

Chemo-, Regio-, and Stereoselectivity in 1,3-Dipolar Cycloaddition of Piperine with Nitrones. A Cycloadditive Route to Aminoalcohols

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Supporting Information

Spectral characterization data for compounds:

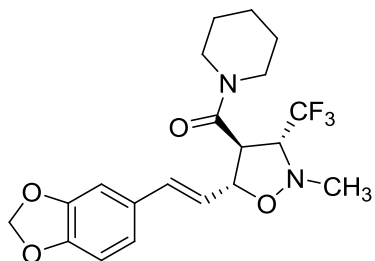
6a - 6c, 7, 8, 10a -10d, 11a, 11c, 12a and 13 2-8

¹H NMR, ¹⁹F NMR, ¹³C NMR and 2D spectra of compounds:

6a - 6c, 7, 8, 10a -10d, 11a, 11c, 12a and 13 9-35

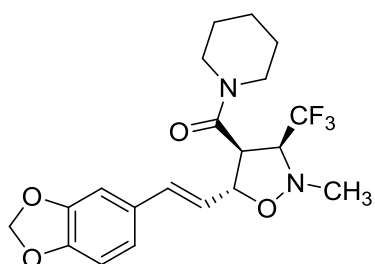
Compound 6a5-((*E*)-2-(Benzo[d][1,3]dioxol-5-yl)vinyl)-2-methyl-3-

(trifluoromethyl)isoxazolidin-4-yl)(piperidin-1-yl)methanones



6aA: $^1\text{H NMR}$ (600 MHz, CDCl_3): δ 6.94 (d, $J = 1.4$ Hz, 1H), 6.83 (dd, $J = 8.0, 1.5$ Hz, 1H), 6.78 (d, $J = 8.0$ Hz, 1H), 6.66 (d, $J = 15.8$ Hz, 1H), 6.02 (m, 1H), 5.99 (s, 2H), 4.93 (t, $J = 8.3$ Hz, 1H), 4.13(m, 1H), 3.72 (m, 2H), 3.56 (m, 1H), 3.45 (m, 2H), 3.02 (s, 3H), 1.57 (m, 6H); $^{19}\text{F NMR}$ (565 MHz, CDCl_3): δ -74.67 (d, $J = 7.9$ Hz); $^{13}\text{C NMR}$ (151 MHz, CDCl_3): δ 167.00 (s), 148.20 (s), 148.10 (s), 135.82 (s), 129.96 (s), 127.12 (q, $J = 280.1.0$ Hz), 121.89 (s), 121.49 (s), 108.40 (s), 105.82 (s), 101.30 (s), 83.32 (s), 72.76 (q, $J = 29.8$ Hz), 53.13 (s), 47.61 (s), 45.20 (s), 43.99 (s), 26.74 (s), 25.63 (s), 24.29 (s).

$^1\text{H NMR}$ (600 MHz, CD_3CN): δ 7.04 (s, 1H), 6.88 (d, $J = 8.0$ Hz, 1H), 6.80 (d, $J = 8.0$ Hz, 1H), 6.68 (d, $J = 15.8$ Hz, 1H), 6.11 (dd, $J = 15.8, 8.5$ Hz, 1H), 5.96 (s, 2H), 4.84 (t, $J = 8.5$ Hz, 1H), 4.19 (qd, $J = 8.4, 4.9$ Hz, 1H), 3.79 (dd, $J = 8.4, 4.9$ Hz, 1H), 3.68 (ddd, $J = 12.9, 6.7, 3.8$ Hz, 1H), 3.41 (dddd, $J = 21.7, 9.6, 6.7, 4.3$ Hz, 3H), 2.89 (s, 3H), 1.54 (q, $J = 5.8$ Hz, 2H), 1.54 – 1.39 (m, 2H), 1.39 – 1.30 (m, 2H); $^{19}\text{F NMR}$ (565 MHz, CD_3CN): δ -75.08 (d, $J = 8.6$ Hz); $^{13}\text{C NMR}$ (151 MHz, CD_3CN): δ 167.74 (s), 149.30 (s), 149.12 (s), 136.60 (s), 131.45 (s), 126.75 (q, $J = 278.3$ Hz), 123.29 (s), 123.09 (s), 109.23 (s), 106.72 (s), 102.68 (s), 84.30 (s), 73.32 (q, $J = 29.5$ Hz), 53.75 (s), 48.20 (s), 45.82 (s), 44.50 (s), 27.65 (s), 26.56 (s), 25.08 (s).

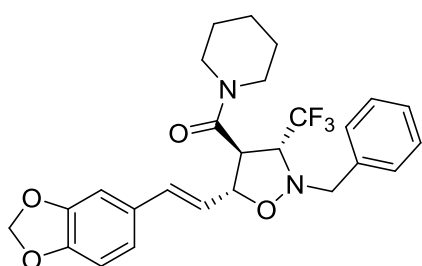


6aB: $^1\text{H NMR}$ (600 MHz, CDCl_3): δ 6.83 (s, 1H), 6.74 (d, $J = 8.0$ Hz, 1H), 6.66 (d, $J = 8.0$ Hz, 1H), 6.61 (d, $J = 15.8$ Hz, 1H), 5.87 (s, 2H), 5.81 (dd, $J = 15.8, 7.1$ Hz, 1H), 5.13 (t, $J = 8.5$ Hz, 1H), 3.44 (m, 6H), 2.86 (s, 3H), 1.51 (m, 6H); $^{19}\text{F NMR}$ (565 MHz, CDCl_3): δ -70.60 (d, $J = 7.0$ Hz).

$^1\text{H NMR}$ (600 MHz, CD_3CN): δ 7.00 (d, $J = 1.7$ Hz, 1H), 6.86 (dd, $J = 8.0, 1.7$ Hz, 1H), 6.79 (d, $J = 8.0$ Hz, 1H), 6.58 (d, $J = 15.8$ Hz, 1H), 6.00 (dd, $J = 15.8, 7.9$ Hz, 1H), 5.95 (d, $J = 2.8$ Hz, 2H), 5.02 (t, $J = 8.8$ Hz, 1H), 3.97 (p, $J = 8.5$ Hz, 1H), 3.73 (t, $J = 9.3$ Hz, 1H), 3.53 (dd, $J = 12.6, 5.8$ Hz, 2H), 3.41 (ddt, $J = 16.1, 8.9, 3.5$ Hz, 2H),

2.84 (s, 3H), 1.66 – 1.39 (m, 6H); ^{19}F NMR (565 MHz, CD_3CN): δ -71.39 (d, J = 8.2 Hz); ^{13}C NMR (151 MHz, CD_3CN): δ 164.81 (s), 149.27 (s), 148.84 (s), 134.94 (s), 131.74 (s), 125.76 (q, J = 280.2 Hz), 125.64 (s), 122.71 (s), 109.21 (s), 106.53 (s), 102.59 (s), 83.76 (s), 69.88 (q, J = 28.8 Hz), 50.56 (s), 47.91 (s), 47.23 (s), 43.53 (s), 27.02 (s), 26.22 (s), 25.14 (s).

Compound 6bA 5-((*E*)-2-(Benzo[*d*][1,3]dioxol-5-yl)vinyl)-2-benzyl-3-(trifluoromethyl)isoxazolidin-4-yl)(piperidin-1-yl)methanone

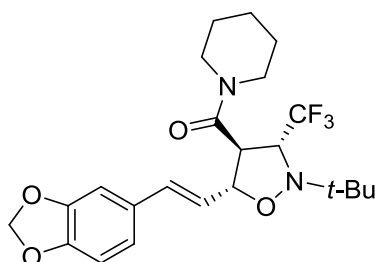


^1H NMR (400 MHz, CDCl_3): δ 7.50 (d, J = 7.0 Hz, 2H), 7.34 (dd, J = 7.2, 5.7 Hz, 2H), 7.28 (m, 2H), 6.91 (d, J = 1.5 Hz, 1H), 6.81 (dd, J = 8.0, 1.6 Hz, 1H), 6.76 (d, J = 8.0 Hz, 1H), 6.65 (d, J = 15.8 Hz, 1H), 5.99 (dd, J = 14.9, 7.4 Hz, 1H), 5.96 (s, 2H), 5.00 (t, J = 8.3 Hz, 1H), 4.39 (d, J = 12.3 Hz, 1H), 4.32 (d, J = 12.4 Hz, 1H), 4.25 (td, J = 8.1, 4.7 Hz, 1H), 3.64 (m, 4H), 3.43 (m, 1H), 1.49 (m, 6H); ^{19}F NMR (376 MHz, CDCl_3): δ -74.59 (d, J = 8.1 Hz); ^{13}C NMR (101 MHz, CDCl_3): δ 167.51 (s), 148.19 (s), 148.10 (s), 135.86 (s), 135.84 (s), 129.95 (s), 129.67 (s), 128.43 (s), 127.72 (s), 125.10 (q, J = 279.4 Hz), 121.90 (s), 121.62 (s), 108.40 (s), 105.83 (s), 101.30 (s), 84.30 (s), 69.92 (q, J = 29.9 Hz), 60.82 (s), 53.09 (s), 47.74 (s), 44.03 (s), 26.80 (s), 25.71 (s), 24.28 (s).

^1H NMR (600 MHz, CD_3CN): δ 7.46 (d, J = 7.2 Hz, 2H), 7.37 (t, J = 7.5 Hz, 2H), 7.31 (t, J = 7.3 Hz, 1H), 7.05 (d, J = 1.7 Hz, 1H), 6.90 (dd, J = 8.0, 1.7 Hz, 1H), 6.81 (d, J = 8.0 Hz, 1H), 6.72 (d, J = 15.7 Hz, 1H), 6.12 (dd, J = 15.7, 8.5 Hz, 1H), 5.97 (s, 2H), 4.95 (t, J = 8.4 Hz, 1H), 4.42 – 4.35 (m, 1H), 4.35 (d, J = 12.8 Hz, 1H), 4.23 (d, J = 12.8 Hz, 1H), 3.86 (dd, J = 8.4, 4.5 Hz, 1H), 3.73 (ddd, J = 13.0, 6.7, 3.8 Hz, 1H), 3.50 – 3.36 (m, 3H), 1.61 – 1.24 (m, 6H); ^{19}F NMR (565 MHz, CD_3CN): δ -74.92 (d, J = 8.4 Hz); ^{13}C NMR (151 MHz, CD_3CN): δ 168.07 (s), 149.29 (s), 149.14 (s), 137.93 (s), 136.83 (s), 131.41 (s), 130.63 (s), 129.35 (s), 128.63 (s), 126.62 (q, J = 278.4 Hz), 123.25 (s), 123.13 (s), 109.22 (s), 106.75 (s), 102.68 (s), 84.96 (s), 71.08 (q, J = 29.7 Hz), 61.36 (s), 53.66 (s), 48.28 (s), 44.55 (s), 27.68 (s), 26.56 (s), 25.07 (s).

Compound 6cA

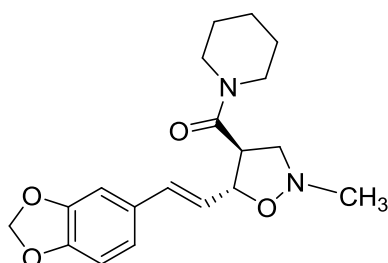
5-((*E*)-2-(Benzo[d][1,3]dioxol-5-yl)vinyl)-tert-butyl-3-(trifluoromethyl) isoxazolidin-4-yl)(piperidin-1-yl)methanone



^1H NMR (600 MHz, CDCl_3): δ 6.90 (s, 1H), 6.80 (d, J = 8.0 Hz, 1H), 6.76 (d, J = 8.0 Hz, 1H), 6.59 (d, J = 15.8 Hz, 1H), 5.97 (s, 2H), 5.91 (dd, J = 15.8, 8.1 Hz, 1H), 4.81 (t, J = 8.8 Hz, 1H), 4.62 (p, J = 6.6 Hz, 1H), 3.82 – 3.73 (m, 1H), 3.68 – 3.52 (m, 2H), 3.45 – 3.30 (m, 2H), 1.47 (ddd, J = 89.2, 47.0, 19.0 Hz, 6H), 1.27 (s, 9H); ^{19}F NMR (565 MHz, CDCl_3): δ -73.88 (d, J = 6.8 Hz); ^{13}C NMR (151 MHz, CDCl_3): δ 166.44 (s), 148.19 (s), 148.03 (s), 135.38 (s), 130.06 (s), 125.65 (q, J = 279.4 Hz), 122.17 (s), 121.81 (s), 108.40 (s), 105.71 (s), 101.28 (s), 86.23 (s), 65.59 (q, J = 29.8 Hz), 61.49 (s), 53.93 (s), 47.49 (s), 43.89 (s), 27.09 (s), 26.64 (s), 25.70 (s), 24.31 (s).

Compound 7

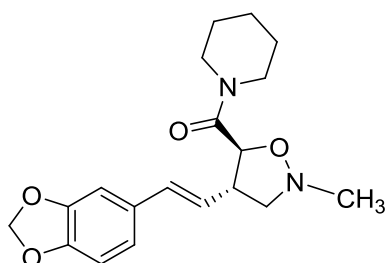
(*E*)-(5-(2-(Benzo[d][1,3]dioxol-5-yl)vinyl)-2-methyl isoxazolidin-4-yl)(piperidin-1-yl)methanone



^1H NMR (600 MHz, CDCl_3): δ 6.92 (s, 1H), 6.81 (d, J = 8.0 Hz, 1H), 6.74 (d, J = 8.0 Hz, 1H), 6.58 (d, J = 15.8 Hz, 1H), 6.08 (s, J = 12.1 Hz, 2H), 5.94 (m, 1H), 4.92 (m, 1H), 3.54 (m, 7H), 2.75 (s, 3H), 1.52 (m, 6H); ^{13}C NMR (151 MHz, CDCl_3): δ 168.82 (s), 148.04 (s), 147.61 (s), 133.21 (s), 130.66 (s), 125.28 (s), 121.31 (s), 108.55 (s), 105.82 (s), 101.03 (s), 81.41 (s), 61.03 (s), 52.23 (s), 46.88 (s), 45.82 (s), 43.37 (s), 27.04 (s), 25.59 (s), 24.45 (s).

Compound 8

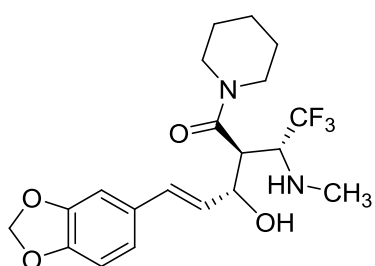
(*E*)-(4-(2-(benzo[d][1,3]dioxol-5-yl)vinyl)-2-methyl isoxazolidin-5-yl)(piperidin-1-yl)methanone



^1H NMR (600 MHz, CDCl_3): δ 6.90 (d, J = 1.4 Hz, 1H), 6.78 (dd, J = 8.0, 1.4 Hz, 1H), 6.74 (d, J = 8.0 Hz, 1H),

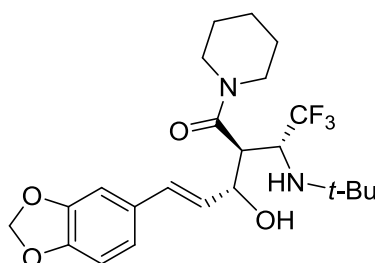
6.48 (d, $J = 15.7$ Hz, 1H), 6.06 (m, 1H), 5.94 (s, 2H), 4.45 (m, 1H), 4.08 (s, 1H), 3.43 (m, 6H), 2.75 (s, 3H), 1.60 (m, 6H); ^{13}C NMR (151 MHz, CDCl_3): δ 148.01 (s), 147.18 (s), 131.96 (s), 131.27 (s), 126.65 (s), 120.93 (s), 108.28 (s), 105.48 (s), 101.06 (s), 81.31 (s), 63.72 (s), 47.82 (s), 46.88 (s), 46.01 (s), 43.45 (s), 29.59 (s), 26.57 (s), 25.48 (s), 24.46 (s).

Compound 10a (*E*)-5-(benzo[d][1,3]dioxol-5-yl)-3-hydroxy-1-(piperidin-1-yl)-2-(2,2,2-trifluoro-1-(methylamino)ethyl)pent-4-en-1-one



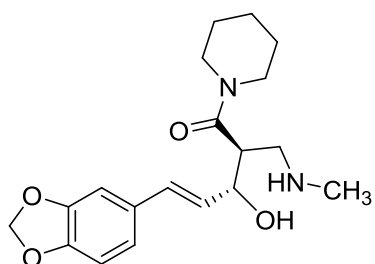
^1H NMR (400 MHz, CDCl_3): δ 6.89 (d, $J = 1.5$ Hz, 1H), 6.81 (dd, $J = 8.0, 1.6$ Hz, 1H), 6.75 (d, $J = 8.0$ Hz, 1H), 6.59 (d, $J = 15.8$ Hz, 1H), 5.96 (s, 2H), 5.95 (m, 3H), 4.70 (t, $J = 7.0$ Hz, 1H), 3.99 (m, 1H), 3.49 (m, 5H), 3.04 (dd, $J = 10.4, 8.3$ Hz, 1H), 2.72 (s, 3H), 1.42 (m, 6H); ^{19}F NMR (376 MHz, CDCl_3): δ -73.03 (d, $J = 7.0$ Hz); ^{13}C NMR (101 MHz, CDCl_3): δ 168.13 (s), 147.94 (s), 147.23 (s), 131.16 (s), 131.04 (s), 126.32 (s), 126.22 (q, $J = 287.8$ Hz), 121.33 (s), 108.28 (s), 105.55 (s), 101.04 (s), 74.70 (s), 64.32 (q, $J = 26.7$ Hz), 47.02 (s), 46.60 (s), 42.81 (s), 36.15 (s), 25.96 (s), 25.33 (s), 24.35 (s).

Compound 10c (*E*)-5-(benzo[d][1,3]dioxol-5-yl)-3-hydroxy-1-(piperidin-1-yl)-2-(2,2,2-trifluoro-1-(tert-butylamino)ethyl)pent-4-en-1-one



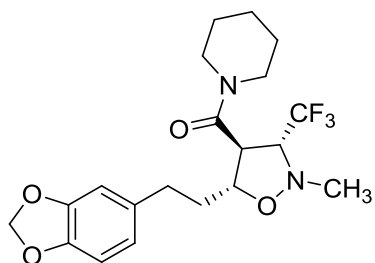
^1H NMR (400 MHz, CDCl_3): δ 6.88 (d, $J = 1.4$ Hz, 1H), 6.80 (dd, $J = 8.0, 1.5$ Hz, 1H), 6.75 (d, $J = 8.0$ Hz, 1H), 6.59 (d, $J = 15.9$ Hz, 1H), 5.96 (s, 1H), 5.92 (dd, $J = 15.9, 6.3$ Hz, 1H), 4.62 (dd, $J = 14.6, 7.8$ Hz, 1H), 4.40 (m, 1H), 3.48 (m, 5H), 3.07 (t, $J = 9.3$ Hz, 1H), 1.36 (m, 6H), 1.28 (s, 9H); ^{19}F NMR (376 MHz, CDCl_3): δ -73.25 (dd, $J = 6.1$ Hz); ^{13}C NMR (101 MHz, CDCl_3): δ 168.97 (s), 147.97 (s), 147.21 (s), 131.19 (s), 130.79 (s), 126.35 (s), 126.05 (q, $J = 285.0$ Hz), 121.22 (s), 108.11 (s), 105.52 (s), 100.97 (s), 73.55 (s), 57.36 (q, $J = 27.0$ Hz), 52.62 (s), 47.50 (s), 47.01 (s), 42.76 (s), 29.63 (s), 25.80 (s), 25.31 (s), 24.31 (s).

Compound 10d (E)-5-(benzo[d][1,3]dioxol-5-yl)-3-hydroxy-2-((methylamino)methyl)-1-(piperidin-1-yl)pent-4-en-1-one



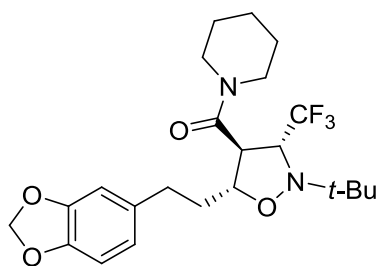
^1H NMR (600 MHz, CDCl_3): δ 6.90 (d, $J = 1.1$ Hz, 1H), 6.80 (dd, $J = 8.0, 1.2$ Hz, 1H), 6.74 (d, $J = 8.0$ Hz, 1H), 6.58 (d, $J = 15.8$ Hz, 1H), 6.03 (dd, $J = 15.8, 5.8$ Hz, 1H), 5.94 (s, 2H), 4.68 (t, $J = 5.6$ Hz, 1H), 4.13 (bs, 1H), 3.60 (s, 1H), 3.47 (s, 3H), 3.14 (s, 1H), 2.97 (s, 2H), 2.43 (s, 3H), 1.65 (s, 6H); ^{13}C NMR (101 MHz, CDCl_3): δ 171.08 (s), 147.94 (s), 147.18 (s), 131.30 (s), 129.93 (s), 128.37 (s), 121.14 (s), 108.19 (s), 105.62 (s), 101.01 (s), 74.95 (s), 52.54 (s), 47.23 (s), 45.62 (s), 42.86 (s), 36.28 (s), 26.60 (s), 25.65 (s), 24.45 (s).

Compound 11a 5-(2-(benzo[d][1,3]dioxol-5-yl)ethyl)-2-methyl-3-(trifluoromethyl)-isoxazolidin-4-yl(piperidin-1-yl)methanone



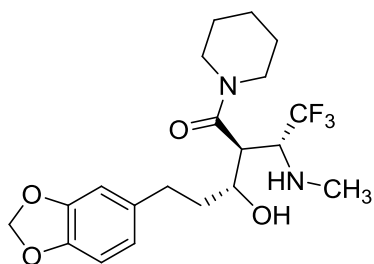
^1H NMR (600 MHz, CDCl_3): δ 6.93 (d, $J = 1.2$ Hz, 1H), 6.80 (dd, $J = 8.0, 1.2$ Hz, 1H), 6.76 (d, $J = 7.9$ Hz, 1H), 5.96 (d, $J = 2.0$ Hz, 2H), 4.18 (m, 1H), 3.96 (dd, $J = 11.2, 3.2$ Hz, 1H), 3.84 (d, $J = 8.1$ Hz, 1H), 3.78 (dq, $J = 13.7, 4.6$ Hz, 1H), 3.53 (m, 4H), 3.39 (t, $J = 4.4$ Hz, 1H), 2.55 (m, 1H), 2.28 (s, 3H), 2.06 (m, 1H), 1.67 (dd, $J = 42.9, 5.5$ Hz, 6H); ^{19}F NMR (565 MHz, CDCl_3): δ -67.30 (s); ^{13}C NMR (101 MHz, CDCl_3): δ 170.36 (s), 147.88 (s), 146.79 (s), 136.10 (s), 127.31 (q, $J = 292.0$ Hz), 120.97 (s), 108.33 (s), 107.82 (s), 100.97 (s), 65.83 (s), 63.45 (q, $J = 25.4$ Hz), 58.47 (s), 47.07 (s), 43.44 (s), 39.70 (s), 39.15 (s), 35.79 (s), 26.50 (s), 25.58 (s), 24.45 (s).

Compound 11c 5-(2-(benzo[d][1,3]dioxol-5-yl)ethyl)-2-tert-butyl-3-(trifluoromethyl)isoxazolidin-4-yl(piperidin-1-yl)methanone



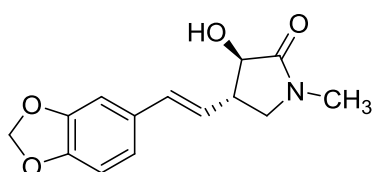
^1H NMR (400 MHz, CDCl_3): δ 6.76 (d, $J = 8.1$ Hz, 1H), 6.66 (d, $J = 2.1$ Hz, 1H), 6.63 (dd, $J = 8.1, 2.1$ Hz, 1H), 5.95 (s, 2H), 4.42 (m, 1H), 4.31 (dt, $J = 9.8, 6.1$ Hz, 1H), 3.82 (m, 1H), 3.61 (m, 2H), 3.44 (m, 2H), 2.77 (m, 1H), 2.57 (m, 1H), 1.84 (dt, $J = 13.6, 7.6$ Hz, 2H), 1.65 (m, 6H), 1.25 (s, 9H); ^{19}F NMR (376 MHz, CDCl_3): δ -73.77 (d, $J = 6.8$ Hz); ^{13}C NMR (101 MHz, CDCl_3): δ 167.17 (s), 147.66 (s), 145.87 (s), 134.86 (s), 125.60 (q, $J = 279.2$ Hz), 121.18 (s), 108.74 (s), 108.26 (s), 100.82 (s), 83.70 (s), 65.71 (q, $J = 29.6$ Hz), 61.40 (s), 52.61 (s), 47.49 (s), 43.87 (s), 35.13 (s), 32.28 (s), 27.13 (s), 26.74 (s), 25.63 (s), 24.41 (s).

Compound 12a 5-(benzo[d][1,3]dioxol-5-yl)-3-hydroxy-1-(piperidin-1-yl)-2-(2,2,2-trifluoro-1-(methylamino)ethyl)pentan-1-one



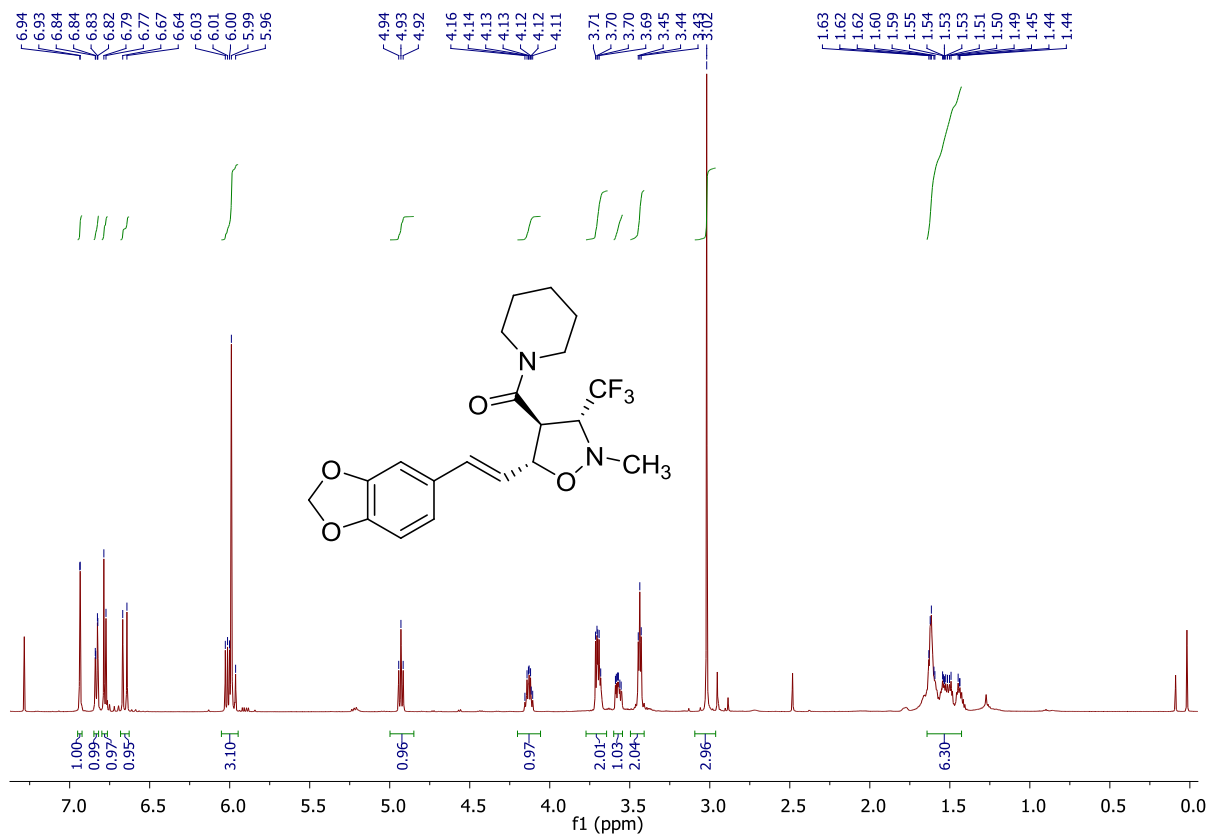
^1H NMR (600 MHz, CDCl_3): δ 6.74 (d, $J = 8.1$ Hz, 1H), 6.67 (d, $J = 1.5$ Hz, 1H), 6.63 (dd, $J = 8.1, 1.5$ Hz, 1H), 5.94 (s, 2H), 4.45 (td, $J = 8.4, 3.6$ Hz, 1H), 3.91 (dd, $J = 13.7, 7.1$ Hz, 1H), 3.76 (m, 1H), 3.53 (m, 4H), 3.43 (m, 1H), 2.99 (s, 3H), 2.74 (m, 1H), 2.58 (m, 1H), 2.13 (s, 1H), 1.96 (m, 1H), 1.89 (m, 1H), 1.65 (m, 6H); ^{19}F NMR (565 MHz, CDCl_3): δ -74.49 (s); ^{13}C NMR (101 MHz, CDCl_3): δ 167.63 (s), 147.66 (s), 145.87 (s), 134.79 (s), 125.17 (q, $J = 278.6$ Hz), 121.15 (s), 108.79 (s), 108.27 (s), 100.83 (s), 80.89 (s), 72.88 (q, $J = 29.4$ Hz), 51.72 (s), 47.52 (s), 45.69 (s), 43.96 (s), 34.18 (s), 32.01 (s), 26.78 (s), 25.59 (s), 24.38 (s).

Compound 13 (*E*)-4-(2-(benzo[d][1,3]dioxol-5-yl)vinyl)-3-hydroxy-1-methylpyrrolidin-2-one

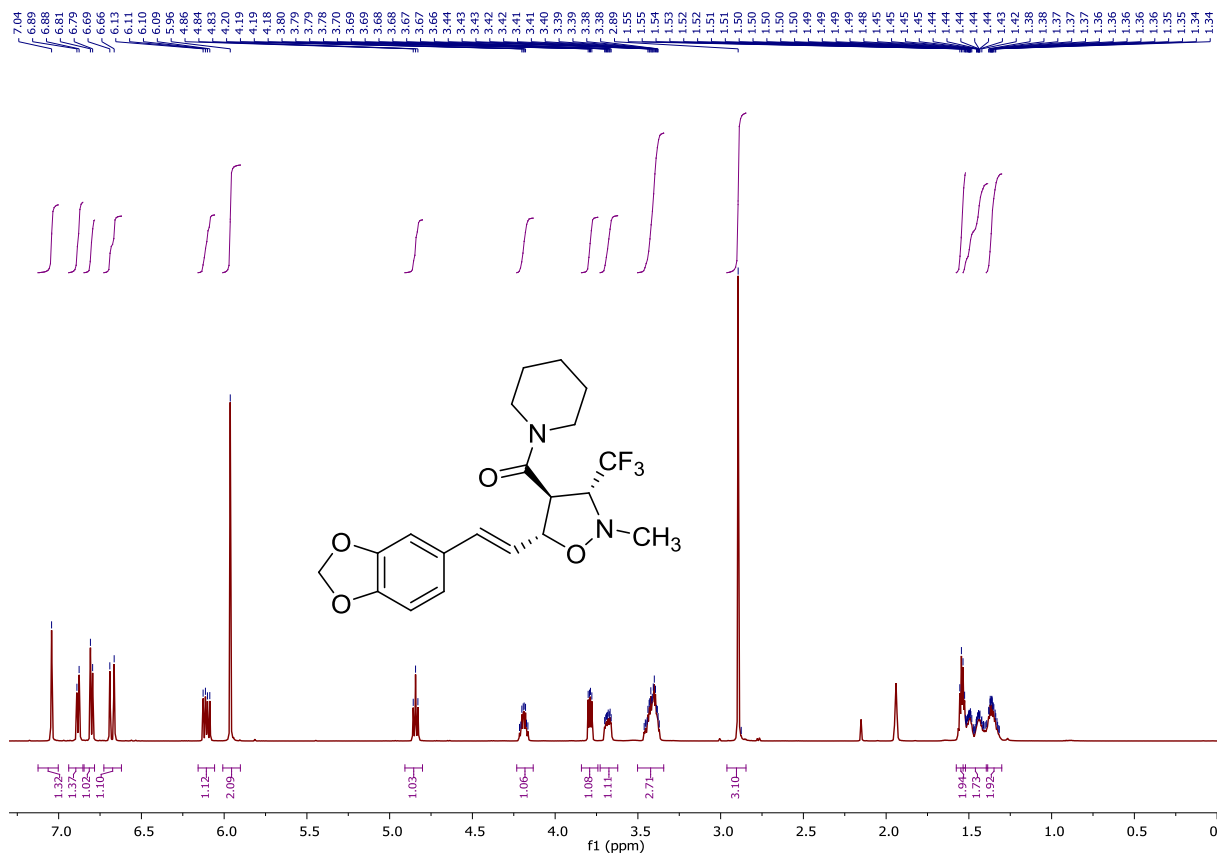


^1H NMR (600 MHz, CDCl_3): δ 6.95 (d, $J = 1.6$ Hz, 1H), 6.81 (dd, $J = 8.0, 1.6$ Hz, 1H), 6.75 (d, $J = 8.0$ Hz, 1H), 6.45 (d, $J = 15.8$ Hz, 1H), 6.13 (dt, $J = 21.6, 10.8$ Hz,

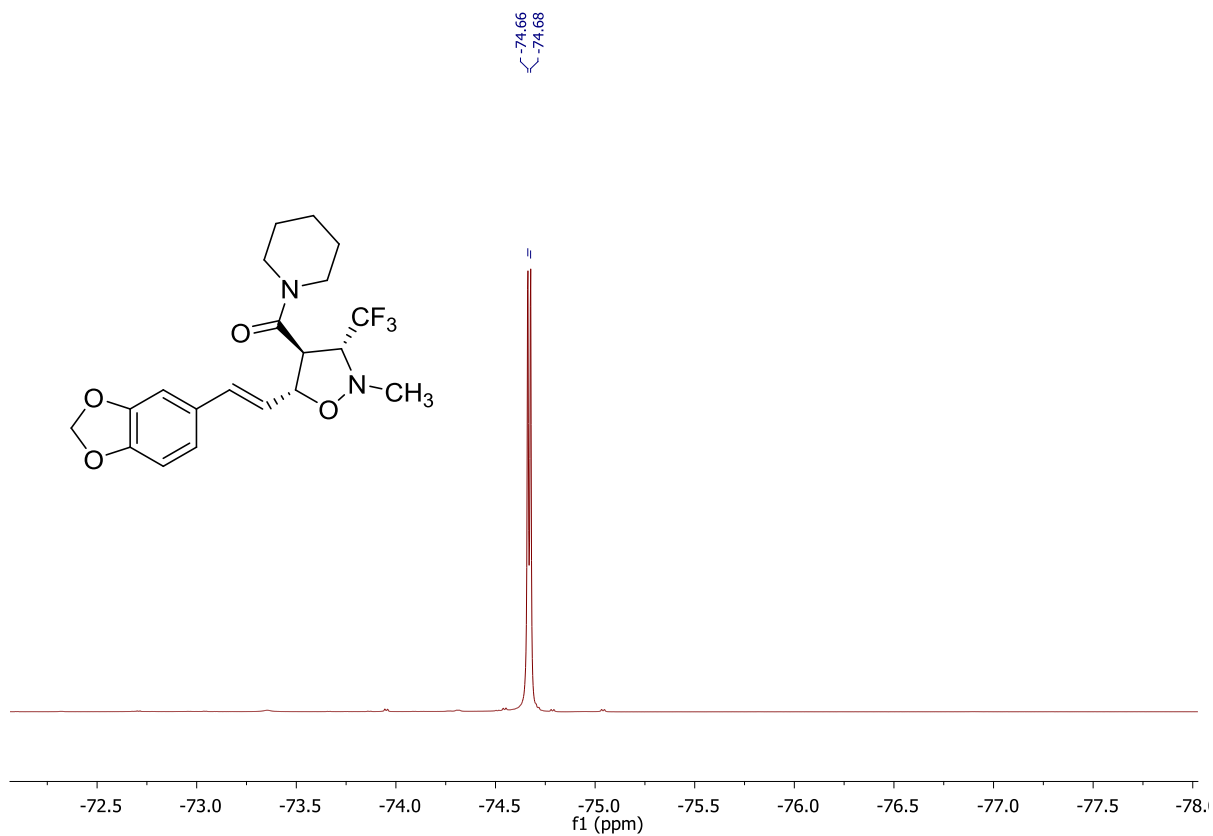
1H), 5.95 (s, 2H), 4.38 (d, $J = 7.2$ Hz, 1H), 3.54 (dd, $J = 10.0, 6.7$ Hz, 1H), 3.31 (dd, $J = 10.0, 4.2$ Hz, 1H), 3.26 – 3.20 (m, 1H), 2.92 (s, 3H); ^{13}C NMR (151 MHz, CDCl_3): δ 174.35 (s), 148.00 (s), 147.20 (s), 132.74 (s), 131.31 (s), 123.63 (s), 120.99 (s), 108.21 (s), 105.70 (s), 101.05 (s), 71.88 (s), 52.49 (s), 41.73 (s), 30.05 (s).



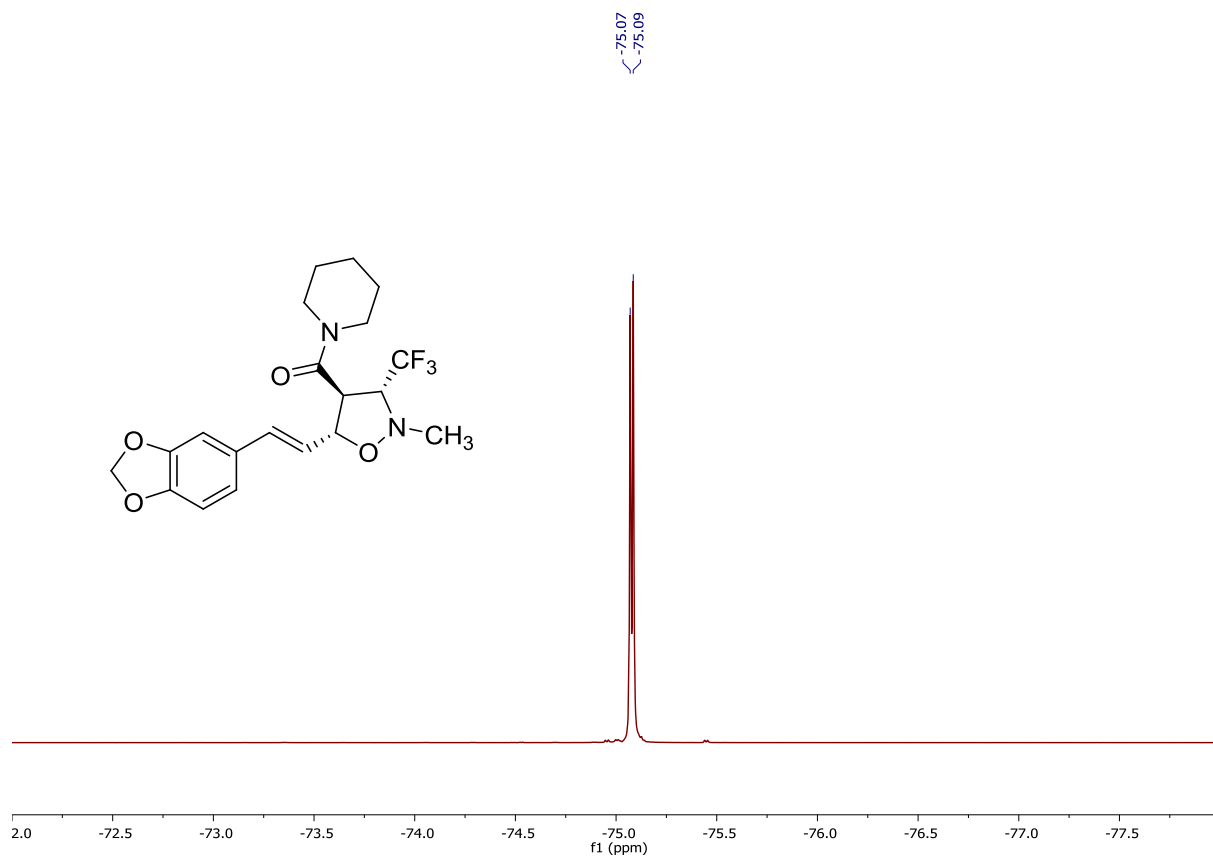
Compound 6aA, ¹H NMR (CDCl₃)



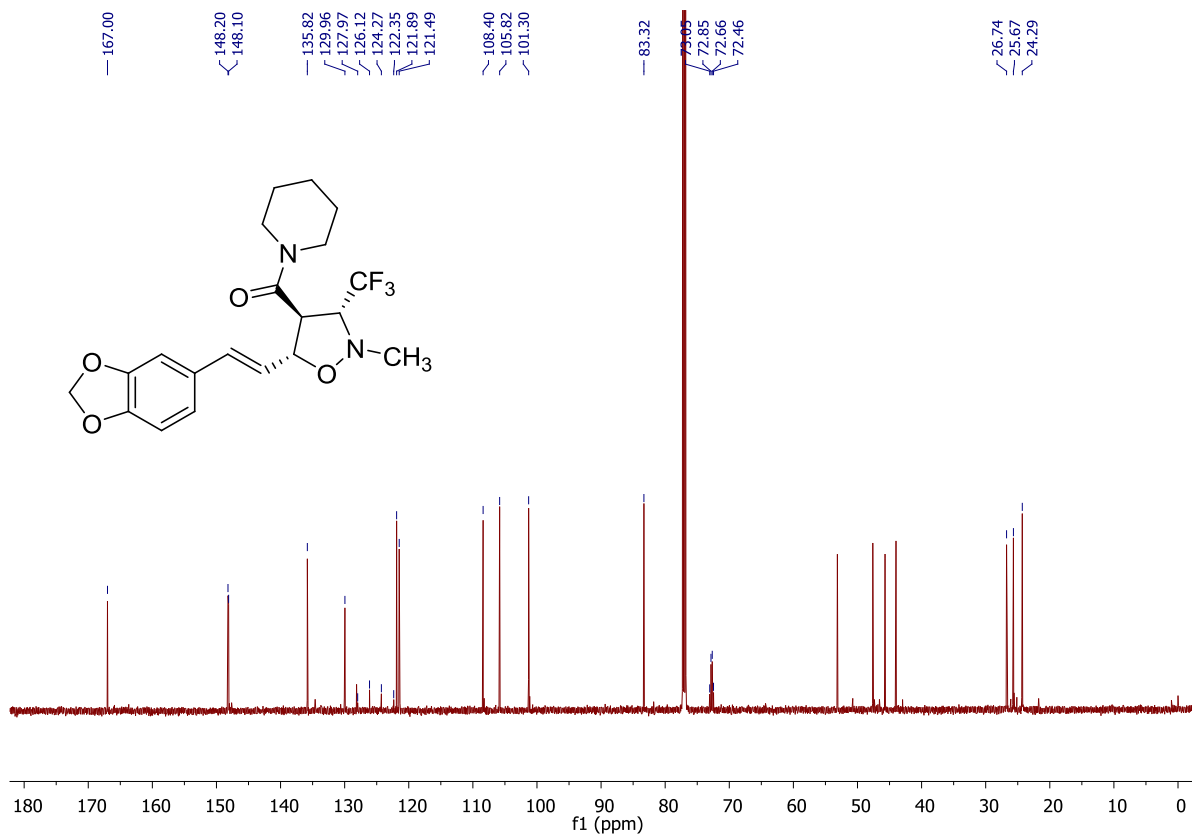
Compound 6aA, ¹H NMR (CD₃CN)



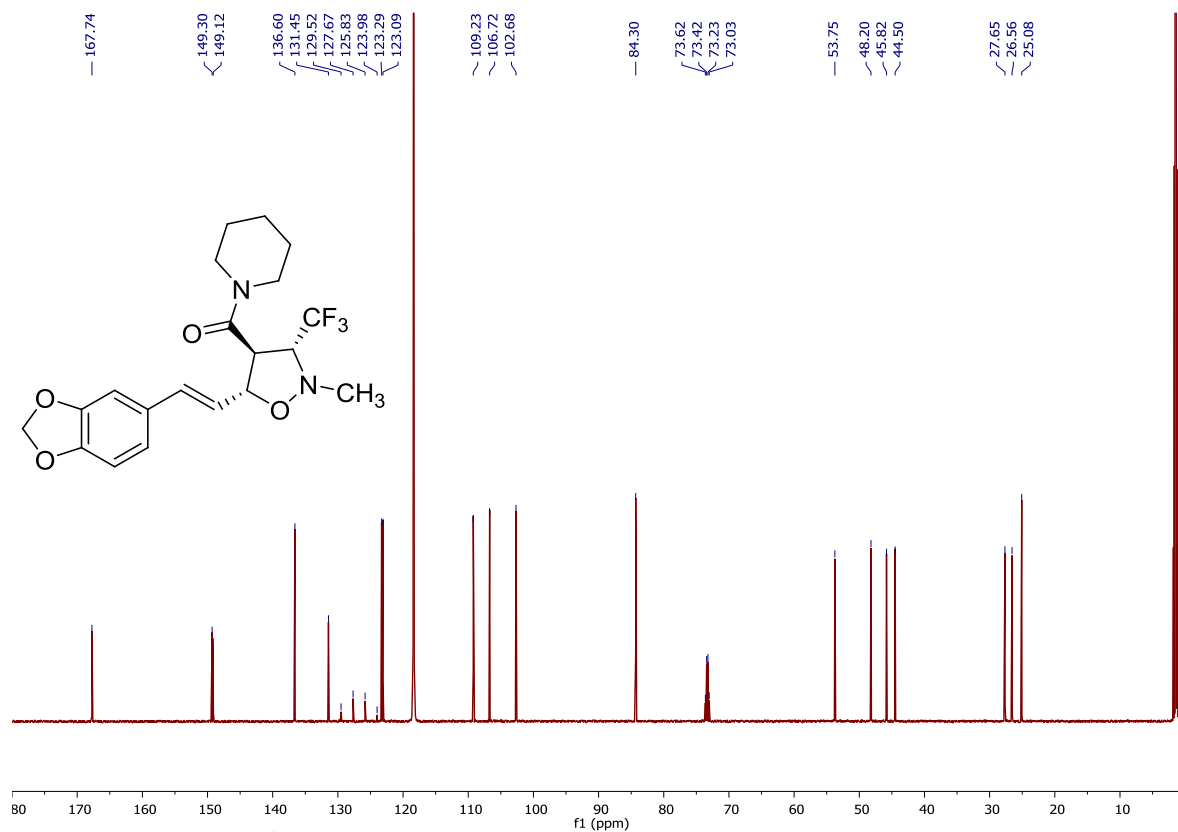
Compound 6aA, ^{19}F NMR (CDCl₃)



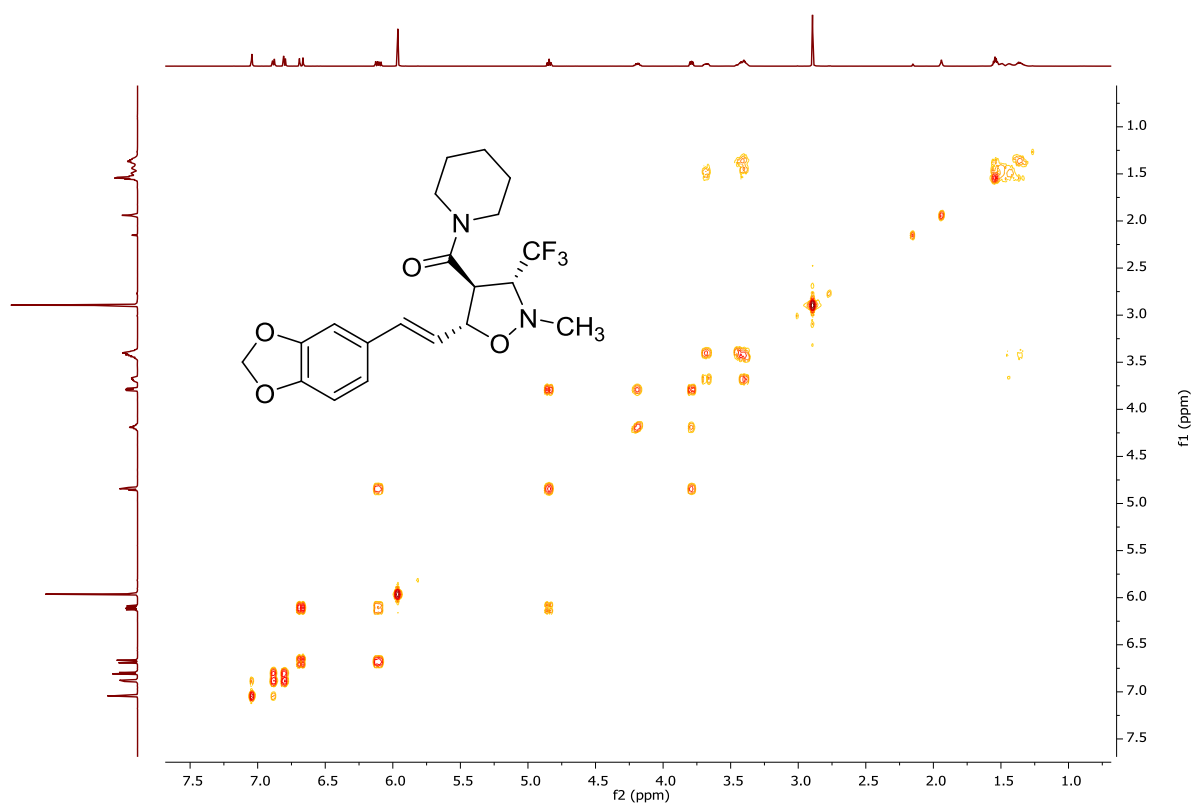
Compound 6aA, ^{19}F NMR (CD₃CN)



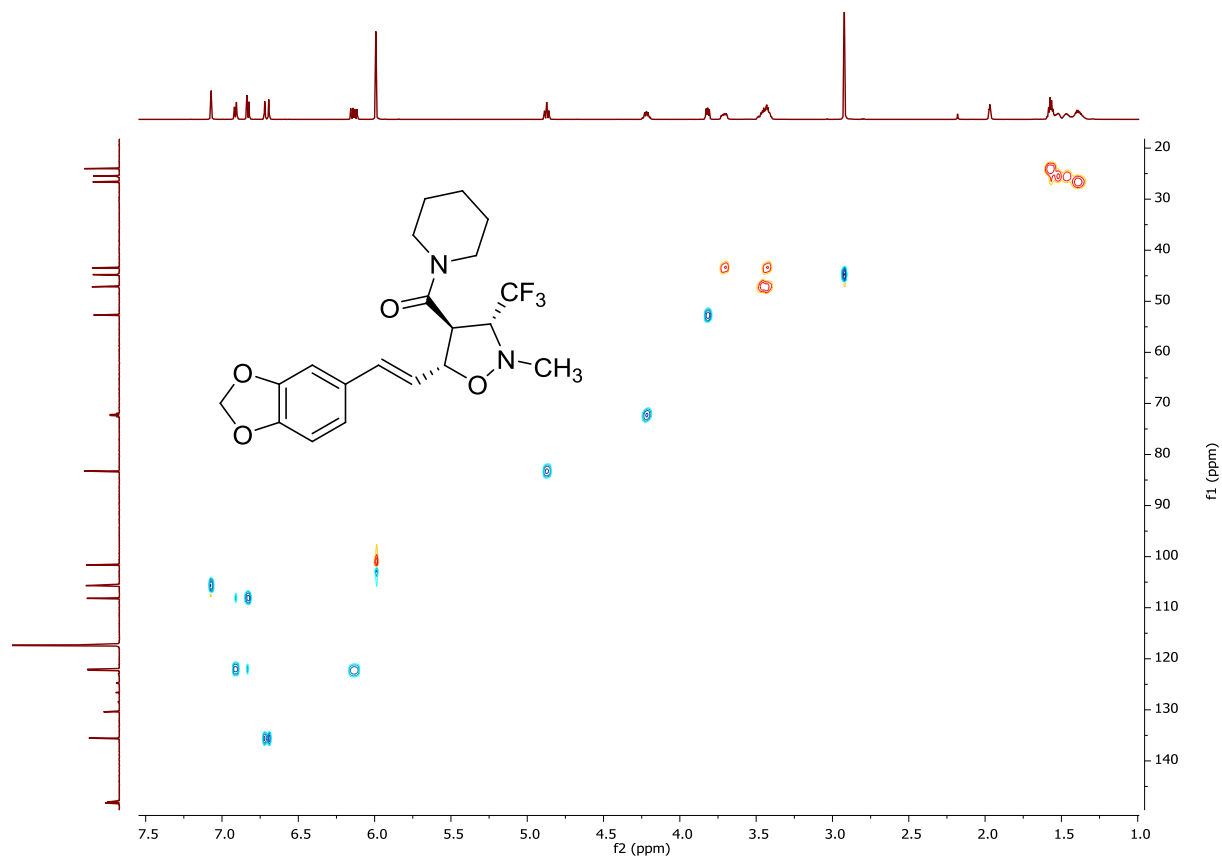
Compound 6aA, ^{13}C NMR (CDCl_3)



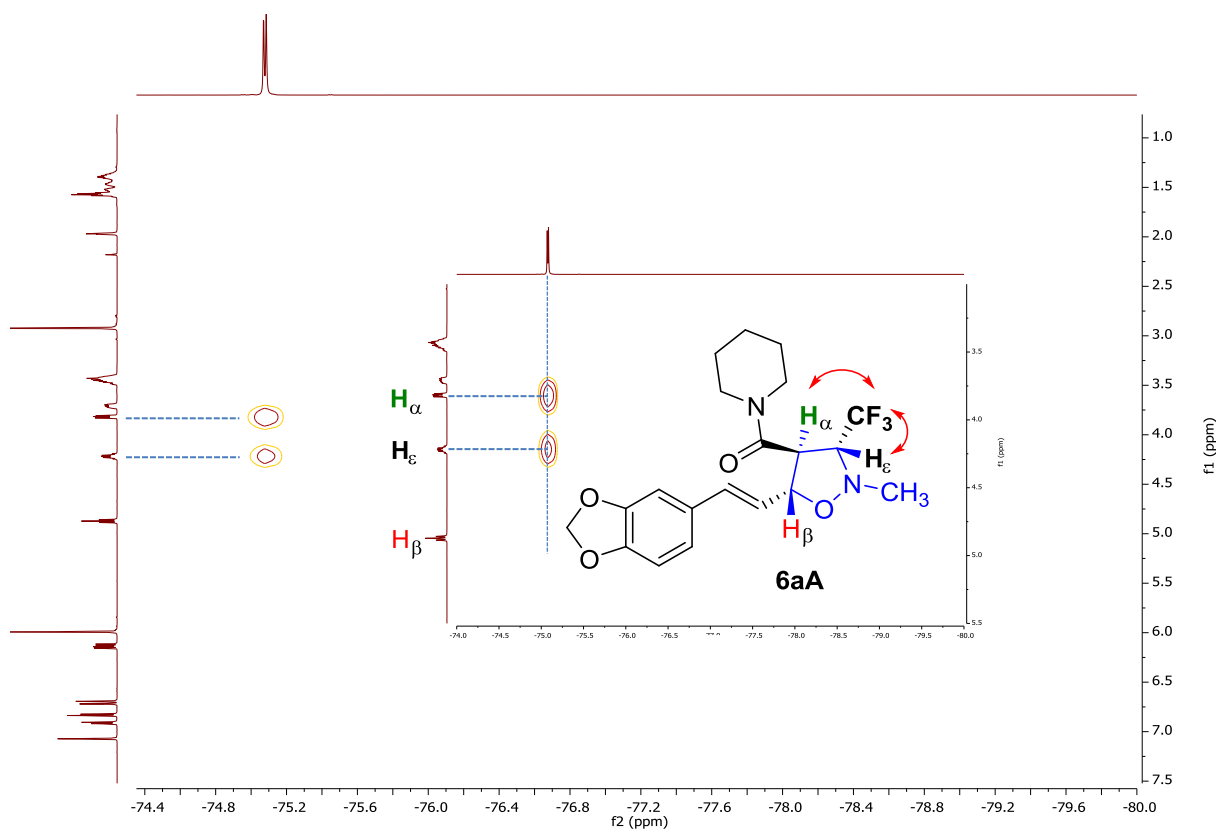
Compound 6aA, ^{13}C NMR (CD_3CN)



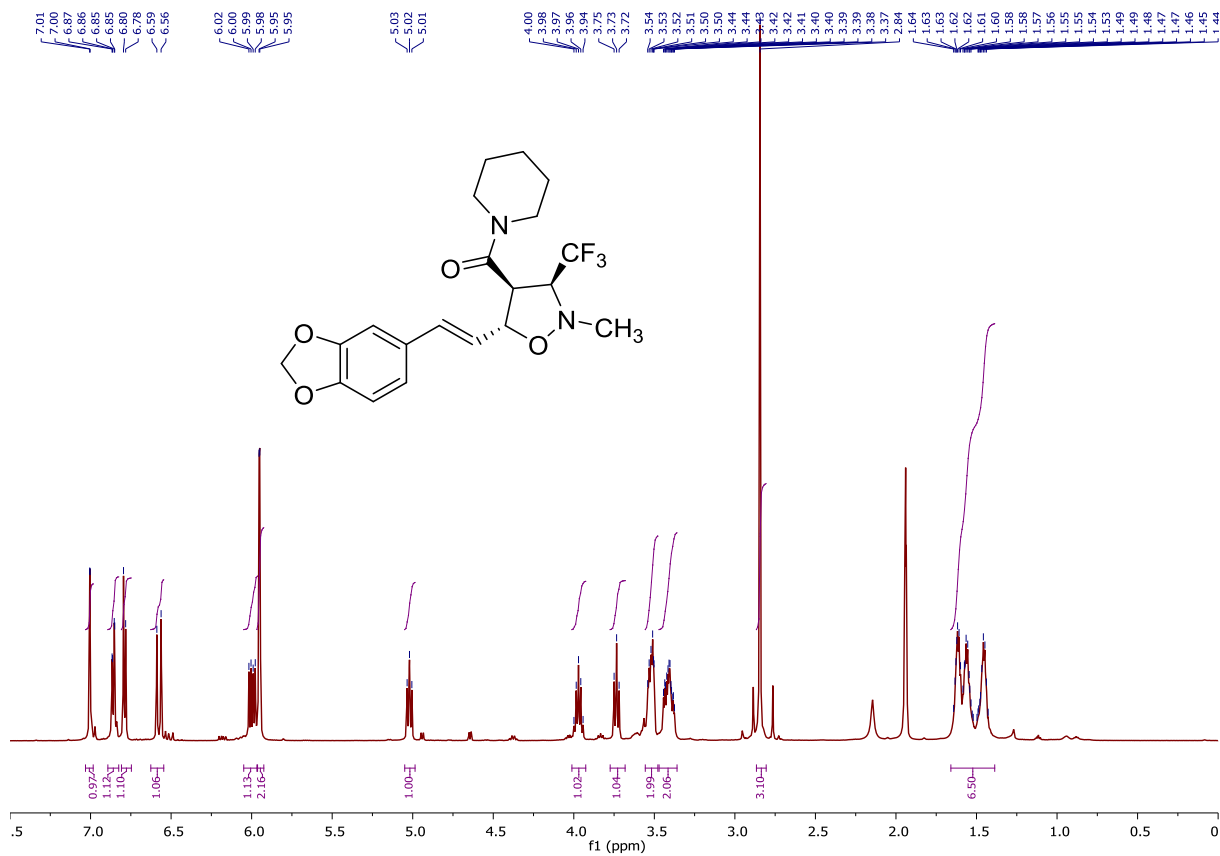
Compound 6aA, ¹H-¹H COSY NMR (CD₃CN)



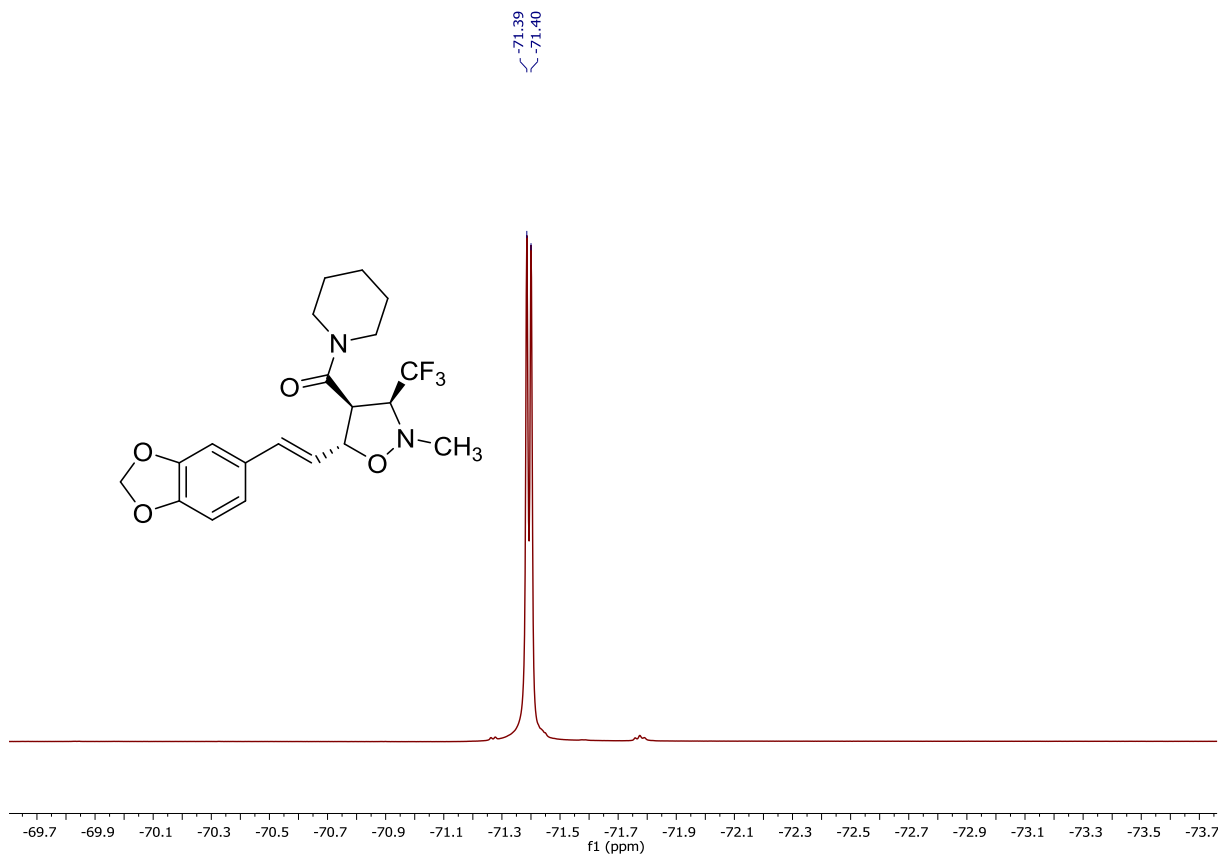
Compound 6aA, ¹H-¹³C HSQC NMR (CD₃CN)



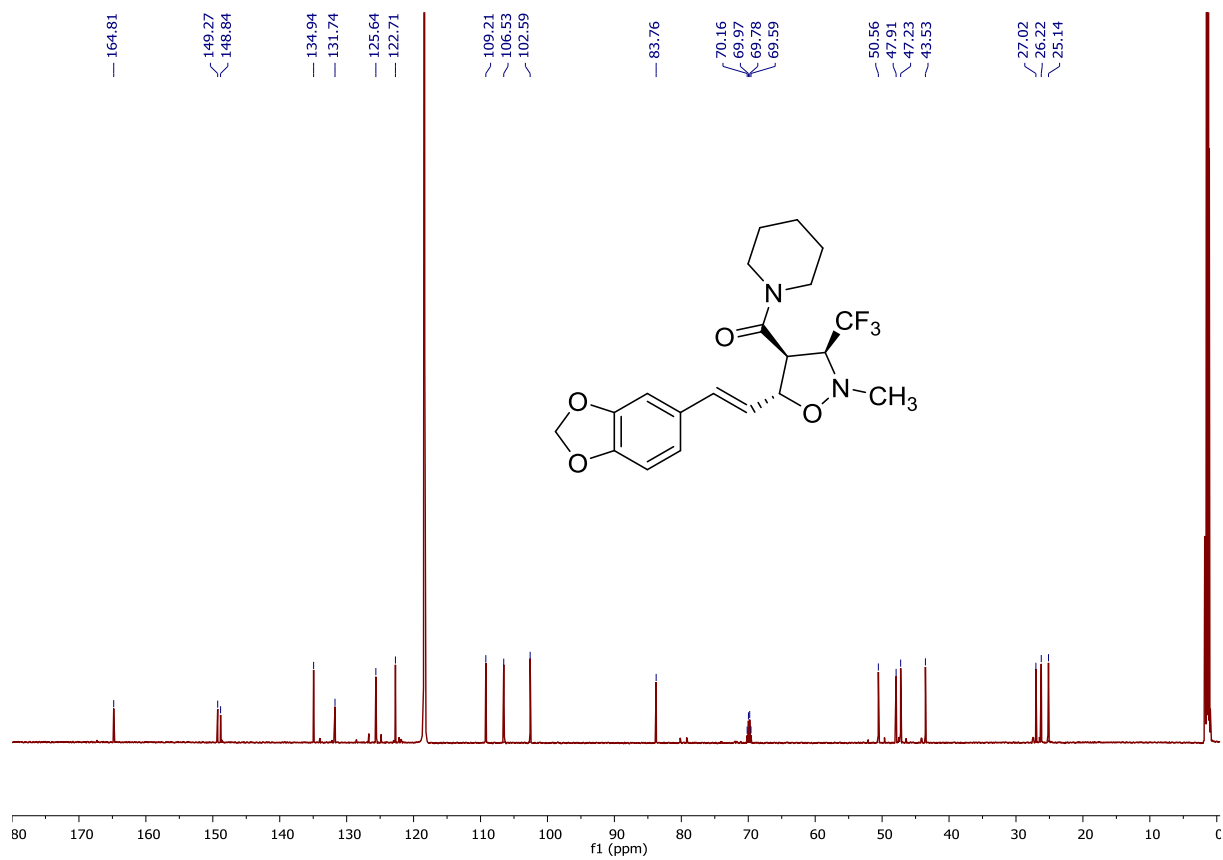
Compound 6aA, ^1H - ^{19}F HOESY NMR (CD_3CN)



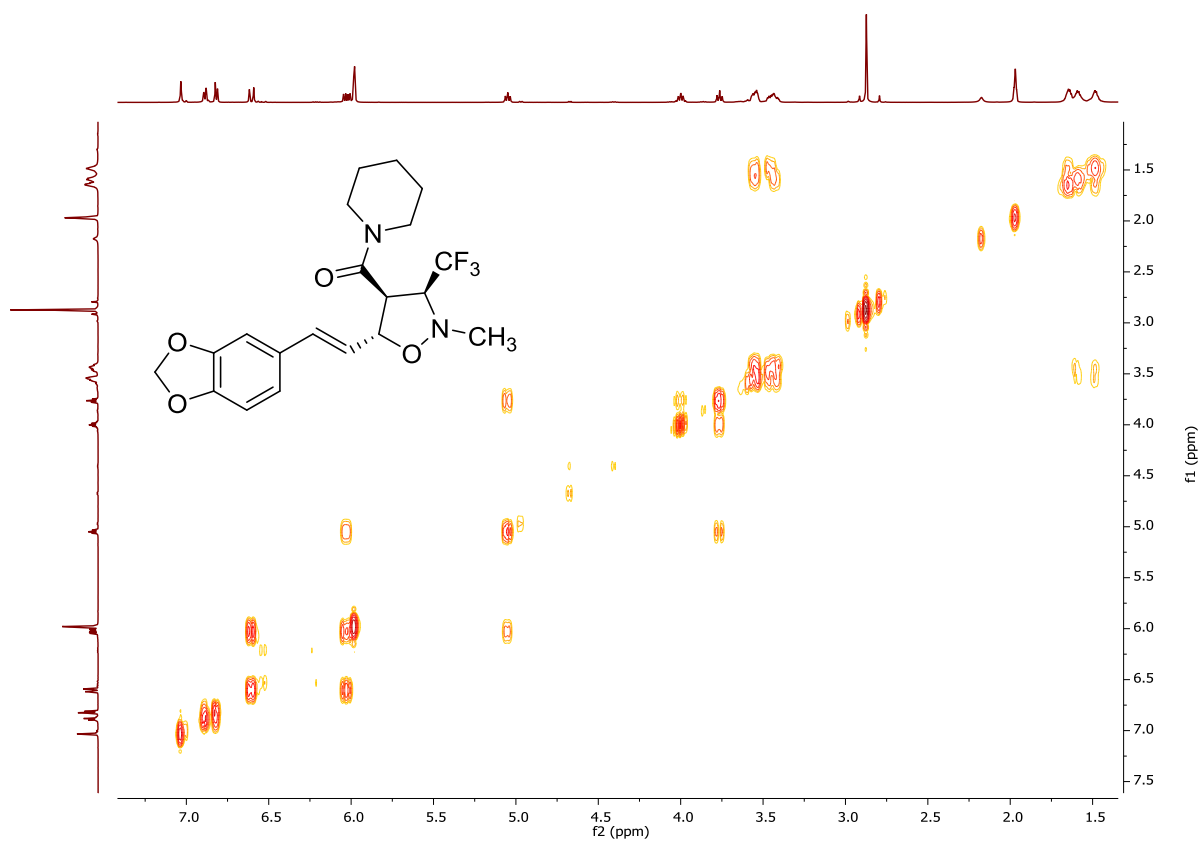
Compound 6aB, ^1H NMR (CD_3CN)



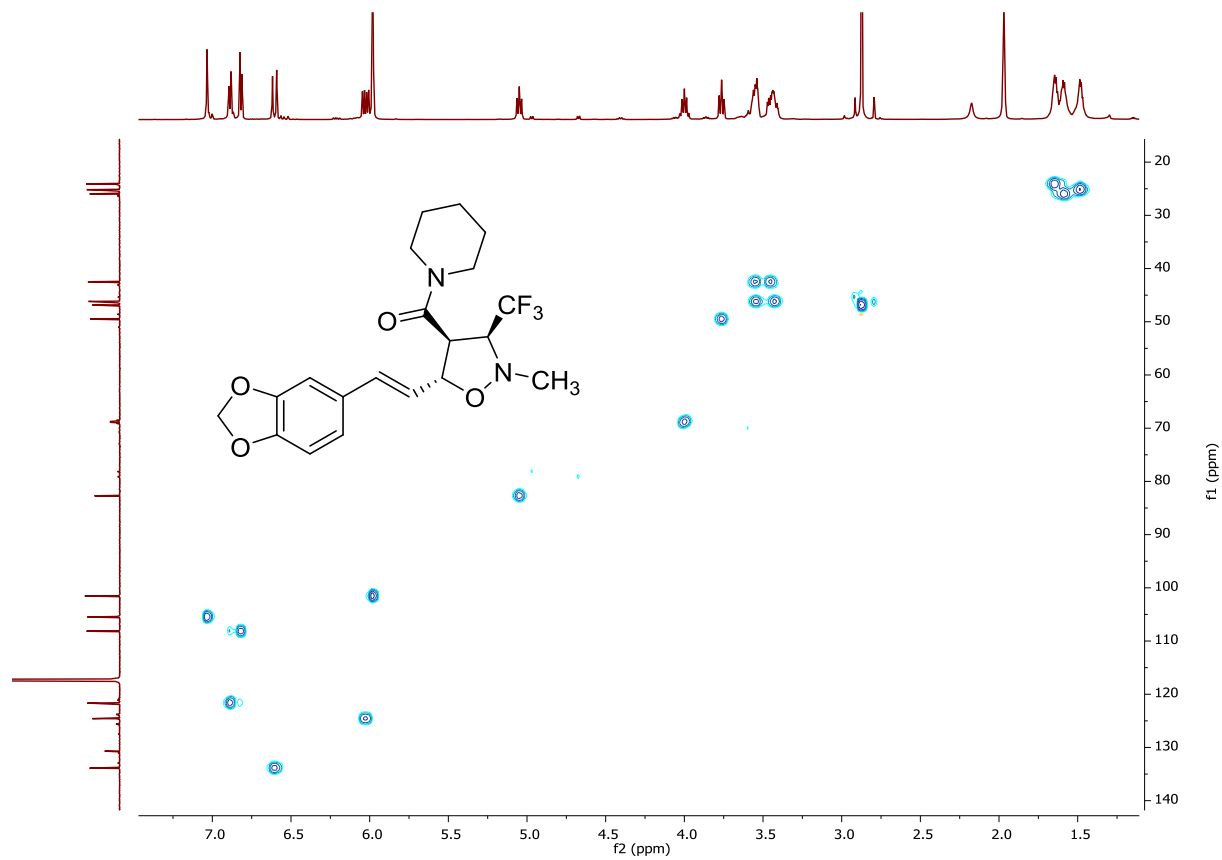
Compound 6aB, ¹⁹F NMR (CD₃CN)



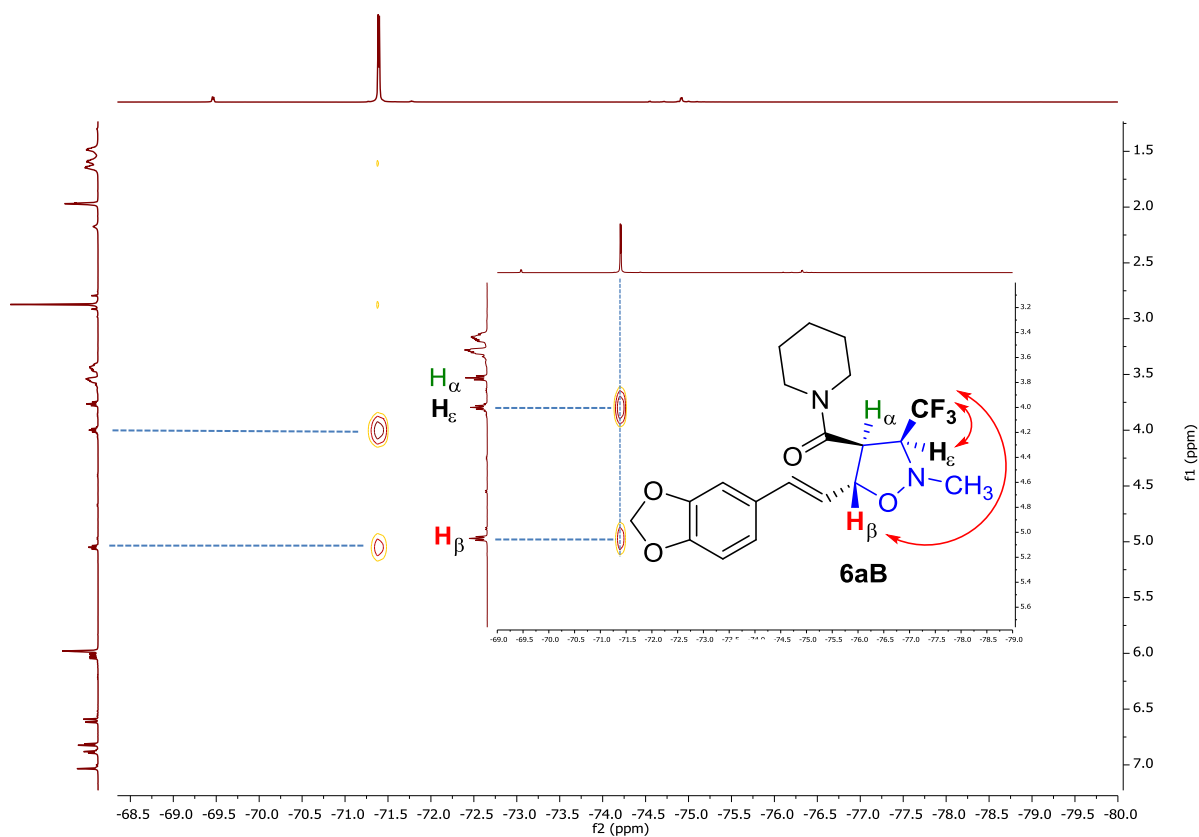
Compound 6aB, ¹³C NMR (CD₃CN)



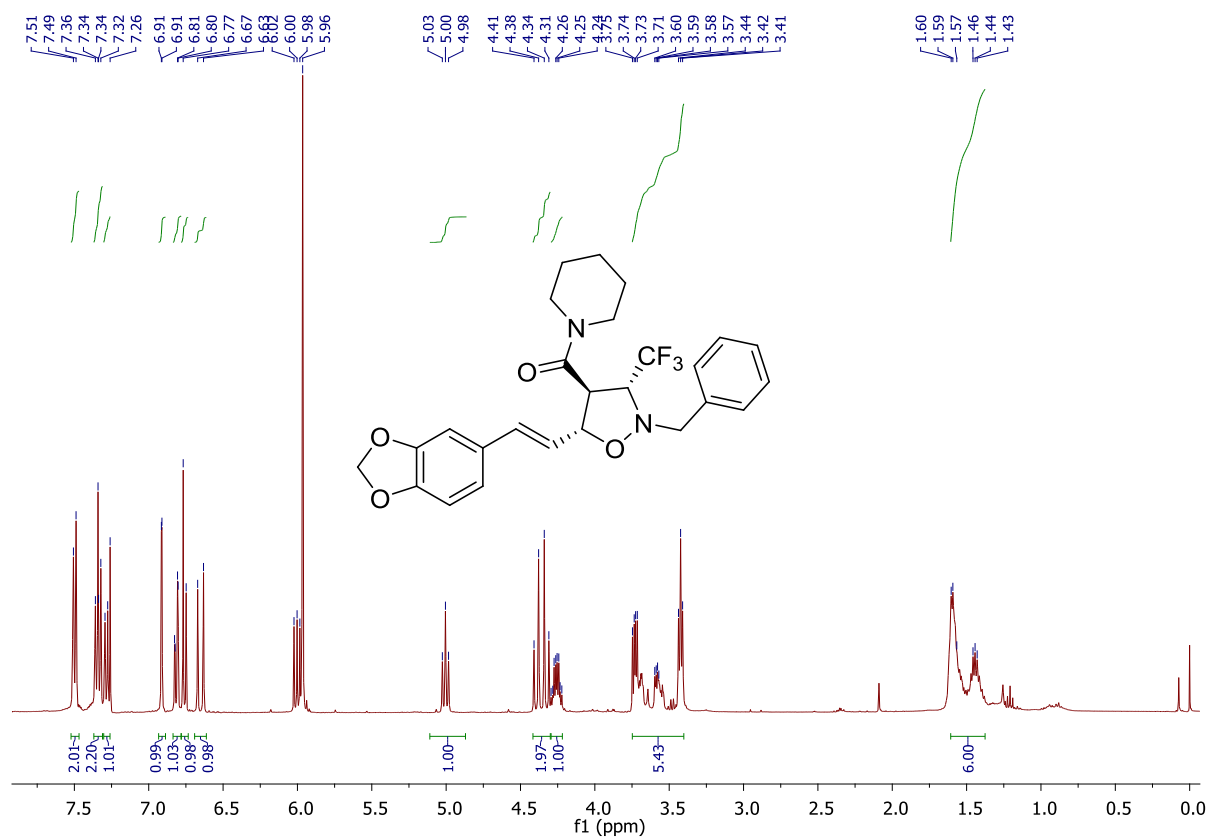
Compound 6aB, ^1H - ^1H COSY NMR (CD_3CN)



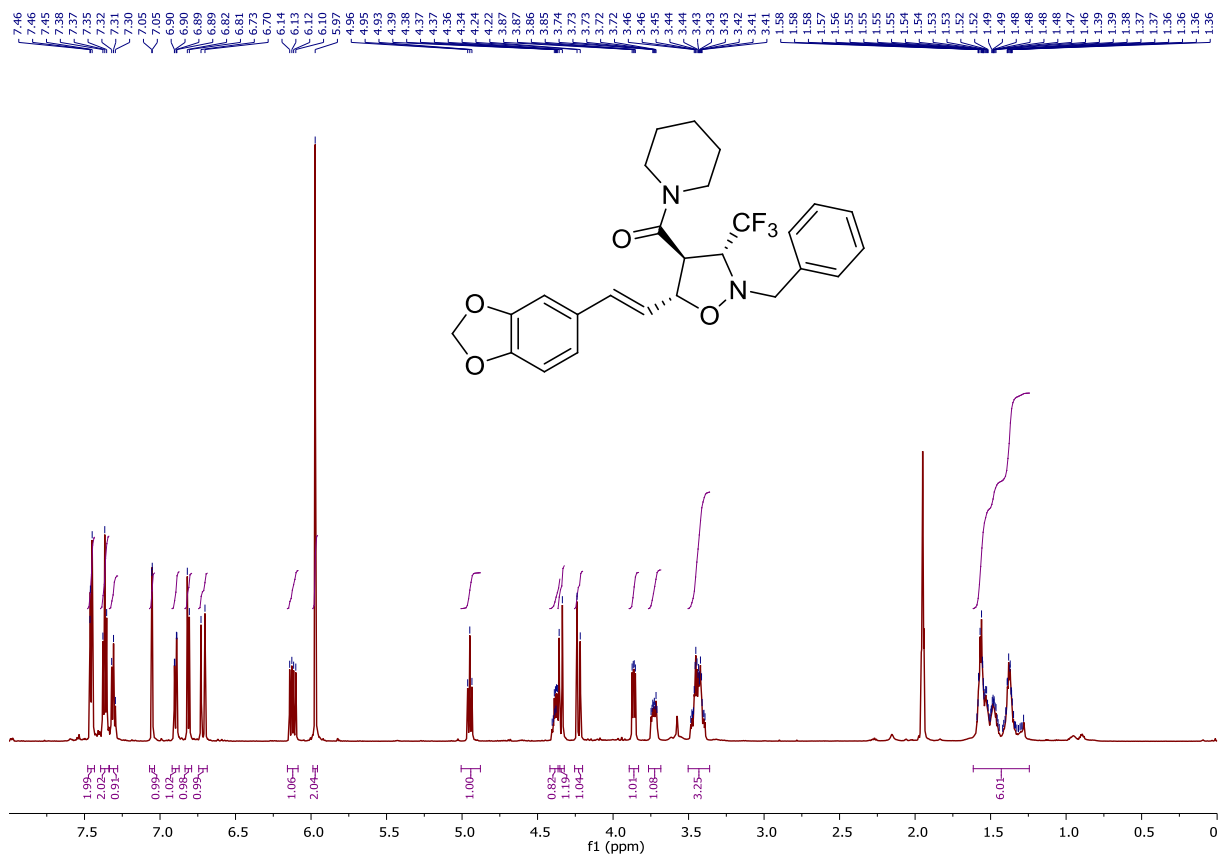
Compound 6aB, ^1H - ^{13}C HSQC NMR (CD_3CN)



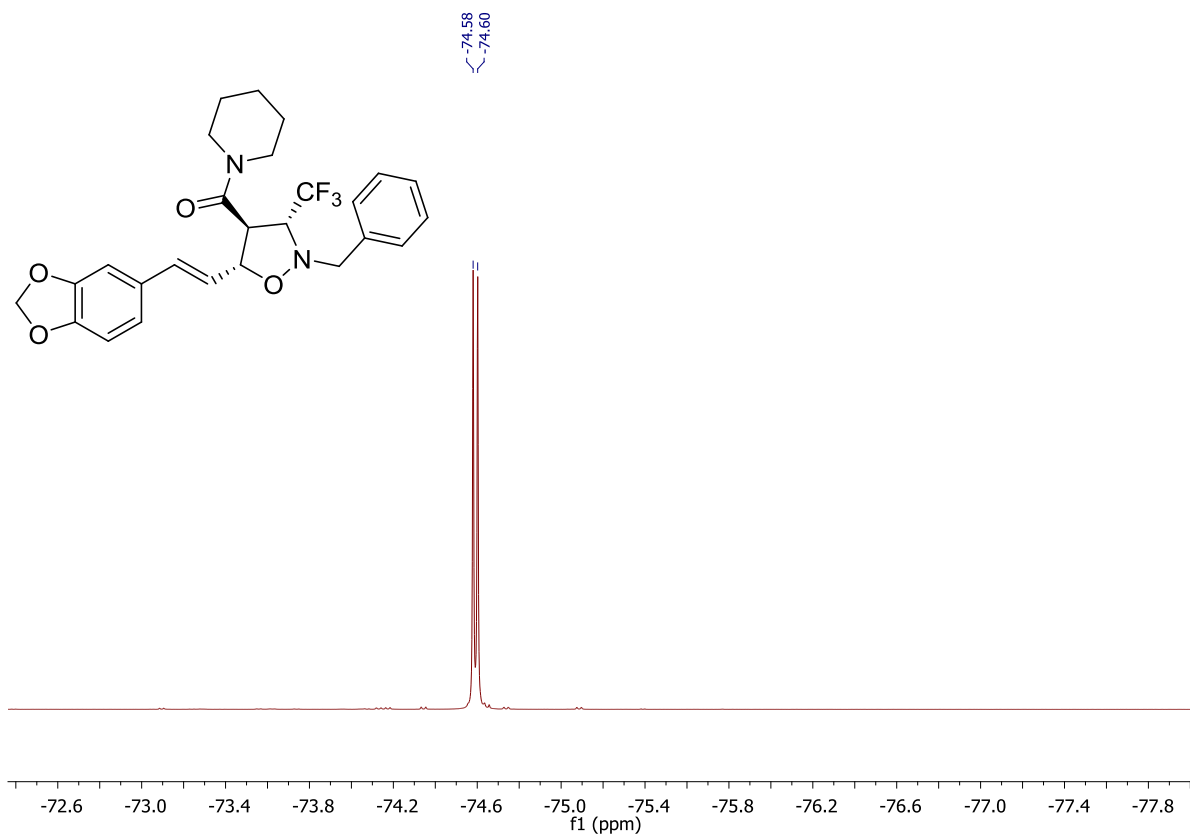
Compound 6aB, ^1H - ^{19}F HOESY NMR (CD_3CN)



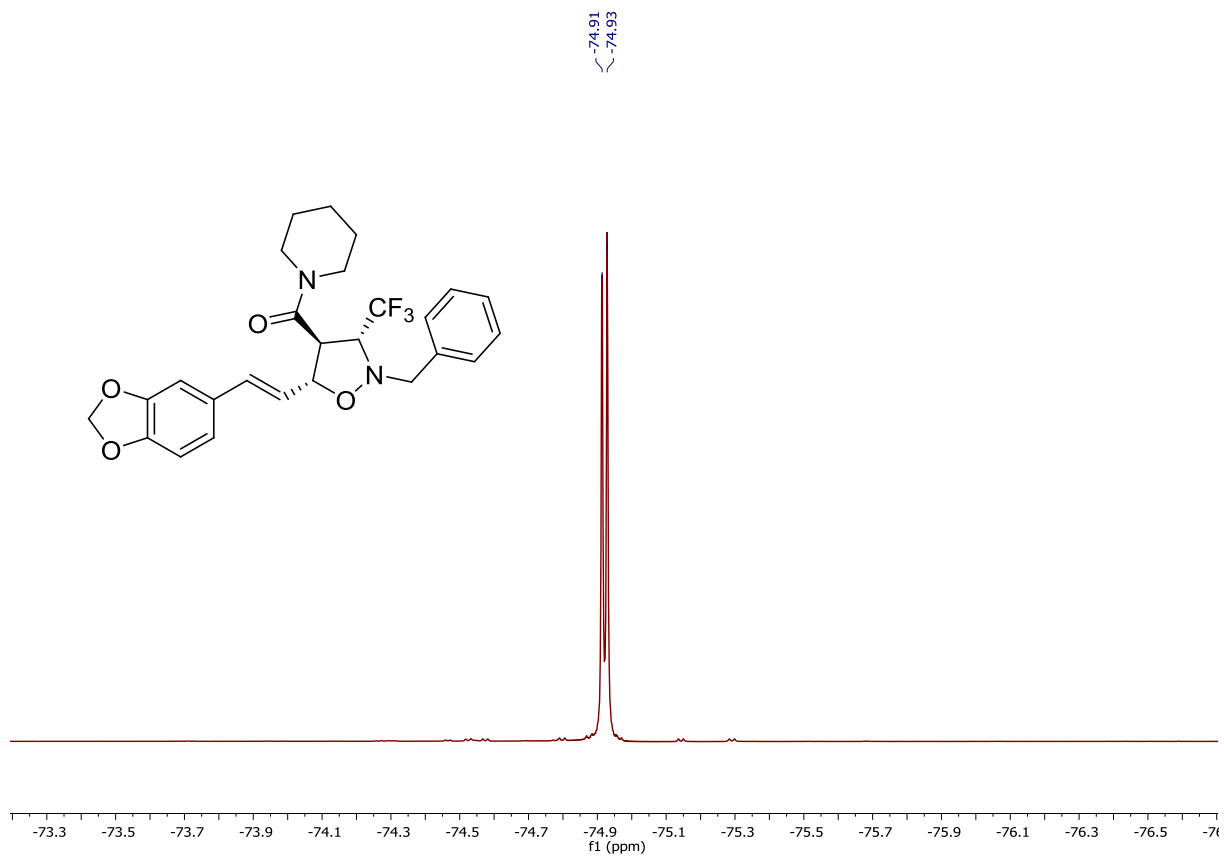
Compound 6aA, ^1H NMR (CDCl_3)



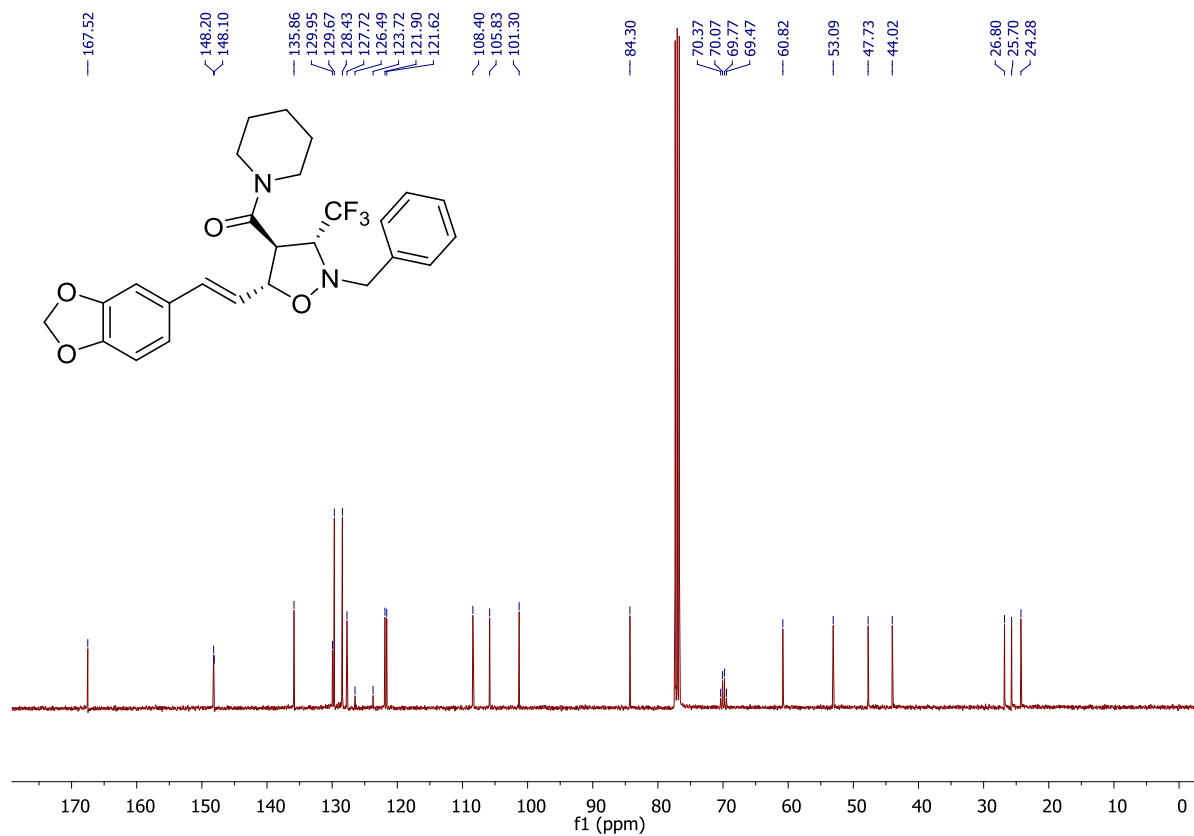
Compound 6a, ¹H NMR (CD₃CN)



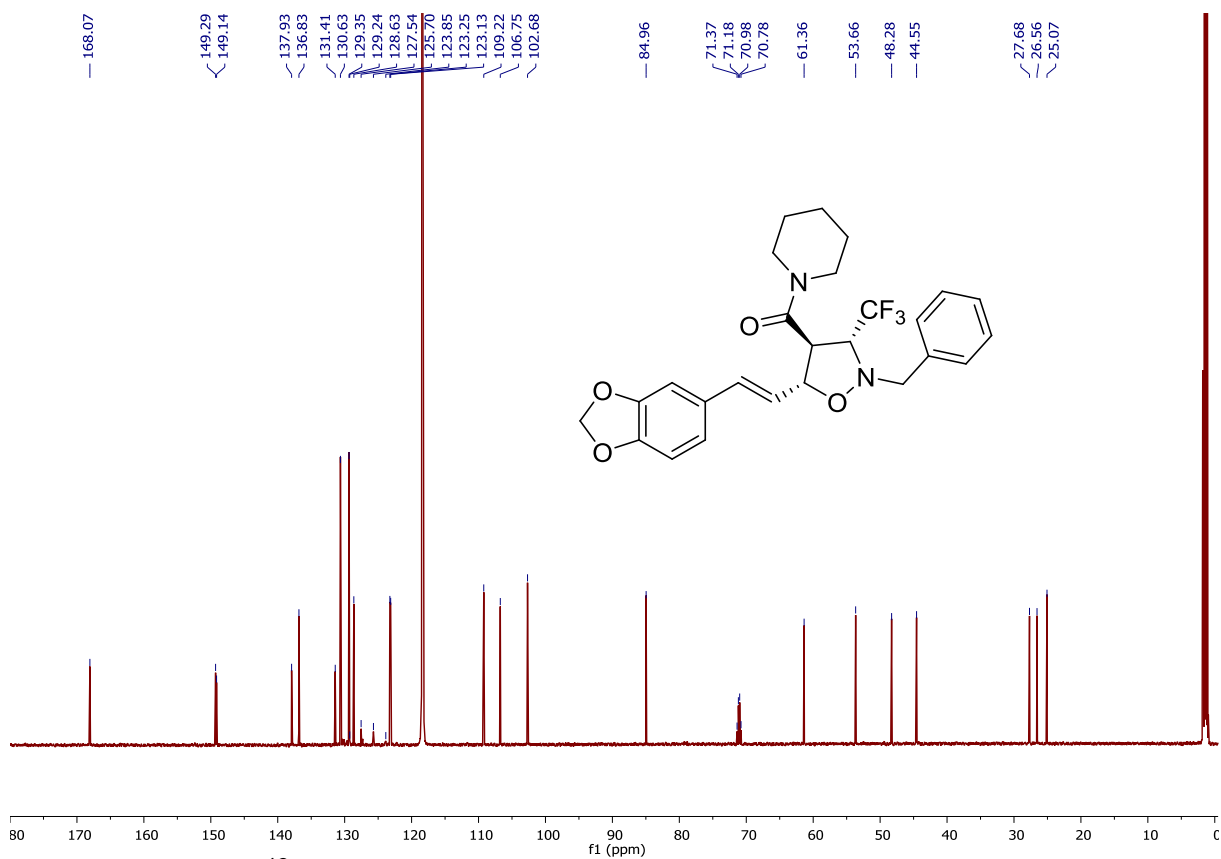
Compound 6a, ¹⁹F NMR (CDCl₃)



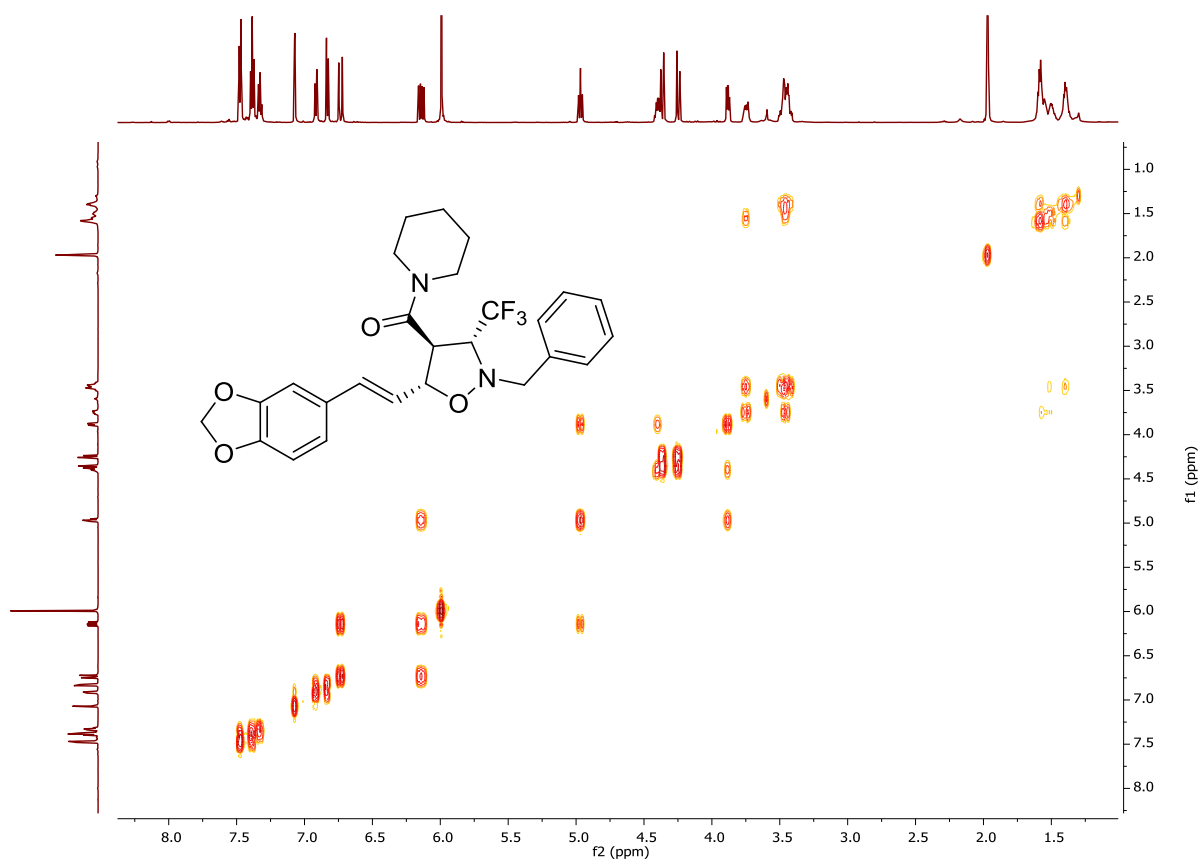
Compound 6a, ^{13}C NMR (CDCl_3)



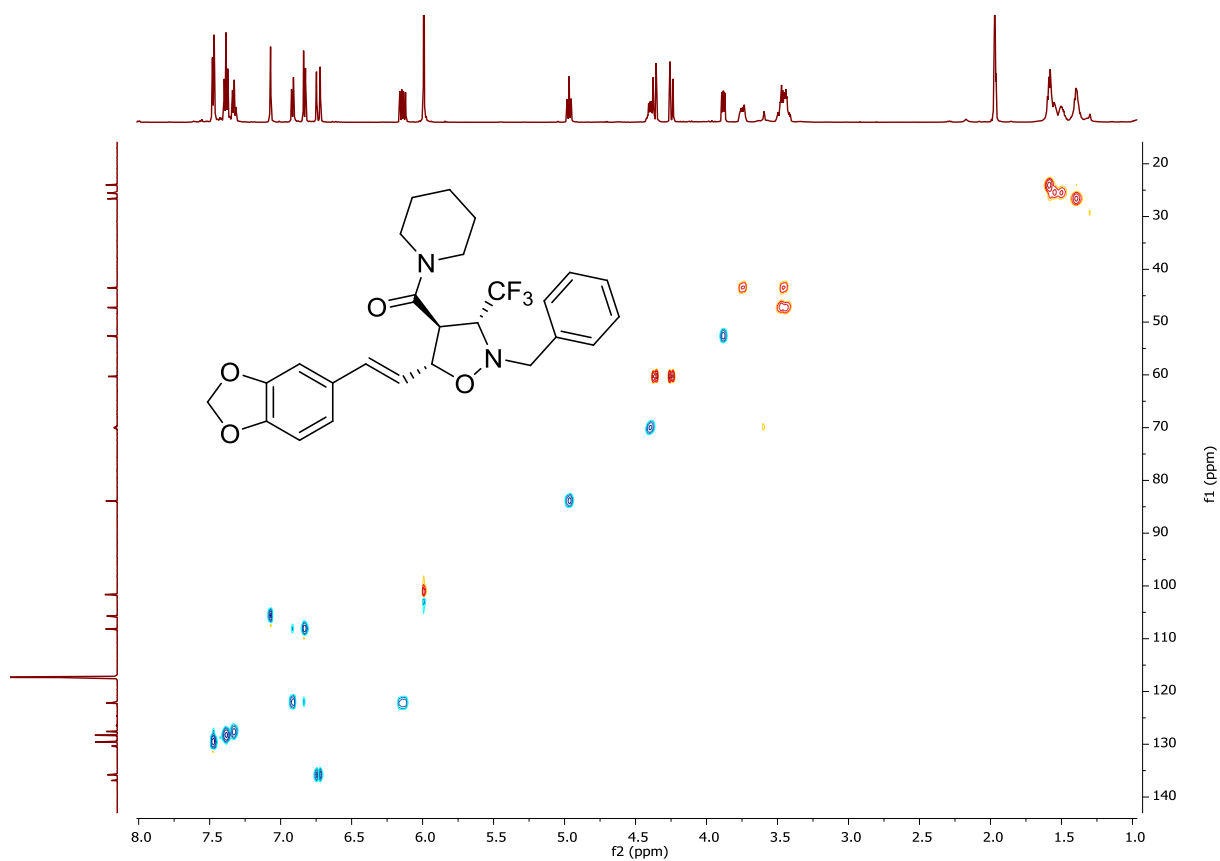
Compound 6a, ^{13}C NMR (CDCl_3)



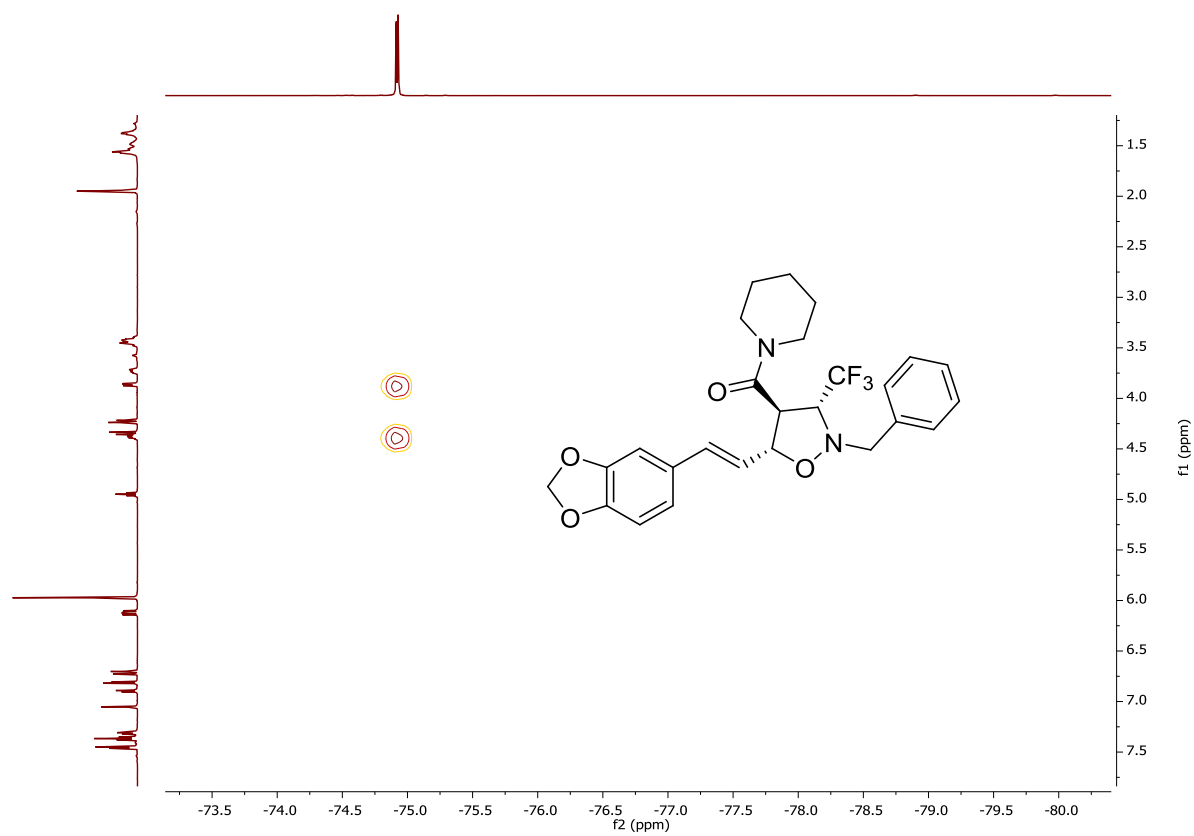
Compound 6a, ^{13}C NMR (CD_3CN)



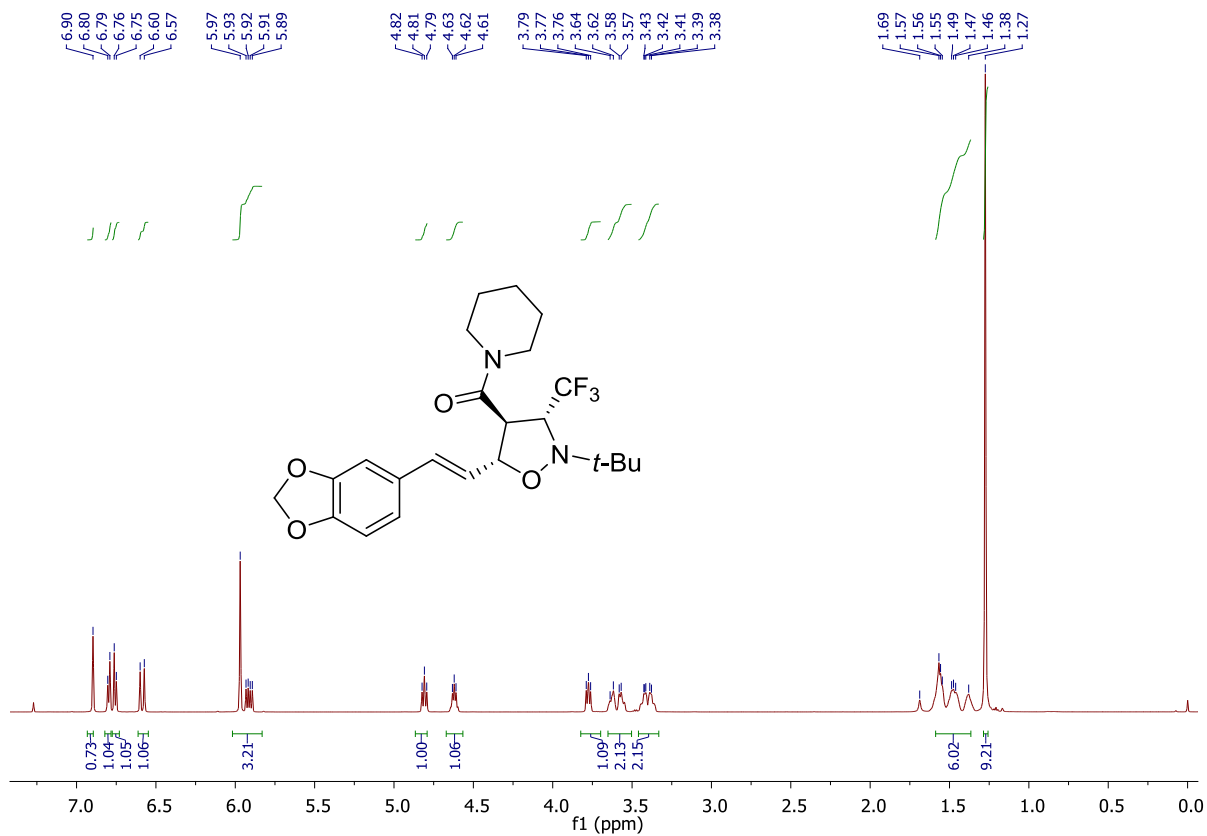
Compound 6a, ^1H - ^1H COSY NMR (CD_3CN)



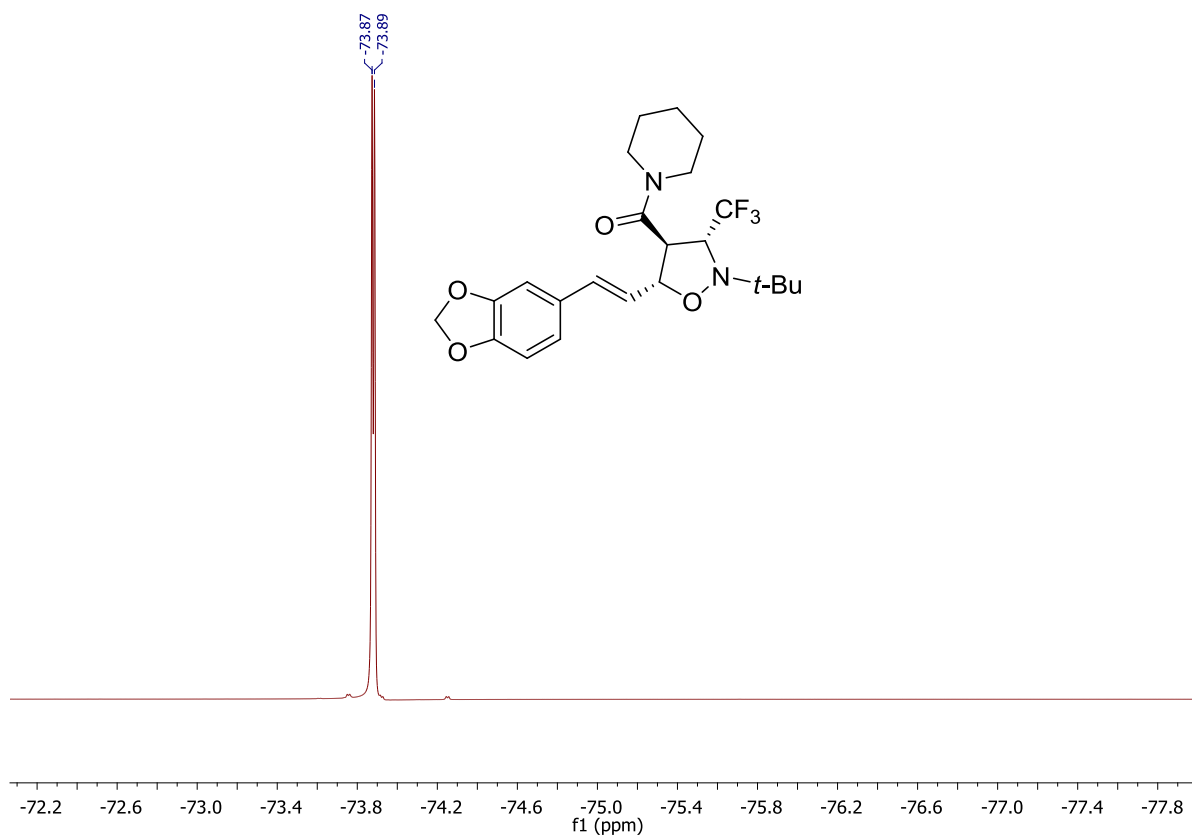
Compound 6a, ^1H - ^{13}C HSQC NMR (CD_3CN)



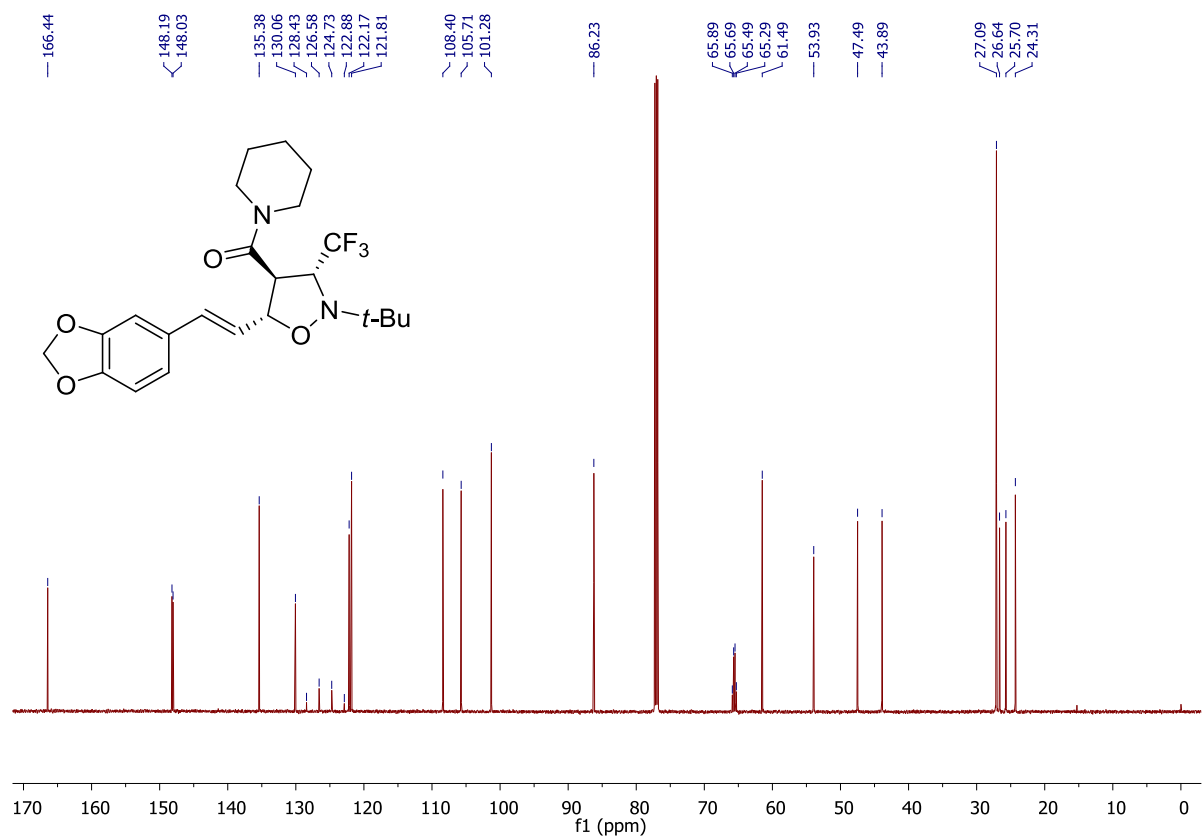
Compound 6a, ^1H - ^{19}F HOESY NMR (CD_3CN)



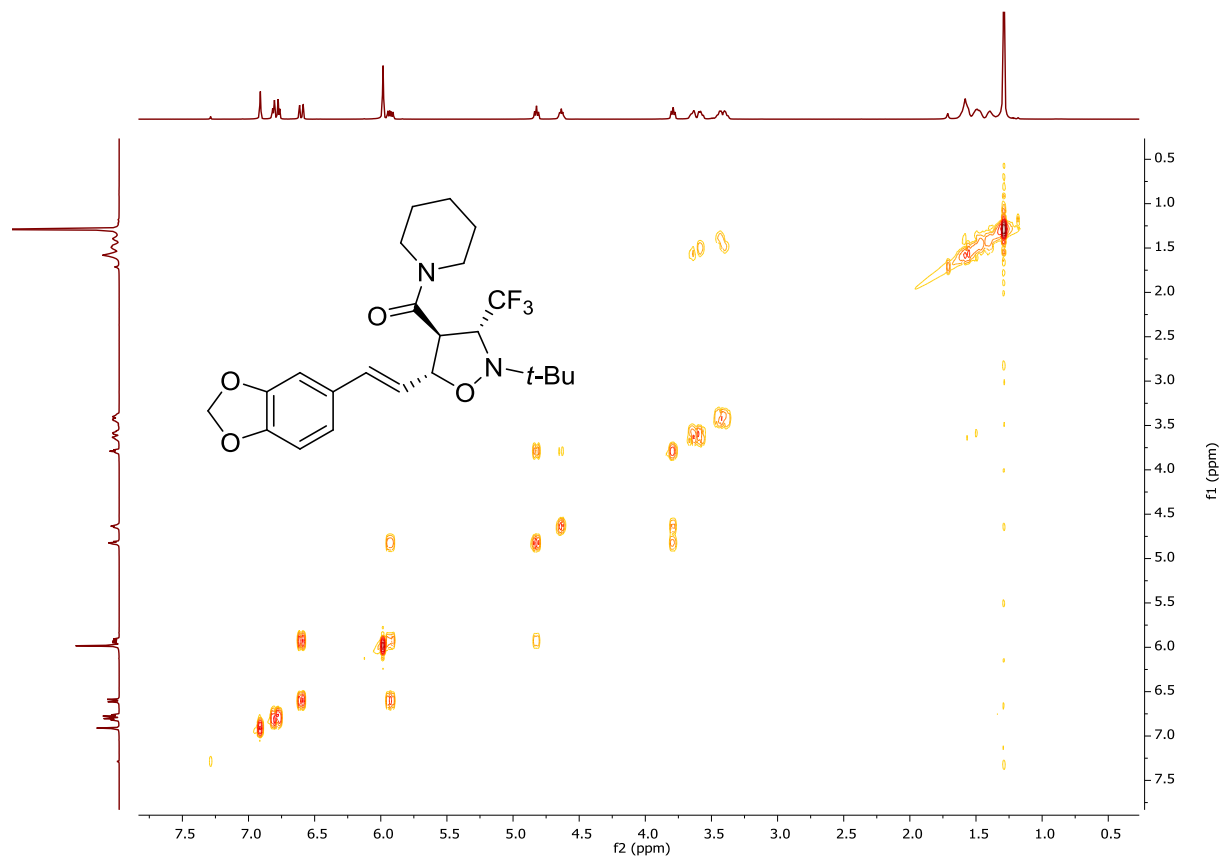
Compound 6cA, ¹H NMR (CDCl₃)



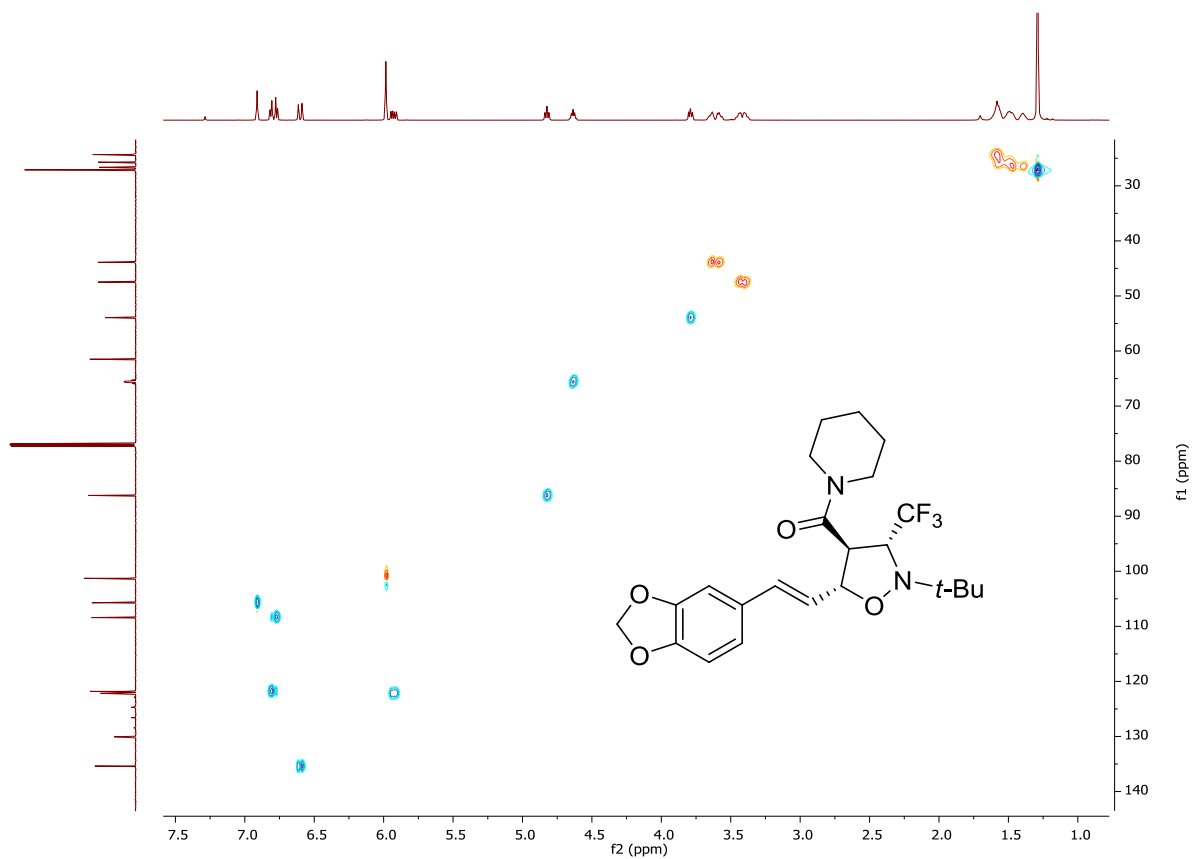
Compound 6cA, ¹⁹F NMR (CDCl₃)



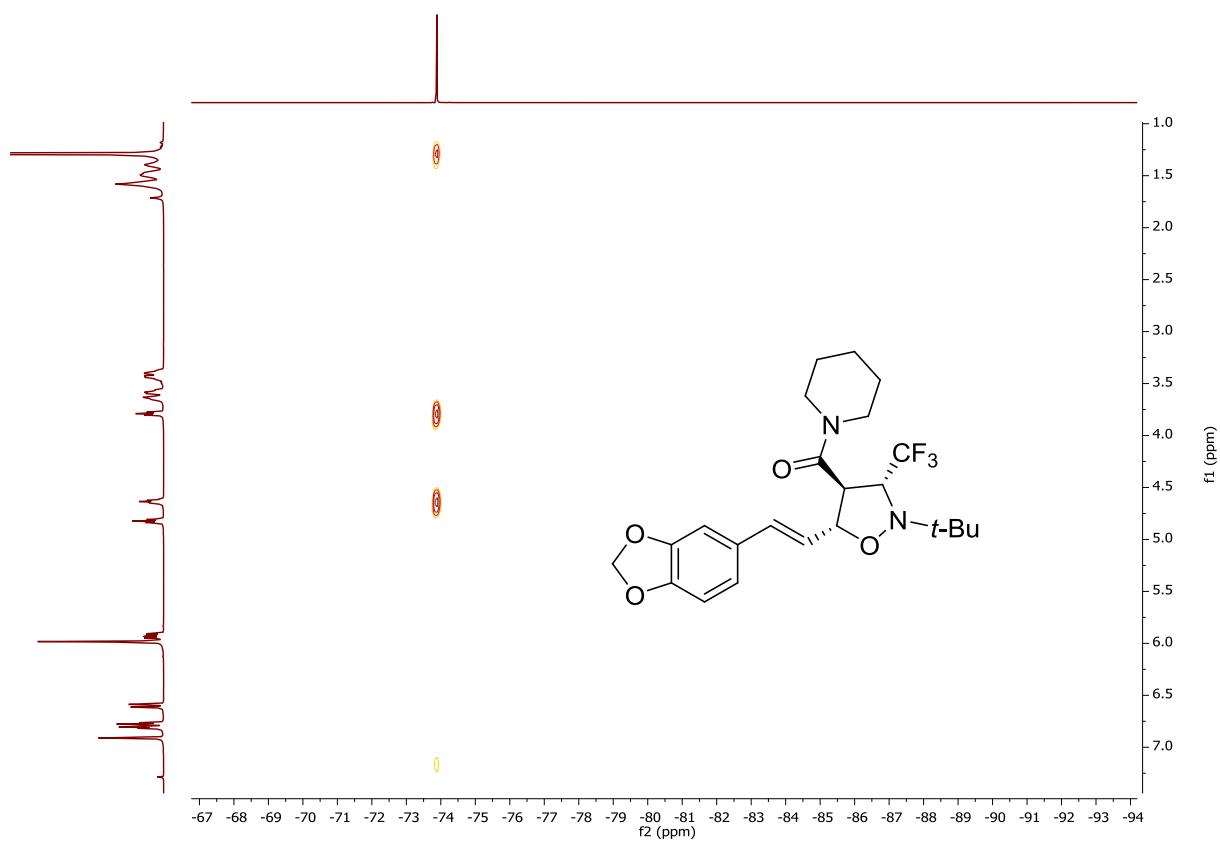
Compound 6cA, ^{13}C NMR (CDCl_3)



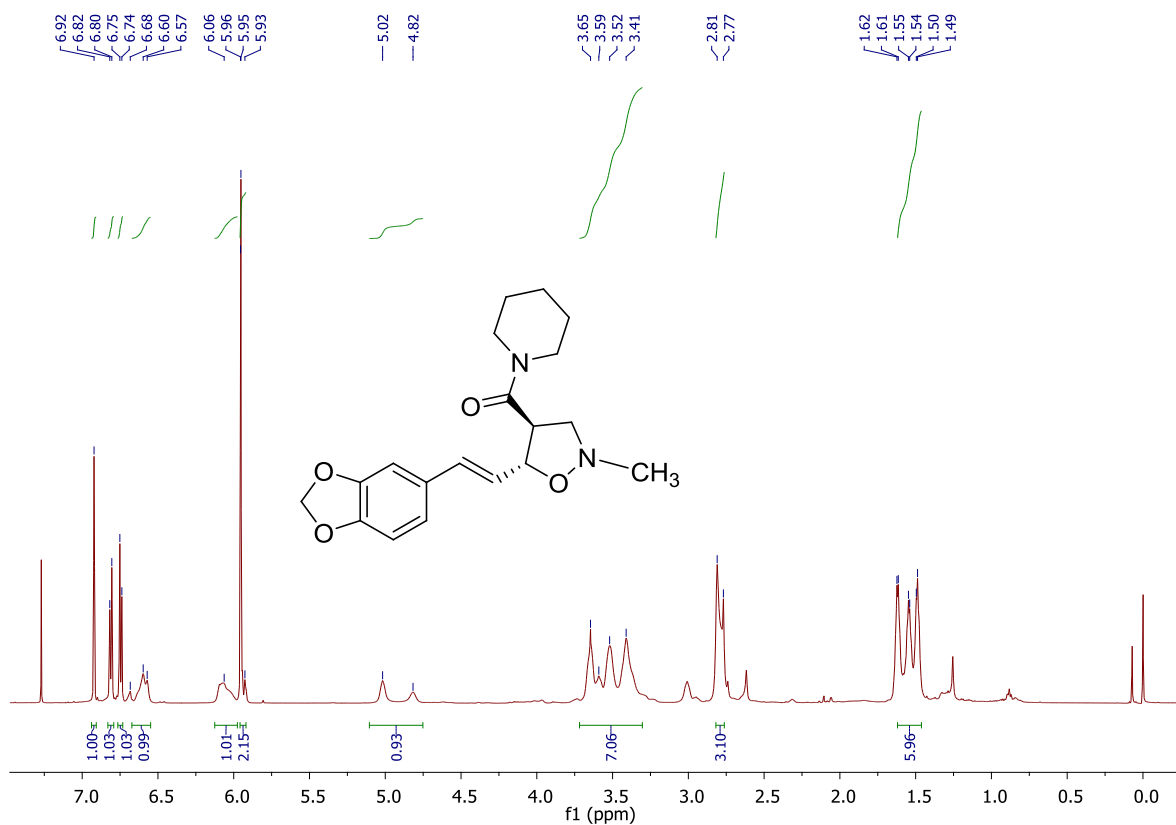
Compound 6cA, ^1H - ^1H COSY NMR (CDCl_3)



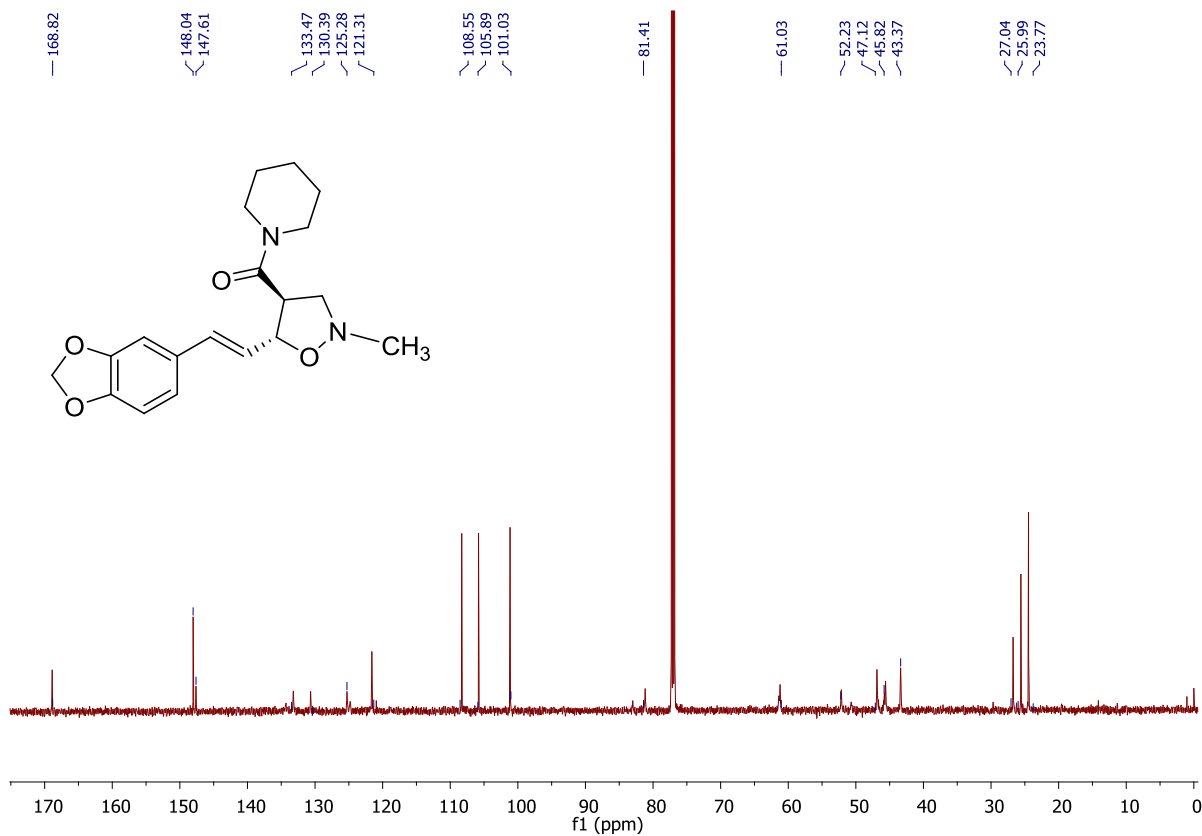
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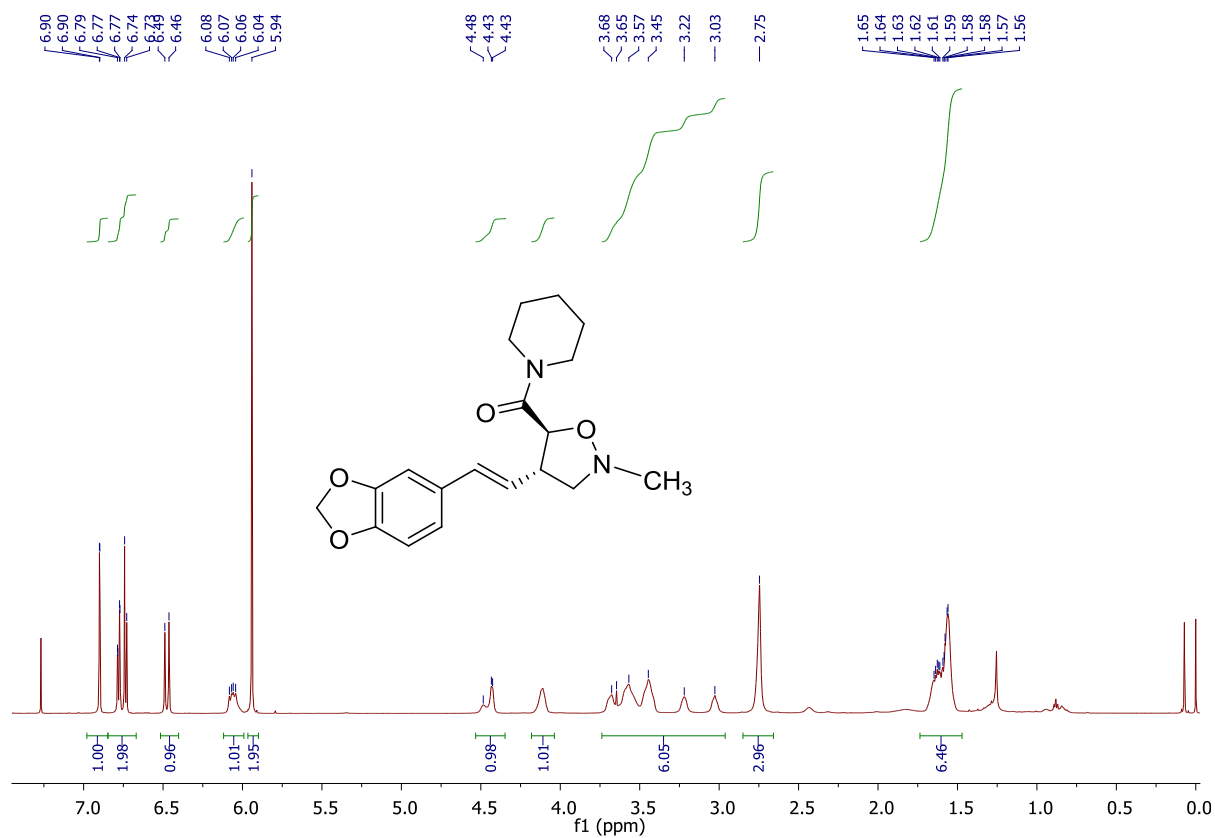
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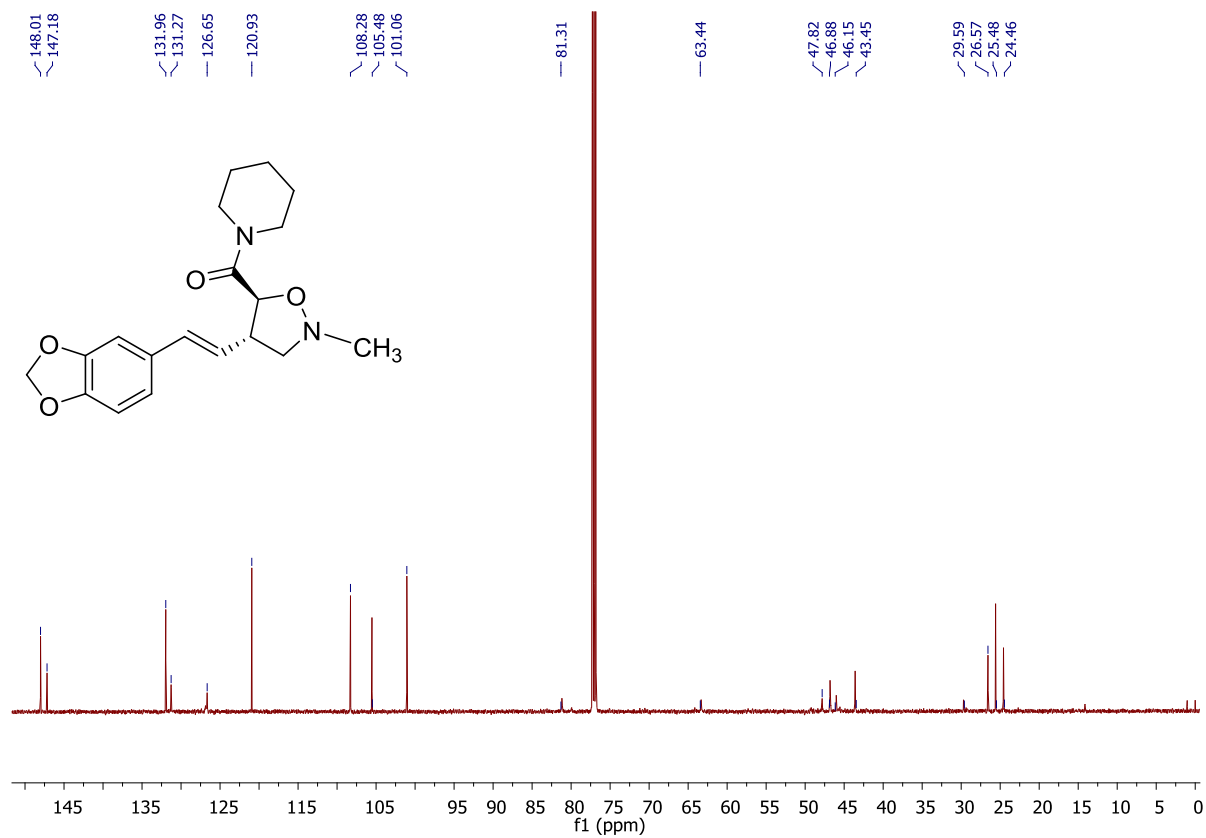
Compound 7, ¹H NMR (CDCl₃)



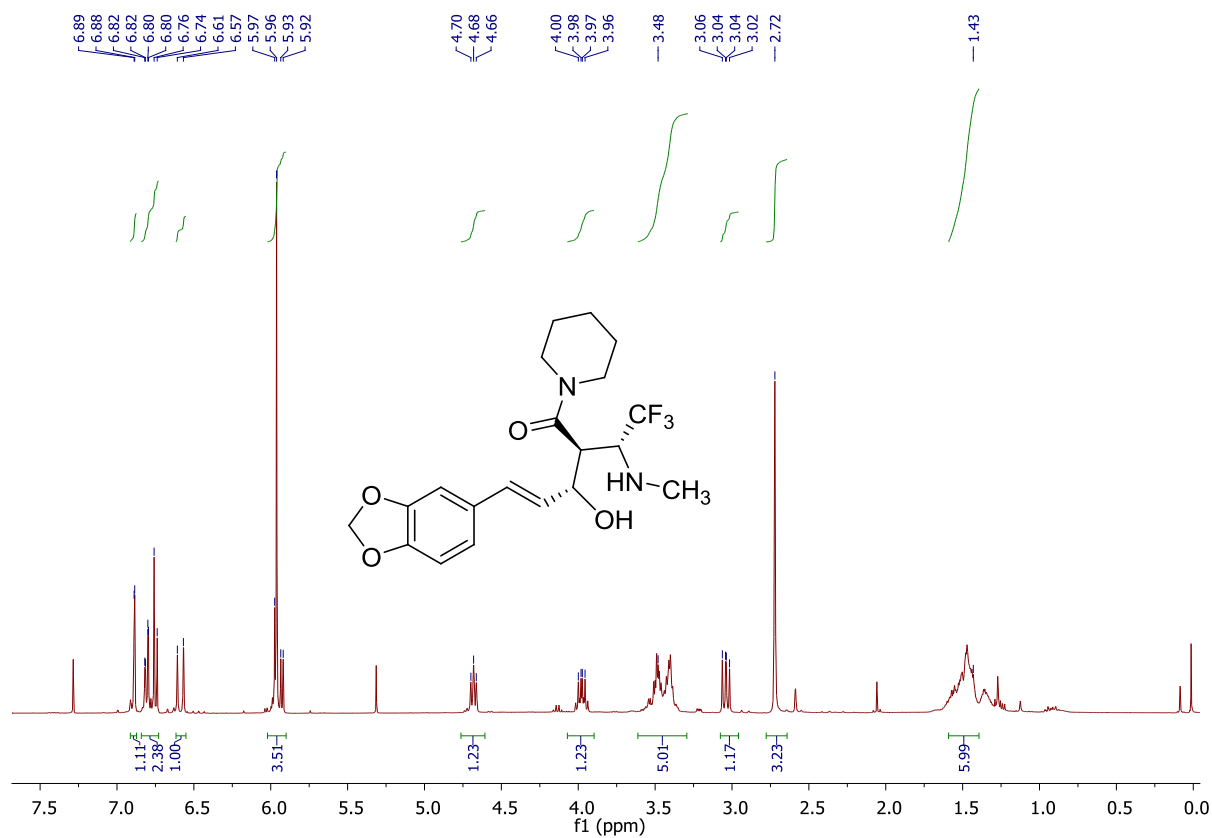
Compound 7, ¹³C NMR (CDCl₃)



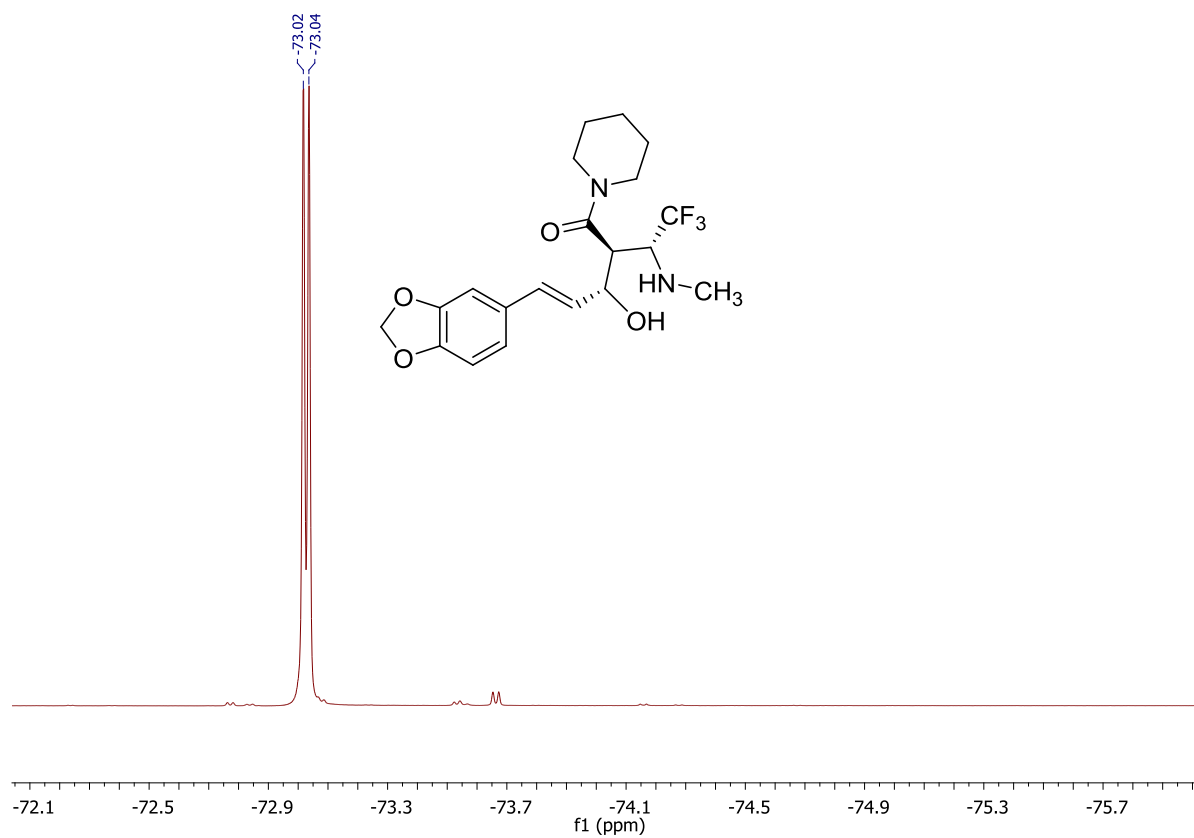
Compound 8, ^1H NMR (CDCl_3)



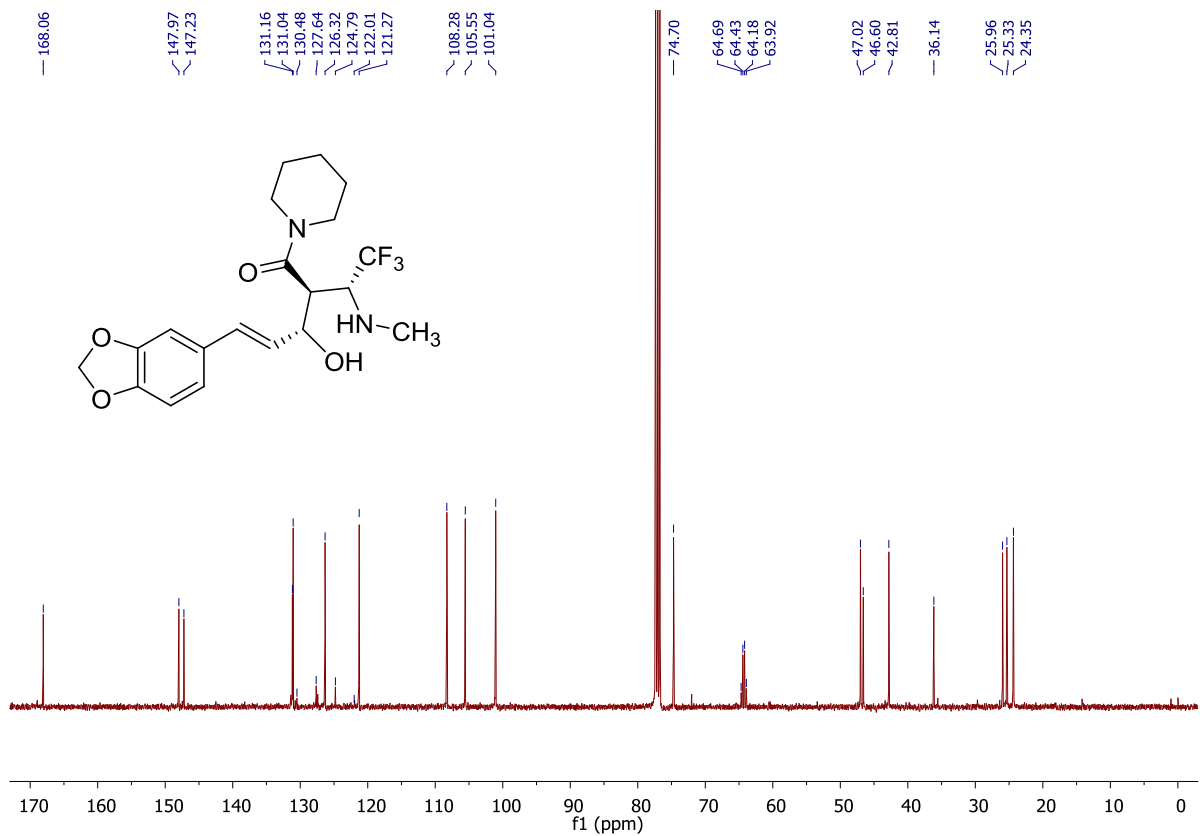
Compound 8, ^{13}C NMR (CDCl_3)



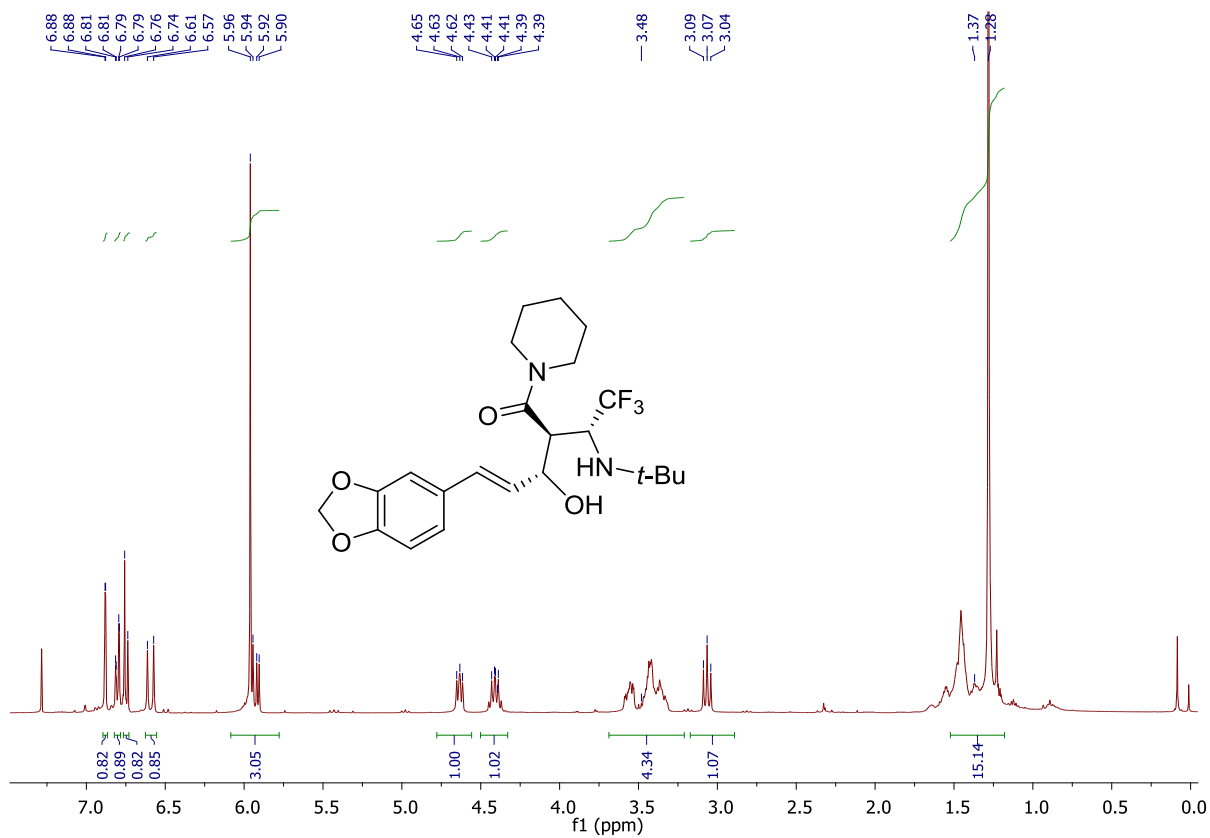
Compound 10a, ^1H NMR (CDCl_3)



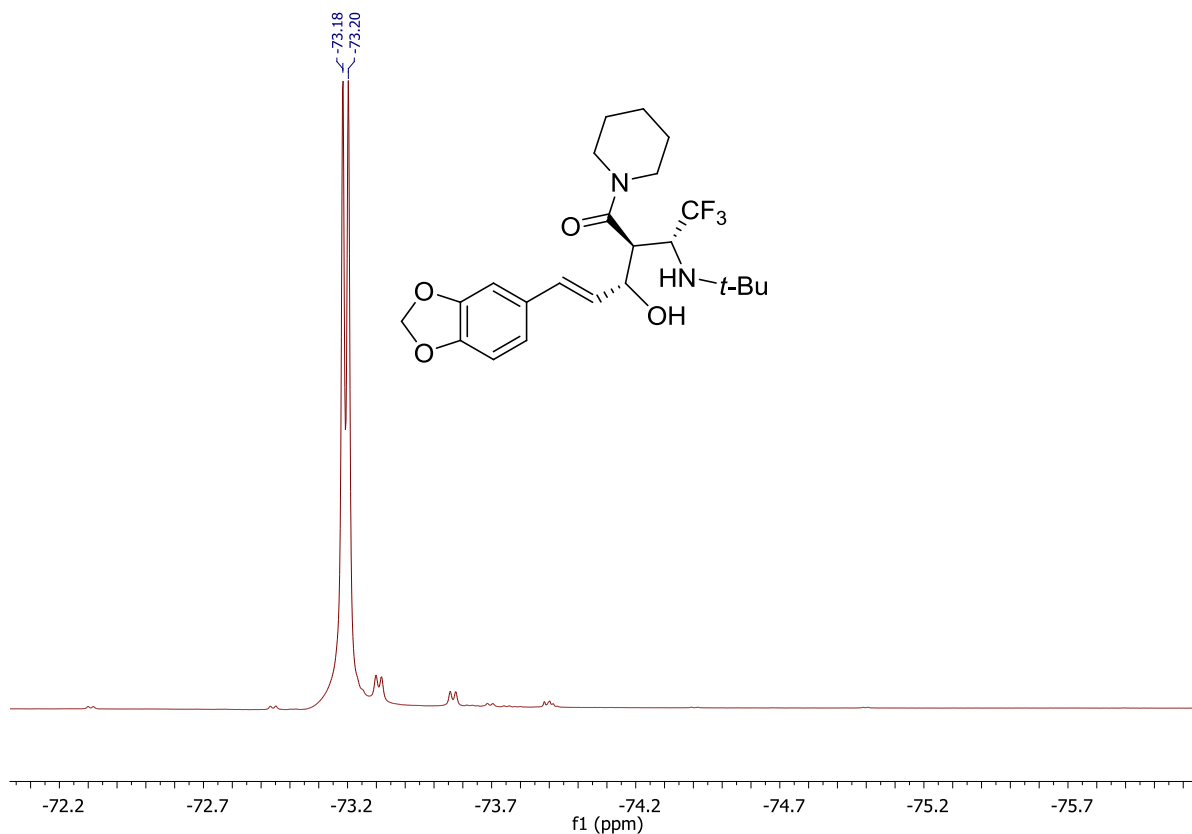
Compound 10a, ^{19}F NMR (CDCl_3)



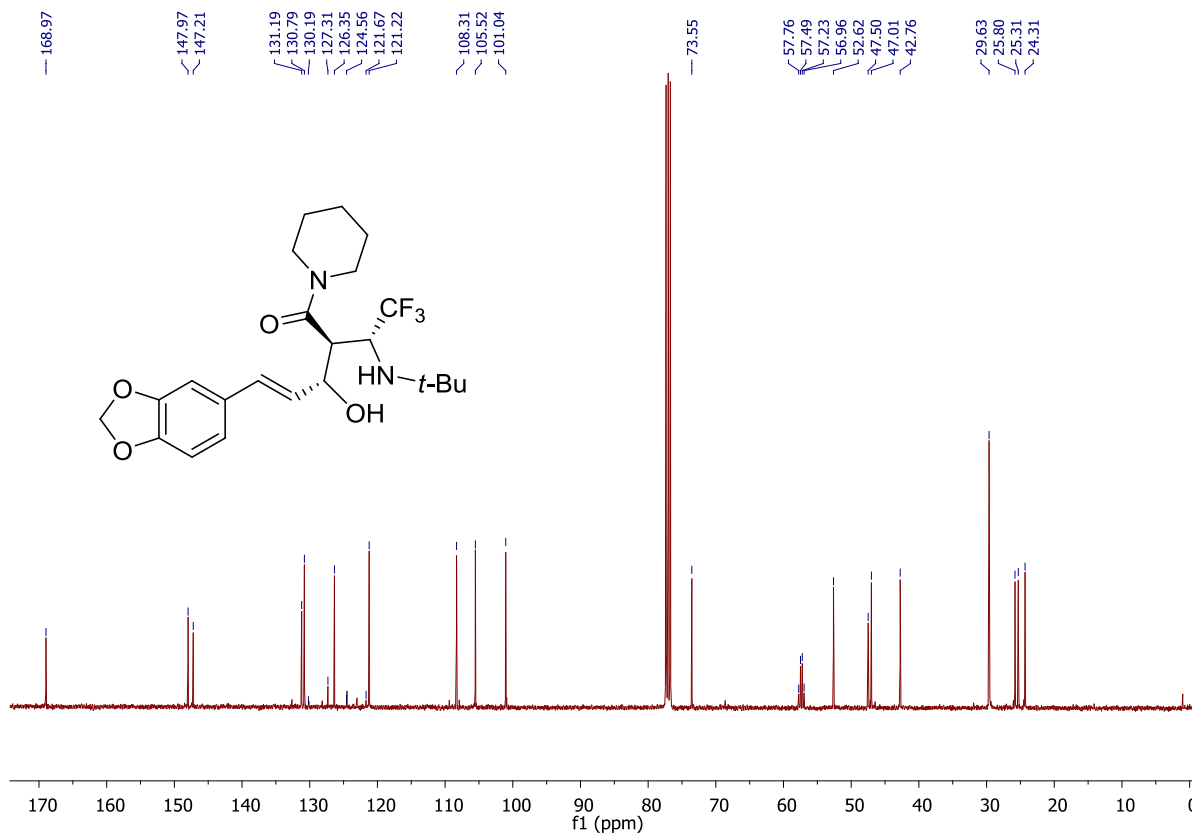
Compound 10a, ^{13}C NMR (CDCl_3)



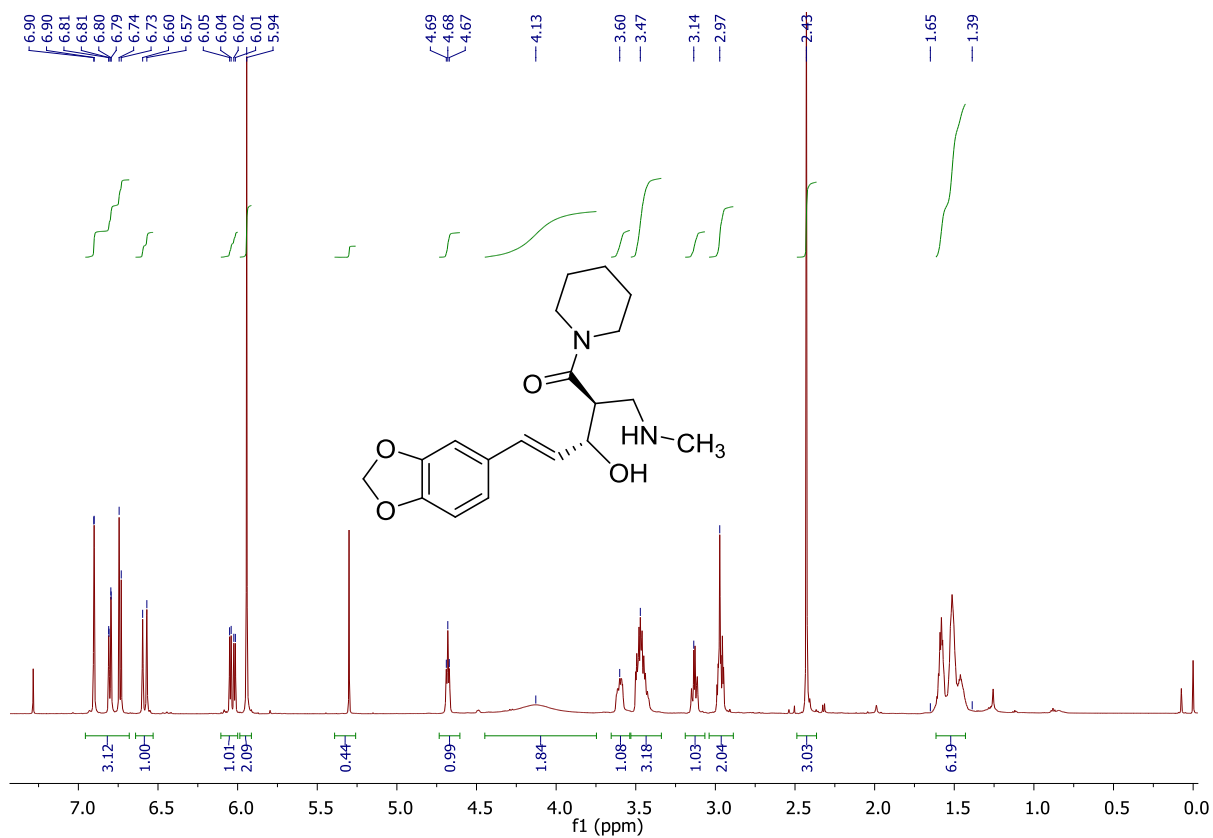
Compound 10c, ^1H NMR (CDCl_3)



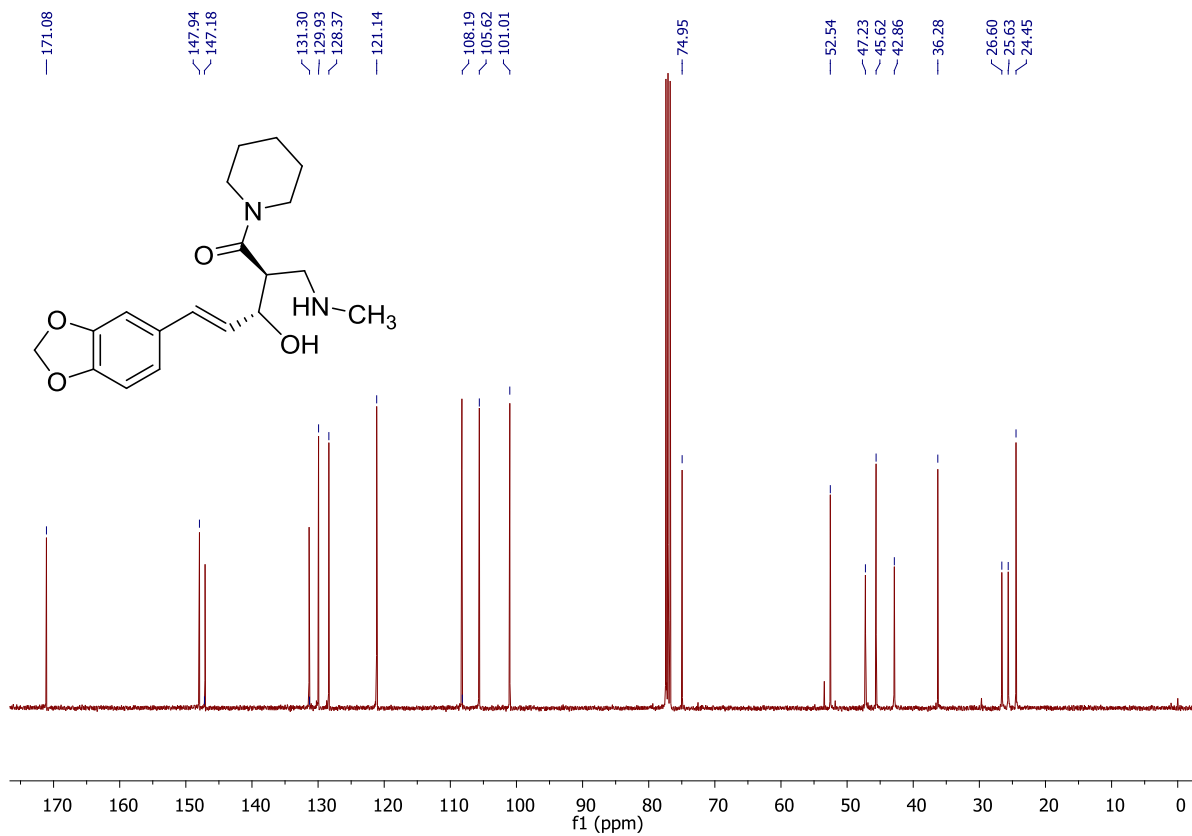
Compound 10c, ^{19}F NMR (CDCl₃)



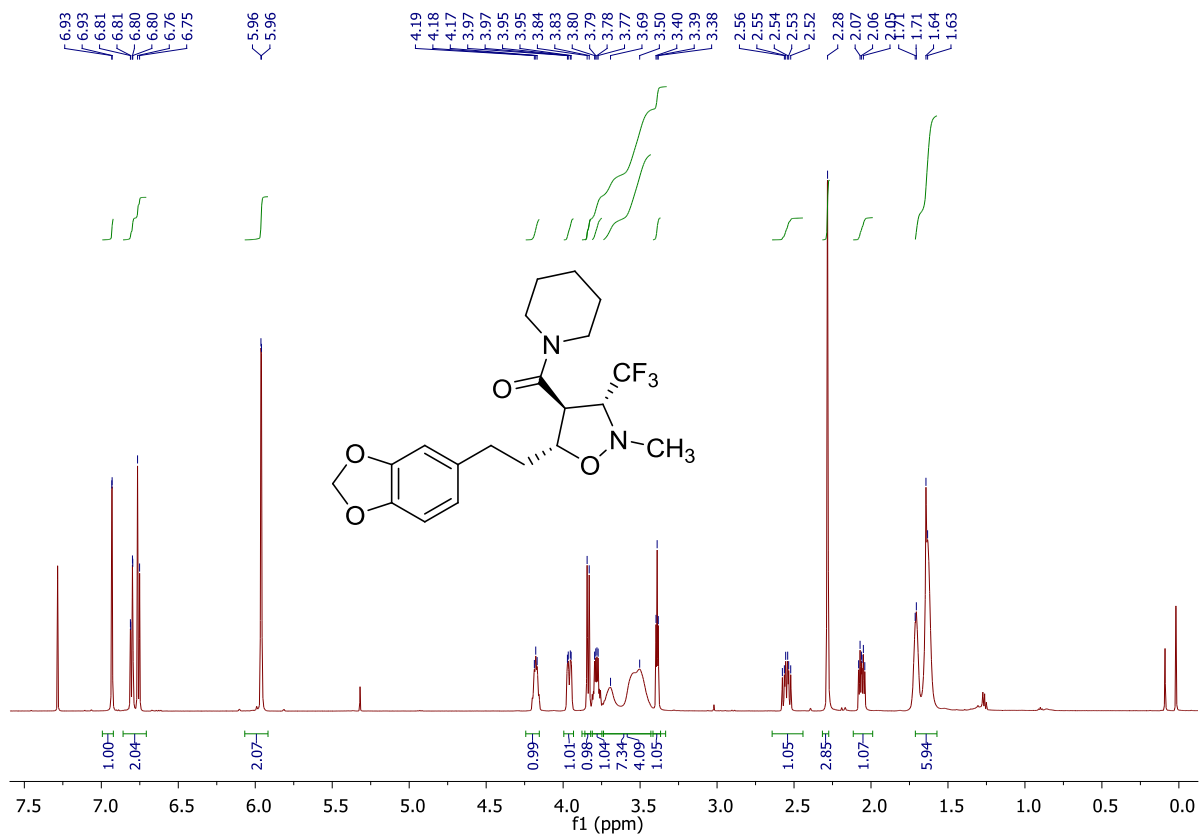
Compound 10c, ^{13}C NMR (CDCl₃)



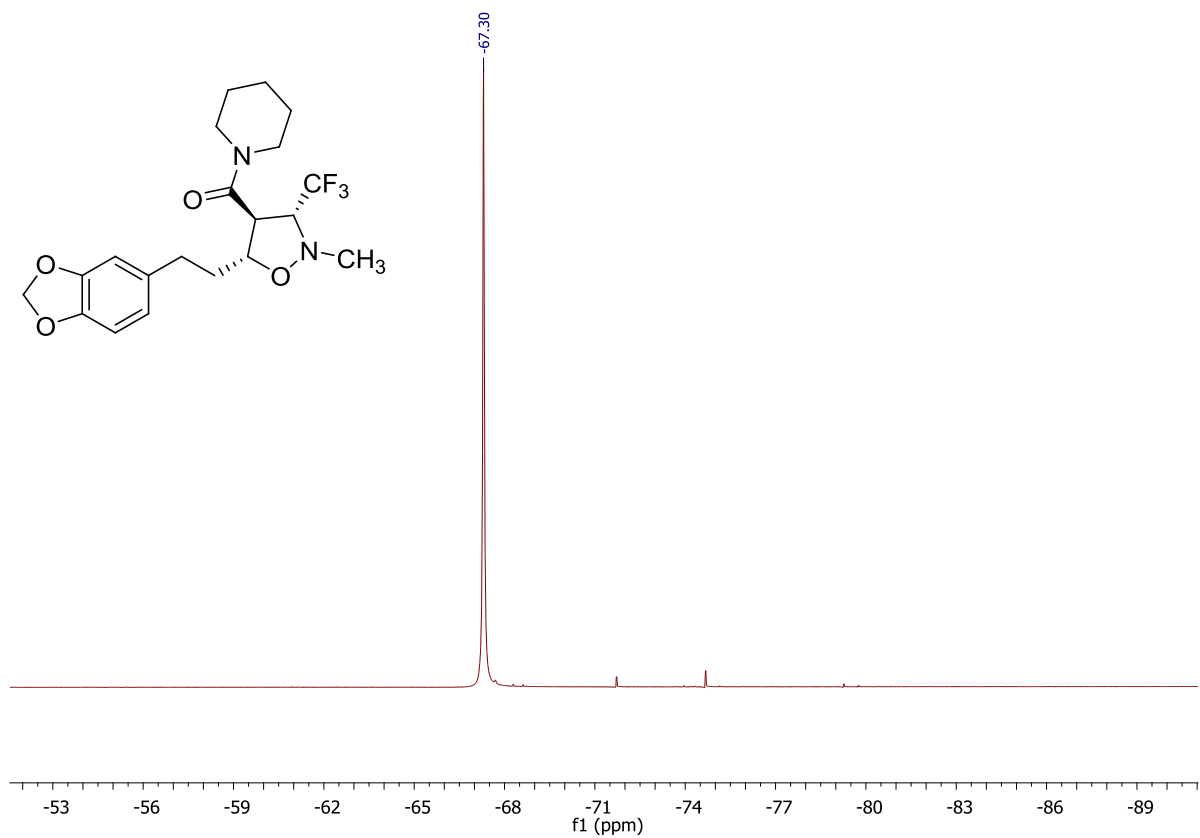
Compound 10d, ^1H NMR (CDCl_3)



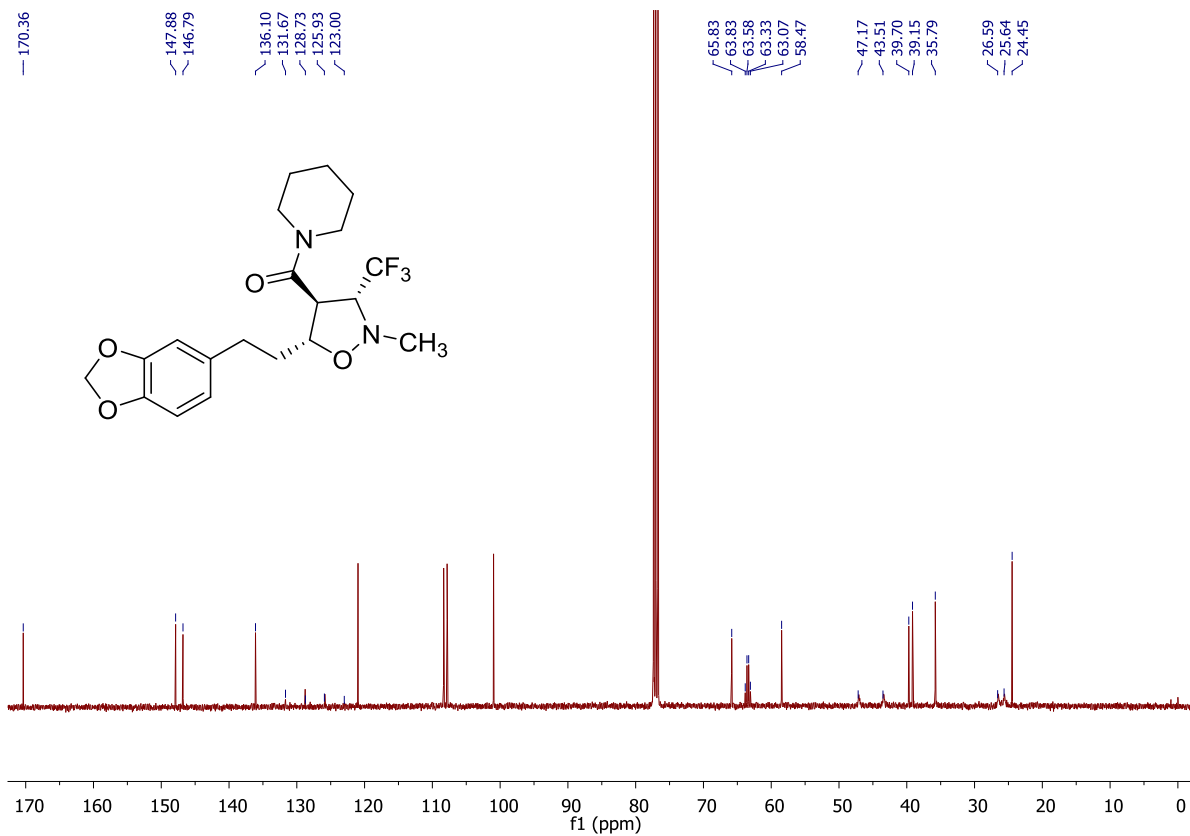
Compound 10d, ^{13}C NMR (CDCl_3)



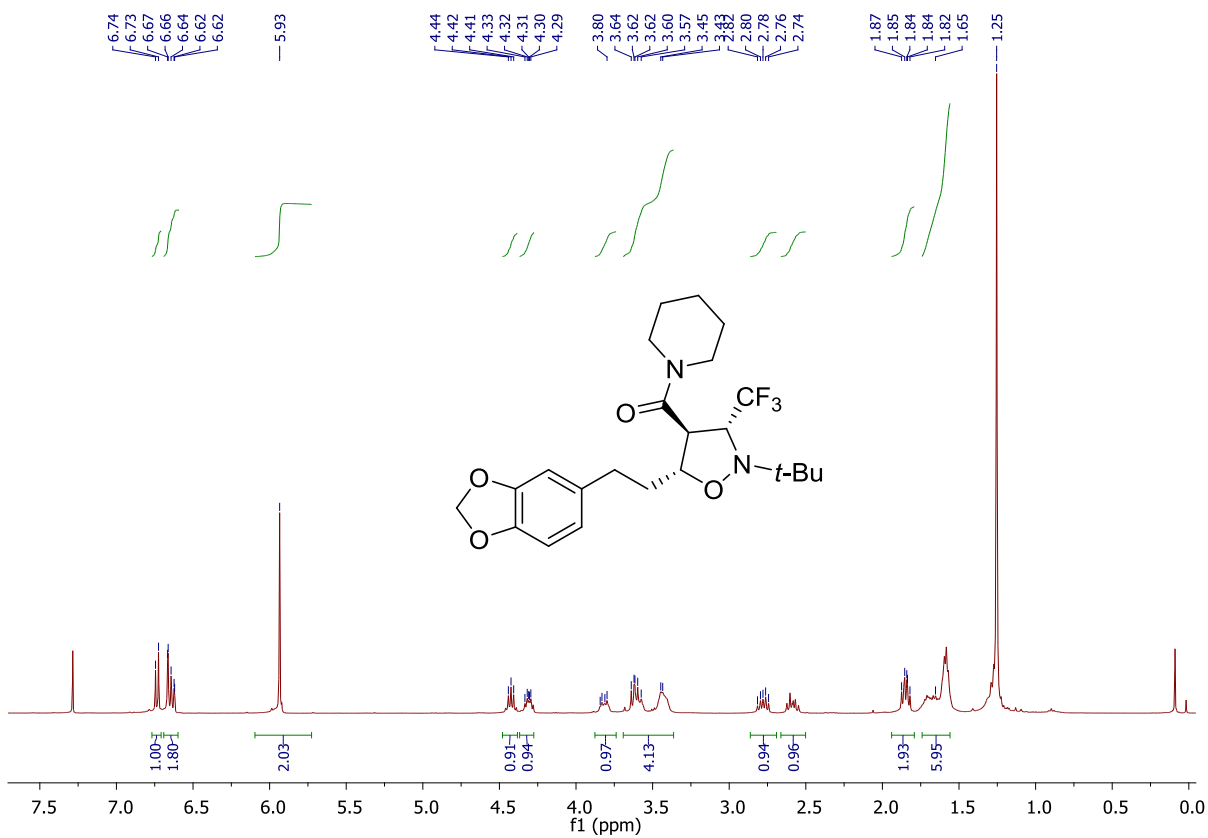
Compound 11a, $^1\text{H NMR}$ (CDCl₃)



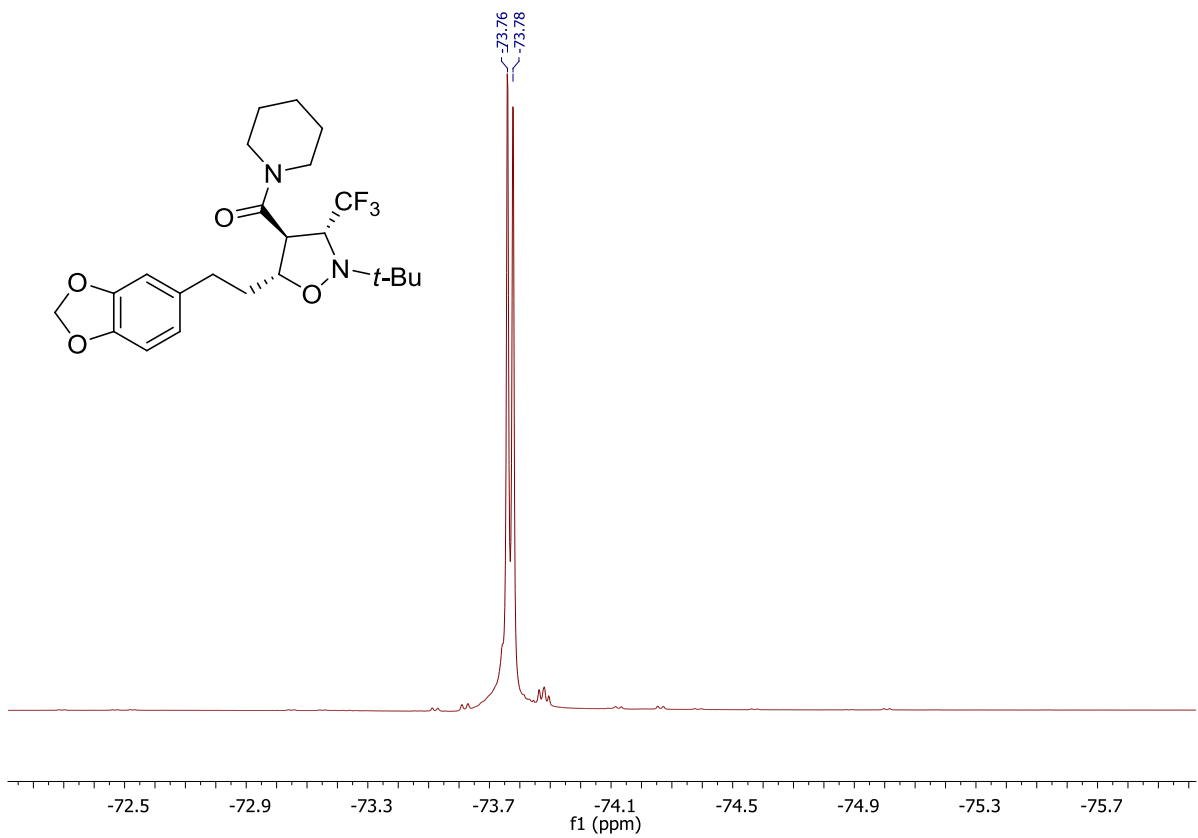
Compound 11a, $^{19}\text{F NMR}$ (CDCl₃)



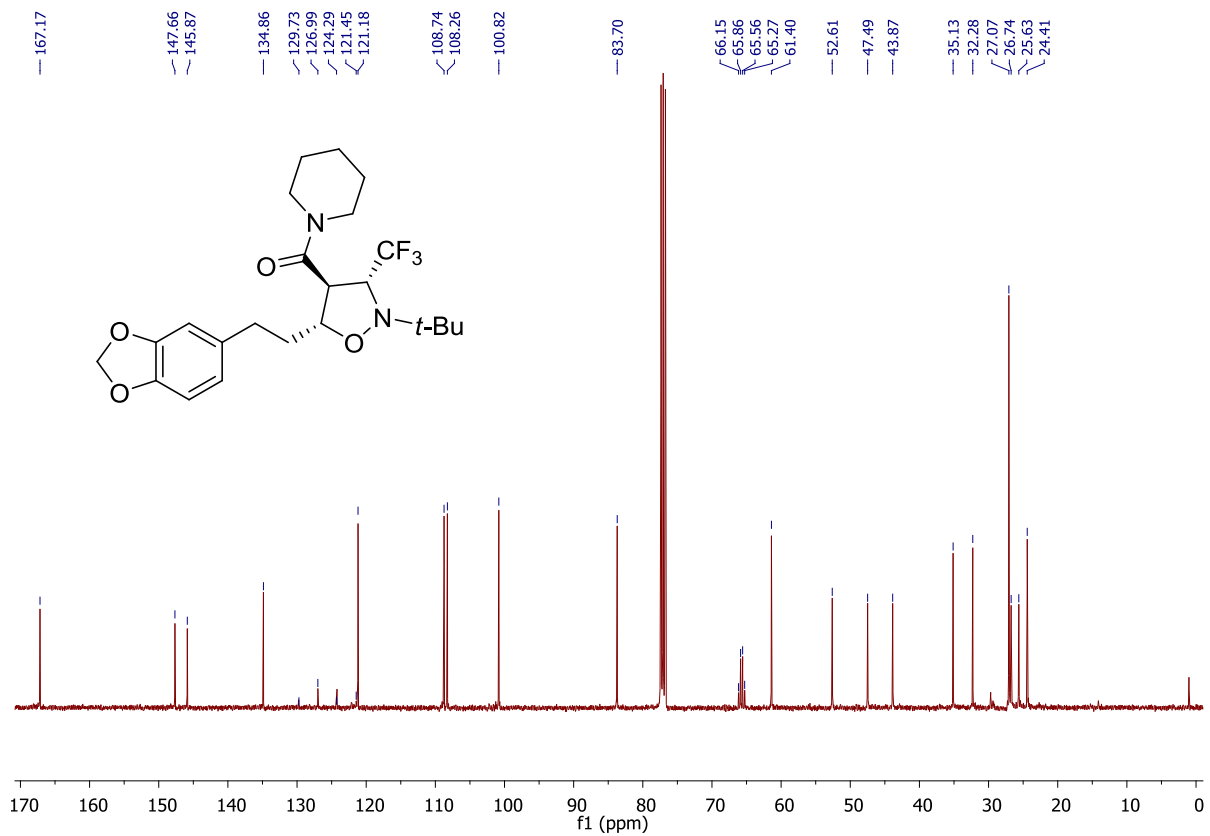
Compound 11a, ^{13}C NMR (CDCl₃)



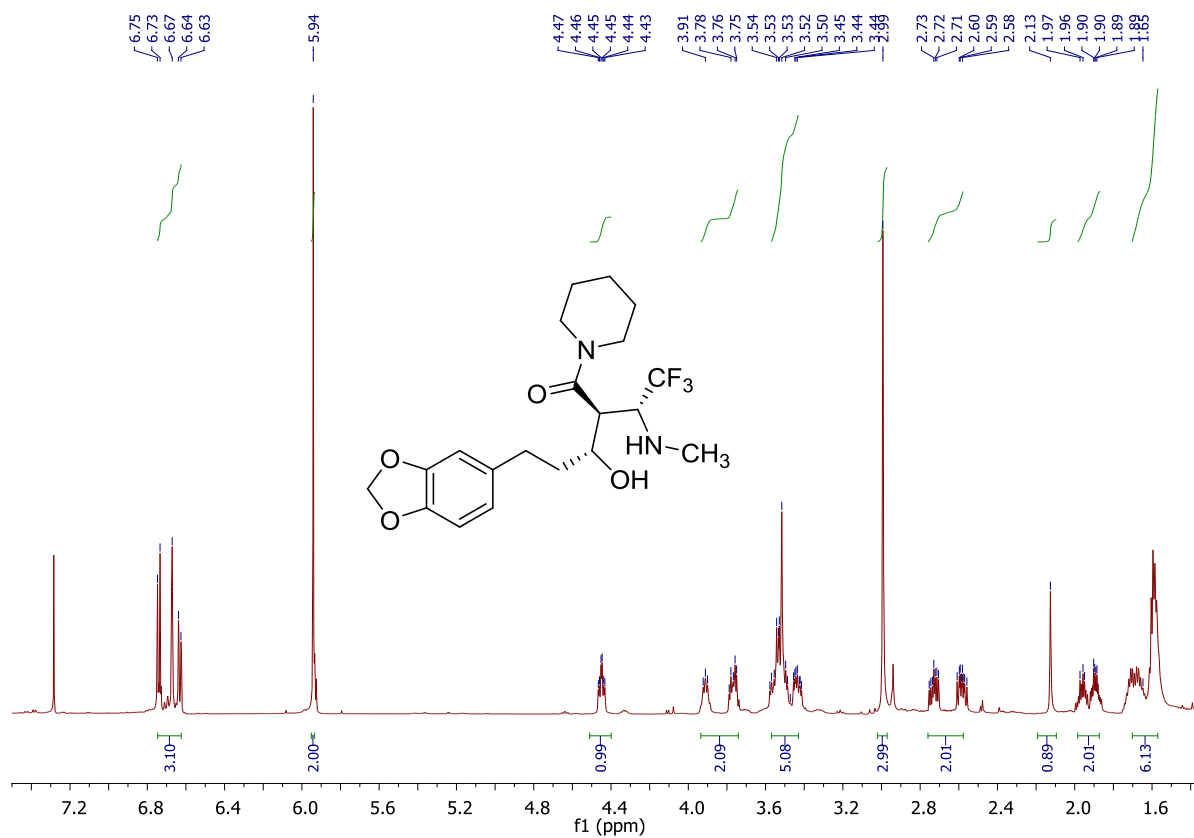
Compound 11c, ^1H NMR (CDCl₃)



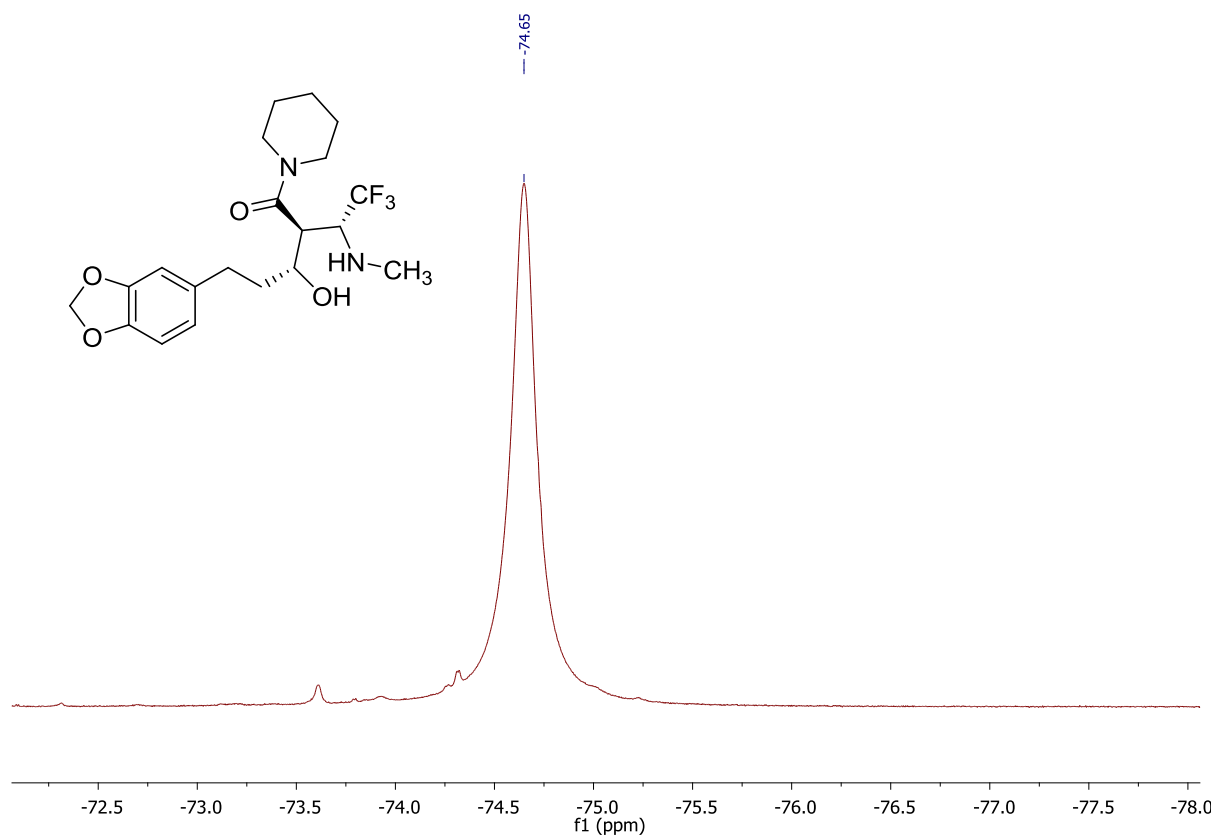
Compound 11c, ^{13}C NMR (CDCl_3)



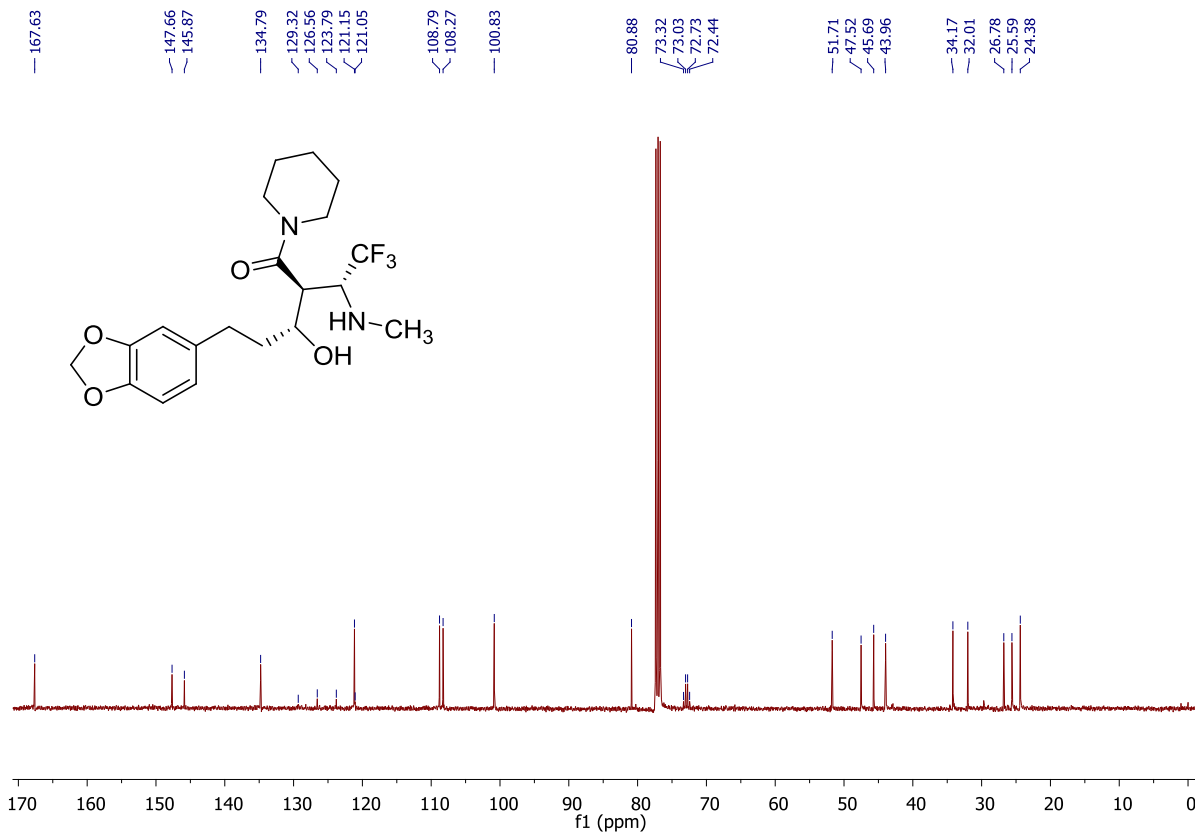
Compound 11c, ^{13}C NMR (CDCl_3)



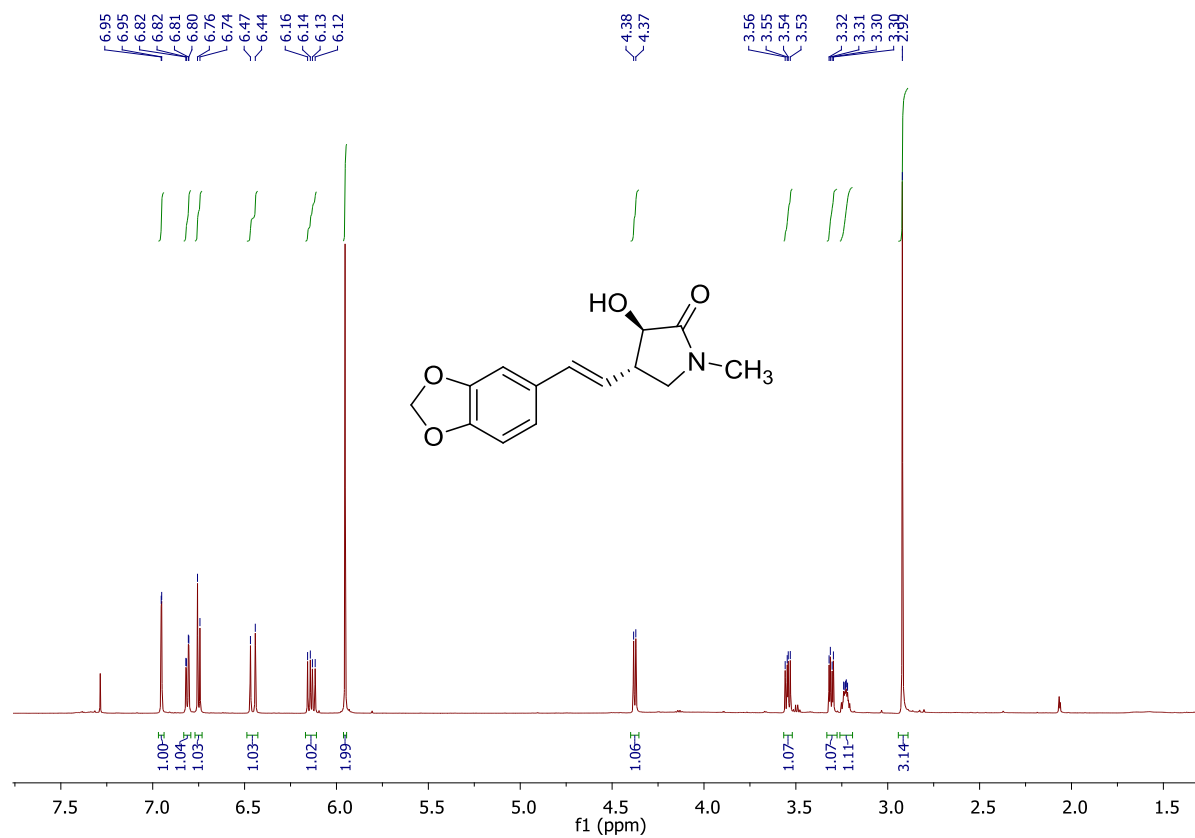
Compound 12a, ¹H NMR (CDCl₃)



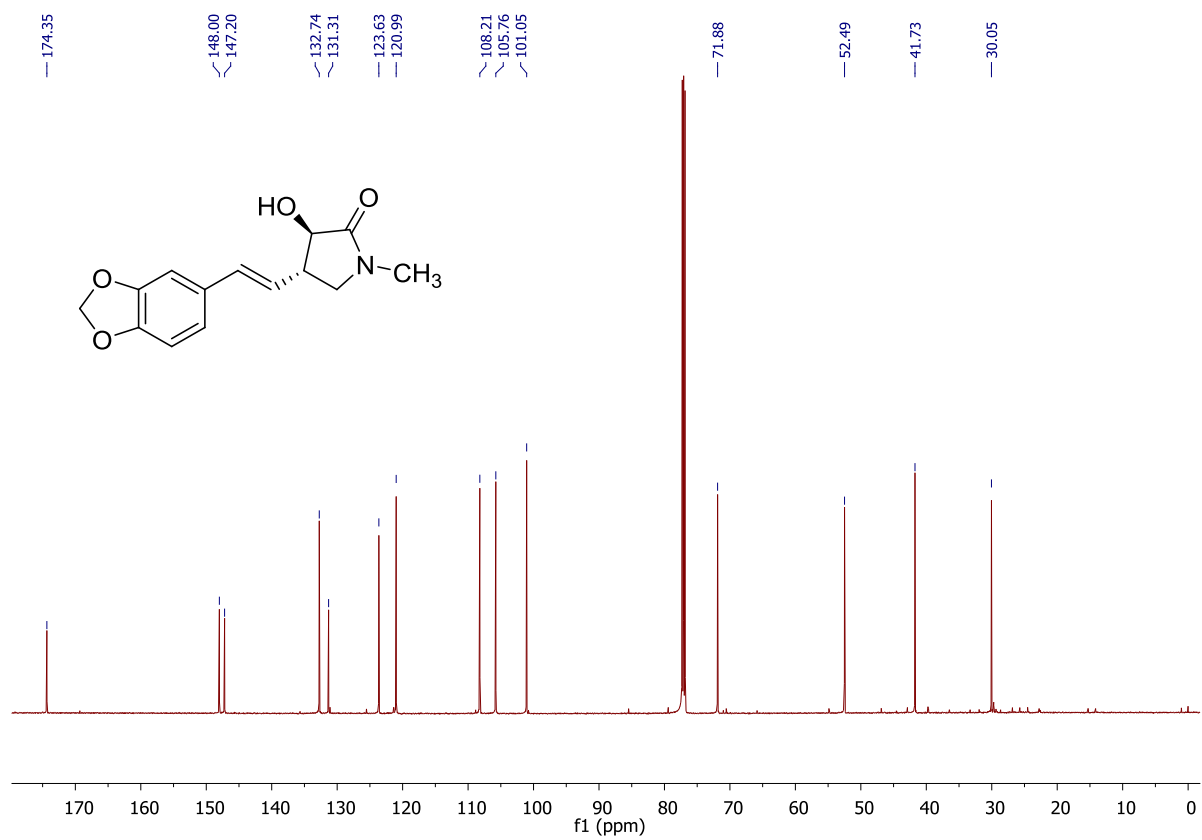
Compound 12a, ¹⁹F NMR (CDCl₃)



Compound 12a, ^{13}C NMR (CDCl_3)



Compound 13, ^1H NMR (CDCl_3)



Compound 13, ^{13}C NMR (CDCl_3)