

Supporting Information

Palladium-Catalyzed Ring-Opening Defluorination of *gem*-Difluorocyclopropanes: Expedient Synthesis of Fluorinated 1,3-Dienes and Arenes

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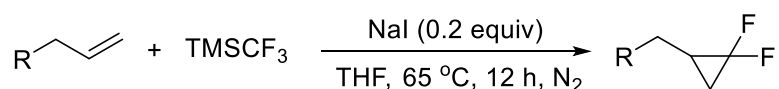
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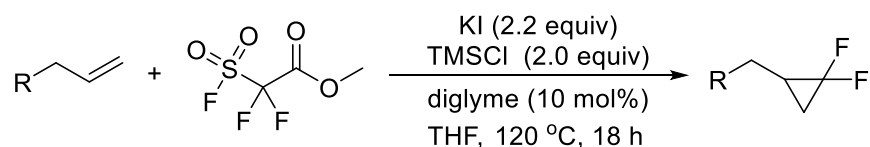
1. General information

^1H NMR spectra were recorded on Bruker 400 or 600 MHz spectrometer and the chemical shifts were reported in parts per million (δ) relative to internal standard TMS (0 ppm) for CDCl_3 . The peak patterns are indicated as follows: s, singlet; d, doublet; dd, doublet of doublet; t, triplet; m, multiplet; q, quartet. The coupling constants, J , are reported in Hertz (Hz). ^{13}C NMR spectra were obtained at Bruker 100 MHz or 150 MHz and referenced to the internal solvent signals (central peak is 77.0 ppm in CDCl_3). ^{19}F NMR spectra were obtained at Bruker 565 MHz and referenced to CFCl_3 ($\delta = 0$ ppm). CDCl_3 was used as the NMR solvent. High-resolution mass spectra (HRMS) were acquired on Thermo Q-Exactive instrument (quadrupole mass analyzer) using atmospheric pressure chemical ionization source (APCI) and electron spray ionization source (ESI). Flash column chromatography was performed over silica gel 200-300. All chemical reagents were purchased from Alfa, Aldrich, TCI, Innochem and J&K and used without further purification.

2. Synthesis of alkyl-substituted *gem*-difluorocyclopropanes 1 and 4



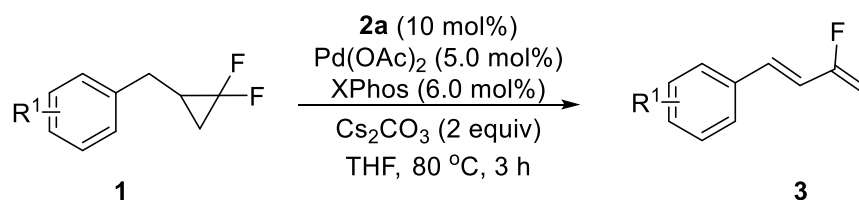
The *gem*-difluorocyclopropanes (**1a**, **1b**, **1m**, **4a**, **4c**, **4d**) were prepared according to the known procedure.^[1-3] A flame-dried reaction tube (50.0 mL) equipped with a magnetic stir bar was charged with anhydrous NaI (0.2 equiv), dry THF (10.0 mL), TMSCF₃ (2.5 equiv) and corresponding alkenes (1.0 mmol) under nitrogen atmosphere. The reaction tube was sealed with Teflon septum and stirred at 65 °C for 12 h. After the mixture was cooled to room temperature, the resulting solution was directly filtered through a pad of celite, and then evaporated to dryness under reduce pressure. The crude mixture was extracted with DCM (20.0 mL), washed with saturated Na₂S₂O₃ (10.0 mL) and brine (10.0 mL). The organic layer was dried over Na₂SO₄, filtered and concentrated, the residue was purified by column chromatography on silica gel to give the pure corresponding *gem*-difluorocyclopropanes.^[1-3]



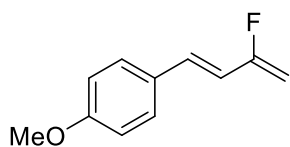
The *gem*-difluorocyclopropanes (**1c-1l**, **4b**, **4e-4h**) were prepared according to the known procedure.^[4] A 100 mL three-necked, round-bottomed flask equipped with reflux condenser, rubber septum, and a magnetic stir bar was flame-dried under a nitrogen atmosphere. Then oven-dried potassium iodide (2.2 equiv) was added, and the flask allowed to cool to room temperature. A nitrogen

atmosphere was maintained until the end of the reaction *via* a slow N₂ flow through a tube attached above the reflux condenser. Using a syringe, the alkene substrate (1.0 mmol, 1.0 equiv), THF (5.0 mL) and diglyme (0.1 mmol, 10 mol%) were added in that order via injection through the rubber septum. The mixture was then heated by an oil bath maintained 120 °C. At this temperature, the trimethylsilyl chloride (2.0 mmol, 2.0 equiv) was added by syringe, followed by analogous addition of methyl 2,2-difluoro-2-(fluorosulfonyl)acetate (MDFA) (2.0 mmol, 2.0 equiv). The mixture was then stirred at 120 °C for 18 hours. After the mixture was cooled to room temperature, the resulting solution was directly filtered through a pad of celite, and then evaporated to dryness under reduce pressure. The crude mixture was extracted with ethyl acetate (20.0 mL) and brine (10.0 mL). The organic layer was dried over Na₂SO₄, filtered and concentrated, the residue was purified by column chromatography on silica gel to give the pure corresponding *gem*-difluorocyclopropanes.^[4]

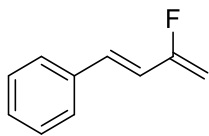
3. General procedure and characterization data for product 3



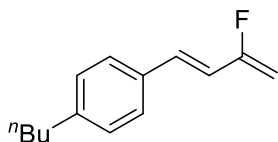
A flame-dried reaction tube (10.0 mL) equipped with a magnetic stir bar was charged with Pd(OAc)₂ (1.1 mg, 5.0 mol%) and XPhos (3.3 mg, 6.0 mol%). The reaction tube was transferred to the glovebox and charged with **1** (0.1 mmol), **2** (0.01 mmol), Cs₂CO₃ (65.0 mg) and THF (1.0 mL). After that, the reaction mixture was sealed with aluminum cap, moved out of glovebox, and stirred at 80 °C for 3 h. After the mixture was cooled to room temperature, the resulting solution was directly filtered through a pad of silica gel by EtOAc (3.0 mL). The solvent was evaporated in *vacuo* to give the crude product. The residue was purified by column chromatography on silica gel to give the pure product **3**.



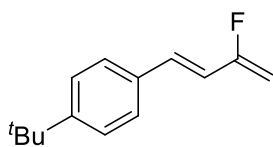
(E)-1-(3-Fluorobuta-1,3-dien-1-yl)-4-methoxybenzene (3a). (16.7 mg, 94% yield). Isolated by column chromatography on silica gel (petroleum ether: ethyl acetate = 50:1, *R_f* = 0.5); ¹H NMR (600 MHz, CDCl₃, ppm) δ 7.30 (d, *J* = 8.6 Hz, 2H), 6.81 (d, *J* = 8.6 Hz, 2H), 6.8 (d, *J* = 16.4 Hz, 1H), 6.33 (dd, *J* = 24.9, 16.4 Hz, 1H), 4.64 (dd, *J* = 17.0, 2.8 Hz, 1H), 4.43 (dd, *J* = 48.4, 3.4 Hz, 1H), 3.75 (s, 3H); ¹³C NMR (150 MHz, CDCl₃) δ 162.5 (d, *J*_{C-F} = 262.2 Hz), 159.9, 130.1, 130.0, 128.6, 128.2, 117.5 (d, *J*_{C-F} = 23.5 Hz), 114.2, 92.8 (d, *J*_{C-F} = 15.9 Hz), 55.3; ¹⁹F NMR (565 MHz, CDCl₃) δ -112.0. The characterization data were consistent with the literature.^[1]



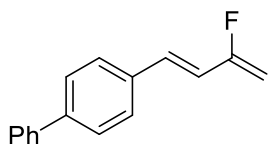
(E)-(3-Fluorobuta-1,3-dien-1-yl)benzene (3b). (13.0 mg, 88% yield). Isolated by column chromatography on silica gel (petroleum ether, R_f = 0.4); ^1H NMR (400 MHz, CDCl_3 , ppm) δ 7.42 (d, $J_{\text{C-F}}$ = 7.8 Hz, 2H), 7.34 (t, $J_{\text{C-F}}$ = 7.2 Hz, 2H), 7.29-7.26 (m, 1H), 7.90 (d, $J_{\text{C-F}}$ = 16.0 Hz, 1H), 6.52 (dd, $J_{\text{C-F}}$ = 24.4 Hz, 16.0 Hz, 1H), 4.77 (dd, $J_{\text{C-F}}$ = 16.1 Hz, 2.8 Hz, 1H), 4.56 (dd, $J_{\text{C-F}}$ = 48.4 Hz, 2.8 Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3 , ppm) δ 162.3 (d, $J_{\text{C-F}}$ = 251.3 Hz), 135.8, 130.6 (d, $J_{\text{C-F}}$ = 3.3 Hz), 128.8, 128.5, 126.9, 119.6 (d, $J_{\text{C-F}}$ = 24.4 Hz), 94.0 (d, $J_{\text{C-F}}$ = 20.9 Hz); ^{19}F NMR (376 MHz, CDCl_3 , ppm) δ -120.0 (1F). HRMS (APCI) m/z : Calcd for $\text{C}_{10}\text{H}_9\text{F}_2$ $[\text{M-F}]^+$: 167.0678; found: 167.0692. The characterization data were consistent with the literature.^[5]



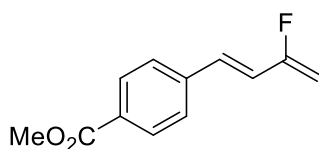
(E)-1-Butyl-4-(3-fluorobuta-1,3-dien-1-yl)benzene (3c). (16.7 mg, 82% yield). Isolated by column chromatography on silica gel (petroleum ether, R_f = 0.4); ^1H NMR (400 MHz, CDCl_3 , ppm) δ 7.33 (d, $J_{\text{C-F}}$ = 8.1 Hz, 2H), 7.15 (d, $J_{\text{C-F}}$ = 8.3 Hz, 2H), 6.87 (d, $J_{\text{C-F}}$ = 16.2 Hz, 1H), 6.47 (dd, $J_{\text{C-F}}$ = 24.4 Hz, 16.0 Hz, 1H), 4.74 (dd, $J_{\text{C-F}}$ = 16.1 Hz, 2.8 Hz, 1H), 4.53 (dd, $J_{\text{C-F}}$ = 48.4 Hz, 2.8 Hz, 1H), 2.60 (t, $J_{\text{C-F}}$ = 7.8 Hz, 2H), 1.61-1.54 (m, 2H), 1.38-1.32 (m, 2H), 0.92 (t, $J_{\text{C-F}}$ = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3 , ppm) δ 162.5 (d, $J_{\text{C-F}}$ = 251.3 Hz), 143.6, 133.3, 130.6 (d, $J_{\text{C-F}}$ = 2.3 Hz), 128.8, 126.9, 118.6 (d, $J_{\text{C-F}}$ = 24.1 Hz), 93.4 (d, $J_{\text{C-F}}$ = 2.2 Hz), 35.5, 33.5, 22.4, 14.0; ^{19}F NMR (376 MHz, CDCl_3 , ppm) δ -111.9 (1F). HRMS (APCI) m/z : Calcd for $\text{C}_{14}\text{H}_{17}$ $[\text{M-F}]^+$: 185.1324; found: 185.1321.



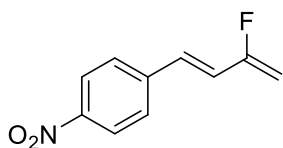
(E)-1-(tert-Butyl)-4-(3-fluorobuta-1,3-dien-1-yl)benzene (3d). (18.4 mg, 90% yield). Isolated by column chromatography on silica gel (petroleum ether, R_f = 0.4); ^1H NMR (400 MHz, CDCl_3 , ppm) δ 7.36 (s, 4H), 6.88 (d, $J_{\text{C-F}}$ = 15.6 Hz, 1H), 6.49 (dd, $J_{\text{C-F}}$ = 25.2 Hz, 16.0 Hz, 1H), 4.74 (dd, $J_{\text{C-F}}$ = 16.1 Hz, 2.8 Hz, 1H), 4.53 (dd, $J_{\text{C-F}}$ = 48.4 Hz, 2.8 Hz, 1H), 1.32 (s, 9H); ^{13}C NMR (100 MHz, CDCl_3 , ppm) δ 162.6 (d, $J_{\text{C-F}}$ = 251.3 Hz), 151.8, 133.1, 130.4 (d, $J_{\text{C-F}}$ = 1.2 Hz), 126.7, 125.7, 118.8 (d, $J_{\text{C-F}}$ = 24.7 Hz), 93.5 (d, $J_{\text{C-F}}$ = 21.9 Hz), 31.7, 31.3; ^{19}F NMR (376 MHz, CDCl_3 , ppm) δ -111.9 (1F). HRMS (APCI) m/z : Calcd for $\text{C}_{14}\text{H}_{17}$ $[\text{M-F}]^+$: 185.1324; found: 185.1331.



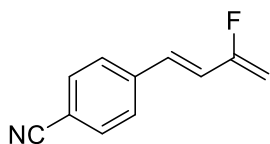
(E)-4-(3-Fluorobuta-1,3-dien-1-yl)-1,1'-biphenyl (3e). (20.6 mg, 92% yield). Isolated by column chromatography on silica gel (petroleum ether, $R_f = 0.3$); ^1H NMR (400 MHz, CDCl_3 , ppm) δ 7.59 (t, $J_{\text{C-F}} = 7.2$ Hz, 4H), 7.49 (d, $J_{\text{C-F}} = 7.6$ Hz, 2H), 7.44 (t, $J_{\text{C-F}} = 7.6$ Hz, 2H), 7.34 (t, $J_{\text{C-F}} = 7.2$ Hz, 1H), 6.93 (d, $J_{\text{C-F}} = 15.9$ Hz, 1H), 6.56 (dd, $J_{\text{C-F}} = 24.8$ Hz, 15.7 Hz, 1H), 4.78 (dd, $J_{\text{C-F}} = 16.1$ Hz, 2.8 Hz, 1H), 4.57 (dd, $J_{\text{C-F}} = 48.4$ Hz, 2.8 Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3 , ppm) δ 162.3 (d, $J_{\text{C-F}} = 251.3$ Hz), 141.2, 140.5, 134.8, 130.1 (d, $J_{\text{C-F}} = 3.3$ Hz), 128.9, 127.5, 127.4, 127.4, 126.9, 119.6 (d, $J_{\text{C-F}} = 24.4$ Hz), 94.0 (d, $J_{\text{C-F}} = 20.9$ Hz); ^{19}F NMR (376 MHz, CDCl_3 , ppm) δ -111.9 (1F). HRMS (APCI) m/z : Calcd for $\text{C}_{16}\text{H}_{13} [\text{M-F}]^+$: 205.1011; found: 205.1008.



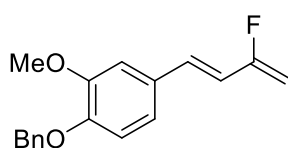
Methyl (E)-4-(3-fluorobuta-1,3-dien-1-yl)benzoate (3f). (16.5 mg, 80% yield). Isolated by column chromatography on silica gel (petroleum ether: ethyl acetate = 40:1, $R_f = 0.5$); ^1H NMR (400 MHz, CDCl_3 , ppm) δ 7.28 (d, $J_{\text{C-F}} = 7.8$ Hz, 2H), 6.80-6.75 (m, 3H), 6.31 (dd, $J_{\text{C-F}} = 24.4$ Hz, 16.0 Hz, 1H), 4.65 (dd, $J_{\text{C-F}} = 16.1$ Hz, 2.8 Hz, 1H), 4.42 (dd, $J_{\text{C-F}} = 48.4$ Hz, 2.8 Hz, 1H), 3.74 (s, 3H); ^{13}C NMR (100 MHz, CDCl_3 , ppm) δ 162.6 (d, $J_{\text{C-F}} = 252.3$ Hz), 159.9, 130.1 (d, $J_{\text{C-F}} = 2.3$ Hz), 128.6, 128.2, 117.5 (d, $J_{\text{C-F}} = 23.8$ Hz), 114.2, 92.8 (d, $J_{\text{C-F}} = 22.0$ Hz), 55.3; ^{19}F NMR (376 MHz, CDCl_3 , ppm) δ -119.2 (1F). HRMS (APCI) m/z : Calcd for $\text{C}_{12}\text{H}_{11}\text{O}_2 [\text{M-F}]^+$: 187.0753; found: 187.0749.



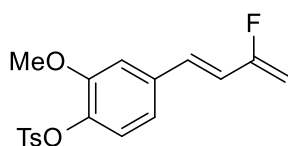
(E)-1-(3-Fluorobuta-1,3-dien-1-yl)-4-nitrobenzene (3g). (15.1 mg, 78% yield). Isolated by column chromatography on silica gel (petroleum ether: ethyl acetate = 40:1, $R_f = 0.4$); ^1H NMR (400 MHz, CDCl_3 , ppm) δ 7.62 (d, $J_{\text{C-F}} = 8.1$ Hz, 2H), 7.51 (d, $J_{\text{C-F}} = 8.2$ Hz, 2H), 6.88 (d, $J_{\text{C-F}} = 16.7$ Hz, 1H), 6.62 (dd, $J_{\text{C-F}} = 24.4$ Hz, 16.0 Hz, 1H), 4.90 (dd, $J_{\text{C-F}} = 16.1$ Hz, 2.8 Hz, 1H), 4.68 (dd, $J_{\text{C-F}} = 48.4$ Hz, 2.8 Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3 , ppm) δ 161.5 (d, $J_{\text{C-F}} = 251.3$ Hz), 140.3, 132.5, 128.6 (d, $J_{\text{C-F}} = 3.3$ Hz), 127.3, 123.1 (d, $J_{\text{C-F}} = 24.4$ Hz), 118.7, 111.6, 96.4 (d, $J_{\text{C-F}} = 20.9$ Hz); ^{19}F NMR (376 MHz, CDCl_3 , ppm) δ -112.2 (1F). HRMS (APCI) m/z : Calcd for $\text{C}_{10}\text{H}_8\text{NO}_2 [\text{M-F}]^+$: 174.0549; found: 174.0549.



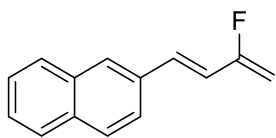
(E)-4-(3-Fluorobuta-1,3-dien-1-yl)benzonitrile (3h). (14.4 mg, 83% yield). Isolated by column chromatography on silica gel (petroleum ether: ethyl acetate = 50:1, R_f = 0.3); ^1H NMR (400 MHz, CDCl_3 , ppm) δ 7.62 (d, $J_{\text{C-F}}$ = 7.8 Hz, 2H), 7.50 (d, $J_{\text{C-F}}$ = 7.2 Hz, 2H), 6.88 (d, $J_{\text{C-F}}$ = 16.0 Hz, 1H), 6.62 (dd, $J_{\text{C-F}}$ = 24.4 Hz, 16.0 Hz, 1H), 4.89 (dd, $J_{\text{C-F}}$ = 16.1 Hz, 2.8 Hz, 1H), 4.68 (dd, $J_{\text{C-F}}$ = 48.4 Hz, 2.8 Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3 , ppm) δ 161.5 (d, $J_{\text{C-F}}$ = 251.3 Hz), 140.3, 132.5, 128.6 (d, $J_{\text{C-F}}$ = 3.3 Hz), 127.3, 123.2, 123.0, 118.7, 111.6, 96.5 (d, $J_{\text{C-F}}$ = 20.9 Hz); ^{19}F NMR (376 MHz, CDCl_3 , ppm) δ -112.2 (1F). HRMS (APCI) m/z : Calcd for $\text{C}_{11}\text{H}_8\text{FNNa}$ $[\text{M}+\text{Na}]^+$: 196.0533; found: 196.0521.



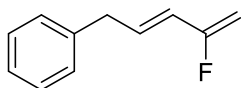
(E)-1-(Benzyloxy)-4-(3-fluorobuta-1,3-dien-1-yl)-2-methoxybenzene (3i). (36.4 mg, 93% yield). Isolated by column chromatography on silica gel (petroleum ether: ethyl acetate = 10:1, R_f = 0.4); ^1H NMR (400 MHz, CDCl_3 , ppm) δ 7.42 (d, $J_{\text{C-F}}$ = 7.8 Hz, 2H), 7.36 (t, $J_{\text{C-F}}$ = 7.2 Hz, 2H), 7.30 (t, $J_{\text{C-F}}$ = 7.2 Hz, 2H), 6.97 (d, $J_{\text{C-F}}$ = 1.2 Hz, 1H), 6.91 (dd, $J_{\text{C-F}}$ = 8.1 Hz, 1.2 Hz, 1H), 6.85-6.80 (m, 2H), 6.38 (dd, $J_{\text{C-F}}$ = 24.8 Hz, 15.7 Hz, 1H), 5.16 (s, 3H), 4.72 (dd, $J_{\text{C-F}}$ = 16.2 Hz, 2.8 Hz, 1H), 4.51 (dd, $J_{\text{C-F}}$ = 48.2 Hz, 2.8 Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3 , ppm) δ 149.2 (d, $J_{\text{C-F}}$ = 251.3 Hz), 136.9, 130.3 (d, $J_{\text{C-F}}$ = 3.3 Hz), 129.3, 128.6, 127.9, 127.3, 120.4, 117.9 (d, $J_{\text{C-F}}$ = 23.4 Hz), 113.8, 109.7, 93.1 (d, $J_{\text{C-F}}$ = 23.9 Hz), 71.0, 56.0; ^{19}F NMR (376 MHz, CDCl_3 , ppm) δ -111.9 (1F). HRMS (APCI) m/z : Calcd for $\text{C}_{18}\text{H}_{17}\text{O}_2$ $[\text{M-F}]^+$: 265.1223; found: 265.1219.



(E)-4-(3-Fluorobuta-1,3-dien-1-yl)-2-methoxyphenyl 4-methylbenzenesulfonate (3j). (31.3 mg, 90% yield). Isolated by column chromatography on silica gel (petroleum ether: ethyl acetate = 10:1, R_f = 0.3); ^1H NMR (400 MHz, CDCl_3 , ppm) δ 7.75 (d, $J_{\text{C-F}}$ = 7.8 Hz, 2H), 7.30 (d, $J_{\text{C-F}}$ = 7.2 Hz, 2H), 7.11 (d, $J_{\text{C-F}}$ = 8.2 Hz, 1H), 6.95 (dd, $J_{\text{C-F}}$ = 8.1 Hz, 1.2 Hz, 1H), 6.85 (d, $J_{\text{C-F}}$ = 1.2 Hz, 1H), 6.79 (d, $J_{\text{C-F}}$ = 16.2 Hz, 1H), 6.45 (dd, $J_{\text{C-F}}$ = 24.8 Hz, 15.7 Hz, 1H), 4.79 (dd, $J_{\text{C-F}}$ = 16.2 Hz, 2.8 Hz, 1H), 4.58 (dd, $J_{\text{C-F}}$ = 48.2 Hz, 2.8 Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3 , ppm) δ 161.9 (d, $J_{\text{C-F}}$ = 251.3 Hz), 151.9, 145.1, 138.4, 135.9, 133.2, 129.5, 129.5, 128.6, 124.2, 120.6 (d, $J_{\text{C-F}}$ = 24.3 Hz), 119.3, 110.8, 94.8 (d, $J_{\text{C-F}}$ = 23.9 Hz), 55.6, 21.7; ^{19}F NMR (376 MHz, CDCl_3 , ppm) δ -111.9 (1F). HRMS (APCI) m/z : Calcd for $\text{C}_{18}\text{H}_{18}\text{FO}_4\text{S}$ $[\text{M}+\text{H}]^+$: 349.0904; found: 349.0887.

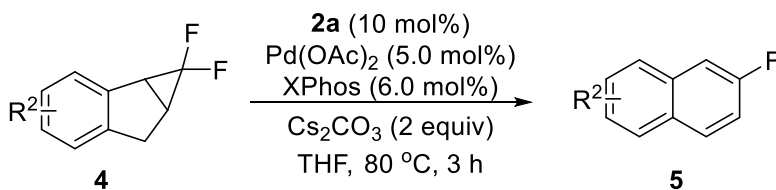


(E)-2-(3-Fluorobuta-1,3-dien-1-yl)naphthalene (3k). (18.2 mg, 92% yield). Isolated by column chromatography on silica gel (petroleum ether, $R_f = 0.4$); ^1H NMR (400 MHz, CDCl_3 , ppm) δ 7.82-7.79 (m, 4H), 7.61 (dd, $J_{\text{C-F}} = 8.6$ Hz, 1.4 Hz, 1H), 7.49-7.44 (m, 2H), 7.06 (d, $J_{\text{C-F}} = 16.0$ Hz, 1H), 6.65 (dd, $J_{\text{C-F}} = 24.4$ Hz, 16.0 Hz, 1H), 4.81 (dd, $J_{\text{C-F}} = 16.1$ Hz, 2.8 Hz, 1H), 4.61 (dd, $J_{\text{C-F}} = 48.4$ Hz, 2.8 Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3 , ppm) δ 162.4 (d, $J_{\text{C-F}} = 251.3$ Hz), 133.5, 133.3 (d, $J_{\text{C-F}} = 11.0$ Hz), 130.7 (d, $J_{\text{C-F}} = 3.3$ Hz), 128.4, 128.2, 127.7, 127.6, 126.5, 126.3, 123.5, 119.9 (d, $J_{\text{C-F}} = 24.4$ Hz), 94.1 (d, $J_{\text{C-F}} = 20.9$ Hz); ^{19}F NMR (376 MHz, CDCl_3 , ppm) δ -111.9 (1F). HRMS (APCI) m/z : Calcd for $\text{C}_{14}\text{H}_{11} [\text{M-F}]^+$: 179.0855; found: 179.0863.

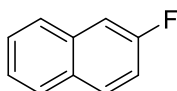


(E)-(4-Fluoropenta-2,4-dien-1-yl)benzene (3l). (13.6 mg, 84% yield). Isolated by column chromatography on silica gel (petroleum ether, $R_f = 0.5$); ^1H NMR (400 MHz, CDCl_3 , ppm) δ 7.29 (d, $J_{\text{C-F}} = 7.5$ Hz, 2H), 7.19 (t, $J_{\text{C-F}} = 8.2$ Hz, 3H), 6.27-6.19 (m, 1H), 5.86 (dd, $J_{\text{C-F}} = 25.1$ Hz, 15.6 Hz, 1H), 4.60 (dd, $J_{\text{C-F}} = 16.1$ Hz, 2.8 Hz, 1H), 3.46 (d, $J_{\text{C-F}} = 4.8$ Hz, 2H); ^{13}C NMR (100 MHz, CDCl_3 , ppm) δ 162.3 (d, $J_{\text{C-F}} = 251.3$ Hz), 139.1, 131.9 (d, $J_{\text{C-F}} = 3.3$ Hz), 128.7, 128.6, 126.4, 122.7 (d, $J_{\text{C-F}} = 24.4$ Hz), 92.1 (d, $J_{\text{C-F}} = 20.9$ Hz), 38.5; ^{19}F NMR (376 MHz, CDCl_3 , ppm) δ -120.0 (1F). HRMS (APCI) m/z : Calcd for $\text{C}_{11}\text{H}_{11} [\text{M-F}]^+$: 143.0855; found: 143.0855.

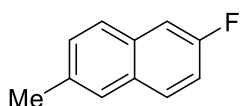
4. General procedure and characterization data for product 5



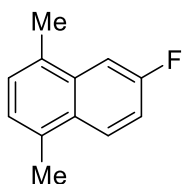
A flame-dried reaction tube (10.0 mL) equipped with a magnetic stir bar was charged with $\text{Pd}(\text{OAc})_2$ (1.1 mg, 5.0 mol%) and XPhos (3.3 mg, 6.0 mol%). The reaction tube was transferred to the glovebox and charged with **4** (0.1 mmol), **2** (0.01 mmol), Cs_2CO_3 (65.0 mg) and THF (1.0 mL). After that, the reaction mixture was sealed with aluminum cap, moved out of glovebox, and stirred at 80 °C for 3 h. After the mixture was cooled to room temperature, the resulting solution was directly filtered through a pad of silica gel by EtOAc (3.0 mL). The solvent was evaporated in *vacuo* to give the crude product. The residue was purified by column chromatography on silica gel to give the pure product **5**.



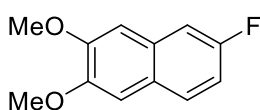
2-Fluoronaphthalene (5a). (13.3 mg, 91% yield). Isolated by column chromatography on silica gel (petroleum ether, $R_f = 0.5$); ^1H NMR (600 MHz, CDCl_3 , ppm) δ 7.86-7.82 (m, 2H), 7.79 (dd, $J = 8.4$ Hz, 1.0 Hz, 1H), 7.51 (ddd, $J = 7.5$ Hz, 7.5 Hz, 1 Hz, 1H), 7.46 (m, 1H), 7.45 (ddd, $J = 7.5$ Hz, 7.5 Hz, 1 Hz, 1H), 7.27 (ddd, $J = 10.5$ Hz, 8.4 Hz, 1 Hz, 1H); ^{13}C NMR (150 MHz, CDCl_3 , ppm) δ 160.1 (d, $J_{\text{C-F}} = 244.0$ Hz), 134.3 (d, $J_{\text{C-F}} = 9.4$ Hz), 130.6, 130.4 (d, $J_{\text{C-F}} = 9.6$ Hz), 128.0 (d, $J_{\text{C-F}} = 1.4$ Hz), 127.4 (d, $J_{\text{C-F}} = 5.4$ Hz), 127.0, 125.2 (d, $J_{\text{C-F}} = 2.8$ Hz), 116.4 (d, $J_{\text{C-F}} = 25.0$ Hz), 111.0 (d, $J_{\text{C-F}} = 20.3$ Hz); ^{19}F NMR (565 MHz, CDCl_3 , ppm) δ -114.9 (1F). The characterization data were consistent with the literature.^[1]



2-Fluoro-6-methylnaphthalene (5b). (13.7 mg, 86% yield). Isolated by column chromatography on silica gel (petroleum ether, $R_f = 0.5$); ^1H NMR (400 MHz, CDCl_3 , ppm) δ 7.70 (dd, $J = 9.0$ Hz, 5.6 Hz, 1H), 7.65 (d, $J = 8.4$ Hz, 1H), 7.57 (s, 1H), 7.38 (dd, $J = 9.9$ Hz, 2.4 Hz, 1H), 7.31 (d, $J = 8.3$ Hz, 1H), 7.20 (td, $J = 8.8$ Hz, 2.5 Hz, 1H), 2.47 (s, 3H); ^{13}C NMR (101 MHz, CDCl_3 , ppm) δ 160.3 (d, $J_{\text{C-F}} = 244.4$ Hz), 134.8 (d, $J_{\text{C-F}} = 2.6$ Hz), 132.3 (d, $J_{\text{C-F}} = 9.0$ Hz), 130.7, 129.6 (d, $J_{\text{C-F}} = 8.8$ Hz), 129.3, 127.2 (d, $J_{\text{C-F}} = 5.3$ Hz), 127.0, 116.3 (d, $J_{\text{C-F}} = 25.3$ Hz), 110.8 (d, $J_{\text{C-F}} = 20.3$ Hz), 21.7; ^{19}F NMR (377 MHz, CDCl_3 , ppm) δ -116.3 (1F). HRMS (APCI) m/z : Calcd for C_{11}H_9 $[\text{M-F}]^+$: 141.0698; found: 141.0697.

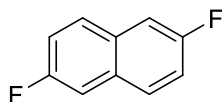


6-Fluoro-1,4-dimethylnaphthalene (5c). (15.6 mg, 90% yield). Isolated by column chromatography on silica gel (petroleum ether, $R_f = 0.5$); ^1H NMR (600 MHz, CDCl_3 , ppm) δ 7.99 (dd, $J_{\text{C-F}} = 9.1$ Hz, 5.7 Hz, 1H), 7.59 (dd, $J_{\text{C-F}} = 11.2$ Hz, 2.8 Hz, 1H), 7.30-7.27 (m, 1H), 7.23 (d, $J_{\text{C-F}} = 6.7$ Hz, 1H), 7.16 (d, $J_{\text{C-F}} = 6.7$ Hz, 1H), 2.65 (s, 3H), 2.60 (s, 3H); ^{13}C NMR (150 MHz, CDCl_3 , ppm) δ 160.5 (d, $J_{\text{C-F}} = 245.2$ Hz), 133.9 (d, $J_{\text{C-F}} = 8.0$ Hz), 132.5, 131.8 (d, $J_{\text{C-F}} = 5.8$ Hz), 129.7, 127.3, 127.1 (d, $J_{\text{C-F}} = 9.1$ Hz), 125.5 (d, $J_{\text{C-F}} = 1.9$ Hz), 115.3 (d, $J_{\text{C-F}} = 24.6$ Hz), 108.3 (d, $J_{\text{C-F}} = 24.1$ Hz), 19.4 (d, $J_{\text{C-F}} = 17.7$ Hz); ^{19}F NMR (565 MHz, CDCl_3 , ppm) δ -115.1 (1F). HRMS (APCI) m/z : Calcd for $\text{C}_{12}\text{H}_{12}$ $[\text{M-F}]^+$: 155.0855; found: 155.0857.

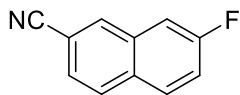


6-Fluoro-2,3-dimethoxynaphthalene (5d). (17.5 mg, 85% yield). Isolated by column

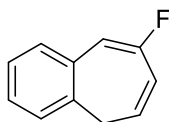
chromatography on silica gel (petroleum ether: ethyl acetate = 10:1, R_f = 0.5); ^1H NMR (600 MHz, CDCl_3 , ppm) δ 7.63 (dd, $J_{\text{C-F}}$ = 9.1 Hz, 5.7 Hz, 1H), 7.30 (dd, $J_{\text{C-F}}$ = 11.2 Hz, 2.8 Hz, 1H), 7.11-7.08 (m, 1H), 7.03 (m, 1H), 3.98 (s, 3H), 3.97 (s, 3H); ^{13}C NMR (150 MHz, CDCl_3 , ppm) δ 160.0 (d, $J_{\text{C-F}}$ = 245.2 Hz), 150.4, 148.8 (d, $J_{\text{C-F}}$ = 2.3 Hz), 130.0 (d, $J_{\text{C-F}}$ = 9.4 Hz), 128.3 (d, $J_{\text{C-F}}$ = 9.4 Hz), 125.9, 113.9 (d, $J_{\text{C-F}}$ = 25.2 Hz), 109.9 (d, $J_{\text{C-F}}$ = 21.1 Hz), 106.4, 105.7 (d, $J_{\text{C-F}}$ = 4.6 Hz), 55.9, 55.9; ^{19}F NMR (565 MHz, CDCl_3 , ppm) δ -117.9 (1F). HRMS (APCI) m/z : Calcd for $\text{C}_{12}\text{H}_{12}\text{FO}_2$ $[\text{M}+\text{H}]^+$: 207.0816; found: 207.0801.



2,6-Difluoronaphthalene (5e). (14.6 mg, 89% yield). Isolated by column chromatography on silica gel (petroleum ether, R_f = 0.5); ^1H NMR (600 MHz, CDCl_3 , ppm) δ 8.10 (dd, J = 5.5 Hz, 4.1 Hz, 1H), 7.55 (d, J = 8.8 Hz, 1H), 7.47 (dt, J = 10.1 Hz, 2.2 Hz, 1H), 7.43-7.39 (m, 1H), 7.30 (td, J = 8.9 Hz, 2.6 Hz, 1H), 7.09 (dd, J = 11.3 Hz, 7.7 Hz, 1H); ^{13}C NMR (101 MHz, CDCl_3 , ppm) δ 161.3 (d, J = 249.9 Hz), 158.9 (d, J = 249.9 Hz), 135.9 (q, J = 5.1 Hz), 127.1 (d, J = 9.4 Hz), 123.4 (q, J = 4.7 Hz), 123.0 (d, J = 5.5 Hz), 116.6 (dd, J = 25.3 Hz, 2.1 Hz), 110.8 (dd, J = 20.9 Hz, 3.3 Hz), 108.8 (dd, J = 19.9 Hz, 2.8 Hz); ^{19}F NMR (377 MHz, CDCl_3 , ppm) δ -113.2 (1F), -122.2 (1F). HRMS (APCI) m/z : Calcd for $\text{C}_{10}\text{H}_6\text{F}_2$ $[\text{M}^+]$: 164.0438; found: 164.0418.

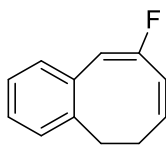


7-Fluoro-2-naphthonitrile (5f). (15.1 mg, 88% yield). Isolated by column chromatography on silica gel (petroleum ether: ethyl acetate = 20:1, R_f = 0.5); ^1H NMR (600 MHz, CDCl_3 , ppm) δ 8.17 (s, 1H), 7.93-7.89 (m, 2H), 7.58 (dd, $J_{\text{C-F}}$ = 8.7 Hz, 1.1 Hz, 1H), 7.52 (dd, $J_{\text{C-F}}$ = 9.5 Hz, 2.5 Hz, 1H), 7.44 (m, 1H); ^{13}C NMR (150 MHz, CDCl_3 , ppm) δ 161.4 (d, $J_{\text{C-F}}$ = 249.8 Hz), 133.2 (d, $J_{\text{C-F}}$ = 5.7 Hz), 133.1 (d, $J_{\text{C-F}}$ = 9.7 Hz), 131.6, 130.7 (d, $J_{\text{C-F}}$ = 9.2 Hz), 129.2, 125.8 (d, $J_{\text{C-F}}$ = 2.2 Hz), 119.5 (d, $J_{\text{C-F}}$ = 25.2 Hz), 118.9, 111.6 (d, $J_{\text{C-F}}$ = 21.4 Hz), 110.4; ^{19}F NMR (565 MHz, CDCl_3 , ppm) δ -111.2 (1F). HRMS (APCI) m/z : Calcd for $\text{C}_{11}\text{H}_6\text{FN}$ $[\text{M}]^+$: 171.0479; found: 171.0471.



1,1,4-Trifluoro-1,1a,6,6a-tetrahydrocyclopropa[a]indene (7). (15.2 mg, 95% yield). Isolated by column chromatography on silica gel (petroleum ether, R_f = 0.4); ^1H NMR (600 MHz, CDCl_3 , ppm) δ 7.31 (t, $J_{\text{C-F}}$ = 7.2 Hz, 1H), 7.29 (d, $J_{\text{C-F}}$ = 7.6 Hz, 1H), 7.22 (d, $J_{\text{C-F}}$ = 7.2 Hz, 1H), 7.16 (d, $J_{\text{C-F}}$ = 7.6 Hz, 1H), 7.83 (d, $J_{\text{C-F}}$ = 19.0 Hz, 1H), 6.10-6.07 (m, 1H), 5.96-5.91 (m, 1H), 3.10 (d, $J_{\text{C-F}}$ = 7.1 Hz, 2H); ^{13}C NMR (150 MHz, CDCl_3 , ppm) δ 159.6 (d, $J_{\text{C-F}}$ = 244.4 Hz), 133.7, 132.7 (d, $J_{\text{C-F}}$ = 11.7 Hz),

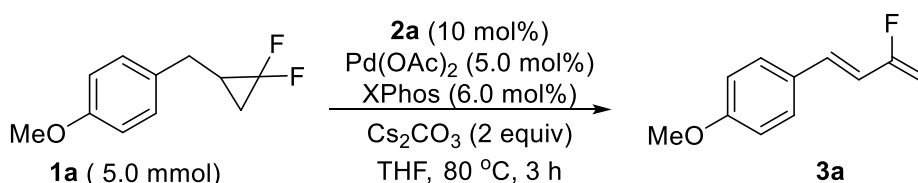
130.2 (d, J_{C-F} = 13.9 Hz), 128.5, 128.0, 127.9 (d, J_{C-F} = 3.6 Hz), 126.1, 121.2 (d, J_{C-F} = 35.4 Hz), 113.6 (d, J_{C-F} = 27.0 Hz), 34.6; ^{19}F NMR (565 MHz, CDCl_3 , ppm) δ -100.2 (1F). HRMS (APCI) m/z : Calcd for $\text{C}_{11}\text{H}_9[\text{M-F}]^+$: 141.0698; found: 141.0699.



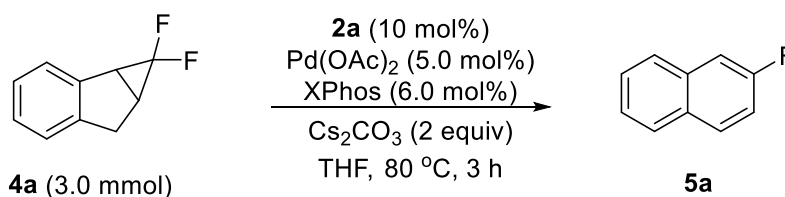
1,1,4-Trifluoro-1,1a,6,6a-tetrahydrocyclopropa[a]indene (8). (13.9 mg, 80% yield). Isolated by column chromatography on silica gel (petroleum ether, R_f = 0.4); ^1H NMR (600 MHz, CDCl_3 , ppm) δ 7.23-7.21 (m, 1H), 7.19-7.17 (m, 2H), 7.15 (d, J_{C-F} = 7.2 Hz, 1H), 6.24 (d, J_{C-F} = 21.6 Hz, 1H), 5.87 (dt, J_{C-F} = 13.4 Hz, 4.0 Hz, 1H), 5.71-5.67 (m, 1H), 3.01 (t, J_{C-F} = 5.9 Hz, 2H), 2.68-2.64 (m, 2H); ^{13}C NMR (150 MHz, CDCl_3 , ppm) δ 155.6 (d, J_{C-F} = 236.9 Hz), 141.6, 135.6 (d, J_{C-F} = 14.2 Hz), 133.8 (d, J_{C-F} = 11.8 Hz), 129.4, 129.3 (d, J_{C-F} = 3.3 Hz), 127.8, 125.9, 118.8 (d, J_{C-F} = 40.7 Hz), 107.9 (d, J_{C-F} = 31.9 Hz), 34.4, 30.6; ^{19}F NMR (565 MHz, CDCl_3 , ppm) δ -94.7 (1F). HRMS (APCI) m/z : Calcd for $\text{C}_{12}\text{H}_{11}[\text{M-F}]^+$: 155.0855; found: 155.0853.

5. Scale-up experiment and downstream transformations.

5.1 Scale-up experiment



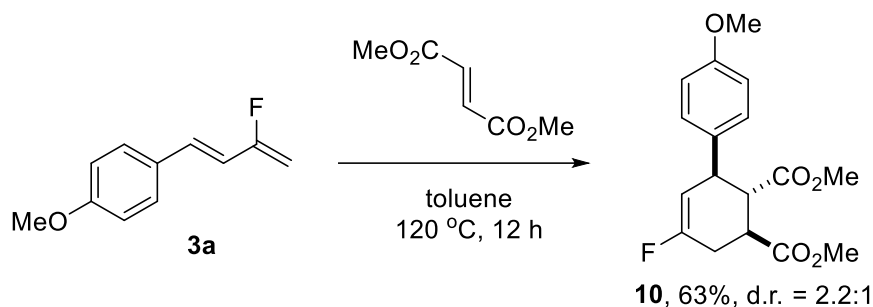
A flame-dried reaction tube (100.0 mL) equipped with a magnetic stir bar was charged with $\text{Pd}(\text{OAc})_2$ (55.0 mg, 5.0 mol%) and XPhos (165.0 mg, 6.0 mol%). The reaction tube was transferred to the glovebox and charged with **1** (5.0 mmol), **2** (0.5 mmol), Cs_2CO_3 (3.3 g) and THF (10.0 mL). After that, the reaction mixture was sealed with aluminum cap, moved out of glovebox, and stirred at 80 °C for 3 h. After the mixture was cooled to room temperature, the resulting solution was directly filtered through a pad of silica gel by EtOAc (100.0 mL). The solvent was evaporated in vacuo to give the crude product. The residue was purified by column chromatography on silica gel (petroleum ether/ethyl acetate = 50:1, R_f = 0.4) to give the pure product **3a** (686 mg, 77% yield).



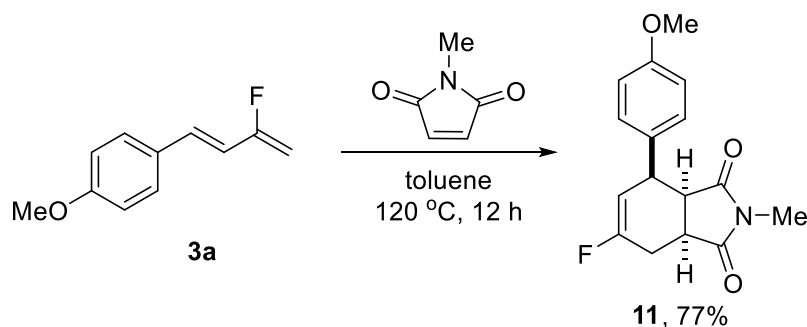
A flame-dried reaction tube (100.0 mL) equipped with a magnetic stir bar was charged with $\text{Pd}(\text{OAc})_2$ (33.0 mg, 5.0 mol%) and XPhos (0.1 g, 6.0 mol%). The reaction tube was transferred to the glovebox

and charged with **4a** (3.0 mmol), **2** (0.3 mmol), Cs₂CO₃ (1.9 g) and THF (10.0 mL). After that, the reaction mixture was sealed with aluminum cap, moved out of glovebox, and stirred at 80 °C for 3 h. After the mixture was cooled to room temperature, the resulting solution was directly filtered through a pad of silica gel by EtOAc (50.0 mL). The solvent was evaporated in vacuo to give the crude product. The residue was purified by column chromatography on silica gel (petroleum ether, R_f = 0.5) to give the pure product **5a** (377 mg, 86% yield).

5.2 Downstream transformations of fluoro-1,3-diene

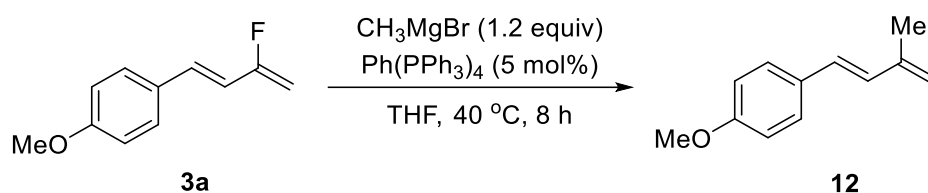


To a 10 mL vial equipped with a magnetic stir bar was added **3a** (17.8 mg, 0.1 mmol), dimethyl fumarate (17.3 mg, 0.12 mmol, 1.2 equiv), and toluene (1.0 mL). The vial was sealed and stirred at 120 °C for 24 h. After the reaction was completed, purification by column chromatography on silica gel to afford the desired product **10** (20.1 mg, 63% yield). **Dimethyl 5-fluoro-4'-methoxy-1,2,3,4-tetrahydro-[1,1'-biphenyl]-2,3-dicarboxylate (10)**. Isolated by column chromatography on silica gel (petroleum ether: ethyl acetate = 10:1, R_f = 0.4, d.r. = 2.2:1); Major: ¹H NMR (600 MHz, CDCl₃, ppm) δ 7.06 (d, J_{C-F} = 8.6 Hz, 2H), 6.82 (d, J_{C-F} = 8.6 Hz, 2H), 5.24 (d, J_{C-F} = 16.0 Hz, 1H), 3.79 (s, 3H), 3.65 (s, 3H), 3.49 (s, 3H), 3.24-3.18 (m, 1H), 3.12-3.07 (m, 1H), 2.70 (t, J_{C-F} = 11.0 Hz, 1H), 2.63-2.62 (m, 2H); ¹³C NMR (150 MHz, CDCl₃, ppm) δ 173.9, 172.9, 158.8, 158.6 (d, J_{C-F} = 153.6 Hz), 156.4, 129.8, 128.7, 114.0, 113.7, 105.9 (d, J_{C-F} = 16.1 Hz), 55.2, 55.2, 51.7, 50.6, 42.7 (dd, J_{C-F} = 76.0 Hz, 18.6 Hz), 27.6 (d, J_{C-F} = 27.9 Hz); ¹⁹F NMR (565 MHz, CDCl₃, ppm) δ -103.3 (1F). HRMS (APCI) *m/z*: Calcd for C₁₇H₂₀FO₅ [M+H]⁺: 323.1289; found: 323.1271.



To a 10 mL vial equipped with a magnetic stir bar was added **3a** (17.8 mg, 0.1 mmol), 1-methyl-1H-pyrrole-2,5-dione (13.3 mg, 0.12 mmol, 1.2 equiv), and toluene (1.0 mL). The vial was sealed and

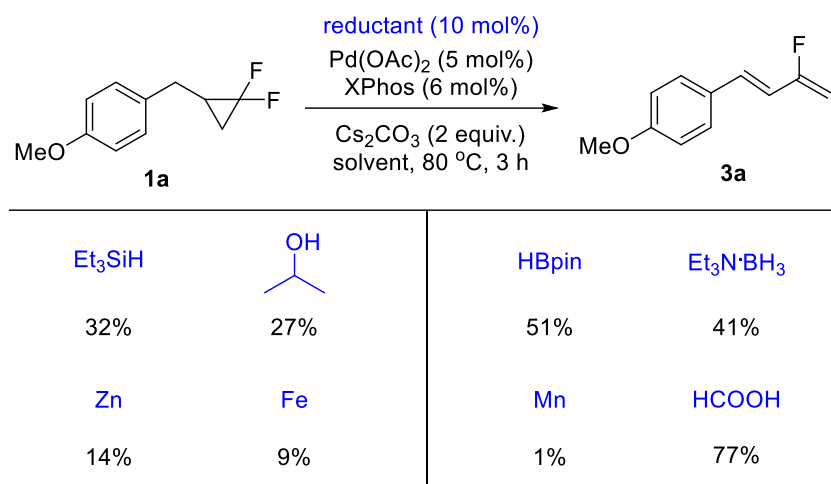
stirred at 120 °C for 12 h. After the reaction was completed, purification by column chromatography on silica gel to afford the desired product **11** (22.2 mg, 77% yield). **6-Fluoro-4-(4-methoxyphenyl)-2-methyl-3a,4,7,7a-tetrahydro-1H-isoindole-1,3(2H)-dione (11)**. Isolated by column chromatography on silica gel (petroleum ether: ethyl acetate = 5:1, R_f = 0.4); ^1H NMR (600 MHz, CDCl_3 , ppm) δ 6.96 (d, $J_{\text{C-F}}$ = 8.9 Hz, 2H), 6.79 (d, $J_{\text{C-F}}$ = 8.9 Hz, 2H), 5.50 (dd, $J_{\text{C-F}}$ = 15.7 Hz, 6.8 Hz, 1H), 3.96 (s, 1H), 3.78 (s, 3H), 3.29-2.28 (m, 2H), 3.15 (d, $J_{\text{C-F}}$ = 19.1 Hz, 1H), 2.63-2.58 (m, 1H), 2.39 (s, 3H); ^{13}C NMR (150 MHz, CDCl_3 , ppm) δ 177.5 (d, $J_{\text{C-F}}$ = 217.3 Hz), 159.6, 159.1, 157.9, 129.9, 113.6, 103.8 (d, $J_{\text{C-F}}$ = 17.1 Hz), 55.3, 44.4, 39.6 (d, $J_{\text{C-F}}$ = 8.5 Hz), 38.5 (d, $J_{\text{C-F}}$ = 9.5 Hz), 24.0, 21.4 (d, $J_{\text{C-F}}$ = 28.5 Hz); ^{19}F NMR (565 MHz, CDCl_3 , ppm) δ -101.3 (1F). HRMS (APCI) m/z : Calcd for $\text{C}_{16}\text{H}_{17}\text{FNO}_3$ $[\text{M}+\text{H}]^+$: 290.1187; found: 290.1194.



Following the Xia's procedure^[8], to a 10 mL vial was added $\text{Pd}(\text{PPh}_3)_4$ (5.8 mg, 5.0 μmol), **3a** (17.8 mg, 0.1 mmol), and THF (1.0 mL, dry) in the glove box. To solution was added a THF solution of CH_3MgBr (0.12 mL, 1.0 M, 0.12 mmol) at room temperature. The vial was removed from the glove box and stirred for 8 h at 40 °C. After completion of the reaction, the reaction mixture was quenched with a saturated aqueous solution of NH_4Cl (5.0 mL) and extracted with ethyl acetate (3×10.0 mL). The combined organic layer was washed with water and brine, then dried over anhydrous MgSO_4 , filtered, and concentrated under vacuum. Purification by column chromatography on silica gel afforded the desired product **12** (17.8 mg, 89% yield). **(E)-1-Methoxy-4-(3-methylbuta-1,3-dien-1-yl)benzene (12)**. Isolated by column chromatography on silica gel (petroleum ether: ethyl acetate = 50:1, R_f = 0.4); ^1H NMR (400 MHz, CDCl_3 , ppm) δ 7.37 (d, J = 8.7 Hz, 2H), 6.87 (d, J = 8.7 Hz, 2H), 6.76 (d, J = 16.1 Hz, 1H), 6.49 (d, J = 16.1 Hz, 1H), 5.07 (s, 1H), 5.02 (s, 1H), 3.82 (s, 3H), 1.97 (s, 3H); ^{13}C NMR (100 MHz, CDCl_3 , ppm) δ 159.4, 142.3, 130.4, 129.9, 128.3, 127.8, 116.3, 114.3, 55.4, 18.7. HRMS (APCI) m/z : Calcd for $\text{C}_{12}\text{H}_{15}\text{O}$ $[\text{M}+\text{H}]^+$: 175.1117; found: 175.1114.

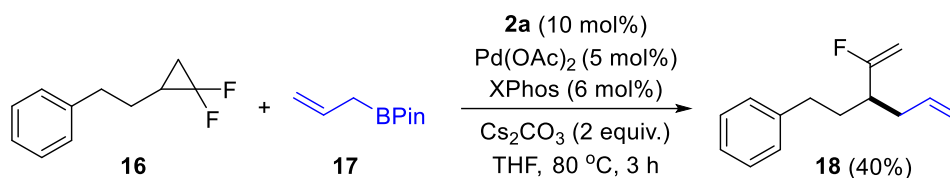
6. Evaluation of other common reductants

The use of other common reductants (e.g., hydrosilanes, alcohols, boranes, metals, or formate) resulted in lower reaction efficiency (Scheme S1). This is likely because the allyl boronate substrate more readily undergoes transmetalation with palladium and subsequent β -hydride elimination, thereby efficiently regenerating the $\text{Pd}(0)$ catalyst.



Scheme S1. Evaluation of other common reductants

7. Preliminary results of *gem*-F₂CP with allyl boronate

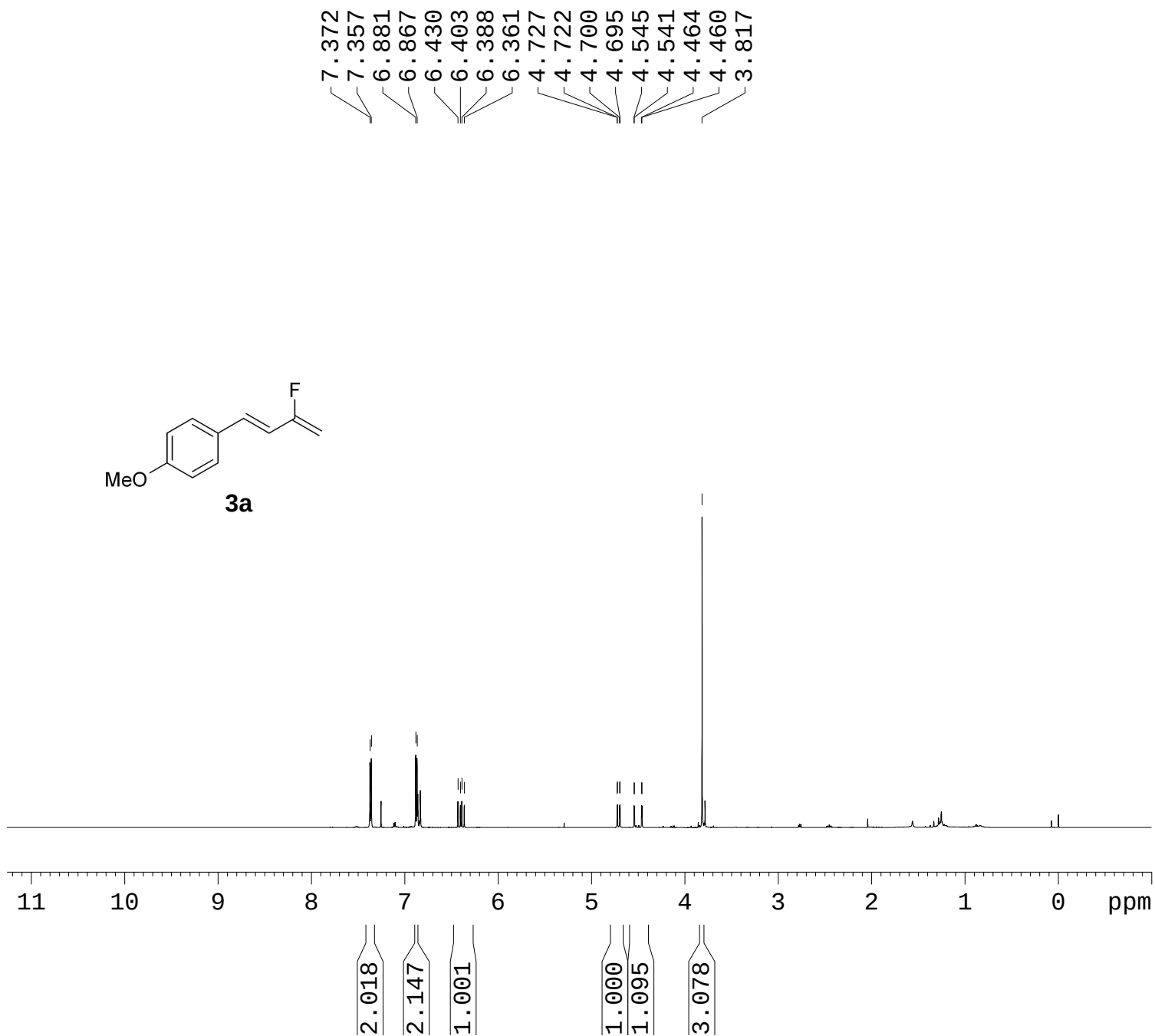
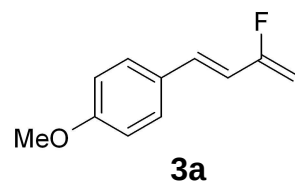


The procedure followed that used for the synthesis of product **3**, except that 2.0 equivalents of allyl boronate **17** were employed. **(3-(1-Fluorovinyl)hex-5-en-1-yl)benzene (18)**. (8.2 mg, 40% yield). ¹H NMR (600 MHz, CDCl₃, ppm) δ 7.28 (t, *J* = 8.0 Hz, 2H), 7.18 (t, *J* = 8.2 Hz, 3H), 5.78- 5.71 (m, 1H), 5.05 (dd, *J*_{C-F} = 17.1, 1.4 Hz, 1H), 5.03 (dd, *J*_{C-F} = 10.2, 1.0 Hz, 1H), 4.62 (dd, *J*_{C-F} = 17.7, 3.0 Hz, 1H), 4.25 (dd, *J*_{C-F} = 50.0, 3.0 Hz, 1H), 2.73-2.69 (m, 1H), 2.60-2.55 (m, 1H), 2.31-2.18 (m, 2H), 1.83-1.70 (m, 2H); ¹³C NMR (150 MHz, CDCl₃) δ 167.3 (d, *J*_{C-F} = 260.7 Hz), 142.0, 135.7, 128.4, 128.3, 125.9, 116.6, 90.9 (d, *J*_{C-F} = 20.9 Hz), 42.1 (d, *J*_{C-F} = 25.5 Hz), 33.2, 32.9 (d, *J*_{C-F} = 3.3 Hz), 29.7; ¹⁹F NMR (565 MHz, CDCl₃) δ -105.6 (1F). The characterization data were consistent with the literature.^[7]

8. References

- [1] F. Wang, W. Zhang, J. Zhu, H. Li, K.-W. Huang and J. Hu, *Chem. Commun.*, 2011, **47**, 2411-2413.
- [2] H. Qian, Z. P. Cheng, Y. Luo, L. Lv, S. Chen and Z. Li, *J. Am. Chem. Soc.*, 2024, **146**, 24-32.
- [3] Z.-T. Jiang, J. Huang, Y. Zeng, F. Hu and Y. Xia, *Angew. Chem. Int. Ed.*, 2021, **60**, 10626-10631.
- [4] S. Eusterwiemann, H. Martinez and W. R. Dolbier, Jr., *J. Org. Chem.*, 2012, **77**, 5461-5464.
- [5] H. Yu, Q. Zhang and W. Zi, *Nat. Commun.*, 2022, **13**, 2470.
- [6] Y. Zeng, H. Yang, J. Du, Q. Huang, G. Huang and Y. Xia, *Chem. Sci.*, 2022, **13**, 12419-12425.
- [7] L. Lv, H. Qian, A. B. Crowell, S. Chen and Z. Li, *ACS Catal.*, 2022, **12**, 6495-6505.

9. Copies of ¹H NMR, ¹³C NMR and ¹⁹F NMR spectra for products

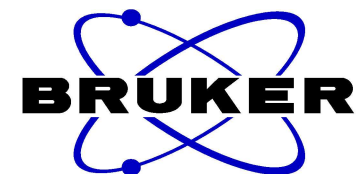
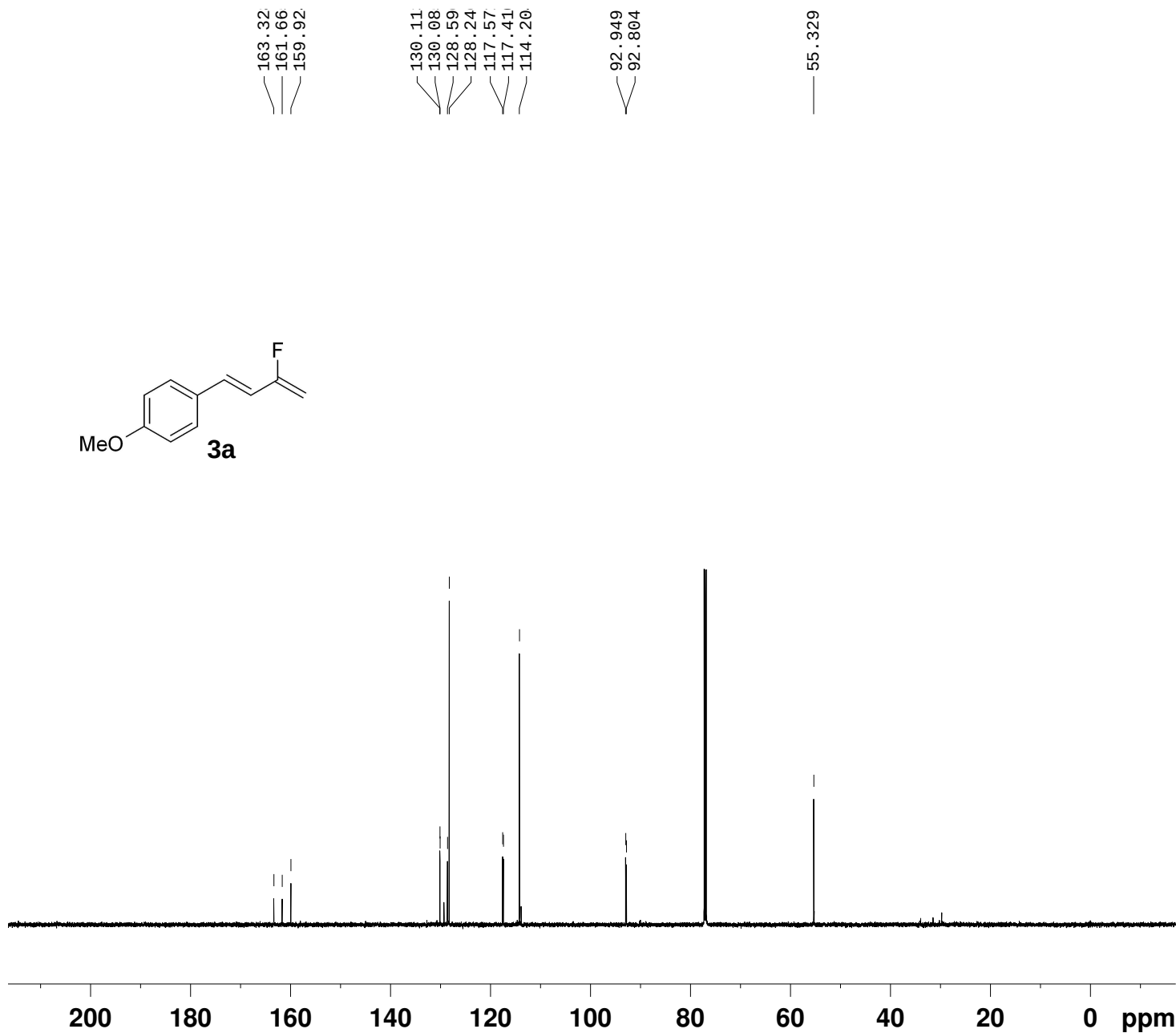
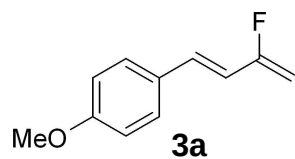


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PULPROG   zg30
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SOLVENT   CDCl3
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DS        2
SWH       12019.230 Hz
FIDRES    0.183399 Hz
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TE        297.0 K
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TD0       1
  
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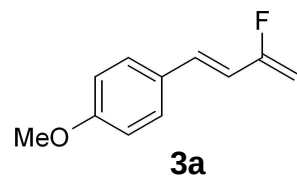
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LB       0.30 Hz
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PC       1.00
  
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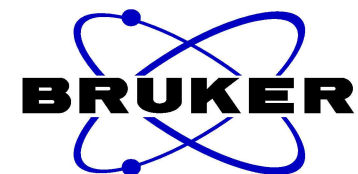


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 PROCNO 1
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 PULPROG zgpg30
 TD 65536
 SOLVENT CDCl3
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 DS 4
 SWH 36057.691 Hz
 FIDRES 0.550197 Hz
 AQ 0.9088159 sec
 RG 190.02
 DW 13.867 usec
 DE 6.50 usec
 TE 298.0 K
 D1 2.00000000 sec
 D11 0.03000000 sec
 TD0 1

===== CHANNEL f1 =====
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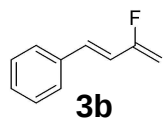


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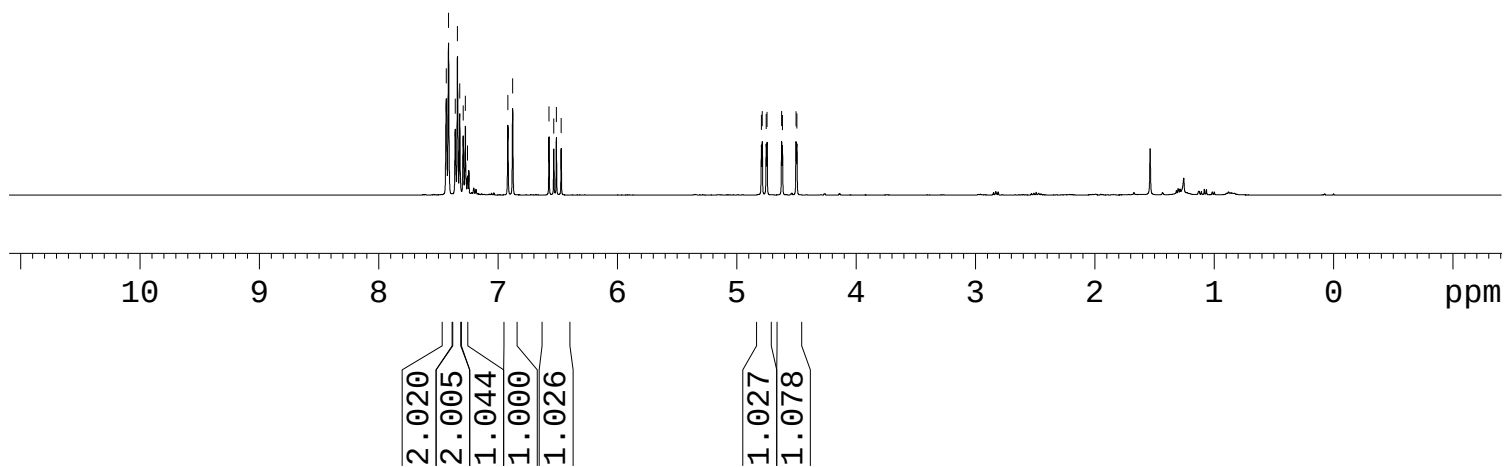
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TD          131072
SOLVENT     CDCl3
NS          16
DS          4
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AQ          0.4893855 sec
RG          190.02
DW          3.733 usec
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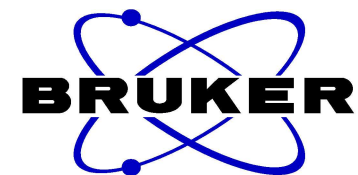
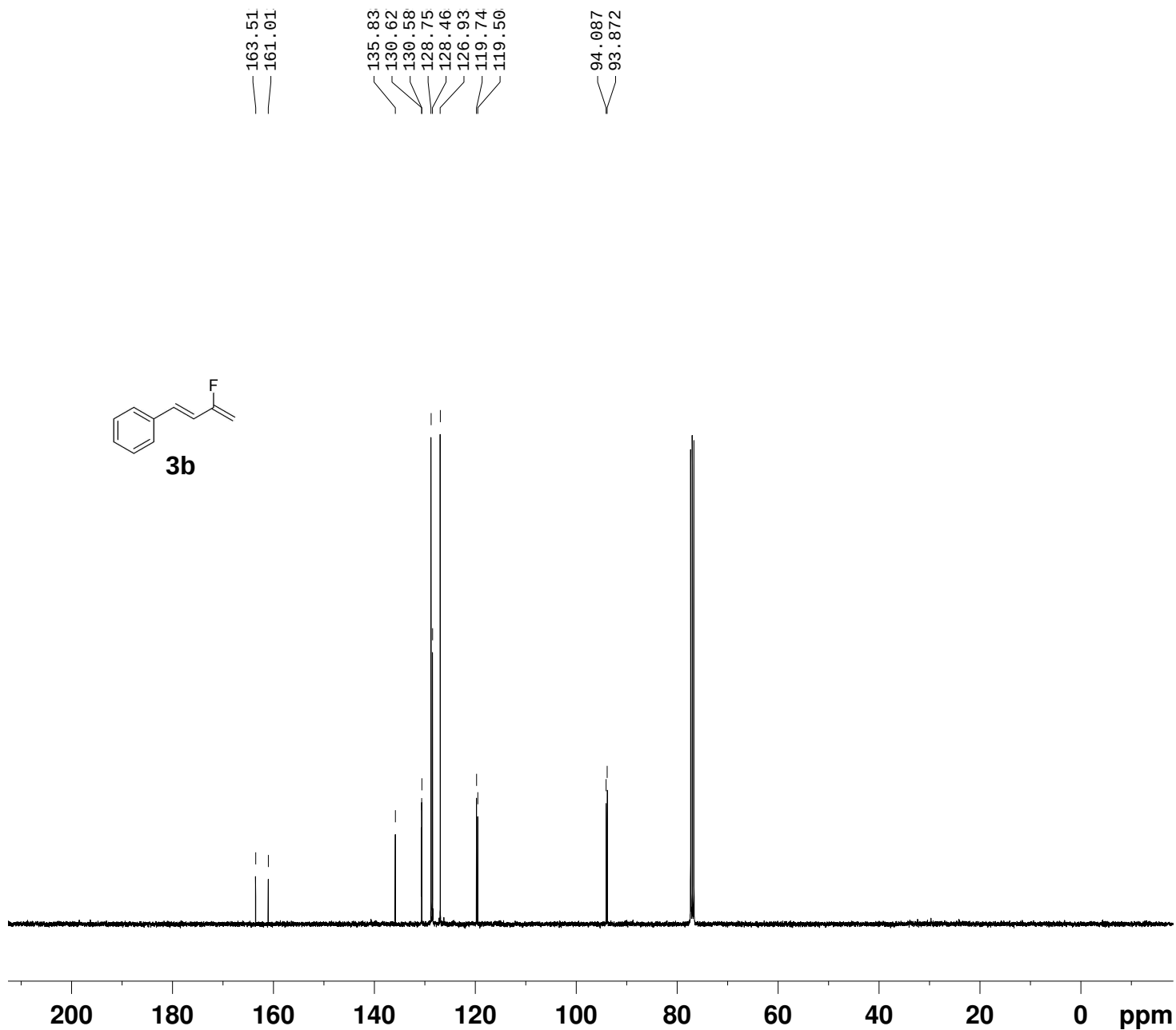
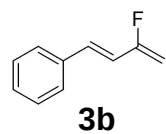
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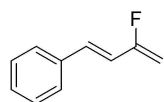
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4.504
4.497



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PROCNO 1
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Time 14.35 h
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PULPROG zg30
TD 65536
SOLVENT CDCl3
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DS 2
SWH 8196.722 Hz
FIDRES 0.250144 Hz
AQ 3.9977460 sec
RG 101
DW 61.000 usec
DE 13.89 usec
TE 298.0 K
D1 1.00000000 sec
TD0 1
SF01 400.1324708 MHz
NUC1 1H
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GB 0
PC 1.00

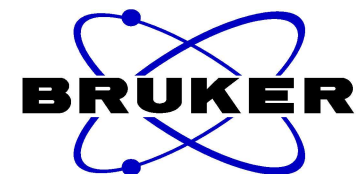


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 TD 65536
 SOLVENT CDCl3
 NS 600
 DS 4
 SWH 23809.523 Hz
 FIDRES 0.726609 Hz
 AQ 1.3763061 sec
 RG 101
 DW 21.000 usec
 DE 6.50 usec
 TE 298.9 K
 D1 2.00000000 sec
 D11 0.03000000 sec
 TD0 1
 SF01 100.6228298 MHz
 NUC1 13C
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 P1 8.00 usec
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 SF 100.6127685 MHz
 WDW EM
 SSB 0
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 GB 0
 PC 1.40



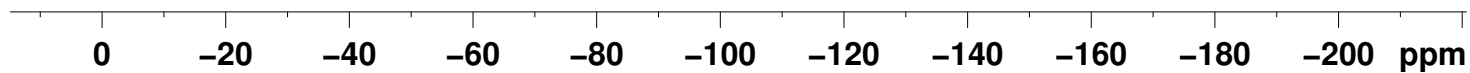
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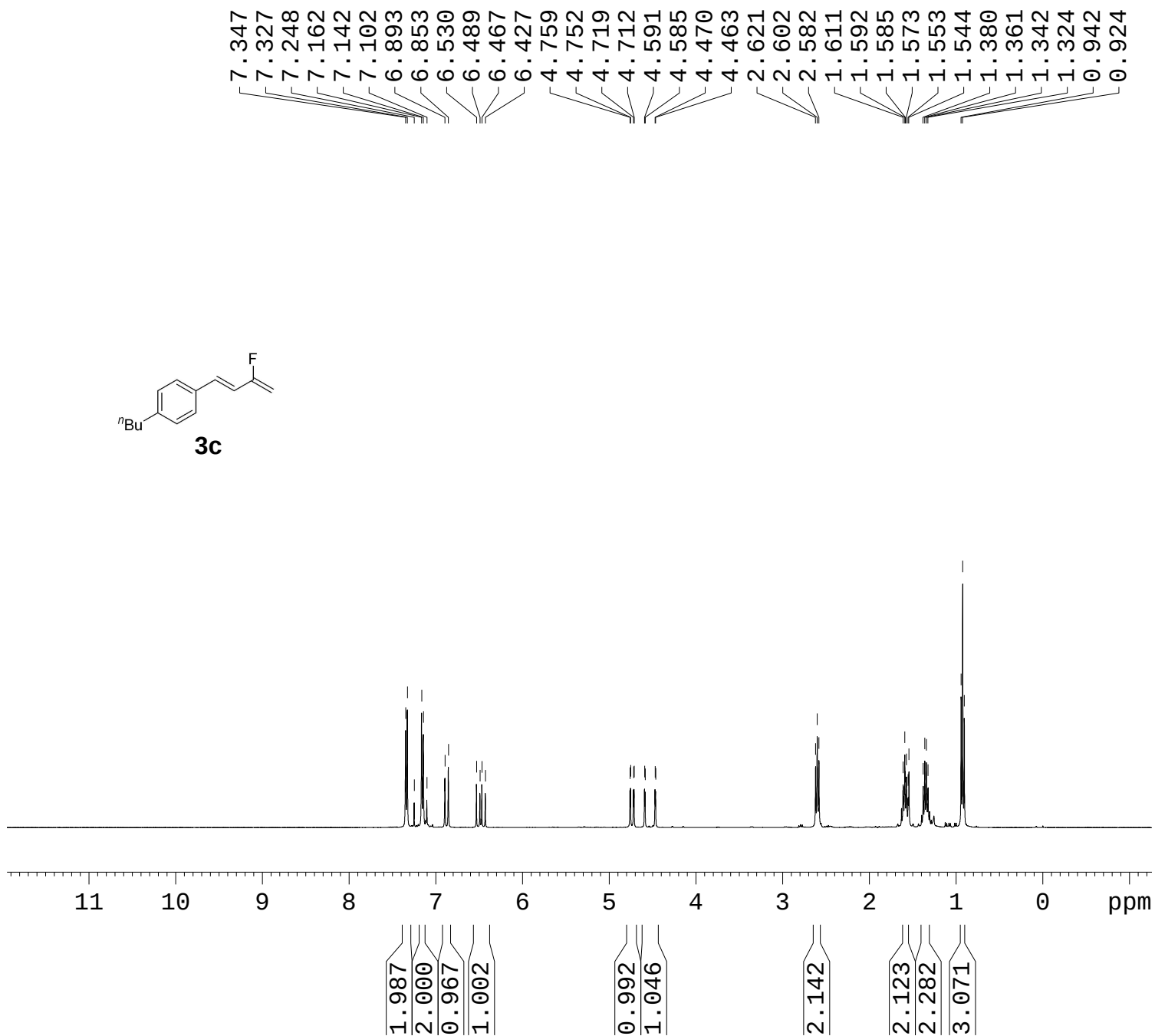
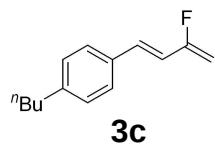
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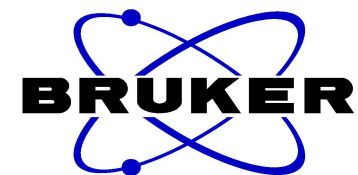
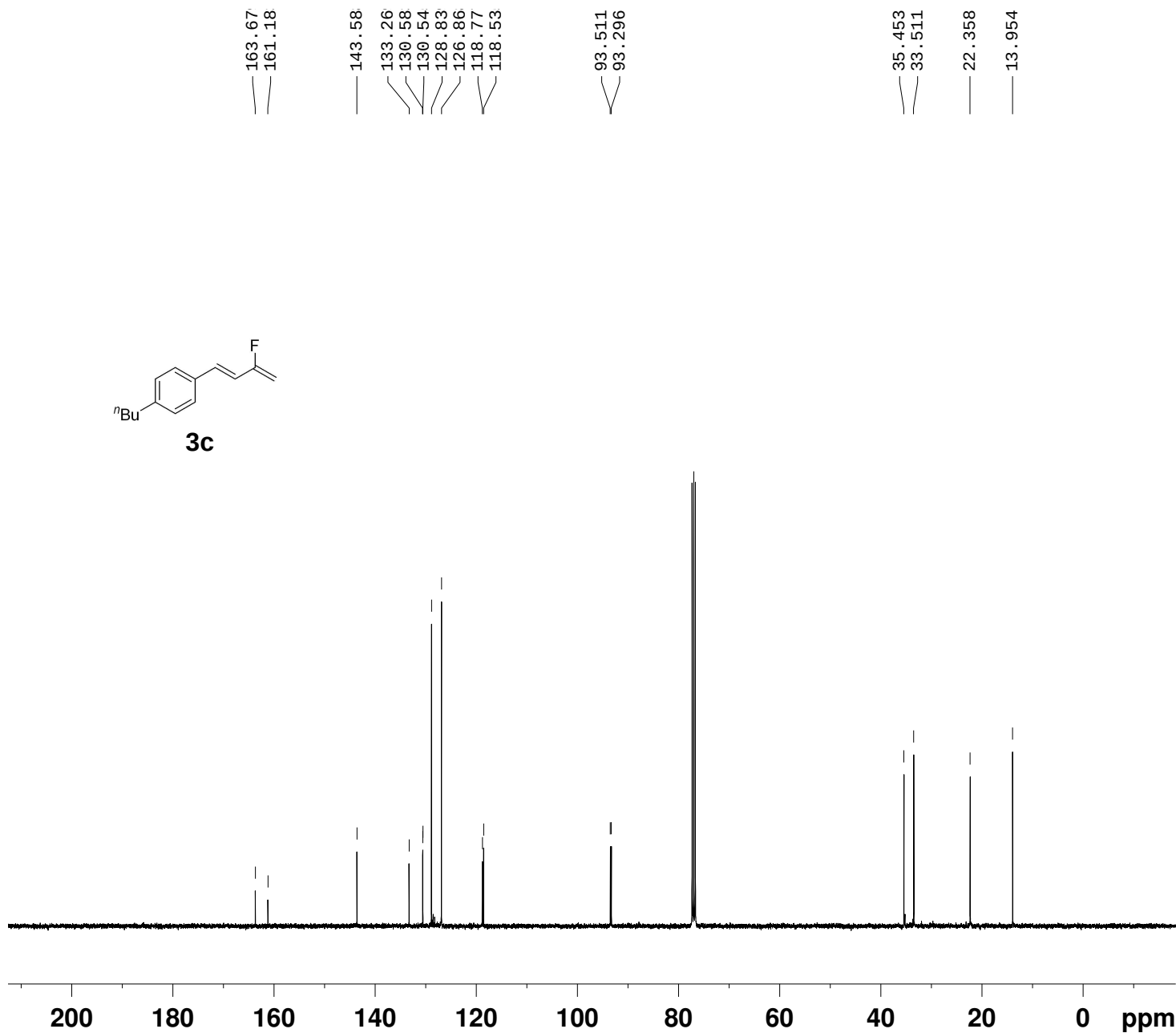
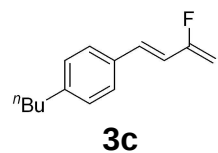
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TD         131072
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RG         101
DW         5.500 usec
DE         6.50 usec
TE         298.2 K
D1         1.00000000 sec
D11        0.03000000 sec
TD0        1
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NUC1       19F
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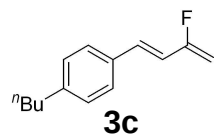




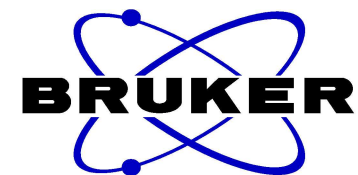
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TD	65536
SOLVENT	CDCl3
NS	16
DS	2
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FIDRES	0.250144 Hz
AQ	3.9977460 sec
RG	101
DW	61.000 usec
DE	13.89 usec
TE	298.0 K
D1	1.00000000 sec
TD0	1
SF01	400.1324708 MHz
NUC1	1H
P0	2.67 usec
P1	8.00 usec
SI	65536
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LB	0.30 Hz
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PC	1.00



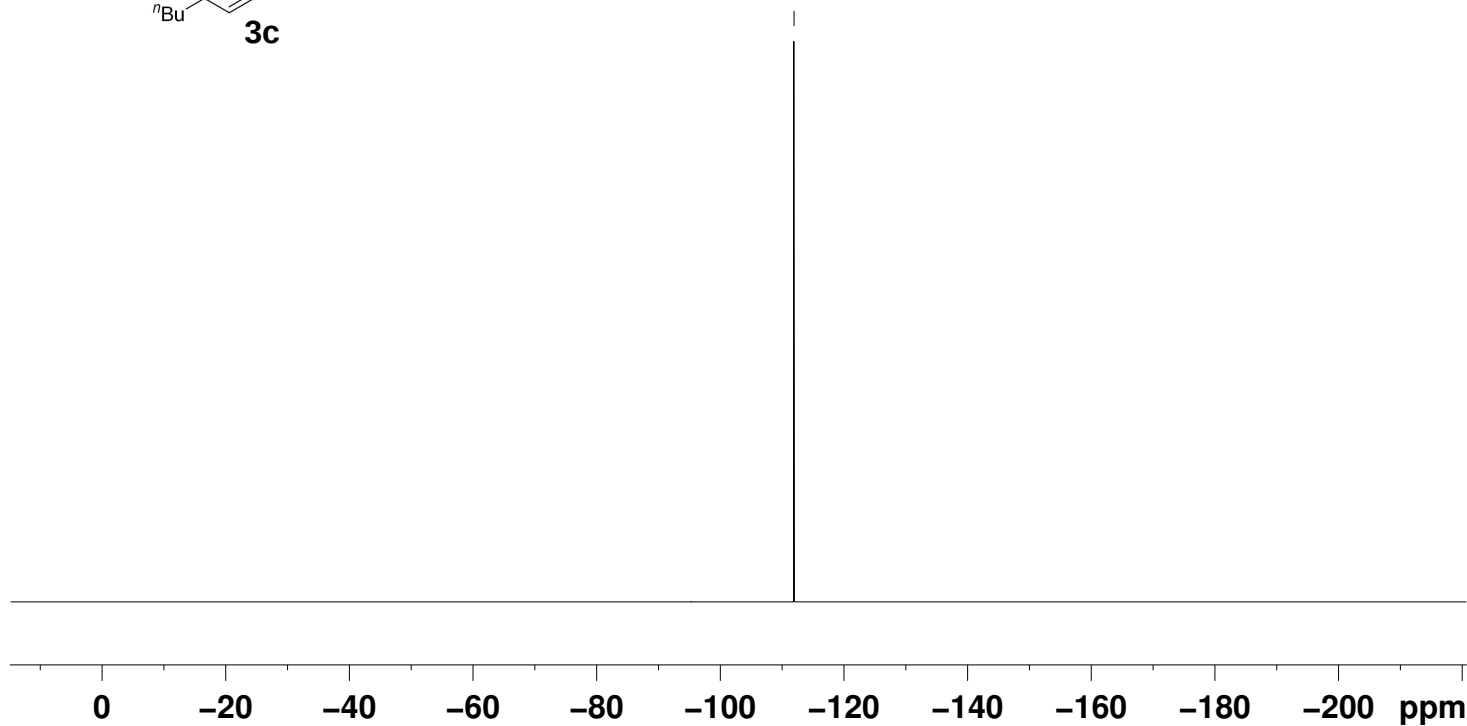
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 SOLVENT CDCl3
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 FIDRES 0.726609 Hz
 AQ 1.3763061 sec
 RG 101
 DW 21.000 usec
 DE 6.50 usec
 TE 298.6 K
 D1 2.00000000 sec
 D11 0.03000000 sec
 TD0 1
 SF01 100.6228298 MHz
 NUC1 13C
 P0 2.67 usec
 P1 8.00 usec
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 LB 1.00 Hz
 GB 0
 PC 1.40

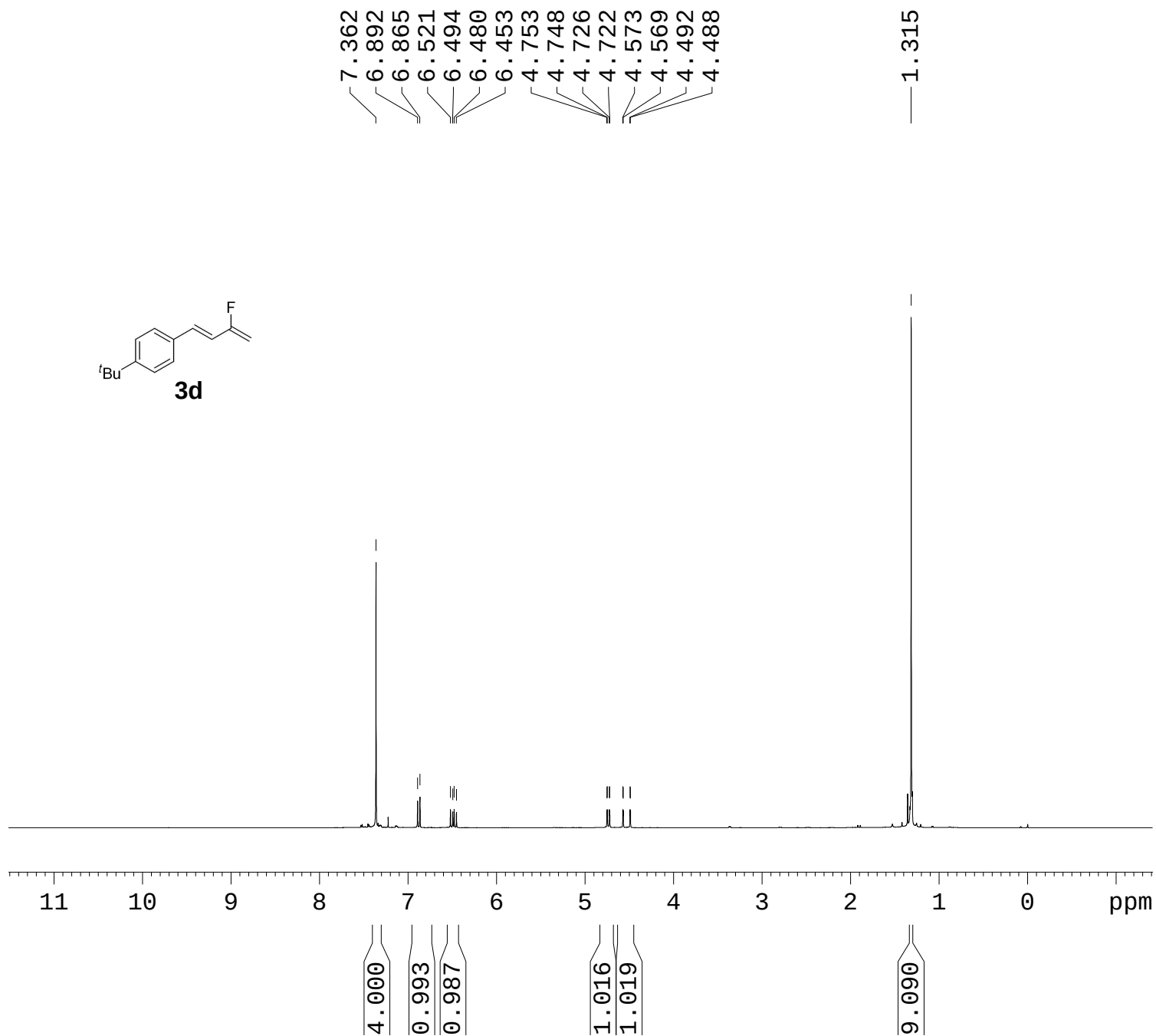
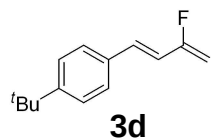


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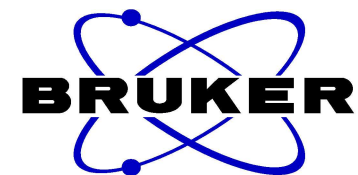
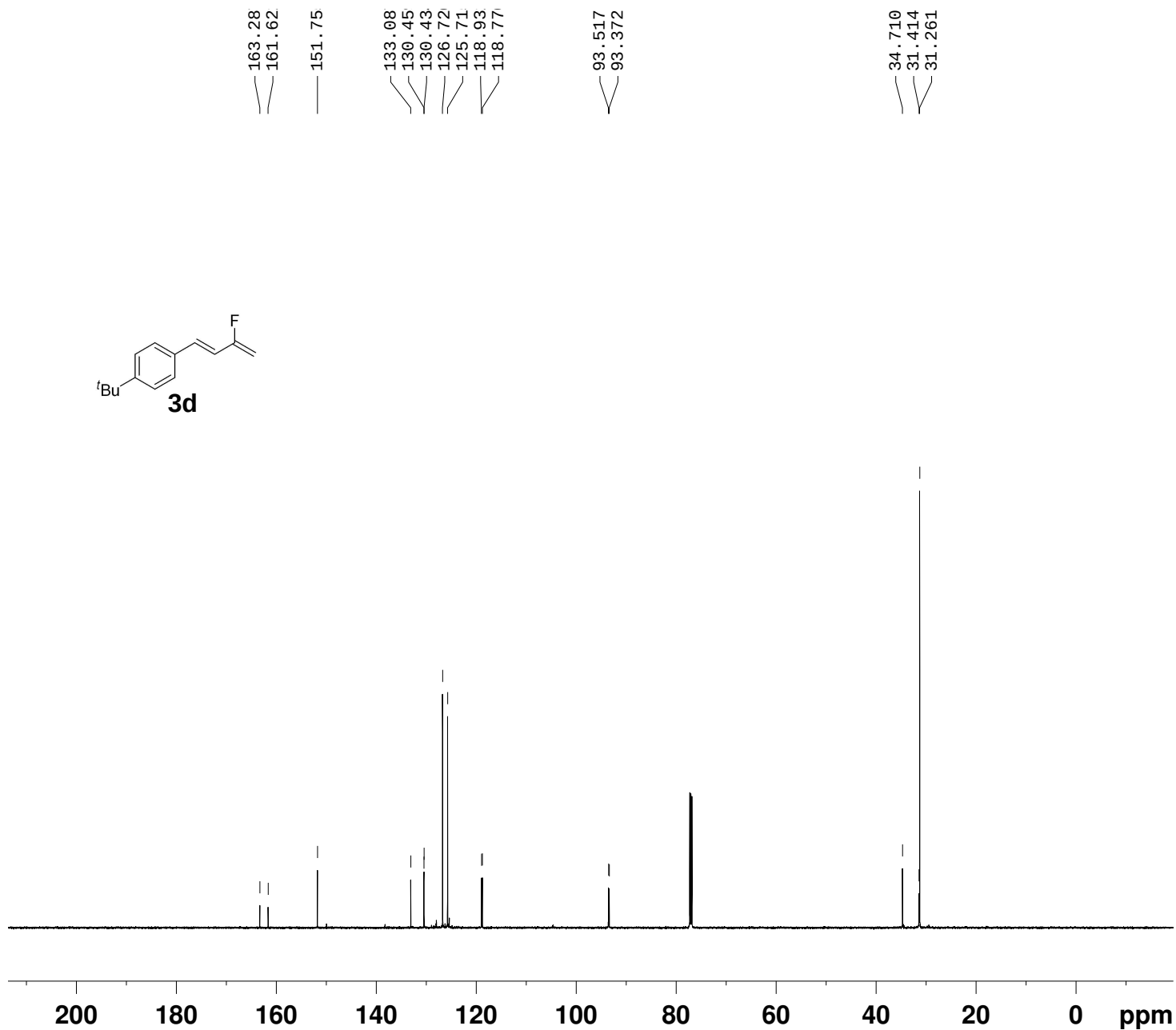
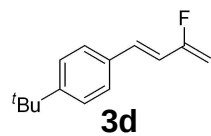
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 TD 131072
 SOLVENT CDCl3
 NS 16
 DS 4
 SWH 90909.094 Hz
 FIDRES 1.387163 Hz
 AQ 0.7209460 sec
 RG 101
 DW 5.500 usec
 DE 6.50 usec
 TE 298.1 K
 D1 1.00000000 sec
 D11 0.03000000 sec
 TD0 1
 SF01 376.4607164 MHz
 NUC1 19F
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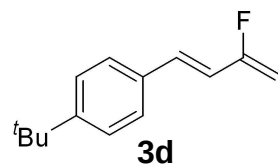
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 RG 30.73
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 DE 6.50 usec
 TE 0.0 K
 D1 1.00000000 sec
 TD0 1

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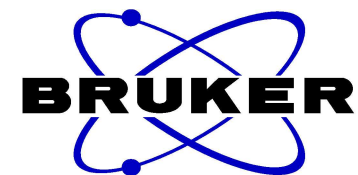


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 PULPROG zgpg30
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 SOLVENT CDCl3
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 DS 4
 SWH 36057.691 Hz
 FIDRES 0.550197 Hz
 AQ 0.9088159 sec
 RG 190.02
 DW 13.867 usec
 DE 6.50 usec
 TE 0.0 K
 D1 2.00000000 sec
 D11 0.03000000 sec
 TD0 1

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 NUC1 13C
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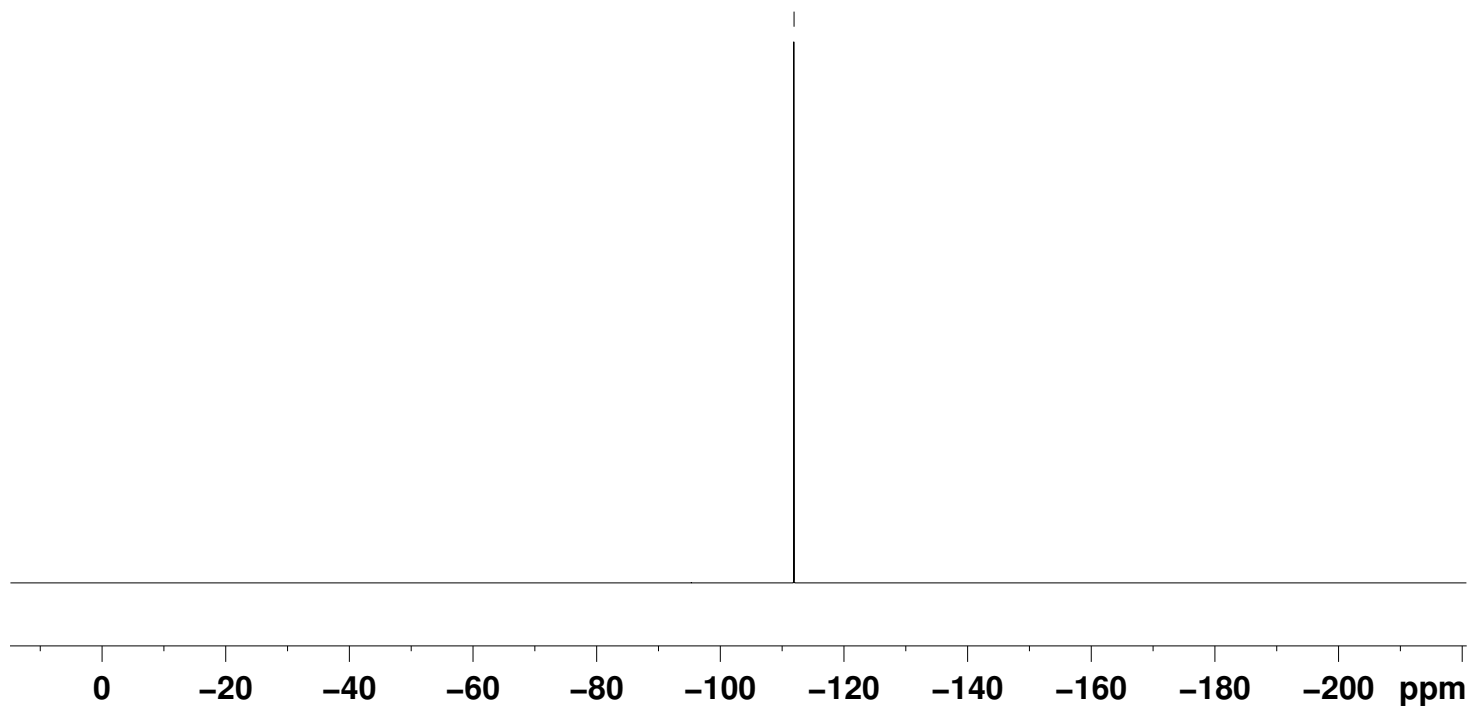


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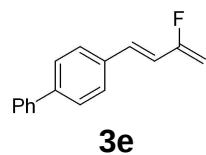


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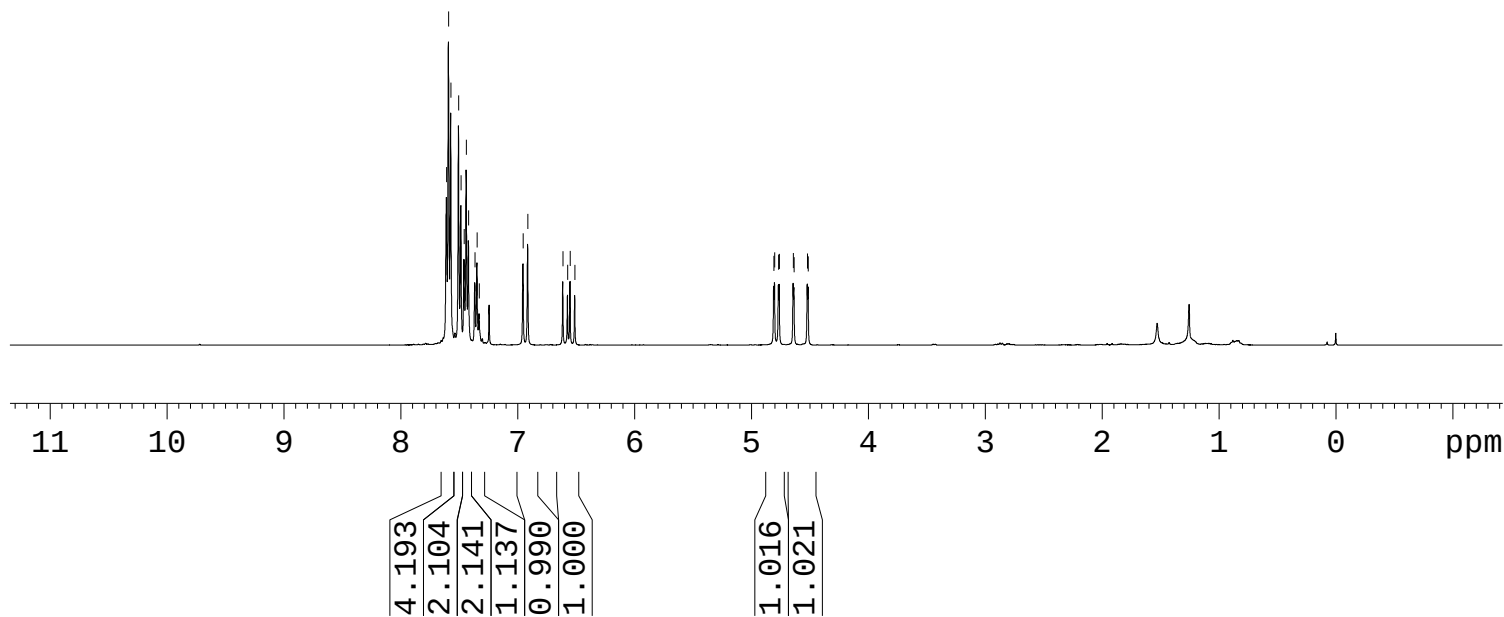
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PULPROG   zgig
TD         131072
SOLVENT   CDCl3
NS         16
DS         4
SWH        90909.094 Hz
FIDRES     1.387163 Hz
AQ         0.7209460 sec
RG         101
DW         5.500 usec
DE         6.50 usec
TE         298.1 K
D1         1.00000000 sec
D11        0.03000000 sec
TD0        1
SF01       376.4607164 MHz
NUC1       19F
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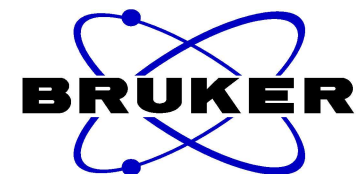
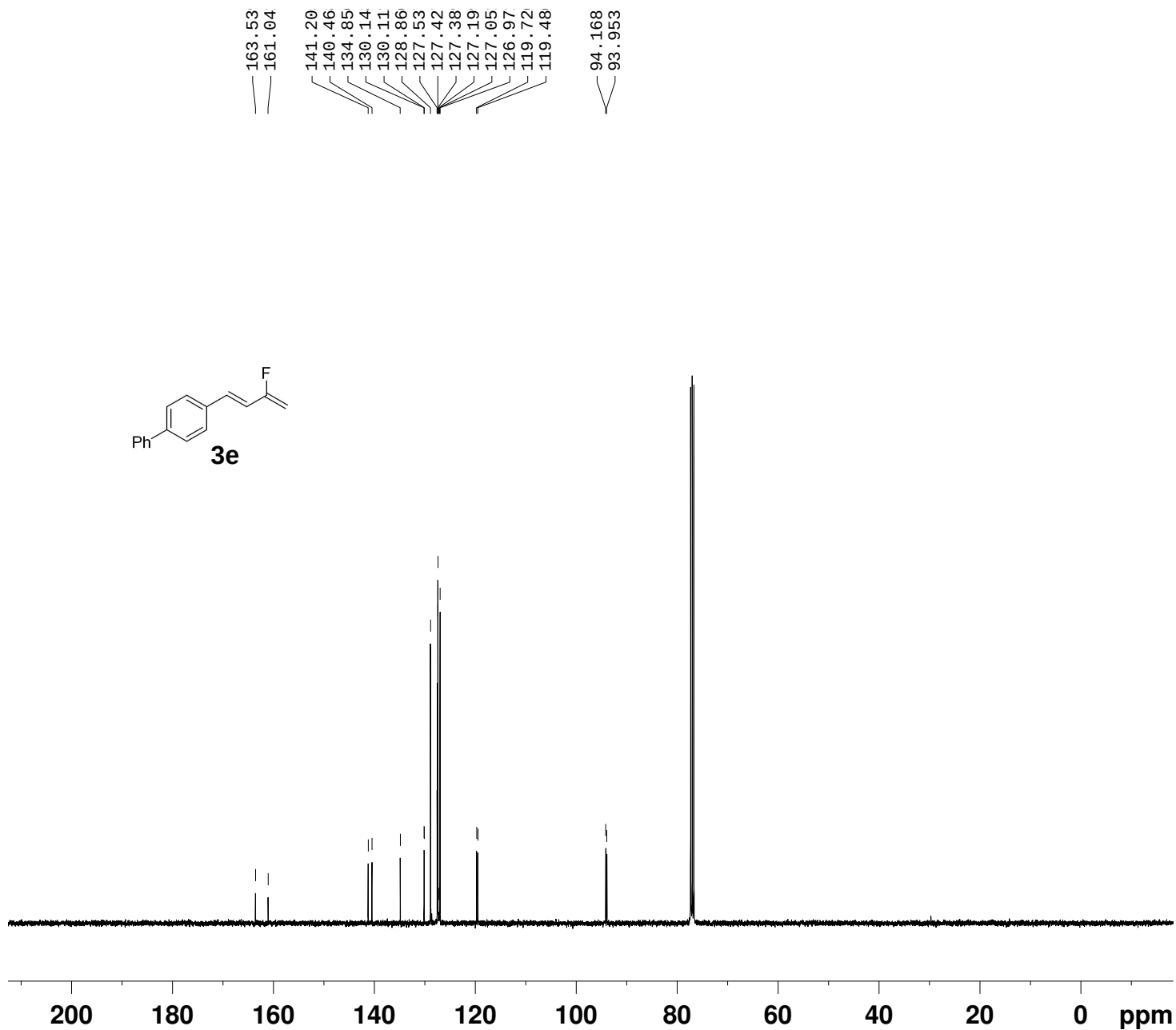
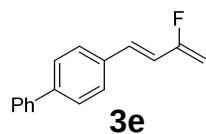


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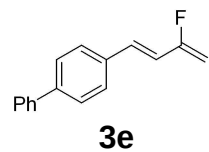


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TD 65536
SOLVENT CDCl3
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DS 2
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FIDRES 0.250144 Hz
AQ 3.9977460 sec
RG 101
DW 61.000 usec
DE 13.89 usec
TE 298.0 K
D1 1.00000000 sec
TD0 1
SF01 400.1324708 MHz
NUC1 1H
P0 2.67 usec
P1 8.00 usec
SI 65536
SF 400.1300173 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

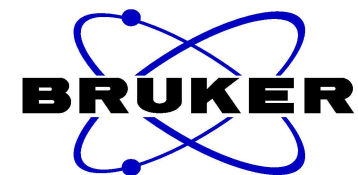




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 FIDRES 0.726609 Hz
 AQ 1.3763061 sec
 RG 101
 DW 21.000 usec
 DE 6.50 usec
 TE 298.0 K
 D1 2.00000000 sec
 D11 0.03000000 sec
 TD0 1
 SF01 100.6228298 MHz
 NUC1 13C
 P0 2.67 usec
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 SF 100.6127685 MHz
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 LB 1.00 Hz
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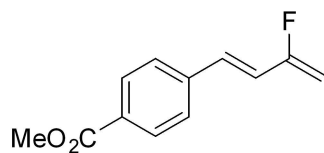


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 TD 131072
 SOLVENT CDCl3
 NS 16
 DS 4
 SWH 90909.094 Hz
 FIDRES 1.387163 Hz
 AQ 0.7209460 sec
 RG 101
 DW 5.500 usec
 DE 6.50 usec
 TE 298.1 K
 D1 1.00000000 sec
 D11 0.03000000 sec
 TD0 1
 SF01 376.4607164 MHz
 NUC1 19F
 P1 12.00 usec
 SI 65536
 SF 376.4983662 MHz
 WDW EM
 SSB 0
 LB 0.30 Hz
 GB 0
 PC 1.00

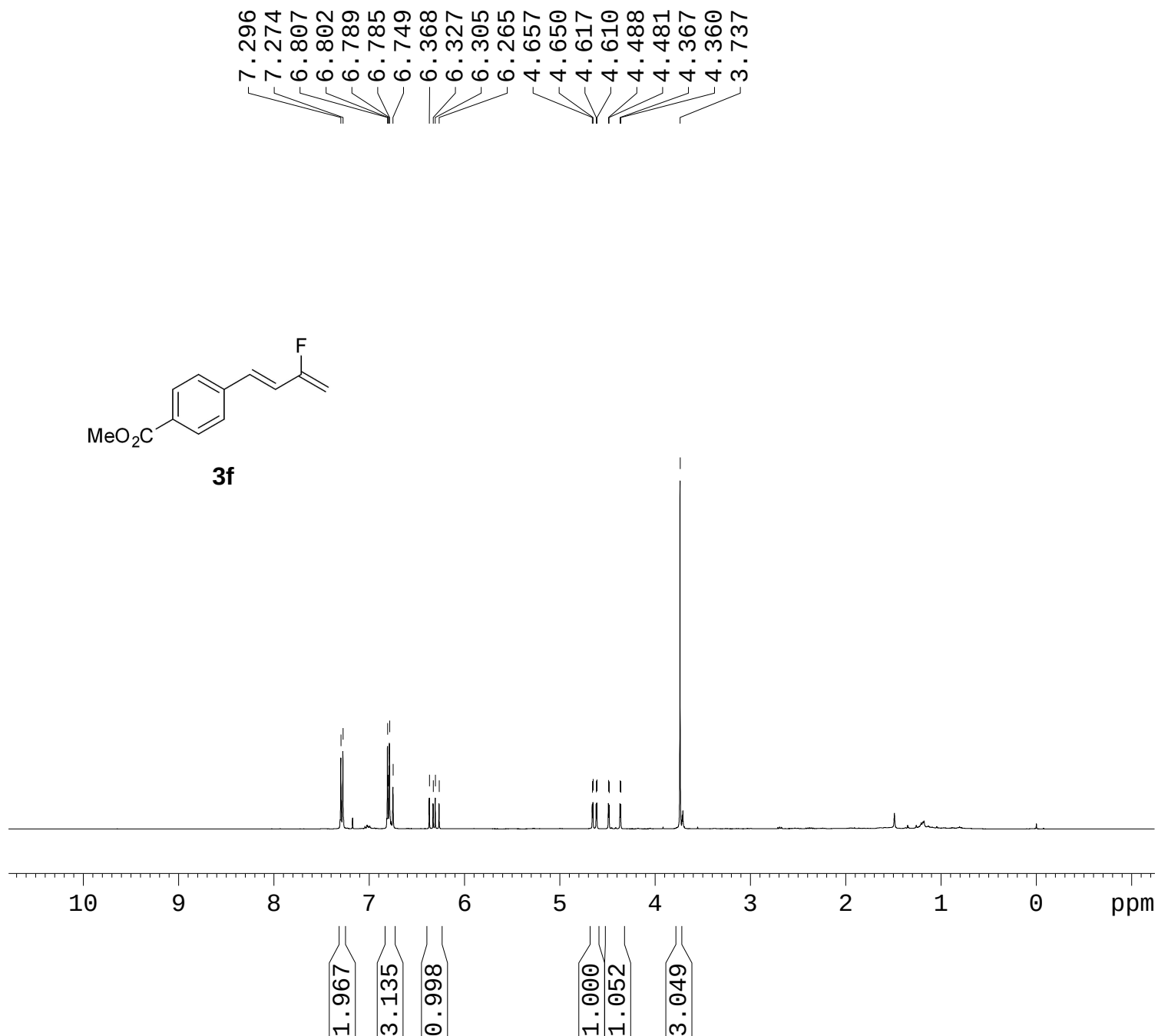
0 -20 -40 -60 -80 -100 -120 -140 -160 -180 -200 ppm

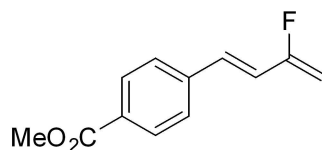


NAME LV-SJQ-648P-20250515
 EXPNO 10
 PROCNO 1
 Date_ 20250516
 Time 1.01 h
 INSTRUM Avance
 PROBHD Z163739_0744 (
 PULPROG zg30
 TD 65536
 SOLVENT CDCl3
 NS 16
 DS 2
 SWH 8196.722 Hz
 FIDRES 0.250144 Hz
 AQ 3.9977460 sec
 RG 71.8
 DW 61.000 usec
 DE 13.89 usec
 TE 298.5 K
 D1 1.00000000 sec
 TD0 1
 SF01 400.1324708 MHz
 NUC1 1H
 P0 2.67 usec
 P1 8.00 usec
 SI 65536
 SF 400.1300455 MHz
 WDW EM
 SSB 0
 LB 0.30 Hz
 GB 0
 PC 1.00

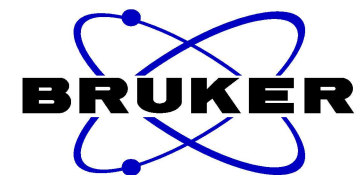
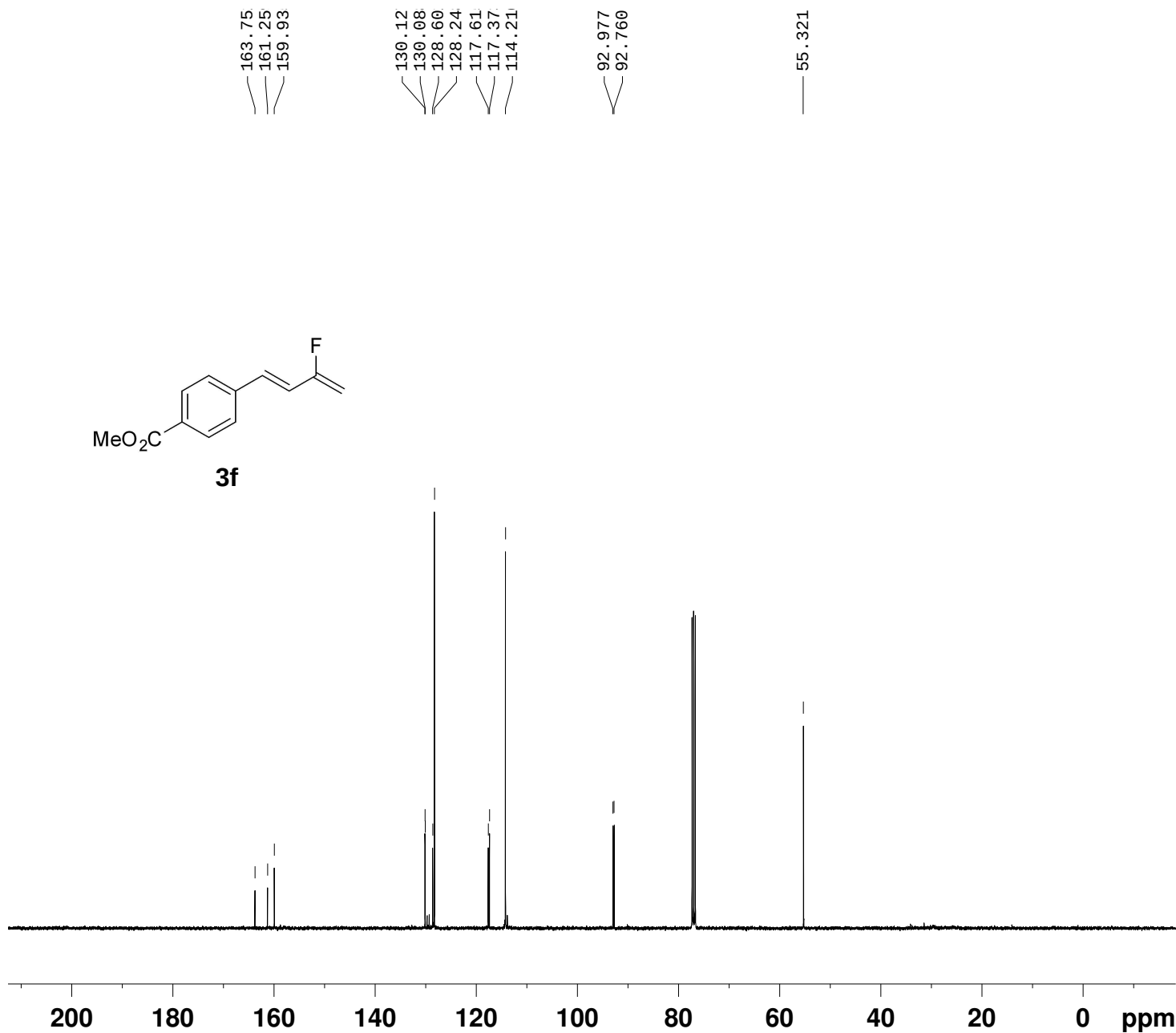


3f

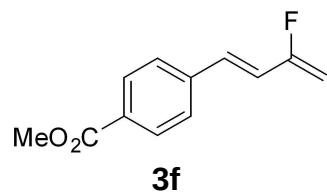




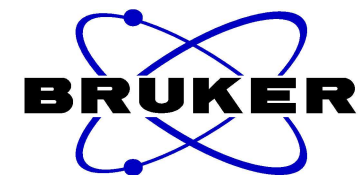
3f



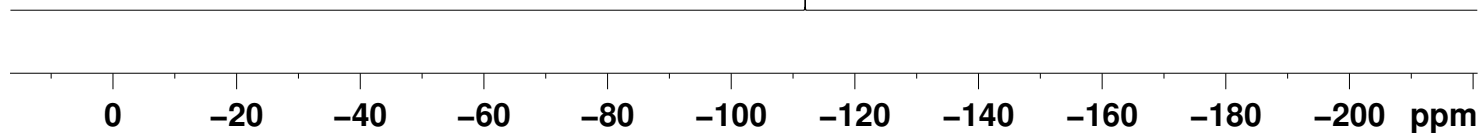
NAME LV-SJQ-648P-20250515
 EXPNO 12
 PROCNO 1
 Date_ 20250516
 Time 1.38 h
 INSTRUM Avance
 PROBHD Z163739_0744 (
 PULPROG zgpg30
 TD 65536
 SOLVENT CDCl3
 NS 600
 DS 4
 SWH 23809.523 Hz
 FIDRES 0.726609 Hz
 AQ 1.3763061 sec
 RG 101
 DW 21.000 usec
 DE 6.50 usec
 TE 299.0 K
 D1 2.00000000 sec
 D11 0.03000000 sec
 TD0 1
 SF01 100.6228298 MHz
 NUC1 13C
 P0 2.67 usec
 P1 8.00 usec
 SI 32768
 SF 100.6127685 MHz
 WDW EM
 SSB 0
 LB 1.00 Hz
 GB 0
 PC 1.40

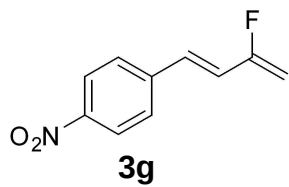


— -111.92



NAME LV-SJQ-648P-20250515
 EXPNO 11
 PROCNO 1
 Date_ 20250516
 Time 1.02 h
 INSTRUM Avance
 PROBHD Z163739_0744 (
 PULPROG zgig
 TD 131072
 SOLVENT CDCl3
 NS 16
 DS 4
 SWH 90909.094 Hz
 FIDRES 1.387163 Hz
 AQ 0.7209460 sec
 RG 101
 DW 5.500 usec
 DE 6.50 usec
 TE 298.6 K
 D1 1.00000000 sec
 D11 0.03000000 sec
 TD0 1
 SF01 376.4607164 MHz
 NUC1 19F
 P1 12.00 usec
 SI 65536
 SF 376.4983662 MHz
 WDW EM
 SSB 0
 LB 0.30 Hz
 GB 0
 PC 1.00

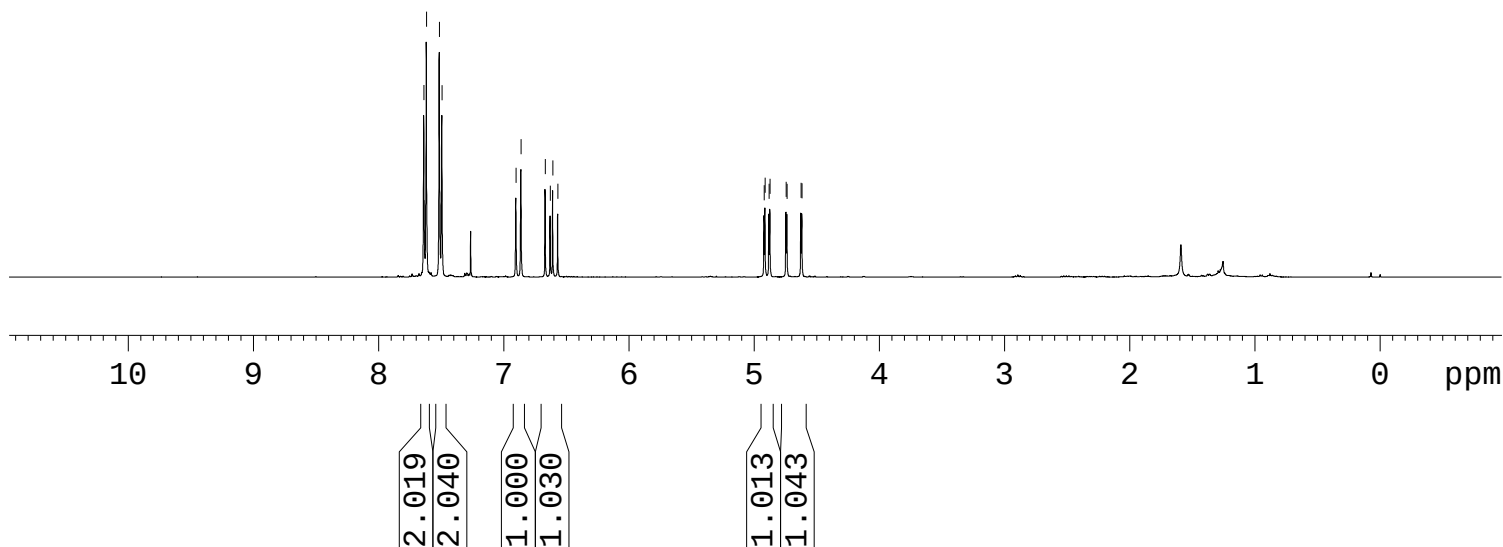


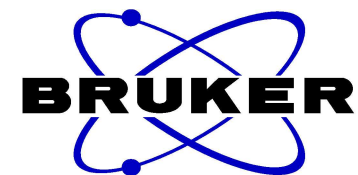
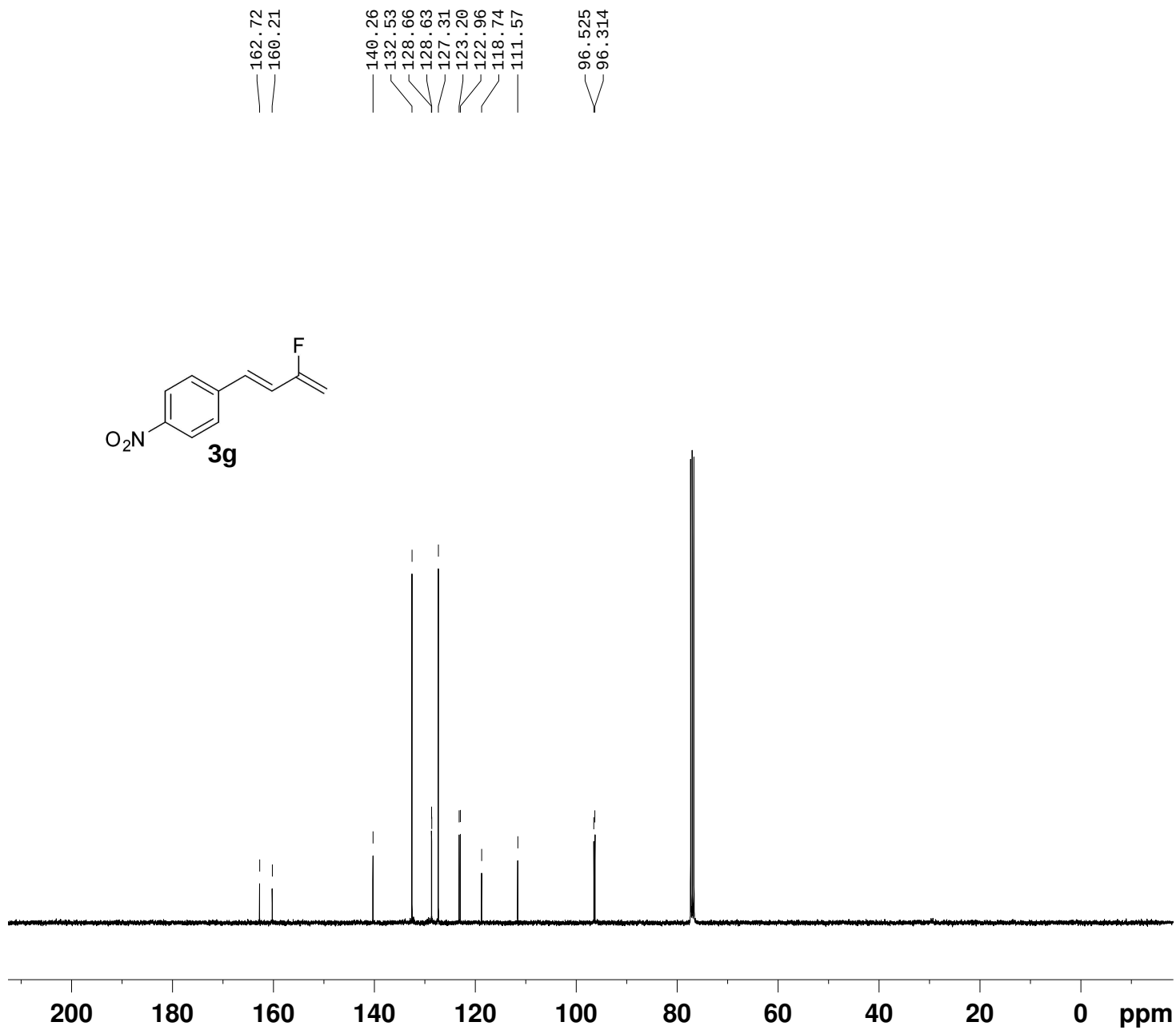
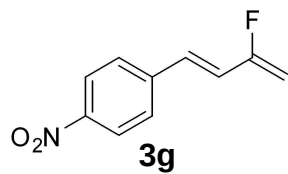


7.638
 7.617
 7.514
 7.494
 6.902
 6.862
 6.669
 6.629
 6.608
 6.568
 4.920
 4.913
 4.881
 4.873
 4.745
 4.737
 4.625
 4.618

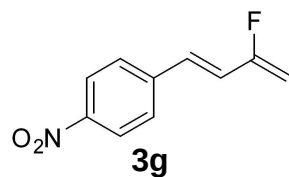


NAME LV-SJQ-646P-20250515
 EXPNO 10
 PROCNO 1
 Date_ 20250516
 Time 2.07 h
 INSTRUM Avance
 PROBHD Z163739_0744 (
 PULPROG zg30
 TD 65536
 SOLVENT CDCl3
 NS 16
 DS 2
 SWH 8196.722 Hz
 FIDRES 0.250144 Hz
 AQ 3.9977460 sec
 RG 101
 DW 61.000 usec
 DE 13.89 usec
 TE 298.4 K
 D1 1.00000000 sec
 TD0 1
 SF01 400.1324708 MHz
 NUC1 1H
 P0 2.67 usec
 P1 8.00 usec
 SI 65536
 SF 400.1300092 MHz
 WDW EM
 SSB 0
 LB 0.30 Hz
 GB 0
 PC 1.00

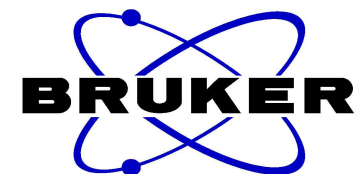




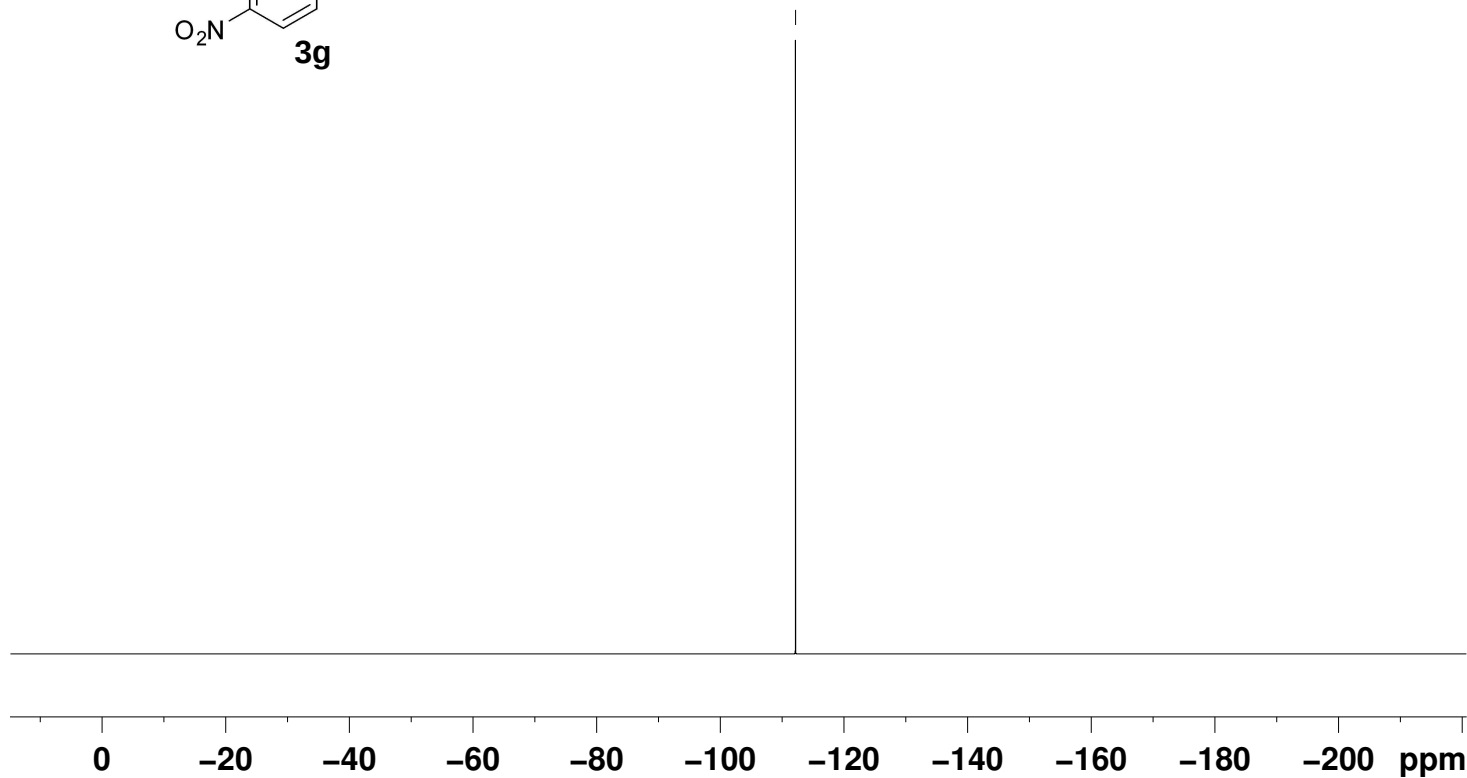
NAME LV-SJQ-646P-20250515
 EXPNO 12
 PROCNO 1
 Date_ 20250516
 Time 2.45 h
 INSTRUM Avance
 PROBHD Z163739_0744 (
 PULPROG zgpg30
 TD 65536
 SOLVENT CDCl3
 NS 600
 DS 4
 SWH 23809.523 Hz
 FIDRES 0.726609 Hz
 AQ 1.3763061 sec
 RG 101
 DW 21.000 usec
 DE 6.50 usec
 TE 298.8 K
 D1 2.00000000 sec
 D11 0.03000000 sec
 TD0 1
 SF01 100.6228298 MHz
 NUC1 13C
 P0 2.67 usec
 P1 8.00 usec
 SI 32768
 SF 100.6127685 MHz
 WDW EM
 SSB 0
 LB 1.00 Hz
 GB 0
 PC 1.40

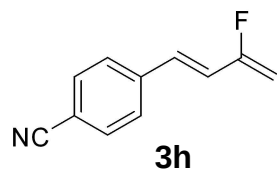


— -112.1



NAME LV-SJQ-646P-20250515
 EXPNO 11
 PROCNO 1
 Date_ 20250516
 Time 2.09 h
 INSTRUM Avance
 PROBHD Z163739_0744 (
 PULPROG zgig
 TD 131072
 SOLVENT CDCl3
 NS 16
 DS 4
 SWH 90909.094 Hz
 FIDRES 1.387163 Hz
 AQ 0.7209460 sec
 RG 101
 DW 5.500 usec
 DE 6.50 usec
 TE 298.5 K
 D1 1.00000000 sec
 D11 0.03000000 sec
 TD0 1
 SF01 376.4607164 MHz
 NUC1 19F
 P1 12.00 usec
 SI 65536
 SF 376.4983662 MHz
 WDW EM
 SSB 0
 LB 0.30 Hz
 GB 0
 PC 1.00



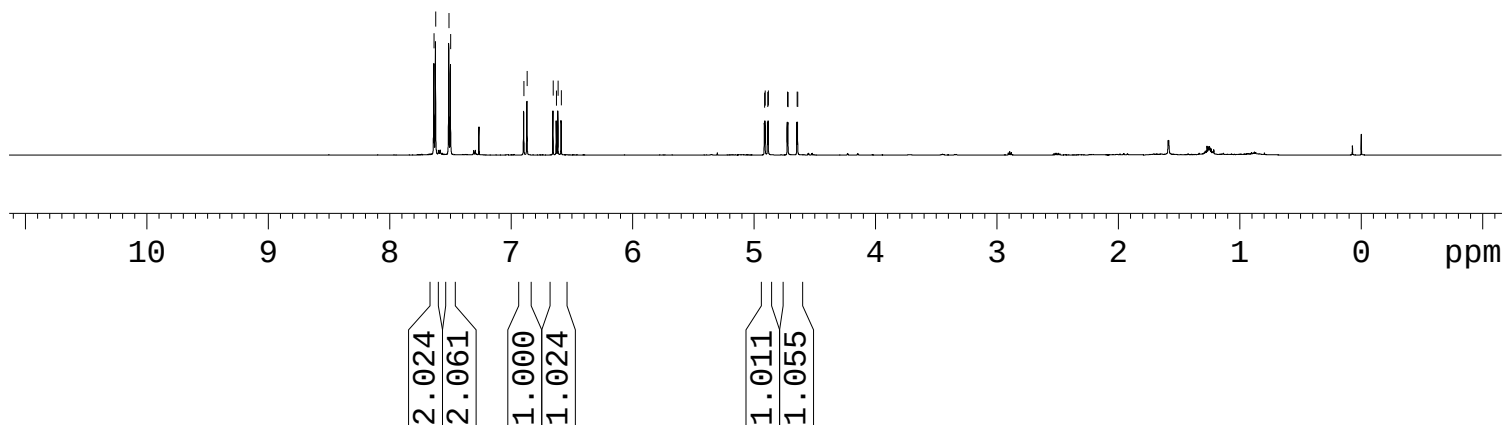


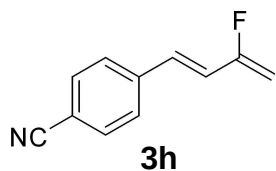
7.635
7.622
7.512
7.498
6.895
6.869
6.654
6.627
6.614
6.587
4.913
4.908
4.887
4.882
4.725
4.720
4.645
4.640



NAME LV-SJQ-652P-20250527
EXPNO 1
PROCNO 1
Date_ 20250527
Time 18.05
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 12019.230 Hz
FIDRES 0.183399 Hz
AQ 2.7263477 sec
RG 96.28
DW 41.600 usec
DE 6.50 usec
TE 298.0 K
D1 1.00000000 sec
TD0 1

===== CHANNEL f1 =====
SF01 600.1737063 MHz
NUC1 1H
P1 9.96 usec
SI 65536
SF 600.1700119 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

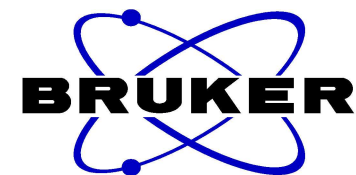




162.29
160.62

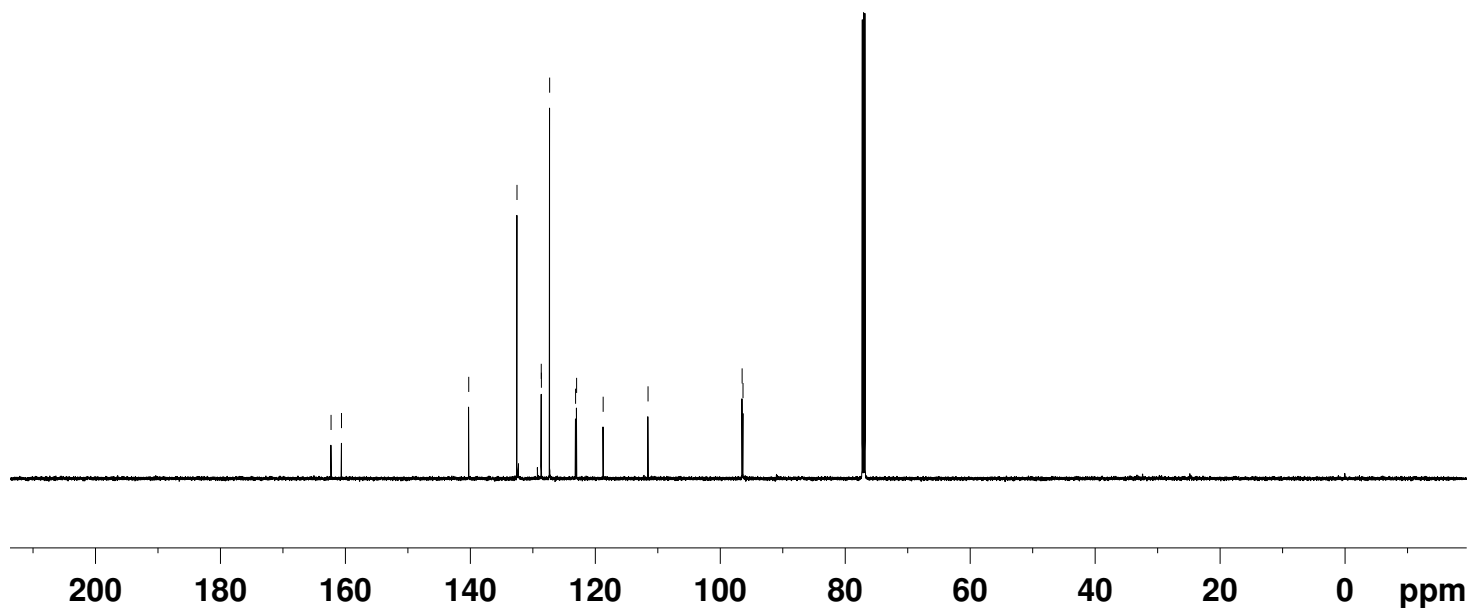
140.26
132.53
128.65
128.63
127.31
123.16
122.99
118.74
111.56

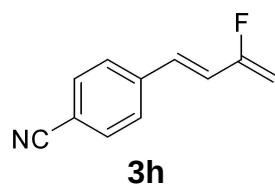
96.505
96.364



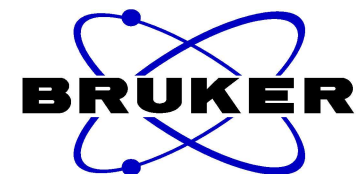
NAME LV-SJQ-652P-20250527
EXPNO 3
PROCNO 1
Date_ 20250527
Time 18.38
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 600
DS 4
SWH 36057.691 Hz
FIDRES 0.550197 Hz
AQ 0.9088159 sec
RG 190.02
DW 13.867 usec
DE 6.50 usec
TE 298.0 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1

===== CHANNEL f1 =====
SF01 150.9279571 MHz
NUC1 13C
P1 11.90 usec
SI 32768
SF 150.9128665 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40



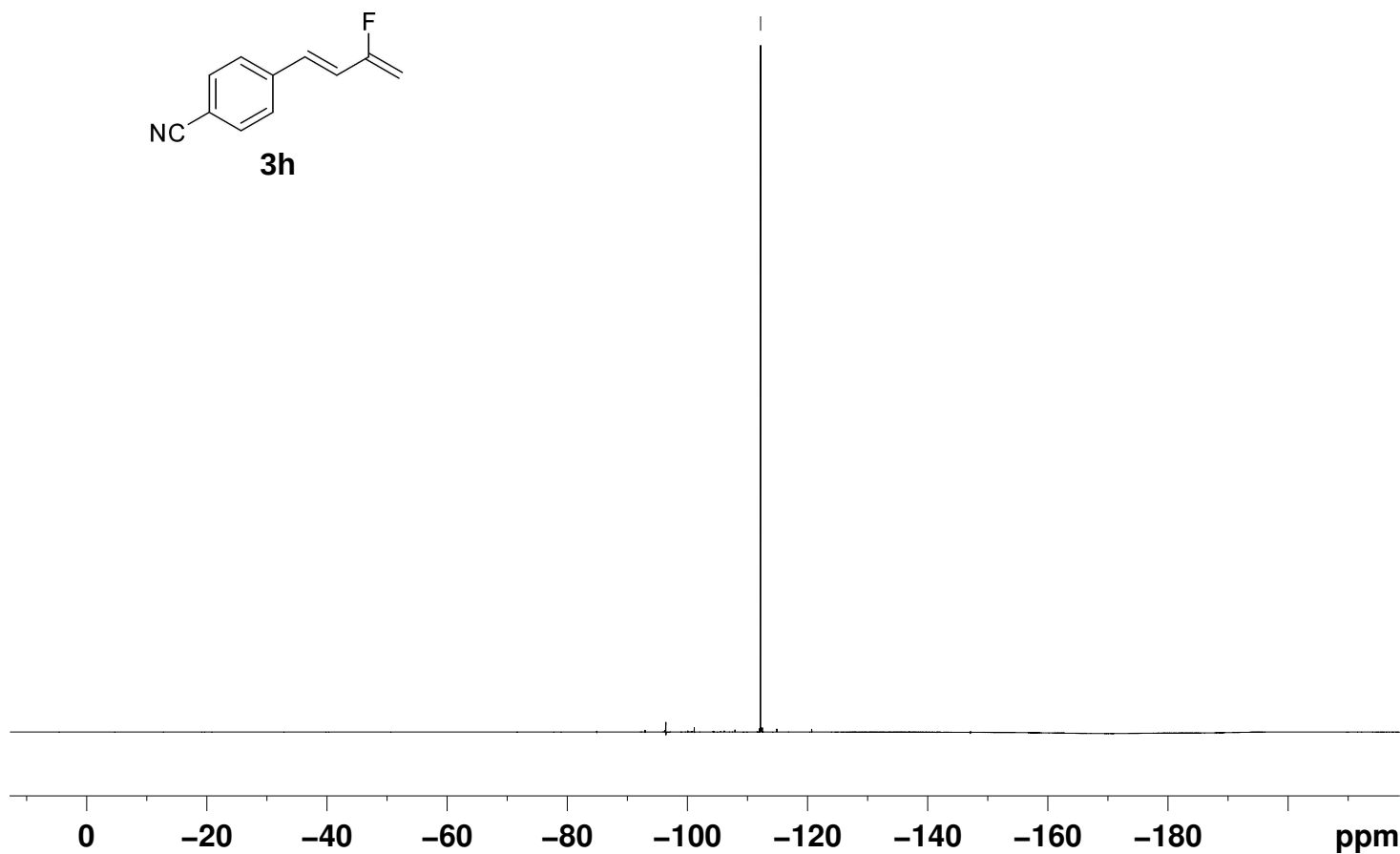


— -112.1



NAME LV-SJQ-652P-20250527
 EXPNO 2
 PROCNO 1
 Date_ 20250527
 Time 18.07
 INSTRUM spect
 PROBHD 5 mm PABBO BB/
 PULPROG zgfhigqn.2
 TD 131072
 SOLVENT CDCl3
 NS 16
 DS 4
 SWH 133928.578 Hz
 FIDRES 1.021794 Hz
 AQ 0.4893855 sec
 RG 190.02
 DW 3.733 usec
 DE 6.50 usec
 TE 298.1 K
 D1 1.00000000 sec
 D11 0.03000000 sec
 D12 0.00002000 sec
 TD0 1

===== CHANNEL f1 =====
 SF01 564.6675534 MHz
 NUC1 19F
 P1 12.00 usec
 SI 65536
 SF 564.7240258 MHz
 WDW EM
 SSB 0
 LB 0.30 Hz
 GB 0
 PC 1.00

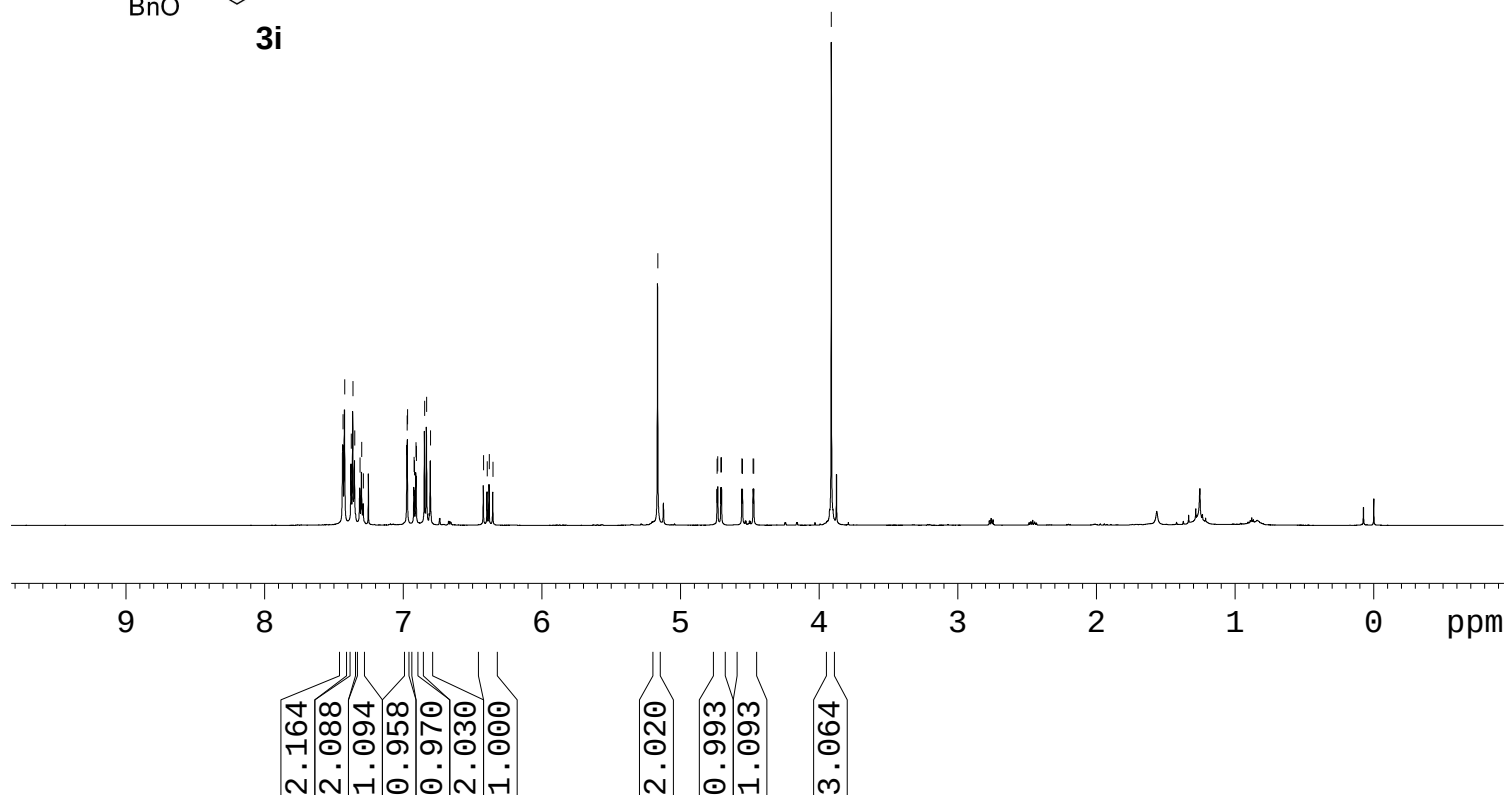
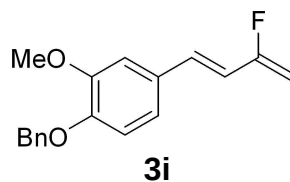


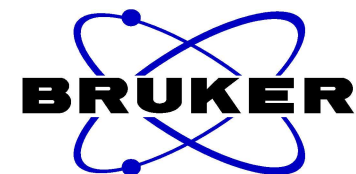
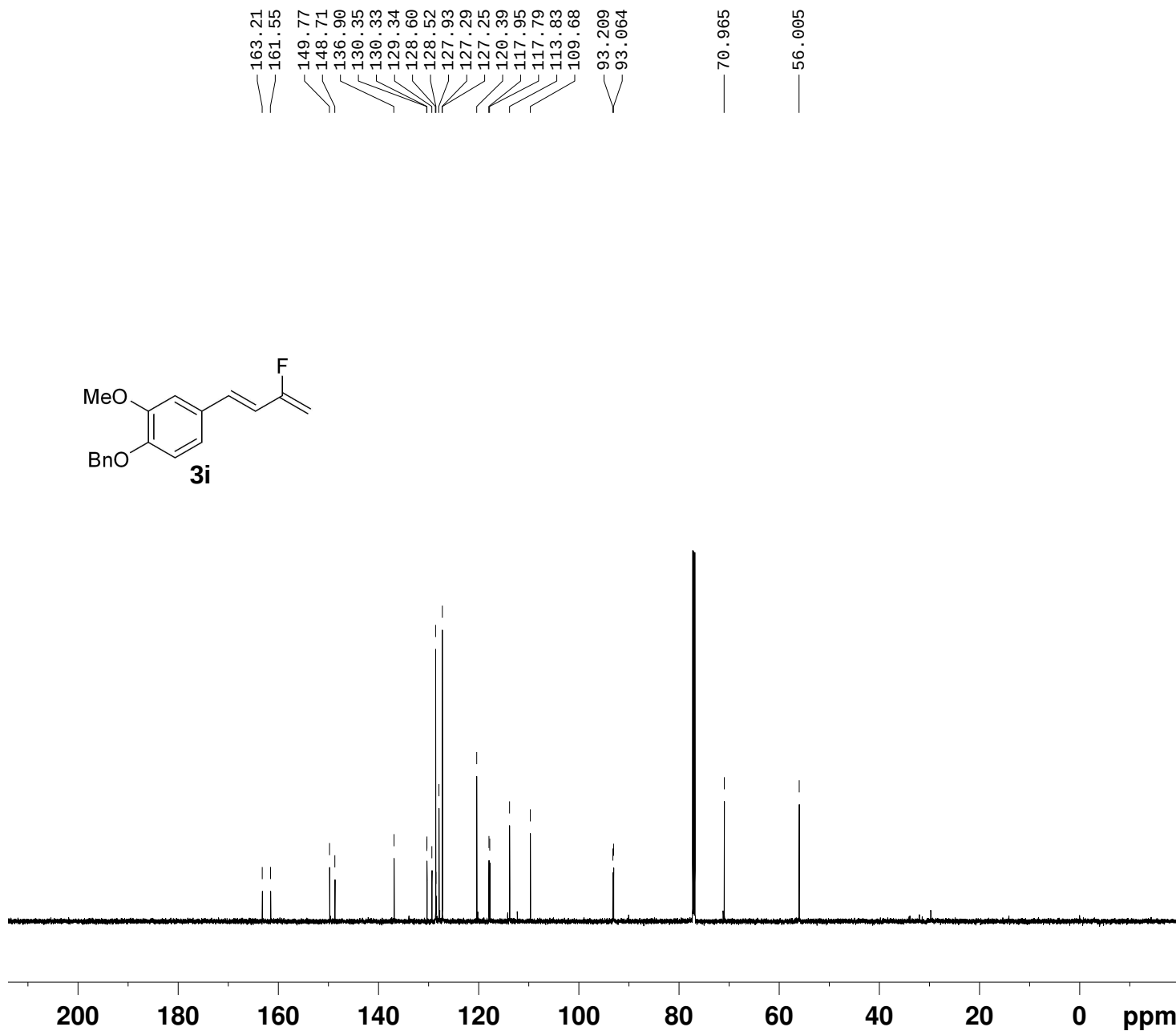
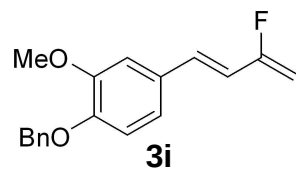


NAME LV-SJQ-Bn-table1-20250919
 EXPNO 1
 PROCNO 1
 Date_ 20250919
 Time 18.05
 INSTRUM spect
 PROBHD 5 mm PABBO BB/
 PULPROG zg30
 TD 65536
 SOLVENT CDCl3
 NS 16
 DS 2
 SWH 12019.230 Hz
 FIDRES 0.183399 Hz
 AQ 2.7263477 sec
 RG 69.87
 DW 41.600 usec
 DE 6.50 usec
 TE 297.1 K
 D1 1.00000000 sec
 TD0 1

===== CHANNEL f1 =====
 SF01 600.1737063 MHz
 NUC1 1H
 P1 9.96 usec
 SI 65536
 SF 600.1700209 MHz
 WDW EM
 SSB 0
 LB 0.30 Hz
 GB 0
 PC 1.00

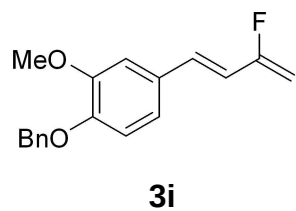
7.422
 7.375
 7.363
 7.350
 7.312
 7.300
 7.288
 6.972
 6.969
 6.922
 6.919
 6.908
 6.905
 6.846
 6.832
 6.803
 6.421
 6.394
 6.379
 6.353
 5.164
 4.736
 4.732
 4.709
 4.705
 4.558
 4.553
 4.477
 4.472
 3.913



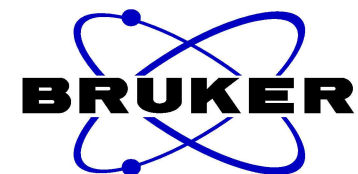


NAME LV-SJQ-Bn-table1-20250919
 EXPNO 4
 PROCNO 1
 Date_ 20250919
 Time 18.23
 INSTRUM spect
 PROBHD 5 mm PABBO BB/
 PULPROG zgpg30
 TD 65536
 SOLVENT CDCl3
 NS 300
 DS 4
 SWH 36057.691 Hz
 FIDRES 0.550197 Hz
 AQ 0.9088159 sec
 RG 190.02
 DW 13.867 usec
 DE 6.50 usec
 TE 298.1 K
 D1 2.00000000 sec
 D11 0.03000000 sec
 TD0 1

===== CHANNEL f1 =====
 SF01 150.9279571 MHz
 NUC1 13C
 P1 11.90 usec
 SI 32768
 SF 150.9128665 MHz
 WDW EM
 SSB 0
 LB 1.00 Hz
 GB 0
 PC 1.40



— -111.8

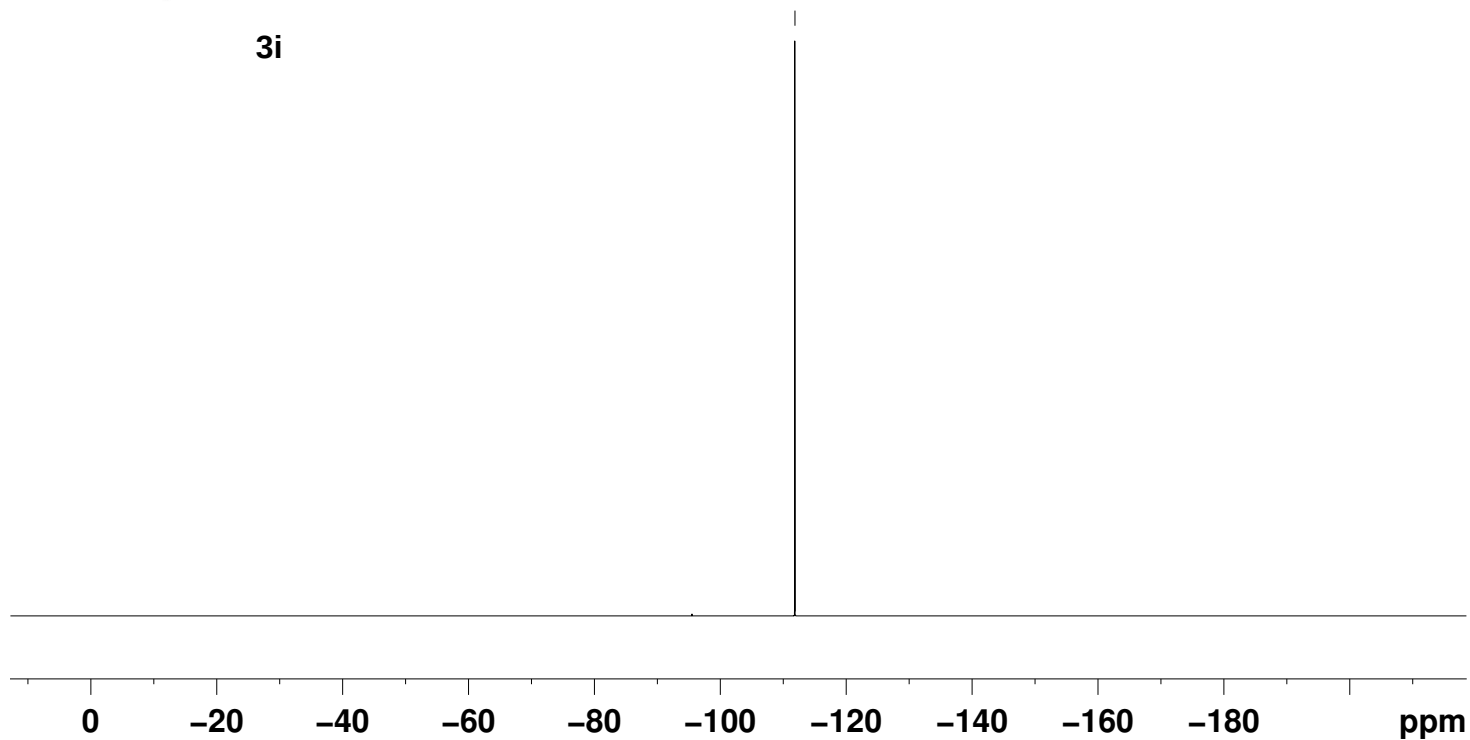


```

NAME      LV-SJQ-Bn-table1-20250919
EXPNO     3
PROCNO    1
Date_     20250919
Time      18.07
INSTRUM   spect
PROBHD    5 mm PABBO BB/
PULPROG   zgfhigqn.2
TD        131072
SOLVENT   CDCl3
NS        16
DS        4
SWH       133928.578 Hz
FIDRES    1.021794 Hz
AQ        0.4893855 sec
RG        190.02
DW        3.733 usec
DE        6.50 usec
TE        297.1 K
D1        1.00000000 sec
D11       0.03000000 sec
D12       0.00002000 sec
TD0       1
  
```

```

===== CHANNEL f1 =====
SF01    564.6675534 MHz
NUC1     19F
P1       12.00 usec
SI       65536
SF       564.7240258 MHz
WDW      EM
SSB      0
LB       0.30 Hz
GB       0
PC       1.00
  
```

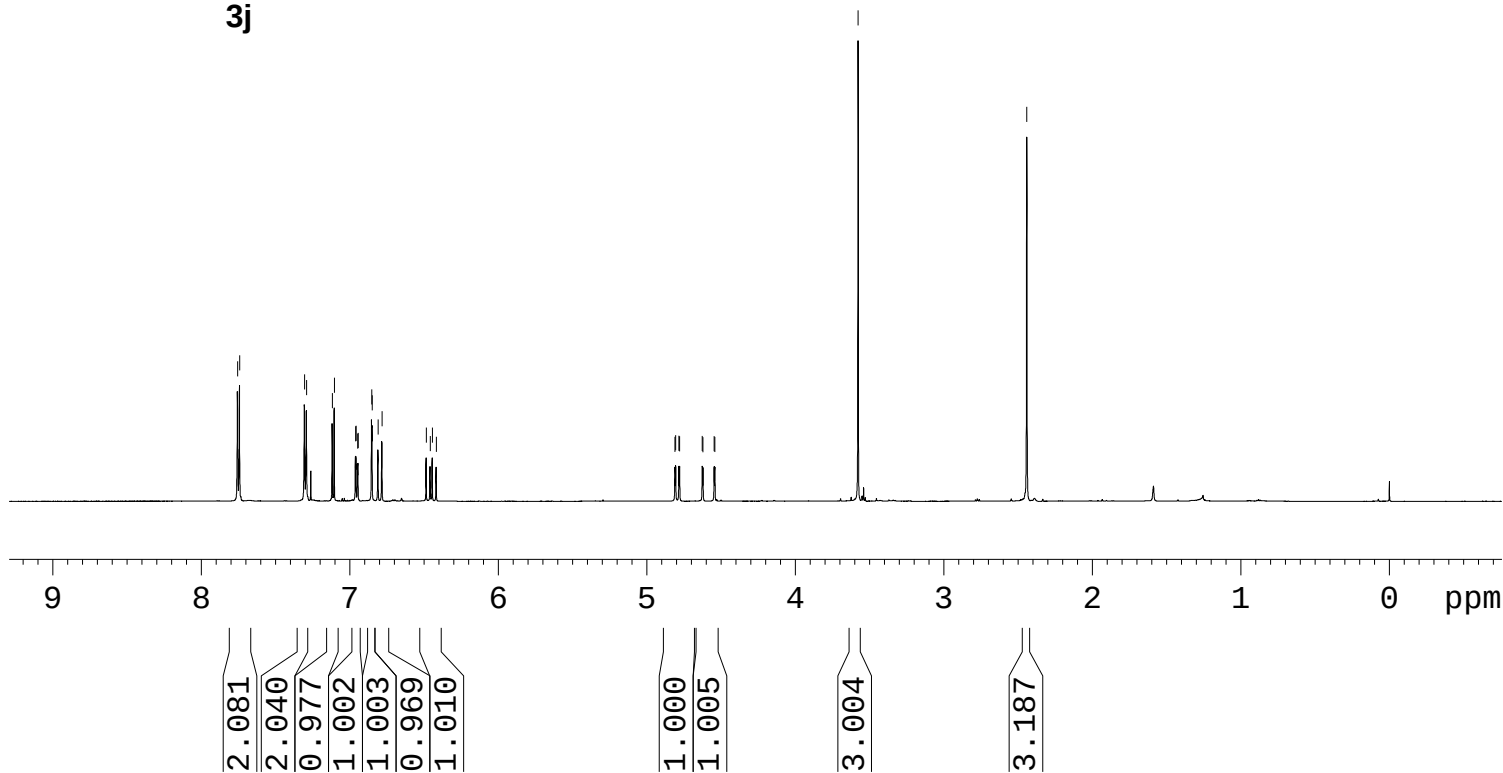
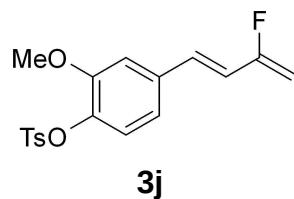


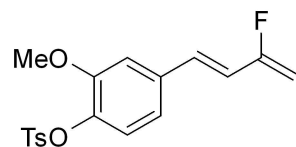


NAME LV-SJQ-653P-20250527
 EXPNO 1
 PROCNO 1
 Date_ 20250527
 Time 17.26
 INSTRUM spect
 PROBHD 5 mm PABBO BB/
 PULPROG zg30
 TD 65536
 SOLVENT CDCl3
 NS 16
 DS 2
 SWH 12019.230 Hz
 FIDRES 0.183399 Hz
 AQ 2.7263477 sec
 RG 69.87
 DW 41.600 usec
 DE 6.50 usec
 TE 298.0 K
 D1 1.00000000 sec
 TD0 1

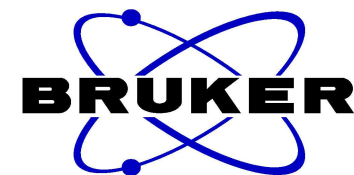
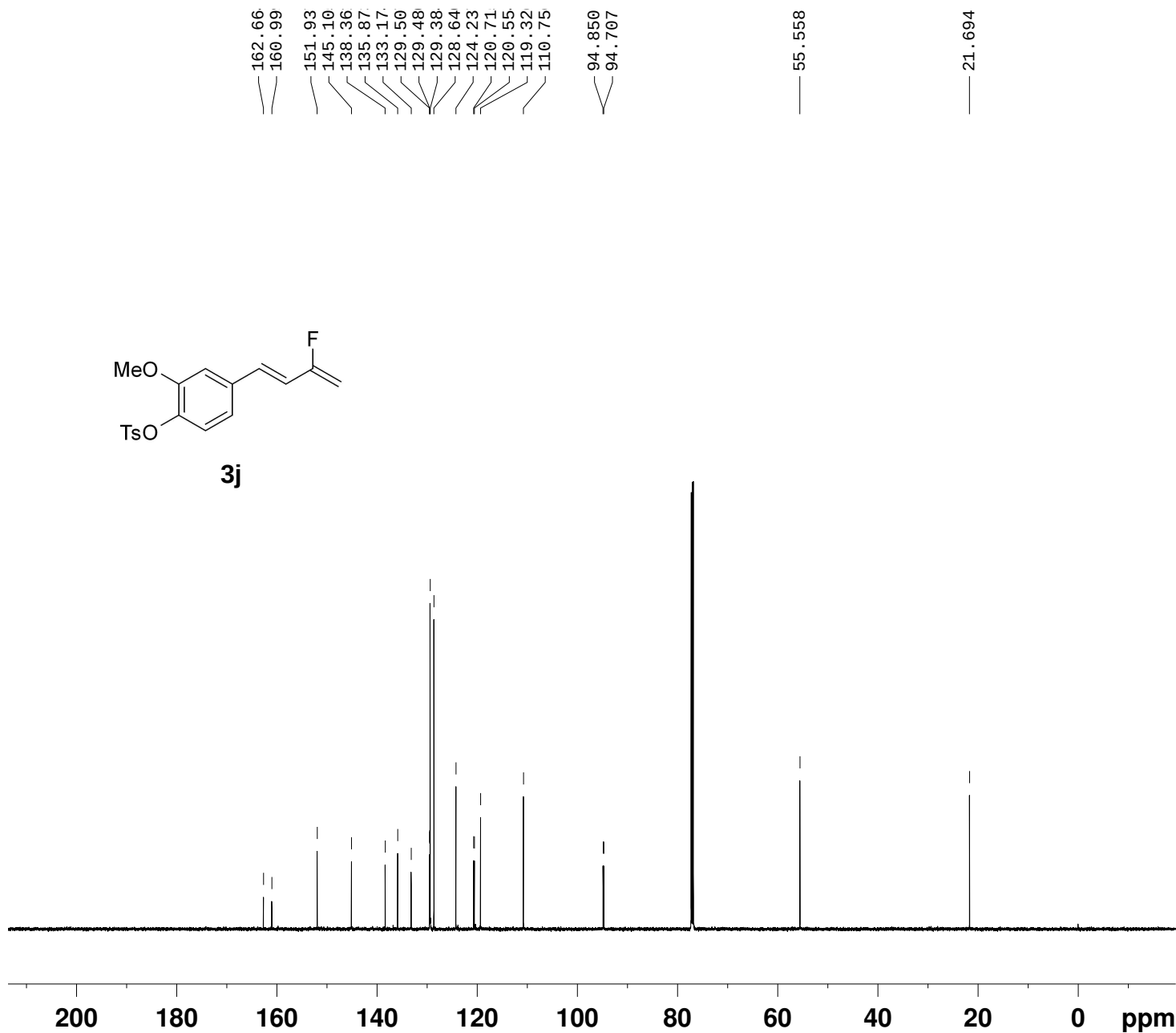
===== CHANNEL f1 =====
 SF01 600.1737063 MHz
 NUC1 1H
 P1 9.96 usec
 SI 65536
 SF 600.1700136 MHz
 WDW EM
 SSB 0
 LB 0.30 Hz
 GB 0
 PC 1.00

7.755
 7.742
 7.305
 7.291
 7.117
 7.104
 6.961
 6.958
 6.947
 6.944
 6.852
 6.849
 6.809
 6.783
 6.485
 6.458
 6.444
 6.417
 4.811
 4.806
 4.784
 4.779
 4.627
 4.622
 4.547
 4.542
 3.578
 — 2.442



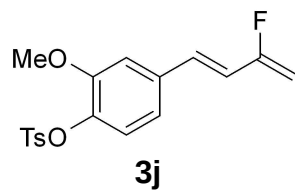


3j

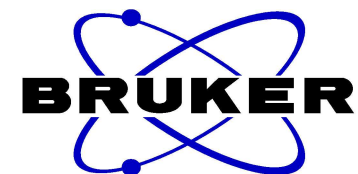


NAME LV-SJQ-653P-20250527
 EXPNO 3
 PROCNO 1
 Date_ 20250527
 Time 17.59
 INSTRUM spect
 PROBHD 5 mm PABBO BB/
 PULPROG zgpg30
 TD 65536
 SOLVENT CDCl3
 NS 600
 DS 4
 SWH 36057.691 Hz
 FIDRES 0.550197 Hz
 AQ 0.9088159 sec
 RG 190.02
 DW 13.867 usec
 DE 6.50 usec
 TE 298.0 K
 D1 2.00000000 sec
 D11 0.03000000 sec
 TD0 1

===== CHANNEL f1 =====
 SF01 150.9279571 MHz
 NUC1 13C
 P1 11.90 usec
 SI 32768
 SF 150.9128665 MHz
 WDW EM
 SSB 0
 LB 1.00 Hz
 GB 0
 PC 1.40

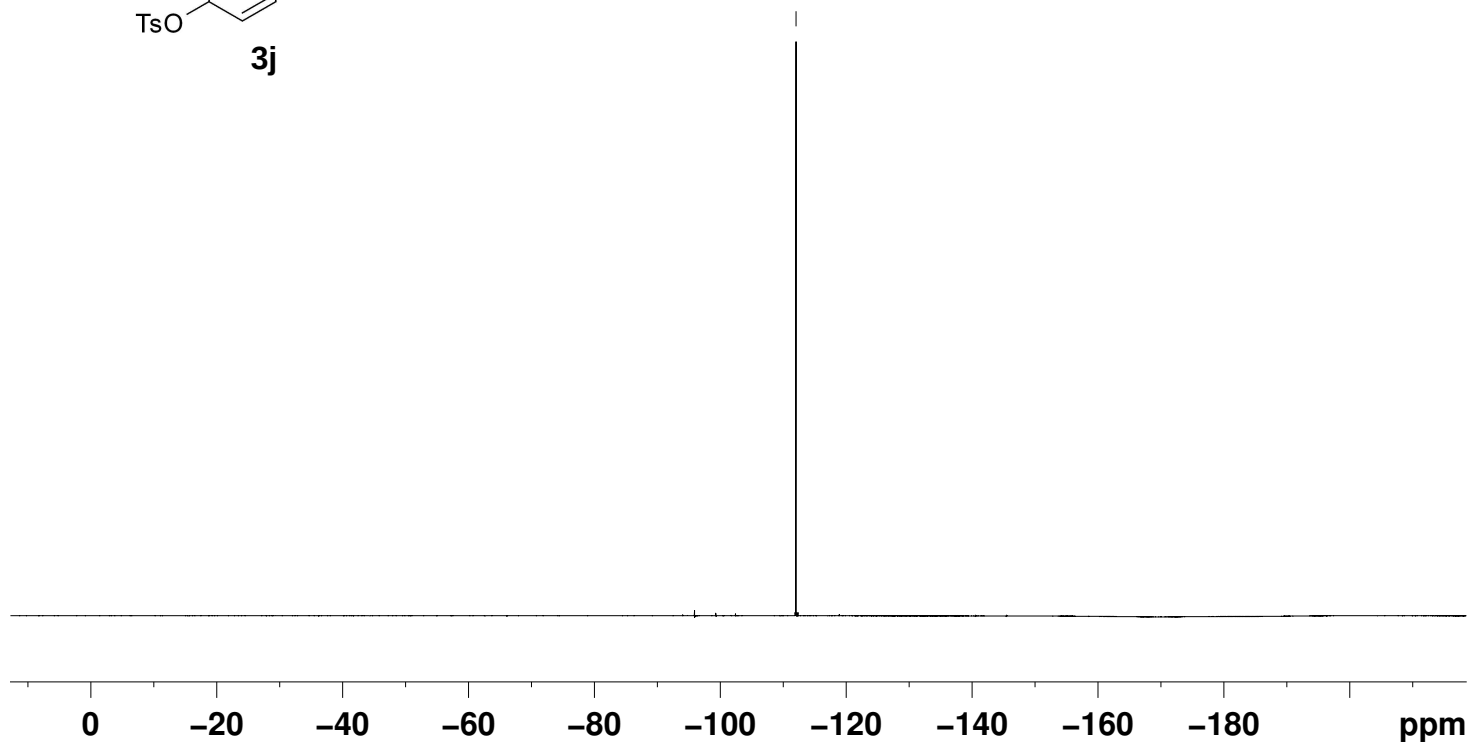


— -112.0



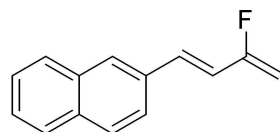
NAME LV-SJQ-653P-20250527
 EXPNO 2
 PROCNO 1
 Date_ 20250527
 Time 17.28
 INSTRUM spect
 PROBHD 5 mm PABBO BB/
 PULPROG zgfhigqn.2
 TD 131072
 SOLVENT CDCl3
 NS 16
 DS 4
 SWH 133928.578 Hz
 FIDRES 1.021794 Hz
 AQ 0.4893855 sec
 RG 190.02
 DW 3.733 usec
 DE 6.50 usec
 TE 298.1 K
 D1 1.00000000 sec
 D11 0.03000000 sec
 D12 0.00002000 sec
 TD0 1

===== CHANNEL f1 =====
 SF01 564.6675534 MHz
 NUC1 19F
 P1 12.00 usec
 SI 65536
 SF 564.7240258 MHz
 WDW EM
 SSB 0
 LB 0.30 Hz
 GB 0
 PC 1.00





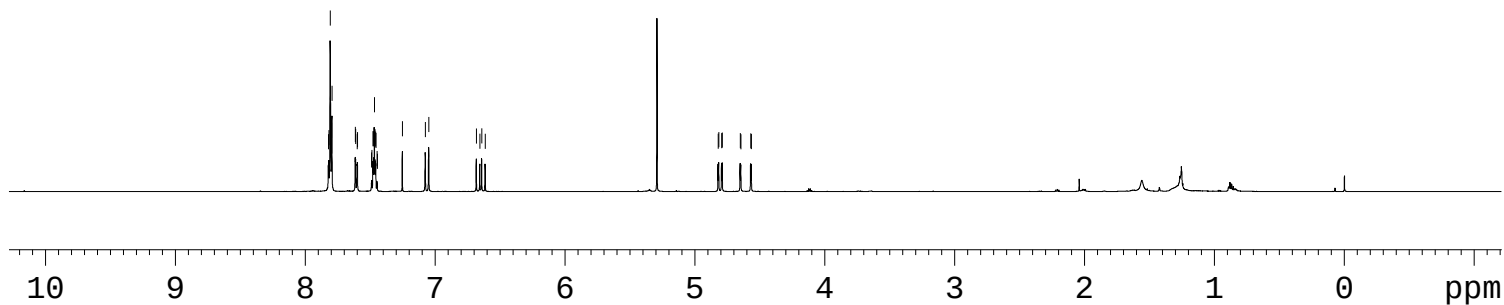
7.615
7.612
7.600
7.598
7.490
7.487
7.479
7.476
7.471
7.467
7.463
7.458
7.456
7.447
7.445
7.252
7.075
7.049
7.049
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4.821
4.816
4.794
4.789
4.650
4.646
4.570
4.565



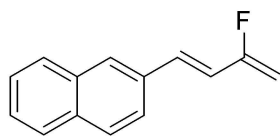
3k

NAME LV-SJQ-697P-20250627
EXPNO 1
PROCNO 1
Date_ 20250627
Time 10.20
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 12019.230 Hz
FIDRES 0.183399 Hz
AQ 2.7263477 sec
RG 109.27
DW 41.600 usec
DE 6.50 usec
TE 298.0 K
D1 1.00000000 sec
TD0 1

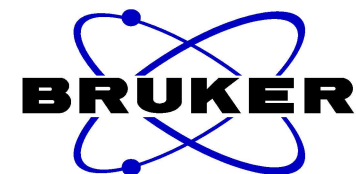
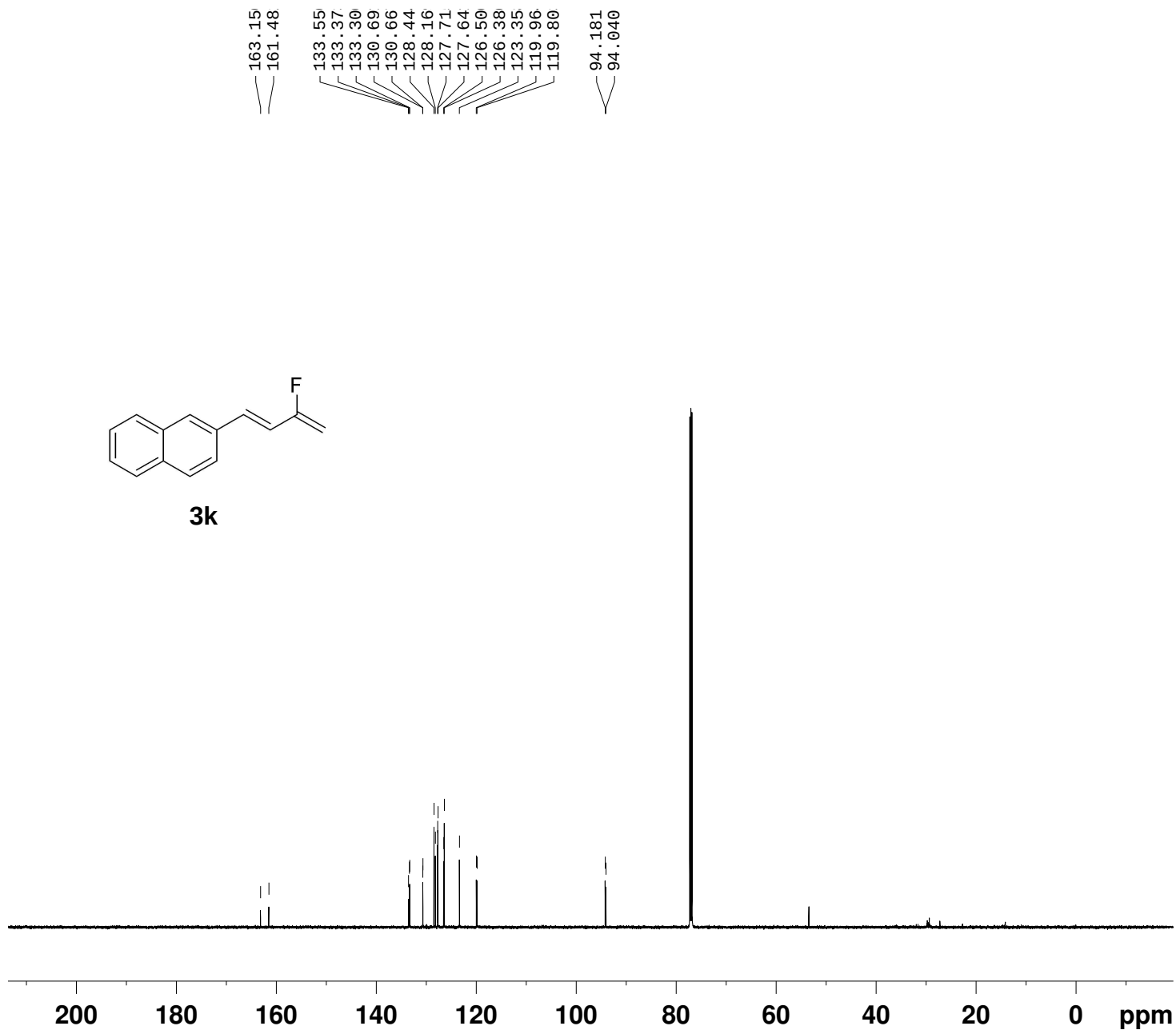
===== CHANNEL f1 =====
SF01 600.1737063 MHz
NUC1 1H
P1 9.96 usec
SI 65536
SF 600.1700190 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00



4.012
1.041
2.006
0.998
1.000
1.009
1.037

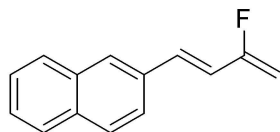


3k



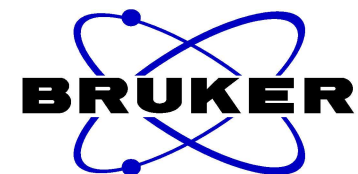
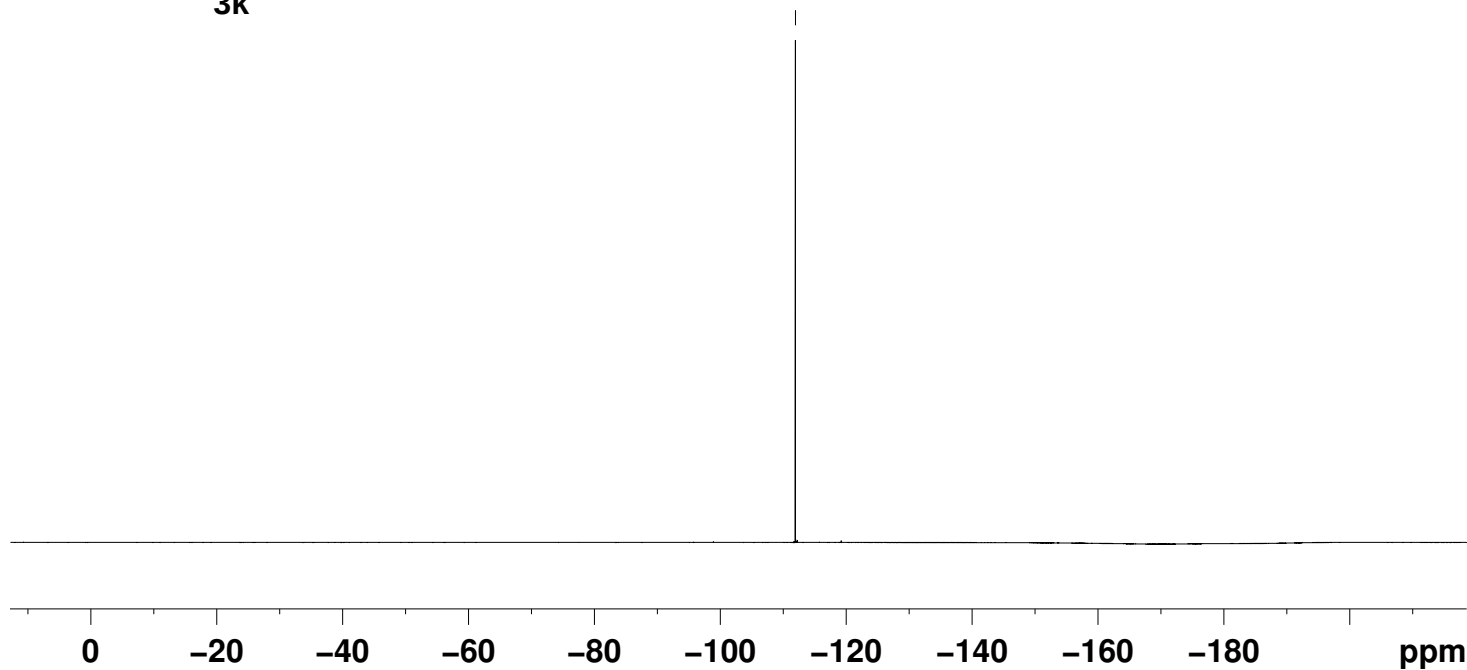
NAME LV-SJQ-697P-20250627
 EXPNO 3
 PROCNO 1
 Date_ 20250627
 Time 11.14
 INSTRUM spect
 PROBHD 5 mm PABBO BB/
 PULPROG zgpg30
 TD 65536
 SOLVENT CDCl3
 NS 1024
 DS 4
 SWH 36057.691 Hz
 FIDRES 0.550197 Hz
 AQ 0.9088159 sec
 RG 190.02
 DW 13.867 usec
 DE 6.50 usec
 TE 298.1 K
 D1 2.00000000 sec
 D11 0.03000000 sec
 TD0 1

===== CHANNEL f1 =====
 SF01 150.9279571 MHz
 NUC1 13C
 P1 11.90 usec
 SI 32768
 SF 150.9128665 MHz
 WDW EM
 SSB 0
 LB 1.00 Hz
 GB 0
 PC 1.40



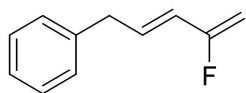
3k

— -111.9



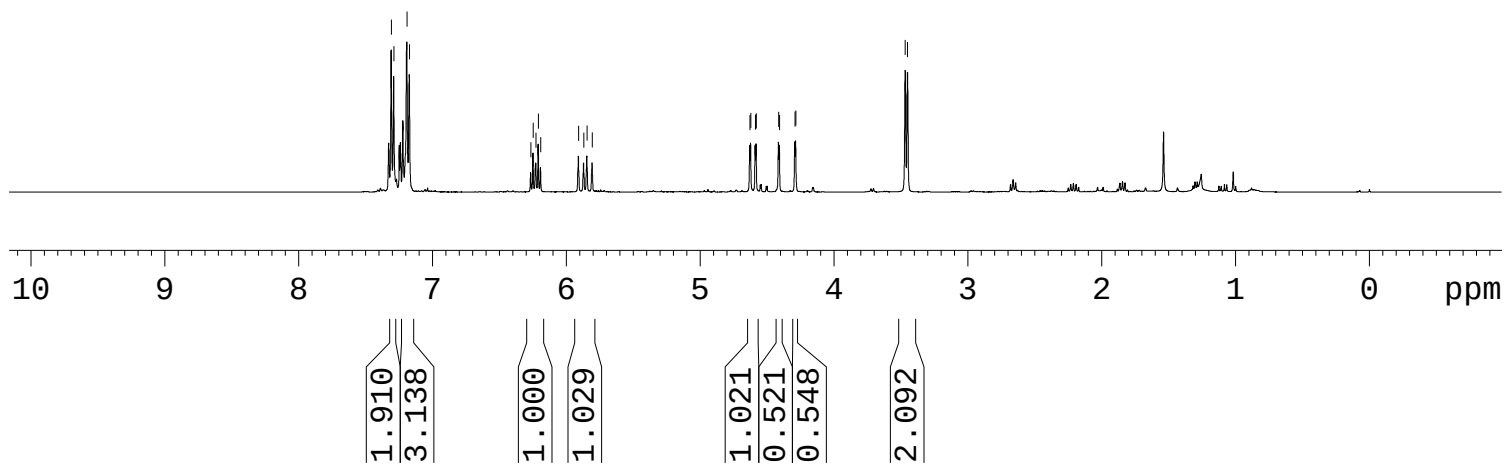
NAME LV-SJQ-697P-20250627
 EXPNO 2
 PROCNO 1
 Date_ 20250627
 Time 10.22
 INSTRUM spect
 PROBHD 5 mm PABBO BB/
 PULPROG zgfhigqn.2
 TD 131072
 SOLVENT CDCl3
 NS 16
 DS 4
 SWH 133928.578 Hz
 FIDRES 1.021794 Hz
 AQ 0.4893855 sec
 RG 190.02
 DW 3.733 usec
 DE 6.50 usec
 TE 298.1 K
 D1 1.00000000 sec
 D11 0.03000000 sec
 D12 0.00002000 sec
 TD0 1

===== CHANNEL f1 =====
 SF01 564.6675534 MHz
 NUC1 19F
 P1 12.00 usec
 SI 65536
 SF 564.7240258 MHz
 WDW EM
 SSB 0
 LB 0.30 Hz
 GB 0
 PC 1.00

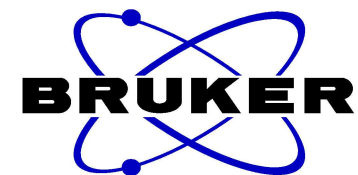
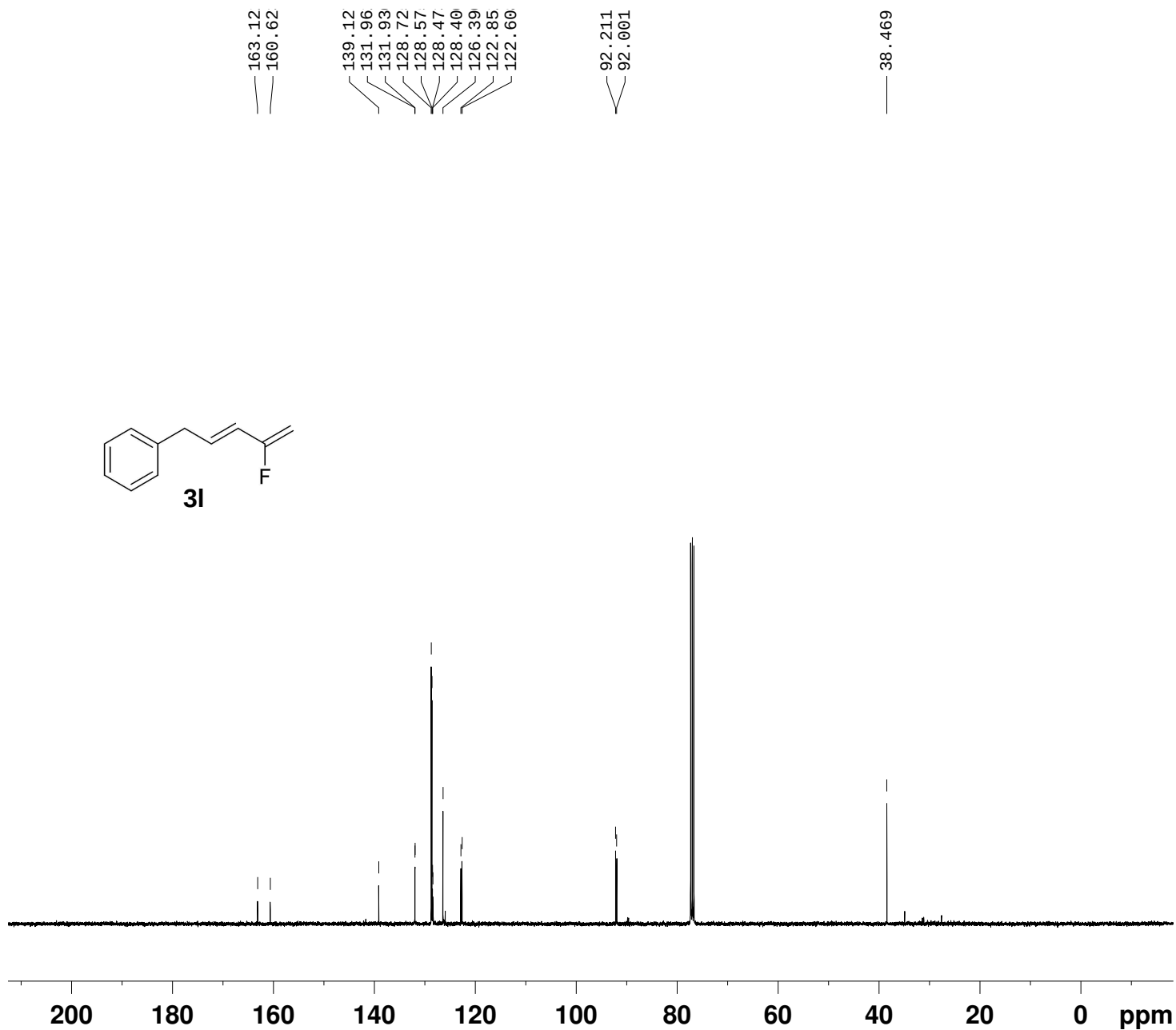
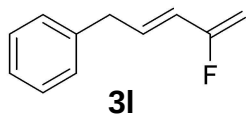


3I

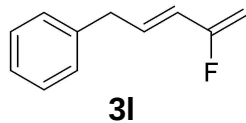
7.307
7.288
7.190
7.172
6.265
6.248
6.227
6.209
6.191
5.908
5.870
5.845
5.806
4.628
4.622
4.587
4.581
4.414
4.407
4.292
4.285
3.469
3.451



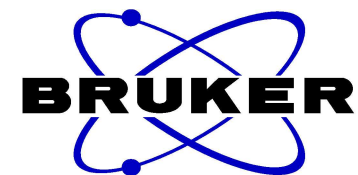
NAME LV-SJQ-589P-20250515
EXPNO 10
PROCNO 1
Date_ 20250515
Time 13.07 h
INSTRUM Avance
PROBHD Z163739_0744 (
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 8196.722 Hz
FIDRES 0.250144 Hz
AQ 3.9977460 sec
RG 101
DW 61.000 usec
DE 13.89 usec
TE 298.0 K
D1 1.00000000 sec
TD0 1
SF01 400.1324708 MHz
NUC1 1H
P0 2.67 usec
P1 8.00 usec
SI 65536
SF 400.1300158 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00



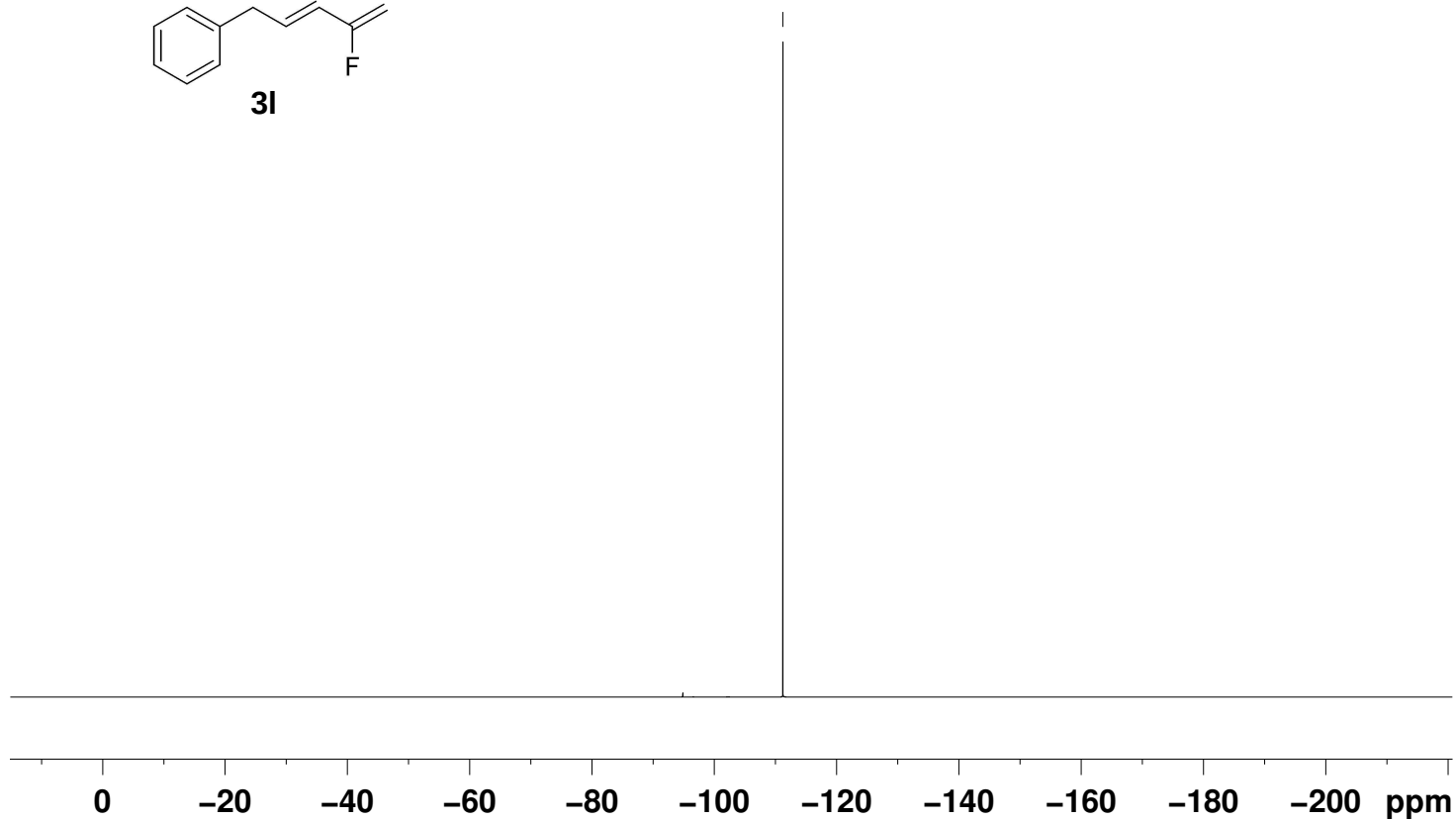
NAME LV-SJQ-589P-20250515
 EXPNO 12
 PROCNO 1
 Date_ 20250515
 Time 13.45 h
 INSTRUM Avance
 PROBHD Z163739_0744 (
 PULPROG zgpg30
 TD 65536
 SOLVENT CDCl3
 NS 600
 DS 4
 SWH 23809.523 Hz
 FIDRES 0.726609 Hz
 AQ 1.3763061 sec
 RG 101
 DW 21.000 usec
 DE 6.50 usec
 TE 298.5 K
 D1 2.00000000 sec
 D11 0.03000000 sec
 TD0 1
 SF01 100.6228298 MHz
 NUC1 13C
 P0 2.67 usec
 P1 8.00 usec
 SI 32768
 SF 100.6127685 MHz
 WDW EM
 SSB 0
 LB 1.00 Hz
 GB 0
 PC 1.40



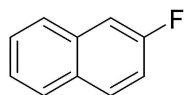
— -111.2—



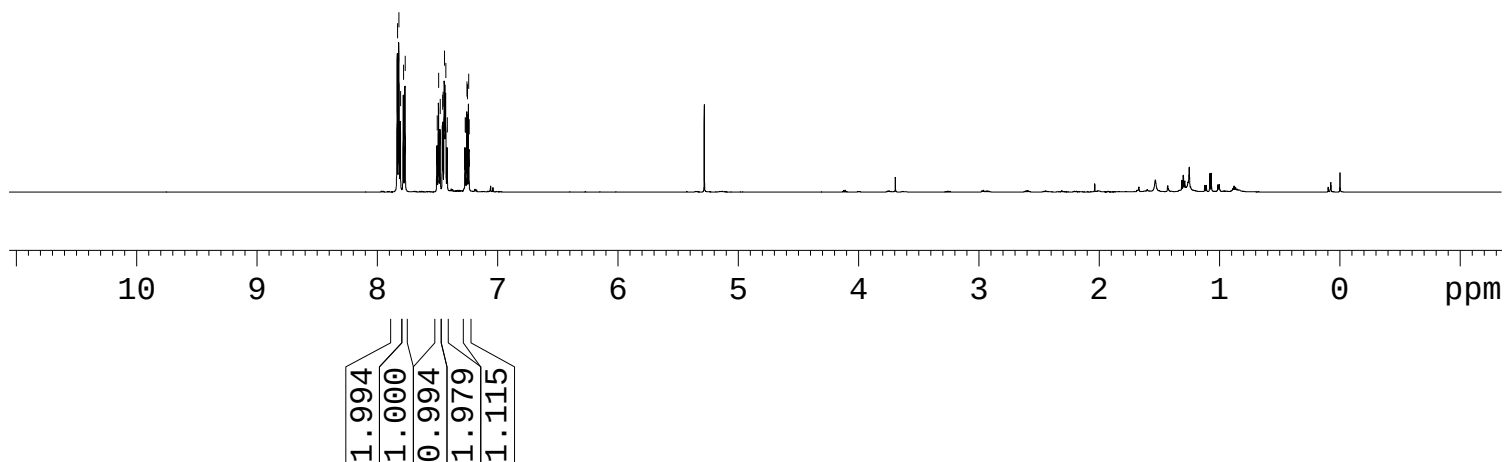
NAME LV-SJQ-589P-20250515
 EXPNO 11
 PROCNO 1
 Date_ 20250515
 Time 13.09 h
 INSTRUM Avance
 PROBHD Z163739_0744 (
 PULPROG zgig
 TD 131072
 SOLVENT CDCl3
 NS 16
 DS 4
 SWH 90909.094 Hz
 FIDRES 1.387163 Hz
 AQ 0.7209460 sec
 RG 101
 DW 5.500 usec
 DE 6.50 usec
 TE 298.2 K
 D1 1.00000000 sec
 D11 0.03000000 sec
 TD0 1
 SF01 376.4607164 MHz
 NUC1 19F
 P1 12.00 usec
 SI 65536
 SF 376.4983662 MHz
 WDW EM
 SSB 0
 LB 0.30 Hz
 GB 0
 PC 1.00



7.832
7.821
7.807
7.782
7.768
7.502
7.490
7.477
7.457
7.453
7.442
7.436
7.431
7.418
7.270
7.265
7.255
7.251
7.241
7.236

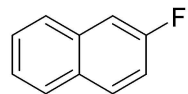


5a



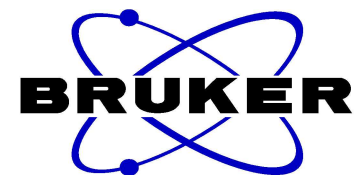
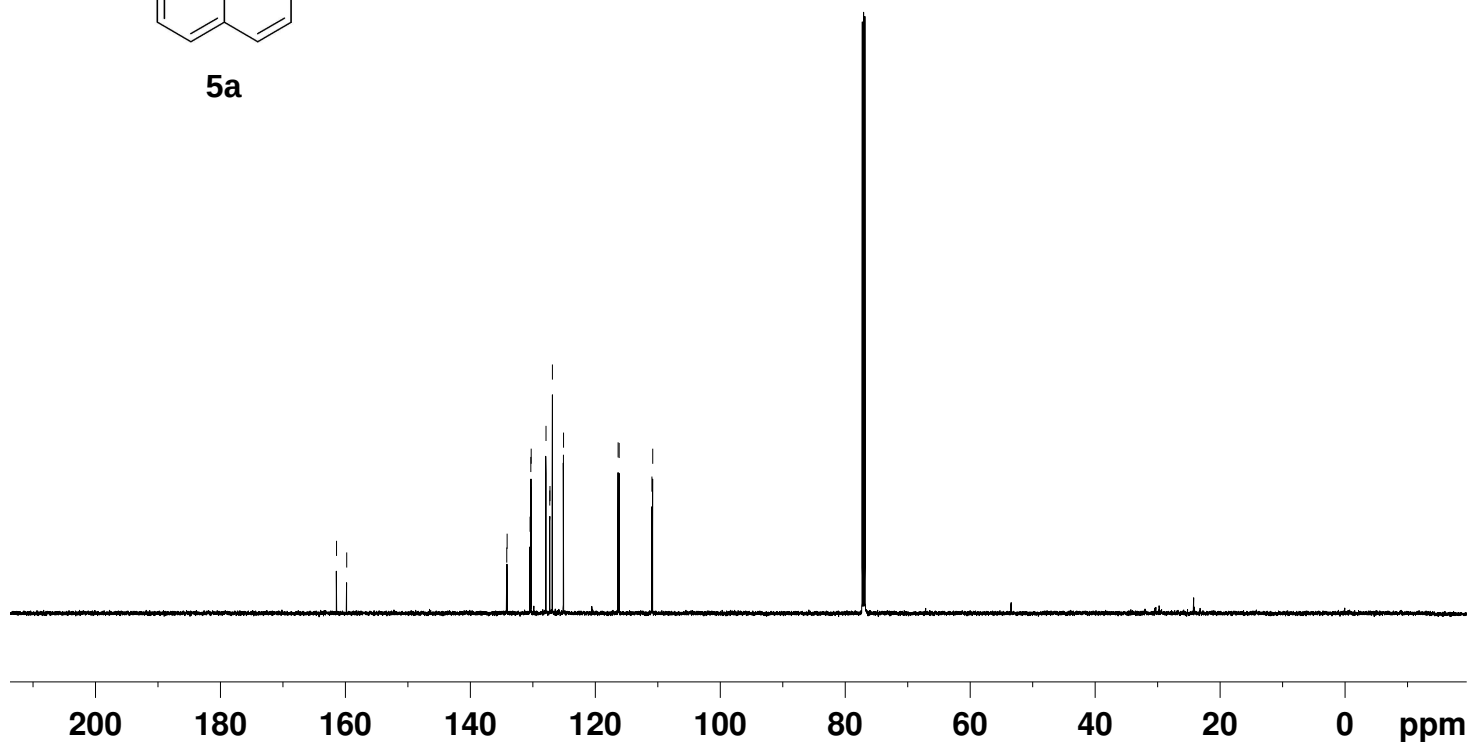
NAME LV-SJQ-650P-20250527
EXPNO 1
PROCNO 1
Date_ 20250527
Time 18.44
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 12019.230 Hz
FIDRES 0.183399 Hz
AQ 2.7263477 sec
RG 87.54
DW 41.600 usec
DE 6.50 usec
TE 298.1 K
D1 1.00000000 sec
TD0 1

===== CHANNEL f1 =====
SF01 600.1737063 MHz
NUC1 1H
P1 9.96 usec
SI 65536
SF 600.1700259 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00



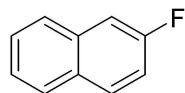
5a

161.42
159.79
134.17
134.11
130.44
130.32
130.26
127.89
127.29
127.26
126.86
125.10
125.09
116.35
116.18
110.94
110.81



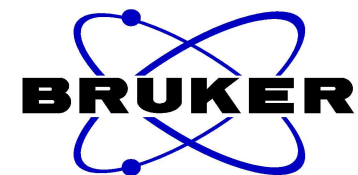
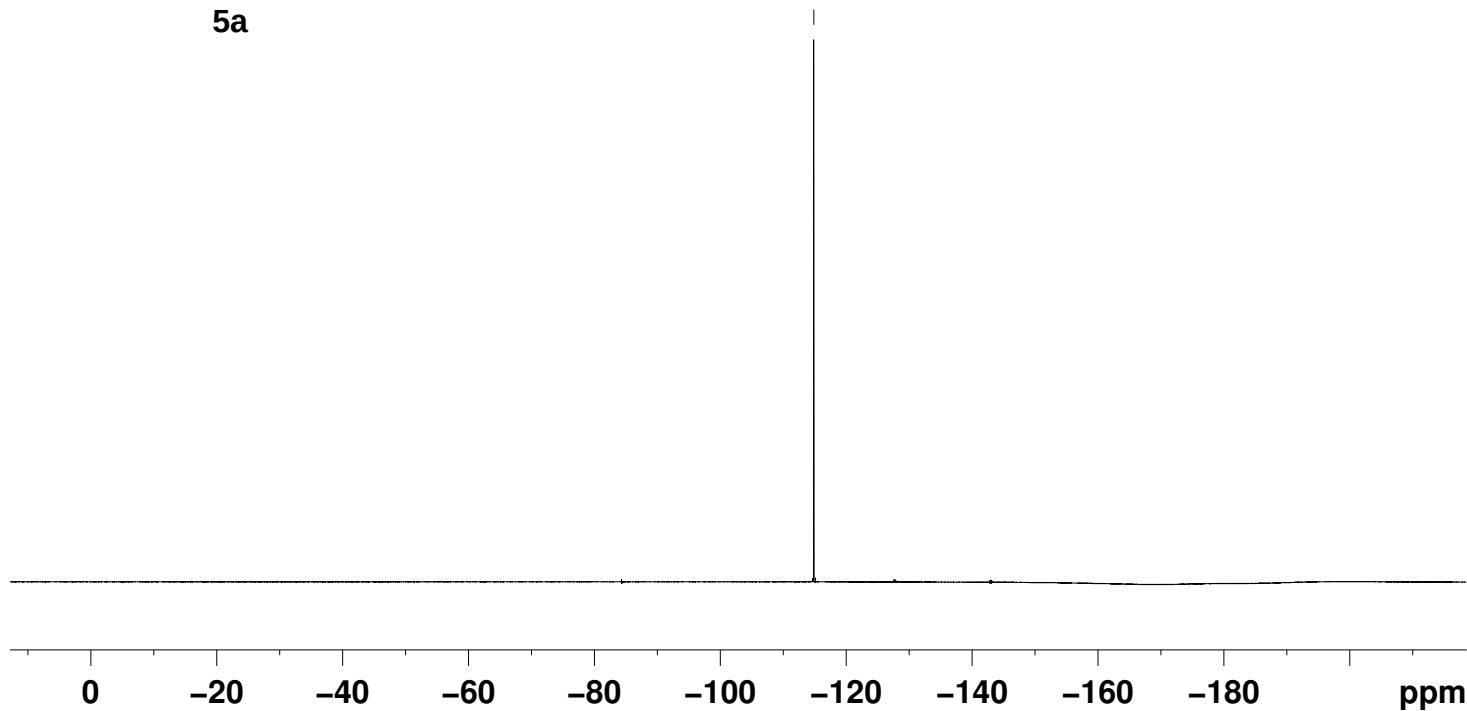
NAME LV-SJQ-650P-20250527
EXPNO 3
PROCNO 1
Date_ 20250527
Time 19.17
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 65536
SOLVENT CDCl₃
NS 600
DS 4
SWH 36057.691 Hz
FIDRES 0.550197 Hz
AQ 0.9088159 sec
RG 190.02
DW 13.867 usec
DE 6.50 usec
TE 298.0 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1

===== CHANNEL f1 =====
SF01 150.9279571 MHz
NUC1 13C
P1 11.90 usec
SI 32768
SF 150.9128665 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40



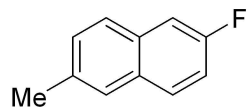
5a

— -114.8



NAME LV-SJQ-650P-20250527
 EXPNO 2
 PROCNO 1
 Date_ 20250527
 Time 18.46
 INSTRUM spect
 PROBHD 5 mm PABBO BB/
 PULPROG zgfhigqn.2
 TD 131072
 SOLVENT CDCl3
 NS 16
 DS 4
 SWH 133928.578 Hz
 FIDRES 1.021794 Hz
 AQ 0.4893855 sec
 RG 190.02
 DW 3.733 usec
 DE 6.50 usec
 TE 298.1 K
 D1 1.00000000 sec
 D11 0.03000000 sec
 D12 0.00002000 sec
 TD0 1

===== CHANNEL f1 =====
 SF01 564.6675534 MHz
 NUC1 19F
 P1 12.00 usec
 SI 65536
 SF 564.7240258 MHz
 WDW EM
 SSB 0
 LB 0.30 Hz
 GB 0
 PC 1.00



5b

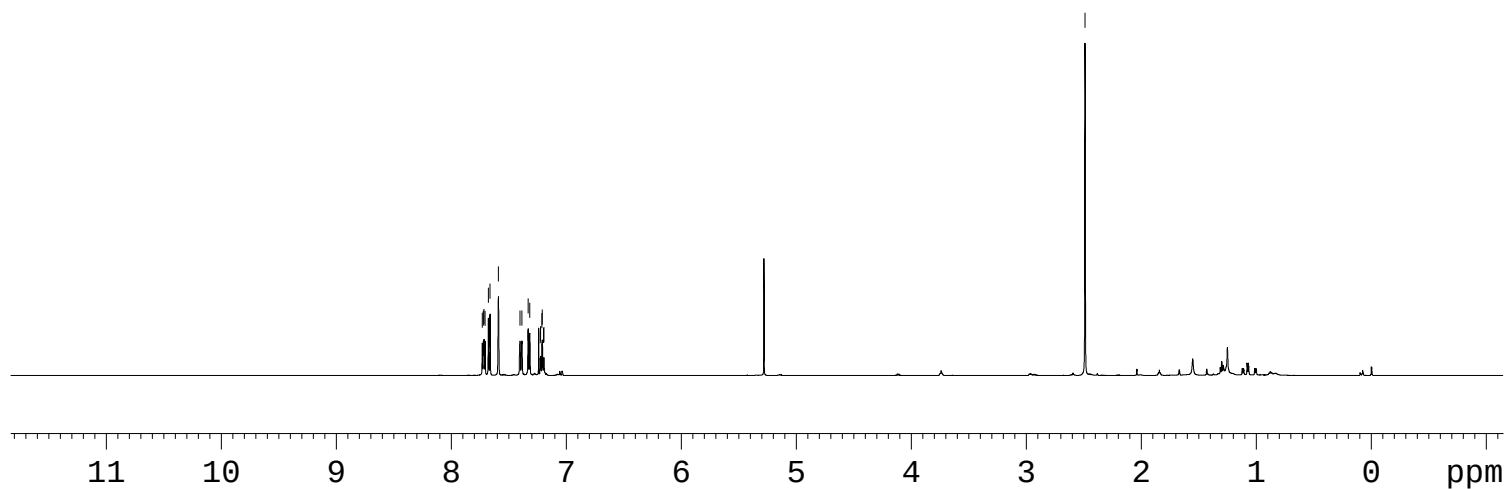
7.731
7.722
7.716
7.707
7.678
7.664
7.591
7.403
7.386
7.332
7.318
7.227
7.224
7.213
7.209
7.198
7.195

— 2.490



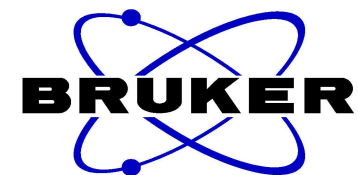
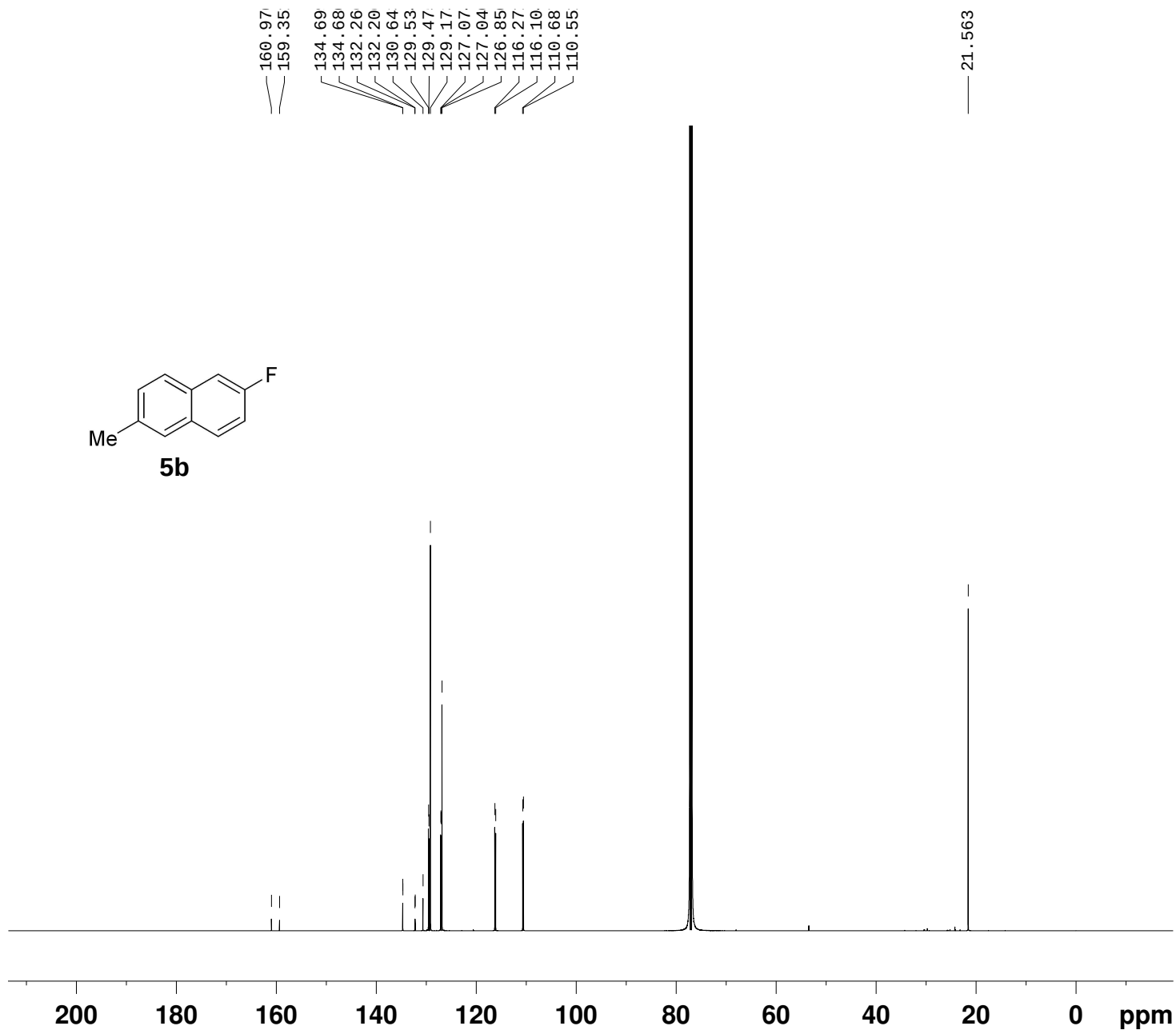
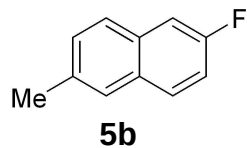
NAME LV-SJQ-744P-20250915
EXPNO 1
PROCNO 1
Date_ 20250915
Time 14.09
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 12019.230 Hz
FIDRES 0.183399 Hz
AQ 2.7263477 sec
RG 76.92
DW 41.600 usec
DE 6.50 usec
TE 296.0 K
D1 1.00000000 sec
TD0 1

===== CHANNEL f1 =====
SF01 600.1737063 MHz
NUC1 1H
P1 9.96 usec
SI 65536
SF 600.1700266 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00



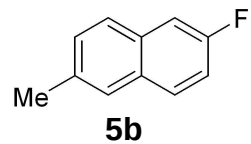
1.013
1.000
0.984
1.043
1.021
1.028

3.066

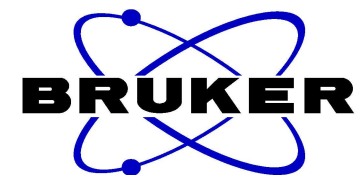


NAME LV-SJQ-744P-20250915
 EXPNO 3
 PROCNO 1
 Date_ 20250915
 Time 14.52
 INSTRUM spect
 PROBHD 5 mm PABBO BB/
 PULPROG zgpg30
 TD 65536
 SOLVENT CDCl3
 NS 800
 DS 4
 SWH 36057.691 Hz
 FIDRES 0.550197 Hz
 AQ 0.9088159 sec
 RG 190.02
 DW 13.867 usec
 DE 6.50 usec
 TE 297.4 K
 D1 2.00000000 sec
 D11 0.03000000 sec
 TD0 1

===== CHANNEL f1 =====
 SF01 150.9279571 MHz
 NUC1 13C
 P1 11.90 usec
 SI 32768
 SF 150.9128665 MHz
 WDW EM
 SSB 0
 LB 1.00 Hz
 GB 0
 PC 1.40



— -116.3

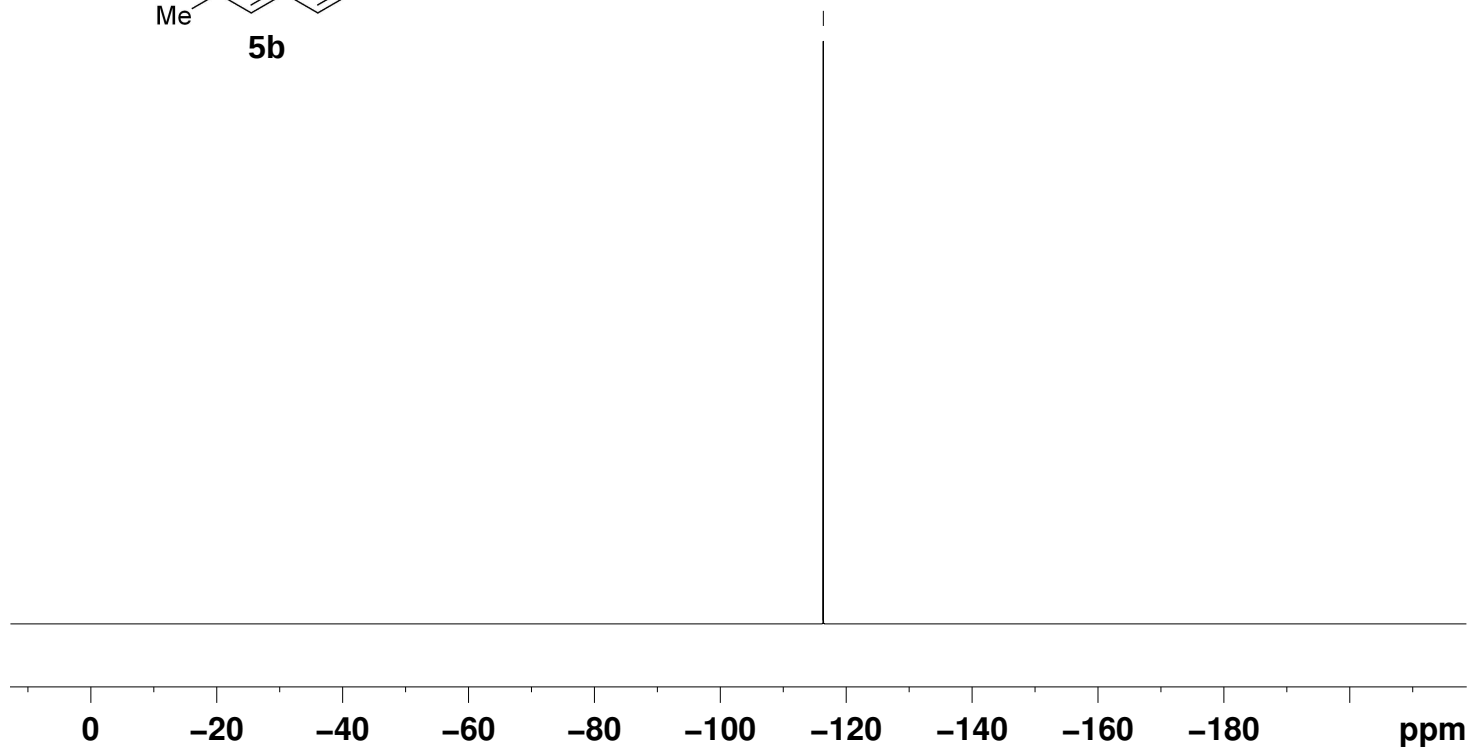


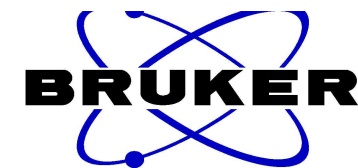
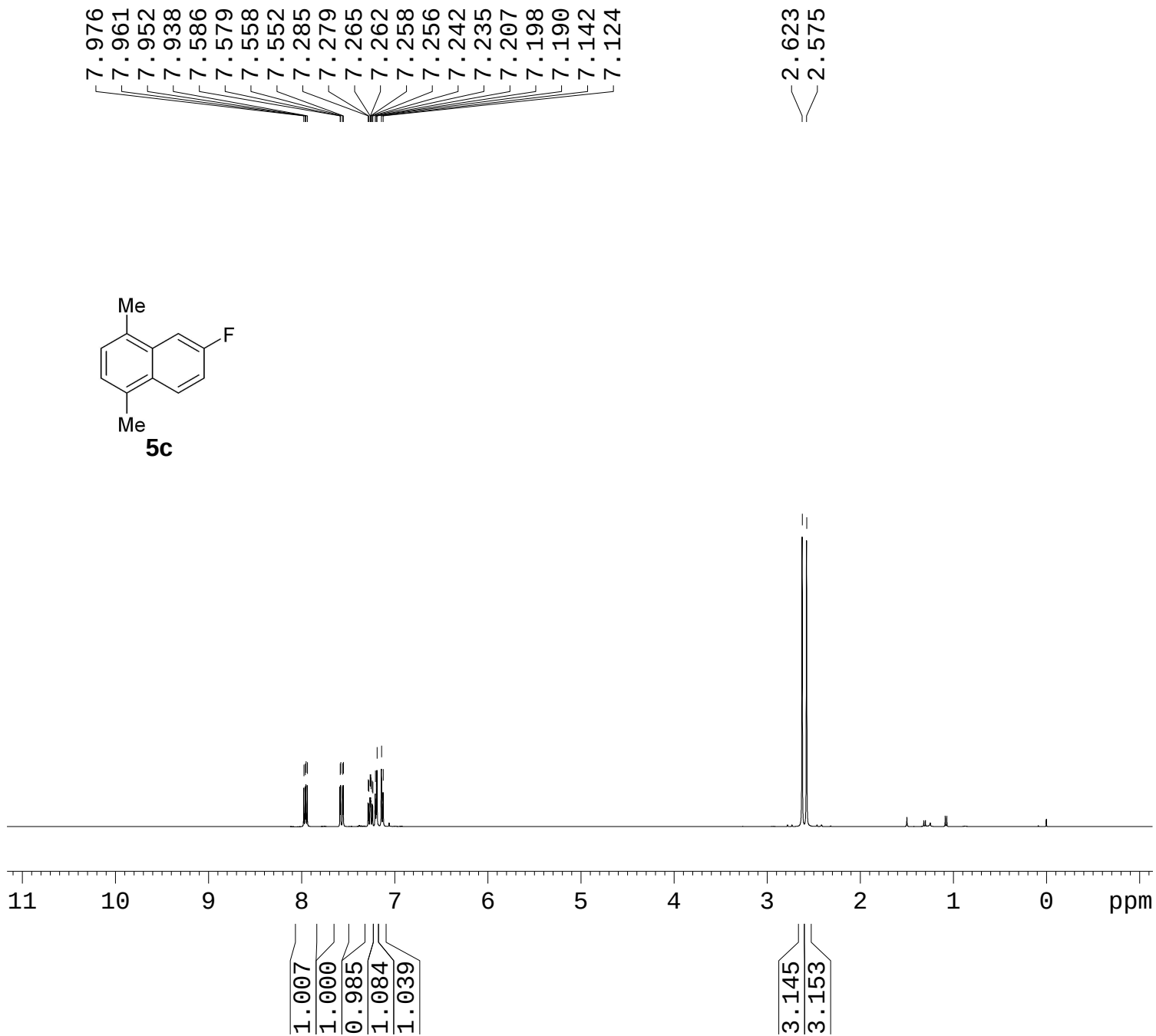
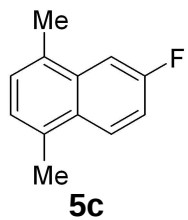
```

NAME      LV-SJQ-744P-20250915
EXPNO      2
PROCNO     1
Date_      20250915
Time       14.11
INSTRUM    spect
PROBHD     5 mm PABBO BB/
PULPROG    zgfhigqn.2
TD         131072
SOLVENT    CDCl3
NS         16
DS         4
SWH        133928.578 Hz
FIDRES     1.021794 Hz
AQ         0.4893855 sec
RG         190.02
DW         3.733 usec
DE         6.50 usec
TE         296.1 K
D1         1.00000000 sec
D11        0.03000000 sec
D12        0.00002000 sec
TD0        1
  
```

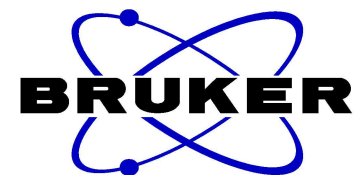
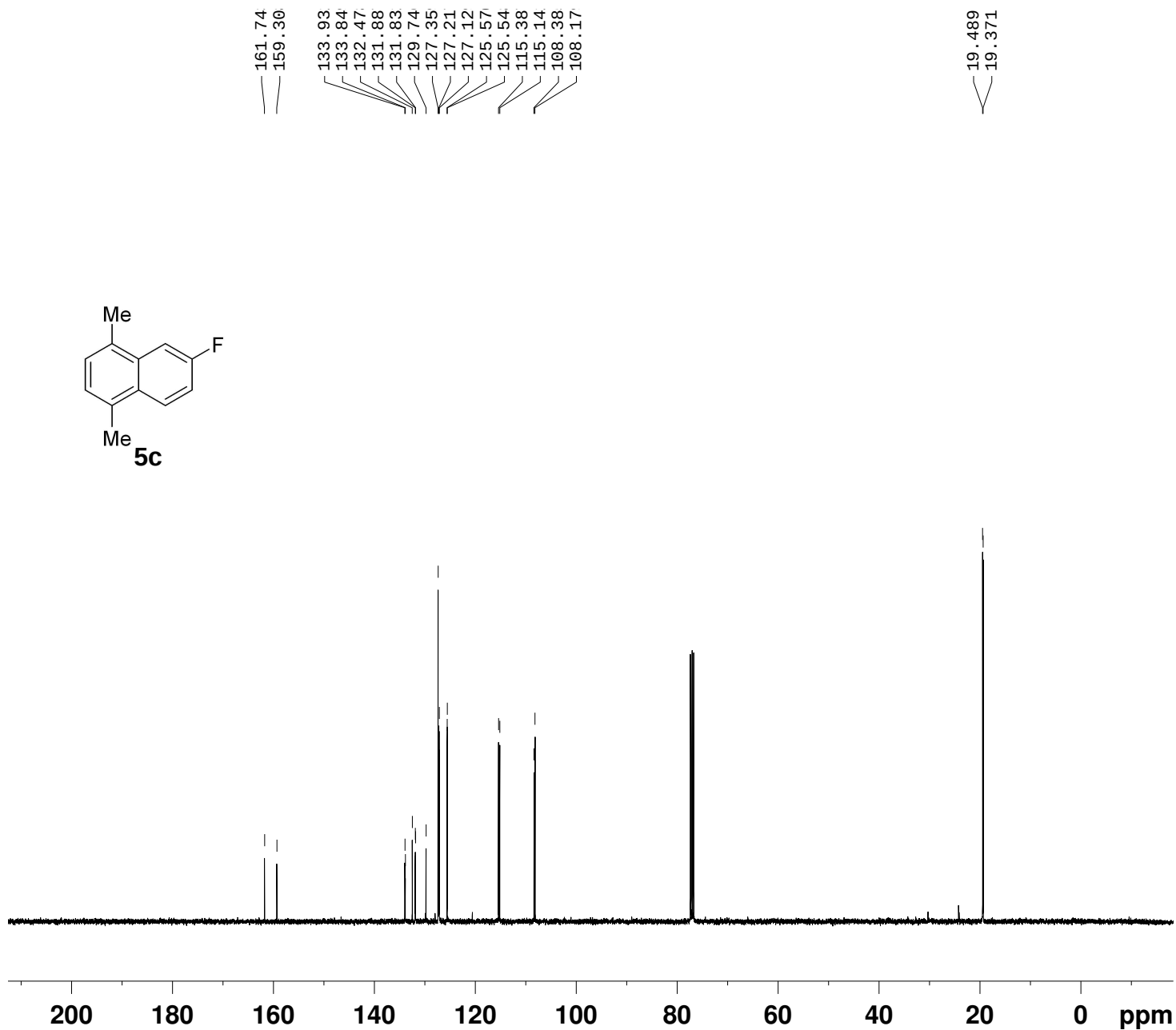
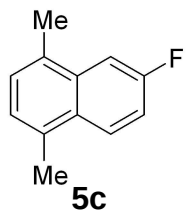
```

===== CHANNEL f1 =====
SF01      564.6675534 MHz
NUC1       19F
P1         12.00 usec
SI         65536
SF         564.7240258 MHz
WDW        EM
SSB        0
LB         0.30 Hz
GB         0
PC         1.00
  
```

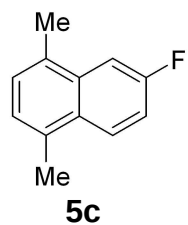




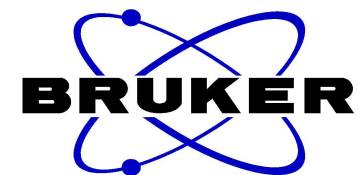
NAME	LV-SJQ-846P-20251115	
EXPNO	10	
PROCNO	1	
Date_	20251116	
Time	20.17	h
INSTRUM	Avance	
PROBHD	Z163739_0744	(
PULPROG	zg30	
TD	65536	
SOLVENT	CDCl3	
NS	16	
DS	2	
SWH	8196.722	Hz
FIDRES	0.250144	Hz
AQ	3.9977460	sec
RG	45.2	
DW	61.000	usec
DE	13.89	usec
TE	296.5	K
D1	1.00000000	sec
TD0	1	
SF01	400.1324708	MHz
NUC1	1H	
P0	2.67	usec
P1	8.00	usec
SI	65536	
SF	400.1300348	MHz
WDW	EM	
SSB	0	
LB	0.30	Hz
GB	0	
PC	1.00	



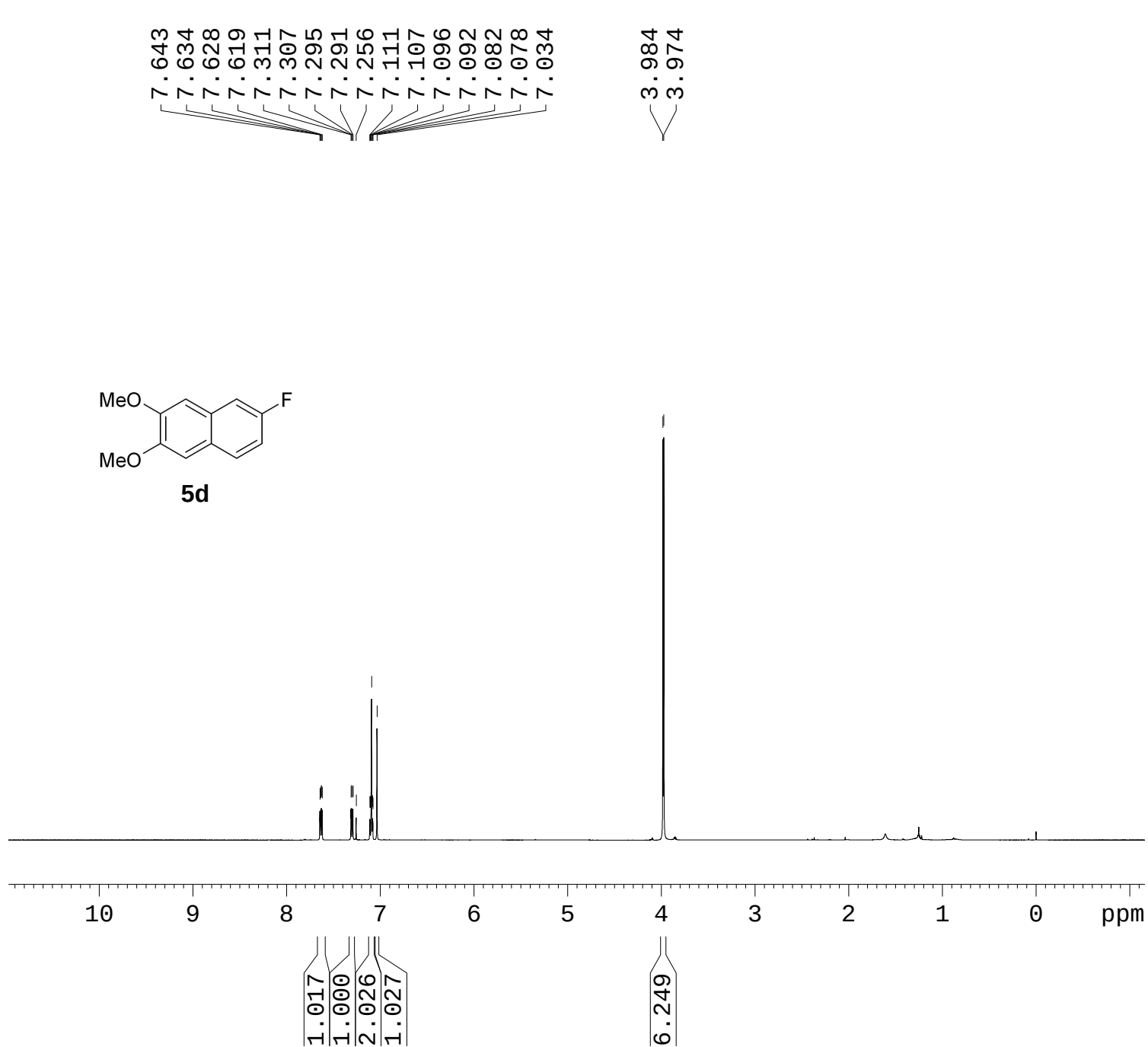
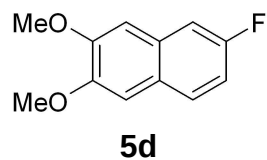
NAME LV-SJQ-846P-20251115
 EXPNO 12
 PROCNO 1
 Date_ 20251116
 Time 20.32 h
 INSTRUM Avance
 PROBHD Z163739_0744 (
 PULPROG zgpg30
 TD 65536
 SOLVENT CDCl3
 NS 200
 DS 4
 SWH 23809.523 Hz
 FIDRES 0.726609 Hz
 AQ 1.3763061 sec
 RG 101
 DW 21.000 usec
 DE 6.50 usec
 TE 297.2 K
 D1 2.00000000 sec
 D11 0.03000000 sec
 TD0 1
 SF01 100.6228298 MHz
 NUC1 13C
 P0 2.67 usec
 P1 8.00 usec
 SI 32768
 SF 100.6127685 MHz
 WDW EM
 SSB 0
 LB 1.00 Hz
 GB 0
 PC 1.40



— -114.9

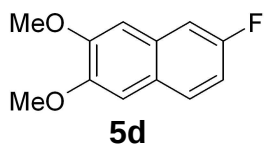


NAME LV-SJQ-846P-20251115
 EXPNO 11
 PROCNO 1
 Date_ 20251116
 Time 20.19 h
 INSTRUM Avance
 PROBHD Z163739_0744 (
 PULPROG zgig
 TD 131072
 SOLVENT CDCl3
 NS 16
 DS 4
 SWH 90909.094 Hz
 FIDRES 1.387163 Hz
 AQ 0.7209460 sec
 RG 101
 DW 5.500 usec
 DE 6.50 usec
 TE 296.6 K
 D1 1.00000000 sec
 D11 0.03000000 sec
 TD0 1
 SF01 376.4607164 MHz
 NUC1 19F
 P1 12.00 usec
 SI 65536
 SF 376.4983662 MHz
 WDW EM
 SSB 0
 LB 0.30 Hz
 GB 0
 PC 1.00



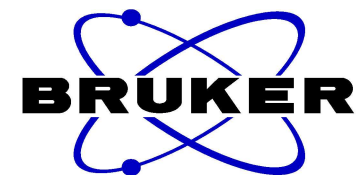
NAME LV-SJQ-729P-20250829
 EXPNO 1
 PROCNO 1
 Date_ 20250829
 Time 0.31
 INSTRUM spect
 PROBHD 5 mm PABBO BB/
 PULPROG zg30
 TD 65536
 SOLVENT CDCl3
 NS 16
 DS 2
 SWH 12019.230 Hz
 FIDRES 0.183399 Hz
 AQ 2.7263477 sec
 RG 62.22
 DW 41.600 usec
 DE 6.50 usec
 TE 298.5 K
 D1 1.00000000 sec
 TD0 1

===== CHANNEL f1 =====
 SF01 600.1737063 MHz
 NUC1 1H
 P1 9.96 usec
 SI 65536
 SF 600.1700171 MHz
 WDW EM
 SSB 0
 LB 0.30 Hz
 GB 0
 PC 1.00



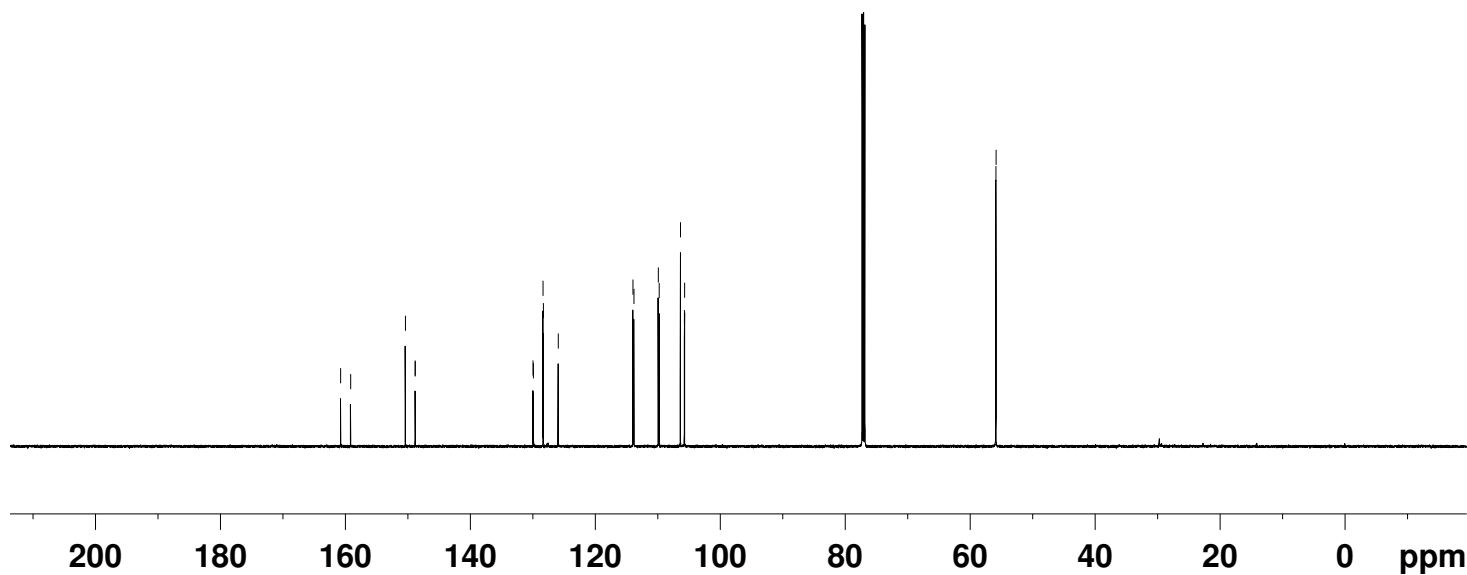
160.76
159.15
150.39
148.83
148.82
129.97
129.91
128.37
128.31
125.93
113.97
113.81
109.91
109.77
106.36
105.74
105.70

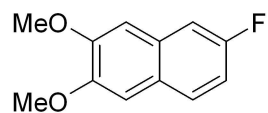
55.879
55.855



NAME LV-SJQ-729P-20250829
EXPNO 3
PROCNO 1
Date_ 20250829
Time 1.25
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 1024
DS 4
SWH 36057.691 Hz
FIDRES 0.550197 Hz
AQ 0.9088159 sec
RG 190.02
DW 13.867 usec
DE 6.50 usec
TE 300.0 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1

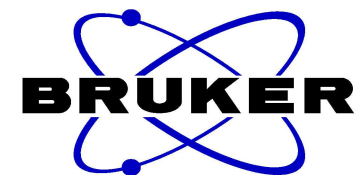
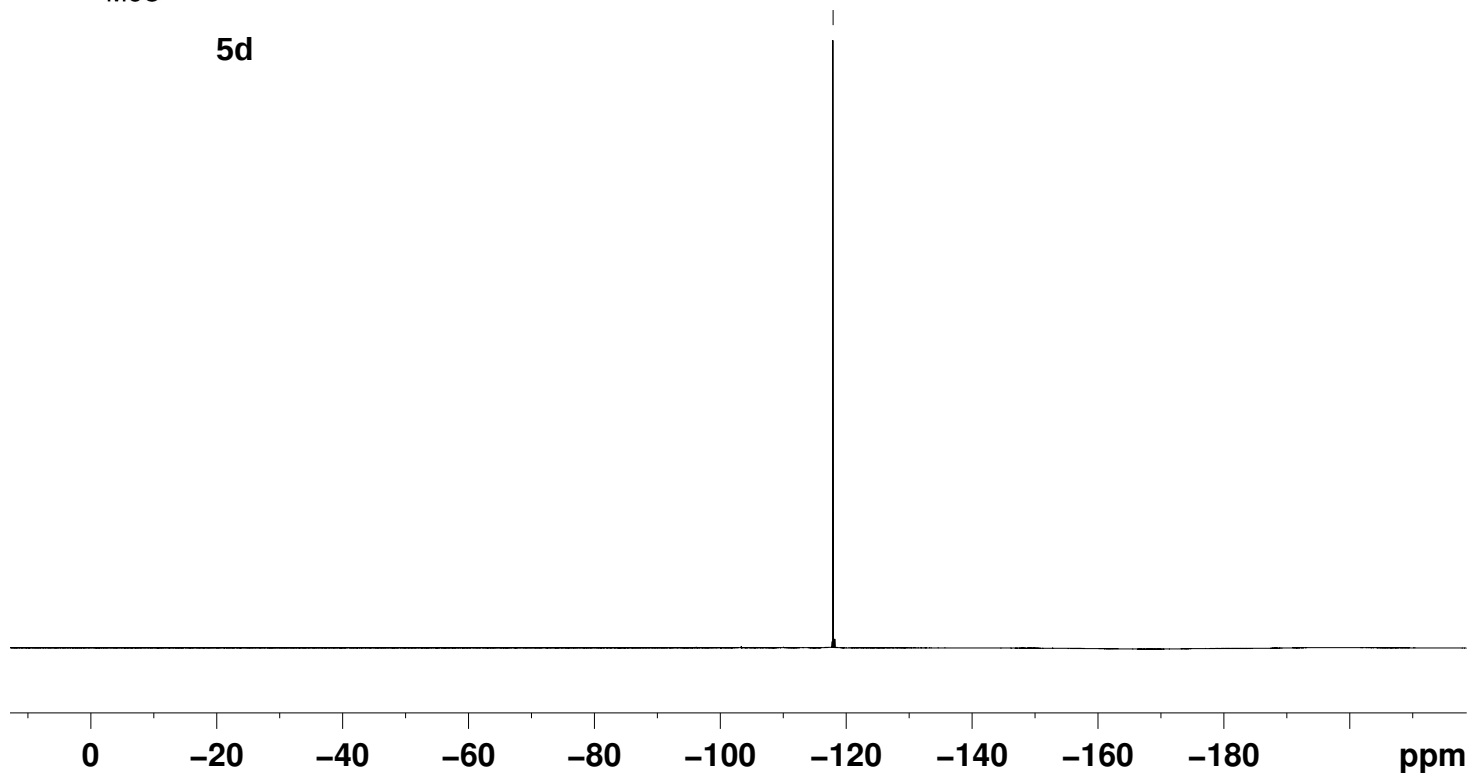
===== CHANNEL f1 =====
SF01 150.9279571 MHz
NUC1 13C
P1 11.90 usec
SI 32768
SF 150.9128665 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40





5d

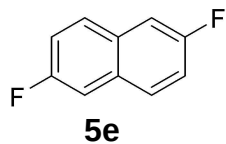
— -117.9



NAME LV-SJQ-729P-20250829
 EXPNO 2
 PROCNO 1
 Date_ 20250829
 Time 0.33
 INSTRUM spect
 PROBHD 5 mm PABBO BB/
 PULPROG zgfhigqn.2
 TD 131072
 SOLVENT CDCl3
 NS 16
 DS 4
 SWH 133928.578 Hz
 FIDRES 1.021794 Hz
 AQ 0.4893855 sec
 RG 190.02
 DW 3.733 usec
 DE 6.50 usec
 TE 298.6 K
 D1 1.00000000 sec
 D11 0.03000000 sec
 D12 0.00002000 sec
 TD0 1

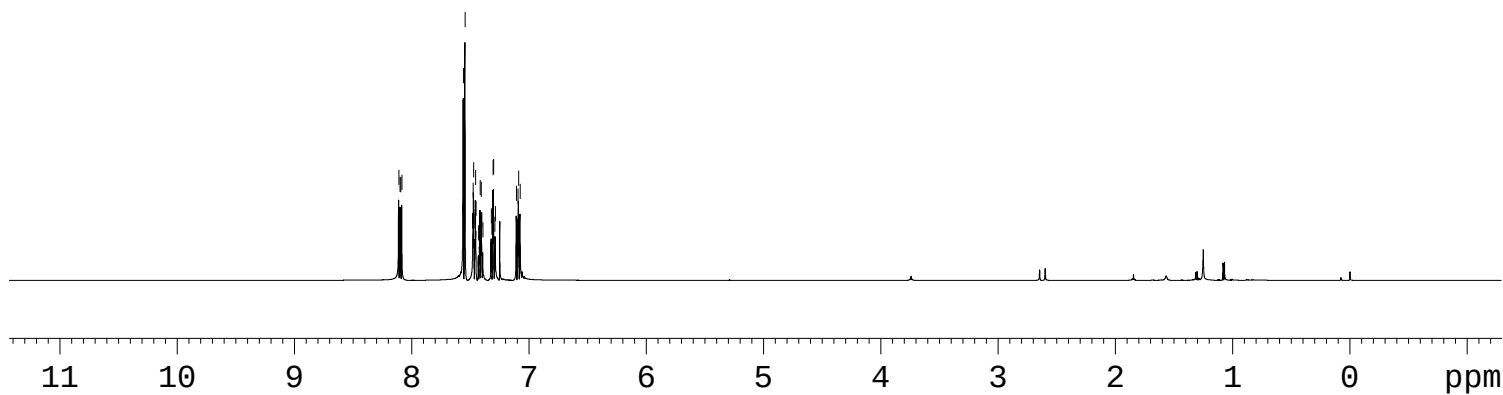
===== CHANNEL f1 =====
 SF01 564.6675534 MHz
 NUC1 19F
 P1 12.00 usec
 SI 65536
 SF 564.7240258 MHz
 WDW EM
 SSB 0
 LB 0.30 Hz
 GB 0
 PC 1.00

8.100
8.093
8.084
7.559
7.545
7.476
7.472
7.469
7.460
7.456
7.452
7.430
7.421
7.416
7.407
7.402
7.393
7.321
7.317
7.306
7.302
7.291
7.287
7.107
7.094
7.088
7.075

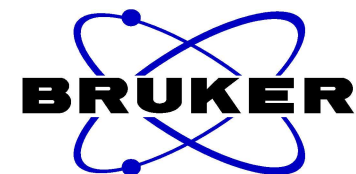
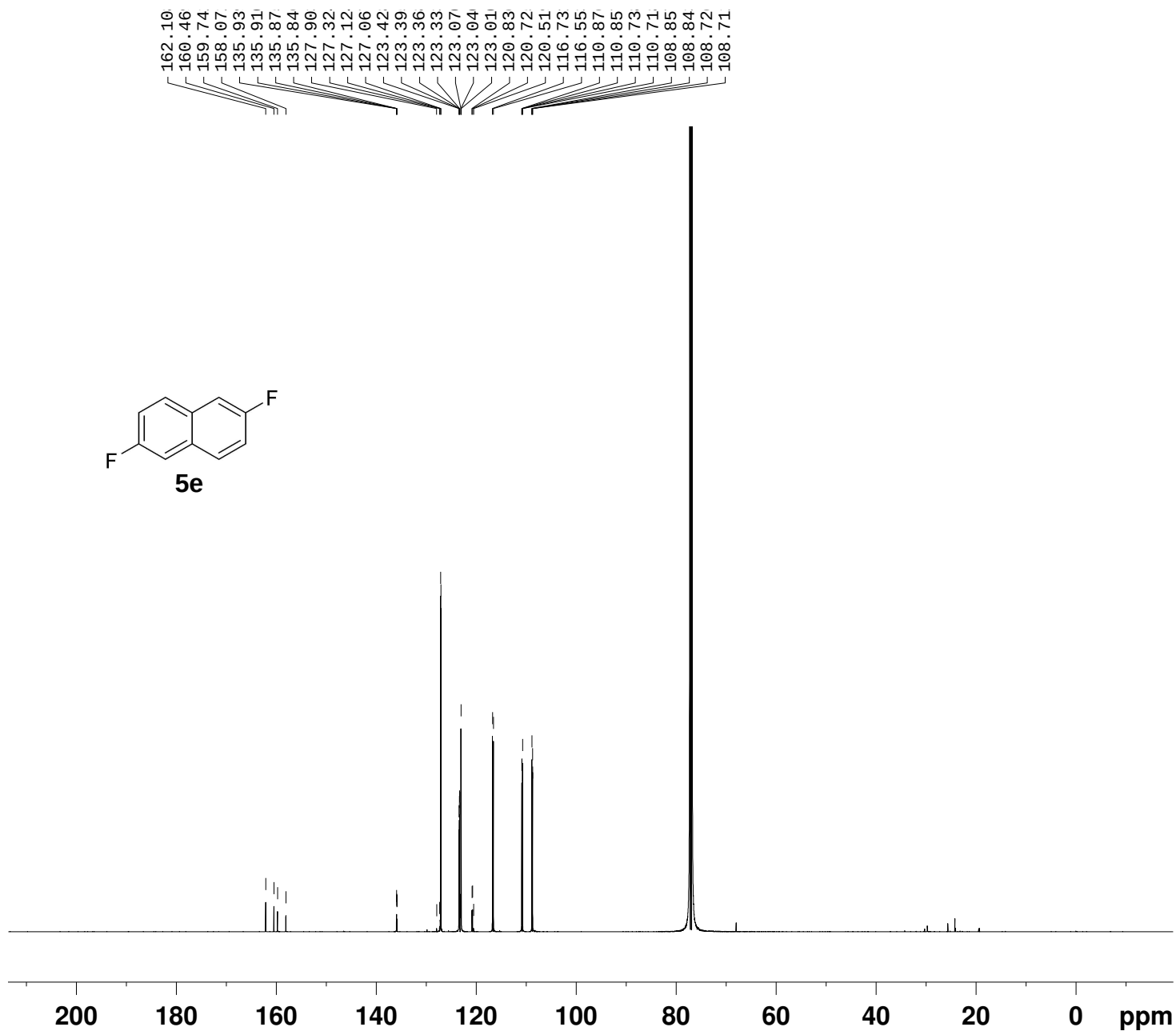
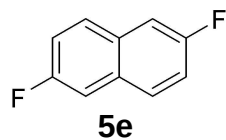


NAME LV-SJQ-745P-20250915
EXPNO 1
PROCNO 1
Date_ 20250915
Time 14.59
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 12019.230 Hz
FIDRES 0.183399 Hz
AQ 2.7263477 sec
RG 76.92
DW 41.600 usec
DE 6.50 usec
TE 296.3 K
D1 1.00000000 sec
TD0 1

===== CHANNEL f1 =====
SF01 600.1737063 MHz
NUC1 1H
P1 9.96 usec
SI 65536
SF 600.1700219 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

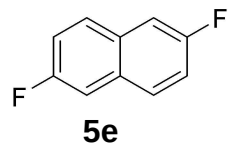


1.027
1.177
1.035
0.819
0.975
1.000

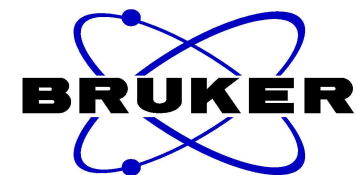


NAME LV-SJQ-745P-20250915
 EXPNO 3
 PROCNO 1
 Date_ 20250915
 Time 15.32
 INSTRUM spect
 PROBHD 5 mm PABBO BB/
 PULPROG zgpg30
 TD 65536
 SOLVENT CDCl3
 NS 600
 DS 4
 SWH 36057.691 Hz
 FIDRES 0.550197 Hz
 AQ 0.9088159 sec
 RG 190.02
 DW 13.867 usec
 DE 6.50 usec
 TE 297.4 K
 D1 2.00000000 sec
 D11 0.03000000 sec
 TD0 1

===== CHANNEL f1 =====
 SF01 150.9279571 MHz
 NUC1 13C
 P1 11.90 usec
 SI 32768
 SF 150.9128665 MHz
 WDW EM
 SSB 0
 LB 1.00 Hz
 GB 0
 PC 1.40

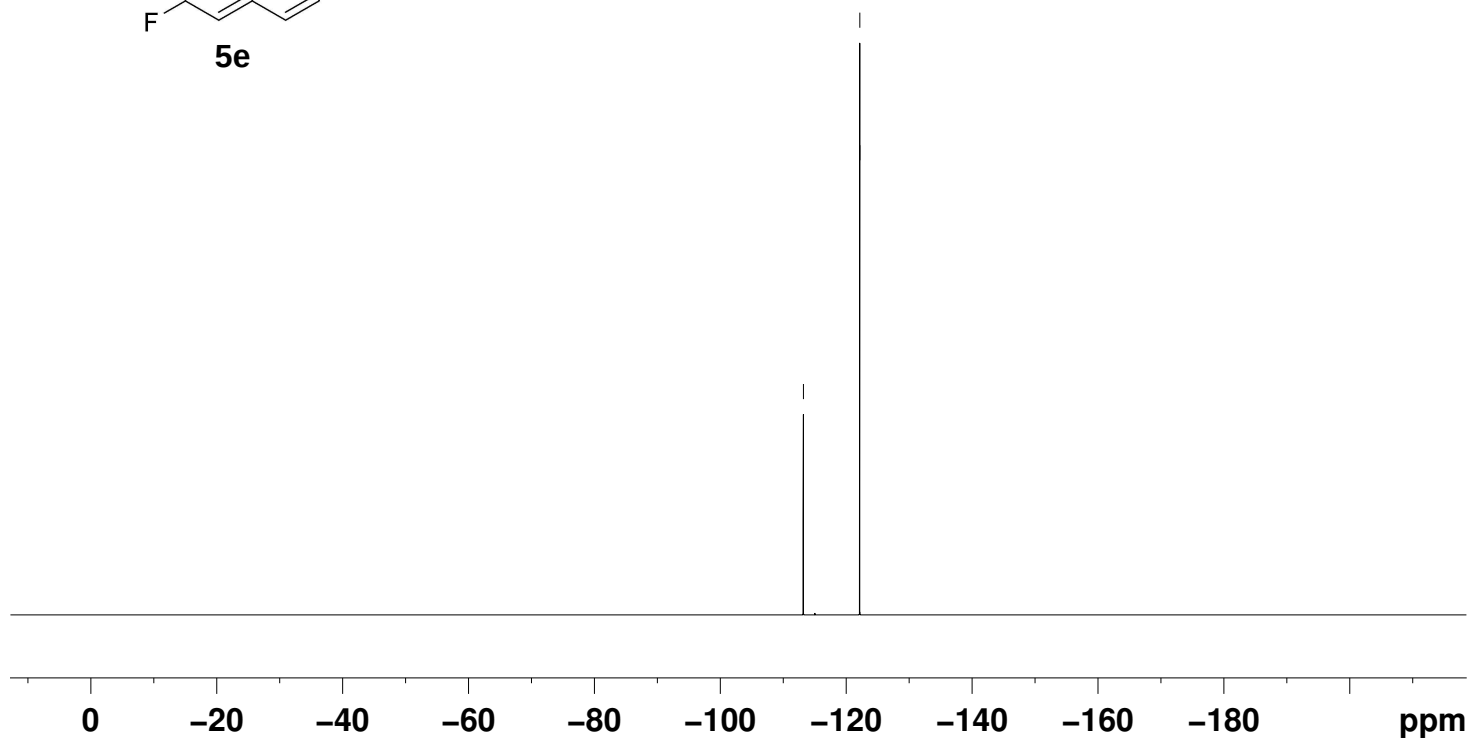


-113.2
-122.1
-122.1



NAME LV-SJQ-745P-20250915
EXPNO 2
PROCNO 1
Date_ 20250915
Time 15.01
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgfhigqn.2
TD 131072
SOLVENT CDCl3
NS 16
DS 4
SWH 133928.578 Hz
FIDRES 1.021794 Hz
AQ 0.4893855 sec
RG 190.02
DW 3.733 usec
DE 6.50 usec
TE 296.4 K
D1 1.00000000 sec
D11 0.03000000 sec
D12 0.00002000 sec
TD0 1

===== CHANNEL f1 =====
SF01 564.6675534 MHz
NUC1 19F
P1 12.00 usec
SI 65536
SF 564.7240258 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

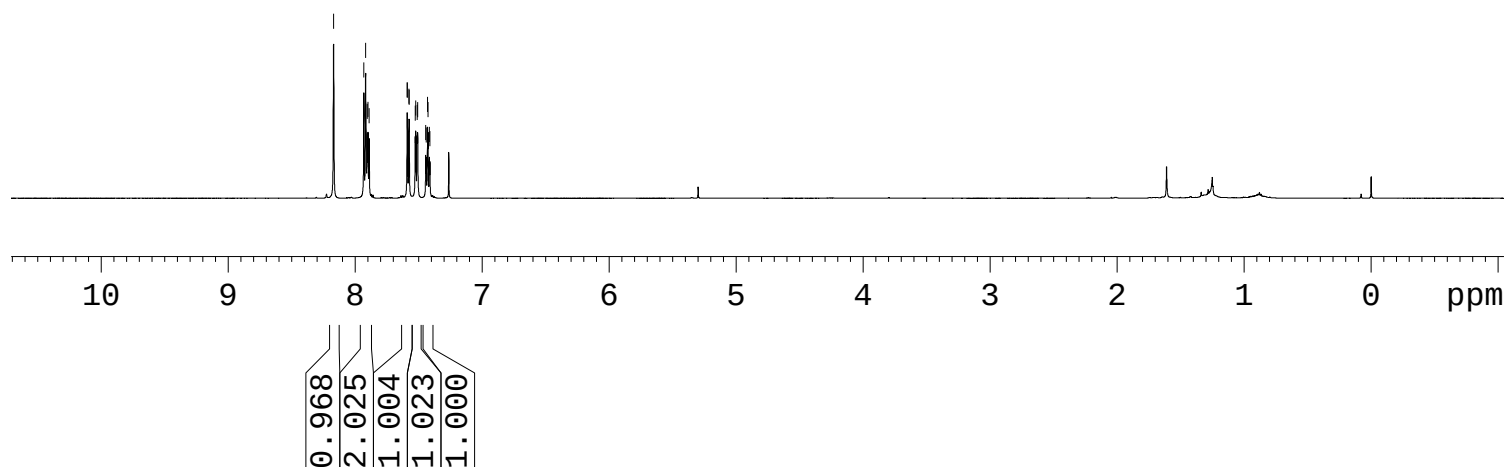
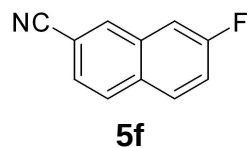


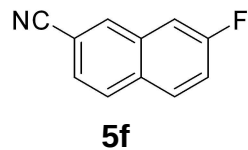


NAME LV-SJQ-739P-1-20250914
 EXPNO 1
 PROCNO 1
 Date_ 20250914
 Time 23.15
 INSTRUM spect
 PROBHD 5 mm PABBO BB/
 PULPROG zg30
 TD 65536
 SOLVENT CDCl3
 NS 16
 DS 2
 SWH 12019.230 Hz
 FIDRES 0.183399 Hz
 AQ 2.7263477 sec
 RG 87.54
 DW 41.600 usec
 DE 6.50 usec
 TE 296.6 K
 D1 1.00000000 sec
 TD0 1

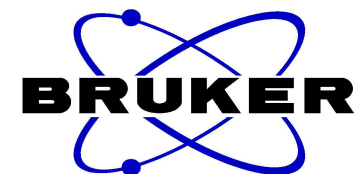
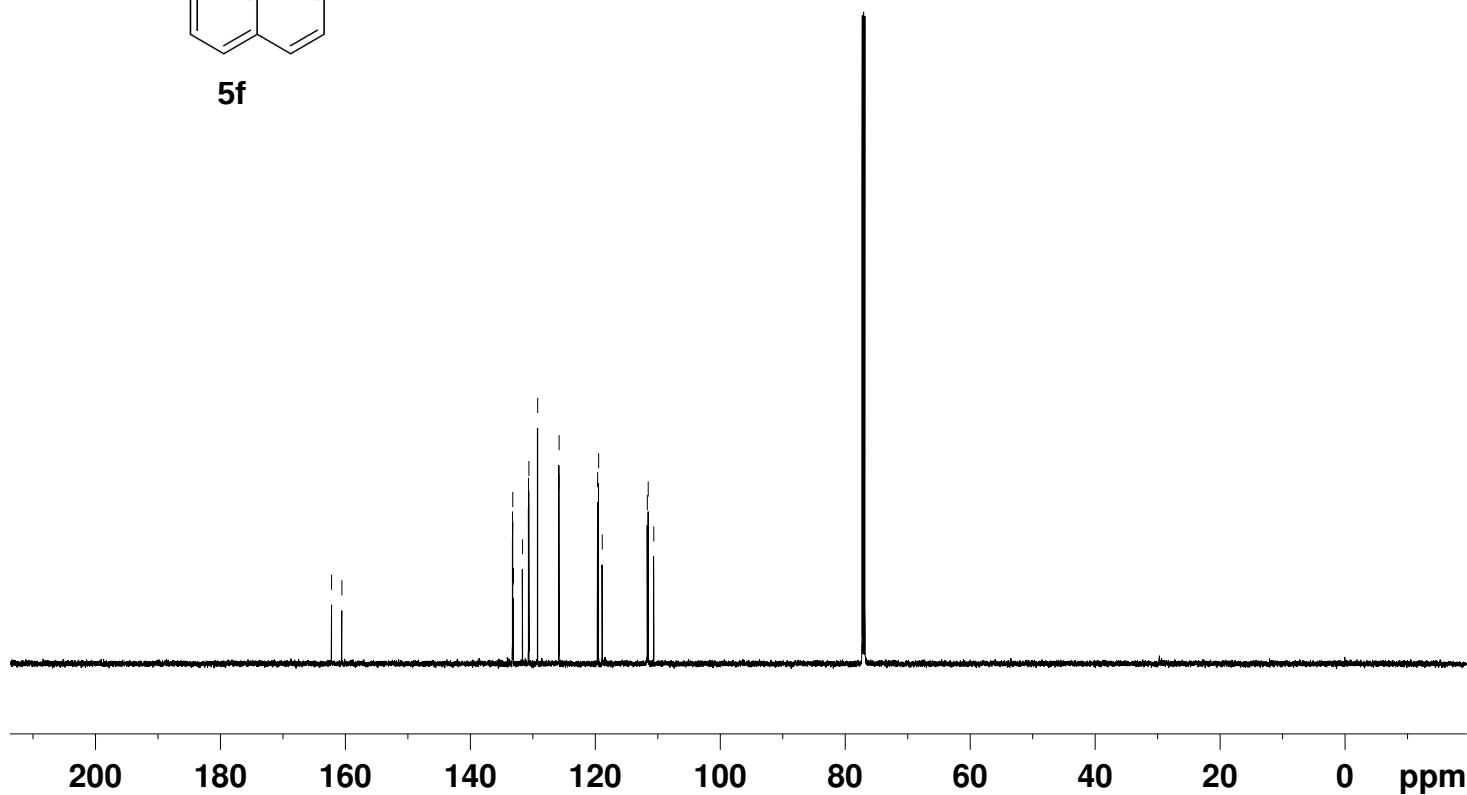
===== CHANNEL f1 =====
 SF01 600.1737063 MHz
 NUC1 1H
 P1 9.96 usec
 SI 65536
 SF 600.1700129 MHz
 WDW EM
 SSB 0
 LB 0.30 Hz
 GB 0
 PC 1.00

8.170
 7.932
 7.918
 7.905
 7.899
 7.890
 7.591
 7.589
 7.577
 7.575
 7.527
 7.523
 7.512
 7.508
 7.445
 7.441
 7.431
 7.426
 7.416
 7.412



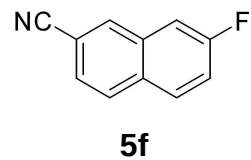


162.21
 160.56
 133.25
 133.21
 133.16
 133.10
 131.64
 130.69
 130.63
 129.22
 125.81
 125.79
 119.63
 119.46
 118.89
 111.67
 111.53
 110.64

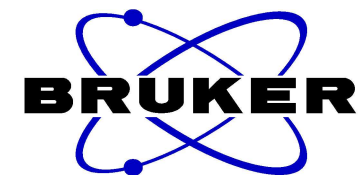


NAME LV-SJQ-739P-1-20250914
 EXPNO 4
 PROCNO 1
 Date_ 20250914
 Time 23.39
 INSTRUM spect
 PROBHD 5 mm PABBO BB/
 PULPROG zgpg30
 TD 65536
 SOLVENT CDCl3
 NS 400
 DS 4
 SWH 36057.691 Hz
 FIDRES 0.550197 Hz
 AQ 0.9088159 sec
 RG 190.02
 DW 13.867 usec
 DE 6.50 usec
 TE 297.6 K
 D1 2.00000000 sec
 D11 0.03000000 sec
 TD0 1

===== CHANNEL f1 =====
 SF01 150.9279571 MHz
 NUC1 13C
 P1 11.90 usec
 SI 32768
 SF 150.9128665 MHz
 WDW EM
 SSB 0
 LB 1.00 Hz
 GB 0
 PC 1.40



— -111.1



```

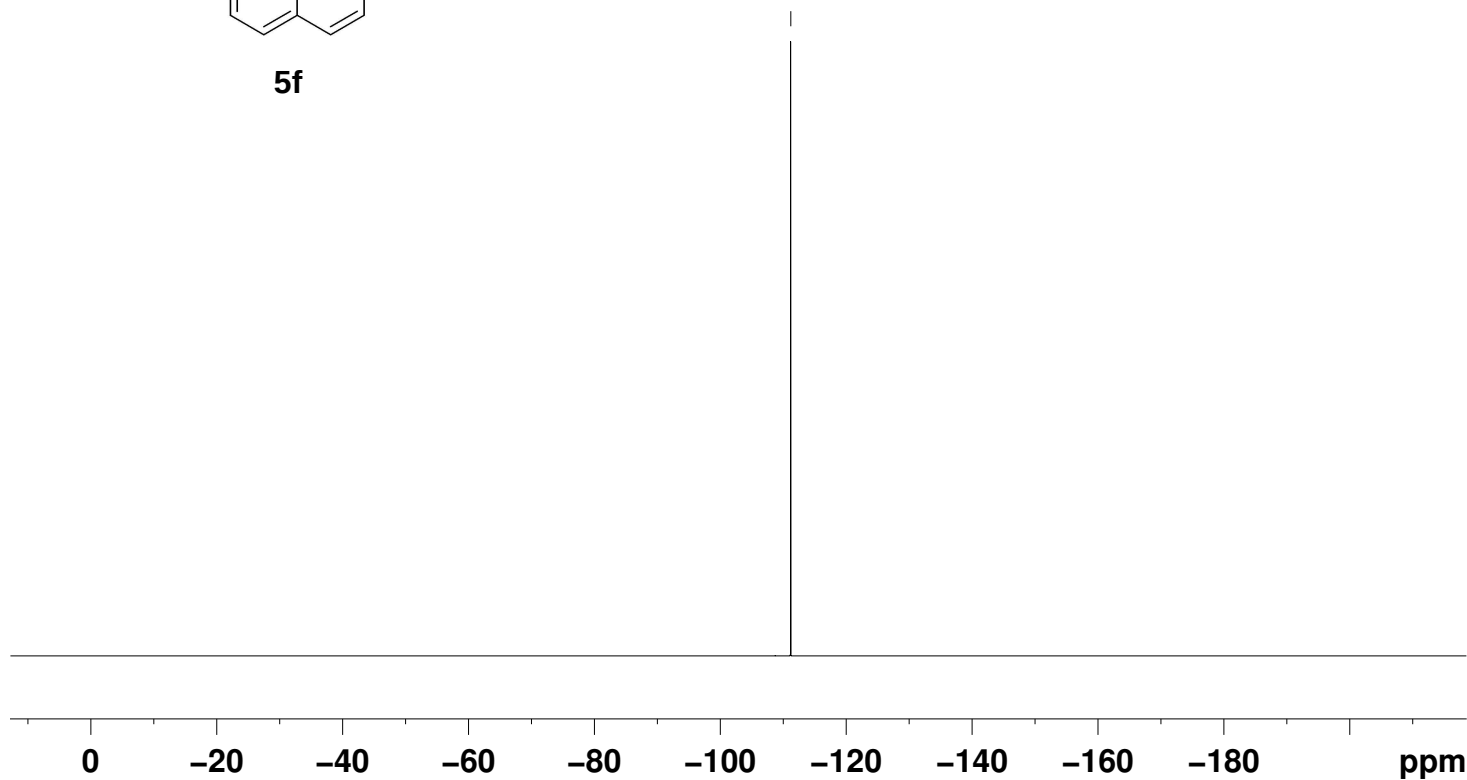
NAME      LV-SJQ-739P-1-20250914
EXPNO      3
PROCNO     1
Date_      20250914
Time       23.17
INSTRUM    spect
PROBHD     5 mm PABBO BB/
PULPROG    zgfhigqn.2
TD         131072
SOLVENT    CDCl3
NS         16
DS         4
SWH        133928.578 Hz
FIDRES     1.021794 Hz
AQ         0.4893855 sec
RG         190.02
DW         3.733 usec
DE         6.50 usec
TE         296.7 K
D1         1.00000000 sec
D11        0.03000000 sec
D12        0.00002000 sec
TD0        1

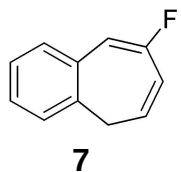
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```

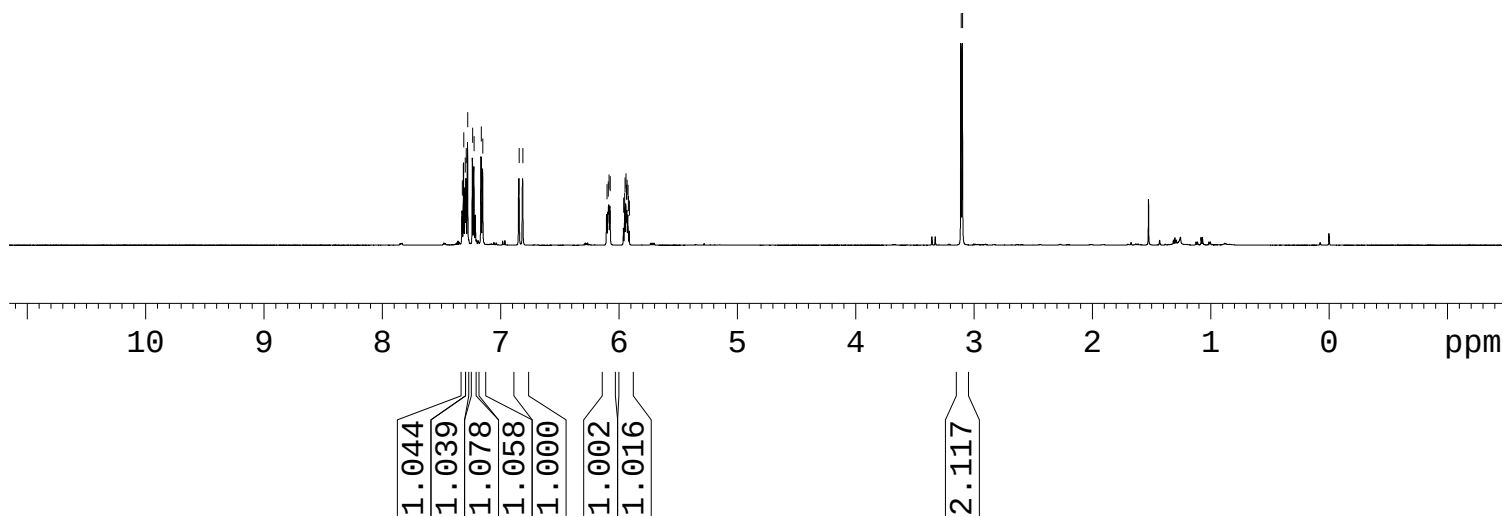
===== CHANNEL f1 =====
SF01      564.6675534 MHz
NUC1       19F
P1         12.00 usec
SI         65536
SF         564.7240258 MHz
WDW        EM
SSB        0
LB         0.30 Hz
GB         0
PC         1.00

```



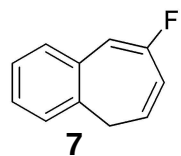


7.324
7.312
7.300
7.291
7.279
7.237
7.225
7.164
7.151
6.844
6.813
6.101
6.091
6.085
6.074
5.961
5.953
5.949
5.941
5.937
5.932
5.924
5.921
5.912
3.109
3.097



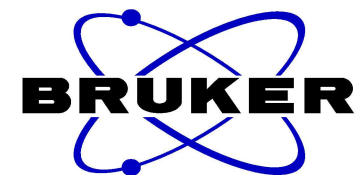
NAME LV-SJQ-651P-20250527
EXPNO 1
PROCNO 1
Date_ 20250527
Time 16.46
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 12019.230 Hz
FIDRES 0.183399 Hz
AQ 2.7263477 sec
RG 76.92
DW 41.600 usec
DE 6.50 usec
TE 298.1 K
D1 1.00000000 sec
TD0 1

===== CHANNEL f1 =====
SF01 600.1737063 MHz
NUC1 1H
P1 9.96 usec
SI 65536
SF 600.1700281 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00



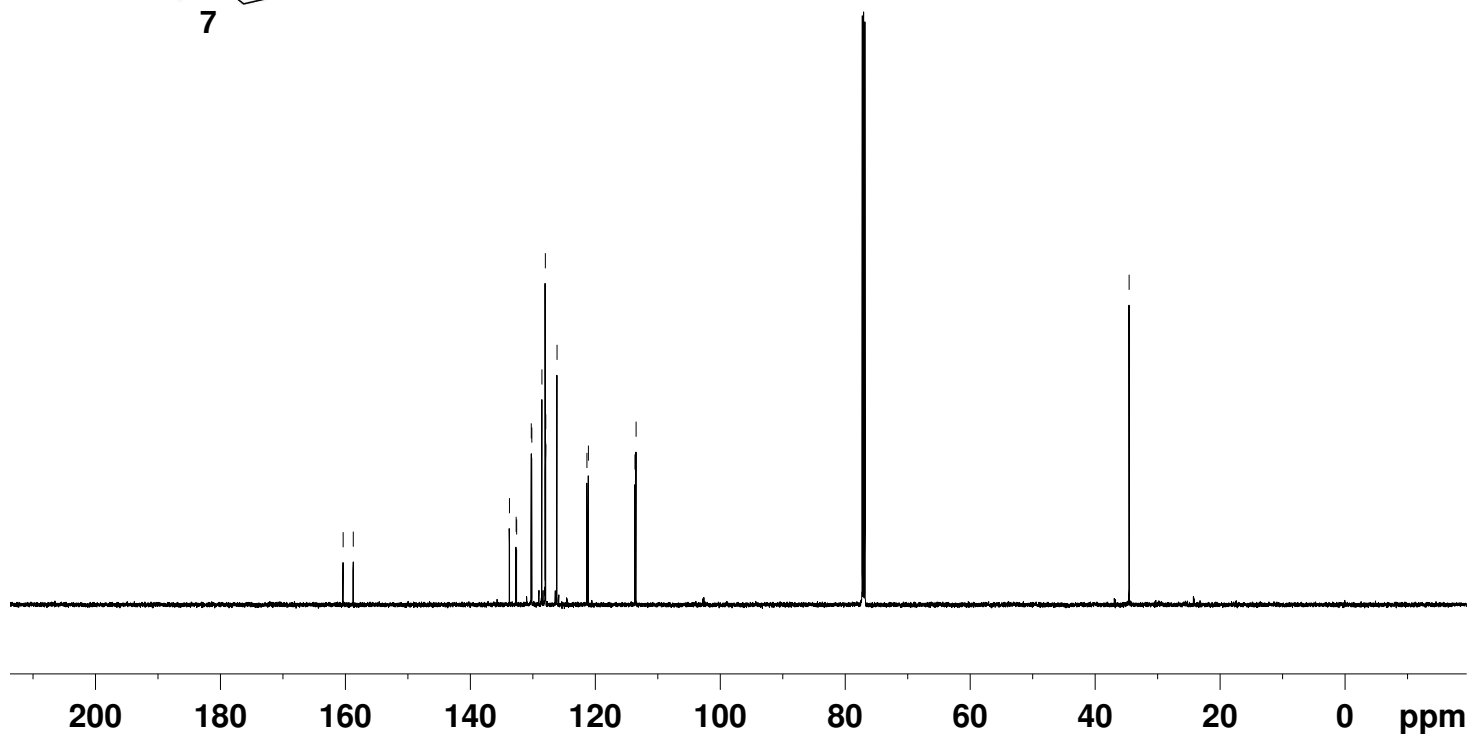
160.36
158.74
133.74
132.67
132.59
130.25
130.16
128.54
127.99
127.95
127.93
126.12
121.34
121.11
113.65
113.47

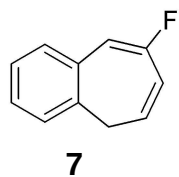
34.563



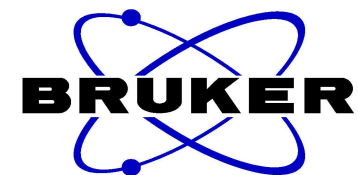
NAME LV-SJQ-651P-20250527
EXPNO 3
PROCNO 1
Date_ 20250527
Time 17.19
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 600
DS 4
SWH 36057.691 Hz
FIDRES 0.550197 Hz
AQ 0.9088159 sec
RG 190.02
DW 13.867 usec
DE 6.50 usec
TE 298.1 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1

===== CHANNEL f1 =====
SF01 150.9279571 MHz
NUC1 13C
P1 11.90 usec
SI 32768
SF 150.9128665 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40





— -100.2

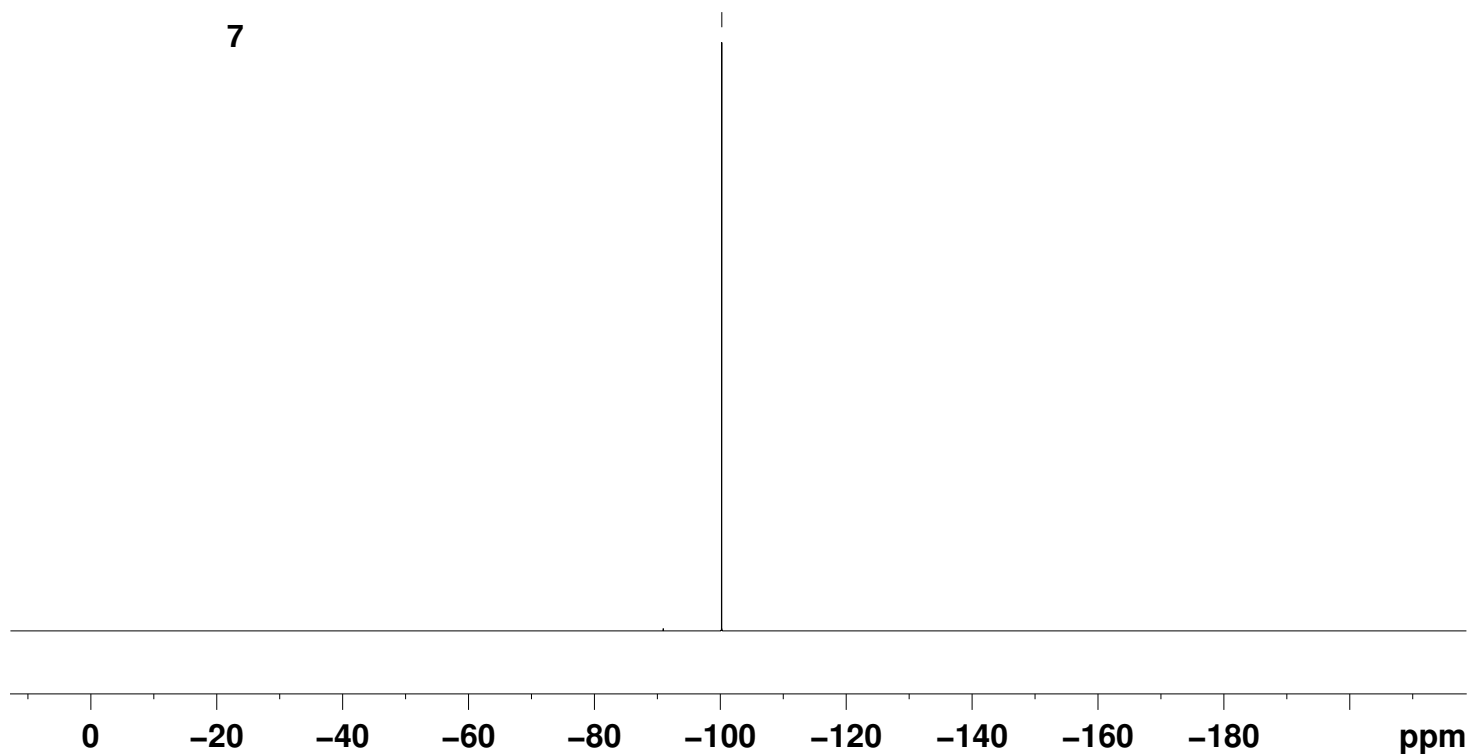


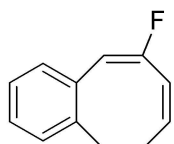
```

NAME      LV-SJQ-651P-20250527
EXPNO     2
PROCNO    1
Date_     20250527
Time      16.48
INSTRUM    spect
PROBHD     5 mm PABBO BB/
PULPROG    zgfhigqn.2
TD         131072
SOLVENT    CDCl3
NS         16
DS         4
SWH        133928.578 Hz
FIDRES     1.021794 Hz
AQ         0.4893855 sec
RG         190.02
DW         3.733 usec
DE         6.50 usec
TE         298.1 K
D1         1.00000000 sec
D11        0.03000000 sec
D12        0.00002000 sec
TD0        1
  
```

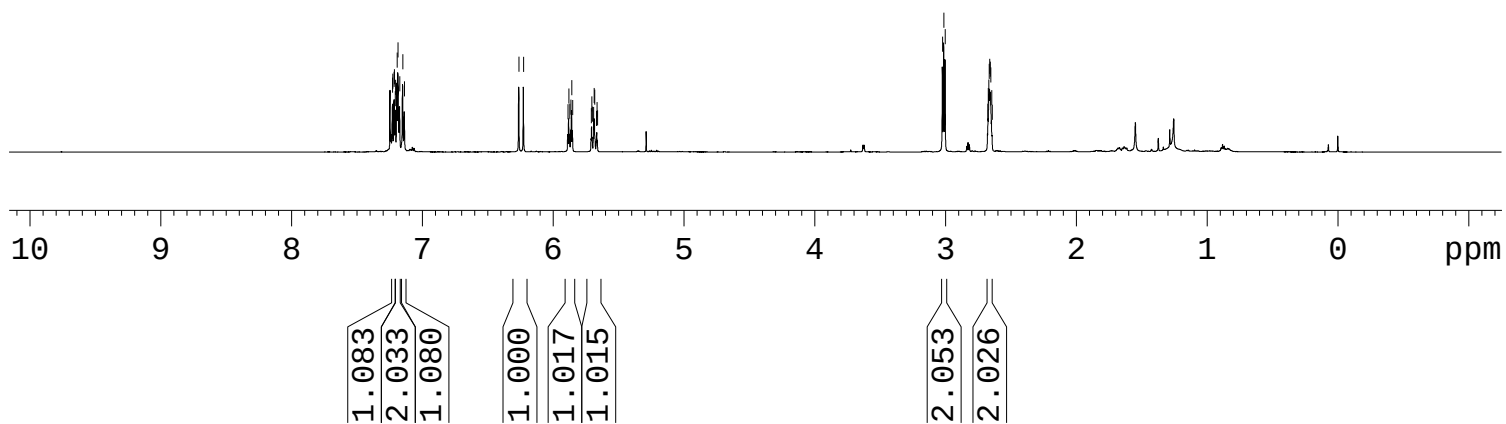
```

===== CHANNEL f1 =====
SF01      564.6675534 MHz
NUC1       19F
P1         12.00 usec
SI         65536
SF         564.7240258 MHz
WDW        EM
SSB        0
LB         0.30 Hz
GB         0
PC         1.00
  
```





9

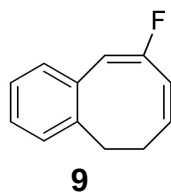


7.216
7.214
7.207
7.205
7.193
7.186
7.173
7.149
7.137
6.262
6.226
5.887
5.880
5.873
5.865
5.858
5.851
5.708
5.705
5.700
5.691
5.687
5.683
5.669
5.665
5.661
3.023
3.013
3.003
2.678
2.674
2.670
2.667
2.663
2.658
2.654
2.647
2.643



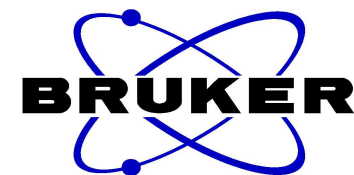
NAME LV-SJQ-737P-20250912
EXPNO 1
PROCNO 1
Date_ 20250913
Time 0.29
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 12019.230 Hz
FIDRES 0.183399 Hz
AQ 2.7263477 sec
RG 76.92
DW 41.600 usec
DE 6.50 usec
TE 297.0 K
D1 1.00000000 sec
TD0 1

===== CHANNEL f1 =====
SF01 600.1737063 MHz
NUC1 1H
P1 9.96 usec
SI 65536
SF 600.1700235 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00



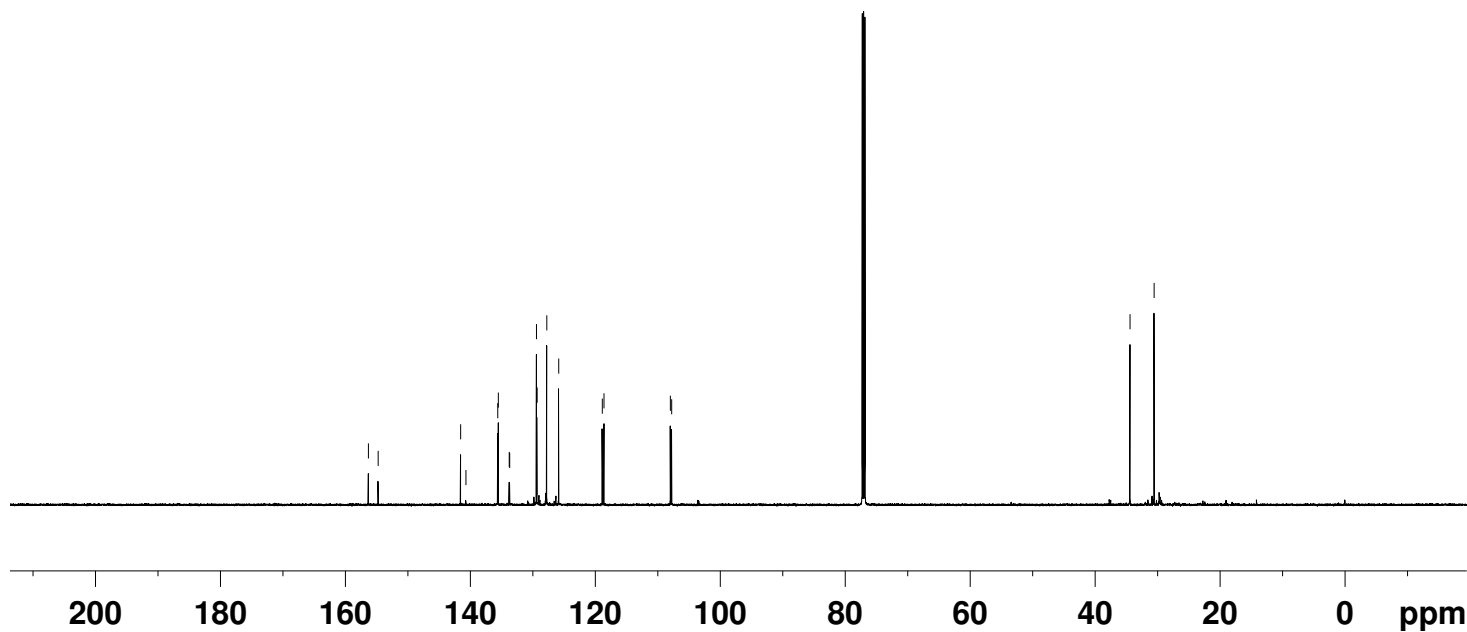
156.31
154.75
141.55
140.70
135.61
135.52
133.78
133.70
129.42
129.36
129.34
127.76
125.85
118.88
118.61
107.99
107.78

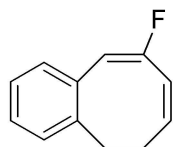
34.417
30.561



NAME LV-SJQ-737P-20250912
EXPNO 3
PROCNO 1
Date_ 20250913
Time 2.11
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 2000
DS 4
SWH 36057.691 Hz
FIDRES 0.550197 Hz
AQ 0.9088159 sec
RG 190.02
DW 13.867 usec
DE 6.50 usec
TE 298.0 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1

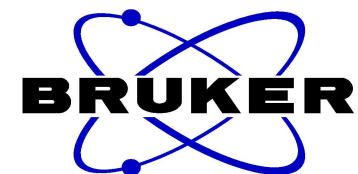
===== CHANNEL f1 =====
SF01 150.9279571 MHz
NUC1 13C
P1 11.90 usec
SI 32768
SF 150.9128665 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40





9

— -94.68



```

NAME      LV-SJQ-737P-20250912
EXPNO      2
PROCNO     1
Date_      20250913
Time       0.31
INSTRUM    spect
PROBHD     5 mm PABBO BB/
PULPROG    zgfhigqn.2
TD         131072
SOLVENT    CDCl3
NS         16
DS         4
SWH        133928.578 Hz
FIDRES     1.021794 Hz
AQ         0.4893855 sec
RG         190.02
DW         3.733 usec
DE         6.50 usec
TE         297.1 K
D1         1.00000000 sec
D11        0.03000000 sec
D12        0.00002000 sec
TD0        1
  
```

```

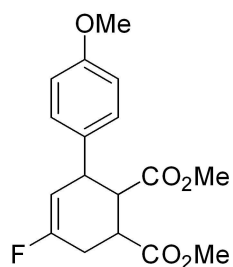
===== CHANNEL f1 =====
SF01      564.6675534 MHz
NUC1       19F
P1         12.00 usec
SI         65536
SF         564.7240258 MHz
WDW        EM
SSB        0
LB         0.30 Hz
GB         0
PC         1.00
  
```



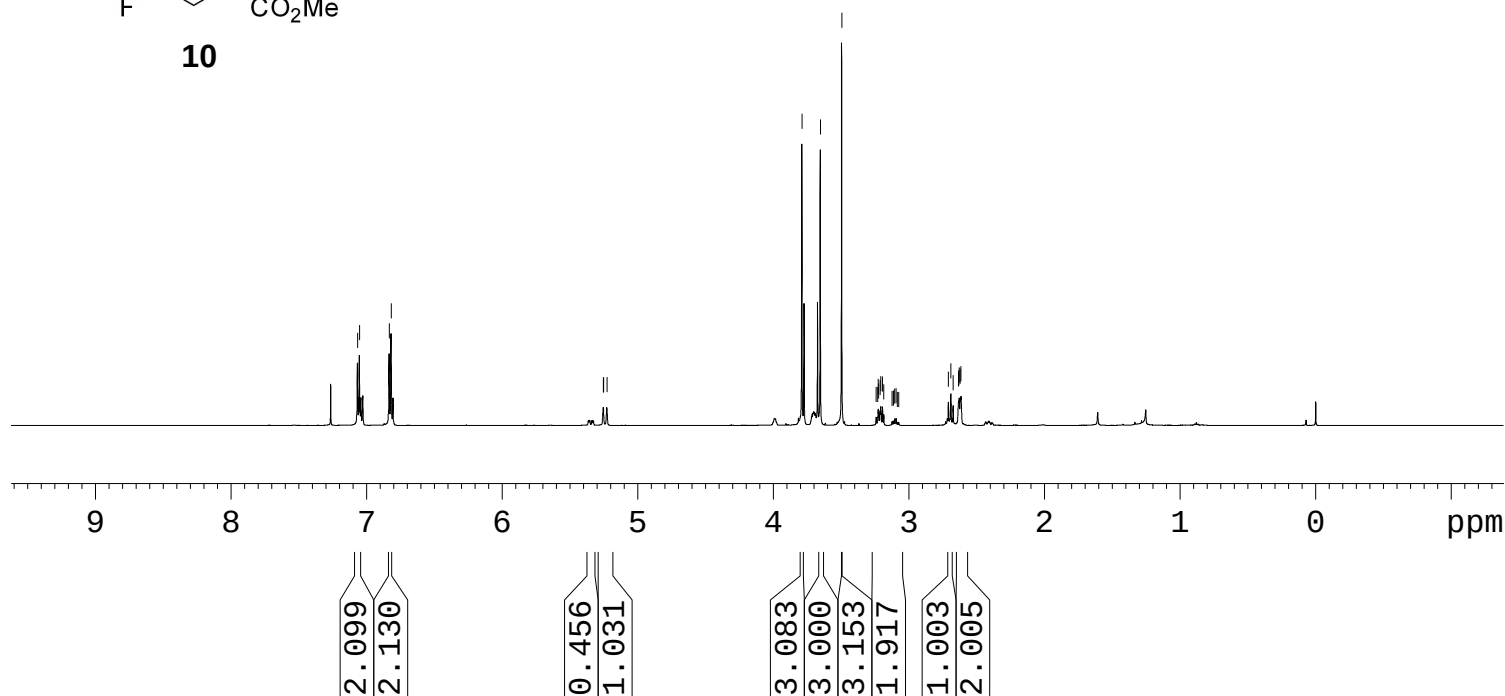
NAME LV-SJQ-803P-2-20251018
 EXPNO 1
 PROCNO 1
 Date_ 20251020
 Time 0.43
 INSTRUM spect
 PROBHD 5 mm PABBO BB/
 PULPROG zg30
 TD 65536
 SOLVENT CDCl3
 NS 16
 DS 2
 SWH 12019.230 Hz
 FIDRES 0.183399 Hz
 AQ 2.7263477 sec
 RG 69.87
 DW 41.600 usec
 DE 6.50 usec
 TE 0.0 K
 D1 1.00000000 sec
 TD0 1

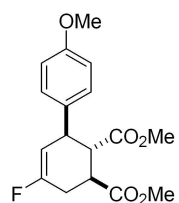
===== CHANNEL f1 =====
 SF01 600.1737063 MHz
 NUC1 1H
 P1 9.96 usec
 SI 65536
 SF 600.1700131 MHz
 WDW EM
 SSB 0
 LB 0.30 Hz
 GB 0
 PC 1.00

7.066
 7.052
 6.833
 6.818
 5.254
 5.252
 5.227
 3.788
 3.652
 3.495
 3.242
 3.230
 3.227
 3.224
 3.213
 3.208
 3.195
 3.186
 3.125
 3.114
 3.105
 3.095
 3.086
 3.075
 2.709
 2.691
 2.674
 2.634
 2.632
 2.629
 2.622
 2.617



10





10

173.91,
172.87,
172.86,
159.08,
158.79,
158.06,
156.36,

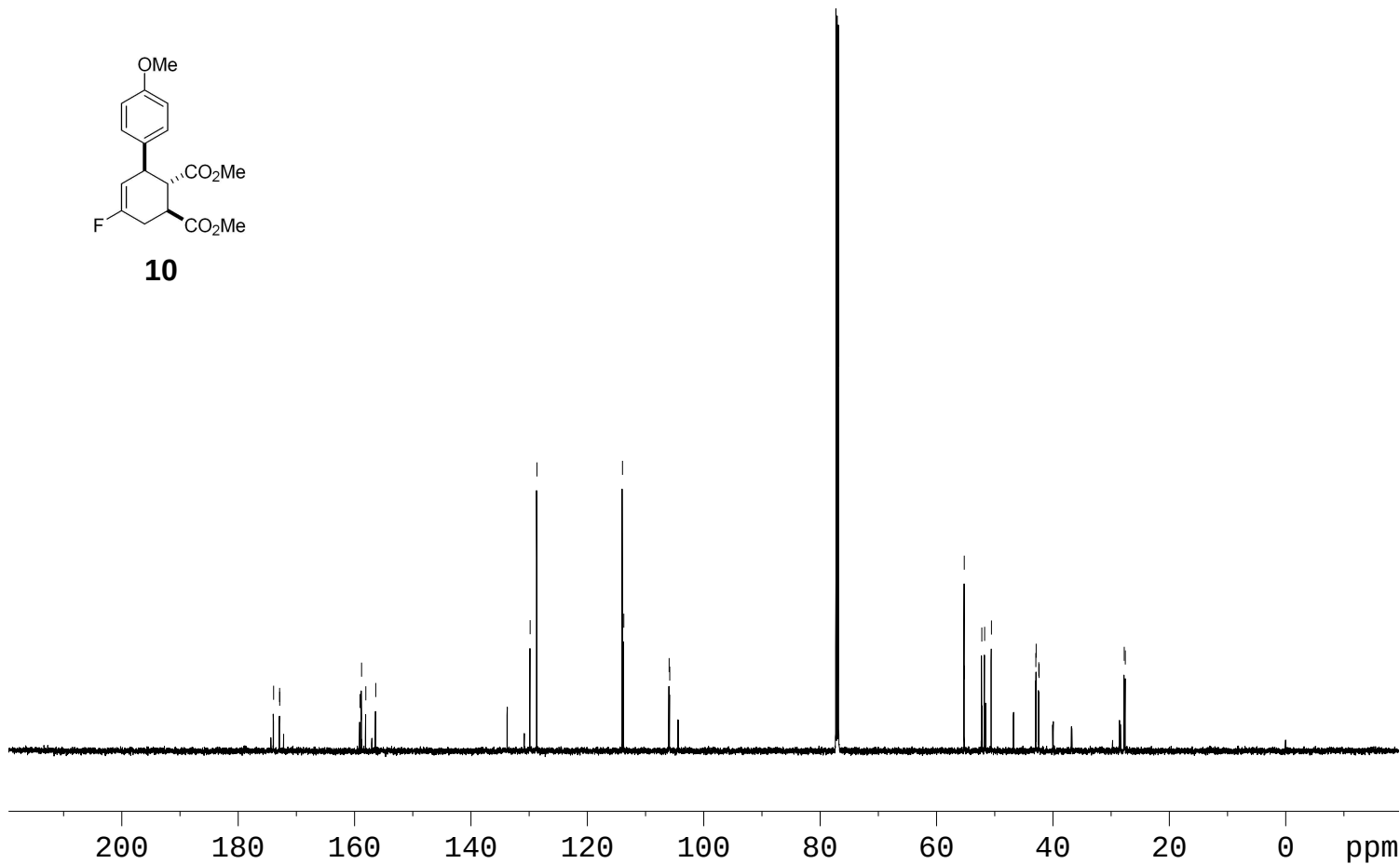
129.83,
128.66,
113.96,
113.73,
105.95,
105.84,

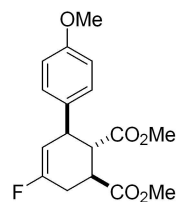
55.237
55.204
52.220
51.739
50.564
42.937
42.884
42.434
42.369
27.747
27.565



NAME LV-SJQ-803P-2-20251018
EXPNO 4
PROCNO 1
Date_ 20251020
Time 3.35
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 500
DS 4
SWH 36057.691 Hz
FIDRES 0.550197 Hz
AQ 0.9088159 sec
RG 190.02
DW 13.867 usec
DE 6.50 usec
TE 0.0 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1

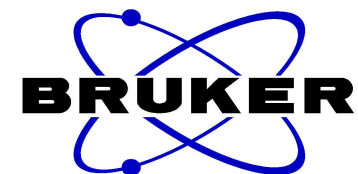
===== CHANNEL f1 =====
SF01 150.9279571 MHz
NUC1 13C
P1 11.90 usec
SI 32768
SF 150.9128665 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40





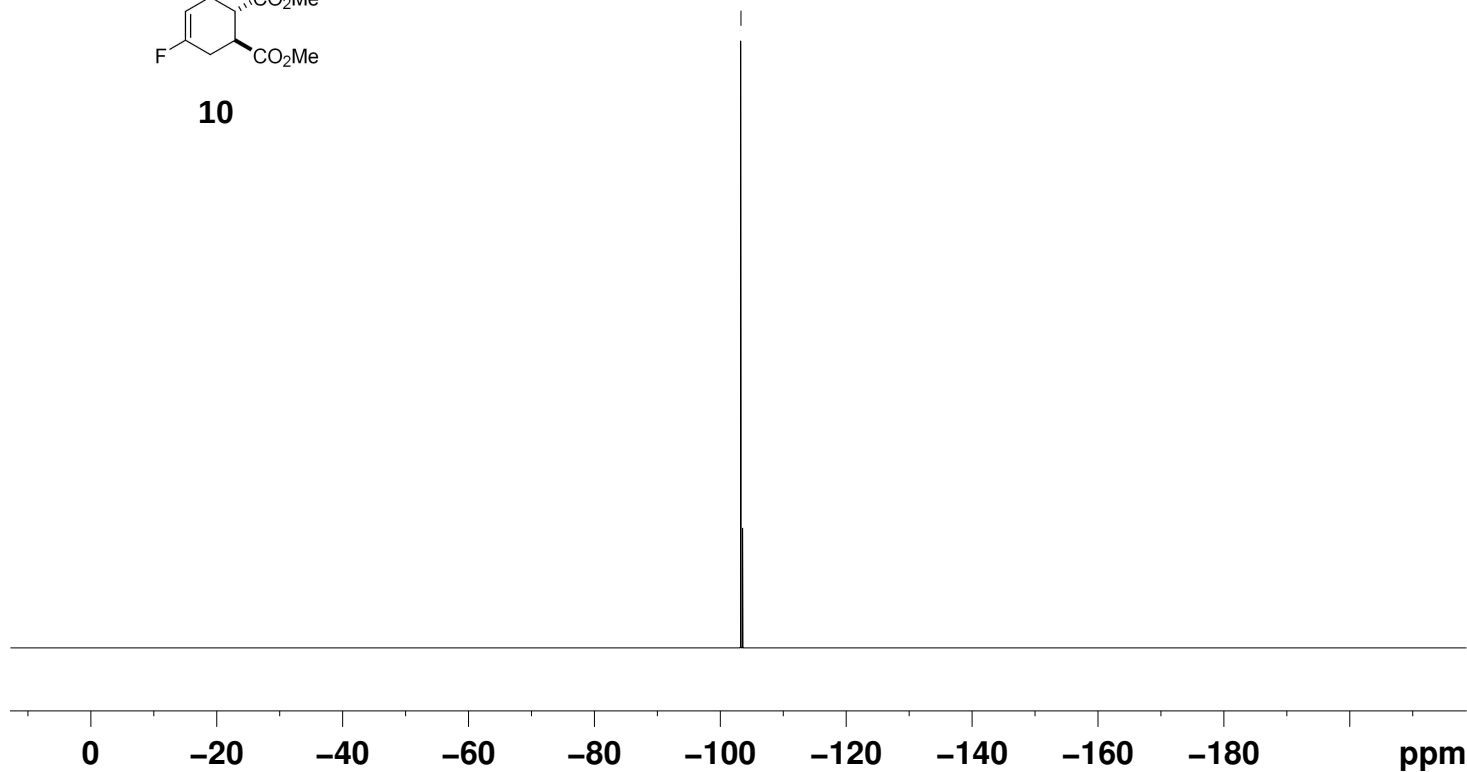
10

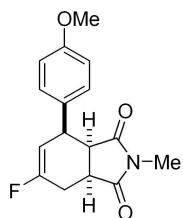
— -103.2



NAME LV-SJQ-803P-2-20251018
 EXPNO 3
 PROCNO 1
 Date_ 20251020
 Time 0.45
 INSTRUM spect
 PROBHD 5 mm PABBO BB/
 PULPROG zgfhigqn.2
 TD 131072
 SOLVENT CDCl3
 NS 16
 DS 4
 SWH 133928.578 Hz
 FIDRES 1.021794 Hz
 AQ 0.4893855 sec
 RG 190.02
 DW 3.733 usec
 DE 6.50 usec
 TE 0.0 K
 D1 1.00000000 sec
 D11 0.03000000 sec
 D12 0.00002000 sec
 TD0 1

===== CHANNEL f1 =====
 SF01 564.6675534 MHz
 NUC1 19F
 P1 12.00 usec
 SI 65536
 SF 564.7240258 MHz
 WDW EM
 SSB 0
 LB 0.30 Hz
 GB 0
 PC 1.00





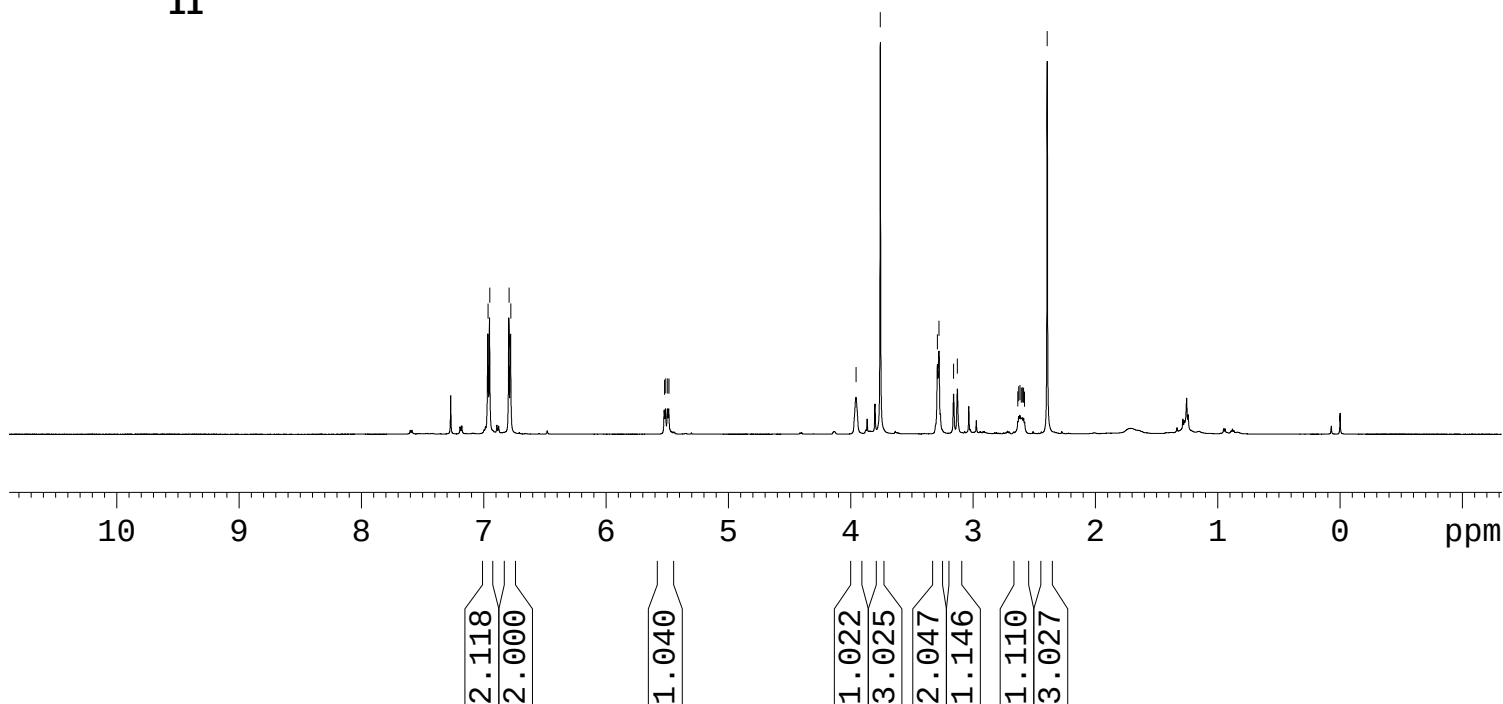
11

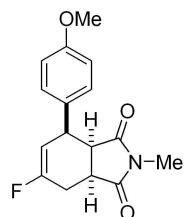
6.965
6.951
6.793
6.779
5.522
5.512
5.496
5.486
3.957
3.759
3.292
3.279
3.160
3.129
2.635
2.627
2.617
2.606
2.597
2.587
2.580
2.394



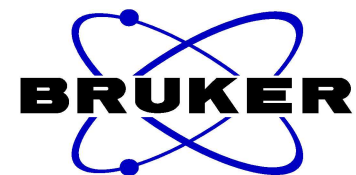
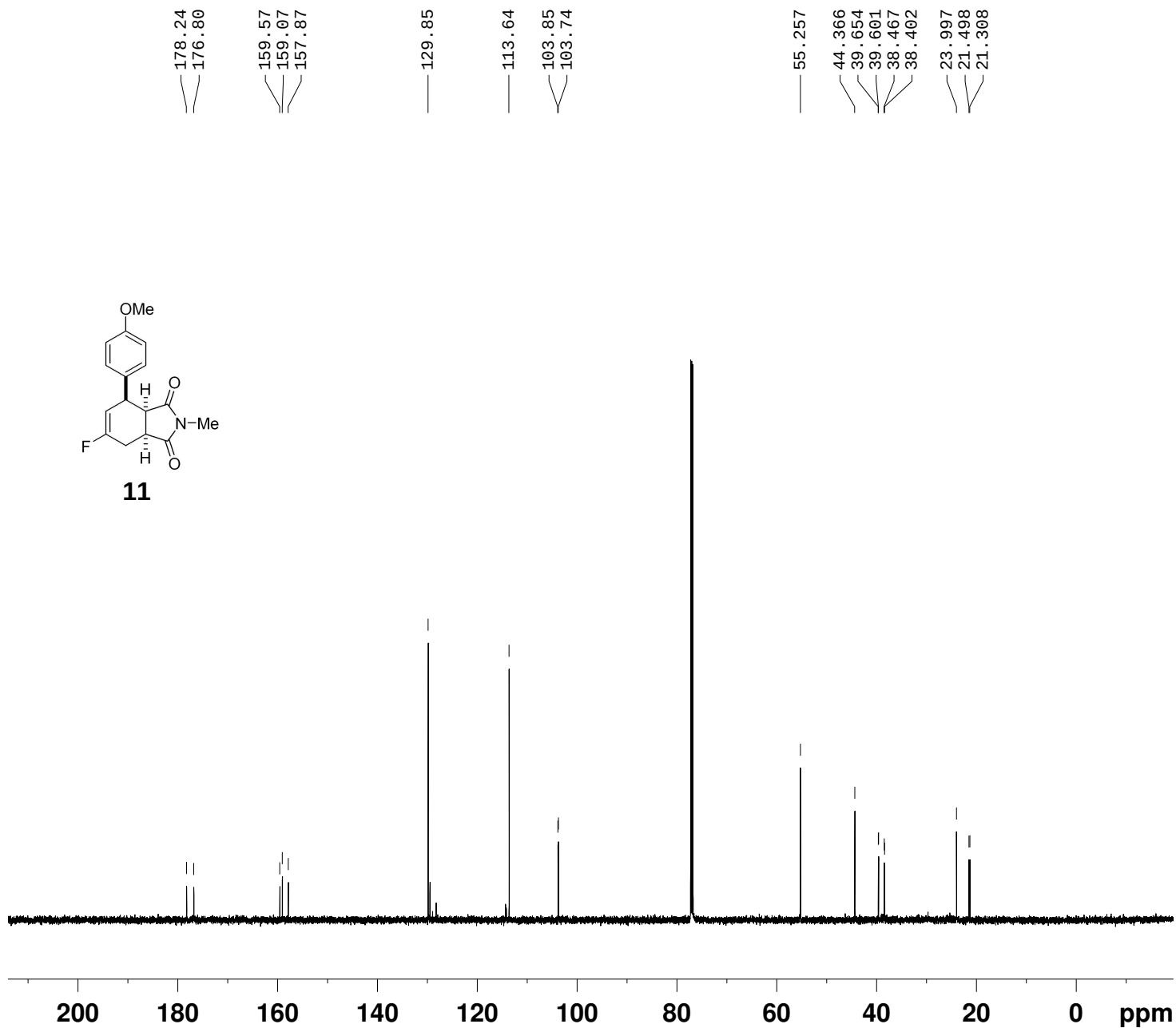
NAME LV-SJQ-757P-20251004
EXPNO 4
PROCNO 1
Date_ 20251004
Time 17.10
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 12019.230 Hz
FIDRES 0.183399 Hz
AQ 2.7263477 sec
RG 69.87
DW 41.600 usec
DE 6.50 usec
TE 0.0 K
D1 1.00000000 sec
TD0 1

===== CHANNEL f1 =====
SF01 600.1737063 MHz
NUC1 1H
P1 9.96 usec
SI 65536
SF 600.1700096 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00



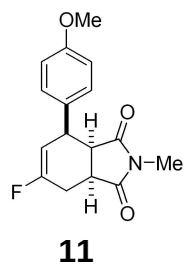


11

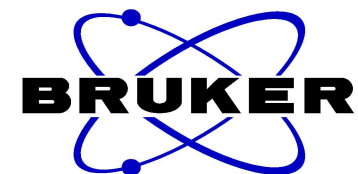


NAME LV-SJQ-757P-20251004
 EXPNO 1
 PROCNO 1
 Date_ 20251004
 Time 18.45
 INSTRUM spect
 PROBHD 5 mm PABBO BB/
 PULPROG zgpg30
 TD 65536
 SOLVENT CDCl₃
 NS 200
 DS 4
 SWH 36057.691 Hz
 FIDRES 0.550197 Hz
 AQ 0.9088159 sec
 RG 190.02
 DW 13.867 usec
 DE 6.50 usec
 TE 0.0 K
 D1 2.00000000 sec
 D11 0.03000000 sec
 TD0 1

===== CHANNEL f1 =====
 SF01 150.9279571 MHz
 NUC1 13C
 P1 11.90 usec
 SI 32768
 SF 150.9128665 MHz
 WDW EM
 SSB 0
 LB 1.00 Hz
 GB 0
 PC 1.40

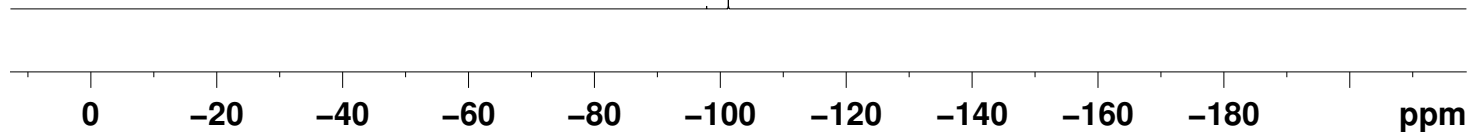


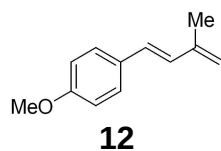
— -101.2



NAME LV-SJQ-757P-20251004
 EXPNO 3
 PROCNO 1
 Date_ 20251004
 Time 17.12
 INSTRUM spect
 PROBHD 5 mm PABBO BB/
 PULPROG zgfhigqn.2
 TD 131072
 SOLVENT CDCl3
 NS 16
 DS 4
 SWH 133928.578 Hz
 FIDRES 1.021794 Hz
 AQ 0.4893855 sec
 RG 190.02
 DW 3.733 usec
 DE 6.50 usec
 TE 0.0 K
 D1 1.00000000 sec
 D11 0.03000000 sec
 D12 0.00002000 sec
 TD0 1

===== CHANNEL f1 =====
 SF01 564.6675534 MHz
 NUC1 19F
 P1 12.00 usec
 SI 65536
 SF 564.7240258 MHz
 WDW EM
 SSB 0
 LB 0.30 Hz
 GB 0
 PC 1.00



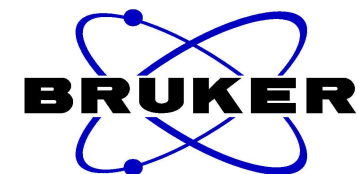


7.374
 7.360
 6.870
 6.856
 6.833
 6.820
 6.774
 6.747
 6.500
 6.473

5.066
 5.018

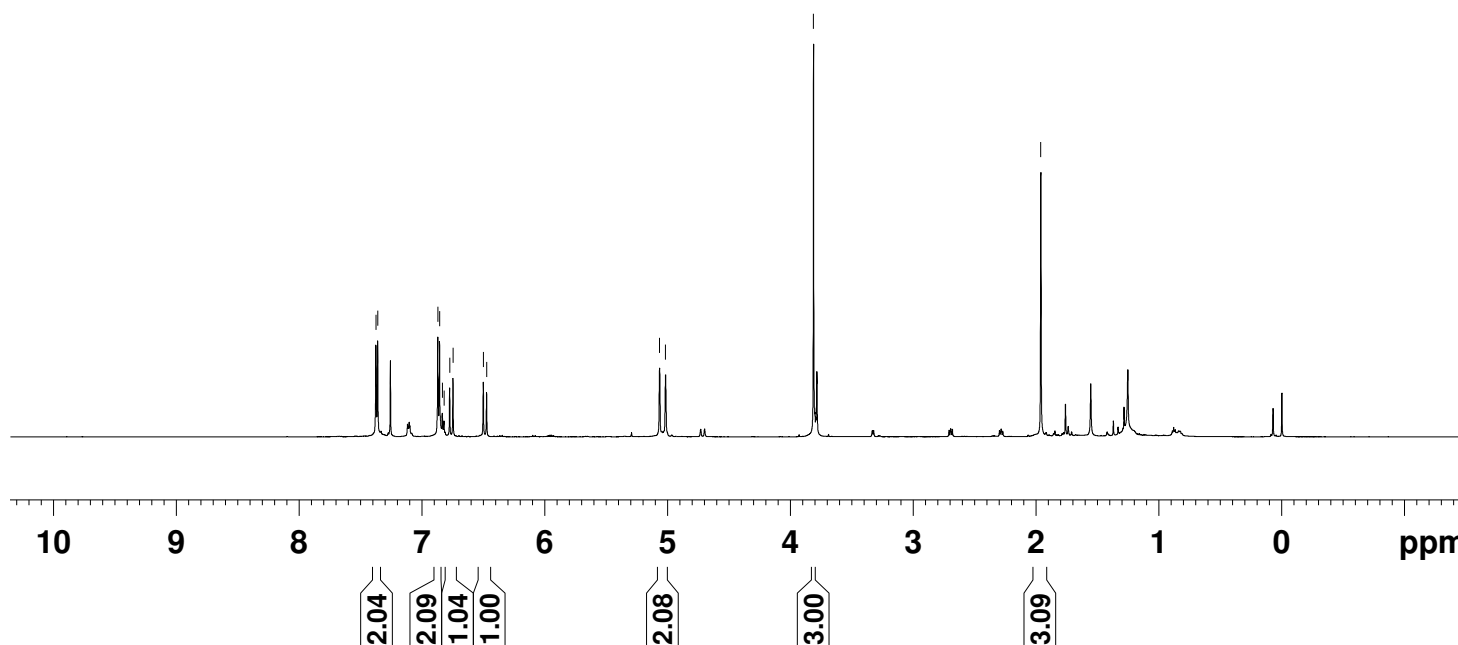
3.813

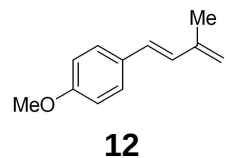
1.962



NAME LV-SJQ-759P-20251006
 EXPNO 1
 PROCNO 1
 Date_ 20251006
 Time 14.16
 INSTRUM spect
 PROBHD 5 mm PABBO BB/
 PULPROG zg30
 TD 65536
 SOLVENT CDCl3
 NS 16
 DS 2
 SWH 12019.230 Hz
 FIDRES 0.183399 Hz
 AQ 2.7263477 sec
 RG 96.28
 DW 41.600 usec
 DE 6.50 usec
 TE 0.0 K
 D1 1.00000000 sec
 TD0 1

===== CHANNEL f1 =====
 SF01 600.1737063 MHz
 NUC1 1H
 P1 9.96 usec
 SI 65536
 SF 600.1700176 MHz
 WDW EM
 SSB 0
 LB 0.30 Hz
 GB 0
 PC 1.00





—159.151
 —142.181
 129.73
 128.18
 127.64
 116.26
 114.08

—55.302

—18.628



NAME LV-SJQ-759P-20251006
 EXPNO 3
 PROCNO 1
 Date_ 20251006
 Time 14.34
 INSTRUM spect
 PROBHD 5 mm PABBO BB/
 PULPROG zgpg30
 TD 65536
 SOLVENT CDCl3
 NS 300
 DS 4
 SWH 36057.691 Hz
 FIDRES 0.550197 Hz
 AQ 0.9088159 sec
 RG 190.02
 DW 13.867 usec
 DE 6.50 usec
 TE 0.0 K
 D1 2.00000000 sec
 D11 0.03000000 sec
 TD0 1

===== CHANNEL f1 =====
 SF01 150.9279571 MHz
 NUC1 13C
 P1 11.90 usec
 SI 32768
 SF 150.9128665 MHz
 WDW EM
 SSB 0
 LB 1.00 Hz
 GB 0
 PC 1.40

