Supporting Information

Cu(I)-catalyzed, *N*-Fluorobenzamides Enabling 1,2-Carbo-fluorination of Unactivated alkenes Via Free Radical Relay

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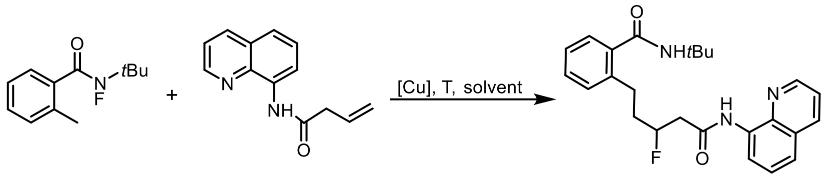
Table S1. Optimization of the reaction conditions on the 1,2-carbofluorination bifunctionalization of *N*-fluorobenzamide **1a** and unactivated alkene **2a**.[a]



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

Entry	Catalyst	Temp (°C)	solvent	additive	Yield of **3a** (%)[a]
1	CuCI	80	DCE		33
2	CuCI	80	$CHCI_3$		36
3	CuCI	80	DME		26
4	CuCI	80	CH_3CN		trace
5	CuCI	80	1,4-dioxane		54
6	CuBr	80	$CHCI_3$		32
7	CuI	80	$CHCI_3$		N.R.
8	$CuCI_2$	80	$CHCI_3$		27
9	CuCN	80	$CHCI_3$		trace
10	CuOTf	80	$CHCI_3$		trace
11	$Fe(OTf)_2$	80	$CHCI_3$		N.R.
12	CuCI	80	$CHCl_3$		36
13[b]	CuCI	80	$CHCI_3$		46
14[c]	CuCI	80	$CHCI_3$		38
15	CuCI	70	$CHCI_3$		50
16	CuCI	60	$CHCI_3$		35
17[b]	CuCI	70	$CHCI_3$ (2 mL)		67(65)[d]
18[b]	CuCl	70	$CHCI_3$ (3 mL)		35

19[b]	CuCI	70	$CHCI_3$ (2 mL)	TBAF	18
20[b]	CuCI	70	$CHCI_3$ (2 mL)	AgF	10
21[b]	CuCI	70	$CHCI_3$ (2 mL)	Selectfluor	complicated
22[b]	CuCI	70	$CHCI_3$ (2 mL)	$Et_3N{\cdot}HF$	complicated
23[b]	CuCI	70	$CHCI_3$ (2 mL)	CsF	trace
24[b]	CuCI	70	$CHCI_3$ (2 mL)	NFSI	complicated

[a] The yields were determined by ^{1}H NMR of crude product with $PhCF_3$ as an internal standard sample. [b] CuCl (0.02 mmol). [c] CuCl (0.03 mmol). [d] isolated yield. N. R.: no reaction.

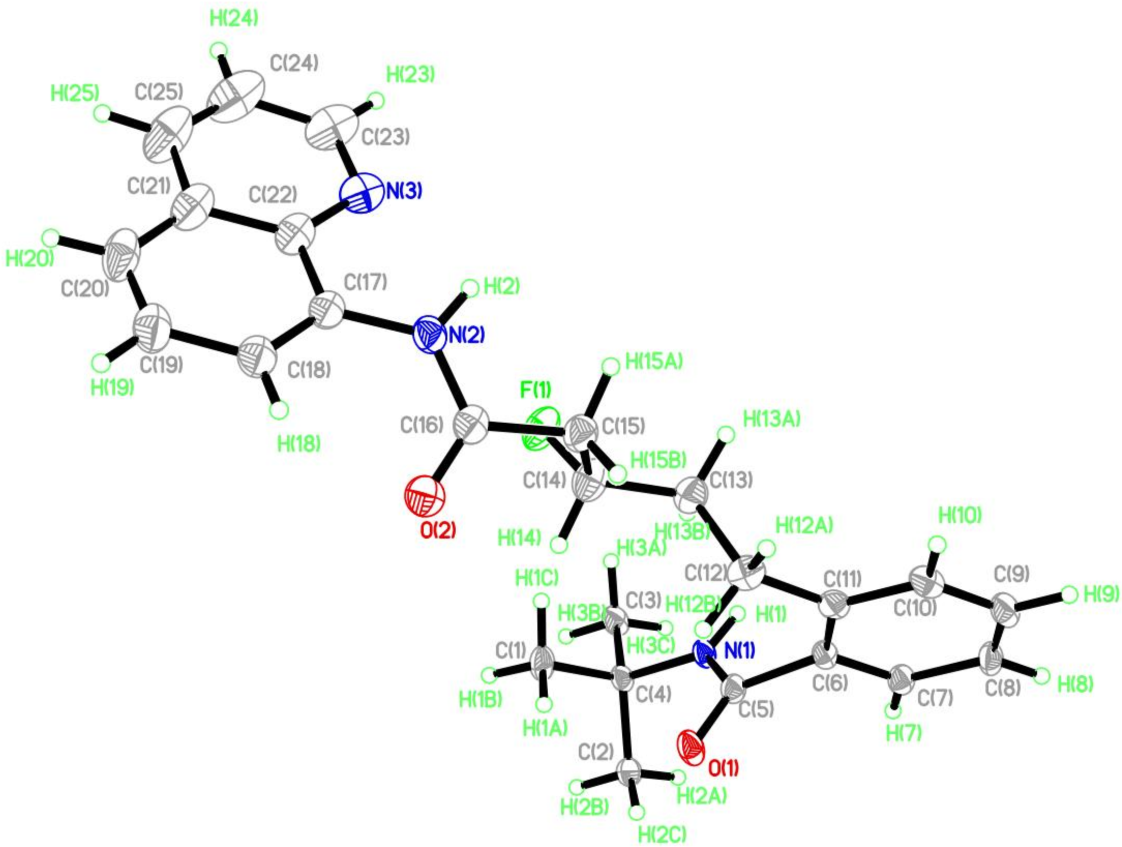


Figure S1. The ORTEP drawings of **3a** (30% probability)

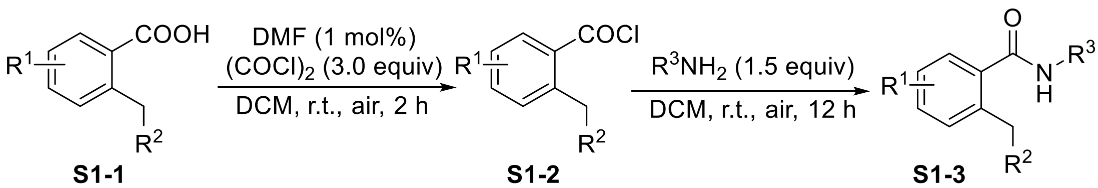
I. General Information

Unless otherwise noted, reagents and solvents were purchased from commercial suppliers (such as Energy Chemical Corporation, J&K Scientific, Tianjin Xiensi Biochemical Technology Co., Ltd. etc.) and used without further purification. ^{1}H NMR, ^{13}C NMR and ^{19}F NMR spectra were recorded at 25 ℃ on Bruker Advance 400 M NMR spectrometers ($CDCl_3$). Chemical shifts for ^{1}H NMR spectra were reported as δ in parts per million (ppm) downfield from $SiMe_4$ (δ 0.00) and relative to the signal of $CDCl_3$ residual peak (δ 7.26 singlet). Multiplicities were given as: s (singlet); d (doublet); t (triplet); q (quartet); dd (doublet of doublets); dt (doublet of triplets); m (multiplets) etc. Chemical shifts for ^{13}C NMR spectra were reported as δ in parts per million (ppm) downfield from $SiMe_4$ (δ 0.00) and relative to the signal of $CDCl_3$ (δ 77.2 triplet). Coupling constants were reported as *J* value in Hz. High-resolution mass spectral analysis (HRMS) was performed on Waters Xevo G2-XS using electrospray ionization (ESI). Chromatography was performed using 200-300 mesh silica gel with the indicated solvent system. Melting points were measured by X-5 Micro Melting Point Detector.

II. Experiment Procedures

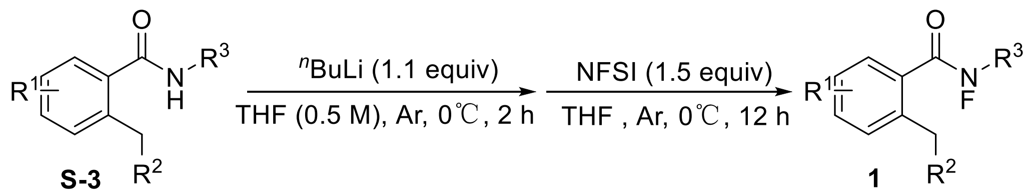
(1) Synthesis of substrates **1** and **2**

(a) Synthesis of *N*-(*tert*-butyl)amide **S1-3**



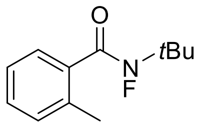
To a stirred solution of **S1-1** (10 mmol, 1.0 equiv) and *N*,*N*-dimethylformamide (DMF, 1 mol%) in dichloromethane (DCM, 10 mL) at room temperature under air atmosphere in a round-bottom flask, $(COCl)_2$ (3.81 g, 30 mmol, 3.0 equiv) was added dropwise and the reaction was stirred for at least 2 h until no bubbles emerge from the system. Then, the solution was filtered and concentrated under reduced pressure directly to remove excess $(COCl)_2$ and DCM. The crude residue (**S1-2**) was directly applied to next step without further purification. DCM (40 mL) was re-added to the crude product and the amine R^3NH_2 (25 mmol, 2.5 equiv) was added dropwise, the reaction was stirred for another 12 h until the complete consumption of starting material. After completion, the mixture was filtered and concentrated under reduced pressure. The residual solid was purified by flash chromatography on silica gel to afford *N*-(*tert*-butyl)amide **S1-3**.

(b) Synthesis of *N*-(*tert*-butyl)-*N*-fluoroamides **1**

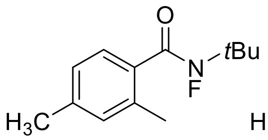


All the following *N*-fluorobenzamides **1** (5 mmol) were synthesized according to the reported procedure.[1] To a Schlenk tube containing **S1-3** was added anhydrous THF (50 mL) under argon atmosphere, the mixture was stirred until **S1-3** was completely dissolved and the solution was cooled down to 0 °C with the aid of cryogenic reactors. ^{n}BuLi (1.1 equiv, 2.5 M solution in *n*-hexane) was added dropwise and the reaction was stirred for 2 h. *N*-Fluorobenzenesulfonimide (NFSI) (2.37 g, 1.5 equiv, 0.7 M in THF) was added dropwise (~ 1 drop/sec). The resulting mixture was stirred at 0 °C overnight and then allowed to warm up to room temperature. After 12 h, the reaction was quenched with 1 M HCl aqueous. The resulting mixture was diluted with ethyl acetate (EA, 50 mL) and water (50 mL). The two layers were separated and the aqueous layer was extracted with EA for three times (3 x 50 mL). The combined organic layers were washed with saturated Na_2CO_3 aqueous and then saturated NaCl aqueous, dried over anhydrous $MgSO_4$ for 30 min, filtered and concentrated under reduced pressure. The expected product *N*-fluoroamides **1** were obtained through purification by column chromatography on silica gel in 23%-37% yield.

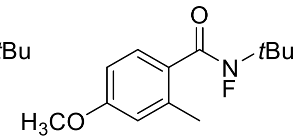
List of *N*-fluorobenzamides **1**



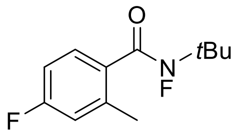
1a



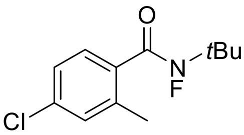
1b



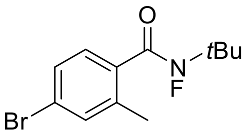
1c



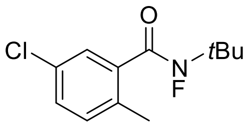
1d



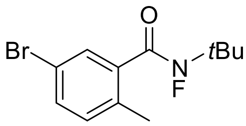
1e



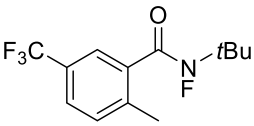
1f



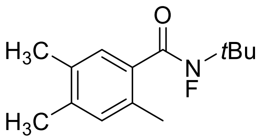
1g



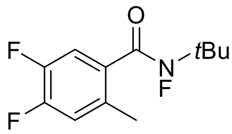
1h



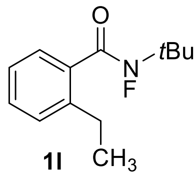
1i



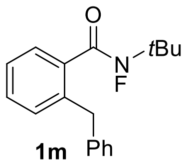
1j



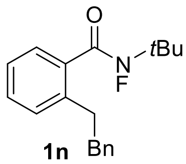
1k



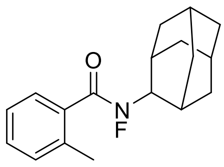
1l



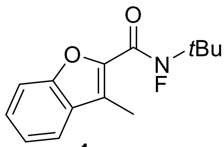
1m



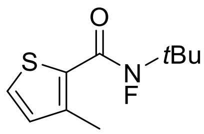
1n



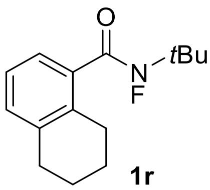
1o



1p

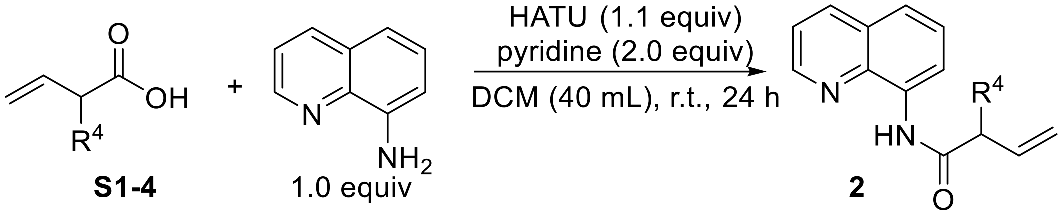


1q



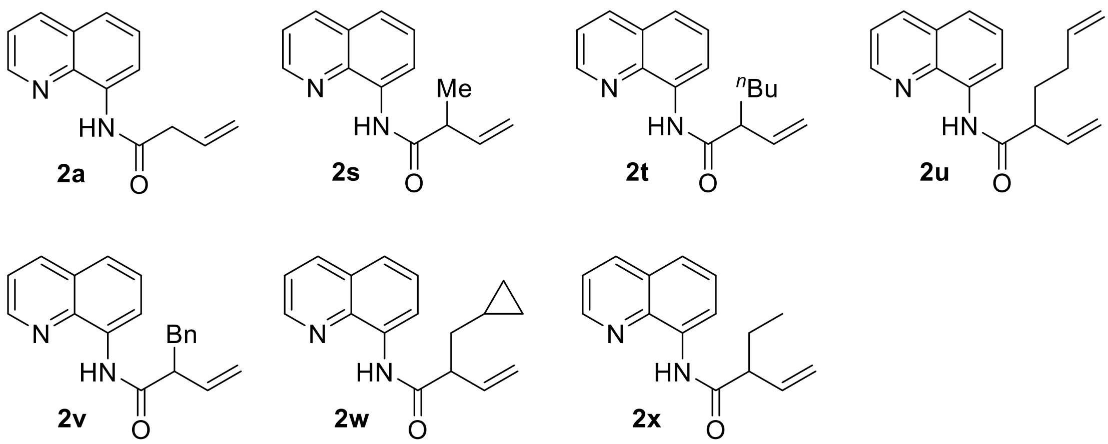
1r

(c) Synthesis of *N*-(quinolin-8-yl)but-3-enamides **2**

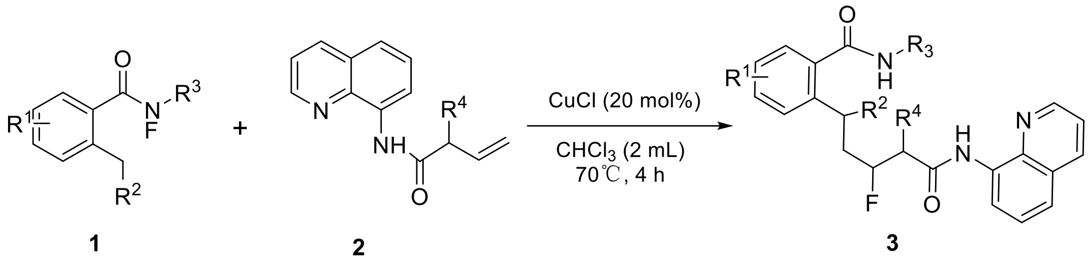


The substrates *N*-(quinolin-8-yl)but-3-enamides **2** were synthesized according to the reported procedure.[2] The acid **S1-4** (5.0 mmol) was charged into a 100 mL flask containing 20 mL dichloromethane (DCM). 8-Aminoquinoline (649 mg, 4.5 mmol, 1.0 equiv), pyridine (0.73 mL, 9.0 mmol, 2.0 equiv), and 2-(7-azabenzotriazol-1-yl)-*N*, *N*, *N'*, *N'*-tetramethyluronium hexafluorophosphate (HATU, 1.90 g, 5.0 mmol, 1.1 equiv) were added sequentially, and the reaction was stirred at ambient temperature for 16 h. The deep brown solution was quenched with saturated $NaHCO_3$ aqueous (15 mL) and extracted with DCM. The combined organic layers were washed with brine and dried over anhydrous Na_2SO_4, filtered and the filtration was concentrated in vacuo, the resulting residue was purified by column chromatography (PE/EA = 20:1) to afford the desired products **2** in 25%-75% yields.

List of unactivated alkenes **2**

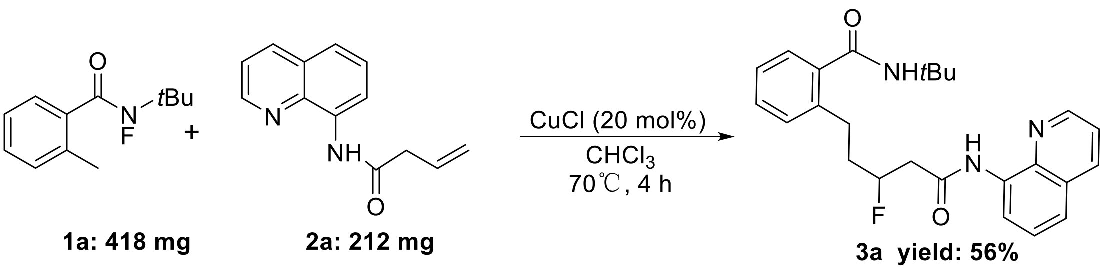


(2) Synthesis of products **3**



The CuCl (1.9 mg, 0.02 mmol, 20 mol %) was added into a reaction tube filled with nitrogen, then unactivated alkenes **2** (0.1 mmol, 1.0 equiv), *N*-fluorobenzamide **1** (0.2 mmol, 2.0 equiv) in $CHCl_3$ (2 mL) were added under nitrogen. The reaction mixture was continuously stirred at 70 ℃ for 4 h. After completion, the reaction mixture was filtered by sand core funnel with small amount of short silica gel filled and elution with DCM solvent, then the combined filtrates were concentrated under vacuum, the resulting residue was purified by column chromatography on silica gel to give the products **3**.

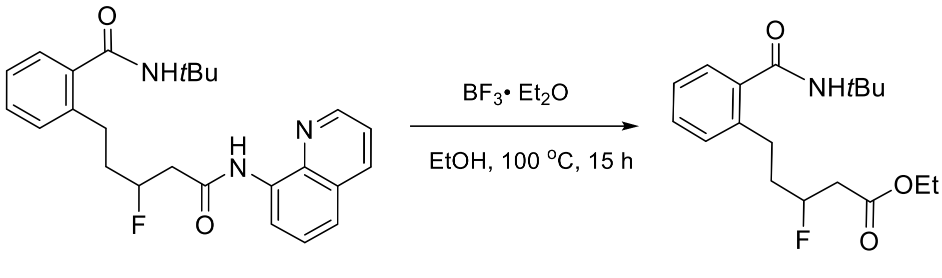
(3) Scale-up reaction of **3a**



The CuCl (19 mg, 0.2 mmol) was added into a reaction tube filled with nitrogen, then unactivated alkene **2a** (1.0 mmol, 1.0 equiv), *N*-fluorobenzamide **1** (2.0 mmol, 2.0 equiv) in $CHCl_3$ (20 mL) were added under nitrogen. The reaction mixture was continuously stirred at 70 ℃ for 4 h. The work-up of reaction mixture was the same as above of synthesizing the **3a** with small amount.

(4) Derivative reactions

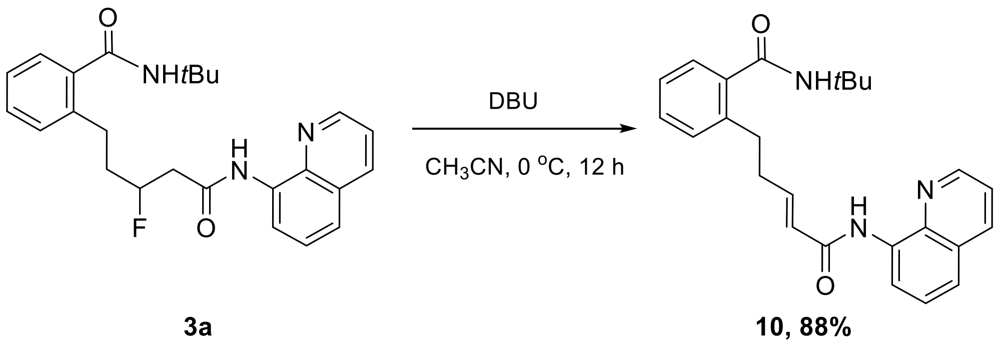
(a) Removal experiment of 8-aminoquinoline directing group



9, 65%

To a dry Schlenk flask were added **3a** (84.2 mg, 0.20 mmol, 1.0 equiv), anhydrous EtOH (2.0 mL) and BF_3 Et_2O (0.32 mL, 1.2 mmol, 6.0 equiv, 48% in Et_2O) at ambient temperature. The mixture was degassed three times with argon and refluxed at 100 ℃ (oil bath) for 15 hrs. Once completion, the reaction was cooled to ambient temperature, diluted with DCM (10 mL) and quenched by Et_3N (0.28 mL, 2.0 mmol, 10 equiv). Rotary evaporation of the organic solvent and further purification using column chromatography (PE/EA = 5:1) afforded **9** as colorless oil (42.0 mg, 65% yield).

(b) HF Elimination of product **3a**



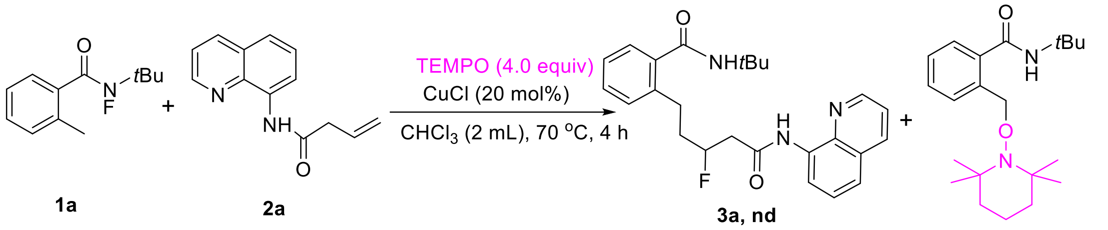
3a

10, 88%

To a solution of the compound **3a** (84.2 mg, 0.20 mmol, 1.0 equiv) in CH_3CN (2.0 mL) was added 1,8-diazabicyclo[5.4.0]undec-7-ene (DBU, 60 μL, 0.40 mmol, 2.0 equiv) at 0°C, and the reaction mixture was stirred at this temperature for 12 hr. After completed, the solvent was removed under reduced pressure and the residue was purified by column chromatography using eluents (PE/EA = 1:2) to afford the desired product **10** as a yellow oil (70.4 mg, 88%).

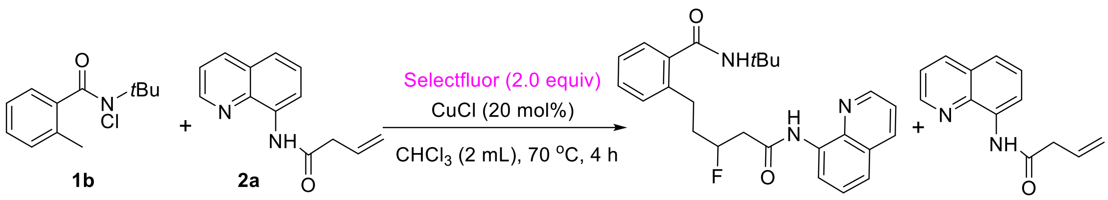
(5) Control experiments

(a) Free radical capture experiment



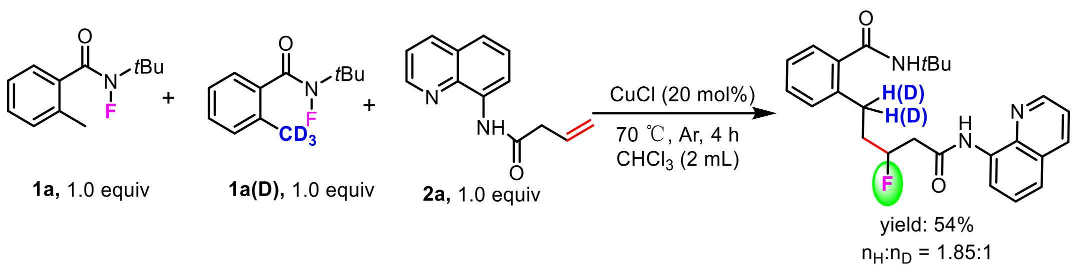
The CuCI (1.9 mg, 0.02 mmol, 20 mol %) was added into a reaction tube filled with nitrogen, then unactivated alkene **2a** (0.1 mmol, 1.0 equiv), *N*-fluorobenzamide **1a** (0.2 mmol, 2.0 equiv) 2,2,2,6,6-tetramethylpyridine oxide (TEMPO) (31.2 mg, 0.2 mmol, 2.0 equiv) in $CHCI_3$ (2 mL) were added under nitrogen. The reaction mixture was continuously stirred at 70 ℃ for 4 h. After that process, the resulting mixture was filtrated by a sand core funnel filled with silica gel and washed with DCM (5 mL). The combined filtrates were concentrated under vacuum and were detected by HRMS (ESI) to determine the obtained substance as compound **11**.

(b) 1,5-HAT validation experiment



The CuCl (1.9 mg, 0.02 mmol) and Selectfluor (70.8 mg, 0.2 mmol) was added into a reaction tube filled with nitrogen, then unactivated alkene **2a** (0.1 mmol, 1.0 equiv), *N*-chlorobenzamide **1b** (0.2 mmol, 2.0 equiv) in $CHCl_3$ (2 mL) were added under nitrogen. The reaction mixture was continuously stirred at 70 ℃ for 4 h. The combined filtrates were concentrated under vacuum and purified by column chromatography on silica. The product **3a** was not detected, and the alkene substrate **2a** was recovered in 45% yield.

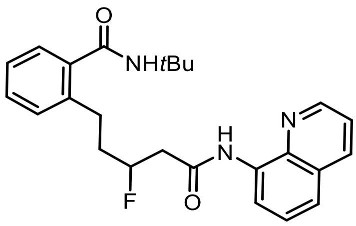
(c) Deuterium labeling experiment



The CuCl (1.9 mg, 0.02 mmol, 20 mol %) was added into a reaction tube filled with nitrogen, then unactivated alkene **2a** (0.1 mmol, 1.0 equiv), *N*-fluorobenzamide **1a** (0.1 mmol, 1.0 equiv) and deuterated *N*-fluorobenzamide **1a(D)** (0.1 mmol, 1.0 equiv) in $CHCl_3$ (2 mL) were added under nitrogen. The reaction mixture was continuously stirred at 70 ℃ for 4 h. After completion, the reaction mixture was filtered by sand core funnel with small amount of short silica gel filled and elution with DCM solvent, then the combined filtrates were concentrated under vacuum, the resulting residue was purified by column chromatography on silica gel to give the products **3a(H)** and **3a(D)** as a white solid 54% total yield (1.78 mg). The nH : nD ratio was determined by ^{1}H NMR.

III. Characterization Data of Compounds

(3a) *N*-(*tert*-butyl)-2-(3-fluoro-5-*oxo*-5-(quinolin-8-ylamino)pentyl) benzamide



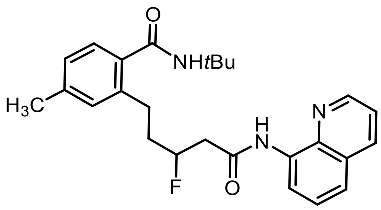
White solid, 27.3 mg, yield 65%. m.p. 112-114 °C. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 9.89 (s, 1H), 8.71 (m, *J* = 8.9, 5.2, 2.1 Hz, 2H), 8.08 (dd, *J* = 8.3, 1.5 Hz, 1H), 7.48 - 7.42 (m, 2H), 7.38 (dd, *J* = 8.3, 4.2 Hz, 1H), 7.24 (t, *J* = 7.2 Hz, 2H), 7.19 (t, *J* = 3.5 Hz, 2H), 7.13 (t, *J* = 7.3 Hz, 1H), 5.58 (s, 1H), 5.10 (s, 1H), 4.98 (dt, *J* = 8.0, 3.8 Hz, 1H), 3.06 - 2.94 (m, 1H), 2.91 - 2.79 (m, 3H), 2.77 - 2.66 (m, 1H), 2.12 - 1.97 (m, 2H), 1.37 (s, 9H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 169.7, 168.0 (d, *J* = 3.4 Hz), 148.3, 138.8, 137.9, 136.3, 134.4, 130.3, 129.7, 127.9, 127.3, 126.8, 126.2, 121.7 (d, *J* = 11.4 Hz), 116.7, 91.3, 89.6, 51.8, 44.0 (d, *J* = 22.5 Hz), 36.7 (d, *J* = 20.7 Hz), 29.7(s), 28.8.

^{19}F NMR (376 MHz, $CDCl_3$) δ -179.89 – -180.09 (m, 1F).

HRMS (ESI) calcd for $C_{25}H_{29}FN_3O_2^+$ [M+H]$^+$: 422.2238; found 422.2242.

(3b) *N*-(*tert*-butyl)-2-(3-fluoro-5-*oxo*-5-(quinolin-8-ylamino)pentyl)-4-methyl-benzamide



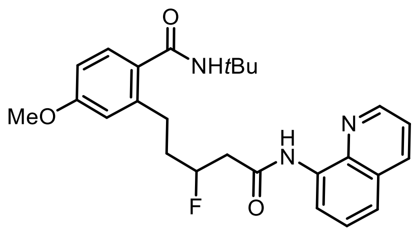
Colorless liquid, 31.7 mg, yield 73%. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 9.98 (s, 1H), 8.83 - 8.74 (m, 2H), 8.15 (d, *J* = 8.2 Hz, 1H), 7.52 (d, *J* = 6.4 Hz, 2H), 7.45 (dd, *J* = 8.2, 4.2 Hz, 1H), 7.22 (d, *J* = 7.7 Hz, 1H), 7.03 (dd, *J* = 18.5, 11.5 Hz, 2H), 5.20 (s, 1H), 5.11 - 5.03 (m, 1H), 3.06 - 2.75 (m, 4H), 2.33 (s, 3H), 2.17 - 2.05 (m, 3H), 1.45 (s, 9H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 169.8, 168.0 (d, *J* = 3.5 Hz), 148.3, 139.7, 138.8, 136.3, 135.0, 134.3, 131.1, 127.9, 127.3, 126.8, 126.8, 121.7 (d, *J* = 11.8 Hz), 116.7, 91.4, 89.7, 77.4, 77.1, 76.8, 51.7, 44.0 (d, *J* = 22.8 Hz), 36.8 (d, *J* = 20.6 Hz), 28.8, 21.3 (s), 14.2.

^{19}F NMR (376 MHz, $CDCl_3$) δ -180.06 (s, 1F).

HRMS (ESI) calcd for $C_{26}H_{30}FN_3O_2Na^+$ $[M+Na]^+$: 458.2214; found 458.2214.

(3c) *N*-(*tert*-butyl)-2-(3-fluoro-5-*ox*o-5-(quinolin-8-ylamino)pentyl)-4-methoxybenzamide



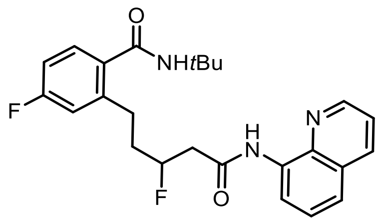
Colorless liquid, 34.6 mg, yield 77%. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 9.99 (s, 1H), 8.83 (dd, *J* = 4.2, 1.6 Hz, 1H), 8.78 (dd, *J* = 6.3, 2.6 Hz, 1H), 8.17 (dd, *J* = 8.3, 1.6 Hz, 1H), 7.55 - 7.52 (m, 2H), 7.47 (dd, *J* = 8.3, 4.2 Hz, 1H), 7.30 - 7.27 (m, 1H), 6.80 (d, *J* = 2.5 Hz, 1H), 6.73 (dd, *J* = 8.4, 2.5 Hz, 1H), 5.65 (s, 1H), 5.21 (dt, *J* = 12.1, 8.1 Hz, 1H), 5.09 (m, *J* = 12.1, 4.0 Hz, 1H), 3.82 (s, 3H), 3.14 - 3.04 (m, 1H), 2.99 - 2.89 (m, 2H), 2.87 - 2.75 (m, 1H), 2.20 - 2.04 (m, 2H), 1.45 (s, 9H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 169.4, 168.0, 167.9 (d, *J* = 3.4 Hz), 160.5, 148.3, 141.2, 138.4, 136.3, 134.4, 130.4, 128.5, 127.9, 127.3, 121.7 (d, *J* = 8.9 Hz), 115.8, 111.3, 91.3, 89.6, 55.3, 51.6, 44.0 (d, *J* = 22.5 Hz), 36.6 (d, *J* = 20.5 Hz), 29.1 (d, *J* = 4.8 Hz), 28.8.

^{19}F NMR (376 MHz, $CDCl_3$) δ -182.60 (s, 1F).

HRMS (ESI) calcd for $C_{31}H_{32}N_3O_2Na^+$ $[M+Na]^+$: 474.2163; found 474.2161.

(3d) *N*-(*tert*-butyl)-4-fluoro-2-(3-fluoro-5-*oxo*-5-(quinolin-8-ylamino)pentyl)benzamide



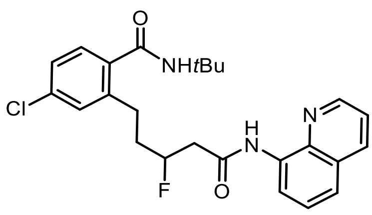
Colorless liquid, 25.4 mg, yield 58%. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 9.88 (s, 1H), 8.73 (dd, *J* = 5.5, 4.5 Hz, 1H), 8.67 (dt, *J* = 7.6, 3.8 Hz, 1H), 8.09 - 8.04 (m, 1H), 7.43 (dd, *J* = 6.8, 3.9 Hz, 2H), 7.37 (dd, *J* = 8.2, 4.2 Hz, 1H), 7.22 (dt, *J* = 11.1, 6.3 Hz, 1H), 6.93 - 6.83 (m, 1H), 6.80 (td, *J* = 8.2, 2.4 Hz, 1H), 5.58 (d, *J* = 10.4 Hz, 1H), 5.09 (t, *J* = 11.9 Hz, 1H), 4.97 (m, *J* = 8.1, 3.9 Hz, 1H), 3.04 - 2.92 (m, 1H), 2.91 - 2.77 (m, 2H), 2.76 - 2.64 (m, 1H), 2.64 - 2.39 (m, 1H), 2.11 - 1.94 (m, 2H), 1.35 (d, *J* = 6.8 Hz, 9H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 168.8, 167.8 (d, *J* = 3.7 Hz), 161.8 (s), 148.3, 142.0 (d, *J* = 7.7 Hz), 138.3, 136.3, 134.3, 134.1 (d, *J* = 3.0 Hz), 128.8 (d, *J* = 8.6 Hz), 127.9, 127.3, 121.7 (d, *J* = 13.3 Hz), 117.0 (d, *J* = 21.4 Hz), 116.6, 113.0 (d, *J* = 21.3 Hz), 91.1, 89.4, 51.9, 43.9 (d, *J* = 22.5 Hz), 36.3 (d, *J* = 20.5 Hz), 28.7, 28.7 (d, *J* = 5.2 Hz)..

^{19}F NMR (376 MHz, $CDCl_3$) δ -111.02 (s, 1F), -180.35 (s, 1F).

HRMS (ESI) calcd for $C_{25}H_{28}F_2N_3O_2^+$ $[M+H]^+$: 462.1964; found:462.1965.

(3e) *N*-(*tert*-butyl)-4-chloro-2-(3-fluoro-5-*oxo*-5-(quinolin-8-ylamino)pentyl)benzamide



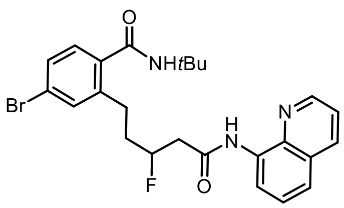
Colorless liquid, 24.7 mg, yield 55 %. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 9.88 (s, 1H), 8.73 (d, *J* = 3.6 Hz, 1H), 8.67 (dd, *J* = 5.8, 2.7 Hz, 1H), 8.07 (d, *J* = 8.2 Hz, 1H), 7.46 - 7.40 (m, 2H), 7.37 (dd, *J* = 8.2, 4.2 Hz, 1H), 7.17 (t, *J* = 7.3 Hz, 2H), 7.09 (d, *J* = 7.0 Hz, 1H), 5.59 (s, 1H), 5.09 (s, 1H), 5.00 - 4.92 (m, 1H), 3.06 - 2.60 (m, 5H), 2.01 (m, *J* = 16.9, 14.2, 7.5 Hz, 2H), 1.35 (s, 9H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 168.1, 167.8 (d, *J* = 3.4 Hz), 148.3, 139.3, 138.3, 137.3, 136.3, 134.3, 131.9, 131.8, 129.6, 127.9, 127.3, 126.8, 121.7 (d, *J* = 12.7 Hz), 116.6, 91.1, 89.4, 52.1, 44.0 (d, *J* = 22.7 Hz), 36.5(d, *J* = 20.6 Hz), 28.7, 28.2 (d, *J* = 4.3 Hz).

^{19}F NMR (376 MHz, $CDCl_3$) δ -180.35 (s, 1F).

HRMS (ESI) calcd for $C_{27}H_{32}N_3O_2Na^+$ $[M+Na]^+$: 478.1668; found: 478.1665.

(3f) 4-bromo-*N*-(*tert*-butyl)-2-(3-fluoro-5-*oxo*-5-(quinolin-8-ylamino)pentyl)benzamide



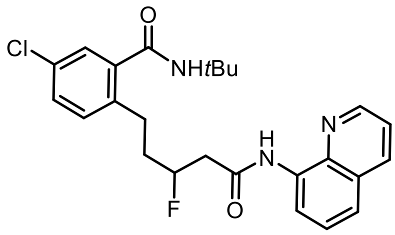
Colorless liquid, 18.9 mg, yield 38 %. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 9.89 (s, 1H), 8.75 - 8.72 (m, 1H), 8.68 (dd, *J* = 5.9, 3.0 Hz, 1H), 8.08 (dd, *J* = 8.2, 1.3 Hz, 1H), 7.47 - 7.42 (m, 2H), 7.38 (dd, *J* = 8.3, 4.2 Hz, 1H), 7.34 (d, *J* = 1.3 Hz, 1H), 7.26 (dd, *J* = 8.1, 1.5 Hz, 1H), 7.10 (d, *J* = 8.1 Hz, 1H), 5.58 (s, 1H), 5.09 (t, *J* = 12.1 Hz, 1H), 4.97 (m, *J* = 8.0, 3.9 Hz, 1H), 2.98 - 2.67 (m, 4H), 2.12 - 1.94 (m, 2H), 1.35 (d, *J* = 7.9 Hz, 9H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 168.6, 167.7 (d, *J* = 3.9 Hz), 148.3, 141.2, 138.3, 136.7, 136.3, 134.3, 133.2, 129.3, 128.3, 127.9, 127.3, 123.7, 121.7 (d, *J* = 13.5 Hz), 116.7, 91.2, 89.5, 52.0, 43.9 (d, *J* = 22.6 Hz), 36.4 (d, *J* = 20.6 Hz), 28.7, 28.6 (d, *J* = 4.4 Hz).

^{19}F NMR (376 MHz, $CDCl_3$) δ -180.35 (s, 1F).

HRMS (ESI) calcd for $C_{25}H_{26}F_2N_3O_2Na^+$ $[M+Na]^+$: 522.1163; found: 522.1155.

(3g) ***N*-(*tert*-butyl)-4-chloro-2-(3-fluoro-5-*oxo*-5-(quinolin-8-ylamino)pentyl)benzamide**



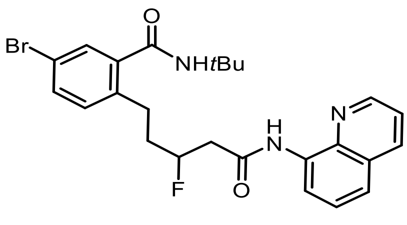
Colorless liquid, 23.2 mg, yield 51 %. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 9.87 (s, 1H), 8.76 - 8.66 (m, 2H), 8.08 (d, *J* = 8.2 Hz, 1H), 7.46 - 7.42 (m, 2H), 7.38 (dd, *J* = 8.2, 4.2 Hz, 1H), 7.21 - 7.18 (m, 2H), 7.11 (d, *J* = 8.8 Hz, 1H), 5.60 (s, 1H), 5.07 (t, *J* = 12.0 Hz, 1H), 4.95 (dt, *J* = 12.0, 4.0 Hz, 1H), 2.98 - 2.64 (m, 4H), 2.01 (m, *J* = 23.8, 16.1, 8.7 Hz, 2H), 1.36 (s, 9H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 168.1, 167.8 (d, *J* = 3.4 Hz), 148.3, 139.3, 138.3, 137.3, 136.3, 134.3, 131.9, 131.8, 129.6, 127.9, 127.3, 126.8, 121.7 (d, *J* = 12.7 Hz), 116.6, 91.1, 89.4, 52.1, 43.9 (d, *J* = 22.7 Hz), 36.5 (d, *J* = 20.6 Hz), 28.7, 28.2 (d, *J* = 4.3 Hz).

^{19}F NMR (376 MHz, $CDCl_3$) δ -180.40 (s, 1F).

HRMS (ESI) calcd for $C_{25}H_{26}F_2N_3O_2Na^+$ $[M+Na]^+$: 478.1668; found: 478.1665.

(3h) **5-bromo-*N*-(*tert*-butyl)-2-(3-fluoro-5-*oxo*-5-(quinolin-8-ylamino)pentyl)benzamide**



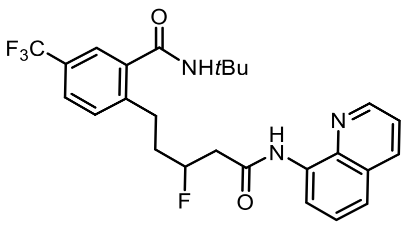
Colorless liquid, 16.4 mg, yield 33 %. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 9.90 (s, 1H), 8.74 (d, *J* = 2.8 Hz, 1H), 8.69 (dd, *J* = 6.3, 2.4 Hz, 1H), 8.09 (d, *J* = 8.2 Hz, 1H), 7.48 - 7.43 (m, 2H), 7.38 (dd, *J* = 8.3, 4.2 Hz, 1H), 7.24 (d, *J* = 7.3 Hz, 1H), 7.19 (d, *J* = 4.9 Hz, 1H), 7.13 (t, *J* = 7.5 Hz, 1H), 5.56 (s, 1H), 5.11 (s, 1H), 4.99 (dt, *J* = 8.2, 4.1 Hz, 1H), 3.08 - 2.94 (m, 1H), 2.89 - 2.78 (m, 2H), 2.77 - 2.67 (m, 1H), 2.13 - 1.97 (m, 2H), 1.38 (s, 9H)

^{13}C NMR (101 MHz, $CDCl_3$) δ 169.7, 168.0 (d, J = 2.0 Hz), 148.4, 138.8, 137.9, 136.4, 134.8, 134.4, 134.3, 130.4, 129.7, 127.9, 127.3, 126.8, 126.2, 121.7 (d, J = 11.9 Hz), 91.3, 89.6, 51.8, 44.0 (d, J = 22.5 Hz), 36.7 (d, J = 17.0 Hz), 28.7, 28.7. (d, J = 5.9 Hz)

^{19}F NMR (376 MHz, $CDCl_3$) δ -180.00 (s, 1F).

HRMS (ESI) calcd for $C_{25}H_{26}F_2N_3O_2Na^+$ $[M+Na]^+$:522.1163; found: 522.1157.

(3i) *N*-(*tert*-butyl)-2-(3-fluoro-5-*oxo*-1-phenyl-5-(quinolin-8 ylamino)pentyl)-4-(trifluoromethyl) benzamide



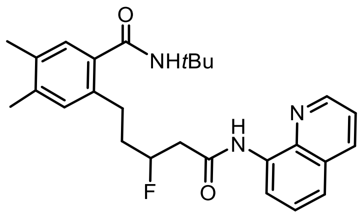
Colorless liquid, 7.3 mg, yield 13 %. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 9.88 (s, 1H), 8.73 (dd, J = 4.1, 1.4 Hz, 1H), 8.67 (dd, J = 5.4, 3.6 Hz, 1H), 8.08 (dd, J = 8.3, 1.3 Hz, 1H), 7.50 - 7.43 (m, 4H), 7.38 (dd, J = 8.2, 4.2 Hz, 1H), 7.31 (d, J = 7.8 Hz, 1H), 5.12 - 5.05 (m, 1H), 4.96 (m, J = 8.1, 4.0 Hz, 1H), 3.02 (dd, J = 14.3, 6.7 Hz, 1H), 2.92 - 2.67 (m, 3H), 2.12 - 1.98 (m, 2H), 1.38 (s, 9H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 168.2, 167.7 (d, J = 3.4 Hz), 148.3, 143.0, 138.4, 138.3, 136.4, 134.2, 130.8, 127.9, 127.3, 126.3 (d, J = 3.7 Hz), 125.2 (d, J = 1.5 Hz), 124.9 (d, J = 2.4 Hz), 123.7 (d, J = 3.7 Hz), 121.8 (d, J = 17.6 Hz), 116.7, 91.1, 89.4, 52.2, 43.9 (d, J = 22.6 Hz), 36.3 (d, J = 20.3 Hz), 28.8 (d, J = 4.6 Hz), 28.7.

^{19}F NMR (376 MHz, $CDCl_3$) δ -62.44 (s, 3F), -180.57 (s, 1F).

HRMS (ESI) calcd for $C_{25}H_{26}F_2N_3O_2Na^+$ $[M+Na]^+$:512.1934; found: 512.1934.

(3j) *N*-(*tert*-butyl)-2-(3-fluoro-5-*oxo*-5-(quinolin-8-ylamino)pentyl)-4,5-dimethylbenzamide



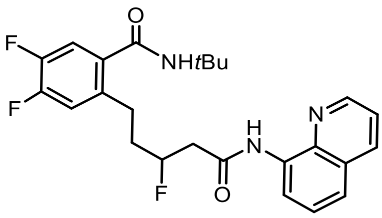
Colorless liquid, 24.6 mg, yield 55 %. **^{1}H NMR** (400 MHz, CDCl$_3$) δ 9.87 (s, 1H), 8.69 (m, J = 8.8, 5.3, 1.9 Hz, 2H), 8.04 (dd, J = 8.3, 1.5 Hz, 1H), 7.40 (dd, J = 6.1, 4.0 Hz, 2H), 7.36 - 7.32 (m, 1H), 6.98 (s, 1H), 6.91 (s, 1H), 5.58 (s, 1H), 5.13 - 5.05 (m, 1H), 4.97 (m, J = 8.0, 3.8 Hz, 1H), 2.97 - 2.63 (m, 5H), 2.12 (d, J = 3.9 Hz, 6H), 2.07 - 1.96 (m, 2H), 1.35 (s, 9H).

^{13}C NMR (101 MHz, CDCl$_3$) δ 169.8, 168.1 (s), 167.9, 148.3, 138.3, 136.3, 136.1, 135.1, 134.4, 134.4, 131.6, 128.0, 127.9, 127.3, 121.7 (d, J = 10.1 Hz), 116.7, 91.4, 89.7, 51.7, 44.1 (d, J = 22.5 Hz), 36.8 (d, J = 20.7 Hz), 28.8, 28.3 (d, J = 4.3 Hz), 19.6, 19.1.

^{19}F NMR (376 MHz, CDCl$_3$) δ -179.99 (s, 1F).

HRMS (ESI) calcd for $C_{25}H_{26}F_2N_3O_2Na^+$ $[M+Na]^+$:472.2371; found: 472.2369.

(3k) *N*-(*tert*-butyl)-4,5-difluoro-2-(3-fluoro-5-*oxo*-5-(quinolin-8-ylamino)pentyl)benzamide



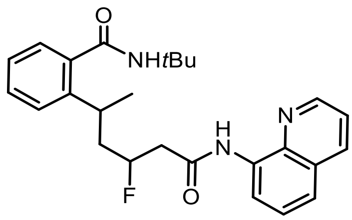
Colorless liquid, 21.4 mg, yield 47 %. **^{1}H NMR** (400 MHz, CDCl$_3$) δ 10.00 (s, 1H), 8.84 (d, J = 4.0 Hz, 1H), 8.78 (dd, J = 5.4, 3.1 Hz, 1H), 8.21 (d, J = 8.2 Hz, 1H), 7.56 (d, J = 3.1 Hz, 2H), 7.50 (dd, J = 8.2, 4.2 Hz, 1H), 7.19 - 7.06 (m, 2H), 5.65 (s, 1H), 5.17 (s, 1H), 5.10 - 5.01 (m, 1H), 3.05 - 2.77 (m, 4H), 2.19 - 2.01 (m, 2H), 1.46 (s, 9H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 167.7 (d, J = 3.8 Hz), 167.4, 149.3 (d, J = 12.9 Hz), 148.3, 143.0 (d, J = 1.7 Hz), 138.3, 136.4, 136.2 (d, J = 9.9 Hz), 134.2, 134.1 (d, J = 4.3 Hz), 127.9, 127.3, 121.8 (d, J = 18.2 Hz), 119.1 (d, J = 17.1 Hz), 116.7, 116.2 (d, J = 17.5 Hz), 91.0, 89.3, 52.2, 43.9 (d, J = 22.8 Hz), 36.3 (d, J = 20.4 Hz), 28.7, 28.2 (d, J = 4.6 Hz)

^{19}F NMR (376 MHz, $CDCl_3$) δ -137.94 (d, J = 20.7 Hz, 1F), -142.65 (d, J = 21.8 Hz, 1F), -182.93.

HRMS (ESI) calcd for $C_{26}H_{30}N_3O_2Na^+$ $[M+Na]^+$: 480.1869; found 480.1865.

(3l) *N*-(*tert*-butyl)-2-(4-fluoro-6-*oxo*-6-(quinolin-8-ylamino)hexan-2-yl)benzamide



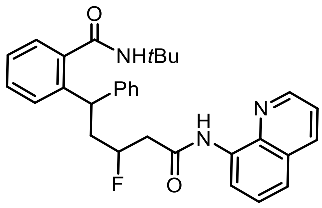
Colorless liquid, 27.4 mg, yield 63%. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 9.96 (s, 1H), 8.84 - 8.80 (m, 1H), 8.79 - 8.73 (m, 1H), 8.18 (d, J = 8.3 Hz, 2H), 7.56 - 7.52 (m, 3H), 7.47 (dd, J = 8.2, 4.2 Hz, 2H), 7.37 (t, J = 5.5 Hz, 3H), 7.34 - 7.28 (m, 3H), 7.24 - 7.18 (m, 2H), 5.84 (d, J = 9.4 Hz, 1H), 5.16 - 5.08 (m, 1H), 4.99 (dd, J = 12.4, 6.9 Hz, 1H), 4.96 - 4.89 (m, 1H), 4.80 (t, J = 8.7 Hz, 1H), 3.49 (m, J = 20.9, 6.8 Hz, 2H), 2.96 - 2.81 (m, 2H), 2.69 (m, J = 32.4, 15.0, 3.5 Hz, 1H), 2.31 - 2.11 (m, 2H), 2.02 (m, J = 19.6, 12.6, 5.0 Hz, 1H), 1.47 (s, 13H), 1.40 (d, J = 6.5 Hz, 3H), 1.36 (d, J = 6.9 Hz, 2H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 169.9, 169.8, 168.1 (d, J = 3.3 Hz), 167.9 (d, J = 4.2 Hz), 148.2, 143.7, 142.6, 138.7, 138.4, 137.9, 136.3, 134.4, 134.3, 129.8, 129.7, 127.9, 127.3, 126.9, 126.6, 126.5, 126.3, 126.2, 126.1, 121.8 (d, J = 4.1 Hz), 121.6 (s), 116.6, 116.6, 90.8, 90.7, 89.1, 89.0, 51.9, 51.8, 44.0 (d, J = 22.3 Hz), 43.9 (d, J = 20.0 Hz), 43.1, 42.9, 32.0 (d, J = 3.5 Hz), 32.0 (d, J = 5.6 Hz), 31.7, 31.7, 28.8, 28.7, 23.6 (s), 22.3 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ -178.19 (s, 1F), -178.77 (s, 1F).

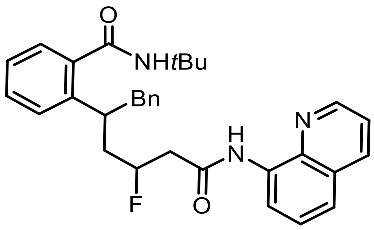
HRMS (ESI) calcd for $C_{26}H_{30}N_3O_3Na^+$ $[M+Na]^+$: 458.2214; found 458.2210.

(3m) (*E*)-*N*-(*tert*-butyl)-4-methyl-2-(5-*oxo*-5-(quinolin-8-ylamino)pent-2-en-1-yl)benzamide



Colorless liquid, 8.9 mg, yield 18%. **^{1}H NMR** (400 MHz, $CDCl_3$) *δ* 9.93 (s, 2H), 8.78 (dd, *J* = 4.1, 1.7 Hz, 2H), 8.75 - 8.69 (m, 2H), 8.16 - 8.11 (m, 2H), 7.50 (dd, *J* = 5.9, 2.7 Hz, 3H), 7.43 (m, *J* = 8.1, 4.1, 2.1 Hz, 2H), 7.37 (d, *J* = 7.7 Hz, 3H), 7.33 - 7.30 (m, 3H), 7.30 - 7.24 (m, 4H), 7.18 (dd, *J* = 13.1, 5.6 Hz, 3H), 5.78 (s, 1H), 5.59 (s, 1H), 5.00 (td, *J* = 8.1, 4.0 Hz, 1H), 4.92 - 4.81 (m, 2H), 2.96 - 2.85 (m, 2H), 2.74 (m, *J* = 31.7, 15.1, 3.7 Hz, 1H), 2.53 (m, *J* = 13.6, 11.8, 4.4 Hz, 3H), 1.42 (s, 9H), 1.40 (s, 4H).
^{13}C NMR (101 MHz, $CDCl_3$) *δ* 169.7, 169.6, 167.9 (d, *J* = 3.2 Hz), 167.8 (d, *J* = 3.3 Hz), , 148.3, 148.3, 144.0, 143.2, 141.4, 140.2, 138.9, 138.3, 138.3, 138.1, 136.4, 136.3, 134.3, 134.3, 129.8, 129.8, 128.7, 128.6, 128.6, 128.6, 128.2, 127.9, 127.8, 127.7, 127.5, 127.5, 127.3, 127.3, 126.6, 126.5, 126.4, 126.3, 121.8 (d, *J* = 7.8 Hz), 121.7 (d, *J* = 3.2 Hz), 116.6, 116.6, 90.4, 90.3, 88.7, 88.6, 51.9, 51.9, 44.3 (d, *J* = 22.8 Hz), 44.0 (d, *J* = 22.7 Hz), 41.8 (d, *J* = 5.2 Hz), 41.7 (d, *J* = 4.6 Hz), 28.7, 28.7, 28.2 (s), 28.2 (s).
^{19}F NMR (376 MHz, $CDCl_3$) *δ* -179.93 (s, 1F), -180.52 (s, 1F).
HRMS (ESI) calcd for $C_{26}H_{30}N_3O_3Na^+$ $[M+Na]^+$: 520.2371; found 520.2376.

(3n) *N*-(*tert*-butyl)-2-(4-fluoro-6-*oxo*-1-phenyl-6-(quinolin-8-ylamino)hexan-2-yl)benzamide



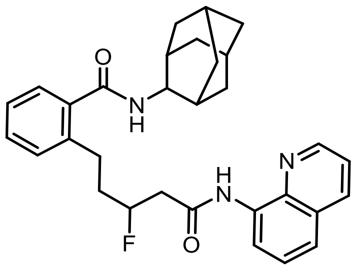
Colorless liquid, 6.12 mg, yield 12%. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 9.80 (s, 1H), 8.70 - 8.60 (m, 2H), 8.06 (d, J = 7.4 Hz, 1H), 7.44 - 7.40 (m, 2H), 7.35 (dd, J = 8.2, 4.2 Hz, 1H), 7.32 - 7.23 (m, 2H), 7.19 - 7.07 (m, 5H), 7.01 (d, J = 7.1 Hz, 2H), 4.91 - 4.82 (m, 1H), 4.75 (t, J = 8.6 Hz, 1H), 2.99 (dd, J = 13.3, 6.4 Hz, 1H), 2.77 - 2.51 (m, 3H), 2.09 - 2.02 (m, 1H), 1.96 (s, 5H), 1.31 (s, 9H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 171.2, 169.6, 167.9 (d, J = 3.5 Hz), 148.2, 140.4, 140.1, 139.3, 138.3, 136.30, 134.3, 129.6, 129.3, 128.3, 127.9, 127.3, 127.0, 126.4, 126.1, 121.7 (d, J = 12.9 Hz), 116.6, 90.4, 88.8, 60.4, 51.7, 44.3 (d, J = 5.9 Hz), 39.7 (d, J = 6.4 Hz), 28.6, 28.5 (d, J = 1.2 Hz).

^{19}F NMR (376 MHz, $CDCl_3$) δ -178.93 (s, 1F).

HRMS (ESI) calcd for $C_{25}H_{27}FN_3O_2Na^+$ $[M+Na]^+$: 534.2527; found 534.2524.

(3o) *N*-((3s,5s,7s)-adamantan-1-yl)-2-(3-fluoro-5-*oxo*-5-(quinolin-8-ylamino)pentyl)benzamide



Colorless liquid, 23.4 mg, yield 47 %. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 9.89 (s, 1H), 8.75 - 8.64 (m, 2H), 8.07 (d, J = 8.2 Hz, 1H), 7.44 (d, J = 6.2 Hz, 2H), 7.37 (dd, J = 8.2, 4.2 Hz, 1H), 7.23 (t, J = 6.2 Hz, 2H), 7.17 (d, J = 7.7 Hz, 1H), 7.13 (d, J = 7.4 Hz, 1H), 5.44 (s, 1H), 5.11 (d, J = 23.5 Hz, 1H), 5.02 - 4.95 (m, 1H), 3.06 - 2.94 (m, 1H), 2.84

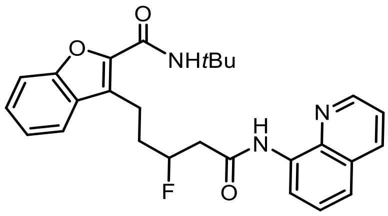
(m, *J* = 15.7, 11.8, 6.2 Hz, 3H), 2.77 - 2.66 (m, 1H), 2.01 (d, *J* = 8.9 Hz, 10H), 1.60 (s, 5H).

^{13}C NMR (101 MHz, $CDCl_3$) *δ* 169.4, 168.0 (d, *J* = 2.9 Hz), 148.2, 138.7, 138.0, 136.4, 134.3, 130.4, 129.6, 127.9, 127.3, 126.8, 126.2, 121.7 (d, *J* = 11.0), 116.7, 91.3, 89.6, 52.6, 44.0 (d, *J* = 22.2 Hz), 41.6, 36.7 (d, *J* = 20.4 Hz), 36.3, 29.5, 28.8 (d, *J* = 4.6 Hz).

^{19}F NMR (376 MHz, $CDCl_3$) *δ* -182.41 (s, 1F).

HRMS (ESI) calcd for $C_{25}H_{27}FN_3O_2Na^+$ $[M+Na]^+$: 522.2527; found 522.2527.

(3p) *N*-(*tert*-butyl)-2-(3-fluoro-5-*oxo*-5-(quinolin-8-ylamino)pentyl)benzofuran-3-carboxamide

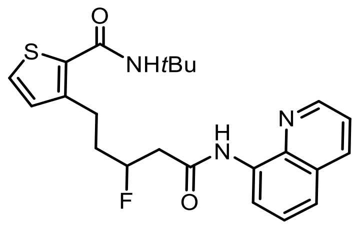


Colorless liquid, 19.3 mg, yield 43 %. **^{1}H NMR** (400 MHz, $CDCl_3$) *δ* 9.90 (s, 1H), 8.72 (dd, *J* = 4.2, 1.6 Hz, 1H), 8.68 (dd, *J* = 6.5, 2.4 Hz, 1H), 8.05 (dt, *J* = 5.3, 2.6 Hz, 1H), 7.60 (d, *J* = 7.8 Hz, 1H), 7.45 - 7.40 (m, 2H), 7.37 - 7.29 (m, 3H), 7.21 - 7.16 (m, 1H), 6.42 (s, 1H), 5.15 (dt, *J* = 13.6, 6.7 Hz, 1H), 5.03 (m, *J* = 11.9, 8.0, 4.0 Hz, 1H), 3.35 - 3.27 (m, 1H), 3.24 - 3.17 (m, 1H), 2.91 - 2.74 (m, 2H), 2.21 - 2.07 (m, 2H), 1.41 (s, 9H). **^{13}C NMR** (101 MHz, $CDCl_3$) *δ* 168.0 (d, *J* = 2.4 Hz) , 159.3, 153.1, 148.3, 143.5, 138.4, 136.3, 134.4, 129.2, 127.9, 127.3, 126.9 , 124.7, 123.3, 121.6 (d, *J* = 7.5 Hz), 121.0, 116.7, 111.5, 91.5 , 89.8 , 51.6, 44.0 (d, *J* = 22.4 Hz), 34.9 (d, *J* = 20.5 Hz), 29.0, 19.3 (d, *J* = 5.0 Hz).

^{19}F NMR (376 MHz, $CDCl_3$) *δ* -180.07 (s, 1F).

HRMS (ESI) calcd for $C_{25}H_{27}FN_3O_2Na^+$ $[M+Na]^+$: 484.2007; found 484.2006.

(3q) *N*-(*tert*-butyl)-8-(3-fluoro-5-*oxo*-5-(quinolin-8-ylamino)pentyl)-5,6,7,8-tetrahydronaphthalene-1-carboxamide



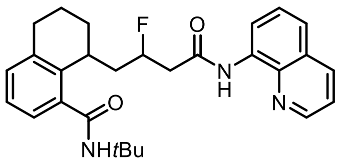
Colorless liquid, 21.6 mg, yield 47 %. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 9.90 (s, 1H), 8.74 (dd, J = 4.2, 1.6 Hz, 1H), 8.69 (dd, J = 6.3, 2.7 Hz, 1H), 8.08 (dd, J = 8.3, 1.6 Hz, 1H), 7.47 - 7.42 (m, 2H), 7.38 (dd, J = 8.3, 4.2 Hz, 1H), 7.16 (d, J = 5.0 Hz, 1H), 6.87 (d, J = 5.0 Hz, 1H), 5.68 (s, 1H), 5.11 (dd, J = 14.3, 10.0 Hz, 1H), 4.99 (m, J = 8.1, 3.9 Hz, 1H), 3.06 (m, J = 22.0, 13.8, 6.4 Hz, 2H), 2.93 - 2.69 (m, 2H), 2.11 - 1.97 (m, 2H), 1.35 (s, 9H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 167.9 (d, J = 3.3 Hz), 162.3, 148.3, 143.8, 138.4, 136.3, 134.3, 132.6, 130.7, 127.9, 127.3, 125.9, 121.7 (d, J = 11.3 Hz), 116.7, 91.3, 89.6, 52.0, 44.0 (d, J = 22.7 Hz), 35.7 (d, J = 20.6 Hz), 28.9, 24.8 (d, J = 4.6 Hz).

^{19}F NMR (376 MHz, $CDCl_3$) δ -180.23 (s, 1F).

HRMS (ESI) calcd for $C_{25}H_{27}FN_3O_2Na^+$ $[M+Na]^+$: 450.1622; found 450.1622.

(3r) *N*-(*tert*-butyl)-8-(3-fluoro-5-*oxo*-5-(quinolin-8-ylamino)pentyl)-5,6,7,8-tetrahydronaphthalene-1-carboxamide



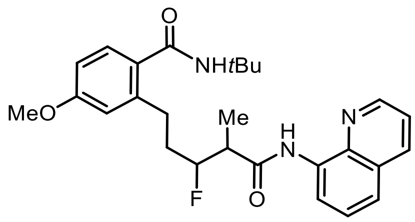
Colorless liquid, 21.6 mg, yield 47 %, *dr* = 5:3. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 9.93 (s, 1H), 8.75 - 8.69 (m, 2H), 8.07 (d, J = 8.2 Hz, 1H), 7.43 (t, J = 7.4 Hz, 2H), 7.37 (dd, J = 8.2, 4.2 Hz, 1H), 7.03 (m, J = 4.6 Hz, 3H), 5.27 (m, J = 8.4 Hz, 1H), 5.19 - 5.11 (m, 1H), 3.57 (d, J = 6.1 Hz, 1H), 2.89 - 2.64 (m, 5H), 2.12 - 1.98 (m, 2H), 1.93 - 1.80 (m, 2H), 1.70 (dd, J = 13.5, 10.2 Hz, 3H), 1.41 (s, 9H).

^{13}C NMR (101 MHz, CDCl$_3$) δ 170.2, 168.3 (d, J = 1.2 Hz), 148.3, 138.8, 138.4, 137.9, 137.5, 136.3, 134.5, 130.9, 127.9, 127.3, 125.7, 124.7, 121.6 (d, J = 4.3 Hz), 116.6, 92.3, 90.6, 51.8, 44.2 (d, J = 22.5 Hz), 40.5 (d, J = 19.1 Hz), 32.0 (d, J = 4.7 Hz), 29.3, 28.9, 26.1 (d, J = 1.7 Hz), 17.5.

^{19}F NMR (376 MHz, CDCl$_3$) δ -176.08 (s, 1F).

HRMS (ESI) calcd for $C_{25}H_{27}FN_3O_2Na^+$ [M+Na]$^+$: 484.2371; found :484.2365.

(3s) *N*-(*tert*-butyl)-2-(3-fluoro-4-methyl-5-*oxo*-5-(quinolin-8-ylamino)pentyl)-4-methoxybenzamide



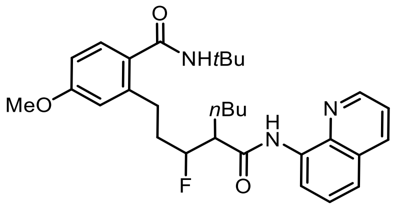
Colorless liquid, 17.8 mg, yield 41 %. **^{1}H NMR** (400 MHz, CDCl$_3$) δ 9.92 (s, 1H), 8.73 (m, J = 9.0, 5.5, 1.9 Hz, 2H), 8.08 (dd, J = 8.3, 1.5 Hz, 1H), 7.48 - 7.41 (m, 2H), 7.38 (dd, J = 8.3, 4.2 Hz, 1H), 7.22 - 7.13 (m, 2H), 6.71 - 6.58 (m, 2H), 5.52 (s, 1H), 4.82 - 4.75 (m, 1H), 4.70 - 4.63 (m, 1H), 3.71 (s, 3H), 3.08 - 2.97 (m, 1H), 2.82 (m, J = 21.0, 7.1 Hz, 2H), 2.14 - 1.93 (m, 2H), 1.35 (s, 9H), 1.26 (d, J = 7.0 Hz, 3H).

^{13}C NMR (101 MHz, CDCl$_3$) δ 171.9, 169.4 (s), 160.4, 148.2, 141.3, 136.4, 134.4, 130.4, 128.5, 127.9, 127.4, 121.6 (d, J = 5.0 Hz), 116.7, 115.9, 111.2, 95.4, 93.7, 77.4, 77.0, 76.7, 55.3, 51.6, 47.6 (d, J = 20.6 Hz), 34.1 (d, J = 20.7 Hz), 29.0 (d, J = 3.5 Hz), 28.8, 13.7 (d, J = 7.5 Hz).

^{19}F NMR (376 MHz, CDCl$_3$) δ -176.08 (s, 1F).

HRMS (ESI) calcd for $C_{27}H_{33}FN_3O_3^+$ [M+H]$^+$: 466.2500; found: 466.2507.

(3t) *N*-(*tert*-butyl)-2-(3-fluoro-4-(quinolin-8-ylcarbamoyl)octyl)-4-methoxybenzamide



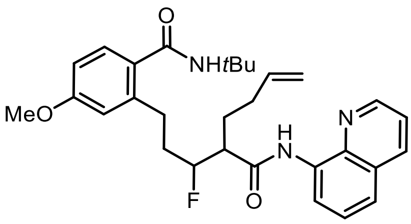
Colorless liquid, 18.1 mg, yield 38 %. **^{1}H NMR** (400 MHz, CDCl$_3$) δ 9.92 (s, 1H), 8.74 (dd, *J* = 6.6, 2.1 Hz, 2H), 8.08 (d, *J* = 8.1 Hz, 1H), 7.45 (d, *J* = 6.7 Hz, 2H), 7.38 (dd, J = 8.2, 4.3 Hz, 1H), 7.18 (d, *J* = 7.7 Hz, 1H), 6.70 - 6.58 (m, 2H), 5.51 (s, 1H), 4.78 (t, *J* = 6.7 Hz, 1H), 4.70 - 4.62 (m, 1H), 3.70 (s, 3H), 3.08 - 2.94 (m, 1H), 2.84 (dd, *J* = 13.6, 6.6 Hz, 1H), 2.63 (m, *J* = 16.1, 10.9, 6.9 Hz, 1H), 2.06 - 1.93 (m, 2H), 1.76 (d, *J* = 4.3 Hz, 1H), 1.54 (dd, *J* = 11.1, 5.8 Hz, 1H), 1.35 (s, 9H), 1.30 (d, *J* = 3.3 Hz, 4H), 0.80 (d, *J* = 7.0 Hz, 3H).

^{13}C NMR (101 MHz, CDCl$_3$) δ 171.3 (d, *J* = 2.6 Hz), 169.4, 160.4, 148.3, 141.3, 138.5, 136.3, 134.4, 131.8, 130.4, 128.4, 127.9, 127.4, 121.6 (d, *J* = 2.5 Hz), 116.6, 115.8, 113.7, 111.2, 93.2, 55.3, 54.2 (d, *J* = 19.6 Hz), 34.5 (d, *J* = 20.6 Hz), 29.5, 29.1 (d, *J* = 3.7 Hz), 28.8, 28.5 (d, *J* = 6.1 Hz), 22.7, 13.9.

^{19}F NMR (376 MHz, CDCl$_3$) δ -182.68 (s, 1F).

HRMS (ESI) calcd for $C_{30}H_{39}FN_3O_3^+$ [M+H]$^+$: 508.2970; found: 508.2975.

(3u) *N*-(*tert*-butyl)-2-(3-fluoro-4-(quinolin-8-ylcarbamoyl)oct-7-en-1-yl)-4-methoxybenzamide



Colorless liquid, 15.1 mg, yield 30 %. **^{1}H NMR** (400 MHz, Chloroform-*d*) δ 9.99 (s, 1H), 8.81 (dd, *J* = 6.7, 2.6 Hz, 2H), 8.16 (dd, *J* = 8.2, 1.5 Hz, 1H), 7.52 (dd, *J* = 7.3, 5.3

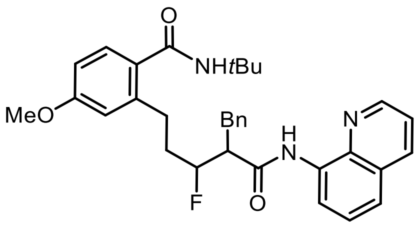
Hz, 2H), 7.46 (dd, *J* = 8.3, 4.2 Hz, 1H), 7.26 (s, 1H), 6.75 (d, *J* = 2.4 Hz, 1H), 6.69 (dd, *J* = 8.4, 2.5 Hz, 1H), 5.79 (m, *J* = 17.0, 10.2, 6.7 Hz, 1H), 5.59 (s, 1H), 5.01 (dd, *J* = 16.5, 13.9 Hz, 2H), 4.87 (t, *J* = 6.5 Hz, 1H), 4.75 (t, *J* = 6.3 Hz, 1H), 3.77 (d, *J* = 3.0 Hz, 3H), 3.08 (m, *J* = 14.4, 9.5, 5.3 Hz, 1H), 2.89 (m, *J* = 13.4, 9.4, 6.9 Hz, 1H), 2.81 - 2.71 (m, 1H), 2.24 - 1.93 (m, 6H), 1.42 (d, *J* = 3.8 Hz, 9H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 171.0 (d, *J* = 2.9 Hz), 169.4, 160.4, 148.3, 141.3, 138.5, 137.3, 136.3, 134.3, 130.4, 128.4, 127.9, 127.3, 121.7 (d, *J* = 7.8 Hz), 116.7, 115.9, 115.9, 111.2, 94.8, 93.1, 55.3, 53.2 (d, J = 20.0 Hz), 51.6, 34.4 (d, *J* = 20.8 Hz) 31.3, 28.8, 28.8 (d, *J* = 3.5 Hz), 27.7 (d, *J* = 6.1 Hz).

^{19}F NMR (376 MHz, $CDCl_3$) δ -182.60 (s, 1F).

HRMS (ESI) calcd for $C_{30}H_{37}FN_3O_3^+$ $[M+H]^+$: 506.2813; found: 506.2813.

(3v) 2-(4-benzyl-3-fluoro-5-*oxo*-5-(quinolin-8-ylamino)pentyl)-*N*-(*tert*-butyl)benzamide



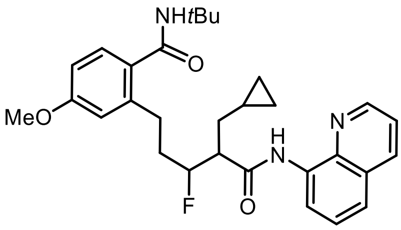
Colorless liquid, 11.2 mg, yield 22 %. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 9.88 (s, 1H), 8.77 (m, *J* = 8.9, 5.3, 2.0 Hz, 2H), 8.15 (dd, *J* = 8.2, 1.5 Hz, 1H), 7.51 (dd, *J* = 7.4, 5.4 Hz, 2H), 7.44 (dd, *J* = 8.2, 4.2 Hz, 1H), 7.29 (t, *J* = 5.7 Hz, 3H), 7.26 - 7.21 (m, 2H), 7.14 (d, *J* = 7.3 Hz, 1H), 6.75 (d, *J* = 2.4 Hz, 1H), 6.70 (dd, *J* = 8.4, 2.5 Hz, 1H), 5.59 (s, 1H), 4.90 (dd, *J* = 12.2, 5.1 Hz, 1H), 4.78 (dd, *J* = 12.1, 5.7 Hz, 1H), 3.78 (s, 3H), 3.20 - 3.09 (m, 2H), 3.08 - 2.89 (m, 3H), 2.26 - 2.12 (m, 2H), 1.41 (s, 9H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 170.2 (d, *J* = 2.6 Hz), 169.4, 160.4, 148.2, 141.3, 138.3, 136.2, 134.3, 130.3, 129.0, 128.6, 128.4, 127.8, 127.3, 126.5, 121.6 (d, *J* = 9.1 Hz), 116.6, 115.8, 111.3, 94.0, 92.2, 55.9 (d, *J* = 20.1 Hz), 55.3, 51.6, 34.7 (d, *J* = 5.8 Hz), 34.5 (d, *J* = 21.0 Hz), 29.4, 29.2 (d, *J* = 4.0 Hz), 28.8.

^{19}**F NMR** (376 MHz, $CDCl_3$) δ -185.14 (s, 1F).

HRMS (ESI) calcd for $C_{33}H_{37}FN_3O_3^+$ $[M+H]^+$: 542.2813; found: 542.2821.

(3w) *N*-(*tert*-butyl)-2-(4-(cyclopropylmethyl)-3-fluoro-5-*oxo*-5-(quinolin-8-ylamino)pentyl)-4-methoxybenzamide



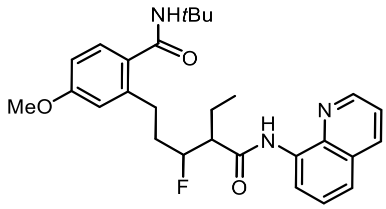
Colorless liquid, 11.6 mg, yield 23 %. ^{1}**H NMR** (400 MHz, $CDCl_3$) δ 9.97 (s, 1H), 8.78 - 8.70 (m, 2H), 8.08 (dd, J = 8.3, 1.6 Hz, 1H), 7.44 (q, J = 6.6 Hz, 2H), 7.37 (dd, J = 8.3, 4.2 Hz, 1H), 7.19 (s, 1H), 6.67 (d, J = 2.5 Hz, 1H), 6.61 (dd, J = 8.4, 2.6 Hz, 1H), 5.53 (s, 1H), 4.87 - 4.81 (m, 1H), 4.72 (td, J = 7.6, 3.9 Hz, 1H), 3.69 (s, 3H), 3.00 (m, J = 14.8, 9.5, 5.5 Hz, 1H), 2.87 - 2.70 (m, 2H), 2.10 - 1.96 (m, 2H), 1.78 (m, J = 13.8, 10.3, 6.5 Hz, 1H), 1.44 - 1.38 (m, 1H), 1.34 (s, 9H), 0.74 - 0.64 (m, 1H), 0.41 - 0.26 (m, 2H), 0.10 - 0.01 (m, 2H).

^{13}**C NMR** (101 MHz, $CDCl_3$) δ 171.4 (d, J = 2.2 Hz), 169.5, 160.4, 148.3, 141.4, 138.5, 136.3, 134.5, 130.3, 128.5, 127.9, 127.4, 121.6 (s), 116.6, 115.8, 111.2, 94.5, 92.8, 55.3, 54.5 (d, J = 19.8 Hz), 51.6, 34.5 (d, J = 21.0 Hz), 33.7 (d, J = 6.3 Hz), 29.1 (d, J = 3.6 Hz), 28.8, 9.0, 5.0, 4.2.

^{19}**F NMR** (376 MHz, $CDCl_3$) δ -183.00 (s, 1F).

HRMS (ESI) calcd for $C_{30}H_{37}FN_3O_3^+$ $[M+H]^+$: 506.2813; found: 506.2810.

(3x) *N*-(*tert*-butyl)-2-(3-fluoro-4-(quinolin-8-ylcarbamoyl)hexyl)-4-methoxybenzamide



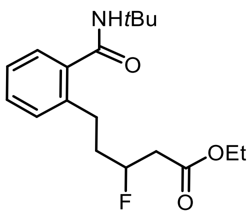
Colorless liquid, 11.9 mg, yield 25 %. ^{1}**H NMR** (400 MHz, $CDCl_3$) δ 9.93 (s, 1H), 8.78 - 8.70 (m, 2H), 8.09 (dd, *J* = 8.3, 1.6 Hz, 1H), 7.49 - 7.42 (m, 2H), 7.38 (dd, *J* = 8.3, 4.2 Hz, 1H), 7.19 (s, 1H), 6.67 (d, *J* = 2.5 Hz, 1H), 6.62 (dd, *J* = 8.4, 2.6 Hz, 1H), 5.52 (s, 1H), 4.83 - 4.77 (m, 1H), 4.68 (td, *J* = 8.3, 3.5 Hz, 1H), 3.70 (s, 3H), 3.00 (m, *J* = 14.7, 9.7, 5.4 Hz, 1H), 2.83 (m, *J* = 13.4, 9.4, 6.9 Hz, 1H), 2.57 (m, *J* = 11.4, 7.0, 4.6 Hz, 1H), 2.13 - 1.97 (m, 2H), 1.85 - 1.74 (m, 1H), 1.65 (dd, *J* = 7.4, 5.2 Hz, 1H), 1.35 (s, 9H), 0.95 (t, *J* = 7.4 Hz, 3H).

^{13}**C NMR** (101 MHz, $CDCl_3$) δ 171.2 (d, *J* = 1.6 Hz), 169.5, 160.4, 148.3, 141.3, 138.5, 136.3, 134.4, 130.4, 128.4, 127.9, 127.3, 121.6 (d, *J* = 3.1 Hz), 116.6, 115.8, 111.2, 94.7, 93.0, 55.6 (d, *J* = 19.4 Hz), 55.3, 51.6, 34.5 (d, *J* = 20.9 Hz), 29.1 (d, *J* = 3.9 Hz), 28.8, 22.0 (d, J = 6.7 Hz), 11.9.

^{19}**F NMR** (376 MHz, $CDCl_3$) δ -183.00 (s, 1F).

HRMS (ESI) calcd for $C_{28}H_{34}FN_3O_3Na^+$ $[M+Na]^+$: 502.2476; found: 502.2479**.**

(9) ethyl 5-(2-(*tert*-butylcarbamoyl)phenyl)-3-fluoropentanoate



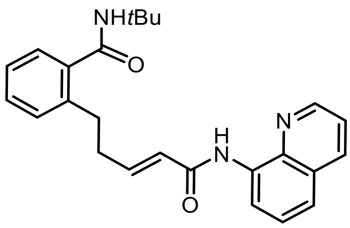
Colorless liquid, 41.8 mg, yield 65 %. ^{1}**H NMR** (400 MHz, $CDCl_3$) δ 7.40 - 7.30 (m, 2H), 7.29 - 7.20 (m, 2H), 5.65 (s, 1H), 5.03 (t, *J* = 12.3 Hz, 1H), 4.91 (m, *J* = 12.2, 4.2 Hz, 1H), 4.18 (q, *J* = 7.1 Hz, 2H), 3.05 - 2.95 (m, 1H), 2.92 - 2.82 (m, 1H), 2.78 - 2.51 (m, 2H), 2.12 - 1.94 (m, 2H), 1.48 (s, 9H), 1.28 (t, *J* = 7.1 Hz, 3H).

^{13}**C NMR** (101 MHz, CDCl$_3$) δ 170.2 (d, *J* = 5.5 Hz), 169.6, 138.8, 137.8, 130.2, 129.7, 126.5 (d, *J* = 53.1 Hz), 90.6, 89.0, 60.8, 51.8, 40.4 (d, *J* = 23.8 Hz), 36.6 (d, *J* = 20.5 Hz), 28.8, 28.7 (s), 14.2.

^{19}**F NMR** (376 MHz, CDCl$_3$) δ -183.33 (s, 1F).

HRMS (ESI) calcd for $C_{18}H_{26}FNO_3Na^+$ [M+Na]$^+$: 346.1789; found: 346.1788**.**

(10) (*E*)-*N*-(*tert*-butyl)-2-(5-*oxo*-5-(quinolin-8-ylamino)pent-3-en-1-yl) benzamide

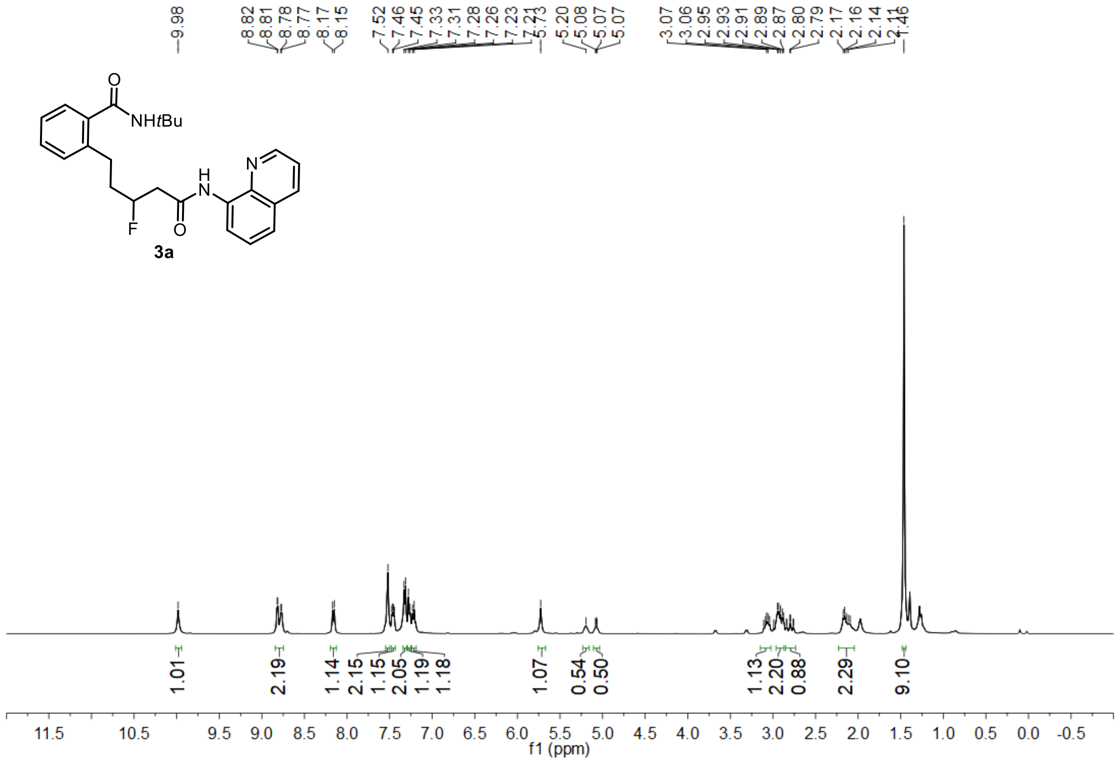


Colorless liquid, 70.6 mg, yield 88 %. ^{1}**H NMR** (400 MHz, CDCl$_3$) δ 9.80 (s, 1H), 8.78 (dd, *J* = 17.0, 4.1 Hz, 2H), 8.10 (d, *J* = 8.2 Hz, 1H), 7.53 - 7.44 (m, 2H), 7.43 - 7.38 (m, 1H), 7.29 (d, *J* = 6.6 Hz, 2H), 7.19 (dd, *J* = 17.1, 8.0 Hz, 2H), 7.09 - 6.98 (m, 1H), 6.15 (d, *J* = 15.2 Hz, 1H), 5.84 (s, 1H), 2.98 (t, *J* = 7.0 Hz, 2H), 2.61 (d, *J* = 7.0 Hz, 2H), 1.47 (d, *J* = 1.0 Hz, 9H).

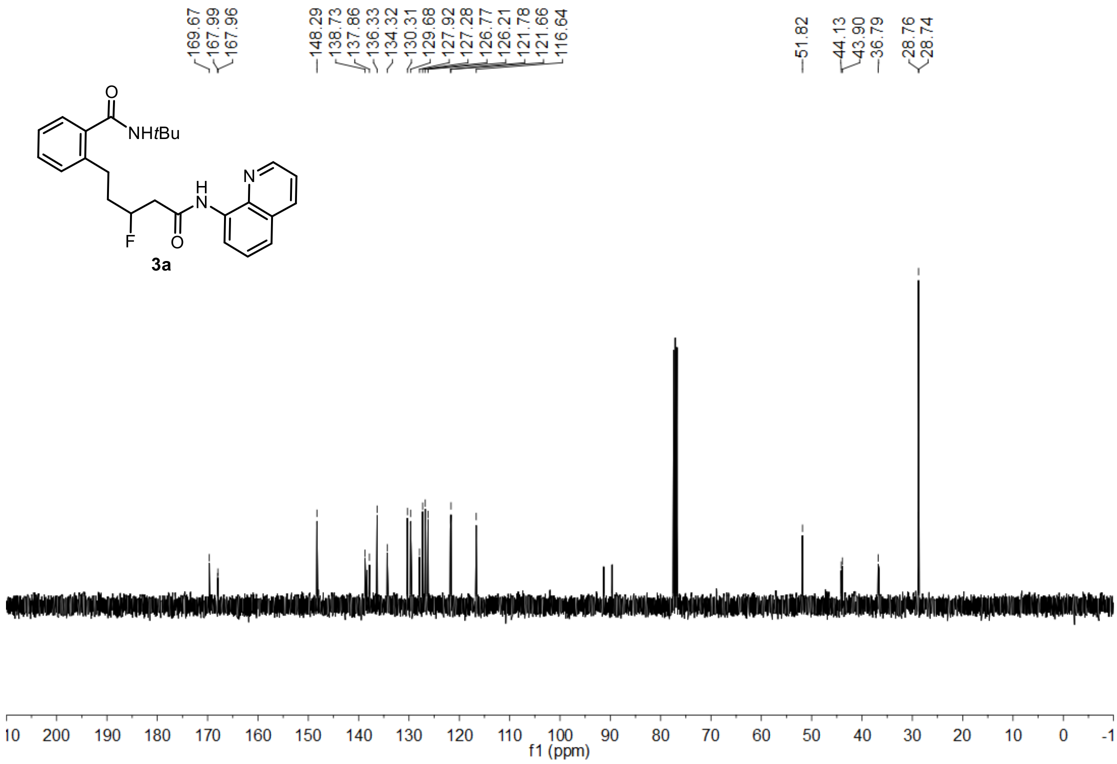
^{13}**C NMR** (101 MHz, CDCl$_3$) δ 169.7, 164.1, 148.1, 145.0, 138.7, 138.4, 137.9, 136.4, 134.6, 130.1, 129.6, 127.9, 127.4, 126.7, 126.2, 125.2, 121.7, 121.6, 116.6, 51.8, 34.0, 32.0, 28.8.

HRMS (ESI) calcd for $C_{25}H_{27}FN_3O_2Na^+$ [M+Na]$^+$: 424.1995; found: 424.1993**.**

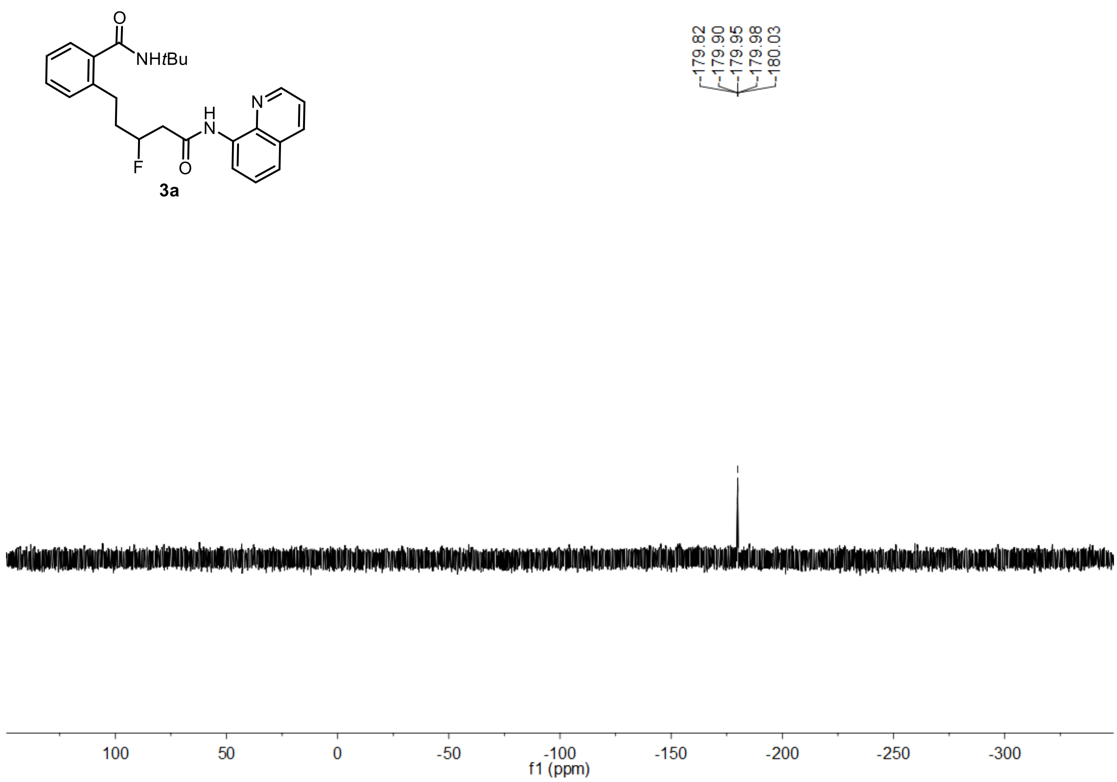
IV. NMR Spectra of Synthesized Compounds



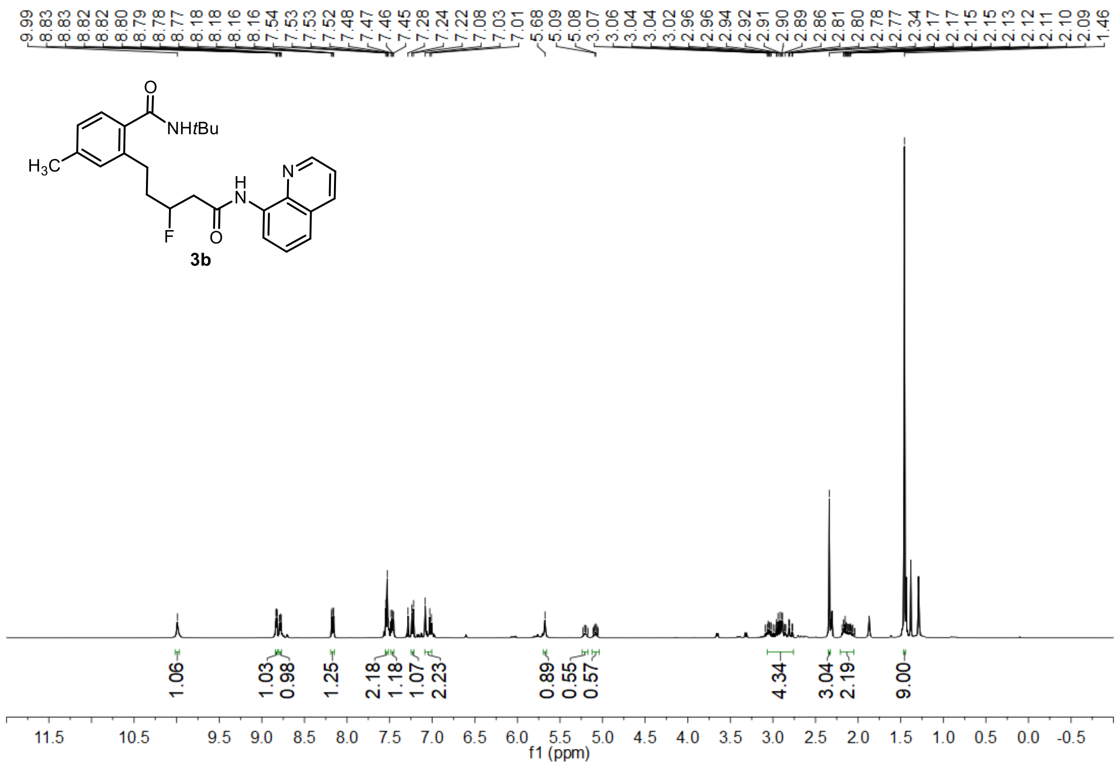
^{1}H NMR (400 MHz, CDCl$_3$) spectra of compound **3a**



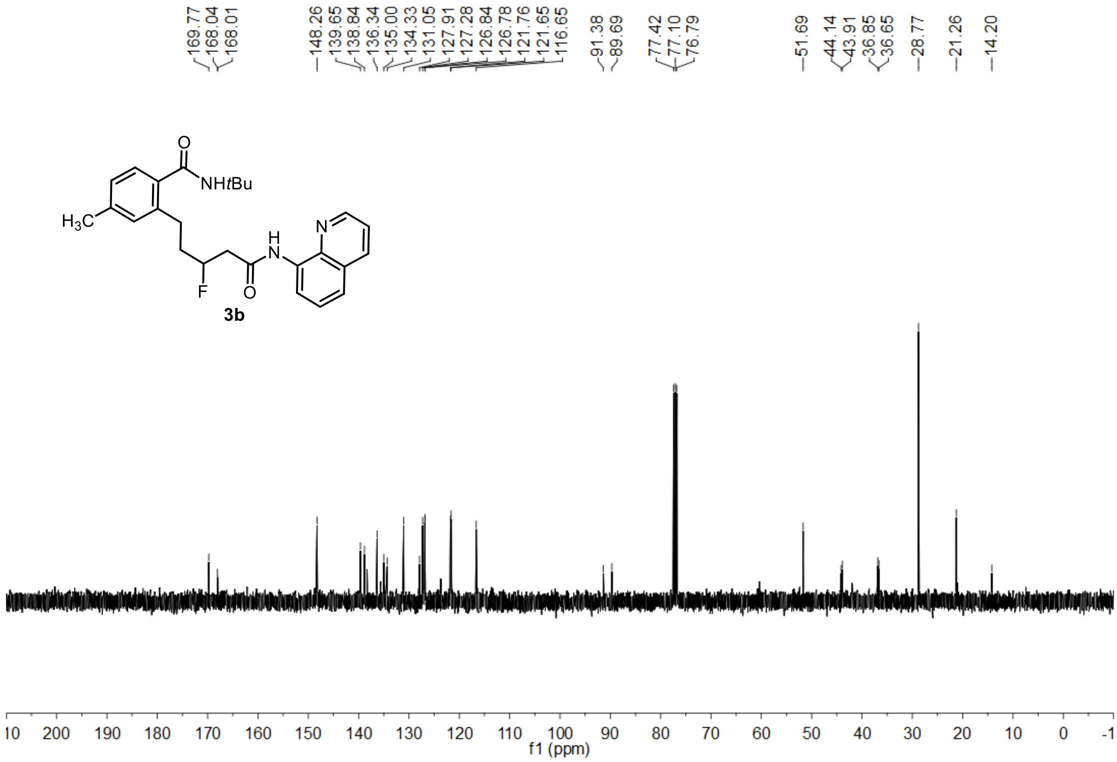
^{13}C NMR (101 MHz, CDCl$_3$) spectra of compound **3a**



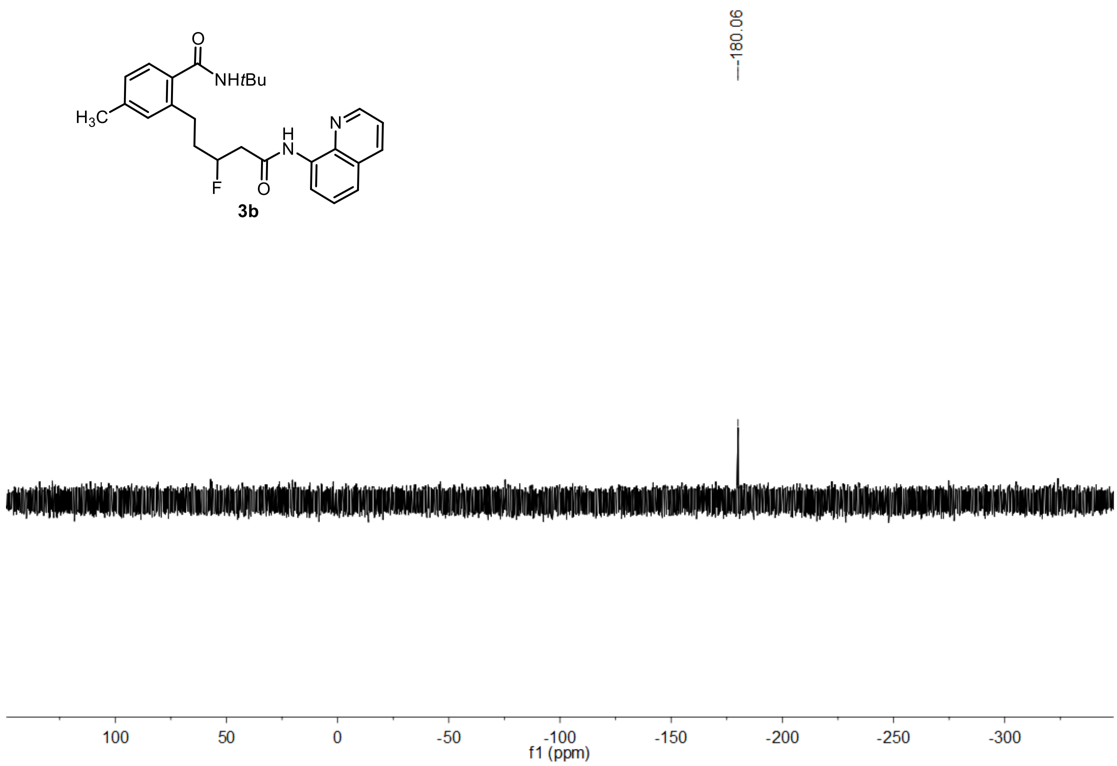
^{19}F NMR (376 MHz, $CDCl_3$) spectra of compound **3a**



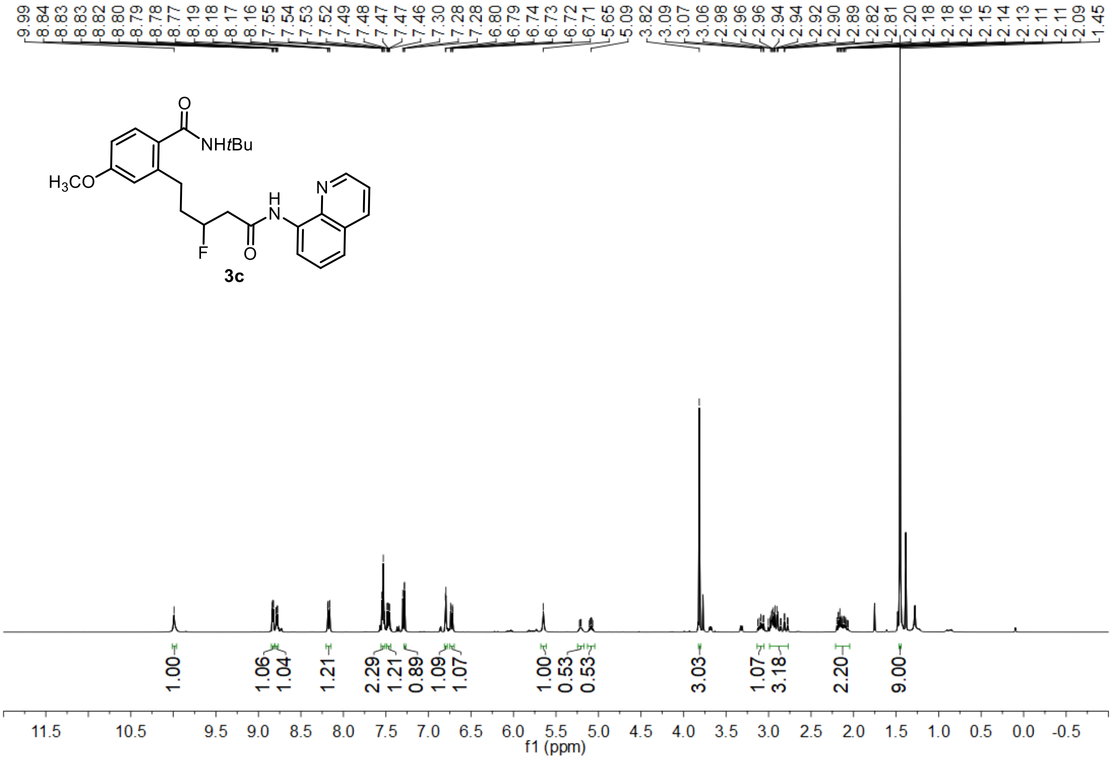
^{1}H NMR (400 MHz, $CDCl_3$) spectra of compound **3b**



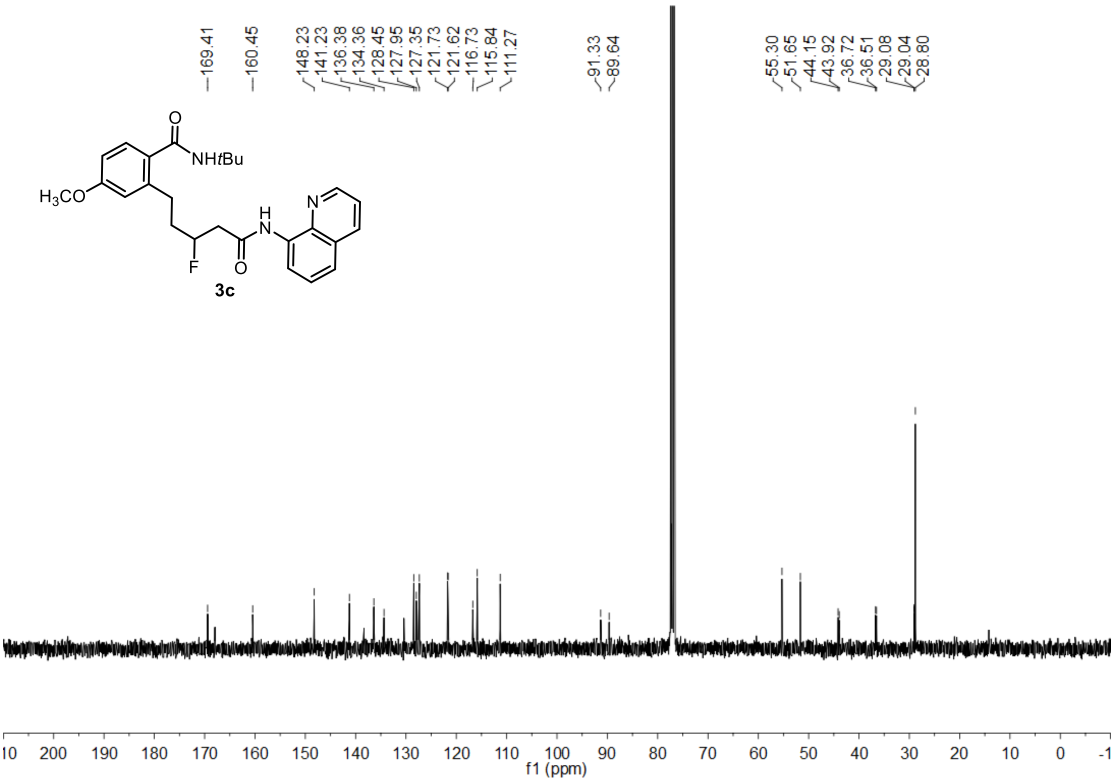
^{13}C NMR (101 MHz, $CDCl_3$) spectra of compound **3b**



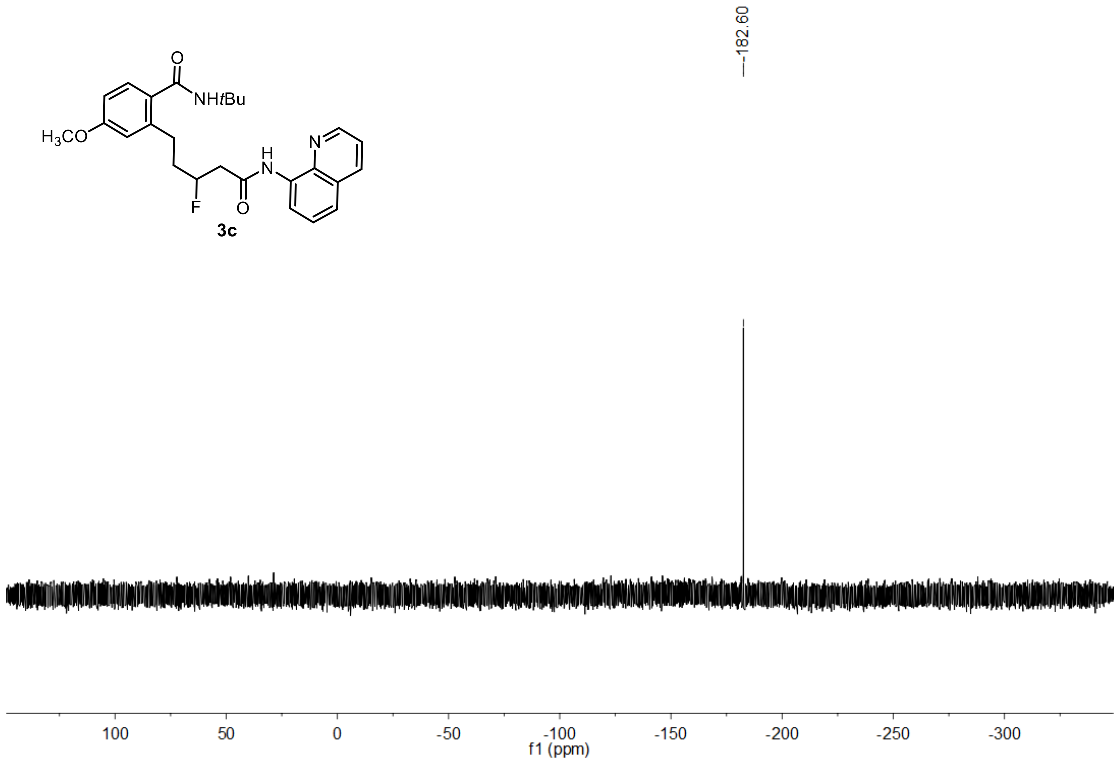
^{19}F NMR (376 MHz, $CDCl_3$) spectra of compound **3b**



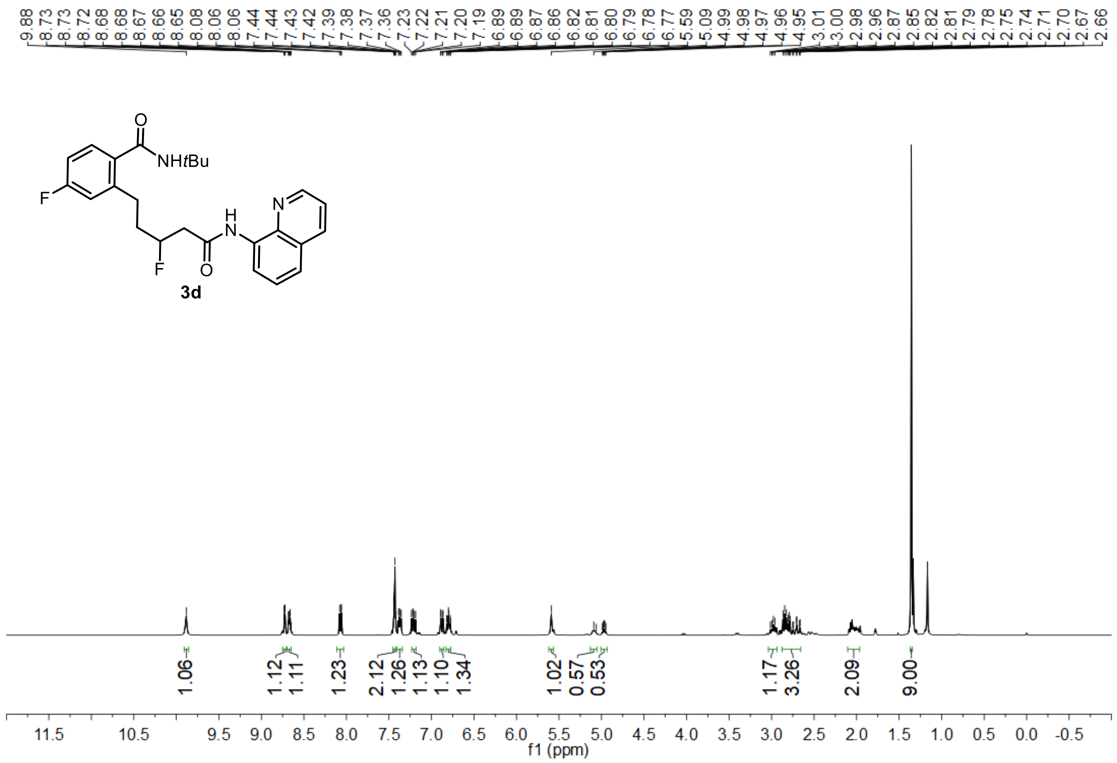
[1]H NMR (400 MHz, $CDCl_3$) spectra of compound **3c**



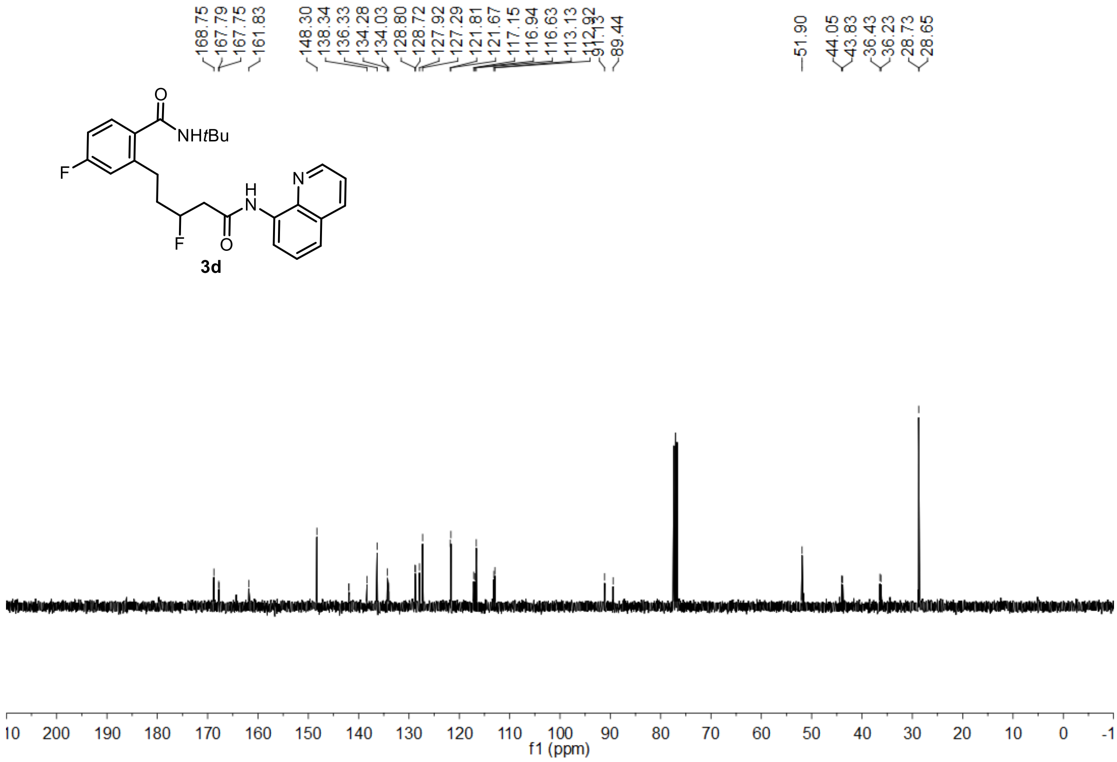
[13]C NMR (101 MHz, $CDCl_3$) spectra of compound **3c**



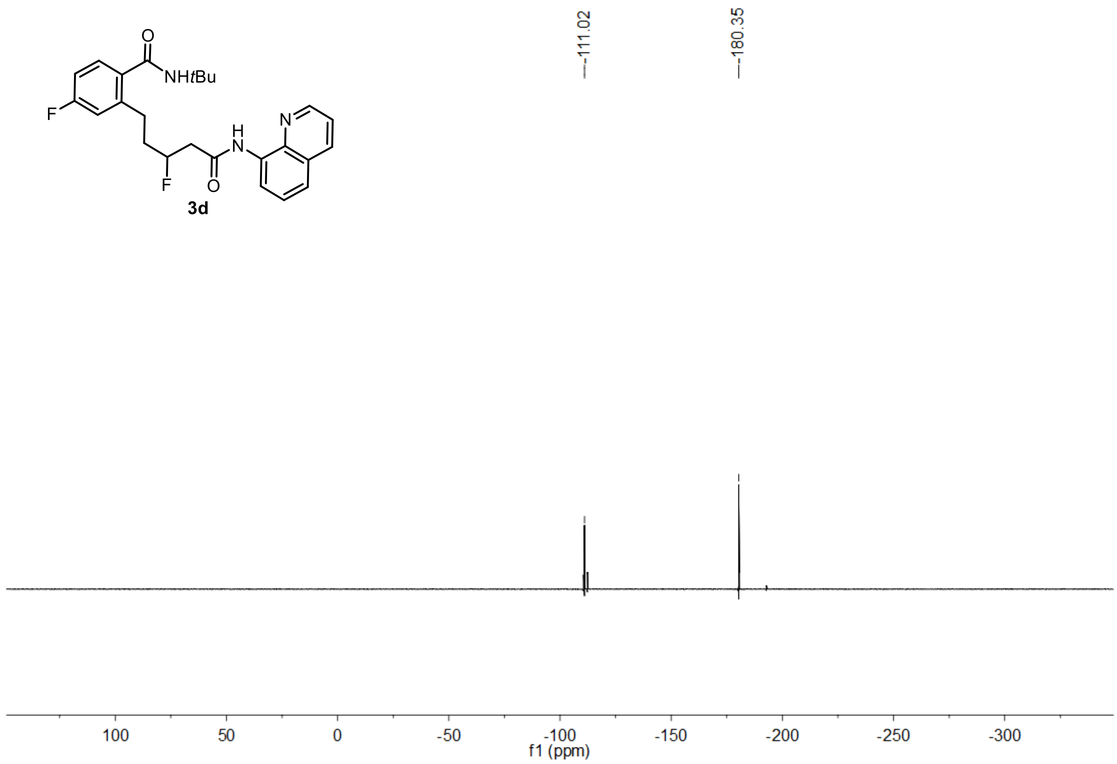
^{19}F NMR (376 MHz, $CDCl_3$) spectra of compound **3c**



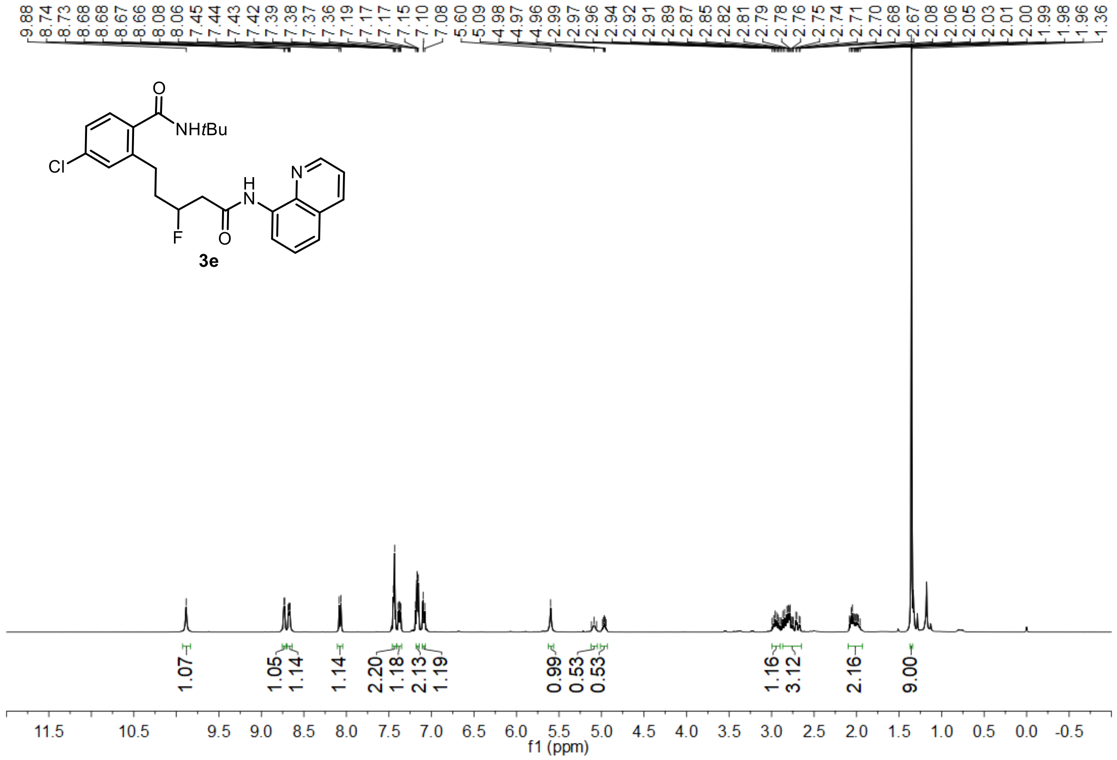
^{1}H NMR (400 MHz, $CDCl_3$) spectra of compound **3d**



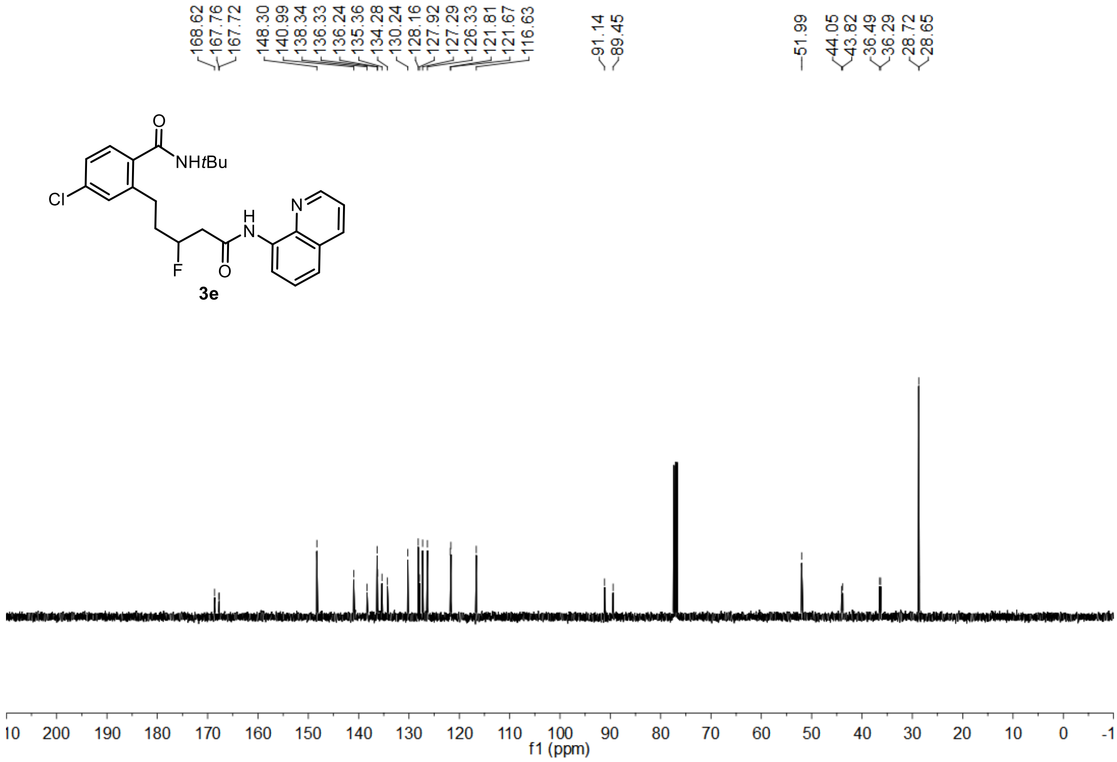
^{13}C NMR (101 MHz, $CDCl_3$) spectra of compound **3d**



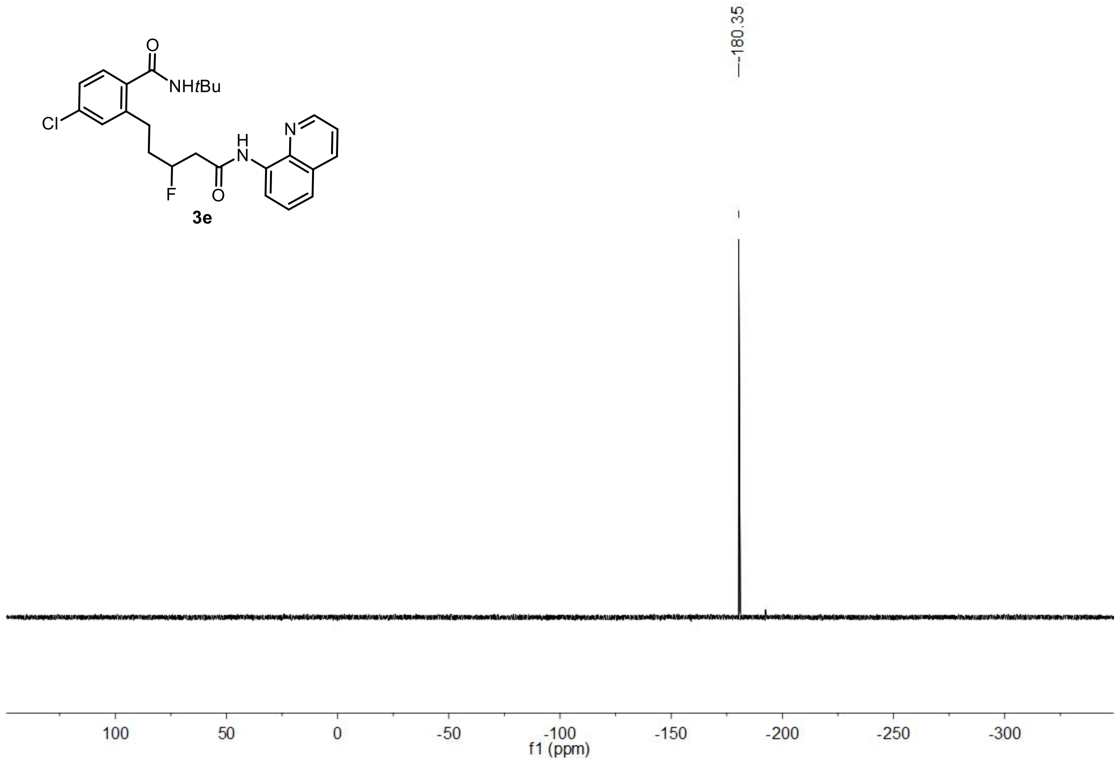
^{19}F NMR (376 MHz, $CDCl_3$) spectra of compound **3d**



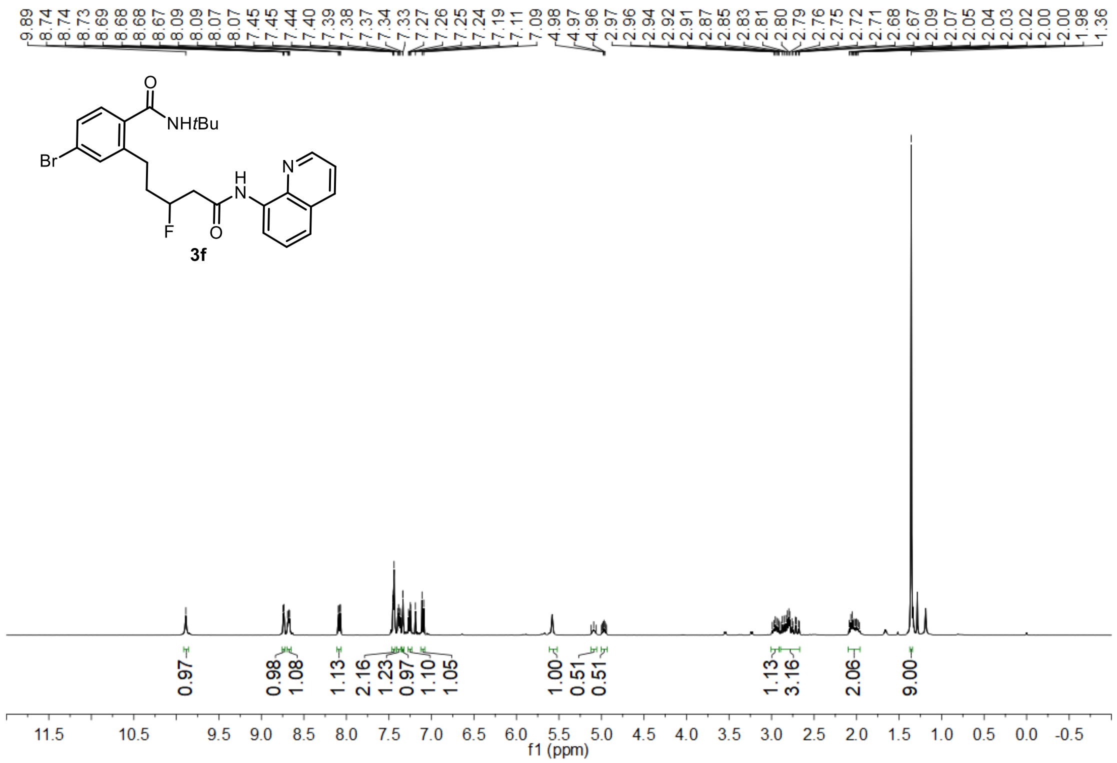
[1]H NMR (400 MHz, $CDCl_3$) spectra of compound **3e**



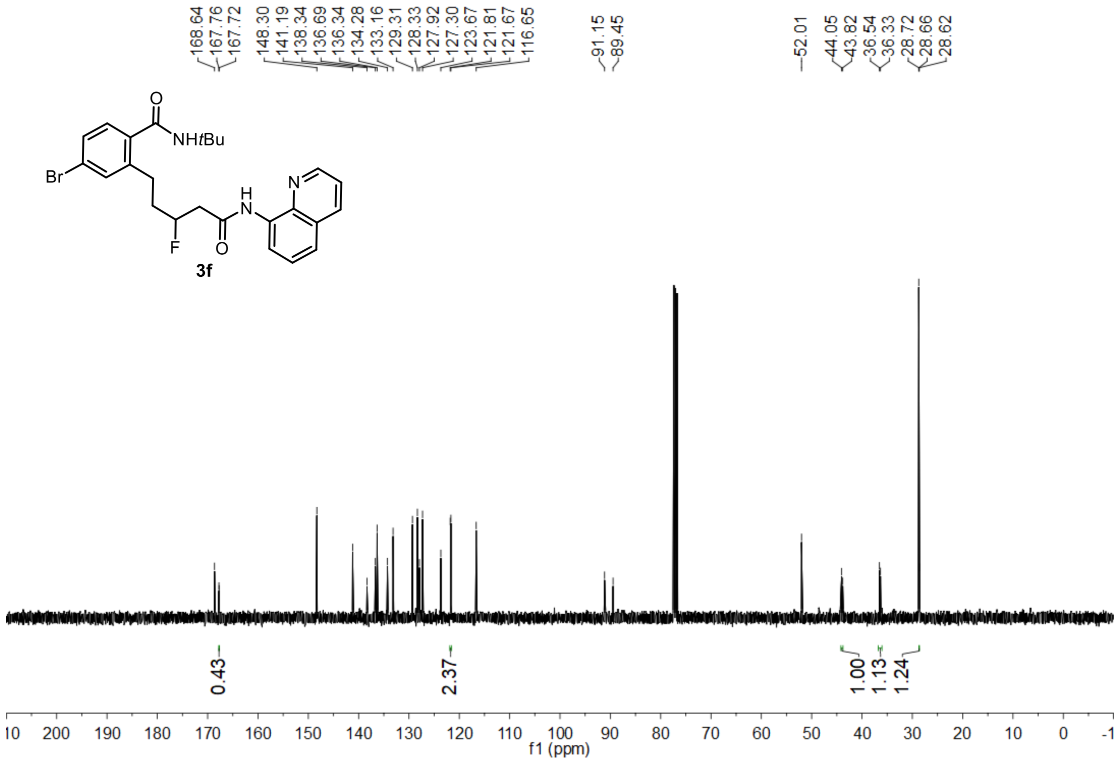
[13]C NMR (101 MHz, $CDCl_3$) spectra of compound **3e**



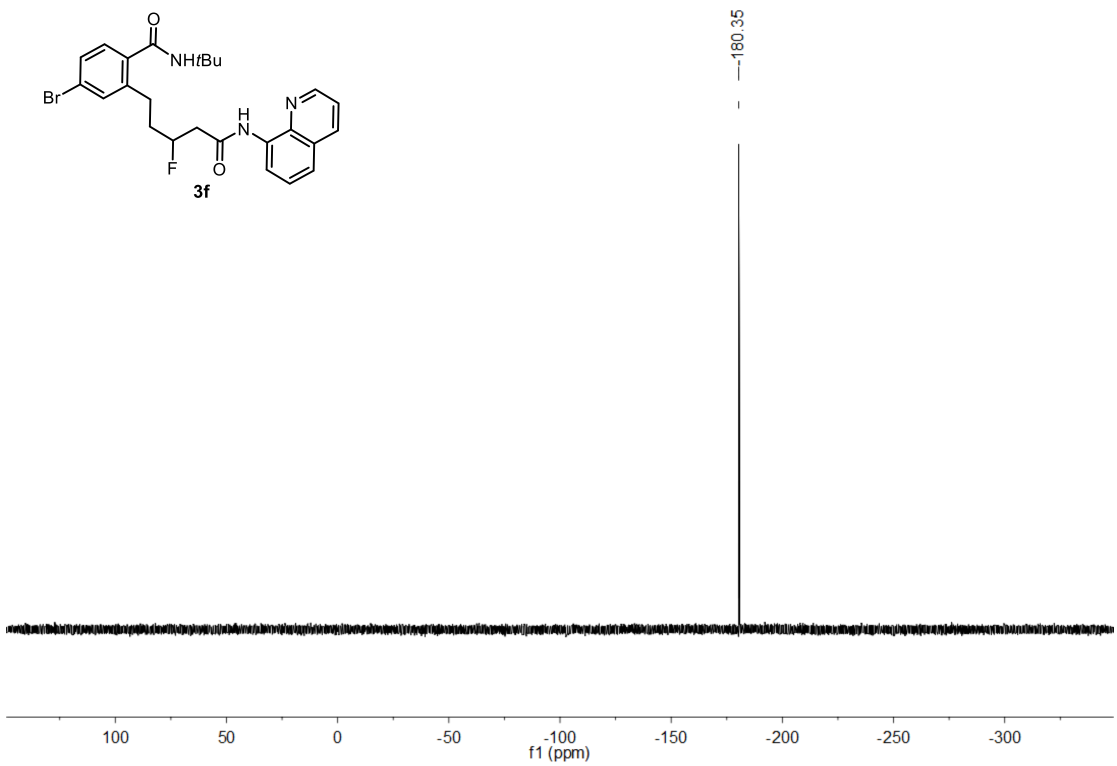
^{19}F NMR (376 MHz, $CDCl_3$) spectra of compound **3e**



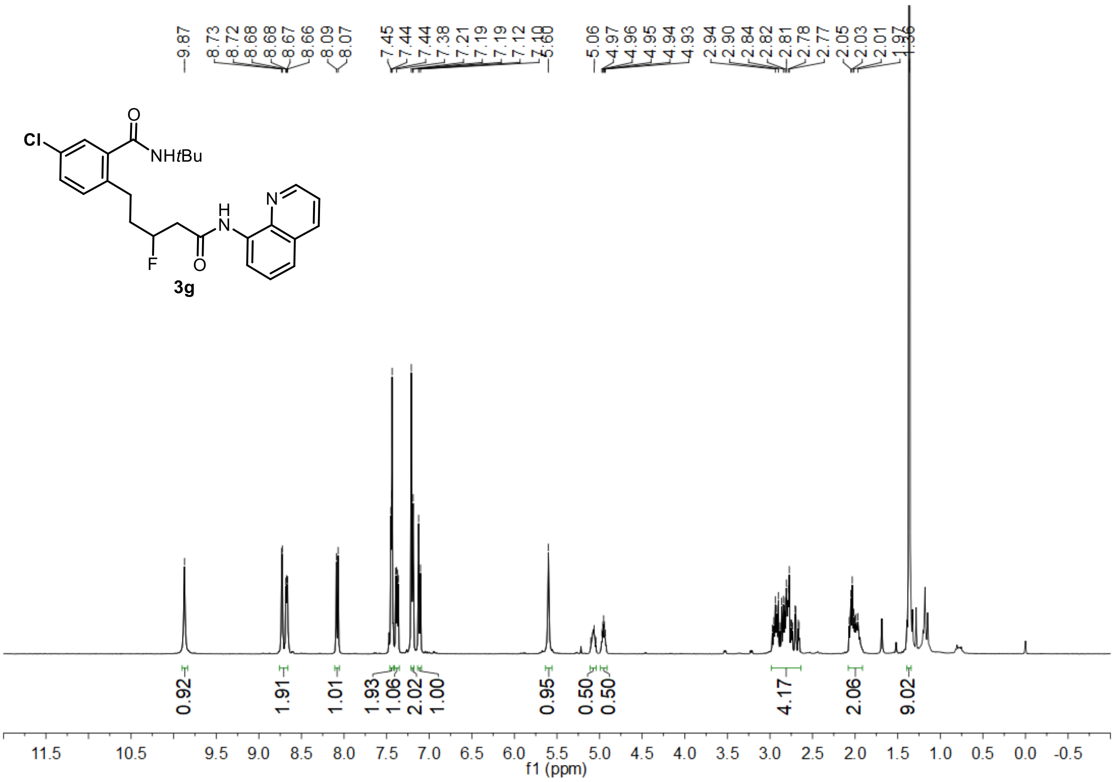
^{1}H NMR (400 MHz, $CDCl_3$) spectra of compound **3f**



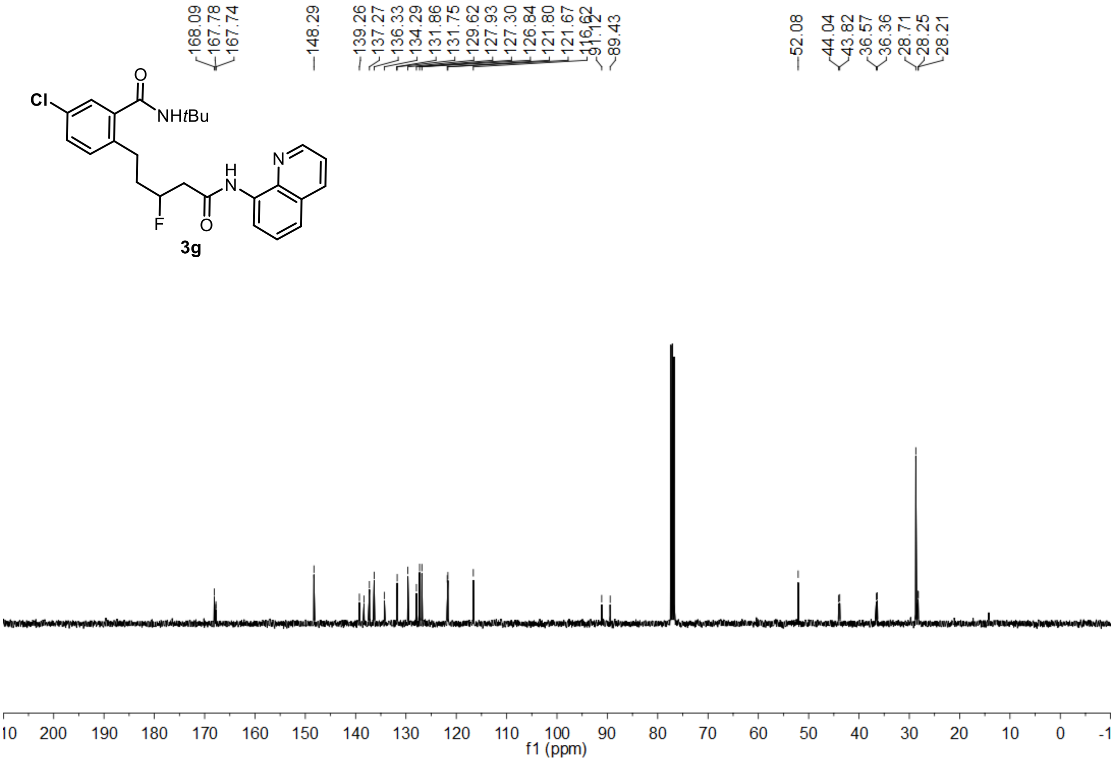
^{13}C NMR (101 MHz, CDCl$_3$) spectra of compound **3f**



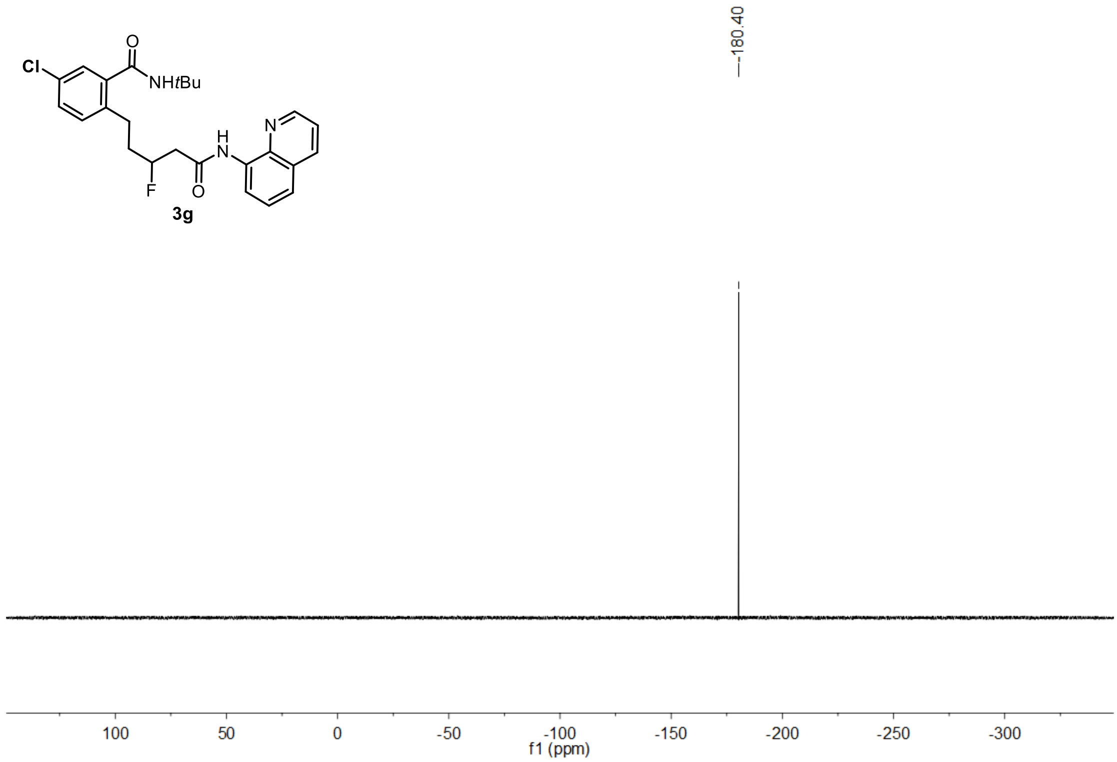
^{19}F NMR (376 MHz, CDCl$_3$) spectra of compound **3f**



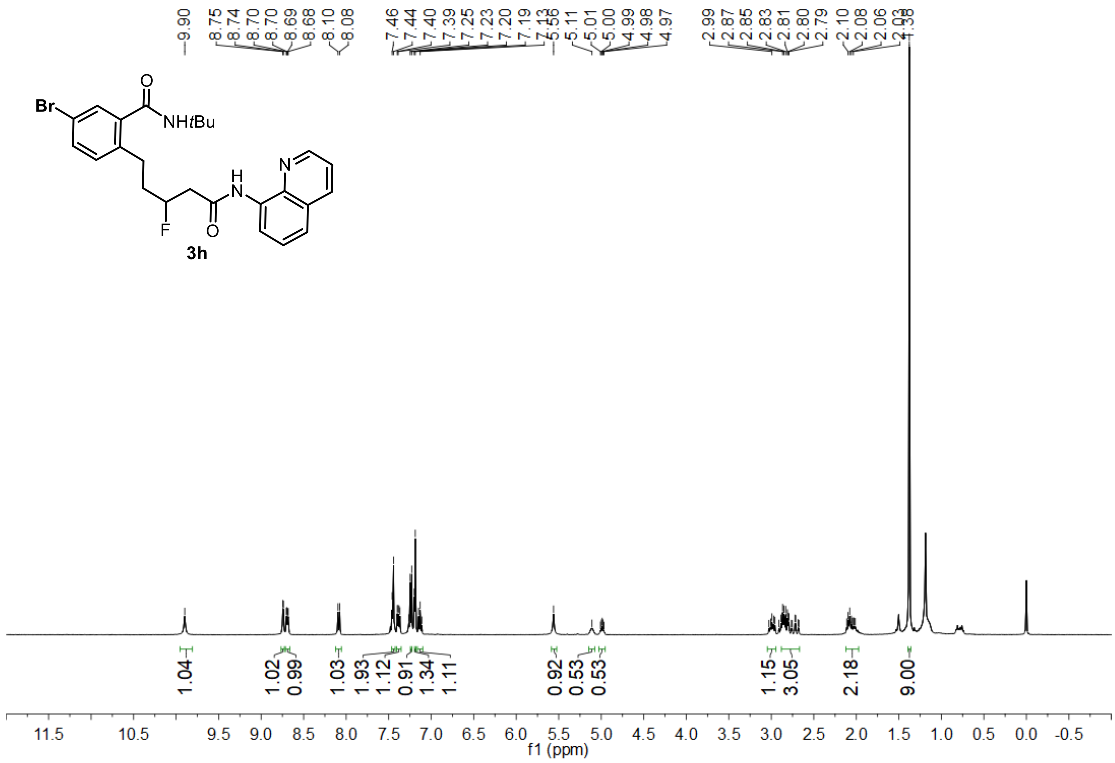
[1]H NMR (400 MHz, $CDCl_3$) spectra of compound **3g**



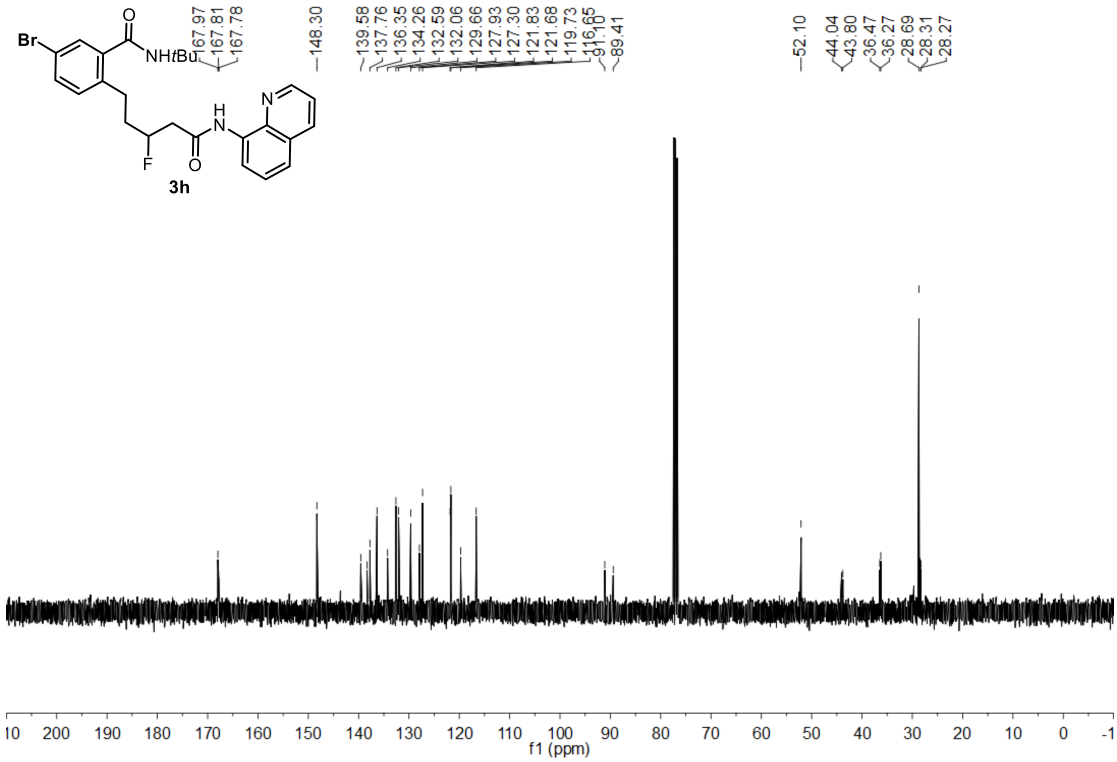
[13]C NMR (101 MHz, $CDCl_3$) spectra of compound **3g**



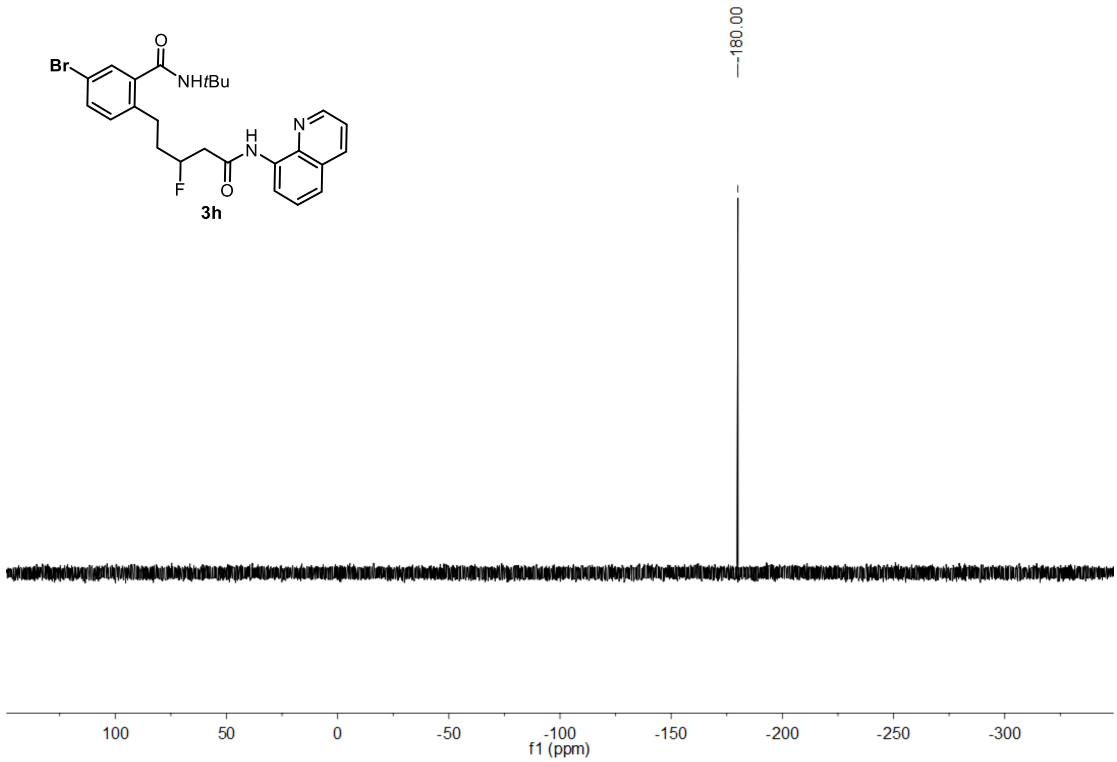
^{19}F NMR (376 MHz, $CDCl_3$) spectra of compound **3g**



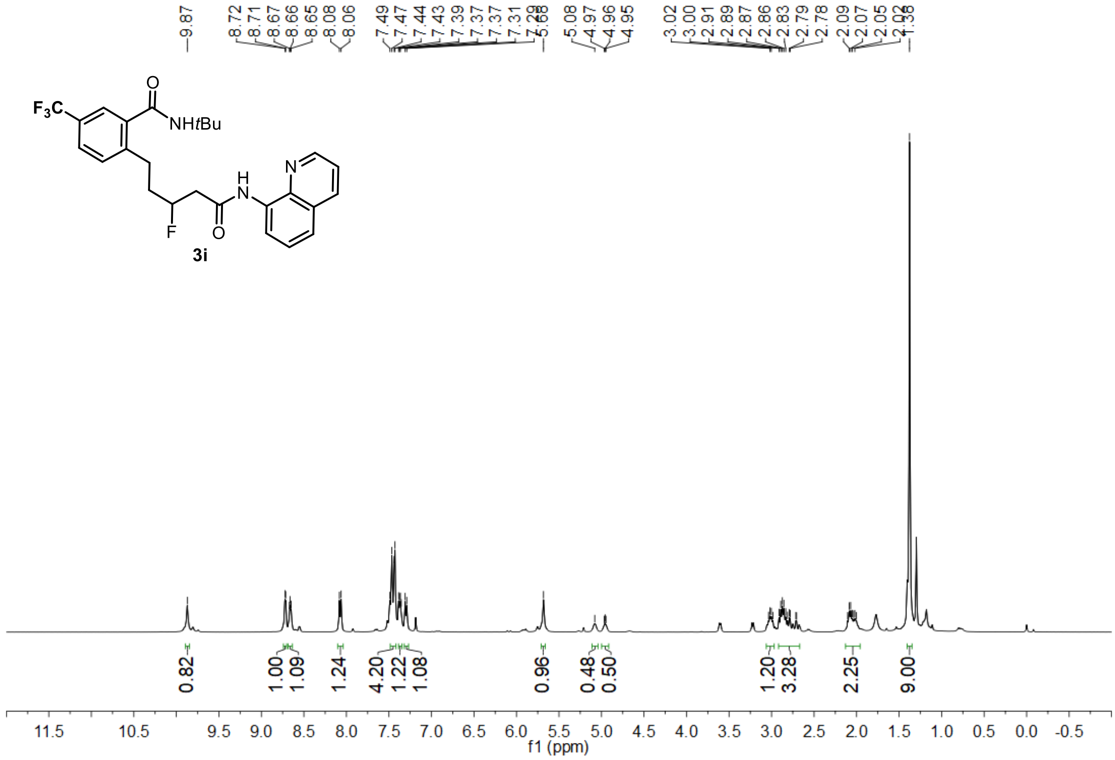
^{1}H NMR (400 MHz, $CDCl_3$) spectra of compound **3h**



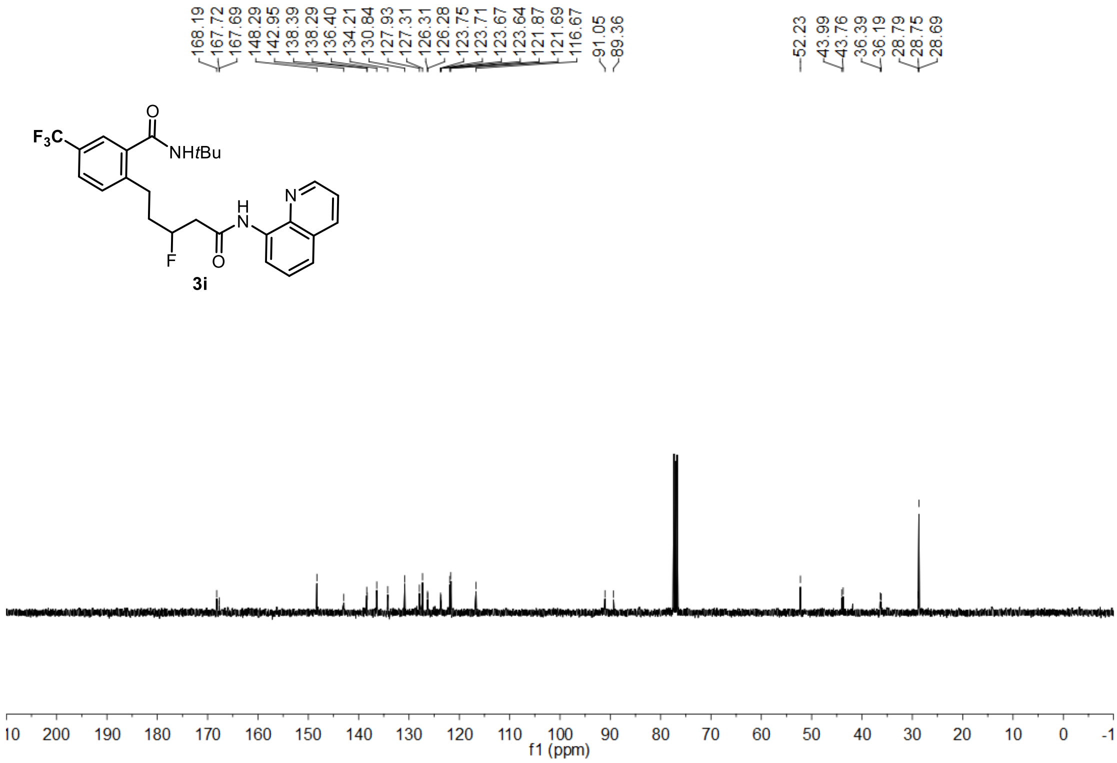
^{13}C NMR (101 MHz, $CDCl_3$) spectra of compound **3h**



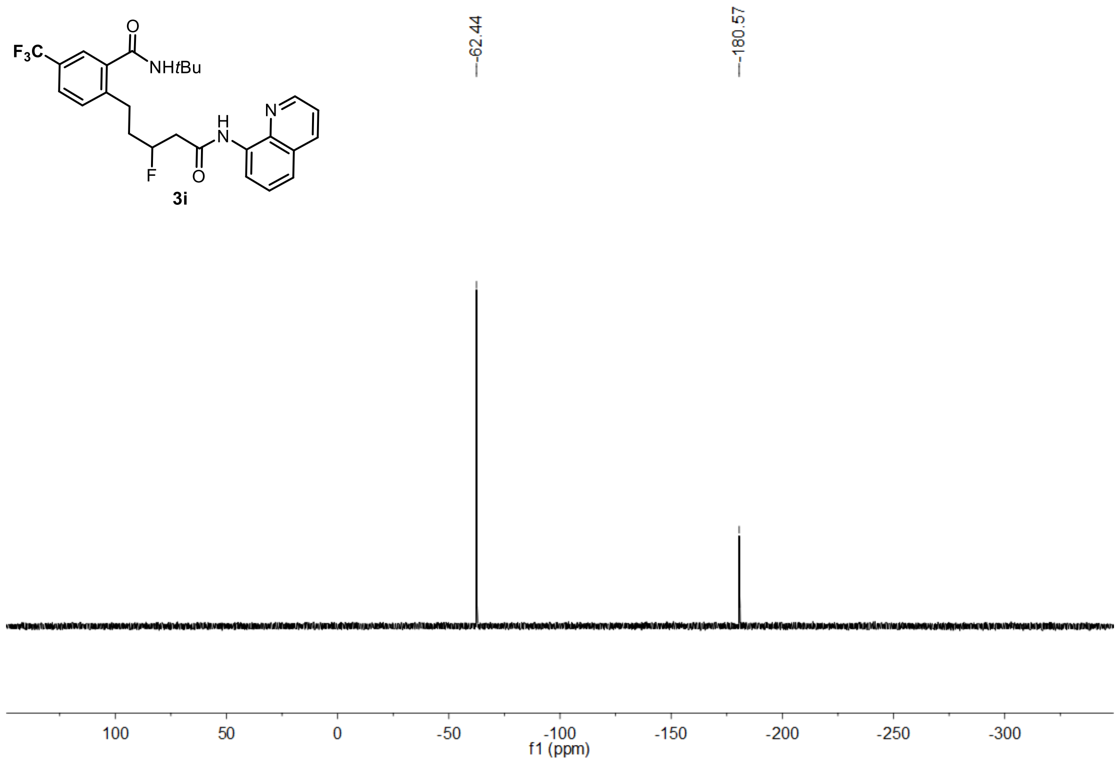
^{19}F NMR (376 MHz, $CDCl_3$) spectra of compound **3h**



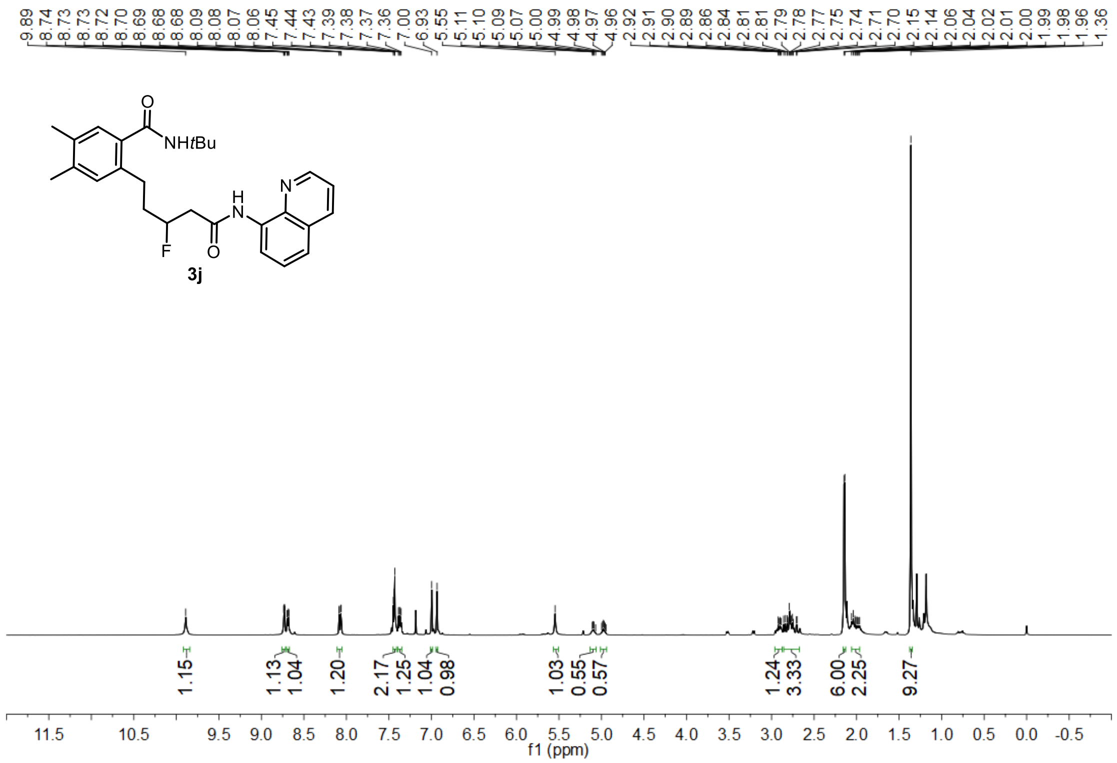
^{1}H NMR (400 MHz, $CDCl_3$) spectra of compound **3i**



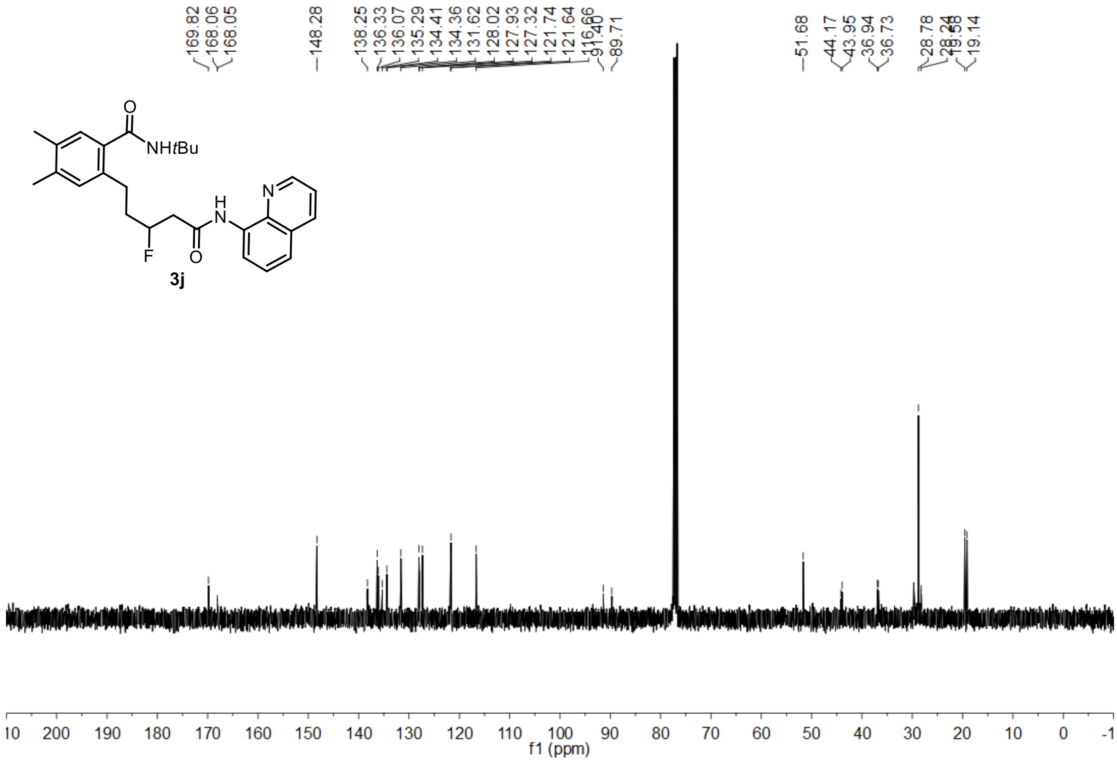
^{13}C NMR (101 MHz, $CDCl_3$) spectra of compound **3i**



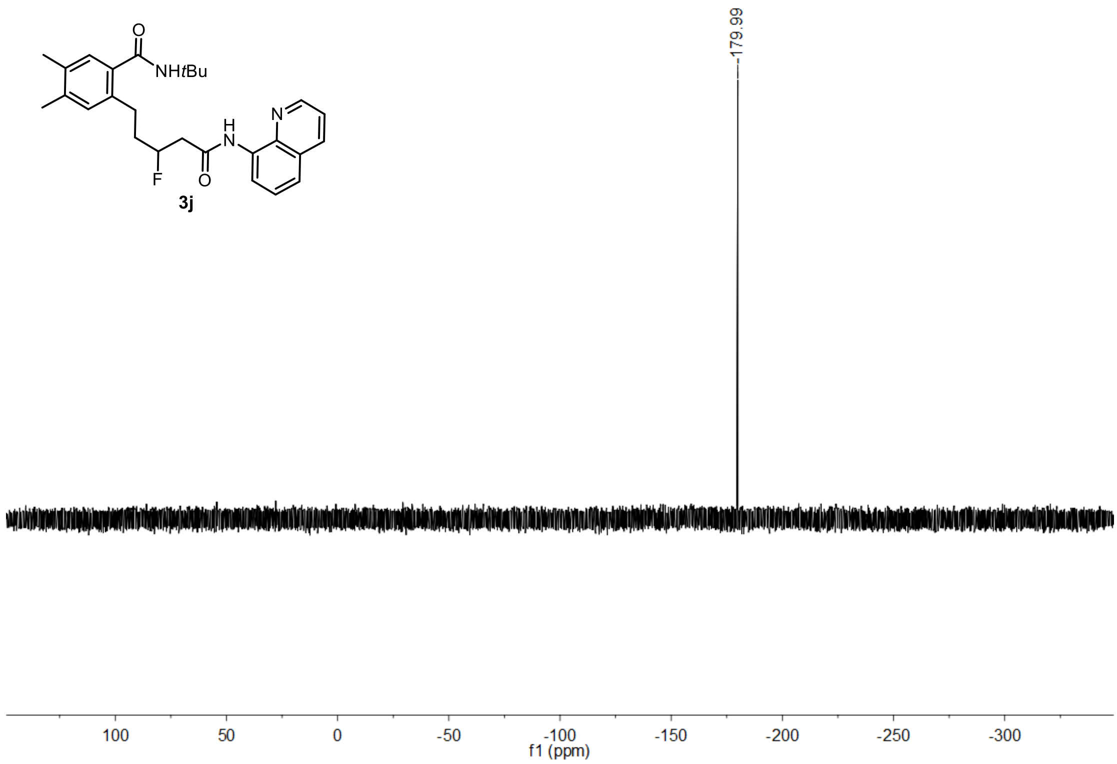
^{19}F NMR (376 MHz, $CDCl_3$) spectra of compound **3i**



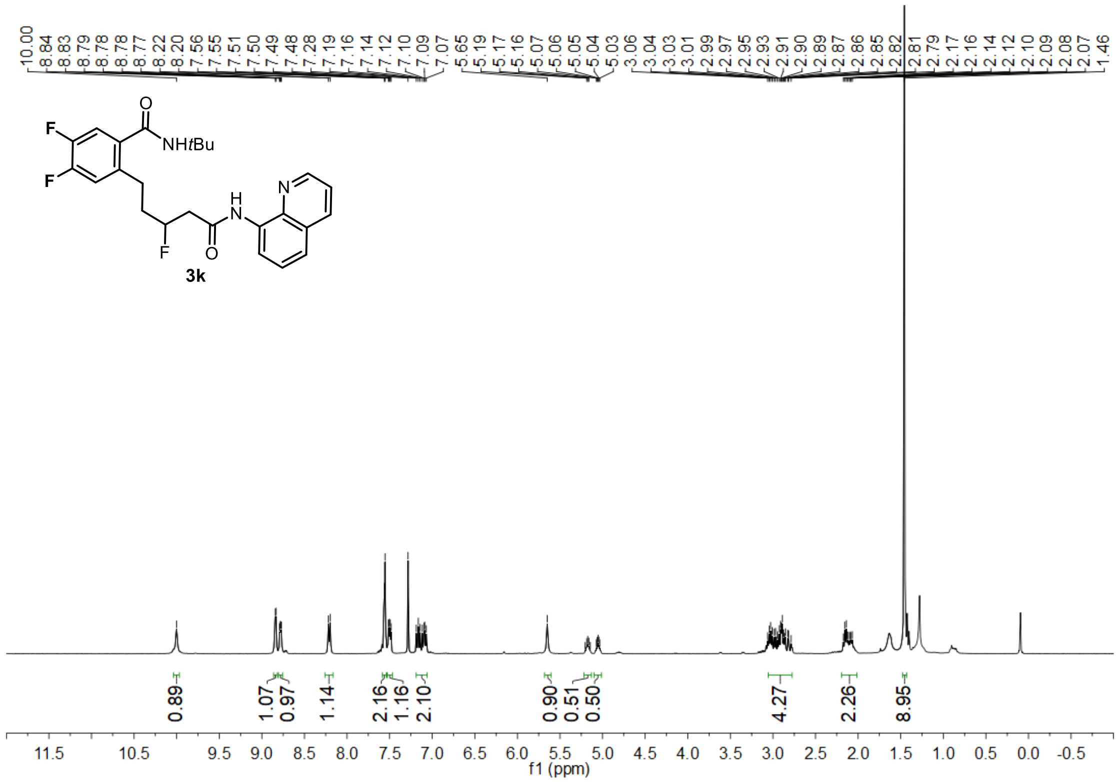
^{1}H NMR (400 MHz, $CDCl_3$) spectra of compound **3j**



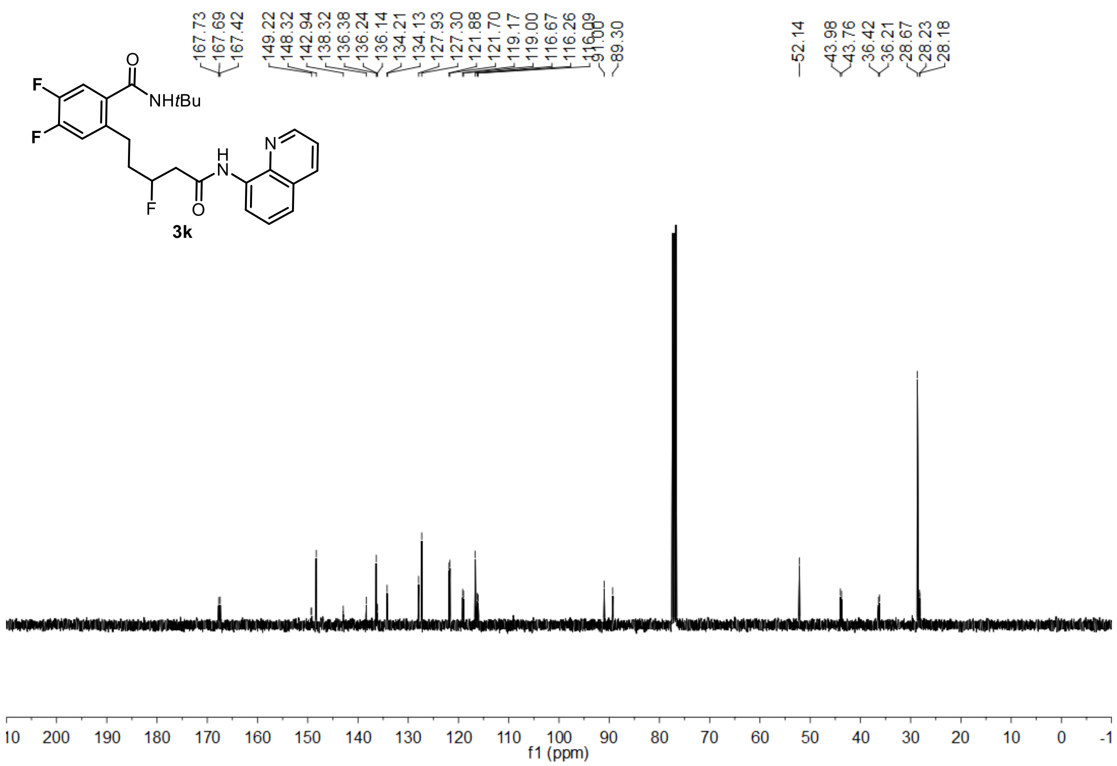
^{13}C NMR (101 MHz, CDCl$_3$) spectra of compound **3j**



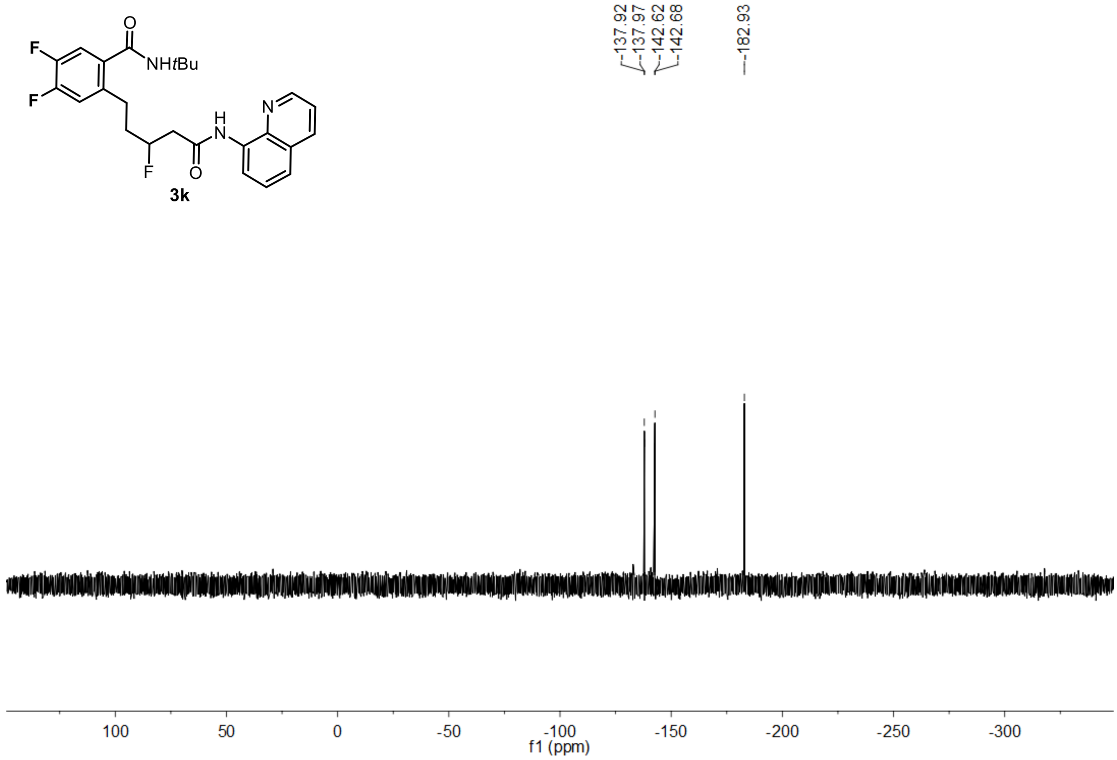
^{19}F NMR (376 MHz, CDCl$_3$) spectra of compound **3j**



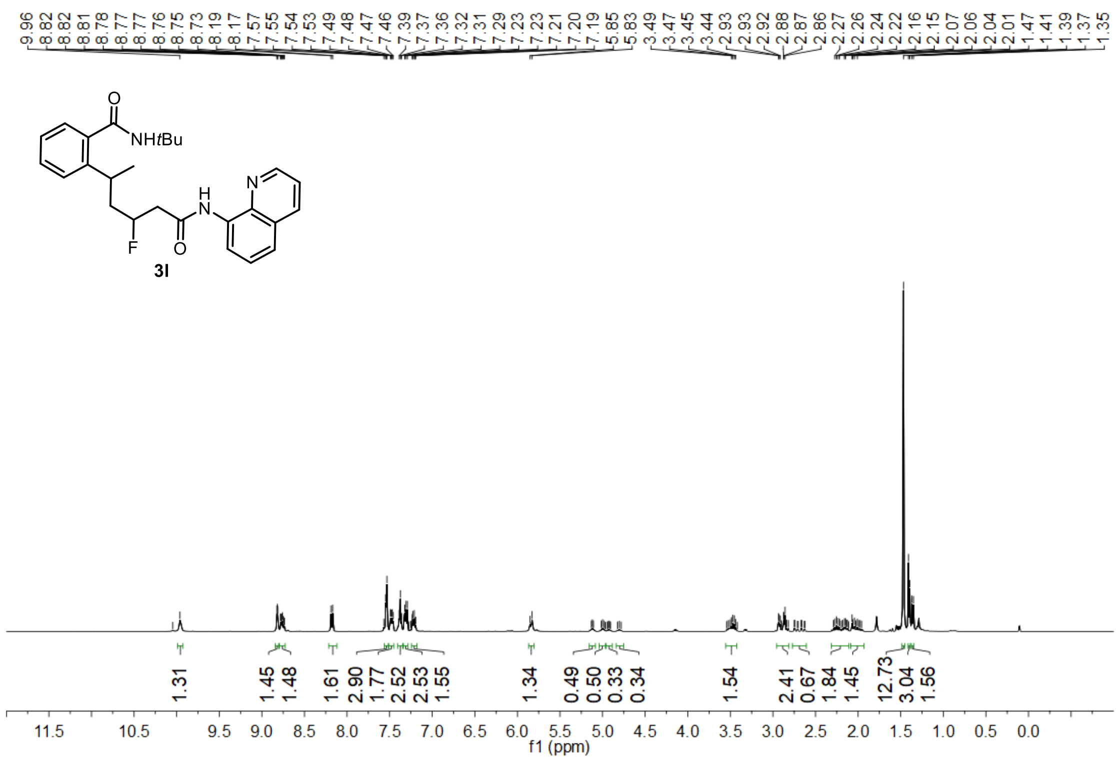
[1]H NMR (400 MHz, $CDCl_3$) spectra of compound **3k**



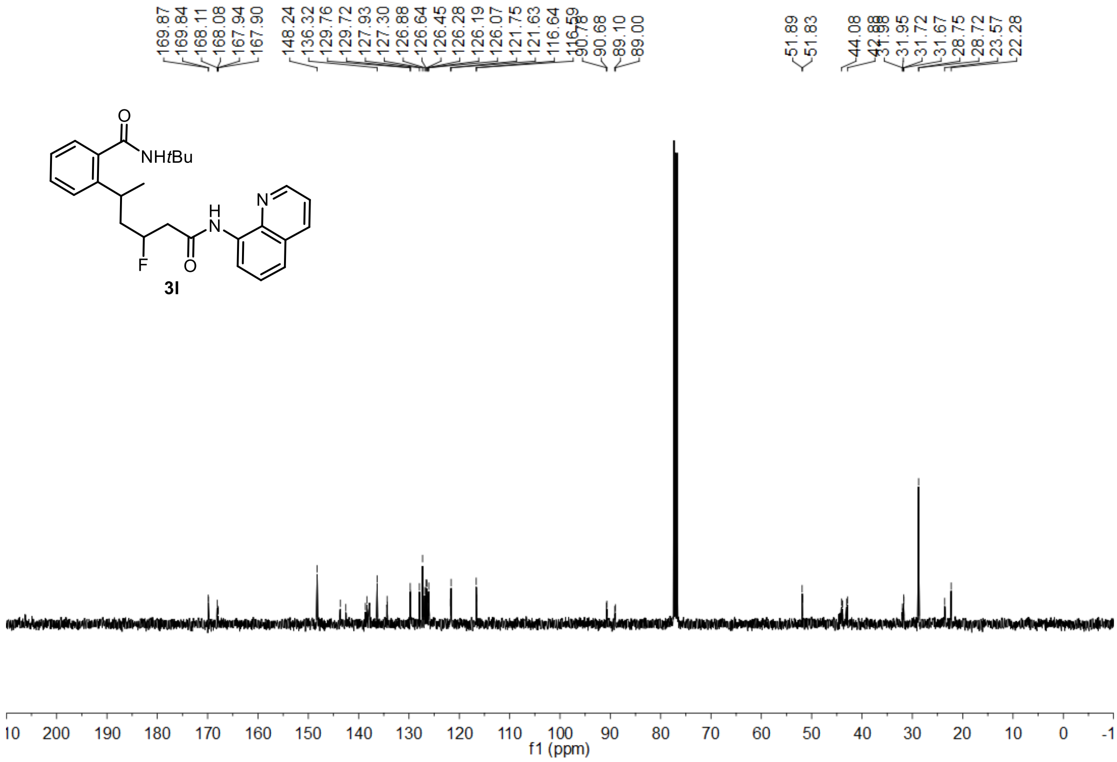
[13]C NMR (101 MHz, $CDCl_3$) spectra of compound **3k**



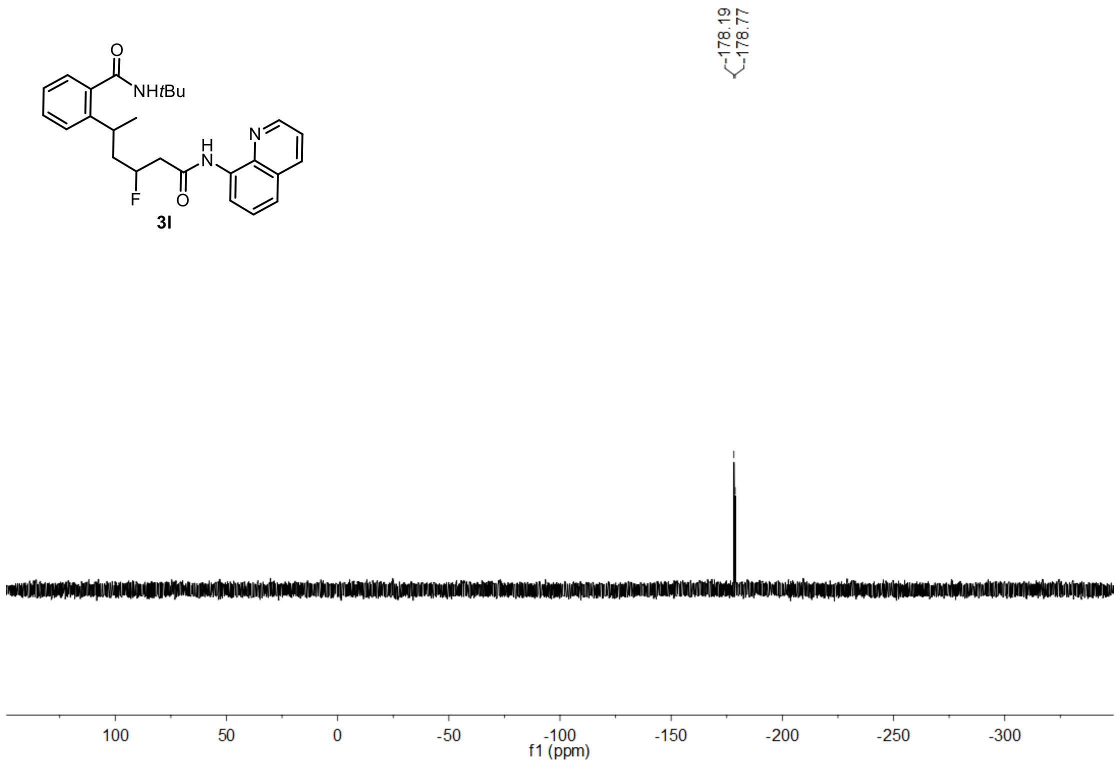
^{19}F NMR (376 MHz, CDCl$_3$) spectra of compound **3k**



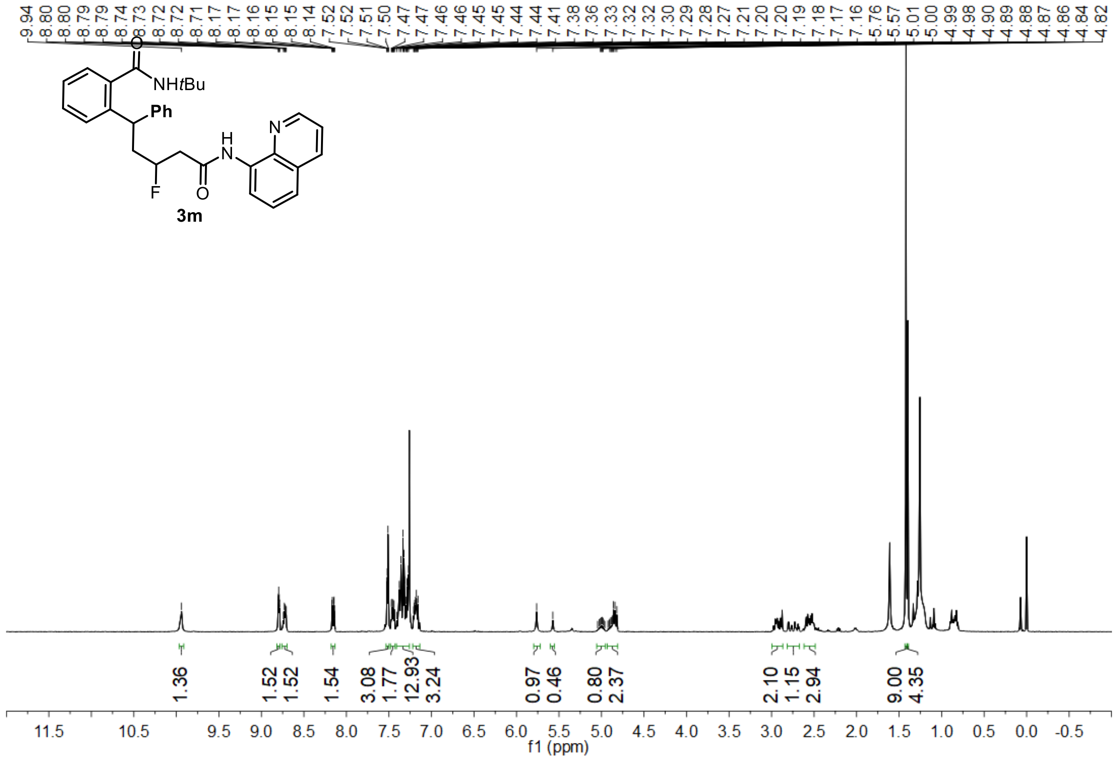
^{1}H NMR (400 MHz, CDCl$_3$) spectra of compound **3l**



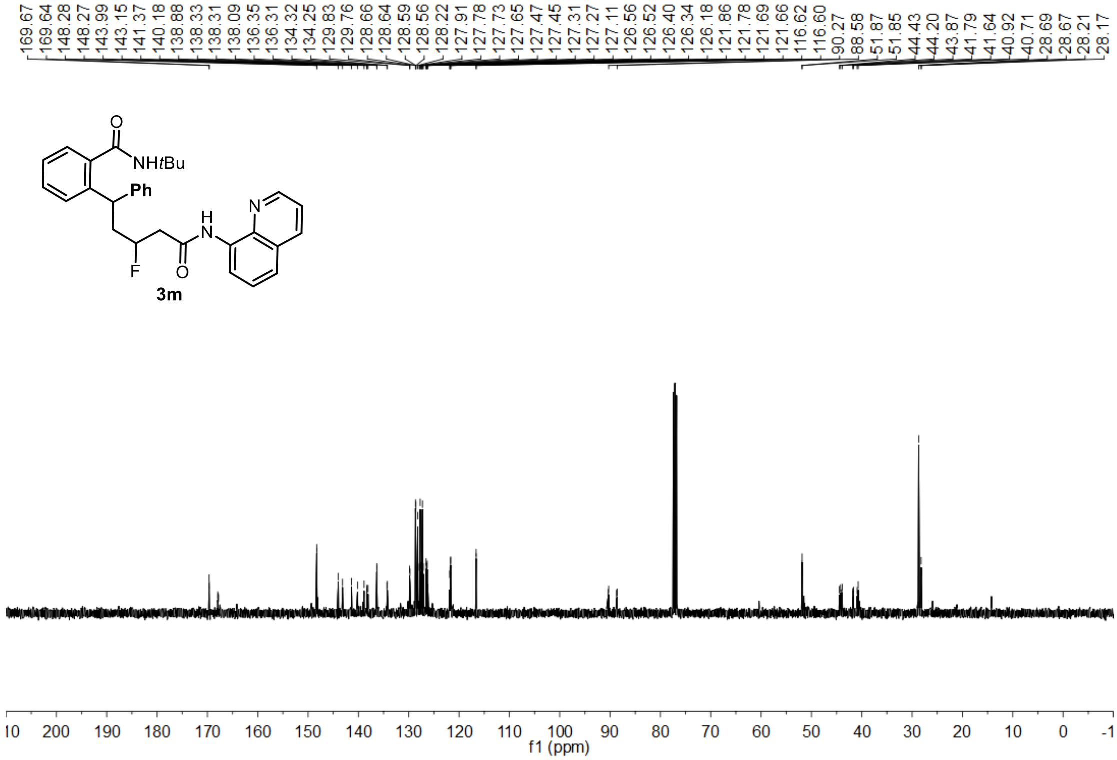
^{13}C NMR (101 MHz, $CDCl_3$) spectra of compound **3l**



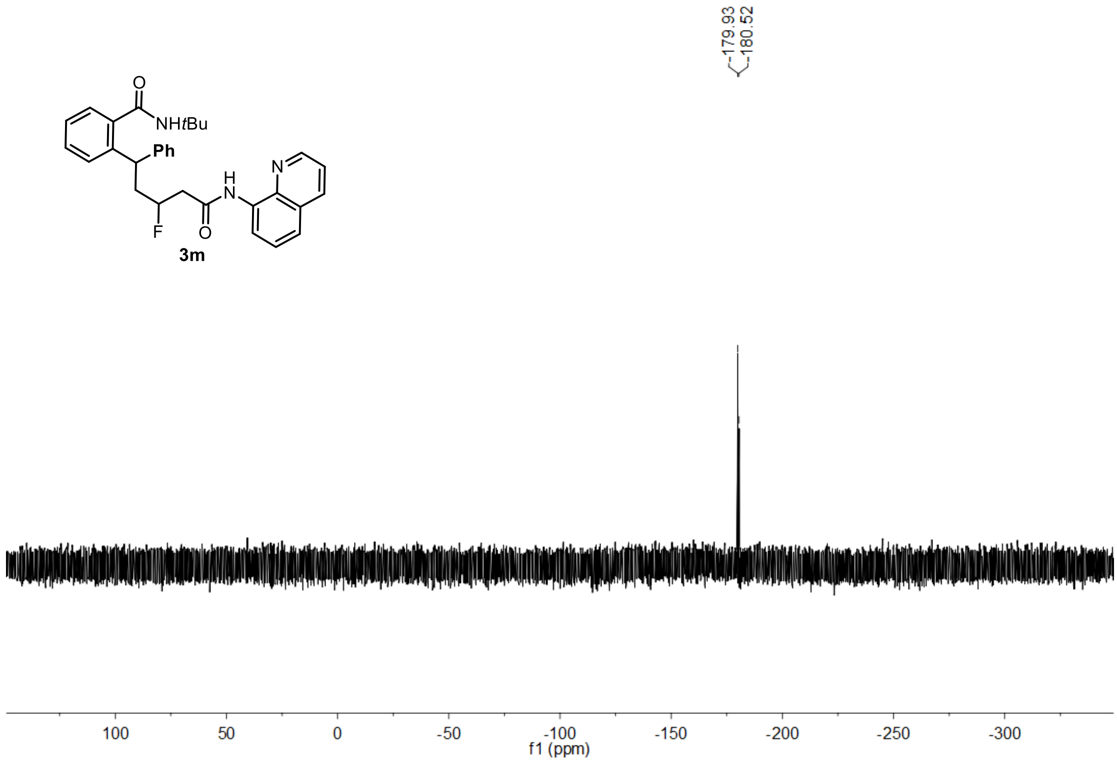
^{19}F NMR (376 MHz, $CDCl_3$) spectra of compound **3l**



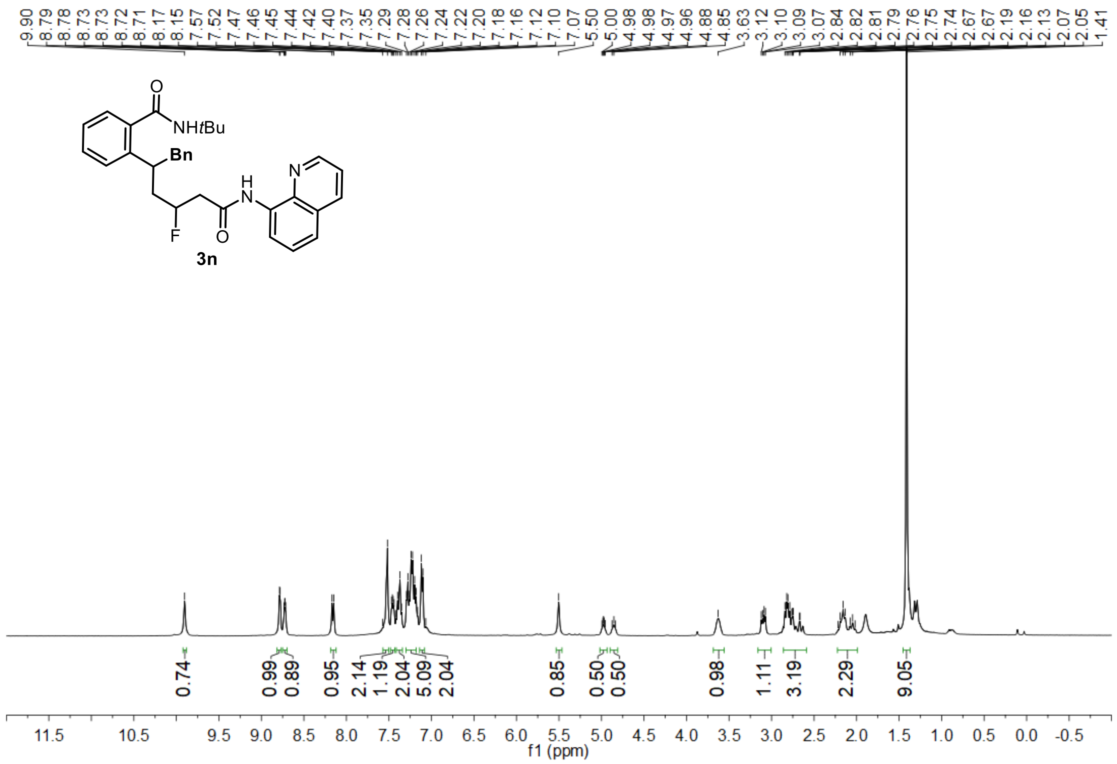
^{1}H NMR (400 MHz, $CDCl_3$) spectra of compound **3m**



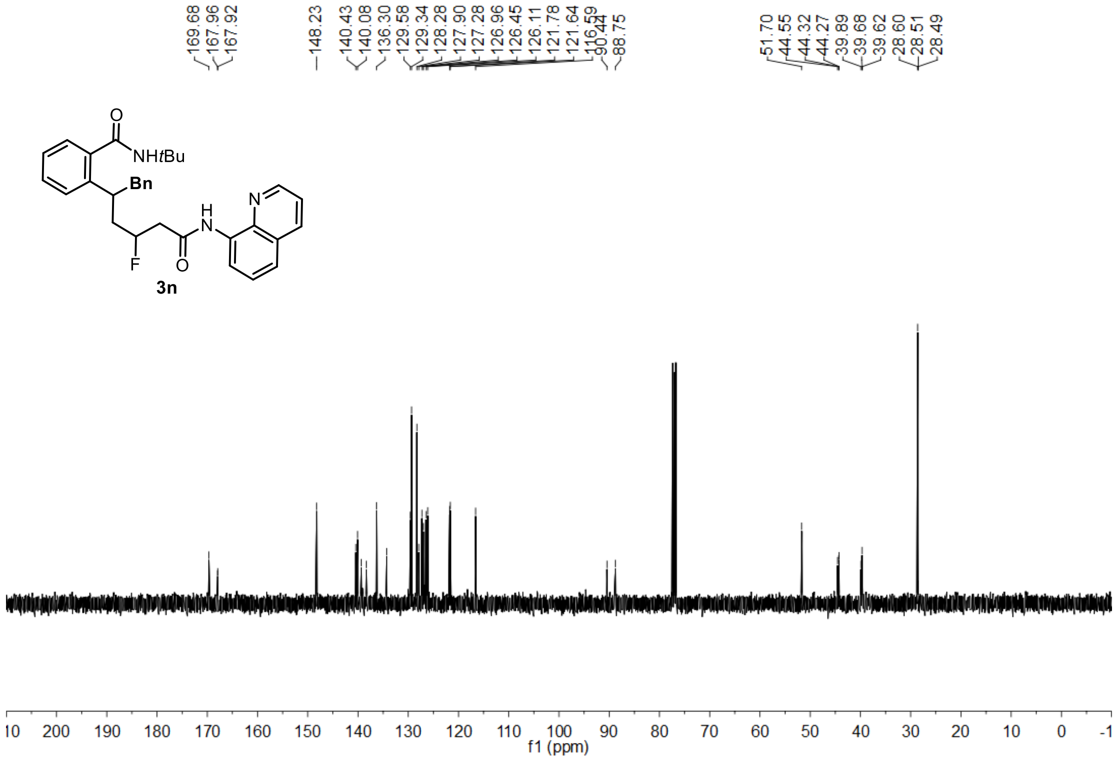
^{13}C NMR (101 MHz, $CDCl_3$) spectra of compound **3m**



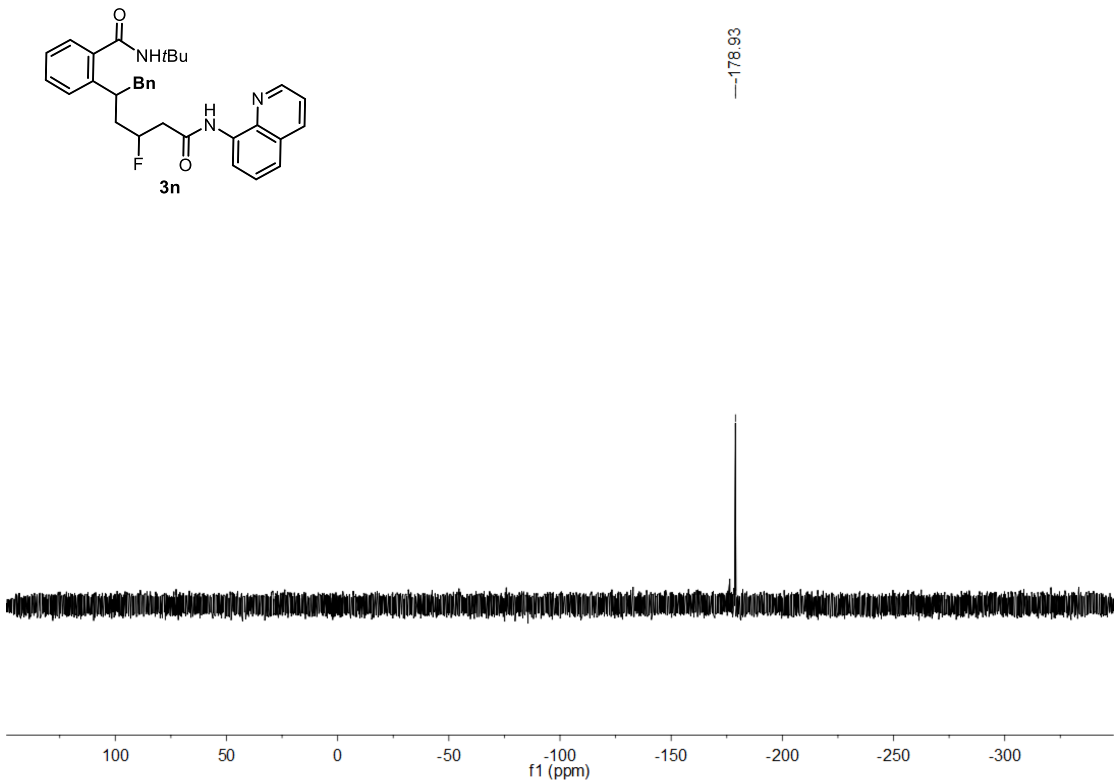
^{19}F NMR (376 MHz, $CDCl_3$) spectra of compound **3m**



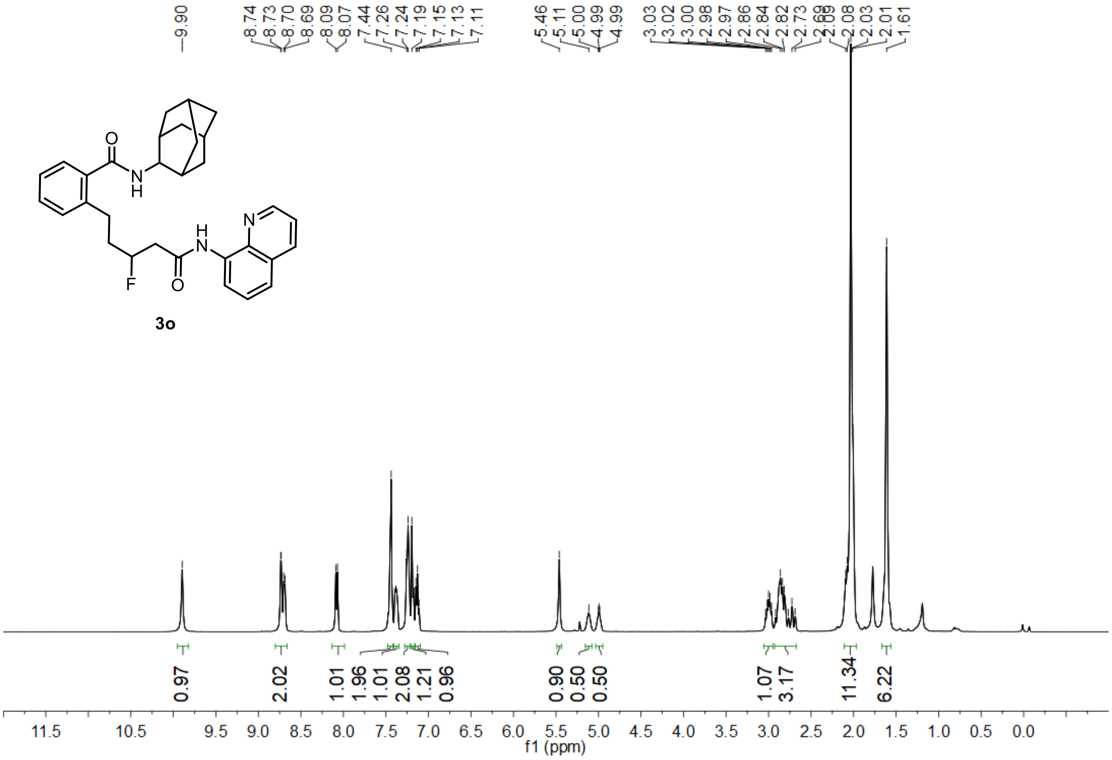
^{1}H NMR (400 MHz, $CDCl_3$) spectra of compound **3n**



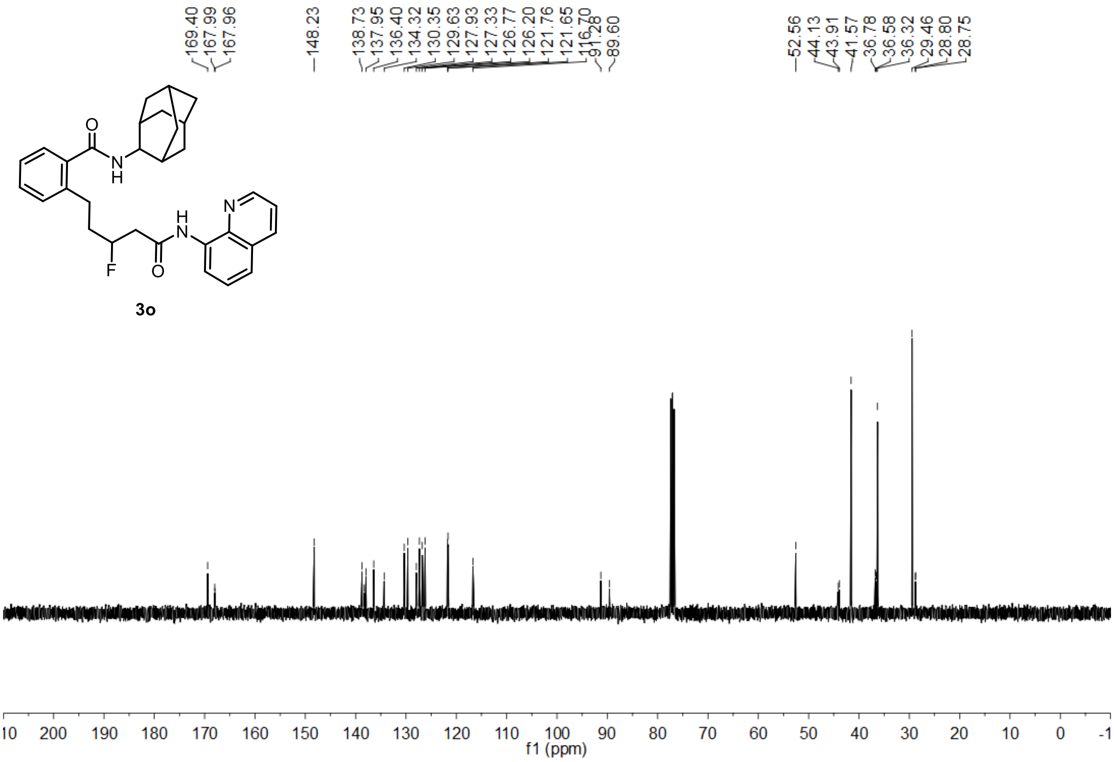
[13]C NMR (101 MHz, $CDCl_3$) spectra of compound **3n**



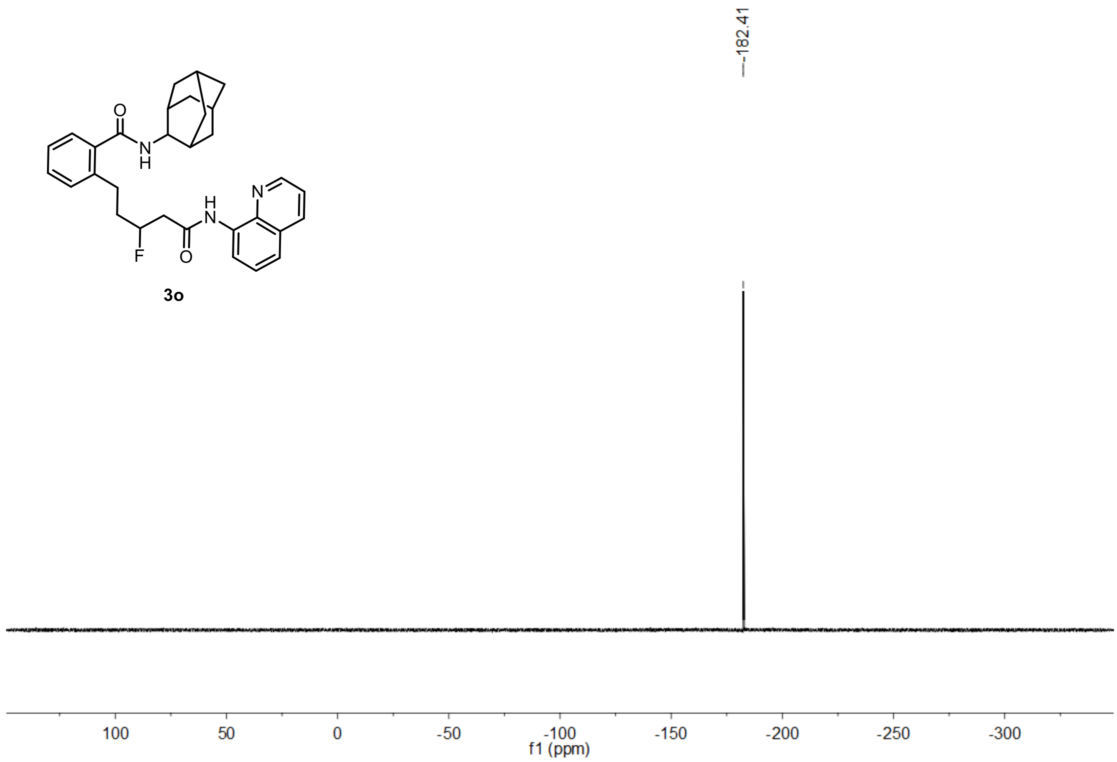
[19]F NMR (376 MHz, $CDCl_3$) spectra of compound **3n**



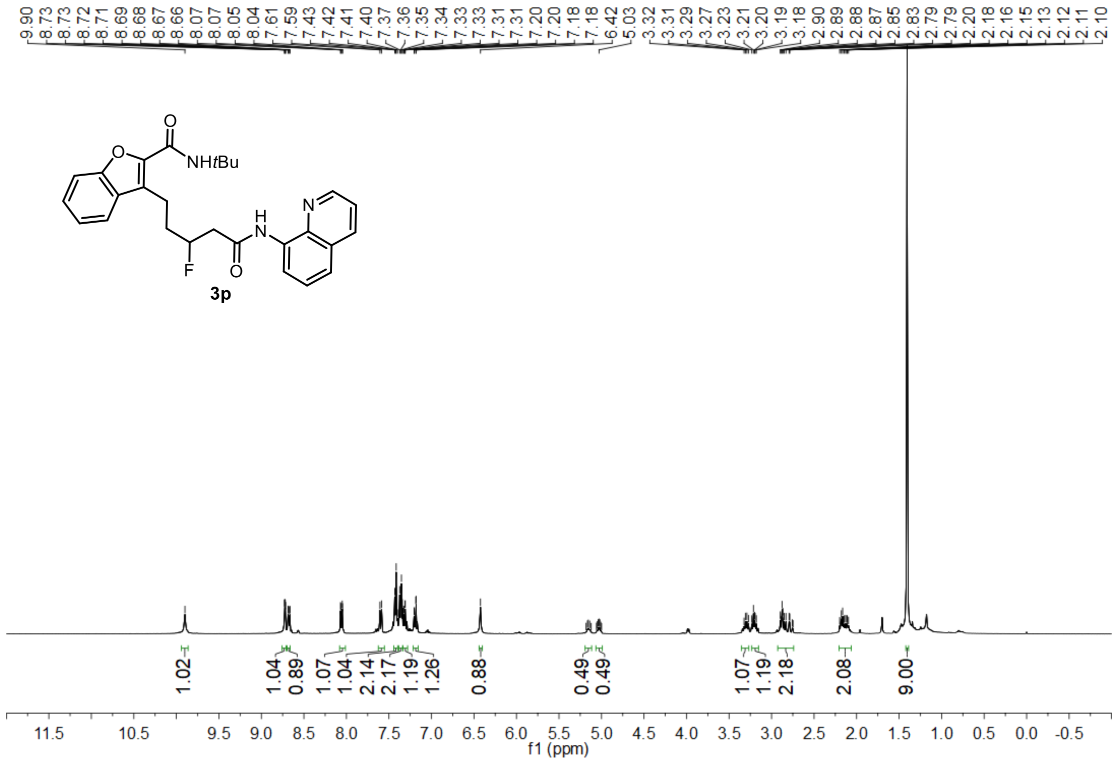
[1]H NMR (400 MHz, $CDCl_3$) spectra of compound **3o**



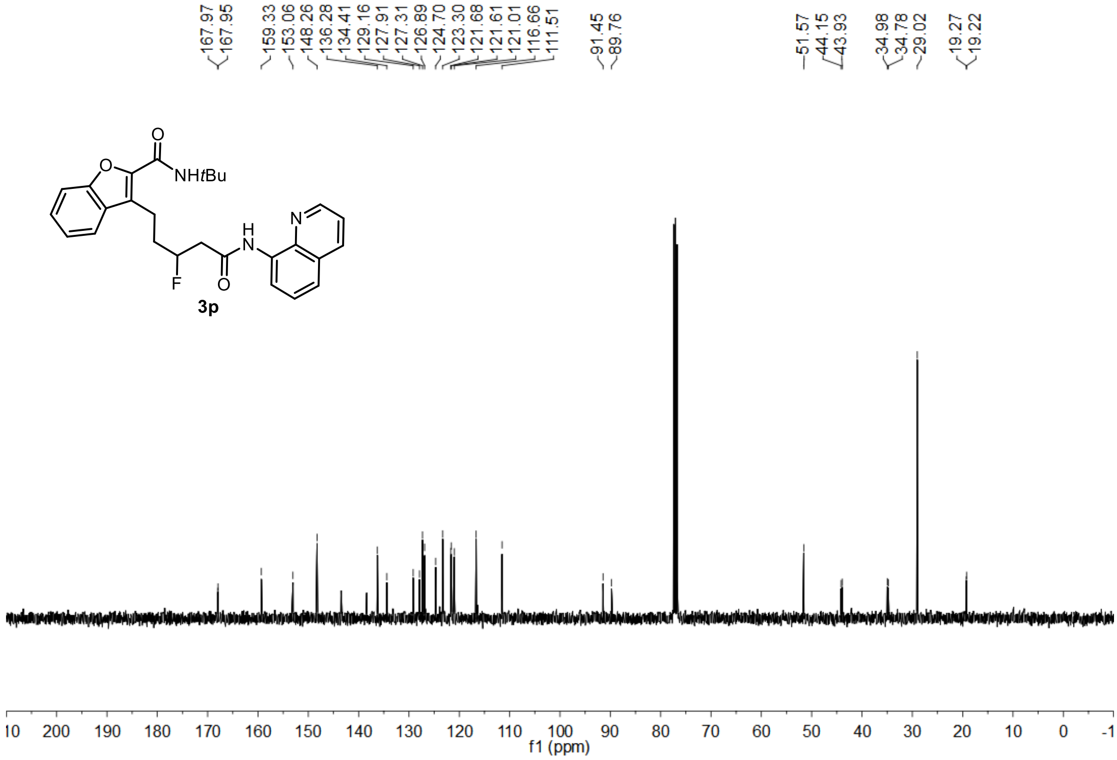
[13]C NMR (101 MHz, $CDCl_3$) spectra of compound **3o**



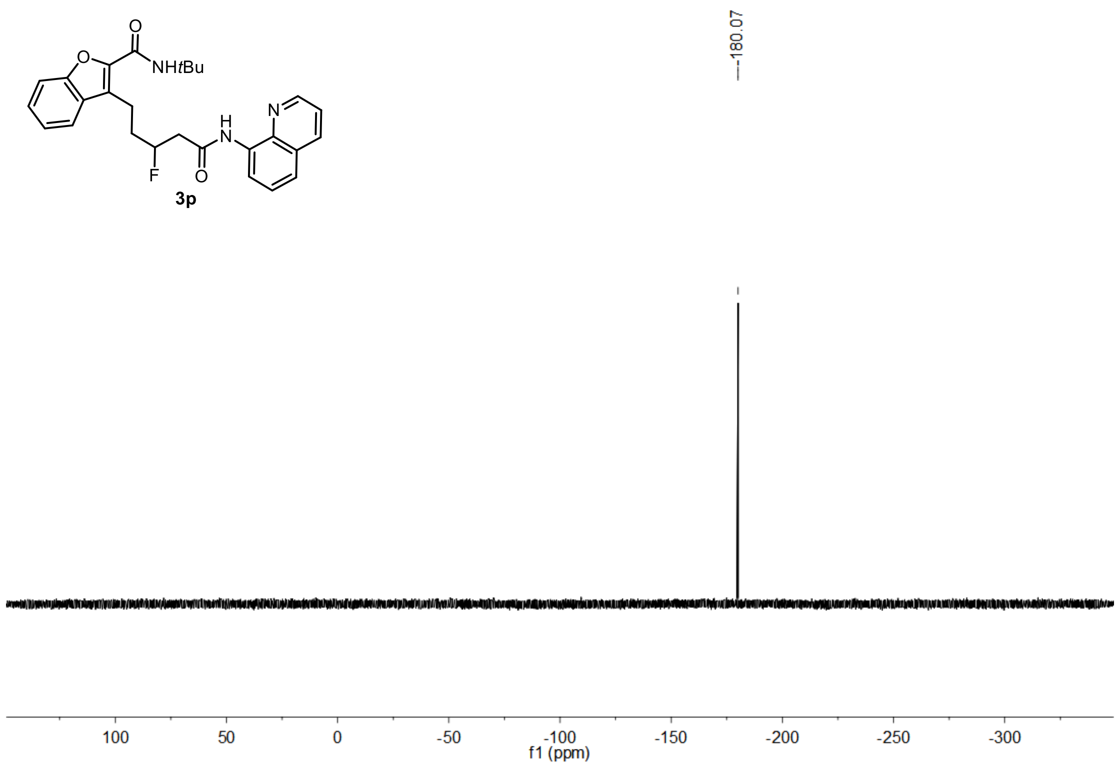
^{19}F NMR (376 MHz, $CDCl_3$) spectra of compound **3o**



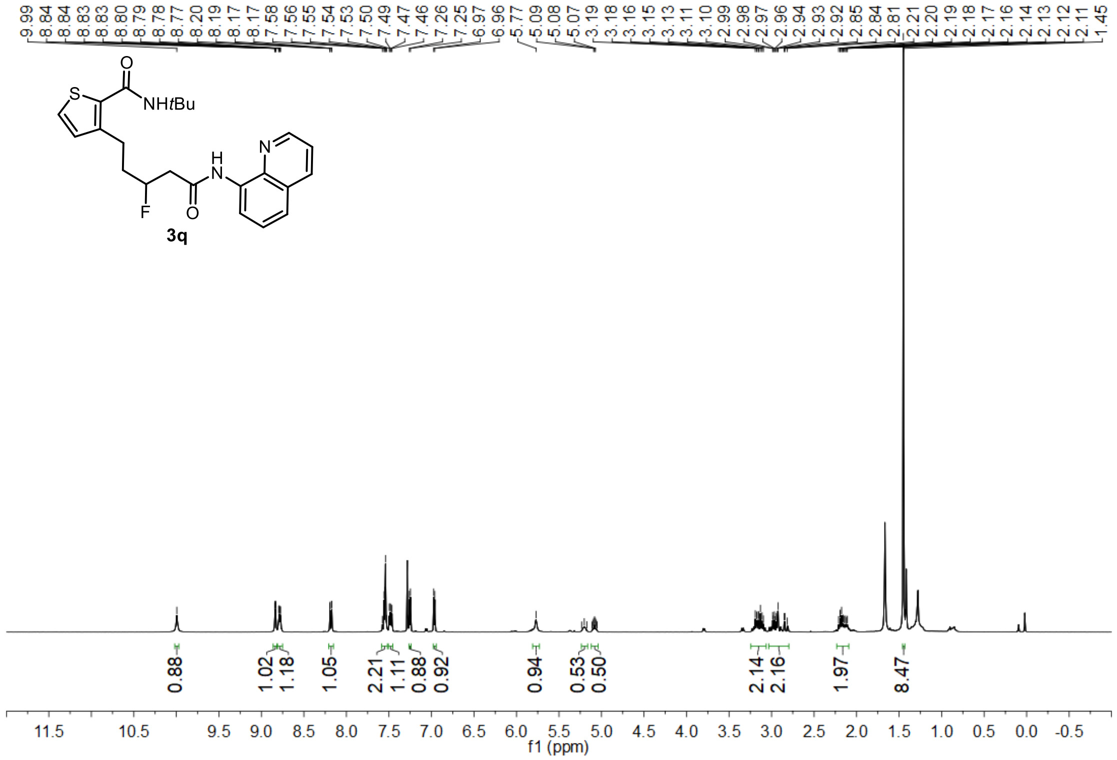
^{1}H NMR (400 MHz, $CDCl_3$) spectra of compound **3p**



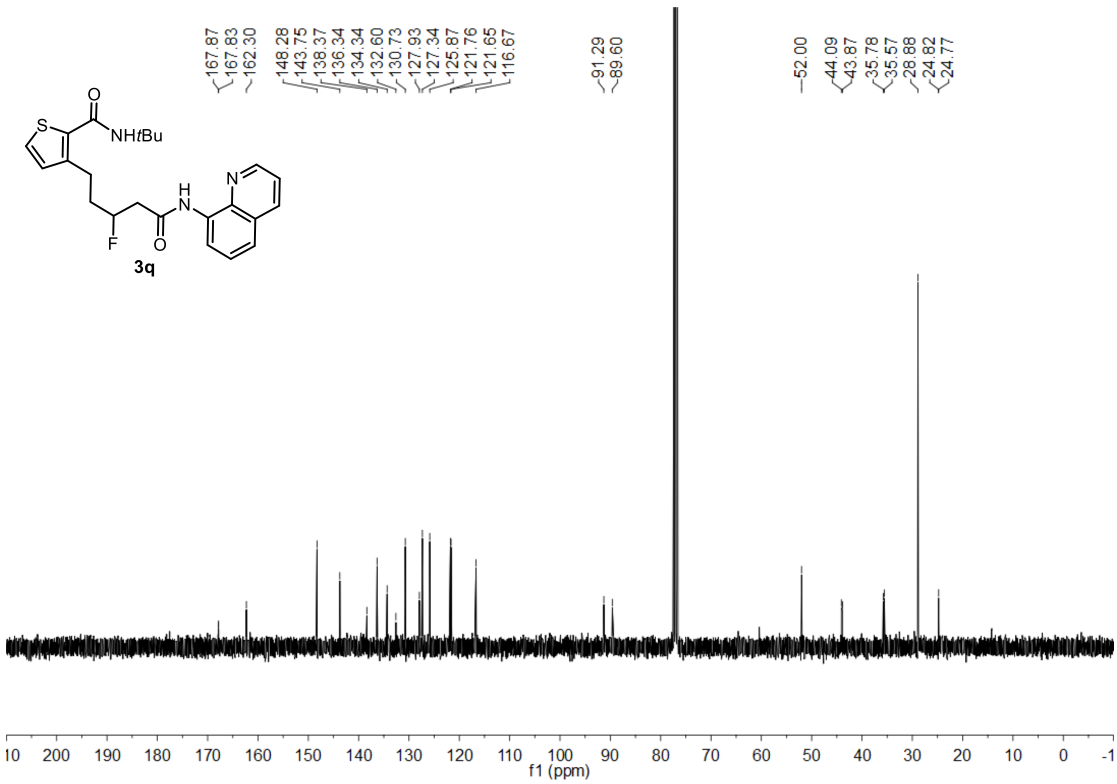
^{13}C NMR (101 MHz, $CDCl_3$) spectra of compound **3p**



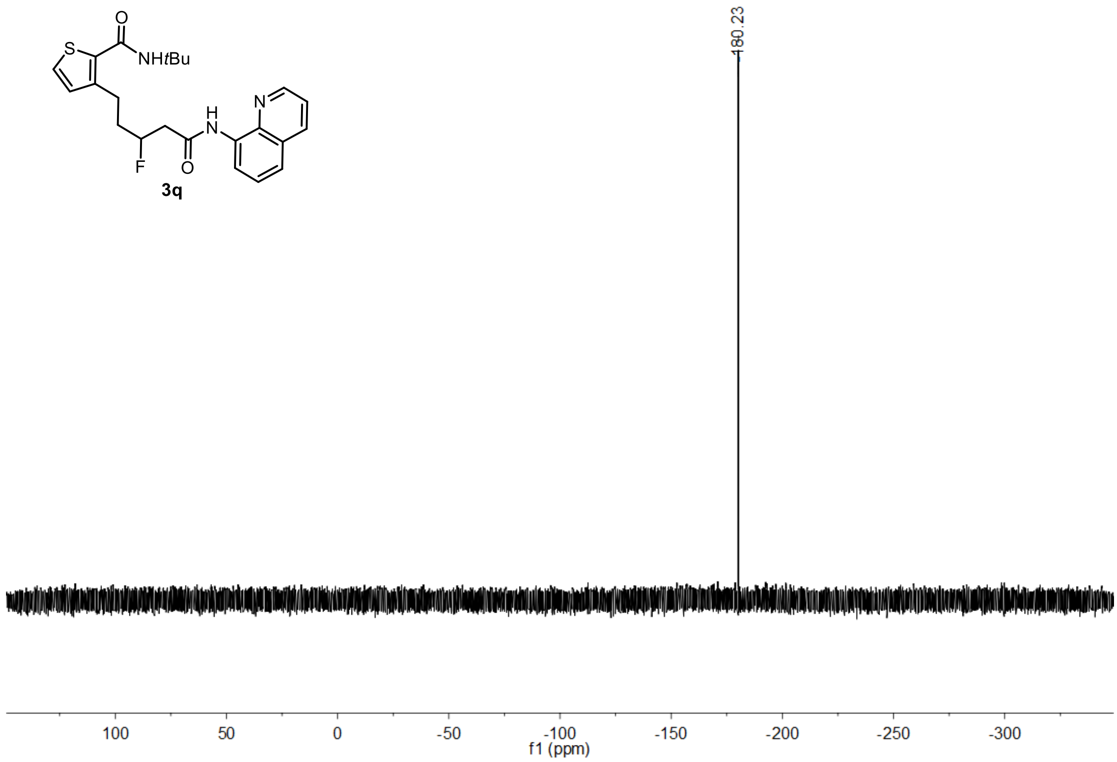
^{19}F NMR (376 MHz, $CDCl_3$) spectra of compound **3p**



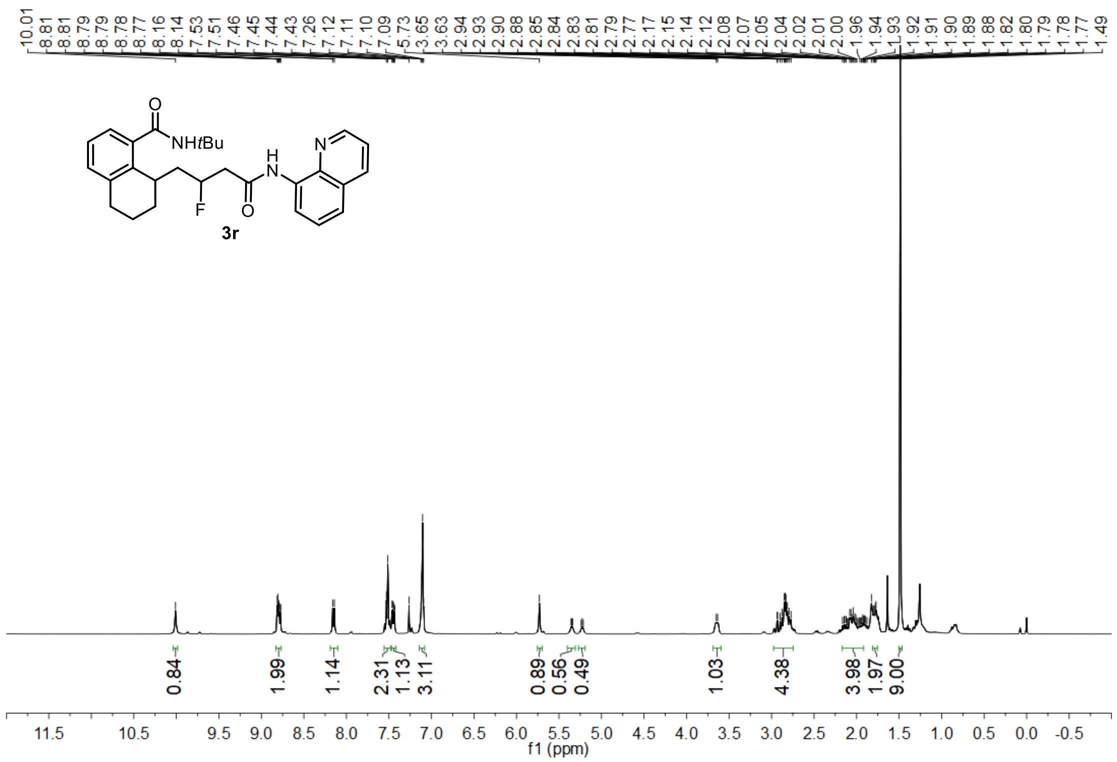
^{1}H NMR (400 MHz, $CDCl_3$) spectra of compound **3q**



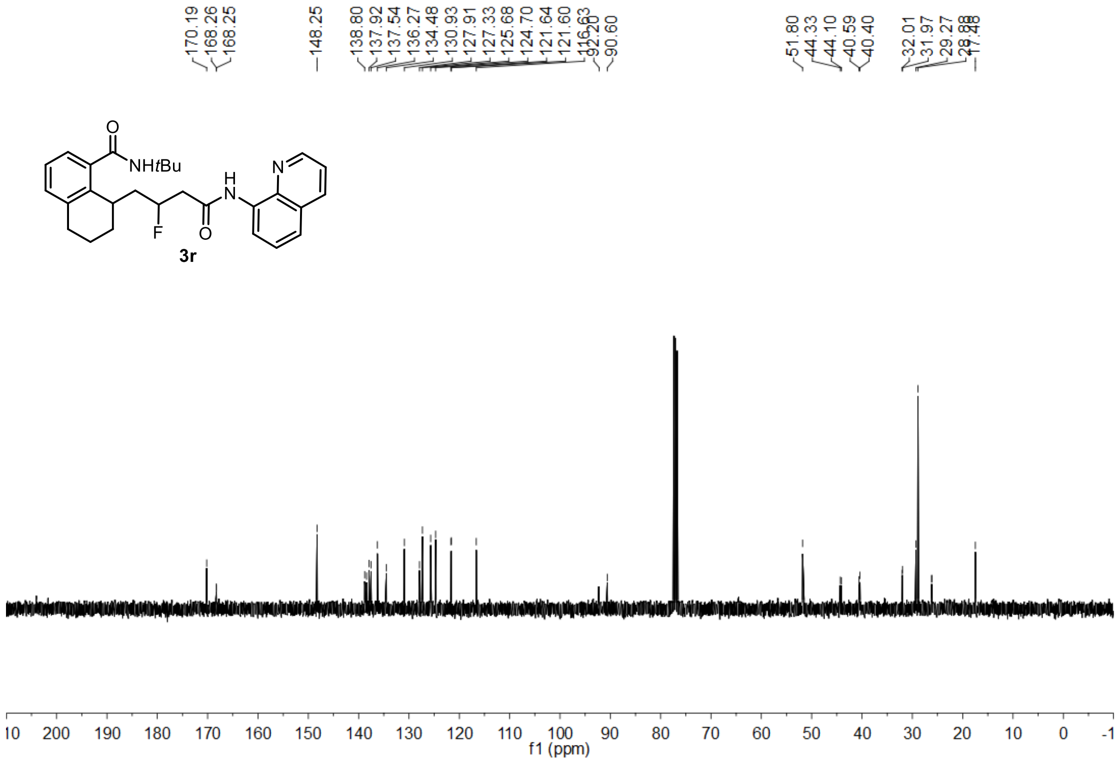
^{13}C NMR (101 MHz, $CDCl_3$) spectra of compound **3q**



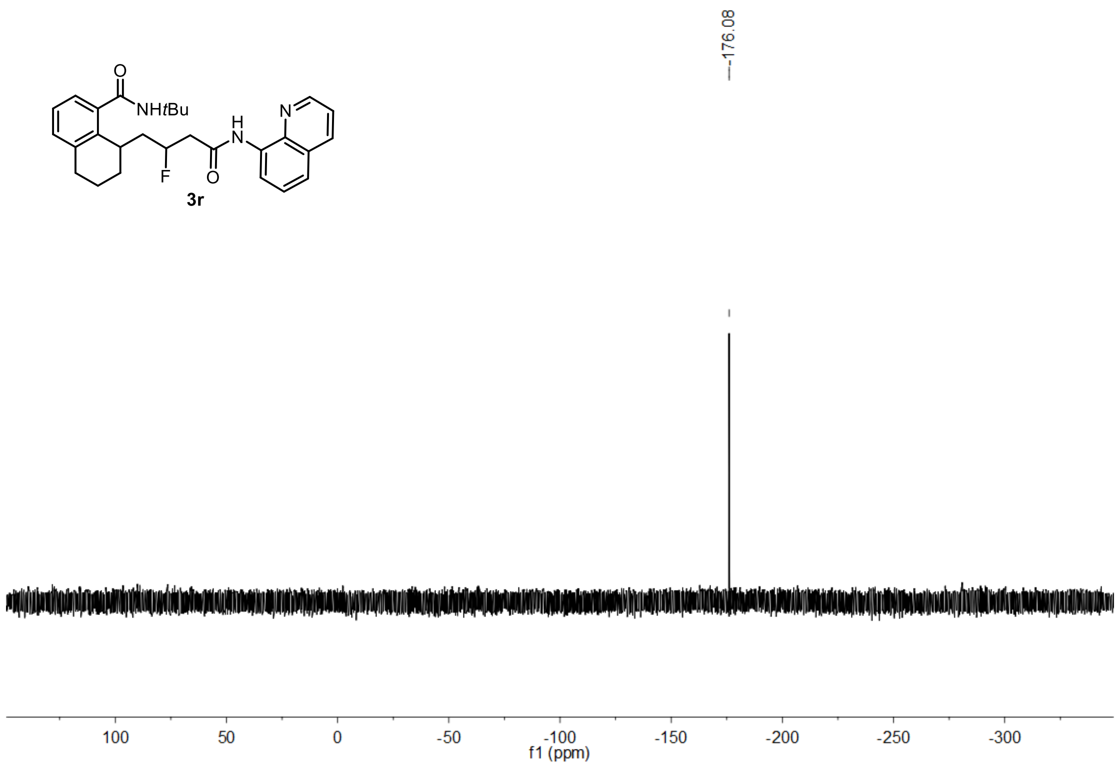
^{19}F NMR (376 MHz, CDCl$_3$) spectra of compound **3q**



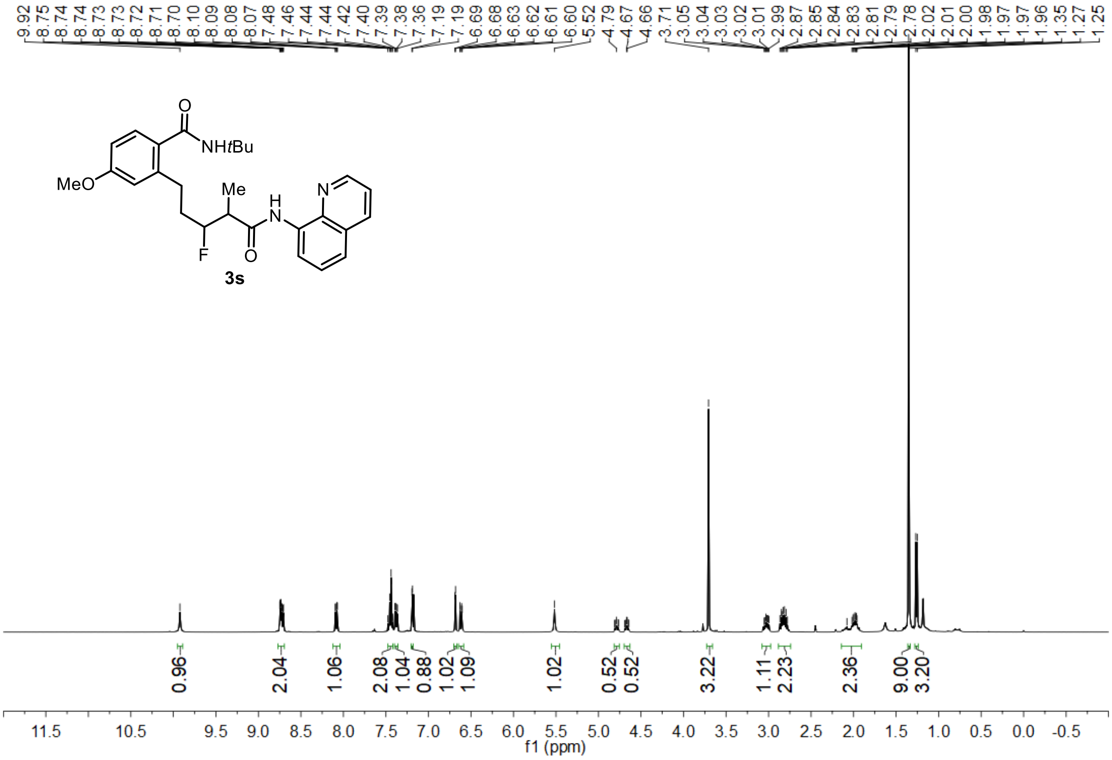
^{1}H NMR (400 MHz, CDCl$_3$) spectra of compound **3r**



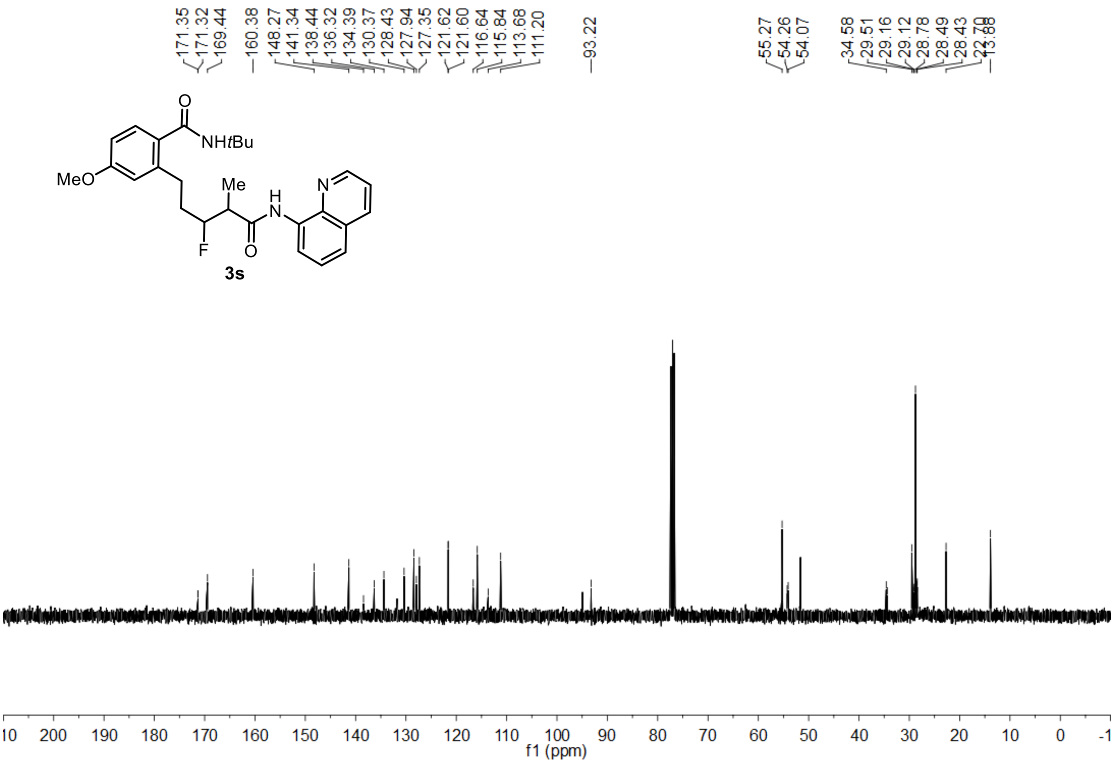
^{13}C NMR (101 MHz, $CDCl_3$) spectra of compound **3r**



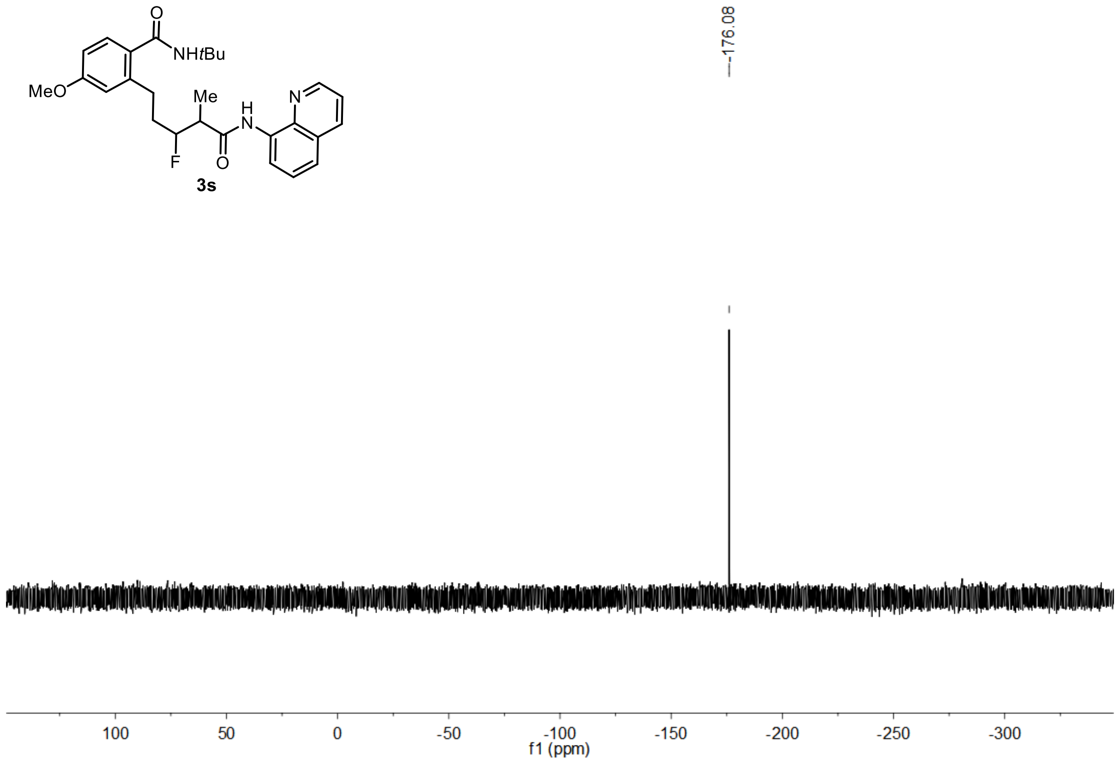
^{19}F NMR (376 MHz, $CDCl_3$) spectra of compound **3r**



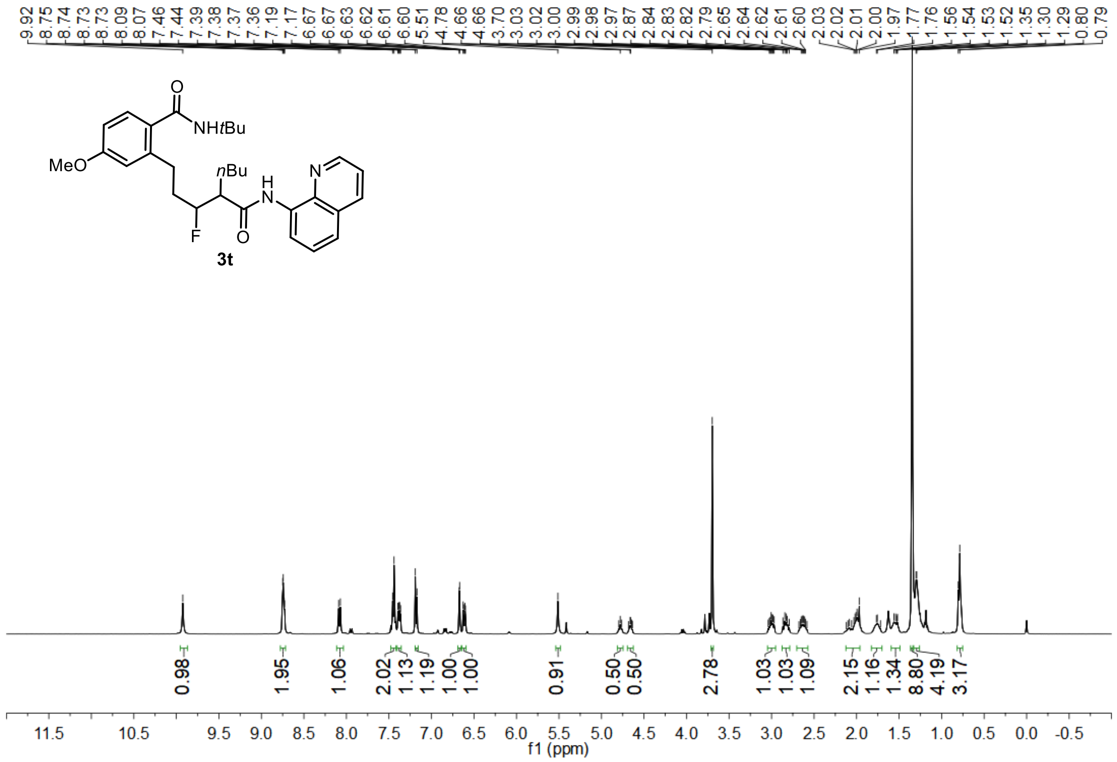
[1]H NMR (400 MHz, $CDCl_3$) spectra of compound **3s**



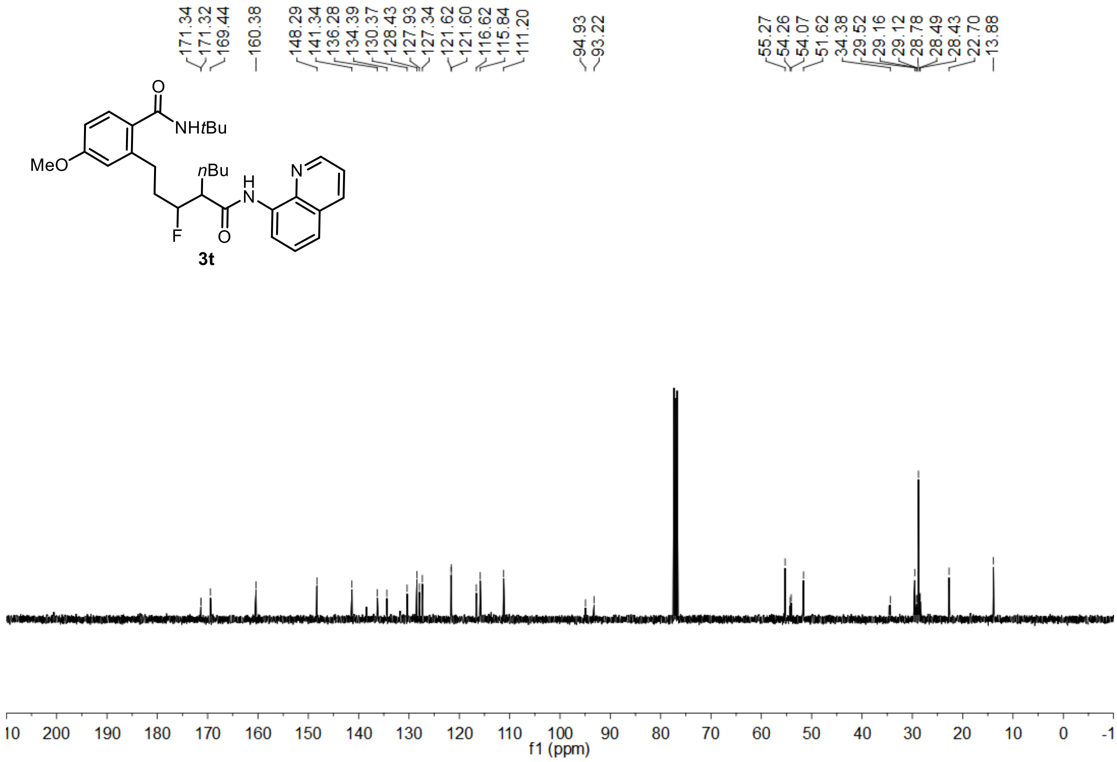
[13]C NMR (101 MHz, $CDCl_3$) spectra of compound **3s**



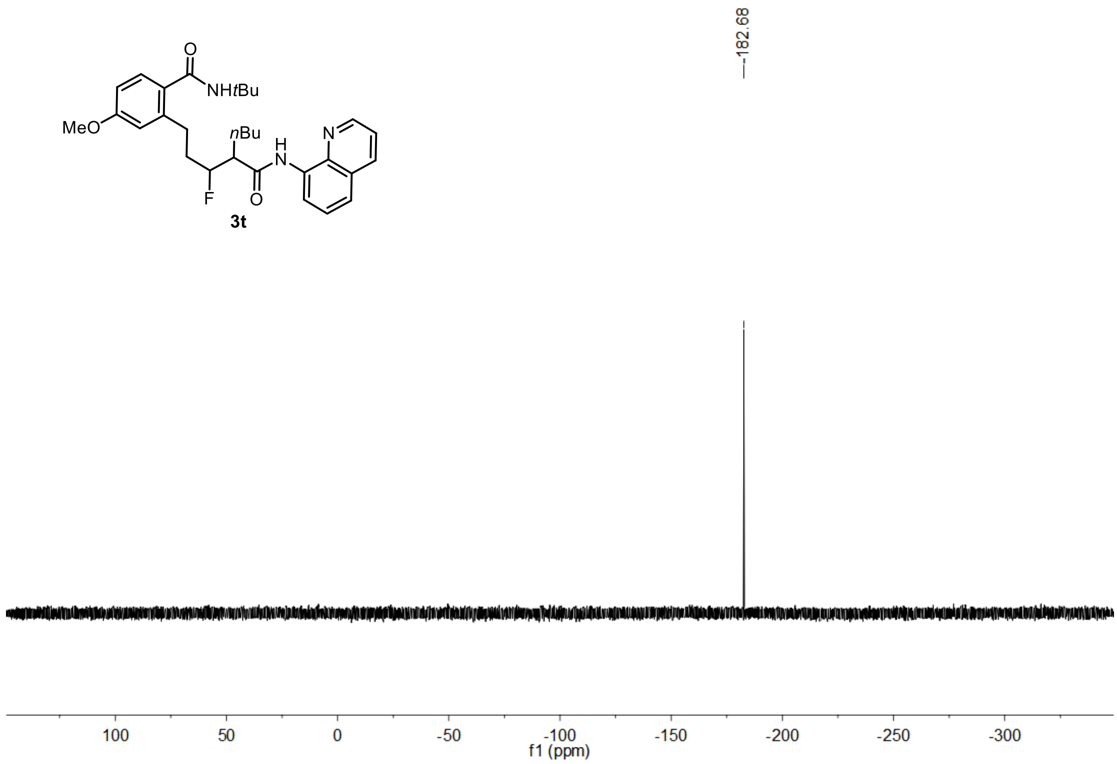
^{19}F NMR (376 MHz, $CDCl_3$) spectra of compound **3s**



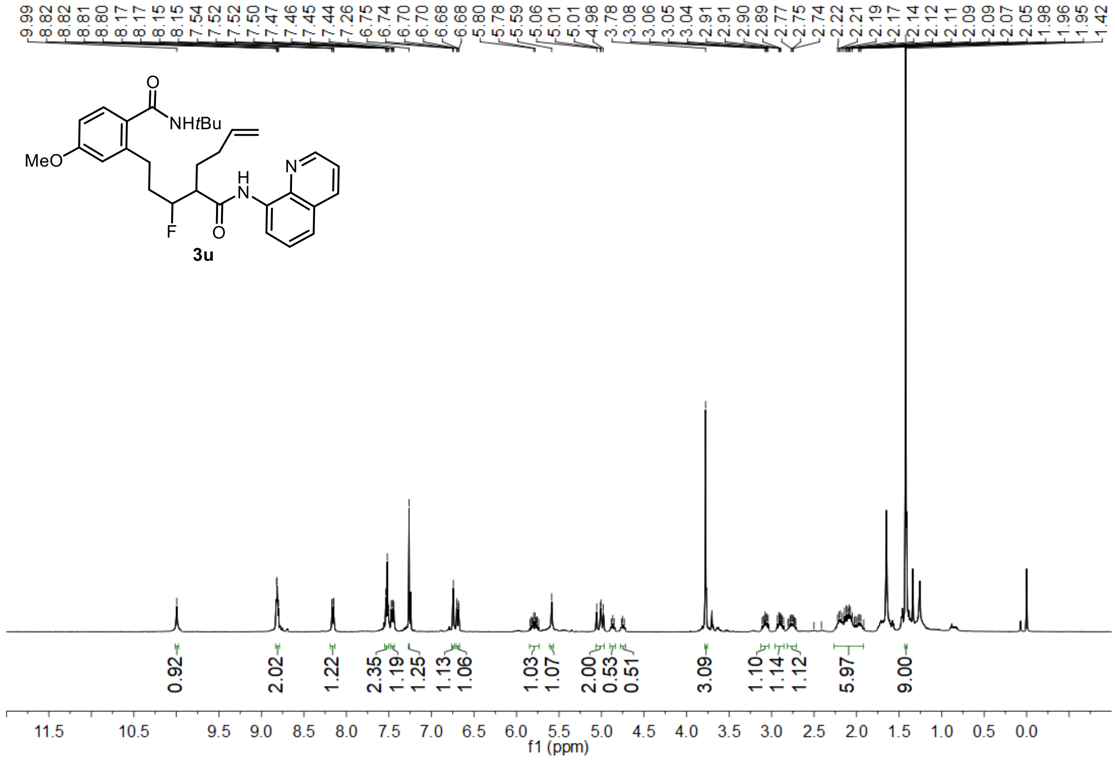
^{1}H NMR (400 MHz, $CDCl_3$) spectra of compound **3t**



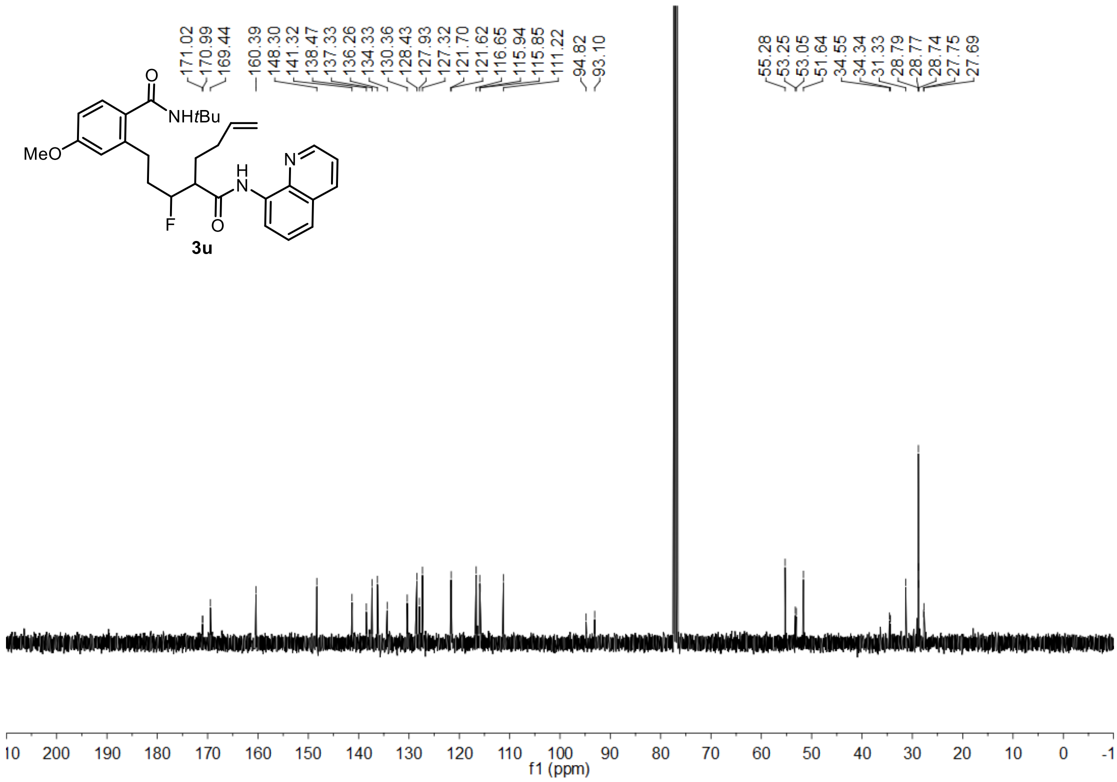
^{13}C NMR (101 MHz, $CDCl_3$) spectra of compound **3t**



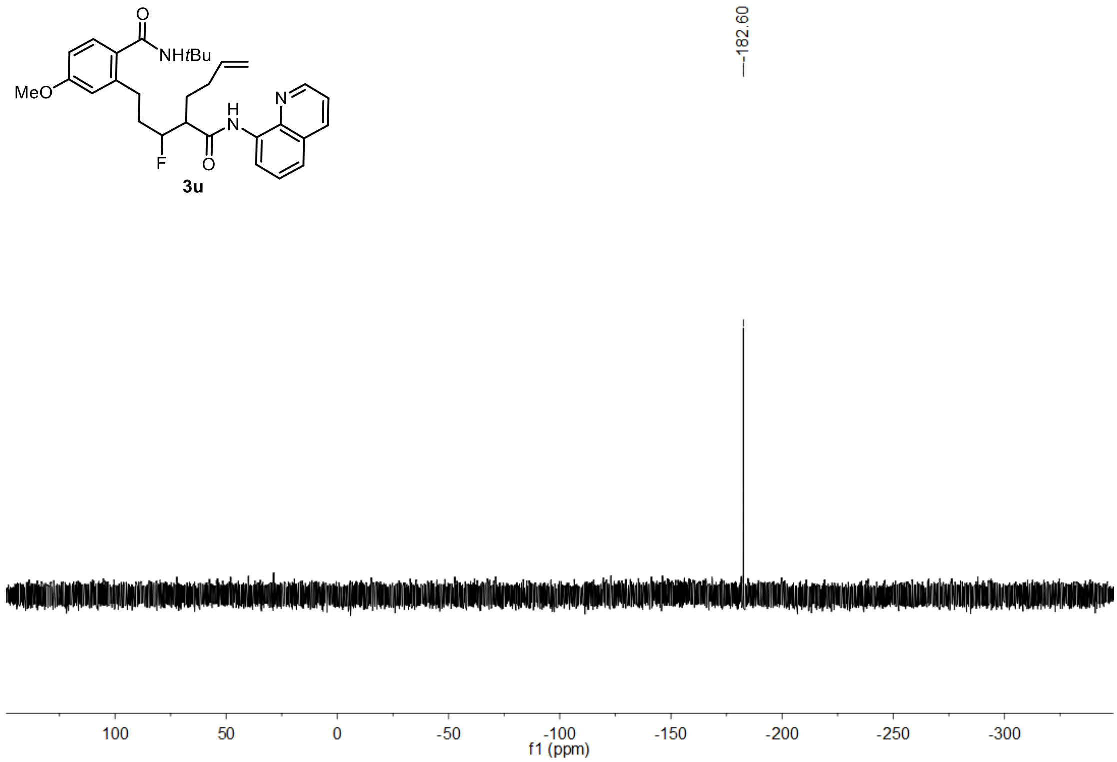
^{19}F NMR (376 MHz, $CDCl_3$) spectra of compound **3t**



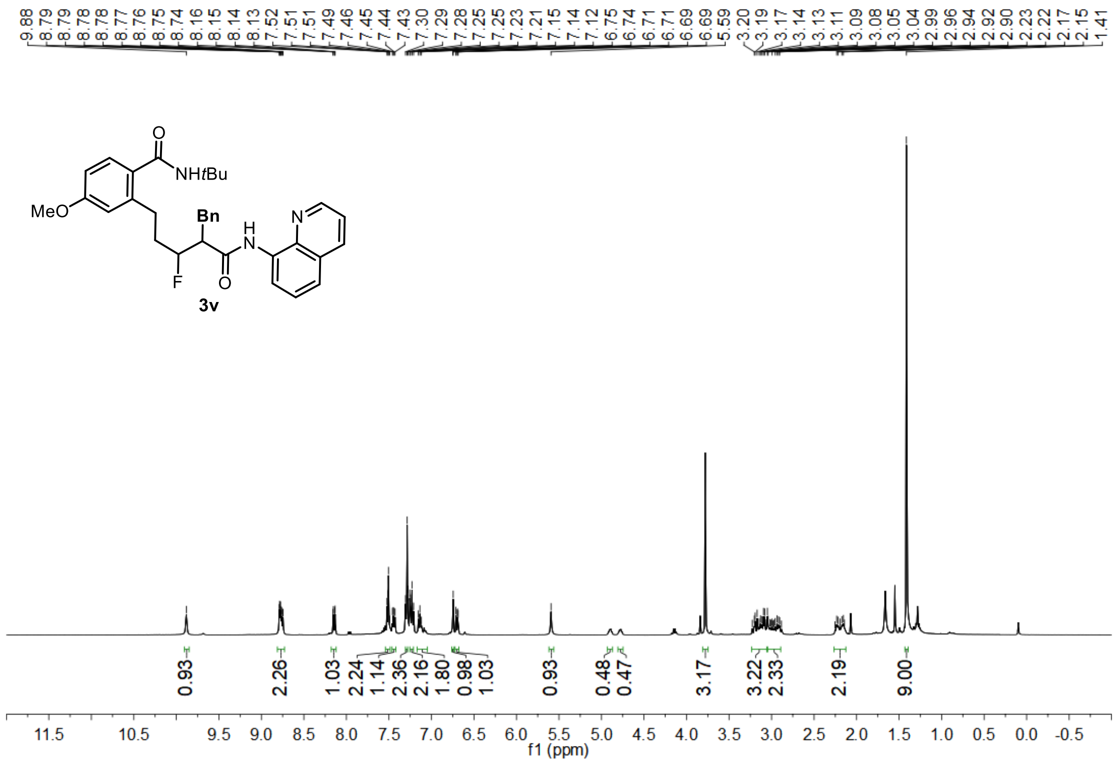
^{1}H NMR (400 MHz, $CDCl_3$) spectra of compound **3u**



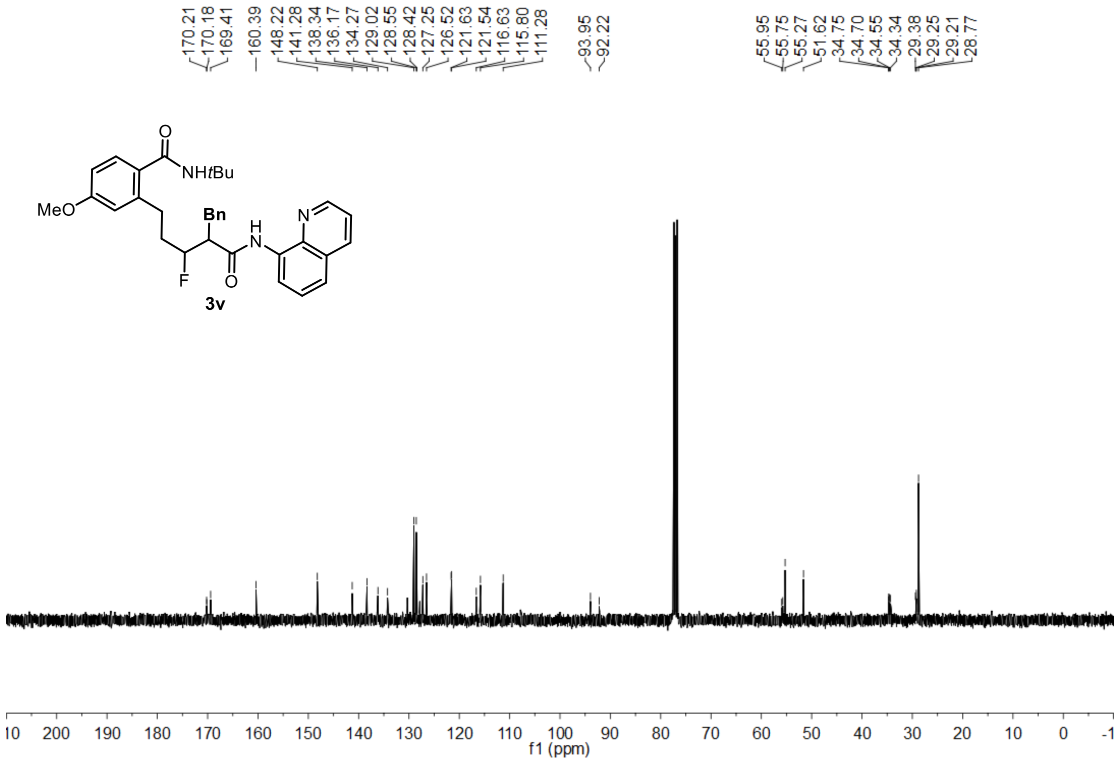
^{13}C NMR (101 MHz, $CDCl_3$) spectra of compound **3u**



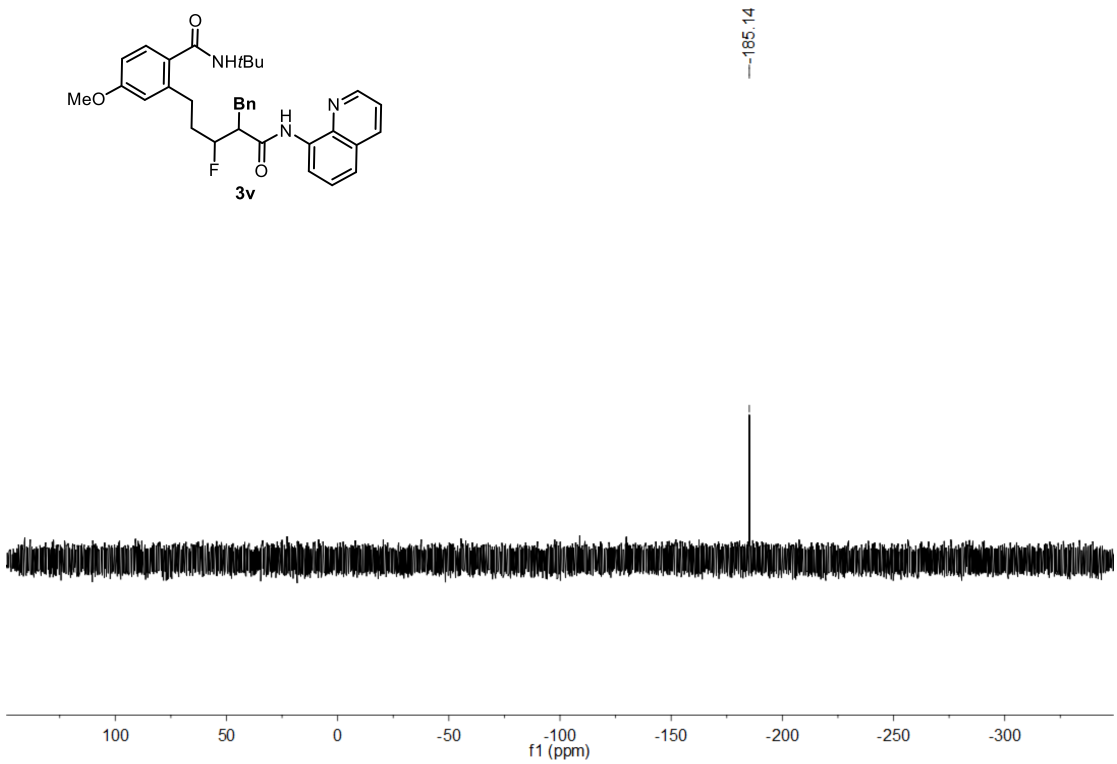
^{19}F NMR (376 MHz, $CDCl_3$) spectra of compound **3u**



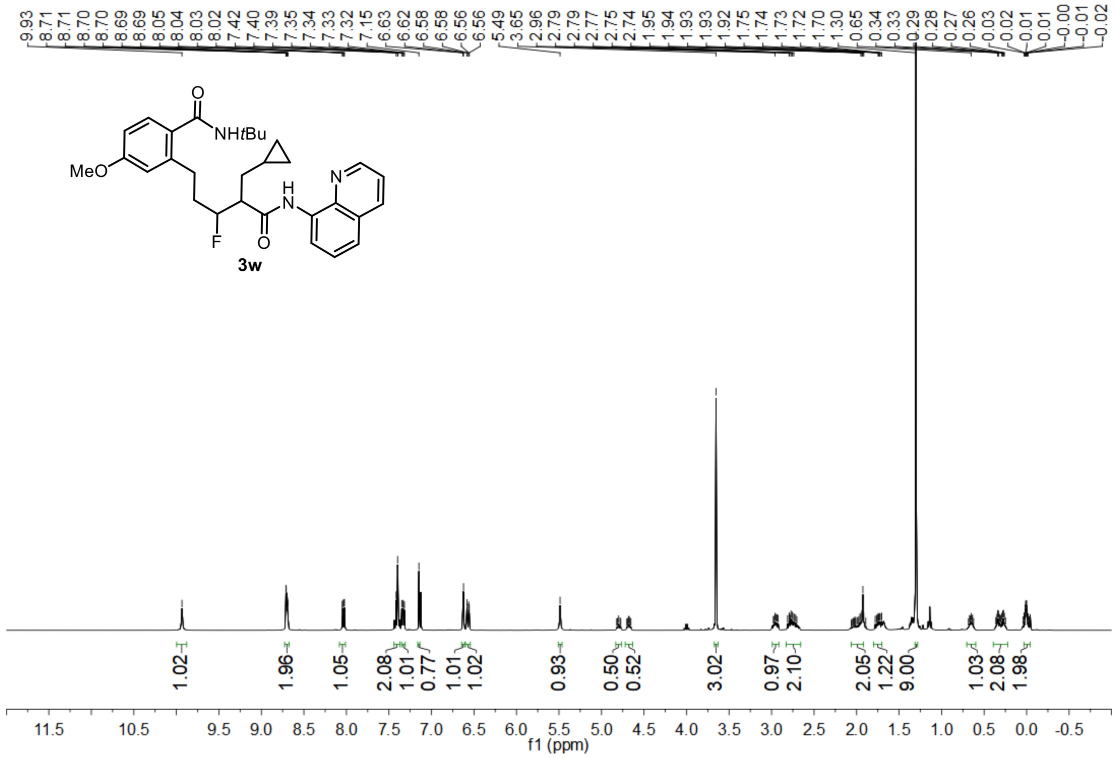
^{1}H NMR (400 MHz, $CDCl_3$) spectra of compound **3v**



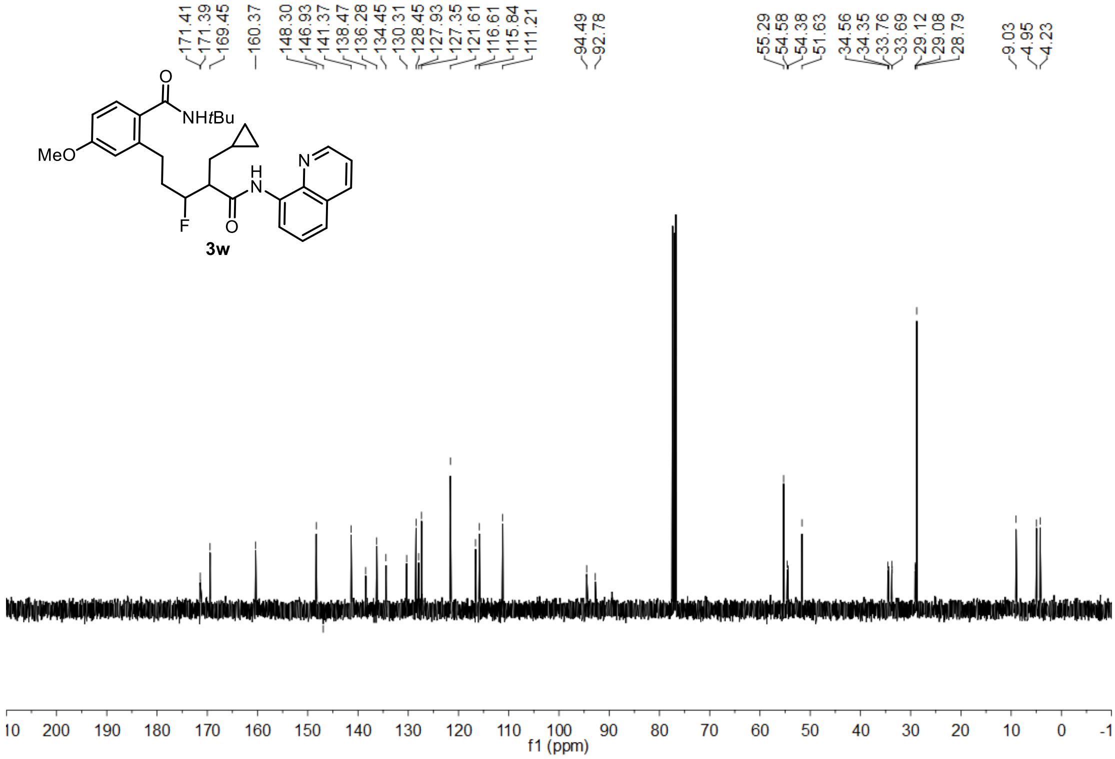
^{13}C NMR (101 MHz, $CDCl_3$) spectra of compound **3v**



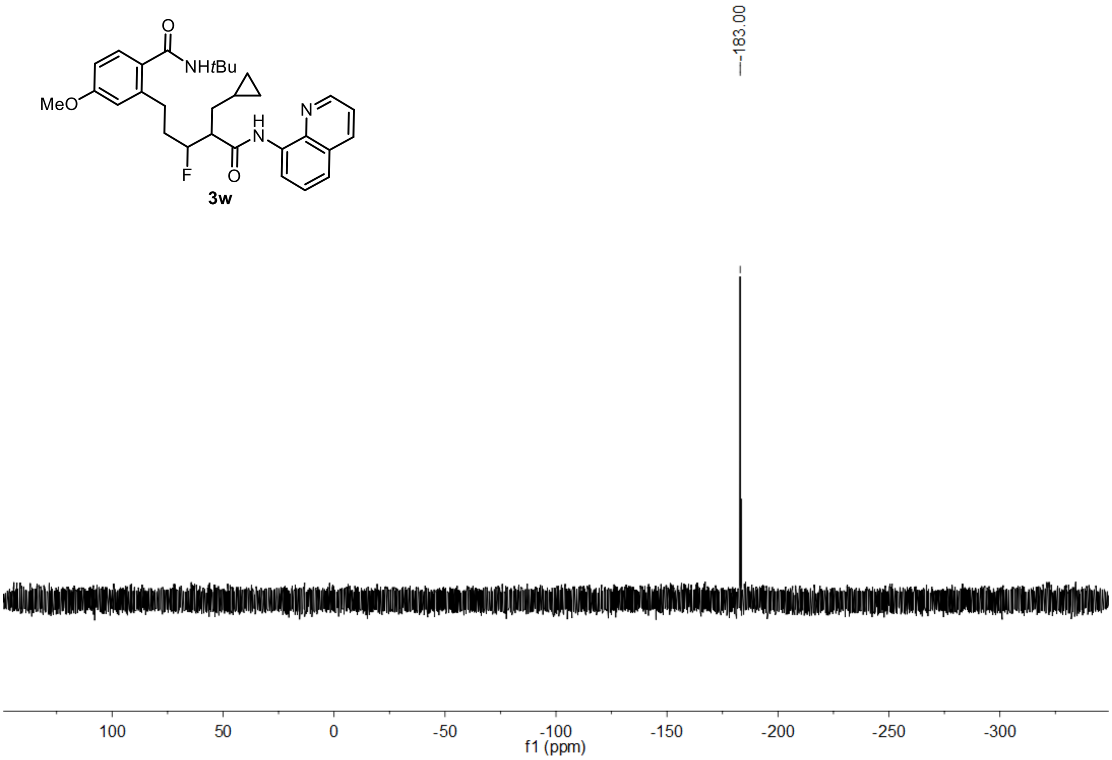
^{19}F NMR (376 MHz, $CDCl_3$) spectra of compound **3v**



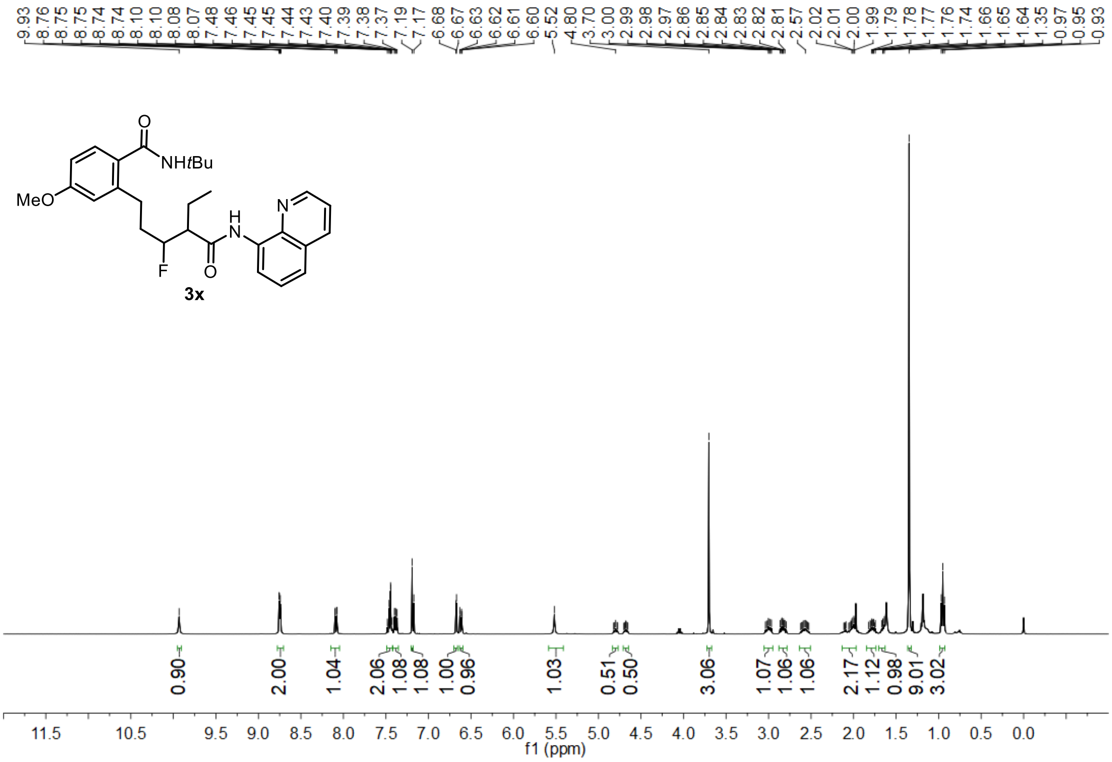
^{1}H NMR (400 MHz, $CDCl_3$) spectra of compound **3w**



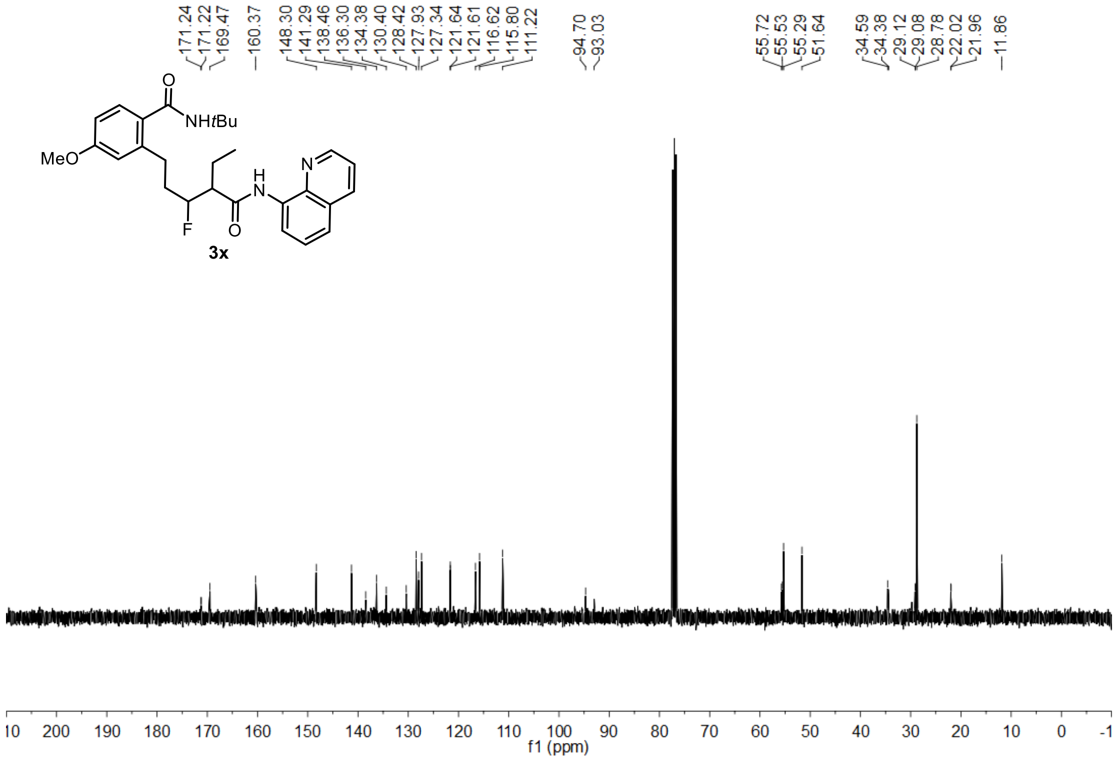
^{13}C NMR (101 MHz, $CDCl_3$) spectra of compound **3w**



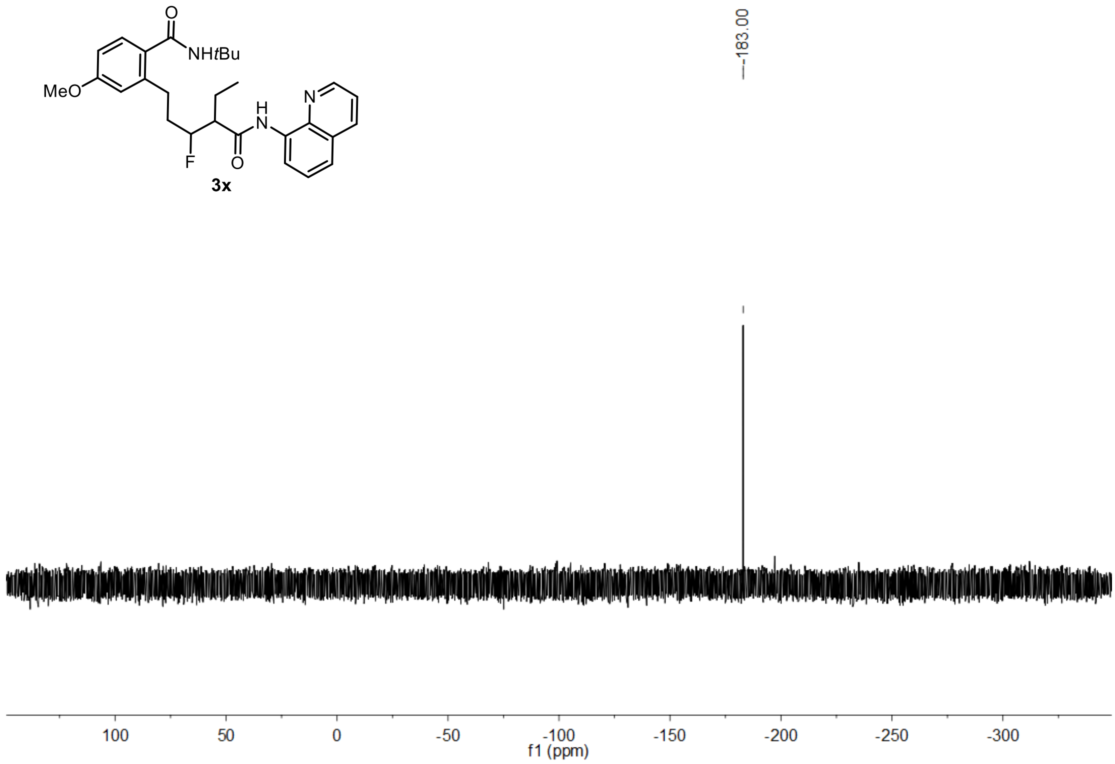
^{19}F NMR (376 MHz, CDCl$_3$) spectra of compound **3w**



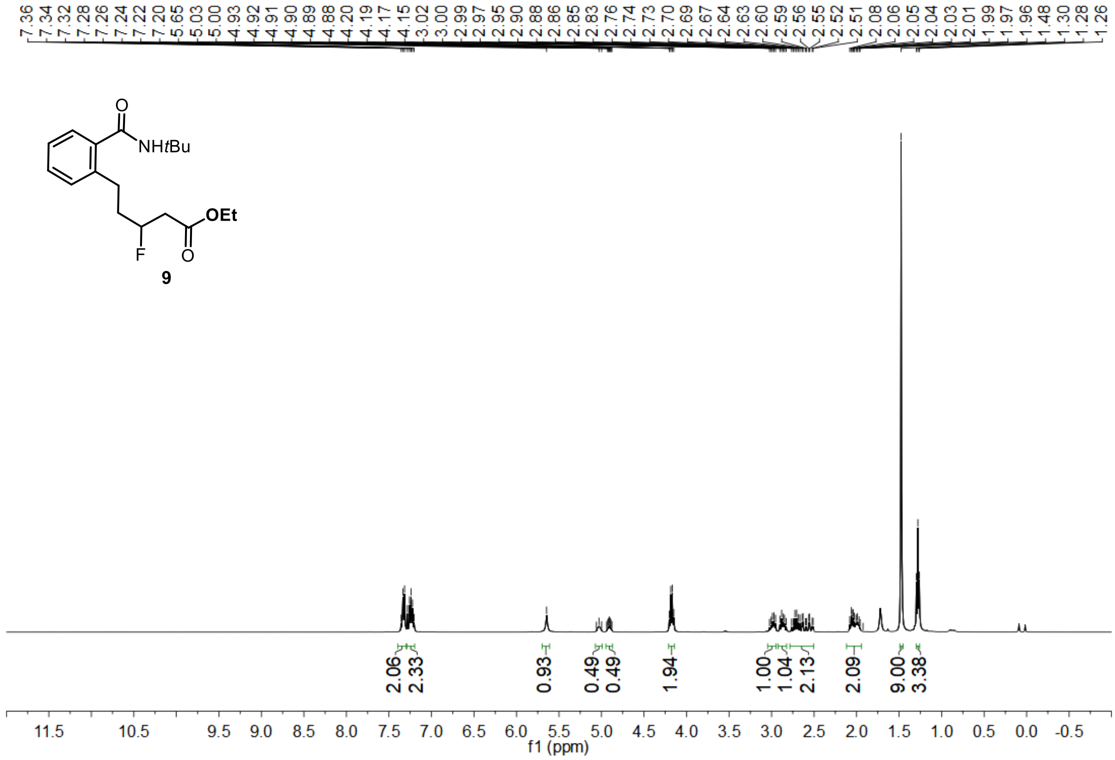
^{1}H NMR (400 MHz, CDCl$_3$) spectra of compound **3x**



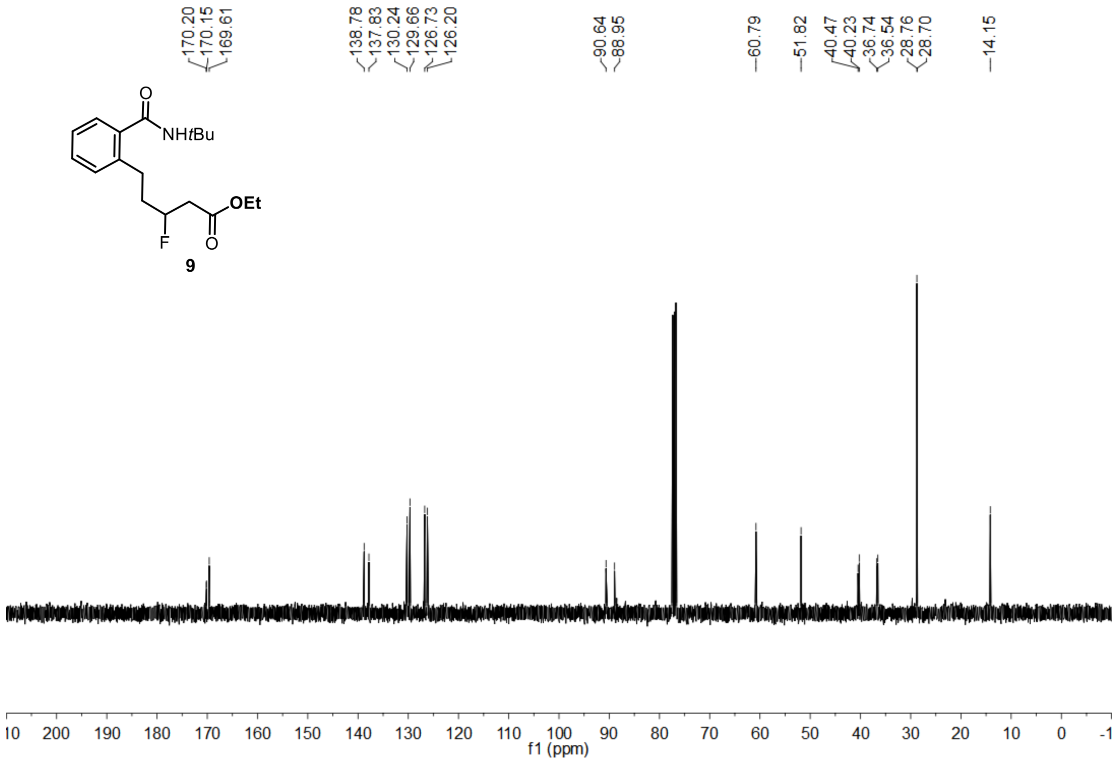
^{13}C NMR (101 MHz, $CDCl_3$) spectra of compound **3x**



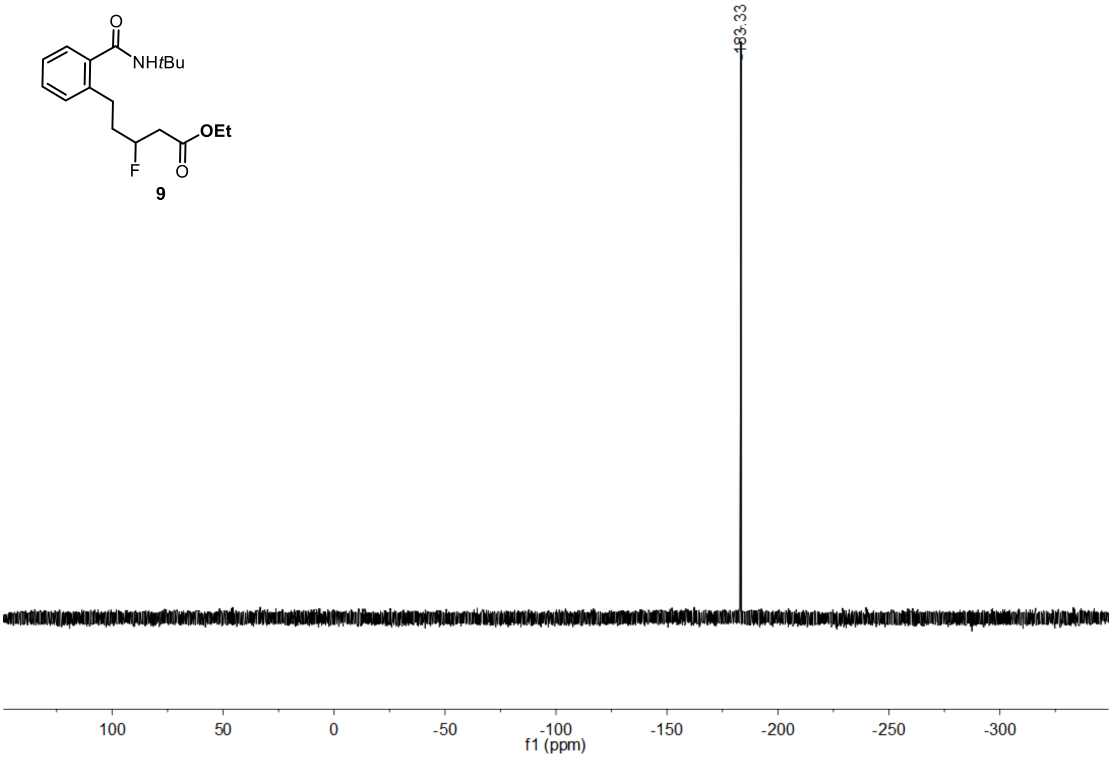
^{19}F NMR (376 MHz, $CDCl_3$) spectra of compound **3x**



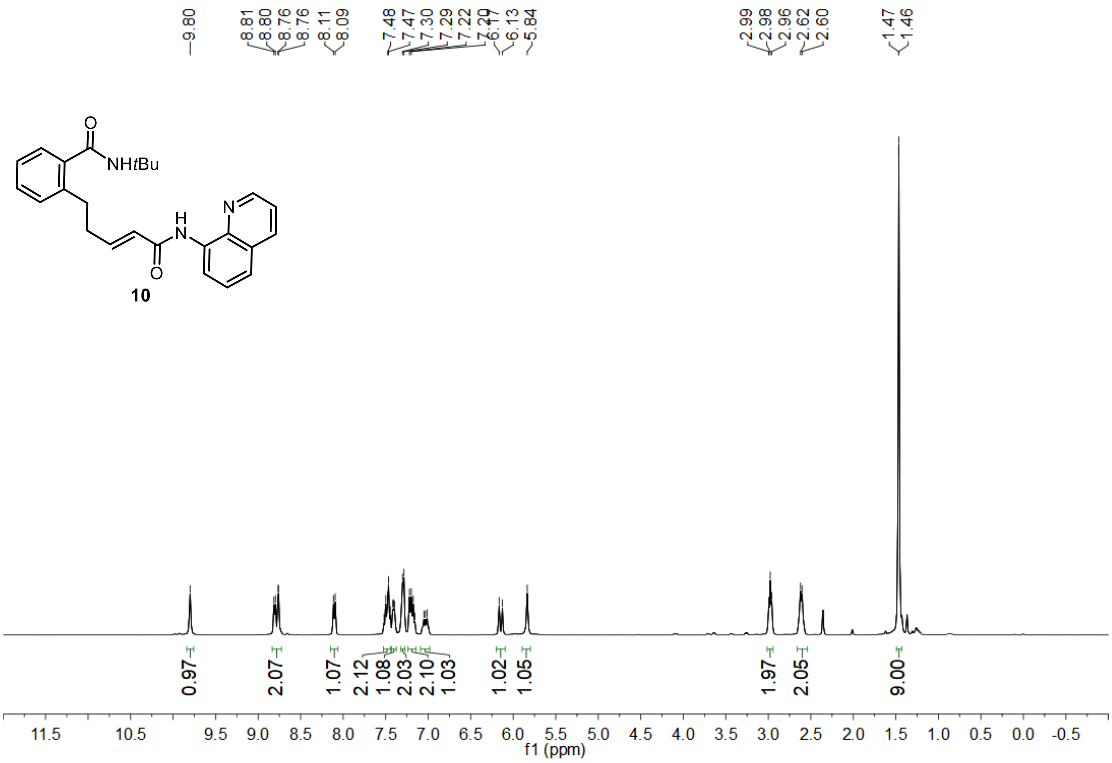
^{1}H NMR (400 MHz, $CDCl_3$) spectra of compound **9**



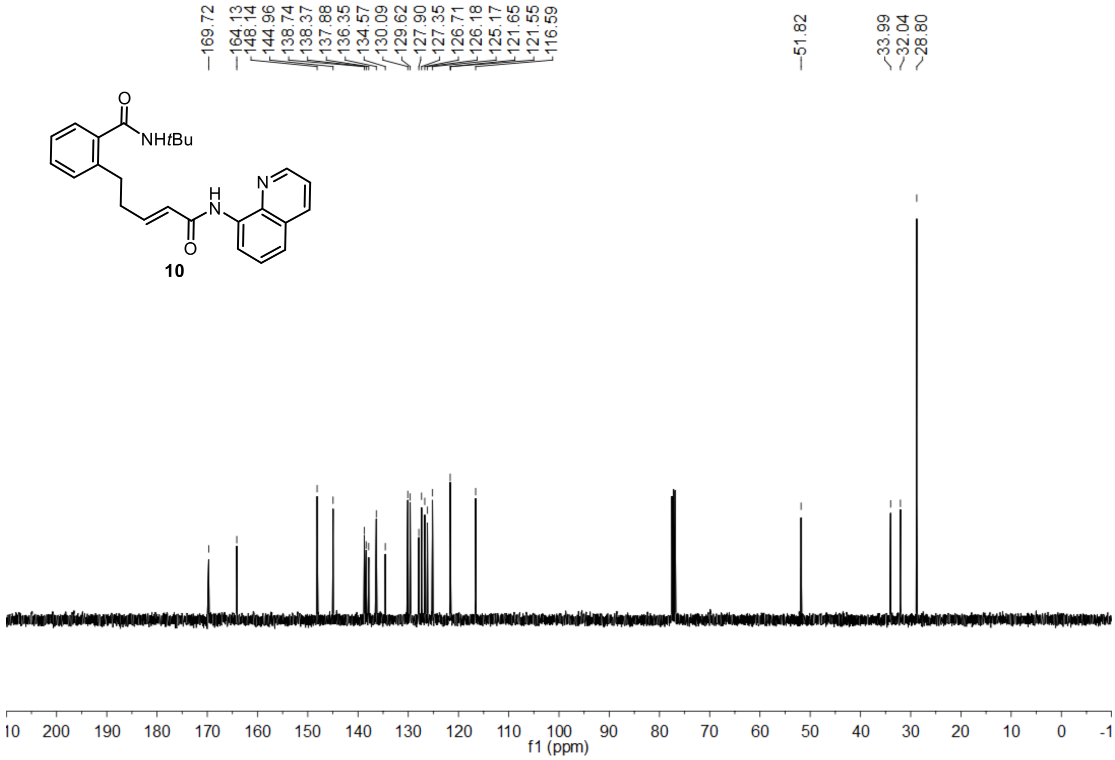
^{13}C NMR (101 MHz, $CDCl_3$) spectra of compound **9**



^{19}F NMR (376 MHz, $CDCl_3$) spectra of compound **9**



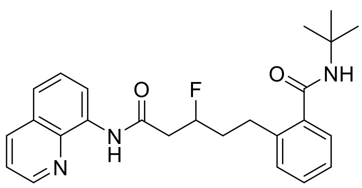
^{1}H NMR (400 MHz, $CDCl_3$) spectra of compound **10**



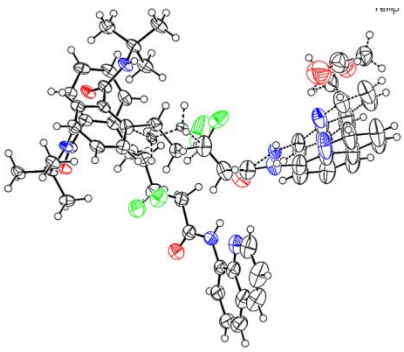
^{13}C NMR (101 MHz, $CDCl_3$) spectra of compound **10**

V. The Single Crystal Data of 3a

X-ray analysis data of compound **3a**



3a



3a, CCDC: **2490587**

Table S2. Crystal data and structure refinement for 3a.

Identification code	**3a**
Empirical formula	$C_{51}H_{58}F_2N_6O_{4.5}$
Formula weight	865.03
Temperature/K	100.00(10)
Crystal system	triclinic
Space group	P-1
a/Å	9.2658(2)
b/Å	9.8221(2)
c/Å	25.9787(5)
α/°	88.513(2)
β/°	84.892(2)
γ/°	76.204(2)
Volume/Å^3	2286.96(8)
Z	2
ρ_{calc}g/cm^3	1.256
μ/mm^{-1}	0.702
F(000)	920.0
Crystal size/mm^3	0.17 × 0.13 × 0.1
Radiation	Cu Kα (λ = 1.54184)
2Θ range for data collection/°	6.832 to 149.278
Index ranges	-11 ≤ h ≤ 11, -12 ≤ k ≤ 12, -31 ≤ l ≤ 32
Reflections collected	49232
Independent reflections	9164 [R_{int} = 0.0544, R_{sigma} = 0.0339]
Data/restraints/parameters	9164/267/759

Goodness-of-fit on F^2	1.079
Final R indexes [I>=2σ (I)]	R_1 = 0.0857, wR_2 = 0.2277
Final R indexes [all data]	R_1 = 0.0955, wR_2 = 0.2348
Largest diff. peak/hole / e Å^{-3}	0.76/-0.4

Table S3. Fractional Atomic Coordinates (×10^4) and Equivalent Isotropic Displacement Parameters (Å^2×10^3) for 3a. U_{eq} is defined as 1/3 of the trace of the orthogonalised U_{IJ} tensor.

Atom	*x*	*y*	*z*	U(eq)
F2A	7000(20)	8005(18)	7269(6)	131(8)
F2	9001(4)	7647(3)	7280.7(10)	66.1(9)
O3	4729(2)	10374.6(19)	9077.6(8)	36.1(4)
O4	6721(3)	6346(3)	6410.6(10)	59.2(7)
N4	6983(2)	10690(2)	8736.6(9)	33.6(5)
N5	9077(8)	5820(9)	6205(3)	47.2(17)
N5A	9330(10)	6385(8)	6218(3)	38.1(16)
N6	11745(7)	5666(10)	5670(2)	77(2)
N6A	11925(7)	6847(9)	5786(3)	57.7(18)
C26	5498(3)	11641(3)	8013.7(12)	39.1(6)
C27	5561(4)	13163(3)	8770.8(12)	43.3(7)

C28	7832(3)	12347(3)	8159.8(13)	42.6(7)
C29	6442(3)	11970(3)	8424.8(11)	32.9(6)
C30	6103(3)	9973(3)	9006.5(10)	30.9(5)
C31	6876(3)	8568(3)	9219.3(10)	30.3(5)
C32	6845(3)	8395(3)	9750.0(10)	31.9(6)
C33	7422(3)	7083(3)	9964.3(10)	33.1(6)
C34	8022(3)	5959(3)	9642.7(11)	34.9(6)
C35	8044(3)	6127(3)	9112.2(11)	38.7(6)
C36	7478(3)	7440(3)	8890.9(11)	36.9(6)
C37A	7137(13)	7277(16)	8317(3)	27(3)
C37	7581(5)	7720(4)	8311.1(13)	37.7(9)
C38A	8500(12)	7275(13)	7946(4)	24(2)
C38	7994(4)	6417(4)	7987.6(13)	38.3(8)
C39	8006(4)	6830(4)	7412.8(14)	60.2(10)
C40	8336(4)	5626(4)	7080.9(13)	53.4(9)

C41	8001(4)	6034(4)	6534.0(13)	53.3(8)
C42	9087(8)	6068(9)	5670(3)	55.8(17)
C42A	9323(8)	6983(9)	5714(3)	46.8(17)
C43A	8086(9)	7362(11)	5443(3)	57(2)
C43	7825(9)	6392(11)	5401(3)	65(2)
C44	7960(9)	6635(11)	4862(3)	77(2)
C44A	8206(11)	7935(13)	4939(3)	76(3)
C45A	9551(12)	8153(12)	4723(4)	79(3)
C45	9304(9)	6606(10)	4596(3)	78(3)
C46A	10834(10)	7781(11)	4995(3)	69(2)
C46	10609(9)	6253(10)	4856(3)	73(2)
C47	10509(8)	6004(10)	5397(3)	66(2)
C47A	10727(9)	7216(10)	5498(3)	56(2)
C48A	13222(10)	7045(12)	5574(3)	71(3)
C48	13048(9)	5600(12)	5418(3)	84(3)
C49A	13450(12)	7595(13)	5083(4)	83(3)
C49	13260(10)	5835(12)	4881(3)	91(3)
C50A	12248(12)	7961(12)	4795(4)	83(3)
C50	12056(9)	6193(11)	4607(3)	85(3)
F1	4470(3)	5997(2)	7687.1(9)	54.0(9)
F1A	2804(17)	6281(13)	7806(4)	77(5)
O1	102(2)	9171(2)	8741.7(9)	40.1(5)

O2	1910(2)	5045(2)	6854.6(9)	47.1(5)
N1	2297(2)	8971(2)	9101.6(8)	28.2(5)
N2	4409(3)	4516(3)	6635.3(9)	41.3(6)
N3	7167(3)	2860(3)	6691.3(10)	52.6(7)
C1	2080(3)	6519(3)	9103.6(11)	36.8(6)
C2	943(3)	8131(3)	9848.6(12)	37.7(6)
C3	3696(3)	7319(3)	9684.1(11)	35.1(6)
C4	2234(3)	7731(3)	9434.0(10)	28.3(5)
C5	1243(3)	9581(3)	8792.3(10)	29.4(5)
C6	1498(3)	10846(3)	8493.4(10)	27.9(5)
C7	1402(3)	12070(3)	8763.2(10)	30.8(5)
C8	1467(3)	13311(3)	8499.6(12)	36.9(6)
C9	1632(3)	13306(3)	7965.2(12)	39.7(7)
C10	1749(3)	12080(3)	7699.1(11)	37.2(6)

C11	1679(3)	10829(3)	7953.1(10)	31.8(5)
C12	1811(3)	9501(3)	7653.3(12)	41.3(7)
C13	3278(3)	8424(3)	7701.1(12)	42.9(7)
C14	3250(4)	6974(3)	7517.6(13)	49.5(8)
C15	3186(4)	6852(3)	6945.8(12)	45.2(7)
C16	3090(4)	5387(3)	6804.4(11)	40.1(7)
C17	4635(4)	3075(3)	6523.2(11)	41.9(7)
C18	3530(4)	2474(4)	6381.1(12)	49.6(8)
C19	3837(5)	1027(4)	6285.2(13)	60.8(10)
C20	5213(6)	188(4)	6321.8(14)	64.6(11)
C21	6378(5)	764(4)	6451.9(12)	59.6(10)
C22	6100(4)	2235(3)	6558.0(11)	47.6(8)
C23	8525(5)	2066(5)	6719.4(14)	70.2(12)
C24	8900(6)	601(5)	6615.1(17)	84.6(16)

C25	7842(6)	-12(5)	6484.2(16)	79.5(15)
O5	11690(20)	9140(20)	5691(7)	121(5)
O6	10735(18)	10135(17)	4901(6)	82(3)
C51	13436(16)	9300(20)	5086(6)	68(4)
C52	11787(17)	9740(30)	5272(7)	83(5)
C53	9160(20)	10500(20)	5088(8)	74(4)
C54	8010(20)	10830(20)	4687(6)	64(4)

Table S4. Anisotropic Displacement Parameters (Å^2×10^3) for 3a. The Anisotropic displacement factor exponent takes the form: $-2\pi^2[h^2a^{*2}U_{11}+2hka^*b^*U_{12}+\ldots]$.

Atom	U_{11}	U_{22}	U_{33}	U_{23}	U_{13}	U_{12}
F2A	134(12)	138(13)	70(9)	3(9)	-12(8)	73(10)
F2	100(2)	38.0(13)	54.5(15)	-0.8(11)	-29.9(14)	4.0(13)
O3	26.5(9)	32.2(9)	49.3(11)	15.5(8)	-4.5(8)	-7.1(7)
O4	55.4(14)	64.7(16)	56.4(14)	23.8(12)	-21.9(12)	-8.4(12)
N4	26.5(10)	31.2(11)	42.4(12)	19.2(10)	-7.3(9)	-5.7(9)
N5	32(3)	64(5)	42(3)	13(4)	-8(2)	-4(3)
N5A	39(4)	48(4)	27(3)	9(3)	-6(2)	-9(3)
N6	49(3)	123(6)	41(3)	28(3)	-1(2)	11(3)
N6A	50(3)	75(4)	45(3)	15(3)	-1(3)	-10(3)
C26	36.1(14)	38.4(15)	44.6(16)	15.5(12)	-11.5(12)	-10.7(12)
C27	48.3(17)	32.0(14)	47.8(17)	13.2(12)	-5.7(13)	-6.6(12)
C28	31.8(14)	40.3(15)	55.9(18)	26.5(14)	-10.2(13)	-9.2(12)

C29	28.5(12)	28.9(13)	41.1(14)	17.7(11)	-8.1(11)	-6.4(10)
C30	28.8(12)	29.0(13)	34.6(13)	12.3(10)	-5.8(10)	-6.2(10)
C31	25.1(12)	29.1(12)	37.2(13)	13.4(10)	-5.6(10)	-7.8(10)
C32	29.5(12)	31.6(13)	37.2(14)	7.2(11)	-8.9(10)	-10.8(10)
C33	34.5(13)	38.1(14)	30.0(13)	14.1(11)	-10.7(10)	-13.6(11)
C34	34.1(14)	30.3(13)	41.5(15)	14.2(11)	-10.4(11)	-9.0(11)
C35	41.9(15)	31.6(14)	38.2(15)	6.3(11)	-6.5(12)	0.5(12)
C36	35.9(14)	35.8(14)	34.0(14)	12.5(11)	-4.3(11)	0.6(11)
C37A	32(5)	22(4)	27(4)	10(4)	3(4)	-9(4)
C37	43(2)	31.8(18)	36.8(18)	10.6(14)	-5.3(15)	-7.3(15)
C38A	27(4)	20(4)	30(4)	2(4)	-2(4)	-11(3)
C38	40.3(18)	35.3(17)	36.9(17)	7.1(14)	-5.8(14)	-4.2(14)
C39	57(2)	68(2)	44.5(19)	12.5(17)	-6.8(16)	7.7(18)
C40	45.3(17)	65(2)	45.8(18)	22.3(16)	-8.5(14)	-5.6(16)
C41	51.1(19)	57(2)	44.5(18)	11.3(15)	-12.1(15)	3.1(16)
C42	51(3)	68(4)	39(3)	6(3)	-7(3)	4(3)
C42A	45(4)	58(4)	30(3)	9(3)	-5(3)	2(3)
C43A	48(4)	80(5)	35(3)	10(4)	-4(3)	-1(4)
C43	53(4)	91(5)	44(3)	3(4)	-11(3)	-1(4)
C44	63(4)	109(6)	44(4)	4(4)	-15(3)	9(4)
C44A	59(5)	111(7)	49(4)	22(5)	-10(4)	-1(5)
C45A	80(6)	98(6)	49(4)	31(4)	-4(4)	-3(5)
C45	68(4)	110(6)	36(3)	13(4)	-7(3)	18(4)
C46A	64(5)	87(6)	48(4)	23(4)	0(4)	-5(4)

C46	59(4)	103(6)	39(3)	13(3)	0(3)	14(4)
C47	54(4)	90(5)	40(3)	15(3)	-3(3)	10(4)
C47A	52(4)	69(5)	38(3)	13(3)	-1(3)	0(3)
C48A	60(5)	93(6)	55(4)	20(4)	3(4)	-16(4)
C48	52(4)	131(7)	52(4)	31(4)	2(3)	7(4)
C49A	66(5)	103(7)	73(5)	26(5)	6(4)	-16(5)
C49	63(4)	129(7)	58(4)	28(4)	10(4)	12(4)
C50A	81(6)	100(7)	60(5)	29(5)	7(4)	-11(5)
C50	71(5)	119(6)	42(3)	26(4)	0(3)	15(4)
F1	64.1(18)	38.4(13)	49.7(14)	5.2(10)	-13.7(11)	9.5(11)
F1A	135(13)	69(8)	35(6)	11(5)	-1(6)	-42(8)
O1	31.3(10)	29.5(9)	63.0(13)	18.1(9)	-17.2(9)	-11.4(8)
O2	47.2(12)	44.5(12)	47.7(12)	11.2(10)	-7.9(10)	-6.8(10)
N1	27.3(10)	22.5(10)	35.8(11)	10.4(8)	-7.5(8)	-7.4(8)
N2	49.9(14)	36.0(13)	38.4(13)	5.9(10)	-1.0(11)	-12.5(11)
N3	56.0(17)	58.5(17)	36.9(14)	11.3(12)	-8.6(12)	-0.3(14)
C1	43.0(15)	23.6(12)	44.2(15)	8.5(11)	-11.8(12)	-6.6(11)
C2	35.7(14)	26.0(12)	48.0(16)	12.5(11)	3.0(12)	-4.3(11)
C3	32.3(13)	33.2(13)	40.7(14)	15.4(11)	-9.3(11)	-9.2(11)
C4	27.2(12)	22.1(11)	36.3(13)	10.5(10)	-5.1(10)	-7.2(9)
C5	27.5(12)	23.3(11)	37.1(13)	6.8(10)	-7.0(10)	-4.3(9)
C6	22.4(11)	25.4(12)	36.3(13)	9.2(10)	-9.6(10)	-5.1(9)
C7	29.2(12)	27.1(12)	36.1(13)	7.1(10)	-9.1(10)	-5.0(10)
C8	31.6(13)	23.2(12)	56.5(17)	9.9(11)	-11.7(12)	-6.1(10)

C9	29.6(13)	34.4(14)	55.2(17)	23.4(13)	-13.1(12)	-7.0(11)
C10	30.3(13)	46.5(16)	34.7(14)	16.6(12)	-7.7(11)	-8.9(12)
C11	23.6(12)	34.5(13)	37.1(14)	5.1(11)	-6.5(10)	-5.5(10)
C12	37.3(15)	47.4(17)	39.2(15)	-4.4(13)	-7.6(12)	-7.9(13)
C13	42.8(16)	38.3(15)	46.2(17)	-0.4(13)	-7.1(13)	-5.6(13)
C14	57.4(19)	38.0(16)	49.0(18)	7.5(14)	-14.1(15)	-0.9(14)
C15	55.1(18)	35.3(15)	41.0(16)	3.8(12)	3.7(13)	-6.1(13)
C16	51.9(17)	37.1(15)	28.9(13)	7.6(11)	-5.4(12)	-6.2(13)
C17	57.0(18)	38.0(15)	28.4(13)	4.7(11)	0.7(12)	-8.8(13)
C18	65(2)	45.0(17)	38.0(16)	2.8(13)	2.6(14)	-15.1(15)
C19	97(3)	47.2(19)	40.6(18)	-1.0(15)	4.4(18)	-27(2)
C20	111(3)	37.4(17)	42.0(18)	4.4(14)	-2.8(19)	-13(2)
C21	92(3)	42.0(18)	32.2(16)	10.6(13)	-3.9(16)	6.9(18)
C22	67(2)	42.6(16)	26.7(14)	9.0(12)	-6.7(13)	-1.2(15)
C23	72(3)	83(3)	43.0(19)	6.2(18)	-16.3(18)	10(2)
C24	91(3)	83(3)	56(2)	8(2)	-26(2)	34(3)
C25	115(4)	53(2)	51(2)	8.9(17)	-24(2)	24(2)
O5	120(10)	111(10)	131(11)	-1(9)	-3(9)	-28(9)
O6	92(5)	94(7)	70(5)	-18(6)	2(4)	-41(6)
C51	62(8)	99(10)	51(7)	-10(7)	-6(6)	-30(8)
C52	90(7)	92(8)	71(7)	3(6)	-8(6)	-28(6)
C53	90(7)	75(8)	63(6)	-14(6)	4(5)	-37(7)
C54	89(10)	85(10)	28(6)	-5(7)	-3(6)	-43(8)

Table S5. Bond Lengths for 3a.

Atom	Atom	Length/Å	Atom	Atom	Length/Å
F2A	C39	1.364(9)	C46	C50	1.424(11)
F2	C39	1.377(5)	C48A	C49A	1.389(13)
O3	C30	1.238(3)	C48	C49	1.412(11)
O4	C41	1.222(4)	C49A	C50A	1.370(15)
N4	C29	1.486(3)	C49	C50	1.347(12)
N4	C30	1.341(3)	F1	C14	1.394(4)
N5	C41	1.235(8)	F1A	C14	1.118(11)
N5	C42	1.405(10)	O1	C5	1.236(3)
N5A	C41	1.522(9)	O2	C16	1.214(4)
N5A	C42A	1.421(10)	N1	C4	1.484(3)
N6	C47	1.370(9)	N1	C5	1.340(3)
N6	C48	1.310(10)	N2	C16	1.357(4)
N6A	C47A	1.366(10)	N2	C17	1.414(4)

N6A	C48A	1.332(11)	N3	C22	1.355(5)
C26	C29	1.526(4)	N3	C23	1.320(5)
C27	C29	1.522(4)	C1	C4	1.526(4)
C28	C29	1.526(4)	C2	C4	1.521(4)
C30	C31	1.511(3)	C3	C4	1.518(3)
C31	C32	1.383(4)	C5	C6	1.503(3)
C31	C36	1.391(4)	C6	C7	1.388(4)
C32	C33	1.394(4)	C6	C11	1.399(4)
C33	C34	1.378(4)	C7	C8	1.394(4)
C34	C35	1.383(4)	C8	C9	1.383(4)
C35	C36	1.401(4)	C9	C10	1.380(4)
C36	C37A	1.572(9)	C10	C11	1.392(4)
C36	C37	1.523(4)	C11	C12	1.512(4)
C37A	C38A	1.518(9)	C12	C13	1.523(4)

C37	C38	1.502(5)	C13	C14	1.521(4)
C38A	C39	1.599(9)	C14	C15	1.501(5)
C38	C39	1.537(5)	C15	C16	1.519(4)
C39	C40	1.438(6)	C17	C18	1.379(5)
C40	C41	1.505(4)	C17	C22	1.420(5)
C42	C43	1.383(10)	C18	C19	1.405(5)
C42	C47	1.429(10)	C19	C20	1.352(6)
C42A	C43A	1.370(11)	C20	C21	1.403(6)
C42A	C47A	1.437(11)	C21	C22	1.435(5)
C43A	C44A	1.416(11)	C21	C25	1.397(6)
C43	C44	1.413(10)	C23	C24	1.424(7)
C44	C45	1.364(12)	C24	C25	1.338(8)
C44A	C45A	1.382(14)	O5	C52	1.236(10)
C45A	C46A	1.406(13)	O6	C52	1.412(10)

C45	C46	1.405(11)	O6	C53	1.462(9)
C46A	C47A	1.410(10)	C51	C52	1.523(10)
C46A	C50A	1.416(14)	C53	C54	1.525(10)
C46	C47	1.419(9)			

Table S6. Bond Angles for 3a.

Atom	Atom	Atom	Angle/°	Atom	Atom	Atom	Angle/°
C30	N4	C29	124.9(2)	N6A	C47A	C42A	118.3(6)
C41	N5	C42	128.5(6)	N6A	C47A	C46A	122.3(8)
C42A	N5A	C41	126.1(7)	C46A	C47A	C42A	119.4(7)
C48	N6	C47	117.9(6)	N6A	C48A	C49A	125.2(9)
C48A	N6A	C47A	117.2(7)	N6	C48	C49	124.1(8)
N4	C29	C26	109.5(2)	C50A	C49A	C48A	117.5(9)
N4	C29	C27	110.5(2)	C50	C49	C48	118.9(8)

N4	C29	C28	106.1(2)	C49A	C50A	C46A	120.4(8)
C26	C29	C28	109.1(2)	C49	C50	C46	119.8(7)
C27	C29	C26	111.2(2)	C5	N1	C4	124.4(2)
C27	C29	C28	110.4(2)	C16	N2	C17	125.8(3)
O3	C30	N4	124.4(2)	C23	N3	C22	117.7(4)
O3	C30	C31	119.4(2)	N1	C4	C1	109.8(2)
N4	C30	C31	116.1(2)	N1	C4	C2	109.2(2)
C32	C31	C30	118.3(2)	N1	C4	C3	106.97(19)
C32	C31	C36	120.8(2)	C2	C4	C1	111.7(2)
C36	C31	C30	120.6(2)	C3	C4	C1	109.2(2)
C31	C32	C33	120.3(3)	C3	C4	C2	109.8(2)
C34	C33	C32	119.4(2)	O1	C5	N1	124.3(2)
C33	C34	C35	120.4(2)	O1	C5	C6	119.3(2)
C34	C35	C36	120.9(3)	N1	C5	C6	116.4(2)

C31	C36	C35	118.2(2)	C7	C6	C5	118.3(2)
C31	C36	C37A	127.6(6)	C7	C6	C11	120.7(2)
C31	C36	C37	118.2(2)	C11	C6	C5	120.7(2)
C35	C36	C37A	110.6(6)	C6	C7	C8	120.5(3)
C35	C36	C37	123.5(3)	C9	C8	C7	119.1(3)
C38A	C37A	C36	111.0(8)	C10	C9	C8	120.2(2)
C38	C37	C36	114.0(3)	C9	C10	C11	121.9(3)
C37A	C38A	C39	102.4(6)	C6	C11	C12	121.4(2)
C37	C38	C39	109.3(3)	C10	C11	C6	117.7(3)
F2A	C39	C38A	103.2(10)	C10	C11	C12	120.9(3)
F2A	C39	C40	118.4(9)	C11	C12	C13	113.5(2)
F2	C39	C38	111.7(3)	C14	C13	C12	113.0(3)
F2	C39	C40	109.5(3)	F1	C14	C13	109.2(3)
C40	C39	C38A	138.3(5)	F1	C14	C15	110.8(3)

C40	C39	C38	112.2(3)	F1A	C14	C13	116.7(7)
C39	C40	C41	111.5(3)	F1A	C14	C15	123.0(7)
O4	C41	N5	121.3(4)	C15	C14	C13	115.0(3)
O4	C41	N5A	124.7(4)	C14	C15	C16	111.0(2)
O4	C41	C40	121.3(3)	O2	C16	N2	124.1(3)
N5	C41	C40	116.4(4)	O2	C16	C15	120.9(3)
C40	C41	N5A	112.0(4)	N2	C16	C15	115.0(3)
N5	C42	C47	116.4(6)	N2	C17	C22	116.5(3)
C43	C42	N5	124.5(7)	C18	C17	N2	123.7(3)
C43	C42	C47	119.1(6)	C18	C17	C22	119.7(3)
N5A	C42A	C47A	115.4(7)	C17	C18	C19	120.3(4)
C43A	C42A	N5A	124.4(8)	C20	C19	C18	121.7(4)
C43A	C42A	C47A	120.2(7)	C19	C20	C21	119.8(3)
C42A	C43A	C44A	119.8(8)	C20	C21	C22	119.9(4)

C42	C43	C44	119.8(7)	C25	C21	C20	123.9(4)
C45	C44	C43	122.0(7)	C25	C21	C22	116.2(4)
C45A	C44A	C43A	120.8(8)	N3	C22	C17	118.4(3)
C44A	C45A	C46A	120.5(8)	N3	C22	C21	123.2(3)
C44	C45	C46	119.5(7)	C17	C22	C21	118.5(3)
C45A	C46A	C47A	119.2(8)	N3	C23	C24	122.8(5)
C45A	C46A	C50A	123.4(8)	C25	C24	C23	119.4(4)
C47A	C46A	C50A	117.3(8)	C24	C25	C21	120.9(4)
C45	C46	C47	119.7(7)	C52	O6	C53	117.7(12)
C45	C46	C50	123.1(7)	O5	C52	O6	130.0(19)
C47	C46	C50	117.0(7)	O5	C52	C51	104.1(15)
N6	C47	C42	118.0(6)	O6	C52	C51	118.8(15)
N6	C47	C46	122.2(7)	O6	C53	C54	117.9(14)
C46	C47	C42	119.8(6)				

Table S7. Torsion Angles for 3a.

A	B	C	D	Angle/°	A	B	C	D	Angle/°
F2A	C39	C40	C41	23.0(13)	C47	C42	C43	C44	0.9(14)
F2	C39	C40	C41	-68.6(4)	C47	C46	C50	C49	3.6(16)
O3	C30	C31	C32	-66.3(3)	C47A	N6A	C48A	C49A	-0.1(17)
O3	C30	C31	C36	107.7(3)	C47A	C42A	C43A	C44A	2.5(15)
N4	C30	C31	C32	115.4(3)	C47A	C46A	C50A	C49A	0.0(17)
N4	C30	C31	C36	-70.6(3)	C48A	N6A	C47A	C42A	178.6(9)
N5	C42	C43	C44	179.4(9)	C48A	N6A	C47A	C46A	0.2(15)
N5	C42	C47	N6	2.1(13)	C48A	C49A	C50A	C46A	0.1(18)
N5	C42	C47	C46	-179.6(9)	C48	N6	C47	C42	179.6(10)

N5A	C42A	C43A	C44A	-179.3(10)	C48	N6	C47	C46	1.3(15)
N5A	C42A	C47A	N6A	0.3(13)	C48	C49	C50	C46	-3.4(17)
N5A	C42A	C47A	C46A	178.8(9)	C50A	C46A	C47A	N6A	-0.1(16)
N6	C48	C49	C50	2.1(18)	C50A	C46A	C47A	C42A	-178.6(10)
N6A	C48A	C49A	C50A	-0.1(19)	C50	C46	C47	N6	-2.5(15)
C29	N4	C30	O3	-8.6(5)	C50	C46	C47	C42	179.2(9)
C29	N4	C30	C31	169.6(2)	F1	C14	C15	C16	58.3(4)
C30	N4	C29	C26	-58.4(4)	F1A	C14	C15	C16	-24.2(10)
C30	N4	C29	C27	64.4(4)	O1	C5	C6	C7	110.2(3)
C30	N4	C29	C28	-176.0(3)	O1	C5	C6	C11	-63.5(3)
C30	C31	C32	C33	174.1(2)	N1	C5	C6	C7	-69.7(3)
C30	C31	C36	C35	-173.5(3)	N1	C5	C6	C11	116.6(3)

C30	C31	C36	C37A	-16.9(7)	N2	C17	C18	C19	-178.8(3)
C30	C31	C36	C37	10.5(4)	N2	C17	C22	N3	-0.3(4)
C31	C32	C33	C34	-0.1(4)	N2	C17	C22	C21	179.5(3)
C31	C36	C37A	C38A	113.3(9)	N3	C23	C24	C25	-0.2(7)
C31	C36	C37	C38	-169.9(3)	C4	N1	C5	O1	-1.1(4)
C32	C31	C36	C35	0.3(4)	C4	N1	C5	C6	178.8(2)
C32	C31	C36	C37A	156.9(6)	C5	N1	C4	C1	57.2(3)
C32	C31	C36	C37	-175.6(3)	C5	N1	C4	C2	-65.7(3)
C32	C33	C34	C35	-0.4(4)	C5	N1	C4	C3	175.6(2)
C33	C34	C35	C36	0.8(4)	C5	C6	C7	C8	-173.0(2)
C34	C35	C36	C31	-0.8(4)	C5	C6	C11	C10	173.2(2)
C34	C35	C36	C37A	-161.1(5)	C5	C6	C11	C12	-7.4(4)
C34	C35	C36	C37	174.9(3)	C6	C7	C8	C9	-0.1(4)

C35	C36	C37A	C38A	-88.7(10)	C6	C11	C12	C13	-70.7(3)
C35	C36	C37	C38	14.3(5)	C7	C6	C11	C10	-0.4(4)
C36	C31	C32	C33	0.1(4)	C7	C6	C11	C12	179.0(2)
C36	C37A	C38A	C39	170.3(8)	C7	C8	C9	C10	-0.8(4)
C36	C37	C38	C39	177.9(3)	C8	C9	C10	C11	1.2(4)
C37A	C38A	C39	F2A	73.5(14)	C9	C10	C11	C6	-0.6(4)
C37A	C38A	C39	C40	-107.2(10)	C9	C10	C11	C12	-180.0(2)
C37	C38	C39	F2	59.0(4)	C10	C11	C12	C13	108.6(3)
C37	C38	C39	C40	-177.7(3)	C11	C6	C7	C8	0.8(4)
C38A	C39	C40	C41	-156.1(7)	C11	C12	C13	C14	165.4(3)
C38	C39	C40	C41	166.9(3)	C12	C13	C14	F1	-165.7(3)
C39	C40	C41	O4	-75.9(5)	C12	C13	C14	F1A	-85.8(10)

C39	C40	C41	N5	115.4(6)	C12	C13	C14	C15	69.1(4)
C39	C40	C41	N5A	88.6(5)	C13	C14	C15	C16	-177.4(3)
C41	N5	C42	C43	-11.4(15)	C14	C15	C16	O2	80.9(4)
C41	N5	C42	C47	167.1(8)	C14	C15	C16	N2	-97.6(3)
C41	N5A	C42A	C43A	1.6(14)	C16	N2	C17	C18	25.6(4)
C41	N5A	C42A	C47A	180.0(7)	C16	N2	C17	C22	-155.0(3)
C42	N5	C41	O4	9.8(12)	C17	N2	C16	O2	-4.1(5)
C42	N5	C41	C40	178.5(7)	C17	N2	C16	C15	174.2(3)
C42	C43	C44	C45	-2.2(16)	C17	C18	C19	C20	-0.8(5)
C42A	N5A	C41	O4	-7.2(11)	C18	C17	C22	N3	179.1(3)
C42A	N5A	C41	C40	-171.1(7)	C18	C17	C22	C21	-1.1(4)
C42A	C43A	C44A	C45A	-1.8(18)	C18	C19	C20	C21	-0.8(5)

C43A	C42A	C47A	N6A	178.7(9)	C19	C20	C21	C22	1.5(5)
C43A	C42A	C47A	C46A	-2.8(14)	C19	C20	C21	C25	-178.1(4)
C43A	C44A	C45A	C46A	1.4(19)	C20	C21	C22	N3	179.3(3)
C43	C42	C47	N6	-179.3(9)	C20	C21	C22	C17	-0.5(5)
C43	C42	C47	C46	-0.9(14)	C20	C21	C25	C24	-179.4(4)
C43	C44	C45	C46	3.4(16)	C22	N3	C23	C24	0.1(5)
C44	C45	C46	C47	-3.4(15)	C22	C17	C18	C19	1.8(4)
C44	C45	C46	C50	179.8(10)	C22	C21	C25	C24	1.0(6)
C44A	C45A	C46A	C47A	-1.6(17)	C23	N3	C22	C17	-179.6(3)
C44A	C45A	C46A	C50A	179.3(12)	C23	N3	C22	C21	0.6(5)
C45A	C46A	C47A	N6A	-179.3(10)	C23	C24	C25	C21	-0.4(7)
C45A	C46A	C47A	C42A	2.3(15)	C25	C21	C22	N3	-1.1(5)

C45A	C46A	C50A	C49A	179.1(11)	C25	C21	C22	C17	179.1(3)
C45	C46	C47	N6	-179.6(10)	C52	O6	C53	C54	-176.2(18)
C45	C46	C47	C42	2.1(15)	C53	O6	C52	O5	32(4)
C45	C46	C50	C49	-179.5(10)	C53	O6	C52	C51	177(2)
C47	N6	C48	C49	-1.0(17)					

Table S8. Hydrogen Atom Coordinates (Å×10[4]) and Isotropic Displacement Parameters (Å[2]×10[3]) for 3a.

Atom	*x*	*y*	*z*	U(eq)
H4	7953.61	10378.86	8744.85	40
H5	9952.75	5465.84	6321.61	57
H5A	10181.53	6201.45	6361.26	46
H26A	6093.34	10876.02	7795.16	59
H26B	5171.2	12476.93	7800.29	59
H26C	4623.82	11360.38	8181.68	59
H27A	4660.3	12915.47	8932.17	65
H27B	5277.73	14017.03	8563.08	65
H27C	6177.25	13324.87	9039.88	65
H28A	8443.75	12559.02	8421.96	64

H28B	7536.34	13169.54	7937.24	64
H28C	8410.18	11555.04	7949.97	64
H32	6428.36	9174.17	9969.49	38
H33	7401.92	6965.55	10328.77	40
H34	8422.67	5063.17	9786.3	42
H35	8448.6	5340.58	8894.74	46
H37A	6827.58	6388.28	8281.82	32
H37B	6303.68	8058.51	8227.6	32
H37C	6607.38	8292.69	8217.28	45
H37D	8333.38	8276.87	8227.48	45
H38A	9390.01	6588.56	8053.67	29
H38B	8713.38	8216.68	7919.07	29
H38C	7263.41	5838.06	8071.55	46
H38D	8992.1	5857.12	8062.74	46
H39A	7180.36	6480.91	7605.26	72
H39	6986.11	7396.01	7350.37	72
H40A	7736.89	4961.29	7213.05	64
H40B	9403.13	5145.71	7085.9	64
H43A	7150.21	7241.06	5591.59	69
H43	6869.94	6451.75	5578.16	78
H44	7088.72	6823.46	4680.16	92
H44A	7353.03	8172.05	4748	92
H45A	9608.25	8556.66	4388.04	95
H45	9356.66	6822.21	4236.94	94

H48A	14057.26	6790.84	5773.26	85
H48	13903.94	5380.37	5608.28	101
H49A	14404.42	7711.97	4953.15	99
H49	14234.81	5742.91	4715.88	109
H50A	12363.91	8339.19	4457.29	100
H50	12172.42	6404.29	4249.29	101
H1	3079.81	9328.82	9108.12	34
H2	5191.83	4880.37	6591.58	50
H1A	1122.92	6770.55	8949.81	55
H1B	2122.08	5681.27	9320.31	55
H1C	2895.79	6327.84	8828.59	55
H2A	1091.78	8893.44	10058.41	57
H2B	898.07	7316.6	10069.99	57
H2C	6.18	8441.7	9684.58	57
H3A	4523.85	7058.9	9415.61	53
H3B	3684.66	6520.26	9916.97	53
H3C	3824.95	8113.29	9881.28	53
H7	1291.12	12061.49	9130.22	37
H8	1399.22	14148.87	8684.51	44
H9	1665.14	14147.31	7780.82	48
H10	1881.39	12091.18	7332.29	45
H12A	1710.63	9743.79	7283.89	50
H12B	977.48	9073.55	7777.95	50
H13A	4086.85	8747.76	7495.9	51

H13B	3508.41	8362.07	8067.05	51
H14A	4334.44	6525.88	7532.3	59
H14	2331.32	6738.45	7690.43	59
H15A	4088.55	7066.66	6761.62	54
H15B	2304.64	7544.52	6834.46	54
H18	2556.85	3039.66	6347.9	60
H19	3058.91	628.86	6192.25	73
H20	5388.68	-789.15	6259.5	78
H23	9284.77	2489.07	6813.11	84
H24	9891.54	64.6	6638.19	102
H25	8090.21	-987.44	6412.36	95
H51A	13972.75	8688.59	5347.31	103
H51B	13841.74	10128	5031.81	103
H51C	13554.2	8783.1	4760.83	103
H53A	8984.91	11321.07	5316.6	88
H53B	8949.51	9708.62	5303.12	88
H54A	8230.49	10079.82	4430.23	96
H54B	8058.12	11720.8	4514.87	96
H54C	7010.03	10905.72	4858.69	96

Table S9. Atomic Occupancy for 3a.

Atom	***Occupancy***	**Atom**	***Occupancy***	**Atom**	***Occupancy***
F2A	0.186(5)	F2	0.814(5)	N5	0.539(4)

H5	0.539(4)	N5A	0.461(4)	H5A	0.461(4)
N6	0.539(4)	N6A	0.461(4)	C37A	0.186(5)
H37A	0.186(5)	H37B	0.186(5)	C37	0.814(5)
H37C	0.814(5)	H37D	0.814(5)	C38A	0.186(5)
H38A	0.186(5)	H38B	0.186(5)	C38	0.814(5)
H38C	0.814(5)	H38D	0.814(5)	H39A	0.186(5)
H39	0.814(5)	C42	0.539(4)	C42A	0.461(4)
C43A	0.461(4)	H43A	0.461(4)	C43	0.539(4)
H43	0.539(4)	C44	0.539(4)	H44	0.539(4)
C44A	0.461(4)	H44A	0.461(4)	C45A	0.461(4)
H45A	0.461(4)	C45	0.539(4)	H45	0.539(4)
C46A	0.461(4)	C46	0.539(4)	C47	0.539(4)
C47A	0.461(4)	C48A	0.461(4)	H48A	0.461(4)
C48	0.539(4)	H48	0.539(4)	C49A	0.461(4)
H49A	0.461.(4)	C49	0.539(4)	H49	0.539(4)
C50A	0.461(4)	H50A	0.461(4)	C50	0.539(4)
H50	0.539(4)	F1	0.803(7)	F1A	0.197(7)
H14A	0.197(7)	H14	0.803(7)	O5	0.25
O6	0.25	C51	0.25	H51A	0.25
H51B	0.25	H51C	0.25	C52	0.25
C53	0.25	H53A	0.25	H53B	0.25
C54	0.25	H54A	0.25	H54B	0.25
H54C	0.25				

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