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Supporting information

for

Pd(II)-catalyzed direct functionalization of C-H bonds of benzamides for synthesis of 1,1-difluoro-l-alkenes

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General Information

Unless otherwise stated, all reagents used were commercially purchased without further purification. Substrates **1a-1t** and **1aa-1ae** were prepared according to the known literature procedure.[1-4] Analytical thin layer chromatography (TLC) was HSGF 254 (0.15-0.2 mm thickness). Compound spots were visualized by UV light (254 nm). Column chromatography was performed on silica gel FCP 200-300. NMR spectra were run on 400 or 500 MHz instrument. Chemical shifts were reported in parts per million (ppm, δ) downfield from tetramethylsilane. Proton coupling patterns are described as singlet (s), doublet (d), triplet (t), quartet (q), multiplet (m), and broad (br). High-resolution mass spectra (HRMS) was measured on Micromass Ultra Q-TOF spectrometer.

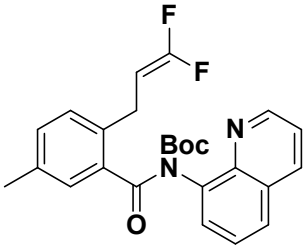
General Procedures and Characterization Data of All Products

General Procedure for the Synthesis of 2-(3,3-Difluoroallyl)-6-methyl-*N*-(quinolin-8-yl)benzamide (3a)

To a dry sealed tube was added 2-Methyl-*N*-(quinolin-8-yl)benzamide **1a** (52.5 mg, 0.20 mmol), 3-Bromo-3,3-difluoroprop-1-ene **2a** (94.2 mg, 0.60 mmol), $Pd(OAc)_2$ (2.3 mg, 0.01 mmol), K_2CO_3 (55.3 mg, 0.40 mmol) and NaOTf (103.3 mg, 0.60 mmol) under air. The resulting mixture was dissolved in toluene (2 mL) and kept stirring for 24 h at 90 °C. After cooling down to room temperature, the reaction mixture was filtered through a celite pad and concentrated under reduced pressure, and the obtained residue was purified by column chromatography (silica gel) to give **3a**.

The Procedure of Removal of Quinolinyl Directing Group

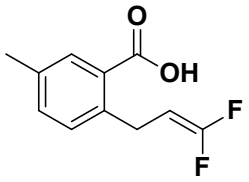
tert-Butyl (2-(3,3-difluoroallyl)-5-methylbenzoyl)(quinolin-8-yl)carbamate (4)



2-(3,3-Difluoroallyl)-5-methyl-*N*-(quinolin-8-yl)benzamide **3k** (150.0 mg, 0.443 mmol) and Boc_2O (967.6 mg, 4.43 mmol) were dissolved in 4.5 mL of anhydrous

CH_3CN at rt. Then DMAP (108.3 mg, 0.886 mmol) was added, and the reaction mixture was stirred for 4h at rt. The reaction mixture was concentrated under reduced pressure, and purified by flash chromatography (0-15% EA/PE) to give compound **4** as a white solid (154.0 mg, 79%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.92 (dd, J = 4.2, 1.6 Hz, 1H), 8.20 (dd, J = 8.3, 1.7 Hz, 1H), 7.88 (dd, J = 8.2, 1.3 Hz, 1H), 7.75 – 7.71 (m, 2H), 7.66 – 7.58 (m, 1H), 7.46 – 7.41 (m, 1H), 7.25 – 7.18 (m, 2H), 4.61 (dtd, J = 25.3, 8.0, 2.4 Hz, 1H), 3.54 (d, J = 8.0 Hz, 2H), 2.39 (s, 3H), 1.14 (s, 9H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 172.91, 156.41 (dd, J = 287.4, 285.2 Hz), 152.98, 150.46, 144.11, 137.42, 136.54, 136.14, 135.70, 134.74, 130.79, 129.47, 129.26, 129.22, 128.49, 127.91, 126.27, 121.71, 83.30, 78.04 (dd, J = 23.4, 19.6 Hz), 27.36, 25.75 (d, J = 4.9 Hz), 20.94; MS (ESI, m/z): 439.1 $[M+H]^+$; HRMS (ESI) cacld for $C_{25}H_{25}F_2N_2O_3$ ($[M+H]^+$): 439.1833; found: 439.1845.

2-(3,3-Difluoroallyl)-5-methylbenzoic acid (5)

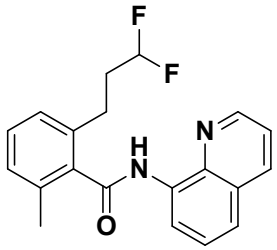


To a solution of compound **4** (106.0 mg, 0.242 mmol) in THF/H_2O (3:1, 4.8 mL) at 0°C was added 30% H_2O_2 (121 μL, 1.21 mmol) and $LiOH{\cdot}H_2O$ (25.4 mg, 0.604 mmol). The reaction was then allowed to warm to rt and stirred for another 6 h. Then saturated $Na_2S_2O_3$ solution was added and the resulting mixture was was concentrated under reduced pressure. The aqueous phase was acidified to pH 2-3 by 1 M HCl, then extracted with EA (3 x 10 mL). Organic layers were combined, dried over anhydrous Na_2SO_4 and concentrated, and purified by flash chromatography (0-5% MeOH/DCM) gave compound **5** as a yellow solid (29.0 mg, 57%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.91 (s, 1H), 7.34 (d, J = 7.7 Hz, 1H), 7.23 (d, J = 7.8 Hz, 1H), 4.51 (dtd, J = 25.4, 8.0, 2.2 Hz, 1H), 3.69 (d, J = 8.0 Hz, 2H), 2.39 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 173.18, 156.69 (dd, J = 287.8, 285.6 Hz), 139.56, 136.67, 134.40, 132.50, 130.88, 127.65, 77.96 (dd, J = 23.5, 19.4 Hz), 27.34 (d, J = 4.9 Hz), 20.94; MS (ESI, m/z):

211.1 [M-H]$^-$; HRMS (ESI) cacld for $C_{11}H_{11}F_2O_2$ ([M+H]$^+$): 213.0727; found: 213.0733.

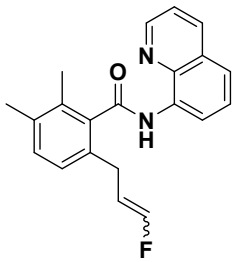
The synthetic versatility of the products

2-(3,3-Difluoropropyl)-6-methyl-*N*-(quinolin-8-yl)benzamide (6)



Compound **3a** (56 mg, 0.242 mmol) are dissolved in THF (3 mL), 18 mg of 10 percent Pd/C (50 percent of water) are added, and the mixture is stirred at 30 ° C under a hydrogen atmosphere for 4 h. After completion, the solid material is filtered off, and the filtrate was concentrated under reduced pressure, and purified by flash chromatography (0-15% EA/PE) to give compound **6** as a yellow oil (51.0 mg, 91%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.93 (s, 1H), 8.96 (d, J = 7.2 Hz, 1H), 8.74 (d, J = 4.1 Hz, 1H), 8.19 (d, J = 8.2 Hz, 1H), 7.69 – 7.55 (m, 2H), 7.46 (dd, J = 8.2, 4.2 Hz, 1H), 7.35 – 7.29 (m, 1H), 7.20 – 7.12 (m, 2H), 5.77 (tt, J = 56.6, 4.5 Hz, 1H), 2.88 (t, J=7.82 Hz, 2H), 2.45 (s, 3H), 2.34 – 2.14 (m, 2H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 168.51, 148.52, 138.66, 138.03, 136.95, 136.55, 135.08, 134.29, 129.51, 128.76, 128.18, 127.54, 126.97, 122.34, 121.89, 117.09, 116.78 (t, J = 239.3 Hz), 35.99 (t, J = 21.1 Hz), 26.42 (t, J = 6.1 Hz), 19.67; MS (ESI, m/z): 341.1 [M+H]$^+$; HRMS (ESI) cacld for $C_{20}H_{19}F_2N_2O$ ([M+H]$^+$): 341.1465 found: 341.1463.

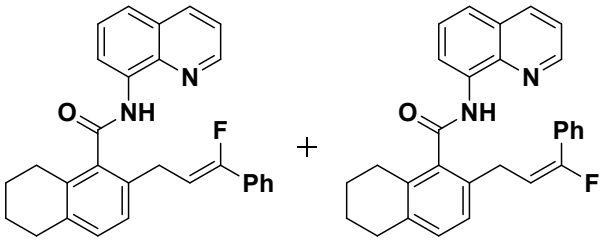
(*E/Z*)-6-(3-fluoroallyl)-2,3-dimethyl-*N*-(quinolin-8-yl)benzamide (7)



To a solution of compound **3l** (36 mg, 0.108 mmol) in toluene (1 mL) at 0°C was added dropwise sodium bis(2-methoxyethoxy)aluminumhydride (Red-Al®, a 70%

w/w in toluene, 80 uL). The mixture was stirred at 80 °C for 2h, then sodium bis(2-methoxyethoxy)aluminumhydride (Red-Al®, a 70% w/w in toluene, 80 uL) was added to the reaction at 80 °C. After the completion of reaction, the reaction was quenched with saturated ammonium chloride solution.. The aqueous phase was extracted with CH_2Cl_2. The combined organic layers were washed with brine, dried over anhydrous Na_2SO_4, concentrated under reduced pressure, and purified by flash chromatography (0-25% EA/PE) gave compound **7** as colorless oil (16.0 mg, 48%). *E/Z* ratio: 89/11. The E/Z ratio was determined by ^{19}F NMR spectroscopy and the same below.^{19}F NMR (376 MHz, CDCl3) δ -128.77 (dd, J = 84.7, 18.0 Hz, 1F, E-isomer), -130.72 (dd, J = 85.1, 41.8 Hz, 1F, Z-isomer). ^1H NMR (400 MHz, CDCl3) δ 9.97 (s, 1H), 8.99 (d, J = 7.1 Hz, 1H), 8.79 – 8.70 (m, 1H), 8.20 (d, J = 8.2 Hz, 1H), 7.66 – 7.56 (m, 2H), 7.50 – 7.41 (m, 1H), 7.20 (d, J = 7.8 Hz, 1H), 7.06 (d, J = 7.9 Hz, 1H), 6.47 (dd, J = 84.7, 11.2 Hz, 1H), 5.64 – 5.48 (m, 1H), 3.31 (d, J = 7.6, 2H), 2.33 (s, 3H), 2.31 (s, 3H). ^{13}C NMR (101 MHz, CDCl3) δ 169.12, 150.90, 148.36, 136.69, 135.76, 134.31, 133.80 (d, J = 2.8 Hz), 133.28, 130.83, 128.21, 127.61, 126.60, 122.26, 121.85, 117.16, 110.73 (d, J = 11.0 Hz), 28.90 (d, J = 10.4 Hz), 20.09, 16.80. 133.80 (d, J = 2.8), 110.73 (d, J=11.0), 28.90 (d, J = 10.4). MS (ESI, m/z): 335.0 $[M+H]^+$; HRMS (ESI) cacld for $C_{21}H_{19}ON_2FNa$ ($[M+Na]^+$): 357.1374; found: 357.1374.

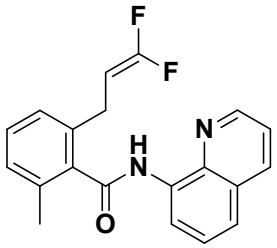
(*E/Z*)-2-(3-fluoro-3-phenylallyl)-N-(quinolin-8-yl)-5,6,7,8-tetrahydronaphthalene-1-carboxamide (8)



To a dry sealed tube was added **3m** (30 mg, 0.079 mmol), phenylboronic acid (14.5 mg, 0.119 mmol), K_3PO_4 (33.7 mg, 0.159 mmol) and $NiCl_2$(dppp) (2.2 mg, 0.004 mmol) under air, followed by exchanging argon three times. The resulting mixture was dissolved in toluene (1 mL) and kept stirring for 24 h at 120 °C. After cooling down to room temperature, the reaction mixture was filtered through a celite pad and

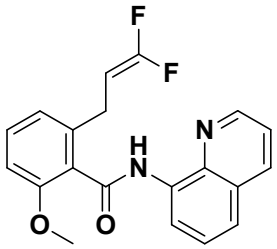
concentrated under reduced pressure, and the obtained residue was purified by column chromatography (silica gel) using PE/EA (15/1) as eluent to afford compound **8** as colorless oil (13.0 mg, 38%). *Z/E* ratio: 91/9. ^{19}F NMR (376 MHz, $CDCl_3$) δ -100.23 (d, J = 21.4 Hz, 1F, *E*-isomer), -120.87 (d, J = 36.3 Hz, 1F, *Z*-isomer). ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.97 (s, 1H), 9.00 (d, J = 7.5 Hz, 1H), 8.64 – 8.55 (m, 1H), 8.18 – 8.12 (m, 1H), 7.63 – 7.53 (m, 2H), 7.41 – 7.35 (m, 1H), 7.33 – 7.27 (m, 2H), 7.23 – 7.10 (m, 5H), 5.63 (dt, J = 36.3, 7.5 Hz, 1H), 3.68 (d, J = 7.1 Hz, 2H), 2.96 – 2.86 (m, 2H), 2.85 – 2.78 (m, 2H), 1.83 – 1.73 (m, 4H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 168.94, 156.78 (d, J = 248.1 Hz), 148.27, 138.19 (d, J = 76.9 Hz), 136.40, 136.09, 134.52, 134.02 (d, J = 1.9 Hz), 133.95, 130.53, 128.45, 128.28, 128.26, 128.10, 127.56, 127.01, 124.04, 123.97, 122.07, 121.71, 116.96, 105.07 (d, J = 16.9 Hz), 29.69, 28.28 (d, J = 6.0 Hz), 26.85, 23.08, 22.87. MS (ESI, m/z): 437.0 $[M+H]^+$; HRMS (ESI) cacld for $C_{29}H_{26}ON_2F$ ($[M+Na]^+$): 437.2024.; found: 437.2017.

2-(3,3-Difluoroallyl)-6-methyl-*N*-(quinolin-8-yl)benzamide (3a)



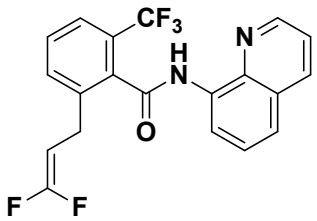
White solid; yield: 57 mg (84%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.96 (s, 1H), 8.98 (d, J = 7.2 Hz, 1H), 8.75 (d, J = 4.1 Hz, 1H), 8.19 (d, J = 8.2 Hz, 1H), 7.66 – 7.54 (m, 2H), 7.46 (dd, J = 8.3, 4.2 Hz, 1H), 7.32 (t, J = 7.7 Hz, 1H), 7.21 – 7.14 (m, 2H), 4.47 (dtd, J = 24.7, 7.9, 2.0 Hz, 1H), 3.44 (d, J = 7.9 Hz, 2H), 2.46 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 168.43, 156.53 (dd, J = 288.2, 286.2 Hz), 148.46, 138.60, 137.70, 136.57, 136.42, 135.03, 134.31, 129.56, 128.84, 128.15, 127.55, 126.71, 122.30, 121.86, 117.05, 77.88 (dd, J = 23.6, 19.9 Hz), 26.45 (d, J = 4.8 Hz), 19.64; MS (ESI, m/z): 339.0 $[M+H]^+$; HRMS (ESI) cacld for $C_{20}H_{17}F_2N_2O$ ($[M+H]^+$): 339.1309; found: 339.1303.

2-(3,3-Difluoroallyl)-6-methoxy-*N*-(quinolin-8-yl)benzamide (3b)



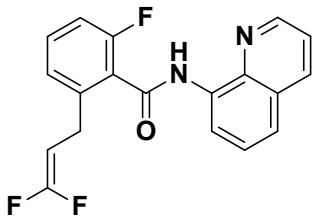
White solid; yield: 45 mg (64%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 10.18 (s, 1H), 8.99 (dd, J = 7.5, 1.5 Hz, 1H), 8.76 (dd, J = 4.2, 1.6 Hz, 1H), 8.19 (dd, J = 8.3, 1.5 Hz, 1H), 7.64 – 7.54 (m, 2H), 7.45 (dd, J = 8.3, 4.2 Hz, 1H), 7.37 (t, J = 8.0 Hz, 1H), 6.97 – 6.87 (m, 2H), 4.50 (dtd, J = 24.9, 8.0, 2.2 Hz, 1H), 3.86 (s, 3H), 3.47 (d, J = 8.0 Hz, 2H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 166.02, 156.70, 156.60 (dd, J = 288.0, 286.0 Hz), 148.27, 139.28, 138.62, 136.56, 134.74, 130.79, 128.18, 127.64, 126.62, 121.97, 121.79, 121.72, 117.07, 109.66, 77.87 (dd, J = 23.8, 19.7 Hz), 56.06, 26.43 (d, J = 4.9 Hz); MS (ESI, m/z): 355.0 $[M+H]^+$; HRMS (ESI) cacld for $C_{20}H_{17}F_2N_2O_2$ ($[M+H]^+$): 335.1258; found: 335.1250.

2-(3,3-Difluoroallyl)-*N*-(quinolin-8-yl)-6-(trifluoromethyl)benzamide (3c)



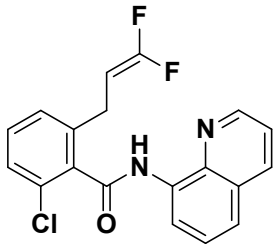
White solid; yield: 44 mg (56%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 10.03 (s, 1H), 8.94 (dd, J = 6.3, 2.7 Hz, 1H), 8.75 (dd, J = 4.2, 1.6 Hz, 1H), 8.19 (dd, J = 8.3, 1.6 Hz, 1H), 7.68 – 7.64 (m, 1H), 7.63 – 7.59 (m, 2H), 7.58 – 7.52 (m, 2H), 7.46 (dd, J = 8.3, 4.2 Hz, 1H), 4.48 (dtd, J = 24.5, 8.0, 2.0 Hz, 1H), 3.50 (d, J = 7.9 Hz, 2H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 165.31, 156.78 (dd, J = 288.8, 287.1 Hz), 148.57, 138.57, 136.55, 135.24, 134.09, 133.17, 129.91, 128.15, 127.73 (d, J = 31.6 Hz), 127.53, 124.79 (q, J = 4.7 Hz), 123.84 (d, J = 274.1 Hz), 122.68, 121.93, 117.27, 77.26 (dd, J = 24.7, 19.6 Hz), 26.24 (d, J = 5.0 Hz); MS (ESI, m/z): 393.0 $[M+H]^+$; HRMS (ESI) cacld for $C_{20}H_{14}F_5N_2O$ ($[M+H]^+$): 393.1026; found: 393.1018.

2-(3,3-Difluoroallyl)-6-fluoro-*N*-(quinolin-8-yl)benzamide (3d)



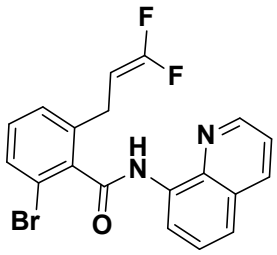
White solid; yield: 43 mg (62%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 10.20 (s, 1H), 8.95 (dd, J = 6.8, 1.7 Hz, 1H), 8.78 (d, J = 4.1 Hz, 1H), 8.19 (d, J = 8.2 Hz, 1H), 7.65 – 7.54 (m, 2H), 7.47 (dd, J = 8.2, 4.2 Hz, 1H), 7.40 (dd, J = 13.8, 8.0 Hz, 1H), 7.15 (d, J = 7.7 Hz, 1H), 7.10 (t, J = 8.8 Hz, 1H), 4.51 (dtd, J = 24.7, 7.9, 1.6 Hz, 1H), 3.54 (d, J = 7.9 Hz, 2H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 163.03, 159.41 (d, J = 247.9 Hz), 156.63 (dd, J = 288.5, 286.6 Hz), 148.40, 140.48 (d, J = 2.0 Hz), 138.43, 134.20, 131.31 (d, J = 8.8 Hz), 128.02, 127.40, 125.28 (d, J = 2.7 Hz), 124.93 (d, J = 17.6 Hz), 122.34, 121.77, 116.99, 114.34 (d, J = 22.3 Hz), 77.35 (dd, J = 24.3, 19.6 Hz), 26.29 – 26.14 (m); MS (ESI, m/z): 343.0 $[M+H]^+$; HRMS (ESI) cacld for $C_{19}H_{14}F_3N_2O$ ($[M+H]^+$): 343.1058; found: 343.1052.

2-Chloro-6-(3,3-difluoroallyl)-*N*-(quinolin-8-yl)benzamide (3e)



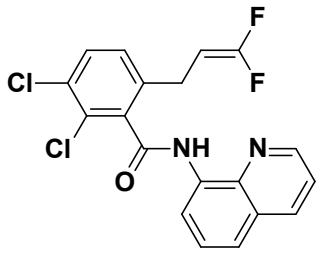
White solid; yield: 53 mg (74%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 10.04 (s, 1H), 8.96 (dd, J = 6.8, 2.1 Hz, 1H), 8.77 (dd, J = 4.2, 1.7 Hz, 1H), 8.19 (dd, J = 8.3, 1.6 Hz, 1H), 7.68 – 7.55 (m, 2H), 7.46 (dd, J = 8.3, 4.2 Hz, 1H), 7.40 – 7.31 (m, 2H), 7.28 – 7.20 (m, 1H), 4.46 (dtd, J = 24.6, 8.0, 2.1 Hz, 1H), 3.46 (dt, J = 8.0, 1.5 Hz, 2H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 165.22, 156.72 (dd, J = 288.6, 286.9 Hz), 148.54, 139.10, 138.60, 136.71, 136.57, 134.12, 131.31, 130.67, 128.16, 128.14, 127.75, 127.53, 122.56, 121.91, 117.24, 77.30 (dd, J = 24.5, 19.7 Hz), 26.55 (d, J = 5.0 Hz); MS (ESI, m/z): 359.0 $[M+H]^+$; HRMS (ESI) cacld for $C_{19}H_{13}ClF_2N_2ONa$ ($[M+Na]^+$): 381.0582; found: 381.0574.

2-Bromo-6-(3,3-difluoroallyl)-*N*-(quinolin-8-yl)benzamide (3f)



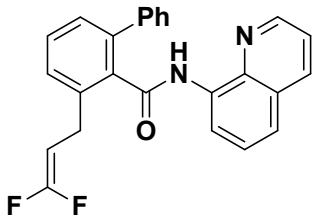
White solid; yield: 53 mg (66%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 10.01 (s, 1H), 8.96 (dd, J = 6.8, 2.1 Hz, 1H), 8.77 (dd, J = 4.2, 1.6 Hz, 1H), 8.20 (dd, J = 8.3, 1.6 Hz, 1H), 7.66 – 7.58 (m, 2H), 7.56 – 7.53(m, 1H), 7.47 (dd, J = 8.3, 4.2 Hz, 1H), 7.31 – 7.27 (m, 2H), 4.46 (dtd, J = 24.6, 8.0, 2.0 Hz, 1H), 3.46 (d, J = 8.0 Hz, 2H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 166.08, 159.19 – 154.11 (m), 139.14, 138.80, 138.59, 136.62, 134.08, 131.28, 130.94, 128.29, 128.19, 127.56, 122.58, 121.91, 120.08, 117.33, 77.32 (dd, J = 24.6, 19.7 Hz), 26.75 (d, J = 5.0 Hz); MS (ESI, m/z): 403.0 $[M+H]^+$; HRMS (ESI) cacld for $C_{19}H_{14}F_2N_2OBr$ ($[M+H]^+$): 403.0258; found: 403.0253.

2,3-Dichloro-6-(3,3-difluoroallyl)-*N*-(quinolin-8-yl)benzamide (3g)



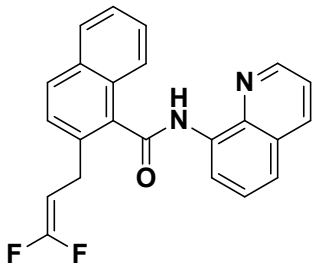
White solid; yield: 53 mg (68%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 10.03 (s, 1H), 8.94 (dd, J = 5.8, 3.0 Hz, 1H), 8.77 (d, J = 4.2 Hz, 1H), 8.21 (d, J = 8.2 Hz, 1H), 7.69 – 7.57 (m, 2H), 7.54 – 7.45 (m, 2H), 7.20 (d, J = 8.3 Hz, 1H), 4.55 – 4.32 (m, 1H), 3.42 (d, J = 7.9 Hz, 2H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 164.26, 156.69 (t, J = 288.2 Hz), 148.47, 138.40, 138.27, 137.95 – 135.76 (m), 136.53, 133.78, 131.77, 131.15, 129.65, 128.54, 128.05, 127.40, 122.66, 121.86, 117.25, 76.84 (dd, J = 24.6, 19.6 Hz), 26.14 (d, J = 5.0 Hz); MS (ESI, m/z): 393.0 $[M+H]^+$; HRMS (ESI) cacld for $C_{19}H_{13}Cl_2F_2N_2O$ ($[M+H]^+$): 393.0373; found: 393.0371.

3-(3,3-Difluoroallyl)-*N*-(quinolin-8-yl)-[1,1'-biphenyl]-2-carboxamide (3h)



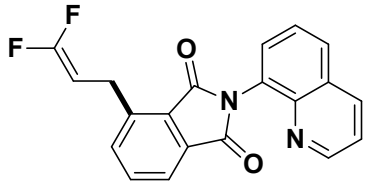
Semi-solid; yield: 49 mg (61%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.63 (s, 1H), 8.75 (dd, J = 7.4, 1.5 Hz, 1H), 8.60 (dd, J = 4.2, 1.7 Hz, 1H), 8.07 (dd, J = 8.3, 1.6 Hz, 1H), 7.56 – 7.44 (m, 5H), 7.40 – 7.32 (m, 3H), 7.25 – 7.19 (m, 2H), 7.13 – 7.05 (m, 1H), 4.56 (dtd, J = 24.9, 8.0, 2.2 Hz, 1H), 3.57 (d, J = 8.0 Hz, 2H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 167.89, 156.64 (dd, J = 288.1, 286.3 Hz), 148.08, 140.22, 140.11, 138.43, 137.71, 136.51, 136.25, 134.30, 129.78, 128.78, 128.69, 128.45, 128.33, 127.88, 127.52, 127.34, 121.98, 121.60, 116.70, 77.90 (dd, J = 23.8, 19.7 Hz), 26.60 (d, J = 4.9 Hz); MS (ESI, m/z): 401.0 $[M+H]^+$; HRMS (ESI) cacld for $C_{25}H_{19}F_2N_2O$ ($[M+H]^+$): 401.1465; found: 401.1476.

2-(3,3-Difluoroallyl)-*N*-(quinolin-8-yl)-1-naphthamide (3i)



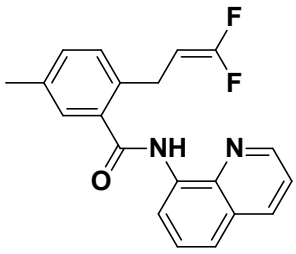
White solid; yield: 59 mg (79%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 10.17 (s, 1H), 9.12 (d, J = 7.5 Hz, 1H), 8.68 (dd, J = 4.2, 1.6 Hz, 1H), 8.20 (dd, J = 8.3, 1.5 Hz, 1H), 8.06 – 8.00 (m, 1H), 7.96 – 7.86 (m, 2H), 7.71 – 7.59 (m, 2H), 7.54 – 7.48 (m, 2H), 7.47 – 7.41 (m, 2H), 4.55 (dtd, J = 24.7, 7.9, 2.0 Hz, 1H), 3.61 (d, J = 7.9 Hz, 2H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 167.96, 156.63 (dd, J = 288.0, 286.8 Hz), 148.48, 138.58, 136.53, 134.43, 134.26, 134.00, 132.39, 130.34, 130.01, 128.20, 128.18, 127.56, 127.45, 127.09, 126.25, 125.14, 122.45, 121.89, 117.14, 77.89 (dd, J = 23.8, 19.8 Hz), 26.90 (d, J = 4.9 Hz); MS (ESI, m/z): 375.0 $[M+H]^+$; HRMS (ESI) cacld for $C_{23}H_{17}F_2N_2O$ ($[M+H]^+$): 375.1309; found: 375.1317.

4-(3,3-Difluoroallyl)-2-(quinolin-8-yl)isoindoline-1,3-dione (3j)



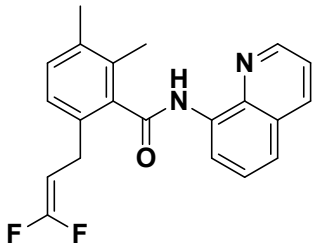
White solid; yield: 52 mg (74%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.87 (dd, J = 4.2, 1.6 Hz, 1H), 8.24 (dd, J = 8.3, 1.5 Hz, 1H), 7.97 (dd, J = 8.2, 1.4 Hz, 1H), 7.89 (d, J = 7.0 Hz, 1H), 7.78 – 7.65 (m, 3H), 7.62 (d, J = 7.8 Hz, 1H), 7.45 (dd, J = 8.3, 4.2 Hz, 1H), 4.56 (dtd, J = 24.8, 8.1, 1.9 Hz, 1H), 3.96 – 3.81 (m, 2H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 168.49, 167.83, 157.11, 151.09, 144.41, 139.73, 136.42, 135.14, 134.47, 133.20, 130.46, 129.86, 129.79, 129.46, 128.85, 126.32, 122.51, 122.08, 76.42 (dd, J = 24.8, 19.9 Hz), 24.31 (d, J = 5.0 Hz); MS (ESI, m/z): 351.0 $[M+H]^+$; HRMS (ESI) cacld for $C_{20}H_{13}F_2N_2O$ ($[M+H]^+$): 351.0945; found: 351.0953.

2-(3,3-Difluoroallyl)-5-methyl-*N*-(quinolin-8-yl)benzamide (3k)



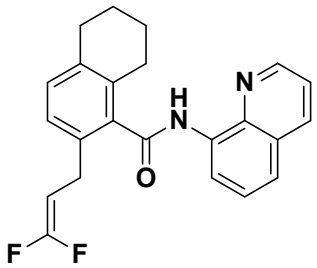
White solid; yield: 43 mg (63%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 10.20 (s, 1H), 8.93 (d, J = 7.0 Hz, 1H), 8.85 – 8.74 (m, 1H), 8.24 – 8.15 (m, 1H), 7.67 – 7.53 (m, 2H), 7.53 – 7.44 (m, 2H), 7.32 – 7.22 (m, 2H), 4.55 (dtd, J = 25.1, 8.0, 2.2 Hz, 1H), 3.58 (d, J = 7.9 Hz, 2H), 2.42 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 168.12, 156.61 (dd, J = 287.9, 285.9 Hz), 148.42, 138.70, 136.78, 136.58, 136.30, 135.53, 134.77, 131.56, 130.28, 128.16, 127.98, 127.56, 122.05, 121.83, 116.77, 78.23 (dd, J = 23.3, 19.6 Hz), 26.13 (d, J = 4.9 Hz), 21.14; MS (ESI, m/z): 339.0 $[M+H]^+$; HRMS (ESI) cacld for $C_{20}H_{17}F_2N_2O$ ($[M+H]^+$): 339.1309; found: 339.1299.

6-(3,3-Difluoroallyl)-2,3-dimethyl-*N*-(quinolin-8-yl)benzamide (3l)



White solid; yield: 65 mg (92%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.94 (s, 1H), 8.99 (d, J = 7.3 Hz, 1H), 8.74 (d, J = 4.1 Hz, 1H), 8.19 (d, J = 8.2 Hz, 1H), 7.65 – 7.55 (m, 2H), 7.46 (dd, J = 8.2, 4.2 Hz, 1H), 7.21 (d, J = 7.8 Hz, 1H), 7.08 (d, J = 7.7 Hz, 1H), 4.45 (dtd, J = 24.8, 8.0, 2.1 Hz, 1H), 3.39 (d, J = 7.9 Hz, 2H), 2.34 (s, 3H), 2.31 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 169.04, 156.49 (dd, J = 288.0, 286.1 Hz), 148.44, 138.63, 137.98, 136.54, 135.89, 134.39, 133.80, 133.29, 130.92, 128.17, 127.55, 126.53, 122.25, 121.84, 117.04, 78.03 (dd, J = 23.4, 19.8 Hz), 26.27 (d, J = 4.8 Hz), 20.08, 16.79; MS (ESI, m/z): 353.1 $[M+H]^+$; HRMS (ESI) cacld for $C_{21}H_{19}F_2N_2O$ ($[M+H]^+$): 353.1465; found: 353.1472.

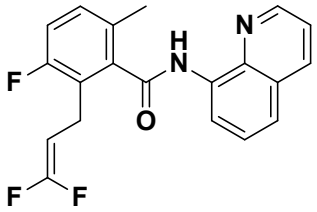
2-(3,3-Difluoroallyl)-*N*-(quinolin-8-yl)-5,6,7,8-tetrahydronaphthalene-1-carboxamide (3m)



White solid; yield: 45 mg (59%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.96 (s, 1H), 8.98 (dd, J = 7.2, 1.5 Hz, 1H), 8.75 (dd, J = 4.2, 1.5 Hz, 1H), 8.20 (dd, J = 8.3, 1.4 Hz, 1H), 7.66 – 7.53 (m, 2H), 7.46 (dd, J = 8.3, 4.2 Hz, 1H), 7.14 (d, J = 7.9 Hz, 1H), 7.07 (d, J = 7.9 Hz, 1H), 4.45 (dtd, J = 24.7, 7.9, 2.1 Hz, 1H), 3.38 (d, J = 7.9 Hz, 2H), 2.92 – 2.85 (m, 2H), 2.84 – 2.78 (m, 2H), 1.84 – 1.72 (m, 4H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 168.72, 156.49 (dd, J = 287.9, 286.2 Hz), 148.42, 138.60, 137.59, 136.57, 136.37, 134.39, 134.00, 133.39, 130.57, 128.17, 127.57, 126.39, 122.22, 121.83, 117.05, 78.08 (dd, J = 23.3, 19.8 Hz), 29.65, 26.85, 26.17 (d, J = 4.8 Hz), 23.02, 22.82; MS (ESI, m/z): 379.1 $[M+H]^+$; HRMS (ESI) cacld for $C_{23}H_{21}F_2N_2O$ ($[M+H]^+$): 379.1622;

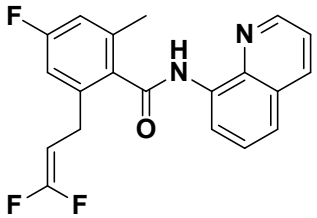
found: 379.1617.

2-(3,3-Difluoroallyl)-3-fluoro-6-methyl-*N*-(quinolin-8-yl)benzamide (3n)



White solid; yield: 60 mg (84%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.95 (s, 1H), 8.96 (dd, J = 6.8, 2.1 Hz, 1H), 8.75 (dd, J = 4.2, 1.5 Hz, 1H), 8.20 (dd, J = 8.3, 1.4 Hz, 1H), 7.66 – 7.55 (m, 2H), 7.47 (dd, J = 8.3, 4.2 Hz, 1H), 7.14 (dd, J = 8.2, 5.2 Hz, 1H), 7.05 (t, J = 9.0 Hz, 1H), 4.52 – 4.36 (m, 1H), 3.42 (d, J = 7.8 Hz, 2H), 2.41 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 166.99 (d, J = 2.8 Hz), 156.35 (dd, J = 288.8, 285.7 Hz). 159.61 (d, J = 245.2 Hz), 148.52, 139.20 (d, J = 3.2 Hz), 138.55, 136.63, 130.62 (d, J = 3.8 Hz), 134.11, 130.33 (d, J = 8.1 Hz), 128.16, 127.53, 123.68 (d, J = 17.0 Hz), 122.51, 121.92, 117.15, 116.25 (d, J = 22.2 Hz), 77.10 (dd, J = 24.5, 19.6 Hz), 20.56 – 20.27 (m), 19.10; MS (ESI, m/z): 357.0 $[M+H]^+$; HRMS (ESI) cacld for $C_{20}H_{16}F_3N_2O$ ($[M+H]^+$): 357.1215; found: 357.1208.

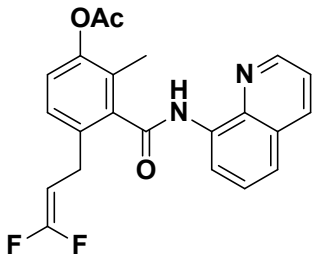
2-(3,3-Difluoroallyl)-4-fluoro-6-methyl-*N*-(quinolin-8-yl)benzamide (3o)



White solid; yield: 63 mg (88%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.94 (s, 1H), 8.95 (dd, J = 6.8, 2.1 Hz, 1H), 8.76 (dd, J = 4.2, 1.6 Hz, 1H), 8.20 (dd, J = 8.3, 1.6 Hz, 1H), 7.66 – 7.57 (m, 2H), 7.47 (dd, J = 8.3, 4.2 Hz, 1H), 6.87 (m, 2H), 4.45 (dtd, J = 24.6, 8.0, 2.1 Hz, 1H), 3.43 (d, J = 8.0 Hz, 2H), 2.44 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 167.67, 162.97 (d, J = 248.3 Hz), 156.77 (dd, J = 288.5, 287.0 Hz), 148.55, 139.27 (d, J = 7.8 Hz), 138.59, 137.98 (d, J = 8.4 Hz), 136.62, 134.19, 133.91 (d, J = 2.7 Hz), 128.18, 127.54, 122.45, 121.93, 117.08, 115.58 (d, J = 21.3 Hz), 113.49 (d, J = 21.9

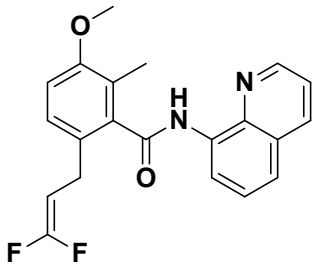
Hz), 77.25 (dd, J = 24.2, 19.7 Hz), 26.43 (d, J = 4.1 Hz), 19.81; MS (ESI, m/z): 357.0 $[M+H]^+$; HRMS (ESI) cacld for $C_{20}H_{16}F_3N_2O$ ($[M+H]^+$): 357.1215; found: 357.1221.

4-(3,3-Difluoroallyl)-2-methyl-3-(quinolin-8-ylcarbamoyl)phenyl acetate (3p)



White solid; yield: 65 mg (82%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.98 (s, 1H), 8.95 (dd, J = 6.6, 2.3 Hz, 1H), 8.76 (dd, J = 4.2, 1.7 Hz, 1H), 8.19 (dd, J = 8.3, 1.7 Hz, 1H), 7.66 – 7.55 (m, 2H), 7.46 (dd, J = 8.3, 4.2 Hz, 1H), 7.20 (d, J = 8.3 Hz, 1H), 7.09 (d, J = 8.4 Hz, 1H), 4.45 (dtd, J = 24.7, 8.0, 2.1 Hz, 1H), 3.41 (d, J = 8.0 Hz, 2H), 2.35 (s, 3H), 2.25 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.51, 167.32, 156.57 (dd, J = 288.3, 286.6 Hz), 148.55, 148.19, 139.14, 138.56, 136.54, 134.15, 128.12, 127.83, 127.47, 123.28, 122.49, 121.93, 117.12, 77.62 (dd, J = 24.0, 19.9 Hz), 26.17 (d, J = 4.9 Hz), 20.98, 13.44; MS (ESI, m/z): 397.1 $[M+H]^+$; HRMS (ESI) cacld for $C_{22}H_{19}F_2N_2O_3$ ($[M+H]^+$): 397.1364; found: 357.1354.

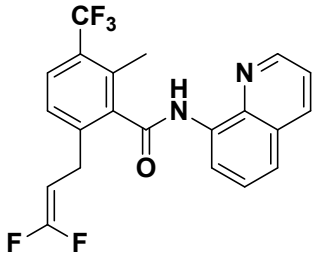
6-(3,3-Difluoroallyl)-3-methoxy-2-methyl-*N*-(quinolin-8-yl)benzamide (3q)



White solid; yield: 61 mg (83%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.95 (s, 1H), 8.97 (dd, J = 7.2, 1.5 Hz, 1H), 8.74 (dd, J = 4.2, 1.4 Hz, 1H), 8.20 (dd, J = 8.3, 1.5 Hz, 1H), 7.67 – 7.54 (m, 2H), 7.46 (dd, J = 8.3, 4.2 Hz, 1H), 7.13 (d, J = 8.4 Hz, 1H), 6.89 (d, J = 8.5 Hz, 1H), 4.44 (dtd, J = 24.8, 7.8, 2.1 Hz, 1H), 3.86 (s, 3H), 3.37 (d, J = 7.9 Hz, 2H), 2.30 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 168.24, 158.99 – 153.88 (m),

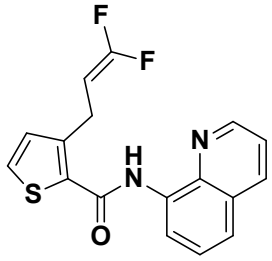
156.66, 148.43, 138.83, 138.60, 136.56, 134.33, 128.16, 127.98, 127.55, 127.46, 123.78, 122.27, 121.84, 117.05, 111.16, 78.19 (dd, J = 22.9, 19.8 Hz), 55.83, 25.84 (d, J = 4.9 Hz), 13.17; MS (ESI, m/z): 369.1 $[M+H]^+$; HRMS (ESI) cacld for $C_{21}H_{19}F_2N_2O_2$ ($[M+H]^+$): 369.1415; found: 369.1411.

6-(3,3-Difluoroallyl)-2-methyl-*N*-(quinolin-8-yl)-3-(trifluoromethyl)benzamide (3r)



White solid; yield: 50 mg (62%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.98 (s, 1H), 8.96 (dd, J = 5.9, 2.5 Hz, 1H), 8.77 (d, J = 2.9 Hz, 1H), 8.21 (d, J = 8.4 Hz, 1H), 7.74 – 7.59 (m, 3H), 7.48 (dd, J = 8.3, 4.2 Hz, 1H), 7.27 (d, J = 9.6 Hz, 1H), 4.45 (dt, J = 24.2, 7.8 Hz, 1H), 3.46 (d, J = 7.8 Hz, 2H), 2.56 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 167.23, 159.68 – 153.99 (m), 148.63, 140.38, 139.86, 138.56, 136.66, 134.11, 133.94, 128.34 (d, J = 30.3 Hz), 128.19, 127.50, 127.04 (q, J = 5.7 Hz), 126.74, 124.38 (d, J = 273.7 Hz), 122.74, 122.01, 117.28, 77.04 (dd, J = 24.7, 19.8 Hz), 26.52 (d, J = 4.9 Hz), 16.29 (d, J = 1.2 Hz); MS (ESI, m/z): 407.0 $[M+H]^+$; HRMS (ESI) cacld for $C_{21}H_{16}F_5N_2O$ ($[M+H]^+$): 407.1183; found: 407.1192.

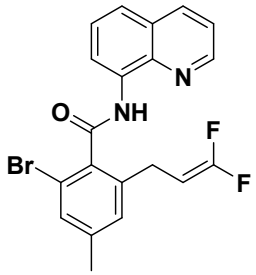
3-(3,3-Difluoroallyl)-*N*-(quinolin-8-yl)thiophene-2-carboxamide (3s)



White solid; yield: 33 mg (50%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 10.42 (s, 1H), 8.86 –

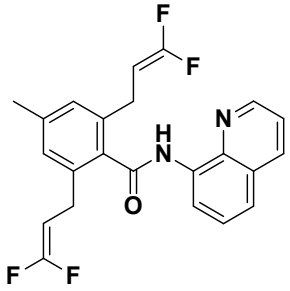
8.80 (m, 2H), 8.19 (dd, *J* = 8.3, 1.6 Hz, 1H), 7.61 – 7.53 (m, 2H), 7.48 (dd, *J* = 8.3, 4.2 Hz, 1H), 7.42 (d, *J* = 5.0 Hz, 1H), 7.05 (d, *J* = 5.1 Hz, 1H), 4.60 (dtd, *J* = 25.0, 8.0, 2.1 Hz, 1H), 3.81 (dt, *J* = 8.0, 1.6 Hz, 2H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 161.02, 156.82 (dd, *J* = 287.7, 286.3 Hz), 148.48, 144.56, 138.67, 136.59, 134.64, 131.66, 130.97, 128.15, 127.58, 127.55, 121.94, 121.88, 116.76, 77.31 (dd, *J* = 23.9, 19.7 Hz), 22.87 (d, *J* = 5.1 Hz); MS (ESI, m/z): 331.0 $[M+H]^+$; HRMS (ESI) cacld for $C_{17}H_{12}F_2N_2OSNa$ ($[M+Na]^+$): 353.0536; found: 353.0540.

2-Bromo-6-(3,3-difluoroallyl)-4-methyl-*N*-(quinolin-8-yl)benzamide (3t)



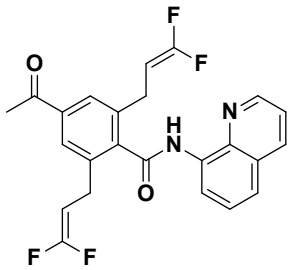
White solid; yield: 54 mg (64%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.98 (s, 1H), 8.95 (d, *J* = 7.1 Hz, 1H), 8.76 (d, *J* = 4.1 Hz, 1H), 8.19 (d, *J* = 8.3 Hz, 1H), 7.52 - 7.66 (m, 2H), 7.46 (dd, *J* = 8.2, 4.2 Hz, 1H), 7.36 (s, 1H), 7.08 (s, 1H), 4.45 (dt, *J* = 24.6, 7.9 Hz, 1H), 3.42 (d, *J* = 8.0 Hz, 2H), 2.38 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 166.31, 156.65 (dd, *J* = 288.7, 286.6 Hz), 148.51, 141.37, 138.98 – 138.68, 136.54, 136.04, 134.16, 131.67, 129.05, 128.15, 127.53, 122.46, 121.88, 119.83, 117.18, 77.78 – 77.10 (m), 26.70 (d, *J* = 5.0 Hz), 21.19; MS (ESI, m/z): 416.8 $[M+H]^+$, 418.9 $[M+H+2]^+$; HRMS (ESI) cacld for $C_{20}H_{16}ON_2$ BrF_2 ($[M+Na]^+$): 417.0409.; found: 437.0402.

2,6-Bis(3,3-difluoroallyl)-4-methyl-*N*-(quinolin-8-yl)benzamide (3aa)



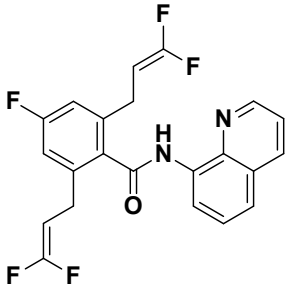
White solid; yield: 58 mg (70%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.95 (s, 1H), 8.95 (d, J = 5.7 Hz, 1H), 8.74 (d, J = 3.4 Hz, 1H), 8.20 (d, J = 8.3 Hz, 1H), 7.69 – 7.54 (m, 2H), 7.46 (dd, J = 8.3, 4.2 Hz, 1H), 7.03 (s, 2H), 4.46 (dtd, J = 25.0, 7.9, 1.7 Hz, 2H), 3.41 (d, J = 8.0 Hz, 4H), 2.39 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 168.10, 156.55 (dd, J = 288.2, 286.2 Hz), 148.49, 140.00, 138.55, 136.68, 136.59, 134.61, 134.20, 128.35, 128.14, 127.54, 122.40, 121.90, 117.05, 77.84 (dd, J = 23.7, 19.8 Hz), 26.40 (d, J = 4.8 Hz), 21.46; MS (ESI, m/z): 415.1 $[M+H]^+$; HRMS (ESI) cacld for $C_{23}H_{18}F_4N_2ONa$ ($[M+Na]^+$): 437.1253; found: 437.1258.

4-Acetyl-2,6-bis(3,3-difluoroallyl)-*N*-(quinolin-8-yl)benzamide (3ab)



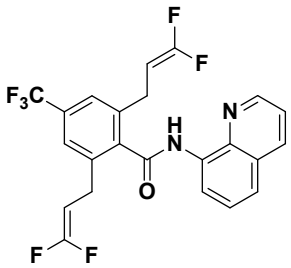
White solid; yield: 46 mg (52%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 10.00 (s, 1H), 8.99 – 8.87 (m, 1H), 8.74 (dd, J = 4.2, 1.6 Hz, 1H), 8.22 (dd, J = 8.3, 1.5 Hz, 1H), 7.79 (s, 2H), 7.68 – 7.58 (m, 2H), 7.48 (dd, J = 8.3, 4.2 Hz, 1H), 4.47 (dtd, J = 24.5, 7.9, 2.0 Hz, 2H), 3.50 (d, J = 7.9 Hz, 4H), 2.65 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 197.51, 166.87, 156.69 (dd, J = 288.8, 287.2 Hz), 148.60, 141.12, 138.44, 138.29, 137.51, 136.74, 133.76, 128.17, 127.60, 127.52, 122.84, 122.02, 117.33, 77.26 (dd, J = 24.4, 19.6 Hz), 26.94, 26.53 (d, J = 5.0 Hz); MS (ESI, m/z): 443.0 $[M+H]^+$; HRMS (ESI) cacld for $C_{24}H_{19}F_4N_2O_2$ ($[M+H]^+$): 443.1371; found: 443.1363.

2,6-Bis(3,3-difluoroallyl)-4-fluoro-*N*-(quinolin-8-yl)benzamide (3ac)



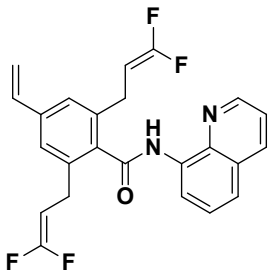
White solid; yield: 59 mg (71%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.96 (s, 1H), 8.98 – 8.86 (m, 1H), 8.76 (dd, J = 4.2, 1.6 Hz, 1H), 8.21 (dd, J = 8.3, 1.6 Hz, 1H), 7.68 – 7.57 (m, 2H), 7.48 (dd, J = 8.3, 4.2 Hz, 1H), 6.93 (d, J = 9.3 Hz, 2H), 4.45 (dtd, J = 24.5, 8.0, 2.0 Hz, 2H), 3.44 (d, J = 8.0 Hz, 4H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 167.08, 163.27 (d, J = 249.3 Hz), 156.82 (dd, J = 288.6, 287.3 Hz), 148.61, 139.64 (d, J = 7.7 Hz), 138.55, 136.65, 133.99, 133.45 (d, J = 2.9 Hz), 128.17, 127.51, 122.67, 121.99, 117.17, 114.58, 114.40, 77.08 (dd, J = 24.5, 19.7 Hz), 26.43 (d, J = 4.4 Hz); MS (ESI, m/z): 419.0 $[M+H]^+$; HRMS (ESI) cacld for $C_{22}H_{16}F_5N_2O$ ($[M+H]^+$): 419.1183; found: 419.1176.

2,6-Bis(3,3-difluoroallyl)-*N*-(quinolin-8-yl)-4-(trifluoromethyl)benzamide (3ad)



White solid; yield: 62 mg (66%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 10.00 (s, 1H), 8.92 (dd, J = 8.9, 4.4 Hz, 1H), 8.75 (dd, J = 4.2, 1.6 Hz, 1H), 8.22 (dd, J = 8.3, 1.3 Hz, 1H), 7.68 – 7.59 (m, 2H), 7.53 – 7.43 (m, 3H), 4.46 (dtd, J = 24.3, 7.9, 1.9 Hz, 2H), 3.50 (d, J = 7.9 Hz, 4H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 166.44, 156.82 (dd, J = 288.9, 287.6 Hz), 148.68, 140.31, 138.50, 137.97, 136.71, 133.74, 132.17 (q, J = 32.4 Hz), 128.18, 127.50, 124.56, 124.53, 123.76 (q, J = 272.7 Hz), 122.91, 122.07, 117.33, 76.96 (dd, J = 24.8, 19.7 Hz), 26.47 (d, J = 5.0 Hz); MS (ESI, m/z): 469.0 $[M+H]^+$; HRMS (ESI) cacld for $C_{23}H_{16}F_7N_2O$ ($[M+H]^+$): 469.1151; found: 469.1162.

2,6-Bis(3,3-difluoroallyl)-*N*-(quinolin-8-yl)-4-vinylbenzamide (3ae)



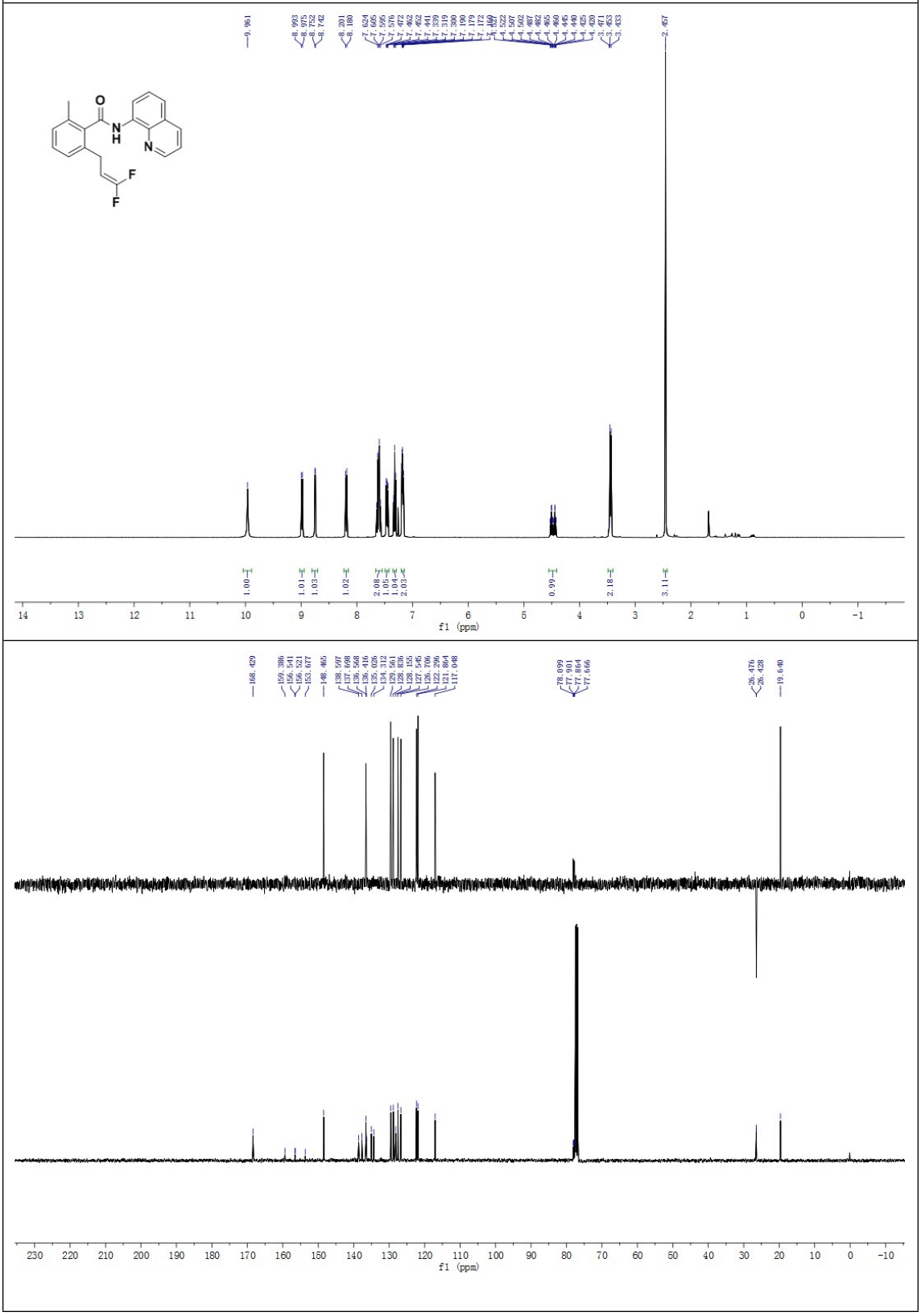
White solid; yield: 59 mg (69%); ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.97 (s, 1H), 8.94 (dd, J = 6.8, 2.1 Hz, 1H), 8.74 (dd, J = 4.2, 1.5 Hz, 1H), 8.21 (dd, J = 8.3, 1.6 Hz, 1H), 7.69 – 7.56 (m, 2H), 7.47 (dd, J = 8.3, 4.2 Hz, 1H), 7.24 (s, 2H), 6.73 (dd, J = 17.6, 10.9 Hz, 1H), 5.83 (d, J = 17.6 Hz, 1H), 5.36 (d, J = 10.9 Hz, 1H), 4.47 (dtd, J = 24.7, 8.0, 2.1 Hz, 2H), 3.44 (d, J = 8.0 Hz, 4H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 167.70, 156.61 (dd, J = 288.2, 286.6 Hz), 148.52, 139.25, 138.54, 137.12, 136.62, 136.58, 136.02, 134.11, 128.16, 127.54, 125.49, 122.51, 121.93, 117.13, 115.75, 77.68 (dd, J = 24.0, 19.8 Hz), 26.50 (d, J = 4.9 Hz); MS (ESI, m/z): 427.0 $[M+H]^+$; HRMS (ESI) cacld for $C_{24}H_{19}F_4N_2O$ ($[M+H]^+$): 427.1434; found: 427.1425.

References

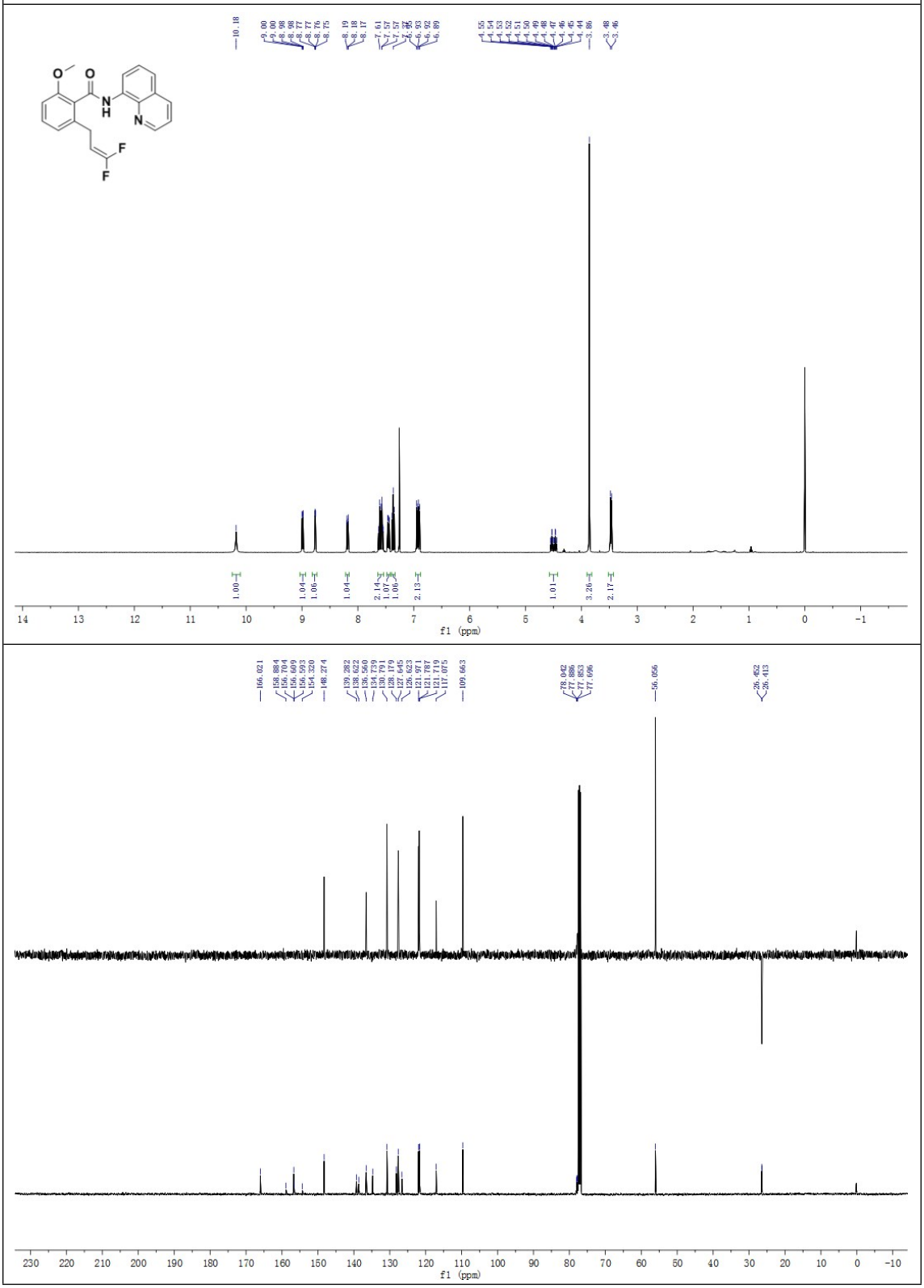
1. Y. Ano, M. Tobisu, N. Chatani, *Org. Lett.* 2012, 14, 354-357.
2. D. Shabashov, O. Daugulis, *J. Am. Chem. Soc.* 2010, *132*, 3965-3972.
3. T. Truong, K. Klimovica, O. Daugulis, *J. Am. Chem. Soc.* 2013, 135, 9342-9345.
4. K. S. Kanyiva, Y. Kuninobu, M. Kanai, *Org. Lett.* 2014, 16, 1968-1971.

^{1}H and ^{13}C NMR Spectra

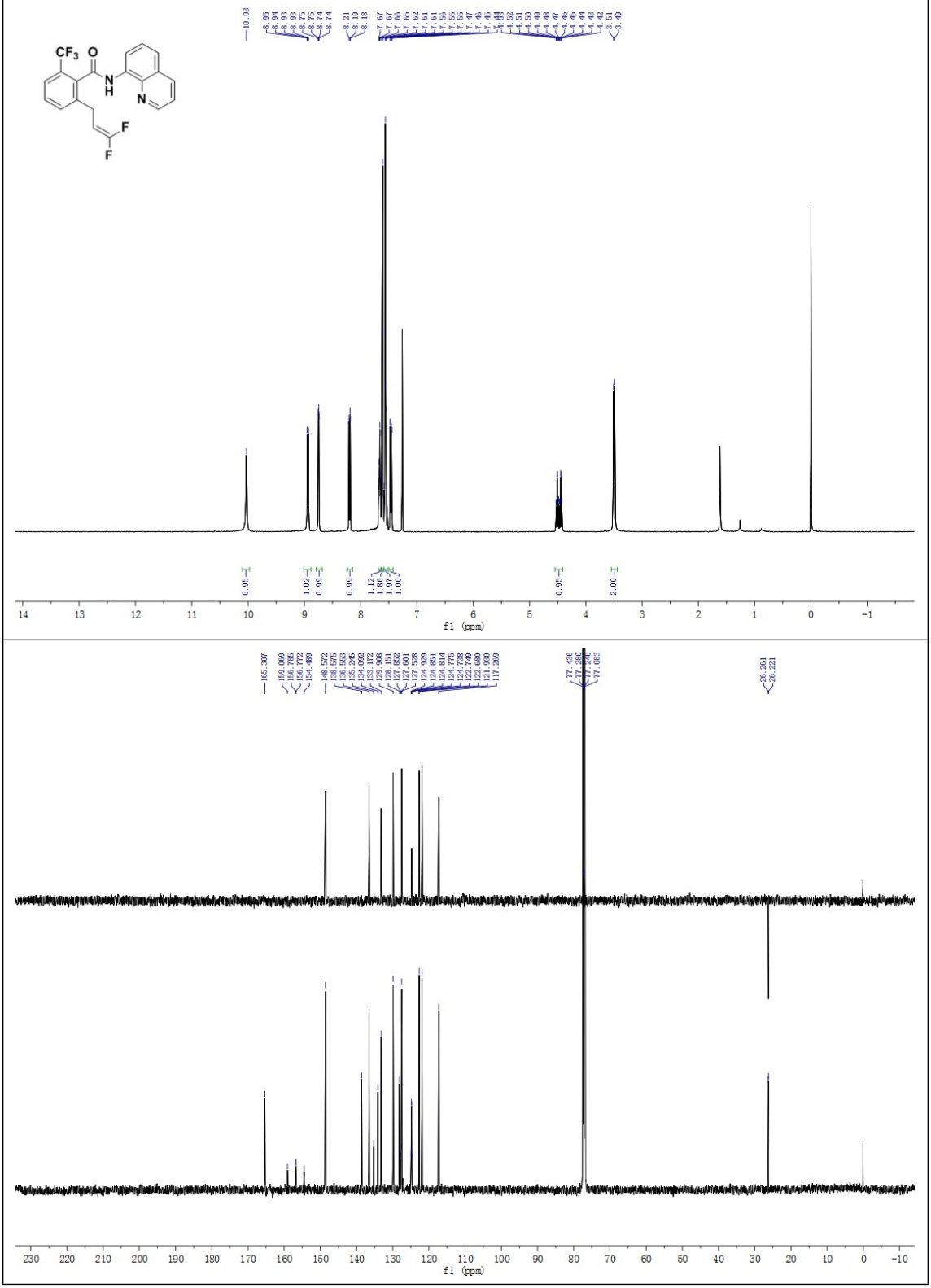
2-(3,3-Difluoroallyl)-6-methyl-*N*-(quinolin-8-yl)benzamide (3a)



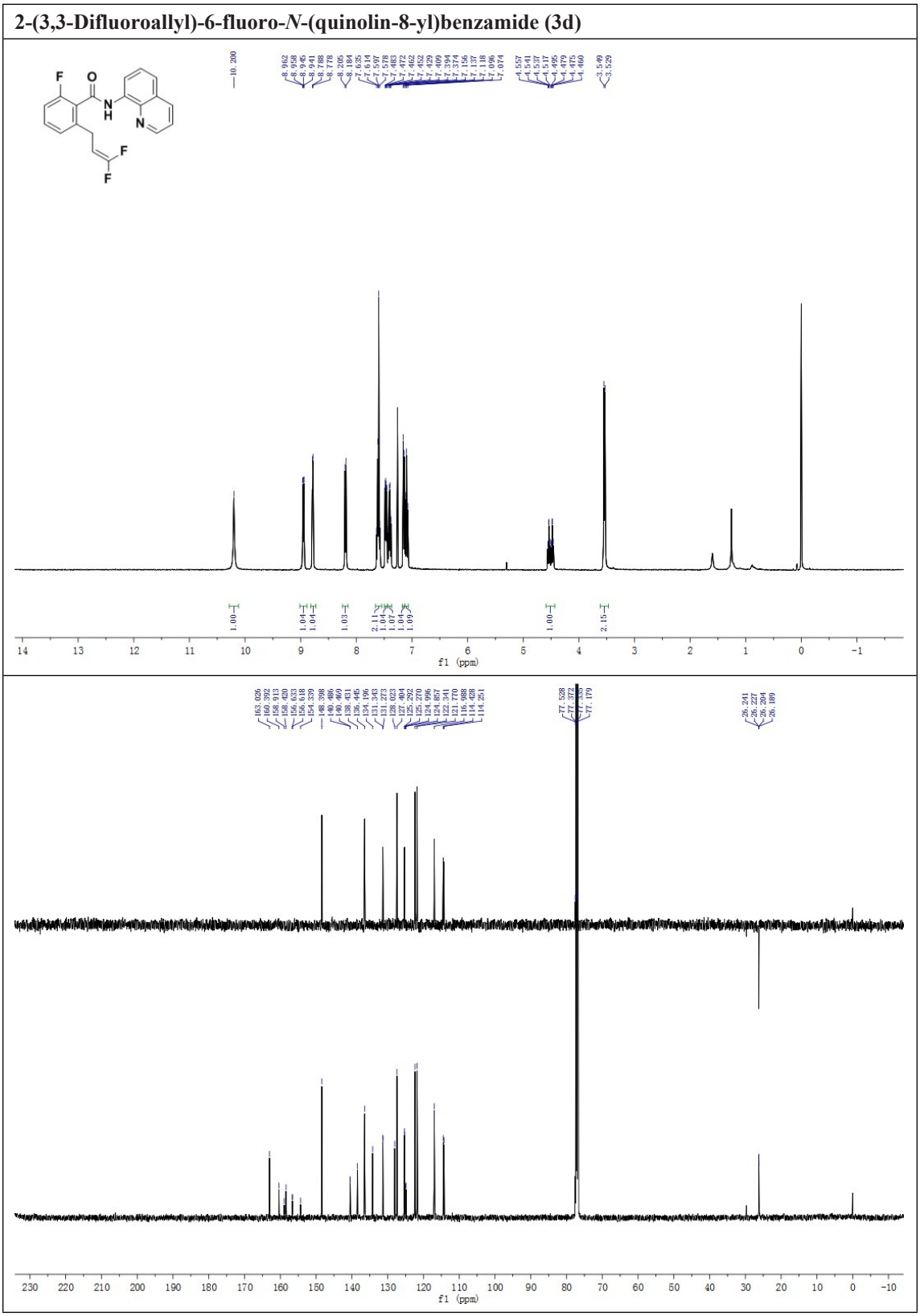
2-(3,3-Difluoroallyl)-6-methoxy-*N*-(quinolin-8-yl)benzamide (3b)



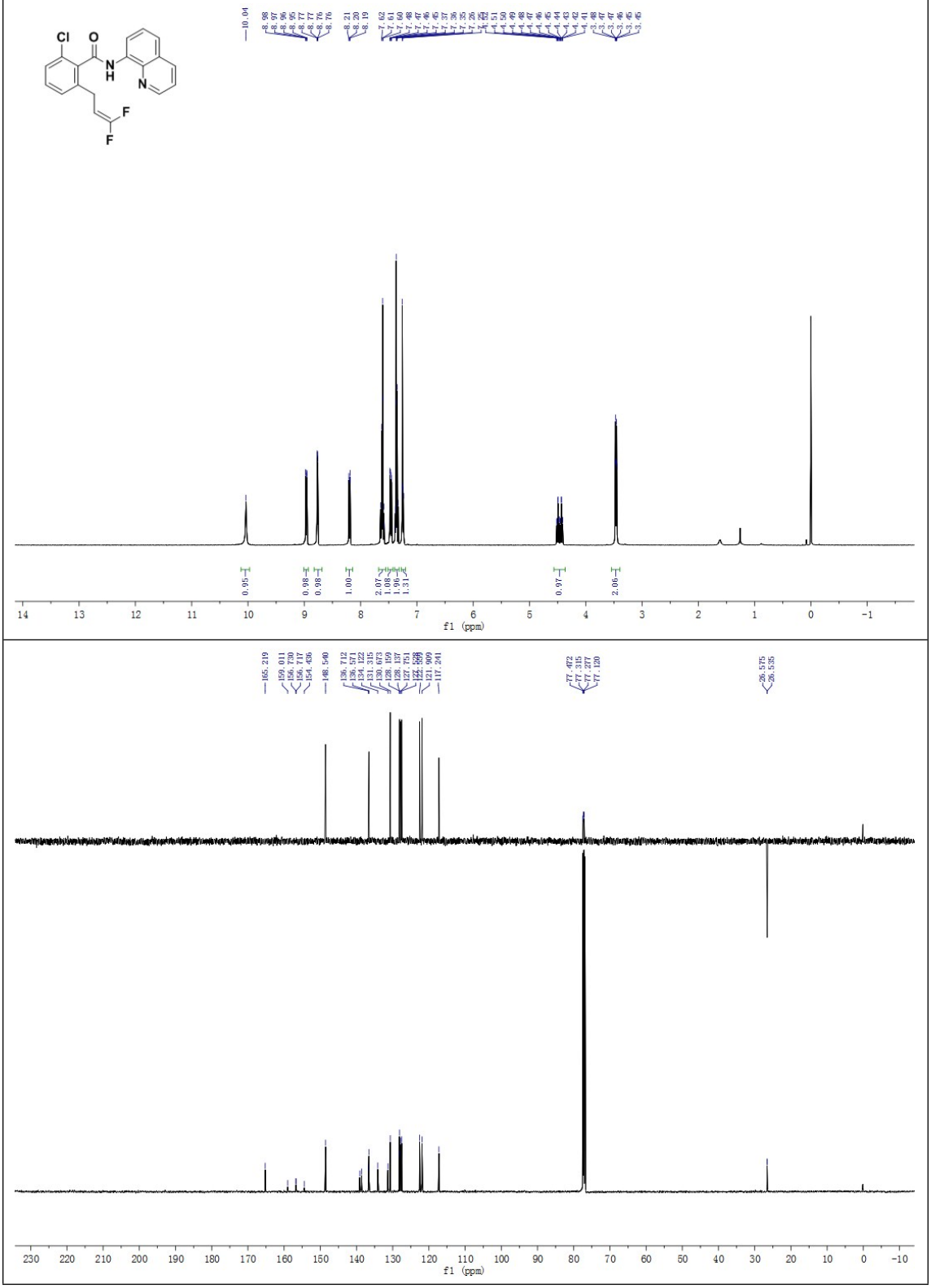
2-(3,3-Difluoroallyl)-*N*-(quinolin-8-yl)-6-(trifluoromethyl)benzamide (3c)



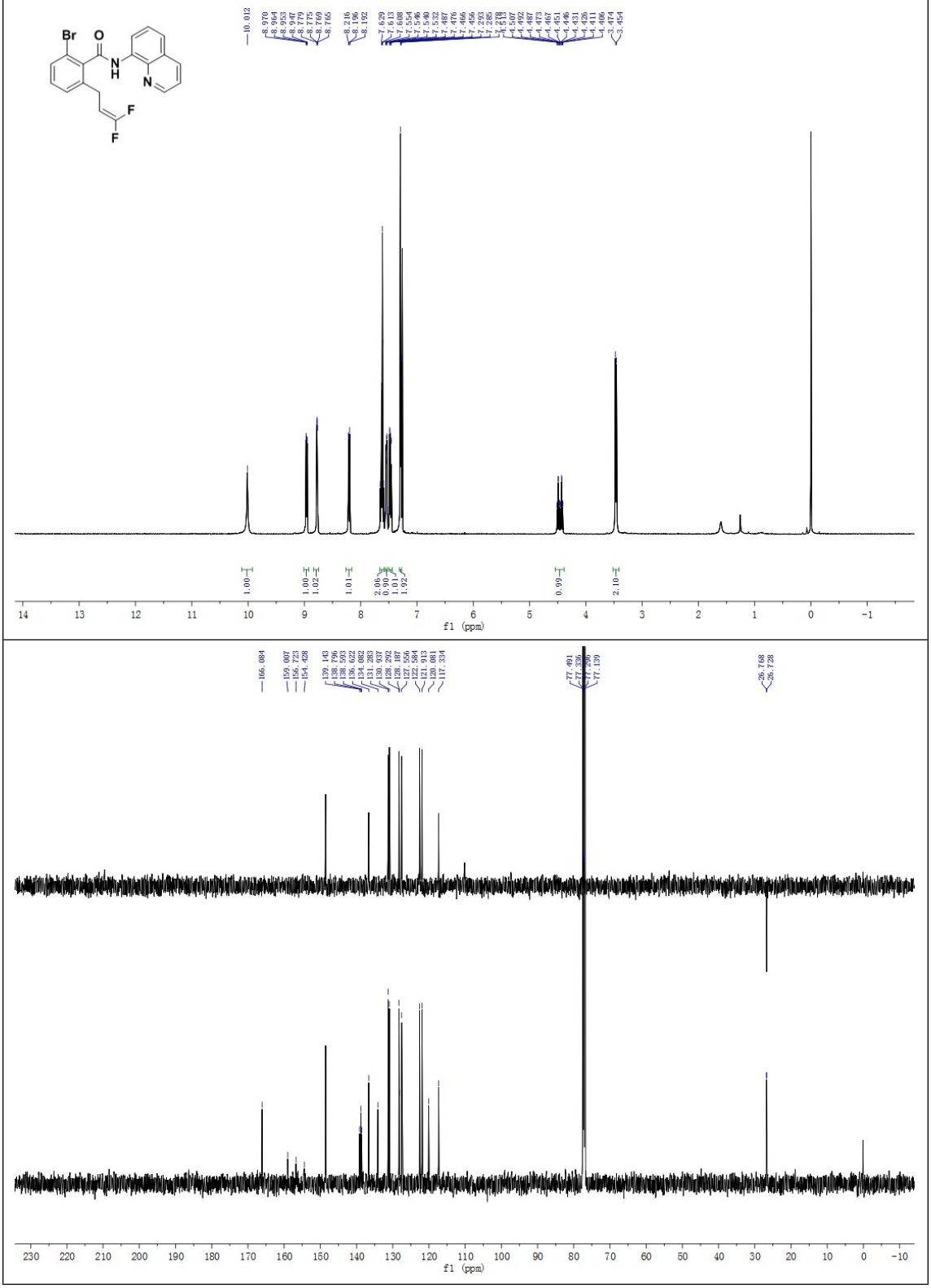
2-(3,3-Difluoroallyl)-6-fluoro-*N*-(quinolin-8-yl)benzamide (3d)



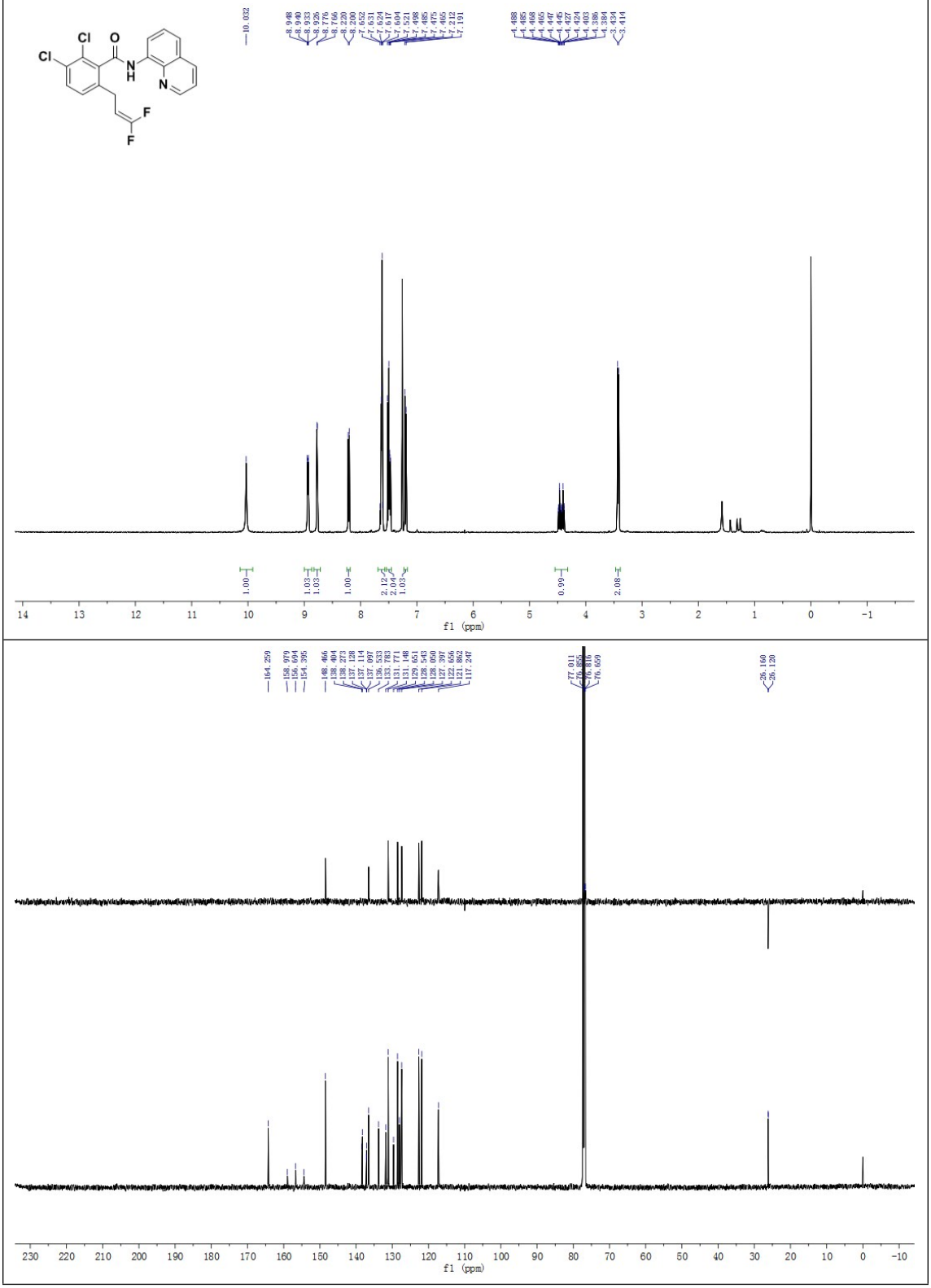
2-Chloro-6-(3,3-difluoroallyl)-*N*-(quinolin-8-yl)benzamide (3e)



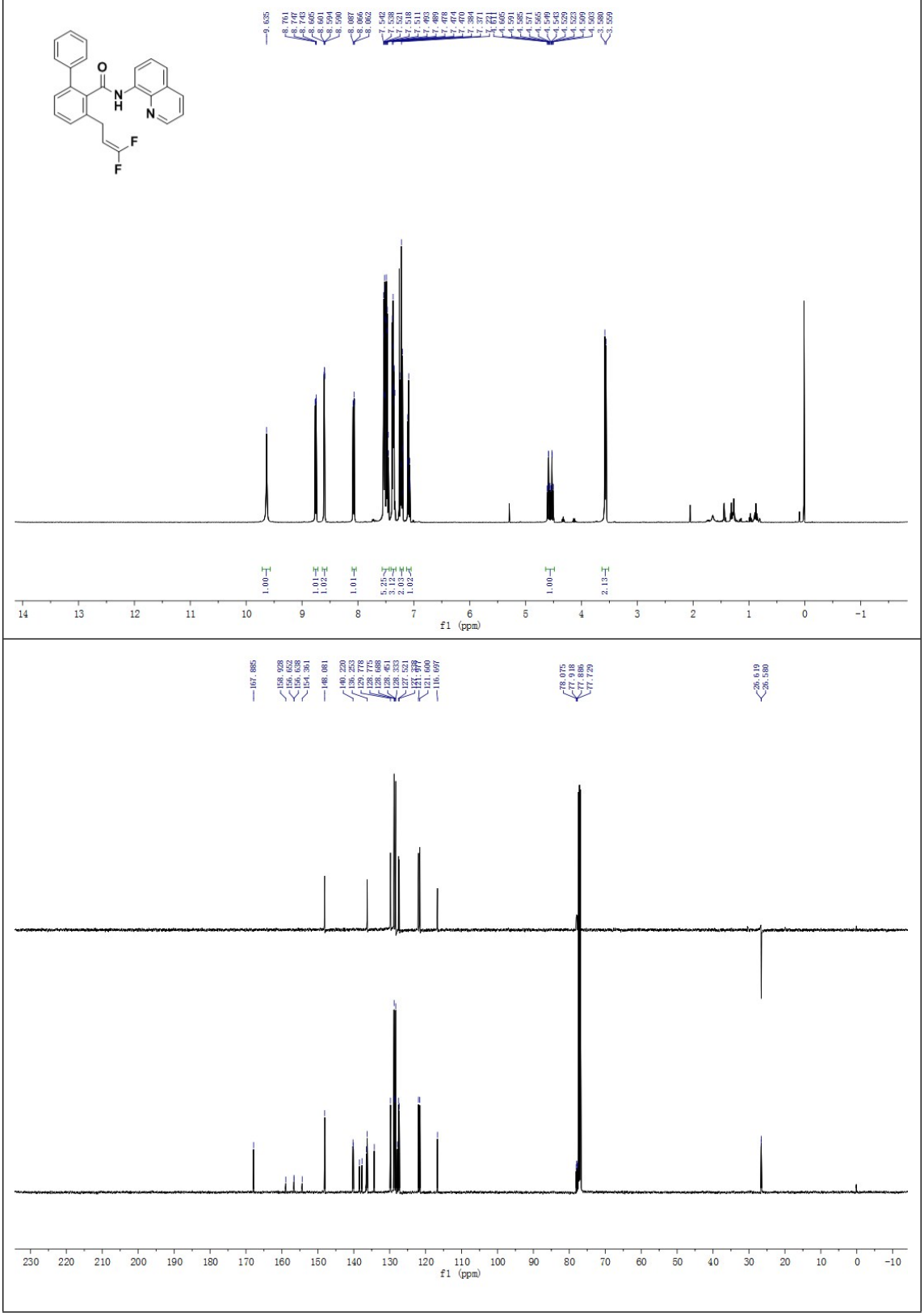
2-Bromo-6-(3,3-difluoroallyl)-*N*-(quinolin-8-yl)benzamide (3f)



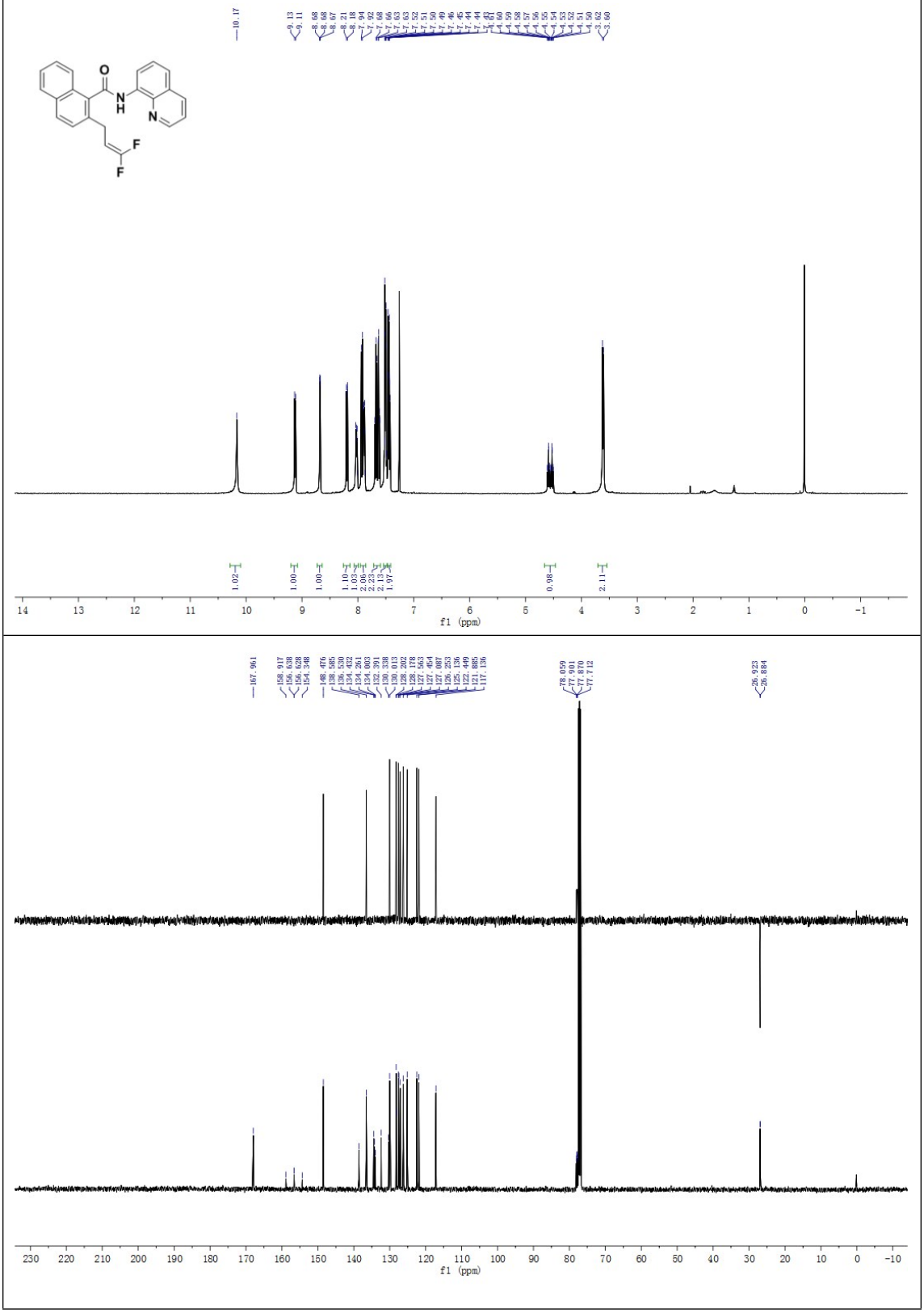
2,3-Dichloro-6-(3,3-difluoroallyl)-*N*-(quinolin-8-yl)benzamide (3g)



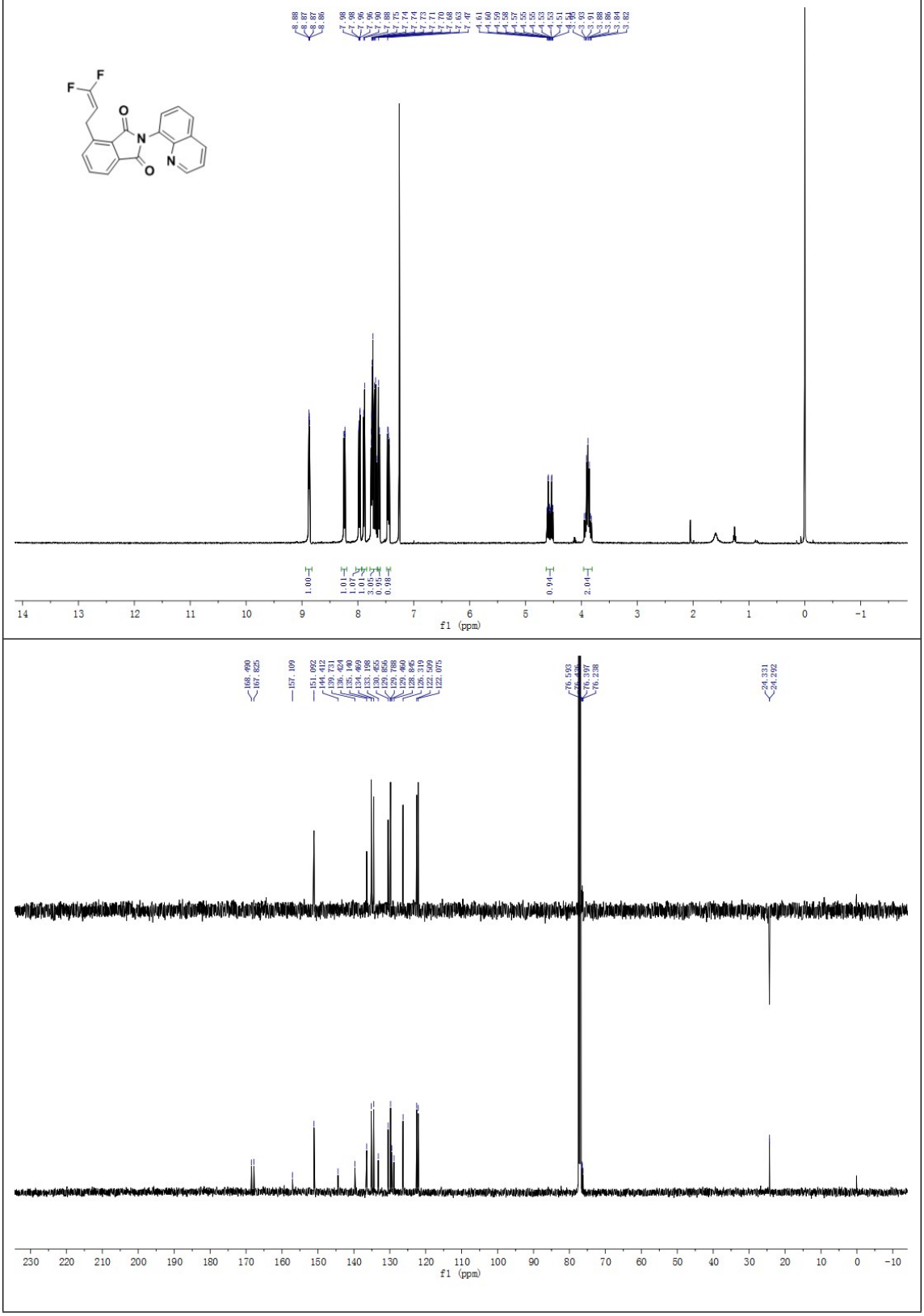
3-(3,3-Difluoroallyl)-*N*-(quinolin-8-yl)-[1,1'-biphenyl]-2-carboxamide (3h)



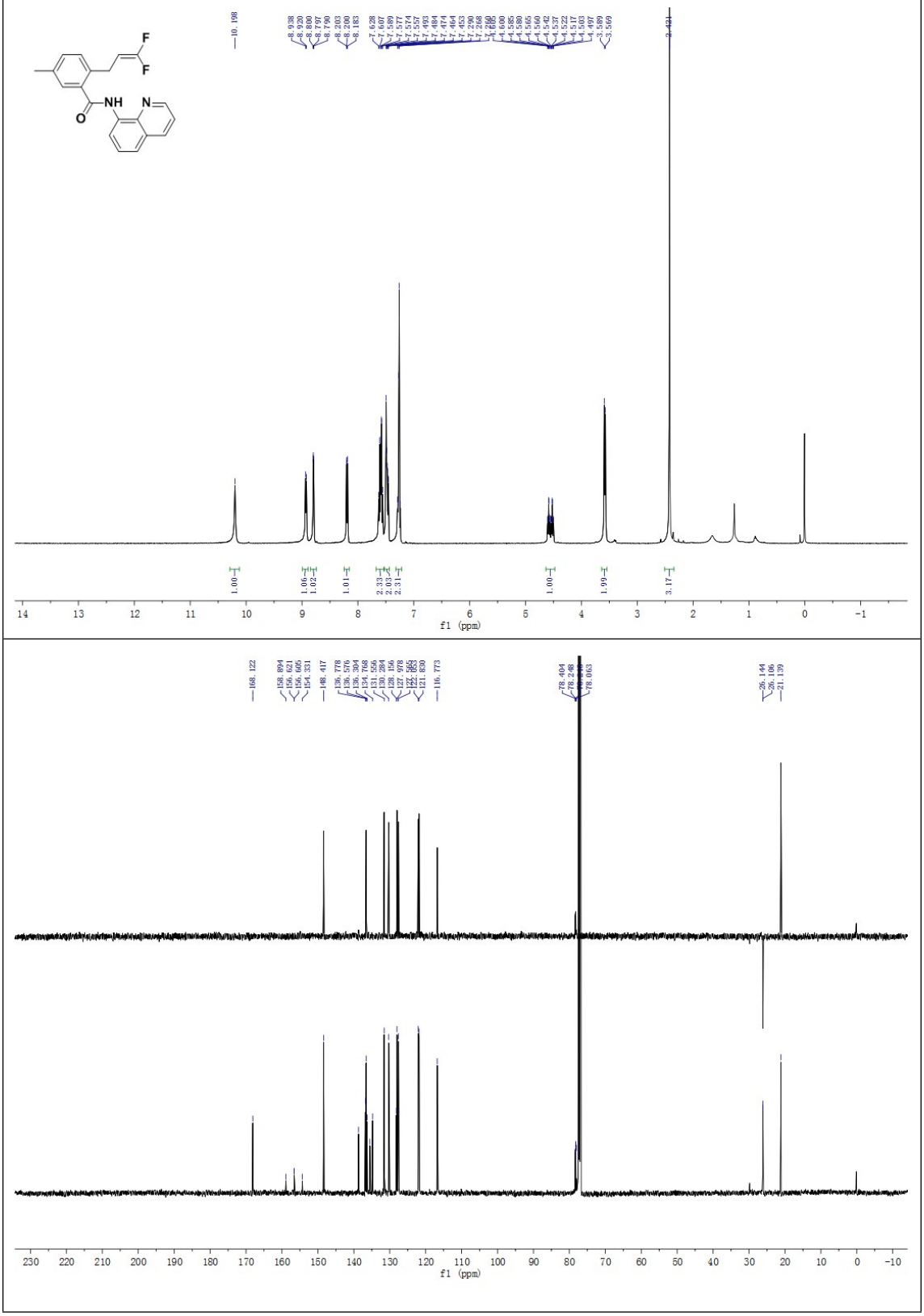
2-(3,3-Difluoroallyl)-*N*-(quinolin-8-yl)-1-naphthamide (3i)



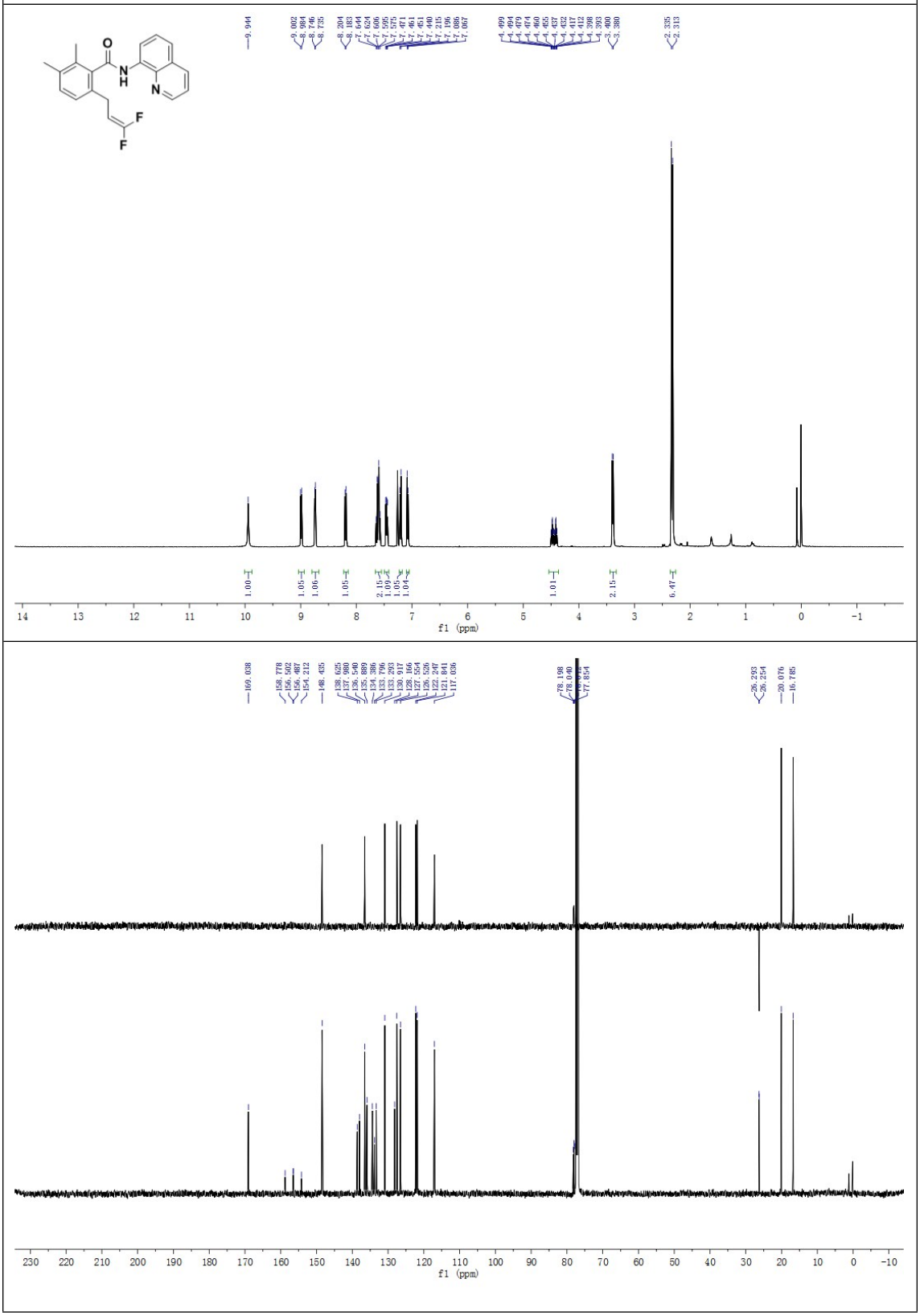
4-(3,3-Difluoroallyl)-2-(quinolin-8-yl)isoindoline-1,3-dione (3j)



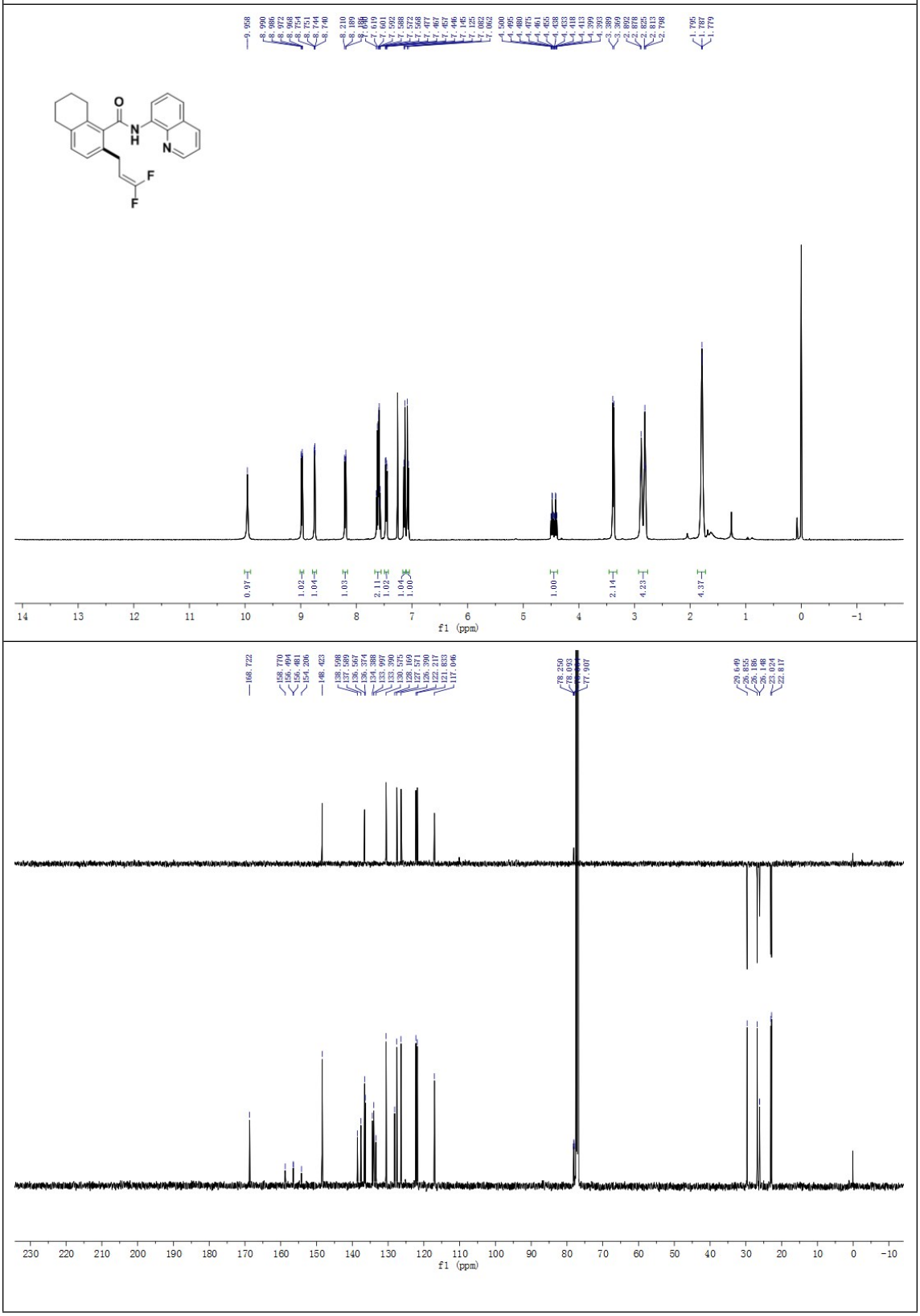
2-(3,3-Difluoroallyl)-5-methyl-*N*-(quinolin-8-yl)benzamide (3k)



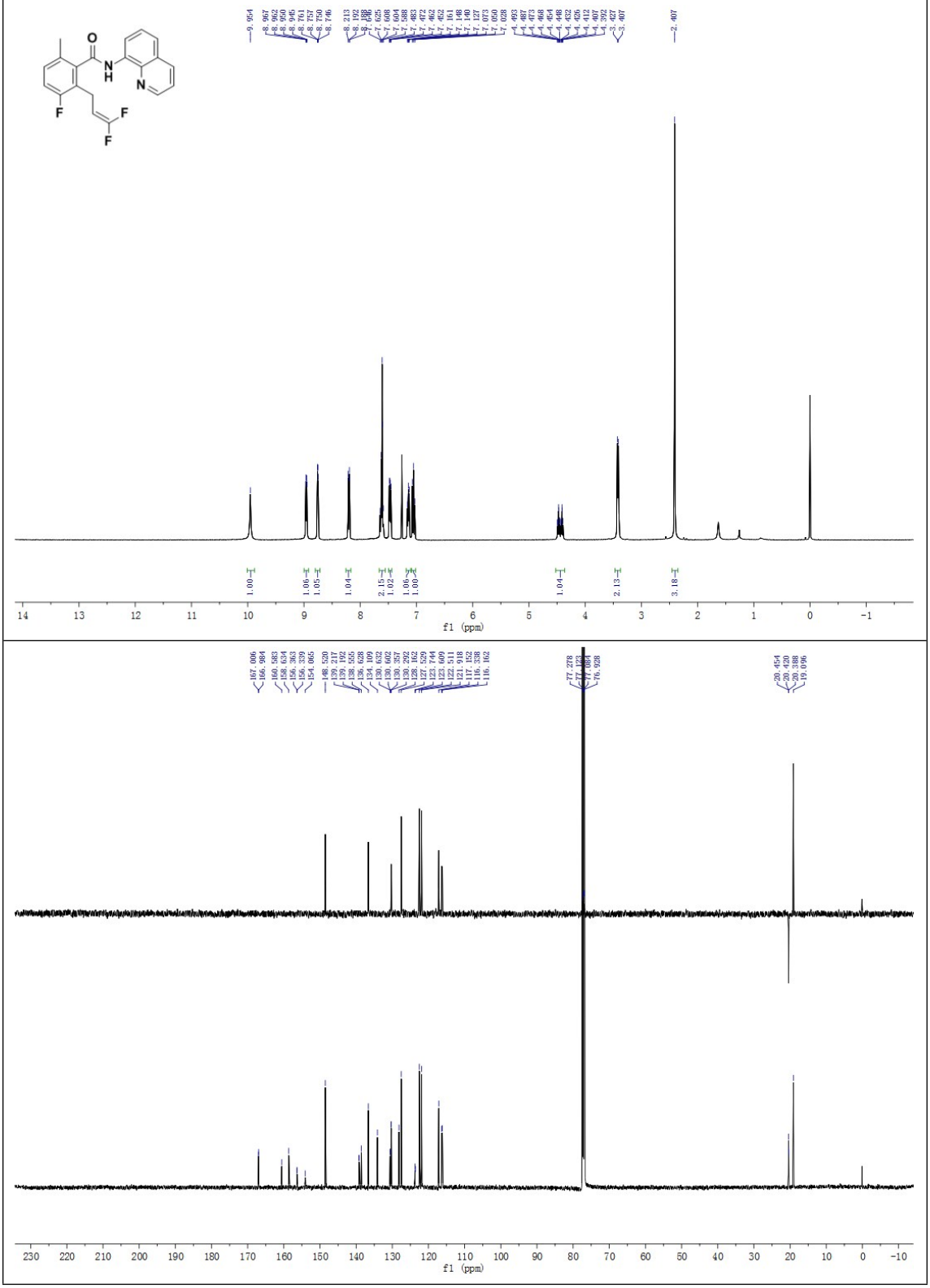
6-(3,3-Difluoroallyl)-2,3-dimethyl-*N*-(quinolin-8-yl)benzamide (3l)



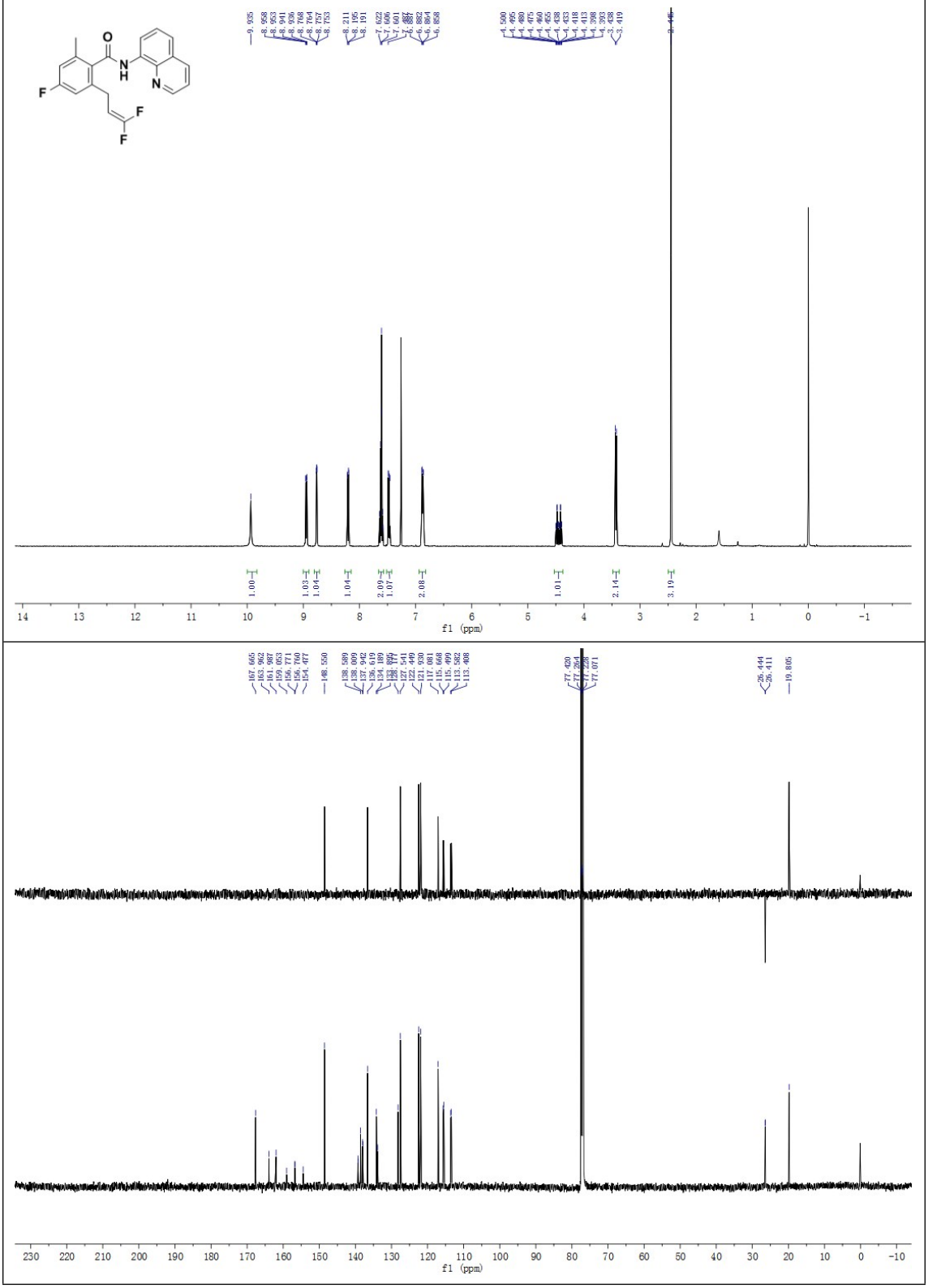
2-(3,3-Difluoroallyl)-*N*-(quinolin-8-yl)-5,6,7,8-tetrahydronaphthalene-1-carboxamide (3m)



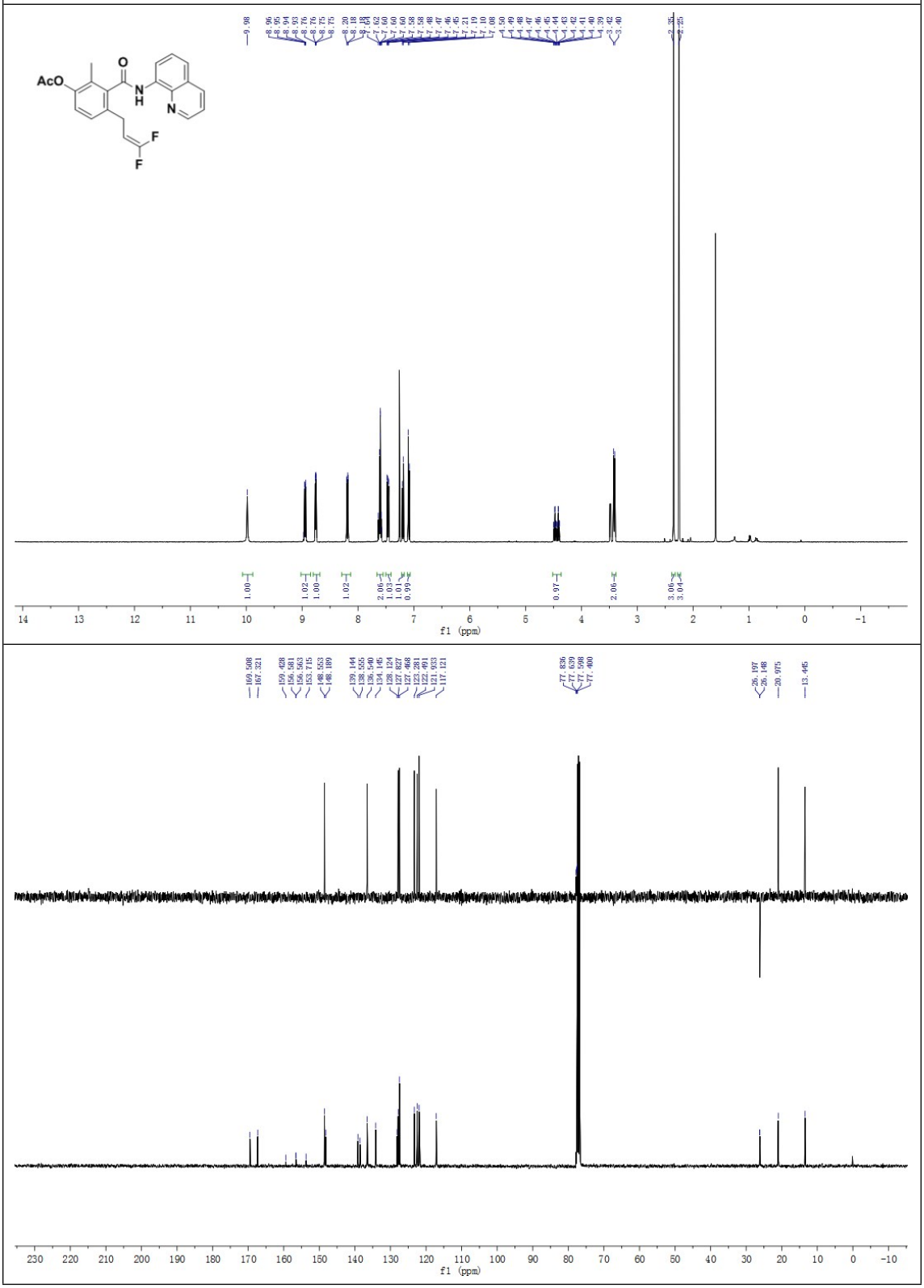
2-(3,3-Difluoroallyl)-3-fluoro-6-methyl-*N*-(quinolin-8-yl)benzamide (3n)



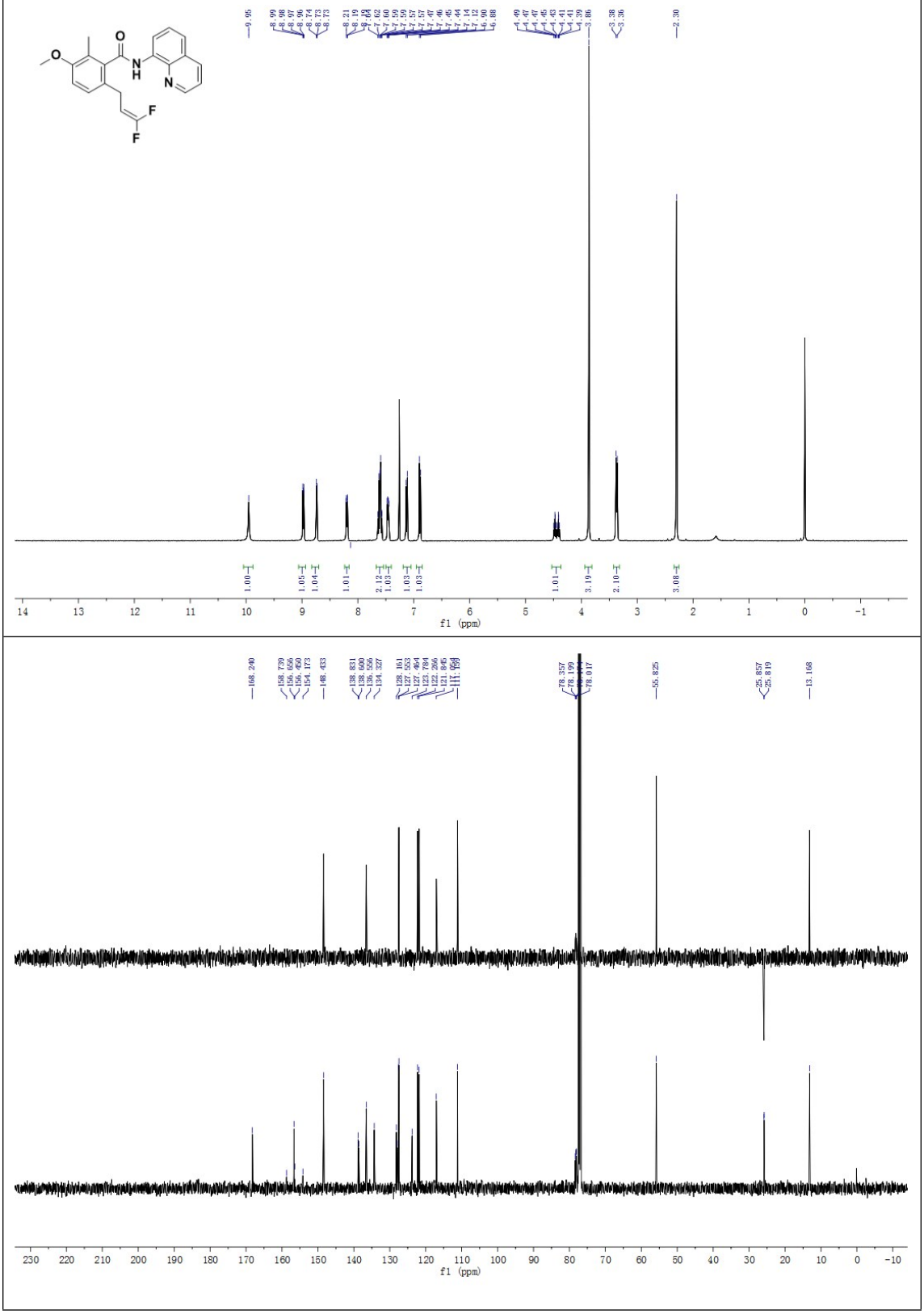
2-(3,3-Difluoroallyl)-4-fluoro-6-methyl-*N*-(quinolin-8-yl)benzamide (3o)



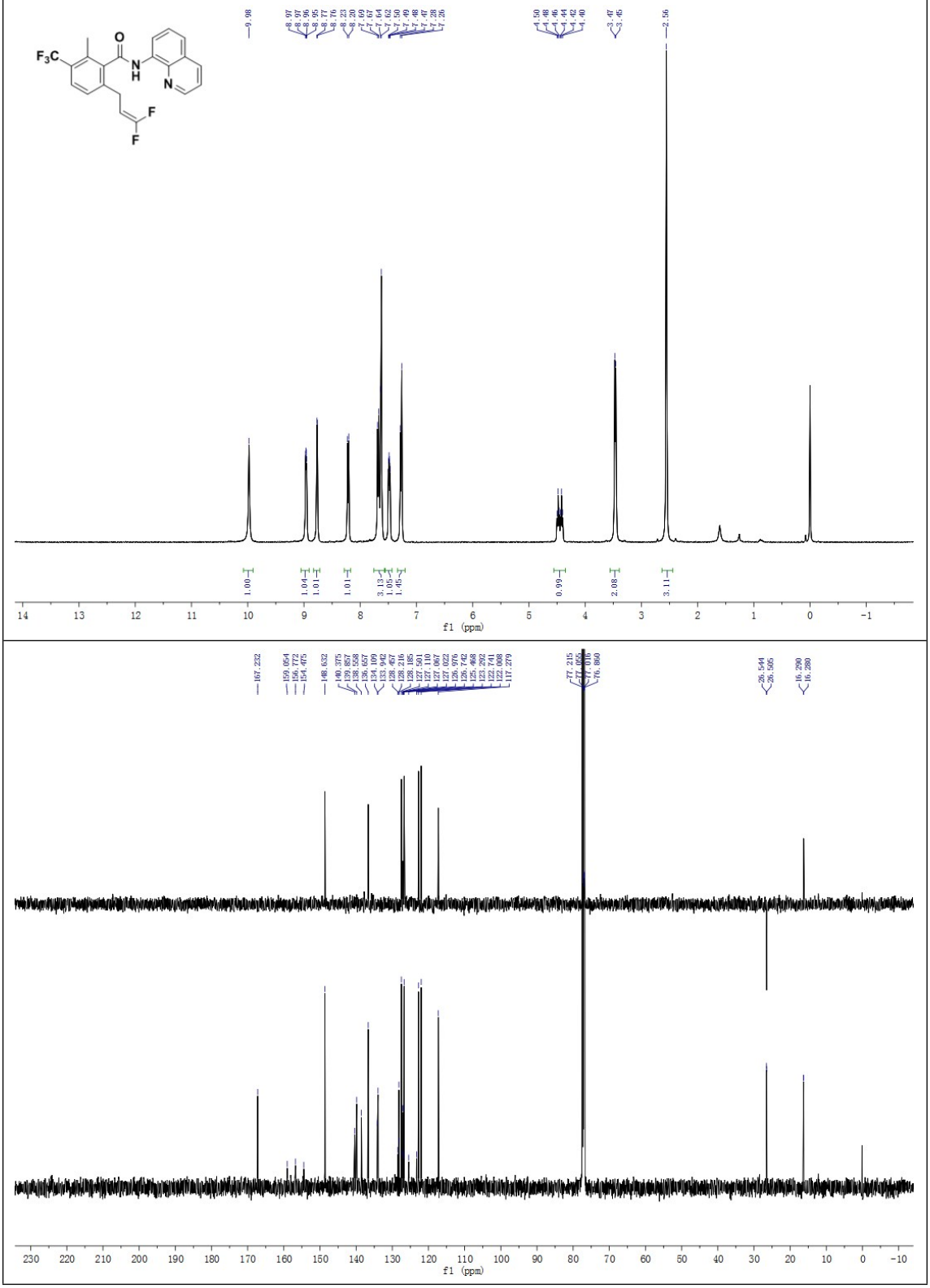
4-(3,3-Difluoroallyl)-2-methyl-3-(quinolin-8-ylcarbamoyl)phenyl acetate (3p)



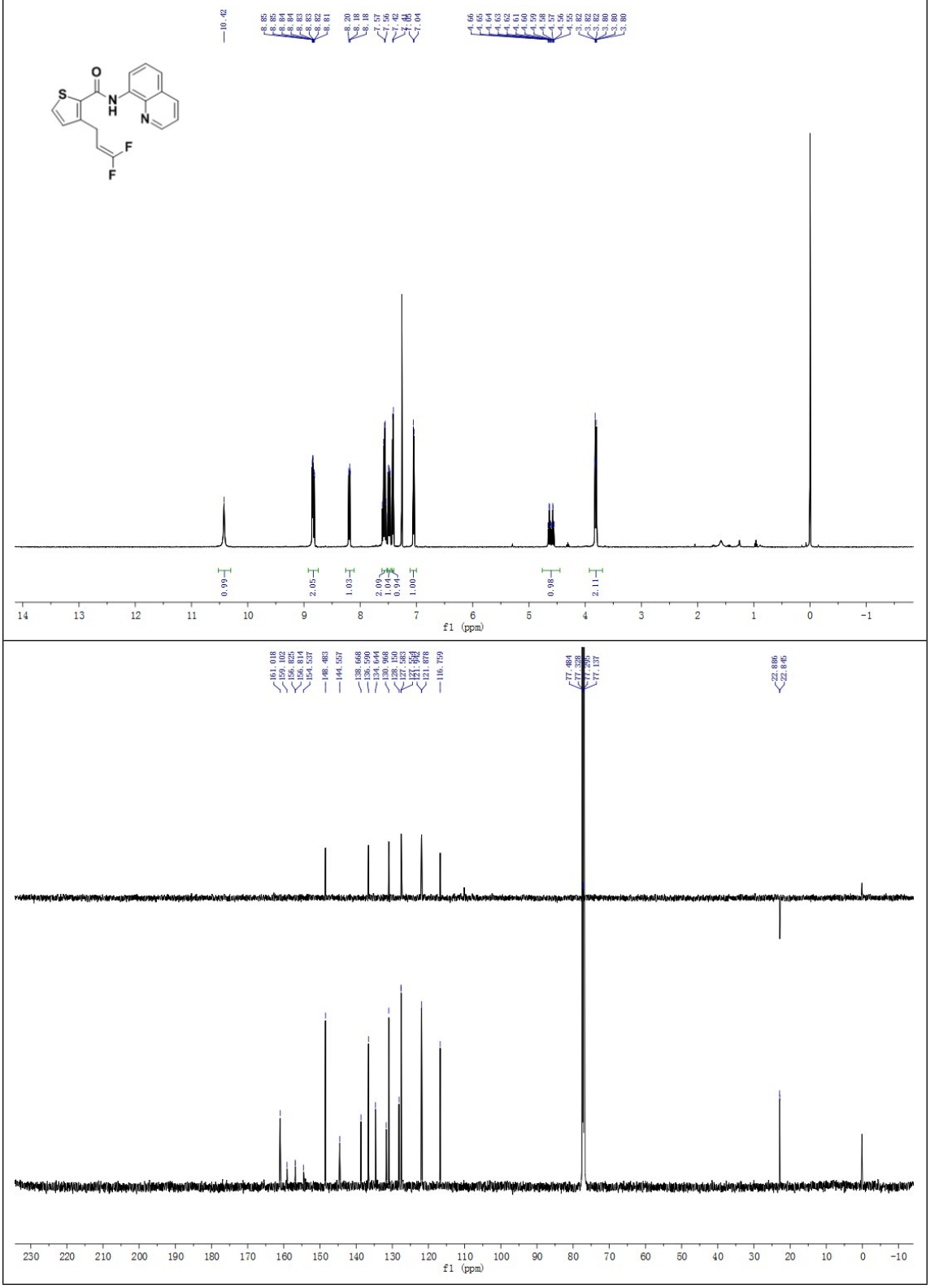
6-(3,3-Difluoroallyl)-3-methoxy-2-methyl-*N*-(quinolin-8-yl)benzamide (3q)



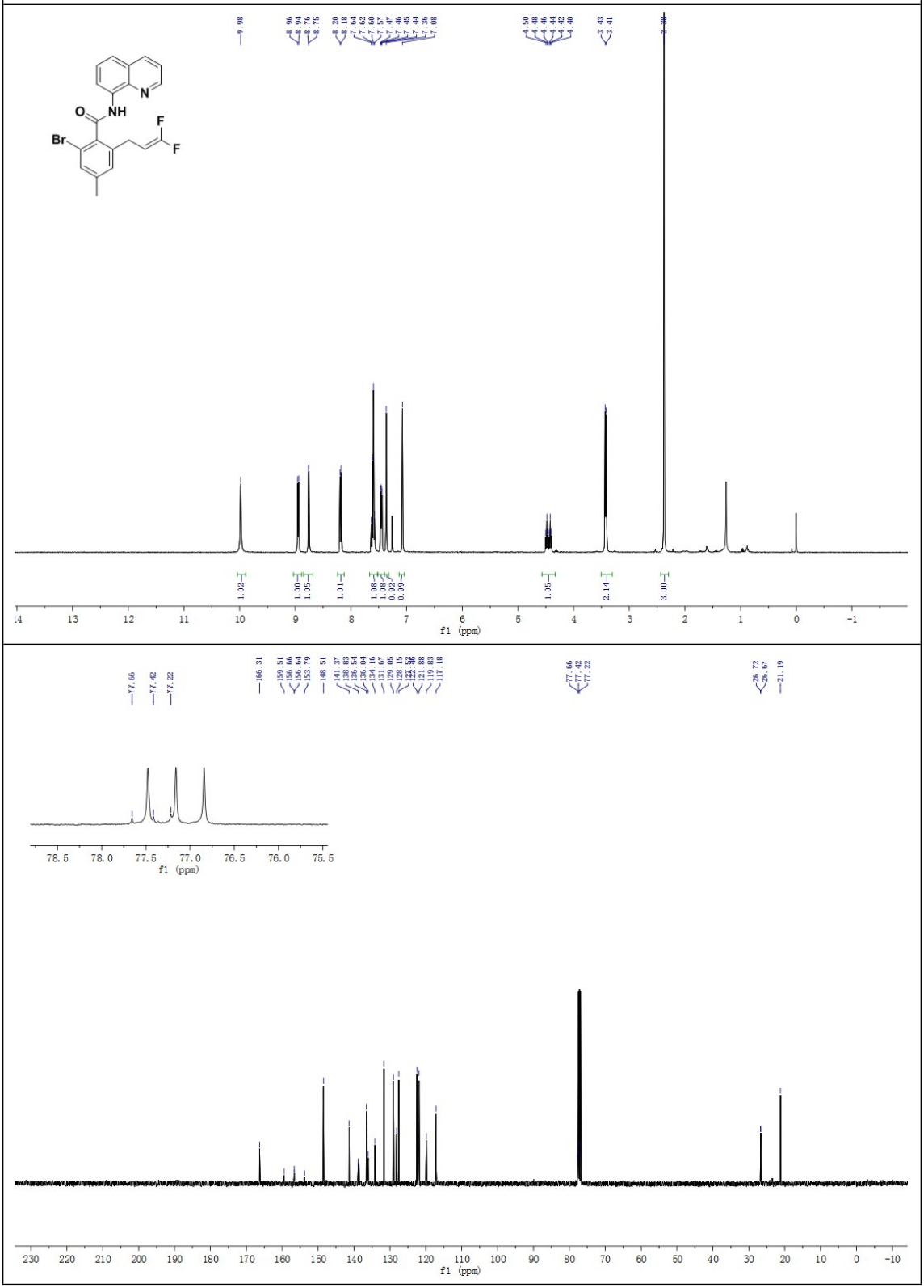
6-(3,3-Difluoroallyl)-2-methyl-*N*-(quinolin-8-yl)-3-(trifluoromethyl)benzamide (3r)



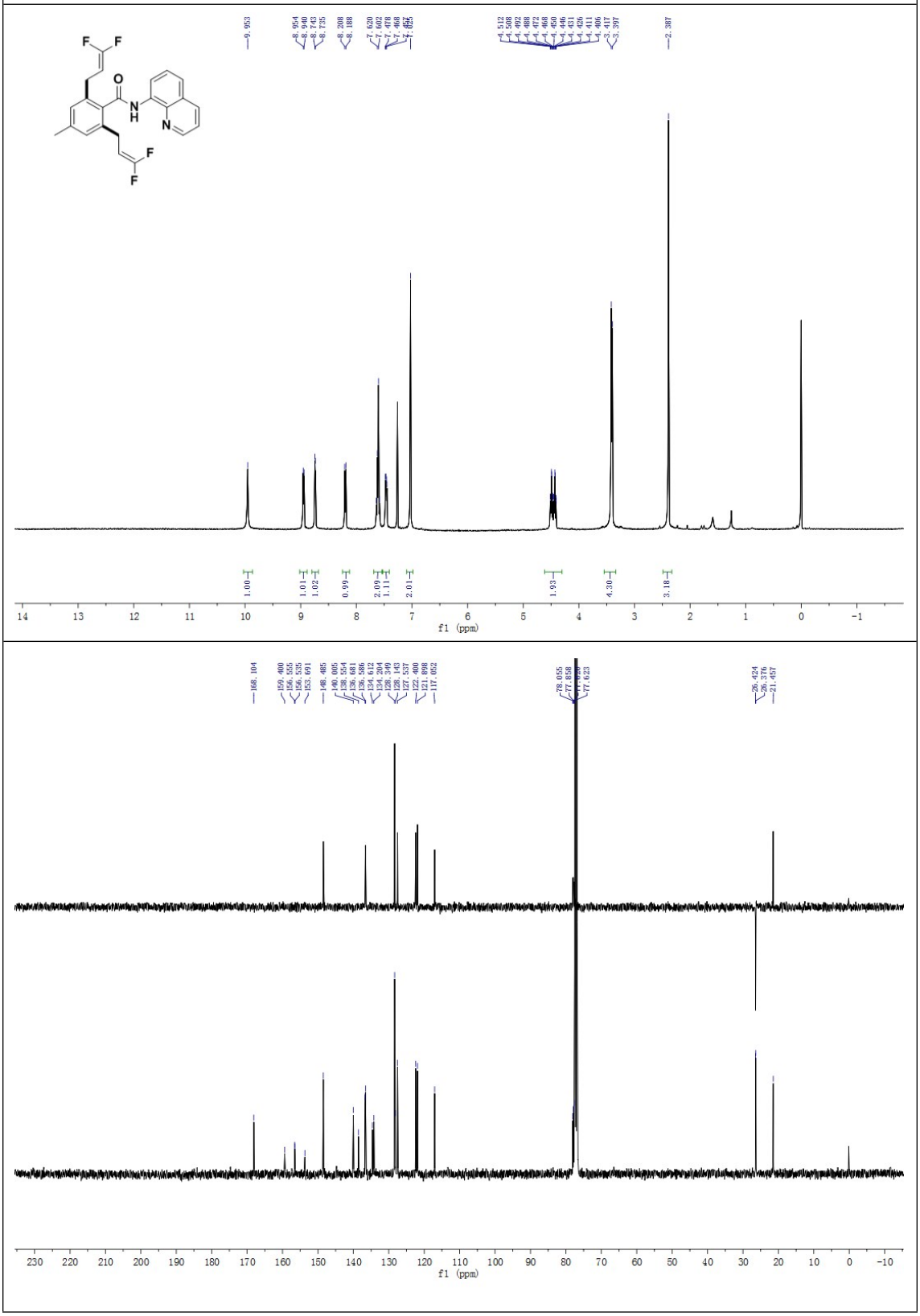
3-(3,3-Difluoroallyl)-*N*-(quinolin-8-yl)thiophene-2-carboxamide (3s)



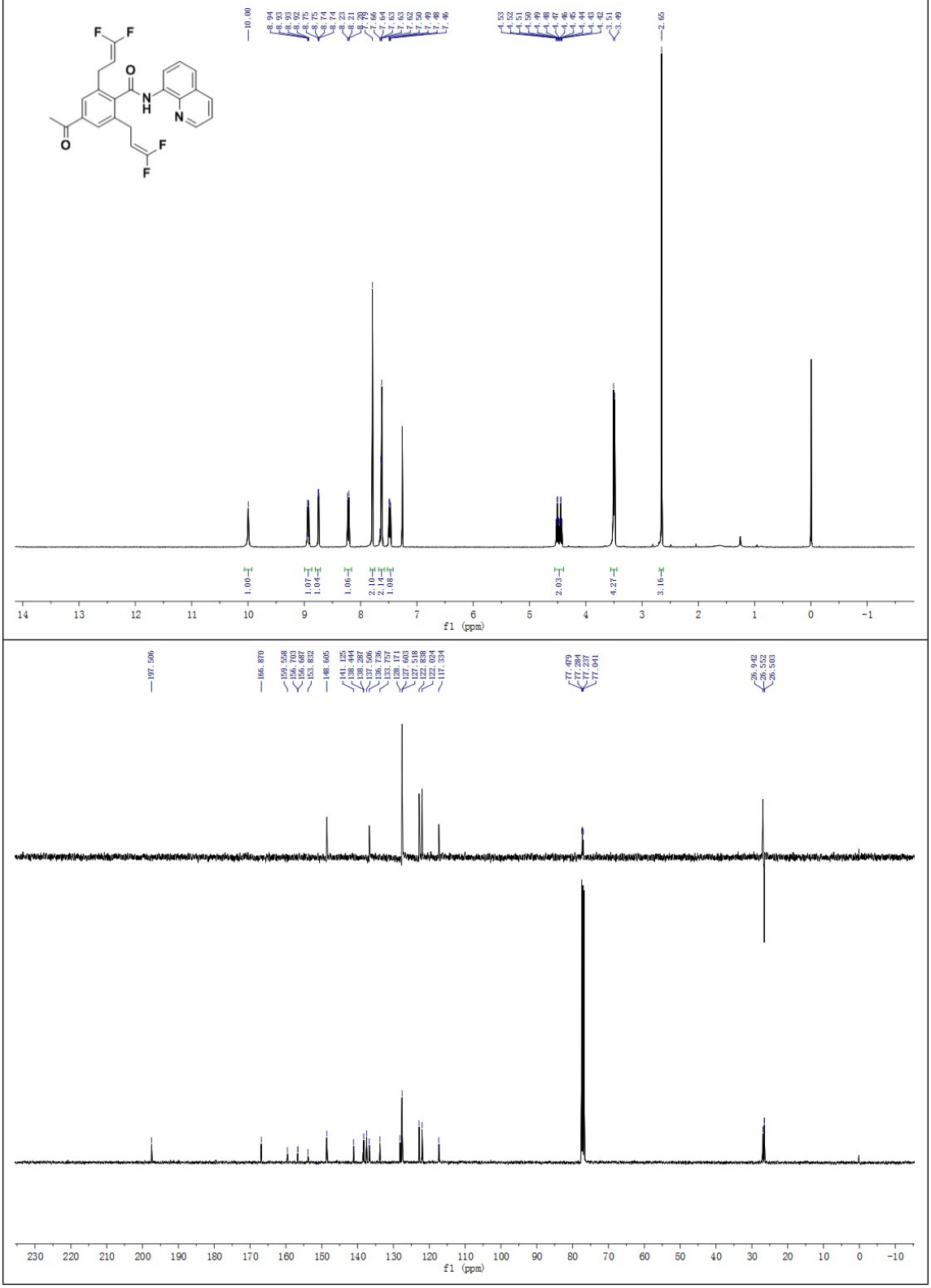
2-Bromo-6-(3,3-difluoroallyl)-4-methyl-*N*-(quinolin-8-yl)benzamide (3t)



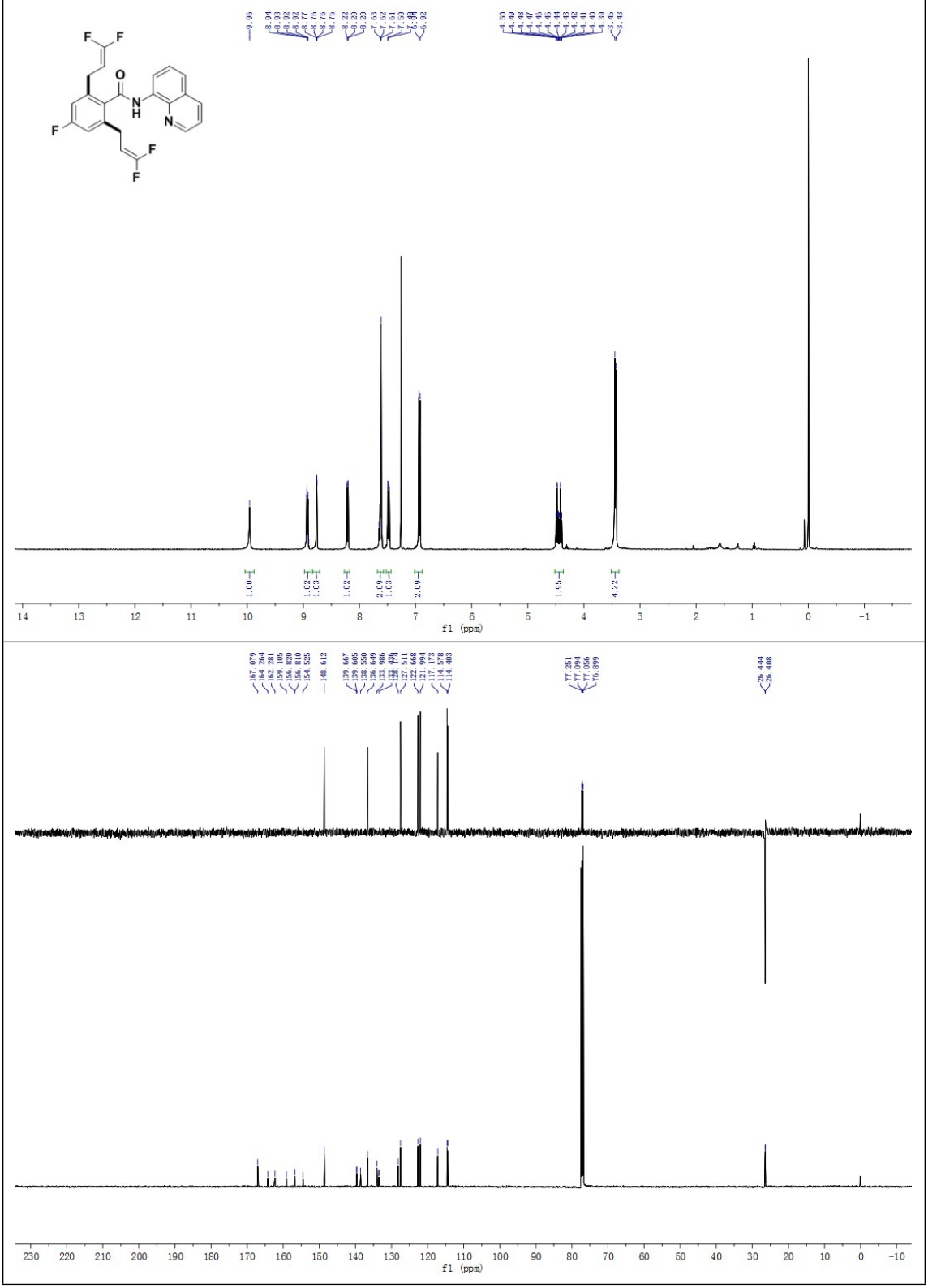
2,6-Bis(3,3-difluoroallyl)-4-methyl-*N*-(quinolin-8-yl)benzamide (3aa)



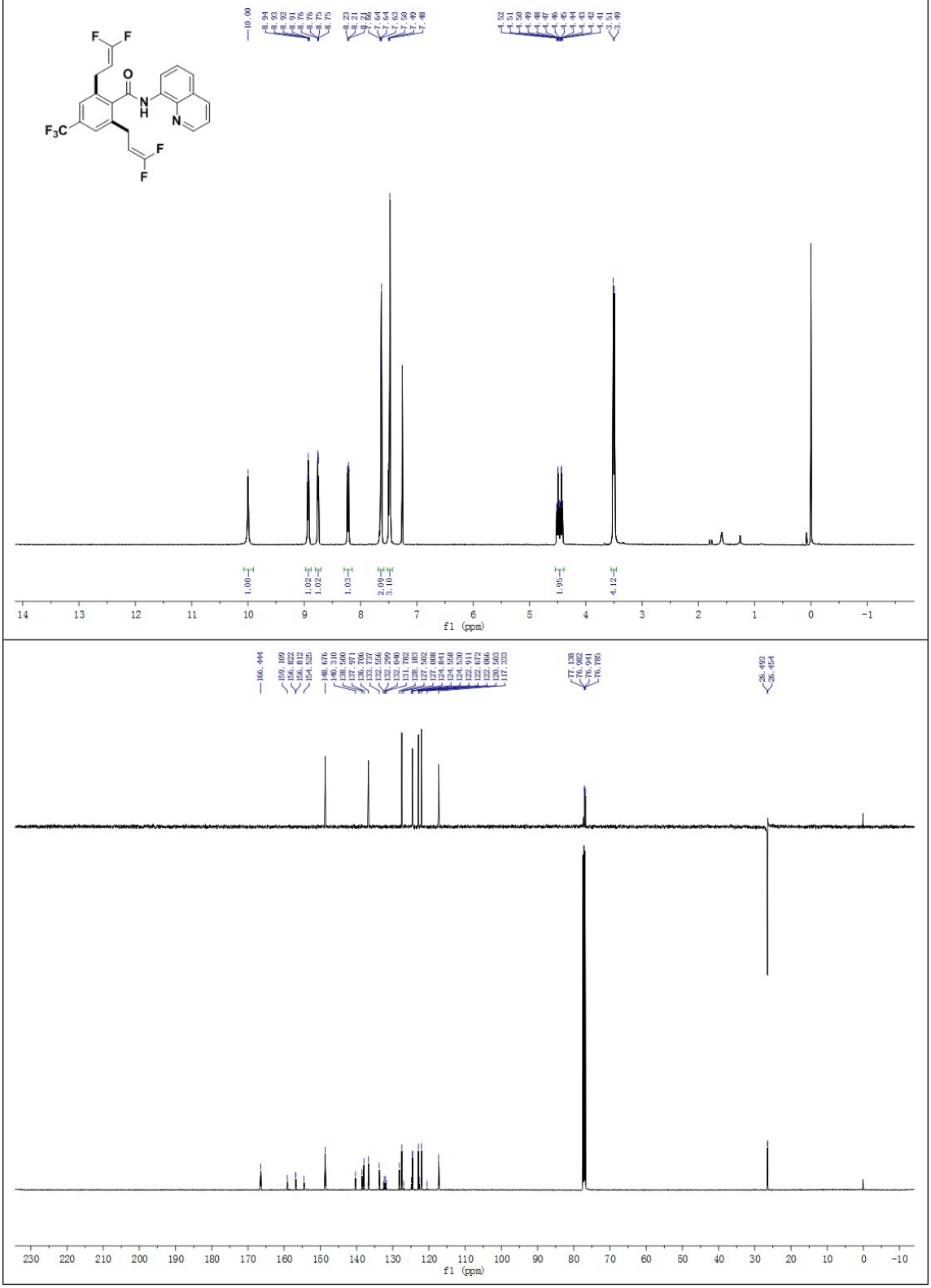
4-Acetyl-2,6-bis(3,3-difluoroallyl)-*N*-(quinolin-8-yl)benzamide (3ab)



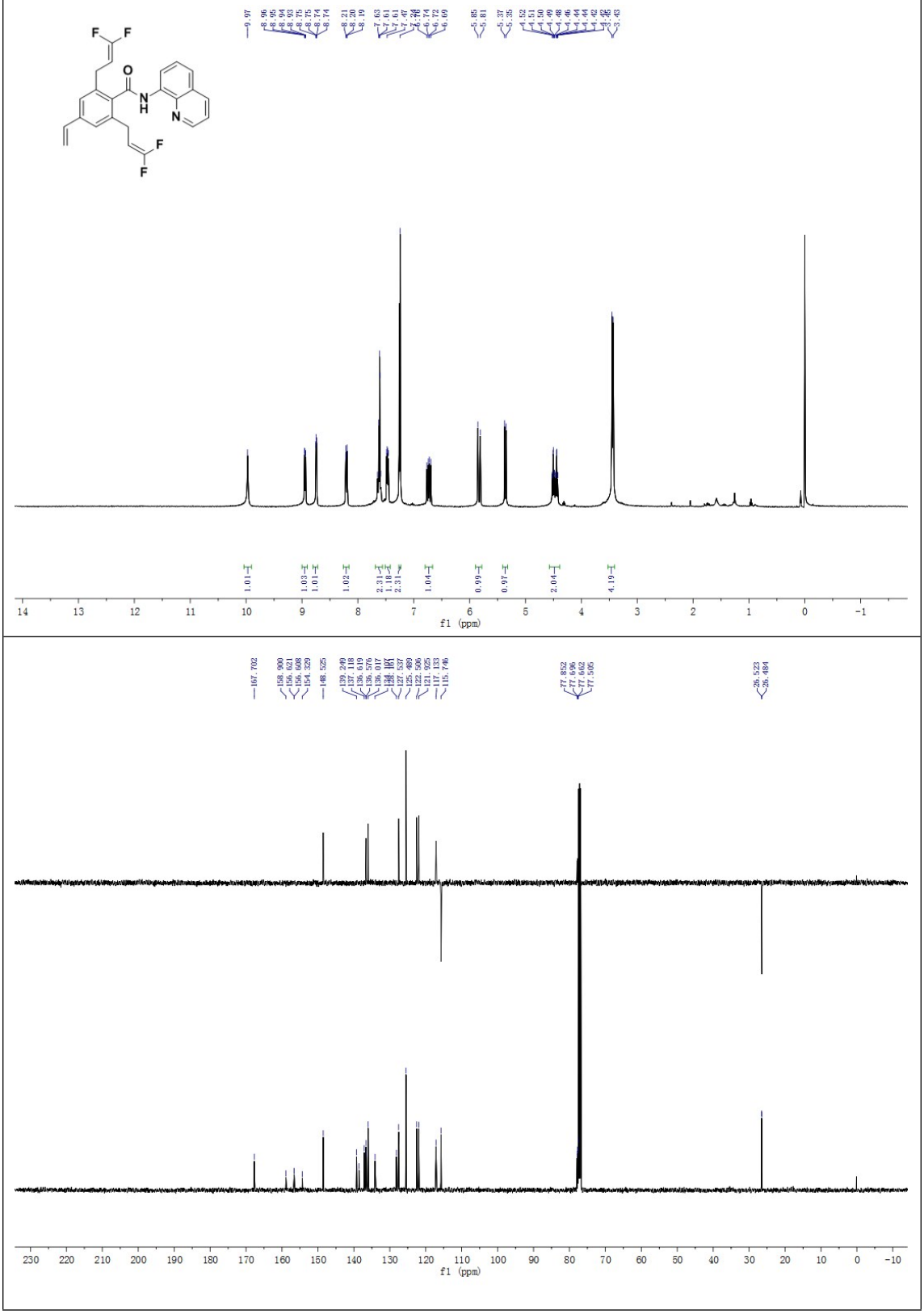
2,6-Bis(3,3-difluoroallyl)-4-fluoro-*N*-(quinolin-8-yl)benzamide (3ac)



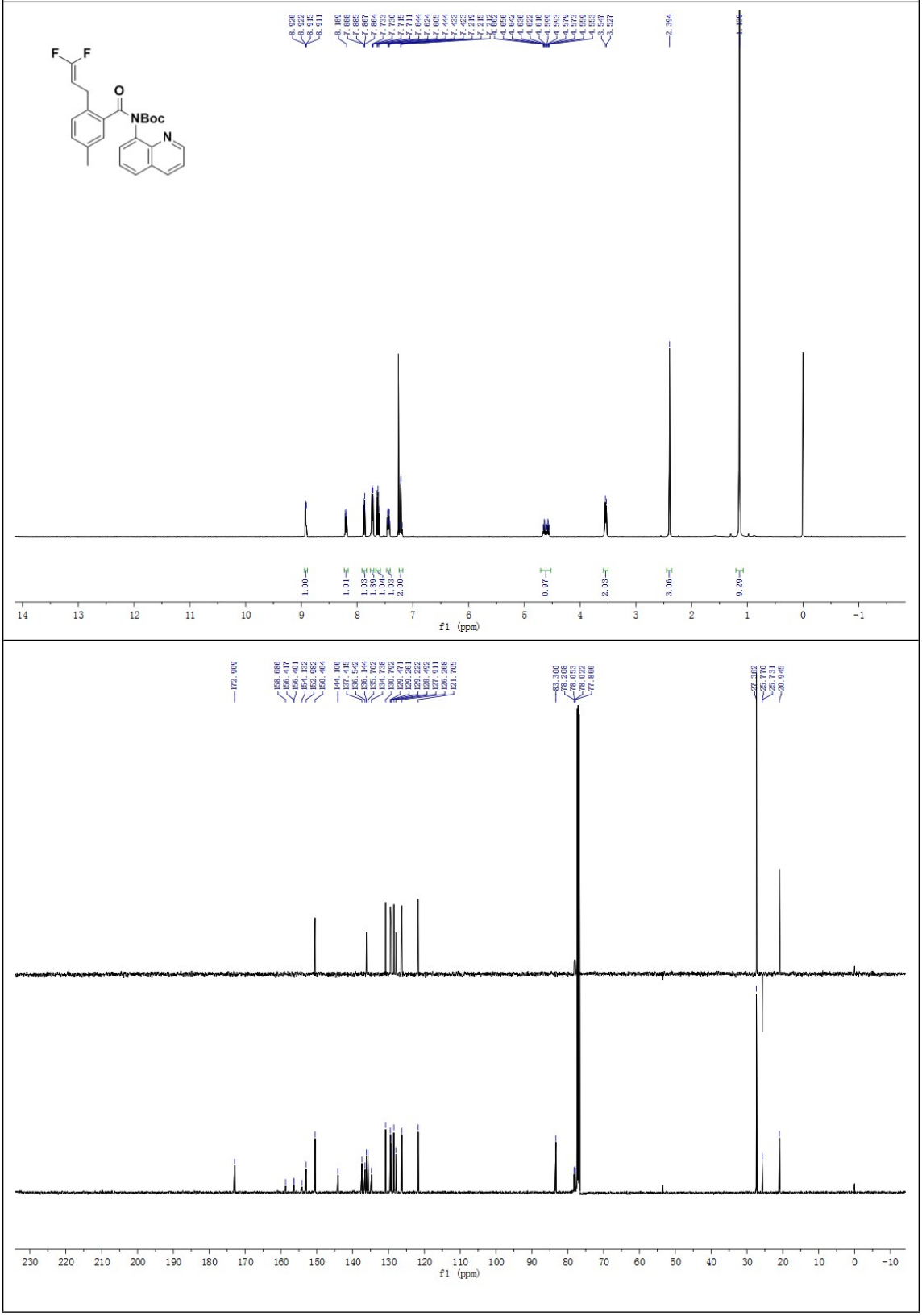
2,6-Bis(3,3-difluoroallyl)-*N*-(quinolin-8-yl)-4-(trifluoromethyl)benzamide (3ad)



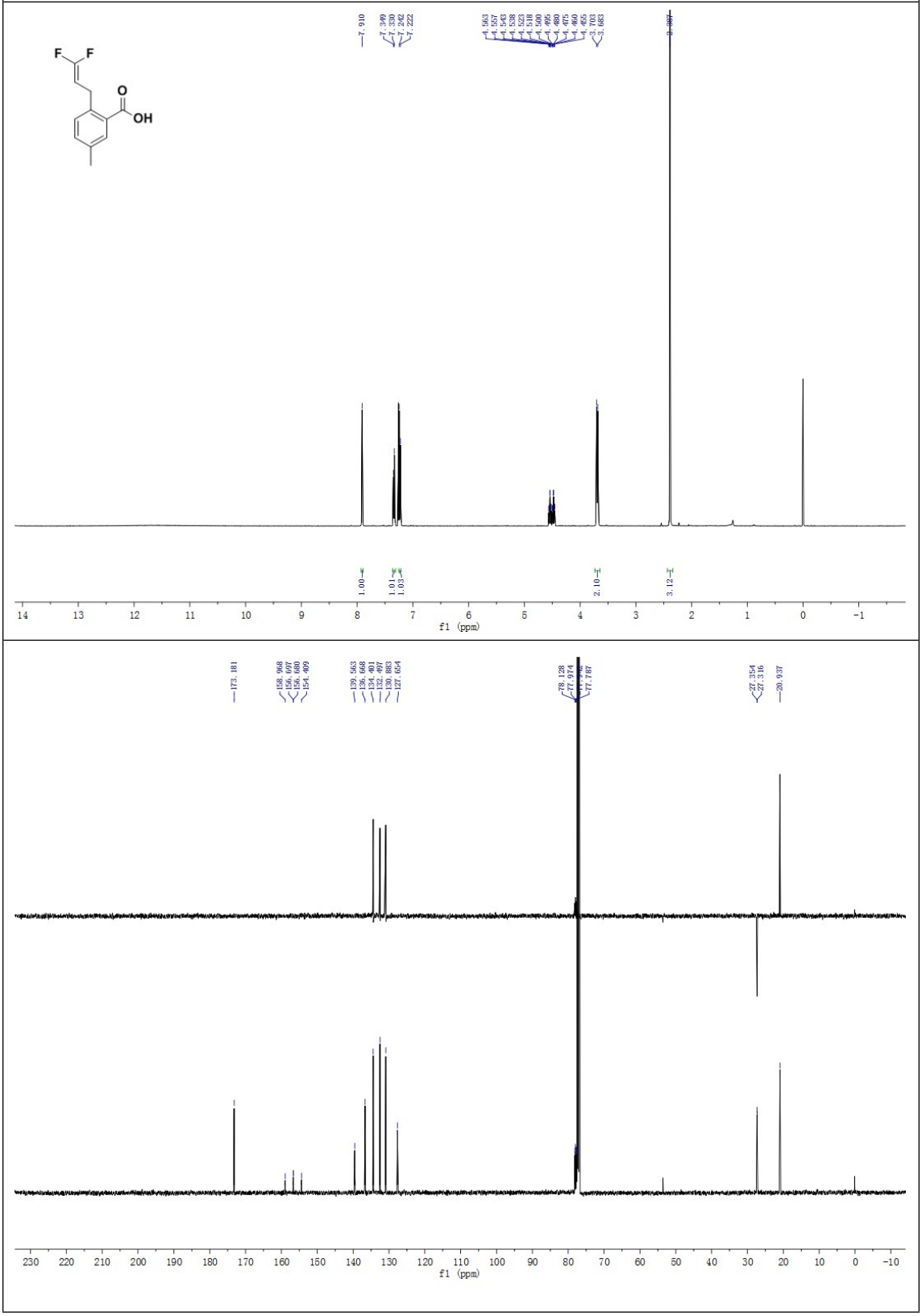
2,6-Bis(3,3-difluoroallyl)-*N*-(quinolin-8-yl)-4-vinylbenzamide (3ae)



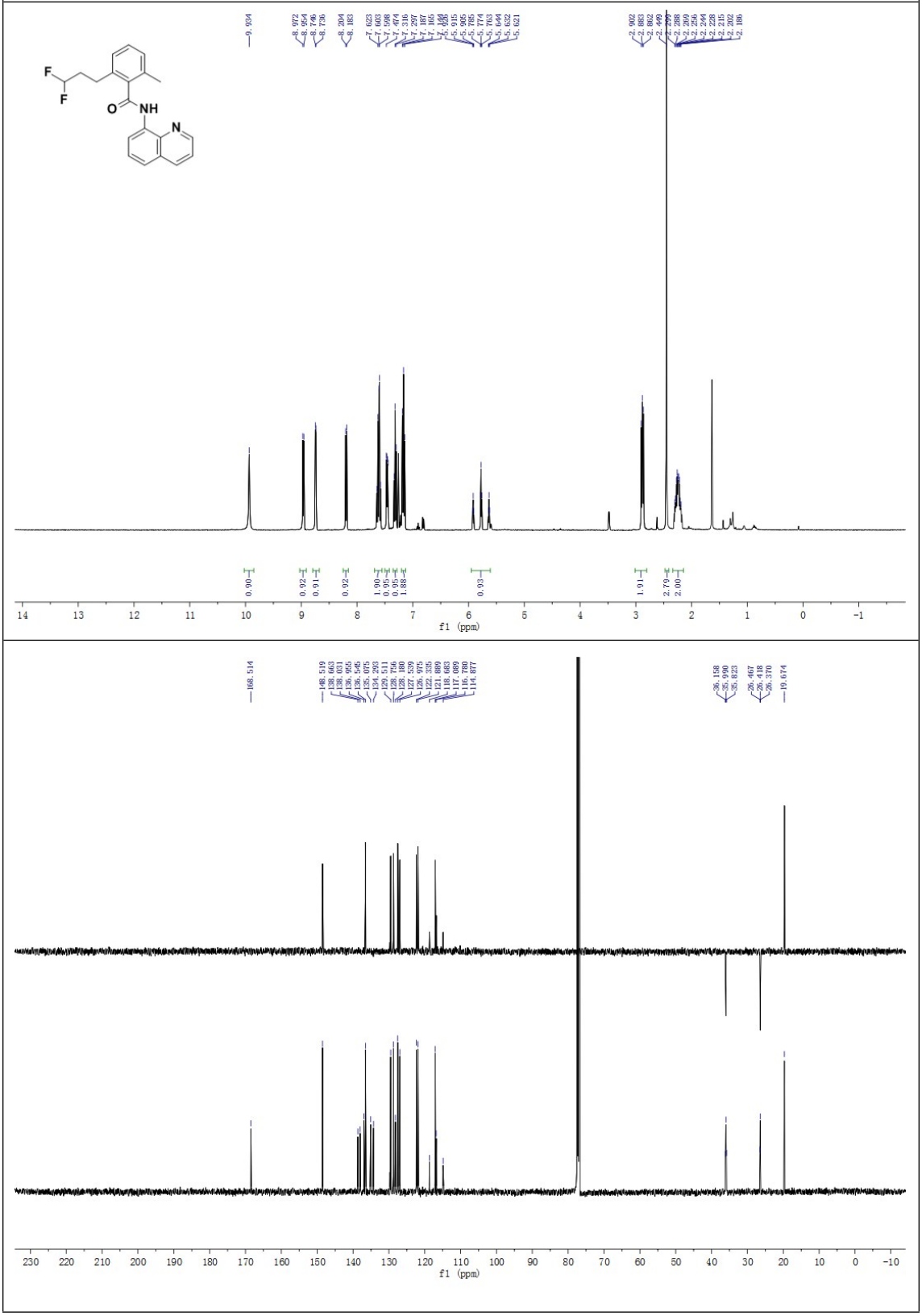
tert-Butyl (2-(3,3-difluoroallyl)-5-methylbenzoyl)(quinolin-8-yl)carbamate (4)



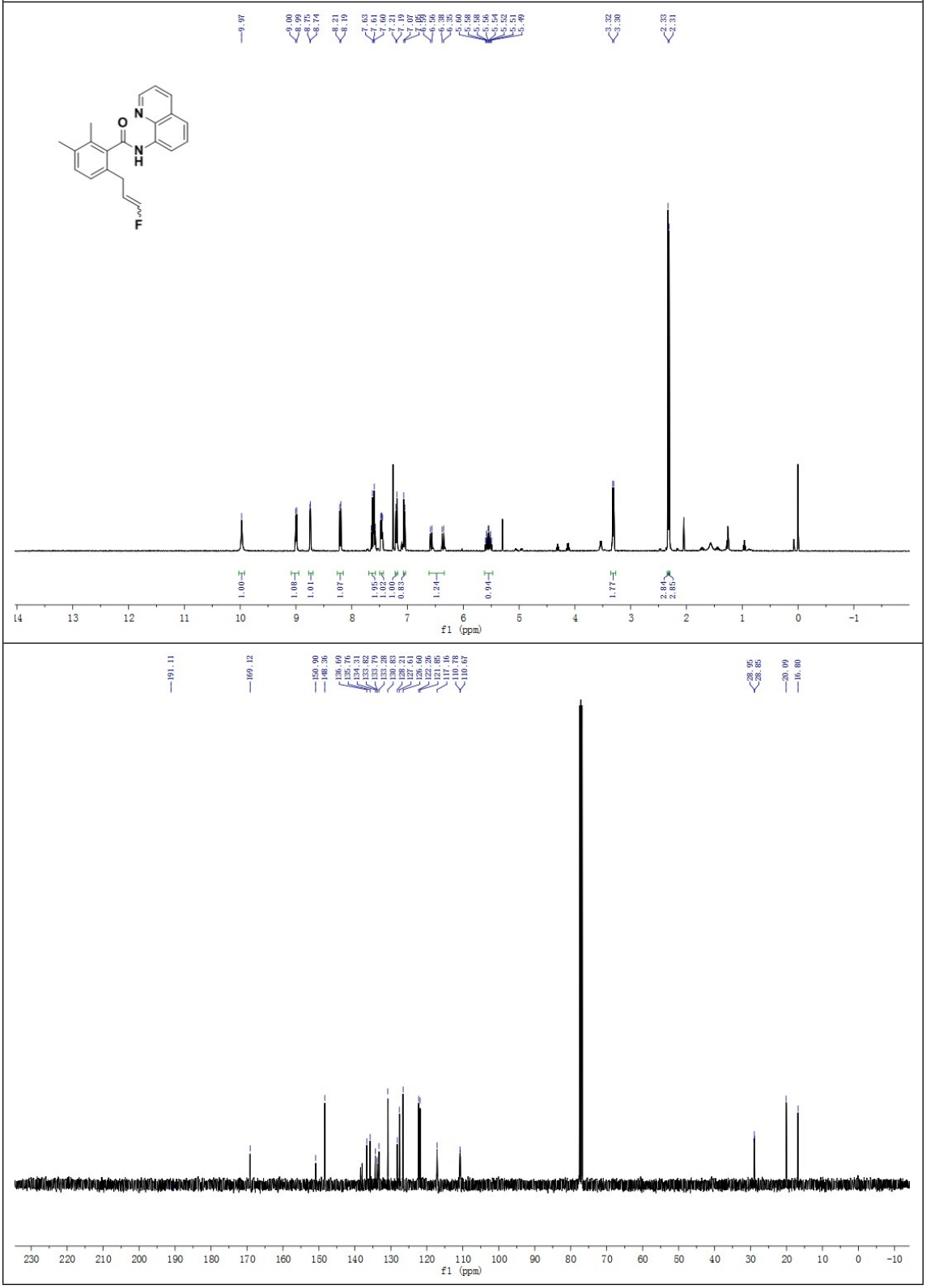
2-(3,3-Difluoroallyl)-5-methylbenzoic acid (5)



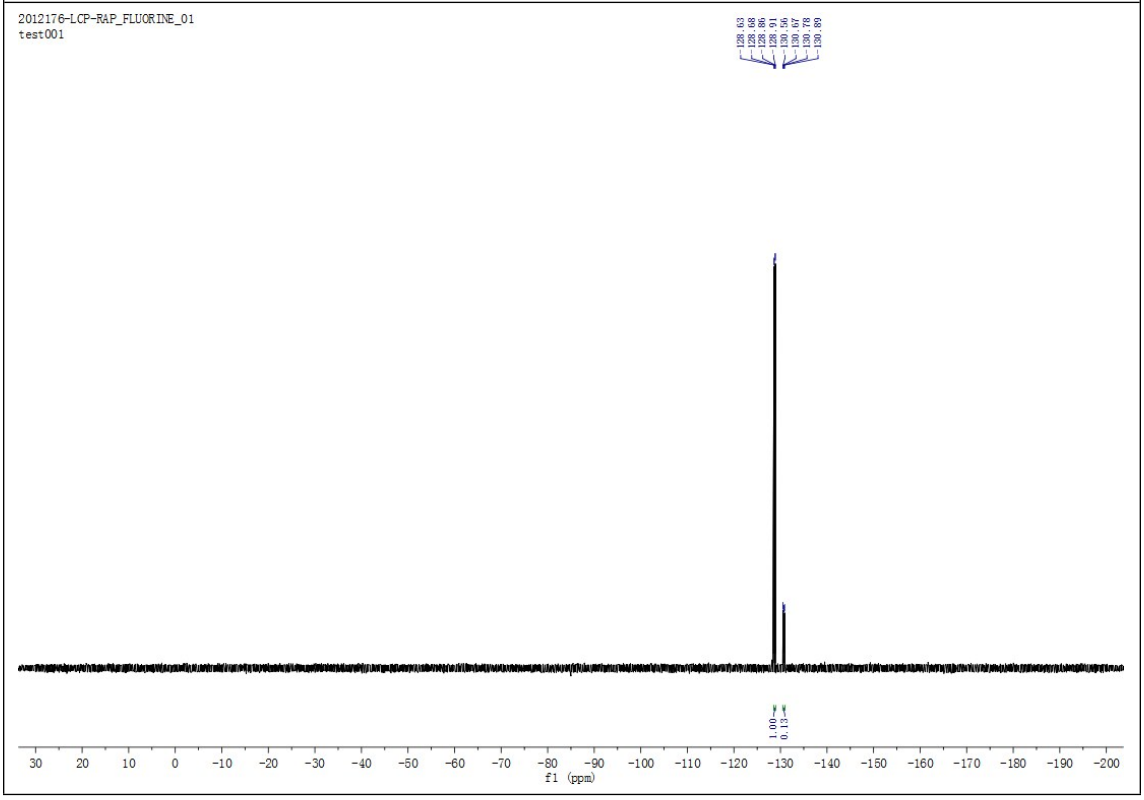
2-(3,3-Difluoropropyl)-6-methyl-*N*-(quinolin-8-yl)benzamide (6)



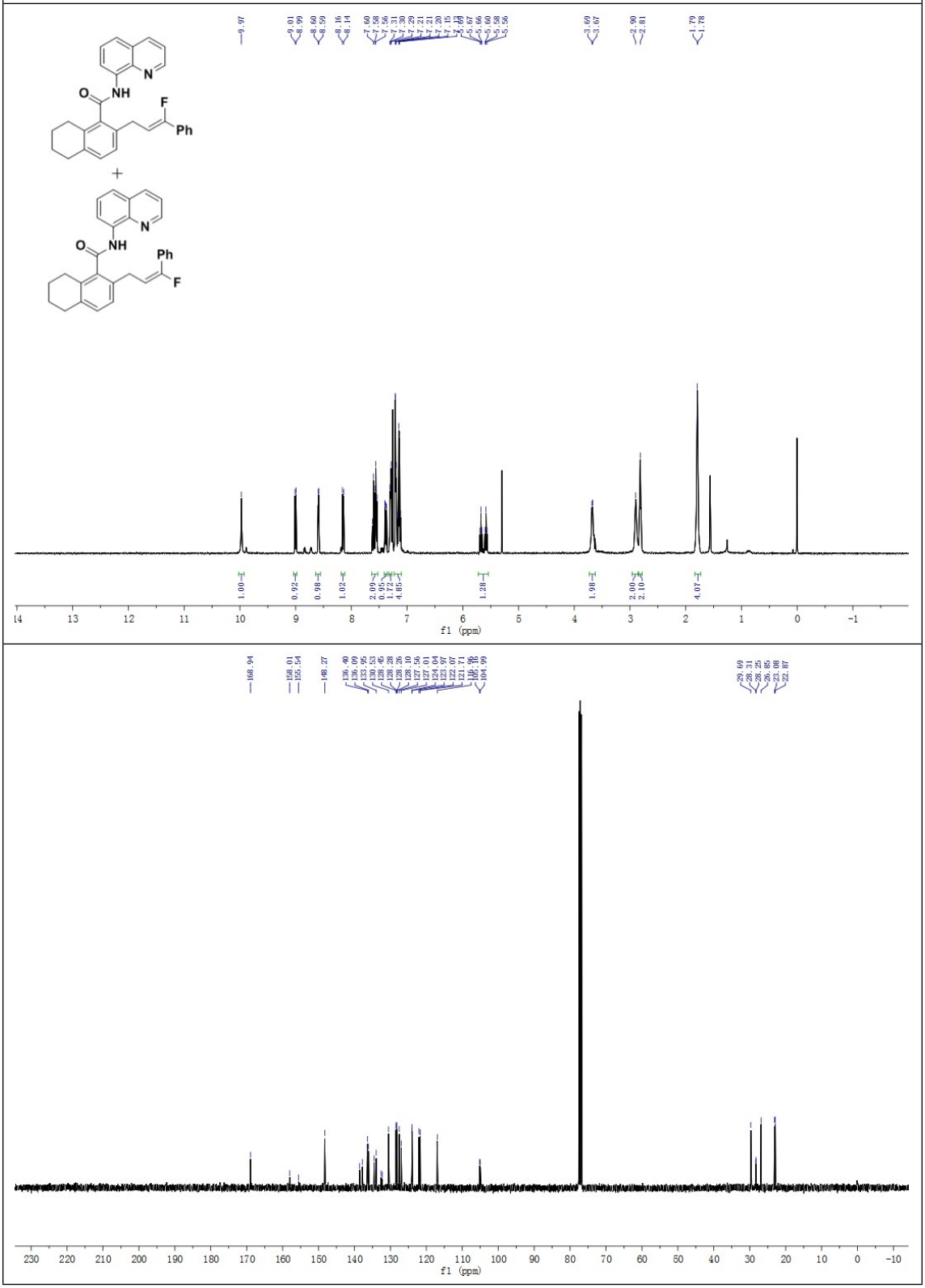
6-(3-Fluoroallyl)-2,3-dimethyl-N-(quinolin-8-yl)benzamide (7)



^{19}F NMR 6-(3-Fluoroallyl)-2,3-dimethyl-N-(quinolin-8-yl)benzamide (7)



2-(3-fluoro-3-phenylallyl)-N-(quinolin-8-yl)-5,6,7,8-tetrahydronaphthalene-1-carboxamide (8)



^{19}F NMR 2-(3-fluoro-3-phenylallyl)-N-(quinolin-8-yl)-5,6,7,8-tetrahydronaphthalene-1-carboxamide (8)