**General methods.** All reactions were carried out under a dry nitrogen atmosphere. All solvents were dried before use following standard procedures. All reagents were obtained from commercial suppliers and used without further purification unless otherwise noted. Column chromatography was performed on silica gel (200-300 mesh), and thin-layer chromatography (TLC) was performed on precoated silica gel plates (0.4-0.5 mm thick, GF254) and observed under UV light. Nuclear magnetic resonance (NMR) spectra were recorded on 400 or 500 MHz spectrometers in the indicated solvents at room temperature (298 K). Chemical shifts were referenced to the residual solvent peaks ($CHCl_3$ or $SiMe_4$ for $^1H$ NMR and to $PhCF_3$ (-62.7 ppm) for $^{19}F$ NMR).

**Compound 4.** To a solution of compound **1**[1] (2.00 g, 10.8 mmol) in THF (40 mL), cooled in an ice-bath, were added DMF (0.05 mL) and oxalyl chloride (3.00 mL, 33.8 mmol). The solution was stirred at room temperature for 0.5 h and then evaporated under reduced pressure. The resulting acyl chloride (**2**) was dissolved in THF (40 mL) and the solution was added slowly to a stirred solution of triphenylmethylamine **3** (2.80 g, 11.4 mmol) and triethylamine (2.00 mL, 14.4 mmol) in THF (40 mL), which was cooled in an ice-bath. The solution was stirred at room temperature for 24 h and then concentrated with a rotavapor. The resulting residue was triturated with dichloromethane (50 mL). The solution was washed with hydrochloric acid (0.5 N, 25 mL), saturated sodium bicarbonate solution (25 mL), and brine (25 mL), and dried over sodium sulfate. Upon removal of the solvent under reduced pressure, the resulting crude product was subjected to column chromatography (petroleum ether/AcOEt 4:1) to give compound **4** as a white solid (3.46 g, 75%). $^1H$ NMR (400 MHz, DMSO-$d_6$) δ 9.09 (s, 1H), 8.74–8.56 (m, 1H), 8.45 (dd, $J_1$ = 11.7 Hz, $J_2$ = 1.7 Hz, 1H), 8.42–8.33 (m, 1H), 7.95–7.64 (m, 15H). $^{19}F$ NMR (376 MHz, $CDCl_3$) δ -114.6 (dd, $J_1$ = 11.6 Hz, $J_2$ = 7.5 Hz, 1F). $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 163.2, 156.9, 154.2, 144.1, 142.2, 139.1, 128.7, 128.4, 127.6, 126.7, 122.8, 118.0, 117.8, 71.6. MS (EI): *m/z* 426 $[M]^+$. HRMS (ESI): Calcd for $C_{26}H_{19}N_2O_3Cl_2F$ $[M+H]^+$: 426.1380. Found: 426.1378.

**Compound 5.** A suspension of compound **4** (0.21 g, 0.50 mmol) and Pd-C (40 mg) in THF (20 mL) was stirred under 1 atm of hydrogen for 5 h and then the solid was filtrated off. The filtrate was concentrated and the resulting solid recrystallized from methanol to give compound **5** as a pale yellow solid (0.18 g, 91%). $^1H$ NMR (400 MHz, $CD_3CN$): δ 7.57 (s, 1H), 7.50–7.17 (m, 17H), 6.79 (t, $J$ = 8.8 Hz, 1H), 4.61 (s, 2H). $^{19}F$ NMR (376 MHz, $CDCl_3$): δ –134.72 (s, 1F). $^{13}C$ NMR

(101 MHz, $CDCl_3$): δ 165.3, 152.0, 149.6, 144.9, 138.4, 138.2, 128.8, 128.2, 127.2, 125.1, 123.5, 115.8, 114.8, 114.6, 70.8. MS (ESI): *m/z* 419.6 $[M + H]^+$. HRMS (ESI): Calcd for $C_{26}H_{21}N_2OFNa$ $[M + Na]^+$: 419.1530. Found: 419.1536.

**Compound 6.** A solution of compound **5** (0.20 g, 0.50 mmol) in concentrated hydrochloric acid (20 mL) and ethanol (10 mL) was cooled to –10 °C. To the solution was added sodium nitrite (40 mg, 0.6 mmol). After stirring for 0.5 h, another part of sodium azide (61 g, 0.9 mmol) was added. Stirring was continued for another 2 h and the solution was neutralized with sodium carbonate solution. The solution was then extracted with dichloromethane (20 mL × 3). The combined organic phase was washed with water (30 mL × 2) and brine, and dried over sodium sulfate. Upon removal of the solvent with a rotavapor, the resulting residue was subjected to column chromatography (petroleum ether/AcOEt) to afford compound 6 as a white solid (0.16 g, 75%). $^1$H NMR (400 MHz, $CD_3CN$): δ 7.81 (s, 1H), 7.68–7.58 (m, 2H), 7.41–7.17 (m, 16H). $^{19}$F NMR (376 MHz, $CD_3CN$): δ –127.56 (dd, $J_1$ = 11.5 Hz, $J_2$ = 8.4 Hz, 1F). $^{13}$C NMR (101 MHz, $CDCl_3$): δ 164.4, 155.9, 153.4, 147.0, 144.9, 144.5, 133.0, 132.9, 131.5, 131.4, 128.7, 128.2, 128.0, 127.3, 123.4, 121.1, 116.2, 116.0, 71.1. MS (EI): *m/z* 422 $[M]^+$. HRMS (EI): Calcd for $C_{26}H_{19}N_4OF$ $[M]^+$: 422.1543. Found: 422.1540.

**Compounds T1 and 8.** To a stirred solution of compounds **6** (0.15 g, 0.36 mmol) and **7**[2] (0.29 g, 1.78 mmol) in the mixture of THF (3 mL), methanol (3 mL) and water (0.7 mL) were added sodium ascorbate (35.2 mg, 0.18 mmol), copper sulfate pentahydrate (29.2 mg, 0.07 mmol) and Tris[(1-benzyl-1H-1,2,3-triazol-4-yl)methyl]amine (TBTA) (18.8 mg, 0.04 mmol). The mixture was stirred at room temperature for 24 h and then concentrated with a rotavapor. The resulting slurry was triturated with dichloromethane (50 mL). The organic phase was then washed with water (25 mL × 3) and brine (30 mL), and dried over sodium sulfate. Upon removal of the solvent, the resulting crude product was subjected to column chromatography (petroleum ether/$CH_2Cl_2$ 1:4) to afford compounds **8** (0.12 g, 58%) and **T1** (22 mg, 6%) as white solids. **Compound 8.** $^1$H NMR (400 MHz, $CD_2Cl_2$): δ 8.57–8.42 (m, 2H), 8.13 (t, $J$ = 7.8 Hz, 1H), 7.86–7.72 (m, 1H), 7.34 (ddd, $J_1$ = 16.6 Hz, $J_2$ = 15.6 Hz, $J_3$ = 9.7 Hz, 16H), 7.03 (dd, $J_1$ = 10.4 Hz, $J_2$ = 9.2 Hz, 1H), 3.41 (s, 1H). $^{19}$F NMR (376 MHz, $CD_2Cl_2$): δ –106.81 (dd, $J_1$ = 17.8 Hz, $J_2$ = 9.1 Hz, 1F), –107.35– –107.69 (m, 1F), –121.94 – –122.16 (m, 2F). $^{13}$C NMR (101 MHz, $CD_2Cl_2$): δ 163.7, 161.8, 161.7,

160.5, 160.3, 157.9, 157.8, 154.2, 151.7, 144.3, 140.3, 137.3, 137.2, 132.8, 128.6, 128.1, 127.2, 124.6, 123.4, 116.7, 116.5, 104.9, 104.7, 104.4, 82.7, 75.5, 70.9, 54.0, 53.7, 53.4, 53.2, 52.9. MS (EI): *m/z* 607 $[M + Na]^+$. HRMS (ESI): Calcd for $C_{36}H_{23}F_3N_4ONa$ $[M + Na]^+$: 607.1722. Found: 607.1698. **Compound T1.** $^1$H NMR (500 MHz, $CDCl_3$): δ 9.30 (t, $J$ = 8.2 Hz, 1H), 8.53 (s, 2H), 8.20 (t, $J$ = 7.8 Hz, 2H), 7.83 (dd, $J_1$ = 11.5 Hz, $J_2$ = 1.7 Hz, 2H), 7.75 (dd, $J_1$ = 8.4 Hz, $J_2$ = 1.4 Hz, 2H), 7.39–7.28 (m, 32H), 7.10 (t, $J$ = 10.3 Hz, 1H). $^{19}$F NMR (470 MHz, $CDCl_3$): δ –110.3 (t, $J$ = 9.3 Hz, 1F), –121.26 – –121.34 (m, 1F). MS (ESI): *m/z* 1029 $[M + Na]^+$. HRMS (ESI): Calcd for $C_{62}H_{42}F_4N_8O_2Na$: 1029.3265 $[M + Na]^+$. Found: 1029.3236 $[M + Na]^+$.

**Compound 10.** A stirred solution of compound **9**[3] (0.10 g, 0.60 mmol) in trifluoroacetic acid (TFA) (4 mL) was cooled to -10°C and to the solution was added sodium nitrite (50 mg, 0.70 mmol). After stirring for 10 min, sodium azide (75 mg, 1.2 mmol) was added. Stirring was continued for another 1 h and the solution was neutralized with saturated sodium carbonate solution. The mixture was triturated with ether (50 mL). The solution was washed with water (25 mL × 3) and brine and dried over sodium sulfate. The solvent was then removed and the resulting residue was subjected to column chromatography (petroleum ether/AcOEt 10:1) to give compound **10** as a white solid (0.11 g, 95%). $^1$H NMR (400 MHz, $CDCl_3$): δ 7.85 (t, $J$ = 7.7 Hz, 1H), 7.12 (t, $J$ = 10.0 Hz, 1H). $^{19}$F NMR (376 MHz, $CDCl_3$): δ -110.53 (d, $J$ = 10.9 Hz, 1F), -116.02 (d, $J$ = 10.9 Hz, 1F). $^{13}$C NMR (101 MHz, $CDCl_3$): δ 158.9, 158.8, 156.3, 156.2, 154.3, 154.2, 151.6, 151.5, 134.0, 125.8, 118.5, 108.1, 107.9, 107.6. MS (EI): *m/z* 200 $[M]^+$. HRMS (EI): Calcd for $C_6H_2F_2N_4O_2$ $[M]^+$: 200.0146. Found: 200.0145.

**Compound 11.** A solution of compounds **7** (0.24 g, 1.50 mmol), **10** (0.10 g, 0.50 mmol), copper sulfate pentahydrate (41 mg, 0.10 mmol), sodium ascorbate (50 mg, 0.25 mmol) and TBTA (26.5 mg, 0.05 mmol) in THF (2 mL), methanol (2 mL) and water (0.5 mL) was stirred for 24 h and then concentrated with a rotavapor. The resulting slurry was triturated in dichloromethane (20 mL). The organic phase was then washed with water (10 mL × 3) and brine (10 mL), and dried over sodium sulfate. After removing the solvent with a rotavapor, the resulting residue was subjected to column chromatography (petroleum ether/AcOEt 3:1) to give compound **11** as a white solid (60 mg, 33%). $^1$H NMR (400 MHz, $CDCl_3$): δ 8.89 (t, $J$ = 7.5 Hz, 1H), 8.52 (t, $J$ = 8.0 Hz, 1H), 8.42 (t, $J$ = 3.1 Hz, 1H), 7.37 (t, $J$ = 9.9 Hz, 1H), 7.00 (dd, $J_1$ = 10.5 Hz, $J_2$ = 8.8 Hz, 1H), 3.35 (s, 1H). $^{19}$F NMR

(376 MHz, $CDCl_3$): δ -105.15 (dd, $J_1$ = 17.9 Hz, $J_2$ = 8.9 Hz, 1F), -107.52 (qd, $J_1$ = 10.7 Hz, $J_2$ = 3.4 Hz, 1F), -108.01– -108.19 (m, 1F), -109.56– -109.71 (m, 1F). HRMS (ESI): *m/z* 363 $[M+H]^+$. HRMS (ESI): Calcd. for $C_{16}H_7F_4N_4O_2$ $[M+H]^+$: 363.0505. Found: 363.0502.

**Compound 14.** A suspension of compound **11** (40 mg, 0.12 mmol) and iron dust (31 mg, 0.60 mmol) and ammonium chloride (9.0 mg, 0.2 mmol) in ethanol (10 mL) and water (1 mL) was stirred under reflux for 2 h and then concentrated with a rotavapor. The resulting residue was triturated with dichloromethane (5 mL). After workup, the solvent was removed to give compound **12** as a pale yellow solid (36 mg). The crude product was dissolved in trifluoroacetic acid (2 mL) and the solution was cooled to -10 °C. To the solution was added sodium nitrite (15 mg, 0.2 mmol). After stirring for 10 min, sodium azide (21 mg, 0.4 mmol) was added. Stirring was continued for another 1 h and then the mixture was concentrated with a rotavapor. The resulting residue was triturated with ether (5 mL). After workup, the solvent was removed to give compound **13** as a white solid. This product was then added to a solution of compounds **7** (0.10 g, 0.60 mmol), copper sulfate pentahydrate (9 mg, 0.02 mmol), sodium ascorbate (11 mg, 0.06 mmol) and TBTA (5.8 mg, 0.01 mmol) in THF (4 mL), methanol (4 mL) and water (1 mL). The solution was stirred for 24 h and then concentrated in vacuo. The resulting residue was triturated with dichloromethane (5 mL). After workup, the resulting crude product was subjected to column chromatography ($CH_2Cl_2$) to give compound **14** as a white solid (40 mg, 71% for three steps). $^1H$ NMR (400 MHz, $CD_2Cl_2$): δ 8.66 (t, $J$ = 7.5 Hz, 1H), 8.55–8.45 (m, 4H), 7.46 (t, $J$ = 10.1 Hz, 1H), 7.05 (dd, $J_1$ = 10.4 Hz, $J_2$ = 9.2 Hz, 2H), 3.42 (s, 2H). $^{19}F$ NMR (376 MHz, $CD_2Cl_2$): δ -106.5– -106.7 (m, 2F), -107.5– -107.8 (m, 2F), -117.1– -117.3 (m, 2F). MS (ESI): *m/z* 521 $[M + H]^+$. HRMS (ESI): Calcd for $C_{26}H_{11}F_6N_6$ $[M + H]^+$: 521.0949. Found: 521.0970.

**Compound T2.** A suspension of compounds **6** (30.4 mg, 0.07 mmol), **14** (15 mg, 0.03 mmol), copper sulfate pentahydrate (4.7 mg, 0.01 mmol), sodium ascorbate (5.7 mg, 0.03 mmol) and TBTA (3.1 mg, 0.03 mmol) in tert-butanol (2 mL), dichloromethane (2 mL) and water (1 mL) was stirred for 24 h and then concentrated in vacuo. The resulting residue was triturated with dichloromethane (5 mL). The organic phase was then washed with water (20 mL × 3) and brine (3 mL), and dried over sodium sulfate. Upon removal of the solvent, the resulting crude product was subjected to column chromatography ($CH_2Cl_2$/AcOEt 20:1) to give compound **T2** as a white solid

(24 mg, 61%). $^1$H NMR (400 MHz, $CDCl_3$): δ 9.21 (t, *J* = 8.3 Hz, 2H), 8.69 (t, *J* = 7.5 Hz, 1H), 8.61–8.44 (m, 4H), 8.16 (t, *J* = 7.8 Hz, 2H), 7.90–7.70 (m, 4H), 7.51–7.40 (m, 3H), 7.39–7.23 (m, 30H), 7.13 (t, *J* = 10.4 Hz, 2H). $^{19}$F NMR (376 MHz, $CD_2Cl_2$): δ -110.3– -110.6 (m, 2F), -110.6– -110.8 (m, 2F), -117.2 (t, *J* = 8.7 Hz, 2F), -121.88– -122.08 (m, 2F). MS (ESI): *m/z* 1387 [M + Na]$^+$. HRMS (ESI): Calcd. for $C_{96}H_{55}F_{12}N_{20}O_2Na$ [M + Na]$^+$: 1387.3855. Found: 1387.3842.

**Compound 16.** A suspension of compound **15** (20 mg, 0.04 mmol), iron dust (60 mg, 1.1 mmol) and ammonium chloride (20 mg, 0.4 mmol) in THF (10 mL), iso-propanol (5 mL) and water (1 mL) was stirred under reflux for 2 h and then concentrated in vacuo. The resulting slurry was triturated with dichloromethane (5 mL). The organic phase was washed with water (3 mL × 2) and brine (3 mL), and dried over sodium sulfate. After removal of the solvent, the resulting diamine crude product was dissolved in TFA (1 mL). The solution was cooled to -10 °C and then sodium nitrite (7.5 mg, 0.1 mmol) was added. After stirring for 10 min, sodium azide (11 mg, 0.2 mmol) was added. The mixture was stirred for 1 h and then neutralized with saturated sodium carbonate solution. The resulting mixture was then extracted with ether (5 mL × 3). After workup, the resulting residue was subjected to column chromatography ($CH_2Cl_2$) to give compound 16 as white solid (70%). $^1$H NMR (400 MHz, $CDCl_3$): δ 9.28 (t, *J* = 8.2 Hz, 1H), 8.43 (s, 2H), 7.85–7.76 (m, 2H), 7.17 (t, *J* = 10.2 Hz, 2H), 7.10 (t, *J* = 10.4 Hz, 1H). $^{19}$F NMR (376 MHz, $CDCl_3$): δ -110.29 (s, 1F), -119.85 (d, *J* = 4.1 Hz, 1F), -123.40 (d, *J* = 4.1 Hz, 1F). MS (ESI): *m/z* 557 [M + Na]$^+$. HRMS (ESI): Calcd for $C_{22}H_9F_6N_{12}Na$ [M + Na]$^+$: 557.0797. Found: 557.0767.

**Compound 15.** A solution of compounds **7** (41 mg, 0.25 mmol), **10** (0.10 g, 0.50 mmol), copper sulfate pentahydrate (41 mg, 0.10 mmol), sodium ascorbate (50 mg, 0.25 mmol) and TBTA (27 mg, 0.05 mmol) in THF (2 mL), methanol (2 mL) and water (0.2 mL) was stirred at room temperature for 24 h and then concentrated with a rotavapor. The resulting residue was triturated with dichloromethane (5 mL). The solution was washed with water (3 mL × 3) and brine (3 mL), and dried over sodium sulfate. Upon removal of the solvent, the resulting residue was subjected to column chromatography to give compound **15** as a white solid (50%). $^1$H NMR (400 MHz, $CD_2Cl_2$): δ 9.27 (d, *J* = 8.3 Hz, 1H), 8.88 (t, *J* = 7.5 Hz, 2H), 8.51 (s, 2H), 7.42 (t, *J* = 10.0 Hz, 2H), 7.17 (t, *J* = 10.6 Hz, 1H). $^{19}$F NMR (376 MHz, $CD_2Cl_2$): δ -108.3 (d, *J* = 13.9 Hz, 1F), -110.4 (s, 1F), -110.8 (d, *J* = 14.0 Hz, 1F). MS (ESI): *m/z* 563 [M + H]$^+$. HRMS (ESI): Calcd for

$C_{22}H_9F_6N_8O_4$ $[M + H]^+$: 563.0651. Found: 563.0612 $[M + H]^+$.

**Compound 16.** A suspension of compound **15** (20 mg, 0.04 mmol), iron dust (60 mg, 1.1 mmol) and ammonium chloride (20 mg, 0.4 mmol) in THF (10 mL), iso-propanol (5 mL) and water (1 mL) was stirred under reflux for 2 h and then concentrated in vacuo. The resulting slurry was triturated with dichloromethane (10 mL). The organic phase was washed with water (5 mL) and brine (5 mL), and dried over sodium sulfate. After the solvent was removed with a rotavapor, the obtained diamine crude product was dissolved in TFA (1 mL). The solution was cooled to -10 °C and then sodium nitrite (7.5 mg, 0.1 mmol) was added. The mixture was stirred for 10 min and then sodium azide (11 mg, 0.2 mmol) was added. After stirring for another 1 h, the mixture was concentrated. The resulting slurry was triturated with dichloromethane (10 mL). The organic phase was then washed with water (5 mL × 2) and brine (5 mL), and dried over sodium sulfate. After the solvent was removed, the resulting crude product was subjected to column chromatography ($CH_2Cl_2$) to give compound 16 as a white solid (70%). $^1$H NMR (400 MHz, $CDCl_3$): δ 9.28 (t, $J$ = 8.2 Hz, 1H), 8.43 (s, 2H), 7.85–7.76 (m, 2H), 7.17 (t, $J$ = 10.2 Hz, 2H), 7.10 (t, $J$ = 10.4 Hz, 1H). $^{19}$F NMR (376 MHz, $CDCl_3$): δ -110.3 (s, 1F), -119.9 (d, $J$ = 4.1 Hz, 1F), -123.4 (d, $J$ = 4.1 Hz, 1F). MS (ESI): *m/z* 557 $[M + Na]^+$. HRMS (ESI): Calcd for $C_{22}H_9F_6N_{12}Na$ $[M + Na]^+$: 557.0797. Found: 557.0767.

**Compound T3.** A mixture of compounds **8** (0.21 g, 0.36 mmol), **16** (0.10 g, 0.18 mmol), copper sulfate pentahydrate (30 mg, 0.07 mmol), sodium ascorbate (36 mg, 0.18 mmol) and TBTA (19 mg, 0.04 mmol) in tert-butanol (4 mL), dichloromethane (4 mL), and water (2 mL) was stirred at room temperature for 24 h. After workup, the crude product was purified by column chromatography ($CH_2Cl_2$/AcOEt 5:1) to give compound **T3** as a white solid (0.25 g, 80%). $^1$H NMR (400 MHz, $CDCl_3$): δ 9.30–9.18 (m, 3H), 8.72 (t, $J$ = 7.5 Hz, 2H), 8.62–8.45 (m, 6H), 8.18 (t, $J$ = 7.8 Hz, 2H), 7.88–7.72 (m, 4H), 7.48 (t, $J$ = 10.0 Hz, 2H), 7.41 (s, 2H), 7.38–7.26 (m, 30H), 7.16 (td, $J_1$ = 10.4 Hz, $J_2$ = 5.6 Hz, 3H). $^{19}$F NMR (376 MHz, $CD_2Cl_2$): δ -110.6 (s, 2F), -110.6 (d, $J$ = 8.1 Hz, 2F), -110.81 (d, $J$ = 9.3 Hz, 2F), -117.19 (s, 4F), -121.99 (s, 2F). MS (ESI): *m/z* 1723 $[M + H]^+$. HRMS (ESI): Calcd for $C_{96}H_{55}F_{12}N_{20}O_2$ $[M + H]^+$: 1723.4625. Found: 1723.4602.

**Compound 17.** A suspension of compounds **6** (0.15 g, 0.34 mmol), **11** (0.12 g, 0.34 mmol), copper sulfate pentahydrate (28 mg, 0.07 mmol), sodium ascorbate (34 mg, 0.17 mmol) and TBTA

(18 mg, 0.03 mmol) in THF (6 mL), methanol (3 mL) and water (0.7 mL) was stirred at room temperature for 24 h. After workup, the obtained crude product was subjected to column chromatography ($CH_2Cl_2$/AcOEt 20:1) to give compound **17** as a pale yellow solid (0.15 g, 57%). $^1$H NMR (500 MHz, $CDCl_3$): δ 9.30 (t, *J* = 8.2 Hz, 1H), 8.92 (t, *J* = 7.5 Hz, 1H), 8.53 (t, *J* = 2.8 Hz, 1H), 8.47 (t, *J* = 2.9 Hz, 1H), 8.25–8.15 (m, 1H), 7.84 (dd, $J_1$ = 11.5 Hz, $J_2$ = 1.6 Hz, 1H), 7.76 (dd, $J_1$ = 8.4 Hz, $J_2$ = 1.5 Hz, 1H), 7.41–7.27 (m, 17H), 7.11 (t, *J* = 10.4 Hz, 1H). $^{19}$F NMR (470 MHz, $CDCl_3$): δ -108.0– -108.2 (m, 1F), -109.6– -109.8 (m, 1F), -109.8– -110.0 (m, 1F), -110.33– -110.51 (m, 1F), -121.2– -121.4 (m, 1F). MS (ESI): *m/z* 785 $[M + H]^+$. HRMS (ESI): Calcd for $C_{42}H_{26}F_5N_8O_3$: 785.2037 $[M + H]^+$. Found: 785.2048.

**Compound 18.** A suspension of compound **17** (40 mg, 0.05 mmol), iron dust (14.2 mg, 0.25 mmol) and ammonium chloride (5.6 mg, 0.1 mmol) in THF (10 mL), iso-propanol (5 mL) and water (1 mL) was stirred under reflux for 2 h and then concentrated in vacuo. The resulting slurry was triturated with dichloromethane (5 mL). After workup, the obtained amine crude product (36 mg) was dissolved in TFA (2 mL). The solution was cooled to -10 °C and then sodium nitrite (5 mg, 0.07 mmol) was added. After stirring for 10 min, sodium azide (9.3 mg, 0.14 mmol) was added. The mixture was stirred for another 1 h and then neutralized with saturated sodium carbonate solution. The solution was extracted with dichloromethane (5 mL × 3). After workup, the crude product was purified by column chromatography ($CH_2Cl_2$) to give **18** as a white solid (8.6 mg, 23%). $^1$H NMR (300 MHz, $CDCl_3$): δ 9.23 (t, *J* = 9.4 Hz, 1H), 8.57 (t, *J* = 3.0 Hz, 1H), 8.47 (t, *J* = 2.9 Hz, 1H), 8.20 (t, *J* = 7.8 Hz, 1H), 7.90–7.75 (m, 3H), 7.44 (s, 1H), 7.42–7.28 (m, 15H), 7.28–7.10 (m, 2H). $^{19}$F NMR (282 MHz, $CDCl_3$): δ -111.05– -111.23 (m, 1F), -111.23– -111.40 (m, 1F), -120.90– -121.06 (m, 1F), -122.35– -122.50 (m, 1F), -124.20– -124.36 (m, 1F). MS (ESI): *m/z* 781 $[M + H]^+$. HRMS (ESI): Calcd for $C_{42}H_{26}F_5N_{10}O$: 781.2211 $[M + H]^+$. Found: 781.2201.

**Compound T4.** A suspension of compounds **8** (8 mg, ), **14** (30 mg), copper sulfate pentahydrate (8 mg, ), sodium ascorbate (10 mg, ) and TBTA (5 mg, ) in tert-butanol (4 mL), dichloromethane (4 mL) and water (2 mL) was stirred for 24 h and then concentrated in vacuo. The resulting slurry was triturated with dichloromethane (5 mL). After workup, the obtained crude product was purified by column chromatography ($CH_2Cl_2$/MeOH 20:1) to give **T4** as a white solid (28 mg, 87%). $^1$H NMR (400 MHz, DMSO-$d_6$): δ 9.40 (s, 2H), 9.13-8.99 (m, 10H), 8.66-8.62 (m, 2H),

8.23-8.20 (m, 2H), 8.15-8.00 (m, 4H), 7.97-7.89 (m, 2H), 7.83-7.68 (m, 3H),7.45-7.18 (m, 35H). $^{19}$F NMR (CDCl3): δ -110.65 – -111.72 (m, 8F), -117.13 – -118.25 (m, 6F), -122.39 (s, 2F). MS (ESI): *m/z* 2081 $[M + H]^+$. HRMS (ESI): Calcd for $C_{110}H_{61}F_{16}N_{26}O_2$: 2081.5210 $[M + H]^+$. Found: 2081.5108.

**Computational methods.** All structures were optimized with the M062X/6-31G(d,p) method of calculation,[4] using the GAUSSIAN09 program.[5] For the final structures, the solvent effect of chloroform was included with the PCM approach.[6]

*References*


(1) R. S. Alexander, C. G. Clark, C. D. Ellis, Q. Han, M. Y. He, P. Y. S. Lam, R. Li, D. J. P. Pinto, M. L. Quan, J.-H. Sun, C.-A. Teleha, R. R. Wexler, S. Bai, R. M. Knabb, J. M. Lüttgen and P. C. Wong, *J. Med. Chem*., 2005, **48**, 1729.

(2) B. Schulze, D. Escudero, C. Friebe, R. Siebert, H. Goerls, S. Sinn, M. Thomas, S. Mai, J. Popp, B. Dietzek, L. Gonzalez U. S. Schubert, *Chem. Eur. J*., 2012, **18**, 4010.

(3) S. Fischer, H. K. Wentsch, S. C. Mayer-Wrangowski, M. Zimmermann, S. M. Bauer, K. Storch, R. Niess, S. C. Koeberle, C. Gruetter, F. M. Boeckler, D. Rauh and S. A. Laufer, *J. Med. Chem*., 2013, **56**, 241.

(4) Y. Zhao and D. G. Truhlar, *Theor. Chem. Acc.*, 2008, **120**, 215-241.

(5) Gaussian 09, Revision A.02, M. J. Frisch, G. W. Trucks, H. B. Schlegel, G. E. Scuseria, M. A. Robb, J. R. Cheeseman, G. Scalmani, V. Barone, B. Mennucci, G. A. Petersson, H. Nakatsuji, M. Caricato, X. Li, H. P. Hratchian, A. F. Izmaylov, J. Bloino, G. Zheng, J. L. Sonnenberg, M. Hada, M. Ehara, K. Toyota, R. Fukuda, J. Hasegawa, M. Ishida, T. Nakajima, Y. Honda, O. Kitao, H. Nakai, T. Vreven, J. A. Montgomery, Jr. J. E. Peralta, F. Ogliaro, M. Bearpark, J. J. Heyd, E. Brothers, K. N. Kudin, V. N. Staroverov, R. Kobayashi, J. Normand, K. Raghavachari, A. Rendell, J. C. Burant, S. S. Iyengar, J. Tomasi, M. Cossi, N. Rega, J. M. Millam, M. Klene, J. E. Knox, J. B. Cross, V. Bakken, C. Adamo, J. Jaramillo, R. Gomperts, R. E. Stratmann, O. Yazyev, A. J. Austin, R. Cammi, C. Pomelli, J. W. Ochterski, R. L. Martin, K. Morokuma, V. G. Zakrzewski, G. A. Voth, P. Salvador, J. J. Dannenberg, S. Dapprich, A. D. Daniels, Ö. Farkas, J. B. Foresman, J. V. Ortiz, J. Cioslowski and D. J. Fox, Gaussian, Inc., Wallingford CT, 2009.

(6) V. Barone and M. Cossi, *J. Phys. Chem. A*, 1998, **102**, 1995-2001.

**Table S1.** Crystal data and structure refinement for compound **8** (CCDC 986427)

| | |
|---|---|
| Empirical formula | $C_{36}H_{23}F_3N_4O$ |
| Formula weight | 584.58 |
| Temperature | 296(2) K |
| Wavelength | 1.54178 A |
| Crystal system, space group | Triclinic, P -1 |
| Unit cell dimensions | a = 10.327(2) A alpha = 79.88(3) deg. |
| | b = 11.834(2) A beta = 88.92(3) deg. |
| | c = 23.984(5) A gamma = 87.48(3) deg. |
| Volume | 2882.7(10) A^3 |
| Z | 4, |
| Calculated density | 1.347 Mg/m^3 |
| Absorption coefficient | 0.797 mm^-1 |
| F(000) | 1208 |
| Crystal size | 0.18 x 0.15 x 0.12 mm |
| Theta range for data collection | 4.29 to 67.37 deg. |
| Limiting indices | -12<=h<=12, -13<=k<=13, -28<=l<=28 |
| Reflections collected / unique | 23132 / 9223 [R(int) = 0.0329] |
| Completeness to theta = 67.37 | 88.9 % |
| Absorption correction | Semi-empirical from equivalents |
| Max. and min. transmission | 0.7530 and 0.7091 |
| Refinement method | Full-matrix least-squares on F^2 |
| Data / restraints / parameters | 9223 / 0 / 794 |
| Goodness-of-fit on F^2 | 3.898 |
| Final R indices [I>2sigma(I)] | R1 = 0.1762, wR2 = 0.5008 |
| R indices (all data) | R1 = 0.1848, wR2 = 0.5033 |
| Extinction coefficient | 0.015(3) |
| Largest diff. peak and hole | 1.008 and -0.853 e.A^-3 |

**Table S2.** Crystal data and structure refinement for compound **11** (CCDC 986426)

| | |
|---|---|
| Empirical formula | $C_{16}H_6F_4N_4O_2$ |
| Formula weight | 362.25 |
| Temperature | 296(2) K |
| Wavelength | 1.54178 A |
| Crystal system, space group | Monoclinic, P 21/c |
| Unit cell dimensions | a = 14.965(3) A alpha = 90 deg. |
| | b = 8.1190(16) A beta = 116.87(3) deg. |
| | c = 13.829(3) A gamma = 90 deg. |
| Volume | 1498.7(5) A^3 |
| Z | 4 |
| Calculated density | 1.605 Mg/m^3 |
| Absorption coefficient | 1.264 mm^-1 |
| F(000) | 728 |
| Crystal size | 0.64 x 0.34 x 0.18 mm |
| Theta range for data collection | 3.31 to 66.98 deg. |
| Limiting indices | -15<=h<=17, -8<=k<=9, -16<=l<=16 |
| Reflections collected / unique | 12197 / 2573 [R(int) = 0.0310] |
| Completeness to theta = 66.98 | 96.2 % |
| Absorption correction | Semi-empirical from equivalents |
| Max. and min. transmission | 0.7529 and 0.5368 |
| Refinement method | Full-matrix least-squares on F^2 |
| Data / restraints / parameters | 2573 / 0 / 236 |
| Goodness-of-fit on F^2 | 1.041 |
| Final R indices [I>2sigma(I)] | R1 = 0.0446, wR2 = 0.1275 |
| R indices (all data) | R1 = 0.0462, wR2 = 0.1292 |
| Extinction coefficient | 0.0094(10) |
| Largest diff. peak and hole | 0.252 and -0.203 e.A^-3 |

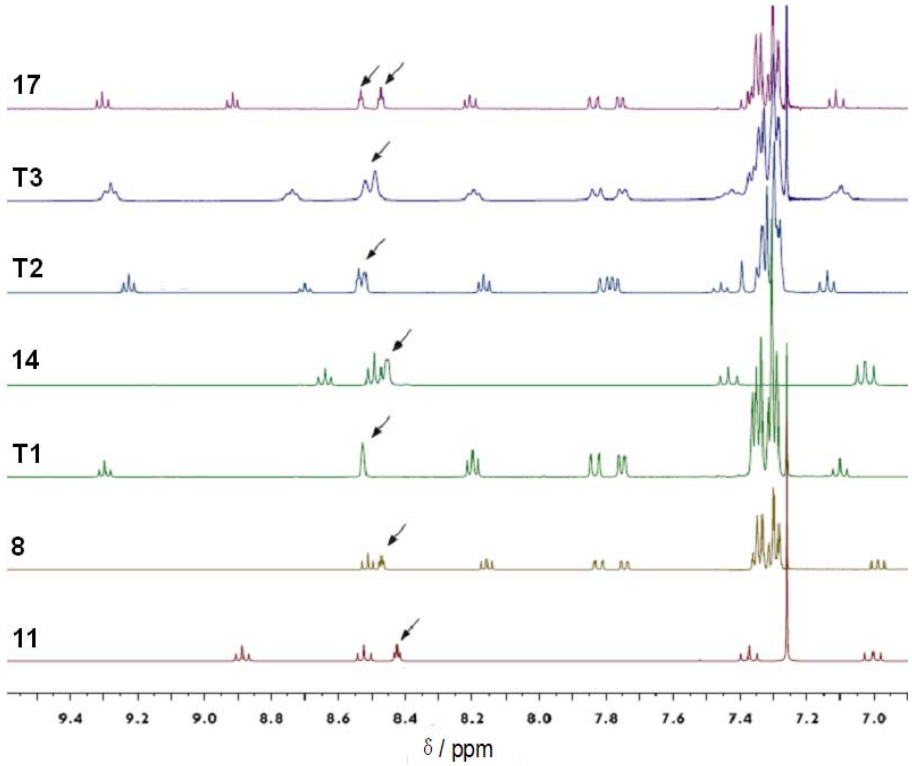


**Fig S1** Partial $^{1}$H NMR spectrum (300 MHz) of compounds **17**, **T3**, **T2**, **14**, **T1**, **8**, and **11** in $CDCl_3$ (5 mM).

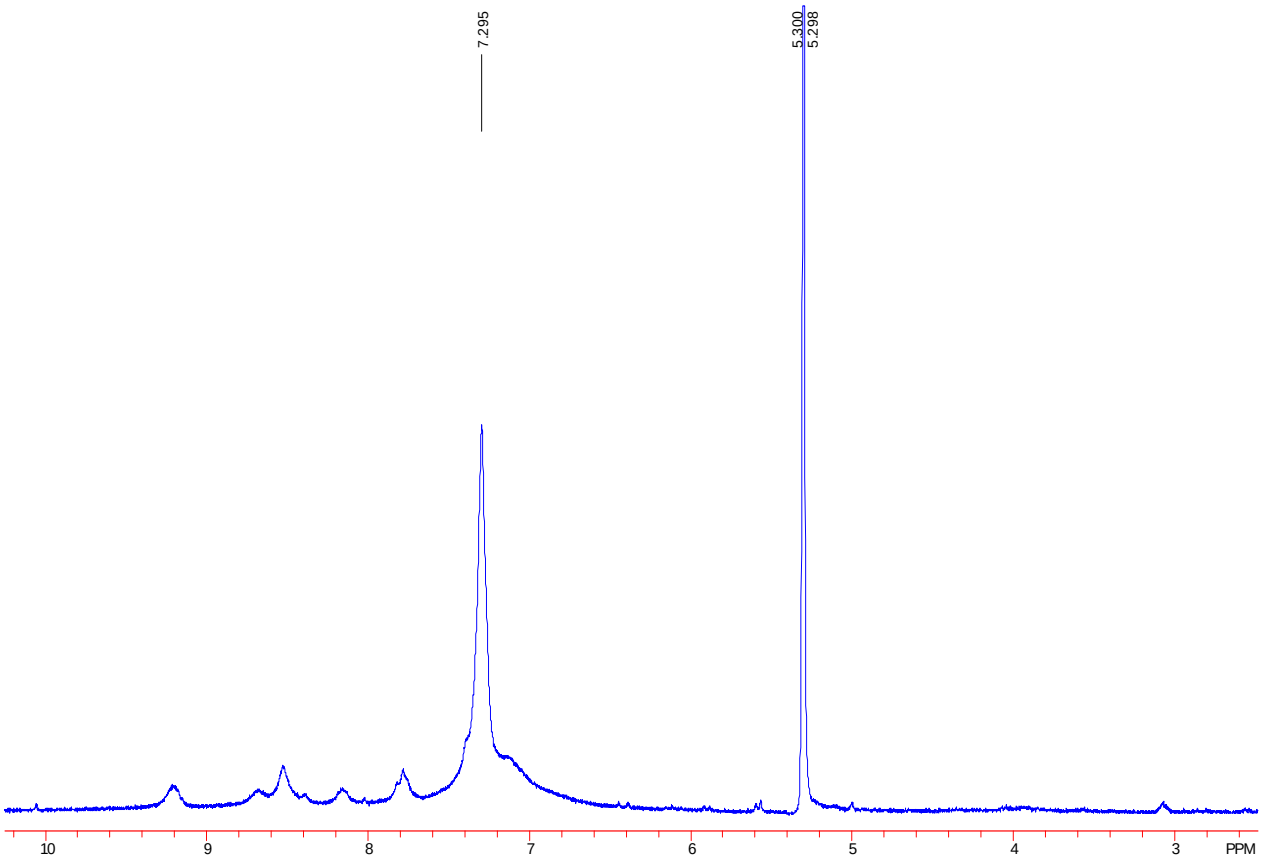


**Fig S2** $^{1}$H NMR spectrum (300 MHz) of compound **T4** in $CDCl_3$ (5 mM).

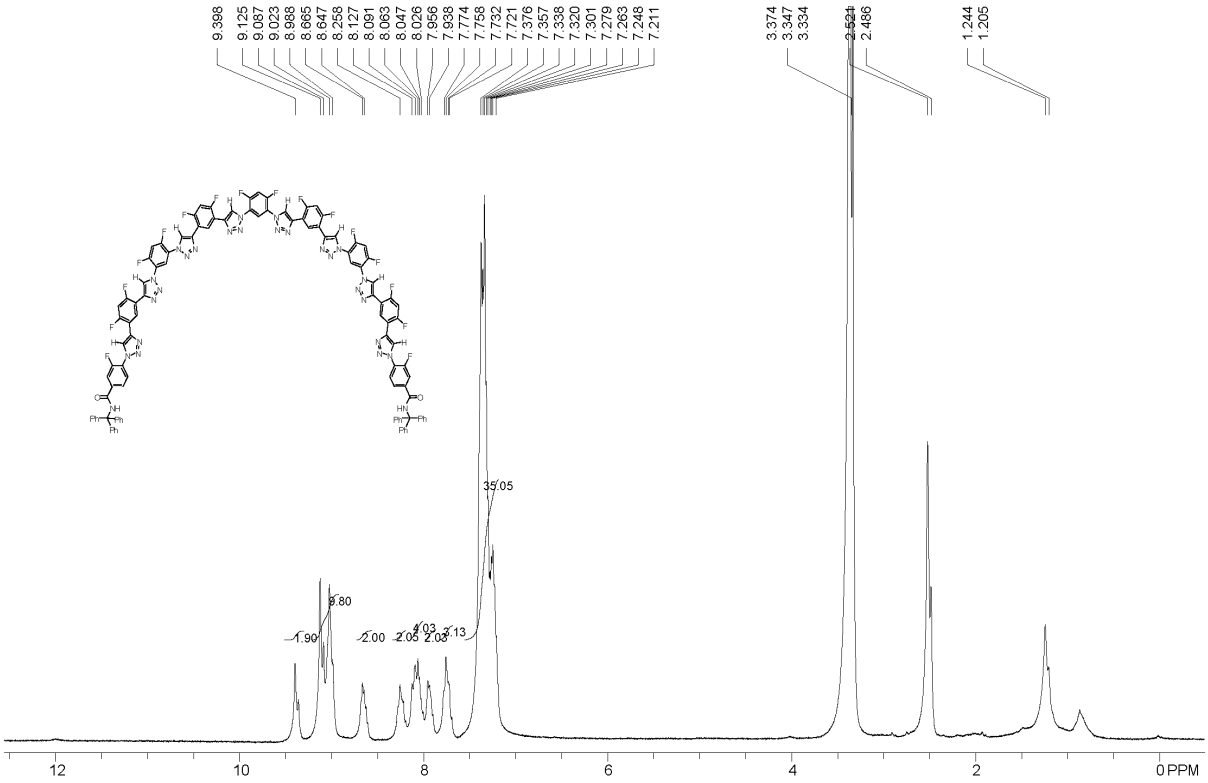


**Fig S3** $^{1}$H NMR spectrum (300 MHz) of compound **T4** in DMSO-$d_6$ (5 mM).

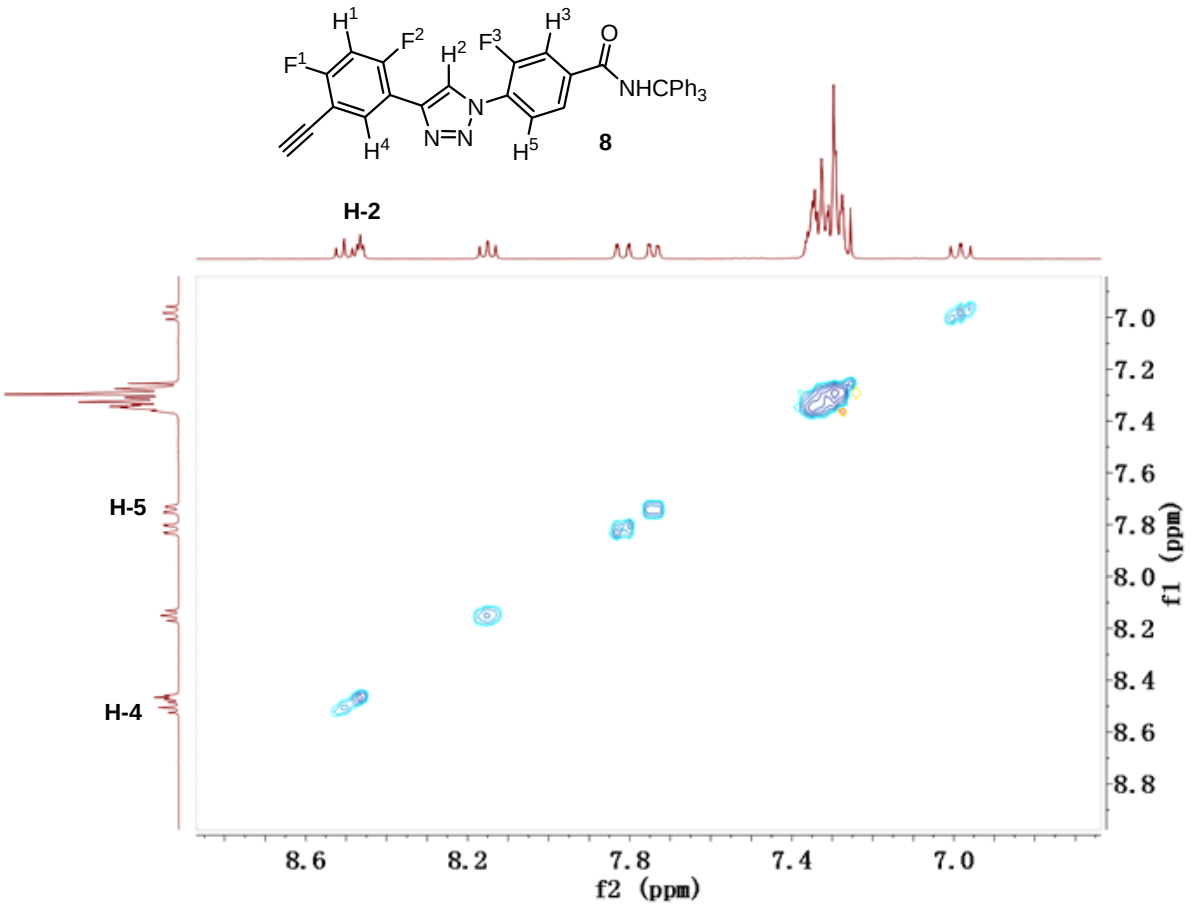


**Fig S4** $^{1}$H NOESY spectrum (500 MHz) of compound **8** in $CDCl_3$ (40 mM).

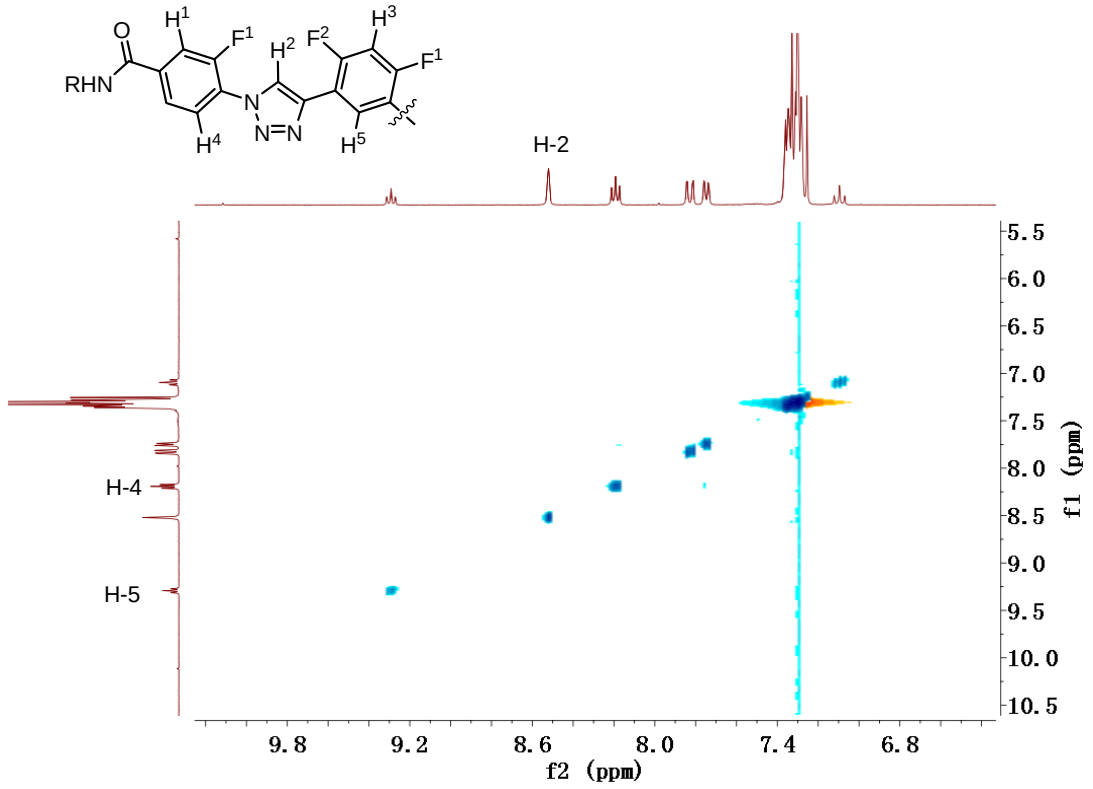


**Fig S5** $^{1}$H NOESY spectrum (500 MHz) of compound **T1** in $CDCl_3$ (10 mM).

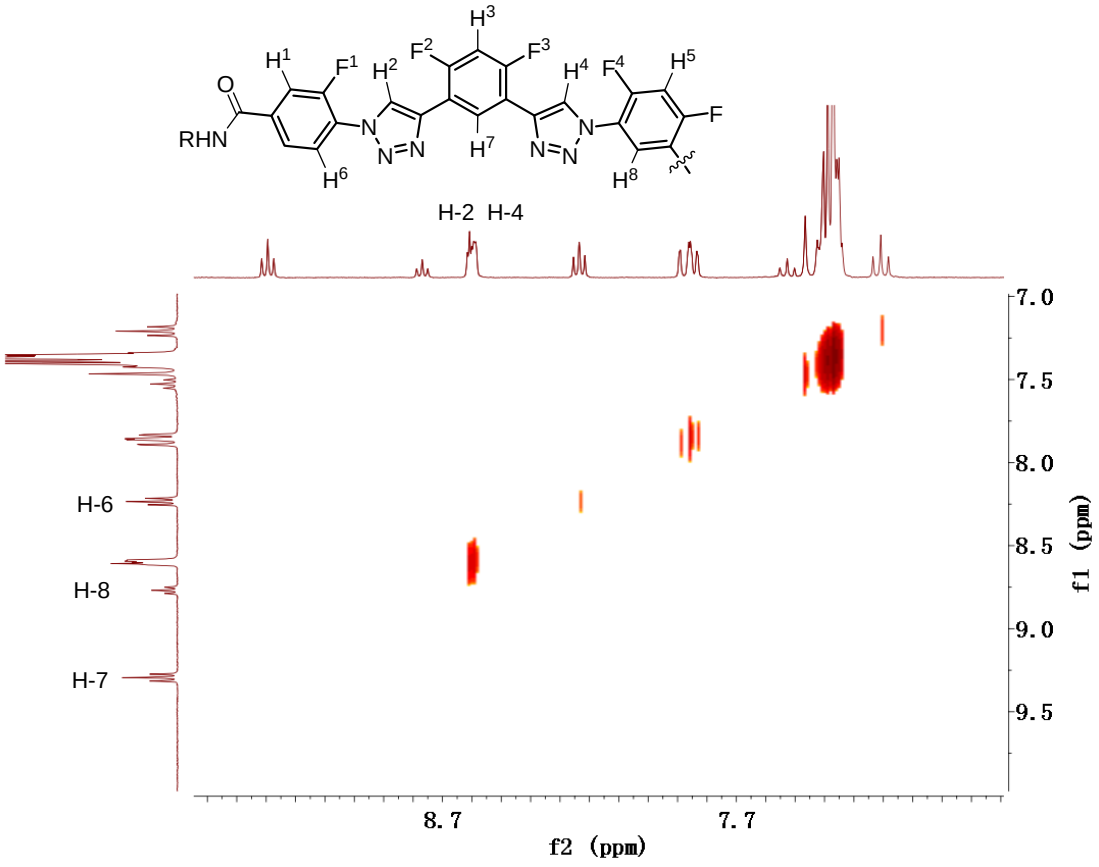


**Fig S6** $^{1}$H NOESY spectrum (500 MHz) of compound **T2** in $CDCl_3$ (5 mM).

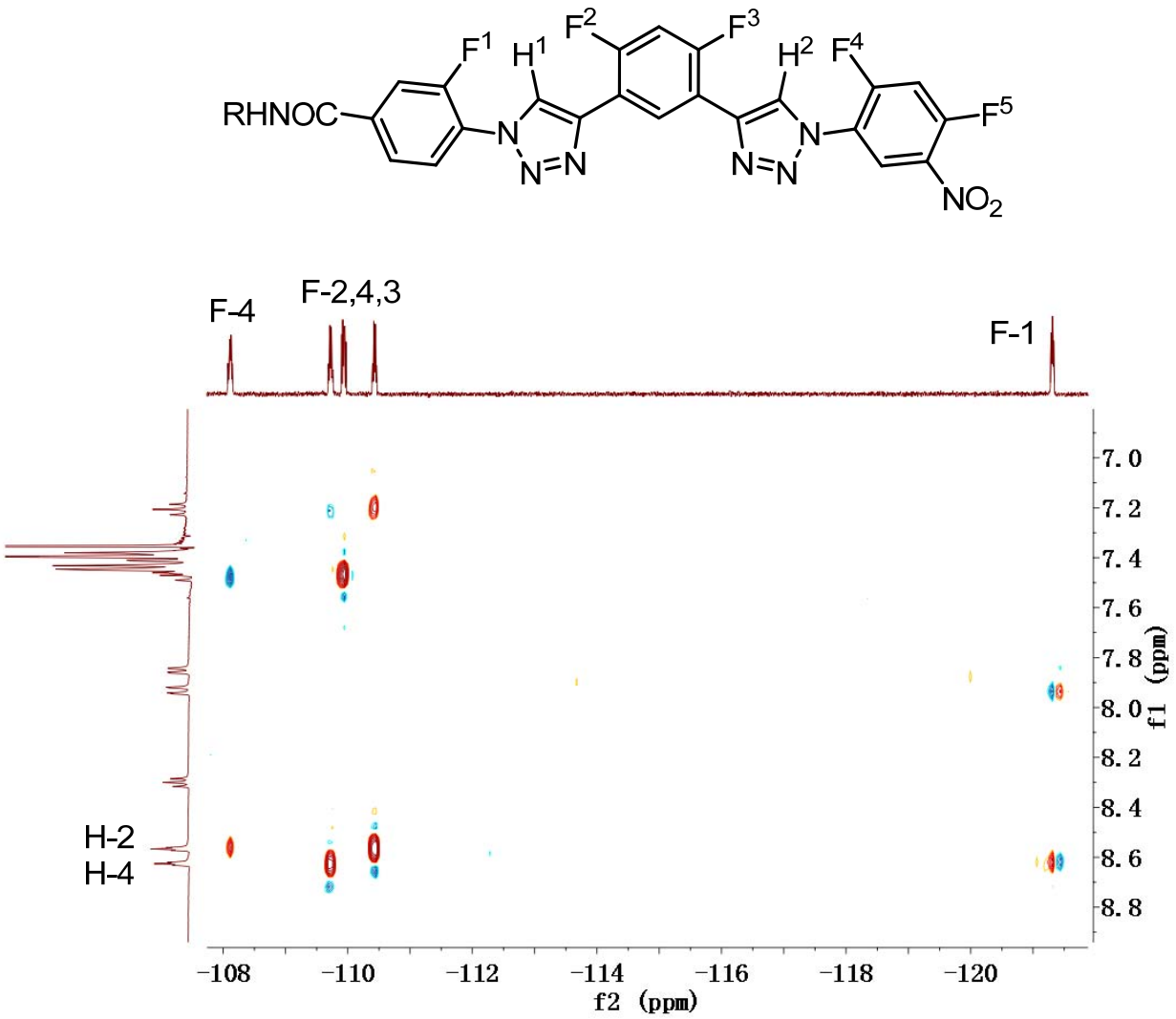


**Fig S7** $^{1}H$-$^{19}F$ HOESY spectrum (500 MHz) of compound **17** in $CDCl_3$ (5 mM).

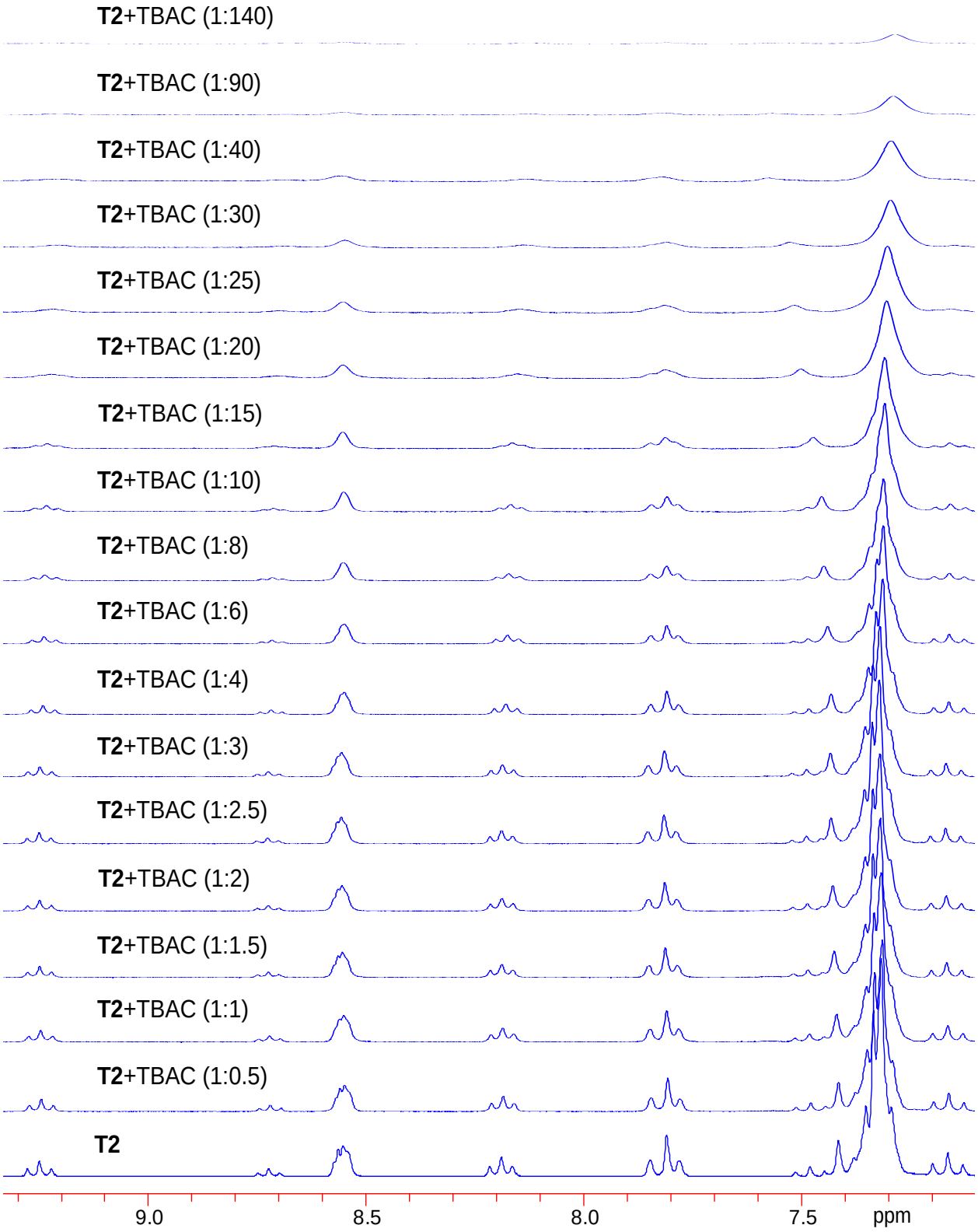


**Fig S8** $^{1}$H NMR spectra (200 MHz) of **T2** (3 mM) in $CD_2Cl_2$ in the presence of tetrabutylammonium chloride (TBAC) of incremental amount.

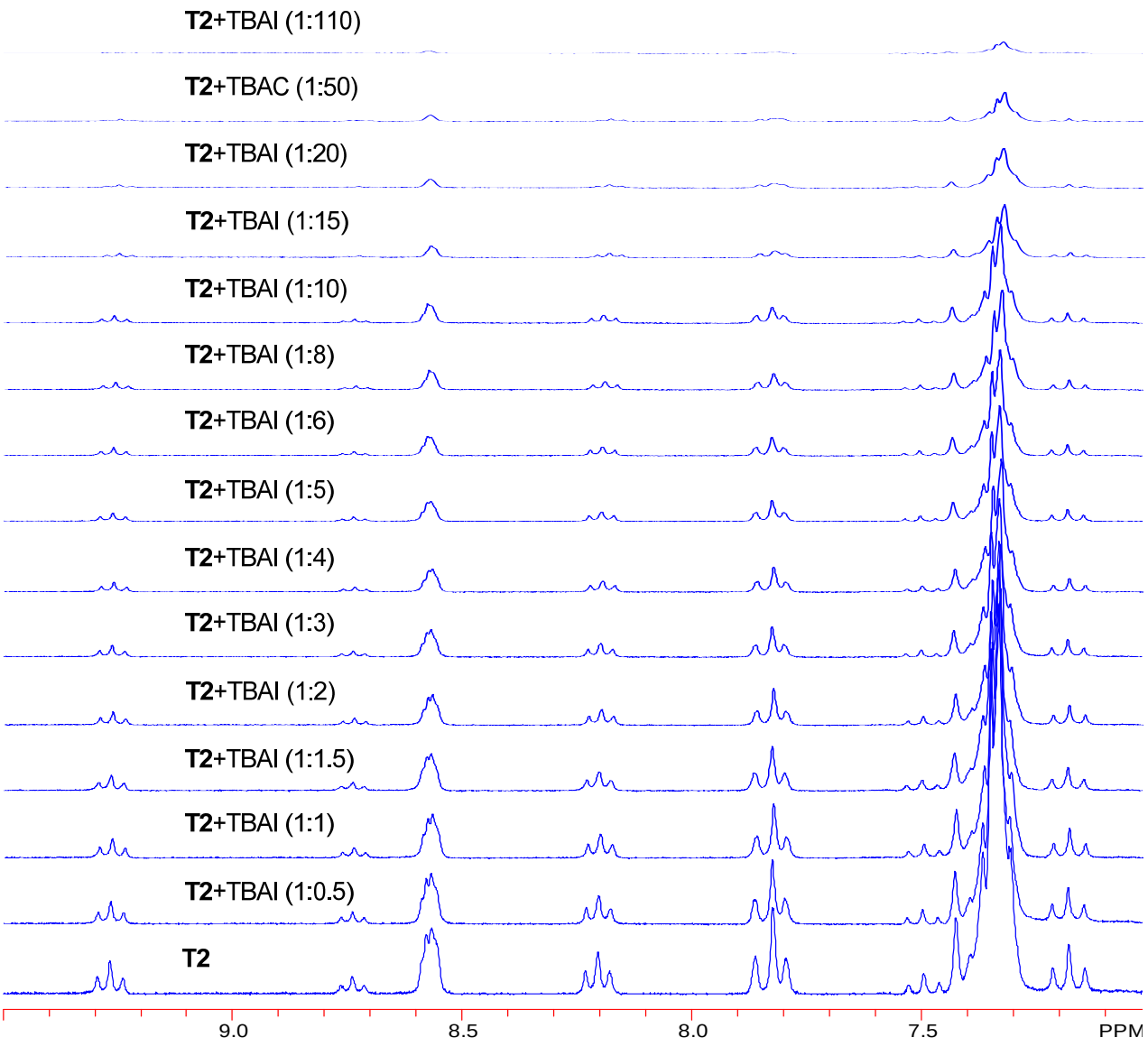


**Fig S9** $^{1}$H NMR spectra (300 MHz) of **T2** (3 mM) in $CD_2Cl_2$ in the presence of tetrabutylammonium iodide of incremental amount.

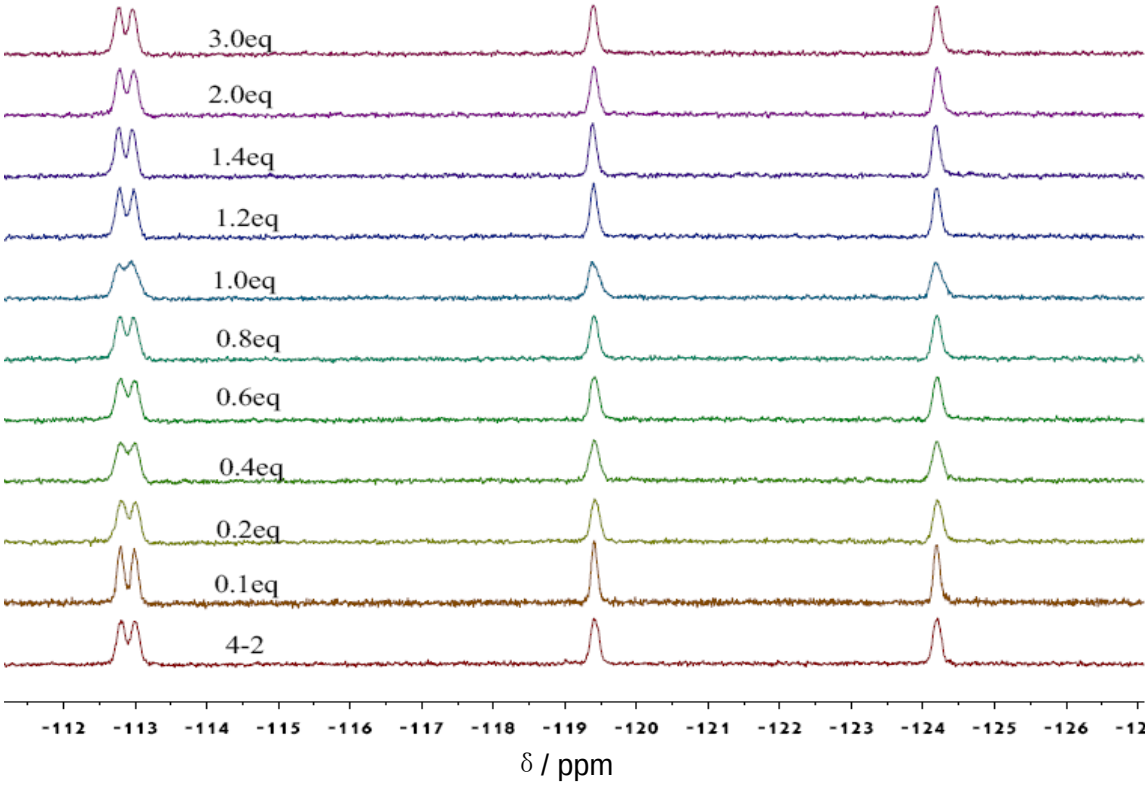


**Fig S10** $^{19}F$ NMR spectra of **T2** (3 mM) in $CD_2Cl_2$ in the presence of tetrabutylammonium iodide of incremental amount.

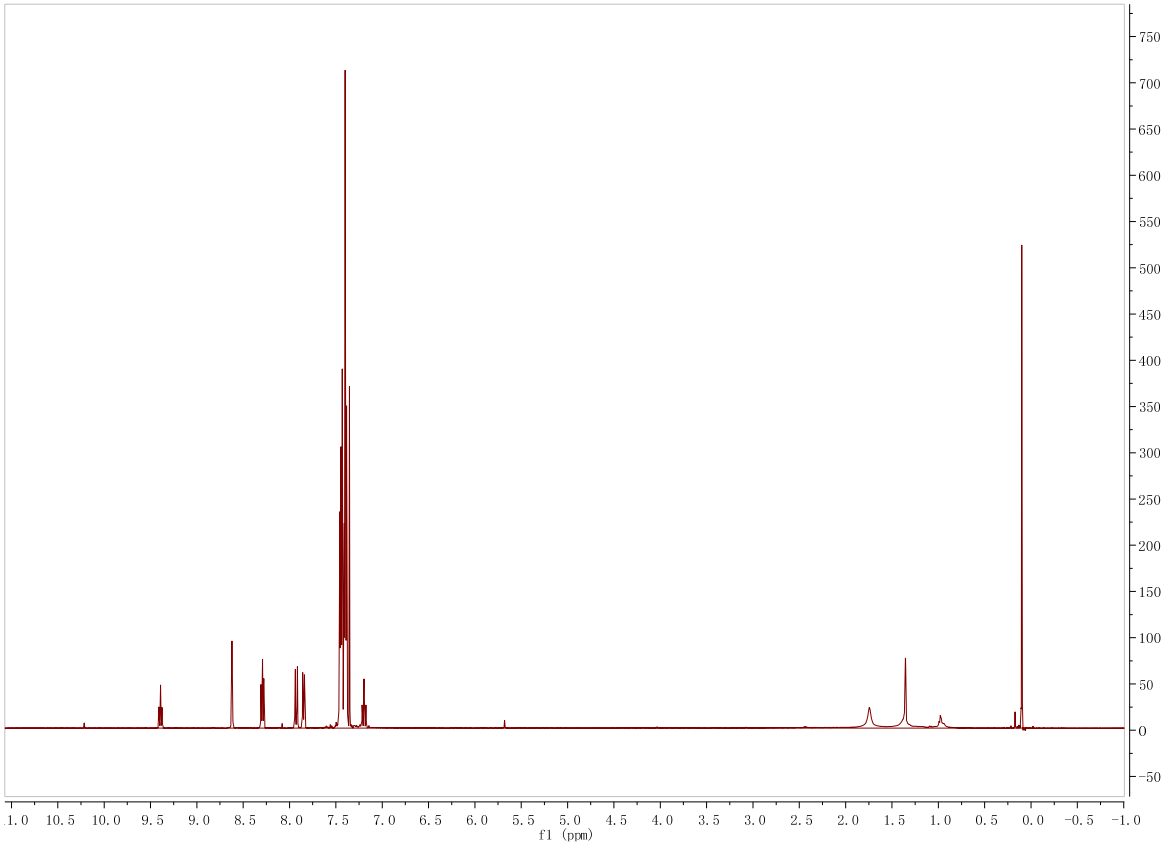


**Fig S11** $^{1}H$ NMR spectrum of compound **T1** in $CDCl_3$ (500 MHz).

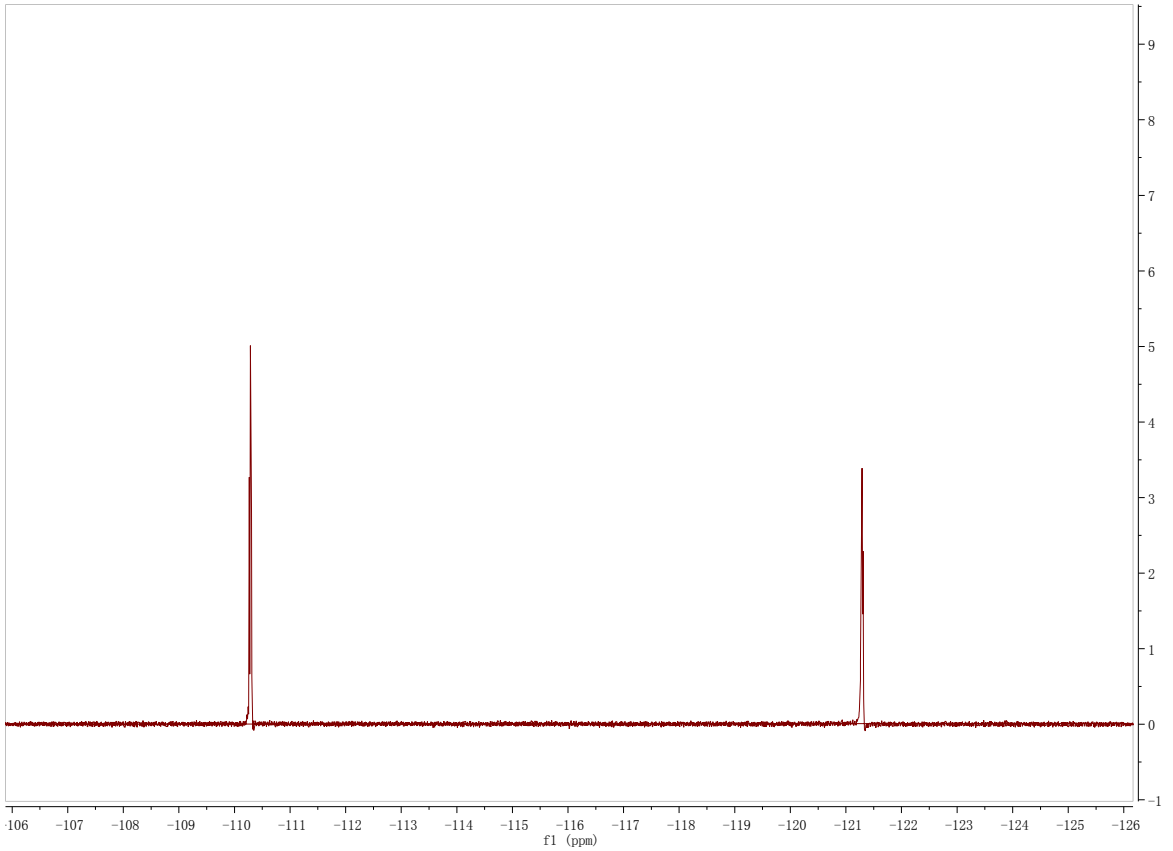


**Fig S12** $^{1}$F NMR spectrum of compound **T1** in $CDCl_3$ (470 MHz).

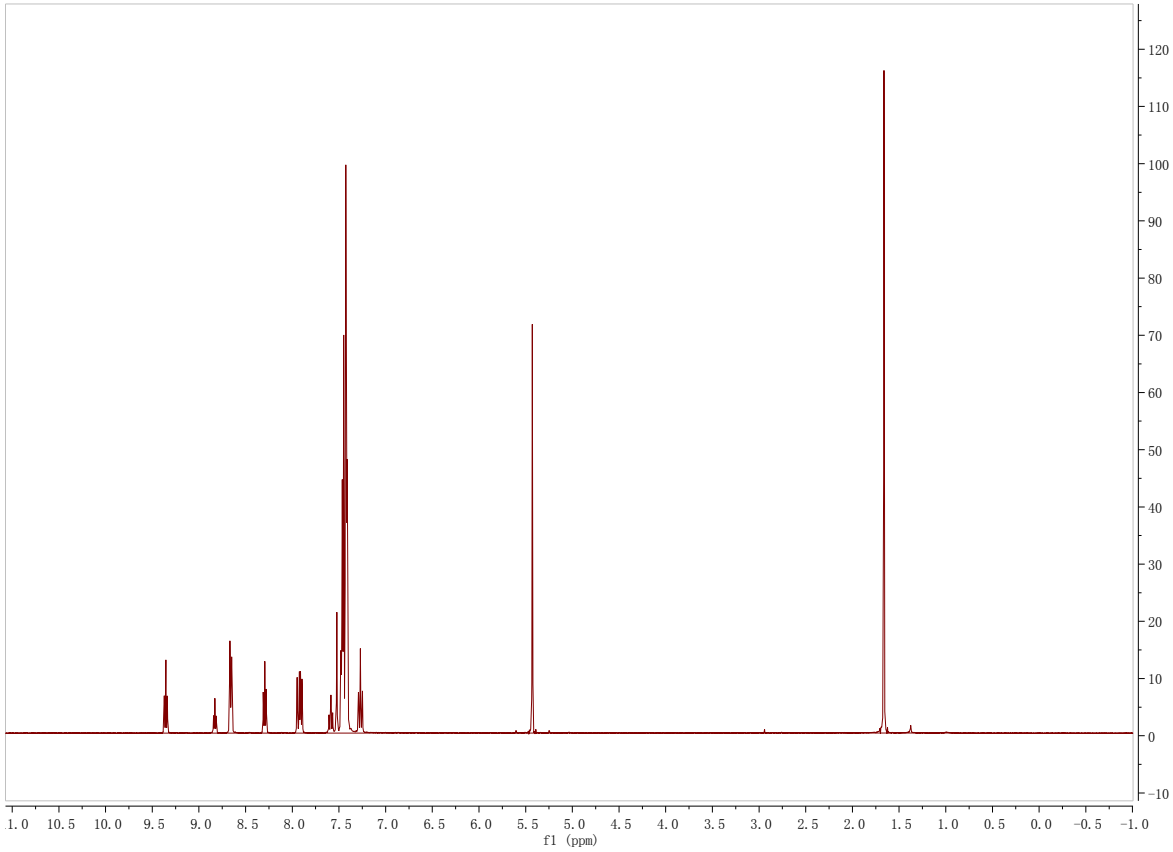


**Fig S13** $^{1}$H NMR spectrum of compound **T2** in $CD_2Cl_2$ (400 MHz).

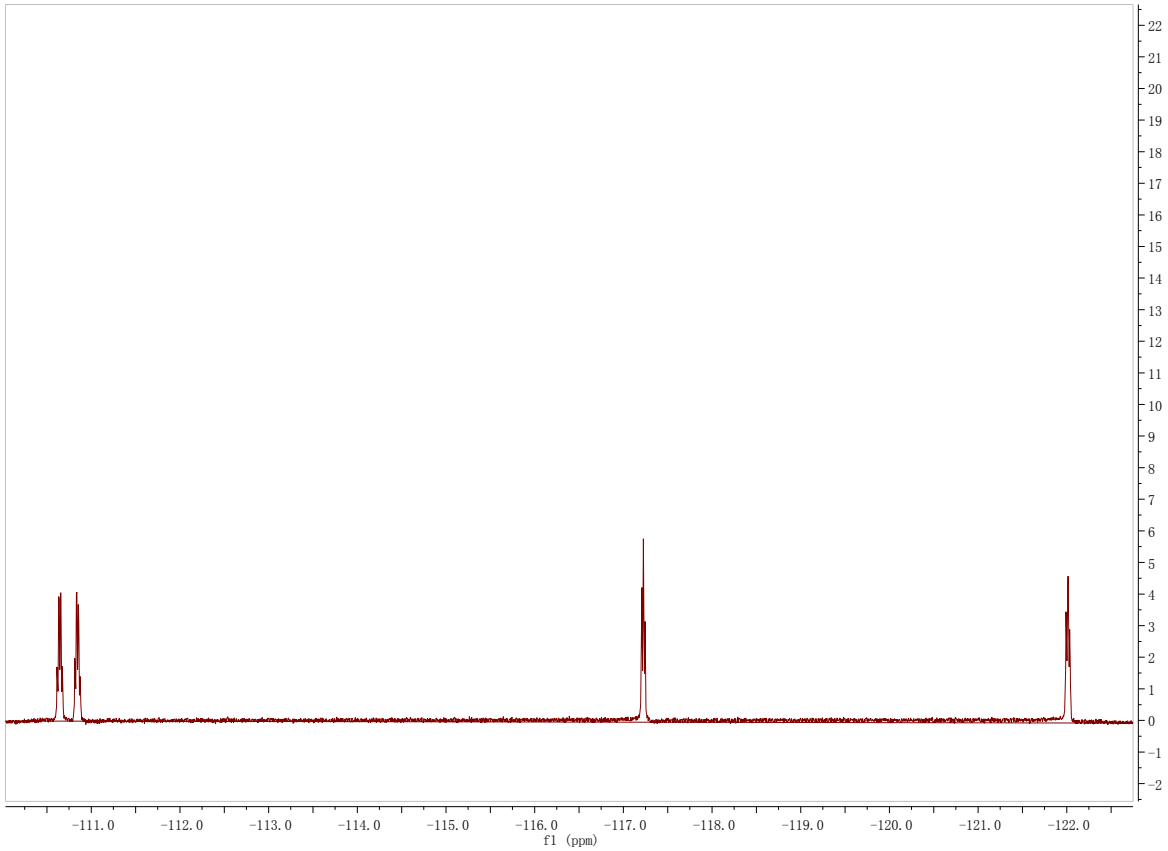


**Fig S14**. $^{19}F$ NMR spectrum of compound **T2** in $CD_2Cl_2$ (376 MHz).

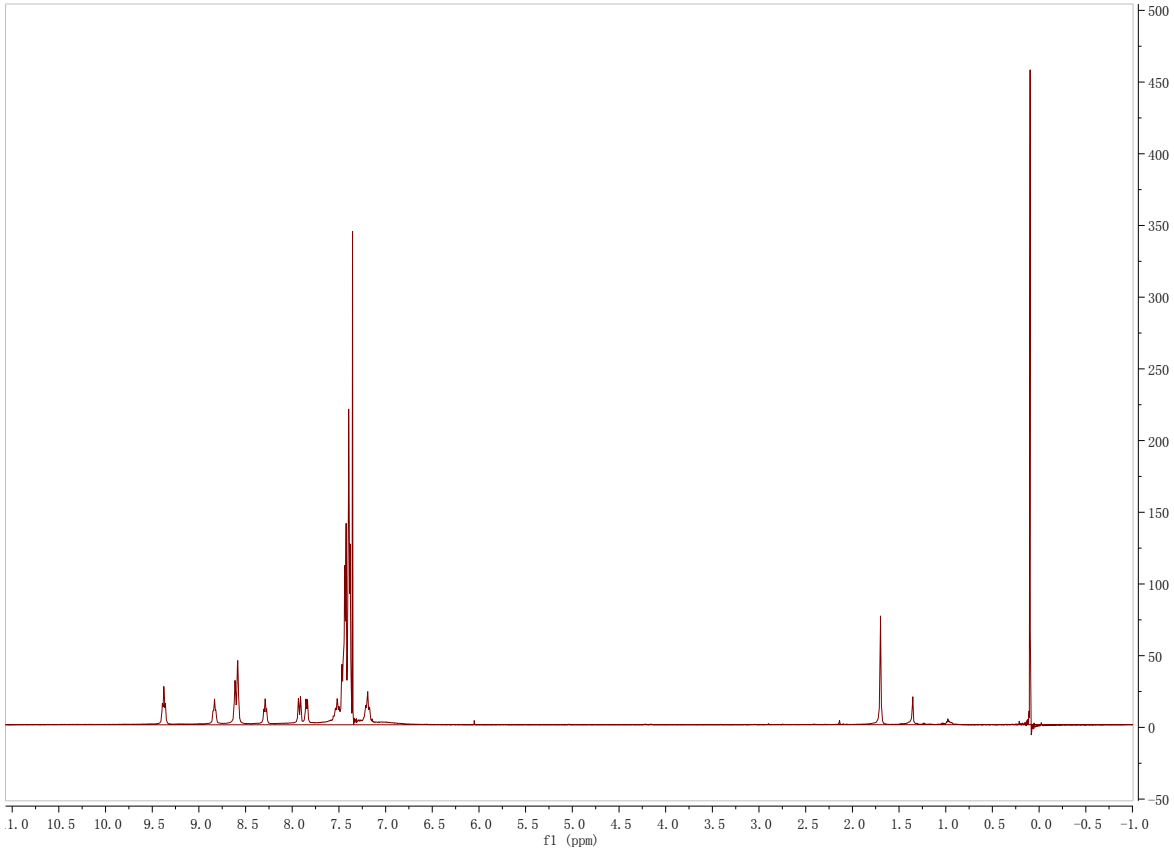


**Fig S15** $^{1}H$ NMR spectrum of compound **T3** in $CD_2Cl_2$ (400 MHz).

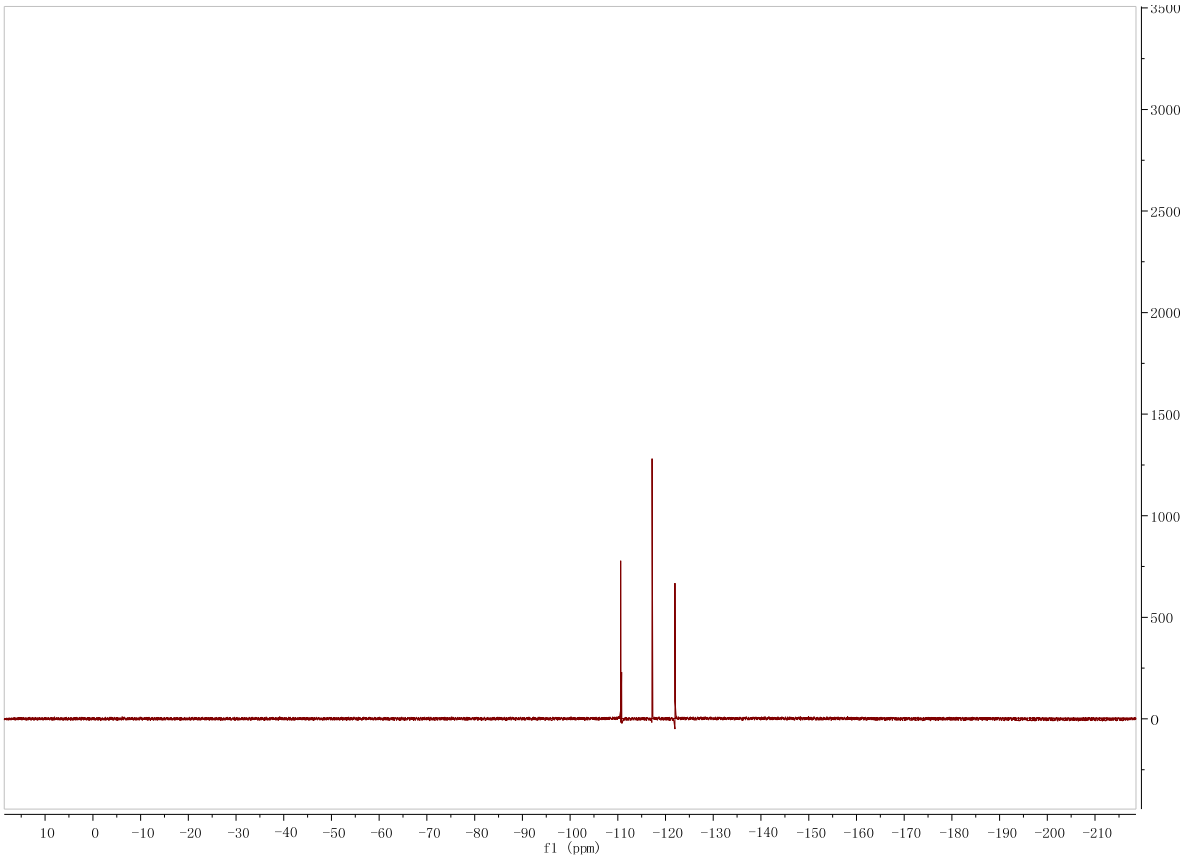


**Fig S16** $^{1}$F NMR spectrum of compound **T3** in $CD_2Cl_2$ (376 MHz).

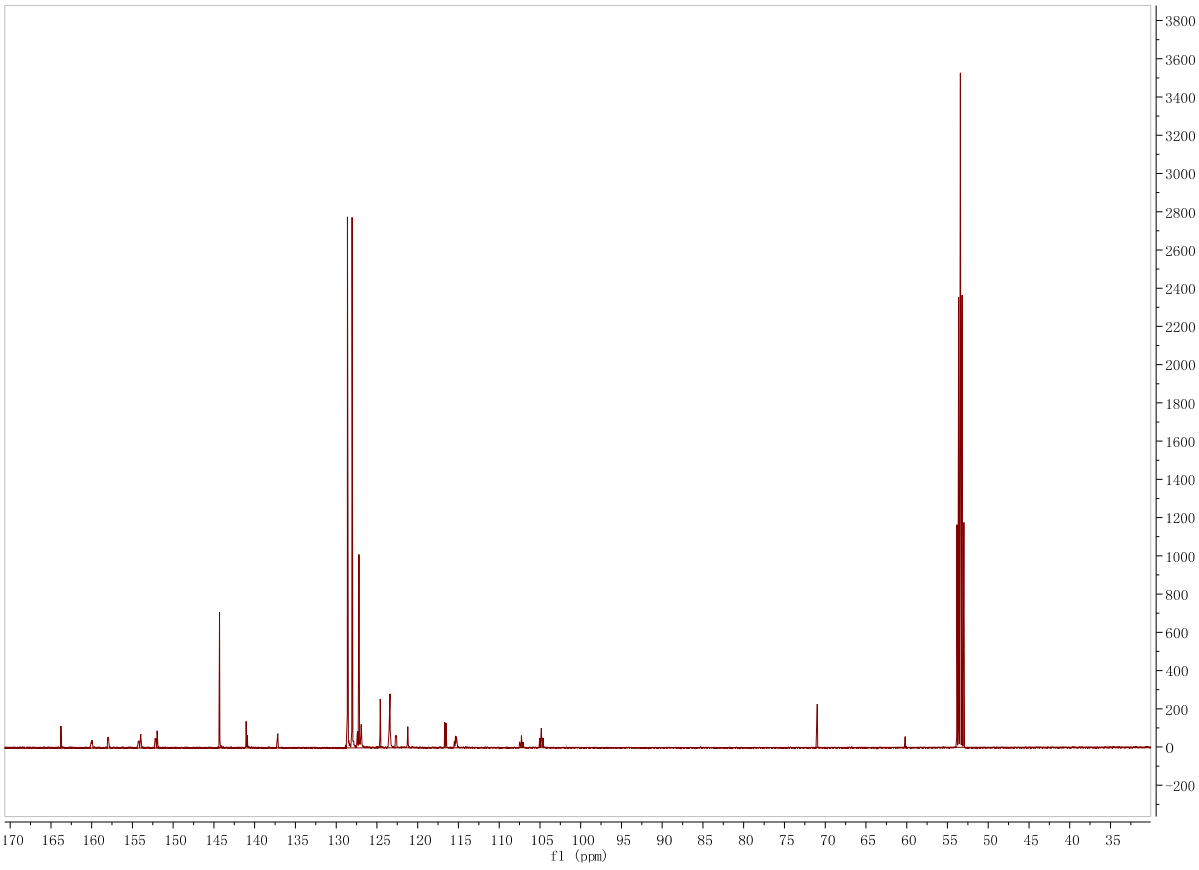


**Fig S17** $^{13}$C NMR spectrum of compound **T3** in $CD_2Cl_2$ (126 MHz).

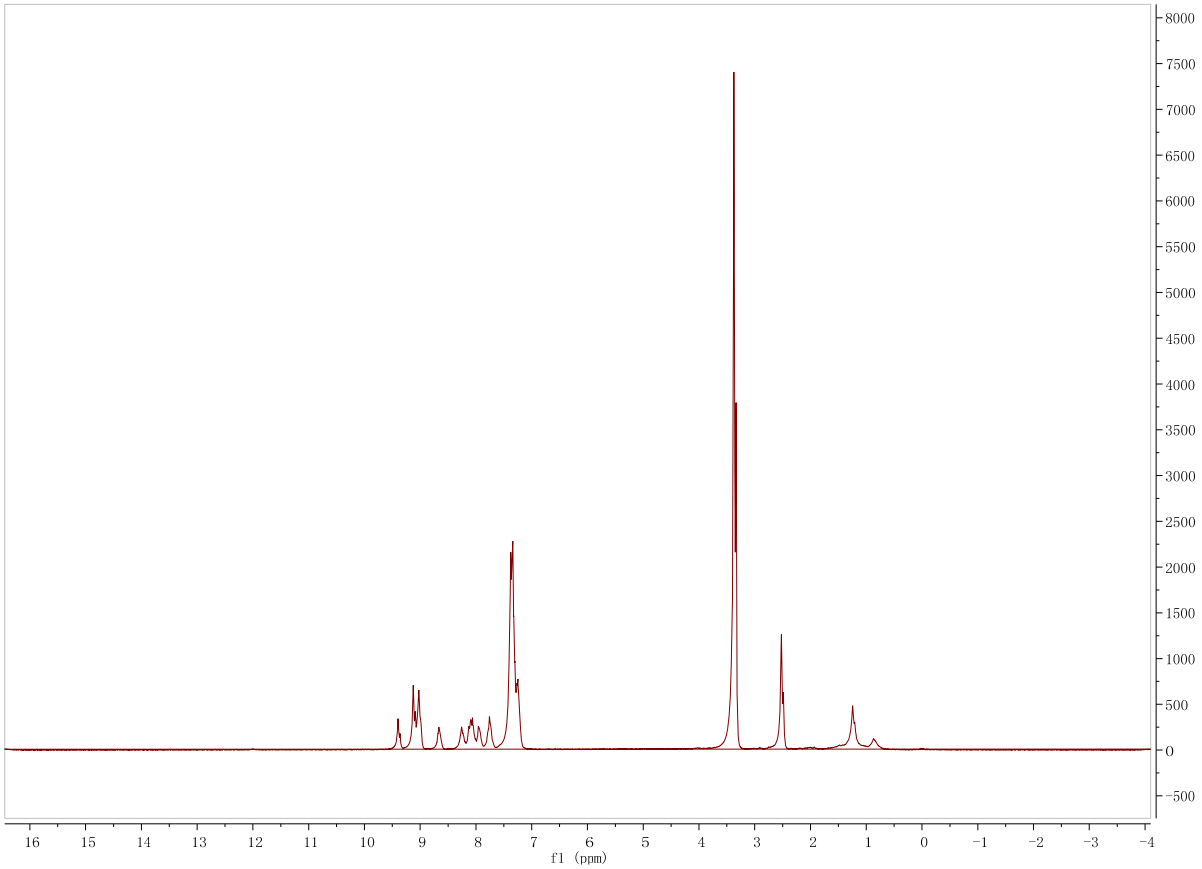


**Fig S18** $^{1}$H NMR spectrum of compound **T4** in DMSO-$d_6$ (400 MHz).

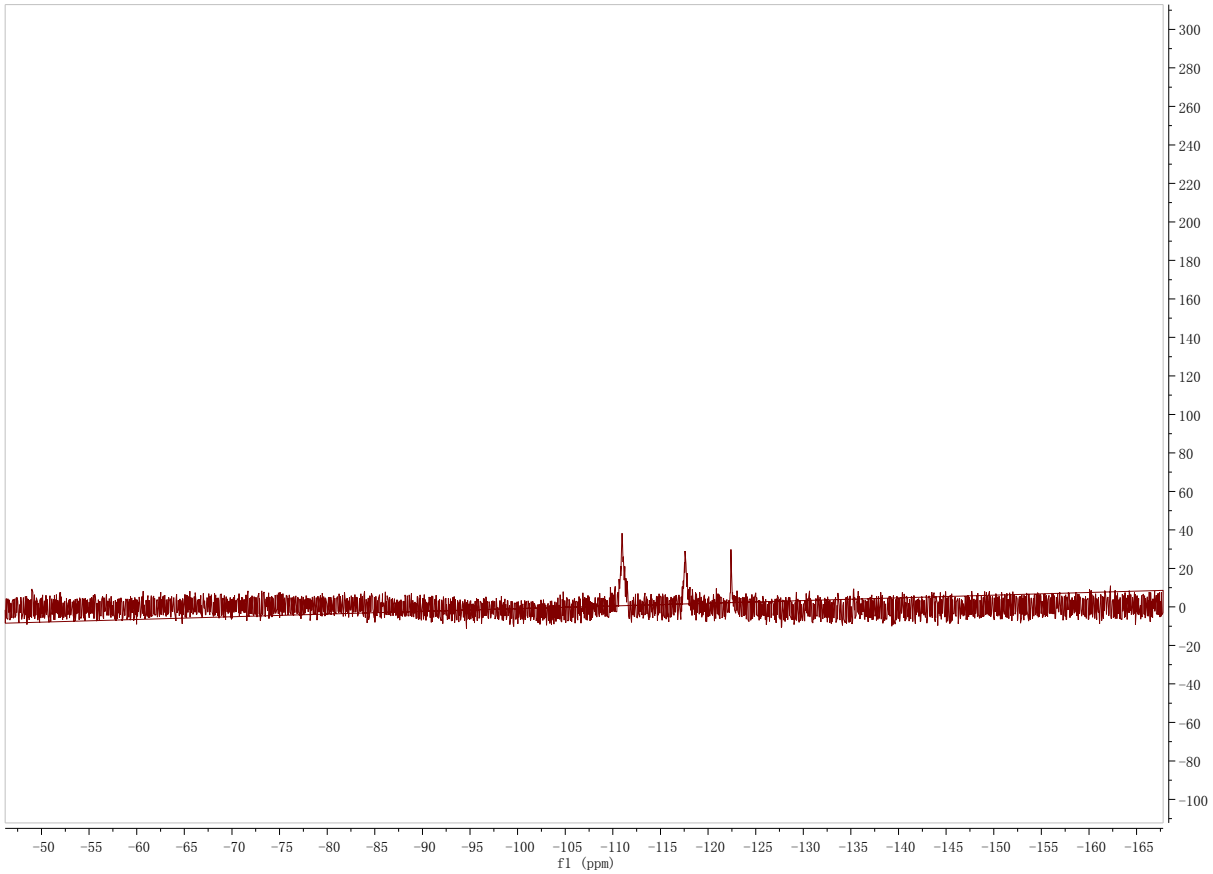


**Fig S19** $^{1}$F NMR spectrum of compound **T4** in $CD_2Cl_2$ (376 MHz).

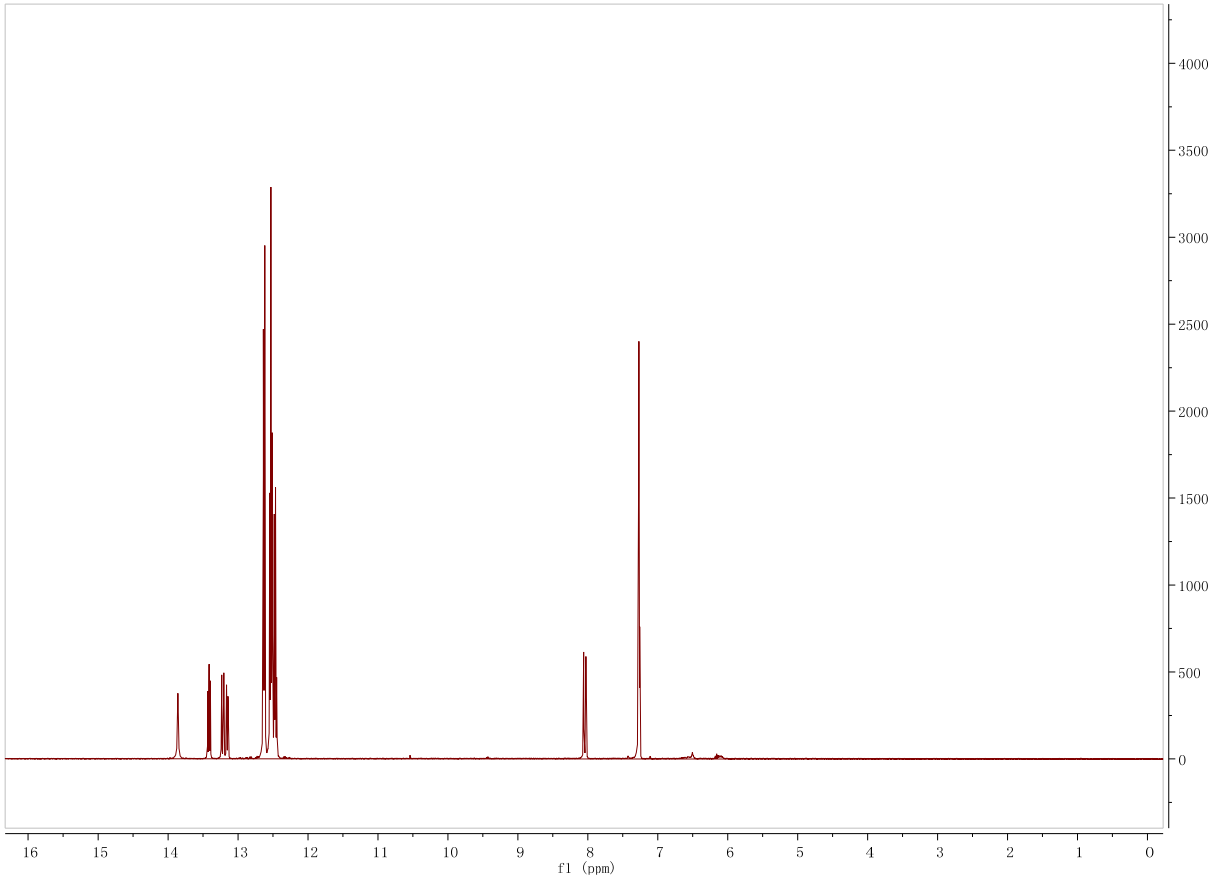


**Fig S20** $^{1}$H NMR spectrum of compound **4** in DMSO-$d_6$ (400 MHz).

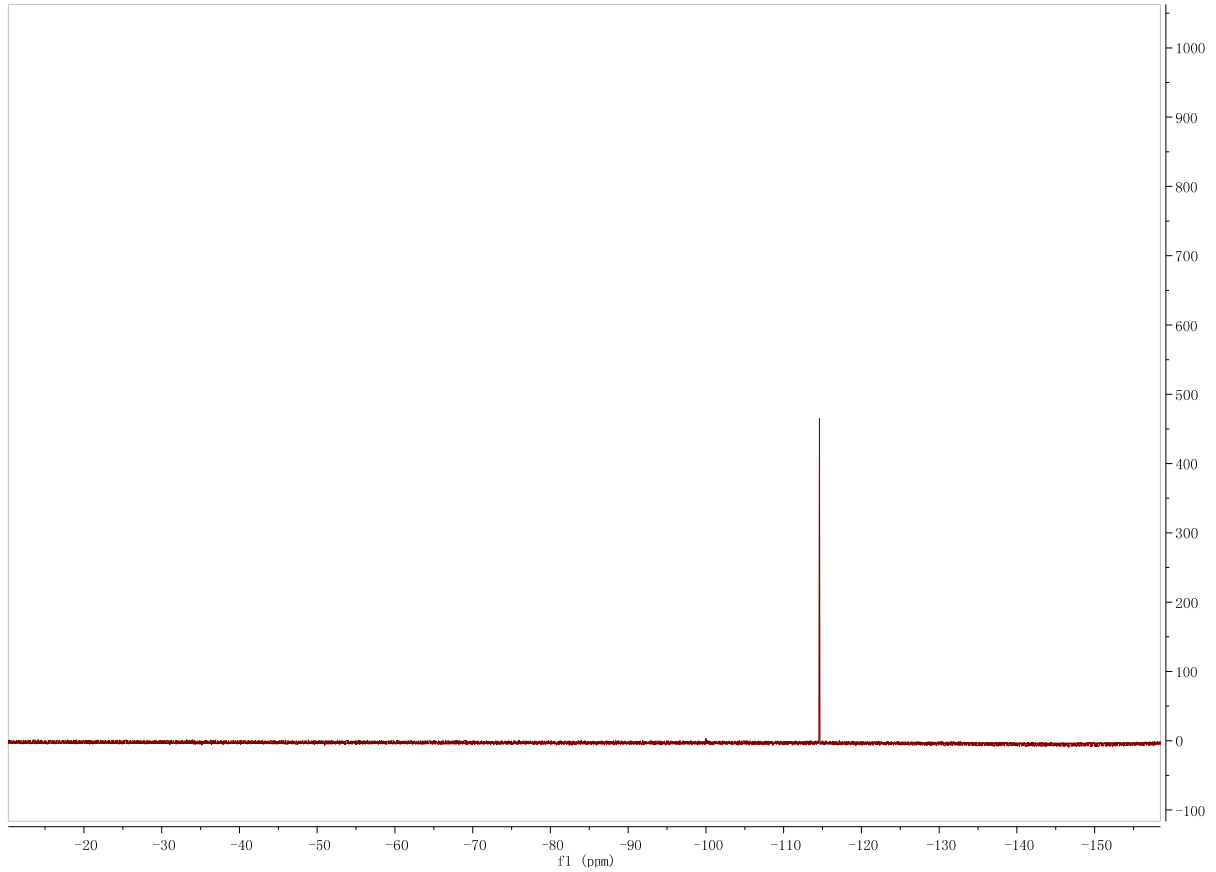


**Fig S21** $^{1}$F NMR spectrum of compound **4** in $CDCl_3$ (376 MHz).

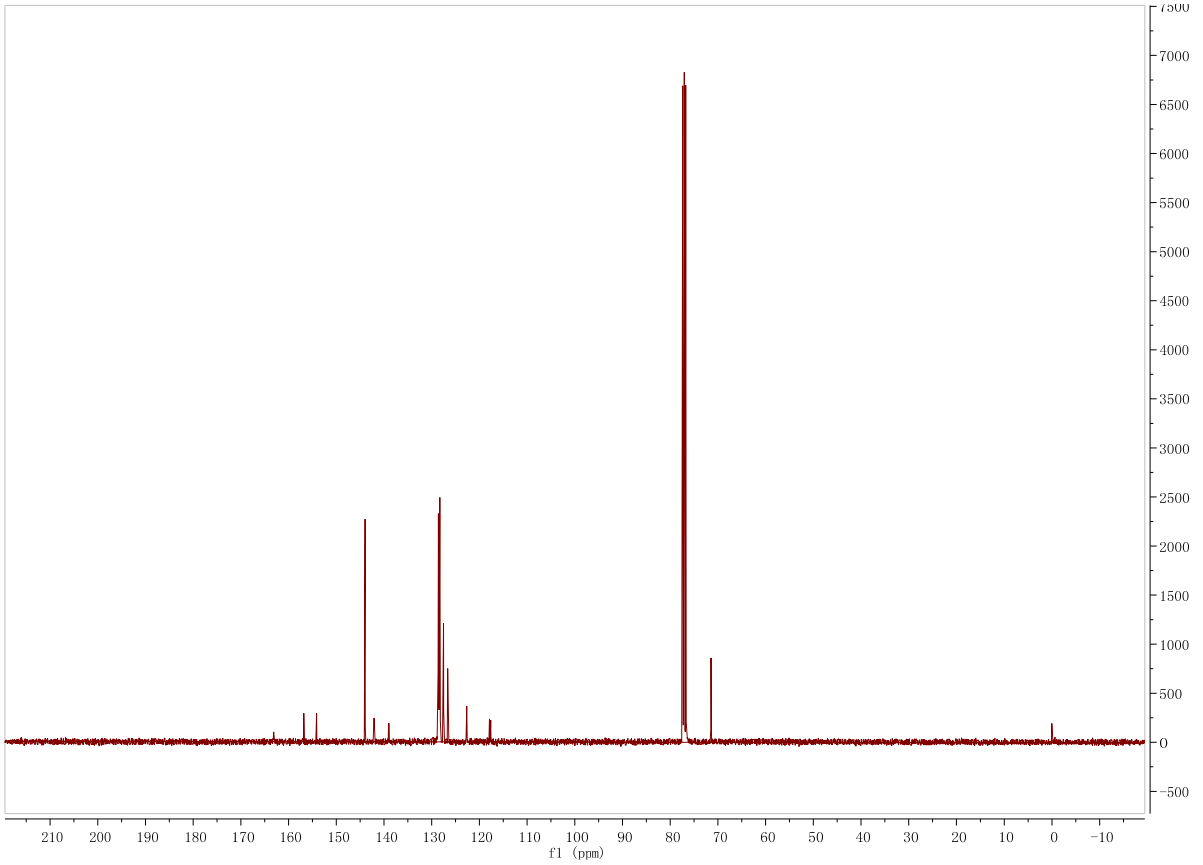


**Fig S22** $^{13}C$ NMR spectrum of compound **4** in $CDCl_3$ (101 MHz).

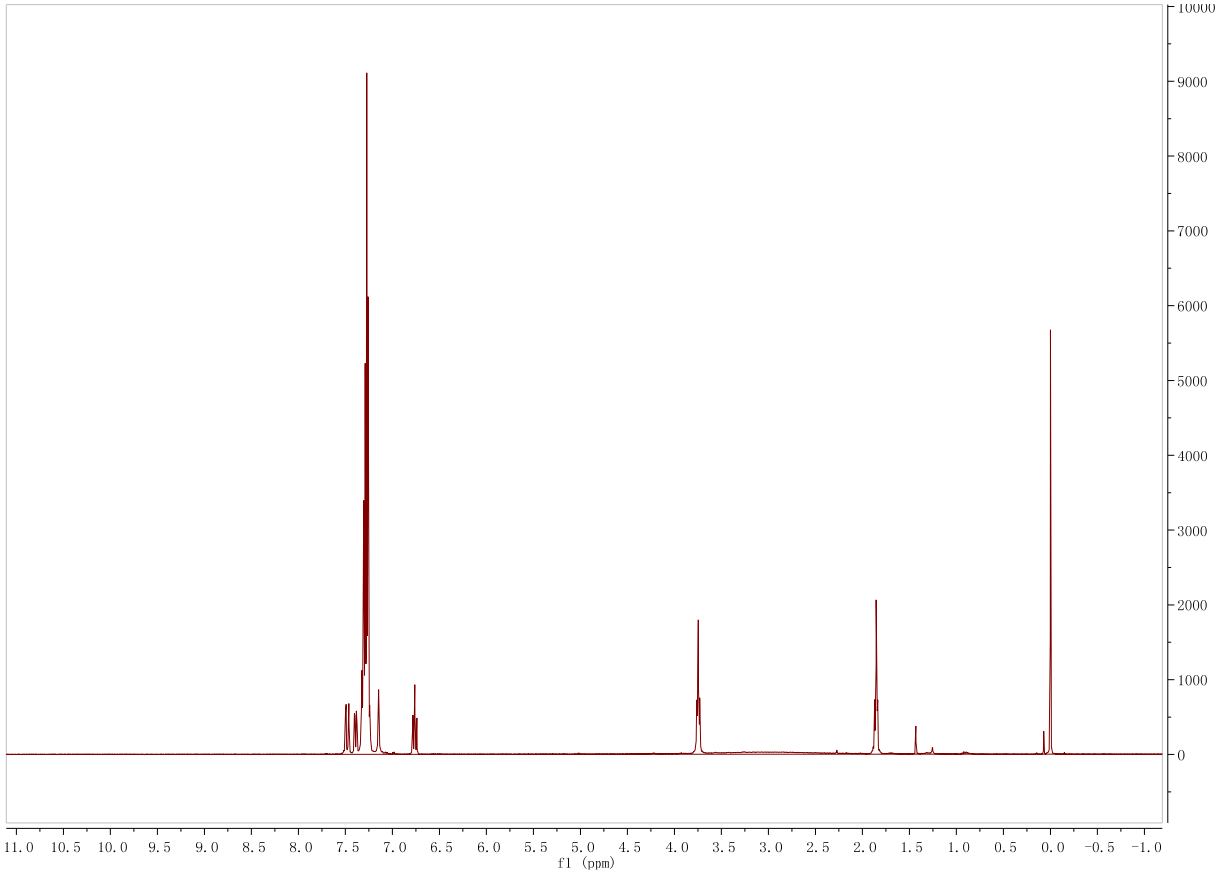


**Fig S23** $^{1}H$ NMR spectrum of compound **5** in $CD_3CN$ (400 MHz).

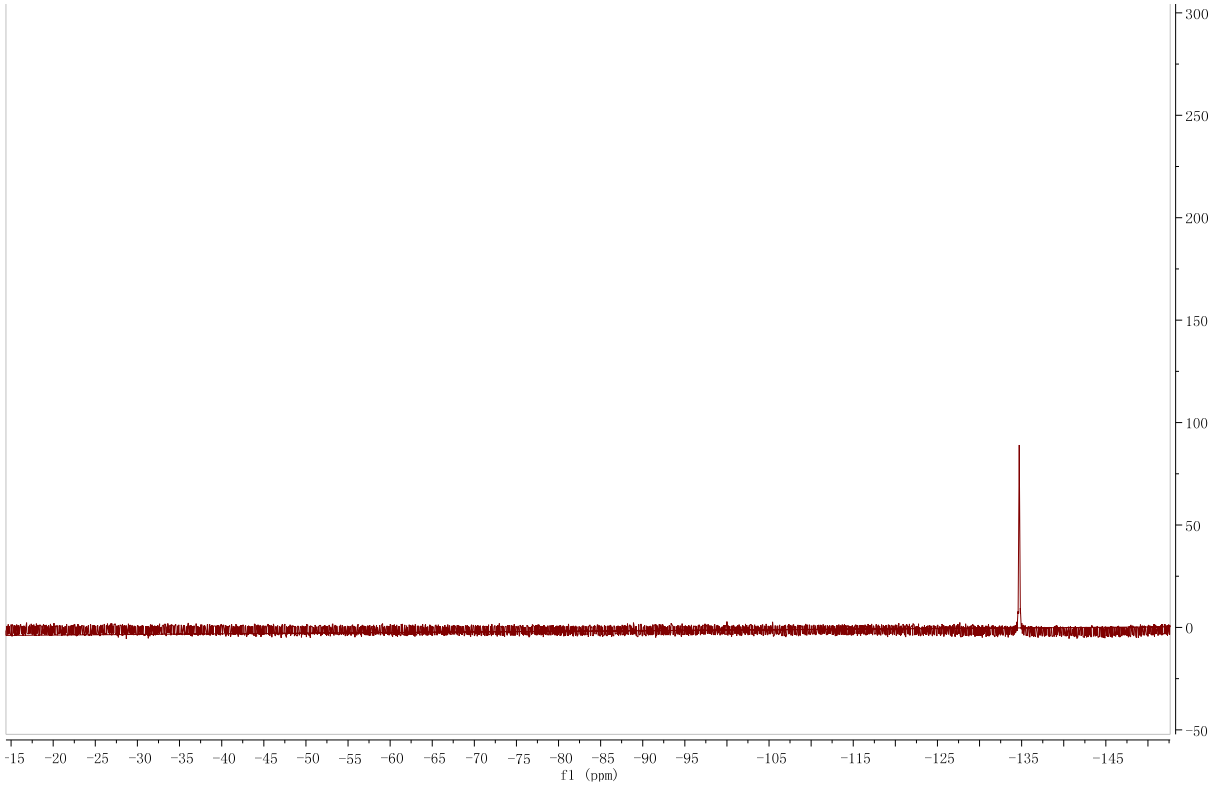


**Fig S24** $^{1}$F NMR spectrum of compound **5** in $CDCl_3$ (376 MHz).

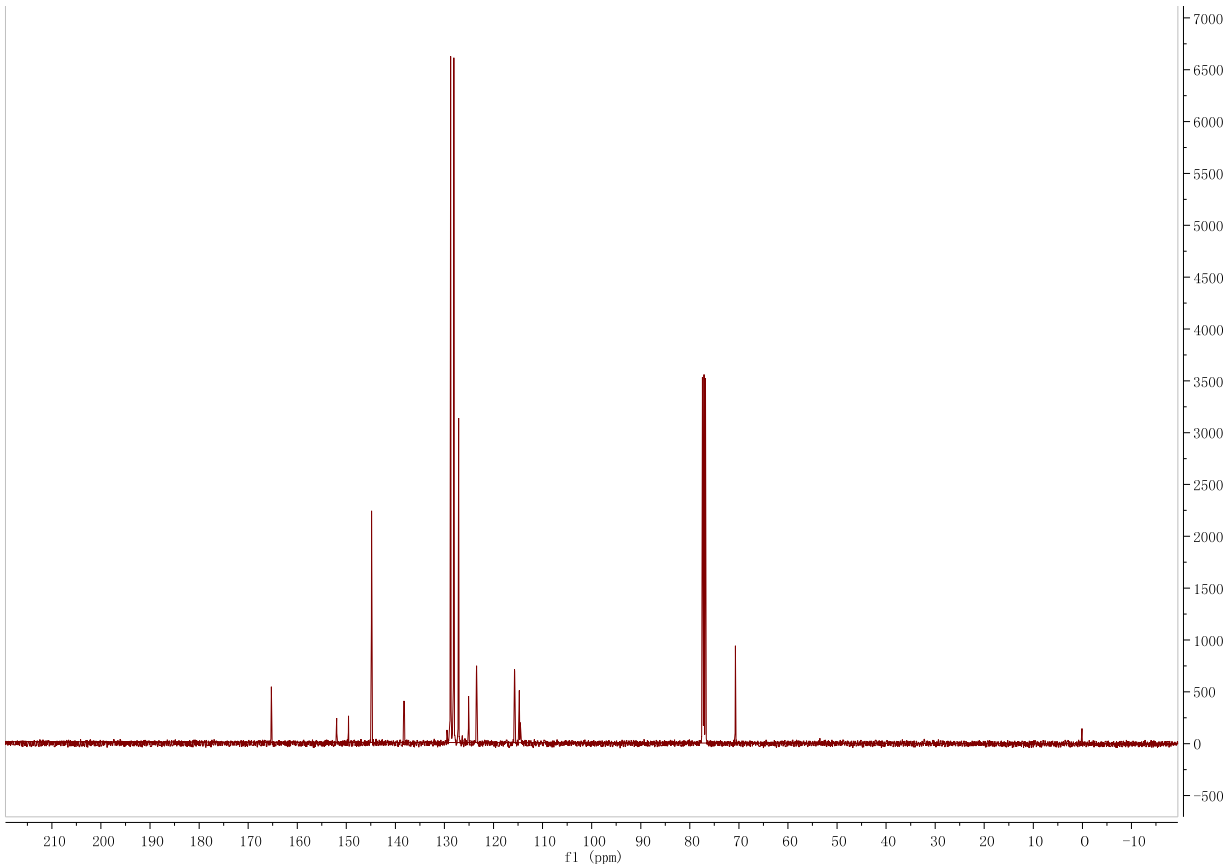


**Fig S25** $^{13}$C NMR spectrum of compound **5** in $CDCl_3$ (101 MHz).

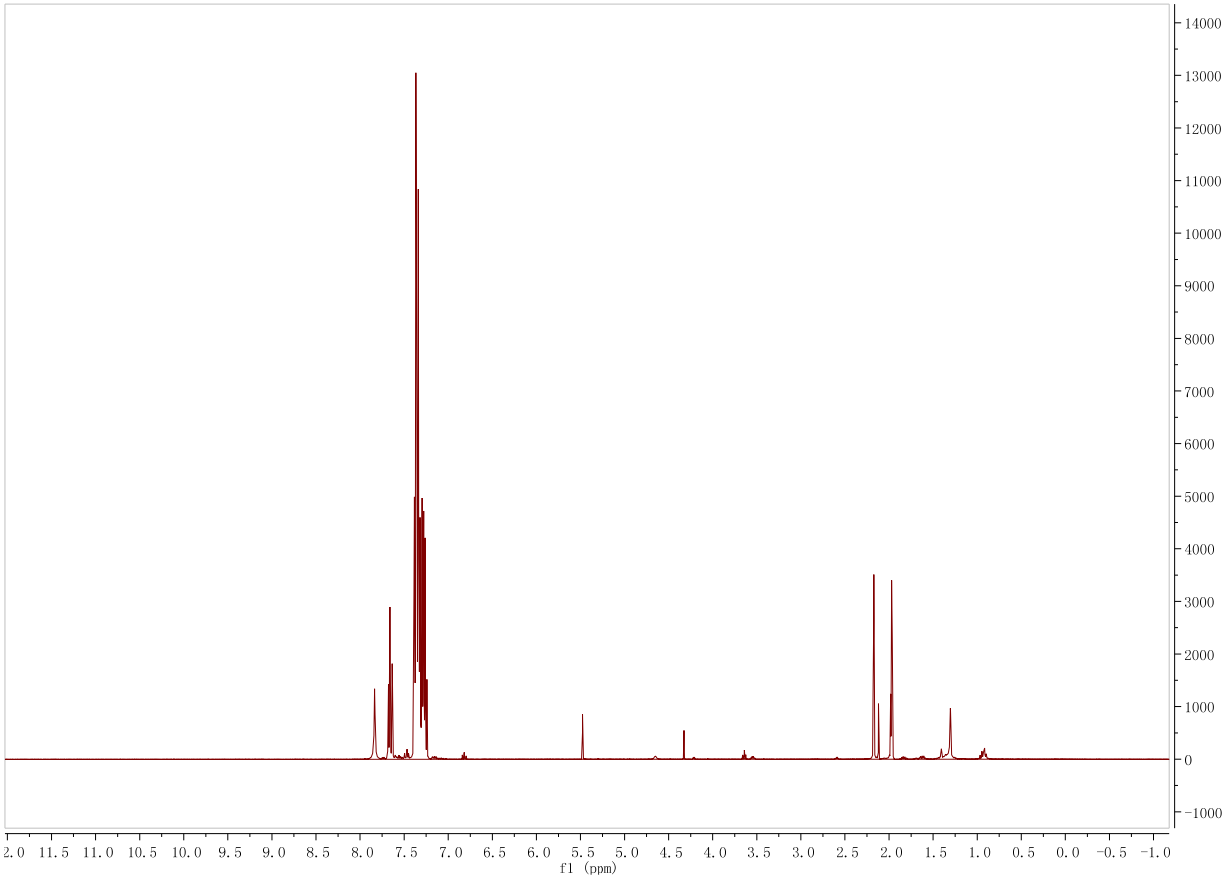


**Fig S26** $^{1}$H NMR spectrum of compound **6** in $CD_3CN$ (400 MHz).

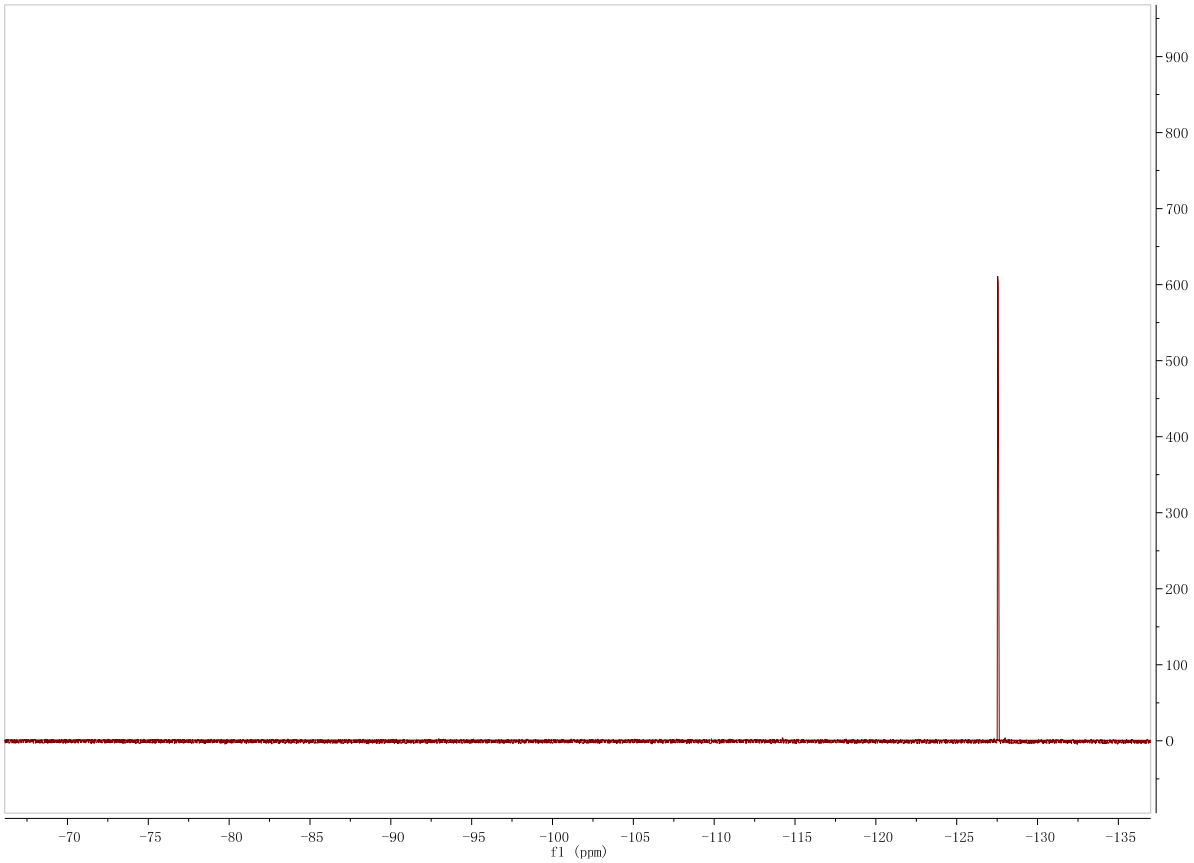


**Fig S27** $^{1}$F NMR spectrum of compound **6** in $CD_3CN$ (376 MHz).

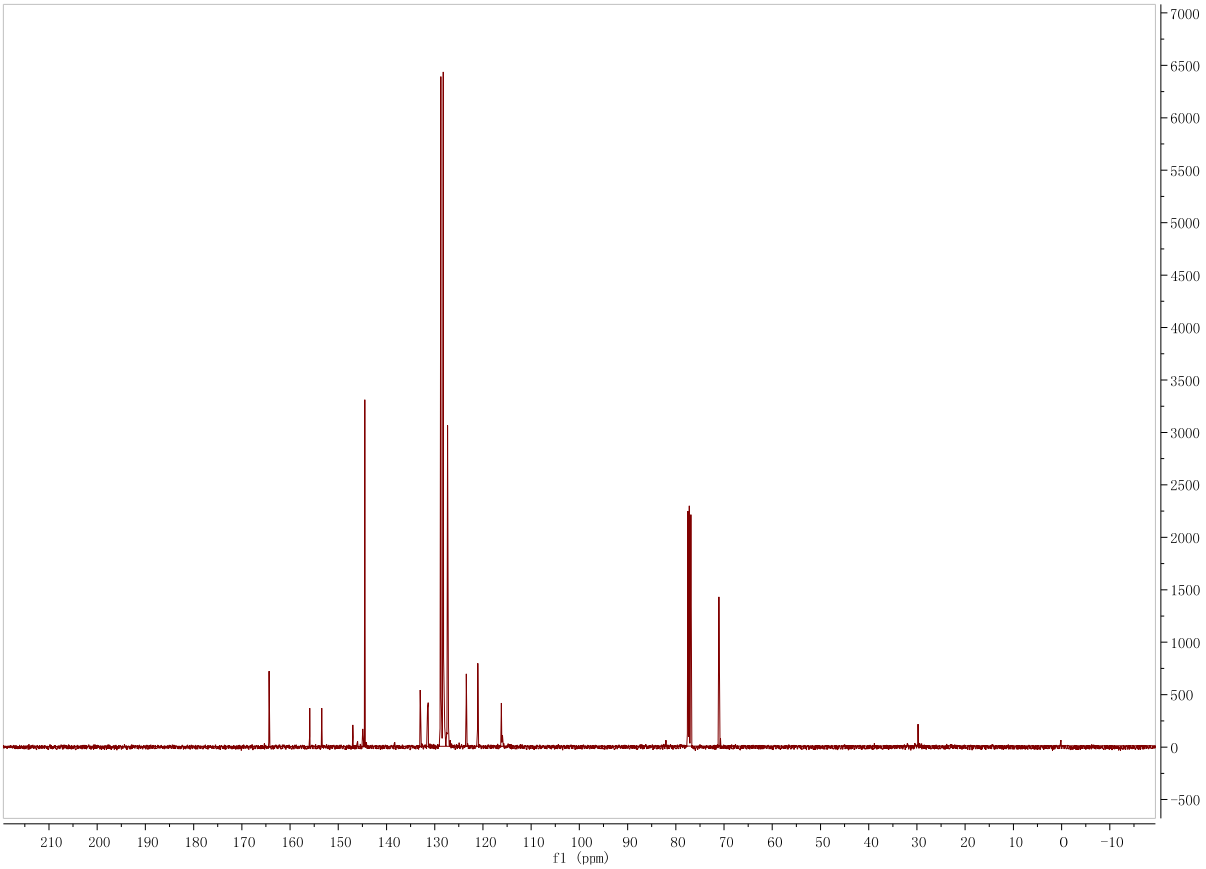


**Fig S28** $^{13}C$ NMR spectrum of compound **6** in $CDCl_3$ (101 MHz).

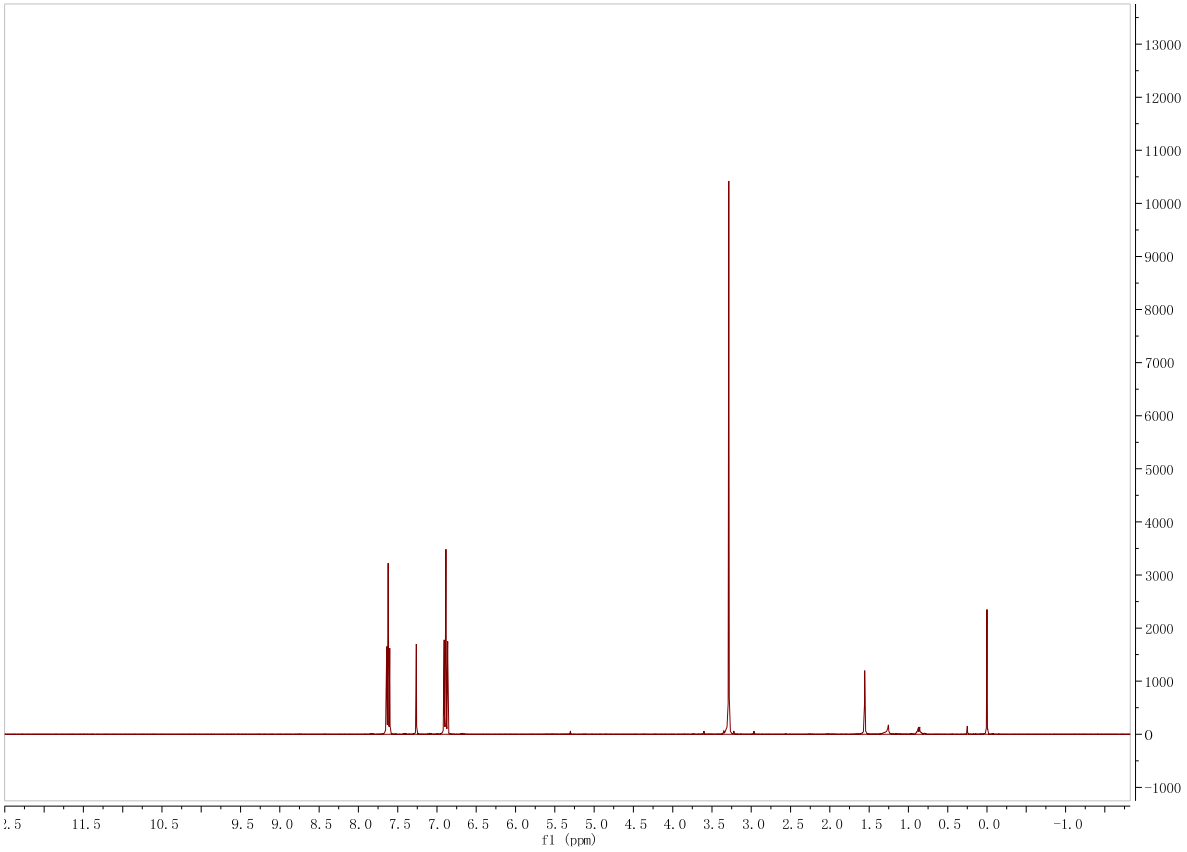


**Fig S29** $^{1}H$ NMR spectrum of compound **7** in $CDCl_3$ (400 MHz).

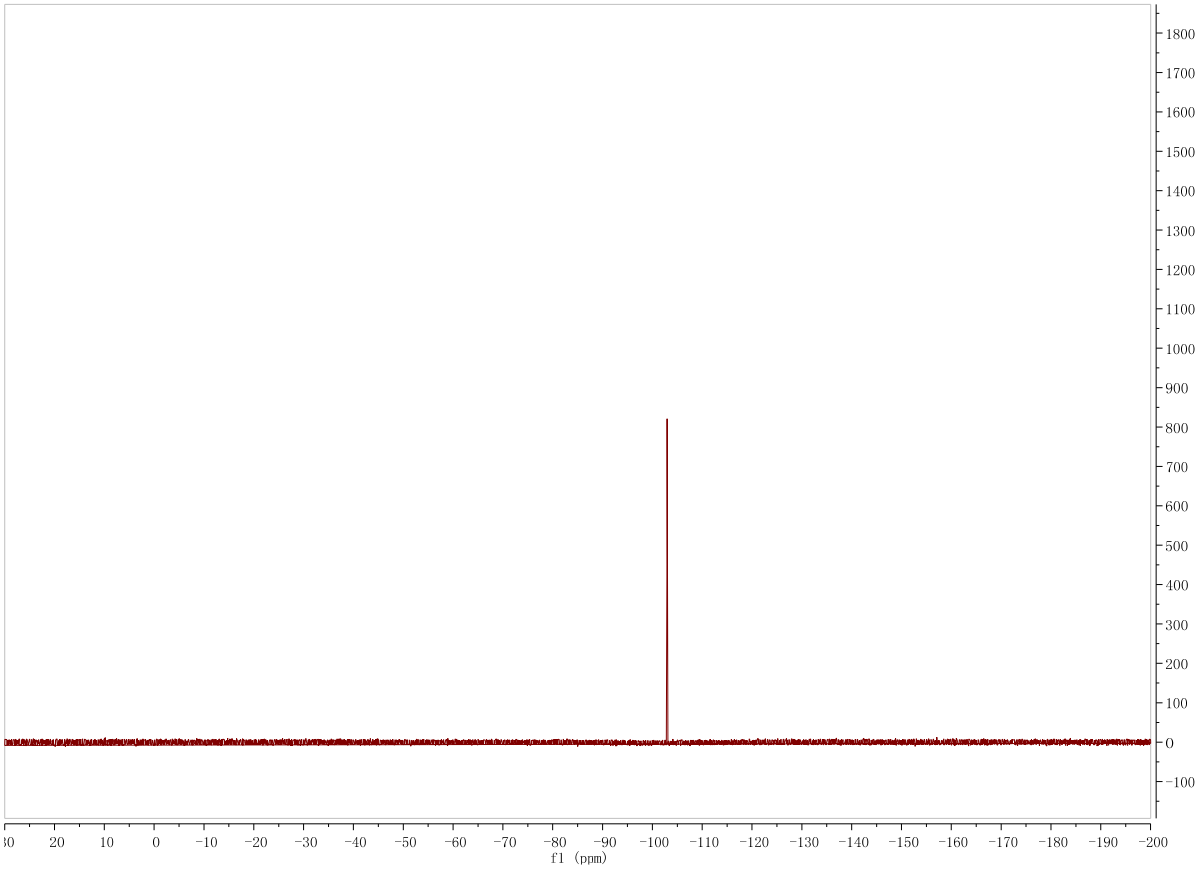


**Fig S30** $^{1}$F NMR spectrum of compound **7** in $CDCl_3$ (282 MHz).

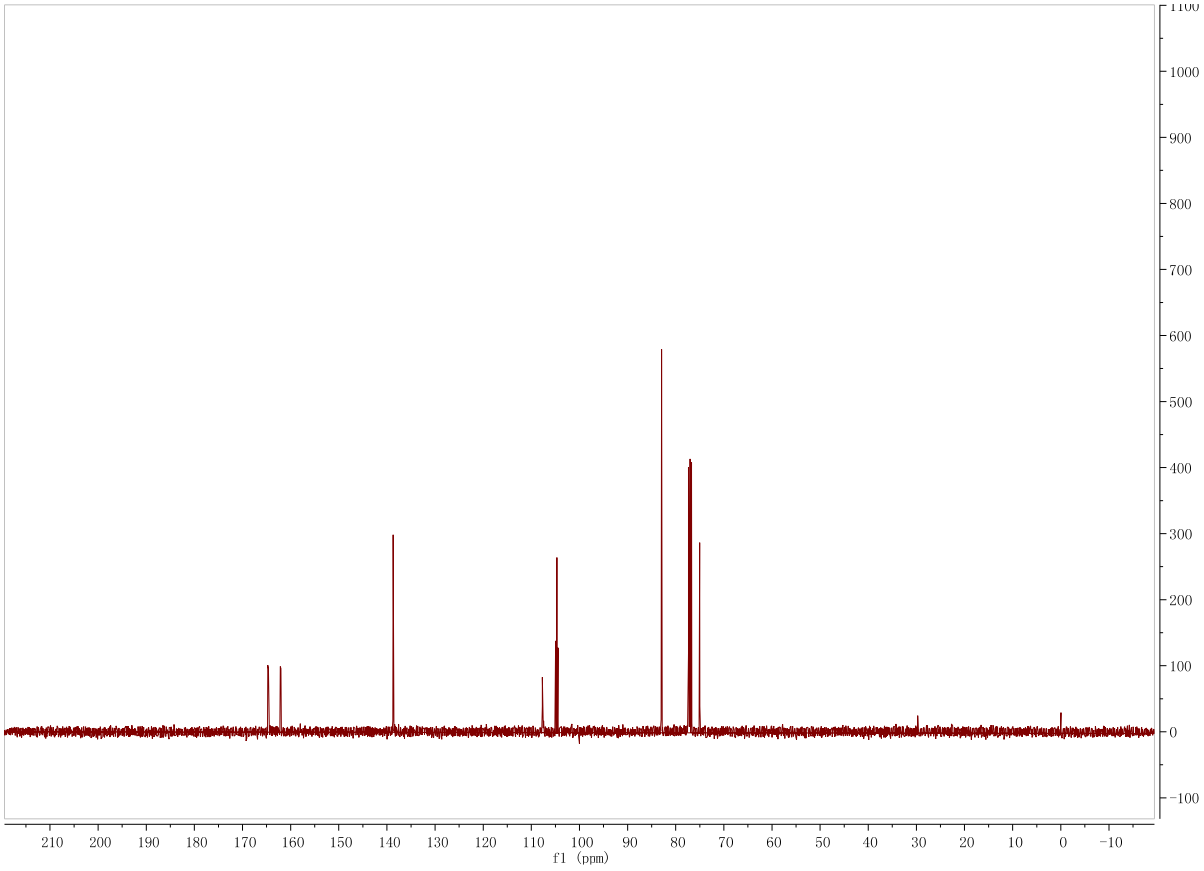


**Fig S31** $^{13}$C NMR spectrum of compound **7** in $CDCl_3$ (101 MHz).

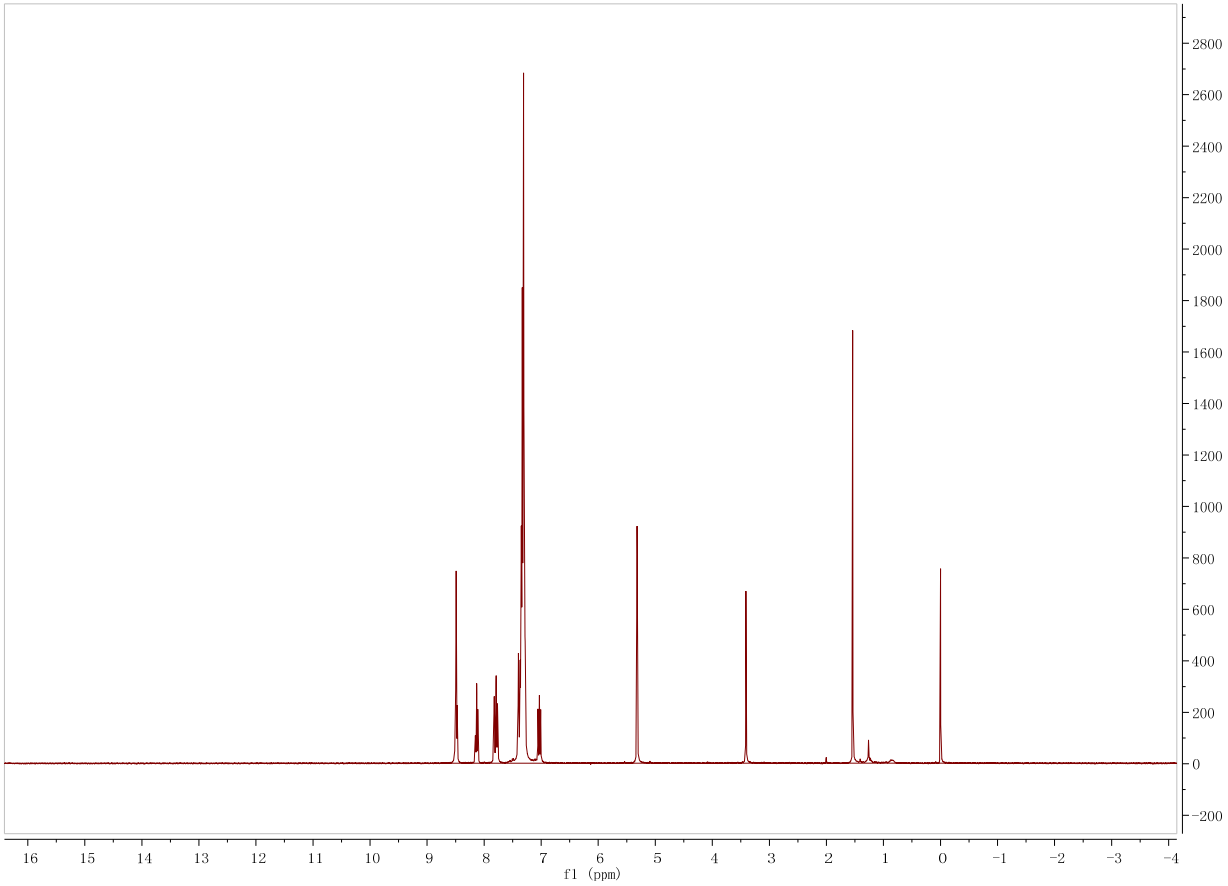


**Fig S32** $^{1}$H NMR spectrum of compound **8** in $CD_2Cl_2$ (400 MHz).

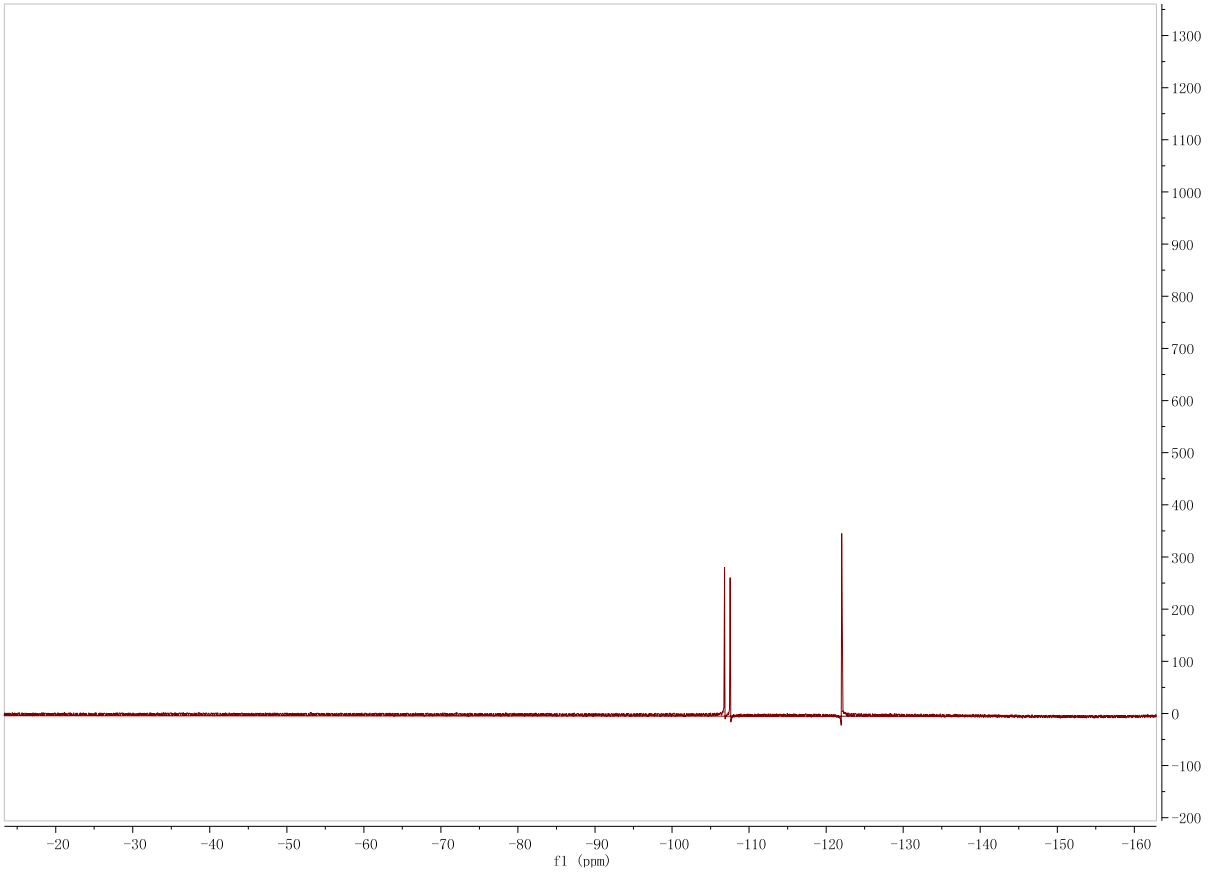


**Fig S33** $^{1}$F NMR spectrum of compound **8** in $CD_2Cl_2$ (376 MHz).

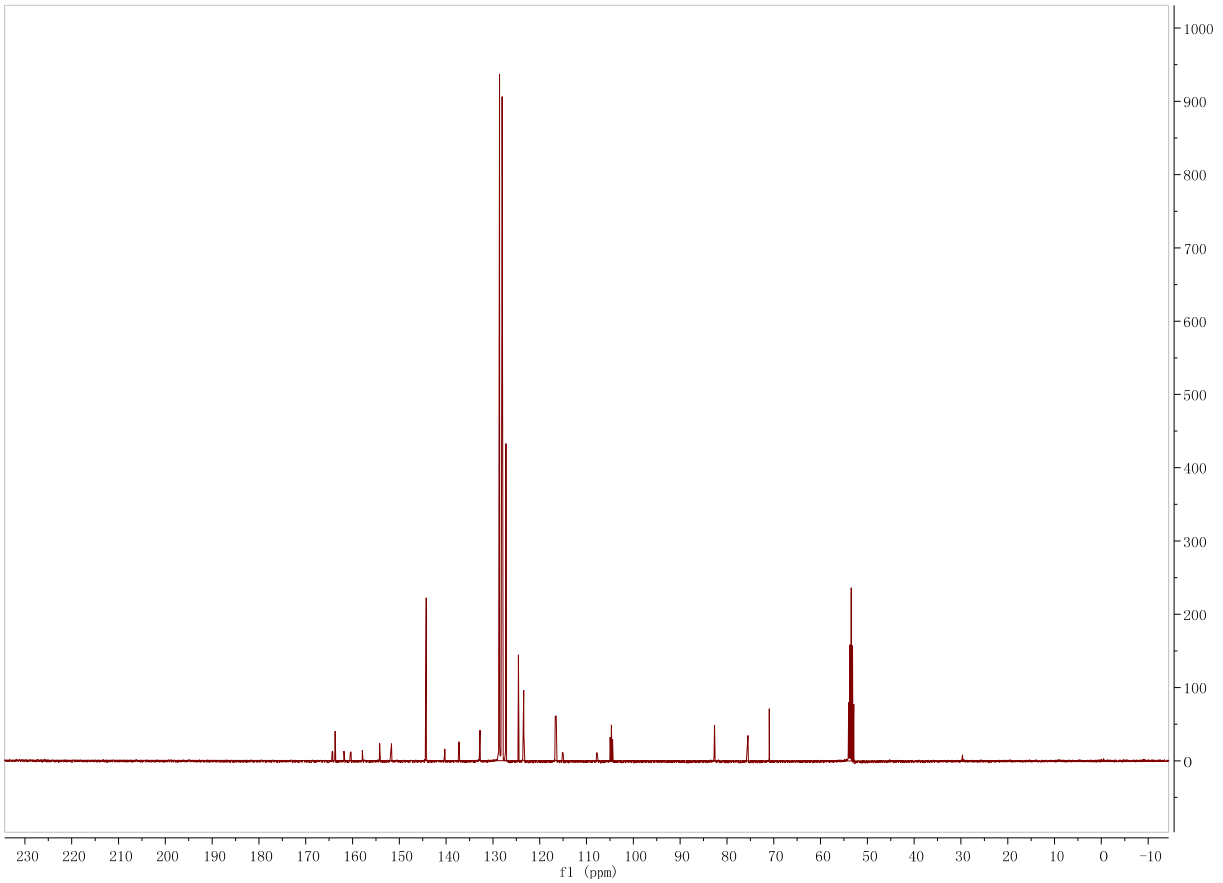


**Fig S34** $^{13}C$ NMR spectrum of compound **8** in $CD_2Cl_2$ (101 MHz).

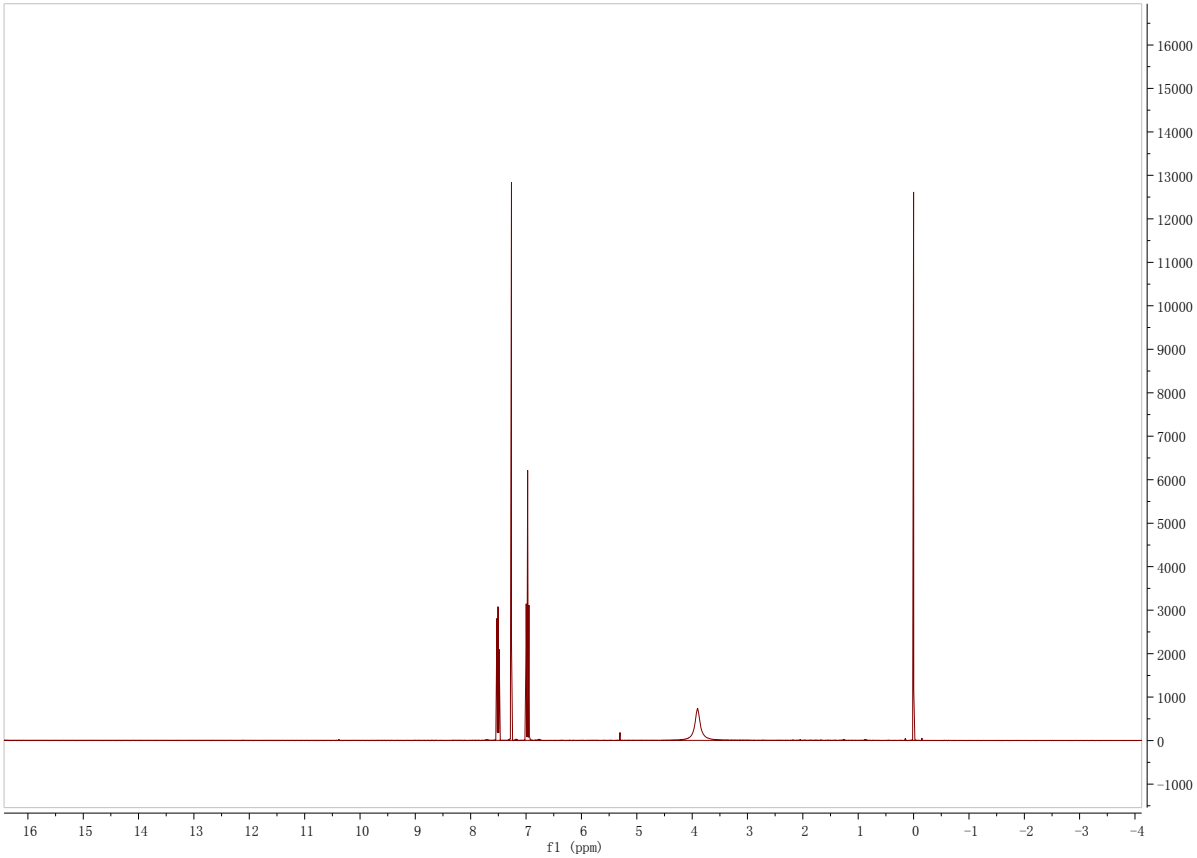


**Fig S35** $^{1}H$ NMR spectrum of compound **9** in $CDCl_3$ (400 MHz).

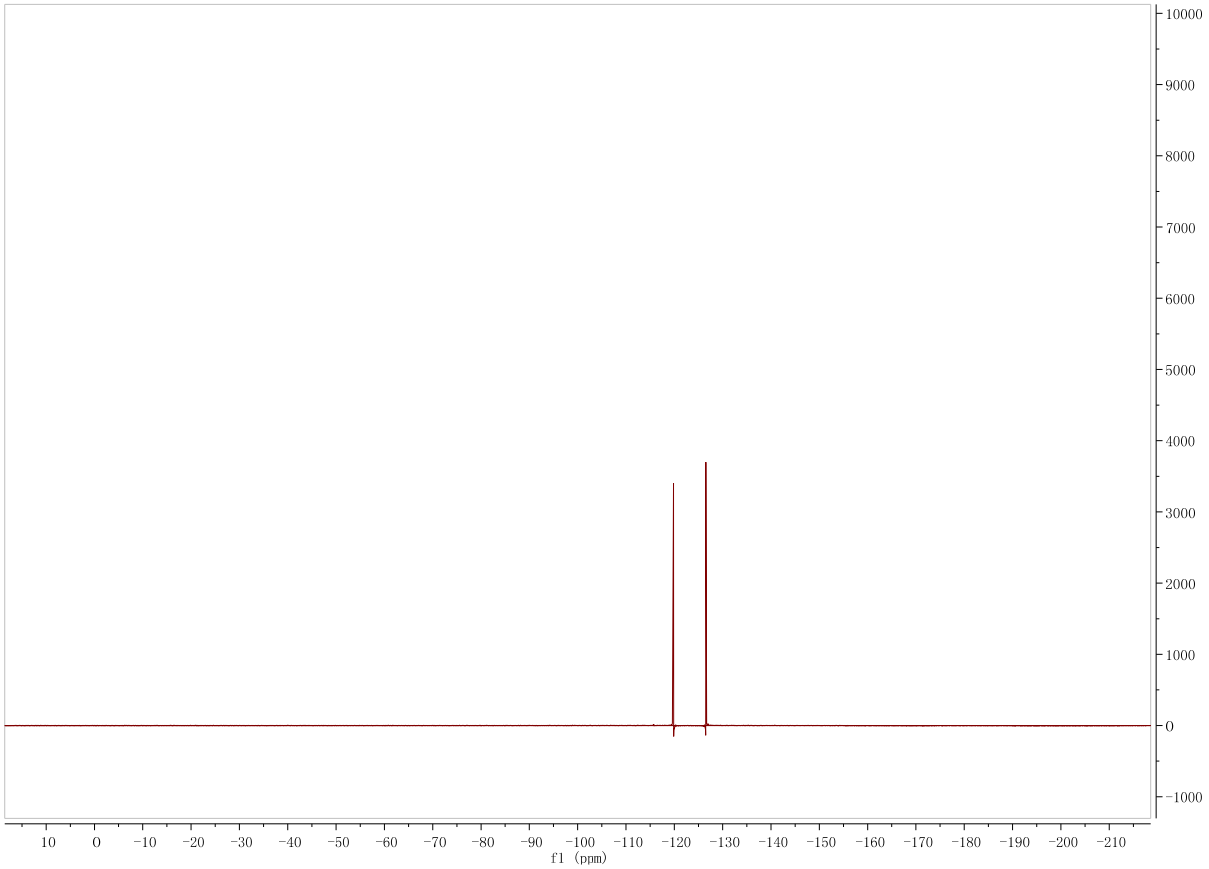


**Fig S36** $^{1}$F NMR spectrum of compound **9** in $CDCl_3$ (376 MHz).

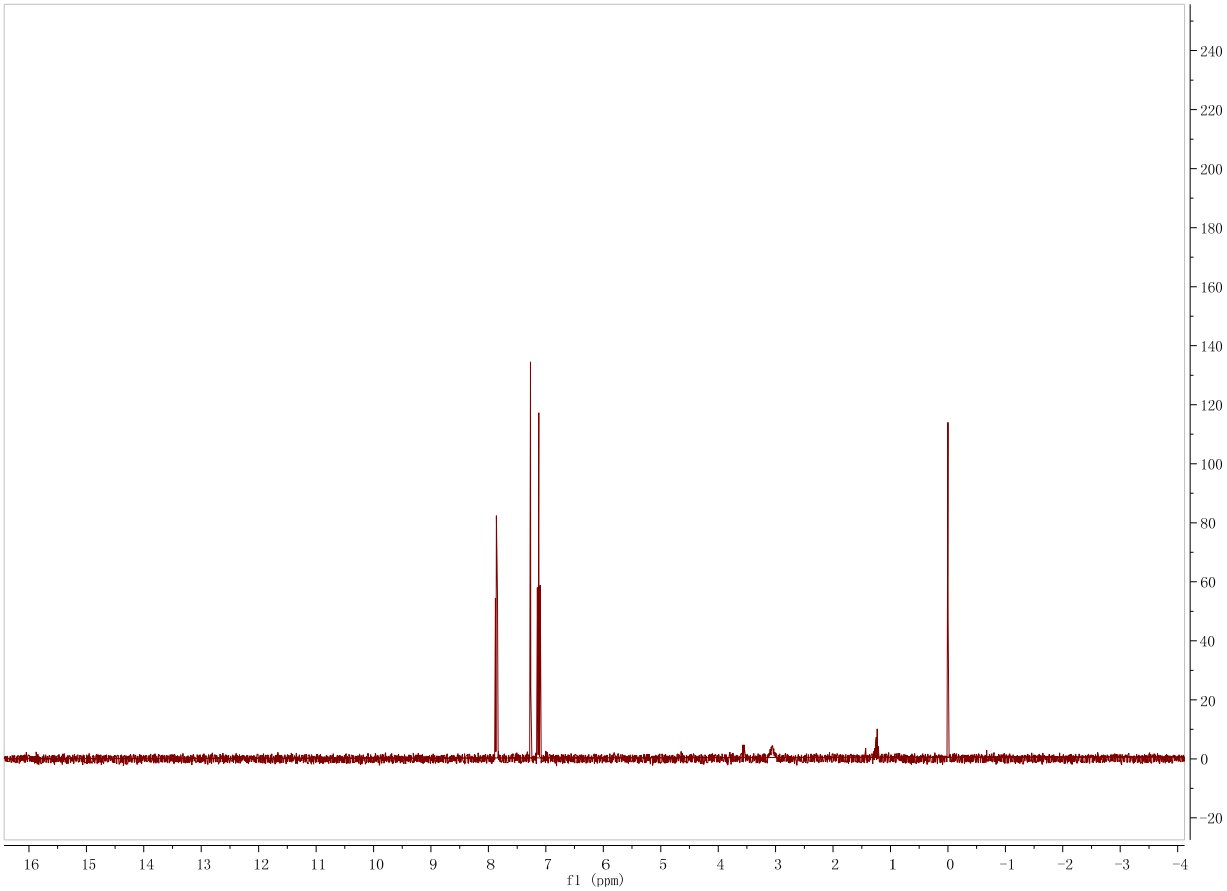


**Fig S37** $^{1}$H NMR spectrum of compound **10** in $CDCl_3$ (400 MHz).

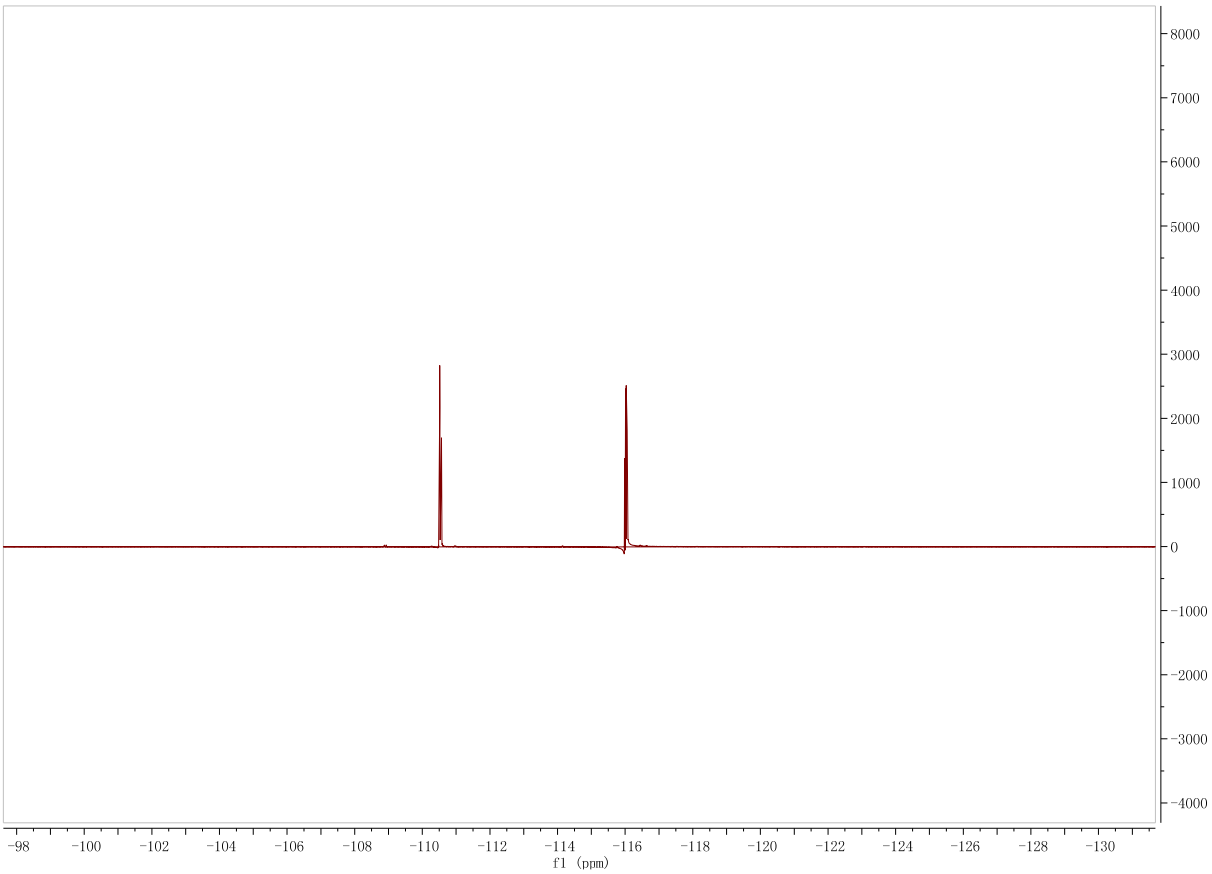


**Fig S38** $^{1}$F NMR spectrum of compound **10** in $CDCl_3$ (376 MHz).

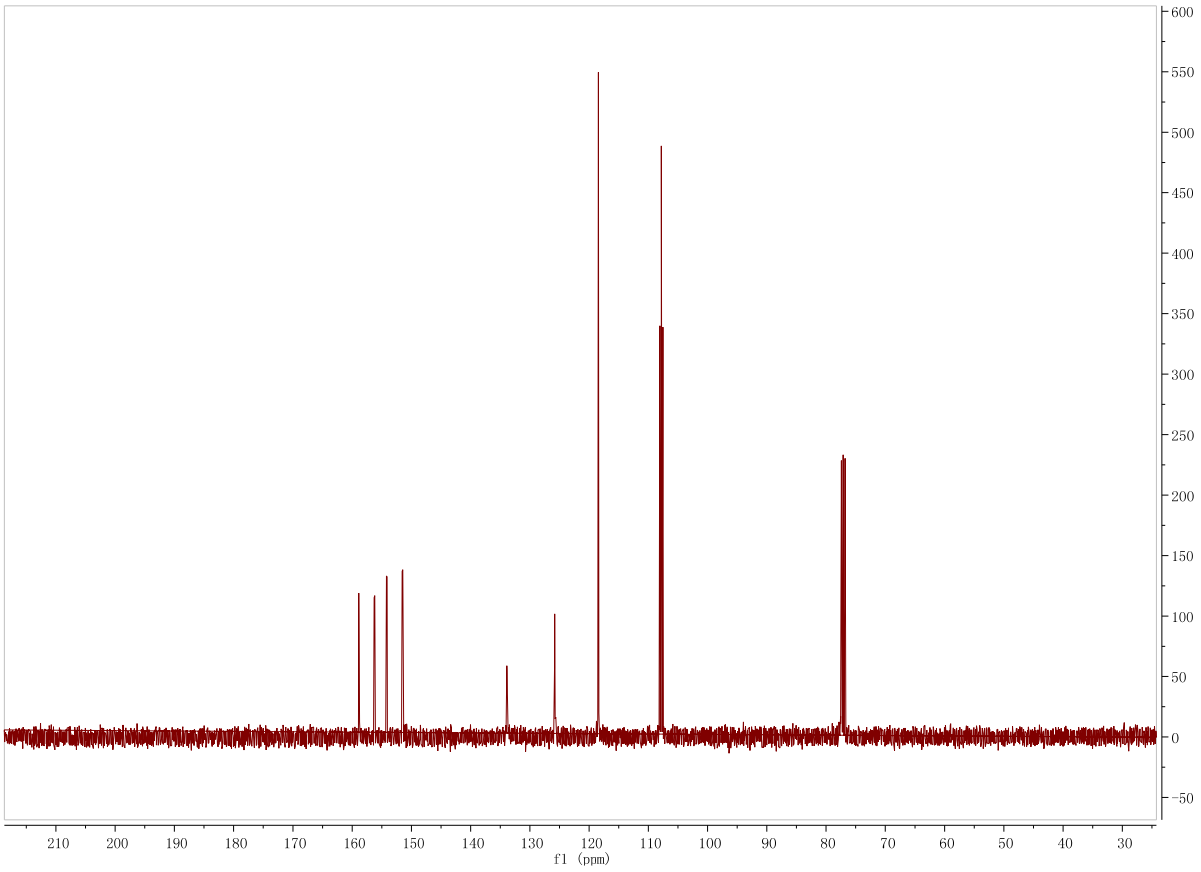


**Fig S39** $^{13}$C NMR spectrum of compound **10** in $CDCl_3$ (101 MHz).

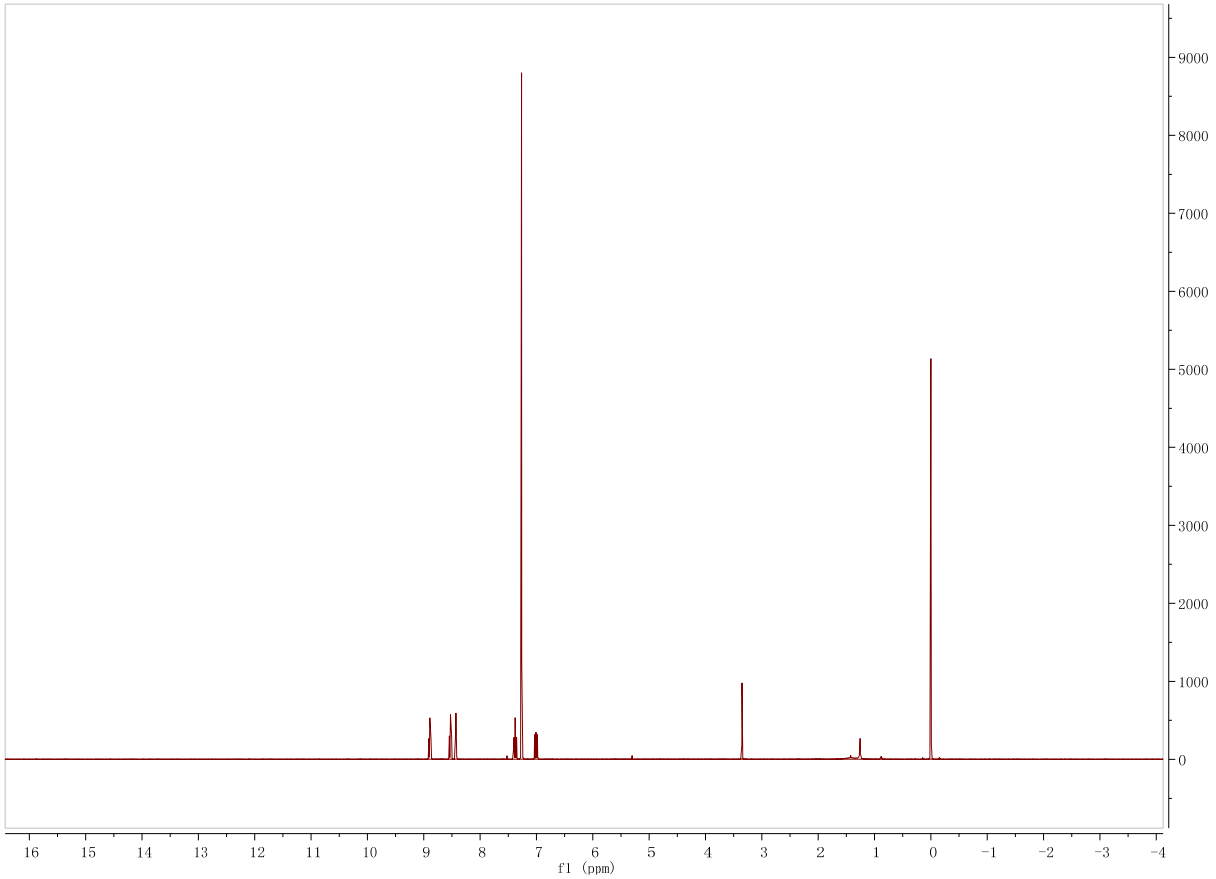


**Fig S40** $^{1}$H NMR spectrum of compound **11** in $CDCl_3$ (400 MHz).

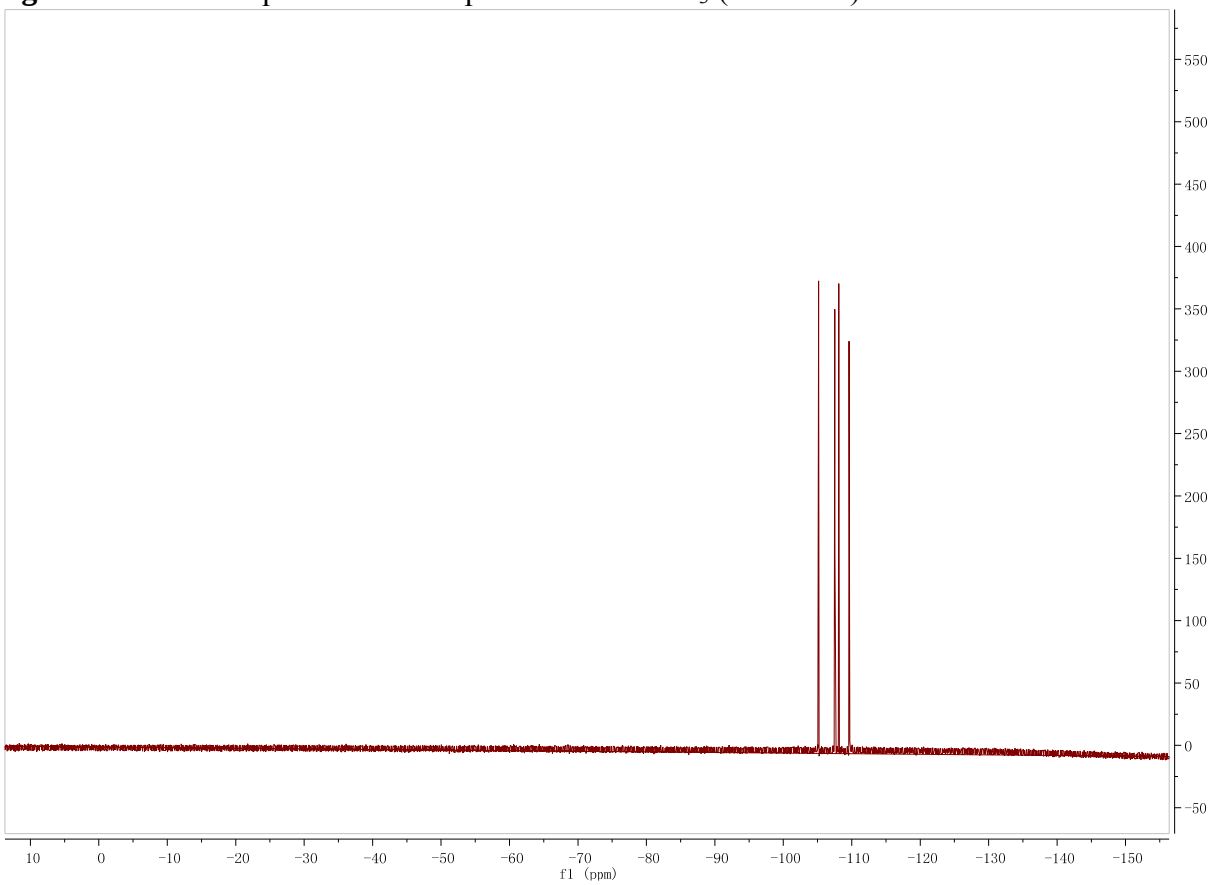


**Fig S41** $^{1}$F NMR spectrum of compound **11** in $CDCl_3$ (376 MHz).

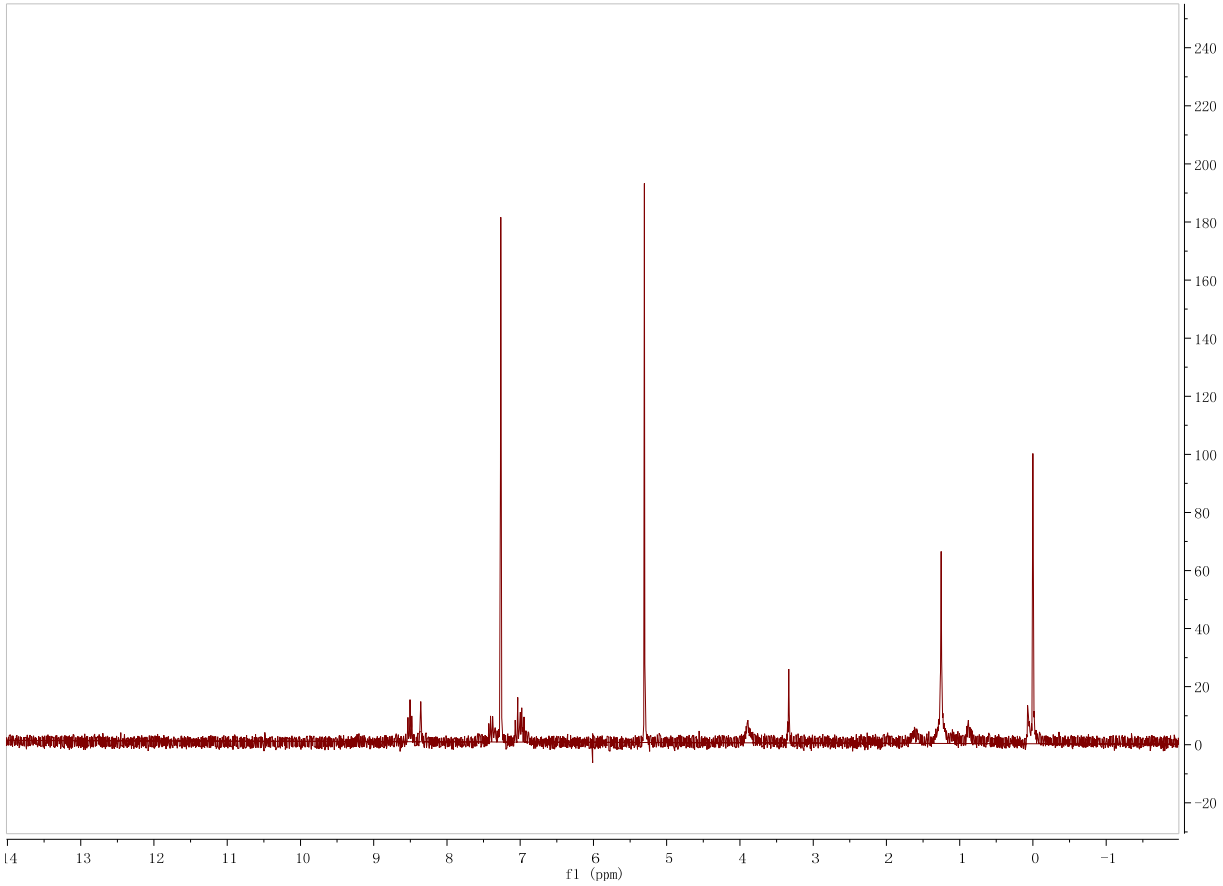


**Fig S42** $^{1}$H NMR spectrum of compound **12** in $CDCl_3$ (400 MHz).

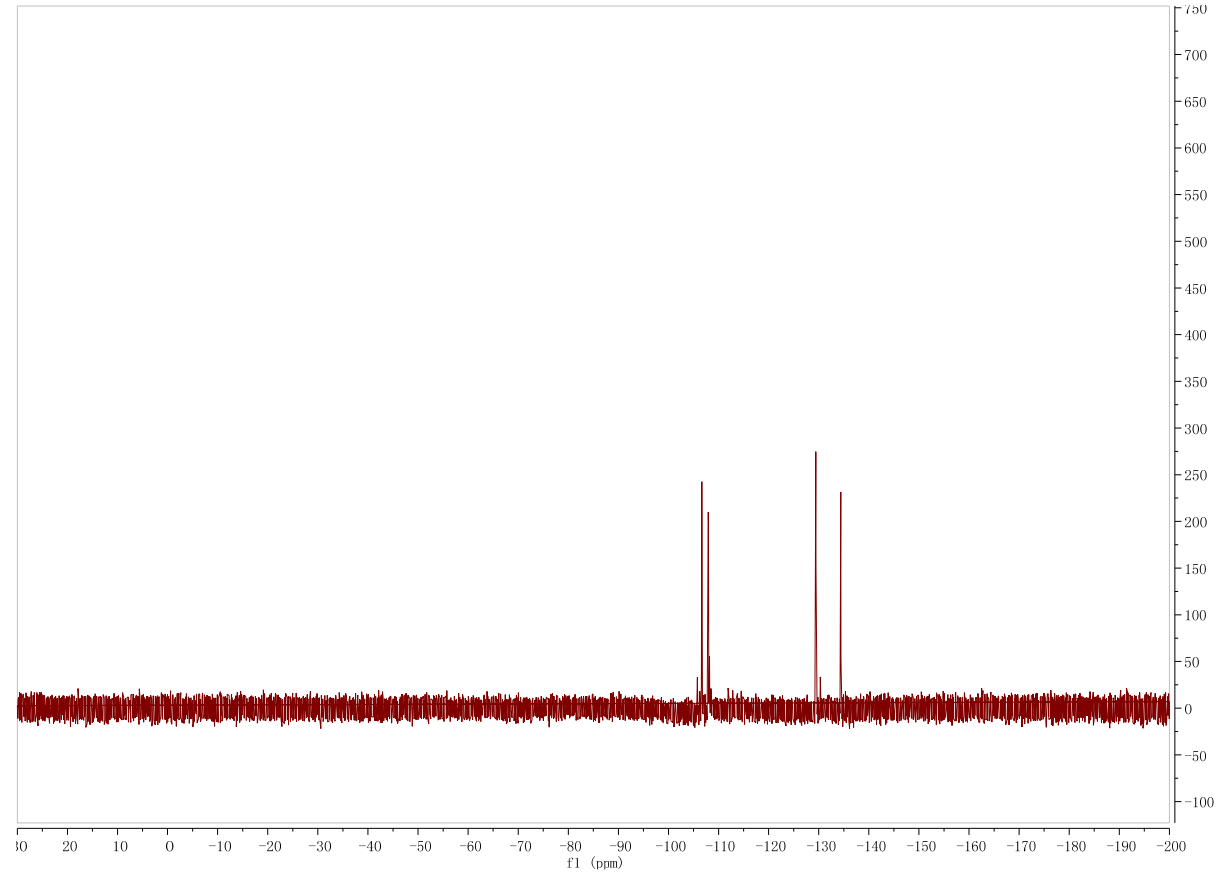


**Fig S43** $^{1}$F NMR spectrum of compound **12** in $CDCl_3$ (282 MHz).

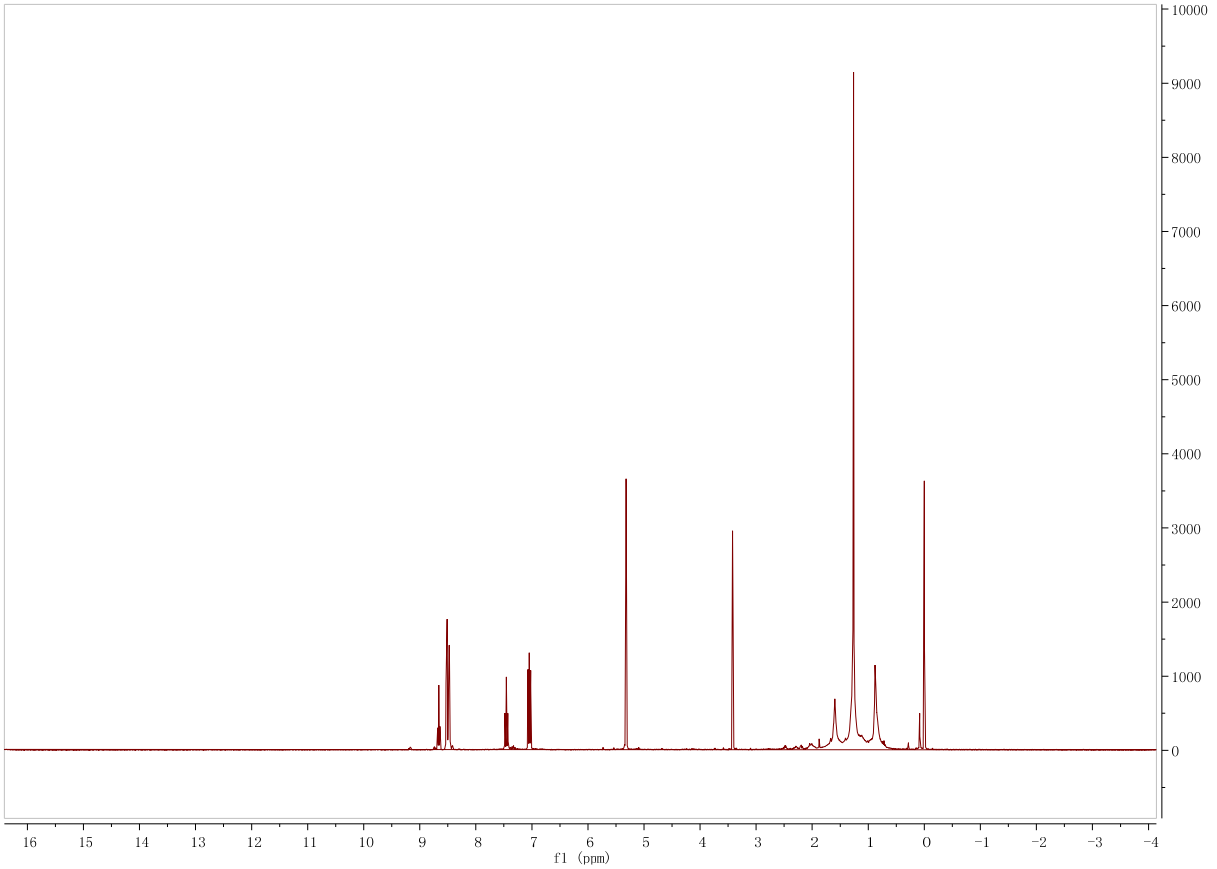


**Fig S44** $^{1}$H NMR spectrum of compound **14** in $CD_2Cl_2$ (400 MHz).

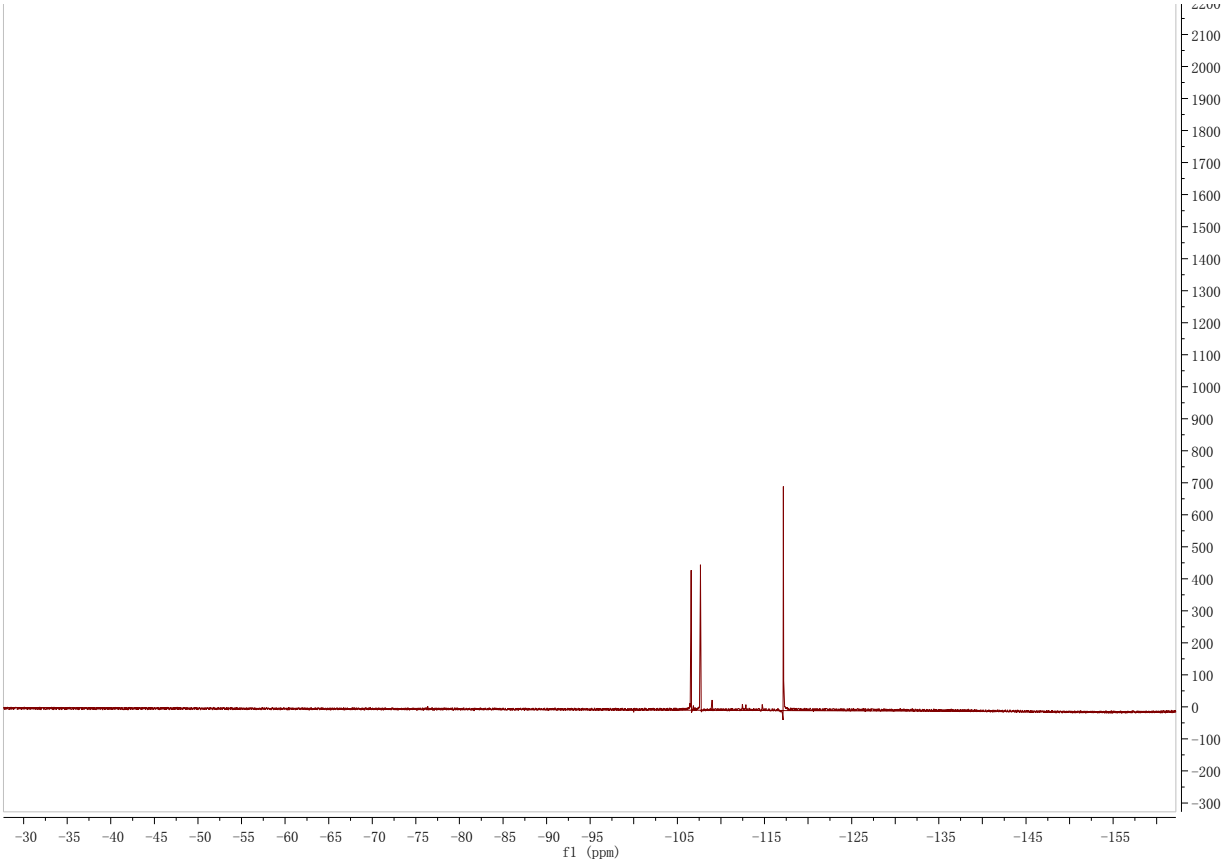


**Fig S45** $^{1}$F NMR spectrum of compound **14** in $CD_2Cl_2$ (376 MHz).

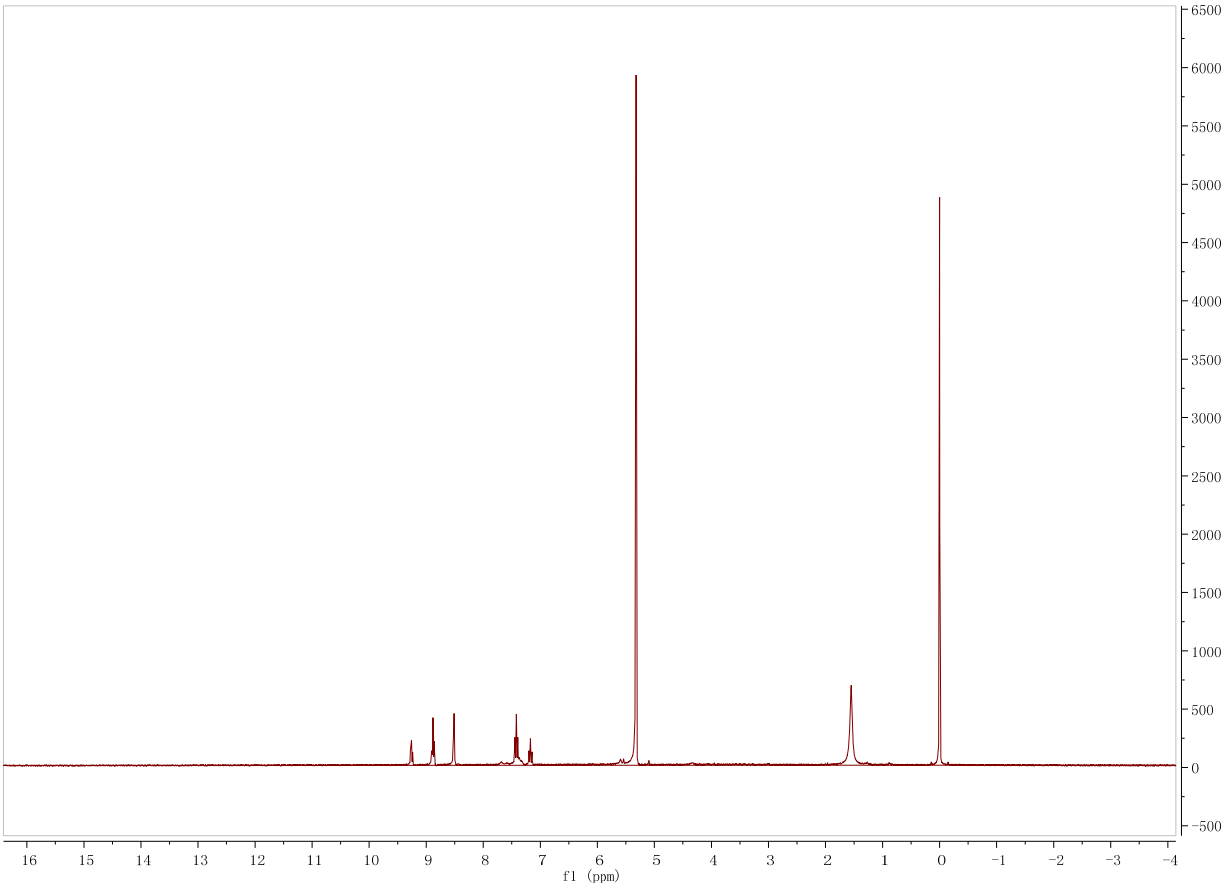


**Fig S46** $^{1}$H NMR spectrum of compound **15** in $CD_2Cl_2$ (400 MHz).

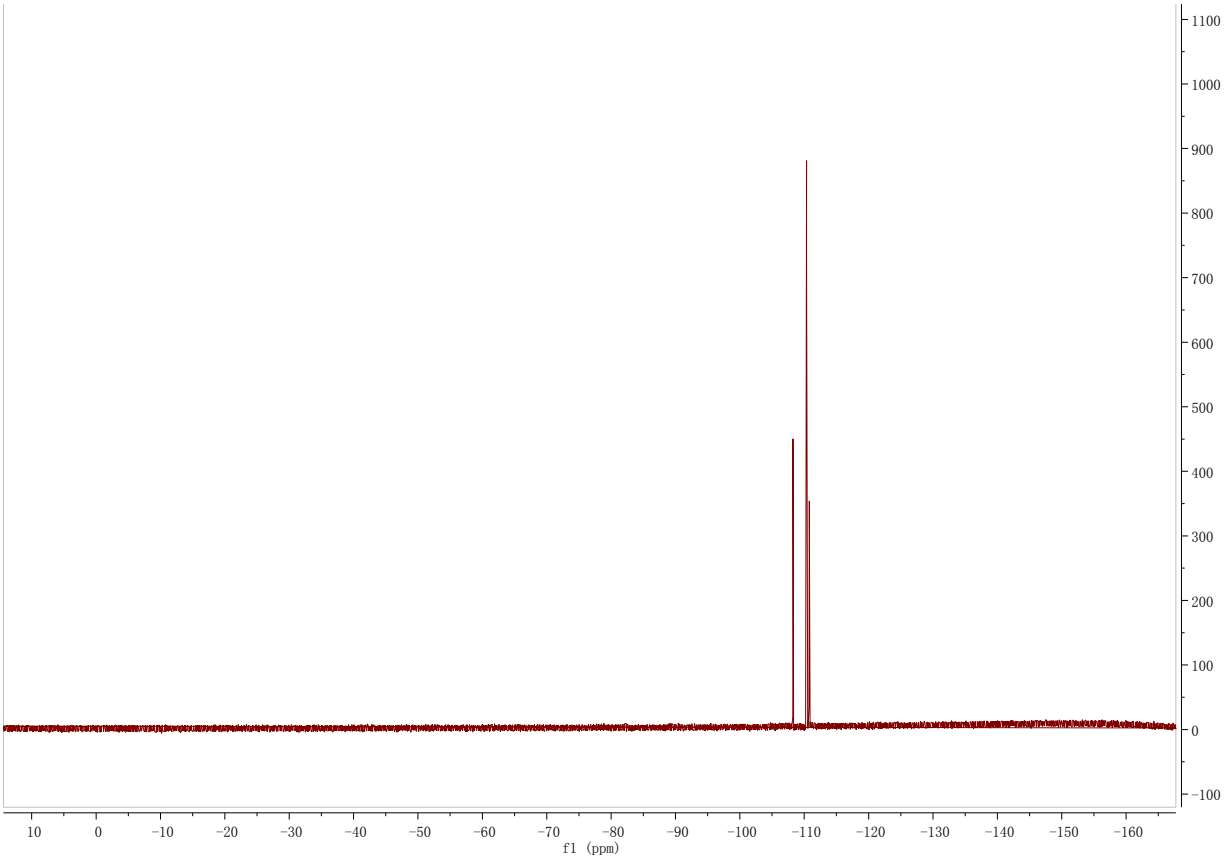


**Fig S47** $^{1}$F NMR spectrum of compound **15** in $CD_2Cl_2$ (376 MHz).

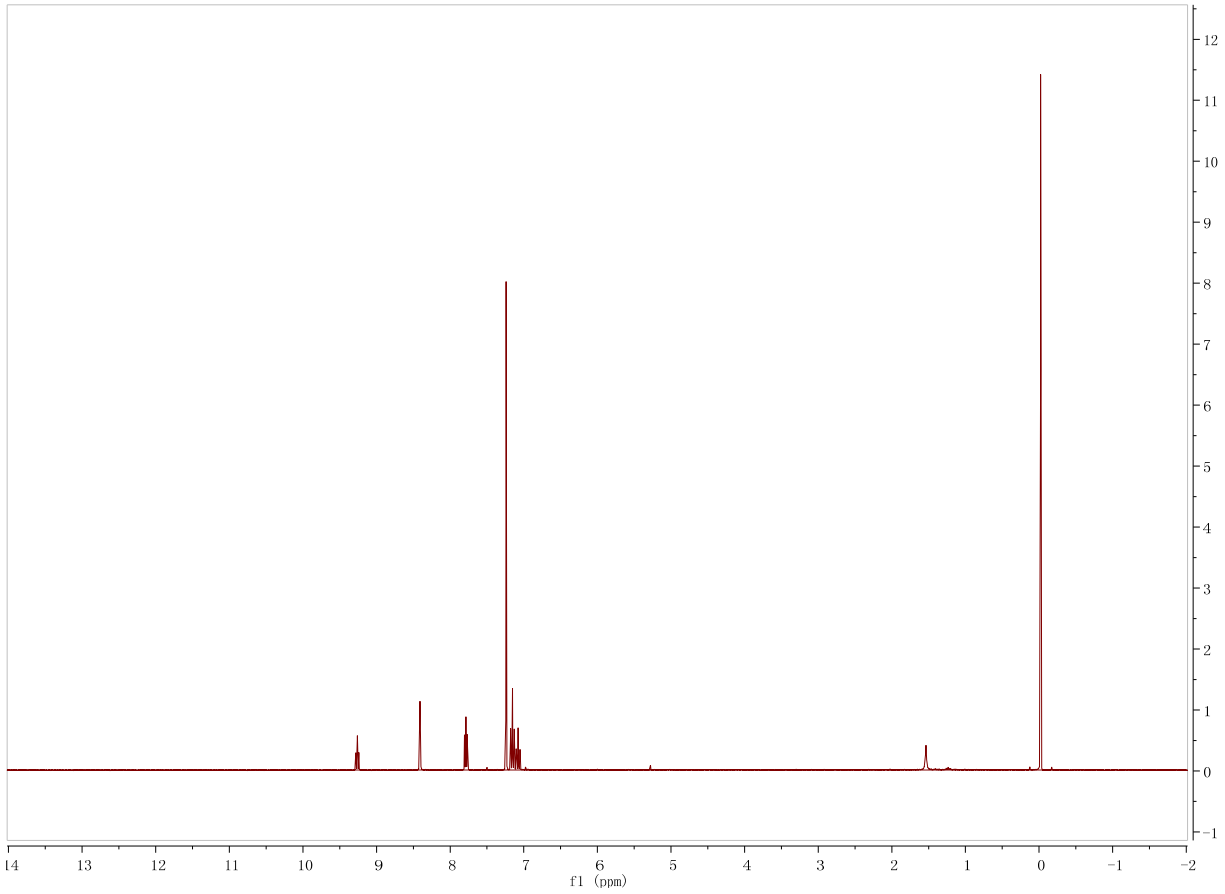


**Fig S48** $^{1}$H NMR spectrum of compound **16** in $CDCl_3$ (400 MHz).

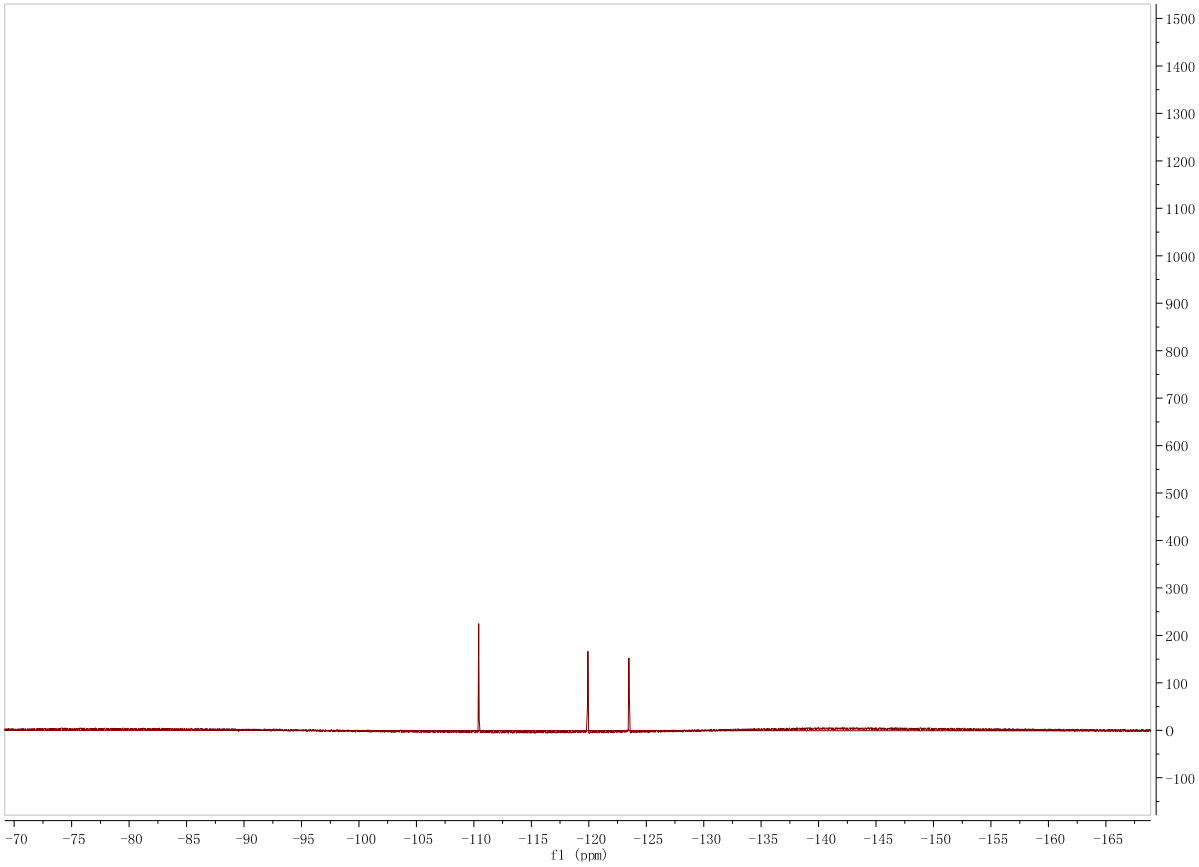


**Fig S49** $^{1}$F NMR spectrum of compound **16** in $CDCl_3$ (376 MHz).

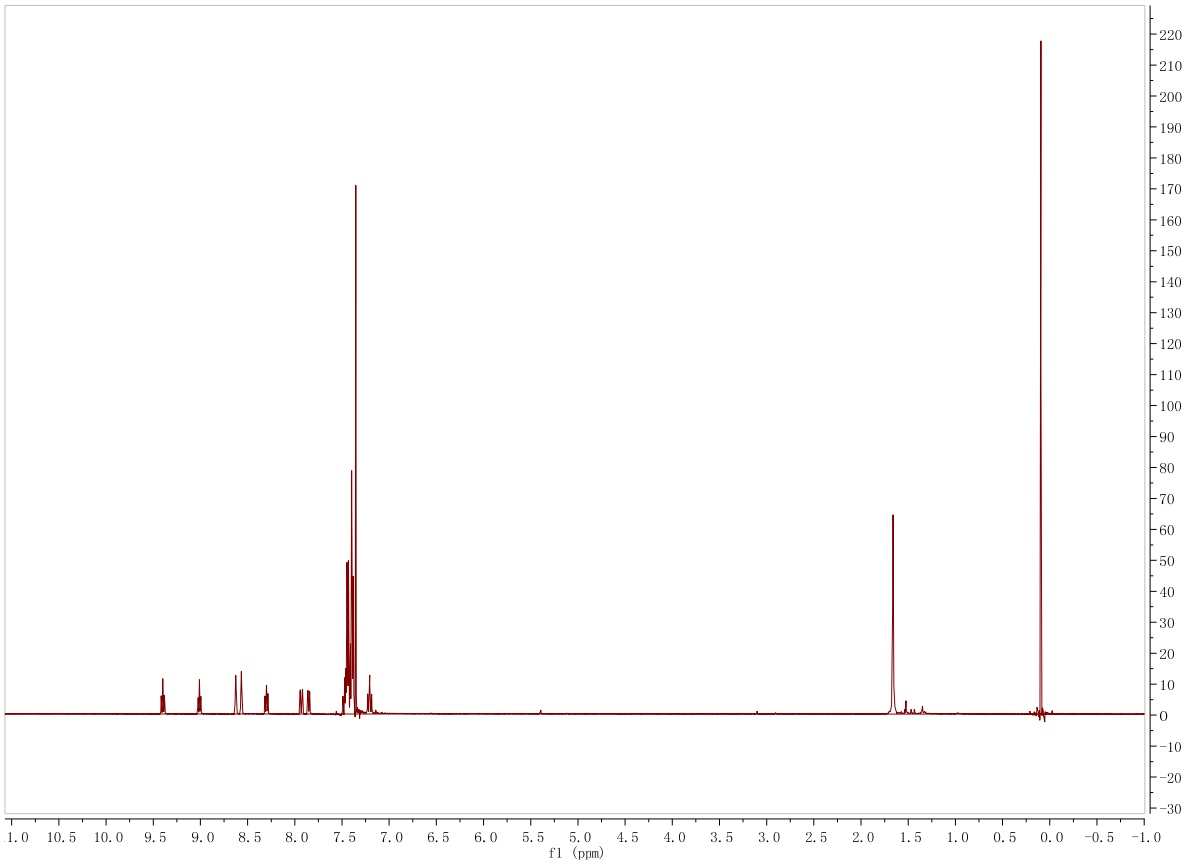


**Fig S50** $^{1}$H NMR spectrum of compound **17** in $CDCl_3$ (500 MHz).

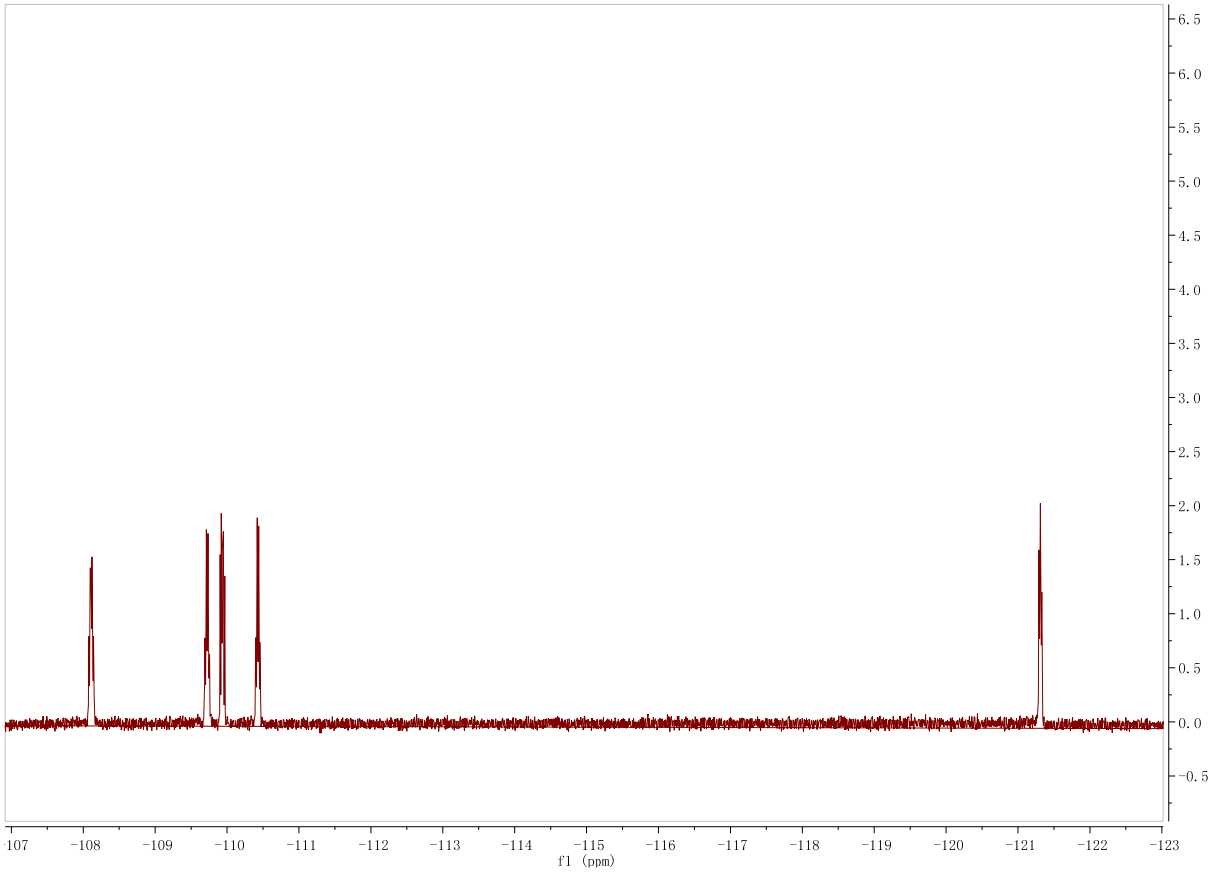


**Fig S51** $^{1}$F NMR spectrum of compound **17** in $CDCl_3$ (470 MHz).

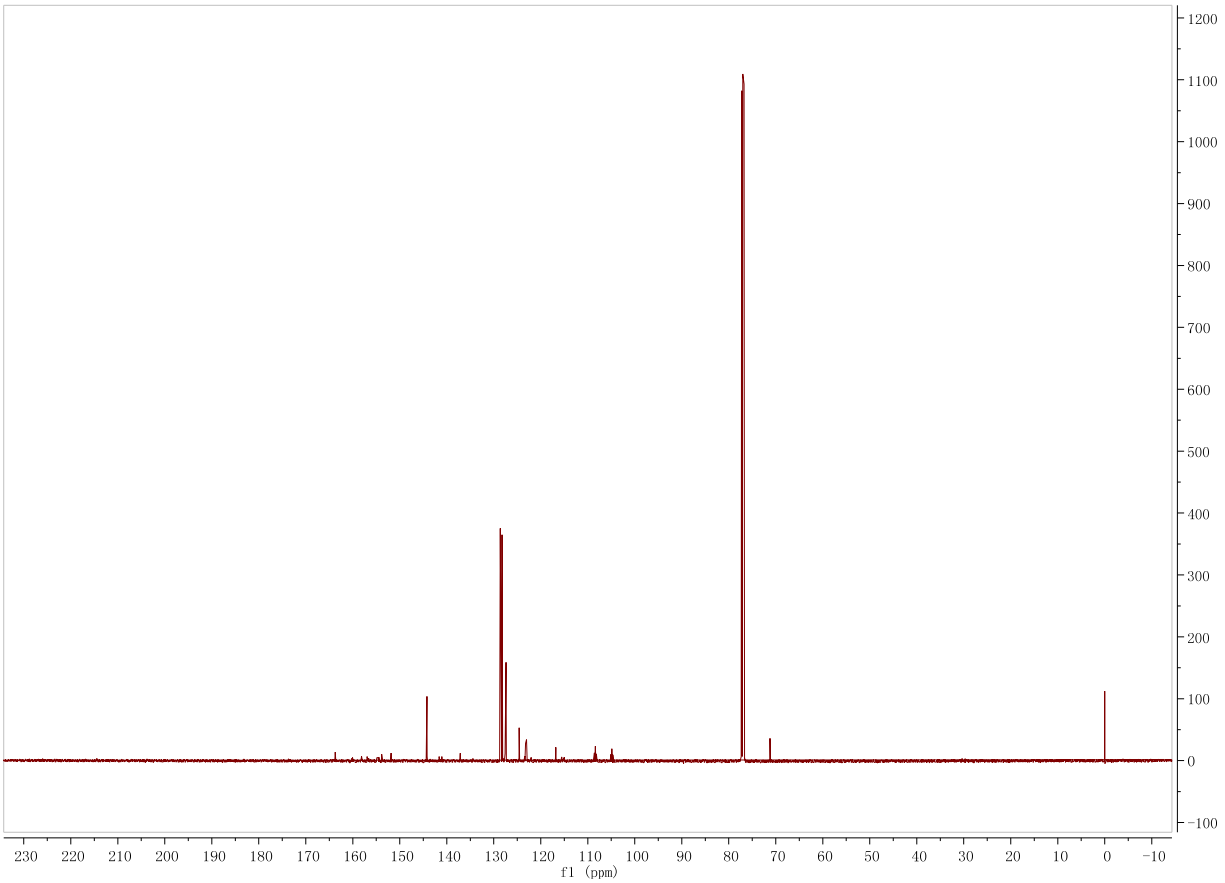


**Fig S52** $^{13}C$ NMR spectrum of compound **17** in $CDCl_3$ (126 MHz).

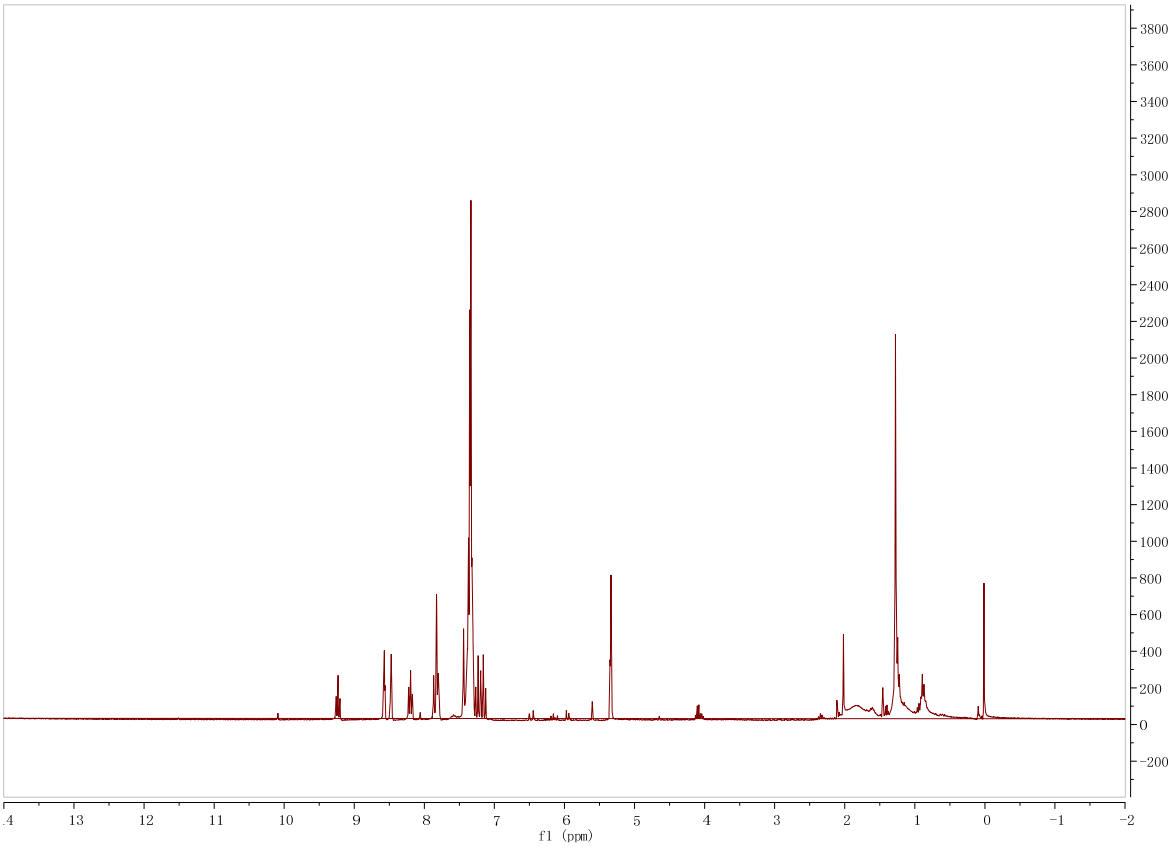


**Fig S53** $^{1}H$ NMR spectrum of compound **18** in $CDCl_3$ (300 MHz).

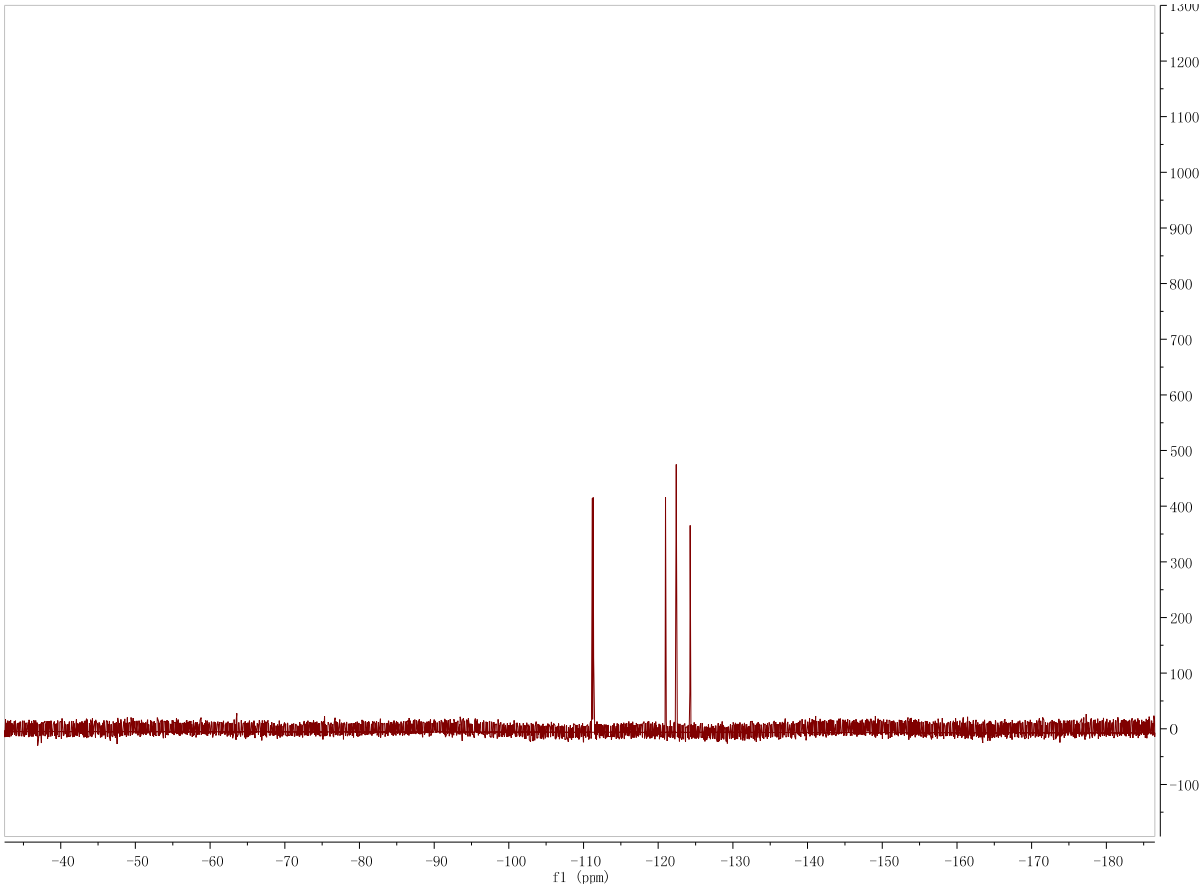


**Fig S54** $^{1}$F NMR spectrum of compound **18** in $CDCl_3$ (282 MHz).