Supporting Information

Heterogeneous photocatalytic C4 remote fluorosulfonamidation of pyridines

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1. General Information

All reagents were purchased from commercial suppliers and used as received. Reaction progress was monitored by thin-layer chromatography (TLC) under UV light at 254 or 365 nm. Products were purified by flash column chromatography on silica gel (200–300 mesh). ^{1}H, ^{13}C, and ^{19}F NMR spectra were recorded on Bruker Avance spectrometers (400 or 600 MHz for ^{1}H). Chemical shifts (δ) are reported in parts per million (ppm) relative to tetramethylsilane (TMS). Spectra were acquired in $CDCl_3$ at ambient temperature (20 ± 3 °C). High-resolution mass spectrometry (HRMS) was performed on an Agilent 6546 Q-TOF mass spectrometer with electrospray ionization (ESI). X-ray diffraction (XRD) measurements were carried out on an XRD-6000 diffractometer using Cu Kα radiation (λ = 1.54056 Å). Cyclic voltammetry (CV) was performed using a CHI 660E electrochemical workstation (Shanghai Chenhua Instrument Co., Ltd., China). Fluorescence spectra were recorded on an F-4600 spectrofluorometer. The LED used were purchased from Taobao (https://e.tb.cn/h.htoBHtaDeHZiZAf).

2. Experimental Procedures

2.1 Emission spectrum of photoreactor lamp

The photochemical reaction was carried out under visible light irradiation by a blue LED at room temperature. The blue LED's energy peak wavelength is 424.6 nm.

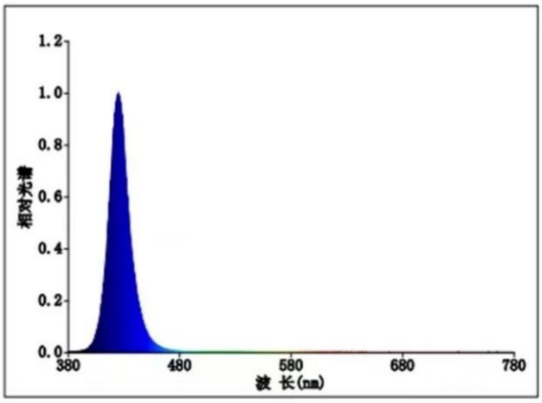


Figure S1 The spectrum of our lamp (blue LED)

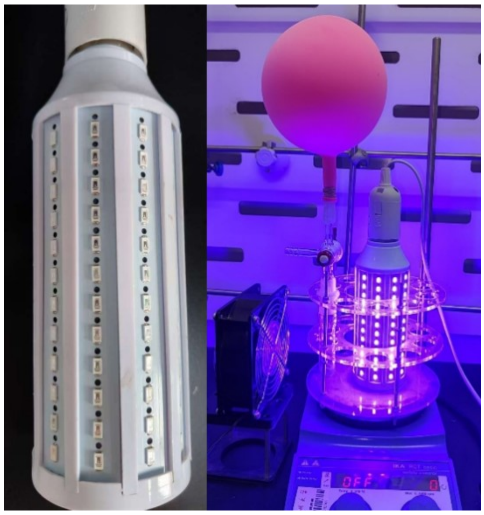


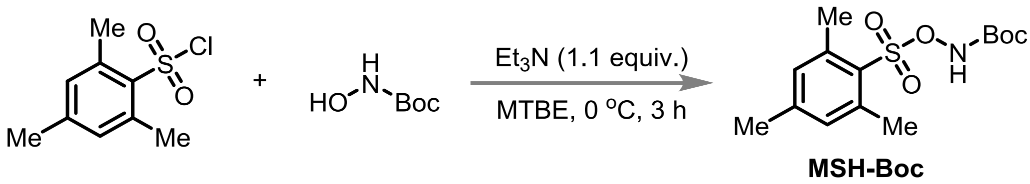
Figure S2 The visible-light irradiation instrument

2.2 General procedures for the synthesis of pyridinium fluoroborate salts

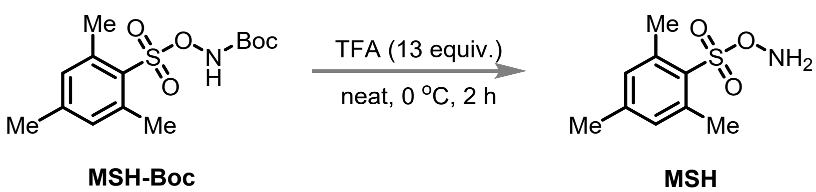
Pyridinium fluoroborate salts were synthesized according to the following procedure:

(1) Synthesis of *O*-(mesitylsulfonyl)hydroxylamine (MSH)

The **MSH** was synthesized according to the previous literature reports[1]

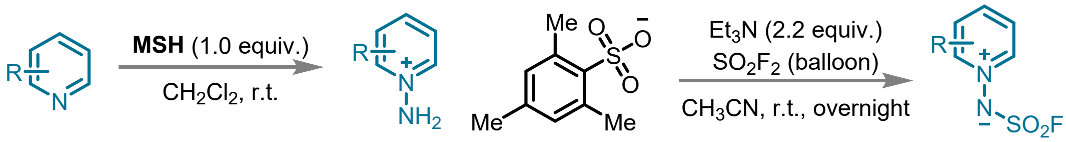


A 250 mL three-necked round-bottom flask equipped with a magnetic stirring bar was charged with 2,4,6-trimethylbenzenesulfonyl chloride (1.0 equiv.) and *tert*-butyl hydroxycarbamate (1.0 equiv.). After evacuating the flask and refilling it with nitrogen, methyl tert-butyl ether (MTBE, 0.4 M) was added *via* syringe. Once the solution was cooled to 0 °C, triethylamine (Et_3N, 1.1 equiv.) was added dropwise. The resulting mixture was stirred at 0 °C for 3 h. Upon completion of the reaction, the mixture was filtered through a sintered glass funnel and washed with MTBE. The filtrate was then evaporated to dryness, and petroleum ether was added, followed by sonication, to yield the **MSH-Boc** solid.

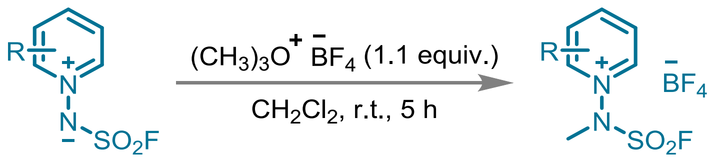


A 50 mL round-bottom flask was charged with **MSH-Boc** (1.0 equiv.) at 0 °C. Pre-cooled trifluoroacetic acid (TFA, 13.0 equiv.) was then added slowly under gentle stirring. The mixture was stirred at 0 °C for 2 h. Ice was subsequently added directly to the mixture, resulting in the formation of a white precipitate. This precipitate was collected by filtration and washed with cold water and alkanes to yield **MSH** as a white solid.

(2) Synthesis of pyridinium fluoroborate salts

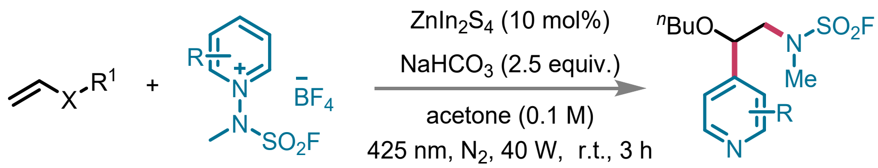


To a DCM solution of **MSH** (1.0 equiv.) was added the substituted pyridine (1.0 equiv.). After stirring at room temperature until consumption of the starting material, the solvent was removed by rotary evaporation. The resulting aminopyridine salt was dissolved in acetonitrile (0.2 M) in a three-necked flask under inert atmosphere, followed by addition of triethylamine (2.2 equiv.) and SO_2F_2. The reaction was stirred overnight at room temperature. Upon completion, the volatiles were removed under reduced pressure. The residue was diluted with DCM and extracted with saturated aqueous sodium bicarbonate ($NaHCO_3$). The organic layer was separated, dried over anhydrous sodium sulfate (Na_2SO_4) and concentrated under reduced pressure. The crude product was recrystallized from a DCM/diethyl ether (Et_2O) mixture to afford the *N*-protected 1-aminopyridinium.



To a solution of *N*-protected 1-aminopyridinium ylides (1.0 equiv) in dichloromethane (0.2 M) were added trimethyloxonium tetrafluoroborate (Meerwein's reagent, 1.1 equiv) at room temperature. The reaction mixture was stirred at room temperature for 5 h. The resulting mixture was concentrated under reduced pressure. The pyridinium fluoroborate salt was recrystallized with Et_2O from CH_2Cl_2 and MeOH (20:1).

2.3 General experimental procedures for the desired product

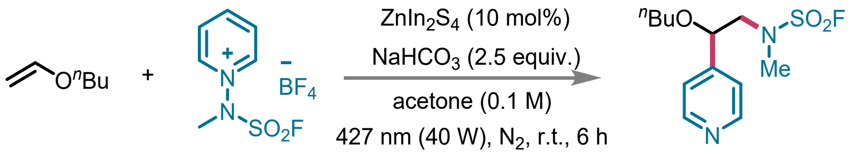


1, 0.1 mmol **2**, 3.0 equiv. **3**

A mixture of alkene (**1**, 0.1 mmol), pyridinium fluoroborate salt (**2**, 3.0 equiv.), $ZnIn_2S_4$ (10 mol%), $NaHCO_3$ (2.5 equiv.), and acetone (0.1 M) were added to a 15 mL tube. The reaction mixtures were degassed with N_2 and then irradiated with 40 W blue LED (425 nm) at room temperature under N_2 atmosphere for 3 h. After this period, the reaction was quenched with saturated $NaHCO_3$ solution, and the mixture was extracted with CH_2Cl_2. The combined organic extracts were dried over Na_2SO_4 and concentrated under reduced pressure. The crude products were purified by silica gel chromatography, using petroleum ether/ethyl acetate as the eluting solvent, to yield the desired products **3**.

2.4 Scale-up synthesis

(1) Flow scale-up reaction:



1a, 6 mmol **2a**, 3.0 equiv. **3a**, 1.14 g, 65%

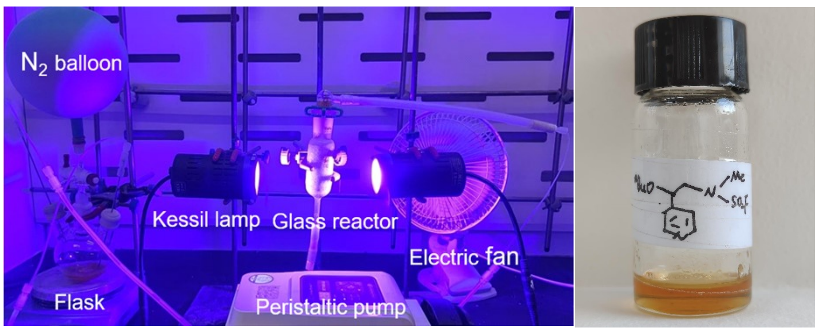
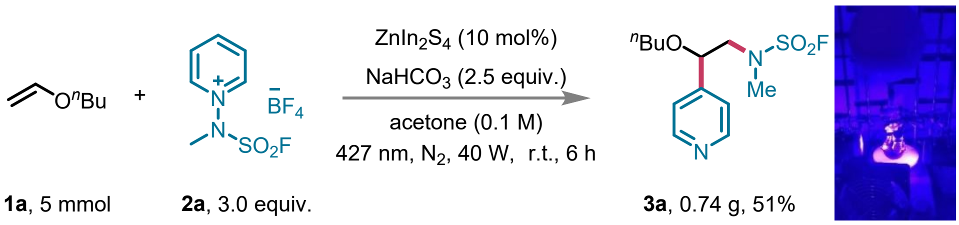


Figure S3 The flow scale-up reaction system

A continuous-flow fixed-bed photoreactor was connected in sequence: A glass reactor with a total internal volume of 30 mL was filled by $ZnIn_2S_4$ (10 mol%) and $NaHCO_3$ (2.5 equiv.) and commercially available silica microsphere (50.0 g, ca. 0.8

mm diameter). Two 427 nm LED Kessil lamps (40 W) were placed perpendicular to the glass reactor at a 5 cm distance (average intensity ≤ 399 mW/cm^2). An electric fan was positioned adjacent to the reactor and operated continuously throughout the reaction to maintain the temperature at room temperature. Then *n*-butyl vinyl ether **1a** (6.0 mmol), pyridinium fluoroborate salt **2a** (3.0 equiv.), and acetone (0.1 M) were loaded into a three-necked flask under N_2, then conveyed to the photoreactor by a peristaltic pump (flow rate = 3 mL/min, V = 5 mL, time = 100 s). Finally, the reactor effluent was collected, processed, and analyzed.

(2) One-pot scale-up synthesis



The mixture of *n*-butyl vinyl ether **1a** (5.0 mmol), pyridinium fluoroborate salt **2a** (3.0 equiv.), $ZnIn_2S_4$ (10 mmol), $NaHCO_3$ (2.5 equiv.), and acetone (0.1 M) were sequentially added in a 100 mL three-necked round-bottom flask. Then the reaction vessel was irradiated with 40 W blue LED (427 nm) at room temperature under N_2 atmosphere for 6 h. After the reaction, the solvent was evaporated under vacuum. The residue was purified by chromatography on aluminum oxide using petroleum ether/ethyl acetate as eluent to afford the desired product **3a** (0.74 g, 51%).

Note: the 427 nm LED was employed only for the gram-scale reaction owing to reactor-specific hardware; all small-scale reactions were carried out with the 425 nm LED specified in the main text.

2.5 Recycle experiments

In a 15 mL tube, *n*-butyl vinyl ether **1a** (0.1 mmol), pyridinium fluoroborate salt **2a** (3.0 equiv.), $ZnIn_2S_4$ (10 mmol), $NaHCO_3$ (2.5 equiv.), and acetone (0.1 M) were added. The mixture was stirred under the irradiation of 40 W blue LED (425 nm) in an N_2 atmosphere at room temperature for 3 h. After the reaction, the solvent was removed, washing the residue five times with H_2O and CH_3OH each. Then, the $ZnIn_2S_4$ was dried under vacuum and directly reused for the next cycle without any further purification.

Yields were given by ^{1}H NMR using 1,1,2,2-tetrachloroethane as an internal standard based on **1a** (Figure S4). The XRD of fresh $ZnIn_2S_4$ and recovered $ZnIn_2S_4$ are almost the same (Figure S5). The SEM images of fresh $ZnIn_2S_4$ and recovered $ZnIn_2S_4$ revealed no significant changes in overall morphology compared to the fresh material, indicating that the primary structural framework remained intact throughout the reaction and recovery process. However, upon closer examination, we observed small particles on the surface of the recovered catalyst that were absent in the fresh sample. These likely arise from minor deposition of slight agglomeration or adsorption of trace impurities. While the macroscopic structure is well preserved, these surface modifications could block active sites or disrupt light–matter interactions, which reasonably explains the slight decline in catalytic efficiency upon recycling. (Figure S6).

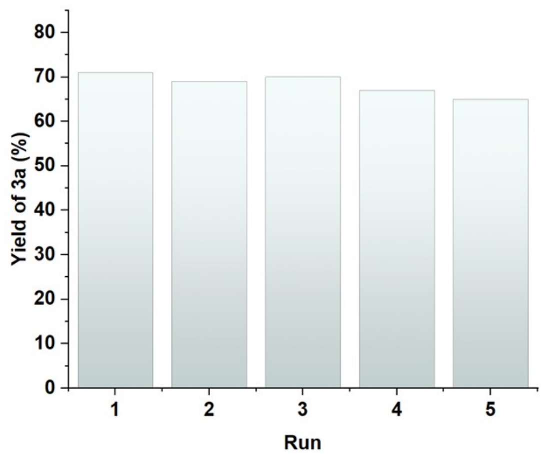


Figure S4 Recycle experiments

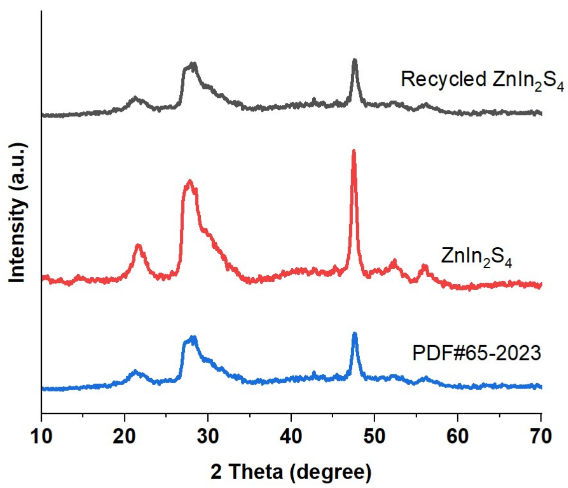


Figure S5 XRD of fresh $ZnIn_2S_4$, recycled $ZnIn_2S_4$ and PDF#65-2023

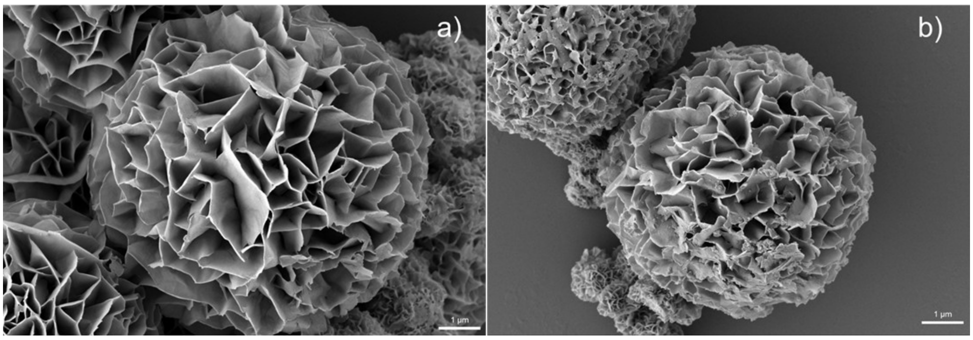


Figure S6 SEM images of a) Fresh $ZnIn_2S_4$; b) Recycled $ZnIn_2S_4$

2.6 Procedure for emission quenching experiments

Emission intensities were recorded using an F-4600 FL Spectrophotometer. The solutions were irradiated at 363 nm (Maximum absorption wavelength of $ZnIn_2S_4$ and fluorescence was measured from 385 nm to 600 nm. In a typical experiment, the emission spectrum of a 0.01 M solution of $ZnIn_2S_4$ with different concentrations of **2a** in degassed acetone in a 10 mm path-length quartz cuvette was collected.

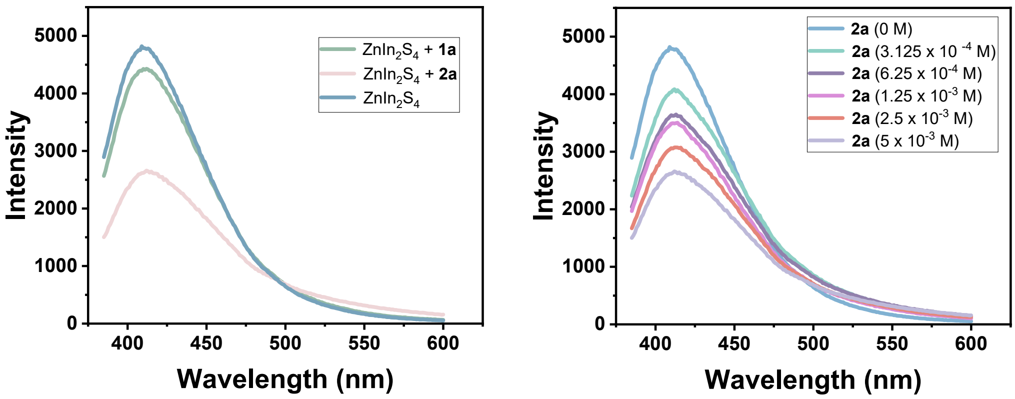


Figure S7. Luminescence quenching experiments

2.7 Cyclic voltammetry experiment

Cyclic voltammetry was performed on the CHI-660E electrochemical workstation (Shanghai Chenhua Instrument Co., Ltd., China). Cyclic voltammograms of 0.1 M tetrabutylammonium hexafluorophosphate (TBAH) and pyridinium fluoroborate salt (**2a**) or **S0** in acetone using a glassy carbon disk electrode as working electrode, Pt wire as the counter electrode, and silver chloride electrode (Ag/AgCl) as reference electrode at 100 mV/s scan rate.

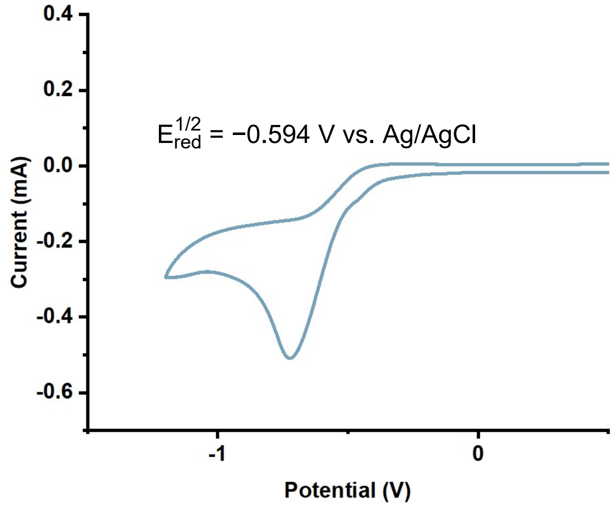
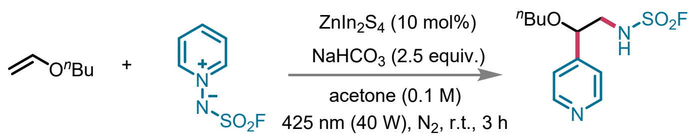


Figure S8 Cyclic voltammetry experiment of **2a**



1a, 0.1 mmol **S0**, 3.0 equiv. N.D.

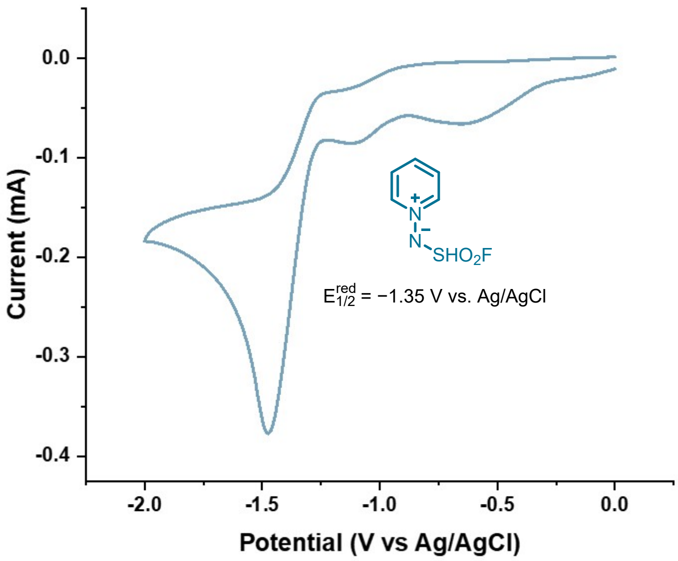
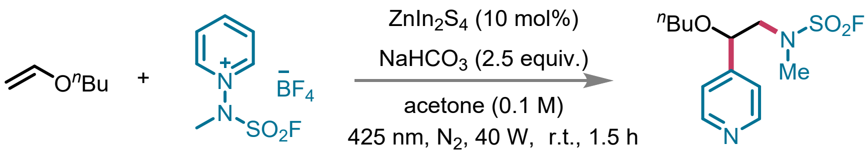


Figure S9 Cyclic voltammetry experiment of **S0**

2.8 Light on-off experiment



1a, 5 mmol **2a**, 3.0 equiv. **3a**

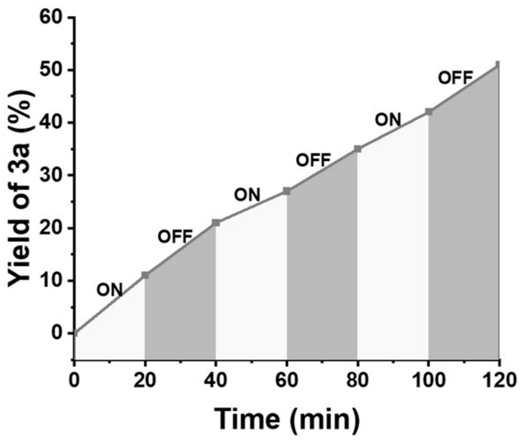


Figure S10. Light on-off experiments

Reaction mixtures in a 15 mL reaction vessel were charged with *n*-butyl vinyl ether **1a** (0.1 mmol), pyridinium fluoroborate salt **2a** (3.0 equiv.), $ZnIn_2S_4$ (10 mmol), $NaHCO_3$ (2.5 equiv.), and acetone (0.1 M). The reaction mixtures were degassed by N_2, and then irradiated with 40 W blue LED (425 nm). After 20 minutes, the lamps were turned off, and one vial was removed from the irradiation setup. The reaction mixture was quenched with saturated $NaHCO_3$ solution and extracted with CH_2Cl_2. The organic extracts were combined, dried over Na_2SO_4, and concentrated under reduced pressure. The yield of the product was determined by ^{1}H NMR using 1,1,2,2-tetrachloroethane as the internal standard. The remaining mixture was stirred in the absence of light for an additional 20 minutes. Then remove one of the tubes. The reaction mixture was quenched with H_2O and extracted with CH_2Cl_2. ^{1}H NMR analysis was performed every 20 minutes until the reaction time reached 120 minutes.

2.9 Measurement of quantum yield

(a) Determination of the light intensity at 425 nm:

The photon flux of the spectrophotometer was determined by standard ferrioxalate actinometry[2]. A 0.15 M solution of ferrioxalate was prepared by dissolving 2.21 g of potassium ferrioxalate hydrate in 30.0 mL of 0.05 M H_2SO_4. A buffered solution of phenanthroline was prepared by dissolving 50.0 mg of phenanthroline and 11.25 g of sodium acetate in 50.0 mL of 0.5 M H_2SO_4. Both solutions were stored in the dark. To determine the photon flux of the spectrophotometer, 2.0 mL of the ferrioxalate solution was placed in a cuvette and irradiated for 90.0 seconds at λ = 425 nm with an emission slit width at 10.0 nm. After irradiation, 0.35 mL of the phenanthroline solution was added to the cuvette. The solution was then allowed to rest for 1 h to allow the ferrous ions to completely coordinate with the phenanthroline. The absorbance of the solution was measured at 510 nm. A non-irradiated sample was also prepared and the absorbance at 510 nm was measured. Conversion was calculated using eq 1:

$$mol\ Fe^{2+} = \frac{V * \Delta A}{L * \varepsilon} \quad (1)$$

Where V is the total volume (0.00235 L) of the solution after the addition of phenanthroline, ΔA is the difference in absorbance at 510 nm between the irradiated and non-irradiated solutions, L is the path length (1.000 cm), and ε is the molar absorptivity at 510 nm (11100 L mol^{-1} cm^{-1}). The photon flux can be calculated using eq 2.

$$photon\ flux = \frac{mol\ Fe^{2+}}{\varphi * t * f}$$

Where Φ is the quantum yield for the ferrioxalate actinometer (1.01 for 0.15 M solution at λ = 436 nm), t is the time (90.0 s), and f is the fraction of light absorbed at λ = 425 nm (0.998, vide infra). The photon flux was calculated to be 7.36 x 10^{-10} einstein s^{-1}.

Sample calculation:

$$\text{mol } Fe^{2+} = \frac{0.00235\ L\ *\ (2.3697 - 2.0853)}{1.0000\ cm\ *\ 11100\ L\ mol^{-1} cm^{-1}} = 6.02 *\ 10^{-8}\ mol$$

$$\text{photon flux} = \frac{6.02\ *\ 10^{-8}\ mol}{1.01\ *\ 90\ *\ 0.998} = 6.64 * 10^{-10}$$

(b) Determination of the quantum yield

A cuvette was pumped into the glovebox. A mixture of **1a** (0.1 mmol), **2a** (3.0 equiv.), $ZnIn_2S_4$ (10 mol%) and $NaHCO_3$ (2.5 equiv.) were dissolved in acetone (1.0 mL) under N_2 atmosphere. The sample was stirred and irradiated (λ = 425 nm) at room temperature for 20 min. After irradiation, the yield of product formed was determined by ^{1}H NMR. The quantum yield was determined using eq 3

$$\varphi = \frac{mol\ product}{flux * t * f} \quad (3)$$

$$f = 1 - 10^{-A} \quad (4)$$

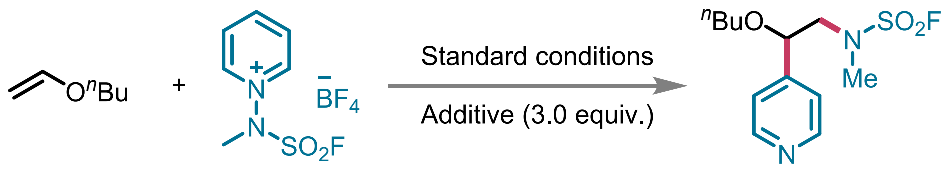
Sample calculation:

$$\varphi = \frac{1 *\ 10^{-5}\ mol}{6.64 *\ 10^{-10}\ einstein\ s^{-1} * 1200\ s * 0.87} = 14$$

Thus, 14 equivalents of product were formed for every photon absorbed by the photocatalyst, ruling out the possibility of a non-chain propagation process.

2.10 Control experiments

In a 15 mL tube, *n*-butyl vinyl ether **1a** (0.1 mmol), pyridinium fluoroborate salt **2a** (3.0 equiv.), $ZnIn_2S_4$ (10 mmol), $NaHCO_3$ (2.5 equiv.), and acetone were added. Afterward, scavengers (3.0 equiv), such as 2,2,6,6-tetramethyl-1-piperidinyloxy (TEMPO), 2,6-ditert-butyl-4-methyl-phenol (BHT), CuCl, ammonium oxalate, and $K_2S_2O_8$ were added to the mixture, respectively. The mixture was stirred under the irradiation of 40 W blue LED (425 nm) in an N_2 atmosphere at room temperature for 3 h. The yields of **3a** were determined by ^{1}H NMR using 1,1,2,2-tetrachloroethane as an internal standard.



1a **2a** **3a**

Additive	Yield
None	75%
TEMPO	N.D.
BHT	Trace
CuCl	N.D.
$(NH_4)_2C_2O_4$	N.D.
$K_2S_2O_8$	N.D.

Scheme S1 Control experiments

Among them, the BHT adducts were detected by high-resolution mass spectrometry (HRMS) during the radical scavenger experiments, definitely in line with our proposed mechanism.

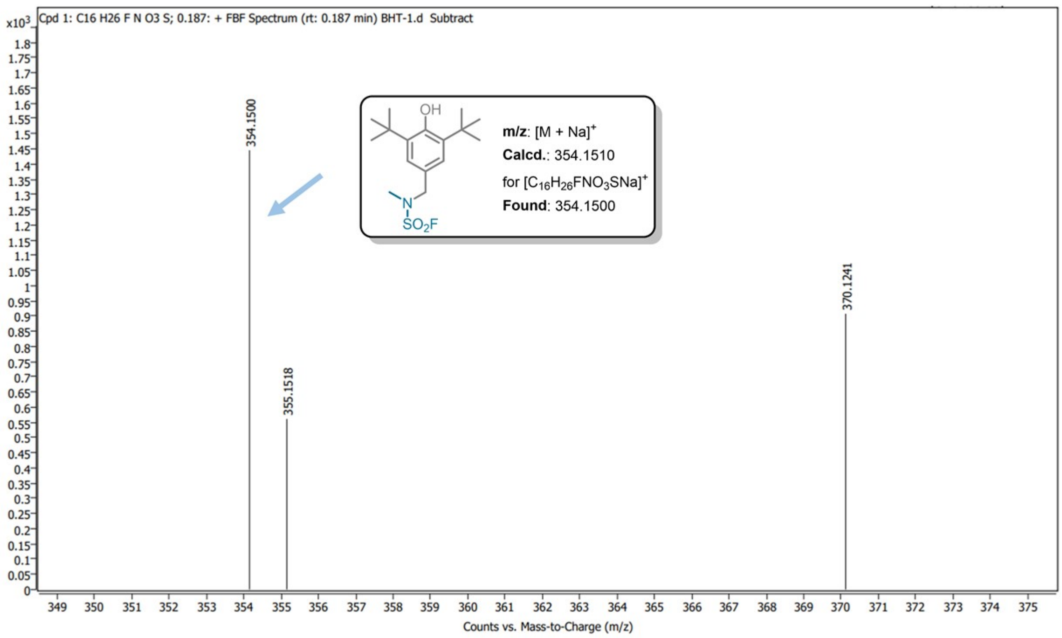
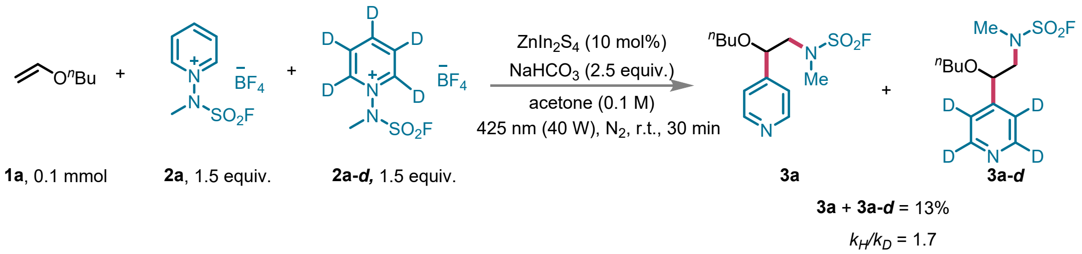


Figure S11. The HRMS analysis of the radical adduct

2.11 KIE experiments

A mixture of **1a** (0.1 mmol), **2a** (1.5 equiv.), **2a-*d*$_6$** (1.5 equiv.), $ZnIn_2S_4$ (10 mol%), $NaHCO_3$ (2.5 equiv.), and acetone (0.1 M) were added to a 15 mL tube. The reaction mixtures were degassed with N_2 and then irradiated with 40 W blue LED (425 nm) at room temperature under N_2 atmosphere for 30 minutes. After this period, the reaction was quenched with H_2O, and the mixture was extracted with CH_2Cl_2. The combined organic extracts were dried over Na_2SO_4 and concentrated under reduced pressure. The crude products were purified by silica gel chromatography, using petroleum ether/ethyl acetate as the eluting solvent, to yield the desired products.



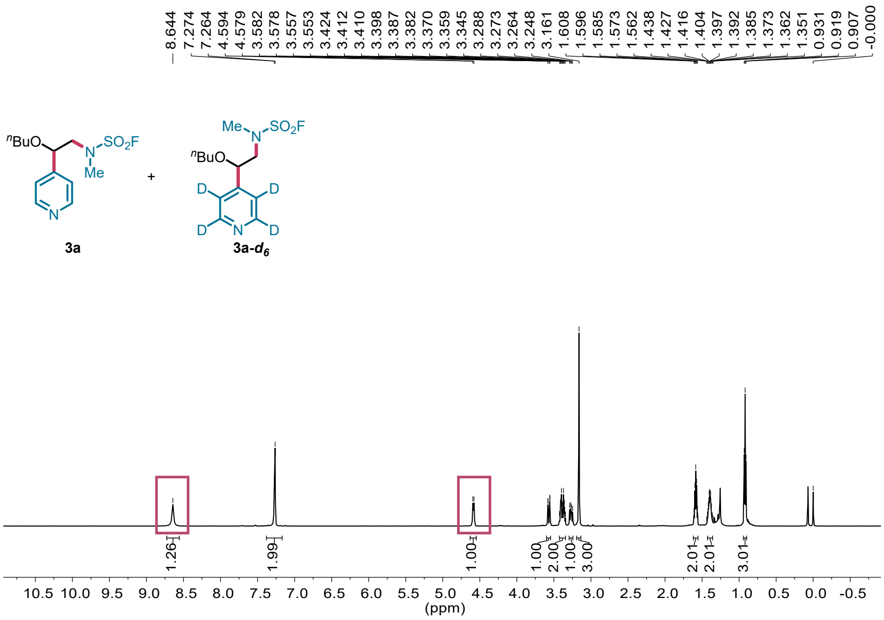
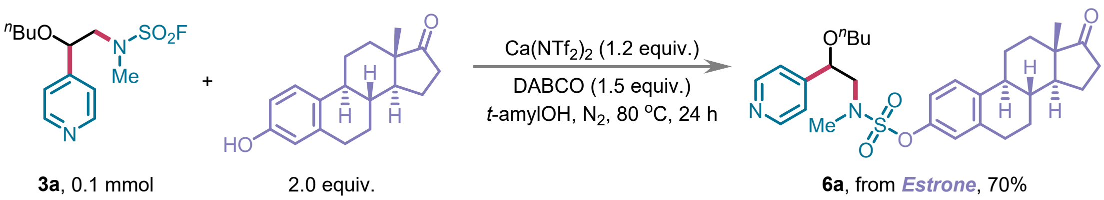
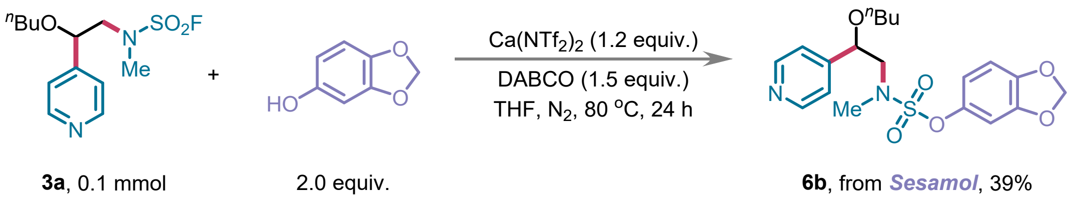


Figure S12 The [1]H NMR Spectra of **3a** and **3a-*d*$_6$**

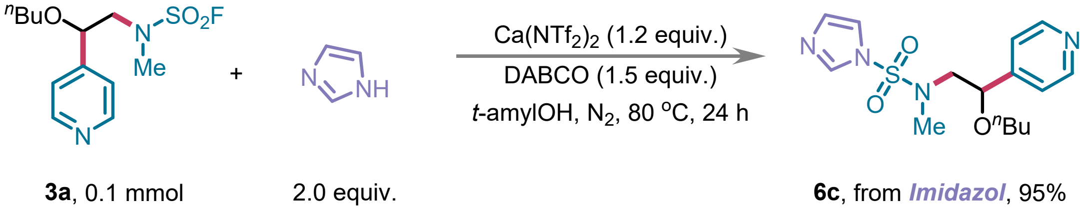
2.12 Synthetic transformation of 3a



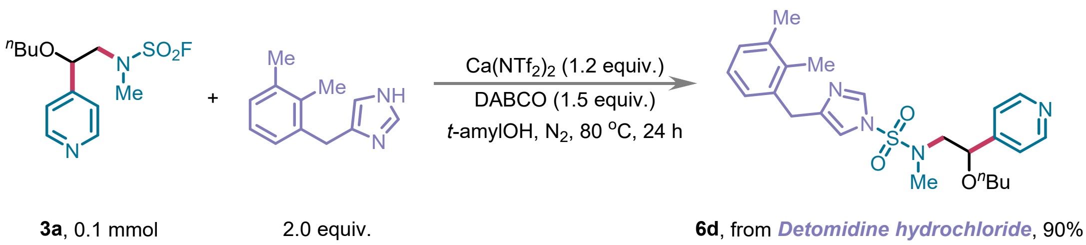
In a 10 mL Schlenk tube, **3a** (0.1 mmol), estrone (2.0 equiv.), $Ca(NTf_2)_2$ (1.2 equiv.) and DABCO (1.5 equiv.) were dissolved in 2-Methyl-2-butanol (1.0 M), and then charged with nitrogen more than three times. The reaction mixture was allowed to stir at 80 °C for 24 h. The organic extracts were combined, dried over Na_2SO_4, and concentrated under reduced pressure. The residue was purified by chromatography on silica gel using petroleum ether/ethyl acetate as eluent to afford the desired product **6a**.



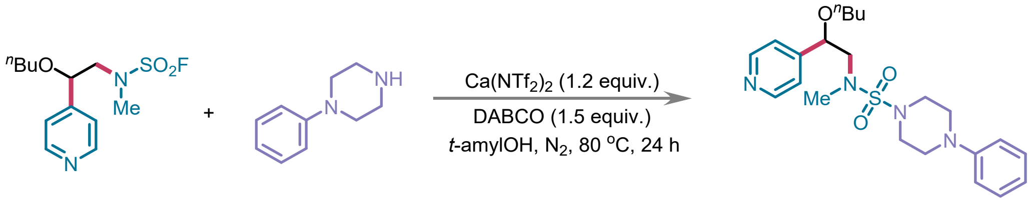
In a 10 mL Schlenk tube, **3a** (0.1 mmol), sesamol (2.0 equiv.), $Ca(NTf_2)_2$ (1.2 equiv.) and DABCO (1.5 equiv.) were dissolved in THF (0.05 M), and then charged with nitrogen more than three times. The reaction mixture was allowed to stir at 80 °C for 24 h. The organic extracts were combined, dried over Na_2SO_4, and concentrated under reduced pressure. The residue was purified by chromatography on silica gel using petroleum ether/ethyl acetate as eluent to afford the desired product **6b**.



In a 10 mL Schlenk tube, **3a** (0.1 mmol), imidazole (2.0 equiv.), $Ca(NTf_2)_2$ (1.2 equiv.) and DABCO (1.5 equiv.) were dissolved in 2-methyl-2-butanol (1.0 M), and then charged with nitrogen more than three times. The reaction mixture was allowed to stir at 80 °C for 24 h. The organic extracts were combined, dried over Na_2SO_4, and concentrated under reduced pressure. The residue was purified by chromatography on silica gel using petroleum ether/ethyl acetate as eluent to afford the desired product **6c**.

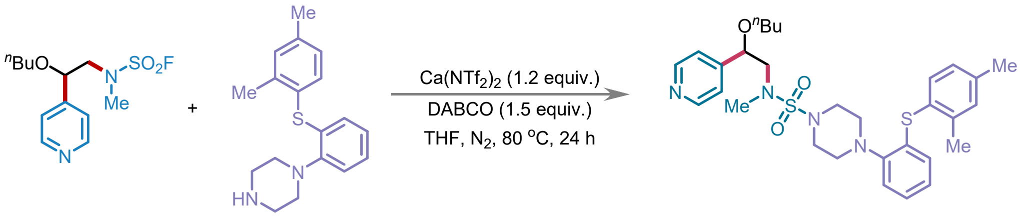


In a 10 mL Schlenk tube, **3a** (0.1 mmol), detomidine hydrochloride (2.0 equiv.), $Ca(NTf_2)_2$ (1.2 equiv.) and DABCO (1.5 equiv.) were dissolved in 2-Methyl-2-butanol (1.0 M), and then charged with nitrogen more than three times. The reaction mixture was allowed to stir at 80 °C for 24 h. The organic extracts were combined, dried over Na_2SO_4, and concentrated under reduced pressure. The residue was purified by chromatography on silica gel using petroleum ether/ethyl acetate as eluent to afford the desired product **6d**.



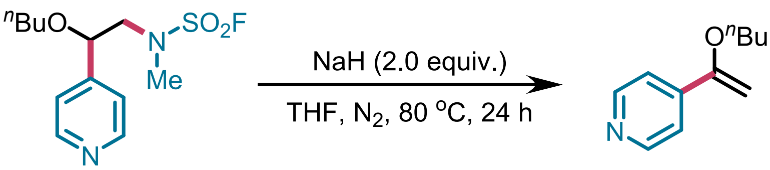
3a, 0.1 mmol 2.0 equiv. **6e**, from ***Fenylpiperazin***, 95%

In a 10 mL Schlenk tube, **3a** (0.1 mmol), fenylpiperazin (2.0 equiv.), $Ca(NTf_2)_2$ (1.2 equiv.) and DABCO (1.5 equiv.) were dissolved in 2-Methyl-2-butanol (1.0 M), and then charged with nitrogen more than three times. The reaction mixture was allowed to stir at 80 °C for 24 h. The organic extracts were combined, dried over Na_2SO_4, and concentrated under reduced pressure. The residue was purified by chromatography on silica gel using petroleum ether/ethyl acetate as eluent to afford the desired product **6e**.



3a, 0.1 mmol 2.0 equiv. **6f**, from ***Vortioxetine***, 96%

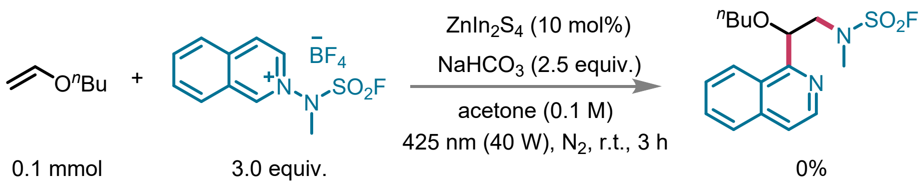
In a 10 mL Schlenk tube, **3a** (0.1 mmol), vortioxetine (2.0 equiv.), $Ca(NTf_2)_2$ (1.2 equiv.) and DABCO (1.5 equiv.) were dissolved in 2-methyl-2-butanol (1.0 M), and then charged with nitrogen more than three times. The reaction mixture was allowed to stir at 80 °C for 24 h. The organic extracts were combined, dried over Na_2SO_4, and concentrated under reduced pressure. The residue was purified by chromatography on silica gel using petroleum ether/ethyl acetate as eluent to afford the desired product **6f**.



3a, 0.1 mmol **6g**, 58%

In a 10 mL Schlenk tube, **3a** (0.1 mmol), NaH (2.0 equiv.) were dissolved in THF (0.1 M) and then charged with nitrogen more than three times. The reaction mixture was allowed to stir at 80 °C for 24 h. The organic extracts were combined, dried over Na_2SO_4, and concentrated under reduced pressure. The residue was purified by chromatography on silica gel using petroleum ether/ethyl acetate as eluent to afford the desired product **6g**.

2.13 Unsuccessful substrate



The isoquinolinium salts failed to react with *n*-butyl vinyl ether, likely due to the lack of a suitable 4-position reaction site analogous to that in pyridinium and quinolinium systems.

2.14 DFT Computational

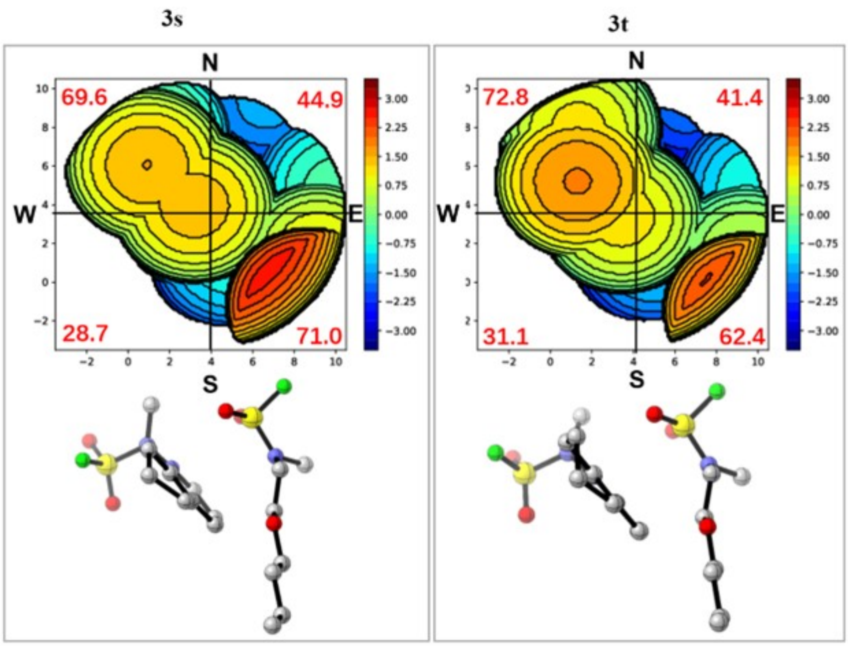
All density functional theory (DFT) calculations were performed to fully optimize all structures in the gas phase using B3LYP-D3[3] method combined with a Def2-SVP basis set[4] for all atoms. The vibrational frequency calculations on these optimized geometries were carried out at the same level of theory to confirm no imaginary frequency for all local minima. To obtain higher accurate energies, the M06-2X combined with Def2-TZVP basis set was also used for the single-point energy calculations in PCM solvent model[5] using acetone solution. All DFT calculations were carried out by Gaussian09 program. The Natural Population Analysis (PNA) were performed by NBO7.0 program to obtain the NPA atomic charges. All free energies are corrected with Grimme's quasi-harmonic approximation for vibrational entropy correction at all frequencies below 100 cm^{-1} by GoodVibes using default settings[6]. In addition, (relative) distortion/interaction energy analysis on the key structures were performed[7]. All 3D images of the optimized structures were shown by CYLview. Non-covalent interaction (NCI) plots and Fukui function analyses were performed using the multifunctional wavefunction analyzer Multiwfn (version 3.8)[8]. The NCI isosurfaces were visualized with an isovalue of 0.50 a.u. Steric maps and steric analysis were generated using the web tool SambVca 2.0[9]. The coordination point was placed 2.3 Å from the center of the sphere, and the mesh spacing for numerical integration was set to 0.050 Å. Other parameters were kept at their default values. Transition states (e.g., **TSBo** and **TSBp**) were located based on structural interpolation from adjacent stable intermediates followed by geometry optimization and frequency verification. This approach, focused on the kinetically most relevant pathway derived from characterized minima, follows the methodology established in prior work [Ref: Nat Commun **2019**, 10, 4117]

The primary nucleophilic attack occurs in regions with high free volume (%Vf) and low buried volume (%Vb). The results showed that the SW quadrants serve as the main attack vectors for both substrates, and their steric parameters exhibit significant differences:

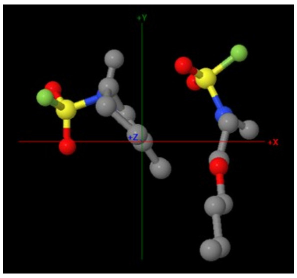
3s (5-membered ring): SW quadrant %Vf = 71.3%, %Vb = 28.7;

3t (6-membered ring): SW quadrant %Vf = 68.9%, %Vb = 31.1%

Compared with **3s**, **3t** shows a ~2.4% decrease in free volume and a ~2.4% increase in buried volume in the main attack quadrant (SW). This dual steric effect directly leads to a significant reduction in the effective collision frequency at the reaction site, which is highly consistent with its experimentally observed lower yield.



3s

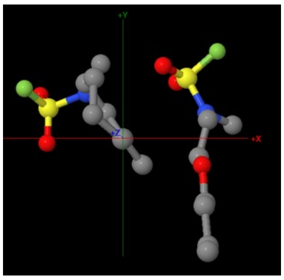


%V Free	%V Buried	% V Tot/V Ex
46.4	53.6	100.0

Quadrant	V f	V b	V t	%V f	%V b
SW	32.0	12.9	44.9	71.3	28.7
NW	13.6	31.3	44.9	30.4	69.6
NE	24.7	20.2	44.9	55.1	44.9
SE	13.0	31.9	44.9	29.0	71.0

Steric Map

3t

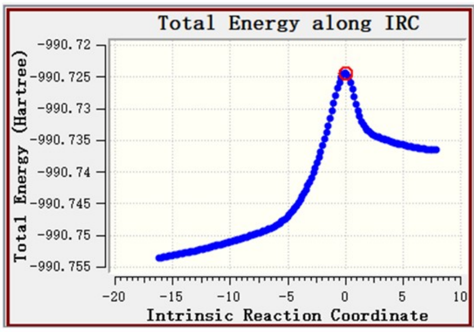


%V Free	%V Buried	% V Tot/V Ex
48.0	52.0	100.0

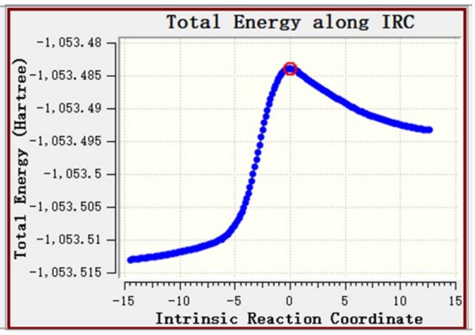
Quadrant	V f	V b	V t	%V f	%V b
SW	30.9	14.0	44.9	68.9	31.1
NW	12.2	32.7	44.9	27.2	72.8
NE	26.3	18.6	44.9	58.6	41.4
SE	16.9	28.0	44.9	37.6	62.4

Steric Map

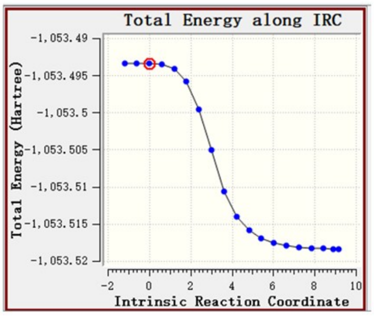
Figure S13 Steric analysis of **3s** and **3t**



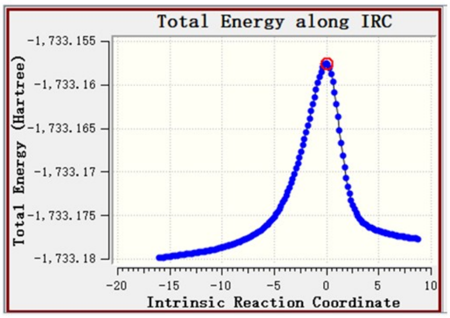
TS2a′



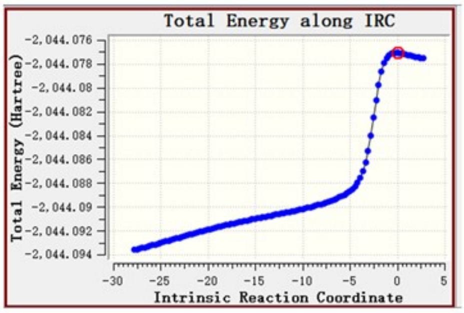
TSAa



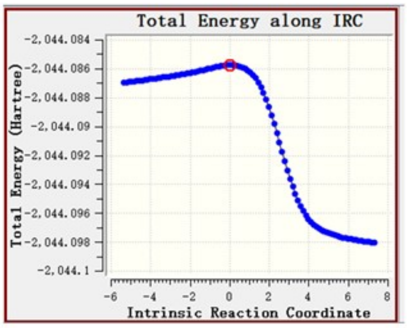
TSA



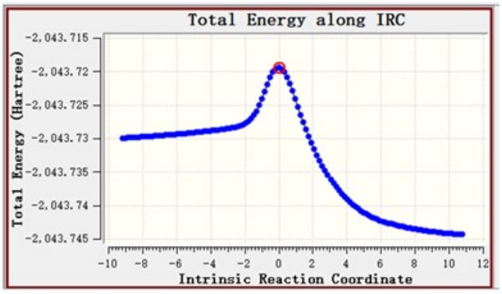
TSAp



TSBo



TSBp



TSD

Figure S14 IRC calculations of all transition states

Fukui function (f^0) calculation results: The Fukui indices (f^0) of C2 and C4 in pyridinium salt **2a** were calculated to be 0.074 and 0.154, respectively. A higher f^0 value indicates a greater susceptibility to radical attack at that position. Therefore, the significantly larger Fukui index at C4 (0.154) compared to C2 (0.074) suggests that C4 is the more favorable site for radical addition. This computational prediction aligns well with our experimental finding that the reaction exclusively occurs at the C4 position, thus providing a robust theoretical rationalization for the observed regioselectivity.

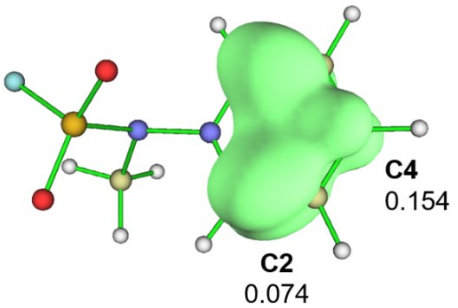


Figure S15 Fukui function calculation of pyridinium salt **2a**

The explicit NCI analysis (visualized via the isosurfaces in the structural models) provides direct evidence that the additional O···N non-covalent interaction (unique to **TSBp**, and absent in **TSBo** due to steric constraints) is responsible for the observed difference in interaction energies (Figure S16).

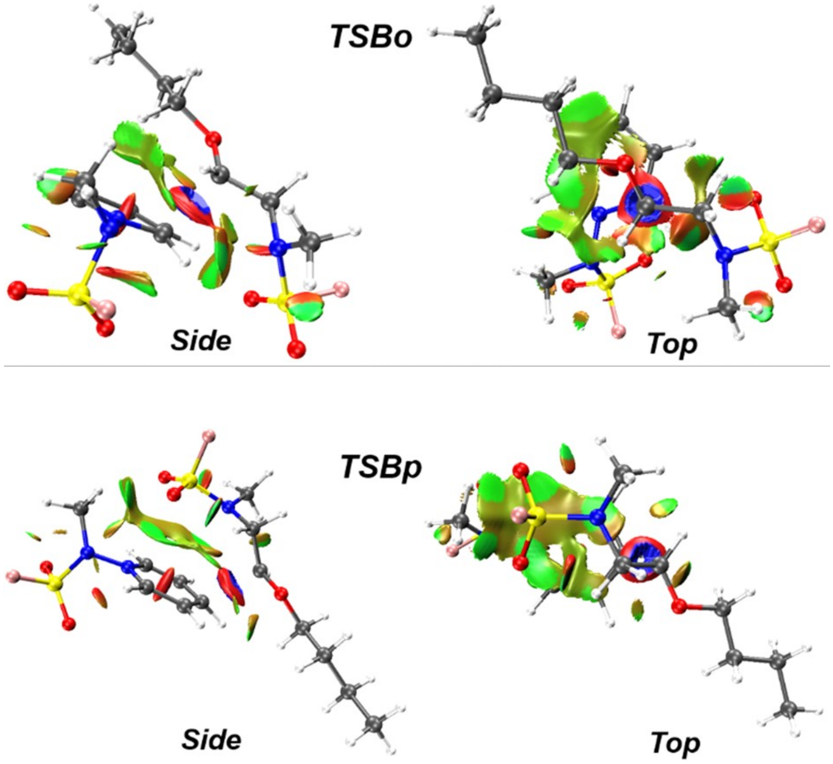


Figure S16 Non-covalent interaction (NCI) analysis

Table S1. The absolute electronic and corrected free energies (in Hartree) of the optimized structures of intermediates and transition states for the reaction calculated by the PCM M06-2X/Def2-TZVP//B3LYP-D3/Def2-SVP method in acetone solution. The free energies are corrected with the quasi-harmonic entropy correction (G-qh$_{gas}$).

	E_{gas} (in Hartree)	E_{soln} (in Hartree)	G-qh$_{gas}$ (in Hartree)	ΔG_{soln} (in kcal/mol)	im freq (cm^{-1})
H	0.00000	-0.15856	-0.01000		
1a	-310.84379	-311.02578	-310.70789		
2a	-990.53000	-991.19668	-990.41783		
HCO_3^-	-264.23715	-264.57309	-264.23644		
H_2CO_3	-264.80641	-265.03340	-264.79274		
Py	-248.10984	-248.26987	-248.04854		
2a'	-990.73675	-991.33152	-990.63000	0.0	
TS2a'	-990.72448	-991.32068	-990.61846	6.4	-603.56
A	-742.62474	-743.07393	-742.60367	-23.0	
TSA	-1053.49337	-1054.11263	-1053.31061	-14.9	-70.40
TSAa	-1053.483968	-1054.10603	-1053.301744	-11.1	-252.99
TSAp	-1733.15758	-1734.25167	-1732.99987	4.2	-510.30
B	-1053.52051	-1054.14536	-1053.33505	-33.8	
Bp	-1733.17273	-1734.27792	-1733.01297	-10.9	
TSBo	-2044.07709	-2045.34245	-2043.75398	-18.0	-115.09
TSBp	-2044.08575	-2045.34690	-2043.76234	-20.6	-139.10
Co	-2044.09444	-2045.36353	-2043.76773	-29.0	
Cp	-2044.09813	-2045.36388	-2043.77286	-30.1	
D	-2043.73043	-2044.95165	-2043.41881	-55.5	
TSD	-2043.71947	-2044.94096	-2043.40877	-49.3	-595.69
3a	-1301.10184	-1301.88787	-1300.83674	-77.8	

Table S2. The absolute electronic energies of the optimized structures of intermediates and transition states for the reaction calculated by the PCM M06-2X/def2-TZVP method in acetone solution. based on the B3LYP-D3/def2-SVP-optimized structures in gas-phase. Free-energies are corrected with quasi-harmonic entropy correction.

	E_{soln} (in Hartree)		E_{soln} (in Hartree)
2a	-991.19668	**2a**	-991.19668
B	-1054.14536	**B**	-1054.14536
TSBo-2a	-991.18507	**TSBp-2a**	-991.18503
TSBo-B	-1054.13802	**TSBp-B**	-1054.13843
TSBo	-2045.34245	**TSBp**	-2045.34690
	E_{soln} (kcal/mol)		E_{soln} (kcal/mol)
ΔE_{2a}	7.3	ΔE_{2a}	7.3
ΔE_{B}	4.6	ΔE_{B}	4.3
ΔE_{int}	-12.1	ΔE_{int}	-14.7
ΔE_{a}	-0.3	ΔE_{a}	-3.1
Total Distortion Energy	11.9	**Total Distortion Energy**	11.6

E_{soln}: The single-point electronic energy of the fully optimized structure (corrected for solvent effects via PCM model in acetone solution).
ΔE_{2a}: Distortion energy of intermediate **2a**, representing the energy required to deform **2a** from its equilibrium gas-phase structure to its configuration in the reaction complex.
ΔE_{B}: Distortion energy of intermediate **B**, defined as the energy cost to distort **B** to its geometry in the reaction complex.
Total Distortion Energy: Sum of ΔE_{2a} and ΔE_{B}, reflecting the total energy required to deform all reactant/intermediate species in the reaction system.
ΔE_{int}: Interaction energy between the distorted **2a** and **B** species in the reaction complex, calculated as $E_{\mathrm{complex}} - (E_{\mathrm{distorted\text{-}2a}} + E_{\mathrm{distorted\text{-}B}})$.
ΔE_{a}: Apparent activation energy derived from the distortion–interaction analysis, corresponding to the energy barrier of the reaction step.

XYZ coordinates

1a.xyz

C	2.545486	0.305000	-0.000114
H	2.528893	1.404463	-0.000359
C	3.695305	-0.376997	-0.000018
H	4.645454	0.158045	-0.000199
H	3.700362	-1.469424	0.000230
O	1.333860	-0.298610	0.000073
C	0.192736	0.545910	0.000136
H	0.202782	1.203392	0.892603
H	0.202847	1.203617	-0.892166
C	-1.051688	-0.324892	-0.000015
H	-1.014893	-0.986290	0.883044
H	-1.014820	-0.986094	-0.883218
C	-2.349877	0.485479	0.000023
H	-2.366423	1.151688	0.881953
H	-2.366386	1.151829	-0.881801
C	-3.600673	-0.394294	-0.000073
H	-4.521566	0.210111	-0.000062
H	-3.627408	-1.046787	-0.888697
H	-3.627462	-1.046904	0.888462

2a.xyz

C	2.802734	-0.974574	0.685879
C	1.483770	-0.726442	1.032612
N	0.787543	0.237753	0.380981
C	1.329032	0.969391	-0.630948
C	2.644639	0.755759	-1.002107
C	3.393428	-0.226240	-0.338174
N	-0.555963	0.405336	0.761779
C	-0.947605	1.757375	1.194728
S	-1.605508	-0.363929	-0.394767
O	-2.112394	0.613095	-1.326365
O	-0.961821	-1.599146	-0.759304
H	3.354756	-1.751623	1.217390
H	0.933404	-1.258671	1.809221
H	0.671407	1.691407	-1.117815
H	3.071113	1.347064	-1.814288
H	4.432022	-0.409973	-0.624168
H	-0.282283	2.058070	2.015626
H	-0.928515	2.500598	0.381545
H	-1.970433	1.682537	1.587161
F	-2.761852	-0.664598	0.655077

2a'.xyz

C	2.783369	-0.802124	0.861464
C	1.525359	-0.423332	1.236622
N	0.788604	0.471765	0.441495
C	1.322982	0.905589	-0.792541
C	2.583355	0.518967	-1.166152
C	3.363725	-0.334892	-0.350220
N	-0.564475	0.569054	0.682702
C	-1.100281	1.916378	0.888418
S	-1.537229	-0.433448	-0.339274
O	-2.187804	0.317323	-1.397811
O	-0.827263	-1.670934	-0.560127
H	3.333969	-1.480156	1.517193
H	1.014417	-0.755960	2.138787
H	0.675800	1.547916	-1.388932
H	2.971055	0.884770	-2.119842
H	4.363391	-0.645643	-0.653030
H	-0.564088	2.360275	1.738282
H	-0.997196	2.564446	0.001782
H	-2.164399	1.829664	1.146220
F	-2.706300	-0.723391	0.752945

3a.xyz

C	2.677791	0.481783	-0.996719
C	4.026805	0.660109	-1.318694
N	5.034563	0.227223	-0.555492
C	4.720205	-0.406970	0.576806
C	3.405038	-0.633863	0.995290
C	2.352088	-0.181222	0.192050
H	1.884808	0.855095	-1.647752
H	4.303309	1.180467	-2.243507
H	5.558436	-0.752380	1.193940
H	3.210552	-1.149884	1.940187
C	-0.175078	1.699779	0.723445
O	0.019380	0.494070	0.001767
C	0.903651	-0.442862	0.557974
H	0.787311	2.237305	0.839413
H	-0.549750	1.468211	1.741503

C	-1.185821	2.543124	-0.033512
H	-2.095519	1.935553	-0.167381
H	-0.787945	2.742638	-1.043862
N	-0.948371	-2.116812	0.362743
C	-1.281395	-2.366642	1.764567
H	-1.280095	-1.450907	2.380227
H	-2.275670	-2.829190	1.826677
H	-0.547130	-3.079867	2.166909
S	-2.147449	-1.376771	-0.519521
C	0.437437	-1.808486	0.015956
O	-2.914318	-0.431488	0.271349
O	-1.691697	-1.120920	-1.865514
H	0.814766	-0.450203	1.663570
H	0.536931	-1.808779	-1.077817
H	1.070793	-2.616054	0.413900
F	-3.133651	-2.668445	-0.614177
C	-1.518207	3.858903	0.672551
H	-0.592182	4.444601	0.820896
H	-1.905341	3.642672	1.685137
C	-2.539468	4.699768	-0.094498
H	-3.484929	4.148438	-0.227866
H	-2.769078	5.639900	0.431825
H	-2.165768	4.960018	-1.098929

A.xyz

N	-0.981117	0.000351	-0.831428
C	-2.201092	0.000024	-0.064715
S	0.387314	0.000000	0.137026
O	0.519458	1.273387	0.815214
O	0.518951	-1.273493	0.815117
H	-3.055396	0.000463	-0.754604
H	-2.253840	-0.889179	0.594736
H	-2.253766	0.888480	0.595751
F	1.459231	-0.000170	-1.051406

B.xyz

C	-0.950292	1.525945	0.207001
H	-1.370348	2.246382	-0.505196
H	-1.160384	1.862840	1.238493
N	-1.504804	0.193099	-0.049354
S	-3.129768	0.094543	-0.277204
O	-3.497574	-1.261767	-0.622622
O	-3.594731	1.256107	-1.002929
H	0.136438	1.464856	0.068637
C	0.451453	-1.323211	0.041295
H	0.480345	-1.841822	-0.925949
C	-0.845938	-0.946352	0.654577
H	-1.528979	-1.804078	0.606754
H	-0.700079	-0.673824	1.715561
O	1.506438	-0.536387	0.362097
C	2.745417	-0.830994	-0.277396
H	3.045341	-1.867811	-0.034095
H	2.618344	-0.772334	-1.376362
C	3.791500	0.160850	0.198650
H	3.855327	0.102291	1.299042
H	3.445579	1.182177	-0.039249
F	-3.678155	0.299896	1.256176
C	5.168259	-0.084719	-0.423982
H	5.498405	-1.112617	-0.187658
H	5.085701	-0.039534	-1.525236

C	6.223455	0.914329	0.051982
H	7.204125	0.715847	-0.408181
H	5.936617	1.948181	-0.202843
H	6.350701	0.867275	1.146313

Bp.xyz

C	0.603957	0.582971	-0.532397
C	-0.716720	0.384099	-0.769464
N	-1.414980	-0.607017	-0.093166
C	-0.780983	-1.462068	0.798925
C	0.541408	-1.323908	1.068290
C	1.362820	-0.216980	0.486842
N	-2.760707	-0.707961	-0.327650
C	-3.406313	-2.029325	-0.367245
S	-3.703970	0.658725	0.199003
O	-5.029355	0.169228	0.451789
O	-2.881080	1.444822	1.080087
H	1.146865	1.348377	-1.091736
H	-1.298569	0.951832	-1.496451
H	-1.404036	-2.225814	1.261938
H	1.024242	-2.005677	1.772082
H	1.578794	0.474178	1.336783
H	-2.764142	-2.702785	-0.950693
H	-3.602632	-2.442872	0.634287
H	-4.363617	-1.912447	-0.890423
N	2.670238	-0.695326	0.030668
C	2.712793	-1.591768	-1.135069
H	2.055877	-2.451482	-0.939180
H	2.395984	-1.086790	-2.063555
H	3.736613	-1.965033	-1.258497

S	3.938801	0.379958	0.214109
O	3.716835	1.131148	1.427663
O	5.164839	-0.268478	-0.160824
F	-3.734415	1.431522	-1.204587
F	3.579279	1.412902	-1.004560

Co.xyz

C	-1.493265	2.535660	-1.215366
H	-2.468052	2.631526	-0.718612
H	-1.251662	3.492370	-1.694947
N	-0.465900	2.273893	-0.194422
S	1.124982	2.781307	-0.416126
O	1.833117	2.517120	0.810411
O	1.106719	4.010886	-1.157656
N	-0.703302	1.393303	0.849853
C	-1.383488	1.874691	1.902911
C	-0.096590	0.044327	0.827803
C	-1.654871	1.097935	3.024725
H	-1.713960	2.912053	1.815740
C	-0.396639	-0.718961	2.065798
H	1.001276	0.194809	0.787640
C	-1.148652	-0.222706	3.097394
H	-2.230375	1.537373	3.840708
H	0.054869	-1.708842	2.128684
H	-1.334387	-0.831160	3.984899
H	-1.539117	1.741841	-1.974600
C	2.469653	-1.109414	-2.250994
H	3.403893	-0.538233	-2.205429
H	2.638840	-2.059527	-2.784670
N	1.966692	-1.336818	-0.888524

S	3.065244	-1.752022	0.278796
O	2.395112	-1.670488	1.565460
O	4.336866	-1.143177	-0.007672
H	1.727641	-0.507922	-2.792019
C	-0.439723	-0.777807	-0.475851
H	-0.407669	-0.063032	-1.318528
C	0.615511	-1.869997	-0.735735
H	0.570572	-2.618147	0.067113
H	0.315433	-2.391949	-1.656790
O	-1.657580	-1.437038	-0.380479
C	-2.841811	-0.709027	-0.689447
H	-2.960534	0.143424	0.008986
H	-2.764644	-0.290355	-1.712136
C	-4.034924	-1.640051	-0.581051
H	-4.050754	-2.070662	0.434958
H	-3.882243	-2.483693	-1.274957
F	3.231372	-3.339275	0.000872
F	1.611490	1.641224	-1.470181
C	-5.362113	-0.937053	-0.881327
H	-5.495213	-0.090802	-0.181808
H	-5.320719	-0.492628	-1.892470
C	-6.564580	-1.876582	-0.784279
H	-7.504437	-1.348066	-1.004217
H	-6.474153	-2.711214	-1.498151
H	-6.651332	-2.310445	0.225315

Cp.xyz

C	3.779882	0.367913	-0.609162
H	4.005959	0.804794	0.375845
H	4.717551	0.115635	-1.121210
N	2.986795	-0.872116	-0.528557
S	3.754838	-2.230223	0.219930
O	2.756782	-3.265262	0.317768
O	4.599750	-1.797269	1.306949
N	1.668957	-0.746987	-0.100660
C	1.370905	-0.172625	1.116228
C	0.689025	-1.221320	-0.941442
C	0.076128	-0.039777	1.515322
H	2.220374	0.155685	1.714762
C	-0.622979	-1.123942	-0.596183
H	1.054098	-1.644293	-1.876652
C	-1.057209	-0.525531	0.691518
H	-0.122391	0.402917	2.493209
H	-1.389789	-1.478521	-1.286752
H	-1.587869	-1.313120	1.275233
H	3.211153	1.078612	-1.220079
C	-1.070531	3.502304	1.425020
H	-0.161067	3.823761	1.947896
H	-1.571075	4.378049	0.980600
N	-0.724179	2.507739	0.397984
S	0.702291	2.733244	-0.400115
O	0.831288	1.725570	-1.437213
O	1.759357	2.988910	0.552627
H	-1.742541	3.033346	2.156950
C	-2.239819	0.537843	0.508275
H	-2.551573	0.822470	1.532676
C	-1.809501	1.792880	-0.270234
H	-1.510659	1.498859	-1.284367
H	-2.690661	2.447880	-0.361896
O	-3.276732	-0.032632	-0.204745

C	-4.262363	-0.757168	0.538447
H	-3.775832	-1.571098	1.115092
H	-4.739537	-0.077690	1.270412
C	-5.283855	-1.327093	-0.427316
H	-4.762252	-1.978779	-1.149650
H	-5.712788	-0.494479	-1.010594
F	0.435181	4.128722	-1.158056
F	4.715080	-2.555496	-1.012462
C	-6.396584	-2.108350	0.278748
H	-5.950905	-2.928841	0.870128
H	-6.901924	-1.448117	1.006342
C	-7.425064	-2.679467	-0.698006
H	-6.952231	-3.368362	-1.417178
H	-8.212272	-3.237086	-0.168493
H	-7.912962	-1.877988	-1.276411

D.xyz

C	0.843613	0.738190	-0.691396
C	2.153582	1.080367	-0.849624
N	3.065135	0.913164	0.206412
C	2.625615	0.331512	1.414332
C	1.309891	-0.016847	1.567113
C	0.364159	0.173060	0.529100
N	4.408650	0.936229	-0.103876
C	5.247360	1.855772	0.668321
S	5.097437	-0.630406	-0.343485
O	5.887991	-1.065771	0.792834
O	4.106984	-1.458836	-0.989262
H	0.143570	0.912532	-1.510616
H	2.582384	1.503093	-1.757104
H	3.386588	0.201701	2.183257
H	1.000753	-0.448617	2.523260
H	4.837847	2.866721	0.538087
H	5.291783	1.605034	1.741640
H	6.263550	1.828813	0.252454
C	-2.377984	1.732191	0.640379
O	-1.956059	0.571196	-0.046081
C	-1.070952	-0.279013	0.644263
H	-1.505180	2.353004	0.929113
H	-2.901939	1.444552	1.575379
C	-3.317056	2.504520	-0.270307
H	-4.127968	1.821469	-0.571742
H	-2.771796	2.768842	-1.193268
N	-2.598636	-2.265349	0.309961
C	-2.842166	-2.793692	1.651745
H	-2.922274	-1.995550	2.410156
H	-3.769430	-3.379824	1.652377
H	-2.009190	-3.461127	1.918479
S	-3.918229	-1.826352	-0.569766
C	-1.288092	-1.670508	0.023059
O	-3.511305	-1.314686	-1.857266
O	-4.954137	-2.824392	-0.402720
H	-1.341264	-0.331264	1.720069
H	-1.165388	-1.589350	-1.065552
H	-0.531109	-2.375606	0.398401
C	-3.891520	3.762612	0.382779
H	-3.065046	4.424177	0.702191
H	-4.428257	3.482004	1.307501
C	-4.835732	4.532595	-0.541421
H	-4.316557	4.857038	-1.458794

H	-5.686476	3.903092	-0.851105
H	-5.243071	5.431039	-0.050918
F	6.179676	-0.184240	-1.468355
F	-4.493788	-0.545383	0.284041

TSD.xyz

C	-4.367377	-2.288949	-0.596400
H	-4.232268	-2.777905	0.384297
H	-5.438391	-2.075255	-0.735335
N	-3.619972	-1.045523	-0.738269
S	-3.975487	0.132018	0.397161
O	-3.059696	1.239269	0.218544
O	-4.281608	-0.406255	1.712131
N	-1.972673	-1.367371	-0.741295
C	-1.424279	-1.619888	0.494804
C	-1.334357	-0.485748	-1.579479
C	-0.308842	-0.935861	0.938629
H	-1.937369	-2.363080	1.107710
C	-0.201933	0.187241	-1.185869
H	-1.807083	-0.341402	-2.551824
C	0.321125	0.005959	0.110294
H	0.081800	-1.153863	1.935455
H	0.285712	0.876661	-1.877237
H	-4.034093	-2.962393	-1.397482
C	3.702406	-1.403593	1.911883
H	3.548441	-2.413851	2.310247
H	4.782897	-1.224187	1.773054
N	2.966505	-1.250828	0.658149
S	2.808289	-2.560081	-0.316973
O	1.998644	-2.221892	-1.466241
O	2.609108	-3.745130	0.487623
H	3.308491	-0.680295	2.640790
C	1.547107	0.775724	0.550441
H	1.557967	0.813665	1.660830
C	2.843146	0.089183	0.082006
H	2.840279	0.037361	-1.014541
H	3.709034	0.699083	0.385347
O	1.594533	2.074160	0.014662
C	0.618131	2.976110	0.528553
H	-0.400714	2.576533	0.368327
H	0.760972	3.085977	1.624041
C	0.786457	4.316528	-0.166511
H	0.615488	4.173302	-1.248391
H	-0.013964	4.989485	0.188809
F	4.331067	-2.700297	-0.896509
F	-5.411556	0.608970	-0.215319
C	2.156776	4.960852	0.059683
H	2.935777	4.253334	-0.269238
H	2.312387	5.103925	1.145115
C	2.318960	6.295904	-0.666637
H	1.563223	7.027761	-0.334429
H	3.312446	6.737379	-0.487998
H	2.199747	6.172787	-1.756315

H.xyz

H	0.000000	0.000000	0.000000

H_2CO_3.xyz

C	-0.054745	0.135963	0.000034
O	-0.738092	1.117738	-0.000016

O	1.281999	0.149200	-0.000000
O	-0.518875	-1.137573	-0.000044
H	-1.487600	-1.090002	0.000231
H	1.615815	-0.760693	0.000050

HCO_3.xyz

C	0.158554	0.067928	-0.000051
O	-0.103070	1.289917	0.000032
O	1.221852	-0.559169	-0.000008
O	-1.022370	-0.768963	0.000062
H	-1.722626	-0.101846	-0.000384

Py.xyz

C	1.200092	0.673516	-0.000037
C	1.143445	-0.724886	0.000030
N	0.000751	-1.417080	0.000004
C	-1.142728	-0.726080	-0.000029
C	-1.200798	0.672370	0.000049
C	-0.000703	1.387341	-0.000036
H	2.164838	1.186551	0.000014
H	2.070150	-1.311753	0.000082
H	-2.068806	-1.313936	-0.000126
H	-2.166059	1.184442	0.000112
H	-0.001224	2.480683	0.000033

TS2a'.xyz

C	-2.663650	-0.473773	-1.037051
C	-1.561192	0.303924	-1.330017
N	-0.870624	0.966707	-0.346151
C	-1.296367	0.852831	0.957638
C	-2.381433	0.064958	1.294160
C	-3.090916	-0.620979	0.294589
N	0.785337	0.809225	-0.591292
C	1.454387	2.041660	-0.193710
S	1.355557	-0.578496	0.151914
O	1.758351	-0.365337	1.532464
O	0.514573	-1.686939	-0.242204
H	-3.193891	-0.965022	-1.855748
H	-1.166923	0.426577	-2.339682
H	-0.725318	1.412632	1.700653
H	-2.683971	0.006100	2.342102
H	-3.945182	-1.251884	0.544458
H	0.991693	2.863063	-0.757393
H	1.394449	2.249901	0.889090
H	2.516124	1.972089	-0.476213
F	2.752527	-0.720284	-0.683503

TSA.xyz

O	0.986130	1.418114	0.095781
C	1.908320	0.625352	-0.679694
H	2.271835	1.234145	-1.527703
H	1.367630	-0.250448	-1.073150
C	3.051762	0.207737	0.223480
H	2.638920	-0.375265	1.064871
H	3.511405	1.110883	0.661372
C	-1.280576	-0.129710	2.066999
N	-2.171214	0.335957	1.018867
S	-2.118103	-0.581428	-0.352686
H	-1.403896	0.532753	2.936051
H	-1.553629	-1.157397	2.372169

H	-0.217268	-0.141520	1.763933
O	-2.837967	0.083872	-1.419656
O	-0.823556	-1.210866	-0.612088
C	-0.157323	1.761877	-0.485921
H	-0.275460	1.516648	-1.548455
C	-1.196376	2.275670	0.238487
H	-1.047375	2.579370	1.274952
H	-2.104884	2.581822	-0.276323
F	-3.068615	-1.809432	0.149947
C	4.107876	-0.618540	-0.516268
H	4.510460	-0.027994	-1.359250
H	3.626781	-1.504253	-0.968678
C	5.254231	-1.064378	0.391921
H	5.999788	-1.656608	-0.161368
H	5.774026	-0.197462	0.832806
H	4.883014	-1.685648	1.223821

TSAp.xyz

C	-0.602663	-1.707838	-1.248935
C	0.485431	-0.881279	-1.286345
N	0.890205	-0.225053	-0.152693
C	0.295064	-0.424637	1.054858
C	-0.793375	-1.259684	1.155638
C	-1.362689	-1.839967	-0.031070
N	1.950163	0.668797	-0.283234
C	1.659375	2.092976	-0.014944
S	3.454155	0.009830	0.212921
O	4.400651	1.088800	0.214562
O	3.237973	-0.931479	1.287305
H	-0.916962	-2.228262	-2.154496

H	1.087036	-0.685395	-2.173893
H	0.748208	0.078689	1.908490
H	-1.242424	-1.433131	2.134225
H	-1.961781	-2.747125	0.079649
H	0.750794	2.347178	-0.576550
H	1.514730	2.304382	1.056910
H	2.504221	2.679922	-0.394354
N	-2.980218	-0.815260	-0.255672
C	-4.061661	-1.310429	0.585300
H	-3.904888	-1.127575	1.662410
H	-4.985154	-0.783507	0.286852
H	-4.197146	-2.383273	0.391207
S	-2.774853	0.854974	-0.257268
O	-1.503951	1.173941	-0.871223
O	-4.026848	1.455414	-0.636222
F	3.696638	-0.881634	-1.099942
F	-2.570639	1.152033	1.331930

TSBo.xyz

C	-0.886143	2.498895	-1.798143
H	-1.600661	3.293221	-1.529296
H	-0.202448	2.886961	-2.564650
N	-0.062287	2.041011	-0.670301
S	0.968622	3.262612	0.017215
O	1.625922	2.664690	1.150319
O	0.302281	4.542362	0.027612
N	-0.698421	1.303609	0.332375
C	-1.896392	1.702367	0.869267
C	-0.035427	0.161877	0.763483
C	-2.463051	0.986215	1.893066

H	-2.341584	2.605823	0.453232
C	-0.549908	-0.499848	1.904375
H	1.021139	0.133543	0.508037
C	-1.766955	-0.130094	2.434800
H	-3.418131	1.313887	2.305290
H	0.045422	-1.313502	2.319902
H	-2.180202	-0.663463	3.293263
H	-1.417954	1.630515	-2.210007
C	2.698018	-1.593485	-2.166362
H	3.591121	-0.958003	-2.141668
H	2.969037	-2.597263	-2.535690
N	2.098117	-1.650099	-0.824719
S	3.130188	-1.816119	0.467665
O	2.351632	-1.644128	1.679276
O	4.361592	-1.125519	0.190587
H	1.967477	-1.140509	-2.851582
C	-0.354197	-1.370282	-0.853385
H	-0.287987	-0.593850	-1.630883
C	0.804390	-2.318539	-0.696269
H	0.715644	-2.832441	0.271794
H	0.710090	-3.109143	-1.466542
O	-1.525025	-1.941809	-0.641248
C	-2.729264	-1.303977	-1.122835
H	-2.627767	-0.211789	-1.006283
H	-2.825545	-1.530188	-2.198696
C	-3.912217	-1.823647	-0.332384
H	-3.726901	-1.632334	0.738419
H	-3.965816	-2.918712	-0.451051
F	3.453980	-3.401595	0.395500
F	1.988475	3.277991	-1.215729
C	-5.230753	-1.174780	-0.765335
H	-5.151502	-0.077175	-0.653603
H	-5.394310	-1.359072	-1.842123
C	-6.429791	-1.687500	0.032724
H	-7.362766	-1.204809	-0.294618
H	-6.554209	-2.775257	-0.091277
H	-6.308120	-1.487526	1.110142

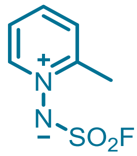
TSBp.xyz

C	3.680366	0.384736	-0.797128
H	3.806788	0.969194	0.126948
H	4.663466	0.114619	-1.203193
N	2.938798	-0.870277	-0.588426
S	3.794870	-2.140283	0.205005
O	2.854057	-3.213838	0.406799
O	4.665546	-1.613566	1.229837
N	1.634021	-0.771474	-0.105980
C	1.379418	-0.303246	1.160478
C	0.633269	-1.276844	-0.892115
C	0.107736	-0.345151	1.667049
H	2.241546	0.053523	1.724134
C	-0.651712	-1.345382	-0.421743
H	0.952223	-1.636359	-1.869742
C	-0.970393	-0.854172	0.880748
H	-0.054834	-0.009127	2.692304
H	-1.425142	-1.780711	-1.055680
H	-1.840502	-1.262138	1.396614
H	3.133040	0.973755	-1.541629
C	-0.976917	3.466993	1.422084
H	-0.049667	3.765010	1.927440

H	-1.466144	4.357376	0.993556
N	-0.670096	2.472613	0.383376
S	0.771183	2.644604	-0.393416
O	0.829903	1.713899	-1.504811
O	1.837136	2.758396	0.578075
H	-1.639067	3.012287	2.171788
C	-2.465048	0.793081	0.480441
H	-2.644277	0.980126	1.549585
C	-1.778565	1.853881	-0.334635
H	-1.423857	1.407867	-1.274072
H	-2.536799	2.614923	-0.611600
O	-3.412377	0.165689	-0.194358
C	-4.463485	-0.519714	0.531510
H	-4.002491	-1.228014	1.243852
H	-5.023927	0.232728	1.113191
C	-5.352659	-1.237764	-0.462234
H	-4.738046	-1.949116	-1.040706
H	-5.742574	-0.499342	-1.183075
F	0.616254	4.111514	-1.044734
F	4.723984	-2.500403	-1.045099
C	-6.510466	-1.974581	0.220643
H	-6.105157	-2.697572	0.951656
H	-7.108651	-1.252659	0.805082
C	-7.412572	-2.702147	-0.776677
H	-6.847731	-3.454687	-1.350851
H	-8.235132	-3.221595	-0.262696
H	-7.859066	-1.998027	-1.497473

3. Characterization Data for Products

(fluorosulfonyl)(2-methylpyridin-1-ium-1-yl)amide (S1)



White solid (4 steps, 24.0 mmol, 2.7 g, 58%); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.68 – 8.66 (m, 1H), 8.09 (td, *J* = 7.8, 1.4 Hz, 1H), 7.76 – 7.73 (m, 1H), 7.70 – 7.67 (m, 1H), 2.88 (s, 3H); ^{13}C NMR (101 MHz, Chloroform-*d*) δ 157.0, 146.5, 140.3, 128.7, 124.8, 19.9; ^{19}F NMR (376 MHz, Chloroform-*d*) δ 51.16; HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_6H_8FN_2O_2S^+$ 191.0285; found 191.0290.

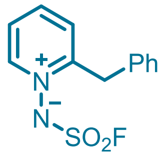
(fluorosulfonyl)(2-methoxypyridin-1-ium-1-yl)amide (S2)

White solid (4 steps, 22.0 mmol, 2.7 g, 59%); ^{1}H NMR (600 MHz, DMSO-d_6) δ 8.53 (dd, *J* = 6.6, 1.8 Hz, 1H), 8.38 – 8.35 (m, 1H), 7.72 (dd, *J* = 9.0, 1.2 Hz, 1H), 7.49 – 7.46 (m, 1H), 4.22 (s, 3H); ^{13}C NMR (151 MHz, DMSO-d_6) δ 160.9, 145.7, 145.2, 118.9, 112.2, 59.5; ^{19}F NMR (565 MHz, DMSO-d_6) δ 53.48; HRMS (ESI) *m/z*: $[M + Na]^+$ calcd for $C_6H_7FN_2O_3SNa^+$ 229.0054; found 229.0056.

(fluorosulfonyl)(2-phenylpyridin-1-ium-1-yl)amide (S3)

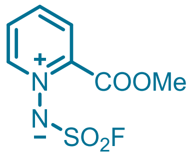
White solid (4 steps, 20.0 mmol, 1.7 g, 34%); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.76 (d, *J* = 6.4 Hz, 1H), 8.18 (t, *J* = 7.6 Hz, 1H), 7.81 (d, *J* = 8.0 Hz, 1H), 7.77 – 7.71 (m, 3H), 7.53 – 7.52 (m, 3H); ^{13}C NMR (101 MHz, Chloroform-*d*) δ 156.6, 146.7, 140.6, 131.6, 130.9, 129.7, 129.6, 128.5, 125.6; ^{19}F NMR (376 MHz, Chloroform-*d*) δ 51.91; HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{11}H_{10}FN_2O_2S^+$ 253.0442; found 253.0448.

(2-benzylpyridin-1-ium-1-yl)(fluorosulfonyl)amide (S4)



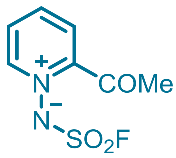
White solid (4 steps, 23.0 mmol, 2.5 g, 41%); ^{1}H NMR (600 MHz, DMSO-d_6) δ 8.87 (d, J = 6.6 Hz, 1H), 8.33 (t, J = 7.8 Hz, 1H), 7.91 (t, J = 7.2 Hz, 1H), 7.78 (d, J = 8.4 Hz, 1H), 7.37 – 7.35 (m, 2H), 7.32 – 7.28 (m, 3H), 4.51 (s, 2H); ^{13}C NMR (151 MHz, DMSO-d_6) δ 157.7, 146.9, 142.9, 136.0, 130.0, 129.33, 129.25, 127.7, 126.6, 37.2; ^{19}F NMR (565 MHz, DMSO-d_6) δ 53.27; HRMS (ESI) m/z: [M + Na]$^+$ calcd for $C_{12}H_{11}FN_2O_2SNa^+$ 289.0417; found 289.0423.

(fluorosulfonyl)(2-(methoxycarbonyl)pyridin-1-ium-1-yl)amide (S5)



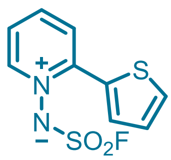
White solid (4 steps, 23.0 mmol, 1.1 g, 21%); ^{1}H NMR (600 MHz, DMSO-d_6) δ 9.03 (d, J = 6.0 Hz, 1H), 8.58 (t, J = 9.0 Hz, 1H), 8.35 (dd, J = 7.8, 1.2 Hz, 1H), 8.20 – 8.18 (m, 1H), 3.97 (s, 3H); ^{13}C NMR (151 MHz, DMSO-d_6) δ 160.5, 147.4, 145.7, 144.0, 130.2, 127.8, 54.4; ^{19}F NMR (565 MHz, DMSO-d_6) δ 52.29; HRMS (ESI) m/z: [M + Na]$^+$ calcd for $C_7H_7FN_2O_4SNa^+$ 257.0003; found 2257.0010.

(2-acetylpyridin-1-ium-1-yl)(fluorosulfonyl)amide (S6)



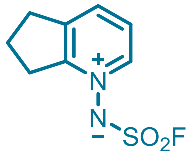
Orange solid (4 steps, 23.0 mmol, 1.1 g, 22%); ^{1}H NMR (400 MHz, DMSO-d_6) δ 8.96 (d, J = 6.0 Hz, 1H), 8.58 – 8.54 (m, 1H), 8.17 – 8.13 (m, 2H), 2.67 (s, 3H); ^{13}C NMR (101 MHz, DMSO-d_6) δ 194.4, 146.6, 144.2, 129.9, 127.1, 30.4; ^{19}F NMR (377 MHz, DMSO-d_6) δ 51.28.

(fluorosulfonyl)(2-(thiophen-2-yl)pyridin-1-ium-1-yl)amide (S7)



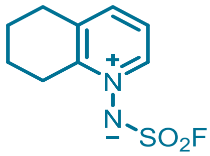
White solid (4 steps, 23.0 mmol, 3.8 g, 63%); ^{1}H NMR (600 MHz, DMSO-d_6) δ 8.78 (d, J = 6.6 Hz, 1H), 8.71 (d, J = 6.0 Hz, 1H), 8.39 (d, J = 4.2 Hz, 1H), 8.35 – 8.32 (m, 1H), 8.14 (d, J = 4.8 Hz, 1H), 7.81 – 7.79 (m, 1H), 7.35 – 7.34 (m, 1H); ^{13}C NMR (151 MHz, DMSO-d_6) δ 148.3, 145.9, 141.8, 137.3, 134.9, 131.0, 128.0, 126.5, 125.1; ^{19}F NMR (565 MHz, DMSO-d_6) δ 55.66; HRMS (ESI) *m/z*: [M + H]$^+$ calcd for $C_9H_8FN_2O_2S_2^+$ 259.0006; found 259.0012.

(6,7-dihydro-5H-cyclopenta[b]pyridin-1-ium-1-yl)(fluorosulfonyl)amide (S8)



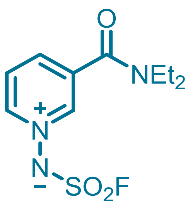
Grayish-green solid (4 steps, 23.0 mmol, 4.2 g, 85%); ^{1}H NMR (600 MHz, DMSO-d_6) δ 8.58 (d, J = 6.0 Hz, 1H), 8.23 (d, J = 7.8 Hz, 1H), 7.78 (t, J = 6.6 Hz, 1H), 3.30 (t, J = 7.8 Hz, 2H), 3.16 (t, J = 7.2 Hz, 2H), 2.22 – 2.17 (m, 2H); ^{13}C NMR (151 MHz, DMSO-d_6) δ 161.4, 145.4, 143.4, 138.3, 126.3, 31.8, 31.5, 22.3; ^{19}F NMR (565 MHz, DMSO-d_6) δ 52.77; HRMS (ESI) *m/z*: [M + Na]$^+$ calcd for $C_8H_9FN_2O_2SNa^+$ 239.0261; found 239.0263.

(fluorosulfonyl)(5,6,7,8-tetrahydroquinolin-1-ium-1-yl)amide (S9)



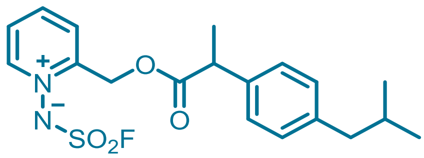
Yellow solid (4 steps, 23.0 mmol, 2.9 g, 54%); ^{1}H NMR (600 MHz, DMSO-d_6) δ 8.66 (d, J = 6.0 Hz, 1H), 8.14 (d, J = 7.8 Hz, 1H), 7.77 (t, J = 7.2 Hz, 1H), 3.09 (t, J = 6.0 Hz, 2H), 2.93 (t, J = 6.0 Hz, 2H), 1.87 – 1.85 (m, 2H), 1.76 – 1.74 (m, 2H); ^{13}C NMR (151 MHz, DMSO-d_6) δ 154.9, 144.5, 142.7, 139.4, 124.7, 28.3, 26.7, 21.3, 20.9; ^{19}F NMR (565 MHz, DMSO-d_6) δ 53.68; HRMS (ESI) *m/z*: [M + Na]$^+$ calcd for $C_9H_{11}FN_2O_2SNa^+$ 253.0417; found 253.0422.

(3-(diethylcarbamoyl)pyridin-1-ium-1-yl)(fluorosulfonyl)amide (S10)



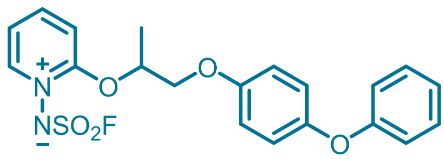
White solid (4 steps, 23.0 mmol, 3.9 g, 65%); ^{1}H NMR (400 MHz, DMSO-d_6) δ 9.10 (s, 1H), 8.97 (d, J = 6.4 Hz, 1H), 8.49 (d, J = 8.0 Hz, 1H), 8.11 (dd, J = 7.6, 6.0 Hz, 1H), 3.48 (q, J = 7.2 Hz, 2H), 3.19 (q, J = 6.8 Hz, 2H), 1.18 (t, J = 6.8 Hz, 3H), 1.06 (t, J = 6.8 Hz, 3H); ^{13}C NMR (101 MHz, DMSO-d_6) δ 163.8, 146.5, 143.9, 140.6, 137.7, 129.1, 43.5, 39.7, 14.2, 13.0; ^{19}F NMR (377 MHz, DMSO-d_6) δ 48.34; HRMS (ESI) *m/z*: $[M + Na]^+$ calcd for $C_{10}H_{14}FN_3O_3SNa^+$ 298.0632; found 298.0633.

(fluorosulfonyl)(2-(((2-(4-isobutylphenyl)propanoyl)oxy)methyl)pyridin-1-ium-1-yl)amide (S11)



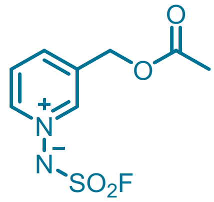
White solid (5 steps, 23.0 mmol, 1.5 g, 17%); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.66 (d, J = 6.4 Hz, 1H), 7.90 – 7.86 (m, 1H), 7.68 – 7.64 (m, 1H), 7.25 (d, J = 8.0 Hz, 2H), 7.15 – 7.14 (m, 3H), 5.76 (d, J = 17.6 Hz, 1H), 5.49 (d, J = 17.6 Hz, 1H), 3.88 (q, J = 7.2 Hz, 1H), 2.49 (d, J = 7.2 Hz, 2H), 1.92 – 1.82 (m, 1H), 1.58 (d, J = 7.2 Hz, 3H), 0.92 (d, J = 6.8 Hz, 6H); ^{13}C NMR (101 MHz, Chloroform-*d*) δ 173.1, 146.09, 146.07, 141.3, 140.4, 136.9, 129.7, 127.4, 125.6, 124.6, 60.32, 60.30, 45.0, 30.3, 22.4, 17.8; ^{19}F NMR (377 MHz, Chloroform-*d*) δ 51.20; HRMS (ESI) *m/z*: $[M + Na]^+$ calcd for $C_{19}H_{23}FN_2O_4SNa^+$ 417.1255; found 417.1268.

(fluorosulfonyl)(2-((1-(4-phenoxyphenoxy)propan-2-yl)oxy)pyridin-1-ium-1-yl)amide (S12)



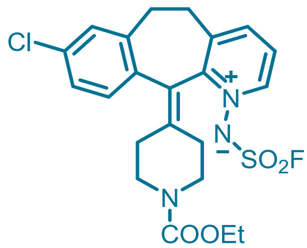
White solid (4 steps, 23.0 mmol, 4.0 g, 42%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.39 (d, J = 6.6 Hz, 1H), 8.07 (t, J = 7.8 Hz, 1H), 7.52 (d, J = 9.0 Hz, 1H), 7.31 – 7.27 (m, 3H), 7.05 (t, J = 7.2 Hz, 1H), 6.94 (dd, J = 11.4, 9.0 Hz, 4H), 6.80 (d, J = 9.0 Hz, 2H), 5.28 – 5.24 (m, 1H), 4.32 (dd, J = 10.8, 7.8 Hz, 1H), 4.19 (dd, J = 10.2, 3.0 Hz, 1H), 1.66 (d, J = 6.6 Hz, 3H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 160.5, 158.1, 153.9, 151.2, 146.0, 142.9, 129.7, 122.7, 120.7, 117.93, 117.85, 115.9, 112.9, 79.1, 71.7, 16.8; ^{19}F NMR (565 MHz, Chloroform-*d*) δ 51.53; HRMS (ESI) *m/z*: $[M + Na]^+$ calcd for $C_{20}H_{19}FN_2O_5SNa^+$ 441.0891; found 441.0896.

(3-(acetoxymethyl)pyridin-1-ium-1-yl)(fluorosulfonyl)amide (S13)



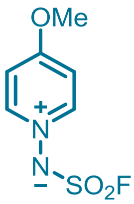
White solid (5 steps, 23.0 mmol, 1.4 g, 25%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.69 (s, 1H), 8.64 (d, *J* = 6.0 Hz, 1H), 8.18 (d, *J* = 8.4 Hz, 1H), 7.84 (dd, *J* = 7.8, 6.0 Hz, 1H), 5.26 (s, 2H), 2.18 (s, 3H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 170.1, 144.6, 144.4, 140.0, 137.8, 127.3, 61.5, 20.6; ^{19}F NMR (565 MHz, Chloroform-*d*) δ 47.15; HRMS (ESI) *m/z*: $[M + Na]^+$ calcd for $C_8H_9FN_2O_4SNa^+$ 249.0159; found 249.0171.

(8-chloro-11-(1-(ethoxycarbonyl)piperidin-4-ylidene)-6,11-dihydro-5H-benzo[5,6]cyclohepta[1,2-b]pyridin-1-ium-1-yl)(fluorosulfonyl)amide (S14)



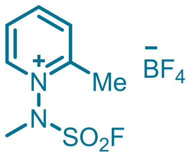
White solid (4 steps, 23.0 mmol, 3.3 g, 30%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.55 (d, *J* = 6.6 Hz, 1H), 7.95 (d, *J* = 7.8 Hz, 1H), 7.59 – 7.56 (m, 1H), 7.24 (d, *J* = 8.4 Hz, 1H), 7.18 – 7.17 (m, 1H), 7.08 (s, 1H), 4.14 (d, *J* = 6.6 Hz, 2H), 3.80 – 3.76 (m, 1H), 3.64 – 3.60 (m, 1H), 3.53 – 3.44 (m, 3H), 3.40 (dt, *J* = 17.4, 4.8 Hz, 1H), 3.02 (dt, *J* = 14.4, 4.8 Hz, 1H), 2.96 – 2.90 (m, 1H), 2.56 – 2.52 (m, 1H), 2.31 – 2.27 (m, 2H), 1.91 – 1.87 (m, 1H), 1.25 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 155.4, 154.82, 154.80, 143.6, 143.08, 143.06, 140.2, 139.5, 137.3, 134.3, 133.5, 132.1, 130.0, 126.6, 125.2, 122.9, 61.5, 44.5, 43.7, 32.5, 31.4, 30.8, 30.5, 14.7; ^{19}F NMR (565 MHz, Chloroform-*d*) δ 54.25, 53.98; HRMS (ESI) *m/z*: $[M + Na]^+$ calcd for $C_{22}H_{23}ClFN_3O_4SNa^+$ 502.0974; found 502.0978.

(fluorosulfonyl)(4-methoxypyridin-1-ium-1-yl)amide (S15)



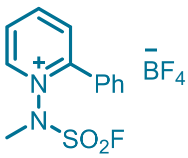
White solid (4 steps, 23.0 mmol, 2.5 g, 52%); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.45 (d, *J* = 7.6 Hz, 2H), 7.19 (d, *J* = 7.5 Hz, 2H), 4.09 (s, 3H); ^{13}C NMR (101 MHz, Chloroform-*d*) δ 168.5, 147.1, 112.7, 57.6; ^{19}F NMR (377 MHz, Chloroform-*d*) δ 45.33; HRMS (ESI) *m/z*: $[M + Na]^+$ calcd for $C_6H_7FN_2O_3SNa^+$ 229.0054; found 229.0057.

1-((fluorosulfonyl)(methyl)amino)-2-methylpyridin-1-ium tetrafluoroborate (S16)



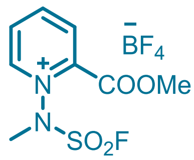
White solid (14.0 mmol, 3.2 g, 78%); ^{1}H NMR (400 MHz, DMSO-d_6) δ 9.66 (d, *J* = 6.4 Hz, 1H), 8.84 (t, *J* = 7.6 Hz, 1H), 8.39 (t, *J* = 7.6 Hz, 1H), 8.32 (t, *J* = 6.4 Hz, 1H), 3.93 (s, 3H), 2.94 (s, 3H); ^{13}C NMR (101 MHz, DMSO-d_6) δ 160.4, 150.5, 145.9, 132.1, 128.7, 42.4, 19.4; ^{19}F NMR (376 MHz, DMSO-d_6) δ 46.61, -148.26; HRMS (ESI) *m/z*: $[M – BF_4]^+$ calcd for $C_7H_{10}FN_2O_2S^+$ 205.0442; found 205.0445.

1-((fluorosulfonyl)(methyl)amino)-2-phenylpyridin-1-ium tetrafluoroborate (S17)



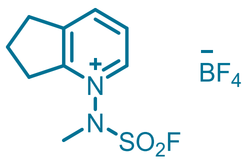
White solid (6.8 mmol, 1.1 g, 46%); ^{1}H NMR (600 MHz, DMSO-d_6) δ 9.89 (d, *J* = 6.6 Hz, 1H), 9.03 (t, *J* = 7.8 Hz, 1H), 8.55 – 8.52 (m, 2H), 7.76 – 7.68 (m, 5H), 4.01 (s, 3H); ^{13}C NMR (151 MHz, DMSO-d_6) δ 158.4, 151.3, 146.2, 132.54, 132.50, 129.99, 129.96, 129.9, 129.5, 42.8; ^{19}F NMR (376 MHz, DMSO-d_6) δ 45.48, -148.33; HRMS (ESI) *m/z*: $[M – BF_4]^+$ calcd for $C_{12}H_{12}FN_2O_2S^+$ 267.0598; found 267.0606.

1-((fluorosulfonyl)(methyl)amino)-2-(methoxycarbonyl)pyridin-1-ium tetrafluoroborate (S18)



White solid (4.8 mmol, 1.2 g, 74%); ^{1}H NMR (600 MHz, DMSO-d_6) δ 10.01 (d, J = 6.0 Hz, 1H), 9.16 (t, J = 7.2 Hz, 1H), 8.86 (d, J = 7.8 Hz, 1H), 8.71 (t, J = 6.6 Hz, 1H), 4.09 (s, 3H), 3.95 (s, 3H); ^{13}C NMR (151 MHz, DMSO-d_6) δ 158.0, 153.0, 150.2, 144.1, 133.7, 132.2, 55.7, 43.2; ^{19}F NMR (565 MHz, DMSO-d_6) δ 48.76, -148.37; HRMS (ESI) m/z: $[M - BF_4]^+$ calcd for $C_8H_{10}FN_2O_4S^+$ 249.0340; found 249.0341.

1-((fluorosulfonyl)(methyl)amino)-6,7-dihydro-5H-cyclopenta[b]pyridin-1-ium tetrafluoroborate (S19)

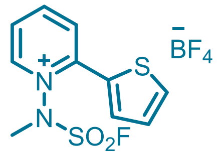


Gray solid (19.5 mmol, 3.5 g, 57%); ^{1}H NMR (600 MHz, DMSO-d_6) δ 9.46 (d, J = 6.0 Hz, 1H), 8.72 (d, J = 7.8 Hz, 1H), 8.22 (t, J = 7.2 Hz, 1H), 3.92 (s, 3H), 3.61 – 3.55 (m, 1H), 3.42 – 3.36 (m, 1H), 3.33 – 3.22 (m, 2H), 2.37 – 2.24 (m, 2H); ^{13}C NMR (151 MHz, DMSO-d_6) δ 165.6, 148.4, 145.8, 141.8, 128.6, 42.2, 32.3, 31.8, 22.4; ^{19}F NMR (565 MHz, DMSO-d_6) δ 46.49, -148.37; HRMS (ESI) m/z: $[M - BF_4]^+$ calcd for $C_9H_{12}FN_2O_2S^+$ 231.0598; found 231.0597.

1-((fluorosulfonyl)(methyl)amino)-5,6,7,8-tetrahydroquinolin-1-ium tetrafluoroborate (S20)

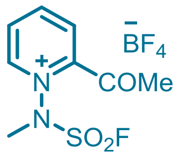
White solid (12.5 mmol, 1.7 g, 42%); ^{1}H NMR (600 MHz, DMSO-d_6) δ 9.53 (d, J = 6.6 Hz, 1H), 8.67 (d, J = 7.8 Hz, 1H), 8.23 (t, J = 7.2 Hz, 1H), 3.89 (s, 3H), 3.33 – 3.28 (m, 1H), 3.11 – 2.95 (m, 3H), 2.03 – 1.99 (m, 1H), 1.87 – 1.85 (m, 2H), 1.78 – 1.71 (m, 1H); ^{13}C NMR (151 MHz, DMSO-d_6) δ 158.7, 150.4, 143.7, 142.2, 127.1, 42.4, 28.3, 26.6, 20.8, 20.4; ^{19}F NMR (377 MHz, DMSO-d_6) δ 46.87, -148.32; HRMS (ESI) m/z: $[M - BF_4]^+$ calcd for $C_{10}H_{14}FN_2O_2S^+$ 245.0755; found 245.0756.

1-((fluorosulfonyl)(methyl)amino)-2-(thiophen-2-yl)pyridin-1-ium tetrafluoroborate (S21)



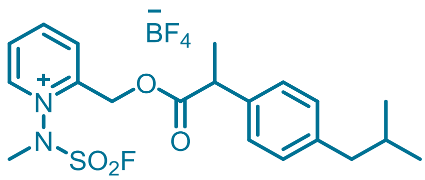
White solid (14.6 mmol, 3.8 g, 61%); ^{1}H NMR (600 MHz, DMSO-d_6) δ 9.59 (d, J = 6.6 Hz, 1H), 8.98 – 8.97 (m, 1H), 8.81 (t, J = 8.4 Hz, 1H), 8.54 – 8.53 (m, 1H), 8.45 (d, J = 5.4 Hz, 1H), 8.25 – 8.22 (m, 1H), 7.53 – 7.52 (m, 1H), 4.06 (s, 3H); ^{13}C NMR (151 MHz, DMSO-d_6) δ 151.7, 149.3, 144.2, 139.7, 138.6, 129.9, 129.2, 128.9, 127.6, 42.0; ^{19}F NMR (377 MHz, DMSO-d_6) δ 46.15, -148.21; HRMS (ESI) m/z: $[M – BF_4]^+$ calcd for $C_{10}H_{10}FN_2O_2S_2^+$ 273.0162; found 273.0157.

2-acetyl-1-((fluorosulfonyl)(methyl)amino)pyridin-1-ium tetrafluoroborate (S22)



Orange solid (5.0 mmol, 0.8 g, 51%); ^{1}H NMR (600 MHz, DMSO-d_6) δ 9.95 (d, J = 6.0 Hz, 1H), 9.18 (t, J = 7.8 Hz, 1H), 8.85 (d, J = 7.2 Hz, 1H), 8.66 (t, J = 6.6 Hz, 1H), 3.93 (s, 3H), 2.83 (s, 3H); ^{13}C NMR (151 MHz, DMSO-d_6) δ 191.7, 152.9, 149.8, 148.7, 132.9, 130.7, 43.2, 30.4; ^{19}F NMR (565 MHz, DMSO-d_6) δ 47.16, -148.28; HRMS (ESI) m/z: $[M – BF_4]^+$ calcd for $C_8H_{10}FN_2O_3S^+$ 233.0391; found 233.0398.

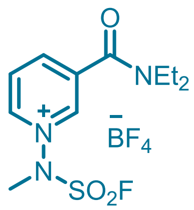
1-((fluorosulfonyl)(methyl)amino)-2-(((2-(4-isobutylphenyl)propanoyl)oxy)methyl)pyridin-1-ium tetrafluoroborate (S23)



Brown oil (3.9 mmol, 1.47 g, 77%); ^{1}H NMR (400 MHz, Chloroform-d) δ 9.17 (d, J = 5.2 Hz, 1H), 8.65 – 8.57 (m, 1H), 8.22 (q, J = 6.0 Hz, 1H), 7.96 (d, J = 8.0 Hz, 1H), 7.21 – 7.18 (m, 2H), 7.11 (dd, J = 8.0, 3.2 Hz, 2H), 5.51 – 5.36 (m, 1H), 3.85 (q, J = 6.8 Hz, 1H), 3.75 (d, J = 26.4 Hz, 3H), 2.44 (dd, J = 7.2, 3.6 Hz, 2H), 1.89 – 1.78 (m, 1H), 1.51 (dd, J = 14.4, 7.2 Hz, 3H), 0.89 (dd, J = 6.4, 2.0 Hz, 6H); ^{13}C NMR (101

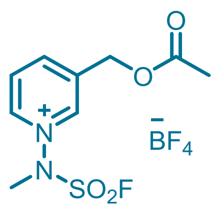
MHz, Chloroform-*d*) δ 173.7, 173.6, 155.5, 155.0, 151.1, 150.8, 145.5, 145.2, 141.3, 141.2, 136.534, 136.526, 130.6, 130.4, 130.03, 129.96, 129.7, 129.6, 127.4, 127.3, 60.03, 60.01, 44.96, 44.95, 44.7, 44.6, 42.0, 41.9, 30.2, 22.4, 18.2, 18.0; ^{19}F NMR (377 MHz, Chloroform-*d*) δ 43.19, 43.12, -150.62; HRMS (ESI) *m/z*: $[M - BF_4]^+$ calcd for $C_{20}H_{26}FN_2O_4S^+$ 409.1592; found 409.1592.

3-(diethylcarbamoyl)-1-((fluorosulfonyl)(methyl)amino)pyridin-1-ium tetrafluoroborate (S24)



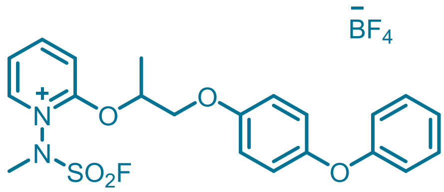
White solid (14.9 mmol, 3.9 g, 52%); ^{1}H NMR (600 MHz, DMSO-d_6) δ 10.05 (s, 1H), 9.83 (d, *J* = 6.6 Hz, 1H), 9.04 (d, *J* = 7.8 Hz, 1H), 8.56 (t, *J* = 7.2 Hz, 1H), 3.98 (s, 3H), 3.51 (q, *J* = 6.6 Hz, 2H), 3.22 (q, *J* = 6.6 Hz, 2H), 1.20 (t, *J* = 6.6 Hz, 3H), 1.08 (t, *J* = 6.6 Hz, 3H); ^{13}C NMR (151 MHz, DMSO-d_6) δ 162.7, 148.3, 147.8, 145.2, 139.2, 131.3, 43.5, 42.5, 14.1, 13.0; ^{19}F NMR (565 MHz, DMSO-d_6) δ 43.56, -148.33; HRMS (ESI) *m/z*: $[M - BF_4]^+$ calcd for $C_{11}H_{17}FN_3O_3S^+$ 290.0975; found 290.0958.

3-(acetoxymethyl)-1-((fluorosulfonyl)(methyl)amino)pyridin-1-ium tetrafluoroborate (S25)



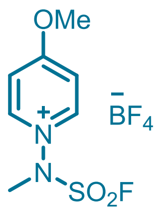
Brown oil (2.0 mmol, 0.4 g, 56%); ^{1}H NMR (400 MHz, DMSO-d_6) δ 9.81 (s, 1H), 9.72 (d, *J* = 6.4 Hz, 1H), 8.97 (d, *J* = 8.0 Hz, 1H), 8.50 (dd, *J* = 7.6, 6.4 Hz, 1H), 5.37 (s, 2H), 3.96 (s, 3H), 2.16 (s, 3H); ^{13}C NMR (101 MHz, DMSO-d_6) δ 170.5, 149.9, 146.7, 145.9, 140.5, 130.4, 61.6, 42.6, 21.0; ^{19}F NMR (377 MHz, DMSO-d_6) δ 43.79, -148.28; HRMS (ESI) *m/z*: $[M - BF_4]^+$ calcd for $C_9H_{12}FN_2O_4S^+$ 263.0496; found 263.0500.

1-((fluorosulfonyl)(methyl)amino)-2-((1-(4-phenoxyphenoxy)propan-2-yl)oxy)pyridin-1-ium tetrafluoroborate (S26)



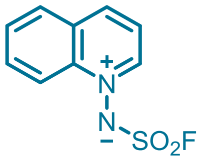
White solid (2.0 mmol, 0.8 g, 78%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.61 (t, *J* = 9.0 Hz, 0.48H), 8.52 (t, *J* = 8.4 Hz, 0.52H), 8.40 (d, *J* = 6.6 Hz, 0.48H), 8.35 (d, *J* = 6.6 Hz, 0.52H), 7.93 (d, *J* = 9.0 Hz, 0.52H), 7.88 (d, *J* = 9.0 Hz, 0.44H), 7.59 (t, *J* = 7.2 Hz, 0.45H), 7.54 (t, *J* = 7.2 Hz, 0.55H), 7.30 – 7.28 (m, 2H), 7.04 (t, *J* = 7.2 Hz, 1H), 6.96 – 6.89 (m, 5H), 6.76 (d, *J* = 9.0 Hz, 1H), 5.71 – 5.67 (m, 0.54H), 5.600 – 5.596 (m, 0.41H), 4.39 – 4.37 (m, 0.44H), 4.27 (d, *J* = 11.4 Hz, 0.53H), 4.22 (dd, *J* = 10.8, 5.4 Hz, 0.48H), 4.12 (dd, *J* = 10.8, 7.8 Hz, 0.52H), 3.75 (s, 1.52H), 3.68 (s, 1.34H), 1.70 (d, *J* = 6.0 Hz, 1.61H), 1.66 (d, *J* = 6.0 Hz, 1.39H); ^{13}C NMR (151 MHz, Chloroform-d) δ 160.9, 160.3, 158.1, 158.0, 154.1, 153.8, 152.8, 151.7, 151.2, 151.1, 144.3, 143.7, 141.0, 139.1, 129.7, 122.8, 120.80, 120.77, 120.7, 120.6, 120.3, 117.8, 117.7, 114.9, 114.1, 82.3, 82.1, 70.7, 69.6, 40.5, 15.9, 15.5; ^{19}F NMR (565 MHz, Chloroform-*d*) δ 50.44, 49.97, -151.47, -151.53; HRMS (ESI) *m/z*: $[M – BF_4]^+$ calcd for $C_{21}H_{22}FN_2O_5S^+$ 433.1228; found 433.1201.

1-((fluorosulfonyl)(methyl)amino)-4-methoxypyridin-1-ium tetrafluoroborate (S27)



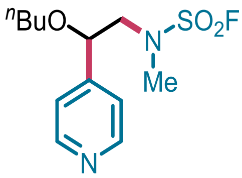
White solid (12.0 mmol, 3.3 g, 89%); ^{1}H NMR (400 MHz, DMSO-d_6) δ 9.46 (d, *J* = 7.6 Hz, 2H), 7.91 (d, *J* = 7.7 Hz, 2H), 4.23 (s, 3H), 3.87 (d, *J* = 1.2 Hz, 3H); ^{13}C NMR (101 MHz, DMSO-d_6) δ 174.3, 148.0, 115.7, 60.0, 42.1; ^{19}F NMR (377 MHz, DMSO-d_6) δ 43.52, -148.26; HRMS (ESI) *m/z*: $[M – BF_4]^+$ calcd for $C_7H_{10}FN_2O_3S^+$ 221.0391; found 221.0413.

(fluorosulfonyl)(quinolin-1-ium-1-yl)amide (S28)



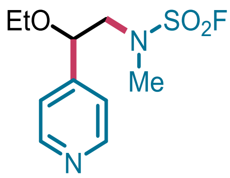
White solid (4 steps, 23.0 mmol, 1.9 g, 26%); ^{1}H NMR (600 MHz, DMSO-d_6) δ 9.38 (d, J = 6.0 Hz, 1H), 9.14 (d, J = 8.4 Hz, 1H), 8.65 (d, J = 9.0 Hz, 1H), 8.44 (d, J = 7.8 Hz, 1H), 8.24 (t, J = 8.4 Hz, 1H), 8.10 (dd, J = 8.4, 6.0 Hz, 1H), 8.02 (t, J = 7.2 Hz, 1H); ^{13}C NMR (151 MHz, DMSO-d_6) δ 149.6, 144.6, 139.9, 135.7, 130.6, 130.5, 130.3, 122.7, 119.7; ^{19}F NMR (565 MHz, DMSO-d_6) δ 51.43; HRMS (ESI) m/z: $[M + H]^+$ calcd for $C_9H_8FN_2O_2SNa^+$ 227.0285; found 227.0263.

(2-butoxy-2-(pyridin-4-yl)ethyl)(methyl)sulfamoyl fluoride (3a)



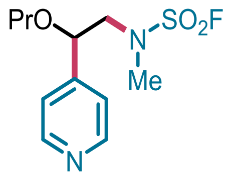
Yellow liquid (20.6 mg, 71%); ^{1}H NMR (400 MHz, Chloroform-d) δ 8.63 (d, J = 6.0 Hz, 2H), 7.28 (d, J = 6.0 Hz, 2H), 4.59 (dd, J = 9.2, 3.6 Hz, 1H), 3.57 (dd, J = 15.2, 2.4 Hz, 1H), 3.44 – 3.34 (m, 2H), 3.30 – 3.24 (m, 1H), 3.17 (d, J = 2.0 Hz, 3H), 1.62 – 1.55 (m, 2H), 1.44 – 1.34 (m, 2H), 0.92 (t, J = 7.2 Hz, 3H); ^{13}C NMR (101 MHz, Chloroform-d) δ 150.3, 147.8, 121.5, 80.1, 69.9, 57.3, 38.7, 31.8, 19.3, 13.8; ^{19}F NMR (377 MHz, Chloroform-d) δ 44.04; HRMS (ESI) m/z: $[M + H]^+$ calcd for $C_{12}H_{20}FN_2O_3S^+$ 291.1173; found 291.1194.

(2-ethoxy-2-(pyridin-4-yl)ethyl)(methyl)sulfamoyl fluoride (3b)



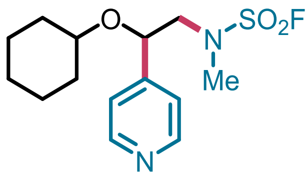
Colorless liquid (18.0 mg, 69%); ^{1}H NMR (400 MHz, Chloroform-d) δ 8.63 (d, J = 5.6 Hz, 1H), 7.28 (d, J = 4.0 Hz, 1H), 4.61 (dd, J = 8.8, 3.2 Hz, 1H), 3.59 – 3.55 (m, 1H), 3.51 – 3.41 (m, 2H), 3.31 – 3.25 (m, 1H), 3.17 (d, J = 2.0 Hz, 3H), 1.24 (t, J = 7.2 Hz, 3H); ^{13}C NMR (101 MHz, Chloroform-d) δ 150.3, 147.8, 121.4, 79.9, 65.5, 57.4, 38.7, 15.2; ^{19}F NMR (377 MHz, Chloroform-*d*) δ 44.04; HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{10}H_{16}FN_2O_3S^+$ 263.0860; found 263.0867.

methyl(2-propoxy-2-(pyridin-4-yl)ethyl)sulfamoyl fluoride (3c)



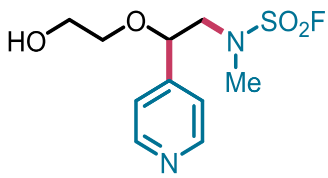
Colorless liquid (20.1 mg, 73%); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.64 (d, *J* = 4.0 Hz, 2H), 7.28 (d, *J* = 4.0 Hz, 2H), 4.60 (dd, *J* = 9.2, 3.2 Hz, 1H), 3.60 – 3.55 (m, 1H), 3.39 – 3.24 (m, 3H), 3.17 (d, *J* = 2.0 Hz, 3H), 1.67 – 1.58 (m, 2H), 0.95 (t, *J* = 7.6 Hz, 3H); ^{13}C NMR (101 MHz, Chloroform-*d*) δ 150.2, 147.9, 121.5, 80.1, 71.8, 57.4, 38.7, 23.0, 10.6; ^{19}F NMR (377 MHz, Chloroform-*d*) δ 44.05; HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{11}H_{18}FN_2O_3S^+$ 277.1017; found 277.1024.

(2-(cyclohexyloxy)-2-(pyridin-4-yl)ethyl)(methyl)sulfamoyl fluoride (3d)



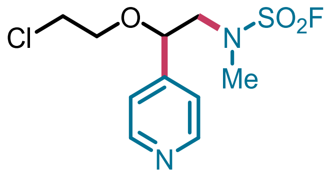
Colorless liquid (22.1 mg, 70%); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.62 (d, *J* = 6.0 Hz, 2H), 7.30 (d, *J* = 6.0 Hz, 2H), 4.77 (dd, *J* = 9.2, 3.2 Hz, 1H), 3.55 (dd, *J* = 14.8, 2.8 Hz, 1H), 3.26 – 3.19 (m, 2H), 3.17 (d, *J* = 2.0 Hz, 3H), 1.95 (d, *J* = 12.4 Hz, 1H), 1.75 – 1.66 (m, 3H), 1.36 – 1.19 (m, 6H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 149.8, 149.2, 121.6, 77.1, 77.0, 57.7, 38.8, 33.4, 31.3, 25.5, 24.0, 23.8; ^{19}F NMR (377 MHz, Chloroform-*d*) δ 44.27; HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{14}H_{22}FN_2O_3S^+$ 317.1330; found 317.1330.

(2-(2-hydroxyethoxy)-2-(pyridin-4-yl)ethyl)(methyl)sulfamoyl fluoride (3e)



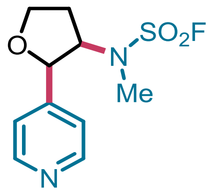
Colorless liquid (17.5 mg, 63%); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.64 (d, *J* = 6.0 Hz, 2H), 7.30 (d, *J* = 6.0 Hz, 2H), 4.67 (dd, *J* = 9.2, 4.0 Hz, 1H), 3.81 – 3.78 (m, 2H), 3.60 – 3.49 (m, 3H), 3.46 – 3.39 (m, 1H), 3.15 (d, *J* = 2.0 Hz, 2H), 2.27 (s, 1H); ^{13}C NMR (101 MHz, Chloroform-*d*) δ 150.4, 147.2, 121.5, 80.0, 71.3, 61.8, 57.3, 38.4; ^{19}F NMR (377 MHz, Chloroform-*d*) δ 44.00; HRMS (ESI) *m/z*: [M + H]$^+$ calcd for $C_{10}H_{16}FN_2O_4S^+$ 279.0809; found 279.0815.

(2-(2-chloroethoxy)-2-(pyridin-4-yl)ethyl)(methyl)sulfamoyl fluoride (3f)



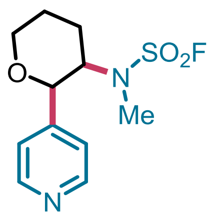
Colorless liquid (20.4 mg, 69%); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.66 (d, *J* = 6.0 Hz, 2H), 7.31 (d, *J* = 6.0 Hz, 2H), 4.69 (dd, *J* = 9.2, 3.2 Hz, 1H), 3.73 – 3.60 (m, 5H), 3.35 – 3.28 (m, 1H), 3.21 (d, *J* = 2.4 Hz, 3H); ^{13}C NMR (101 MHz, Chloroform-*d*) δ 150.4, 146.7, 121.4, 80.7, 69.9, 57.2, 42.9, 38.9; ^{19}F NMR (377 MHz, Chloroform-*d*) δ 44.21; HRMS (ESI) *m/z*: [M + H]$^+$ calcd for $C_{10}H_{15}ClFN_2O_3S^+$ 297.0470; found 297.0476.

methyl(3-(pyridin-4-yl)tetrahydrofuran-2-yl)sulfamoyl fluoride (3g)



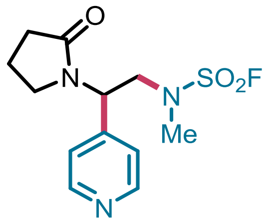
Colorless liquid (8.6 mg, 33%); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.62 (d, *J* = 6.0 Hz, 2H), 7.30 (d, *J* = 6.0 Hz, 2H), 5.00 (d, *J* = 4.4 Hz, 1H), 4.60 – 4.56 (m, 1H), 4.23 – 4.10 (m, 2H), 3.13 (d, *J* = 2.0 Hz, 3H), 2.39 – 3.29 (m, 1H), 2.26 – 2.17 (m, 1H); ^{13}C NMR (101 MHz, Chloroform-*d*) δ 150.1, 148.8, 120.2, 80.6, 67.8, 66.2, 31.7, 28.3; ^{19}F NMR (377 MHz, Chloroform-*d*) δ 43.94; HRMS (ESI) *m/z*: [M + H]$^+$ calcd for $C_{10}H_{14}FN_2O_3S^+$ 261.0704; found 261.0711.

methyl(3-(pyridin-4-yl)tetrahydro-2H-pyran-2-yl)sulfamoyl fluoride (3h)



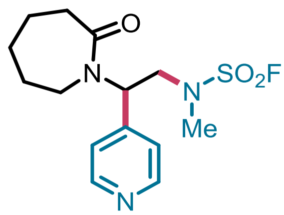
Colorless liquid (12.9 mg, 47%); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.63 (d, *J* = 6.0 Hz, 2H), 7.30 (d, *J* = 8.0 Hz, 2H), 4.38 (d, *J* = 9.6 Hz, 1H), 4.11 – 4.07 (m, 1H), 3.74 – 3.71 (m, 1H), 3.52 (td, *J* = 11.6, 3.0 Hz, 1H), 2.86 (d, *J* = 2.0 Hz, 3H), 2.21 – 2.18 (m, 1H), 2.11 – 1.87 (m, 3H); ^{13}C NMR (101 MHz, Chloroform-*d*) δ 150.1, 147.0, 122.0, 79.83, 79.80, 68.2, 26.9, 26.0; HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{11}H_{16}FN_2O_3S^+$ 275.0860; found 275.0860.

methyl(2-(2-oxopyrrolidin-1-yl)-2-(pyridin-4-yl)ethyl)sulfamoyl fluoride (3i)



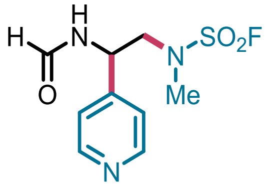
Colorless liquid (18.4 mg, 61%); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.65 (d, *J* = 4.4 Hz, 2H), 7.20 (d, *J* = 6.0 Hz, 2H), 5.58 (dd, *J* = 11.6, 4.4 Hz, 1H), 4.28 (dd, *J* = 14.4, 11.6 Hz, 1H), 3.54 - 3.41 (m, 2H), 3.15 (d, *J* = 1.6 Hz, 3H), 2.99 – 2.93 (m, 1H), 2.53 – 2.38 (m, 2H), 2.13 – 1.92 (m, 2H); ^{13}C NMR (101 MHz, Chloroform-*d*) δ 176.1, 150.7, 144.1, 122.5, 50.1, 42.9, 36.0, 30.8, 17.9; ^{19}F NMR (377 MHz, Chloroform-*d*) δ 43.47; HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{12}H_{17}FN_3O_3S^+$ 302.0969; found 302.0969.

methyl(2-(2-oxoazepan-1-yl)-2-(pyridin-4-yl)ethyl)sulfamoyl fluoride (3j)



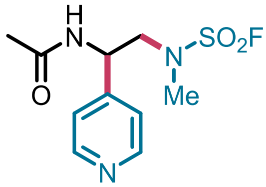
Colorless liquid (14.5 mg, 44%); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.65 (s, 2H), 7.24 (d, *J* = 4.4 Hz, 2H), 6.15 (dd, *J* = 11.2, 4.8 Hz, 1H), 4.17 (dd, *J* = 14.4, 11.2 Hz, 1H), 3.61 – 3.55 (m, 1H), 3.28 (dd, *J* = 15.6, 10.0 Hz, 1H), 3.13 – 3.07 (m, 4H), 2.66 – 2.55 (m, 2H), 1.84 – 1.66 (m, 3H), 1.62 – 1.50 (m, 3H); ^{13}C NMR (101 MHz, Chloroform-*d*) δ 177.1, 150.4, 145.4, 122.8, 51.6, 50.1, 44.7, 37.2, 36.1, 29.6, 28.4, 23.2; ^{19}F NMR (377 MHz, Chloroform-*d*) δ 42.87; HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{14}H_{21}FN_3O_3S^+$ 330.1282; found 330.1288.

(2-formamido-2-(pyridin-4-yl)ethyl)(methyl)sulfamoyl fluoride (3k)



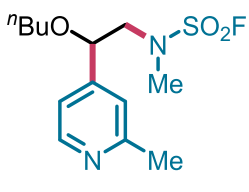
Colorless liquid (9.7 mg, 37%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.62 (d, *J* = 4.8 Hz, 2H), 8.30 (s, 1H), 7.26 (d, *J* = 6.6 Hz, 2H), 6.78 (s, 1H), 5.41 – 5.37 (m, 1H), 3.81 (dd, *J* = 14.4, 9.6 Hz, 1H), 3.48 (dd, *J* = 14.4, 4.2 Hz, 1H), 3.08 (d, *J* = 1.8 Hz, 3H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 161.2, 150.5, 146.5, 121.6, 54.7, 48.9, 36.7; ^{19}F NMR (565 MHz, Chloroform-*d*) δ 43.10; HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_9H_{12}FN_3O_3S^+$ 262.0656; found 262.0655.

(2-acetamido-2-(pyridin-4-yl)ethyl)(methyl)sulfamoyl fluoride (3l)



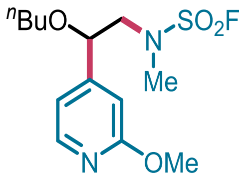
Colorless liquid (12.1 mg, 44%); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.60 (d, *J* = 5.6 Hz, 2H), 7.24 (d, *J* = 5.6 Hz, 2H), 6.66 (d, *J* = 8.0 Hz, 1H), 5.37 – 5.31 (m, 1H), 3.76 (dd, *J* = 14.8, 10.4 Hz, 1H), 3.46 – 3.41 (m, 1H), 3.08 (d, *J* = 1.6 Hz, 3H), 2.05 (s, 3H);^{13}C NMR (101 MHz, Chloroform-*d*) δ 170.5, 150.4, 147.0, 121.6, 54.9, 49.9, 36.6, 23.1; ^{19}F NMR (377 MHz, Chloroform-*d*) δ 43.44; HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{10}H_{14}FN_2O_3S^+$ 261.0704; found 261.0711.

(2-butoxy-2-(2-methylpyridin-4-yl)ethyl)(methyl)sulfamoyl fluoride (3m)



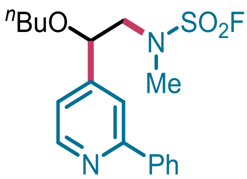
Colorless liquid (18.2 mg, 60%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.50 (d, *J* = 4.8 Hz, 1H), 7.11 (s, 1H), 7.07 (d, *J* = 5.4 Hz, 2H), 4.54 (dd, *J* = 9.0, 3.0 Hz, 1H), 3.56 (dd, *J* = 15.0, 3.0 Hz, 1H), 3.42 – 3.39 (m, 1H), 3.36 – 3.33 (m, 1H), 3.27 – 3.23 (m, 1H), 3.17 (d, *J* = 1.2 Hz, 3H), 2.58 (s, 3H), 1.61 – 1.56 (m, 2H), 1.43 – 1.37 (m, 2H), 0.92 (t, *J* = 7.8 Hz, 3H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 159.1, 149.6, 148.1, 121.0, 118.5, 80.2, 69.8, 57.4, 38.6, 31.8, 24.4, 19.3, 13.8; ^{19}F NMR (565 MHz, Chloroform-*d*) δ 44.06; HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{13}H_{22}FN_2O_3S^+$ 305.1330; found 305.1343.

(2-butoxy-2-(2-methoxypyridin-4-yl)ethyl)(methyl)sulfamoyl fluoride (3n)



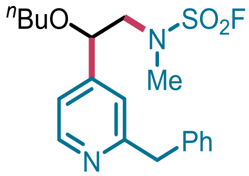
Colorless liquid (11.2 mg, 35%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.17 (d, *J* = 6.6 Hz, 1H), 6.83 (d, *J* = 4.8 Hz, 1H), 6.72 (s, 1H), 4.53 (dd, *J* = 9.6, 3.6 Hz, 1H), 3.95 (s, 3H), 3.56 (dd, *J* = 15.0, 3.0 Hz, 1H), 3.44 – 3.40 (m, 1H), 3.36 – 3.32 (m, 1H), 3.27 – 3.23 (m, 1H), 3.15 (d, *J* = 1.2 Hz, 3H), 1.60 – 1.55 (m, 2H), 1.37 – 1.43 (m, 3H), 0.91 (t, *J* = 7.8 Hz, 3H); ^{13}C NMR (101 MHz, Chloroform-*d*) δ 164.7, 150.6, 147.5, 114.6, 108.5, 80.0, 69.8, 57.3, 53.5, 38.7, 31.9, 19.3, 13.8; ^{19}F NMR (377 MHz, Chloroform-*d*) δ 44.05; HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{13}H_{22}FN_2O_4S^+$ 321.1279; found 3321.1281.

(2-butoxy-2-(2-phenylpyridin-4-yl)ethyl)(methyl)sulfamoyl fluoride (3o)



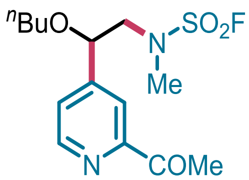
Colorless liquid (22.7 mg, 62%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.69 (d, *J* = 4.8 Hz, 1H), 8.01 (d, *J* = 7.8 Hz, 2H), 7.68 (s, 1H), 7.49 (t, *J* = 7.8 Hz, 2H), 7.43 (t, *J* = 7.2 Hz, 2H), 7.20 (d, *J* = 4.8 Hz, 1H), 4.65 (dd, *J* = 9.6, 3.0 Hz, 1H), 3.60 – 3.63 (m, 1H), 3.48 – 3.44 (m, 1H), 3.41 – 3.37 (m, 1H), 3.31 (dd, *J* = 15.0, 9.6 Hz, 1H), 3.18 (s, 3H), 1.63 – 1.58 (m, 2H), 1.46 – 1.37 (m, 2H), 0.93 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 158.2, 150.2, 148.6, 138.9, 129.3, 128.8, 127.0, 119.9, 118.1, 80.4, 69.9, 57.4, 38.7, 31.9, 19.3, 13.8; ^{19}F NMR (565 MHz, Chloroform-*d*) δ 44.19; HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{18}H_{24}FN_2O_3S^+$ 367.1486; found 367.1476.

(2-(2-benzylpyridin-4-yl)-2-butoxyethyl)(methyl)sulfamoyl fluoride (3p)



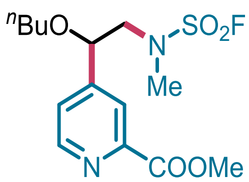
Colorless liquid (25.8 mg, 68%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.55 (d, *J* = 4.8 Hz, 1H), 7.30 (t, *J* = 7.8 Hz, 2H), 7.26 (d, *J* = 6.6 Hz, 2H), 7.22 (t, *J* = 7.2 Hz, 1H), 7.08 (s, 2H), 4.52 – 4.50 (m, 1H), 4.17 (s, 3H), 3.51 (d, *J* = 15.0 Hz, 1H), 3.32 (t, *J* = 6.0 Hz, 2H), 3.23 (dd, *J* = 15.0, 9.6 Hz, 1H), 3.10 (s, 3H), 1.55 – 1.50 (m, 2H), 1.38 – 1.28 (m, 2H), 0.89 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 161.8, 149.9, 148.4, 139.2, 129.1, 128.6, 126.5, 120.7, 119.1, 80.1, 69.8, 57.3, 44.7, 38.6, 31.8, 19.3, 13.8; ^{19}F NMR (565 MHz, Chloroform-*d*) δ 44.06; HRMS (ESI) *m/z*: [M + H]$^+$ calcd for $C_{19}H_{26}FN_2O_3S^+$ 381.1643; found 381.1665.

methyl-4-(1-butoxy-2-((fluorosulfonyl)(methyl)amino)ethyl)picolinate (3q)



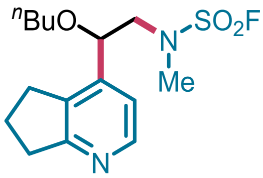
Colorless liquid (14.3 mg, 43%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.70 (d, *J* = 4.8 Hz, 1H), 8.01 (s, 1H), 7.45 (d, *J* = 4.2 Hz, 1H), 4.65 (dd, *J* = 9.0, 3.0 Hz, 1H), 3.57 (dd, *J* = 15.0, 2.4 Hz, 1H), 3.40 – 3.34 (m, 2H), 3.28 (dd, *J* = 14.4, 9.0 Hz, 1H), 3.18 (s, 3H), 2.74 (s, 3H), 1.61 – 1.56 (m, 2H), 1.42 – 1.36 (m, 2H), 0.91 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 199.8, 154.2, 149.6, 149.1, 124.8, 119.3, 80.0, 70.1, 57.1, 38.7, 31.8, 25.8, 19.3, 13.8; ^{19}F NMR (565 MHz, Chloroform-*d*) δ 43.99; HRMS (ESI) *m/z*: [M + H]$^+$ calcd for $C_{14}H_{22}FN_2O_4S^+$ 333.1279; found 333.1289.

methyl 4-(1-butoxy-2-((fluorosulfonyl)(methyl)amino)ethyl)nicotinate (3r)



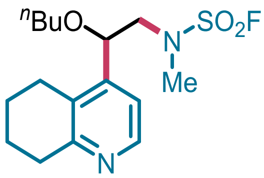
Colorless liquid (12.2 mg, 35%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.77 (d, *J* = 4.8 Hz, 1H), 8.11 (s, 1H), 7.47 (d, *J* = 4.8 Hz, 1H), 4.67 (dd, *J* = 9.0, 3.0 Hz, 1H), 4.03 (s, 3H), 3.59 (dd, *J* = 15.0, 2.4 Hz, 1H), 3.41 – 3.38 (m, 2H), 3.31 – 3.27 (m, 1H), 3.19 (s, 3H), 1.59 (q, J = 6.6 Hz, 2H), 1.43 – 1.38 (m, 2H), 0.92 (t, J = 7.8 Hz, 3H); ^{13}C NMR (151 MHz, Chloroform-d) δ 165.4, 150.3, 149.4, 148.7, 124.7, 122.8, 79.9, 70.1, 57.1, 53.0, 38.7, 31.8, 19.2, 13.8; ^{19}F NMR (565 MHz, Chloroform-d) δ 44.03; HRMS (ESI) m/z: $[M + H]^+$ calcd for $C_{14}H_{21}FN_2O_5S^+$ 349.1228; found 349.1226.

(2-butoxy-2-(6,7-dihydro-5H-cyclopenta[b]pyridin-4-yl)ethyl)(methyl)sulfamoyl fluoride (3s)



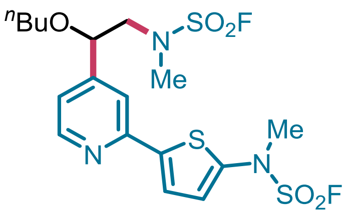
Colorless liquid (31.7 mg, 96%); ^{1}H NMR (600 MHz, Chloroform-d) δ 8.38 (d, J = 5.4 Hz, 1H), 7.07 (d, J = 5.4 Hz, 1H), 4.65 (dd, J = 9.6, 3.0 Hz, 1H), 3.57 (dd, J = 15.0, 2.4 Hz, 1H), 3.41 – 3.37 (m, 1H), 3.34 – 3.30 (m, 1H), 3.21 – 3.17 (m, 4H), 3.03 (t, J = 7.8 Hz, 2H), 2.95 (t, J = 7.8 Hz, 2H), 2.21 – 2.10 (m, 2H), 1.61 – 1.56 (m, 2H), 1.43 – 1.37 (m, 2H), 0.92 (t, J = 7.2 Hz, 3H); ^{13}C NMR (151 MHz, Chloroform-d) δ 166.5, 148.3, 143.1, 134.7, 117.7, 78.7, 69.8, 56.0, 38.7, 34.1, 31.9, 28.8, 22.9, 19.3, 13.8; ^{19}F NMR (565 MHz, Chloroform-d) δ 44.06; HRMS (ESI) m/z: $[M + H]^+$ calcd for $C_{15}H_{24}FN_2O_3S^+$ 331.1486; found 331.1498.

(2-butoxy-2-(5,6,7,8-tetrahydroquinolin-4-yl)ethyl)(methyl)sulfamoyl fluoride (3t)



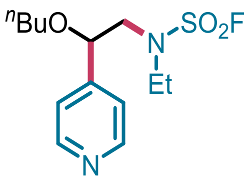
Colorless liquid (23.7 mg, 69%); ^{1}H NMR (600 MHz, Chloroform-d) δ 8.40 (d, J = 4.8 Hz, 1H), 7.17 (d, J = 4.8 Hz, 1H), 4.81 (dd, J = 9.6, 2.4 Hz, 1H), 3.57 (dd, J = 15.6, 2.4 Hz, 1H), 3.37 – 3.33 (m, 1H), 3.30 – 3.27 (m, 1H), 3.23 (d, J = 1.8 Hz, 3H), 3.09 – 3.05 (m, 1H), 2.96 (t, J = 6.0 Hz, 2H), 2.81 – 2.77 (m, 1H), 2.70 – 2.65 (m, 1H), 1.91 – 1.81 (m, 5H), 1.59 – 1.55 (m, 2H), 1.44 – 1.36 (m, 2H), 0.92 (t, J = 7.8 Hz, 3H); ^{13}C NMR (151 MHz, Chloroform-d) δ 158.0, 147.1, 145.6, 129.9, 117.8, 69.6, 56.2, 38.9, 33.2, 31.9, 24.8, 22.6, 22.5, 19.3, 13.8; ^{19}F NMR (565 MHz, Chloroform-d) δ 44.17; HRMS (ESI) m/z: $[M + Na]^+$ calcd for $C_{16}H_{25}FN_2O_3SNa^+$ 367.1462; found 367.1490.

(2-butoxy-2-(2-(5-((fluorosulfonyl)(methyl)amino)thiophen-2-yl)pyridin-4-yl)ethyl)(methyl)sulfamoyl fluoride (3u)



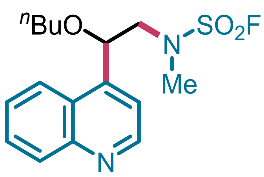
Colorless liquid (26.6 mg, 55%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.55 (d, *J* = 5.4 Hz, 1H), 7.58 (s, 1H), 7.44 (d, *J* = 3.6 Hz, 1H), 7.16 (d, *J* = 4.2 Hz, 1H), 7.09 (d, *J* = 4.2 Hz, 1H), 4.62 (dd, *J* = 9.0, 3.0 Hz, 1H), 3.60 (dd, *J* = 15.0, 3.0 Hz, 1H), 3.51 (d, *J* = 0.6 Hz, 3H), 3.45 – 3.38 (m, 2H), 3.32 – 3.28 (m, 1H), 3.18 (s, 3H), 1.63 – 1.58 (m, 2H), 1.44 – 1.39 (m, 2H), 0.93 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 152.3, 150.2, 148.9, 143.6, 142.8, 126.5, 123.0, 120.4, 116.0, 80.2, 70.1, 57.3, 42.4, 38.8, 31.9, 19.3, 13.8; ^{19}F NMR (565 MHz, Chloroform-*d*) δ 44.13, 40.52; HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{17}H_{24}F_2N_3O_5S_3^+$ 484.0841; found 484.0847.

2-butoxy-2-(pyridin-4-yl)ethyl)(ethyl)sulfamoyl fluoride (3v)



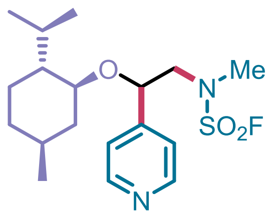
Colorless liquid (19.8 mg, 65%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.63 (d, *J* = 4.8 Hz, 2H), 7.27 (d, *J* = 5.4 Hz, 2H), 4.59 (dd, *J* = 9.0, 3.6 Hz, 1H), 3.60 – 3.47 (m, 3H), 3.42 – 3.34 (m, 2H), 3.29 (dd, *J* = 15.6, 9.6 Hz, 1H), 1.58 (p, *J* = 7.2 Hz, 2H), 1.43 – 1.35 (m, 2H), 1.25 (t, *J* = 7.2 Hz, 3H), 0.92 (t, *J* = 7.2 Hz, 2H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 150.2, 148.1, 121.5, 80.1, 70.0, 54.5, 47.0, 31.8, 19.3, 13.8, 12.8; ^{19}F NMR (565 MHz, Chloroform-*d*) δ 50.36 HRMS (ESI) *m/z*: $[M + NH_4]^+$ calcd for $C_{13}H_{21}FN_2O_3S^+$ 322.1595; found 322.1595.

(2-butoxy-2-(quinolin-4-yl)ethyl)(methyl)sulfamoyl fluoride (3w)



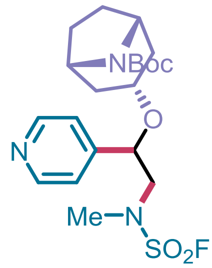
Colorless oil (21.8 mg, 32%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.96 (d, *J* = 3.6 Hz, 1H), 8.17 (d, *J* = 8.4 Hz, 1H), 8.13 (d, *J* = 8.4 Hz, 1H), 7.76 (t, *J* = 7.2 Hz, 1H), 7.64 (t, *J* = 7.8 Hz, 1H), 7.54 (d, *J* = 4.2 Hz, 1H), 5.39 (d, *J* = 9.0 Hz, 1H), 3.89 (d, *J* = 15.0 Hz, 1H), 3.51 – 3.42 (m, 2H), 3.27 (s, 3H), 3.25 – 3.21 (m, 1H), 1.67 - 1.62 (m, 2H), 1.48 - 1.39 (m, 3H), 0.94 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (101 MHz, Chloroform-*d*) δ 149.2, 147.2, 143.1, 129.4, 128.6, 126.4, 121.4, 117.0, 76.9, 69.0, 55.8, 38.2, 30.9, 18.3, 12.84; ^{19}F NMR (565 MHz, Chloroform-*d*) δ 44.32.

(2-(((1S,2R,5S)-2-isopropyl-5-methylcyclohexyl)oxy)-2-(pyridin-4-yl)ethyl)(methyl)sulfamoyl fluoride (3x)



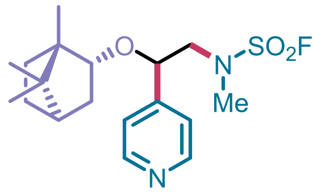
Colorless liquid (19.7 mg, 53%, dr = 2:1); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.63 – 8.61 (m, 2H), 7.32 (d, *J* = 5.4 Hz, 0.7H), 7.29 (d, *J* = 5.4 Hz, 1.4H), 4.80 (dd, *J* = 9.0, 4.2 Hz, 0.65H), 4.63 (dd, *J* = 7.8, 4.8 Hz, 0.34H), 3.51 (dd, *J* = 15.0, 3.6 Hz, 0.7H), 3.43 – 3.35 (m, 1.4H), 3.26 – 3.22 (m, 0.4H), 3.12 (s, 2H), 3.01 (s, 1H), 2.98 – 2.94 (m, 0.7H), 2.36 – 2.27 (m, 1H), 2.16 (d, *J* = 12.0 Hz, 0.67H), 1.65 – 1.57 (m, 2.43H), 1.34 – 1.22 (m, 3H), 0.96 (d, *J* = 6.6 Hz, 1H), 0.93 (d, *J* = 6.6 Hz, 2H), 0.90 (d, *J* = 7.2 Hz, 2H), 0.86 – 0.82 (m, 3H), 0.75 (d, *J* = 6.6 Hz, 1H), 0.44 (d, *J* = 7.2 Hz, 2H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 150.1, 149.9, 147.8, 122.2, 121.7, 81.3, 78.9, 76.2, 75.3, 57.7, 57.2, 49.1, 48.6, 42.5, 39.4, 38.71, 38.68, 34.3, 34.2, 31.5, 31.3, 25.2, 25.0, 22.74, 22.68, 22.3, 22.1, 21.3, 21.2, 15.8, 15.6; ^{19}F NMR (565 MHz, Chloroform-*d*) δ 44.17, 41.56; HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{18}H_{30}FN_2O_3S^+$ 373.1956; found 373.1971.

tert-butyl (1R,3r,5S)-3-(2-((fluorosulfonyl)(methyl)amino)-1-(pyridin-4-yl)ethoxy)-8-azabicyclo[3.2.1]octane-8-carboxylate (3y)



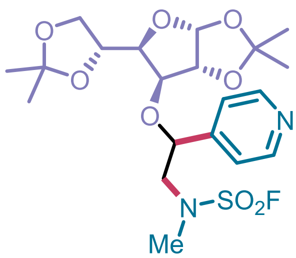
Colorless liquid (17.5 mg, 39%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.64 (d, *J* = 5.6 Hz, 1H), 7.269 – 7.266 (m, 2H), 4.67 (t, *J* = 6.2 Hz, 1H), 4.24 – 4.10 (m, 2H), 3.56 (s, 1H), 3.43 (s, 2H), 3.05 (s, 3H), 2.08 – 1.86 (m, 8H), 1.43 (s, 9H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 153.3, 150.4, 147.8, 121.9, 79.3, 71.9, 57.5, 52.8, 52.0, 38.8, 28.5, 27.7; ^{19}F NMR (565 MHz, Chloroform-*d*) δ 41.94; HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{20}H_{30}FN_3O_5S^+$ 444.1963; found 444.1977.

methyl(2-(pyridin-4-yl)-2-(((1S,2R,4S)-1,7,7-trimethylbicyclo[2.2.1]heptan-2-yl)oxy)ethyl)sulfamoyl fluoride (3z)



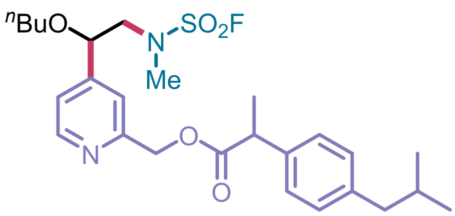
Colorless liquid (17.4 mg, 47%, dr = 2:3); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.63 (s, 2H), 7.28 (dd, *J* = 12.0, 4.8 Hz, 2H), 4.65 – 4.61 (m, 1H), 3.67 (d, *J* = 9.0 Hz, 0.4H), 3.57 (dd, *J* = 15.0, 2.2 Hz, 0.6H), 3.51 (dd, *J* = 14.4, 3.6 Hz, 1H), 3.33 (dd, *J* = 15.0, 9.0 Hz, 0.4H), 3.26 – 3.24 (m, 0.6H), 3.22 (s, 1.8H), 3.16 (s, 1.2H), 2.13 – 2.08 (m, 0.6H), 2.07 – 2.01 (m, 1H), 1.92 – 1.87 (m, 0.4H), 1.81 – 1.75 (m, 0.6H), 1.74 – 1.70 (m, 1H), 1.56 (t, *J* = 4.8 Hz, 0.4H), 1.34 – 1.23 (m, 2H), 1.09 (dd, *J* = 12.6, 2.4 Hz, 0.6H), 0.94 (s, 1.2H), 0.89 (dd, *J* = 13.2, 3.0 Hz, 0.4H), 0.85 – 0.83 (m, 4.8H), 0.76 (s, 1.2H), 0.70 (s, 1.8H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 150.15, 150.07, 149.19, 147.98, 121.82, 121.76, 86.35, 82.69, 80.54, 77.86, 57.69, 57.48, 49.78, 49.16, 47.92, 47.69, 44.88, 38.90, 38.70, 36.67, 35.54, 28.21, 26.81, 26.79, 19.68, 19.64, 18.84, 18.71, 14.13, 13.78; ^{19}F NMR (565 MHz, Chloroform-*d*) δ 44.34, 43.21; HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{18}H_{27}FN_2O_3S^+$ 371.1799; found 371.1799.

(2-(((3aR,5R,6S,6aR)-5-((R)-2,2-dimethyl-1,3-dioxolan-4-yl)-2,2-dimethyltetrahydrofuro[2,3-d][1,3]dioxol-6-yl)oxy)-2-(pyridin-4-yl)ethyl)(methyl)sulfamoyl fluoride (3aa)



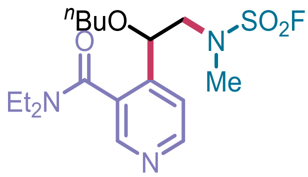
Colorless liquid (32.8 mg, 69%, dr = 4:1); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.68 (s, 0.4H), 8.63 (s, 1.6H), 7.45 (s, 1.6H), 7.31 (s, 0.4H), 5.92 (s, 0.8H), 5.82 (s, 0.2H), 5.03 – 5.02 (m, 0.2H), 4.89 (d, *J* = 9.0 Hz, 0.8H), 4.65 (s, 0.8H), 4.38 – 4.34 (m, 1.2H), 4.22 – 4.16 (m, 1H), 4.03 – 3.98 (m, 2H), 3.96 (s, 0.2H), 3.86 (s, 0.8H), 3.73 (s, 0.2H), 3.64 (d, *J* = 15.0 Hz, 0.8H), 3.48 (d, *J* = 6.0 Hz, 0.2H), 3.30 (dd, *J* = 14.4, 9.0 Hz, 0.8H), 3.12 (s, 2.4H), 3.08 (s, 0.6H), 1.46 (s, 2.4H), 1.44 (s, 0.6H), 1.42 (s, 2.4H), 1.40 (s, 0.6H), 1.37 (s, 2.4H), 1.33 (s, 2.4H), 1.26 (s, 0.6H), 1.24 (s, 0.6H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 150.5, 150.1, 147.5, 145.7, 122.0, 121.6, 112.1, 109.6, 109.3, 105.1, 105.0, 83.6, 81.6, 81.4, 80.8, 79.8, 79.7, 77.8, 71.92, 71.88, 67.9, 67.8, 57.3, 57.0, 38.9, 38.5, 26.86, 26.83, 26.7, 26.6, 26.2, 26.0, 25.5, 25.1; ^{19}F NMR (565 MHz, Chloroform-*d*) δ 44.04, 42.44; HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{20}H_{30}FN_2O_8S^+$ 477.1701; found 477.1701.

(4-(1-butoxy-2-((fluorosulfonyl)(methyl)amino)ethyl)pyridin-2-yl)methyl 2-(4-isobutylphenyl)propanoate (3ab)



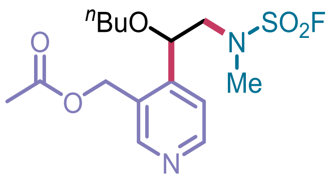
Colorless liquid (38.6 mg, 76%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.55 (d, *J* = 4.8 Hz, 1H), 7.25 (d, *J* = 7.8 Hz, 2H), 7.17 – 7.16 (m, 1H), 7.12 – 7.09 (m, 3H), 5.27 – 5.21 (m, 2H), 4.51 – 4.47 (m, 1H), 3.86 – 3.82 (m, 1H), 3.52 – 3.48 (m, 1H), 3.36 – 3.29 (m, 2H), 3.24 – 3.19 (m, 1H), 3.13 (s, 3H), 2.45 (d, *J* = 7.2 Hz, 2H), 1.88 – 1.81 (m, 1H), 1.59 – 1.54 (m, 5H), 1.43 – 1.36 (m, 2H), 0.93 – 0.89 (m, 9H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 174.2, 157.0, 156.9, 149.8, 148.7, 140.7, 137.44, 137.41, 129.39, 129.38, 127.3, 120.4, 120.3, 118.9, 118.8, 80.1, 69.833, 69.827, 66.64, 66.55, 57.2, 45.09, 45.05, 45.04, 38.635, 38.627, 31.8, 30.2, 22.4, 19.3, 18.5, 13.8; ^{19}F NMR (565 MHz, Chloroform-*d*) δ 44.01; HRMS (ESI) *m/z*: [M + H]$^+$ calcd for $C_{26}H_{38}FN_2O_{55}S^+$ 509.2480; found 509.2473.

(2-butoxy-2-(3-(diethylcarbamoyl)pyridin-4-yl)ethyl)(methyl)sulfamoyl fluoride (3ac)



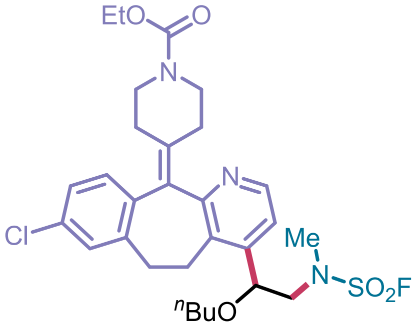
Colorless liquid (30.0 mg, 77%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.66 (d, *J* = 5.4 Hz, 1H), 8.49 (s, 1H), 7.48 (d, *J* = 4.8 Hz, 1H), 4.658 – 4.657 (m, 1H), 3.64 – 3.59 (m, 3H), 3.44 (dd, *J* = 14.4, 9.0 Hz, 1H), 3.39 – 3.33 (m, 1H), 3.22 – 3.18 (m, 2H), 3.15 (s, 3H), 1.55 (p, *J* = 7.2 Hz, 2H), 1.39 – 1.35 (m, 2H), 1.29 (t, *J* = 7.2 Hz, 3H), 1.16 (t, *J* = 7.2 Hz, 3H), 0.90 (t, *J* = 7.8 Hz, 3H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 167.0, 150.5, 146.6, 145.5, 131.9, 121.6, 70.0, 56.5, 43.3, 39.4, 31.8, 19.2, 14.2, 13.8, 12.8; HRMS (ESI) *m/z*: [M + H]$^+$ calcd for $C_{17}H_{29}FN_3O_4S^+$ 390.1857; found 390.1869.

(4-(1-butoxy-2-((fluorosulfonyl)(methyl)amino)ethyl)pyridin-3-yl)methyl acetate (3ad)



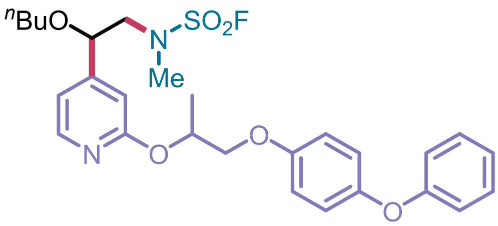
Colorless liquid (19.9 mg, 55%);^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.63 (d, *J* = 16.8 Hz, 2H), 7.42 (s, 1H), 5.18 (dd, *J* = 69.6, 12.6 Hz, 2H), 4.92 (d, *J* = 9.6 Hz, 1H), 3.69 (d, *J* = 15.0 Hz, 1H), 3.340 – 3.336 (m, 2H), 3.23 – 3.19 (m, 4H), 2.09 (s, 3H), 1.58 – 1.56 (m, 2H), 1.40 – 1.37 (m, 2H), 0.91 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 170.4, 151.7, 150.8, 147.1, 129.1, 120.9, 69.8, 61.0, 56.7, 38.9, 31.8, 20.7, 19.3, 13.8; ^{19}F NMR (565 MHz, Chloroform-*d*) δ 43.86; HRMS (ESI) *m/z*: [M + NH$_4$]$^+$ calcd for $C_{15}H_{27}FN_3O_4S^+$ 364.1701; found 364.1671.

ethyl-4-(4-(1-butoxy-2-((fluorosulfonyl)(methyl)amino)ethyl)-8-chloro-5,6-dihydro-11H-benzo[5,6]cyclohepta[1,2-b]pyridin-11-ylidene)piperidine-1-carboxylate (3ae)



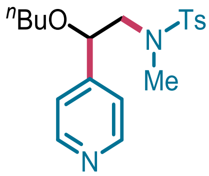
Colorless liquid (22.5 mg, 38%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.44 (t, *J* = 4.7 Hz, 1H), 7.28 – 7.26 (m, 1H), 7.13 – 7.12 (m, 3H), 4.87 (dd, *J* = 52.7, 8.0 Hz, 1H), 4.14 (q, *J* = 7.0 Hz, 2H), 3.79 (s, 2H), 3.62 (dd, *J* = 48.5, 14.4 Hz, 1H), 3.46 – 3.14 (m, 10H), 3.06 – 2.97 (m, 1H), 2.86 – 2.81 (m, 1H), 2.40 (d, *J* = 4.2 Hz, 3H), 2.17 (t, *J* = 16.5 Hz, 1H), 1.63 – 1.53 (m, 2H), 1.45 – 1.34 (m, 2H), 1.25 (t, *J* = 7.0 Hz, 3H), 0.92 (dt, *J* = 21.5, 7.4 Hz, 3H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 160.1, 159.5, 155.5, 147.38, 147.35, 145.6, 145.5, 138.7, 137.3, 137.0, 136.3, 135.8, 134.3, 134.2, 133.11, 133.05, 131.18, 131.15, 131.1, 129.8, 129.6, 126.2, 126.1, 119.5, 119.3, 77.6, 77.4, 69.9, 69.8, 61.3, 56.9, 56.7, 44.79, 44.77, 44.6, 39.00, 38.98, 31.94, 31.86, 31.83, 31.79, 30.62, 30.59, 25.8, 25.6, 19.34, 19.31, 14.7, 13.83, 13.80; ^{19}F NMR (565 MHz, Chloroform-*d*) δ 44.42, 44.08; HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{29}H_{37}ClFN_3O_5S^+$ 594.2199; found 594.2197.

(2-butoxy-2-(2-((1-(4-phenoxyphenoxy)propan-2-yl)oxy)pyridin-4-yl)ethyl)(methyl)sulfamoyl fluoride (3af)



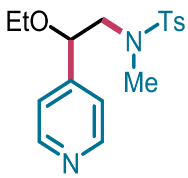
Colorless liquid (14.9 mg, 28%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.14 (d, *J* = 5.4 Hz, 1H), 7.29 (t, *J* = 7.2 Hz, 2H), 7.05 – 7.02 (m, 1H), 6.97 – 6.91 (m, 6H), 6.83 – 6.82 (m, 1H), 6.71 (d, *J* = 4.8 Hz, 1H), 5.61 – 5.56 (m, 1H), 4.52 (d, *J* = 9.0 Hz, 1H), 4.20 – 4.16 (m, 1H), 4.09 – 4.06 (m, 1H), 3.56 (dd, *J* = 15.0, 3.0 Hz, 2H), 3.45 – 3.41 (m, 1H), 3.35 – 3.31 (m, 1H), 3.25 – 3.21 (m, 1H), 3.16 (s, 3H), 1.60 – 1.55 (m, 2H), 1.48 (dd, *J* = 6.0, 4.2 Hz, 3H), 1.42 – 1.35 (m, 2H), 0.91 (td, *J* = 7.8, 3.0 Hz, 3H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 163.8, 158.4, 155.2, 150.9, 150.4, 147.43, 147.42, 129.6, 122.5, 120.7, 117.7, 115.81, 115.80, 114.65, 114.63, 109.21, 109.18, 80.12, 80.11, 71.08, 71.06, 69.805, 69.797, 69.73, 69.71, 57.3, 38.7, 31.9, 19.3, 18.0, 17.0, 13.8; ^{19}F NMR (377 MHz, Chloroform-*d*) δ 44.10; HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{27}H_{33}FN_2O_6S^+$ 533.2116; found 533.2121.

***N-(2-butoxy-2-(pyridin-4-yl)ethyl)-N,4-dimethylbenzenesulfonamide (5a)*[10]**



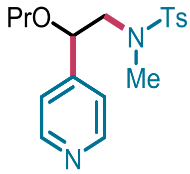
Colorless oil (26.8 mg, 74%); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.60 (d, *J* = 5.2 Hz, 2H), 7.64 (d, *J* = 8.0 Hz, 2H), 7.31 – 7.27 (m, 4H), 4.55 (dd, *J* = 8.0, 4.0 Hz, 1H), 3.38 – 3.28 (m, 3H), 3.03 (dd, *J* = 14.4, 8.4 Hz, 1H), 2.84 (s, 3H), 2.41 (s, 3H), 1.57 – 1.50 (m, 2H), 1.42 – 1.31 (m, 2H), 0.90 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 150.0, 149.1, 143.4, 135.0, 129.7, 127.2, 121.7, 81.4, 69.7, 56.3, 37.4, 31.9, 21.5, 19.3, 13.8.

***N-(2-ethoxy-2-(pyridin-4-yl)ethyl)-N,4-dimethylbenzenesulfonamide (5b)*[10]**



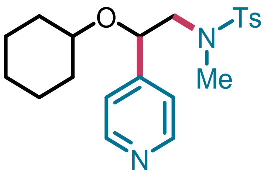
Colorless oil (23.1 mg, 69%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.61 (d, *J* = 4.8 Hz, 2H), 7.64 (d, *J* = 8.4 Hz, 2H), 7.33 (d, *J* = 5.2 Hz, 2H), 7.30 (d, *J* = 8.4 Hz, 2H), 4.59 (dd, *J* = 7.8, 4.2 Hz, 1H), 3.44 – 3.39 (m, 2H), 3.28 (dd, *J* = 14.4, 4.2 Hz, 1H), 3.06 (dd, *J* = 14.4, 8.4 Hz, 1H), 2.82 (s, 3H), 2.42 (s, 3H), 1.19 (t, *J* = 7.0 Hz, 3H); ^{13}C NMR (101 MHz, Chloroform-*d*) δ 149.64, 149.61, 143.5, 134.9, 129.7, 127.2, 121.8, 81.2, 65.4, 56.2, 37.4, 21.5, 15.3.

***N,4-dimethyl-N-(2-propoxy-2-(pyridin-4-yl)ethyl)benzenesulfonamide (5c)*[10]**



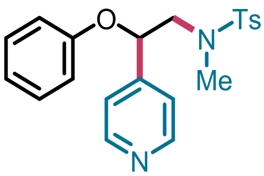
Colorless oil (17.4 mg, 50%); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.59 (d, *J* = 6.0 Hz, 2H), 7.64 (d, *J* = 8.0 Hz, 2H), 7.30 – 7.26 (m, 4H), 4.55 (dd, *J* = 8.0, 4.0 Hz, 1H), 3.35 – 3.25 (m, 3H), 3.03 (dd, *J* = 14.4, 8.0 Hz, 1H), 2.84 (s, 3H), 2.41 (s, 3H), 1.62 – 1.53 (m, 2H), 0.91 (t, *J* = 7.4 Hz, 3H); ^{13}C NMR (101 MHz, Chloroform-*d*) δ 149.9, 149.3, 143.5, 135.0, 129.7, 127.2, 121.8, 81.4, 71.6, 56.3, 37.5, 23.1, 21.5, 10.6.

N-(2-(cyclohexyloxy)-2-(pyridin-4-yl)ethyl)-N,4-dimethylbenzenesulfonamide (5d)[10]



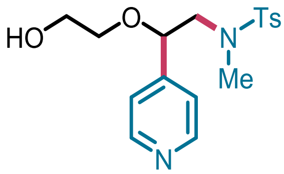
Colorless oil (19.4 mg, 50%); ^{1}H NMR (400 MHz, Chloroform-d) δ 8.60 (s, 2H), 7.65 (d, *J* = 8.2 Hz, 2H), 7.33 – 7.29 (m, 4H), 4.75 (dd, *J* = 8.4, 4.0 Hz, 1H), 3.28 (dd, *J* = 14.4, 3.6 Hz, 1H), 3.23 – 3.17 (m, 1H), 2.96 (dd, *J* = 14.8, 8.4 Hz, 1H), 2.85 (s, 3H), 2.41 (s, 3H), 1.94 – 1.91 (m, 1H), 1.70 (d, *J* = 16.0 Hz, 2H), 1.49 (s, 1H), 1.34 – 1.17 (m, 6H); ^{13}C NMR (101 MHz, Chloroform-*d*) δ 150.3, 149.7, 143.3, 135.5, 129.6, 127.2, 121.7, 78.5, 76.9, 56.8, 37.4, 33.3, 31.5, 25.6, 23.9, 23.8, 21.3;

N,4-dimethyl-N-(2-phenoxy-2-(pyridin-4-yl)ethyl)benzenesulfonamide (5e)[10]



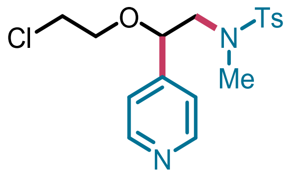
Colorless oil (18.0 mg, 47%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.59 (d, *J* = 6.0 Hz, 2H), 7.65 (d, *J* = 8.2 Hz, 2H), 7.34 (d, *J* = 5.4 Hz, 2H), 7.27 (d, *J* = 7.8 Hz, 2H), 7.20 (t, *J* = 8.0 Hz, 2H), 6.93 (t, *J* = 7.4 Hz, 1H), 6.78 (d, *J* = 8.0 Hz, 2H), 5.42 (dd, *J* = 8.4, 4.2 Hz, 1H), 3.50 (dd, *J* = 14.4, 4.2 Hz, 1H), 3.33 (dd, *J* = 15.0, 8.4 Hz, 1H), 2.88 (s, 3H), 2.40 (s, 3H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 157.1, 150.3, 147.8, 143.6, 135.0, 129.8, 129.6, 127.2, 121.7, 121.2, 115.7, 79.3, 56.3, 37.5, 21.5.

N-(2-(2-hydroxyethoxy)-2-(pyridin-4-yl)ethyl)-N,4-dimethylbenzenesulfonamide (5f)[10]



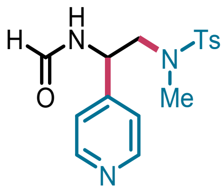
Colorless oil (28.0 mg, 80%); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.60 (d, *J* = 4.4 Hz, 2H), 7.65 (d, *J* = 8.2 Hz, 2H), 7.31 – 7.29 (m, 4H), 4.64 (dd, *J* = 7.6, 4.8 Hz, 1H), 3.76 (t, *J* = 4.4 Hz, 2H), 3.59 – 3.46 (m, 2H), 3.24 (t, *J* = 6.4 Hz, 2H), 2.85 (s, 1H), 2.80 (s, 3H), 2.42 (s, 3H); ^{13}C NMR (101 MHz, Chloroform-*d*) δ 150.0, 148.6, 143.5, 135.3, 129.7, 127.3, 121.7, 81.0, 71.4, 61.8, 56.2, 36.9, 21.3.

(2-(2-chloroethoxy)-2-(pyridin-4-yl)ethyl)-N,4-dimethylbenzenesulfonamide (5g)[10]



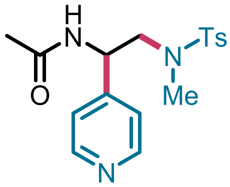
Colorless oil (22.5 mg, 61%); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.62 – 8.61 (m, 2H), 7.65 (d, *J* = 8.2 Hz, 2H), 7.31 – 7.27 (m, 4H), 4.65 (dd, *J* = 8.4, 4.0 Hz, 1H), 3.66 – 3.59 (m, 4H), 3.33 (dd, *J* = 14.6, 4.0 Hz, 1H), 3.07 (dd, *J* = 14.6, 8.2 Hz, 1H), 2.86 (s, 3H), 2.42 (s, 3H); ^{13}C NMR (101 MHz, Chloroform-*d*) δ 150.2, 148.0, 143.4, 135.4, 129.7, 127.2, 121.5, 82.0, 70.0, 56.3, 42.7, 37.4, 21.4.

N-(2-((N,4-dimethylphenyl)sulfonamido)-1-(pyridin-4-yl)ethyl)formamide (5h)[10]



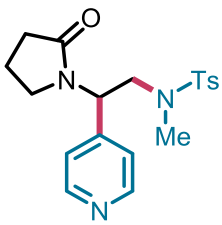
Colorless oil (26.0 mg, 78%); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.58 (d, *J* = 5.2 Hz, 2H), 8.33 (s, 1H), 7.64 (d, *J* = 8.4 Hz, 2H), 7.33 (d, *J* = 8.4 Hz, 2H), 7.27 (d, *J* = 5.8 Hz, 2H), 5.18 – 5.13 (m, 1H), 3.47 (dd, *J* = 14.4, 9.6 Hz, 1H), 3.07 (dd, *J* = 14.4, 4.0 Hz, 1H), 2.72 (s, 3H), 2.51 (s, 1H), 2.43 (s, 3H); ^{13}C NMR (101 MHz, Chloroform-*d*) δ 161.2, 150.1, 148.0, 144.1, 134.5, 129.9, 127.2, 121.6, 54.2, 50.0, 35.9, 21.4.

N-(2-((N,4-dimethylphenyl)sulfonamido)-1-(pyridin-4-yl)ethyl)acetamide (5i)[10]



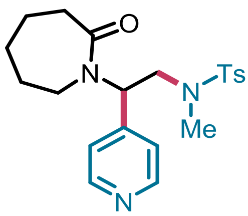
Colorless oil (19.0 mg, 55%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.47 (d, *J* = 5.2 Hz, 2H), 7.55 (d, *J* = 8.4 Hz, 2H), 7.24 (d, *J* = 8.0 Hz, 2H), 7.18 (d, *J* = 5.4 Hz, 2H), 7.06 (d, *J* = 6.6 Hz, 1H), 5.04 – 5.00 (m, 1H), 3.34 (dd, *J* = 14.4, 9.0 Hz, 1H), 2.97 (dd, *J* = 14.4, 4.2 Hz, 1H), 2.64 (s, 3H), 2.34 (s, 3H), 2.02 (s, 3H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 170.7, 149.9, 148.8, 144.1, 134.1, 130.0, 127.2, 121.8, 54.3, 51.0, 36.0, 23.1, 21.5.

N,4-dimethyl-N-(2-(2-oxopyrrolidin-1-yl)-2-(pyridin-4-yl)ethyl)benzenesulfonamide (5j)[10]



Colorless oil (12.3 mg, 33%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.60 (d, *J* = 5.4 Hz, 2H), 7.68 (d, *J* = 8.2 Hz, 2H), 7.35 (d, *J* = 8.0 Hz, 2H), 7.21 (d, *J* = 5.8 Hz, 2H), 5.50 (dd, *J* = 11.4, 5.4 Hz, 1H), 4.03 – 3.99 (m, 1H), 3.69 – 3.65 (m, 1H), 3.09 – 3.05 (m, 1H), 3.01 (dd, *J* = 13.2, 5.2 Hz, 1H), 2.78 (s, 3H), 2.53 – 2.48 (m, 1H), 2.44 (s, 3H), 2.43 – 2.39 (m, 1H), 2.16 – 2.08 (m, 1H), 2.01 – 1.95 (m, 1H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 176.0, 150.4, 145.3, 143.9, 133.8, 129.9, 127.4, 122.5, 50.4, 48.9, 42.9, 34.8, 31.0, 21.5, 18.1.

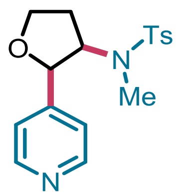
N,4-dimethyl-N-(2-(2-oxoazepan-1-yl)-2-(pyridin-4-yl)ethyl)benzenesulfonamide (5k)[10]



Colorless oil (29.3 mg, 73%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.60 (s, 2H), 7.68

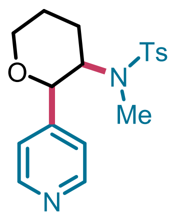
(d, J = 7.5 Hz, 2H), 7.35 (d, J = 7.8 Hz, 2H), 7.28 – 7.27 (m, 2H), 6.04 (t, J = 7.8 Hz, 1H), 3.77 (t, J = 11.4 Hz, 1H), 3.33 (dd, J = 15.0, 9.6 Hz, 1H), 3.22 – 3.14 (m, 2H), 2.75 (s, 3H), 2.61 (s, 2H), 2.45 (s, 3H), 1.70 – 1.62 (m, 6H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 176.9, 150.2, 146.6, 143.8, 133.7, 129.9, 127.5, 123.0, 52.6, 48.9, 45.0, 37.4, 35.0, 29.7, 28.6, 23.3, 21.5.

***N,4-dimethyl-N-(2-(pyridin-4-yl)tetrahydrofuran-3-yl)benzenesulfonamide (5l)*[10]**



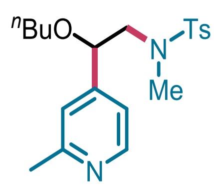
Colorless oil (11.6 mg, 35%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.47 (d, J = 5.4 Hz, 2H), 7.53 (d, J = 7.8 Hz, 2H), 7.20 (dd, J = 13.0, 5.4 Hz, 4H), 4.69 (d, J = 5.6 Hz, 1H), 4.49 – 4.46 (m, 1H), 3.97 – 3.91 (m, 2H), 2.84 (s, 3H), 2.35 (s, 3H), 1.88 – 1.82 (m, 1H), 1.71 – 1.66 (m, 1H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 149.1, 148.4, 142.8, 134.6, 128.8, 126.2, 119.5, 79.2, 66.9, 63.3, 28.6, 26.2, 20.5.

***N,4-dimethyl-N-(2-phenyltetrahydro-2H-pyran-3-yl)benzenesulfonamide (5m)*[10]**



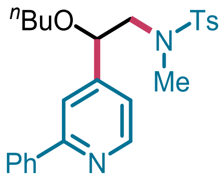
Colorless oil (18.0 mg, 52%); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.51 (s, 2H), 7.25 (dd, J = 8.8, 4.4 Hz, 4H), 7.13 (d, J = 8.2 Hz, 2H), 4.20 (d, J = 9.6, 1H), 4.06 (dd, J = 11.2, 3.2 Hz, 1H), 3.94 – 3.88 (m, 1H), 3.49 – 3.42 (m, 1H), 2.74 (s, 3H), 2.39 (s, 3H), 1.87 – 1.76 (m, 4H); ^{13}C NMR (101 MHz, Chloroform-*d*) δ 149.7, 148.1, 143.3, 136.3, 129.5, 126.9, 122.2, 80.5, 68.3, 58.7, 29.8, 27.4, 26.0, 21.5.

***N-(2-butoxy-2-(2-methylpyridin-4-yl)ethyl)-N,4-dimethylbenzenesulfonamide (5n)*[10]**



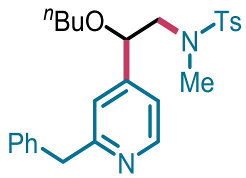
Colorless oil (27.8 mg, 74%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.47 (s, 1H), 7.64 (d, *J* = 7.8 Hz, 2H), 7.29 (d, *J* = 7.6 Hz, 2H), 7.12 (s, 1H), 7.08 (s, 1H), 4.51 – 4.50 (m, 1H), 3.34 – 3.29 (m, 3H), 3.00 (dd, *J* = 14.2, 8.4 Hz, 1H), 2.85 (s, 3H), 2.57 (s, 3H), 2.41 (s, 3H), 1.54 – 1.52 (m, 2H), 1.36 – 1.35 (m, 2H), 0.89 (t, *J* = 7.0 Hz, 3H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 158.7, 149.5, 149.2, 143.4, 135.2, 129.7, 127.2, 121.3, 118.8, 81.6, 69.6, 56.3, 37.4, 31.9, 24.4, 21.5, 19.3, 13.8.

***N-(2-butoxy-2-(2-phenylpyridin-4-yl)ethyl)-N,4-dimethylbenzenesulfonamide (5o)*[10]**



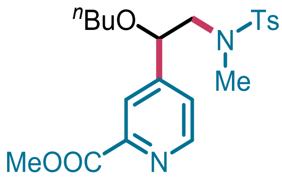
Colorless oil (31.1 mg, 71%); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.67 (d, *J* = 5.0 Hz, 1H), 8.02 – 8.00 (m, 2H), 7.69 (s, 1H), 7.64 (d, *J* = 8.2 Hz, 1H), 7.50 – 7.47 (m, 2H), 7.43 (d, *J* = 7.2 Hz, 1H), 7.28 (d, *J* = 8.2 Hz, 2H), 7.22 – 7.21 (m, 1H), 4.61 (dd, *J* = 8.2, 4.0 Hz, 1H), 3.43 – 3.32 (m, 3H), 3.07 (dd, *J* = 14.8, 8.4 Hz, 1H), 2.86 (s, 3H), 2.39 (s, 3H), 1.59 – 1.52 (m, 2H), 1.44 – 1.33 (m, 2H), 0.91 (t, *J* = 7.6 Hz, 3H); ^{13}C NMR (101 MHz, Chloroform-*d*) δ 157.9, 149.92, 149.89, 143.3, 139.2, 135.6, 129.6, 129.0, 128.7, 127.2, 127.0, 120.1, 118.3, 81.7, 69.8, 56.4, 37.3, 31.9, 21.3, 19.3, 13.7.

***N-(2-(2-benzylpyridin-4-yl)-2-butoxyethyl)-N,4-dimethylbenzenesulfonamide (5p)*[10]**



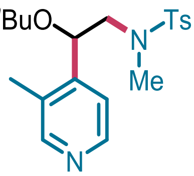
Colorless oil (22.2 mg, 49%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.51 (d, *J* = 4.8 Hz, 1H), 7.61 (d, *J* = 8.4 Hz, 2H), 7.31 – 7.26 (m, 6H), 7.21 (t, *J* = 7.2 Hz, 1H), 7.10 – 7.09 (m, 2H), 4.47 (dd, *J* = 8.2, 4.0 Hz, 1H), 4.16 (s, 2H), 3.28 – 3.23 (m, 3H), 2.98 (dd, *J* = 14.4, 7.8 Hz, 1H), 2.79 (s, 3H), 2.40 (s, 3H), 1.50 – 1.45 (m, 2H), 1.35 – 1.24 (m, 2H), 0.86 (t, *J* = 7.4 Hz, 3H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 161.4, 149.8, 149.6, 143.4, 139.4, 135.1, 129.7, 129.1, 128.6, 127.2, 126.4, 121.0, 119.3, 81.4, 69.7, 56.3, 44.6, 37.4, 31.9, 21.5, 19.3, 13.9.

***methyl-4-(1-butoxy-2-((N,4-dimethylphenyl)sulfonamido)ethyl)picolinate (5q)*[10]**



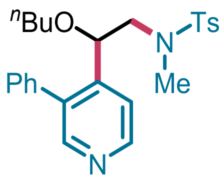
Colorless oil (16.8 mg, 40%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.74 (d, *J* = 3.6 Hz, 1H), 8.10 (s, 1H), 7.63 (d, *J* = 7.8 Hz, 2H), 7.48 (d, *J* = 3.8 Hz, 1H), 7.30 (d, *J* = 7.6 Hz, 2H), 4.63 – 4.62 (m, 1H), 4.02 (s, 3H), 3.35 – 3.33 (m, 2H), 3.05 (dd, *J* = 14.4, 7.8 Hz, 1H), 2.85 (s, 3H), 2.52 (d, *J* = 12.2 Hz, 1H), 2.42 (s, 3H), 1.55 – 1.53 (m, 2H), 1.38 – 1.34 (m, 2H), 0.90 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 165.6, 150.7, 150.1, 148.4, 143.5, 135.0, 129.7, 127.2, 125.1, 123.0, 81.2, 70.0, 56.1, 53.0, 37.5, 31.8, 21.5, 19.3, 13.8.

***N*-(2-butoxy-2-(3-methylpyridin-4-yl)ethyl)-*N*,4-dimethylbenzenesulfonamide (5r)[10]**



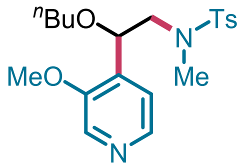
Colorless oil (24.8 mg, 66%); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.43 (d, *J* = 5.0 Hz, 1H), 8.40 (s, 1H), 7.63 (d, *J* = 8.2 Hz, 2H), 7.30 – 7.26 (m, 3H), 4.77 (dd, *J* = 8.8, 3.2 Hz, 1H), 3.35 (dd, *J* = 14.8, 3.2 Hz, 1H), 3.31 – 3.23 (m, 2H), 2.92 (s, 3H), 2.83 (dd, *J* = 14.8, 8.4 Hz, 1H), 2.41 (s, 6H), 1.56 – 1.49 (m, 2H), 1.40 – 1.31 (m, 2H), 0.90 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (101 MHz, Chloroform-*d*) δ 151.3, 147.8, 147.0, 143.3, 135.6, 131.1, 129.6, 127.2, 120.3, 79.1, 69.6, 55.2, 37.5, 31.9, 21.3, 19.3, 15.9, 13.7.

***N*-(2-butoxy-2-(3-phenylpyridin-4-yl)ethyl)-*N*,4-dimethylbenzenesulfonamide (5s)[10]**



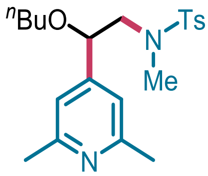
Colorless oil (25.9 mg, 59%); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.61 (d, *J* = 5.2 Hz, 1H), 8.48 (s, 1H), 7.53 – 7.43 (m, 6H), 7.34 – 7.32 (m, 2H), 7.23 (d, *J* = 8.0 Hz, 2H), 4.63 (dd, *J* = 8.4, 3.6 Hz, 1H), 3.30 (dd, *J* = 14.4, 4.8 Hz, 1H), 3.23 – 3.17 (m, 1H), 3.08 – 2.95 (m, 2H), 2.71 (s, 3H), 2.39 (s, 3H), 1.43 – 1.35 (m, 2H), 1.29 – 1.22 (m, 2H), 0.83 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (101 MHz, Chloroform-*d*) δ 150.3, 149.0, 146.4, 143.0, 137.3, 136.6, 135.7, 129.5, 129.4, 128.6, 128.1, 127.2, 120.8, 76.9, 69.2, 55.4, 36.7, 31.8, 21.3, 19.2, 13.7.

N-(2-butoxy-2-(3-methoxypyridin-4-yl)ethyl)-N,4-dimethylbenzenesulfonamide (5t)[10]



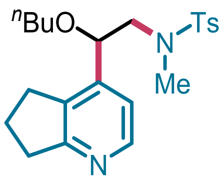
Colorless oil (19.2 mg, 49%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.27 (d, *J* = 4.8 Hz, 1H), 8.25 (s, 1H), 7.63 (d, *J* = 7.8 Hz, 2H), 7.29 – 7.27 (m, 3H), 4.87 (dd, *J* = 8.0, 2.8 Hz, 1H), 3.96 (s, 3H), 3.40 (dd, *J* = 13.8, 2.4 Hz, 1H), 3.35 – 3.31 (m, 1H), 3.28 – 3.25 (m, 1H), 3.03 (dd, *J* = 14.4, 8.4 Hz, 1H), 2.91 (s, 3H), 2.41 (s, 3H), 1.54 – 1.49 (m, 2H), 1.38 – 1.31 (m, 2H), 0.89 (t, *J* = 7.4 Hz, 3H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 153.0, 143.1, 142.9, 136.7, 135.5, 133.0, 129.5, 127.3, 121.0, 75.4, 69.8, 56.1, 54.3, 36.9, 31.9, 21.5, 19.3, 13.9.

N-(2-butoxy-2-(2,6-dimethylpyridin-4-yl)ethyl)-N,4-dimethylbenzenesulfonamide (5u)[10]



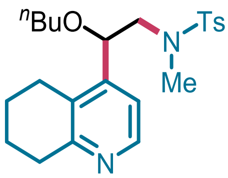
Colorless oil (23.8 mg, 61%); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.65 (d, *J* = 8.2 Hz, 2H), 7.29 (d, *J* = 8.0 Hz, 2H), 6.91 (s, 2H), 4.46 (dd, *J* = 8.4, 3.8 Hz, 1H), 3.36 – 3.24 (m, 3H), 2.98 (dd, *J* = 14.8, 8.8 Hz, 1H), 2.86 (s, 3H), 2.53 (s, 6H), 2.42 (s, 3H), 1.56 – 1.49 (m, 2H), 1.40 – 1.31 (m, 2H), 0.90 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (101 MHz, Chloroform-*d*) δ 158.1, 149.6, 143.2, 135.7, 129.6, 127.2, 118.1, 81.6, 69.6, 56.3, 37.2, 31.9, 24.4, 21.3, 19.2, 13.7.

N-(2-butoxy-2-(6,7-dihydro-5H-cyclopenta[b]pyridin-4-yl)ethyl)-N,4-dimethylbenzenesulfonamide (5v)[10]



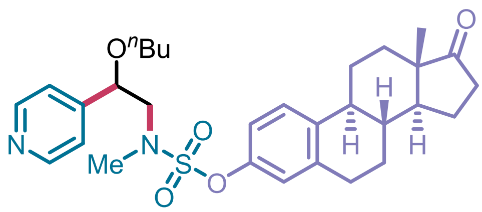
Colorless oil (12.9 mg, 32%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.34 (d, *J* = 5.0 Hz, 1H), 7.63 (d, *J* = 8.2 Hz, 2H), 7.29 (d, *J* = 8.4 Hz, 2H), 7.05 (d, *J* = 4.8 Hz, 1H), 4.62 (dd, *J* = 8.4, 3.6 Hz, 1H), 3.36 – 3.30 (m, 2H), 3.28 – 3.24 (m, 1H), 3.07 – 3.03 (m, 3H), 3.01 – 2.98 (m, 1H), 2.93 (dd, *J* = 14.4, 8.4 Hz, 1H), 2.88 (s, 3H), 2.41 (s, 3H), 2.22 – 2.10 (m, 2H), 1.55 – 1.50 (m, 2H), 1.38 – 1.31 (m, 2H), 0.89 (t, *J* = 7.4 Hz, 3H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 166.0, 147.7, 144.8, 143.4, 135.24, 135.17, 129.7, 127.2, 118.1, 80.1, 69.6, 55.0, 37.5, 34.1, 32.0, 29.1, 22.9, 21.5, 19.3, 13.9.

***N*-(2-butoxy-2-(5,6,7,8-tetrahydroquinolin-4-yl)ethyl)-*N*,4-dimethylbenzenesulfonamide (5w)[10]**



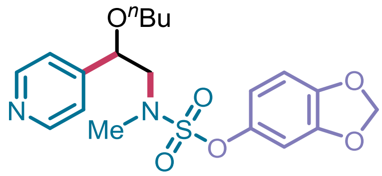
Colorless oil (21.6 mg, 52%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.35 (d, *J* = 4.8 Hz, 1H), 7.63 (d, *J* = 8.2 Hz, 2H), 7.29 (d, *J* = 8.2 Hz, 2H), 7.12 (d, *J* = 4.8 Hz, 1H), 4.77 (dd, *J* = 8.4, 2.8 Hz, 1H), 3.37 (dd, *J* = 14.6, 2.8 Hz, 1H), 3.29 – 3.26 (m, 1H), 3.24 – 3.21 (m, 1H), 2.98 – 2.95 (m, 2H), 2.93 (s, 3H), 2.82 – 2.78 (m, 3H), 2.41 (s, 3H), 1.90 – 1.85 (m, 4H), 1.54 – 1.49 (m, 2H), 1.38 – 1.31 (m, 2H), 0.89 (t, *J* = 7.4 Hz, 3H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 157.6, 147.1, 146.8, 143.3, 135.3, 130.1, 129.7, 127.2, 118.0, 78.3, 69.4, 55.2, 37.5, 33.1, 32.0, 25.1, 22.7, 22.5, 21.5, 19.3, 13.9.

(8R,9S,13S,14S)-13-methyl-17-oxo-7,8,9,11,12,13,14,15,16,17-decahydro-6H-cyclopenta[a]phenanthren-3-yl (2-butoxy-2-(pyridin-4-yl)ethyl)(methyl)sulfamate (6a)



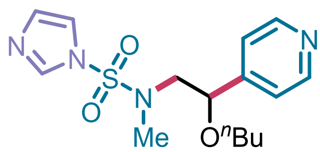
White solid (37.8 mg, 70%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.61 (s, 2H), 7.26 – 7.27 (m, 3H), 7.02 – 7.00 (m, 2H), 4.58 – 4.55 (m, 1H), 3.51 (dd, *J* = 15.0, 3.6 Hz, 1H), 3.39 – 3.33 (m, 2H), 3.22 (dd, *J* = 15.0, 8.4 Hz, 1H), 3.08 (s, 3H), 2.91 (dd, *J* = 9.0, 4.2 Hz, 2H), 2.51 (dd, *J* = 18.6, 8.4 Hz, 1H), 2.41 – 2.38 (m, 1H), 2.30 – 2.26 (m, 1H), 2.18 – 2.12 (m, 1H), 2.08 – 2.00 (m, 2H), 1.99 – 1.95 (m, 1H), 1.66 – 1.37 (m, 10H), 1.07 – 0.78 (m, 3H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 150.1, 148.5, 148.0, 138.6, 126.7, 121.7, 121.6, 118.8, 80.9, 69.8, 57.5, 50.5, 47.9, 44.1, 38.7, 38.0, 35.8, 32.0, 31.5, 29.4, 26.3, 25.8, 21.6, 19.3, 13.9; HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{30}H_{41}N_2O_5S^+$ 541.2731; found 541.2716.

benzo[d][1,3]dioxol-5-yl-(2-butoxy-2-(pyridin-4-yl)ethyl)(methyl)sulfamate (6b)



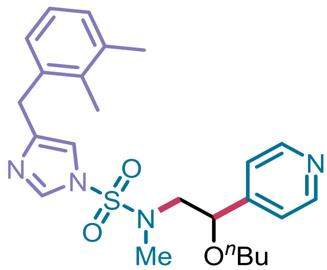
Colorless oil (15.9 mg, 39%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.61 (d, *J* = 4.8 Hz, 2H), 7.26 (d, *J* = 4.2 Hz, 2H), 6.78 (d, *J* = 2.4 Hz, 1H), 6.76 - 6.75 (m, 1H), 6.71 (dd, *J* = 8.4, 1.8 Hz, 1H), 5.99 (s, 2H), 4.55 (dd, *J* = 8.4, 3.6 Hz, 1H), 3.48 (dd, *J* = 15.0, 3.6 Hz, 1H), 3.39 – 3.33 (m, 2H), 3.20 (dd, *J* = 15.0, 8.4 Hz, 1H), 3.07 (s, 3H), 1.60 – 1.55 (m, 2H), 1.43 – 1.34 (m, 2H), 0.91 (t, *J* = 7.8 Hz, 3H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 150.1, 148.6, 148.2, 146.3, 144.3, 121.6, 114.7, 108.0, 104.0, 102.0, 80.9, 69.8, 57.5, 38.7, 31.9, 19.3, 13.8; HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{19}H_{25}N_2O_6S^+$ 409.1428; found 409.1468.

N-(2-butoxy-2-(pyridin-4-yl)ethyl)-N-methyl-1H-imidazole-1-sulfonamide (6c)



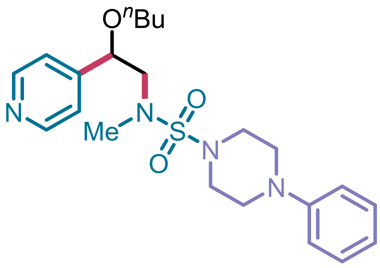
Colorless oil (32.1 mg, 95%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.57 (d, *J* = 4.8 Hz, 2H), 7.85 (s, 1H), 7.19 (d, *J* = 4.8 Hz, 2H), 7.17 (s, 1H), 7.06 (s, 1H), 4.40 (dd, *J* = 8.4, 3.0 Hz, 1H), 3.35 (dd, *J* = 15.0, 3.6 Hz, 1H), 3.29 – 3.26 (m, 1H), 3.23 – 3.20 (m, 1H), 3.12 (dd, *J* = 15.0, 9.0 Hz, 1H), 2.94 (s, 3H), 1.49 – 1.45 (m, 2H), 1.32 – 1.25 (m, 2H), 0.83 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 150.1, 148.11, 136.7, 130.7, 121.6, 117.4, 80.4, 69.8, 56.6, 37.7, 31.8, 19.3, 13.8; HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{15}H_{23}N_4O_3S^+$ 339.1485; found 339.1490.

N-(2-butoxy-2-(pyridin-4-yl)ethyl)-4-(2,3-dimethylbenzyl)-N-methyl-1H-imidazole-1-sulfonamide (6d)



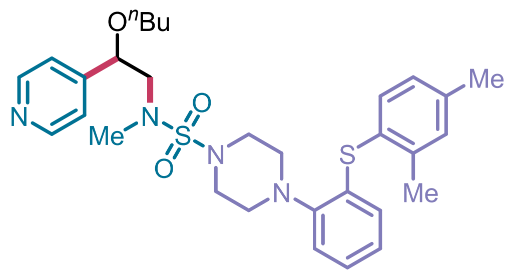
Colorless oil (41.1 mg, 90%); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.61 (d, J = 6.0 Hz, 2H), 7.84 (d, J = 1.2 Hz, 1H), 7.19 (d, J = 5.6 Hz, 2H), 7.08 – 7.03 (m, 3H), 6.67 (d, J = 0.8 Hz, 1H), 4.39 (dd, J = 8.4, 3.6 Hz, 1H), 3.93 (s, 2H), 3.38 – 3.29 (m, 2H), 3.27 – 3.21 (m, 1H), 3.12 (dd, J = 14.8, 8.8 Hz, 1H), 2.94 (s, 3H), 2.27 (s, 3H), 2.16 (s, 3H), 1.56 – 1.49 (m, 2H), 1.39 – 1.30 (m, 2H), 0.90 (t, J = 7.6 Hz, 3H); ^{13}C NMR (101 MHz, Chloroform-*d*) δ 150.3, 147.8, 144.3, 137.2, 136.6, 136.4, 134.9, 128.6, 127.7, 125.6, 121.5, 113.9, 80.4, 69.8, 56.5, 37.8, 33.3, 31.8, 20.7, 19.3, 15.3, 13.8; HRMS (ESI) *m/z*: $[M + Na]^+$ calcd for $C_{24}H_{32}N_4O_3SNa^+$ 479.2087; found 479.2086.

N-(2-butoxy-2-(pyridin-4-yl)ethyl)-N-methyl-4-phenylpiperazine-1-sulfonamide (6e)



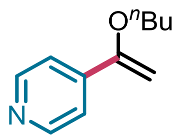
Yellow oil (41.1 mg, 95%); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.61 – 8.60 (m, 2H), 7.29 – 7.25 (m, 4H), 6.93 – 6.89 (m, 3H), 4.57 (dd, J = 8.4, 3.6 Hz, 1H), 3.46 (dd, J = 14.8, 3.6 Hz, 1H), 3.37 (td, J = 6.4, 1.4 Hz, 2H), 3.33 – 3.31 (m, 4H), 3.26 (dd, J = 14.8, 8.4 Hz, 1H), 3.23 – 3.18 (m, 4H), 2.97 (s, 3H), 1.62 – 1.55 (m, 2H), 1.44 – 1.35 (m, 2H), 0.91 (t, J = 7.2 Hz, 3H); ^{13}C NMR (101 MHz, Chloroform-*d*) δ 150.8, 150.1, 148.9, 129.3, 121.6, 120.7, 116.8, 81.1, 69.7, 57.0, 49.2, 46.1, 37.6, 32.0, 19.4, 13.9; HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{22}H_{32}N_4O_3S^+$ 433.2268; found 433.2257.

N-(2-butoxy-2-(pyridin-4-yl)ethyl)-4-(2-((2,4-dimethylphenyl)thio)phenyl)-N-methylpiperazine-1-sulfonamide (6f)



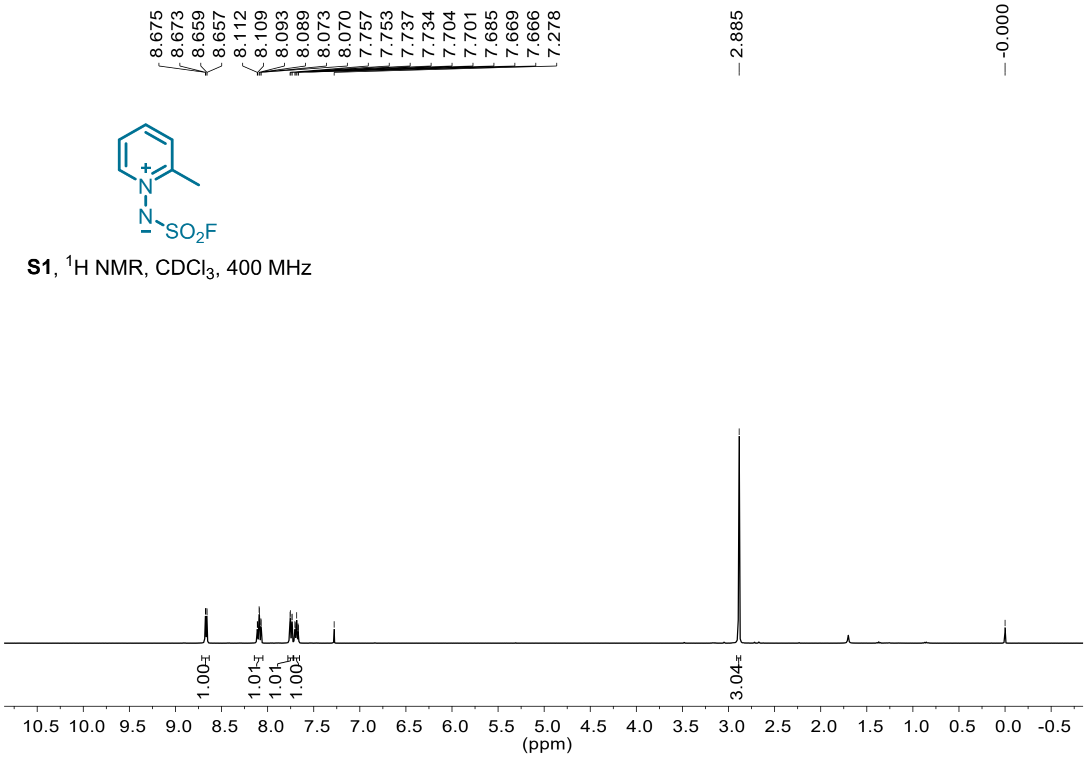
Colorless oil (54.6 mg, 96%); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.61 (d, *J* = 6.0 Hz, 2H), 7.35 (d, *J* = 7.8 Hz, 1H), 7.30 (d, *J* = 6.0 Hz, 2H), 7.15 (s, 1H), 7.09 – 7.06 (m, 1H), 7.02 (d, *J* = 7.8 Hz, 2H), 6.90 – 6.87 (m, 1H), 6.52 (dd, *J* = 7.8, 1.2 Hz, 1H), 4.59 (dd, *J* = 8.4, 3.6 Hz, 1H), 3.47 (dd, *J* = 15.0, 3.6 Hz, 1H), 3.40 – 3.37 (m, 6H), 3.25 (dd, *J* = 14.4, 8.4 Hz, 1H), 3.10 – 3.09 (m, 4H), 2.98 (s, 3H), 2.36 (s, 3H), 2.30 (s, 3H), 1.59 (p, *J* = 7.2 Hz, 2H), 1.43 – 1.37 (m, 2H), 0.91 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (101 MHz, DMSO-d_6) δ 150.2, 149.1, 148.9, 142.0, 139.6, 136.1, 133.9, 132.1, 128.4, 127.6, 126.3, 126.2, 125.2, 122.3, 121.6, 120.9, 118.4, 79.7, 69.2, 56.3, 55.3, 51.2, 46.7, 37.0, 31.9, 27.2, 21.1, 20.5, 19.3, 14.1; HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{30}H_{40}N_4O_3S_2^+$ 569.2615; found 569.2620.

4-(1-butoxyvinyl)pyridine (6g)

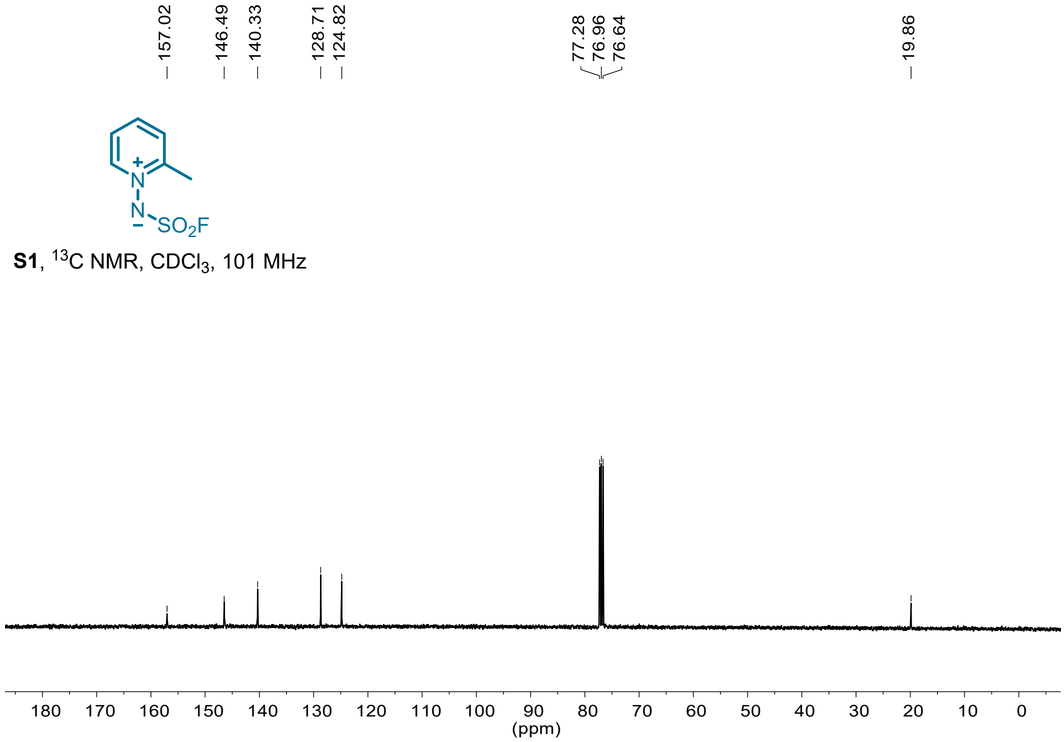


Colorless oil (10.3 mg, 58%); ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.58 (d, *J* = 4.8 Hz, 2H), 7.50 (d, *J* = 6.0 Hz, 2H), 4.84 (d, *J* = 3.2 Hz, 1H), 4.36 (d, *J* = 2.8 Hz, 1H), 3.86 (t, *J* = 6.4 Hz, 2H), 1.83 – 1.76 (m, 2H), 1.57 – 1.47 (m, 2H), 0.99 (t, *J* = 7.6 Hz, 3H); ^{13}C NMR (101 MHz, Chloroform-*d*) δ 157.4, 149.8, 143.9, 119.5, 85.0, 67.7, 31.0, 19.5, 13.9; HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{11}H_{16}NO^+$ 178.1226; found 178.1228.

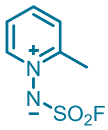
4. NMR Spectra



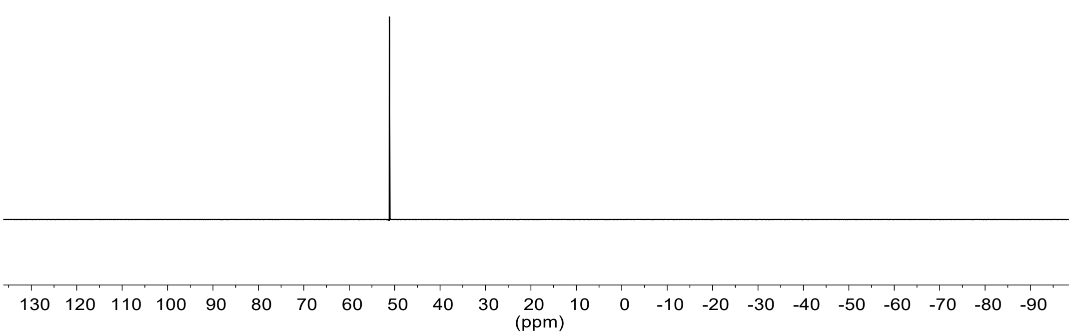
S1, ^{1}H NMR, $CDCl_3$, 400 MHz



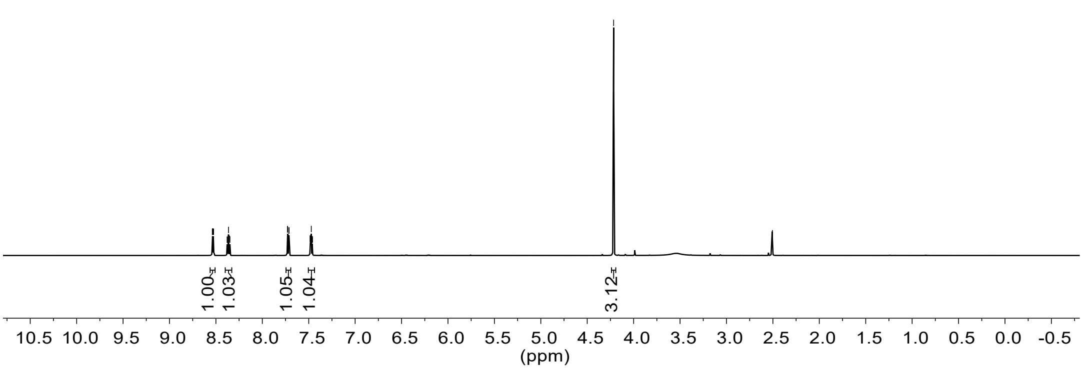
S1, ^{13}C NMR, $CDCl_3$, 101 MHz

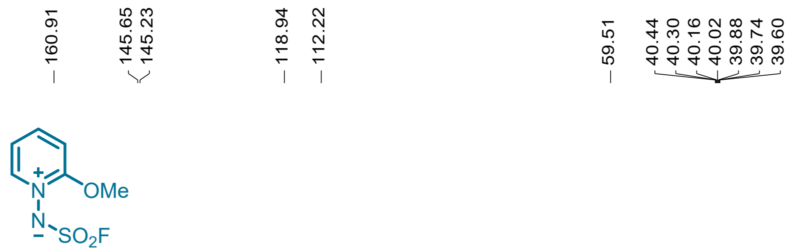


S1, ^{19}F NMR, $CDCl_3$, 376 MHz

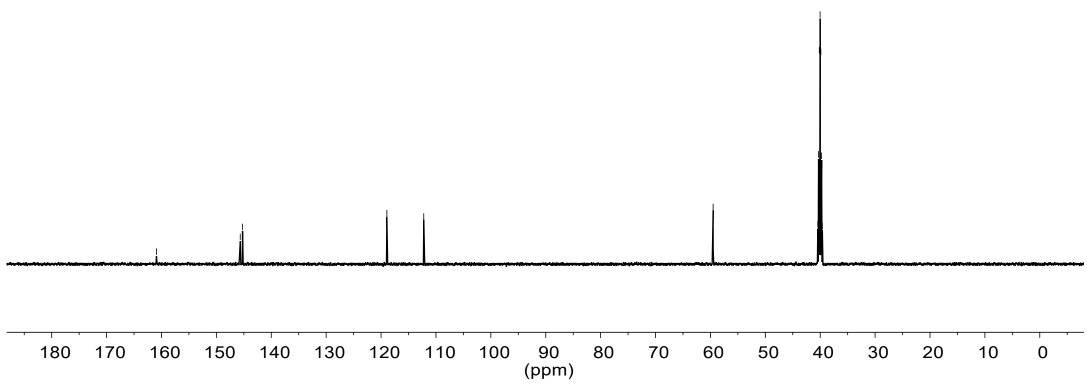


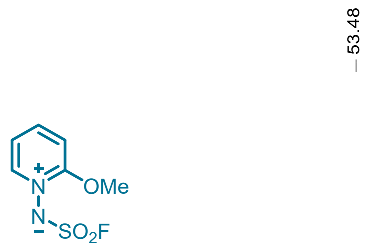
S2, ^{1}H NMR, DMSO-d_6, 600 MHz



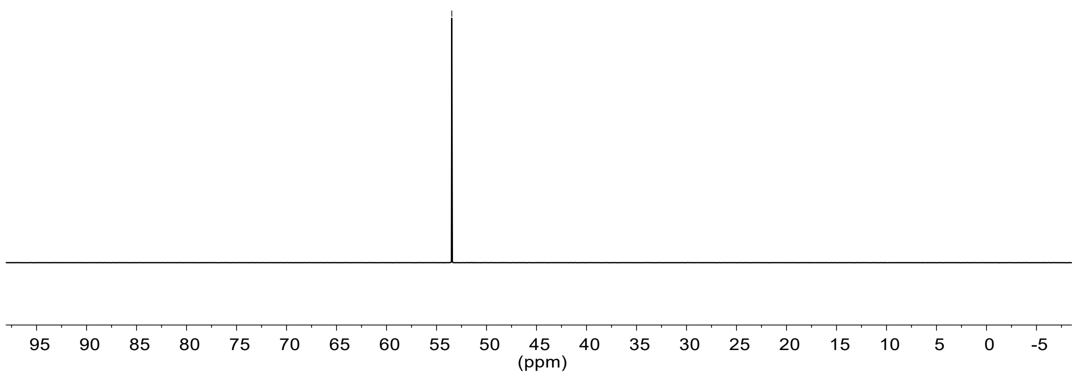


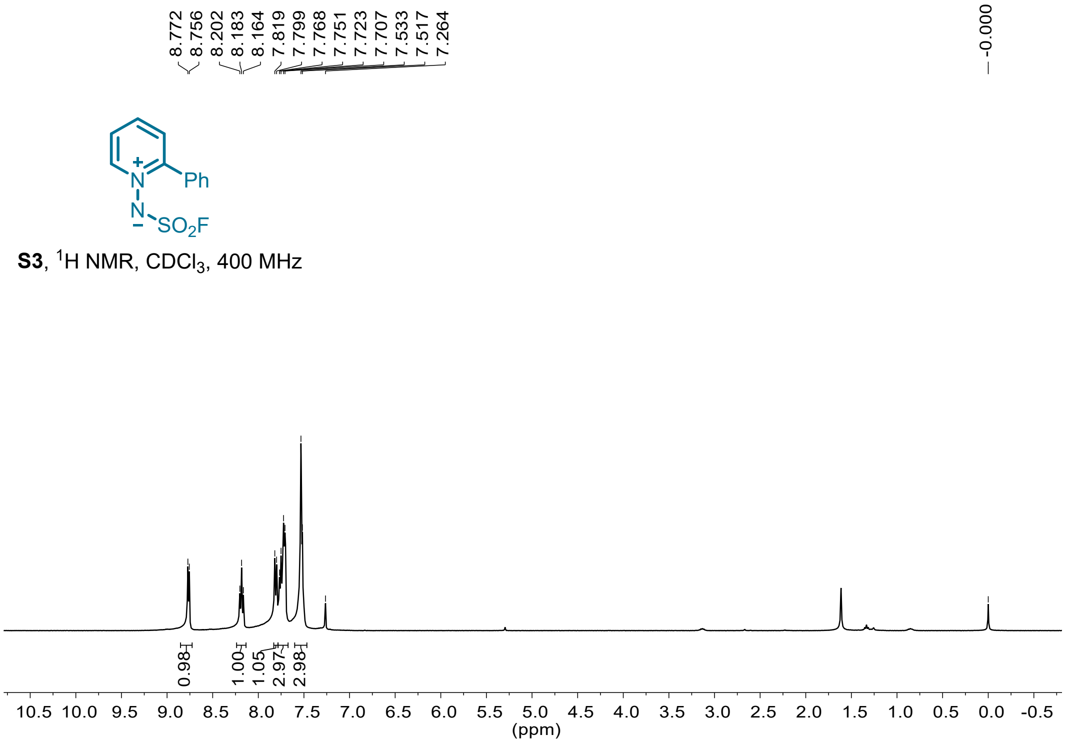
S2, ^{13}C NMR, DMSO-d_6, 151 MHz



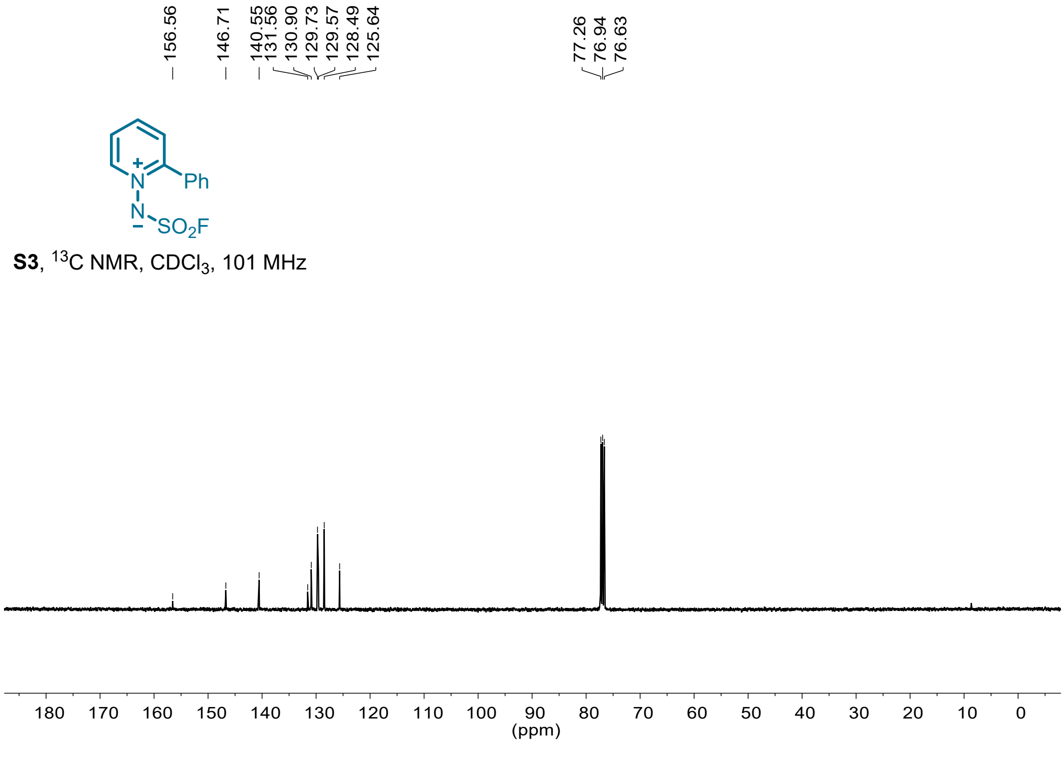


S2, ^{19}F NMR, DMSO-d_6, 565 MHz

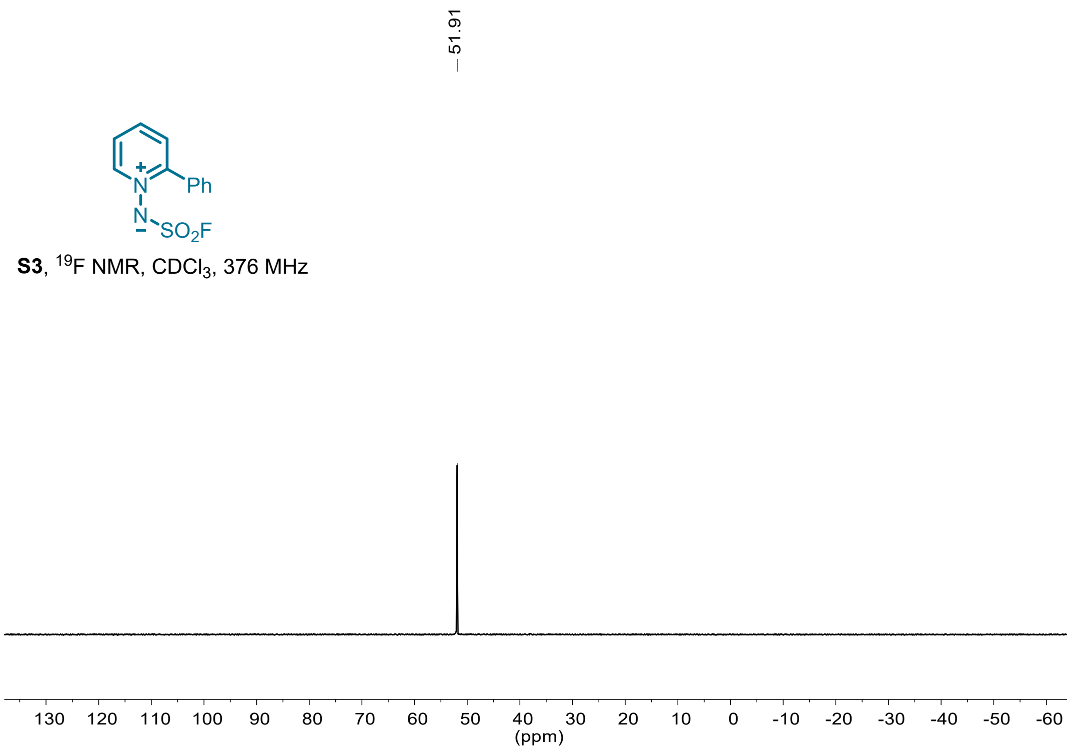




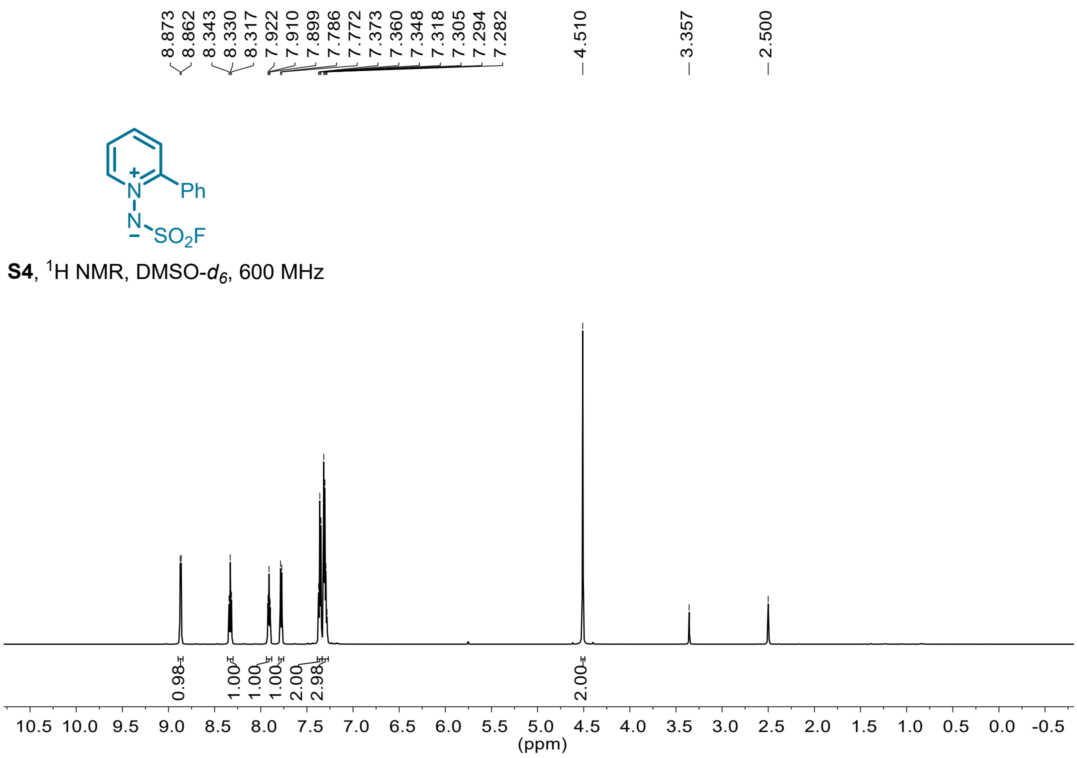
S3, ^{1}H NMR, $CDCl_3$, 400 MHz



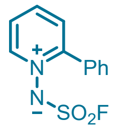
S3, ^{13}C NMR, $CDCl_3$, 101 MHz



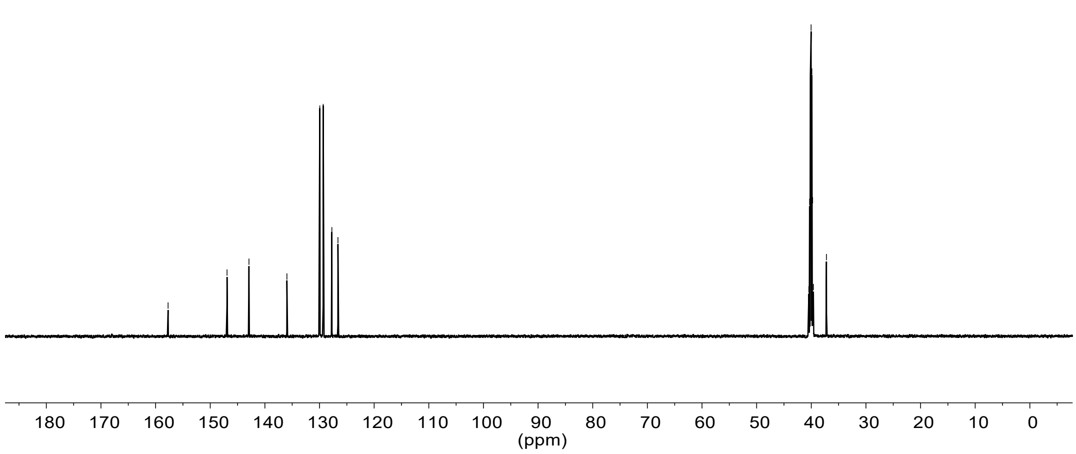
S3, ^{19}F NMR, $CDCl_3$, 376 MHz

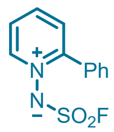


S4, ^{1}H NMR, DMSO-d_6, 600 MHz

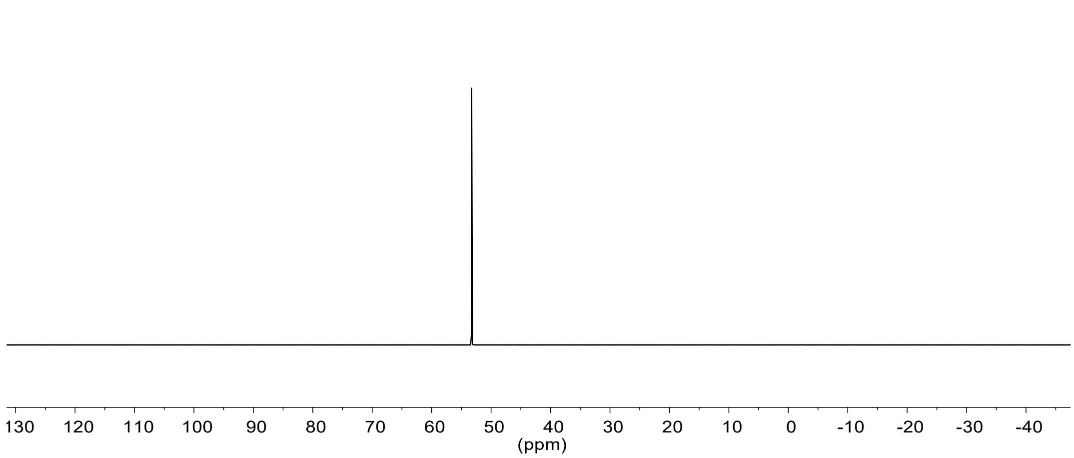


S4, ^{13}C NMR, DMSO-d_6, 151 MHz

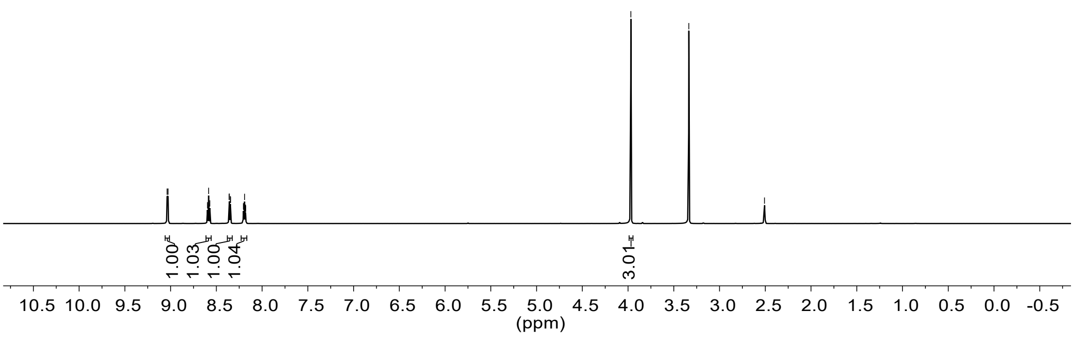




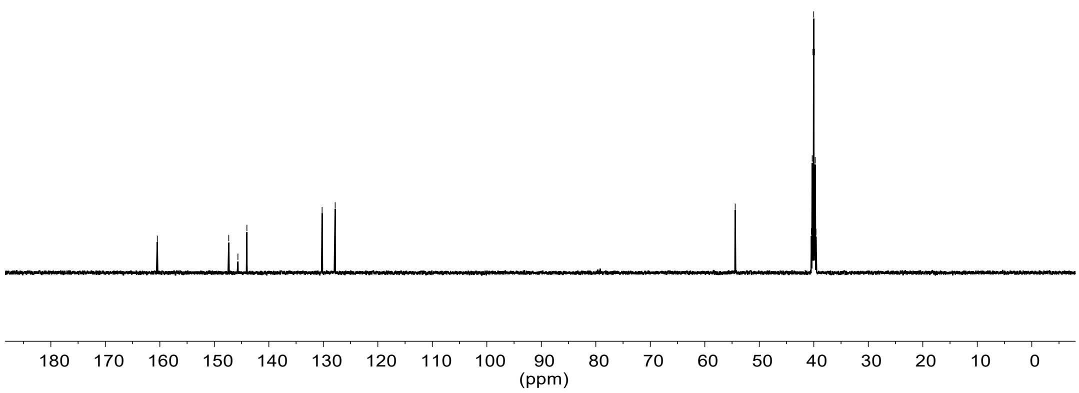
S4, ^{19}F NMR, DMSO-d_6, 565 MHz

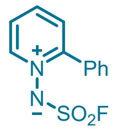


S5, ^{1}H NMR, DMSO-d_6, 600 MHz

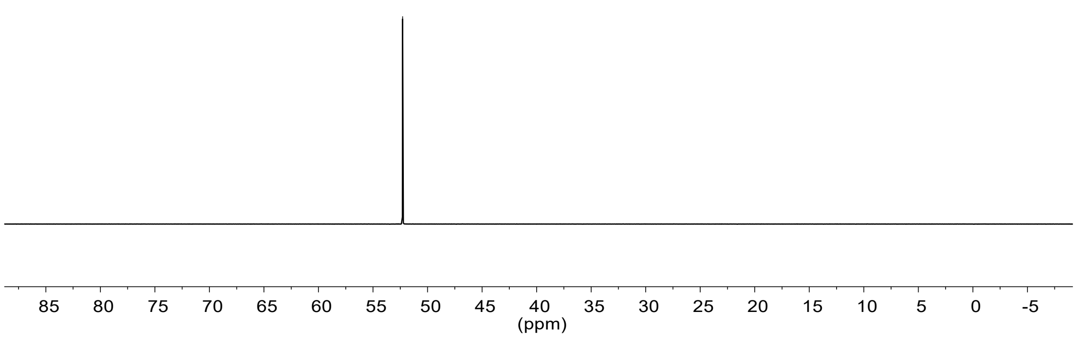


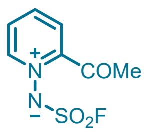
S5, ^{13}C NMR, DMSO-d_6, 151 MHz



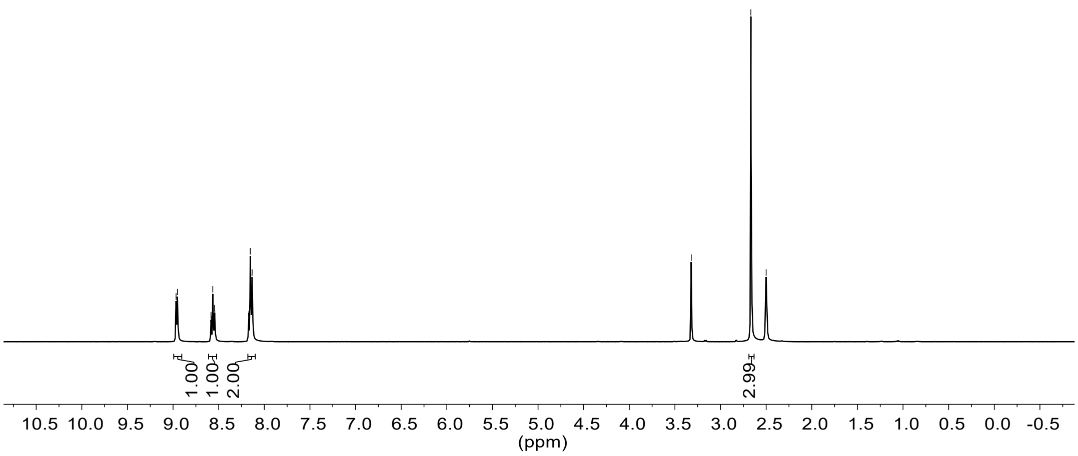


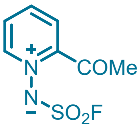
S5, [19]F NMR, DMSO-d_6, 565 MHz



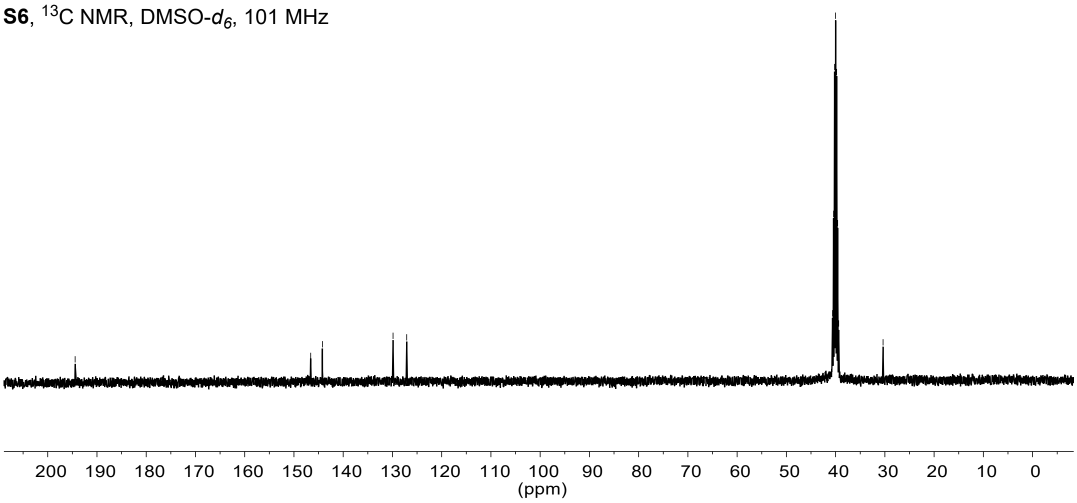


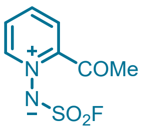
S6, [1]H NMR, DMSO-d_6, 400 MHz



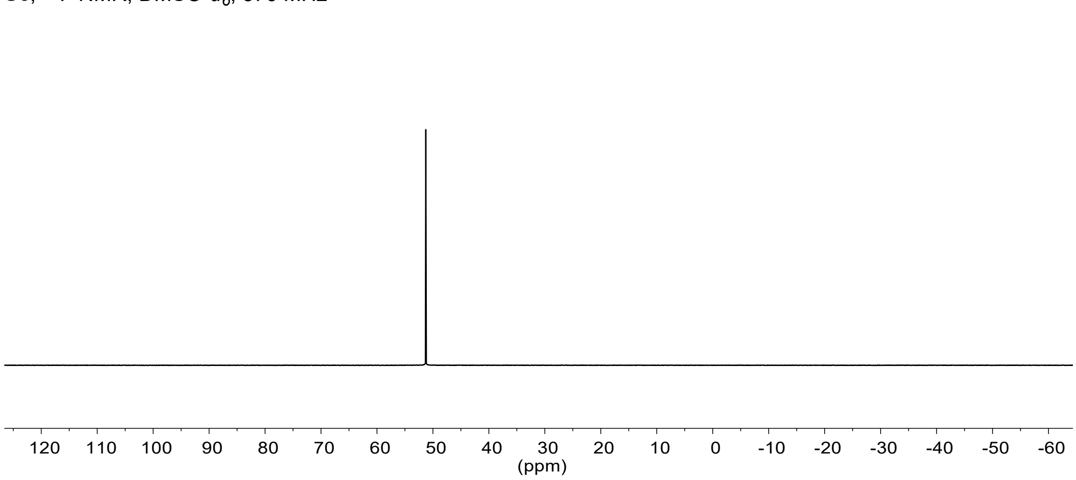


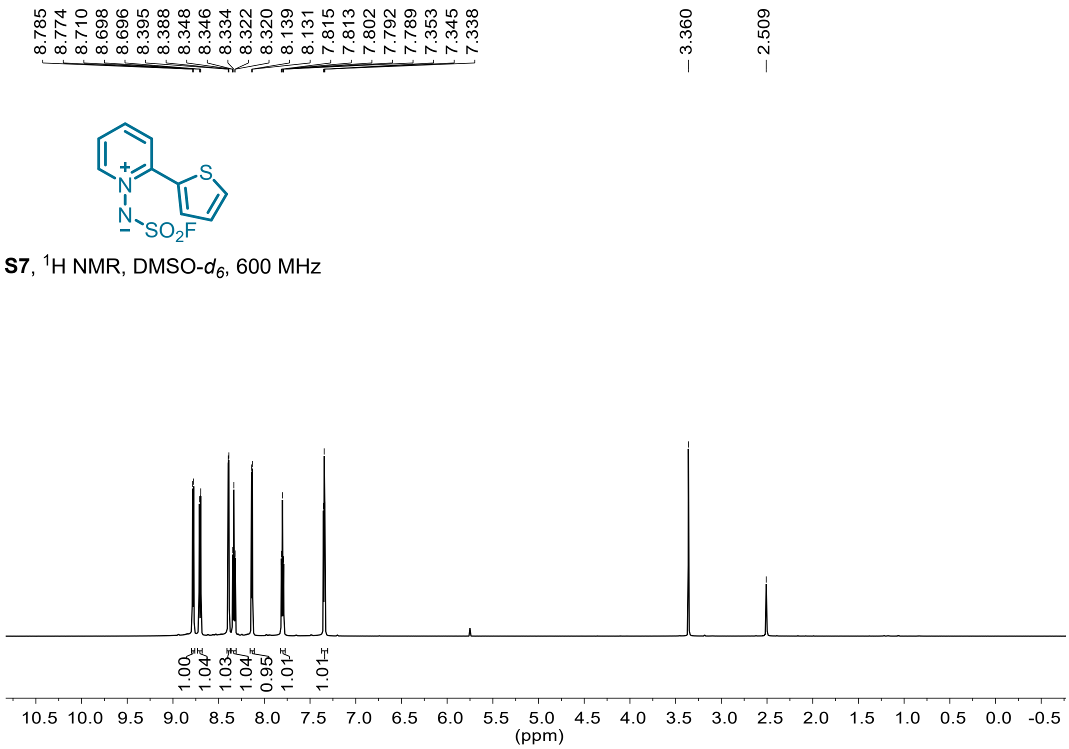
S6, ^{13}C NMR, DMSO-d_6, 101 MHz



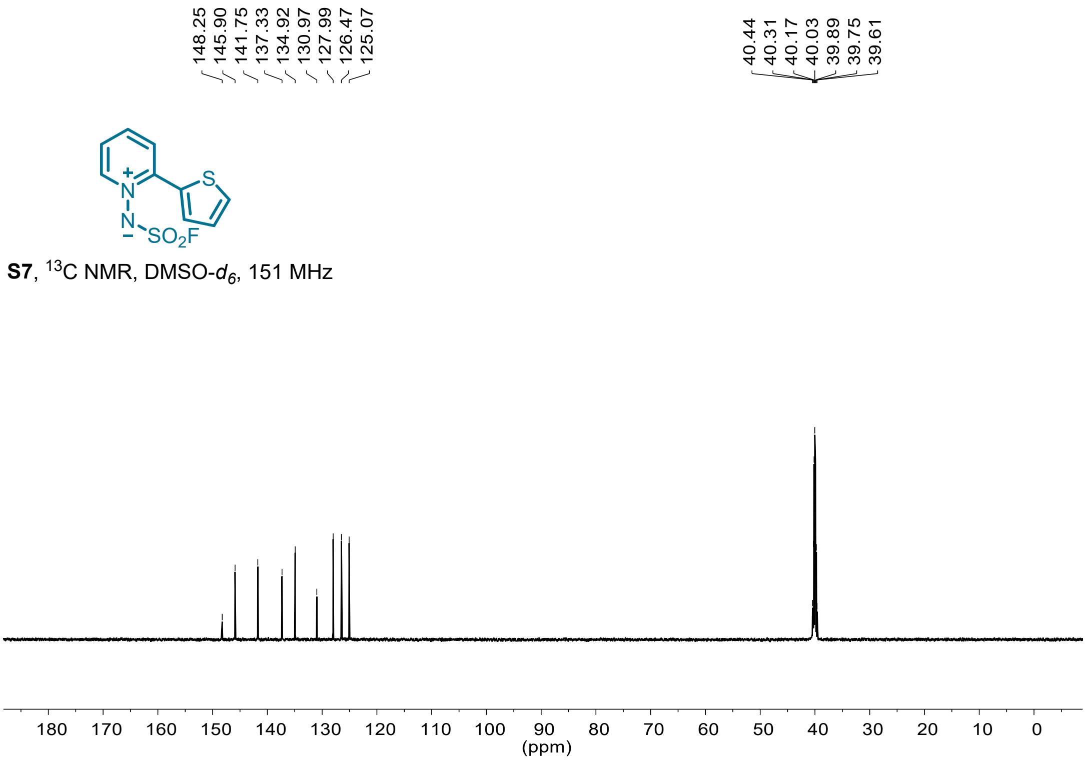


S6, ^{19}F NMR, DMSO-d_6, 376 MHz



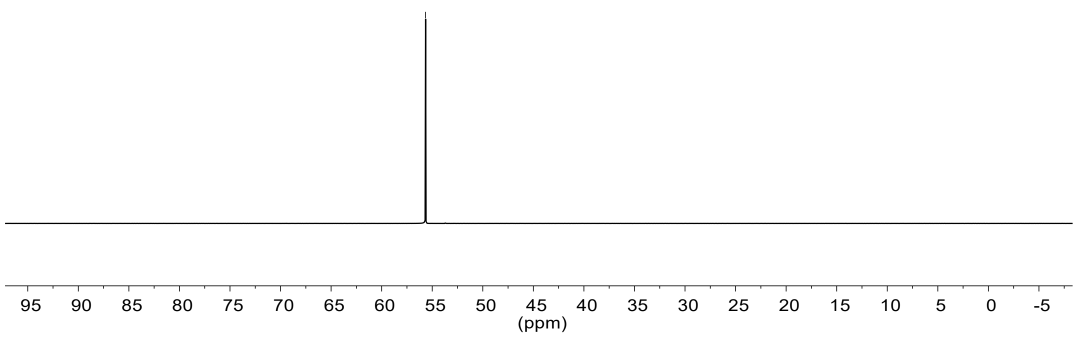


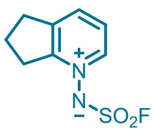
S7, ^{1}H NMR, DMSO-d_6, 600 MHz



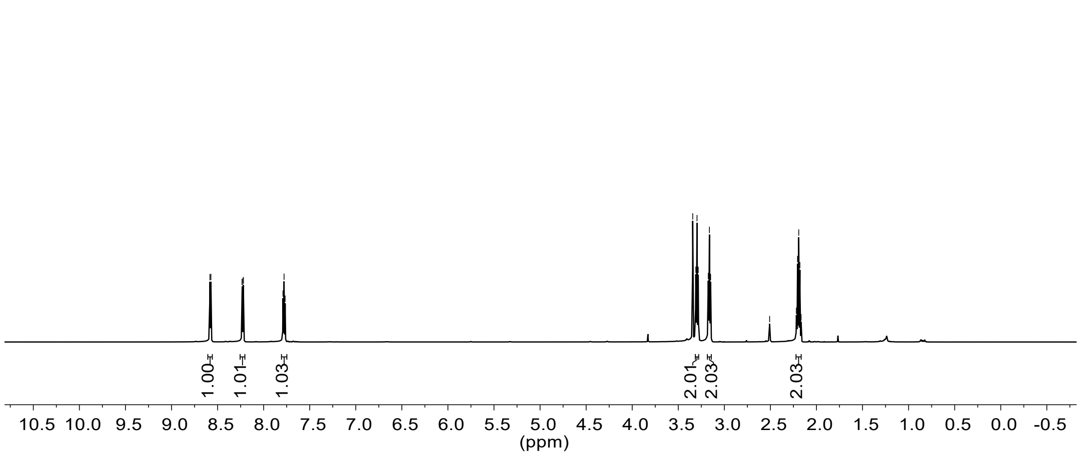
S7, ^{13}C NMR, DMSO-d_6, 151 MHz

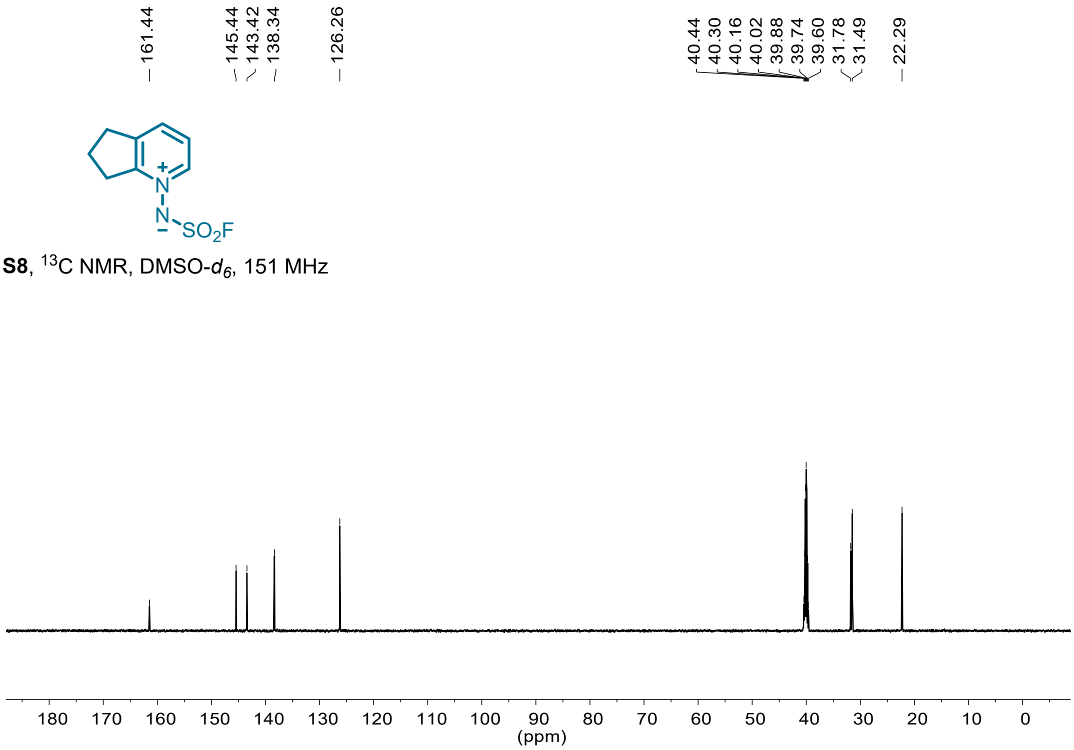
S7, ^{19}F NMR, DMSO-d_6, 565 MHz



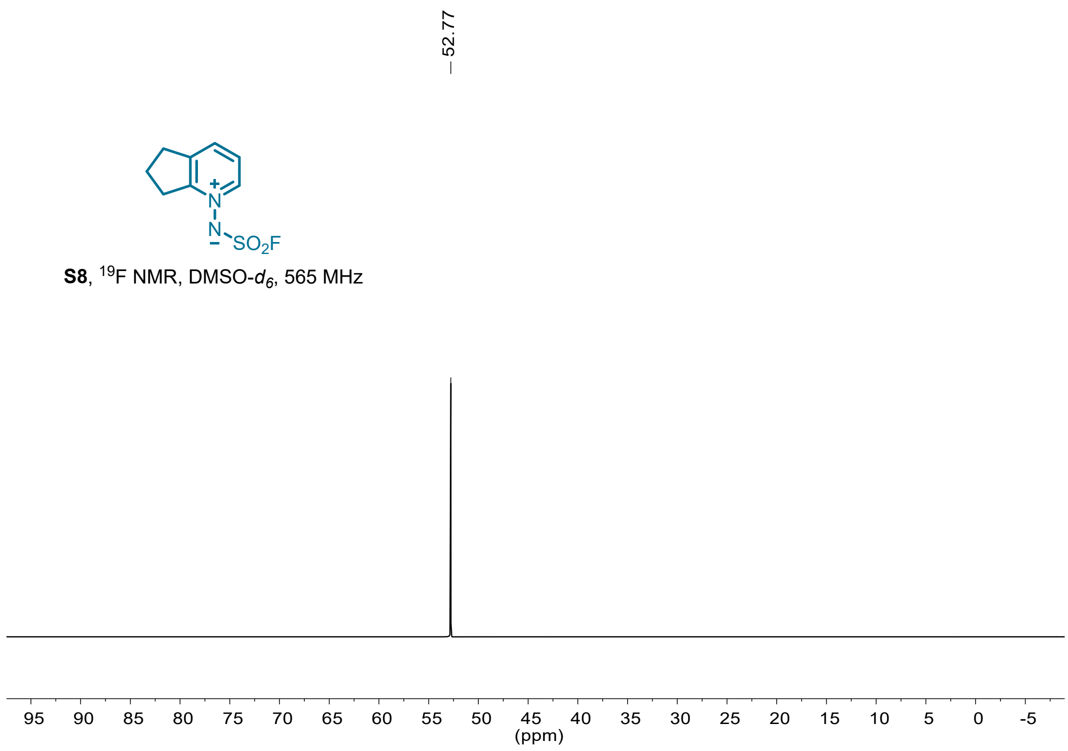


S8, ^{1}H NMR, DMSO-d_6, 600 MHz

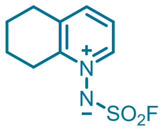




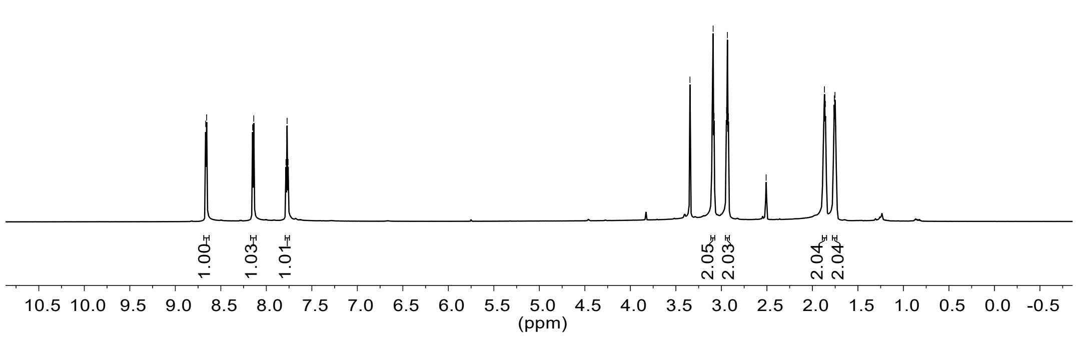
S8, ^{13}C NMR, DMSO-d_6, 151 MHz

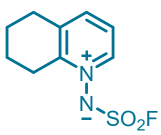


S8, ^{19}F NMR, DMSO-d_6, 565 MHz

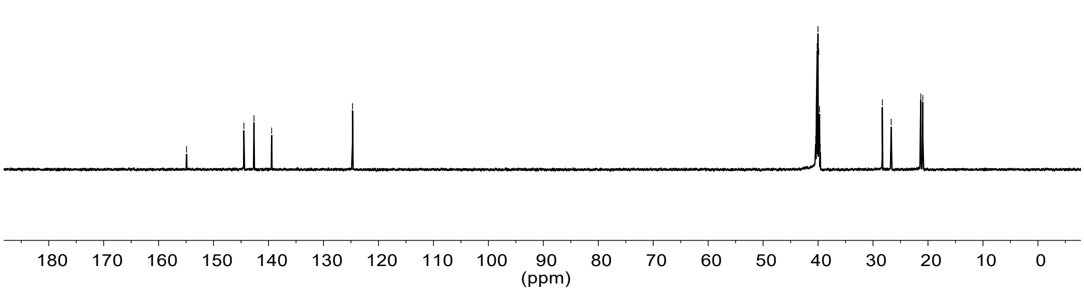


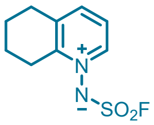
S9, ^{1}H NMR, DMSO-d_6, 600 MHz



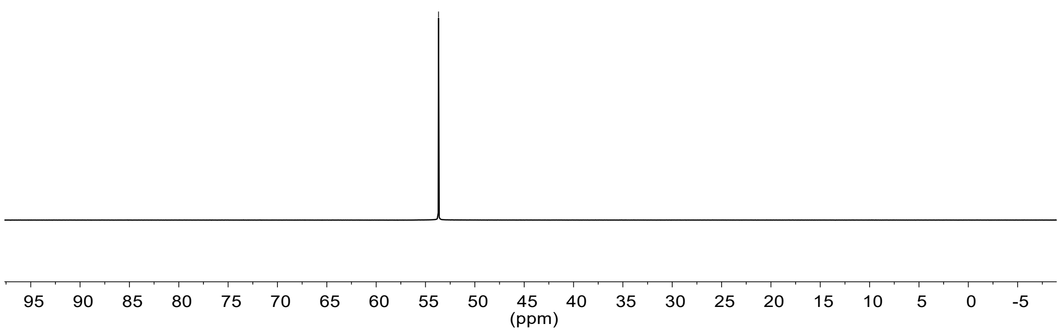


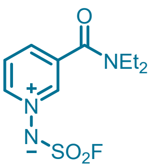
S9, ^{13}C NMR, DMSO-d_6, 151 MHz



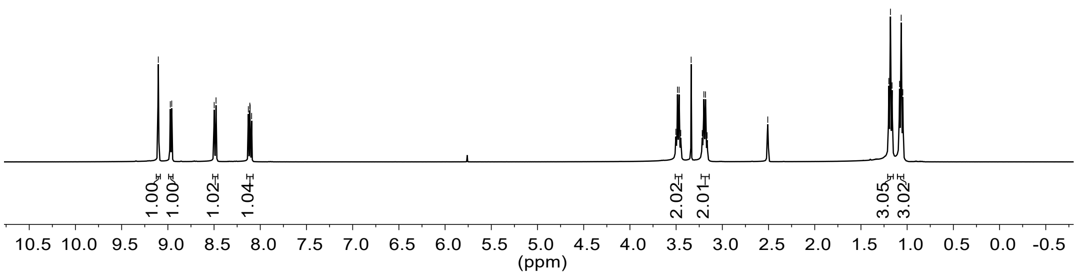


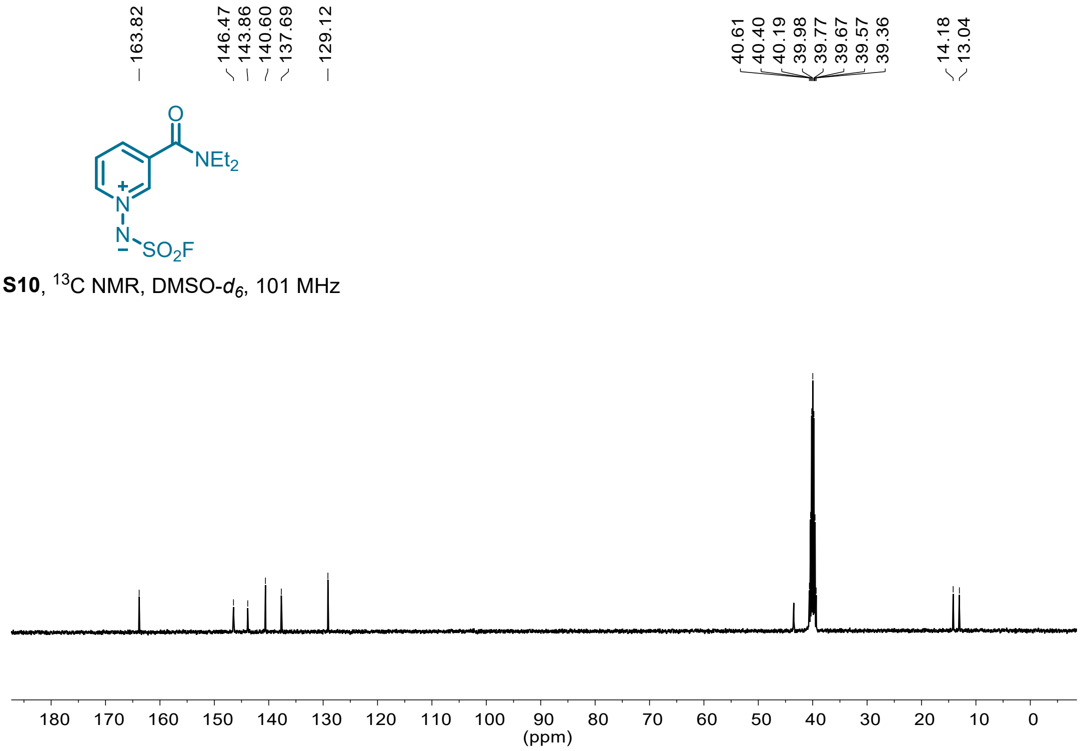
S9, ^{19}F NMR, DMSO-d_6, 565 MHz



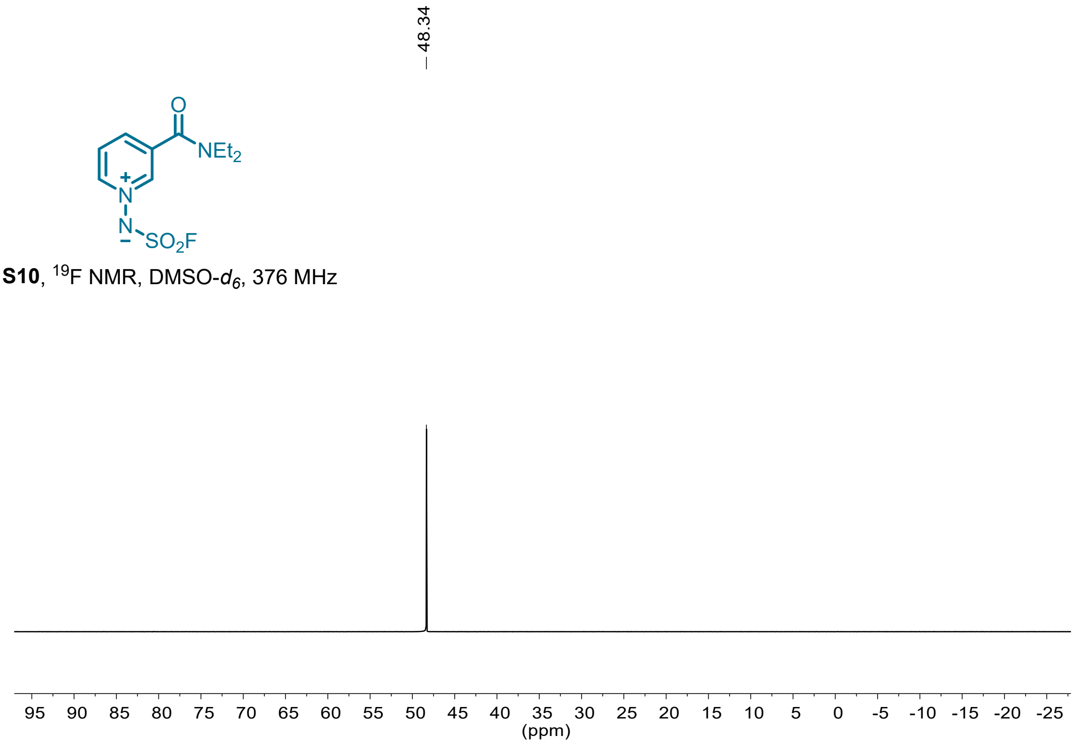


S10, ^{1}H NMR, DMSO-d_6, 400 MHz

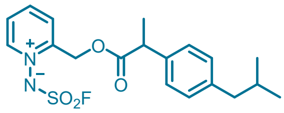




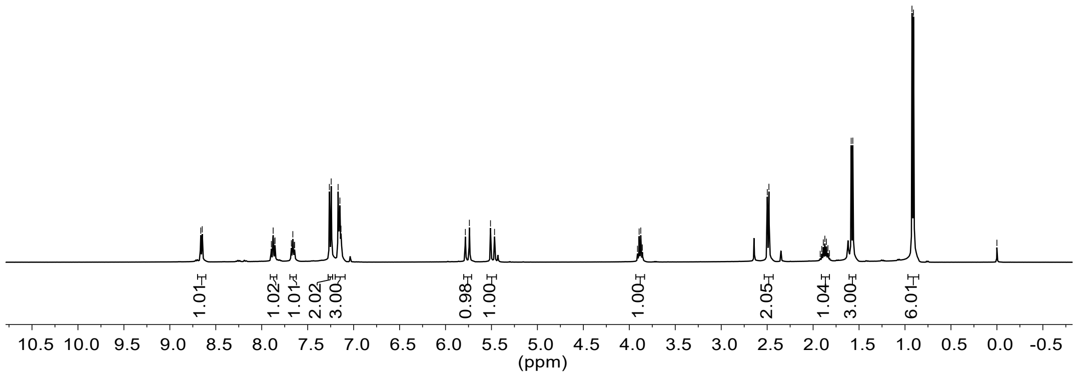
S10, ^{13}C NMR, DMSO-d_6, 101 MHz

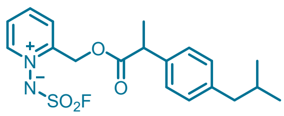


S10, ^{19}F NMR, DMSO-d_6, 376 MHz

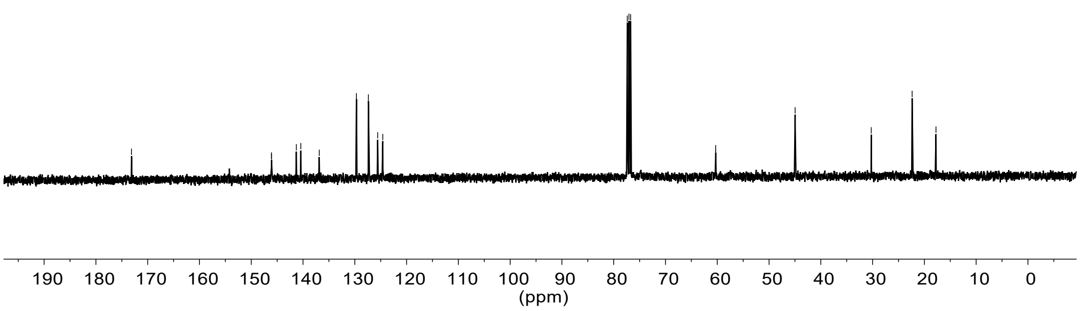


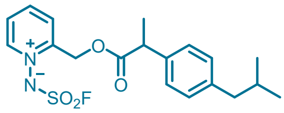
S11, ^{1}H NMR, $CDCl_3$, 400 MHz

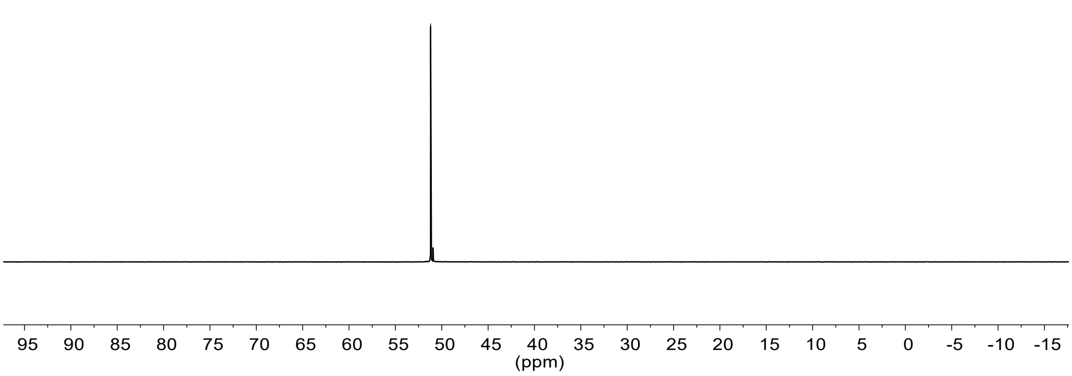




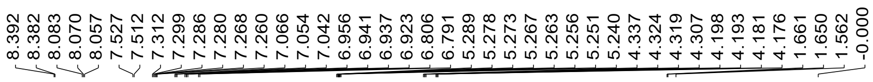
S11, ^{13}C NMR, $CDCl_3$, 101 MHz

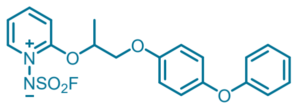




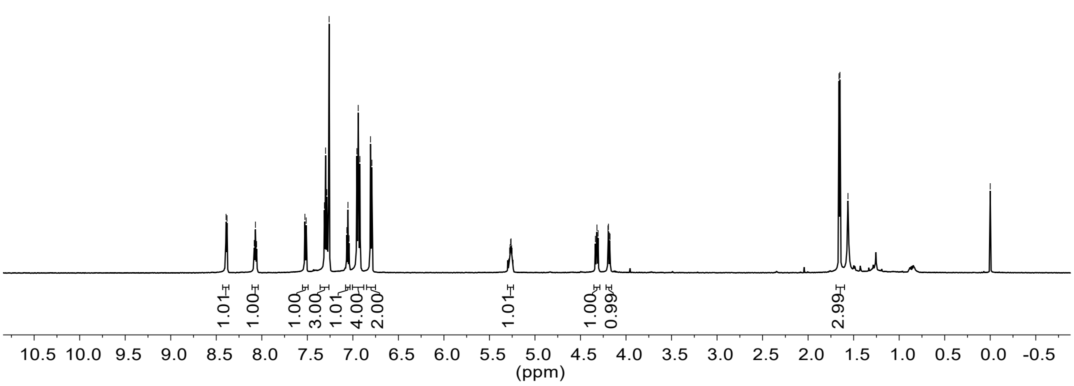


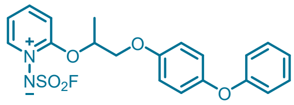
S11, ^{19}F NMR, $CDCl_3$, 376 MHz



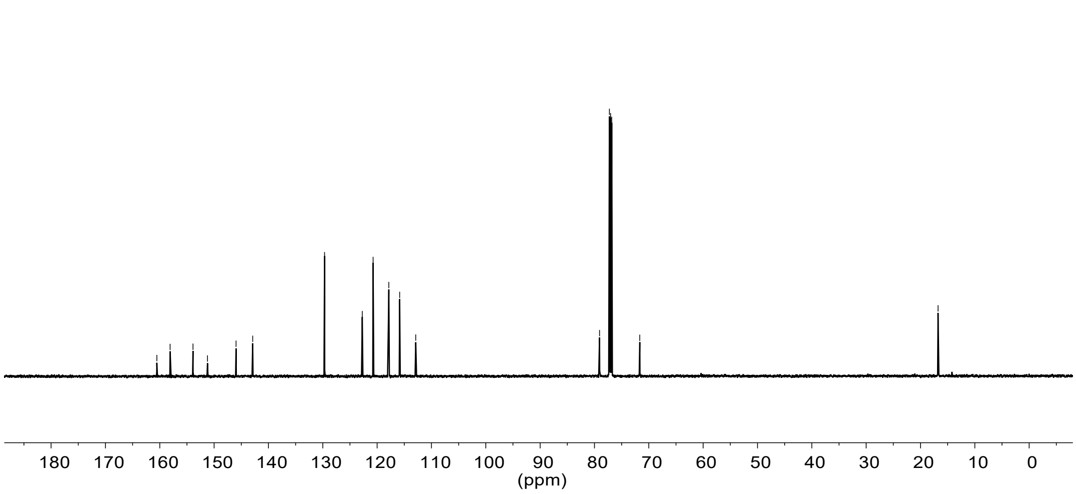


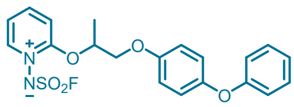
S12, ^{1}H NMR, $CDCl_3$, 600 MHz



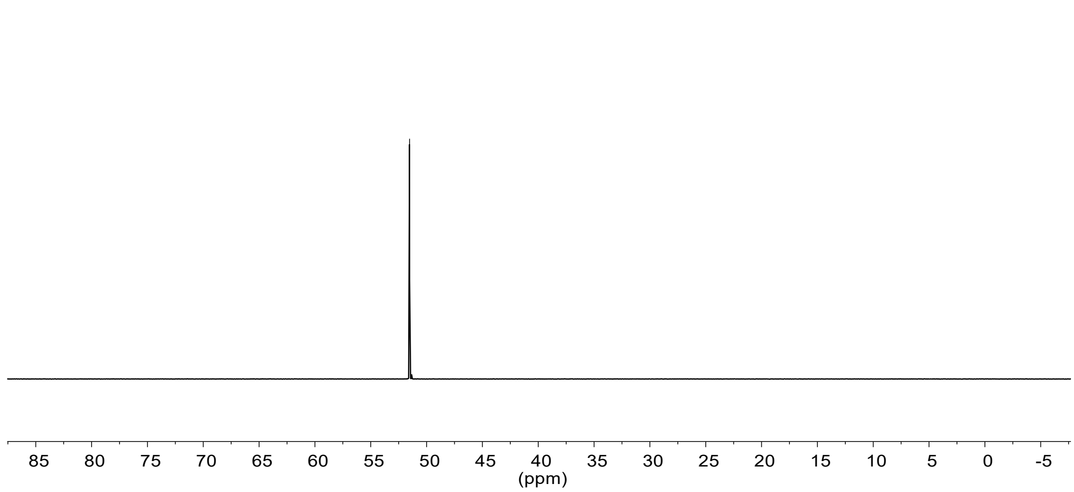


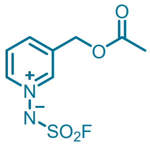
S12, ^{13}C NMR, $CDCl_3$, 151 MHz



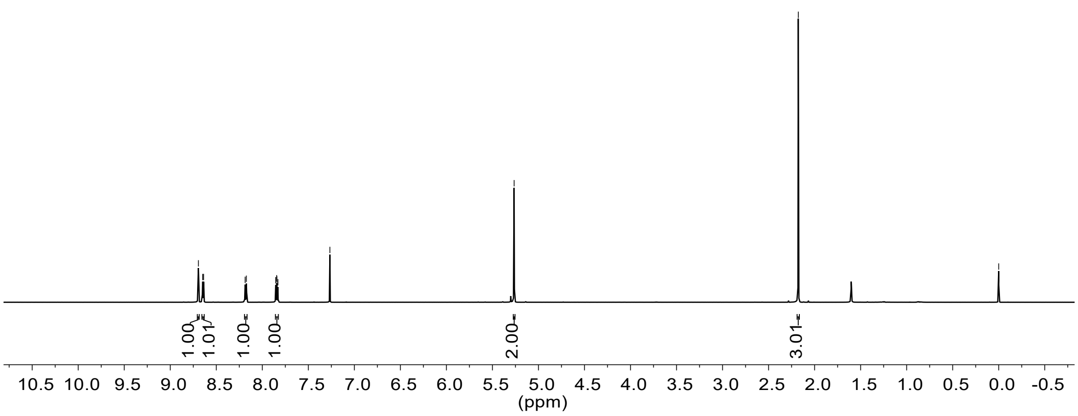


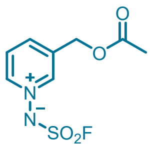
S12, ^{19}C NMR, $CDCl_3$, 565 MHz



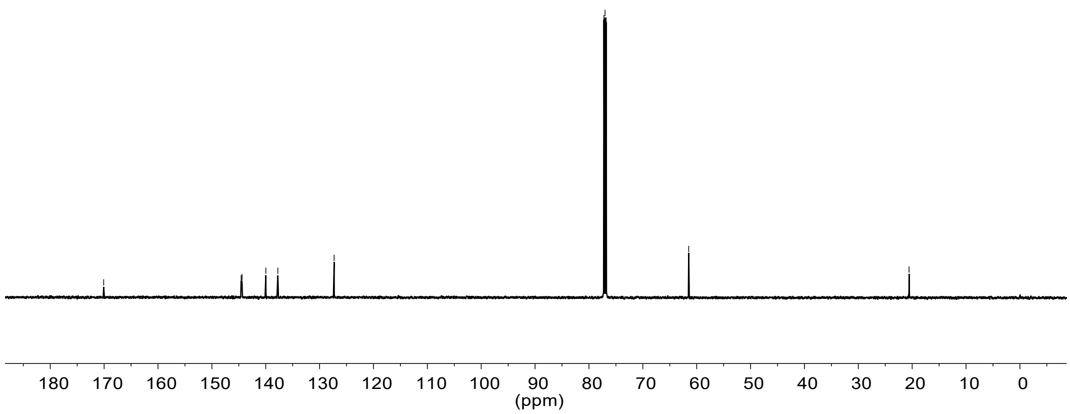


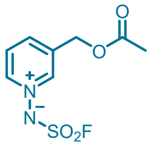
S13, ^{1}H NMR, $CDCl_3$, 600 MHz



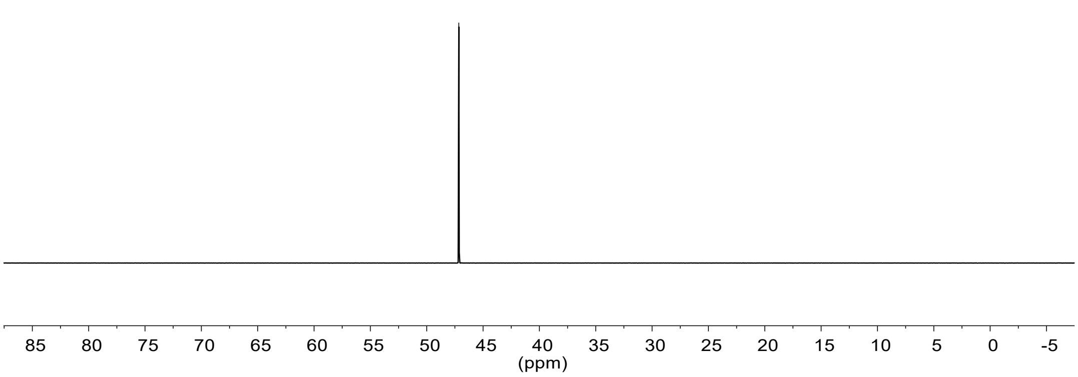


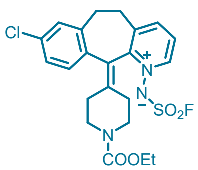
S13, ^{13}C NMR, $CDCl_3$, 151 MHz



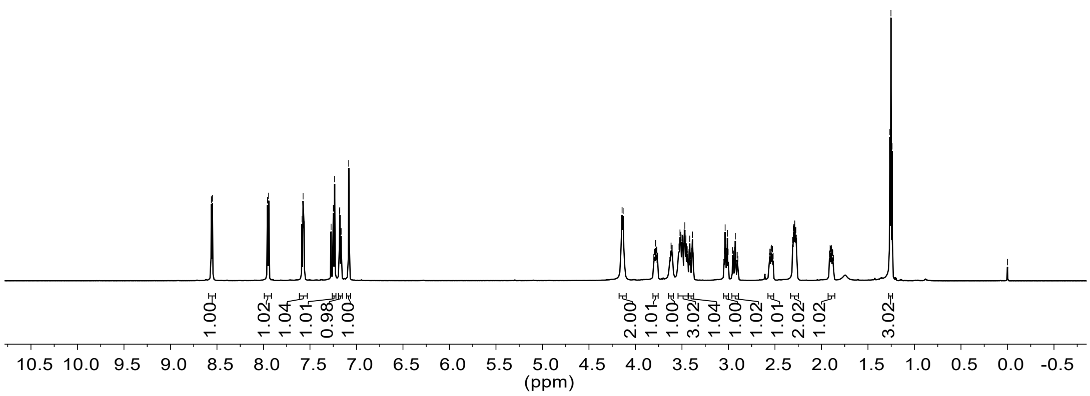


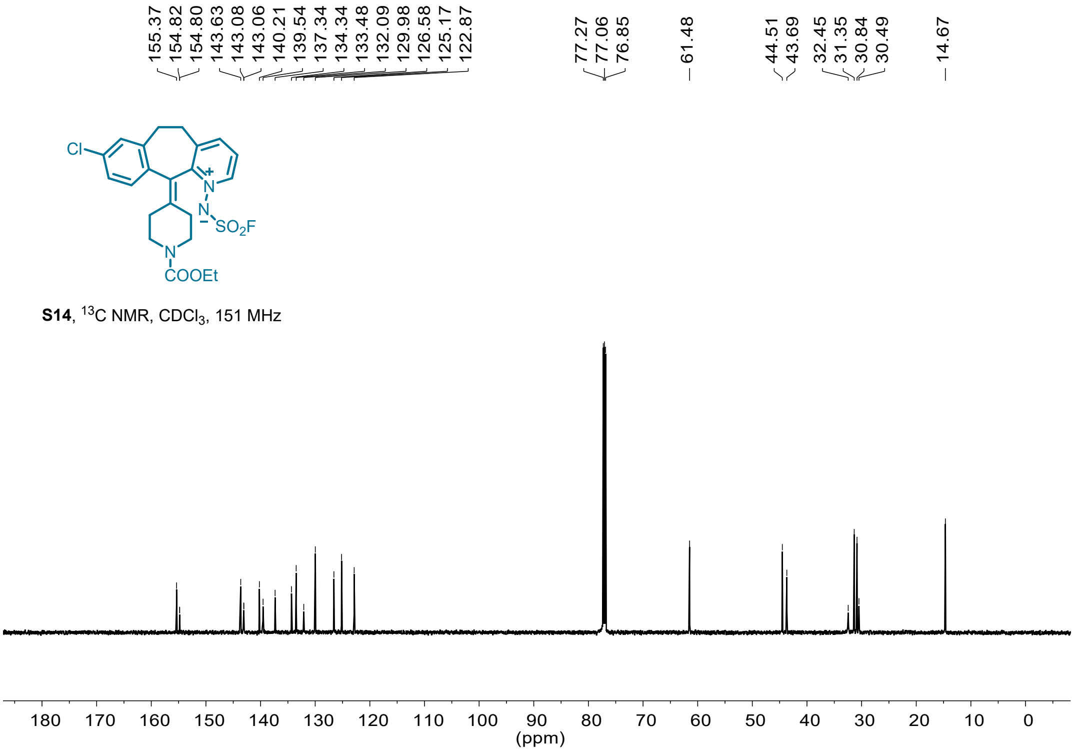
S13, ^{19}F NMR, $CDCl_3$, 565 MHz



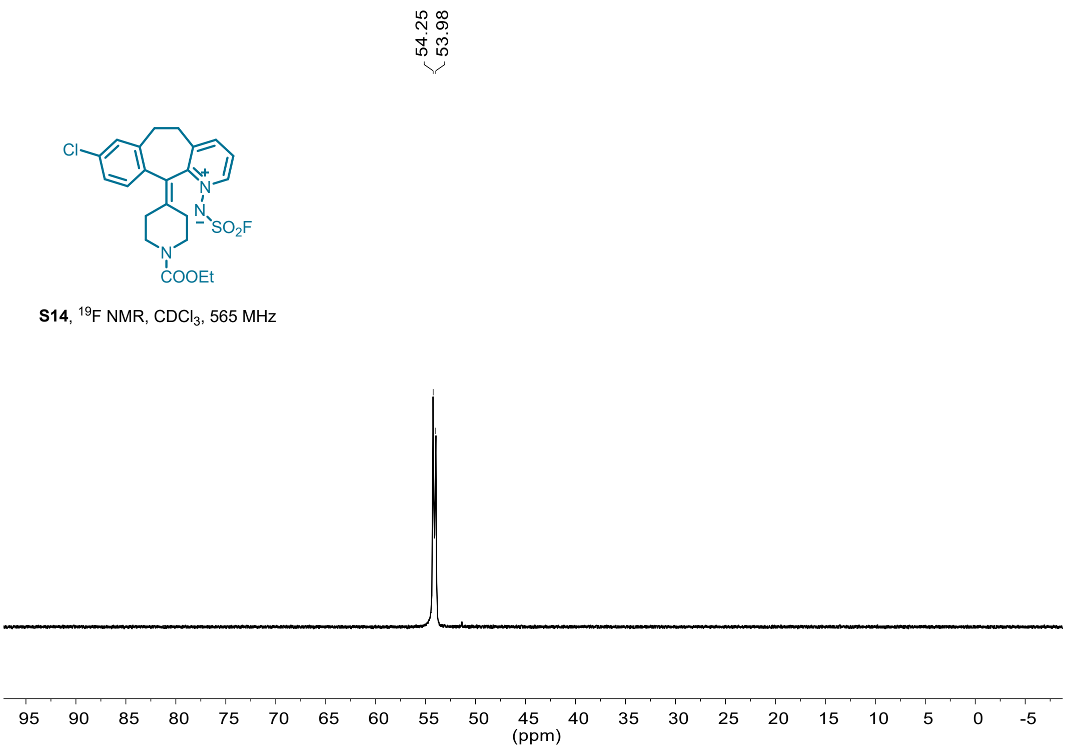


S14, ^{1}H NMR, $CDCl_3$, 600 MHz

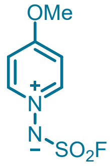




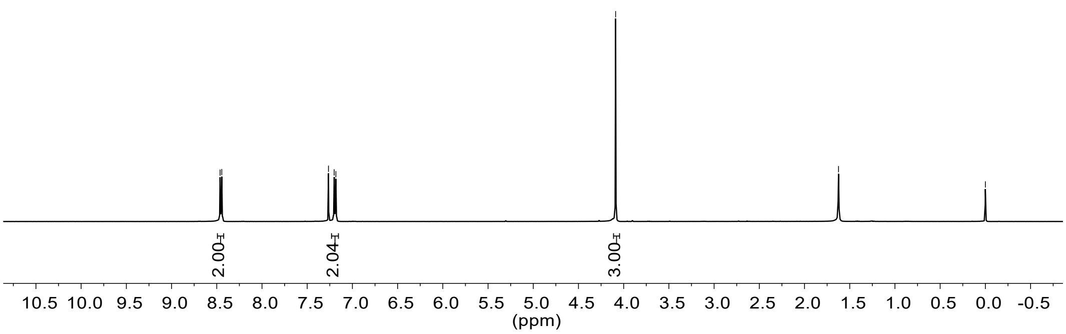
S14, ^{13}C NMR, $CDCl_3$, 151 MHz

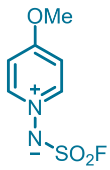


S14, ^{19}F NMR, $CDCl_3$, 565 MHz

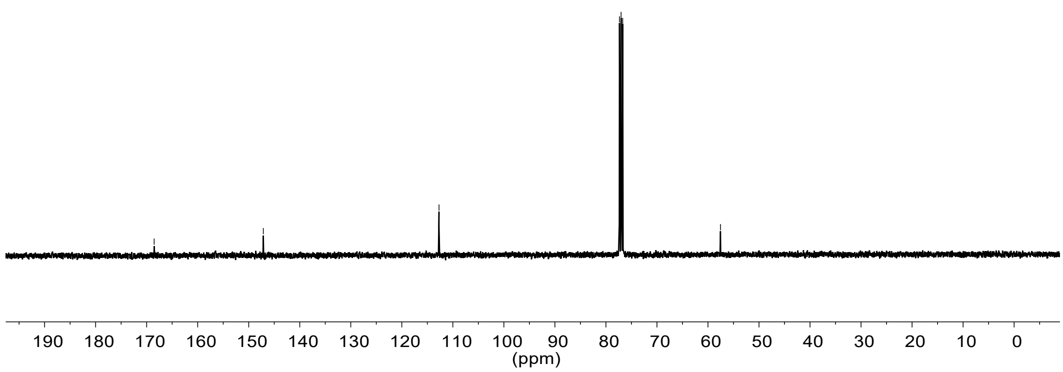


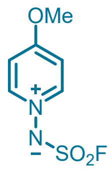
S15, ^{1}H NMR, $CDCl_3$, 400 MHz



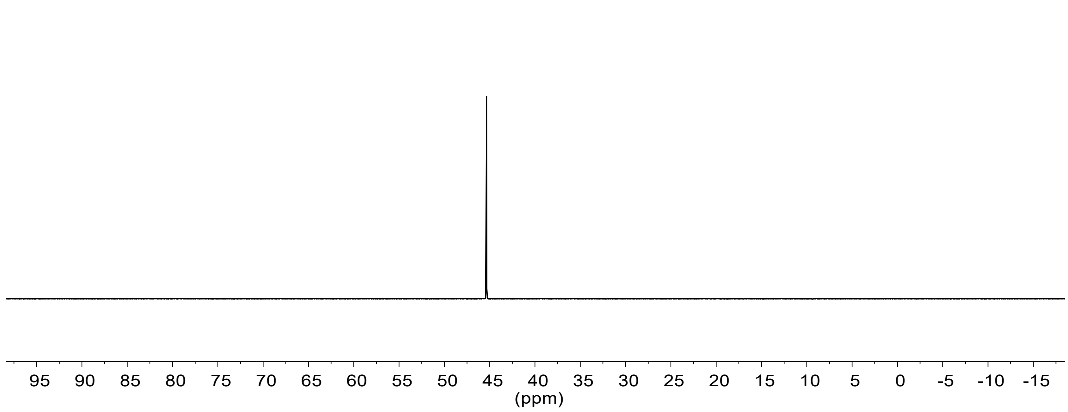


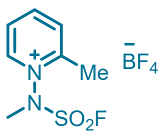
S15, ^{13}C NMR, $CDCl_3$, 101 MHz



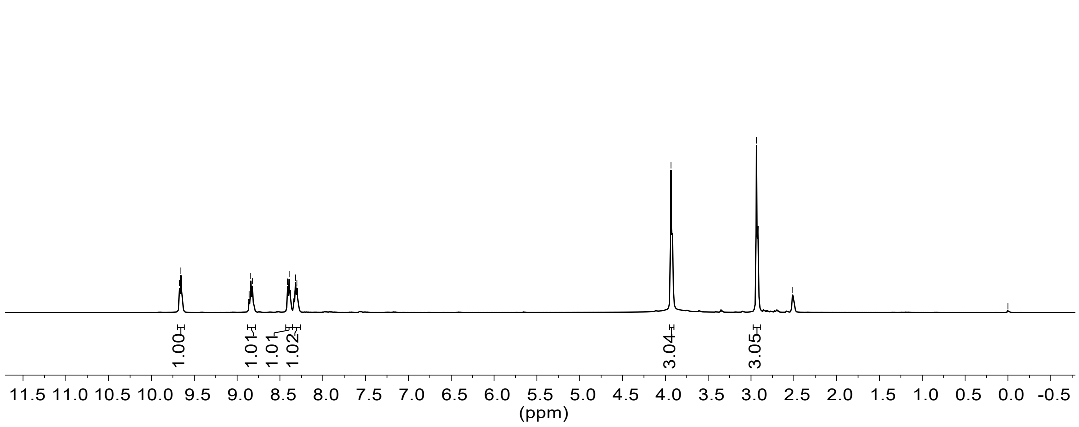


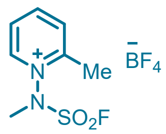
S15, ^{19}F NMR, $CDCl_3$, 376 MHz



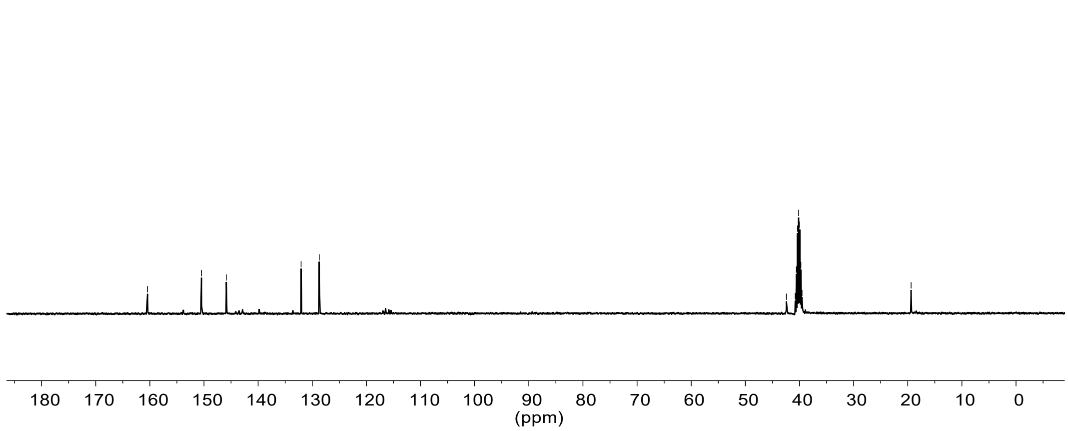


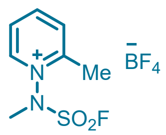
S16, ^{1}H NMR, DMSO-d_6, 400 MHz



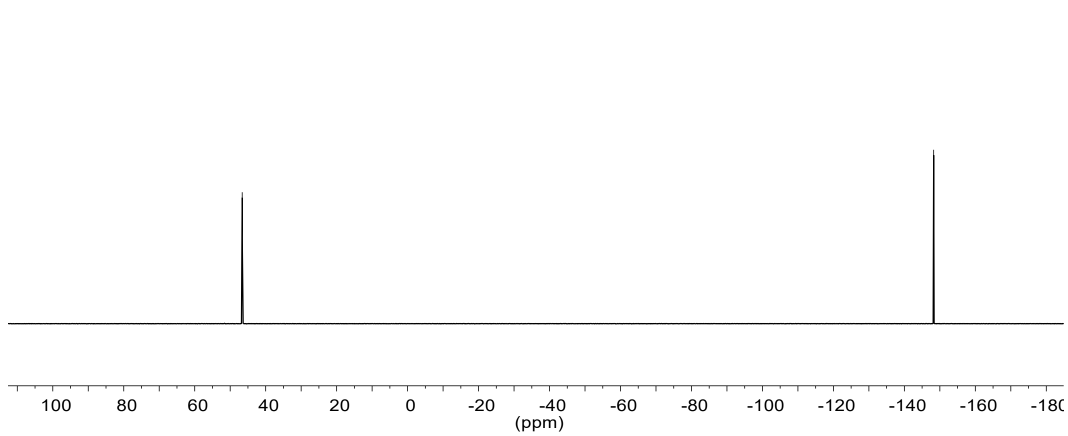


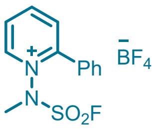
S16, ^{13}C NMR, DMSO-d_6, 101 MHz



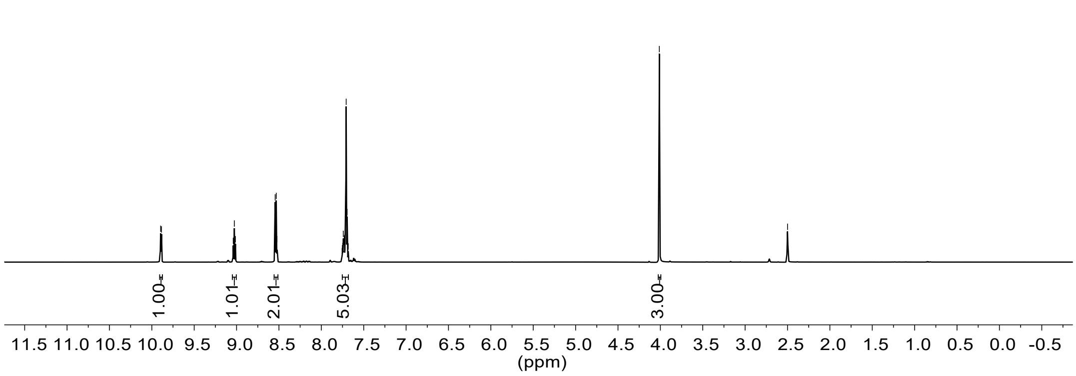


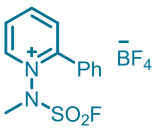
S16, ^{19}F NMR, DMSO-d_6, 376 MHz



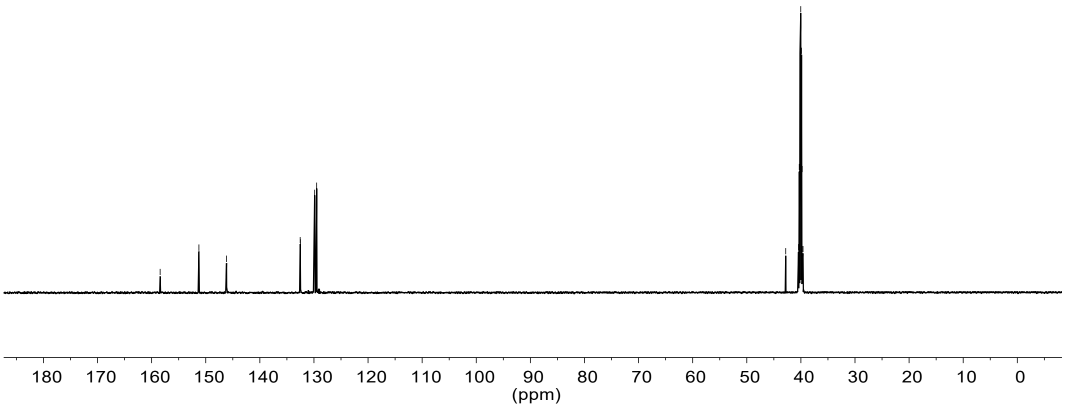


S17, ^{1}H NMR, DMSO-d_6, 600 MHz

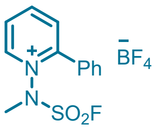




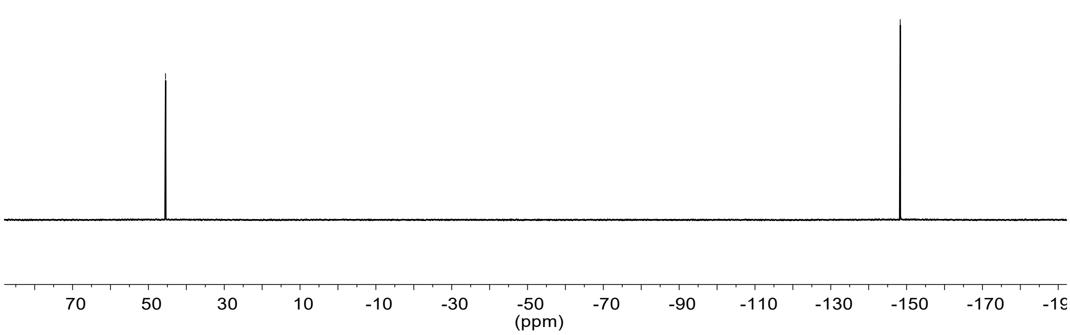
S17, ^{13}C NMR, DMSO-d_6, 151 MHz



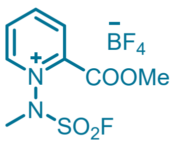
-45.48
-148.33



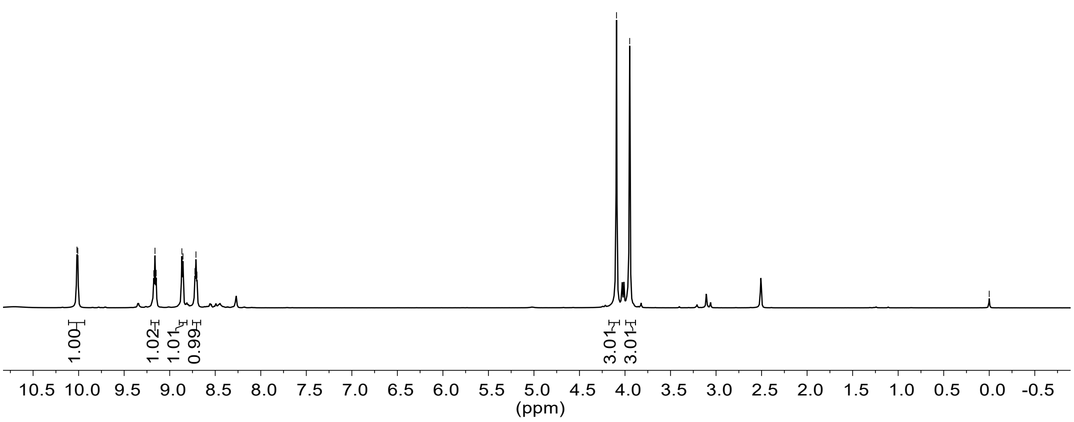
S17, ^{19}F NMR, DMSO-d_6, 565 MHz

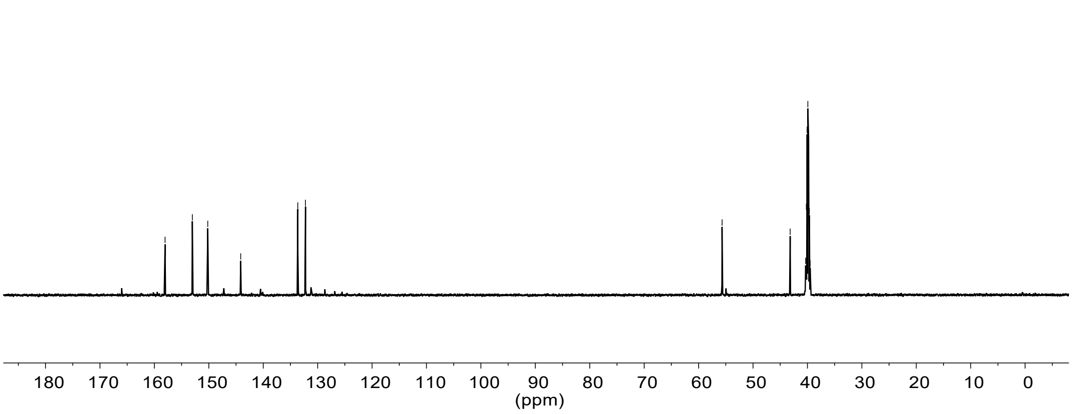


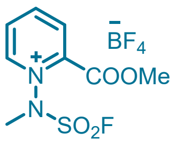
10.019
10.009
9.174
9.162
9.149
8.867
8.854
8.723
8.712
8.701
4.093
3.948
0.000



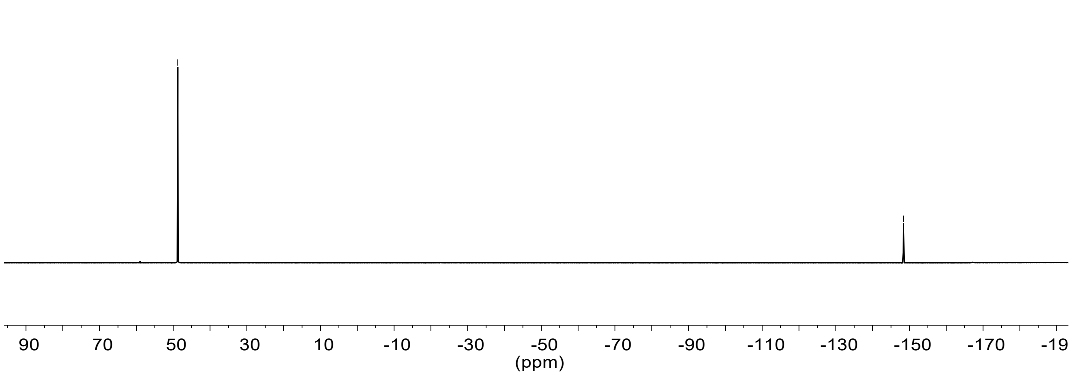
S18, ^{1}H NMR, DMSO-d_6, 600 MHz

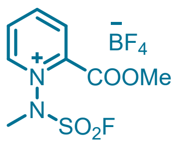




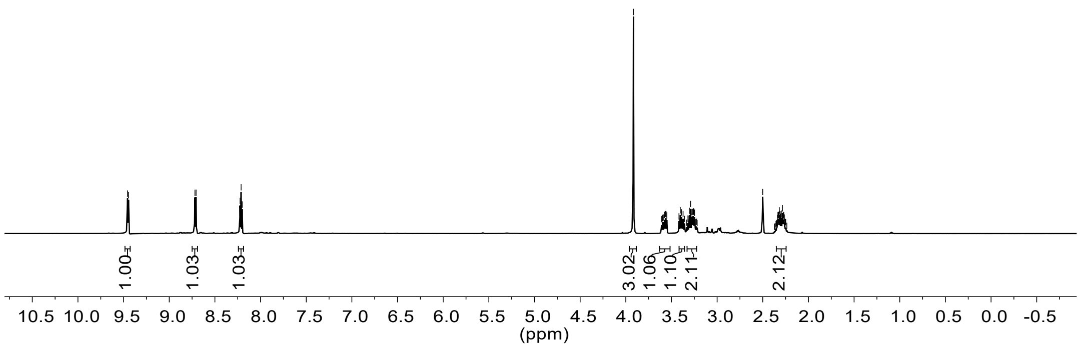


S18, ^{13}C NMR, DMSO-d_6, 151 MHz

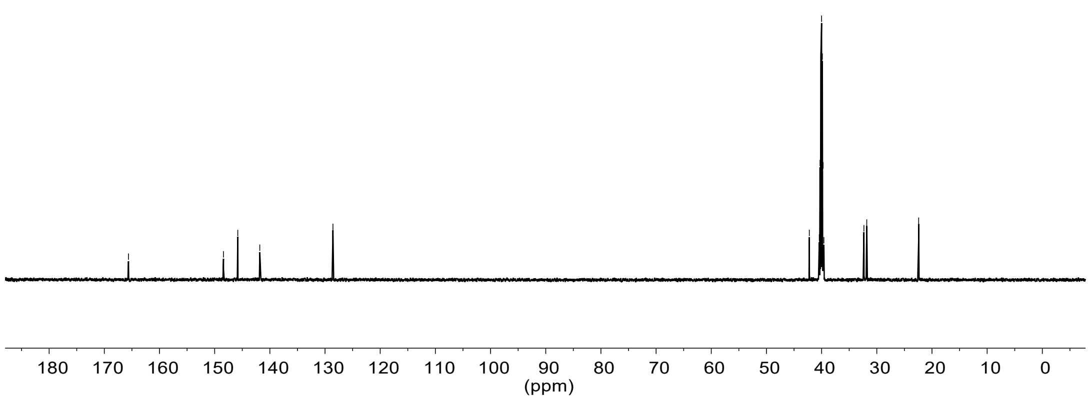




S18, ^{19}F NMR, DMSO-d_6, 565 MHz

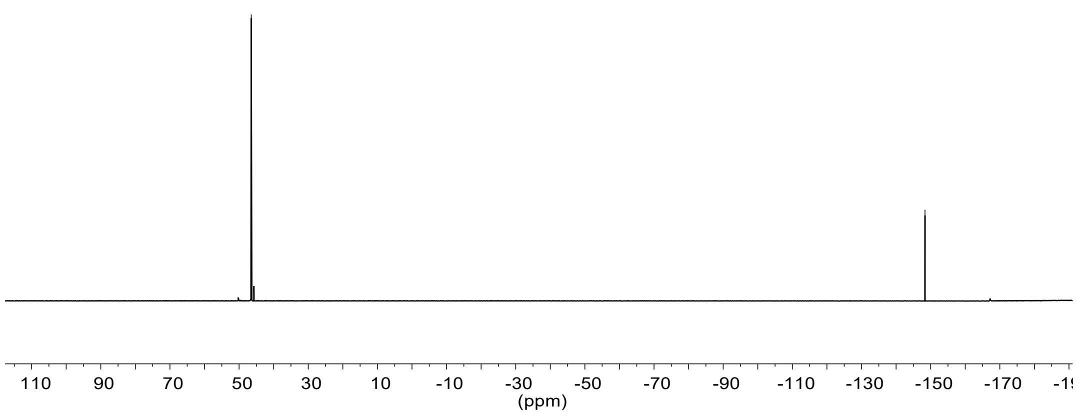


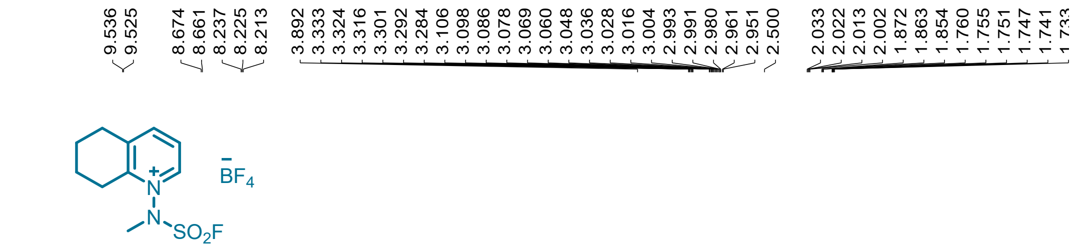
S19, ^{1}H NMR, DMSO-d_6, 600 MHz



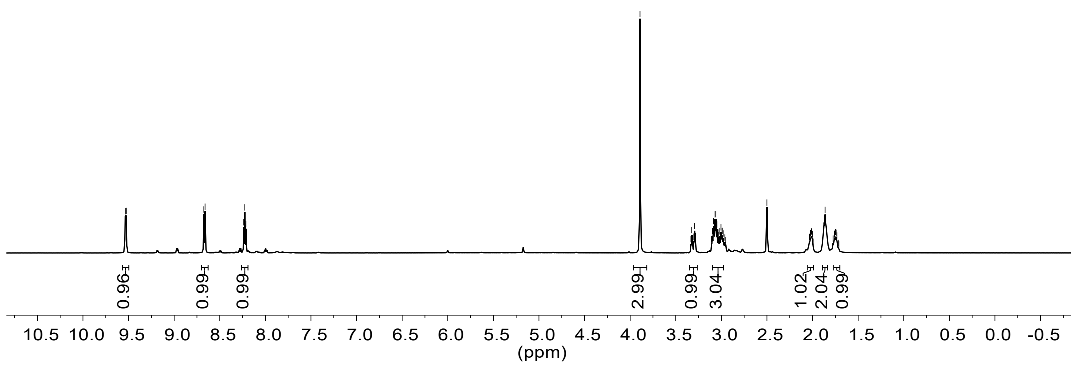
S19, ^{13}C NMR, DMSO-d_6, 151 MHz

S19, ^{19}F NMR, DMSO-d_6, 565 MHz

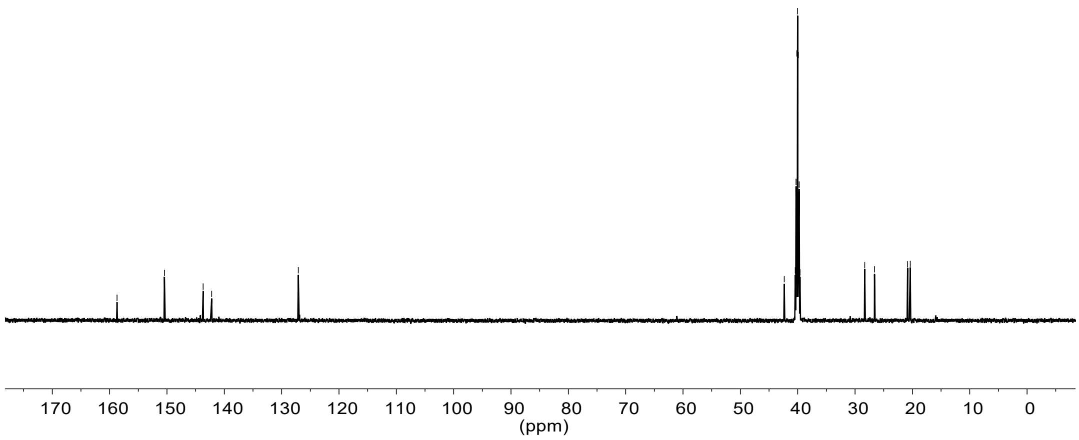




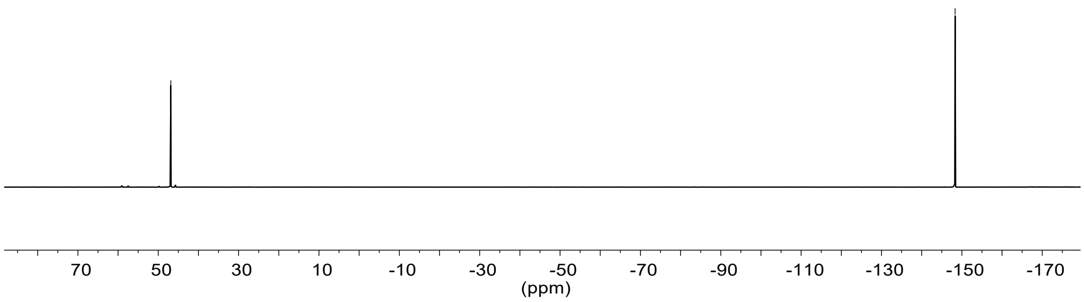
S20, ^{1}H NMR, DMSO-d_6, 600 MHz

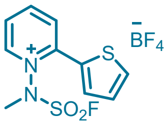


S20, ^{13}C NMR, DMSO-d_6, 151 MHz

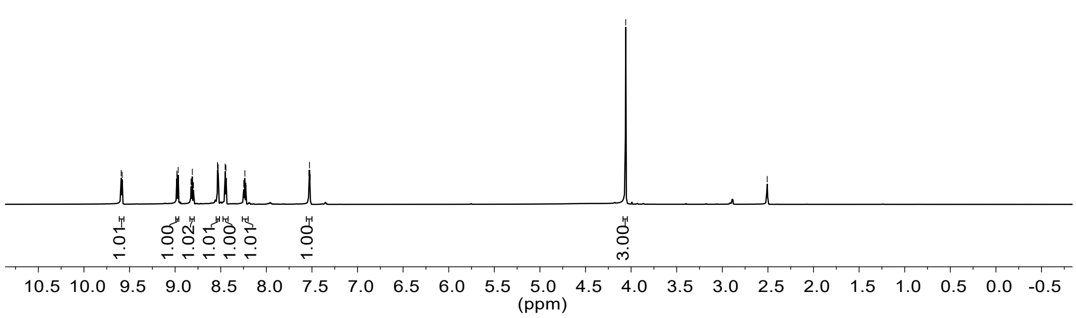


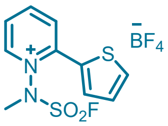
S20, ^{19}F NMR, DMSO-d_6, 565 MHz



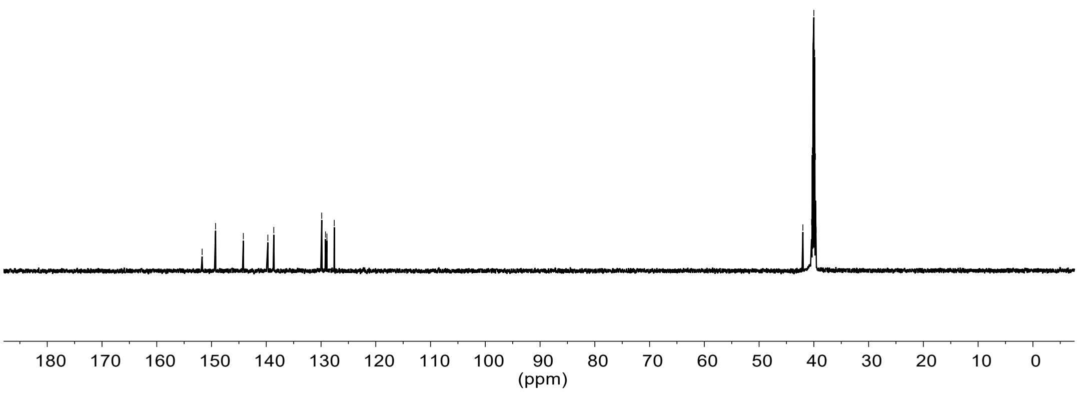


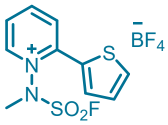
S21, ^{1}H NMR, DMSO-d_6, 600 MHz



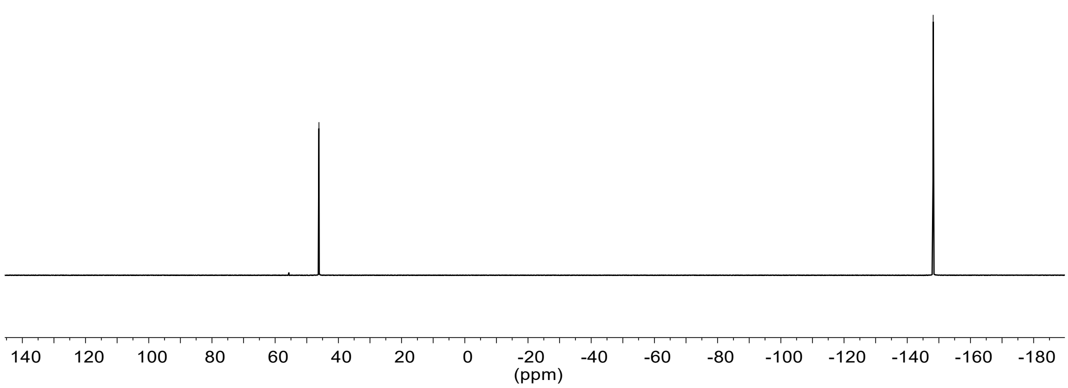


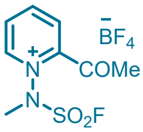
S21, ^{13}C NMR, DMSO-d_6, 151 MHz



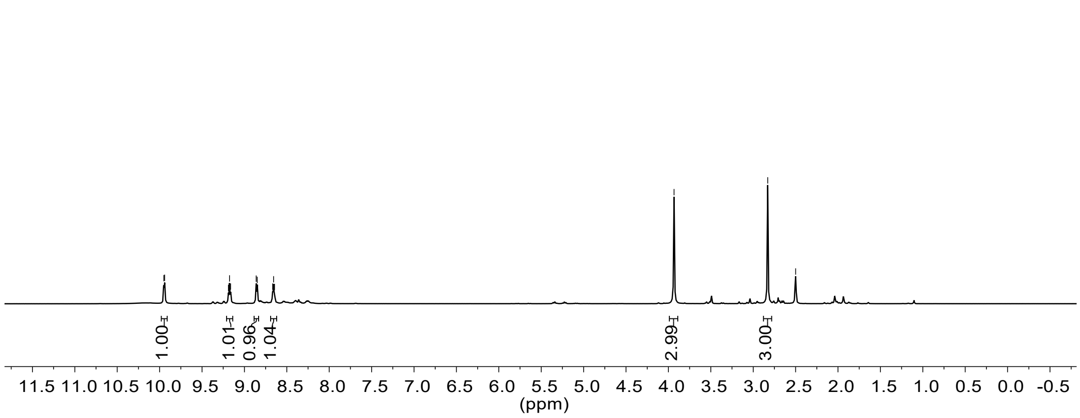


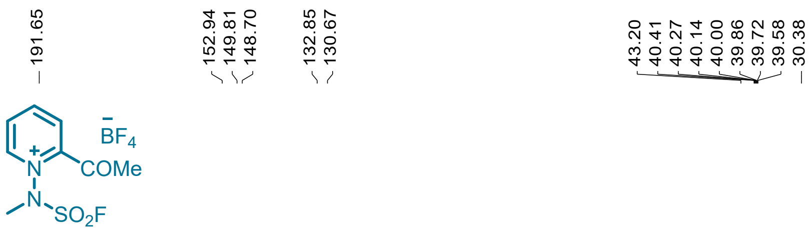
S21, ^{19}F NMR, DMSO-d_6, 565 MHz



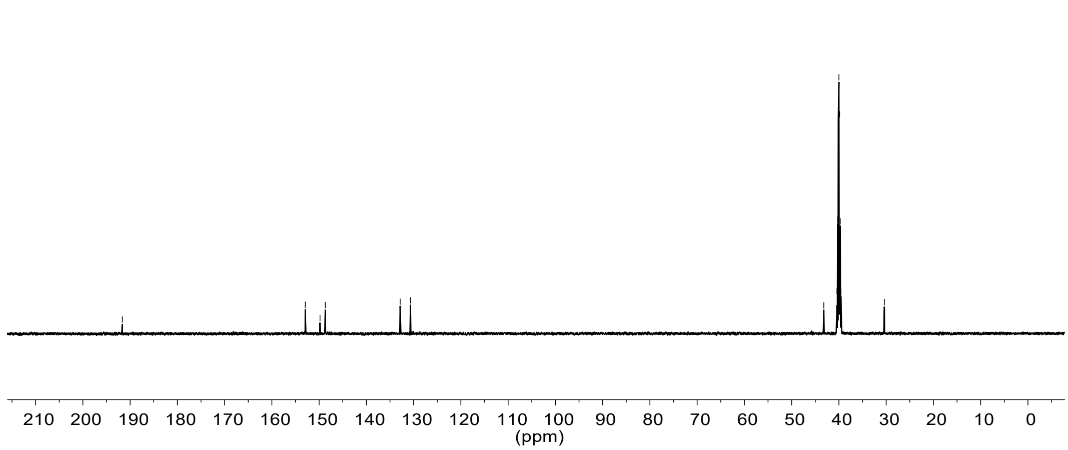


S22, ^{1}H NMR, DMSO-d_6, 600 MHz

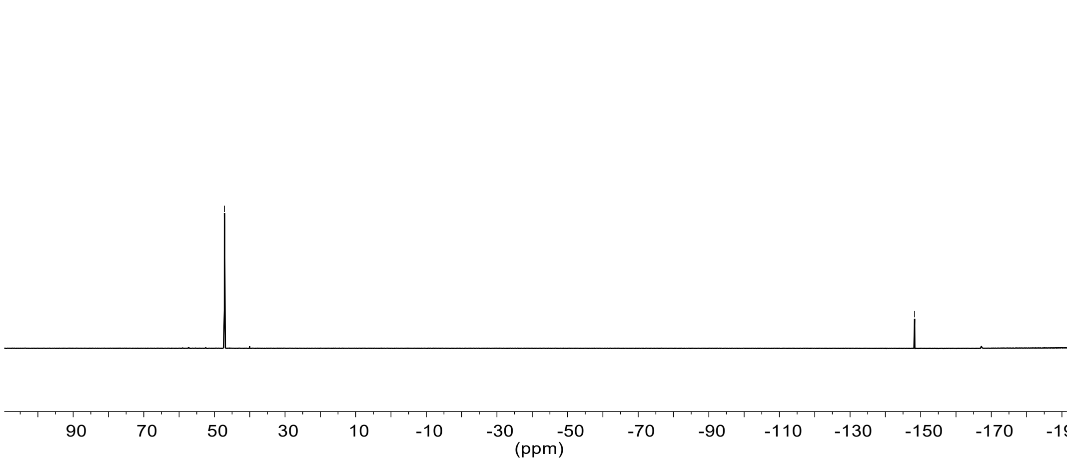


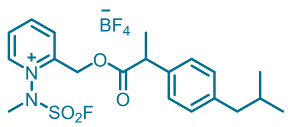


S22, [13]C NMR, DMSO-d_6, 151 MHz

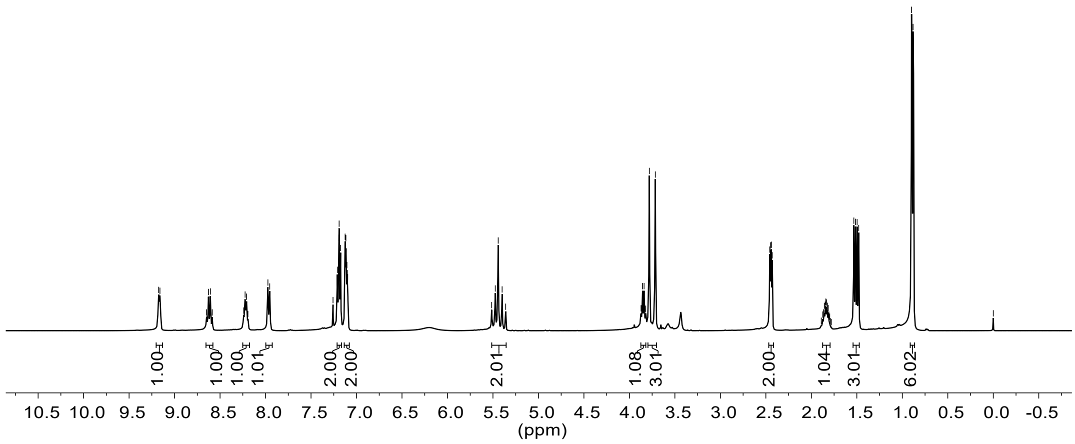


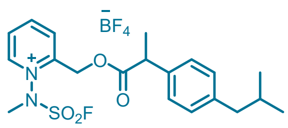
S22, [19]F NMR, DMSO-d_6, 565 MHz



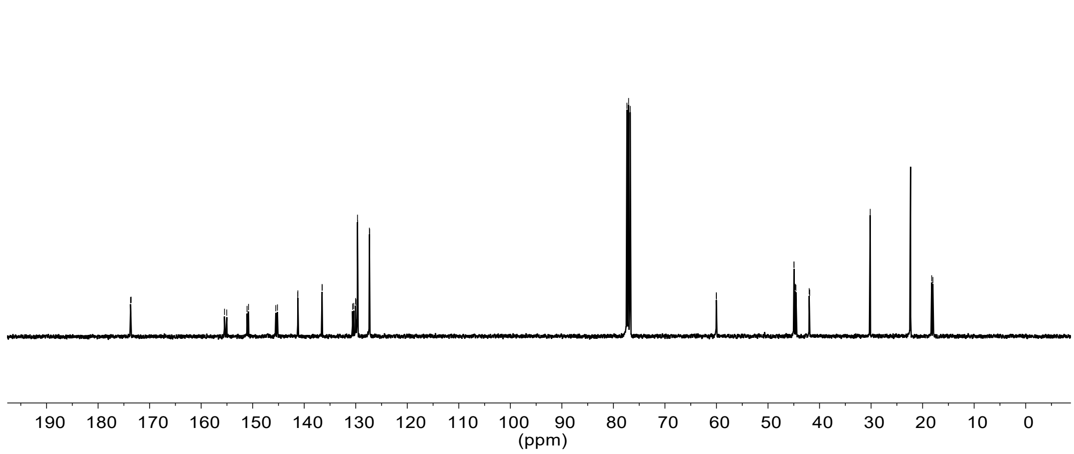


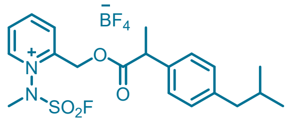
S23, ^{1}H NMR, $CDCl_3$, 400 MHz



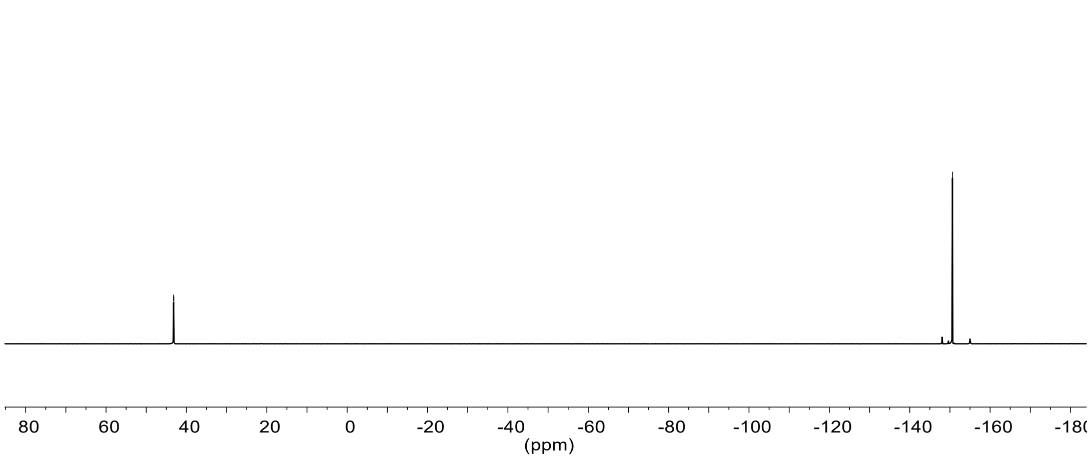


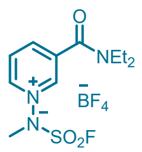
S23, ^{13}C NMR, $CDCl_3$, 101 MHz



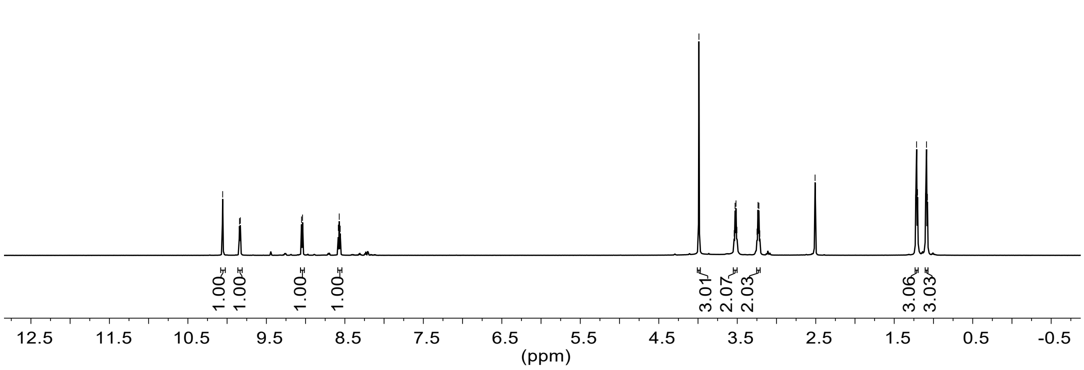


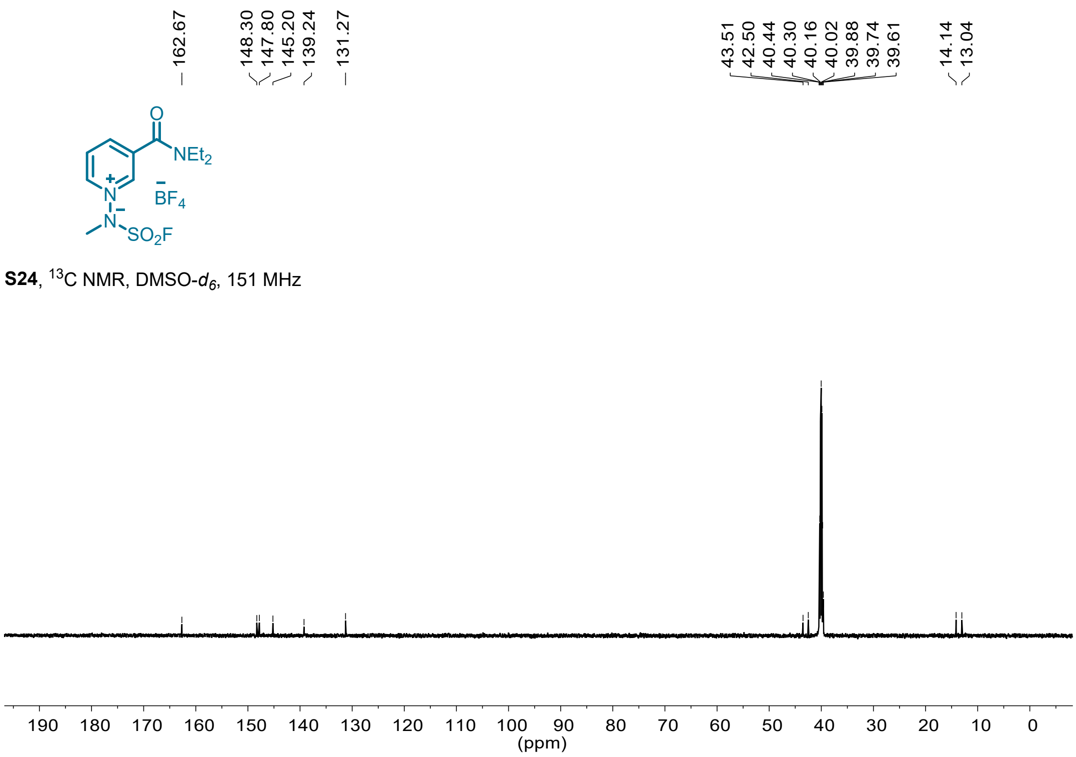
S23, ^{19}F NMR, $CDCl_3$, 376 MHz



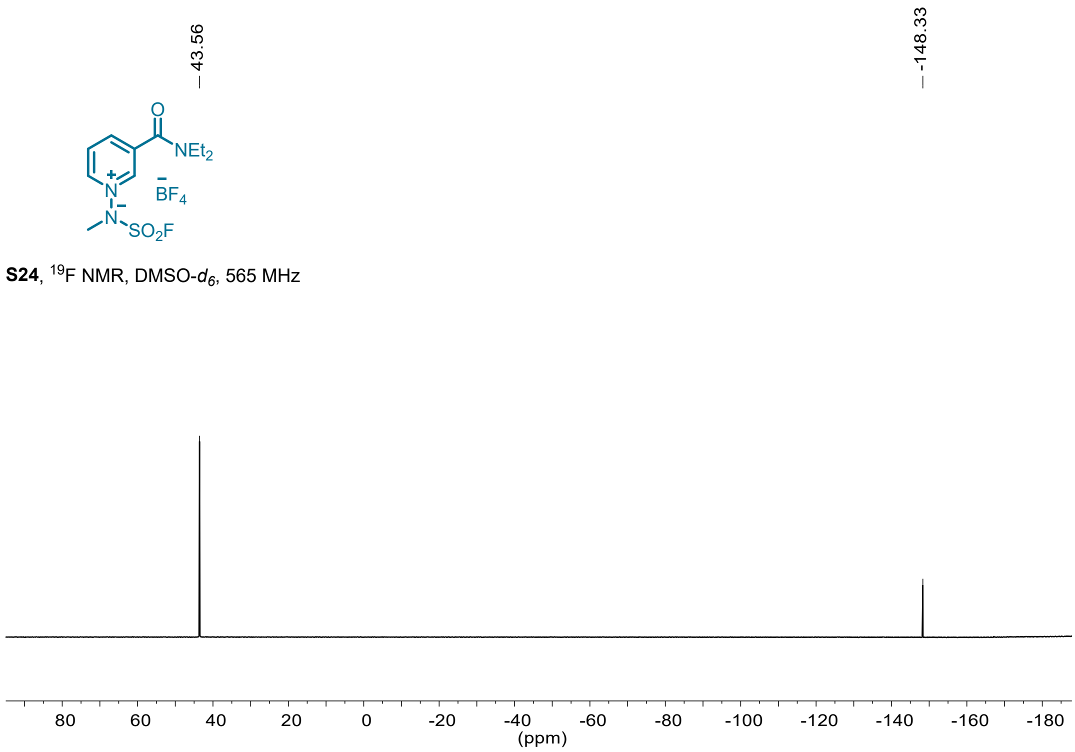


S24, ^{1}H NMR, DMSO-d_6, 600 MHz

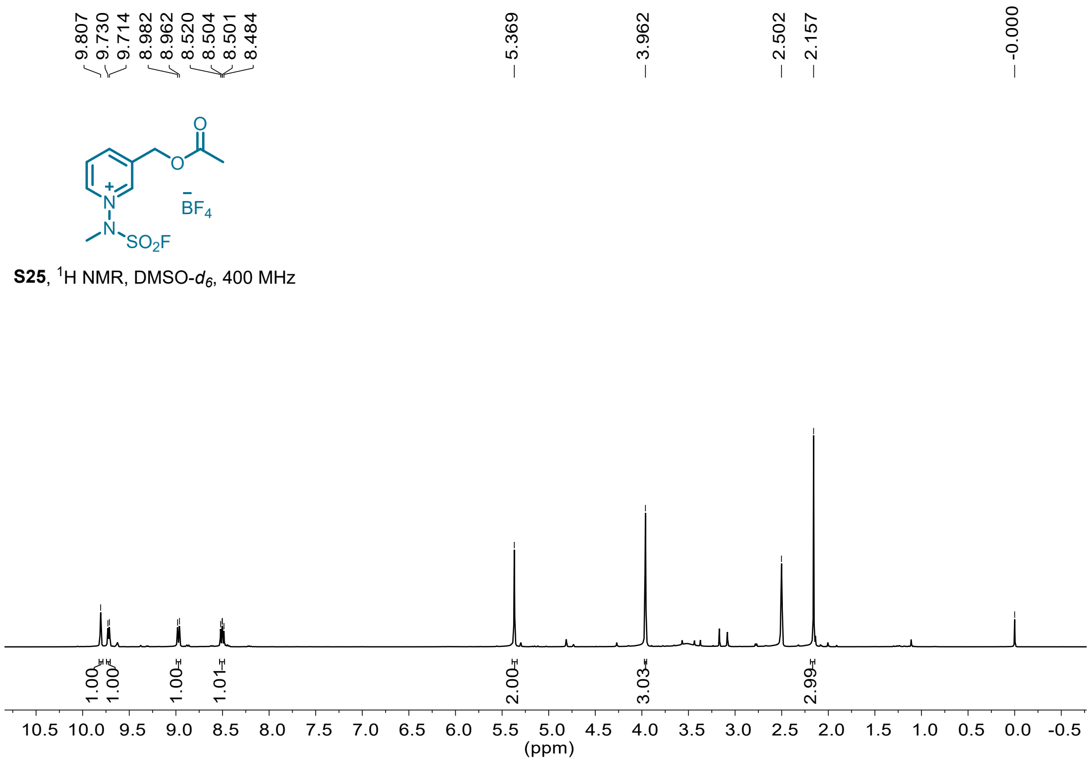




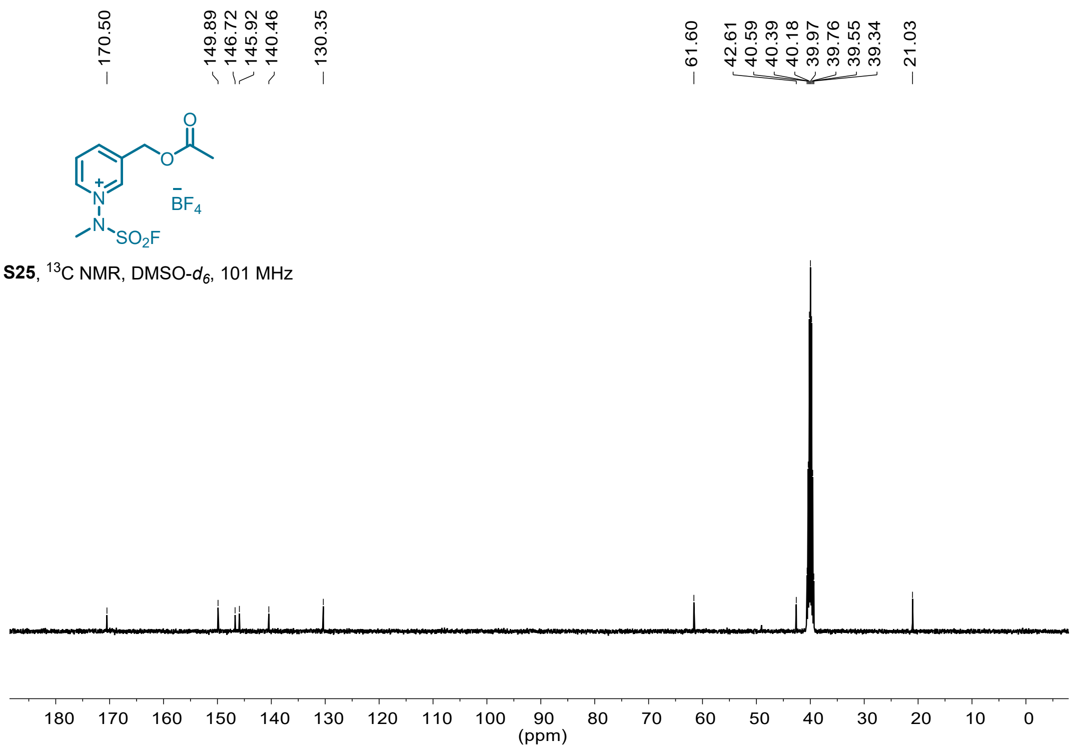
S24, ^{13}C NMR, DMSO-d_6, 151 MHz



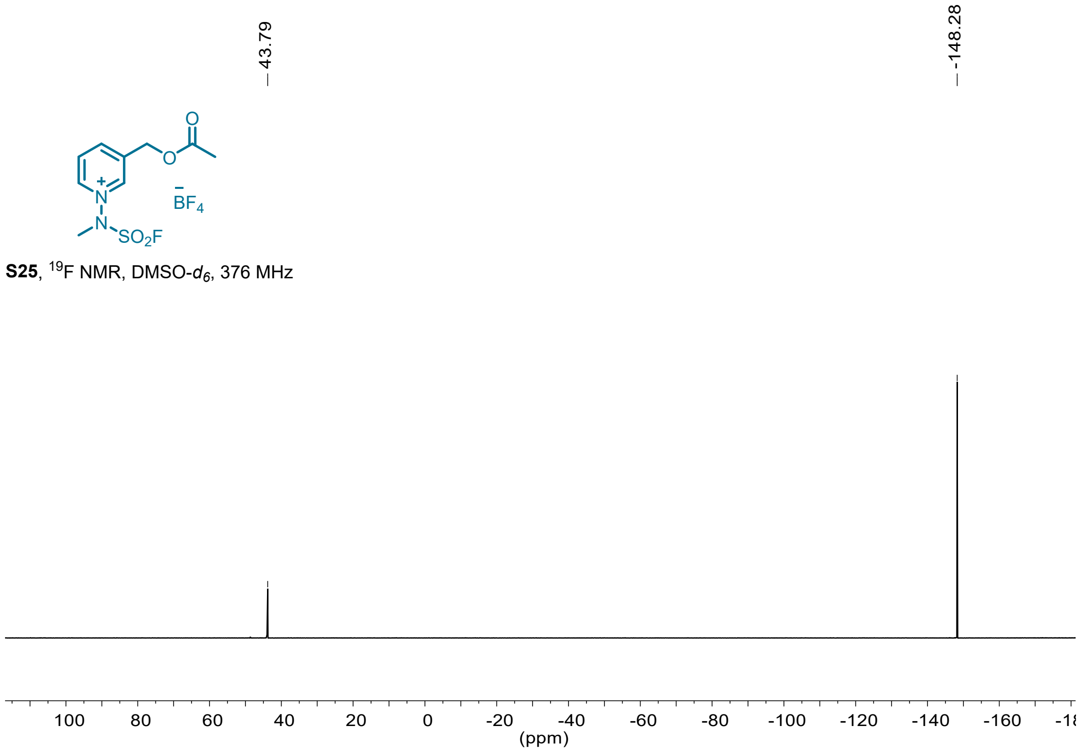
S24, ^{19}F NMR, DMSO-d_6, 565 MHz



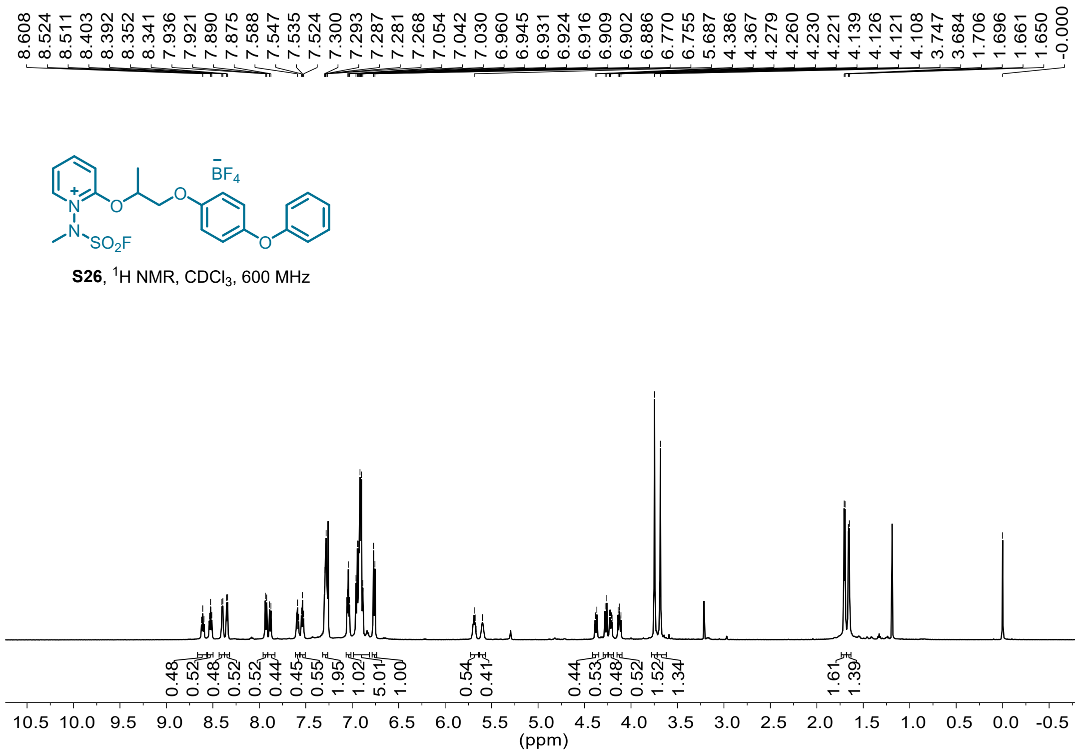
S25, [1]H NMR, DMSO-d_6, 400 MHz



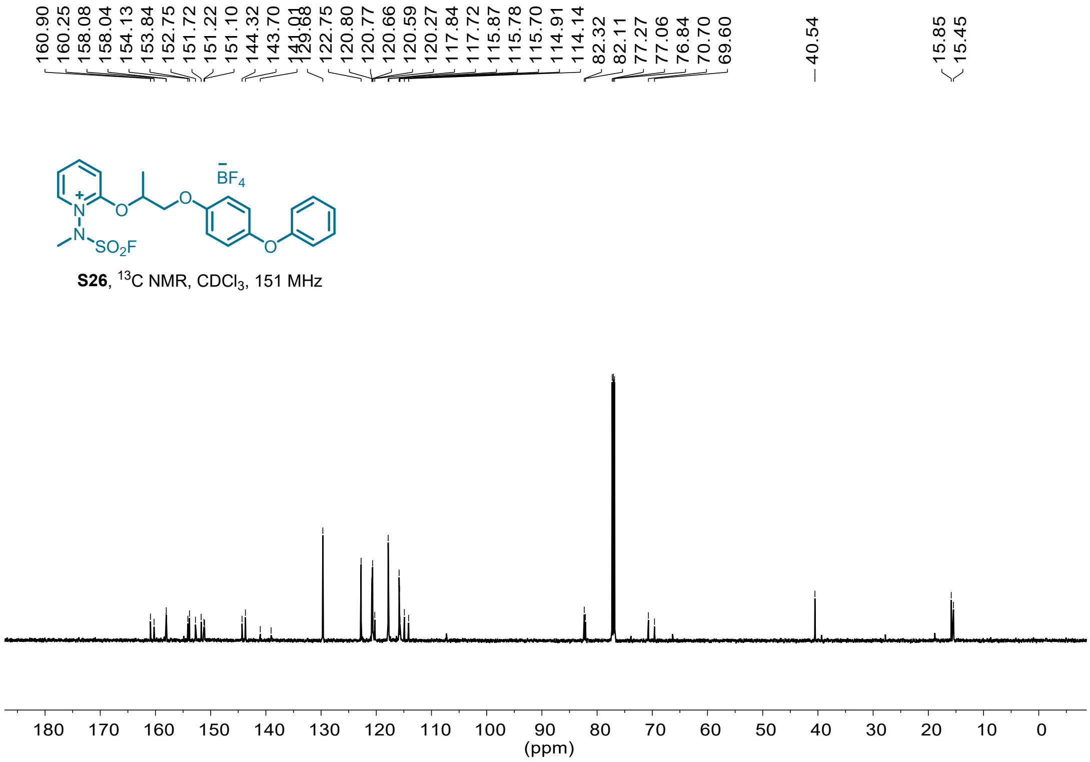
S25, [13]C NMR, DMSO-d_6, 101 MHz



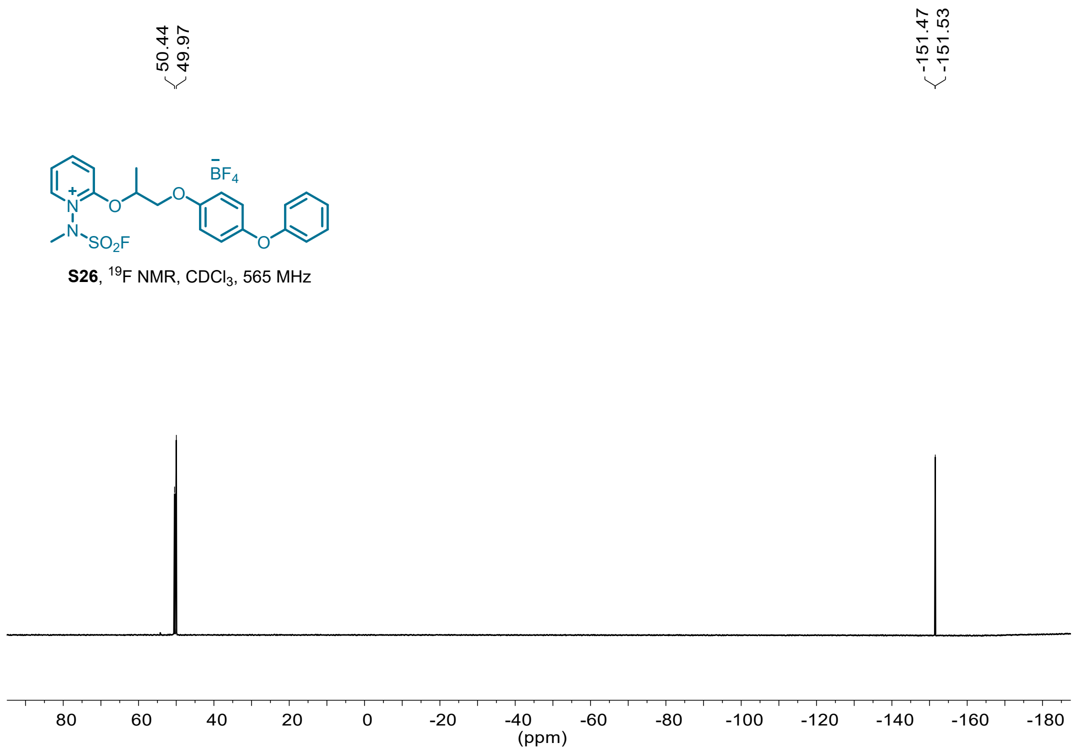
S25, ^{19}F NMR, DMSO-d_6, 376 MHz



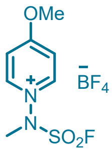
S26, ^{1}H NMR, $CDCl_3$, 600 MHz



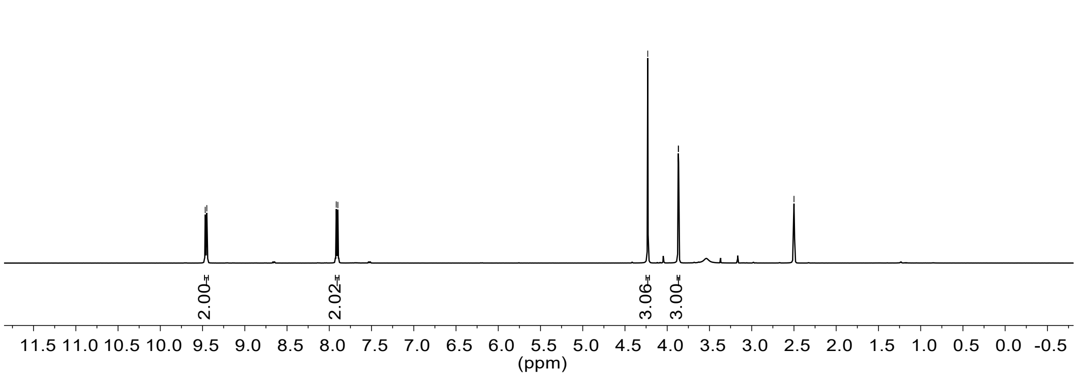
S26, ^{13}C NMR, $CDCl_3$, 151 MHz

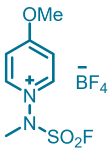


S26, ^{19}F NMR, $CDCl_3$, 565 MHz

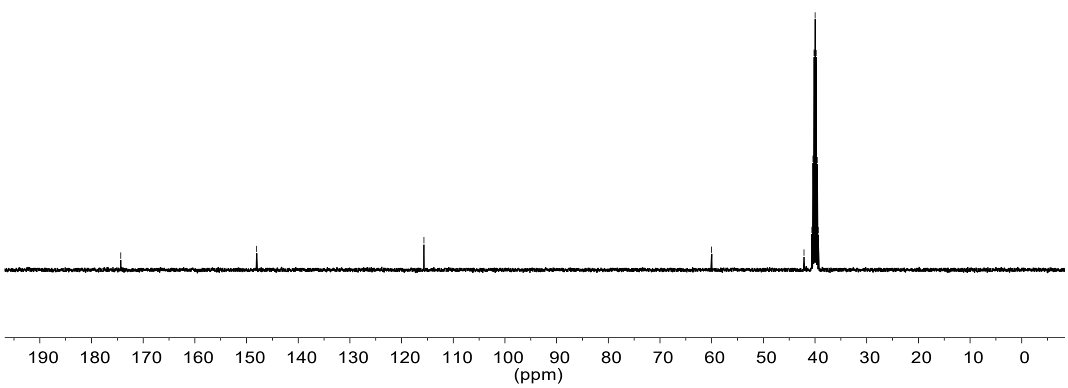


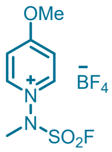
S27, ^{1}H NMR, DMSO-d_6, 400 MHz



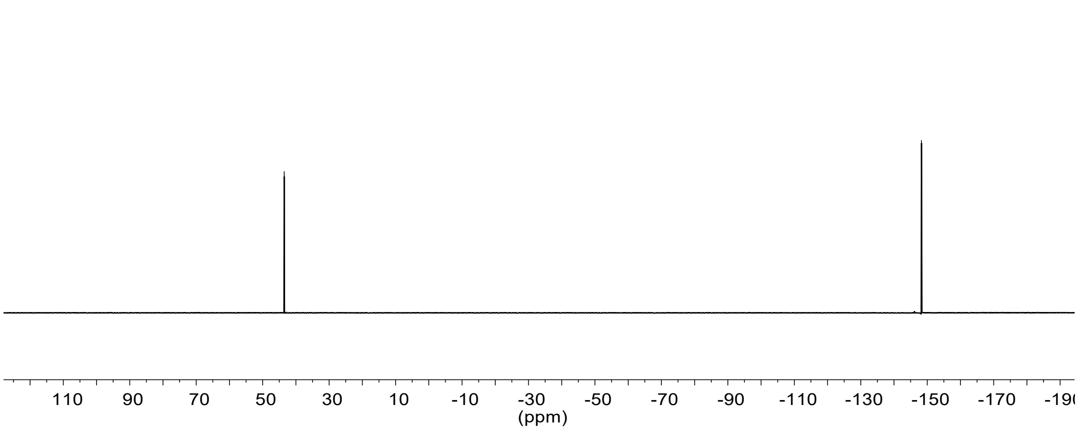


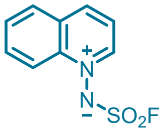
S27, ^{13}C NMR, DMSO-d_6, 101 MHz



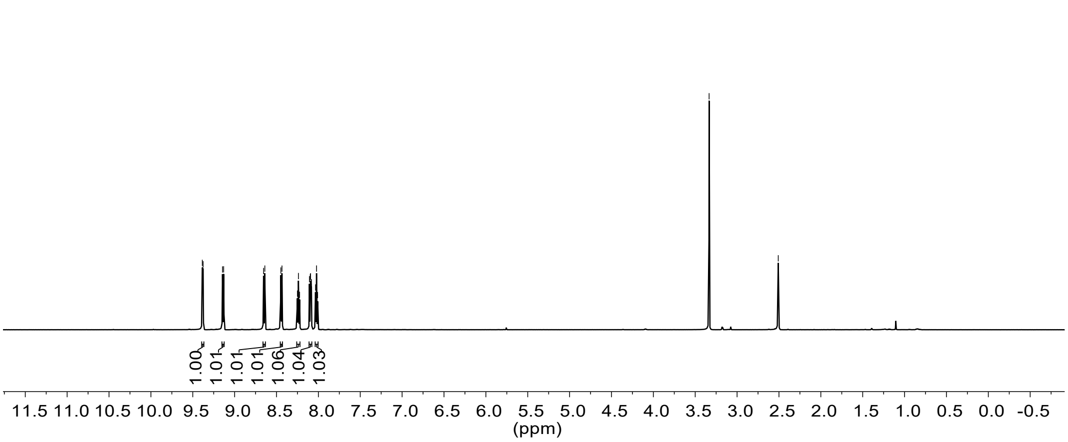


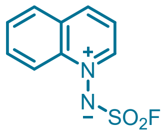
S27, ^{19}F NMR, DMSO-d_6, 376 MHz



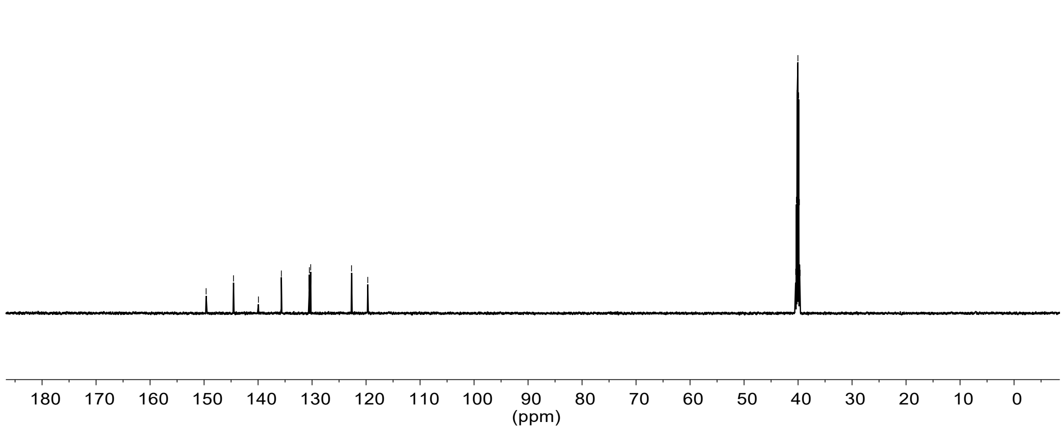


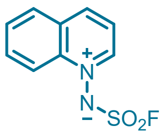
S28, ^{1}H NMR, DMSO-d_6, 600 MHz



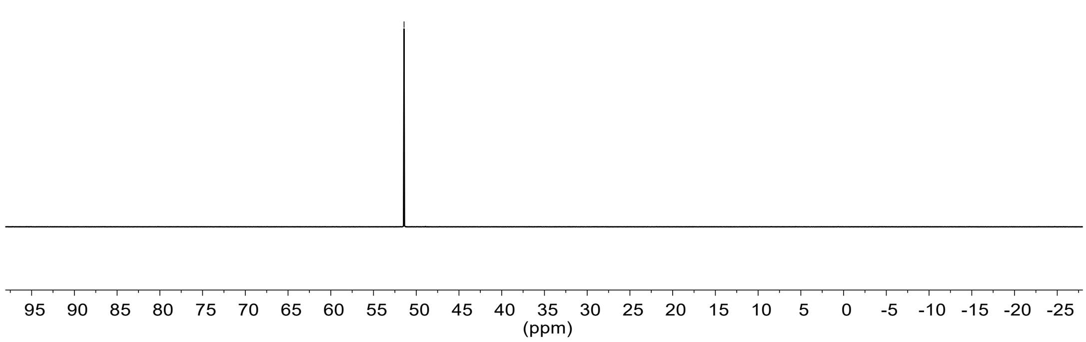


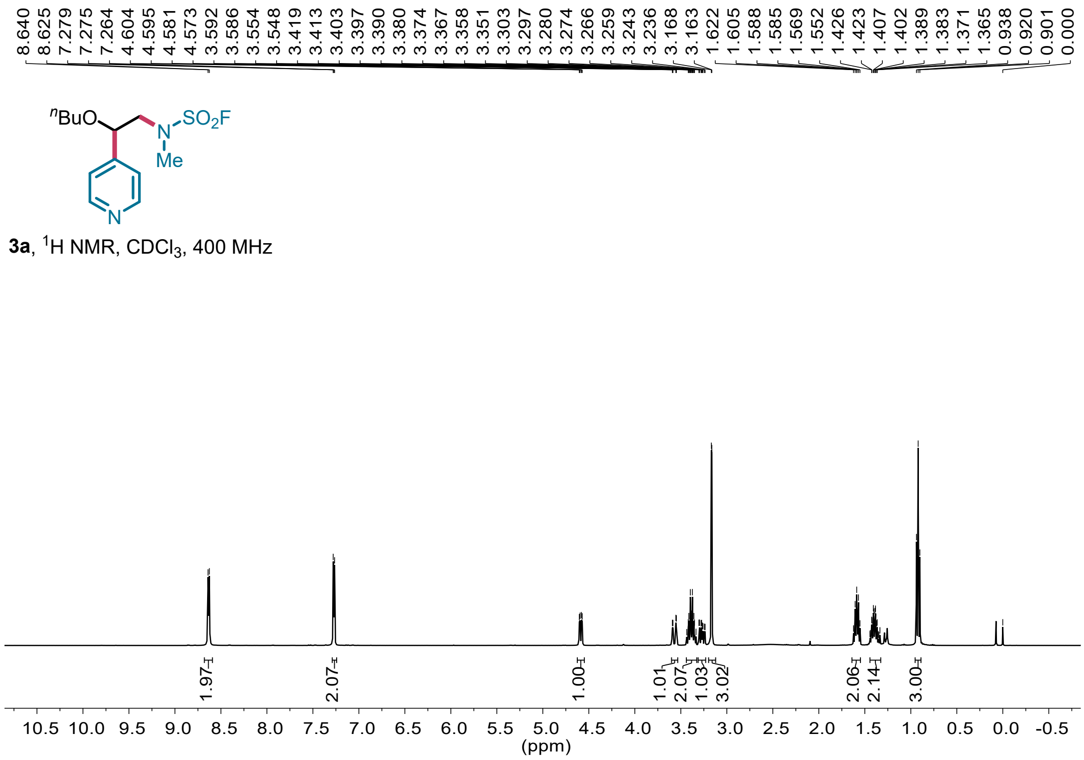
S28, ^{13}C NMR, DMSO-d_6, 151 MHz



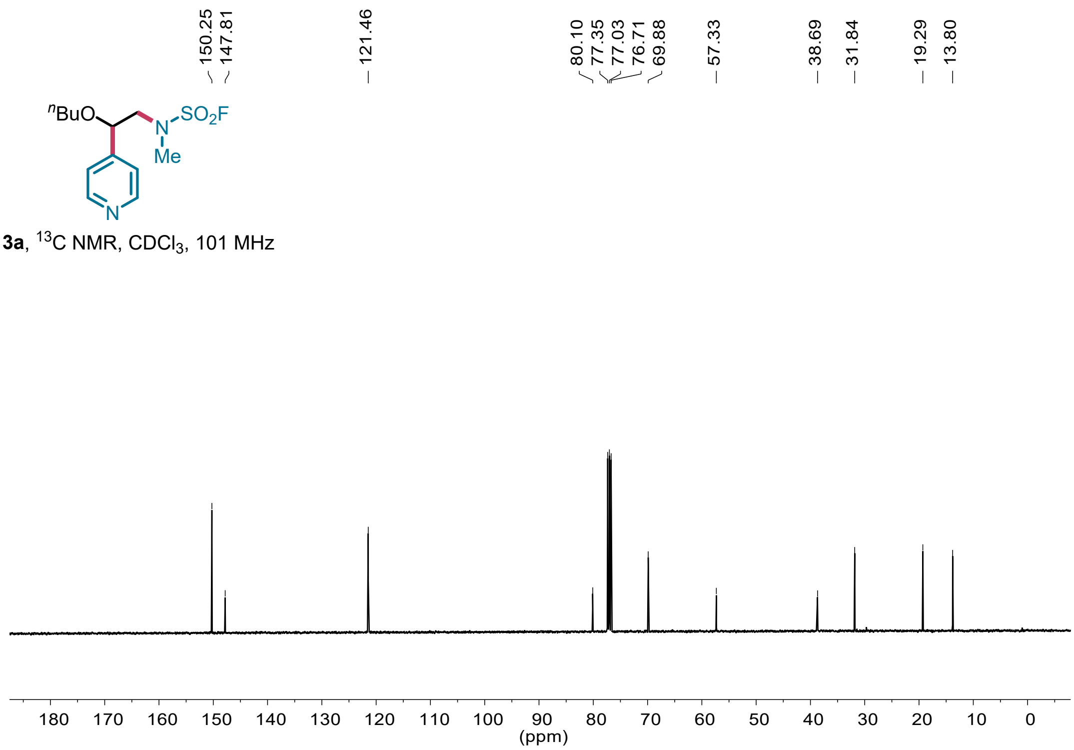


S28, ^{19}F NMR, DMSO-d_6, 565 MHz

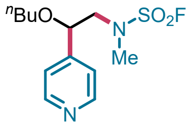




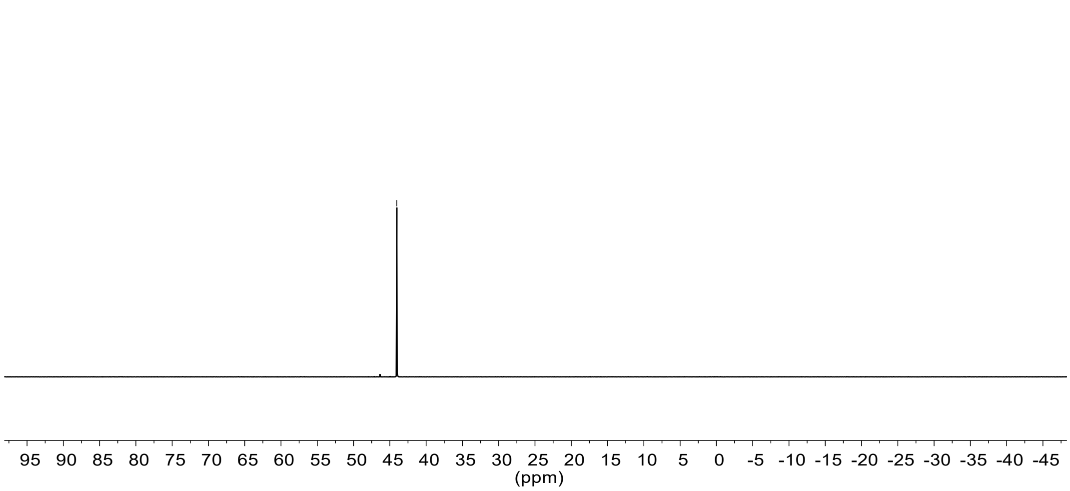
3a, ^{1}H NMR, $CDCl_3$, 400 MHz

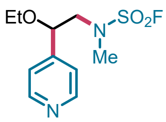


3a, ^{13}C NMR, $CDCl_3$, 101 MHz

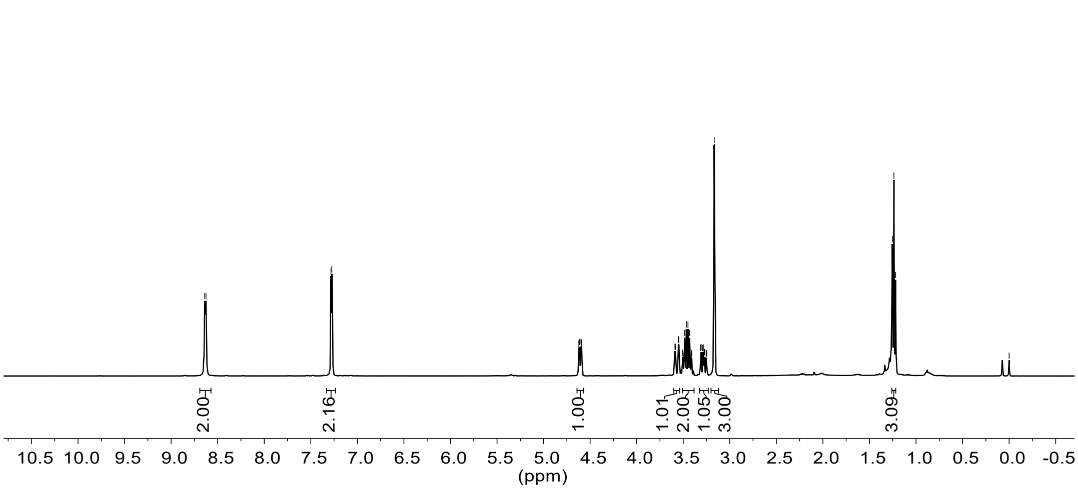


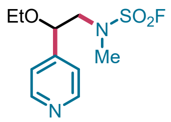
3a, ^{19}F NMR, $CDCl_3$, 376 MHz



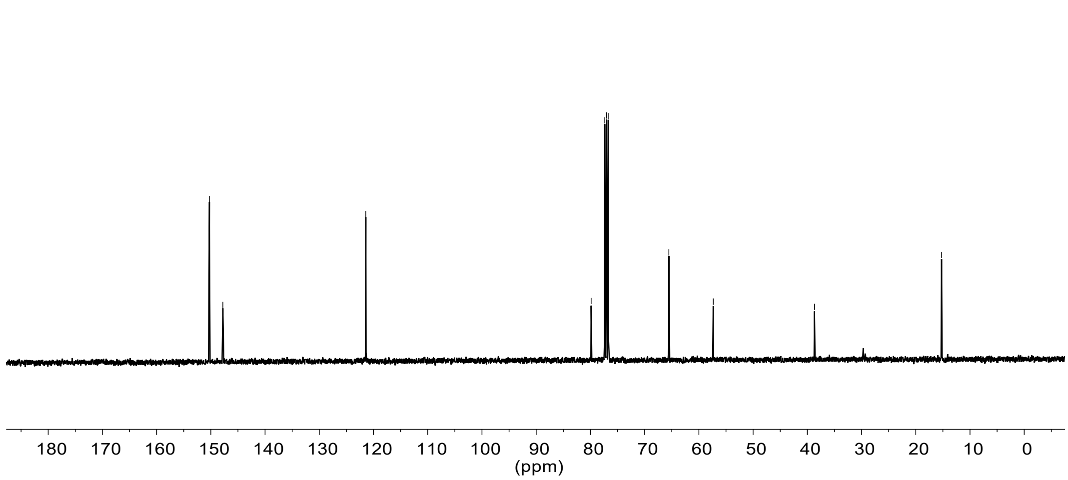


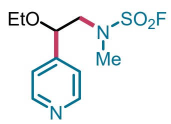
3b, ^{1}H NMR, $CDCl_3$, 400 MHz



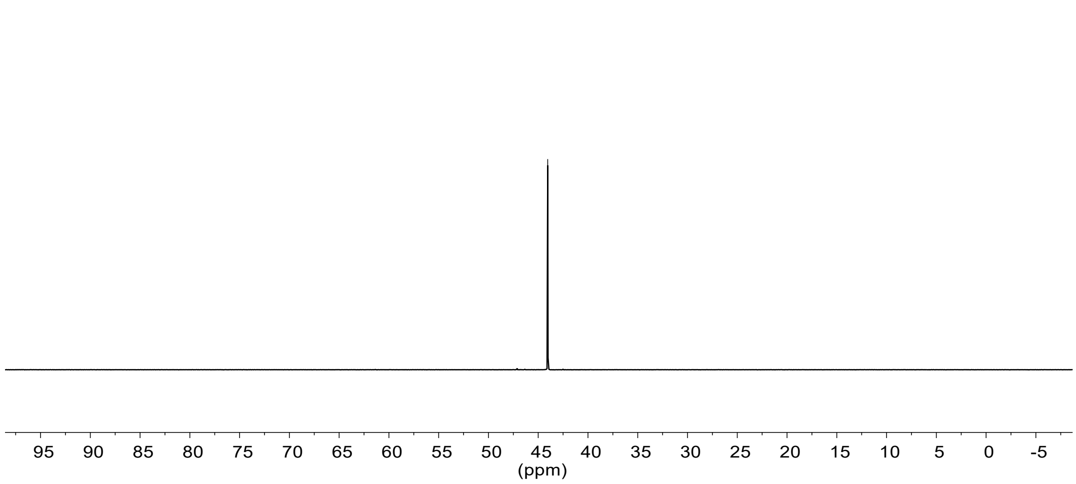


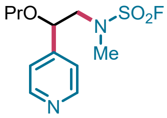
3b, ^{13}C NMR, $CDCl_3$, 101 MHz



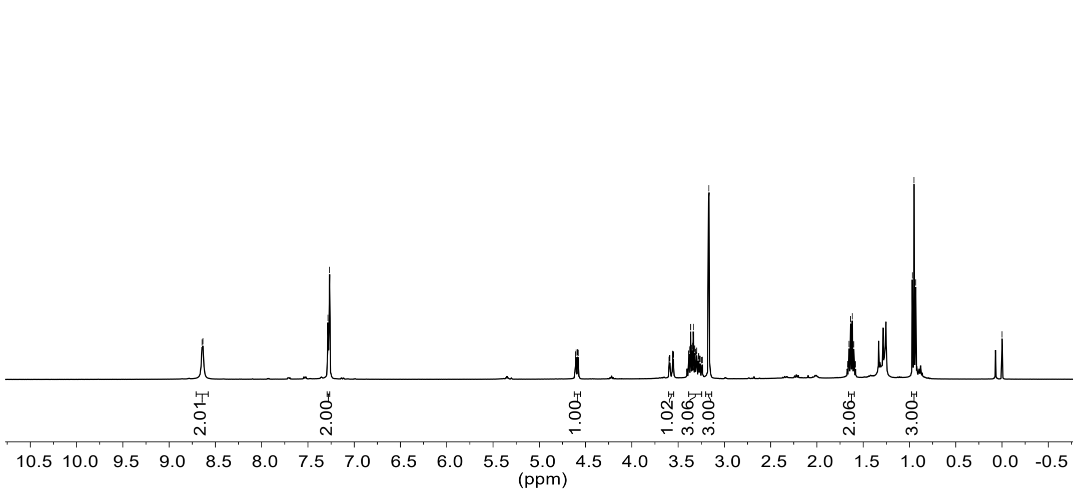


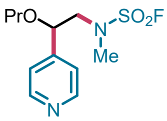
3b, ^{19}F NMR, $CDCl_3$, 376 MHz



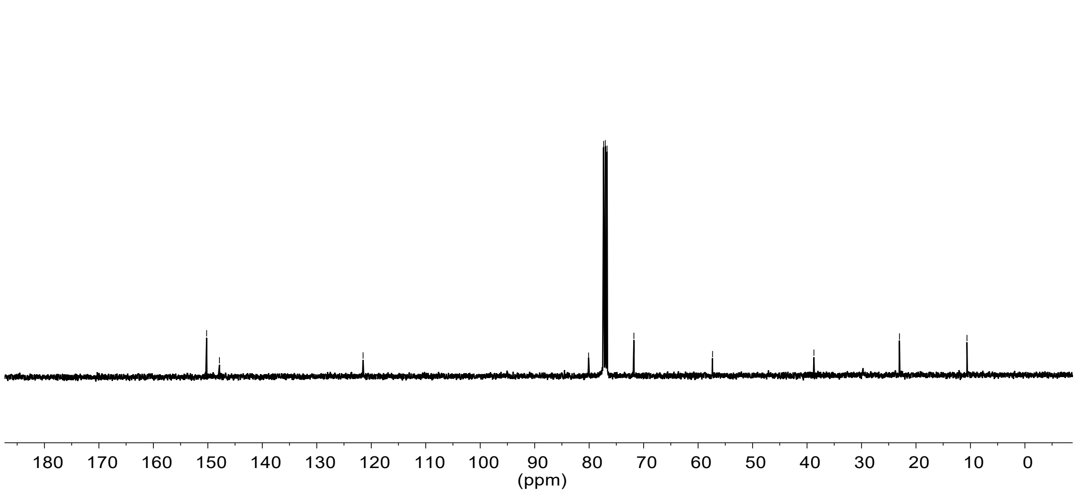


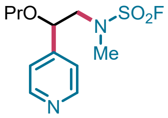
3c, ^{1}H NMR, $CDCl_3$, 400 MHz



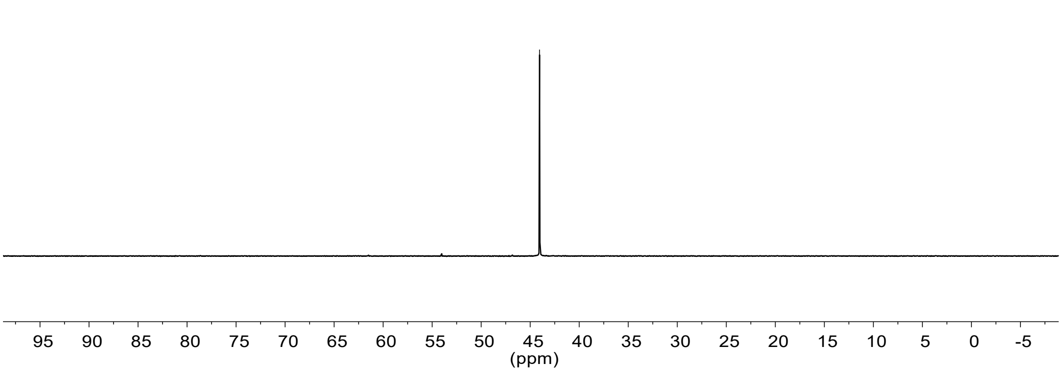


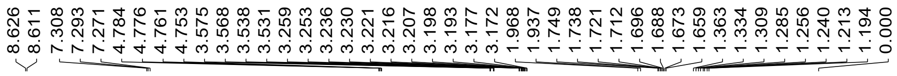
3c, ^{13}C NMR, $CDCl_3$, 101 MHz

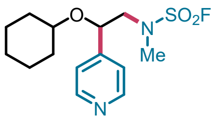




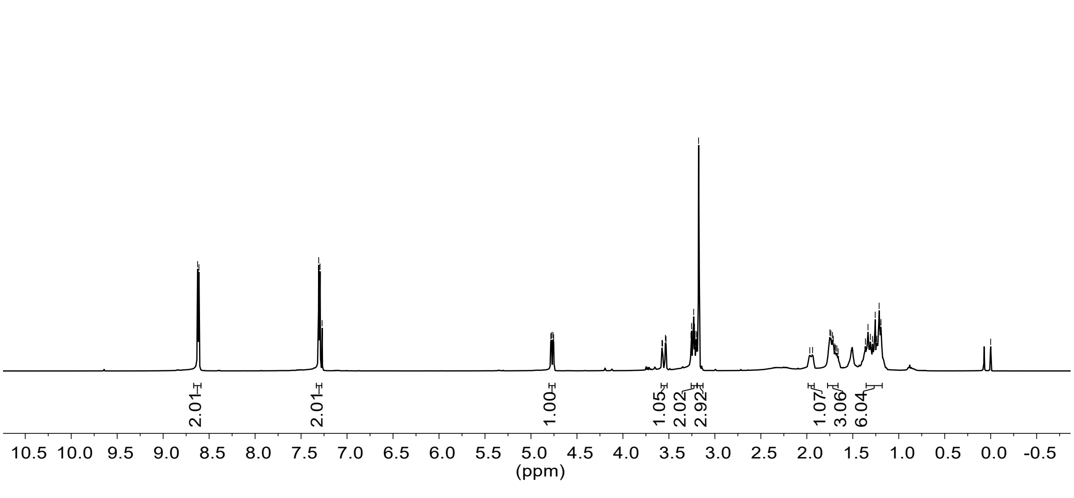
3c, ^{19}F NMR, $CDCl_3$, 376 MHz

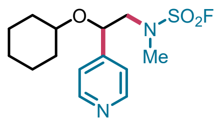




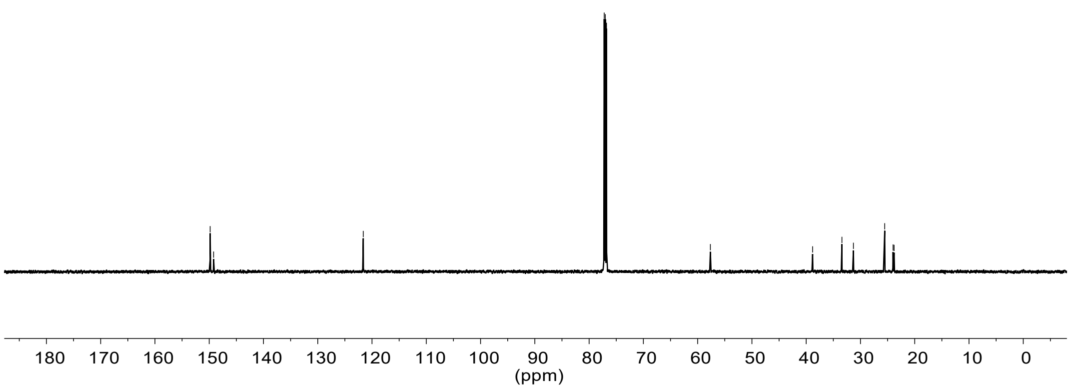


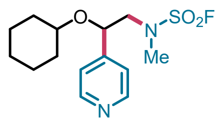
3d, ^{1}H NMR, $CDCl_3$, 400 MHz



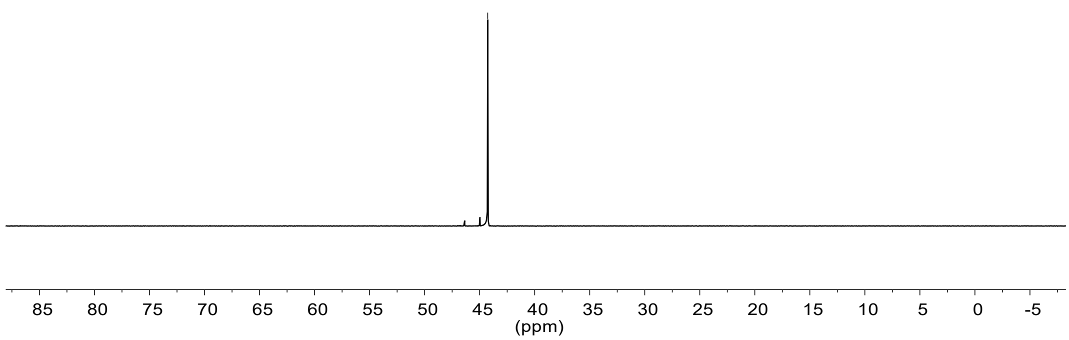


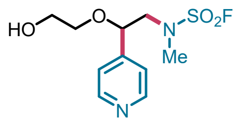
3d, ^{13}C NMR, $CDCl_3$, 101 MHz

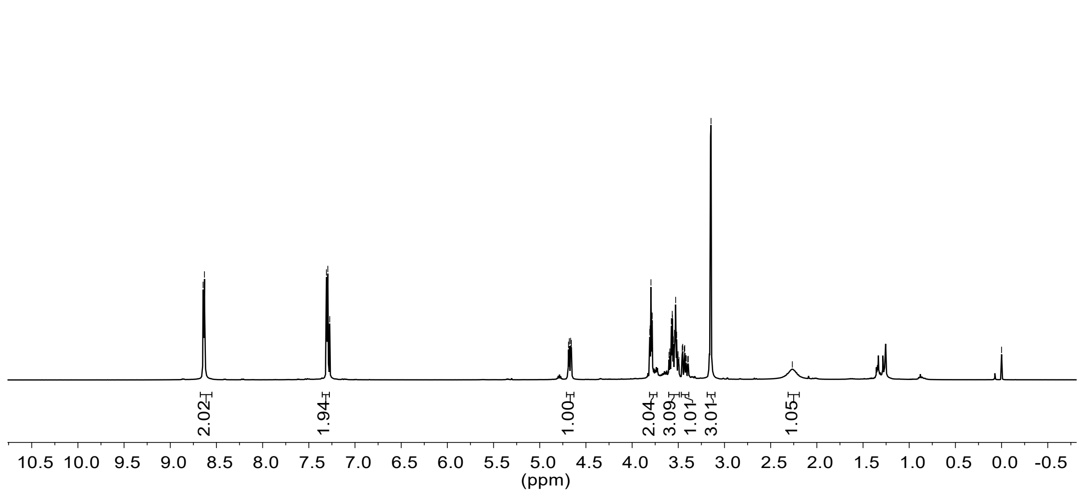




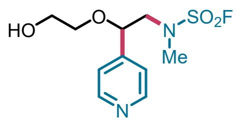
3d, ^{19}F NMR, $CDCl_3$, 376 MHz

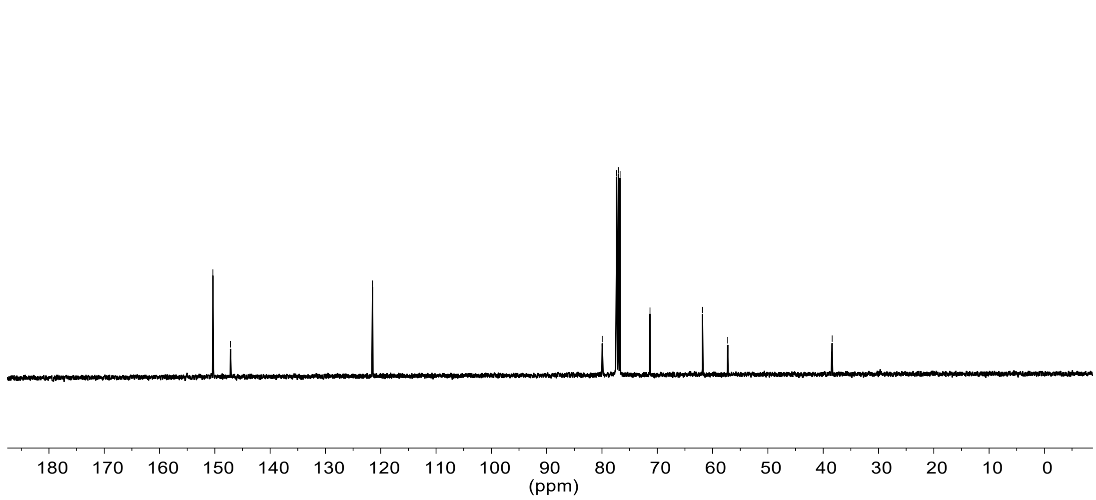




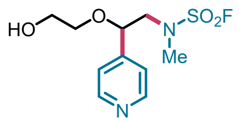


3e, ^{1}H NMR, $CDCl_3$, 400 MHz

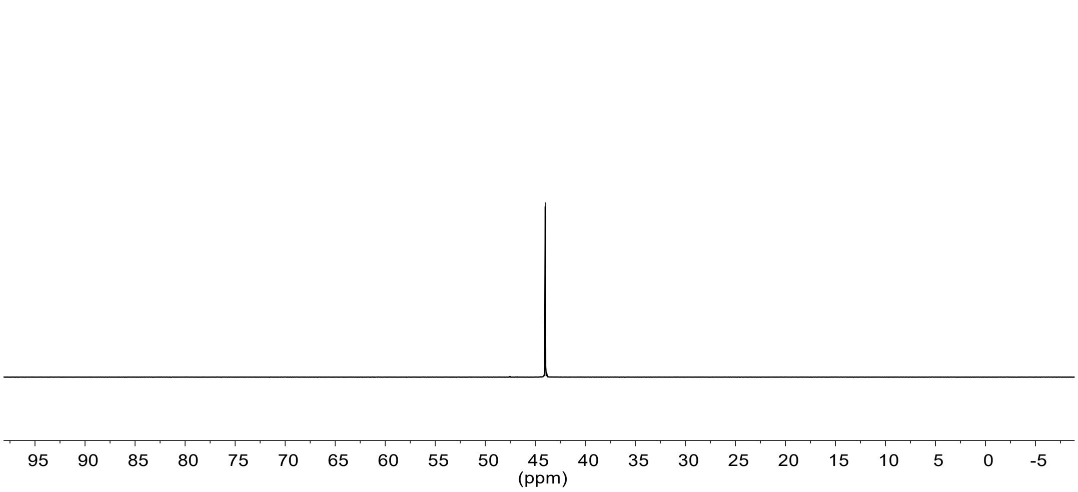


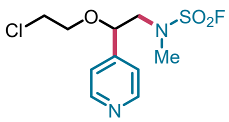


3e, ^{13}C NMR, $CDCl_3$, 101 MHz

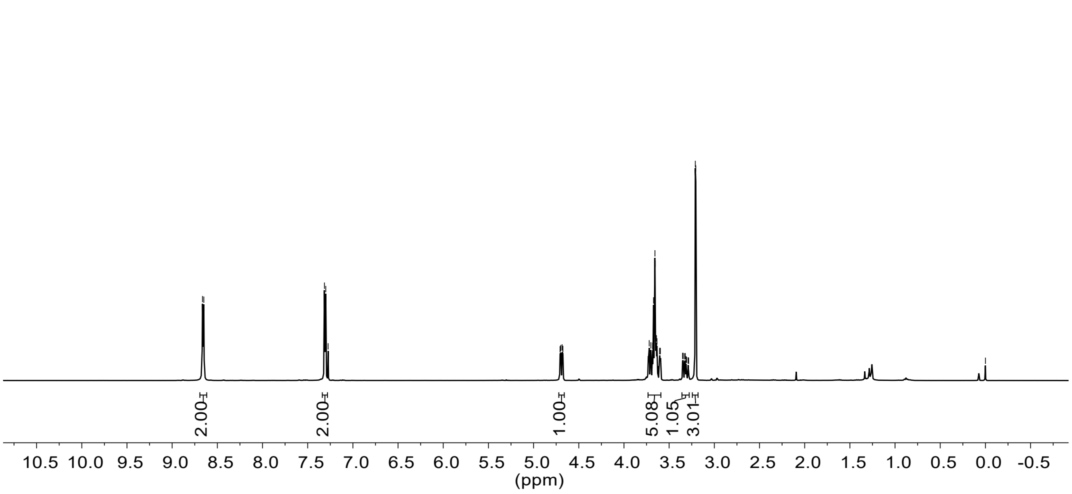


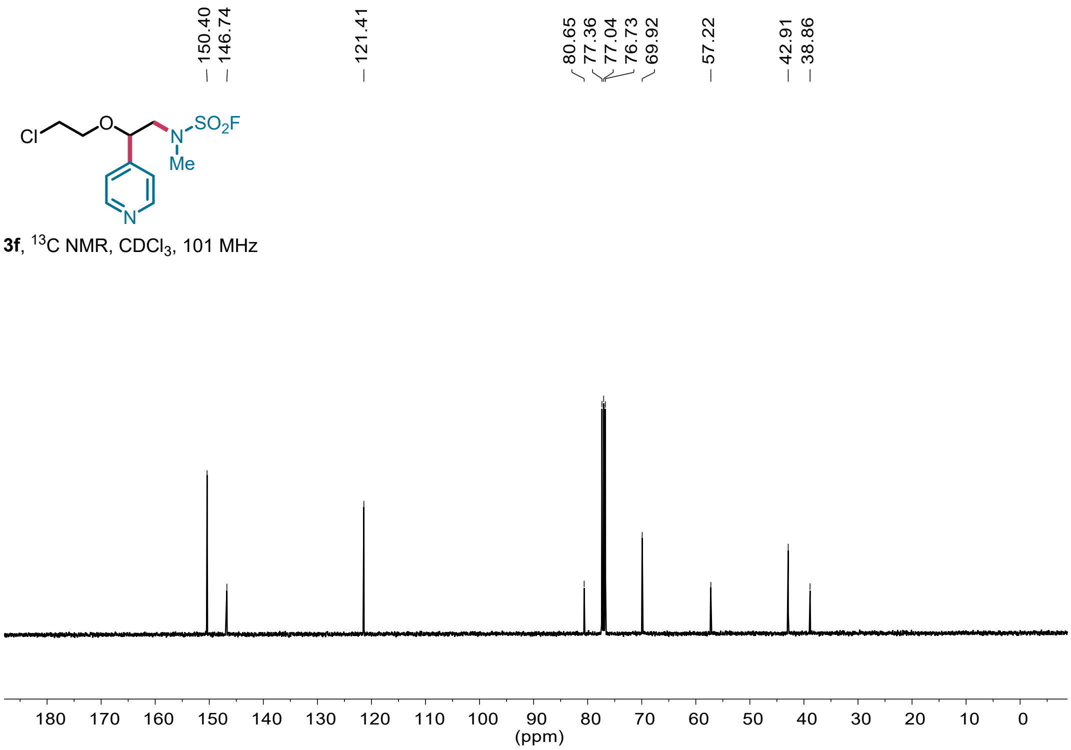
3e, ^{19}F NMR, $CDCl_3$, 376 MHz



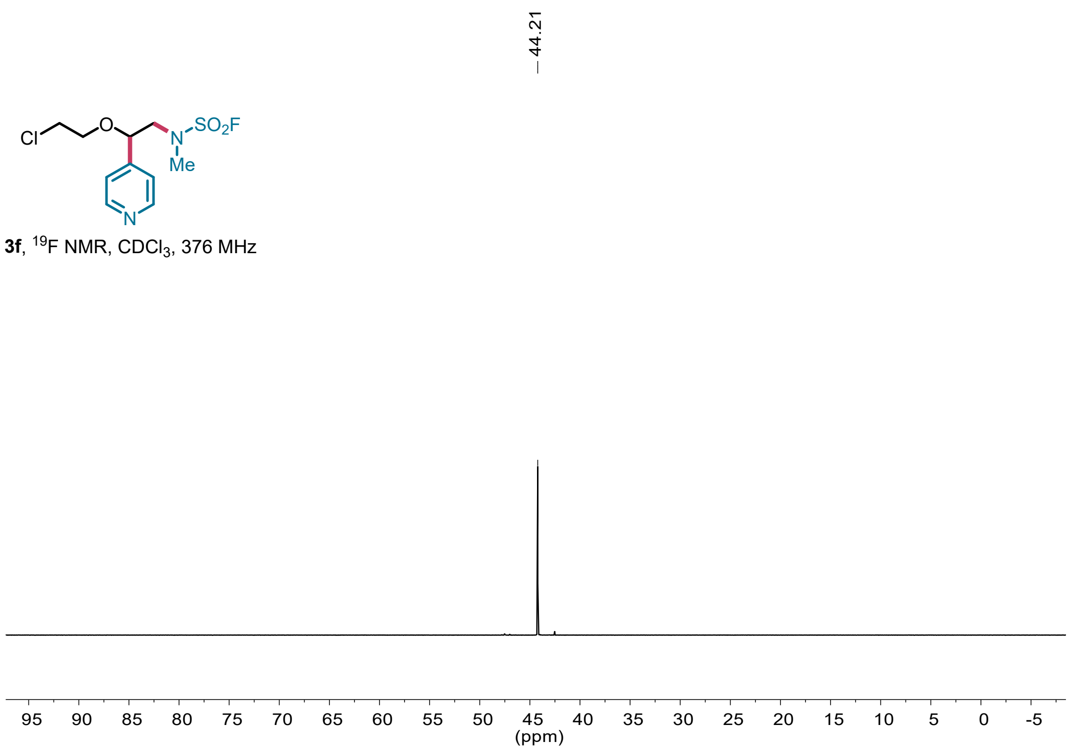


3f, ^{1}H NMR, $CDCl_3$, 400 MHz

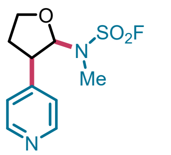




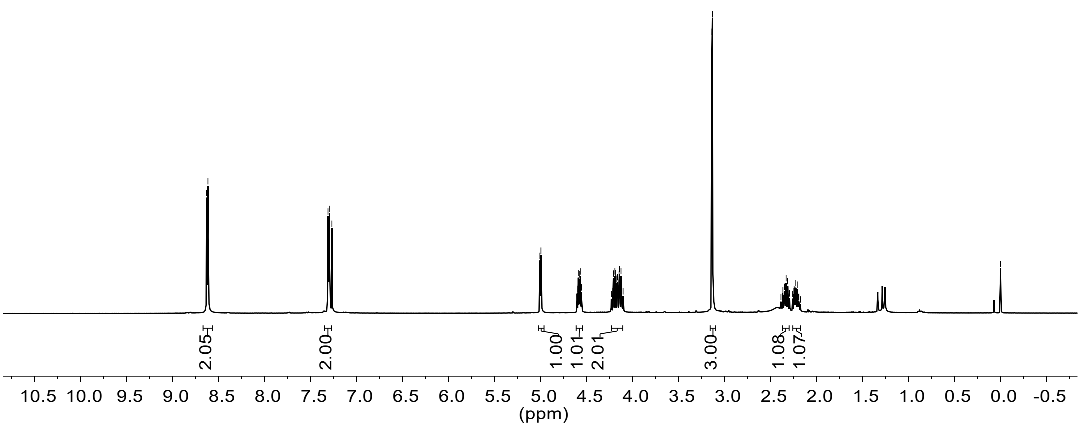
3f, ^{13}C NMR, $CDCl_3$, 101 MHz

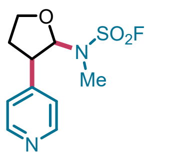


3f, ^{19}F NMR, $CDCl_3$, 376 MHz

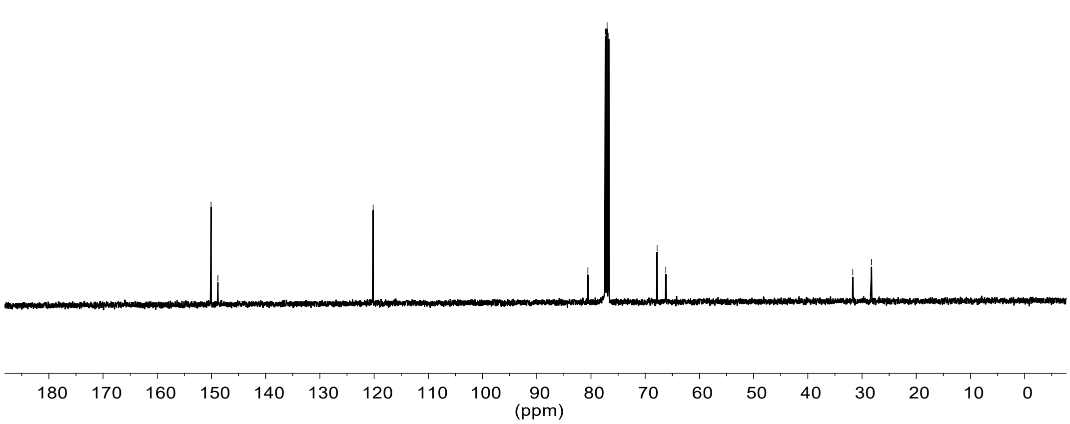


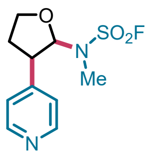
3g, ^{1}H NMR, $CDCl_3$, 400 MHz

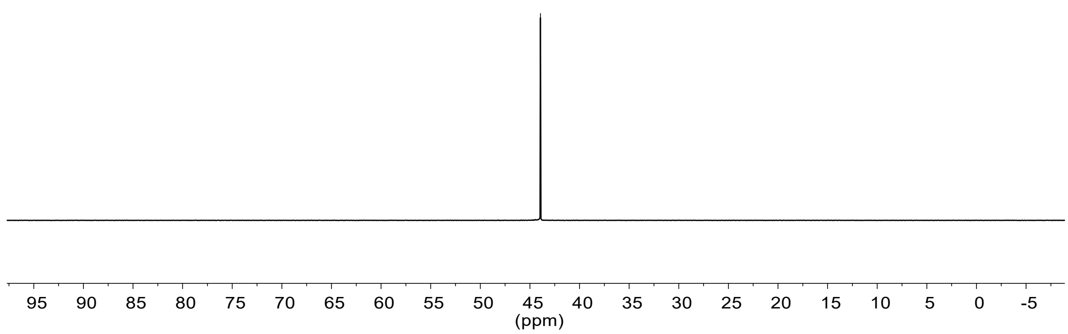




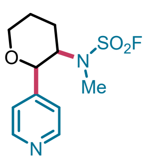
3g, ^{13}C NMR, $CDCl_3$, 101 MHz

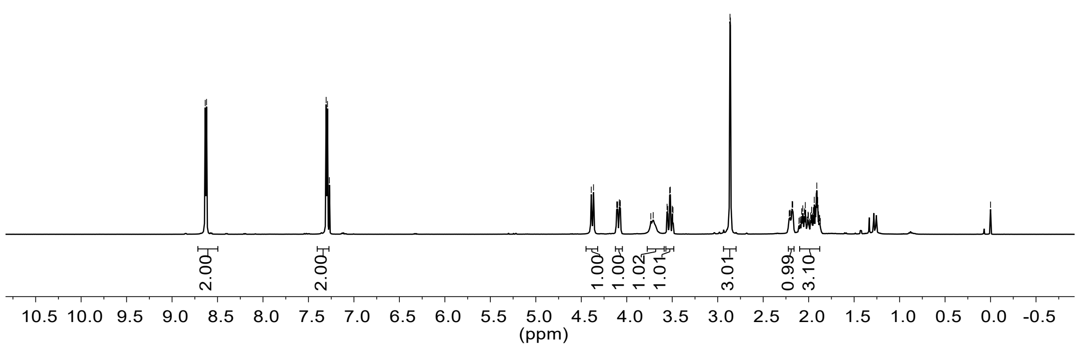




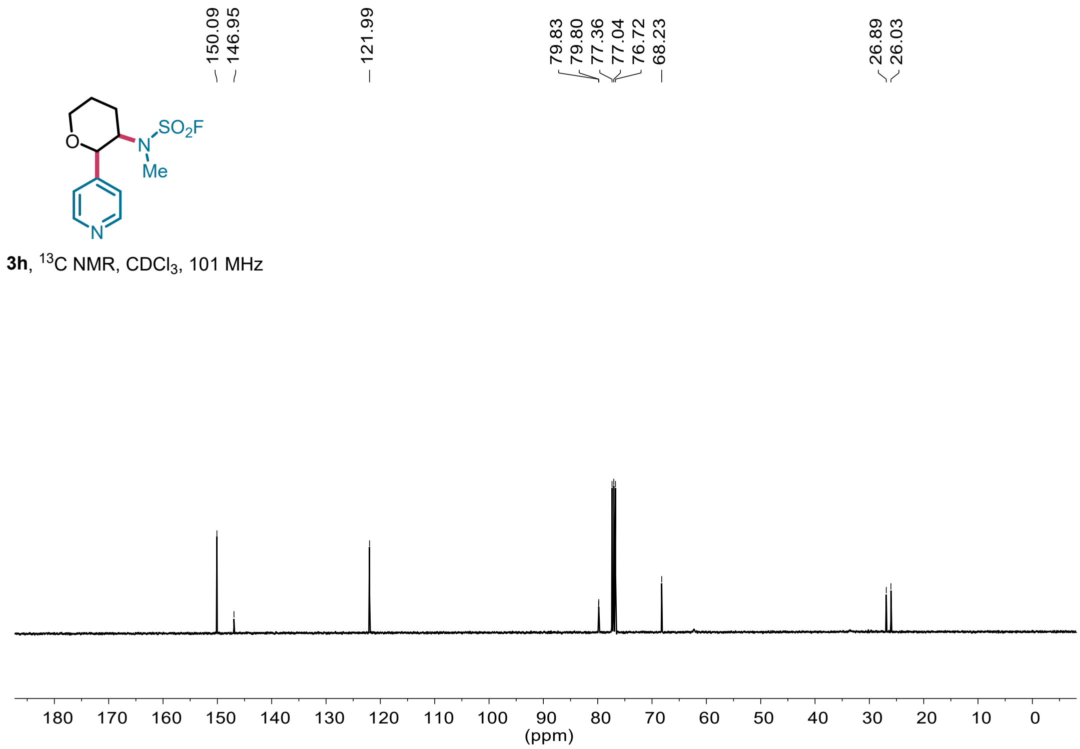


3g, ^{19}F NMR, $CDCl_3$, 376 MHz

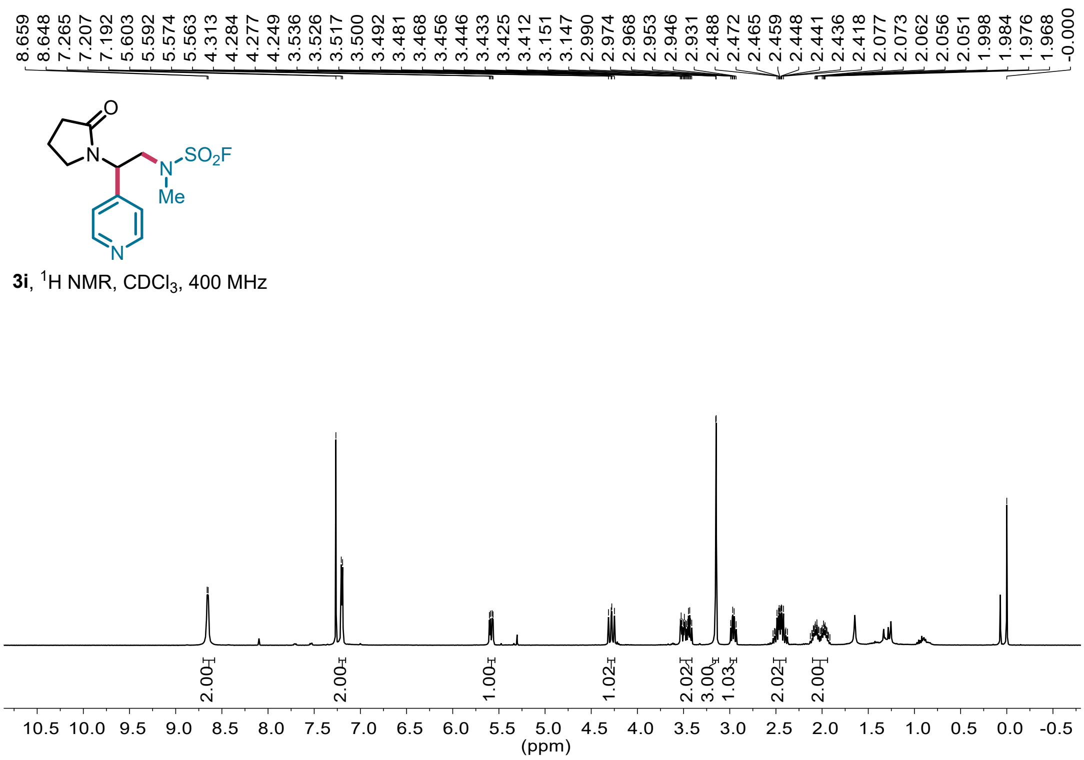




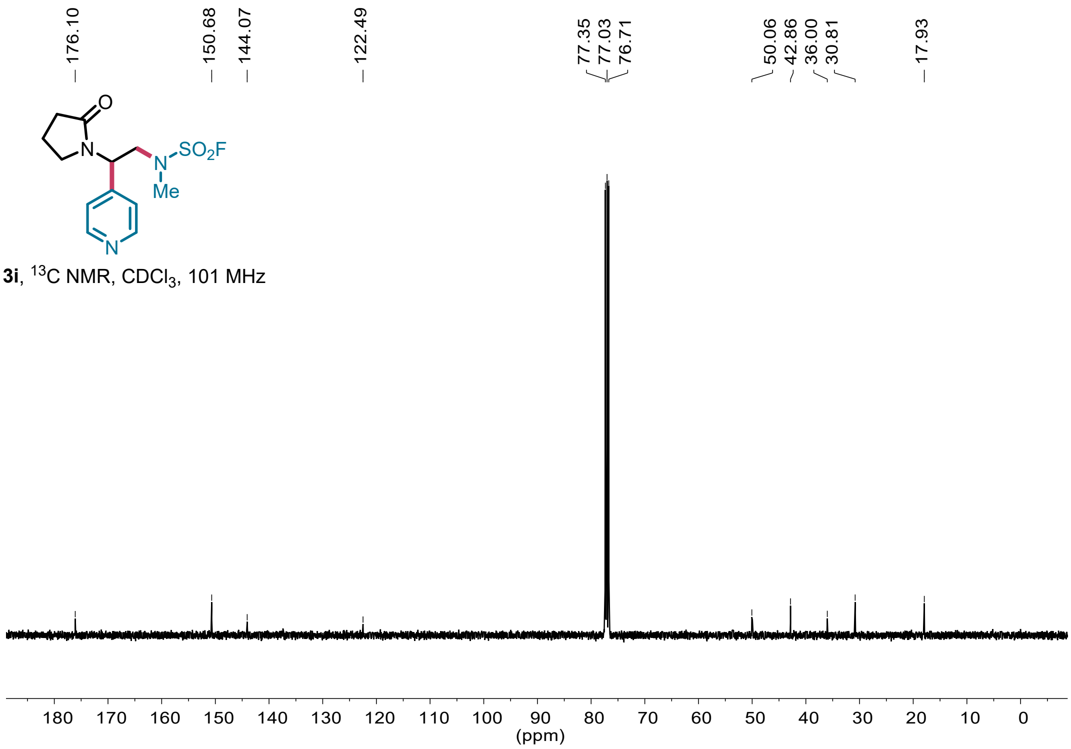
3h, ^{1}H NMR, $CDCl_3$, 400 MHz



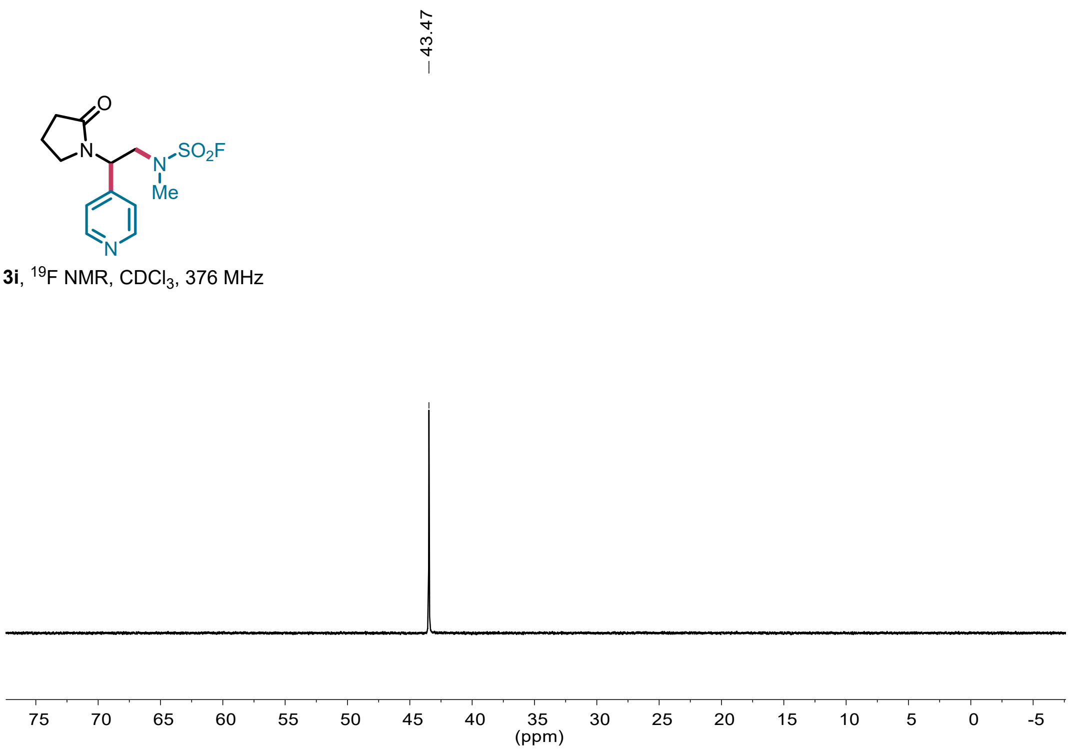
3h, ^{13}C NMR, $CDCl_3$, 101 MHz



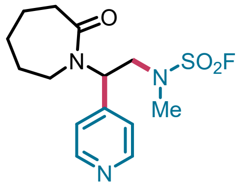
3i, ^{1}H NMR, $CDCl_3$, 400 MHz



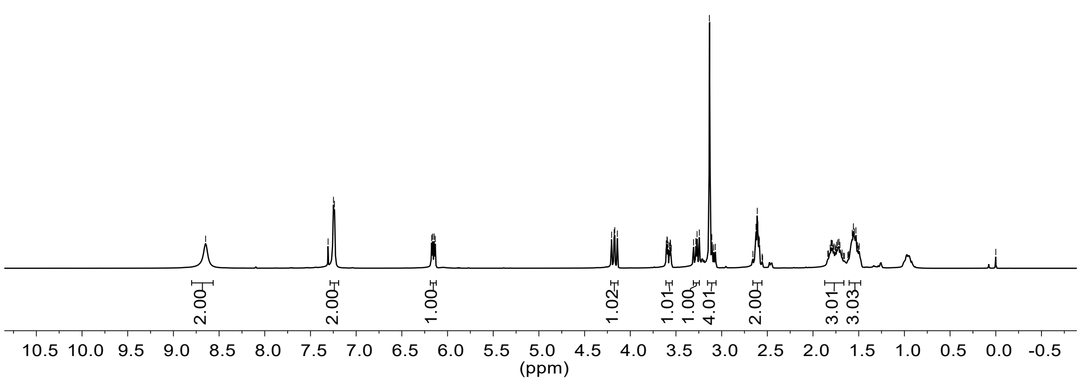
3i, ^{13}C NMR, $CDCl_3$, 101 MHz

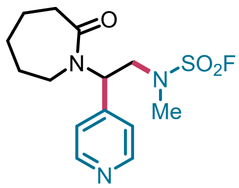


3i, ^{19}F NMR, $CDCl_3$, 376 MHz

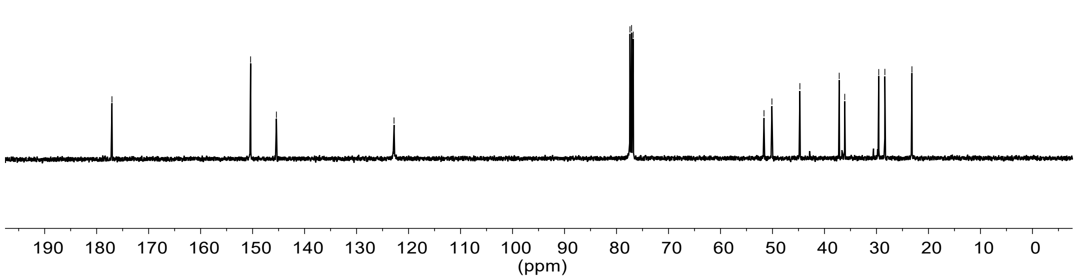


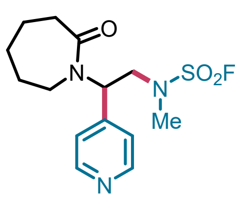
3j, ^{1}H NMR, $CDCl_3$, 400 MHz



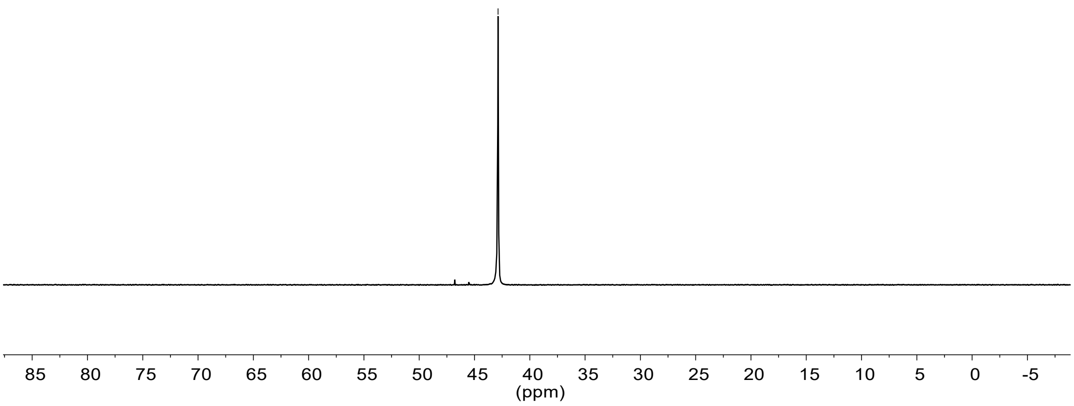


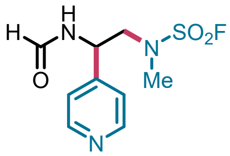
3j, ^{13}C NMR, $CDCl_3$, 101 MHz



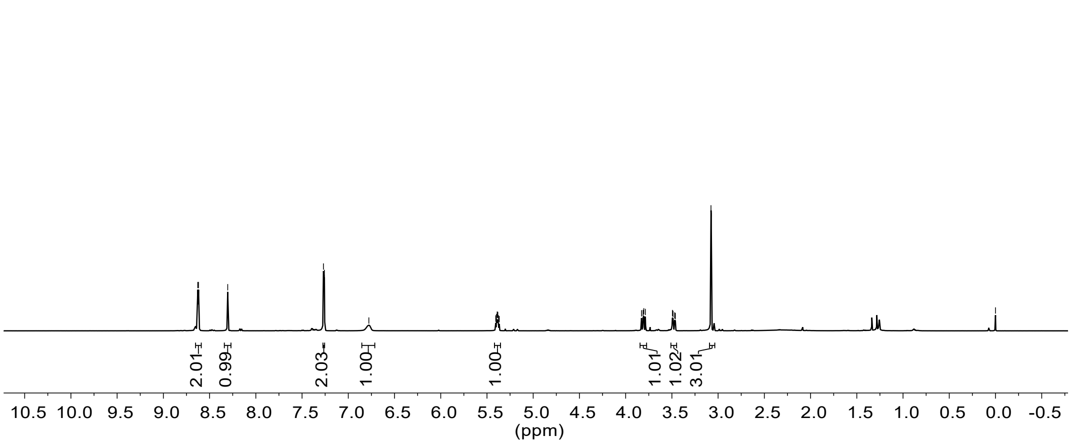


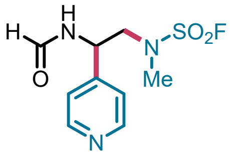
3j, ^{19}F NMR, $CDCl_3$, 376 MHz



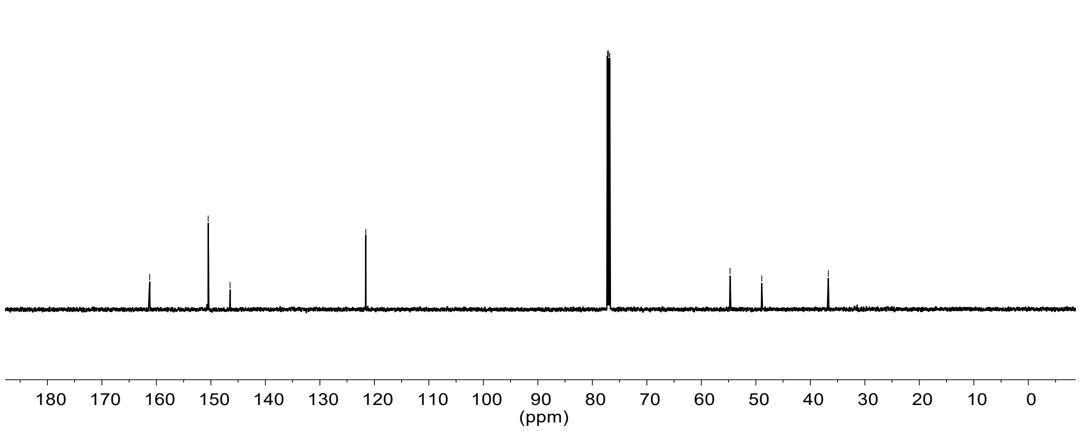


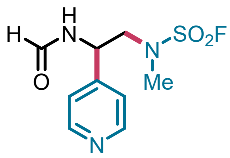
3k, ^{1}H NMR, $CDCl_3$, 600 MHz



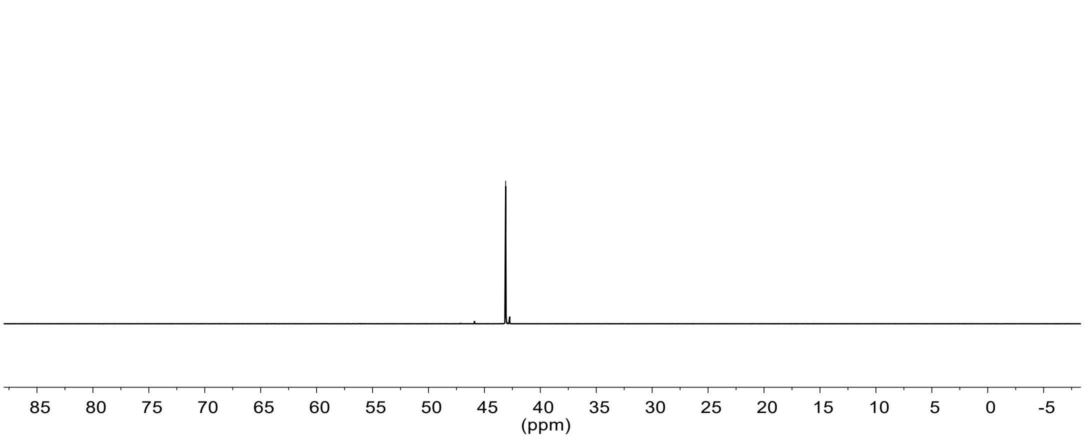


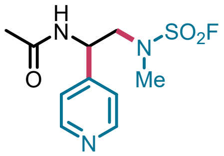
3k, ^{13}C NMR, $CDCl_3$, 151 MHz



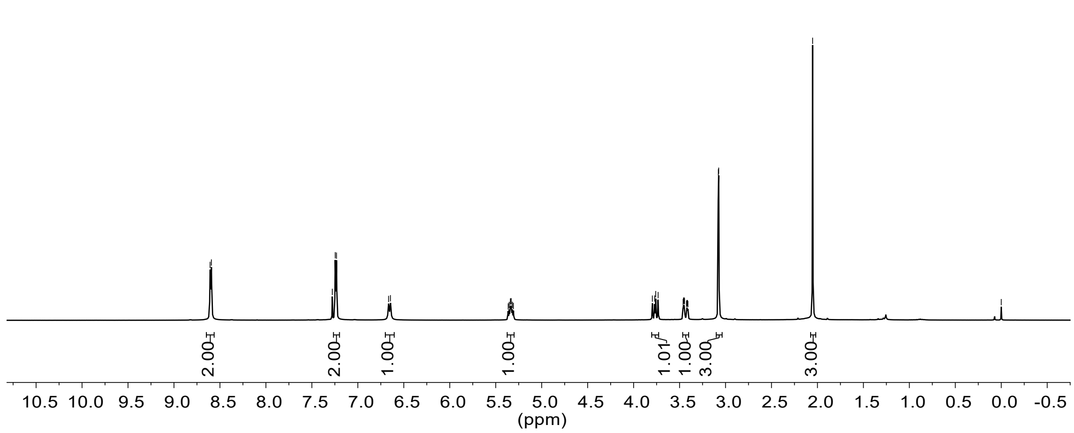


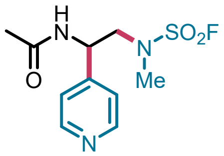
3k, ^{19}F NMR, $CDCl_3$, 565 MHz



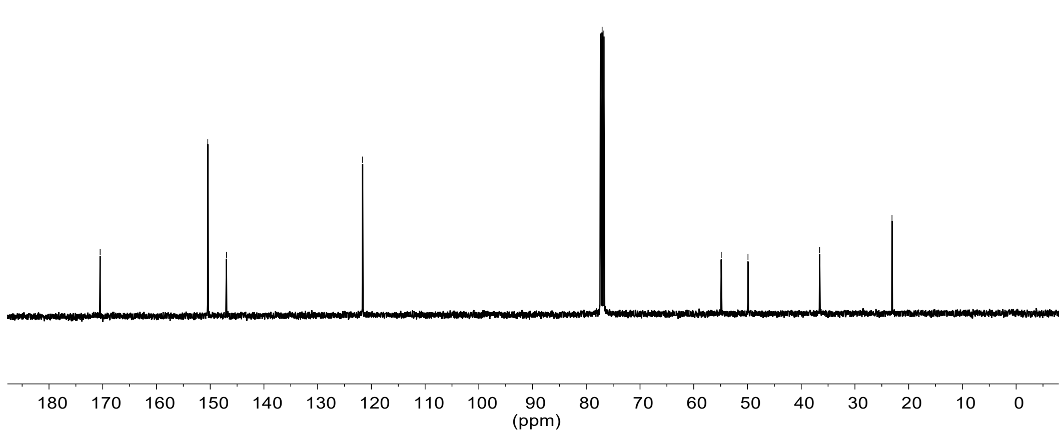


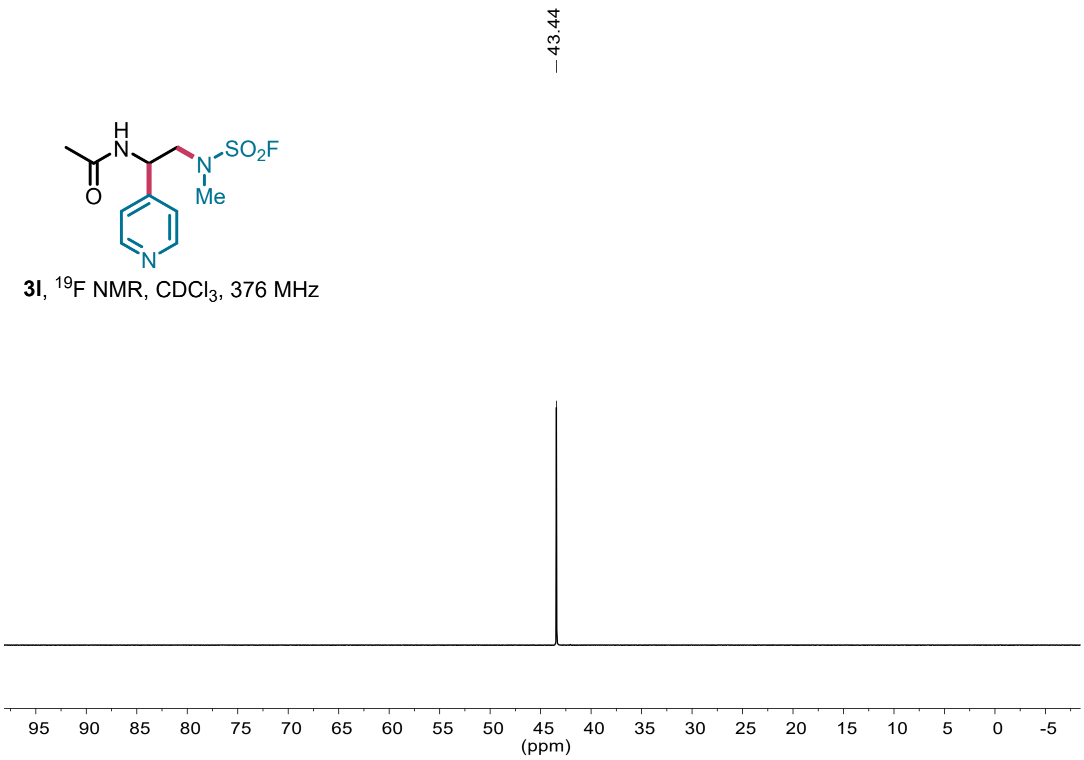
3l, ^{1}H NMR, $CDCl_3$, 400 MHz



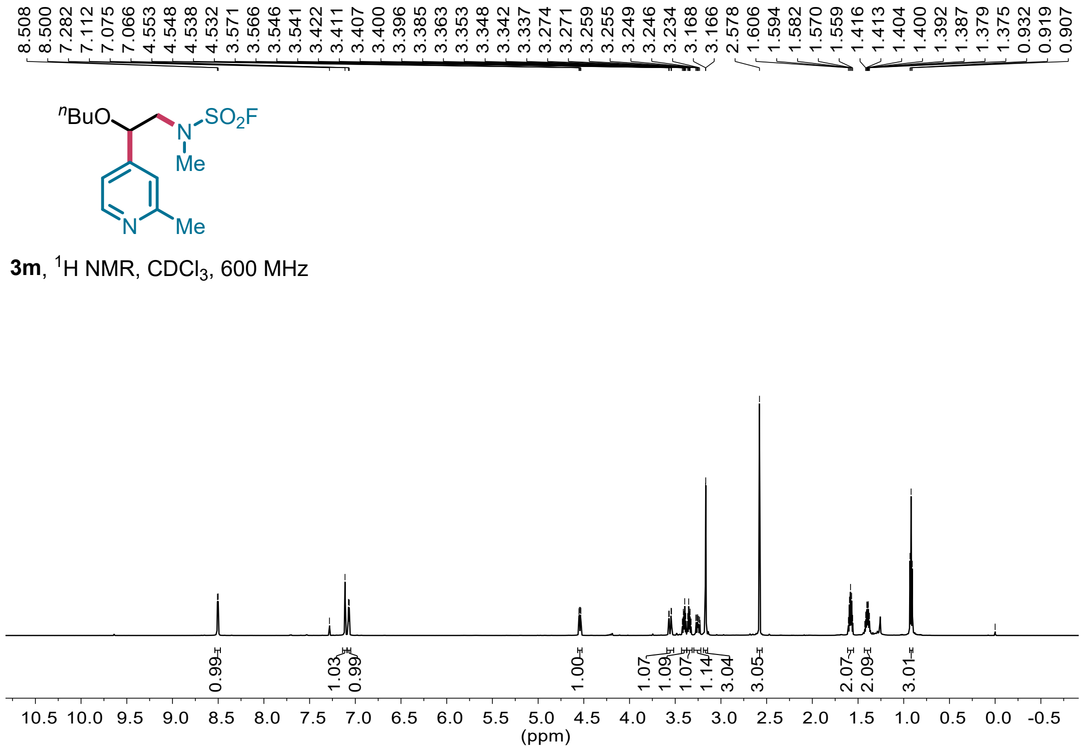


3l, ^{13}C NMR, $CDCl_3$, 101 MHz

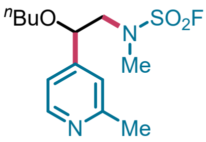




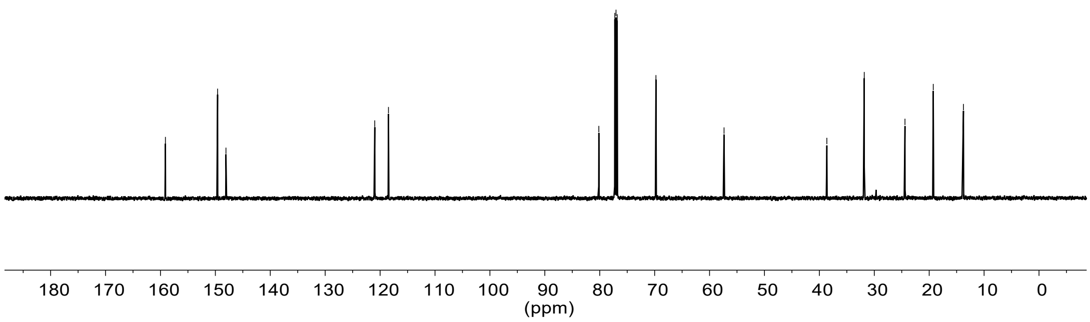
3l, ^{19}F NMR, $CDCl_3$, 376 MHz

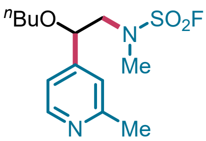


3m, ^{1}H NMR, $CDCl_3$, 600 MHz

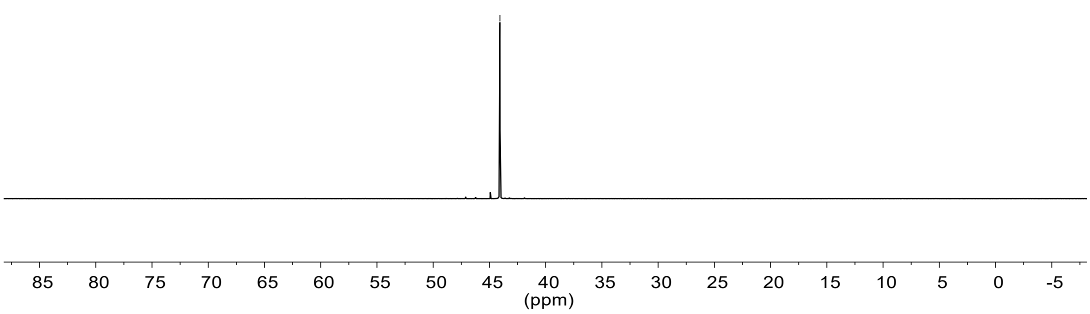


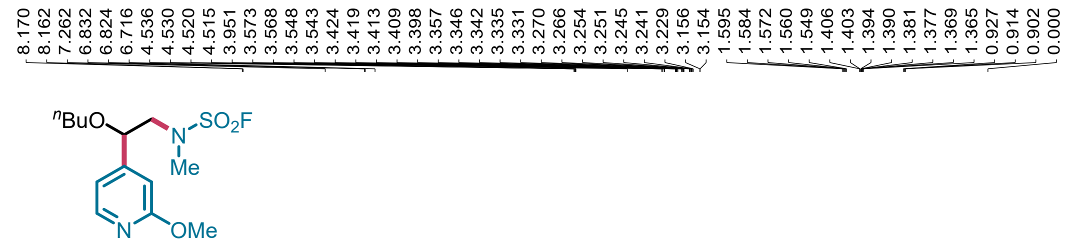
3m, ^{13}C NMR, $CDCl_3$, 151 MHz



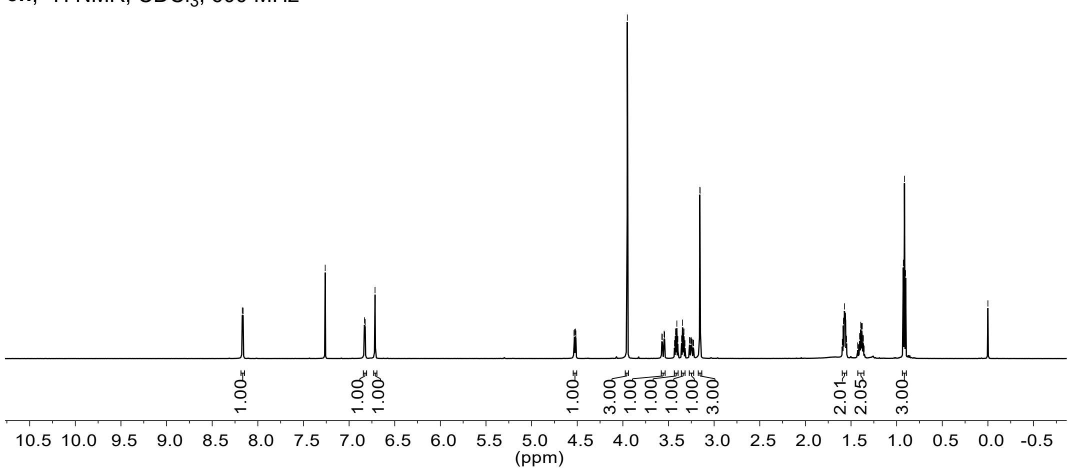


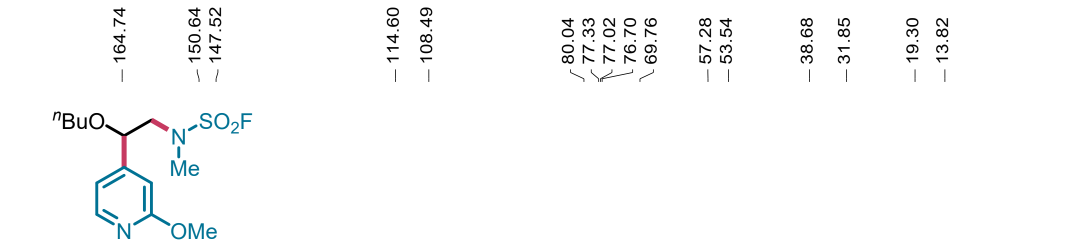
3m, ^{19}F NMR, $CDCl_3$, 565 MHz



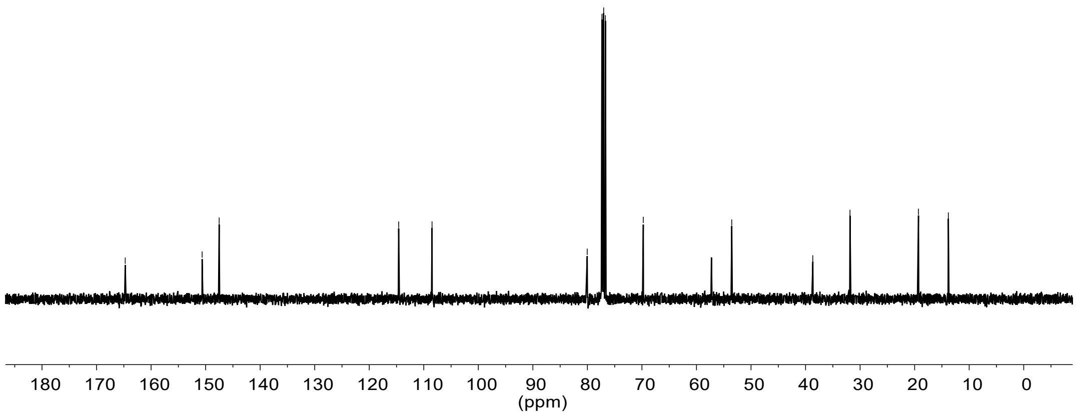


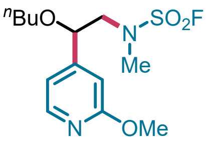
3n, ^{1}H NMR, $CDCl_3$, 600 MHz



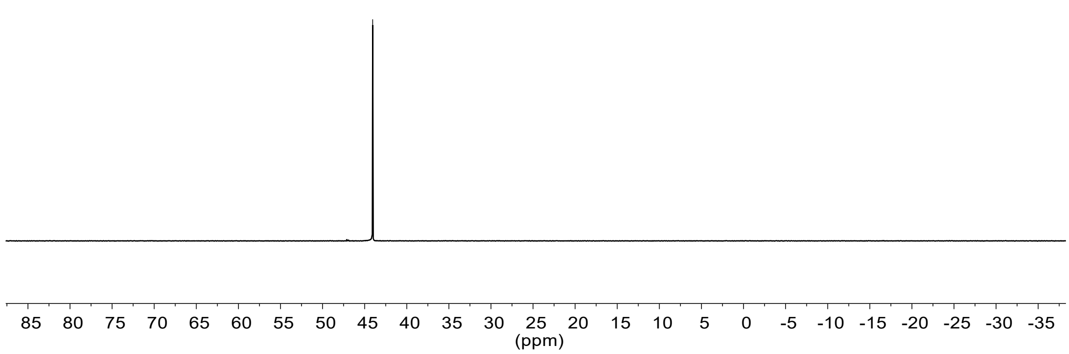


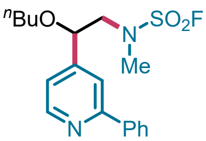
3n, ^{13}C NMR, $CDCl_3$, 151 MHz



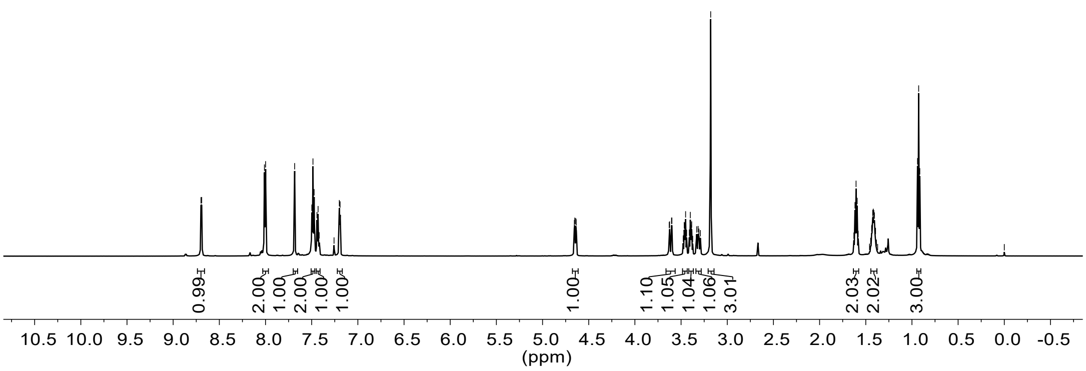


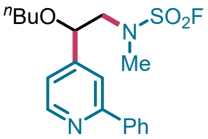
3n, ^{19}F NMR, $CDCl_3$, 565 MHz



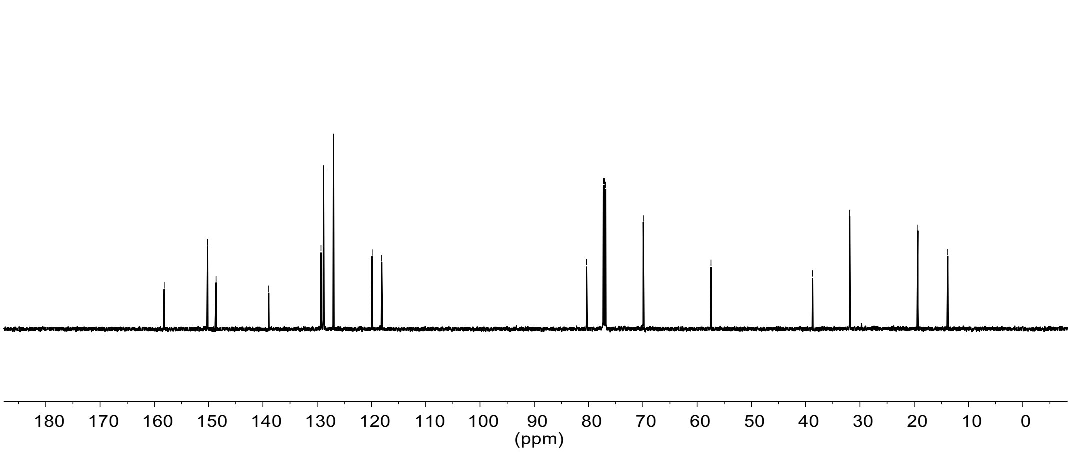


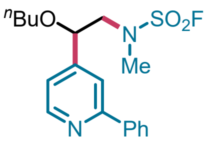
3o, ^{1}H NMR, $CDCl_3$, 600 MHz



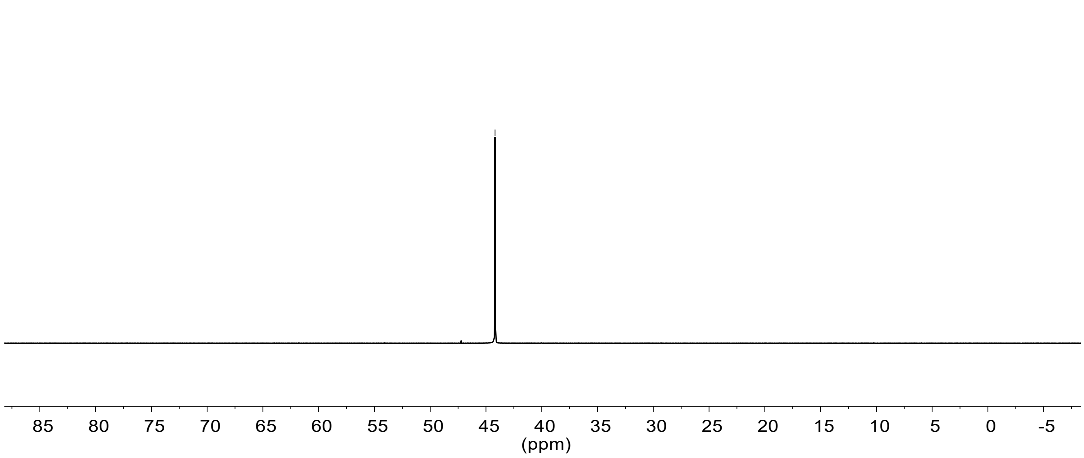


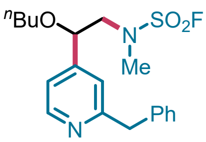
3o, ^{13}C NMR, $CDCl_3$, 151 MHz



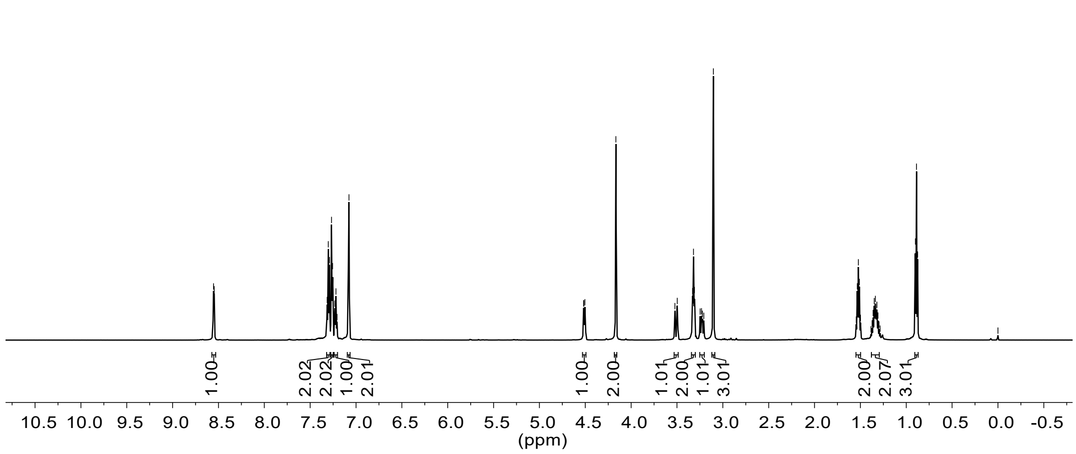


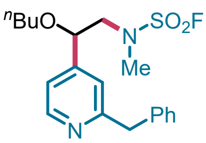
3o, ^{19}F NMR, $CDCl_3$, 565 MHz



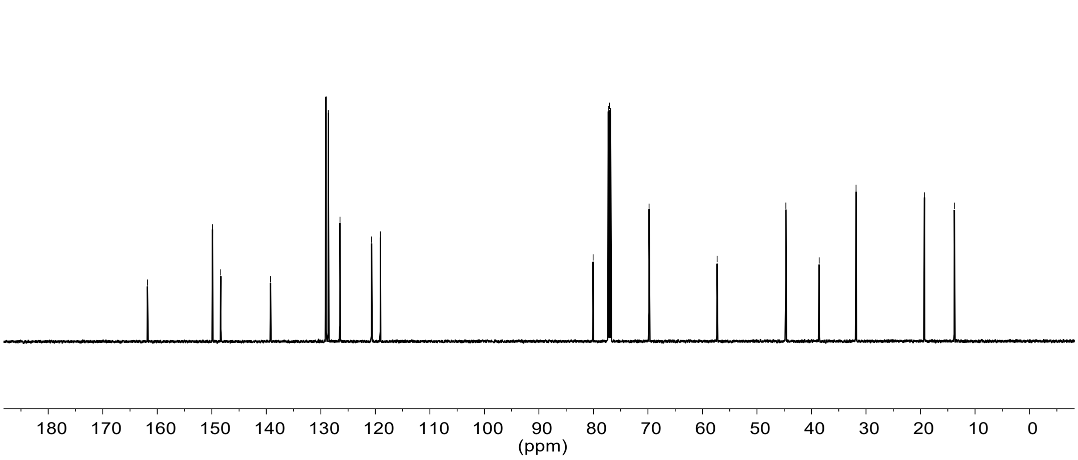


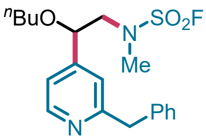
3p, ^{1}H NMR, $CDCl_3$, 600 MHz



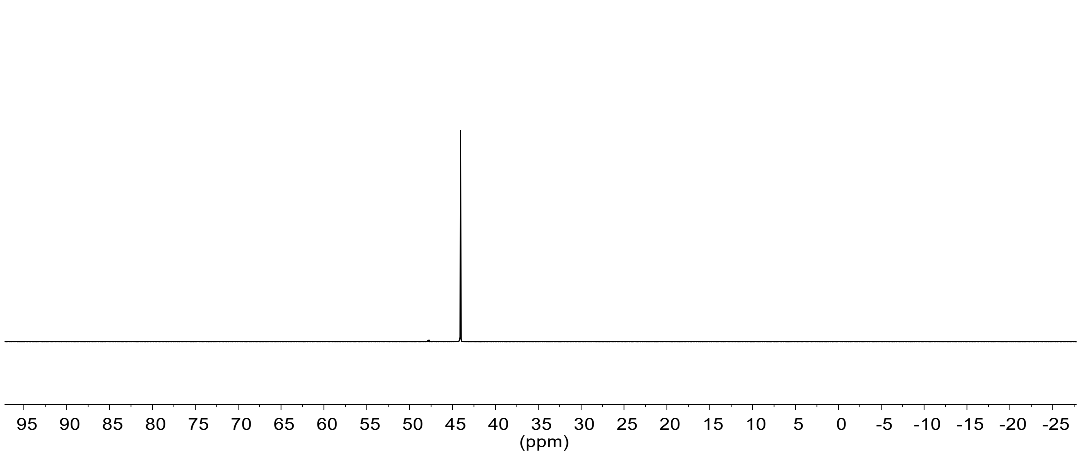


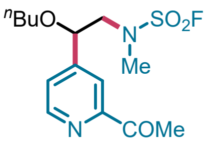
3p, ^{13}C NMR, $CDCl_3$, 151 MHz



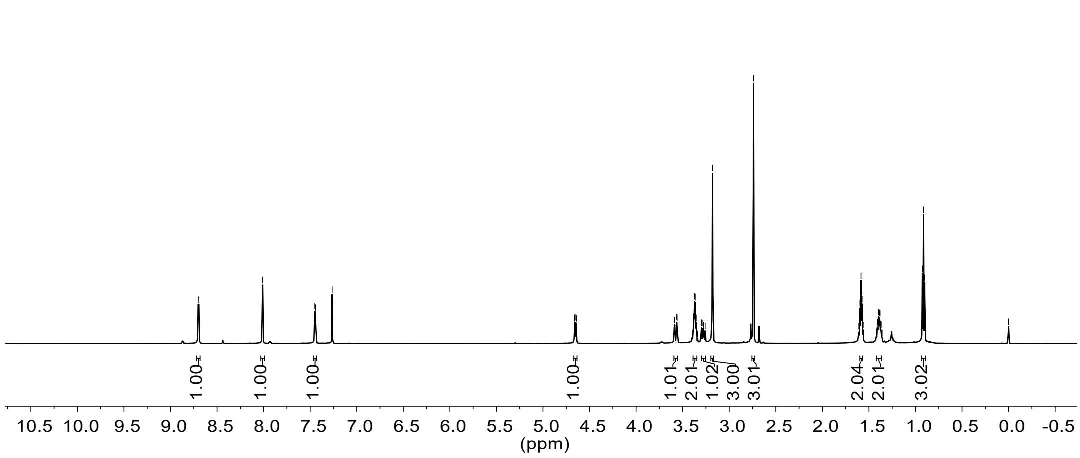


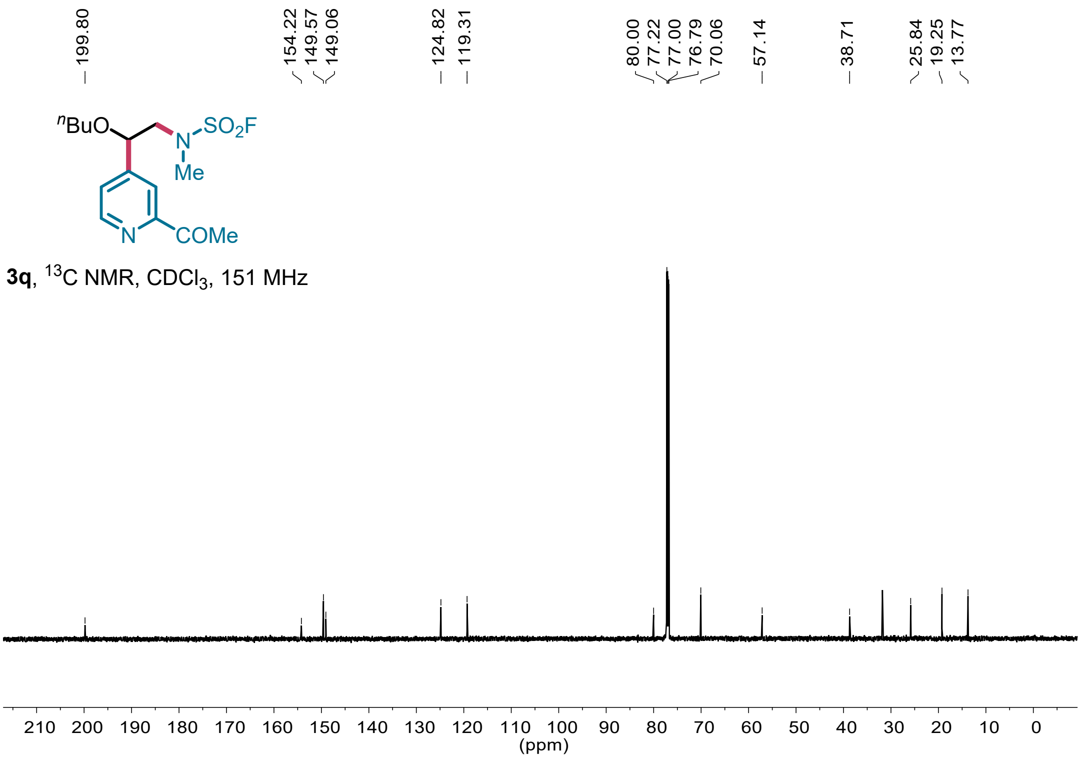
3p, ^{19}F NMR, $CDCl_3$, 565 MHz



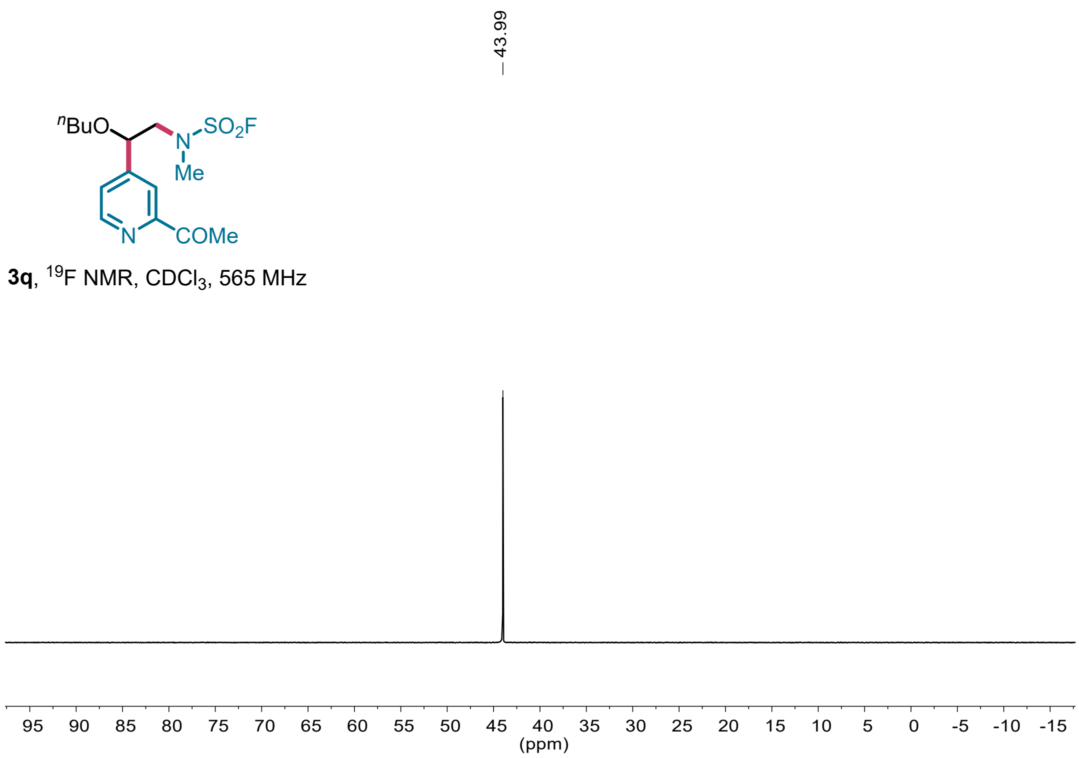


3q, ^{1}H NMR, $CDCl_3$, 600 MHz

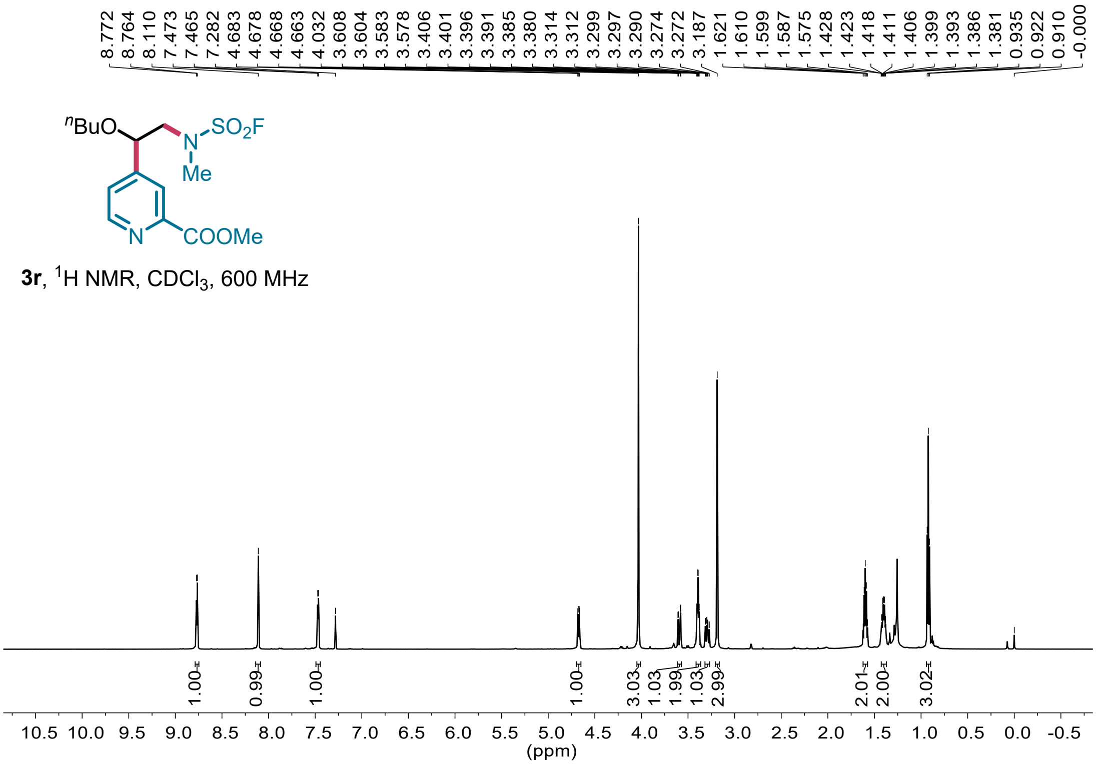




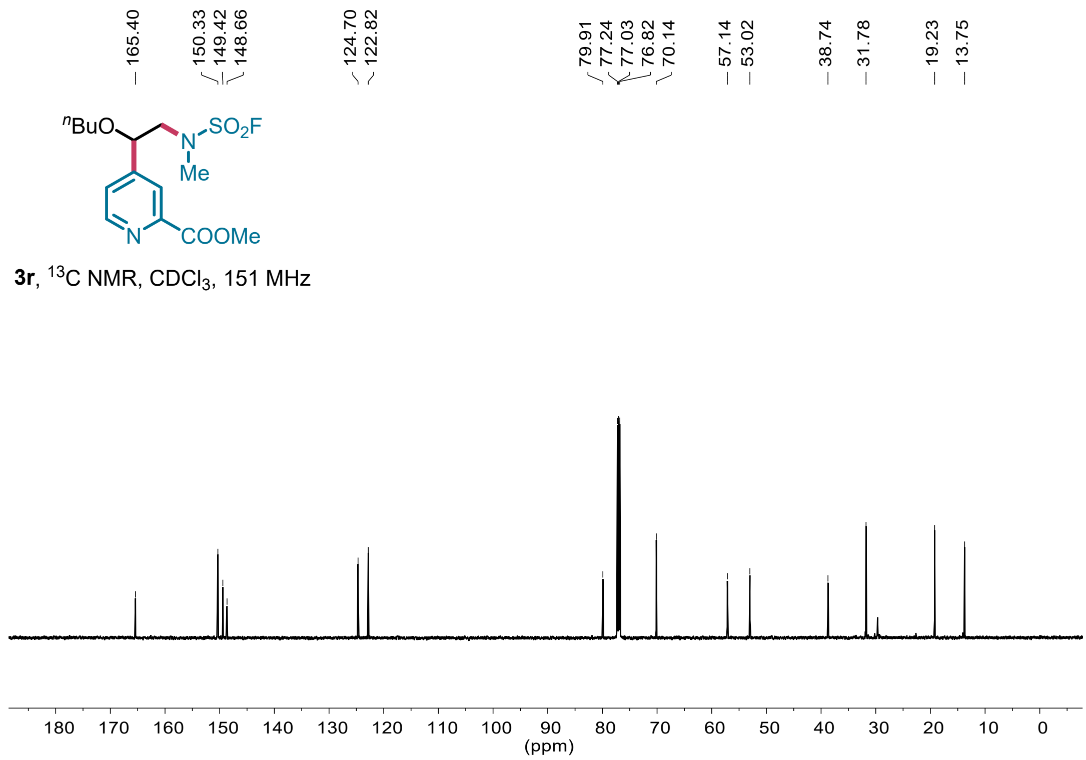
3q, ^{13}C NMR, $CDCl_3$, 151 MHz



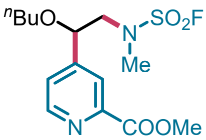
3q, ^{19}F NMR, $CDCl_3$, 565 MHz



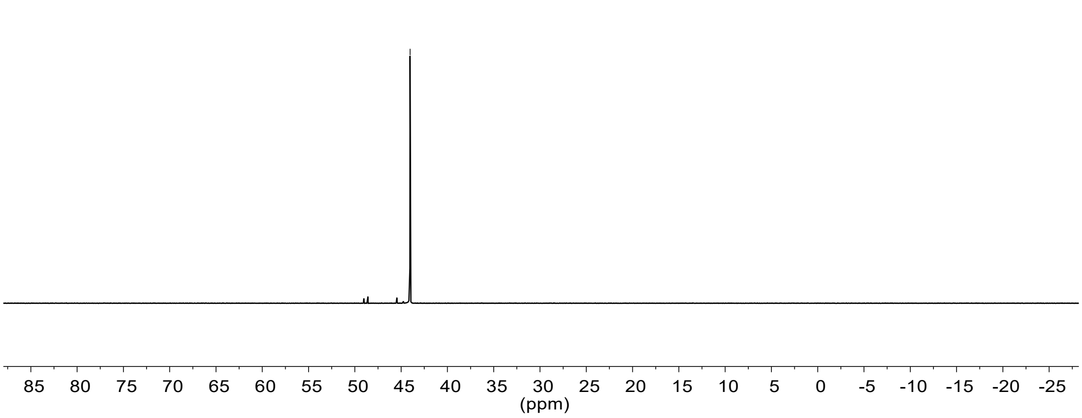
3r, ^{1}H NMR, $CDCl_3$, 600 MHz

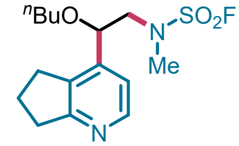


3r, ^{13}C NMR, $CDCl_3$, 151 MHz

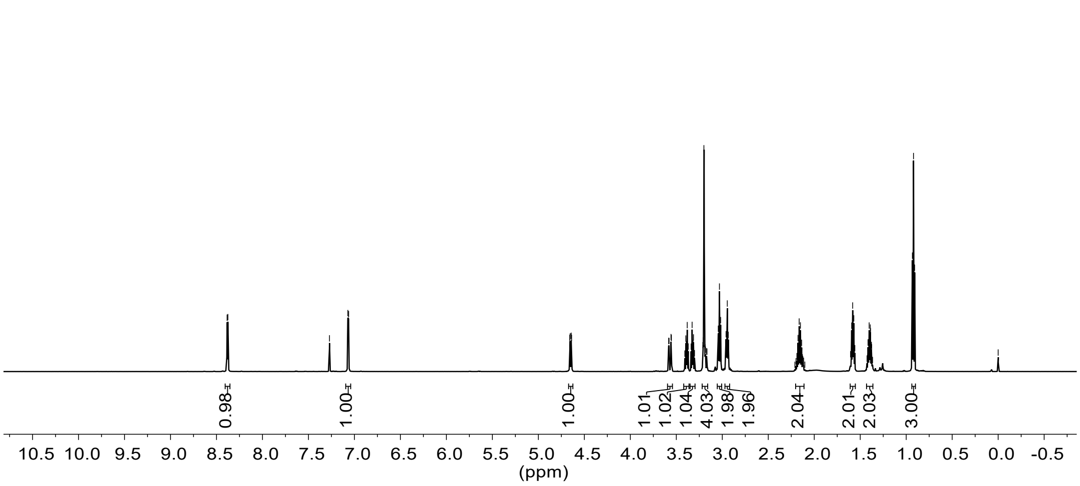


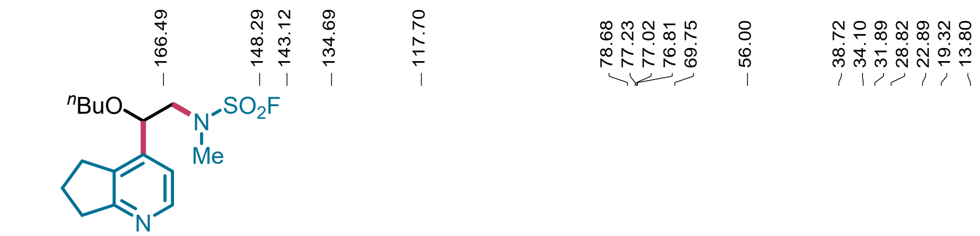
3r, ^{19}F NMR, $CDCl_3$, 565 MHz



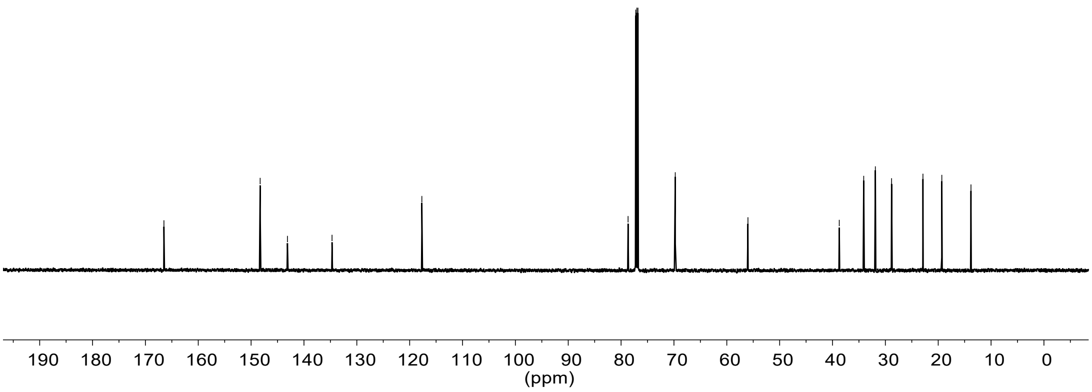


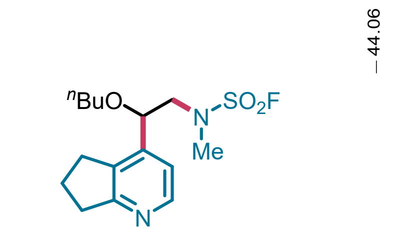
3s, ^{1}H NMR, $CDCl_3$, 600 MHz



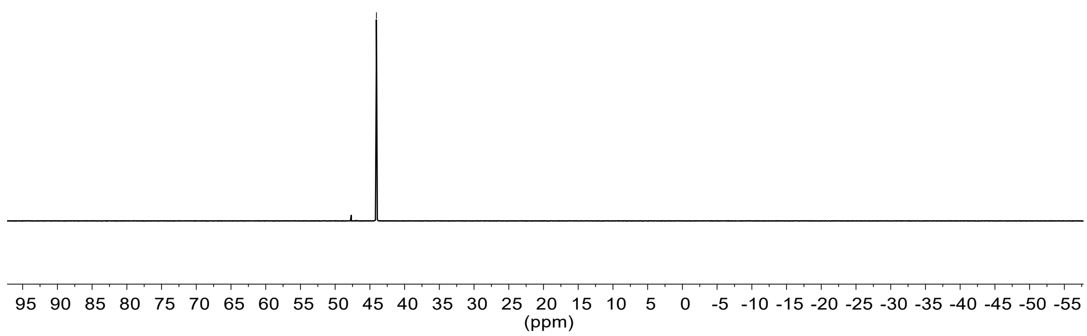


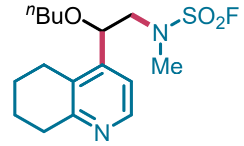
3s, ^{13}C NMR, $CDCl_3$, 151 MHz



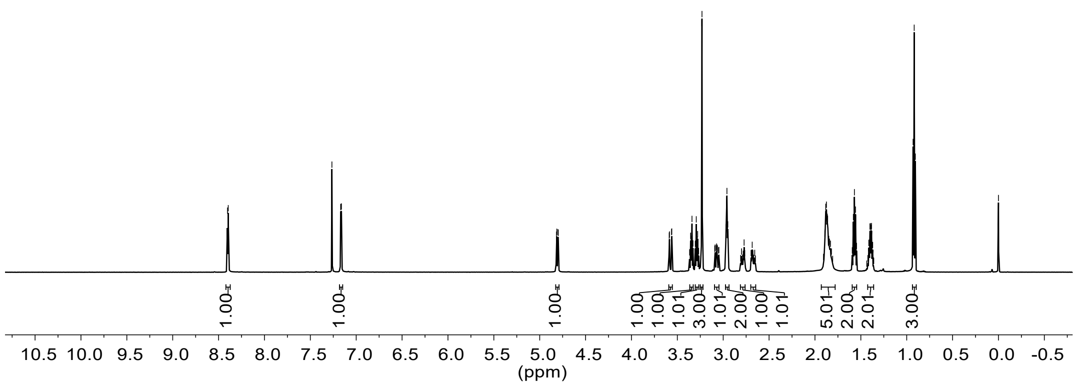


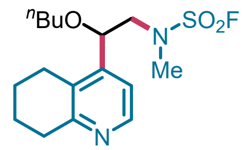
3s, ^{19}F NMR, $CDCl_3$, 565 MHz



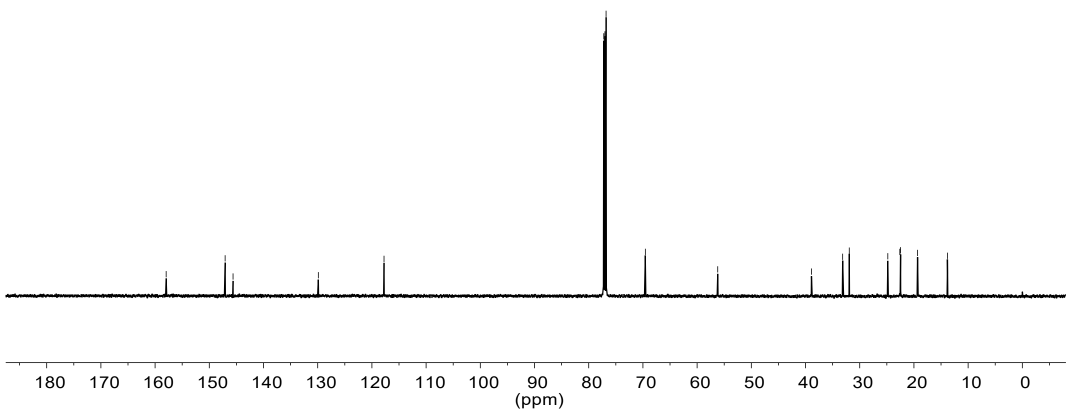


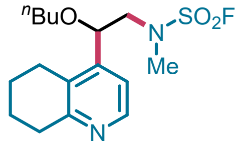
3t, ^{1}H NMR, $CDCl_3$, 600 MHz



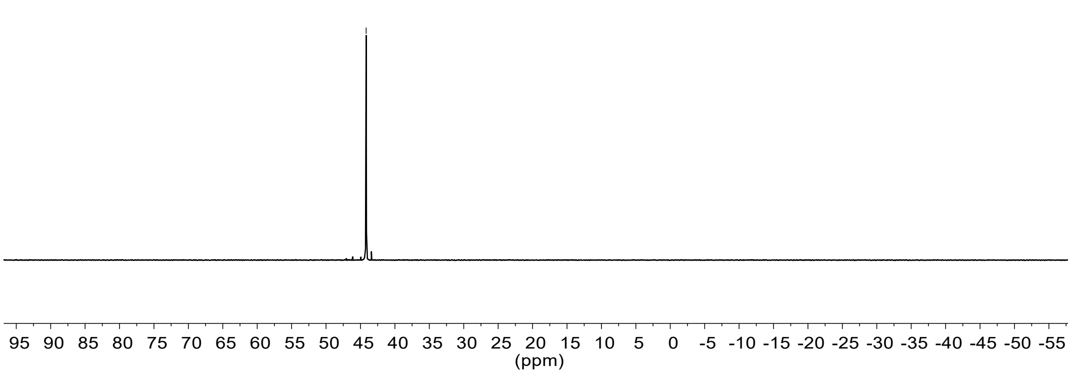


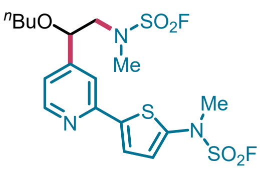
3t, ^{13}C NMR, $CDCl_3$, 151 MHz



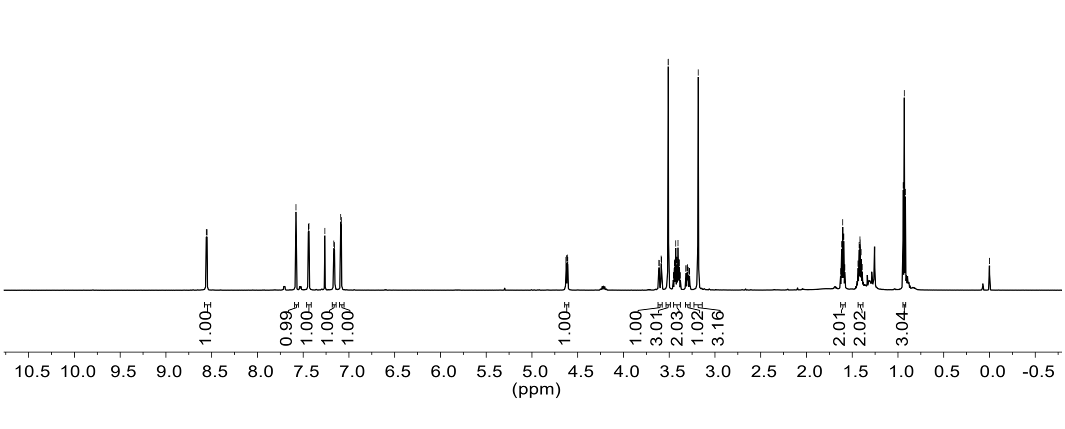


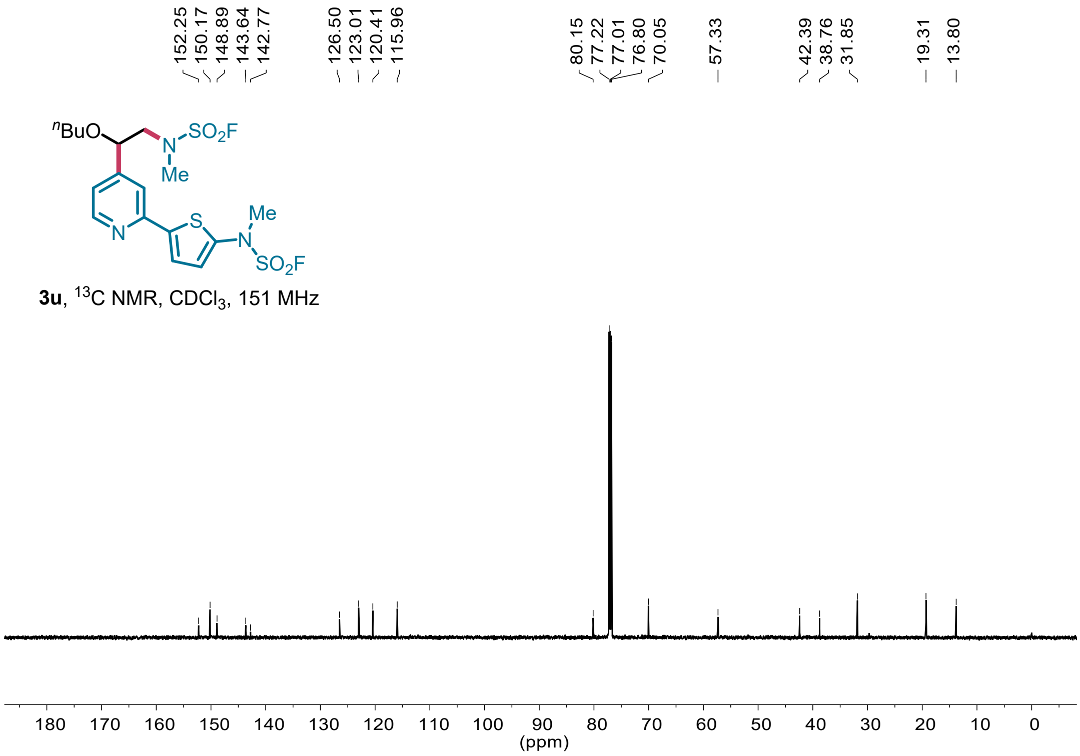
3t, ^{19}F NMR, CDCl$_3$, 565 MHz



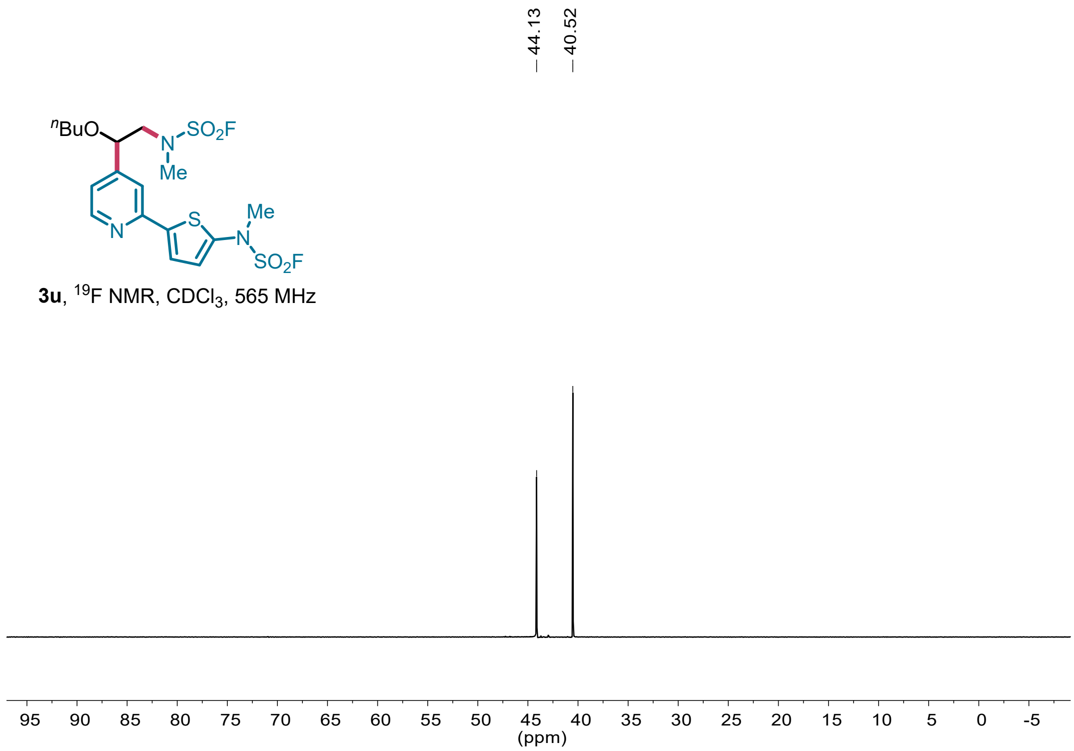


3u, ^{1}H NMR, CDCl$_3$, 600 MHz

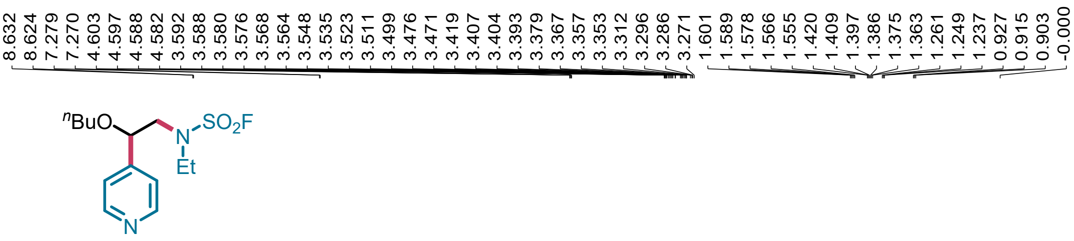




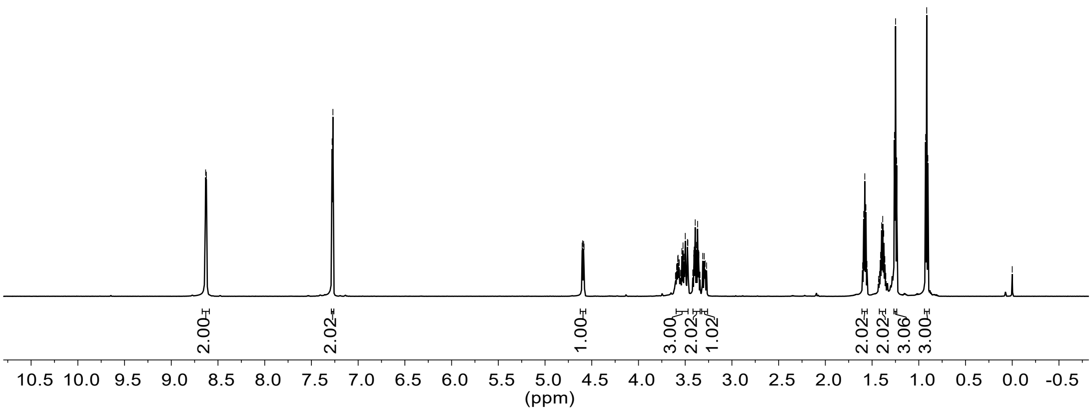
3u, ^{13}C NMR, $CDCl_3$, 151 MHz

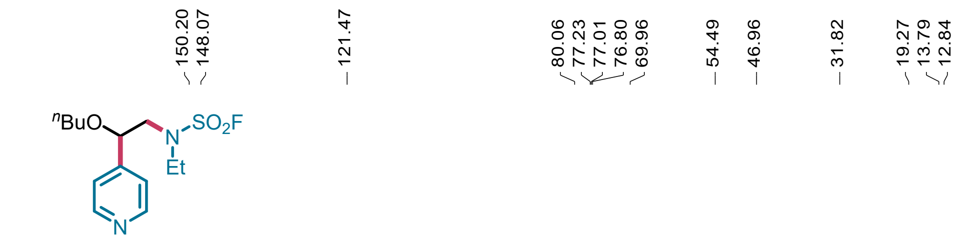


3u, ^{19}F NMR, $CDCl_3$, 565 MHz

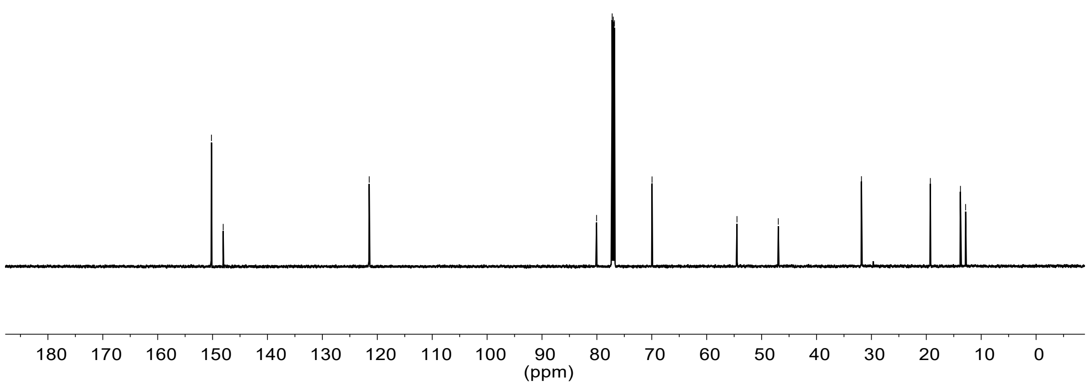


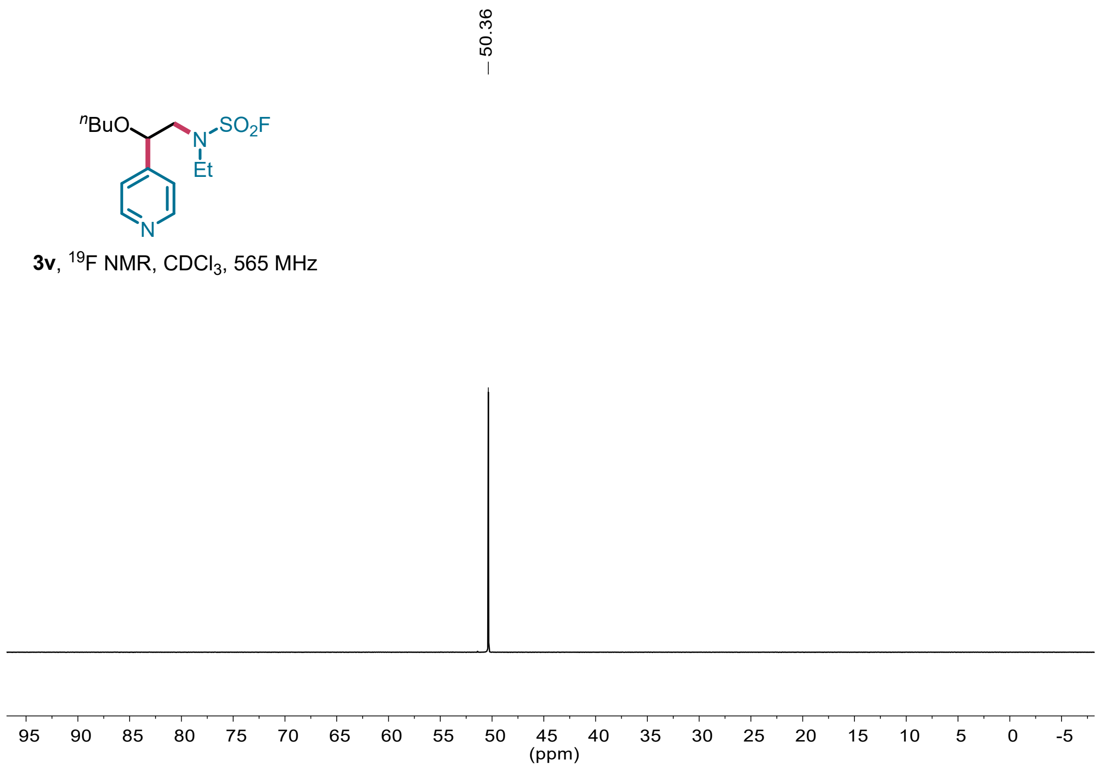
3v, ^{1}H NMR, $CDCl_3$, 600 MHz



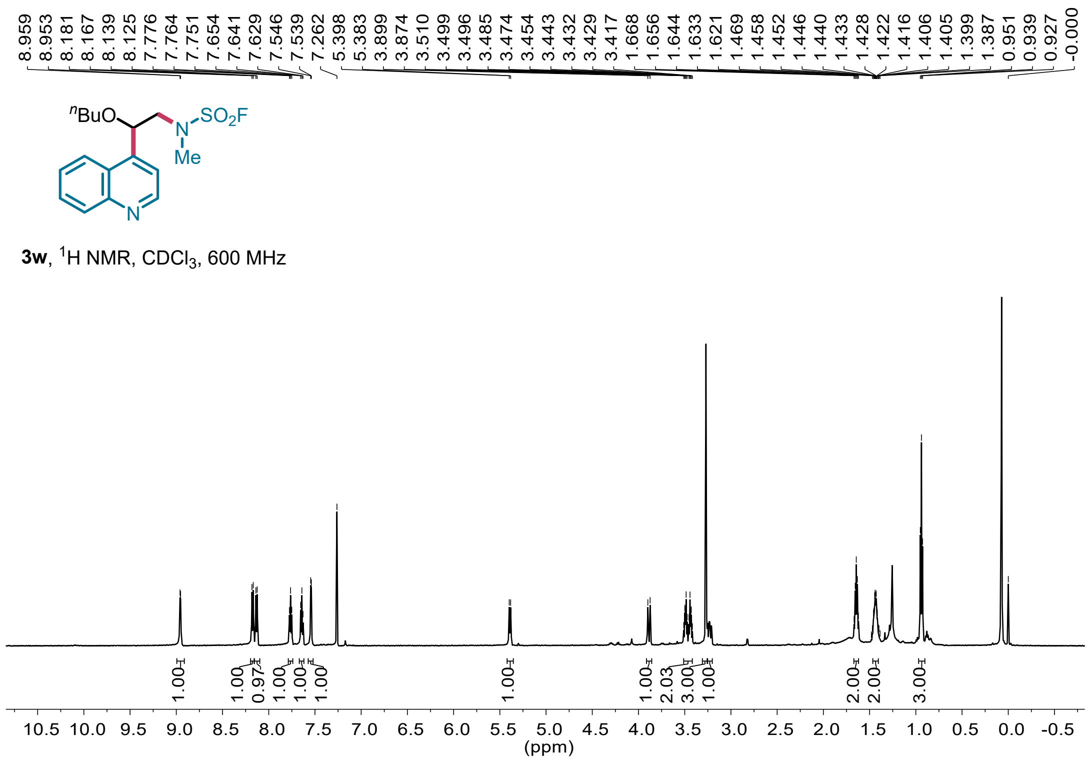


3v, ^{13}C NMR, $CDCl_3$, 151 MHz

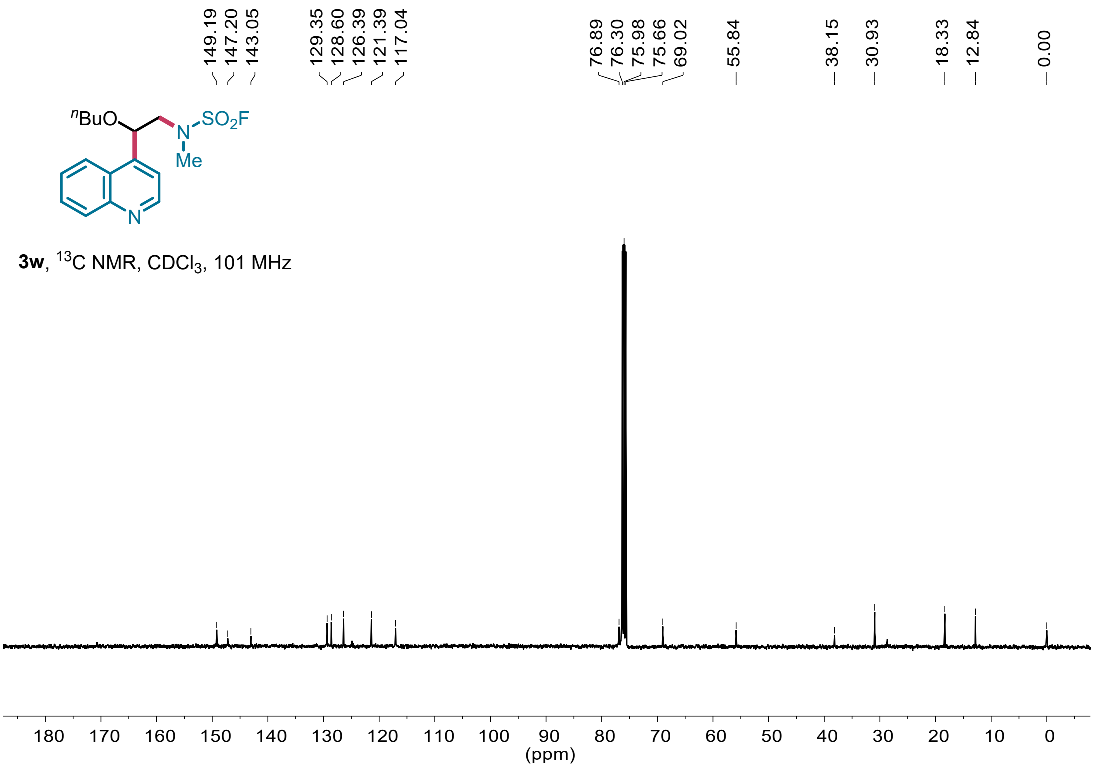




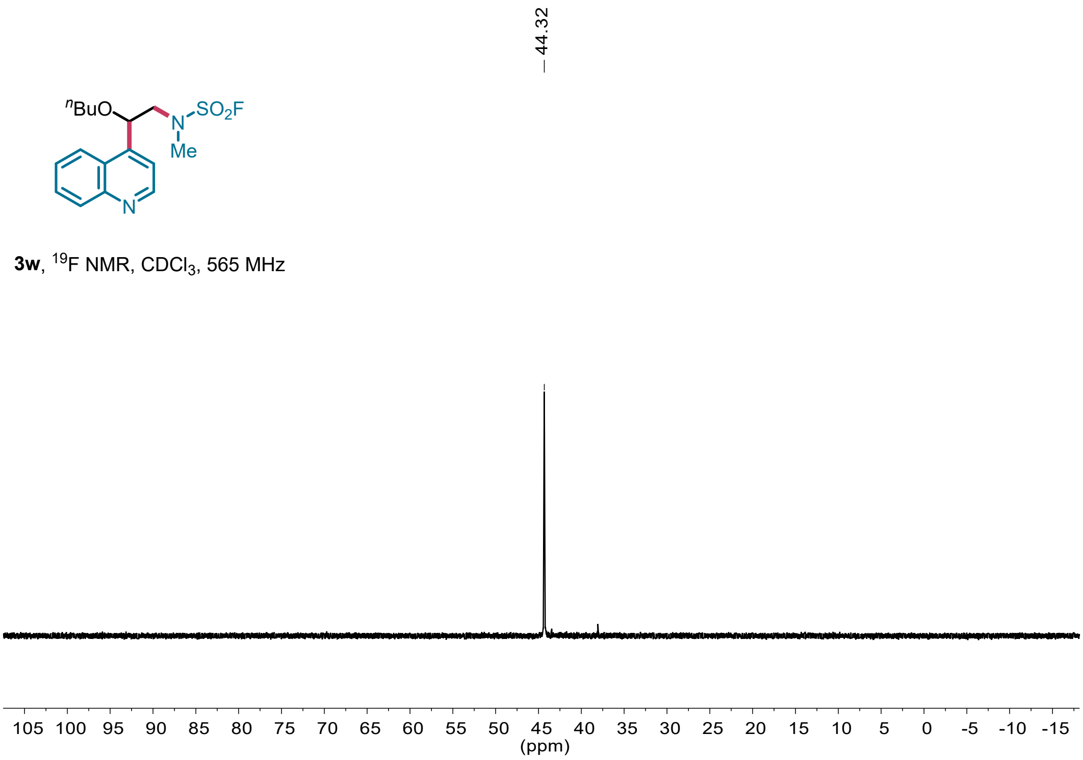
3v, ^{19}F NMR, $CDCl_3$, 565 MHz



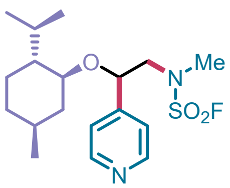
3w, ^{1}H NMR, $CDCl_3$, 600 MHz



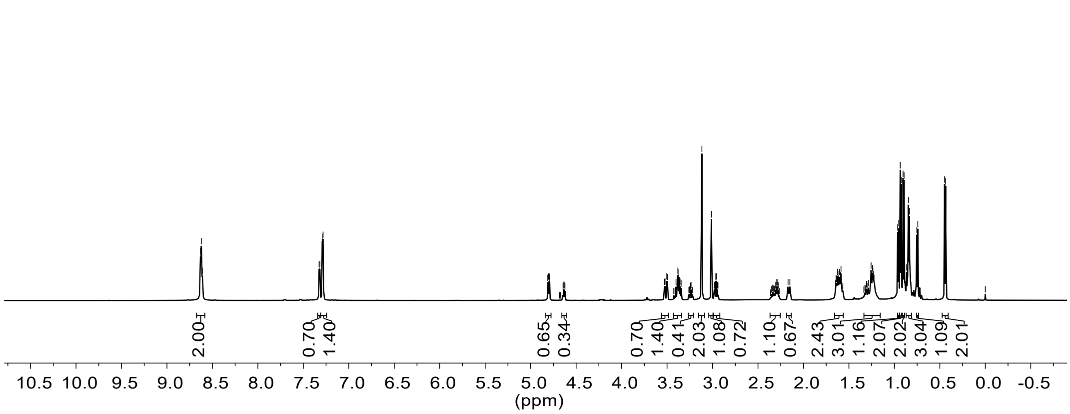
3w, ^{13}C NMR, $CDCl_3$, 101 MHz

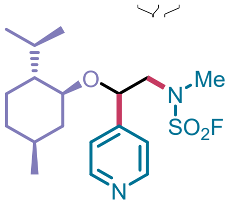


3w, ^{19}F NMR, $CDCl_3$, 565 MHz

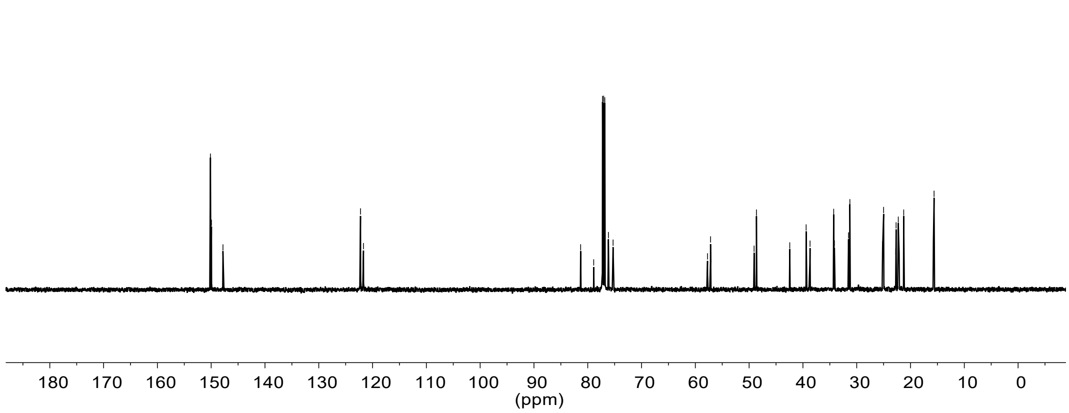


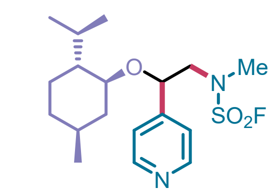
3x, ^{1}H NMR, $CDCl_3$, 600 MHz



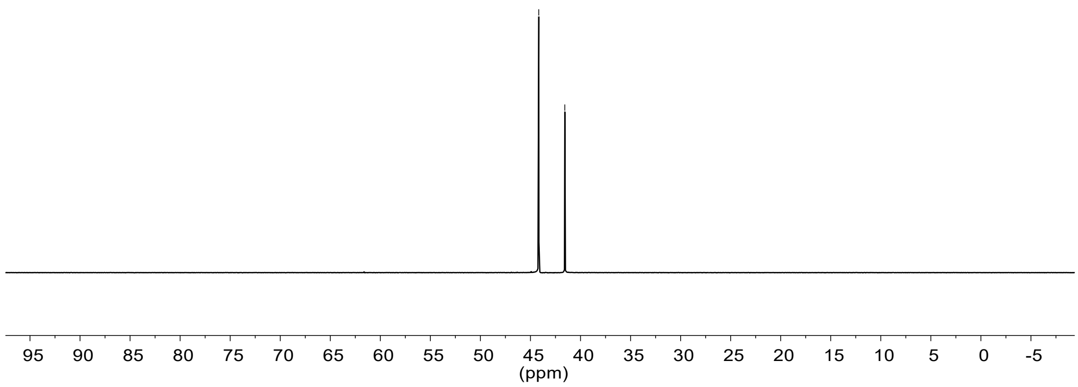


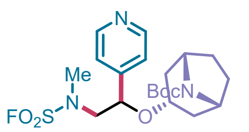
3x, ^{13}C NMR, $CDCl_3$, 151 MHz



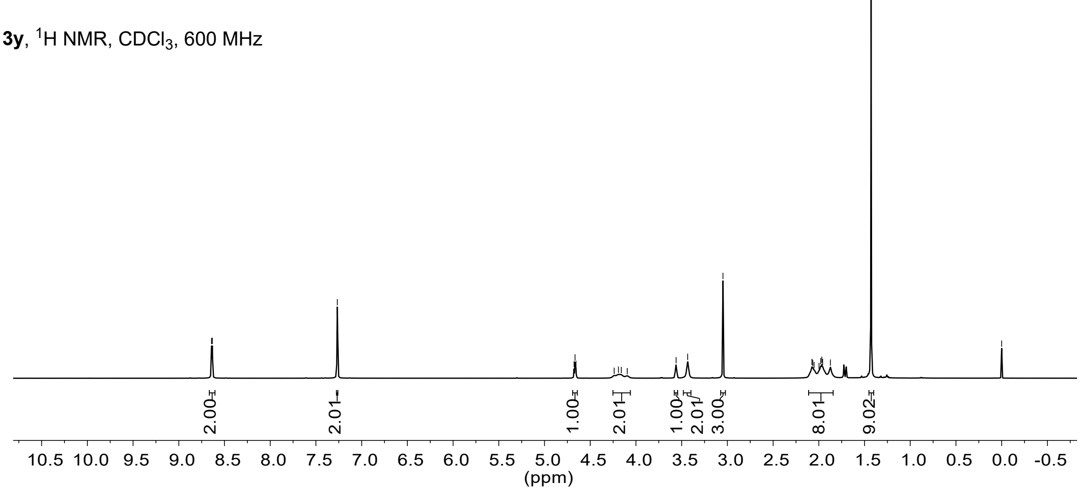


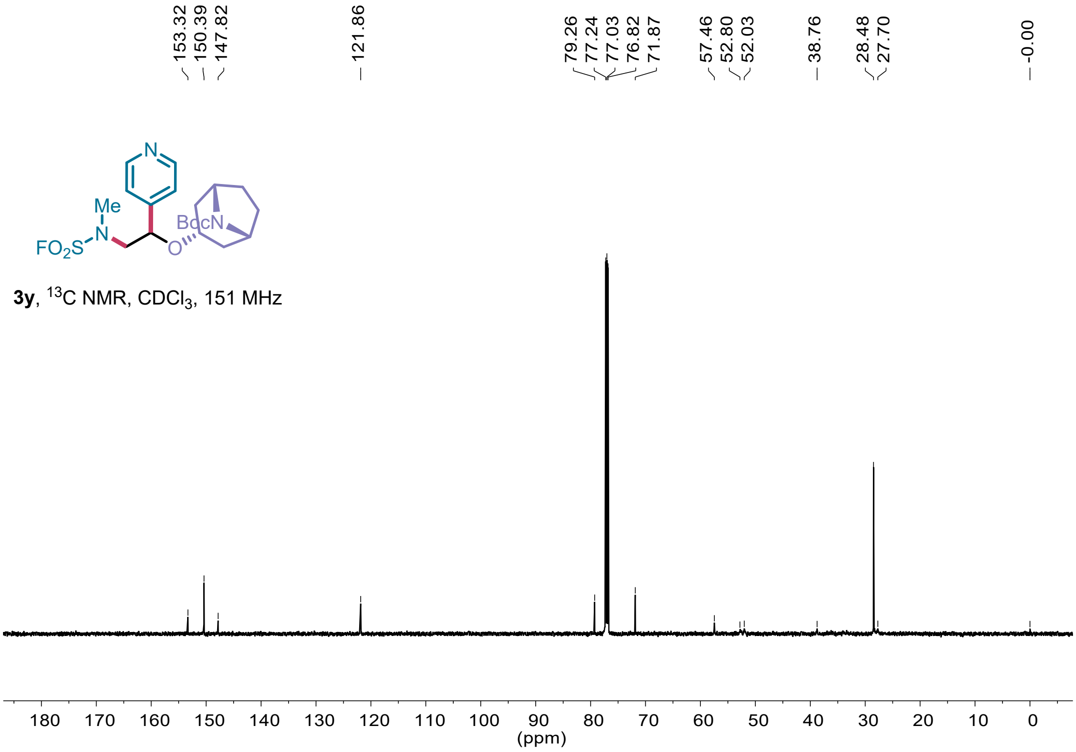
3x, ^{19}F NMR, CDCl$_3$, 565 MHz



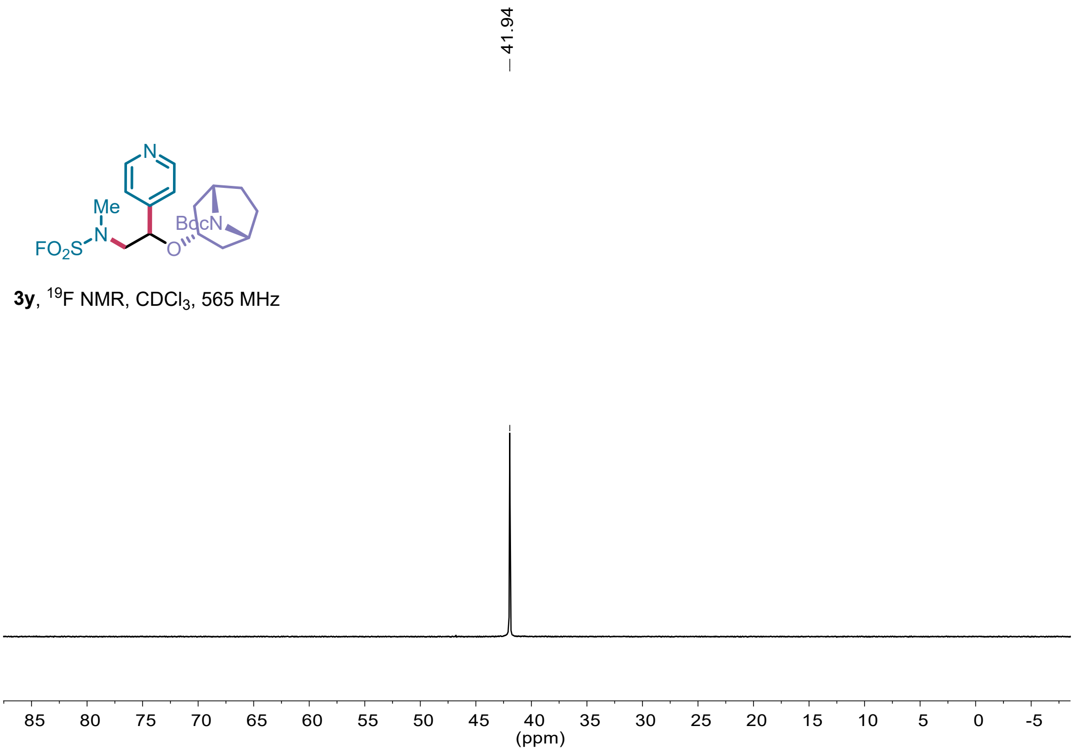


3y, ^{1}H NMR, CDCl$_3$, 600 MHz

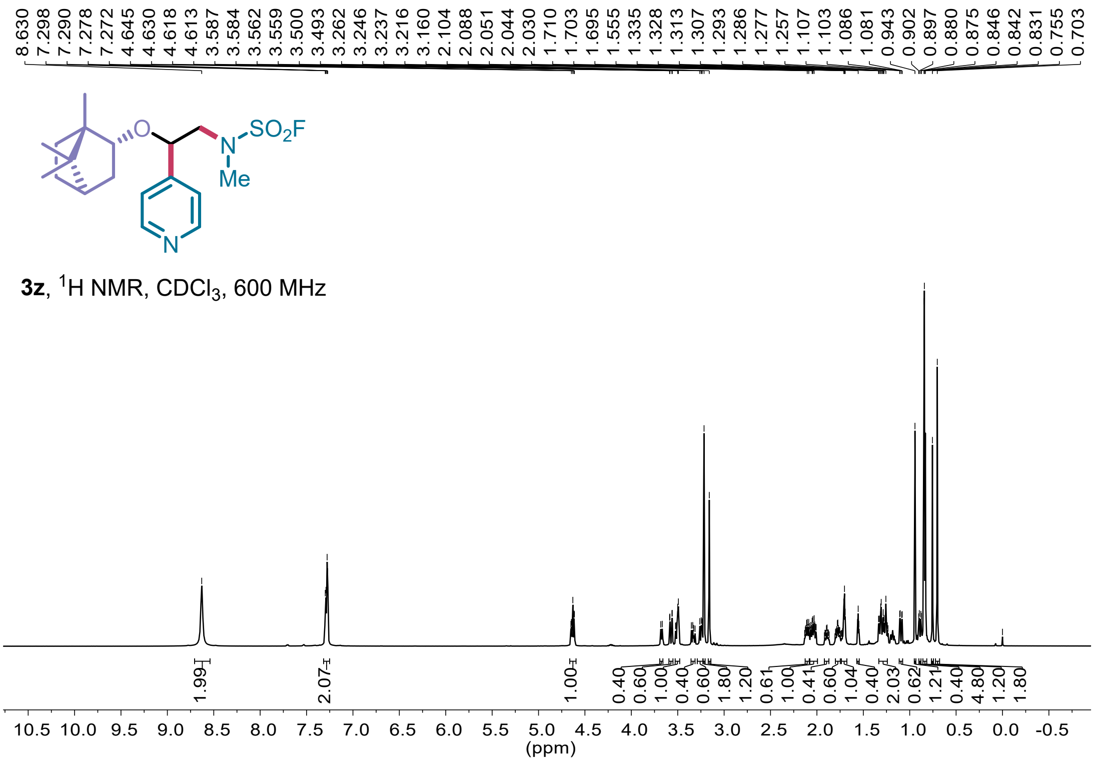




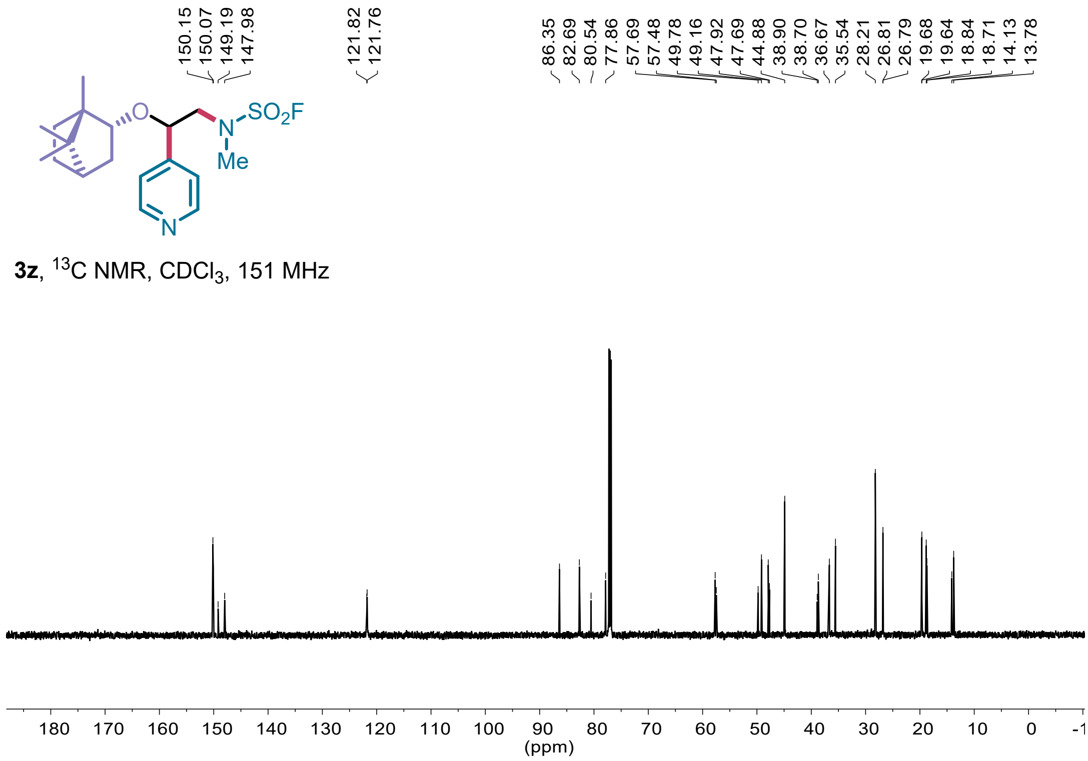
3y, ^{13}C NMR, $CDCl_3$, 151 MHz



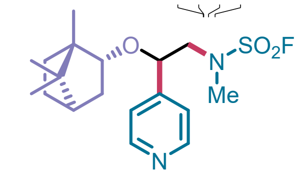
3y, ^{19}F NMR, $CDCl_3$, 565 MHz



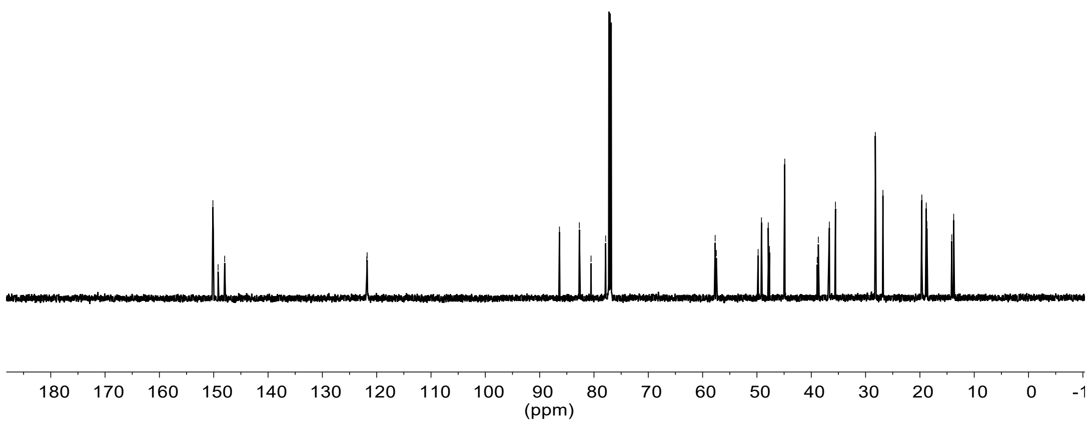
3z, ^{1}H NMR, $CDCl_3$, 600 MHz

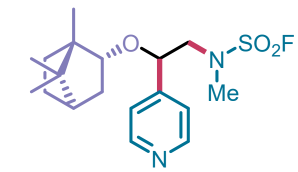


3z, ^{13}C NMR, $CDCl_3$, 151 MHz

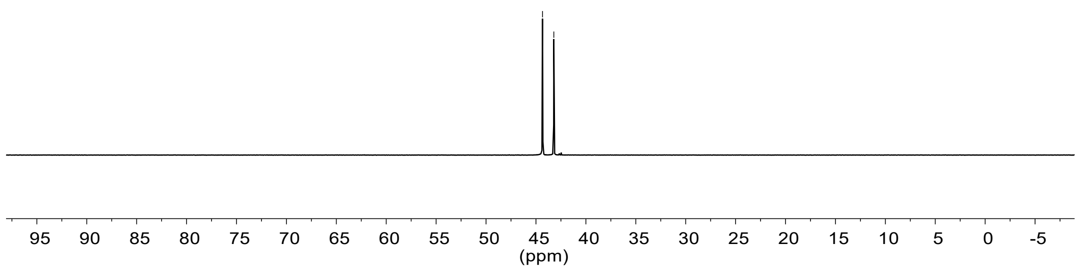


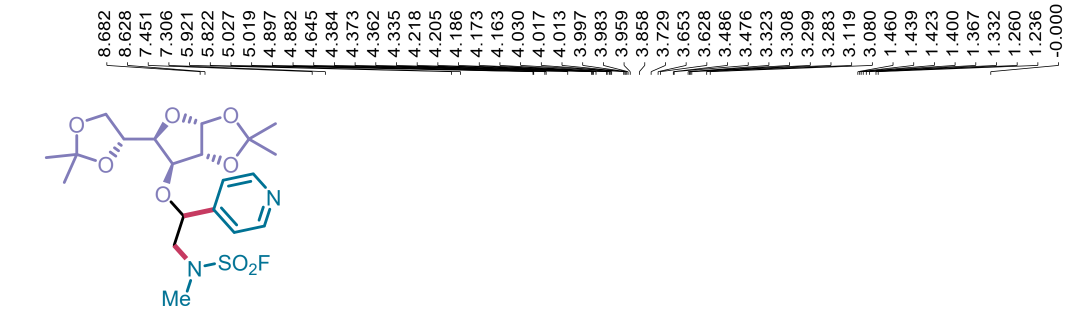
3z, ^{13}C NMR, $CDCl_3$, 151 MHz



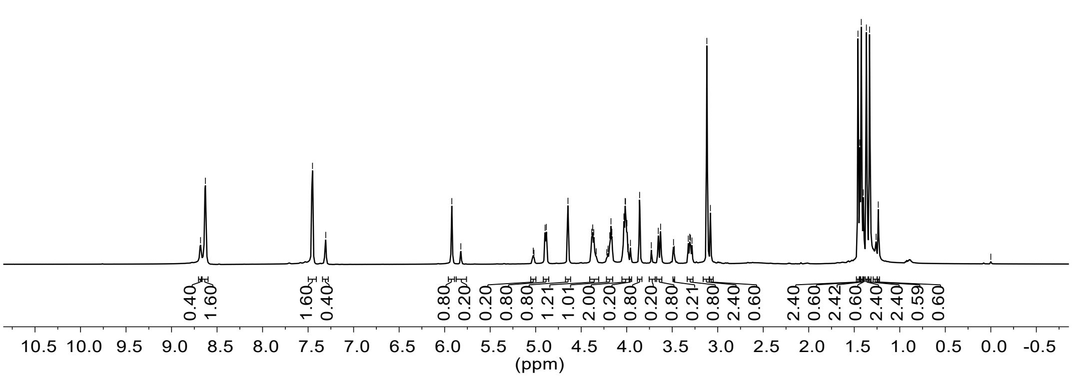


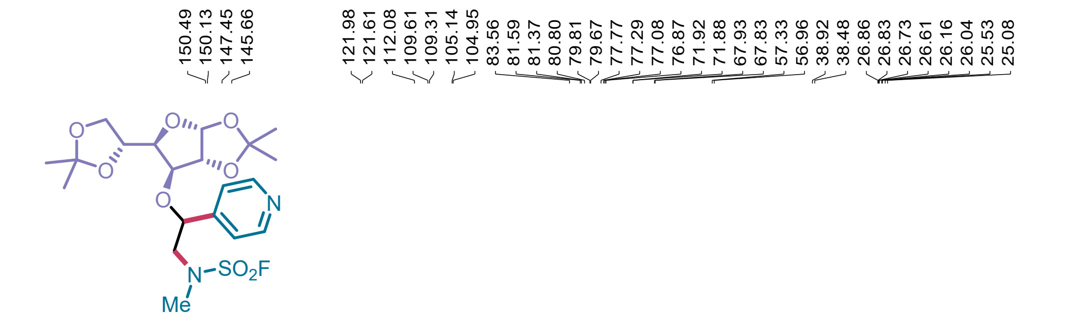
3z, ^{19}F NMR, $CDCl_3$, 565 MHz



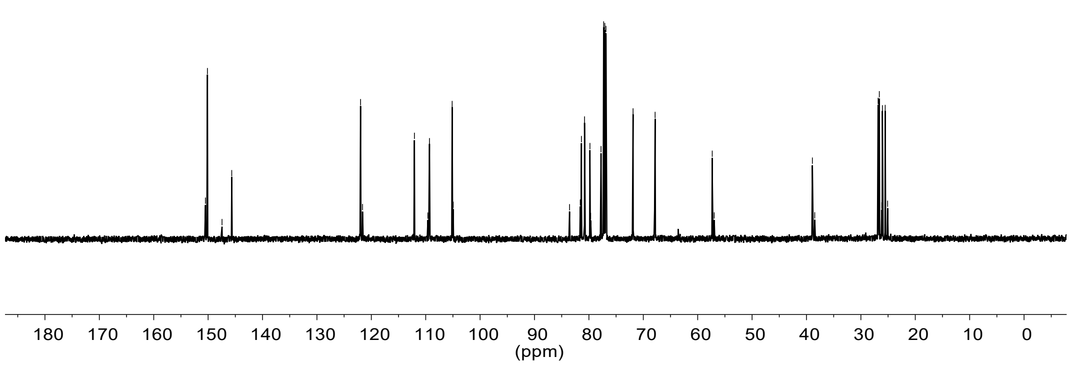


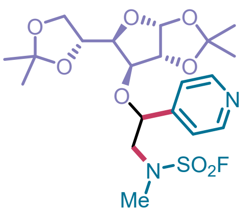
3aa, ^{1}H NMR, $CDCl_3$, 600 MHz



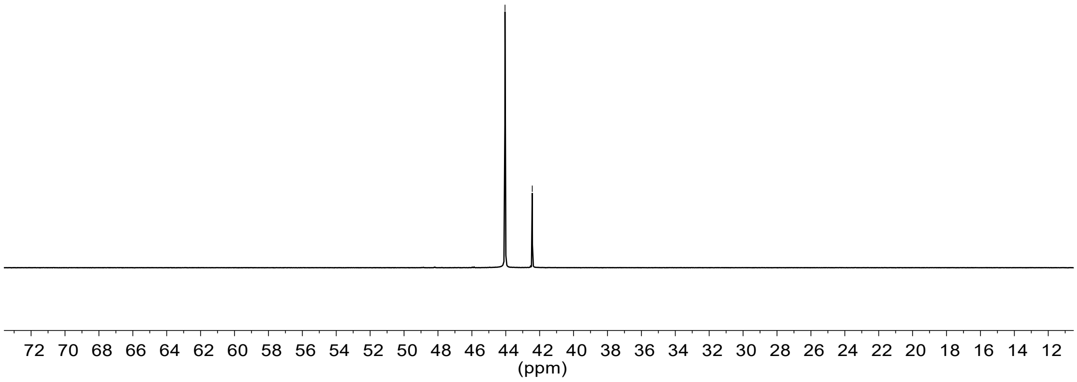


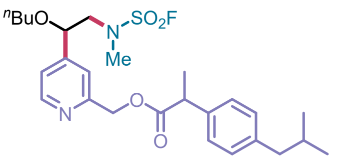
3aa, ^{13}C NMR, $CDCl_3$, 151 MHz



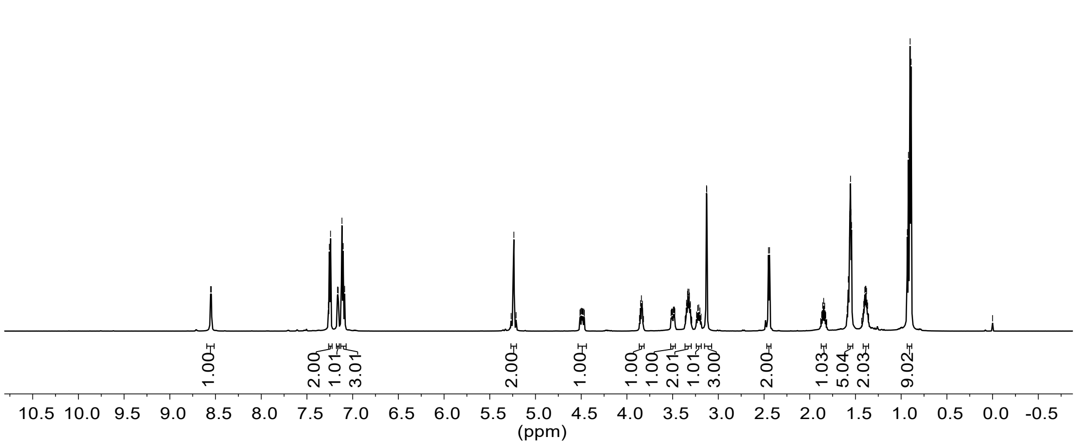


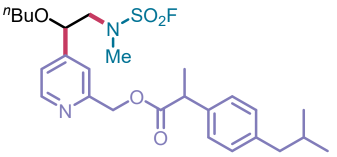
3z, ^{19}F NMR, $CDCl_3$, 565 MHz



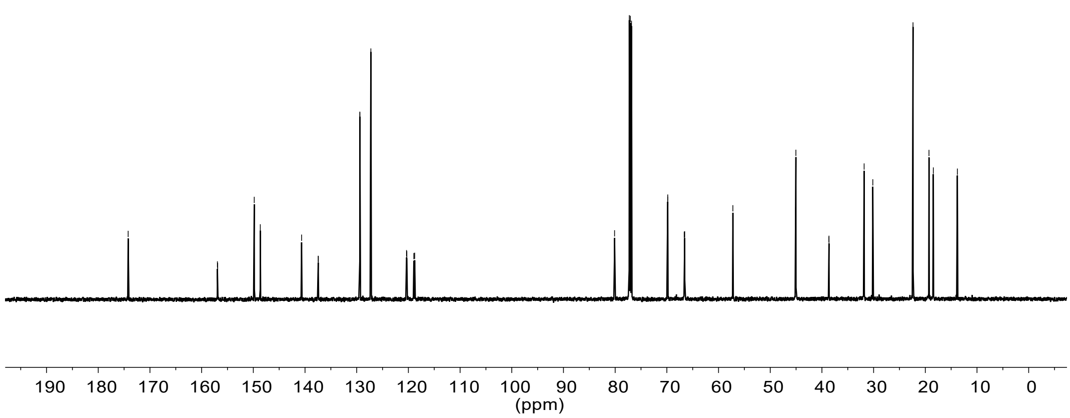


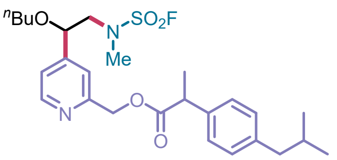
3ab, ^{1}H NMR, $CDCl_3$, 600 MHz



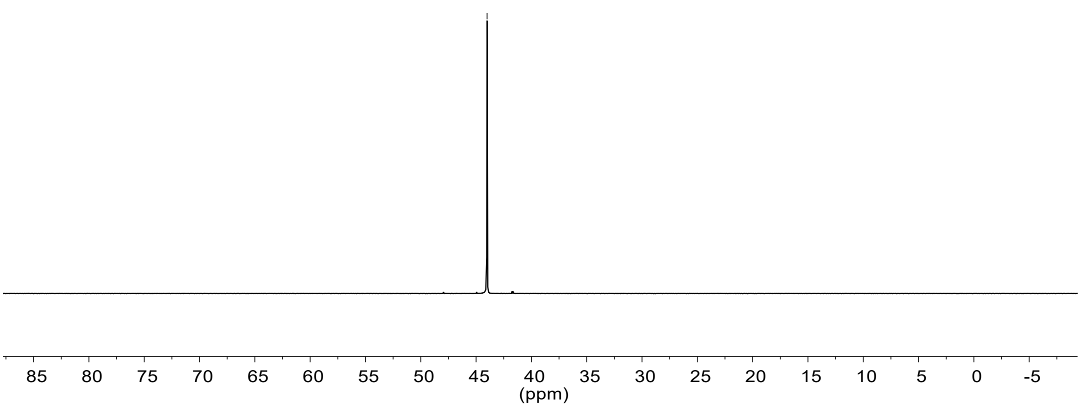


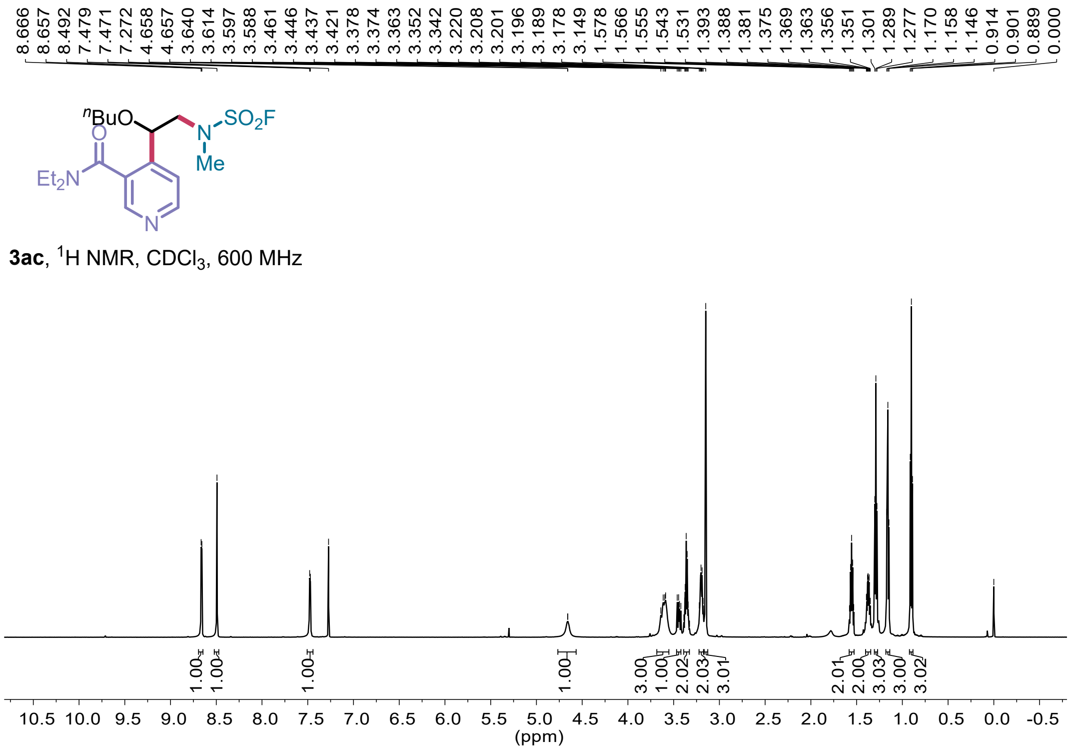
3ab, ^{13}C NMR, $CDCl_3$, 151 MHz



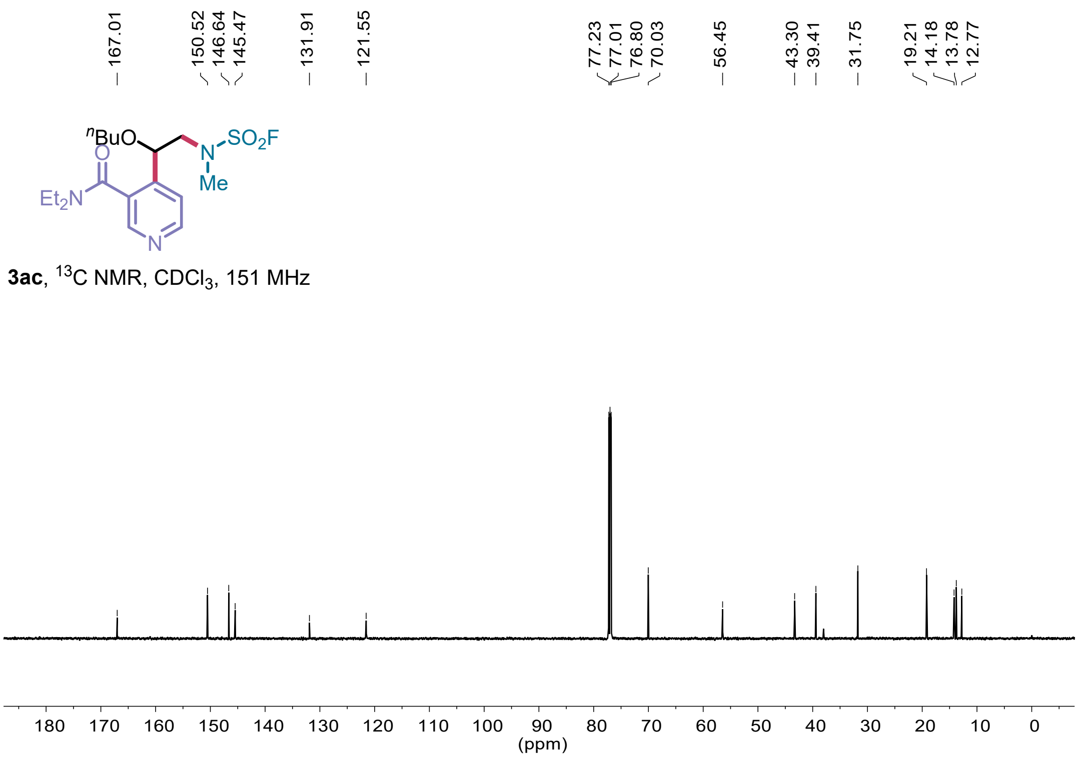


3ab, ^{19}F NMR, $CDCl_3$, 565 MHz

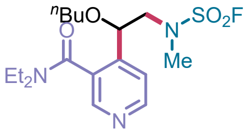




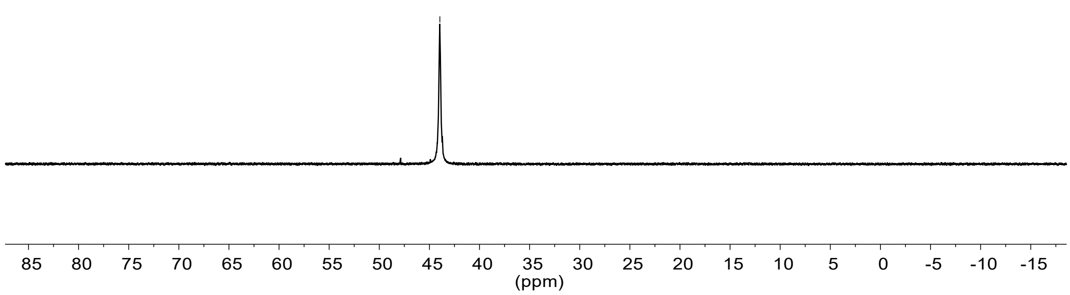
3ac, ^{1}H NMR, $CDCl_3$, 600 MHz

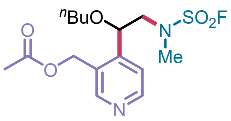


3ac, ^{13}C NMR, $CDCl_3$, 151 MHz

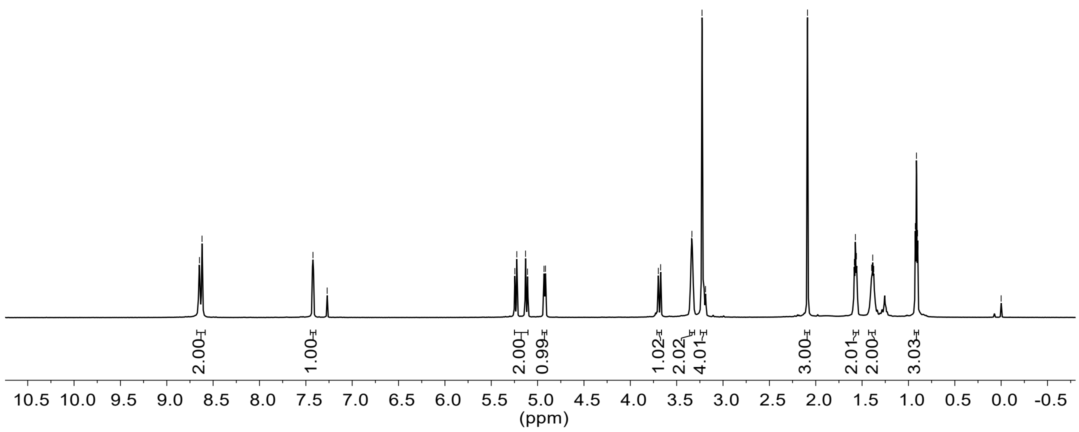


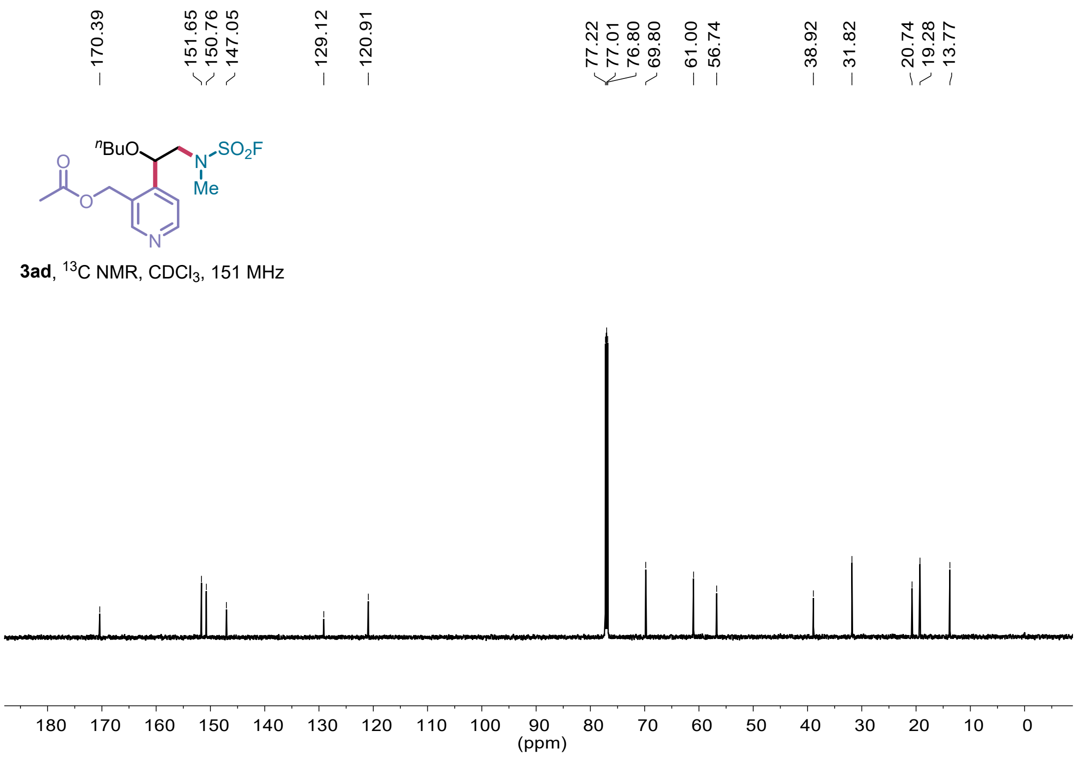
3ac, ^{19}F NMR, $CDCl_3$, 565 MHz



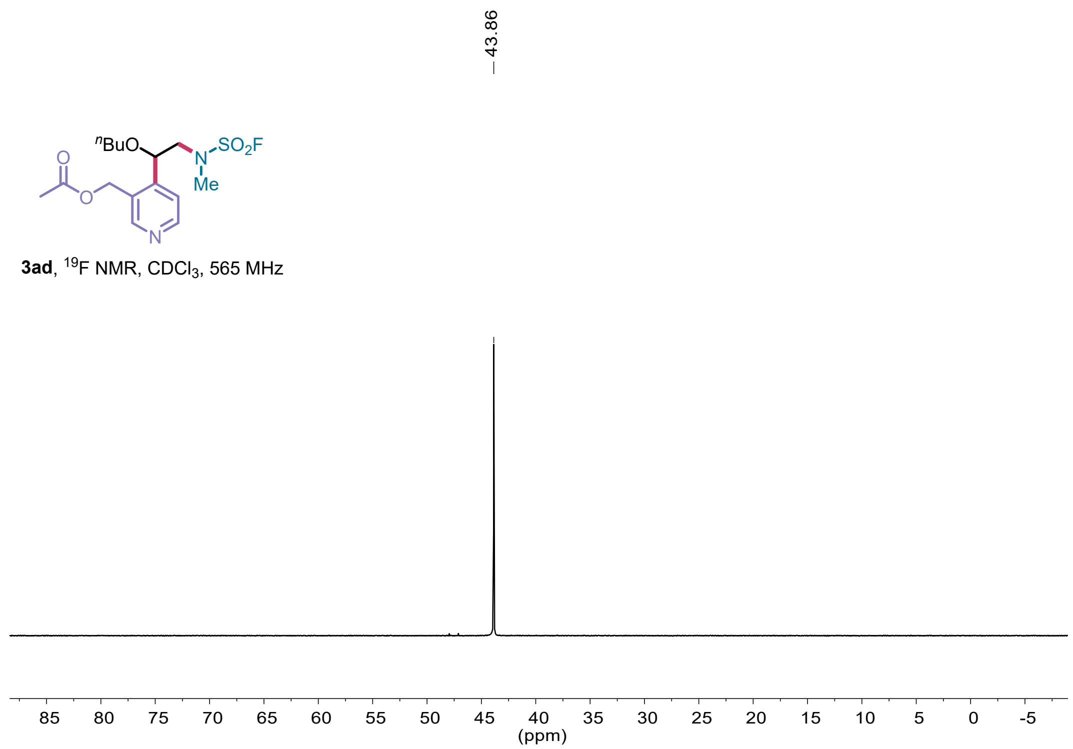


3ad, ^{1}H NMR, $CDCl_3$, 600 MHz

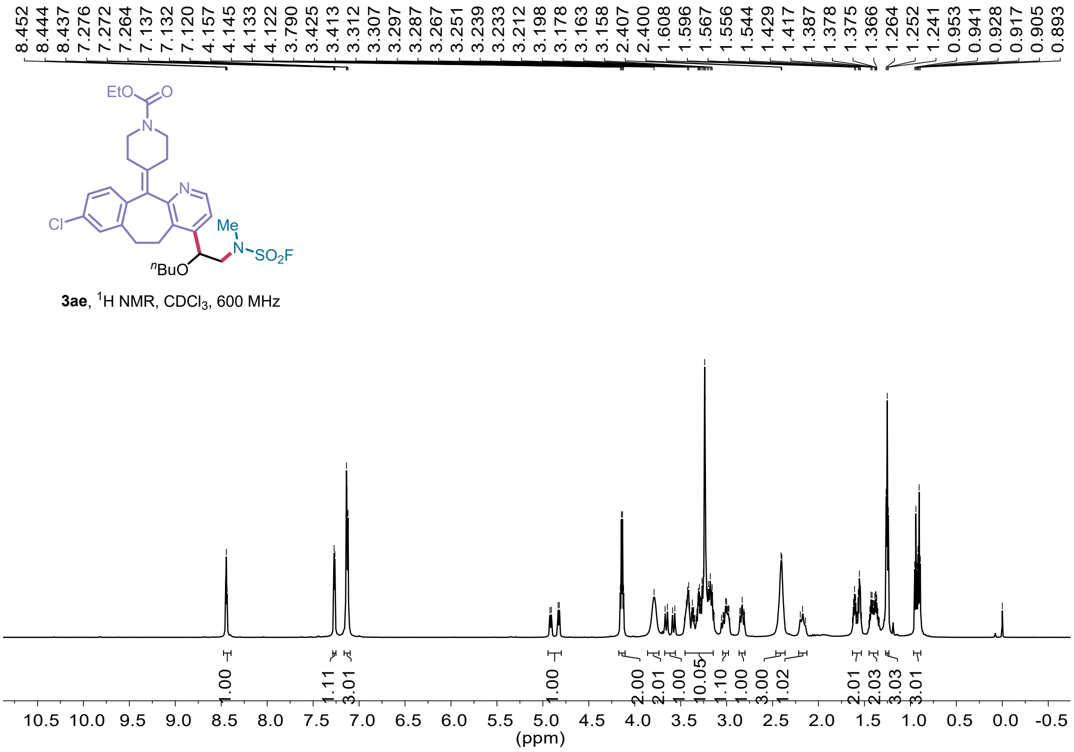




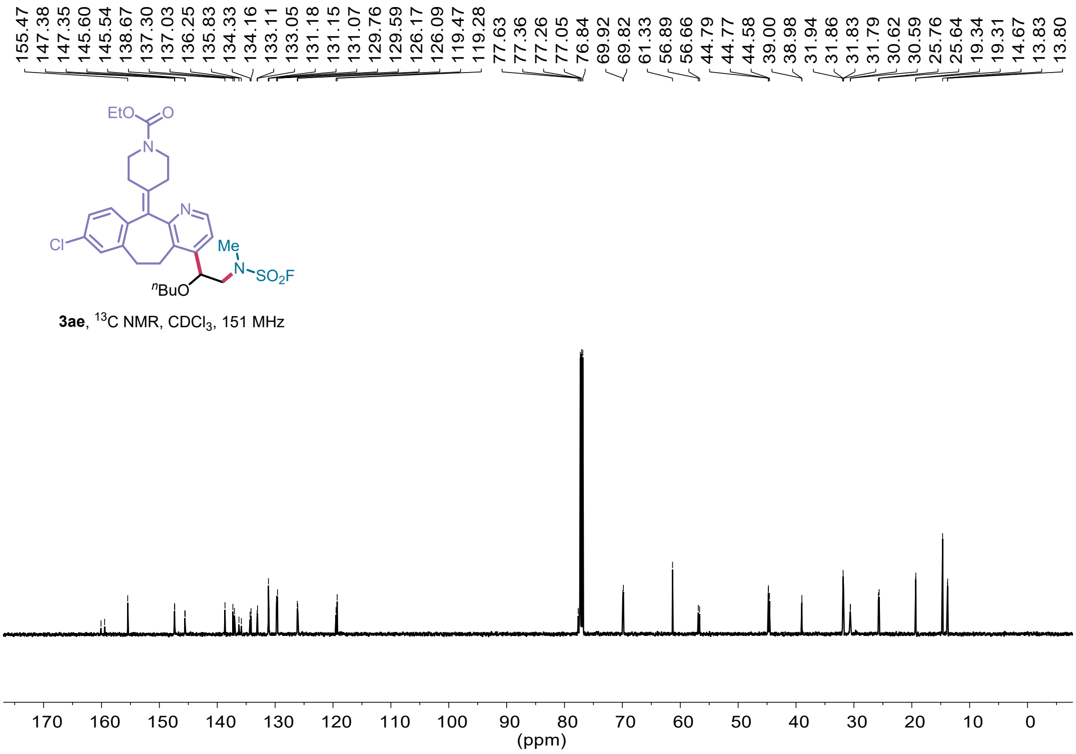
3ad, ^{13}C NMR, $CDCl_3$, 151 MHz



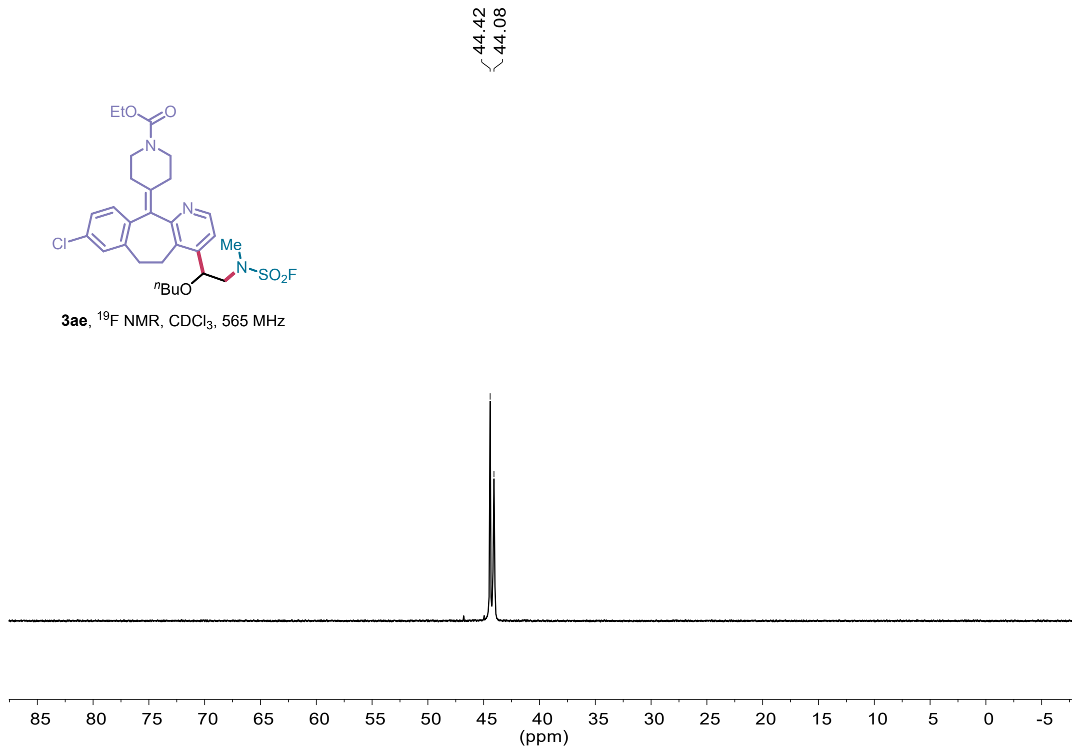
3ad, ^{19}F NMR, $CDCl_3$, 565 MHz



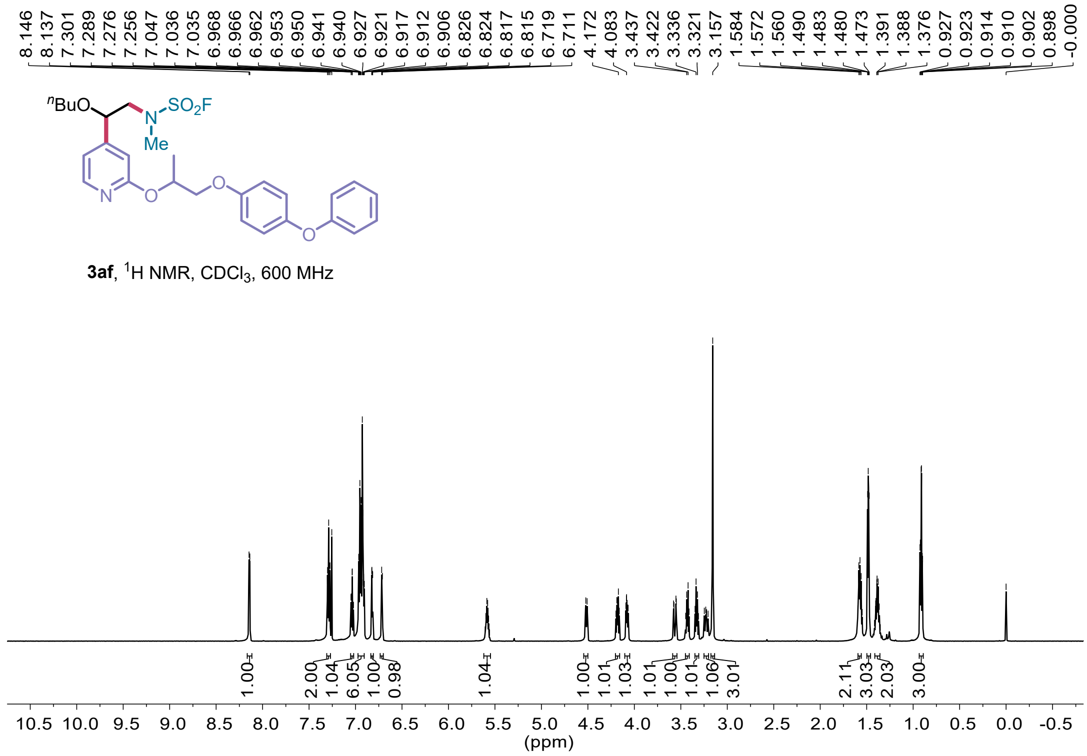
3ae, ^{1}H NMR, $CDCl_3$, 600 MHz



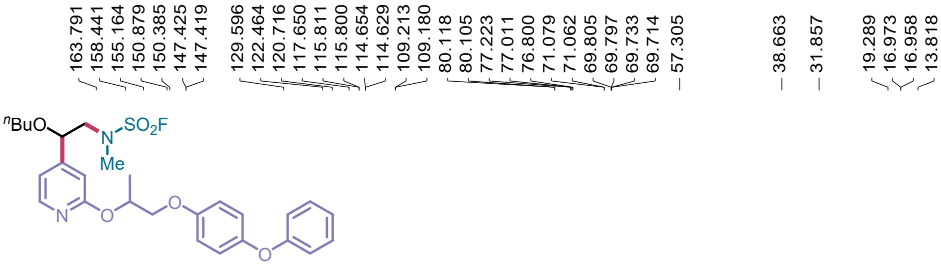
3ae, ^{13}C NMR, $CDCl_3$, 151 MHz



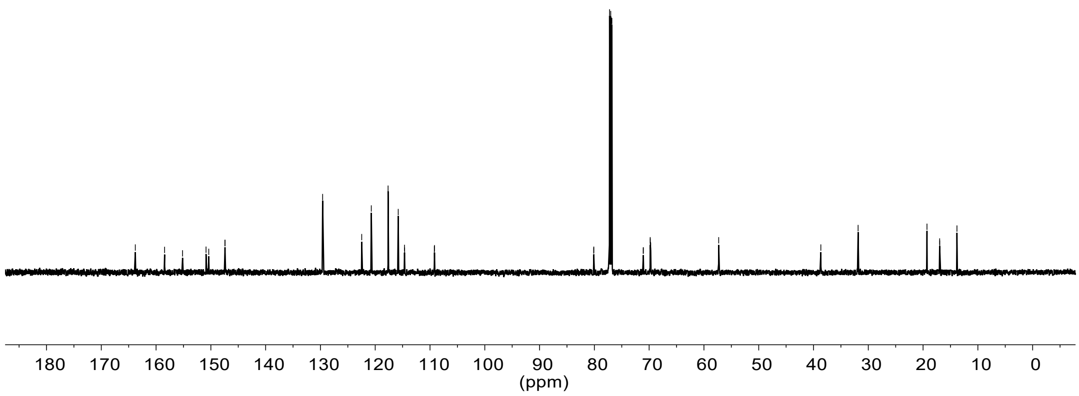
3ae, ^{19}F NMR, $CDCl_3$, 565 MHz

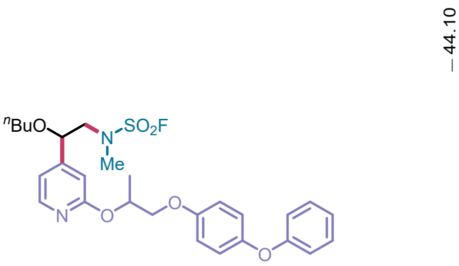


3af, ^{1}H NMR, $CDCl_3$, 600 MHz

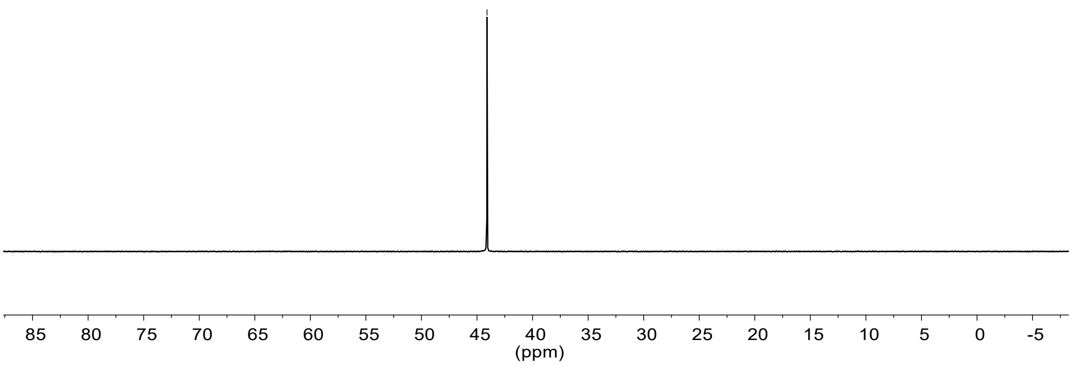


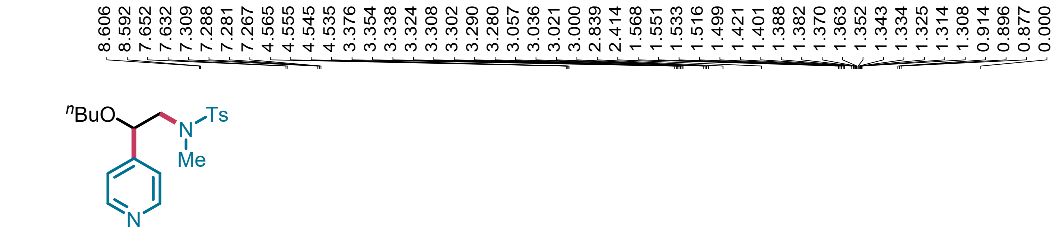
3af, ^{13}C NMR, $CDCl_3$, 151 MHz



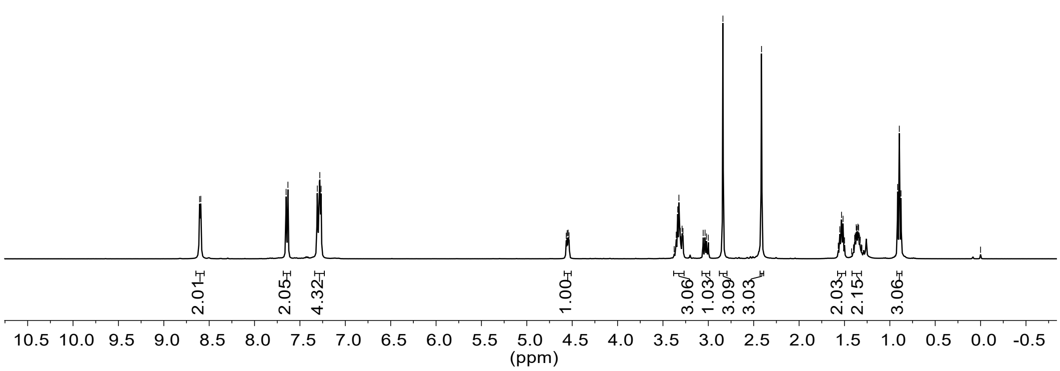


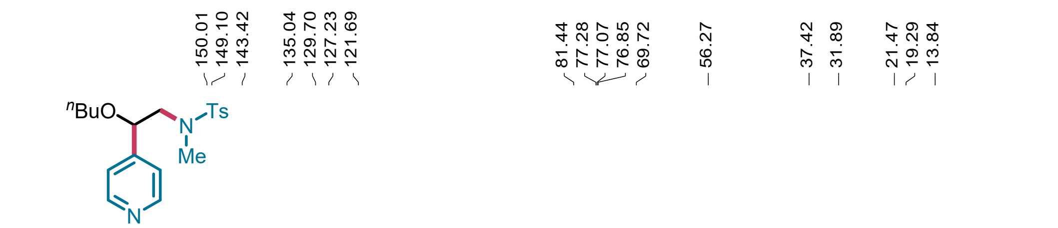
3af, ^{19}F NMR, $CDCl_3$, 565 MHz



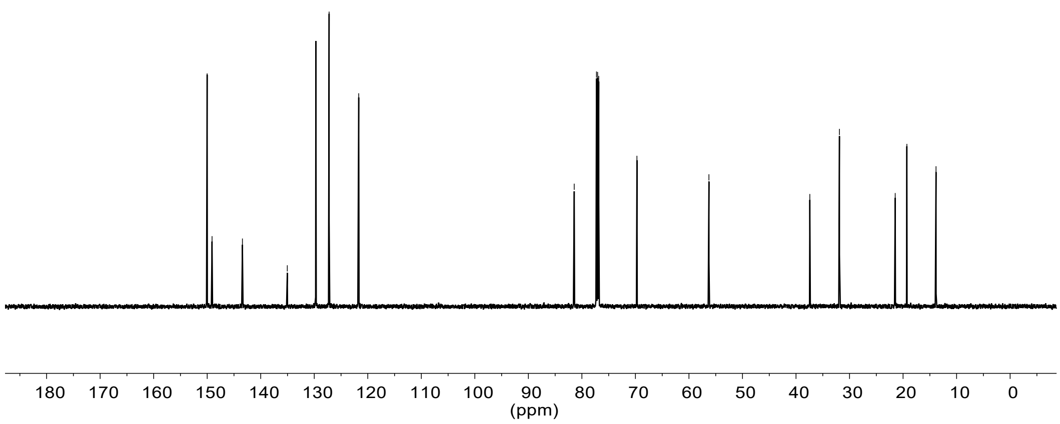


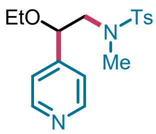
5a, ^{1}H NMR, $CDCl_3$, 400 MHz



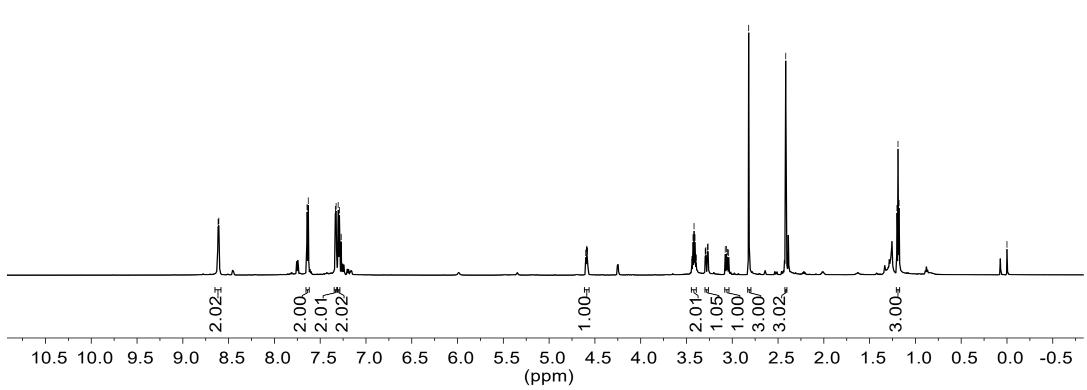


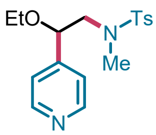
5a, ^{13}C NMR, $CDCl_3$, 101 MHz



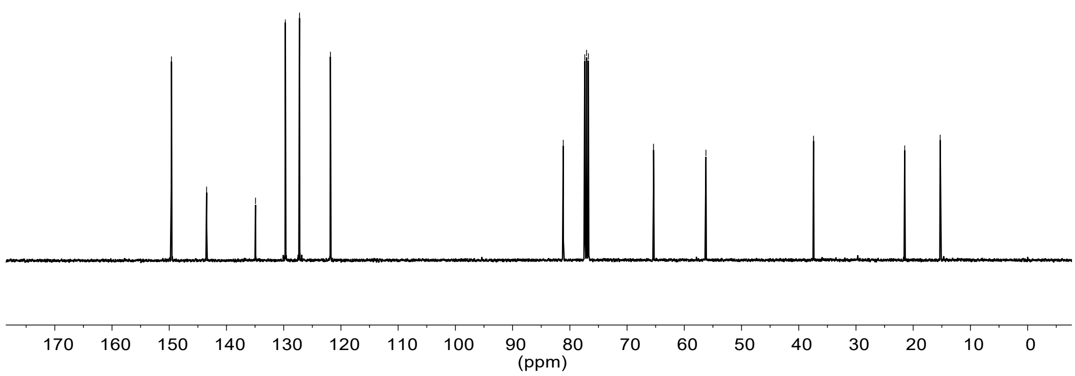


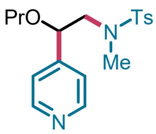
5b, ^{1}H NMR, $CDCl_3$, 600 MHz



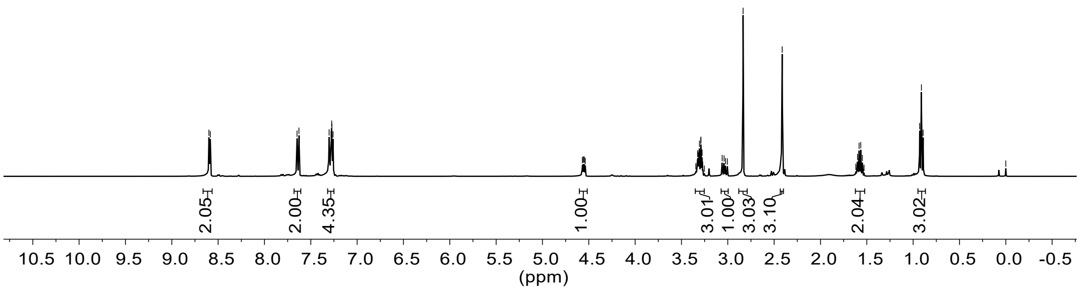


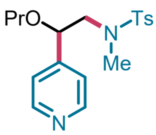
5b, ^{13}C NMR, $CDCl_3$, 151 MHz



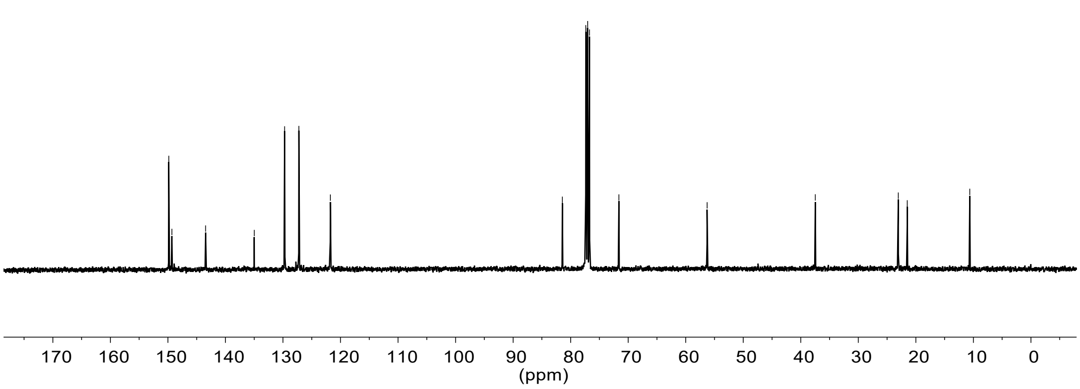


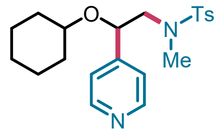
5c, ^{1}H NMR, $CDCl_3$, 400 MHz



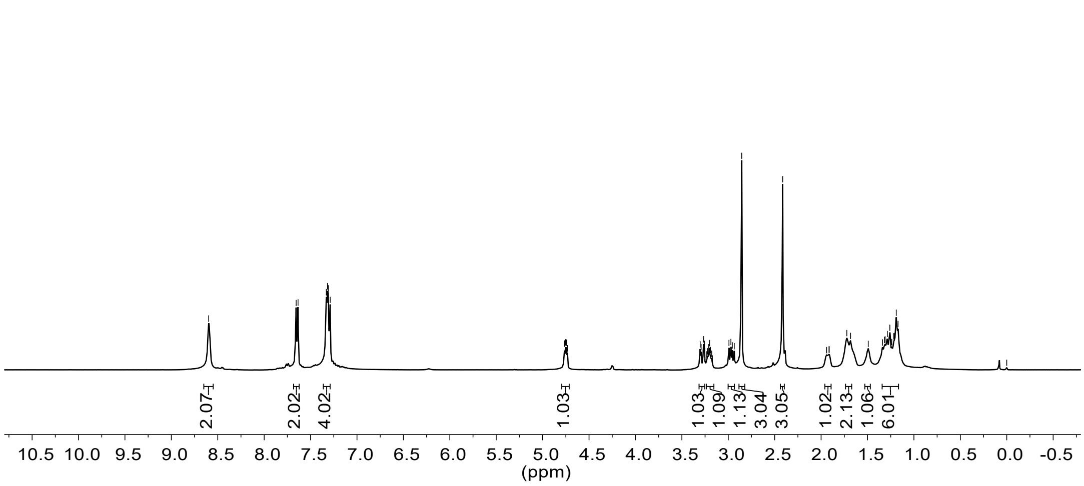


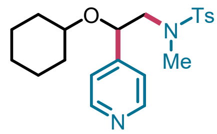
5c, ^{13}C NMR, $CDCl_3$, 101 MHz



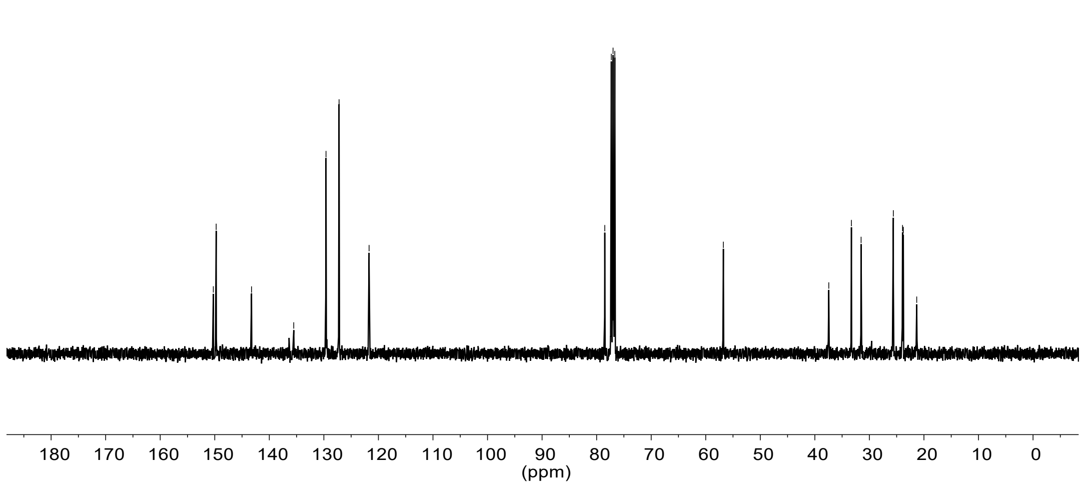


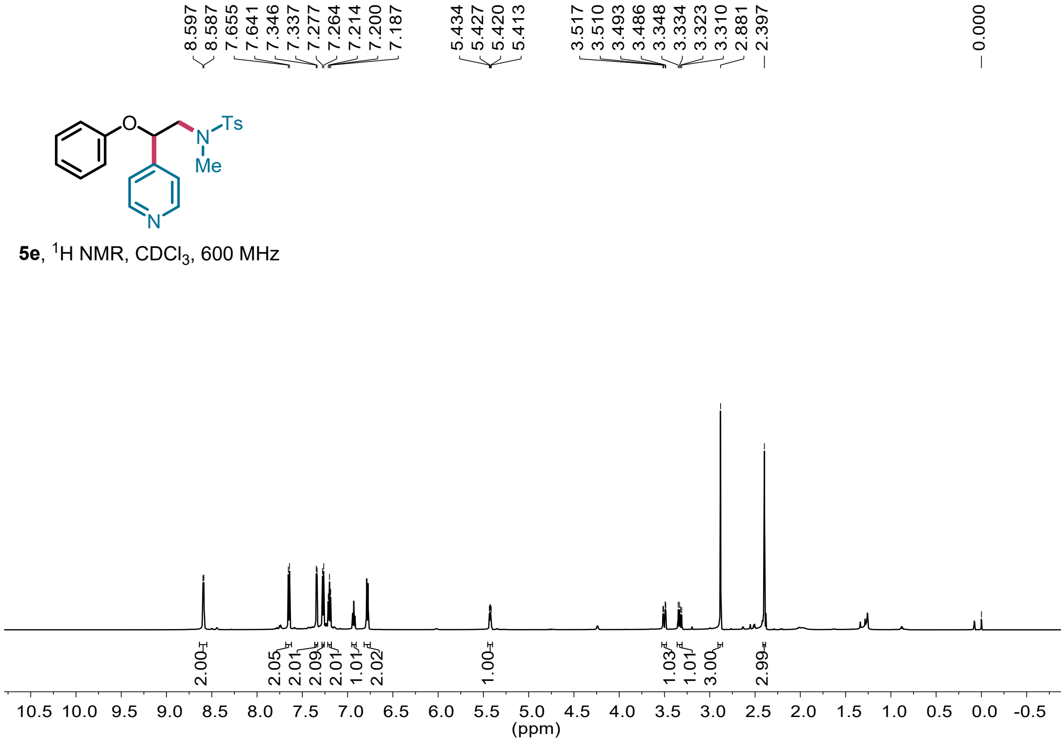
5d, ^{1}H NMR, $CDCl_3$, 400 MHz



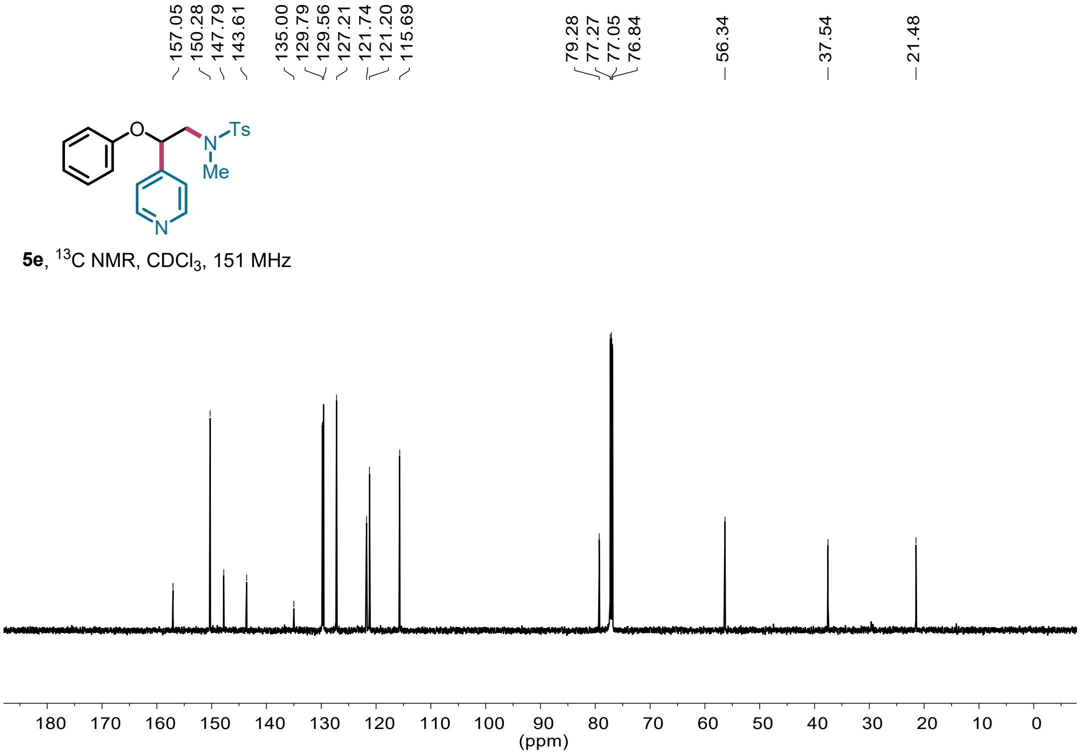


5d, ^{13}C NMR, $CDCl_3$, 101 MHz

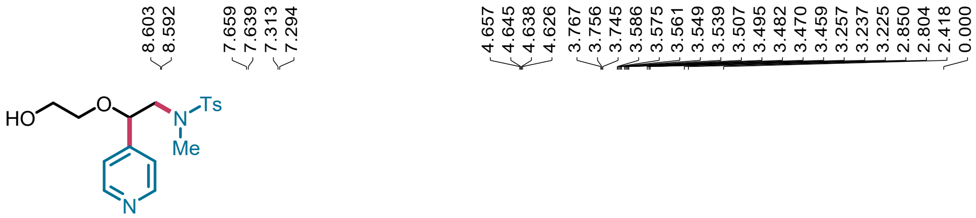




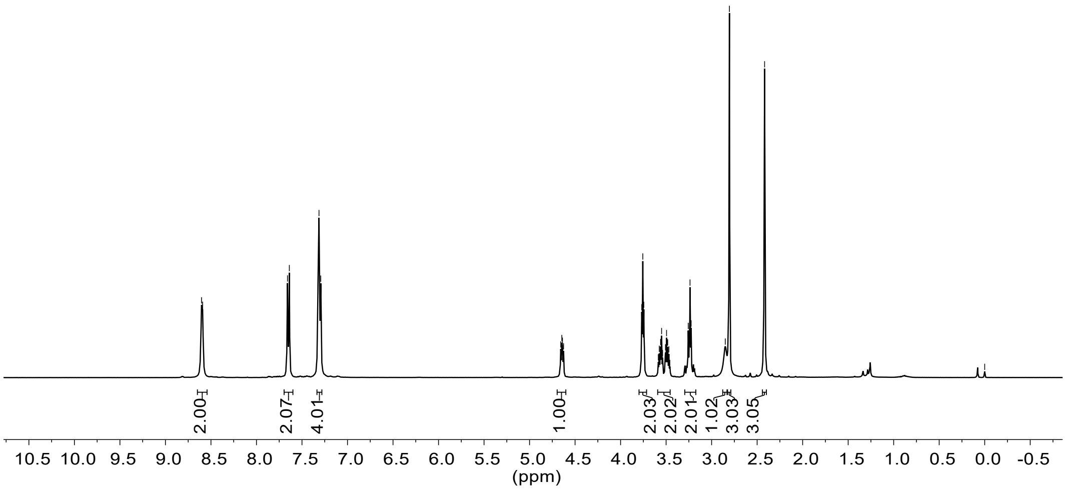
5e, ^{1}H NMR, $CDCl_3$, 600 MHz

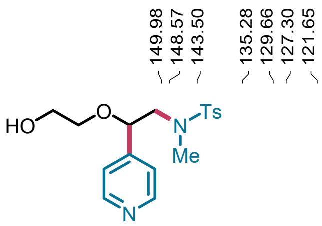


5e, ^{13}C NMR, $CDCl_3$, 151 MHz

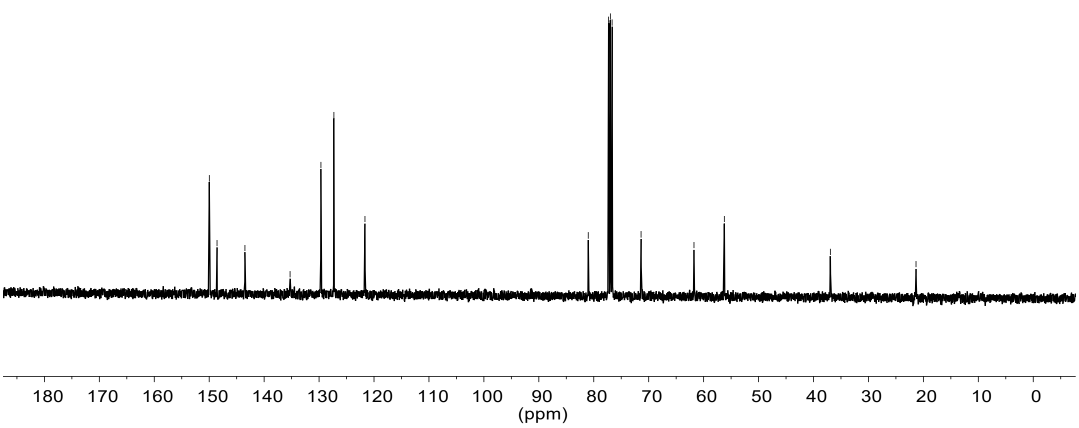


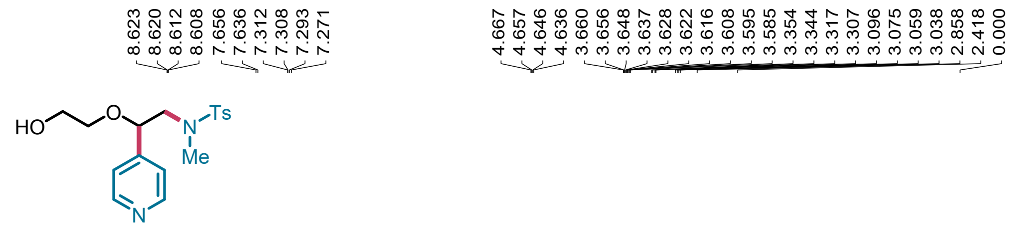
5f, ^{1}H NMR, $CDCl_3$, 400 MHz



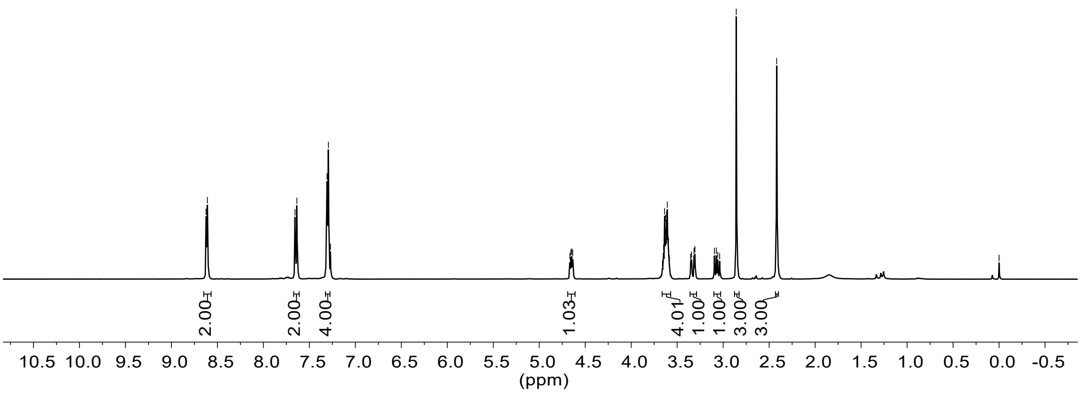


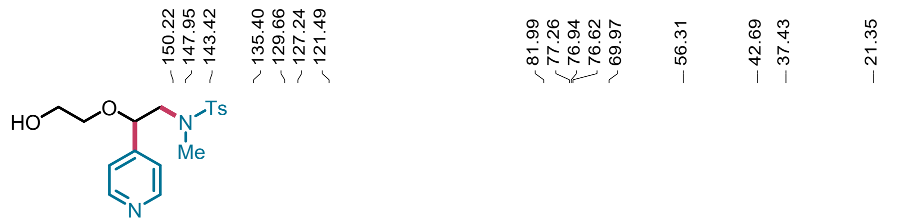
5f, ^{13}C NMR, $CDCl_3$, 101 MHz



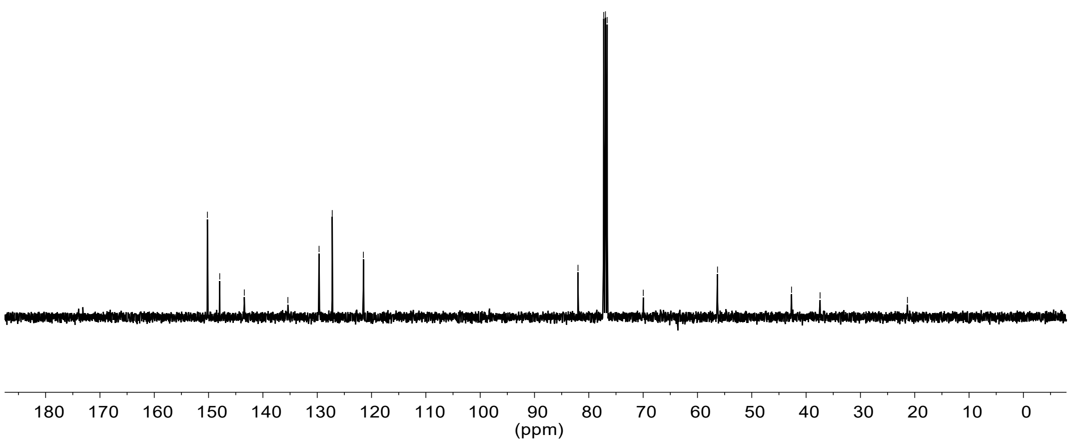


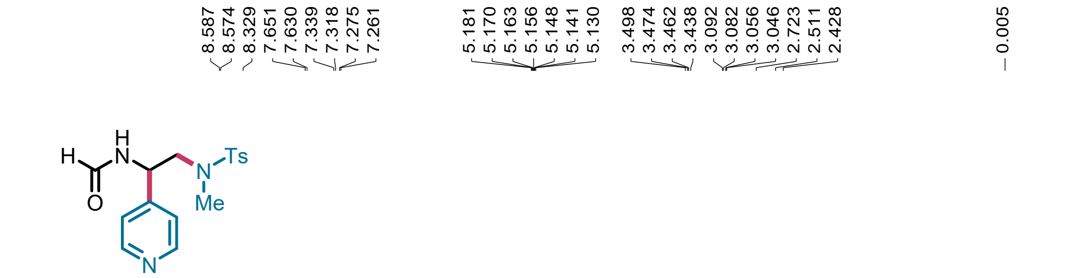
5g, ^{1}H NMR, $CDCl_3$, 400 MHz



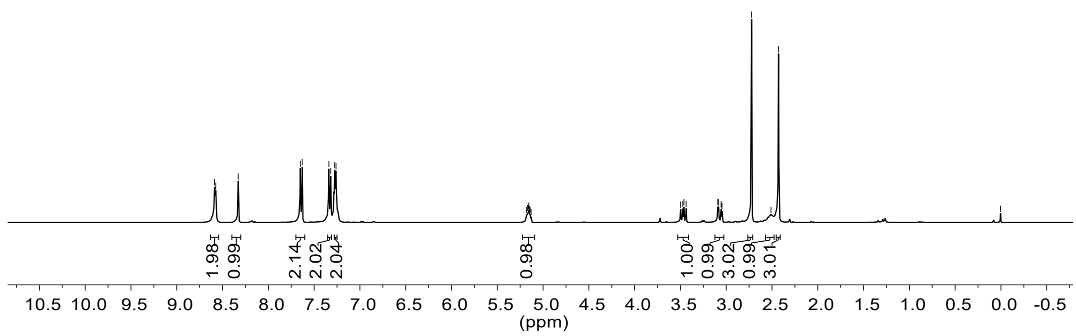


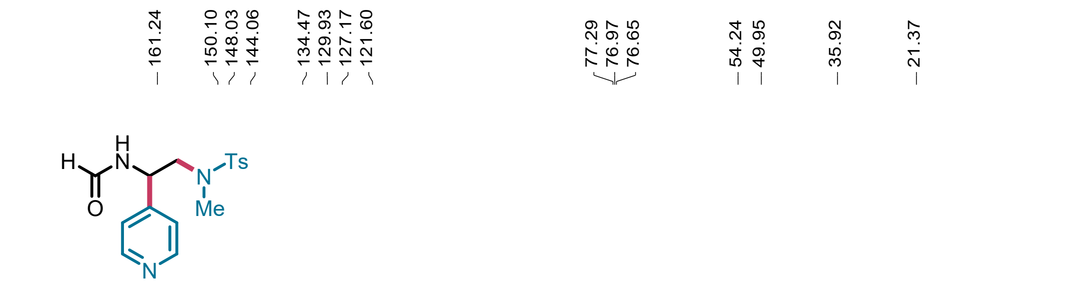
5g, ^{13}C NMR, $CDCl_3$, 101 MHz



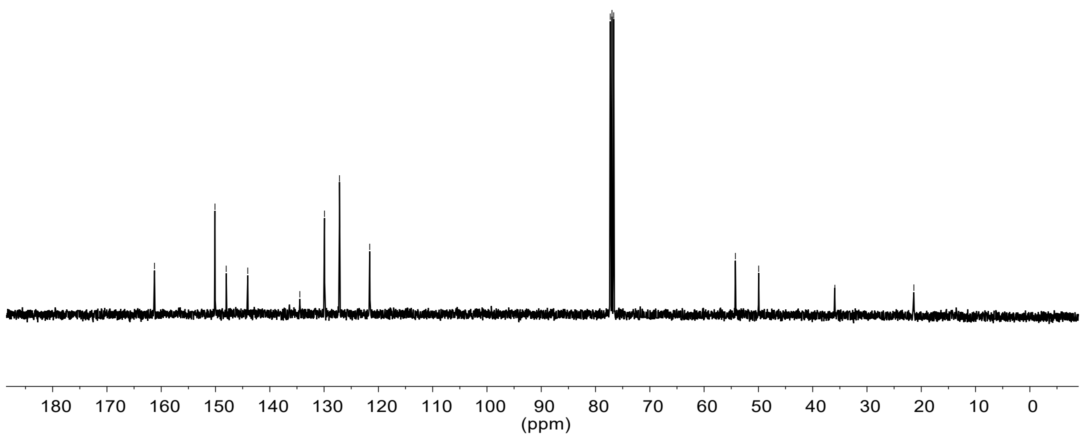


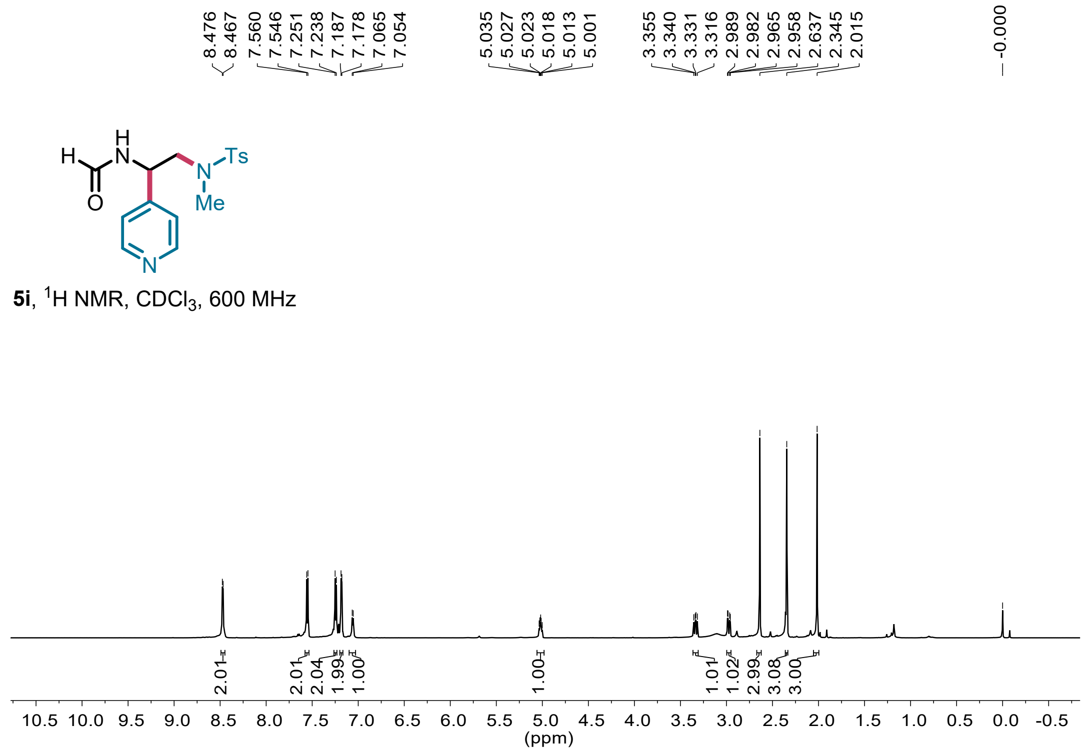
5h, ^{1}H NMR, $CDCl_3$, 400 MHz



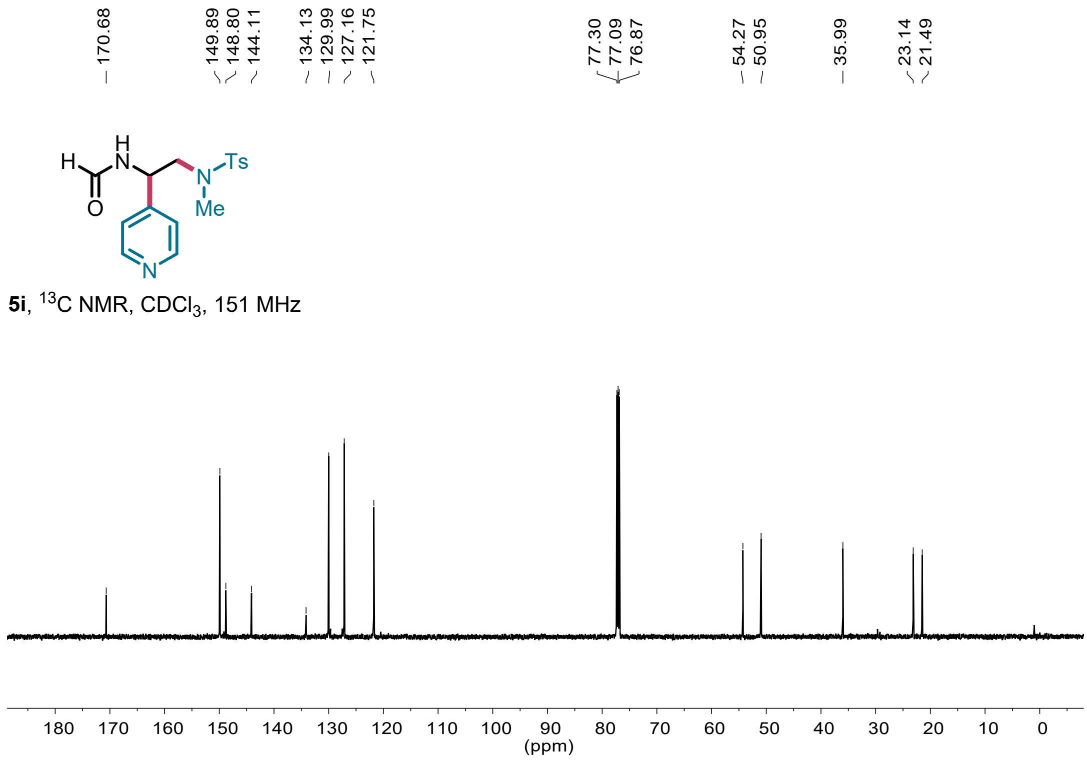


5h, ^{13}C NMR, $CDCl_3$, 101 MHz

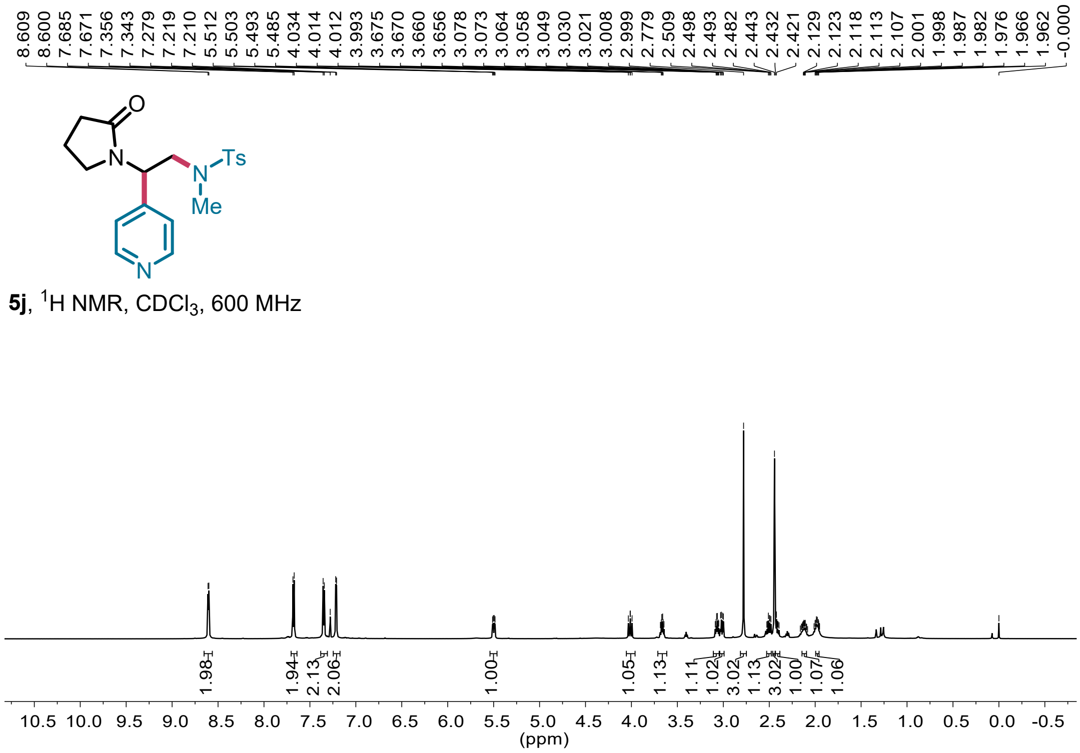




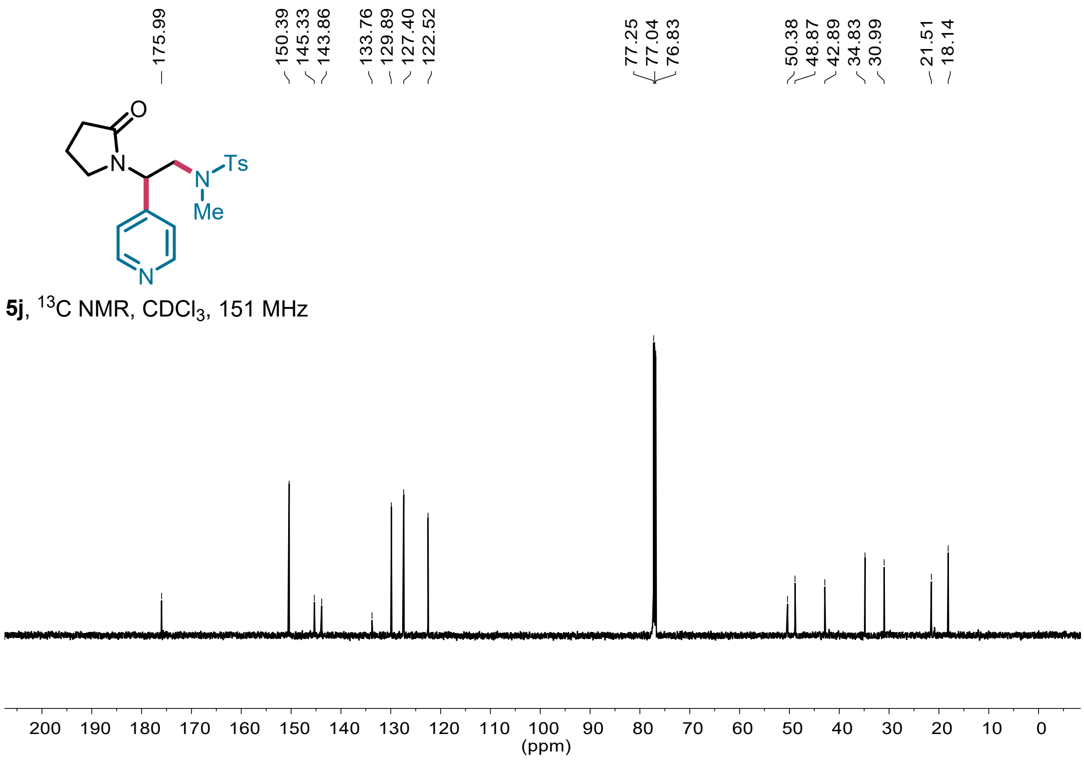
5i, ^{1}H NMR, $CDCl_3$, 600 MHz



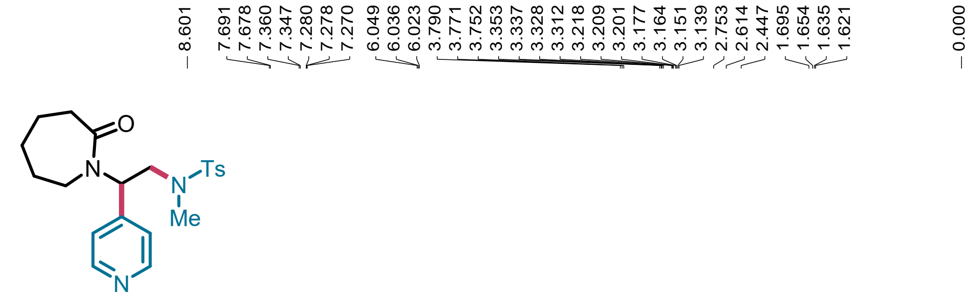
5i, ^{13}C NMR, $CDCl_3$, 151 MHz



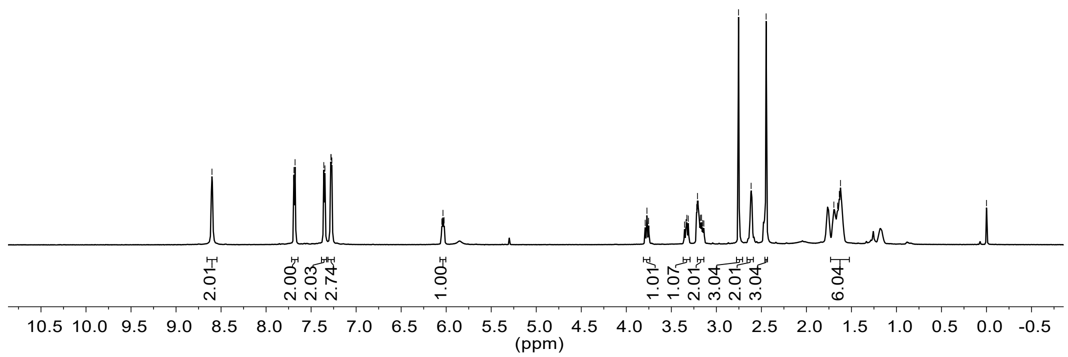
5j, ^{1}H NMR, $CDCl_3$, 600 MHz

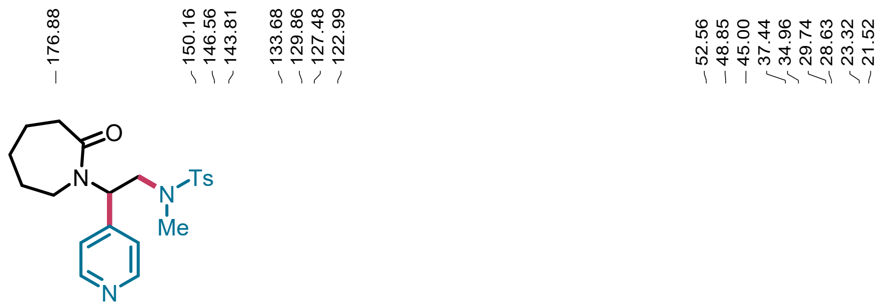


5j, ^{13}C NMR, $CDCl_3$, 151 MHz

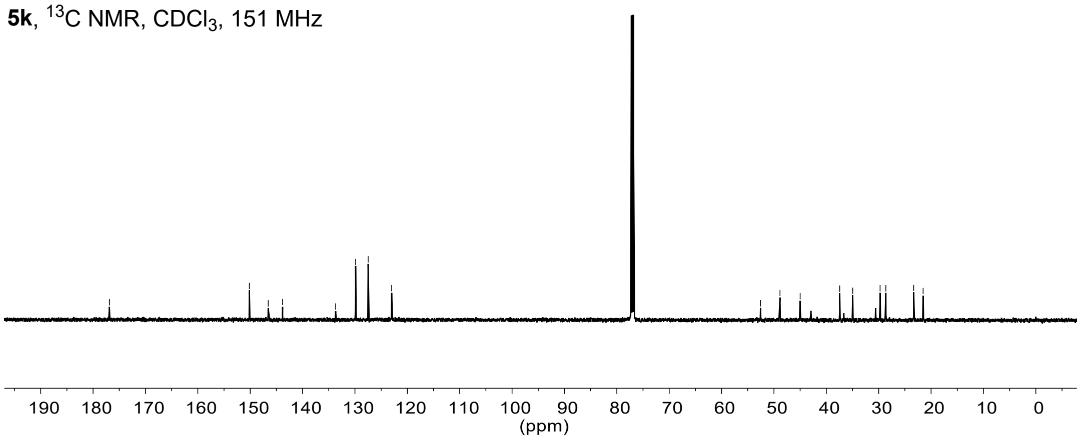


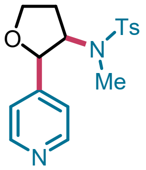
5k, ^{1}H NMR, $CDCl_3$, 600 MHz



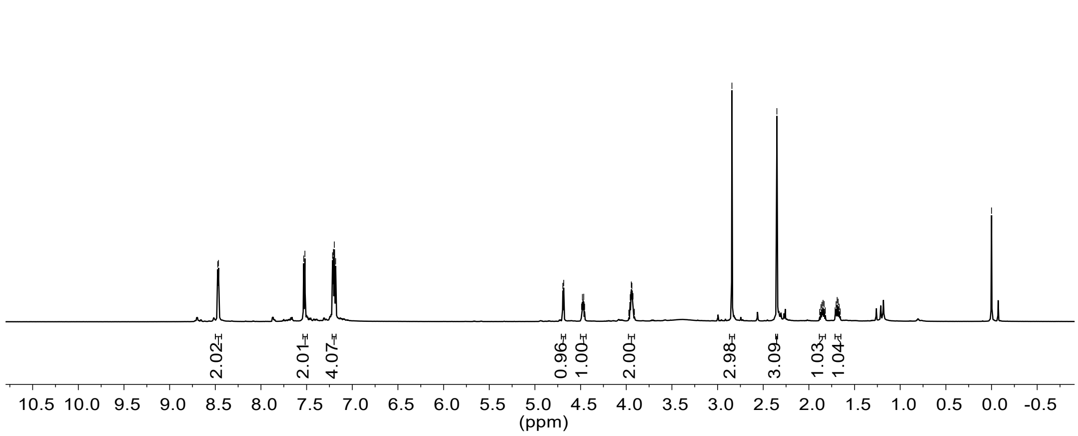


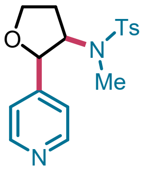
5k, ^{13}C NMR, $CDCl_3$, 151 MHz



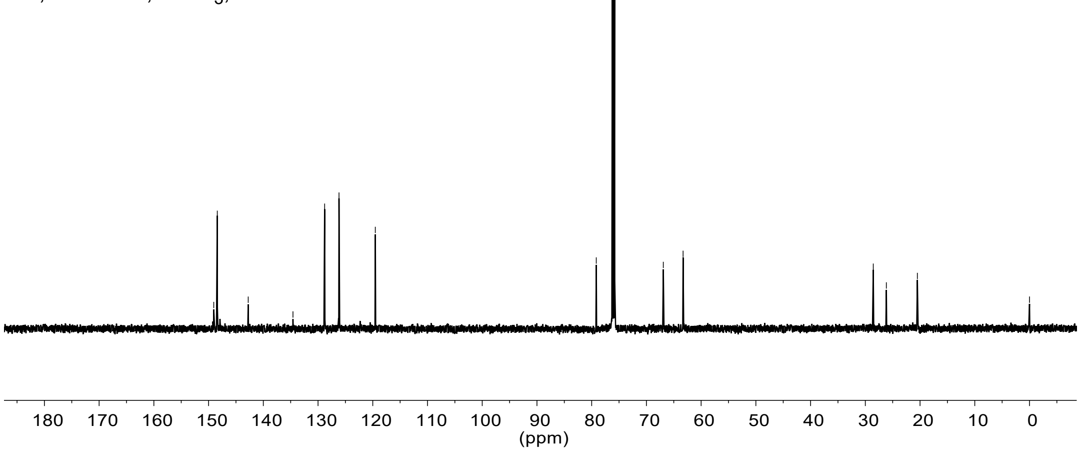


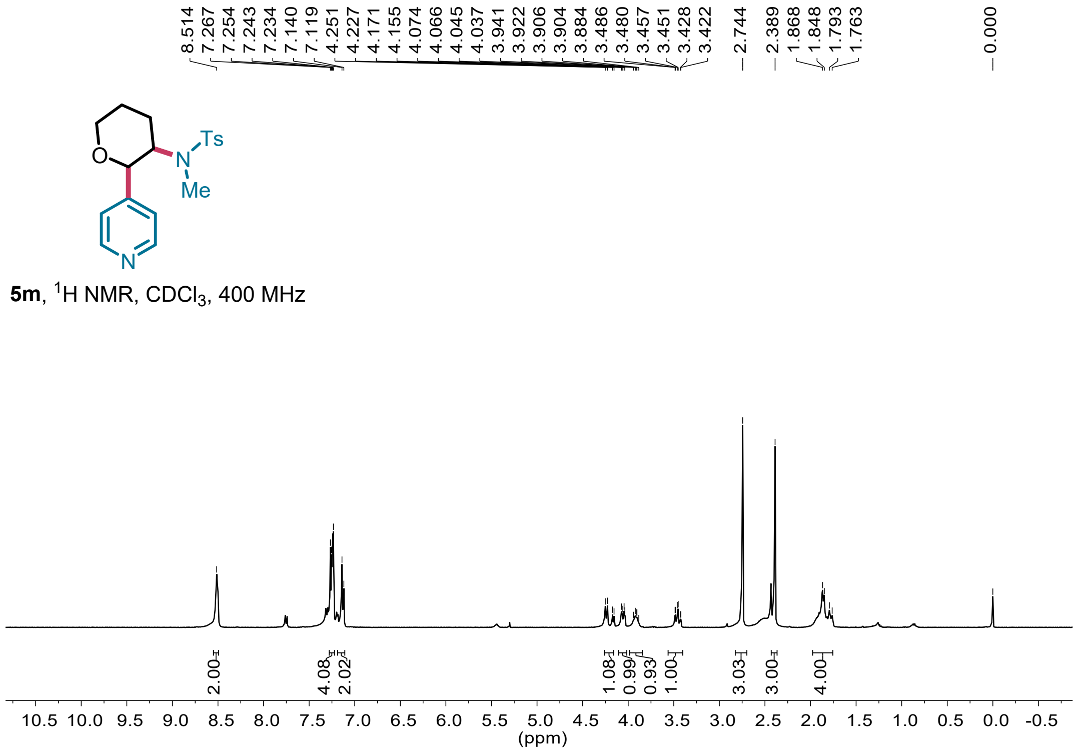
5l, ^{1}H NMR, $CDCl_3$, 600 MHz



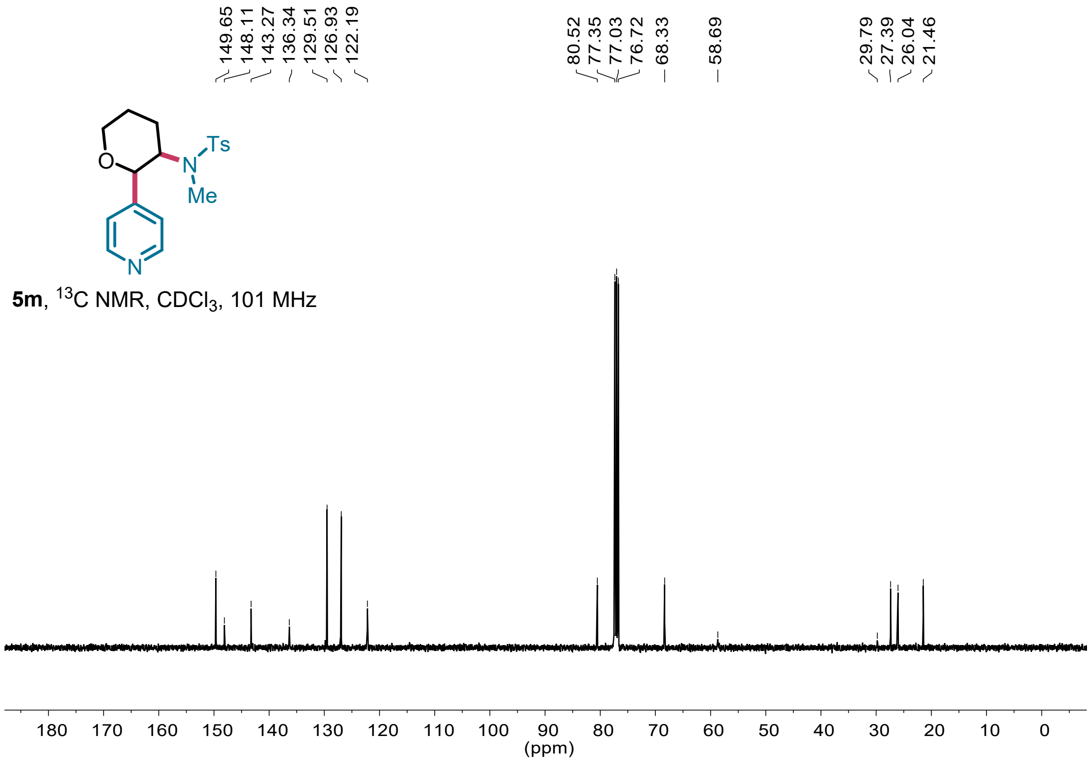


5l, ^{13}C NMR, $CDCl_3$, 151 MHz

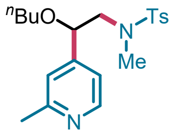




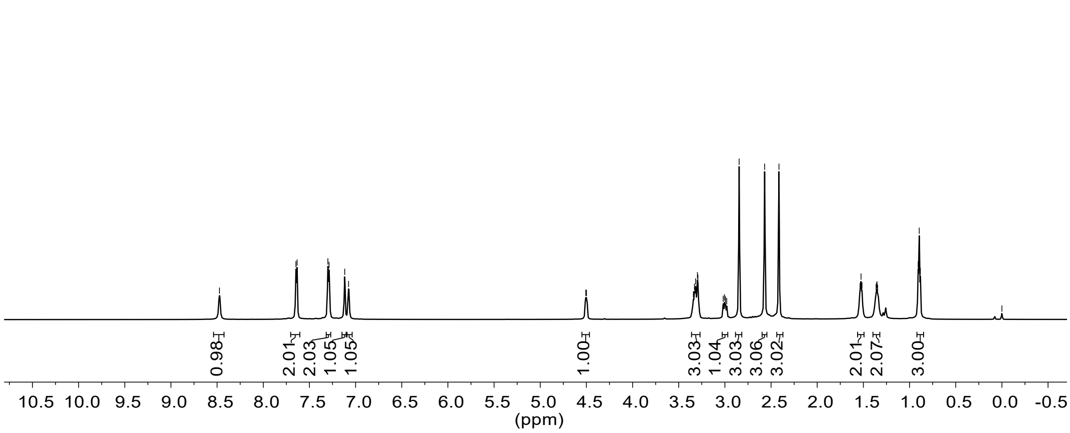
5m, ^{1}H NMR, $CDCl_3$, 400 MHz

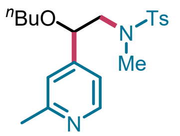


5m, ^{13}C NMR, $CDCl_3$, 101 MHz

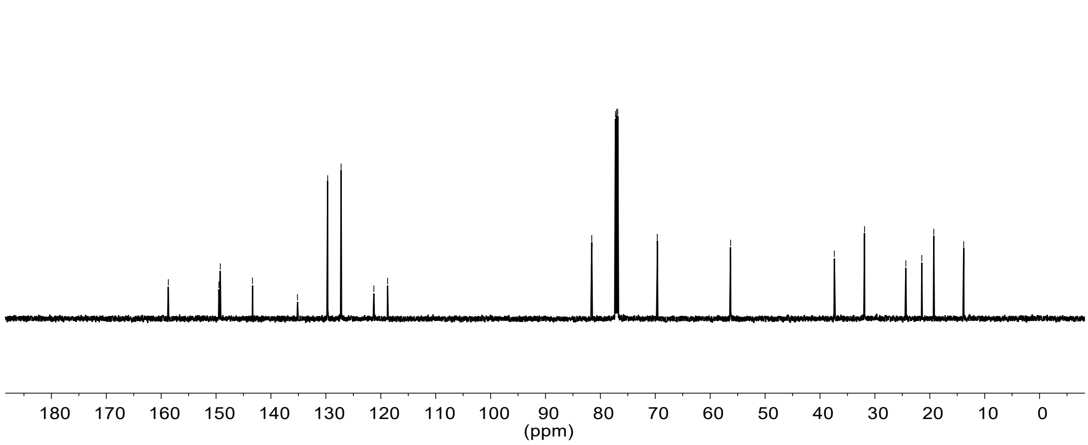


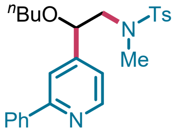
5n, ^{1}H NMR, $CDCl_3$, 600 MHz



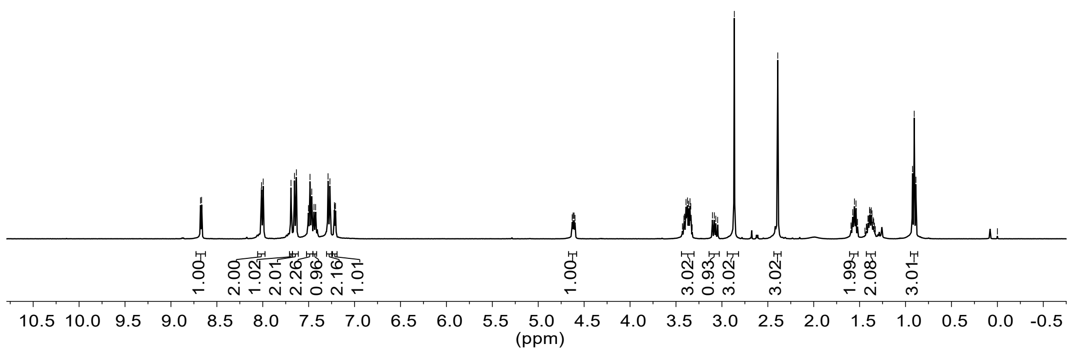


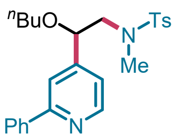
5n, ^{13}C NMR, $CDCl_3$, 151 MHz



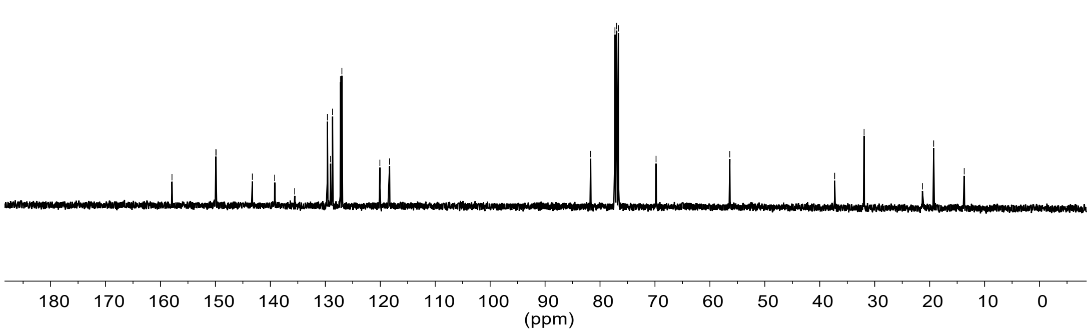


5o, ^{1}H NMR, $CDCl_3$, 400 MHz

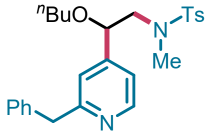




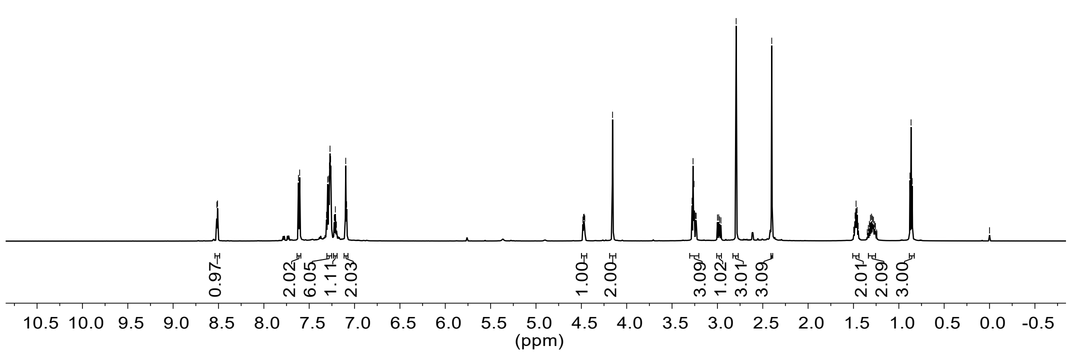
5o, ^{13}C NMR, $CDCl_3$, 101 MHz



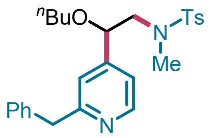
8.518 8.510 7.619 7.605 7.309 7.296 7.284 7.276 7.270 7.264 7.224 7.212 7.200 7.097 7.087 4.482 4.476 4.469 4.462 4.156 3.279 3.268 3.258 3.241 3.234 2.999 2.986 2.975 2.961 2.793 2.401 1.497 1.493 1.482 1.471 1.460 1.448 1.348 1.336 1.325 1.313 1.301 1.291 1.280 1.267 1.258 1.245 0.877 0.865 0.853 0.000



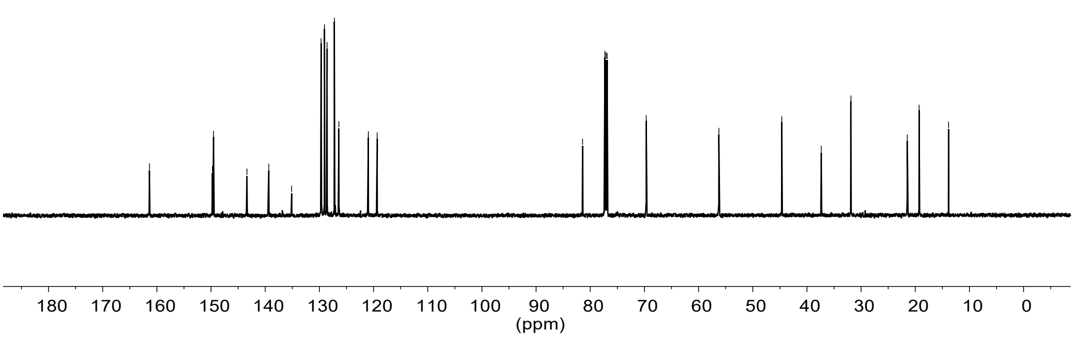
5p, ^{1}H NMR, $CDCl_3$, 600 MHz

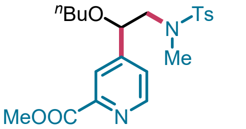


161.38 149.75 149.55 143.38 139.35 135.13 129.69 129.07 128.59 127.24 126.41 120.97 119.34 81.42 77.30 77.09 76.88 69.66 56.26 44.64 37.36 31.88 21.48 19.29 13.85

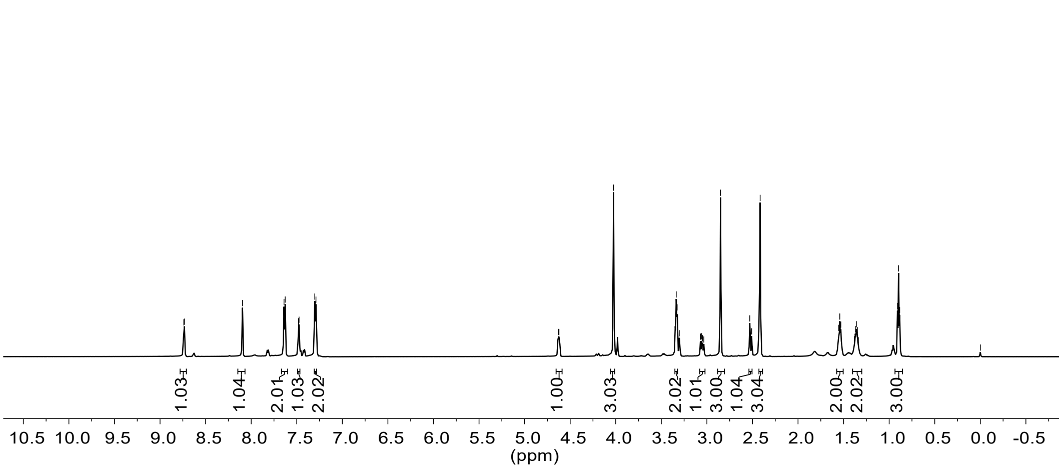


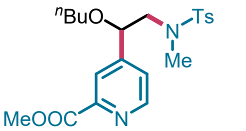
5p, ^{13}C NMR, $CDCl_3$, 151 MHz



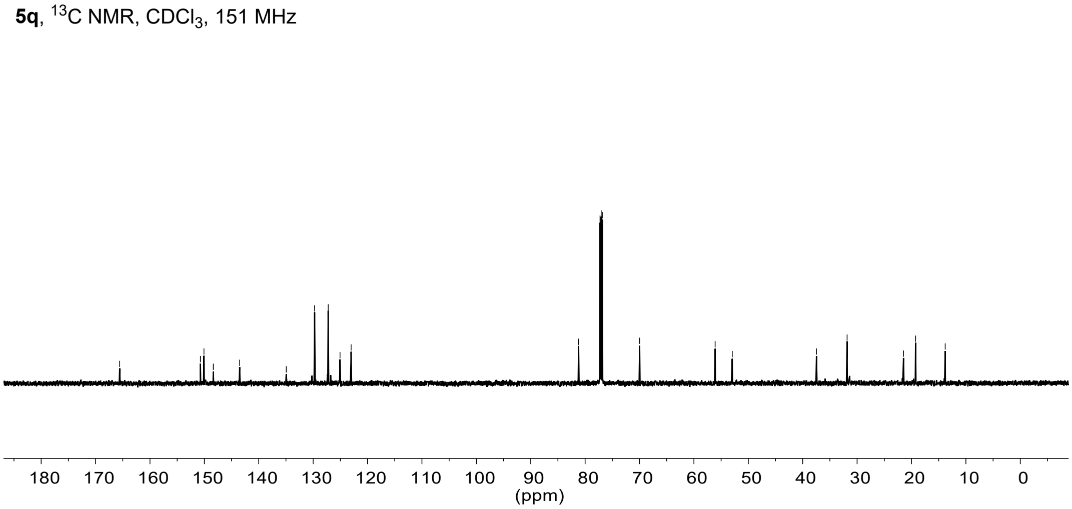


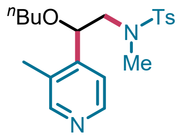
5q, ^{1}H NMR, $CDCl_3$, 600 MHz



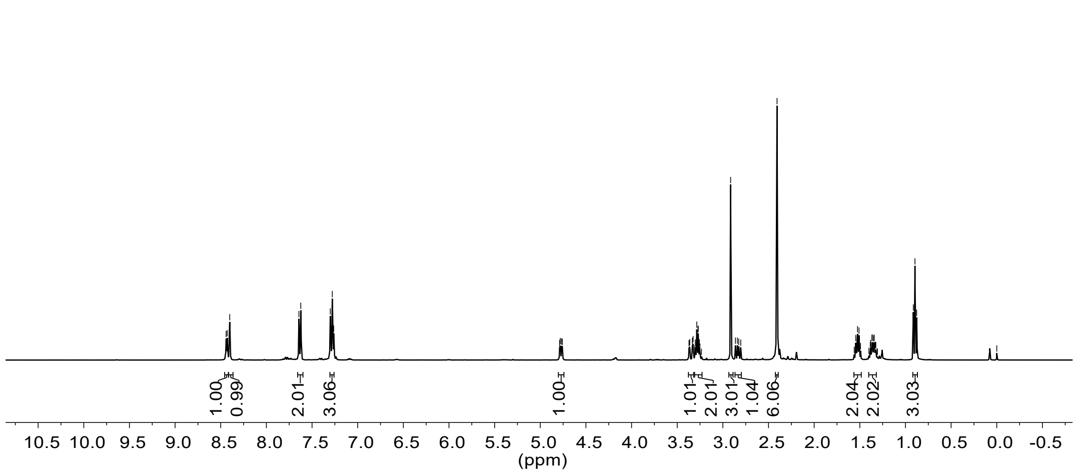


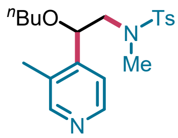
5q, ^{13}C NMR, $CDCl_3$, 151 MHz



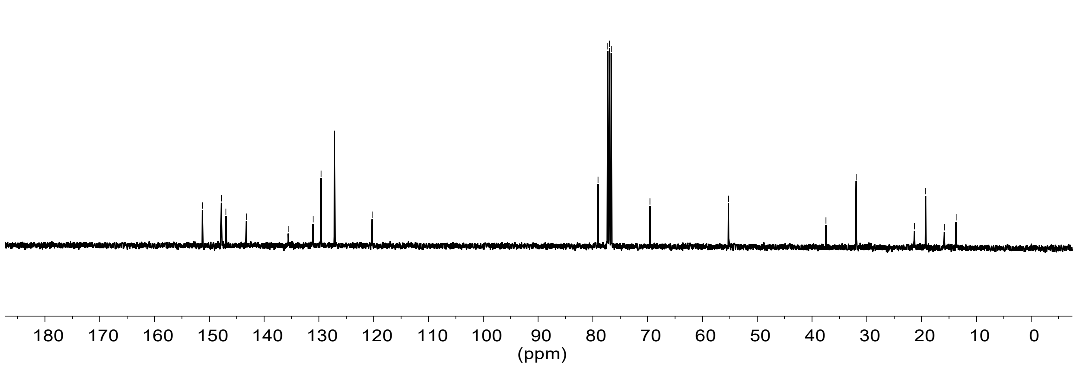


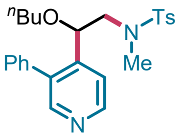
5r, ^{1}H NMR, $CDCl_3$, 400 MHz



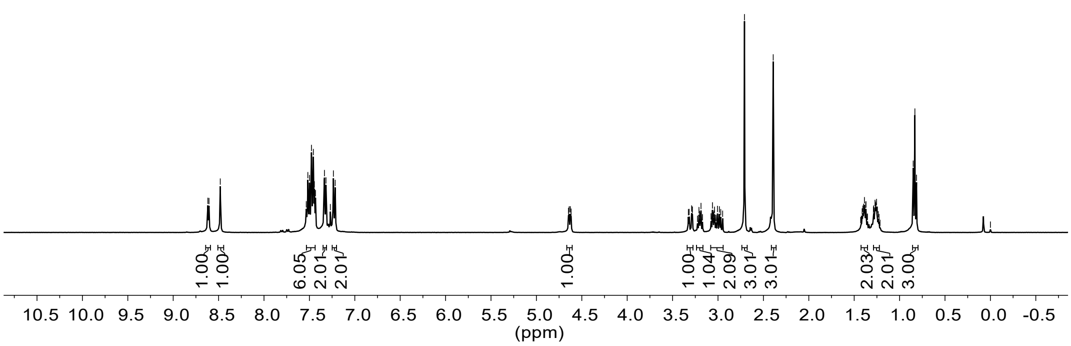


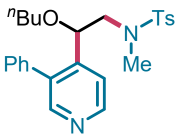
5r, ^{13}C NMR, $CDCl_3$, 101 MHz



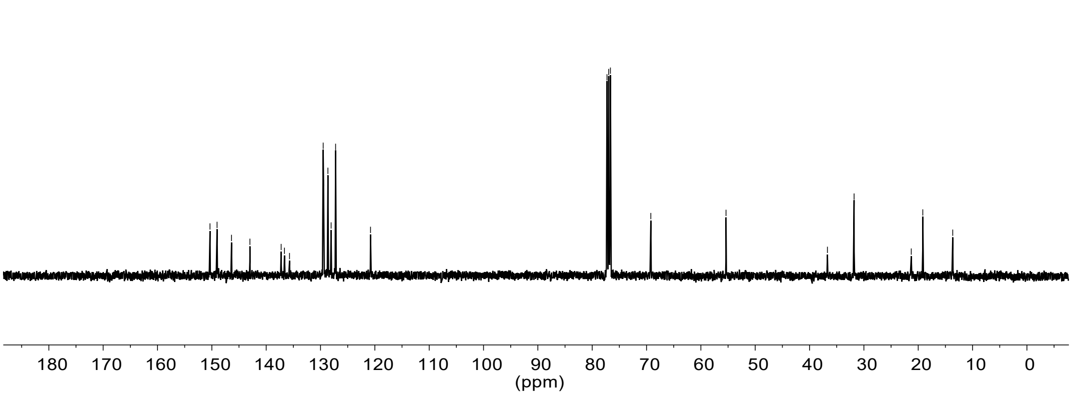


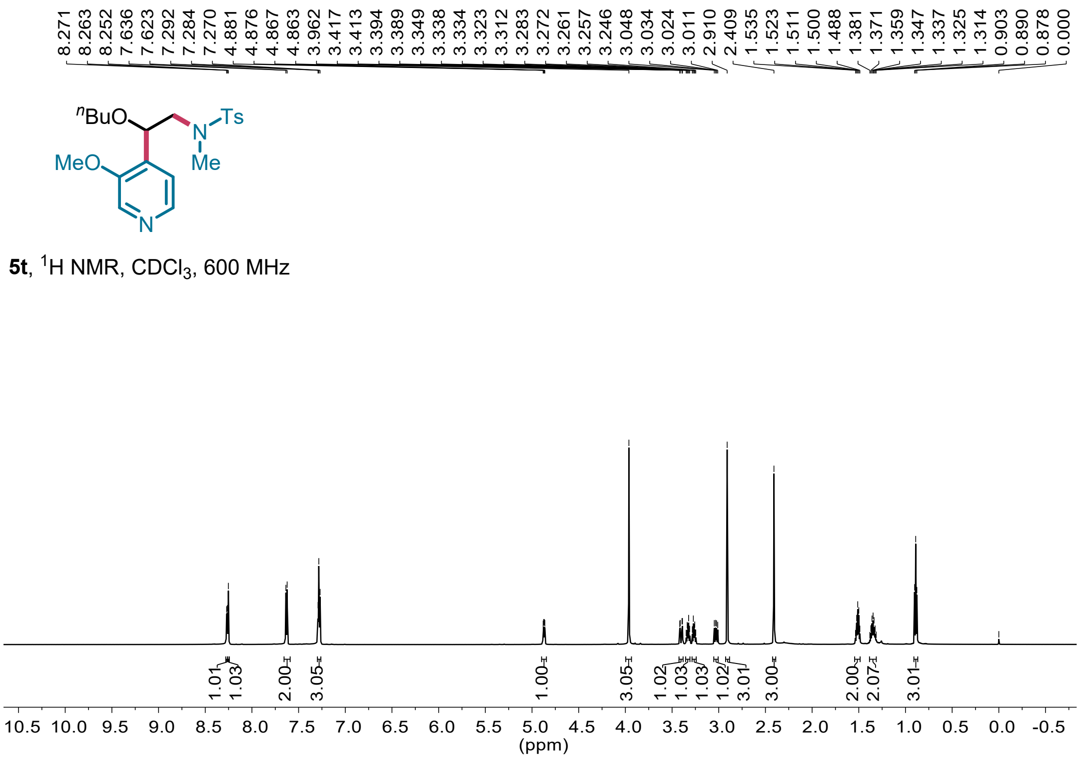
5s, ^{1}H NMR, $CDCl_3$, 400 MHz



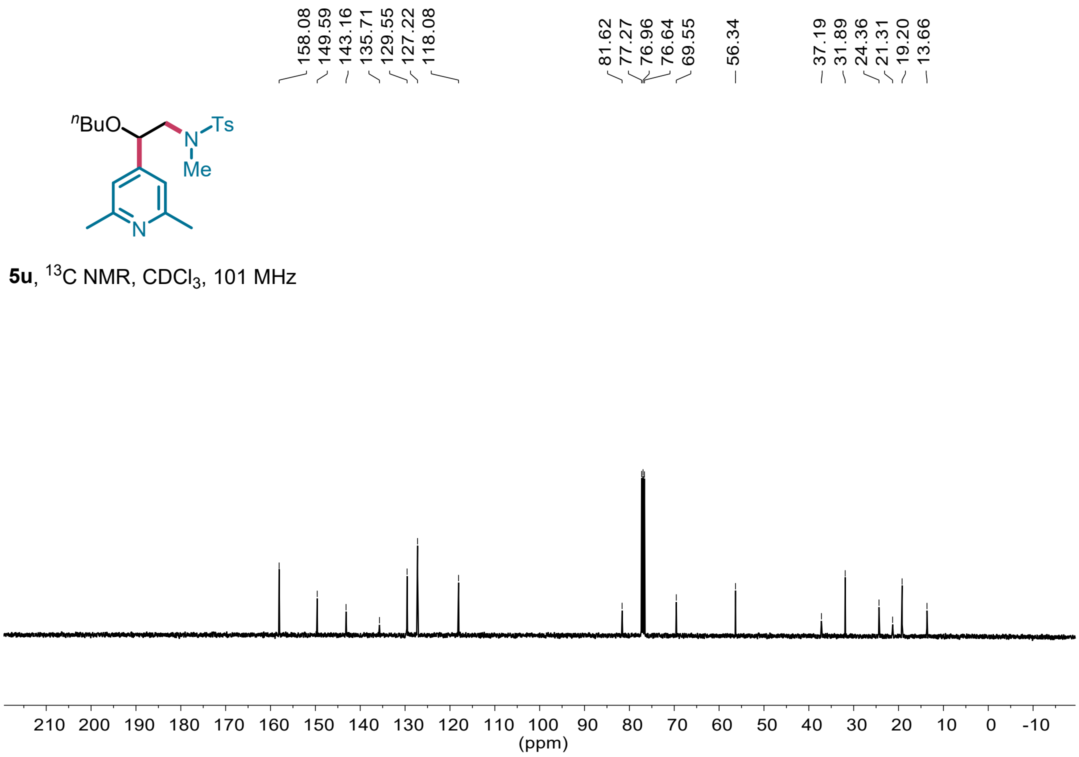


5s, ^{13}C NMR, $CDCl_3$, 101 MHz

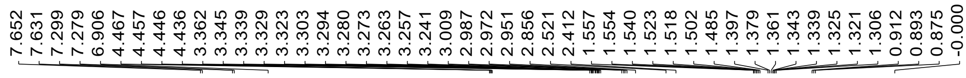


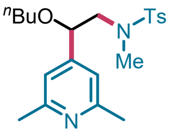


5t, ^{1}H NMR, $CDCl_3$, 600 MHz

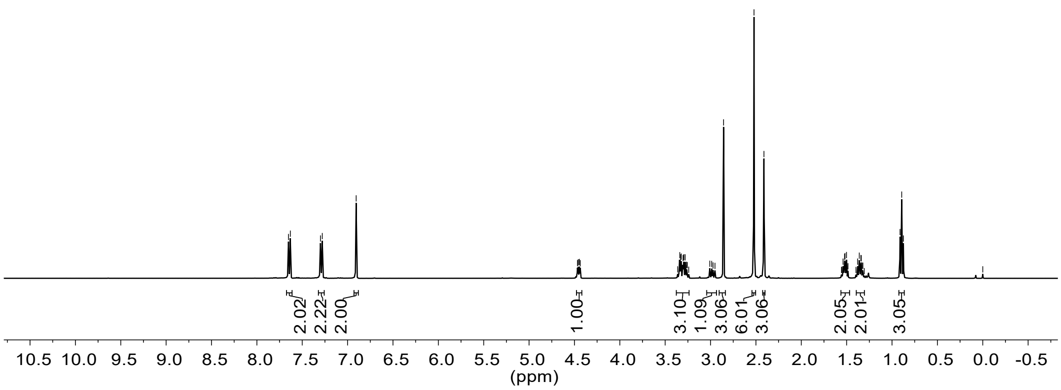


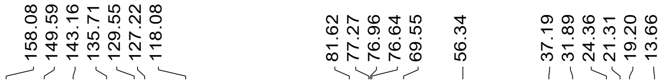
5u, ^{13}C NMR, $CDCl_3$, 101 MHz

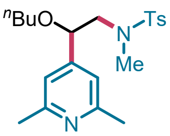




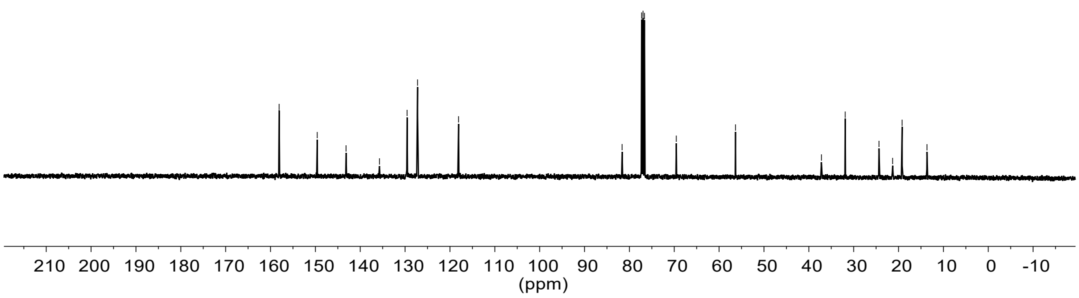
5u, ^{1}H NMR, $CDCl_3$, 400 MHz

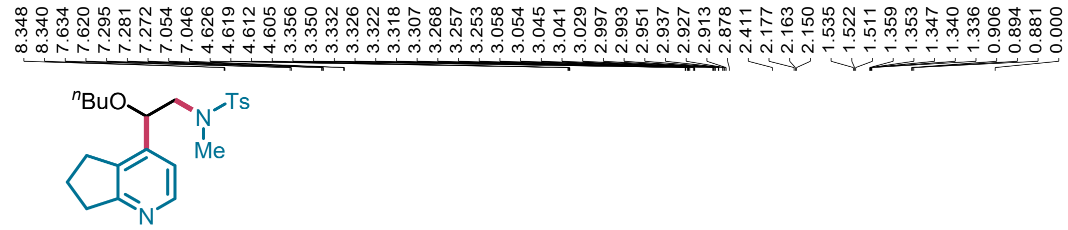




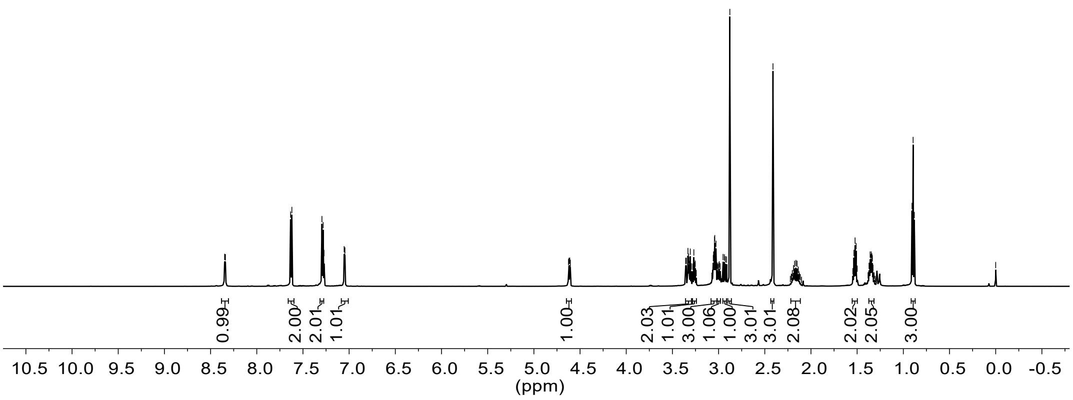


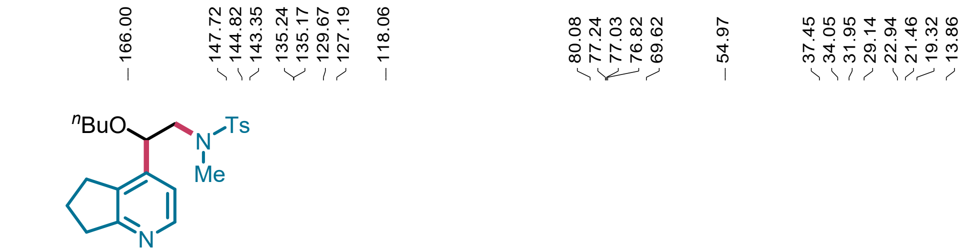
5u, ^{13}C NMR, $CDCl_3$, 101 MHz



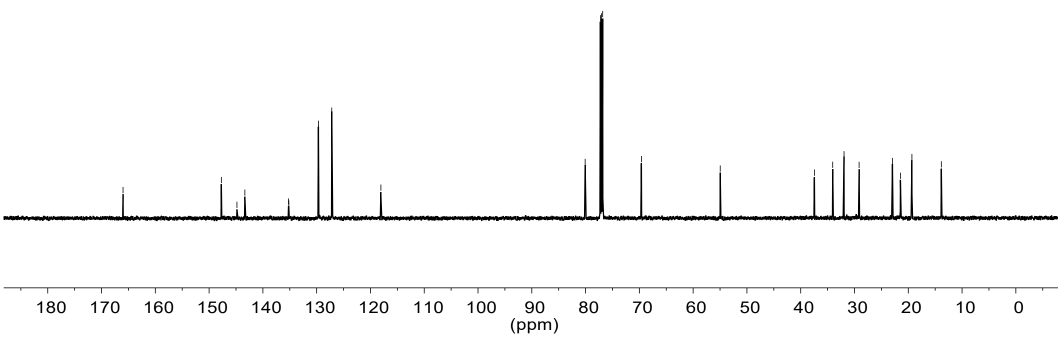


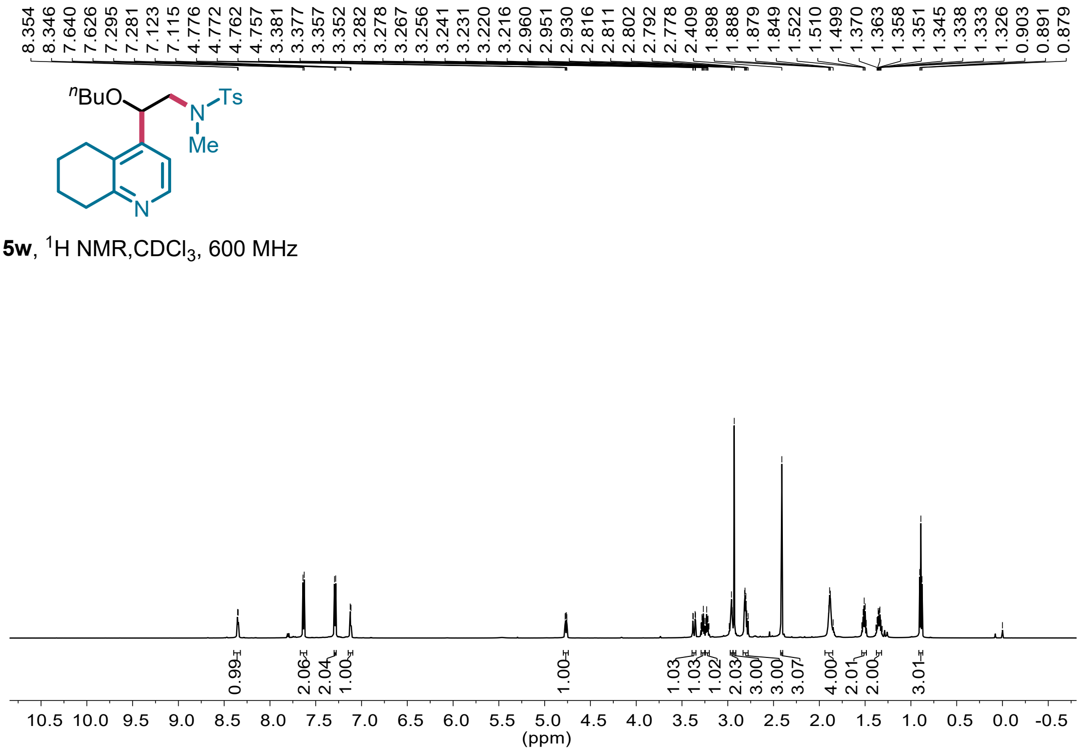
5v, ^{1}H NMR, $CDCl_3$, 600 MHz



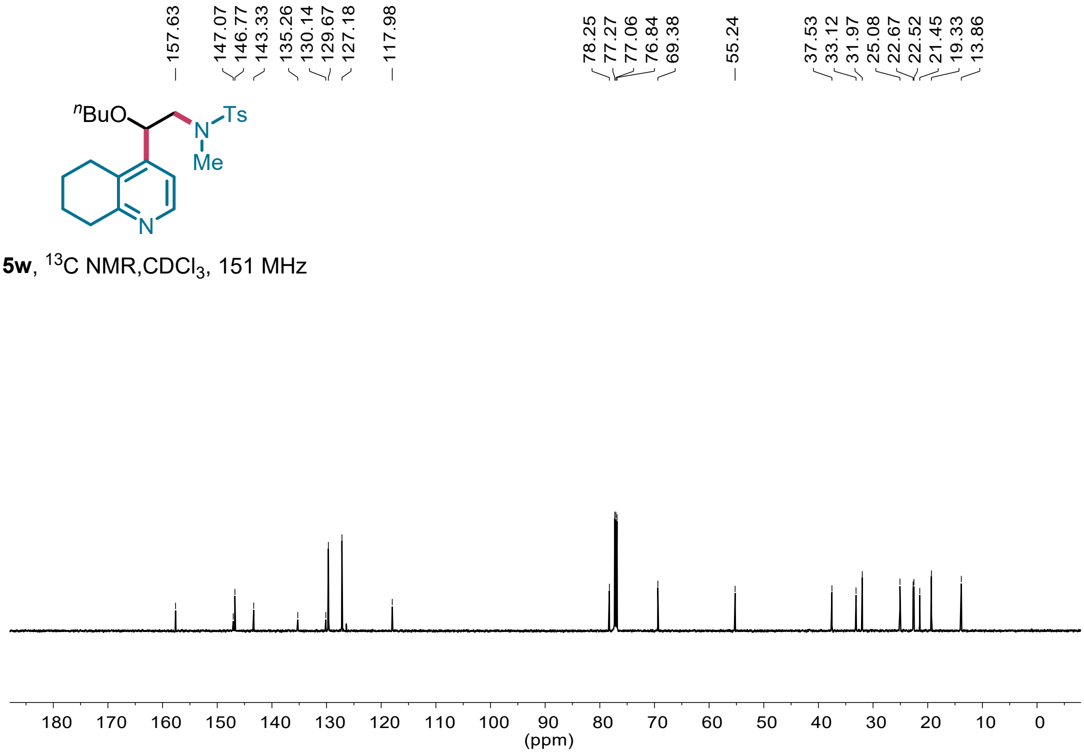


5v, ^{13}C NMR, $CDCl_3$, 151 MHz

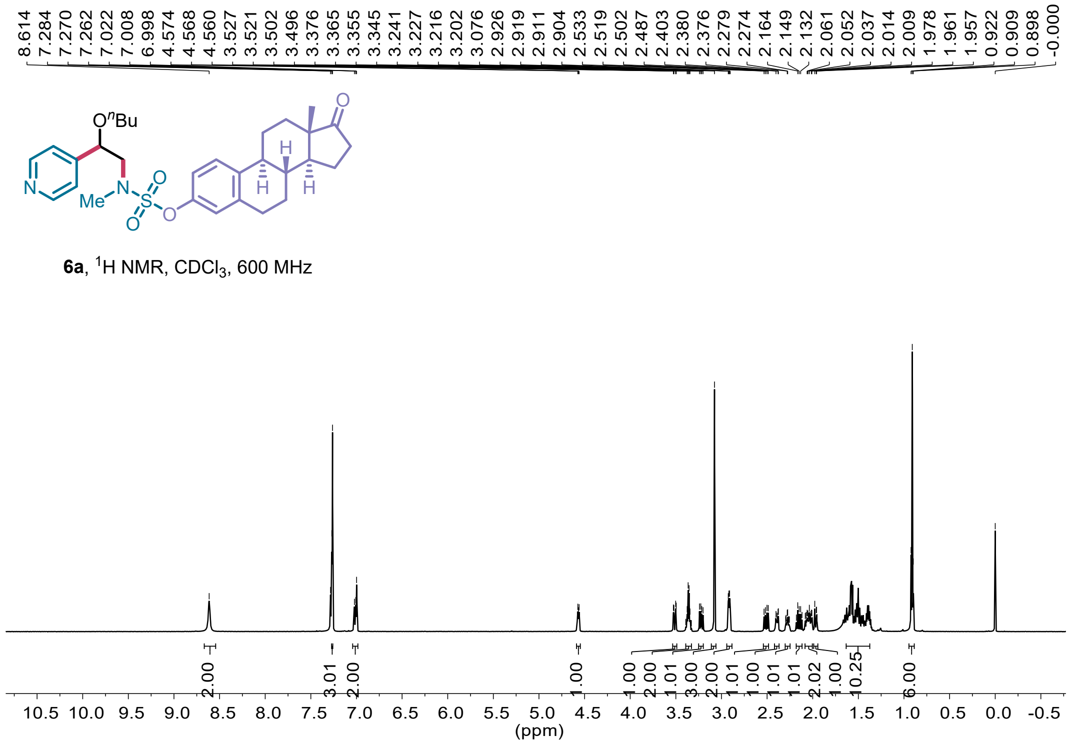




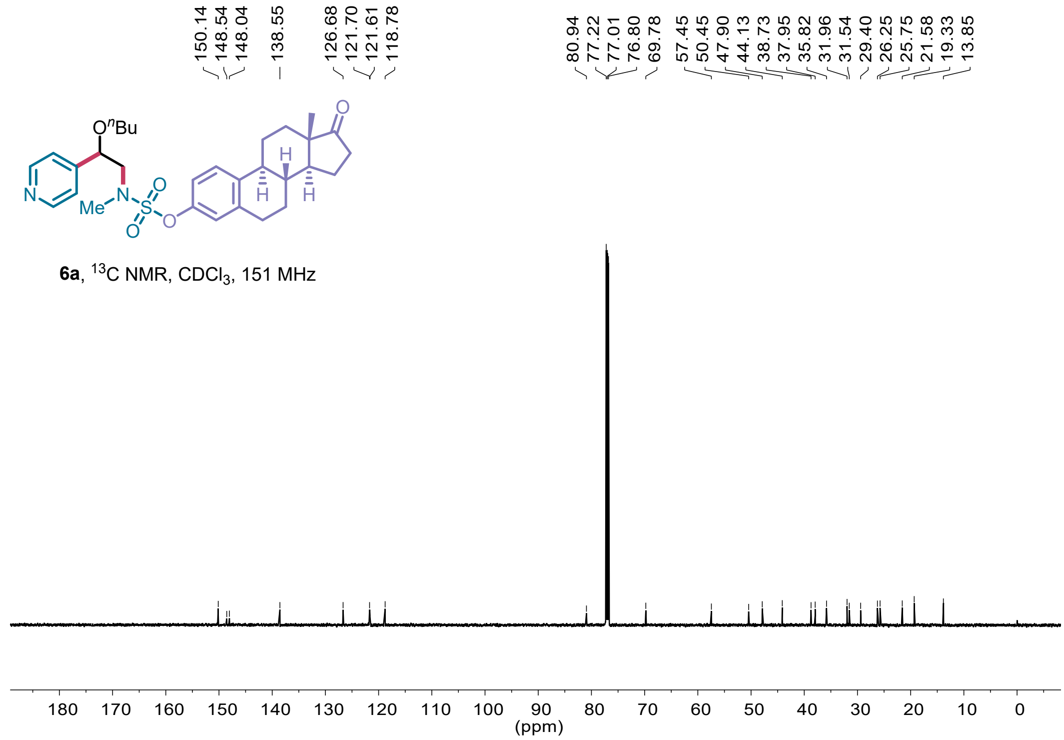
5w, ^{1}H NMR, $CDCl_3$, 600 MHz



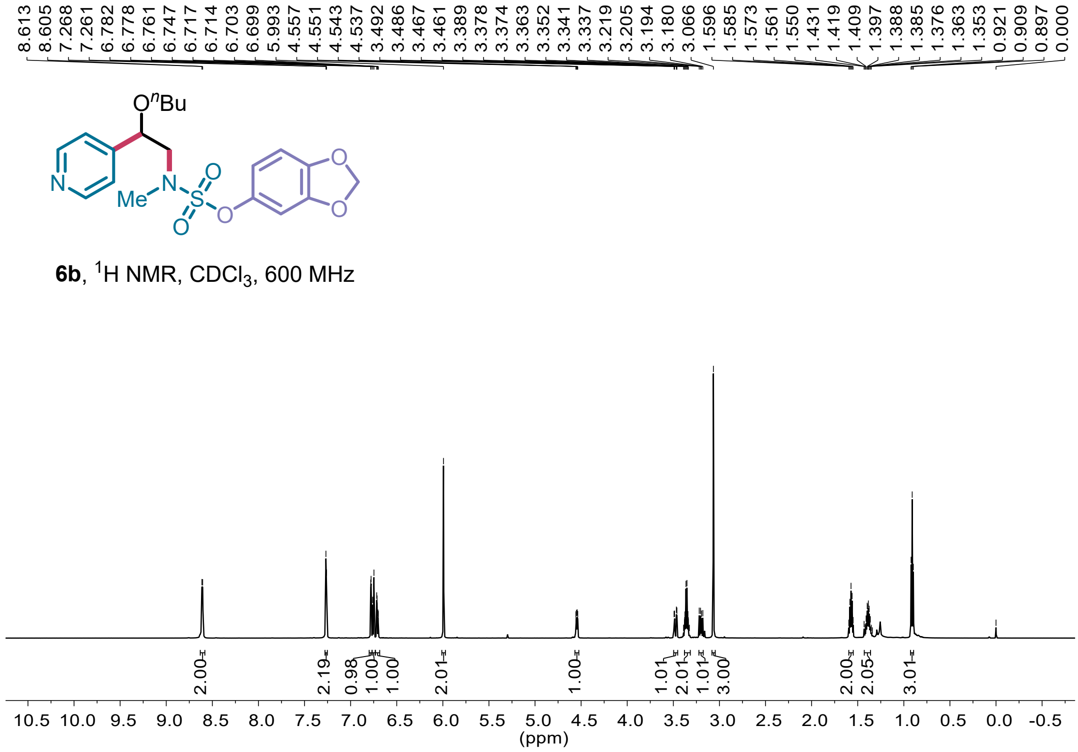
5w, ^{13}C NMR, $CDCl_3$, 151 MHz



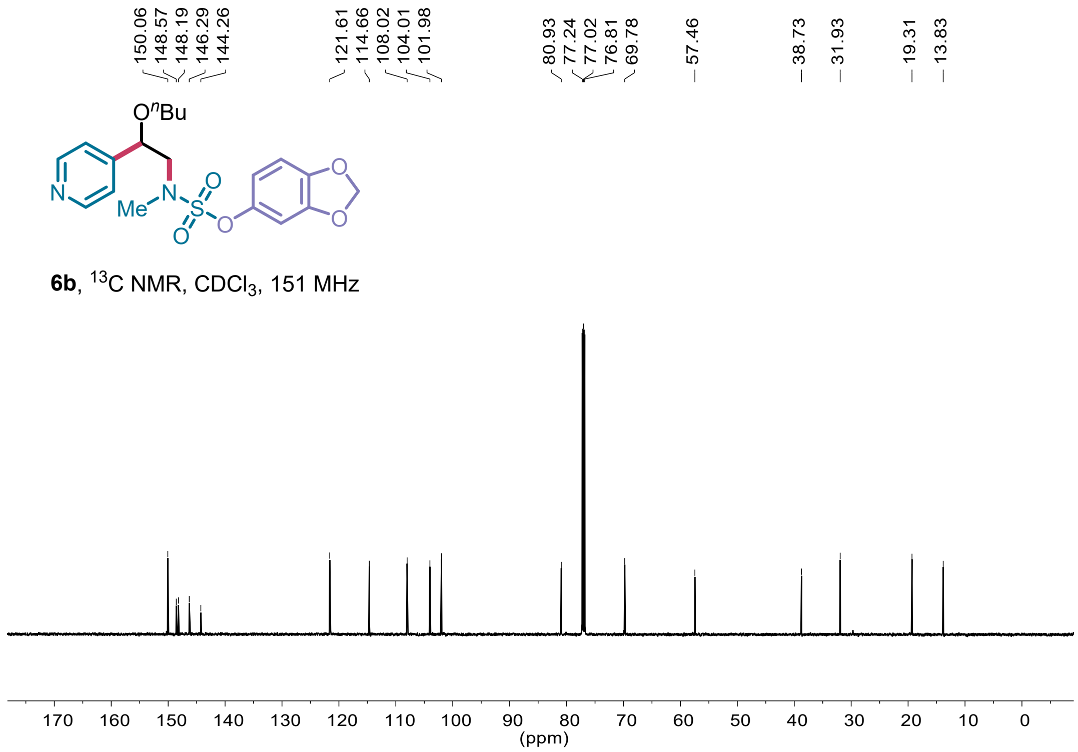
6a, ^{1}H NMR, $CDCl_3$, 600 MHz



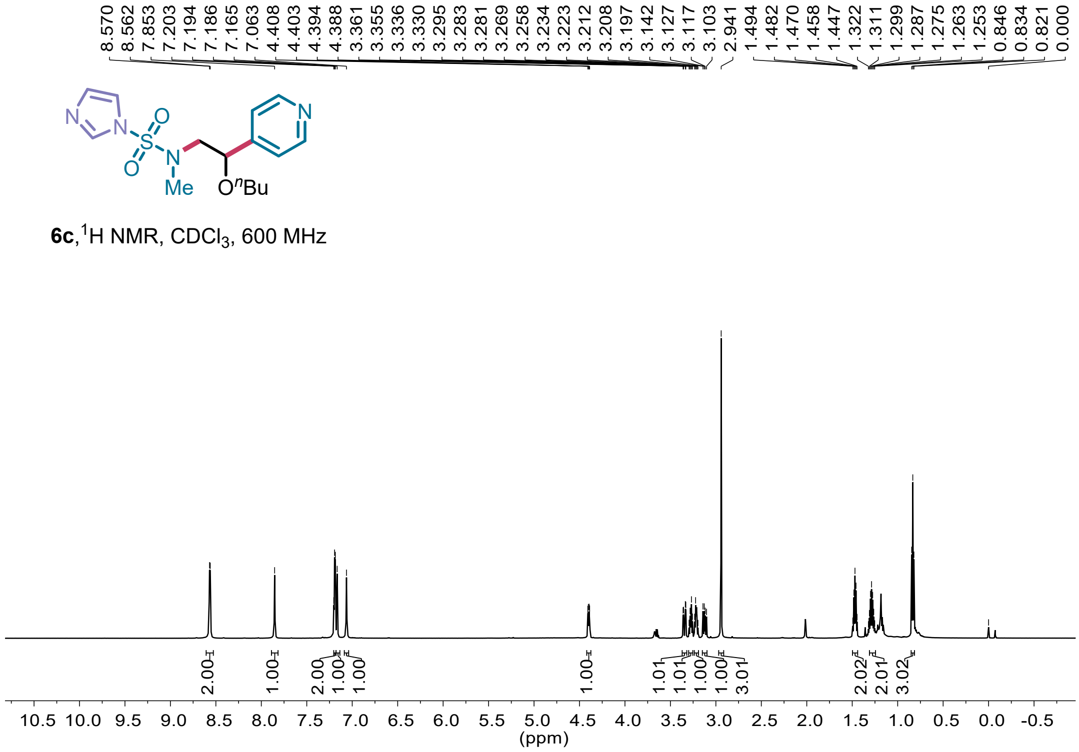
6a, ^{13}C NMR, $CDCl_3$, 151 MHz



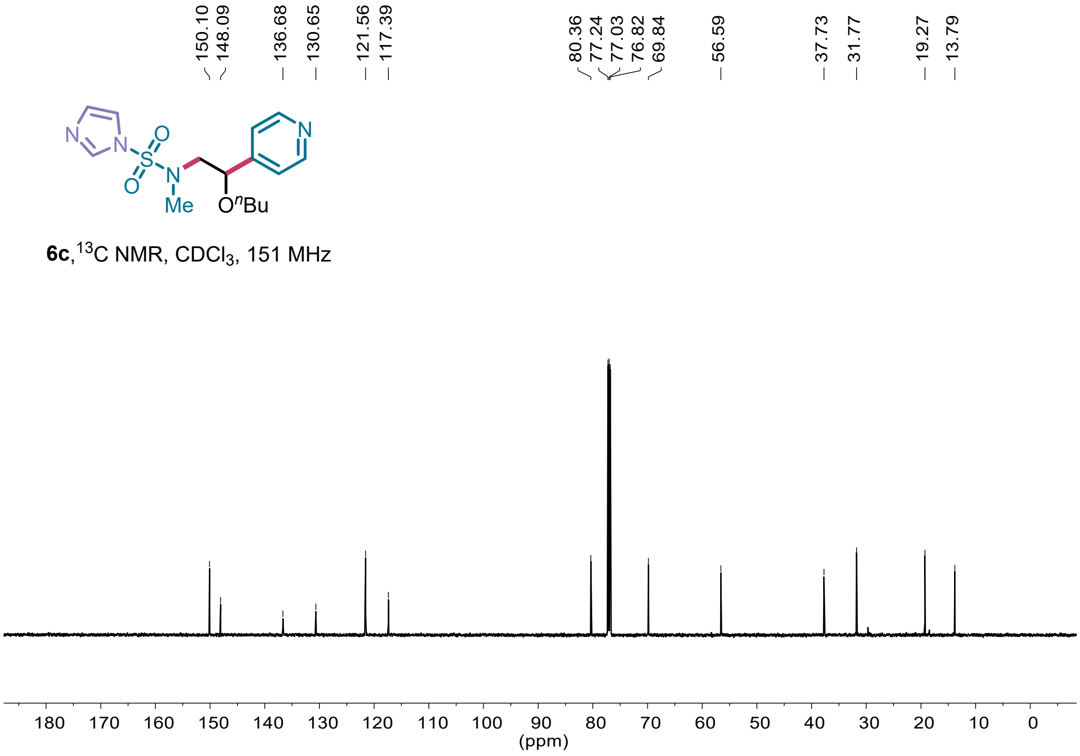
6b, ^{1}H NMR, $CDCl_3$, 600 MHz



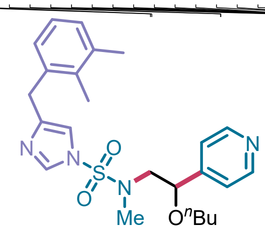
6b, ^{13}C NMR, $CDCl_3$, 151 MHz



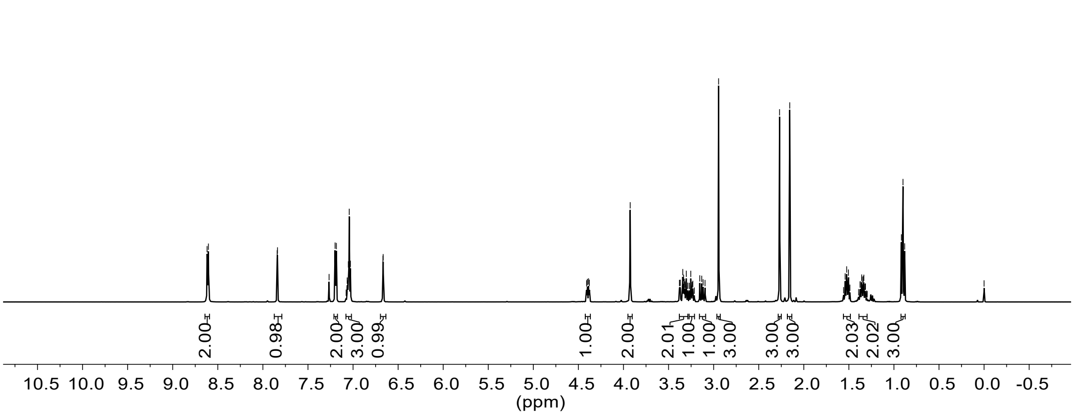
6c, ^{1}H NMR, $CDCl_3$, 600 MHz

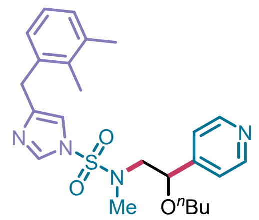


6c, ^{13}C NMR, $CDCl_3$, 151 MHz

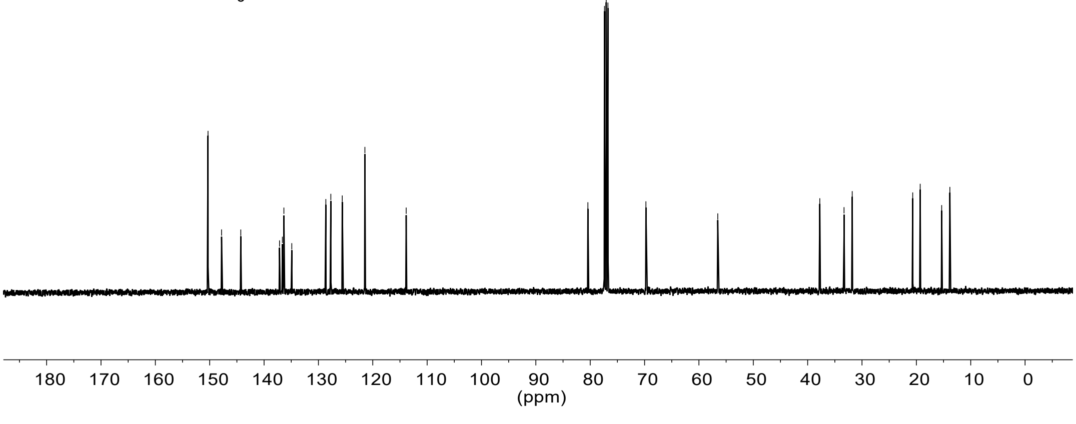


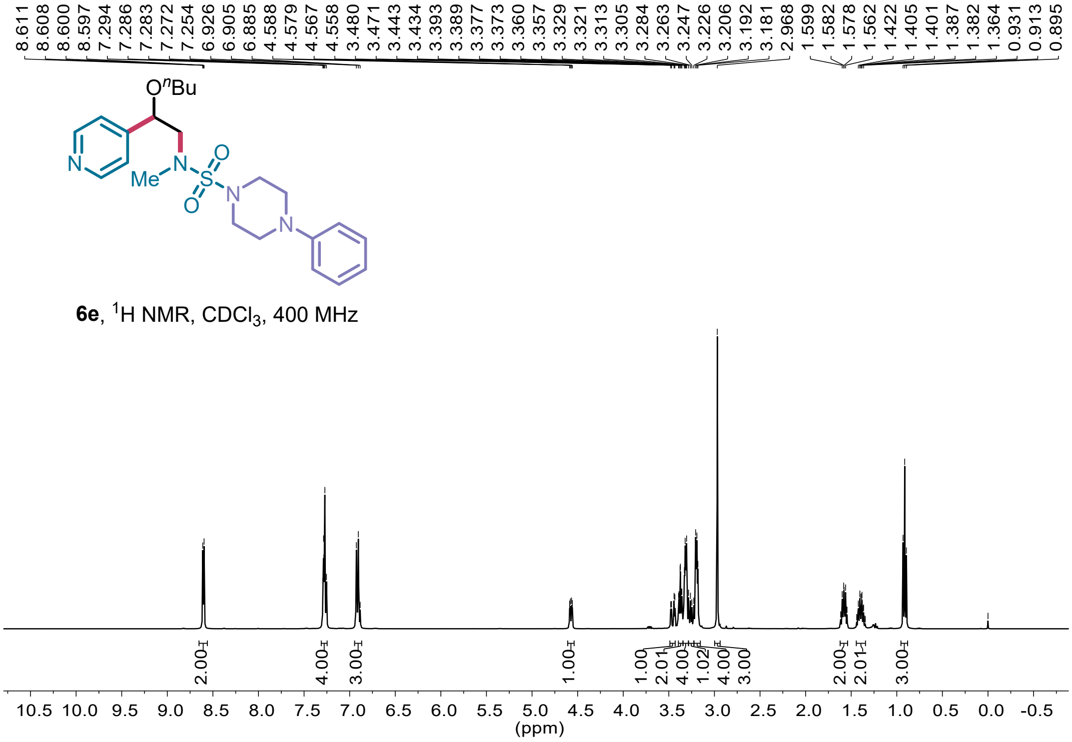
6d, ^{1}H NMR, $CDCl_3$, 400 MHz



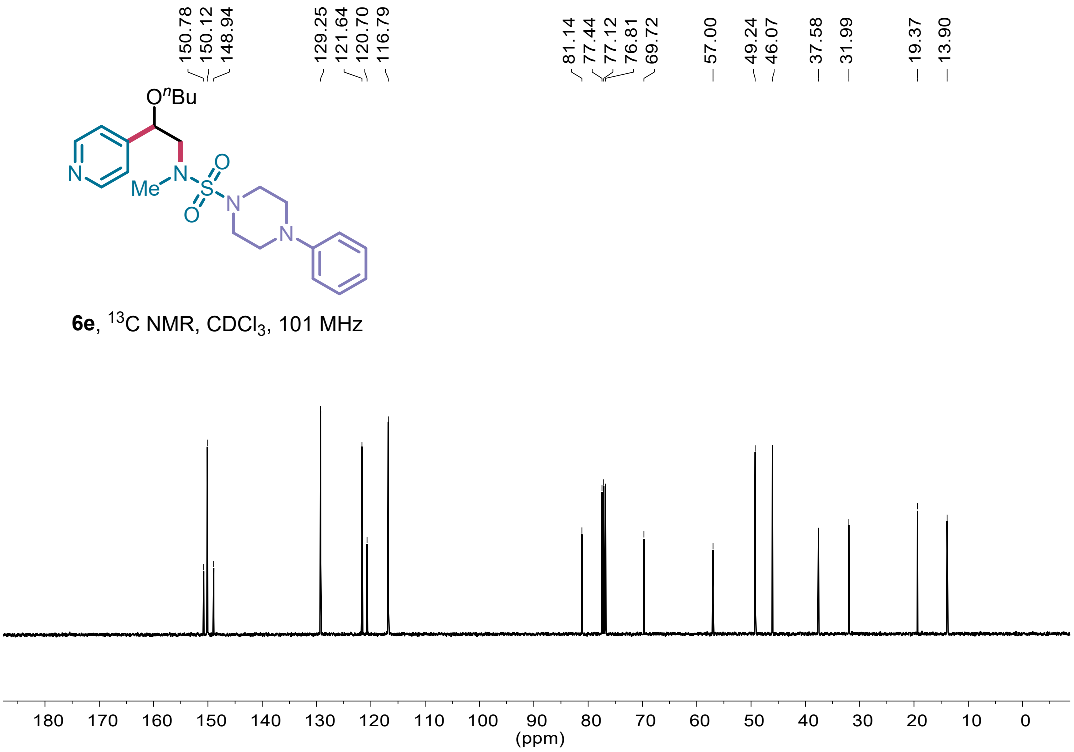


6d, ^{13}C NMR, $CDCl_3$, 101 MHz

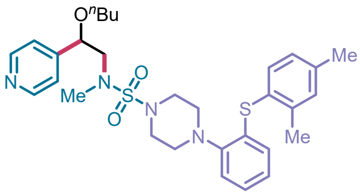




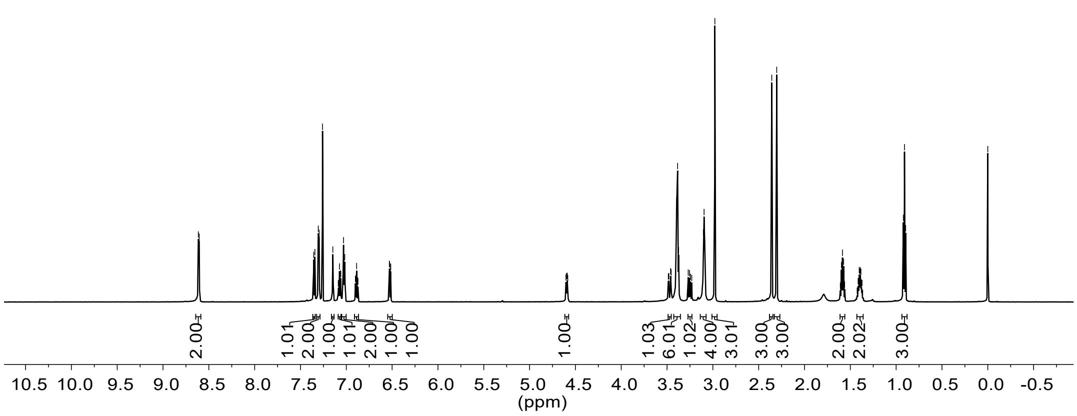
6e, ^{1}H NMR, $CDCl_3$, 400 MHz

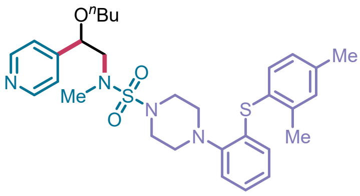


6e, ^{13}C NMR, $CDCl_3$, 101 MHz

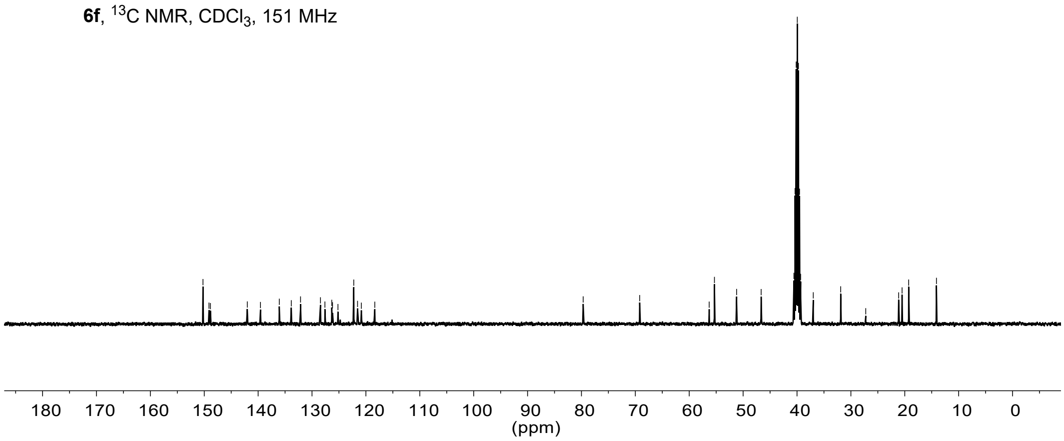


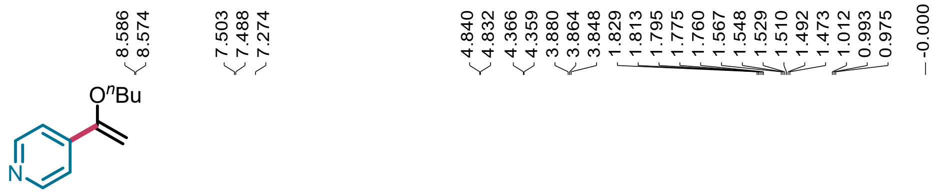
6f, ^{1}H NMR, $CDCl_3$, 600 MHz



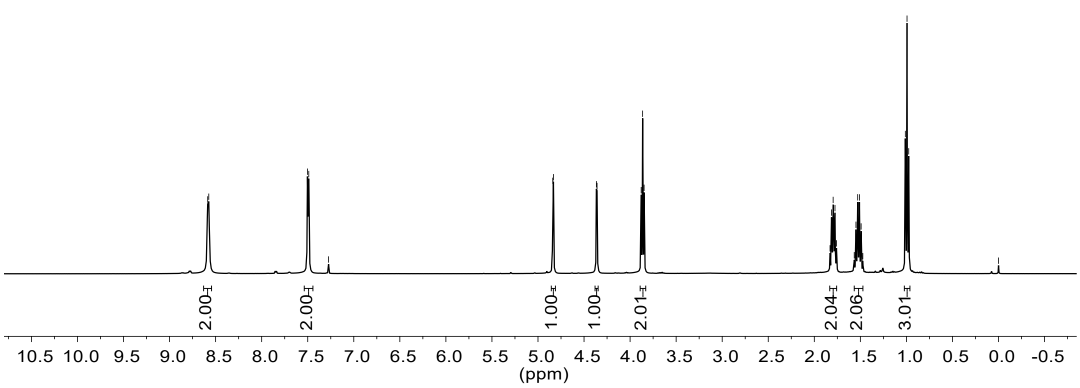


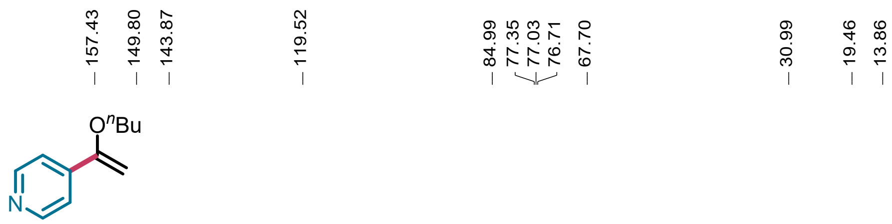
6f, ^{13}C NMR, $CDCl_3$, 151 MHz



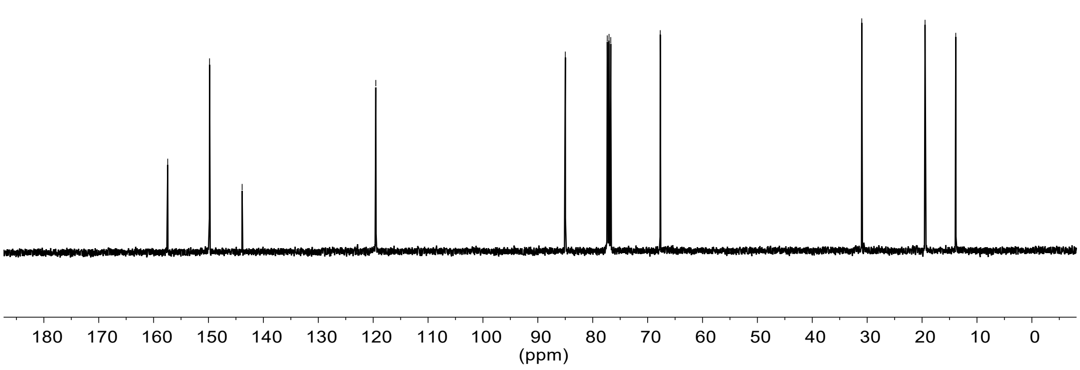


6g, ^{1}H NMR, $CDCl_3$, 400 MHz





6g, ^{13}C NMR, $CDCl_3$, 101 MHz



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