Supporting Information for

Neighboring Phenolic Group-Enabled *gem*-Difluoroallylboration of Imines for the Catalyst-Free Synthesis of *gem*-Difluorohomoallyl Amines

Xing Yang,[a] Feng Zhang,[b] Yang Zhou[a] and Yi-Yong Huang[a,]*

[a] Department of Chemistry, School of Chemistry, Chemical Engineering and Life Science, Wuhan University of Technology, Wuhan 430070, P. R. China
[b] College of Science, Hunan Agricultural University, Changsha 410128, P. R. China.

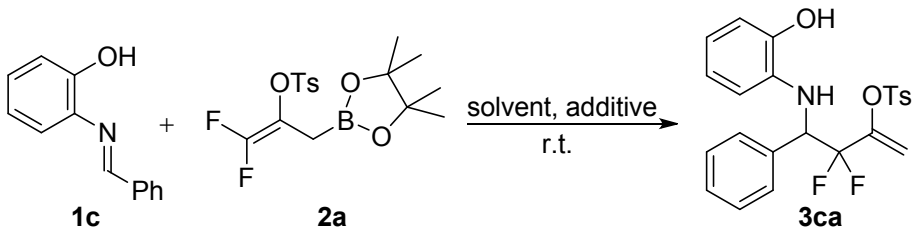
Contents

General methods

All reactions and manipulations involving air-sensitive compounds were carried out using standard Schlenk techniques. Anhydrous Et_2O, toluene and THF were distilled from sodium benzophenone ketyl. Anhydrous CH_2Cl_2 and $CHCl_3$ were distilled from CaH_2 under an atmosphere of nitrogen. All reactions were monitored by TLC. TLC analysis was performed by illumination with a UV lamp (254 nm). All flash chromatography was packed with silica-gel as the stationary phase. ^{1}H NMR (500 MHz) spectra were recorded on a Bruker Avance 500 instrument, and chemical shifts were reported in ppm downfield from internal TMS with the solvent resonance as the internal standard ($CDCl_3$, δ = 7.26 ppm). ^{13}C NMR (126 MHz) spectra were recorded on a Bruker Avance 500 instrument, and chemical shifts were reported in ppm downfield from TMS with the solvent resonance as the internal standard ($CDCl_3$, δ = 77.2 ppm). ^{19}F NMR (471 MHz) spectra were recorded on a Bruker Avance 500 instrument. Infrared spectra were recorded on a NICOLET FT/IR-200 spectrometer. High resolution MS (P-ESI HRMS) were obtained on Thermo Fisher Q Exactive Mass Spectrometer.

Additional experiments

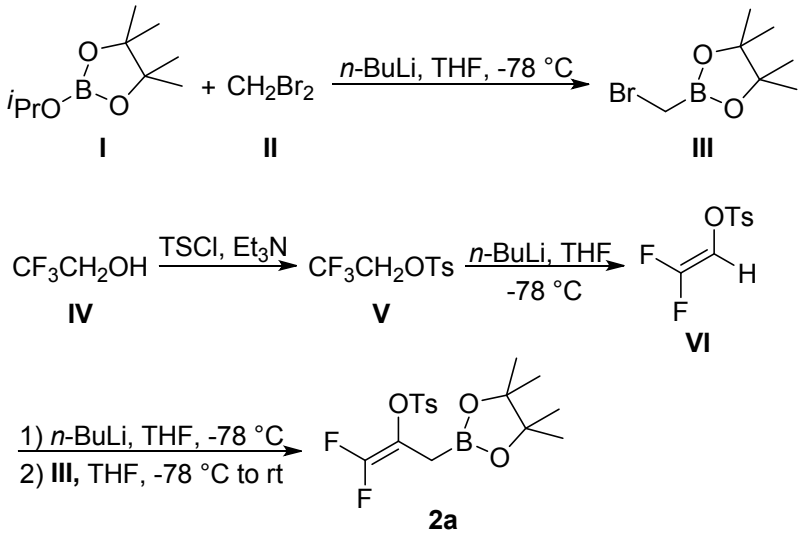
Table S-1: Optimization of the *gem*-difluoroallylboration of imines[a]



entry	additive	solvent	t/h	yield/%[b]
1	none	$CHCl_3$	48	75
2	none	Et_2O	48	70
3	none	EtOAc	48	71
4	none	CH_3CN	48	73
5[c]	H_2O	THF	24	96
6[c]	EtOH	THF	24	94
7[d]	MeOH	THF	24	99
8[d,e]	MeOH	THF	22	98
9[d,f]	MeOH	THF	18	99 (96)

[a] Reaction conditions: **1c** (0.1 mmol), **2a** (0.12 mmol), solvent (0.5 mL). [b] NMR yield was determined by ^{1}H NMR analysis with 1,3,5-trimethoxybenzene as an internal standard, and data in parenthesis is isolated yield. [c] Additive (2.0 equiv). [d] Additive (5.0 equiv). [e] Solvent (0.25 mL). [f] Solvent (0.1 mL).

General procedure for the synthesis of *gem*-difluoroallylboronates



(1) Synthesis of compound **III**: To a solution of compound **I** (18.6 g, 100 mmol) and dibromomethane **II** (19.2 g, 110 mmol) in anhydrous THF (300 mL) was added dropwise *n*-BuLi (2.5 M in hexane, 44 mL) over 30 min at -78 °C. The mixture was stirred at -78 °C for 1 h, then the cooling bath was removed and the reaction mixture was stirred at rt for 3 h. The mixture was cooled again to 0 °C, and a solution of

concentrated sulfuric acid (2.5 mL) in methanol (6.5 mL) was added dropwise over 5 min. The volatiles were removed under vacuum, and the residue was distilled (110 ^{o}C/20 torr) to give compound **III** (18.2 g, 83% yield) as a colorless liquid.[1]

(2) Synthesis of compound **V**: To a solution of compound **IV** (5.0 g, 50 mmol) and triethylamine (18.2 g, 180 mmol) in anhydrous THF (50 mL) was added tosyl chloride (12.0 g, 62.5 mmol) at 0 ^{o}C. The reaction mixture was stirred at 0 ^{o}C for 1 h, then stirred at rt overnight. The mixture was then washed with brine (50 mL) and dried over Na_2SO_4. After concentration under vacuum, the residue was purified by chromatography (PE:EA = 5:1) to give compound **V** (11.7 g, 92% yield) as a colorless solid.[2]

(3) Synthesis of compound **VI**: To a solution of compound **V** (7.6 g, 30 mmol) in anhydrous THF (150 mL) was added dropwise *n*-BuLi (2.5 M in hexane, 27.6 mL) at -78 ^{o}C under nitrogen atmosphere. The reaction mixture was stirred at -78 ^{o}C for 45 min. The reaction was then quenched with a mixture of H_2O/THF (1:1, 100 mL). The mixture was concentrated under vacuum and extracted with ethyl acetate (3×60 mL). The combined organic phase was dried over Na_2SO_4. After concentration under vacuum, the residue was purified by chromatography (PE:EA = 10:1) to give compound **VI** (6.2 g, 88% yield) as a colorless liquid.[2]

(4) Synthesis of compound **2a**: To a solution of compound **VI** (3.5 g, 15 mmol) in anhydrous THF (100 mL) was added dropwise *n*-BuLi (2.5 M in hexane, 6.0 mL) at -78 ^{o}C under nitrogen atmosphere. The reaction mixture was stirred at -78 ^{o}C for 1 h, then compound **III** (3.3 g, 15 mmol) was added. After stirring at -78 ^{o}C for 2 h, the reaction mixture was warmed up to 60 ^{o}C and stirred at that temperature for 4 h. The mixture was cooled to rt, then H_2O (50 mL) was added to quench the reation. The mixture was concentrated under vacuum and extracted with ethyl acetate (3×50 mL). The combined organic phase was dried over Na_2SO_4. After concentration under vacuum, the residue was purified by chromatography (PE:EA = 15:1) to give compound **2a** (3.8 g, 68% yield) as a sticky yellow oil.[1]

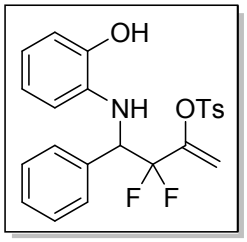
Compounds **2b-2r** were synthesized according to the literature procedure.[3]

General procedure for *gem*-difluoroallylboration of imines

To a 2 mL test tube with a stir bar was added imine (0.2 mmol) and *gem*-difluoroallylboronate (0.24 mmol), anhydrous THF (0.2 mL) and MeOH (5.0 equiv),

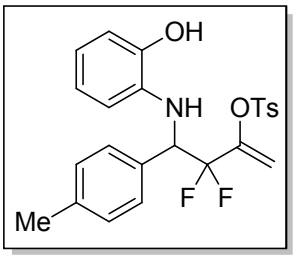
and the reaction mixture was stirred at rt for the time indicated in the table. Then the reaction mixture was directly subjected to preparative thin layer chromatography to give desired products.

Characterization data of the reaction products



3,3-difluoro-4-((2-hydroxyphenyl)amino)-4-phenylbut-1-en-2-yl 4-methylbenzenesulfonate (3ca):

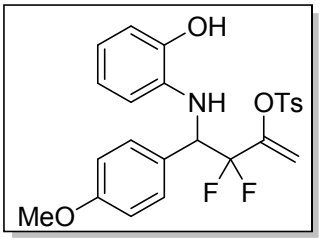
According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 97% yield as a brown oil. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.76 (d, 8.2 Hz, 2H), 7.33 (d, 6.2 Hz, 2H), 7.28 - 7.24 (m, 5H), 6.70 - 6.65 (m, 2H), 6.61 (t, 7.3 Hz, 1H), 6.39 (d, 7.7 Hz, 1H), 5.50 (d, 1.4 Hz, 1H), 5.32 (d, 3.1 Hz, 1H), 4.75 (dd, 15.4 Hz, 10.4 Hz, 1H), 2.41 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 146.1 (dd, 33.3 Hz, 29.9 Hz), 145.9, 144.3, 134.8, 134.4, 132.2, 130.0, 129.9, 129.8, 128.5, 128.4, 121.3, 119.2, 116.8 (t, 250.5 Hz), 114.8, 114.7, 105.9 (t, 4.6 Hz), 60.4 (dd, 27.6 Hz, 23.8 Hz), 21.7; ^{19}F NMR (471 MHz, $CDCl_3$) δ -107.4 (dd, 255.9 Hz, 9.0 Hz, 1F), -113.9 (dd, 255.9 Hz, 15.6 Hz, 1F); IR (KBr): 3419, 2922, 1597, 1513, 1452, 1366, 1174, 1086, 950, 715 cm^{-1}; HRMS (ESI) m/z: $[M+Na]^+$ calcd for $C_{23}H_{21}F_2NO_4SNa$ 468.1057, found 468.1048.



3,3-difluoro-4-((2-hydroxyphenyl)amino)-4-(p-tolyl)but-1-en-2-yl 4-methylbenzenesulfonate (3da):

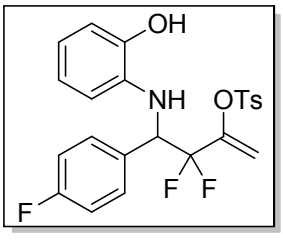
According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained

in 98% yield as a brown oil. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.76 (d, 8.2 Hz, 2H), 7.25 (d, 8.0 Hz, 2H), 7.21 (d, 7.7 Hz, 2H), 7.08 (d, 7.8 Hz, 2H), 6.69 - 6.65 (m, 2H), 6.59 (t, 7.4 Hz, 1H), 6.40 (d, 7.7 Hz, 1H), 5.49 (d, 1.4 Hz, 1H), 5.32 (d, 3.1 Hz, 1H), 4.72 (dd, 15.5 Hz, 10.4 Hz, 1H), 2.40 (s, 3H), 2.28 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 146.2 (dd, 33.4 Hz, 30.1 Hz), 145.9, 144.3, 138.3, 134.5, 132.2, 131.7, 129.9, 129.2, 128.5, 128.3, 121.3, 119.2, 116.9 (t, 250.4 Hz), 114.6, 114.1, 105.8 (t, 4.6 Hz), 60.1 (dd, 27.7 Hz, 23.8 Hz), 21.7, 21.1; ^{19}F NMR (471 MHz, $CDCl_3$) δ -107.4 (dd, 255.8 Hz, 9.1 Hz, 1F), -113.9 (dd, 255.7 Hz, 15.7 Hz, 1F); IR (KBr): 3493, 1597, 1513, 1449, 1366, 1268, 1174, 1086, 1040, 726 cm^{-1}; HRMS (ESI) m/z: $[M+Na]^+$ calcd for $C_{24}H_{23}F_2NO_4SNa$ 482.1214, found 482.1208.



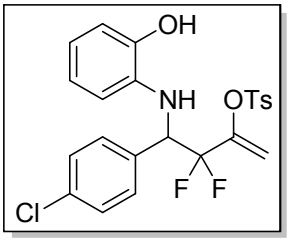
3,3-difluoro-4-((2-hydroxyphenyl)amino)-4-(4-methoxyphenyl)but-1-en-2-yl 4-methylbenzenesulfonate (3ea):

According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 97% yield as a brown oil. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.76 (d, 8.2 Hz, 2H), 7.25 (t, 7.4 Hz, 4H), 6.80 (d, 8.6 Hz, 2H), 6.70 - 6.65 (m, 2H), 6.60 (t, 7.4 Hz, 1H), 6.40 (d, 7.7 Hz, 1H), 5.49 (s, 1H), 5.31 (d, 3.2 Hz, 1H), 4.71 (dd, 14.8 Hz, 10.9 Hz, 1H), 3.74 (s, 3H), 2.40 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 159.6, 146.2 (dd, 33.3 Hz, 30.4 Hz), 145.9, 144.4, 134.5, 132.2, 129.9, 129.5, 128.5, 126.8, 121.3, 119.1, 116.9 (t, 250.2 Hz), 114.6, 114.1, 113.9, 105.8 (t, 4.5 Hz), 59.8 (dd, 27.7 Hz, 23.8 Hz), 55.2, 21.7; ^{19}F NMR (471 MHz, $CDCl_3$) δ -107.8 (dd, 255.3 Hz, 9.8 Hz, 1F), -113.8 (dd, 255.3 Hz, 15.2 Hz, 1F); IR (KBr): 3416, 1610, 1511, 1449, 1366, 1247, 1173, 1035, 950, 728 cm^{-1}; HRMS (ESI) m/z: $[M+Na]^+$ calcd for $C_{24}H_{23}F_2NO_5SNa$ 498.1163, found 498.1157.



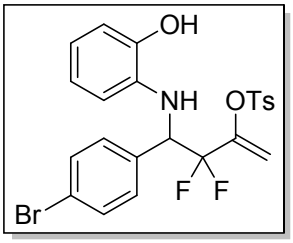
3,3-difluoro-4-(4-fluorophenyl)-4-((2-hydroxyphenyl)amino)but-1-en-2-yl 4-methylbenzenesulfonate (3fa):

According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 96% yield as a brown oil. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.76 (d, 8.2 Hz, 2H), 7.33 - 7.28 (m, 2H), 7.26 (d, 8.0 Hz, 2H), 6.95 (t, 8.6 Hz, 2H), 6.71 - 6.66 (m, 2H), 6.61 (t, 7.4 Hz, 1H), 6.35 (d, 7.7 Hz, 1H), 5.50 (s, 1H), 5.33 (d, 3.2 Hz, 1H), 4.76 (dd, 15.5 Hz, 9.9 Hz, 1H), 2.40 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 162.8 (d, 247.5 Hz), 146.0, 145.9 (dd, 33.4 Hz, 29.9 Hz), 144.1, 134.3, 132.1, 130.1 (d, 8.2 Hz), 129.9, 128.5, 121.3, 119.2, 116.7 (t, 250.6 Hz), 115.5, 115.3, 114.7, 113.7, 105.9 (t, 4.6 Hz), 59.7 (dd, 28.2 Hz, 24.2 Hz), 21.7; ^{19}F NMR (471 MHz, $CDCl_3$) δ -107.2 (dd, 256.2 Hz, 9.4 Hz, 1F), -113.2 – -113.6 (m, 1F), -114.3 (dd, 256.2 Hz, 15.6 Hz, 1F); IR (KBr): 3421, 1599, 1509, 1366, 1226, 1174, 1096, 1051, 950, 726 cm^{-1}; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{23}H_{21}F_3NO_4S$ 464.1143, found 464.1138.



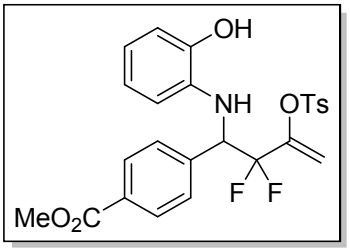
4-(4-chlorophenyl)-3,3-difluoro-4-((2-hydroxyphenyl)amino)but-1-en-2-yl 4-methylbenzenesulfonate (3ga):

According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 96% yield as a brown oil. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.75 (d, 8.2 Hz, 2H), 7.27 - 7.23 (m, 6H), 6.71 - 6.66 (m, 2H), 6.61 (t, 7.4 Hz, 1H), 6.34 (d, 7.7 Hz, 1H), 5.52 (s, 1H), 5.35 (d, 3.3 Hz, 1H), 4.75 (dd, 15.6 Hz, 9.7 Hz, 1H), 2.41 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 146.0, 145.8 (dd, 33.4 Hz, 29.7 Hz), 144.1, 134.4, 134.2, 133.4, 132.1, 129.9, 129.8, 128.6, 128.5, 121.4, 119.2, 116.6 (t, 250.9 Hz), 114.7, 113.7, 106.0 (t, 4.6 Hz), 59.8 (dd, 28.2 Hz, 24.1 Hz), 21.7; ^{19}F NMR (471 MHz, $CDCl_3$) δ -107.0 (dd, 256.5 Hz, 9.1 Hz, 1F), -114.2 (dd, 256.5 Hz, 15.6 Hz, 1F); IR (KBr): 3420, 1660, 1597, 1514, 1365, 1173, 1088, 1014, 950, 727 cm^{-1}; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{23}H_{21}ClF_2NO_4S$ 480.0848, found 480.0842.



4-(4-bromophenyl)-3,3-difluoro-4-((2-hydroxyphenyl)amino)but-1-en-2-yl 4-methylbenzenesulfonate (3ha):

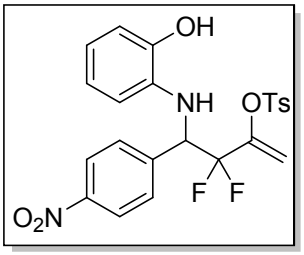
According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 97% yield as a brown oil. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.75 (d, 8.2 Hz, 2H), 7.39 (d, 8.3 Hz, 2H), 7.26 (d, 8.0 Hz, 2H), 7.20 (d, 8.1 Hz, 2H), 6.71 - 6.66 (m, 2H), 6.61 (t, 7.4 Hz, 1H), 6.34 (d, 7.7 Hz, 1H), 5.52 (s, 1H), 5.35 (d, 3.2 Hz, 1H), 4.74 (dd, 15.6 Hz, 9.7 Hz, 1H), 2.41 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 146.0, 145.8 (dd, 33.4 Hz, 29.9 Hz), 144.1, 134.1, 133.9, 132.0, 131.6, 130.1, 129.9, 128.5, 122.7, 121.4, 119.2, 116.5 (t, 250.5 Hz), 114.7, 113.6, 106.0 (t, 4.6 Hz), 59.8 (dd, 28.2 Hz, 24.2 Hz), 21.7; ^{19}F NMR (471 MHz, $CDCl_3$) δ -106.9 (dd, 256.5 Hz, 9.1 Hz, 1F), -114.2 (dd, 256.6 Hz, 15.6 Hz, 1F); IR (KBr): 3420, 1660, 1596, 1514, 1365, 1173, 1076, 1051, 950, 726 cm^{-1}; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{23}H_{21}BrF_2NO_4S$ 524.0343, found 524.0337.



methyl 4-(2,2-difluoro-1-((2-hydroxyphenyl)amino)-3-(tosyloxy)but-3-en-1-yl)benzoate (3ia):

According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 92% yield as a brown solid. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.94 (d, 8.2 Hz, 2H), 7.75 (d, 8.2 Hz, 2H), 7.42 (d, 8.0 Hz, 2H), 7.25 (d, 8.0 Hz, 2H), 6.72 (d, 7.5 Hz, 1H), 6.64 (t, 7.4 Hz, 1H), 6.59 (t, 7.4 Hz, 1H), 6.33 (d, 7.7 Hz, 1H), 5.52 (s, 1H), 5.35 (d, 3.1 Hz, 1H), 4.86 (dd, 15.9 Hz, 9.2 Hz, 1H), 3.88 (s, 3H), 2.40 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 167.0, 146.0, 145.8 (dd, 33.5 Hz, 29.5 Hz), 144.1, 140.3, 134.2, 132.0,

130.2, 129.9, 129.7, 128.6, 128.5, 121.2, 119.1, 116.6 (t, 251.2 Hz), 114.6, 113.2, 106.0 (t, 4.6 Hz), 60.0 (dd, 28.2 Hz, 24.2 Hz), 52.3, 21.7; ^{19}F NMR (471 MHz, $CDCl_3$) δ -106.4 (dd, 257.0 Hz, 8.1 Hz, 1F), -114.4 (dd, 257.0 Hz, 16.0 Hz, 1F); IR (KBr): 3390, 1703, 1600, 1517, 1436, 1371, 1294, 1192, 956, 745 cm^{-1}; mp = 95.1-96.3 ^{o}C; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{25}H_{24}F_2NO_6S$ 504.1292, found 504.1287.



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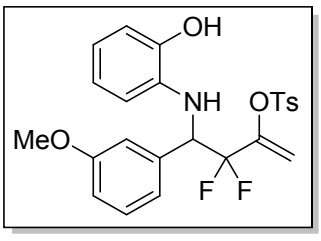
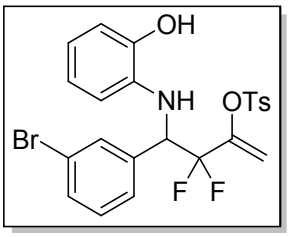
According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 95% yield as a brown solid. ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.12 (d, 8.6 Hz, 2H), 7.75 (d, 8.2 Hz, 2H), 7.53 (d, 8.4 Hz, 2H), 7.28 (d, 8.0 Hz, 2H), 6.73 (d, 7.5 Hz, 1H), 6.67 (t, 7.3 Hz, 1H), 6.63 (t, 7.3 Hz, 1H), 6.29 (d, 7.6 Hz, 1H), 5.56 (s, 1H), 5.41 (d, 3.1 Hz, 1H), 4.92 (dd, 16.1 Hz, 8.5 Hz, 1H), 2.43 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 148.1, 146.2, 145.4 (dd, 33.5 Hz, 29.2 Hz), 143.9, 142.4, 133.8, 132.0, 129.9, 129.5, 128.5, 123.6, 121.5, 119.5 , 116.3 (t, 251.4 Hz), 114.8, 113.3, 106.3 (t, 4.6 Hz), 59.9 (dd, 28.9 Hz, 24.1 Hz), 21.8; ^{19}F NMR (471 MHz, $CDCl_3$) δ -105.8 (dd, 257.8 Hz, 8.2 Hz, 1F), -114.5 (dd, 257.8 Hz, 16.1 Hz, 1F); IR (KBr): 3359, 1664, 1610, 1523, 1365, 1180, 1098, 1057, 946, 745 cm^{-1}; mp = 164.3-165.6 ^{o}C; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{23}H_{21}F_2N_2O_6S$ 491.1088, found 491.1083.



3,3-difluoro-4-((2-hydroxyphenyl)amino)-4-(3-methoxyphenyl)but-1-en-2-yl 4-methylbenzenesulfonate (3ka):

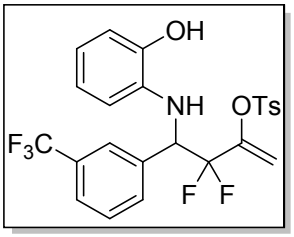
According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained

in 94% yield as a brown oil. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.76 (d, 8.2 Hz, 2H), 7.25 (d, 8.0 Hz, 2H), 7.19 (t, 7.9 Hz, 1H), 6.93 (d, 7.6 Hz, 1H), 6.89 (s, 1H), 6.80 (dd, 8.2 Hz, 1.0 Hz, 1H), 6.69 - 6.65 (m, 2H), 6.59 (t, 7.4 Hz, 1H), 6.41 (d, 7.7 Hz, 1H), 5.49 (s, 1H), 5.34 (d, 3.1 Hz, 1H), 4.73 (dd, 15.6 Hz, 10.1 Hz, 1H), 3.74 (s, 3H), 2.39 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 159.5, 146.1(dd, 35.9 Hz, 29.9 Hz), 145.9, 144.3, 136.5, 134.5, 132.1, 130.0, 129.9, 129.4, 128.4, 121.3, 120.9, 119.1, 116.8 (t, 250.7 Hz), 114.6, 114.2, 113.9, 105.8 (t, 4.6 Hz), 60.3 (dd, 28.0 Hz, 23.9 Hz), 55.2, 21.7; ^{19}F NMR (471 MHz, $CDCl_3$) δ -107.1 (dd, 256.0 Hz, 8.5 Hz, 1F), -113.8 (dd, 255.9 Hz, 15.7 Hz, 1F); IR (KBr): 3418, 1660, 1597, 1513, 1451, 1262, 1174, 1039, 950, 722 cm^{-1}; HRMS (ESI) m/z: $[M+Na]^+$ calcd for $C_{24}H_{23}F_2NO_5SNa$ 498.1163, found 498.1157.



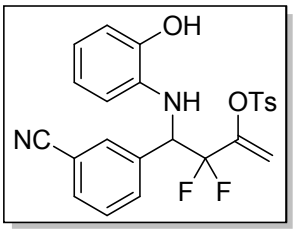
4-(3-bromophenyl)-3,3-difluoro-4-((2-hydroxyphenyl)amino)but-1-en-2-yl 4-methylbenzenesulfonate (3la):

According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 95% yield as a brown oil. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.75 (d, 8.2 Hz, 2H), 7.46 (s, 1H), 7.39 (d, 8.0 Hz, 1H), 7.27 (d, 7.9 Hz, 3H), 7.14 (t, 7.8 Hz, 1H), 6.71 - 6.67 (m, 2H), 6.61 (t, 7.4 Hz, 1H), 6.35 (d, 7.7 Hz, 1H), 5.53 (s, 1H), 5.38 (d, 2.9 Hz, 1H), 4.73 (dd, 16.5 Hz, 8.8 Hz, 1H), 2.41 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 146.1, 145.7 (dd, 34.1 Hz, 31.2 Hz), 144.0, 137.3, 134.1, 132.0, 131.7, 131.5, 130.0, 129.9, 128.5, 127.1, 122.5, 121.4, 119.1, 116.5 (t, 251.0 Hz), 114.7, 113.3, 106.2 (t, 4.5 Hz), 59.7 (dd, 28.7 Hz, 23.9 Hz), 21.7; ^{19}F NMR (471 MHz, $CDCl_3$) δ -105.8 (dd, 257.3 Hz, 8.0 Hz, 1F), -114.8 (dd, 257.3 Hz, 16.5 Hz, 1F); IR (KBr): 3418, 1659, 1513, 1450, 1366, 1191, 1174, 1051, 950, 724 cm^{-1}; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{23}H_{21}BrF_2NO_4S$ 524.0343, found 524.0337.



3,3-difluoro-4-((2-hydroxyphenyl)amino)-4-(3-(trifluoromethyl)phenyl)but-1-en-2-yl 4-methylbenzenesulfonate (3ma):

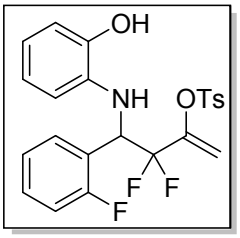
According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 97% yield as a brown oil. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.76 (d, 8.2 Hz, 2H), 7.58 (s, 1H), 7.54 (t, 7.1 Hz, 2H), 7.40 (t, 7.7 Hz, 1H), 7.27 (d, 8.0 Hz, 2H), 6.72 - 6.67 (m, 2H), 6.62 (t, 7.4 Hz, 1H), 6.34 (d, 7.7 Hz, 1H), 5.54 (s, 1H), 5.40 (d, 2.6 Hz, 1H), 4.84 (dd, 16.8 Hz, 8.3 Hz, 1H), 2.41 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 146.2, 145.7 (dd, 34.0 Hz, 31.4 Hz), 144.0, 136.1, 134.1, 132.0, 131.8, 130.8 (q, 35.1 Hz), 130.0, 129.0, 128.5, 125.4 (q, 3.7 Hz), 125.3 (q, 3.6 Hz), 124.0 (q, 272.9 Hz), 121.4, 119.3, 116.5 (t, 251.0 Hz), 114.8, 113.4, 106.32 (t, 4.6 Hz), 59.9 (dd, 29.0 Hz, 23.9 Hz), 21.7; ^{19}F NMR (471 MHz, $CDCl_3$) δ -62.5 (s, 3F), -105.3 (dd, 257.9 Hz, 7.7 Hz, 1F), -115.3 (dd, 257.9 Hz, 16.8 Hz, 1F); IR (KBr): 3500, 1660, 1597, 1514, 1368, 1326, 1170, 1122, 952, 730 cm^{-1}; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{24}H_{21}F_5NO_4S$ 514.1111, found 514.1106.



4-(3-cyanophenyl)-3,3-difluoro-4-((2-hydroxyphenyl)amino)but-1-en-2-yl 4-methylbenzenesulfonate (3na):

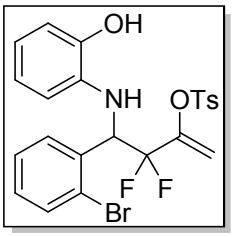
According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 98% yield as a brown solid. ^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 9.65 (s, 1H), 7.88 - 7.83 (m, 3H), 7.74 (dd, 14.0 Hz, 7.8 Hz, 2H), 7.55 - 7.51 (m, 1H), 7.41 (d, 8.0 Hz, 2H), 6.70 (d, 7.5 Hz, 1H), 6.57 - 6.50 (m, 3H), 5.61 (d, 3.3 Hz, 1H), 5.54 (s, 1H), 5.36 - 5.13 (m, 1H), 5.05 (d, 10.4 Hz, 1H), 2.39 (s, 3H); ^{13}C NMR (126 MHz, DMSO-d_6) δ 146.7, 145.7 (dd, 33.6 Hz, 28.4 Hz), 145.2, 137.4, 134.2, 133.8, 132.8, 132.6, 131.7,

130.6, 130.0, 128.8, 120.0, 119.0, 118.8, 117.1 (t, 251.2 Hz), 114.6, 112.7, 111.7, 107.3, 58.2 (dd, 30.2 Hz, 23.2 Hz), 21.7; ^{19}F NMR (471 MHz, DMSO) δ -101.7 (d, 257.4 Hz, 1F), -114.7 (dd, 257.4 Hz, 19.6 Hz, 1F); IR (KBr): 3341, 2360, 2238, 1595, 1516, 1376, 1192, 1087, 958, 779 cm^{-1}; mp = 176.9-178.0 ^{o}C; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{24}H_{21}F_2N_2O_4S$ 471.1190, found 471.1185.



3,3-difluoro-4-(2-fluorophenyl)-4-((2-hydroxyphenyl)amino)but-1-en-2-yl 4-methylbenzenesulfonate (3oa):

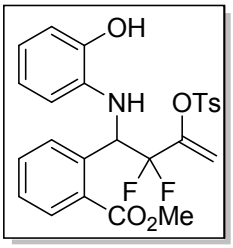
According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 90% yield as a brown oil. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.78 (d, 8.2 Hz, 2H), 7.35 (t, 7.6 Hz, 1H), 7.26 - 7.22 (m, 3H), 7.11 -6.96 (m, 2H), 6.75 - 6.65 (m, 2H), 6.60 (t, 7.3 Hz, 1H), 6.45 (d, 7.8 Hz, 1H), 5.57 (s, 1H), 5.43 (s, 1H), 5.23 (dd, 18.3 Hz, 7.2 Hz, 1H), 2.40 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 161.4 (d, 248.0 Hz), 146.0 (dd, 34.3 Hz, 28.9 Hz), 145.9, 144.2, 134.0, 132.1, 130.2 (d, 8.4 Hz), 130.1, 129.8, 129.2 (d, 2.9 Hz), 128.4, 124.3 (d, 3.4 Hz), 122.1 (d, 13.5 Hz), 121.4, 119.3, 116.6 (t, 250.9 Hz), 115.3 (d, 22.4 Hz), 114.7, 106.1 (t, 4.6 Hz), 53.3 (dd, 28.1 Hz, 23.9 Hz), 21.7; ^{19}F NMR (471 MHz, $CDCl_3$) δ -105.8 (dd, 257.8 Hz, 7.5 Hz, 1F), -115.8 (dd, 257.8 Hz, 18.0 Hz, 1F), -117.6 (d, 5.8 Hz, 1F); IR (KBr): 3501, 1662, 1596, 1488, 1452, 1174, 1091, 1052, 950, 756 cm^{-1}; HRMS (ESI) m/z: $[M+Na]^+$ calcd for $C_{23}H_{20}F_3NO_4SNa$ 486.0963, found 486.0957.



4-(2-bromophenyl)-3,3-difluoro-4-((2-hydroxyphenyl)amino)but-1-en-2-yl 4-methylbenzenesulfonate (3pa):

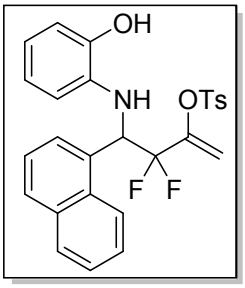
According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained

in 95% yield as a brown oil. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.80 - 7.73 (m, 4H), 7.46 - 7.42 (m, 2H), 7.21 (d, 8.1 Hz, 2H), 6.70 (d, 7.6 Hz, 1H), 6.62 (t, 7.5 Hz, 1H), 6.57 (t, 7.4 Hz, 1H), 6.43 (d, 7.7 Hz, 1H), 5.49 (s, 1H), 5.34 (d, 3.3 Hz, 1H), 4.94 (dd, 15.3 Hz, 10.4 Hz, 1H), 2.37 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 146.0 (dd, 33.4 Hz, 28.2 Hz), 145.9, 144.3, 134.5, 133.3, 133.0, 132.0, 129.8, 128.4, 128.2, 127.6, 126.2, 125.6, 121.2, 119.1, 116.9 (t, 250.4 Hz), 114.6, 113.8, 105.9 (t, 4.5 Hz), 60.6 (dd, 30.4 Hz, 23.2 Hz), 21.7; ^{19}F NMR (471 MHz, $CDCl_3$) δ -107.0 (dd, 255.9 Hz, 9.3 Hz, 1F), -113.3 (dd, 255.8 Hz, 15.4 Hz, 1F); IR (KBr): 3418, 1659, 1597, 1512, 1366, 1174, 1085, 1040, 950, 726 cm^{-1}; HRMS (ESI) m/z: $[M+Na]^+$ calcd for $C_{23}H_{20}BrF_2NO_4SNa$ 546.0162, found 546.0157.



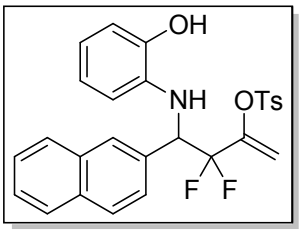
methyl 2-(2,2-difluoro-1-((2-hydroxyphenyl)amino)-3-(tosyloxy)but-3-en-1-yl)benzoate (3qa):

According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 84% yield as a brown solid. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.92 - 7.84 (m, 1H), 7.77 (d, 8.3 Hz, 2H), 7.54 (d, 7.8 Hz, 1H), 7.39 (dd, 11.1 Hz, 4.1 Hz, 1H), 7.30 (t, 7.6 Hz, 1H), 7.21 (d, 8.1 Hz, 2H), 6.68 (t, 6.8 Hz, 2H), 6.63 - 6.43 (m, 3H), 5.56 - 5.48 (m, 1H), 5.39 (s, 1H), 3.95 (s, 3H), 2.36 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 168.3, 146.3 (dd, 34.1 Hz, 28.7 Hz), 145.7, 143.6, 135.9, 134.4, 132.1, 132.0, 131.5, 130.5, 129.7, 128.6, 128.2, 128.1, 121.5, 118.4, 116.7 (t, 250.6 Hz), 114.5, 113.2, 105.5 (t, 4.6 Hz), 53.8 (dd, 30.2 Hz, 22.4 Hz), 52.4, 21.7; ^{19}F NMR (471 MHz, $CDCl_3$) δ -104.0 (d, 259.7 Hz, 1F), -116.8 (dd, 259.7 Hz, 20.2 Hz, 1F); IR (KBr): 3580, 1713, 1673, 1597, 1360, 1178, 1089, 1070, 950, 743 cm^{-1}; mp = 84.7-86.0 ^{o}C; HRMS (ESI) m/z: $[M+Na]^+$ calcd for $C_{25}H_{23}F_2NO_6SNa$ 526.1112, found 526.1106.



3,3-difluoro-4-((2-hydroxyphenyl)amino)-4-(naphthalen-1-yl)but-1-en-2-yl 4-methylbenzenesulfonate (3ra):

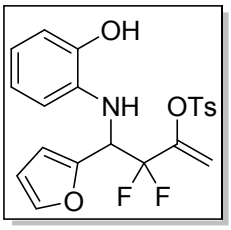
According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 83% yield as a brown oil. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.79 (d, 8.2 Hz, 2H), 7.51 (d, 7.6 Hz, 1H), 7.40 (d, 7.8 Hz, 1H), 7.25 (d, 8.0 Hz, 2H), 7.20 (t, 7.4 Hz, 1H), 7.10 (t, 7.3 Hz, 1H), 6.71 - 6.66 (m, 2H), 6.58 (t, 7.5 Hz, 1H), 6.39 (d, 7.8 Hz, 1H), 5.62 (s, 1H), 5.55 - 5.40 (m, 2H), 2.39 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 146.4, 146.0 (dd, 35.4 Hz, 28.9 Hz), 145.9, 143.7, 134.4, 134.0, 132.8, 132.1, 130.1, 130.0, 129.8, 129.3, 128.6, 128.5, 128.4, 127.7, 125.9, 121.5, 118.9, 116.6 (t, 250.9 Hz), 114.6, 113.2, 106.2 (t, 4.6 Hz), 57.8 (dd, 31.1 Hz, 22.2 Hz), 21.8; ^{19}F NMR (471 MHz, $CDCl_3$) δ -103.8 (d, 260.2 Hz, 1F), -117.9 (dd, 260.1 Hz, 20.4 Hz, 1F); IR (KBr): 3418, 1661, 1514, 1449, 1366, 1174, 1087, 1042, 950, 727 cm^{-1}; HRMS (ESI) m/z: $[M+Na]^+$ calcd for $C_{27}H_{23}F_2NO_4SNa$ 518.1214, found 518.1208.



3,3-difluoro-4-((2-hydroxyphenyl)amino)-4-(naphthalen-2-yl)but-1-en-2-yl 4-methylbenzenesulfonate (3sa):

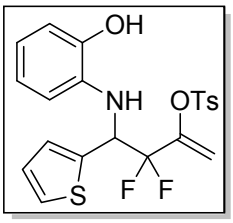
According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 86% yield as a brown oil. ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.02 (d, 8.0 Hz, 1H), 7.89 - 7.82 (m, 1H), 7.77 (d, 8.2 Hz, 3H), 7.63 (d, 7.2 Hz, 1H), 7.56 - 7.44 (m, 2H), 7.43 - 7.35 (m, 1H), 7.23 (t, 6.3 Hz, 2H), 6.76 - 6.61 (m, 1H), 6.60 - 6.45 (m, 2H), 6.32 - 6.18 (m, 1H), 5.76 (dd, 18.7 Hz, 4.7 Hz, 1H), 5.55 (s, 1H), 5.46 (s, 1H), 2.38 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 146.3 (dd, 35.3 Hz, 28.5 Hz), 145.9, 143.9, 134.4,

133.7, 132.5, 132.2, 130.7, 129.9, 129.1, 129.0, 128.5, 126.5, 125.8, 125.6, 125.3, 122.7, 121.4, 118.7, 117.0 (t, 250.9 Hz), 114.6, 113.1, 106.0 (d, 4.5 Hz), 50.5 (dd, 30.2 Hz, 24.1 Hz), 21.7; ^{19}F NMR (471 MHz, $CDCl_3$) δ -103.5 (d, 259.3 Hz, 1F), -116.1 (d, 259.7 Hz, 1F); IR (KBr): 3418, 1661, 1597, 1512, 1367, 1174, 1083, 1041, 950, 718 cm^{-1}; HRMS (ESI) m/z: $[M+Na]^+$ calcd for $C_{27}H_{23}F_2NO_4SNa$ 518.1214, found 518.1208.



3,3-difluoro-4-(furan-2-yl)-4-((2-hydroxyphenyl)amino)but-1-en-2-yl 4-methylbenzenesulfonate (3ta):

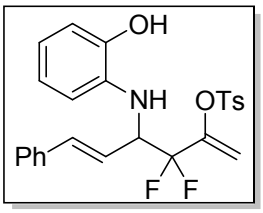
According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 96% yield as a brown oil. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.77 (d, 8.2 Hz, 2H), 7.34 (s, 1H), 7.28 (d, 8.0 Hz, 2H), 6.79 - 6.64 (m, 3H), 6.56 (d, 7.3 Hz, 1H), 6.35 - 6.22 (m, 2H), 5.51 (d, 2.0 Hz, 1H), 5.39 (d, 3.4 Hz, 1H), 4.84 (dd, 14.4 Hz, 10.6 Hz, 1H), 2.41 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 148.1, 146.0, 145.9 (dd, 33.8 Hz, 28.9 Hz), 145.4, 142.9, 133.8, 132.0, 129.9, 128.5, 121.1, 120.6, 116.2 (t, 251.4 Hz), 115.5, 114.9, 110.5, 109.9, 106.0 (t, 4.6 Hz), 55.5 (dd, 28.9 Hz, 25.1 Hz), 21.7; ^{19}F NMR (471 MHz, $CDCl_3$) δ -108.1 (dd, 254.8 Hz, 10.2 Hz, 1F), -112.6 (dd, 254.8 Hz, 14.6 Hz, 1F); IR (KBr): 3501, 1597, 1514, 1450, 1366, 1174, 1083, 1040, 950, 734 cm^{-1}; HRMS (ESI) m/z: $[M+Na]^+$ calcd for $C_{21}H_{19}F_2NO_5SNa$ 458.0850, found 458.0844.



3,3-difluoro-4-((2-hydroxyphenyl)amino)-4-(thiophen-2-yl)but-1-en-2-yl 4-methylbenzenesulfonate (3ua):

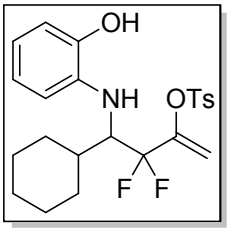
According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 92% yield as a brown oil. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.77 (d, 8.2 Hz, 2H), 7.27

(d, 8.0 Hz, 2H), 7.24 - 7.20 (m, 1H), 7.03 (d, 2.8 Hz, 1H), 6.92 (dd, 4.8 Hz, 3.8 Hz, 1H), 6.73 - 6.67 (m, 3H), 6.54 (d, 7.6 Hz, 1H), 5.52 (d, 1.7 Hz, 1H), 5.40 (d, 3.3 Hz, 1H), 5.04 (dd, 15.0 Hz, 10.1 Hz, 1H), 2.41 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 146.0, 145.9 (dd, 33.0 Hz, 30.0 Hz), 144.8, 138.1, 134.1, 132.1, 129.9, 128.5, 127.4, 126.9, 126.1, 121.3, 120.0, 116.4 (t, 251.1 Hz), 114.8, 114.6, 106.2 (t, 4.5 Hz), 56.9 (dd, 29.0 Hz, 25.3 Hz), 21.8; ^{19}F NMR (471 MHz, $CDCl_3$) δ -107.3 (dd, 254.8 Hz, 9.7 Hz, 1F), -113.8 (dd, 254.7 Hz, 15.1 Hz, 1F); IR (KBr): 3501, 1661, 1597, 1512, 1450, 1365, 1174, 1083, 950, 707 cm^{-1}; HRMS (ESI) m/z: $[M+Na]^+$ calcd for $C_{21}H_{19}F_2NO_4S_2Na$ 474.0621, found 474.0616.



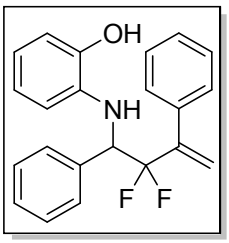
(*E*)-3,3-difluoro-4-((2-hydroxyphenyl)amino)-6-phenylhexa-1,5-dien-2-yl 4-methylbenzenesulfonate (3va):

According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 94% yield as a brown oil. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.77 (d, 8.2 Hz, 2H), 7.30 - 7.22 (m, 7H), 6.80 - 6.71 (m, 2H), 6.70 - 6.57 (m, 3H), 6.08 (dd, 15.9 Hz, 6.6 Hz, 1H), 5.55 (s, 1H), 5.46 (d, 3.5 Hz, 1H), 4.51 - 4.33 (m, 1H), 2.39 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 146.2 (t, 31.4 Hz), 145.9, 144.6, 136.0, 134.8, 134.5, 132.2, 129.9, 128.5, 128.4, 128.1, 126.7, 122.2, 121.3, 119.5, 117.1 (t, 250.4 Hz), 114.8, 114.5, 106.0 (t, 4.6 Hz), 58.9 (dd, 27.6 Hz, 25.3 Hz), 21.7; ^{19}F NMR (471 MHz, $CDCl_3$) δ -108.7 (dd, 254.8 Hz, 10.3 Hz, 1F), -112.5 (dd, 254.8 Hz, 13.6 Hz, 1F); IR (KBr): 3419, 1660, 1596, 1514, 1449, 1366, 1175, 1082, 950, 734 cm^{-1}; HRMS (ESI) m/z: $[M+Na]^+$ calcd for $C_{25}H_{23}F_2NO_4SNa$ 494.1214, found 494.1208.



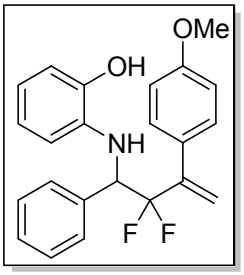
4-cyclohexyl-3,3-difluoro-4-((2-hydroxyphenyl)amino)but-1-en-2-yl 4-methylbenzenesulfonate (3wa):

According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 92% yield as a brown oil. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.77 (d, 8.2 Hz, 2H), 7.30 (d, 8.0 Hz, 2H), 6.76 (s, 1H), 6.66 (s, 1H), 6.55 (s, 2H), 5.44 (s, 1H), 5.39 (d, 3.3 Hz, 1H), 5.06 (s, 1H), 4.21 (s, 1H), 3.69 (s, 1H), 2.42 (s, 3H), 1.83 - 1.49 (m, 7H), 1.30 - 0.96 (m, 6H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 147.1 (t, 32.1 Hz), 145.8, 142.6, 136.9, 132.4, 129.9, 128.5, 121.6, 118.4 (t, 251.4 Hz), 114.7, 111.9, 105.3 (d, 4.6 Hz), 59.5 (t, 24.4 Hz), 38.4, 31.2, 26.8, 26.3, 26.0, 25.9, 21.7; ^{19}F NMR (471 MHz, $CDCl_3$) δ -108.3 (s, 2F); IR (KBr): 3502, 2926, 2853, 1609, 1521, 1365, 1174, 1088, 947, 729 cm^{-1}; HRMS (ESI) m/z: $[M+Na]^+$ calcd for $C_{23}H_{27}F_2NO_4SNa$ 474.1527, found 474.1521.



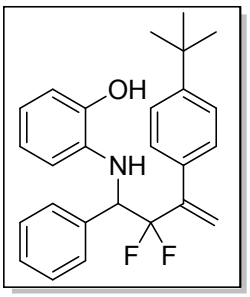
2-((2,2-difluoro-1,3-diphenylbut-3-en-1-yl)amino)phenol (3cb):

According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 97% yield as a brown oil. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.36 - 7.26 (m, 10H), 6.65 (d, 3.1 Hz, 1H), 6.57 (d, 3.8 Hz, 2H), 6.23 - 6.14 (m, 1H), 5.74 (s, 1H), 5.47 (s, 1H), 4.59 (dd, 14.4 Hz, 11.3 Hz, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 144.4, 143.3 (t, 22.2 Hz), 136.7, 135.9, 134.6, 128.6, 128.5, 128.4, 128.3, 128.2, 128.1, 121.2, 121.0 (t, 250.9 Hz), 120.3 (t, 8.8 Hz), 119.1, 114.5, 114.3, 61.9 (dd, 27.6 Hz, 25.1 Hz); ^{19}F NMR (471 MHz, $CDCl_3$) δ -101.8 (d, 250.7 Hz, 1F), -107.6 (dd, 250.3 Hz, 12.5 Hz, 1F); IR (KBr): 3418, 2923, 1610, 1511, 1450, 1265, 1170, 1025, 848, 695 cm^{-1}; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{22}H_{20}F_2NO$ 352.1513, found 352.1508.



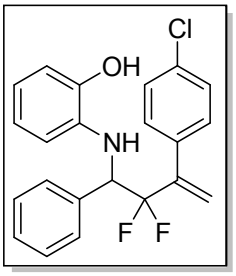
2-((2,2-difluoro-3-(4-methoxyphenyl)-1-phenylbut-3-en-1-yl)amino)phenol (3cc):

According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 96% yield as a brown oil. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.30 - 7.25 (m, 7H), 6.85 (d, 8.6 Hz, 2H), 6.65 (d, 6.8 Hz, 1H), 6.56 (t, 6.2 Hz, 2H), 6.21 (d, 7.2 Hz, 1H), 5.66 (s, 1H), 5.41 (s, 1H), 4.65 - 4.55 (m, 1H), 3.80 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 159.6, 144.3, 142.6 (t, 22.2 Hz), 136.0, 134.8, 129.7, 129.0, 128.6, 128.1 (2C), 121.2, 121.1 (t, 250.2 Hz), 119.3 (t, 8.8 Hz), 118.8, 114.4, 113.9, 113.8, 61.8 (dd, 27.6 Hz, 25.1 Hz), 55.3; ^{19}F NMR (471 MHz, $CDCl_3$) δ -102.5 (dd, 249.5 Hz, 8.6 Hz, 1F), -107.3 (dd, 249.5 Hz, 13.6 Hz, 1F); IR (KBr): 3417, 2960, 1607, 1510, 1451, 1246, 1173, 1026, 835, 727 cm^{-1}; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{23}H_{22}F_2NO_2$ 382.1619, found 382.1613.



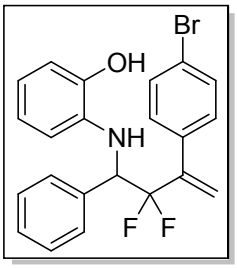
2-((3-(4-(tert-butyl)phenyl)-2,2-difluoro-1-phenylbut-3-en-1-yl)amino)phenol (3cd):

According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 89% yield as a brown oil. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.41 - 7.19 (m, 9H), 6.65 (d, 3.8 Hz, 1H), 6.61 - 6.44 (m, 2H), 6.27 - 6.04 (m, 1H), 5.68 (s, 1H), 5.46 (s, 1H), 4.64 (dd, 13.7 Hz, 11.8 Hz, 1H), 1.33 (s, 9H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 151.4, 144.5 , 143,0 (t, 22.3 Hz), 136.0, 134.7, 133.6, 128.6, 128.1, 128.0, 125.7, 125.3, 121.1, 121.0 (t, 249.5 Hz), 119.8 (t, 8.9 Hz), 118.9, 114.4, 114.2, 61.9 (dd, 30.3 Hz, 24.7 Hz), 34.6, 31.3; ^{19}F NMR (471 MHz, $CDCl_3$) δ -101.8 (dd, 249.5 Hz, 9.1 Hz, 1F), -107.2 (dd, 249.5 Hz, 14.0 Hz, 1F); IR (KBr): 3419, 2962, 1610, 1510, 1452, 1267, 1173, 1030, 907, 732 cm^{-1}; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{26}H_{28}F_2NO$ 408.2139, found 408.2134.



2-((3-(4-chlorophenyl)-2,2-difluoro-1-phenylbut-3-en-1-yl)amino)phenol (3ce):

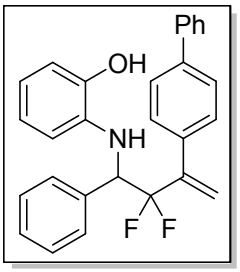
According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 96% yield as a brown oil. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.27 (s, 9H), 6.65 (d, 6.6 Hz, 1H), 6.58 (t, 6.2 Hz, 2H), 6.22 (d, 7.0 Hz, 1H), 5.75 (s, 1H), 5.45 (s, 1H), 4.56 (dd, 14.2 Hz, 11.5 Hz, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 144.3, 142.4 (t, 22.7 Hz), 135.7, 135.1, 134.5, 129.9, 128.9, 128.6, 128.5, 128.3, 128.2, 121.3, 120.8 (t, 250.2 Hz), 120.7 (t, 8.7 Hz), 118.8, 114.4, 114.1, 61.9 (dd, 28.1 Hz, 24.8 Hz); ^{19}F NMR (471 MHz, $CDCl_3$) δ -101.9 (dd, 250.9 Hz, 8.8 Hz, 1F), -107.8 (dd, 250.9 Hz, 14.6 Hz, 1F); IR (KBr): 3418, 2921, 1610, 1512, 1451, 1265, 1172, 1087, 834, 731 cm^{-1}; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{22}H_{19}ClF_2NO$ 386.1123, found 386.1118.



2-((3-(4-bromophenyl)-2,2-difluoro-1-phenylbut-3-en-1-yl)amino)phenol (3cf):

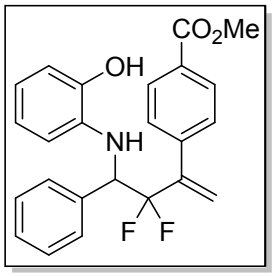
According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 92% yield as a brown oil. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.44 (d, 8.4 Hz, 2H), 7.27 (s, 5H), 7.20 (d, 8.3 Hz, 2H), 6.66 (d, 7.1 Hz, 1H), 6.61 - 6.55 (m, 2H), 6.22 (d, 7.7 Hz, 1H), 5.76 (s, 1H), 5.46 (s, 1H), 4.56 (dd, 14.8 Hz, 11.0 Hz, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 144.2, 142.4 (t, 22.6 Hz), 135.7, 135.6, 134.5, 131.6, 130.2, 128.6, 128.3, 128.2, 122.8, 121.3, 120.8 (t, 8.6 Hz), 120.6 (t, 251.7 Hz), 119.1, 114.4, 114.1, 61.8 (dd, 28.1 Hz, 24.7 Hz); ^{19}F NMR (471 MHz, $CDCl_3$) δ -101.9 (dd, 251.0 Hz, 8.8 Hz, 1F), -107.8 (dd, 250.9 Hz, 14.7 Hz, 1F); IR (KBr): 3419, 1610, 1511, 1451, 1266,

1172, 1070, 1030, 906, 729 cm^{-1}; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{22}H_{19}BrF_2NO$ 430.0618, found 430.0613.



2-((3-([1,1'-biphenyl]-4-yl)-2,2-difluoro-1-phenylbut-3-en-1-yl)amino)phenol (3cg):

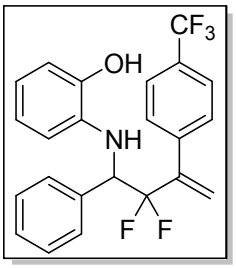
According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 95% yield as a brown oil. ^1H NMR (500 MHz, $CDCl_3$) δ 7.63 - 7.58 (m, 2H), 7.55 (d, 8.4 Hz, 2H), 7.44 (dd, 12.4 Hz, 7.8 Hz, 4H), 7.35 (dd, 10.5 Hz, 4.2 Hz, 1H), 7.33 - 7.23 (m, 5H), 6.73 - 6.62 (m, 1H), 6.57 (d, 3.9 Hz, 2H), 6.30 - 6.17 (m, 1H), 5.75 (s, 1H), 5.52 (s, 1H), 4.69 - 4.61 (m, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 144.5, 142.9 (t, 22.4 Hz), 141.2, 140.4, 135.9, 135.6, 134.6, 128.9, 128.8, 128.6, 128.2, 127.6, 127.4, 127.1, 127.0, 121.3, 121.1 (t, 249.6 Hz), 120.3 (t, 8.7 Hz), 119.1, 114.5, 114.4, 62.0 (dd, 28.0 Hz, 24.8 Hz); ^{19}F NMR (471 MHz, $CDCl_3$) δ -102.0 (d, 250.2 Hz, 1F), -107.1 (dd, 250.1 Hz, 13.1 Hz, 1F); IR (KBr): 3418, 3031, 1610, 1512, 1450, 1265, 1172, 1031, 906, 721 cm^{-1}; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{28}H_{24}F_2NO$ 428.1826, found 428.1821.



methyl 4-(3,3-difluoro-4-((2-hydroxyphenyl)amino)-4-phenylbut-1-en-2-yl)benzoate (3ch):

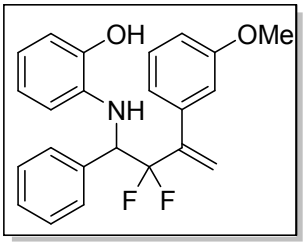
According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 96% yield as a brown oil. ^1H NMR (500 MHz, $CDCl_3$) δ 7.99 (d, 8.3 Hz, 2H), 7.42 (d, 8.2 Hz, 2H), 7.27 - 7.25 (m, 5H), 6.68 (d, 6.5 Hz, 1H), 6.55 (t, 6.1 Hz, 2H), 6.18 (d,

6.9 Hz, 1H), 5.83 (s, 1H), 5.53 (s, 1H), 4.59 (dd, 14.8 Hz, 10.8 Hz, 1H), 3.92 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 167.1, 144.2, 142.8 (t, 22.7 Hz), 141.4, 135.7, 134.7, 129.9, 129.7, 128.6, 128.5, 128.3, 128.2, 121.4 (t, 8.6 Hz), 121.1, 120.8 (t, 249.1 Hz), 118.7, 114.4, 113.4, 61.8 (t, 28.1 Hz), 52.3; ^{19}F NMR (471 MHz, $CDCl_3$) δ -101.1 (d, 251.5 Hz, 1F), -107.7 (dd, 251.5 Hz, 14.4 Hz, 1F); IR (KBr): 3417, 1699, 1609, 1513, 1437, 1276, 1180, 1034, 907, 727 cm^{-1}; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{24}H_{22}F_2NO_3$ 410.1568, found 410.1562.



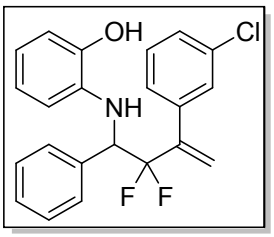
2-((2,2-difluoro-1-phenyl-3-(4-(trifluoromethyl)phenyl)but-3-en-1-yl)amino)phenol (3ci):

According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 87% yield as a brown oil. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.56 (d, 8.1 Hz, 2H), 7.43 (d, 8.1 Hz, 2H), 7.27 (s, 5H), 6.66 (s, 1H), 6.61 - 6.50 (m, 2H), 6.21 (dd, 7.0 Hz, 2.0 Hz, 1H), 5.84 (s, 1H), 5.52 (s, 1H), 4.56 (dd, 15.2 Hz, 10.5 Hz, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 144.2, 142.6 (t, 22.8 Hz), 140.3, 135.6, 134.4, 130.5 (q, 32.6 Hz), 128.9, 128.6, 128.4, 128.3, 125.3 (q, 3.6 Hz), 124.0 (q, 294.3 Hz), 123.0, 121.7 (t, 8.6 Hz), 120.7 (t, 251.7 Hz), 119.2, 114.5, 114.1, 62.0 (dd, 28.2 Hz, 24.8 Hz); ^{19}F NMR (471 MHz, $CDCl_3$) δ -62.7 (s, 3F), -101.3 (dd, 251.7 Hz, 7.5 Hz, 1F), -107.7 (dd, 251.6 Hz, 14.9 Hz, 1F); IR (KBr): 3419, 1612, 1512, 1452, 1323, 1166, 1121, 1064, 848, 730 cm^{-1}; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{23}H_{19}F_5NO$ 420.1387, found 420.1381.



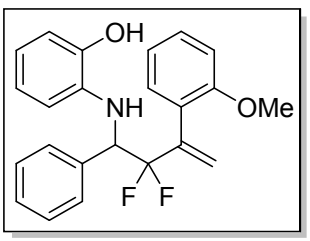
2-((2,2-difluoro-3-(3-methoxyphenyl)-1-phenylbut-3-en-1-yl)amino)phenol (3cj):

According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 95% yield as a brown oil. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.33 - 7.19 (m, 6H), 6.95 (d, 7.6 Hz, 1H), 6.88 (dd, 11.6 Hz, 3.1 Hz, 2H), 6.64 (d, 6.3 Hz, 1H), 6.56 (s, 2H), 6.21 (d, 7.0 Hz, 1H), 5.75 (s, 1H), 5.48 (s, 1H), 4.66 - 4.53 (m, 1H), 3.70 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 159.4, 144.3, 143.2 (t, 22.2 Hz), 138.0, 135.9, 134.7, 129.4, 128.7, 128.3, 128.2, 121.3, 121.0, 120.9 (t, 245.3 Hz), 120.32 (t, 8.8 Hz), 119.0, 114.4, 114.3, 114.2, 113.9, 61.8 (dd, 28.0 Hz, 24.9 Hz), 55.2; ^{19}F NMR (471 MHz, $CDCl_3$) δ -101.3 (d, 250.1 Hz, 1F), -108.1 (dd, 250.2 Hz, 14.6 Hz, 1F); IR (KBr): 3417, 3033, 1598, 1512, 1451, 1234, 1170, 1031, 906, 721 cm^{-1}; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{23}H_{22}F_2NO_2$ 382.1619, found 382.1613.



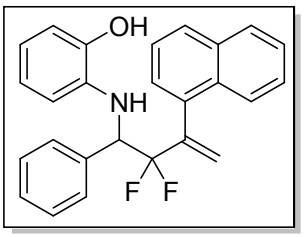
2-((3-(3-chlorophenyl)-2,2-difluoro-1-phenylbut-3-en-1-yl)amino)phenol (3ck):

According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 94% yield as a brown oil. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.34 - 7.17 (m, 9H), 6.65 (d, 6.6 Hz, 1H), 6.58 (t, 6.6 Hz, 2H), 6.23 (d, 7.1 Hz, 1H), 5.77 (s, 1H), 5.47 (s, 1H), 4.58 (dd, 14.2 Hz, 11.4 Hz, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 144.2, 142.3 (t, 22.8 Hz), 138.4, 135.6, 134.5, 134.3, 129.6, 128.7, 128.6, 128.5, 128.4, 128.3, 126.6, 121.3, 121.2 (t, 8.7 Hz), 120.7 (t, 250.7 Hz), 119.1, 114.5, 114.1, 62.0 (t, 27.1 Hz); ^{19}F NMR (471 MHz, $CDCl_3$) δ -101.4 (dd, 251.3 Hz, 7.2 Hz, 1F), -107.5 (dd, 251.2 Hz, 14.5 Hz, 1F); IR (KBr): 3419, 3063, 1610, 1511, 1451, 1265, 1174, 1031, 906, 728 cm^{-1}; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{22}H_{19}ClF_2NO$ 386.1123, found 386.1118.



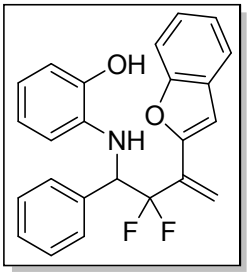
2-((2,2-difluoro-3-(2-methoxyphenyl)-1-phenylbut-3-en-1-yl)amino)phenol (3cl):

According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 95% yield as a brown oil. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.37 (d, 6.8 Hz, 2H), 7.32 - 7.22 (m, 4H), 7.18 (d, 7.5 Hz, 1H), 6.90 (td, 7.5, 0.7 Hz, 1H), 6.84 (d, 8.2 Hz, 1H), 6.68 (s, 1H), 6.58 (s, 2H), 6.27 (s, 1H), 5.92 (d, 1.9 Hz, 1H), 5.48 (s, 1H), 4.69 - 4.58 (m, 1H), 3.57 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 157.0, 144.9, 140.0 (t, 24.6 Hz), 136.0, 134.8, 131.1, 129.6, 128.9, 128.1 (2C), 125.7, 122.4 (t, 7.9 Hz), 121.2, 121.0 (t, 249.8 Hz), 120.3, 119.2, 114.6, 114.5, 110.9, 61.9 (dd, 29.6 Hz, 26.7 Hz), 55.3; ^{19}F NMR (471 MHz, $CDCl_3$) δ -97.3 (d, 249.4 Hz, 1F), -110.6 (dd, 249.3 Hz, 18.2 Hz, 1F); IR (KBr): 3397, 3032, 1597, 1514, 1492, 1242, 1170, 1024, 907, 727 cm^{-1}; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{23}H_{22}F_2NO_2$ 382.1619, found 382.1613.



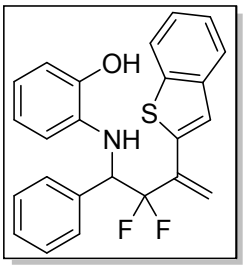
2-((2,2-difluoro-3-(naphthalen-1-yl)-1-phenylbut-3-en-1-yl)amino)phenol (3cm):

According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 95% yield as a brown oil. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.95 (d, 8.4 Hz, 1H), 7.84 - 7.75 (m, 2H), 7.48 - 7.12 (m, 9H), 6.64 (s, 1H), 6.54 (s, 2H), 6.19 (d, 2.1 Hz, 1H), 6.14 (s, 1H), 5.54 (s, 1H), 4.60 (d, 19.2 Hz, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 143.8, 141.8 (t, 24.2 Hz), 135.6, 134.4, 134.2, 134.1, 133.6, 132.4, 128.8, 128.7, 128.2 (2C), 128.0, 127.1, 126.2, 125.9, 124.9, 122.8 (t, 8.1 Hz), 121.4, 120.6 (t, 250.8 Hz), 118.5, 114.4, 113.5, 61.0 (dd, 31.2 Hz, 24.3 Hz); IR (KBr): 3419, 3059, 1610, 1511, 1451, 1264, 1167, 1037, 906, 726 cm^{-1}; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{26}H_{22}F_2NO$ 402.1669, found 402.1664.



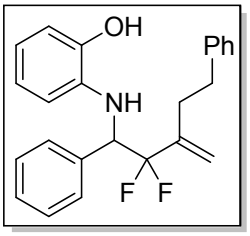
2-((3-(benzofuran-2-yl)-2,2-difluoro-1-phenylbut-3-en-1-yl)amino)phenol (3cn):

According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 93% yield as a brown solid. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.55 (d, 7.7 Hz, 1H), 7.44 (d, 8.2 Hz, 1H), 7.36 (d, 6.7 Hz, 2H), 7.31 - 7.25 (m, 4H), 7.21 (t, 7.5 Hz, 1H), 6.85 (s, 1H), 6.67 (d, 6.8 Hz, 1H), 6.61 (dd, 17.6 Hz, 7.5 Hz, 2H), 6.40 (d, 7.3 Hz, 1H), 6.11 (s, 1H), 5.58 (s, 1H), 4.99 (t, 12.4 Hz, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 154.5, 150.7, 144.6, 135.9, 134.8, 132.9 (t, 25.8 Hz), 128.6, 128.5 (2C), 128.4, 125.3, 123.1, 121.6, 121.3, 120.5 (t, 250.9 Hz), 119.3, 119.0 (t, 8.2 Hz), 114.6, 114.3, 111.1, 106.0 (t, 3.2 Hz), 63.1 (t, 26.0 Hz); ^{19}F NMR (471 MHz, $CDCl_3$) δ -104.8 (dd, 251.2 Hz, 11.4 Hz, 1F), -105.5 (dd, 251.2 Hz, 11.8 Hz, 1F); IR (KBr): 3272, 1614, 1593, 1515, 1450, 1254, 1164, 1032, 941, 742 cm^{-1}; mp = 140.6-141.5 ^{o}C; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{24}H_{20}F_2NO_2$ 392.1462, found 392.1457.



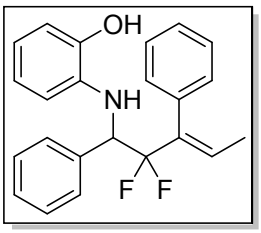
2-((3-(benzo[b]thiophen-2-yl)-2,2-difluoro-1-phenylbut-3-en-1-yl)amino)phenol (3co):

According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 92% yield as a brown solid. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.82 - 7.67 (m, 2H), 7.41 (s, 1H), 7.34 - 7.32 (m, 4H), 7.28 - 7.25 (m , 3H), 6.66 (dd, 6.8 Hz, 2.0 Hz, 1H), 6.60 - 6.55 (m, 8.1 Hz, 2H), 6.33 (dd, 7.1 Hz, 1.9 Hz, 1H), 5.72 (s, 1H), 5.59 (s, 1H), 4.92 (t, 12.6 Hz, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 144.5, 140.1, 139.3, 138.1, 136.6 (t, 24.6 Hz), 135.9, 134.7, 128.5, 128.4, 128.3, 125.2, 124.6, 124.1, 123.8, 122.0, 121.2, 120.9 (t, 8.5 Hz), 120.8 (t, 251.2 Hz), 119.2, 114.5, 114.4, 62.5 (t, 25.5 Hz); ^{19}F NMR (471 MHz, $CDCl_3$) δ -105.2 (d, 11.5 Hz, 2F); IR (KBr): 3305, 3061, 1614, 1515, 1452, 1249, 1165, 1104, 922, 788 cm^{-1}; mp = 108.2-108.9 ^{o}C; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{24}H_{20}F_2NOS$ 408.1234, found 408.1228.



2-((2,2-difluoro-3-methylene-1,5-diphenylpentyl)amino)phenol (3cp):

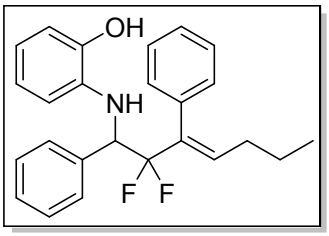
According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 90% yield as a brown oil. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.40 (d, 6.9 Hz, 2H), 7.35 - 7.28 (m, 3H), 7.28 - 7.21 (m, 2H), 7.17 (t, 7.3 Hz, 1H), 7.10 (d, 7.0 Hz, 2H), 6.73 - 6.64 (m, 2H), 6.61 (td, 7.5 Hz, 1.3 Hz, 1H), 6.43 (dd, 7.7 Hz, 1.2 Hz, 1H), 5.49 (s, 1H), 5.24 (s, 1H), 4.70 - 4.63 (m, 1H), 2.81 - 2.66 (m, 2H), 2.39 - 2.24 (m, 2H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 144.5, 142.7 (t, 22.9 Hz), 141.1, 136.1, 134.8, 128.6, 128.4 (3C), 128.3, 126.1, 121.6 (t, 248.0 Hz), 121.4, 119.2, 116.6 (t, 8.5 Hz), 114.5, 114.4, 62.6 (dd, 28.7 Hz, 26.0 Hz), 34.0, 32.4; ^{19}F NMR (471 MHz, $CDCl_3$) δ -104.6 (dd, 245.7 Hz, 9.8 Hz, 1F), -108.5 (dd, 245.7 Hz, 14.3 Hz, 1F); IR (KBr): 3541, 2932, 1610, 1515, 1450, 1267, 1144, 1107, 926, 743 cm^{-1}; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{24}H_{24}F_2NO$ 380.1826, found 380.1821.



(*E*)-2-((2,2-difluoro-1,3-diphenylpent-3-en-1-yl)amino)phenol (3cq):

According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 92% yield as a brown oil. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.31 - 7.30 (m, 5H), 7.29 - 7.22 (m, 3H), 7.17 (s, 2H), 6.65 (d, 6.7 Hz, 1H), 6.56 (t, 7.6 Hz, 2H), 6.41 - 6.28 (m, 1H), 6.18 (d, 7.2 Hz, 1H), 4.44 (dd, 18.1 Hz, 7.5 Hz, 1H), 1.63 - 1.31 (m, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 144.1, 136.1, 136.0 (t, 21.7 Hz), 134.8, 134.6, 130.2, 129.5 (t, 9.6 Hz), 128.8, 128.4, 128.2, 128.1, 127.9, 121.4, 121.0 (t, 249.5 Hz), 118.8, 114.5, 114.0, 61.5 (dd, 31.7 Hz, 25.1 Hz), 14.5; ^{19}F NMR (471 MHz, $CDCl_3$) δ -98.1 (d, 246.4 Hz, 1F), -112.0 (dd, 246.3 Hz, 17.8 Hz, 1F); IR (KBr): 3421, 2928, 1610,

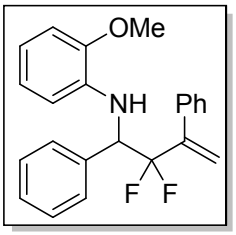
1512, 1453, 1268, 1167, 1035, 849, 697 cm^{-1}; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{23}H_{22}F_2NO$ 366.1669, found 366.1664.



(*E*)-2-((2,2-difluoro-1,3-diphenylhept-3-en-1-yl)amino)phenol (3cr):

According to the general procedure of the *gem*-difluoroallylboration of imines for the synthesis of racemic *gem*-difluorohomoallyl amines, the title compound was obtained in 90% yield as a brown oil. ^1H NMR (500 MHz, $CDCl_3$) δ 7.36 - 7.24 (m, 8H), 7.16 (d, 3.4 Hz, 2H), 6.66 (d, 6.3 Hz, 1H), 6.57 (t, 6.5 Hz, 2H), 6.24 (td, 7.5 Hz, 2.8 Hz, 1H), 6.19 (d, 6.9 Hz, 1H), 4.98 (s, 1H), 4.64 (s, 1H), 4.42 (dd, 17.6 Hz, 7.6 Hz, 1H), 1.90 - 1.84 (m, 2H), 1.41 - 1.28 (m, 2H), 0.79 (t, 7.4 Hz, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 144.1, 136.1, 135.2 - 134.7 (4C), 130.1, 128.8, 128.3, 128.2, 128.1, 127.8, 121.4, 120.9 (t, 246.8 Hz), 118.7, 114.4, 113.9, 61.4 (dd, 30.6 Hz, 24.9 Hz), 30.6, 22.3, 13.6; ^{19}F NMR (471 MHz, $CDCl_3$) δ -98.7 (d, 245.5 Hz, 1F), -111.6 (dd, 245.4 Hz, 17.3 Hz, 1F); IR (KBr): 3418, 1610, 1523, 1453, 1268, 1172, 1086, 1027, 848, 708 cm^{-1}; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{25}H_{26}F_2NO$ 394.1982, found 394.1977.

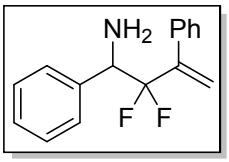
Deprotection of compound 3cb



N-(2,2-difluoro-1,3-diphenylbut-3-en-1-yl)-2-methoxyaniline (4):

To a solution of compound **3cb** (175.7 mg, 0.5 mmol) in acetone (5 mL) was added K_2CO_3 (0.42 mg, 3.0 mmol) and CH_3I (0.14 mg, 1.0 mmol). The reaction mixture was stirred at rt until the complete consumption of compound **3cb** as indicated by TLC analysis (about 5 h), then the mixture was filtered through a short pad of celite and washed with CH_2Cl_2. The filtrate was dried and concentrated under vacuum. The residue was purified by column chromatography (PE:EA = 5:1) to afford title

compound **4** (168.1 mg, 92% yield) as a colorless oil. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.41 - 7.17 (m, 10H), 6.72 - 6.70 (m, 1H), 6.63 - 6.48 (m, 2H), 6.11 (dd, 5.6 Hz, 3.7 Hz, 1H), 5.72 (s, 1H), 5.46 (s, 1H), 5.07 (d, 7.3 Hz, 1H), 4.74 - 4.59 (m, 1H), 3.83 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 146.9, 143.2 (t, 22.3 Hz), 136.7, 136.0, 135.9, 135.8, 128.6, 128.5, 128.4, 128.3, 128.1, 121.0, 120.9 (t, 250.2 Hz), 120.2 (t, 8.8 Hz), 117.2, 110.8, 109.5, 61.0 (dd, 28.5 Hz, 24.6 Hz), 55.5; ^{19}F NMR (471 MHz, $CDCl_3$) δ -101.3 (dd, 249.7 Hz, 9.5 Hz), -108.1 (dd, 249.7 Hz, 14.9 Hz); IR (KBr): 3419, 3061, 2939, 1601, 1511, 1456, 1247, 1221, 1025, 1731, 696 cm^{-1}; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{23}H_{22}F_2NO$ 366.1669, found 366.1664.



2,2-difluoro-1,3-diphenylbut-3-en-1-amine (5):

To a solution of **4** (73.1 mg, 0.2 mmol) in MeCN/H_2O (4 mL, 1:1) was added trichloroisocyanuric acid (TCCA) (47.3 mg, 0.1 mmol) and 1 M aqueous H_2SO_4 (0.2 mL). The mixture was stirred at rt for 16 h, then washed with CH_2Cl_2 (3×8 mL). The resulting aqueous phase was subsequently brought to basic (pH = 10.5) through the addition of 5.0 M of aqueous KOH, and extracted with EtOAc (3×10 mL). Then the organic layer was concentrated under vacuum to afford title compound **5** (21.7 mg, 42% yield) as a yellow oil. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.70 - 6.85 (m, 10H), 5.63 (s, 1H), 5.42 (s, 1H), 4.15 (t, 13.0 Hz, 1H), 1.78 (br, 2H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 143.2 (t, 22.6 Hz), 137.5, 137.4, 136.8, 128.4, 128.3 (2C), 128.2, 128.1, 121.4 (t, 248.7 Hz), 120.2 (t, 8.9 Hz), 59.3 (t, 26.2 Hz); ^{19}F NMR (471 MHz, $CDCl_3$) δ -105.0 (dd, 245.2 Hz, 11.4 Hz), -107.9 (dd, 245.3 Hz, 13.7 Hz); IR (KBr): 3390, 3032, 1493, 1160, 1022, 718, 695 cm^{-1}; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{16}H_{16}F_2N$ 260.1251, found 260.1245.

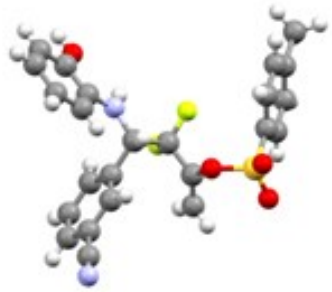
References

[1] B. Zhang and X. Zhang, *Chin. J. Chem.*, 2016, **34**, 477–480.

[2] T. M. Gøgsig, L. S. Søbjerg, A. T. Lindhardt, K. L. Jensen and T. Skrydstrup, *J. Org. Chem.*, 2008, **73**, 3404-3410.

[3] Y. Liu, Y.-H. Zhou, Y.-L. Zhao and J.-P. Qu, *Org. Lett.*, 2017, **19**, 946–949.

X-ray structure of 3na



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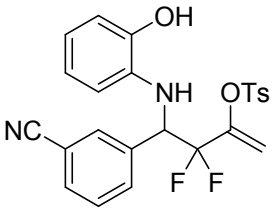


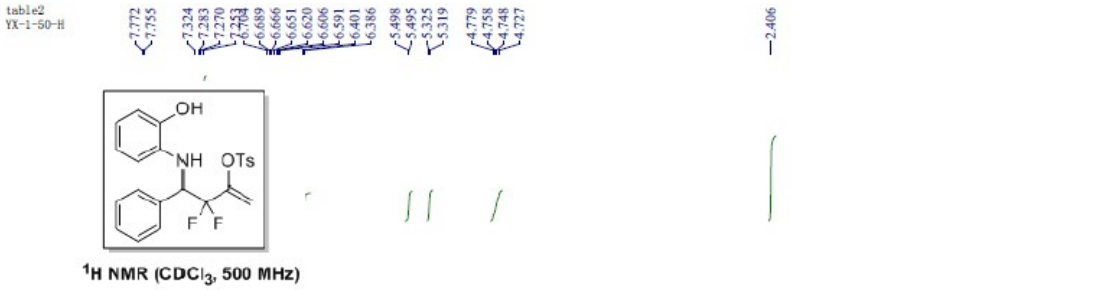
CCDC 1831916

Crystal data for compound **8**

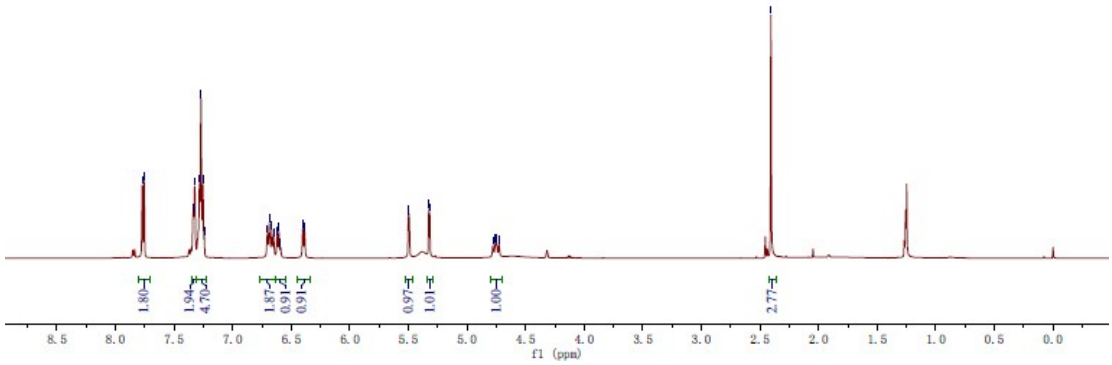
Identification code	T	
Empirical formula	C24 H20 F2 N2 O4 S	
Formula weight	470.48	
Temperature	120(2) K	
Wavelength	0.71073 Å	
Crystal system	Monoclinic	
Space group	$P2_1/c$	
Unit cell dimensions	a = 10.457(6) Å	a= 90°.
	b = 18.104(11) Å	b= 98.239(11)°.
	c = 11.424(7) Å	g = 90°.
Volume	2140(2) $Å^3$	
Z	4	
Density (calculated)	1.460 Mg/m^3	
Absorption coefficient	0.204 mm^{-1}	
F(000)	976	
Crystal size	0.130 x 0.120 x 0.100 mm^3	
Theta range for data collection	1.968 to 24.998°.	
Index ranges	-12<=h<=12, -21<=k<=21, -13<=l<=13	
Reflections collected	14986	
Independent reflections	3768 [R(int) = 0.1128]	
Completeness to theta = 24.998°	99.8 %	
Absorption correction	None	
Refinement method	Full-matrix least-squares on F^2	

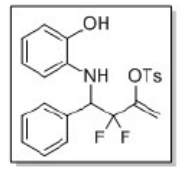
Data / restraints / parameters	3768 / 0 / 299
Goodness-of-fit on F^2	1.052
Final R indices [I>2sigma(I)]	R1 = 0.0596, wR2 = 0.1309
R indices (all data)	R1 = 0.0969, wR2 = 0.1482
Extinction coefficient	n/a
Largest diff. peak and hole	0.372 and -0.373 e.$Å^{-3}$

^{1}H, ^{13}C, and ^{19}F NMR spectra



^{1}H NMR ($CDCl_3$, 500 MHz)





^{13}C NMR ($CDCl_3$, 126 MHz)

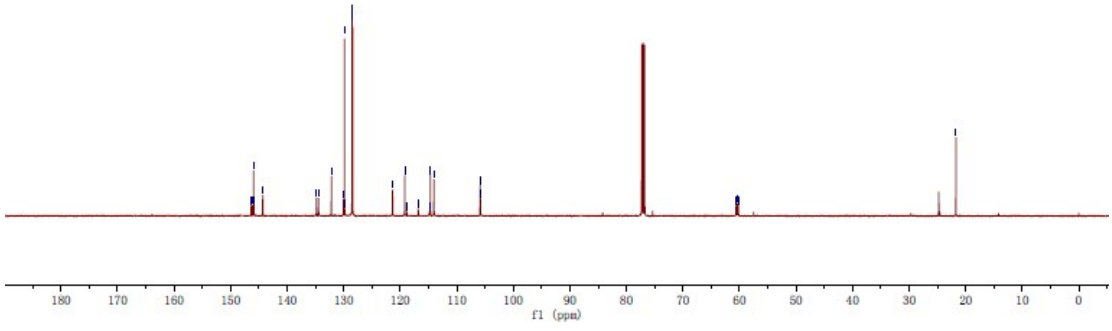
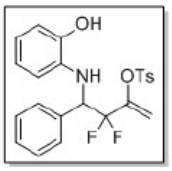
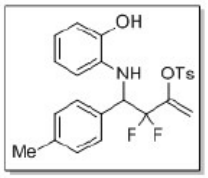


table2
YX-1-50-H

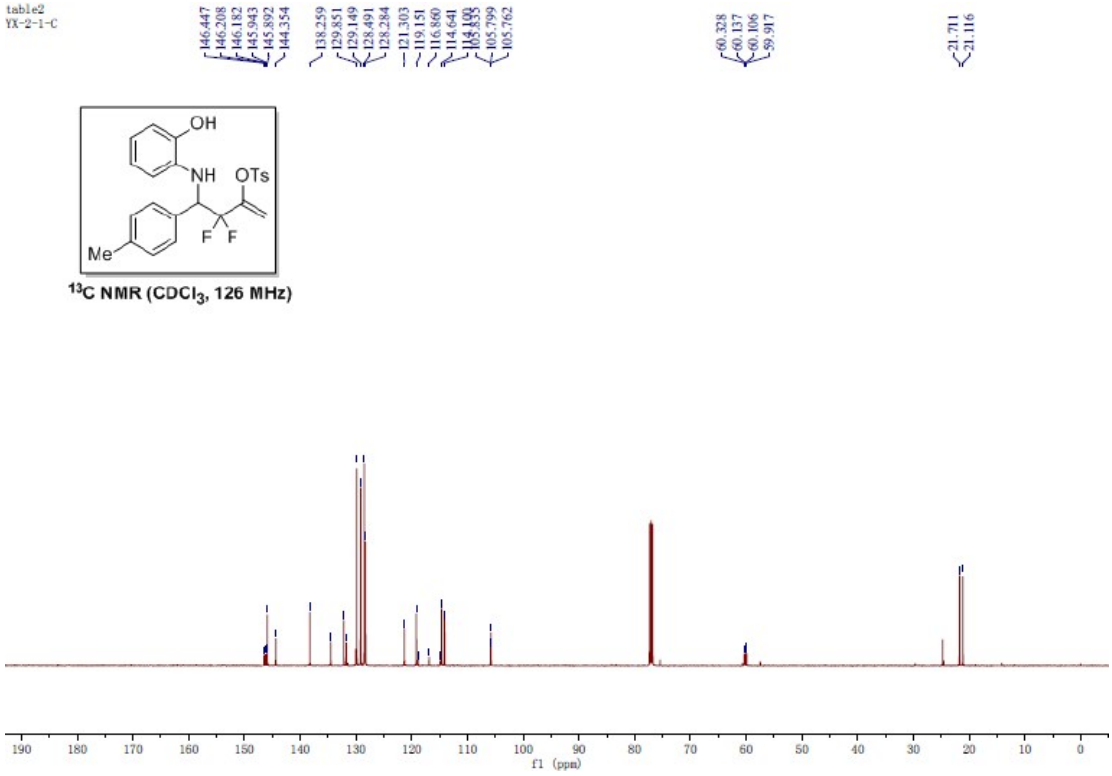


^{19}F NMR ($CDCl_3$, 471 MHz)

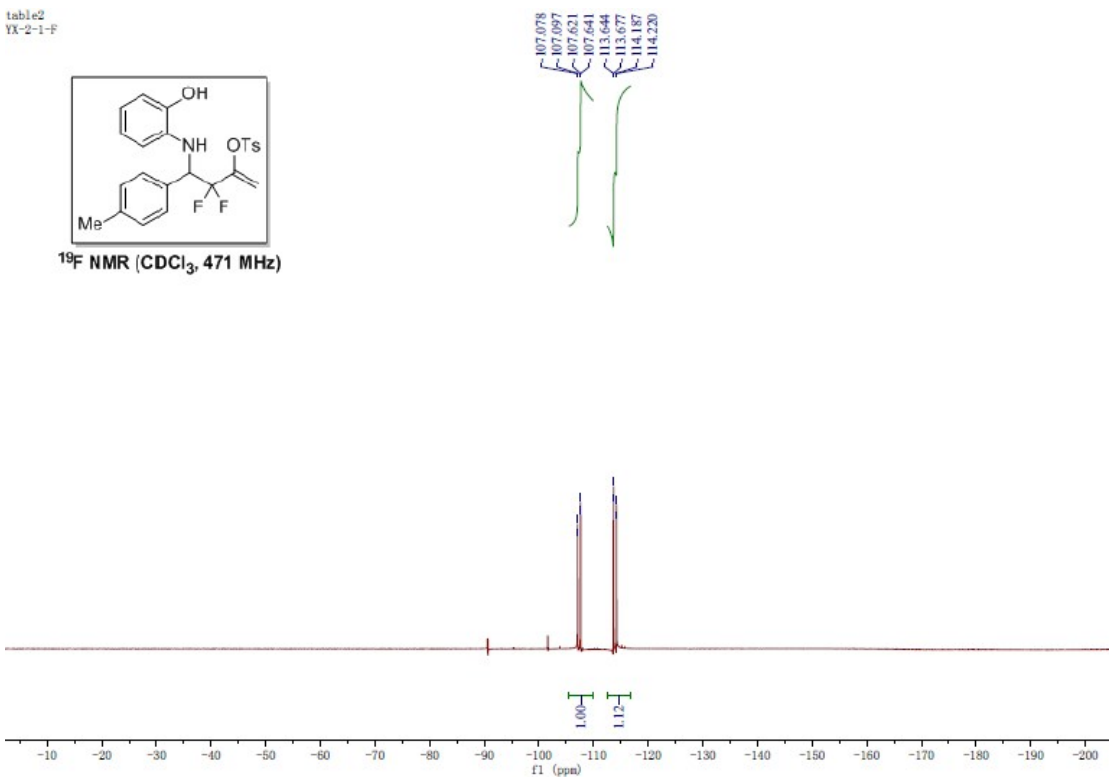
table2
YX-2-1-H



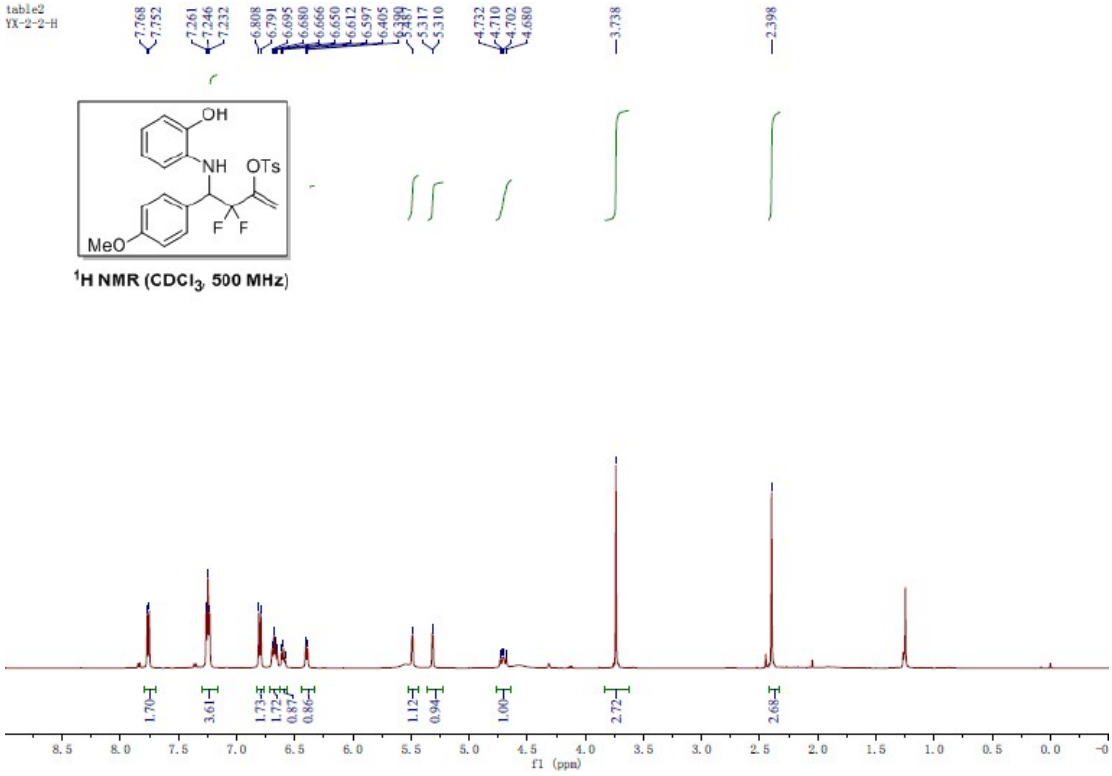
^{1}H NMR ($CDCl_3$, 500 MHz)



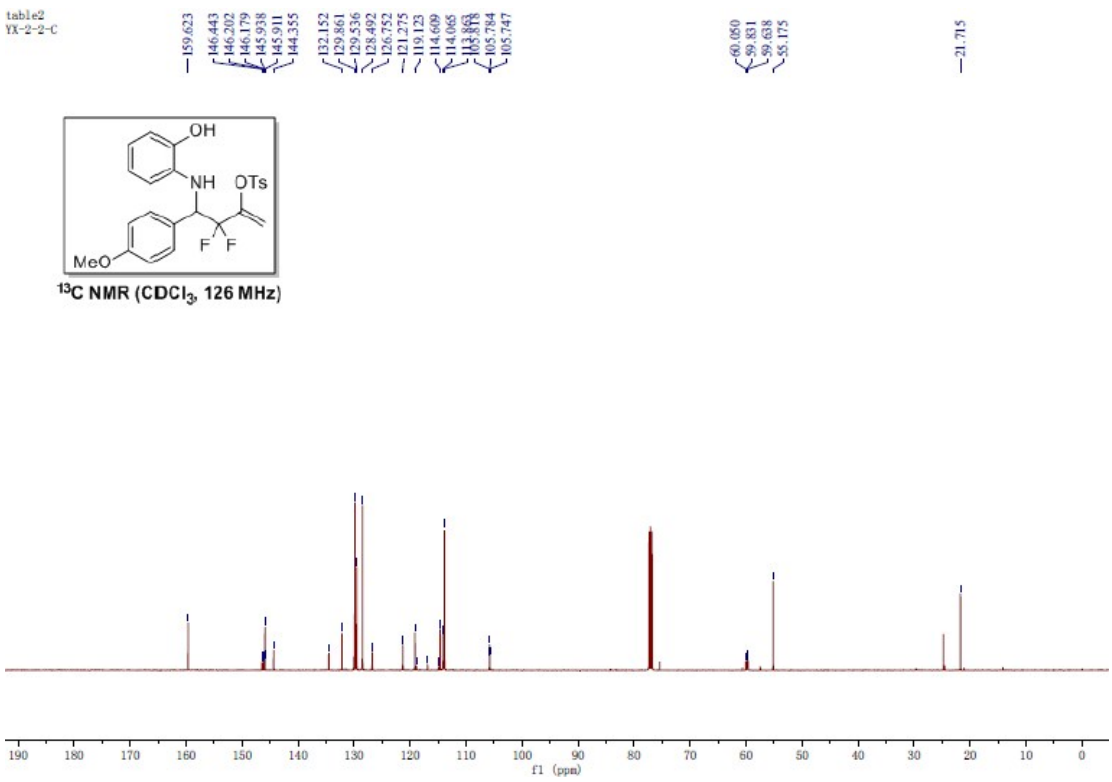
^{13}C NMR ($CDCl_3$, 126 MHz)



^{19}F NMR ($CDCl_3$, 471 MHz)

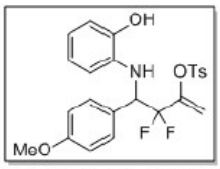


^{1}H NMR ($CDCl_3$, 500 MHz)



^{13}C NMR ($CDCl_3$, 126 MHz)

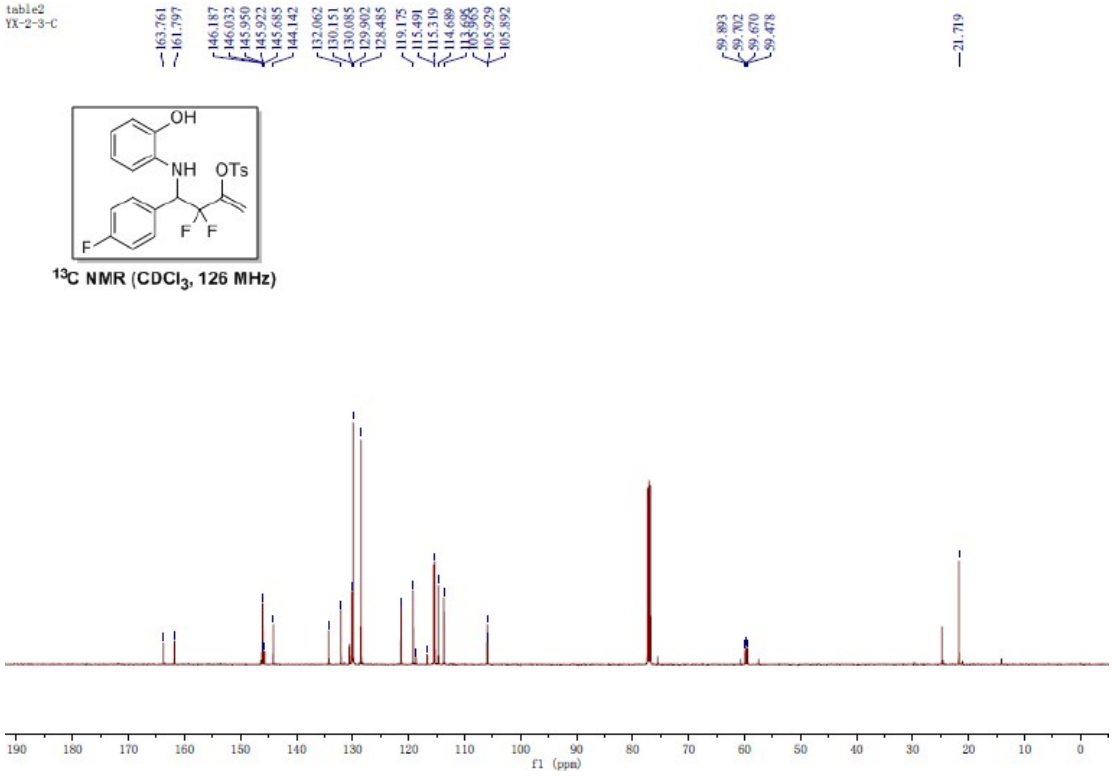
table2
YX-2-2-F



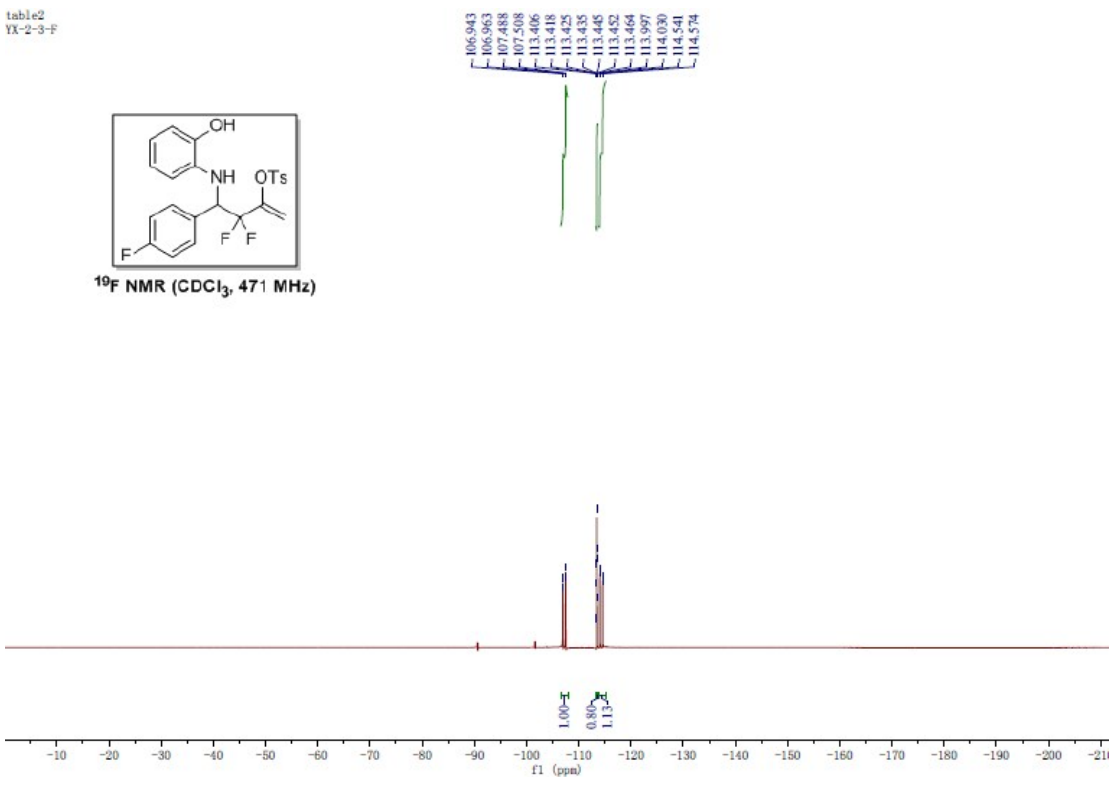
^{19}F NMR ($CDCl_3$, 471 MHz)

table2
YX-2-3-H

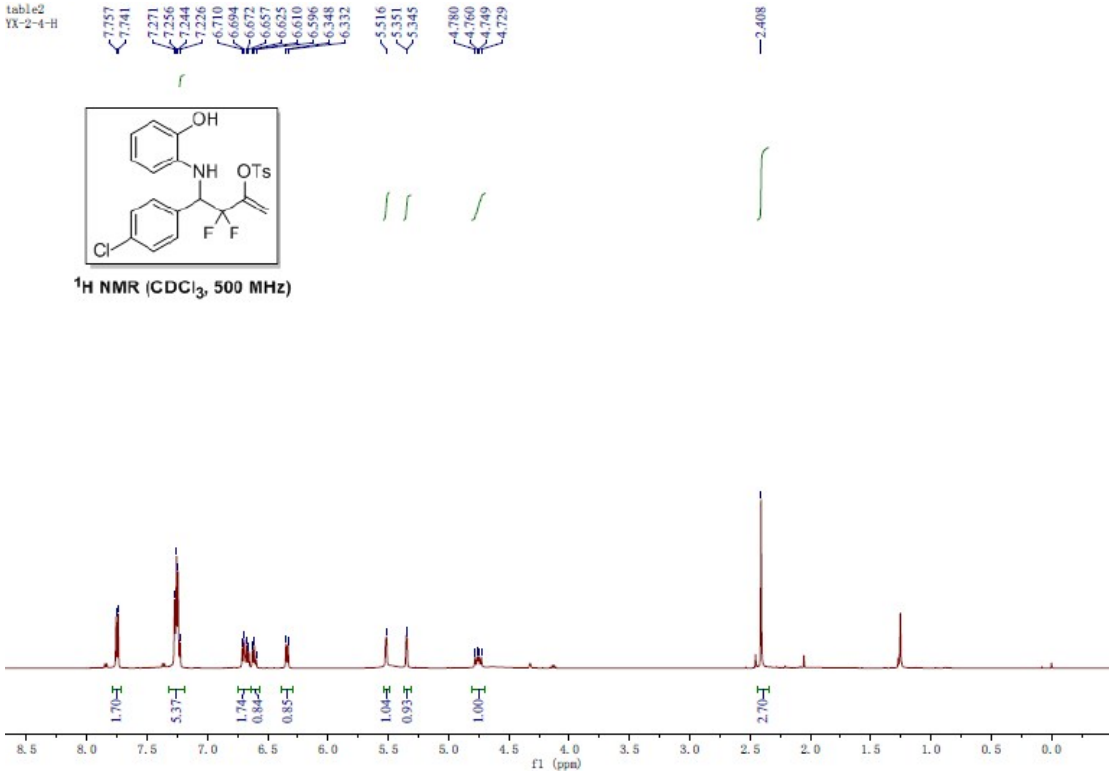
^{1}H NMR ($CDCl_3$, 500 MHz)



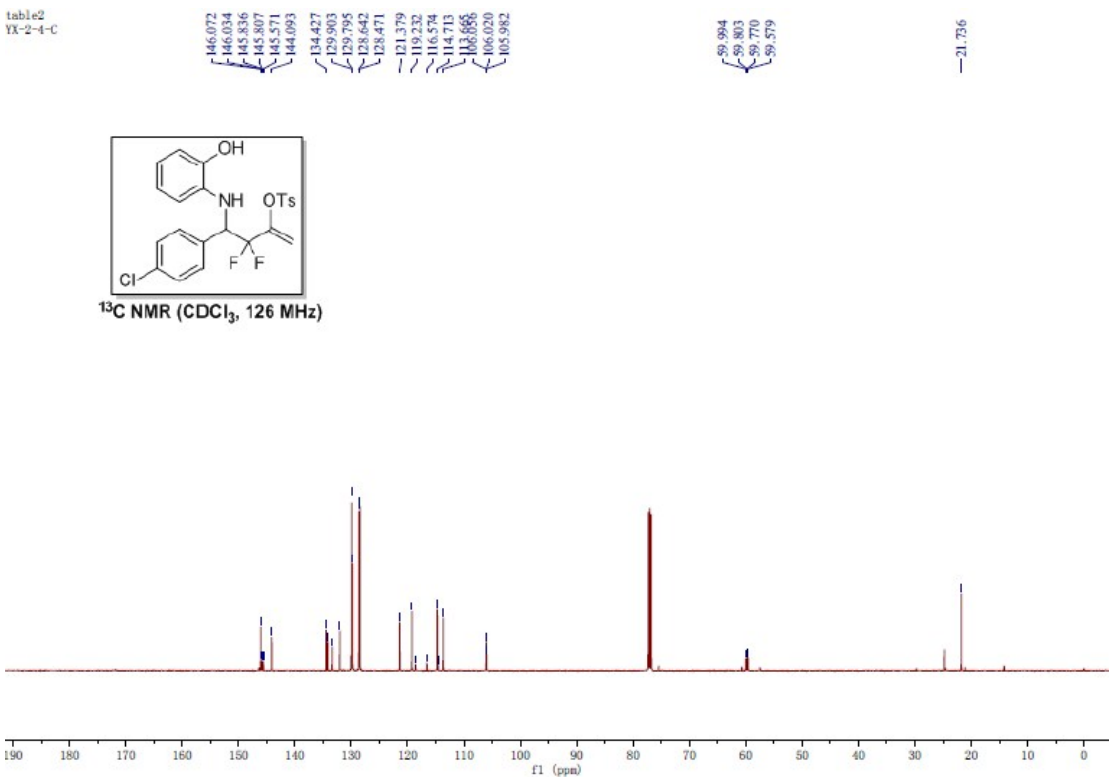
^{13}C NMR ($CDCl_3$, 126 MHz)



^{19}F NMR ($CDCl_3$, 471 MHz)

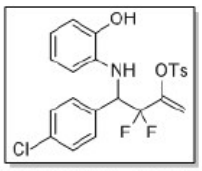


^{1}H NMR ($CDCl_3$, 500 MHz)



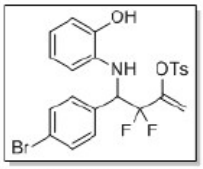
^{13}C NMR ($CDCl_3$, 126 MHz)

table2
YX-2-4-F



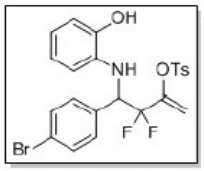
^{19}F NMR ($CDCl_3$, 471 MHz)

table2
YX-2-5-H



^{1}H NMR ($CDCl_3$, 500 MHz)

table2
YX-2-5-C



^{13}C NMR ($CDCl_3$, 126 MHz)

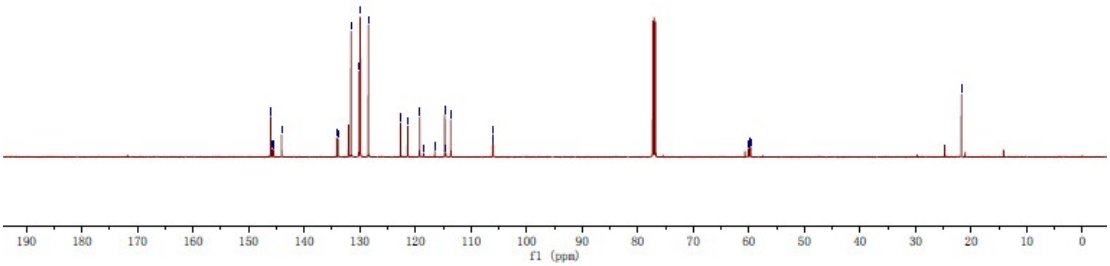
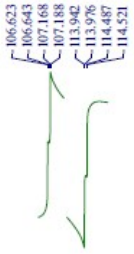
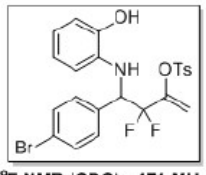
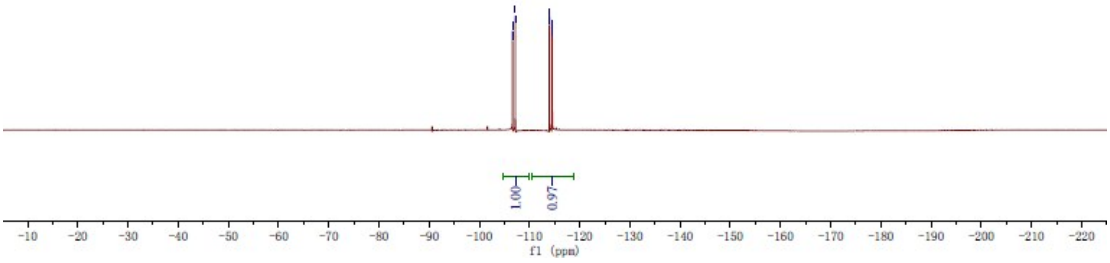


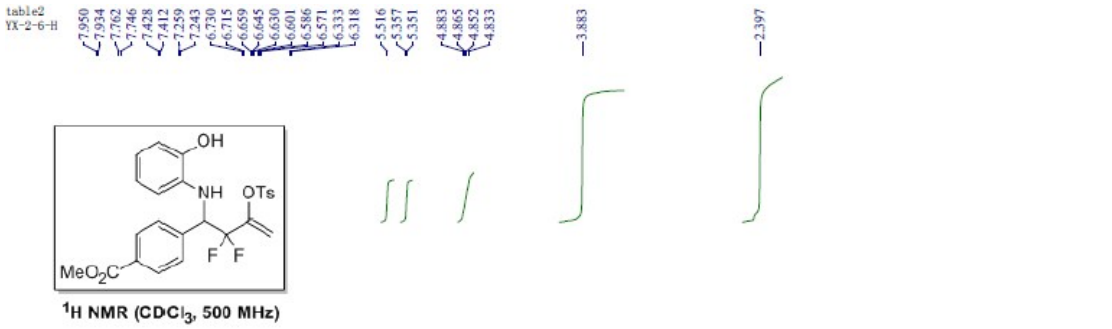
table2
YX-2-5-F



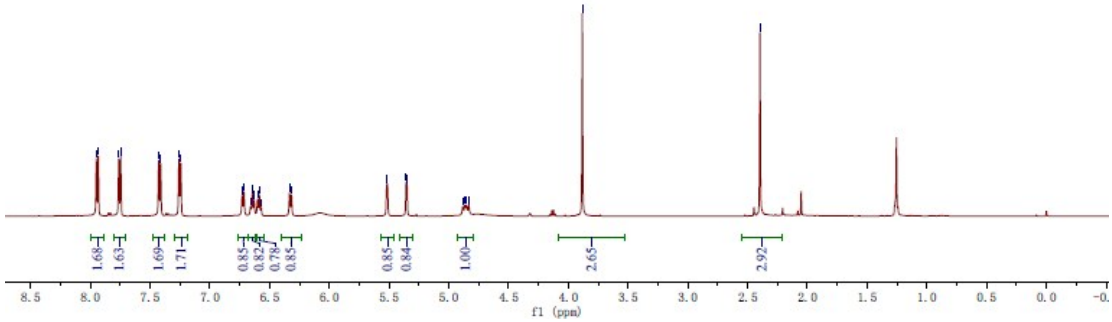


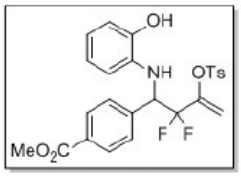
^{19}F NMR ($CDCl_3$, 471 MHz)





^{1}H NMR ($CDCl_3$, 500 MHz)





^{13}C NMR ($CDCl_3$, 126 MHz)

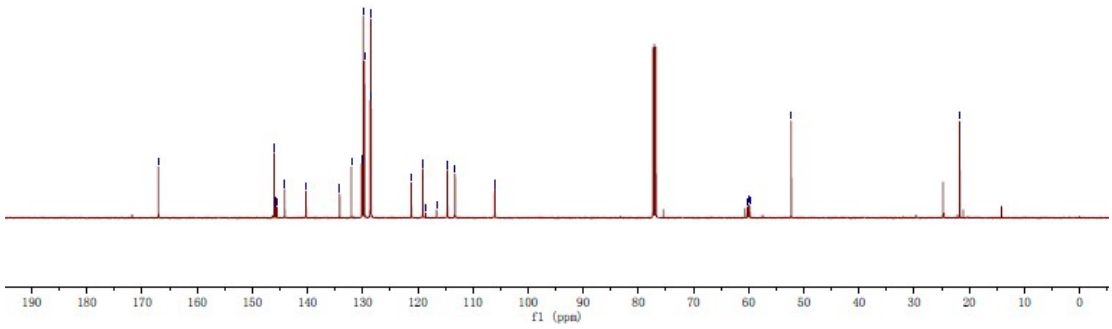
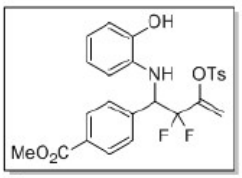
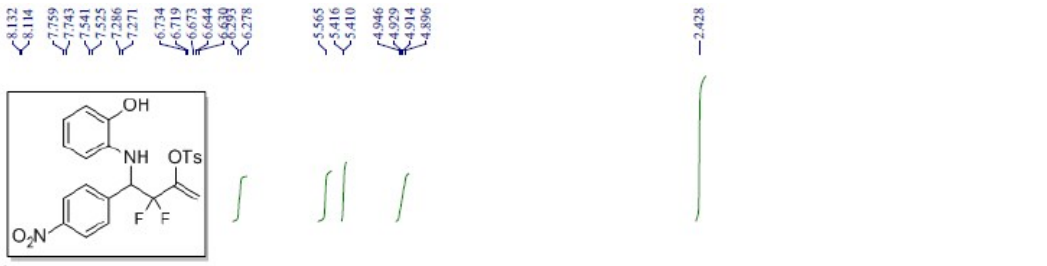


table2
YX-2-6-F



^{19}F NMR ($CDCl_3$, 471 MHz)

table2
YX-2-7-H



^{1}H NMR ($CDCl_3$, 500 MHz)

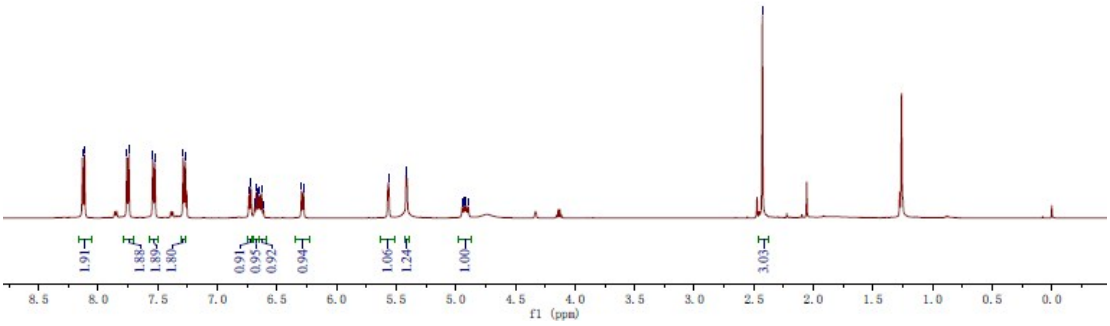
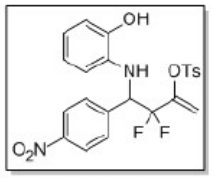


table2
YX-2-7-C

148.068
146.189
145.673
145.441
145.407
145.175
143.875
142.407
133.766
131.995
129.944
129.527
128.473
123.546
121.491
119.446
114.844
113.252
106.269
60.082
59.890
59.852
59.661
21.756



^{13}C NMR ($CDCl_3$, 126 MHz)

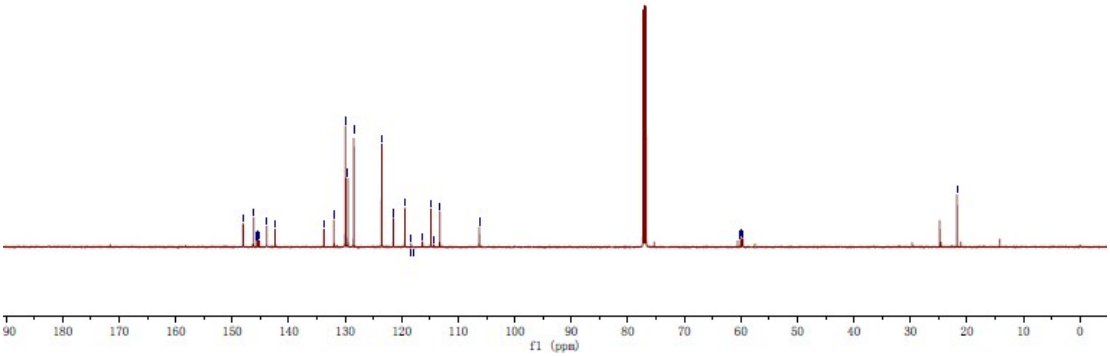
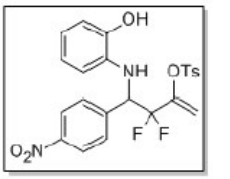
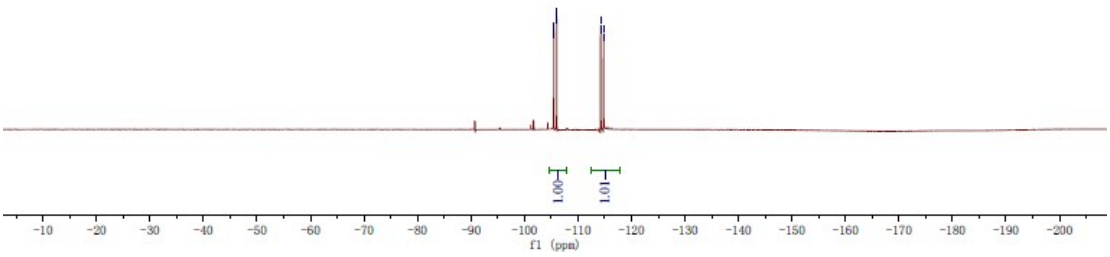


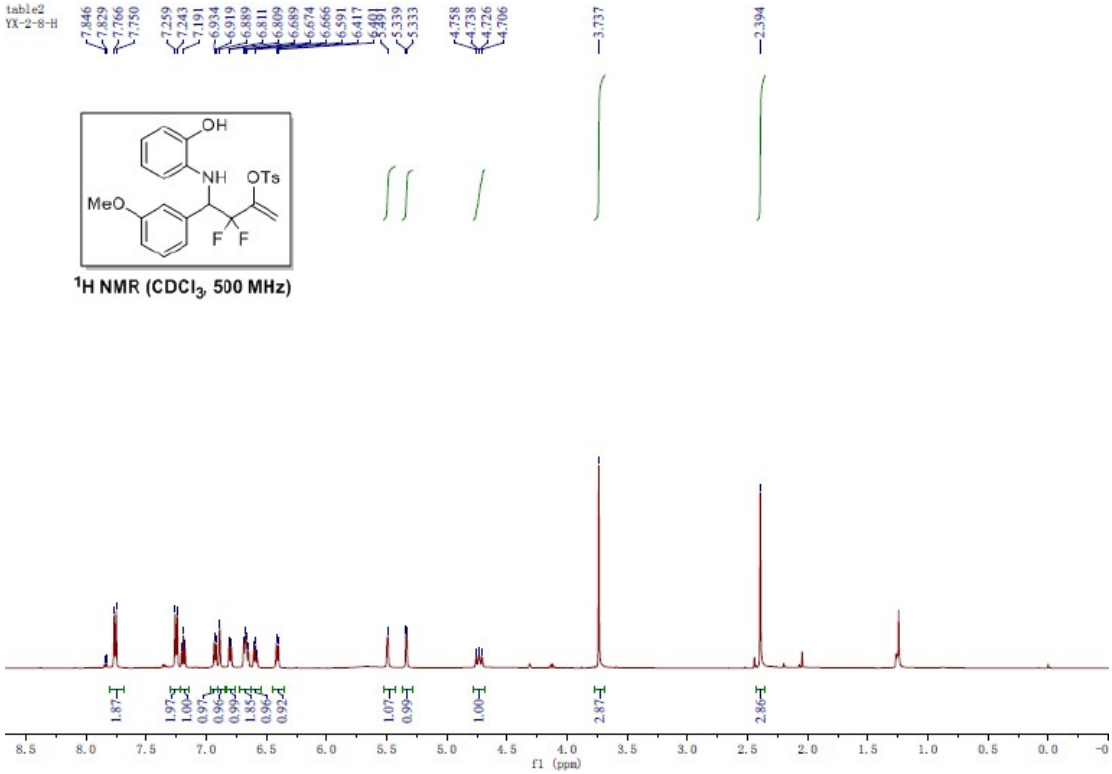
table2
YX-2-7-F

105.489
105.506
106.037
106.054
114.235
114.269
114.783
114.817

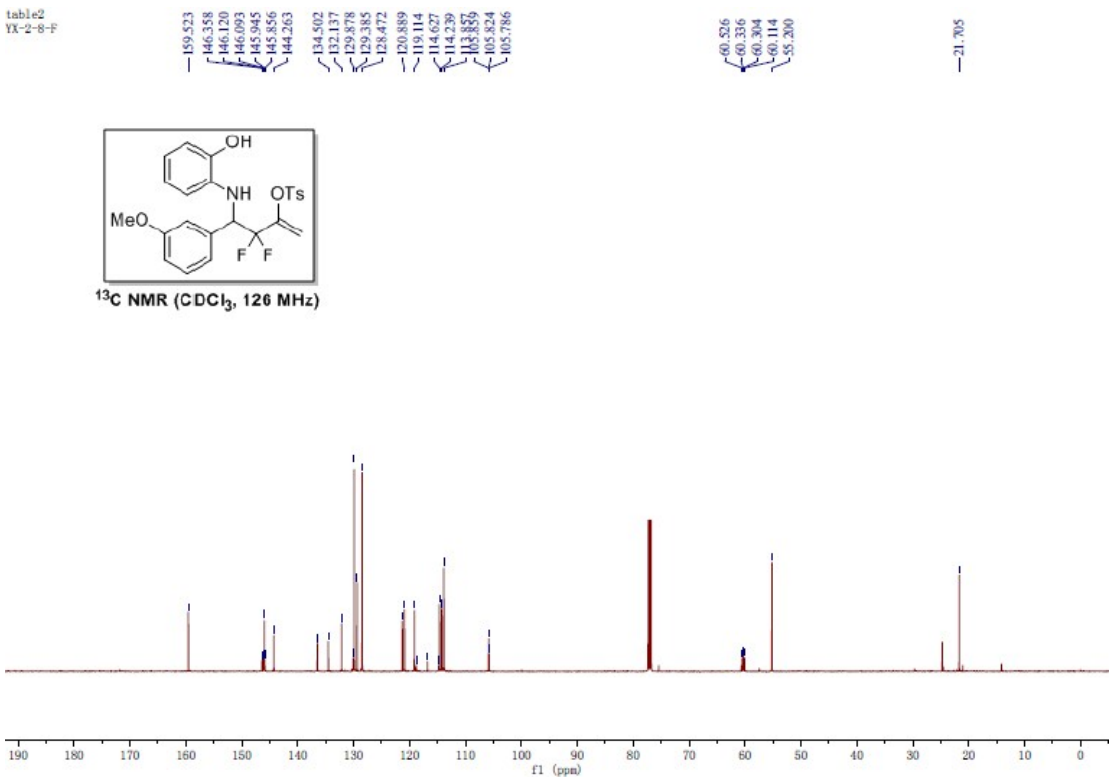


^{19}F NMR ($CDCl_3$, 471 MHz)

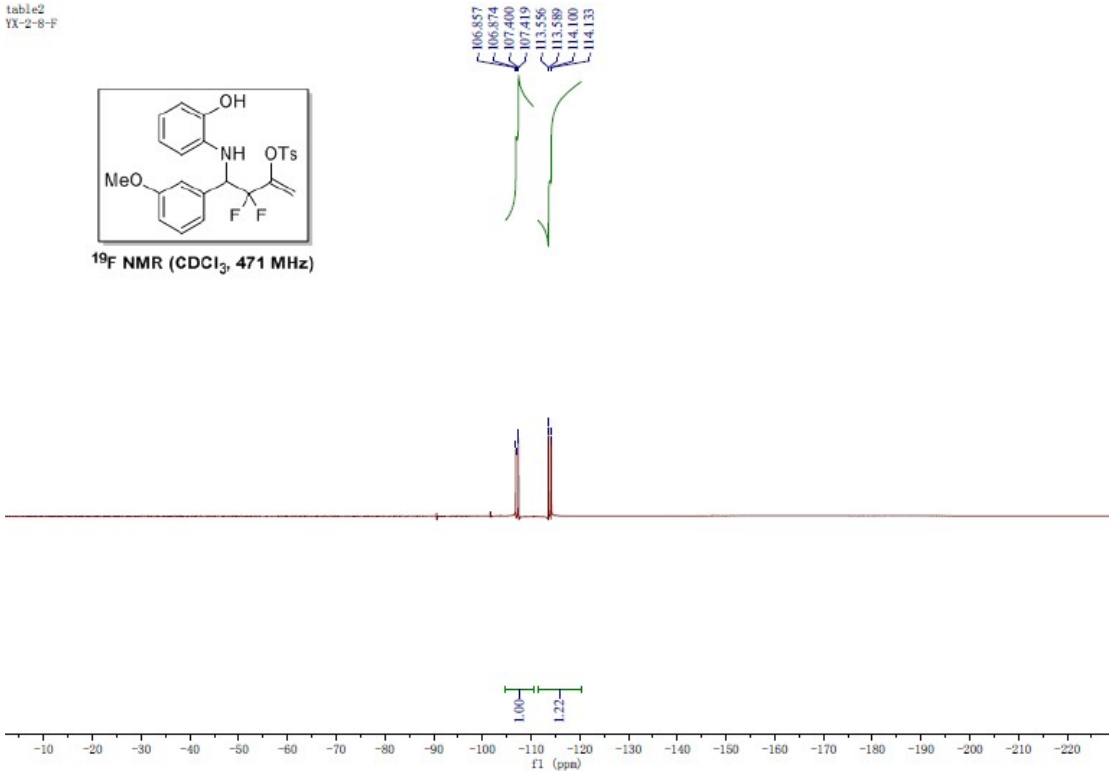




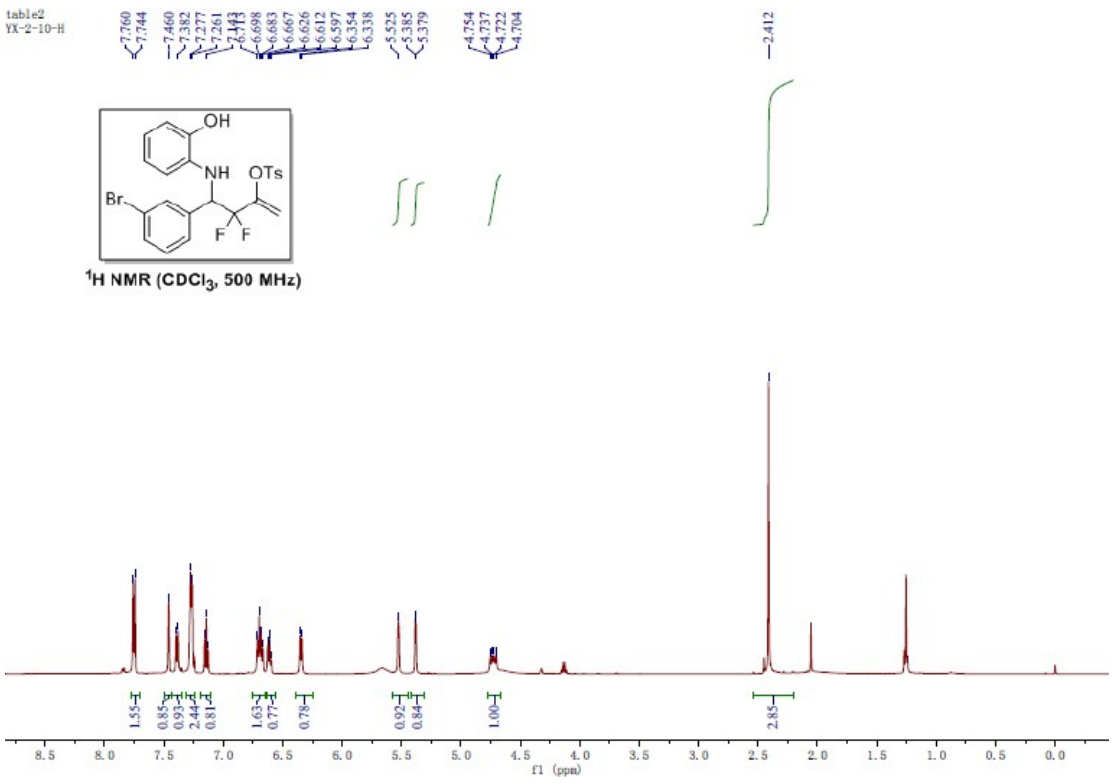
^{1}H NMR ($CDCl_3$, 500 MHz)



^{13}C NMR ($CDCl_3$, 126 MHz)

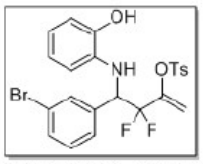


^{19}F NMR ($CDCl_3$, 471 MHz)



^{1}H NMR ($CDCl_3$, 500 MHz)

table2
YX-2-10-C



^{13}C NMR ($CDCl_3$, 126 MHz)

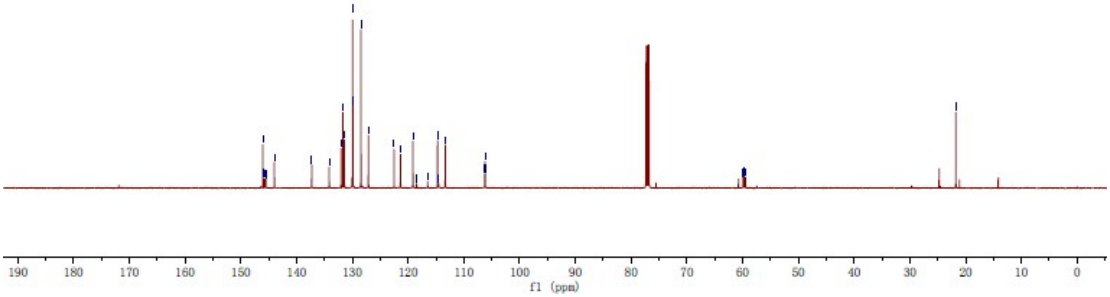
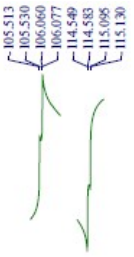
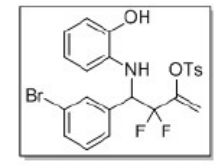
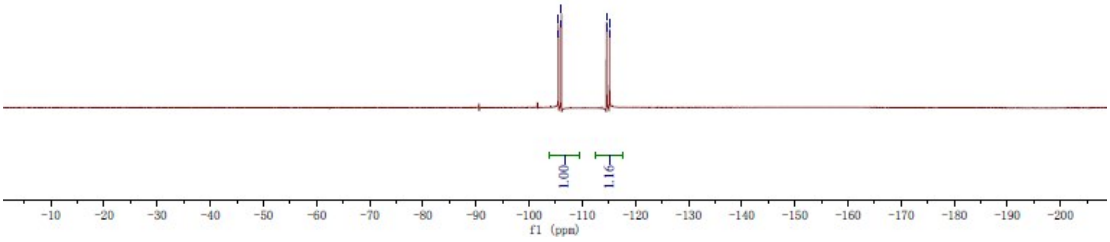


table2
YX-2-10-F





^{19}F NMR ($CDCl_3$, 471 MHz)



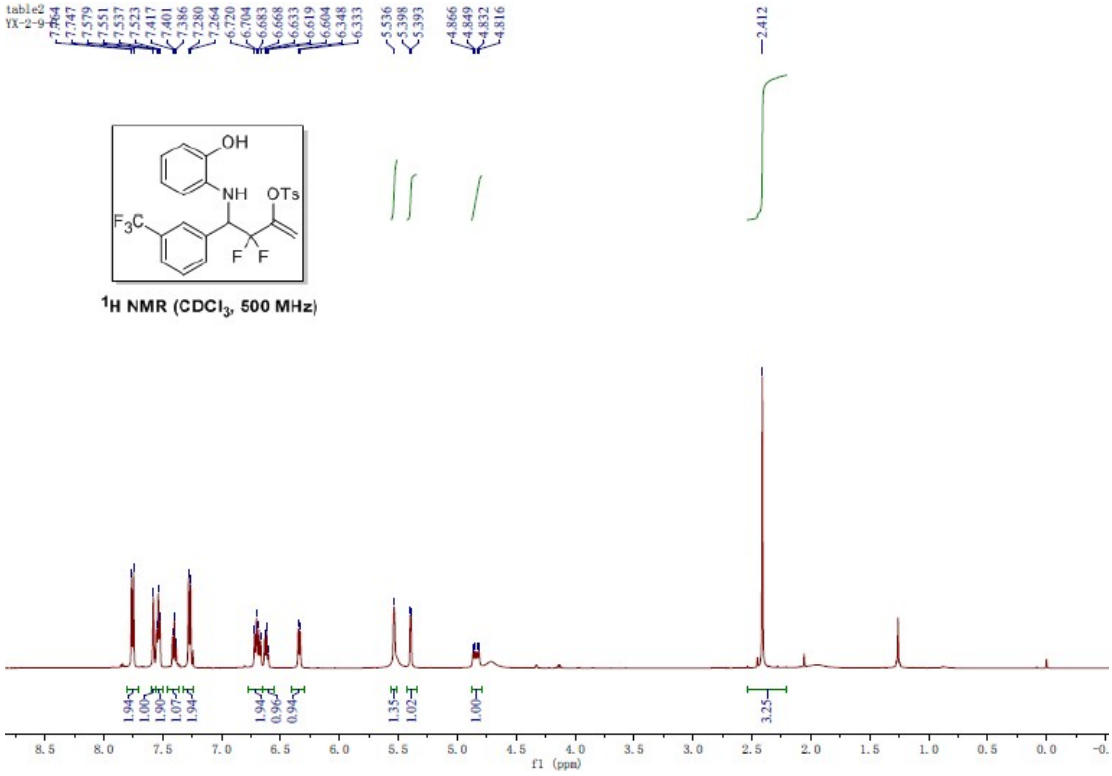


table2
YX-2-9-H
OH
NH
OTs
F3C
F F
1H NMR (CDCl3, 500 MHz)
f1 (ppm)

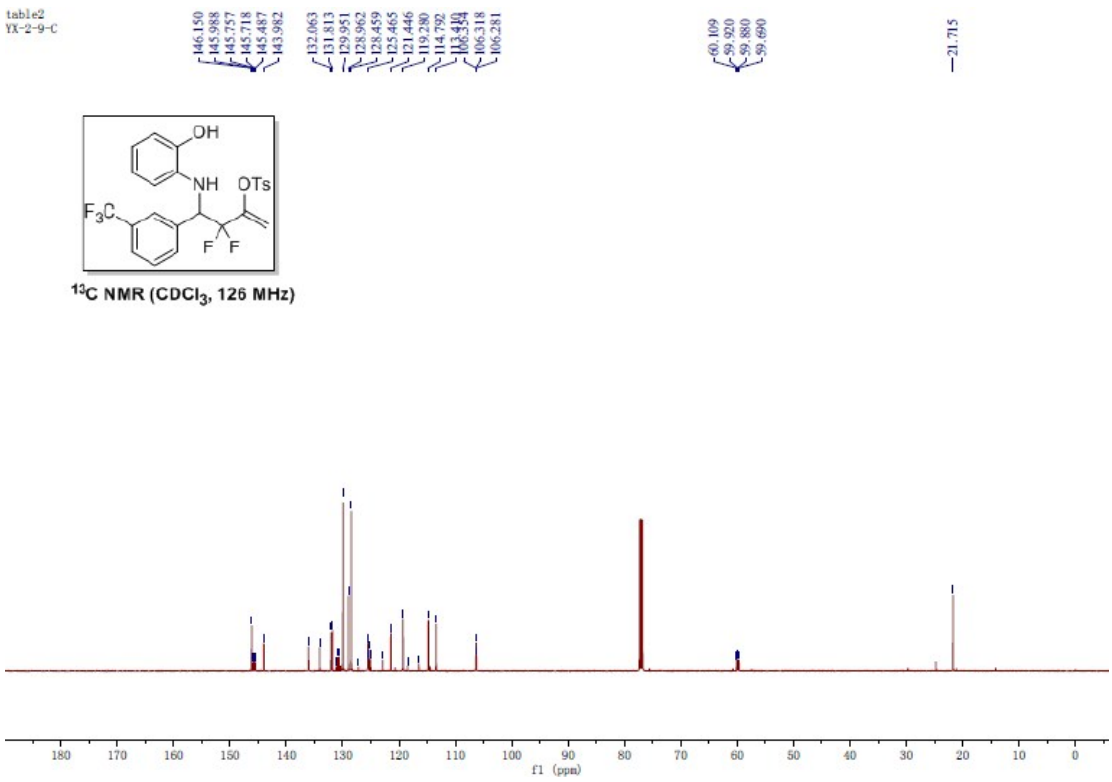
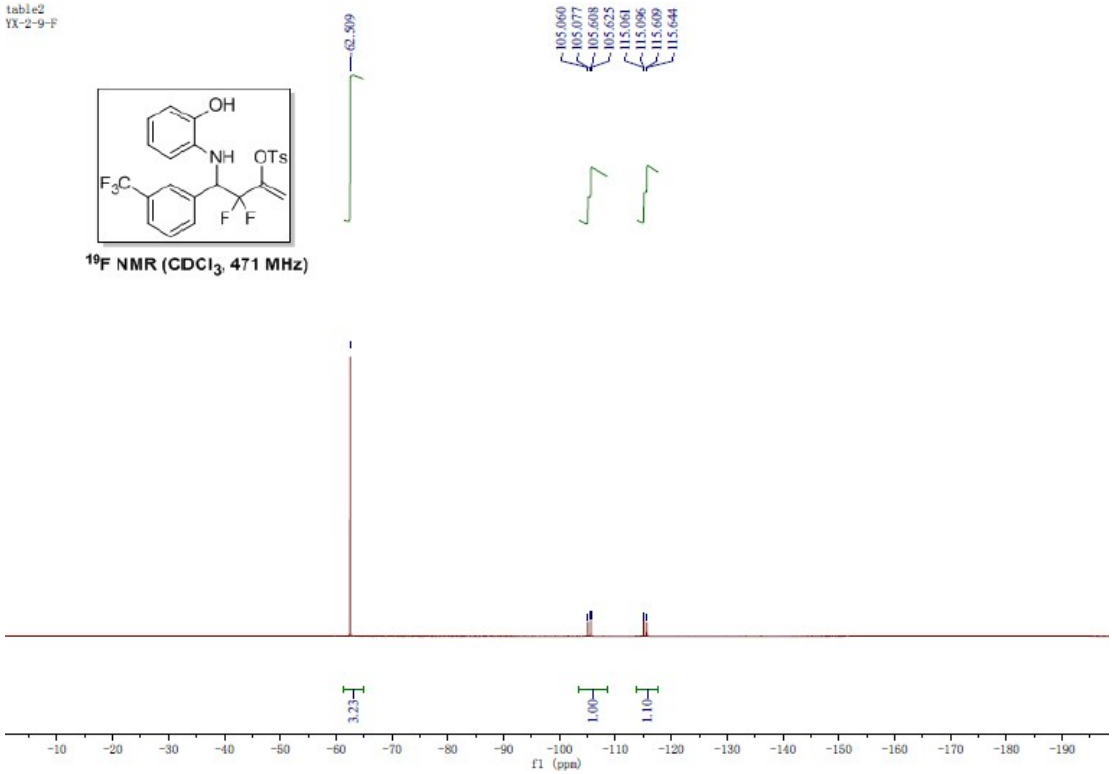
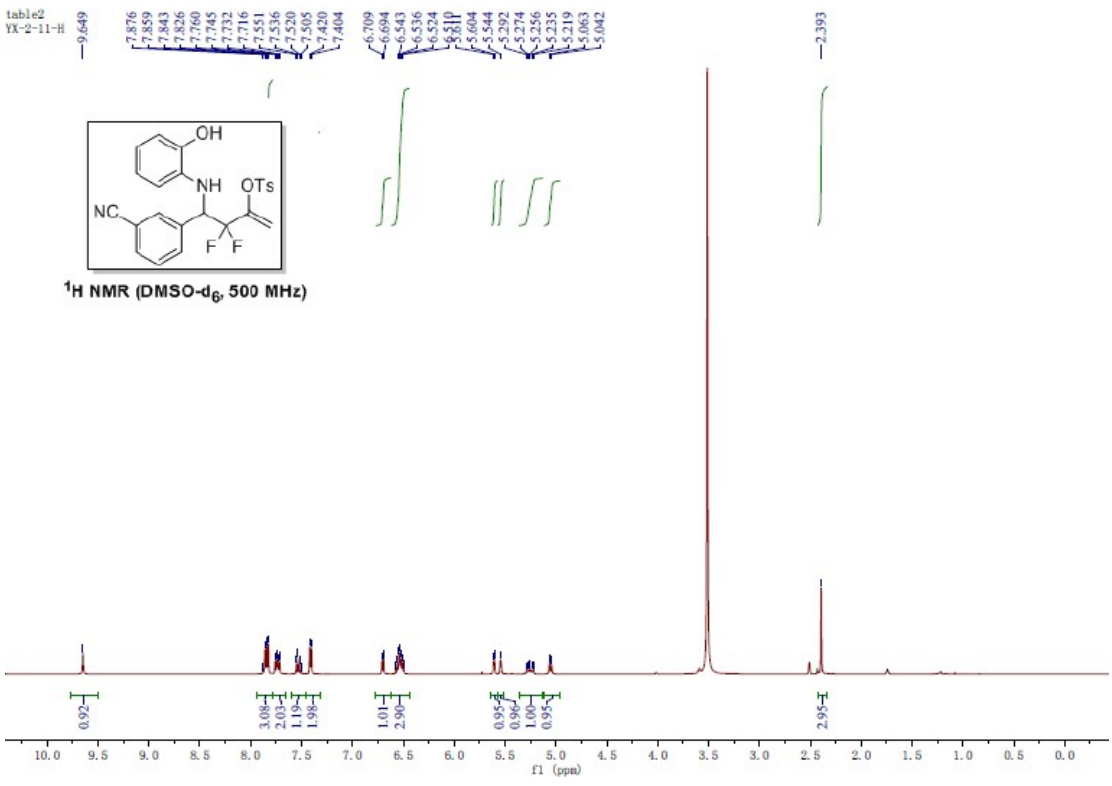


table2
YX-2-9-C
OH
NH
OTs
F3C
F F
13C NMR (CDCl3, 126 MHz)
f1 (ppm)

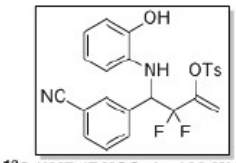


^{19}F NMR ($CDCl_3$, 471 MHz)



^{1}H NMR (DMSO-d_6, 500 MHz)

table2
YX-2-11-C



^{13}C NMR (DMSO-d_6, 126 MHz)

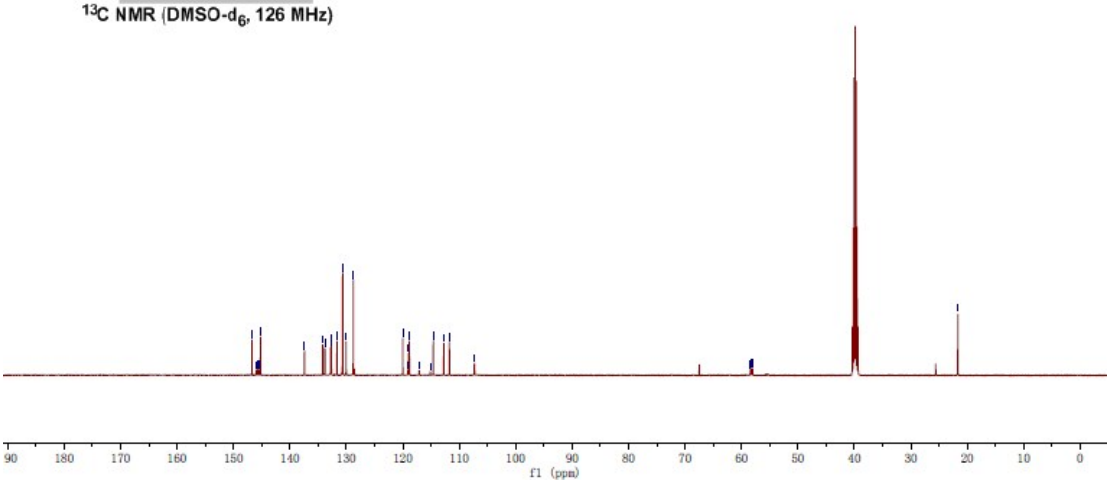
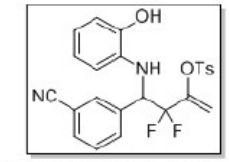
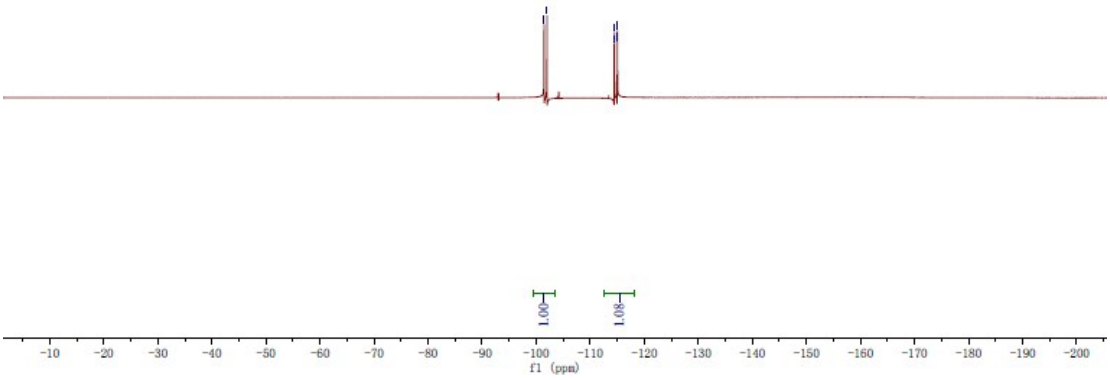
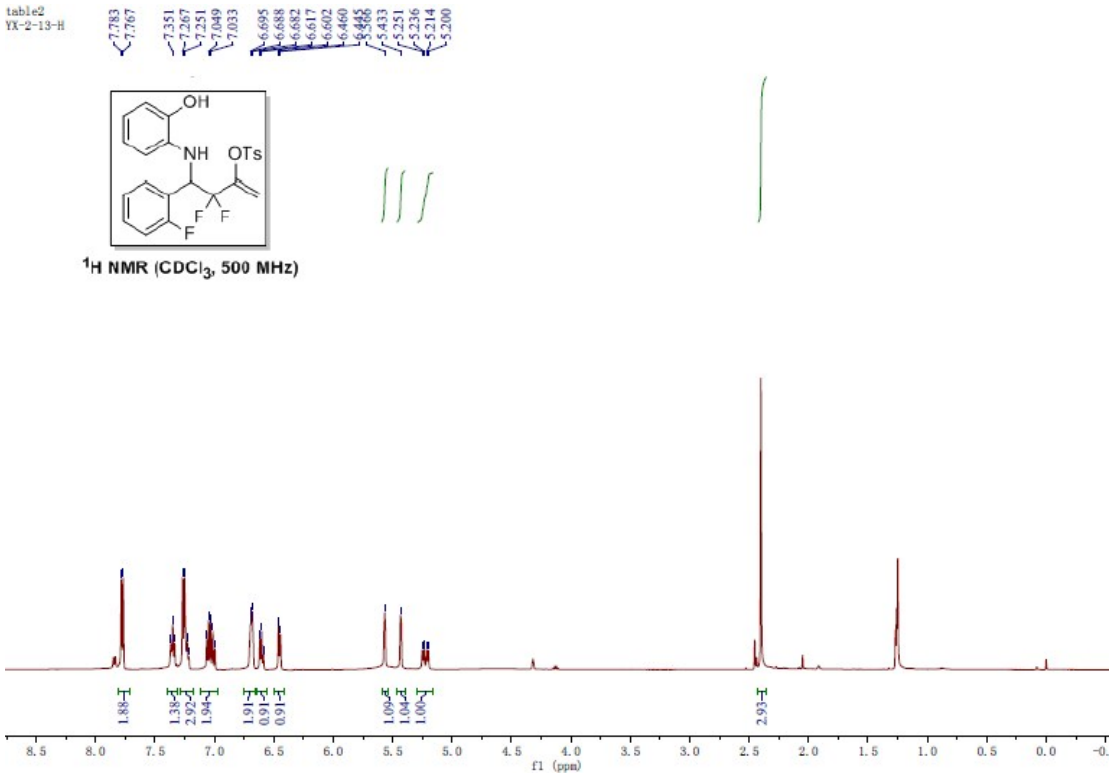


table2
YX-2-11-F

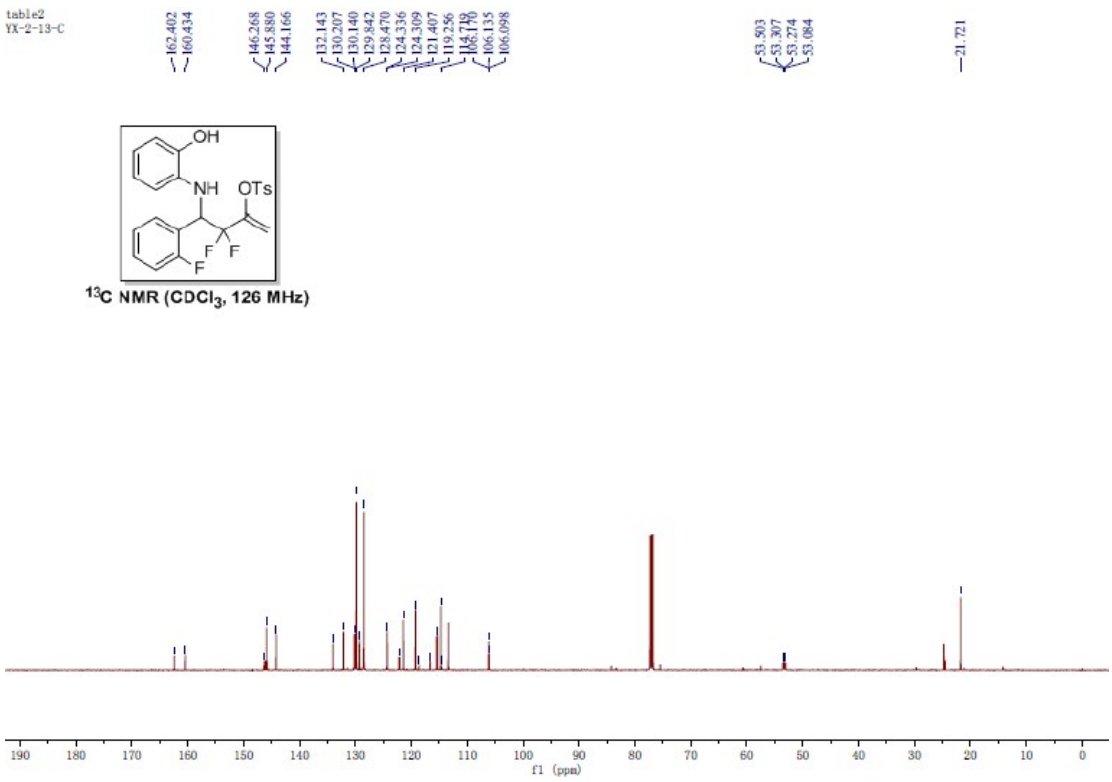


^{19}F NMR (DMSO-d_6, 471 MHz)



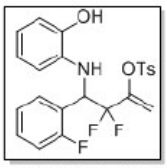


^{1}H NMR ($CDCl_3$, 500 MHz)



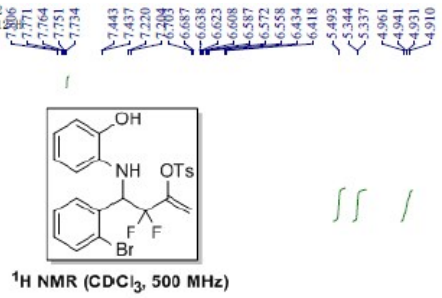
^{13}C NMR ($CDCl_3$, 126 MHz)

table2
YX-2-13-F



^{19}F NMR ($CDCl_3$, 471 MHz)

table2
YX-2-13-H



^{1}H NMR ($CDCl_3$, 500 MHz)

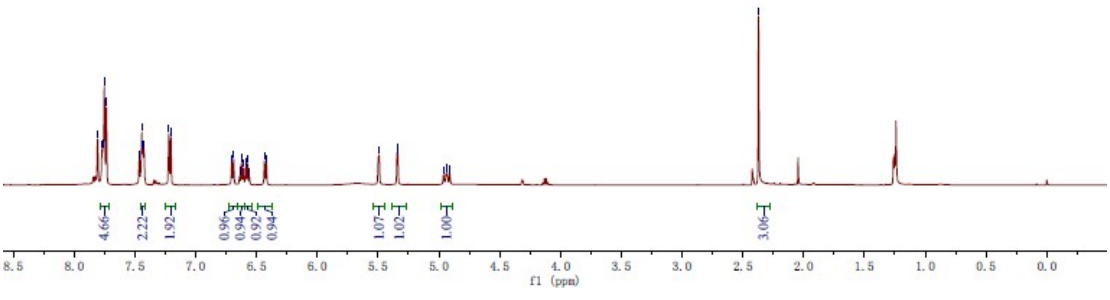
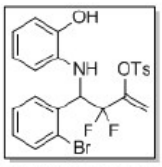


table2
YX-2-12-C



^{13}C NMR ($CDCl_3$, 126 MHz)

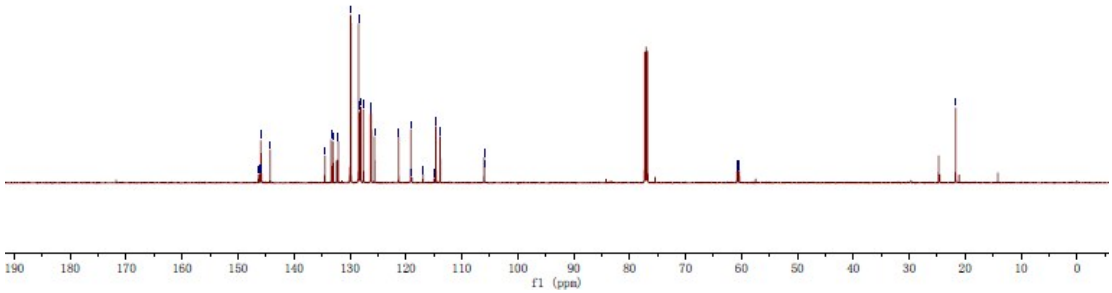
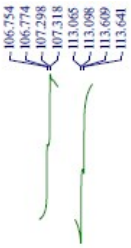
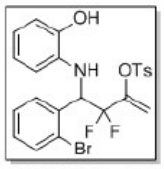
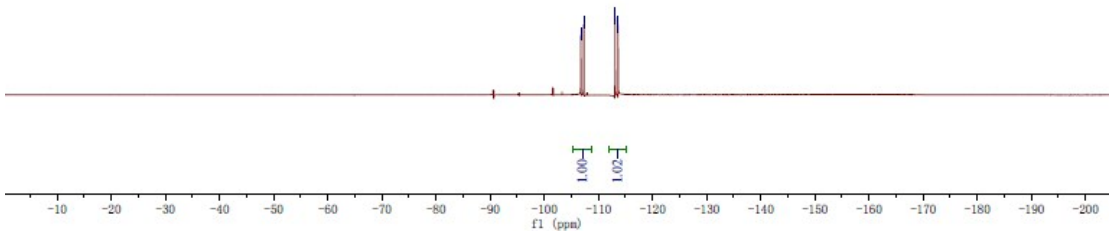


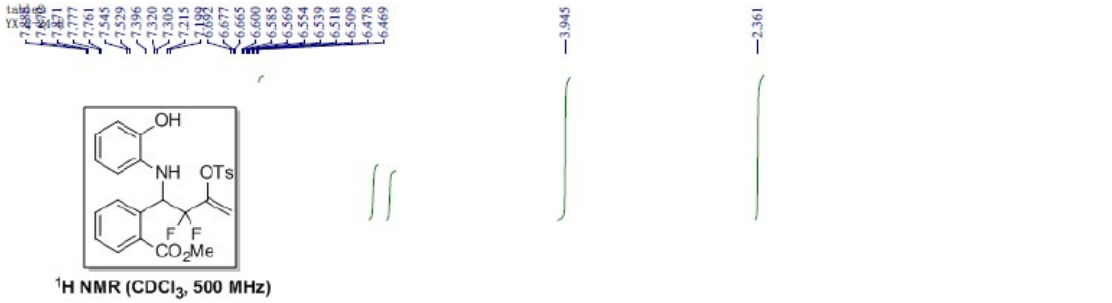
table2
YX-2-12-F



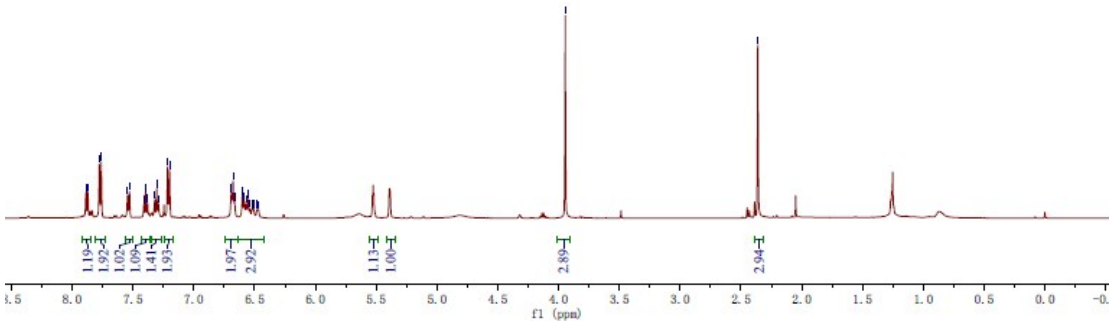


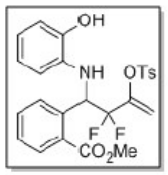
^{19}F NMR ($CDCl_3$, 471 MHz)



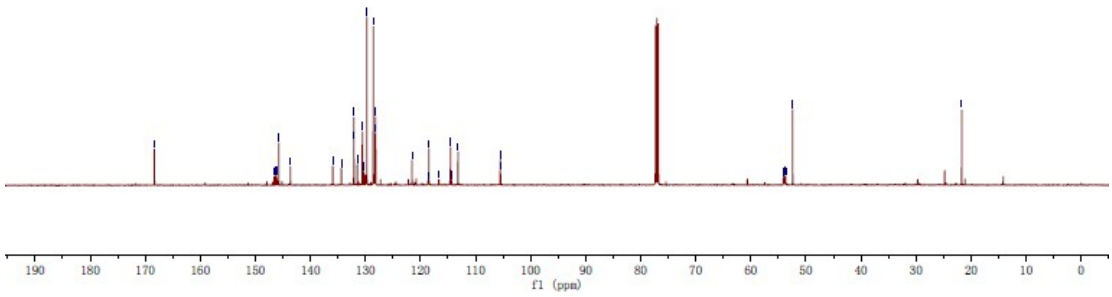


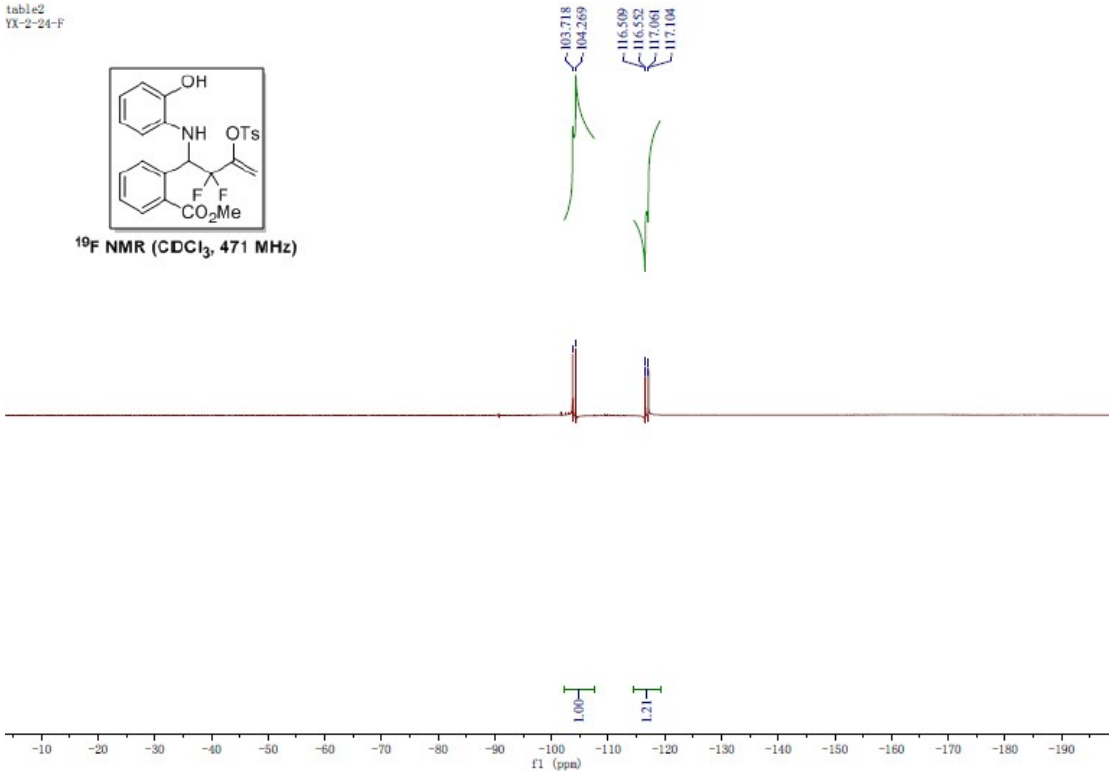
^{1}H NMR ($CDCl_3$, 500 MHz)



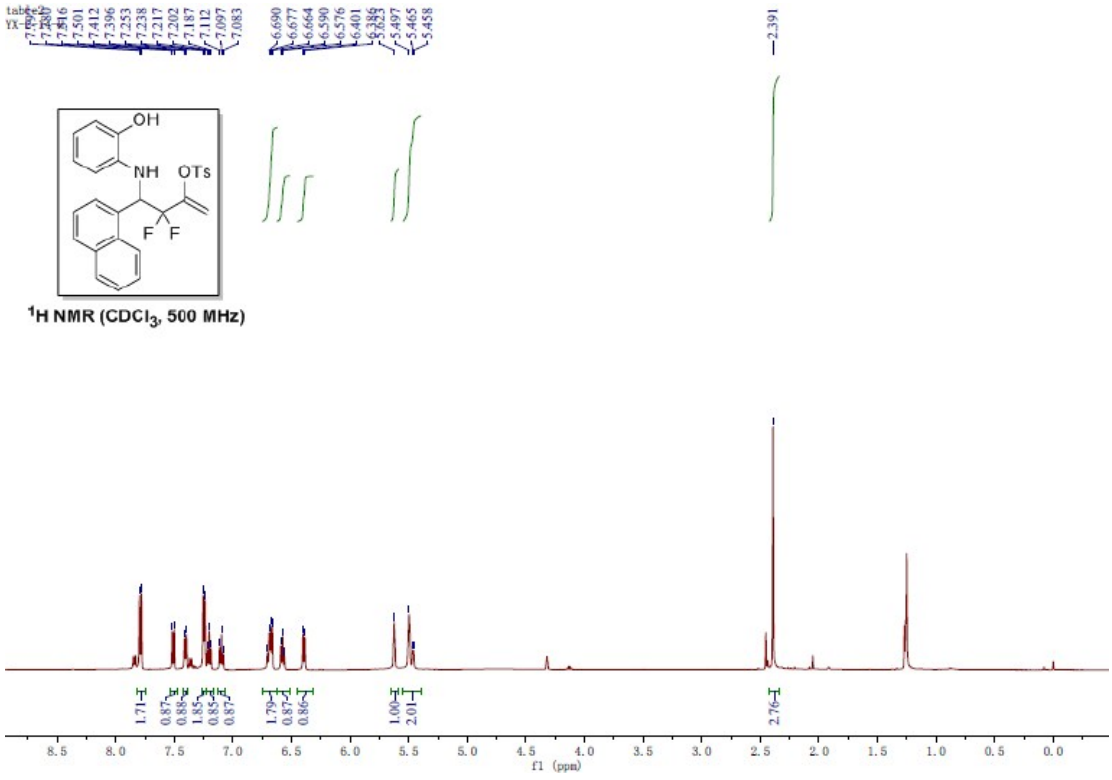


^{13}C NMR ($CDCl_3$, 126 MHz)



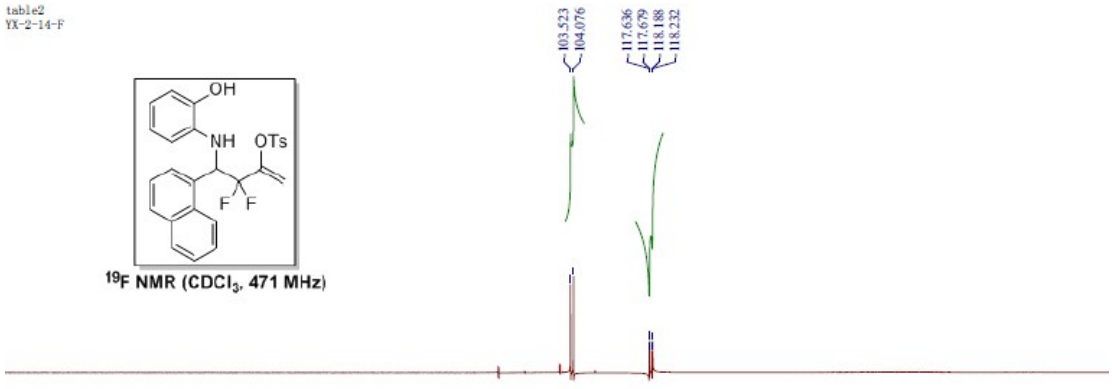


^{19}F NMR ($CDCl_3$, 471 MHz)

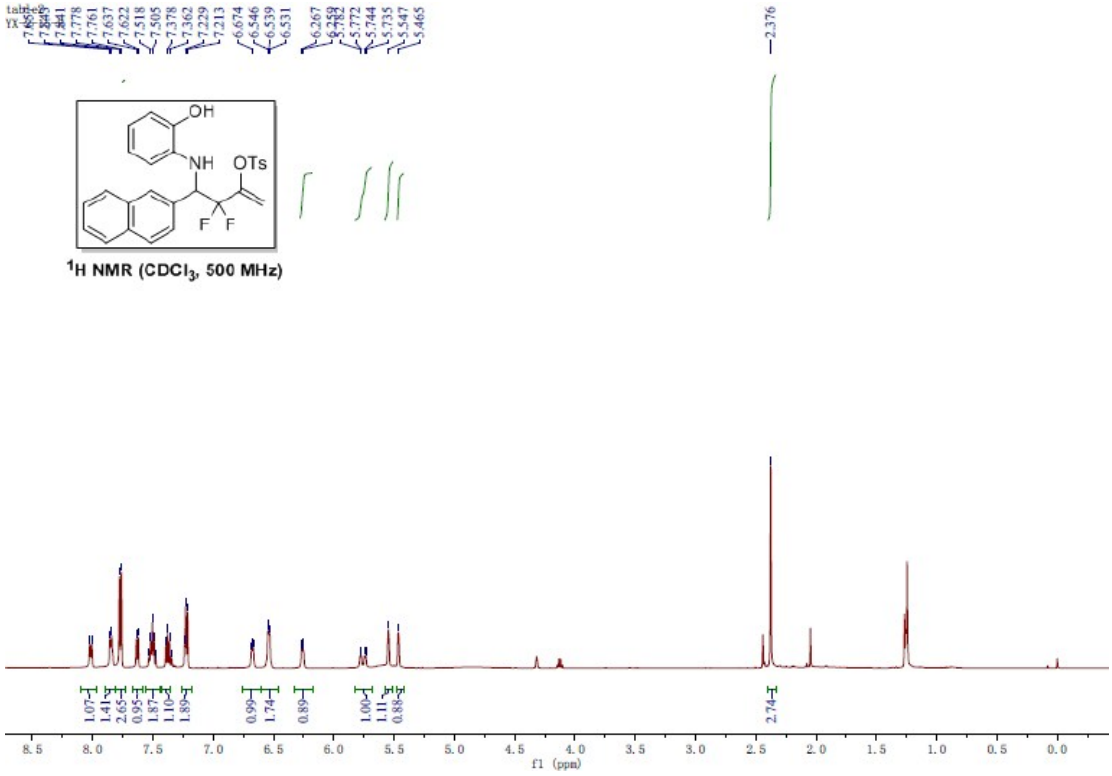


^{1}H NMR ($CDCl_3$, 500 MHz)

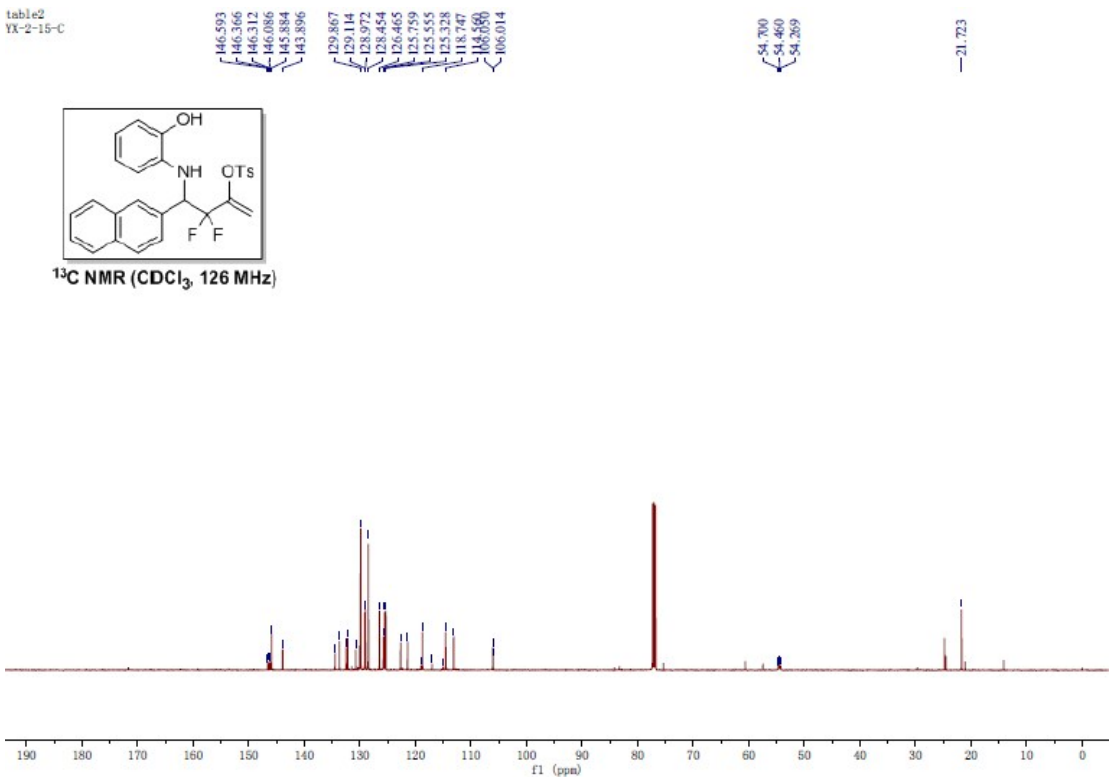
^{13}C NMR ($CDCl_3$, 126 MHz)



^{19}F NMR ($CDCl_3$, 471 MHz)

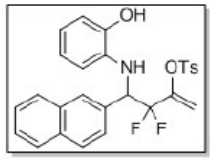


^{1}H NMR ($CDCl_3$, 500 MHz)



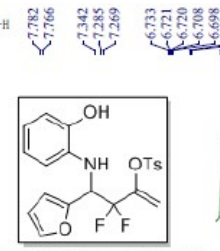
^{13}C NMR ($CDCl_3$, 126 MHz)

table2
YX-2-15-F



^{19}F NMR ($CDCl_3$, 471 MHz)

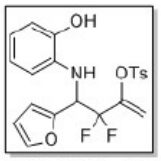
table2
YX-2-17-H



^{1}H NMR ($CDCl_3$, 500 MHz)

table2
YX-2-17-C

148.157
148.135
146.222
145.993
145.725
145.413
133.855
132.073
129.886
128.501
121.137
120.617
118.211
115.476
114.886
110.497
109.884
106.000
105.964
105.928
55.745
55.541
55.516
55.312
21.714



^{13}C NMR ($CDCl_3$, 126 MHz)

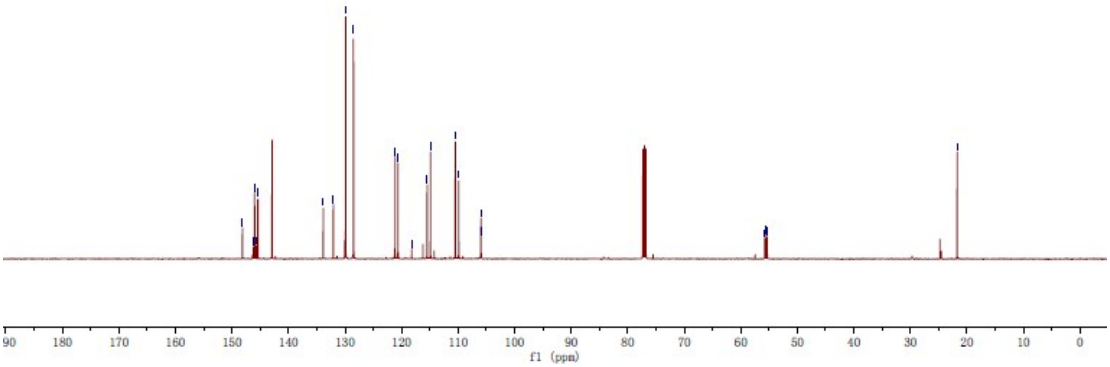
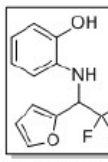


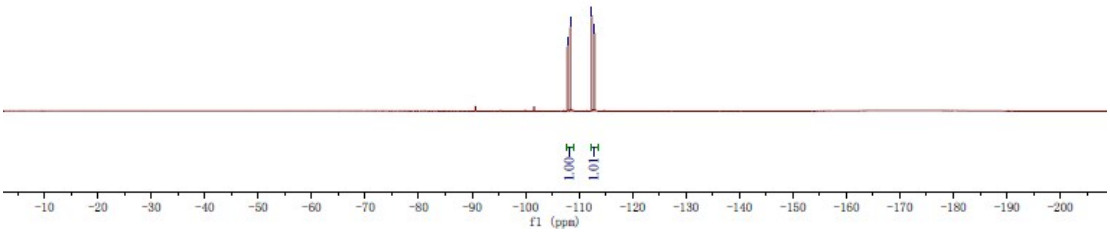
table2
YX-2-17-F

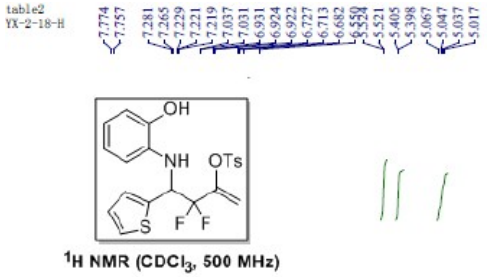
107.822
107.843
108.363
108.385
112.336
112.367
112.878
112.909



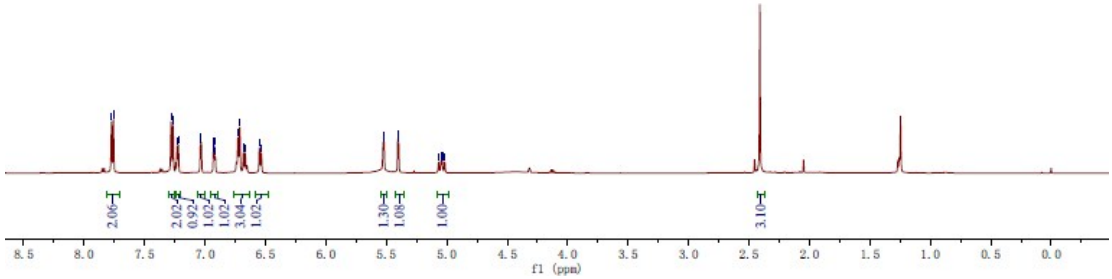
^{19}F NMR ($CDCl_3$, 471 MHz)

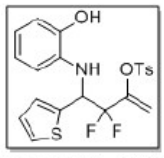
1.00
1.01





^{1}H NMR ($CDCl_3$, 500 MHz)





^{13}C NMR ($CDCl_3$, 126 MHz)

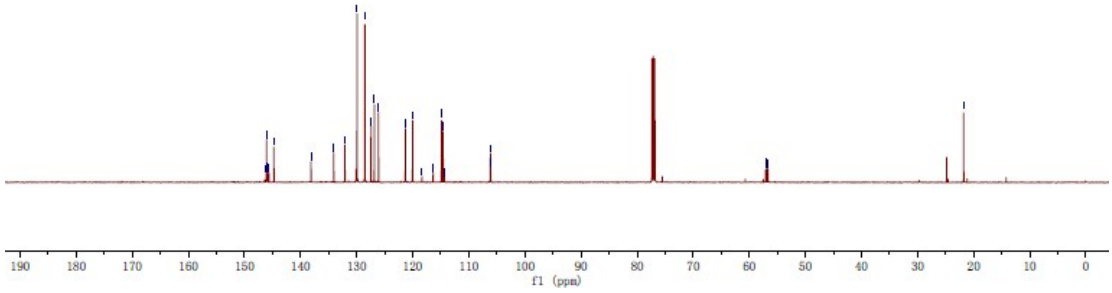
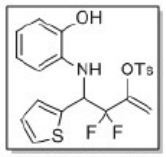
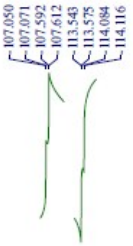


table2
YX-2-18-F



^{19}F NMR ($CDCl_3$, 471 MHz)



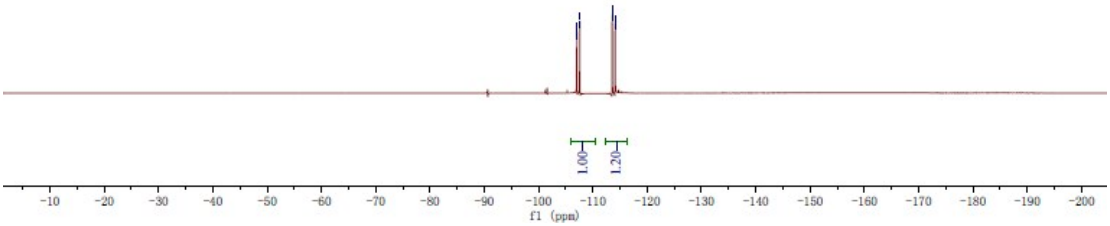
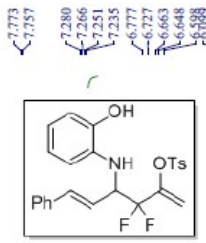


table2
YX-2-19-H



^{1}H NMR ($CDCl_3$, 500 MHz)

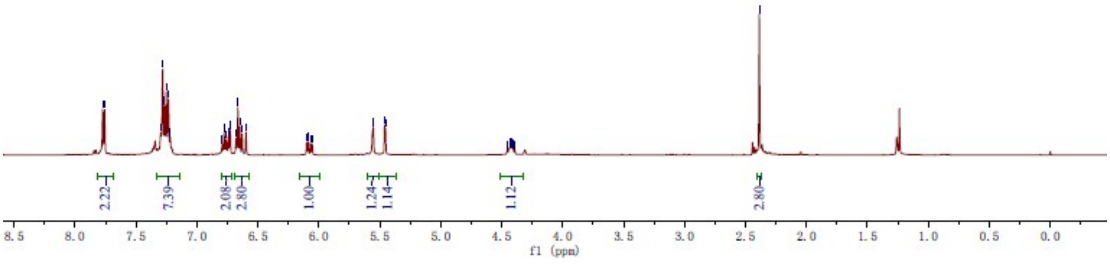
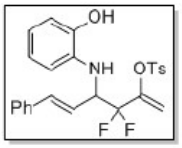


table2
YX-2-19-C



^{13}C NMR ($CDCl_3$, 126 MHz)

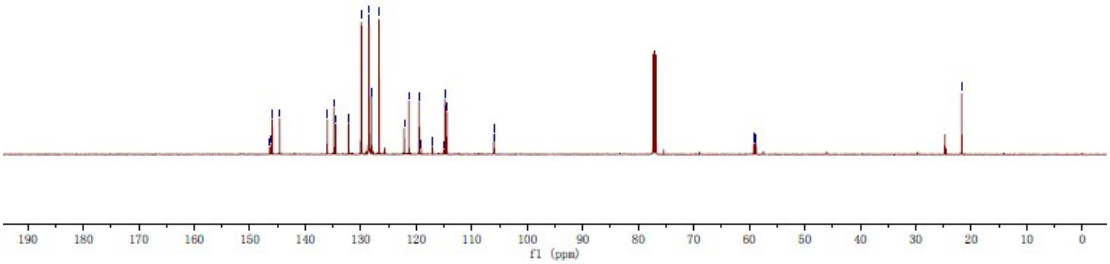
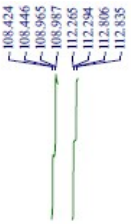
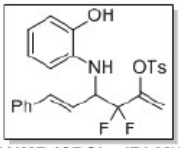
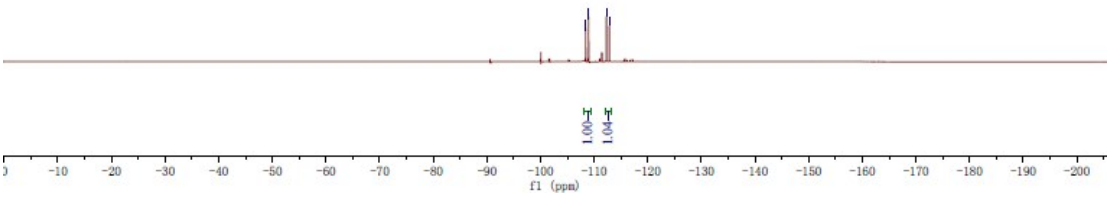


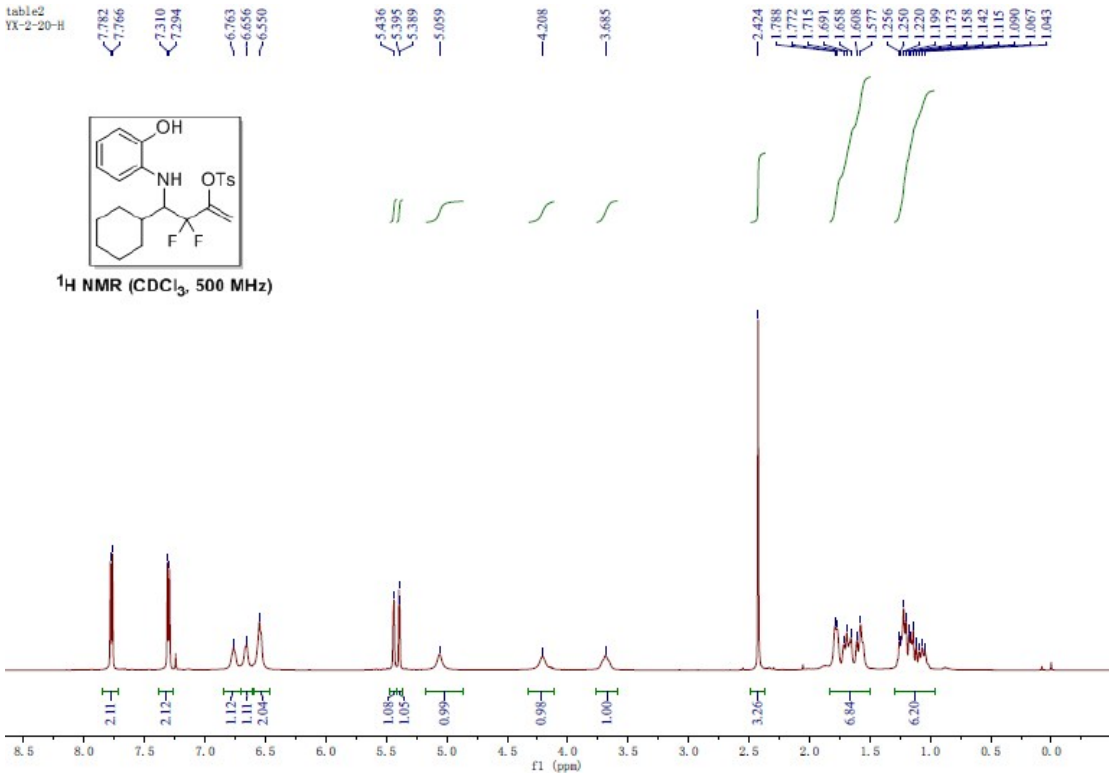
table2
YX-2-19-F



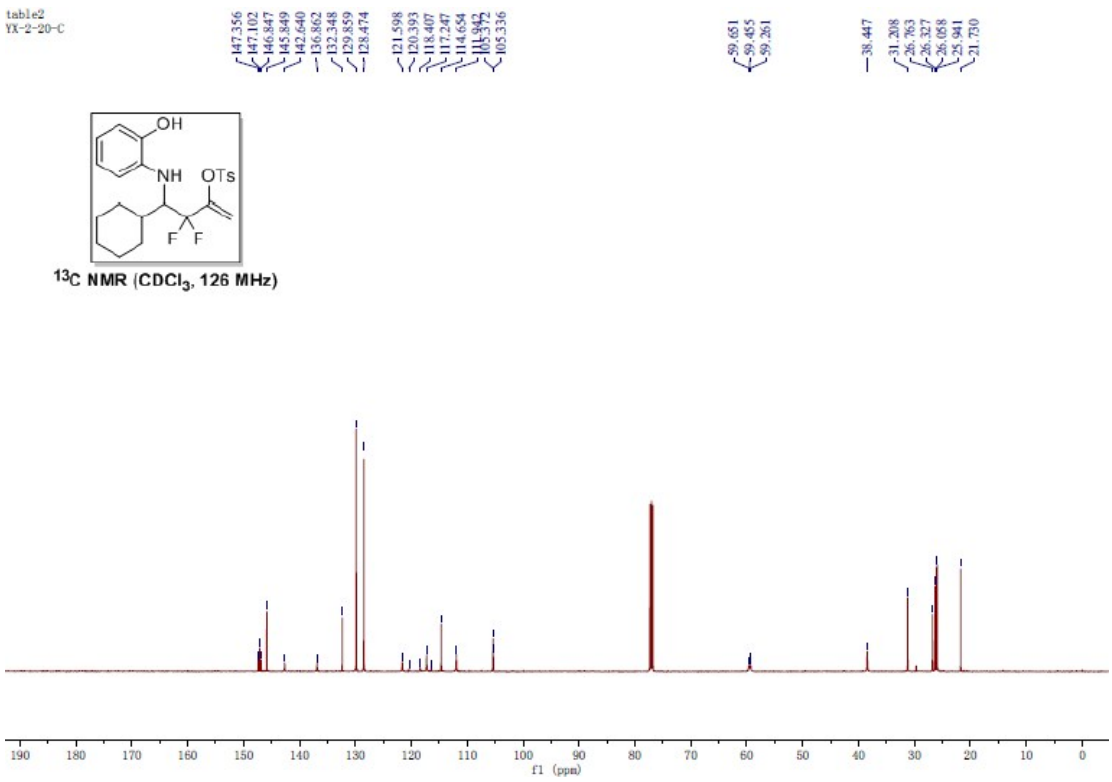


^{19}F NMR ($CDCl_3$, 471 MHz)





^{1}H NMR ($CDCl_3$, 500 MHz)



^{13}C NMR ($CDCl_3$, 126 MHz)

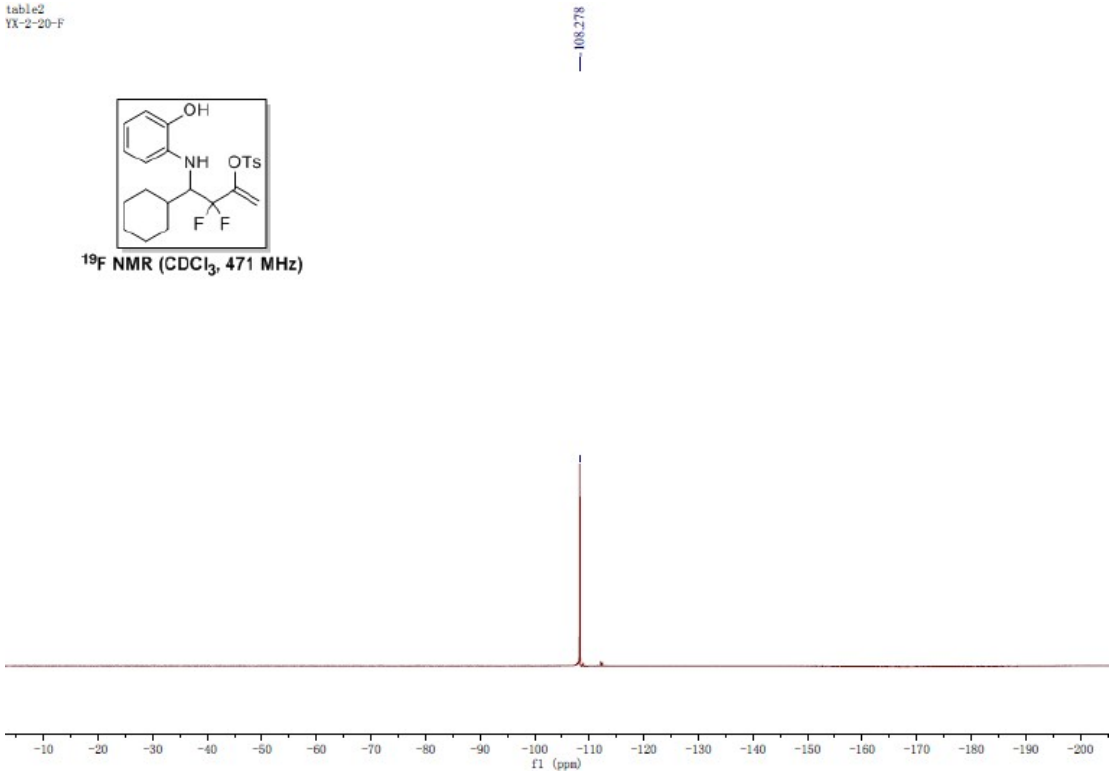


table2
YX-2-20-F
-108.278
OH
NH
OTs
F F
19F NMR (CDCl3, 471 MHz)
-10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200
f1 (ppm)

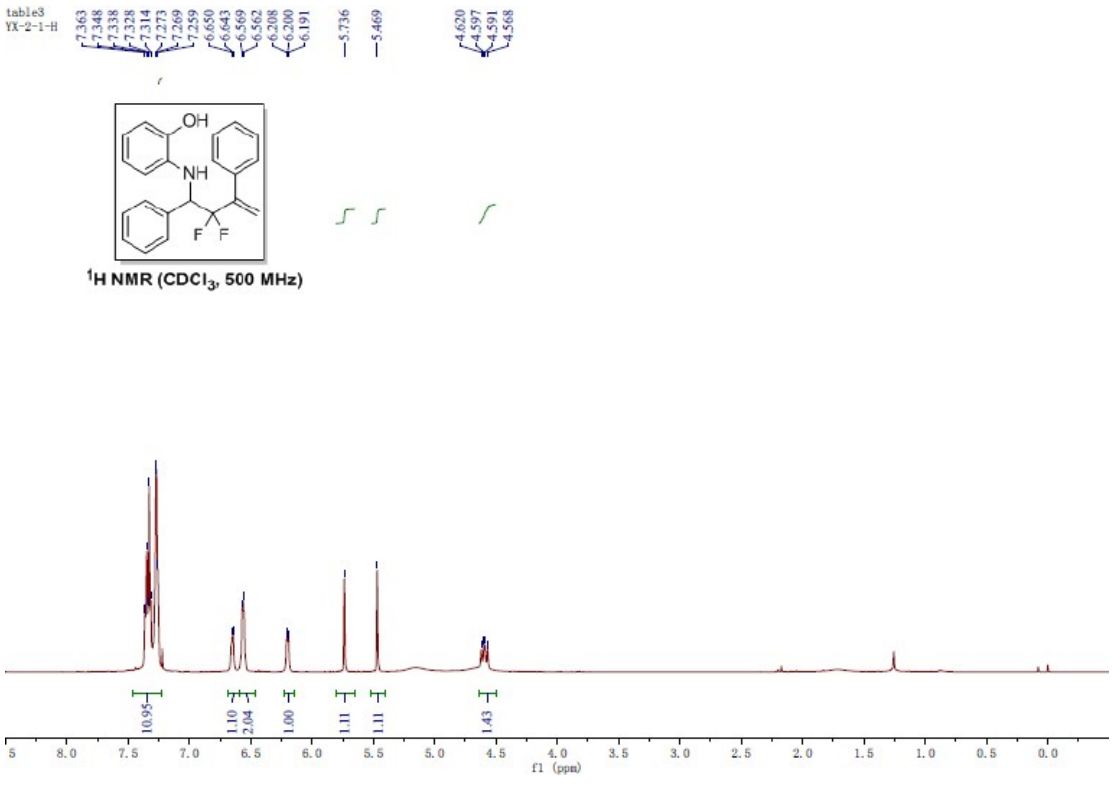
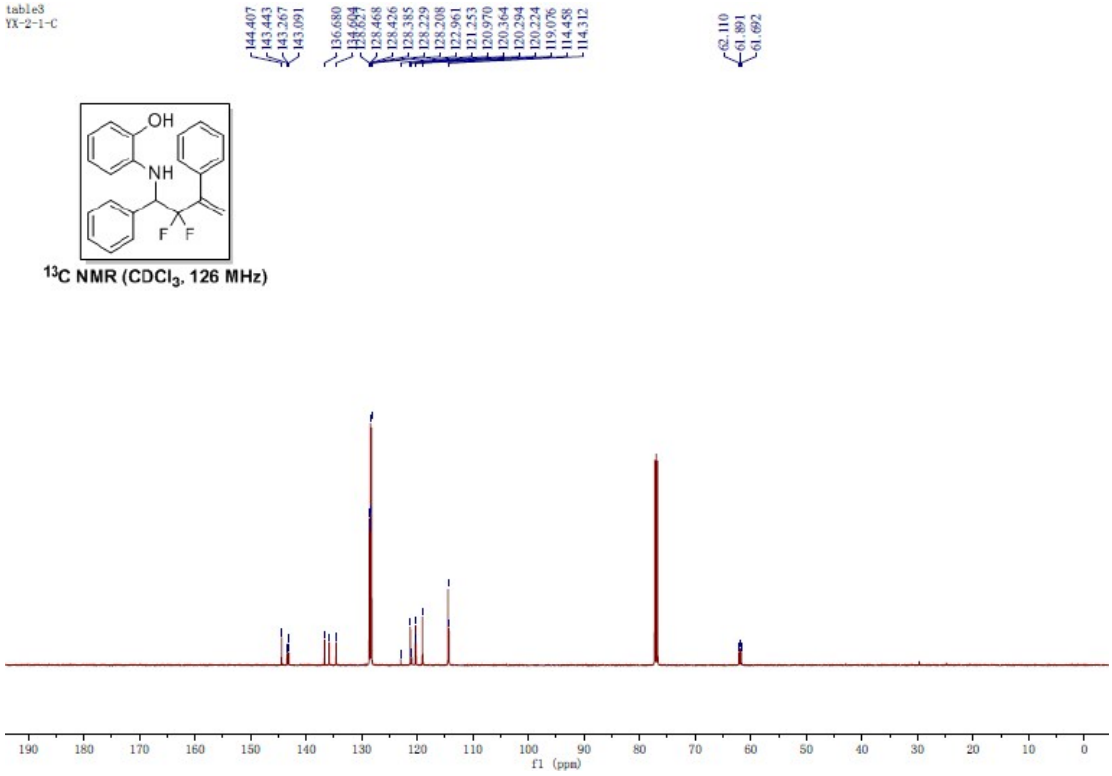
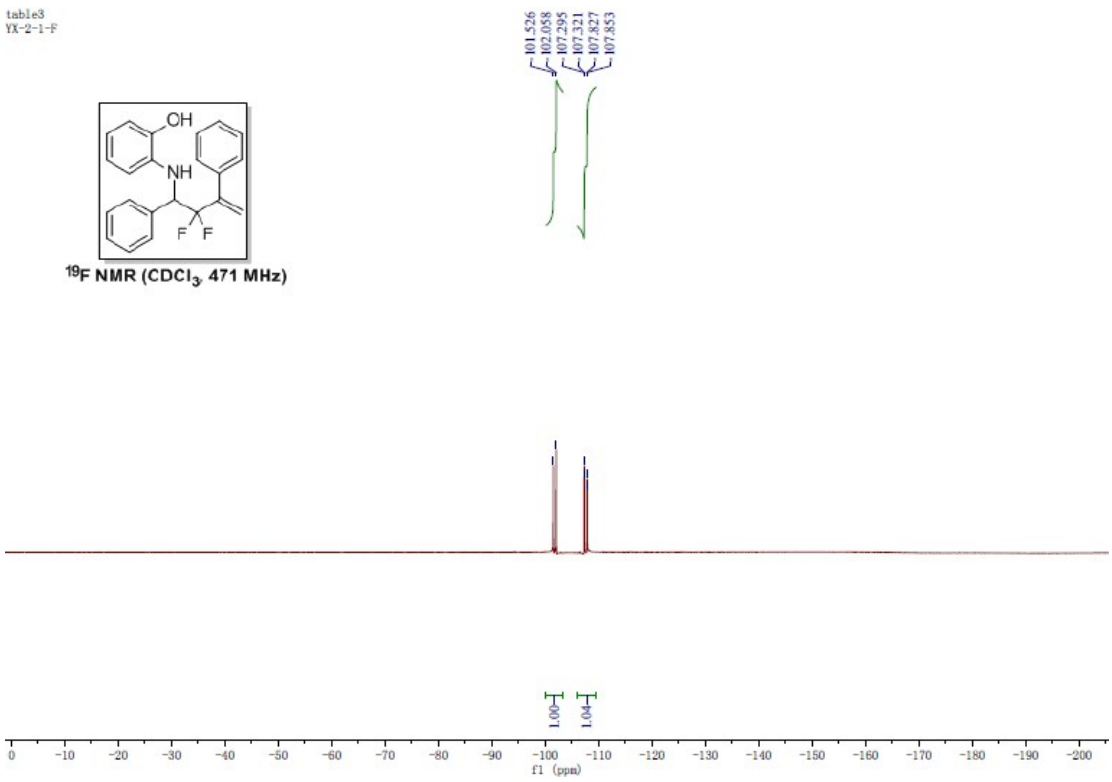


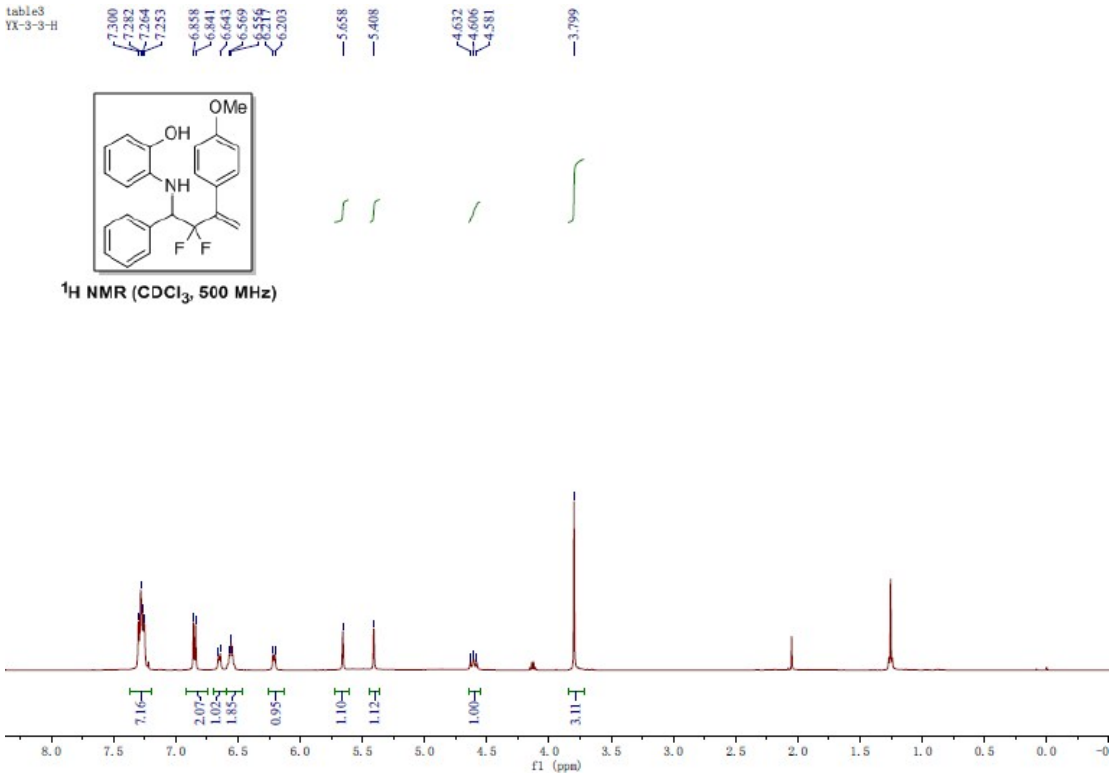
table3
YX-2-1-H
7.363
7.348
7.338
7.328
7.314
7.273
7.269
7.259
6.650
6.643
6.569
6.562
6.208
6.200
6.191
5.736
5.469
4.620
4.597
4.591
4.568
OH
NH
F F
1H NMR (CDCl3, 500 MHz)
10.95
1.10
2.04
1.00
1.11
1.11
1.43
8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)



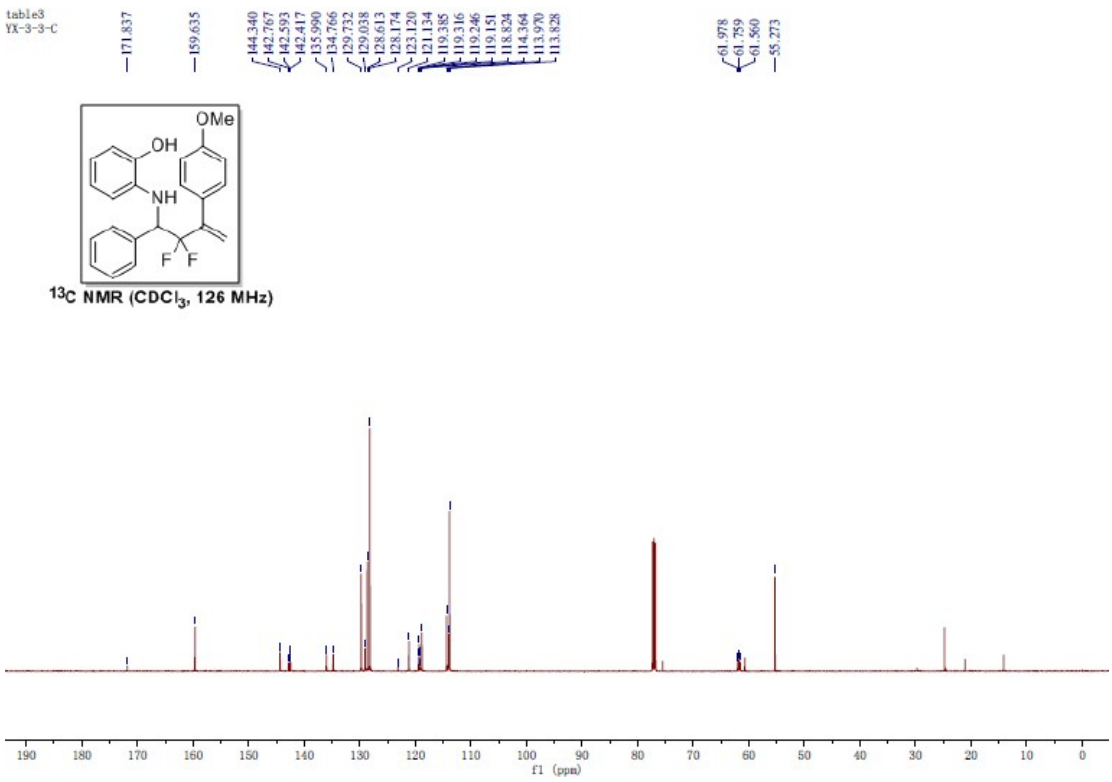
^{13}C NMR ($CDCl_3$, 126 MHz)



^{19}F NMR ($CDCl_3$, 471 MHz)

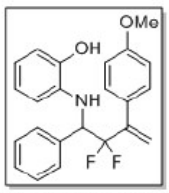


^{1}H NMR ($CDCl_3$, 500 MHz)



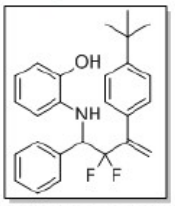
^{13}C NMR ($CDCl_3$, 126 MHz)

table3
YX-3-3-F



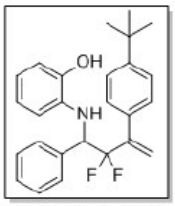
^{19}F NMR ($CDCl_3$, 471 MHz)

table3
YX-3-4-H



^{1}H NMR ($CDCl_3$, 500 MHz)

table3
YX-3-4-C



^{13}C NMR ($CDCl_3$, 126 MHz)

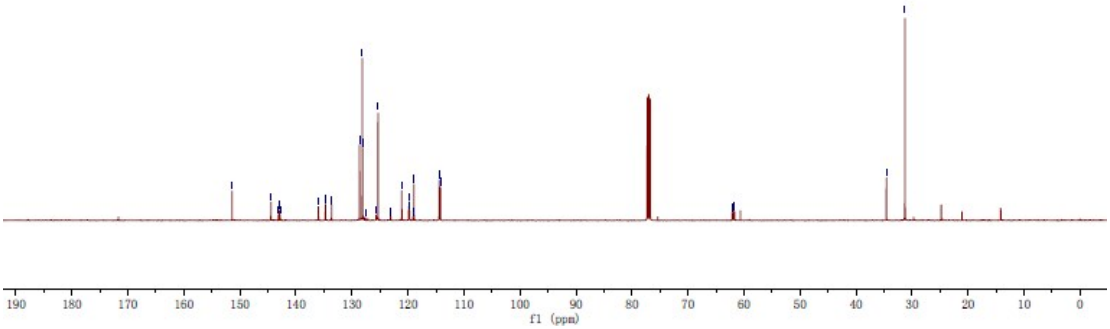
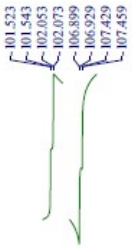
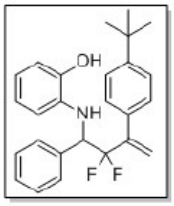
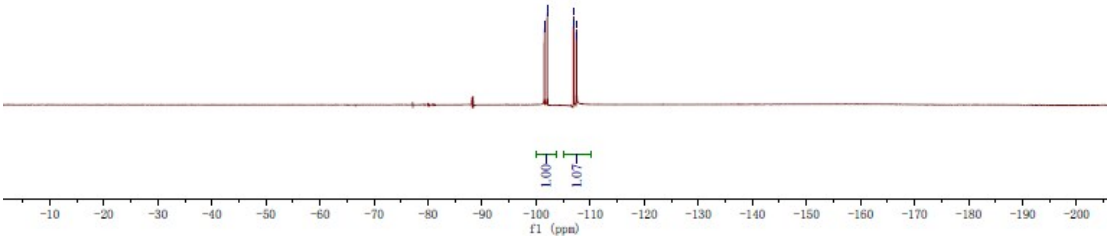


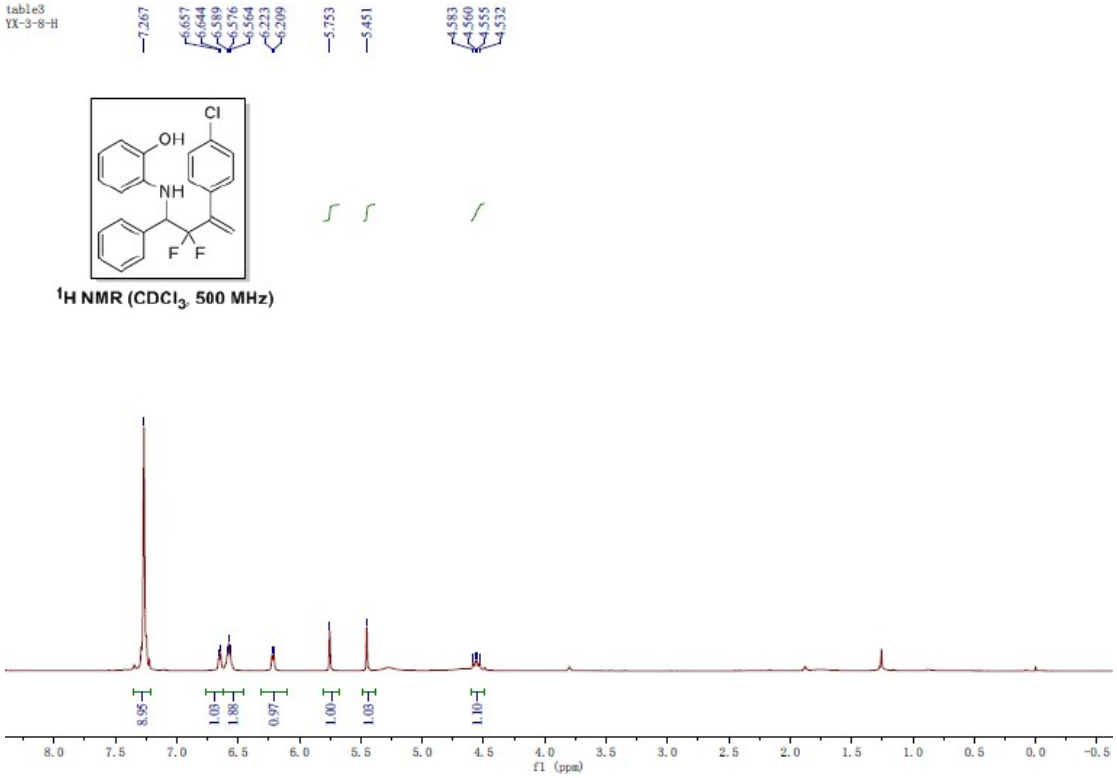
table3
YX-3-4-F



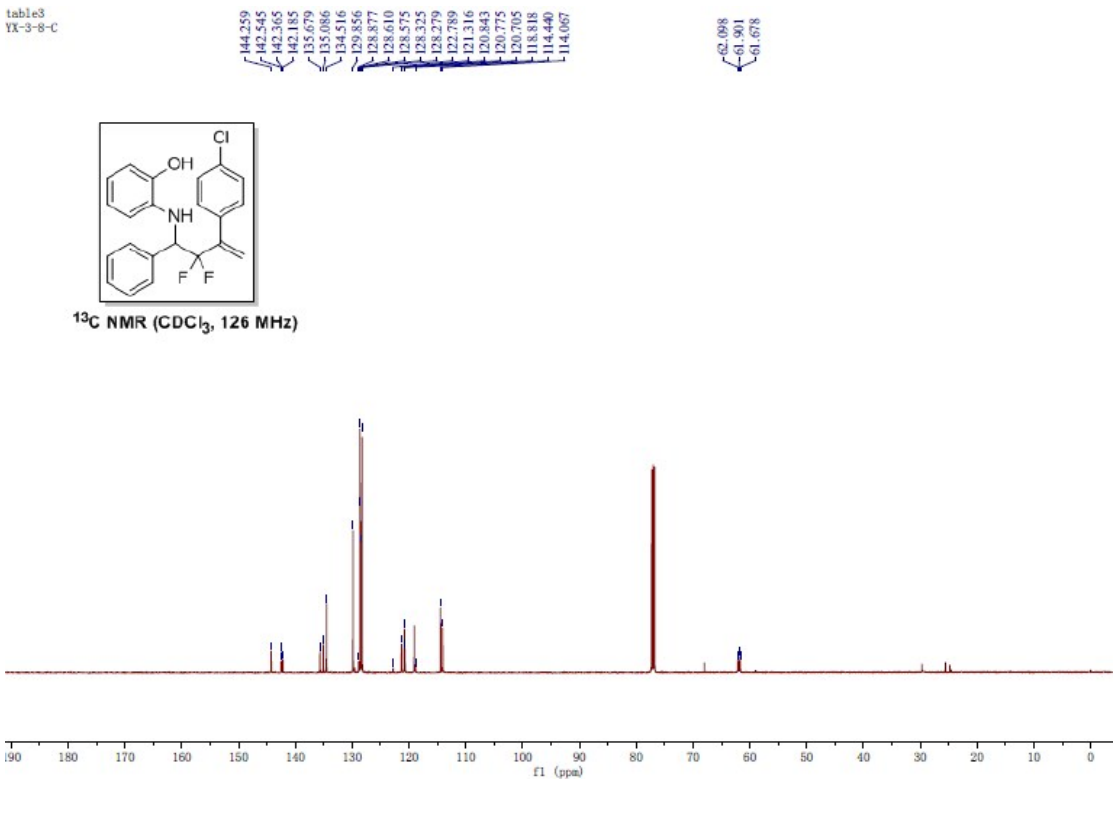


^{19}F NMR ($CDCl_3$, 471 MHz)



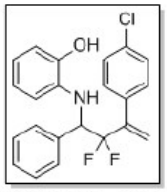


^{1}H NMR ($CDCl_3$, 500 MHz)



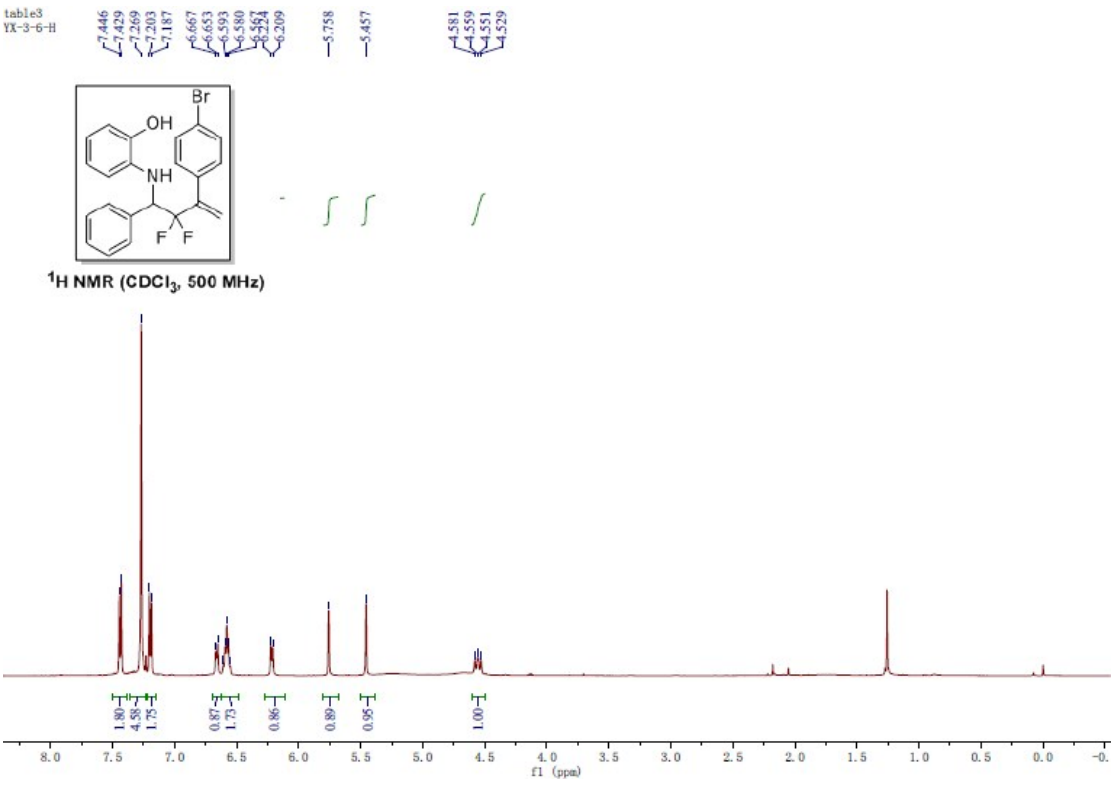
^{13}C NMR ($CDCl_3$, 126 MHz)

table3
YX-3-8-F



^{19}F NMR ($CDCl_3$, 471 MHz)

table3
YX-3-6-H

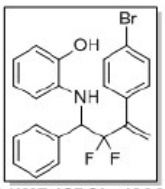


^{1}H NMR ($CDCl_3$, 500 MHz)

table3
YX-3-6-C

144.244
142.584
142.404
142.225
135.653
135.552
134.503
131.572
130.148
128.566
128.324
128.279
122.749
121.315
120.858
120.789
120.721
119.063
118.753
114.436
114.059

62.078
61.855
61.659



^{13}C NMR ($CDCl_3$, 126 MHz)

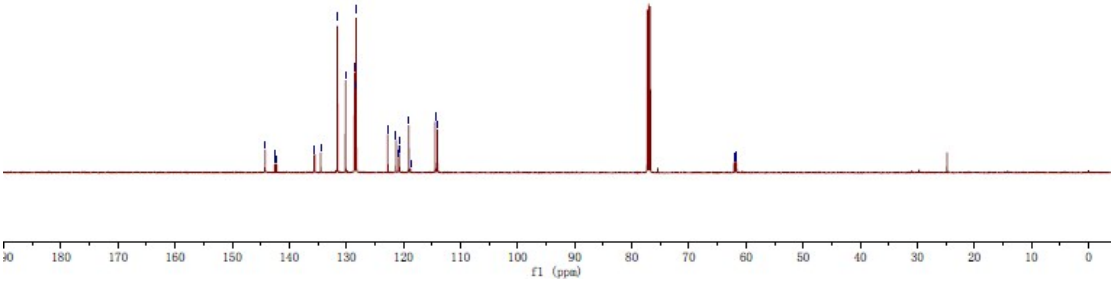
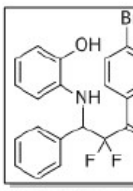
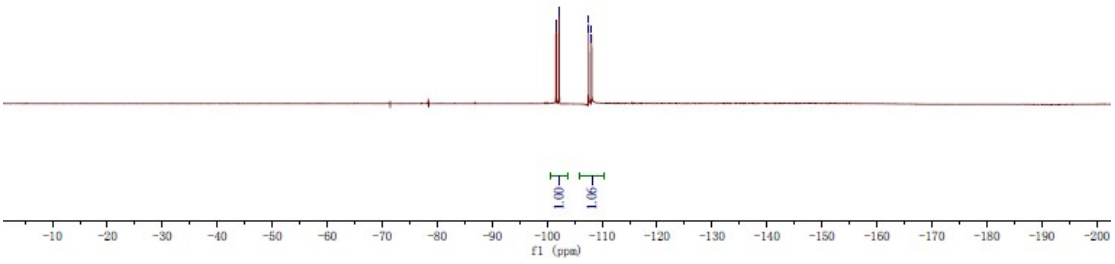


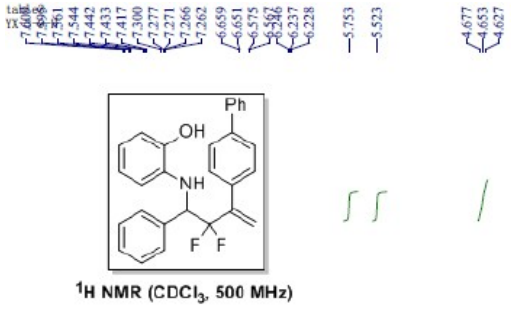
table3
YX-3-6-F

-101.638
-101.657
-102.172
-102.190
-107.531
-107.562
-108.063
-108.095

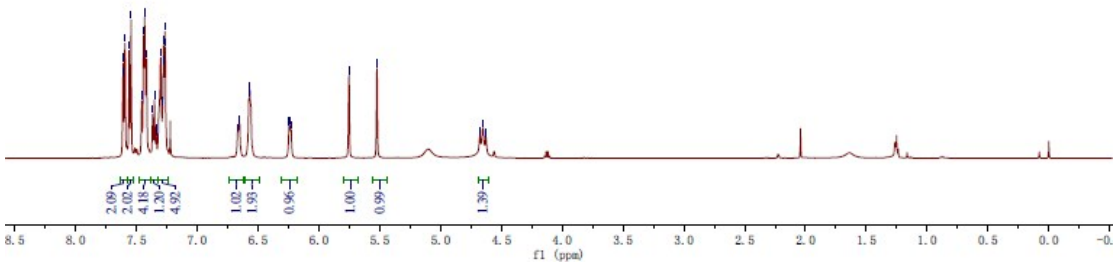


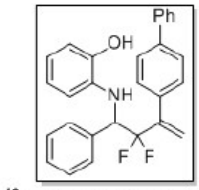
^{19}F NMR ($CDCl_3$, 471 MHz)





^{1}H NMR ($CDCl_3$, 500 MHz)





^{13}C NMR ($CDCl_3$, 126 MHz)

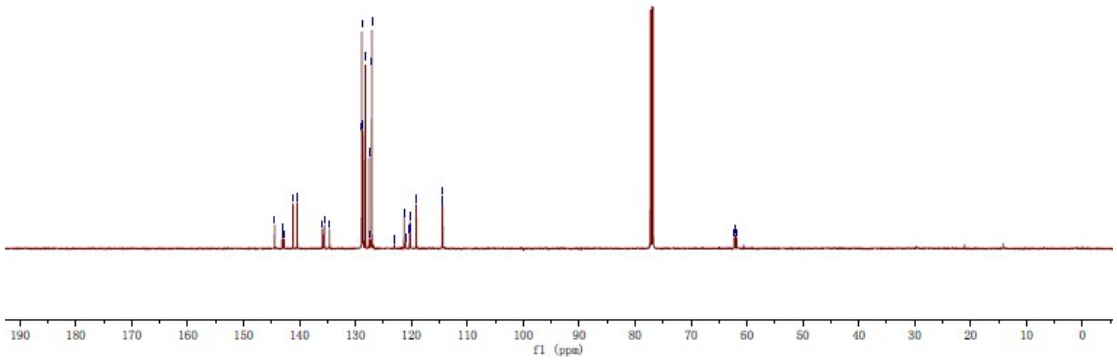
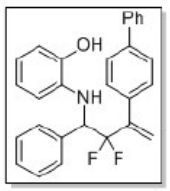
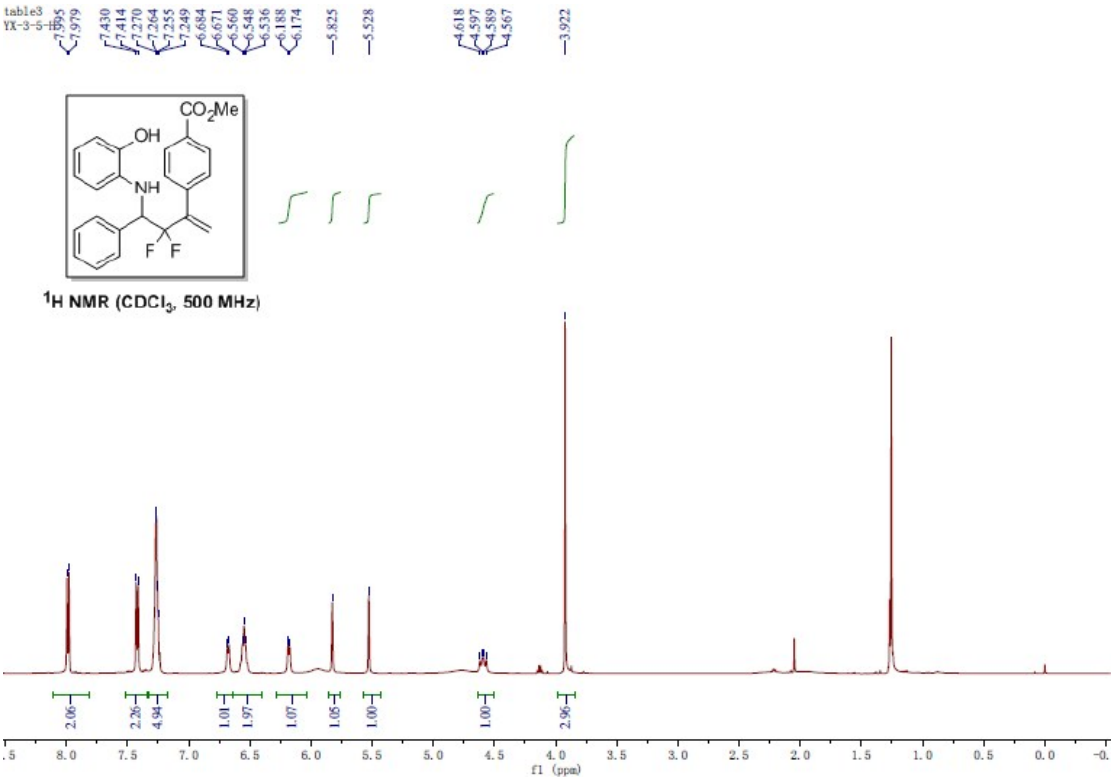


table3
YX-3-9-F



^{19}F NMR ($CDCl_3$, 471 MHz)

table3
YX-3-5-H



^{1}H NMR ($CDCl_3$, 500 MHz)

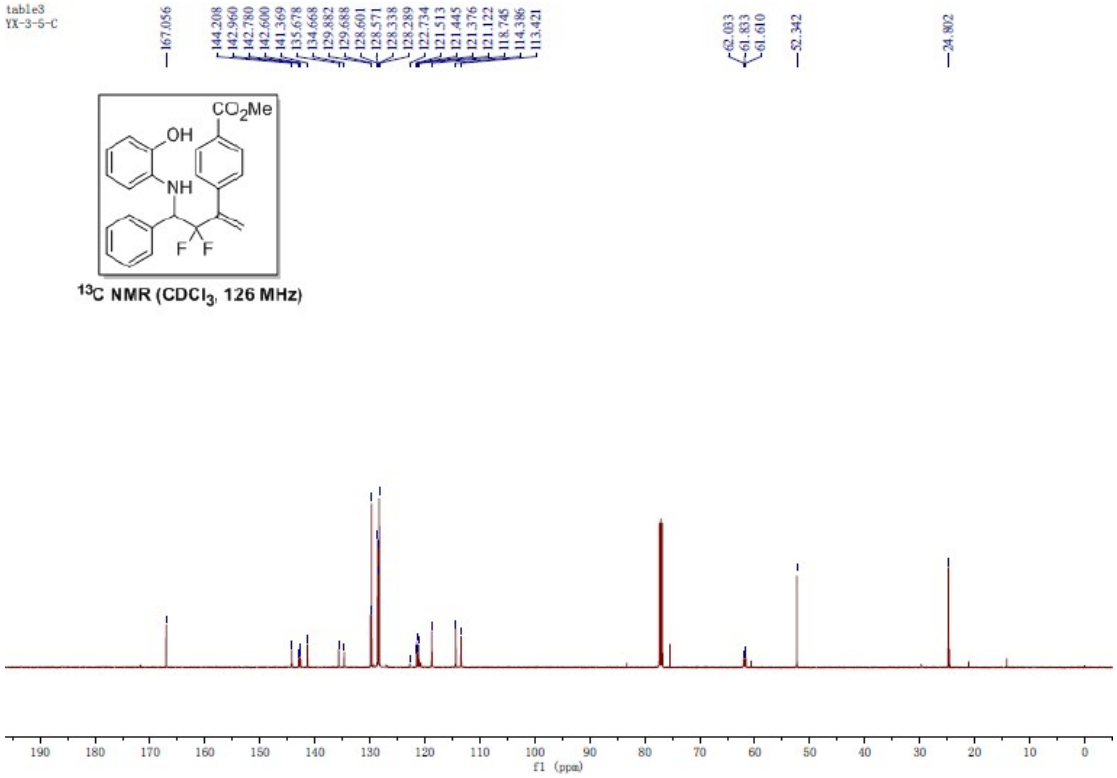


table3
YX-3-5-C
167.056
144.208
142.960
142.780
142.600
141.369
135.678
134.668
129.882
129.688
128.601
128.571
128.338
128.289
122.734
121.513
121.445
121.376
121.122
118.745
114.386
113.421
62.033
61.833
61.610
52.342
34.802
CO2Me
OH
NH
F F
13C NMR (CDCl3, 126 MHz)
f1 (ppm)

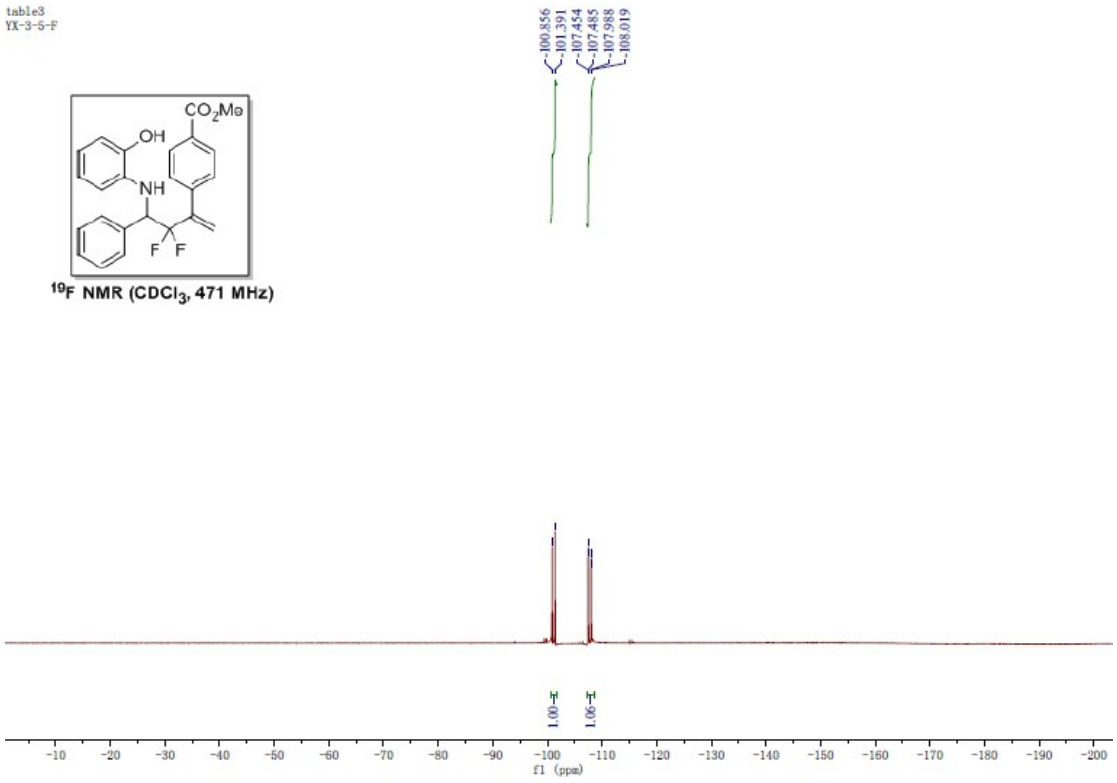


table3
YX-3-5-F
-100.856
-101.391
-107.454
-107.485
-107.988
-108.019
CO2Me
OH
NH
F F
19F NMR (CDCl3, 471 MHz)
1.00
1.06
f1 (ppm)

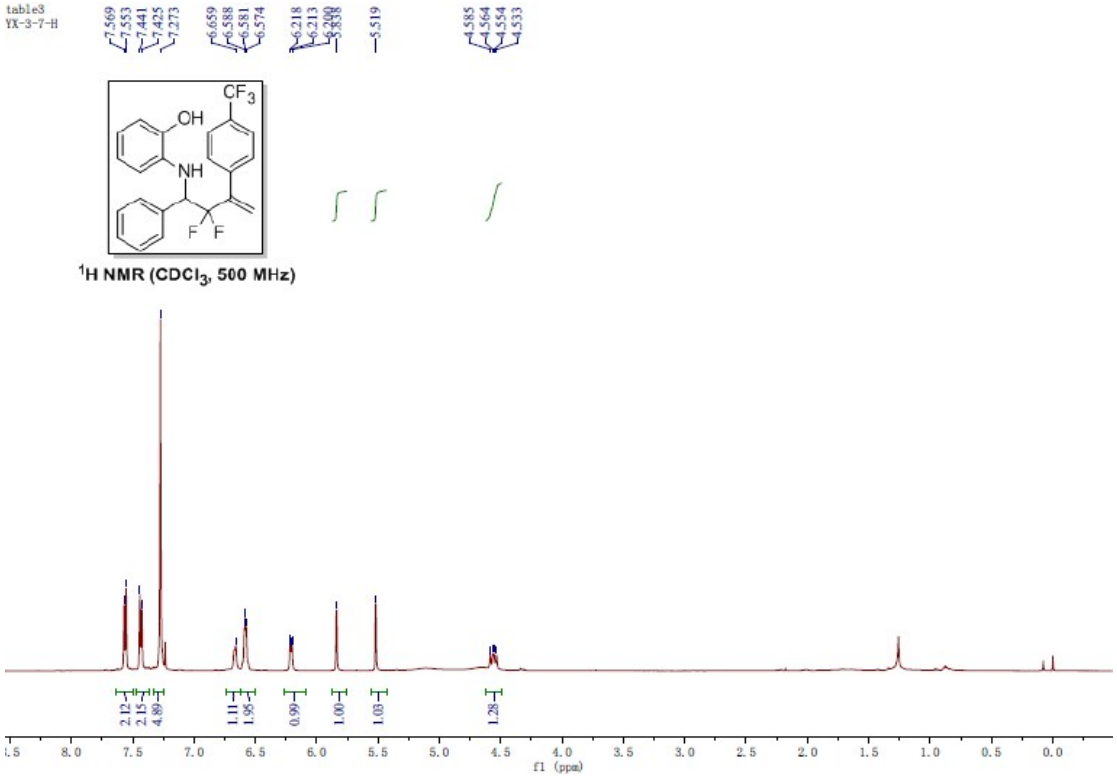


table3
YX-3-7-H
7.569
7.553
7.441
7.425
7.273
6.659
6.588
6.581
6.574
6.218
6.213
6.200
5.838
5.519
4.585
4.564
4.554
4.533
CF3
OH
NH
F F
1H NMR (CDCl3, 500 MHz)
2.12
2.15
4.89
1.11
1.95
0.99
1.00
1.03
1.28
f1 (ppm)

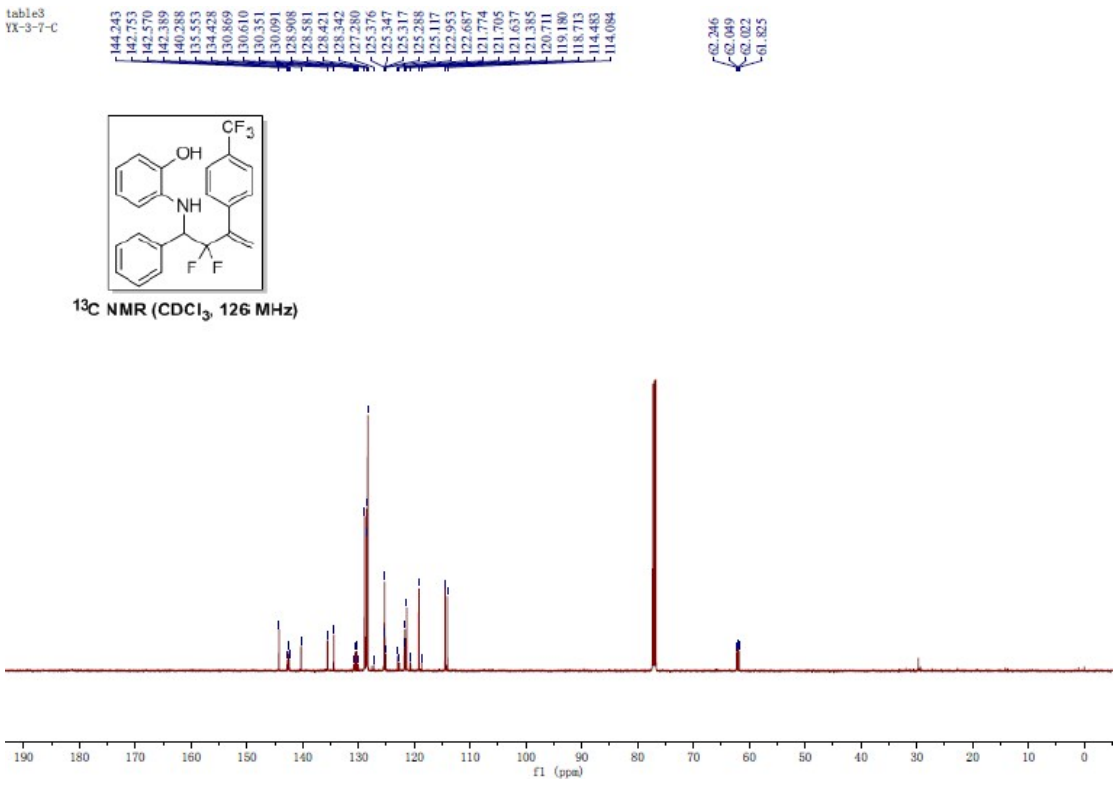
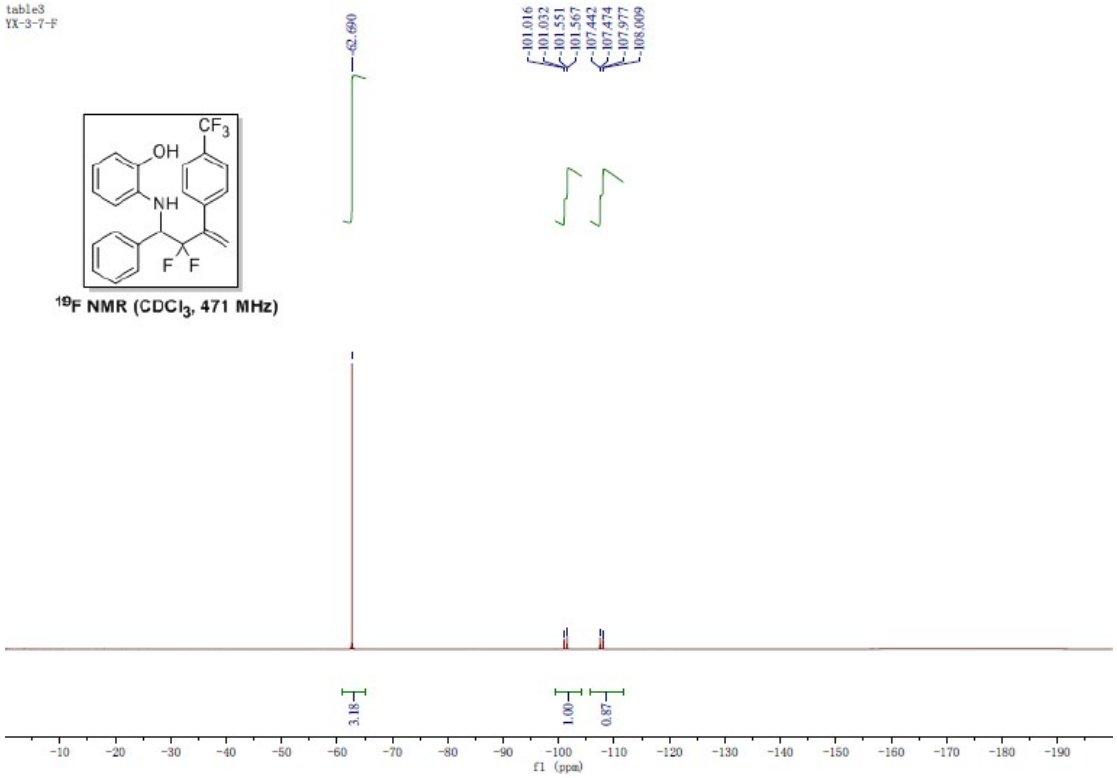
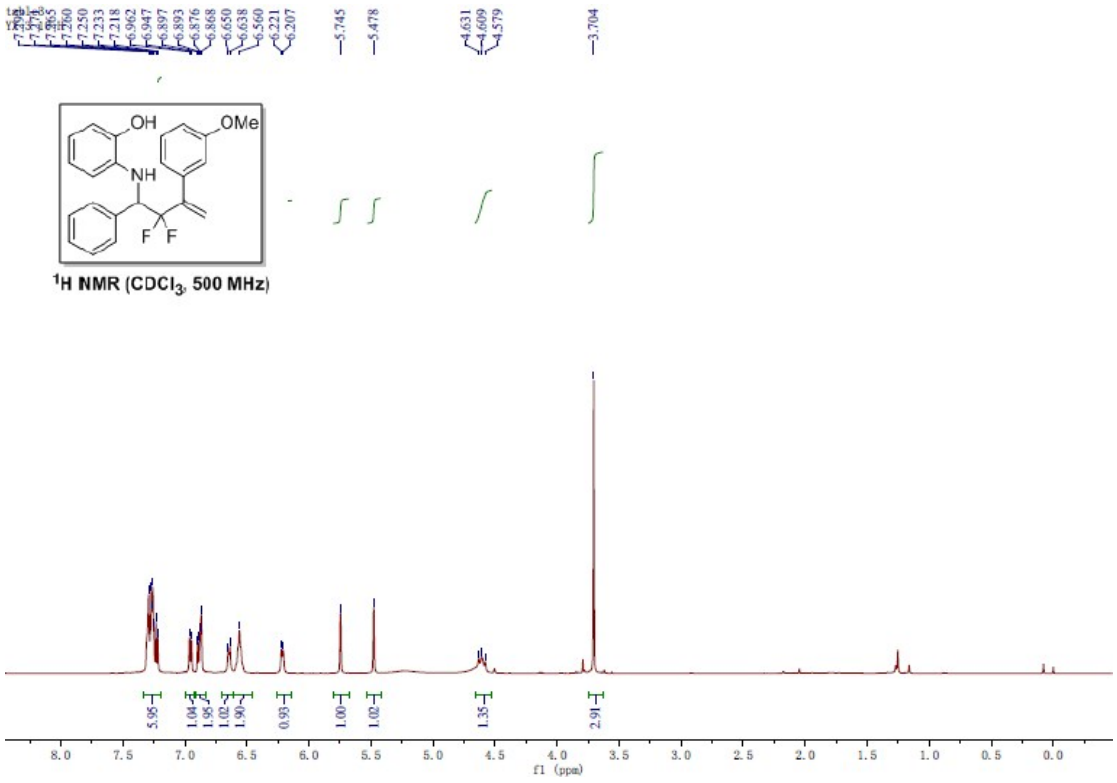


table3
YX-3-7-C
144.243
142.753
142.570
142.389
140.288
135.553
134.428
130.869
130.610
130.351
130.091
128.908
128.581
128.421
128.342
127.280
125.376
125.347
125.317
125.288
123.117
122.953
122.687
121.774
121.705
121.637
121.385
120.711
119.180
118.713
114.483
114.084
62.246
62.049
62.022
61.825
CF3
OH
NH
F F
13C NMR (CDCl3, 126 MHz)
f1 (ppm)



^{19}F NMR ($CDCl_3$, 471 MHz)

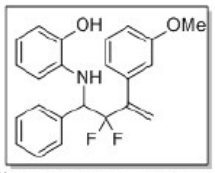


^{1}H NMR ($CDCl_3$, 500 MHz)

table3
YX-3-10-C

159.401
144.326
143.390
143.214
143.038
138.013
135.887
134.675
129.442
128.657
128.234
128.204
122.890
121.267
120.983
120.391
120.321
120.251
118.998
114.440
114.366
114.154
113.913

61.994
61.796
61.574
55.201



^{13}C NMR ($CDCl_3$, 126 MHz)

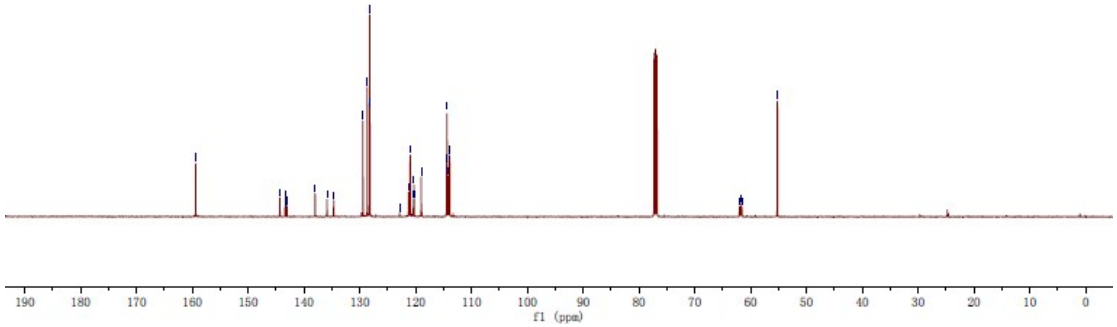
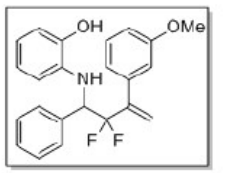
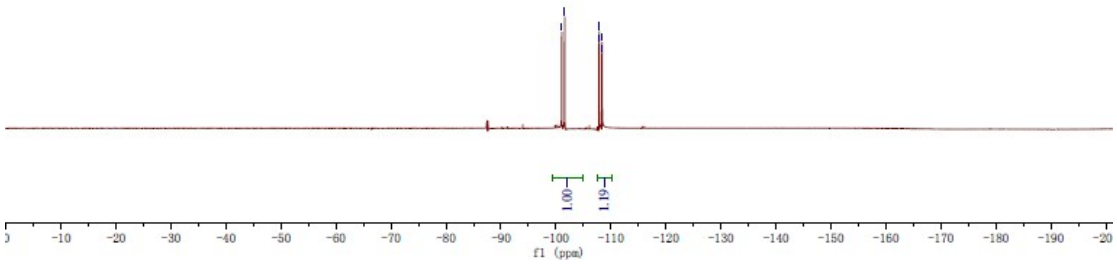


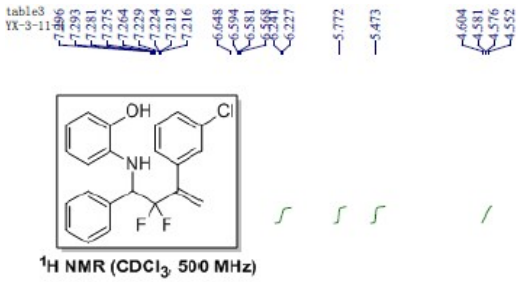
table3
YX-3-10-F

-101.057
-101.589
-107.837
-107.868
-108.369
-108.400

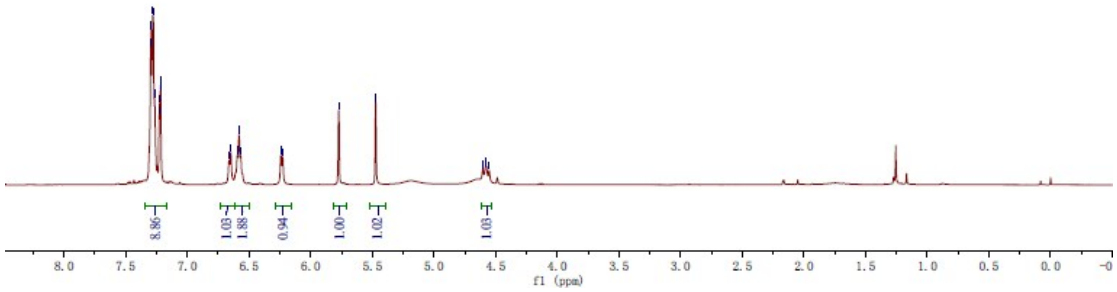


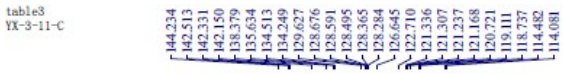
^{19}F NMR ($CDCl_3$, 471 MHz)

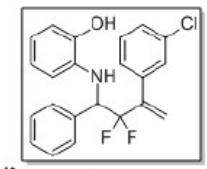




^{1}H NMR ($CDCl_3$, 500 MHz)







^{13}C NMR ($CDCl_3$, 126 MHz)

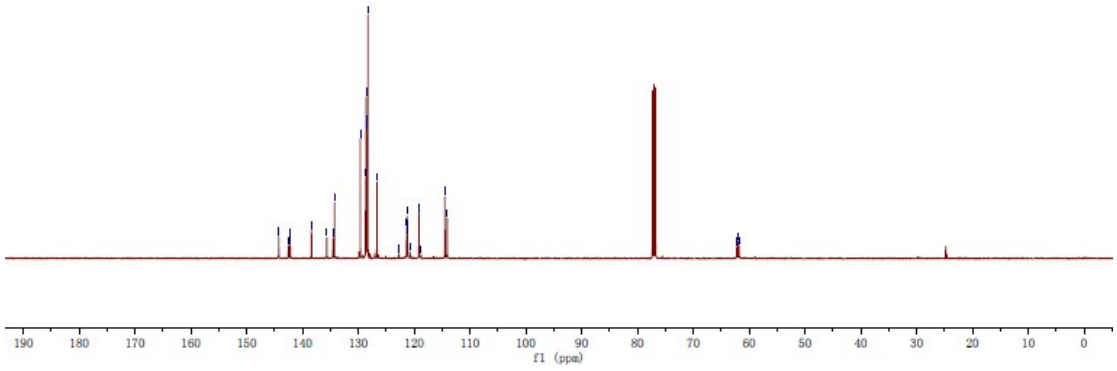
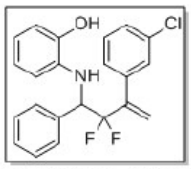
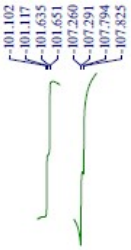
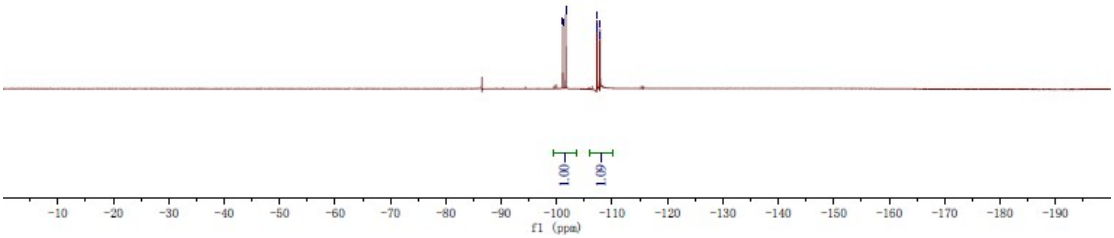


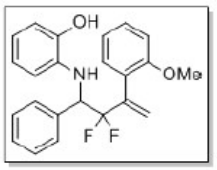
table3
YX-3-11-F



^{19}F NMR ($CDCl_3$, 471 MHz)







^{1}H NMR ($CDCl_3$, 500 MHz)

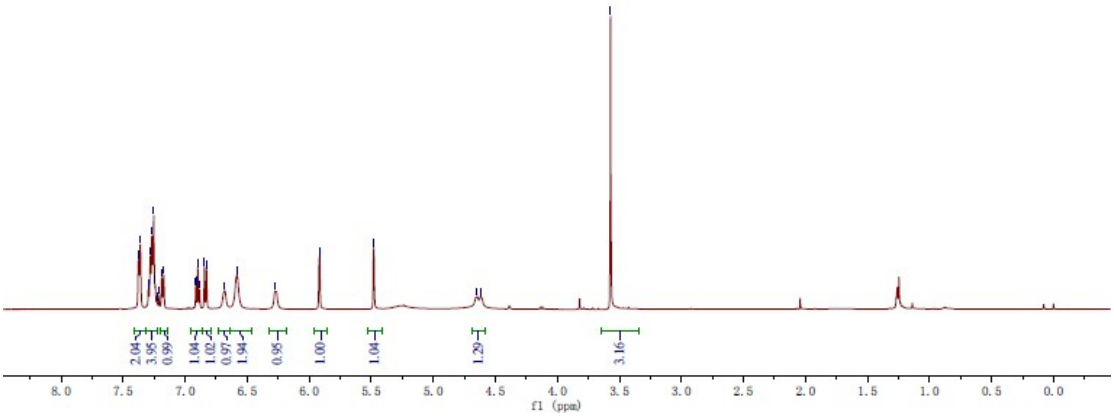
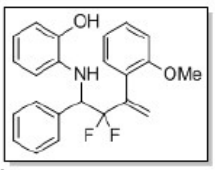


table3
YX-3-20-C



^{13}C NMR ($CDCl_3$, 126 MHz)

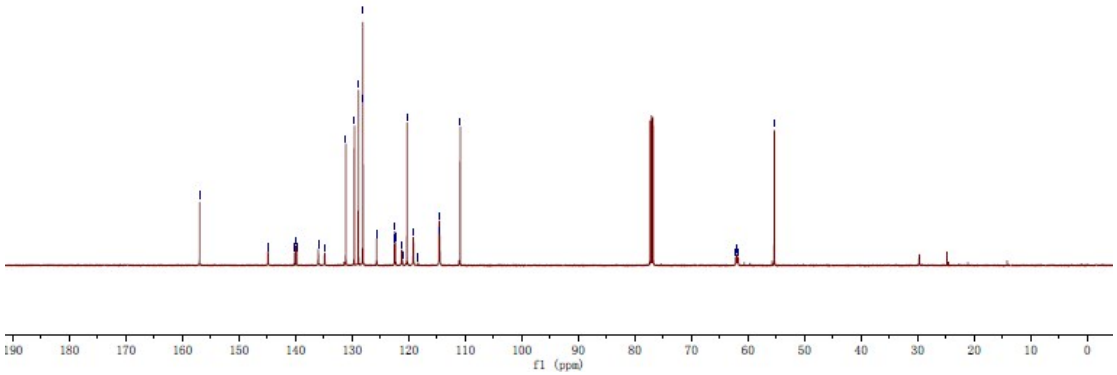
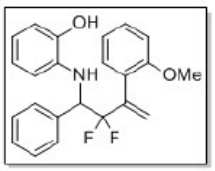
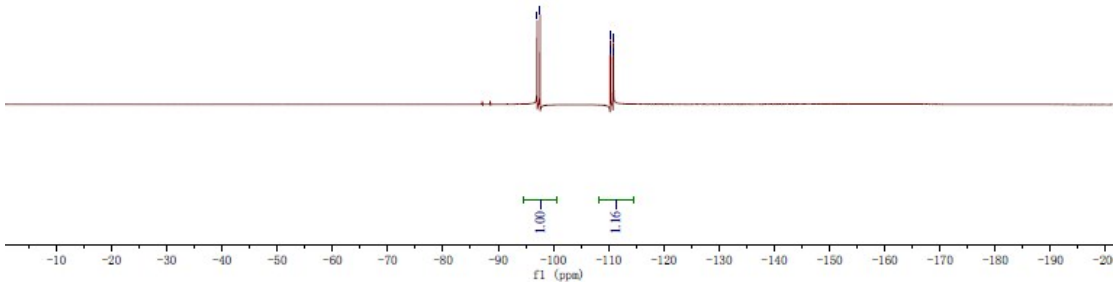
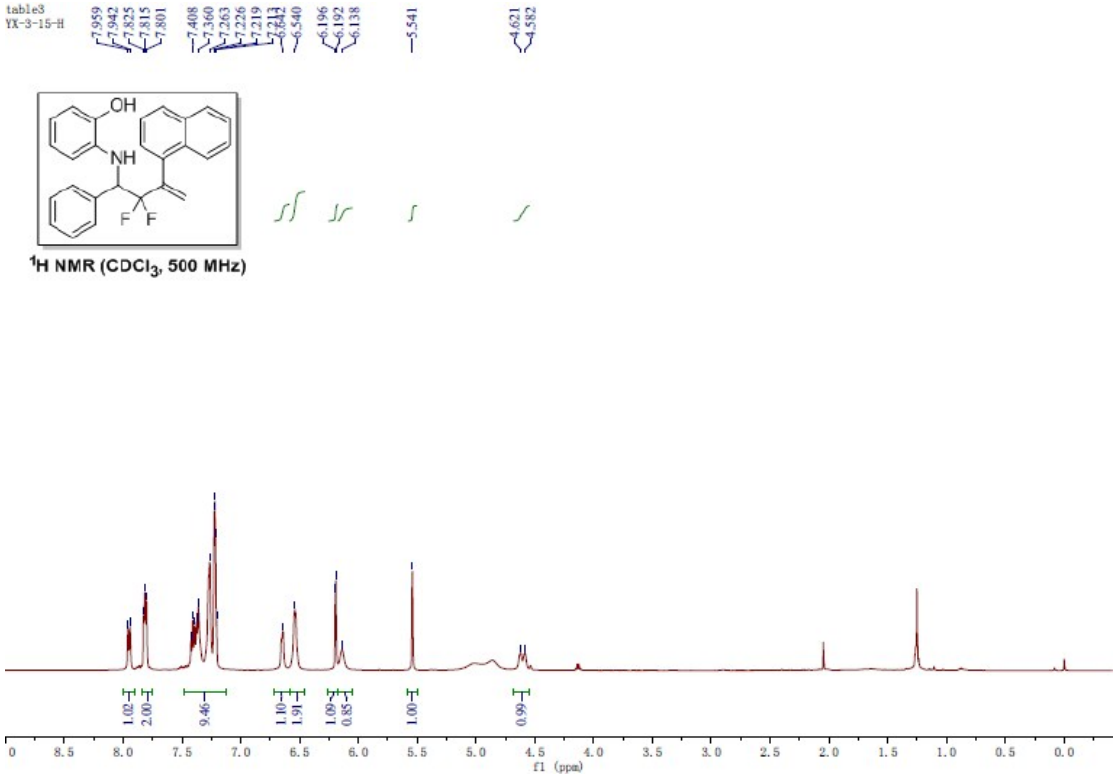


table3
YX-3-20-F

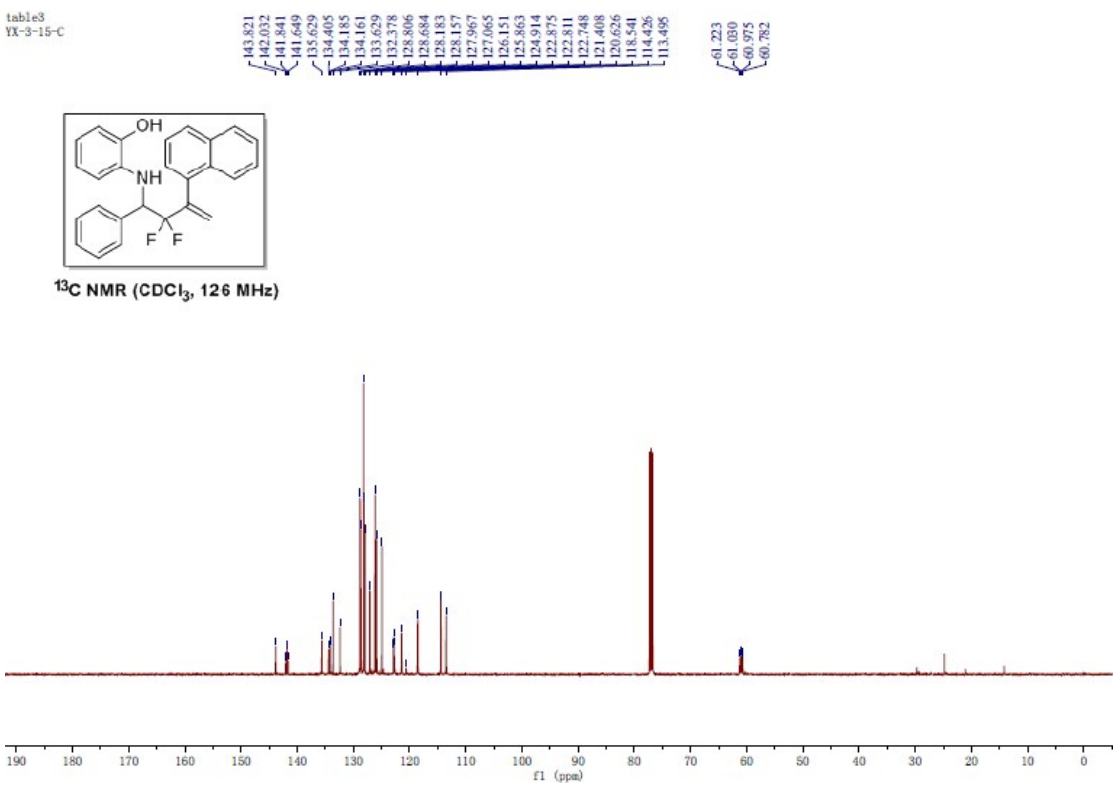


^{19}F NMR ($CDCl_3$, 471 MHz)

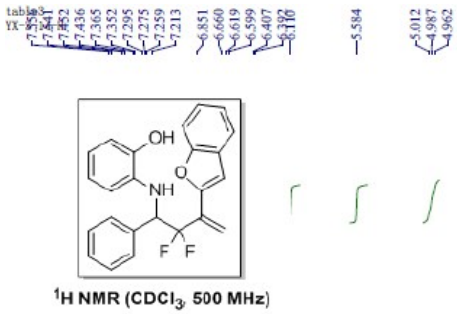




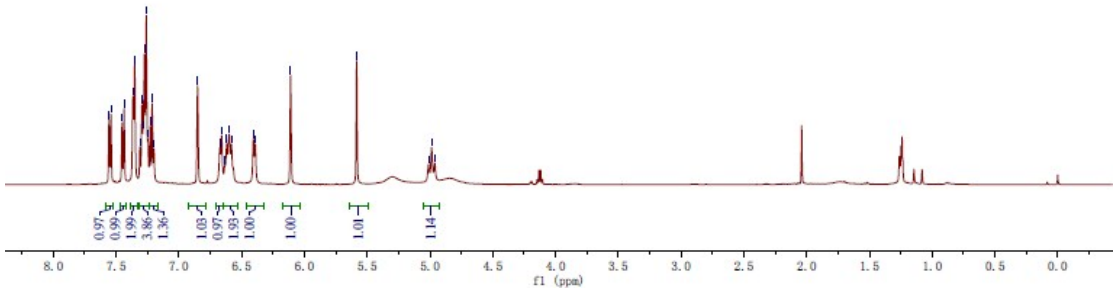
^{1}H NMR ($CDCl_3$, 500 MHz)

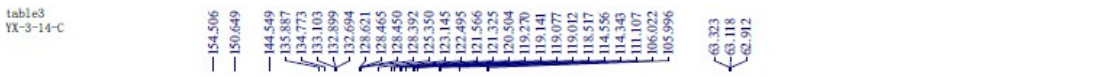


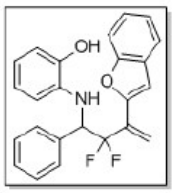
^{13}C NMR ($CDCl_3$, 126 MHz)



^{1}H NMR ($CDCl_3$, 500 MHz)







^{13}C NMR ($CDCl_3$, 126 MHz)

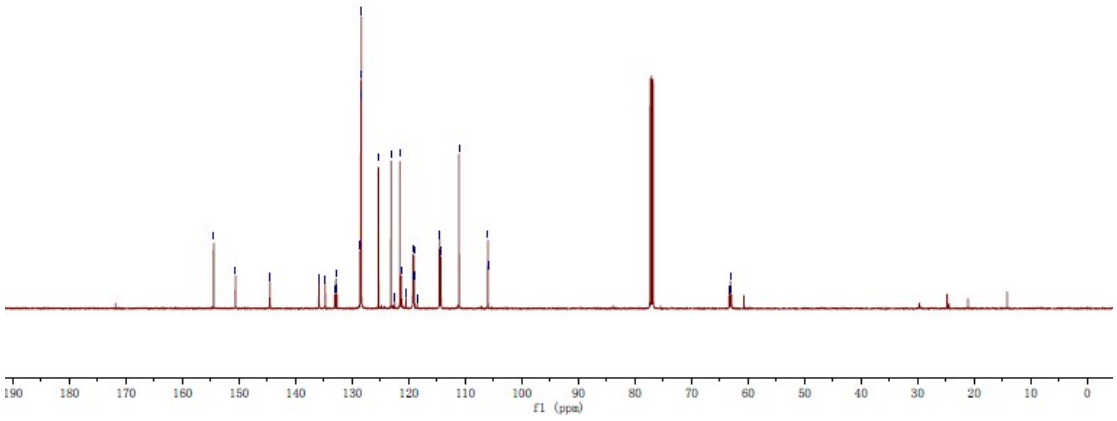
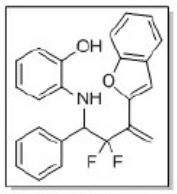
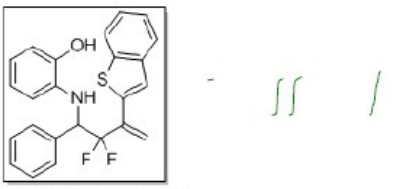


table3
YX-3-14-F



^{19}F NMR ($CDCl_3$, 471 MHz)



^{1}H NMR ($CDCl_3$, 500 MHz)

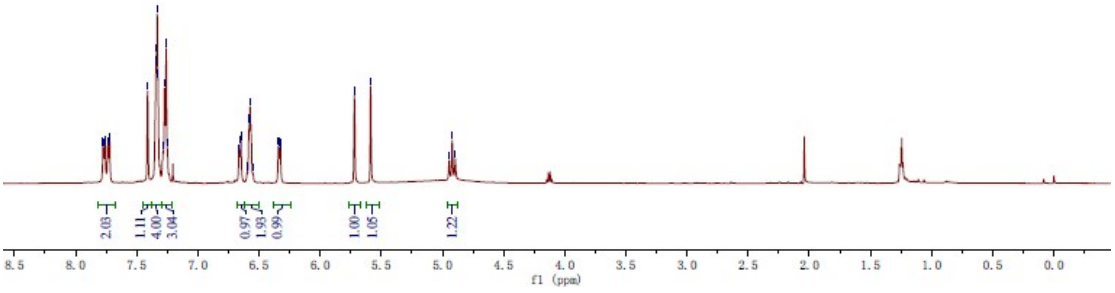
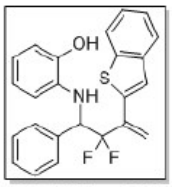


table3
YX-3-17-C



^{13}C NMR ($CDCl_3$, 126 MHz)

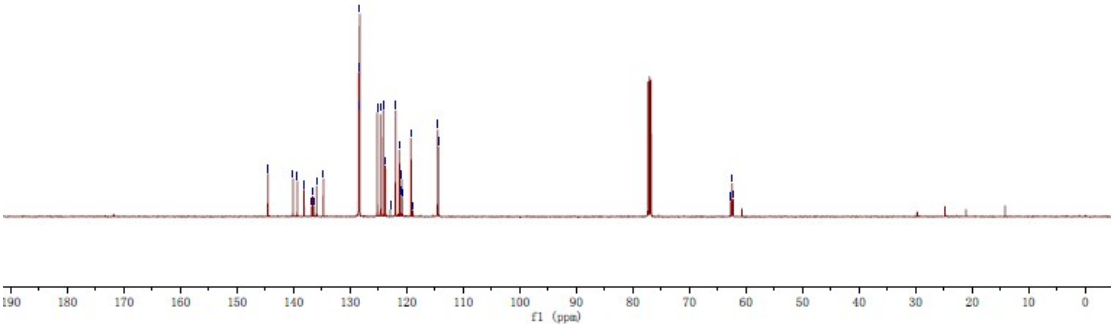
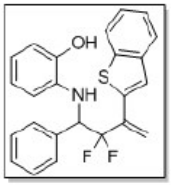
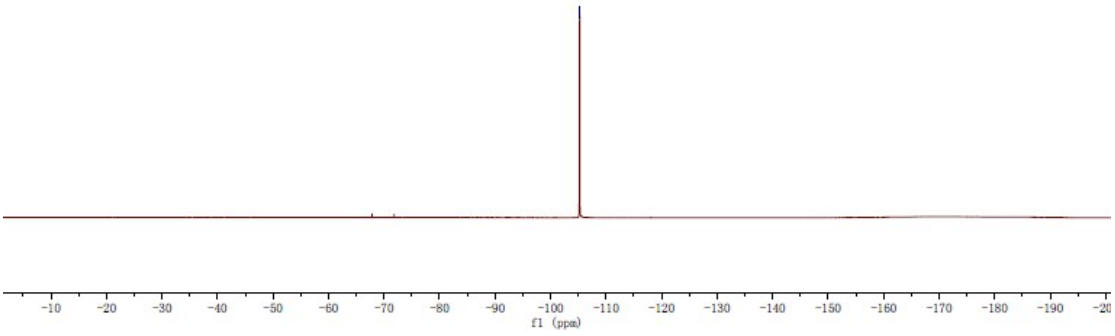
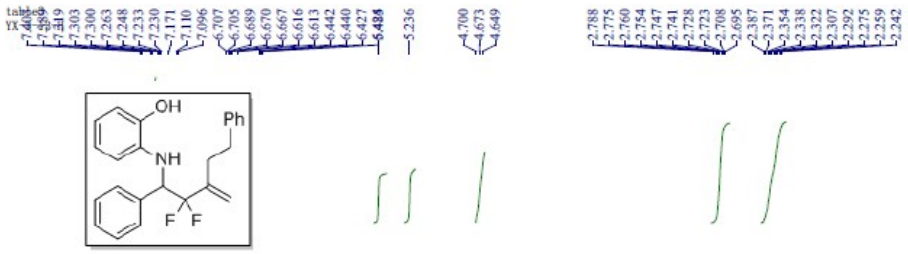


table3
YX-3-17-F

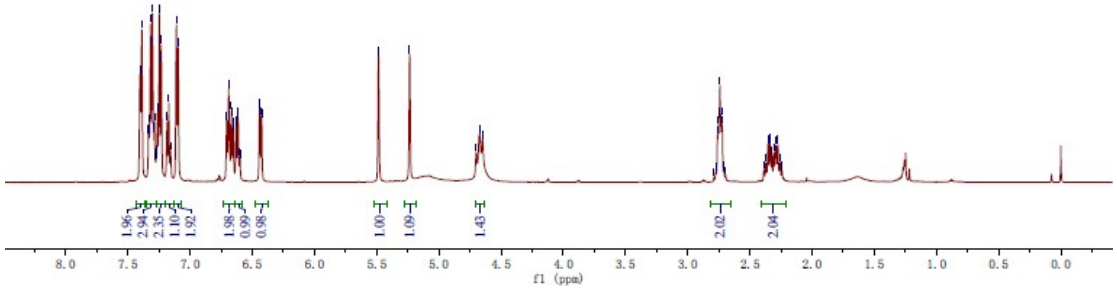


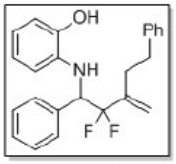
^{19}F NMR ($CDCl_3$, 471 MHz)





^{1}H NMR ($CDCl_3$, 500 MHz)





^{13}C NMR ($CDCl_3$, 126 MHz)

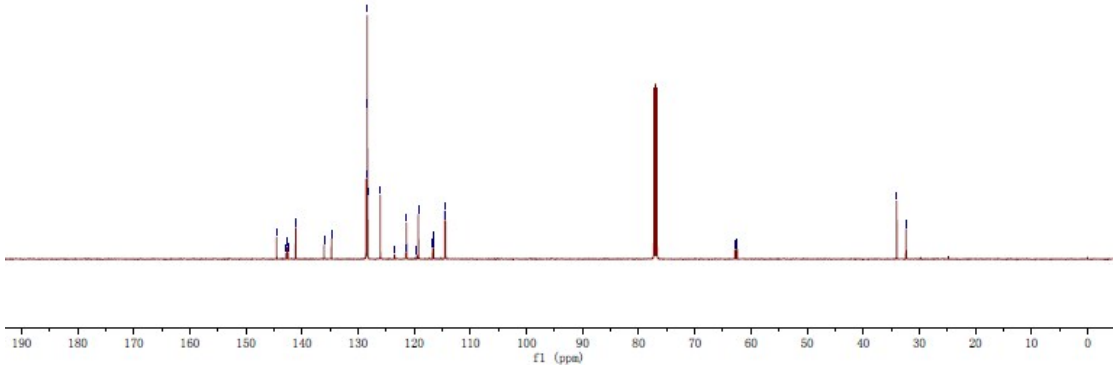
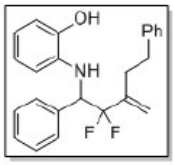
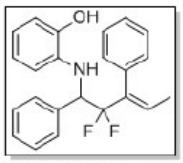


table3
YX-3-13-F



^{19}F NMR ($CDCl_3$, 471 MHz)

table3
YX-3-13-H



^{1}H NMR ($CDCl_3$, 500 MHz)

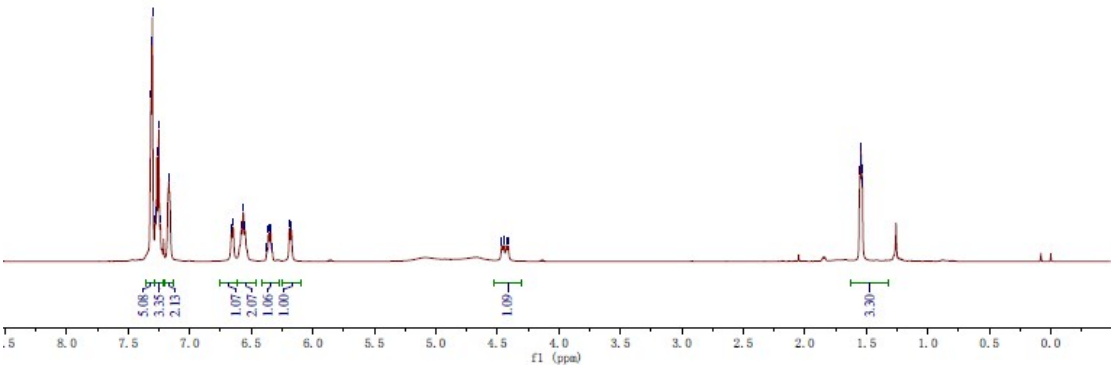
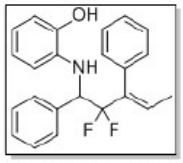


table3
YX-3-19-C



^{13}C NMR ($CDCl_3$, 126 MHz)

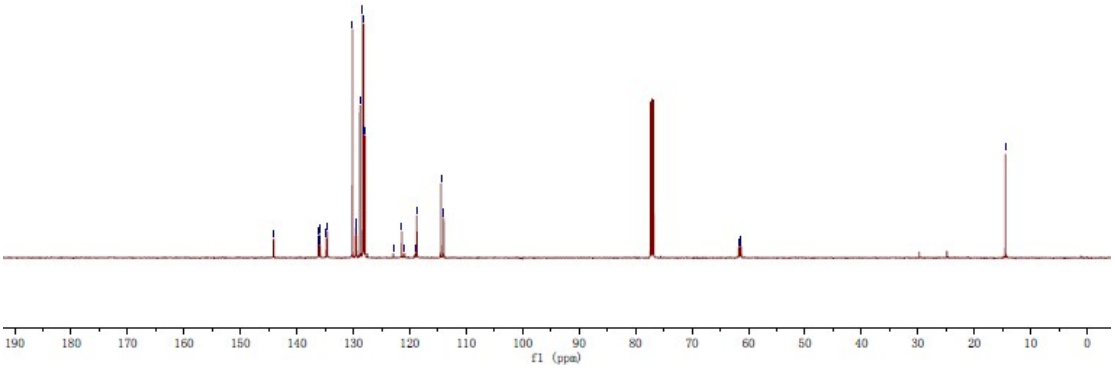
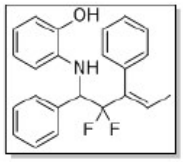
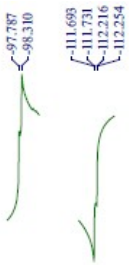
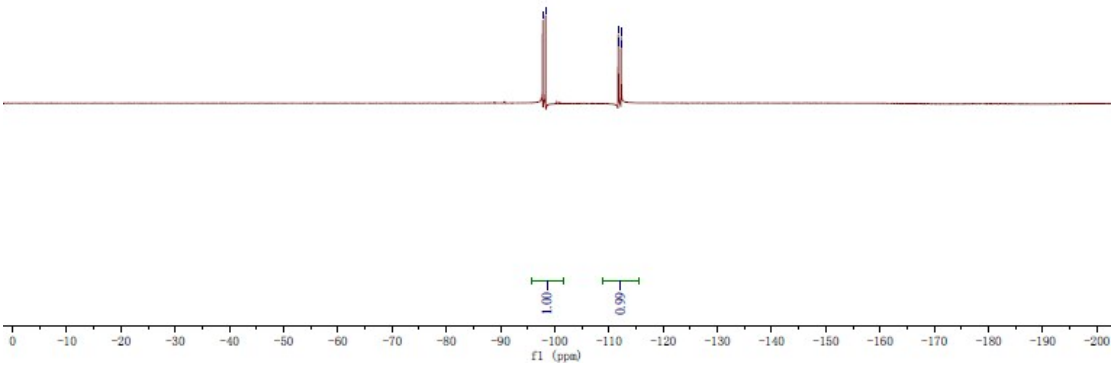


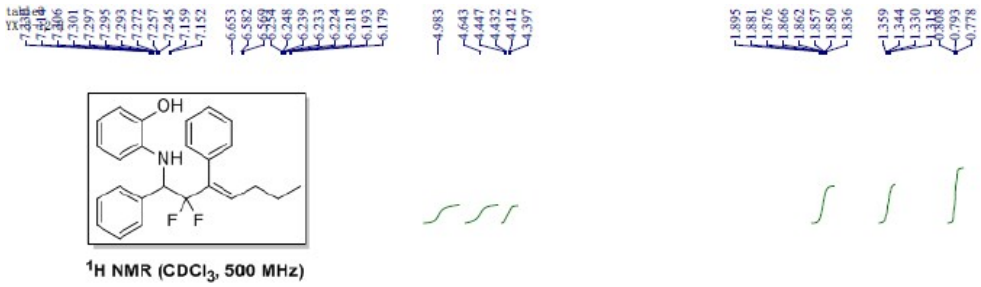
table3
YX-3-19-F



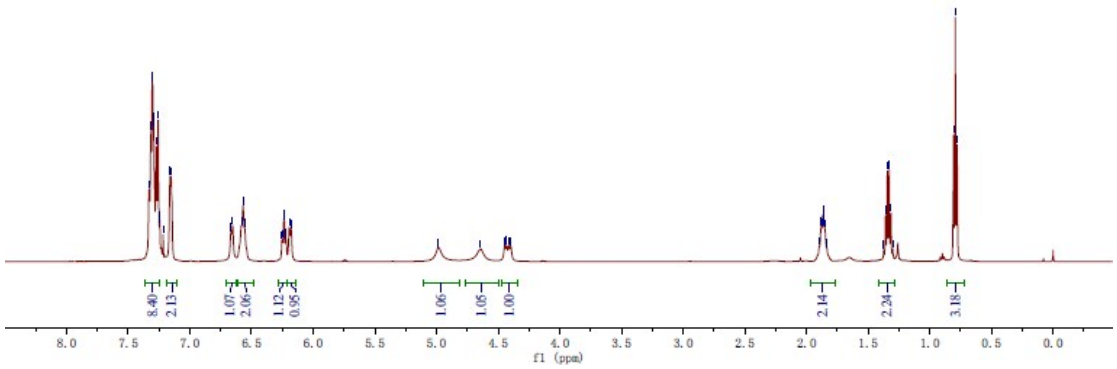
^{19}F NMR ($CDCl_3$, 471 MHz)

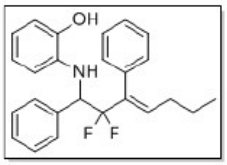






^{1}H NMR ($CDCl_3$, 500 MHz)





^{13}C NMR ($CDCl_3$, 126 MHz)

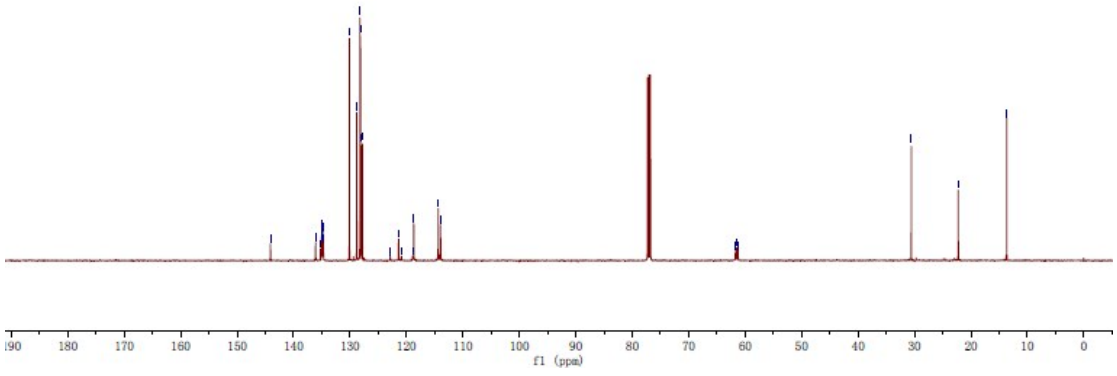
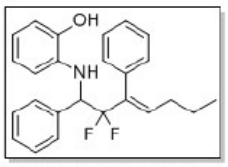
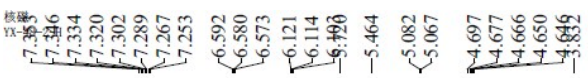


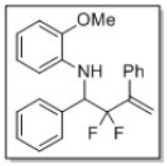
table3
YX-3-12-F



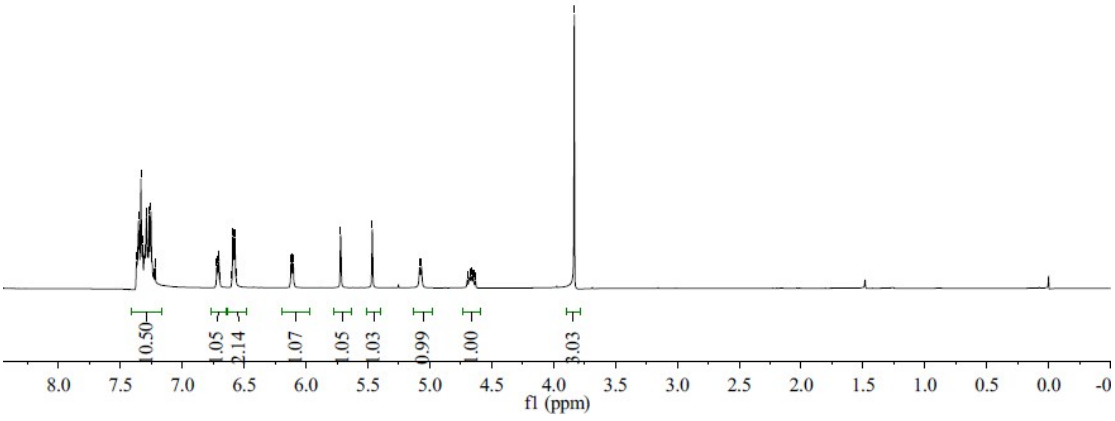
^{19}F NMR ($CDCl_3$, 471 MHz)

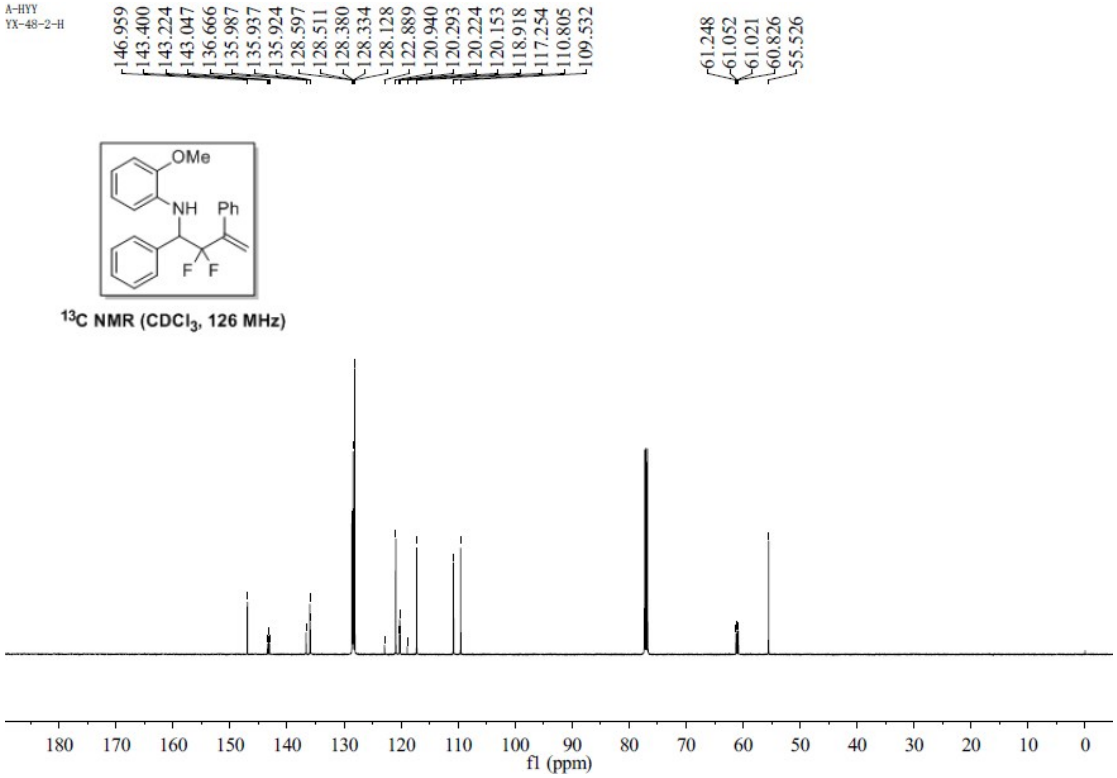
核磁
YX-3-12



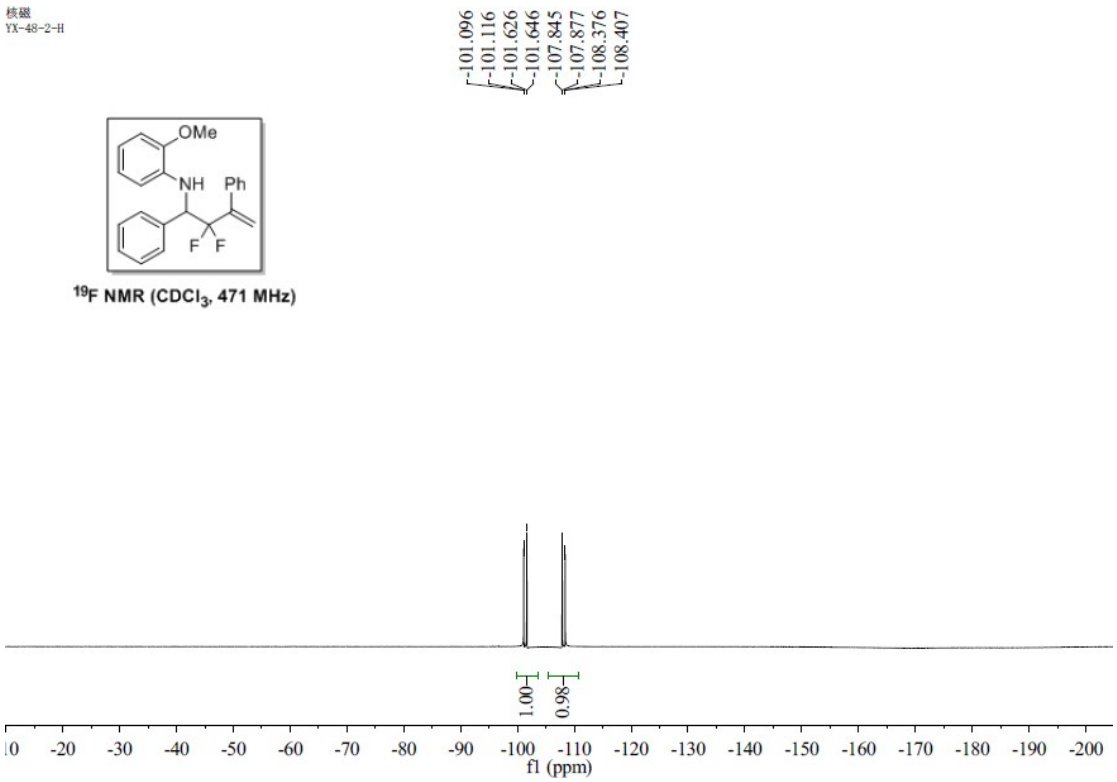


^{1}H NMR ($CDCl_3$, 500 MHz)



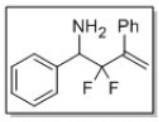


^{13}C NMR ($CDCl_3$, 126 MHz)

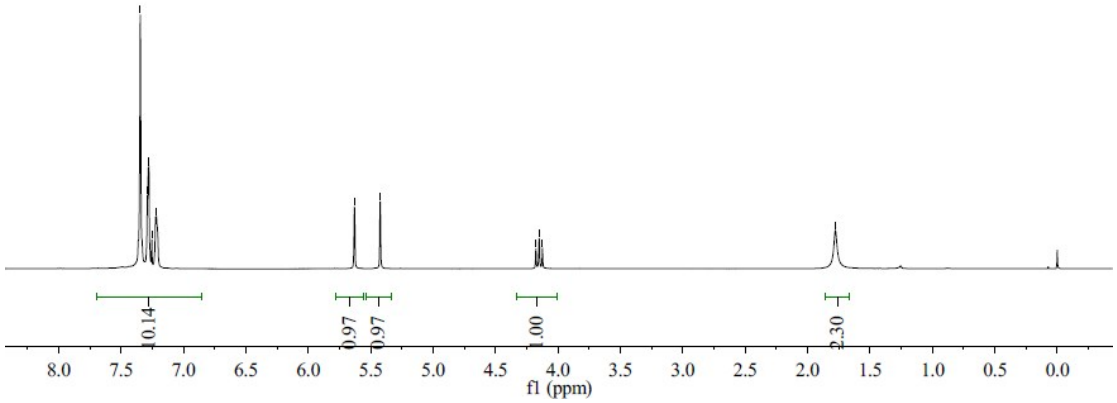


^{19}F NMR ($CDCl_3$, 471 MHz)

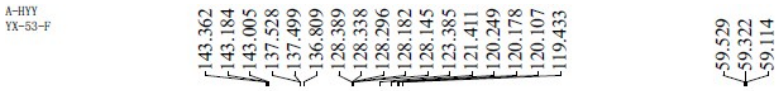
核磁
YX-53-H

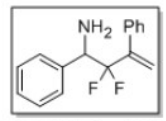


^{1}H NMR ($CDCl_3$, 500 MHz)

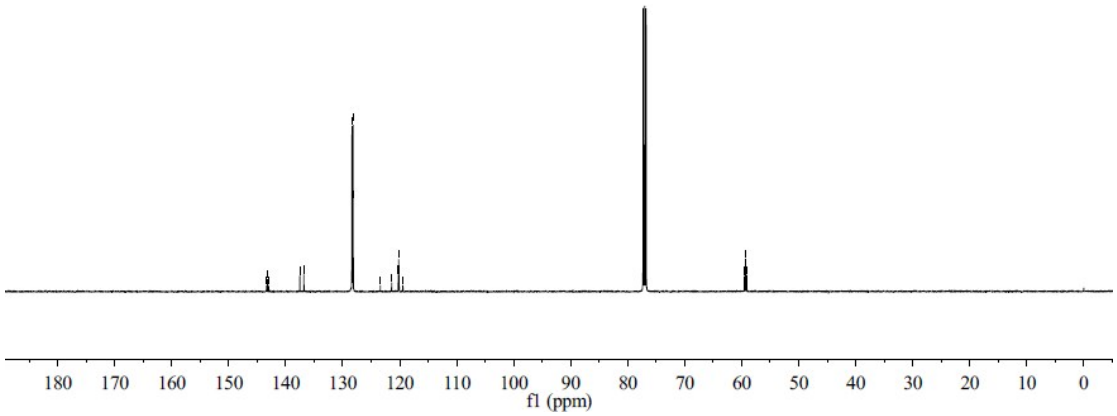


A-HYY
YX-53-F





^{13}C NMR ($CDCl_3$, 126 MHz)



核磁
YX-53-C

^{19}F NMR ($CDCl_3$, 471 MHz)