Supporting Information

Ammonia-Promoted One-Pot Tetrazolopiperidinone Synthesis by Ugi Reaction

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Experimental section

1. General methods

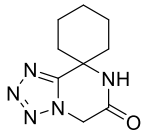
Nuclear magnetic resonance spectra (NMR) were recorded on a Bruker Avance 500 spectrometer (^{1}H NMR (500 MHz), ^{13}C NMR (126 MHz)). Chemical shifts for ^{1}H NMR were reported as δ values and coupling constants were in hertz (Hz). The following abbreviations were used for spin multiplicity: s = singlet, d = doublet, t = triplet, dd = double doublet, m = multiplet, bs = broad singlet. Chemical shifts for ^{13}C NMR reported in ppm relative to the solvent peak. Thin layer chromatography was performed on Fluka precoated silica gel plates (0.20 mm thick, particle size 25 µm). Flash chromatography was performed using SiliCycle silica gel type SiliaFlash P60 (230 – 400 mesh) as obtained from Screening Devices or with automated column chromatography using a Reveleris flash purification system purchased from Grace Davison Discovery Sciences. Reveleris pre-fabricated silica cartridges were purchased and used, for automated column chromatography, containing 40 µm silica. Reagents were available from commercial suppliers and used without any purification unless otherwise noted. All isocyanides were made in house by performing the Ugi procedure. Other reagents were purchased from Sigma Aldrich, ABCR, Acros and AK Scientific and were used without further purification. Electrospray ionization mass spectra (ESI-MS) were recorded on a Waters Investigator Semi-prep 15 SFC-MS instrument.

2. General Procedure

Procedure A (One-pot Ugi Reaction followed by cyclization):

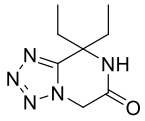
To a stirred solution of oxo compound (**A**, 1 equiv.) in methanol:H_2O (3:1; 0.5M) was added ammonium chloride (1.2 equiv.) and stirred for 10 min., followed by addition of isocyanide (**B**, 1 equiv.) and sodium azide (1.2 equiv.). The reaction was allowed to stir at room temperature for 18 h. Then, the ammonium hydroxide (0.1 equiv.) was added to the reaction mixture and stirred at 50 ^{o}C for additional 18 h. The solvents were evaporated under vacuum and the crude mass obtained was purified by using flash column chromatography to give pure product **C**.

1c: 5'H-spiro[cyclohexane-1,8'-tetrazolo[1,5-a]pyrazin]-6'(7'H)-one



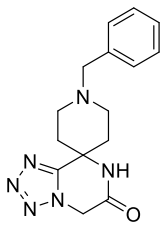
The product was obtained using procedure **A**, 67 % as white solid, M.P. = 142-144 ^{o}C; SFC-MS (ESI) m/z calcd for $C_9H_{13}N_5O$ $[M]^+$: 207.11; found $[M+H]^+$: 208.16. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.92 (s, 1H), 5.08 (s, 2H), 2.24 – 2.14 (m, 2H), 2.03 – 1.94 (m, 2H), 1.90 – 1.83 (m, 2H), 1.78 – 1.58 (m, 4H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 162.9, 154.0, 54.3, 47.5, 38.1, 24.2, 20.9.

2c: 8,8-diethyl-7,8-dihydrotetrazolo[1,5-a]pyrazin-6(5H)-one



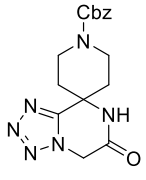
The product was obtained using procedure **A**, 58 % as white solid, M.P. = 150-152 ^{o}C; SFC-MS (ESI) m/z calcd for $C_8H_{13}N_5O$ $[M]^+$: 195.11; found $[M+H]^+$: 196.20. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.42 (s, 1H), 5.09 (s, 2H), 2.28 (dq, *J* = 14.7, 7.4 Hz, 2H), 1.97 (dq, *J* = 14.7, 7.4 Hz, 2H), 0.80 (t, *J* = 7.4 Hz, 6H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 163.6, 152.1, 60.3, 47.4, 34.7, 8.0.

3c: 1-benzyl-5'H-spiro[piperidine-4,8'-tetrazolo[1,5-a]pyrazin]-6'(7'H)-one



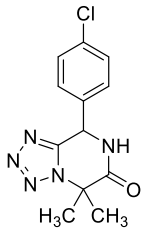
The product was obtained using procedure **A**, 67 % as white solid, M.P. = 204-206 ^{o}C; SFC-MS (ESI) m/z calcd for $C_{15}H_{18}N_6O$ $[M]^+$: 298.15; found $[M+H]^+$: 299.18. ^{1}H NMR (500 MHz, DMSO) δ 8.95 (s, 1H), 7.35 – 7.31 (m, 4H), 7.28 – 7.23 (m, 1H), 5.12 (s, 2H), 3.58 (s, 2H), 2.76 – 2.65 (m, 4H), 2.04 – 1.95 (m, 4H); ^{13}C NMR (126 MHz, DMSO) δ 162.9, 153.3, 138.6, 128.8, 128.2, 126.9, 61.8, 51.8, 48.0, 47.5, 37.0.

4c: benzyl 6'-oxo-6',7'-dihydro-5'H-spiro[piperidine-4,8'-tetrazolo[1,5-a]pyrazine]-1-carboxylate



The product was obtained using procedure **A**, 69 % as white solid, M.P. = 138-140 ^{o}C; SFC-MS (ESI) m/z calcd for $C_{16}H_{18}N_6O_3$ $[M]^+$: 342.14; found $[M-H]^+$: 341.08. ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.82 (s, 1H), 7.42 – 7.29 (m, 5H), 5.14 (s, 2H), 5.06 (s, 2H), 3.99 – 3.74 (m, 4H), 2.23 – 2.07 (m, 2H), 2.04 – 1.82 (m, 2H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 163.4, 155.0, 152.4, 136.2, 128.5, 128.1, 127.8, 67.4, 52.8, 47.4, 39.3, 37.3.

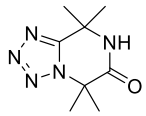
12c: 8-(4-chlorophenyl)-5,5-dimethyl-7,8-dihydrotetrazolo[1,5-a]pyrazin-6(5H)-one



The product was obtained using procedure **A**, 22 % as white solid, M.P. = 130-132 ^{o}C; SFC-MS (ESI) m/z calcd for $C_{12}H_{12}ClN_5O$ $[M]^+$: 277.07; found $[M-H]^+$: 276.10. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.53 (s, 1H), 7.41 – 7.36 (m, 2H), 7.35 – 7.30 (m, 2H), 6.11 (d, *J* = 2.2 Hz, 1H), 1.92 (s, 3H), 1.84 (s, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 170.0, 148.2, 135.7, 134.7, 129.7, 127.8, 62.6, 51.6, 27.6, 26.3.

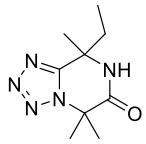
13c: 5,5,8,8-tetramethyl-7,8-dihydrotetrazolo[1,5-a]pyrazin-6(5H)-one

The product was obtained using procedure **A**, 72 % as white solid, M.P. = 207-209 ^{o}C; SFC-



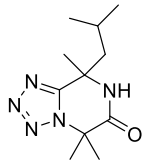
MS (ESI) m/z calcd for $C_8H_{13}N_5O$ $[M]^+$: 195.11; found $[M+H]^+$: 196.20; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.99 (s, 1H), 1.88 (d, *J* = 1.6 Hz, 6H), 1.79 (s, 6H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 169.7, 153.1, 62.2, 51.7, 30.5, 27.1.

14c: 8-ethyl-5,5,8-trimethyl-7,8-dihydrotetrazolo[1,5-a]pyrazin-6(5H)-one



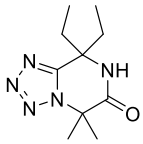
The product was obtained using procedure **A**, 62 % as white solid, M.P. = 181-183 ^{o}C; SFC-MS (ESI) m/z calcd for $C_9H_{15}N_5O$ $[M]^+$: 209.13; found $[M+H]^+$: 210.21; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.69 (s, 1H)2.33 – 2.19 (m, 1H), 2.02 – 1.94 (m, 1H), 1.92 (s, 3H), 1.90 (s, 3H), 1.78 (s, 3H), 0.80 (d, *J* = 7.3 Hz, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 170.1, 151.9, 62.0, 55.6, 35.8, 29.5, 27.6, 27.2, 8.3.

15c: 8-isobutyl-5,5,8-trimethyl-7,8-dihydrotetrazolo[1,5-a]pyrazin-6(5H)-one



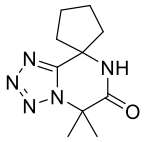
The product was obtained using procedure **A**, 67 % as white solid, M.P. = 169-171 ^{o}C; SFC-MS (ESI) m/z calcd for $C_{11}H_{19}N_5O$ $[M]^+$: 237.16; found $[M+H]^+$: 238.16; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.91 (s, 1H), 2.26 – 2.17 (m, 1H), 1.91 (s, 3H), 1.87 (s, 3H), 1.75 (s, 3H), 1.51 – 1.39 (m, 1H), 0.89 (d, *J* = 6.7 Hz, 3H), 0.57 (d, *J* = 6.7 Hz, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 169.9, 152.3, 62.0, 55.0, 50.4, 31.4, 27.9, 26.8, 24.6, 24.0, 23.0.

16c: 8,8-diethyl-5,5-dimethyl-7,8-dihydrotetrazolo[1,5-a]pyrazin-6(5H)-one



The product was obtained using procedure **A**, 62 % as white solid, M.P. = 167-169 ^{o}C; SFC-MS (ESI) m/z calcd for $C_{10}H_{17}N_5O$ $[M]^+$: 223.14; found $[M+H]^+$: 224.19; ^{1}H NMR (500 MHz, $CDCl_3$) δ 2.34 – 2.22 (m, 2H), 2.00 – 1.91 (m, 2H), 1.90 (s, 6H), 0.75 (t, *J* = 7.4 Hz, 6H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 170.9, 150.7, 61.8, 60.1, 34.9, 34.9, 27.7, 8.1.

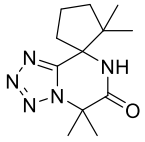
23c: 5',5'-dimethyl-5'H-spiro[cyclopentane-1,8'-tetrazolo[1,5-a]pyrazin]-6'(7'H)-one



The product was obtained using procedure **A**, 68 % as white solid, M.P. = 152-154 ^{o}C; SFC-MS (ESI) m/z calcd for $C_{10}H_{15}N_5O$ $[M]^+$: 221.13; found $[M+H]^+$: 222.20; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.09 (s, 1H), 2.49 – 2.25 (m, 2H), 2.21 – 1.96 (m, 6H), 1.80 (s, 6H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 169.8, 153.3, 62.1, 60.7, 42.2, 26.9, 23.7.

24c: 2,2,5',5'-tetramethyl-5'H-spiro[cyclopentane-1,8'-tetrazolo[1,5-a]pyrazin]-6'(7'H)-one.

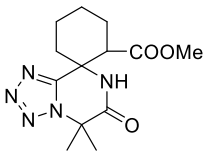
The product was obtained using procedure **A**, 8 % as white solid, M.P. = 212-214 ^{o}C; SFC-MS



(ESI) m/z calcd for $C_{12}H_{19}N_5O$ $[M]^+$: 249.16; found $[M-H]^+$: 248.18; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.57 (s, 1H), 2.52 – 2.37 (m, 1H), 2.31 – 2.06 (m, 3H), 2.06 – 1.94 (m, 1H), 1.88 (s, 6H), 1.80 – 1.69 (m, 1H), 1.07 (s, 3H), 0.74 (s, 3H), ^{13}C NMR (126 MHz, $CDCl_3$) δ 170.4, 151.4, 66.3, 61.7, 47.9, 38.4, 37.3, 27.9, 27.7, 23.7, 23.5, 18.7.

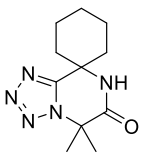
25c: methyl 5',5'-dimethyl-6'-oxo-6',7'-dihydro-5'H-spiro[cyclohexane-1,8'-tetrazolo[1,5-a]pyrazine]-2-carboxylate

The product was obtained using procedure **A**, 14 % as white solid, M.P. = 90-92 ^{o}C; SFC-MS



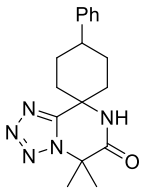
(ESI) m/z calcd for $C_{13}H_{19}N_5O_3$ $[M]^+$: 293.15; found $[M-H]^+$: 292.39; ^{1}H NMR (500 MHz, $CDCl_3$) (major) δ 7.90 (s, 1H), 3.50 (s, 3H), 2.75 (dd, *J* = 13.0, 3.9 Hz, 1H), 2.52 (qd, *J* = 13.3, 3.9 Hz, 1H), 2.24 (qt, *J* = 13.6, 4.2 Hz, 1H), 2.16 – 2.08 (m, 1H), 2.05 – 1.98 (m, 1H), 1.94 (s, 3H), 1.93 – 1.87 (m, 1H), 1.85 (s, 3H), 1.82 – 1.79 (m, 1H), 1.74 – 1.66 (m, 1H), 1.49 – 1.39 (m, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) (major) δ 171.8, 170.5, 149.9, 61.6, 55.1, 52.7, 51.9, 40.6, 28.4, 26.0, 25.7, 24.6, 21.1.

26c: 5',5'-dimethyl-5'H-spiro[cyclohexane-1,8'-tetrazolo[1,5-a]pyrazin]-6'(7'H)-one



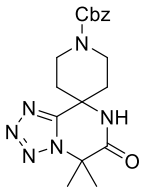
The product was obtained using procedure **A**, 87 % as white solid, M.P. = 169-171 ^{o}C; SFC-MS (ESI) m/z calcd for $C_{11}H_{17}N_5O$ $[M]^+$: 235.14; found $[M+H]^+$: 236.18; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.54 (s, 1H), 2.25 – 2.13 (m, 2H), 2.01 – 1.92 (m, 2H), 1.88 (s, 6H), 1.85 – 1.78 (m, 2H), 1.74 – 1.65 (m, 3H), 1.63 – 1.54 (m, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 169.6, 152.8, 62.0, 53.8, 38.6, 27.3, 24.3, 20.8.

27c: 5',5'-dimethyl-4-phenyl-5'H-spiro[cyclohexane-1,8'-tetrazolo[1,5-a]pyrazin]-6'(7'H)-one



The product was obtained using procedure **A**, 81 % as oil; SFC-MS (ESI) m/z calcd for $C_{17}H_{21}N_5O$ $[M]^+$: 311.18; found $[M+H]^+$: 312.18; ^{1}H NMR (500 MHz, $CDCl_3$) (major) δ 7.94 (s, 1H), 7.43 – 7.39 (m, 2H), 7.35 (d, *J* = 7.5 Hz, 2H), 7.27 – 7.22 (m, 1H), 2.75 – 2.65 (m, 1H), 2.63 – 2.48 (m, 2H), 2.19 – 2.10 (m, 2H), 2.03 – 1.88 (m, 10H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 170.1, 151.4, 145.6, 128.5, 127.1, 126.4, 61.9, 54.0, 42.8, 39.7, 29.4, 27.3.

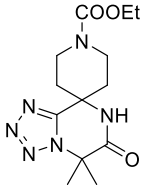
28c: benzyl 5',5'-dimethyl-6'-oxo-6',7'-dihydro-5'H-spiro[piperidine-4,8'-tetrazolo[1,5-a]pyrazine]-1-carboxylate



The product was obtained using procedure **A**, 87 % as white solid, M.P. = 185-187 ^{o}C; SFC-MS (ESI) m/z calcd for $C_{18}H_{22}N_6O_3$ $[M]^+$: 370.18; found $[M+Na]^+$: 393.32; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.70 (s, 1H), 7.41 – 7.29 (m, 5H), 5.17 (s, 2H), 4.02 – 3.80 (m, 4H), 2.23 – 2.04 (m, 2H), 2.03 – 1.90 (m, 2H), 1.86 (s, 6H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 170.2, 155.1, 151.2, 136.3, 128.5, 128.1, 127.8, 67.4, 61.9, 52.4, 39.3, 37.8, 27.2.

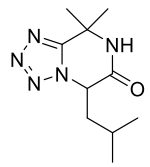
29c: ethyl 5',5'-dimethyl-6'-oxo-6',7'-dihydro-5'H-spiro[piperidine-4,8'-tetrazolo[1,5-a]pyrazine]-1-carboxylate

The product was obtained using procedure **A**, 88 % as white solid, M.P. = 165-167 ^{o}C; SFC-MS (ESI) m/z calcd for $C_{13}H_{20}N_6O_3$ $[M]^+$: 308.16; found $[M+Na]^+$: 331.30; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.37 (s, 1H), 4.28 – 4.12 (m, 2H), 4.01 – 3.76 (m, 4H), 2.20 – 2.07 (m, 2H), 1.98 – 1.79 (m, 8H), 1.28 (d, *J* = 7.1 Hz, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 170.1, 155.4, 151.3, 62.1, 61.8, 52.6, 39.2, 38.0, 27.3, 14.7.

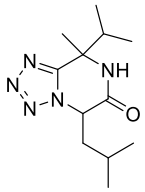


36c: 5-isobutyl-8,8-dimethyl-7,8-dihydrotetrazolo[1,5-a]pyrazin-6(5H)-one

The product was obtained using procedure **A**, 75 % as white solid, M.P. = 163-165 ^{o}C; SFC-MS (ESI) m/z calcd for $C_{10}H_{17}N_5O$ $[M]^+$: 223.14; found $[M-H]^+$: 222.00; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.92 (s, 1H), 5.12 (dd, *J* = 7.6, 4.9 Hz, 1H), 2.20 – 2.12 (m, 1H), 2.03 – 1.89 (m, 2H), 1.82 (s, 3H), 1.77 (s, 3H), 0.98 (d, *J* = 1.2 Hz, 3H), 0.97 (d, *J* = 1.3 Hz, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 166.5, 154.0, 57.8, 51.5, 42.3, 31.0, 29.3, 24.2, 22.7, 21.4.

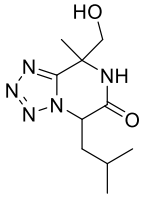


37c: 5-isobutyl-8-isopropyl-8-methyl-7,8-dihydrotetrazolo[1,5-a]pyrazin-6(5H)-one



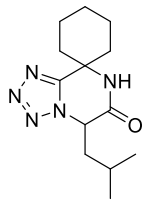
The product was obtained using procedure **A**, 46 % as white solid, M.P. = 185-187 ^{o}C; SFC-MS (ESI) m/z calcd for $C_{12}H_{21}N_5O$ $[M]^+$: 251.17; found $[M-H]^+$: 250.04; ^{1}H NMR (500 MHz, $CDCl_3$) (major) δ 7.18 (s, 1H), 5.07 (dd, *J* = 8.2, 4.8 Hz, 1H), 2.26 – 2.10 (m, 3H), 1.93 (ddd, *J* = 13.5, 8.1, 5.2 Hz, 1H), 1.72 (s, 3H), 1.07 (d, *J* = 6.5 Hz, 3H), 1.03 (d, *J* = 3.5 Hz, 3H), 1.01 (d, *J* = 3.5 Hz, 3H), 0.92 (d, *J* = 6.5 Hz, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) (major) δ 167.1, 153.0, 58.1, 57.4, 43.5, 38.9, 26.1, 24.8, 22.7, 21.5, 17.4, 16.6.

38c: 8-(hydroxymethyl)-5-isobutyl-8-methyl-7,8-dihydrotetrazolo[1,5-a]pyrazin-6(5H)-one



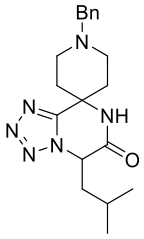
The product was obtained using procedure **A**, 65 % as oil; SFC-MS (ESI) m/z calcd for $C_{10}H_{17}N_5O_2$ $[M]^+$: 239.14; found $[M-H]^+$: 238.06; ^{1}H NMR (500 MHz, MeOD) (Major) δ 5.21 (s, 1H), 3.86 (d, *J* = 11.1 Hz, 1H), 3.72 (d, *J* = 11.1 Hz, 1H), 3.61 – 3.52 (m, 1H), 2.33 – 2.27 (m, 1H), 2.22 – 2.16 (m, 1H), 1.92 – 1.83 (m, 1H), 1.67 (s, 3H), 1.00 (d, *J* = 6.6 Hz, 3H), 0.83 (d, *J* = 6.6 Hz, 3H); ^{13}C NMR (126 MHz, MeOD) (major) δ 169.2, 154.0, 78.2, 70.0, 59.1, 44.8, 25.7, 23.3, 22.8, 21.8.

41c: 5'-isobutyl-5'H-spiro[cyclohexane-1,8'-tetrazolo[1,5-a]pyrazin]-6'(7'H)-one



The product was obtained using procedure **A**, 80 % as white solid, M.P. = 226-228 ^{o}C; SFC-MS (ESI) m/z calcd for $C_{13}H_{21}N_5O$ $[M]^+$: 263.17; found $[M-H]^+$: 262.13; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.68 (s, 1H), 5.11 (dd, *J* = 7.2, 5.1 Hz, 1H), 2.35 – 2.21 (m, 1H), 2.18 – 2.01 (m, 3H), 2.01 – 1.92 (m, 2H), 1.91 – 1.77 (m, 3H), 1.75 – 1.57 (m, 4H), 0.99 (d, *J* = 1.4 Hz, 3H), 0.97 (d, *J* = 1.4 Hz, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 166.7, 153.7, 57.7, 53.9, 42.9, 39.5, 37.4, 24.5, 24.3, 22.7, 21.6, 20.8, 20.6.

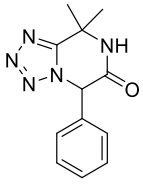
42c: 1-benzyl-5'-isobutyl-5'H-spiro[piperidine-4,8'-tetrazolo[1,5-a]pyrazin]-6'(7'H)-one



The product was obtained using procedure **A**, 76 % as white solid, M.P. = 203-205 ^{o}C; SFC-MS (ESI) m/z calcd for $C_{19}H_{26}N_6O$ $[M]^+$: 354.22; found $[M+H]^+$: 355.20; ^{1}H NMR (500 MHz, DMSO) δ 8.98 (s, 1H), 7.36 – 7.30 (m, 4H), 7.29 – 7.21 (m, 1H), 5.22 (dd, *J* = 7.3, 4.8 Hz, 1H), 3.58 (s, 2H), 2.87 – 2.78 (m, 1H), 2.76 – 2.64 (m, 3H), 2.07 – 1.89 (m, 6H), 1.88 – 1.77 (m, 1H), 0.90 (d, *J* = 6.6 Hz, 3H), 0.86 (d, *J* = 6.6 Hz, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ

165.5, 153.1, 138.6, 128.8, 128.2, 126.9, 61.8, 57.1, 51.6, 48.0, 41.4, 38.1, 36.8, 24.2, 22.7, 21.6.

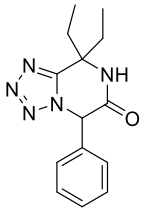
44c: 8,8-dimethyl-5-phenyl-7,8-dihydrotetrazolo[1,5-a]pyrazin-6(5H)-one



The product was obtained using procedure **A**, 70 % as white solid, M.P. = 180-182 ºC; SFC-MS (ESI) m/z calcd for $C_{12}H_{13}N_5O$ $[M]^+$: 243.11; found $[M-H]^+$: 242.33; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.92 (s, 1H), 7.41 (p, *J* = 3.6, 3.1 Hz, 3H), 7.24 – 7.12 (m, 2H), 6.26 (s, 1H), 1.86 (s, 4H), 1.75 (s, 4H), ^{13}C NMR (126 MHz, $CDCl_3$) δ 164.6, 154.6, 133.6, 129.6, 129.2, 126.8, 62.5, 52.1, 31.4, 29.6.

45c: 8,8-diethyl-5-phenyl-7,8-dihydrotetrazolo[1,5-a]pyrazin-6(5H)-one

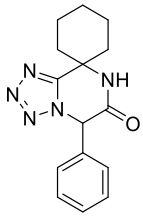
The product was obtained using procedure **A**, 63 % as white solid, M.P. = 209-216 ºC; SFC-



MS (ESI) m/z calcd for $C_{14}H_{17}N_5O$ $[M]^+$: 271.14; found $[M-H]^+$: 270.14; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.41 – 7.36 (m, 3H), 7.34 (s, 1H), 7.22 – 7.13 (m, 2H), 6.15 (s, 1H), 2.32 – 2.17 (m, 2H), 2.00 – 1.83 (m, 2H), 0.87 (t, *J* = 7.4 Hz, 3H), 0.73 (t, *J* = 7.3 Hz, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 165.7, 152.4, 133.9, 129.6, 129.1, 128.4, 127.3, 124.9, 62.3, 60.1, 34.7, 34.5, 8.5, 7.9.

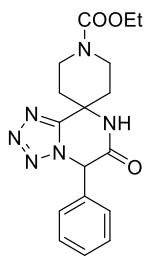
46c: 5'-phenyl-5'H-spiro[cyclohexane-1,8'-tetrazolo[1,5-a]pyrazin]-6'(7'H)-one

The product was obtained using procedure **A**, 75 % as white solid, M.P. = 218-220 ºC; SFC-



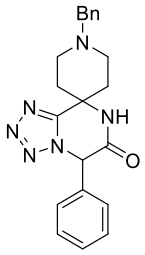
MS (ESI) m/z calcd for $C_{15}H_{17}N_5O$ $[M]^+$: 283.14; found $[M-H]^+$: 282.04; ^{1}H NMR (500 MHz, DMSO) δ 9.13 (s, 1H), 7.49 – 7.33 (m, 3H), 7.28 – 7.10 (m, 2H), 6.41 (s, 1H), 2.09 – 1.58 (m, 9H), 1.38 (d, *J* = 12.4 Hz, 1H); ^{13}C NMR (126 MHz, DMSO) δ 163.7, 153.8, 135.5, 128.9, 127.6, 61.7, 53.4, 37.5, 24.2, 20.9, 20.7.

47c: ethyl 6'-oxo-5'-phenyl-6',7'-dihydro-5'H-spiro[piperidine-4,8'-tetrazolo[1,5-a]pyrazine]-1-carboxylate



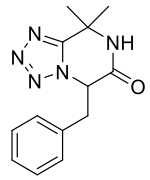
The product was obtained using procedure **A**, 65 % as white solid, M.P. = 190-192ºC; SFC-MS (ESI) m/z calcd for $C_{17}H_{20}N_6O_3$ $[M]^+$: 356.16; found $[M+Na]^+$: 379.14; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.64 (s, 1H), 7.46 – 7.30 (m, 3H), 7.18 – 7.01 (m, 2H), 6.25 (s, 1H), 4.30 – 4.11 (m, 2H), 4.10 – 3.97 (m, 1H), 3.91 – 3.51 (m, 3H), 2.37 – 2.22 (m, 1H), 2.11 – 1.72 (m, 3H), 1.28 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 165.2, 155.2, 152.9, 133.4, 129.5, 129.1, 126.5, 62.0, 61.6, 52.7, 39.0, 38.6, 36.5, 14.5.

48c: 1-benzyl-5'-phenyl-5'H-spiro[piperidine-4,8'-tetrazolo[1,5-a]pyrazin]-6'(7'H)-one



The product was obtained using procedure **A**, 68 % as white solid, M.P. = 138-140 °C; SFC-MS (ESI) m/z calcd for $C_{21}H_{22}N_6O$ $[M]^+$: 374.19; found $[M+H]^+$: 375.23; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.50 – 7.45 (m, 2H), 7.39 – 7.34 (m, 2H), 7.34 – 7.28 (m, 5H), 7.28 – 7.23 (m, 1H), 7.01 (s, 1H), 4.69 (s, 1H), 3.52 (s, 2H), 2.64 – 2.41 (m, 4H), 1.93 – 1.78 (m, 4H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 175.6, 138.5, 138.2, 129.0, 128.6, 128.2, 127.9, 127.5, 127.0, 72.5, 62.6, 62.1, 50.3, 50.1, 39.4, 38.4.

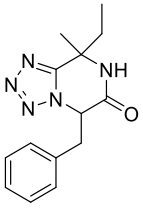
50c: 5-benzyl-8,8-dimethyl-7,8-dihydrotetrazolo[1,5-a]pyrazin-6(5H)-one



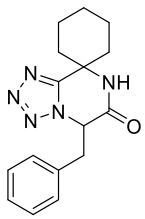
The product was obtained using procedure **A**, 79 % as white solid, M.P. = 176-178 °C; SFC-MS (ESI) m/z calcd for $C_{13}H_{15}N_5O$ $[M]^+$: 257.13; found $[M-H]^+$: 256.27; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.23 – 7.03 (m, 3H), 6.82 – 6.63 (m, 2H), 5.55 – 5.34 (m, 1H), 3.81 – 3.55 (m, 2H), 1.67 (s, 3H), 0.72 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 164.6, 154.5, 133.0, 129.7, 128.9, 127.9, 60.0, 51.9, 38.3, 30.2.

51c: 5-benzyl-8-ethyl-8-methyl-7,8-dihydrotetrazolo[1,5-a]pyrazin-6(5H)-one

The product was obtained using procedure **A**, 65 % as white solid, M.P. = 233-235 °C; SFC-MS (ESI) m/z calcd for $C_{14}H_{17}N_5O$ $[M]^+$: 271.14; found $[M-H]^+$: 270.14; ^{1}H NMR (500 MHz, $CDCl_3$) (major) δ 7.66 (s, 1H), 7.14 – 7.10 (m, 3H), 6.76 – 6.66 (m, 2H), 5.44 (dd, *J* = 4.7, 3.0 Hz, 1H), 3.71 – 3.62 (m, 2H), 2.17 – 2.09 (m, 1H), 1.86 – 1.77 (m, 1H), 0.76 (s, 3H), 0.67 (t, *J* = 7.3 Hz, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) (major) δ 165.4, 153.5, 132.9, 129.6, 128.8, 127.8, 59.7, 55.6, 38.3, 35.5, 28.7, 8.0.

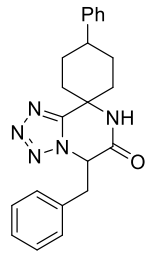


52c: 5'-benzyl-5'H-spiro[cyclohexane-1,8'-tetrazolo[1,5-a]pyrazin]-6'(7'H)-one



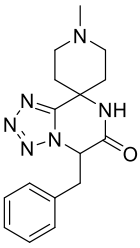
The product was obtained using procedure **A**, 86 % as white solid, M.P. = 145-146 °C; SFC-MS (ESI) m/z calcd for $C_{16}H_{19}N_5O$ $[M]^+$: 297.16; found $[M+H]^+$: 298.24; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.59 (s, 1H), 7.23 – 7.09 (m, 3H), 6.91 – 6.66 (m, 2H), 5.53 – 5.42 (m, 1H), 3.78 – 3.61 (m, 2H), 2.19 – 2.07 (m, 1H), 2.03 – 1.91 (m, 1H), 1.77 – 1.68 (m, 1H), 1.67 – 1.39 (m, 4H), 1.38 – 1.20 (m, 1H), 1.04 – 0.89 (m, 1H), 0.31 – 0.19 (m, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 164.6, 154.2, 133.0, 129.7, 128.7, 127.8, 59.8, 53.8, 38.3, 37.8, 24.1, 20.6, 20.5.

53c: 5'-benzyl-4-phenyl-5'H-spiro[cyclohexane-1,8'-tetrazolo[1,5-a]pyrazin]-6'(7'H)-one



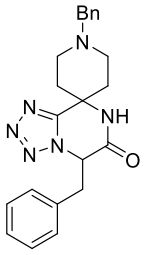
The product was obtained using procedure **A**, 87 % as white solid, M.P. = 213-216 °C; SFC-MS (ESI) m/z calcd for $C_{22}H_{23}N_5O$ $[M]^+$: 337.19; found $[M-H]^+$: 372.21; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.56 (s, 1H), 7.38 – 7.28 (m, 4H), 7.23 – 7.18 (m, 1H), 7.17 – 7.10 (m, 3H), 6.84 – 6.66 (m, 2H), 5.50 (dd, *J* = 4.9, 3.0 Hz, 1H), 3.89 – 3.54 (m, 2H), 2.66 (qd, *J* = 13.1, 3.7 Hz, 1H), 2.51 (tt, *J* = 12.6, 3.8 Hz, 2H), 2.12 – 2.03 (m, 1H), 2.03 – 1.91 (m, 2H), 1.90 – 1.58 (m, 3H), 1.53 – 1.43 (m, 1H), 1.29 (td, *J* = 13.5, 3.9 Hz, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 165.1, 152.8, 145.7, 133.1, 129.7, 128.8, 128.5, 128.4, 127.8, 127.0, 126.8, 126.4, 59.7, 54.1, 42.7, 39.4, 39.1, 38.4, 29.2, 29.1.

54c: 5'-benzyl-1-methyl-5'H-spiro[piperidine-4,8'-tetrazolo[1,5-a]pyrazin]-6'(7'H)-one



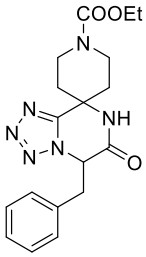
The product was obtained using procedure **A**, 43 % as white solid, M.P. = 111-113 °C; SFC-MS (ESI) m/z calcd for $C_{16}H_{20}N_6O$ $[M]^+$: 312.17; found $[M+H]^+$: 313.17; ^{1}H NMR (500 MHz, DMSO) δ 8.96 (s, 1H), 7.20 – 7.10 (m, 3H), 6.72 – 6.62 (m, 2H), 5.61 (dd, *J* = 4.8, 3.2 Hz, 1H), 3.57 (dd, *J* = 14.0, 3.3 Hz, 1H), 3.48 (dd, *J* = 14.0, 4.8 Hz, 1H), 2.94 – 2.80 (m, 1H), 2.80 – 2.69 (m, 1H), 2.47 – 2.38 (m, 2H), 2.28 (s, 3H), 2.04 – 1.84 (m, 2H), 1.08 – 0.71 (m, 1H), 0.68 – 0.18 (m, 1H); ^{13}C NMR (126 MHz, DMSO) δ 164.0, 153.2, 134.0, 129.4, 128.4, 127.4, 59.2, 50.5, 49.3, 49.0, 44.6, 37.7, 36.8, 35.7.

55c: 1,5'-dibenzyl-5'H-spiro[piperidine-4,8'-tetrazolo[1,5-a]pyrazin]-6'(7'H)-one



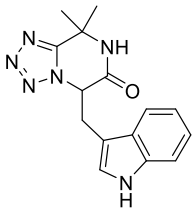
The product was obtained using procedure **A**, 86 % as white solid, M.P. = 140-142 °C; SFC-MS (ESI) m/z calcd for $C_{22}H_{24}N_6O$ $[M]^+$: 388.20; found $[M+H]^+$: 389.22; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.12 (s, 1H), 7.32 – 7.27 (m, 4H), 7.25 – 7.21 (m, 1H), 7.14 – 7.06 (m, 3H), 6.76 – 6.70 (m, 2H), 5.48 (dd, *J* = 4.8, 3.0 Hz, 1H), 3.76 – 3.63 (m, 2H), 3.57 (s, 2H), 3.00 – 2.93 (m, 1H), 2.65 – 2.56 (m, 1H), 2.53 – 2.45 (m, 1H), 2.32 – 2.18 (m, 2H), 1.09 – 0.77 (m, 1H), 0.68 – 0.38 (m, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 164.8, 153.5, 137.9, 132.9, 129.6, 128.8, 128.7, 128.2, 127.8, 127.1, 62.5, 59.7, 52.3, 47.8, 47.4, 38.3, 38.0, 37.4.

56c: ethyl 5'-benzyl-6'-oxo-6',7'-dihydro-5'H-spiro[piperidine-4,8'-tetrazolo[1,5-a]pyrazine]-1-carboxylate



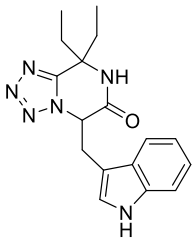
The product was obtained using procedure **A**, 88 % as white solid, M.P. = 115-117 ºC; SFC-MS (ESI) m/z calcd for $C_{18}H_{22}N_6O_3$ $[M]^+$: 370.18; found $[M-H]^+$: 369.12; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.36 (s, 1H), 7.24 – 7.06 (m, 3H), 6.68 (dt, *J* = 7.6, 2.3 Hz, 2H), 5.47 (dt, *J* = 4.8, 2.4 Hz, 1H), 4.22 – 4.01 (m, 2H), 3.99 – 3.85 (m, 1H), 3.79 (d, *J* = 14.5 Hz, 1H), 3.73 – 3.58 (m, 2H), 3.40 (dt, *J* = 16.4, 9.7 Hz, 2H), 2.15 – 1.96 (m, 1H), 1.89 – 1.68 (m, 1H), 1.24 (d, *J* = 7.2 Hz, 3H), 0.66 (ddd, *J* = 13.3, 8.1, 4.9 Hz, 1H), 0.51 – 0.34 (m, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 165.2, 155.1, 152.6, 132.8, 129.5, 128.7, 127.9, 61.5, 59.6, 52.3, 38.7, 38.2, 37.5, 36.9, 14.5.

61c: 5-((1H-indol-3-yl)methyl)-8,8-dimethyl-7,8-dihydrotetrazolo[1,5-a]pyrazin-6(5H)-one



The product was obtained using procedure **A**, 62 % as white solid, M.P. = 247-249 ºC; SFC-MS (ESI) m/z calcd for $C_{15}H_{16}N_6O$ $[M]^+$: 296.14; found $[M+Na]^+$: 319.20; ^{1}H NMR (500 MHz, DMSO) δ 10.88 (s, 1H), 8.69 (s, 1H), 7.24 (d, *J* = 8.1 Hz, 1H), 7.16 (d, *J* = 8.0 Hz, 1H), 7.01 – 6.96 (m, 1H), 6.89 – 6.83 (m, 1H), 6.49 (d, *J* = 2.4 Hz, 1H), 5.54 – 5.50 (m, 1H), 3.75 (dd, *J* = 14.8, 3.0 Hz, 1H), 3.56 (dd, *J* = 14.8, 4.7 Hz, 1H), 1.41 (s, 3H), 0.38 (s, 3H); ^{13}C NMR (126 MHz, DMSO) δ 164.1, 154.8, 135.6, 127.0, 124.2, 124.1, 121.1, 118.7, 118.1, 111.3, 106.3, 59.5, 50.4, 29.5, 29.2, 28.3.

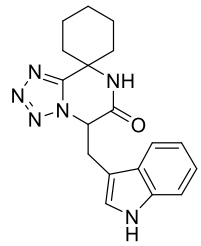
62c: 5-((1H-indol-3-yl)methyl)-8,8-diethyl-7,8-dihydrotetrazolo[1,5-a]pyrazin-6(5H)-one



The product was obtained using procedure **A**, 62 % as white solid, M.P. = 234-236 ºC; SFC-MS (ESI) m/z calcd for $C_{17}H_{20}N_6O$ $[M]^+$: 324.17; found $[M+Na]^+$: 347.36; ^{1}H NMR (500 MHz, DMSO) δ 10.82 (s, 1H), 8.52 (s, 1H), 7.31 (d, *J* = 8.0 Hz, 1H), 7.21 (d, *J* = 8.1 Hz, 1H), 7.03 – 6.93 (m, 1H), 6.85 (t, *J* = 7.4 Hz, 1H), 6.58 (d, *J* = 2.5 Hz, 1H), 5.65 (dd, *J* = 4.6, 2.9 Hz, 1H), 3.81 (dd, *J* = 14.8, 3.0 Hz, 1H), 3.67 (dd, *J* = 14.9, 4.7 Hz, 1H), 1.78 (dq, *J* = 14.4, 7.3 Hz, 1H), 1.64 (dq, *J* = 14.5, 7.3 Hz, 1H), 1.24 (dq, *J* = 14.7, 7.4 Hz, 1H), 1.05 (dq, *J* = 14.6, 7.4 Hz, 1H), 0.48 (t, *J* = 7.3 Hz, 3H), -0.41 (t, *J* = 7.4 Hz, 3H), ^{13}C NMR (126 MHz, DMSO) δ 165.4, 152.5, 135.8, 127.2, 124.5, 121.0, 118.5, 118.3, 111.1, 106.3, 59.1, 58.1, 33.9, 32.7, 27.5, 7.6, 6.0.

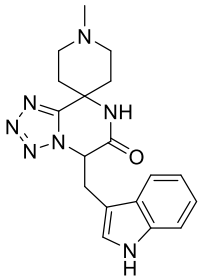
66c: 5'-((1H-indol-3-yl)methyl)-5'H-spiro[cyclohexane-1,8'-tetrazolo[1,5-a]pyrazin]-6'(7'H)-one

The product was obtained using procedure **A**, 88 % as white solid, M.P. = 190-192 ^{o}C; SFC-MS (ESI) m/z calcd for $C_{18}H_{20}N_6O$ $[M]^+$: 336.17; found $[M+Na]^+$: 359.22; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.00 (s, 1H), 7.38 (d, *J* = 8.0 Hz, 1H), 7.24 (d, *J* = 8.2 Hz, 1H), 7.15 – 7.07 (m, 1H), 7.07 – 6.98 (m, 1H), 6.53 (d, *J* = 2.4 Hz, 1H), 6.42 (s, 1H), 5.45 (dd, *J* = 4.9, 2.7 Hz, 1H), 4.00 (dd, *J* = 14.9, 2.7 Hz, 1H), 3.79 (dd, *J* = 14.9, 4.9 Hz, 1H), 2.05 (ddd, *J* = 14.3, 10.6, 4.2 Hz, 1H), 1.88 (dt, *J* = 13.6, 5.0 Hz, 1H), 1.40 (tdd, *J* = 13.9, 6.6, 2.9 Hz, 2H), 1.36 – 1.19 (m, 2H), 0.88 (t, *J* = 8.2 Hz, 2H), -0.08 (d, *J* = 10.7 Hz, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 165.1, 154.3, 135.6, 127.0, 123.8, 122.5, 120.3, 118.8, 110.9, 107.3, 59.8, 53.7, 38.1, 37.8, 29.2, 23.9, 20.7, 20.2.



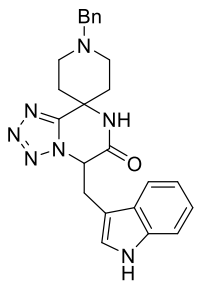
67c: 5'-((1H-indol-3-yl)methyl)-1-methyl-5'H-spiro[piperidine-4,8'-tetrazolo[1,5-a]pyrazin]-6'(7'H)-one

The product was obtained using procedure **A**, 41 % as oil; SFC-MS (ESI) m/z calcd for $C_{18}H_{21}N_7O$ $[M]^+$: 351.18; found $[M+H]^+$: 352.17; ^{1}H NMR (500 MHz, DMSO) δ 10.86 (s, 1H), 8.70 (s, 1H), 7.22 (d, *J* = 8.1 Hz, 1H), 7.07 (d, *J* = 7.9 Hz, 1H), 7.03 – 6.89 (m, 1H), 6.89 – 6.72 (m, 1H), 6.51 (d, *J* = 2.4 Hz, 1H), 5.53 (dd, *J* = 4.6, 2.9 Hz, 1H), 3.73 (dd, *J* = 14.8, 3.0 Hz, 1H), 3.56 (dd, *J* = 14.8, 4.6 Hz, 1H), 2.08 (s, 3H), 2.05 – 1.95 (m, 2H), 1.86 – 1.63 (m, 2H), 0.86 – 0.49 (m, 1H), 0.24 – -0.15 (m, 1H); ^{13}C NMR (126 MHz, DMSO) δ 164.8, 153.4, 135.6, 127.0, 124.2, 121.1, 118.7, 118.0, 111.2, 106.4, 59.4, 50.8, 49.6, 49.3, 37.4, 36.5, 28.4.



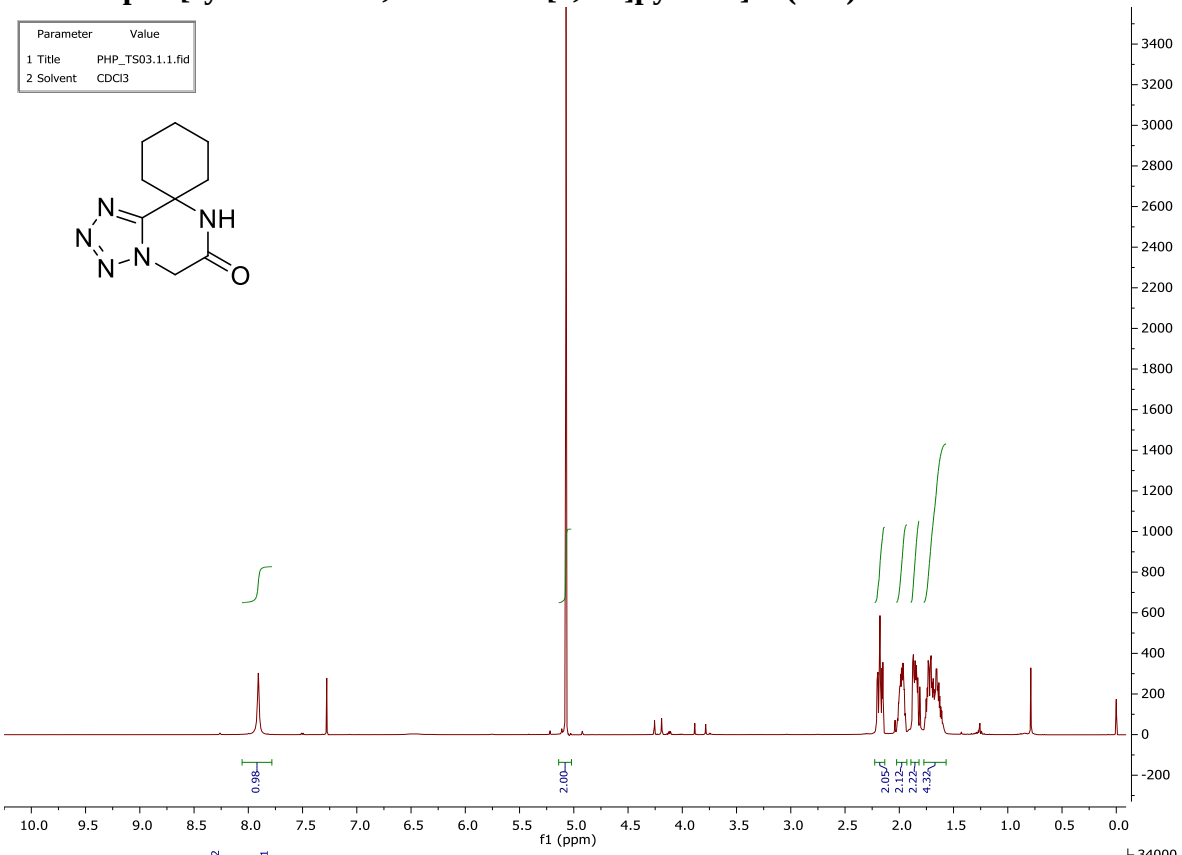
68c: 5'-((1H-indol-3-yl)methyl)-1-benzyl-5'H-spiro[piperidine-4,8'-tetrazolo[1,5-a]pyrazin]-6'(7'H)-one

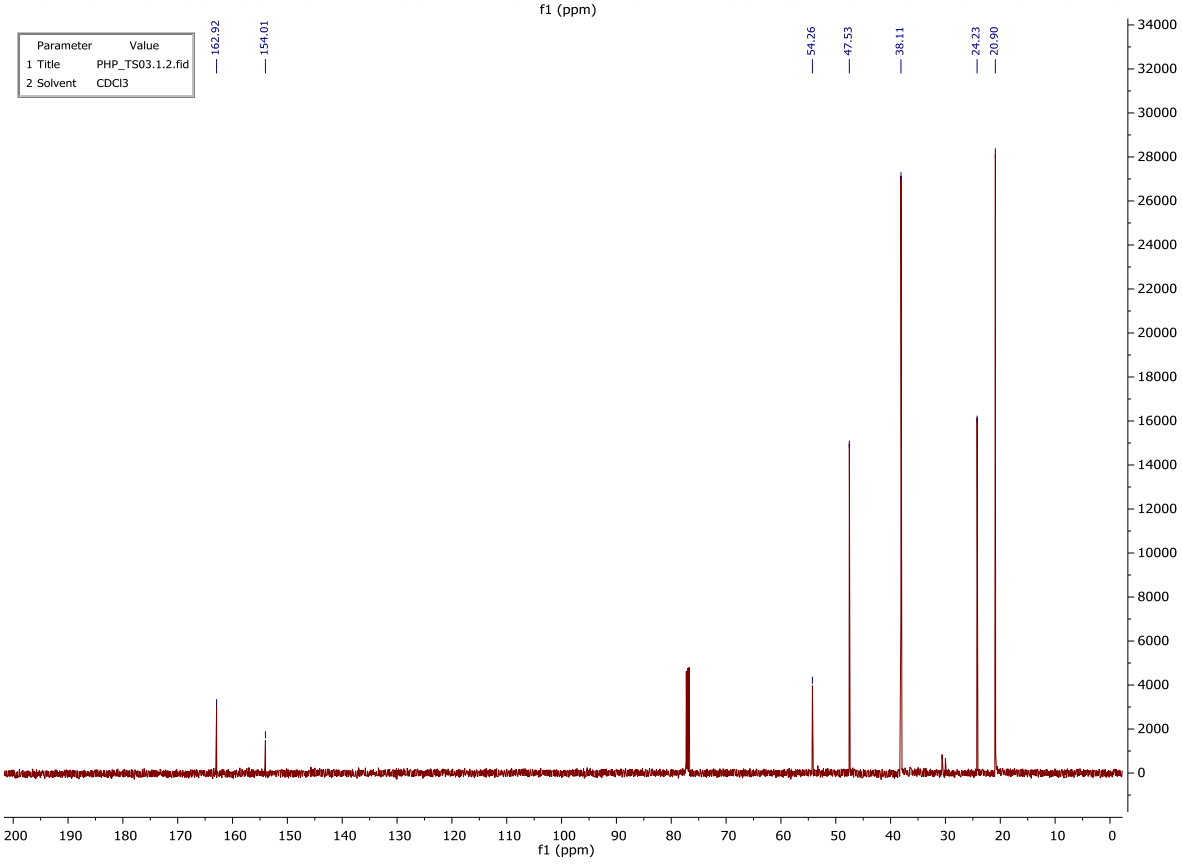
The product was obtained using procedure **A**, 85 % as oil; SFC-MS (ESI) m/z calcd for $C_{24}H_{25}N_7O$ $[M]^+$: 427.21; found $[M+H]^+$: 428.25; ^{1}H NMR (500 MHz, MeOD) δ 7.42 – 7.16 (m, 7H), 7.10 (dd, *J* = 8.0, 2.7 Hz, 1H), 6.99 (td, *J* = 7.6, 2.5 Hz, 1H), 6.86 (td, *J* = 7.5, 2.7 Hz, 1H), 6.59 (s, 1H), 5.54 (dt, *J* = 4.5, 2.9 Hz, 1H), 3.89 – 3.78 (m, 1H), 3.71 (dt, *J* = 14.9, 3.8 Hz, 1H), 3.46 (s, 2H), 2.94 – 2.84 (m, 1H), 2.63 – 2.50 (m, 1H), 2.22 – 2.07 (m, 1H), 2.07 – 1.88 (m, 2H), 1.79 (tt, *J* = 9.6, 3.8 Hz, 1H), 0.69 – 0.41 (m, 1H), 0.32 – -0.05 (m,

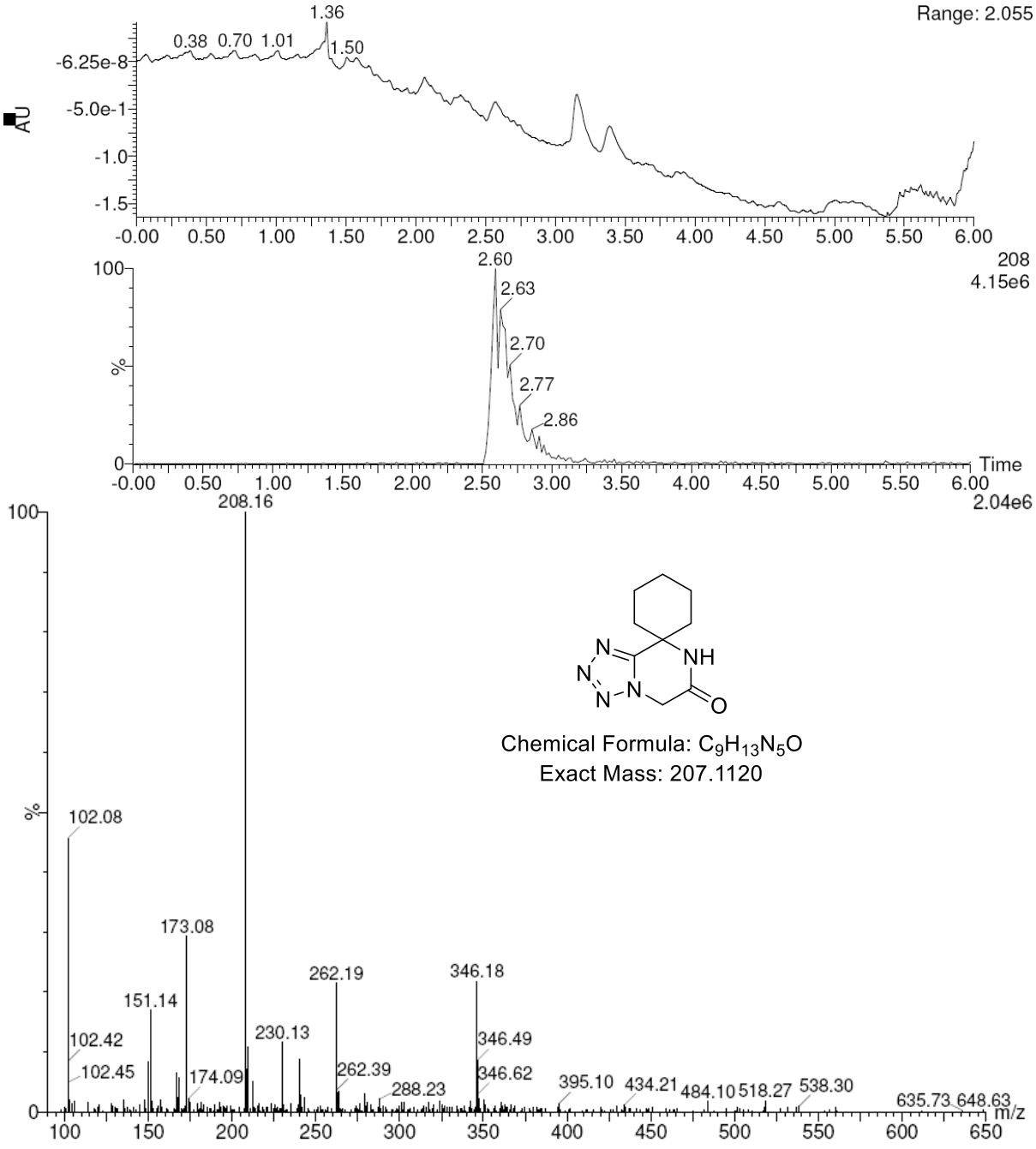


1H); ^{13}C NMR (126 MHz, MeOD) δ 167.3, 138.5, 137.3, 130.3, 129.2, 128.3, 125.2, 122.5, 120.2, 119.0, 112.1, 107.5, 104.2, 63.2, 61.3, 53.0, 38.3, 37.5, 29.9.

1c: 5'H-spiro[cyclohexane-1,8'-tetrazolo[1,5-a]pyrazin]-6'(7'H)-one.

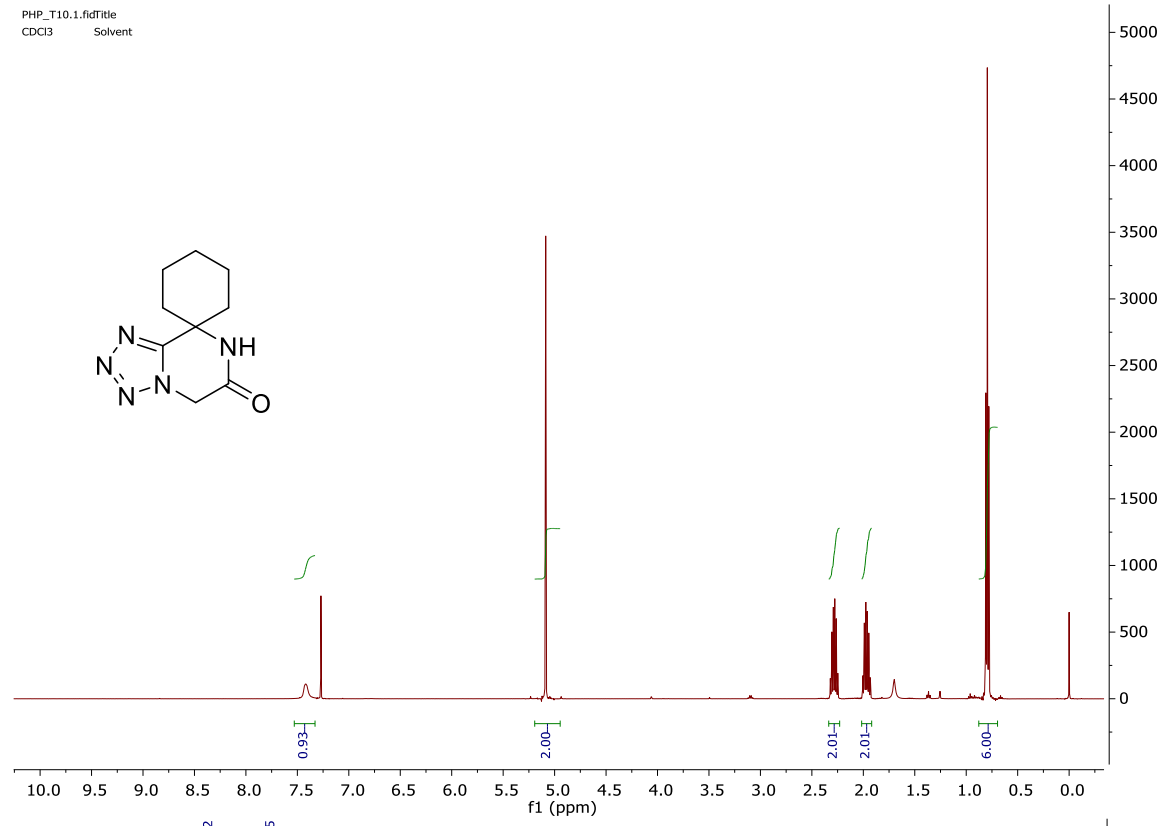


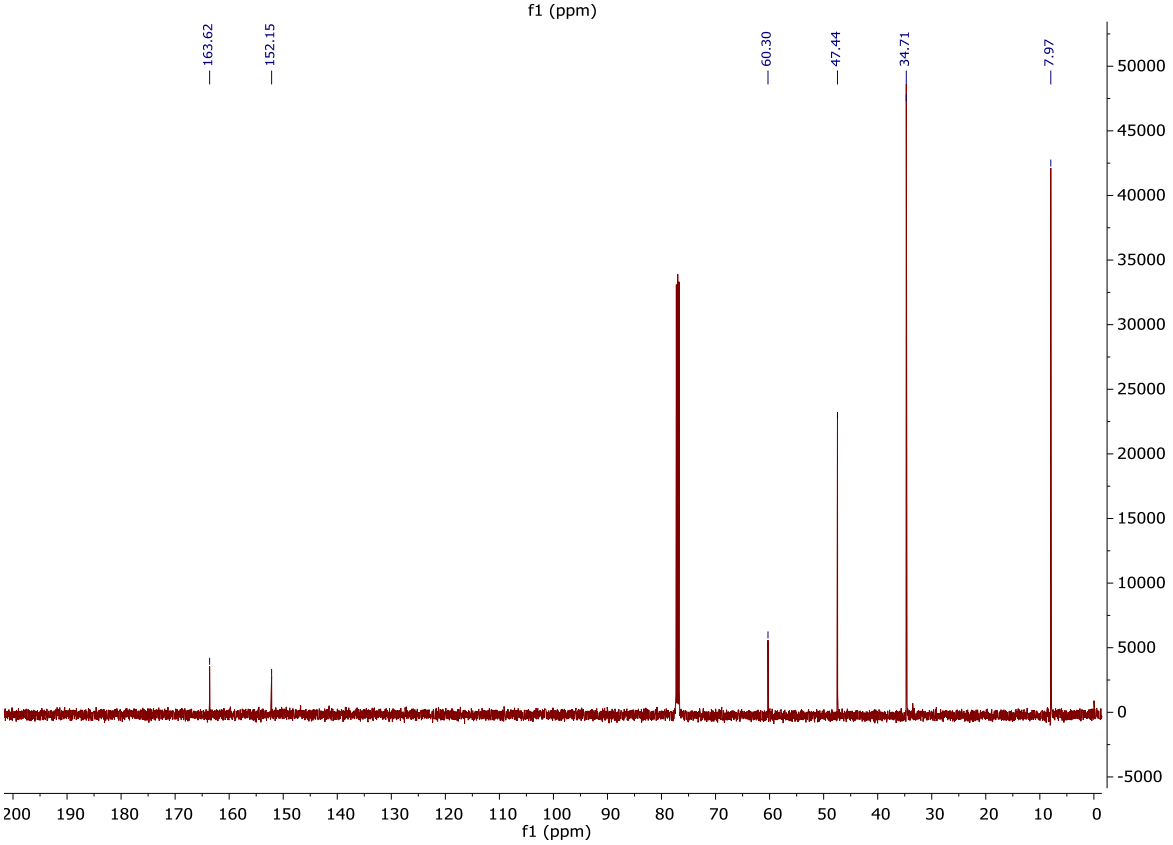




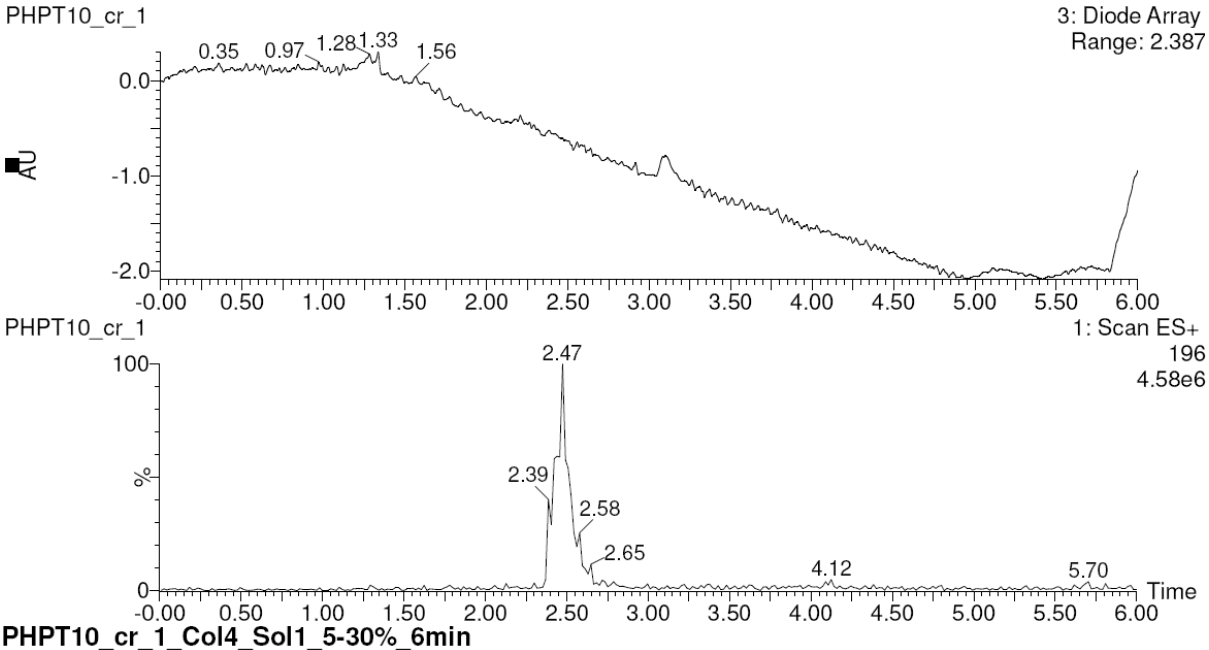
Chemical Formula: $C_9H_{13}N_5O$
Exact Mass: 207.1120

2c: 2c: 8,8-diethyl-7,8-dihydrotetrazolo[1,5-a]pyrazin-6(5H)-one.

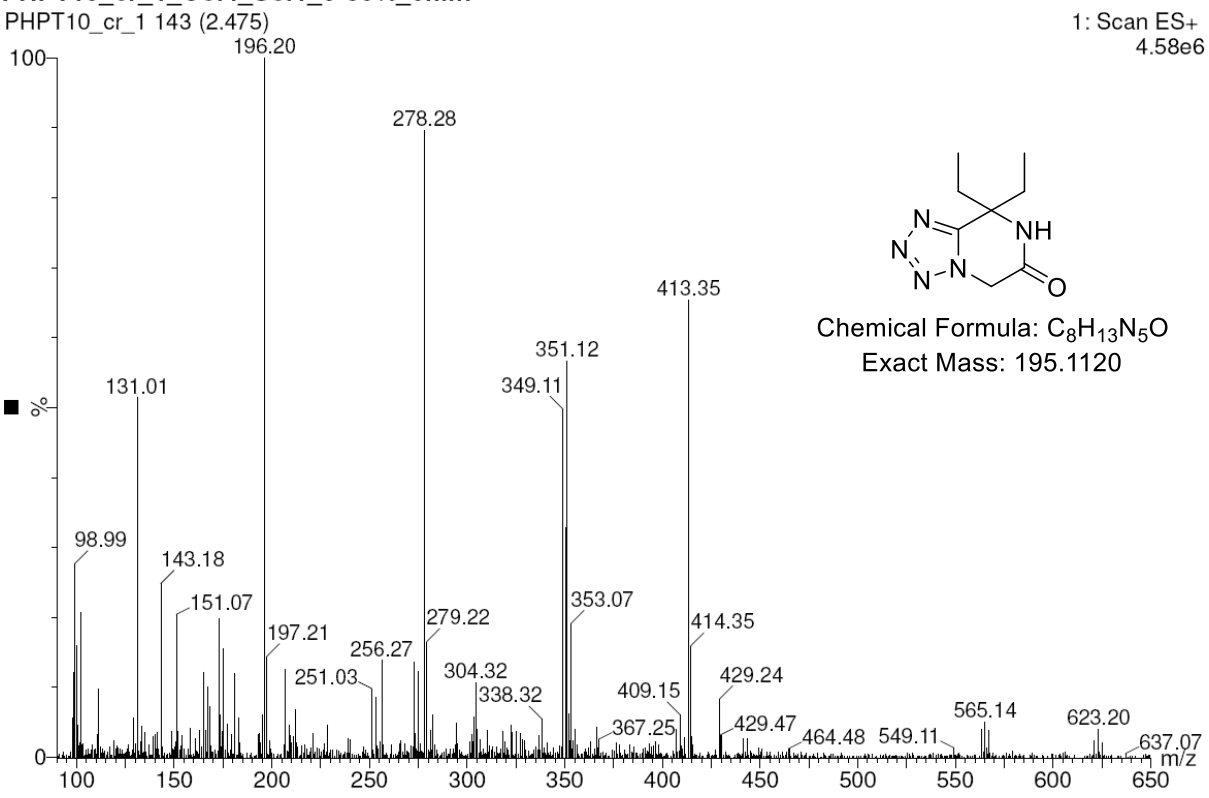




PHPT10_cr_1_Col4_Sol1_5-30%_6min

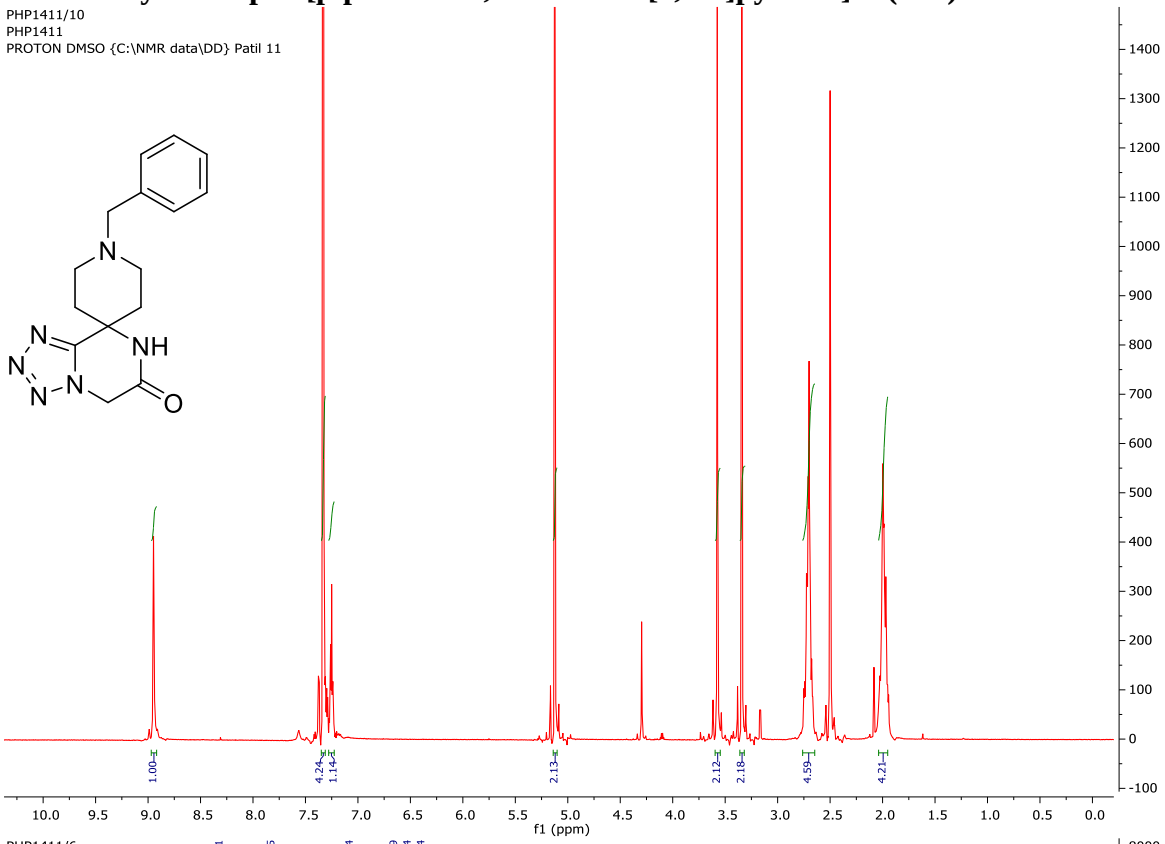


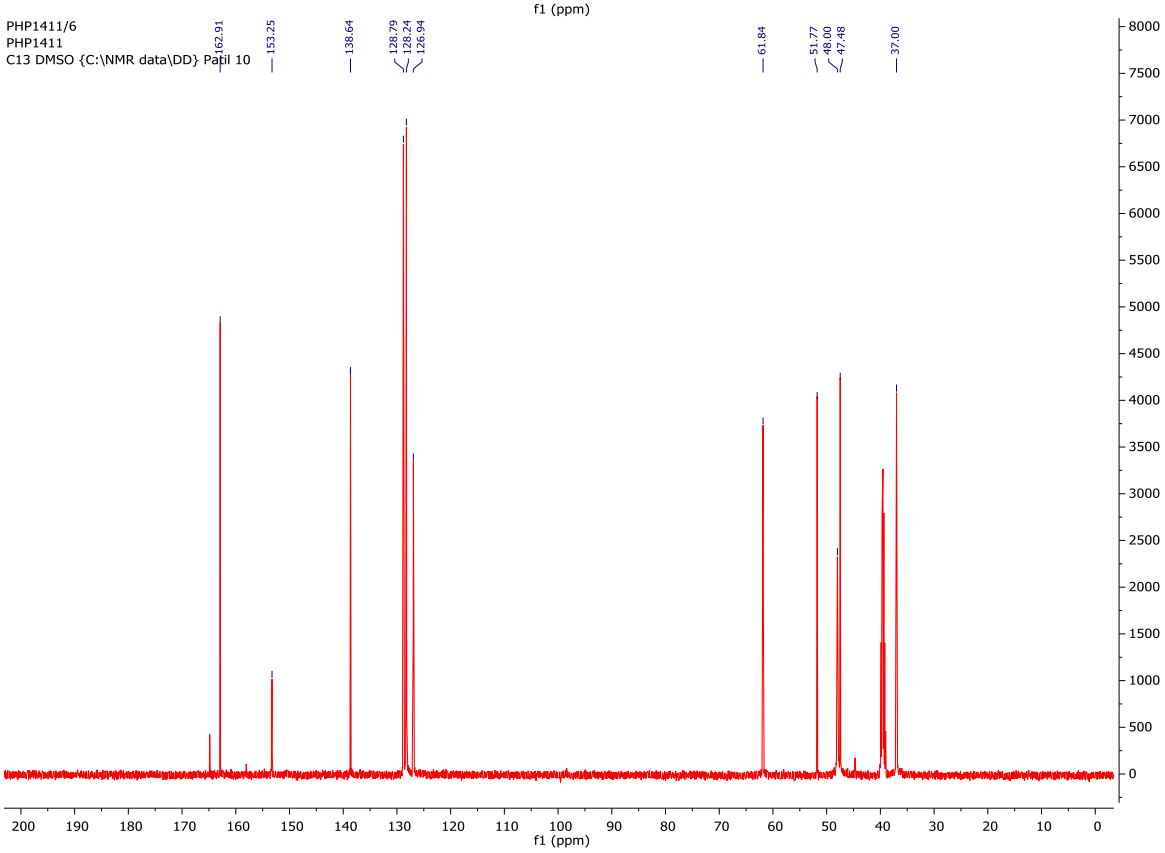
PHPT10_cr_1_Col4_Sol1_5-30%_6min



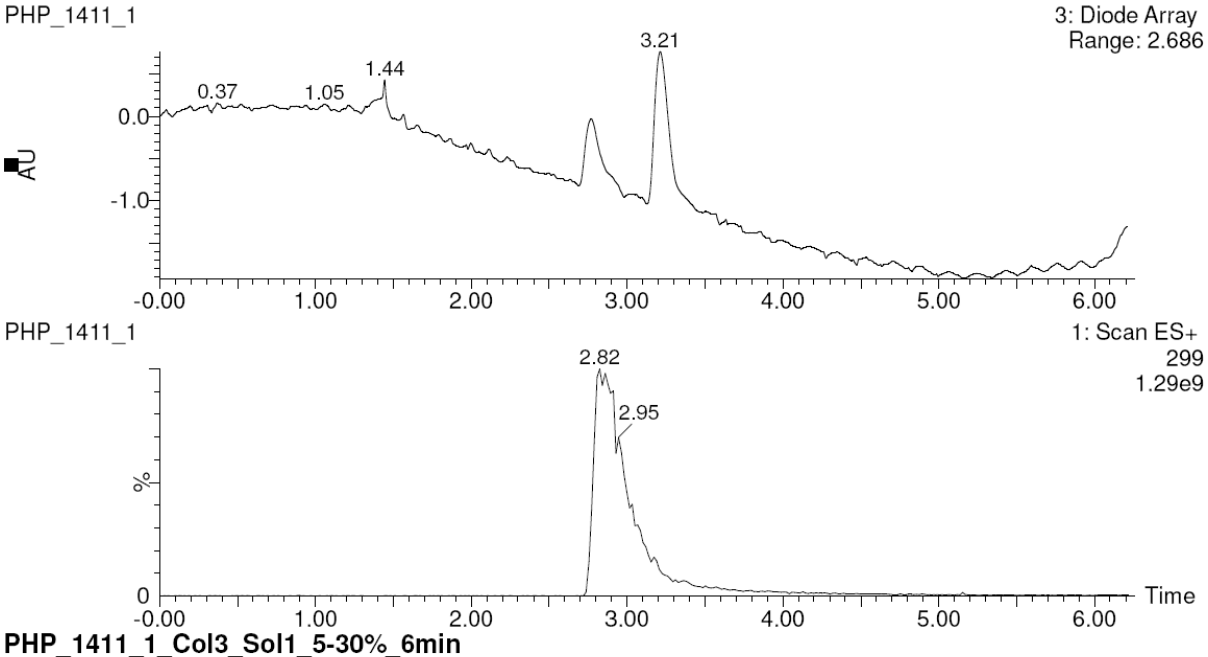
Chemical Formula: $C_8H_{13}N_5O$
Exact Mass: 195.1120

3c: 1-benzyl-5'H-spiro[piperidine-4,8'-tetrazolo[1,5-a]pyrazin]-6'(7'H)-one.





PHP_1411_1_Col3_Sol1_5-30%_6min



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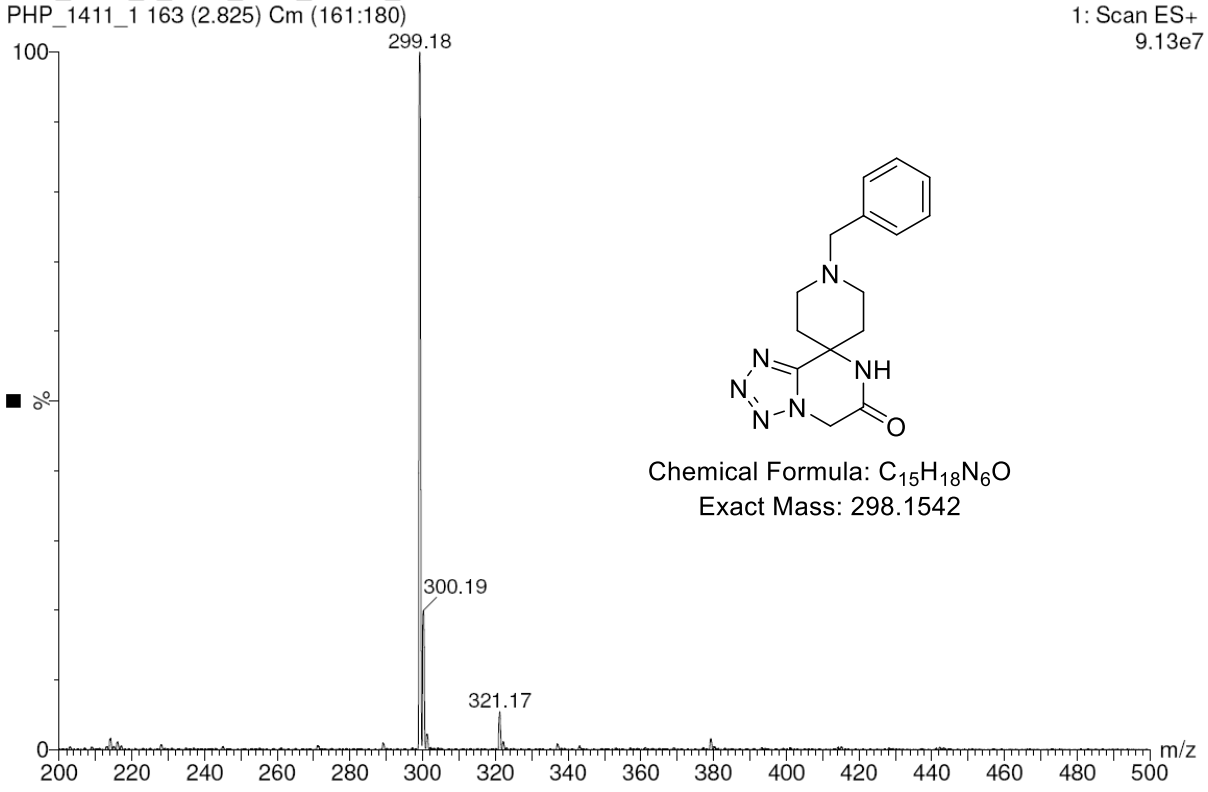
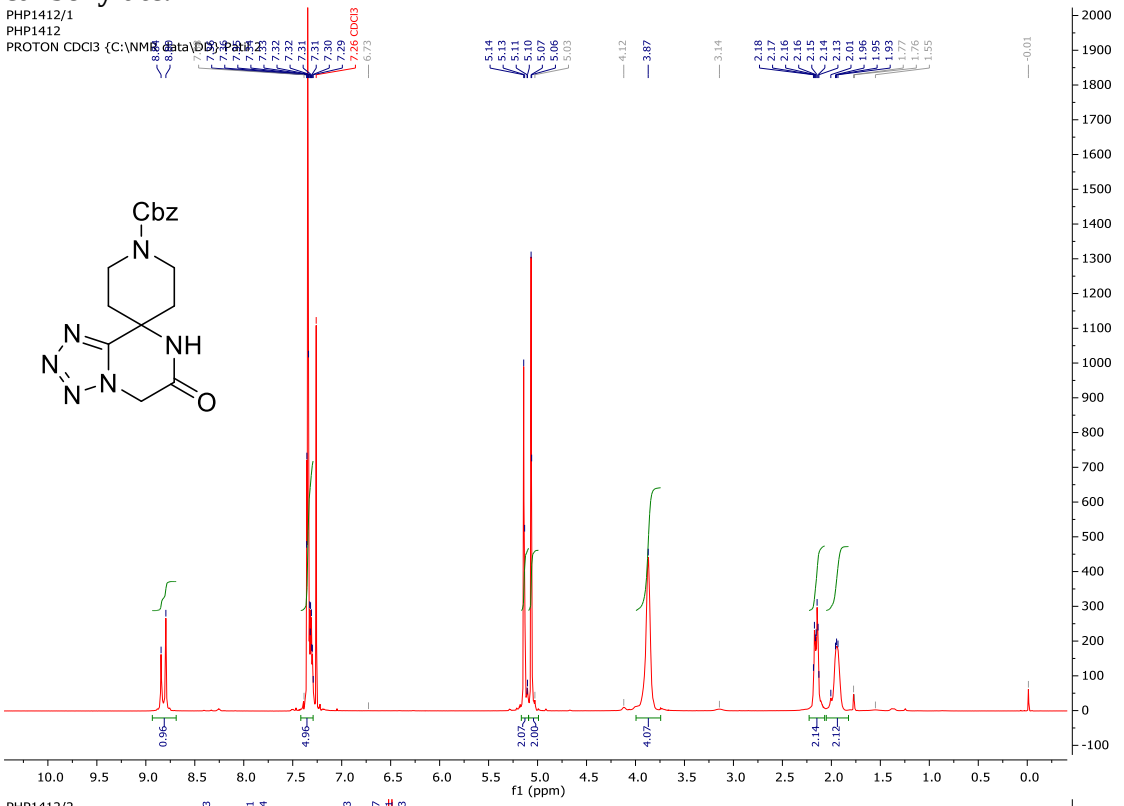
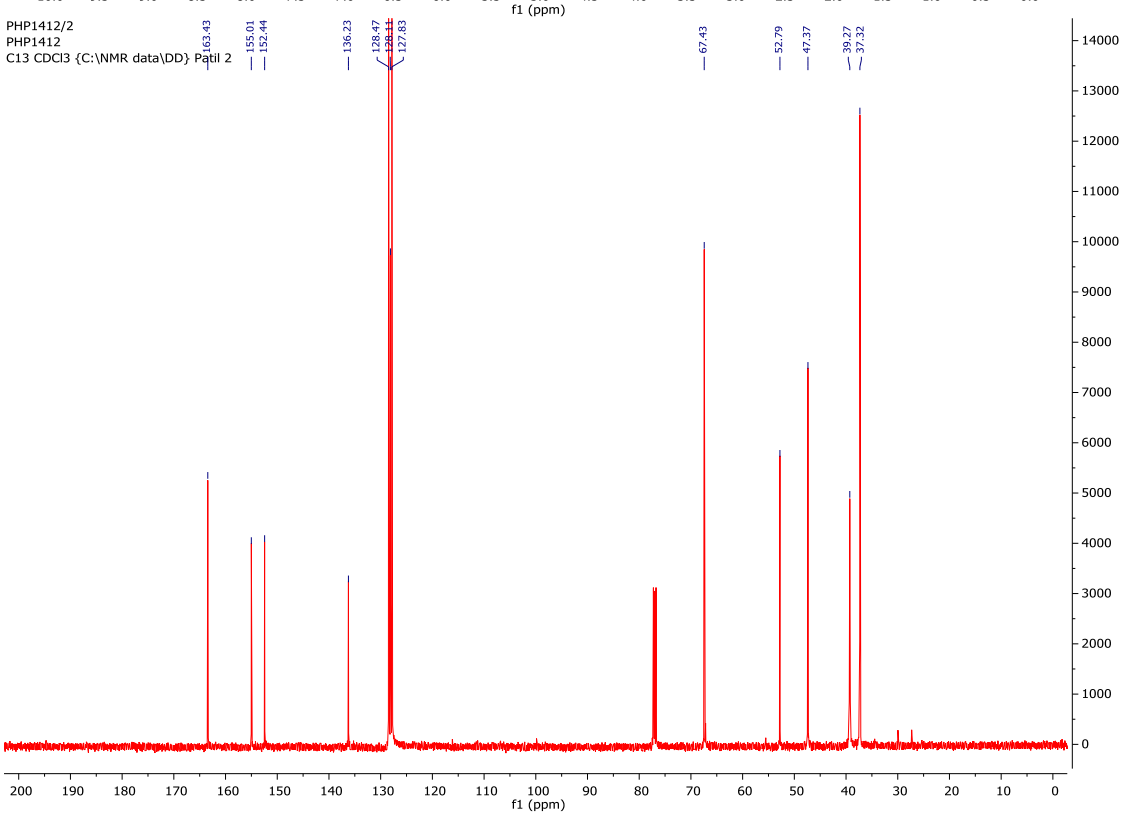


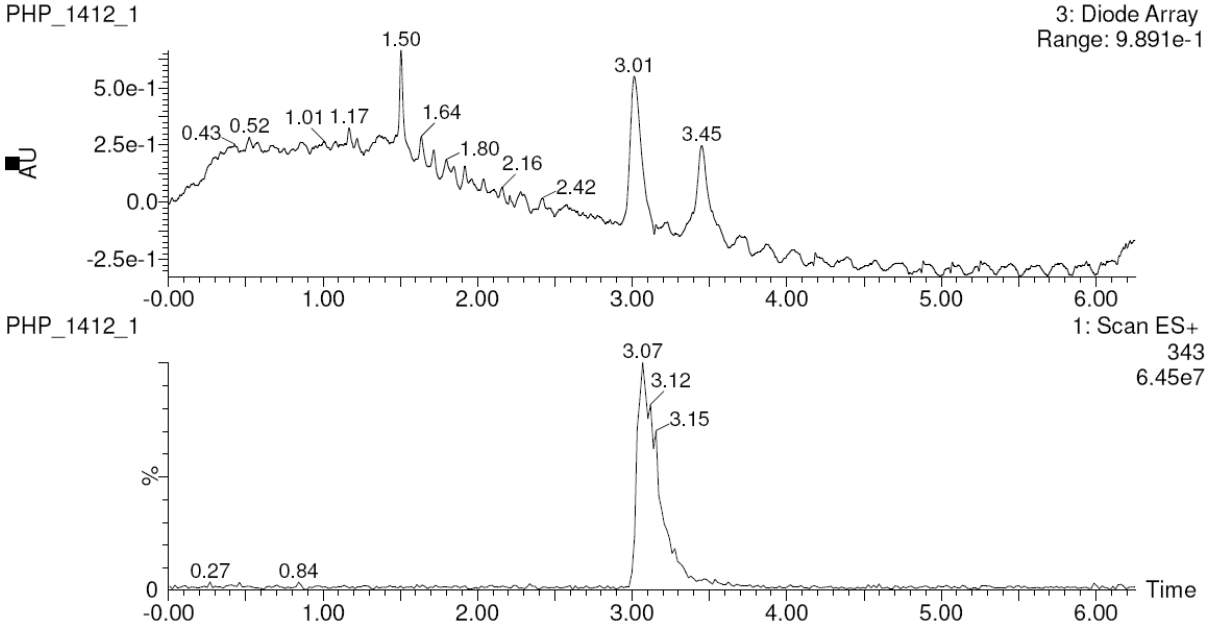
Chemical Formula: $C_{15}H_{18}N_6O$
Exact Mass: 298.1542

4c: benzyl 6'-oxo-6',7'-dihydro-5'H-spiro[piperidine-4,8'-tetrazolo[1,5-a]pyrazine]-1-carboxylate.

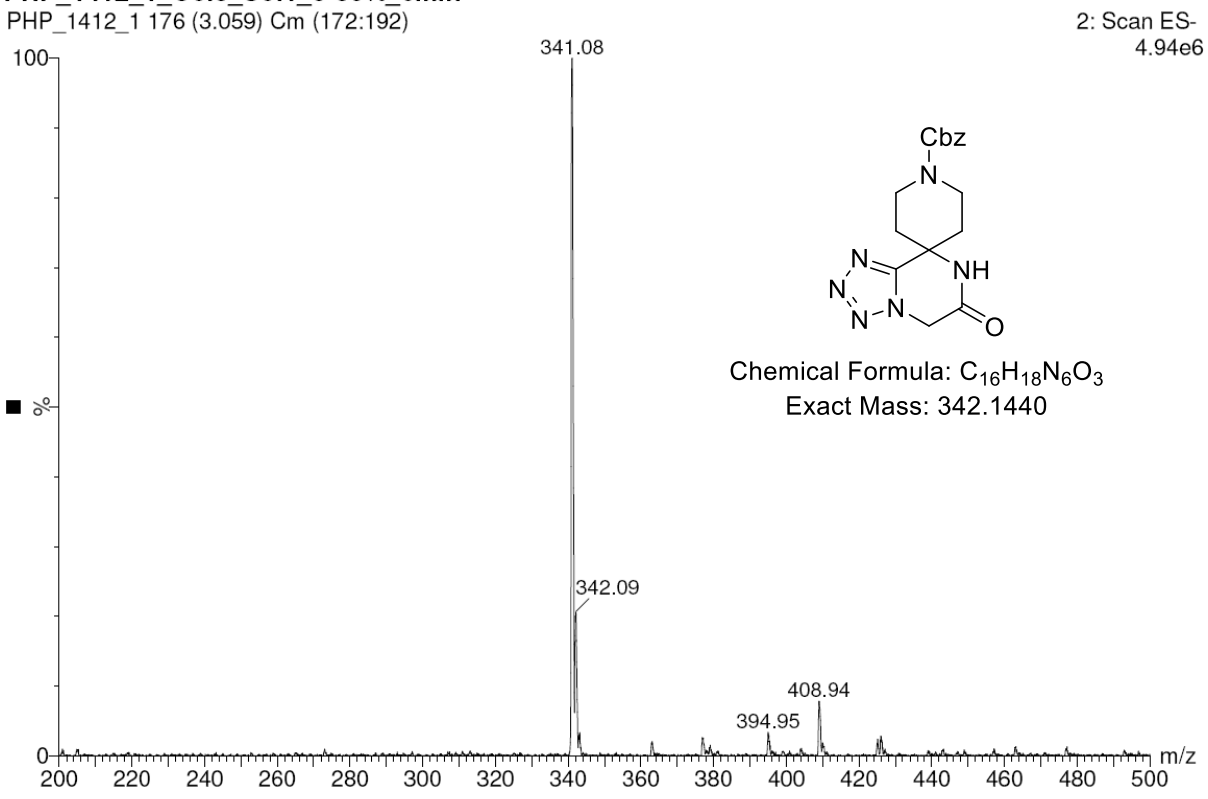




PHP_1412_1_Col3_Sol1_5-30%_6min

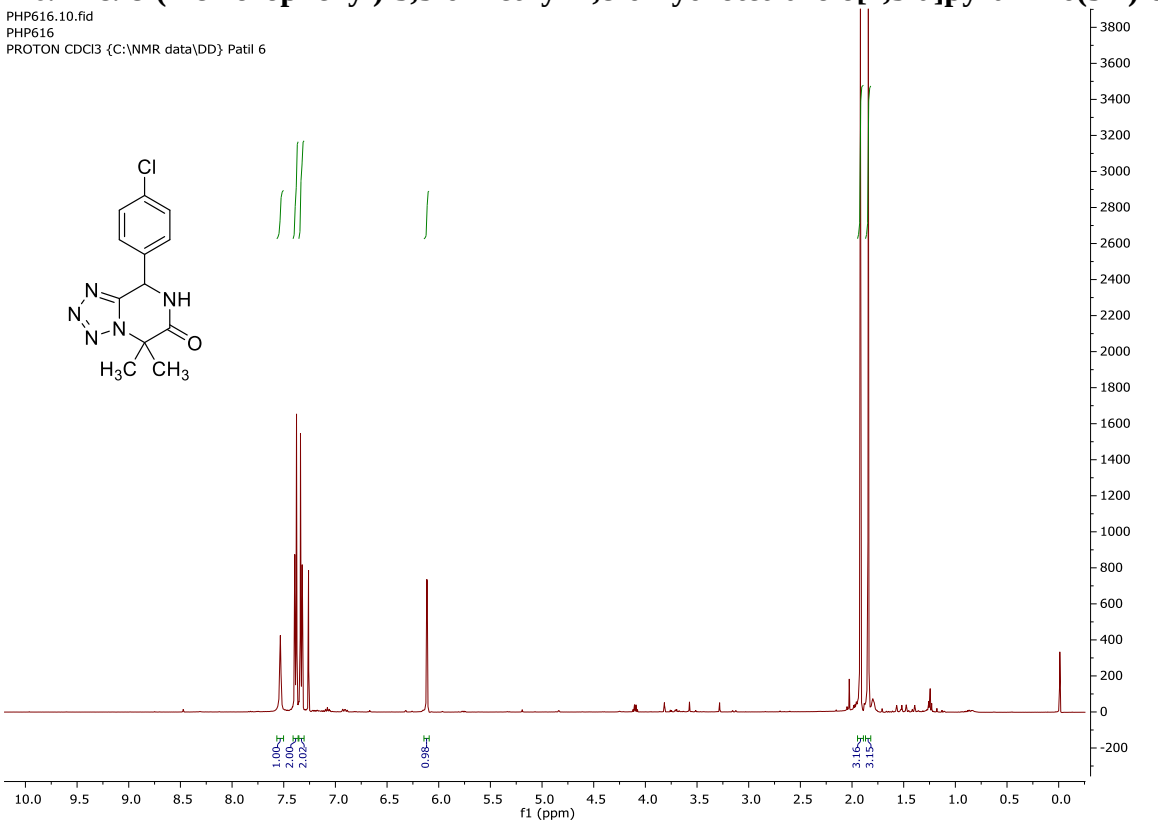


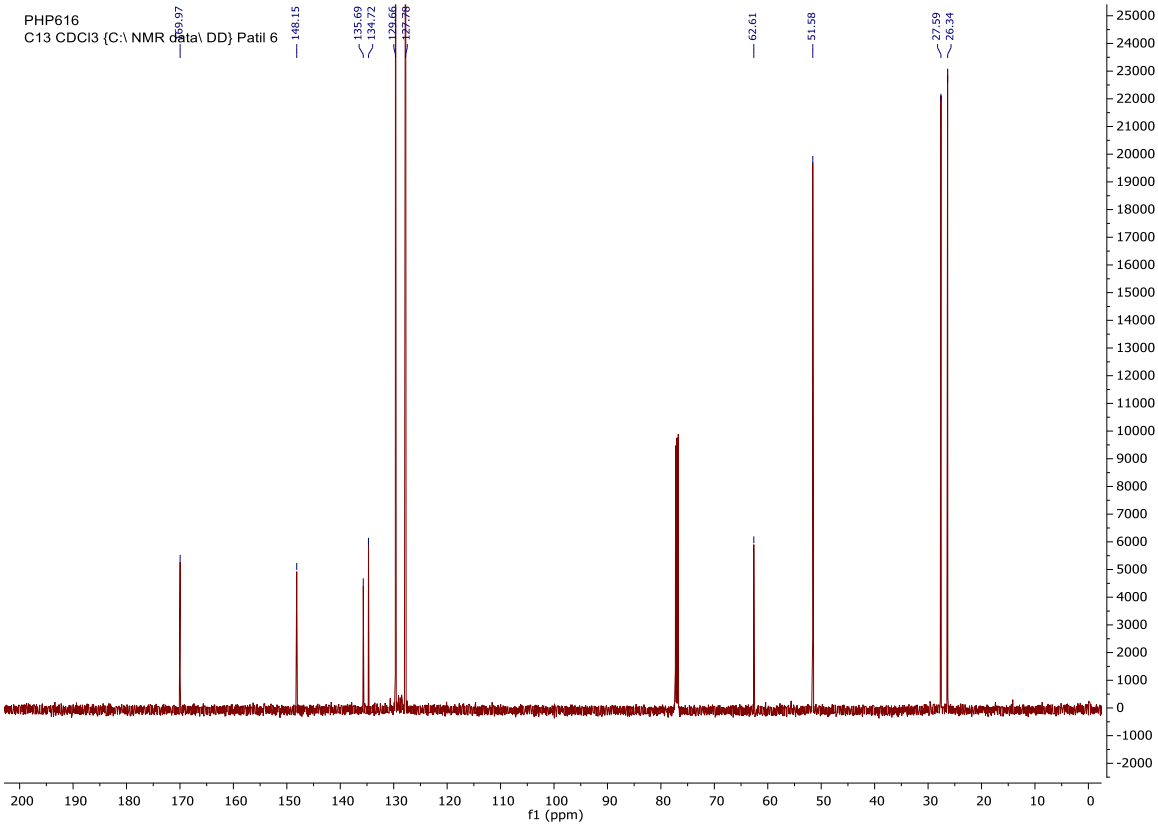
PHP_1412_1_Col3_Sol1_5-30%_6min



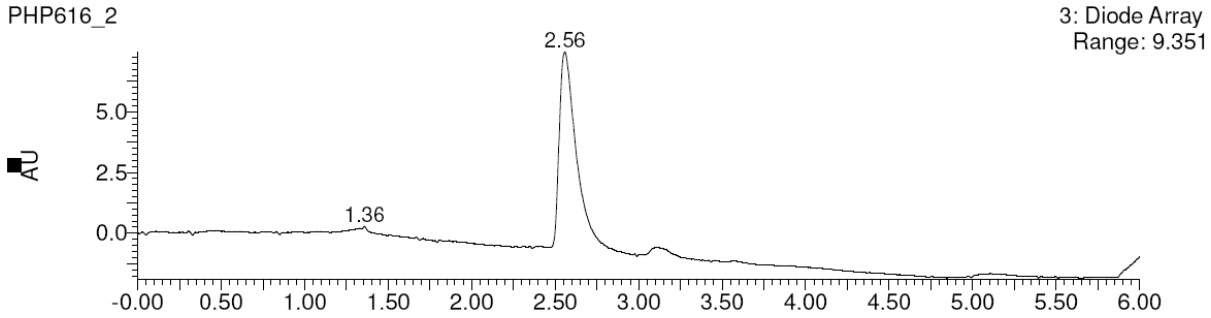
Chemical Formula: $C_{16}H_{18}N_6O_3$
Exact Mass: 342.1440

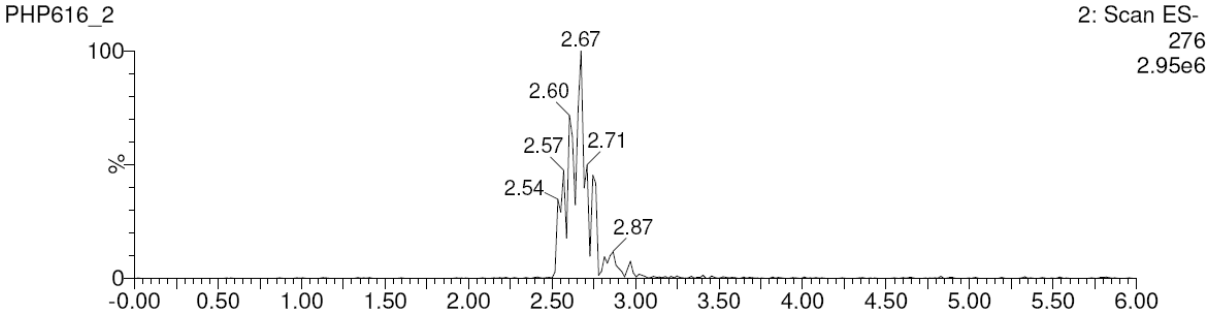
12c: 12c: 8-(4-chlorophenyl)-5,5-dimethyl-7,8-dihydrotetrazolo[1,5-a]pyrazin-6(5H)-one.



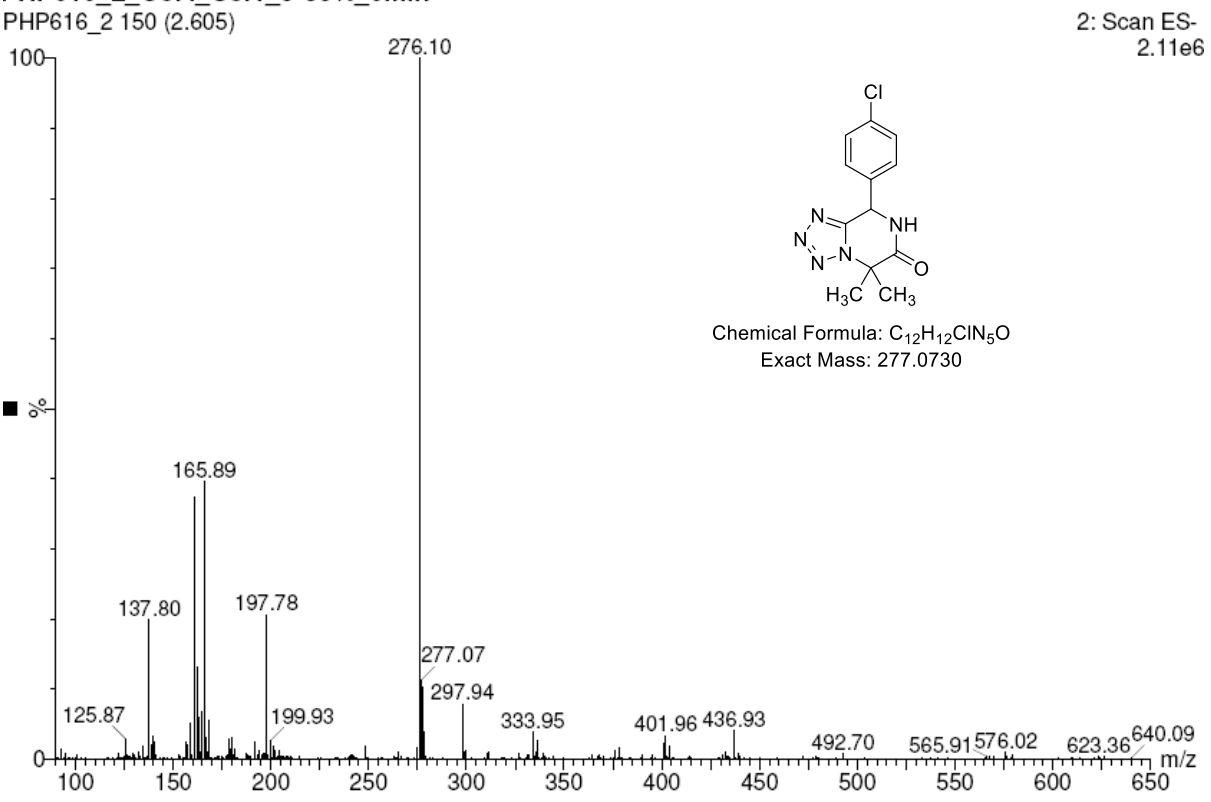


PHP616_2_Col4_Sol1_5-30%_6min

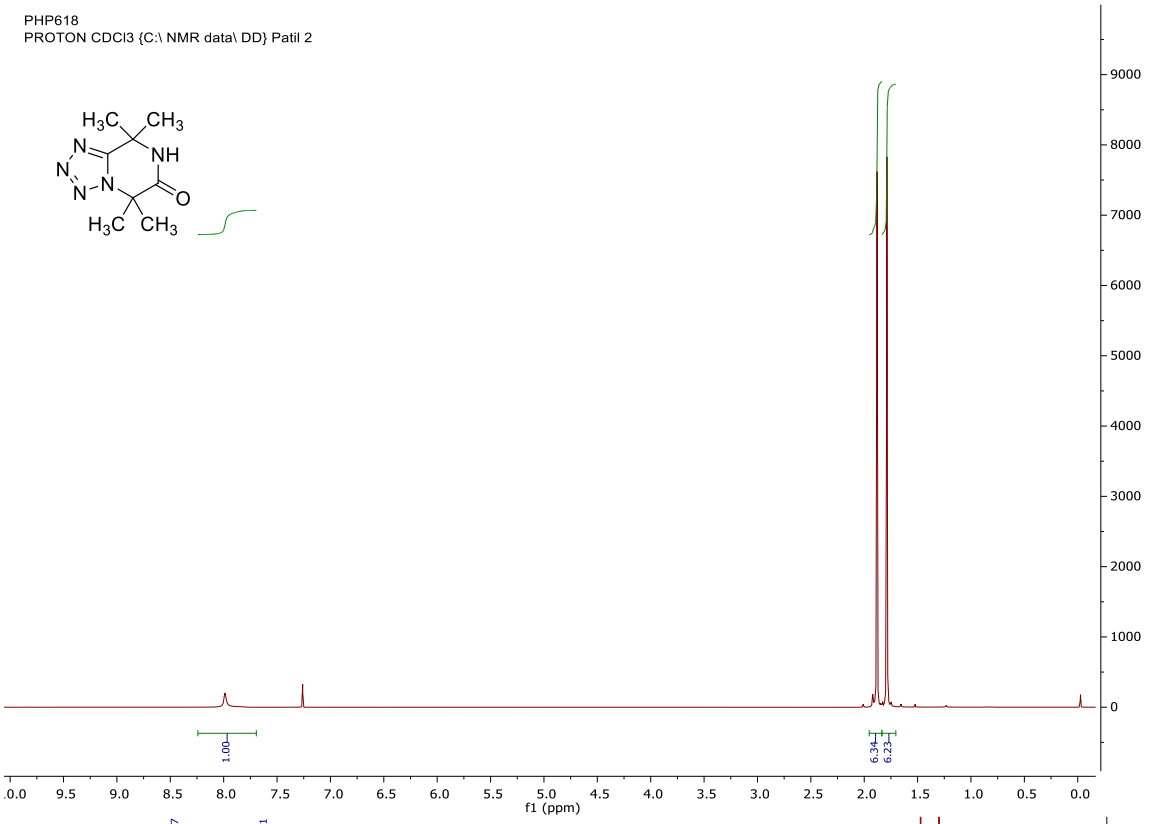


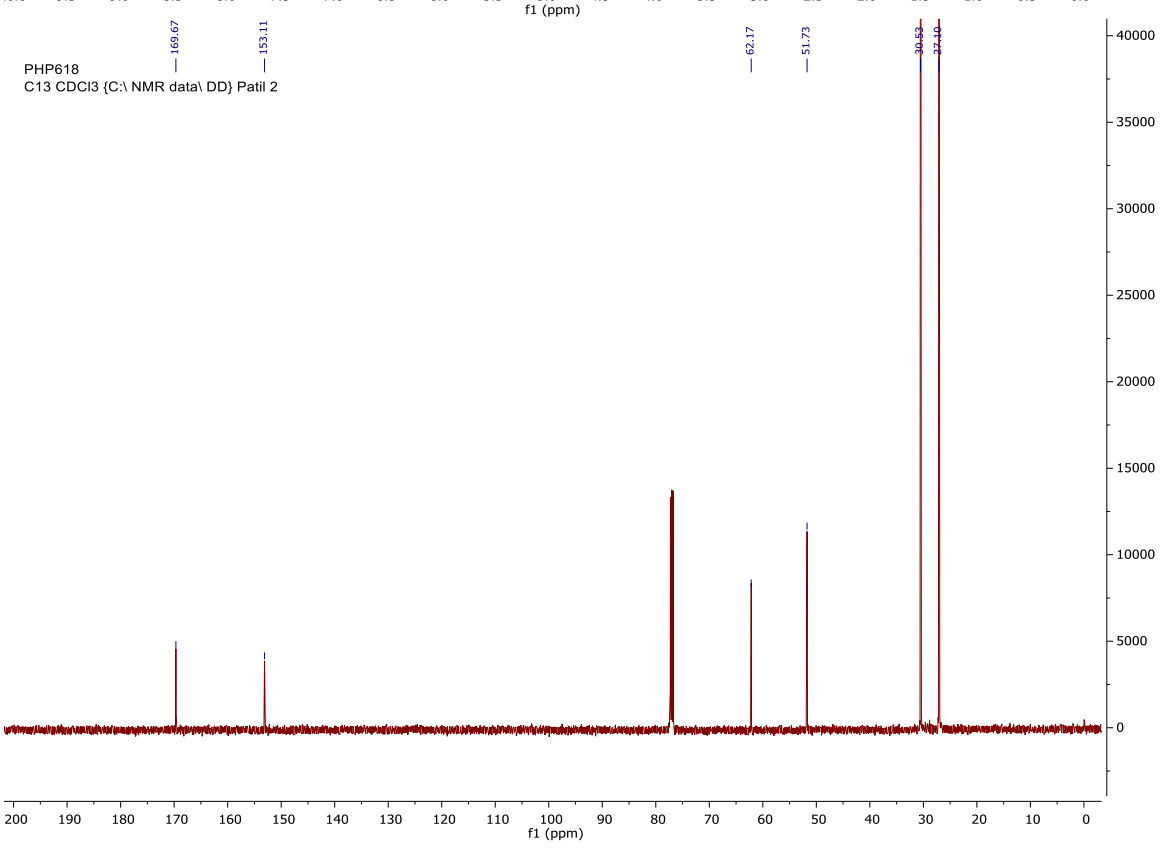


PHP616_2_Col4_Sol1_5-30%_6min



13c: 13c: 5,5,8,8-tetramethyl-7,8-dihydrotetrazolo[1,5-a]pyrazin-6(5H)-one.





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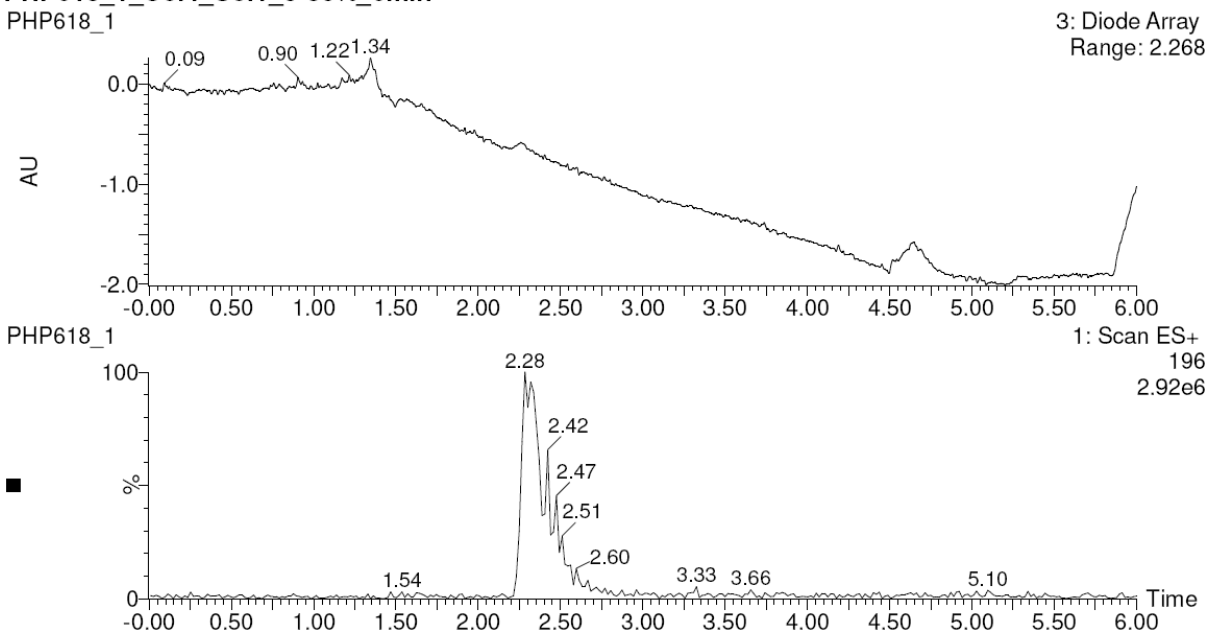
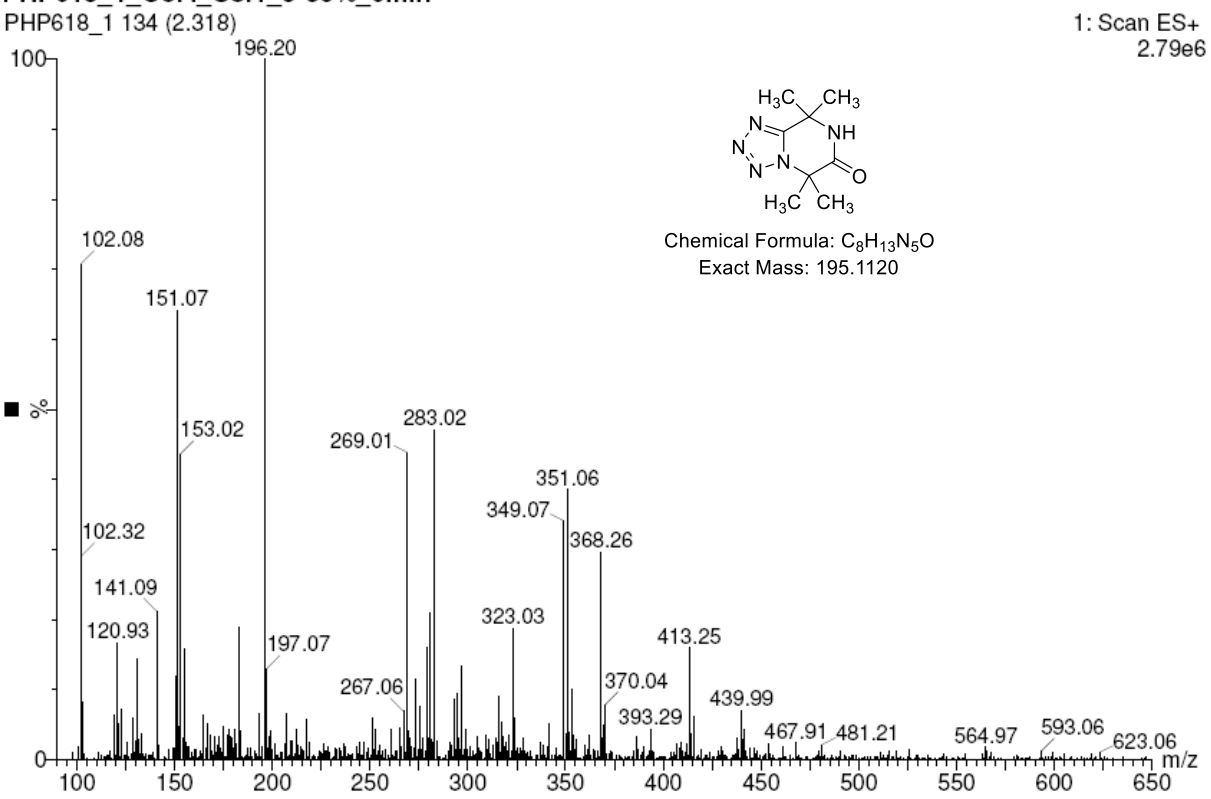
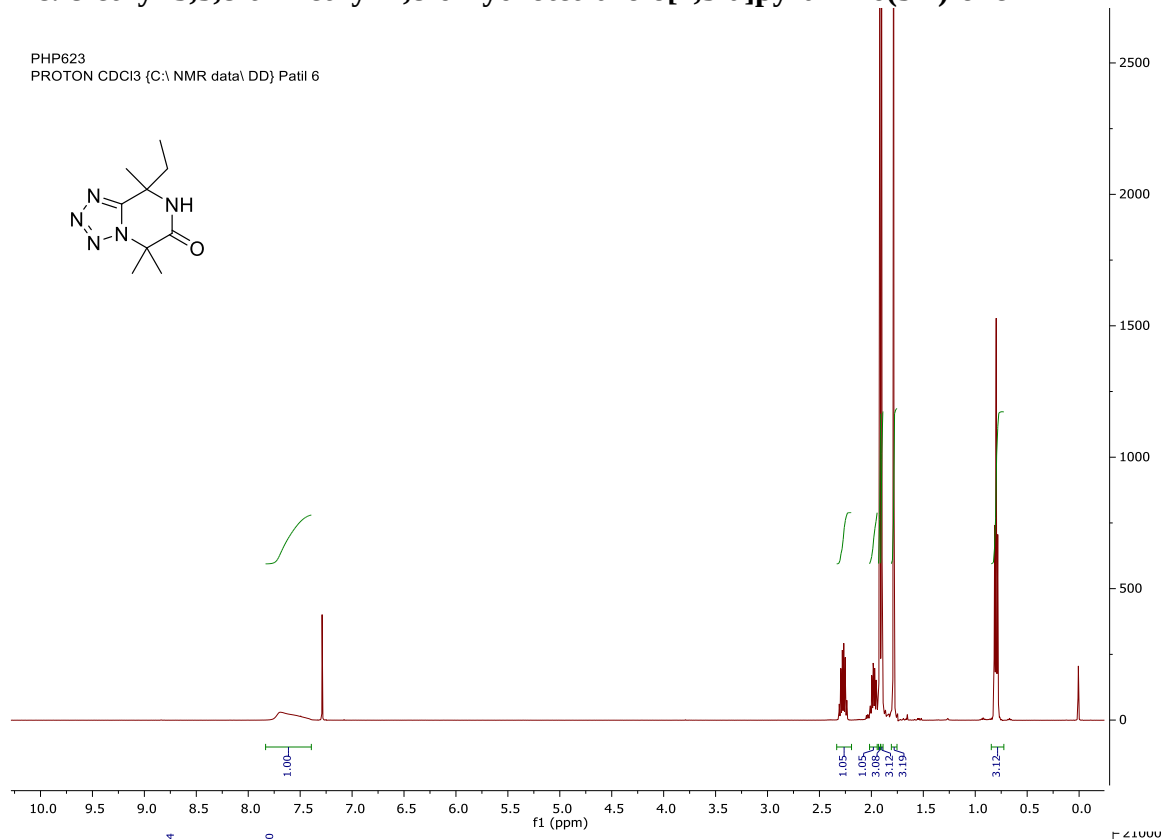


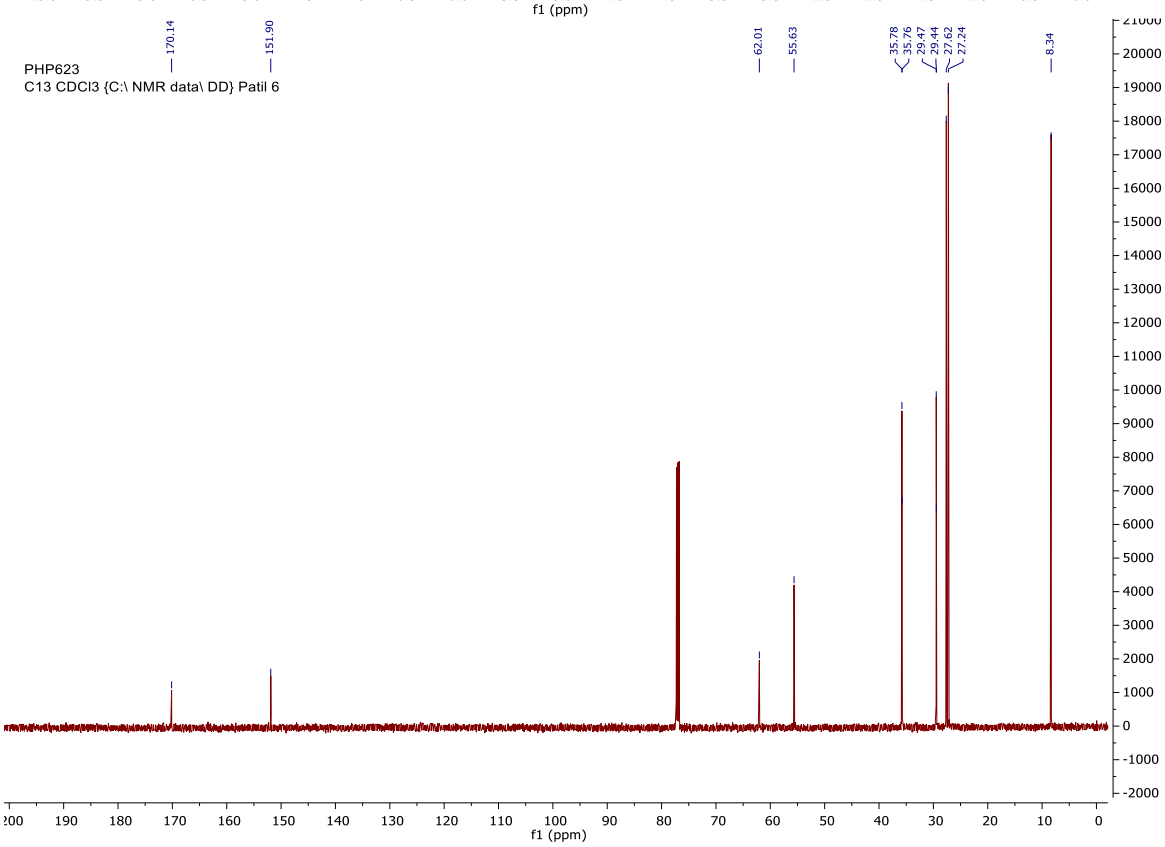
PHP618_1_Col4_Sol1_5-30%_6min

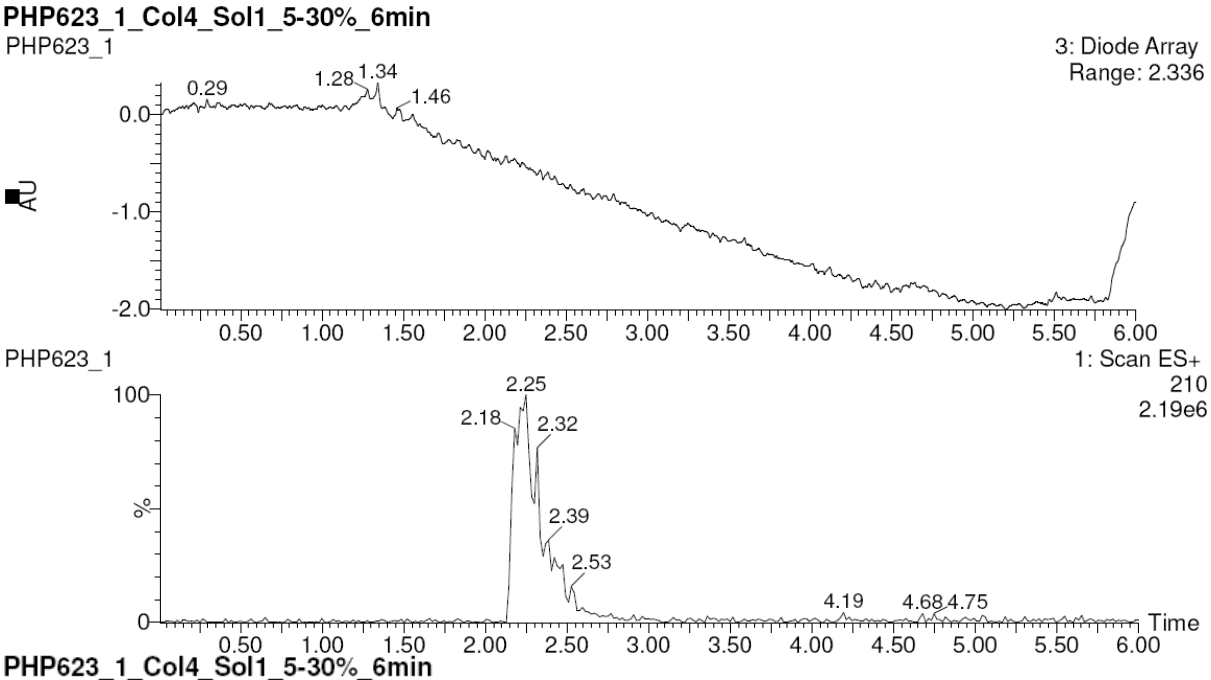


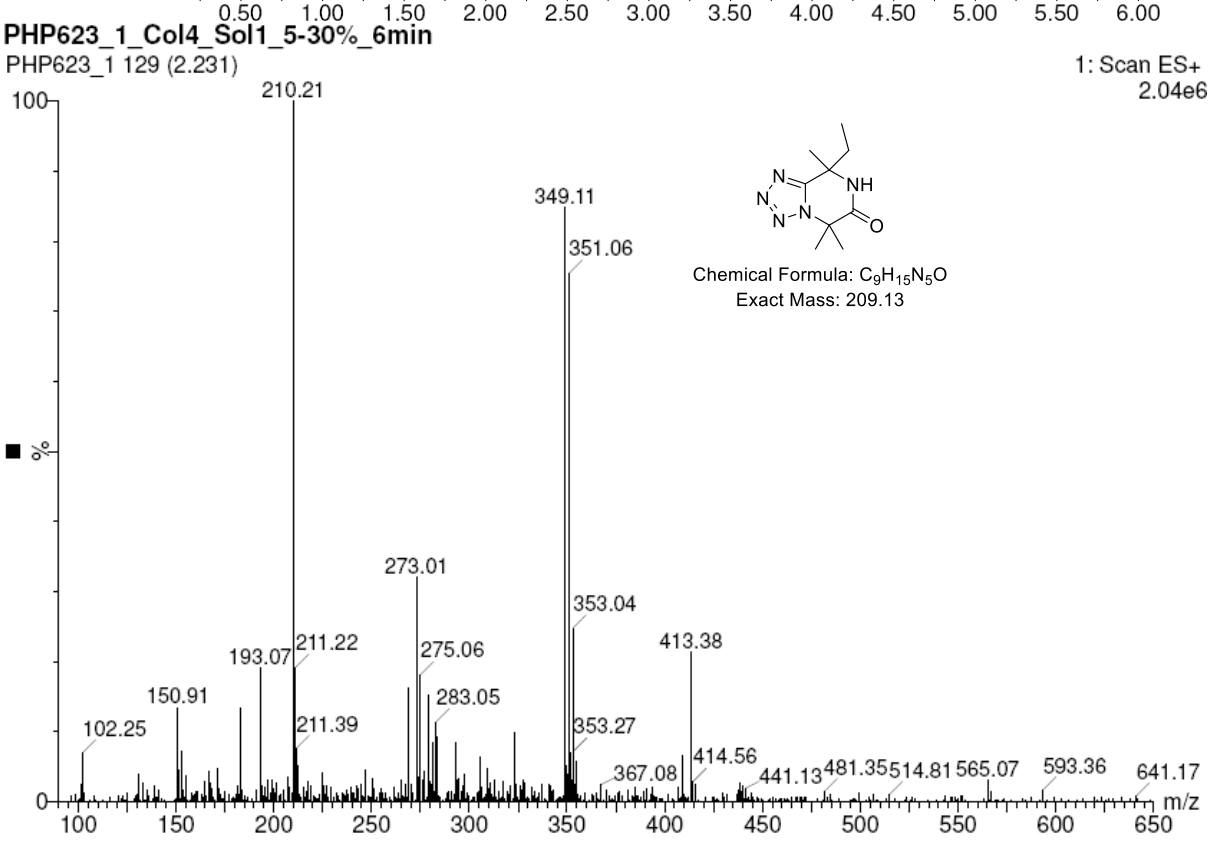
Chemical Formula: $C_8H_{13}N_5O$
Exact Mass: 195.1120

14c: 8-ethyl-5,5,8-trimethyl-7,8-dihydrotetrazolo[1,5-a]pyrazin-6(5H)-one



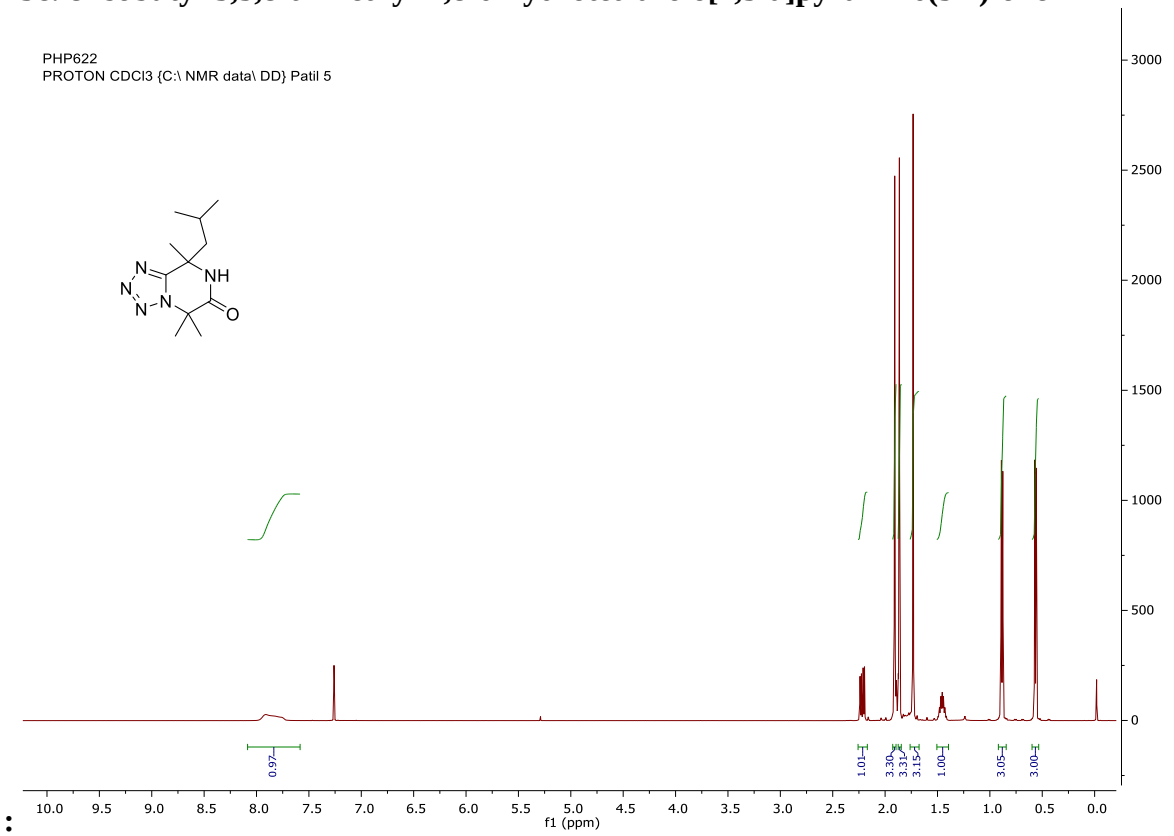






Chemical Formula: $C_9H_{15}N_5O$
Exact Mass: 209.13

15c: 8-isobutyl-5,5,8-trimethyl-7,8-dihydrotetrazolo[1,5-a]pyrazin-6(5H)-one



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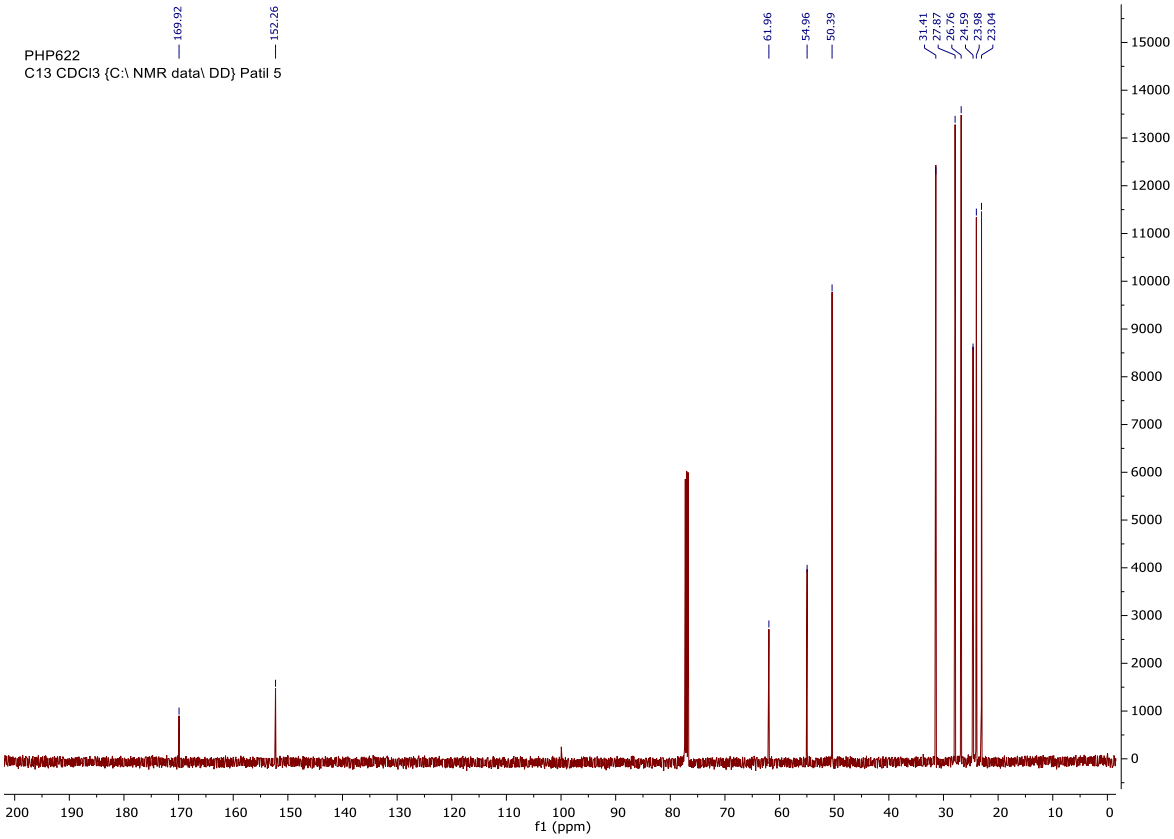

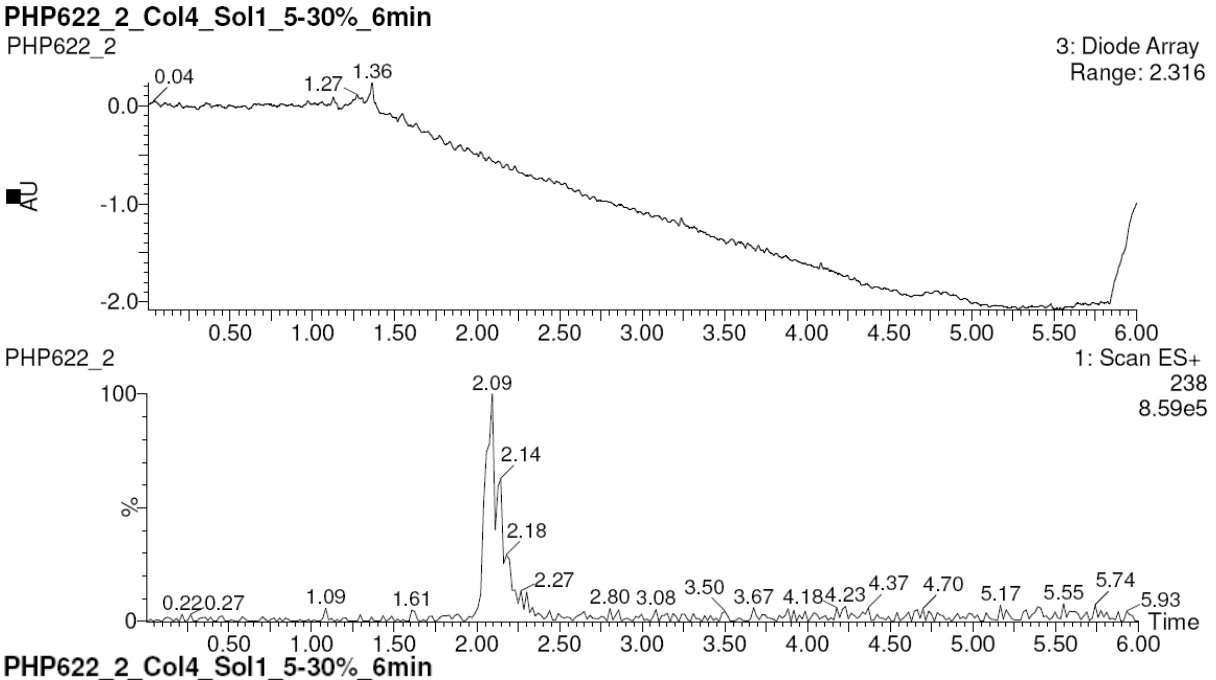
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Range: 2.316
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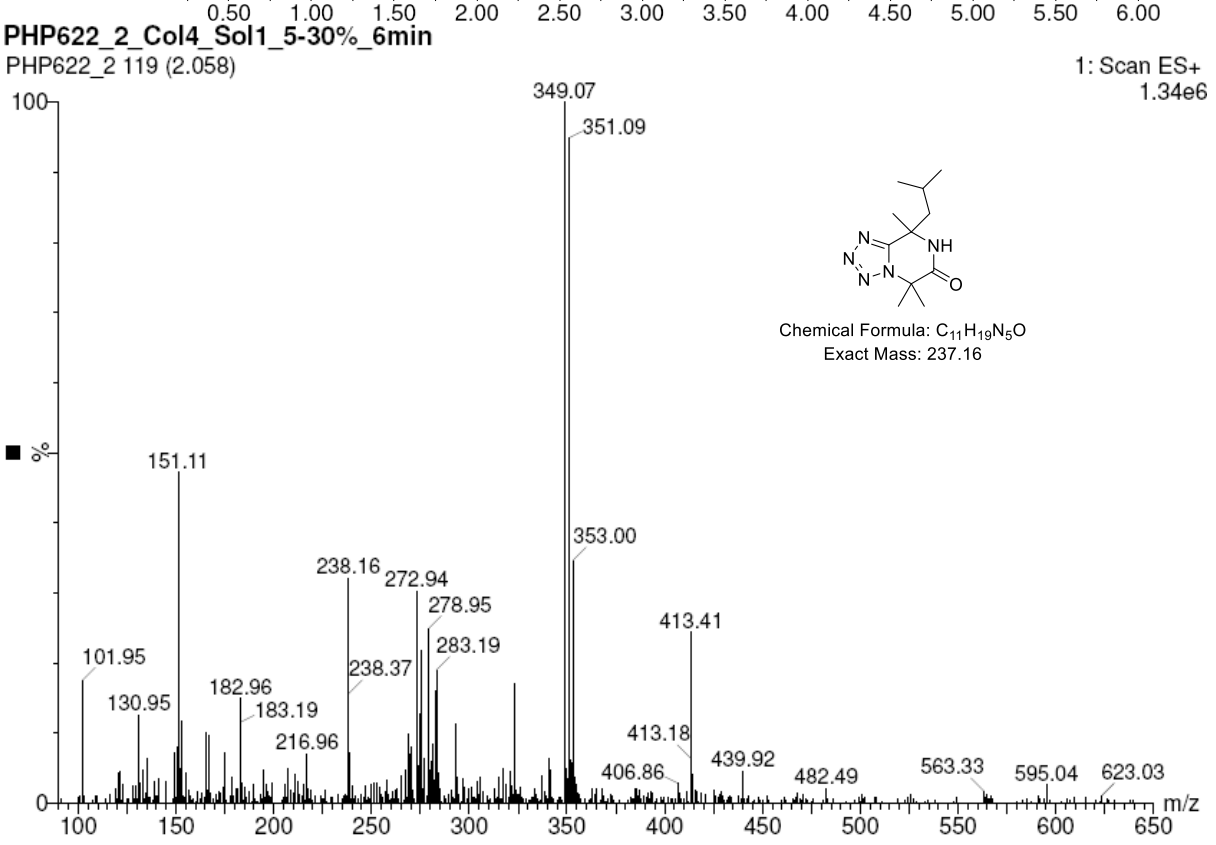
PHP622_2
1: Scan ES+
238
8.59e5
%
Time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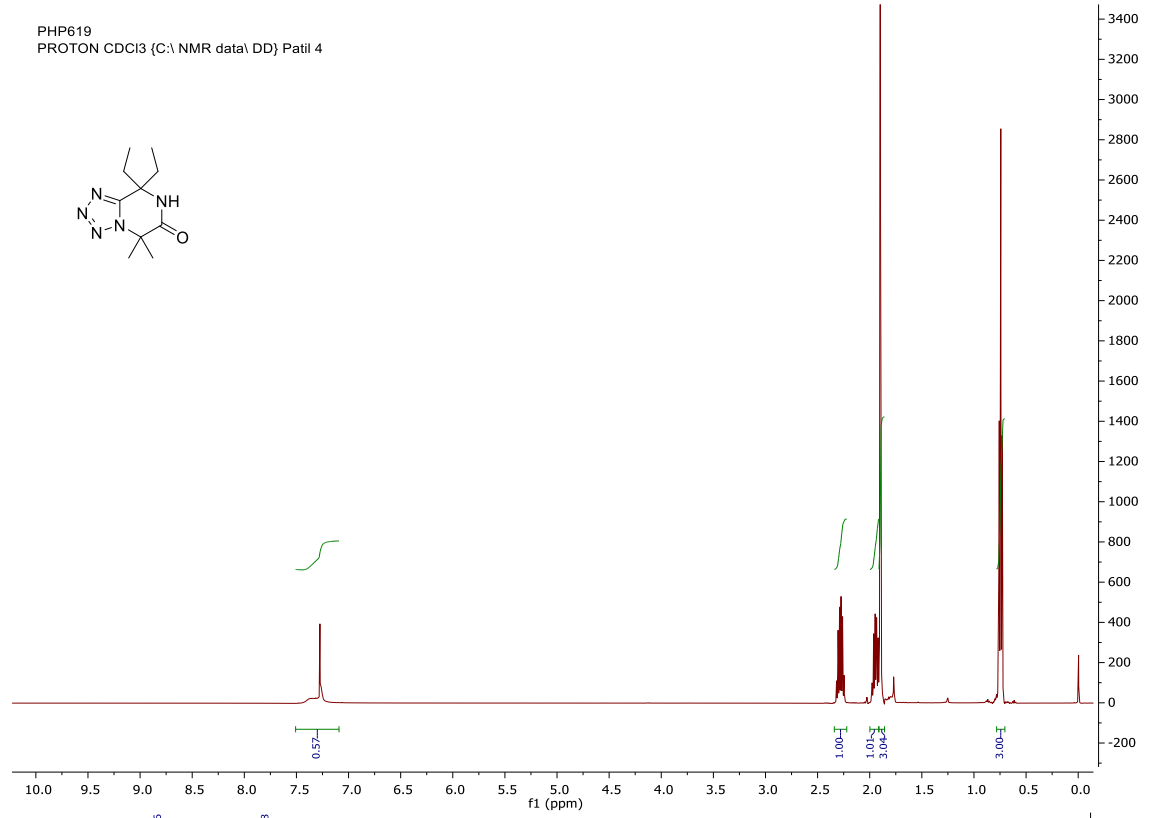
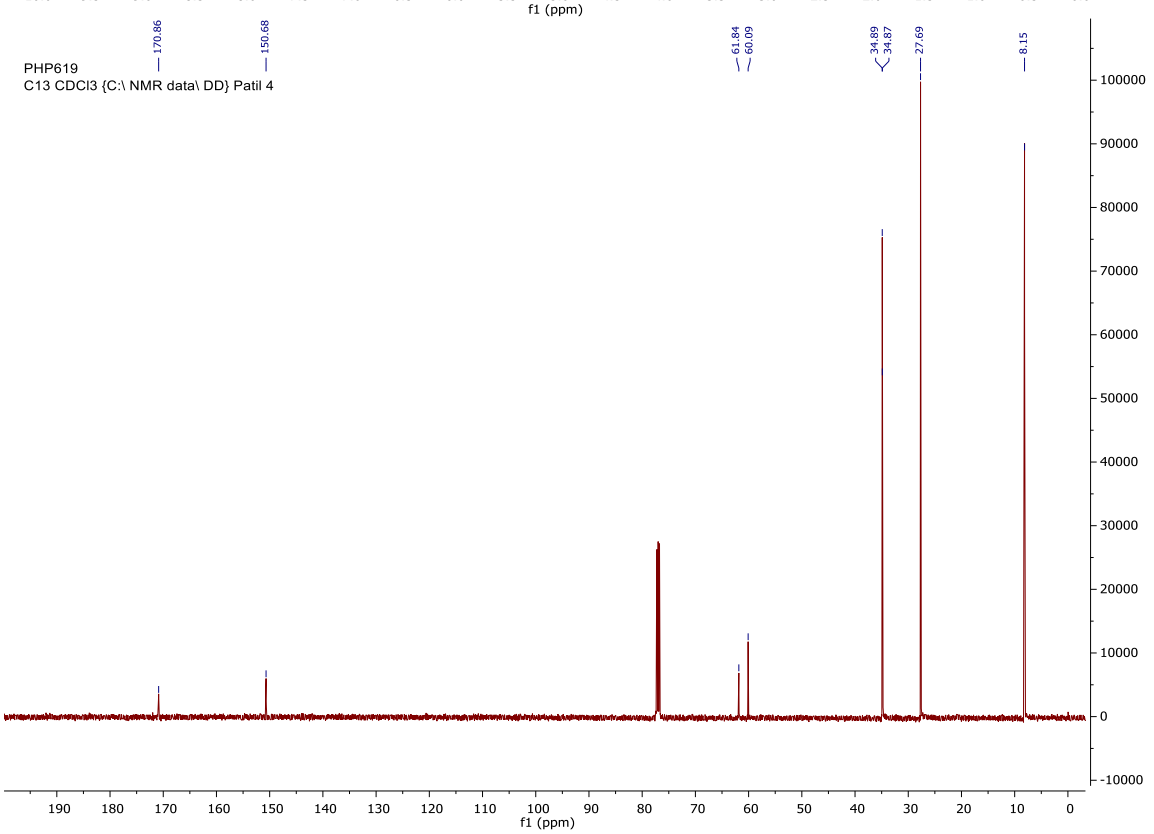
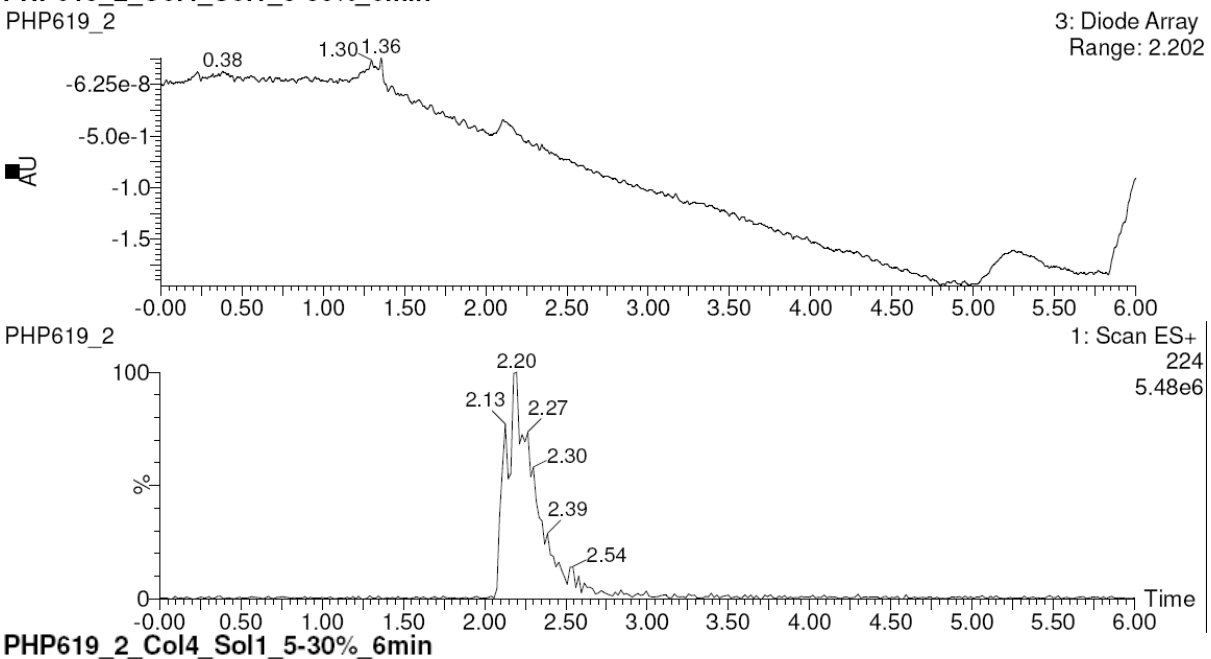
%
m/z
Chemical Formula: C11H19N5O
Exact Mass: 237.16

16c: 8,8-diethyl-5,5-dimethyl-7,8-dihydrotetrazolo[1,5-a]pyrazin-6(5H)-one





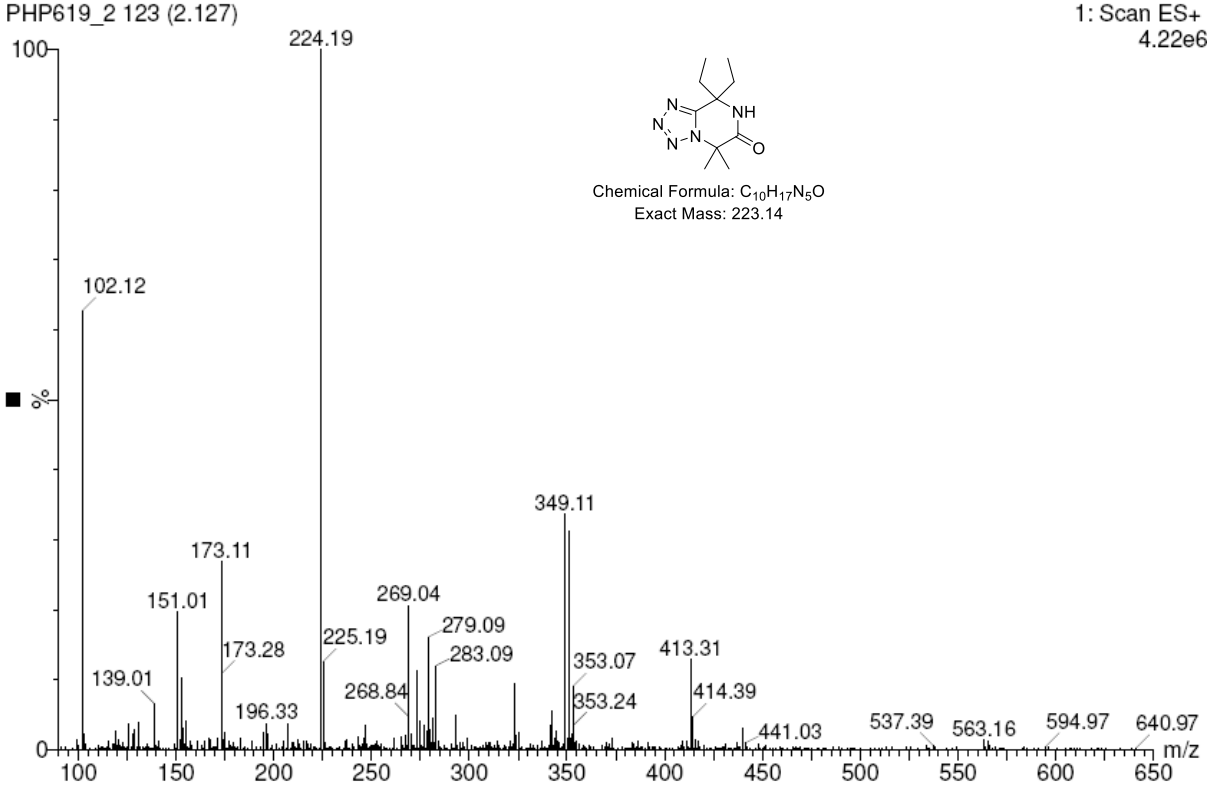
PHP619_2_Col4_Sol1_5-30%_6min



PHP619_2_Col4_Sol1_5-30%_6min

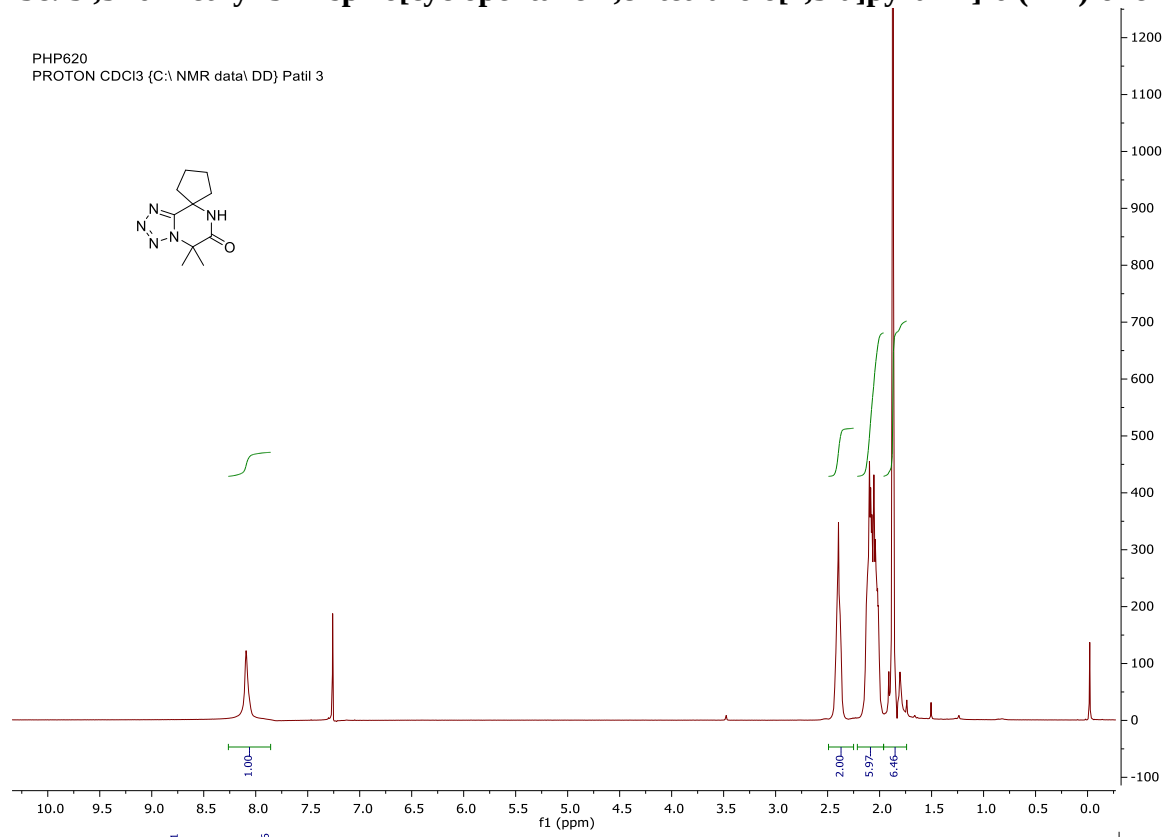
PHP619_2 123 (2.127)

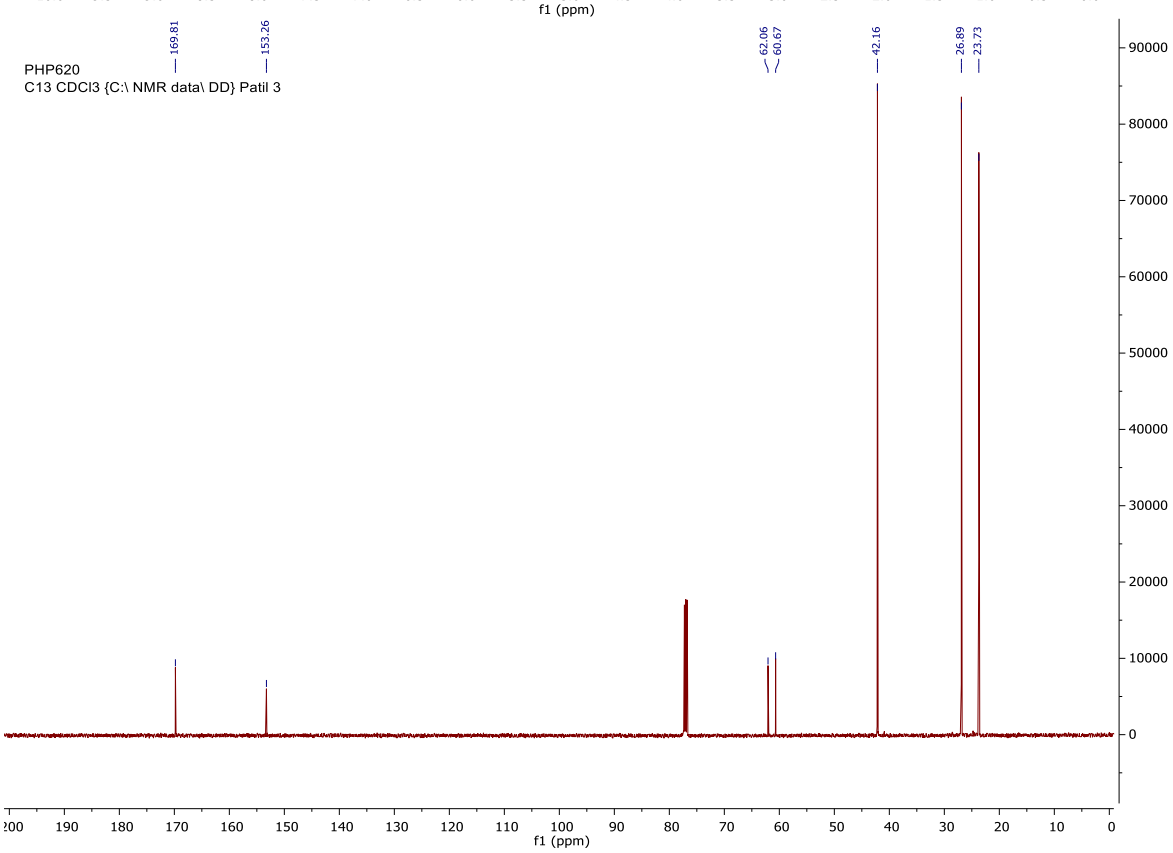
1: Scan ES+
4.22e6



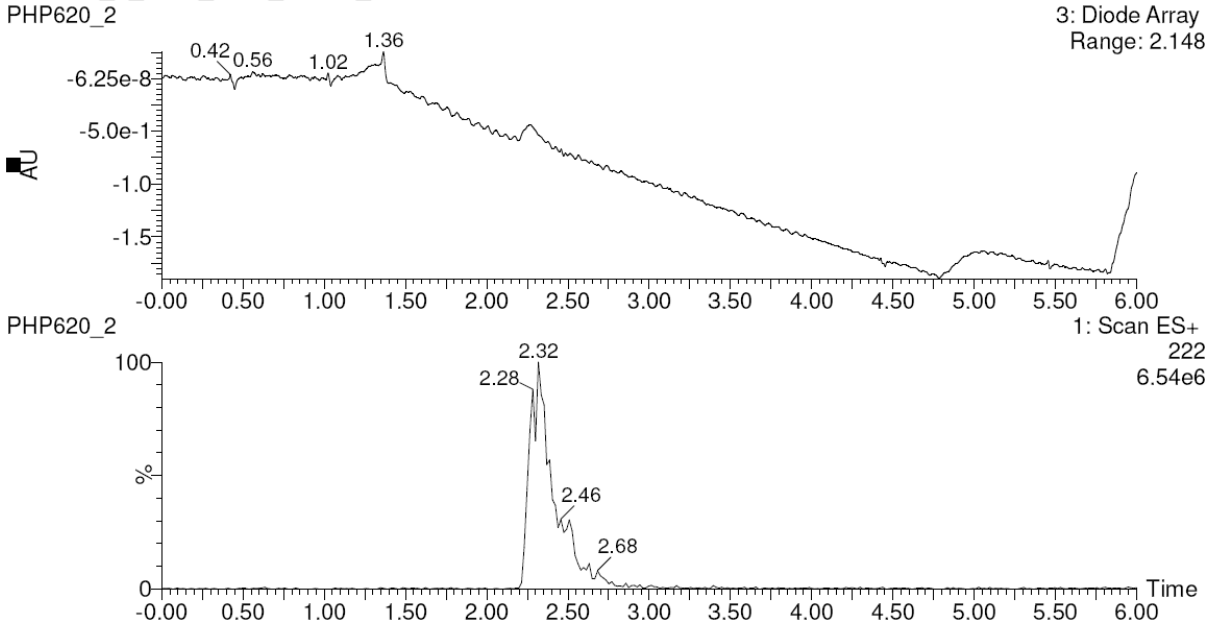
Chemical Formula: $C_{10}H_{17}N_5O$
Exact Mass: 223.14

23c: 5',5'-dimethyl-5'H-spiro[cyclopentane-1,8'-tetrazolo[1,5-a]pyrazin]-6'(7'H)-one

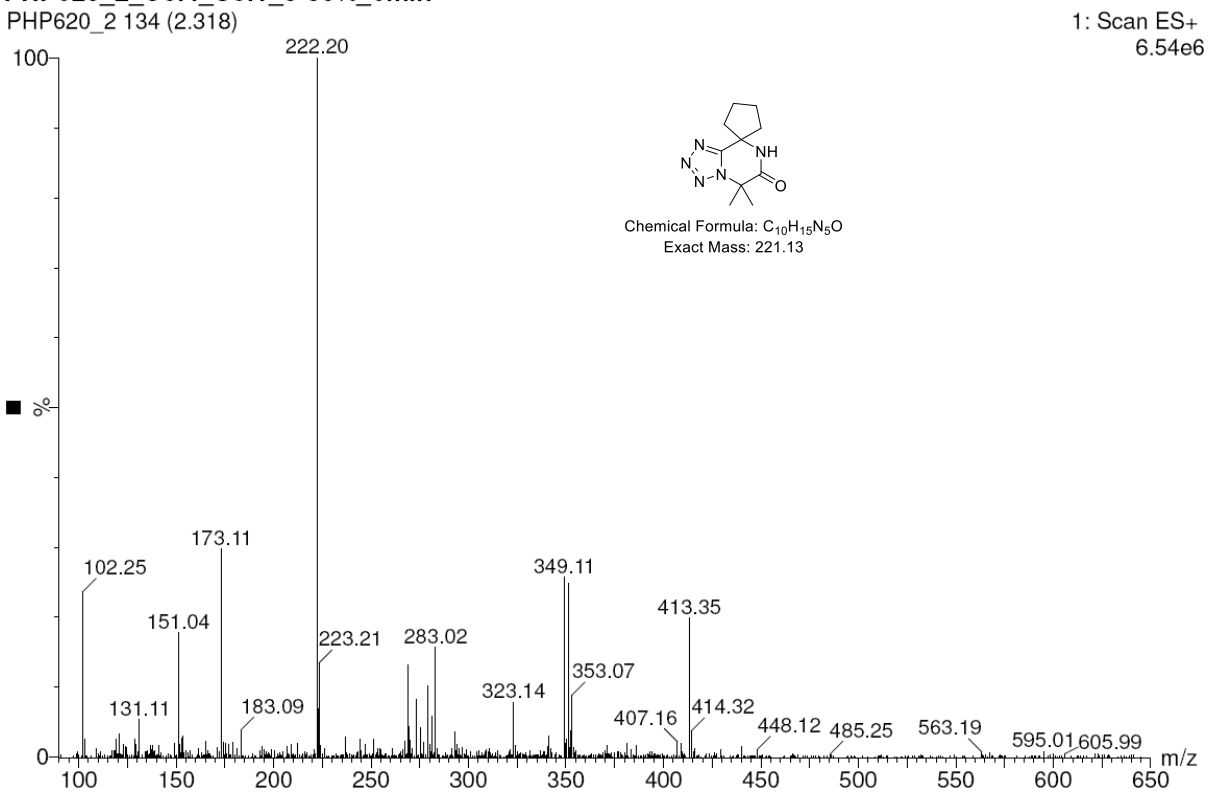




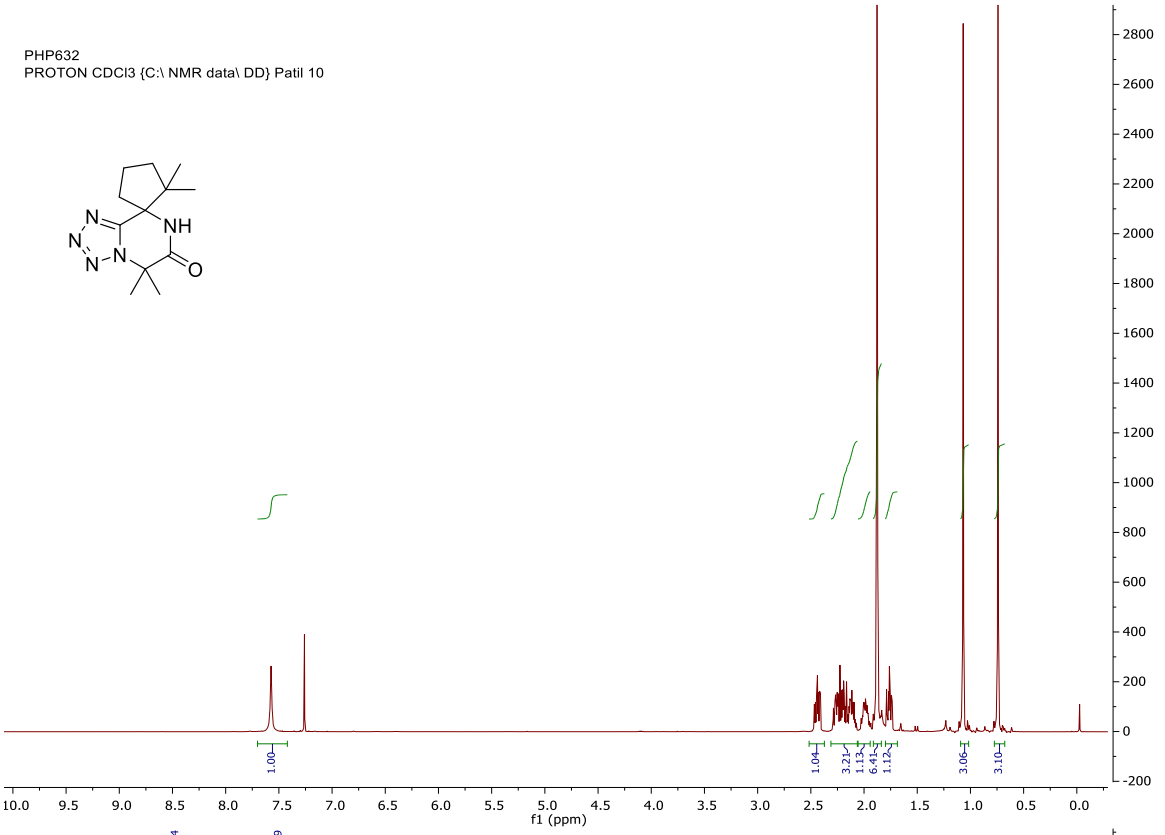
PHP620_2_Col4_Sol1_5-30%_6min

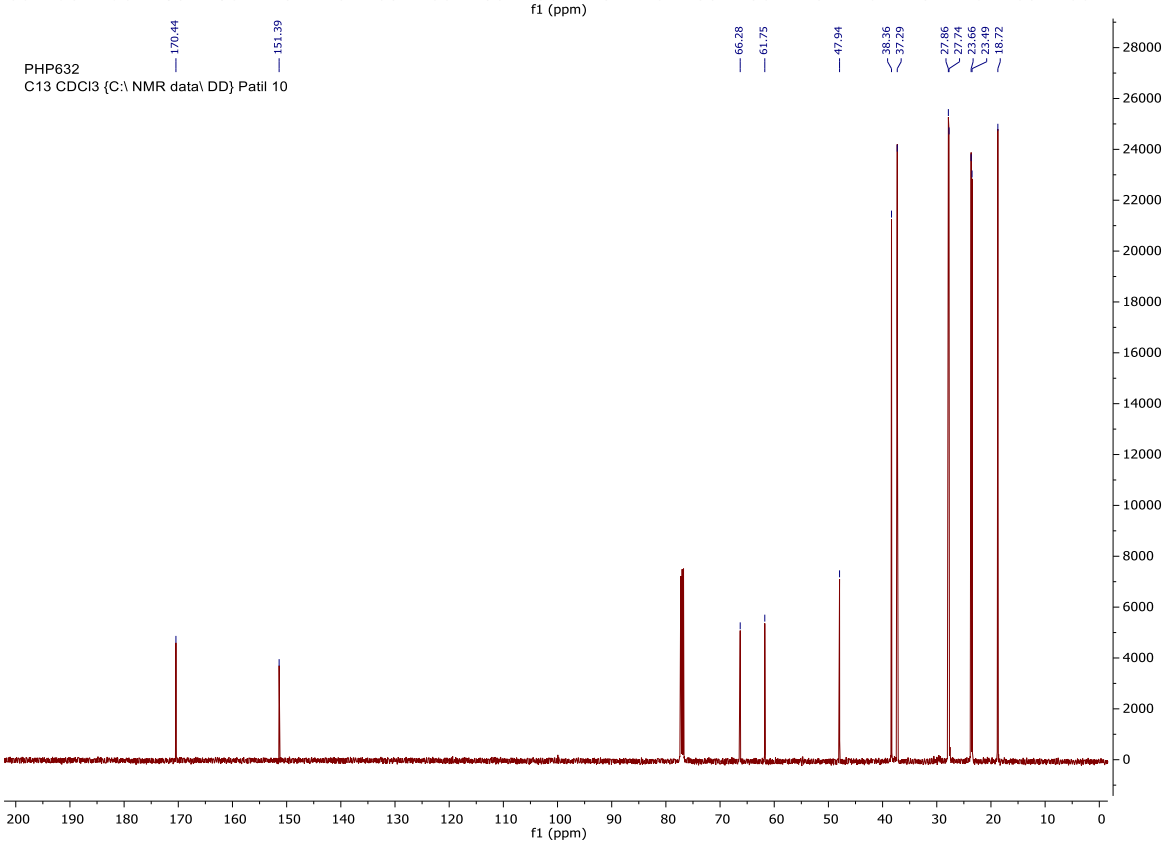


PHP620_2_Col4_Sol1_5-30%_6min

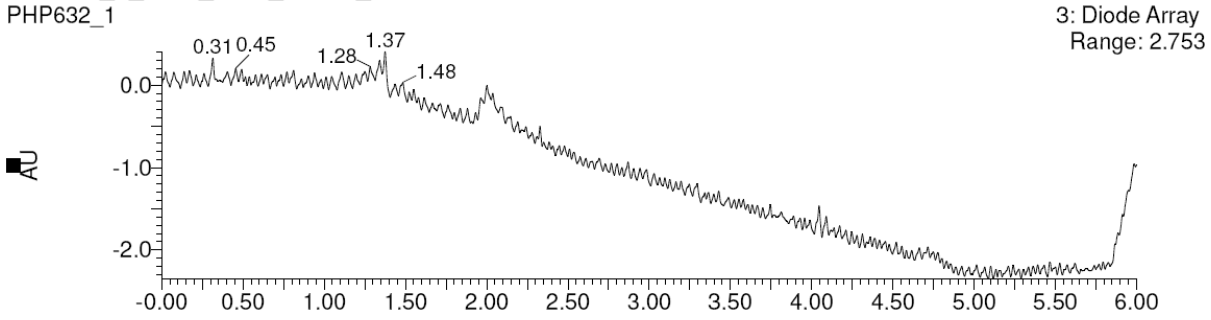


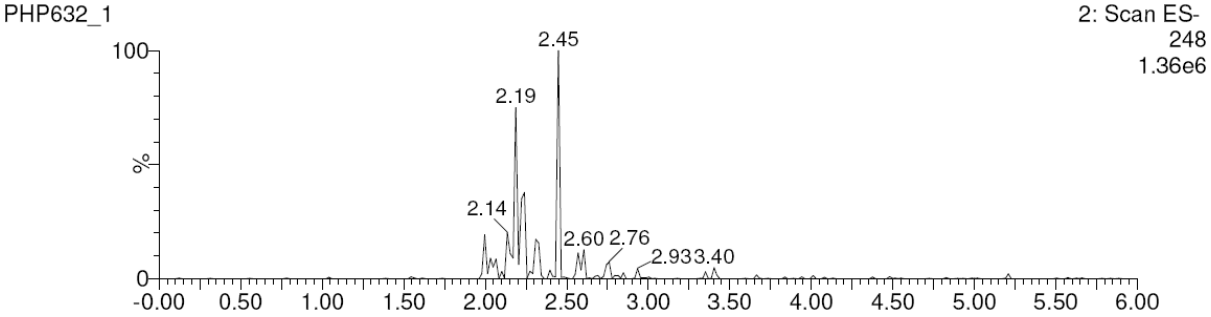
24c: 2,2,5',5'-tetramethyl-5'H-spiro[cyclopentane-1,8'-tetrazolo[1,5-a]pyrazin]-6'(7'H)-one.



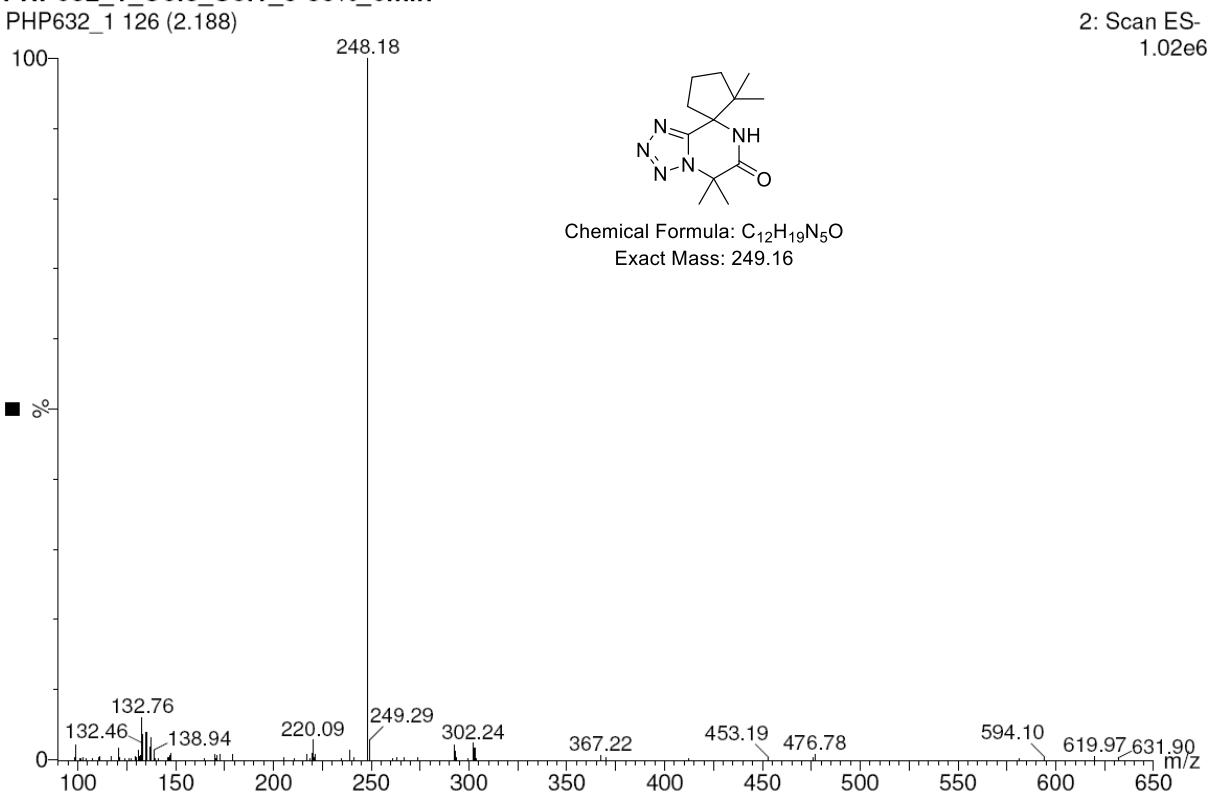


PHP632_1_Col3_Sol1_5-30%_6min



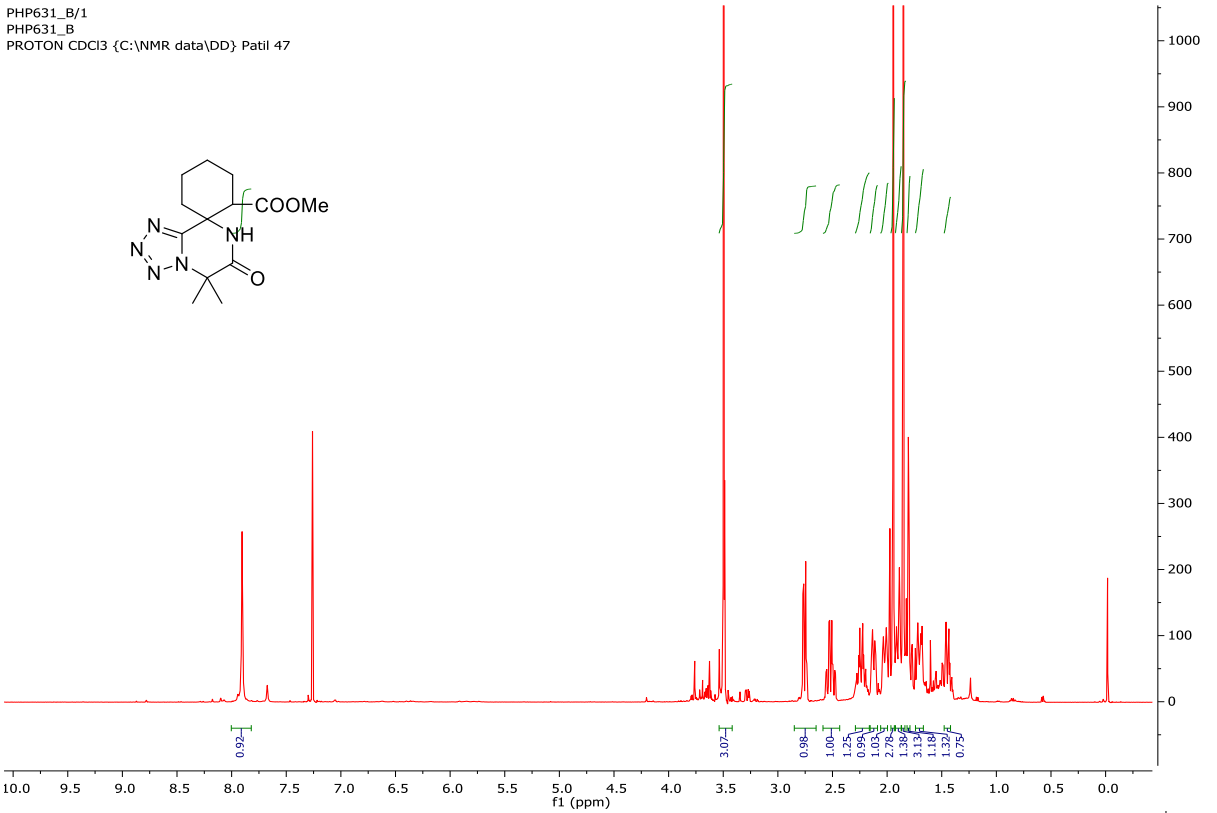


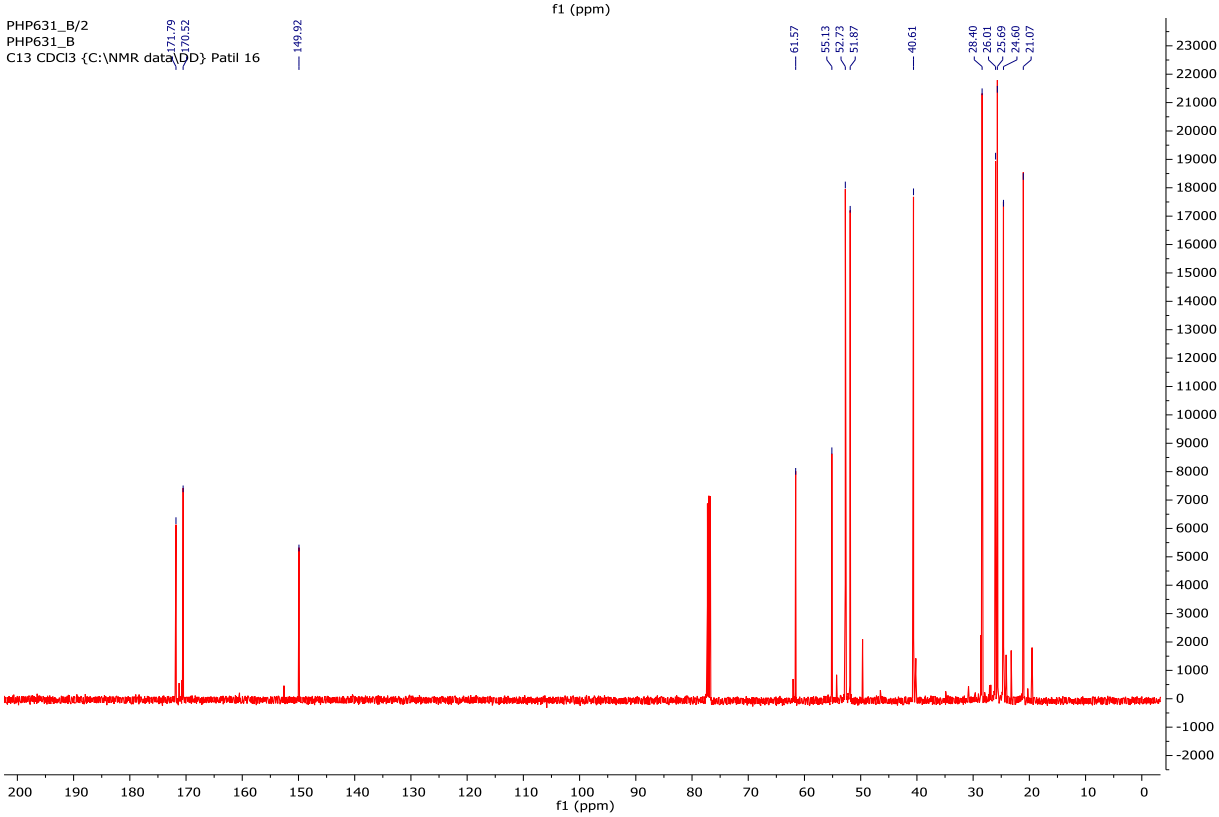
PHP632_1_Col3_Sol1_5-30%_6min



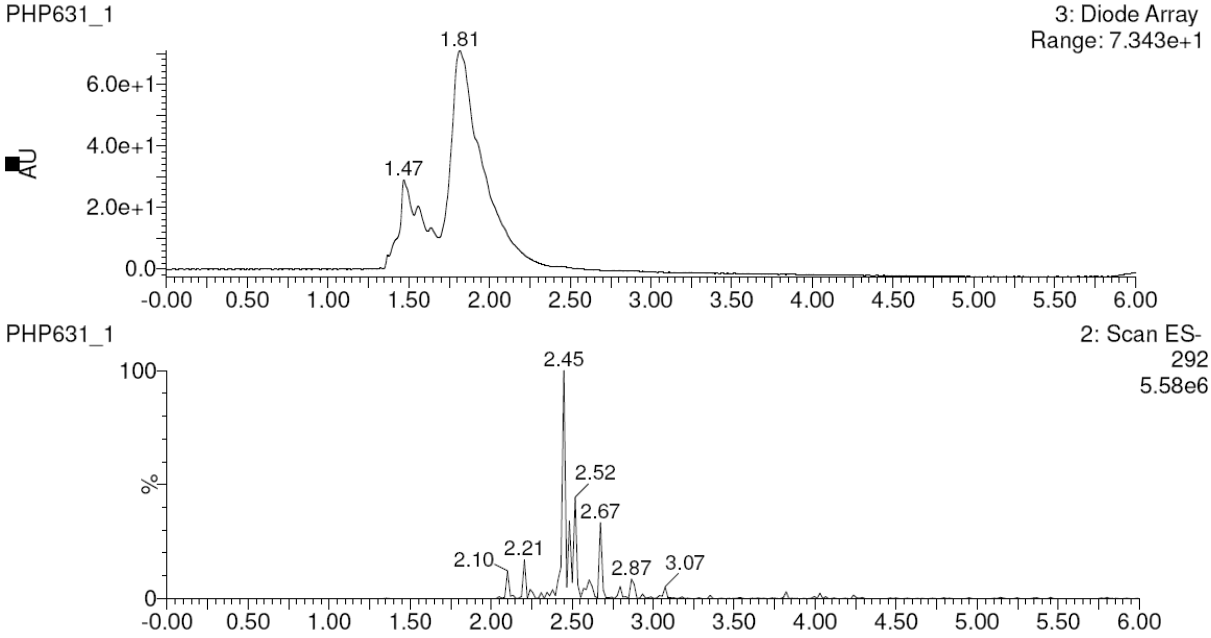
Chemical Formula: $C_{12}H_{19}N_5O$
Exact Mass: 249.16

25c: methyl 5',5'-dimethyl-6'-oxo-6',7'-dihydro-5'H-spiro[cyclohexane-1,8'-tetrazolo[1,5-a]pyrazine]-2-carboxylate

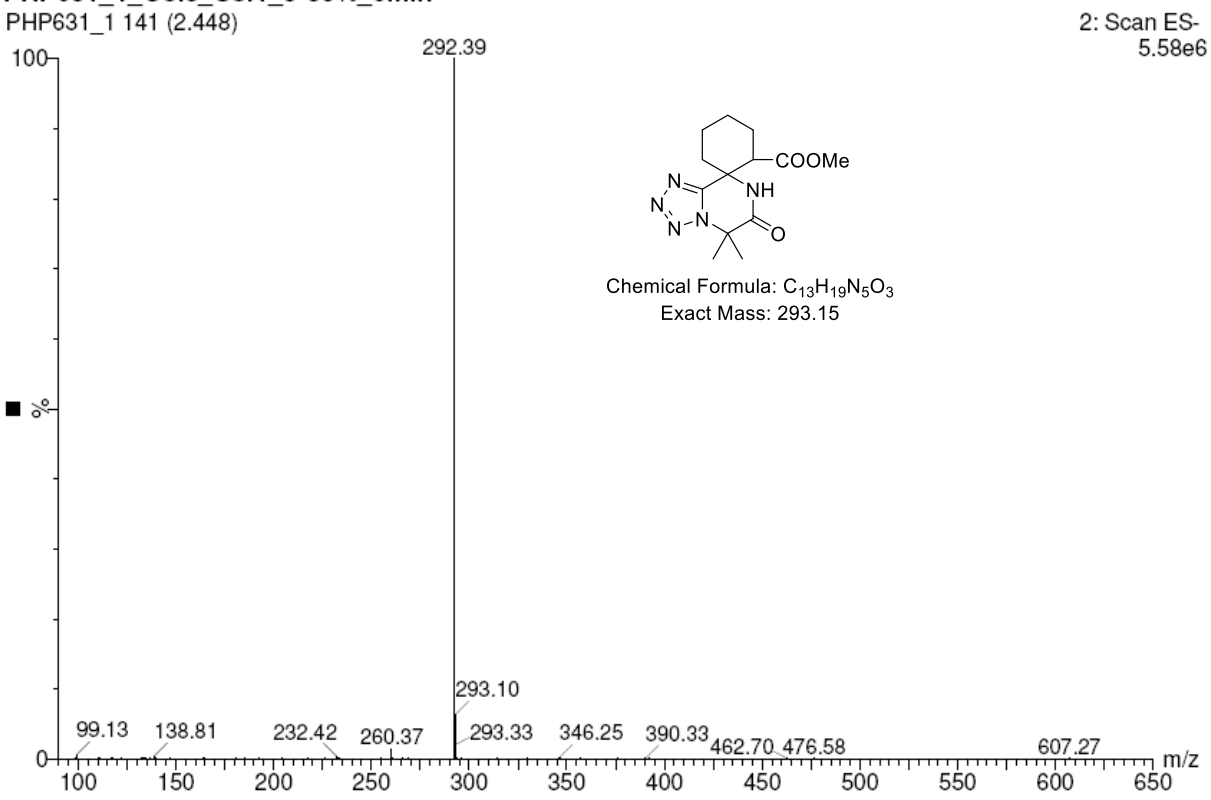




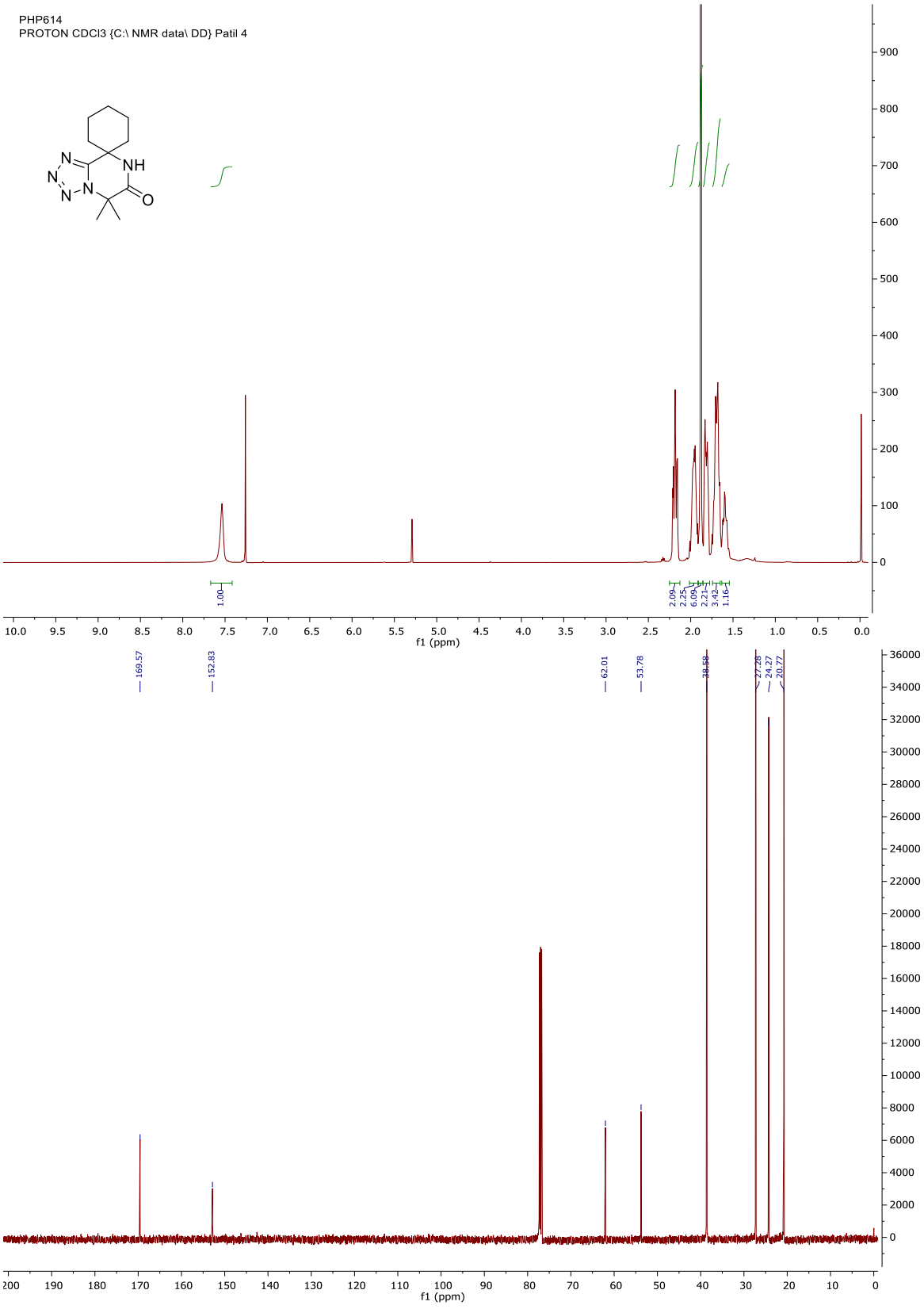
PHP631_1_Col3_Sol1_5-30%_6min



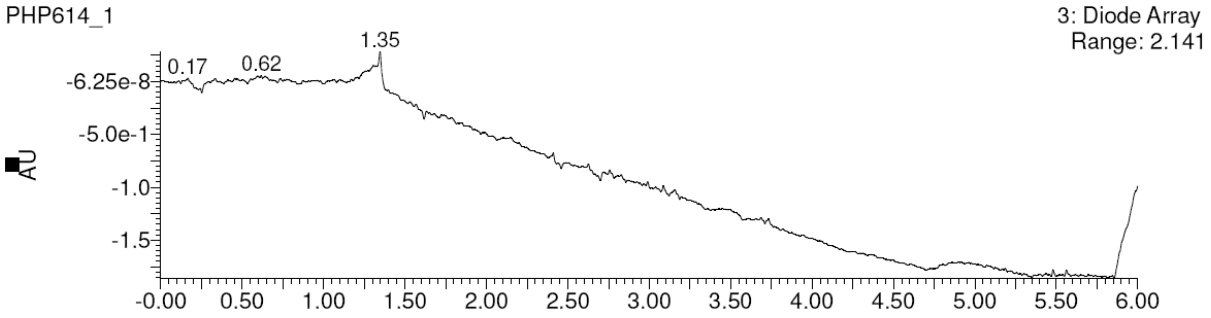
PHP631_1_Col3_Sol1_5-30%_6min

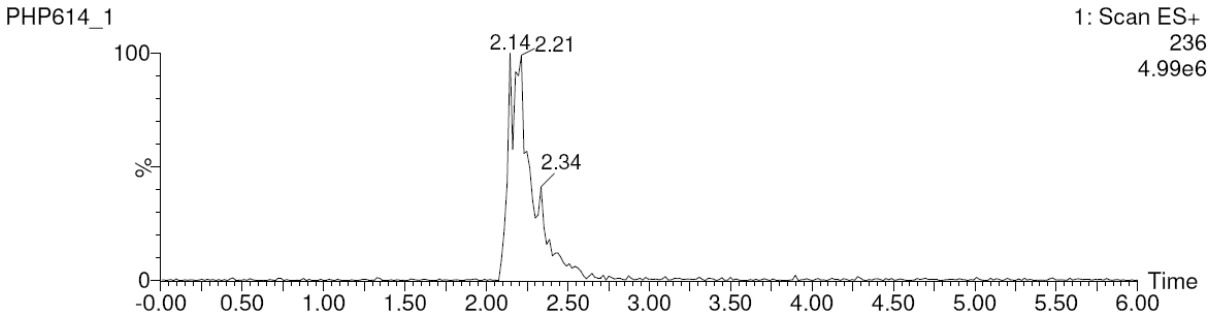


26c: 5',5'-dimethyl-5'H-spiro[cyclohexane-1,8'-tetrazolo[1,5-a]pyrazin]-6'(7'H)-one

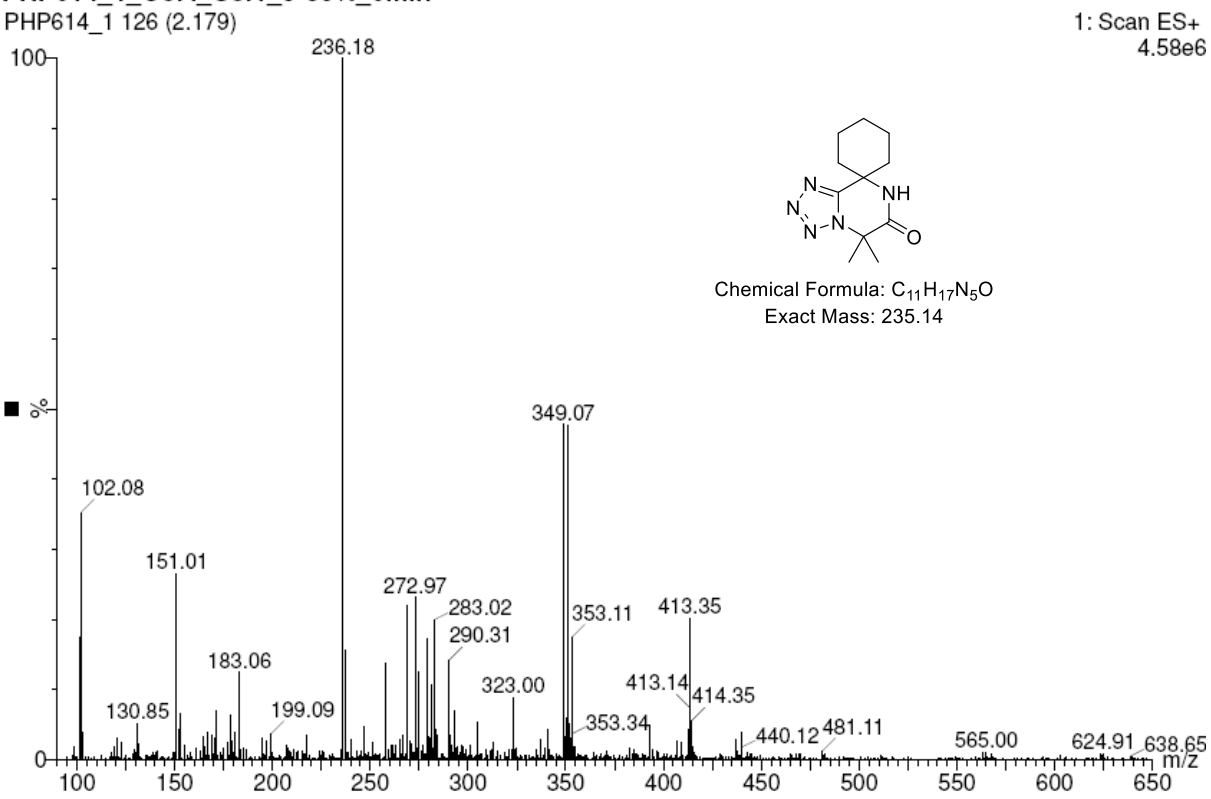


PHP614_1_Col4_Sol1_5-30%_6min



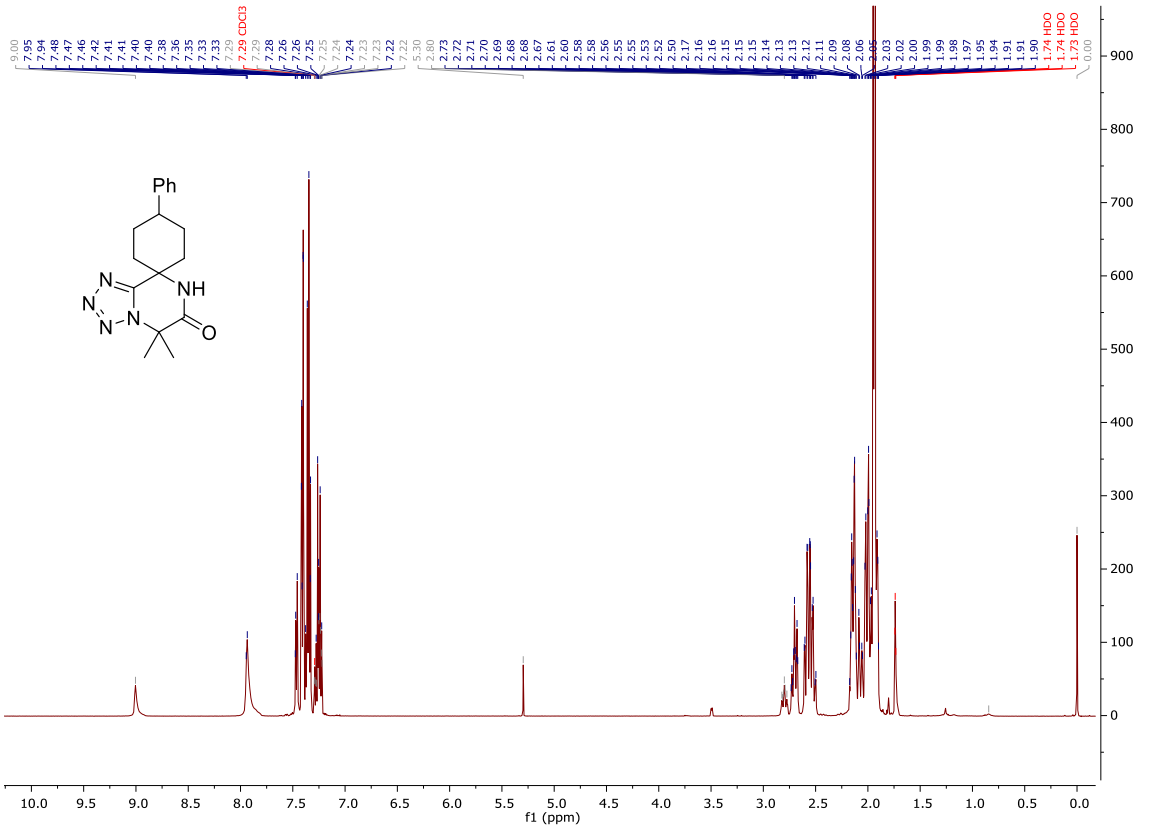


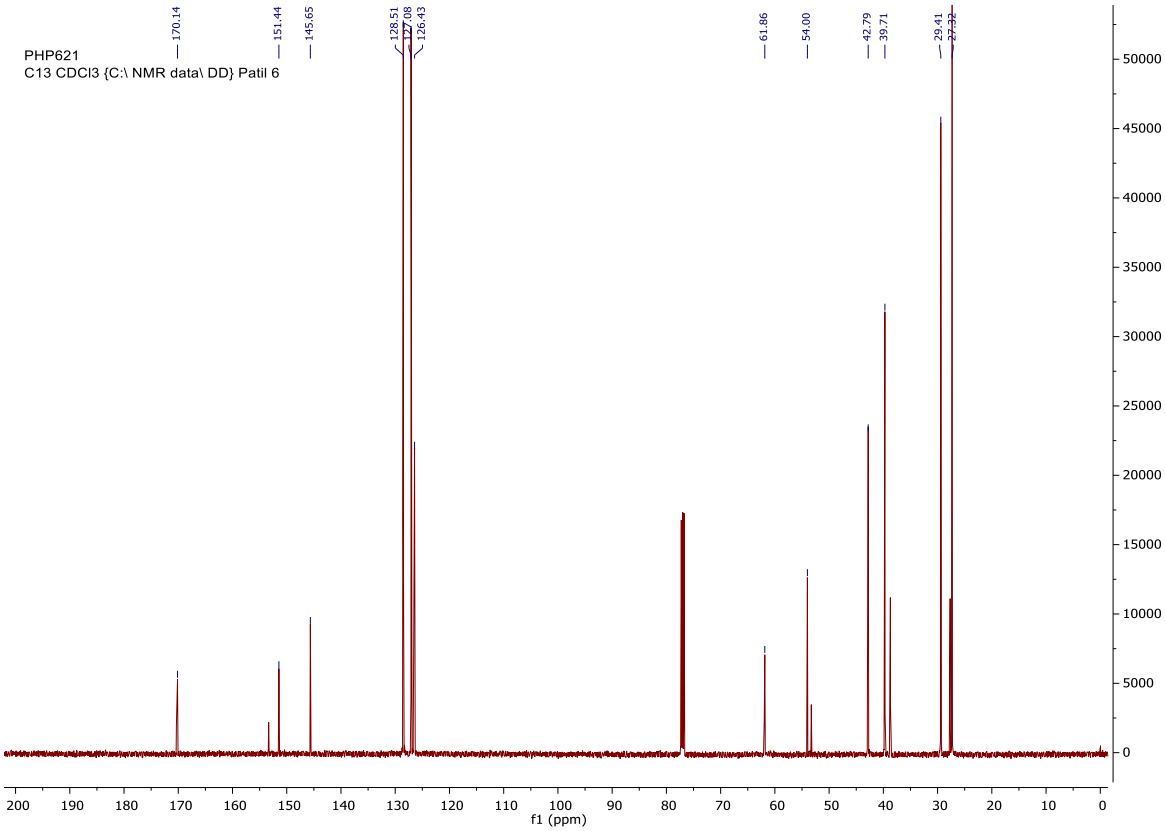
PHP614_1_Col4_Sol1_5-30%_6min

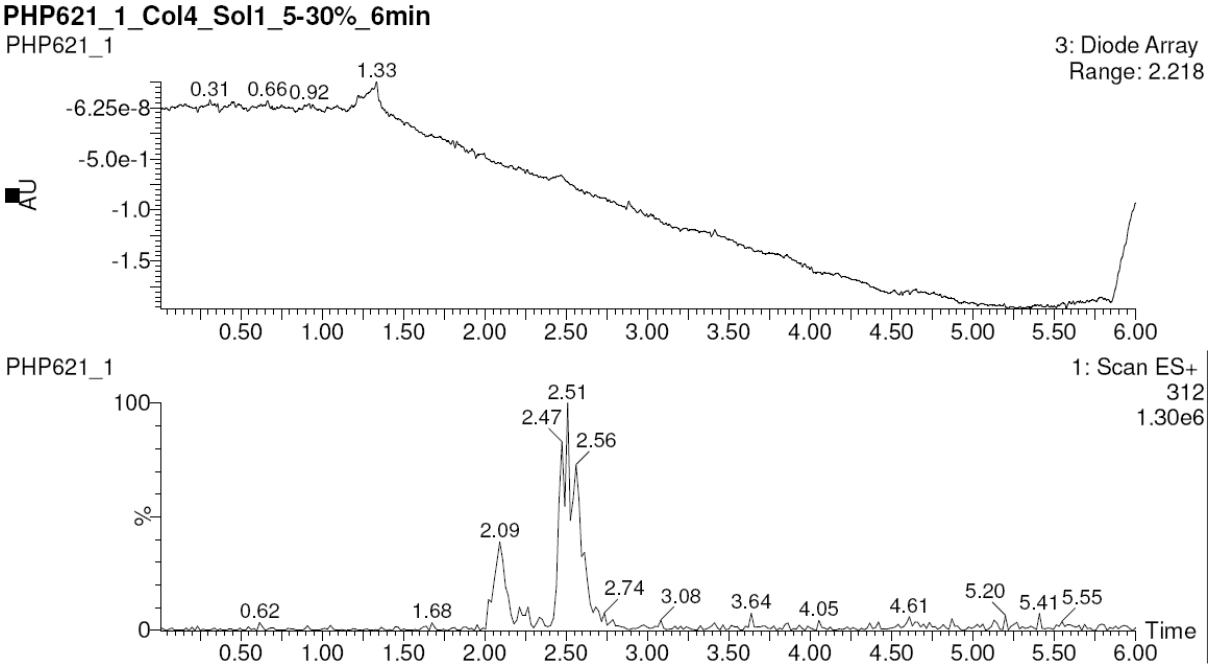


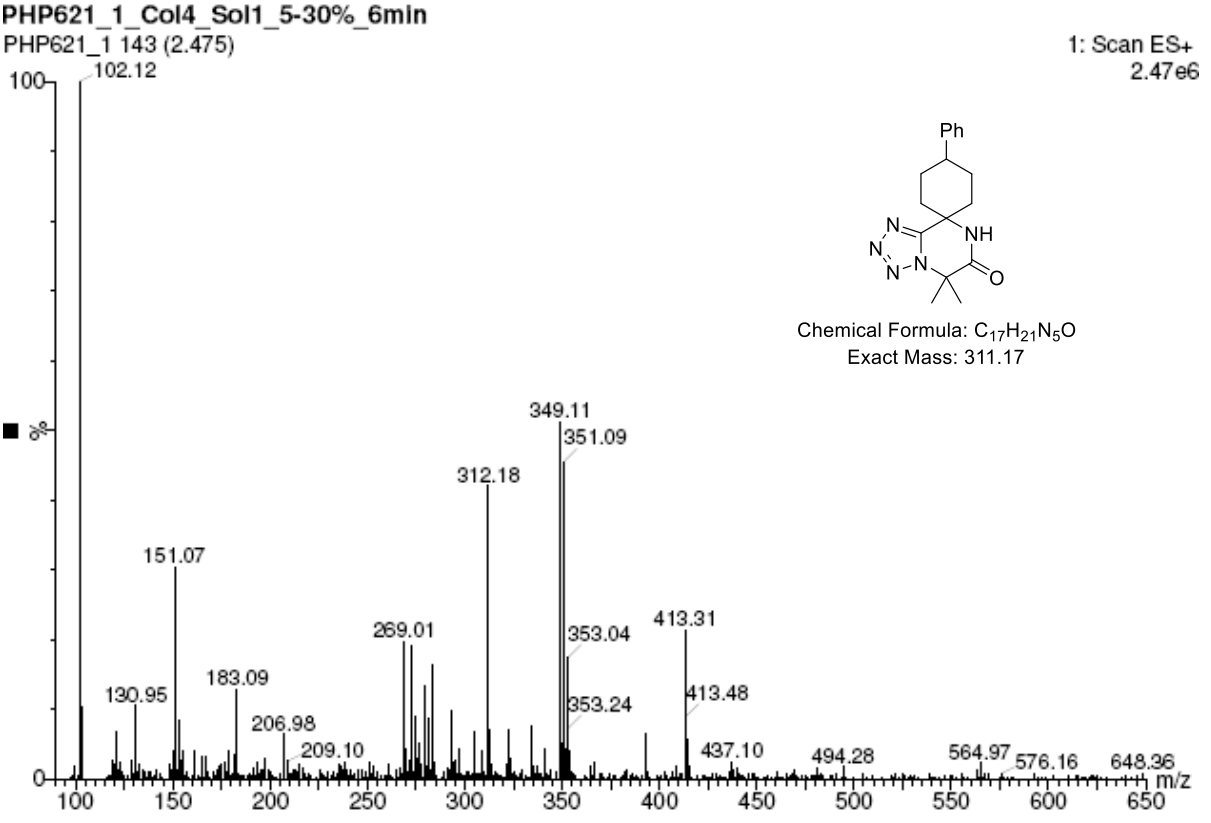
Chemical Formula: $C_{11}H_{17}N_5O$
Exact Mass: 235.14

27c: 27c: 5',5'-dimethyl-4-phenyl-5'H-spiro[cyclohexane-1,8'-tetrazolo[1,5-a]pyrazin]-6'(7'H)-one



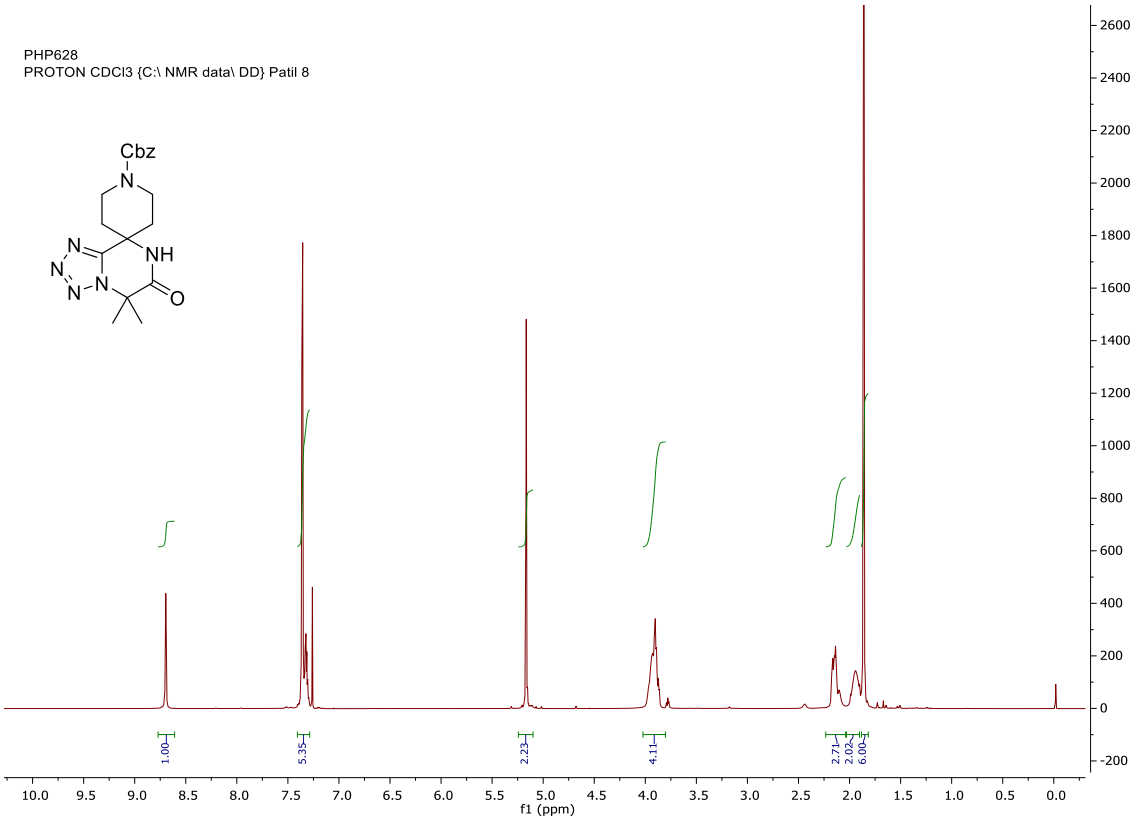


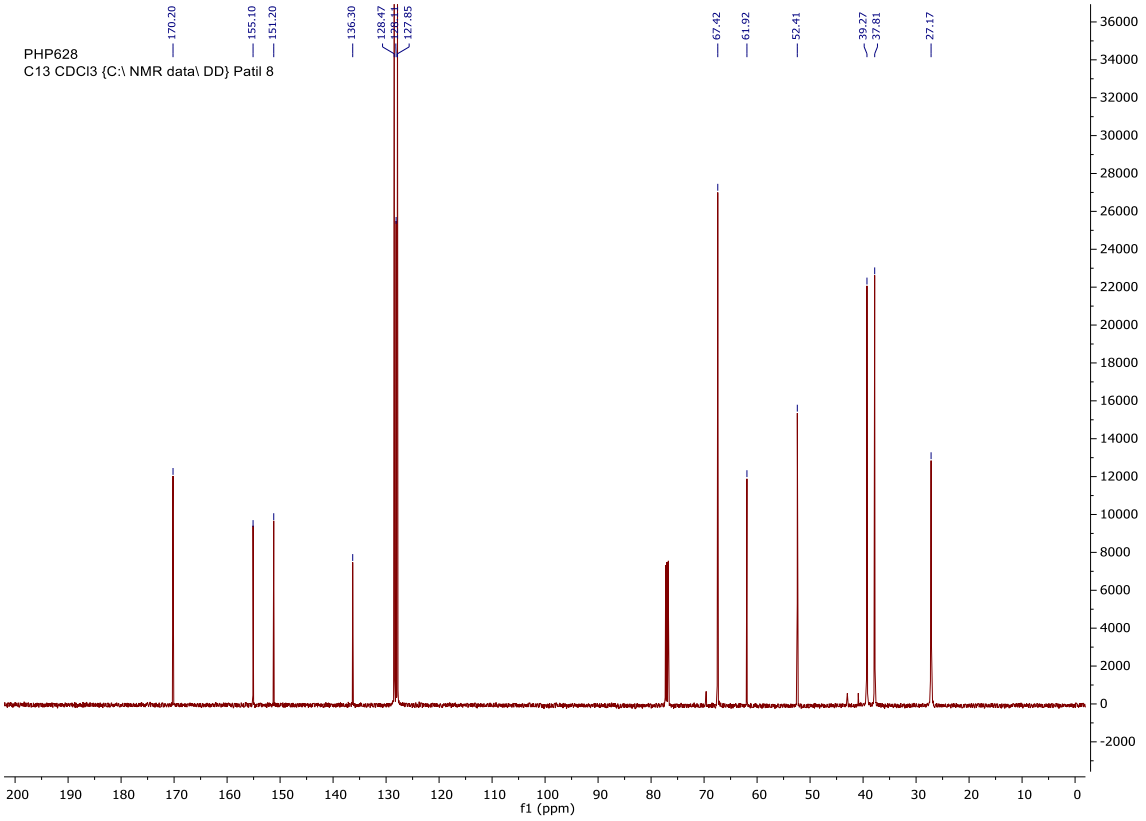


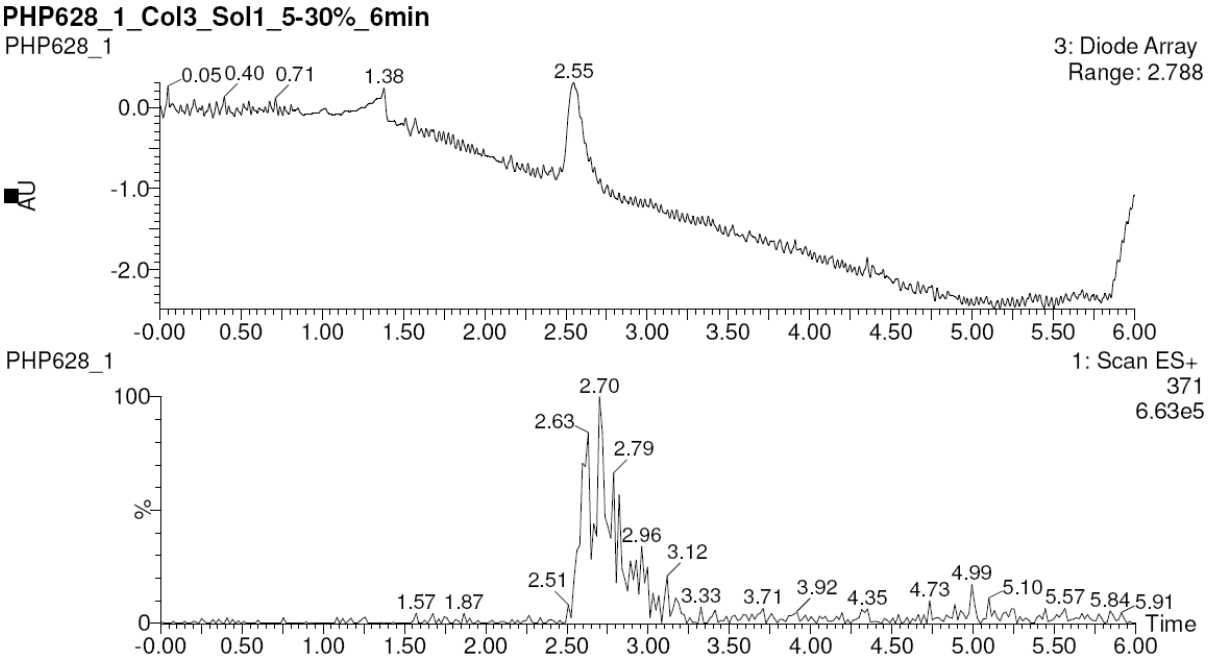


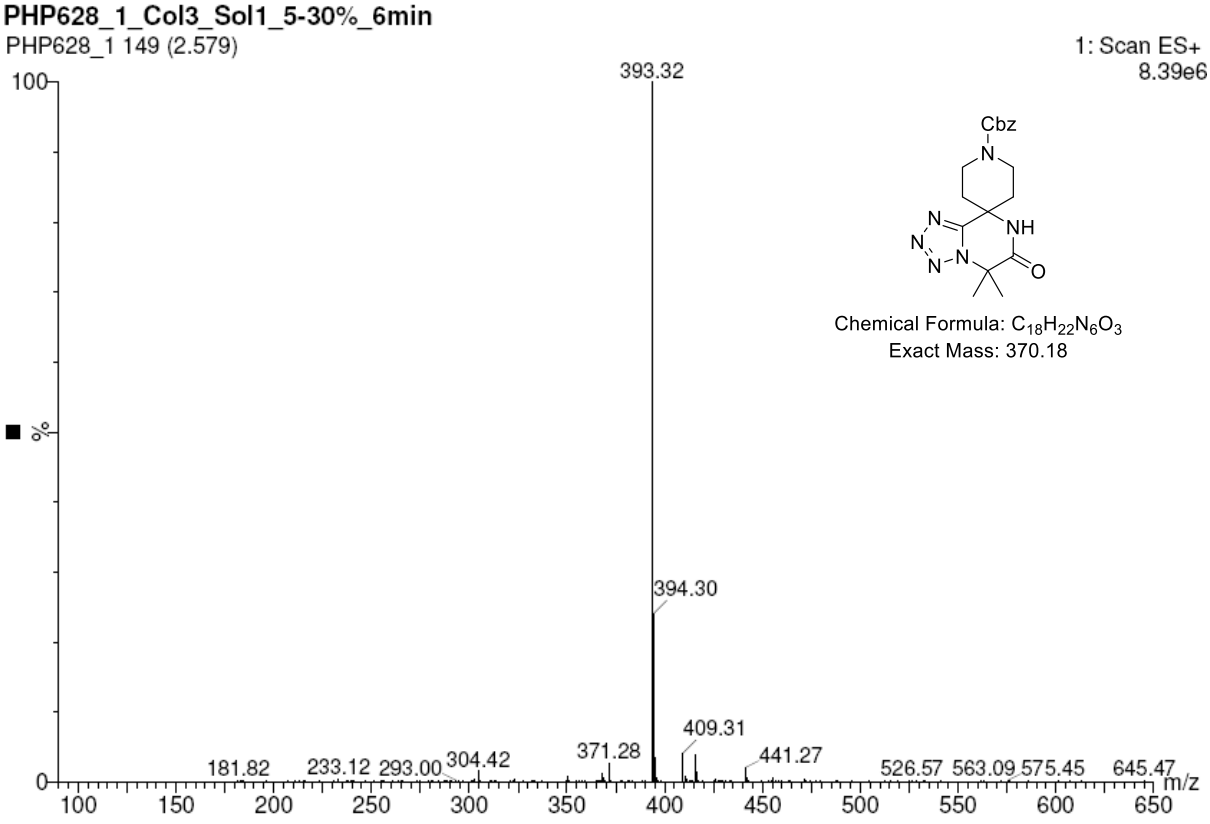
Chemical Formula: $C_{17}H_{21}N_5O$
Exact Mass: 311.17

28c: benzyl 5',5'-dimethyl-6'-oxo-6',7'-dihydro-5'H-spiro[piperidine-4,8'-tetrazolo[1,5-a]pyrazine]-1-carboxylate

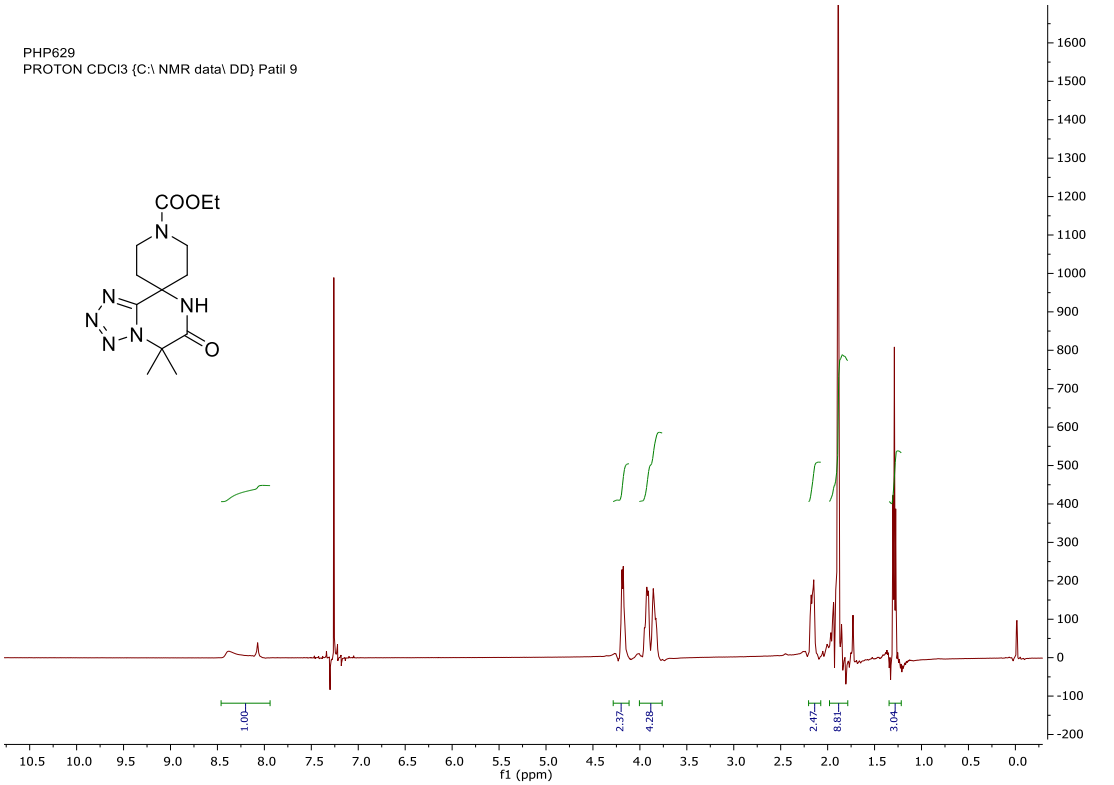


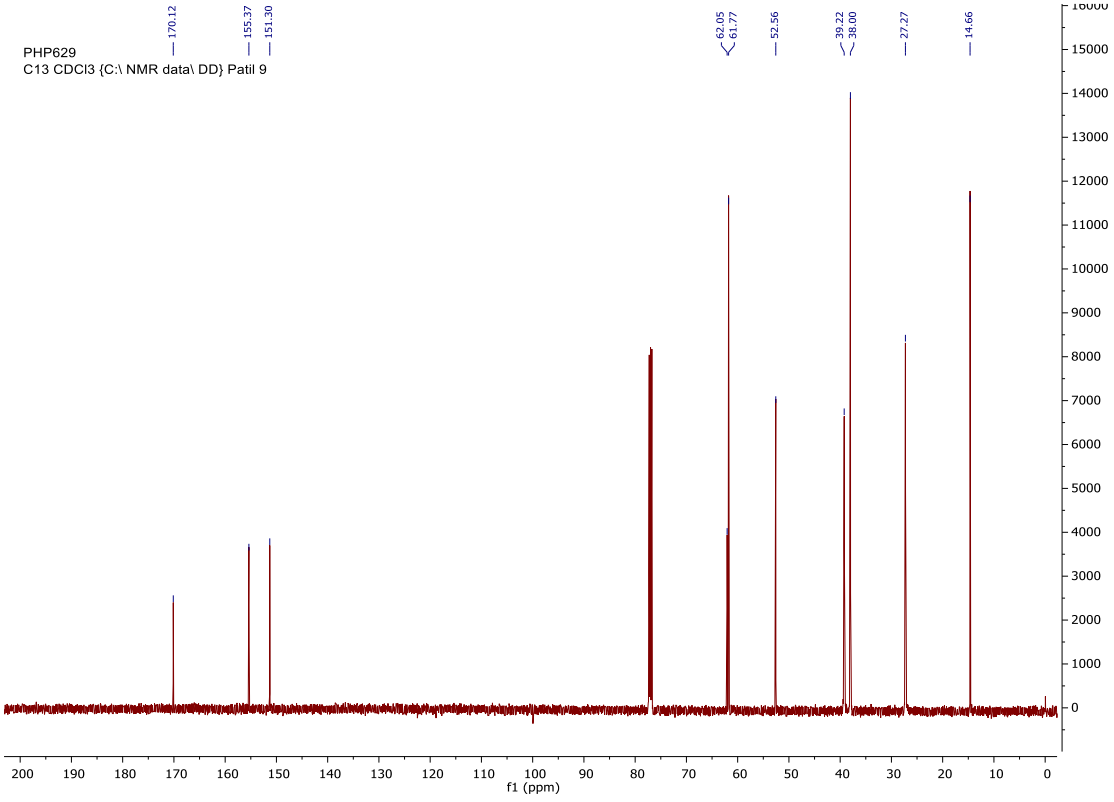



PHP628_1_Col3_Sol1_5-30%_6min
PHP628_1
3: Diode Array
Range: 2.788
0.05
0.40
0.71
1.38
2.55
AU
PHP628_1
1: Scan ES+
371
6.63e5
2.70
2.63
2.79
2.96
3.12
2.51
1.57
1.87
3.33
3.71
3.92
4.35
4.73
4.99
5.10
5.57
5.84
5.91
%
Time

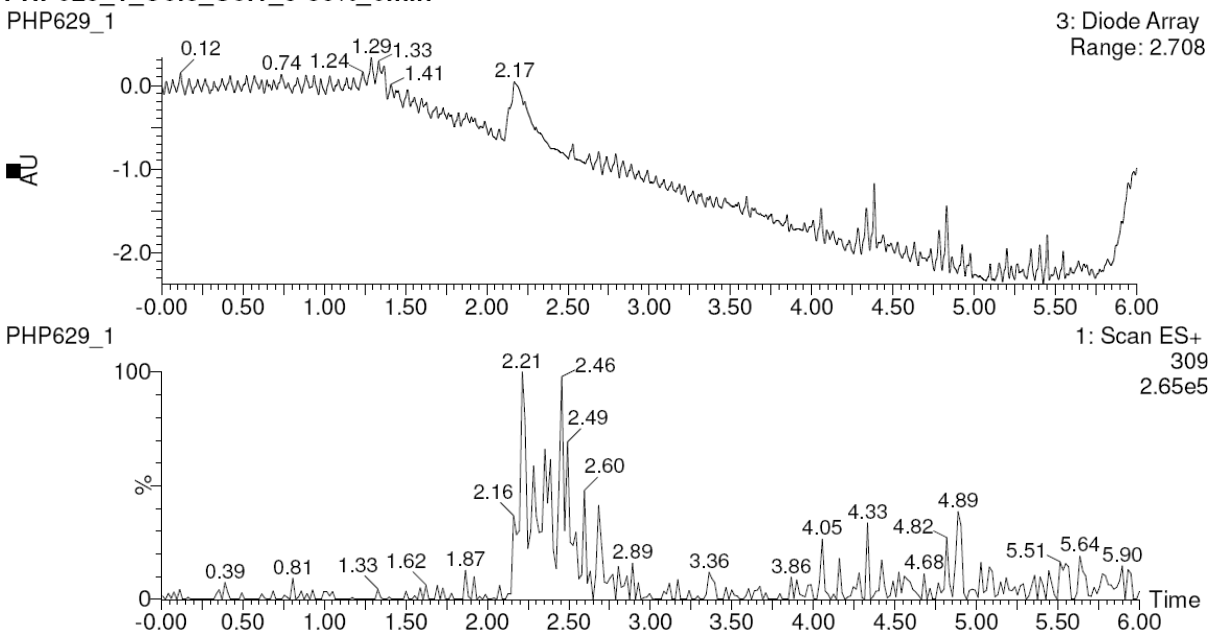

PHP628_1_Col3_Sol1_5-30%_6min
PHP628_1 149 (2.579)
1: Scan ES+
8.39e6
393.32
394.30
409.31
371.28
441.27
181.82
233.12
293.00
304.42
526.57
563.09
575.45
645.47
%
m/z
Cbz
NH
O
Chemical Formula: C18H22N6O3
Exact Mass: 370.18

29c: ethyl 5',5'-dimethyl-6'-oxo-6',7'-dihydro-5'H-spiro[piperidine-4,8'-tetrazolo[1,5-a]pyrazine]-1-carboxylate

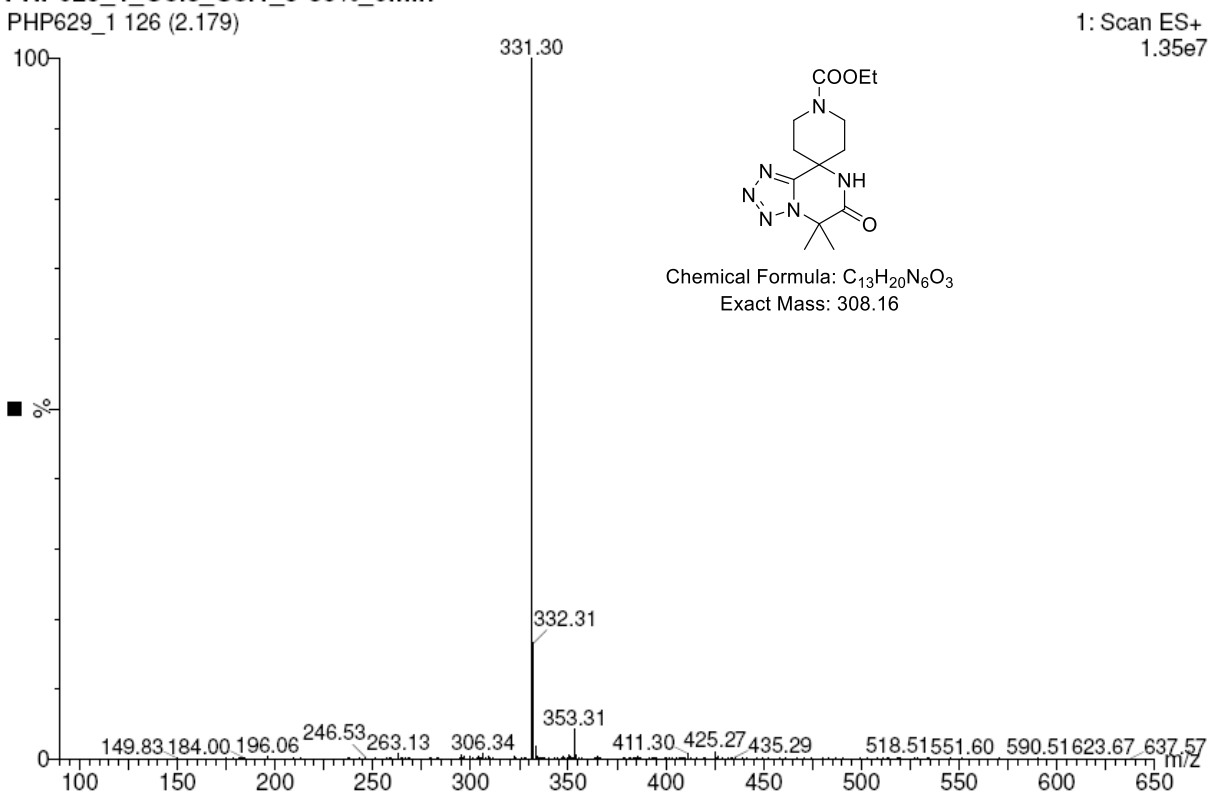




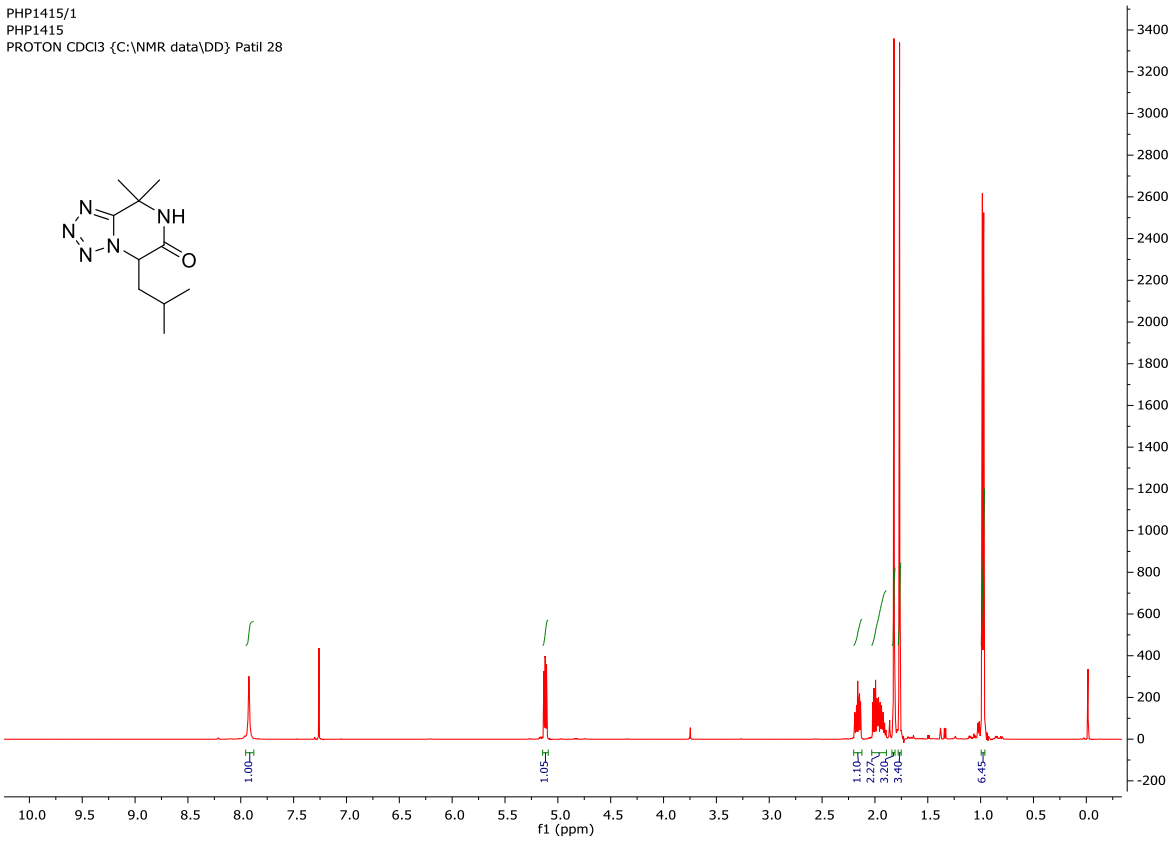
PHP629_1_Col3_Sol1_5-30%_6min

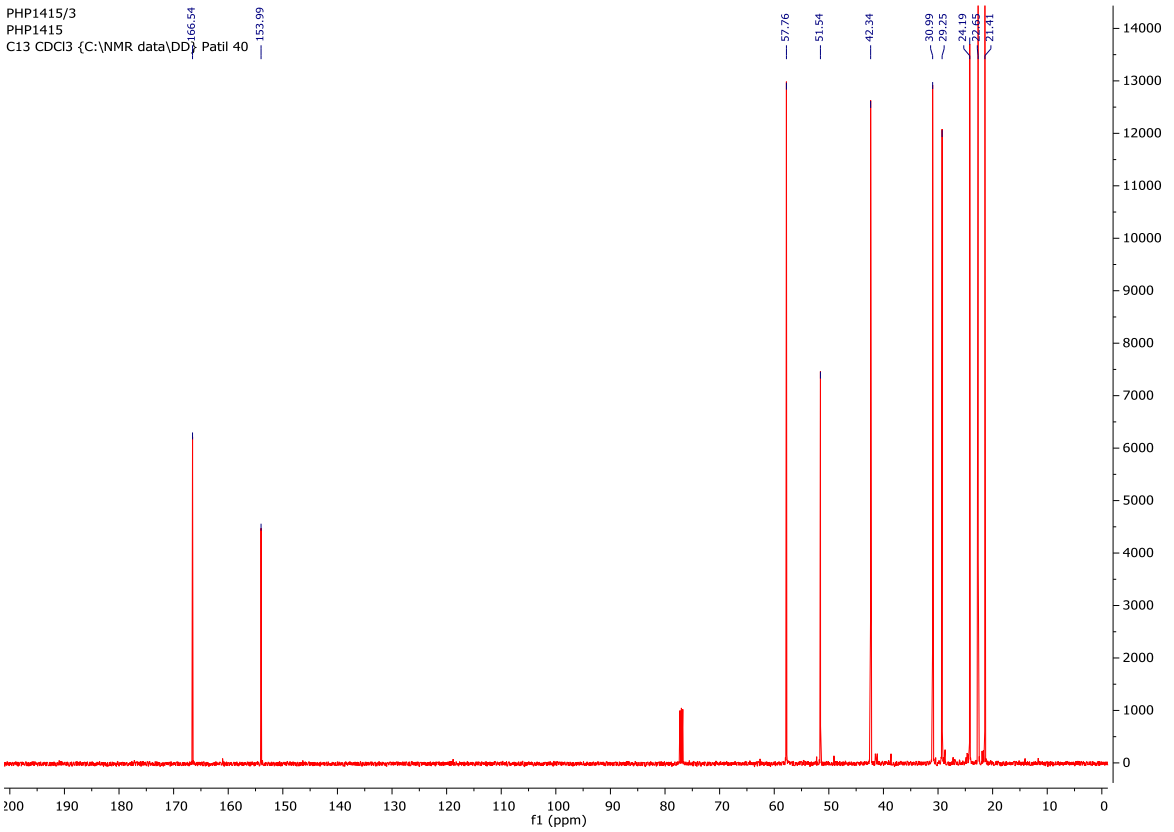


PHP629_1_Col3_Sol1_5-30%_6min

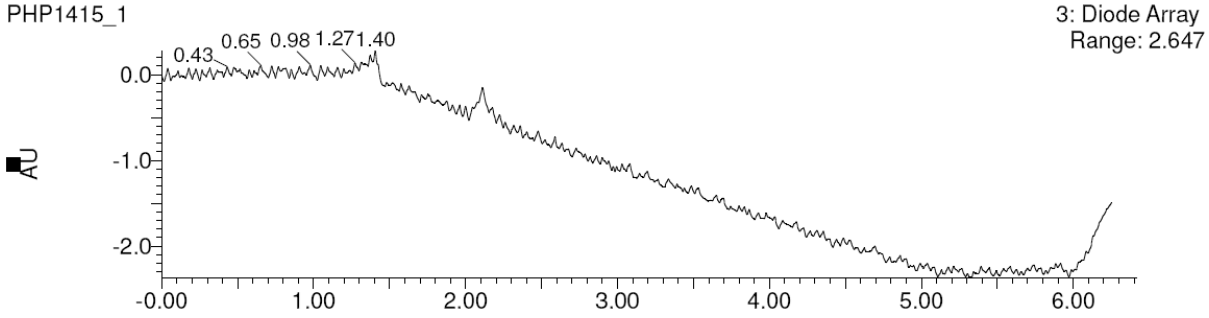


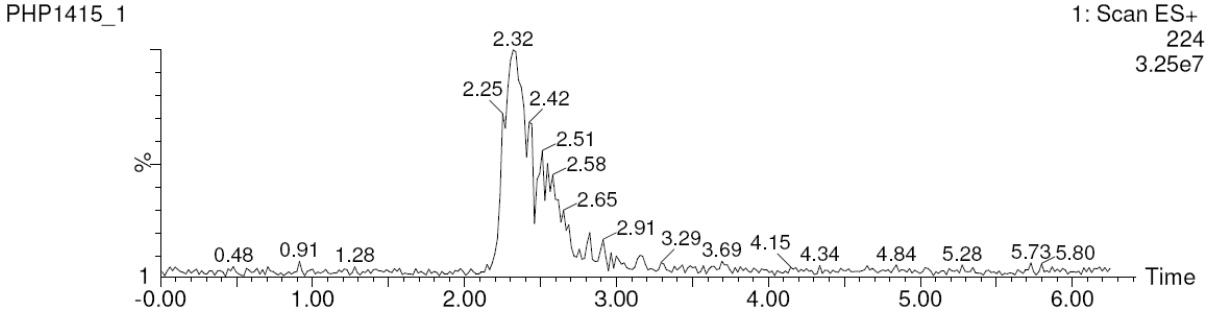
36c: 5-isobutyl-8,8-dimethyl-7,8-dihydrotetrazolo[1,5-a]pyrazin-6(5H)-one

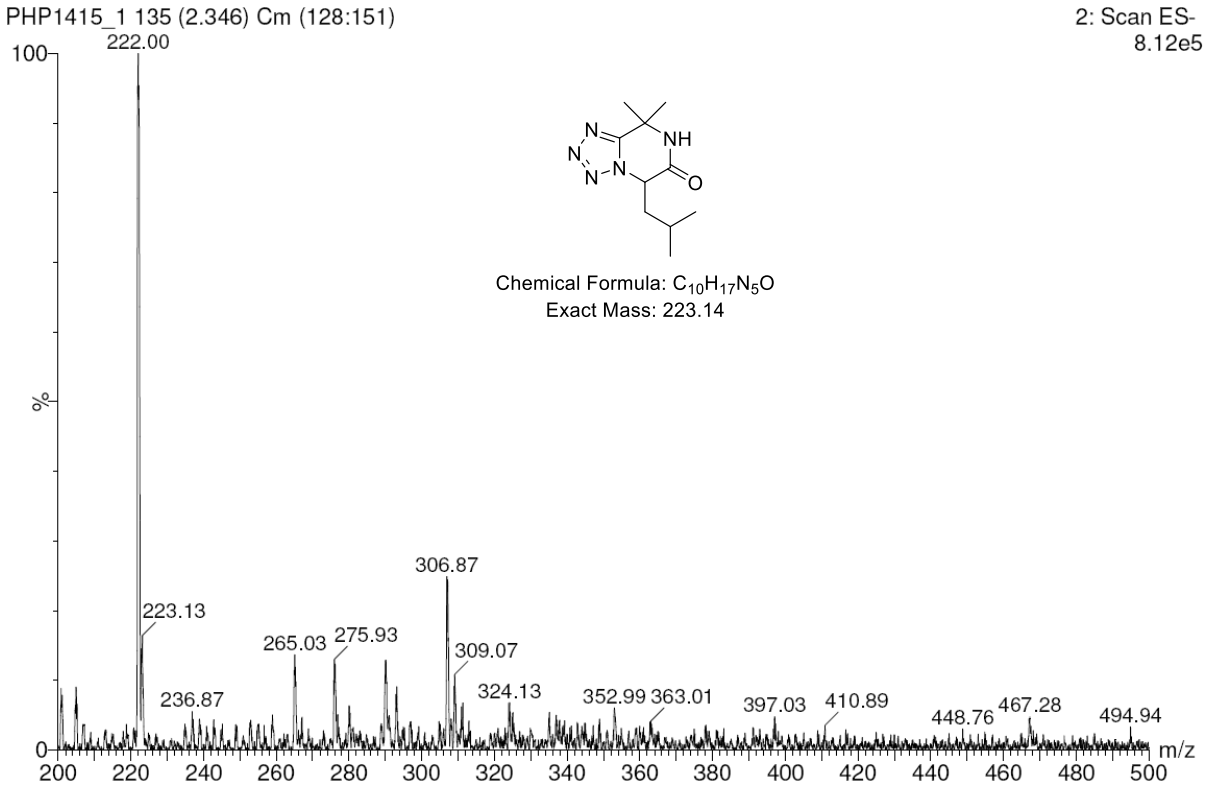




PHP1415_1_Col3_Sol1_5-30%_6min

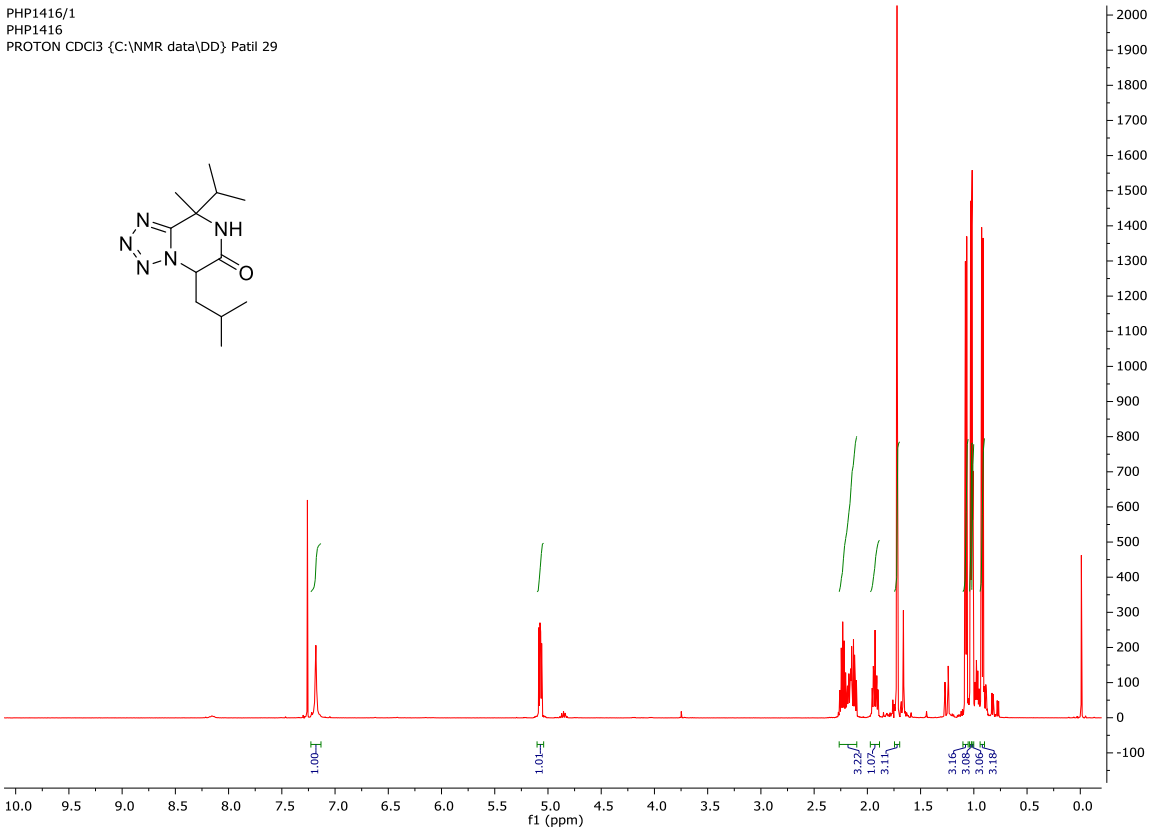


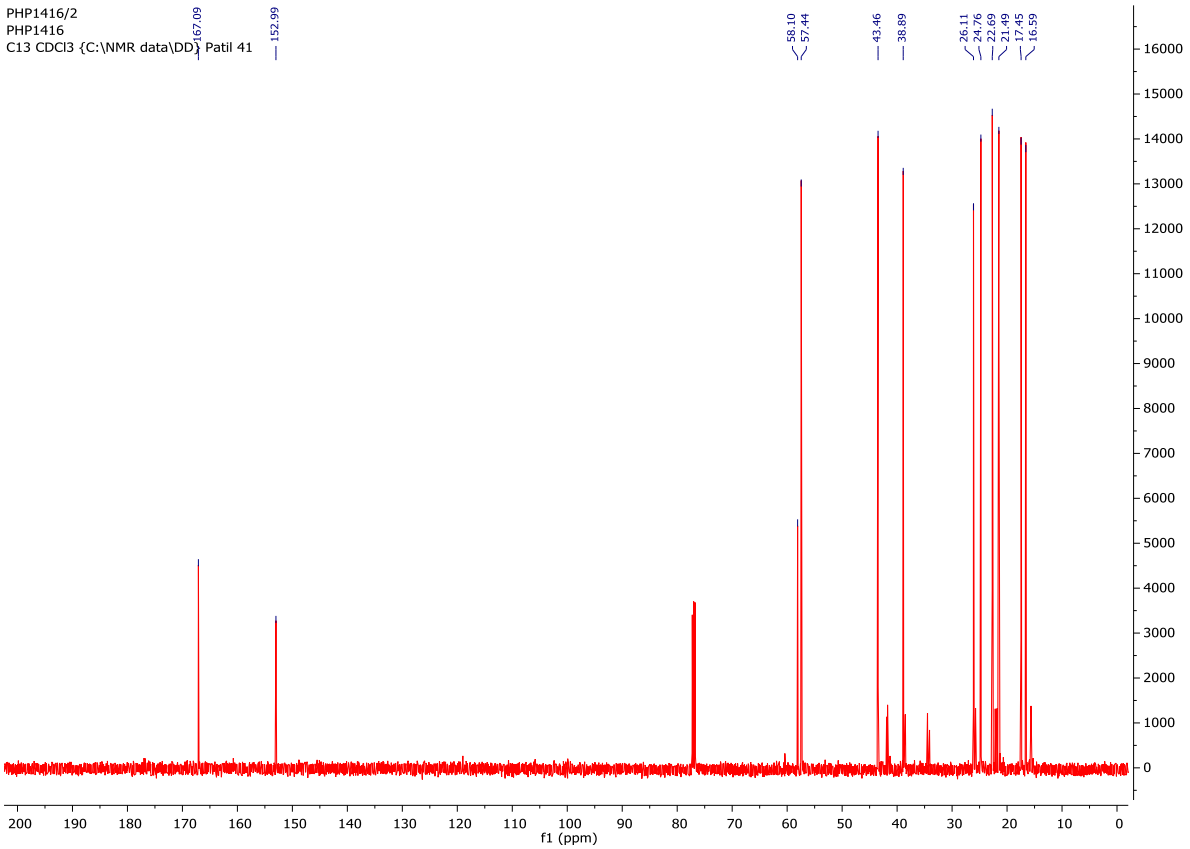




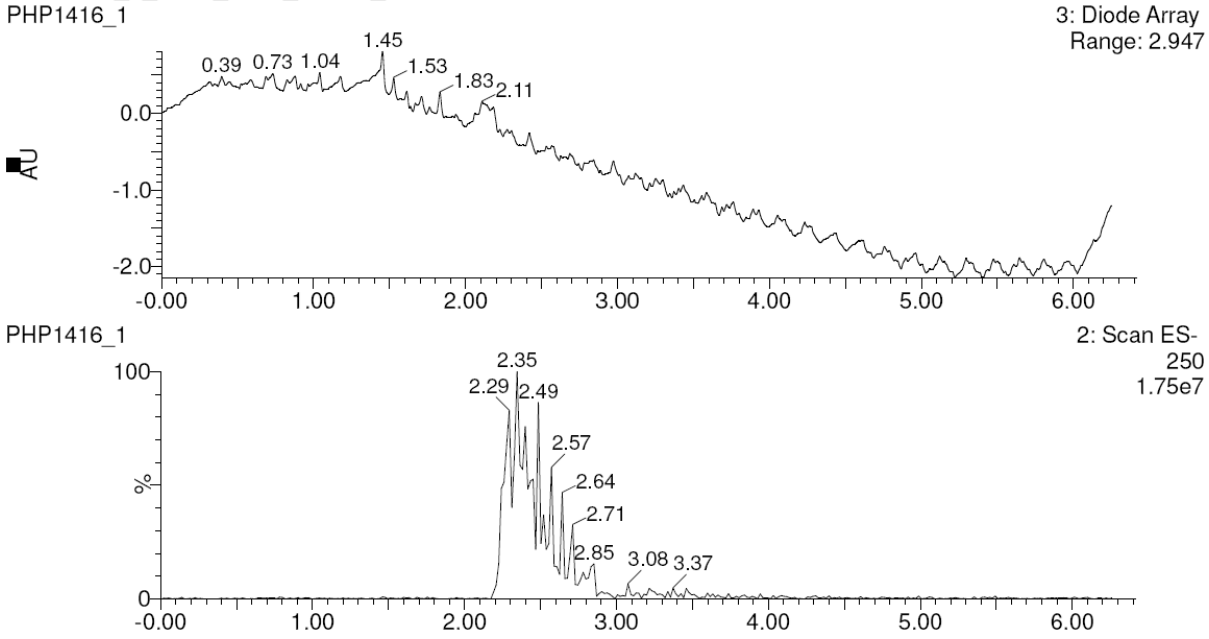
Chemical Formula: $C_{10}H_{17}N_5O$
Exact Mass: 223.14

37c: 37c: 5-isobutyl-8-isopropyl-8-methyl-7,8-dihydrotetrazolo[1,5-a]pyrazin-6(5H)-one

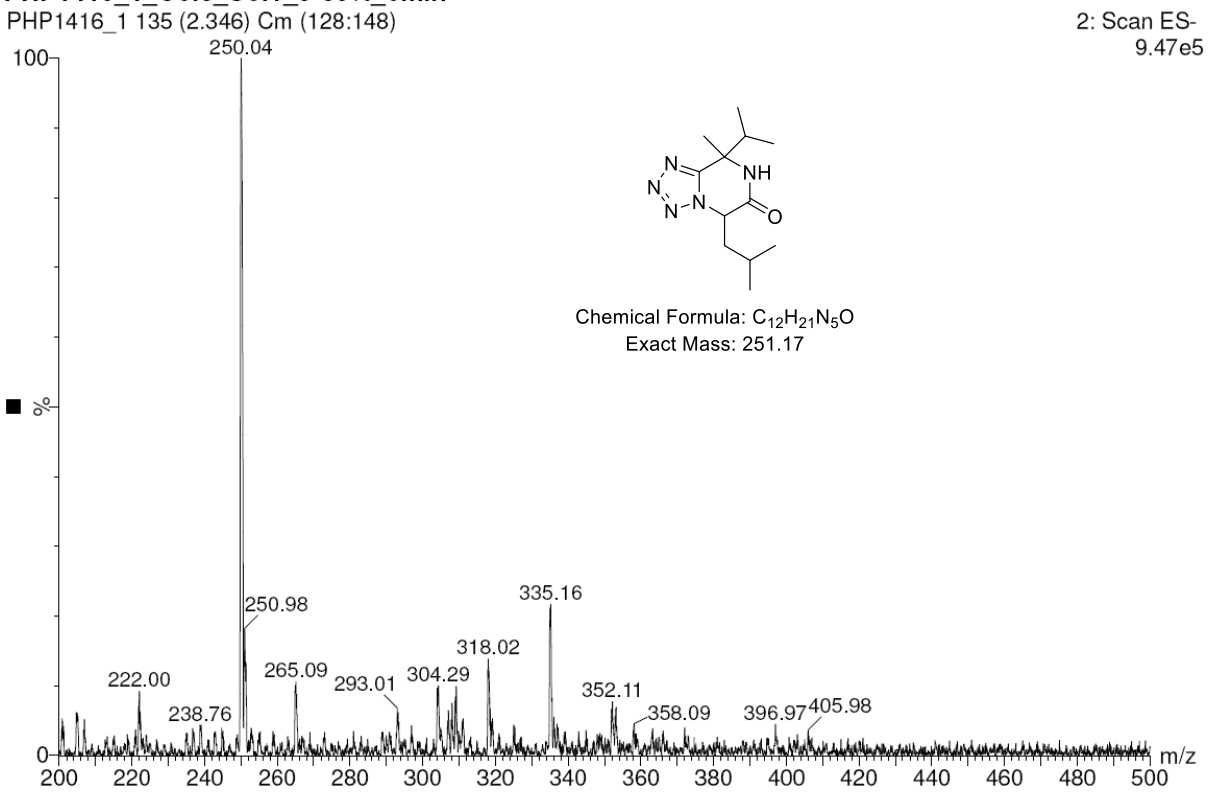




PHP1416_1_Col3_Sol1_5-30%_6min

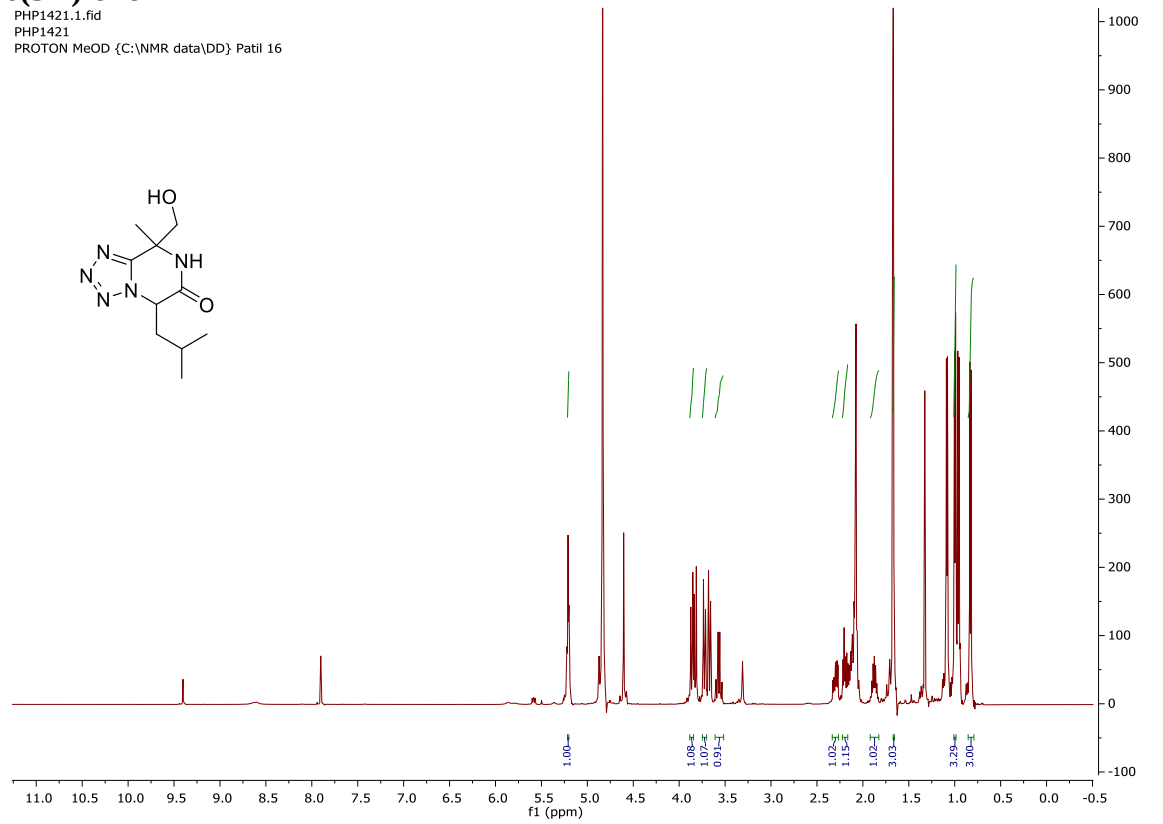


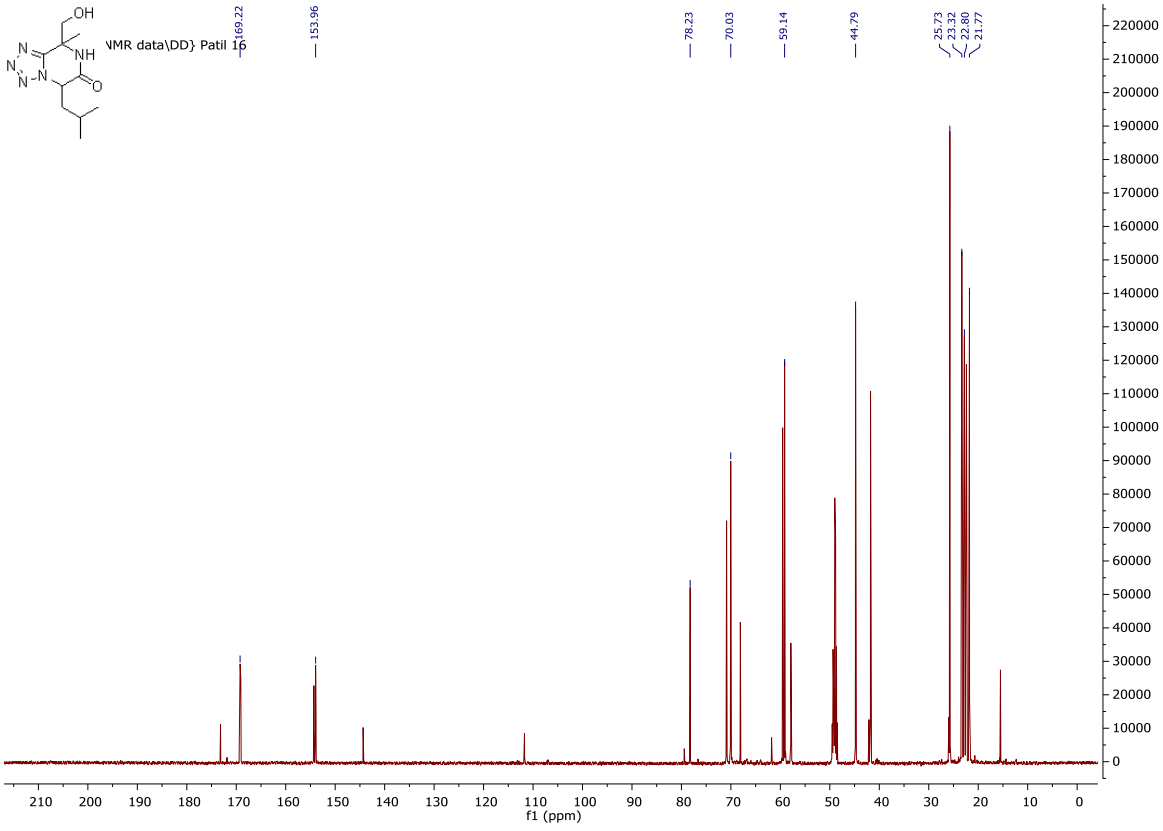
PHP1416_1_Col3_Sol1_5-30%_6min



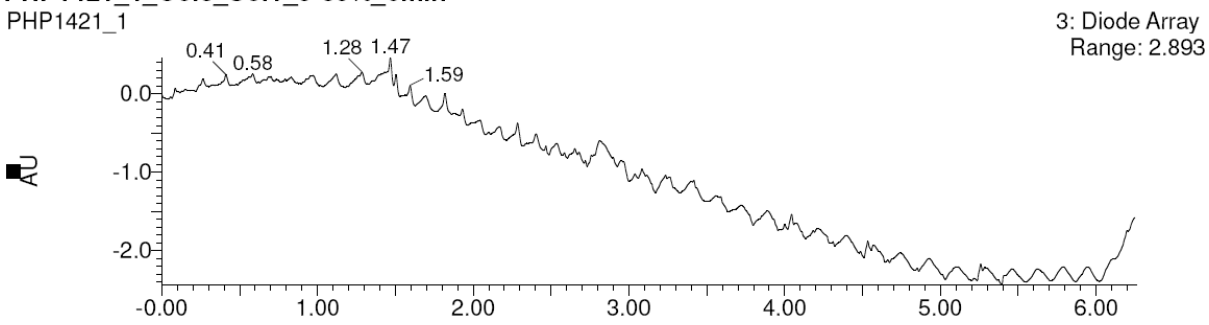
Chemical Formula: $C_{12}H_{21}N_5O$
Exact Mass: 251.17

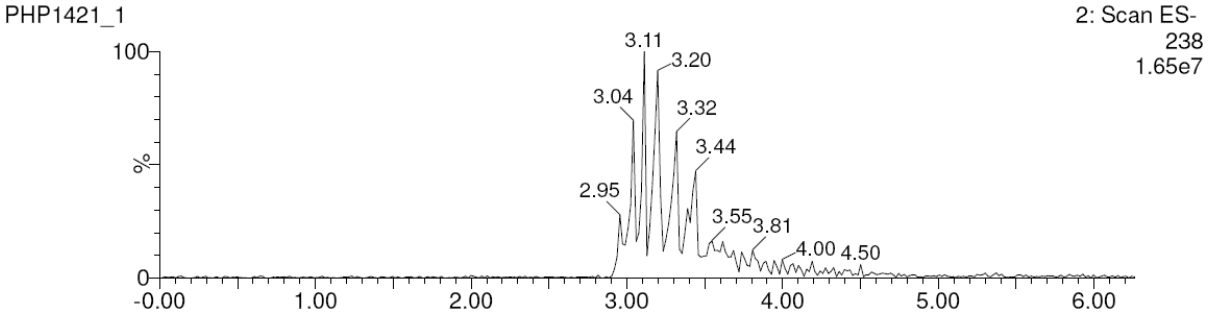
38c: 38c: 8-(hydroxymethyl)-5-isobutyl-8-methyl-7,8-dihydrotetrazolo[1,5-a]pyrazin-6(5H)-one

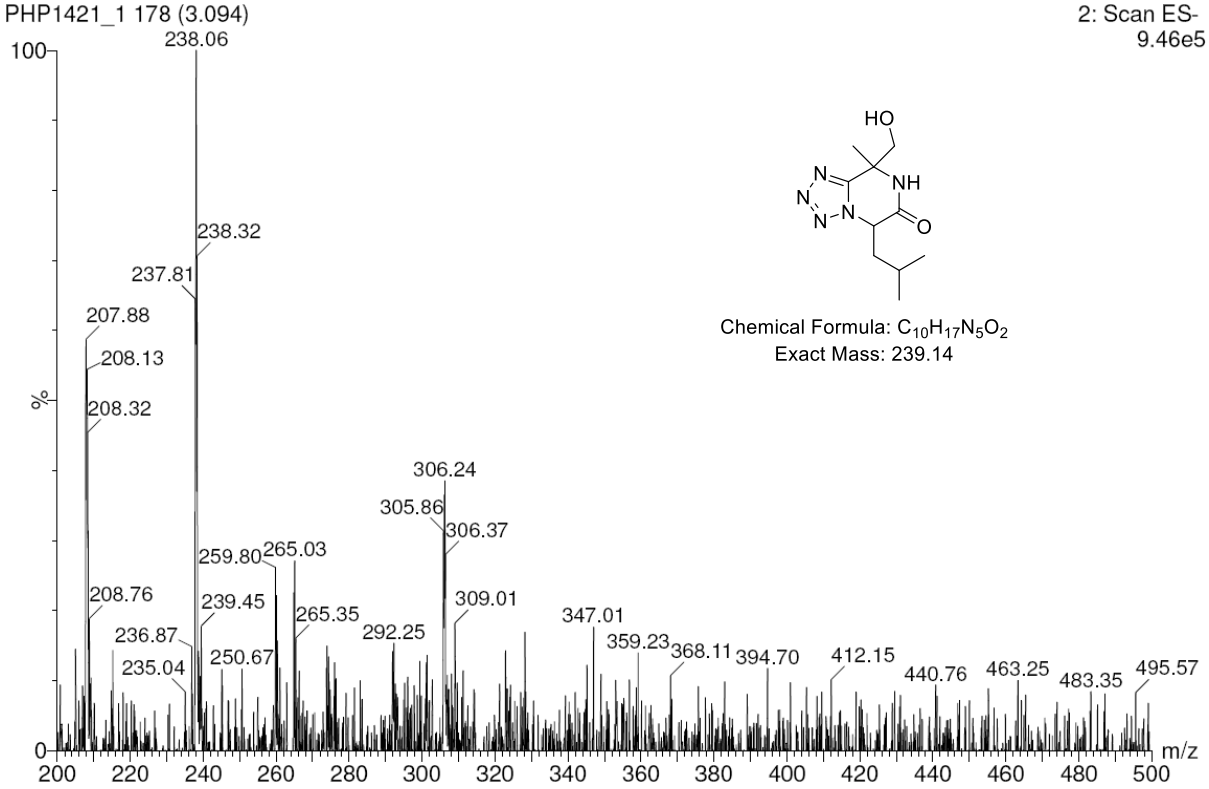




PHP1421_1_Col3_Sol1_5-30%_6min

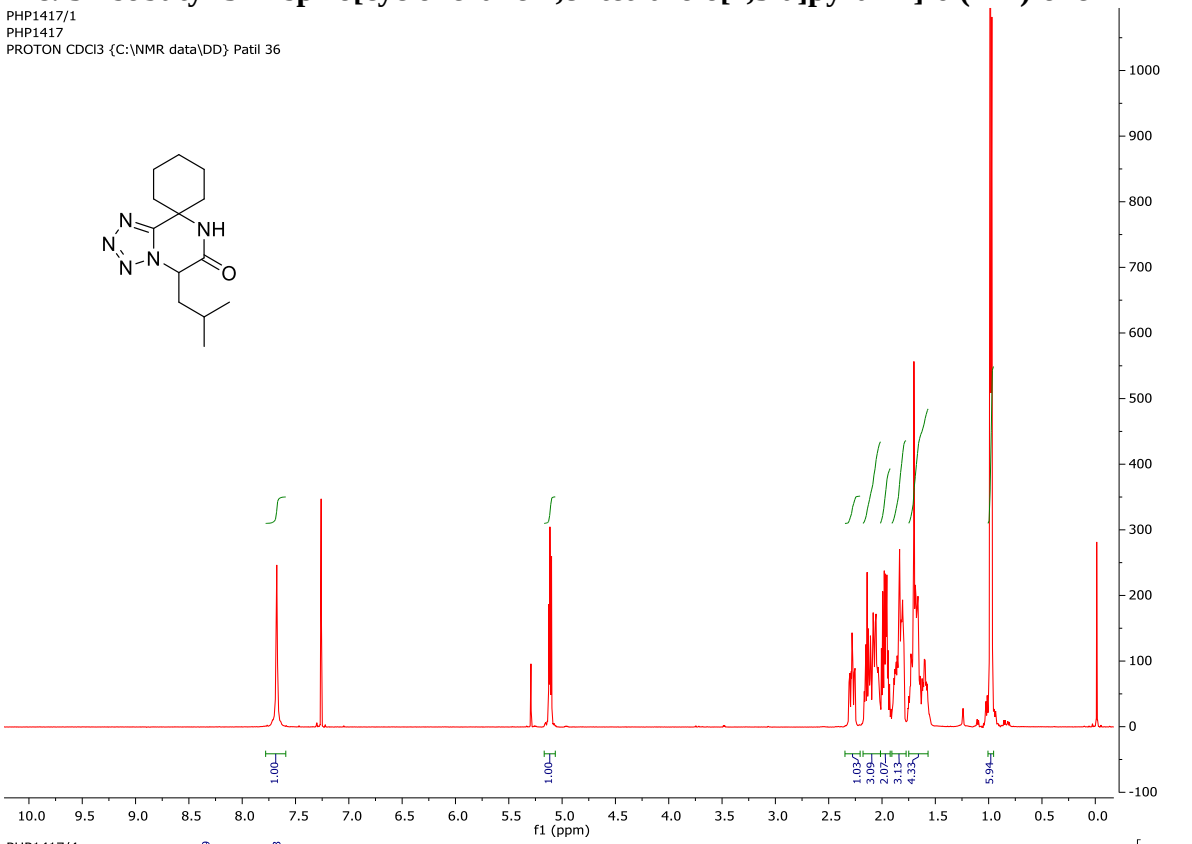


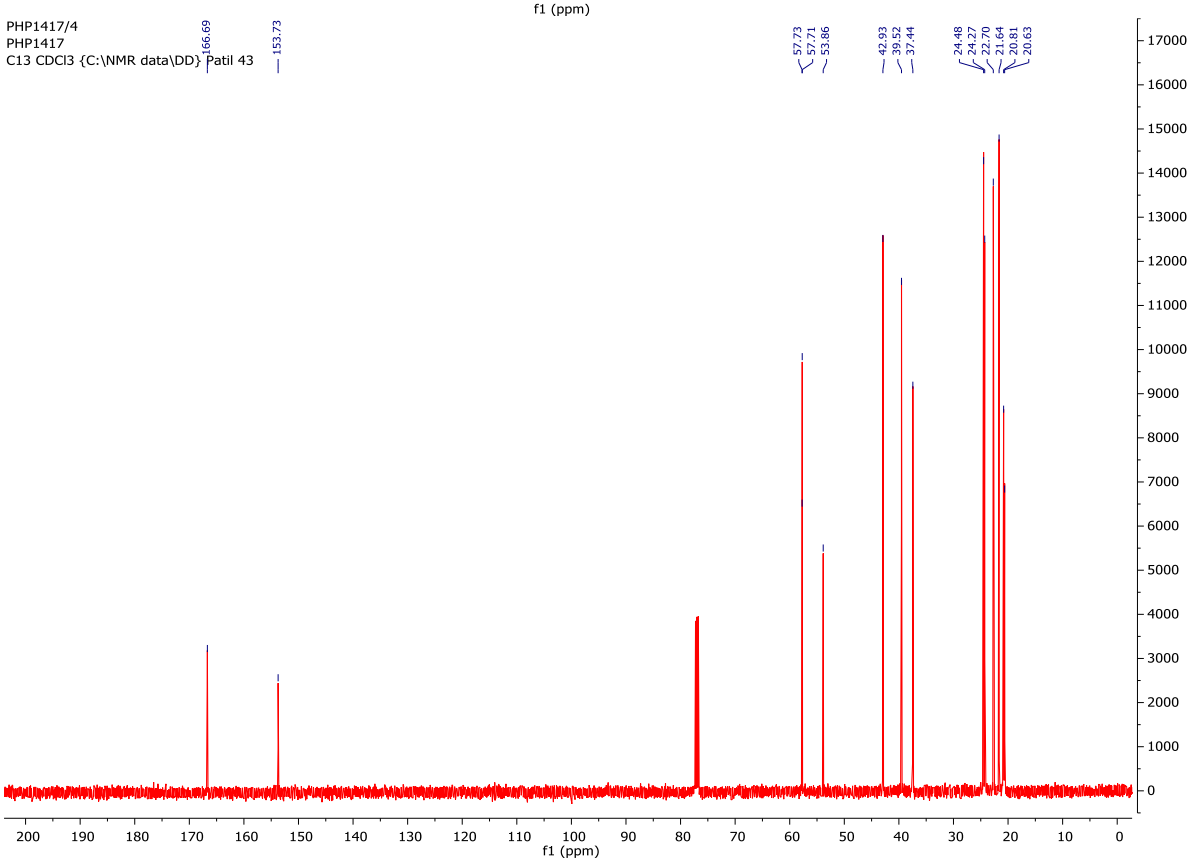




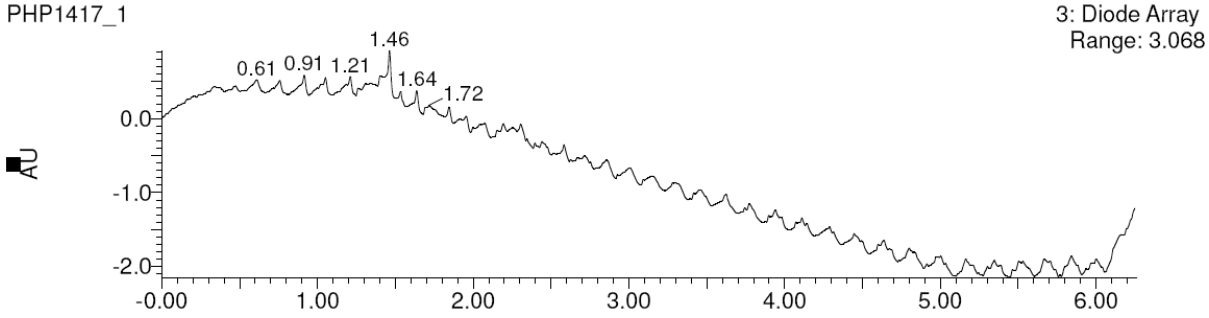
Chemical Formula: $C_{10}H_{17}N_5O_2$
Exact Mass: 239.14

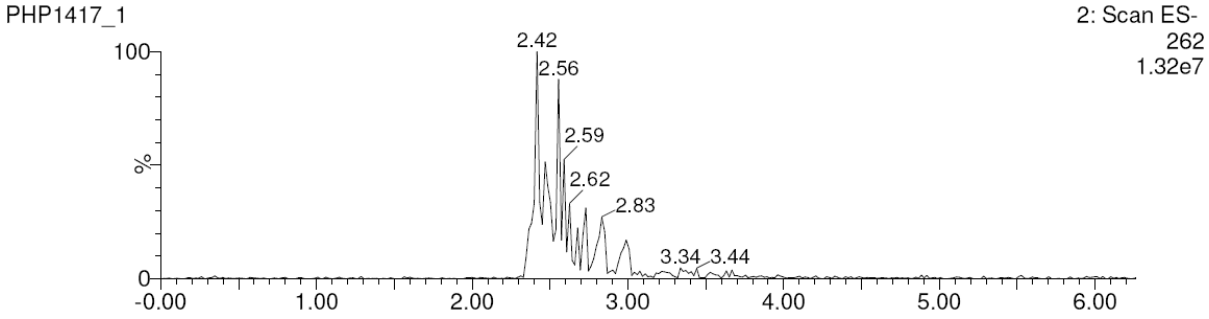
41c: 5'-isobutyl-5'H-spiro[cyclohexane-1,8'-tetrazolo[1,5-a]pyrazin]-6'(7'H)-one

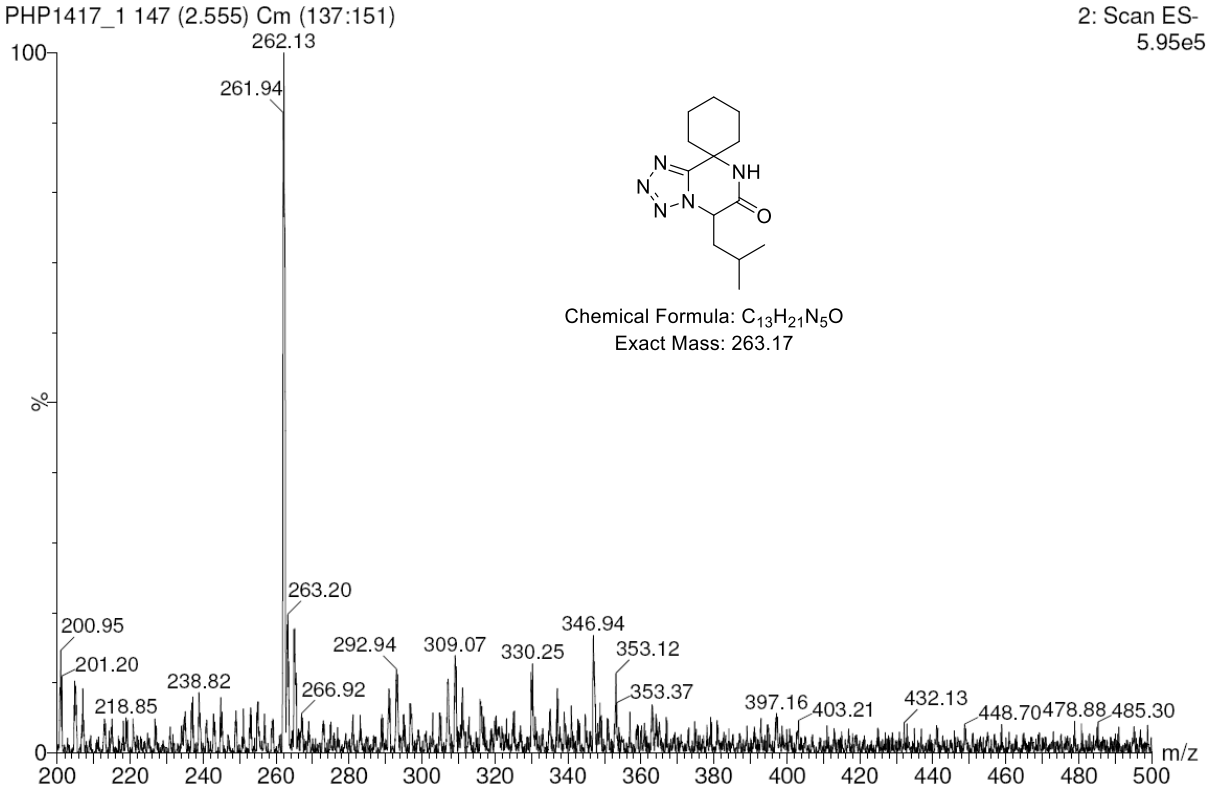




PHP1417_1_Col3_Sol1_5-30%_6min

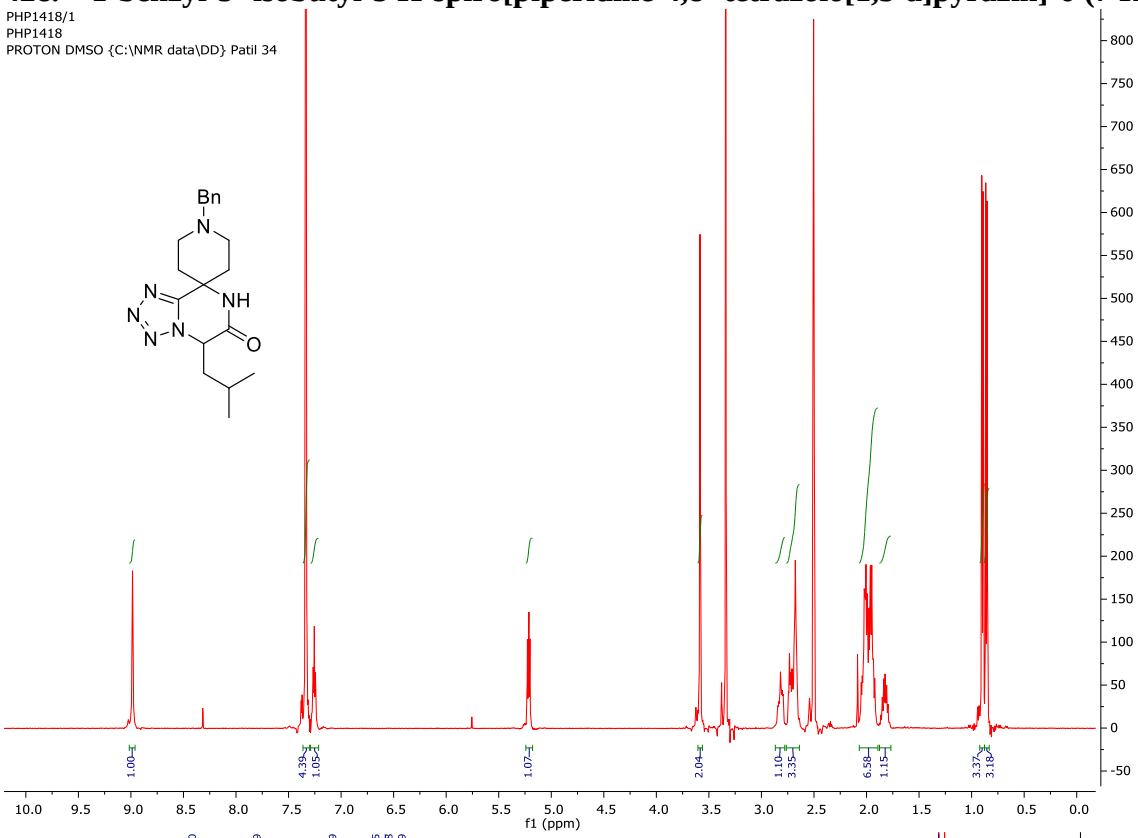


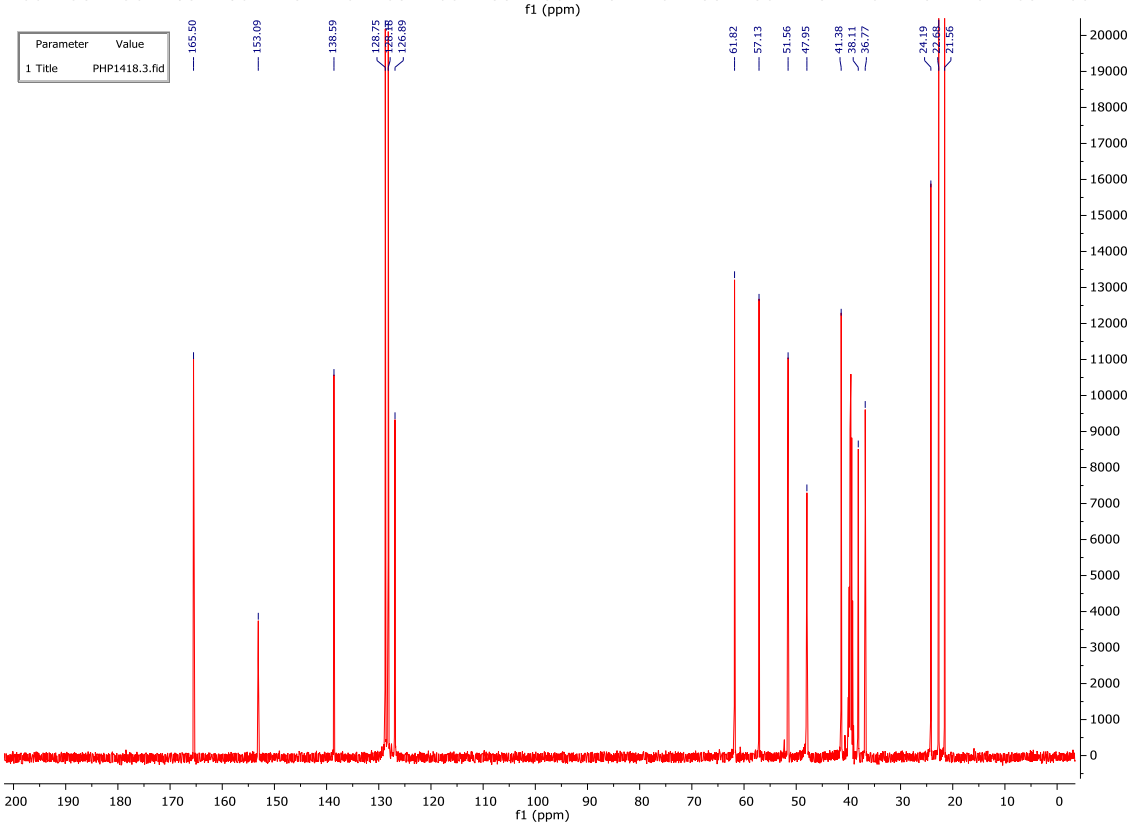




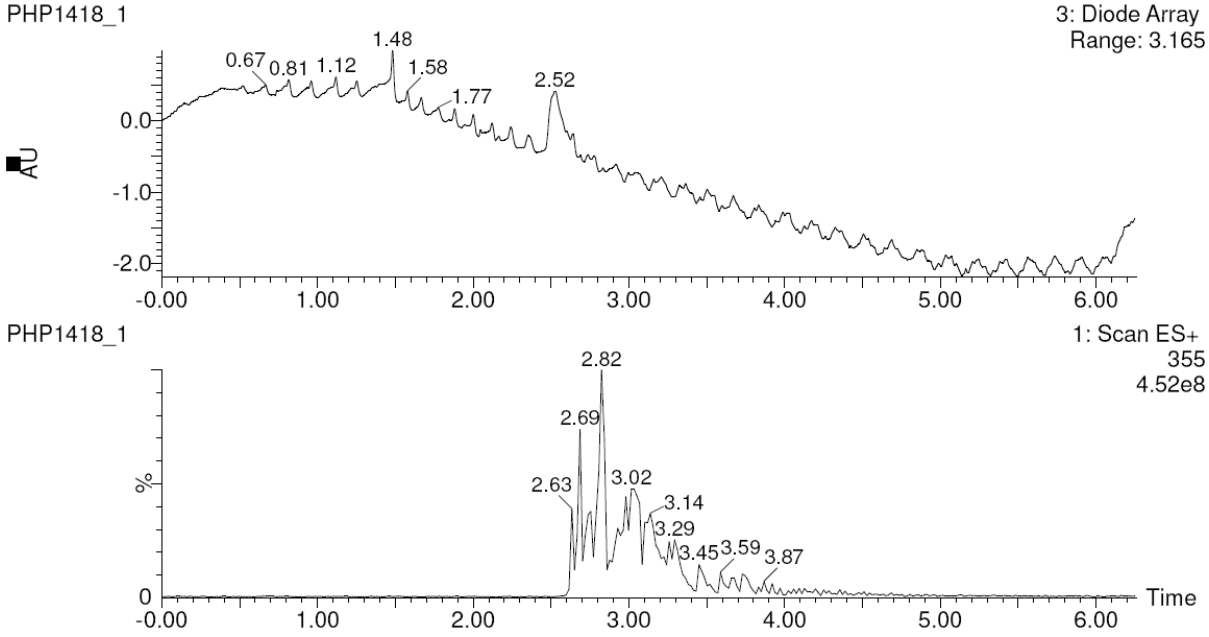
Chemical Formula: $C_{13}H_{21}N_5O$
Exact Mass: 263.17

42c: 1-benzyl-5'-isobutyl-5'H-spiro[piperidine-4,8'-tetrazolo[1,5-a]pyrazin]-6'(7'H)-one

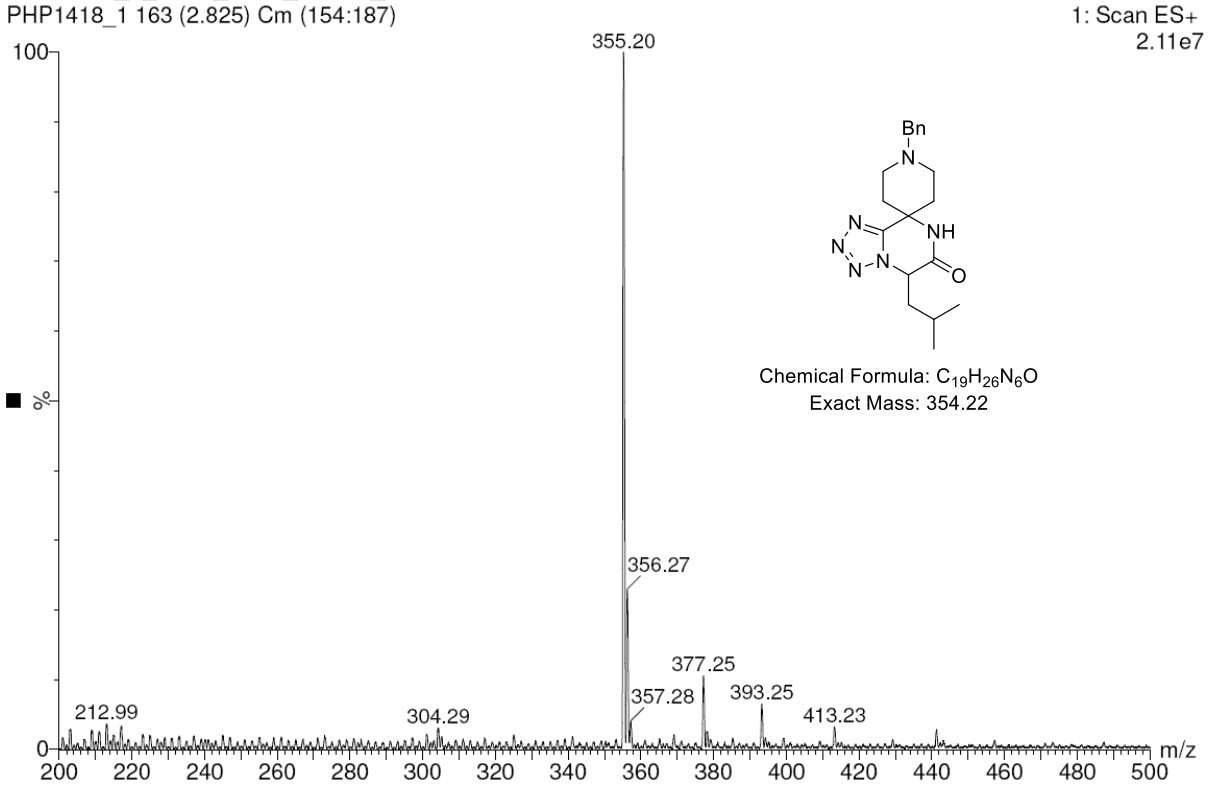




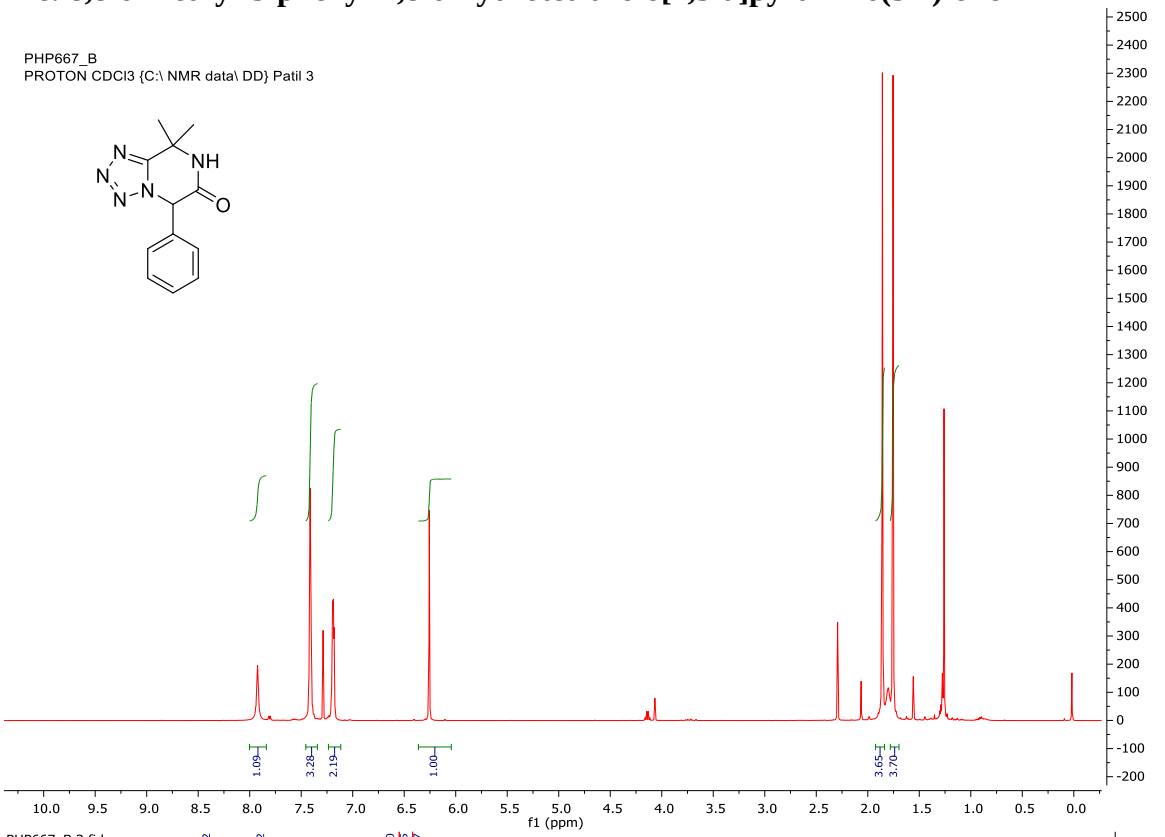
PHP1418_1_Col3_Sol1_5-30%_6min

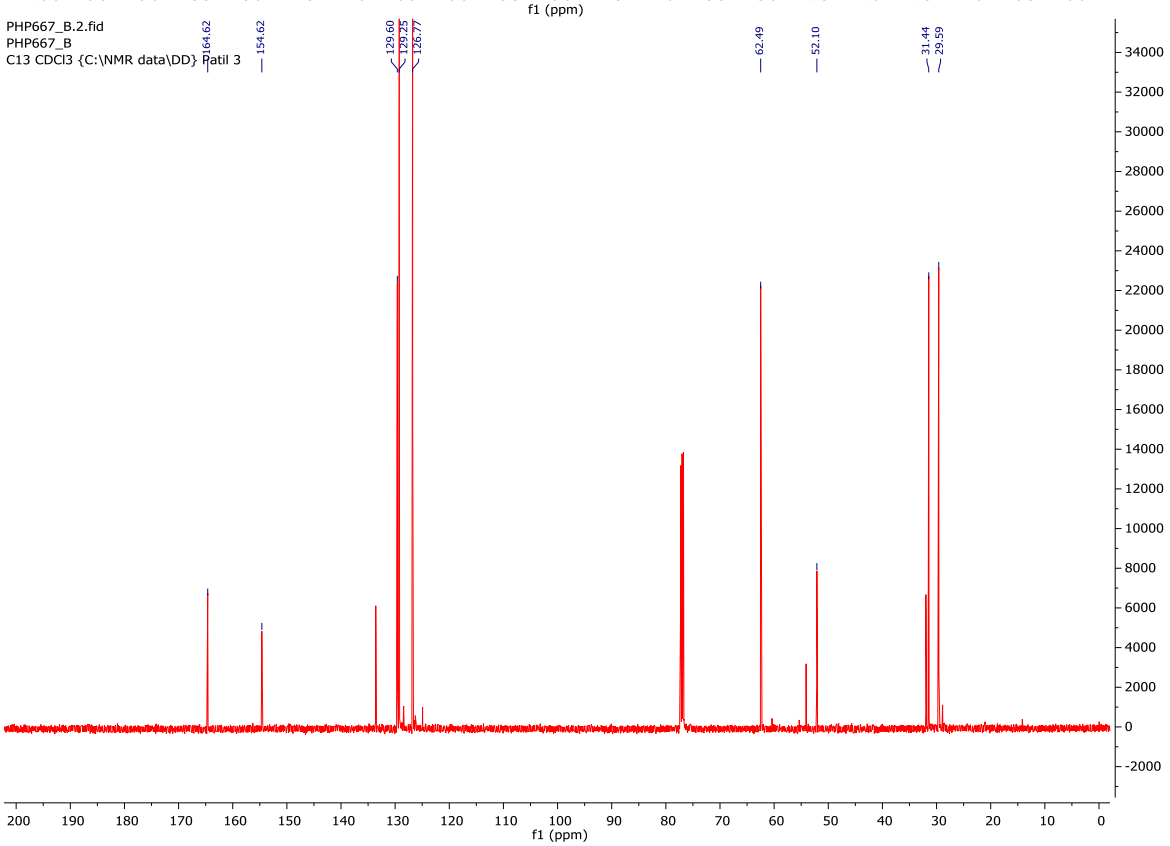


PHP1418_1_Col3_Sol1_5-30%_6min

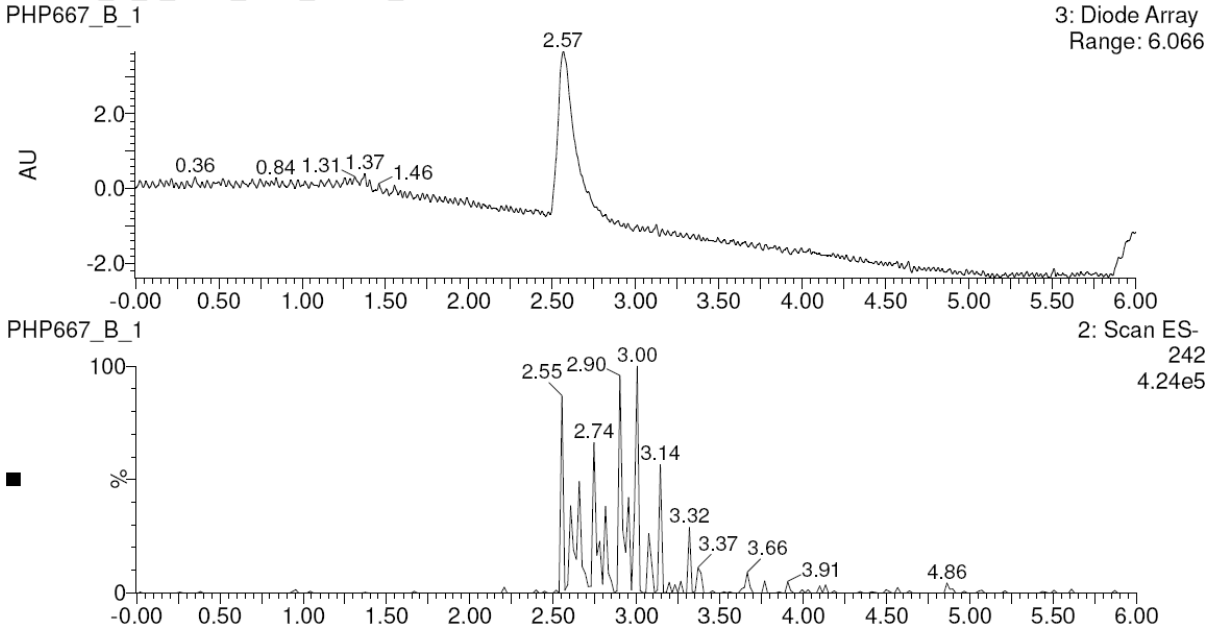


44c: 8,8-dimethyl-5-phenyl-7,8-dihydrotetrazolo[1,5-a]pyrazin-6(5H)-one

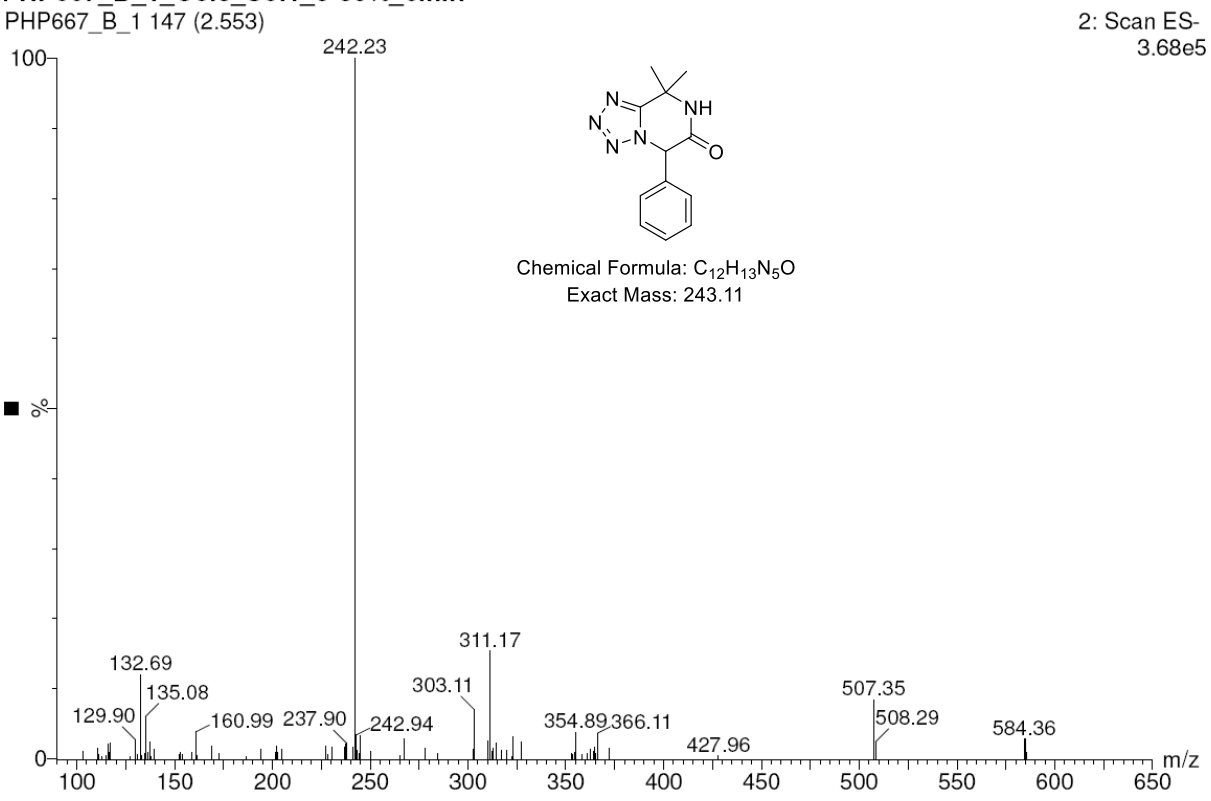




PHP667_B_1_Col3_Sol1_5-30%_6min

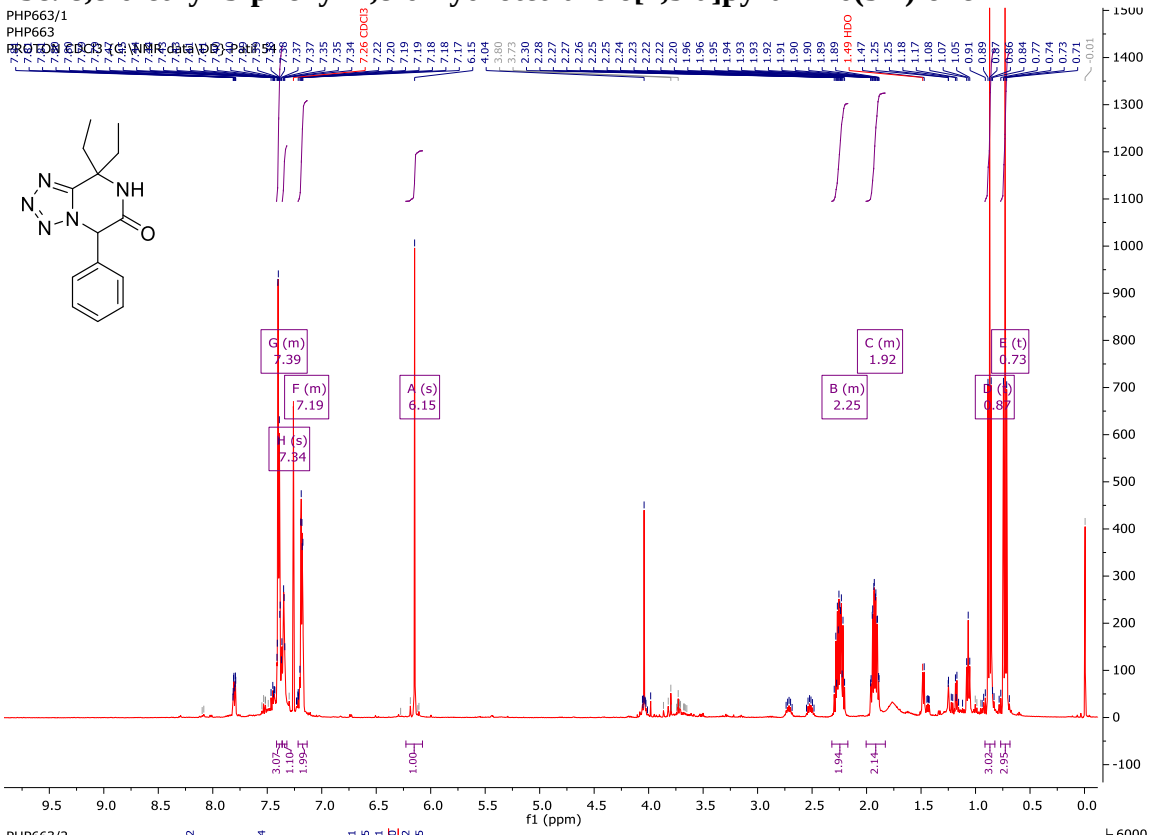


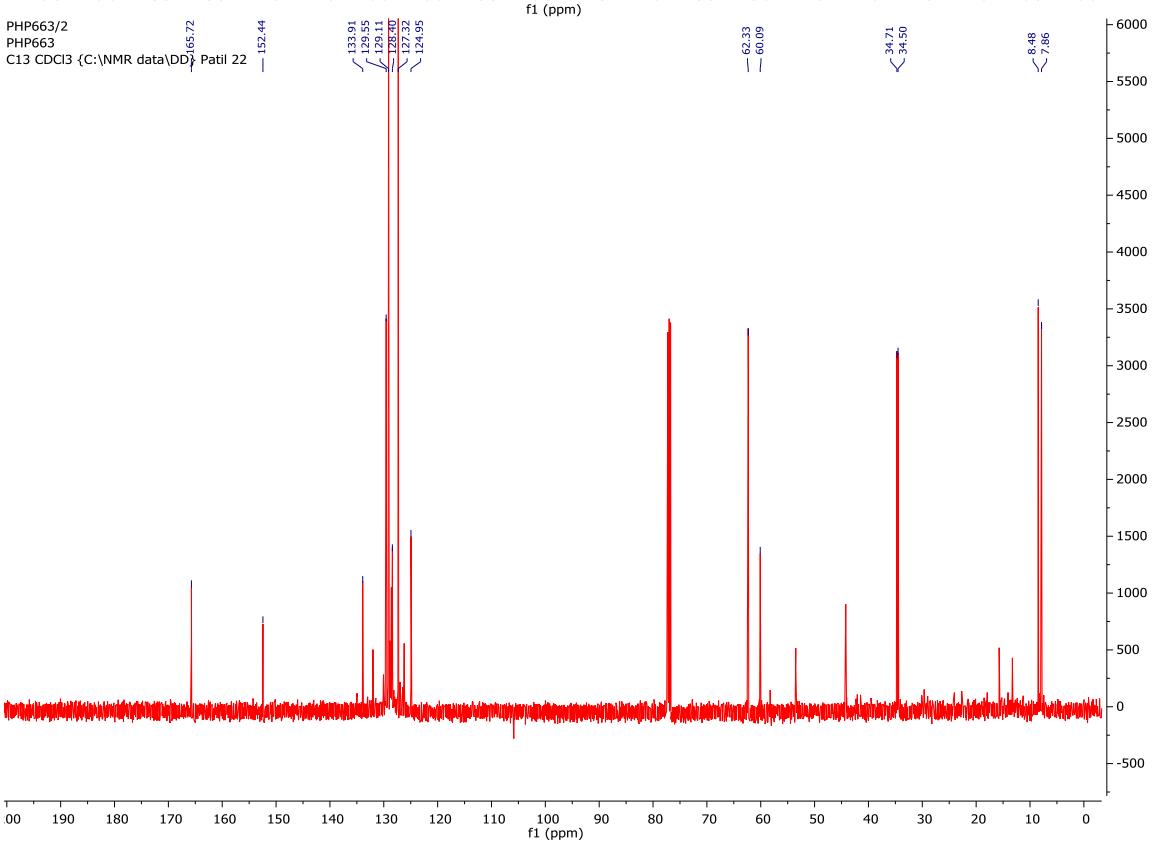
PHP667_B_1_Col3_Sol1_5-30%_6min



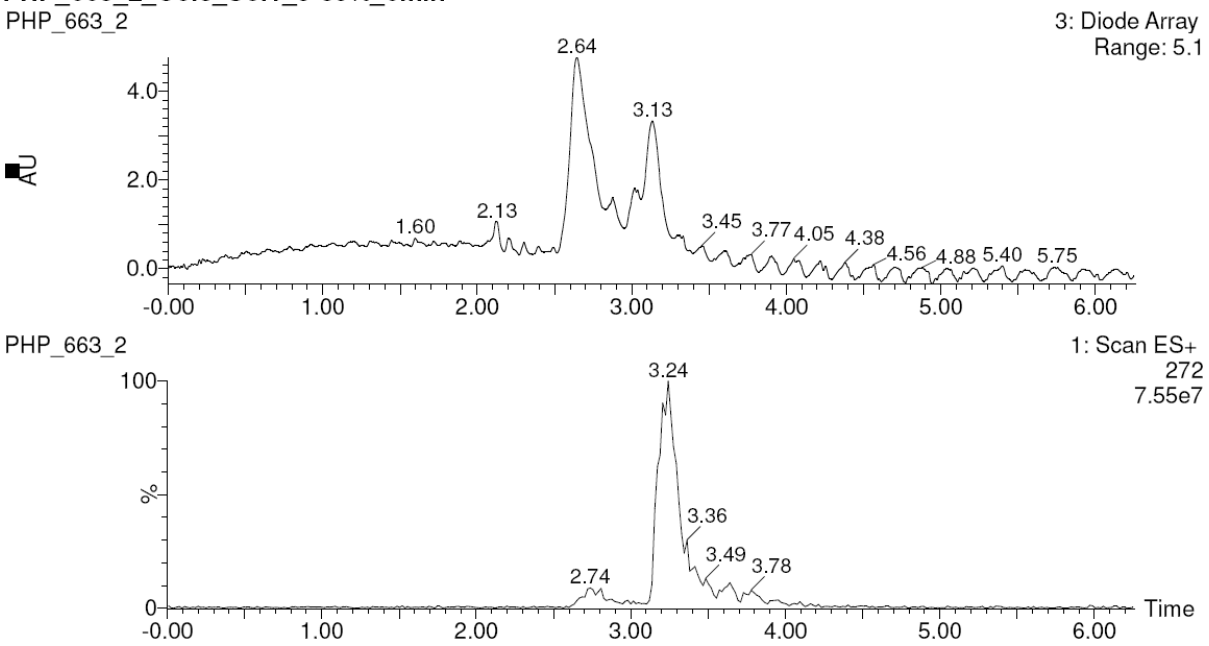
Chemical Formula: $C_{12}H_{13}N_5O$
Exact Mass: 243.11

45c: 8,8-diethyl-5-phenyl-7,8-dihydrotetrazolo[1,5-a]pyrazin-6(5H)-one

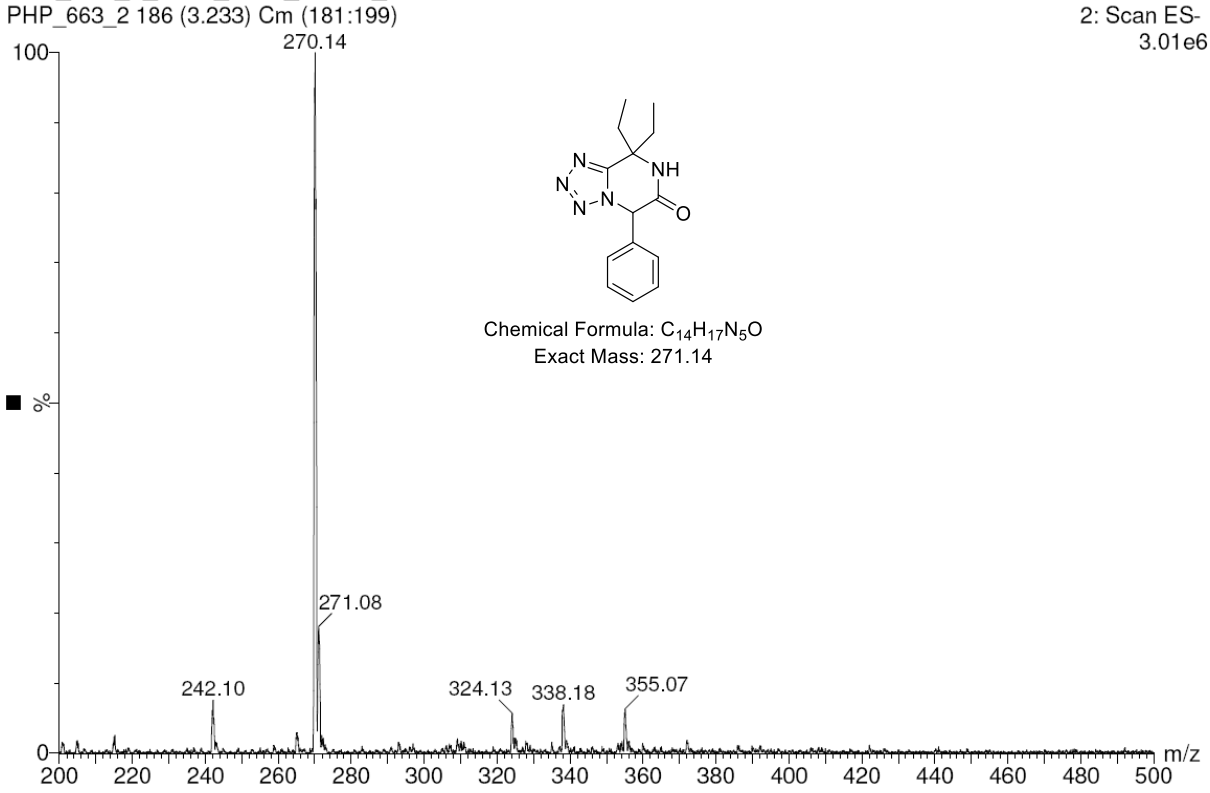




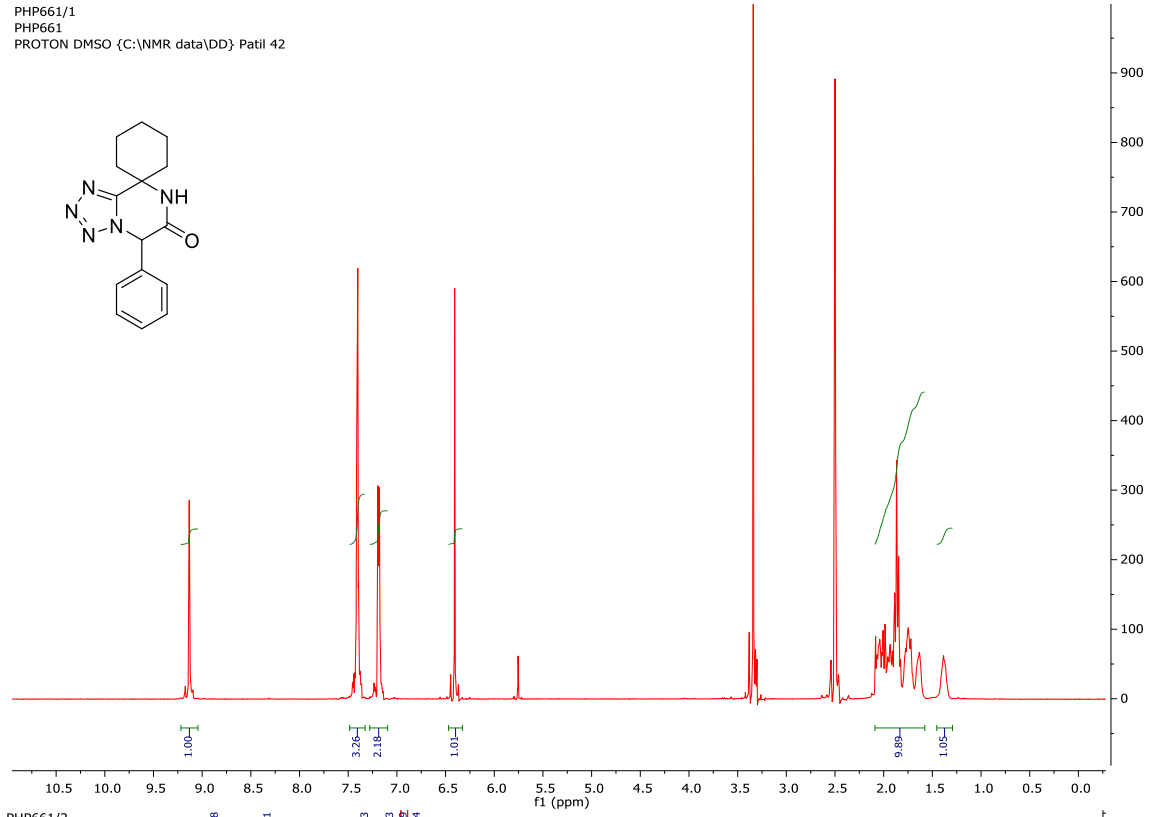
PHP_663_2_Col3_Sol1_5-30%_6min

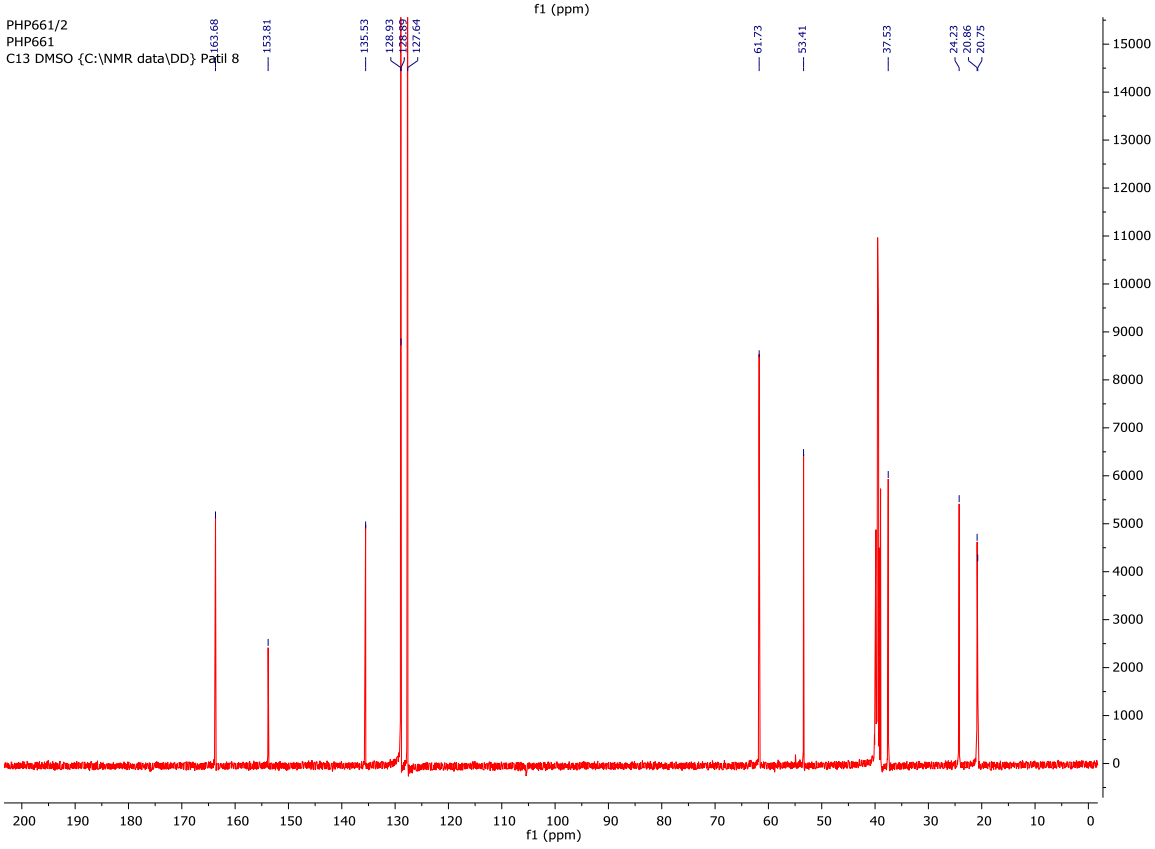


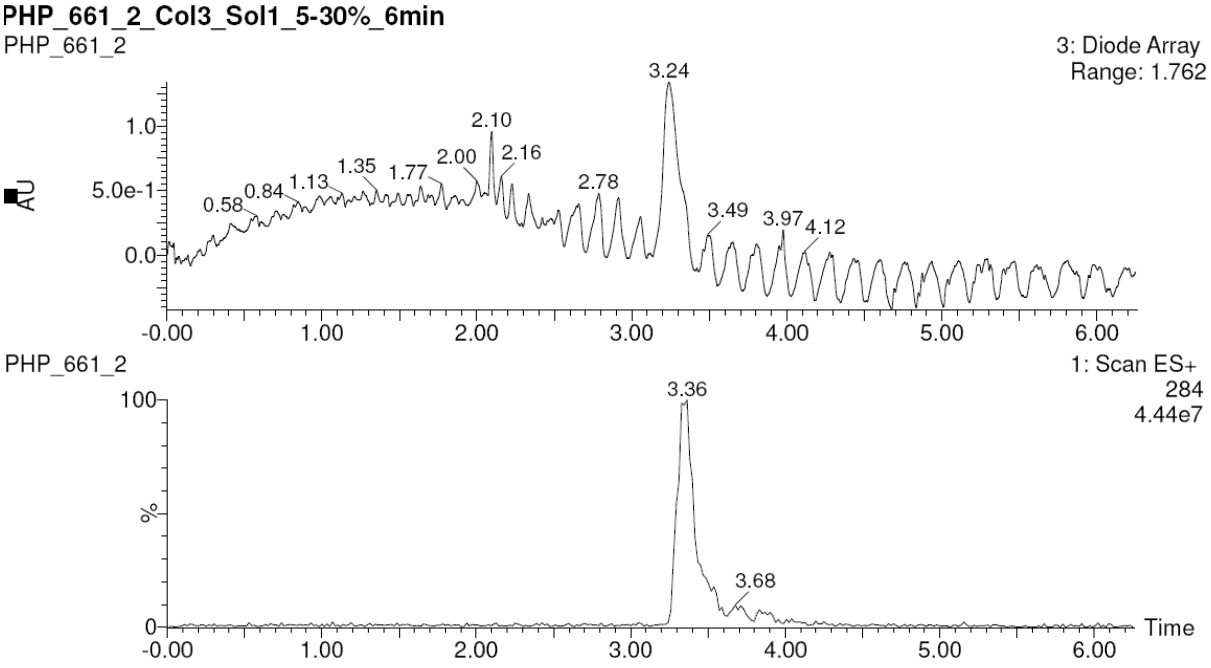
PHP_663_2_Col3_Sol1_5-30%_6min

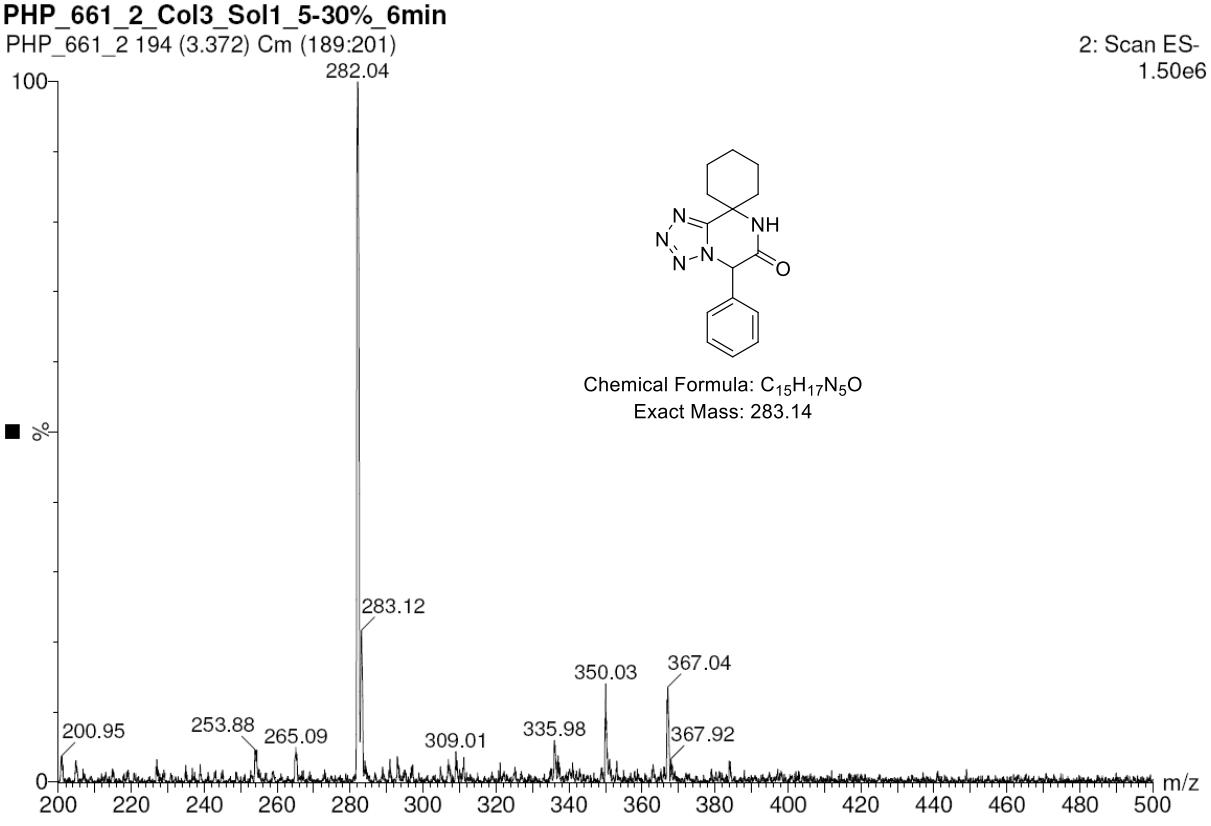


46c: 5'-phenyl-5'H-spiro[cyclohexane-1,8'-tetrazolo[1,5-a]pyrazin]-6'(7'H)-one

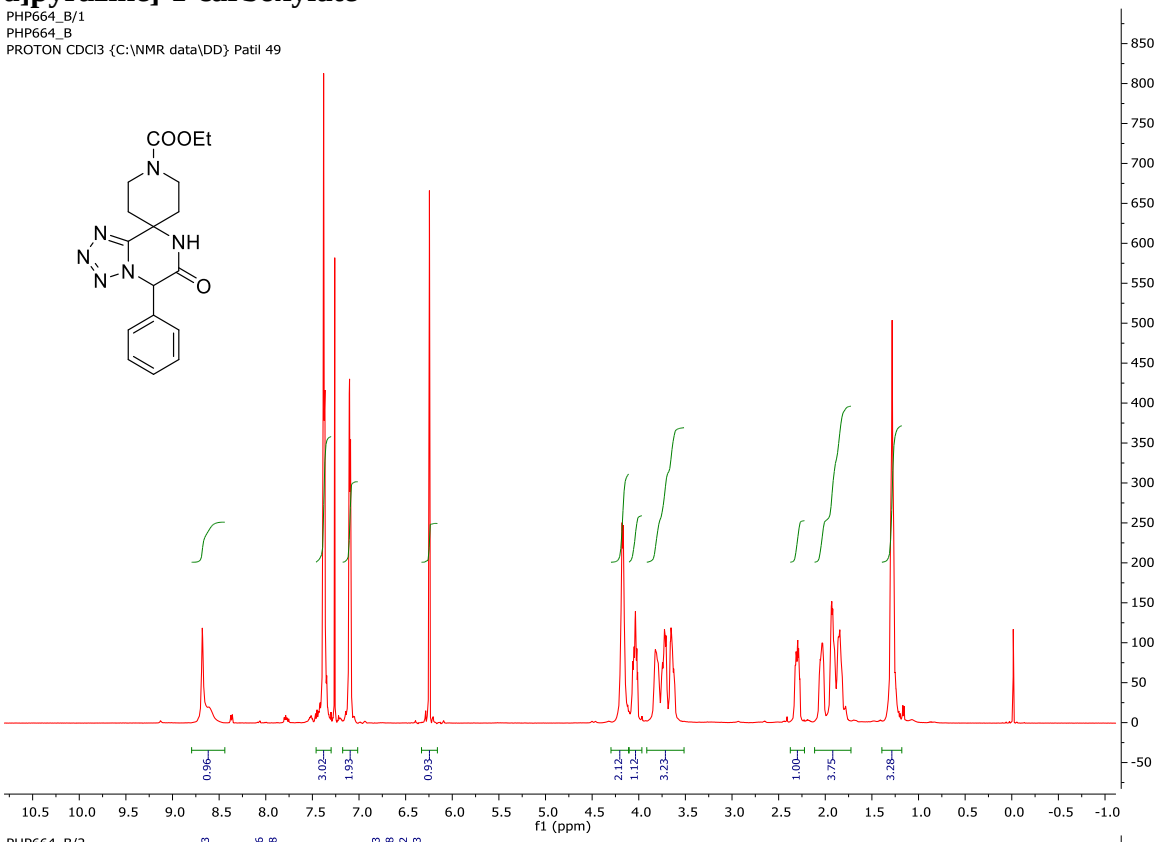


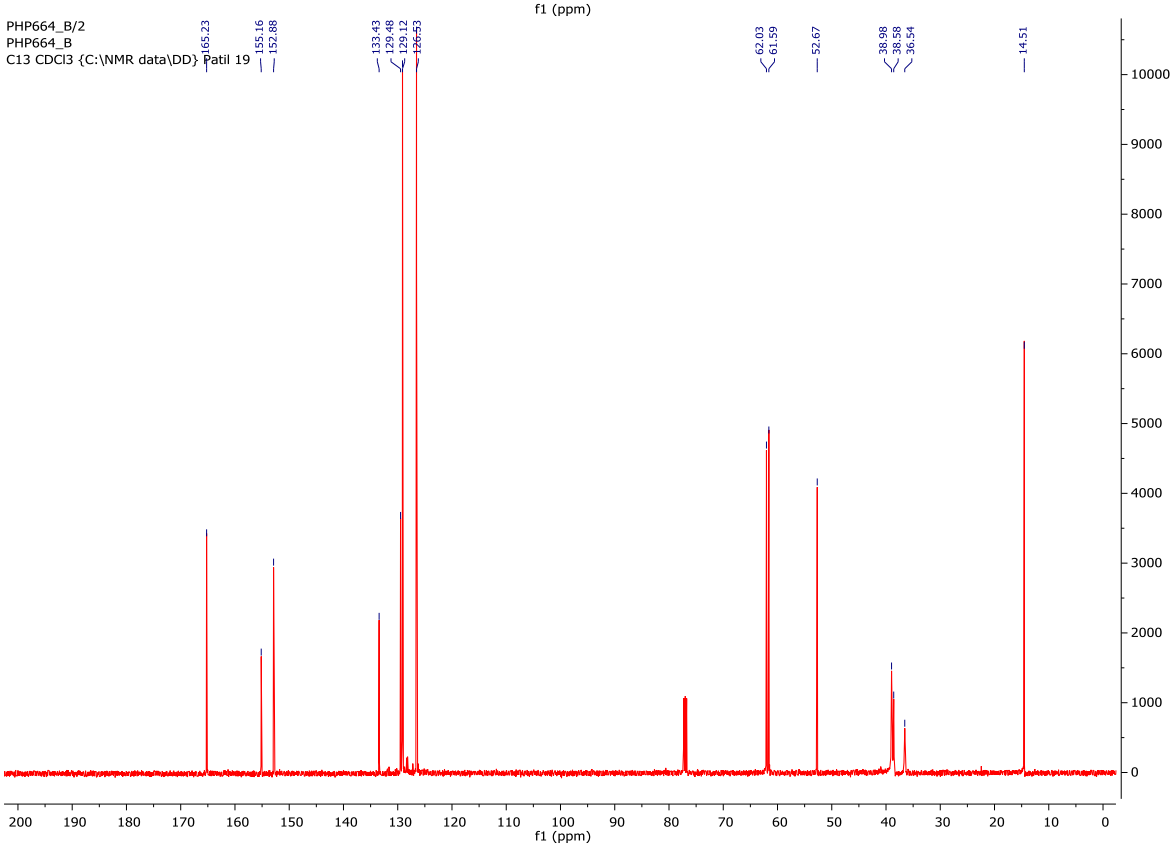



PHP_661_2_Col3_Sol1_5-30%_6min
PHP_661_2
3: Diode Array
Range: 1.762
AU
1.0
5.0e-1
0.0
0.58
0.84
1.13
1.35
1.77
2.00
2.10
2.16
2.78
3.24
3.49
3.97
4.12
-0.00
1.00
2.00
3.00
4.00
5.00
6.00
PHP_661_2
1: Scan ES+
284
4.44e7
100
%
0
3.36
3.68
Time
-0.00
1.00
2.00
3.00
4.00
5.00
6.00

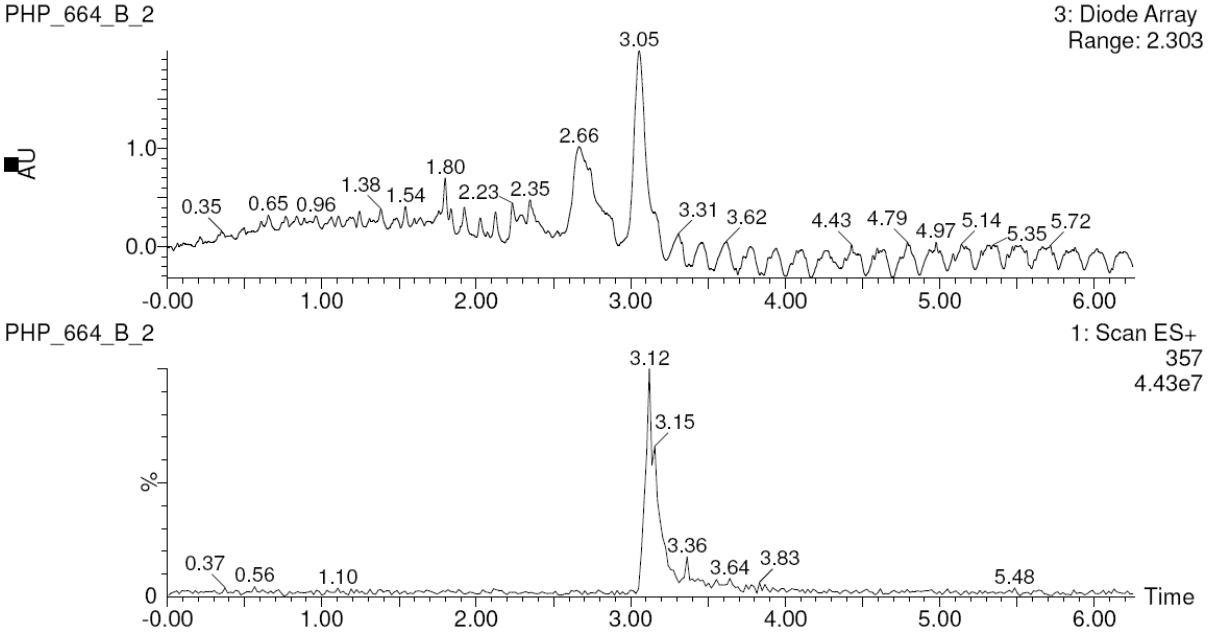

PHP_661_2_Col3_Sol1_5-30%_6min
PHP_661_2 194 (3.372) Cm (189:201)
2: Scan ES-
1.50e6
100
%
0
282.04
283.12
200.95
253.88
265.09
309.01
335.98
350.03
367.04
367.92
m/z
200
220
240
260
280
300
320
340
360
380
400
420
440
460
480
500
NH
O
N
N
N
Chemical Formula: C15H17N5O
Exact Mass: 283.14

47c: ethyl 6'-oxo-5'-phenyl-6',7'-dihydro-5'H-spiro[piperidine-4,8'-tetrazolo[1,5-a]pyrazine]-1-carboxylate

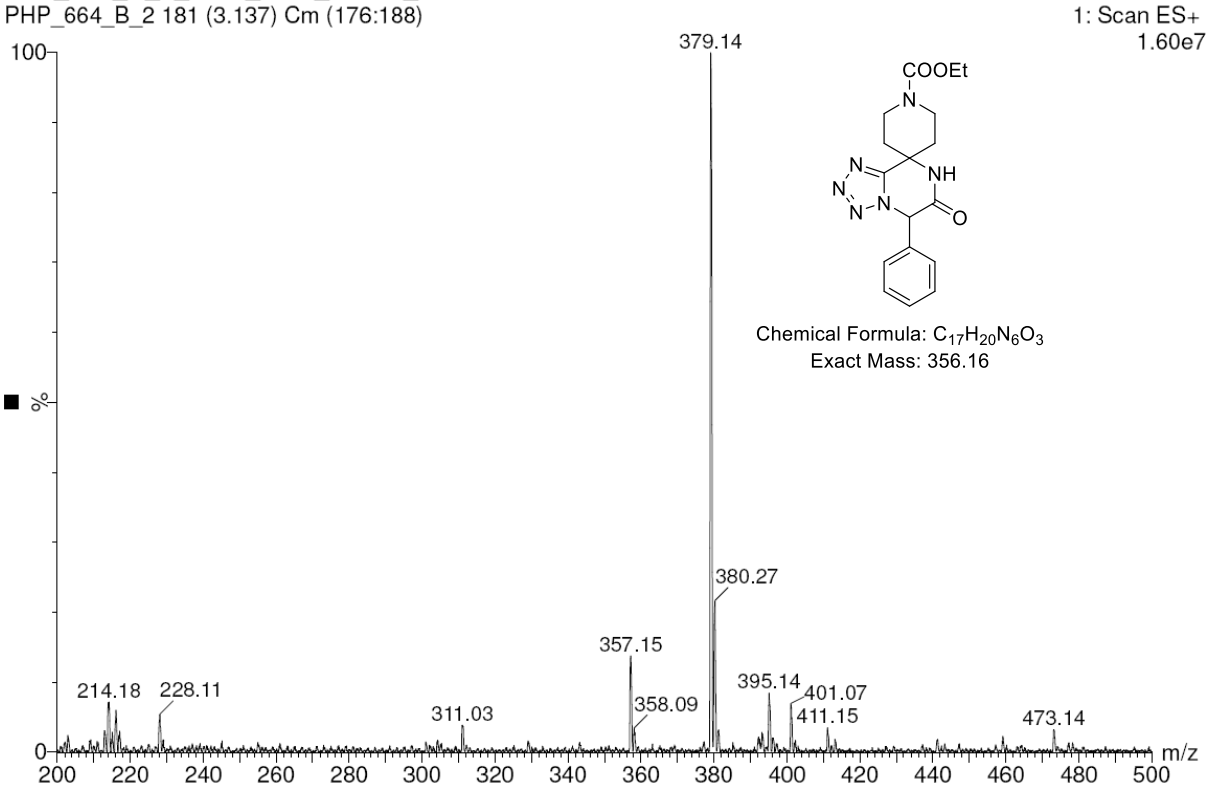




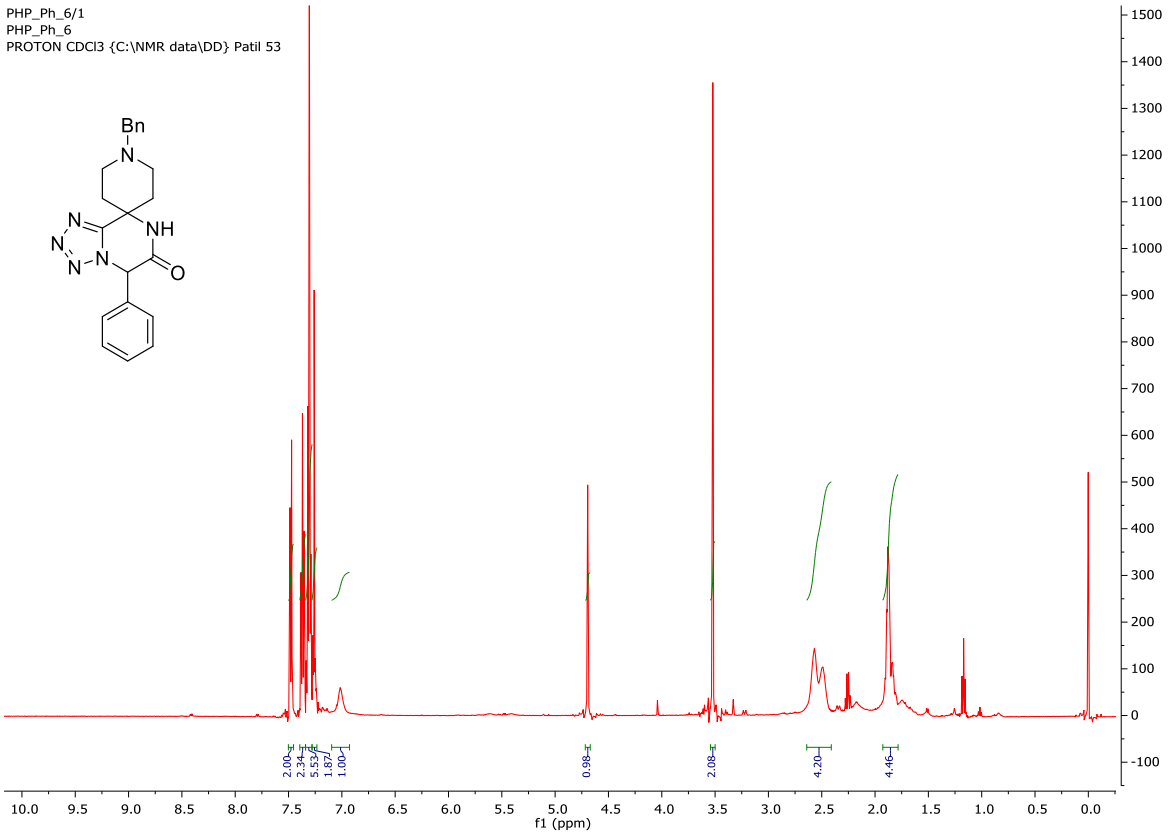
PHP_664_B_2_Col3_Sol1_5-30%_6min

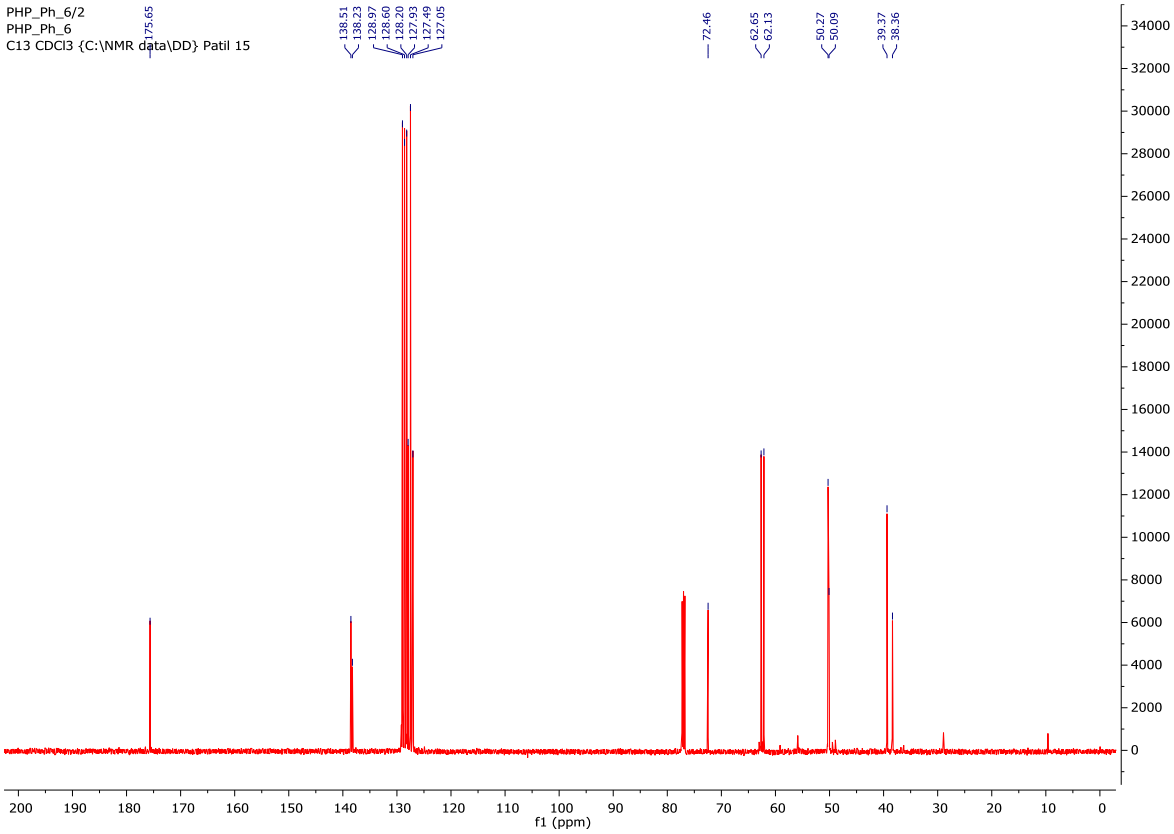


PHP_664_B_2_Col3_Sol1_5-30%_6min

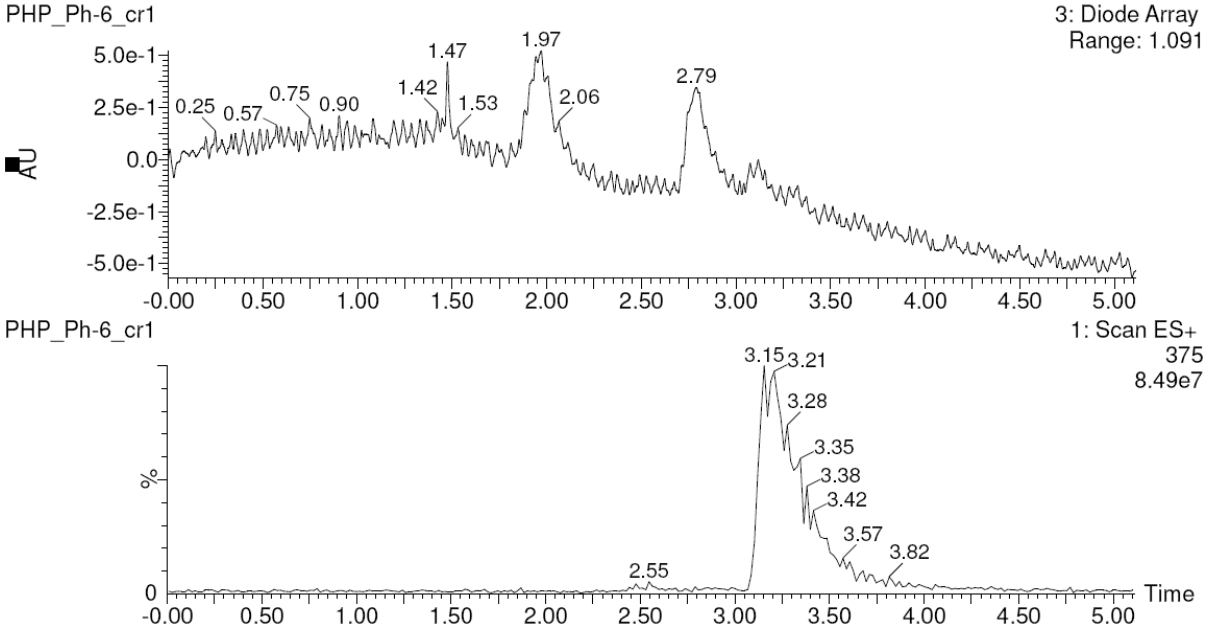


48c: 1-benzyl-5'-phenyl-5'H-spiro[piperidine-4,8'-tetrazolo[1,5-a]pyrazin]-6'(7'H)-one

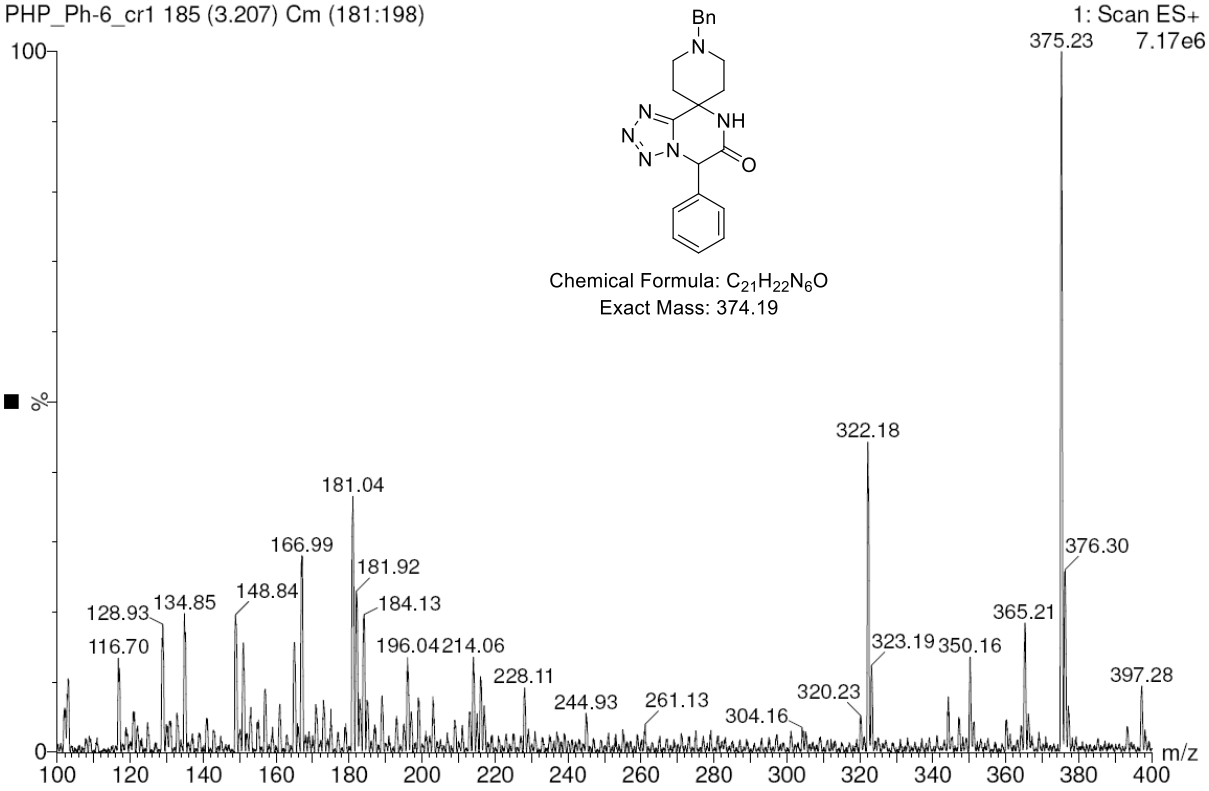




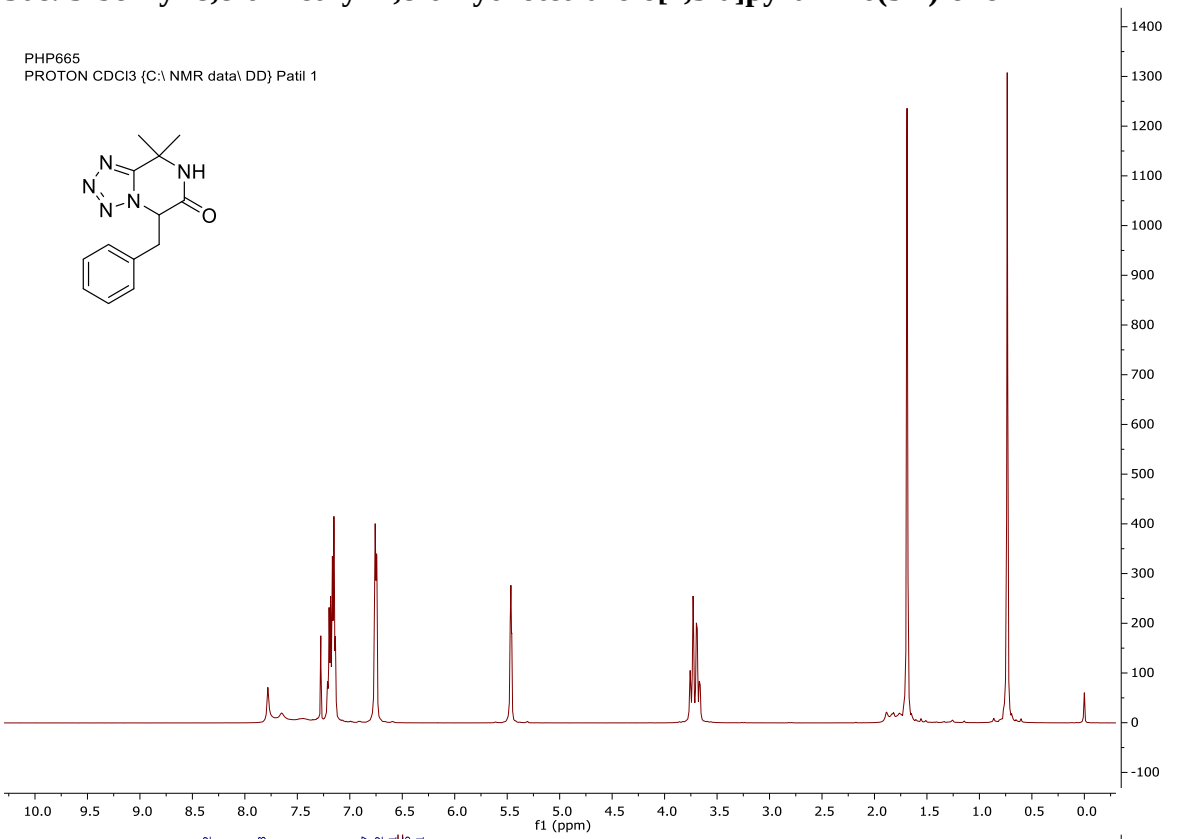
PHP_Ph-6_cr1_Col3_Sol1_5-30%_6min

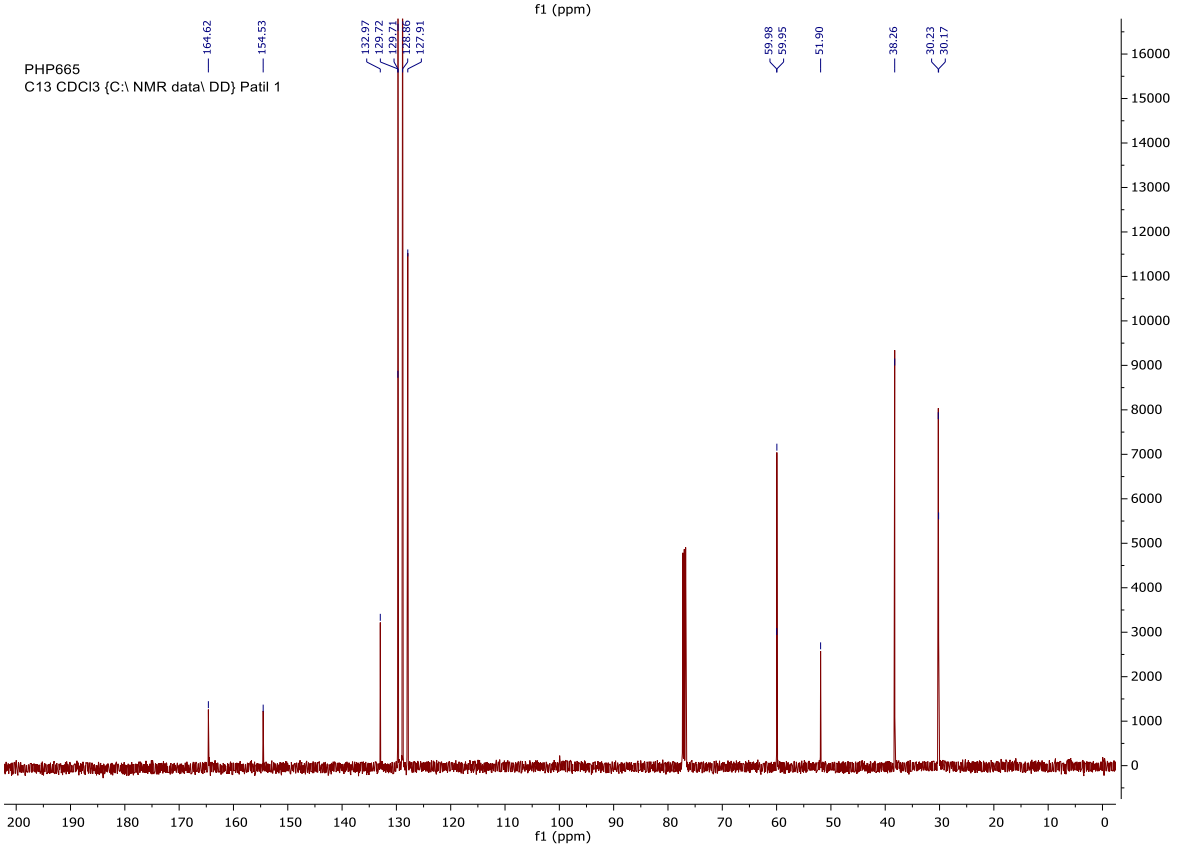


PHP_Ph-6_cr1_Col3_Sol1_5-30%_6min

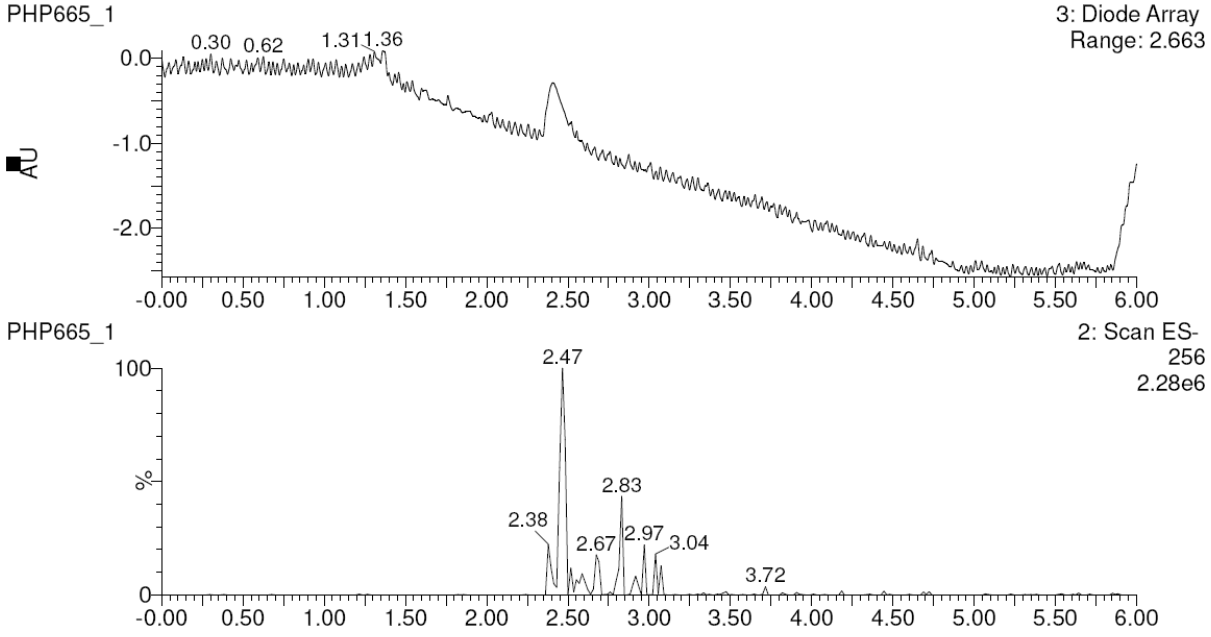


50c: 5-benzyl-8,8-dimethyl-7,8-dihydrotetrazolo[1,5-a]pyrazin-6(5H)-one

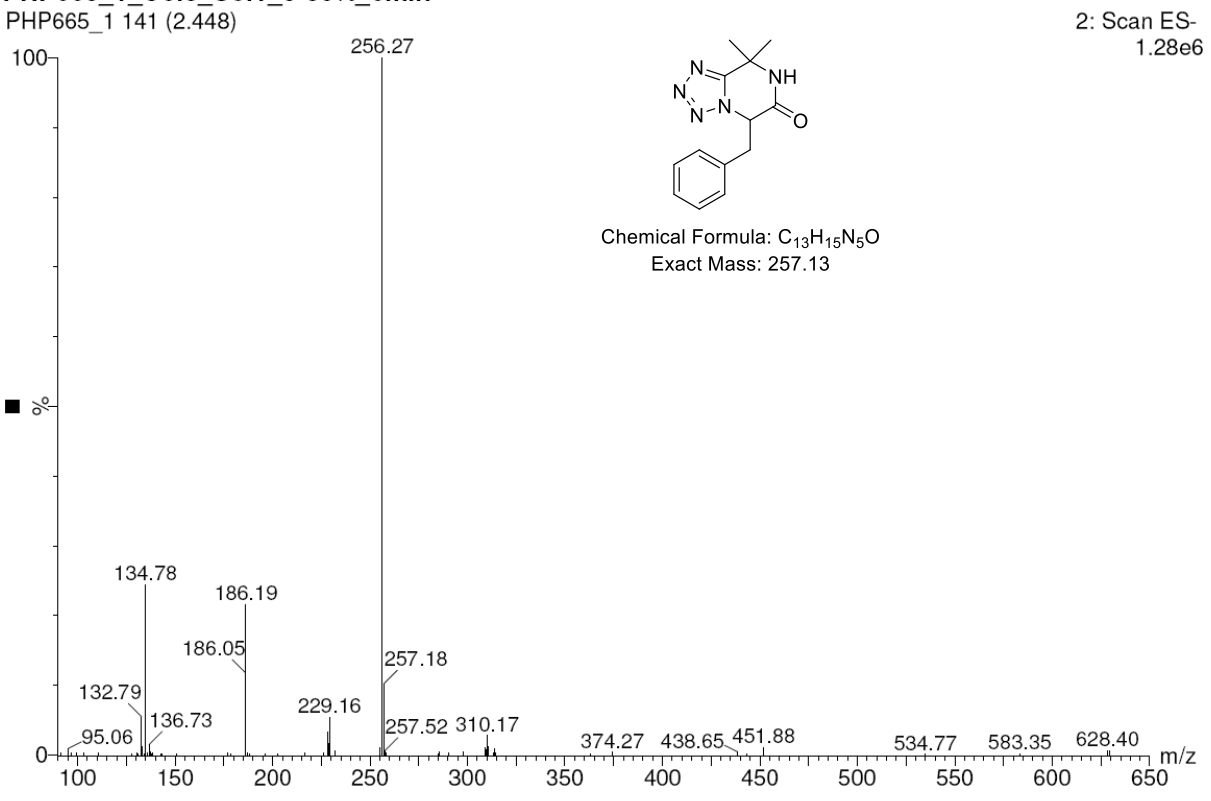




PHP665_1_Col3_Sol1_5-30%_6min

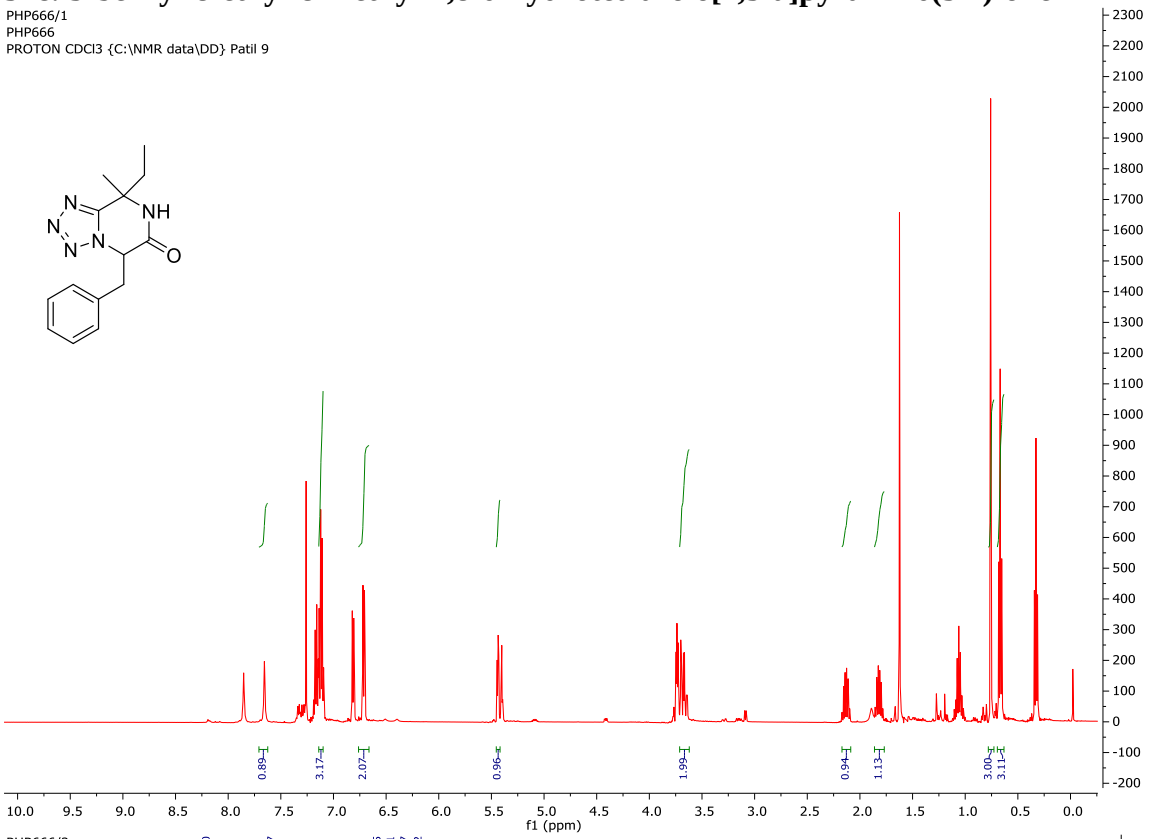


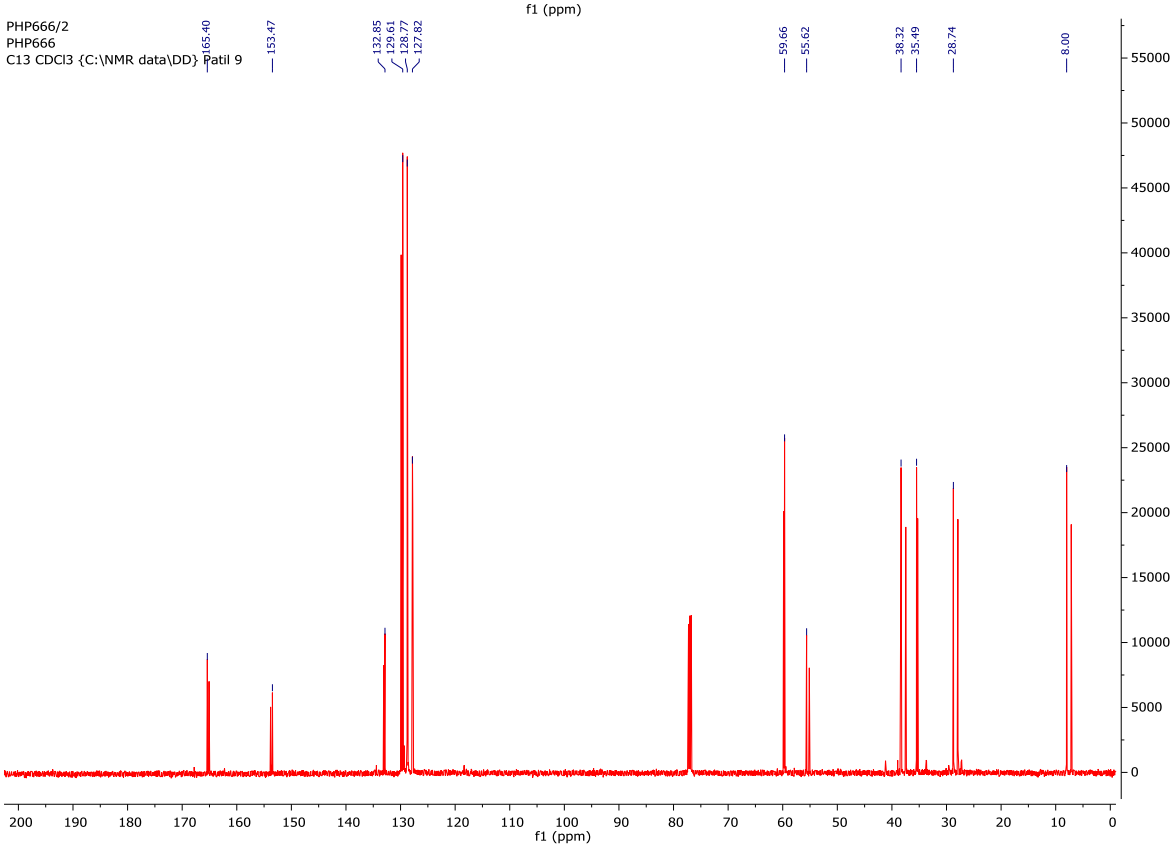
PHP665_1_Col3_Sol1_5-30%_6min



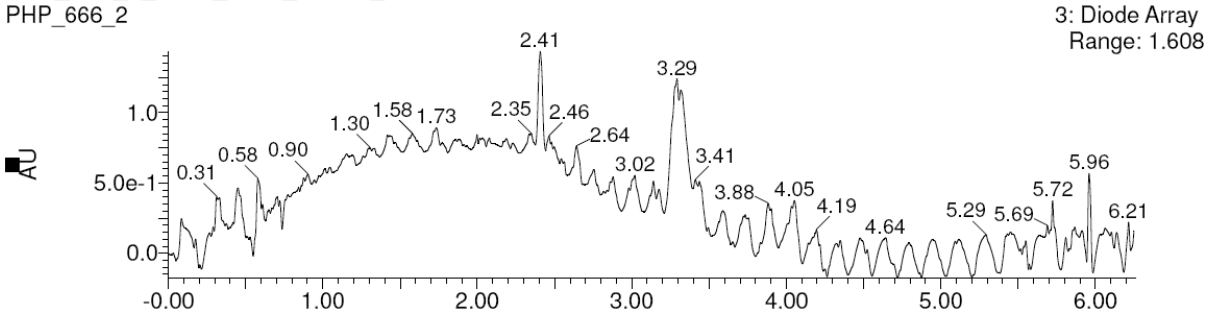
Chemical Formula: $C_{13}H_{15}N_5O$
Exact Mass: 257.13

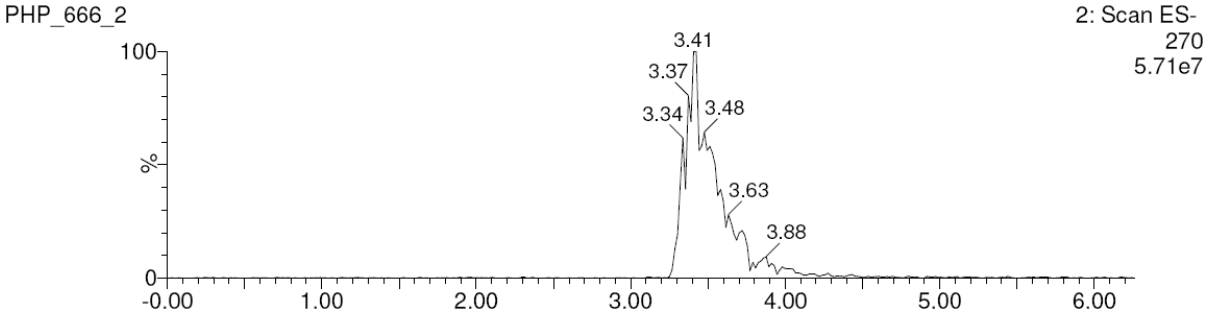
51c: 5-benzyl-8-ethyl-8-methyl-7,8-dihydrotetrazolo[1,5-a]pyrazin-6(5H)-one



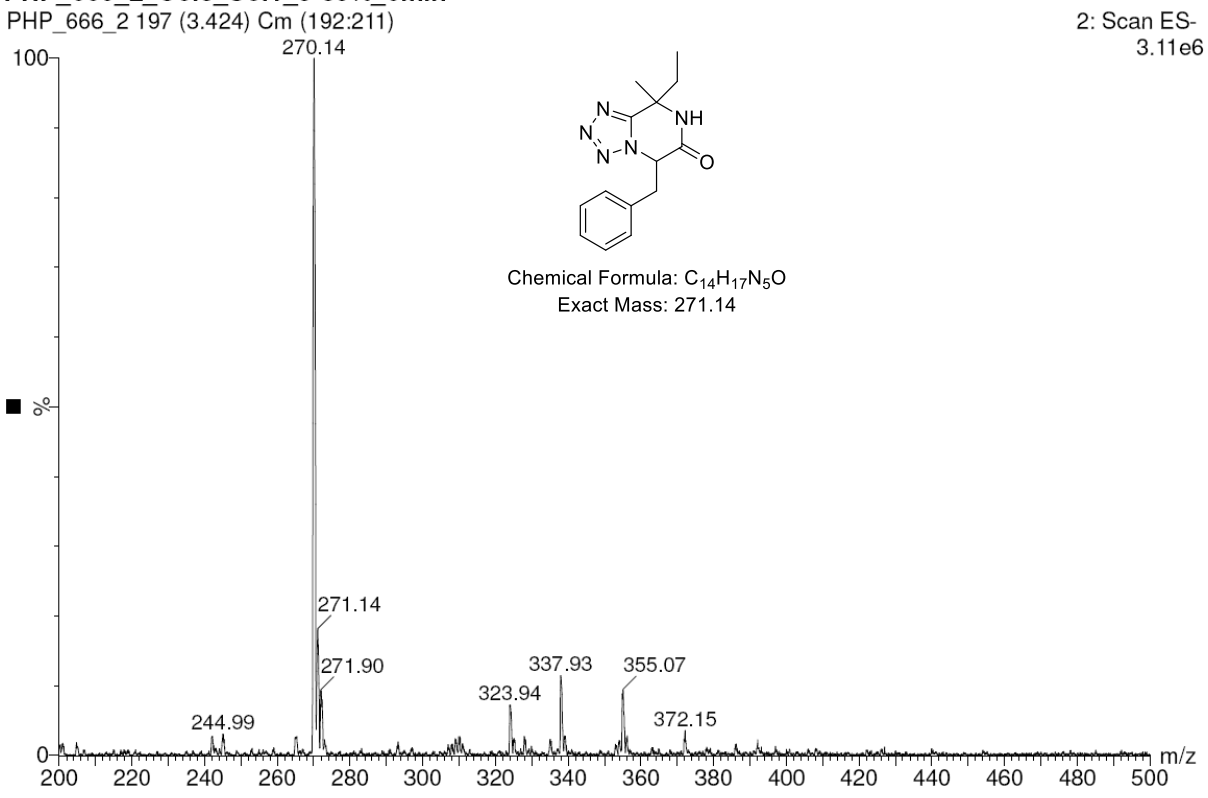


PHP_666_2_Col3_Sol1_5-30%_6min



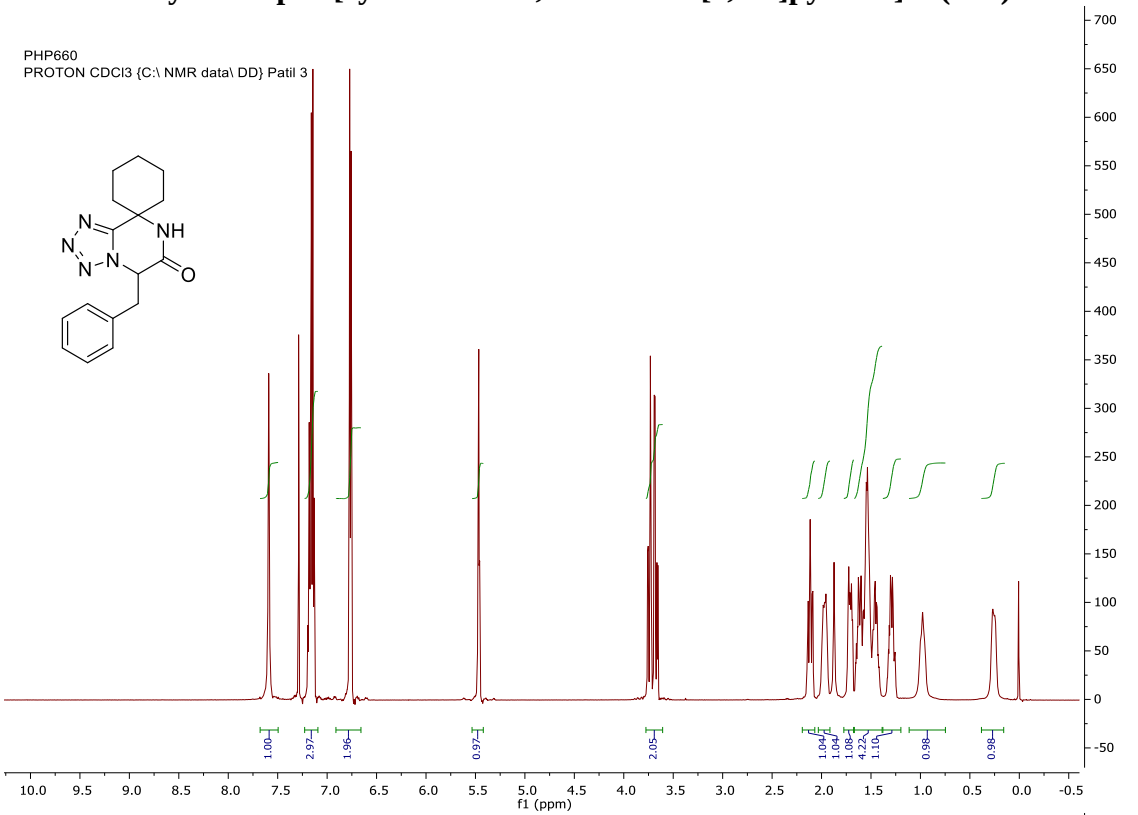


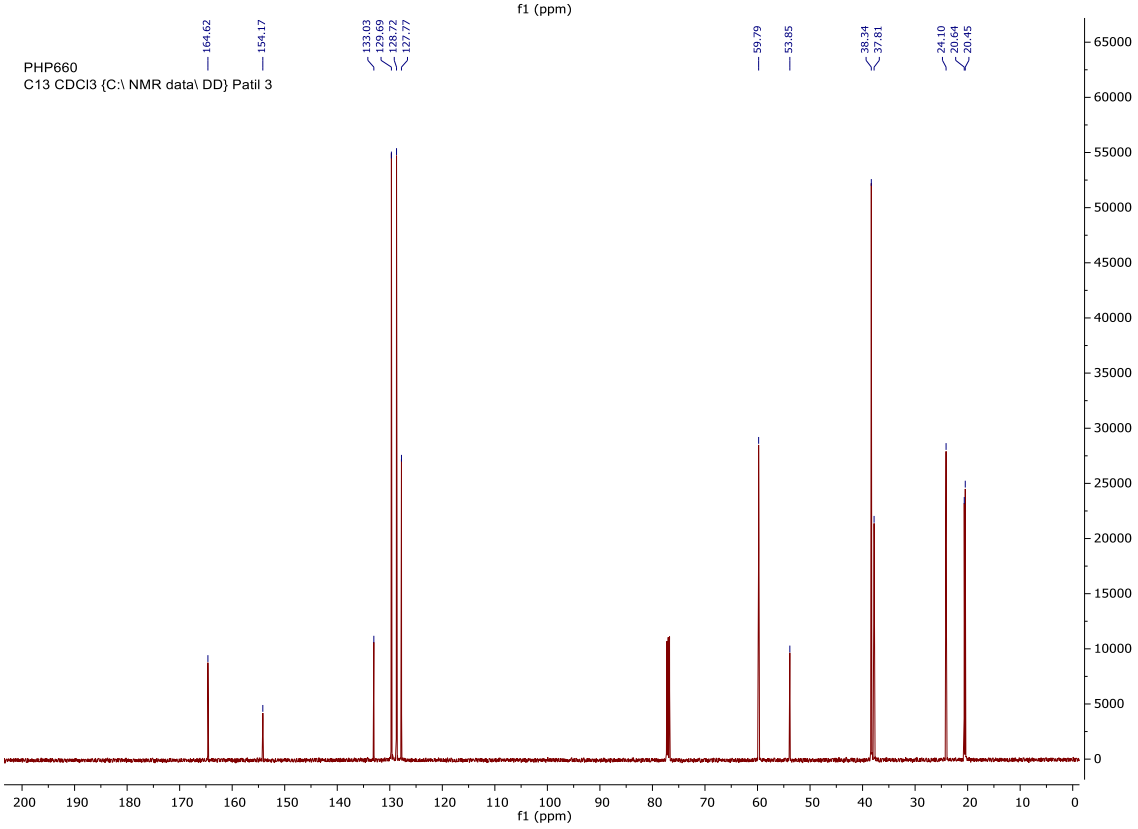
PHP_666_2_Col3_Sol1_5-30%_6min



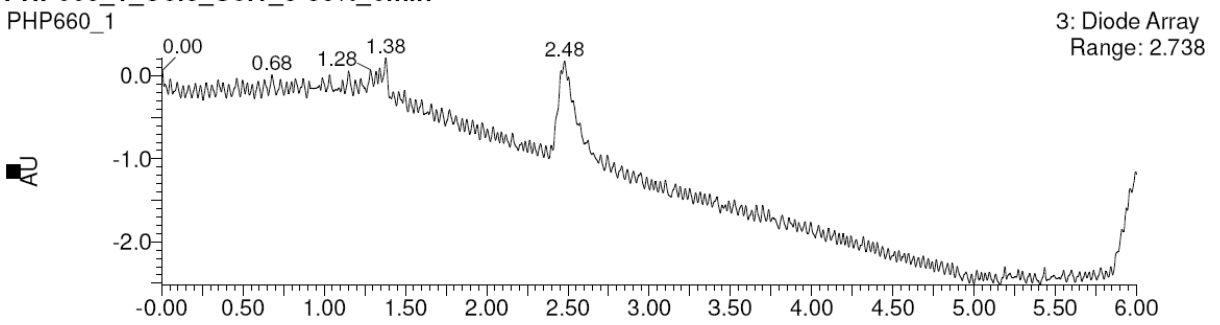
Chemical Formula: $C_{14}H_{17}N_5O$
Exact Mass: 271.14

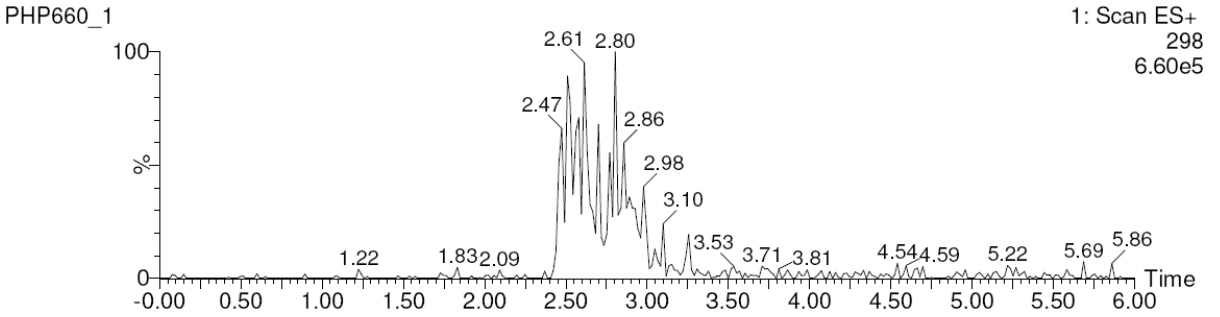
52c: 5'-benzyl-5'H-spiro[cyclohexane-1,8'-tetrazolo[1,5-a]pyrazin]-6'(7'H)-one

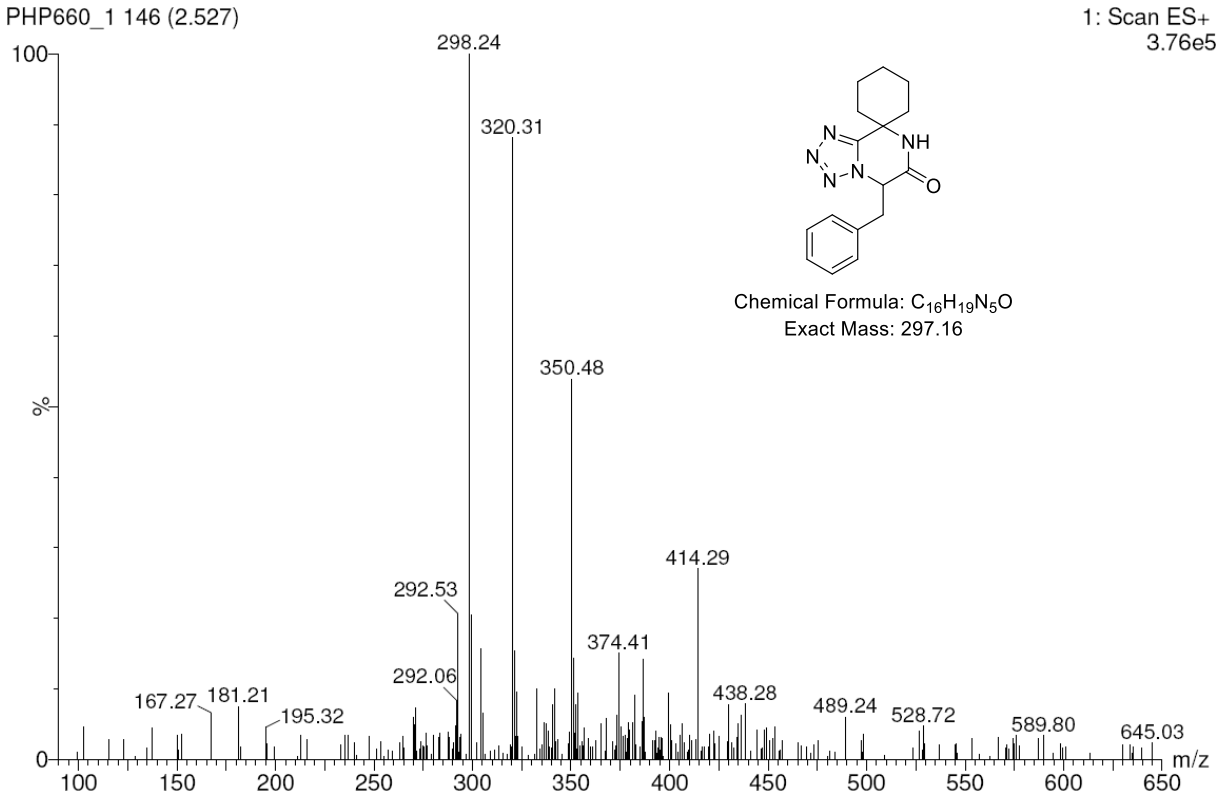




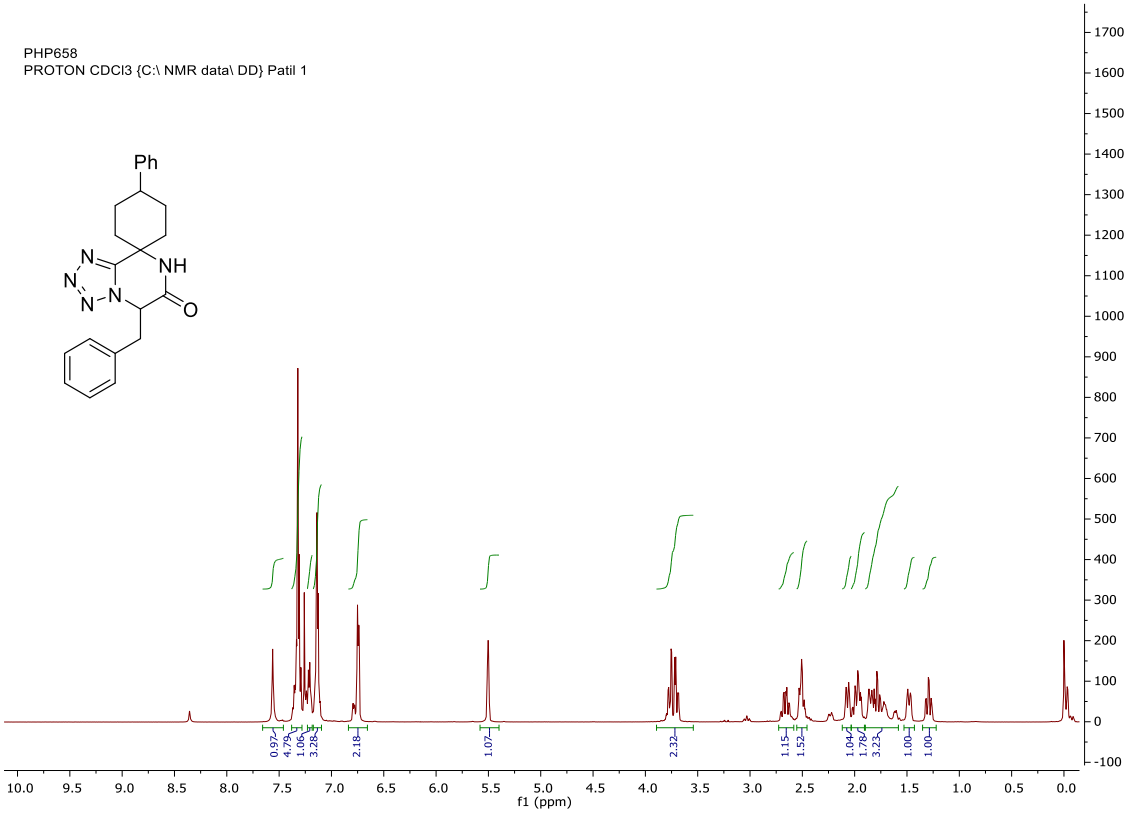
PHP660_1_Col3_Sol1_5-30%_6min

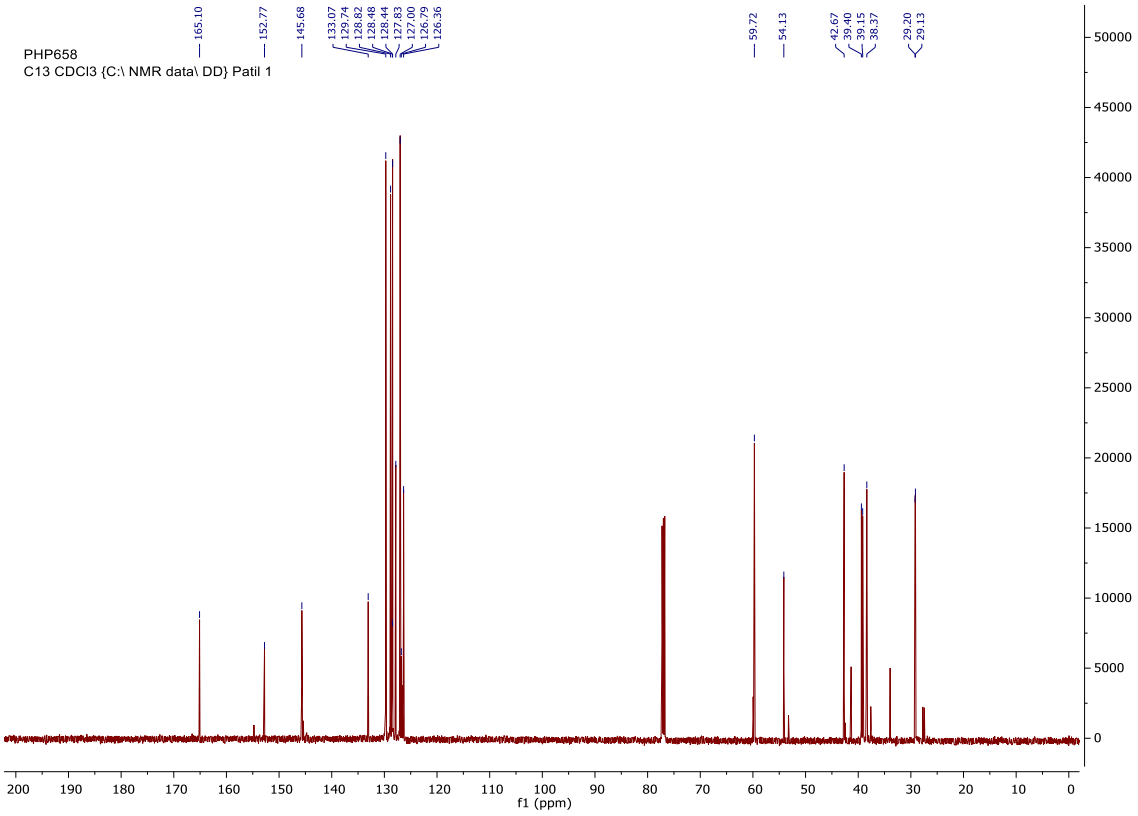




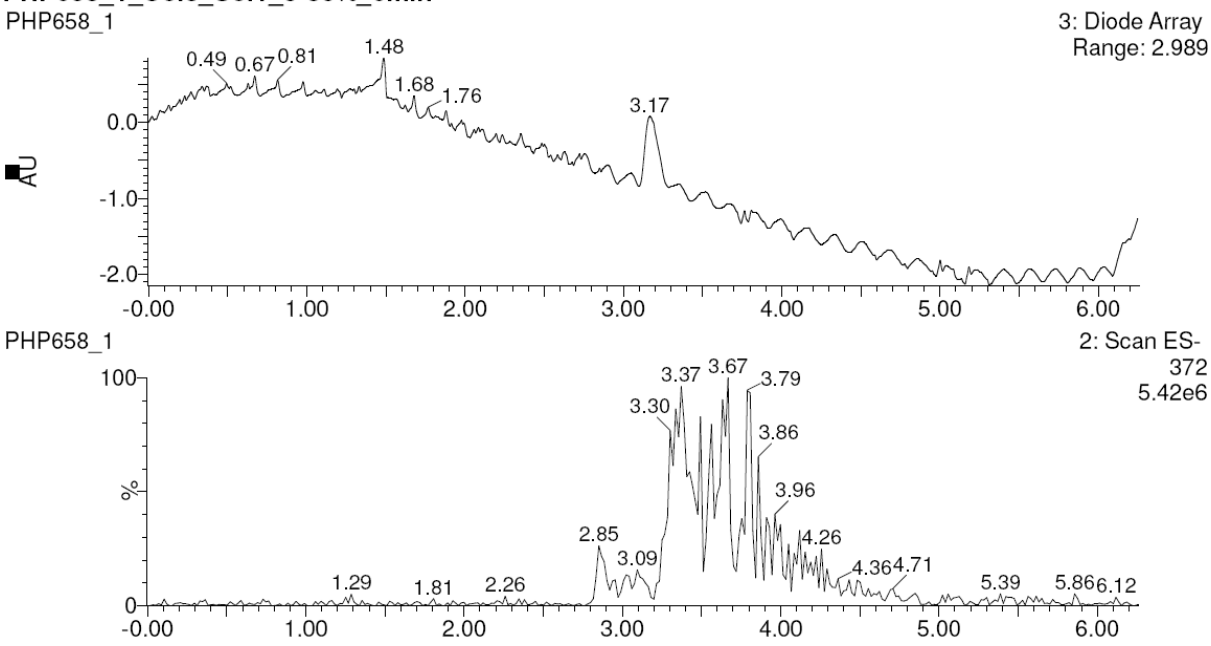


53c: 5'-benzyl-4-phenyl-5'H-spiro[cyclohexane-1,8'-tetrazolo[1,5-a]pyrazin]-6'(7'H)-one

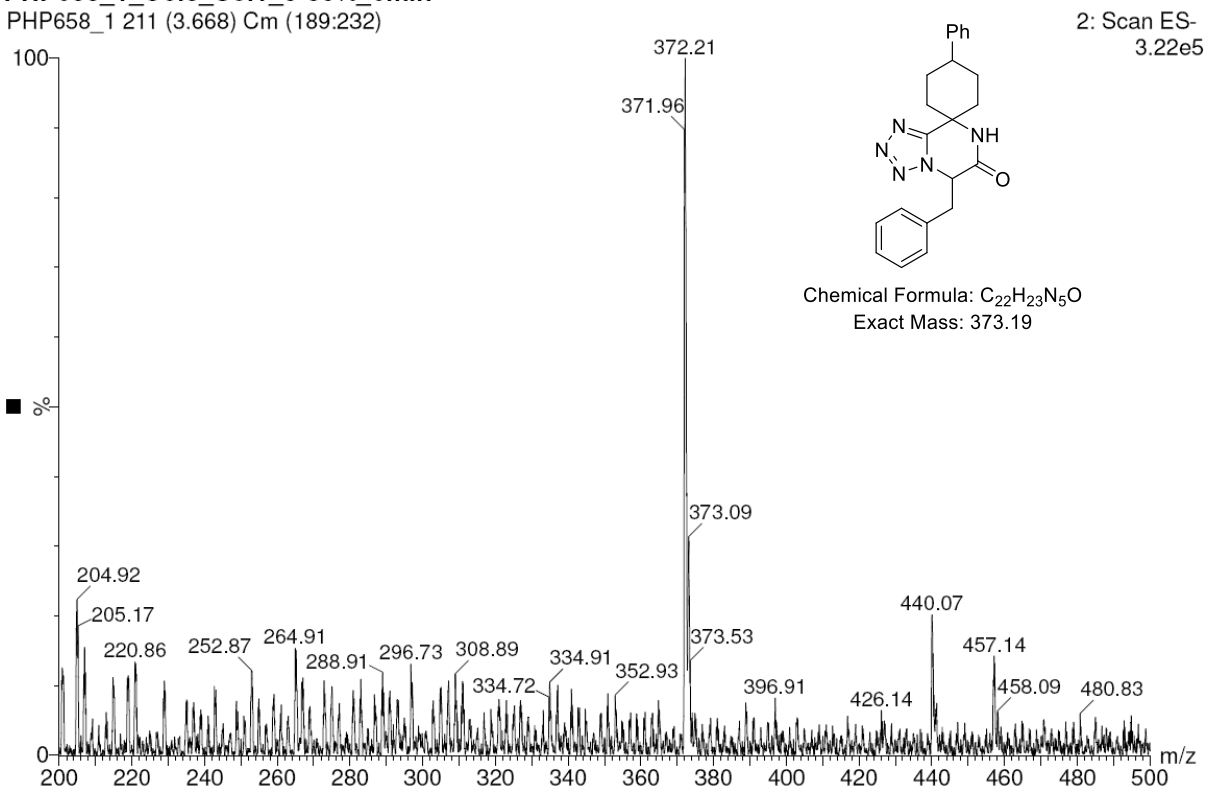




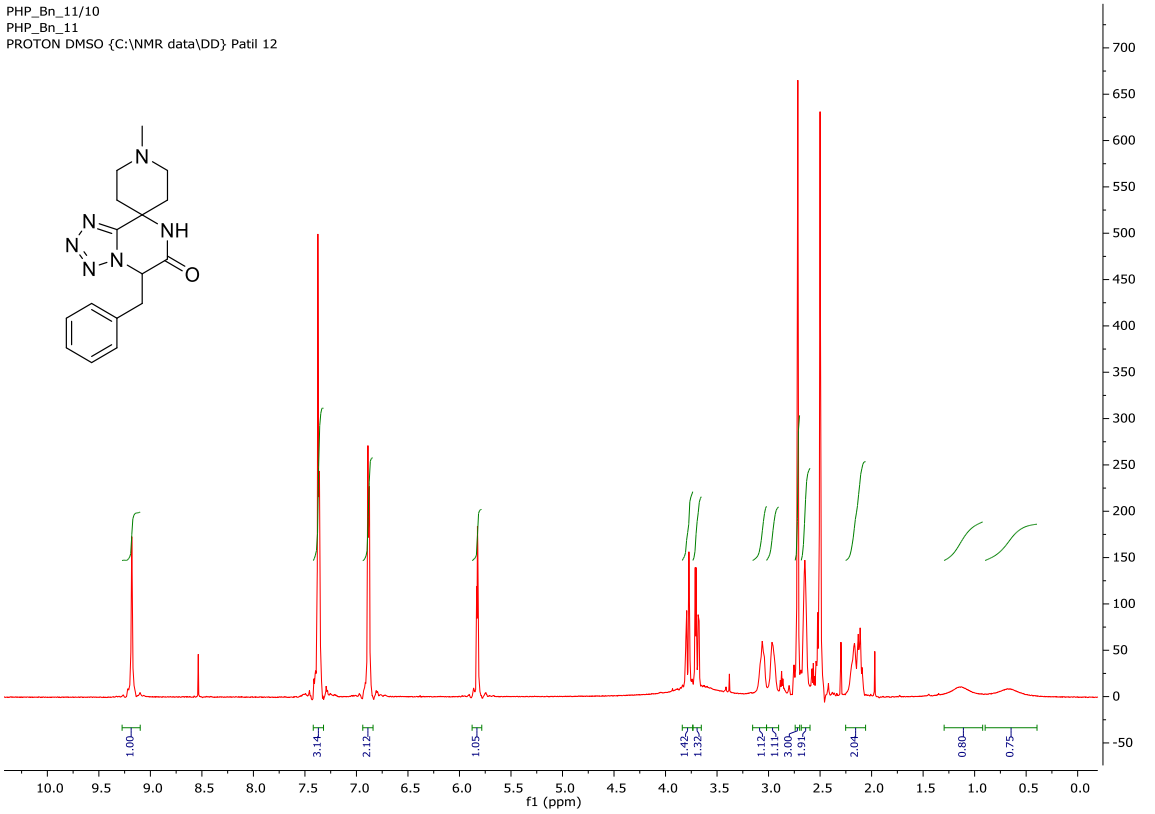
PHP658_1_Col3_Sol1_5-30%_6min

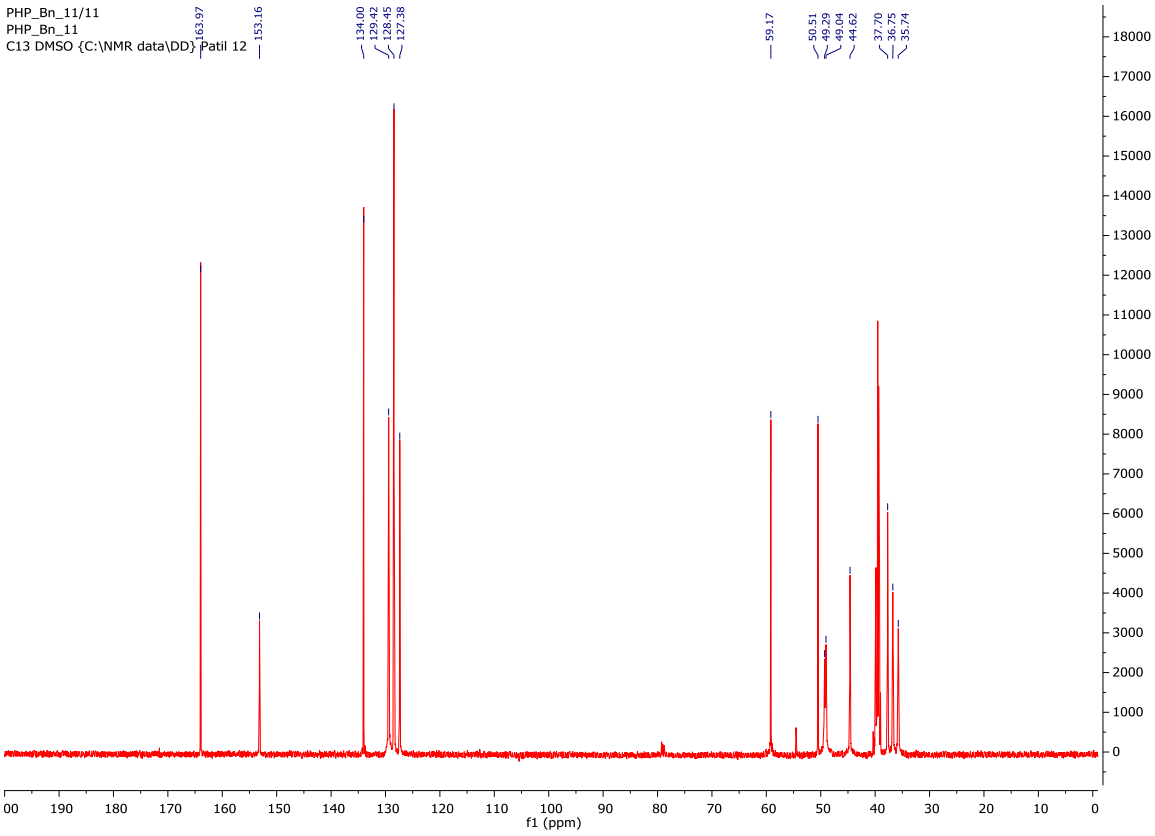


PHP658_1_Col3_Sol1_5-30%_6min

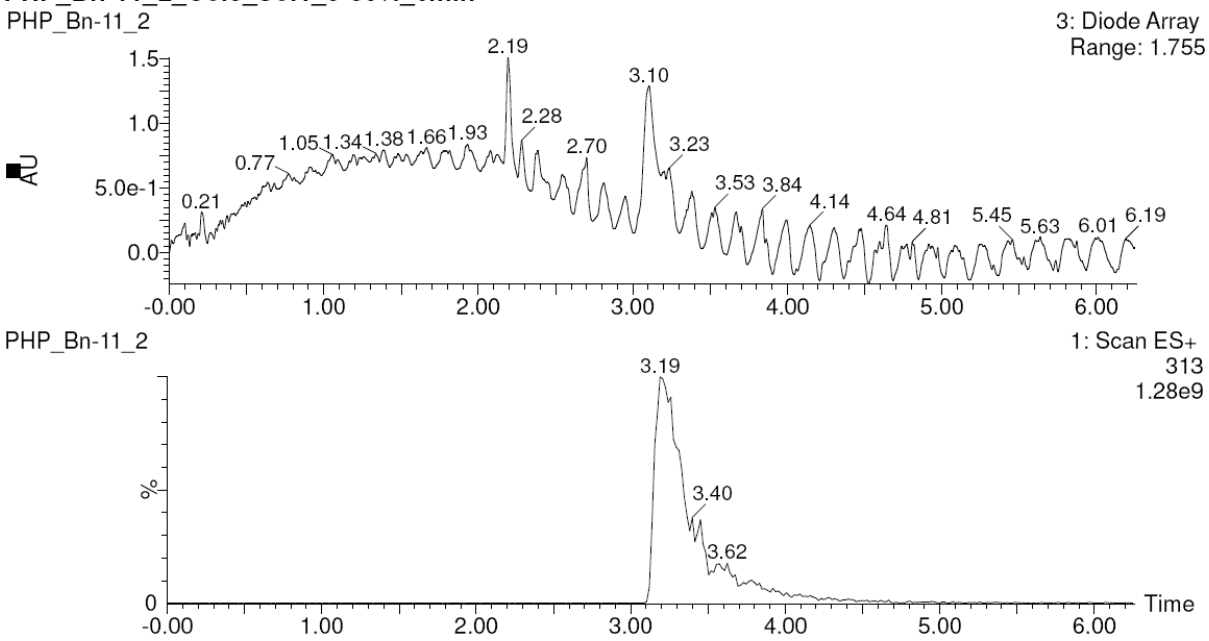


54c: 5'-benzyl-1-methyl-5'H-spiro[piperidine-4,8'-tetrazolo[1,5-a]pyrazin]-6'(7'H)-one

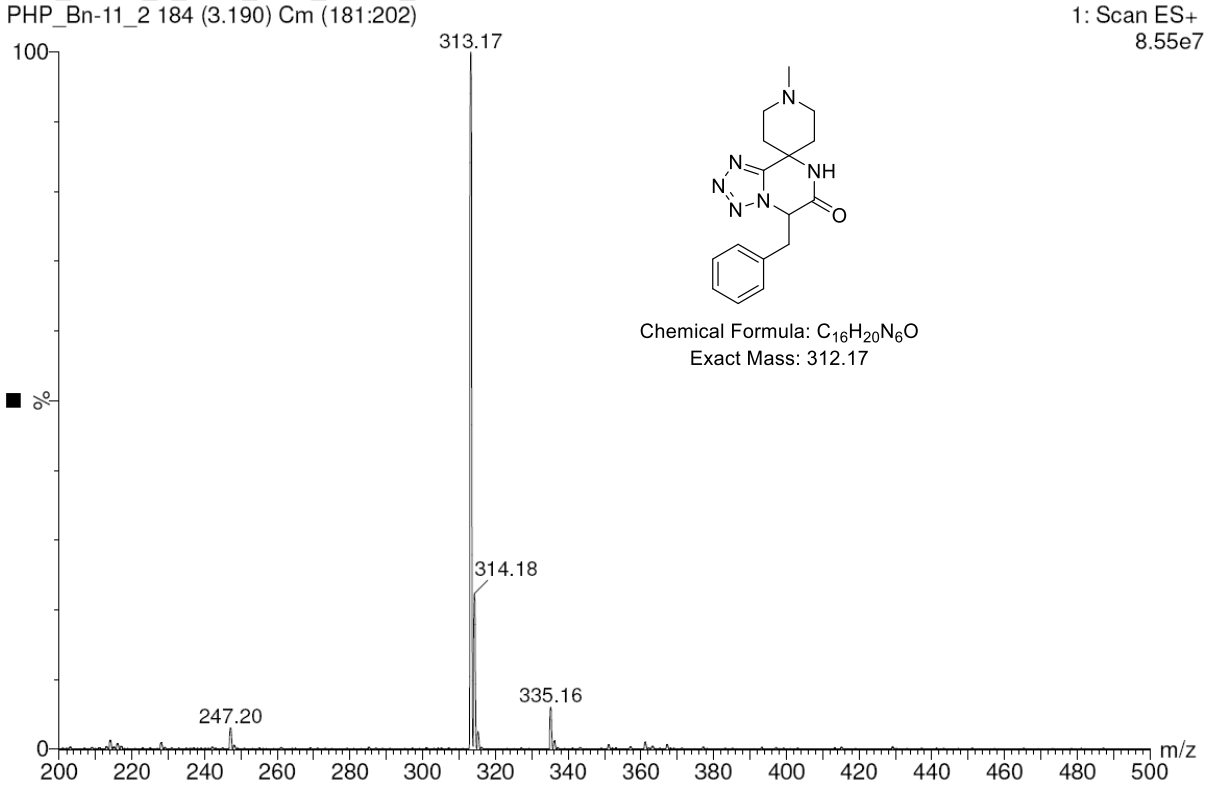




PHP_Bn-11_2_Col3_Sol1_5-30%_6min

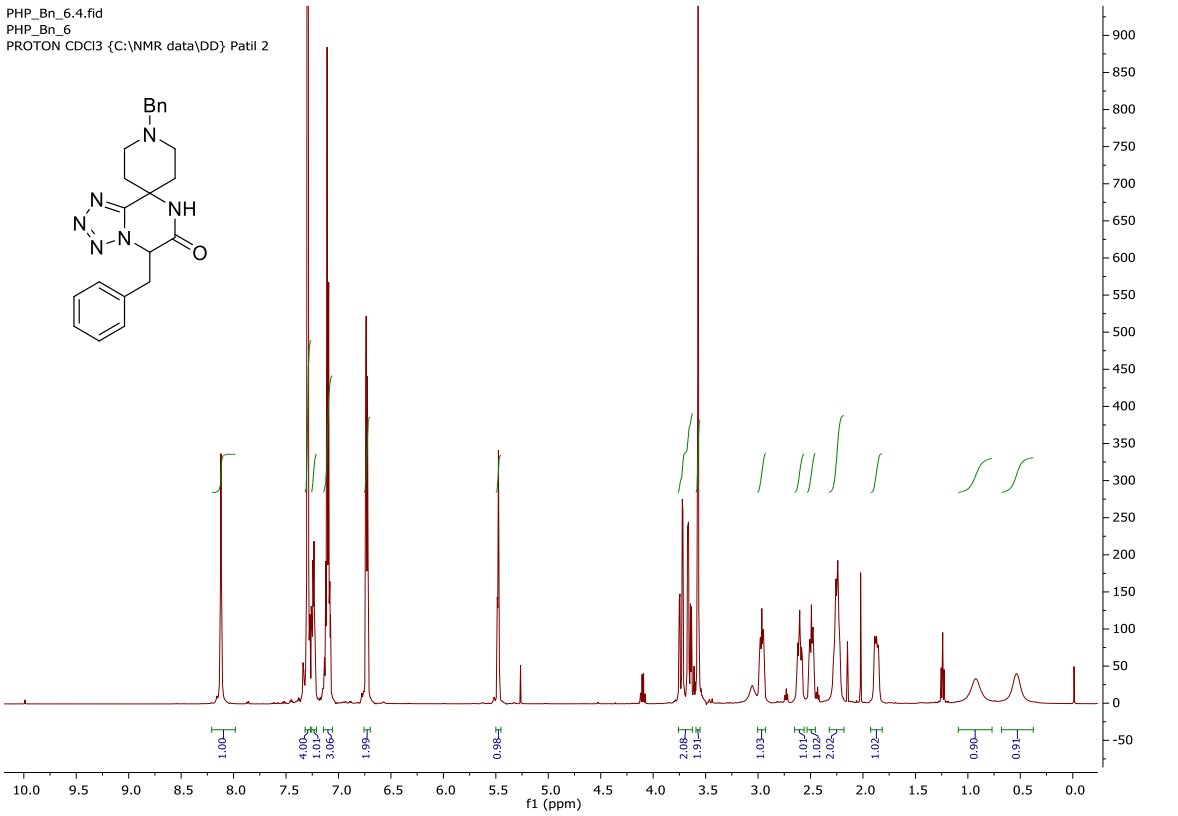


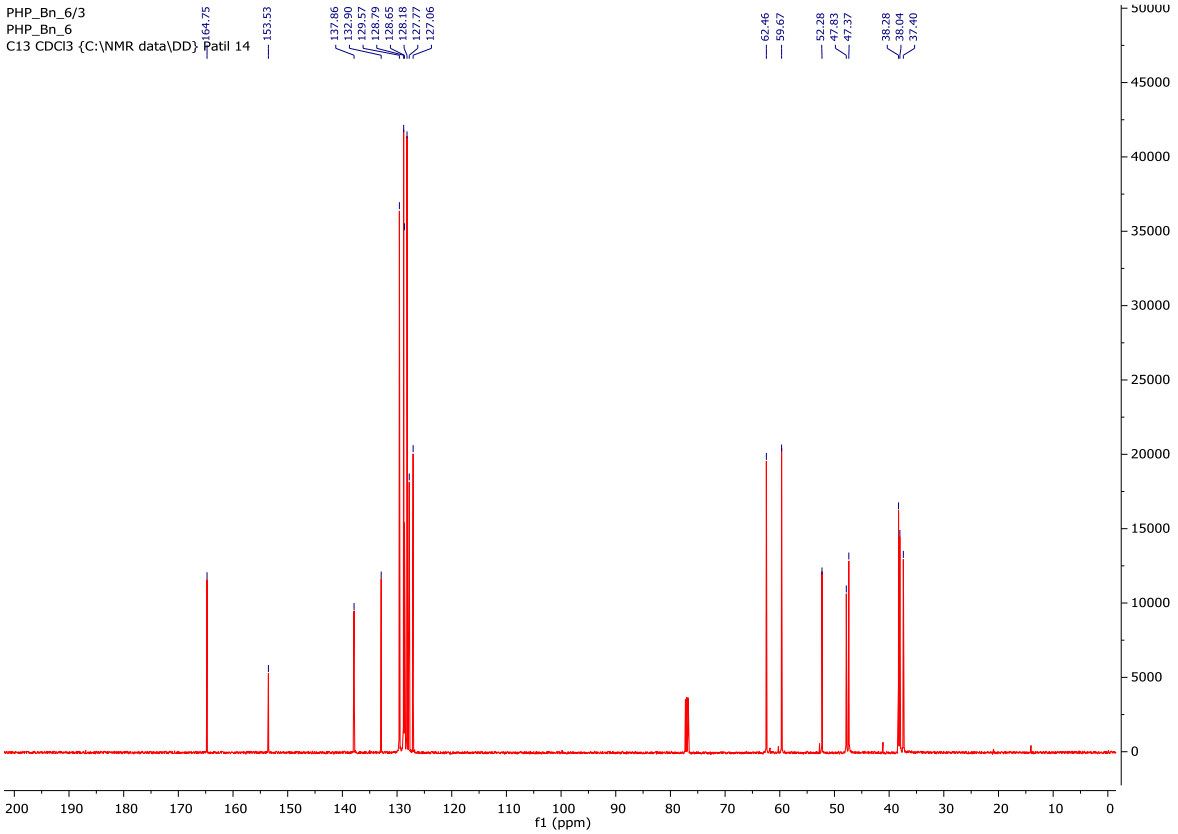
PHP_Bn-11_2_Col3_Sol1_5-30%_6min



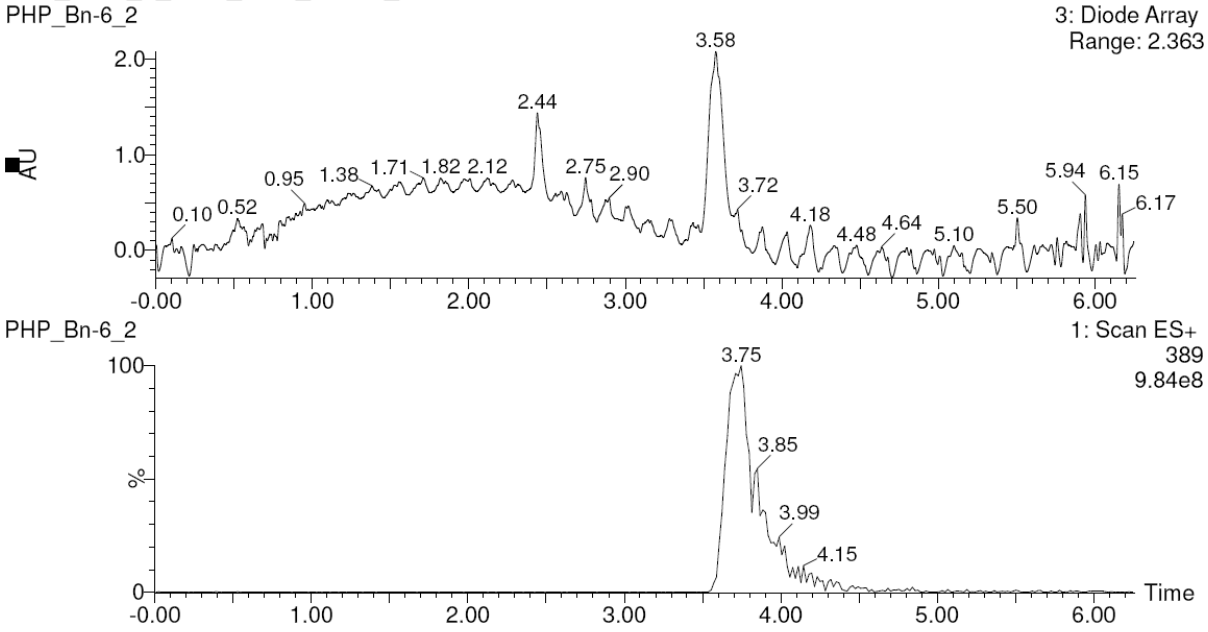
Chemical Formula: $C_{16}H_{20}N_6O$
Exact Mass: 312.17

55c: 1,5'-dibenzyl-5'H-spiro[piperidine-4,8'-tetrazolo[1,5-a]pyrazin]-6'(7'H)-one

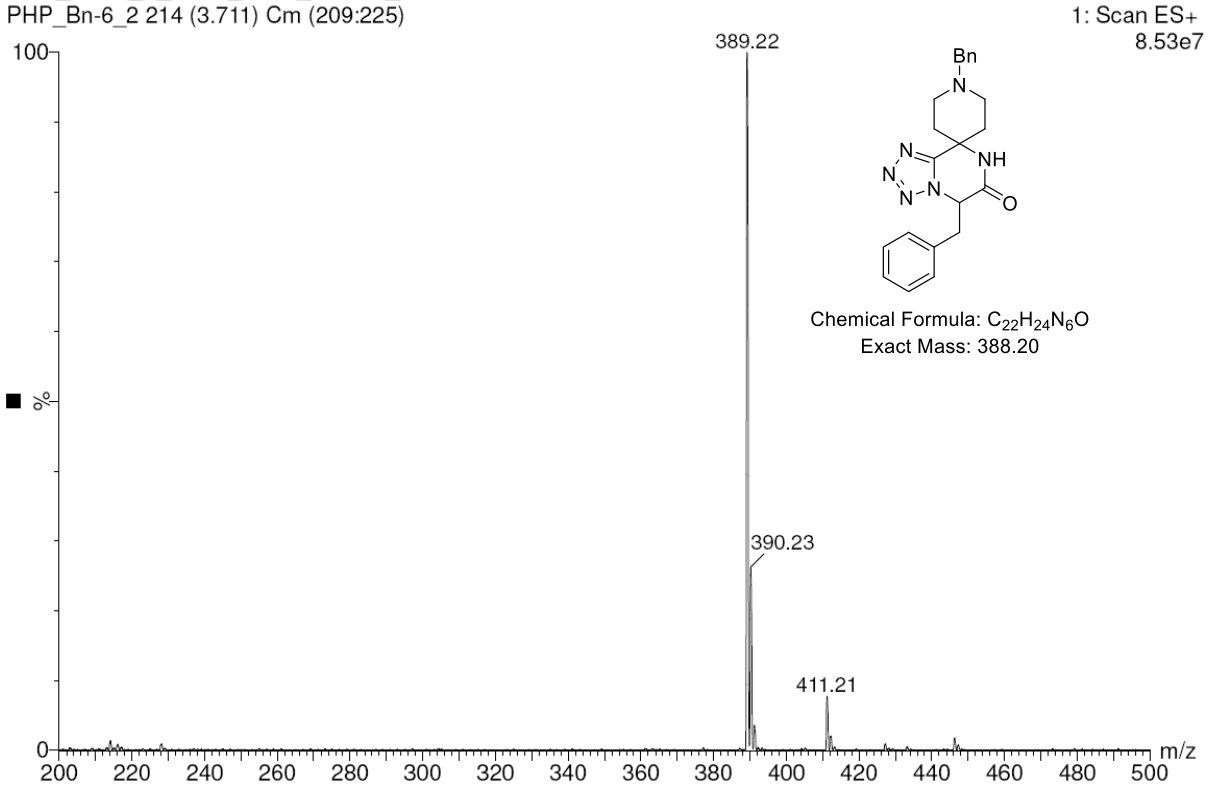




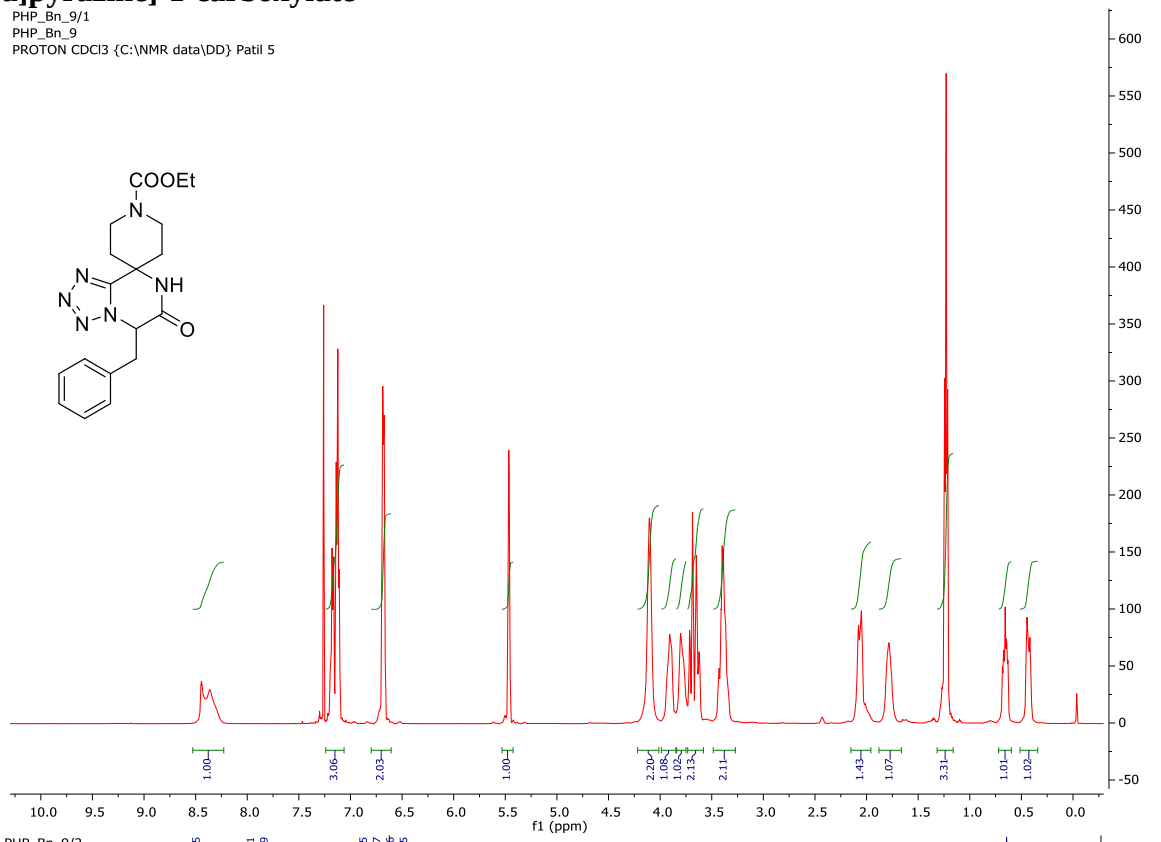
PHP_Bn-6_2_Col3_Sol1_5-30%_6min

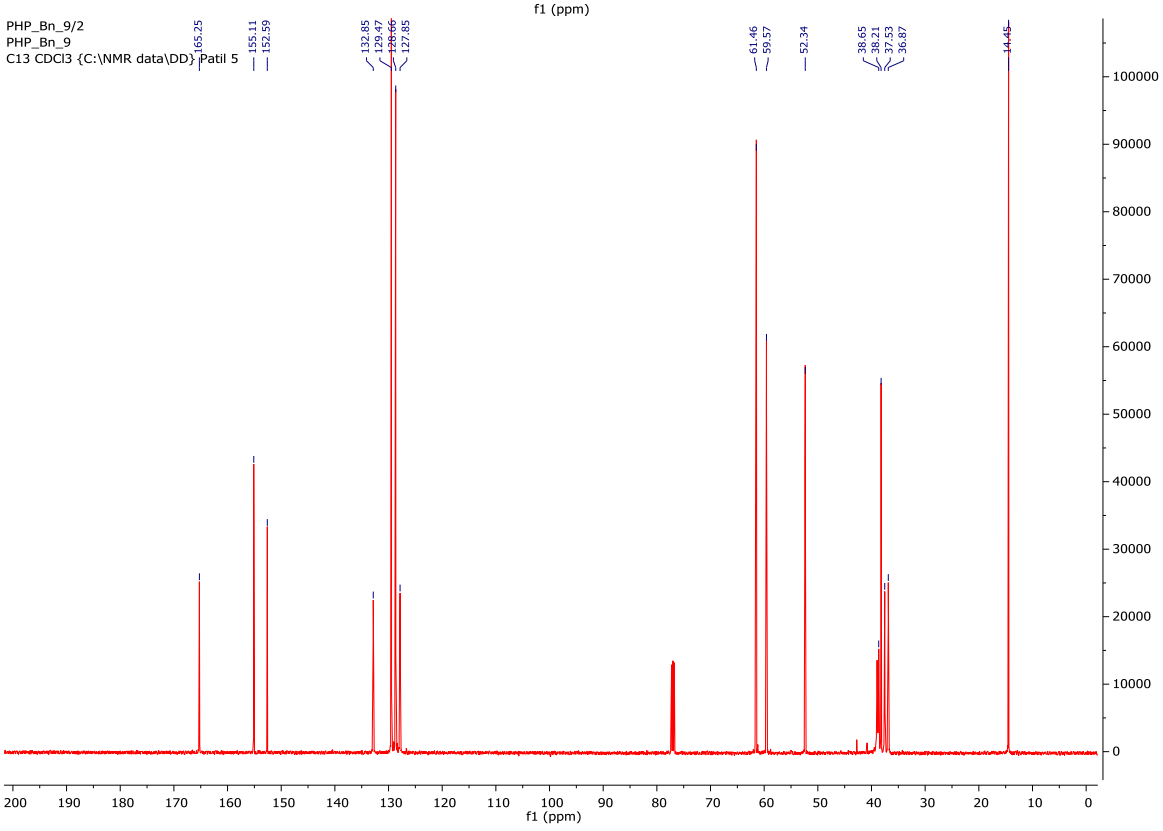


PHP_Bn-6_2_Col3_Sol1_5-30%_6min



56c: ethyl 5'-benzyl-6'-oxo-6',7'-dihydro-5'H-spiro[piperidine-4,8'-tetrazolo[1,5-a]pyrazine]-1-carboxylate





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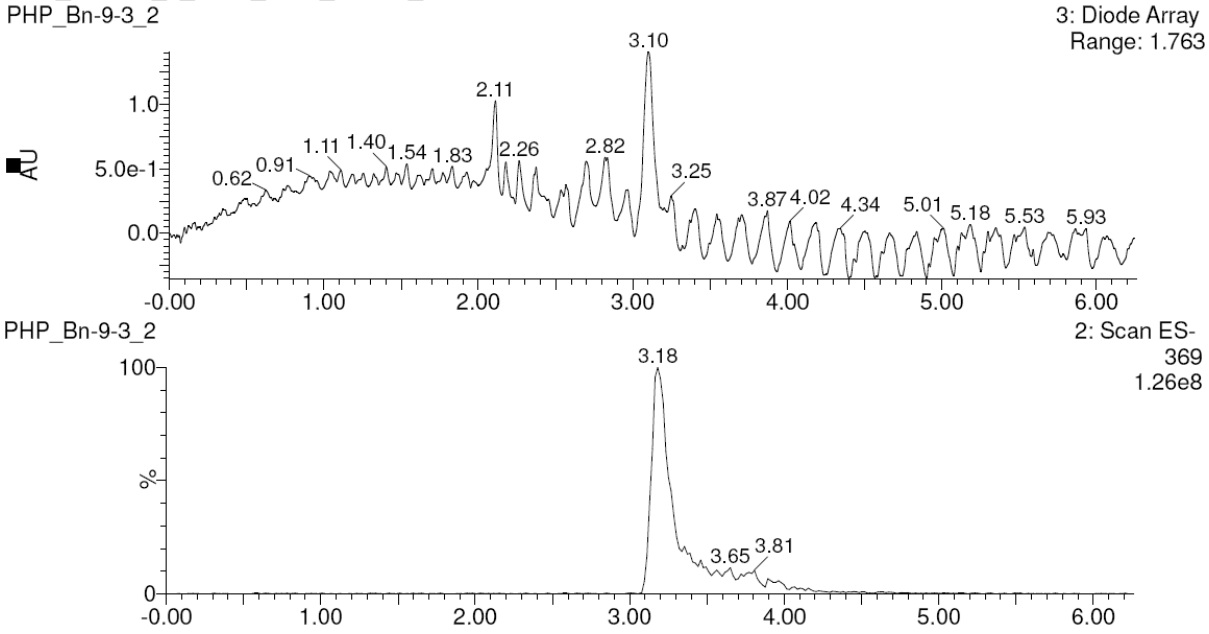

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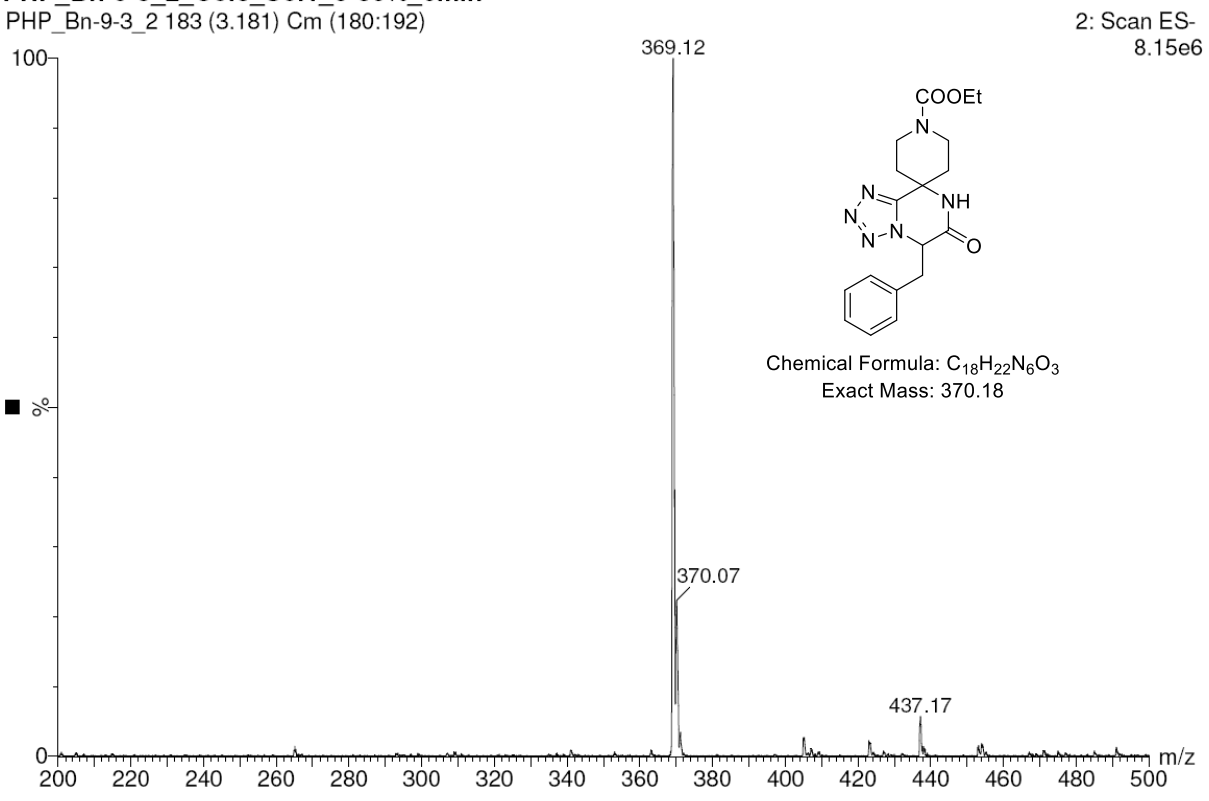
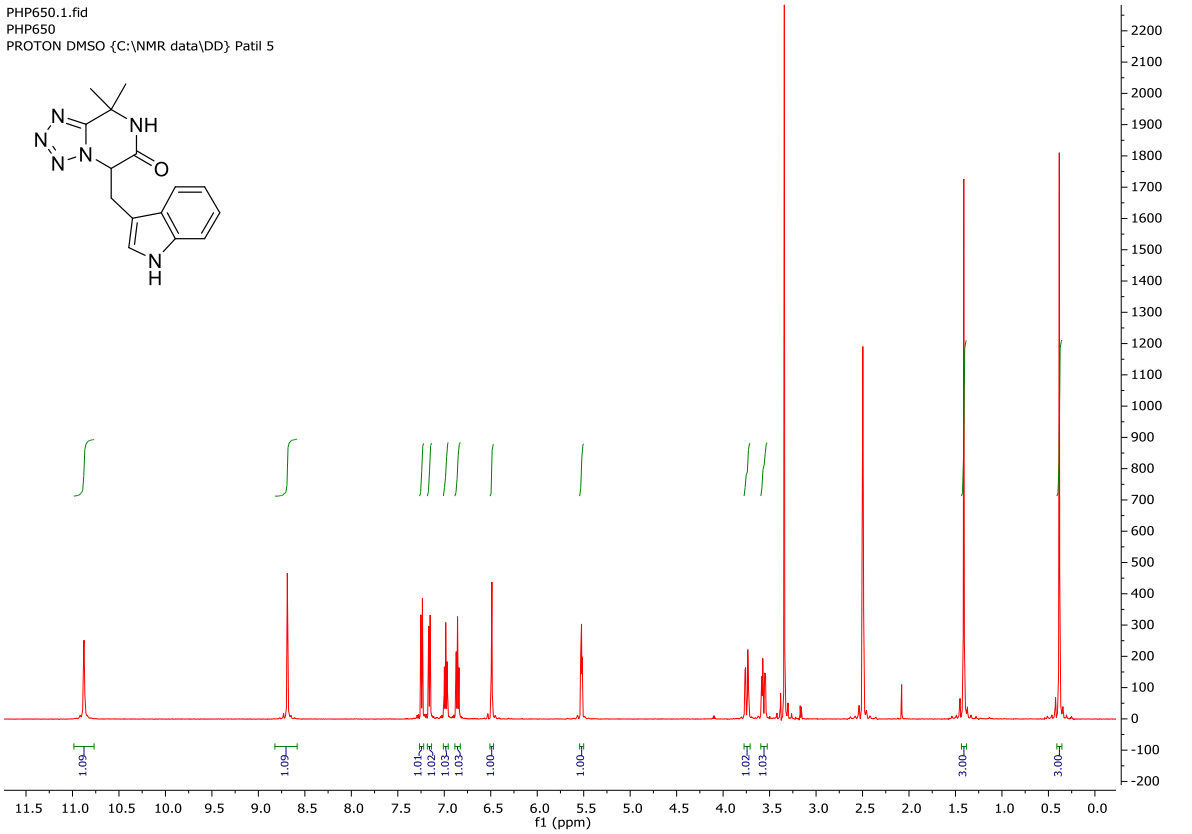
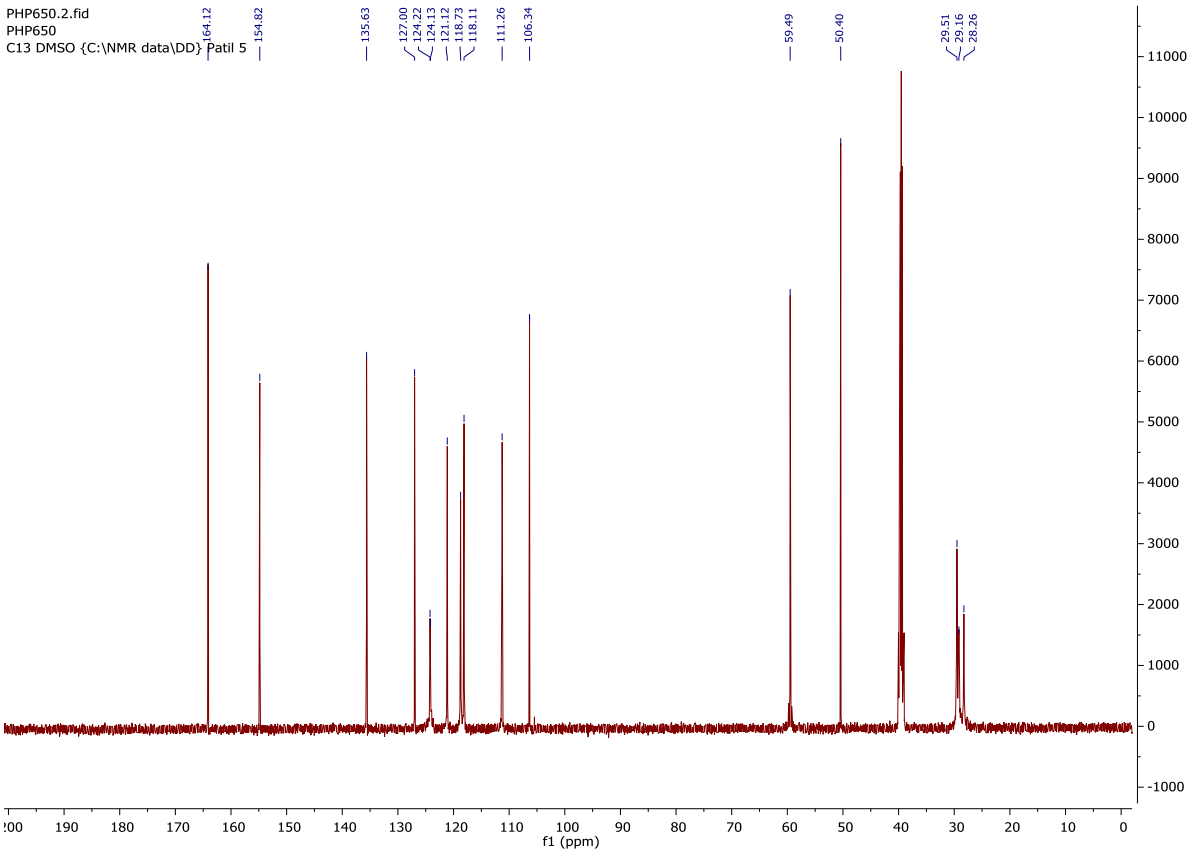


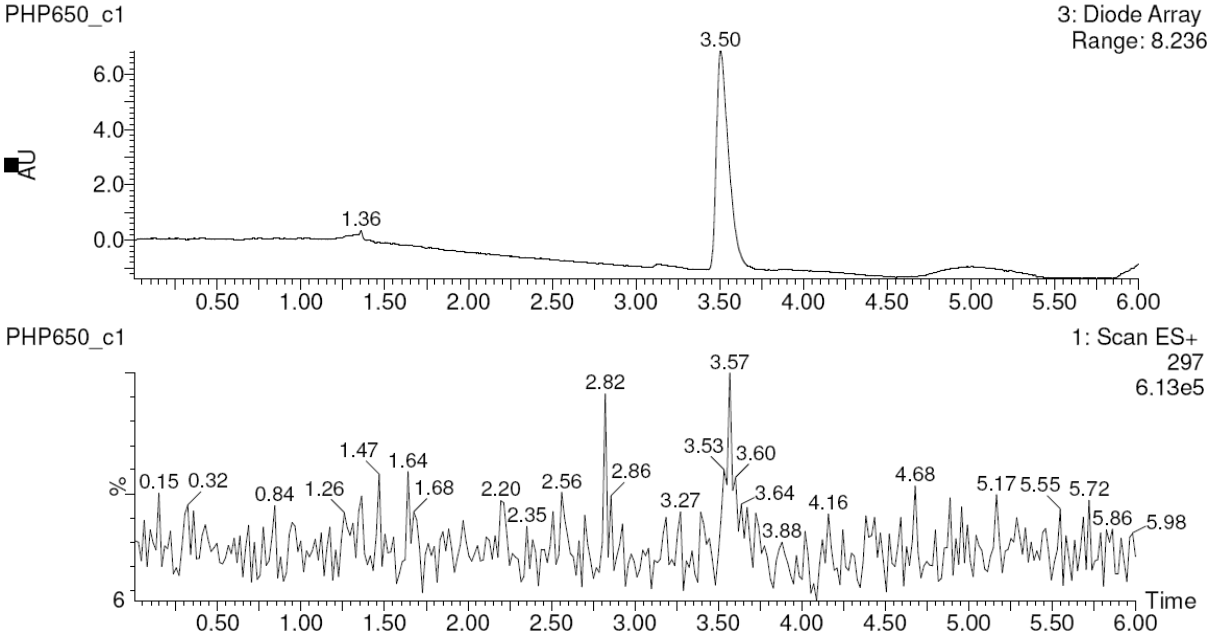
Chemical Formula: $C_{18}H_{22}N_6O_3$
Exact Mass: 370.18

61c: 5-((1H-indol-3-yl)methyl)-8,8-dimethyl-7,8-dihydrotetrazolo[1,5-a]pyrazin-6(5H)-one

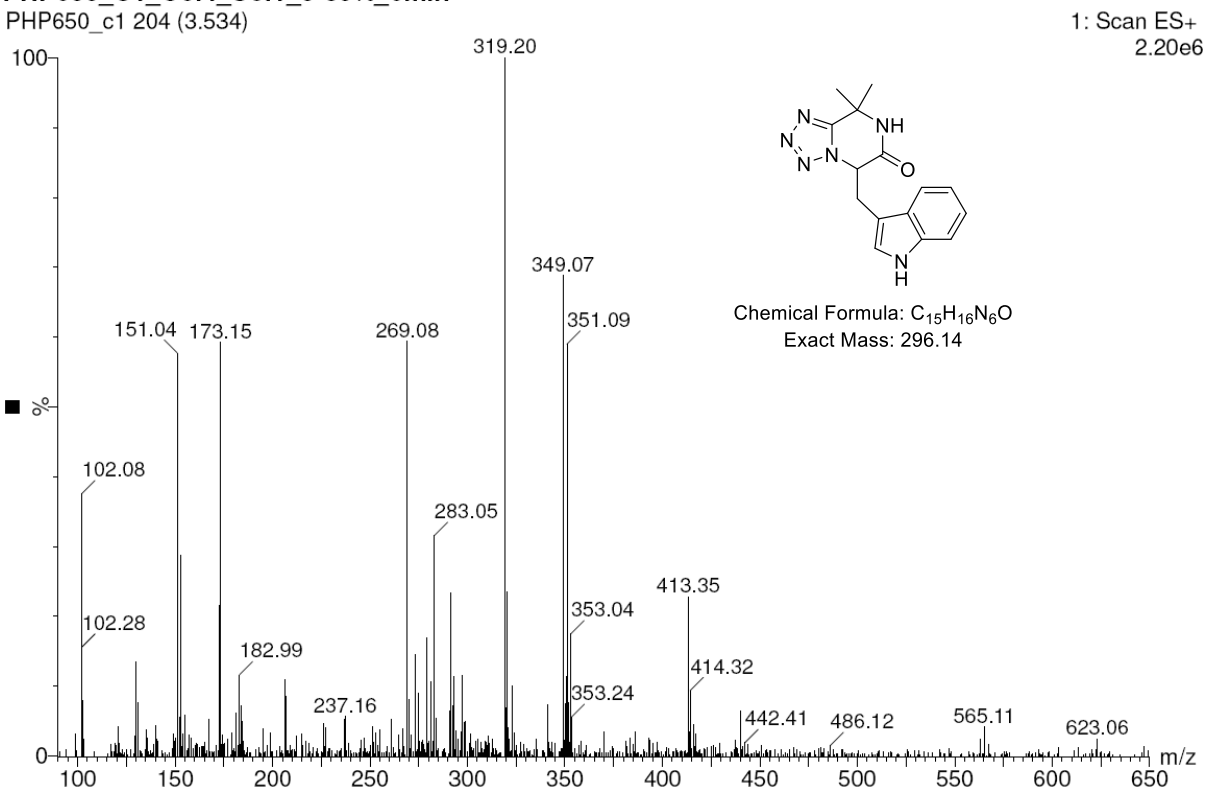




PHP650_C1_Col4_Sol1_5-30%_6min

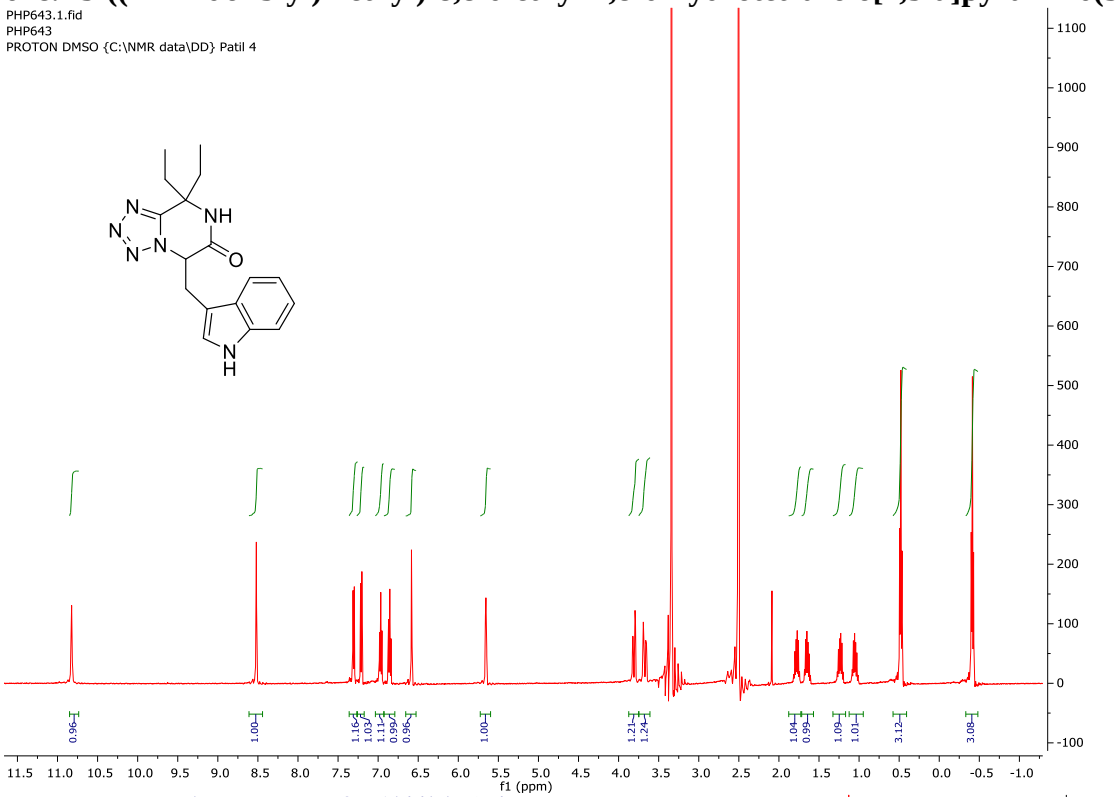


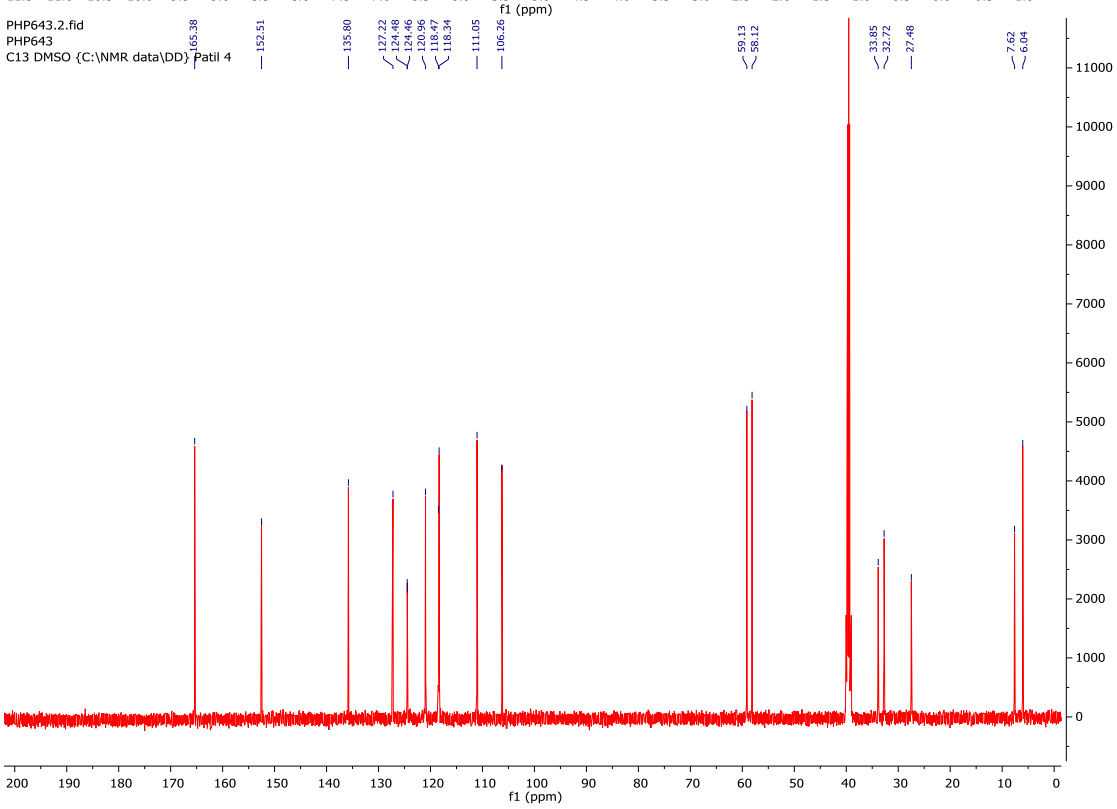
PHP650_C1_Col4_Sol1_5-30%_6min

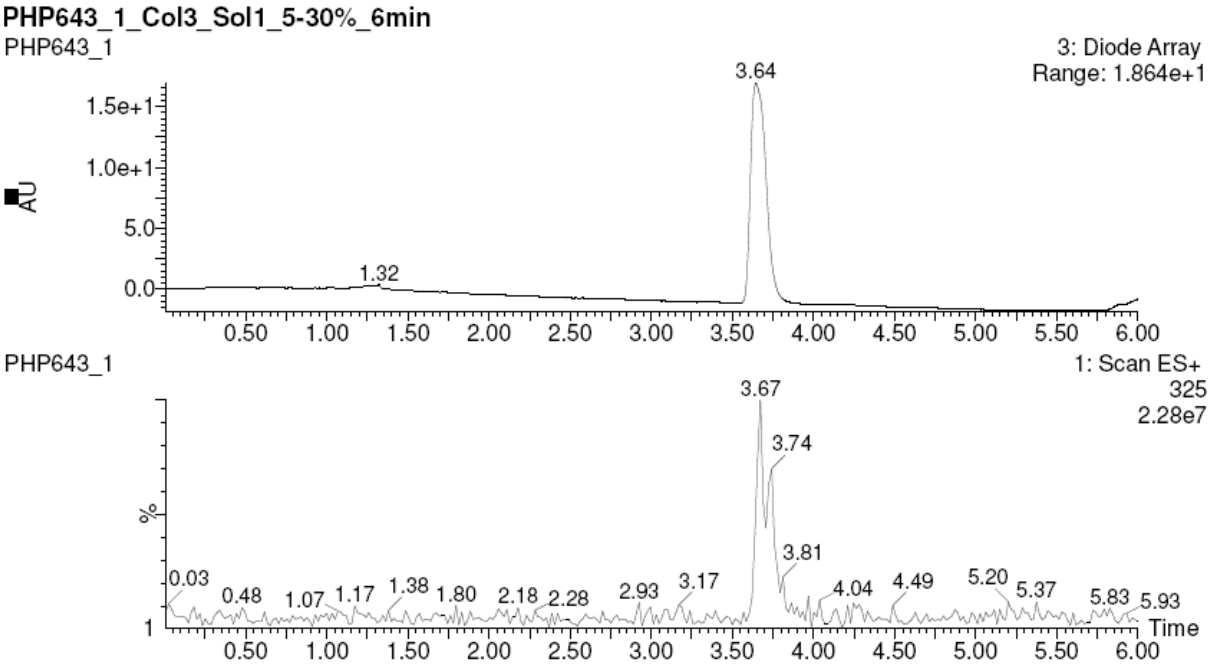


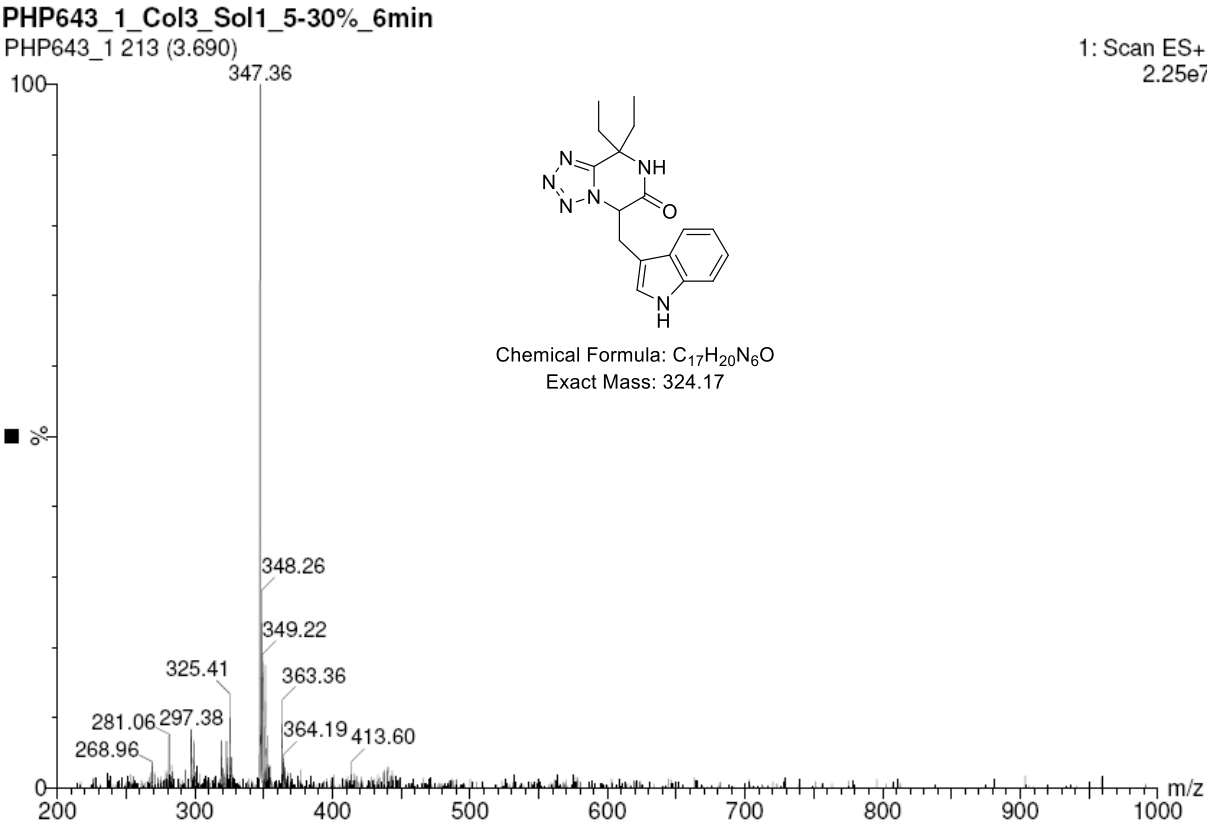
Chemical Formula: $C_{15}H_{16}N_6O$
Exact Mass: 296.14

62c: 5-((1H-indol-3-yl)methyl)-8,8-diethyl-7,8-dihydrotetrazolo[1,5-a]pyrazin-6(5H)-one



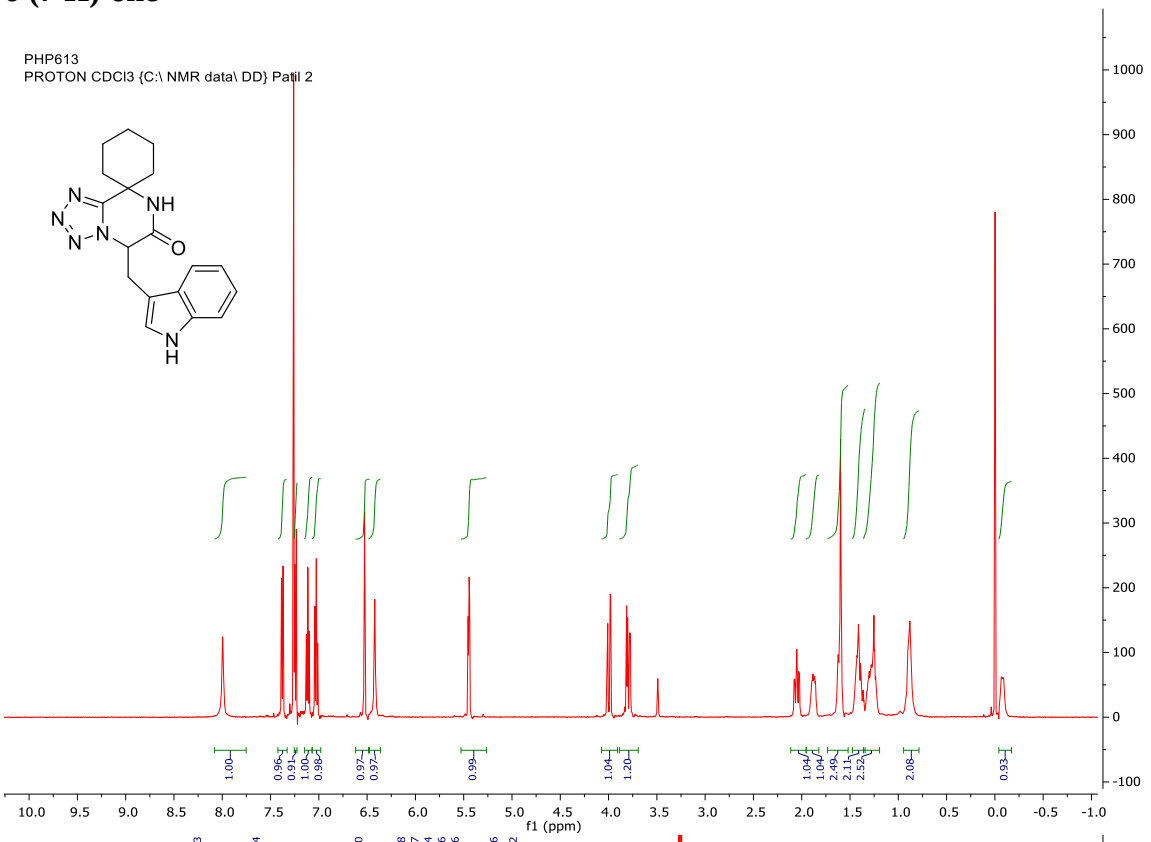


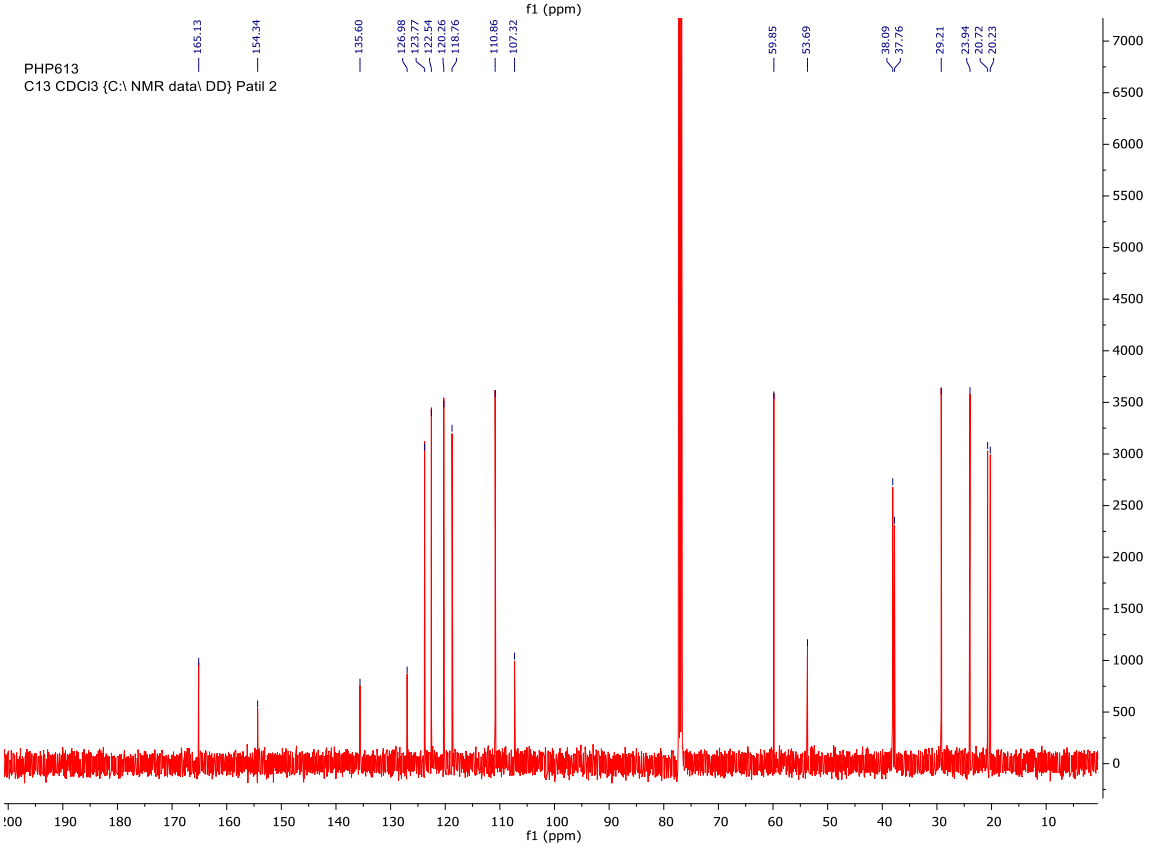




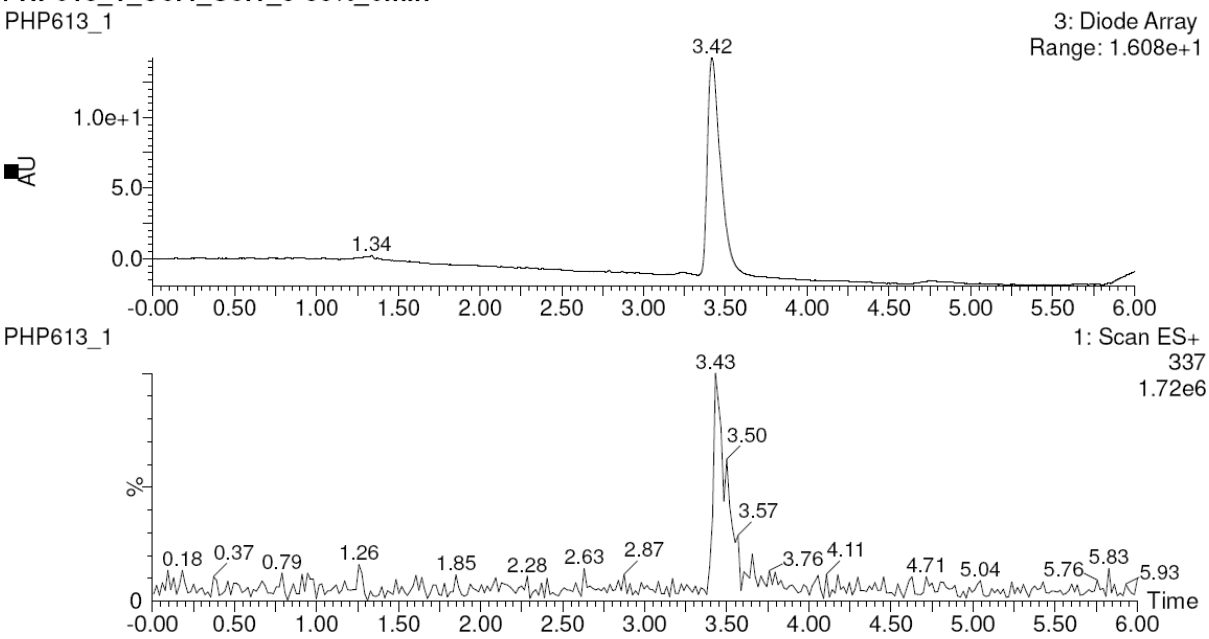
Chemical Formula: $C_{17}H_{20}N_6O$
Exact Mass: 324.17

66c: 5'-((1H-indol-3-yl)methyl)-5'H-spiro[cyclohexane-1,8'-tetrazolo[1,5-a]pyrazin]-6'(7'H)-one

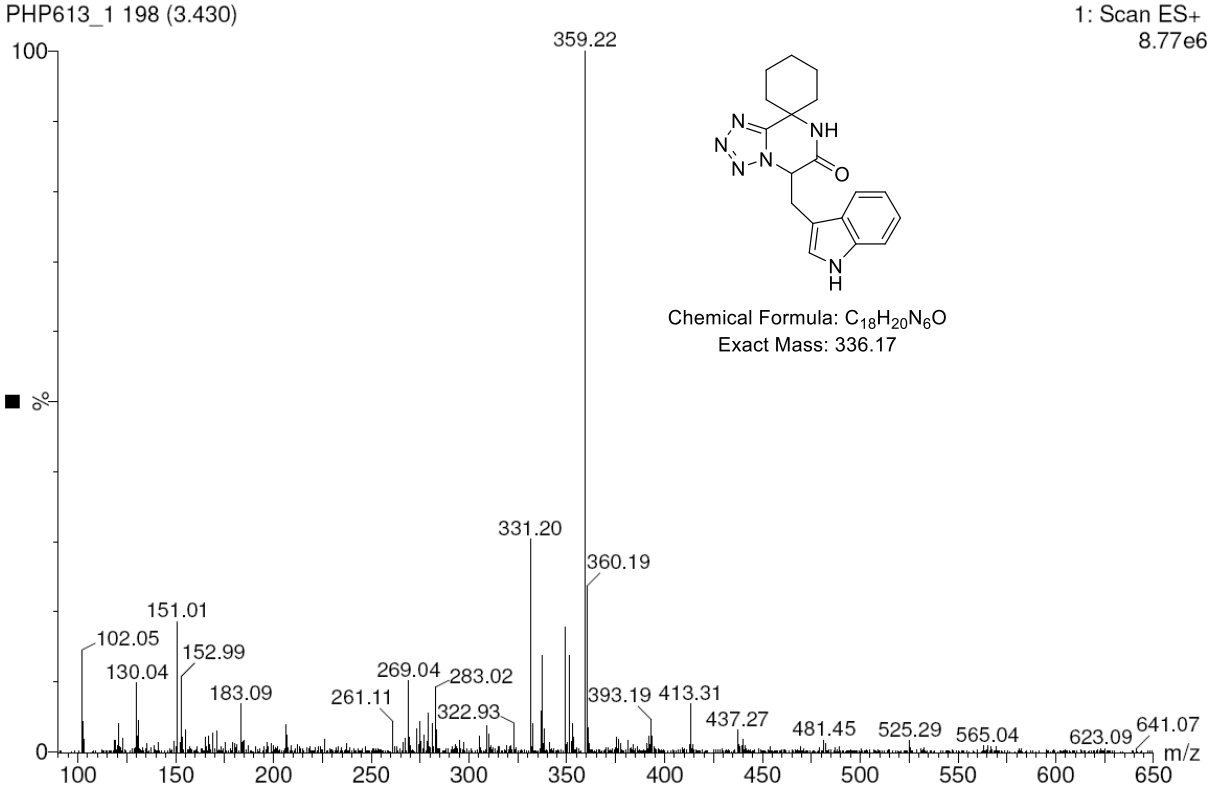




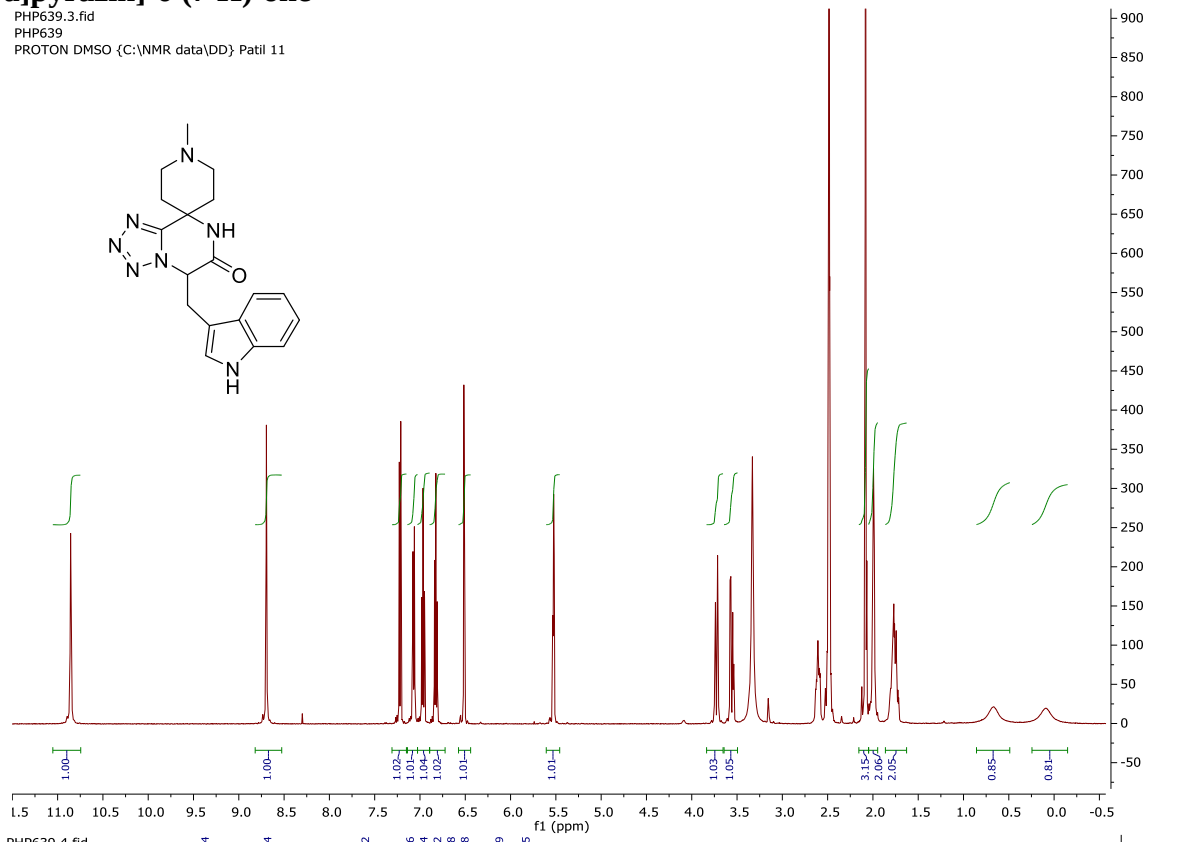
PHP613_1_Col4_Sol1_5-30%_6min

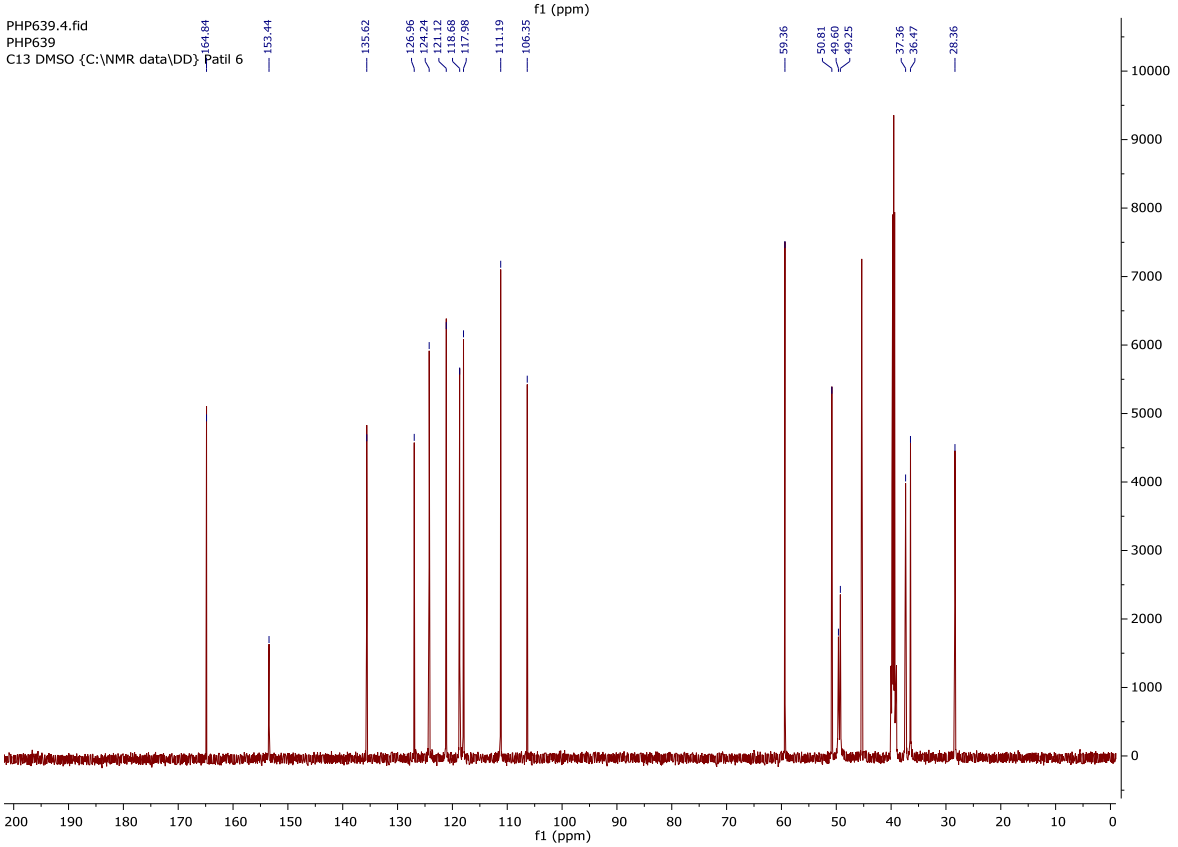


PHP613_1_Col4_Sol1_5-30%_6min



67c: 5'-((1H-indol-3-yl)methyl)-1-methyl-5'H-spiro[piperidine-4,8'-tetrazolo[1,5-a]pyrazin]-6'(7'H)-one





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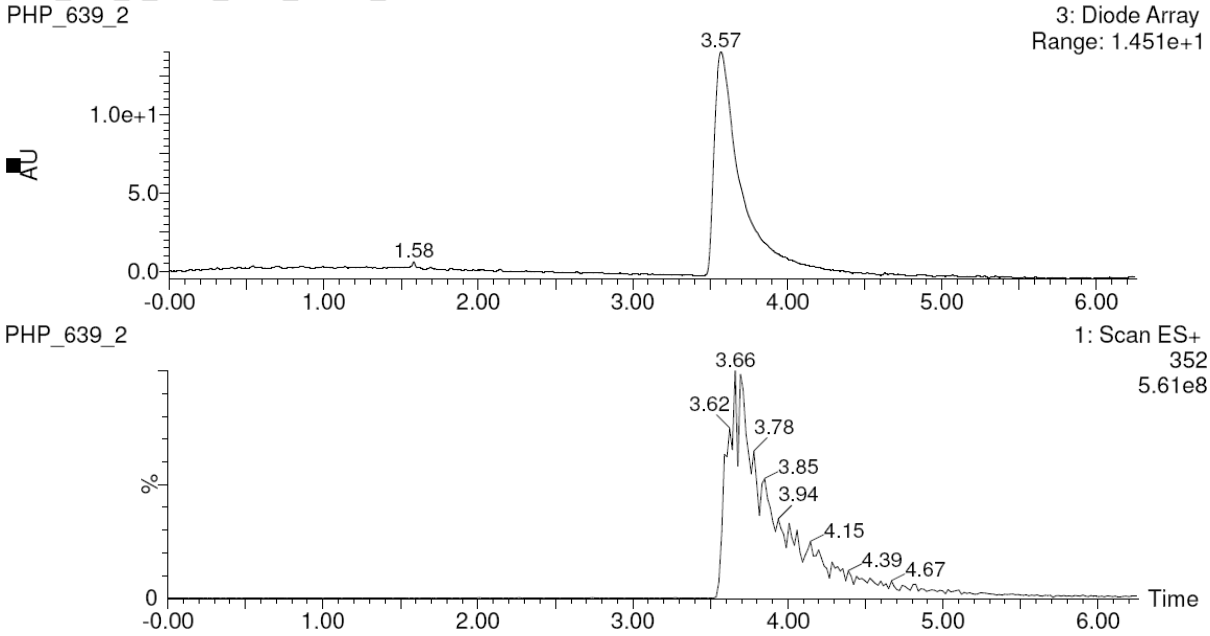
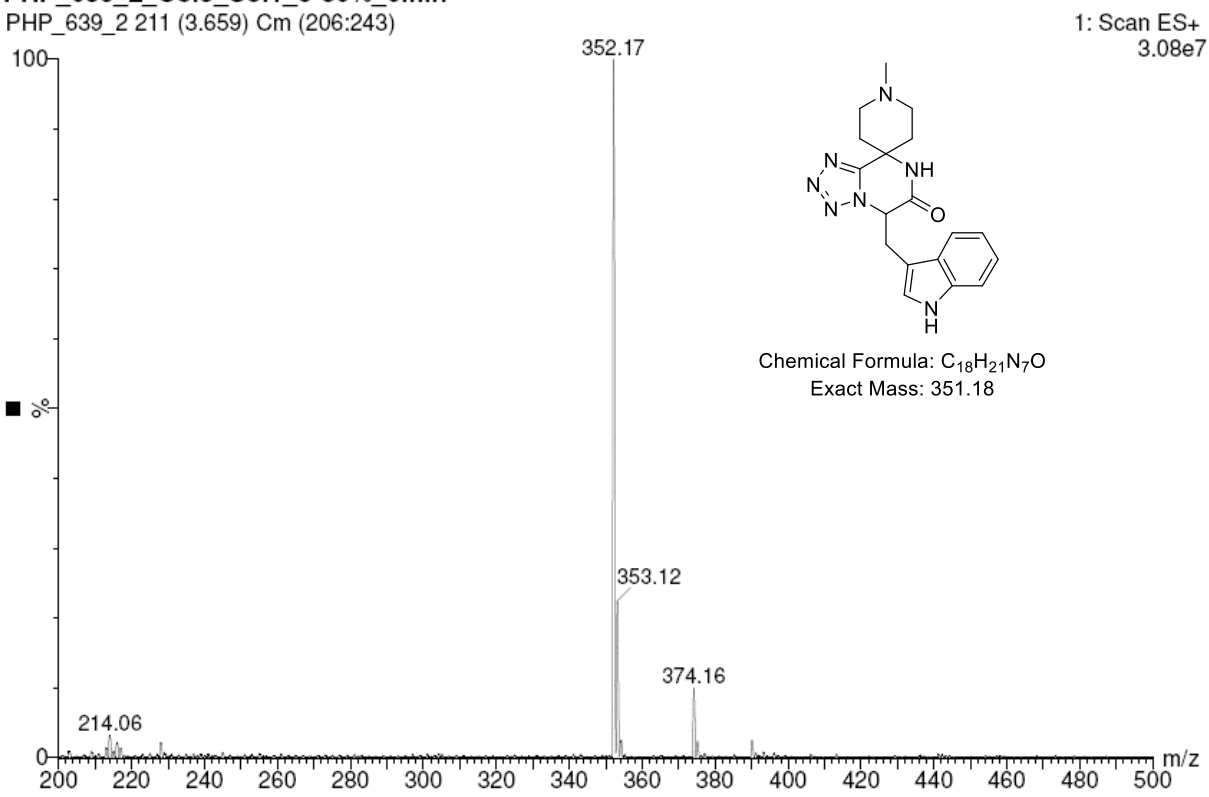
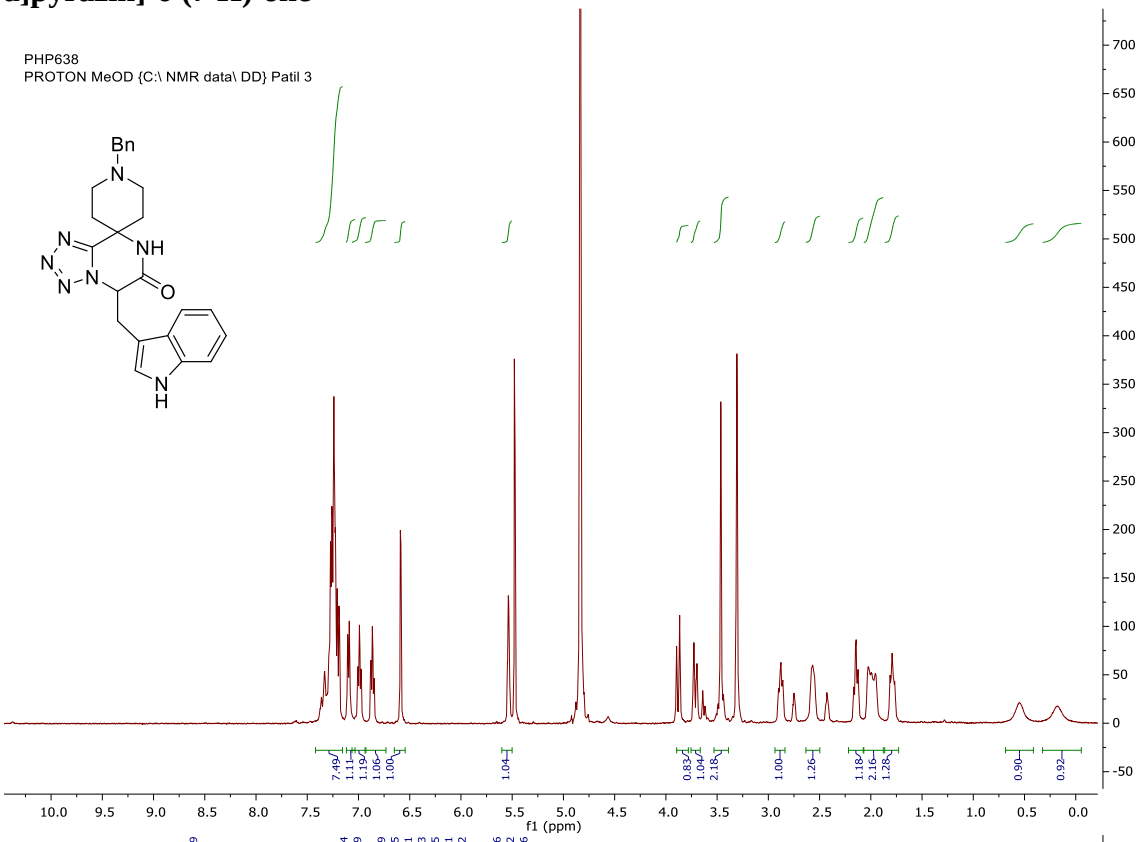


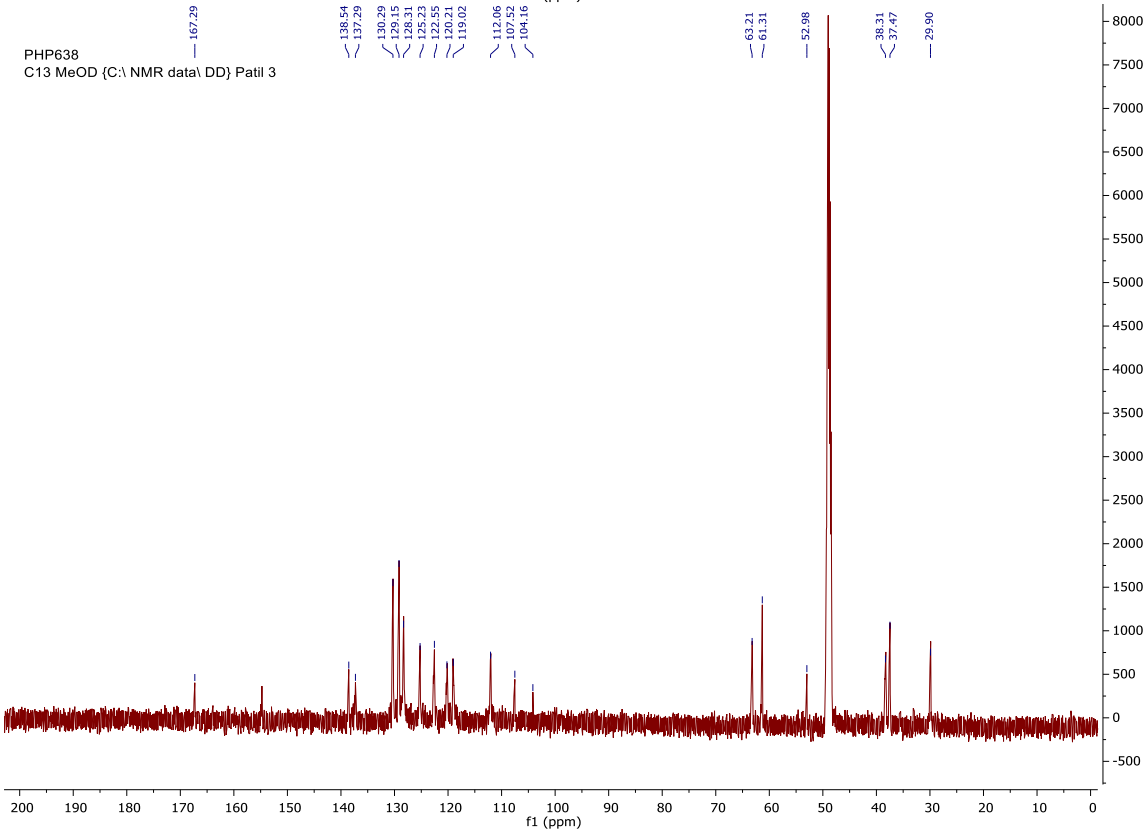
PHP_639_2_Col3_Sol1_5-30%_6min

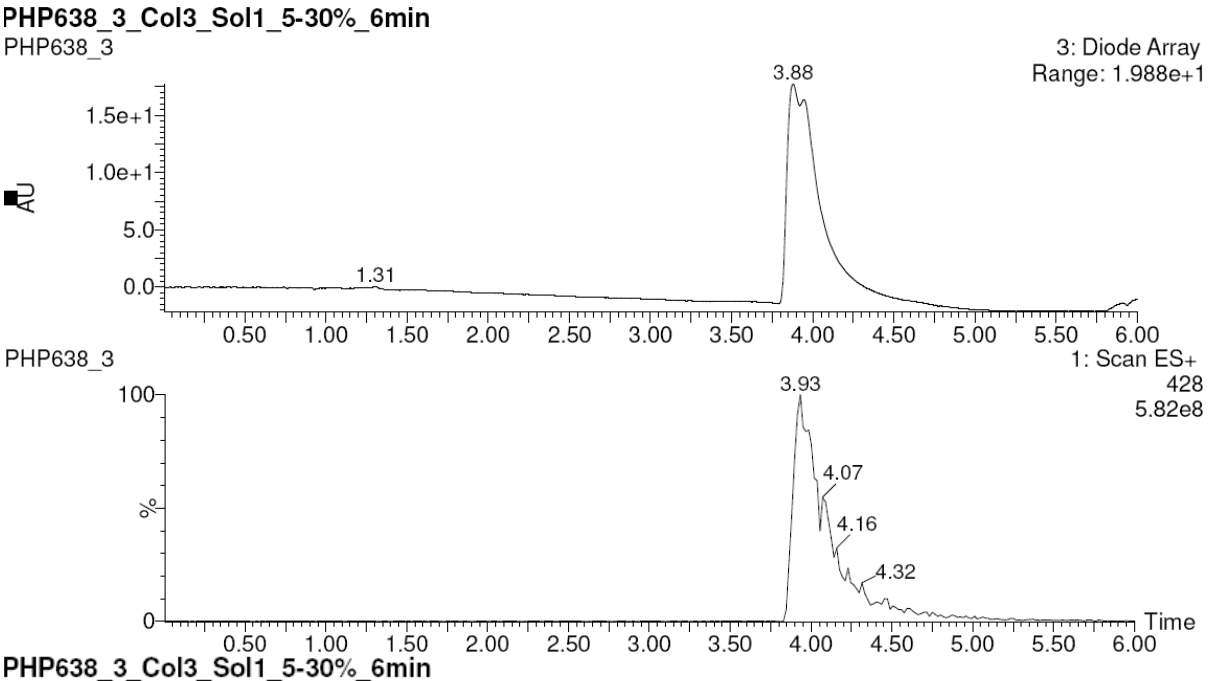


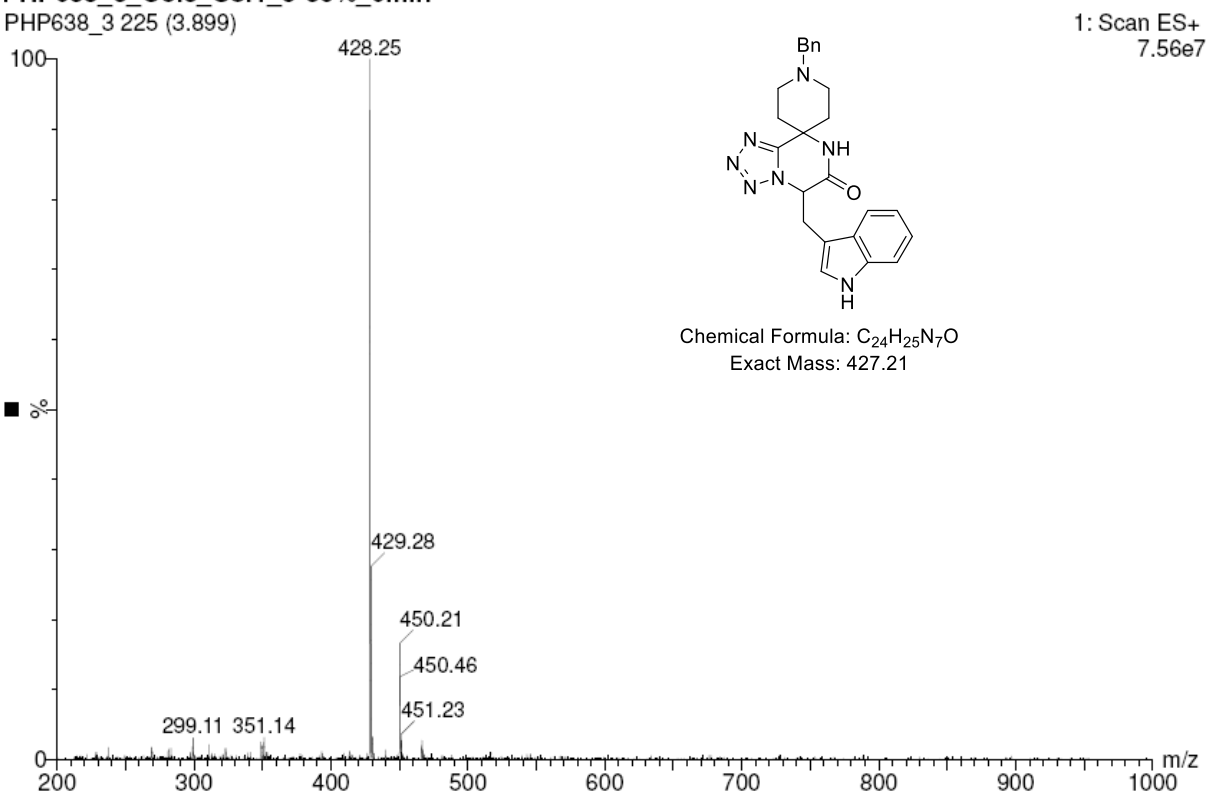
Chemical Formula: $C_{18}H_{21}N_7O$
Exact Mass: 351.18

68c: 5'-((1H-indol-3-yl)methyl)-1-benzyl-5'H-spiro[piperidine-4,8'-tetrazolo[1,5-a]pyrazin]-6'(7'H)-one






PHP638_3_Col3_Sol1_5-30%_6min
PHP638_3
3: Diode Array
Range: 1.988e+1
3.88
1.31
AU
PHP638_3
1: Scan ES+
428
5.82e8
3.93
4.07
4.16
4.32
%
Time


PHP638_3_Col3_Sol1_5-30%_6min
PHP638_3 225 (3.899)
1: Scan ES+
7.56e7
428.25
429.28
450.21
450.46
451.23
299.11
351.14
%
m/z
Bn
NH
O
Chemical Formula: C24H25N7O
Exact Mass: 427.21

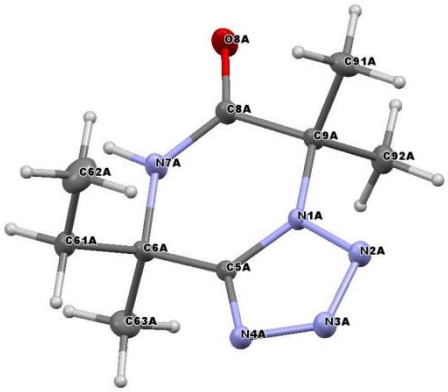
Crystal structure determination

X-ray diffraction data for single crystals of compounds **14c, 16c, 28c, 29c, 46c, 61c** and **62c** were collected using SuperNova (Rigaku - Oxford Diffraction) four circle diffractometer with a mirror monochromator and a microfocus MoKα radiation source (λ = 0.7107 Å) for **14c**, **29c**, **46c** and **62c** and CuKα radiation source (λ = 1.5418 Å) for **16c**, **28c** and **61c**. Additionally, the diffractometer was equipped with a CryoJet HT cryostat system (Oxford Instruments) allowing low temperature experiments. Single crystals were mounted on MicroMounts^{TM} and measured at temperature range 114-293 K. The obtained data sets were processed with CrysAlisPro software [S1]. The phase problem was solved by direct methods using SHELXS [S2], SIR2002 [S3] or SUPERFLIP [S4]. Parameters of obtained models were refined by full-matrix least-squares on F^2 using SHELXL-2014/6 [S2]. Calculations were performed using WinGX integrated system (ver. 2013.2) [S5]. Figures were prepared with Mercury 3.5 software [S6].

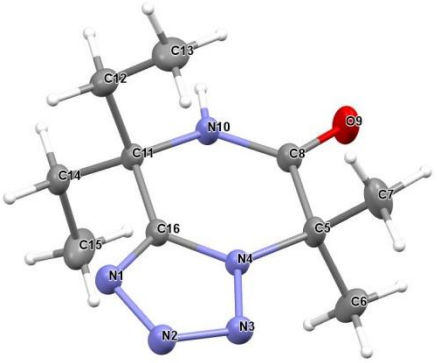
All non-hydrogen atoms in the crystal structures of **14c, 16c, 28c, 29c, 46c, 61c** and **62c** were refined anisotropically to ensure the convergence of the refinement process. All hydrogen atoms attached to carbon atoms were positioned with the idealised geometry and refined using the riding model with the isotropic displacement parameter U_{iso}[H] = 1.2 (or 1.5) U_{eq}[C]. The position of hydrogen atoms linked to the N atoms were found on the difference Fourier map and refined with no restrains on the isotropic displacement parameter. Crystal data and structure refinement results for compounds **14c, 16c, 28c, 29c, 46c, 61c** and **62c** are shown in Table S1.

In the crystal structure of compound **14c**, only one of the two molecules of the asymmetric unit is partially disordered, with site occupancy 62% and 38% (Figure S1). All tested crystals of compound **62c** gave datasets, suggesting racemic twinning of the structure. The twinned crystal consists of two components. For better handling of the twin data, the HKLF5 program was applied for data separation [S7]. From the total number of 11288 reflections, only 9734 were written to the final hkl file. Thus, separation of data for both components resulted in omission of 1554 reflections. This influenced final results and drastically decreased completeness of the data (86,8%).

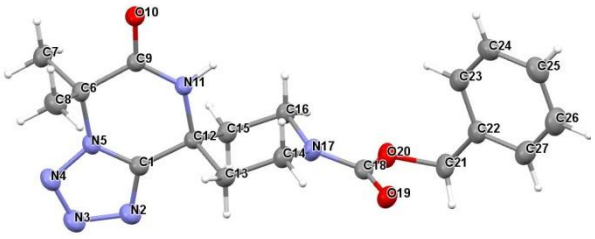
Crystallographic data for structures presented in this paper have been deposited with the Cambridge Crystallographic Data Centre as supplementary publication nos. CCDC 1485229 (**14c**), CCDC 1485014 (**16c**), CCDC 1485015 (**28c**), CCDC 1485018 (**29c**), CCDC 1485230 (**46c**), CCDC 1484776 (**61c**), CCDC1485230 (**62c**). Copies of the data can be obtained, free of charge, on application to CCDC, 12 Union Road, Cambridge CB2 1EZ, UK, (fax: +44-(0)1223-336033 or e-mail: deposit@ccdc.cam.ac.uk).



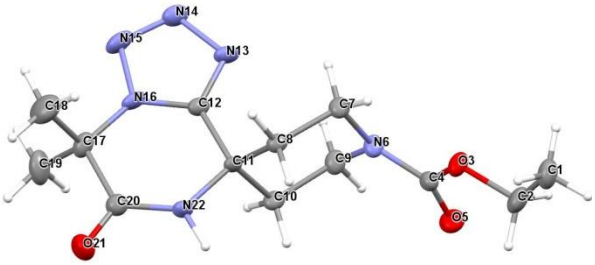
14c



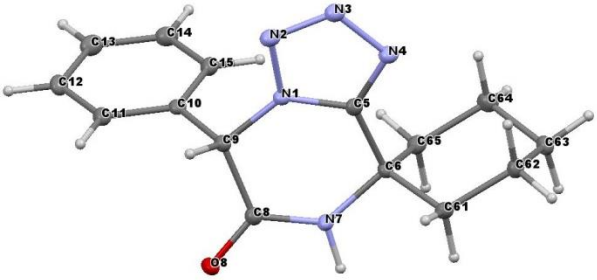
16c



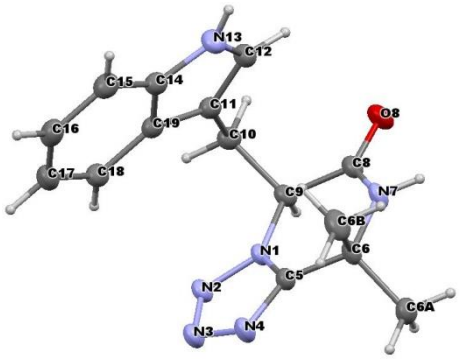
28c



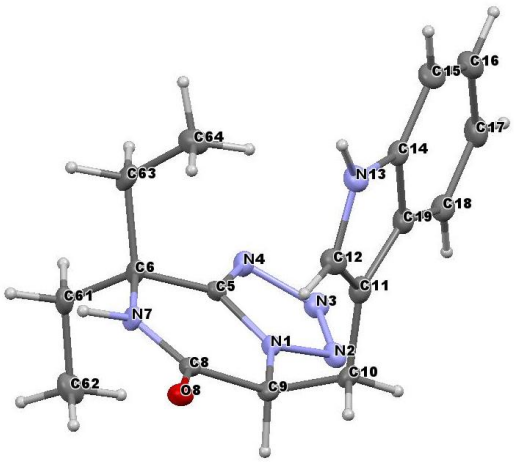
29c



46c



61c



62c

Figure S1. Molecular geometry observed in the crystal structures of compounds **14c, 16c, 28c, 29c, 46c, 61c** and **62c**, showing the atom labelling scheme. For structures **14c**, **16c** and **29c** only one of the four (**16c**,**29c**) or two (**14c**) molecules of the asymmetric unit is presented for clarity of the figure. For structure of **14c** only the non-disordered molecule is presented in the figure. Displacement ellipsoids of non-hydrogen atoms are drawn at the 30% probability level. H atoms are presented as small spheres with an arbitrary radius.

Table S1. Crystal data and structure refinement results for compounds.

compounds	**14c**	**16c**	**28c**	**29c**	**46c**	**61c**	**62c (TWIN)**
Empirical moiety formula	$C_9 H_{15} N_5 O$	$C_{10} H_{17} N_5 O$	$C_{18} H_{22} N_6 O_3$	$C_{13} H_{20} N_6 O_3$	$C_{15} H_{17} N_5 O$	$C_{15} H_{16} N_6 O$	$C_{17} H_{20} N_6 O$
Formula weight [g/mol]	209.26	223.29	370.42	308.35	283.33	296.34	324.39
Temperature [K]	130(2)	130.0 (10)	122.1 (3)	114.0 (2)	298(2)	130(2)	130(2)
Wavelength [Å]	0.7107	1.5418	1.5418	0.7107	0.7107	1.5418	0.7107
Crystal system	Monoclinic	Triclinic	Monoclinic	Triclinic	Monoclinic	Orthorhombic	Monoclinic
Space group	$P2_1/a$	P-1	$P2_1/c$	P-1	$P2_1/a$	P b c a	$P2_1/c$
Unite cell dimensions	a = 12.0138(3) Å b = 11.5538(2) Å c = 16.1111(4) Å α=90° β=103.490(3)° γ=90°	a = 11.5385(4) Å b = 13.1560(4) Å c = 17.7901(4) Å α= 77.400(2)° β=89.452(2)° γ=64.277(3)°	a = 9.5857(2) Å b = 14.8105(2) Å c = 13.4801(2) Å α=90° β=110.159(2)° γ=90°	a=14.5469(5) Å b=15.1175(4) Å c=15.4719(4) Å α=85.090 (2)° β=61.986(3)° γ=89.869(2)°	a = 6.9311(4) Å b = 19.6495(9) Å c = 10.2901(5) Å α=90° β=104.068(5)° γ=90°	a=14.6004(4) Å b=12.6936(3) Å c=15.8003(5) Å α=90° β=90° γ=90°	a = 9.3572(14) Å b = 14.6849(12) Å c = 12.2349(17) Å α=90° β=110.771(17)° γ=90°
Volume [$Å^3$]	2174.60(9)	2363.19(12)	1796.52(5)	2990.01(15)	1359.40(12)	2928.30(14)	1571.9(4)
Z	8	8	4	8	4	8	4
D_{calc} [Mg/m^3]	1.278	1.255	1.370	1.294	1.384	1.344	1.371
μ [mm^{-1}]	0.090	0.704	0.798	0.101	0.092	0.738	0.091
F(000)	896	960	784	1312	600	1248	688
Crystal size [mm^3]	0.5 x 0.4 x 0.2	0.4 x 0.2 x 0.2	0.2 x 0.2 x 0.15	0.4 x 0.4 x 0.2	0.3 x 0.3 x 0.07	0.2 x 0.2 x 0.2	0.3 x 0.15 x 0.05
Θ range	2.98° to 28.61°	3.84° to 77.15°	2.98° to 76.33°	2.96° to 28.59°	2.91° to 28.56°	5.40° to 71.10°	3.54° to 27.63°
Index ranges	-15 ≤ h ≤ 13, -15 ≤ k ≤ 14, -17 ≤ l ≤ 21	-14 ≤ h ≤ 14, -16 ≤ k ≤ 16, -22 ≤ l ≤ 22	-12 ≤ h ≤ 12, -18 ≤ k ≤ 18, -17 ≤ l ≤ 17	-19 ≤ h ≤ 19, -20 ≤ k ≤ 20, -20 ≤ l ≤ 19	-9 ≤ h ≤ 5, -26 ≤ k ≤ 24, -13 ≤ l ≤ 13	-13 ≤ h ≤ 17, -12 ≤ k ≤ 15, -19 ≤ l ≤ 17	-11 ≤ h ≤ 11, -19 ≤ k ≤ 19, -16 ≤ l ≤ 16
Refl. collected	16218	87826	32027	85231	11153	19784	9504
Independent reflections	5117 [R(int) = 0.0262]	9895 [R(int) = 0.0481]	3769 [R(int) = 0.0396]	15294 [R(int)=0.0399]	3202 [R(int) = 0.0671]	2822 [R(int)=0.0451]	2606 [R(int) = 0.076]
Completeness [%] to Θ	99.9 (Θ 25.2°)	99.9 (Θ 77.15°)	99.9 (Θ 74.30°)	99.9(Θ 26.31°)	99.9 (Θ 25.2°)	99.9 (Θ 67.68°)	86.8 (Θ 25.2°)

Absorption correction	Multi-scan	Multi-scan	Multi-scan	Multi-scan	Multi-scan	Multi-scan	Multi-scan
Max. and min. transmission	0.710 to 1.000	0.336 and 1.000	0.447 and 1.000	0.837 and 1.000	0.744 to 1.000	0.852 and 1.000	0.647 to 1.000
Refinement method	Full-matrix least-squares on F^2	Full-matrix least-squares on F2	Full-matrix least-squares on F^2	Full-matrix least-squares on F^2	Full-matrix least-squares on F^2	Full-matrix least-squares on F^2	Full-matrix least-squares on F^2
Data/ restraints/parameters	5117 / 0 / 326	9895 / 0 / 610	3791 / 0 / 251	13813 / 0 / 822	3202 / 0 / 194	2822 / 0 / 209	2606 / 5 / 227
GooF on F2	1.052	1.025	1.032	1.165	1.067	1.069	1.105
Final R indices [I>2sigma(I)]	R1= 0.0545, wR2= 0.1290	R1= 0.0390, wR2= 0.1000	R1= 0.0339, wR2= 0.1019	R1= 0.0984, wR2= 0.2350	R1= 0.0540, wR2= 0.0957	R1= 0.0357, wR2= 0.0866	R1= 0.1095, wR2= 0.2831
R indices (all data)	R1= 0.0730, wR2= 0. 1412	R1= 0.0456, wR2= 0.1059	R1= 0.0386, wR2= 0.1108	R1= 0.1075, wR2= 0.2388	R1= 0.1096, wR2= 0. 1213	R1= 0.0415, wR2= 0.0922	R1= 0.1515, wR2= 0. 3210
$\Delta\rho_{max}$, $\Delta\rho_{min}$ [e·Å^{-3}]	0.60 and -0.27	0.34 and -0.21	0.31 and -0.21	0.55 and -0.38	0.27 and -0.29	0.22 and -0.26	0.40 and -0.42

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