# Supporting Information

## Design, synthesis and insecticidal activity of novel analogues of flubendiamide containing alkoxyhexafluoroisopropyl group

Xianghu Zhao,† Sixue Xu†, Chuan Liu, Jingjing He, Chunmei Li, Yupian Deng, and Song Cao*

Shanghai Key Laboratory of Chemical Biology, School of Pharmacy, East China University of Science and Technology (*ECUST*), Shanghai 200237, China

†These authors have equally contributed to this article.

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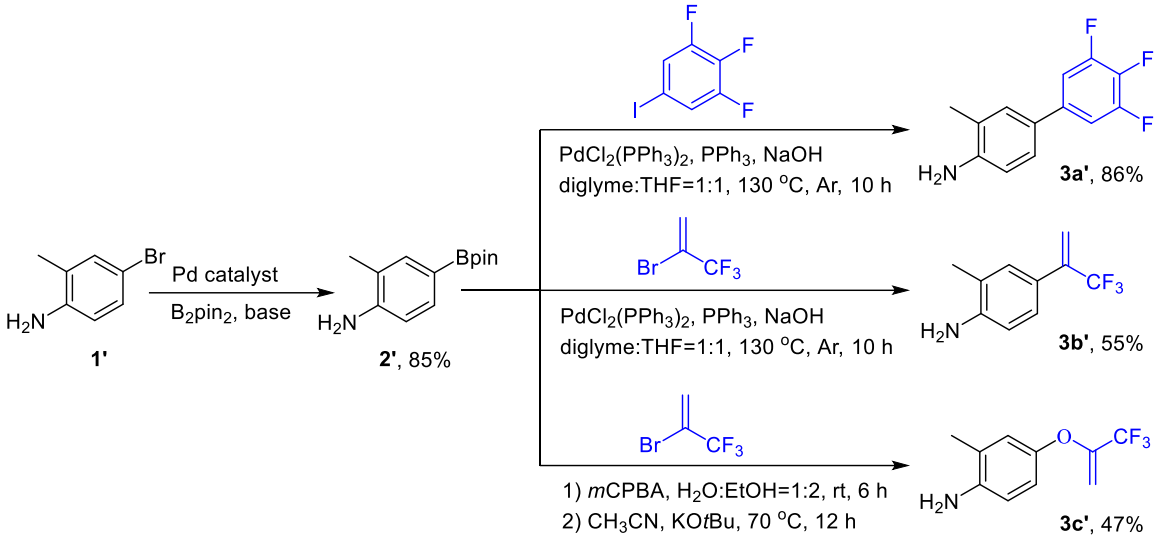
**1. Procedures for the synthesis of compounds in Scheme 1.**

*Synthesis of 2-methyl-4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)aniline (**2'**).* Boronic acid pinacol esters **2'** was prepared from 4-bromo-2-methylaniline **1'** and $B_2pin_2$ according to the reported procedure.[1]

*Synthesis of fluorine-containing anilines **3a'** and **3b'**.* A solution of $PdCl_2(PPh_3)_2$ (280.8 mg, 4 mol%), $PPh_3$ (419.2 mg, 16 mol%), NaOH (1.6 g, 40.0 mmol, 4.0 equiv) and aniline **2'** (2.8 g, 12 mmol, 1.2 equiv) in diglyme/THF = 10 mL/10 mL was stirred at 130 °C under argon atmosphere for about 15 minutes. Subsequently, 1,2,3-trifluoro-5-iodobenzene or 2-bromo-3,3,3-trifluoroprop-1-ene (10.0 mmol, 1.0 equiv) was added to the mixture via a syringe. Stirring was continued at 130 °C for 10 h. After the completion of reaction, the reaction mixture was quenched with $H_2O$ (20 mL) and extracted with ethyl acetate (10 mL×3). The organic layer was separated and dried over $Na_2SO_4$, filtered and evaporated under vacuum. The crude product was purified by column chromatography on silica gel using *n*-hexane/ethyl acetate (10/1) as eluent to afford the pure compounds **3a'** (85%) and **3b'** (55%).

*Synthesis of fluorine-containing aniline **3c'**.* A solution of aniline **2'** (1.16 g, 5 mmol, 1.0 equiv) and *m*-CPBA (10 mmol) in $H_2O$/EtOH = 5 mL/10 mL was stirred at 25 °C under argon atmosphere for about 6 h. After the completion of reaction, the reaction mixture was quenched with saturated $NaHCO_3$ (20 mL) and extracted with ethyl acetate (10 mL×3). The organic layer was separated and dried over $Na_2SO_4$, filtered and evaporated under vacuum. Without further purification, the crude product was allowed to react with the solution of 2-bromo-3,3,3-trifluoroprop-1-ene (2.09 g, 12 mmol), KO*t*Bu (1.23 g, 11 mmol) in $CH_3CN$ (25 mL) at 70 °C. After 12 h, the reaction mixture was quenched with $H_2O$ (20 mL) and extracted with ethyl acetate (10 mL×3). The organic layer was separated and dried over $Na_2SO_4$, filtered and evaporated under vacuum. The crude product was purified by column chromatography on silica gel using *n*-hexane/ethyl acetate (10/1) as eluent to afford the pure compound **3c'** (47%).

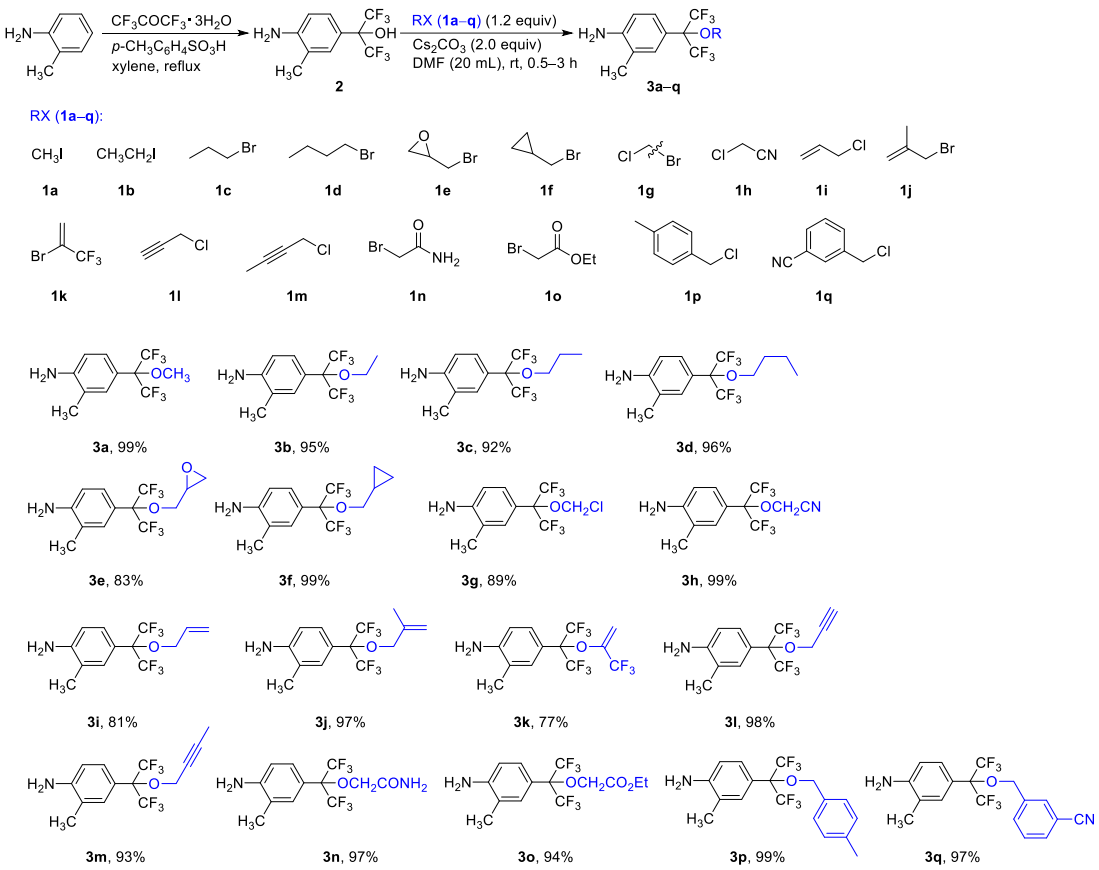



**Scheme 1.** Synthesis of fluorine-containing anilines **3a′**–**c′**.

**2. Procedures for the synthesis of compounds in Scheme 2.**

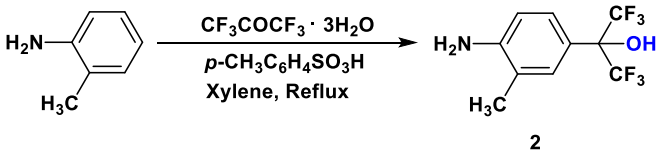
*Synthesis of 2-(4-amino-3-methylphenyl)-1,1,1,3,3,3-hexafluoropropan-2-ol (**2**).* Intermediate **2** was prepared from 2-methylaniline according to the reported procedure.[2]

*Synthesis of 4-(1,1,1,3,3,3-hexafluoro-2-alkoxypropan-2-yl)-2-methylaniline (**3a**–**q**).* A solution of **2** (2.73 g, 10 mmol), $Cs_2CO_3$ (6.51 g, 20 mmol) in DMF (20 mL) was stirred at 25 °C for about 30 minutes. Subsequently, RX (**1a**–**q**, 12 mmol) was added to the mixture. Stirring was continued at 25 °C for 0.5–3 h (monitored by TLC). After the completion of reaction, the reaction mixture was quenched with $H_2O$ (20 mL) and extracted with ethyl acetate (20 mL×3). The organic layer was separated and dried over $Na_2SO_4$, filtered and evaporated under vacuum to afford the crude products **3** in the range of yields (77–99%) (>98% purity, determined by GC-MS or NMR spectroscopy), except for **3e**, **3i** and **3k** (the yields of these three compounds were about 80% and they should be purified by silica gel column chromagraphy). Most of these intermediates **3** were directly reacted with intermediate **6** without purification.




**Scheme 2.** Synthesis of novel anilines **3a**−**q** from various RX and **2**

## 3. General procedure for preparing intermediate 2



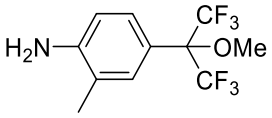

A solution of hexafluoroacetone trihydrate (2.42 g, 11 mmol) and *p*-toluenesulfonic acid (0.1 g, 0.6 mmol) in 5 mL of xylene was added to *o*-toluidine (1.07 g, 10 mmol) at 90 ºC. The mixture was then stirred at 130 ºC for about 12 h (monitored by TLC or GC–MS). After the completion of reaction, the solution was cooled to room temperature and the solid precipitate was filtered, washed by petroleum ether. The crude products **2** were obtained (95% yield, 2.58 g).

## 4. References

(1) B. H. Lipshutz, R. Moser and K. R. Voigtritter, *Isr. J. Chem.* 2010, **50**, 691.

(2) R. Masciadri, M. Kamer and N. Nock, *Eur. J. Org. Chem.* 2003, 4286

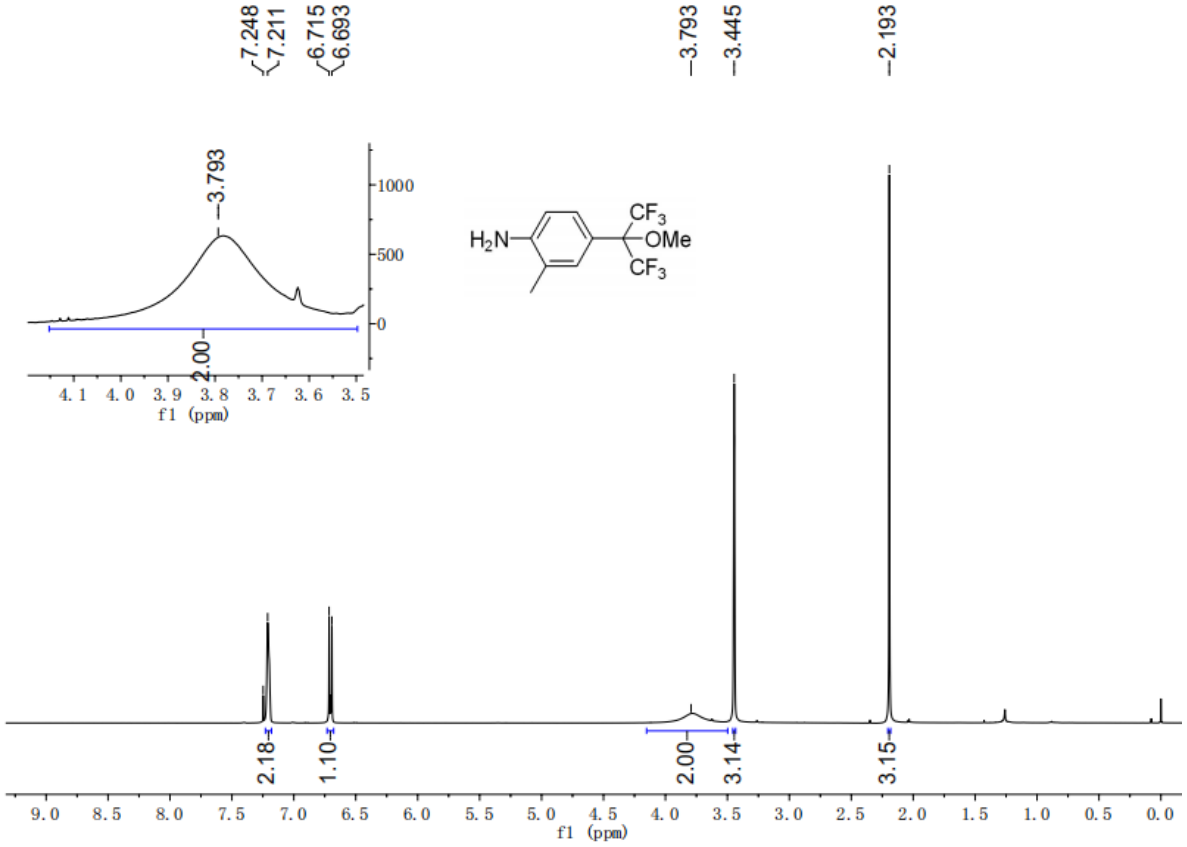
## 5. $^1$H NMR spectrum of several key intermediates

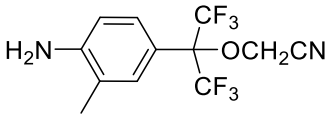



**3a**

Yield: 90%; Oil. $^1$H NMR (400 MHz, $CDCl_3$) δ = 7.25–7.21 (m, 2H), 6.70 (d, *J* = 8.8 Hz, 1H), 3.79 (s, 2H, $NH_2$), 3.44 (s, 3H, $OCH_3$), 2.19 (s, 3H, $CH_3$) ppm.

**$^1$H NMR spectrum of 3a**

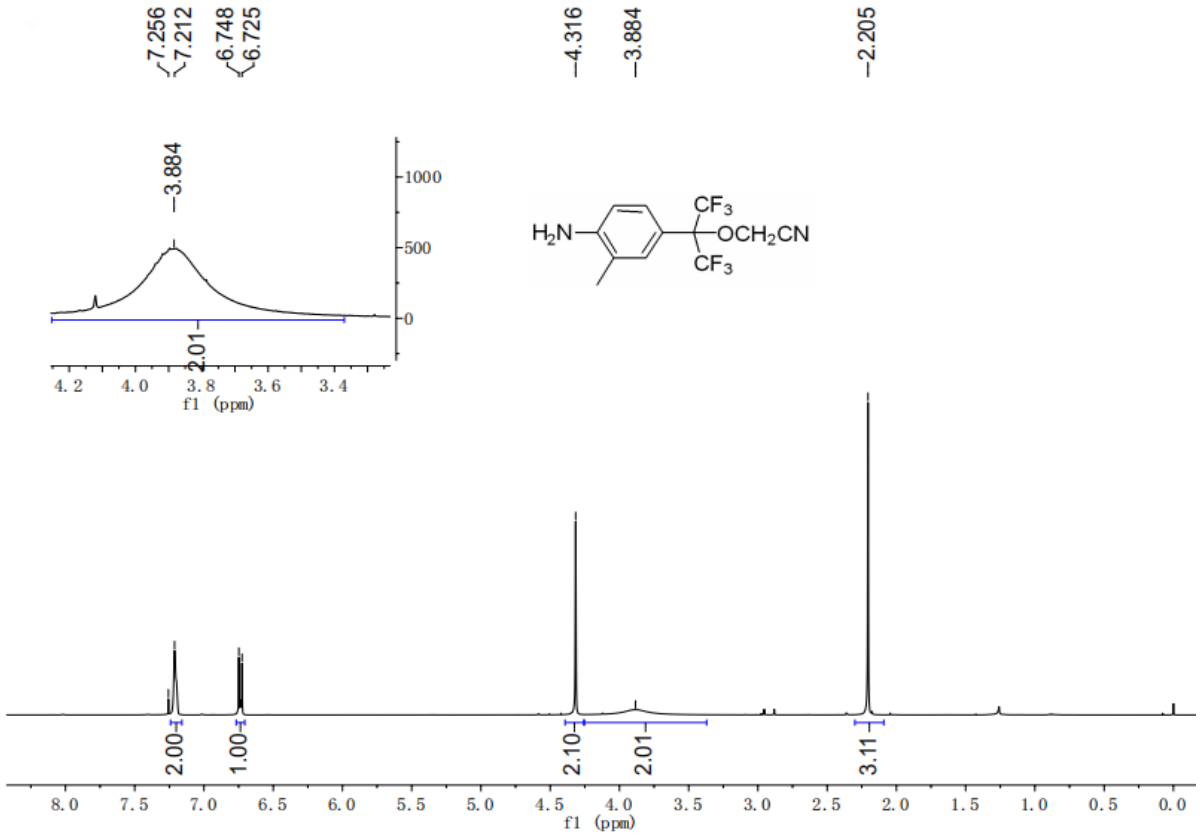


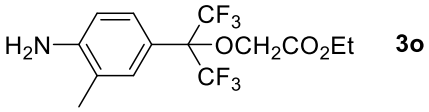



**3h**

Yield: 96%; Oil. $^1$H NMR (400 MHz, $CDCl_3$) δ = 7.26–7.21 (m, 2H), 6.74 (d, *J* = 9.2 Hz, 1H), 4.32 (s, 2H, $OCH_2$) 3.88 (s, 2H, $NH_2$), 2.20 (s, 3H, $CH_3$) ppm.

**$^1$H NMR spectrum of 3h**

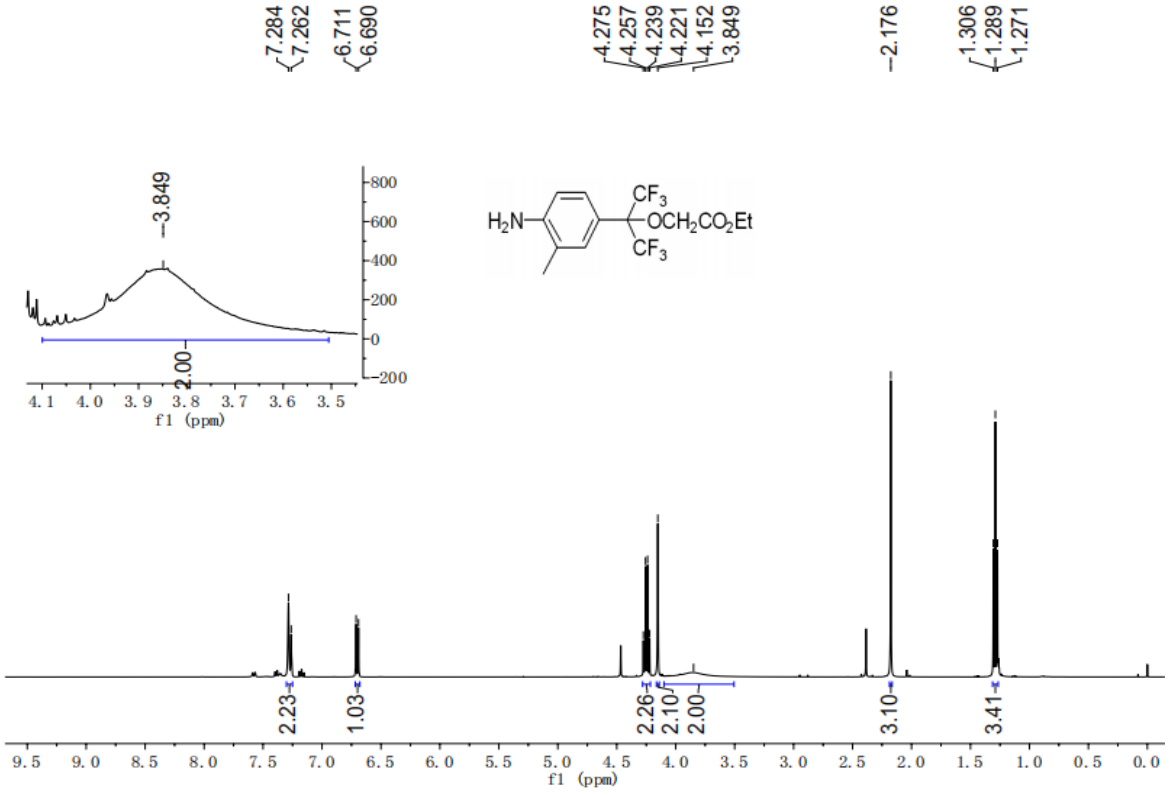


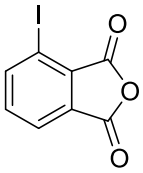



**3o**

Yield: 92%; Oil. $^1$H NMR (400 MHz, $CDCl_3$) δ = 7.28–7.26 (m, 2H), 6.70 (d, *J* = 8.4 Hz, 1H), 4.25 (q, *J* = 7.2 Hz, 2H), 4.15 (s, 2H, $OCH_2$) 3.85 (s, 2H, $NH_2$), 2.17 (s, 3H), 1.29 (t, *J* = 7.2 Hz, 3H) ppm.

**$^1$H NMR spectrum of 3o**

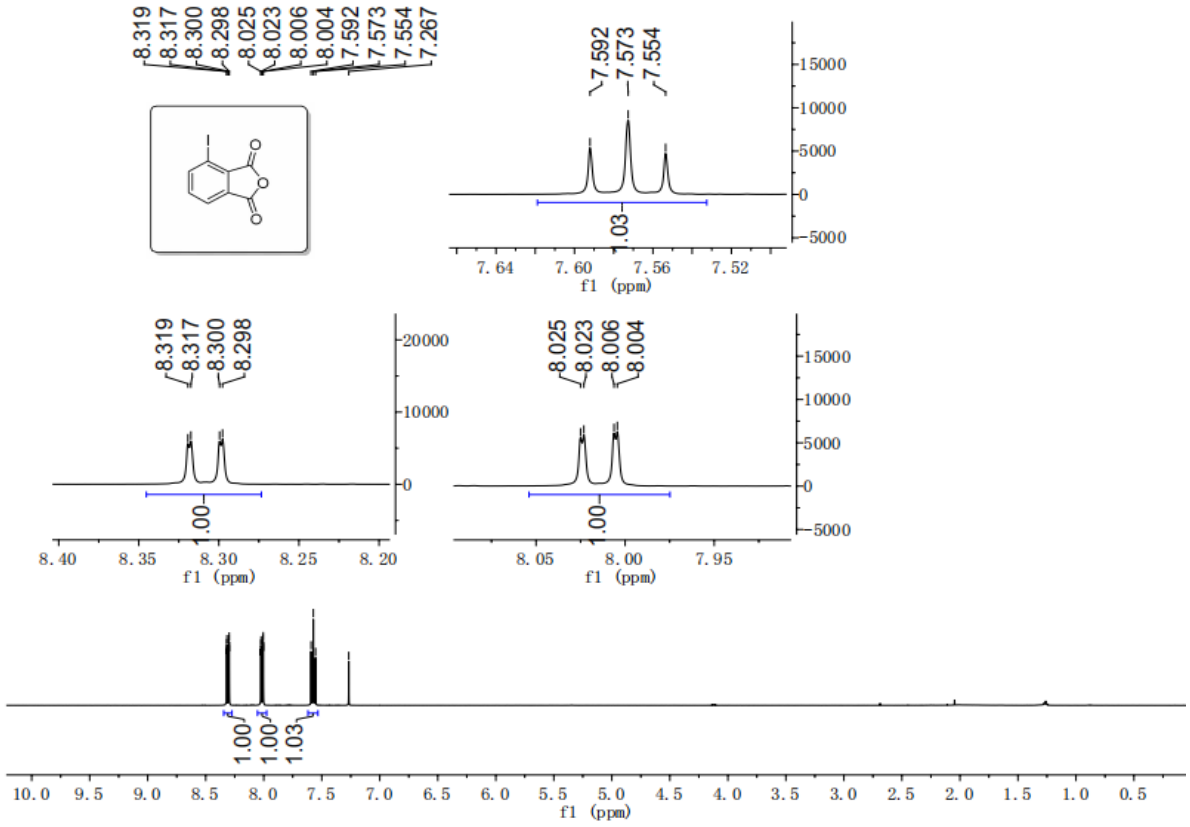


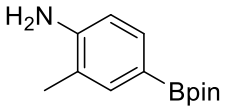


**4**

White solid; m.p.: 156.4–158.7 °C. $^1$H NMR (400 MHz, $CDCl_3$) δ = 8.31 (dd, *J* = 7.6, 0.8 Hz, 1H), 8.01 (dd, *J* = 7.6, 0.8 Hz, 1H) 7.60–7.55 (m, 1H) ppm.

**$^1$H NMR spectrum of 4**

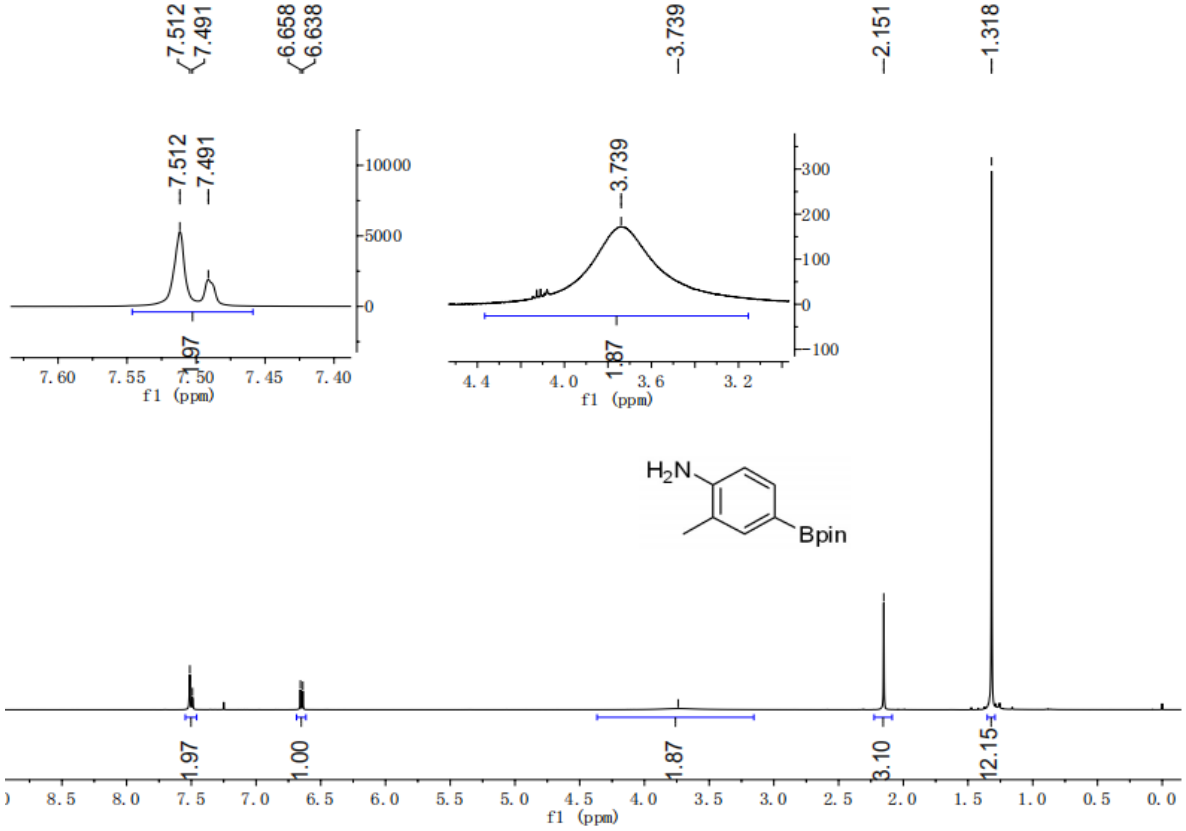


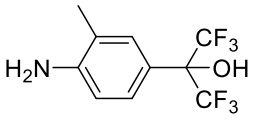



**2'**

Yield: 85%; Yellow solid; m.p.: 138.1–140.3 ℃. $^1$H NMR (400 MHz, $CDCl_3$) δ = 7.51 (s, 1H), 7.50 (d, *J* = 8.4 Hz, 1H), 6.65 (d, *J* = 8.0 Hz, 1H), 3.74 (s, 2H, $NH_2$), 2.15 (s, 3H, $CH_3$), 1.32 (s, 12H) ppm.

**$^1$H NMR spectrum of 2'**

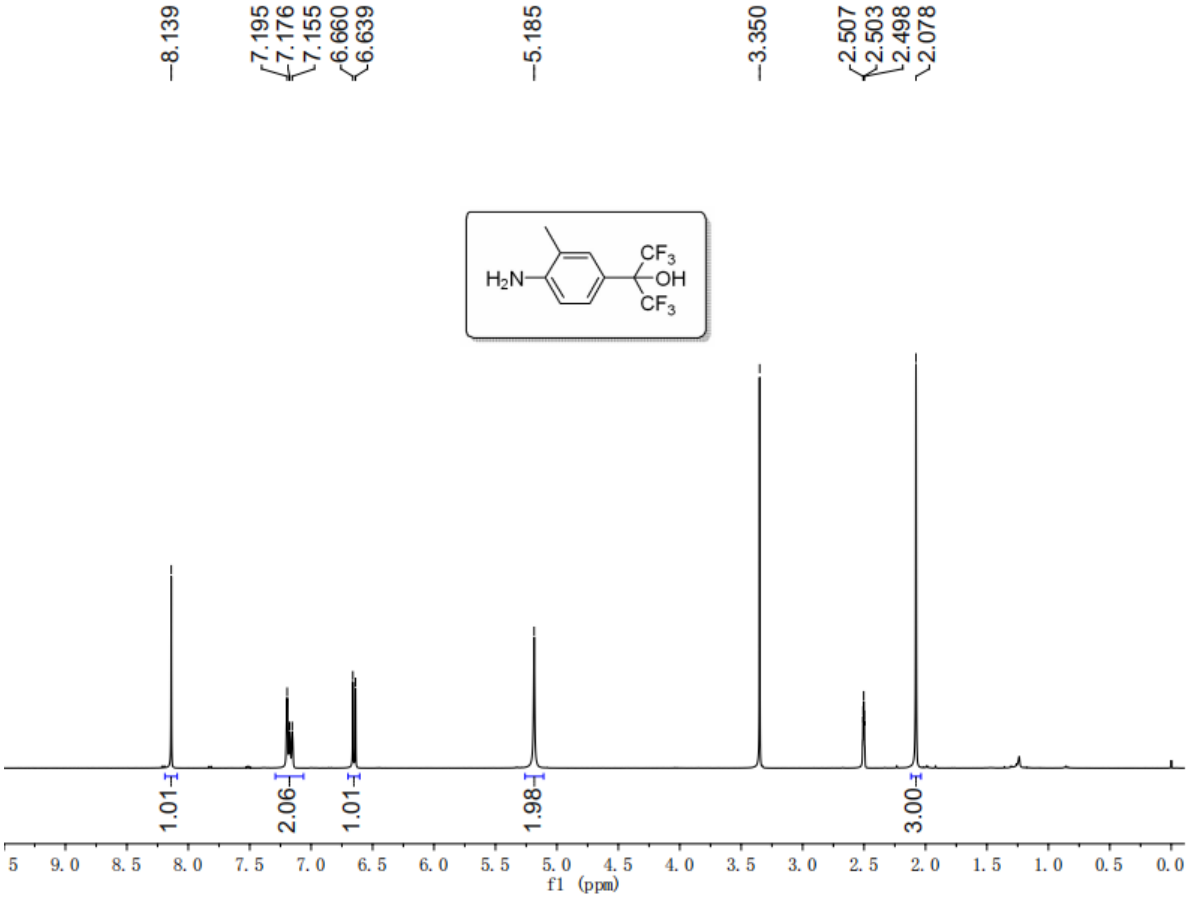





**2**

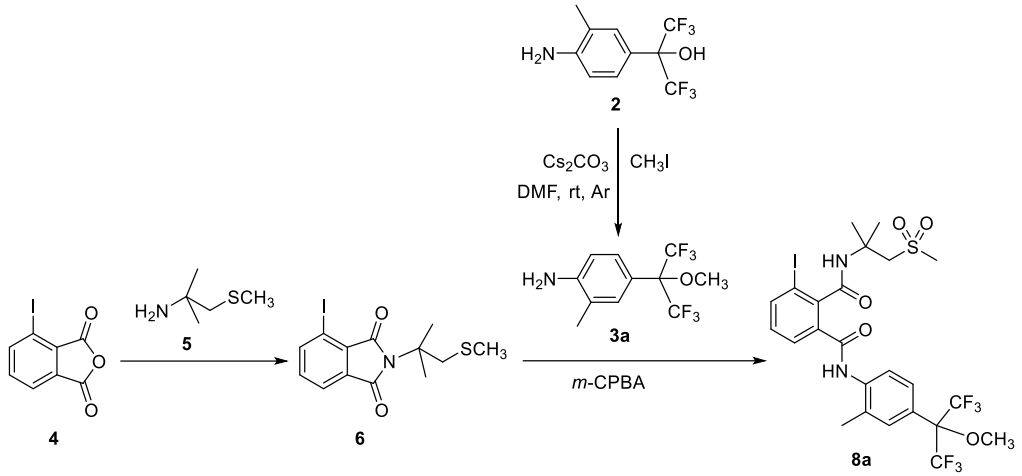
Yield: 95%; Slight pink solid; m.p.: 133.1–134.9 ℃. $^1$H NMR (400 MHz, DMSO-$d_6$) δ = 8.14 (s, 1H, OH), 7.19–7.15 (m, 2H), 6.65 (d, $J$ = 8.4 Hz, 1H), 5.18 (s, 2H, $NH_2$), 2.08 (s, 3H, $CH_3$) ppm.

**$^1$H NMR spectrum of 2**



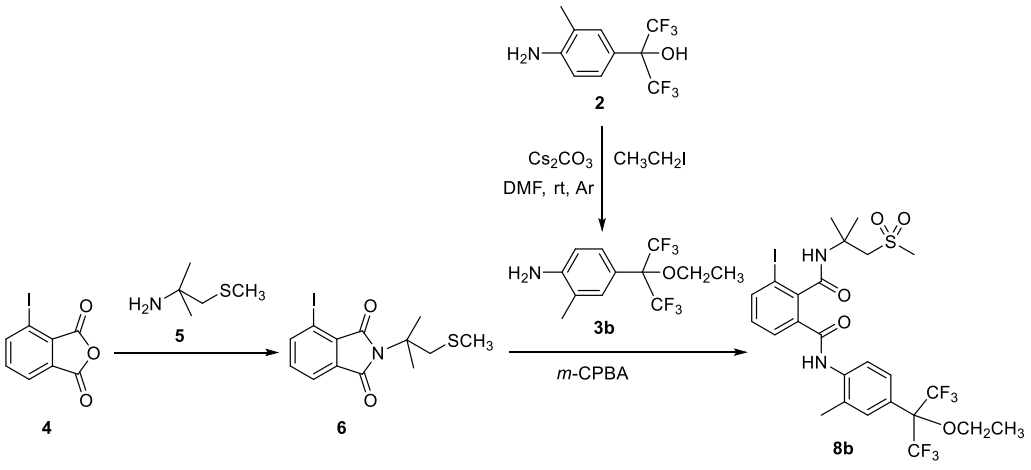
## 6. Analytical data of target compounds 8a'−c' and 8a−q

**$N^1$-(4-(1,1,1,3,3,3-Hexafluoro-2-methoxypropan-2-yl)-2-methylphenyl)-3-iodo-$N^2$-(2-methyl-1-(methylsulfonyl)propan-2-yl)phthalimide (8a)**



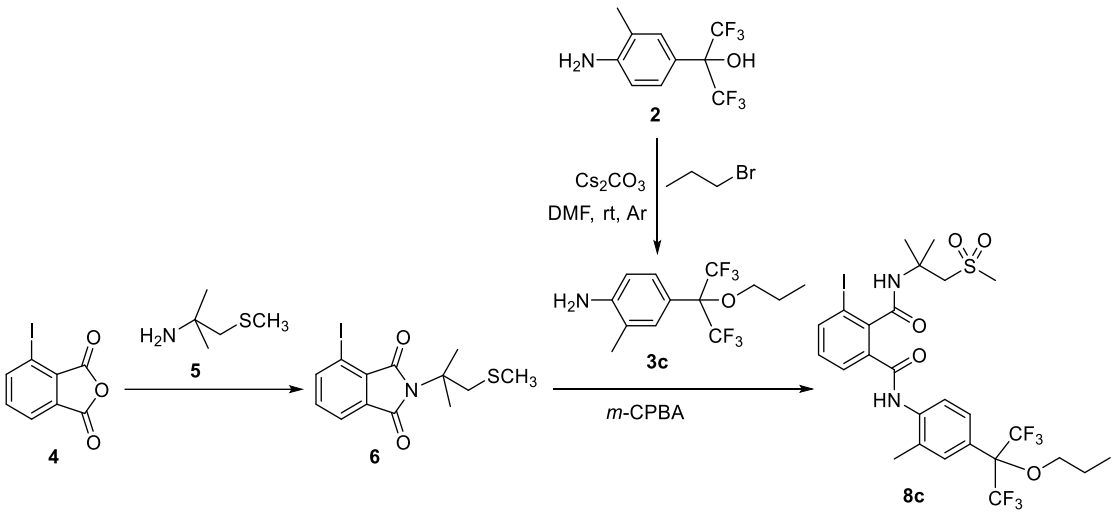

Yield: 56% (*based on intermediate **4**, the same as below*); White solid; m.p.: 133.1–136.7 °C. $^1$H NMR (400 MHz, DMSO-$d_6$) δ = 9.72 (s, 1H, NH), 8.38 (s, 1H, NH), 8.01 (d, $J$ = 8.0 Hz, 1H), 7.78 (d, $J$ = 8.8 Hz, 1H), 7.71 (d, $J$ = 7.2 Hz, 1H), 7.43–7.44 (m, 2H), 7.29–7.25 (m, 1H), 3.63 (s, 2H), 3.45 (s, 3H, $OCH_3$), 2.92 (s, 3H), 2.34 (s, 3H), 1.52 (s, 6H) ppm; $^{13}$C NMR (100 MHz, DMSO-$d_6$) δ = 167.7, 165.6, 141.2, 140.8, 138.3, 136.0, 132.5, 130.2, 129.7, 127.3, 125.8, 124.8, 123.7, 123.0, 95.3, 82.3, 60.7, 54.2, 52.4, 43.1, 26.1, 18.0 ppm; $^{19}$F NMR (376 MHz, DMSO-$d_6$) δ = –70.3 (s, 6F) ppm; HRMS (ESI) calcd for $C_{24}H_{25}F_6IN_2O_5SNa$ $[M+Na]^+$ 717.0331, found 717.0330.

**$N^1$-(4-(2-Ethoxy-1,1,1,3,3,3-hexafluoropropan-2-yl)-2-methylphenyl)-3-iodo-$N^2$-(2-methyl-1-(methylsulfonyl)propan-2-yl)phthalimide (8b)**



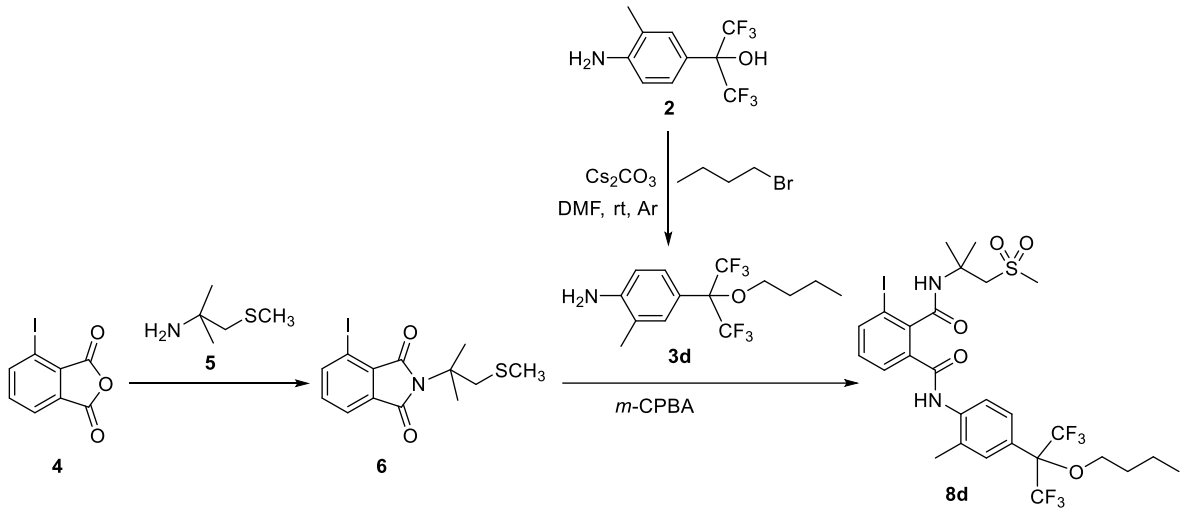
Yield: 63%; White solid; m.p.:136.7–138.9 °C. $^{1}$H NMR (400 MHz, DMSO-$d_6$) δ = 9.73 (s, 1H, NH), 8.43 (s, 1H, NH), 8.03 (d, $J$ = 8.0 Hz, 1H), 7.84 (d, $J$ = 8.0 Hz, 1H), 7.74 (d, $J$ = 7.2 Hz, 1H), 7.46–7.44 (m, 2H), 7.31–7.27 (m, 1H), 3.68 (s, 2H), 3.63 (q, $J$ = 6.8 Hz, 2H), 2.95 (s, 3H), 2.38 (s, 3H, $CH_3$), 1.57 (s, 6H), 1.32 (t, $J$ = 6.8 Hz, 3H) ppm; $^{13}$C NMR (100 MHz, DMSO-$d_6$) δ = 167.6, 165.5, 141.2, 140.7, 138.3, 136.0, 132.3, 130.1, 129.4, 127.3, 125.6, 124.7, 123.7, 123.6, 95.3, 82.1, 62.3, 60.7, 52.4, 43.0, 26.1, 18.1, 14.9 ppm; $^{19}$F NMR (376 MHz, DMSO-$d_6$) δ = –70.4 (s, 6F) ppm; HRMS (ESI) calcd for $C_{25}H_{27}F_6IN_2O_5SNa$ $[M+Na]^+$ 731.0487, found 731.0488.

**$N^1$-(4-(1,1,1,3,3,3-Hexafluoro-2-propoxypropan-2-yl)-2-methylphenyl)-3-iodo-$N^2$-(2-methyl-1-(methyl sulfonyl)propan-2-yl)phthalimide (8c)**



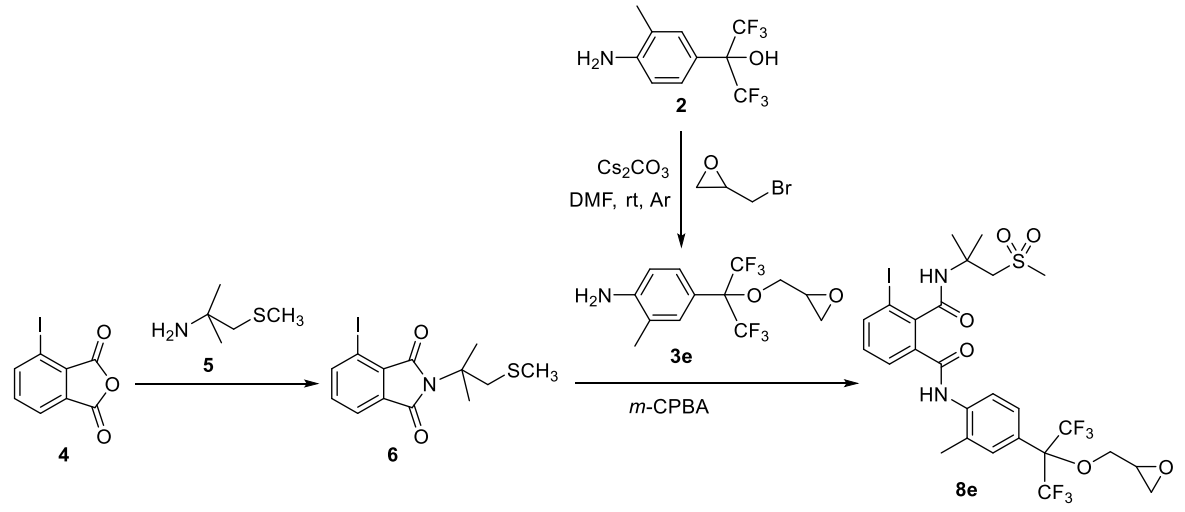

Yield: 61%; White solid; m.p.:142.1–145.0 °C. $^{1}$H NMR (400 MHz, DMSO-$d_6$) δ = 9.72 (s, 1H, NH), 8.41 (s, 1H, NH), 8.02 (d, $J$ = 7.6 Hz, 1H), 7.81 (d, $J$ = 8.0 Hz, 1H), 7.72 (d, $J$ = 7.6 Hz, 1H), 7.44–7.42 (m, 2H), 7.30–7.26 (m, 1H), 3.65 (s, 2H), 3.51 (t, $J$ = 6.4 Hz, 2H), 2.94 (s, 3H), 2.36 (s, 3H), 1.73–1.68 (m, 2H), 1.54 (s, 6H), 0.95 (t, $J$ = 7.6 Hz, 3H) ppm; $^{13}$C NMR (100 MHz, DMSO-$d_6$) δ = 167.7, 165.5, 141.3, 140.7, 138.3, 136.1, 132.4, 130.1, 129.5, 127.3, 125.7, 124.8, 123.7, 123.5, 95.4, 82.1, 67.7, 60.8, 52.4, 43.1, 26.1, 22.4, 18.1, 10.0 ppm; $^{19}$F NMR (376 MHz, DMSO-$d_6$) δ = –70.3 (s, 6F) ppm; HRMS (ESI) calcd for $C_{26}H_{29}F_6IN_2O_5SNa$ $[M+Na]^+$ 745.0644, found 745.0643.

**$N^1$-(4-(2-Butoxy-1,1,1,3,3,3-hexafluoropropan-2-yl)-2-methylphenyl)-3-iodo-$N^2$-(2-methyl-1-(methylsulfonyl)propan-2-yl)phthalimide (8d)**



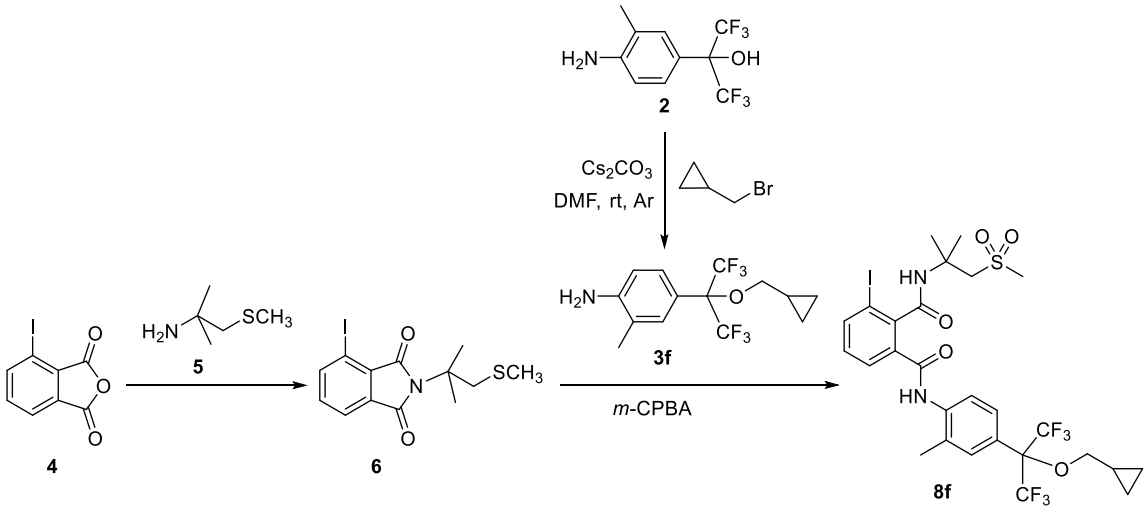

Yield: 72%; White solid; m.p.:151.1–154.4 ℃. $^1$H NMR (400 MHz, DMSO-$d_6$) δ = 9.72 (s, 1H, NH), 8.41 (s, 1H, NH), 8.02 (d, $J$ = 8.0 Hz, 1H), 7.80 (d, $J$ = 8.4 Hz, 1H), 7.72 (d, $J$ = 7.6 Hz, 1H), 7.43–7.41 (m, 2H), 7.30–7.26 (m, 1H), 3.65 (s, 2H), 3.55 (t, $J$ = 6.4 Hz, 2H), 2.94 (s, 3H), 2.35 (s, 3H), 1.70–1.66 (m, 2H), 1.54 (s, 6H), 1.44–1.38 (m, 2H), 0.91 (t, $J$ = 7.2 Hz, 3H) ppm; $^{13}$C NMR (101 MHz, DMSO-$d_6$) δ = 167.6, 165.5, 141.3, 140.7, 138.3, 136.0, 132.4, 130.1, 129.5, 127.3, 125.7, 124.8, 123.7, 123.5, 95.4, 82.1, 65.9, 60.7, 52.4, 43.1, 31.1, 26.1, 18.3, 18.1, 13.5 ppm; $^{19}$F NMR (376 MHz, DMSO-$d_6$) δ = –70.3 (s, 6F) ppm; HRMS (ESI) calcd for $C_{27}H_{31}F_6IN_2O_5SNa$ $[M+Na]^+$ 759.0800, found 759.0798.

**$N^1$-(4-(1,1,1,3,3,3-Hexafluoro-2-(oxiran-2-ylmethoxy)propan-2-yl)-2-methylphenyl)-3-iodo-$N^2$-(2-methyl-1-(methylsulfonyl)propan-2-yl)phthalimide (8e)**



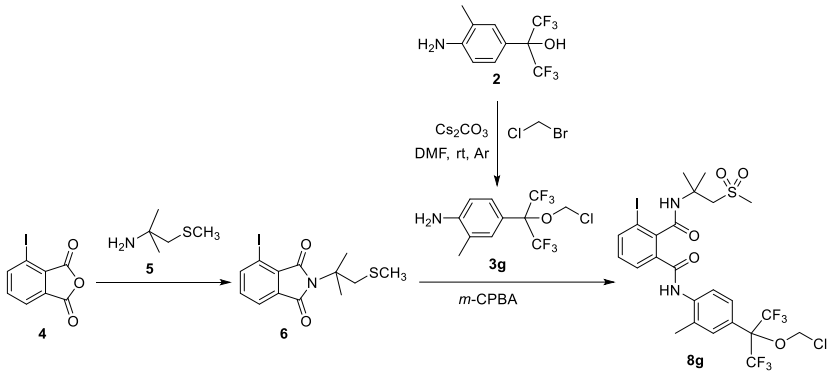
Yield: 51%; White solid; m.p.:152.8–154.4 °C. $^{1}$H NMR (400 MHz, DMSO-$d_6$) δ = 9.75 (s, 1H, NH), 8.44 (s, 1H, NH), 8.03 (d, $J$ = 7.6 Hz, 1H), 7.83 (d, $J$ = 8.4 Hz, 1H), 7.74 (d, $J$ = 7.6 Hz, 1H), 7.50–7.48 (m, 2H), 7.31–7.27 (m, 1H), 3.97 (d, $J$ = 9.6 Hz, 2H), 3.67 (s, 2H), 3.43–3.39 (m, 1H), 2.96 (s, 3H), 2.84–2.69 (m, 2H), 2.38 (s, 3H), 1.56 (s, 6H) ppm; $^{13}$C NMR (101 MHz, DMSO-$d_6$) δ = 167.7, 165.6, 141.3, 140.7, 138.5, 136.0, 132.4, 130.1, 129.7, 127.3, 125.8, 124.7, 122.8, 122.3, 95.3, 82.2, 87.8, 60.7, 52.4, 49.5, 43.4, 43.0, 26.1, 18.1 ppm; $^{19}$F NMR (376 MHz, DMSO-$d_6$) δ = –70.3 (s, 6F) ppm; HRMS (ESI) calcd for $C_{26}H_{27}F_6IN_2O_6SNa$ $[M+Na]^+$ 759.0436, found 759.0437.

**$N^1$-(4-(2-(Cyclopropylmethoxy)-1,1,1,3,3,3-hexafluoropropan-2-yl)-2-methylphenyl)-3-iodo-$N^2$-(2-methyl-1-(methylsulfonyl)propan-2-yl)phthalimide (8f)**



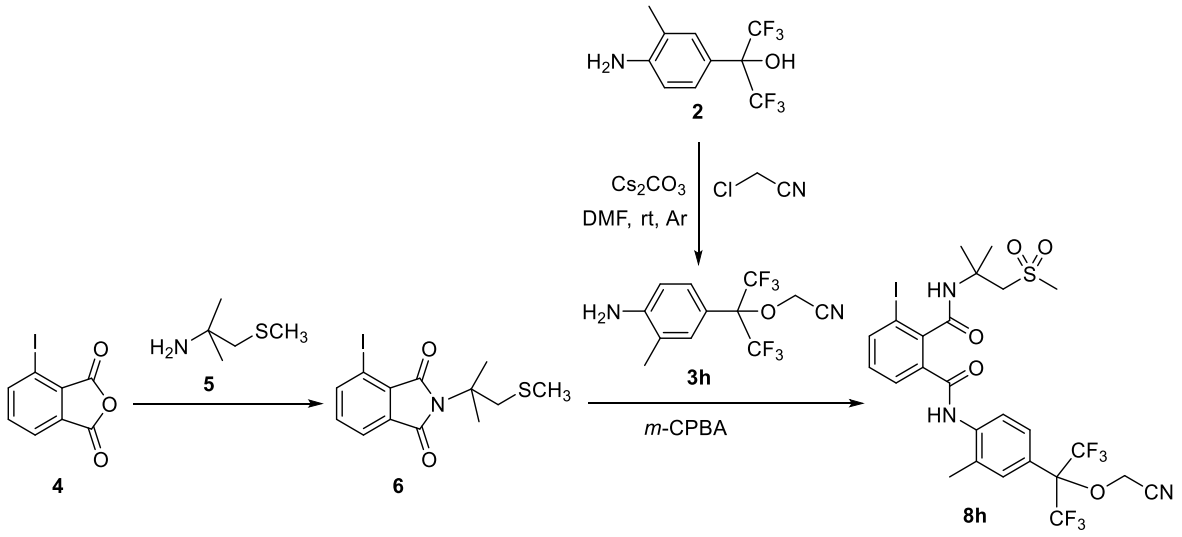

Yield: 40%; White solid; m.p.:152.2–155.1 °C. $^{1}$H NMR (400 MHz, DMSO-$d_6$) δ 9.72 (s, 1H, NH), 8.41 (s, 1H, NH), 8.02 (d, $J$ = 8.0 Hz, 1H), 7.81 (d, $J$ = 8.8 Hz, 1H), 7.72 (d, $J$ = 7.6 Hz, 1H), 7.46–7.44 (m, 2H), 7.30–7.26 (m, 1H), 3.65 (s, 2H), 3.39 (d, $J$ = 6.8 Hz, 2H), 2.96 (s, 3H), 2.36 (s, 3H), 1.53 (s, 6H), 1.26–1.20 (m, 1H), 0.61–0.56 (m, 2H), 0.29–0.26 (m, 2H) ppm; $^{13}$C NMR (100 MHz, DMSO-$d_6$) δ 167.7, 165.5, 141.3, 140.7, 138.3, 136.0, 132.3, 130.1, 129.5, 127.3, 125.7, 124.7, 123.7 (q, $^{1}J_{CF}$ = 290.0 Hz) 123.6, 95.4, 81.7, 71.1, 60.8, 52.4, 43.1, 26.1, 18.1, 10.3, 3.0 ppm; $^{19}$F NMR (376 MHz, DMSO-$d_6$) δ = –73.9 (s, 6F) ppm; HRMS (ESI) calcd for $C_{27}H_{29}F_6IN_2O_5SNa$ $[M+Na]^+$ 757.0644, found 757.0645.

**$N^1$-(4-(2-(Chloromethoxy)-1,1,1,3,3,3-hexafluoropropan-2-yl)-2-methylphenyl)-3-iodo-$N^2$-(2-methyl-1-(methylsulfonyl)propan-2-yl)phthalimide (8g)**




Yield: 39%; White solid; m.p.:150.7–153.6 °C. $^1$H NMR (400 MHz, DMSO-$d_6$) δ 9.76 (s, 1H, NH), 8.43 (s, 1H, NH), 8.03 (d, $J$ = 8.0 Hz, 1H), 7.89 (d, $J$ = 9.6 Hz, 1H), 7.73 (d, $J$ = 7.6 Hz, 1H), 7.52 (s, 1H), 7.51 (d, $J$ = 8.0 Hz, 1H) 7.31–7.27 (m, 1H), 5.70 (s, 2H), 3.66 (s, 2H), 2.96 (s, 3H), 2.28 (s, 3H), 1.56 (s, 6H) ppm; $^{13}$C NMR (100 MHz, DMSO-$d_6$) δ 167.7, 165.6, 141.2, 140.8, 139.0, 136.0, 132.5, 130.2, 129.9, 127.4, 126.0, 124.7, 123.2 (q, $^1J_{CF}$ = 288.0 Hz), 121.8, 95.3, 83.5, 76.3, 60.8, 52.4, 43.1, 26.1, 18.1 ppm; $^{19}$F NMR (376 MHz, DMSO-$d_6$) δ = –70.3 (s, 6F) ppm; HRMS (ESI) calcd for $C_{24}H_{24}ClF_6IN_2O_5SNa$ $[M+Na]^+$ 750.9941, found 750.9942.

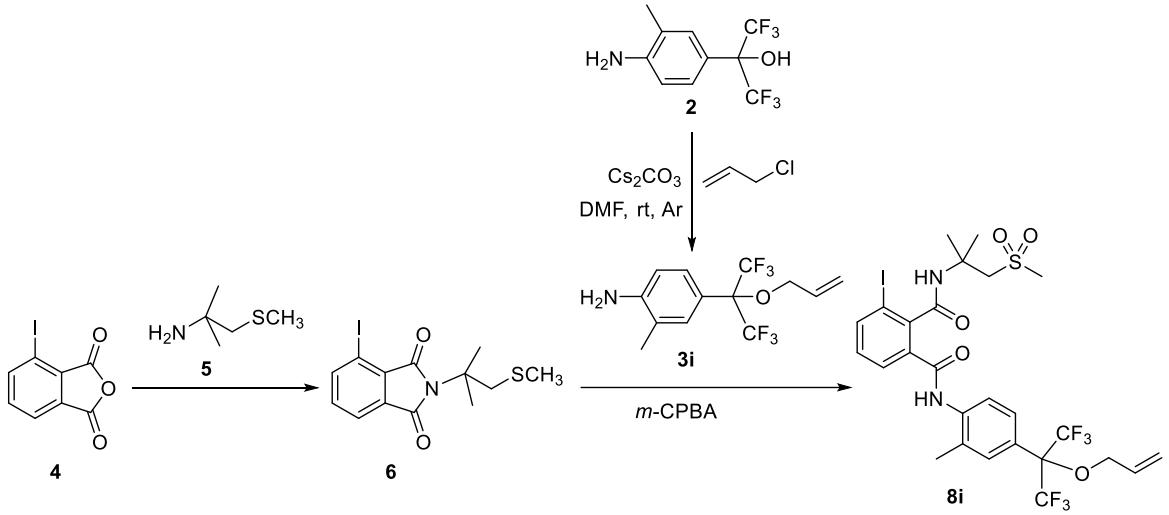
**$N^1$-(4-(2-(Cyanomethoxy)-1,1,1,3,3,3-hexafluoropropan-2-yl)-2-methylphenyl)-3-iodo-$N^2$-(2-methyl-1-(methylsulfonyl)propan-2-yl)phthalimide (8h)**




Yield: 55%; White solid; m.p.:108.5–110.9 °C. $^1$H NMR (400 MHz, DMSO-$d_6$) δ = 9.77 (s, 1H, NH), 8.42 (s, 1H, NH), 8.02 (d, $J$ = 7.6 Hz, 1H), 7.86 (d, $J$ = 9.2 Hz, 1H), 7.72 (d, $J$ = 7.6 Hz, 1H), 7.50–7.45 (m, 2H), 7.30–7.26 (m, 1H), 4.76 (s, 2H), 3.65 (s, 2H), 2.96 (s, 3H), 2.37 (s, 3H), 1.54 (s, 6H) ppm; $^{13}$C NMR (100

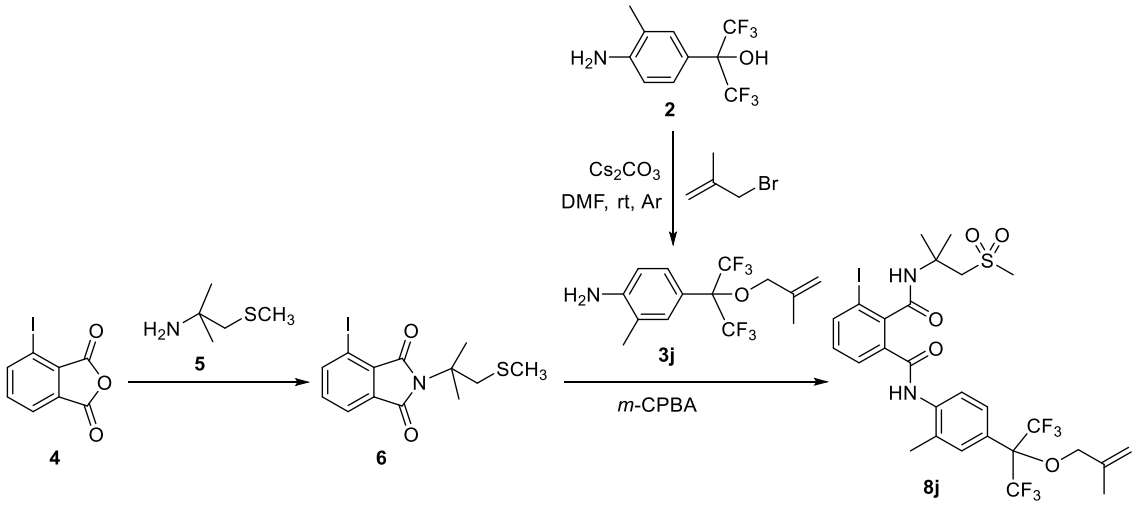
MHz, DMSO-$d_6$) δ = 167.6, 165.6, 141.3, 140.7, 139.1, 136.0, 132.7, 130.1, 129.7, 127.4, 125.8, 124.9, 121.4, 120.3, 115.7, 95.4, 84.1, 60.7, 53.3, 52.4, 43.1, 26.1, 18.1 ppm; $^{19}$F NMR (376 MHz, DMSO-$d_6$) δ = –70.4 (s, 6F) ppm; HRMS (ESI) calcd for $C_{25}H_{24}F_6IN_3O_5SNa$ $[M+Na]^+$ 742.0283, found 742.0284.

**$N^1$-(4-(2-(Allyloxy)-1,1,1,3,3,3-hexafluoropropan-2-yl)-2-methylphenyl)-3-iodo-$N^2$-(2-methyl-1-(methylsulfonyl)propan-2-yl)phthalimide (8i)**



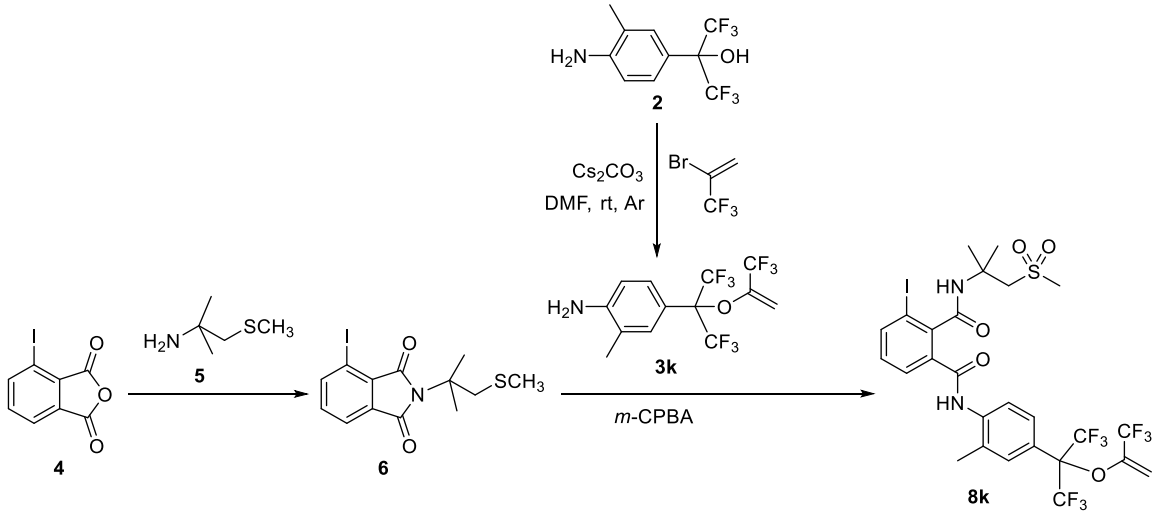

Yield: 52%; White solid; m.p.:92.1–94.8 °C. $^1$H NMR (400 MHz, DMSO-$d_6$) δ = 9.75 (s, 1H, NH), 8.43 (s, 1H, NH), 8.02 (d, $J$ = 8.0 Hz, 1H), 7.81 (d, $J$ = 8.0 Hz, 1H), 7.72 (d, $J$ = 6.8 Hz, 1H), 7.45–7.43 (m, 2H), 7.30–7.26 (m, 1H), 6.06–6.00 (m, 1H), 5.46–5.30 (m, 2H), 4.11 (s, 2H), 3.65 (s, 2H), 2.95 (s, 3H), 2.35 (s, 3H), 1.54 (s, 6H) ppm; $^{13}$C NMR (100 MHz, DMSO-$d_6$) δ = 167.6, 165.5, 141.3, 140.7, 138.5, 136.0, 132.7, 132.4, 130.1, 129.4, 127.3, 125.6, 124.8, 123.6, 123.2, 117.8, 95.4, 82.2, 67.0, 60.7, 52.4, 43.0, 26.1, 18.1 ppm; $^{19}$F NMR (376 MHz, DMSO-$d_6$) δ = –70.4 (s, 6F) ppm; HRMS (ESI) calcd for $C_{26}H_{27}F_6IN_2O_5SNa$ $[M+Na]^+$ 743.0487, found 743.0489.

**$N^1$-(4-(1,1,1,3,3,3-Hexafluoro-2-((2-methylallyl)oxy)propan-2-yl)-2-methylphenyl)-3-iodo-$N^2$-(2-methyl-1-(methylsulfonyl)propan-2-yl)phthalimide (8j)**



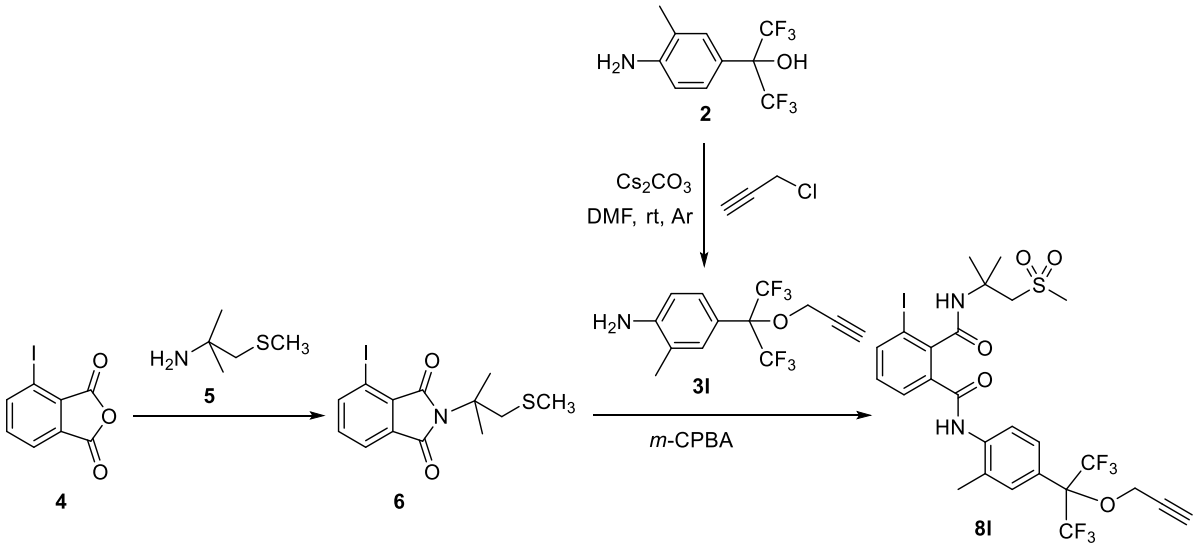

Yield: 54%; White solid; m.p.:104.1–106.3℃. $^1$H NMR (400 MHz, DMSO-$d_6$) δ = 9.73 (s, 1H, NH), 8.41 (s, 1H, NH), 8.02 (d, $J$ = 8.0 Hz, 1H), 7.81 (d, $J$ = 9.2 Hz, 1H), 7.71 (d, $J$ = 7.6 Hz, 1H), 7.45–7.43 (m, 2H), 7.30–7.26 (m, 1H), 5.12–5.02 (m, 2H), 4.00 (s, 2H), 3.65 (s, 2H), 2.94 (s, 3H), 2.34 (s, 3H),1.76 (s, 3H), 1.54 (s, 6H) ppm; $^{13}$C NMR (100 MHz, DMSO-$d_6$) δ = 167.7, 165.6, 141.3, 140.7, 140.0, 138.5, 136.0, 132.4, 130.1, 129.4, 127.3, 125.6, 124.8, 123.6, 123.2, 112.2, 95.4, 82.9, 69.1, 60.8, 52.4, 43.1, 26.1, 19.0, 18.1 ppm; $^{19}$F NMR (376 MHz, DMSO-$d_6$) δ = –70.4 (s, 6F) ppm; HRMS (ESI) calcd for $C_{27}H_{28}F_6IN_2O_5S$ $[M–H]^-$733.0668, found 733.0667.

**$N^1$-(4-(1,1,1,3,3,3-Hexafluoro-2-((3,3,3-trifluoroprop-1-en-2-yl)oxy)propan-2-yl)-2-methylphenyl)-3-iodo-$N^2$-(2-methyl-1-(methylsulfonyl)propan-2-yl)phthalimide (8k)**



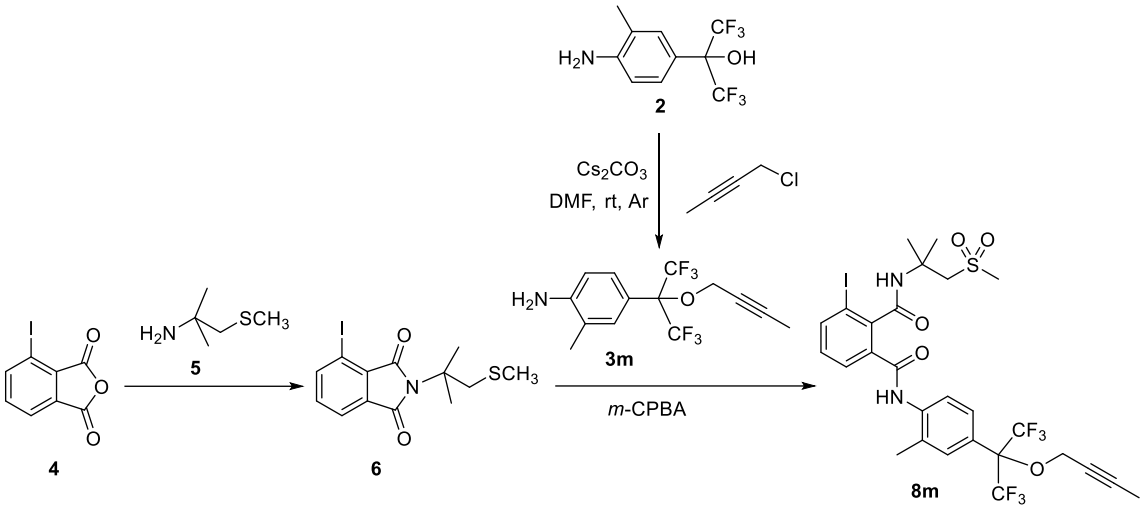
Yield: 38%; White solid; m.p.:142.1–144.2 ℃. $^{1}$H NMR (400 MHz, DMSO-$d_6$) δ 9.81 (s, 1H, NH), 8.44 (s, 1H, NH), 8.04 (d, $J$ = 7.6 Hz, 1H), 7.94 (d, $J$ = 8.4 Hz, 1H) 7.74 (d, $J$ = 7.6 Hz, 1H), 7.45 (d, $J$ = 8.4 Hz, 1H) 7.43 (s, 1H), 7.32–7.28 (m, 1H), 6.75 (d, $J$ = 6.8 Hz, 1H), 5.53–5.45 (m, 1H), 3.68 (s, 2H), 2.97 (s, 3H), 2.40 (s, 3H), 1.57 (s, 6H) ppm; $^{13}$C NMR (100 MHz, DMSO-$d_6$) δ 167.6, 165.6, 146.7, 141.3, 140.8, 139.2, 136.0, 132.7, 130.1, 129.6, 127.4, 125.8, 124.9, 123.9, 121.5, 121.2, 100.5, 95.3, 83.1, 60.8, 52.4, 43.1, 26.1, 18.1 ppm; $^{19}$F NMR (376 MHz, DMSO-$d_6$) δ –57.1 (d, $J$ = 7.6 Hz, 3F), –71.3 (s, 6F) ppm; HRMS (ESI) calcd for $C_{26}H_{24}F_9IN_2O_5SNa$ $[M+Na]^+$ 797.0205, found 797.0204.

**$N^1$-(4-(1,1,1,3,3,3-Hexafluoro-2-(prop-2-yn-1-yloxy)propan-2-yl)-2-methylphenyl)-3-iodo-$N^2$-(2-methyl-1-(methylsulfonyl)propan-2-yl)phthalimide (8l)**



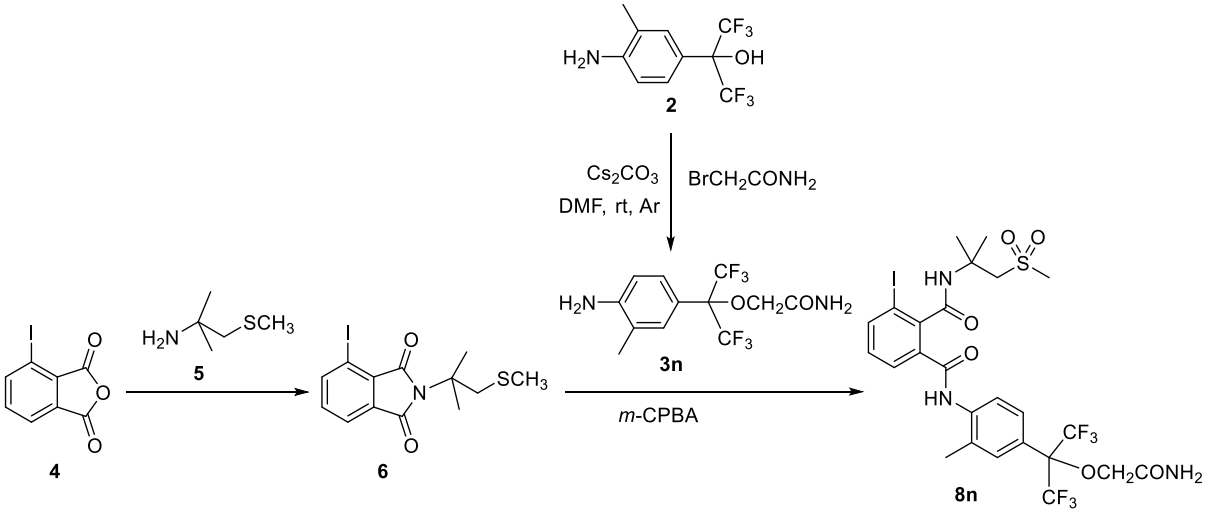

Yield: 49%; White solid; m.p.:164.7–167.6 ℃. $^{1}$H NMR (400 MHz, DMSO-$d_6$) δ = 9.77 (s, 1H, NH), 8.45 (s, 1H, NH), 8.03 (d, $J$ = 8.0 Hz, 1H), 7.87 (d, $J$ = 8.8 Hz, 1H), 7.74 (d, $J$ = 7.6 Hz, 1H), 7.49–7.47 (m, 2H), 7.31–7.28 (m, 1H), 4.35 (s, 2H), 3.71 (s, 1H), 3.68 (s, 2H), 2.96 (s, 3H), 2.50 (s, 3H), 1.57 (s, 6H) ppm; $^{13}$C NMR (100 MHz, DMSO-$d_6$) δ = 167.7, 165.6, 141.3, 140.7, 138.7, 136.0, 132.5, 130.2, 129.7, 127.3, 125.7, 124.8, 122.6, 122.0, 95.3, 82.5, 78.7, 77.9, 60.7, 55.3, 52.4, 43.1, 26.1, 18.1 ppm; $^{19}$F NMR (376 MHz, DMSO-$d_6$) δ = –70.4 (s, 6F) ppm; HRMS (ESI) calcd for $C_{26}H_{25}F_6IN_2O_5SNa$ $[M+Na]^+$ 741.0331, found 741.0333.

**$N^1$-(4-(2-(But-2-yn-1-yloxy)-1,1,1,3,3,3-hexafluoropropan-2-yl)-2-methylphenyl)-3-iodo-$N^2$-(2-methyl-1-(methylsulfonyl)propan-2-yl)phthalimide (8m)**



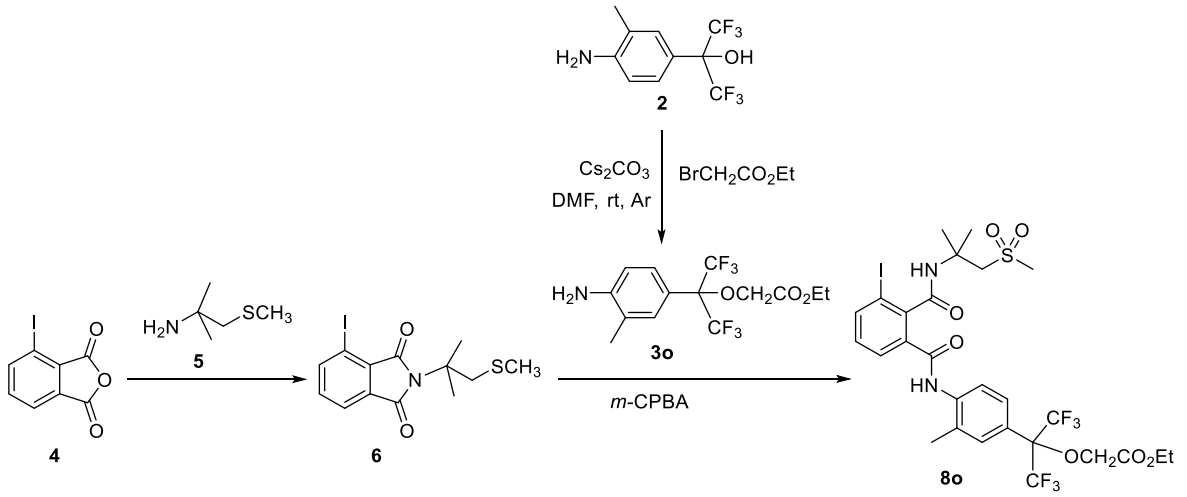

Yield: 49%; White solid; m.p.:170.5–174.3°C. $^1$H NMR (400 MHz, DMSO-$d_6$) δ 9.75 (s, 1H, NH), 8.42 (s, 1H, NH), 8.03 (d, $J$ = 7.6 Hz, 1H), 7.83 (d, $J$ = 8.4 Hz, 1H), 7.73 (d, $J$ = 7.2 Hz, 1H), 7.46 (s, 1H), 7.45 (d, $J$ = 8.0 Hz, 1H), 7.31–7.27 (m, 1H), 4.28 (s, 2H), 3.66 (s, 2H), 2.95 (s, 3H), 2.37 (s, 3H), 1.91 (s, 3H), 1.55 (s, 6H) ppm; $^{13}$C NMR (100 MHz, DMSO-$d_6$) δ 167.7, 165.6, 141.3, 140.7, 138.6, 136.0, 132.5, 130.1, 129.6, 127.3, 125.7, 124.8, 123.5 (q, $^1J_{CF}$ = 288.0 Hz), 122.7, 95.4, 84.4, 82.3, 73.5, 60.8, 55.8, 52.4, 43.1, 26.1, 18.1, 3.1 ppm; $^{19}$F NMR (376 MHz, DMSO-$d_6$) δ = –70.3 (s, 6F) ppm; HRMS (ESI) calcd for $C_{27}H_{27}F_6IN_2O_5SNa$ $[M+Na]^+$ 755.0487, found 755.0488.

**$N^1$-(4-(2-(2-Amino-2-oxoethoxy)-1,1,1,3,3,3-hexafluoropropan-2-yl)-2-methylphenyl)-3-iodo-$N^2$-(2-methyl-1-(methylsulfonyl)propan-2-yl)phthalimide (8n)**



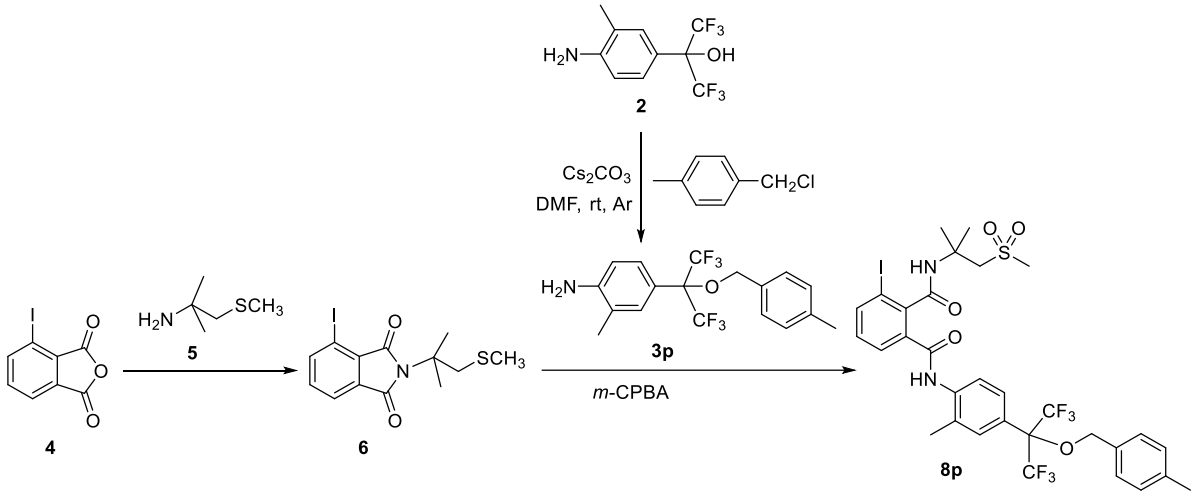
Yield: 44%; White solid; m.p.:174.2–176.3℃. $^{1}$H NMR (400 MHz, DMSO-$d_6$) δ 9.75 (s, 1H, NH), 8.41 (s, 1H, NH), 8.02 (d, *J* = 8.0 Hz, 1H), 7.80 (d, *J* = 8.4 Hz, 1H), 7.72 (d, *J* = 7.6 Hz, 1H), 7.53–7.50 (m, 2H), 7.43 (d, *J* = 9.2 Hz, 2H), 7.30–7.26 (m, 1H), 4.00 (s, 2H), 3.66 (s, 2H), 2.95 (s, 3H), 2.35 (s, 3H), 1.55 (s, 6H) ppm; $^{13}$C NMR (100 MHz, DMSO-$d_6$) δ 168.0, 167.7, 165.6, 141.3, 140.7, 138.6, 136.0, 132.6, 130.1, 129.8, 127.3, 125.8, 124.8, 123.5, 122.8, 95.4, 82.3, 64.7, 60.7, 52.4, 43.0, 26.1, 18.1 ppm; $^{19}$F NMR (376 MHz, DMSO-$d_6$) δ = –70.4 (s, 6F) ppm; HRMS (ESI) calcd for $C_{25}H_{26}F_6IN_3O_6SNa$ $[M+Na]^+$ 760.0388, found 760.0389.

**Ethyl-2-((1,1,1,3,3,3-hexafluoro-2-(4-(3-iodo-2-((2-methyl-1-(methylsulfonyl)propan-2-yl)-carbamoyl) benzamido)-3-methylphenyl)propan-2-yl)oxy)acetate (8o)**



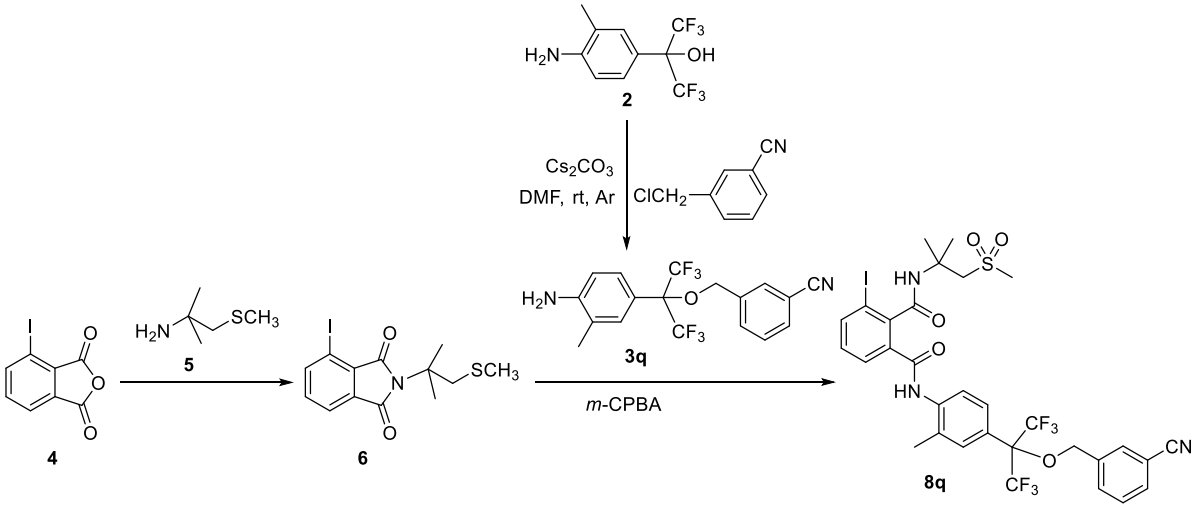

Yield: 67%; White solid; m.p.:110.7–112.2 ℃. $^{1}$H NMR (400 MHz, DMSO-$d_6$) δ = 9.76 (s, 1H, NH), 8.44 (s, 1H, NH), 8.03 (d, *J* = 8.4 Hz, 1H), 7.85 (d, *J* = 8.4 Hz, 1H), 7.73 (d, *J* = 8.0 Hz, 1H), 7.50 – 7.48 (m, 2H), 7.31–7.27 (m, 1H), 4.26 (s, 2H), 4.21 (q, *J* = 7.2 Hz, 2H), 3.67 (s, 2H), 2.96 (s, 3H), 2.36 (s, 3H), 1.57 (s, 6H), 1.24 (t, *J* = 7.2 Hz, 3H) ppm; $^{13}$C NMR (100 MHz, DMSO-$d_6$) δ = 167.6, 167.1, 165.6, 141.3, 140.7, 138.7, 136.0, 132.5, 130.1, 129.7, 127.3, 125.7, 124.7, 122.5, 121.0, 95.3, 82.2, 83.7, 61.0, 60.7, 52.4, 43.1, 26.1, 18.1, 13.9 ppm; $^{19}$F NMR (376 MHz, DMSO-$d_6$) δ = –70.6 (s, 6F); HRMS (ESI) calcd for $C_{27}H_{29}F_6IN_2O_7SNa$ $[M+Na]^+$ 789.0542, found 789.0541.

**$N^1$-(4-(1,1,1,3,3,3-Hexafluoro-2-((4-methylbenzyl)oxy)propan-2-yl)-2-methylphenyl)-3-iodo-$N^2$-(2-methyl-1-(methylsulfonyl)propan-2-yl)phthalimide (8p)**



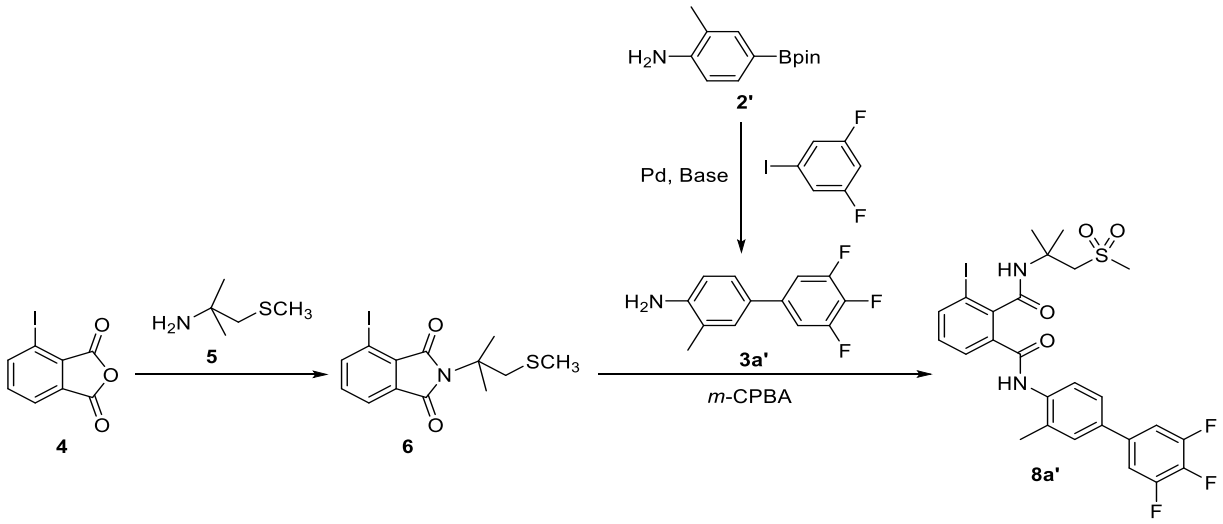

Yield: 40 %; White solid; m.p.:173.8–175.2°C. $^1$H NMR (400 MHz, DMSO-$d_6$) δ = 9.78 (s, 1H, NH), 8.45 (s, 1H, NH), 8.03 (d, *J* = 7.2 Hz, 1H), 7.87 (d, *J* = 8.4 Hz, 1H), 7.74 (d, *J* = 7.6 Hz, 1H), 7.51–7.48 (m, 2H), 7.33 (d, *J* = 8.0 Hz, 2H), 7.31–7.27 (m, 1H), 7.25 (d, *J* = 8.0 Hz, 2H), 4.59 (s, 2H), 3.68 (s, 2H), 2.95 (s, 3H), 2.37 (s, 3H), 2.34 (s, 3H), 1.56 (s, 6H) ppm; $^{13}$C NMR (100 MHz, DMSO-$d_6$) δ = 167.7, 165.6, 141.3, 140.7, 138.5, 137.7, 136.1, 132.7, 132.4, 130.1, 129.7, 129.1, 127.8, 127.3, 125.8, 124.8, 123.7, 123.2, 95.4, 82.3, 67.8, 60.7, 52.4, 43.0, 26.1, 20.7, 18.2 ppm; $^{19}$F NMR (376 MHz, DMSO-$d_6$) δ = –70.1 (s, 6F) ppm; HRMS (ESI) calcd for $C_{31}H_{31}F_6IN_2O_5SNa$ $[M+Na]^+$ 807.0800, found 807.0797.

**$N^1$-(4-(2-((3-Cyanobenzyl)oxy)-1,1,1,3,3,3-hexafluoropropan-2-yl)-2-methylphenyl)-3-iodo-$N^2$-(2-methyl-1-(methylsulfonyl)propan-2-yl)phthalimide (8q)**



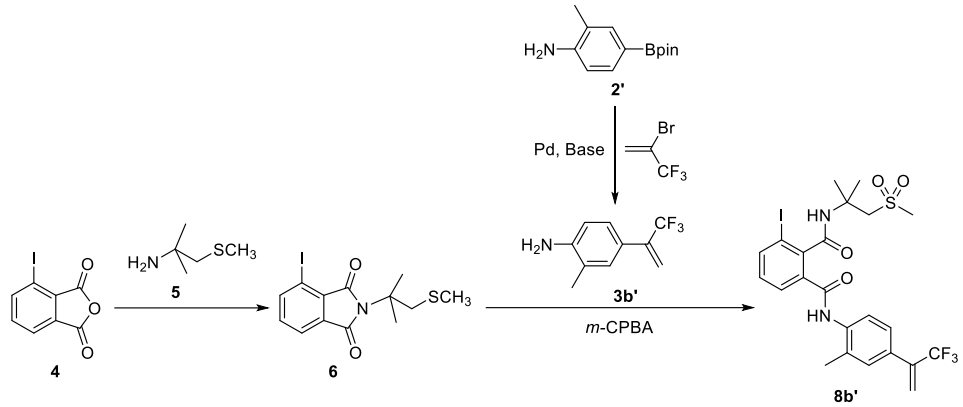
Yield: 48%; White solid; m.p.:170.1–173.4 °C. $^1$H NMR (400 MHz, DMSO-$d_6$) δ = 9.76 (s, 1H, NH), 8.43 (s, 1H, NH), 8.03 (d, *J* = 7.2 Hz, 1H), 7.89 (s, 1H), 7.86 (d, *J* = 7.6 Hz, 2H), 7.81 (d, *J* = 8.0 Hz, 1H), 7.73 (d, *J* = 7.6 Hz, 1H), 7.69–7.65 (m, 1H), 7.51 (d, *J* = 8.8 Hz, 1H), 7.47 (s, 1H), 7.31–7.27 (m, 1H), 4.74 (s, 2H), 3.66 (s, 2H), 2.95 (s, 3H), 2.36 (s, 3H), 1.55 (s, 6H) ppm; $^{13}$C NMR (101 MHz, DMSO-$d_6$) δ = 167.7, 165.6, 141.3, 140.7, 138.6, 137.5, 136.0, 132.5, 132.1, 132.0, 130.8, 130.1, 130.0, 129.6, 127.3, 125.8, 124.8, 122.7, 120.7, 118.5, 111.6, 95.3, 82.5, 66.7, 60.7, 52.4, 43.1, 26.1, 18.1 ppm; $^{19}$F NMR (376 MHz, DMSO-$d_6$) δ = –70.1 (s, 6F) ppm; HRMS (ESI) calcd for $C_{31}H_{28}F_6IN_3O_5SNa$ $[M+Na]^+$ 818.0596, found 818.0594.

**3-Iodo-*N*$^2$-(2-methyl-1-(methylsulfonyl)propan-2-yl)-*N*$^1$-(3',4',5'-trifluoro-3-methyl-[1,1'-biphenyl]-4-yl)phthalimide (8a')**



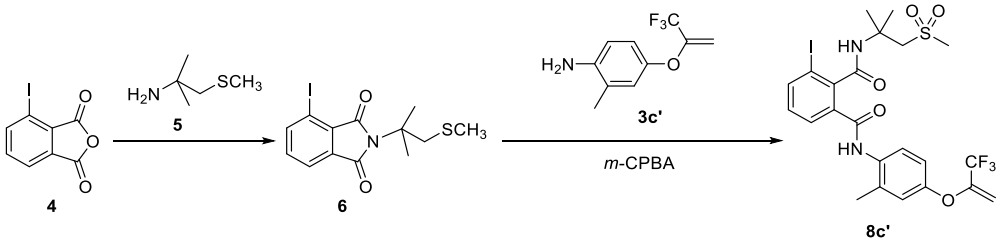

Yield: 48%; White solid; m.p.: 187.1–189.9 °C. $^1$H NMR (400 MHz, DMSO-$d_6$) δ 9.67 (s, 1H, NH), 8.42 (s, 1H, NH), 8.01 (d, *J* = 8.0 Hz, 1H), 7.71–7.65 (m, 5H), 7.59 (d, *J* = 8.4 Hz, 1H), 7.30–7.26 (m, 1H), 3.67 (s, 2H), 2.98 (s, 3H), 2.35 (s, 3H), 1.55 (s, 6H) ppm; $^{13}$C NMR (100 MHz, DMSO-$d_6$) δ 167.7, 165.4, 151.7 (m), 149.4 (m), 141.3, 140.6, 136.6, 136.3, 133.6, 132.4, 130.1, 128.8, 127.3, 124.9, 124.4 ,111.0, 110.8, 95.4, 60.9, 52.4, 43.1, 26.2, 17.9 ppm; $^{19}$F NMR (376 MHz, DMSO-$d_6$) δ = –134.9 – –135.0 (m, 2F), –163.8 – –163.9 (m, 1F) ppm; HRMS (ESI) calcd for $C_{26}H_{24}F_3IN_2O_4SNa$ $[M+Na]^+$ 667.0351, found 667.0354.

**3-Iodo-$N^2$-(2-methyl-1-(methylsulfonyl)propan-2-yl)-$N^1$-(2-methyl-4-(3,3,3-trifluoropro-p-1-en-2-yl)phenyl)phthalimide (8b')**




Yield: 33%; White solid; m.p.: 164.0–168.2 °C. $^1$H NMR (400 MHz, DMSO-$d_6$) δ 9.66 (s, 1H, NH), 8.38 (s, 1H, NH), 8.01 (d, $J$ = 7.6 Hz, 1H), 7.71 (d, $J$ = 7.2 Hz, 1H) 7.62 (d, $J$ = 8.4 Hz, 1H), 7.39 (s, 1H), 7.35 (d, $J$ = 8.0 Hz, 1H), 7.29–7.25 (m, 1H), 6.09–6.05 (m, 2H), 3.64 (s, 2H), 2.96 (s, 3H), 2.30 (s, 3H), 1.53 (s, 6H) ppm; $^{13}$C NMR (100 MHz, DMSO-$d_6$) δ 167.7, 165.4, 141.3, 140.6, 137.1, 136.6, 136.3, 136.2, 132.3, 130.1, 129.5, 129.0, 127.3, 124.8, 124.7, 121.6, 95.4, 60.8, 52.4, 43.1, 26.1, 17.9 ppm; $^{19}$F NMR (376 MHz, DMSO-$d_6$) δ –63.2 (s, 3F) ppm; HRMS (ESI) calcd for $C_{23}H_{24}F_3IN_2O_4SNa$ $[M+Na]^+$ 631.0351, found 631.0350.

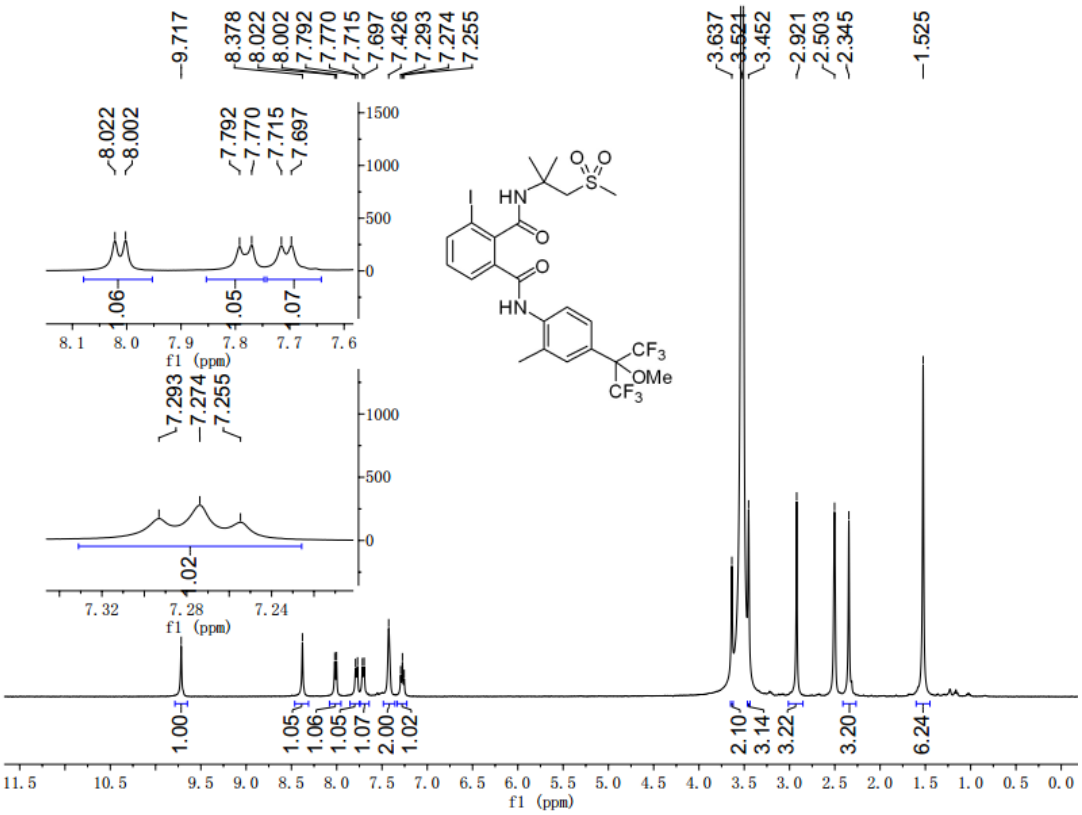
**3-Iodo-$N^2$-(2-methyl-1-(methylsulfonyl)propan-2-yl)-$N^1$-(2-methyl-4-((3,3,3-trifluoropro-p-1-en-2-yl)oxy)phenyl)phthalimide (8c')**



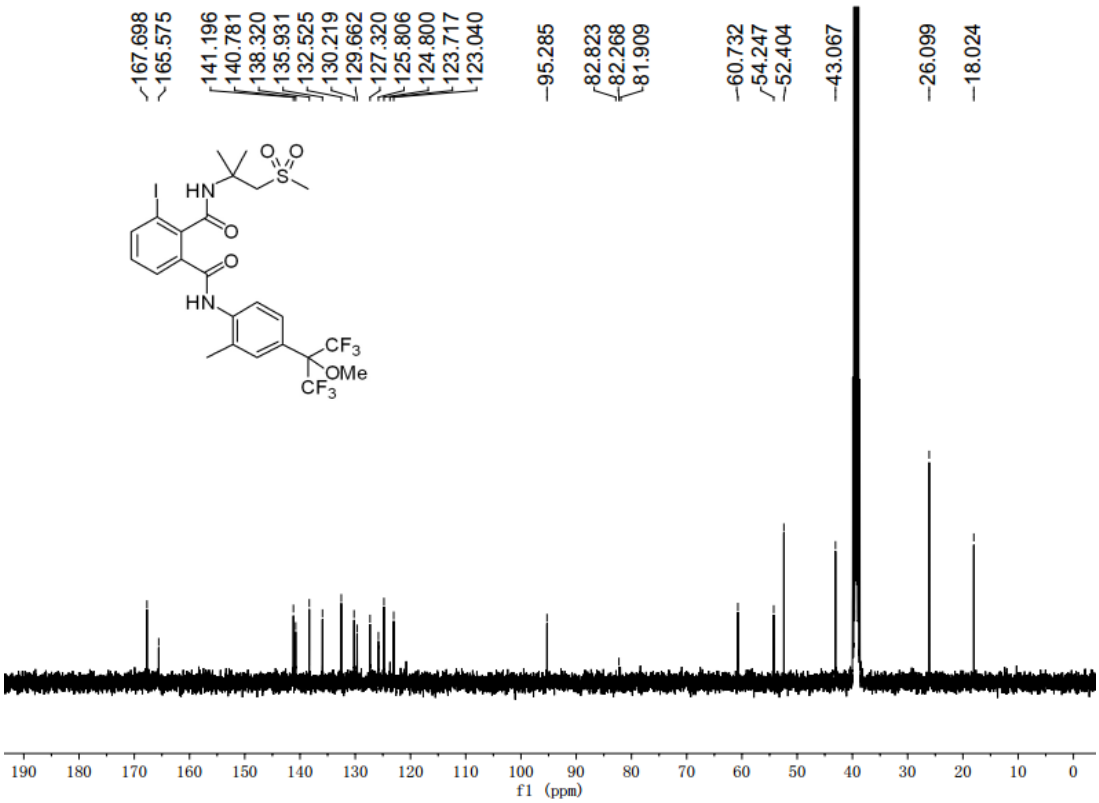

Yield: 39%; White solid; m.p.: 165.5–167.3 °C. $^1$H NMR (400 MHz, DMSO-$d_6$) δ 9.66 (s, 1H, NH), 8.41 (s, 1H, NH), 8.02 (d, $J$ = 8.0 Hz, 1H), 7.75 (d, $J$ = 7.6 Hz, 1H), 7.52 (d, $J$ = 8.4 Hz, 1H), 7.30–7.25 (m, 2H), 7.12 (s, 1H), 7.08–7.05 (m, 1H), 5.40–5.32 (m, 1H) 3.71 (s, 2H), 3.02 (s, 3H), 2.31 (s, 3H), 1.59 (s, 6H) ppm; $^{13}$C NMR (100 MHz, DMSO-$d_6$) δ 167.7, 165.4, 153.4, 150.7, 141.4, 140.6, 136.2, 135.0, 132.6, 130.1, 127.3, 126.7, 122.7 (q, $^1J_{CF}$ = 267.6 Hz), 118.5, 114.3, 97.6 (q, $^2J_{CF}$ = 33.7 Hz), 95.4, 60.9, 52.4, 43.2, 26.2, 17.9 ppm; $^{19}$F NMR (376 MHz, DMSO-$d_6$) δ –55.9 (d, $J$ = 8.3 Hz, 3F) ppm; HRMS (ESI) calcd for $C_{23}H_{24}F_3IN_2O_5SNa$ $[M+Na]^+$ 647.0300, found 647.0302.

## 7. $^{1}H$, $^{13}C$, $^{19}F$ NMR and HRMS (ESI) spectra of target compounds

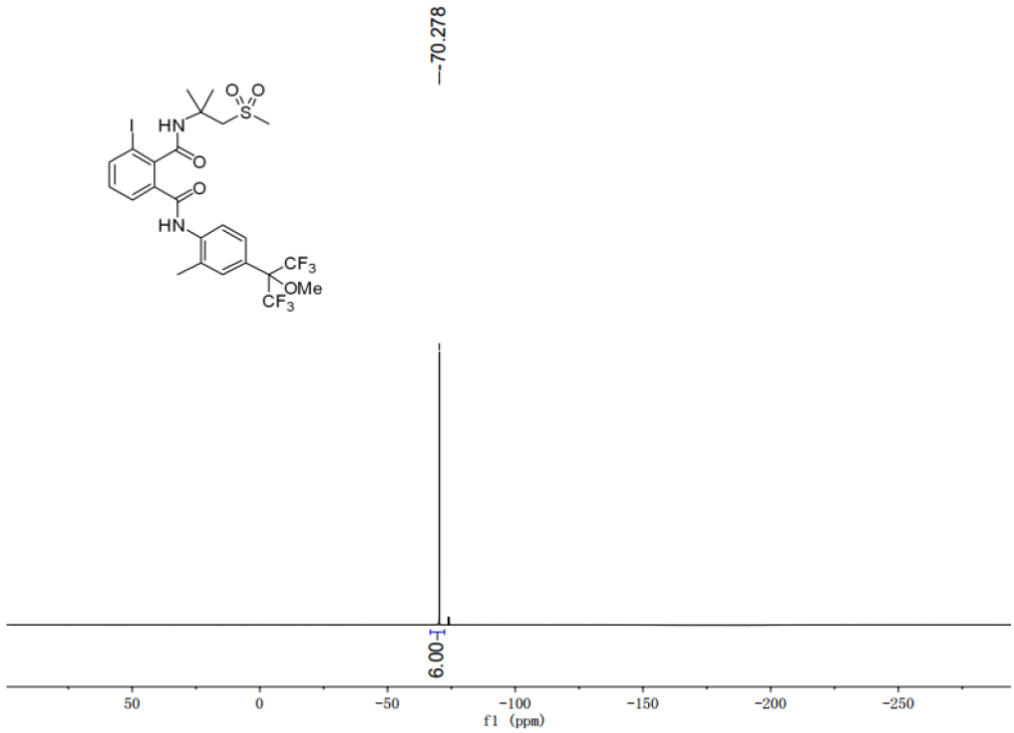
### $^{1}H$ NMR spectrum of 8a



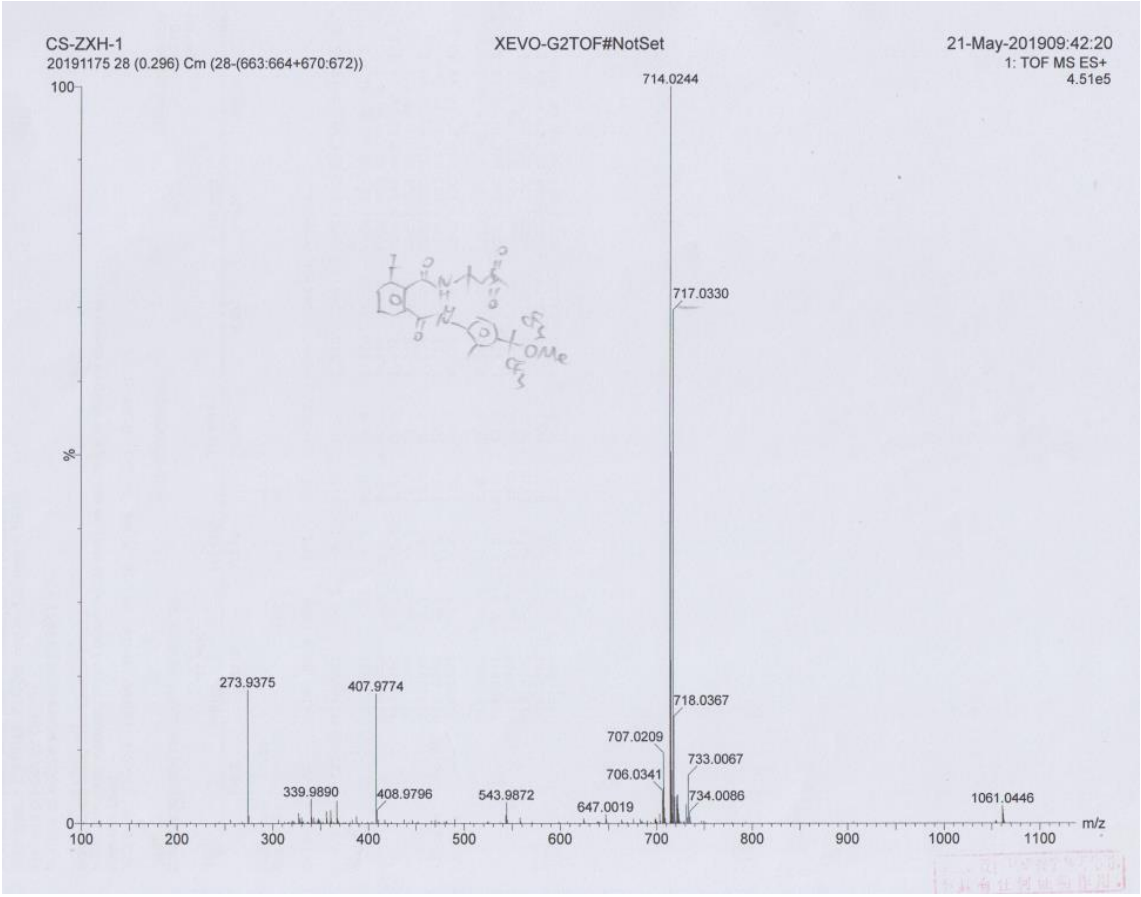

### $^{13}C$ NMR spectrum of 8a



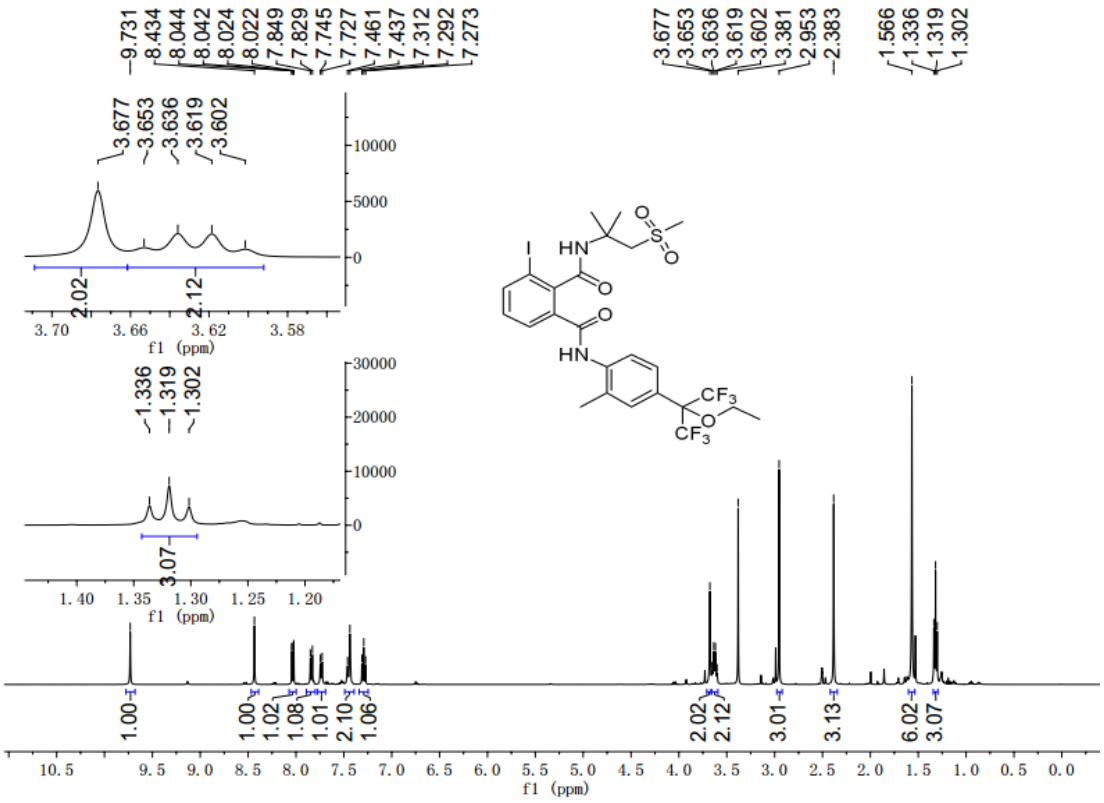
## $^{19}$F NMR spectrum of 8a



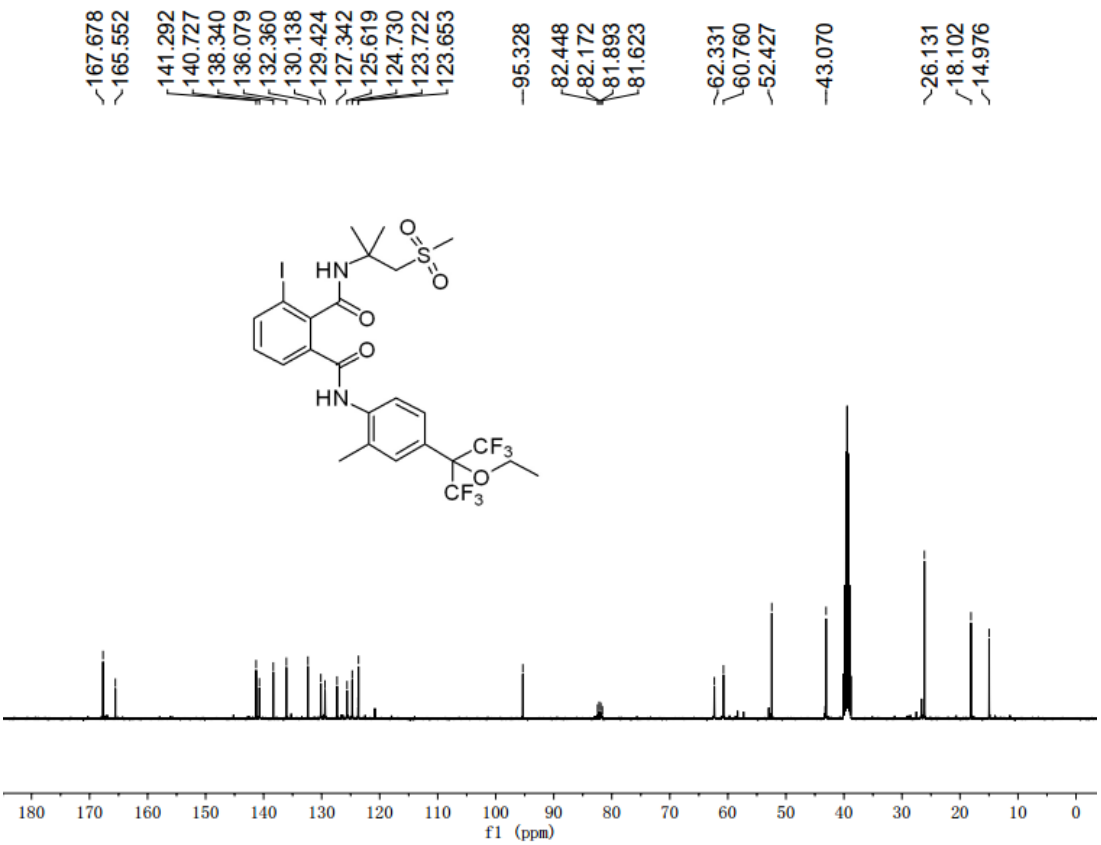

## HRMS (ESI) of 8a



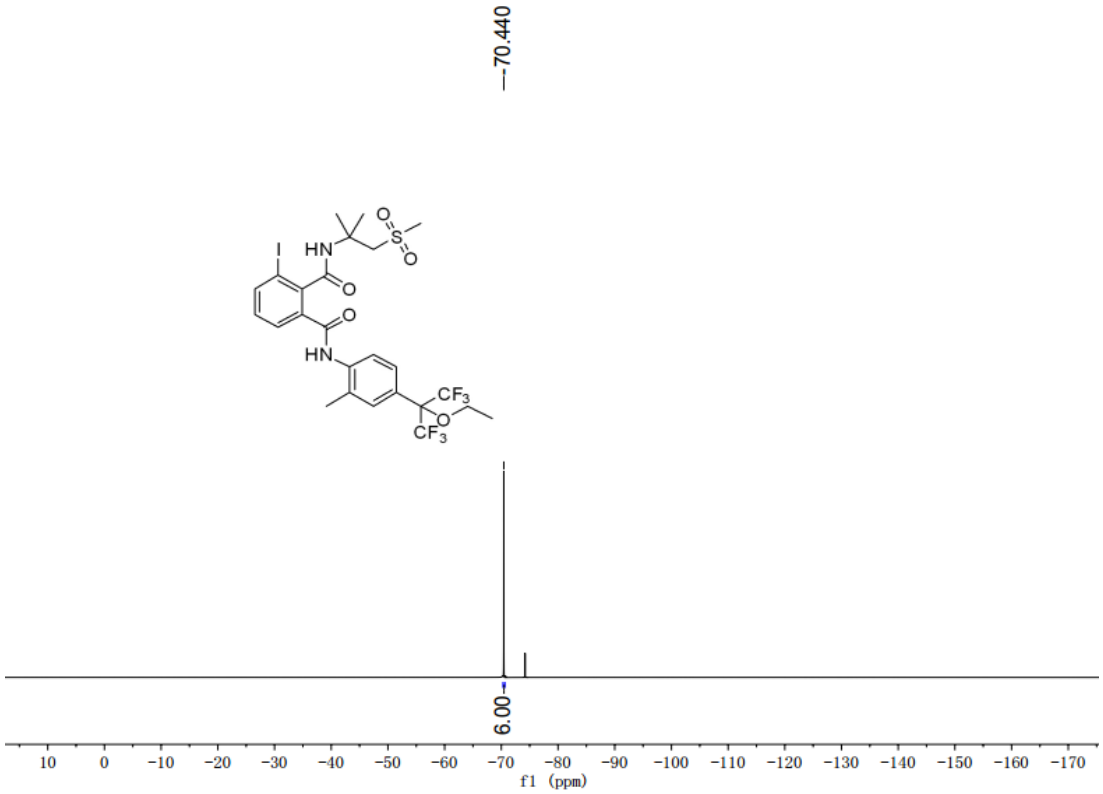
## $^{1}$H NMR spectrum of 8b



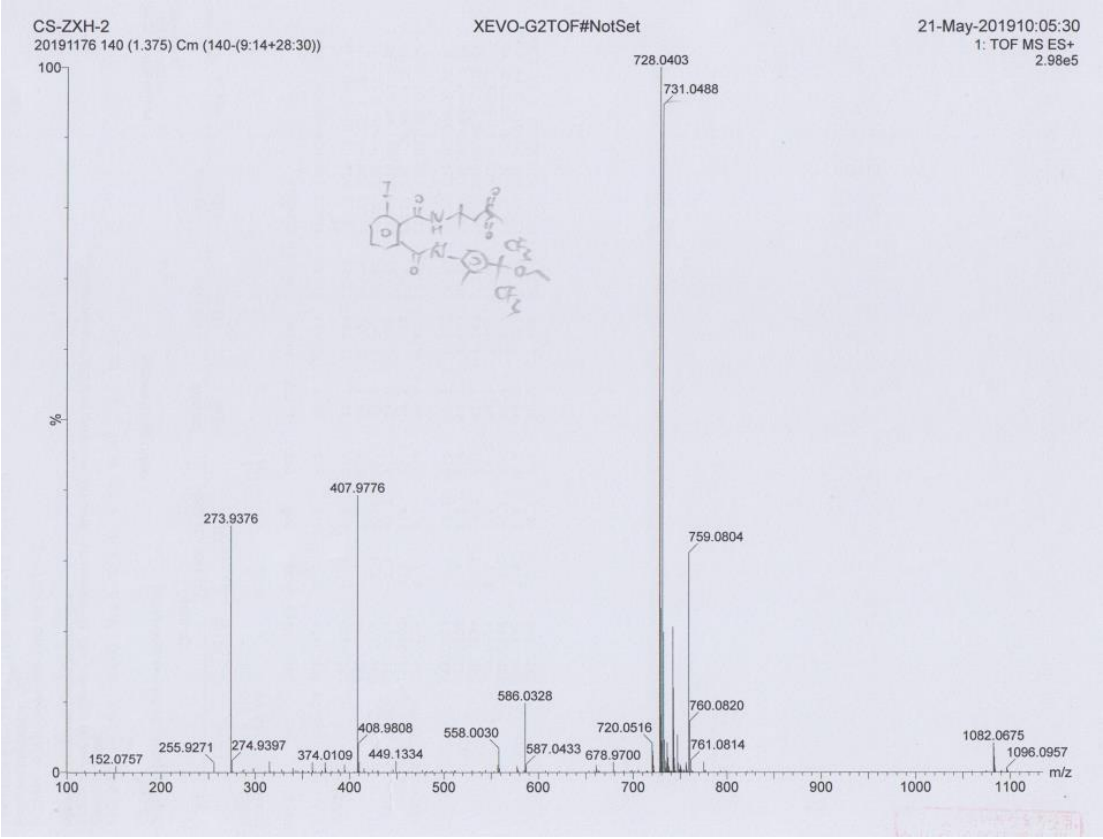

## $^{13}$C NMR spectrum of 8b



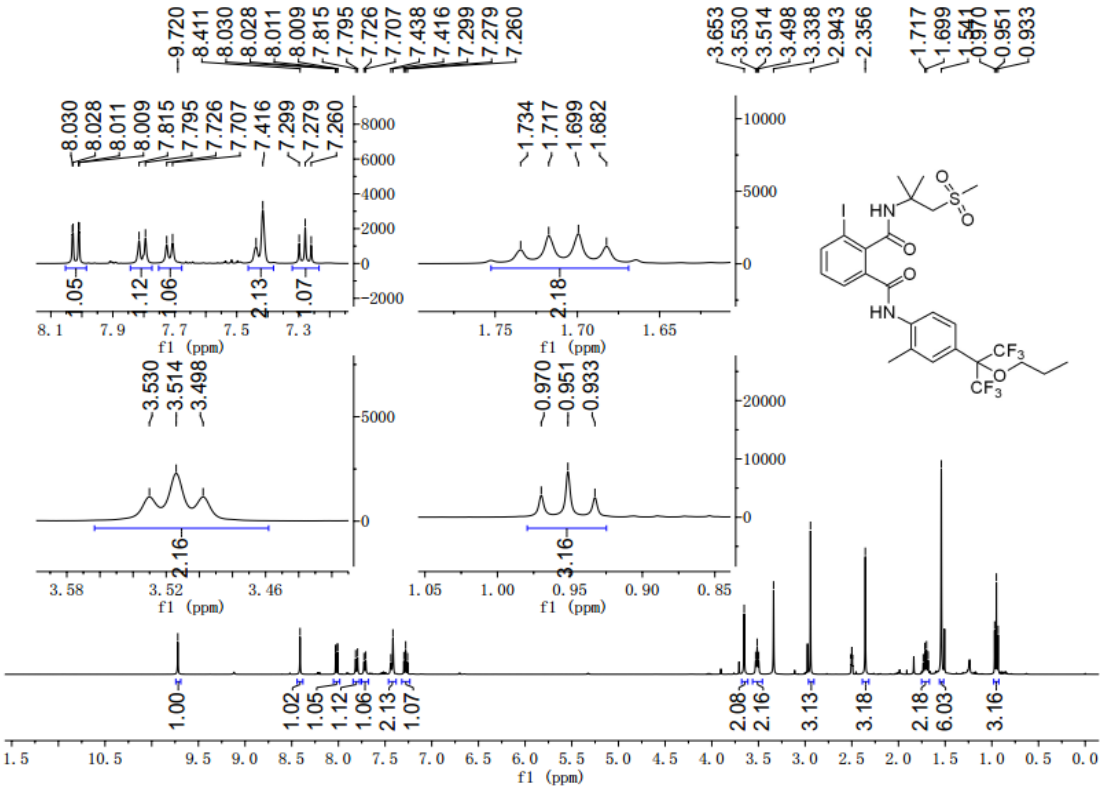
## $^{19}$F NMR spectrum of 8b



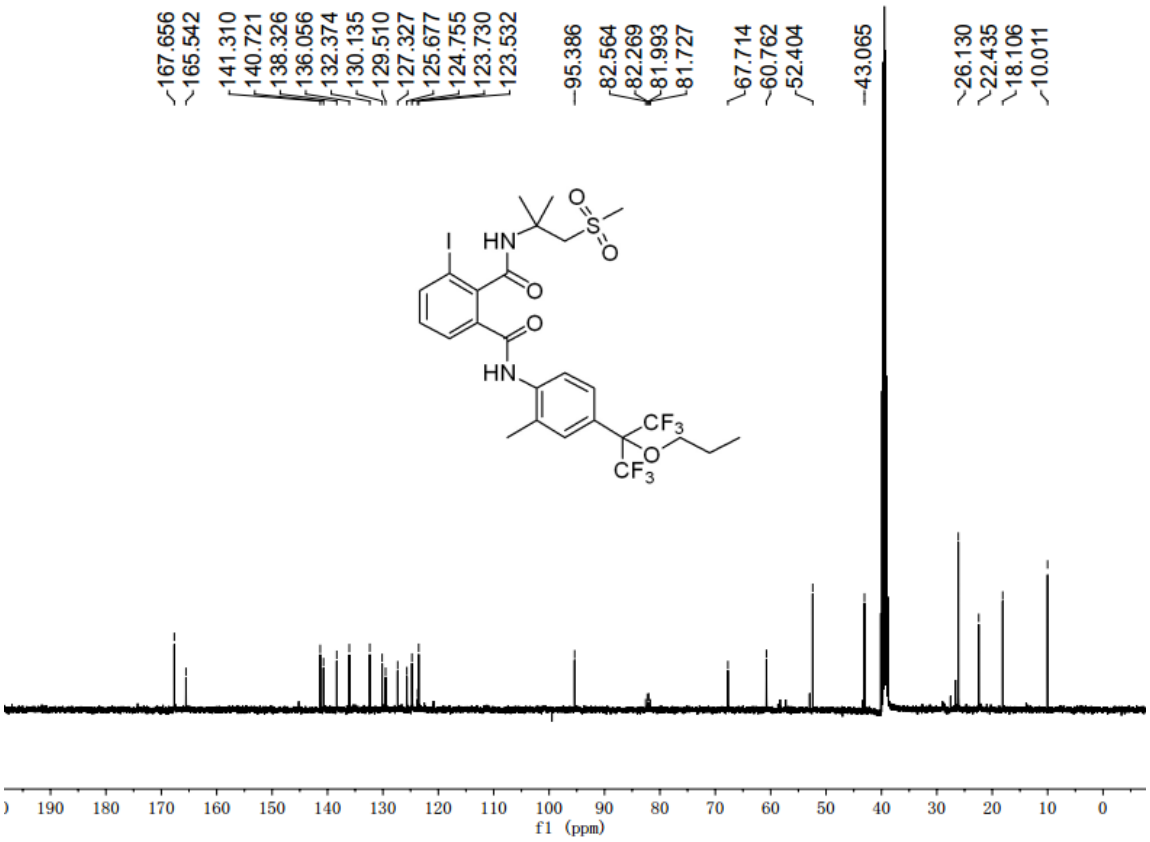

## HRMS (ESI) of 8b



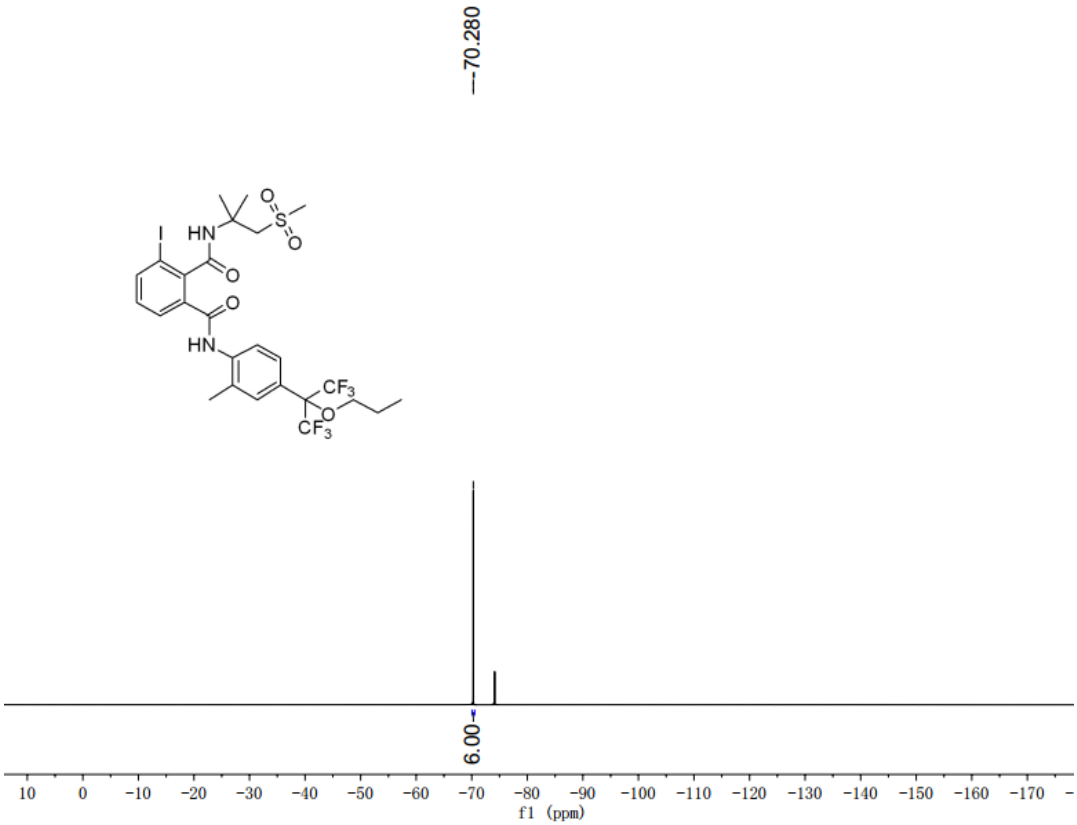
## $^{1}$H NMR spectrum of 8c



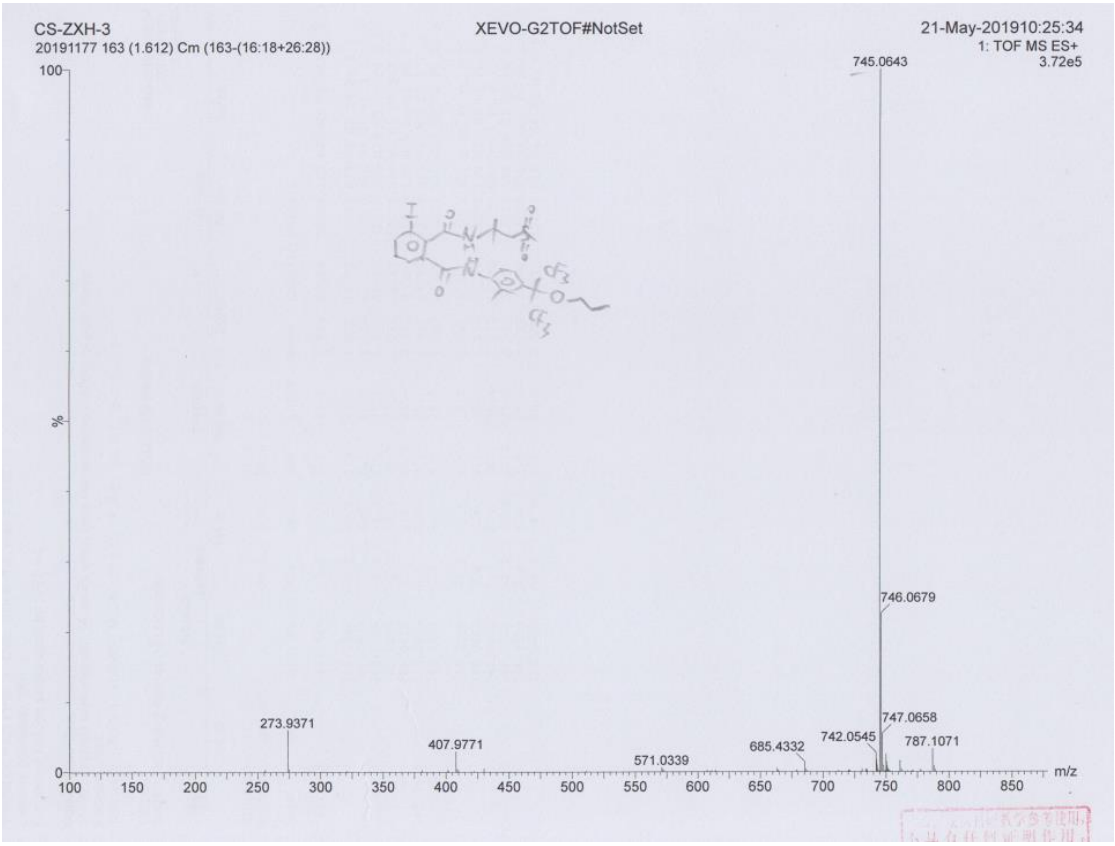
## $^{13}$C NMR spectrum of 8c



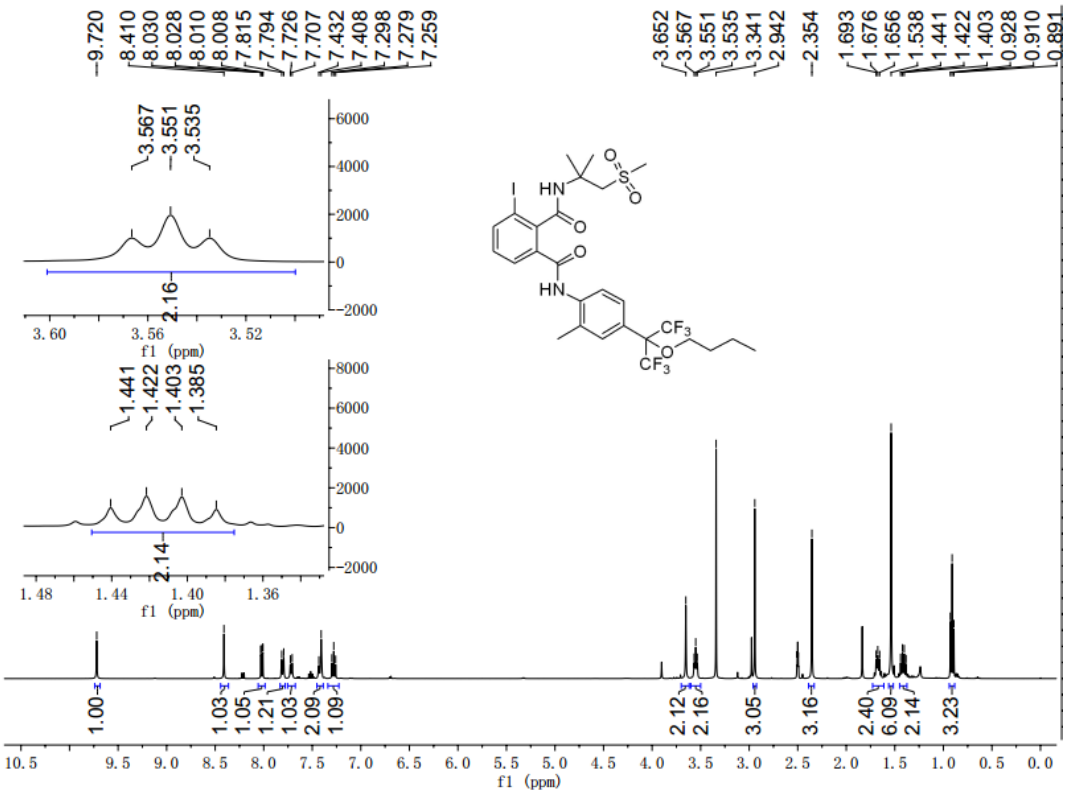
## $^{19}$F NMR spectrum of 8c



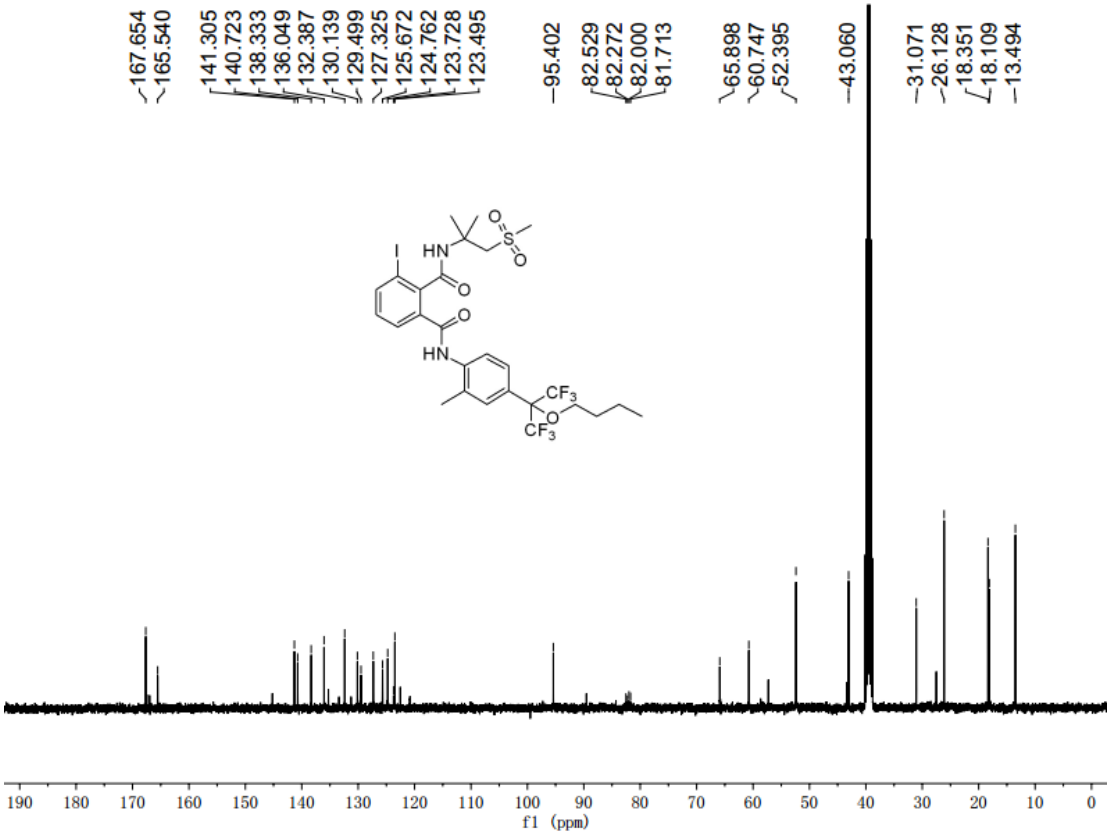

## HRMS (ESI) of 8c



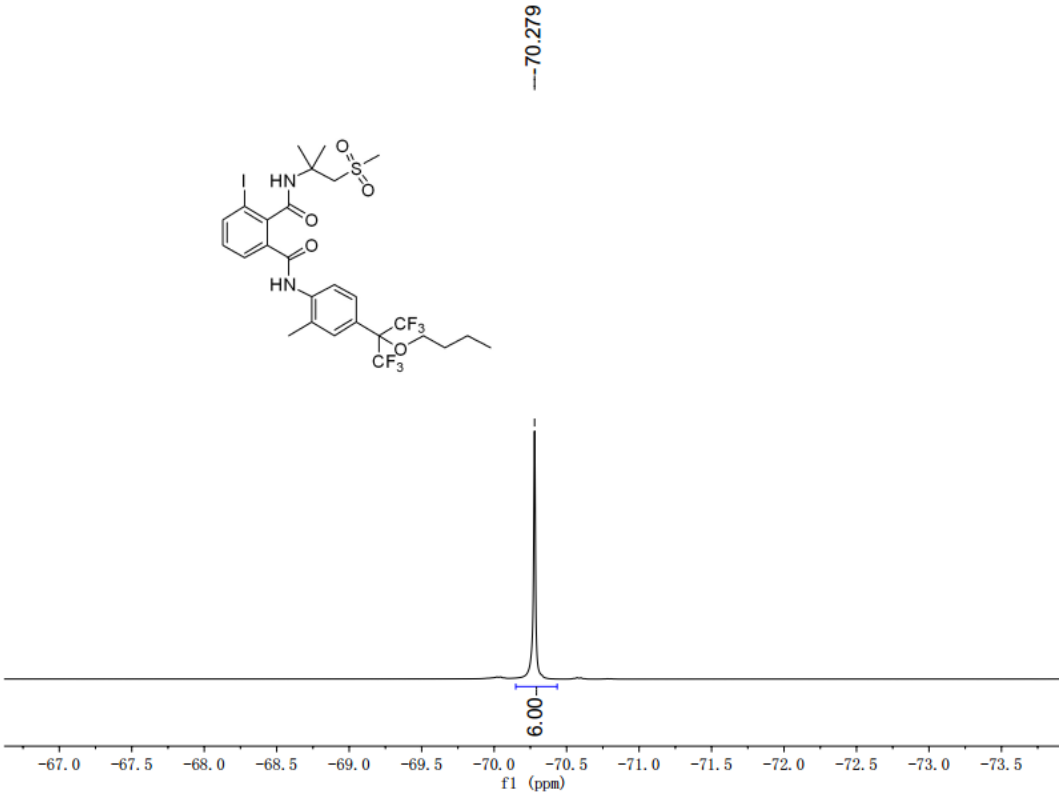
## $^{1}$H NMR spectrum of 8d



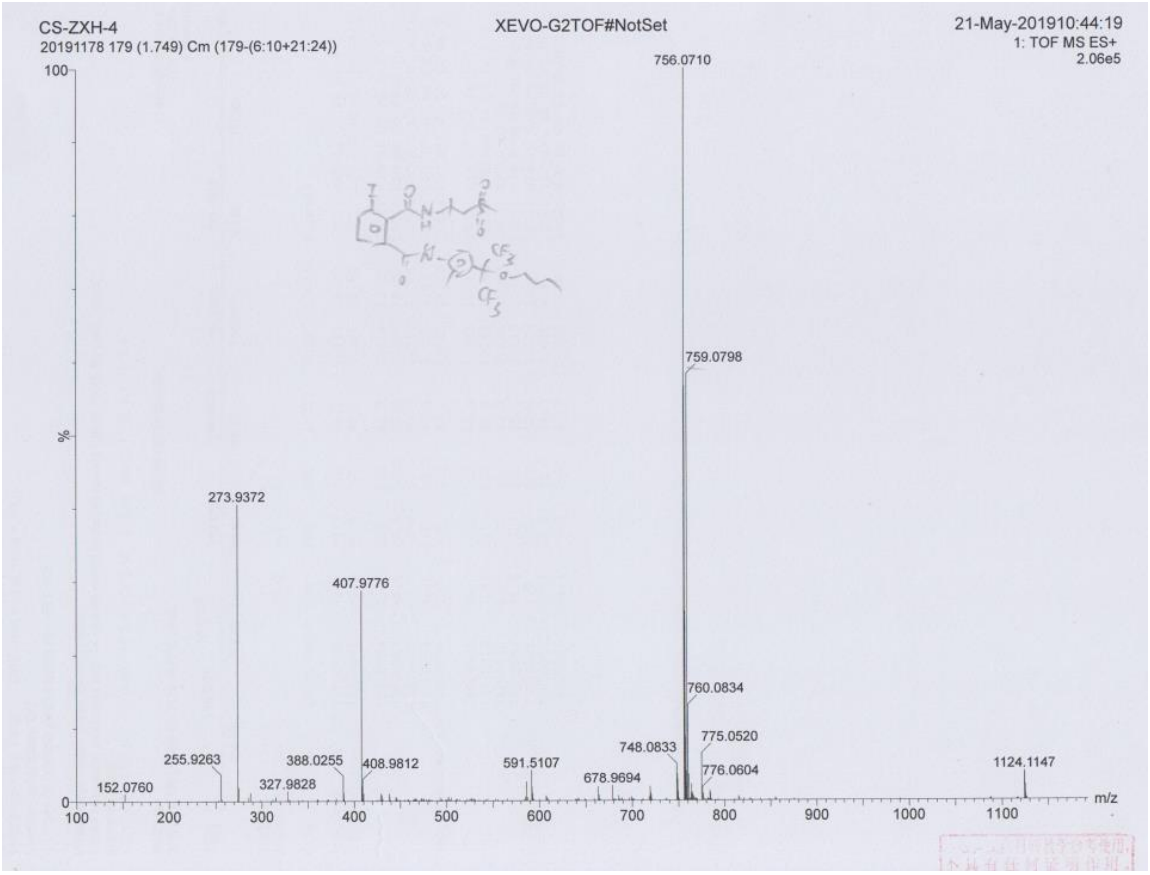

## $^{13}$C NMR spectrum of 8d



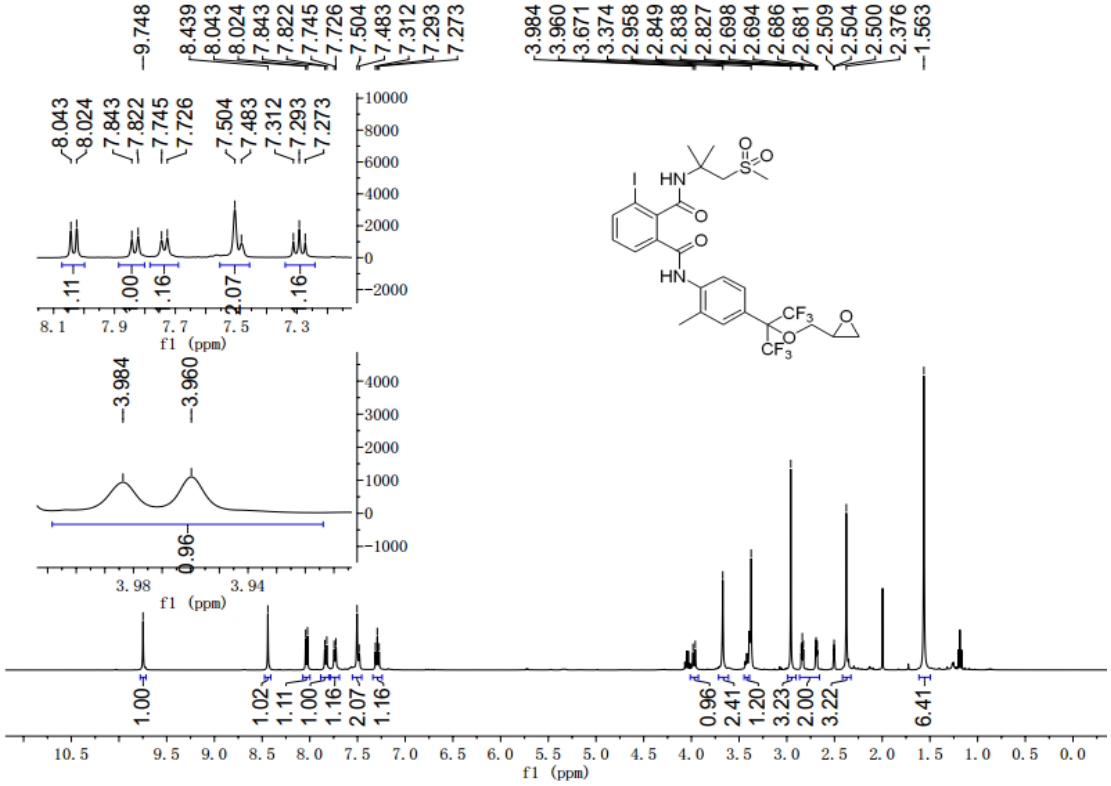
## $^{19}$F NMR spectrum of 8d



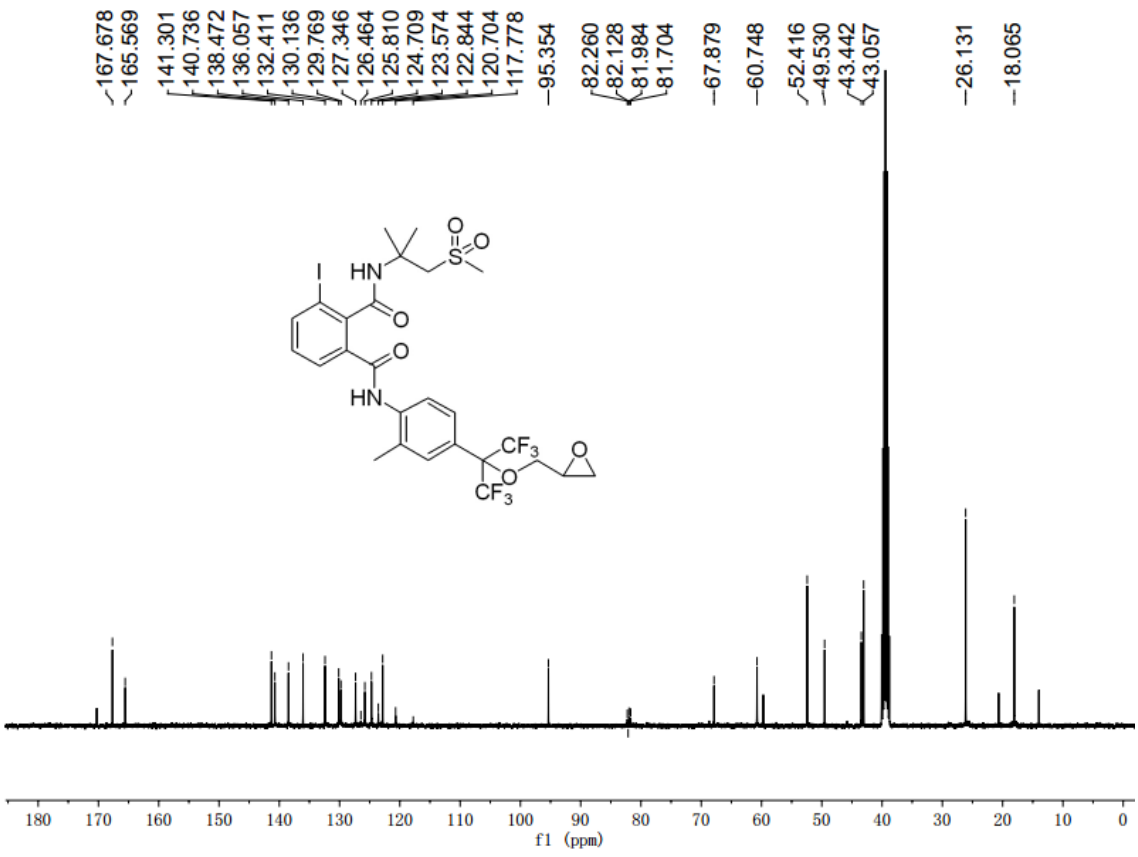

## HRMS (ESI) of 8d



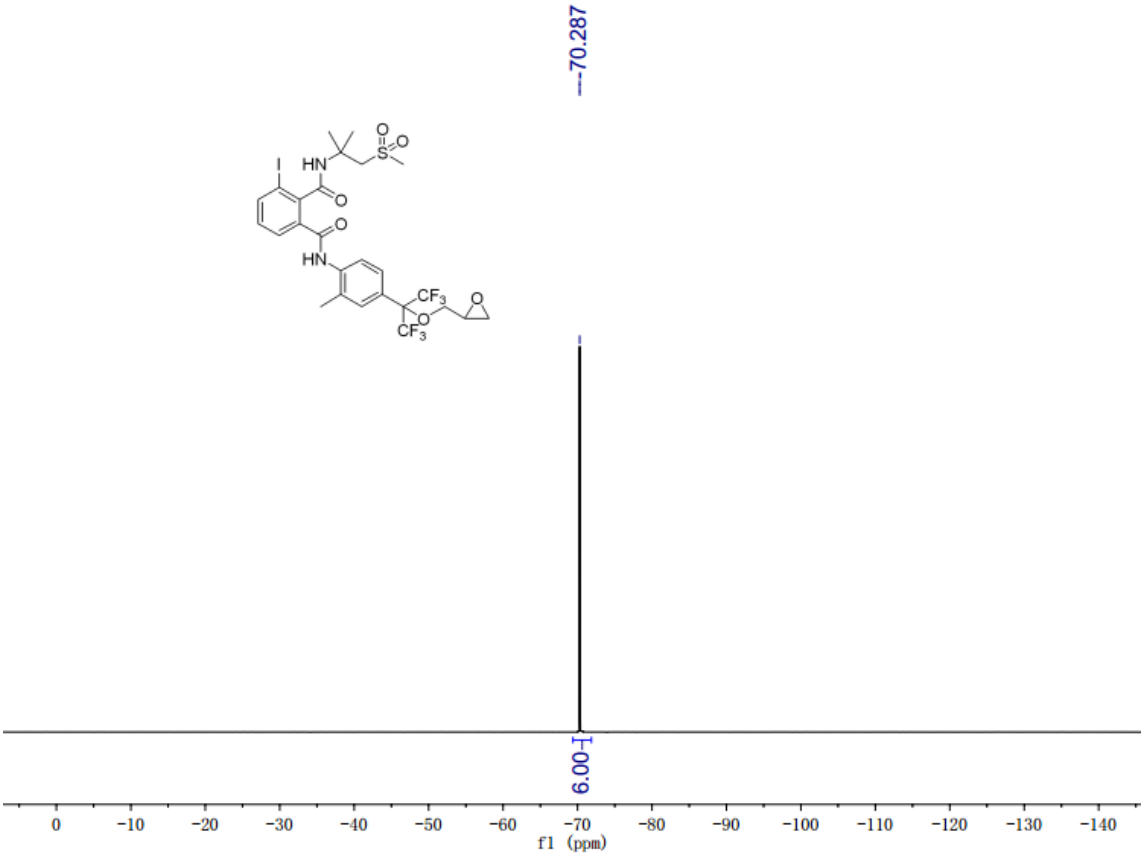
## $^{1}$H NMR spectrum of 8e



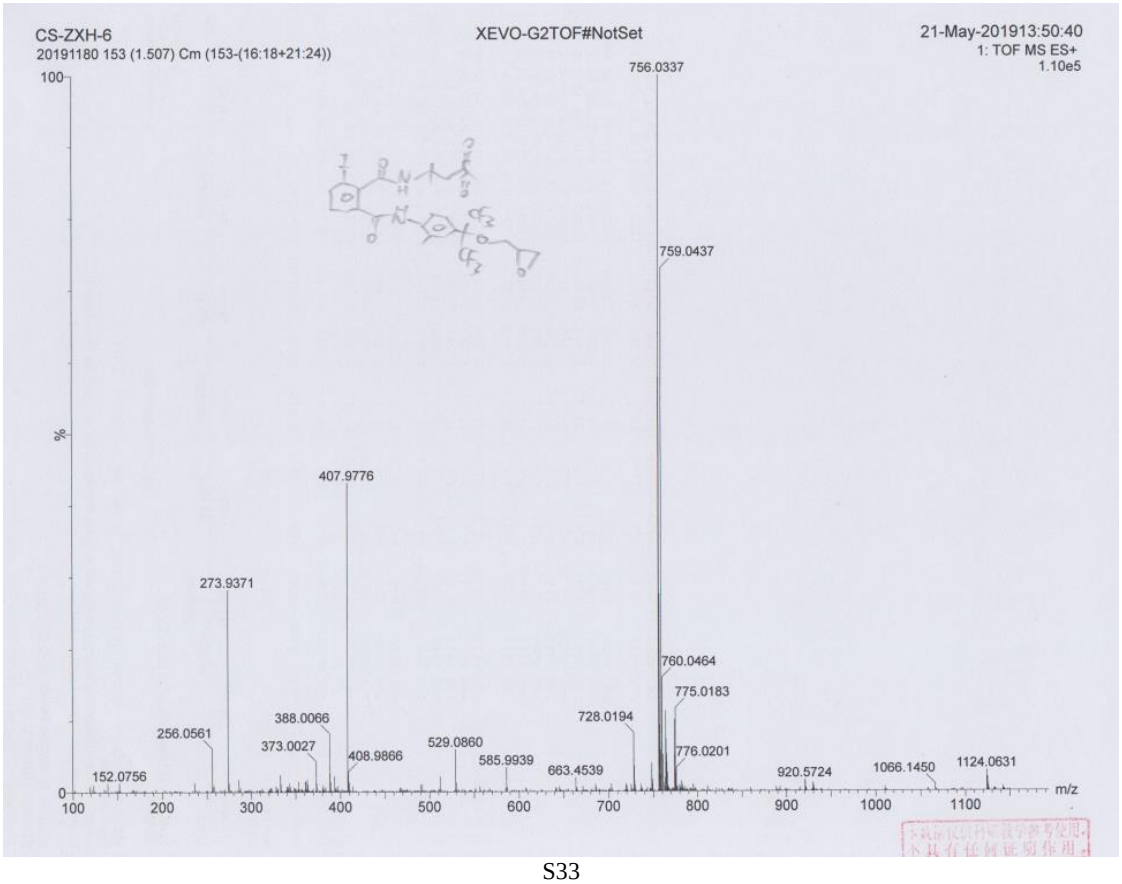
## $^{13}$C NMR spectrum of 8e



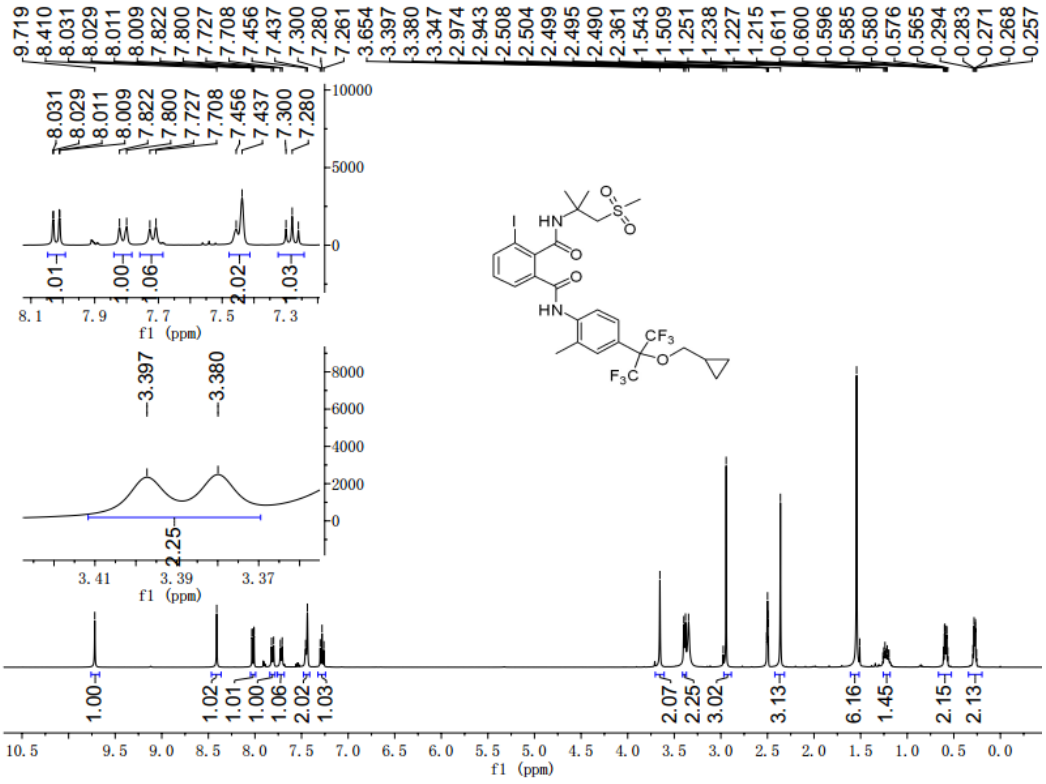
## $^{19}$F NMR spectrum of 8e



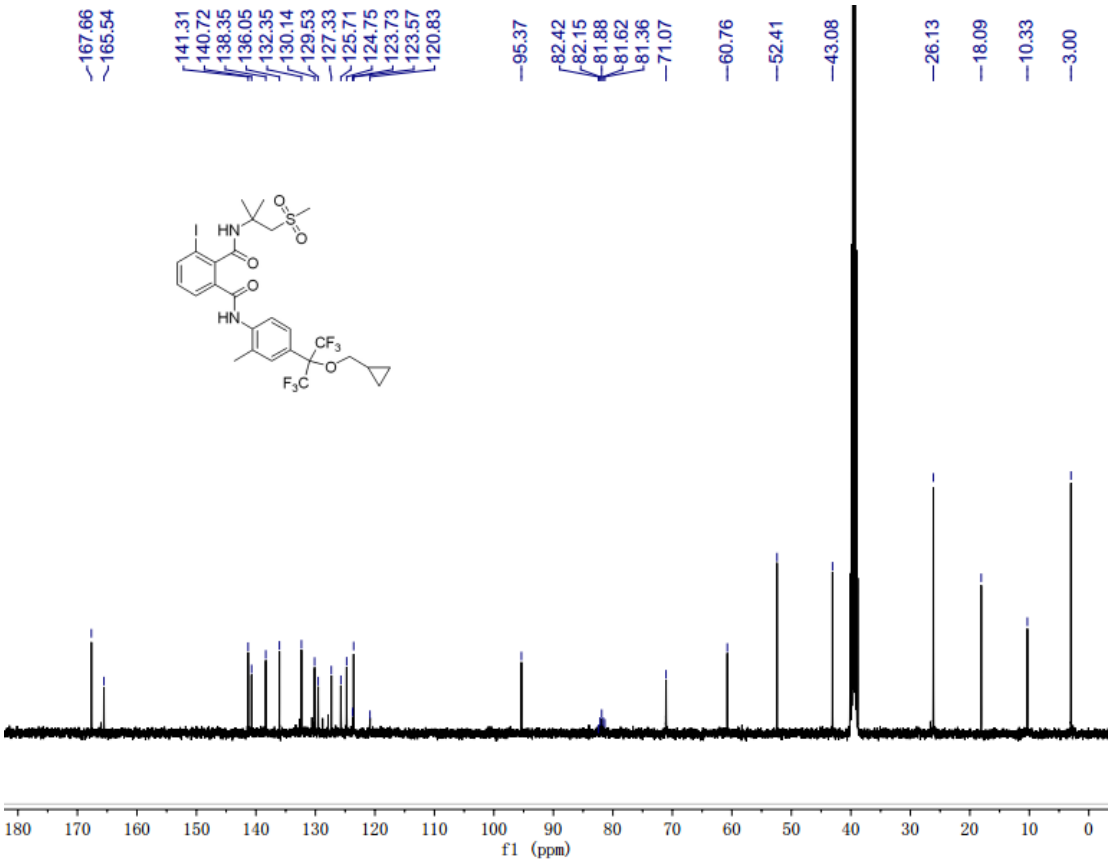

## HRMS (ESI) of 8e



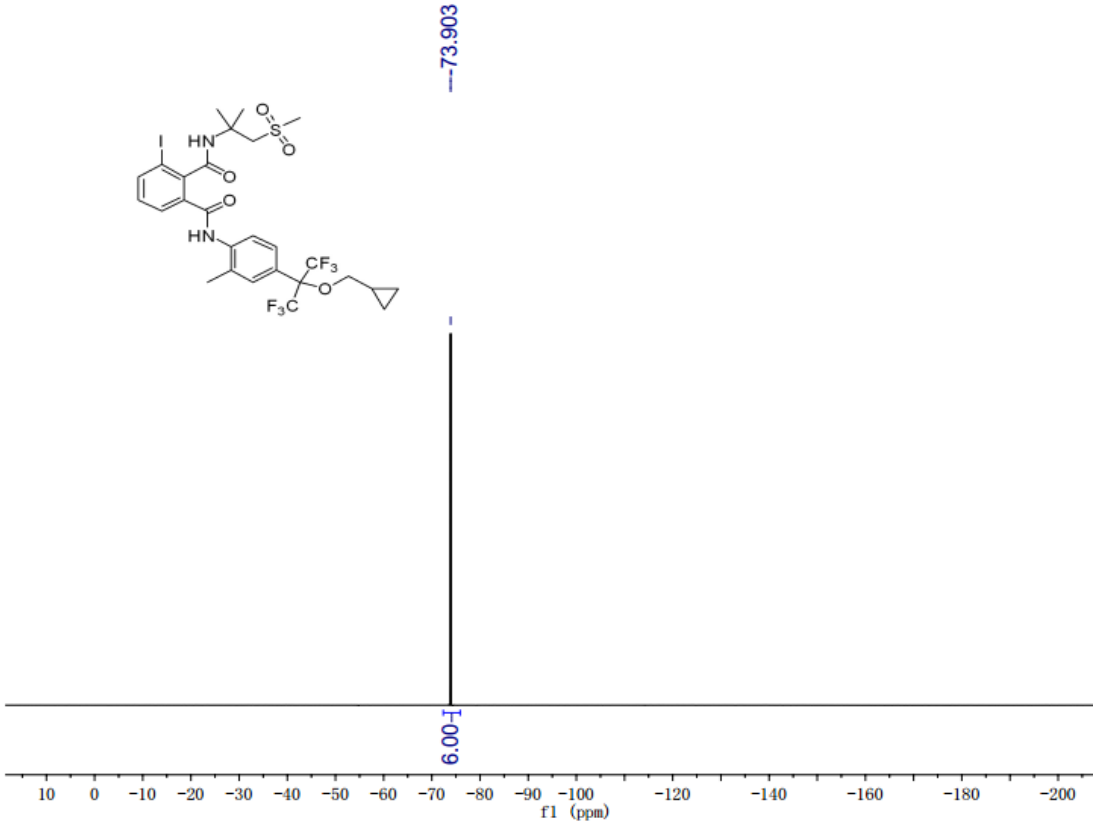
## $^{1}$H NMR spectrum of 8f



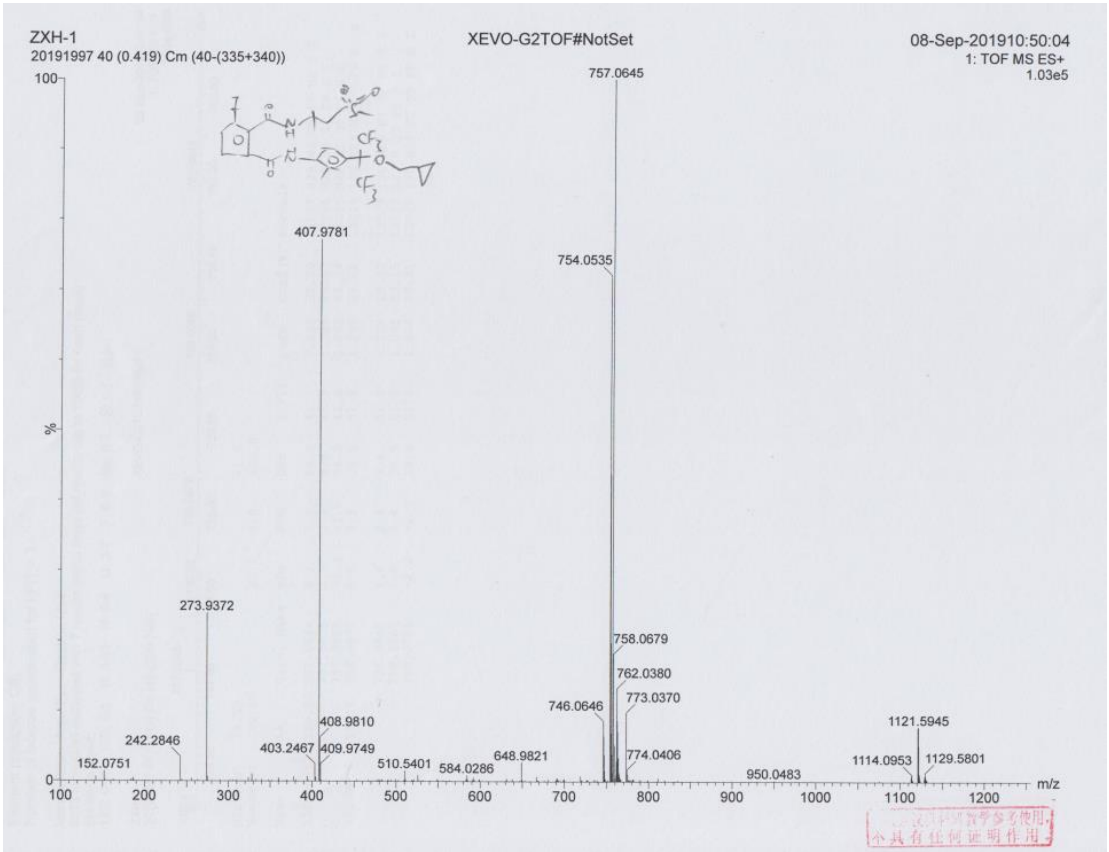
## $^{13}$C NMR spectrum of 8f



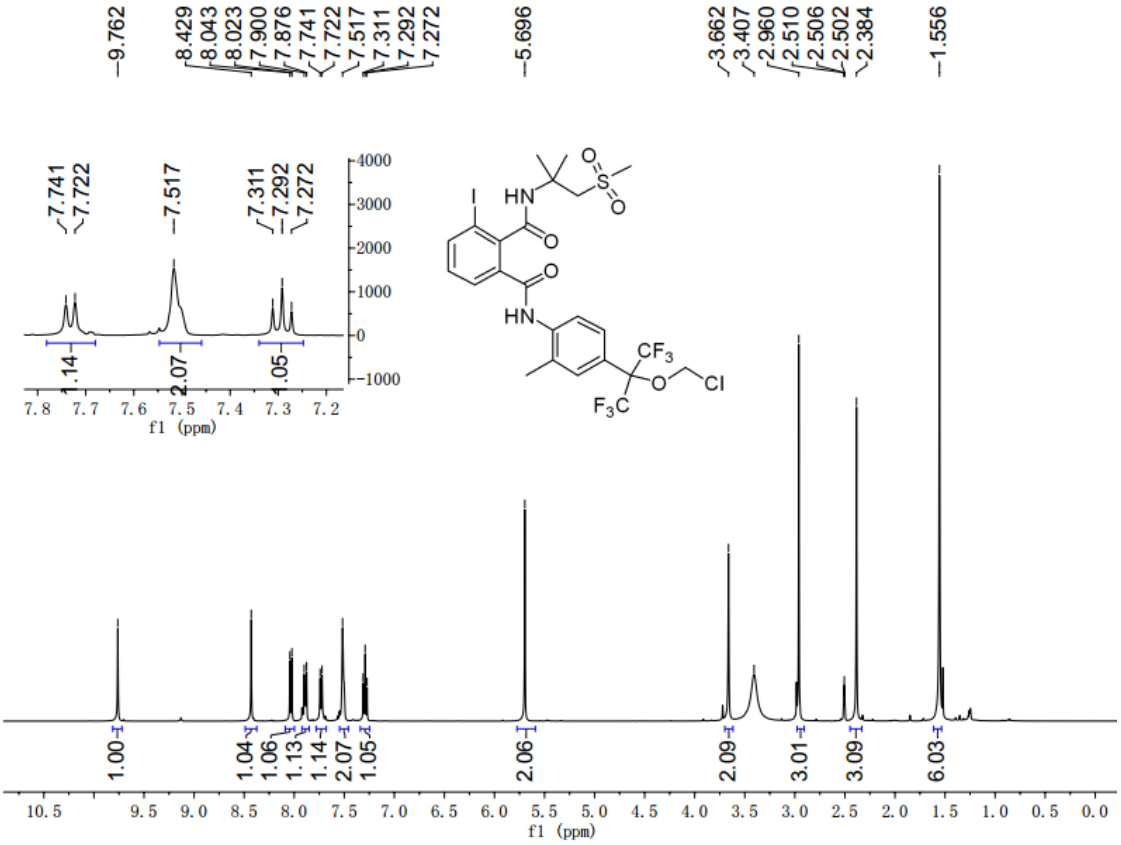
## $^{19}$F NMR spectrum of 8f



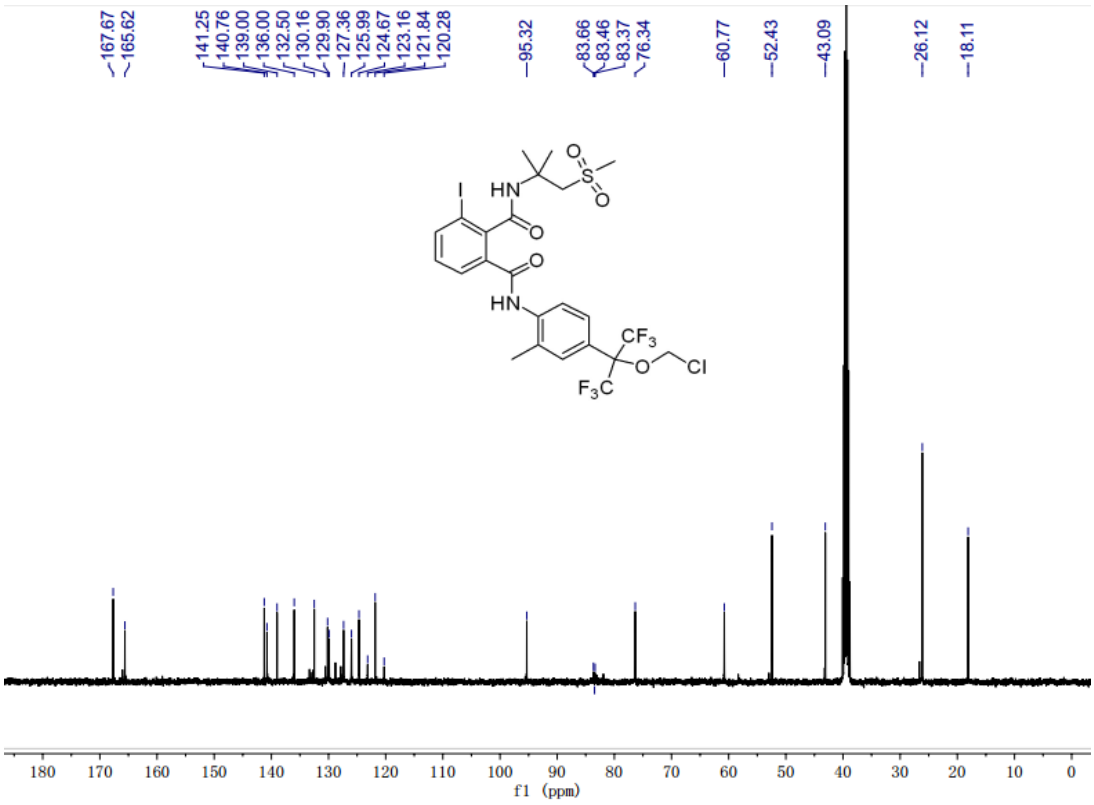

## HRMS (ESI) of 8f



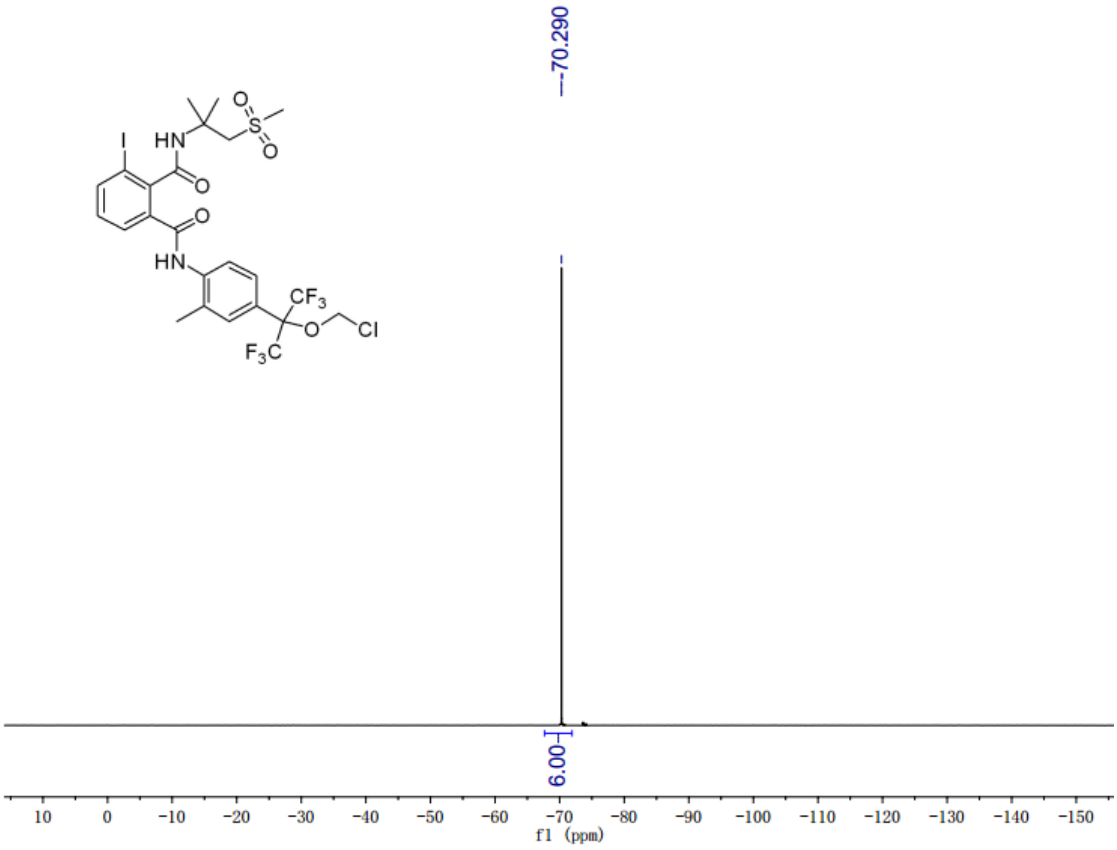
## $^{1}$H NMR spectrum of 8g



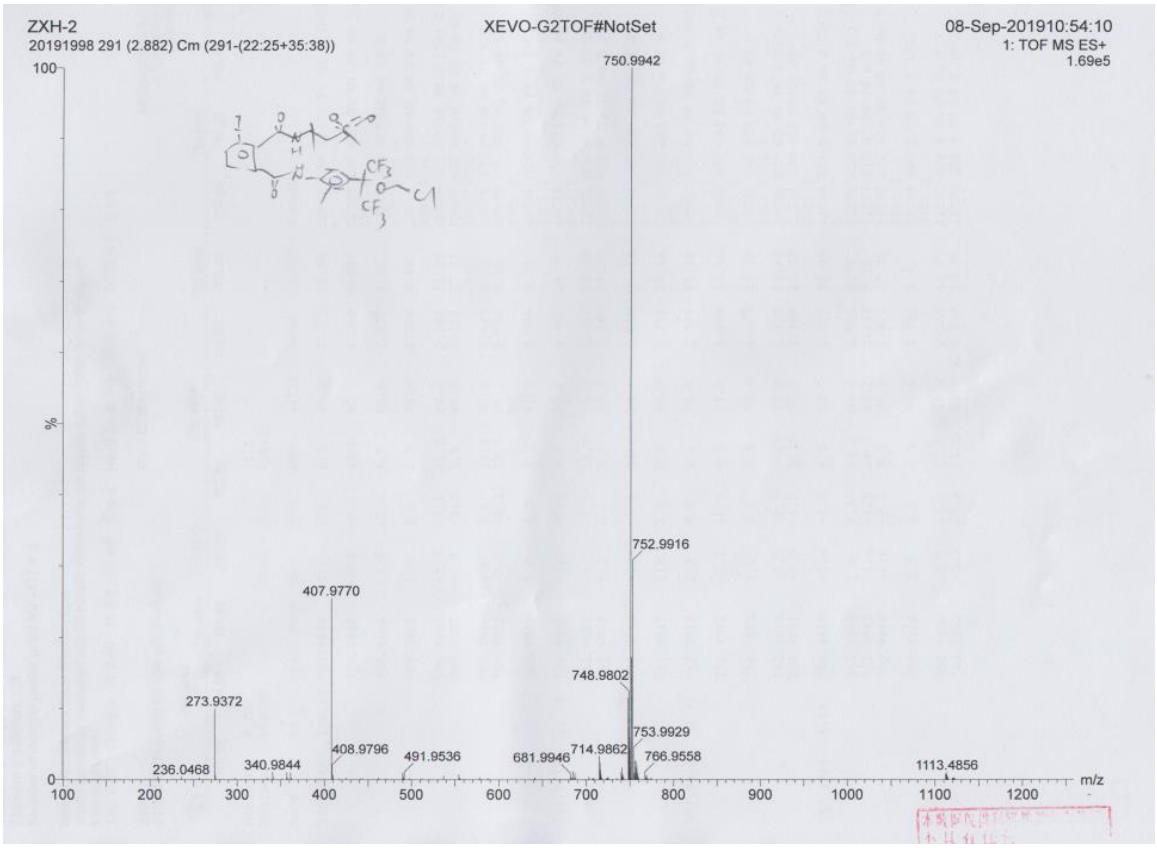

## $^{13}$C NMR spectrum of 8g



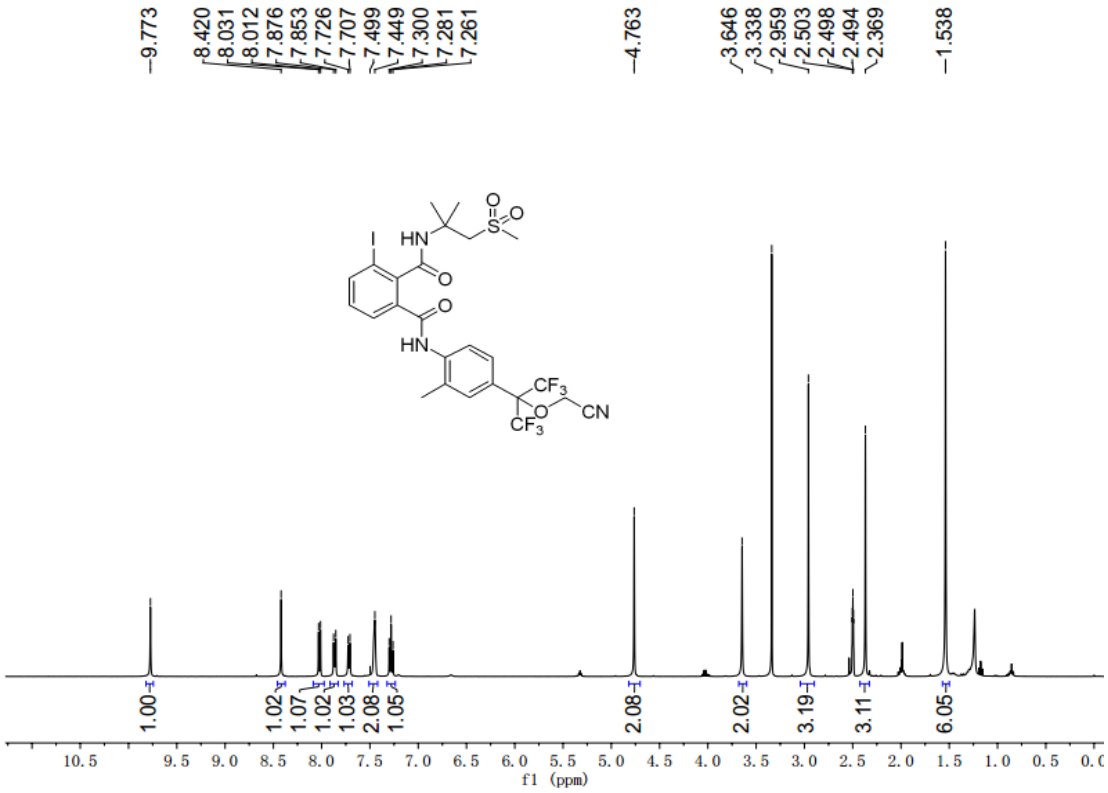
## $^{19}$F NMR spectrum of 8g



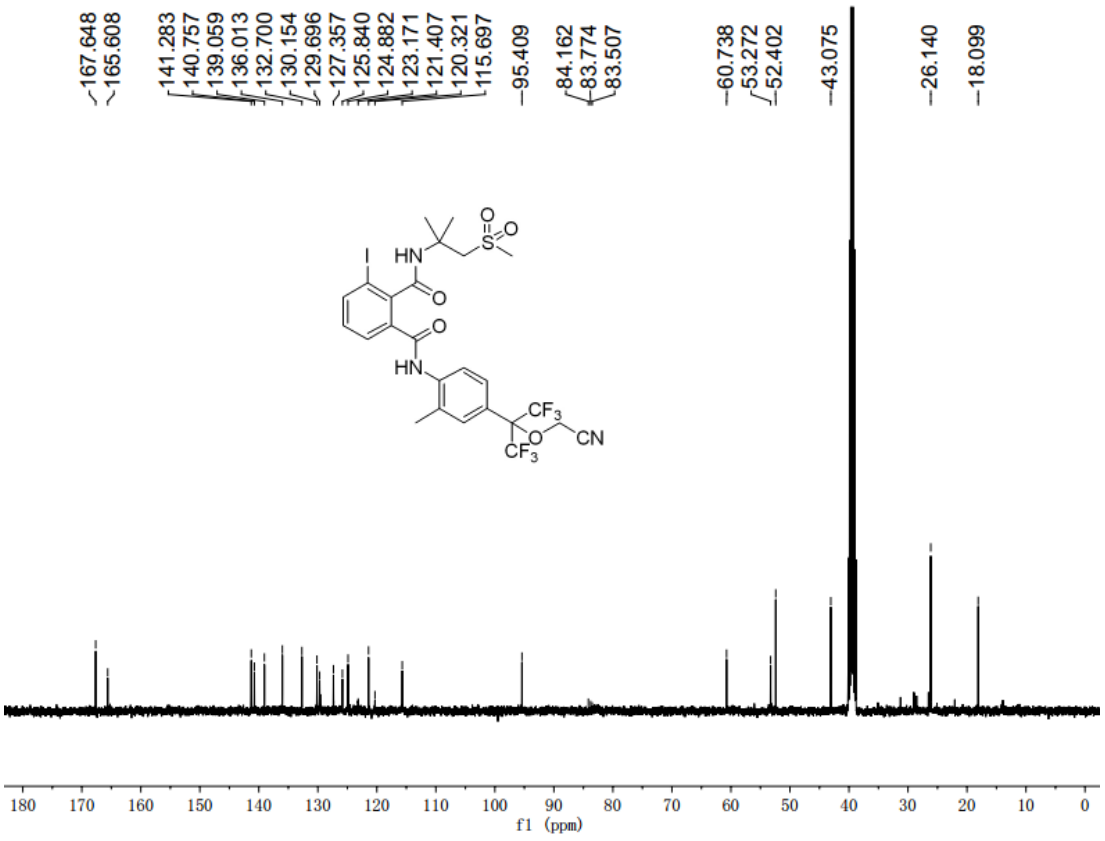

## HRMS (ESI) of 8g



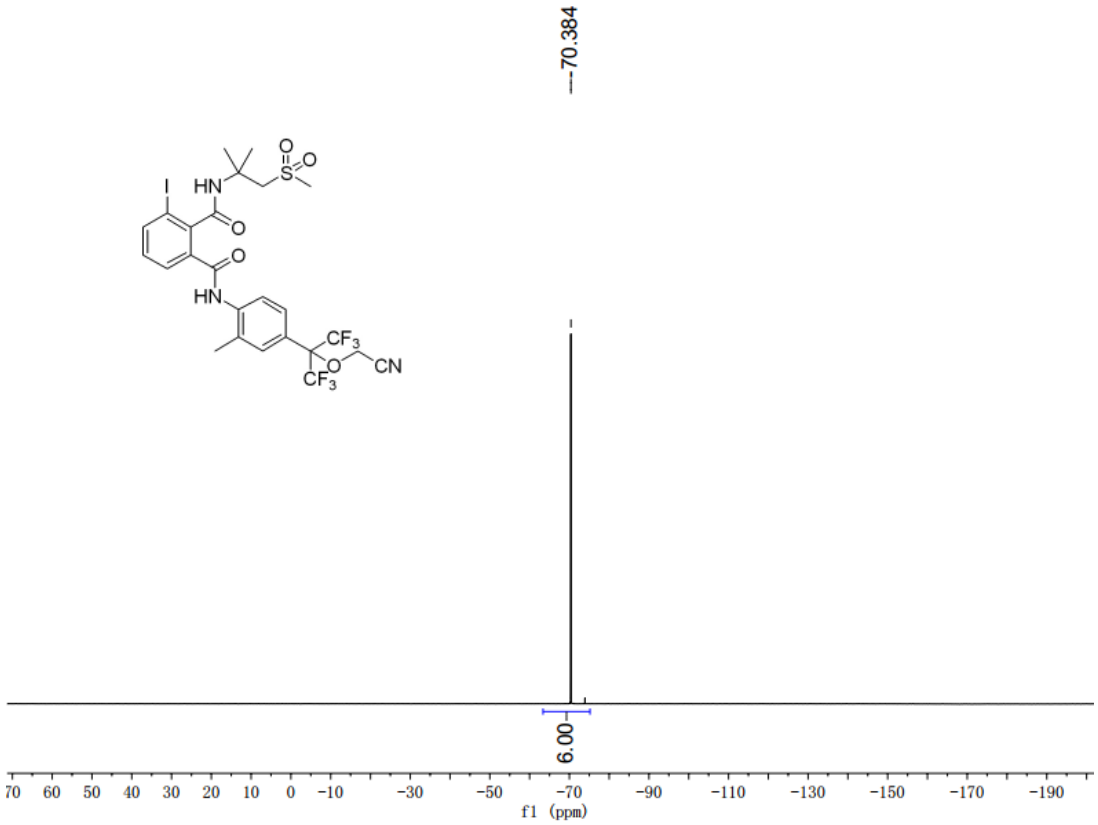
## $^{1}$H NMR spectrum of 8h



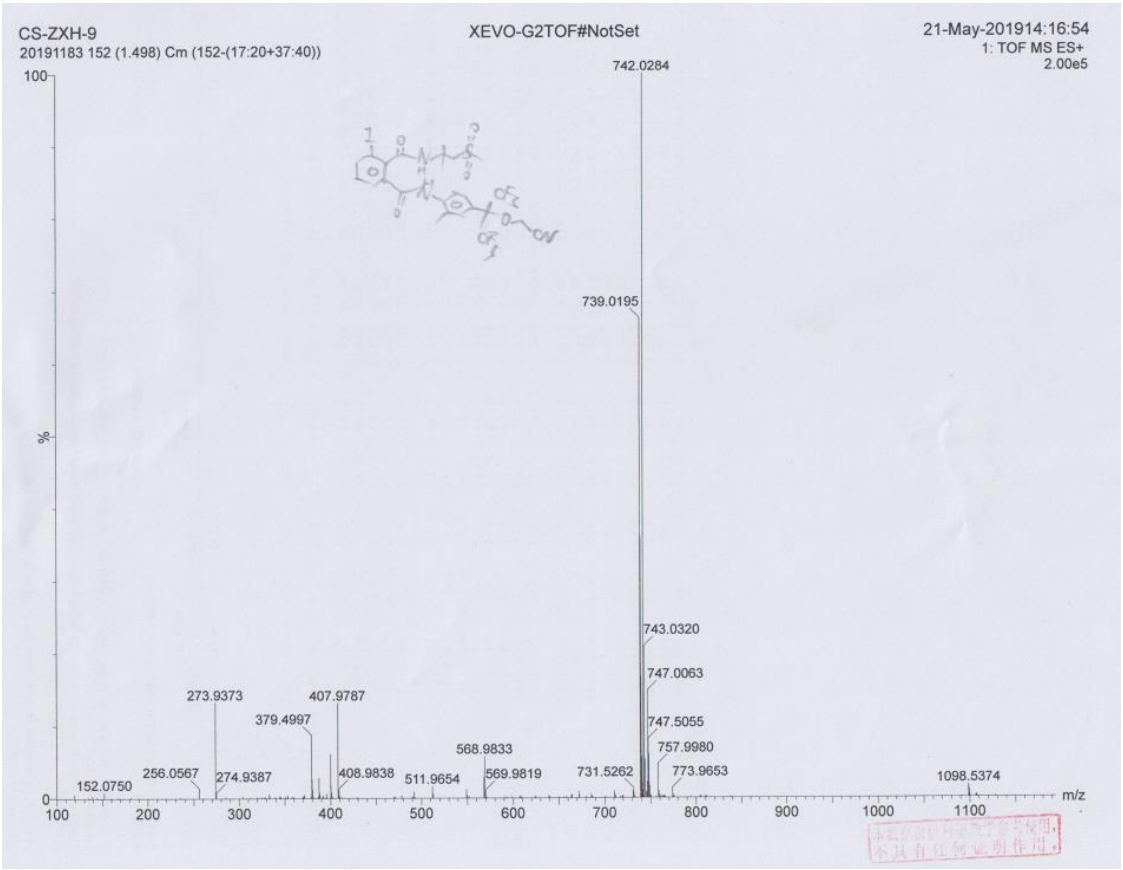

## $^{13}$C NMR spectrum of 8h



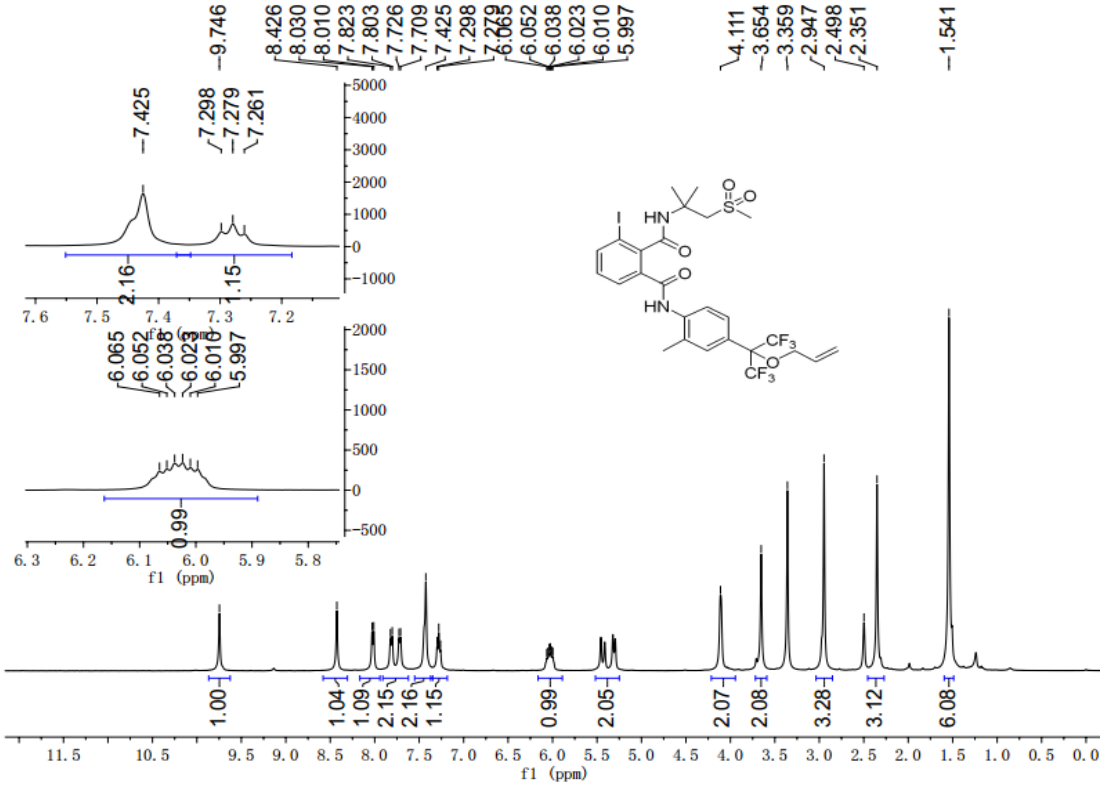
## $^{19}$F NMR spectrum of 8h



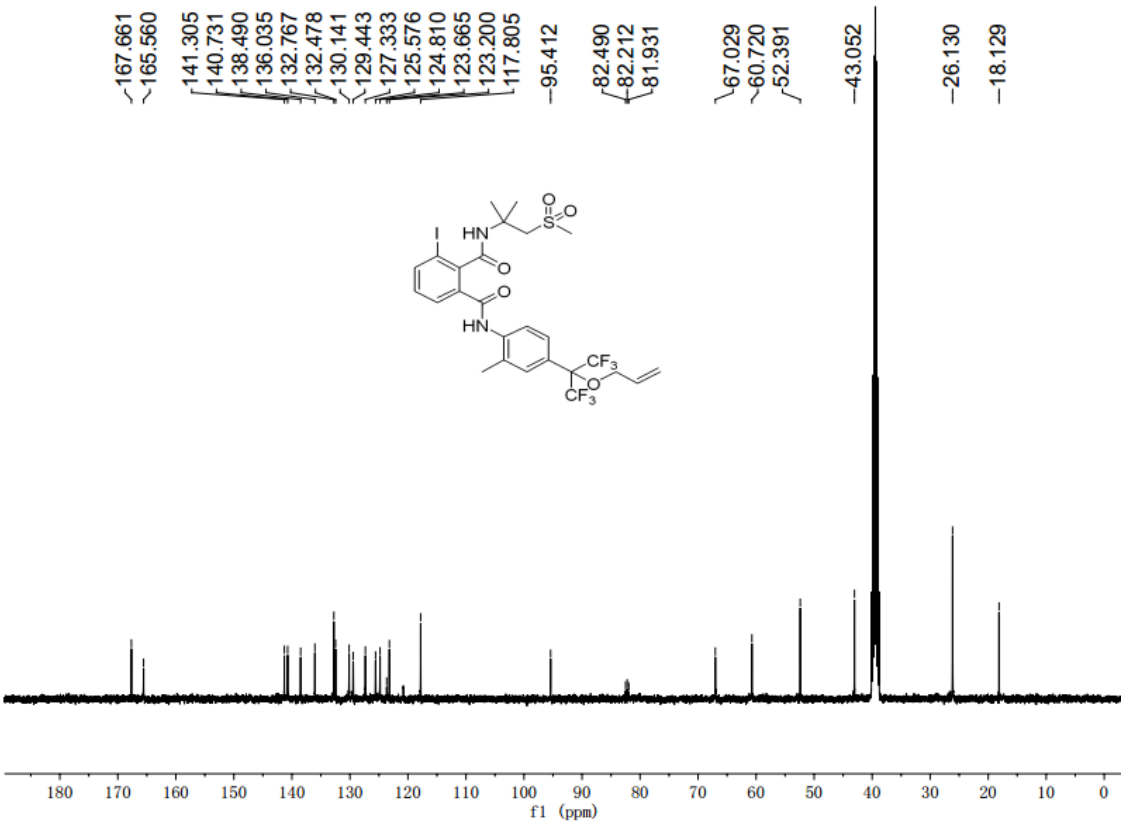

## HRMS (ESI) of 8h



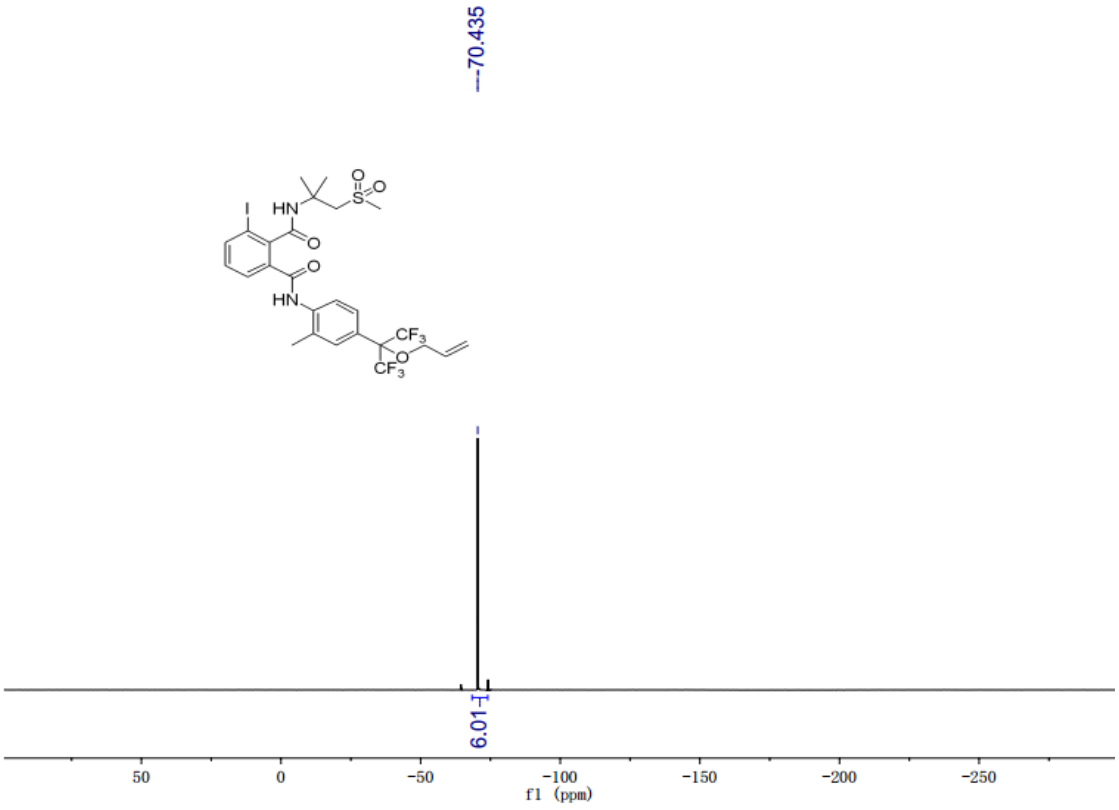
## $^{1}$H NMR spectrum of 8i



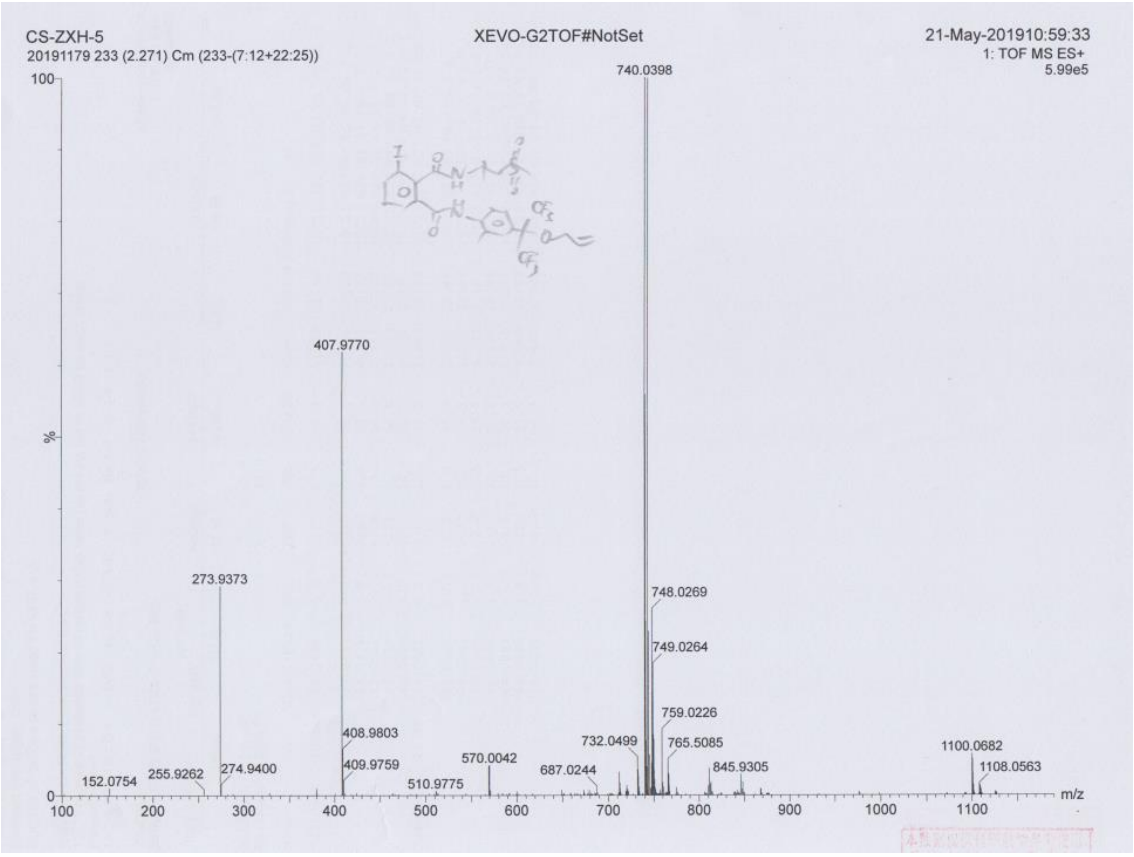

## $^{13}$C NMR spectrum of 8i



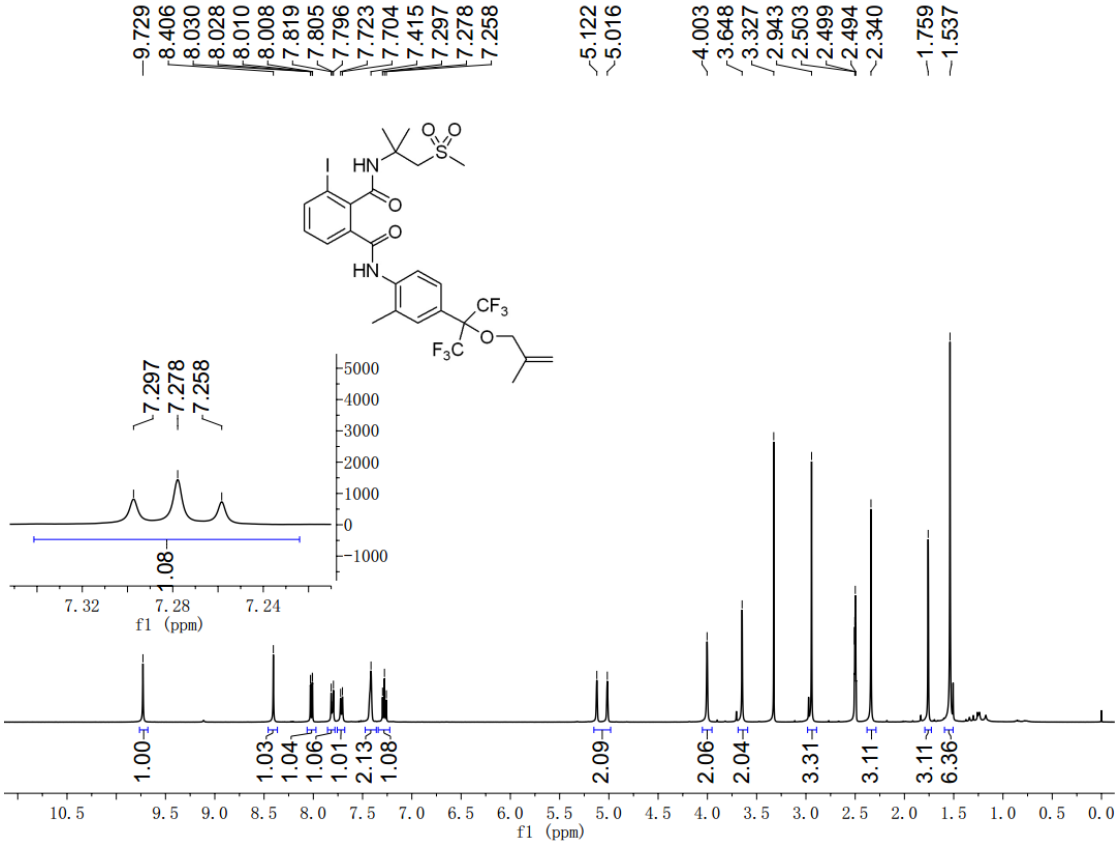
## $^{19}$F NMR spectrum of 8i



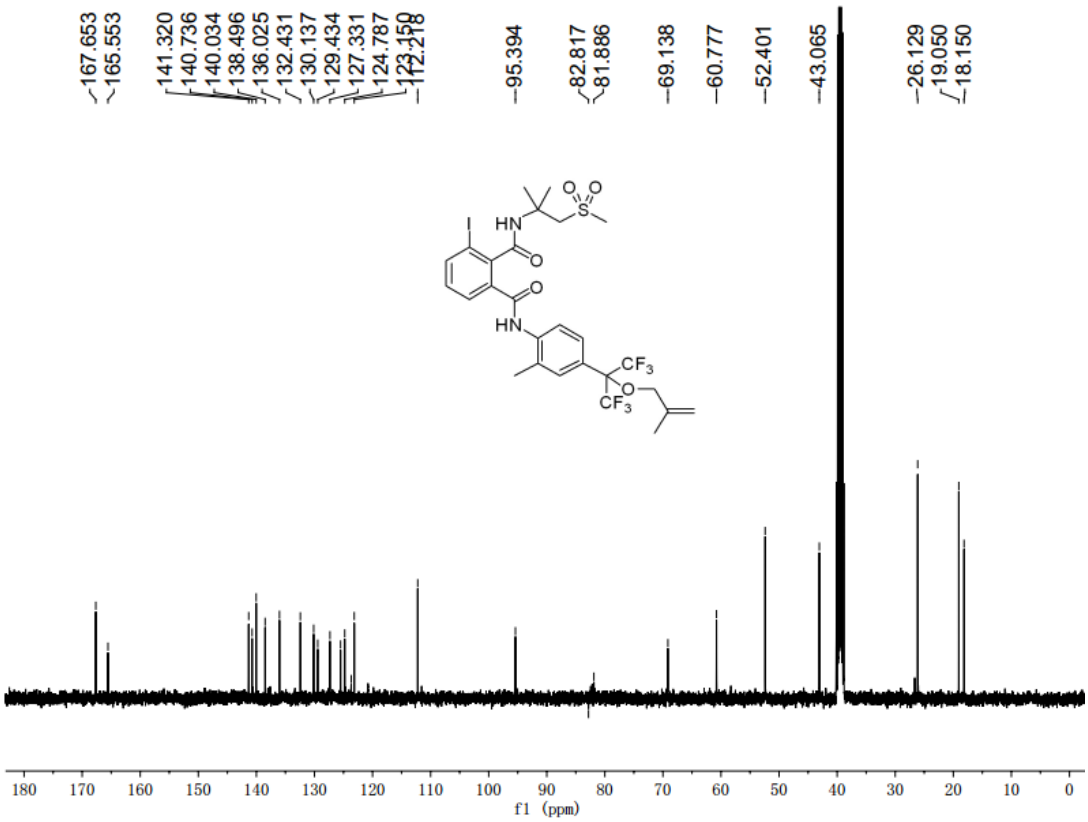

## HRMS (ESI) of 8i



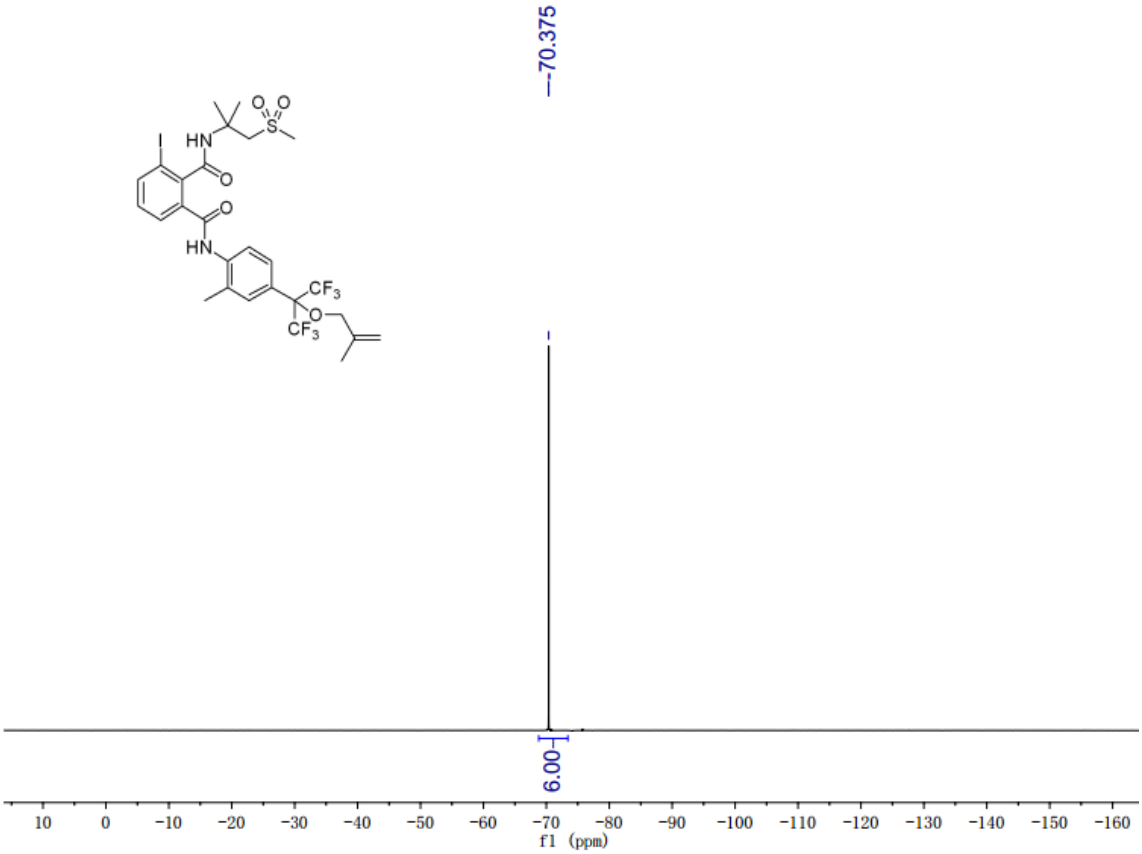
## $^{1}$H NMR spectrum of 8j



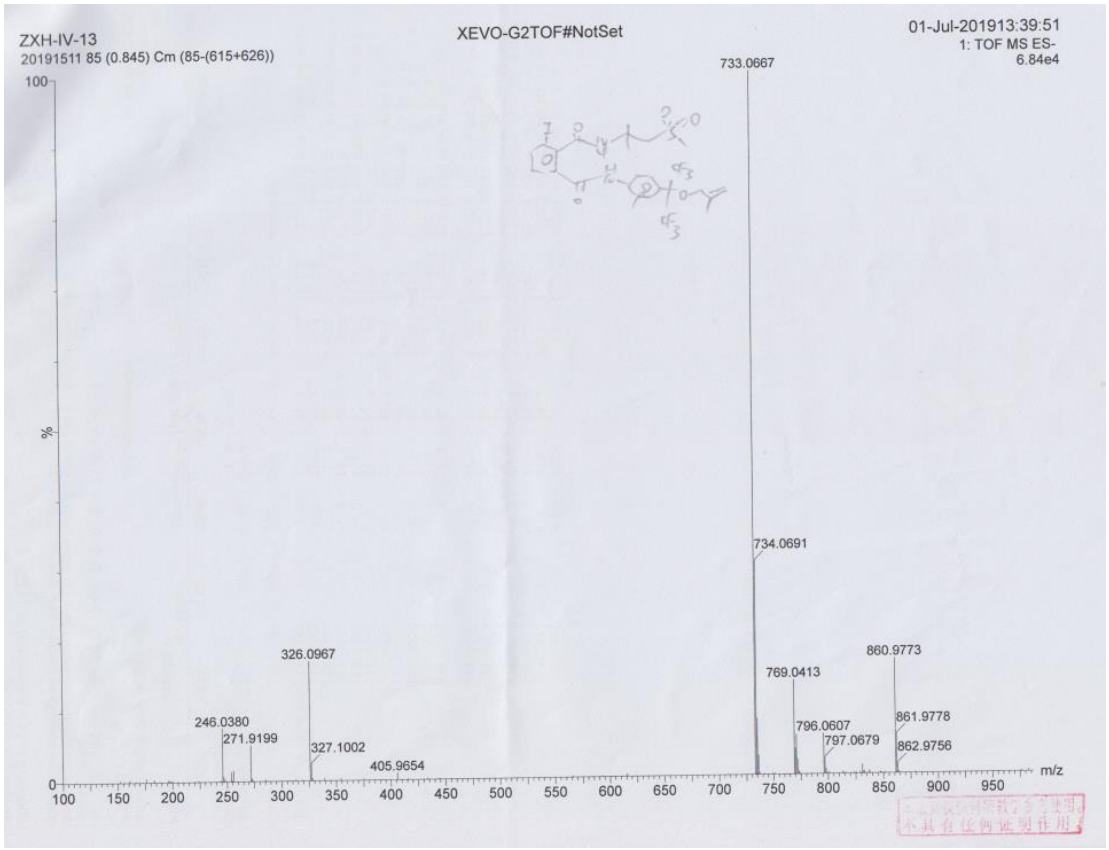

## $^{13}$C NMR spectrum of 8j



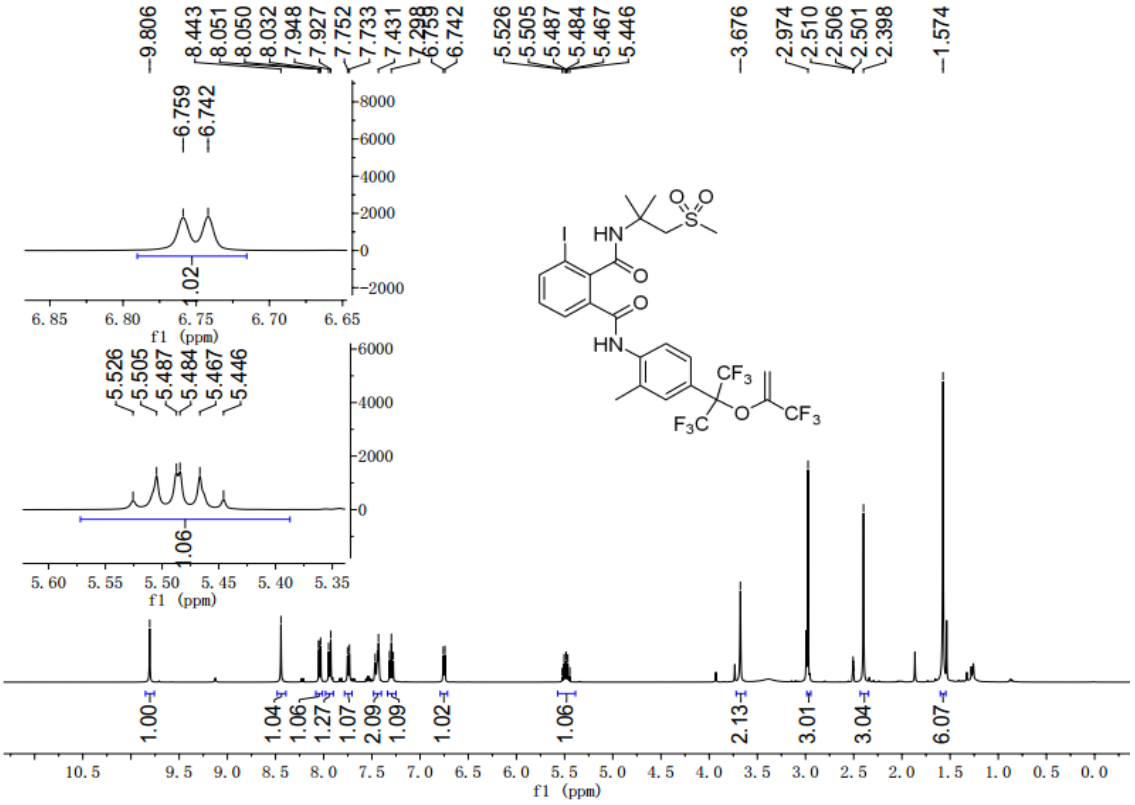
## $^{19}$F NMR spectrum of 8j



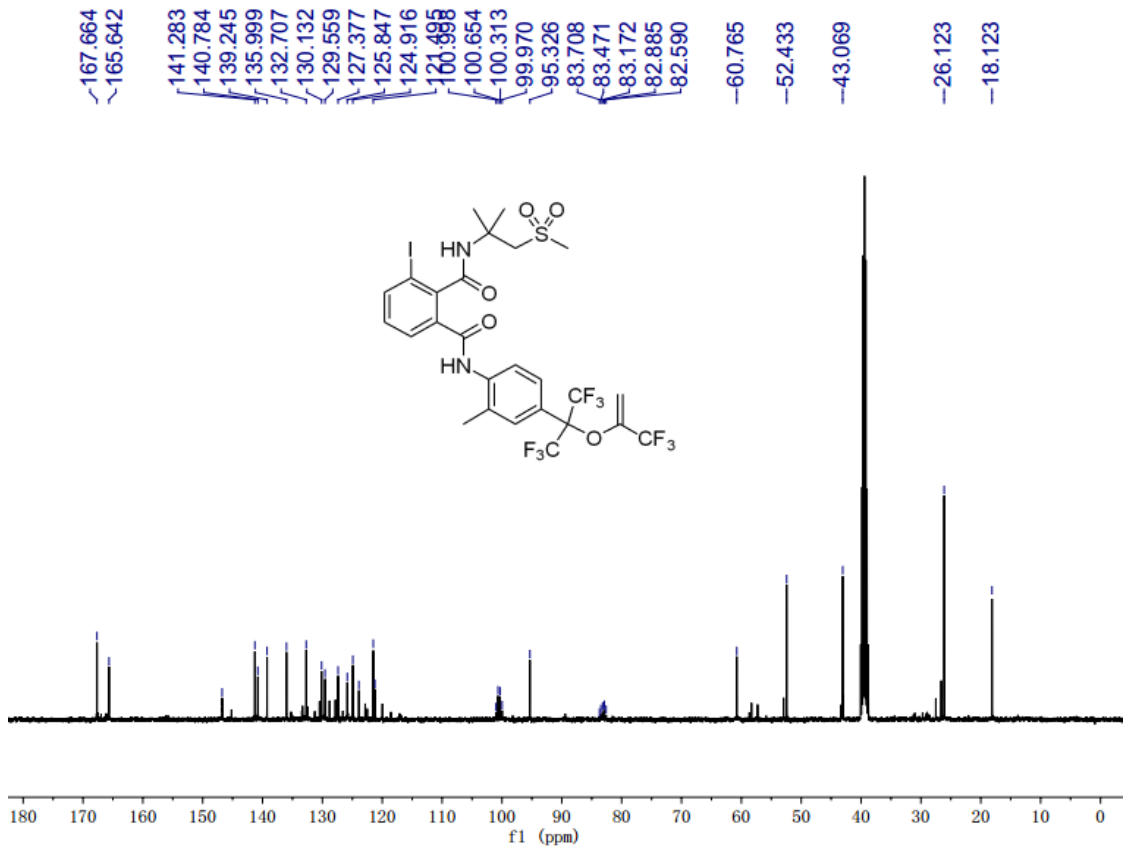

## HRMS (ESI) of 8j



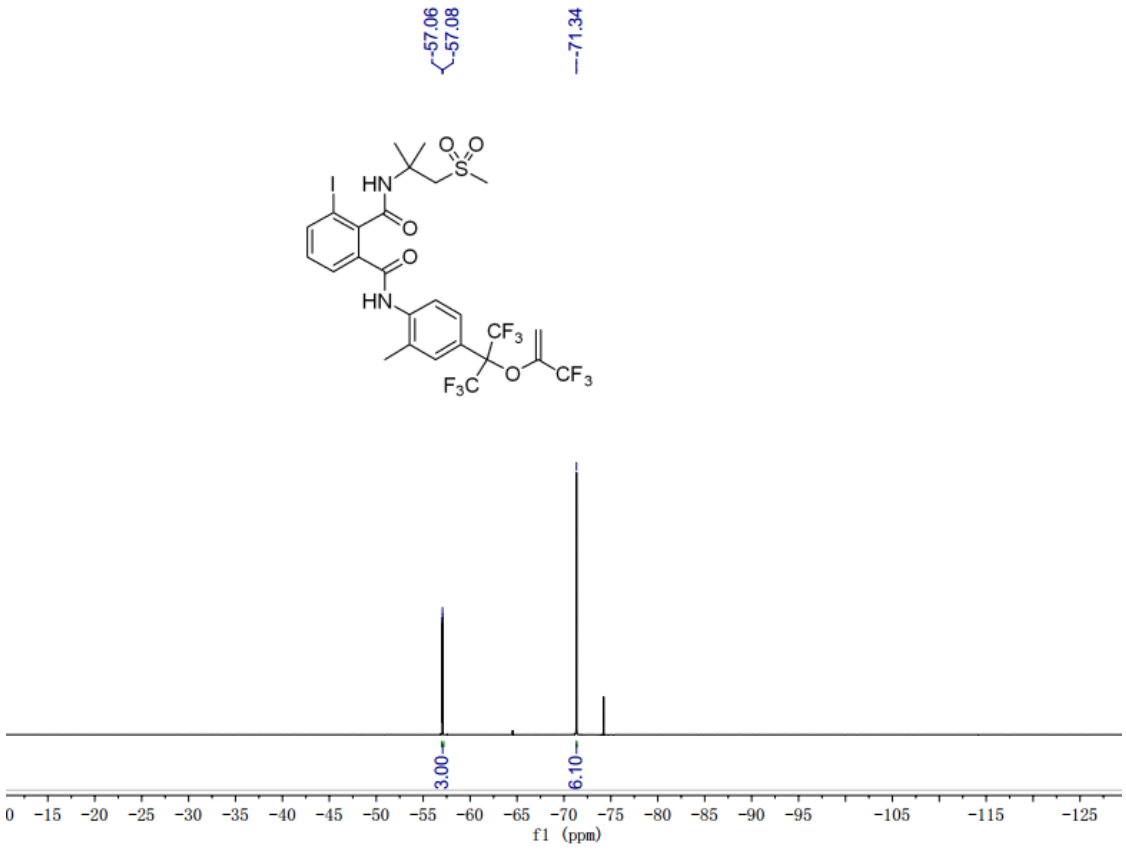
## $^{1}$H NMR spectrum of 8k



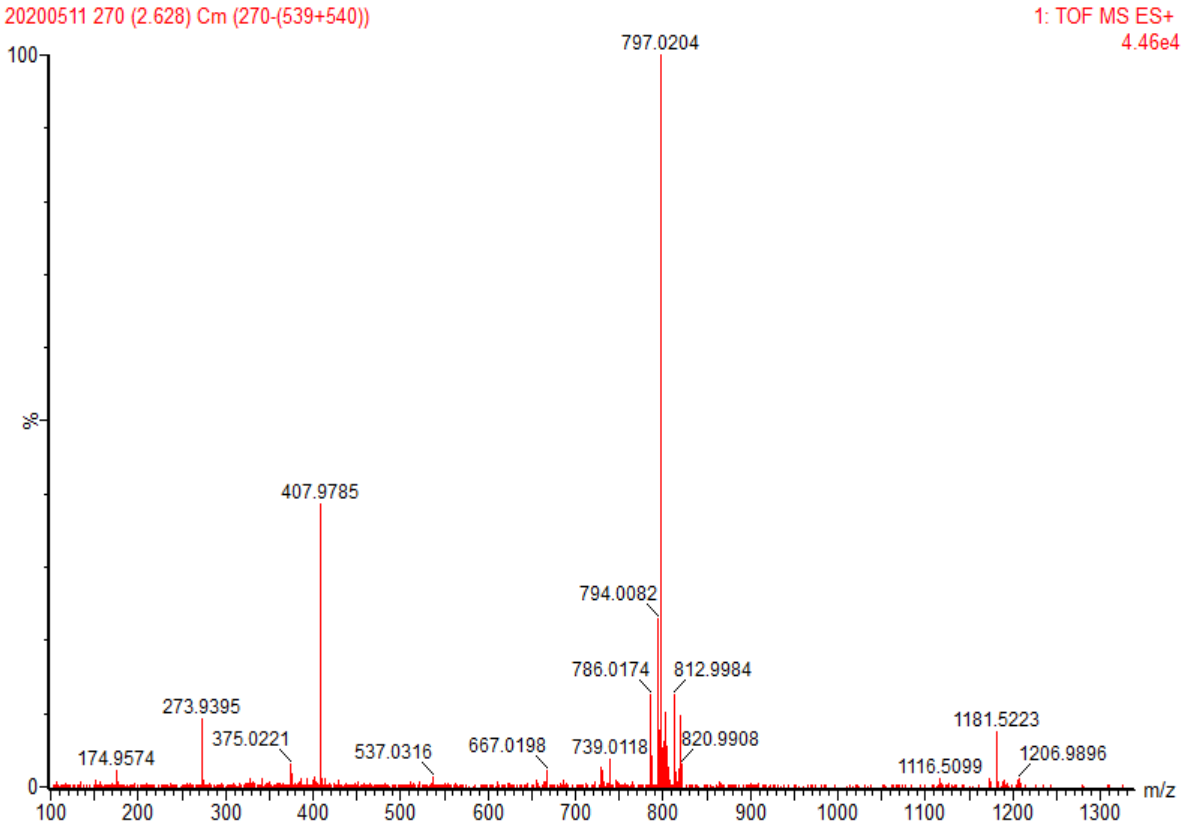

## $^{13}$C NMR spectrum of 8k



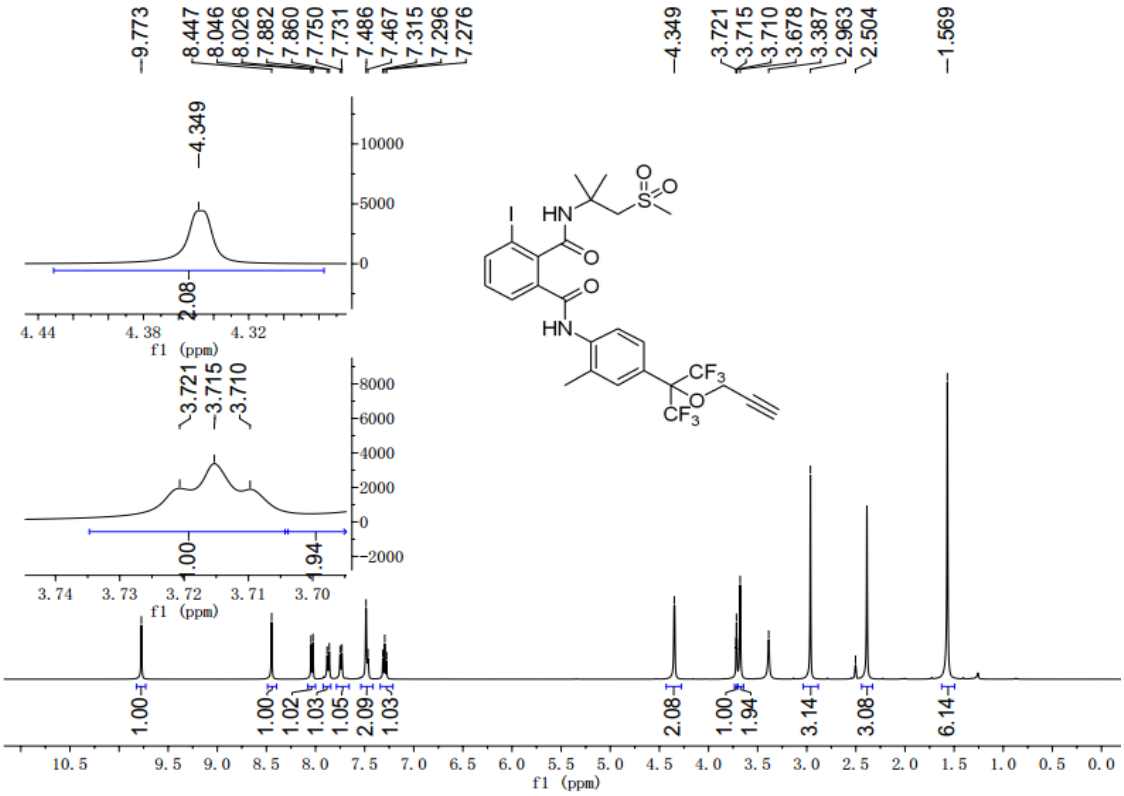
## $^{19}$F NMR spectrum of 8k



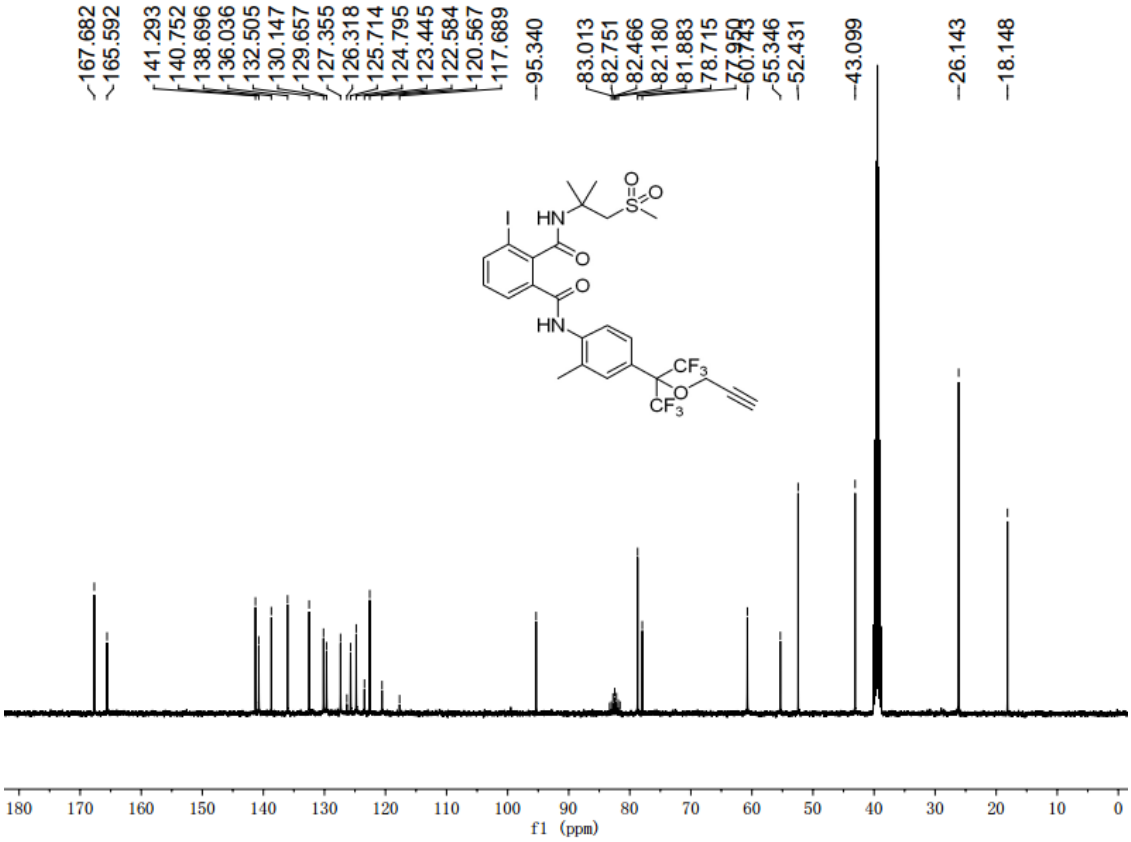

## HRMS (ESI) of 8k



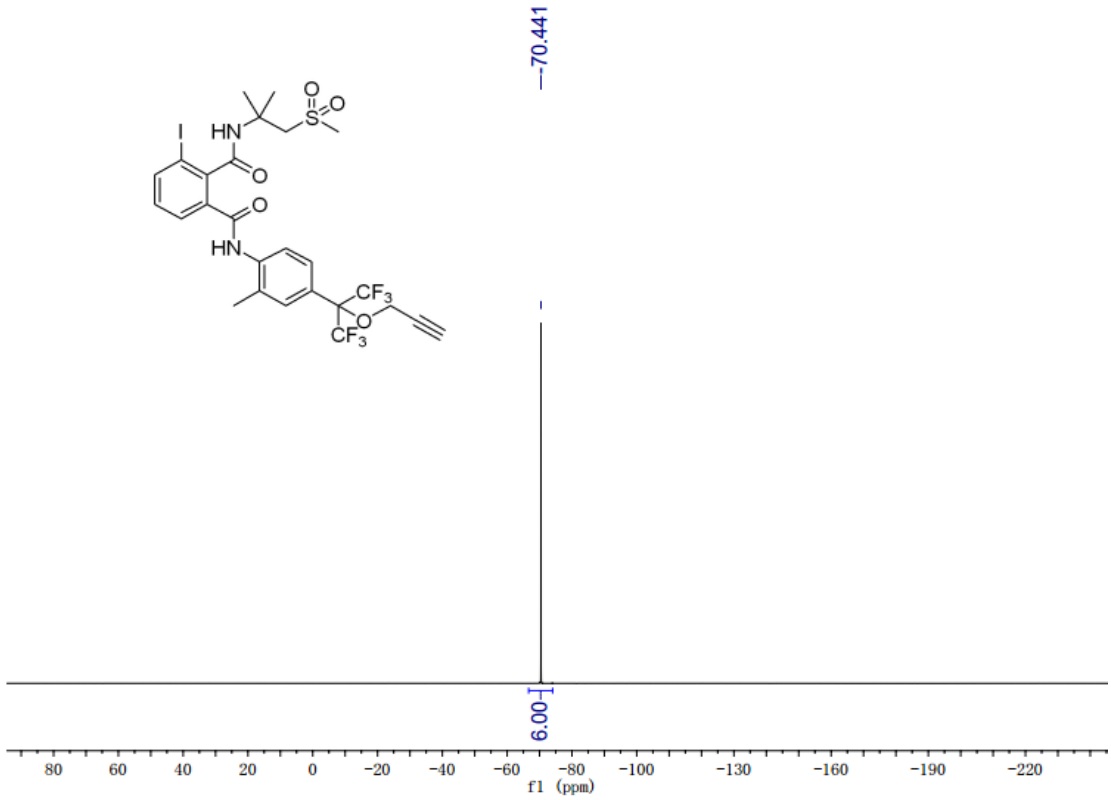
## $^{1}$H NMR spectrum of 8l



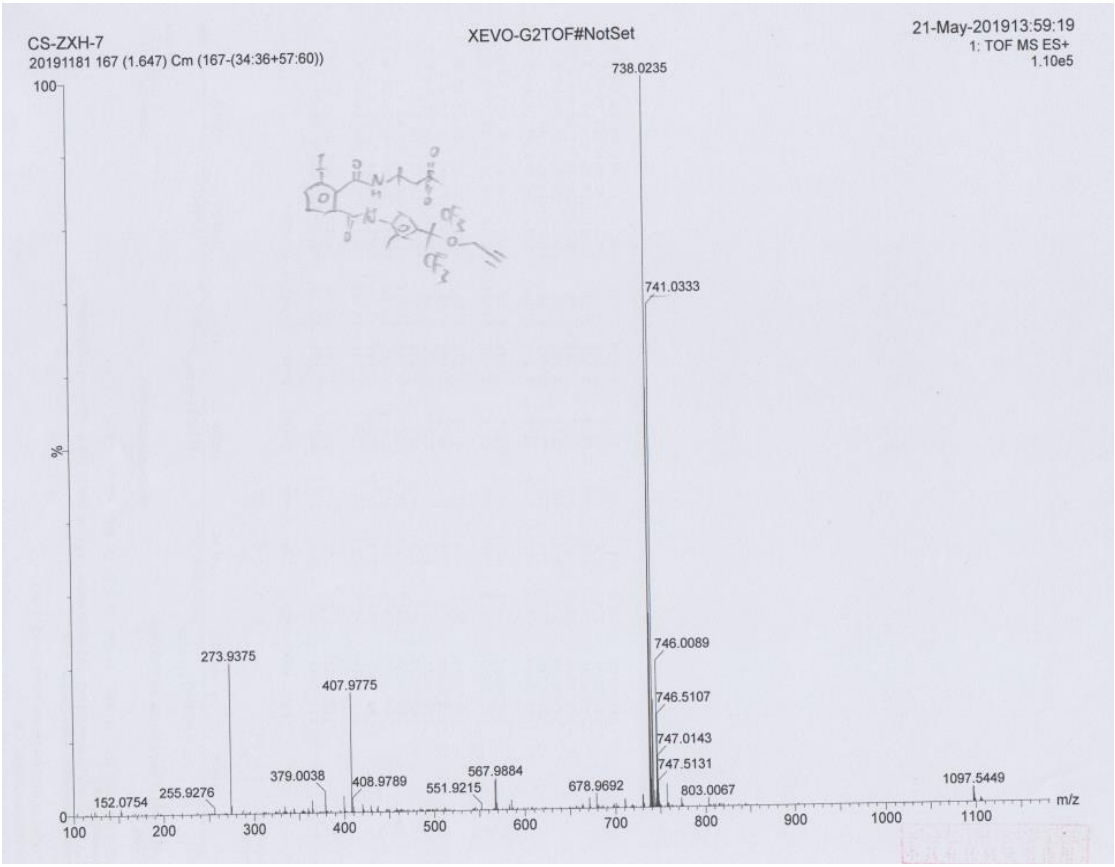

## $^{13}$C NMR spectrum of 8l



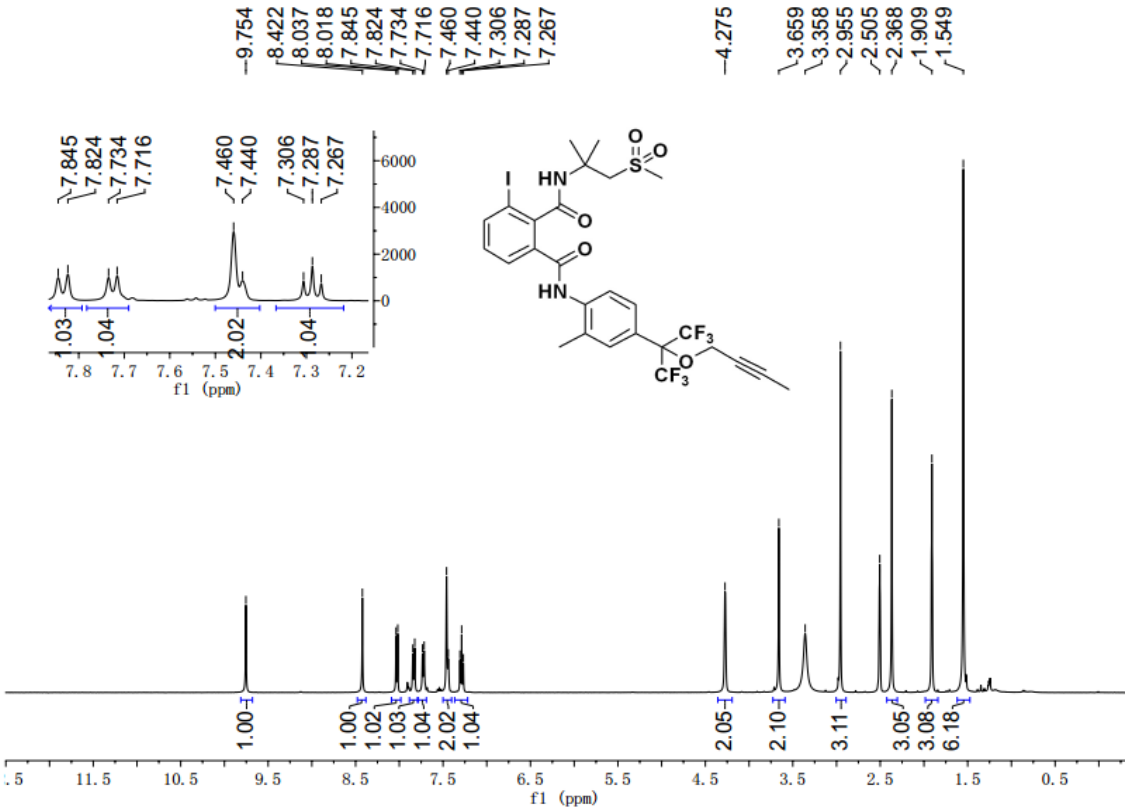
## $^{19}$F NMR spectrum of 8l



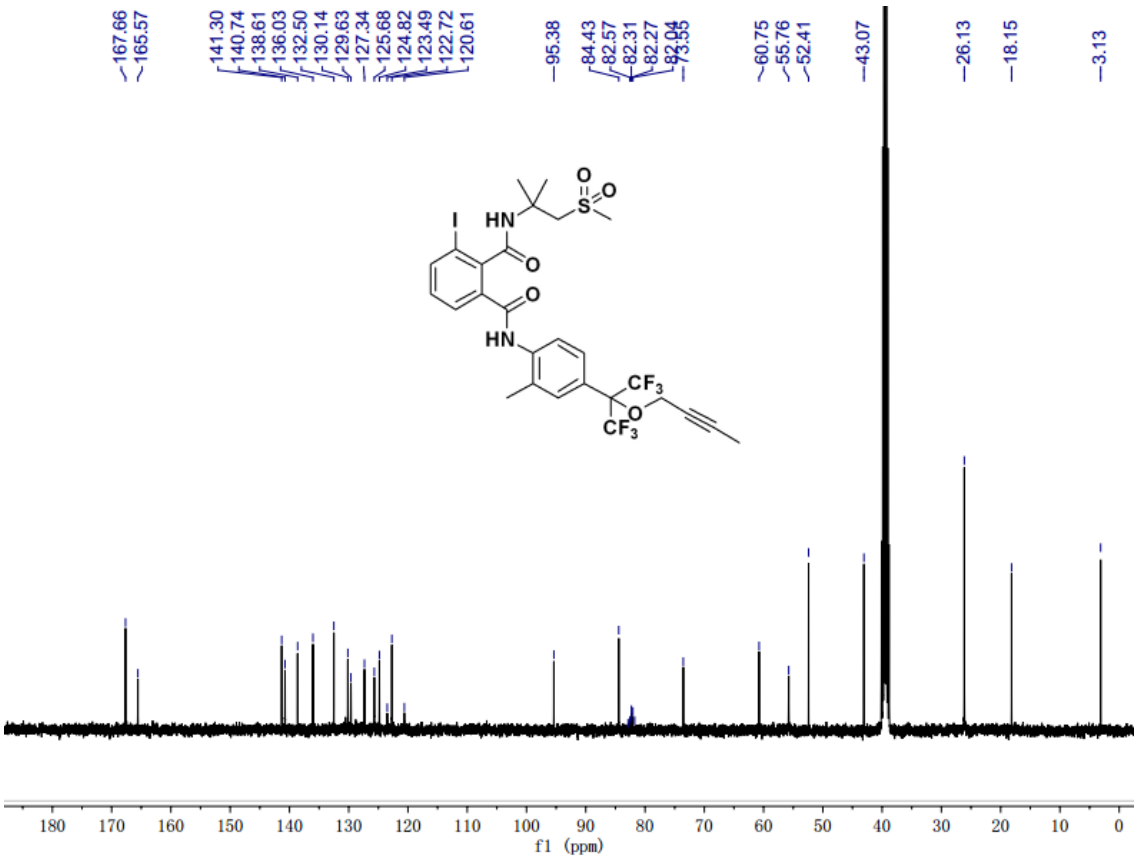

## HRMS (ESI) of 8l



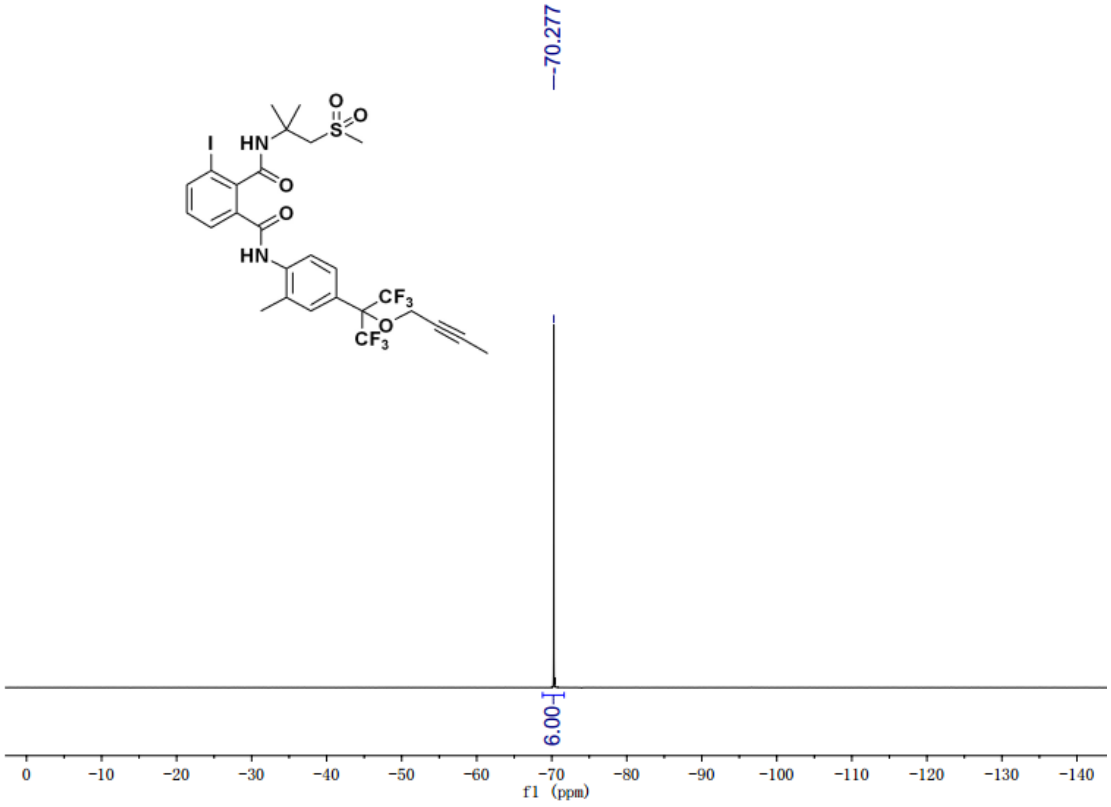
## $^{1}$H NMR spectrum of 8m



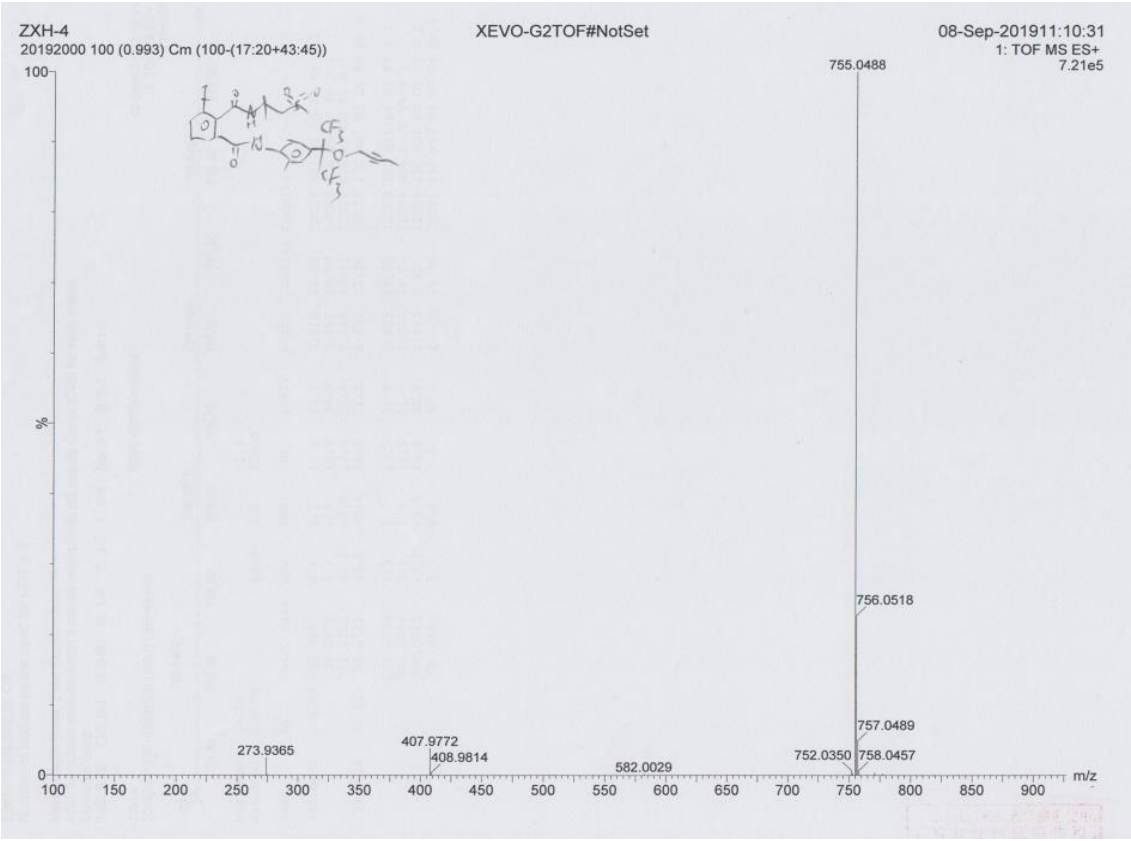

## $^{13}$C NMR spectrum of 8m



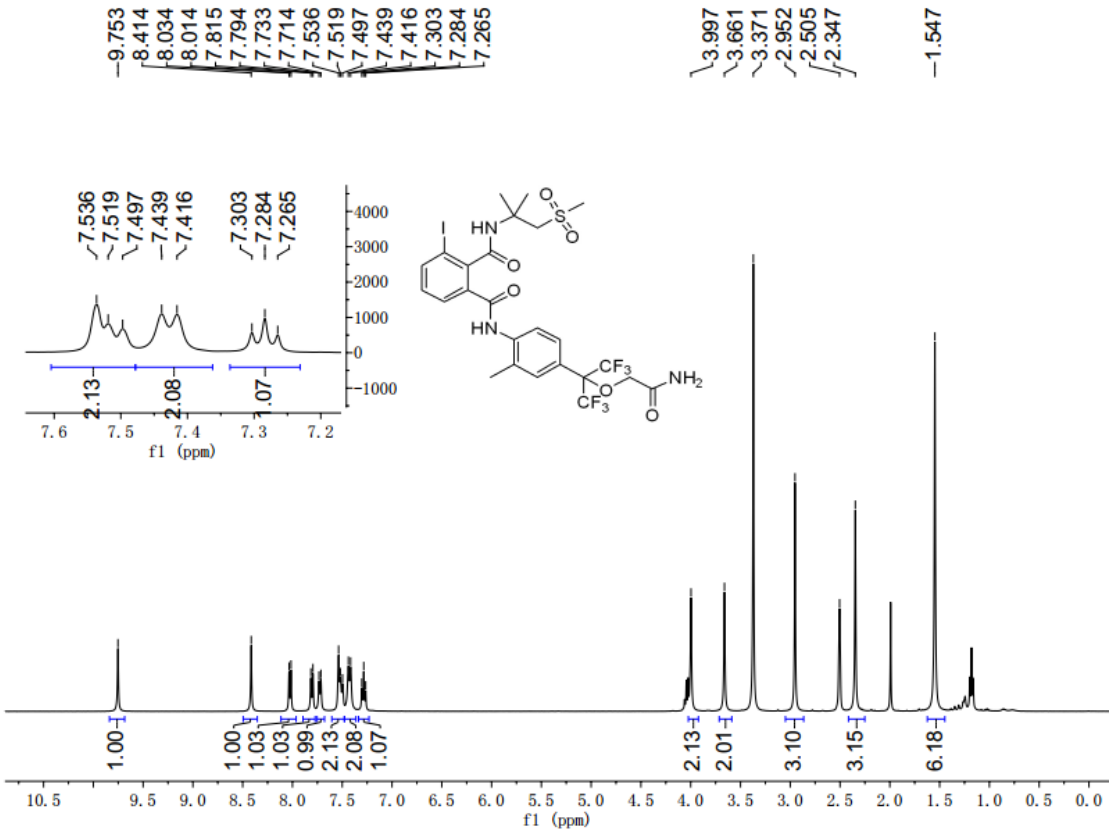
## $^{19}$F NMR spectrum of 8m



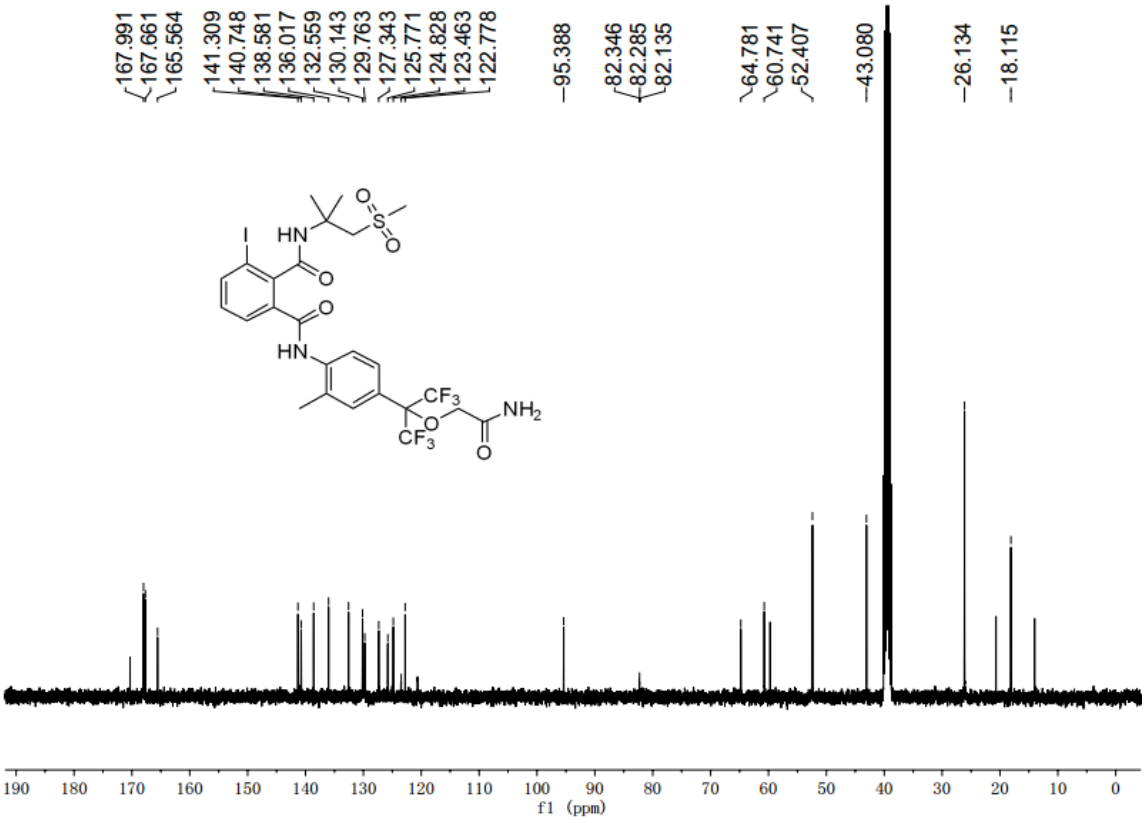

## HRMS (ESI) of 8m



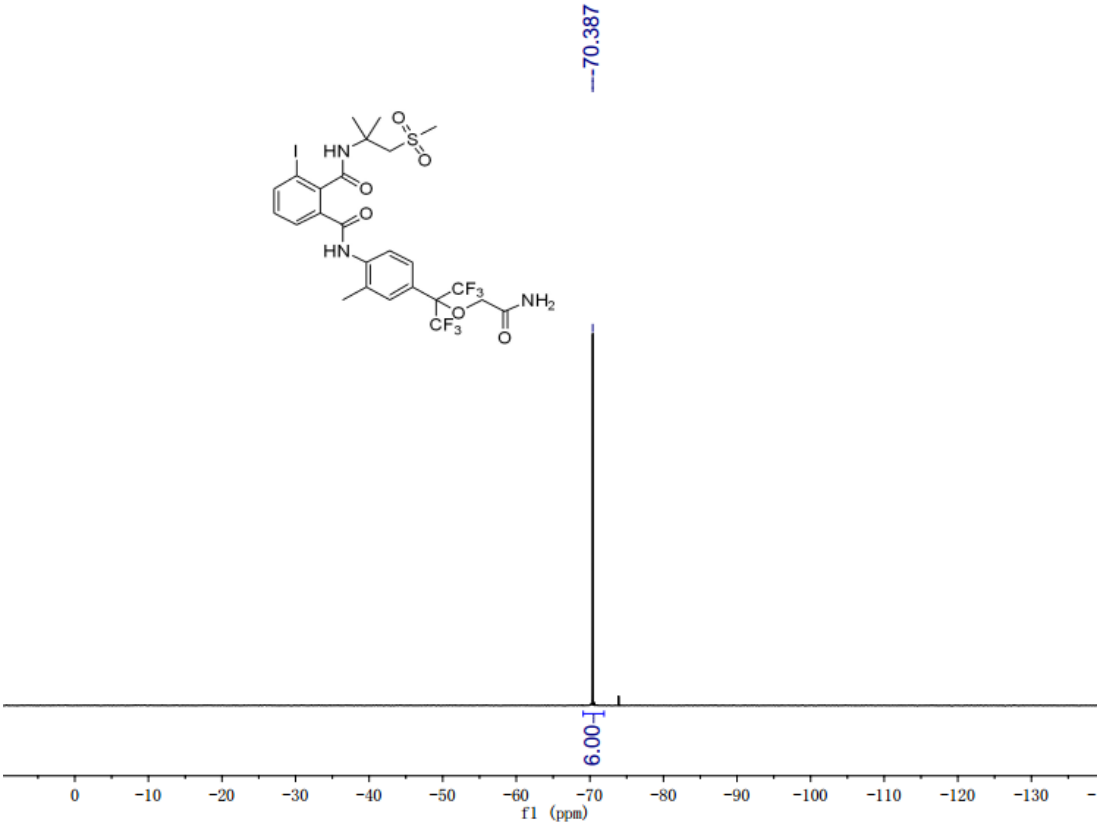
## $^{1}$H NMR spectrum of 8n



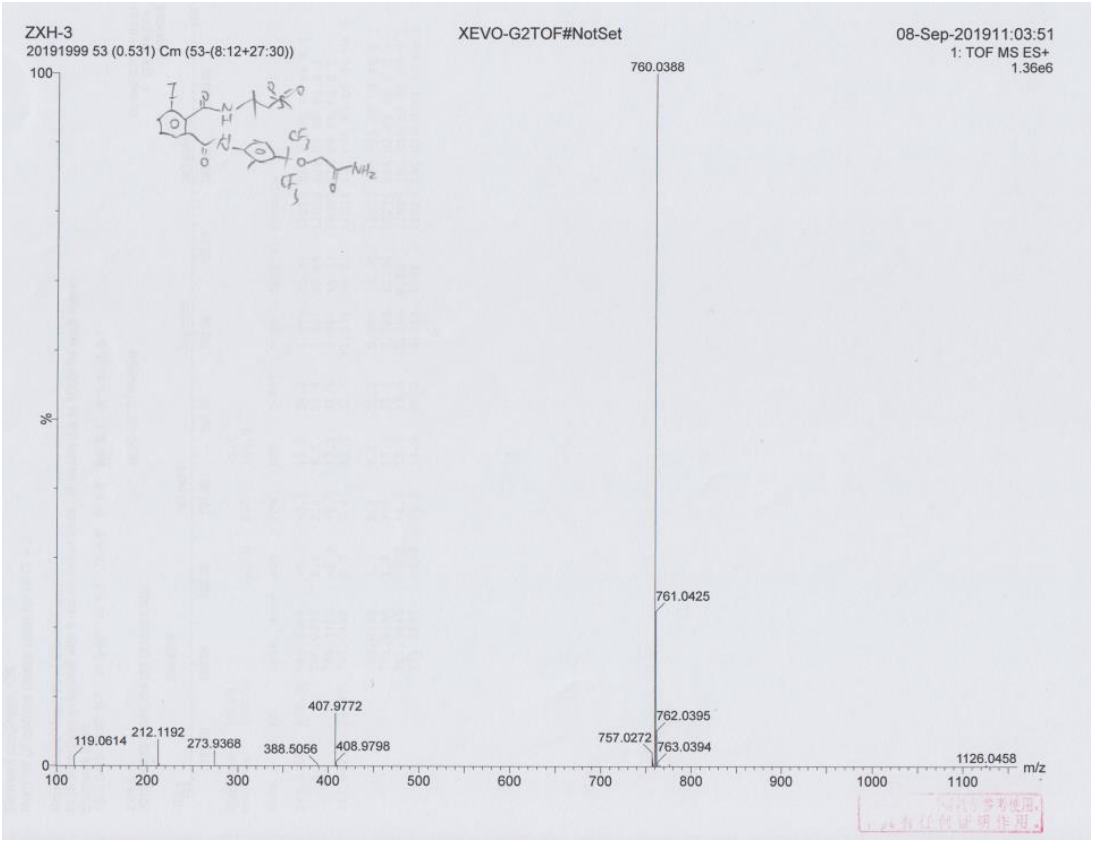

## $^{13}$C NMR spectrum of 8n



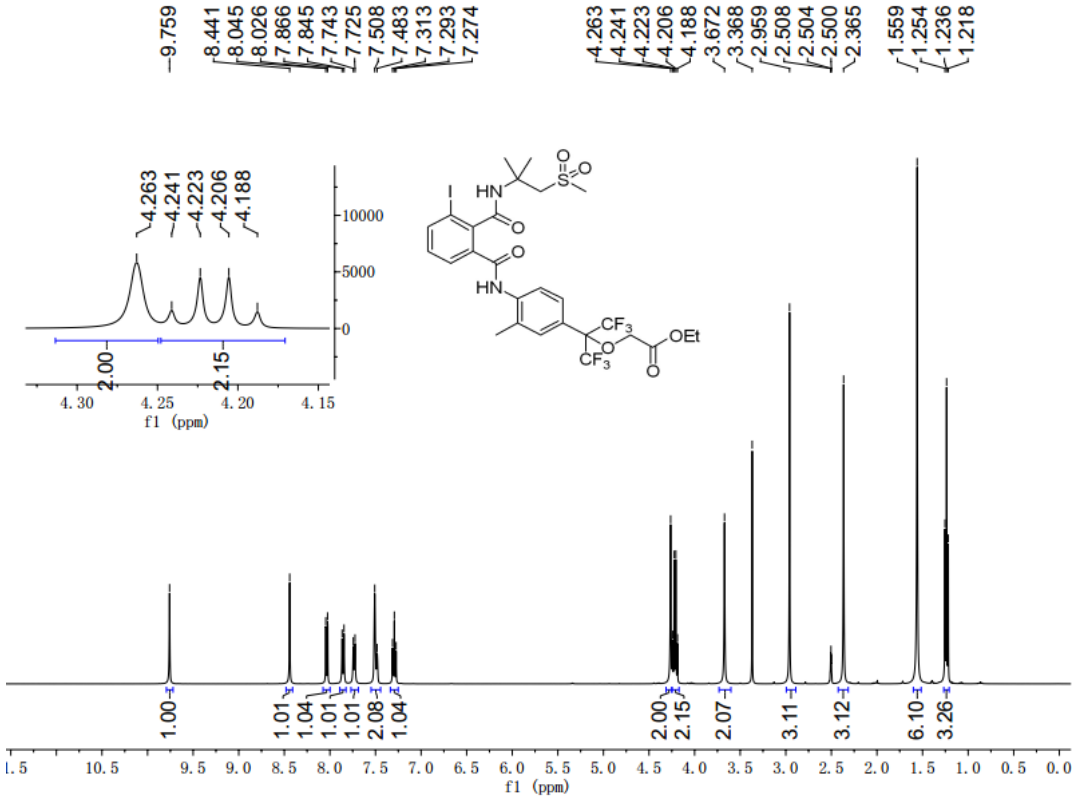
## $^{19}$F NMR spectrum of 8n



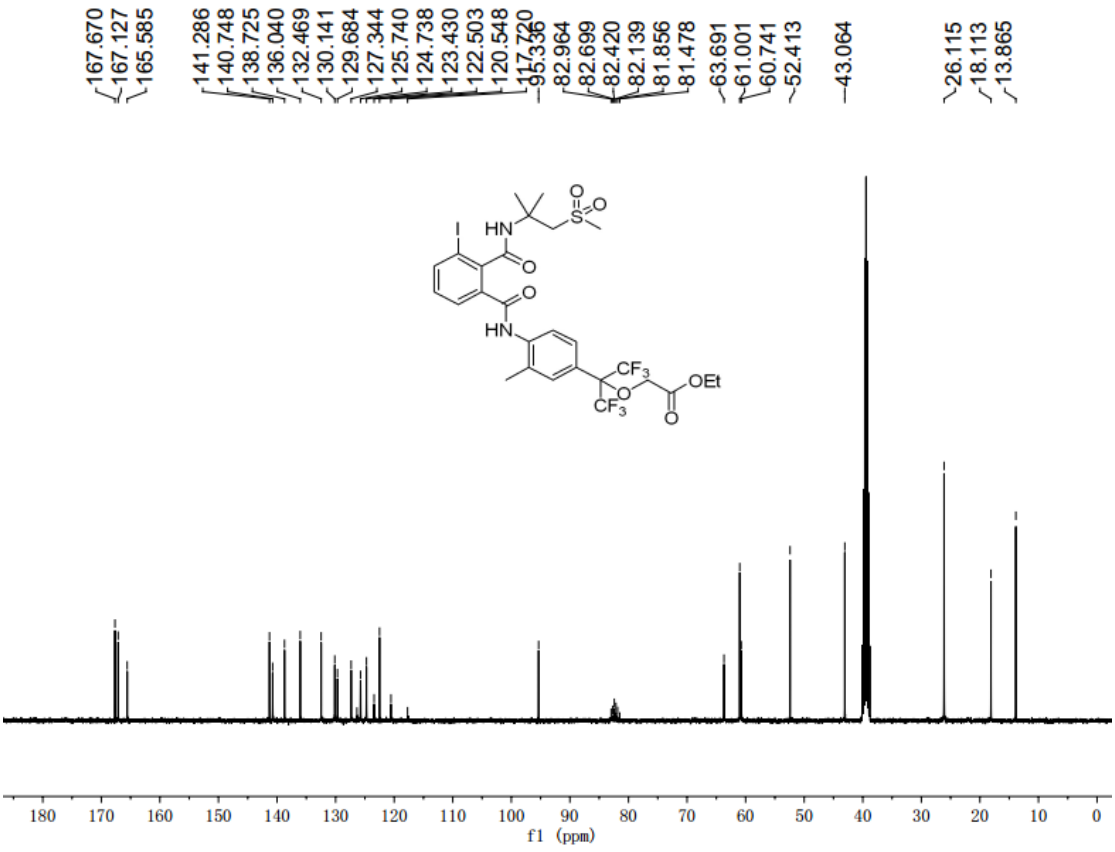

## HRMS (ESI) of 8n



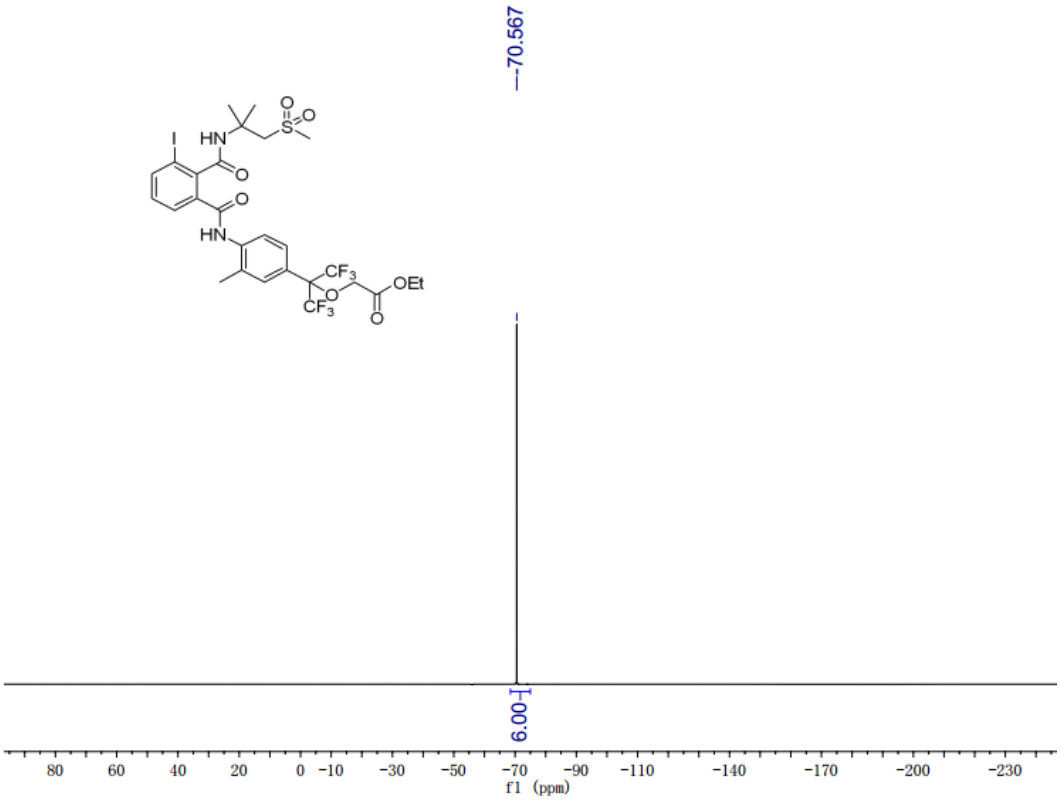
## $^{1}$H NMR spectrum of 8o



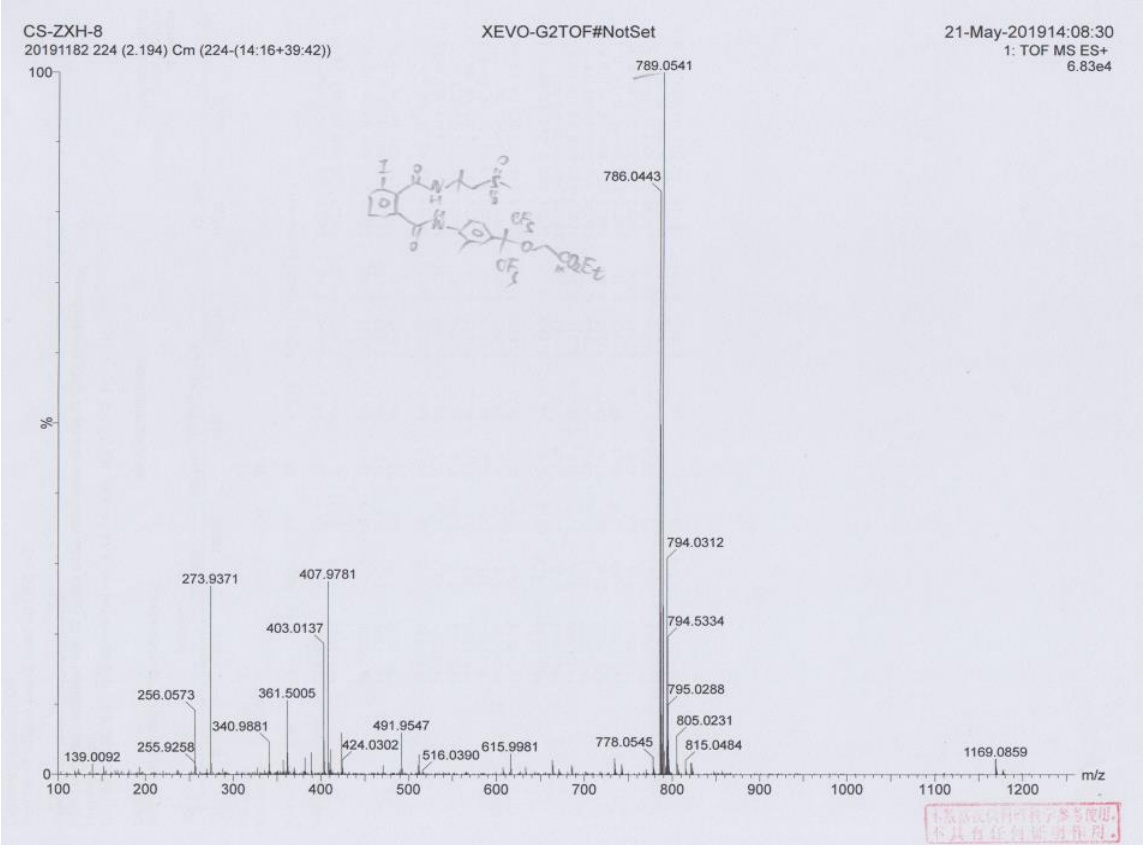

## $^{13}$C NMR spectrum of 8o



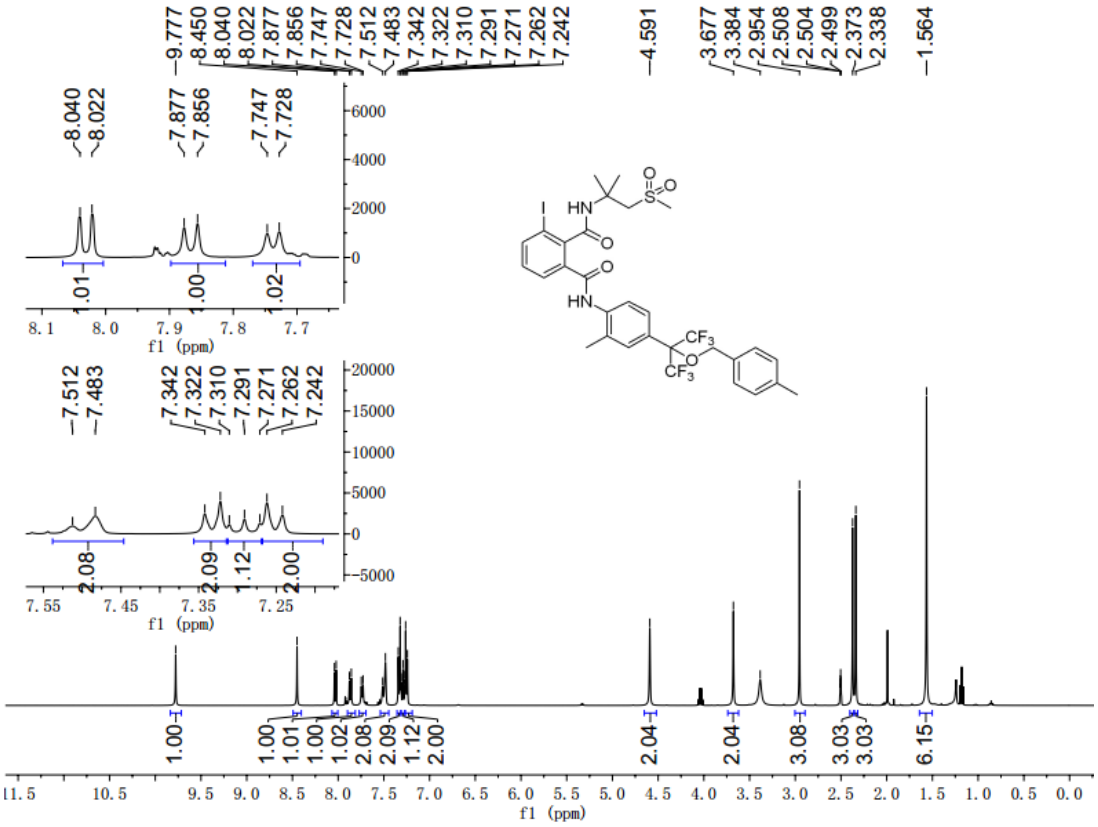
## $^{19}$F NMR spectrum of 8o



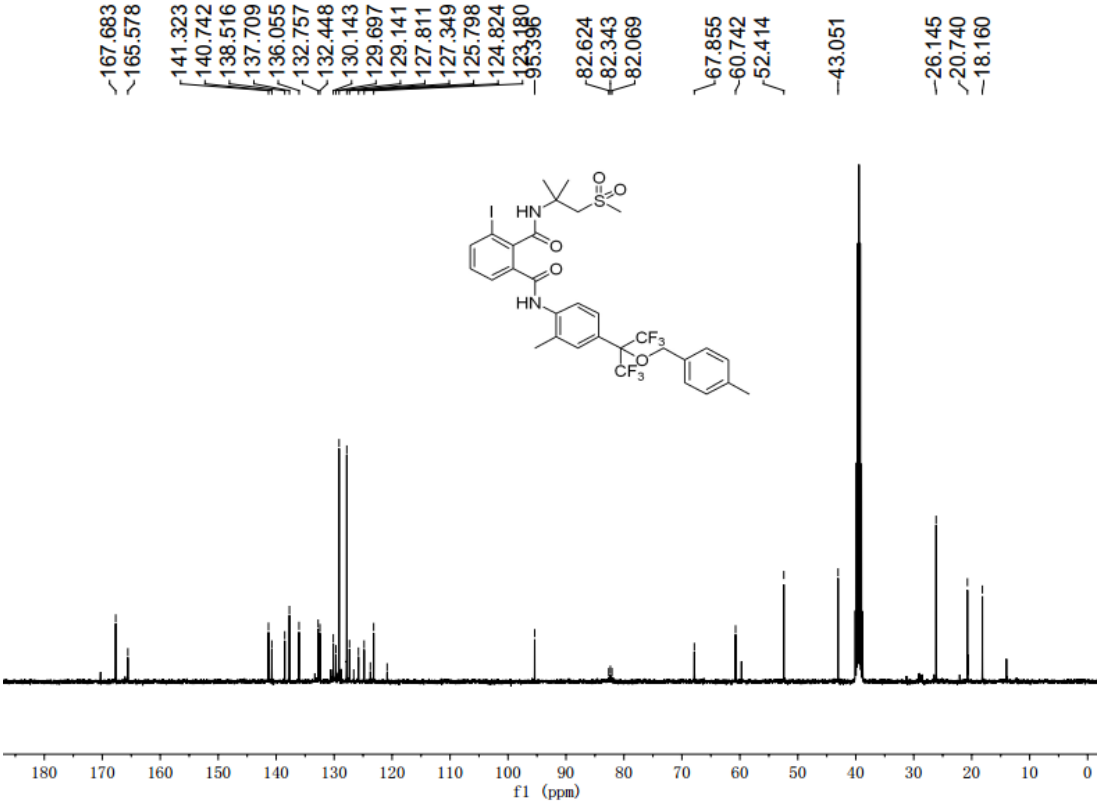

## HRMS (ESI) of 8o



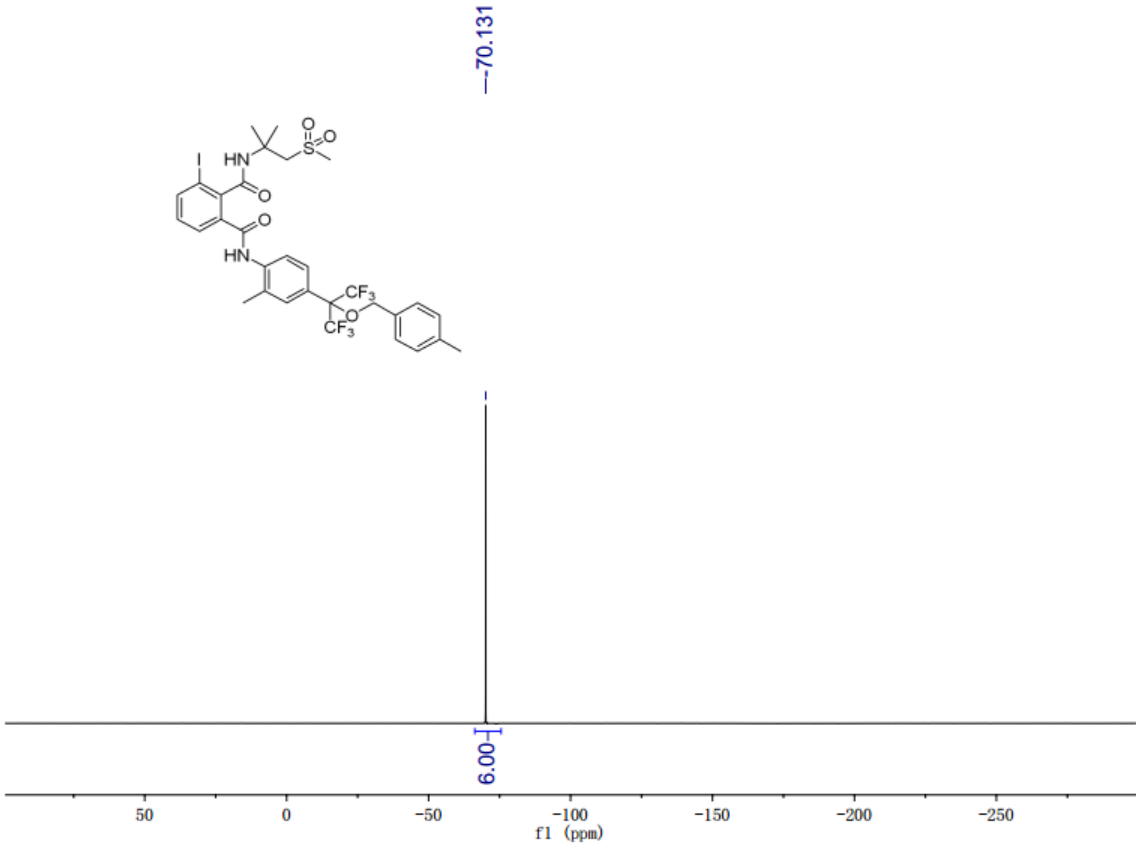
## $^{1}$H NMR spectrum of 8p



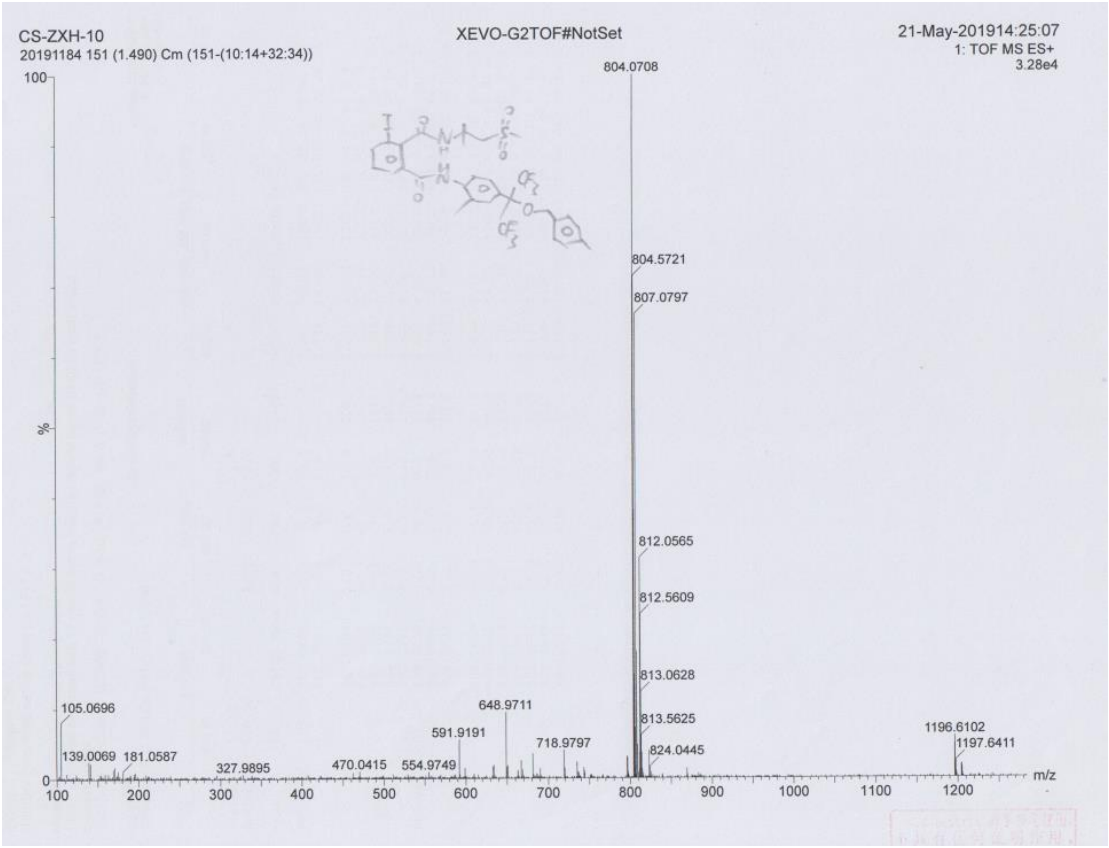

## $^{13}$C NMR spectrum of 8p



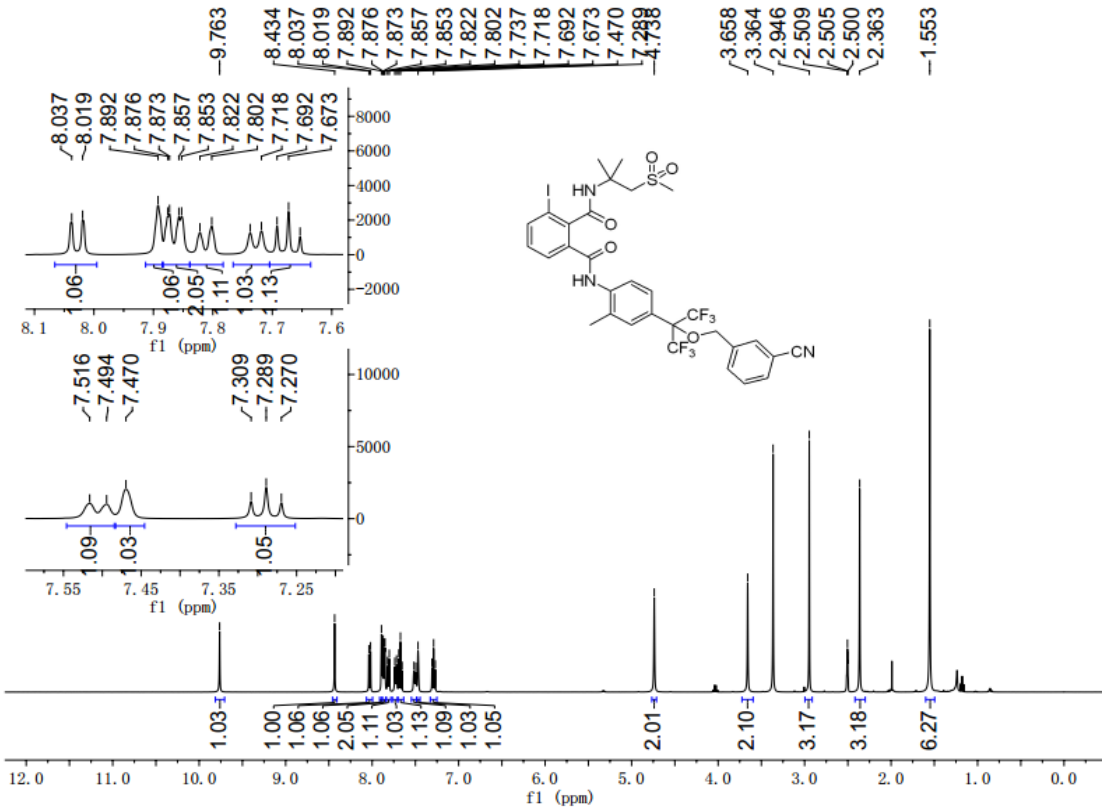
## $^{19}$F NMR spectrum of 8p



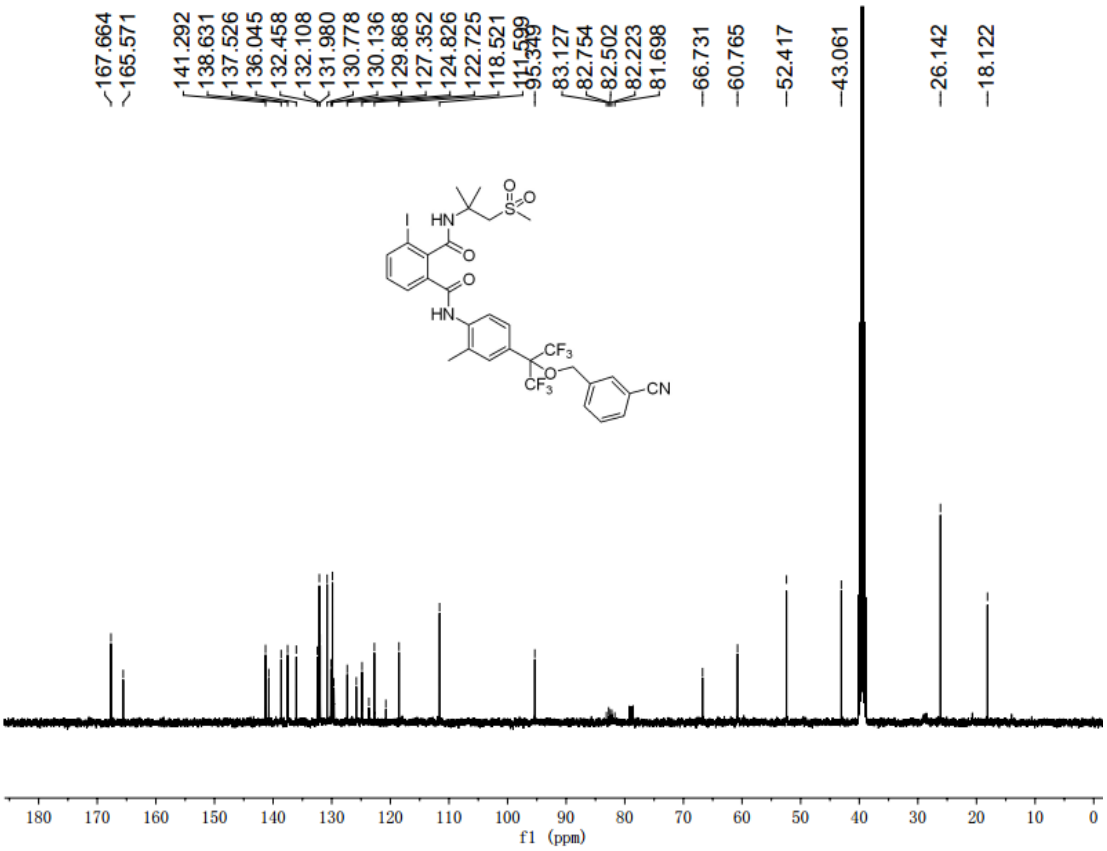

## HRMS (ESI) of 8p



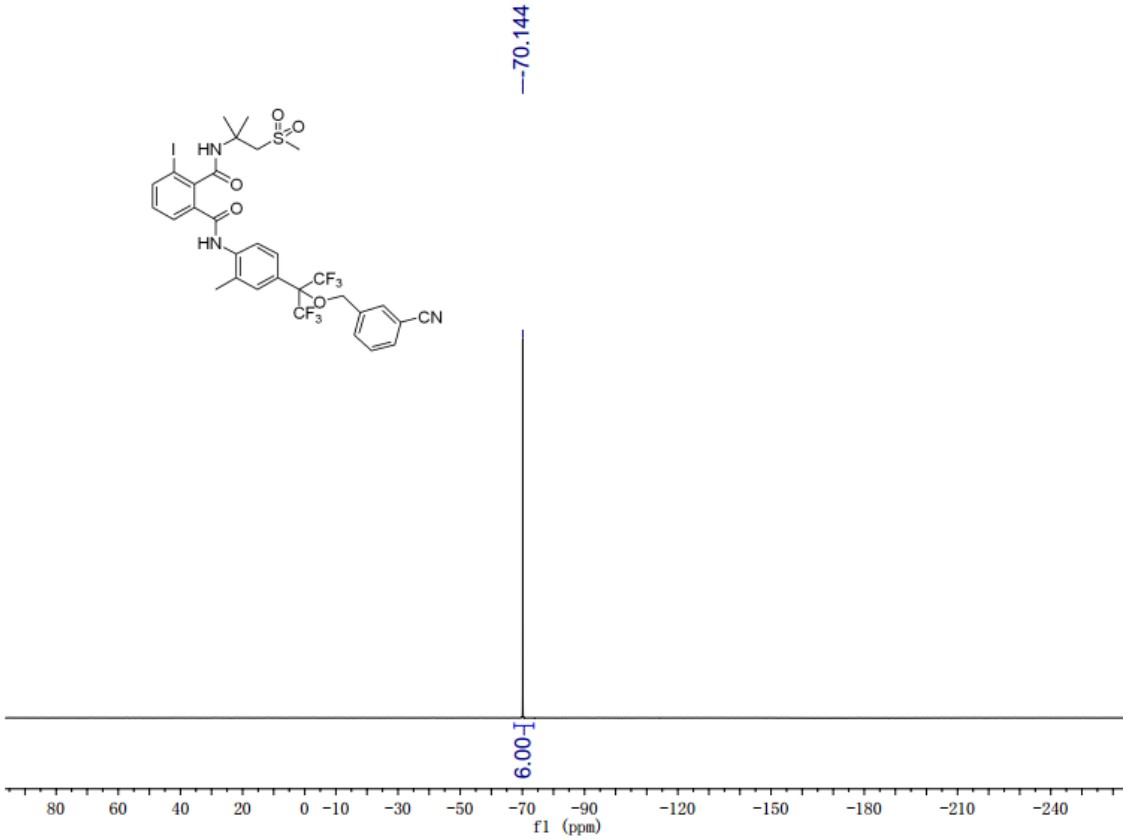
## $^{1}$H NMR spectrum of 8q



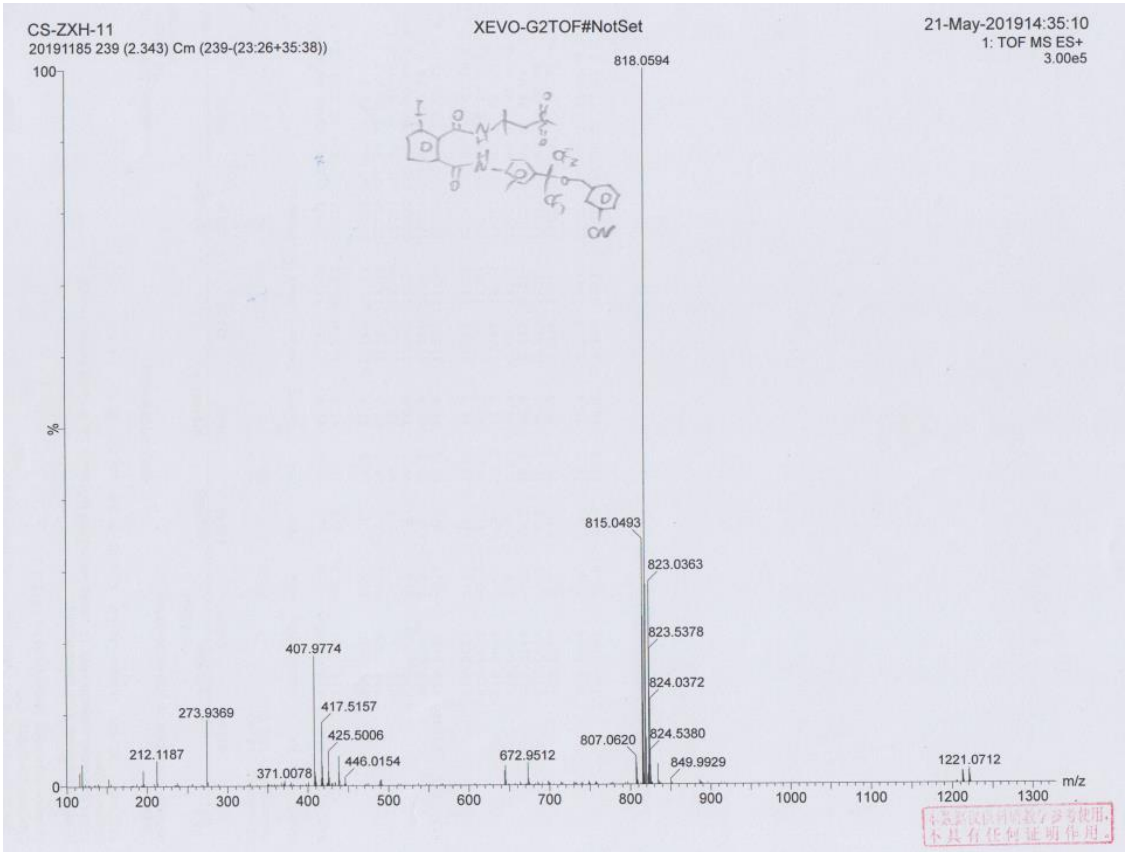
## $^{13}$C NMR spectrum of 8q



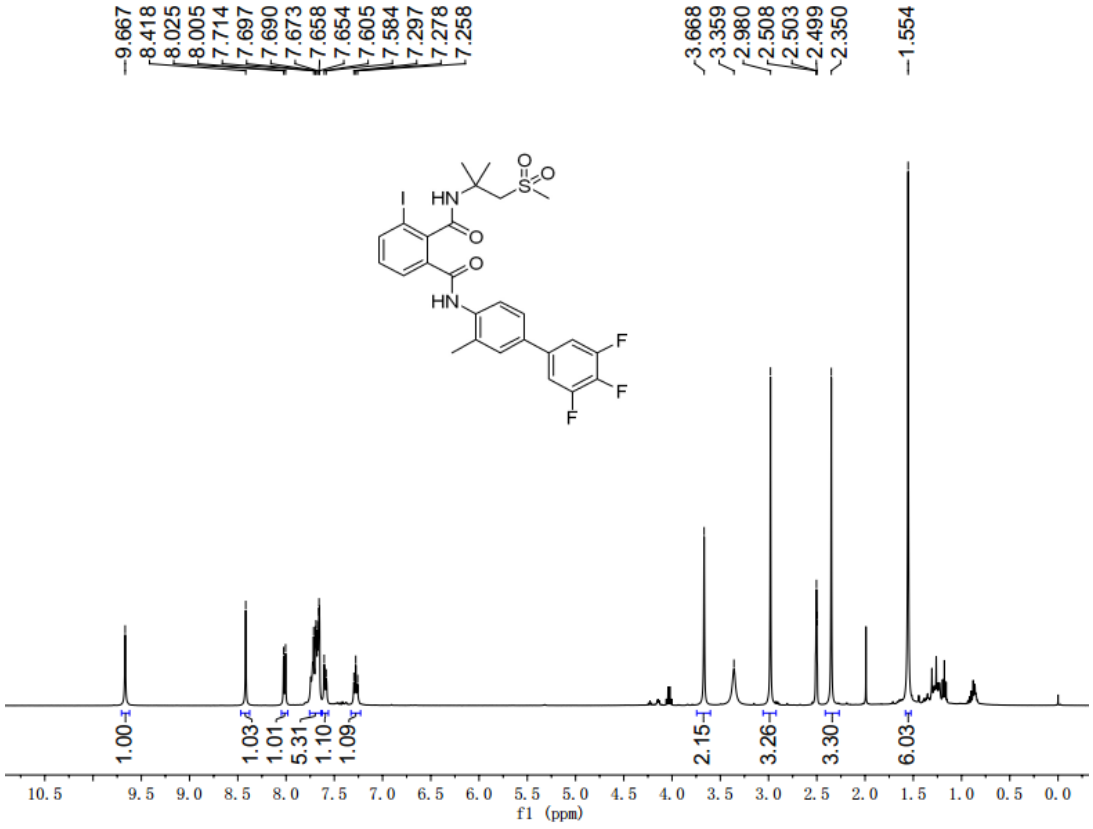
## $^{19}$F NMR spectrum of 8q



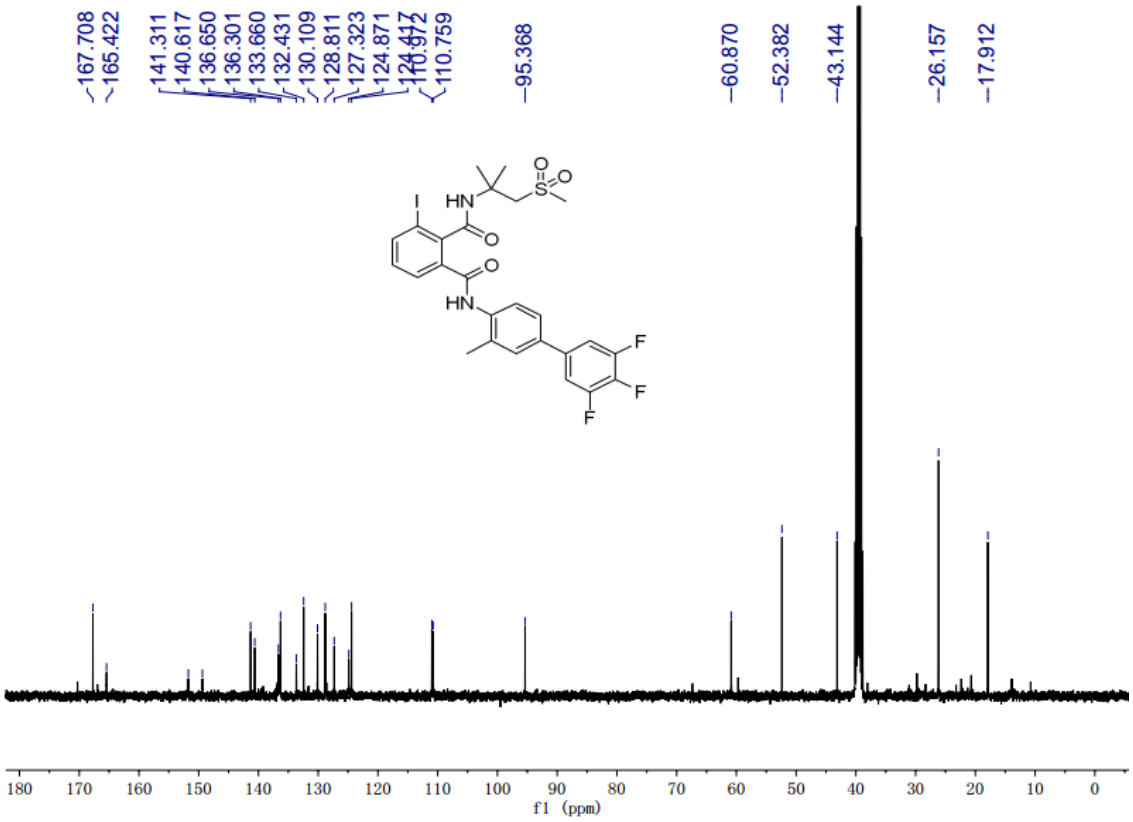

## HRMS (ESI) of 8q



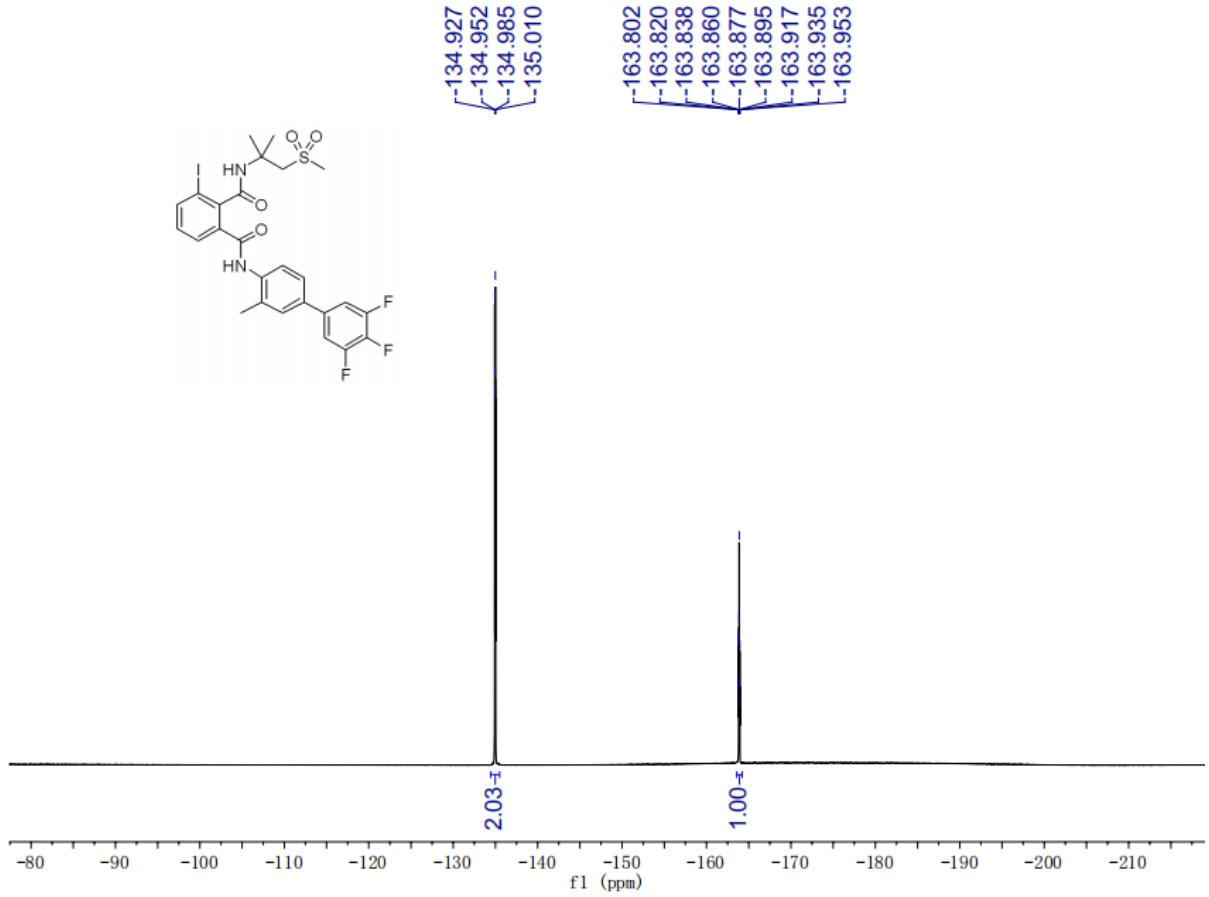
## $^{1}$H NMR spectrum of 8a'



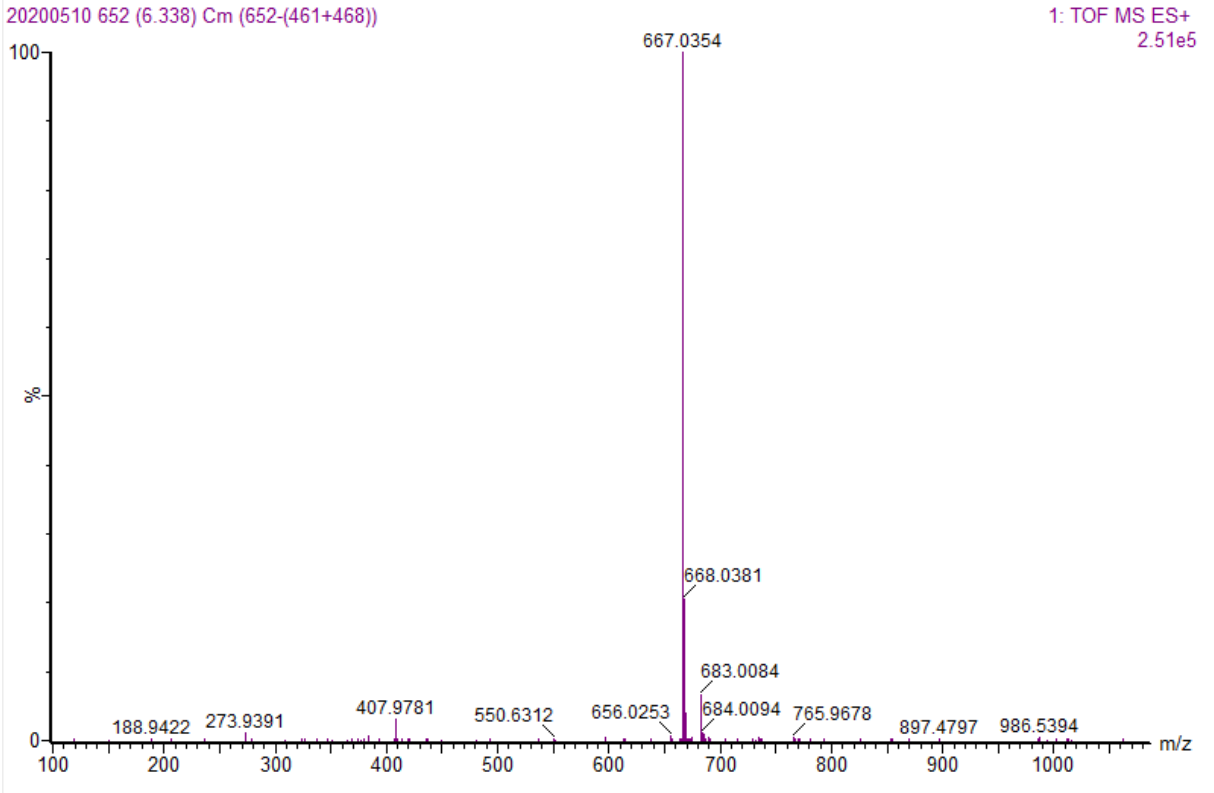

## $^{13}$C NMR spectrum of 8a'



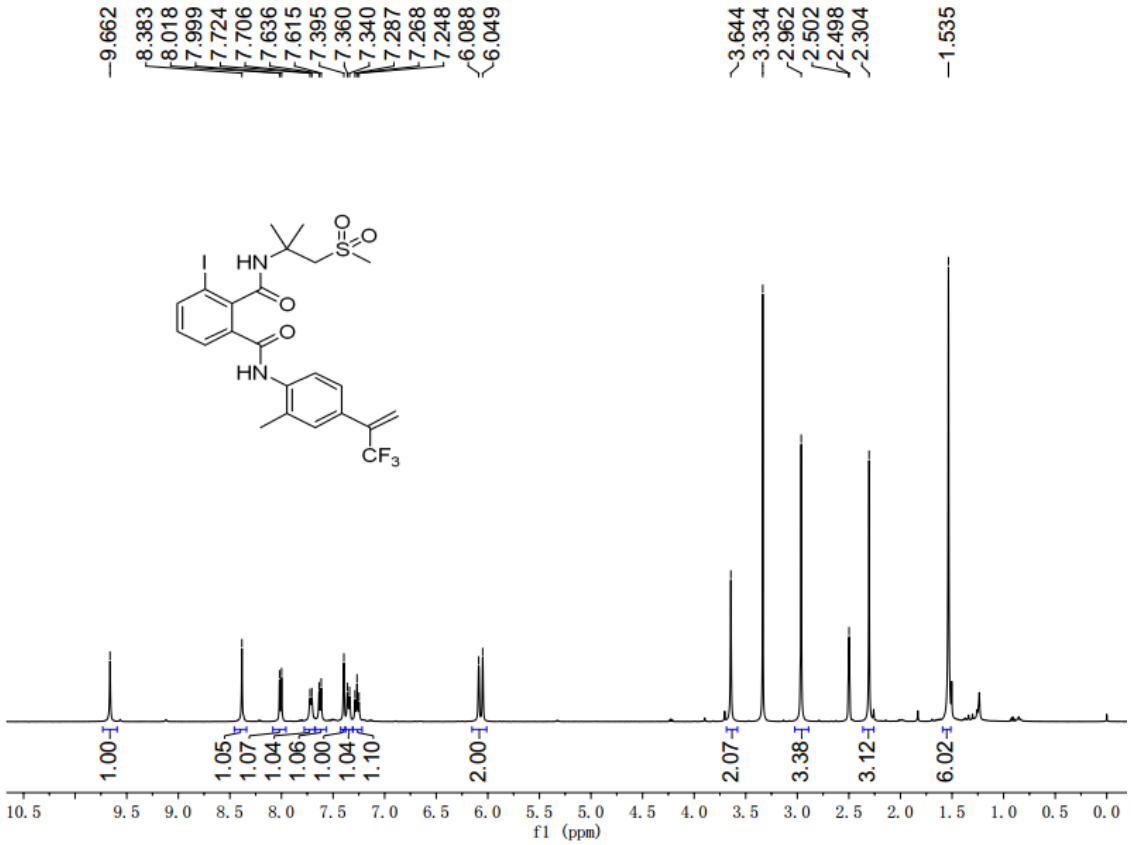
**$^{19}$F NMR spectrum of 8a'**



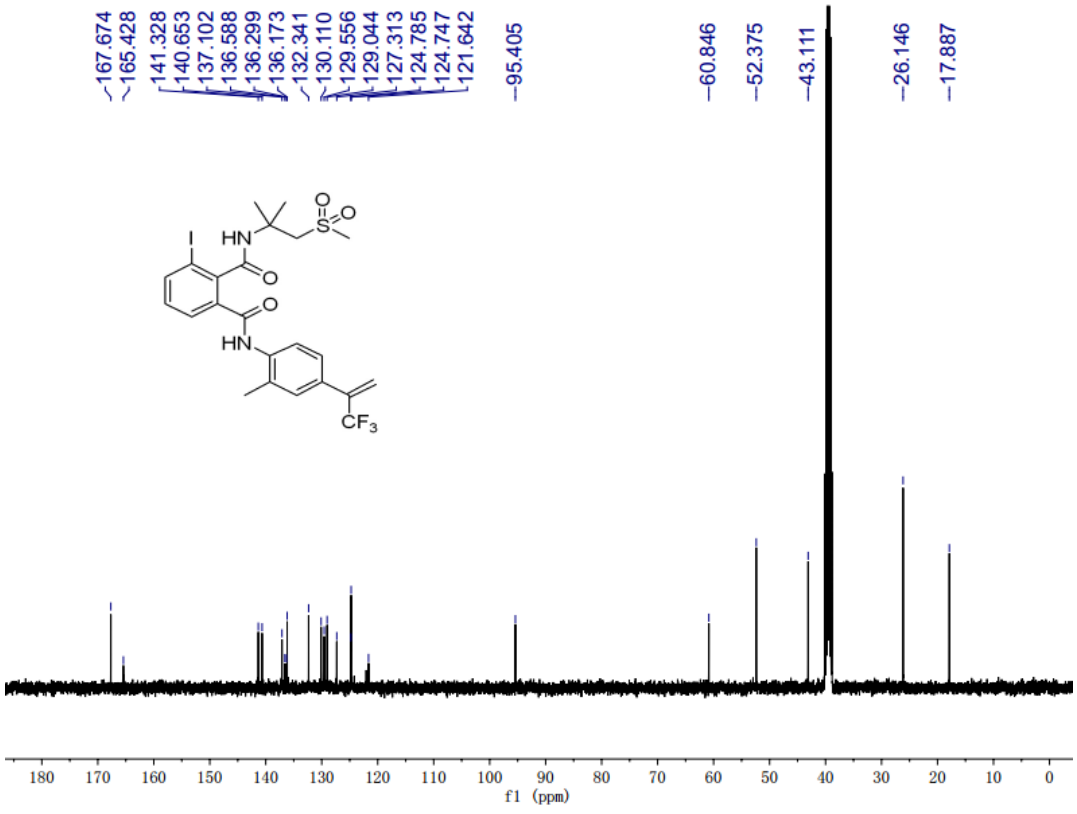

**HRMS (ESI) of 8a'**



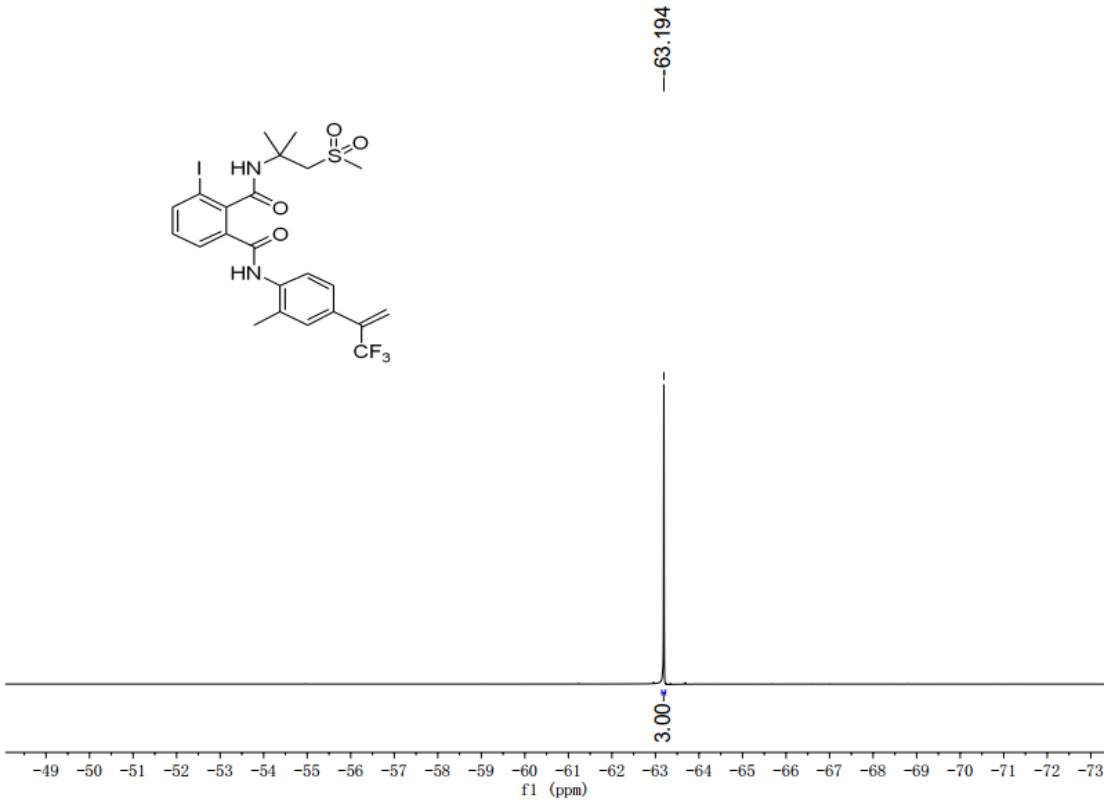
## $^{1}$H NMR spectrum of 8b'



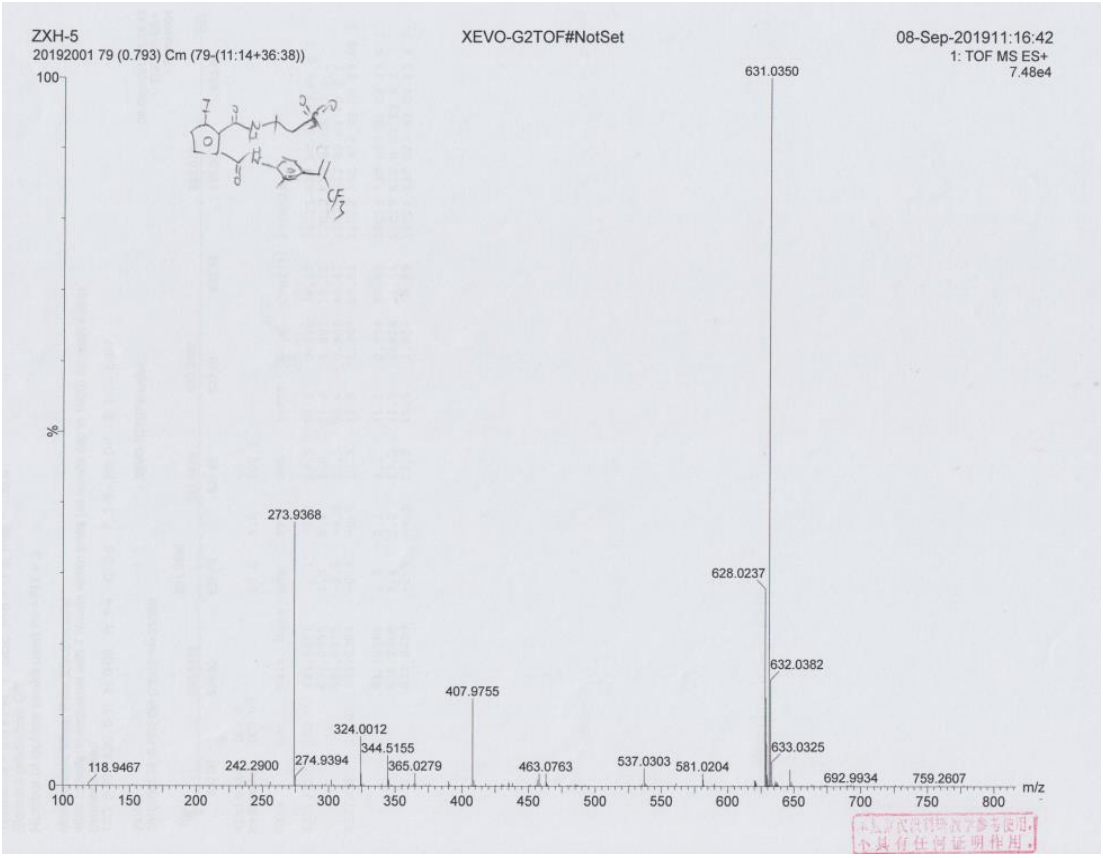

## $^{13}$C NMR spectrum of 8b'



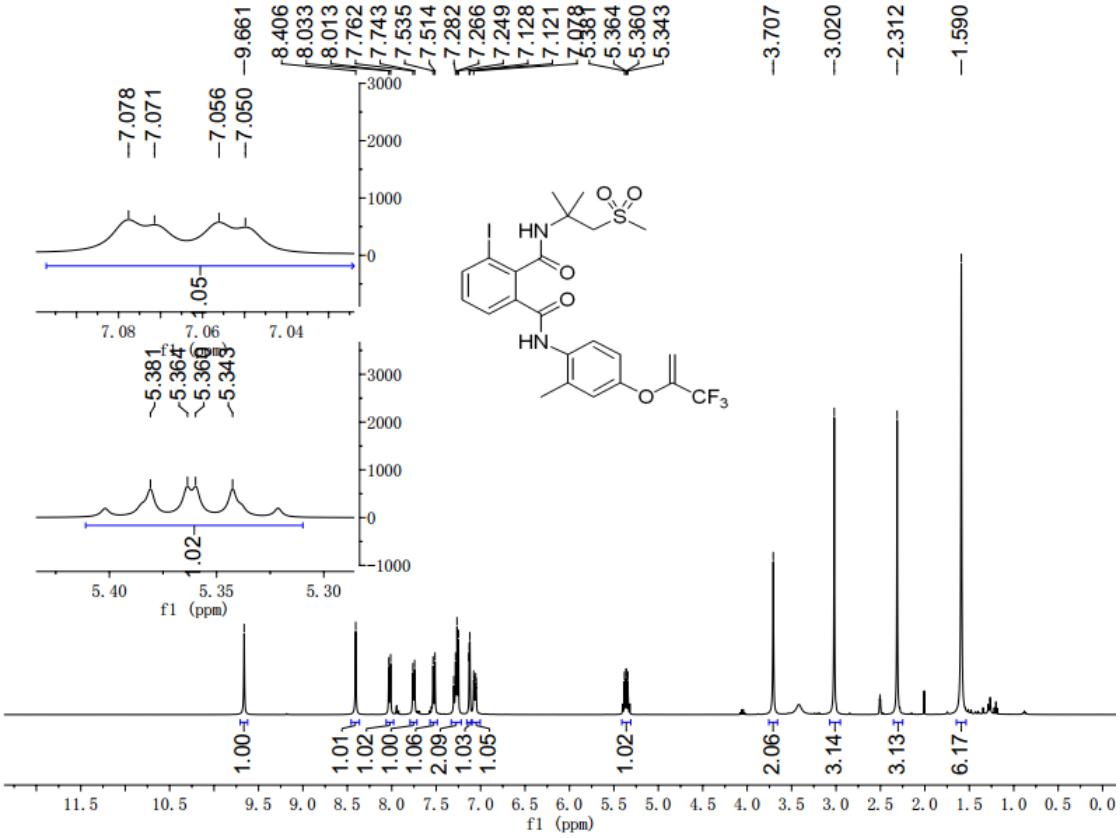
## $^{19}$F NMR spectrum of 8b'



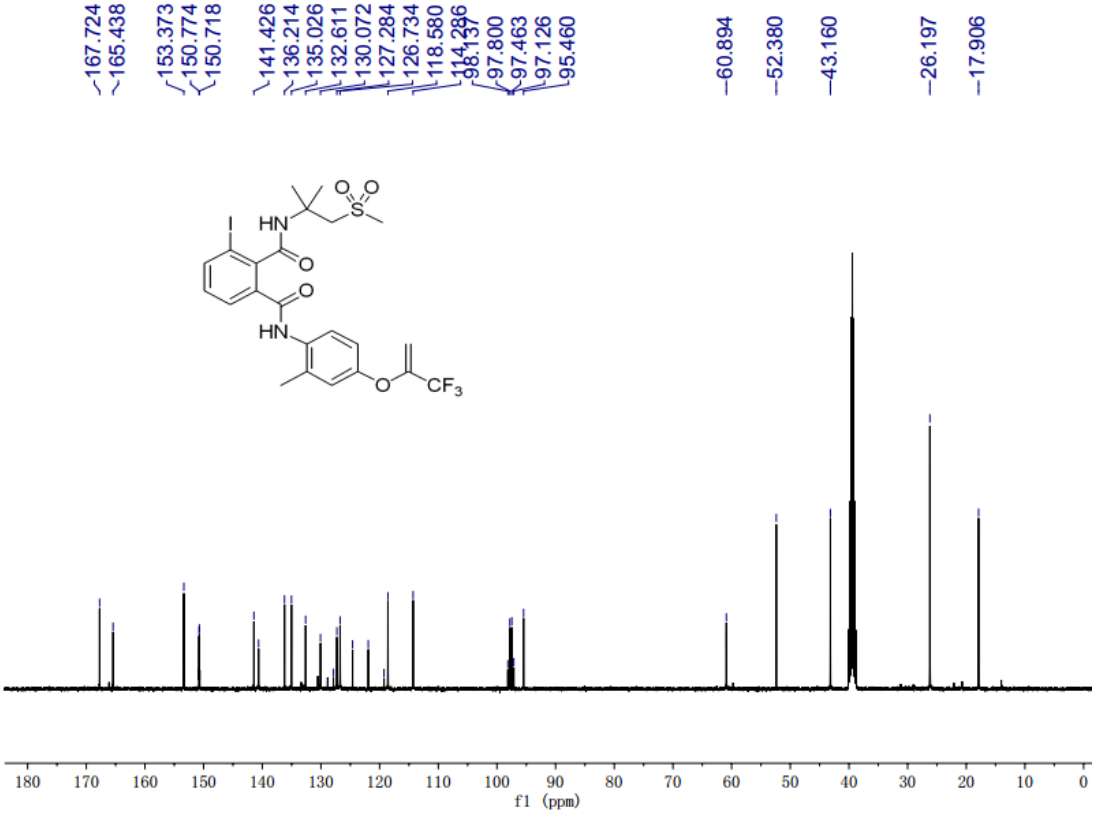

## HRMS (ESI) of 8b'



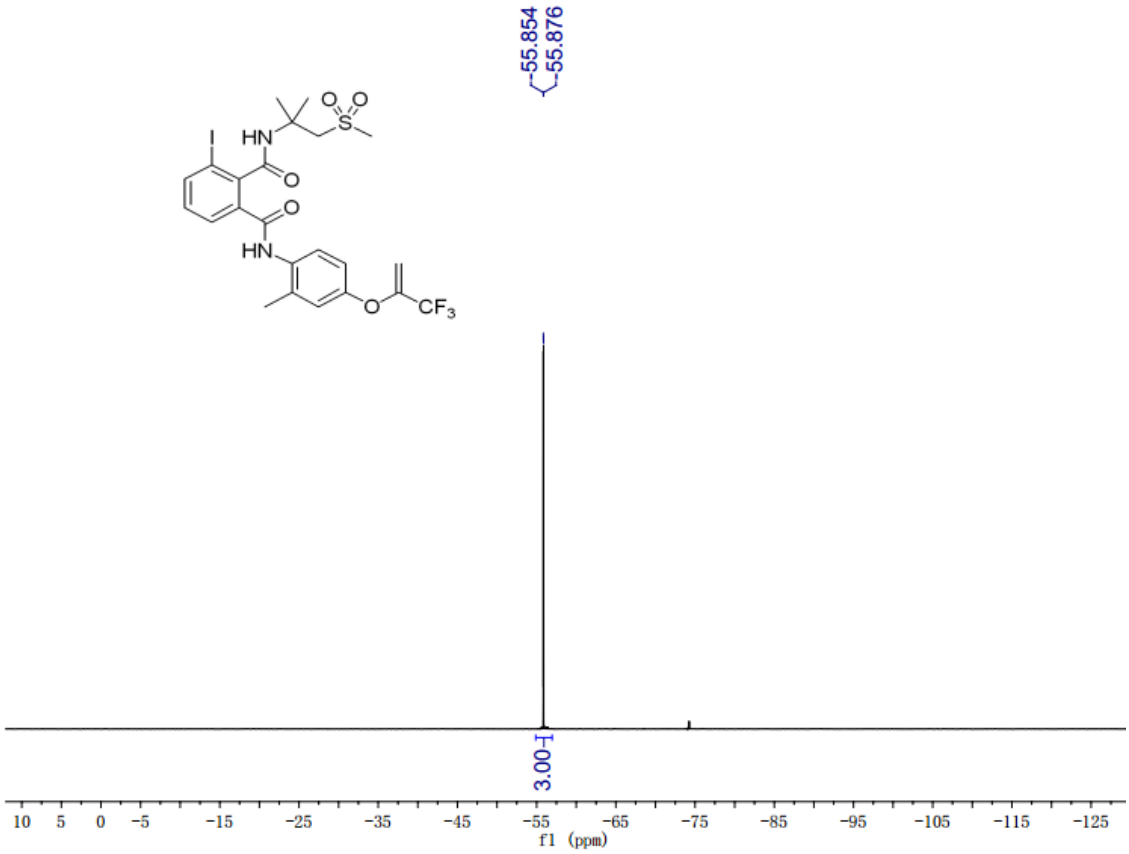
## $^{1}$H NMR spectrum of 8c'




## $^{13}$C NMR spectrum of 8c'



## $^{19}$F NMR spectrum of 8c'




## HRMS (ESI) of 8c'