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Supporting Information

Reductive Coupling of Azonaphthalenes for the Synthesis of BINAMs via a Diboron-Enabled [5,5]-Sigmatropic Rearrangement

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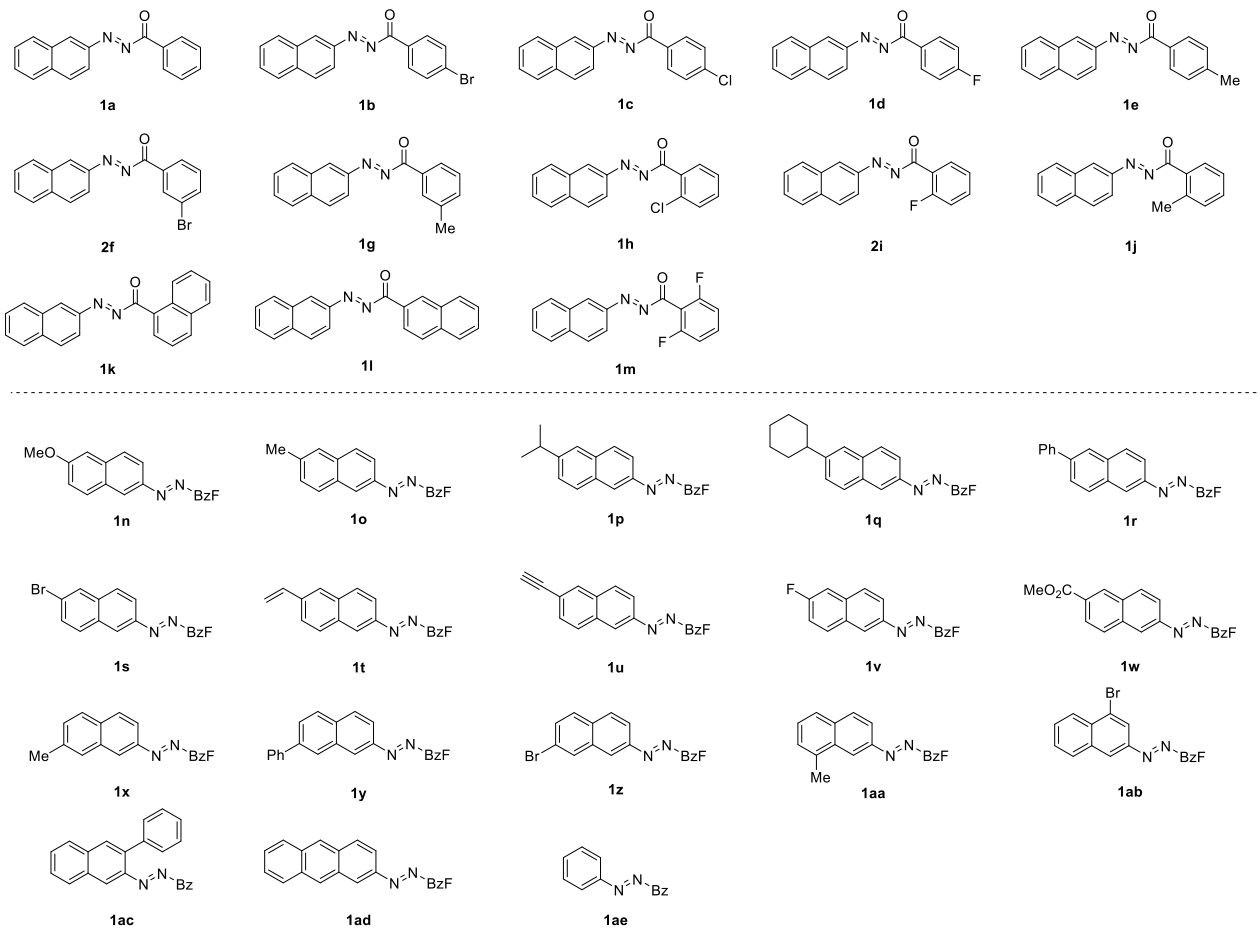
General Information

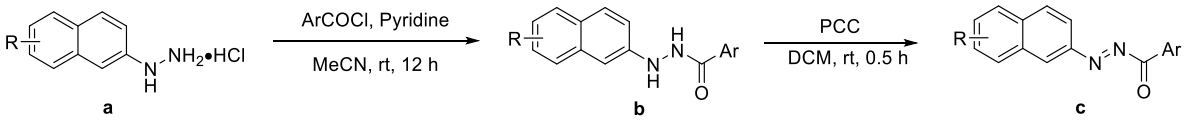
Unless otherwise stated, all reagents and solvents were purchased from reputable commercial sources and used without further purification. Flash column chromatography was performed on silica gel with a particle size range of 200-300 mesh. Analytical thin-layer chromatography was performed on precoated silica gel plates (60F-254) and visualized with a UV light source emitting at 254 nm. Both ^{1}H and ^{13}C NMR spectra were acquired on a Bruker spectrometer, operating at either 400 MHz or 500 MHz and were referenced to tetramethylsilane as the internal standard. Chemical shifts were reported as parts per million (ppm) relative to the signals of $CDCl_3$ and DMSO-d_6. Additionally, chemical constants were expressed in Hertz (Hz), measured downfield from tetramethylsilane. Anhydrous 1,2-dimethoxyethane was purchased from Sigma-Aldrich and used in its unaltered state. High-resolution mass spectrometric analysis reported as the mass-to-charge ratio (m/z), was performed using Agilent 7200 QTOF and Bruker MicroTOF-QII spectrometers.

Substrates explored in the manuscript



General procedure for the synthesis of azonaphthalenes

Azonaphthalenes were prepared according to the reported literature.[1-3]

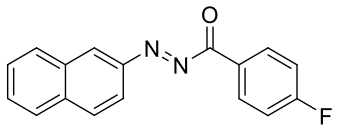


To a solution of 2-naphthylhydrazine hydrochloride (10 mmol) in acetonitrile (20 mL), benzoyl chloride (11 mmol) and pyridine (1.8 mL, 22 mmol) were added and stirred overnight at room temperature. After completion of the reaction, the solvent was concentrated in vacuo and diluted with ethyl acetate (50 mL). The organic phase was carefully washed with saturated aqueous sodium bicarbonate (50 mL) and extracted with ethyl acetate (3 x 50 mL). The combined organic phase was washed with brine, dried over sodium sulphate. After removal of the solvent, the crude

product was then purified by flash chromatography on silica gel eluted with *n*-hexane: ethyl acetate (5:1 to 2:1).

Pyridinium chlorochromate (PCC) (5 mmol) was added to a solution of naphthyl hydrazide (5 mmol) in dichloromethane (20 mL) and the reaction mixture was stirred at room temperature until the complete consumption of the starting material. The mixture was filtered, concentrated and purified by flash chromatography eluting with *n*-hexane: ethyl acetate (10:1).

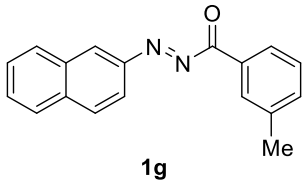
(*E*)-(4-fluorophenyl)(naphthalen-2-yldiazenyl) methanone (1d)



1d

Red solid, 55% yield; R_f 0.61 (*n*-hexane: ethyl acetate = 10:1). **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.68 (s, 1H), 8.25 – 8.16 (m, 2H), 8.09 (d, *J* = 8.0 Hz, 1H), 8.02 (dd, *J* = 8.9, 1.9 Hz, 1H), 7.96 (dd, *J* = 8.4, 3.6 Hz, 2H), 7.70 – 7.62 (m, 2H), 7.24 (t, *J* = 8.6 Hz, 2H).**^{13}C NMR (126 MHz, $CDCl_3$)** δ 180.4, 166.6 (d, *J* = 257.3 Hz), 149.8, 136.0, 133.5 (2C) (d, *J* = 9.6 Hz), 133.2, 132.3, 130.0, 129.6, 129.1, 128.1, 127.7 (d, *J* = 3.1 Hz), 127.3, 116.3 (2C) (d, *J* = 22.1 Hz), 115.4. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{17}H_{12}N_2O$, m/z: 279.0930, found: 279.0928.

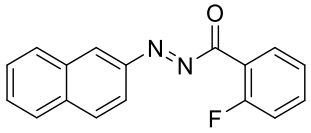
(*E*)-(naphthalen-2-yldiazenyl) (m-tolyl)methanone (1g)



1g

Red solid, 47% yield; R_f 0.50 (*n*-hexane: ethyl acetate = 10:1). **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.67 (d, *J* = 1.5 Hz, 1H), 8.08 (d, *J* = 7.9 Hz, 1H), 8.04 (dd, *J* = 8.9, 1.9 Hz, 1H), 7.99 – 7.92 (m, 4H), 7.69 – 7.61 (m, 2H), 7.50 (d, *J* = 7.6 Hz, 1H), 7.44 (t, *J* = 7.6 Hz, 1H), 2.46 (s, 3H). **^{13}C NMR (126 MHz, $CDCl_3$)** δ 182.2, 149.8, 138.8, 135.9, 135.4, 133.2, 131.8, 131.1, 131.0, 129.9, 129.2, 128.9, 128.8, 128.1, 127.9, 127.2, 115.5, 21.4. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{18}H_{15}N_2O$, m/z: 275.1179, found: 275.1181.

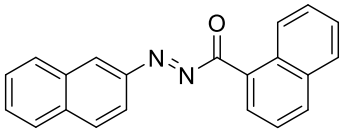
(*E*)-(2-fluorophenyl) (naphthalen-2-yldiazenyl) methanone (1i)



1i

Red solid, 51% yield; R_f 0.53 (*n*-hexane: ethyl acetate = 10:1). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.61 (d, *J* = 1.9 Hz, 1H), 8.19 – 8.12 (m, 1H), 8.09 – 8.02 (m, 1H), 8.01 (d, *J* = 1.9 Hz, 1H), 7.98 – 7.92 (m, 2H), 7.71 – 7.59 (m, 3H), 7.39 – 7.33 (m, 1H), 7.24 – 7.16 (m, 1H). **^{13}C NMR (126 MHz, $CDCl_3$)** δ 180.8, 162.5 (d, *J* = 261.1 Hz), 149.8, 136.3 (d, *J* = 9.1 Hz), 135.9, 133.2, 132.6, 131.5, 129.9, 129.5, 128.9, 128.1, 127.2, 124.6 (d, *J* = 3.6 Hz), 119.6 (d, *J* = 11.4 Hz), 117.2 (d, *J* = 22.1 Hz), 115.7. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{17}H_{12}FN_2O$, m/z: 279.0928, found: 279.0928.

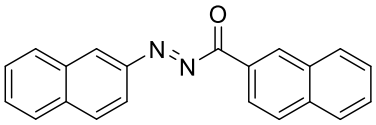
(*E*)-naphthalen-1-yl(naphthalen-2-yldiazenyl) methanone (1k)



1k

Bright orange solid, 45% yield; R_f 0.55 (*n*-hexane: ethyl acetate = 10:1). **^{1}H NMR (400 MHz, $CDCl_3$** δ 9.24 (dd, *J* = 8.7, 1.0 Hz, 1H), 8.65 (d, *J* = 1.9 Hz, 1H), 8.36 (dd, *J* = 7.3, 1.3 Hz, 1H), 8.14 (d, *J* = 8.3 Hz, 1H), 8.08 – 8.02 (m, 2H), 7.94 (t, *J* = 8.3 Hz, 3H), 7.77 – 7.70 (m, 1H), 7.67 – 7.58 (m, 3H), 7.58 – 7.53 (m, 1H). **^{13}C NMR (126 MHz, $CDCl_3$)** δ 183.2, 149.9, 136.0, 135.6, 134.2, 133.6, 133.4, 131.8 (2C), 130.0, 129.6, 129.1, 129.0, 128.9, 128.2, 127.5, 127.3, 127.0, 126.3, 124.5, 115.8. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{21}H_{15}N_2O$, m/z: 311.1179, found: 311.1182.

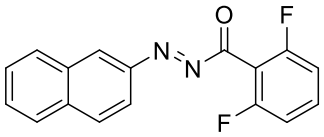
(*E*)-naphthalen-2-yl(naphthalen-2-yldiazenyl) methanone (1l)



1l

Bright orange solid, 39% yield; R_f 0.44 (*n*-hexane: ethyl acetate = 10:1). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.68 (d, *J* = 10.1 Hz, 2H), 8.18 (dd, *J* = 8.6, 1.6 Hz, 1H), 8.11 – 8.06 (m, 2H), 8.01 – 7.90 (m, 5H), 7.67 – 7.55 (m, 4H). **^{13}C NMR (126 MHz, $CDCl_3$)** δ 182.2, 150.3, 136.6, 136.3, 133.7, 133.6, 132.8, 132.5, 130.3, 130.2, 129.9, 129.7, 129.4, 129.3, 128.9, 128.5, 128.4, 127.7, 127.4, 125.6, 116.0. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{21}H_{15}N_2O$, m/z: 311.1179, found: 311.1182.

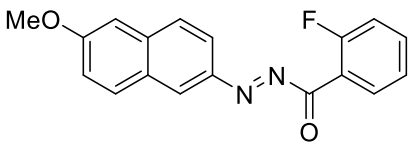
(*E*)-(2,6-difluorophenyl) (naphthalen-2-yldiazenyl) methanone (1m)



1m

Bright orange solid, 54% yield, R_f 0.47 (*n*-hexane: ethyl acetate = 10:1). **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.58 (s, 1H), 8.05 – 8.00 (m, 2H), 7.93 (d, *J* = 9.3 Hz, 2H), 7.71 – 7.52 (m, 3H), 7.05 (t, *J* = 8.4 Hz, 2H). **^{13}C NMR (126 MHz, $CDCl_3$)**) δ 177.7, 161.3 (2C) (d, *J* = 258.2 Hz), 149.5, 136.3, 134.4, 134.3 (t, *J* = 10.6 Hz), 133.1, 132.8, 130.1, 129.6, 129.3, 128.1, 127.3, 115.7, 112.3 (2C) (dd, *J* = 21.6, 3.8 Hz). **HRMS (ESI)** calcd for $[M+H]^+$ $C_{17}H_{11}N_2O$, m/z: 297.0834, found: 297.0837.

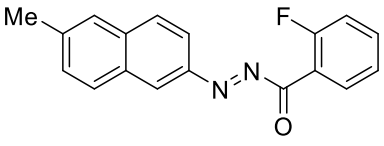
(*E*)-(2-fluorophenyl) ((6-methoxynaphthalen-2-yl)diazenyl) methanone (1n)



1n

Red solid, 45% yield; R_f 0.26 (*n*-hexane: ethyl acetate = 10:1). **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.53 (d, *J* = 2.0 Hz, 1H), 8.16 – 8.11 (m, 1H), 8.00 (dd, *J* = 8.9, 2.0 Hz, 1H), 7.95 (d, *J* = 8.9 Hz, 1H), 7.82 (d, *J* = 8.9 Hz, 1H), 7.68 – 7.64 (m, 1H), 7.37 – 7.33 (m, 1H), 7.28 – 7.24 (m, 1H), 7.24 – 7.22 (m, 1H), 7.22 – 7.18 (m, 1H), 4.00 (s, 3H). **^{13}C NMR (126 MHz, $CDCl_3$)** δ 180.8 (d, *J* = 5.9 Hz), 162.5 (d, *J* = 260.9 Hz), 160.2, 148.5, 137.8, 136.1 (d, *J* = 9.0 Hz), 132.6 (2C), 131.6, 128.4, 128.2, 126.5, 124.5 (d, *J* = 3.5 Hz), 119.9, 117.1 (d, *J* = 22.2 Hz), 116.5, 106.4, 55.5. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{18}H_{14}FN_2O_2$, m/z: 309.1035, found: 309.1035.

(*E*)-(2-fluorophenyl) ((6-methylnaphthalen-2-yl)diazenyl) methanone (1o)

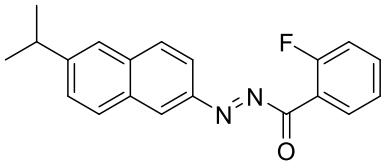


1o

Red orange solid, 57% yield; R_f 0.53 (*n*-hexane: ethyl acetate = 10:1). **^{1}H NMR (400 MHz, $CDCl_3$)** 8.54 (d, *J* = 1.9 Hz, 1H), 8.19 – 8.08 (m, 1H), 8.01 – 7.90 (m, 2H), 7.82 (d, *J* = 8.9 Hz, 1H), 7.68

(s, 1H), 7.67 – 7.60 (m, 1H), 7.42 (dd, *J* = 8.4, 1.7 Hz, 1H), 7.35 – 7.29 (m, 1H), 7.17 (dd, *J* = 10.0, 8.6 Hz, 1H), 2.56 (s, 3H). **^{13}C NMR (126 MHz, $CDCl_3$)** δ 180.8 (d, *J* = 5.3 Hz), 162.5 (d, *J* = 261.0 Hz), 149.3, 139.3 (2C), 136.2, 132.6, 131.6, 131.4, 129.7, 129.5, 128.8, 127.2, 124.6 (d, *J* = 3.5 Hz), 119.8 (d, *J* = 11.4 Hz), 117.2 (d, *J* = 22.2 Hz), 115.8, 22.0. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{18}H_{14}FN_2O$, m/z: 293.1085, found: 293.1085.

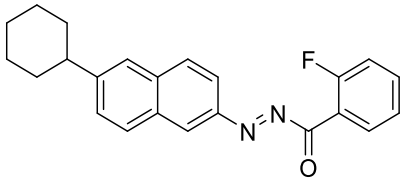
(*E*)-(2-fluorophenyl) ((6-isopropylnaphthalen-2-yl)diazenyl) methanone (1p)



1p

Red solid, 38% yield; R_f 0.59 (*n*-hexane: ethyl acetate = 10:1). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.55 (d, *J* = 1.9 Hz, 1H), 8.17 – 8.09 (m, 1H), 7.97 (dd, *J* = 8.8, 2.1 Hz, 2H), 7.87 (d, *J* = 8.9 Hz, 1H), 7.72 (s, 1H), 7.69 – 7.60 (m, 1H), 7.50 (dd, *J* = 8.5, 1.8 Hz, 1H), 7.33 (t, *J* = 7.6 Hz, 1H), 7.22 – 7.13 (m, 1H), 3.17 – 3.08 (m, 1H), 1.37 (d, *J* = 6.9 Hz, 6H). **^{13}C NMR (126 MHz, $CDCl_3$)** δ 180.8 (d, *J* = 5.9 Hz), 162.5 (d, *J* = 261.0 Hz), 150.1, 149.4, 136.3, 136.2 (d, *J* = 9.0 Hz), 132.6, 131.7, 131.6, 129.9, 129.2, 127.1, 124.6 (d, *J* = 3.7 Hz), 124.5, 119.8 (d, *J* = 11.6 Hz), 117.2 (d, *J* = 22.2 Hz), 115.7, 34.5, 23.8 (2C). **HRMS (ESI)** calcd for $[M+H]^+$ $C_{20}H_{18}FN_2O$, m/z: 321.1398, found: 321.1398.

(*E*)-((6-cyclohexylnaphthalen-2-yl)diazenyl) (2-fluorophenyl) methanone (1q)

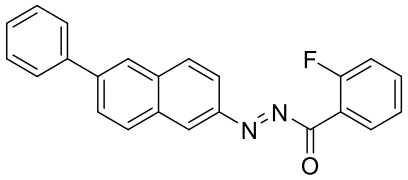


1q

Red solid, 61% yield; R_f 0.48 (*n*-hexane: ethyl acetate = 10:1). **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.54 (d, *J* = 2.0 Hz, 1H), 8.15 – 8.10 (m, 1H), 7.99 – 7.95 (m, 2H), 7.86 (d, *J* = 8.9 Hz, 1H), 7.71 (s, 1H), 7.67 – 7.61 (m, 1H), 7.48 (dd, *J* = 8.4, 1.8 Hz, 1H), 7.36 – 7.31 (m, 1H), 7.22 – 7.15 (m, 1H), 2.76 – 2.67 (m, 1H), 2.03 – 1.97 (m, 2H), 1.91 (d, *J* = 12.8 Hz, 2H), 1.81 (d, *J* = 12.7 Hz, 1H), 1.60 – 1.40 (m, 5H). **^{13}C NMR (126 MHz, $CDCl_3$)** δ 180.8 (d, *J* = 5.7 Hz), 162.5 (d, *J* = 261.2 Hz), 149.4, 149.3, 136.3, 136.2 (d, *J* = 9.0 Hz), 132.6, 131.7, 131.6, 129.8, 129.2, 127.6, 124.9,

124.5 (d, *J* = 3.7 Hz), 119.8 (d, *J* = 11.3 Hz), 117.2 (d, *J* = 22.2 Hz), 115.6, 44.9, 34.3 (2C), 26.9 (2C), 26.1. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{23}H_{22}FN_2O$, m/z: 361.1711, found: 361.1712.

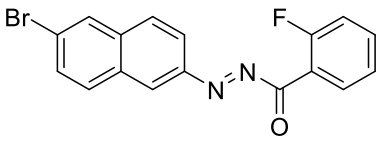
(*E*)-(2-fluorophenyl)((6-phenylnaphthalen-2-yl)diazenyl)methanone (1r)



1r

Red solid, 49% yield; R_f 0.45 (*n*-hexane: ethyl acetate = 10:1). **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.63 (d, *J* = 1.9 Hz, 1H), 8.18 – 8.10 (m, 3H), 8.08 – 8.02 (m, 1H), 8.00 (d, *J* = 8.9 Hz, 1H), 7.88 (dd, *J* = 8.5, 1.8 Hz, 1H), 7.78 (d, *J* = 7.0 Hz, 2H), 7.70 – 7.65 (m, 1H), 7.55 (t, *J* = 7.7 Hz, 2H), 7.45 (t, *J* = 7.4 Hz, 1H), 7.37 (t, *J* = 7.6 Hz, 1H), 7.21 (dd, *J* = 10.4, 8.5 Hz, 1H). **^{13}C NMR (126 MHz, $CDCl_3$)** δ 180.8 (d, *J* = 5.8 Hz), 162.5 (d, *J* = 261.0 Hz), 149.8, 141.7, 140.4, 136.3 (d, *J* = 9.2 Hz), 132.6, 132.3, 131.3, 130.5, 129.8, 129.1 (2C), 128.9, 128.1, 127.5 (2C), 126.9, 125.9, 124.6 (d, *J* = 3.5 Hz), 119.7 (d, *J* = 11.1 Hz), 117.2 (d, *J* = 22.2 Hz), 116.2. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{23}H_{16}FN_2O$, m/z: 355.1241, found: 355.1244.

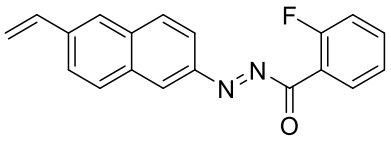
(*E*)-((6-bromonaphthalen-2-yl)diazenyl)(2-fluorophenyl) methanone (1s)



1s

Red solid, 53% yield, R_f 0.54 (*n*-hexane: ethyl acetate = 10:1). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.45 (d, *J* = 1.9 Hz, 1H), 8.08 – 8.01 (m, 1H), 8.00 (d, *J* = 1.9 Hz, 1H), 7.95 – 7.90 (m, 1H), 7.82 (d, *J* = 8.7 Hz, 1H), 7.76 (d, *J* = 8.9 Hz, 1H), 7.61 – 7.55 (m, 2H), 7.30 – 7.23 (m, 1H), 7.13 – 7.06 (m, 1H). **^{13}C NMR (126 MHz, $CDCl_3$)** δ 180.8 (d, *J* = 5.6 Hz), 162.5 (d, *J* = 260.9 Hz), 149.8, 136.7, 136.4 (d, *J* = 9.1 Hz), 132.6, 131.6, 131.3, 130.8, 130.7, 130.3, 128.6, 124.7 (d, *J* = 3.6 Hz), 123.3, 119.4 (d, *J* = 10.7 Hz), 117.2 (d, *J* = 22.6 Hz), 117.1. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{17}H_{11}BrFN_2O$, m/z: 357.0033, found: 357.0033.

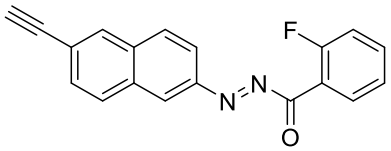
(*E*)-(2-fluorophenyl)((6-vinylnaphthalen-2-yl)diazenyl) methanone (1t)



1t

Red solid, 38% yield; R_f 0.50 (*n*-hexane: ethyl acetate = 10:1). **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.53 (d, *J* = 2.0 Hz, 1H), 8.16 – 8.09 (m, 1H), 8.02 – 7.96 (m, 2H), 7.89 (d, *J* = 8.9 Hz, 1H), 7.82 (d, *J* = 1.6 Hz, 1H), 7.73 (dd, *J* = 8.5, 1.7 Hz, 1H), 7.65 (d, *J* = 8.4 Hz, 1H), 7.38 – 7.31 (m, 1H), 7.21 – 7.15 (m, 1H), 6.91 (dd, *J* = 17.6, 10.9 Hz, 1H), 5.97 (d, *J* = 17.6 Hz, 1H), 5.45 (d, *J* = 10.9 Hz, 1H). **^{13}C NMR (126 MHz, $CDCl_3$)** δ 180.8 (d, *J* = 5.8 Hz), 162.5 (d, *J* = 261.1 Hz), 149.8, 138.0, 136.5, 136.3 (d, *J* = 9.1 Hz), 136.2, 132.8, 132.6, 131.1, 130.3, 129.6, 126.3, 124.6 (2C), 119.7 (d, *J* = 11.1 Hz), 117.2 (d, *J* = 22.3 Hz), 116.3, 116.1. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{19}H_{14}FN_2O$, m/z: 305.1085, found: 305.1090.

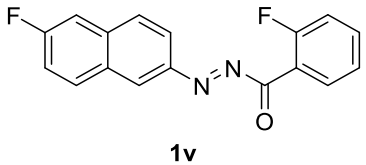
(*E*)-((6-ethynylnaphthalen-2-yl)diazenyl)(2-fluorophenyl) methanone (1u)



1u

Red solid, 65% yield; R_f 0.46 (*n*-hexane: ethyl acetate = 10:1). **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.56 (d, *J* = 2.0 Hz, 1H), 8.18 – 8.11 (m, 1H), 8.09 (d, *J* = 1.4 Hz, 1H), 8.05 – 7.97 (m, 2H), 7.90 (d, *J* = 8.9 Hz, 1H), 7.71 – 7.62 (m, 2H), 7.38 – 7.32 (m, 1H), 7.20 (dd, *J* = 10.0, 8.6 Hz, 1H), 3.28 (s, 1H).**^{13}C NMR (126 MHz, $CDCl_3$)** δ 180.8 (d, *J* = 6.0 Hz), 162.5 (d, *J* = 260.9 Hz), 150.2, 136.4 (d, *J* = 8.9 Hz), 135.3, 132.8 (2C), 132.6, 132.2, 130.7, 129.9 (d, *J* = 2.6 Hz), 129.4, 124.7 (d, *J* = 3.6 Hz), 122.5, 119.4 (d, *J* = 11.2 Hz), 117.2 (d, *J* = 22.2 Hz), 116.8, 83.5, 79.3. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{19}H_{12}FN_2O$, m/z: 303.0928, found: 303.0929.

(*E*)-((6-fluoronaphthalen-2-yl)diazenyl)(2-fluorophenyl) methanone (1v)

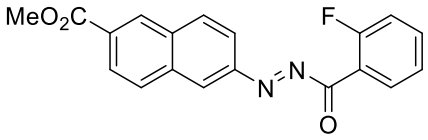


1v

Bright orange solid, 54% yield; R_f 0.50 (*n*-hexane: ethyl acetate = 10:1). **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.56 (d, *J* = 1.9 Hz, 1H), 8.16 – 8.10 (m, 1H), 8.06 – 8.00 (m, 2H), 7.86 (d, *J* = 8.9 Hz,

1H), 7.69 – 7.62 (m, 1H), 7.53 (dd, *J* = 9.6, 2.5 Hz, 1H), 7.39 – 7.31 (m, 2H), 7.20 – 7.15 (m, 1H). **^{13}C NMR (126 MHz, $CDCl_3$)** δ 180.8 (d, *J* = 5.8 Hz), 162.5 (d, *J* = 261.0 Hz), 162.4 (d, *J* = 251.2 Hz), 149.4 (d, *J* = 2.5 Hz), 137.0 (d, *J* = 9.6 Hz), 136.4 (d, *J* = 9.1 Hz), 132.6, 132.5 (d, *J* = 9.4 Hz), 131.1, 130.1, 128.8 (d, *J* = 5.3 Hz), 124.6 (d, *J* = 3.7 Hz), 119.5 (d, *J* = 11.3 Hz), 117.6 (d, *J* = 25.3 Hz), 117.2 (d, *J* = 22.2 Hz), 117.0, 111.7 (d, *J* = 20.9 Hz). **HRMS (ESI)** calcd for $[M+H]^+$ $C_{17}H_{11}F_2N_2O$, m/z: 297.0834, found: 297.0837.

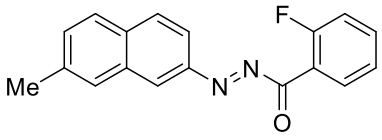
Methyl (*E*)-6-((2-fluorobenzoyl)diazenyl)-2-naphthoate (1w)



1w

Red solid, 63% yield; R_f 0.29 (*n*-hexane: ethyl acetate = 10:1). **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.67 (s, 1H), 8.60 (d, *J* = 1.5 Hz, 1H), 8.20 – 8.12 (m, 2H), 8.11 – 8.07 (m, 1H), 8.07 – 8.04 (m, 2H), 7.72 – 7.59 (m, 1H), 7.41 – 7.33 (m, 1H), 7.23 – 7.15 (m, 1H), 4.03 (s, 3H). **^{13}C NMR (126 MHz, $CDCl_3$)** δ 180.8 (d, *J* = 6.0 Hz), 166.7, 162.6 (d, *J* = 261.1 Hz), 150.9, 136.5 (d, *J* = 9.1 Hz), 135.4, 134.9, 132.8, 132.5, 130.9 (d, *J* = 14.6 Hz), 130.2, 130.0, 129.9, 126.6, 124.7 (d, *J* = 3.6 Hz), 119.3 (d, *J* = 11.3 Hz), 117.2 (d, *J* = 22.2 Hz), 116.8, 52.5. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{19}H_{14}FN_2O_3$, m/z: 337.0983, found: 337.0985.

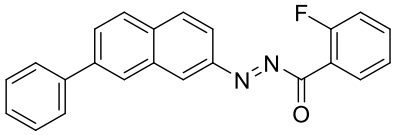
(*E*)-(2-fluorophenyl)((7-methylnaphthalen-2-yl)diazenyl) methanone (1x)



1x

Red solid, 59% yield, R_f 0.55 (*n*-hexane: ethyl acetate = 10:1). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.50 (d, *J* = 1.9 Hz, 1H), 8.15 – 8.09 (m, 1H), 7.92 (dd, *J* = 8.9, 1.9 Hz, 1H), 7.87 (d, *J* = 8.9 Hz, 1H), 7.81 (d, *J* = 8.4 Hz, 2H), 7.67 – 7.60 (m, 1H), 7.46 (dd, *J* = 8.3, 1.8 Hz, 1H), 7.36 – 7.30 (m, 1H), 7.21 – 7.15 (m, 1H), 2.55 (s, 3H). **^{13}C NMR (126 MHz, $CDCl_3$)** δ 180.9 (d, *J* = 5.7 Hz), 162.5 (d, *J* = 261.1 Hz), 149.9, 137.1, 136.3 (d, *J* = 8.9 Hz), 134.2, 133.4, 132.6, 131.2, 131.1, 129.2, 128.9, 127.9, 124.6 (d, *J* = 3.6 Hz), 119.7 (d, *J* = 10.9 Hz) 117.2 (d, *J* = 22.2 Hz), 114.8, 21.7. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{18}H_{14}FN_2O$, m/z: 293.1086, found: 293.1085.

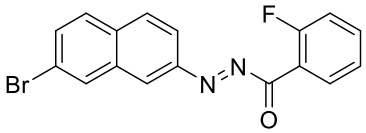
(*E*)-(2-fluorophenyl)((7-phenylnaphthalen-2-yl)diazenyl) methanone (1y)



1y

Red solid, 51% yield; R_f 0.50 (*n*-hexane: ethyl acetate = 10:1). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.55 (d, *J* = 1.8 Hz, 1H), 8.13 (d, *J* = 1.8 Hz, 1H), 8.07 – 8.03 (m, 1H), 7.92 – 7.84 (m, 3H), 7.81 (dd, *J* = 8.5, 1.8 Hz, 1H), 7.68 – 7.64 (m, 2H), 7.59 – 7.54 (m, 1H), 7.46 – 7.40 (m, 2H), 7.36 – 7.31 (m, 1H), 7.28 – 7.23 (m, 1H), 7.12 – 7.07 (m, 1H). **^{13}C NMR (126 MHz, $CDCl_3$)** δ 180.9 (d, *J* = 5.8 Hz), 162.6 (d, *J* = 261.0 Hz), 150.1, 140.3, 140.0, 136.4 (d, *J* = 9.0 Hz), 135.0, 133.5, 132.6, 132.1, 131.7, 129.8, 129.6 (d, *J* = 15.7 Hz), 129.3, 129.0, 128.6, 127.9, 127.6, 127.5, 124.6 (d, *J* = 3.5 Hz), 117.2 (d, *J* = 22.2 Hz), 116.4, 115.8. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{23}H_{16}FN_2O$, m/z: 355.1241, found: 355.1241.

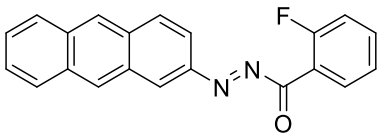
(*E*)-((7-bromonaphthalen-2-yl)diazenyl)(2-fluorophenyl) methanone (1z)



1z

Red solid, 57% yield, R_f 0.58 (*n*-hexane: ethyl acetate = 10:1). **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.61 (d, *J* = 1.9 Hz, 1H), 8.20 – 8.10 (m, 2H), 8.07 – 8.01 (m, 1H), 7.93 (d, *J* = 8.8 Hz, 1H), 7.87 (d, *J* = 8.9 Hz, 1H), 7.75 – 7.66 (m, 2H), 7.60 – 7.52 (m, 2H). **^{13}C NMR (126 MHz, $CDCl_3$)** δ 180.8 (d, *J* = 5.9 Hz), 162.6 (d, *J* = 261.1 Hz), 150.2, 136.5 (d, *J* = 9.1 Hz), 134.3, 134.2, 132.5, 132.1, 131.7, 129.8, 129.7, 129.5, 124.7 (d, *J* = 3.6 Hz), 121.3, 119.3, 117.2 (d, *J* = 22.2 Hz), 116.4. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{17}H_{11}BrFN_2O$, m/z: 357.0033, found: 357.0032.

(*E*)-(anthracen-2-yldiazenyl) (2-fluorophenyl)methanone (1ad)

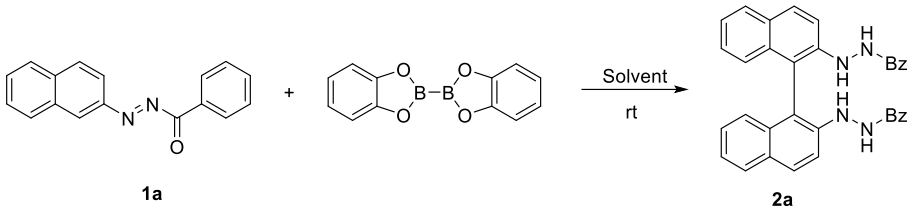


1ad

Orange solid, 29%; R_f 0.55 (*n*-hexane: ethyl acetate = 10:1). **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.80 (s, 1H), 8.65 (s, 1H), 8.47 (s, 1H), 8.17 – 8.12 (m, 1H), 8.10 – 8.03 (m, 3H), 8.00 – 7.94 (m, 1H), 7.65 (dd, *J* = 13.4, 7.2 Hz, 1H), 7.61 – 7.52 (m, 2H), 7.35 (t, *J* = 7.7 Hz, 1H), 7.23 – 7.16 (m, 1H). **^{13}C NMR (126 MHz, $CDCl_3$)** δ 180.8 (d, *J* = 5.8 Hz), 162.5 (d, *J* = 261.0 Hz), 149.6, 136.2 (d, *J* = 9.1 Hz), 135.3, 133.5, 132.9, 132.6, 132.3, 130.9, 130.1, 129.7, 128.5 (d, *J* = 28.9 Hz), 128.2, 127.1, 126.8, 126.4, 125.4, 124.6 (d, *J* = 3.7 Hz), 117.2 (d, *J* = 22.3 Hz), 114.7. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{20}H_{18}FN_2O$, m/z: 321.1398, found: 321.1398.

Reaction development and optimization

Supplementary Table 1: Optimization of reaction conditions in terms of solvent [a]

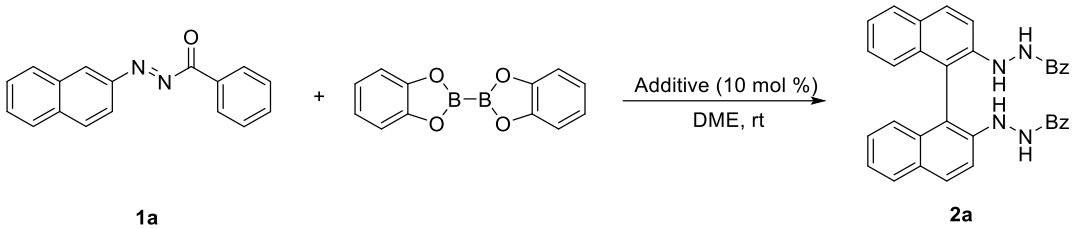


1a **2a**

entry	Solvent	Yield (%)[b]
1	1, 2-dimethoxyethane	51
2	1, 4 dioxane	32
3	MTBE	44
4	THF	40
5	Dichloromethane	33
6	Methanol	0
7	Toluene	16
8	DMF	12
9	DMSO	9
10	Acetone	*n.d*
11	Ethyl acetate	25
12	Acetonitrile	50
13[c]	***1, 2-dimethoxyethane***	***73***

[a]Unless otherwise indicated, reactions were performed using **1a** azonaphthalene (0.1 mmol), and diboron (0.055 mmol) in 1.0 mL solvent at room temperature for 2 h. [b] Yields were determined by crude ^{1}H NMR analysis using 1,3,5-trimethoxybenzene as an internal standard. [c] 0.11 mmol of B_2Cat_2 was used. *n.d* not detected.

Supplementary Table 2: Optimization of reaction conditions in terms of additives

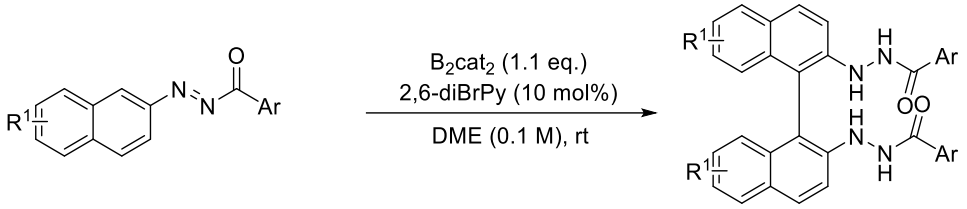


1a 2a

entry	Additive	Yield (%)[a]
1	-	73%
2	Cs_2CO_3	81%
3	PPh_3	67%
4	Triethylamine	68%
5	DABCO	63%
6	DBU	76%
7	DMAP	81%
8	2,6-lutidine	63%
9	***2,6-dibromopyridine***	***89%***
10	2,4,6-tribromopyridine	72%
11	4-iodopyridine	74%
12	3-bromopyridine	71%
13	2-cyanopyridine	66%
14	4-methoxy pyridine	63%
15	4-benzyl pyridine	58%
16	4-acetylpyridine	67%

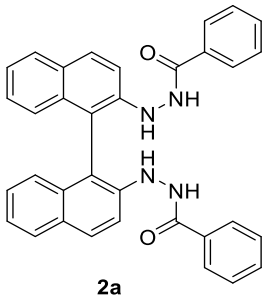
[a] Unless otherwise indicated, reactions were performed using **1a** azonaphthalene (0.1 mmol), B_2cat_2 (0.11 mmol) and additive (0.01 mmol) in 1.0 mL DME at room temperature for 2 h. [b] Yields were determined by crude ^1H NMR analysis using 1,3,5-trimethoxybenzene as an internal standard.

Synthesis of BINAM derivatives via [5,5]-sigmatropic rearrangements



A dry 4 mL vial equipped with a Teflon-coated magnetic stirring bar was charged with azonaphthalene (0.2 mmol), B_2cat_2 (0.22 mmol) and 2,6-dibromopyridine (0.02 mmol). Anhydrous 1,2-dimethoxyethane (2.0 mL) was added and stirred at room temperature. Upon reaction completion, the mixture was concentrated under reduced pressure to give a residue which was then purified by washing with warm methanol to give the desired product.

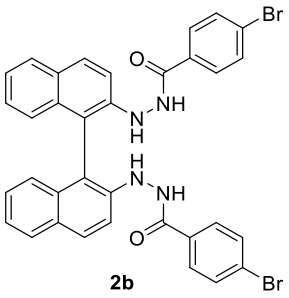
***N*',*N*'''-([1,1'-binaphthalene]-2,2'-diyl)di(benzohydrazide) (2a)**



2a

Following the general protocol, compound **2a** was obtained in 89% yield as a white solid. R_f 0.39 (*n*-hexane: ethyl acetate = 2.5:1). **^{1}H NMR (500 MHz, DMSO-d_6)** δ 10.66 (s, 2H), 8.00 – 7.75 (m, 8H), 7.60 – 7.42 (m, 10H), 7.28 (t, *J* = 7.4 Hz, 2H), 7.19 (t, *J* = 7.7 Hz, 2H), 6.80 (d, *J* = 8.5 Hz, 2H). **^{13}C NMR (126 MHz, DMSO-d_6)** δ 168.0, 145.1, 134.0, 133.2, 132.3, 130.1, 129.2, 128.9 (2C), 128.6, 127.7 (2C), 127.0, 124.5, 123.3, 115.5, 112.2. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{34}H_{27}N_4O_2$ m/z 523.2129, found 523.2130.

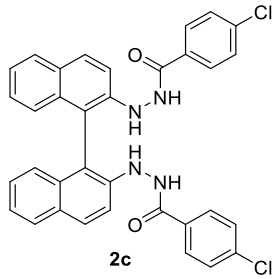
***N*',*N*'''-([1,1'-binaphthalene]-2,2'-diyl)bis(4-bromobenzohydrazide) (2b)**



2b

Following the general protocol, compound **2b** was obtained in 76% yield as a white solid. R_f 0.57 (*n*-hexane: ethyl acetate = 3:1).**^{1}H NMR (400 MHz, DMSO-d_6)** δ 10.71 (d, *J* = 2.0 Hz, 2H), 7.94 (d, *J* = 9.1 Hz, 2H), 7.87 (d, *J* = 6.8 Hz, 2H), 7.78 (d, *J* = 8.6 Hz, 4H), 7.54 (d, *J* = 8.6 Hz, 4H), 7.48 (s, 2H), 7.41 (d, *J* = 9.0 Hz, 2H), 7.31 – 7.24 (m, 2H), 7.21-7.15 (m, 2H), 6.77 (d, *J* = 8.5 Hz, 2H). **^{13}C NMR (126 MHz, DMSO-d_6)** δ 167.0, 144.8, 137.1, 134.0, 131.9, 130.2, 129.6 (2C), 129.2, 129.1 (2C), 128.6, 127.0, 124.5, 123.4, 115.4, 112.2. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{34}H_{25}Br_2N_4O_2$, m/z: 679.0339, found: 679.0338.

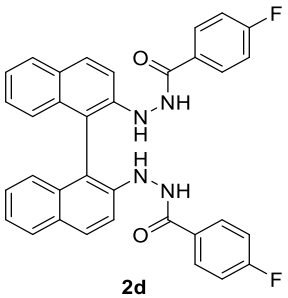
***N*',*N*'''-([1,1'-binaphthalene]-2,2'-diyl)bis(4-chlorobenzohydrazide) (2c)**



2c

Following the general protocol, compound **2c** was obtained in 84% yield as a white solid. R_f 0.54 (*n*-hexane: ethyl acetate = 3:1). **^{1}H NMR (400 MHz, DMSO-d_6)** δ 10.71 (d, *J* = 2.0 Hz, 2H), 7.94 (d, *J* = 9.1 Hz, 2H), 7.87 (d, *J* = 6.8 Hz, 2H), 7.78 (d, *J* = 8.6 Hz, 4H), 7.54 (d, *J* = 8.6 Hz, 4H), 7.48 (s, 2H), 7.41 (d, *J* = 9.0 Hz, 2H), 7.31 – 7.24 (m, 2H), 7.21-7.15 (m, 2H), 6.77 (d, *J* = 8.5 Hz, 2H). **^{13}C NMR (126 MHz, DMSO-d_6)** δ 167.0, 144.8, 137.1, 134.0, 131.9, 130.2, 129.6 (2C), 129.2, 129.1 (2C), 128.6, 127.0, 124.5, 123.4, 115.4, 112.2. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{34}H_{25}Cl_2N_4O_2$, m/z: 591.1349, found: 591.1347.

***N*',*N*'''-([1,1'-binaphthalene]-2,2'-diyl)bis(4-fluorobenzohydrazide) (2d)**

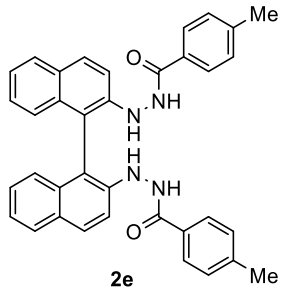


2d

Following the general protocol, compound **2d** was obtained in 79% yield as a white solid. R_f 0.53 (*n*-hexane: ethyl acetate = 2.5:1). **^{1}H NMR (400 MHz, DMSO-d_6)** δ 10.67 (s, 2H), 7.94 (d, *J* = 9.0 Hz, 2H), 7.89 – 7.80 (m, 6H), 7.51 (s, 2H), 7.42 (d, *J* = 9.0 Hz, 2H), 7.34 – 7.23 (m, 6H), 7.20

– 7.15 (m, 2H), 6.77 (d, *J* = 8.5 Hz, 2H). **^{13}C NMR (126 MHz, DMSO)** δ 166.9, 164.6 (d, *J* = 249.1 Hz), 144.9, 134.0, 130.4 (2C) (d, *J* = 9.1 Hz), 130.1, 129.6 (d, *J* = 3.0 Hz), 129.2, 128.6, 127.0, 124.5, 123.3, 116.0 (2C) (d, *J* = 22.0 Hz), 115.4, 112.2. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{34}H_{25}F_2N_4O_2$, m/z: 559.1940, found: 559.1946.

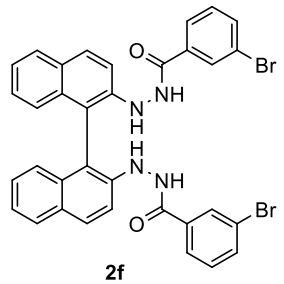
***N*',*N*'''-([1,1'-binaphthalene]-2,2'-diyl)bis(4-methylbenzohydrazide) (2e)**



2e

Following the general protocol, compound **2e** was obtained in 89% yield as a white solid. R_f 0.34 (*n*-hexane: ethyl acetate = 3:1). **^{1}H NMR (500 MHz, DMSO-d_6)** δ 10.55 (d, *J* = 2.1 Hz, 2H), 7.94 (d, *J* = 9.1 Hz, 2H), 7.86 (d, *J* = 8.6 Hz, 2H), 7.67 (d, *J* = 7.9 Hz, 4H), 7.55 (s, 2H), 7.40 (d, *J* = 9.1 Hz, 2H), 7.31 – 7.22 (m, 6H), 7.17 (t, *J* = 7.7 Hz, 2H), 6.77 (d, *J* = 8.5 Hz, 2H), 2.34 (s, 6H). **^{13}C NMR (126 MHz, DMSO-d_6)** δ 167.8, 145.2, 142.2, 134.0, 130.4, 130.0, 129.4 (2C), 129.2, 128.5, 127.7 (2C), 126.9, 124.5, 123.3, 115.4, 112.2, 21.5. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{36}H_{31}N_4O_2$, m/z: 551.2442, found: 551.2438.

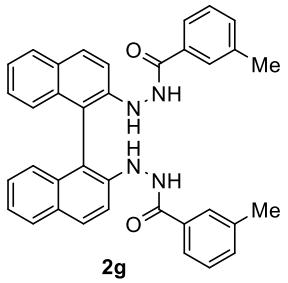
***N*',*N*'''-([1,1'-binaphthalene]-2,2'-diyl)bis(3-bromobenzohydrazide) (2f)**



2f

Following the general protocol, compound **2f** was obtained in 69% yield as a white solid. R_f 0.57 (*n*-hexane: ethyl acetate = 2.5:1). **^{1}H NMR (400 MHz, DMSO-d_6)** δ 10.72 (s, 2H), 7.95 (d, *J* = 9.0 Hz, 2H), 7.90 – 7.84 (m, 4H), 7.80 – 7.72 (m, 4H), 7.47 – 7.40 (m, 6H), 7.28 (t, *J* = 6.8 Hz, 2H), 7.19 (t, *J* = 6.9 Hz, 2H), 6.77 (d, *J* = 8.4 Hz, 2H). **^{13}C NMR (126 MHz, DMSO-d_6)** δ 166.7, 144.7, 135.4, 135.0, 134.0, 131.3, 130.3, 130.2, 129.3, 128.6, 127.0, 126.7, 124.5, 123.4, 122.3, 115.5, 112.2. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{34}H_{25}Br_2N_4O_2$, m/z: 679.0339, found: 679.0337.

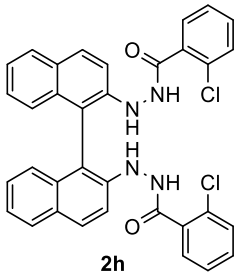
***N*',*N*'''-([1,1'-binaphthalene]-2,2'-diyl)bis(3-methylbenzohydrazide) (2g)**



2g

Following the general protocol, compound **2g** was obtained in 83% yield as a white solid. R_f 0.43 (*n*-hexane: ethyl acetate = 3:1). **^{1}H NMR (400 MHz, DMSO-*d*$_6$)** δ 10.57 (s, 2H), 7.91 (dd, *J* = 30.9, 8.7 Hz, 4H), 7.55 (s, 6H), 7.45 – 7.09 (m, 10H), 6.78 (d, *J* = 8.5 Hz, 2H), 2.31 (s, 6H). **^{13}C NMR (126 MHz, DMSO-*d*$_6$)** δ 168.2, 145.1, 138.2, 134.0, 133.3, 132.8, 130.1, 129.2, 128.8, 128.6, 128.2, 127.0, 124.7, 124.5, 123.3, 115.5, 112.1, 21.3. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{36}H_{31}N_4O_2$ m/z: 551.2442, found: 551.2441.

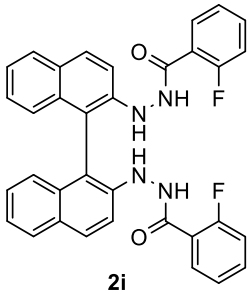
***N*',*N*'''-([1,1'-binaphthalene]-2,2'-diyl)bis(2-chlorobenzohydrazide) (2h)**



2h

Following the general protocol, compound **2h** was obtained in 72% yield as a white solid. R_f 0.29 (*n*-hexane: ethyl acetate = 2.5:1). **^{1}H NMR (400 MHz, DMSO-*d*$_6$)** δ 10.56 (d, *J* = 2.1 Hz, 2H), 8.03 (d, *J* = 9.1 Hz, 2H), 7.91 (d, *J* = 7.5 Hz, 2H), 7.59 (d, *J* = 9.0 Hz, 2H), 7.55 (d, *J* = 8.0 Hz, 2H), 7.51 – 7.45 (m, 2H), 7.39 (d, *J* = 3.8 Hz, 6H), 7.29 (t, *J* = 7.1 Hz, 2H), 7.19 (t, *J* = 6.9 Hz, 2H), 6.77 (d, 2H). **^{13}C NMR (126 MHz, DMSO-*d*$_6$)** δ 167.7, 144.6, 134.9, 133.9, 132.0, 130.9, 130.4, 130.1, 129.7, 129.3, 128.6, 127.6, 127.1, 124.2, 123.5, 115.7, 112.2. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{34}H_{25}Cl_2N_4O_2$, m/z: 591.1349, found: 591.1348.

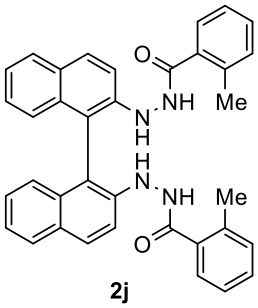
***N*',*N*'''-([1,1'-binaphthalene]-2,2'-diyl)bis(2-fluorobenzohydrazide) (2i)**



2i

Following the general protocol, compound **2i** was obtained in 87% yield as a white solid. R_f 0.33 (*n*-hexane: ethyl acetate = 2.5:1). **^{1}H NMR (400 MHz, DMSO-d_6)** δ 10.52 (s, 2H), 8.01 (d, *J* = 9.0 Hz, 2H), 7.90 (d, *J* = 8.0 Hz, 2H), 7.57 (t, *J* = 7.3 Hz, 4H), 7.50 (d, *J* = 8.9 Hz, 4H), 7.39 – 7.26 (m, 6H), 7.22 – 7.17 (m, 2H), 6.77 (d, *J* = 8.5 Hz, 2H). **^{13}C NMR (126 MHz, DMSO-d_6)** δ 165.5, 159.7 (d, *J* = 250.2 Hz), 144.7, 134.0, 133.5 (d, *J* = 8.3 Hz), 130.4 (d, *J* = 2.8 Hz), 130.2, 129.3, 128.6, 125.1 (d, *J* = 3.2 Hz), 125.1, 124.5, 123.4, 122.7 (d, *J* = 15.0 Hz), 116.8 (d, *J* = 21.7 Hz), 115.4, 112.2. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{34}H_{25}F_2N_4O_2$, m/z: 559.1940, found: 559.1939.

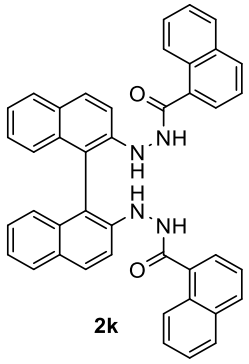
***N*',*N*'''-([1,1'-binaphthalene]-2,2'-diyl)bis(2-methylbenzohydrazide) (2j)**



2j

Following the general protocol, compound **2j** was obtained in 65% yield as a white solid. R_f 0.49 (*n*-hexane: ethyl acetate = 3:1). **^{1}H NMR (400 MHz, DMSO-d_6)** δ 10.39 (d, *J* = 2.2 Hz, 2H), 8.02 (d, *J* = 9.1 Hz, 2H), 7.90 (d, *J* = 6.9 Hz, 2H), 7.56 (s, 2H), 7.49 (d, *J* = 8.9 Hz, 2H), 7.41 (d, *J* = 7.5 Hz, 2H), 7.36 (t, *J* = 7.4 Hz, 2H), 7.31 – 7.22 (m, 6H), 7.18 (t, *J* = 7.3 Hz, 2H), 6.75 (d, *J* = 8.0 Hz, 2H), 2.24 (s, 6H). **^{13}C NMR (126 MHz, DMSO-d_6)** δ 170.4, 145.0, 136.5, 134.8, 134.0, 131.1, 130.5, 130.1, 129.2, 128.6, 127.9, 127.0, 126.0, 124.5, 123.4, 115.4, 112.2, 19.8. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{36}H_{31}N_4O_2$, m/z: 551.2442, found: 551.2444.

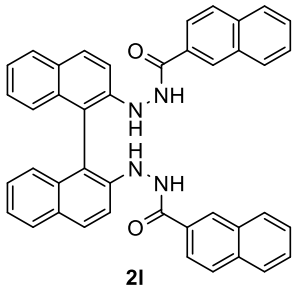
***N*',*N*'''-([1,1'-binaphthalene]-2,2'-diyl)bis(1-naphthohydrazide) (2k)**



2k

Following the general protocol, compound **2k** was obtained in 73% yield as a white solid. R_f 0.46 (*n*-hexane: ethyl acetate = 3:1). **^{1}H NMR (400 MHz, DMSO-d_6)** δ 10.80 (s, 2H), 8.16 – 8.06 (m, 6H), 7.96 (d, *J* = 8.1 Hz, 4H), 7.89 – 7.80 (m, 4H), 7.64 (d, *J* = 8.6 Hz, 4H), 7.46 (t, *J* = 7.5 Hz, 2H), 7.33 (t, *J* = 7.5 Hz, 2H), 7.23 (t, *J* = 7.7 Hz, 2H), 7.05 (t, *J* = 7.7 Hz, 2H), 6.82 (d, *J* = 8.3 Hz, 2H). **^{13}C NMR (126 MHz, DMSO-d_6)** δ 170.2, 145.0, 134.1, 133.6, 132.3, 131.2, 130.9, 130.4, 130.3, 129.3, 128.7, 127.1 (2C), 126.8, 126.5, 125.7, 125.4, 124.5, 123.5, 115.3, 112.3. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{42}H_{31}N_4O_2$ m/z: 623.2440, found: 623.2442.

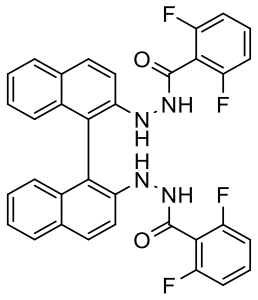
***N'*,*N'''*-([1,1'-binaphthalene]-2,2'-diyl)bis(2-naphthohydrazide) (2l)**



2l

Following the general protocol, compound **2l** was obtained in 82% yield as a white solid. R_f 0.40 (*n*-hexane: ethyl acetate = 3:1). **^{1}H NMR (500 MHz, DMSO-d_6)** δ 10.83 (s, 2H), 8.43 (d, *J* = 4.8 Hz, 2H), 7.96 (dd, *J* = 10.8, 4.1 Hz, 8H), 7.89 (d, *J* = 8.1 Hz, 2H), 7.81 (d, *J* = 6.7 Hz, 2H), 7.67 (d, *J* = 6.4 Hz, 2H), 7.64 – 7.50 (m, 6H), 7.29 (t, *J* = 7.5 Hz, 2H), 7.24 – 7.18 (m, 2H), 6.83 (t, *J* = 6.7 Hz, 2H). **^{13}C NMR (126 MHz, DMSO-d_6)** δ 168.2, 145.1, 134.8, 134.1, 132.5, 130.6, 130.1, 129.3 (2C), 128.6 (2C), 128.3, 128.2, 128.1, 127.4, 127.0, 124.6, 124.3, 123.3, 115.6, 112.3. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{42}H_{31}N_4O_2$, m/z: 623.2442, found: 623.2445.

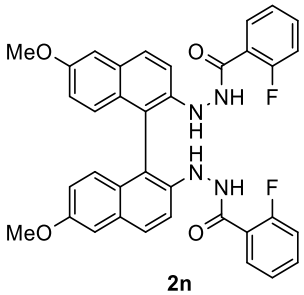
***N'*,*N'''*-([1,1'-binaphthalene]-2,2'-diyl)bis(2,6-difluorobenzohydrazide) (2m)**



2m

Following the general protocol, compound **2m** was obtained in 89% yield as a white solid. R_f 0.37 (*n*-hexane: ethyl acetate = 3:1). **^{1}H NMR (500 MHz, DMSO-d_6)** δ 10.76 (d, *J* = 2.3 Hz, 2H), 8.04 (d, *J* = 9.1 Hz, 2H), 7.91 (d, *J* = 8.0 Hz, 2H), 7.61 – 7.53 (m, 2H), 7.49 (d, *J* = 9.0 Hz, 2H), 7.29 (t, *J* = 6.6 Hz, 4H), 7.25 – 7.16 (m, 6H), 6.77 (d, *J* = 8.5 Hz, 2H). **^{13}C NMR (126 MHz, DMSO-d_6)** δ 161.1, 159.8 (d, *J* = 247.4 Hz), 159.8 (d, *J* = 250.8 Hz), 144.4, 133.9, 133.0, 130.2, 129.3, 128.6, 127.1, 124.5, 123.6, 115.3, 113.5 (t, *J* = 22.2 Hz), 112.6 (d, *J* = 4.3 Hz), 112.40 (2C). **HRMS (ESI)** calcd for $[M+H]^+$ $C_{34}H_{23}F_4N_4O_2$, m/z 595.1752, found: 595.1758.

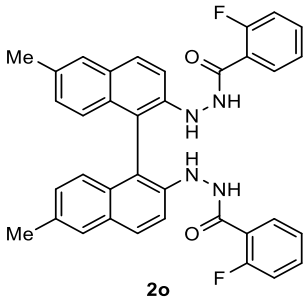
***N'*,*N*'''-(6,6'-dimethoxy-[1,1'-binaphthalene]-2,2'-diyl)bis(2-fluorobenzohydrazide) (2n)**



2n

Following the general protocol, compound **2n** was obtained in 87% yield as a white solid. R_f 0.21 (*n*-hexane: ethyl acetate = 2.5:1). **^{1}H NMR (400 MHz, DMSO-d_6)** δ 10.46 (s, 2H), 7.91 (s, 2H), 7.44 (d, *J* = 95.7 Hz, 14H), 6.89 (s, 2H), 6.68 (s, 2H), 3.83 (s, 6H). **^{13}C NMR (126 MHz, DMSO-d_6)** δ 165.4, 159.7 (d, *J* = 250.1 Hz), 155.8, 142.8, 133.4 (d, *J* = 8.4 Hz), 130.4 (2C), 130.2, 129.2, 129.1 (d, *J* = 24.1 Hz), 125.0 (d, *J* = 3.2 Hz), 122.8 (d, *J* = 15.1 Hz), 119.3, 116.7 (d, *J* = 21.9 Hz), 115.9, 112.9, 107.2, 55.6. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{36}H_{29}F_2N_4O_4$ m/z: 619.2151, found: 619.2154.

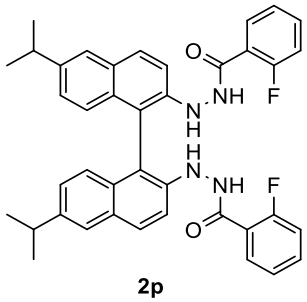
***N'*,*N*'''-(6,6'-dimethyl-[1,1'-binaphthalene]-2,2'-diyl)bis(2-fluorobenzohydrazide) (2o)**



2o

Following the general protocol, compound **2o** was obtained in 83% yield as a white solid. R_f 0.34 (*n*-hexane: ethyl acetate = 3:1). **^{1}H NMR (400 MHz, DMSO-d_6)** δ 10.48 (s, 2H), 7.90 (d, *J* = 9.0 Hz, 2H), 7.65 (s, 2H), 7.55 (t, *J* = 6.8 Hz, 4H), 7.47 – 7.40 (m, 4H), 7.36 – 7.25 (m, 4H), 7.03 (dd, *J* = 8.8, 1.8 Hz, 2H), 6.67 (d, *J* = 8.7 Hz, 2H), 2.38 (s, 6H). **^{13}C NMR (126 MHz, DMSO-d_6)** δ 165.4, 159.7 (d, *J* = 250.1 Hz), 143.9, 133.5 (d, *J* = 8.3 Hz), 132.4, 132.2, 130.4, 129.4 (2C), 129.1, 127.5, 125.0 (d, *J* = 2.6 Hz), 124.6, 122.8 (d, *J* = 15.0 Hz), 116.8 (d, *J* = 21.7 Hz), 115.4, 112.42, 21.3. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{36}H_{29}F_2N_4O_2$, m /z: 587.2253, found: 587.2256.

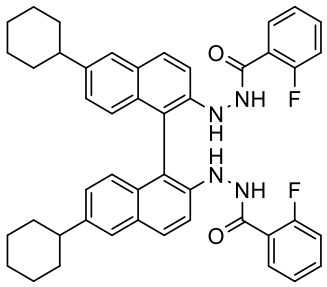
***N*′,*N*‴-(6,6′-diisopropyl-[1,1′-binaphthalene]-2,2′-diyl)bis(2-fluorobenzohydrazide) (2p)**



2p

Following the general protocol, compound **2p** was obtained in 85% yield as a white solid. R_f 0.37 (*n*-hexane: ethyl acetate = 3:1). **^{1}H NMR (500 MHz, DMSO-d_6)** δ 10.46 (s, 2H), 7.93 (d, *J* = 9.1 Hz, 2H), 7.69 (d, *J* = 1.9 Hz, 2H), 7.61 – 7.52 (m, 4H), 7.44 (d, *J* = 9.0 Hz, 2H), 7.40 – 7.38 (m, 2H), 7.37 – 7.23 (m, 4H), 7.13 (dd, *J* = 8.8, 1.9 Hz, 2H), 6.72 (d, *J* = 8.7 Hz, 2H), 2.97 (p, *J* = 6.8 Hz, 2H), 1.25 (dd, *J* = 6.9, 3.4 Hz, 12H). **^{13}C NMR (126 MHz, DMSO-d_6)** δ 165.4, 159.7 (d, *J* = 249.9 Hz), 144.0, 143.3, 133.4 (d, *J* = 8.4 Hz), 132.6, 130.3 (d, *J* = 2.6 Hz), 129.8, 129.4, 126.8, 125.1, 125.0, 124.7, 122.8 (d, *J* = 15.0 Hz), 116.7 (d, *J* = 21.8 Hz), 115.3, 112.4, 33.6, 24.4, 24.2. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{40}H_{37}F_2N_4O_2$, m /z: 643.2879, found: 643.2880.

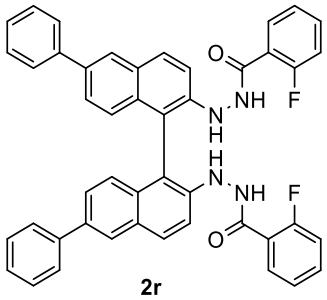
***N*′,*N*‴-(6,6′-dicyclohexyl-[1,1′-binaphthalene]-2,2′-diyl)bis(2-fluorobenzohydrazide) (2q)**



2q

Following the general protocol, compound **2q** was obtained in 87% yield as a white solid. R_f 0.40 (*n*-hexane: ethyl acetate = 3:1). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.65 (d, *J* = 10.8 Hz, 2H), 7.77 (d, *J* = 8.8 Hz, 4H), 7.53 (s, 2H), 7.36 (d, *J* = 9.0 Hz, 4H), 7.12 – 6.96 (m, 8H), 2.58 – 2.46 (m, 2H), 1.84 (d, *J* = 11.4 Hz, 4H), 1.76 (d, *J* = 8.6 Hz, 4H), 1.66 (d, *J* = 12.2 Hz, 2H), 1.44 – 1.26 (m, 8H), 1.24 – 1.15 (m, 2H). **^{13}C NMR (126 MHz, $CDCl_3$)** δ 164.4 (d, *J* = 3.7 Hz), 160.6 (d, *J* = 248.7 Hz), 143.4, 143.0, 133.7 (d, *J* = 9.0 Hz), 132.5, 131.9 (d, *J* = 2.6 Hz), 123.0, 129.8, 127.5, 124.8 (2C), 124.7, 119.8 (d, *J* = 13.3 Hz), 116.1 (d, *J* = 24.0 Hz), 115.5, 113.9, 44.3, 34.5, 34.3, 27.0 (2C), 26.2. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{46}H_{45}F_2N_4O_2$, m/z: 723.3505, found: 723.3507.

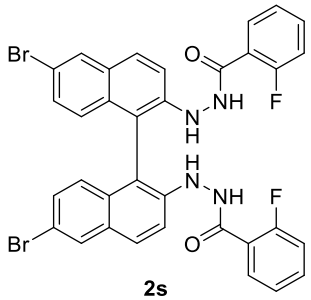
***N'*,*N'''*-(6,6'-diphenyl-[1,1'-binaphthalene]-2,2'-diyl)bis(2-fluorobenzohydrazide) (2r)**



2r

Following the general protocol, compound **2r** was obtained in 75% yield as a white solid. R_f 0.23 (*n*-hexane: ethyl acetate = 3:1). **^{1}H NMR (500 MHz, DMSO-d_6)** δ 10.56 (s, 2H), 8.22 (s, 2H), 8.12 (d, *J* = 9.1 Hz, 2H), 7.74 (d, *J* = 7.7 Hz, 4H), 7.61 – 7.51 (m, 10H), 7.47 (t, *J* = 7.6 Hz, 4H), 7.39 – 7.28 (m, 6H), 6.92 (d, *J* = 8.8 Hz, 2H). **^{13}C NMR (126 MHz, DMSO-d_6)** δ 165.5, 159.8 (d, *J* = 250.3 Hz), 145.0, 140.5, 135.1, 133.5 (d, *J* = 8.6 Hz), 133.3, 130.8, 130.4 (2C), 129.6, 129.4 (2C), 127.6, 127.1 (2C), 126.2 (d, *J* = 12.5 Hz), 125.3, 125.1 (d, *J* = 3.3 Hz), 122.7 (d, *J* = 14.9 Hz), 116.8 (d, *J* = 21.8 Hz), 115.9, 112.0. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{46}H_{33}F_2N_4O_2$, m/z: 711.2566, found: 711.2576.

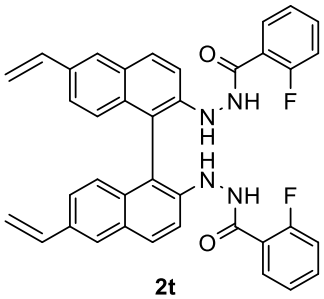
***N'*,*N'''*-(6,6'-dibromo-[1,1'-binaphthalene]-2,2'-diyl)bis(2-fluorobenzohydrazide) (2s)**



2s

Following the general protocol, compound **2s** was obtained in 92% yield as a white solid. R_f 0.29 (*n*-hexane: ethyl acetate = 3:1). **^{1}H NMR (500 MHz, DMSO-d_6)** δ 10.55 (s, 2H), 8.16 (d, *J* = 2.2 Hz, 2H), 8.01 (d, *J* = 9.1 Hz, 2H), 7.62 – 7.53 (m, 4H), 7.51 (d, *J* = 9.1 Hz, 2H), 7.46 (s, 2H), 7.36 – 7.27 (m, 6H), 6.68 (d, *J* = 9.0 Hz, 2H). **^{13}C NMR (126 MHz, DMSO-d_6)** δ 165.5, 159.7 (d, *J* = 250.3 Hz), 145.3, 133.6 (d, *J* = 8.3 Hz), 132.5, 130.5, 130.4 (2C), 130.1, 129.7, 126.6, 125.1 (d, *J* = 3.2 Hz), 122.5 (d, *J* = 14.9 Hz), 116.8 (d, *J* = 21.6 Hz), 116.6, 116.3, 111.6. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{34}H_{23}Br_2F_2N_4O_2$, m/z: 715.0150, found: 715.0147.

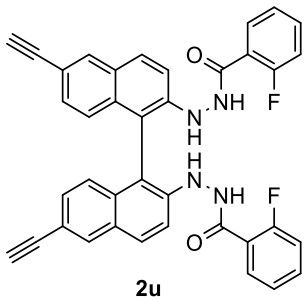
***N*′,*N*′′′-(6,6'-divinyl-[1,1'-binaphthalene]-2,2'-diyl)bis(2-fluorobenzohydrazide) (2t)**



2t

Following the general protocol, compound **2t** was obtained in 58% yield. R_f 0.39 (*n*-hexane: ethyl acetate = 2.5:1). **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.54 (d, *J* = 12.9 Hz, 2H), 8.16 (td, *J* = 7.7, 1.8 Hz, 2H), 7.81 – 7.73 (m, 4H), 7.72 – 7.60 (m, 4H), 7.45 – 7.37 (m, 2H), 7.38 – 7.29 (m, 4H), 7.28 – 7.21 (m, 4H), 7.17 (dd, *J* = 8.8, 2.3 Hz, 2H), 5.82 (d, *J* = 17.6 Hz, 2H), 5.28 (d, *J* = 11.4 Hz, 2H). **^{13}C NMR (126 MHz, $CDCl_3$)** δ 165.5, 160.8 (d, *J* = 245.8 Hz), 145.7, 137.0, 134.2 (d, *J* = 9.3 Hz), 132.3, 129.5, 129.4, 127.7, 127.0, 126.6, 126.5, 126.3, 125.2 (d, *J* = 2.5 Hz), 123.9, 116.4 (d, *J* = 20.0 Hz), 116.2 (d, *J* = 14.3 Hz), 113.0, 108.1. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{38}H_{29}F_2O_2$, m/z: 611.2253, found: 611.2254.

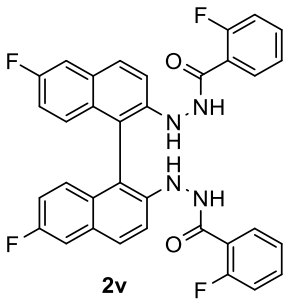
***N*′,*N*′′′-(6,6'-diethynyl-[1,1'-binaphthalene]-2,2'-diyl)bis(2-fluorobenzohydrazide) (2u)**



2u

Following the general protocol, compound **2u** was obtained in 83% yield as a white solid. R_f 0.24 (*n*-hexane: ethyl acetate = 3:1). **^{1}H NMR (400 MHz, DMSO-d_6)** δ 10.57 (s, 2H), 8.10 (s, 2H), 8.04 (d, *J* = 9.1 Hz, 2H), 7.60 – 7.49 (m, 8H), 7.39 – 7.20 (m, 6H), 6.74 (d, *J* = 8.8 Hz, 2H), 4.17 (s, 2H). **^{13}C NMR (126 MHz, DMSO-d_6)** δ 165.4, 159.7 (d, *J* = 250.4 Hz), 145.9, 133.6 (2C), 132.6, 130.4 (2C), 129.6, 128.7, 125.1 (d, *J* = 2.7 Hz), 124.8, 122.5 (d, *J* = 14.9 Hz), 116.8 (d, *J* = 21.7 Hz), 116.37, 116.19, 111.5, 84.4, 80.8. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{38}H_{25}F_2N_4O_2$, m/z: 607.1940 found: 607.1946.

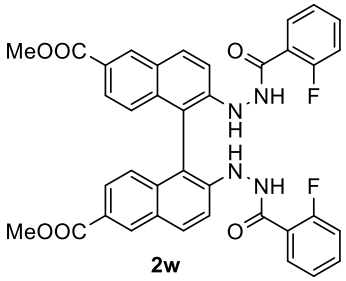
***N'*,*N'''*-(6,6'-difluoro-[1,1'-binaphthalene]-2,2'-diyl)bis(2-fluorobenzohydrazide) (2v)**



2v

Following the general protocol, compound **2v** was obtained in 92% yield as a white solid. R_f 0.27 (*n*-hexane: ethyl acetate = 3:1). **^{1}H NMR (500 MHz, DMSO-d_6)** δ 10.53 (s, 2H), 8.00 (s, 2H), 7.70 (dd, *J* = 9.9, 2.8 Hz, 2H), 7.54 (s, 6H), 7.45 (d, *J* = 2.1 Hz, 2H), 7.36 – 7.27 (m, 4H), 7.14 (d, *J* = 2.8 Hz, 2H), 6.77 (d, *J* = 3.7 Hz, 2H). **^{13}C NMR (126 MHz, DMSO-d_6)** δ 165.4, 159.7 (d, *J* = 250.2 Hz), 158.9 (d, *J* = 240.7 Hz), 144.4, 133.5 (d, *J* = 8.4 Hz), 130.9, 130.4, 129.7 (2C), 127.0 (d, *J* = 8.6 Hz), 125.1 (d, *J* = 2.7 Hz), 122.6 (d, *J* = 14.9 Hz), 117.1 (d, *J* = 24.9 Hz), 116.8 (d, *J* = 9.4 Hz), 116.7, 112.2, 111.7 (d, *J* = 20.4 Hz). **HRMS (ESI)** calcd for $[M+H]^+$ $C_{34}H_{23}F_4N_4O_2$, m/z: 595.1752, found: 595.1753.

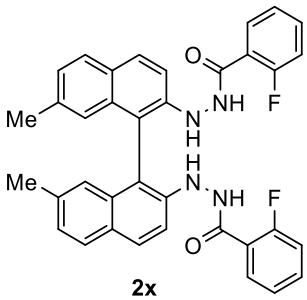
Dimethyl 2,2'-bis(2-(2-fluorobenzoyl)hydrazineyl)-[1,1'-binaphthalene]-6,6'-dicarboxylate (2w)



2w

Following the general protocol, compound **2w** was obtained in 88% yield as a white solid. R_f 0.13 (*n*-hexane: ethyl acetate = 2.5:1). **^{1}H NMR (500 MHz, DMSO-d_6)** δ 10.61 (s, 2H), 8.62 (s, 2H), 8.25 (d, *J* = 9.1 Hz, 2H), 7.70 (dd, *J* = 9.0, 1.9 Hz, 2H), 7.61 – 7.54 (m, 8H), 7.39 – 7.25 (m, 4H), 6.86 (d, *J* = 8.8 Hz, 2H), 3.87 (s, 6H). **^{13}C NMR (126 MHz, DMSO-d_6)** δ 166.9, 165.4, 159.8 (d, *J* = 250.4 Hz), 147.2, 136.3, 133.7 (d, *J* = 7.9 Hz), 132.2, 131.6, 130.4, 128.2, 126.3, 125.1 (d, *J* = 2.7 Hz), 124.6, 124.3, 122.4 (d, *J* = 14.7 Hz), 116.8 (d, *J* = 21.8 Hz), 116.3, 111.3, 52.5. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{38}H_{29}F_2N_4O_6$, m/z: 675.2050, found: 675.2051.

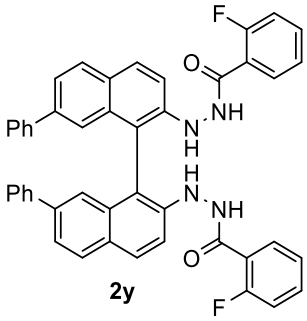
***N*',*N*'''-(7,7'-dimethyl-[1,1'-binaphthalene]-2,2'-diyl)bis(2-fluorobenzohydrazide) (2x)**



2x

Following the general protocol, compound **2x** was obtained in 83% yield as a white solid. R_f 0.28 (*n*-hexane: ethyl acetate = 3:1). **^{1}H NMR (400 MHz, DMSO-d_6)** δ 7.94 (d, *J* = 9.0 Hz, 2H), 7.79 (d, *J* = 8.3 Hz, 2H), 7.63 – 7.50 (m, 4H), 7.39 (d, *J* = 8.9 Hz, 2H), 7.37 – 7.23 (m, 6H), 7.13 (dd, *J* = 8.3, 1.7 Hz, 2H), 6.57 (s, 2H), 2.15 (s, 6H). **^{13}C NMR (126 MHz, DMSO-d_6)** δ 165.3, 159.7 (d, *J* = 250.0 Hz), 144.7, 136.1, 134.1, 133.5 (d, *J* = 8.4 Hz), 130.4, 129.9, 128.5, 127.5, 125.7, 125.1 (d, *J* = 3.5 Hz), 123.3, 122.7 (d, *J* = 14.9 Hz), 116.8 (d, *J* = 21.7 Hz), 114.4, 111.9, 22.2. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{36}H_{29}F_2N_4O_2$, m/z: 587.2253, found: 587.2249.

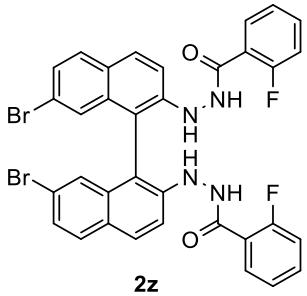
***N*',*N*'''-(7,7'-diphenyl-[1,1'-binaphthalene]-2,2'-diyl)bis(2-fluorobenzohydrazide) (2y)**



2y

Following the general protocol, compound **2y** was obtained in 84% yield as a white solid. R_f 0.25 (*n*-hexane: ethyl acetate = 3:1). **^{1}H NMR (500 MHz, DMSO-d_6)** δ 10.55 (s, 2H), 8.03 (dd, *J* = 31.9, 8.7 Hz, 4H), 7.63 – 7.50 (m, 8H), 7.46 (s, 2H), 7.37 – 7.31 (m, 4H), 7.31 – 7.26 (m, 8H), 7.25 – 7.20 (m, 2H), 7.07 (s, 2H). **^{13}C NMR (126 MHz, DMSO-d_6)** δ 165.4, 159.8 (d, *J* = 250.1 Hz), 145.3, 141.1, 138.8, 134.1, 133.5 (d, *J* = 8.2 Hz), 130.4, 130.1, 129.4 (3C), 128.5, 127.8, 127.1 (2C), 125.1 (d, *J* = 3.4 Hz), 122.9, 122.7 (d, *J* = 14.8 Hz), 122.2, 116.8 (d, *J* = 21.8 Hz), 115.6, 112.2. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{46}H_{33}F_2N_4O_6$, m/z: 711.2566, found: 711.2567.

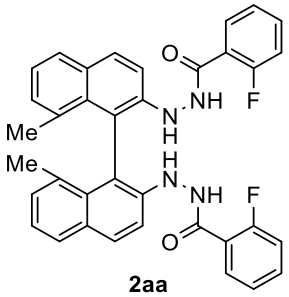
***N*',*N*'''-(7,7'-dibromo-[1,1'-binaphthalene]-2,2'-diyl)bis(2-fluorobenzohydrazide) (2z)**



2z

Following the general protocol, compound **2z** was obtained in 93% yield as a white solid. R_f 0.24 (*n*-hexane: ethyl acetate = 3:1). **^{1}H NMR (500 MHz, DMSO-d_6)** δ 10.54 (s, 2H), 8.06 (d, *J* = 9.1 Hz, 2H), 7.89 (d, *J* = 8.6 Hz, 2H), 7.61 – 7.47 (m, 6H), 7.45 – 7.38 (m, 4H), 7.37 – 7.26 (m, 4H), 6.88 (s, 2H). **^{13}C NMR (126 MHz, DMSO-d_6)** δ 165.3, 159.8 (d, *J* = 250.3 Hz), 146.0, 135.1, 133.6 (d, *J* = 8.5 Hz), 131.2, 130.8, 130.4 (d, *J* = 2.7 Hz), 127.7, 126.5, 125.7, 125.1 (d, *J* = 3.3 Hz), 122.4 (d, *J* = 14.8 Hz), 121.1, 116.8 (d, *J* = 21.7 Hz), 116.0, 110.2. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{34}H_{23}Br_2F_2N_4O_2$, m/z: 715.0150, found: 715.0151.

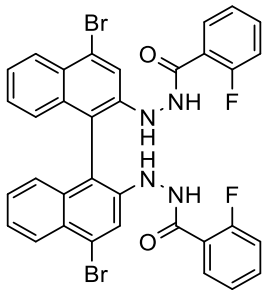
***N*',*N*'''-(8,8'-dimethyl-[1,1'-binaphthalene]-2,2'-diyl)bis(2-fluorobenzohydrazide) (2aa)**



2aa

Following the general protocol, compound **2aa** was obtained in 82% yield as a white solid. R_f 0.35 (*n*-hexane: ethyl acetate = 3:1). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.47 (d, *J* = 11.3 Hz, 2H), 8.04 – 7.95 (m, 2H), 7.64 (d, *J* = 8.7 Hz, 2H), 7.51 (d, *J* = 7.9 Hz, 2H), 7.49 – 7.41 (m, 2H), 7.28 (d, *J* = 2.3 Hz, 2H), 7.21 (t, *J* = 7.4 Hz, 2H), 7.17 – 7.08 (m, 6H), 7.08 – 7.03 (m, 2H), 2.48 (s, 6H).**^{13}C NMR (101 MHz, $CDCl_3$)** δ 164.0 (d, *J* = 3.7 Hz), 160.7 (d, *J* = 248.2 Hz), 145.4, 134.1 (d, *J* = 9.3 Hz), 133.5, 132.9, 132.1 (d, *J* = 2.5 Hz), 130.0, 129.6, 127.2, 126.2, 125.2 (d, *J* = 3.1 Hz), 123.3, 116.2 (d, *J* = 24.4 Hz), 115.6, 115.3, 105.0, 19.4. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{36}H_{29}F_2N_4O_2$, m/z 587.2253 found: 587.2252.

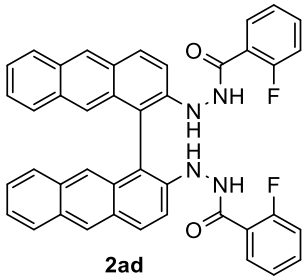
***N'*,*N'''*-(4,4'-dibromo-[1,1'-binaphthalene]-2,2'-diyl)bis(2-fluorobenzohydrazide) (2ab)**



2ab

Following the general protocol, compound **2ab** was obtained in 72% yield as a white solid. R_f 0.43 (*n*-hexane: ethyl acetate = 3:1). **^{1}H NMR (500 MHz, DMSO-d_6)** δ 10.55 (s, 2H), 8.11 (d, *J* = 8.4 Hz, 2H), 7.78 (s, 2H), 7.61 – 7.56 (m, 2H), 7.51 (t, *J* = 6.5 Hz, 2H), 7.47 – 7.42 (m, 4H), 7.39 – 7.33 (m, 2H), 7.31 (t, *J* = 7.5 Hz, 4H), 6.86 (d, *J* = 8.5 Hz, 2H). **^{13}C NMR (126 MHz, DMSO)** δ 165.4, 159.7 (d, *J* = 249.7 Hz), 145.2, 134.9, 133.7 (d, *J* = 8.7 Hz), 130.3, 130.2, 128.3, 127.3, 125.2 (2C), 125.1, 124.5, 122.4 (d, *J* = 15.1 Hz), 119.3, 116.8 (d, *J* = 21.7 Hz), 111.7. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{34}H_{23}Br_2F_2N_4O_2$, m/z: 715.015, found: 715.0145.

***N'*,*N'''*-([1,1'-bianthracene]-2,2'-diyl)bis(2-fluorobenzohydrazide) (2ad)**



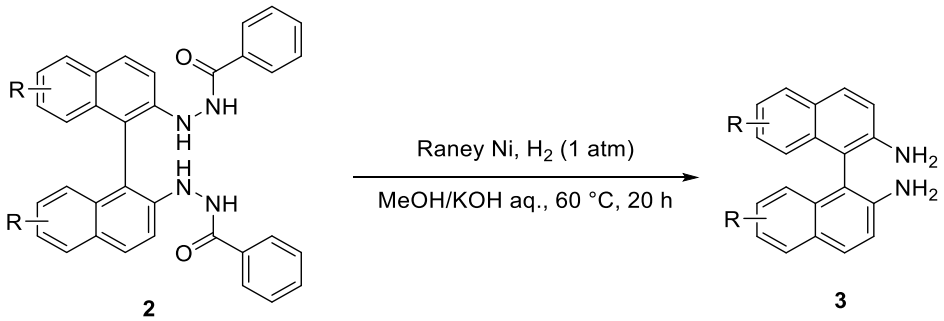
2ad

Following the general protocol, compound **2ad** was obtained in 58% yield as a white solid. R_f 0.44 (*n*-hexane: ethyl acetate = 3:1). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.57 (d, *J* = 12.4 Hz, 2H), 8.31 (s, 2H), 8.19 (s, 2H), 8.14 (dd, *J* = 7.7, 1.9 Hz, 2H), 7.97 – 7.86 (m, 6H), 7.43 – 7.30 (m, 8H), 7.28 – 7.24 (m, 4H), 7.16 (dd, *J* = 9.0, 2.2 Hz, 2H). **^{13}C NMR (126 MHz, $CDCl_3$)** δ 163.7, 160.8 (d, *J* = 248.0 Hz), 144.7, 134.2 (d, *J* = 9.3 Hz), 132.3 (d, *J* = 2.3 Hz), 130.8, 130.4, 129.9, 128.8, 128.3, 127.7, 126.3, 125.5, 125.2 (d, *J* = 3.2 Hz), 124.4, 124.2, 122.9, 117.7, 116.6, 116.3 (d, *J* = 24.5 Hz), 106.0. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{42}H_{29}F_2N_4O_2$, m/z: 659.2253, found: 659.2254.

Gram scale synthesis of BINAM derivatives

Azonaphthalene (15 g, 57.7 mmol), B_2cat_2 (15 g, 63.5 mmol) and 2,6-dibromopyridine (1.4 g, 5.77 mmol) were added to a 500 mL dry round-bottomed flask equipped with a Teflon-coated magnetic stirring bar. Anhydrous 1,2-dimethoxyethane (280 mL) was added and the reaction was stirred at room temperature for 1 hour. The reaction mixture was then concentrated to dryness and purified by washing with warm methanol to give 13.7 g of **2a** (91% yield).

Cleavage of *N*-*N* Bond — Accessing free BINAM

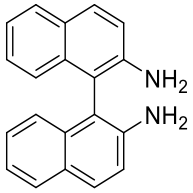


2 **3**

A Schlenk tube containing approximately 100 mg of Raney nickel and equipped with a Teflon-coated magnetic stir bar was washed with methanol (5 x 2 mL). Methanol (1 mL), BINAM derivative **2** (0.1 mmol, 1 equiv.), and aqueous potassium hydroxide solution (0.5 mmol, 0.2 M) were added. The reaction mixture was degassed, backfilled with hydrogen gas (H_2 balloon), and

stirred at 60 °C until complete consumption of the starting material. The reaction was allowed to cool to room temperature and filtered carefully whilst washing with ethyl acetate, and the filtrate was then concentrated to dryness. The resulting residue was dissolved in dichloromethane, washed with brine, and dried over sodium sulfate. The organic phase was filtered off, evaporated to dryness, and purified by flash chromatography using (n-hexane: ethyl acetate = 6:1 to 4:1) to obtain **3** as a white solid.

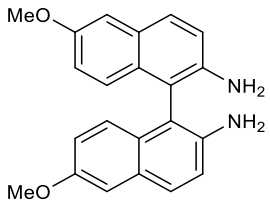
[1,1'-binaphthalene]-2,2'-diamine (3a)



3a

Following the general protocol, compound **3a** was obtained in 90% yield; R_f 0.41 (*n*-hexane: ethyl acetate = 3:1). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.74 – 7.67 (m, 4H), 7.17 – 7.08 (m, 4H), 7.05 (d, *J* = 8.7 Hz, 2H), 6.99 (d, *J* = 8.5 Hz, 2H). **^{13}C NMR (126 MHz, $CDCl_3$)** δ 142.5, 133.7, 129.6, 128.6, 128.2, 126.9, 124.0, 122.5, 118.4, 112.8. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{20}H_{17}N_2$, m/z: 285.1386, found: 285.1384.

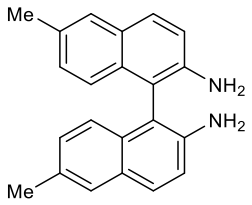
6,6'-dimethoxy-[1,1'-binaphthalene]-2,2'-diamine (3n)



3n

Following the general protocol, compound **3n** was obtained in 83% yield as a white solid. R_f 0.24 (*n*-hexane: ethyl acetate = 3:1). **^{1}H NMR (500 MHz, $CDCl_3$)** δ 7.70 (d, *J* = 8.7 Hz, 2H), 7.14 (dd, *J* = 5.7, 3.0 Hz, 4H), 6.99 (d, *J* = 9.1 Hz, 2H), 6.90 (dd, *J* = 9.2, 2.6 Hz, 2H), 3.88 (s, 6H). **^{13}C NMR (126 MHz, $CDCl_3$)** δ 155.5, 140.6, 129.4, 129.0, 128.2, 125.7, 119.1, 119.0, 113.8, 106.8, 55.3. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{22}H_{21}N_2O_2$, m/z: 345.1598, found: 345.1596.

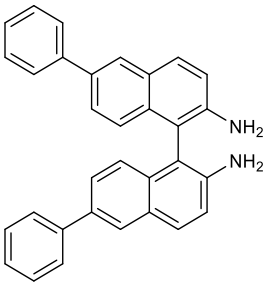
6,6'-dimethyl-[1,1'-binaphthalene]-2,2'-diamine (3o)



3o

Following the general protocol, compound **3o** was obtained in 89% yield as a white solid. R_f 0.47 (*n*-hexane: ethyl acetate = 3:1). **^{1}H NMR (500 MHz, $CDCl_3$)** δ 7.75 (d, *J* = 8.8 Hz, 2H), 7.60 (s, 2H), 7.15 (d, *J* = 8.7 Hz, 2H), 7.07 (d, *J* = 8.7 Hz, 2H), 7.01 (d, *J* = 8.6 Hz, 2H). **^{13}C NMR (126 MHz, $CDCl_3$)** δ 141.8, 131.9, 131.8, 129.0, 128.8, 127.3, 124.0, 118.5, 113.1, 21.3. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{22}H_{21}N_2$, m/z: 313.1699, found: 313.1699.

6,6'-diphenyl-[1,1'-binaphthalene]-2,2'-diamine (3r)

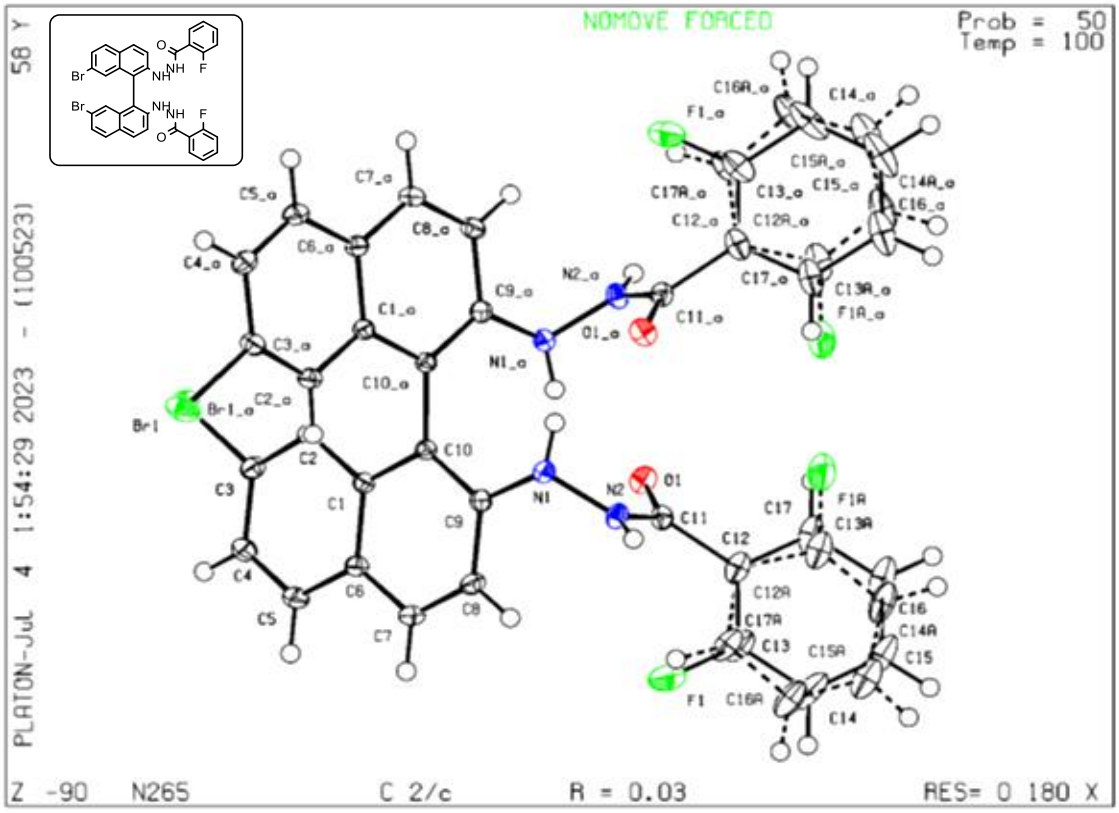


3r

Following the general protocol, compound **3r** was obtained in 85% yield as a white solid. R_f 0.36 (*n*-hexane: ethyl acetate = 3:1). **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.05 (d, *J* = 1.9 Hz, 2H), 7.91 (d, *J* = 8.8 Hz, 2H), 7.69 (d, *J* = 6.9 Hz, 4H), 7.53 (dd, *J* = 8.7, 2.0 Hz, 2H), 7.47 (t, *J* = 7.7 Hz, 4H), 7.35 (t, *J* = 7.4 Hz, 2H), 7.23 (dd, *J* = 8.7, 3.7 Hz, 4H). **^{13}C NMR (126 MHz, $CDCl_3$)** δ 142.9, 141.3, 135.3, 132.9, 123.0, 128.8 (3C), 127.1 (2C), 126.9, 126.5, 126.2, 124.3 118.8, 112.4. **HRMS (ESI)** calcd for $[M+H]^+$ $C_{32}H_{25}N_2$, m/z: 437.2012, found: 437.2011.

Crystal Structure of 2z

The Cambridge Crystallographic Data Centre (CCDC) has received the crystallographic data for compound **2z** (CCDC 2294982) which is accessible at no cost via www.ccdc.cam.ac.uk/conts/retrieving.html.



Single Crystal Structure X-ray Analysis

Sample Code:	N265
Sample ID:	et-7br-bm
Student/Researcher:	Emmanuella Twumasi
Supervisor:	Lu Yixin
CDCC:	2294982
Date:	4-07-2023

Note: The crystal is monoclinic, space group C2/c. The asymmetric unit contains half a molecule of the compound $C_{34}H_{22}Br_2F_2N_4O_2$. The 1-fluoro-benzene group was disordered by flipping over with occupancy ratio =87:13.

Restraints in bond lengths and thermal parameters were applied to the disordered atoms. Hydrogens on the N atoms were located from different map. Final R values are R1=0.0266 and wR2=0.0665 for 2- theta up to 59º.

Supplementary Table 3. Crystal data and structure refinement for N265.

Identification code	N265	
Empirical formula	C34 H22 Br2 F2 N4 O2	
Formula weight	716.37	
Temperature	100(2) K	
Wavelength	0.71073 Å	
Crystal system	Monoclinic	
Space group	C2/c	
Unit cell dimensions	a = 13.8725(9) Å	a= 90°.
	b = 29.1188(18) Å	b= 127.298(2)°.
	c = 9.3620(6) Å	g = 90°.
Volume	3008.4(3) $Å^3$	
Z	4	
Density (calculated)	1.582 Mg/m^3	
Absorption coefficient	2.746 mm^{-1}	
F(000)	1432	
Crystal size	0.299 x 0.294 x 0.124 mm^3	
Theta range for data collection	2.293 to 29.579°.	
Index ranges	-19<=h<=19, -37<=k<=40, -13<=l<=12	
Reflections collected	52265	
Independent reflections	4220 [R(int) = 0.0480]	
Completeness to theta = 25.242°	99.6 %	
Absorption correction	Semi-empirical from equivalents	
Max. and min. transmission	0.7459 and 0.6142	
Refinement method	Full-matrix least-squares on F^2	
Data/restraints /parameters	4220 / 250 / 262	
Goodness-of-fit on F^2	1.034	
Final R indices [I>2sigma(I)]	R1 = 0.0266, wR2 = 0.0640	

R indices (all data)	R1 = 0.0313, wR2 = 0.0665
Extinction coefficient	n/a
Largest diff. peak and hole	0.984 and -0.902 e.Å^{-3}

Supplementary Table 4. Atomic coordinates (x 10^4) and equivalent isotropic displacement parameters (Å^{2}x 10^3) for N265. U(eq) is defined as one-third of the trace of the orthogonalized U^{ij} tensor.

__	x	y	z	U(eq)
Br(1)	3911(1)	2274(1)	10129(1)	26(1)
O(1)	3656(1)	4855(1)	6716(1)	19(1)
N(1)	4470(1)	4300(1)	5285(2)	15(1)
N(2)	3809(1)	4709(1)	4487(2)	15(1)
C(1)	3590(1)	3290(1)	6722(2)	13(1)
C(2)	4057(1)	2987(1)	8197(2)	15(1)
C(3)	3305(1)	2668(1)	8138(2)	17(1)
C(4)	2081(1)	2620(1)	6662(2)	18(1)
C(5)	1618(1)	2908(1)	5227(2)	18(1)
C(6)	2342(1)	3249(1)	5222(2)	15(1)
C(7)	1858(1)	3559(1)	3766(2)	18(1)
C(8)	2552(1)	3900(1)	3825(2)	17(1)
C(9)	3795(1)	3946(1)	5332(2)	14(1)
C(10)	4333(1)	3638(1)	6746(2)	12(1)
C(11)	3433(1)	4960(1)	5266(2)	16(1)
C(12)	2724(2)	5384(1)	4273(2)	21(1)
C(13)	1729(5)	5388(1)	2490(5)	28(1)
C(14)	1063(4)	5784(1)	1629(5)	40(1)
C(15)	1418(3)	6186(1)	2595(4)	40(1)
C(16)	2412(3)	6195(1)	4394(4)	36(1)

C(17)	3061(3)	5794(1)	5242(4)	27(1)
F(1)	1400(1)	4988(1)	1557(2)	36(1)
C(12A)	2724(2)	5384(1)	4273(2)	21(1)
C(13A)	2870(30)	5839(6)	4860(20)	30(3)
C(14A)	2140(20)	6197(6)	3790(30)	31(3)
C(15A)	1160(20)	6107(8)	2070(30)	33(3)
C(16A)	1000(30)	5679(8)	1370(30)	28(2)
C(17A)	1790(30)	5325(9)	2390(30)	22(2)
F(1A)	3867(9)	5855(3)	6622(13)	41(2)

Supplementary Table 5. Bond lengths [Å] and angles [°] for N265.

Br(1)-C(3)	1.8962(14)
O(1)-C(11)	1.2342(18)
N(1)-C(9)	1.4106(18)
N(1)-N(2)	1.4110(16)
N(1)-H(1)	0.86(2)
N(2)-C(11)	1.3406(19)
N(2)-H(2A)	0.84(2)
C(1)-C(2)	1.4220(19)
C(1)-C(6)	1.4270(18)
C(1)-C(10)	1.4359(19)
C(2)-C(3)	1.372(2)
C(2)-H(2)	0.9500
C(3)-C(4)	1.404(2)
C(4)-C(5)	1.369(2)
C(4)-H(4)	0.9500
C(5)-C(6)	1.415(2)
C(5)-H(5)	0.9500
C(6)-C(7)	1.419(2)

C(7)-C(8)	1.361(2)
C(7)-H(7)	0.9500
C(8)-C(9)	1.4260(19)
C(8)-H(8)	0.9500
C(9)-C(10)	1.3848(18)
C(10)-C(10)#1	1.501(3)
C(11)-C(12A)	1.499(2)
C(11)-C(12)	1.499(2)
C(12)-C(13)	1.378(4)
C(12)-C(17)	1.399(3)
C(13)-F(1)	1.357(4)
C(13)-C(14)	1.388(3)
C(14)-C(15)	1.377(4)
C(14)-H(14)	0.9500
C(15)-C(16)	1.387(4)
C(15)-H(15)	0.9500
C(16)-C(17)	1.393(3)
C(16)-H(16)	0.9500
C(17)-H(17)	0.9500
C(12A)-C(13A)	1.402(16)
C(12A)-C(17A)	1.429(17)
C(13A)-F(1A)	1.367(15)
C(13A)-C(14A)	1.377(16)
C(14A)-C(15A)	1.362(16)
C(14A)-H(14A)	0.9500
C(15A)-C(16A)	1.363(16)
C(15A)-H(15A)	0.9500
C(16A)-C(17A)	1.378(17)
C(16A)-H(16A)	0.9500
C(17A)-H(17A)	0.9500

C(9)-N(1)-N(2)	113.75(11)
C(9)-N(1)-H(1)	114.0(14)
N(2)-N(1)-H(1)	109.8(14)
C(11)-N(2)-N(1)	120.95(12)
C(11)-N(2)-H(2A)	121.2(14)
N(1)-N(2)-H(2A)	117.8(14)
C(2)-C(1)-C(6)	118.12(12)
C(2)-C(1)-C(10)	121.52(12)
C(6)-C(1)-C(10)	120.33(12)
C(3)-C(2)-C(1)	119.53(13)
C(3)-C(2)-H(2)	120.2
C(1)-C(2)-H(2)	120.2
C(2)-C(3)-C(4)	122.98(13)
C(2)-C(3)-Br(1)	119.73(11)
C(4)-C(3)-Br(1)	117.28(11)
C(5)-C(4)-C(3)	118.20(13)
C(5)-C(4)-H(4)	120.9
C(3)-C(4)-H(4)	120.9
C(4)-C(5)-C(6)	121.48(13)
C(4)-C(5)-H(5)	119.3
C(6)-C(5)-H(5)	119.3
C(5)-C(6)-C(7)	121.73(13)
C(5)-C(6)-C(1)	119.67(13)
C(7)-C(6)-C(1)	118.60(13)
C(8)-C(7)-C(6)	120.88(13)
C(8)-C(7)-H(7)	119.6
C(6)-C(7)-H(7)	119.6
C(7)-C(8)-C(9)	120.70(13)
C(7)-C(8)-H(8)	119.7
C(9)-C(8)-H(8)	119.7
C(10)-C(9)-N(1)	121.31(12)

C(10)-C(9)-C(8)	120.85(13)
N(1)-C(9)-C(8)	117.76(12)
C(9)-C(10)-C(1)	118.48(12)
C(9)-C(10)-C(10)#1	122.85(11)
C(1)-C(10)-C(10)#1	118.61(11)
O(1)-C(11)-N(2)	122.89(13)
O(1)-C(11)-C(12A)	121.26(13)
N(2)-C(11)-C(12A)	115.85(13)
O(1)-C(11)-C(12)	121.26(13)
N(2)-C(11)-C(12)	115.85(13)
C(13)-C(12)-C(17)	118.3(2)
C(13)-C(12)-C(11)	123.92(19)
C(17)-C(12)-C(11)	117.74(16)
F(1)-C(13)-C(12)	118.1(2)
F(1)-C(13)-C(14)	119.4(3)
C(12)-C(13)-C(14)	122.5(3)
C(15)-C(14)-C(13)	118.5(3)
C(15)-C(14)-H(14)	120.7
C(13)-C(14)-H(14)	120.7
C(14)-C(15)-C(16)	120.7(2)
C(14)-C(15)-H(15)	119.6
C(16)-C(15)-H(15)	119.6
C(15)-C(16)-C(17)	120.0(3)
C(15)-C(16)-H(16)	120.0
C(17)-C(16)-H(16)	120.0
C(16)-C(17)-C(12)	120.0(2)
C(16)-C(17)-H(17)	120.0
C(12)-C(17)-H(17)	120.0
C(13A)-C(12A)-C(17A)	113.8(11)
C(13A)-C(12A)-C(11)	130.5(7)
C(17A)-C(12A)-C(11)	115.5(9)

F(1A)-C(13A)-C(14A)	127.8(15)
F(1A)-C(13A)-C(12A)	107.9(11)
C(14A)-C(13A)-C(12A)	124.3(13)
C(15A)-C(14A)-C(13A)	118.8(17)
C(15A)-C(14A)-H(14A)	120.6
C(13A)-C(14A)-H(14A)	120.6
C(14A)-C(15A)-C(16A)	120.1(16)
C(14A)-C(15A)-H(15A)	119.9
C(16A)-C(15A)-H(15A)	119.9
C(15A)-C(16A)-C(17A)	121.2(18)
C(15A)-C(16A)-H(16A)	119.4
C(17A)-C(16A)-H(16A)	119.4
C(16A)-C(17A)-C(12A)	120.9(17)
C(16A)-C(17A)-H(17A)	119.5
C(12A)-C(17A)-H(17A)	119.5

Symmetry transformations used to generate equivalent atoms:
#1 -x+1,y,-z+3/2

Supplementary Table 6. Anisotropic displacement parameters ($Å^2 x\ 10^3$) for N265. The anisotropic displacement factor exponent takes the form: $-2p^2[\ h^2\ a^{*2}U^{11} + ...\ + 2\ h\ k\ a^*\ b^*\ U^{12}]$

	U^{11}	U^{22}	U^{33}	U^{23}	U^{13}	U^{12}
Br(1)	17(1)	33(1)	25(1)	14(1)	10(1)	1(1)
O(1)	24(1)	20(1)	16(1)	2(1)	14(1)	4(1)
N(1)	14(1)	13(1)	15(1)	1(1)	8(1)	1(1)
N(2)	20(1)	14(1)	15(1)	3(1)	12(1)	2(1)
C(1)	12(1)	13(1)	14(1)	-1(1)	7(1)	1(1)
C(2)	12(1)	17(1)	14(1)	1(1)	6(1)	1(1)

C(3)	15(1)	18(1)	16(1)	3(1)	9(1)	2(1)
C(4)	15(1)	18(1)	20(1)	-1(1)	9(1)	-4(1)
C(5)	13(1)	20(1)	17(1)	-1(1)	7(1)	-2(1)
C(6)	12(1)	15(1)	14(1)	-1(1)	7(1)	0(1)
C(7)	12(1)	20(1)	14(1)	0(1)	5(1)	1(1)
C(8)	16(1)	18(1)	13(1)	2(1)	7(1)	2(1)
C(9)	14(1)	14(1)	14(1)	-1(1)	9(1)	1(1)
C(10)	11(1)	12(1)	13(1)	-1(1)	7(1)	1(1)
C(11)	17(1)	14(1)	18(1)	0(1)	11(1)	-1(1)
C(12)	25(1)	18(1)	27(1)	6(1)	21(1)	6(1)
C(13)	28(1)	29(1)	31(1)	9(1)	19(1)	12(1)
C(14)	42(1)	40(2)	40(1)	22(1)	26(1)	26(1)
C(15)	54(2)	32(1)	54(2)	25(1)	42(2)	26(1)
C(16)	53(2)	20(1)	54(2)	12(1)	43(1)	13(1)
C(17)	38(2)	17(1)	38(1)	5(1)	30(1)	7(1)
F(1)	26(1)	39(1)	25(1)	1(1)	5(1)	5(1)
C(12A)	25(1)	18(1)	27(1)	6(1)	21(1)	6(1)
C(13A)	39(3)	20(3)	38(3)	6(2)	28(3)	8(3)
C(14A)	45(4)	21(3)	44(3)	9(3)	36(3)	15(3)
C(15A)	45(3)	27(3)	41(3)	15(3)	33(3)	15(3)
C(16A)	35(3)	29(3)	36(3)	13(3)	29(2)	19(3)
C(17A)	25(3)	26(3)	28(2)	12(3)	23(2)	13(3)
F(1A)	50(4)	20(3)	40(3)	-2(2)	21(3)	5(3)

Supplementary Table 7. Hydrogen coordinates (x 10^4) and isotropic displacement parameters (Å^{2}x 10^3)for N265.

	x	y	z	U(eq)
H(1)	5144(19)	4359(7)	6310(30)	22(5)
H(2A)	3703(19)	4800(7)	3550(30)	24(5)
H(2)	4883	3005	9217	18
H(4)	1586	2393	6658	22
H(5)	793	2877	4212	21
H(7)	1038	3528	2736	21
H(8)	2205	4110	2853	20
H(14)	378	5777	400	48
H(15)	978	6461	2023	48
H(16)	2650	6475	5047	43
H(17)	3732	5799	6480	32
H(14A)	2304	6502	4245	38
H(15A)	591	6342	1355	39
H(16A)	339	5623	149	34
H(17A)	1704	5039	1843	27

Supplementary Table 8. Torsion angles [°] for N265.

C(9)-N(1)-N(2)-C(11)	66.65(17)
C(6)-C(1)-C(2)-C(3)	0.1(2)
C(10)-C(1)-C(2)-C(3)	178.17(13)
C(1)-C(2)-C(3)-C(4)	0.8(2)
C(1)-C(2)-C(3)-Br(1)	-178.20(10)
C(2)-C(3)-C(4)-C(5)	-0.6(2)
Br(1)-C(3)-C(4)-C(5)	178.49(12)
C(3)-C(4)-C(5)-C(6)	-0.7(2)
C(4)-C(5)-C(6)-C(7)	-177.84(14)
C(4)-C(5)-C(6)-C(1)	1.6(2)
C(2)-C(1)-C(6)-C(5)	-1.3(2)
C(10)-C(1)-C(6)-C(5)	-179.36(13)
C(2)-C(1)-C(6)-C(7)	178.17(13)
C(10)-C(1)-C(6)-C(7)	0.1(2)
C(5)-C(6)-C(7)-C(8)	176.66(14)
C(1)-C(6)-C(7)-C(8)	-2.8(2)
C(6)-C(7)-C(8)-C(9)	1.9(2)
N(2)-N(1)-C(9)-C(10)	-145.63(13)
N(2)-N(1)-C(9)-C(8)	37.75(17)
C(7)-C(8)-C(9)-C(10)	1.7(2)
C(7)-C(8)-C(9)-N(1)	178.39(13)
N(1)-C(9)-C(10)-C(1)	179.14(12)
C(8)-C(9)-C(10)-C(1)	-4.3(2)
N(1)-C(9)-C(10)-C(10)#1	-3.9(2)
C(8)-C(9)-C(10)-C(10)#1	172.66(13)
C(2)-C(1)-C(10)-C(9)	-174.60(13)
C(6)-C(1)-C(10)-C(9)	3.41(19)
C(2)-C(1)-C(10)-C(10)#1	8.3(2)
C(6)-C(1)-C(10)-C(10)#1	-173.71(13)

N(1)-N(2)-C(11)-O(1)	1.3(2)
N(1)-N(2)-C(11)-C(12A)	-179.15(12)
N(1)-N(2)-C(11)-C(12)	-179.15(12)
O(1)-C(11)-C(12)-C(13)	-128.7(4)
N(2)-C(11)-C(12)-C(13)	51.8(4)
O(1)-C(11)-C(12)-C(17)	48.0(3)
N(2)-C(11)-C(12)-C(17)	-131.6(3)
C(17)-C(12)-C(13)-F(1)	-179.5(4)
C(11)-C(12)-C(13)-F(1)	-2.9(8)
C(17)-C(12)-C(13)-C(14)	0.7(8)
C(11)-C(12)-C(13)-C(14)	177.4(4)
F(1)-C(13)-C(14)-C(15)	-179.4(5)
C(12)-C(13)-C(14)-C(15)	0.3(9)
C(13)-C(14)-C(15)-C(16)	-0.7(7)
C(14)-C(15)-C(16)-C(17)	-0.1(6)
C(15)-C(16)-C(17)-C(12)	1.2(6)
C(13)-C(12)-C(17)-C(16)	-1.5(6)
C(11)-C(12)-C(17)-C(16)	-178.3(3)
O(1)-C(11)-C(12A)-C(13A)	50(2)
N(2)-C(11)-C(12A)-C(13A)	-129(2)
O(1)-C(11)-C(12A)-C(17A)	-134(2)
N(2)-C(11)-C(12A)-C(17A)	47(2)
C(17A)-C(12A)-C(13A)-F(1A)	-174(3)
C(11)-C(12A)-C(13A)-F(1A)	2(4)
C(17A)-C(12A)-C(13A)-C(14A)	5(5)
C(11)-C(12A)-C(13A)-C(14A)	-179(2)
F(1A)-C(13A)-C(14A)-C(15A)	-178(3)
C(12A)-C(13A)-C(14A)-C(15A)	3(5)
C(13A)-C(14A)-C(15A)-C(16A)	-7(5)
C(14A)-C(15A)-C(16A)-C(17A)	3(5)
C(15A)-C(16A)-C(17A)-C(12A)	6(6)

C(13A)-C(12A)-C(17A)-C(16A)	-10(5)
C(11)-C(12A)-C(17A)-C(16A)	174(3)

Symmetry transformations used to generate equivalent atoms:
#1 -x+1,y,-z+3/2

Supplementary Table 9. Hydrogen bonds for N265 [Å and °].

D-H...A	d(D-H)	d(H...A)	d(D...A)	<(DHA)
N(1)-H(1)...O(1)#1	0.86(2)	2.13(2)	2.9000(16)	148.8(18)
N(2)-H(2A)...O(1)#2	0.84(2)	1.96(2)	2.7781(16)	166(2)

Symmetry transformations used to generate equivalent atoms:
#1 -x+1,y,-z+3/2 #2 x,-y+1,z-1/2

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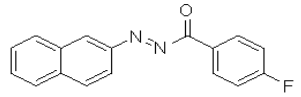

1d

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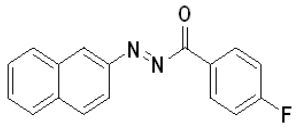

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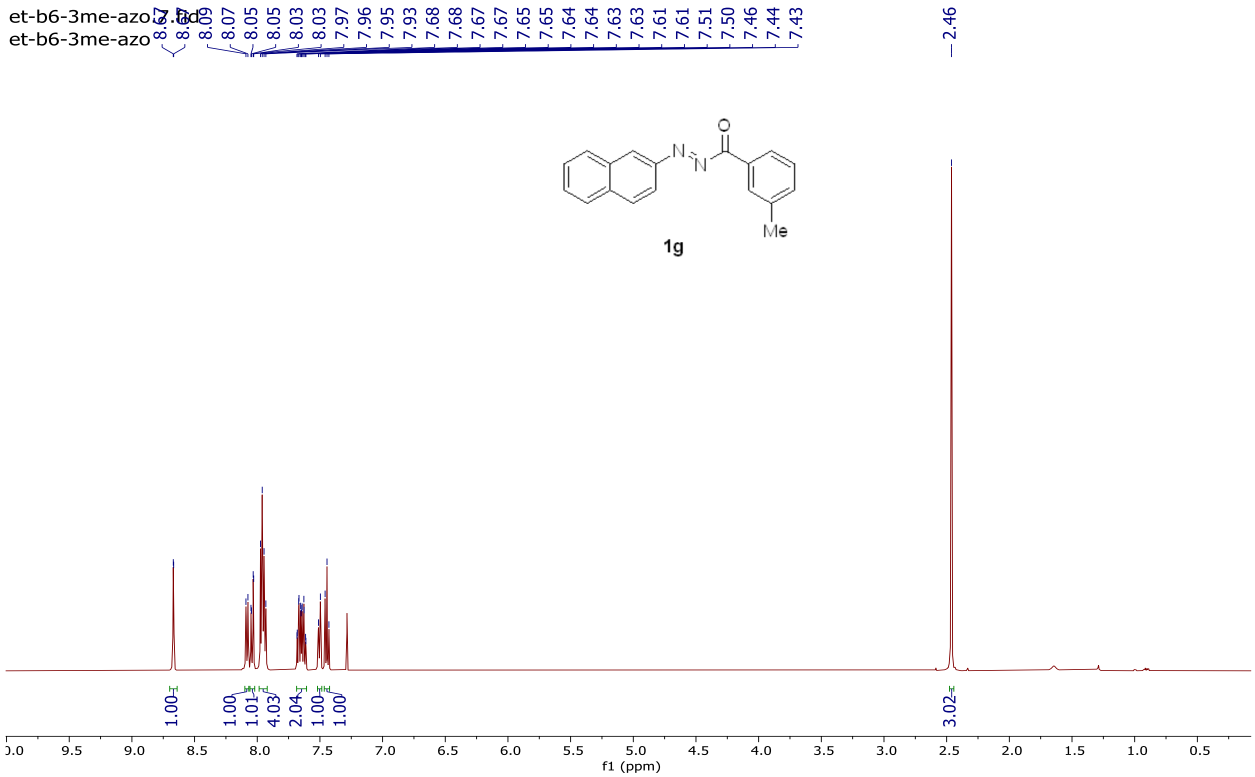
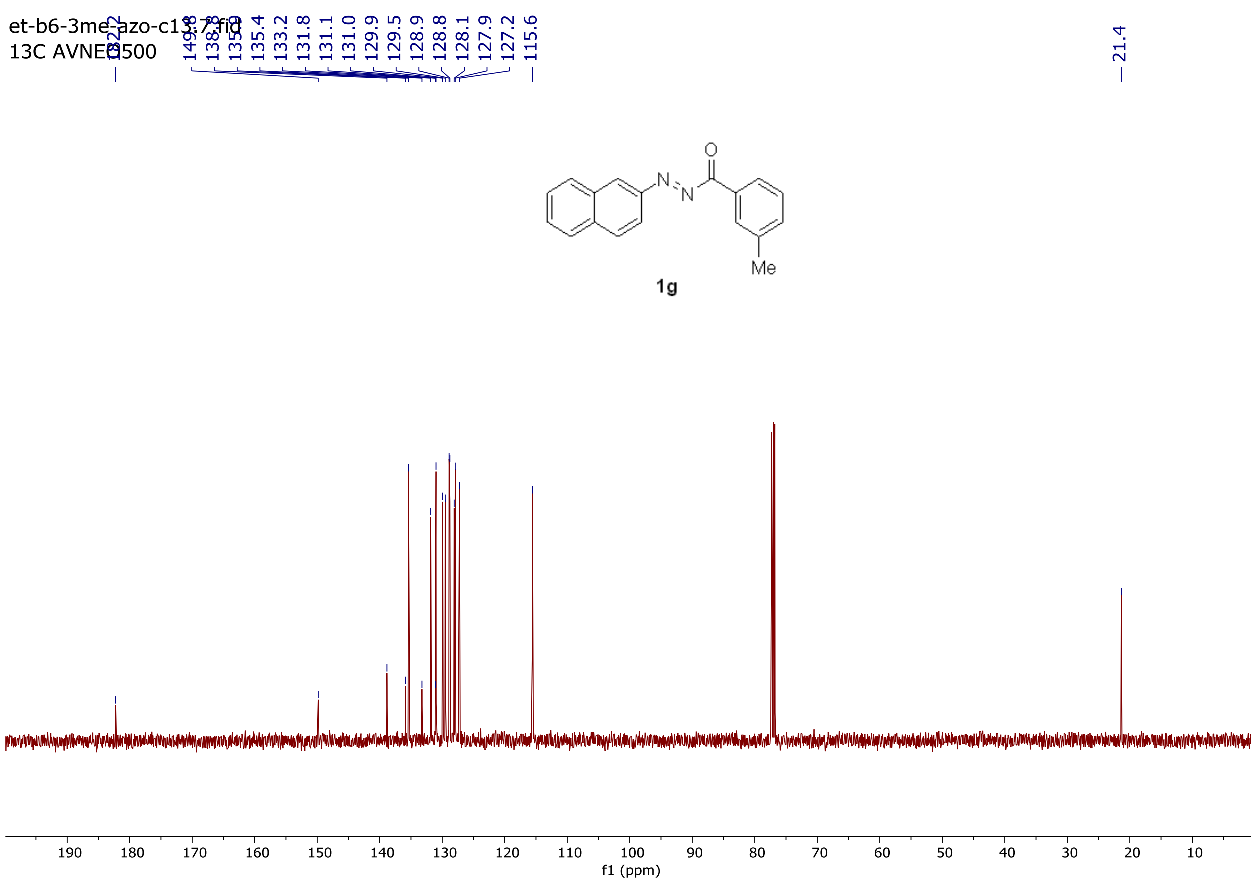
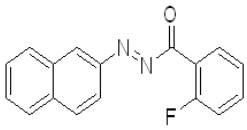
f1 (ppm)

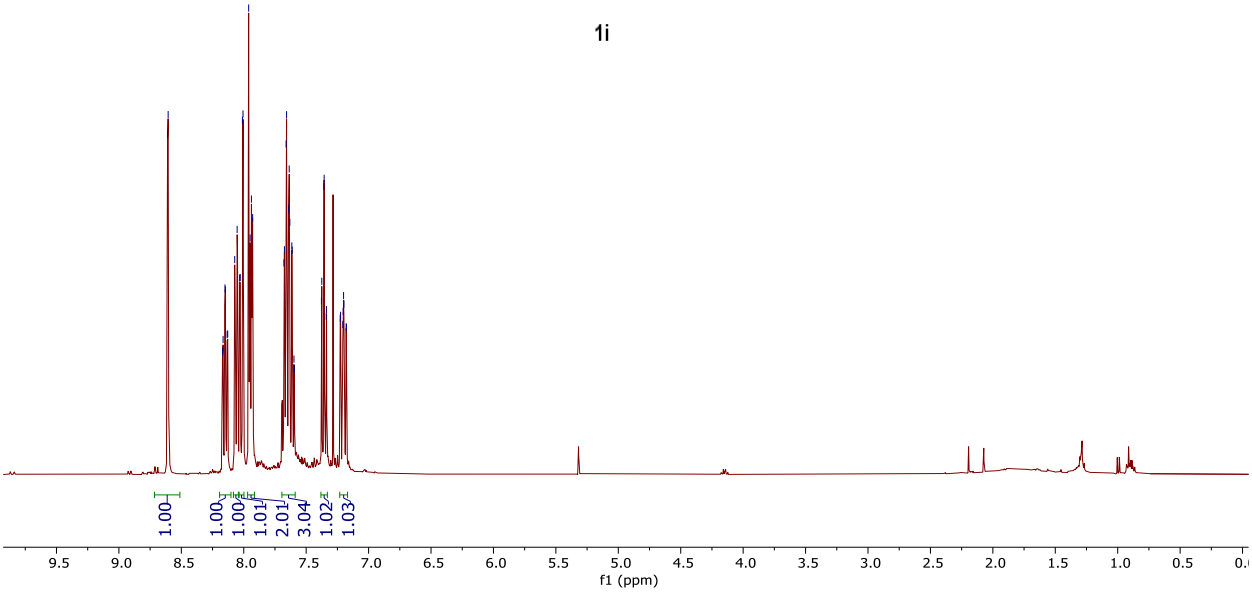

et-b6-3me-azo-7.fid
et-b6-3me-azo
8.67 8.09 8.07 8.05 8.05 8.03 8.03 7.97 7.96 7.95 7.93 7.68 7.68 7.67 7.67 7.65 7.65 7.64 7.64 7.63 7.63 7.61 7.61 7.51 7.50 7.46 7.44 7.43
2.46
N
N
O
Me
1g
1.00 1.00 1.01 4.03 2.04 1.00 1.00
3.02
f1 (ppm)


et-b6-3me-azo-c13-7.fid
13C AVNEO500
182.2
149.8 138.9 135.9 135.4 133.2 131.8 131.1 131.0 129.9 129.5 128.9 128.8 128.1 127.9 127.2 115.6
21.4
N
N
O
Me
1g
f1 (ppm)

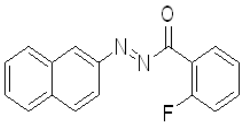
Aug23-2023-et-b6-2bzf-azo.10.fid
Aug23-2023-et-b6-2bzf-azo



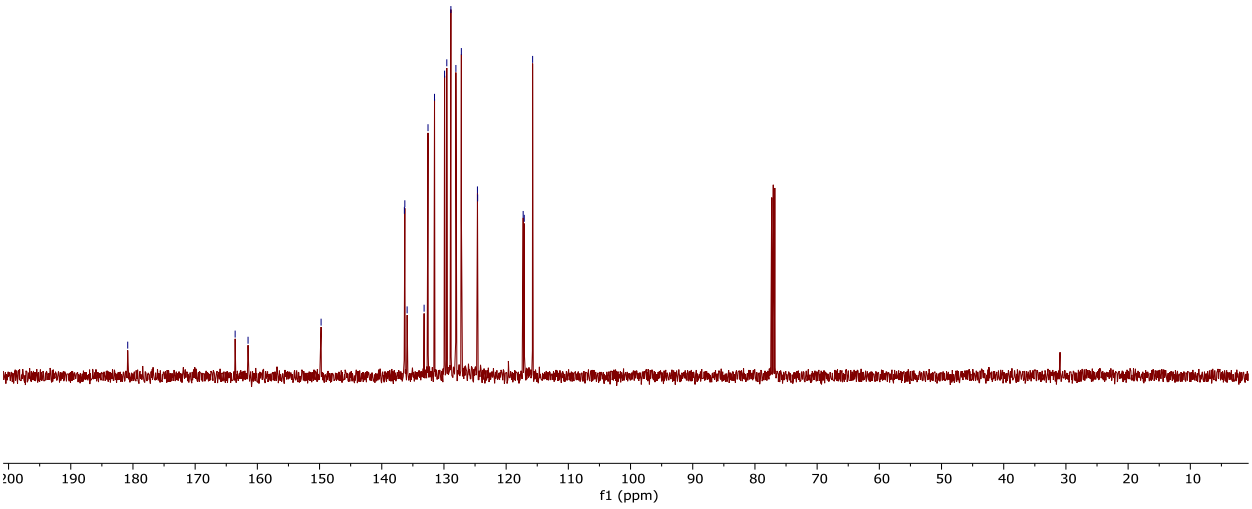
1i



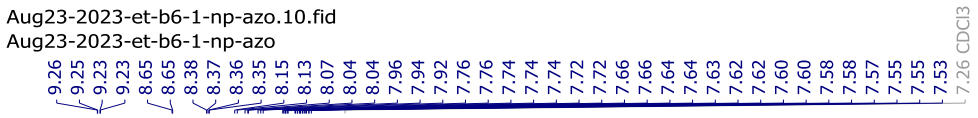
et-b6-2bzf-azo-c13.6.fid
et-b6-2bzf-azo-c13

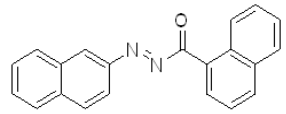


1i

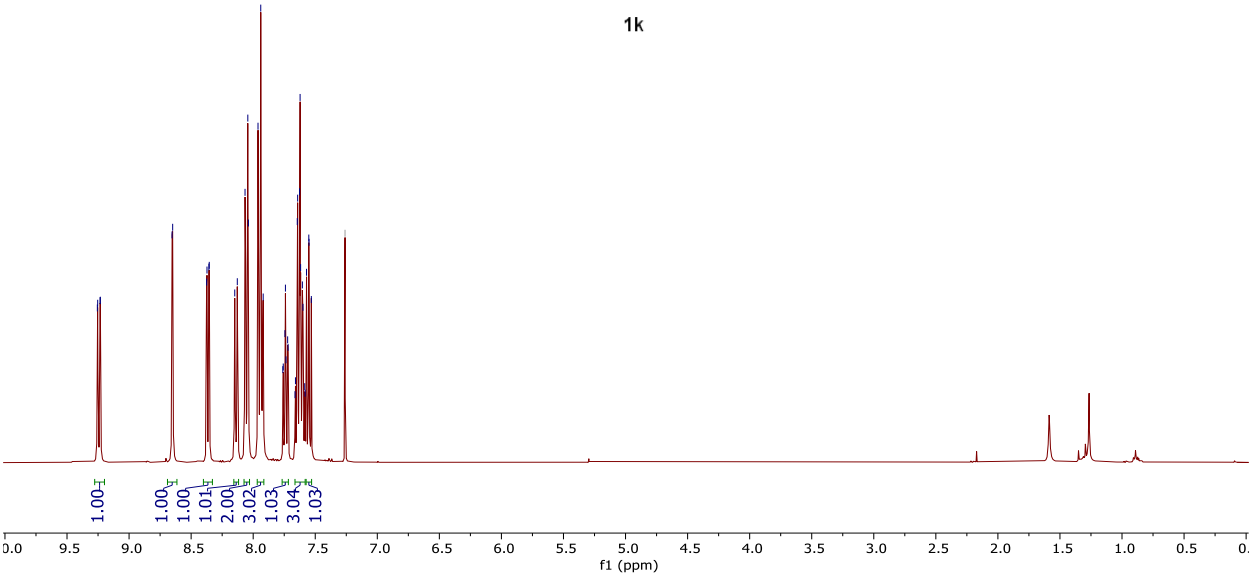


Aug23-2023-et-b6-1-np-azo.10.fid
Aug23-2023-et-b6-1-np-azo

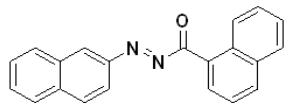




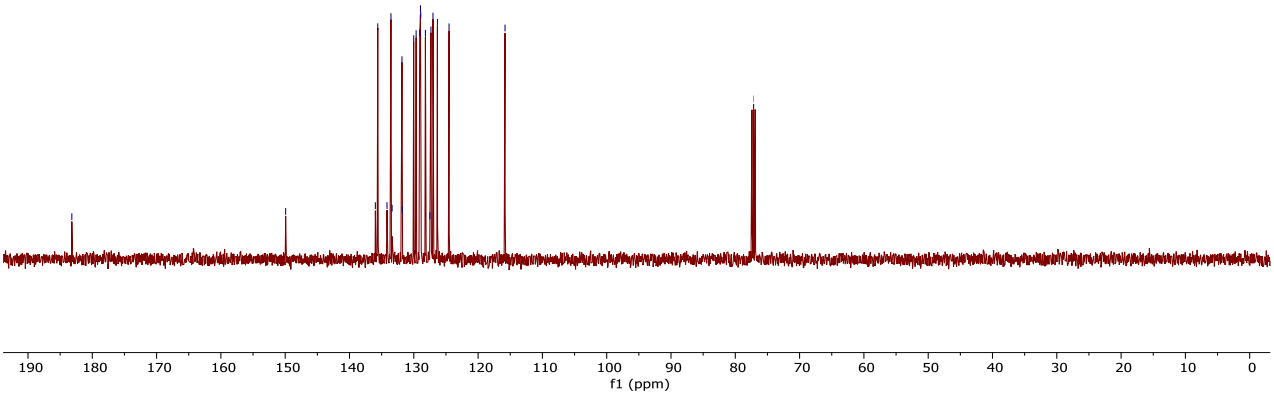
1k



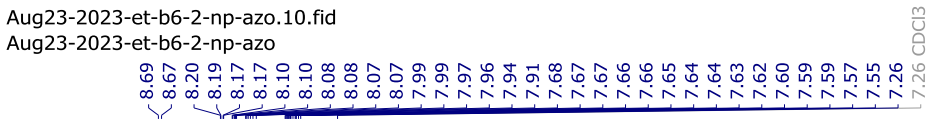
et-b6-1nph-azo-c13.6.fid
et-b6-1nph-azo-c13

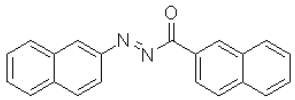


1k

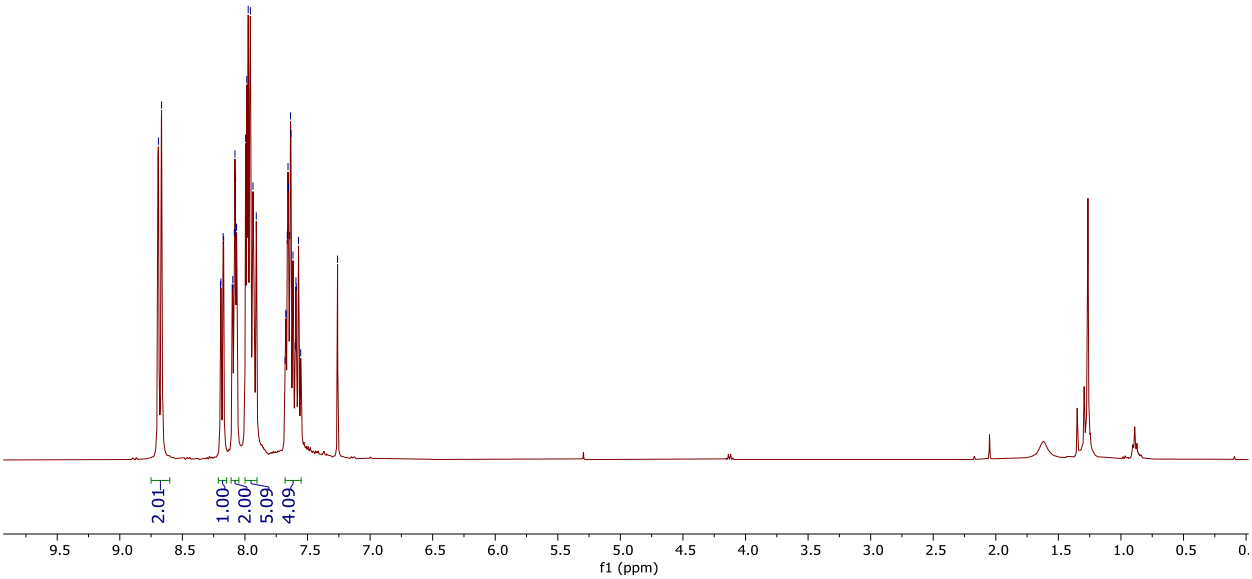


Aug23-2023-et-b6-2-np-azo.10.fid
Aug23-2023-et-b6-2-np-azo

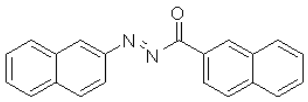




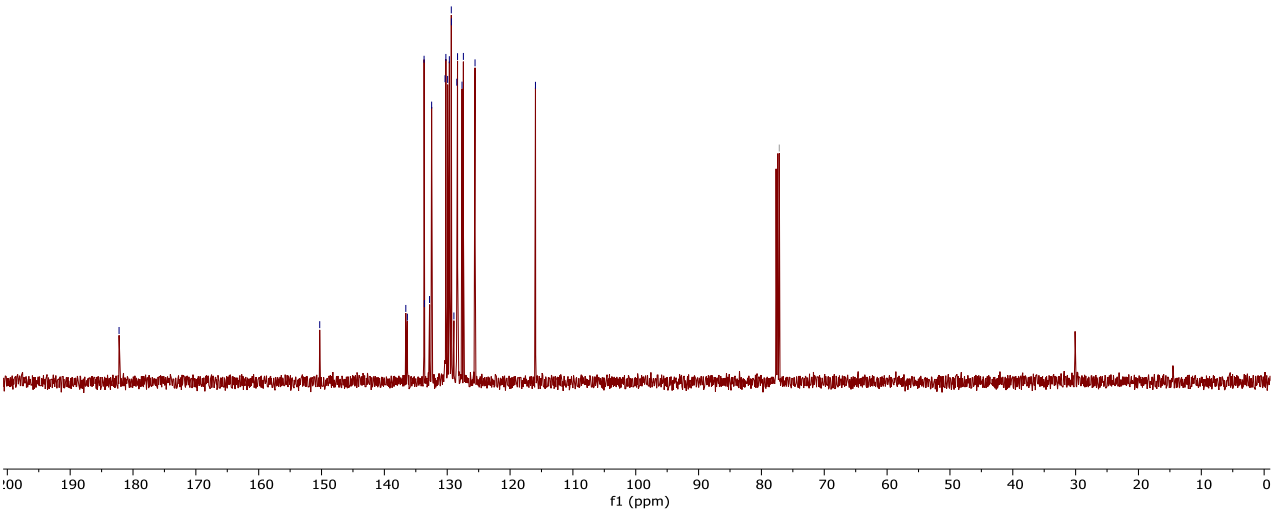
1l



et-b6-2nph-azo-c13.6.fid
et-b6-2nph-azo-c13

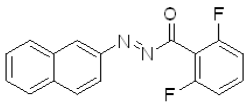


1l

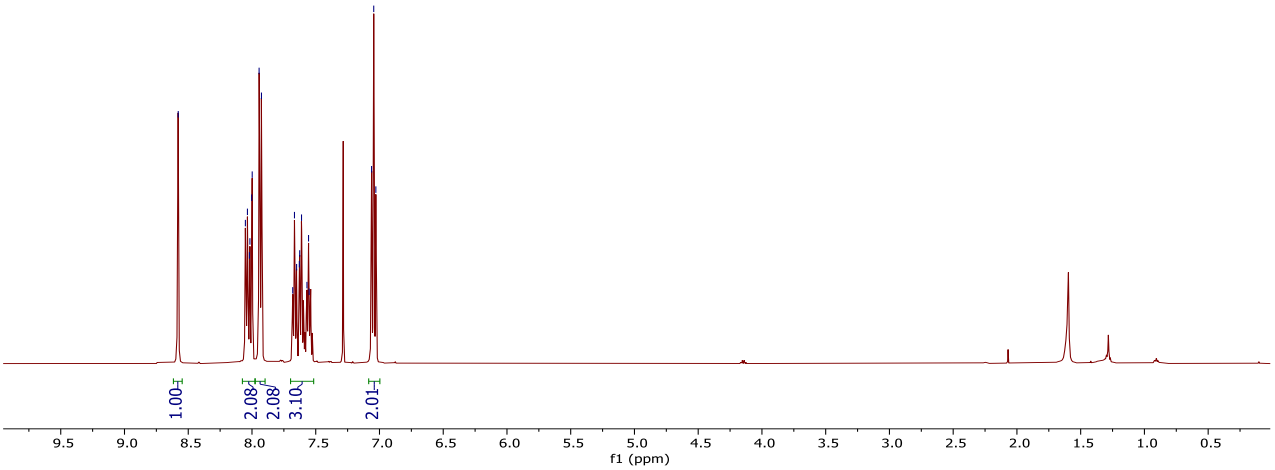


et-b6-rbzff-azo.6.fid
et-b6-rbzff-azo

8.41 8.04 8.04 8.02 8.02 8.00 8.00 7.94 7.93 7.68 7.67 7.65 7.63 7.63 7.61 7.57 7.56 7.55 7.06 7.04 7.03

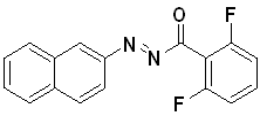


1m

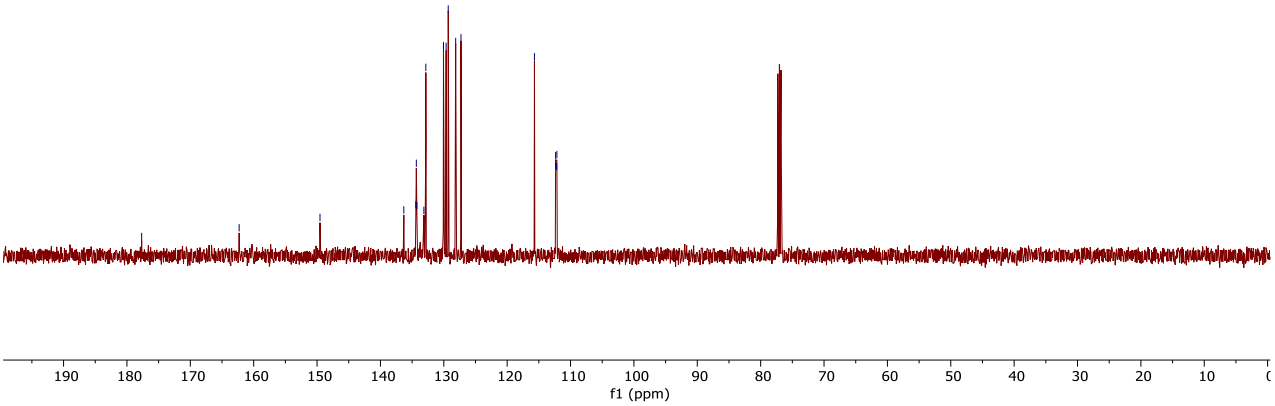


et-b6-rbzff-azo-c13.6.fid
et-b6-rbzff-azo-c13

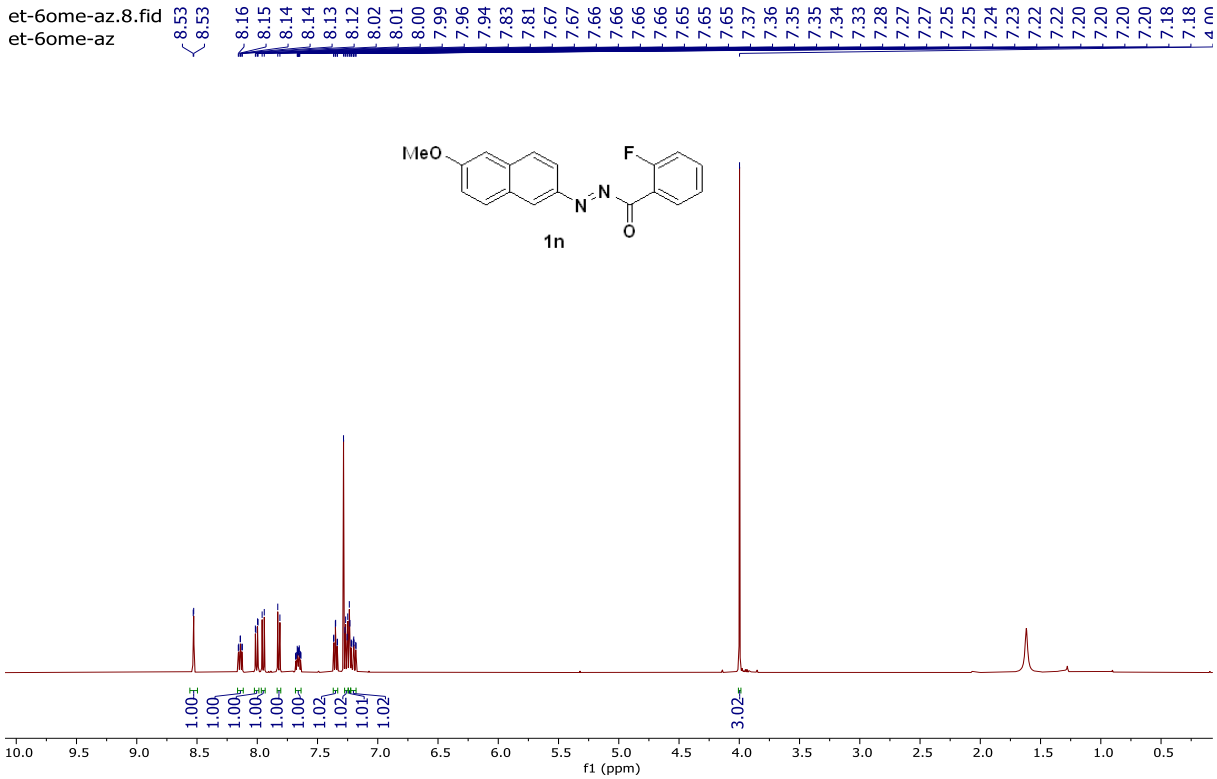
162.8 149.5 136.3 134.4 134.3 134.2 133.1 132.8 130.1 129.6 129.3 128.1 127.3 115.7 112.4 112.3 112.2 112.2



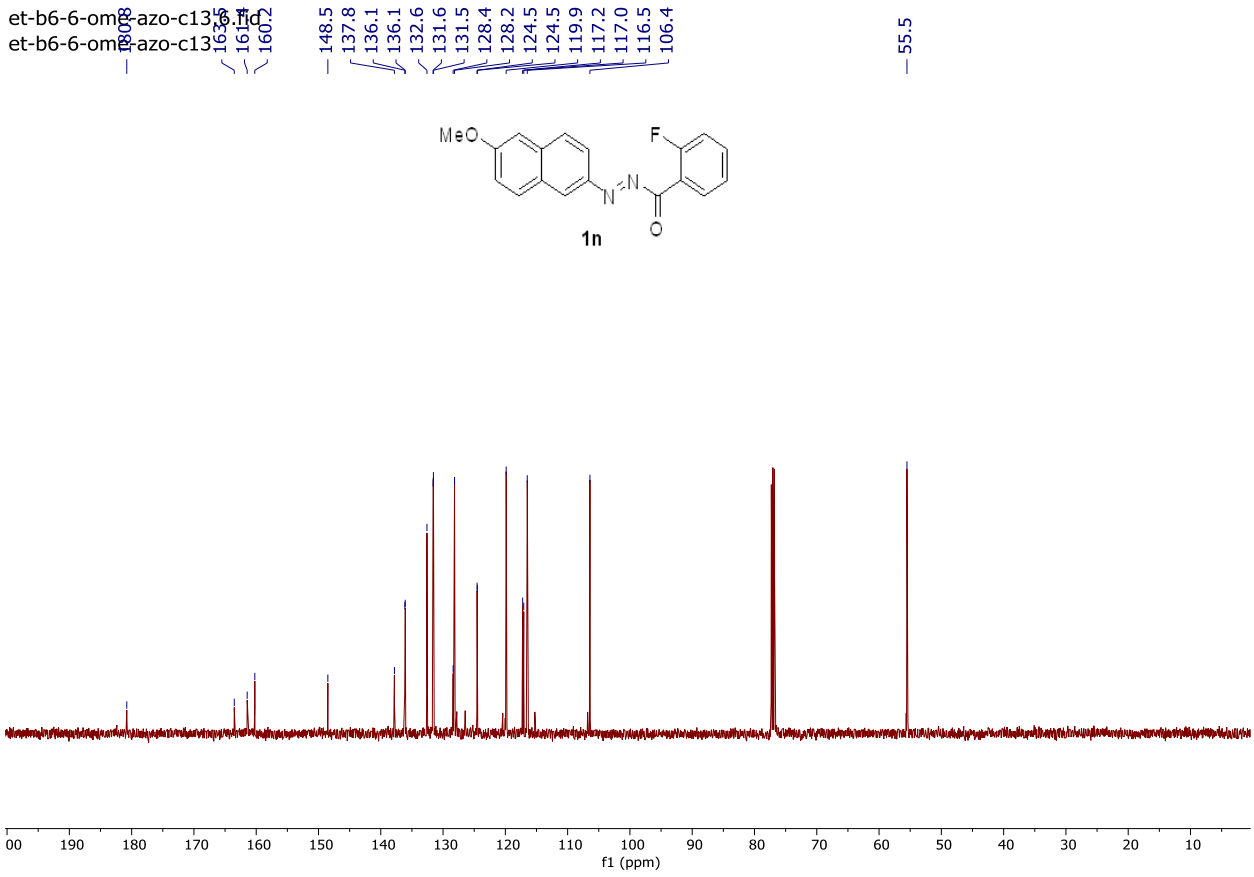
1m



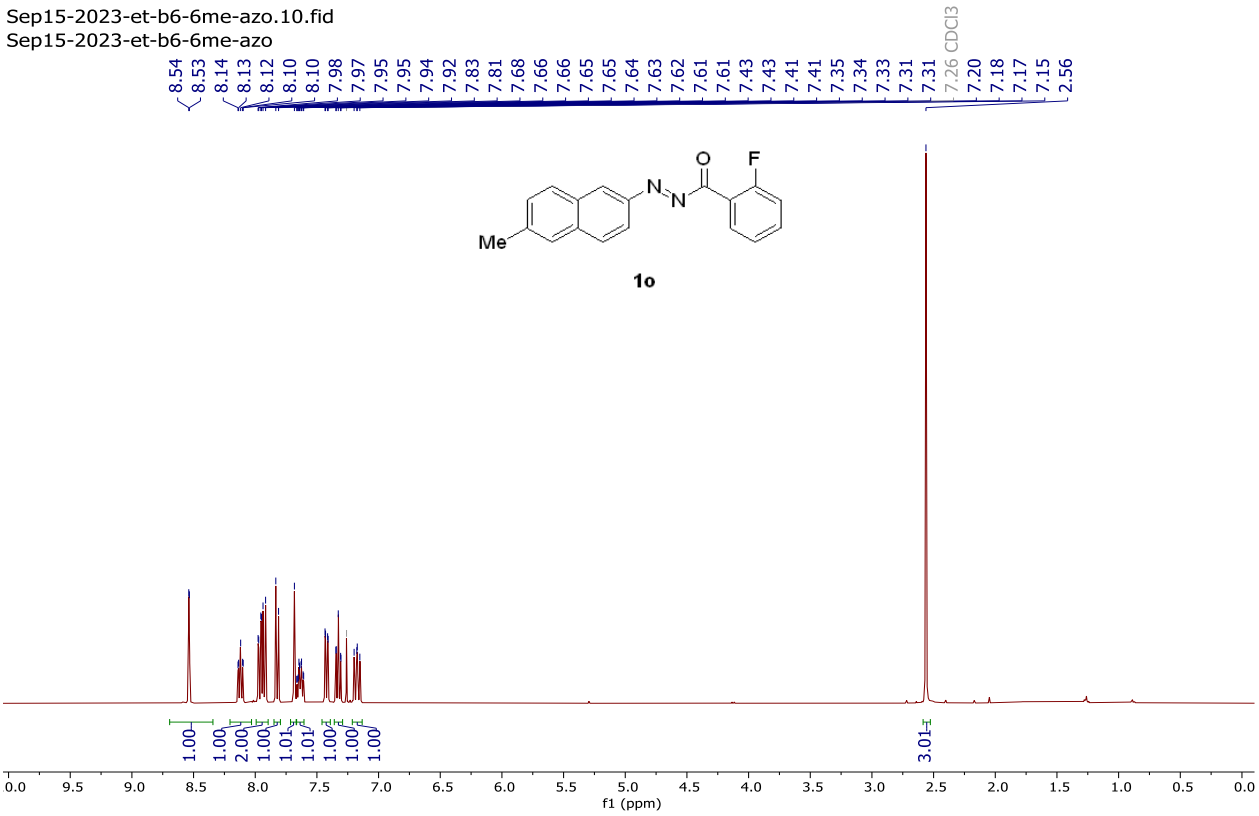
et-6ome-az.8.fid
et-6ome-az



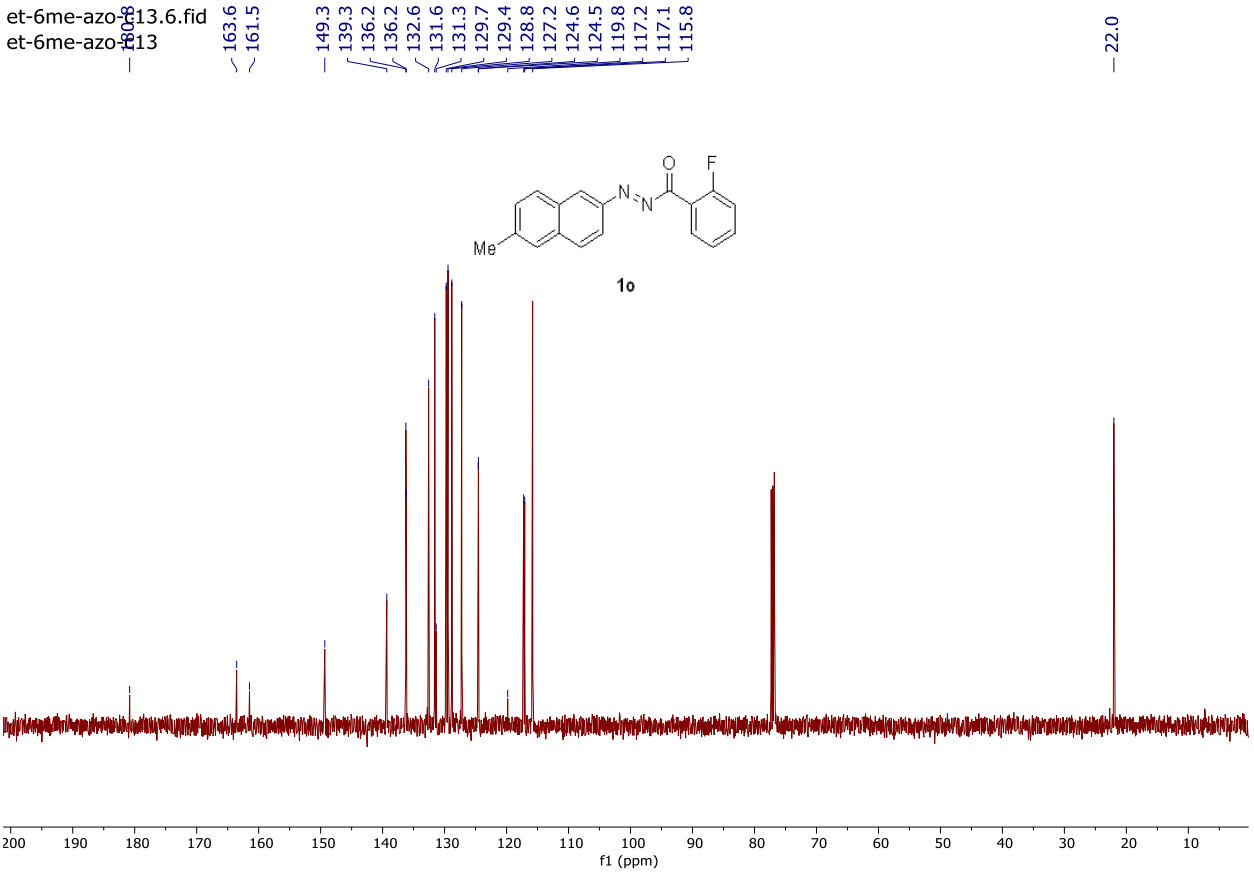
et-b6-6-ome-azo-c13-6.fid
et-b6-6-ome-azo-c13-6



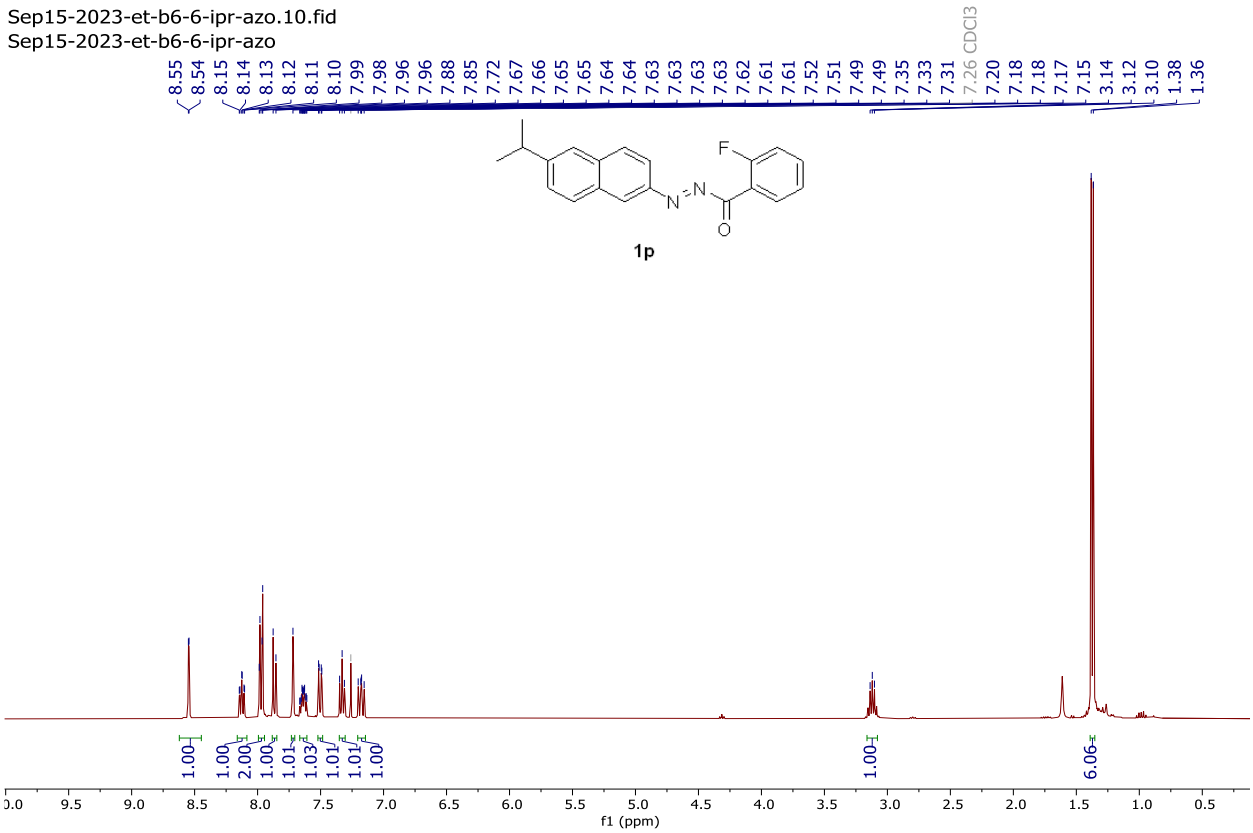
Sep15-2023-et-b6-6me-azo.10.fid
Sep15-2023-et-b6-6me-azo



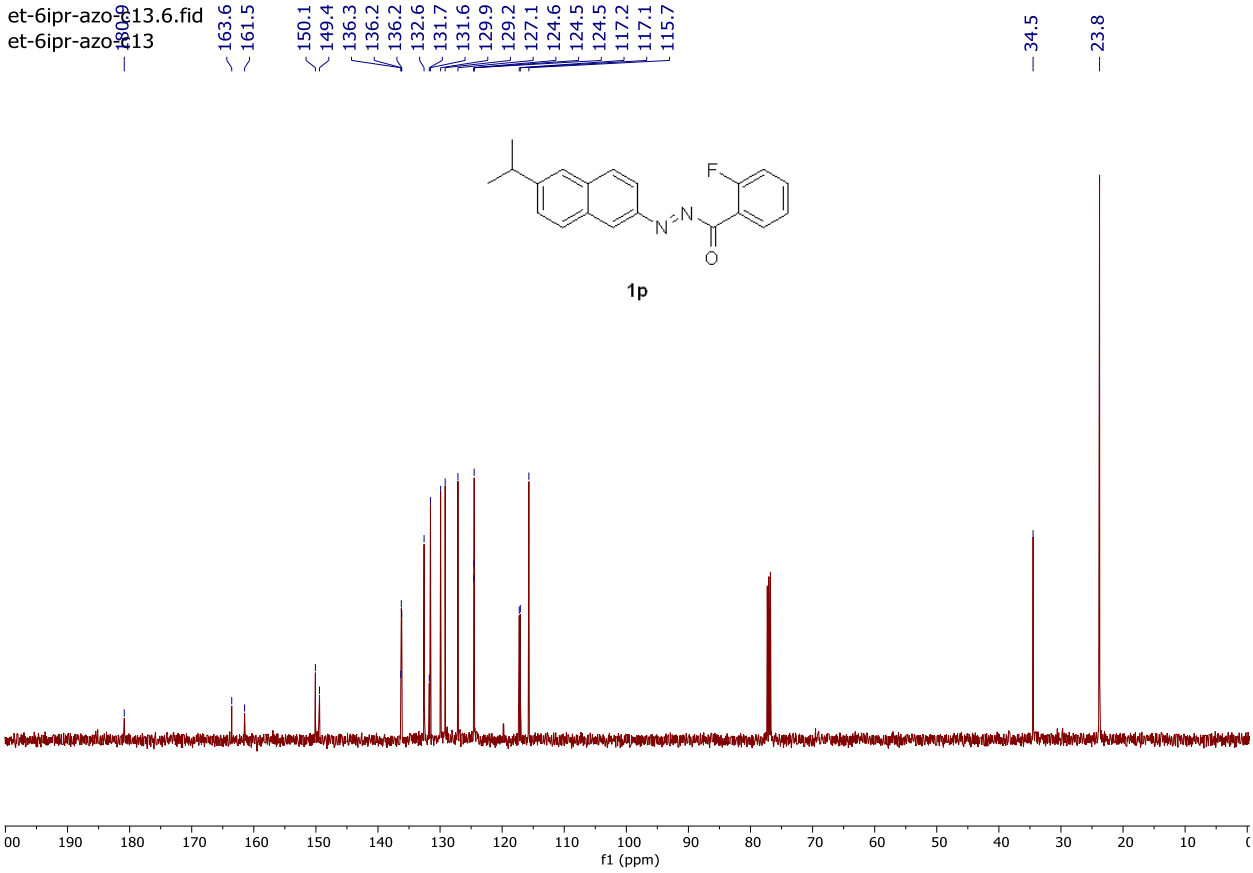
et-6me-azo-c13.6.fid
et-6me-azo-c13



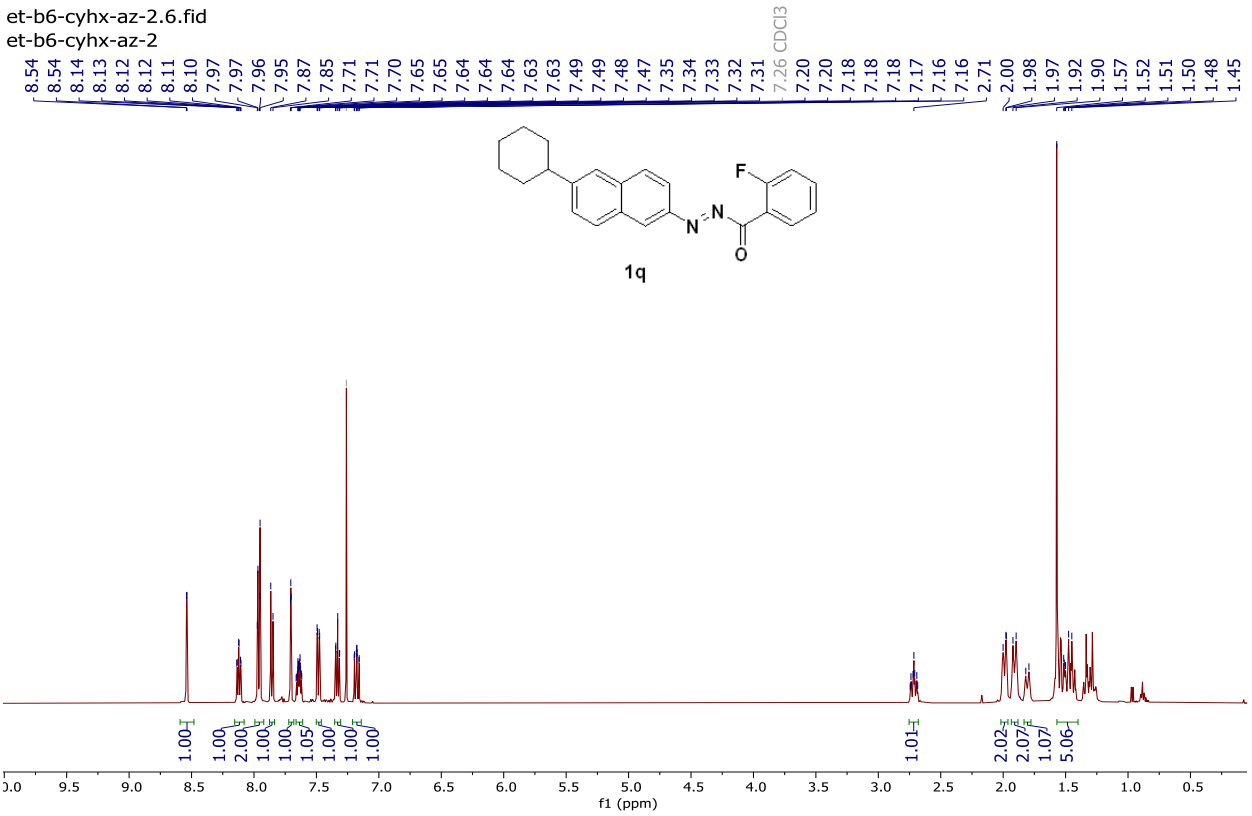
Sep15-2023-et-b6-6-ipr-azo.10.fid
Sep15-2023-et-b6-6-ipr-azo



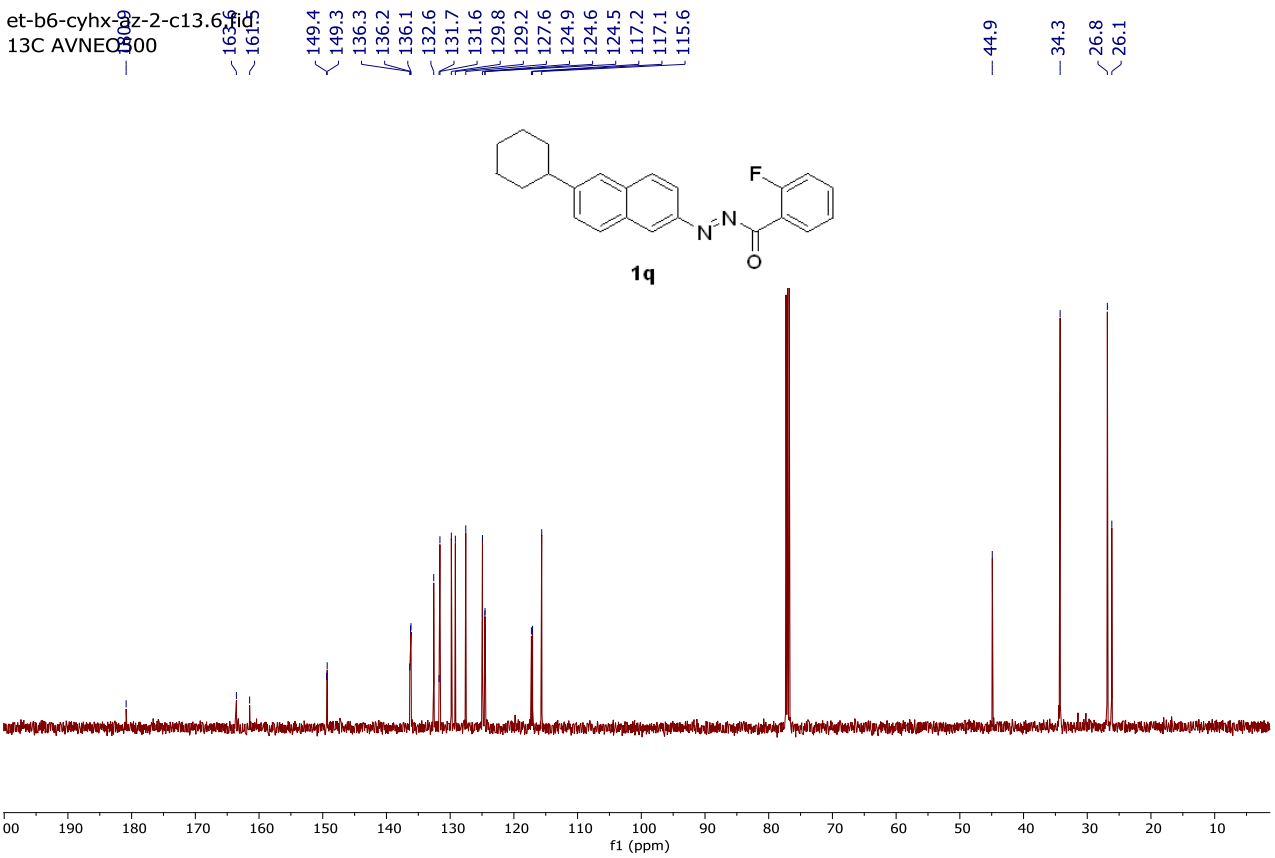
et-6ipr-azo-c13.6.fid
et-6ipr-azo-c13

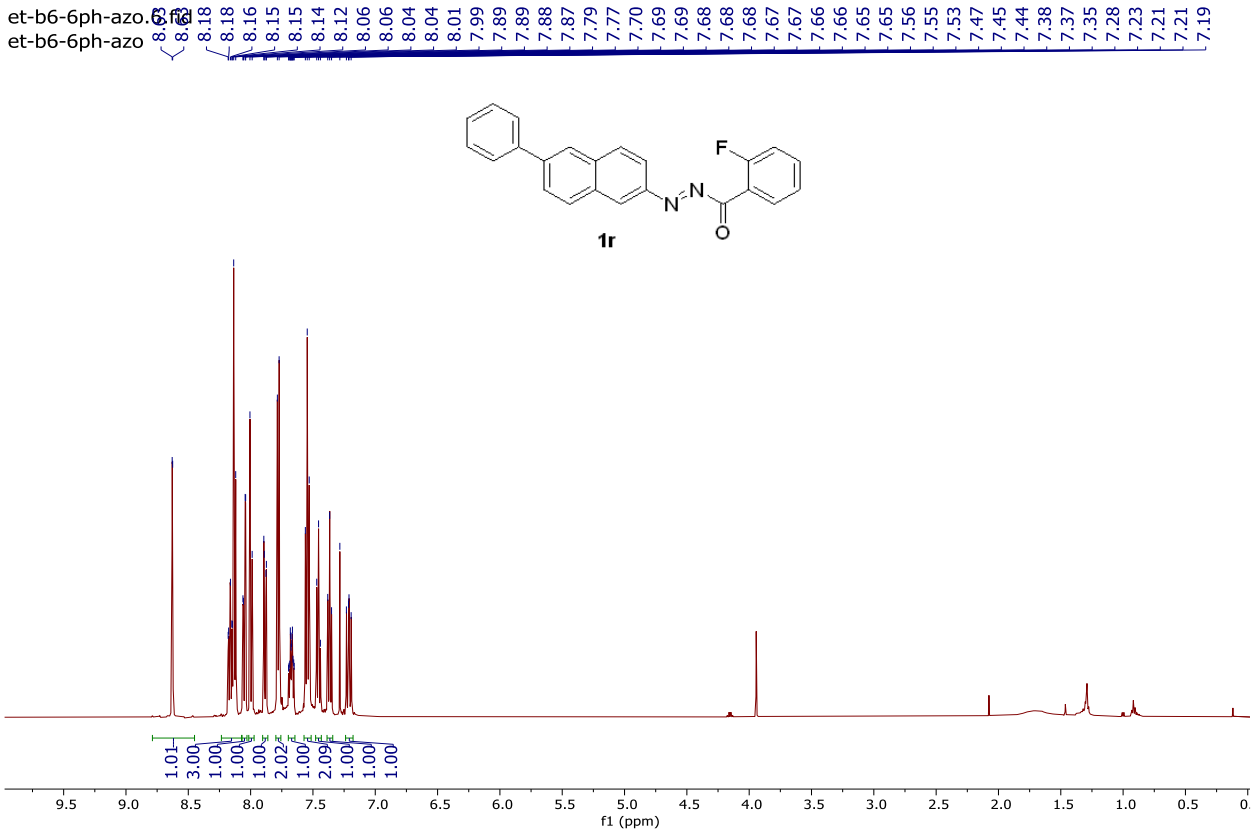


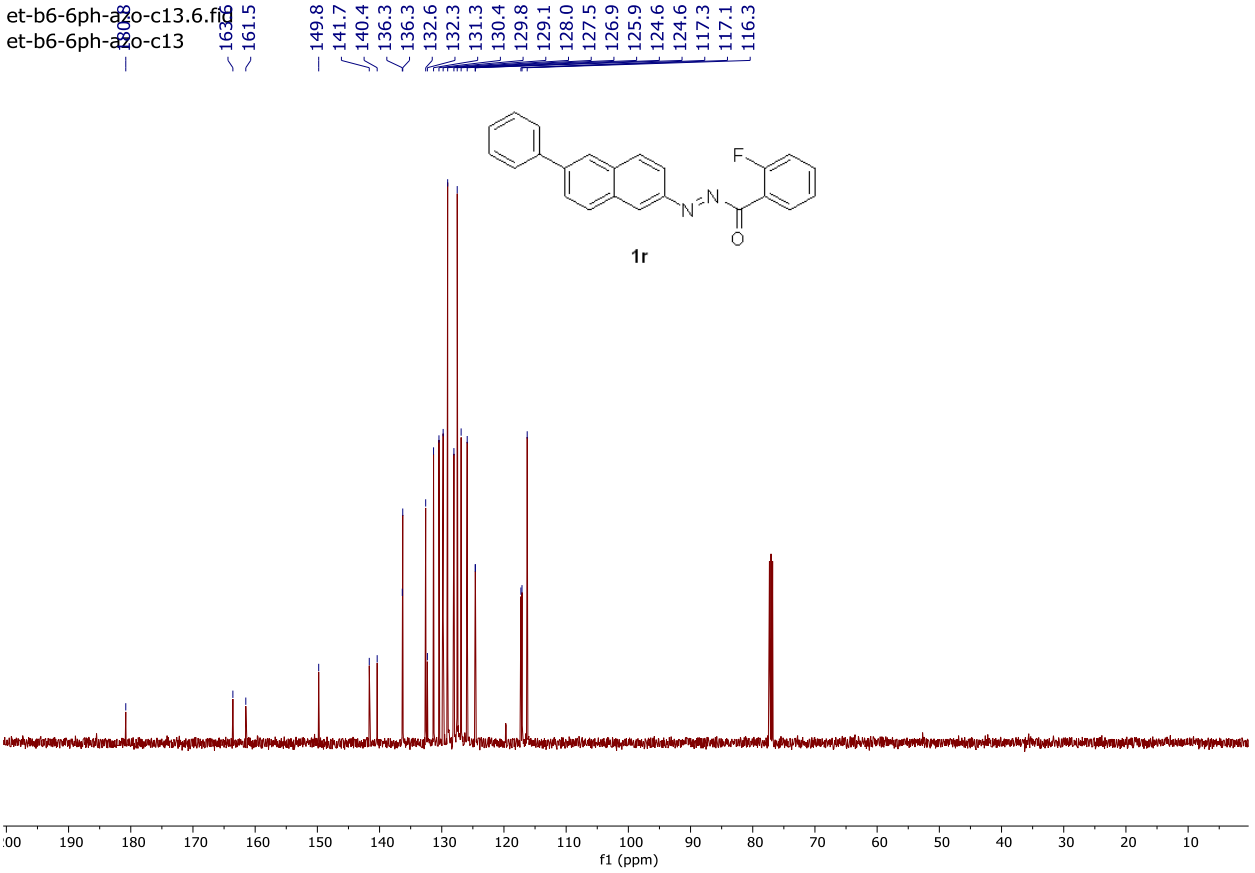
et-b6-cyhx-az-2.6.fid
et-b6-cyhx-az-2



et-b6-cyhx-az-2-c13.6.fid
13C AVNEO500




et-b6-6ph-azo.6.fid
et-b6-6ph-azo
8.18
8.16
8.15
8.15
8.14
8.12
8.06
8.06
8.04
8.04
8.01
7.99
7.89
7.89
7.88
7.87
7.79
7.77
7.70
7.69
7.69
7.68
7.68
7.68
7.67
7.67
7.66
7.66
7.65
7.65
7.56
7.55
7.53
7.47
7.45
7.44
7.38
7.37
7.35
7.28
7.23
7.21
7.21
7.19
F
N
N
O
1r
1.01
3.00
1.00
1.00
1.00
2.02
1.00
2.09
1.00
1.00
1.00
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)


et-b6-6ph-azo-c13.6.fid
et-b6-6ph-azo-c13
163.8
161.5
149.8
141.7
140.4
136.3
136.3
132.6
132.3
131.3
130.4
129.8
129.1
128.0
127.5
126.9
125.9
124.6
124.6
117.3
117.1
116.3
F
N
N
O
1r
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)


Sep15-2023-et-b6-6br-az.10.fid
Sep15-2023-et-b6-6br-az
7.81
7.77
7.75
7.60
7.60
7.58
7.58
7.57
7.57
7.56
7.28
7.28
7.26
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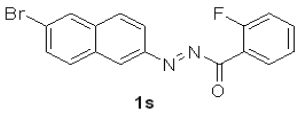
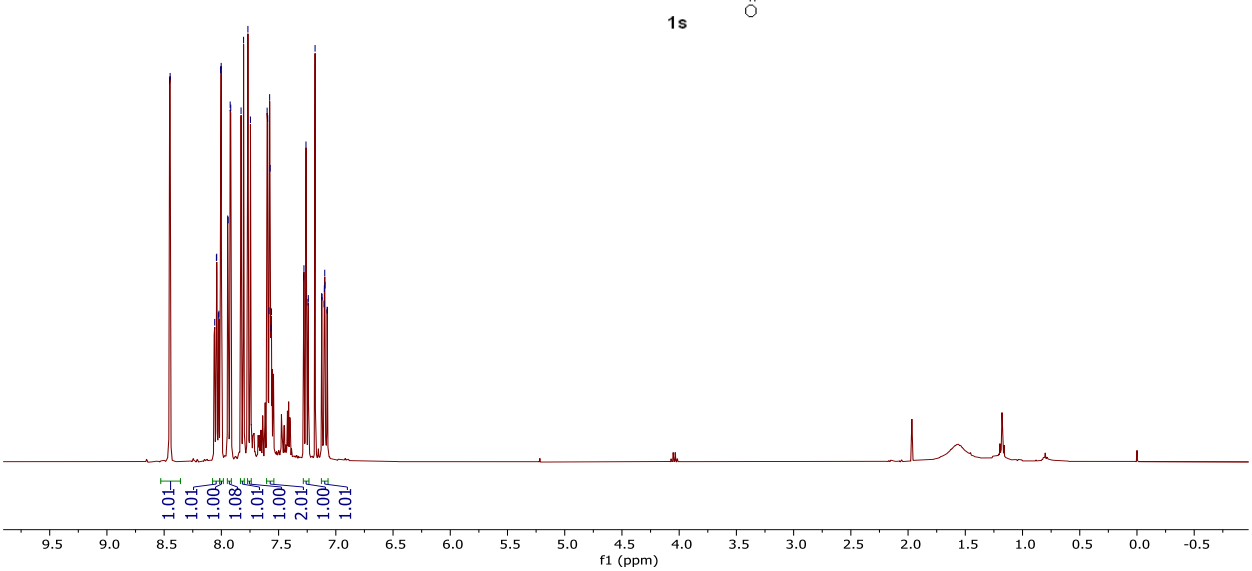
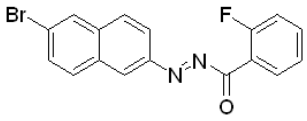
7.10
7.10
7.10
7.09
7.08
7.07


Br
F
N
N
O

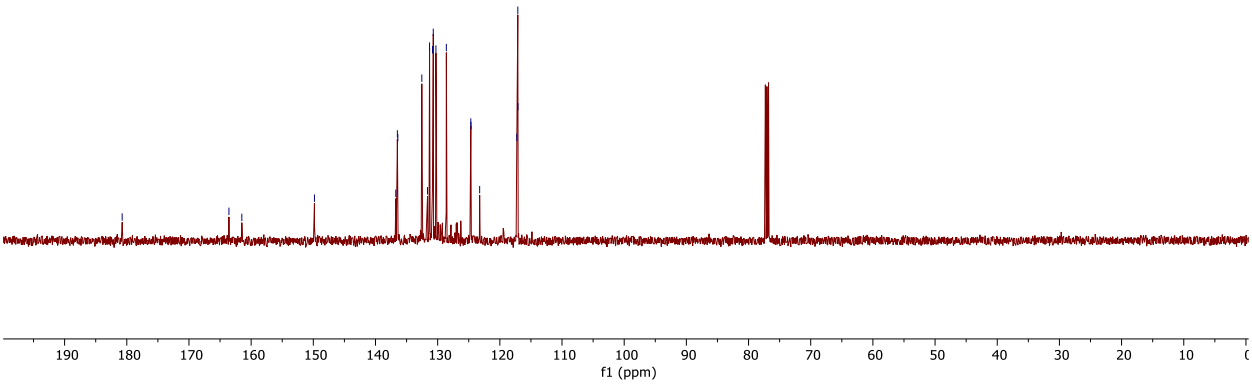
1s


1.01
1.01
1.00
1.08
1.01
1.00
2.01
1.00
1.01
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)

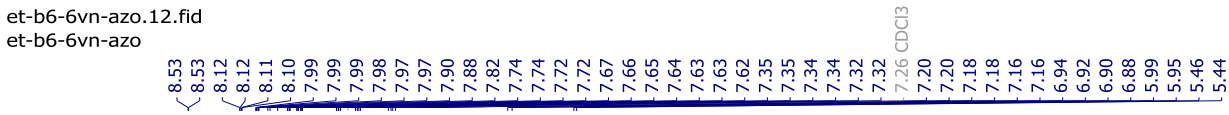

et-b6-6br-azo-c13.6.fid
et-b6-6br-azo-c13
163.6
161.5
149.8
136.7
136.5
136.4
132.5
131.6
131.3
130.8
130.7
130.3
128.6
124.7
124.6
123.2
117.3
117.1
117.1

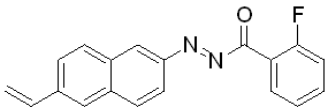

Br
F
N
N
O

1s

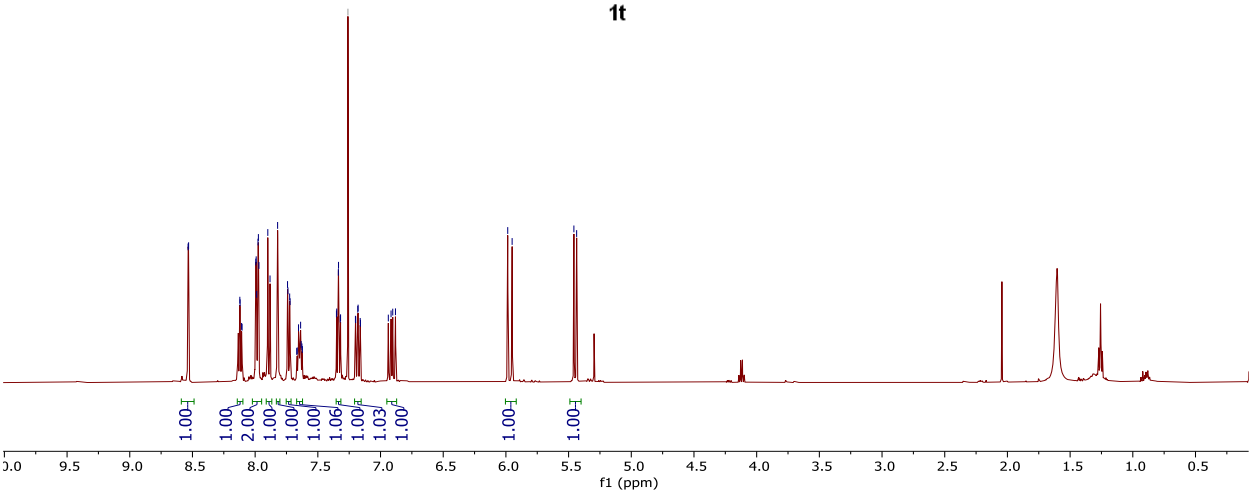

190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

et-b6-6vn-azo.12.fid
et-b6-6vn-azo

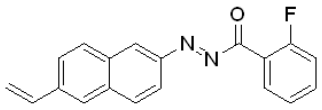




1t

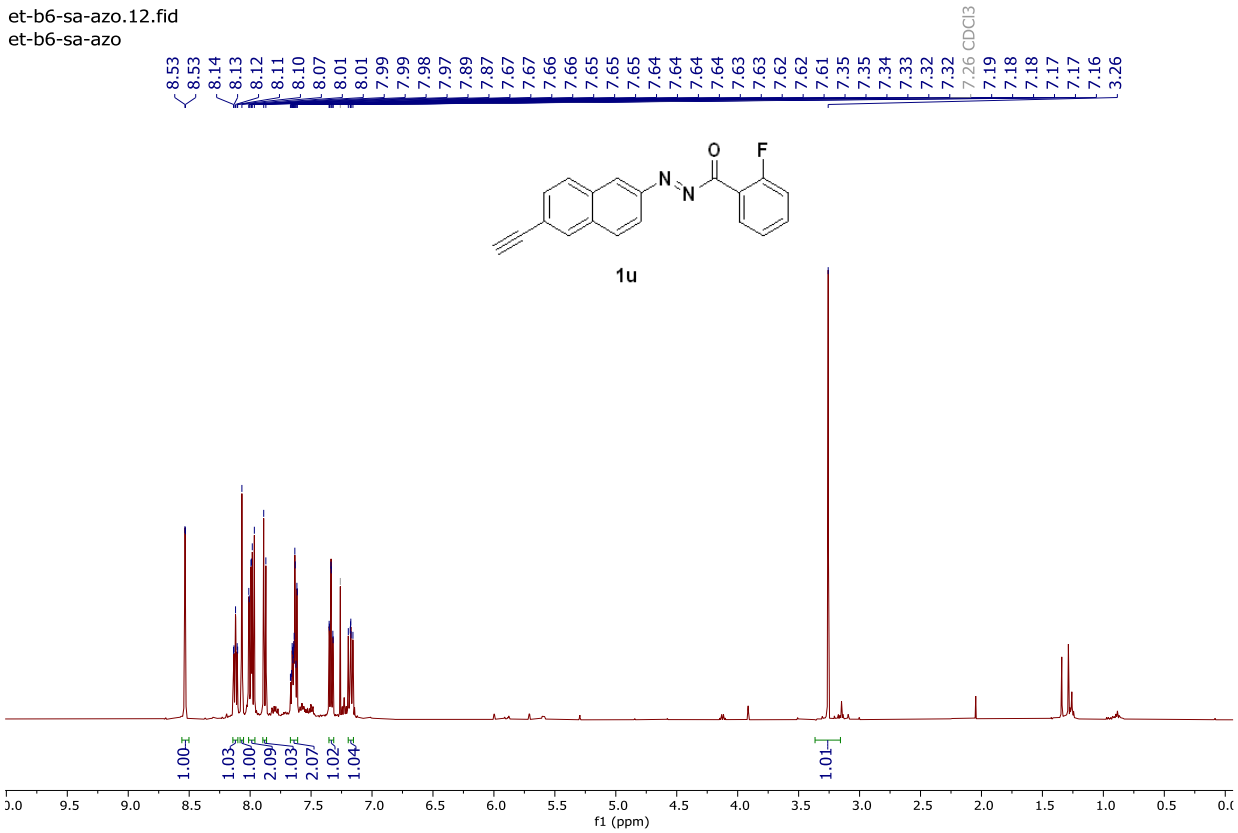


et-b6-6vin-azo-c13-2.7.fid
13C AVNEO500

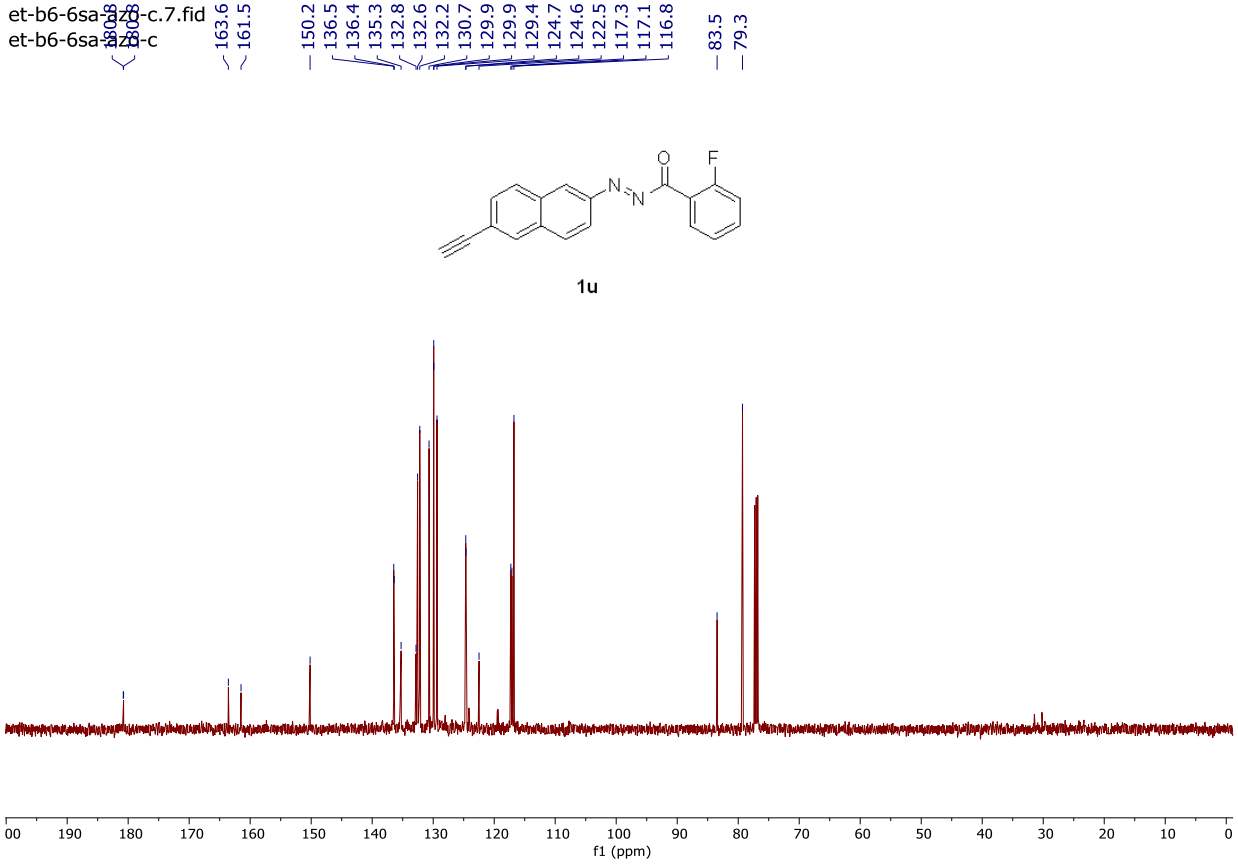


1t

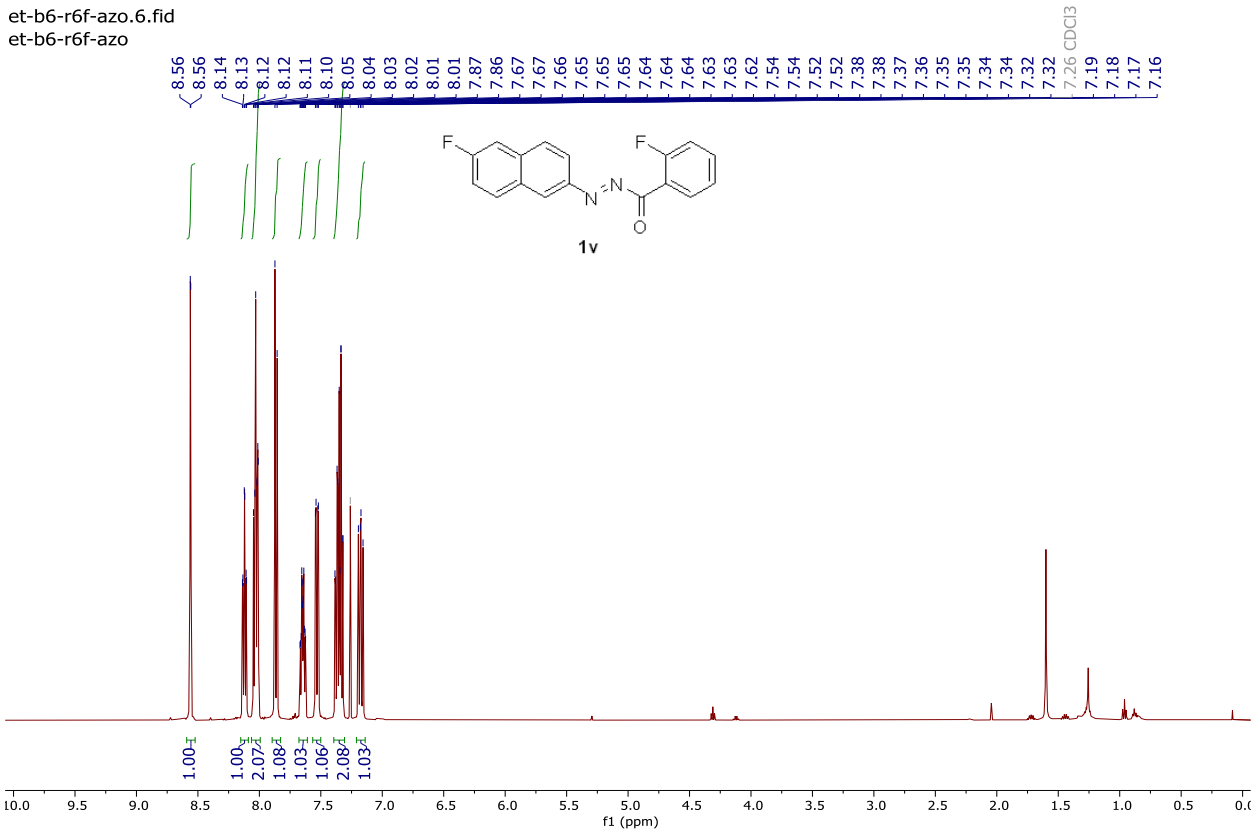
et-b6-sa-azo.12.fid
et-b6-sa-azo



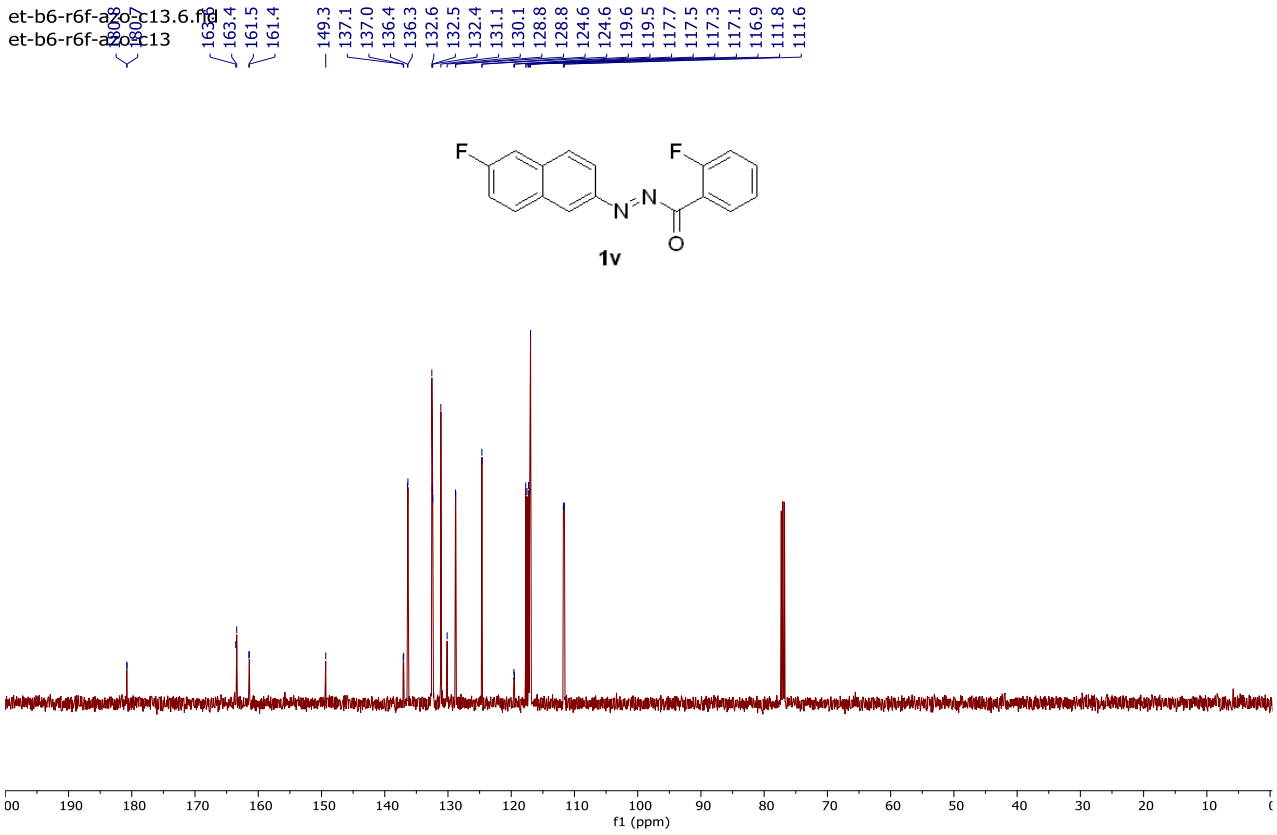
et-b6-6sa-azo-c.7.fid
et-b6-6sa-azo-c



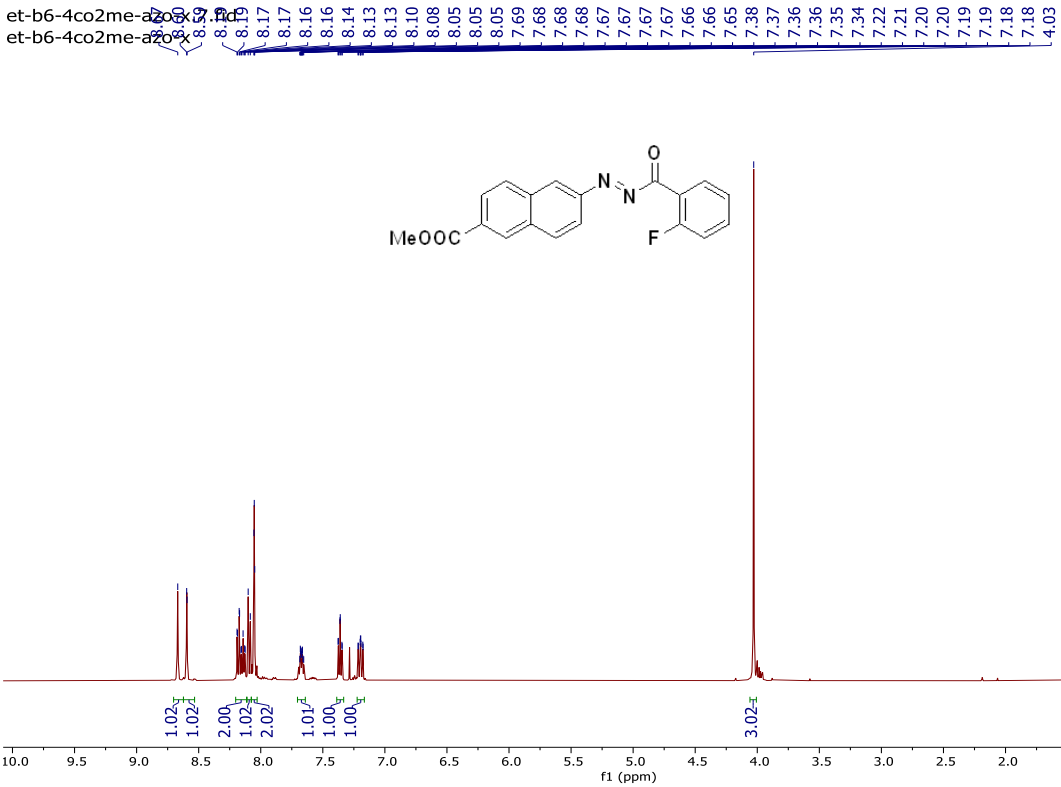
et-b6-r6f-azo.6.fid
et-b6-r6f-azo



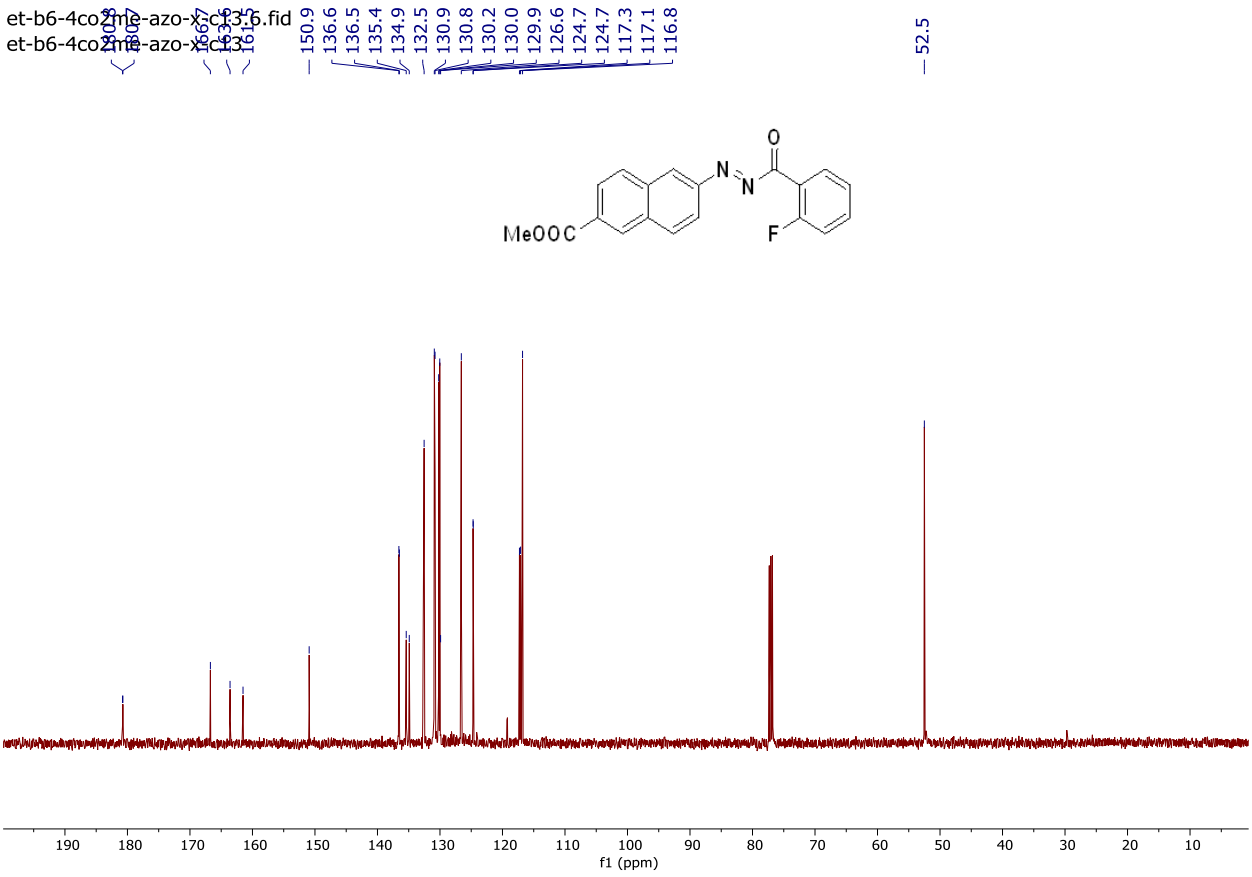
et-b6-r6f-azo-c13.6.fid
et-b6-r6f-azo-c13



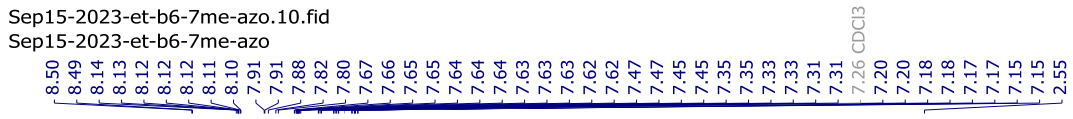
et-b6-4co2me-azo-x-7.fid
et-b6-4co2me-azo-x

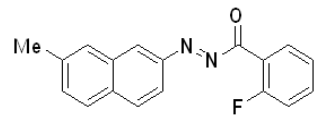


et-b6-4co2me-azo-x-c13-6.fid
et-b6-4co2me-azo-x-c13



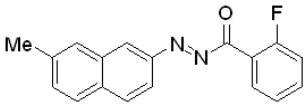
Sep15-2023-et-b6-7me-azo.10.fid
Sep15-2023-et-b6-7me-azo



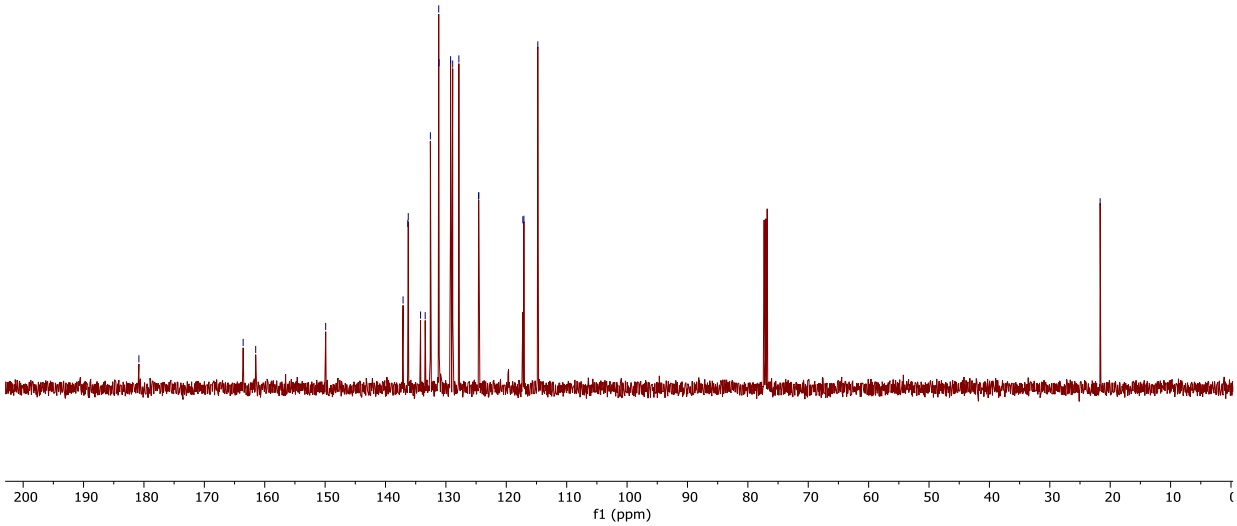


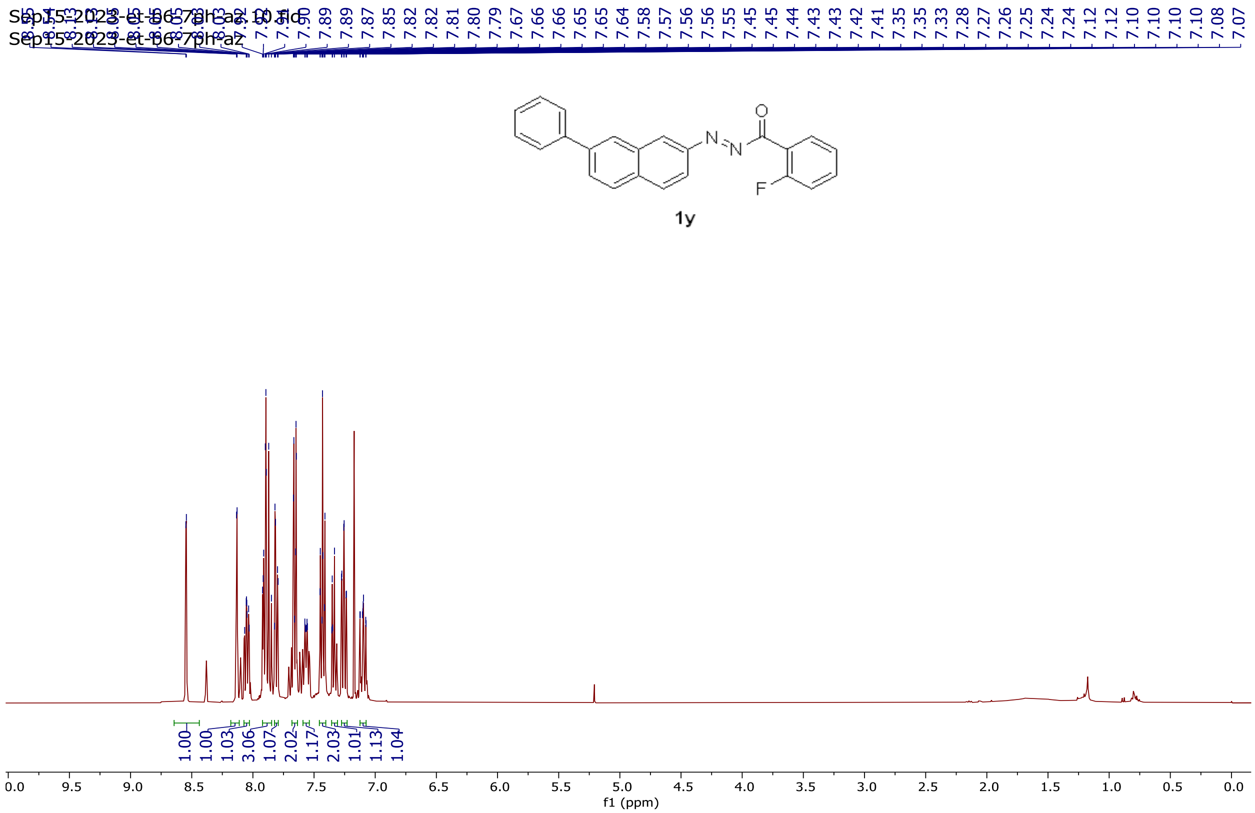
1x

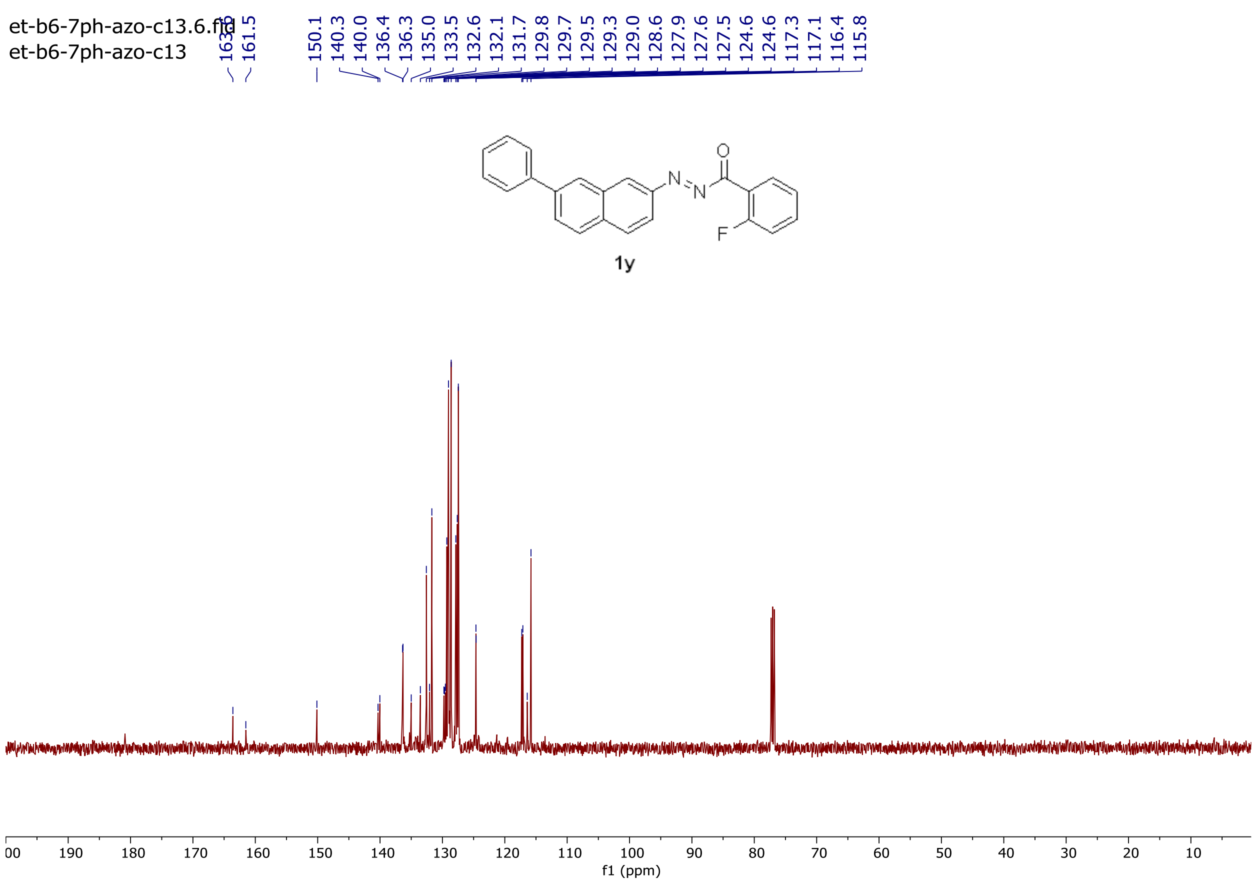
et-7me-aa-azo-c13.6.fid
et-7me-aa-azo-c13

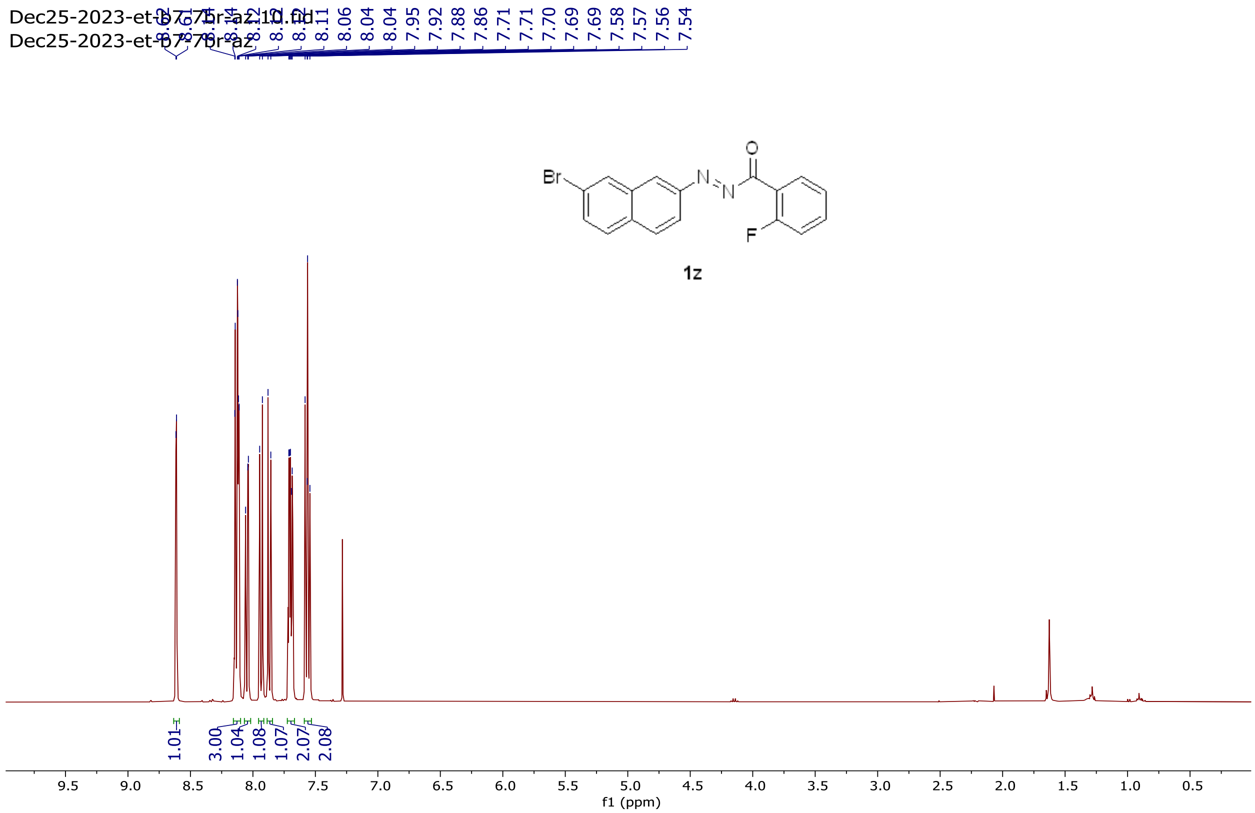


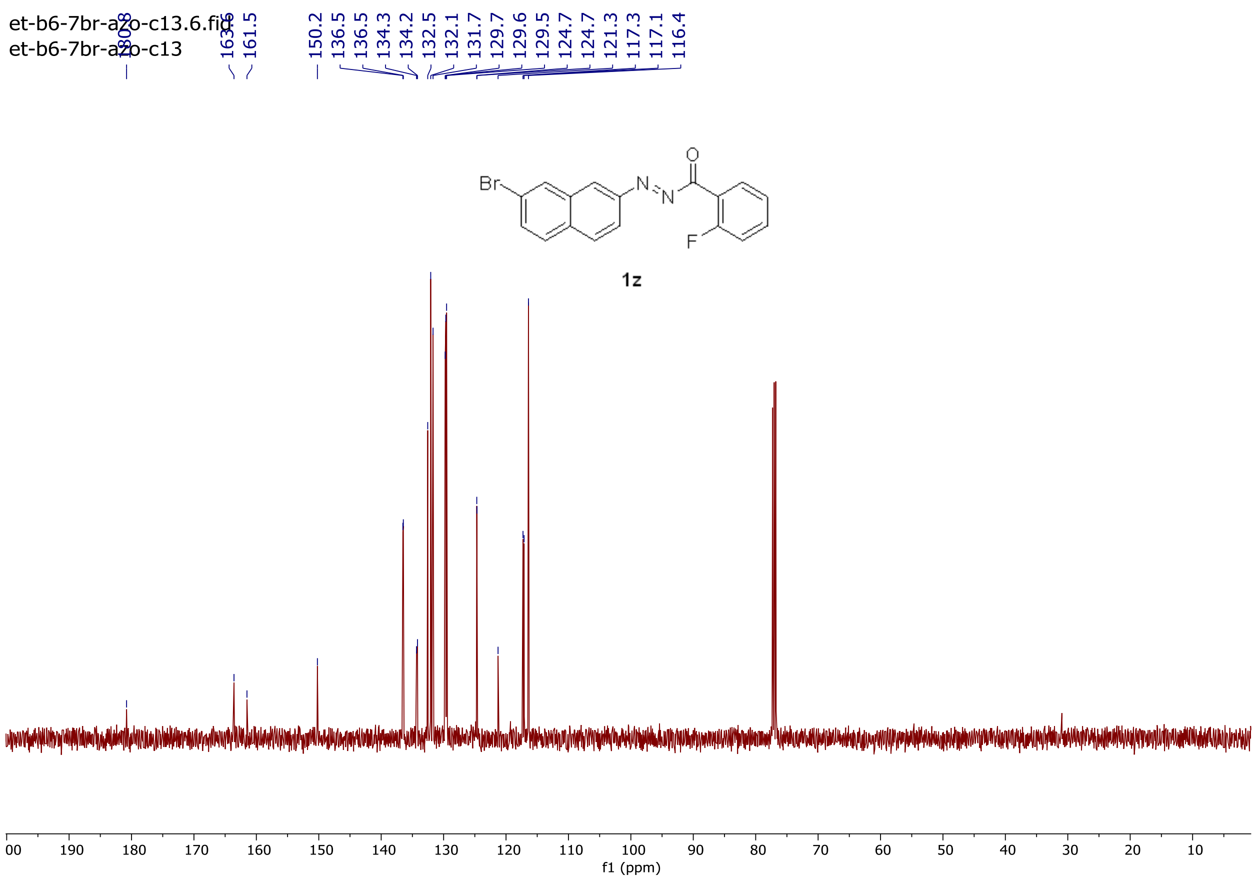
1x




7.90
7.89
7.89
7.87
7.85
7.82
7.81
7.80
7.79
7.67
7.66
7.66
7.65
7.65
7.64
7.58
7.57
7.56
7.56
7.55
7.45
7.45
7.44
7.43
7.43
7.42
7.41
7.35
7.35
7.33
7.28
7.27
7.26
7.25
7.24
7.24
7.12
7.12
7.10
7.10
7.10
7.10
7.08
7.07
1y
1.00
1.00
1.03
3.06
1.07
2.02
1.17
2.03
1.01
1.13
1.04
f1 (ppm)

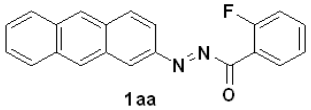

et-b6-7ph-azo-c13.6.fid
et-b6-7ph-azo-c13
161.5
150.1
140.3
140.0
136.4
136.3
135.0
133.5
132.6
132.1
131.7
129.8
129.7
129.5
129.3
129.0
128.6
127.9
127.6
127.5
124.6
124.6
117.3
117.1
116.4
115.8
1y
f1 (ppm)


Dec25-2023-et-b7-7br-az.10.fid
Dec25-2023-et-b7-7br-az
8.06
8.04
8.04
7.95
7.92
7.88
7.86
7.71
7.71
7.70
7.69
7.69
7.58
7.57
7.56
7.54
Br
N
N
O
F
1z
1.01
3.00
1.04
1.08
1.07
2.07
2.08
f1 (ppm)

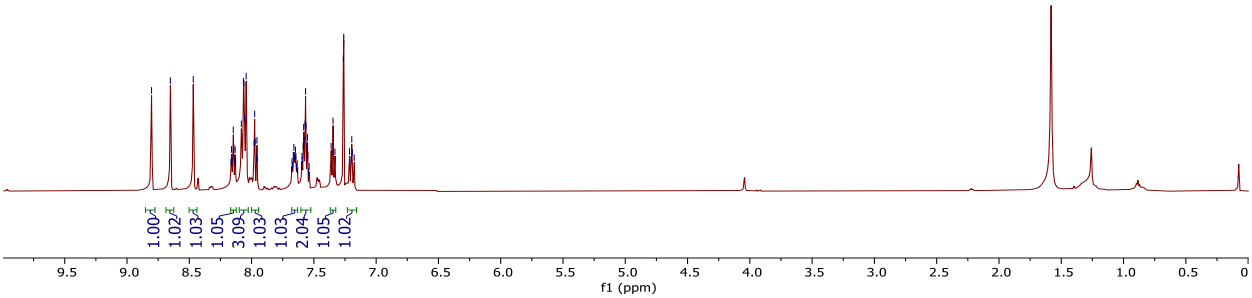

et-b6-7br-azo-c13.6.fid
et-b6-7br-azo-c13
161.5
150.2
136.5
136.5
134.3
134.2
132.5
132.1
131.7
129.7
129.6
129.5
124.7
124.7
121.3
117.3
117.1
116.4
Br
N
N
O
F
1z
f1 (ppm)

et-b6-anc-az.7.fid
et-b6-anc-az

8.80 8.65 8.47 8.17 8.16 8.16 8.15 8.14 8.14 8.13 8.13 8.08 8.07 8.06 8.06 8.04 7.98 7.98 7.97 7.96 7.96 7.95 7.68 7.67 7.67 7.66 7.66 7.65 7.65 7.64 7.64 7.63 7.63 7.60 7.60 7.59 7.59 7.58 7.58 7.57 7.57 7.56 7.55 7.55 7.55 7.54 7.54 7.36 7.35 7.33 7.26 7.26 7.26 CDCl3 7.21 7.20 7.20 7.19 7.18

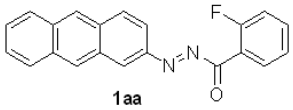


1aa



et-b6-anc-azc13.6.fid
et-b6-anc-azc13

180.8 163.6 161.5 149.6 136.3 136.2 135.3 133.5 132.8 132.6 132.3 130.9 130.1 129.7 128.6 128.3 128.2 127.1 126.8 126.4 125.3 124.6 124.6 117.3 117.1 114.7

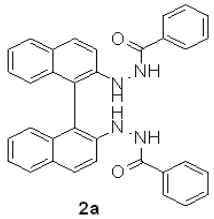


1aa

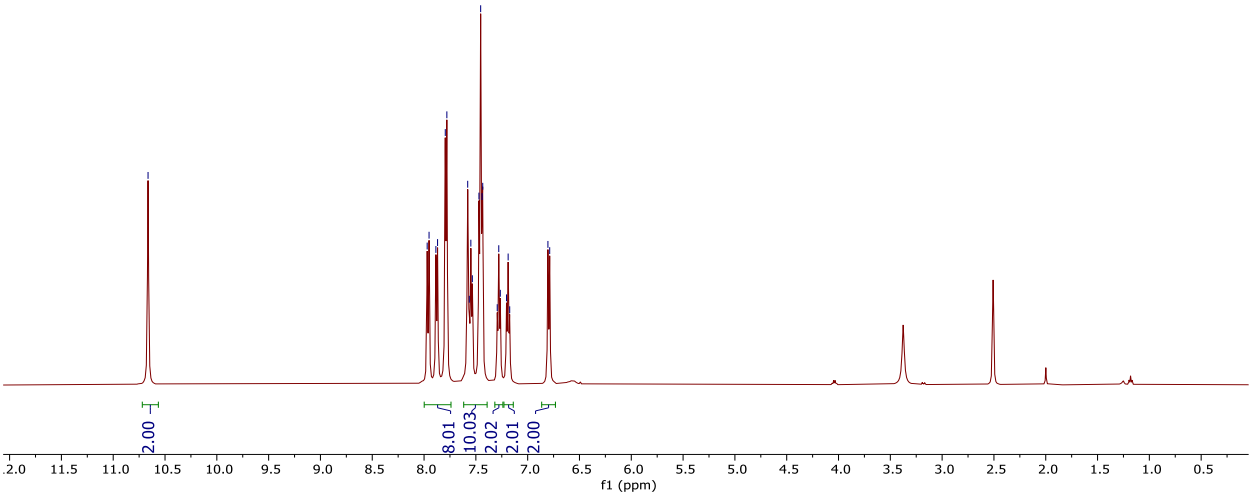
et-b6-bz-bnm-b6.6.fid
et-b6-bz-bnm-b6

10.46

7.97 7.95 7.89 7.87 7.80 7.78 7.58 7.56 7.55 7.53 7.47 7.45 7.44 7.43 7.29 7.28 7.26 7.20 7.19 7.17 6.80 6.79



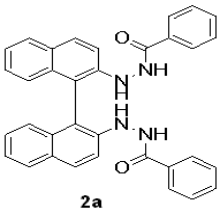
2a



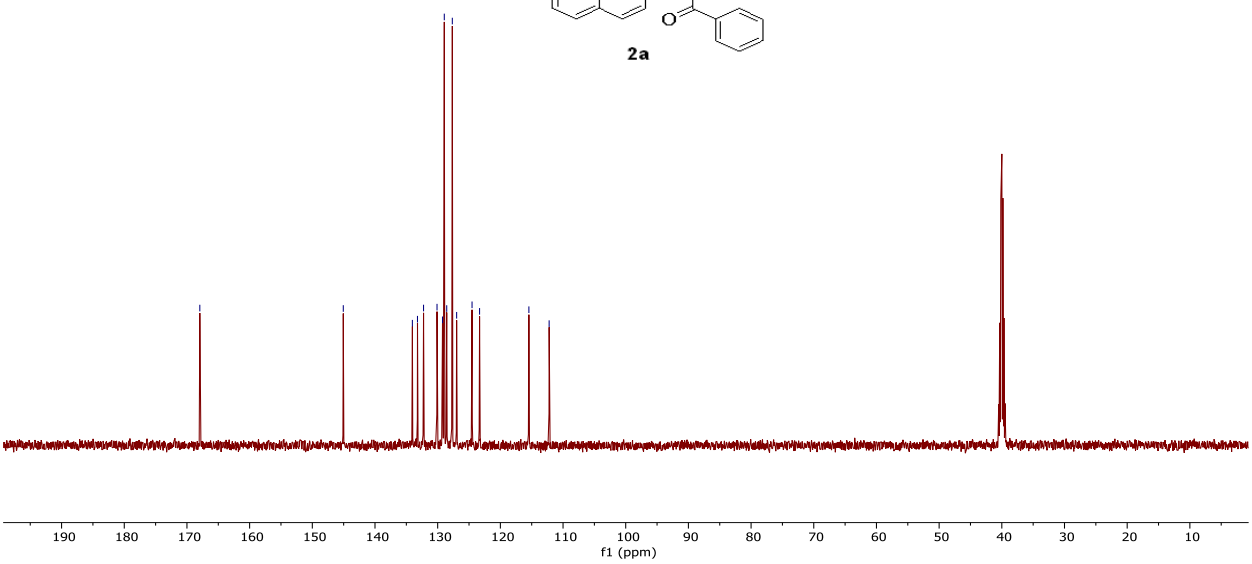
et-b6-bz-bnm-c13.6.fid
et-b6-bz-bnm-c13

167.9

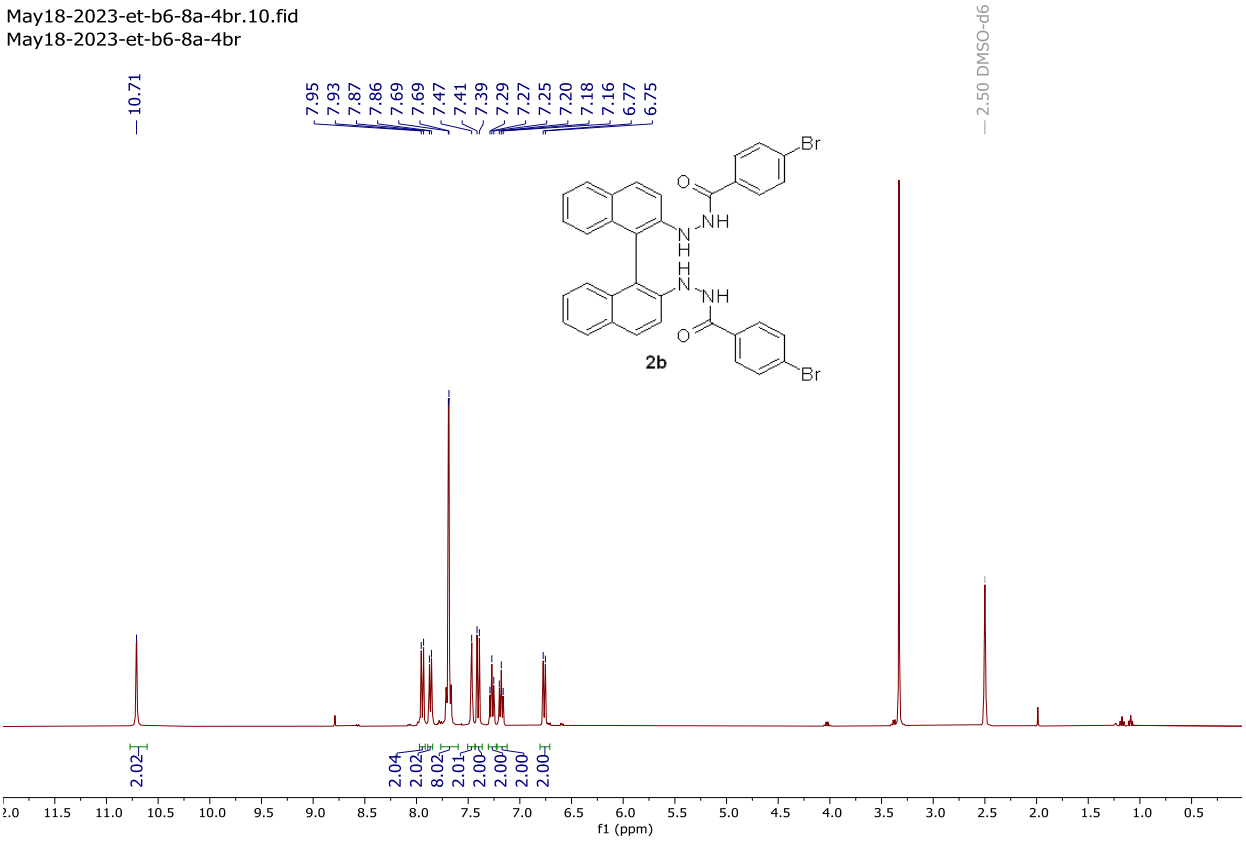
145.1 134.0 133.2 132.3 130.1 129.2 128.9 128.6 127.7 127.0 124.5 123.3 115.5 112.2



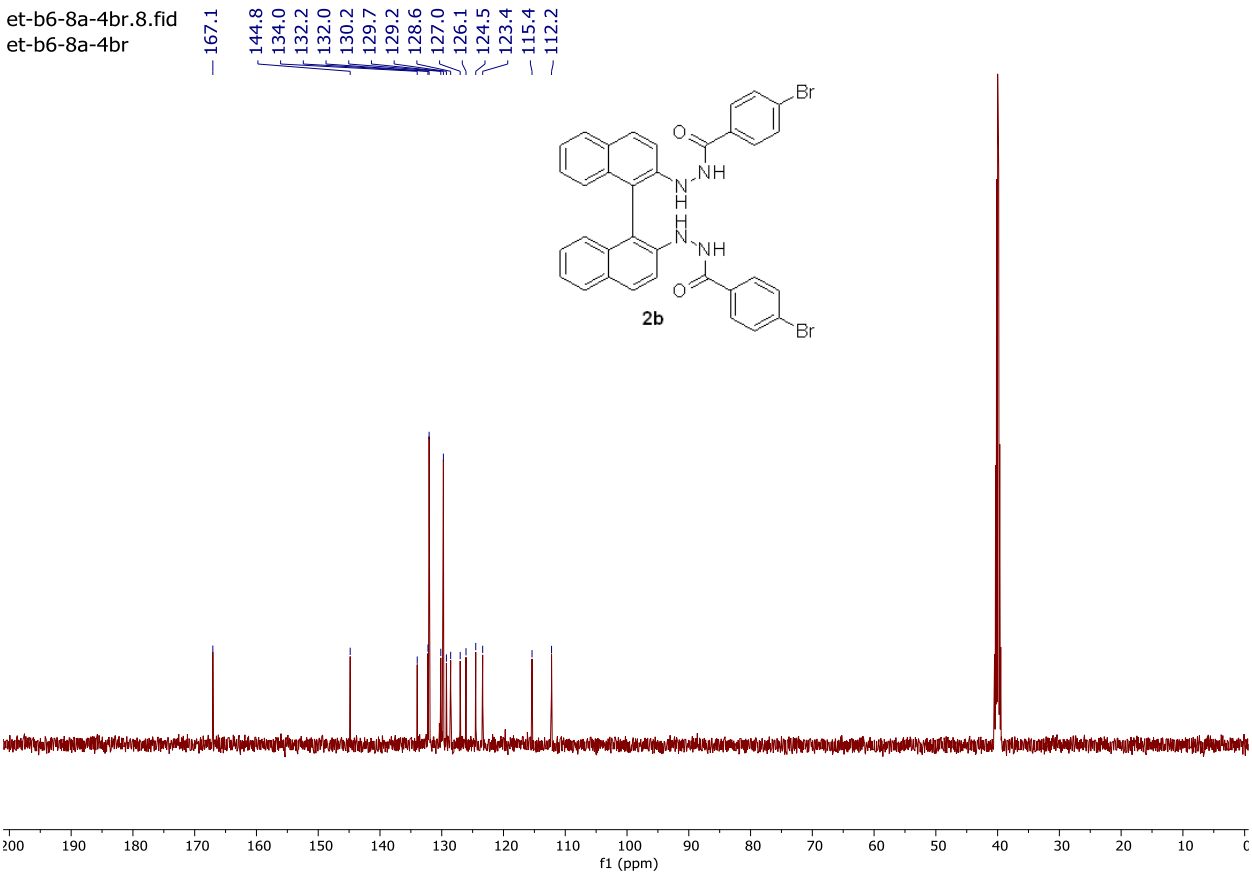
2a

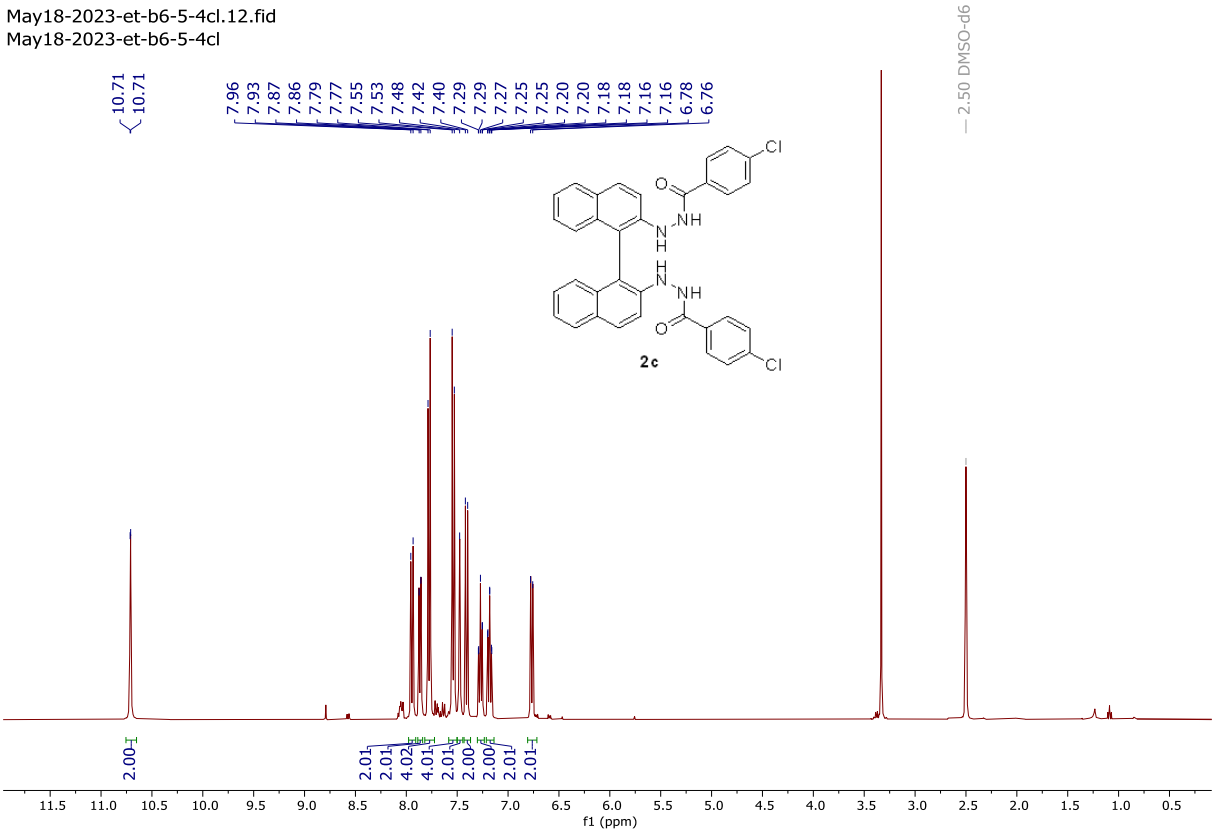


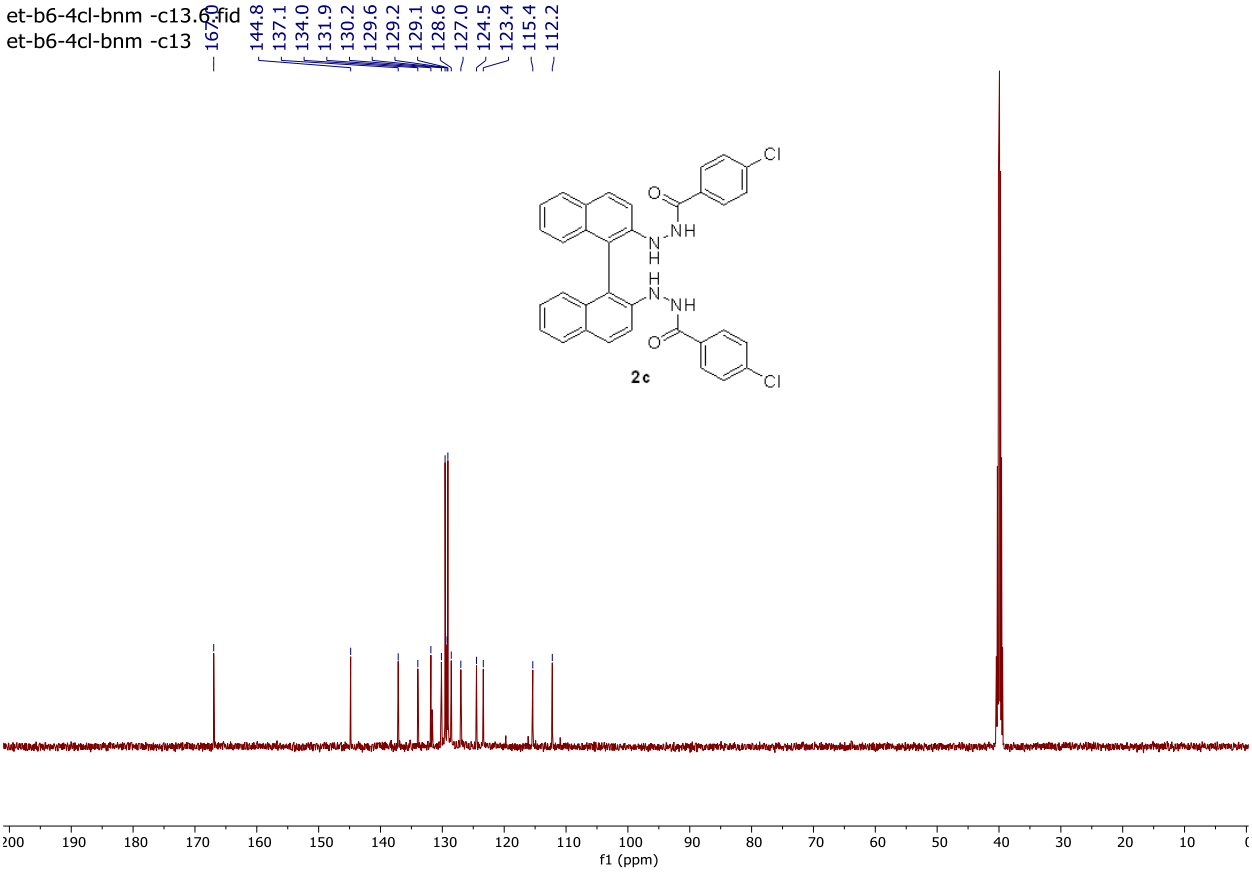
May18-2023-et-b6-8a-4br.10.fid
May18-2023-et-b6-8a-4br



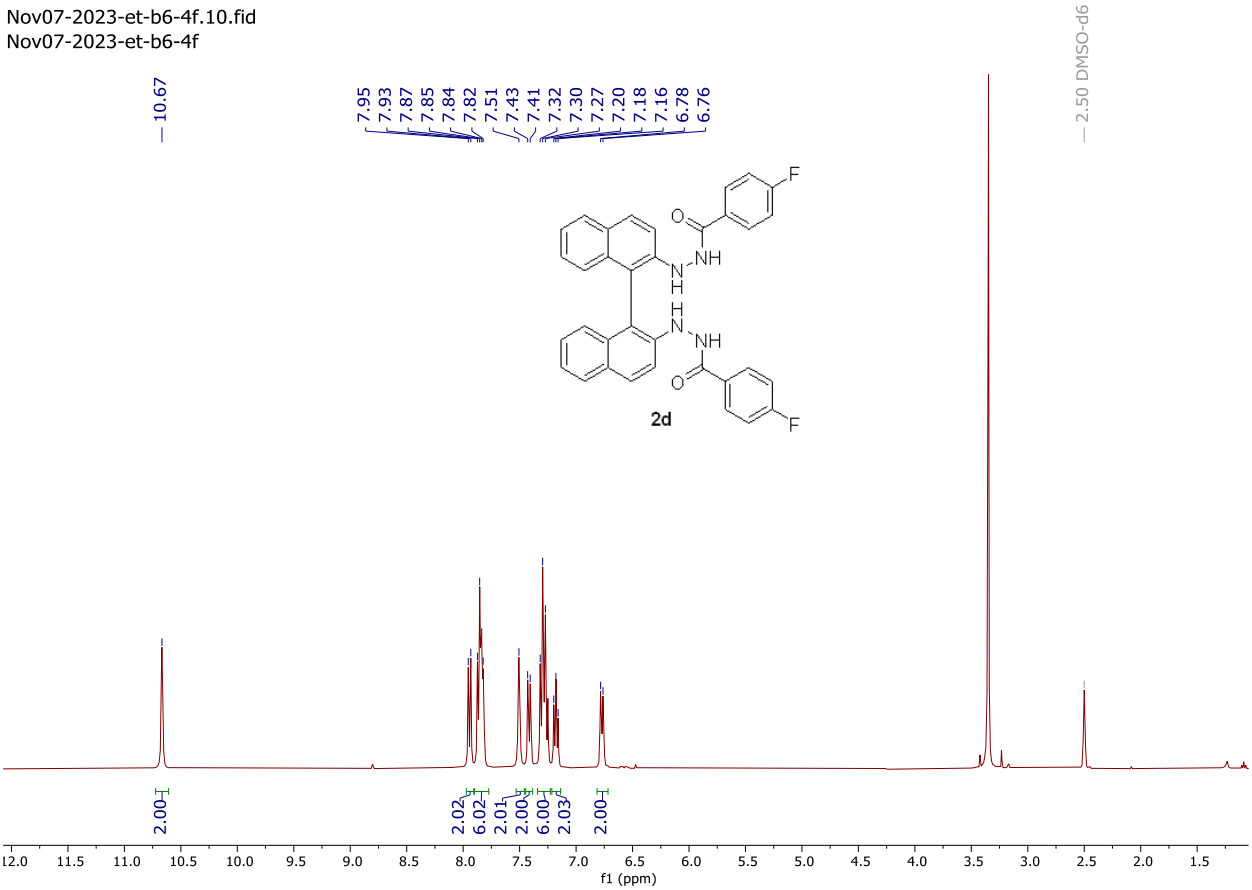
et-b6-8a-4br.8.fid
et-b6-8a-4br



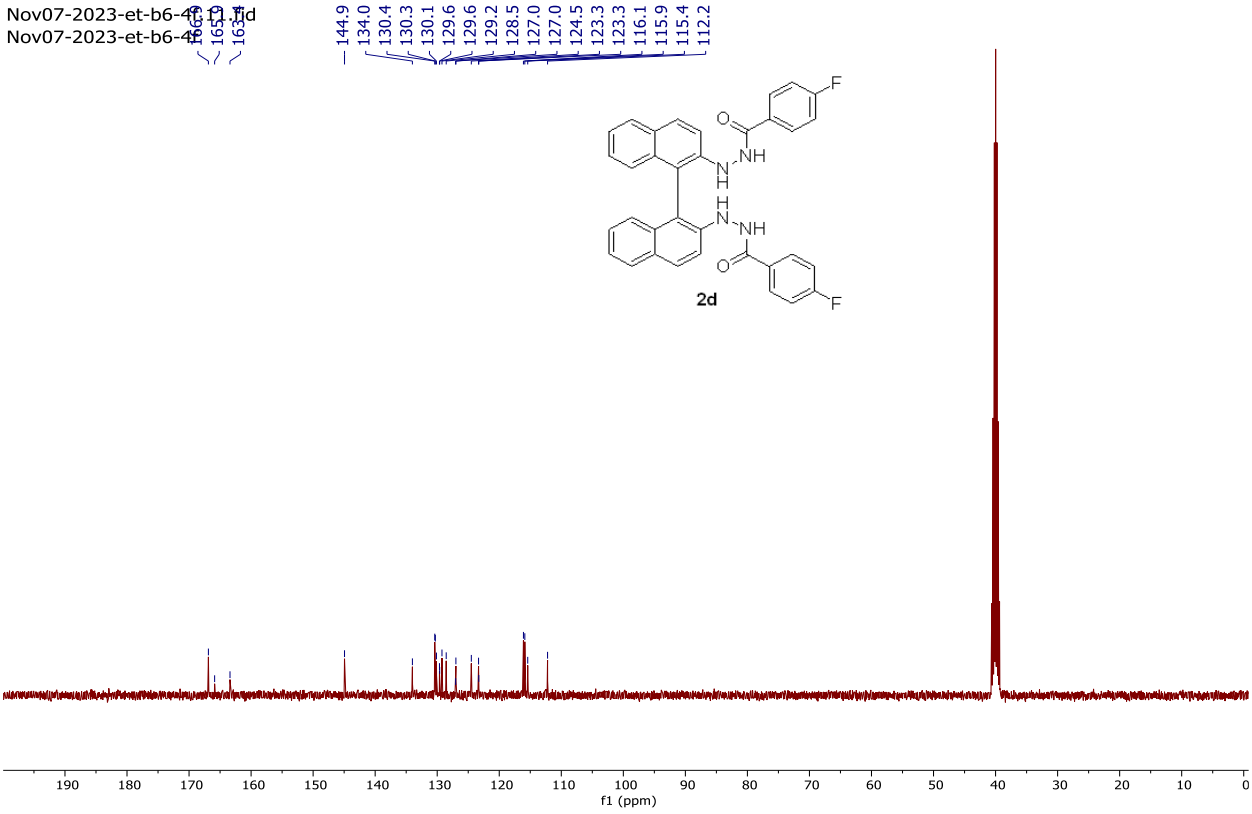

May18-2023-et-b6-5-4cl.12.fid
May18-2023-et-b6-5-4cl
10.71
10.71
7.96
7.93
7.87
7.86
7.79
7.77
7.55
7.53
7.48
7.42
7.40
7.29
7.29
7.27
7.25
7.25
7.20
7.20
7.18
7.16
7.16
6.78
6.76
2.50 DMSO-d6
Cl
O
NH
N
H
H
N
NH
O
Cl
2c
2.00
2.01
2.01
4.02
4.01
2.01
2.00
2.00
2.01
2.01
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)

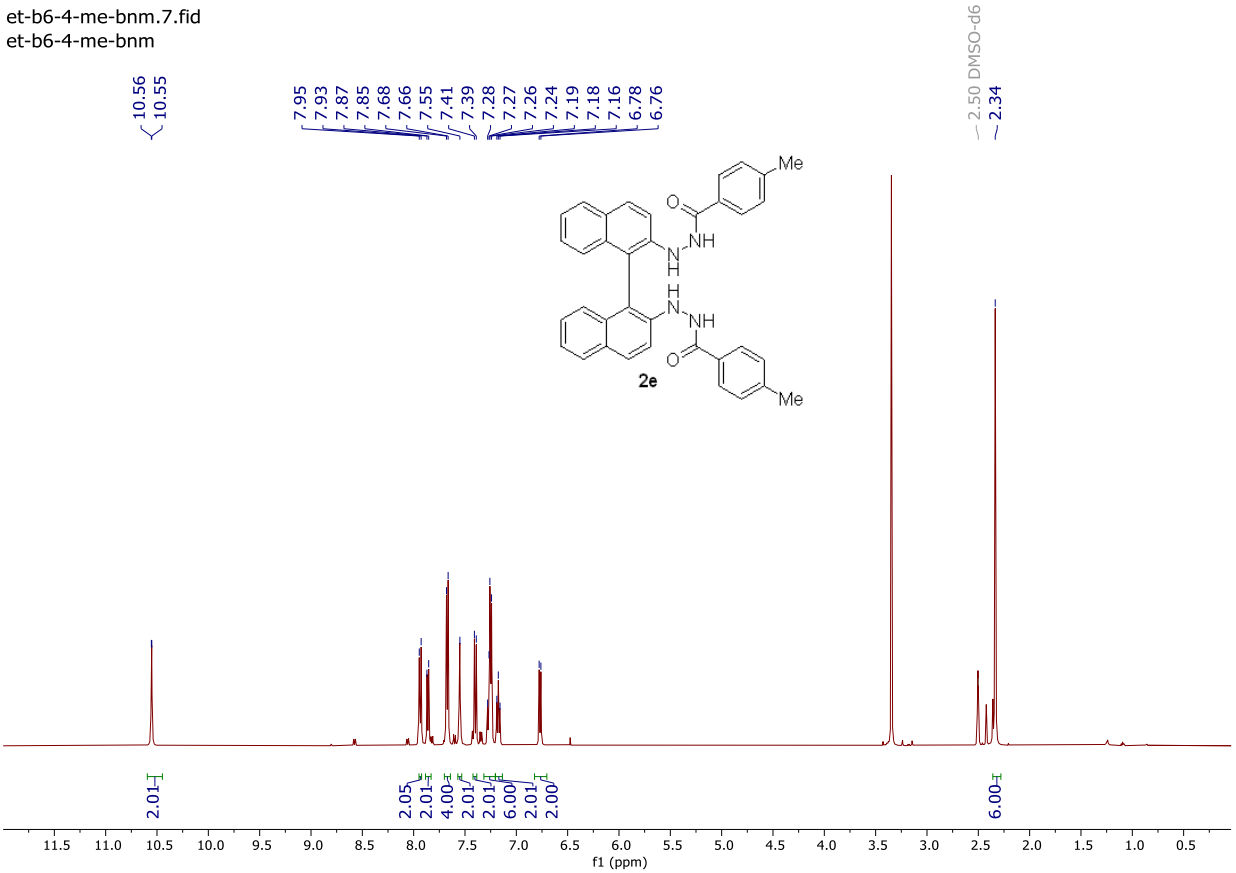

et-b6-4cl-bnm -c13.6.fid
et-b6-4cl-bnm -c13
167.0
144.8
137.1
134.0
131.9
130.2
129.6
129.2
129.1
128.6
127.0
124.5
123.4
115.4
112.2
Cl
O
NH
N
H
H
N
NH
O
Cl
2c
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

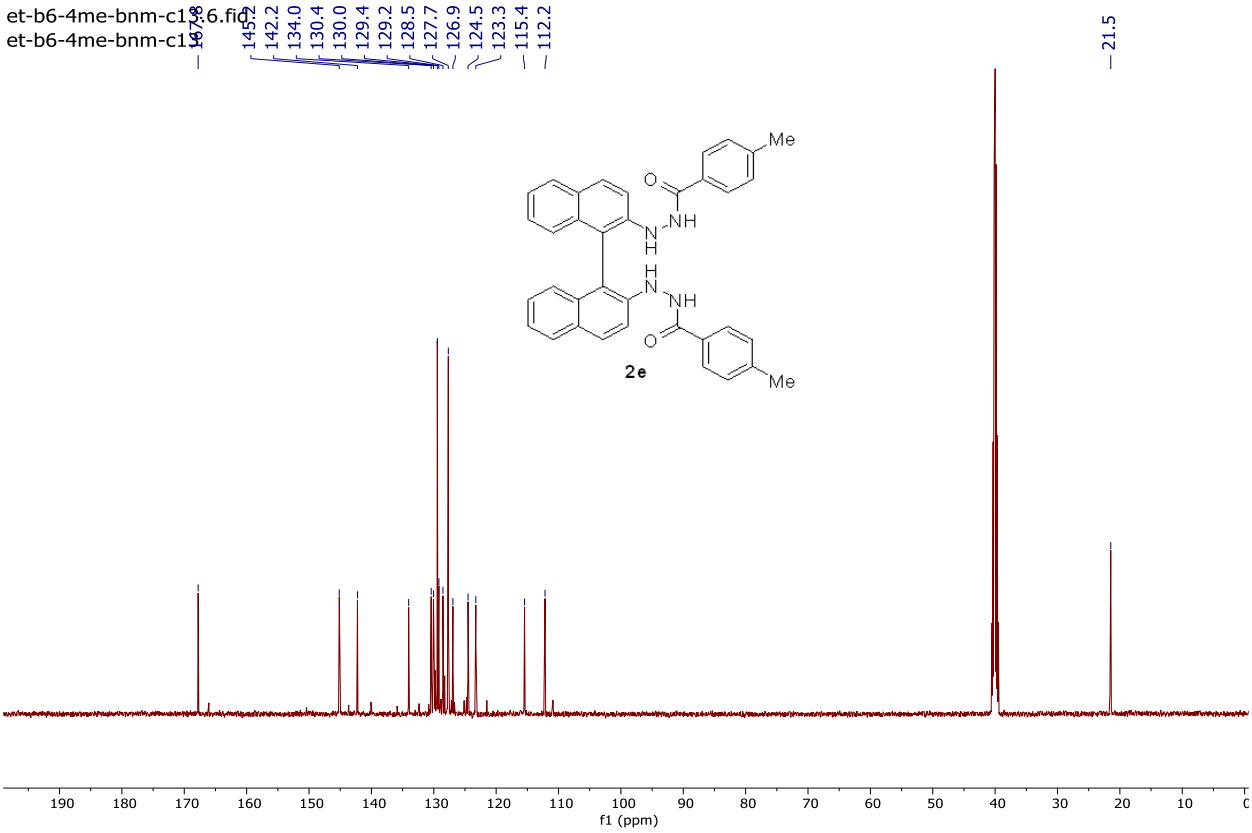
Nov07-2023-et-b6-4f.10.fid
Nov07-2023-et-b6-4f



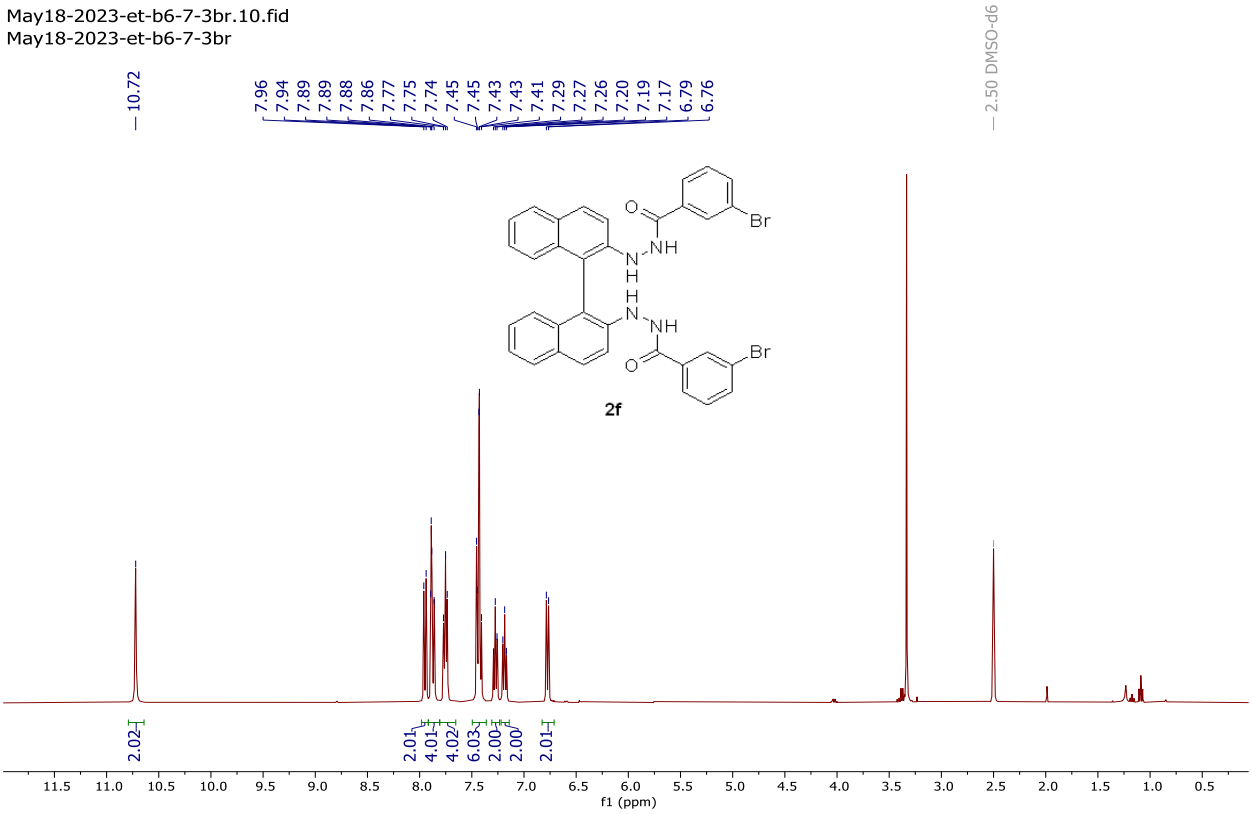
Nov07-2023-et-b6-4f.11.fid
Nov07-2023-et-b6-4f



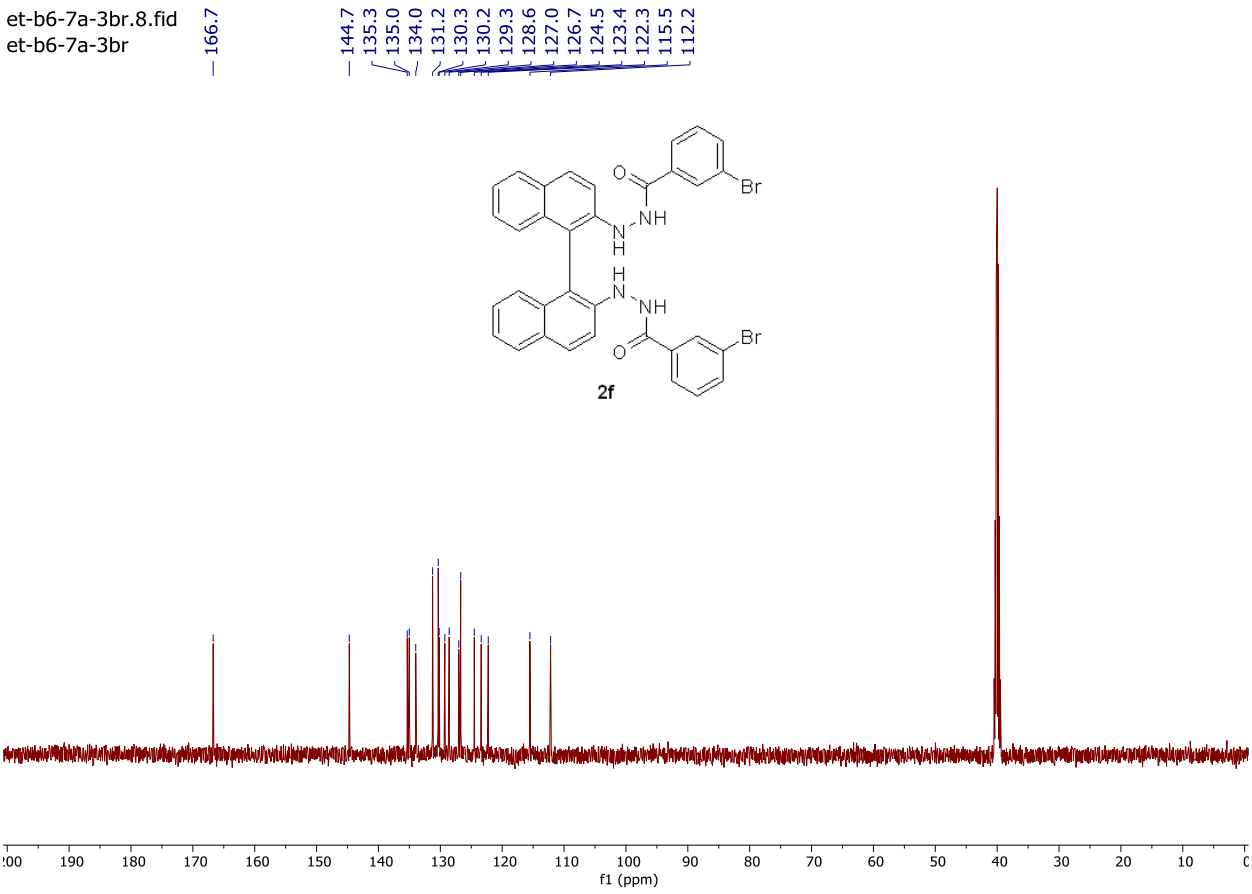

et-b6-4-me-bnm.7.fid
et-b6-4-me-bnm
10.56
10.55
7.95
7.93
7.87
7.85
7.68
7.66
7.55
7.41
7.39
7.28
7.27
7.26
7.24
7.19
7.18
7.16
6.78
6.76
2.50 DMSO-d6
2.34
Me
O
NH
N
H
N
H
NH
O
Me
2e
2.01
2.05
2.01
4.00
2.01
2.01
6.00
2.01
2.00
6.00
11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5
f1 (ppm)

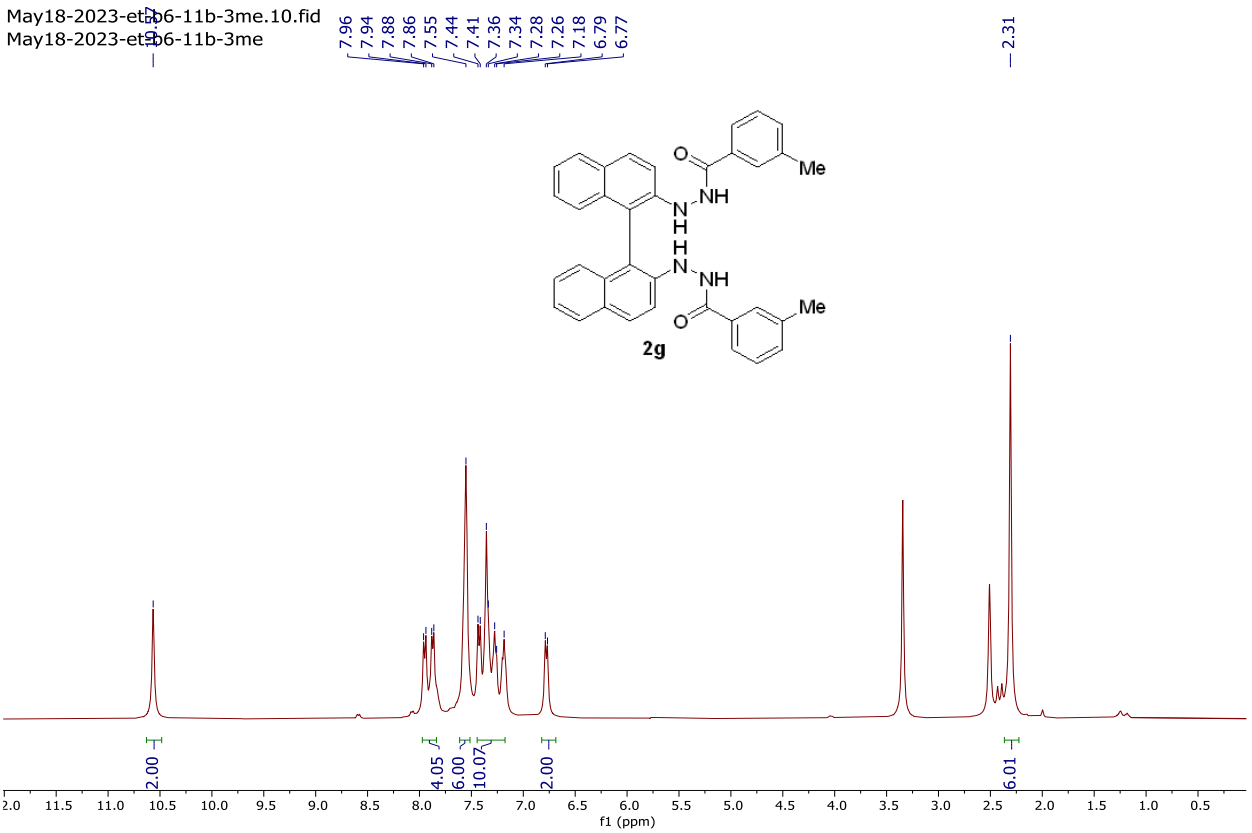

et-b6-4me-bnm-c1
et-b6-4me-bnm-c1
167.8
145.2
142.2
134.0
130.4
130.0
129.4
129.2
128.5
127.7
126.9
124.5
123.3
115.4
112.2
21.5
Me
O
NH
N
H
N
H
NH
O
Me
2e
190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

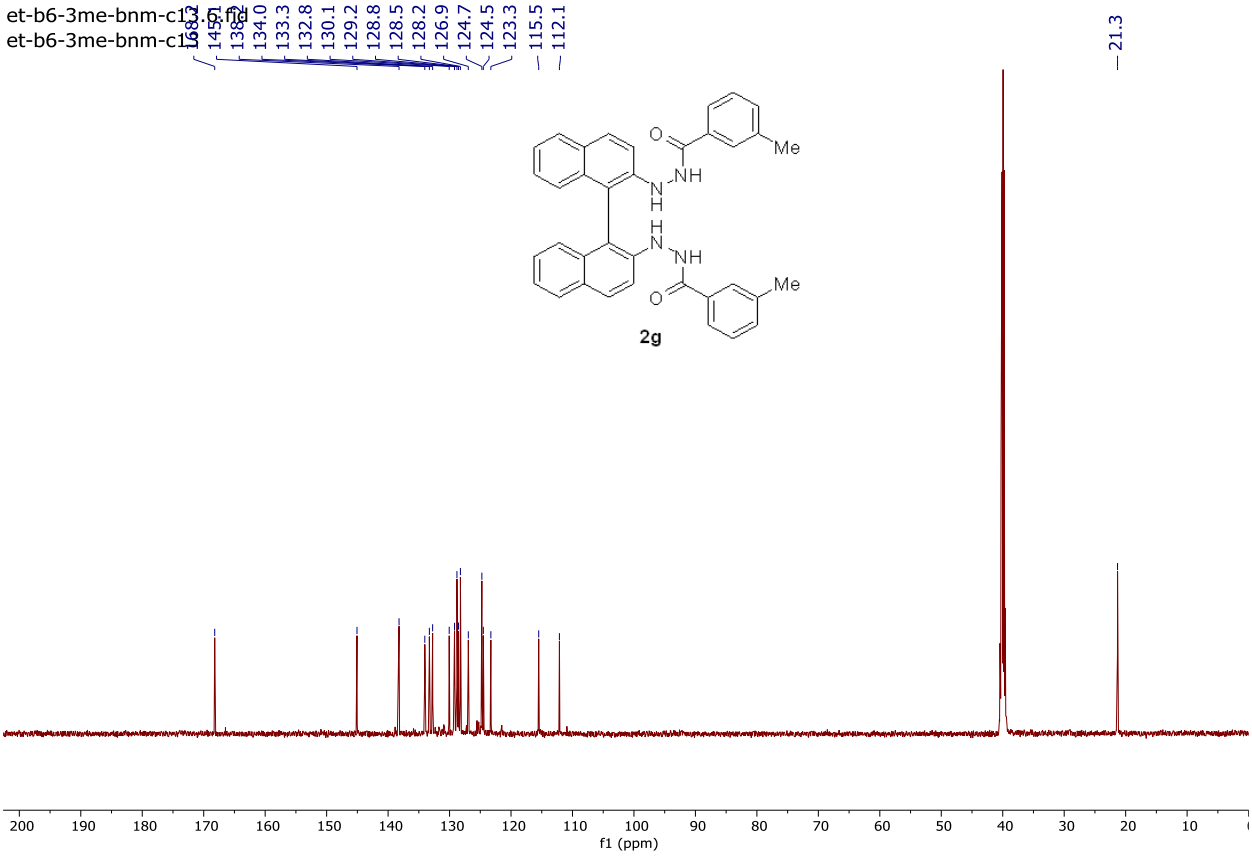
May18-2023-et-b6-7-3br.10.fid
May18-2023-et-b6-7-3br



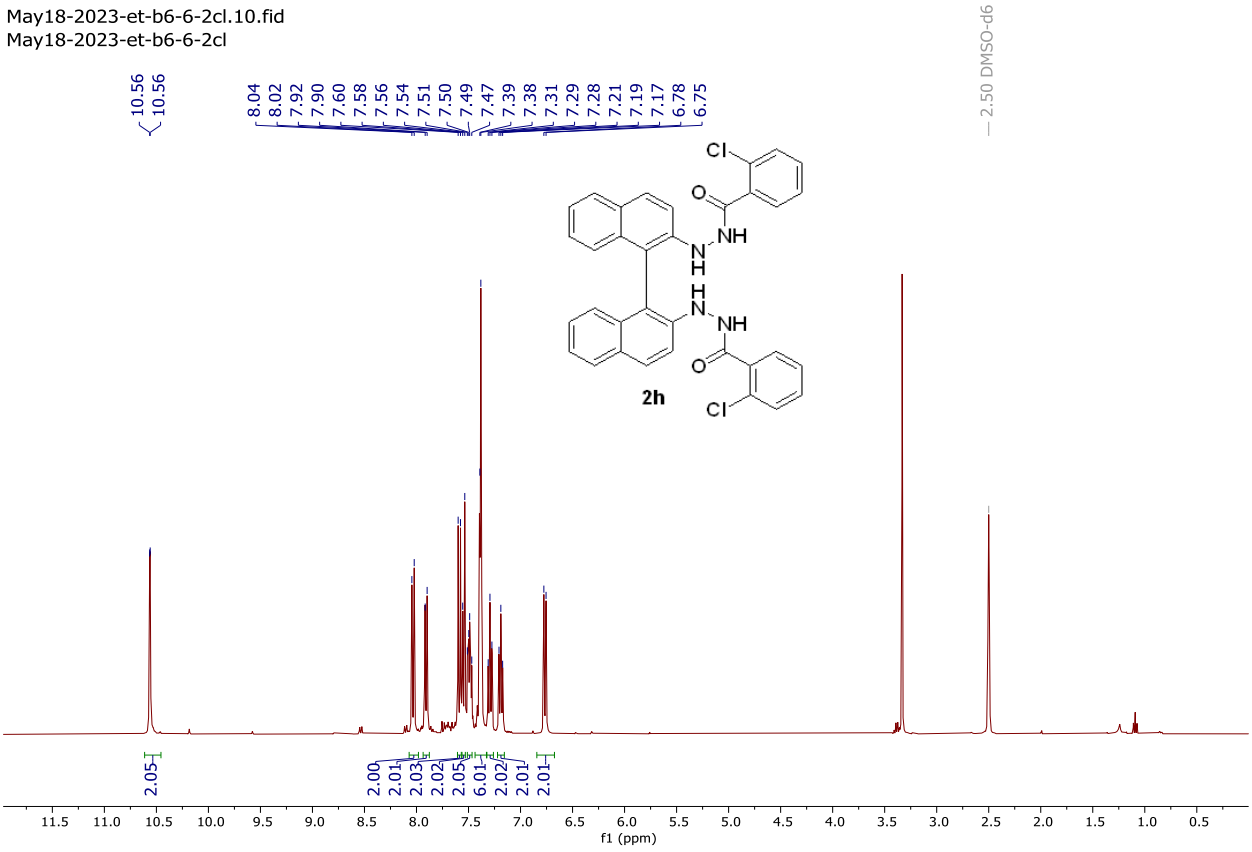
et-b6-7a-3br.8.fid
et-b6-7a-3br



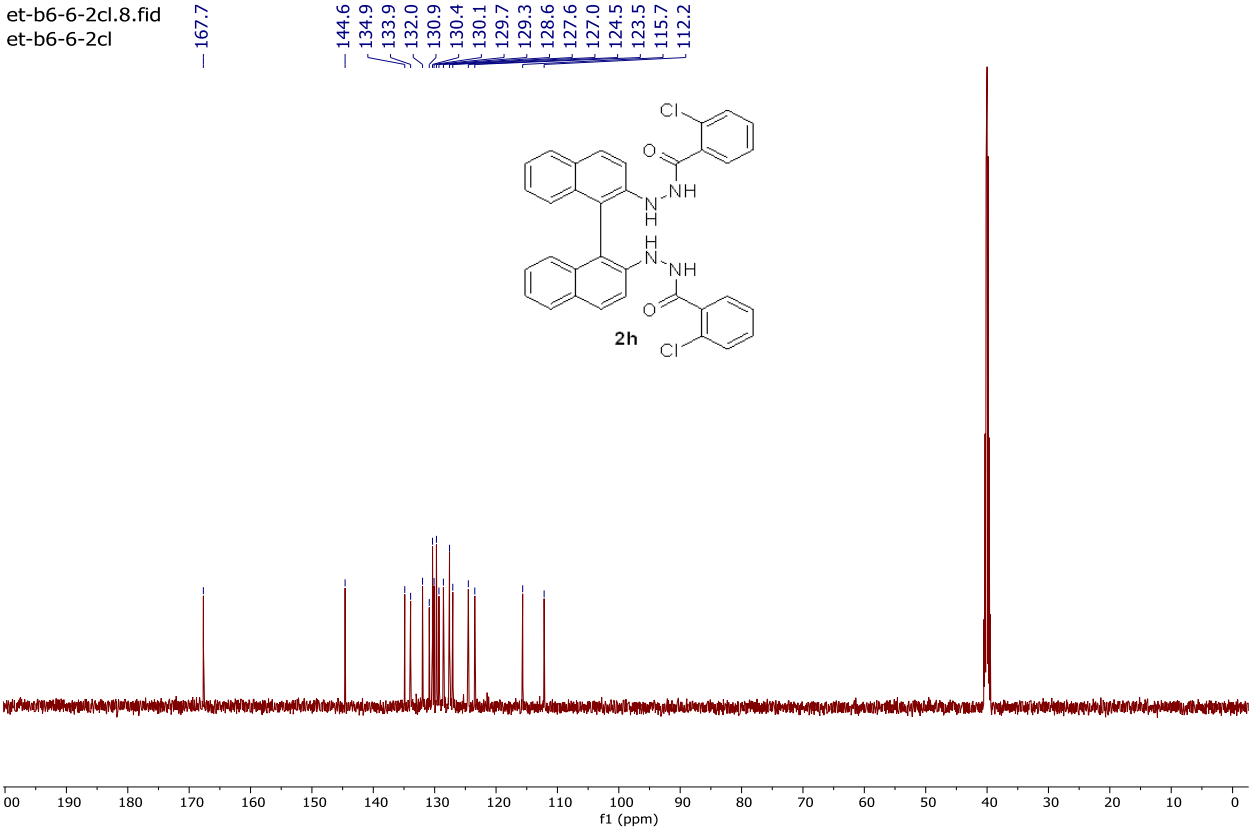

May18-2023-et-b6-11b-3me.10.fid
May18-2023-et-b6-11b-3me
10.37
7.96
7.94
7.88
7.86
7.55
7.44
7.41
7.36
7.34
7.28
7.26
7.18
6.79
6.77
2.31
O
Me
NH
N
H
H
N
NH
O
Me
2g
2.00
4.05
6.00
10.07
2.00
6.01
f1 (ppm)


et-b6-3me-bnm-c13.fid
et-b6-3me-bnm-c13
168.2
145.1
138.2
134.0
133.3
132.8
130.1
129.2
128.8
128.5
128.2
126.9
124.7
124.5
123.3
115.5
112.1
21.3
O
Me
NH
N
H
H
N
NH
O
Me
2g
f1 (ppm)

May18-2023-et-b6-6-2cl.10.fid
May18-2023-et-b6-6-2cl

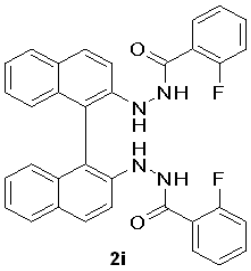


et-b6-6-2cl.8.fid
et-b6-6-2cl

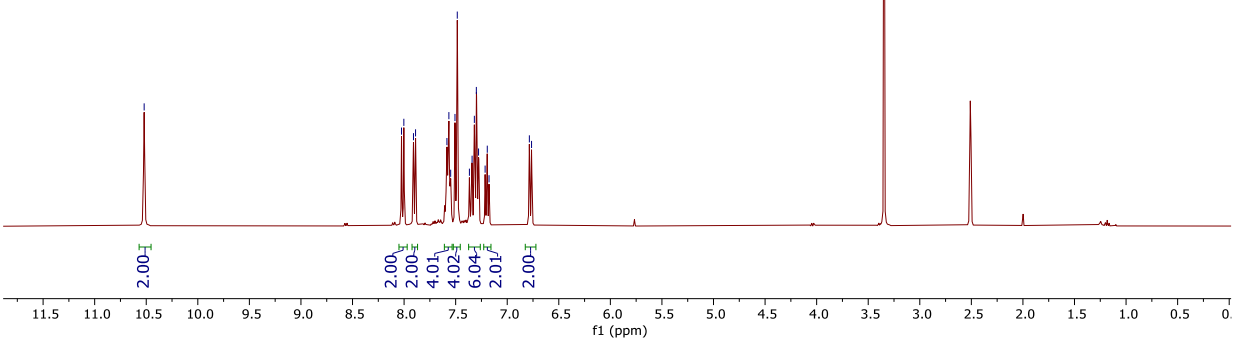


May18-2023-et-b6-3-bzf.10.fid
May18-2023-et-b6-3-bzf

8.02 8.00 7.91 7.89 7.58 7.57 7.55 7.51 7.48 7.37 7.34 7.32 7.30 7.28 7.21 7.19 7.18 6.79 6.76

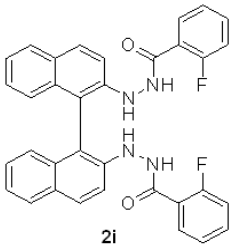


2i

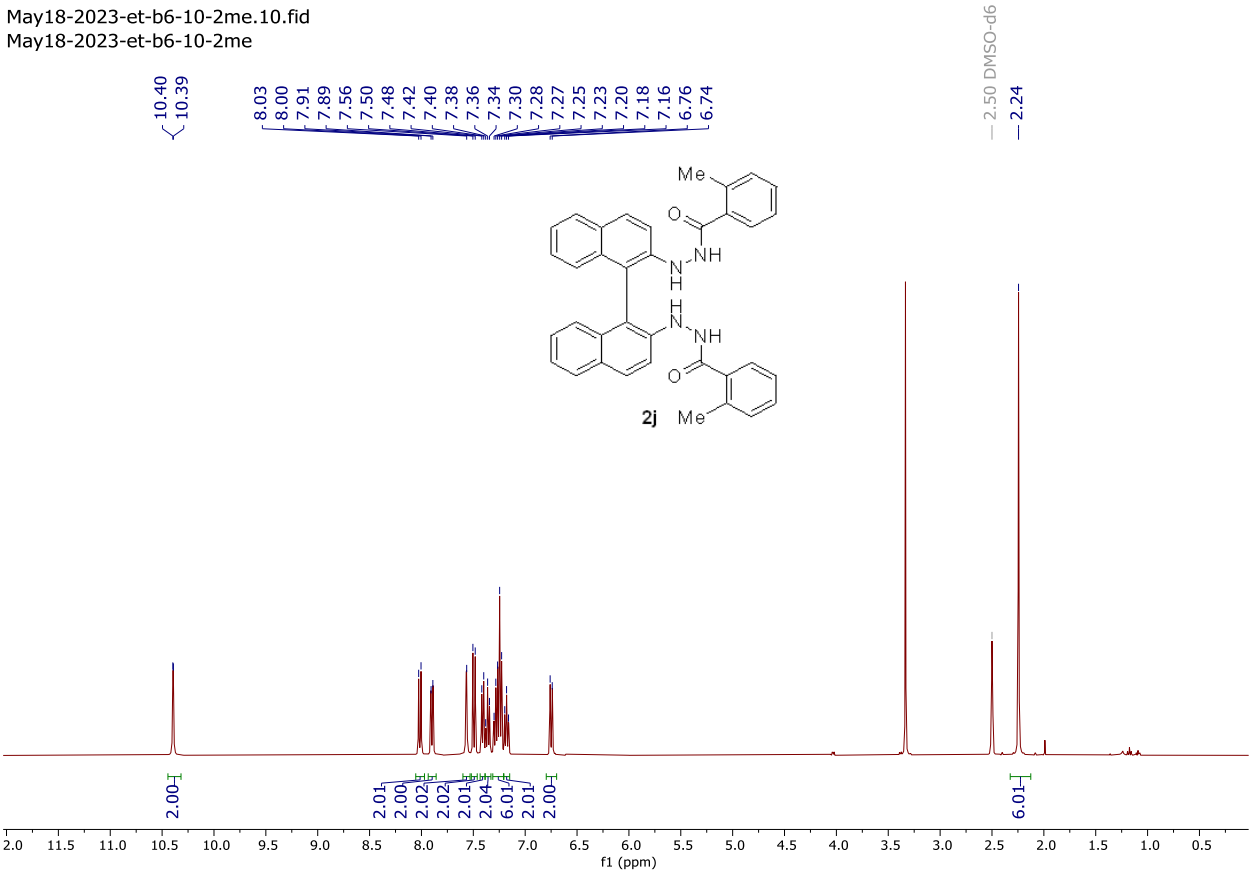


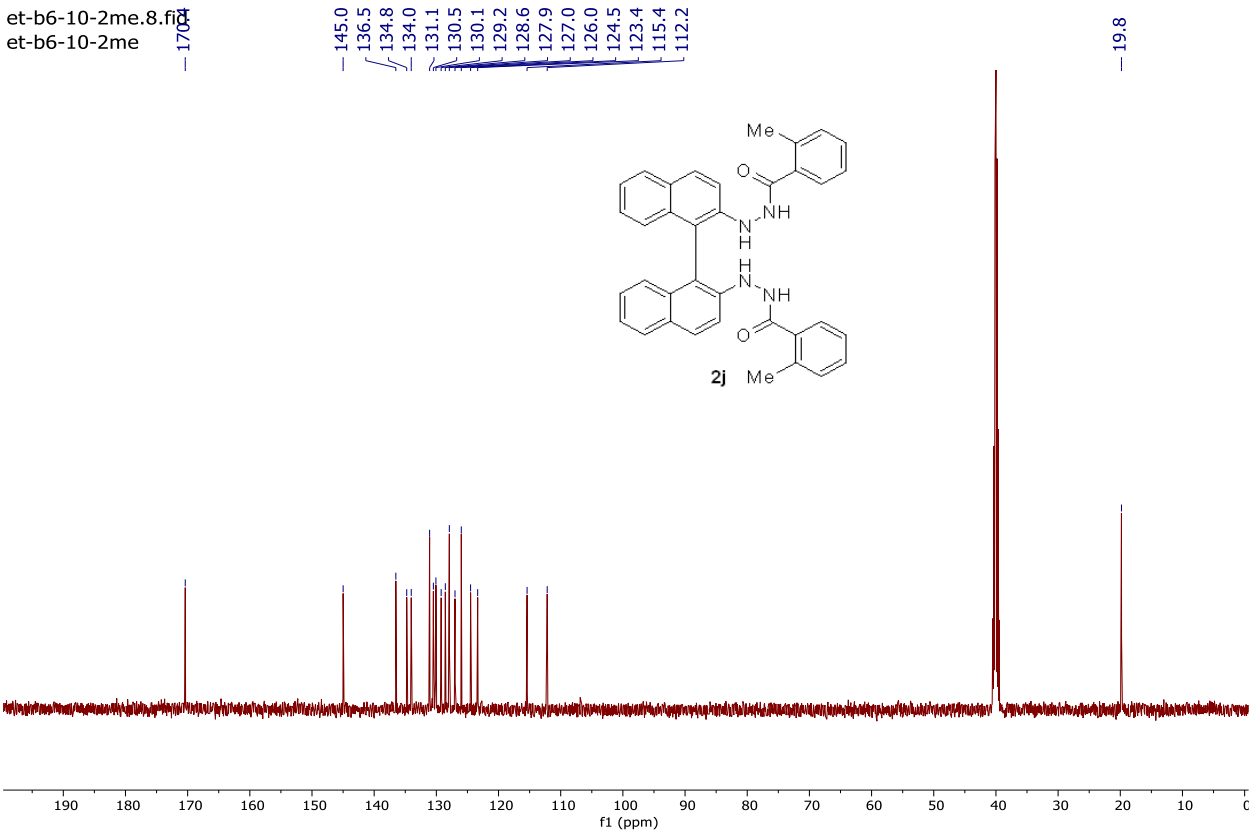
et-b6-13-2bzf.8.fid
et-b6-13-2bzf

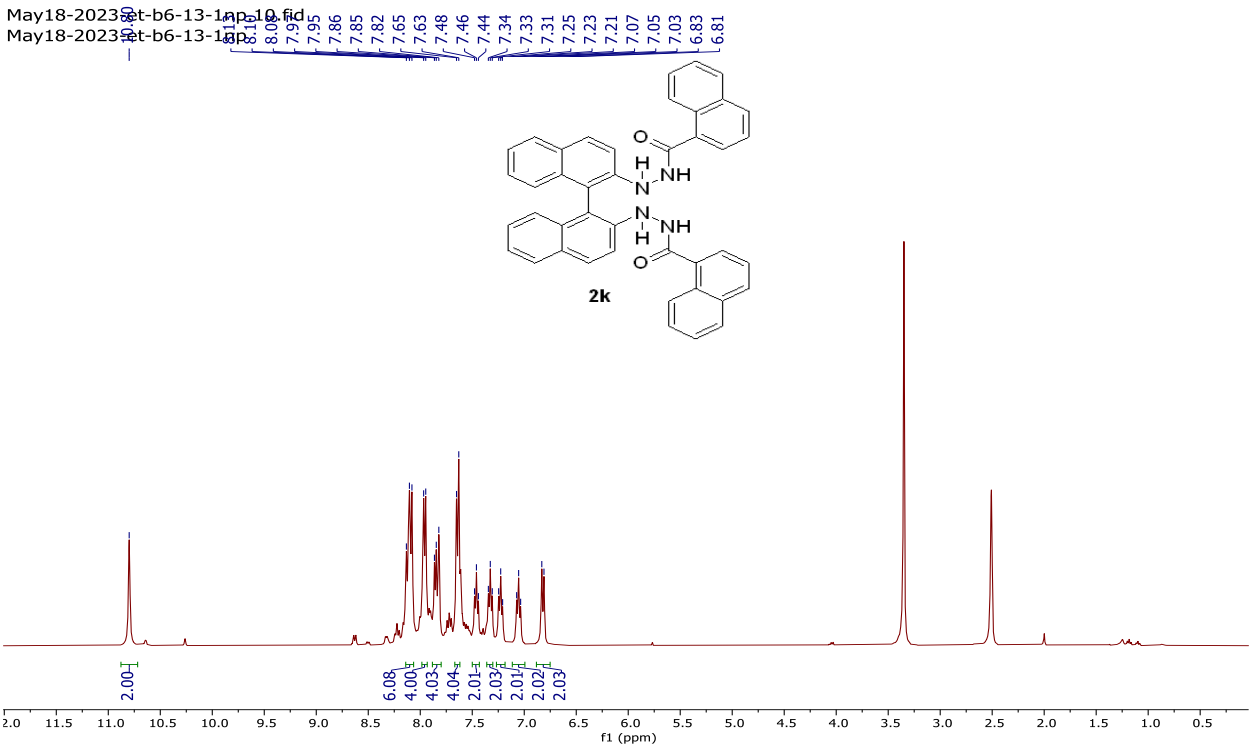
165.5 160.7 158.7 144.7 134.0 133.5 133.5 130.4 130.4 130.2 129.3 128.6 127.0 125.1 125.0 124.5 123.4 122.7 122.6 116.9 116.7 115.4 112.2

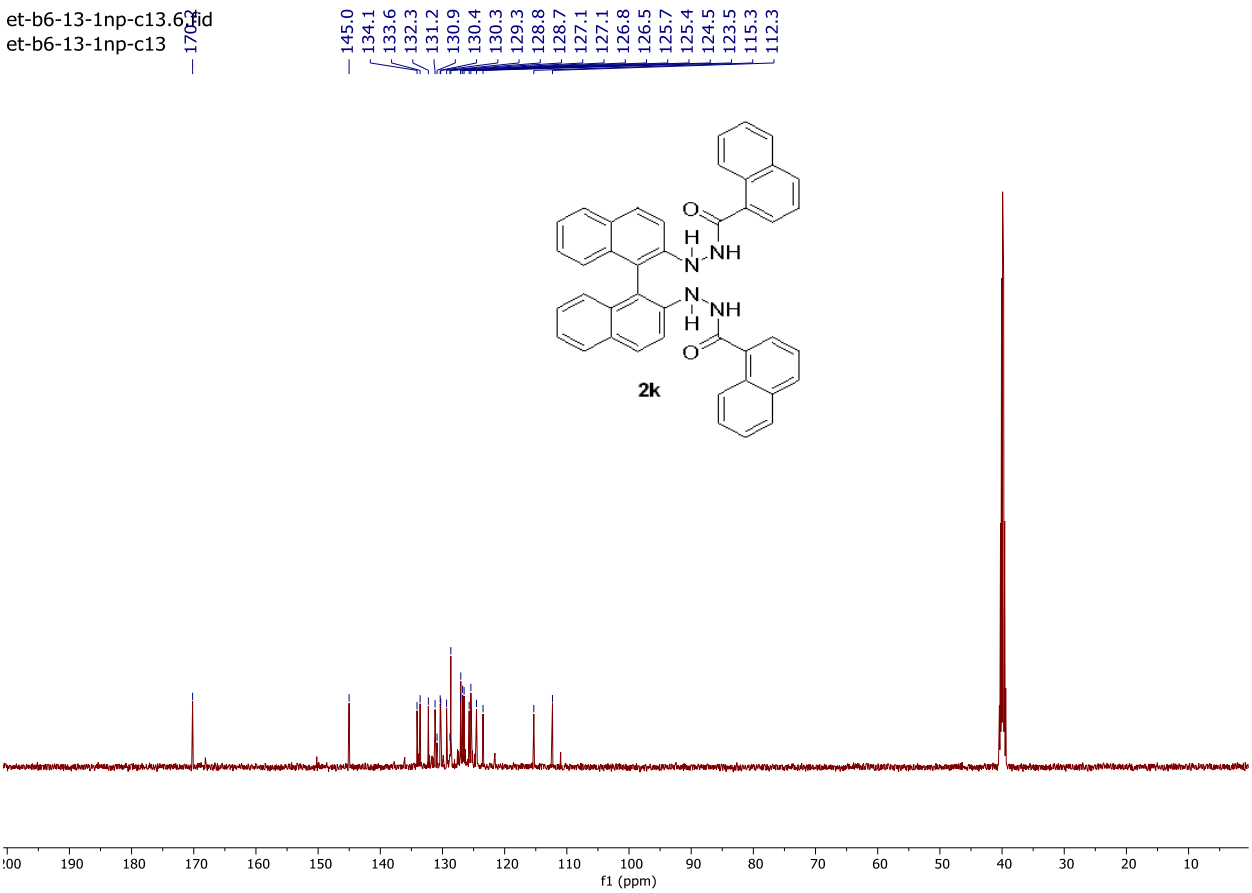


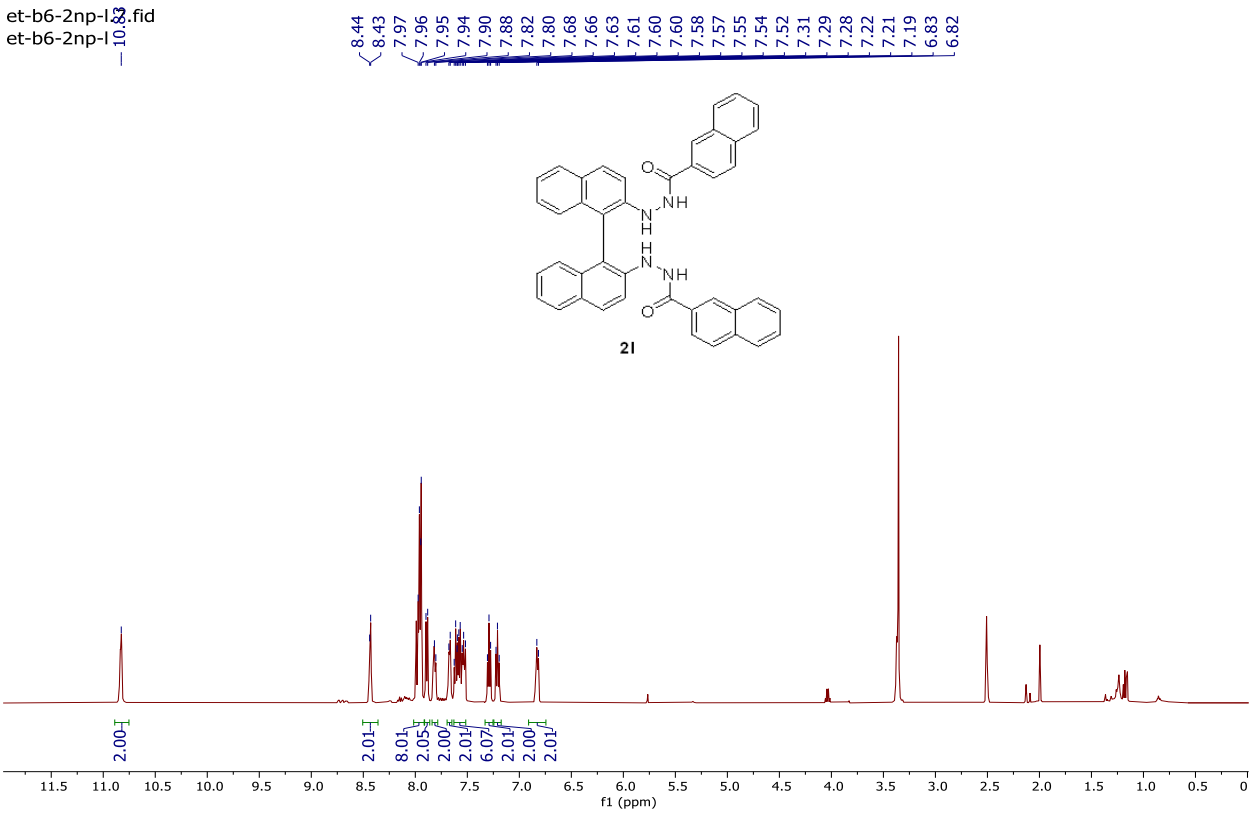
2i


May18-2023-et-b6-10-2me.10.fid
May18-2023-et-b6-10-2me
10.40
10.39
8.03
8.00
7.91
7.89
7.56
7.50
7.48
7.42
7.40
7.38
7.36
7.34
7.30
7.28
7.27
7.25
7.23
7.20
7.18
7.16
6.76
6.74
2.50 DMSO-d6
2.24
Me
O
NH
N
H
NH
N
NH
O
Me
2j
2.00
2.01
2.00
2.02
2.02
2.01
2.04
6.01
2.01
2.00
6.01
f1 (ppm)


et-b6-10-2me.8.fid
et-b6-10-2me
170.4
145.0
136.5
134.8
134.0
131.1
130.5
130.1
129.2
128.6
127.9
127.0
126.0
124.5
123.4
115.4
112.2
19.8
Me
O
NH
N
H
H
N
NH
O
Me
2j
f1 (ppm)


May18-2023et-b6-13-1np-10.fid
May18-2023et-b6-13-1np
10.98
8.15
8.08
7.95
7.95
7.86
7.85
7.82
7.65
7.63
7.48
7.46
7.44
7.34
7.33
7.31
7.25
7.23
7.21
7.07
7.05
7.03
6.83
6.81
2k
2.00
6.08
4.00
4.03
4.04
2.01
2.03
2.01
2.02
2.03
f1 (ppm)


et-b6-13-1np-c13.6.fid
et-b6-13-1np-c13
170.2
145.0
134.1
133.6
132.3
131.2
130.9
130.4
130.3
129.3
128.8
128.7
127.1
127.1
126.8
126.5
125.7
125.4
124.5
123.5
115.3
112.3
2k
f1 (ppm)


et-b6-2np-h1.fid
10.83
8.44
8.43
7.97
7.96
7.95
7.94
7.90
7.88
7.82
7.80
7.68
7.66
7.63
7.61
7.60
7.60
7.58
7.57
7.55
7.54
7.52
7.31
7.29
7.28
7.22
7.21
7.19
6.83
6.82
2l
2.00
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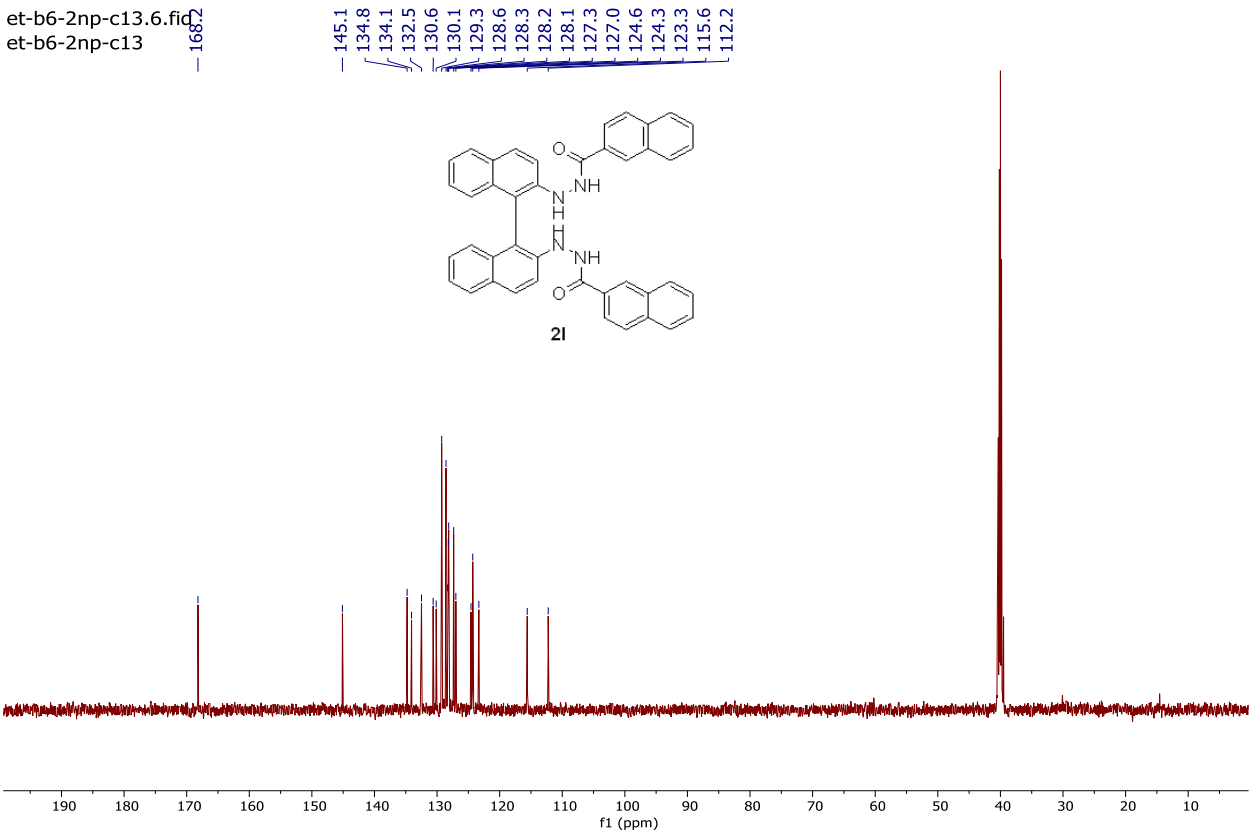
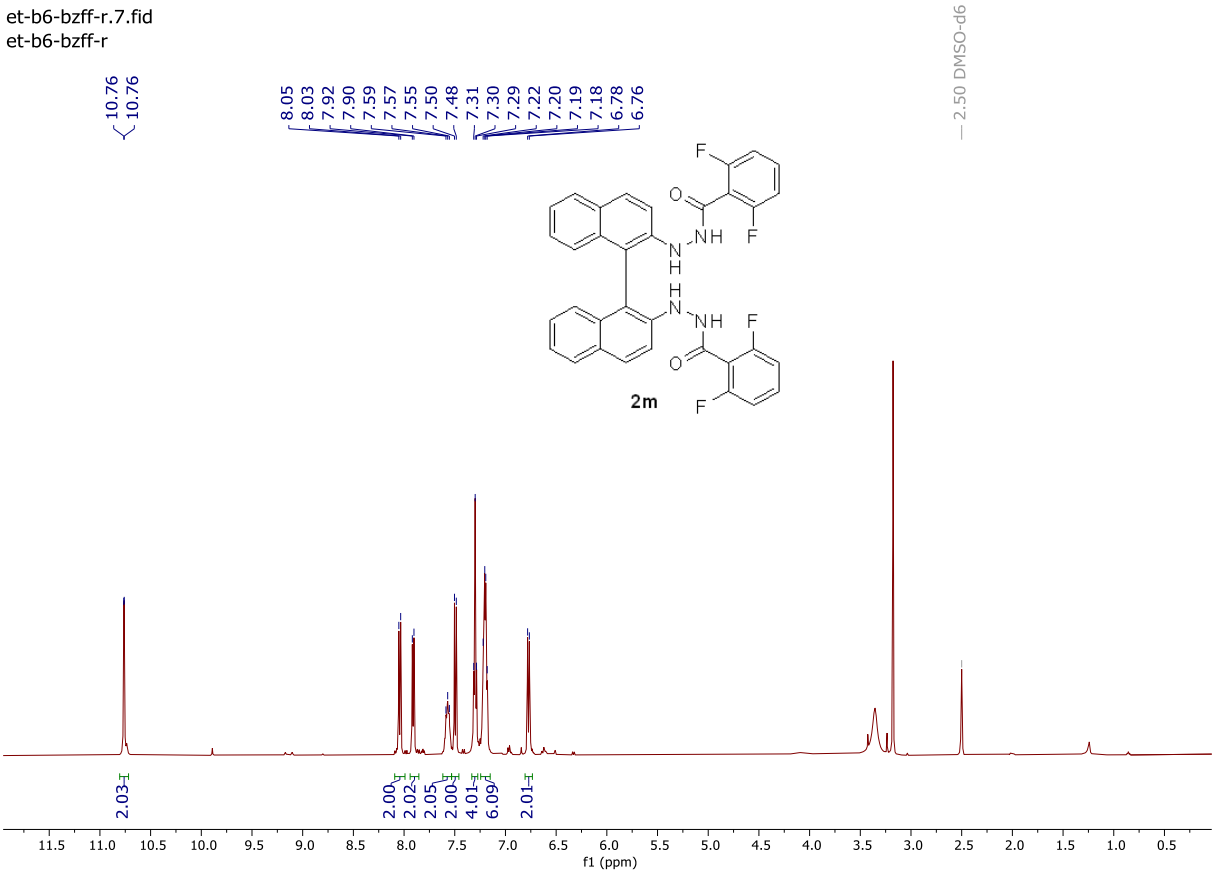
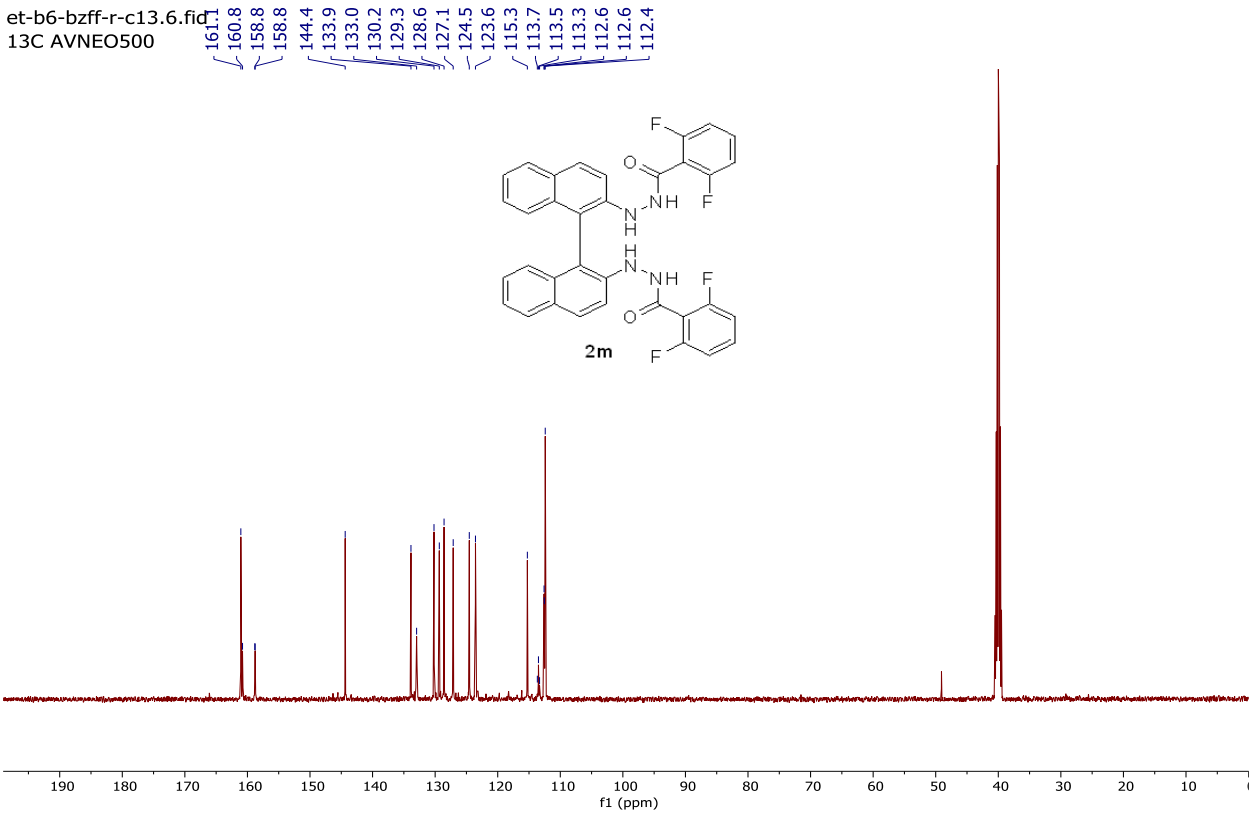
2.01
6.07
2.01
2.00
2.01
f1 (ppm)


et-b6-2np-c13.6.fid
et-b6-2np-c13
168.2
145.1
134.8
134.1
132.5
130.6
130.1
129.3
128.6
128.3
128.2
128.1
127.3
127.0
124.6
124.3
123.3
115.6
112.2
2l
f1 (ppm)

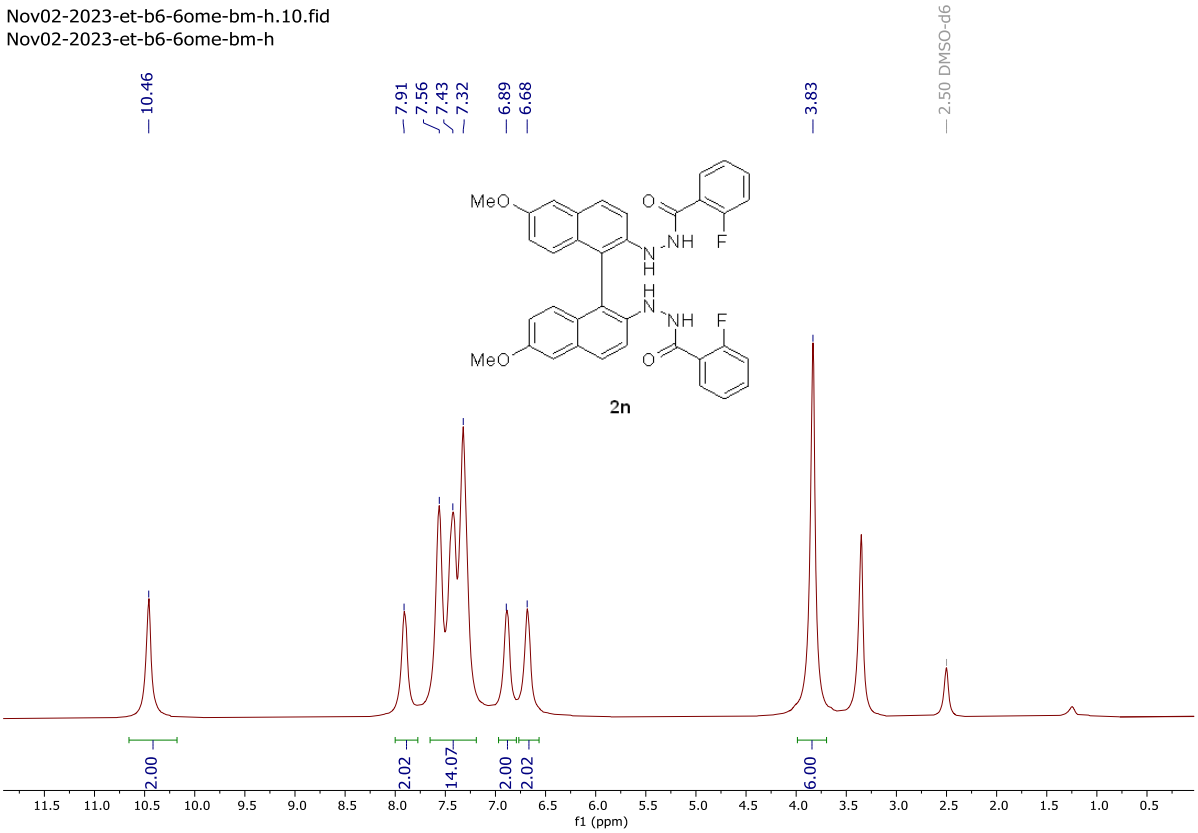
et-b6-bzff-r.7.fid
et-b6-bzff-r



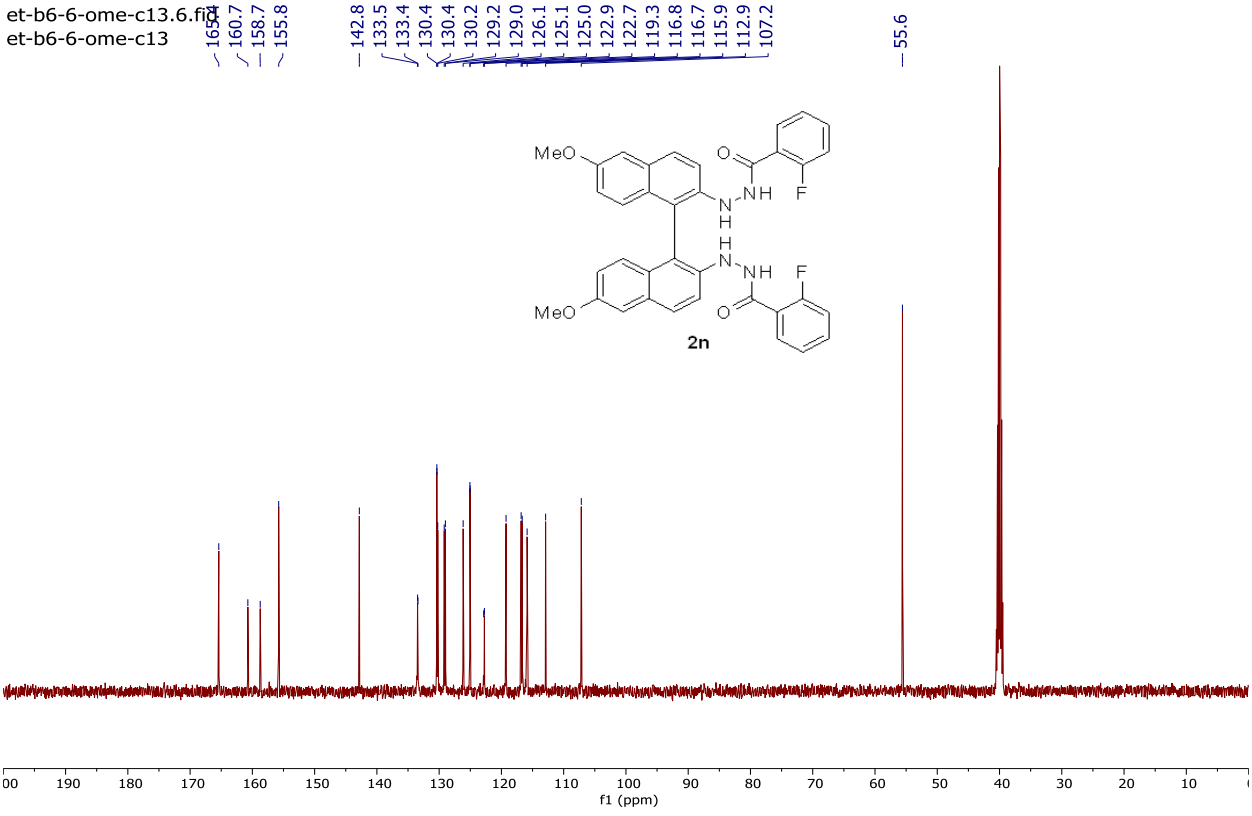
et-b6-bzff-r-c13.6.fid
13C AVNEO500

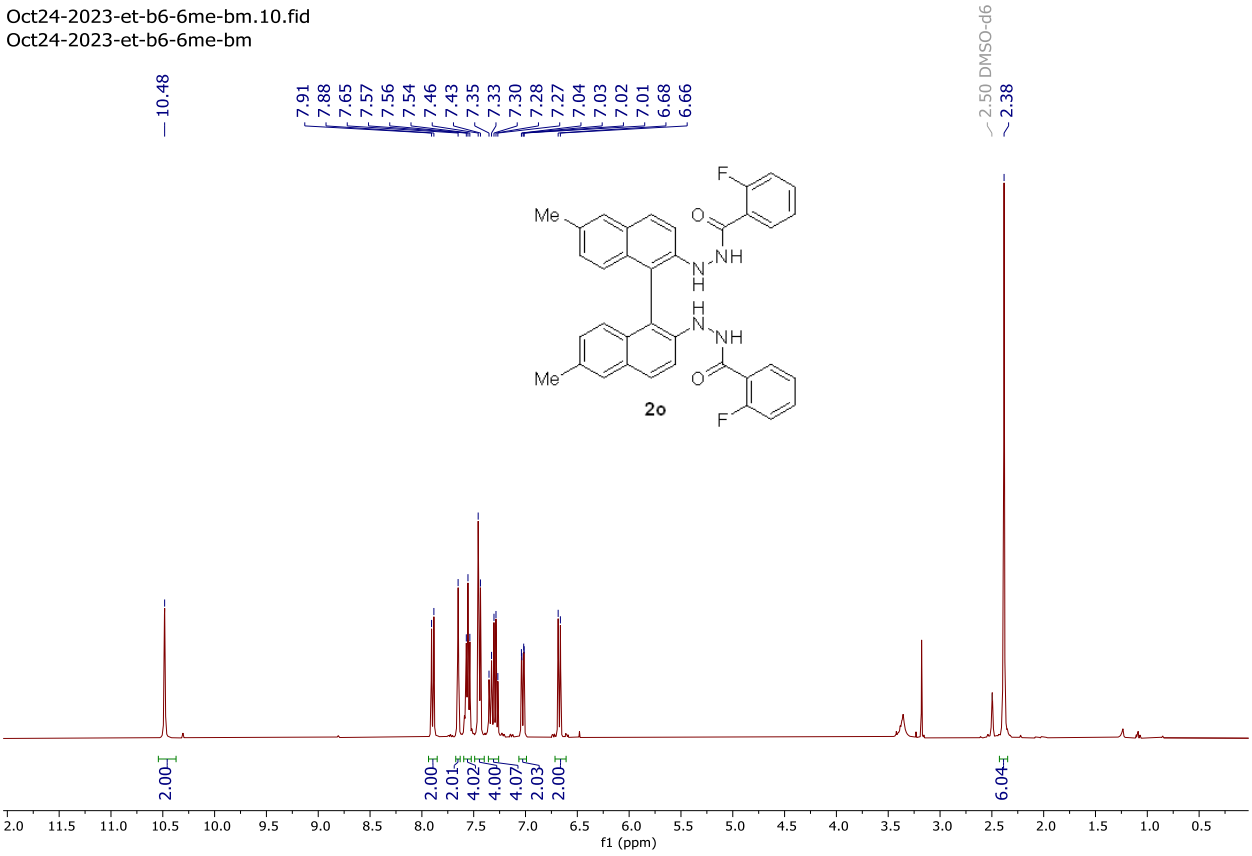


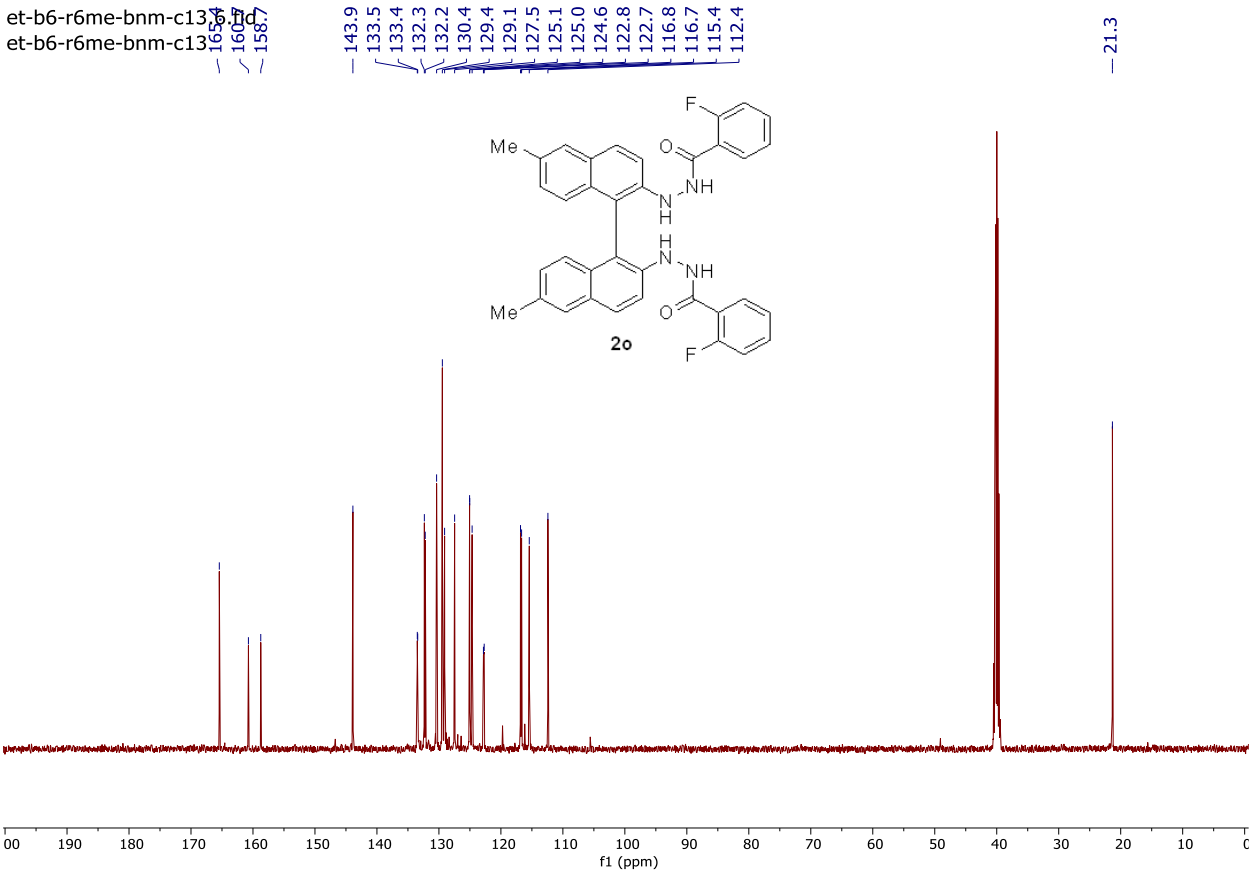
Nov02-2023-et-b6-6ome-bm-h.10.fid
Nov02-2023-et-b6-6ome-bm-h



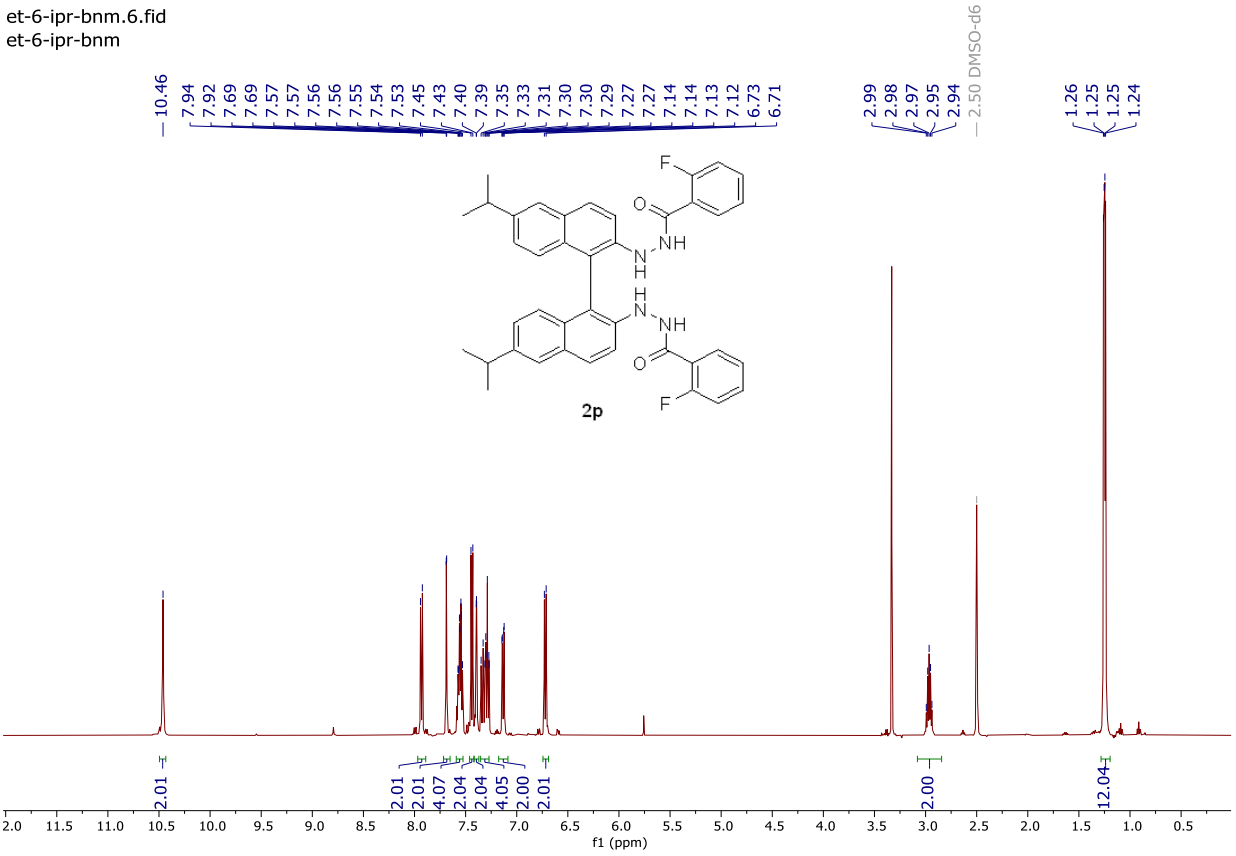
et-b6-6-ome-c13.6.fid
et-b6-6-ome-c13



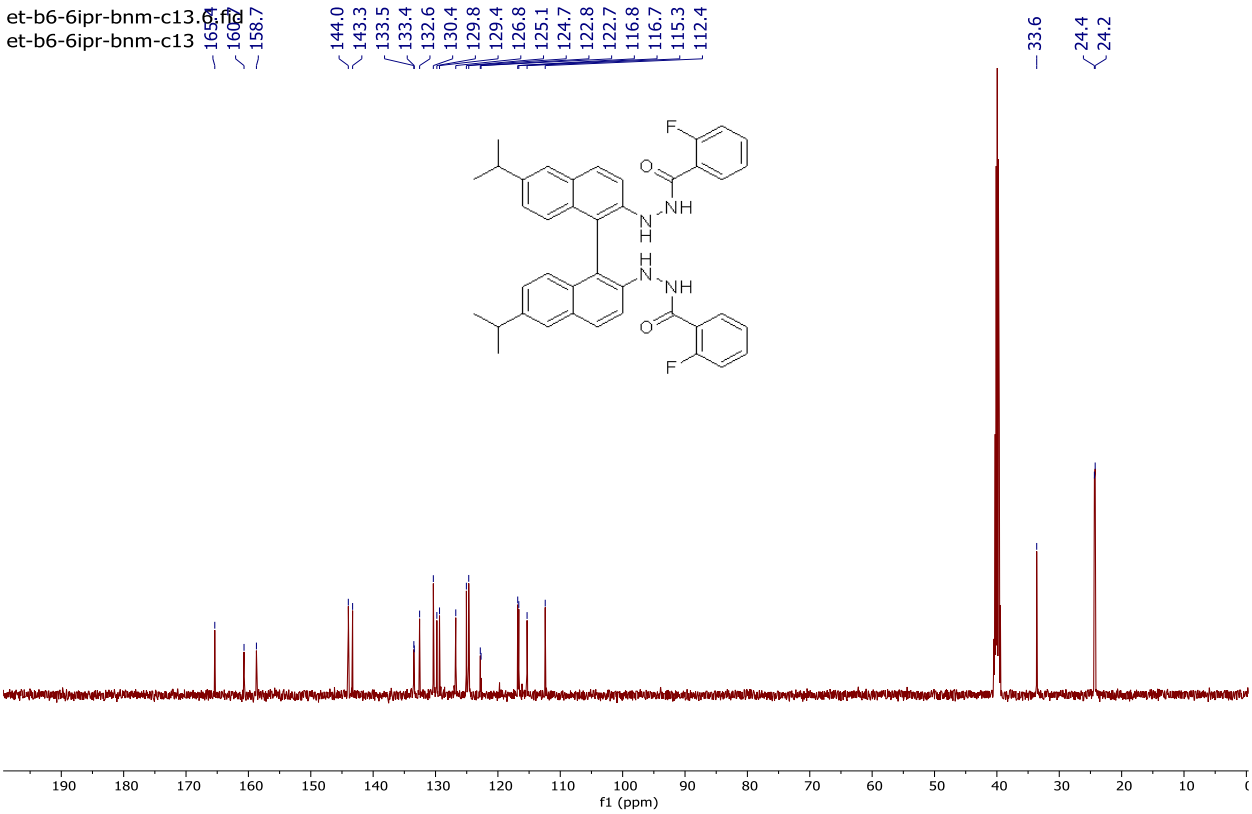

Oct24-2023-et-b6-6me-bm.10.fid
Oct24-2023-et-b6-6me-bm
10.48
7.91
7.88
7.65
7.57
7.56
7.54
7.46
7.43
7.35
7.33
7.30
7.28
7.27
7.04
7.03
7.02
7.01
6.68
6.66
2.50 DMSO-d6
2.38
Me
O
NH
N
H
N
H
NH
O
Me
F
F
2o
2.00
2.00
2.01
4.02
4.00
4.07
2.03
2.00
6.04
f1 (ppm)


et-b6-r6me-bnm-c13-6.fid
et-b6-r6me-bnm-c13-6.fid
165.7
160.0
158.7
143.9
133.5
133.4
132.3
132.2
130.4
129.4
129.1
127.5
125.1
125.0
124.6
122.8
122.7
116.8
116.7
115.4
112.4
21.3
F
O
NH
N
H
Me
Me
2o
f1 (ppm)

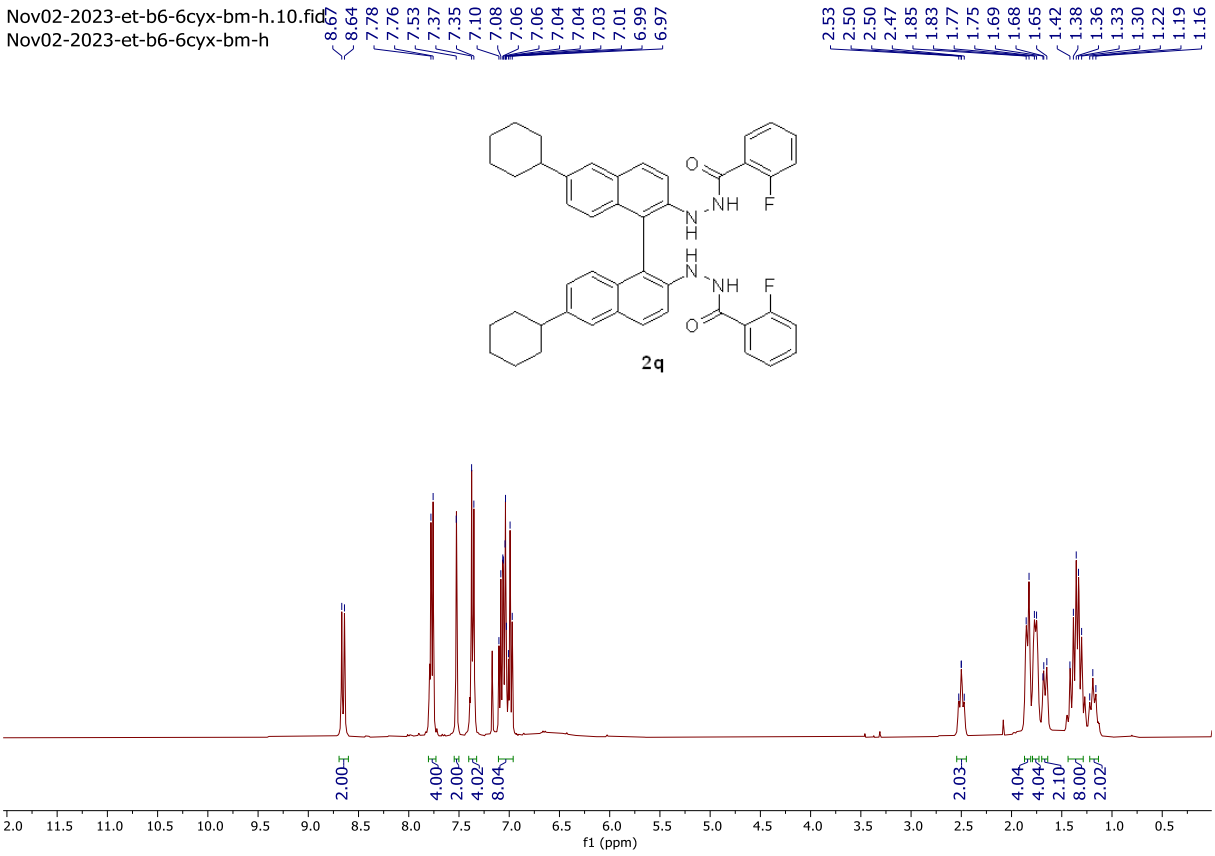
et-6-ipr-bnm.6.fid
et-6-ipr-bnm



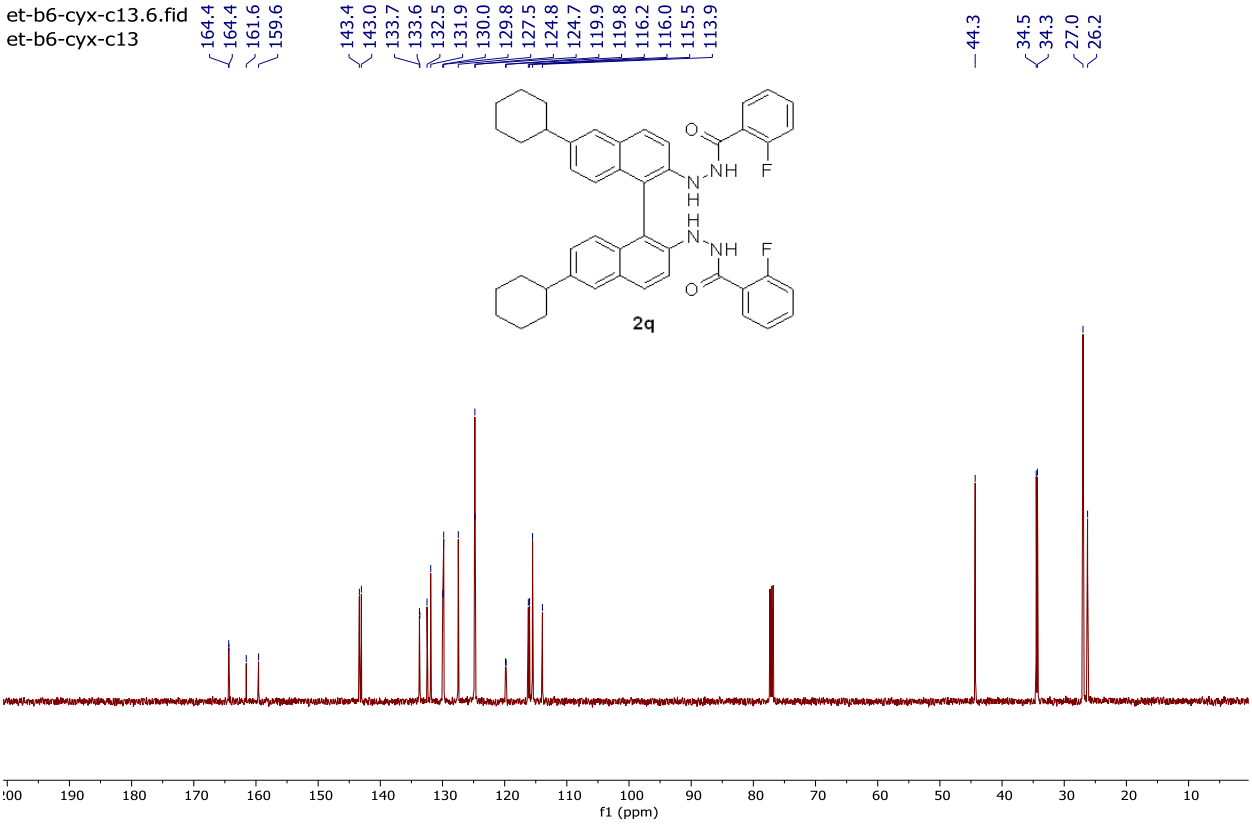
et-b6-6ipr-bnm-c13.6.fid
et-b6-6ipr-bnm-c13



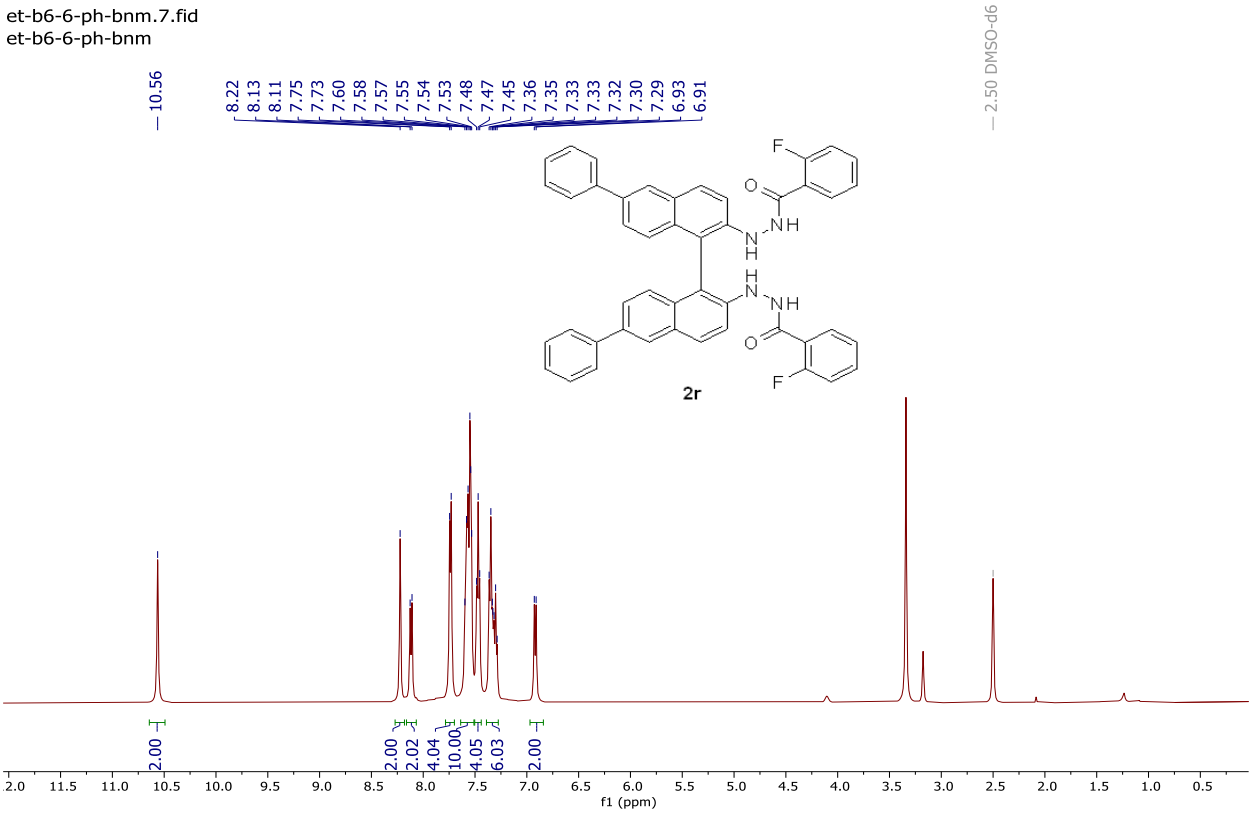
Nov02-2023-et-b6-6cyx-bm-h.10.fid
Nov02-2023-et-b6-6cyx-bm-h



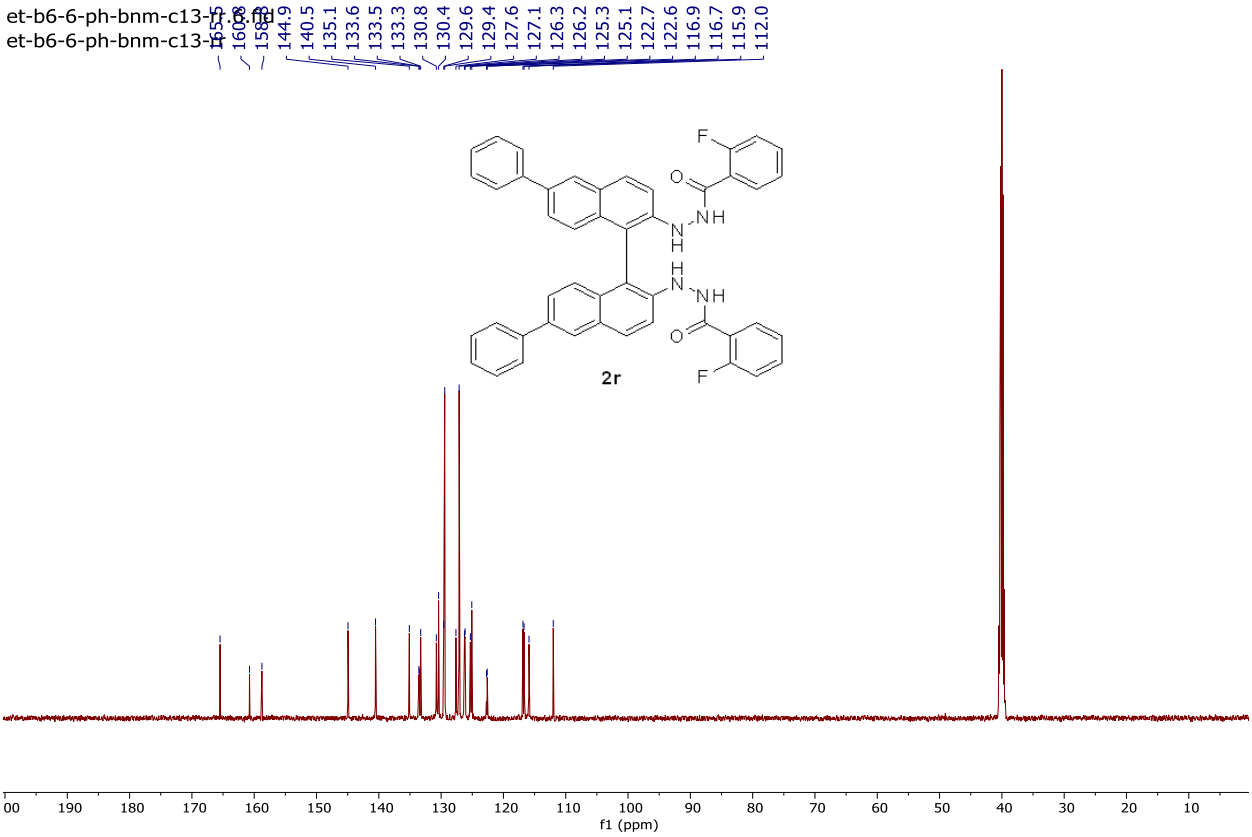
et-b6-cyx-c13.6.fid
et-b6-cyx-c13



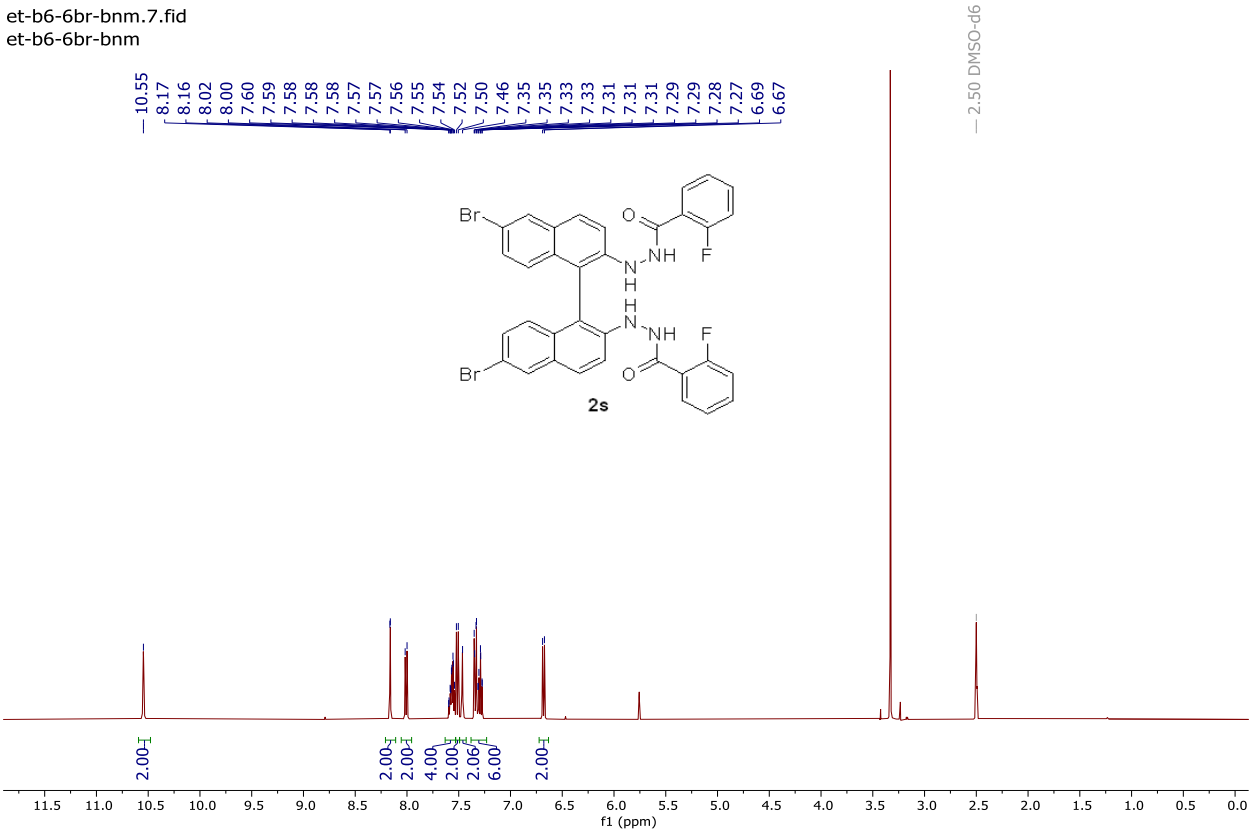
et-b6-6-ph-bnm.7.fid
et-b6-6-ph-bnm



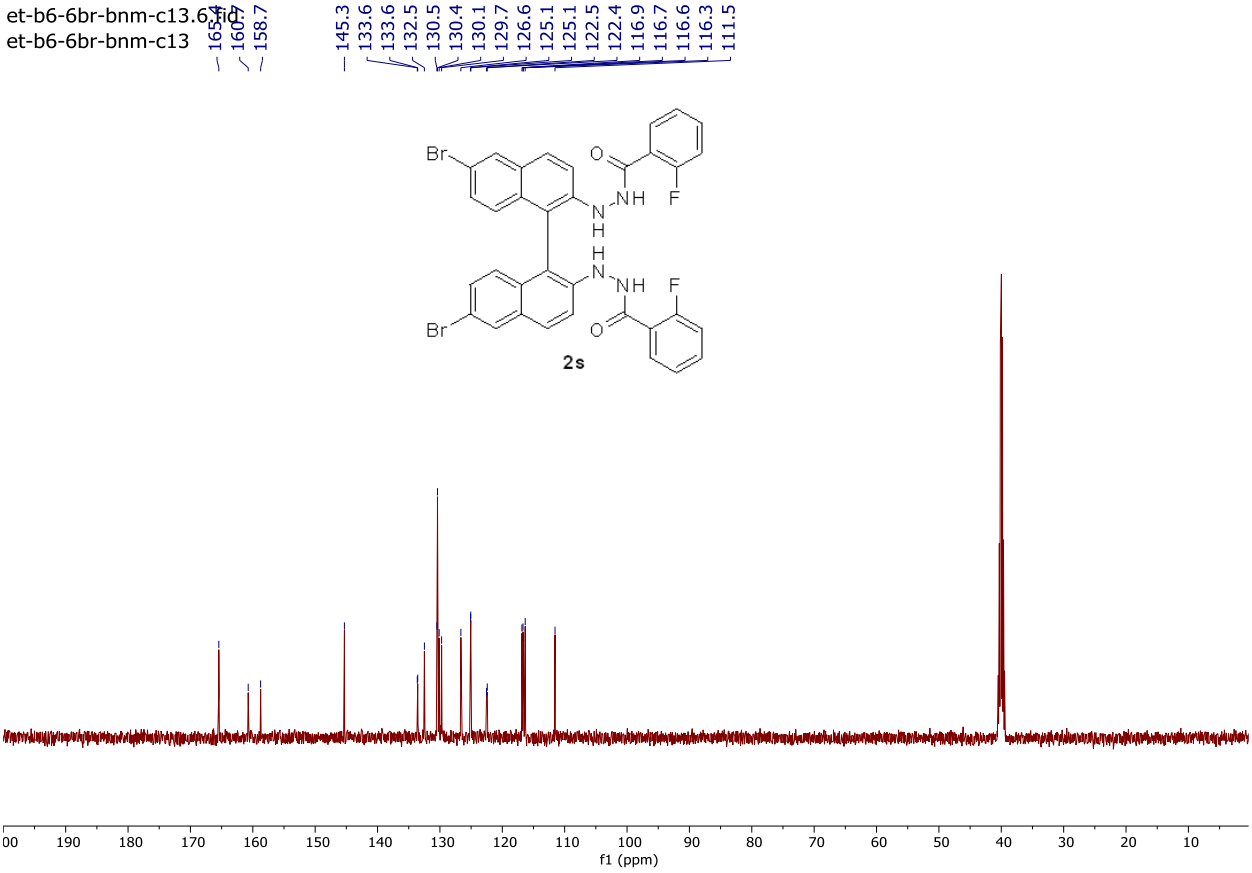
et-b6-6-ph-bnm-c13-rr.6.fid
et-b6-6-ph-bnm-c13-rr

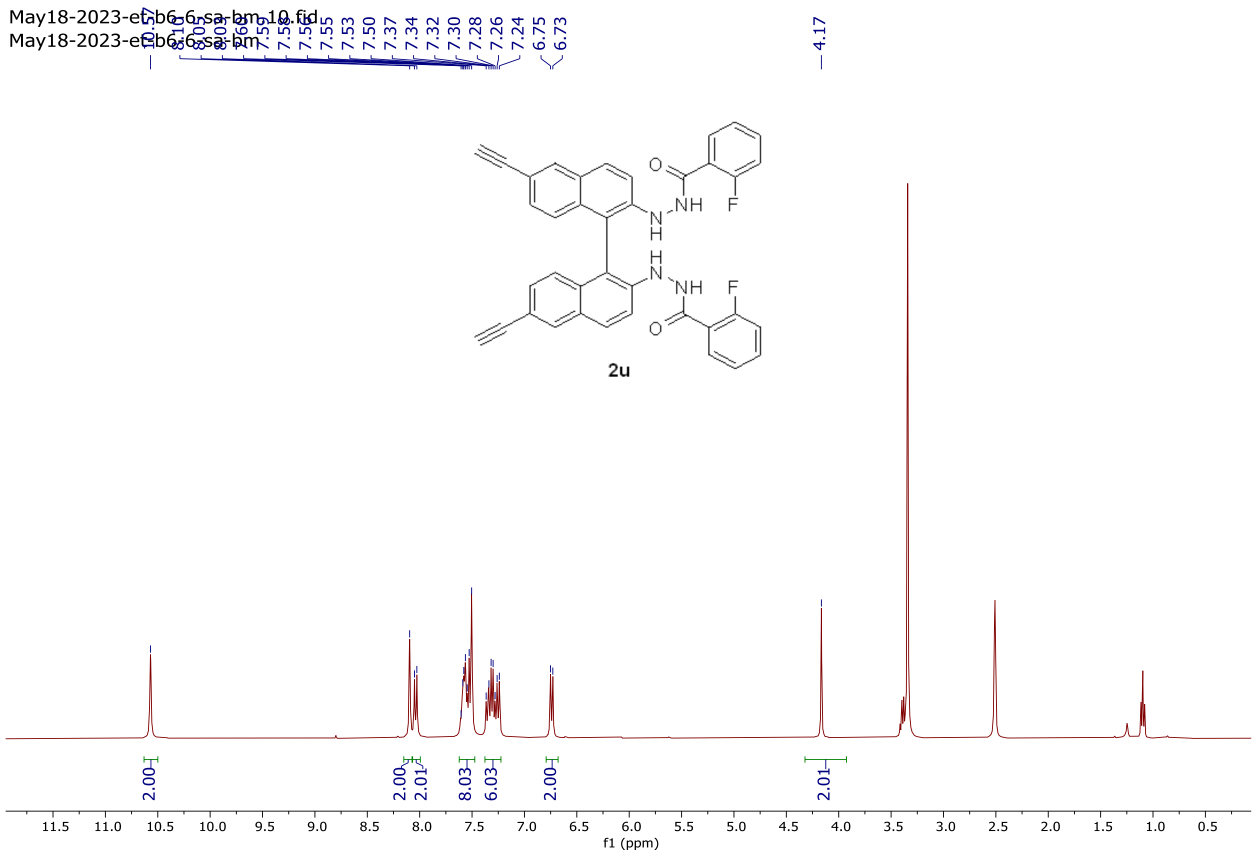


et-b6-6br-bnm.7.fid
et-b6-6br-bnm



et-b6-6br-bnm-c13.6.fid
et-b6-6br-bnm-c13




May18-2023-et-b6-6-sa-bm.10.fid
May18-2023-et-b6-6-sa-bm
7.55
7.53
7.50
7.37
7.34
7.32
7.30
7.28
7.26
7.24
6.75
6.73
4.17
2u
2.00
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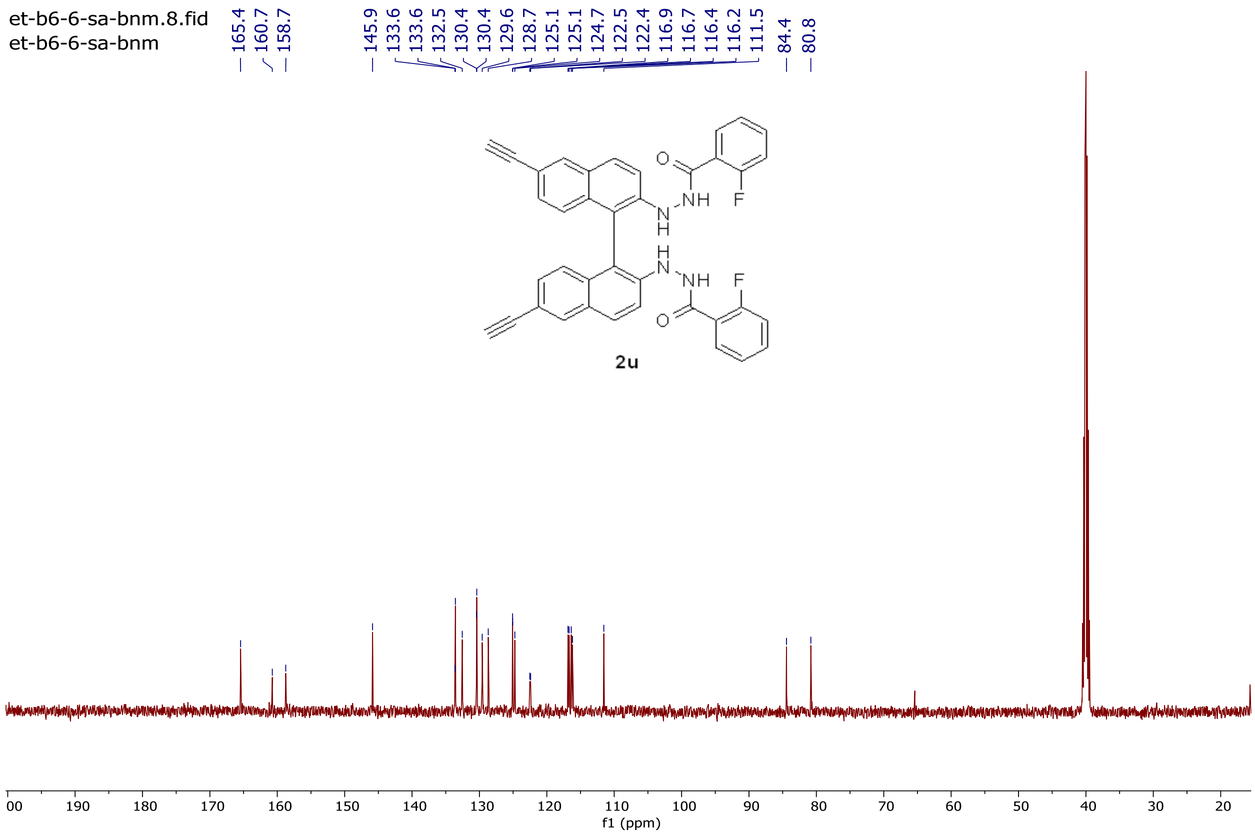
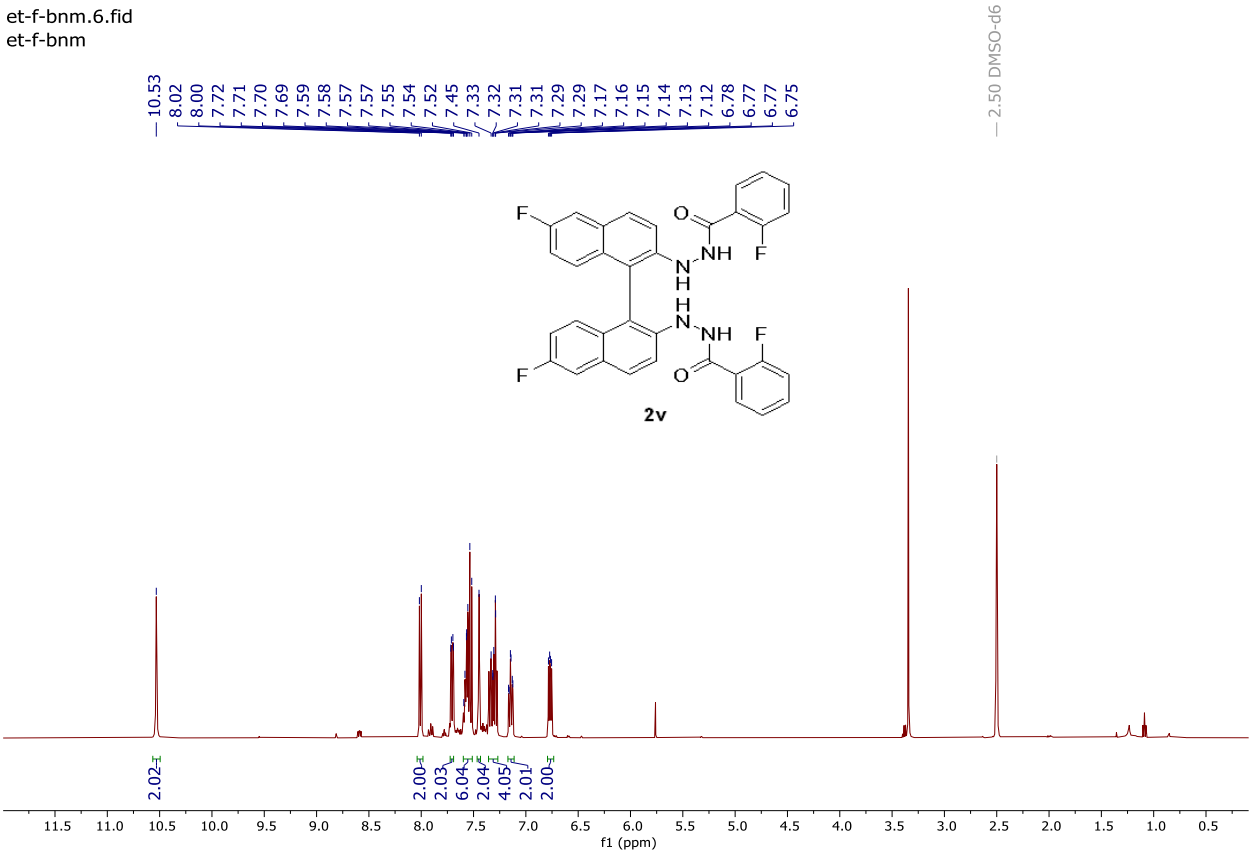
2.01
8.03
6.03
2.00
2.01
f1 (ppm)

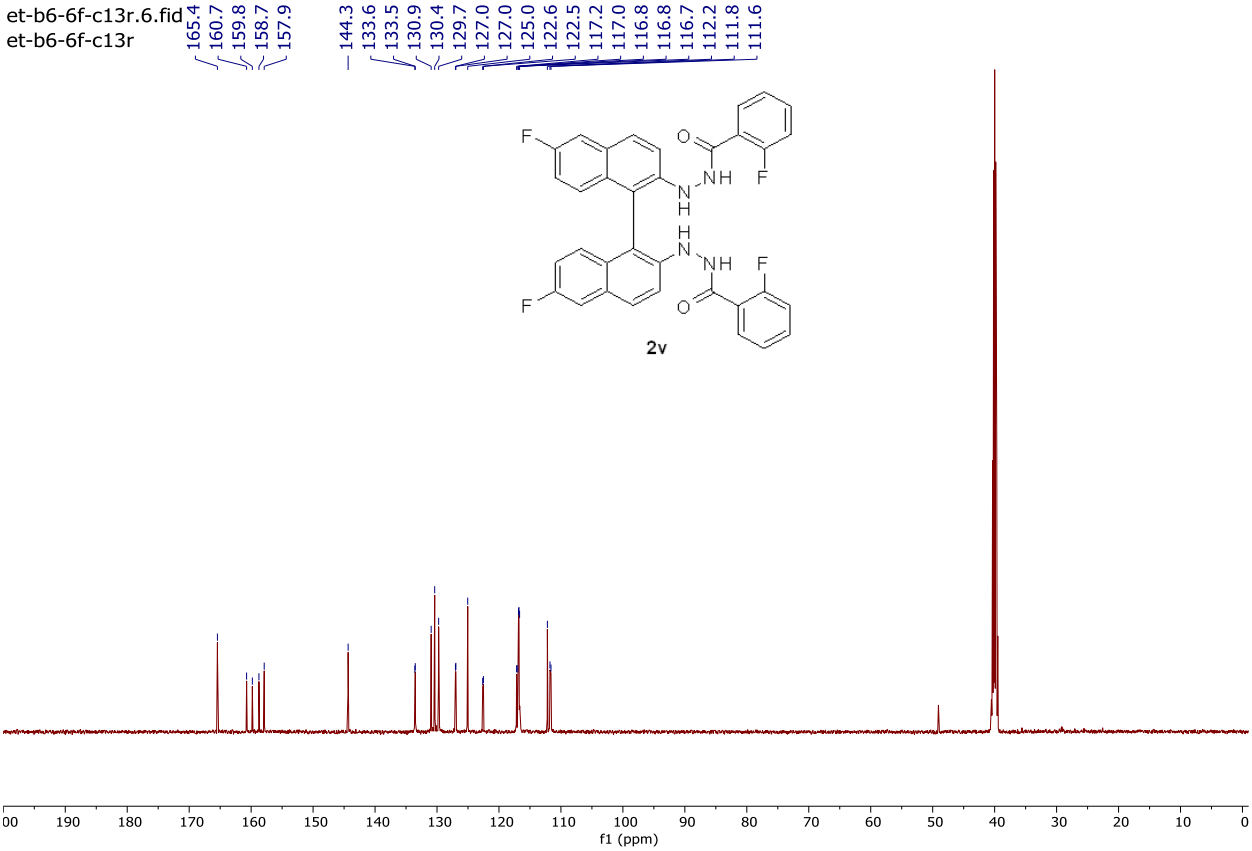

et-b6-6-sa-bnm.8.fid
et-b6-6-sa-bnm
165.4
160.7
158.7
145.9
133.6
133.6
132.5
130.4
130.4
129.6
128.7
125.1
125.1
124.7
122.5
122.4
116.9
116.7
116.4
116.2
111.5
84.4
80.8
2u
f1 (ppm)

et-f-bnm.6.fid
et-f-bnm



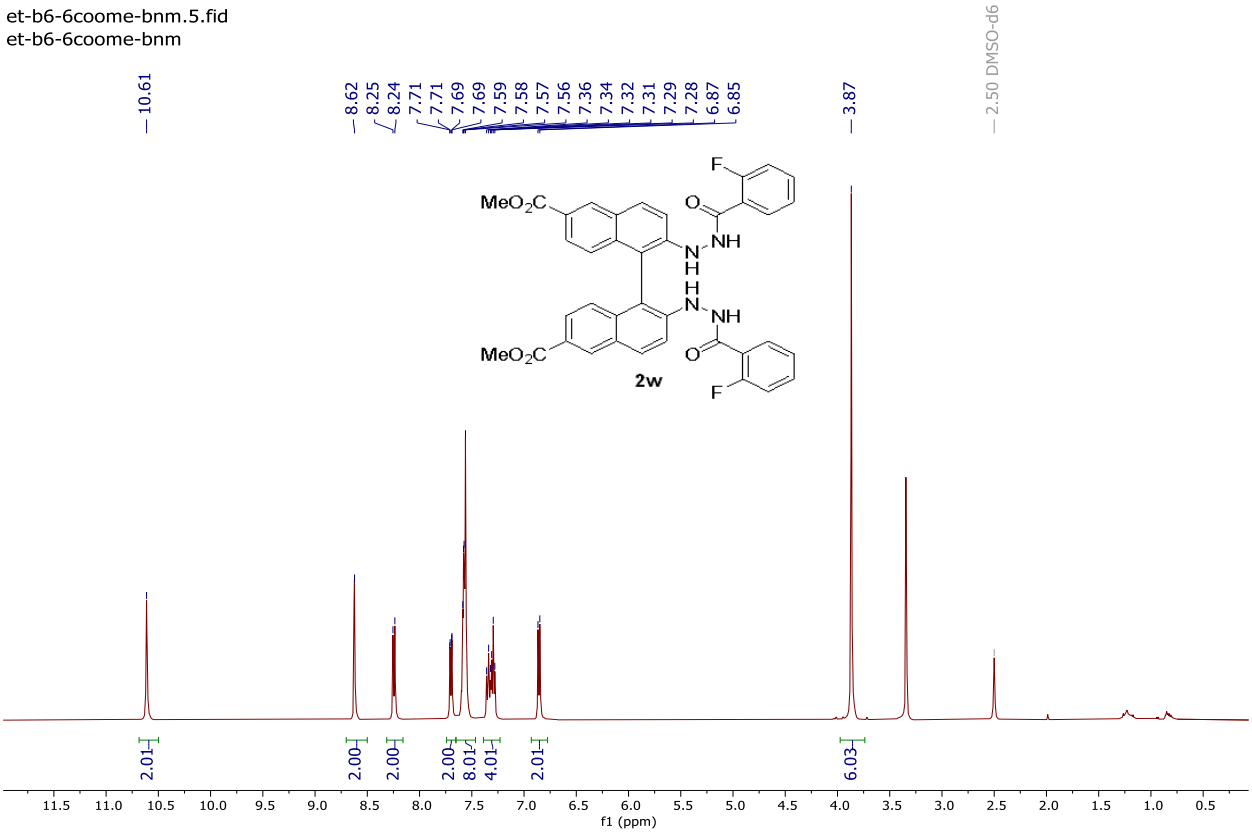
2v

et-b6-6f-c13r.6.fid
et-b6-6f-c13r

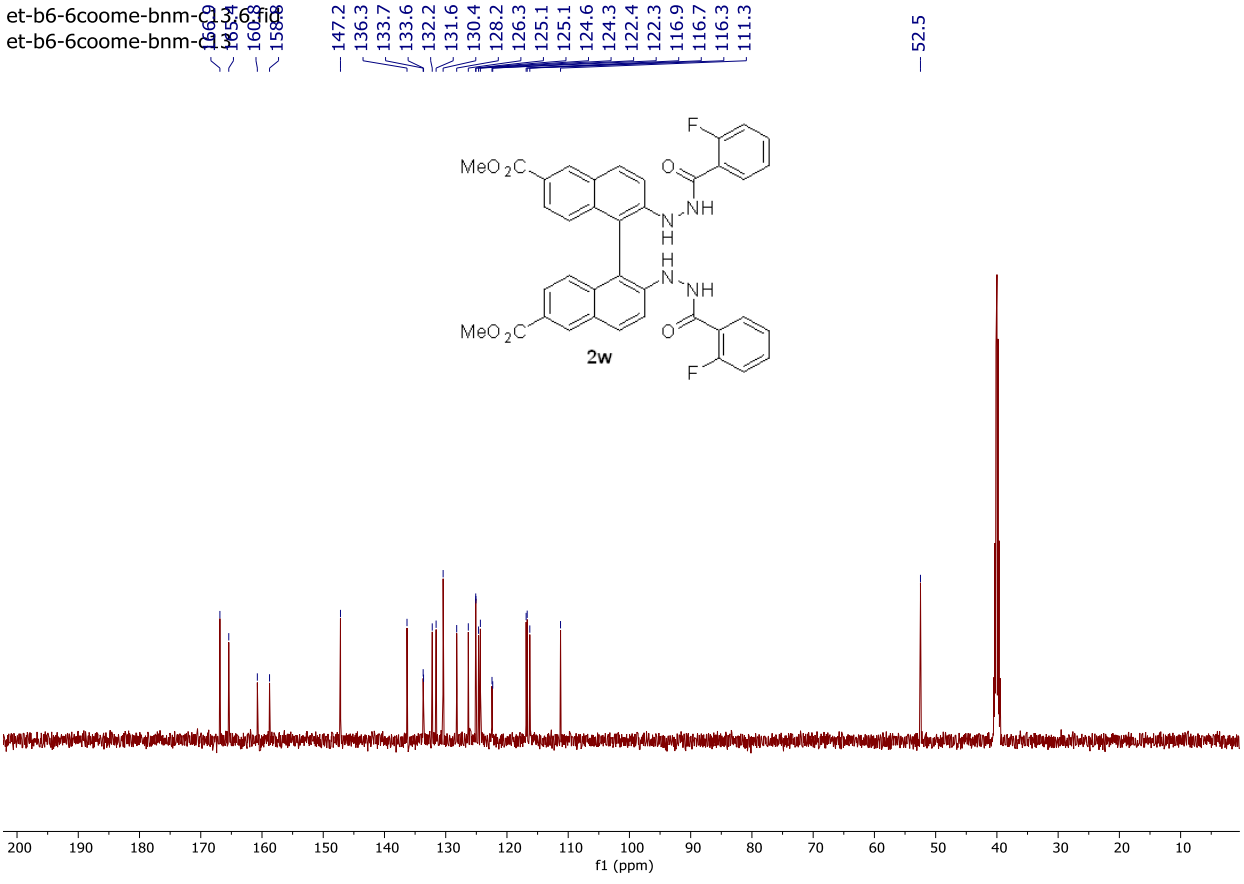


2v

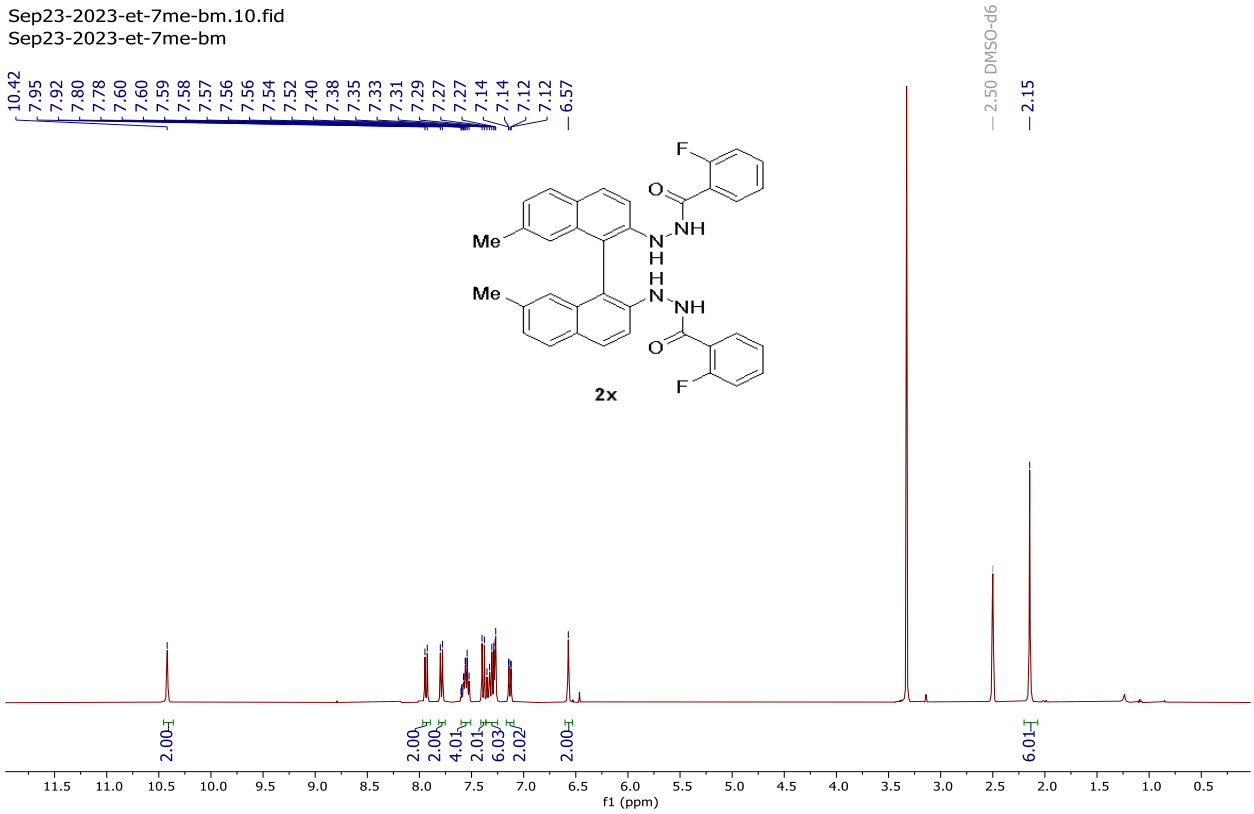
et-b6-6coome-bnm.5.fid
et-b6-6coome-bnm



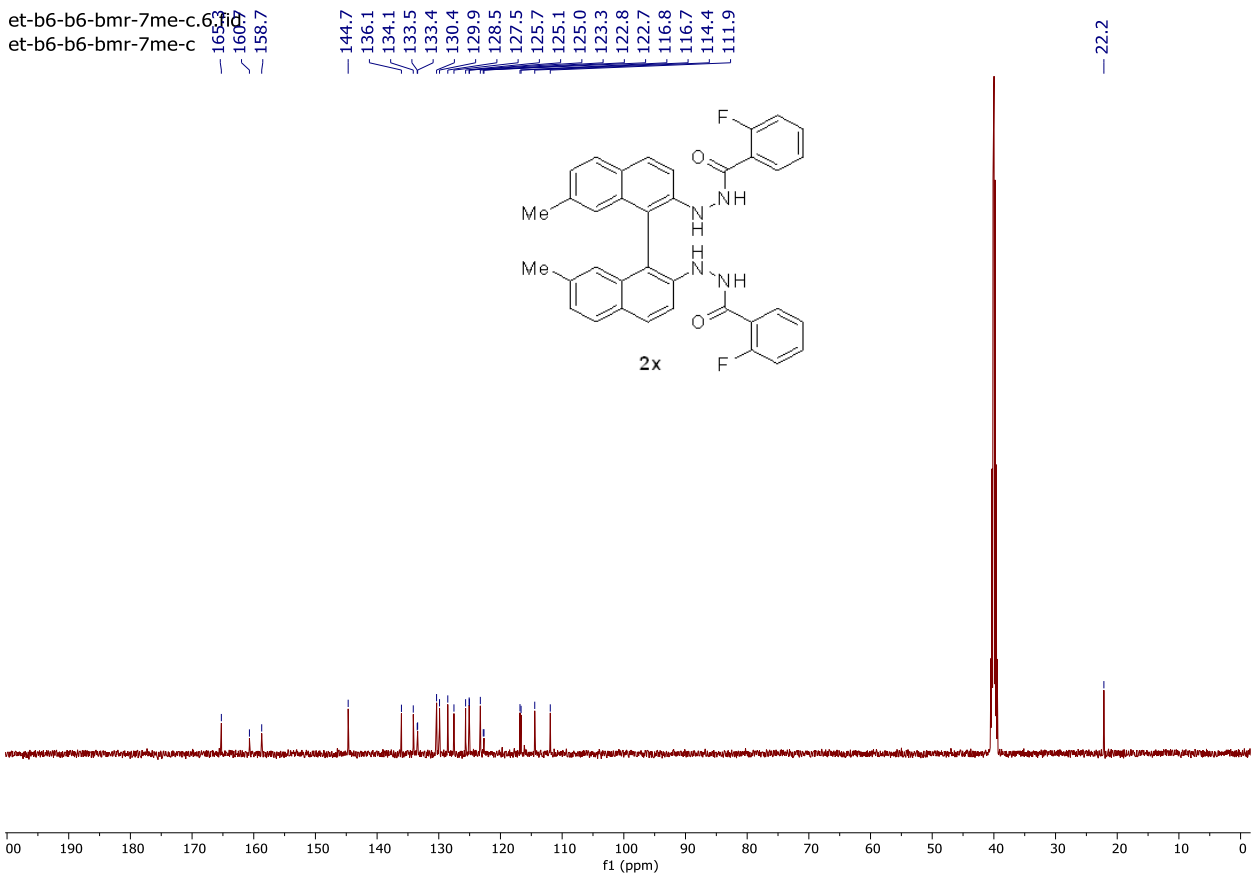
et-b6-6coome-bnm-c13.6.fid
et-b6-6coome-bnm-c13.6.fid

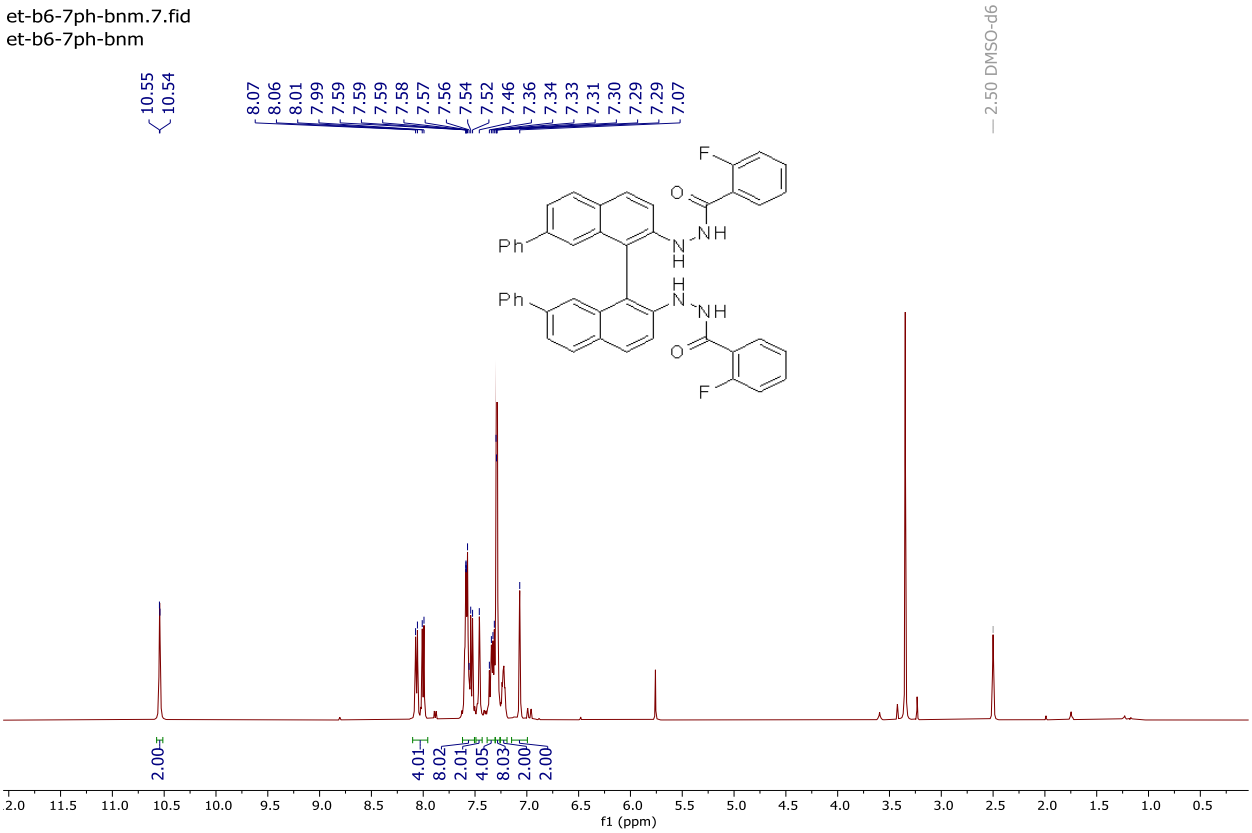


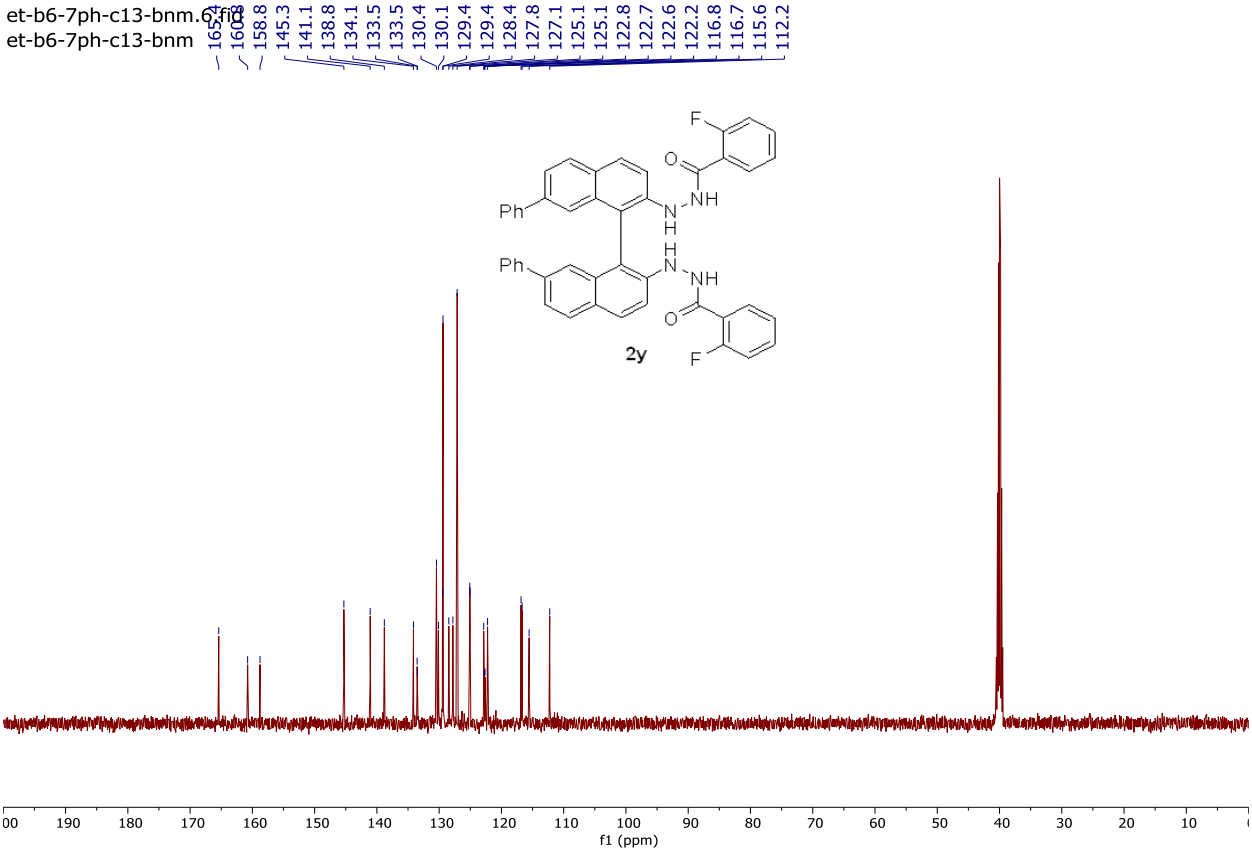
Sep23-2023-et-7me-bm.10.fid
Sep23-2023-et-7me-bm



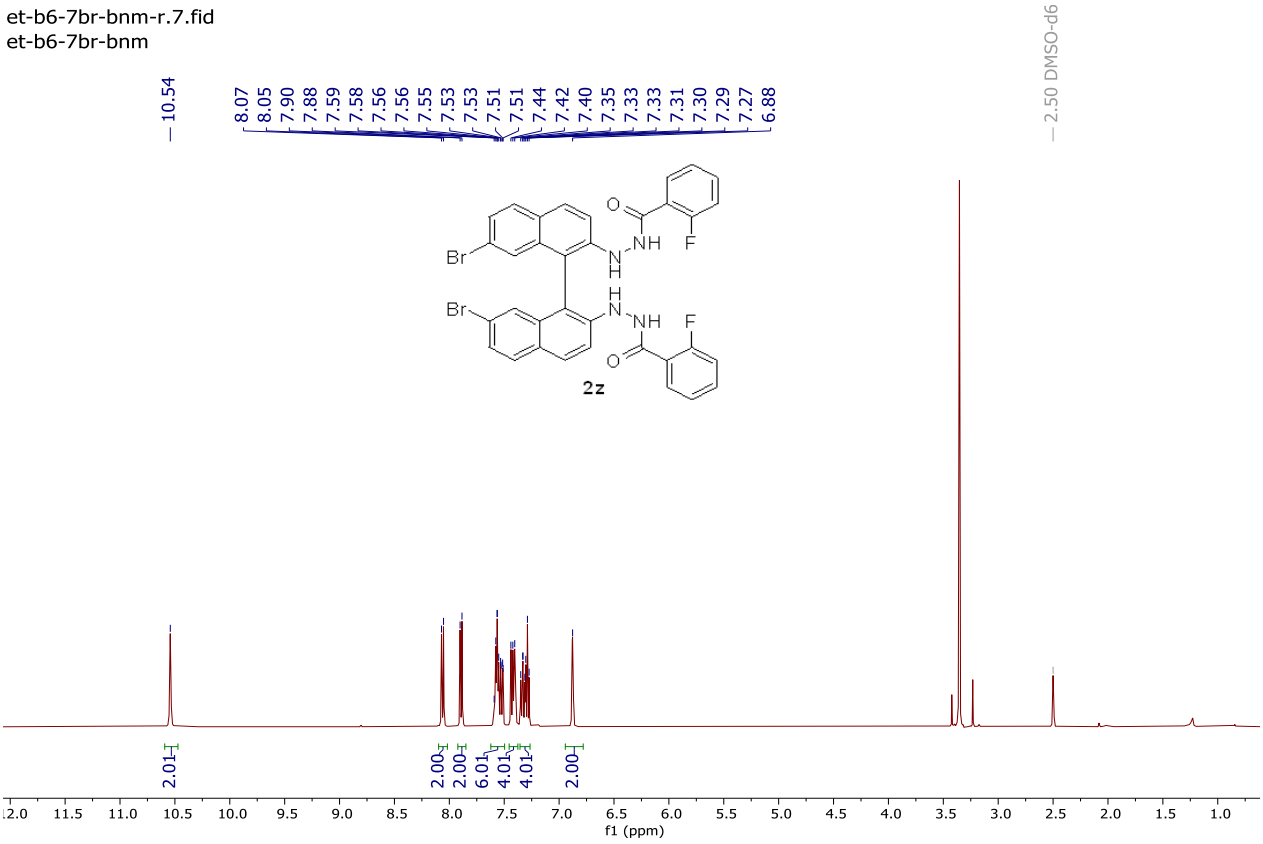
et-b6-b6-bmr-7me-c.6.fid
et-b6-b6-bmr-7me-c



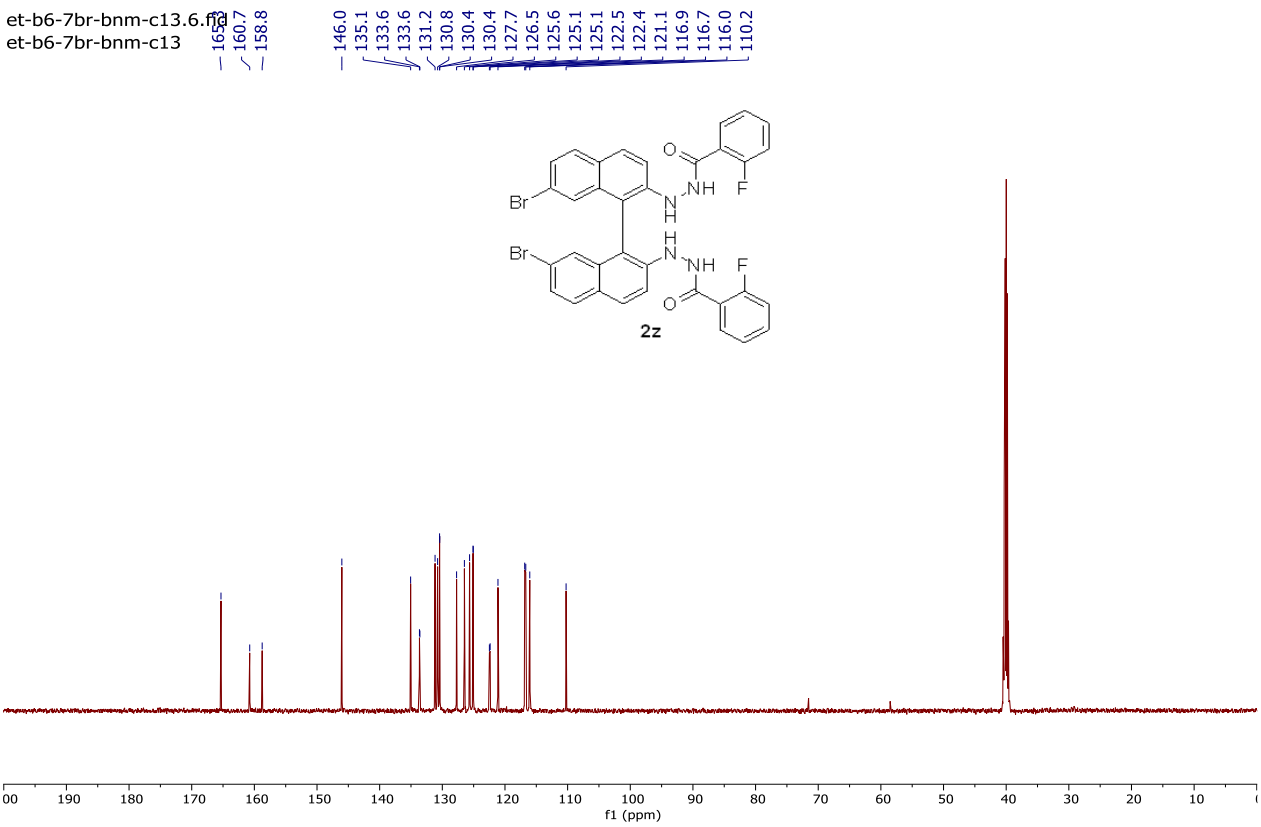

et-b6-7ph-bnm.7.fid
et-b6-7ph-bnm
10.55
10.54
8.07
8.06
8.01
7.99
7.59
7.59
7.59
7.58
7.57
7.56
7.54
7.52
7.46
7.36
7.34
7.33
7.31
7.30
7.29
7.29
7.07
2.50 DMSO-d6
F
O
NH
N
H
Ph
Ph
N
H
NH
O
F
2.00
4.01
8.02
2.01
4.05
8.03
2.00
2.00
f1 (ppm)


et-b6-7ph-c13-bnm.6.fid
et-b6-7ph-c13-bnm
160.8
158.8
145.3
141.1
138.8
134.1
133.5
133.5
130.4
130.1
129.4
129.4
128.4
127.8
127.1
125.1
125.1
122.8
122.7
122.6
122.2
116.8
116.7
115.6
112.2
F
O
NH
N
H
Ph
Ph
N
H
NH
O
F
2y
f1 (ppm)

et-b6-7br-bnm-r.7.fid
et-b6-7br-bnm

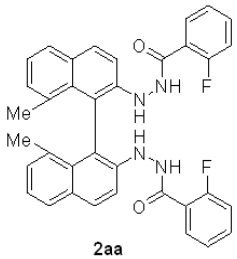


et-b6-7br-bnm-c13.6.fid
et-b6-7br-bnm-c13

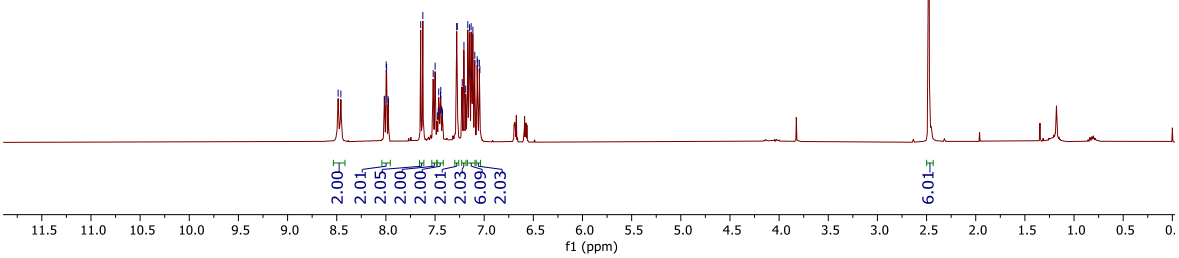


S

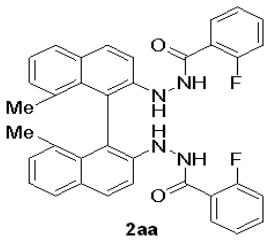
Nov06-2023-et-b6-8ch3-bm.10.fid
Nov06-2023-et-b6-8ch3-bm



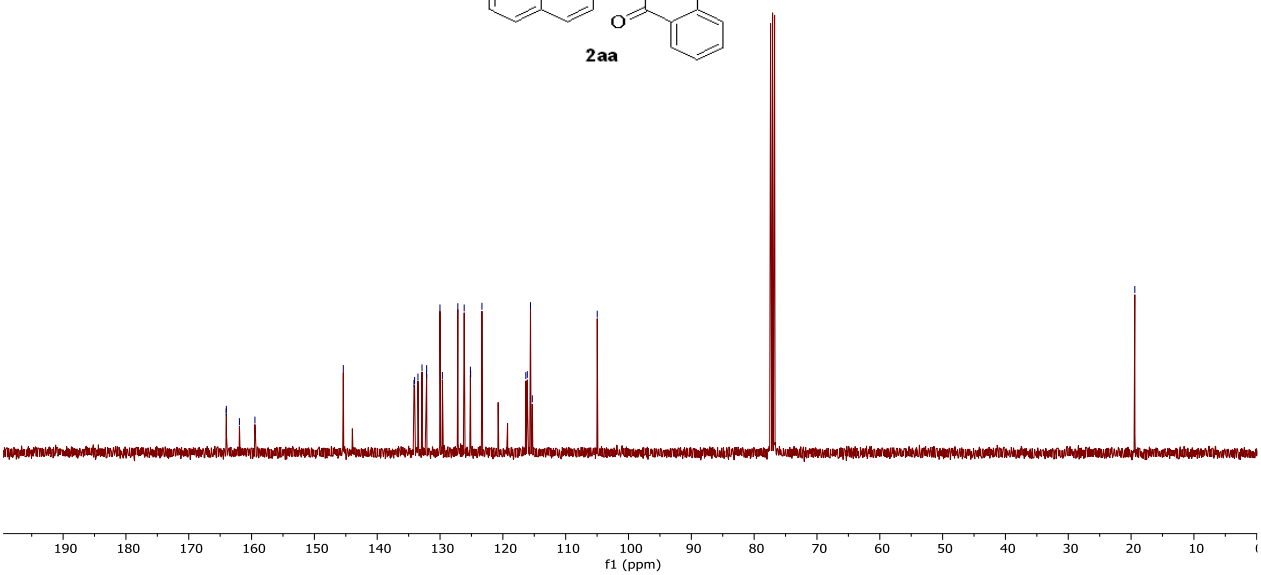
2aa



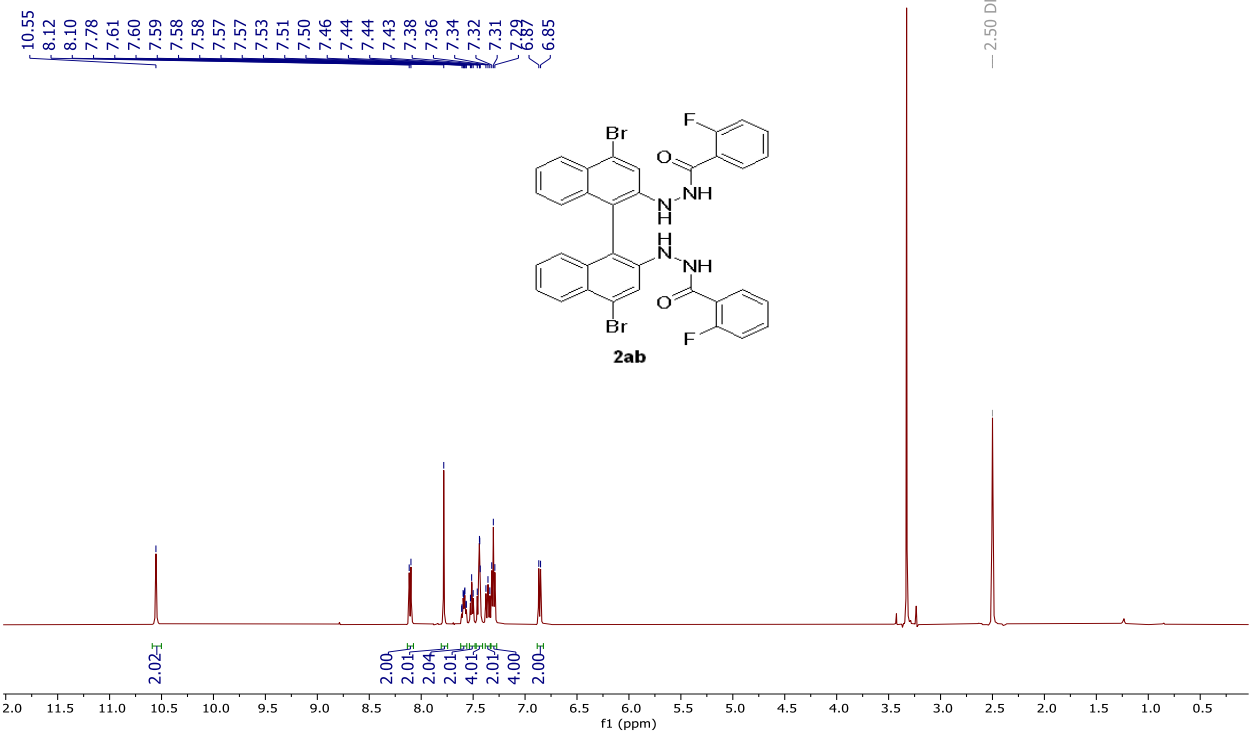
Nov07-2023-et-b6c-8ch3.10.fid
Nov07-2023-et-b6c-8ch3



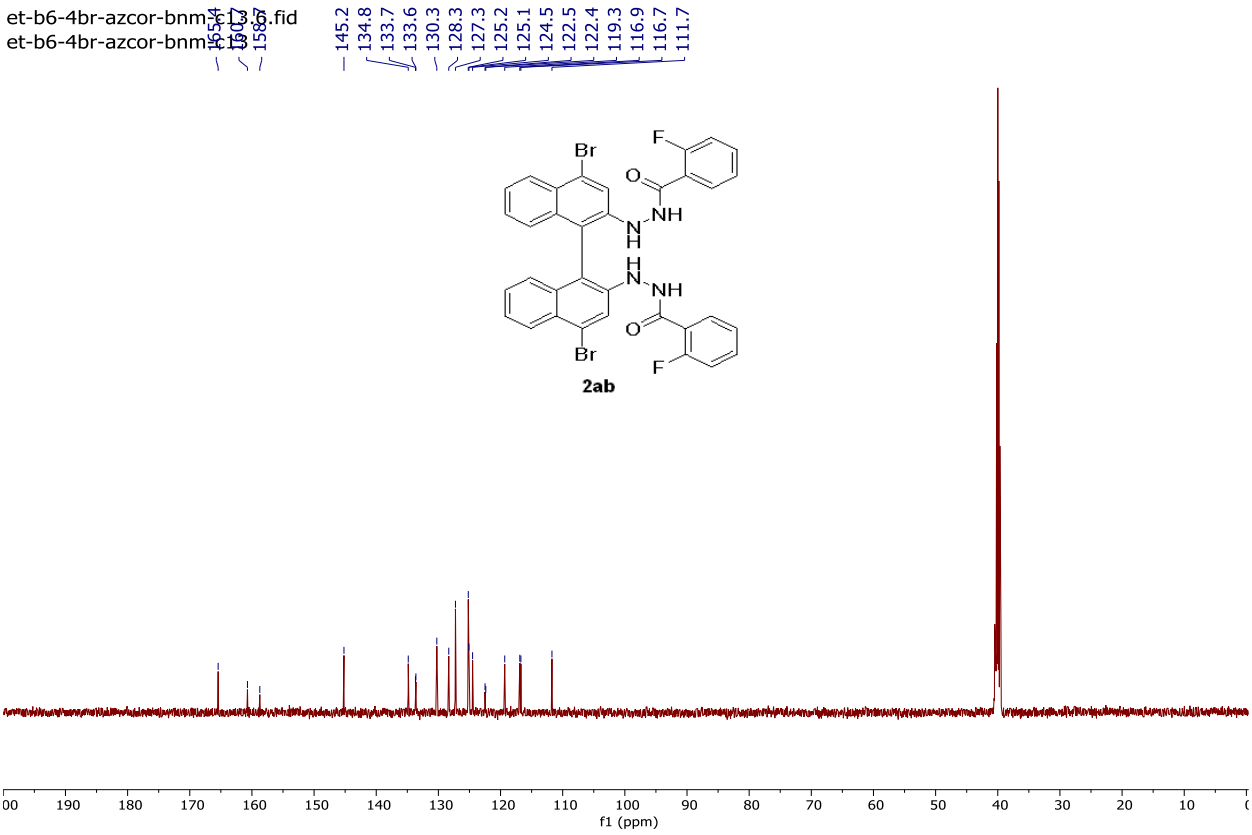
2aa



et-b6-4br-azcor-bnm-h.6.fid
et-b6-4br-azcor-bnm-h



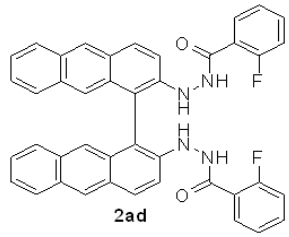
et-b6-4br-azcor-bnm-c.1.fid
et-b6-4br-azcor-bnm-c



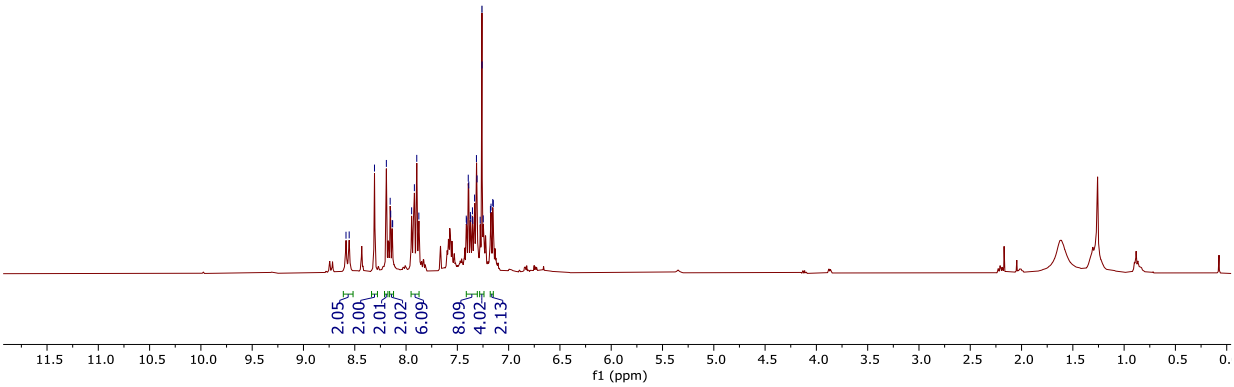
Nov06-2023-et-b6-ant-bm.10.fid
Nov06-2023-et-b6-ant-bm

^{1}H NMR (400 MHz, Chloroform-d) δ 8.57 (d, J = 12.4 Hz, 2H), 8.31 (s, 2H), 8.19 (s, 2H), 8.14 (dd, J = 10.0, 2.2 Hz, 2H), 7.95 – 7.88 (m, 2H), 7.43 – 7.30 (m, 6H), 7.28 – 7.24 (m, 5H), 7.18 (dd, J = 10.0, 2.2 Hz, 2H).

8.59 8.55 8.31 8.19 8.15 8.15 8.13 8.13 7.95 7.92 7.90 7.88 7.41 7.41 7.39 7.39 7.37 7.37 7.35 7.35 7.33 7.31 7.31 7.28 7.26 7.26 CDCl3 7.26 7.25 7.18 7.17 7.15 7.15

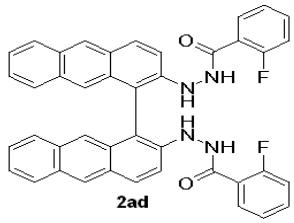


2ad



et-b6-ant-c13.6.fid
et-b6-ant-c13

163.7 161.8 159.8 144.7 134.2 134.2 132.3 132.3 130.8 130.4 129.9 128.8 128.3 127.9 127.7 126.9 126.3 125.5 125.2 125.2 124.4 124.2 122.9 117.7 116.6 116.3 116.1 106.0



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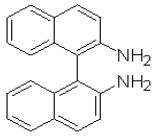
Aug23-2023-et-b6-bnmclv



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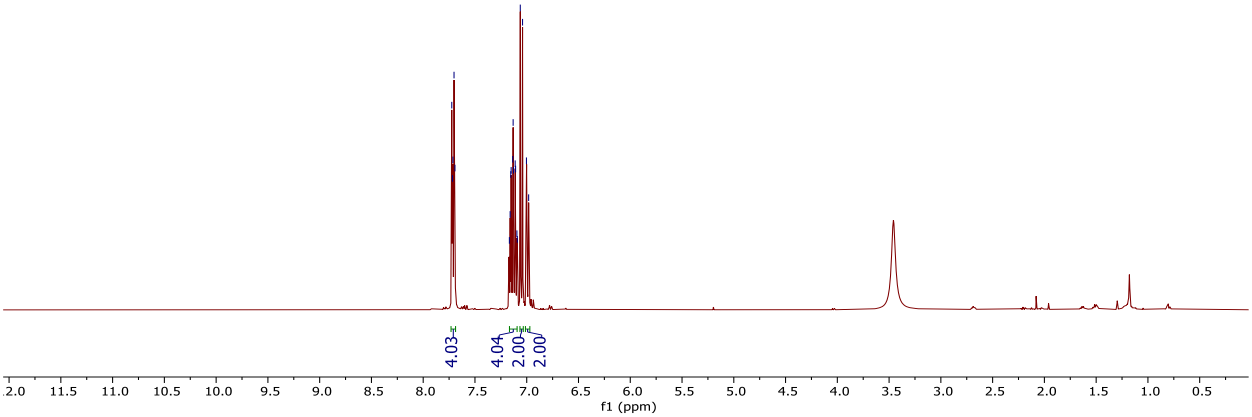

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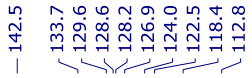

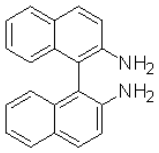

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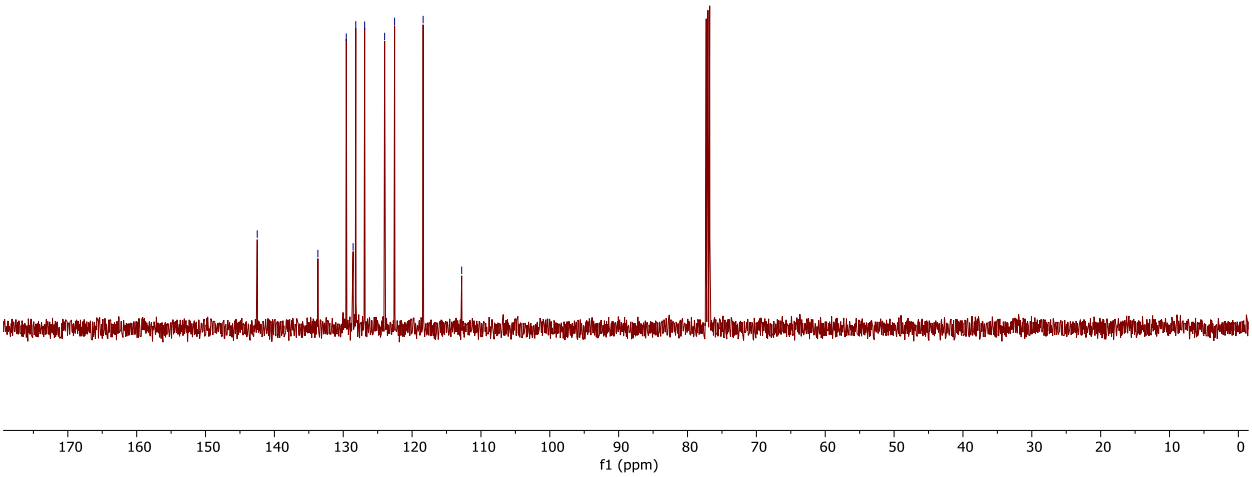

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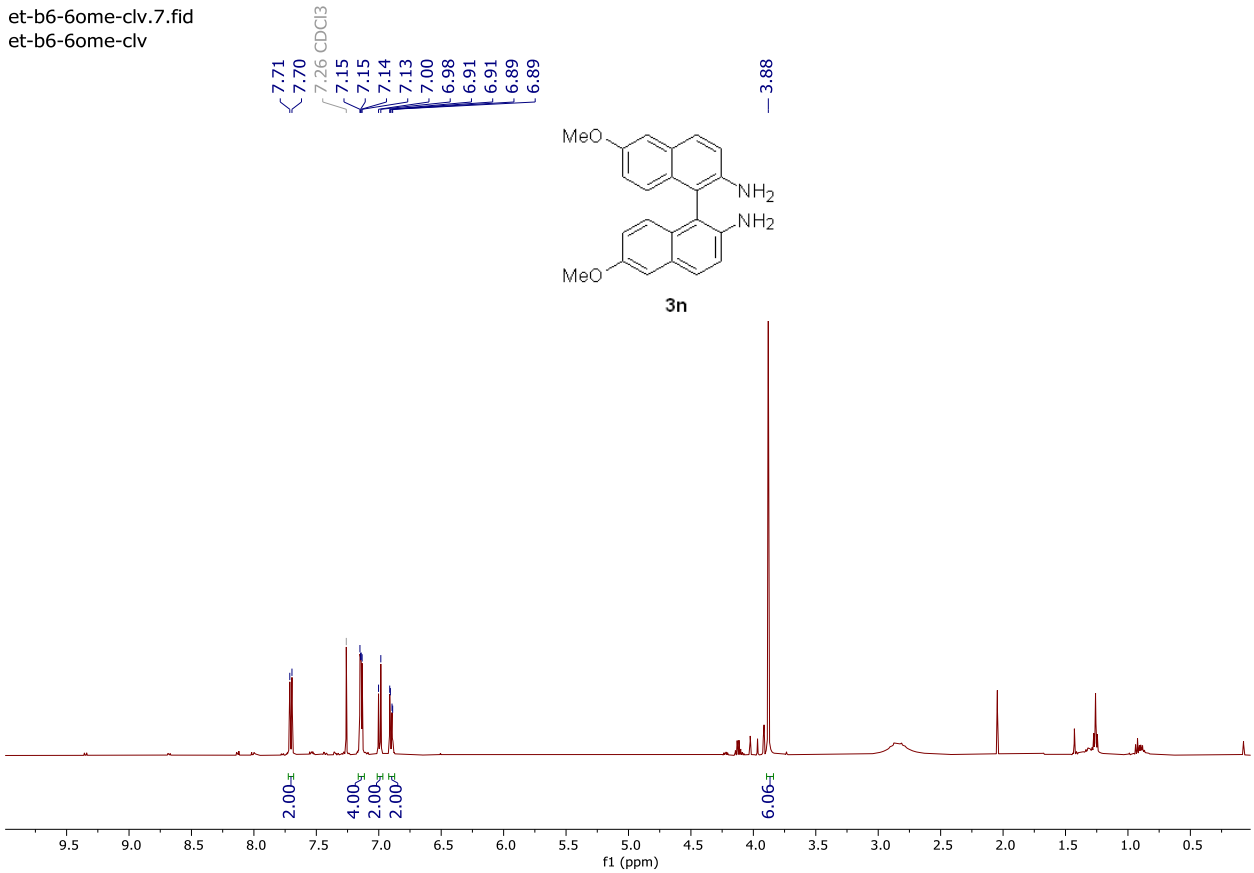
et-b6-6ome-clv



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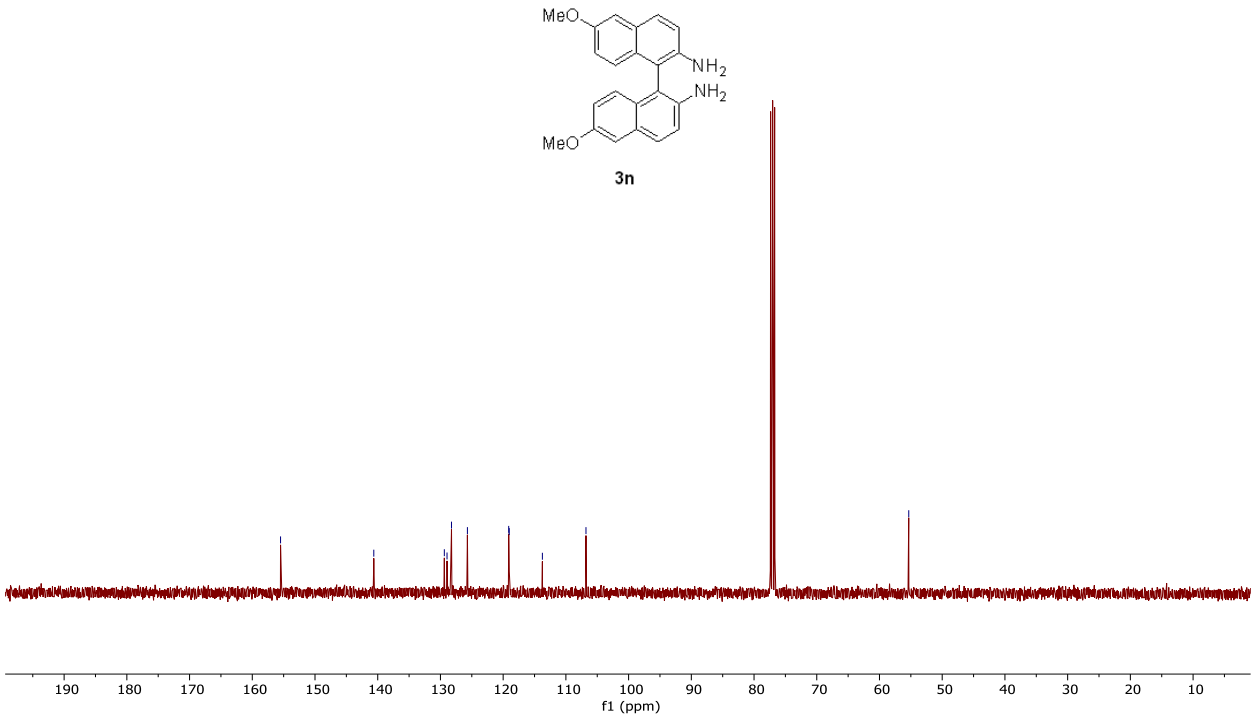

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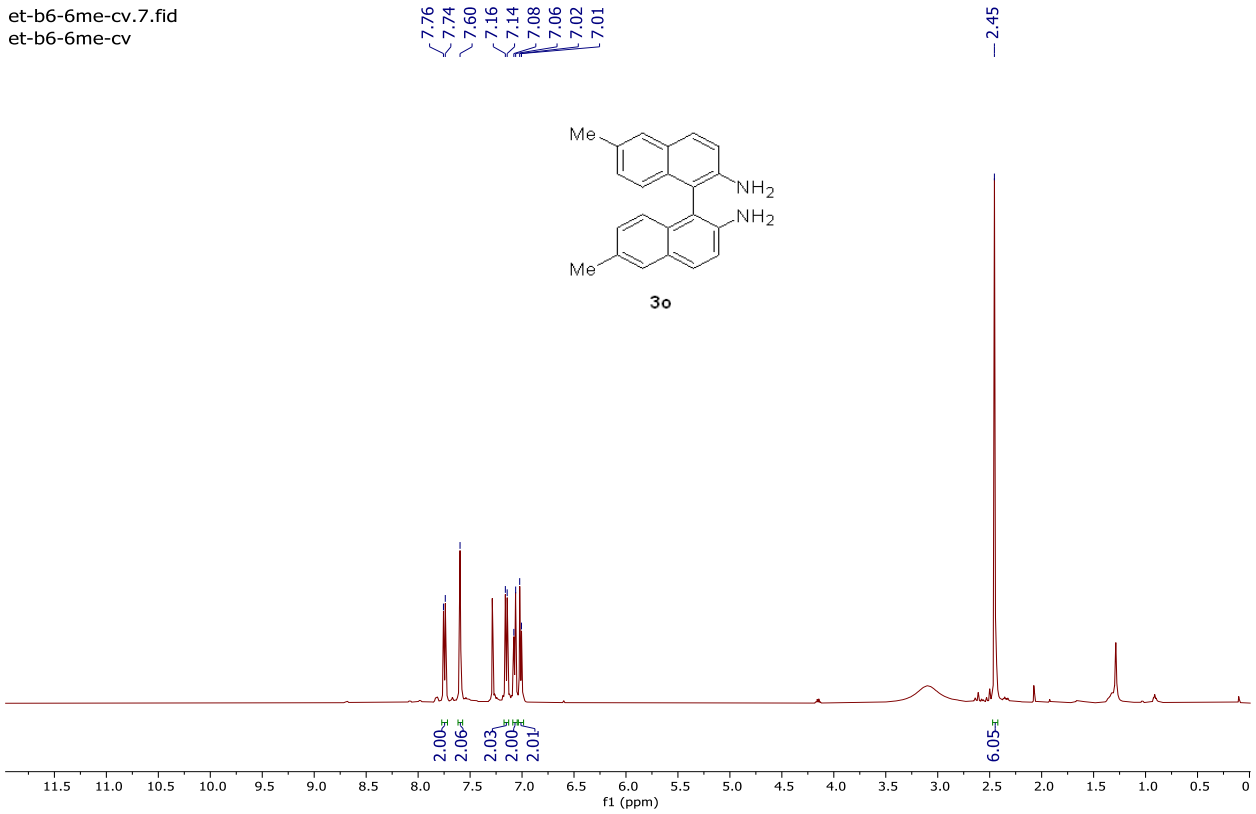

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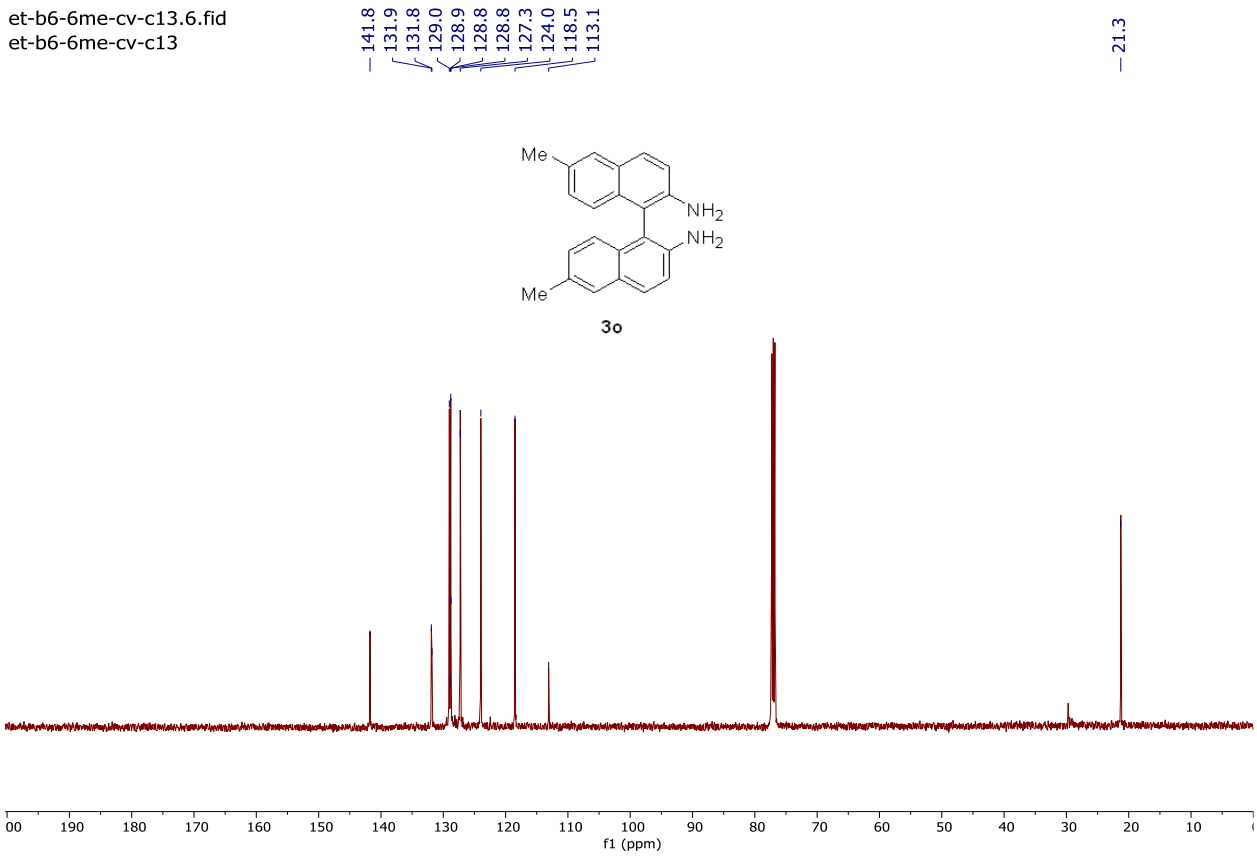

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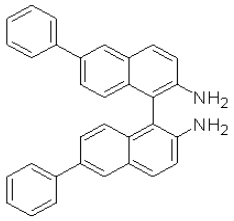

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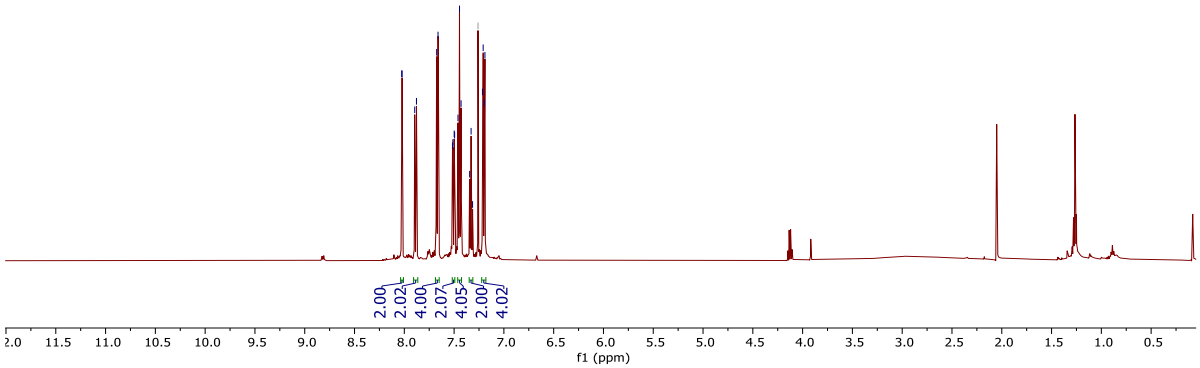

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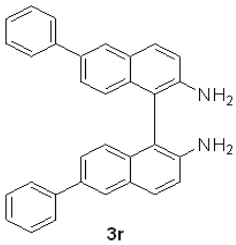

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