A Universal Isocyanide for diverse Heterocycle syntheses.

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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 on a Teledyne ISCO Combiflash Rf, using RediSep Rf Normal-phase Silica Flash Columns (Silica Gel 60 Å, 230 - 400 mesh). Reagents were available from commercial suppliers and used without any purification unless otherwise noted. All isocyanides were made in house by either performing the Hoffman or Ugi procedure. Other reagents were purchased from Sigma Aldrich, ABCR, Acros and AK Scientific and were used without further purification. Mass spectra (HRMS) were recorded on an Orbitrap XL (Thermo Fisher Scientific; ESI pos. mode, resolution of 60000@m/z 400). Electrospray ionization mass spectra (ESI-MS) were recorded on a Waters Investigator Semi-prep 15 SFC-MS instrument.

Synthetic procedure A (Ugi reaction):

To a 1 M solution of aldehyde in methanol were added successively 1.0 equiv of amine, 1.0 equiv of azidotrimethylsilane, and 1.0 equiv of isocyanoacetaldehydedimethylacetal. The resulting mixture was stirred at room temperature for 18 hrs. The solvent was removed under reduced pressure and the residue was purified using flash chromatography to obtain the Ugi-product.

Synthetic procedure B (cyclization):

To a solution of Ugi-tetrazole (1 mmol) was stirred with methanesulfonic acid (100 mmol) at room temperature for 18 hours. The reaction was diluted with dichloromethane and quenched with saturated sodium bicarbonate solution at 0-5 ^{o}C and extracted with dichloromethane (20 mL x 3). The solvent was removed under reduced pressure, and the residue was purified by flash column chromatography to afford cyclic product.

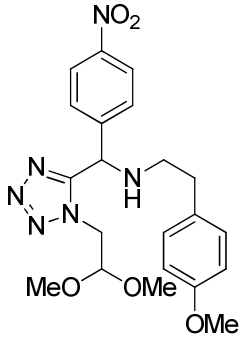
Synthetic procedure C (Pictet–Spengler cyclization**):**

To a solution of Ugi-tetrazole(1 mmol) was stirred with methanesulfonic acid (100mmol) at room temperature for 18 hours. The reaction was quenched with saturated sodium carbonate and extracted with EtOAc (20 mL x3). The solvent was removed under reduced pressure, and the residue was purified by crystallization or flash column chromatography to afford cyclic product.

In all the cases, the spectral data are given for the major diastereomer.

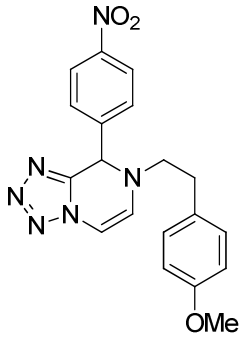
8a: N-((1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)(4-nitrophenyl)methyl)-2-(4-methoxyphenyl)ethanamine.

The product was obtained using procedure **A,** 814 mg, 92 % as pale yellow liquid; HRMS (ESI) m/z calcd for $C_{21}H_{27}N_6O_5$ $[M+H]^+$: 443.2037; found: 443.20361; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.19 (d, *J* = 8.6 Hz, 2H), 7.52 (d, *J* = 8.6 Hz, 2H), 7.07 (d, *J* = 8.5 Hz, 2H), 6.82 (d, *J* = 8.5 Hz, 2H), 5.38 (s, 1H), 4.61 (t, *J* = 5.4 Hz, 1H), 4.43 (dd, *J* = 14.1, 5.0 Hz, 1H), 4.34 (dd, *J* = 14.1, 5.0 Hz, 1H), 3.78 (s, 3H), 3.36 (s, 3H), 3.28 (s, 3H), 2.84 – 2.69 (m, 4H), 2.08 (brs, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 158.1, 155.6, 147.6, 145.0, 131.0, 129.5, 128.6, 123.8, 113.8, 102.6, 56.3, 55.7, 55.5, 55.1, 49.2, 48.9, 35.1.



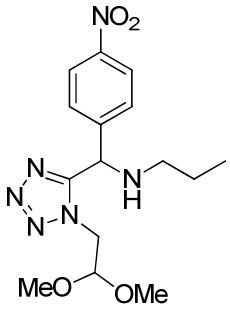
2a: 7-(4-methoxyphenethyl)-8-(4-nitrophenyl)-7,8-dihydrotetrazolo[1,5-a]pyrazine.

The product was obtained using procedure **B,** 230 mg, 61 % as brown liquid; HRMS (ESI) m/z calcd for $C_{19}H_{19}N_6O_3$ $[M+H]^+$: 379.1513; found: 379.1514; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.21 (d, *J* = 8.6 Hz, 2H), 7.52 (d, *J* = 8.6 Hz, 2H), 6.97 (d, *J* = 8.4 Hz, 2H), 6.79 (d, *J* = 8.4 Hz, 2H), 6.59 (d, *J* = 5.6 Hz, 1H), 6.19 (d, *J* = 5.6 Hz, 1H), 6.03 (s, 1H), 3.78 (s, 3H), 3.43 (dt, *J* = 14.1, 6.9 Hz, 1H), 3.35 – 3.23 (m, 1H), 2.87 – 2.78 (m, 2H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 158.5, 148.1, 145.0, 144.2, 129.5, 129.1, 127.9, 127.6, 124.3, 114.2, 95.3, 58.0, 55.2, 54.7, 34.1.



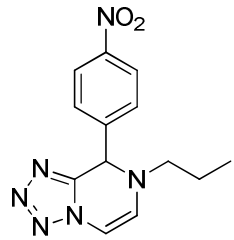
8b: N-((1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)(4-nitrophenyl)methyl) propan-1-amine.

The product was obtained using procedure **A,** 483 mg, 69 % as pale yellow liquid; HRMS (ESI) m/z calcd for $C_{15}H_{23}N_6O_4$ $[M+H]^+$: 351.1775; found: 351.1775; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.23 (d, *J* = 8.7 Hz, 2H), 7.61 (d, *J* = 8.7 Hz, 2H), 5.38 (s, 1H), 4.66 (t, *J* = 5.4 Hz, 1H), 4.50 (dd, 1H), 4.39 (dd, *J* = 14.1, 5.1 Hz, 1H), 3.41 (s, 3H), 3.32 (s, 3H), 2.52 (t, *J* = 7.1 Hz, 2H), 1.57 – 1.49 (m, 2H), 0.92 (t, *J* = 7.4 Hz, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 155.9, 147.8, 145.3, 128.7, 124.2, 123.9, 103.0, 102.6, 56.6, 49.7, 23.0, 11.6.



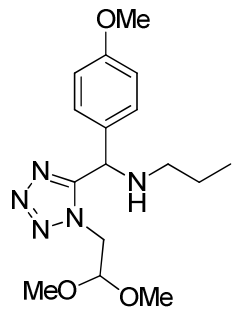
2b: 8-(4-nitrophenyl)-7-propyl-7,8-dihydrotetrazolo[1,5-a]pyrazine.

The product was obtained using procedure **B,** 125 mg, 44 % as brown liquid; HRMS (ESI) m/z calcd for $C_{13}H_{15}N_6O_2$ $[M+H]^+$: 287.1251; found: 287.1251; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.24 (d, *J* = 8.6 Hz, 2H), 7.61 (d, *J* = 8.6 Hz, 2H), 6.64 (d, *J* = 5.7 Hz, 1H), 6.35 (d, *J* = 5.7 Hz, 1H), 6.25 (s, 1H), 3.18 – 3.05 (m, 2H), 1.72 – 1.56 (m, 2H), 0.91 (t, *J* = 7.4 Hz, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 148.3, 145.1, 144.2, 128.2, 127.7, 124.4, 95.0, 57.8, 54.8, 21.3, 10.9.



8c: N-((1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)(4-methoxyphenyl)methyl) propan-1-amine.

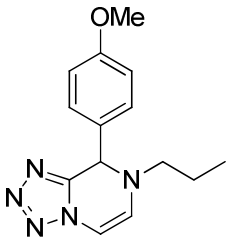
The product was obtained using procedure **A,** 469 mg, 70 % as yellow liquid; HRMS (ESI) m/z calcd for $C_{16}H_{26}N_6O_3$ $[M+H]^+$: 336.2030; found: 336.2029; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.26 (d, *J* = 8.5 Hz, 2H), 6.88 (d, *J* = 8.5 Hz, 2H), 5.23 (s, 1H), 4.58 (t, *J* = 5.5 Hz, 1H), 4.41 (dd, *J* = 14.2, 5.5 Hz, 1H), 4.23 (dd, *J* = 14.2, 6.0 Hz, 1H), 3.79 (s, 3H), 3.36 (s,



3H), 3.33 (s, 3H), 2.53 (t, J = 7.4 Hz, 2H), 1.58 – 1.49 (m, 2H), 0.91 (t, J = 7.4 Hz, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 159.5, 156.9, 130.2, 128.7, 114.3, 102.6, 56.7, 55.5, 55.3, 49.6, 48.9, 23.0, 11.7.

2c: 8-(4-methoxyphenyl)-7-propyl-7,8-dihydrotetrazolo[1,5-a]pyrazine.

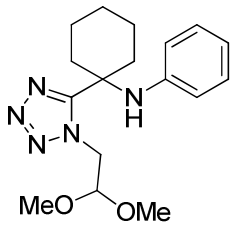
The product was obtained using procedure **B,** 57 mg, 21 % as brown liquid;



HRMS (ESI) m/z calcd for $C_{14}H_{17}N_5O$ $[M+H]^+$: 272.1512; found: 272.1524; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.27 (d, J = 8.5 Hz, 2H), 6.87 (d, J = 8.5 Hz, 2H), 6.55 (d, J = 5.7 Hz, 1H), 6.26 (d, J = 5.7 Hz, 1H), 6.02 (s, 1H), 3.78 (s, 3H), 3.12 – 3.06 (m, 1H), 3.04 – 2.98 (m, 1H), 1.66 – 1.50 (m, 2H), 0.88 (t, J = 7.4 Hz, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 160.1, 146.3, 130.0, 128.6, 127.9, 114.4, 93.9, 57.7, 55.2, 54.1, 21.1, 10.9.

8d: N-(1-(1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)cyclohexyl)aniline.

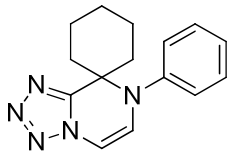
The product was obtained using procedure **A,** 509mg, 77 % as white solid, m.p.:



100-102 ^{o}C; HRMS (ESI) m/z calcd for $C_{17}H_{26}N_5O_2$ $[M+H]^+$: 332.2081; found: 332.2081; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.06 (t, J = 7.8 Hz, 2H), 6.73 (t, J = 7.4 Hz, 1H), 6.22 (d, J = 8.4 Hz, 2H), 4.76 (t, J = 5.6 Hz, 1H), 4.64 (d, J = 5.6 Hz, 2H), 4.10 (s, 1H), 3.30 (s, 6H), 2.37 – 2.30 (m, 2H), 2.23 – 2.14 (m, 2H), 1.74 – 1.67 (m, 3H), 1.58 – 1.36 (m, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 159.7, 143.8, 129.4, 119.2, 115.1, 103.0, 55.5, 54.2, 50.0, 34.2, 24.8, 21.0.

2d: 7'-phenyl-7'H-spiro[cyclohexane-1,8'-tetrazolo[1,5-a]pyrazine].

The product was obtained using procedure **B,** 195 mg, 73 % as white solid, m.p.:

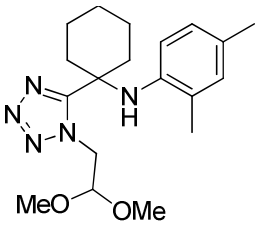


99-101 ^{o}C; HRMS (ESI) m/z calcd for $C_{15}H_{18}N_5$ $[M+H]^+$: 268.1557; found: 268.1556; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.44 – 7.35 (m, 3H), 7.24 – 7.20 (m, 2H), 6.76 (d, J = 5.6 Hz, 1H), 6.27 (d, J = 5.6 Hz, 1H), 2.34 (d, J = 12.4 Hz, 2H), 2.02 – 1.91 (m,

2H), 1.73 – 1.54 (m, 5H), 1.10 – 0.98 (m, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 148.9, 142.1, 130.3, 129.2, 128.9, 127.9, 97.2, 61.0, 33.1, 24.9, 22.3.

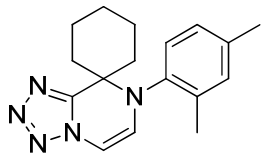
8e: N-(1-(1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)cyclohexyl)-2,4-dimethyl aniline.

The product was obtained using procedure **A,** 604mg, 84 % as white solid; m.p.: 106-108 ^{o}C; HRMS (ESI) m/z calcd for $C_{19}H_{30}N_5O_2$ $[M+H]^+$: 360.2394; found: 360.2394; ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.91 (s, 1H), 6.64 (d, *J* = 8.2 Hz, 1H), 5.64 (d, *J* = 8.2 Hz, 1H), 4.75 – 4.70 (m, 1H), 4.62 (d, *J* = 5.6 Hz, 2H), 3.96 (s, 1H), 3.30 (s, 6H), 2.41 (d, *J* = 13.7 Hz, 2H), 2.24 (s, 3H), 2.21 – 2.10 (m, 5H), 1.78 – 1.65 (m, 3H), 1.53 – 1.36 (m, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 160.0, 139.2, 131.6, 127.9, 127.4, 123.0, 112.8, 103.0, 55.5, 54.2, 49.9, 34.1, 24.9, 21.1, 20.2, 17.6.



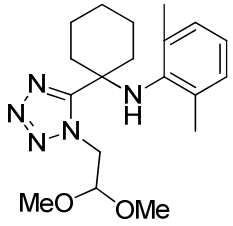
2e: 7'-(2,4-dimethylphenyl)-7'H-spiro[cyclohexane-1,8'-tetrazolo[1,5-a] pyrazine].

The product was obtained using procedure **B,** 207 mg, 70 % as white solid, m.p.: 148-150 ^{o}C; HRMS (ESI) m/z calcd for $C_{17}H_{22}N_5$ $[M+H]^+$: 296.1868; found: 296.1869; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.16 (d, *J* = 8.0Hz, 1H), 7.07 (s, 1H), 7.04 (d, *J* = 8.0 Hz, 1H), 6.80 (d, *J* = 5.4 Hz, 1H), 6.08 (d, *J* = 5.4 Hz, 1H), 2.53 – 2.39 (m, 2H), 2.34 (s, 3H), 2.22 – 2.16 (m, 1H), 2.04 (s, 3H), 1.76 – 1.32 (m, 6H), 1.15 – 1.05 (m, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 148.7, 138.4, 138.3, 138.2, 132.0, 130.6, 128.3, 127.4, 97.4, 61.0, 33.4, 32.4, 25.0, 22.5, 21.9, 20.9, 18.1.



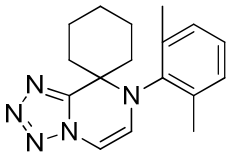
8f: N-(1-(1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)cyclohexyl)-2,6-dimethylaniline.

The product was obtained using procedure **A,** 158 mg, 22 % as white solid, m.p.: 122-124 ^{o}C; HRMS (ESI) m/z calcd for $C_{19}H_{30}N_5O_2$ $[M+H]^+$: 360.2394; found: 360.2393; ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.94 (d, *J* = 7.4 Hz, 2H), 6.85 – 6.82 (m, 1H), 5.05 (t, *J* = 5.7 Hz, 1H), 4.78 (d, *J* = 5.7 Hz, 2H), 3.43 (s, 6H), 2.42 – 2.34 (m, 2H), 1.89 (s, 6H), 1.82 – 1.73 (m, 2H), 1.64 – 1.53 (m, 5H), 1.44 – 1.36 (m, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 160.0, 141.9, 131.1, 129.2, 123.0, 103.3, 56.5, 55.9, 51.0, 37.1, 23.0, 22.0, 19.5.



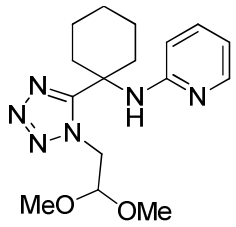
2f: 7'-(2,6-dimethylphenyl)-7'H-spiro[cyclohexane-1,8'-tetrazolo[1,5-a]pyrazine].

The product was obtained using procedure **B,** 177mg, 60 % as white solid, m.p.: 127-129 ^{o}C; HRMS (ESI) m/z calcd for $C_{17}H_{22}N_5$ $[M+H]^+$: 296.1870; found: 296.1869; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.16 – 7.12 (m, 1H), 7.07 (d, *J* = 7.5 Hz, 2H), 7.03 (d, *J* = 5.2 Hz, 1H), 6.04 (d, *J* = 5.2 Hz, 1H), 2.28 – 2.22 (m, 2H), 2.06 (s, 6H), 1.90 – 1.80 (m, 2H), 1.78 – 1.71 (m, 1H), 1.67 – 1.60 (m, 2H), 1.55 – 1.47 (m, 2H), 1.22 – 1.11 (m, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 148.4, 139.6, 138.9, 128.6, 128.1, 126.2, 100.8, 59.7, 32.6, 25.1, 22.1, 18.8.



8g: N-(1-(1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)cyclohexyl)pyridin-2-amine.

The product was obtained using procedure **A,** 358 mg, 54 % as white solid, m.p.: 126-128 ^{o}C; HRMS (ESI) m/z calcd for $C_{16}H_{25}N_6O_2$ $[M+H]^+$: 333.2033; found: 333.2032; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.98 (dd, *J* = 8.0, 0.8 Hz, 1H), 7.35 – 7.31 (m, 1H), 6.62 (dd, *J* = 7.2, 5.0 Hz, 1H), 6.06 (d, *J* = 8.0 Hz, 1H), 4.94 (s, 1H), 4.77 (t, *J* = 5.6 Hz, 1H), 4.52 (d, *J* = 5.6 Hz, 2H), 3.31 (s, 6H),



2.44 – 2.37 (m, 2H), 2.25 – 2.17 (m, 2H), 1.78 – 1.68 (m, 3H), 1.63 – 1.54 (m, 2H), 1.49 – 1.39 (m, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 159.6, 155.9, 148.4, 137.5, 114.6, 108.2, 103.0, 55.5, 53.6, 49.9, 34.4, 24.9, 21.0.

2g: 7'-(pyridin-2-yl)-7'H-spiro[cyclohexane-1,8'-tetrazolo[1,5-a]pyrazine].

The product was obtained using procedure **B,** 80mg, 30 % as white solid, m.p.: 132-134 ^{o}C; HRMS (ESI) m/z calcd for $C_{14}H_{17}N_6$ $[M+H]^+$: 269.1509; found: 269.1509; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.47 (dd, *J* = 5.0,1.7Hz, 1H), 7.74 (td, *J* = 7.5, 1.9 Hz, 1H), 7.19 (dd, *J* = 7.5, 5.0 Hz, 1H), 7.03 (d, *J* = 7.5 Hz, 1H), 6.87 (d, *J* = 5.7 Hz, 1H), 6.41 (d, *J* = 5.7 Hz, 1H), 2.53 – 2.45 (m, 2H), 2.27 – 2.23 (m, 2H), 2.06 – 1.96 (m, 2H), 1.79 – 1.66 (m, 3H), 1.34 – 1.24 (m, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 155.8, 150.0, 148.2, 138.2, 126.7, 121.1, 120.5, 99.5, 62.0, 32.0, 24.7, 22.4.

8h: 1-(1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)-N-phenethylpropan-1-amine.

The product was obtained using procedure **A,** 402 mg, 63 % as liquid; HRMS (ESI) m/z calcd for $C_{16}H_{25}N_5O_2$ $[M+H]^+$: 320.2081; found: 320.2081; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.29 (t, *J* = 7.5 Hz, 2H), 7.21 (t, *J* = 7.5 Hz, 1H), 7.14 (d, *J* = 7.5 Hz, 2H), 4.76 (t, *J* = 5.4 Hz, 1H), 4.48 (dd, *J* = 14.1, 5.4 Hz, 1H), 4.40 (dd, *J* = 14.1, 5.4 Hz, 1H), 4.10 (t, *J* = 7.0 Hz, 1H), 3.39 (s, 3H), 3.36 (s, 3H), 2.80 – 2.63 (m, 4H), 1.95 – 1.84 (m, *J* = 13.8, 7.0 Hz, 2H), 0.89 (t, *J* = 7.4, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 157.0, 139.5, 128.6, 128.4, 126.2, 102.7, 55.0, 54.3, 49.0, 48.3, 36.3, 27.2, 27.2, 10.3.

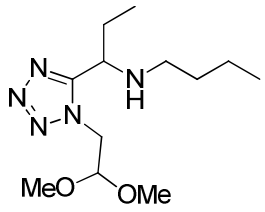
2h: 8-ethyl-7-phenethyl-7,8-dihydrotetrazolo[1,5-a]pyrazine.

The product was obtained using procedure **B,** 117 mg, 46 % as brown solid, m.p.: 89-91 ^{o}C; HRMS (ESI) m/z calcd for $C_{14}H_{17}N_5$ $[M+H]^+$: 256.1562; found:

256.1563; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.29 – 7.20 (m, 3H), 7.11 – 7.08 (m, 2H), 6.44 (d, *J* = 5.6 Hz, 1H), 6.00 (d, *J* = 5.6 Hz, 1H), 4.91 (t, *J* = 5.6 Hz, 1H), 3.51 – 3.40 (m, 2H), 2.92 – 2.82 (m, 2H), 1.90 – 1.82 (m, 2H), 0.88 (t, *J* = 7.4 Hz, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 145.4, 137.7, 128.7, 128.6, 128.1, 126.8, 94.9, 55.9, 54.39, 35.6, 25.8, 8.6.

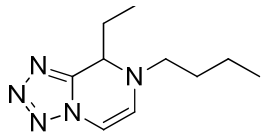
8i: N-(1-(1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)propyl)butan-1-amine.

The product was obtained using procedure **A,** 222 mg, 41 % as white solid, m.p.: 86-88 ^{o}C; HRMS (ESI) m/z calcd for $C_{12}H_{26}N_5O_2$ $[M+H]^+$: 272.2081; found: 272.2079; ^{1}H NMR (500 MHz, $CDCl_3$) δ 4.80 (t, *J* = 5.5 Hz, 1H), 4.60 – 4.50 (m, 2H), 4.06 (t, *J* = 7.0 Hz, 1H), 3.42 (s, 3H), 3.40 (s, 3H), 2.48 – 2.41 (m, 1H), 2.40 – 2.33 (m, 1H), 1.94 – 1.87 (m, 2H), 1.45 – 1.35 (m, 2H), 1.35 – 1.23 (m, 2H), 0.92 (t, *J* = 7.4 Hz, 3H), 0.87 (t, *J* = 7.4 Hz, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 157.4, 102.8, 55.6, 55.4, 54.7, 49.0, 47.0, 32.2, 27.4, 20.3, 13.8, 10.3.



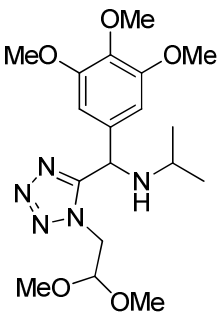
2i: 7-butyl-8-ethyl-7,8-dihydrotetrazolo[1,5-a]pyrazine.

The product was obtained using procedure **B,** 113 mg, 55 % as yellow liquid; HRMS (ESI) m/z calcd for $C_{10}H_{18}N_5$ $[M+H]^+$: 208.1562; found: 208.1563; ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.48 (d, *J* = 5.6 Hz, 1H), 6.10 (d, *J* = 5.6 Hz, 1H), 5.04 (t, *J* = 5.4 Hz, 1H), 3.27 – 3.12 (m, 2H), 1.94 – 1.87 (m, 2H), 1.64 – 1.54 (m, 2H), 1.41 – 1.29 (m, 2H), 0.96 (t, *J* = 7.3 Hz, 3H), 0.91 (t, *J* = 7.3 Hz, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 145.5, 128.5, 94.4, 55.6, 52.3, 30.8, 25.4, 19.7, 13.7, 8.6.



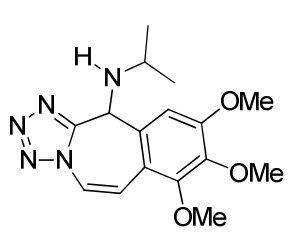
11a: N-((1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)(3,4,5-trimethoxyphenyl) methyl)propan-2-amine.

The product was obtained using procedure **A,** 726 mg, 92 % as white solid, m.p.: 93-95 ^{o}C; HRMS (ESI) m/z calcd for $C_{18}H_{30}N_5O_5$ $[M+H]^+$: 396.2242; found: 396.2242; ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.54 (s, 2H), 5.30 (s, 1H), 4.57 (t, *J* = 5.0 Hz, 1H), 4.42 (dd, *J* = 14.2, 5.0 Hz, 1H), 4.23 (dd, *J* = 14.2, 5.0 Hz, 1H), 3.83 (s, 6H), 3.81 (s, 3H), 3.38 (s, 3H), 3.37 (s, 3H), 2.83 – 2.72 (m, 1H), 2.17 (s, 1H), 1.12 (t, *J* = 6.0, 6H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 156.9, 153.6, 137.8, 133.8, 104.3, 102.8, 60.7, 56.1, 55.8, 55.4, 54.6, 49.0, 46.1, 22.6, 22.5.



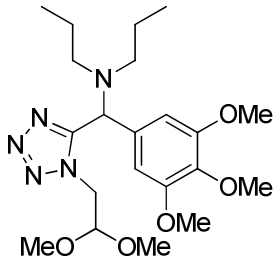
3a: N-isopropyl-7,8,9-trimethoxy-11H-benzo[d]tetrazolo[1,5-a]azepin-11-amine

The product was obtained using procedure **B**, 188 mg, 57 % as white solid, m.p.: 93-95 ^{o}C; HRMS (ESI) m/z calcd for $C_{16}H_{22}N_5O_3$ $[M+H]^+$: 332.1717; found: 332.1716; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.54 (d, *J* = 9.5 Hz, 1H), 7.20 (d, *J* = 9.5 Hz, 1H), 6.90 (s, 1H), 5.33 (s, 1H), 3.94 (s, 3H), 3.92 (s, 3H), 3.86 (s, 3H), 2.53 (dt, *J* = 11.9, 6.0 Hz, 1H), 1.65 (s, 1H), 1.10 (d, *J* = 6.0 Hz, 3H), 0.96 (d, *J* = 6.0 Hz, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 155.7, 153.9, 152.3, 141.8, 133.2, 118.0, 117.1, 107.9, 103.6, 61.5, 60.9, 56.1, 54.2, 46.3, 23.1, 22.2.



11b: N-((1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)(3,4,5-trimethoxyphenyl) methyl)-N-propylpropan-1-amine.

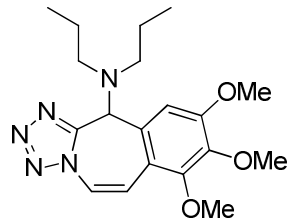
The product was obtained using procedure **A**, 725 mg, 83 % as white solid, m.p.: 63-65 ^{o}C; HRMS (ESI) m/z calcd for $C_{21}H_{36}N_5O_5$ $[M+H]^+$: 438.2711; found: 438.2710; ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.55 (s, 2H), 5.40 (s, 1H), 4.64 (t, *J* = 5.5 Hz, 1H), 4.50 (dd, *J* = 14.2, 5.5 Hz, 1H),



4.36 (dd, J = 14.2, 5.5 Hz, 1H), 3.84 (s, 3H), 3.82 (s, 6H), 3.40 (s, 3H), 3.31 (s, 3H), 2.54 – 2.49 (m, 4H), 1.50-1.38 (m, 4H), 0.81 (t, J = 7.3 Hz, 6H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 155.4, 153.0, 137.8, 131.7, 106.5, 102.8, 60.8, 59.5, 56.2, 55.8, 55.5, 52.6, 49.2, 21.0, 11.7.

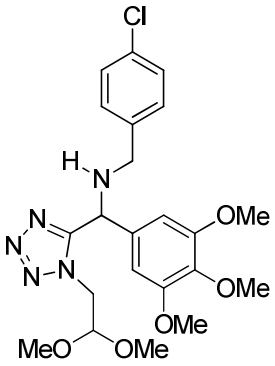
3b: 7,8,9-trimethoxy-N,N-dipropyl-11H-benzo[d]tetrazolo[1,5-a]azepin-11-amine.

The product was obtained using procedure **B**, 283 mg, 76 % as oil; HRMS (ESI) m/z calcd for $C_{19}H_{28}N_5O_3$ $[M+H]^+$: 374.2187; found: 374.2185; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.51 (d, J = 9.4 Hz, 1H), 7.17 (d, J = 9.4 Hz, 1H), 6.79 (s, 1H), 5.34 (s, 1H), 3.93 (s, 3H), 3.92 (s, 3H), 3.90 (s, 3H), 2.21 – 2.11 (m, 4H), 1.32 – 1.05 (m, 4H), 0.63 (t, J = 7.4 Hz, 6H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 154.8, 153.5, 152.0, 142.0, 132.2, 119.1, 117.8, 117.2, 109.8, 61.9, 61.3, 60.8, 56.0, 51.8, 18.8, 11.3.



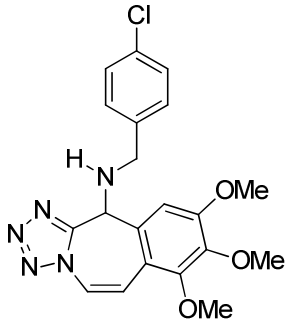
11c: N-(4-chlorobenzyl)-1-(1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)-1-(3,4,5-trimethoxyphenyl)methanamine.

The product was obtained using procedure **A**, 300 mg, 63 % as oil; HRMS (ESI) m/z calcd for $C_{22}H_{29}ClN_5O_5$ $[M+H]^+$: 478.1852, found: 478.1852; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.33 – 7.26 (m, 4H), 6.53 (s, 2H), 5.17 (s, 1H), 4.51 (t, J = 5.4 Hz, 1H), 4.33 (dd, J = 14.2, 4.9 Hz, 1H), 4.18 (dd, J = 14.2, 5.9 Hz, 1H), 3.83 (s, 3H), 3.82 (s, 6H), 3.76 (s, 2H), 3.30 (s, 6H), 2.55 (s, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 156.3, 153.7, 137.5, 133.1, 129.6, 128.6, 104.7, 102.6, 60.8, 56.2, 56.2, 55.5, 55.4, 50.5, 49.0.



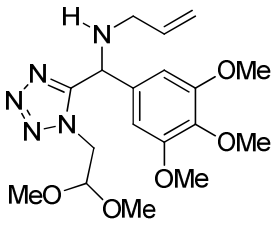
3c: N-(4-chlorobenzyl)-7,8,9-trimethoxy-11H-benzo[d]tetrazolo[1,5-a] azepin-11-amine.

The product was obtained using procedure **B**, 223 mg, 54 % as white solid, m.p.: 156-158 ^{o}C; HRMS (ESI) m/z calcd for $C_{20}H_{20}ClN_5O_3$ $[M+H]^+$: 414.1327; found: 414.1329; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.52 (d, *J* = 9.5 Hz, 1H), 7.28 – 7.25 (m, 2H), 7.21 – 7.16 (m, 3H), 6.79 (s, 1H), 5.23 (s, 1H), 3.92 (s, 3H), 3.90 (s, 3H), 3.88 (d, *J* = 4.5 Hz, 3H), 3.63 (s, 2H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 155.6, 153.4, 152.4, 142.0, 137.2, 133.1, 132.4, 129.4, 128.6, 118.0, 117.1, 108.0, 61.5, 60.9, 56.1, 55.8, 50.4.



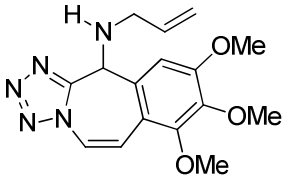
11d: N-((1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)(3,4,5-trimethoxyphenyl) methyl) prop-2-en-1-amine.

The product was obtained using procedure **A**, 747 mg, 95 % as oil; HRMS (ESI) m/z calcd for $C_{18}H_{28}N_5O_5$ $[M+H]^+$: 394.2085; found: 394.2083; ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.58 (s, 2H), 5.91 (dd, *J* = 17.0, 10.4 Hz, 1H), 5.24 (s, 1H), 5.23 - 5.14 (m, 2H), 4.55 (t, *J* = 5.4 Hz, 1H), 4.41 (dd, *J* = 14.2, 5.4 Hz, 1H), 4.27 (dd, *J* = 14.2, 6.0 Hz, 1H), 3.83 (s, 6H), 3.82 (s, 3H), 3.36 (s, 3H), 3.34 (s, 3H), 3.25 (dd, *J* = 6.0, 1.1 Hz, 2H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 156.4, 153.6, 138.0, 135.6, 133.3, 1176.0, 104.6, 102.6, 60.7, 56.3, 56.1, 55.5, 55.3, 49.9, 49.0.



3d: N-allyl-7,8,9-trimethoxy-11H-benzo[d]tetrazolo[1,5-a]azepin-11-amine.

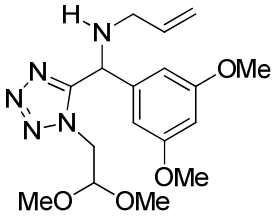
The product was obtained using procedure **B,** 204 mg, 62 % as oil; HRMS (ESI) m/z calcd for $C_{16}H_{20}N_5O_3$ $[M+H]^+$: 330.1561; found: 330.1560; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.55 (d, *J* = 9.5 Hz, 1H), 7.20 (d, *J* = 9.5 Hz, 1H), 6.92 (s, 1H), 5.83 – 5.72 (m, 1H), 5.29 (s, 1H), 5.14 (ddd, *J* = 14.0, 11.2, 1.2 Hz, 2H),



3.95 (s, 3H), 3.93 (s, 3H), 3.88 (s, 3H), 3.23 – 3.05 (m, 2H), 1.71 (s, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 155.5, 153.5, 152.2, 141.8, 135.1, 132.5, 117.9, 117.8, 117.1, 117.0, 107.9, 61.4, 60.8, 56.0, 55.6, 49.6.

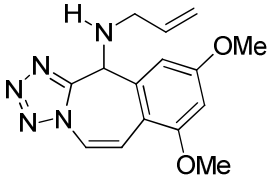
11e: N-((1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)(3,5-dimethoxyphenyl) methyl) prop-2-en-1-amine.

The product was obtained using procedure **A**, 508 mg, 70 % as oil; HRMS (ESI) m/z calcd for $C_{17}H_{26}N_5O_4$ $[M+H]^+$: 364.1979 found: 364.19779; ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.49 (d, *J* = 2.2 Hz, 2H), 6.39 (t, *J* = 2.2 Hz, 1H), 5.90 (dd, *J* = 17.1, 10.2 Hz, 1H), 5.25 (s, 1H), 5.20 (dd, *J* = 17.2, 1.6 Hz, 1H), 5.15 (dd, *J* = 10.2, 1.4 Hz, 1H), 4.56 (t, *J* = 5.5 Hz, 1H), 4.40 (dd, *J* = 14.2, 5.0 Hz, 1H), 4.25 (dd, *J* = 14.2, 5.9 Hz, 1H), 3.76 (s, 6H), 3.36 (s, 3H), 3.34 (s, 3H), 3.25 (d, *J* = 6.0 Hz, 2H), 2.25 (brs, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 161.2, 156.3, 140.0, 135.7, 116.9, 105.5, 102.4, 100.2, 56.2, 55.4, 55.3, 55.1, 49.9, 49.0.



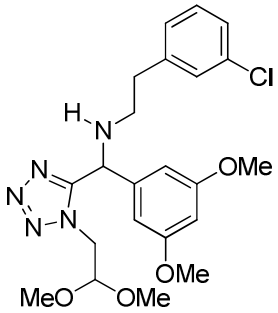
3e: N-allyl-7,9-dimethoxy-11H-benzo[d]tetrazolo[1,5-a]azepin-11-amine.

The product was obtained using procedure **B**, 248 mg, 83 % as white solid, m.p.: 114-116 ^{o}C; HRMS (ESI) m/z calcd for $C_{15}H_{18}N_5O_2$ $[M+H]^+$: 300.1455; found: 300.1455; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.48 (d, *J* = 9.5 Hz, 1H), 7.23 (d, *J* = 9.5 Hz, 1H), 6.68 (d, *J* = 2.2 Hz, 1H), 6.49 (d, *J* = 2.2 Hz, 1H), 5.82 – 5.73 (m, 1H), 5.26 (s, 1H), 5.14 (ddd, *J* = 13.7, 11.4, 1.3 Hz, 2H), 3.88 (s, 3H), 3.87 (s, 3H), 3.19 – 3.06 (m, 2H), 1.74 (brs, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 162.8, 159.0, 153.5, 139.2, 135.2, 117.2, 117.1, 117.0, 113.0, 105.3, 98.3, 56.0, 55.9, 55.6, 49.8.



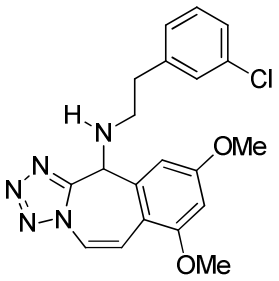
11f: 2-(3-chlorophenyl)-N-((1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)(3,5-dimethoxyphenyl)methyl)ethanamine.

The product was obtained using procedure **A**, 857 mg, 93 % as oil; HRMS (ESI) m/z calcd for $C_{22}H_{29}N_5O_4$ $[M+H]^+$: 462.1903; found: 462.1902; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.24 – 7.17 (m, 3H), 7.11 – 7.04 (m, 1H), 6.45 (d, *J* = 2.2 Hz, 2H), 6.40 (t, *J* = 2.2 Hz, 1H), 5.24 (s, 1H), 4.55 (t, *J* = 5.5 Hz, 1H), 4.40 (dd, *J* = 14.2, 5.0 Hz, 1H), 4.22 (dd, *J* = 14.2, 5.9 Hz, 1H), 3.75 (s, 6H), 3.34 (s, 6H), 2.90 – 2.79 (m, 4H), 2.15 (s, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 161.2, 156.3, 141.6, 140.0, 134.1, 129.7, 128.7, 126.9, 126.4, 105.4, 102.5, 100.3, 57.3, 55.5, 55.3, 49.0, 48.5, 35.9.



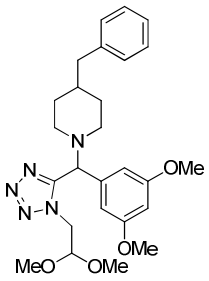
3f: N-(3-chlorophenethyl)-7,9-dimethoxy-11H-benzo[d]tetrazolo[1,5-a]azepin-11-amine.

The product was obtained using procedure **B**, 333 mg, 84 % as oil; HRMS (ESI) m/z calcd for $C_{20}H_{21}ClN_5O_2$ $[M+H]^+$: 398.1378; found: 398.1376; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.31 (d, *J* = 9.5 Hz, 1H), 7.17 (d, *J* = 5.0 Hz, 2H), 7.10 (d, *J* = 9.5 Hz, 1H), 7.06 (s, 1H), 6.97 – 6.92 (m, 1H), 6.63 (d, *J* = 2.3 Hz, 1H), 6.47 (d, *J* = 2.3 Hz, 1H), 5.22 (s, 1H), 3.86 (s, 3H), 3.84 (s, 3H), 2.87 – 2.77 (m, 1H), 2.75 – 2.64 (m, 3H), 1.69 (s, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 162.8, 159.0, 153.4, 141.3, 139.1, 134.1, 129.7, 128.7, 126.8, 126.5, 116.9, 116.8, 112.8, 105.2, 98.4, 56.8, 55.9, 55.5, 48.0, 35.4.



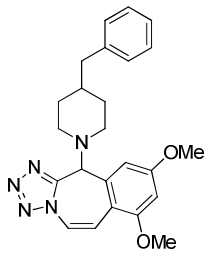
11g: 4-benzyl-1-((1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)(3,5-dimethoxy phenyl)methyl)piperidine.

The product was obtained using procedure **A,** 839 mg, 87 % as oil; HRMS (ESI) m/z calcd for $C_{26}H_{36}N_5O_4$ $[M+H]^+$: 482.2762; found: 482.2760; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.26 (d, *J* = 7.8 Hz, 2H), 7.17 (t, *J* = 7.2 Hz, 1H), 7.10 (d, *J* = 7.8 Hz, 2H), 6.55 (d, *J* = 2.2 Hz, 2H), 6.38 (t, *J* = 2.2 Hz, 1H), 4.96 (s, 1H), 4.65 (t, *J* = 5.5 Hz, 1H), 4.56 (dd, *J* = 14.0, 5.5 Hz, 1H), 4.37 (dd, *J* = 14.0, 5.5 Hz, 1H), 3.75 (s, 6H), 3.37 (s, 3H), 3.33 (s, 3H), 2.94-2.84 (m, 1H), 2.72 (dd, *J* = 7.2, 3.8 Hz, 1H), 2.52 (d, *J* = 7.2 Hz, 2H), 2.19-2.11 (m, 1H), 1.96-1.88 (m, 1H), 1.65-1.56 (m, 1H), 1.56 – 1.45 (m, 1H), 1.42-1.25 (m, 2H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 160.8, 155.3, 140.4, 137.4, 129.0, 128.1, 125.8, 107.0, 102.6, 100.1, 64.9, 55.4, 55.4, 55.3, 51.9, 51.0, 49.2, 43.0, 37.7, 32.2, 32.1.



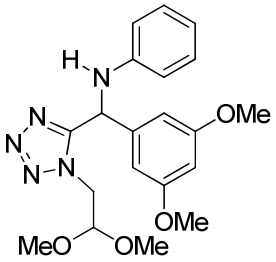
3g: 11-(4-benzylpiperidin-1-yl)-7,9-dimethoxy-11H-benzo[d]tetrazolo[1,5-a]azepine.

The product was obtained using procedure **B,** 400 mg, 96 % as white solid, m.p. : 182-184 ^{o}C; HRMS (ESI) m/z calcd for $C_{24}H_{27}N_5O_2$ $[M+H]^+$: 418.2238; found: 418.2237; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.41 (d, *J* = 9.4 Hz, 1H), 7.22 (t, *J* = 7.4 Hz, 2H), 7.17 (d, *J* = 9.4 Hz, 1H), 7.14 (t, *J* = 7.4 Hz, 1H), 7.05 (d, *J* = 7.1 Hz, 2H), 6.49 (dd, *J* = 7.5, 2.3 Hz, 2H), 4.89 (s, 1H), 3.86 (s, 3H), 3.82 (s, 3H), 2.47 – 2.33 (m, 3H), 2.23 – 2.17 (m, 1H), 1.92 (td, *J* = 11.6, 2.0, 1H), 1.75 (td, *J* = 11.6, 2.0 Hz, 1H), 1.50 – 1.41 (m, 2H), 1.06 – 0.96 (m, 2H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 162.1, 158.9, 152.9, 140.4, 138.0, 128.9, 128.1, 125.7, 117.1, 117.0, 113.9, 107.4, 98.4, 65.2, 55.9, 55.5, 51.9, 51.0, 42.8, 37.8, 31.7, 31.6.



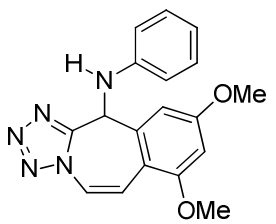
11h: N-((1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)(3,5-dimethoxyphenyl) methyl)aniline.

The product was obtained using procedure **A**, 790 mg, 99 % as oil; HRMS (ESI) m/z calcd for $C_{20}H_{26}N_5O_4$ $[M+H]^+$: 400.1979; found: 400.1979; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.15 (t, *J* = 8.0 Hz, 2H), 6.75 (t, *J* = 7.4 Hz, 1H), 6.66 (d, *J* = 8.0 Hz, 2H), 6.52 (d, *J* = 2.2 Hz, 2H), 6.39 (t, *J* = 2.2 Hz, 1H), 6.04 (d, *J* = 7.1 Hz, 1H), 5.02 (d, *J* = 7.1 Hz, 1H), 4.65 (dd, *J* = 5.8, 4.8 Hz, 1H), 4.41 (dd, *J* = 14.3, 4.8 Hz, 1H), 4.27 (dd, *J* = 14.3, 6.0 Hz, 1H), 3.73 (s, 6H), 3.41 (s, 3H), 3.39 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 161.4, 156.1, 145.8, 139.6, 129.3, 118.9, 113.7, 105.3, 102.9, 100.3, 55.8, 55.6, 55.4, 53.2, 49.3.



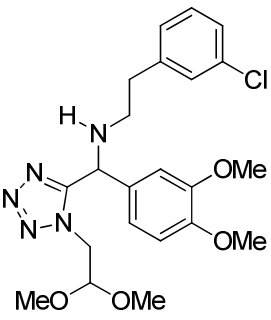
3h: 7,9-dimethoxy-N-phenyl-11H-benzo[d]tetrazolo[1,5-a]azepin-11-amine.

The product was obtained using procedure **B**, 56 mg, 15 % as white solid, m.p. : 185-187 ^{o}C; HRMS (ESI) m/z calcd for $C_{18}H_{18}N_5O_2$ $[M+H]^+$: 336.1455; found: 336.1455; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.49 (d, *J* = 9.3 Hz, 1H), 7.31 (d, *J* = 9.3 Hz, 1H), 7.16 (t, *J* = 7.9 Hz, 2H), 6.81-6.75 (m, 2H), 6.68 (d, *J* = 8.0 Hz, 2H), 6.49 (d, *J* = 2.2 Hz, 1H), 5.61 (s, 1H), 4.90 (s, 1H), 3.89 (s, 3H), 3.77 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 163.3, 158.9, 153.5, 145.8, 138.5, 129.4, 119.1, 118.3, 117.5, 113.6, 112.4, 103.5, 98.5, 56.0, 55.6, 53.0.



11i: 2-(3-chlorophenyl)-N-((1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)(3,4-dimethoxyphenyl)methyl)ethanamine.

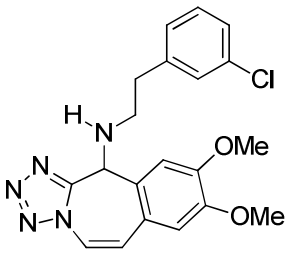
The product was obtained using procedure **A,** 875 mg,95 % as oil; HRMS (ESI) m/z calcd for $C_{22}H_{29}ClN_5O_4$ $[M+H]^+$: 462.1903; found: 462.1902; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.25 – 7.15 (m, 3H), 7.07



(dd, *J* = 7.0, 1.5 Hz, 1H), 6.83 (s, 3H), 5.24 (s, 1H), 4.56 (t, *J* = 6.0 Hz, 1H), 4.38 (dd, *J* = 14.2, 5.0, 1H), 4.19 (dd, *J* = 14.2, 6.0, 1H), 3.87 (s, 3H), 3.82 (s, 3H), 3.34 (s, 6H), 2.91 – 2.76 (m, 4H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 156.6, 149.6, 149.2, 141.6, 134.1, 130.1, 129.7, 128.7, 126.9, 126.4, 119.8, 111.1, 110.2, 102.7, 57.0, 55.9, 55.6, 55.4, 49.0, 48.5, 35.9.

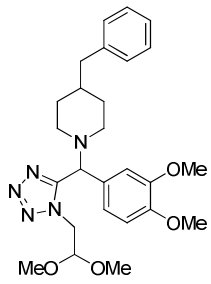
3i: N-(3-chlorophenethyl)-8,9-dimethoxy-11H-benzo[d]tetrazolo[1,5-a]azepin-11-amine.

The product was obtained using procedure **B,** 107 mg, 27 % as oil; HRMS (ESI) m/z calcd for $C_{20}H_{21}ClN_5O_2$ $[M+H]^+$: 398.1378; found: 398.1378; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.38 (d, *J* = 9.4 Hz, 1H), 7.18 – 7.16 (m, 2H), 7.05 (s, 1H), 6.98 (s, 1H), 6.93 (td, *J* = 4.6, 1.6 Hz, 1H), 6.84 (d, *J* = 3.4 Hz, 1H), 6.65 (d, *J* = 9.4 Hz, 1H), 5.32 (s, 1H), 3.93 (s, 3H), 3.90 (s, 3H), 2.85-2.77 (m, 1H), 2.73-2.62 (m, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 153.3, 151.0, 148.8, 141.2, 134.1, 129.7, 129.2, 128.7, 126.8, 126.4, 123.5, 122.0, 117.8, 113.4, 112.2, 56.3, 56.1, 47.7, 35.3.



11j: 4-benzyl-1-((1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)(3,4-dimethoxyphenyl)methyl)piperidine.

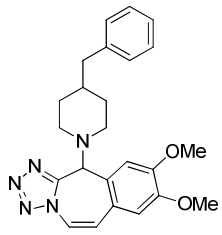
The product was obtained using procedure **A,** 701 mg, 73 % as oil; HRMS (ESI) m/z calcd for $C_{26}H_{36}N_5O_4$ $[M+H]^+$: 482.2762; found: 482.2761; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.24 (t, *J* = 7.4 Hz, 2H), 7.16 (t, *J* = 7.4 Hz, 1H), 7.10 (d, *J* = 7.0 Hz, 2H), 6.99 (d, *J* = 1.9 Hz, 1H), 6.89 (dd, *J* = 8.2, 1.9 Hz, 1H), 6.80 (d, *J* = 8.2 Hz, 1H), 4.97 (s, 1H), 4.66 (t, *J* = 5.5 Hz, 1H), 4.56 (dd, *J* = 14.1, 5.5 Hz, 1H), 4.37 (dd, *J* = 14.1, 5.5 Hz, 1H), 3.86 (s, 3H), 3.85 (s, 3H) 3.38 (s, 3H), 3.32 (s, 3H), 2.85 (d, *J* = 11.2 Hz, 1H), 2.75 (d, *J* = 11.2 Hz, 1H), 2.51 (d, *J* = 7.1 Hz, 2H), 2.16 – 2.10 (m, 1H), 1.91 (td, *J* = 11.2, 2.1 Hz, 1H), 1.61



(dd, *J* = 17.1, 7.1 Hz, 1H), 1.49 (dd, *J* = 7.4, 3.7 Hz, 1H), 1.41 – 1.26 (m, 2H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 155.6, 149.0, 140.4, 129.0, 128.1, 127.3, 125.7, 121.5, 112.0, 110.6, 102.7, 64.4, 55.9, 55.8, 55.5, 55.4, 51.7, 50.6, 49.1, 43.0, 37.7, 32.2, 32.1.

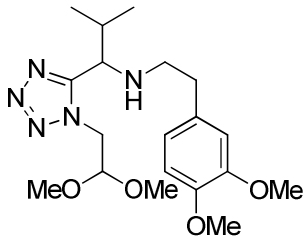
3j: 11-(4-benzylpiperidin-1-yl)-8,9-dimethoxy-11H-benzo[d]tetrazolo[1,5-a]azepine.

The product was obtained using procedure **B,** 171 mg, 41 % as white solid, m.p.: 201-202 ^{o}C; HRMS (ESI) m/z calcd for $C_{24}H_{28}N_5O_2$ $[M+H]^+$: 418.2238; found: 418.2236; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.48 (d, *J* = 9.2 Hz, 1H), 7.21 (t, *J* = 7.5 Hz, 2H), 7.13 (t, *J* = 7.5 Hz, 1H), 7.04 (d, *J* = 7.5 Hz, 2H), 6.87 (s, 1H), 6.85 (s, 1H), 6.72 (d, *J* = 9.2 Hz, 1H), 4.95 (s, 1H), 3.91 (s, 3H), 3.90 (s, 3H), 2.41 (dd, *J* = 6.5, 3.4 Hz, 2H), 2.33 (d, *J* = 11.2 Hz, 1H), 2.24 (d, *J* = 11.2 Hz, 1H), 1.93 – 1.87 (m, 1H), 1.74 (dd, *J* = 17.1, 5.9 Hz, 1H), 1.50 – 1.38 (m, 2H), 1.06-0.94 (m, 2H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 152.7, 150.4, 148.7, 140.2, 128.8, 127.9, 125.6, 124.4, 122.3, 117.8, 113.9, 113.2, 64.2, 56.0, 55.9, 51.5, 50.7, 42.7, 37.6, 31.6.



14a: 1-(1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)-N-(3,4-dimethoxy phenethyl)-2-methylpropan-1-amine

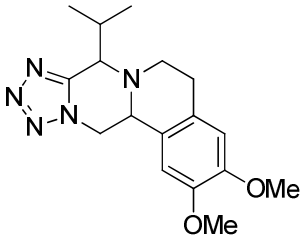
The product was obtained using procedure **A,** 730 mg, 93 % as liquid; HRMS (ESI) m/z calcd for $C_{19}H_{32}N_5O_4$ $[M+H]^+$: 394.2449; found: 394.2448; ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.77 (d, *J* = 8.0 Hz, 1H), 6.70 – 6.64(m, 2H), 4.78 (t, *J* = 5.5 Hz, 1H), 4.42 (d, *J* = 5.5 Hz, 2H), 3.85 (s, 6H), 3.41 (s, 3H), 3.32 (s, 3H), 2.71 – 2.60 (m, 4H), 2.18 - 207 (m,



1H), 1.59 (brs, 1H), 0.99 (d, J = 6.7 Hz, 3H), 0.81 (d, J = 6.7 Hz, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 156.8, 148.8, 147.3, 132.1, 120.4, 111.7, 111.1, 102.8, 59.2, 55.8, 55.7, 55.5, 49.0, 48.6, 35.7, 32.1, 19.3, 19.0.

4a: 8-isopropyl-2,3-dimethoxy-6,8,13,13a-tetrahydro-5H-tetrazolo [1',5':4,5] pyrazino[2,1-a]isoquinoline

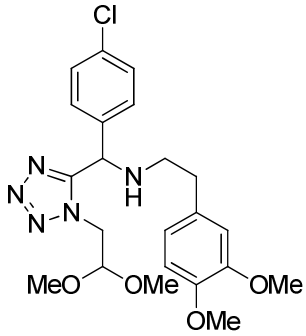
The product was obtained using procedure **C,** 187 mg, 57 % as pale pink solid,



m.p.: 188-190 ^{o}C; HRMS (ESI) m/z calcd for $C_{17}H_{24}N_5O_2$ $[M+H]^+$: 330.1925; found: 330.1924; ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.68 (s, 1H), 6.61 (s, 1H), 4.61 (dd, J = 13.1, 4.0 Hz, 1H), 4.44 (dd, J = 10.8, 4.0 Hz, 1H), 4.35 – 4.26 (m, 1H), 3.88 (s, 6H), 3.81 (d, J = 8.0 Hz, 1H), 3.23 – 3.12 (m, 1H), 3.06 (td, J = 11.3, 3.1 Hz, 1H), 2.87 (dd, J = 10.9, 6.2 Hz, 1H), 2.72 (d, J = 15.3 Hz, 1H), 2.25 – 2.12 (m, 1H), 1.17 (d, J = 6.6 Hz, 3H), 1.08 (d, J = 6.6 Hz, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 151.9, 148.6, 147.5, 126.3, 124.8, 111.9, 109.3, 64.8, 56.3, 56.1, 55.8, 51.4, 46.6, 46.2, 32.2, 29.1, 19.7

14b: N-((4-chlorophenyl)(1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)methyl)-2-(3,4-dimethoxyphenyl)ethanamine

The product was obtained using procedure **A,** 783 mg, 85 % as pale yellow

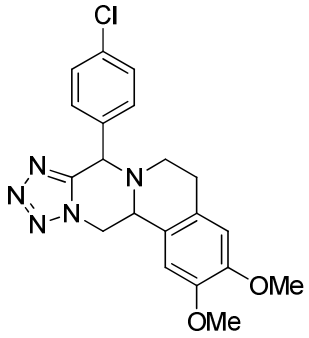


liquid; HRMS (ESI) m/z calcd for $C_{22}H_{29}ClN_5O_4$ $[M+H]^+$: 462.1903; found: 462.1902; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.31 (d, J = 8.4 Hz, 2H), 7.25 (d, J = 8.4 Hz, 2H), 6.78 (d, J = 8.1 Hz, 1H), 6.70 (m, 2H), 5.26 (s, 1H), 4.56 (t, J = 5.4 Hz, 1H), 4.38 (dd, J = 14.2, 5.5 Hz, 1H), 4.23 (dd, J = 14.2, 5.5 Hz, 1H), 3.85 (s, 3H), 3.84 (s, 3H), 3.33 (s, 3H), 3.29 (s, 3H), 2.85 –

2.72 (m, 4H), 2.05 (brs, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 156.2, 148.9, 147.6, 136.4, 134.3, 131.8, 129.1, 128.9, 120.5, 111.8, 111.3, 102.7, 56.5, 55.9, 55.8, 55.6, 55.5, 49.1, 48.8, 35.7.

4b:8-(4-chlorophenyl)-2,3-dimethoxy-6,8,13,13a-tetrahydro-5H-tetrazolo[1',5':4,5]pyrazino[2,1-a]isoquinoline

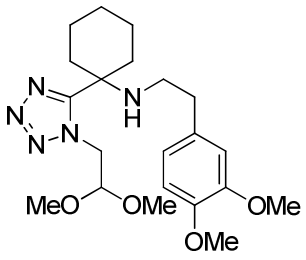
The product was obtained using procedure **C,** 353 mg, 89 % as white solid,



m.p.: 119-121 ^{o}C; HRMS (ESI) m/z calcd for $C_{20}H_{21}ClN_5O_2$ $[M+H]^+$: 398.1378; found: 398.1379; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.31 (d, *J* = 8.4 Hz, 2H), 7.27 (d, *J* = 8.4 Hz, 2H), 6.68 (s, 1H), 6.53 (s, 1H), 5.53 (s, 1H), 4.72 (dd, *J* = 11.6, 3.2 Hz, 1H), 4.39 – 4.27 (m, 2H), 3.88 (s, 3H), 3.84 (s, 3H), 3.17 – 3.05 (m, 2H), 2.97 – 2.87 (m, 2H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 151.1, 148.7, 147.7, 134.4, 134.0, 129.2, 128.8, 126.2, 124.3, 111.9, 109.0, 108.7, 60.4, 56.1, 55.9, 50.1, 48.2, 46.0, 29.1.

14c: 1-(1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)-N-(3,4-dimethoxy phenethyl)cyclohexanamine

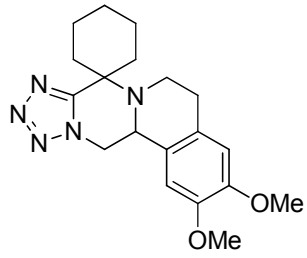
The product was obtained using procedure **A,** 569 mg, 68 % as white solid,



m.p.: 94-96 ^{o}C; HRMS (ESI) m/z calcd for $C_{21}H_{34}N_5O_4$ $[M+H]^+$: 420.2605; found: 420.2604; ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.81 (d, *J* = 8.1 Hz, 1H), 6.69 (dd, *J* = 8.1, 1.6 Hz, 1H), 6.65 (d, *J* = 1.6 Hz, 1H), 4.96 (t, *J* = 5.7 Hz, 1H), 4.66 (d, *J* = 5.7 Hz, 2H), 3.88 (s, 3H), 3.87 (s, 3H), 3.41 (s, 6H), 2.65 (t, *J* = 6.5 Hz, 2H), 2.45 (t, *J* = 6.5 Hz, 2H), 2.14 – 2.04 (m, 2H), 1.99 – 1.90 (m, 2H), 1.68 – 1.56 (m, 2H), 1.51 (s, 1H), 1.40 – 1.31 (m, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 158. 9, 148.9, 147.5, 132.2, 120.7, 111.5, 111.3, 103.1, 55.8, 55.7, 55.6, 55.5, 55.5, 55.3, 49.9, 43.1, 35.9, 34.6, 24.9, 21.3.

4c: 2',3'-dimethoxy-5',6',13',13a'-tetrahydrospiro[cyclohexane-1,8'-tetrazolo[1',5':4,5]pyrazino[2,1-a]isoquinoline]

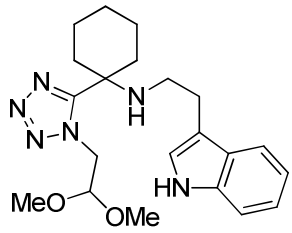
The product was obtained using procedure **C,** 273 mg, 77 % as white solid,



m.p.: 228-230 ^{o}C; HRMS (ESI) m/z calcd for $C_{19}H_{26}N_5O_2$ $[M+H]^+$: 356.2081; found: 356.2081; ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.69 (s, 1H), 6.61 (s, 1H), 4.66 (dd, *J* = 11.1, 4.9 Hz, 1H), 4.56 (dd, *J* = 13.1, 4.9 Hz, 1H), 4.32 (dd, *J* = 13.1, 11.1 Hz, 1H), 3.88 (s, 6H), 3.20 – 3.12 (m, 1H), 3.09 – 3.00 (m, 1H), 2.81 – 2.75 (m, 1H), 2.73 – 2.64 (m, 1H), 2.38 – 2.28 (m, 1H), 2.20-2.06 (m, 2H), 2.00 – 1.91 (m, 1H), 1.84 – 1.73 (m, 2H), 1.69 – 1.50 (m, 4H); ^{13}C NMR (126 MHz,) δ 156.6, 148.6, 147.5, 126.6, 125.7, 111.7, 109.3, 57.1, 56.1, 56.0, 55.8, 50.3, 46.7, 37.5, 35.3, 32.3, 29.4, 25.3, 20.8.

14d: N-(2-(1H-indol-3-yl)ethyl)-1-(1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl) cyclohexanamine

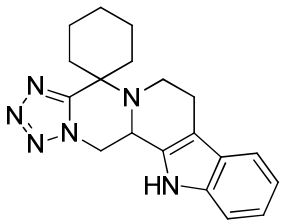
The product was obtained using procedure **A,** 748 mg, 94 % as white solid,



m.p.: 101-103 ^{o}C; HRMS (ESI) m/z calcd for $C_{21}H_{31}N_6O_2$ $[M+H]^+$: 399.2503; found: 399.2503; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.02 (s, 1H), 7.52 (d, *J* = 8.0 Hz, 1H), 7.36 (d, *J* = 8.0 Hz, 1H), 7.20 (t, *J* = 7.5 Hz, 1H), 7.10 (t, *J* = 7.5 Hz, 1H), 6.98 (s, 1H), 4.93 (t, *J* = 5.7 Hz, 1H), 4.66 (d, *J* = 5.7 Hz, 2H), 3.36 (s, 6H), 2.87 (t, *J* = 6.5 Hz, 2H), 2.53 (t, *J* = 6.5 Hz, 2H), 2.13 – 2.01 (m, 2H), 1.96-1.85 (m, 2H), 1.57 – 1.50 (m, 3H), 1.48-1.38 (m, 1H), 1.36 – 1.27 (m, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 159.1, 136.3, 127.2, 121.9, 121.8, 119.2, 118.5, 113.4, 111.2, 102.9, 55.4, 55.3, 49.9, 42.2, 34.7, 25.8, 25.0, 21.3.

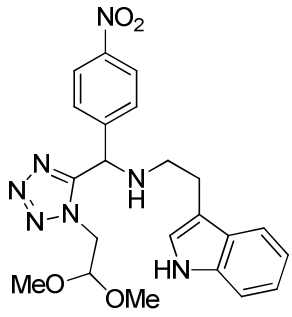
4d: 7',12',12b',13'-tetrahydro-6'H-spiro[cyclohexane-1,4'-tetrazolo [1'',5'':4',5'] pyrazino[1',2':1,2]pyrido[3,4-b]indole]

The product was obtained using procedure **C,** 177 mg, 53 % as white solid, m.p.: 235-237 ^{o}C; HRMS (ESI) m/z calcd for $C_{19}H_{23}N_6$ $[M+H]^+$: 335.1979; found: 335.1979; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.60 (brs, 1H), 7.54 (d, *J* = 8.0 Hz, 1H), 7.40 (d, *J* = 8.0 Hz, 1H), 7.21 (t, *J* = 7.3 Hz, 1H), 7.15 (t, *J* = 7.3 Hz, 1H), 4.90 – 4.81 (m, 1H), 4.76 – 4.67 (m, 1H), 4.43-4.32 (m, 1H), 3.29-3.19 (m, 1H), 3.02 – 2.77 (m, 3H), 2.30-2.18 (m, 2H), 2.14-2.02 (m, 2H), 1.83 – 1.52 (m, 6H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 157.1, 136.5, 131.0, 126.6, 122.3, 119.9, 118.5, 111.3, 109.9, 57.7, 47.3, 46.8, 39.3, 34.5, 32.9, 25.3, 22.6, 21.1, 21.1.



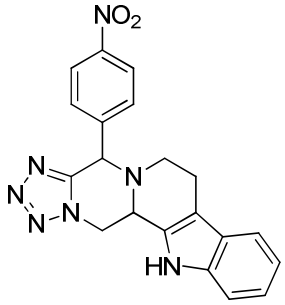
14e: N-((1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)(4-nitrophenyl)methyl)-2-(1H-indol-3-yl)ethanamine

The product was obtained using procedure **A,** 883 mg, 98 % as brown liquid; HRMS (ESI) m/z calcd for $C_{22}H_{26}N_7O_4$ $[M+H]^+$: 452.2041; found: 452.2040; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.17 (brs, 1H), 8.09 (d, *J* = 8.4 Hz, 2H), 7.46 (d, *J* = 8.0 Hz, 1H), 7.43 (d, *J* = 8.4 Hz, 2H), 7.34 (d, *J* = 8.0 Hz, 1H), 7.18 (t, *J* = 7.5 Hz, 1H), 7.05 (t, *J* = 7.5 Hz, 1H), 7.01 (s, 1H), 5.34 (s, 1H), 4.57 (t, *J* = 5.1 Hz, 1H), 4.38 (dd, *J* = 14.1, 5.0 Hz, 1H), 4.30 (dd, *J* = 14.1, 5.0 Hz, 1H), 3.32 (s, 3H), 3.23 (s, 3H), 3.05-2.82 (m, 4H), 2.13 (brs, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 155.8, 147.7, 145.0, 136.4, 128.7, 128.6, 127.1, 123.9, 122.2, 119.3, 118.5, 112.9, 111.3, 102.4, 56.5, 56.3, 49.2, 47.4, 25.6.



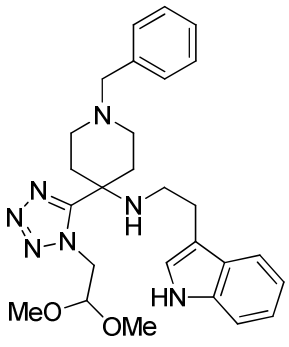
4e: 4-(4-nitrophenyl)-4,6,7,12,12b,13-hexahydrotetrazolo[1'',5'':4',5'] pyrazino[1',2':1,2]pyrido[3,4-b]indole

The product was obtained using procedure **C,** 367 mg, 95 % as white solid, m.p.: decomposes at 236 ^{o}C; HRMS (ESI) m/z calcd for $C_{20}H_{18}N_7O_2$ $[M+H]^+$: 388.1517; found: 388.1516; ^{1}H NMR (500 MHz, DMSO) δ 11.12 (s, 1H), 8.28 (d, *J* = 8.7 Hz, 2H), 7.82 (d, *J* = 8.7 Hz, 2H), 7.42 (dd, *J* = 13.8, 8.0 Hz, 2H), 7.12 (t, *J* = 7.4 Hz, 1H), 7.01 (t, *J* = 7.4 Hz, 1H), 5.39 (dd, *J* = 12.1, 3.2 Hz, 1H), 5.36 (s, 1H), 4.57 (d, *J* = 10.4 Hz, 1H), 4.46 (t, *J* = 11.4 Hz, 1H), 2.98 – 2.90 (m, 1H), 2.74 – 2.62 (m, 3H); ^{13}C NMR (126 MHz, DMSO) δ 153.7, 148.7, 147.0, 137.3, 131.2, 131.1, 127.0, 125.0, 124.9, 122.4, 119.8, 119.0, 118.9, 112.3, 109.0, 62.8, 55.3, 49.6, 49.0, 22.1.



14f: N-(2-(1H-indol-3-yl)ethyl)-1-benzyl-4-(1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)piperidin-4-amine

The product was obtained using procedure **A,** 850 mg, 87 % as pale yellow liquid; HRMS (ESI) m/z calcd for $C_{27}H_{36}N_7O_2$ $[M+H]^+$: 490.2925; found: 490.2925; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.11 (s, 1H), 7.50 (d, *J* = 7.9 Hz, 1H), 7.38 (d, *J* = 8.1 Hz, 1H), 7.31 – 7.17 (m, 6H), 7.10 (t, *J* = 7.4 Hz, 1H), 6.95 (s, 1H), 4.89 (t, *J* = 5.7 Hz, 1H), 4.60 (d, *J* = 5.6 Hz, 2H), 3.34 (s, 6H), 3.31 (s, 2H), 2.85 (t, *J* = 6.3 Hz, 2H), 2.52 (t, *J* = 6.1 Hz, 2H), 2.45 (s, 2H), 2.34 (d, *J* = 9.4 Hz, 2H), 2.17 (s, 2H), 1.90 (s, 2H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 158.2, 138.2, 136.3, 129.0, 128.1, 127.2, 127.0, 122.1, 121.9, 119.4, 118.6, 113.4, 111.2, 103.0, 62.8, 55.4, 53.8, 49.8, 49.0, 42.0, 34.7, 25.7.



4f: 1-benzyl-7',12',12b',13'-tetrahydro-6'H-spiro[piperidine-4,4'-tetrazolo [1'',5'':4',5']pyrazino[1',2':1,2]pyrido[3,4-b]indole]

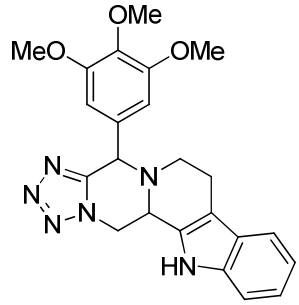
The product was obtained using procedure **C,** 306 mg, 72 % as white solid, m.p.: 156-158 ^{o}C; HRMS (ESI) m/z calcd for $C_{25}H_{28}N_7$ $[M+H]^+$: 426.2401; found: 426.2400; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.29 (brs, 1H), 7.55 (d, *J* = 8.0 Hz, 1H), 7.40 (d, *J* = 8.0 Hz, 1H), 7.38 – 7.28 (m, 4H), 7.28 – 7.20(m, 2H), 7.16 (t, *J* = 7.3 Hz, 1H), 4.79 (dd, *J* = 10.4, 4.0 Hz, 1H), 4.72 (dd, *J* = 12.8, 4.0 Hz, 1H), 4.37 (t, *J* = 11.8 Hz, 1H), 3.60 (s, 2H), 3.24 – 3.11 (m, 2H), 3.08-2.92 (m, 2H), 2.87 – 2.79 (m, 1H), 2.74 – 2.60 (m, 3H), 2.40-2.34 (m, 2H), 2.24 – 2.13 (m, 1H), 2.01 – 1.91 (m, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 156.6, 138.5, 136.5, 130.7, 129.0, 128.2, 127.0, 126.6, 122.3, 119.8, 118.5, 111.3, 109.8, 62.8, 56.4, 48.8, 48.5, 47.7, 47.0, 39.6, 33.7, 32.7, 22.5.

14g: N-((1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)(3,4,5-trimethoxyphenyl) methyl)-2-(1H-indol-3-yl)ethanamine

The product was obtained using procedure **A,** 853 mg, 86 % as pale yellow liquid; HRMS (ESI) m/z calcd for $C_{25}H_{33}N_6O_5$ $[M+H]^+$: 497.2507; found: 497.2506; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.34 (s, 1H), 7.54 (d, *J* = 8.0 Hz, 1H), 7.34 (d, *J* = 8.0 Hz, 1H), 7.16 (t, *J* = 7.5 Hz, 1H), 7.07 (t, *J* = 7.5 Hz, 1H), 7.03 (s, 1H), 6.48 (s, 2H), 5.24 (s, 1H), 4.48 (t, *J* = 5.0 Hz, 1H), 4.37 (dd, *J* = 14.1, 5.0 Hz, 1H), 4.25 (dd, *J* = 14.1, 5.0 Hz, 1H), 3.80 (s, 3H), 3.71 (s, 6H), 3.29 (s, 3H), 3.28 (s,3H), 3.07 – 2.91 (m, 4H), 2.17 (s, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 156.5, 153.5, 137.7, 136.3, 133.4, 127.3, 122.2, 122.0, 119.2, 118.6, 113.2, 111.2, 104.3, 102.5, 60.7, 57.4, 56.0, 55.4, 55.2, 48.9, 47.7, 25.6.

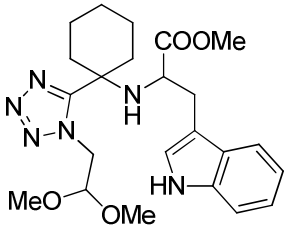
4g: 4-(3,4,5-trimethoxyphenyl)-4,6,7,12,12b,13-hexahydrotetrazolo [1'',5'':4',5']pyrazino[1',2':1,2]pyrido[3,4-b]indole

The product was obtained using procedure **C,** 138 mg, 32 % as white solid, m.p.: 195-197 ^{o}C; HRMS (ESI) m/z calcd for $C_{23}H_{25}N_6O_3$ $[M+H]^+$: 433.1983; found: 433.1982; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.90 (s, 1H), 7.52 (d, *J* = 7.7 Hz, 1H), 7.34 (d, *J* = 8.1 Hz, 1H), 7.20 (t, *J* = 7.5 Hz, 1H), 7.14 (t, *J* = 7.4 Hz, 1H), 6.69 (s, 2H), 5.02 (dd, *J* = 12.1, 3.2 Hz, 1H), 4.70 (s, 1H), 4.29 (t, *J* = 11.5 Hz, 1H), 4.14 (d, *J* = 10.4 Hz, 1H), 3.85 (s, 3H), 3.80 (s, 6H), 3.21 (dd, *J* = 11.1, 4.3 Hz, 1H), 2.89 – 2.70 (m, 2H), 2.55 – 2.46 (m, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 153.8, 153.7, 137.9, 136.8, 133.0, 129.0, 126.4, 122.4, 119.8, 118.4, 111.3, 110.3, 105.2, 64.0, 60.8, 56.1, 55.1, 49.4, 48.1, 21.7.



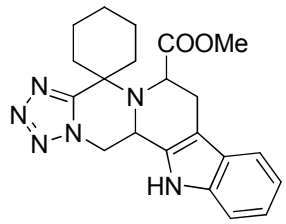
14h: methyl 2-((1-(1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)cyclohexyl) amino)-3-(1H-indol-3-yl)propanoate

The product was obtained using procedure **A,** 802 mg, 88 % as white solid, m.p.: 125-127 ^{o}C; HRMS (ESI) m/z calcd for $C_{23}H_{33}N_6O_4$ $[M+H]^+$: 457.2558; found: 457.2558; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.34 (brs, 1H), 7.45 (d, *J* = 7.5 Hz, 1H), 7.36 (d, *J* = 8.1 Hz, 1H), 7.18 (t, *J* = 7.5 Hz, 1H), 7.09 (t, *J* = 7.5 Hz, 1H), 6.87 (s, 1H), 4.76 (t, *J* = 5.6 Hz, 1H), 4.46 (dd, *J* = 14.4, 5.6 Hz, 1H), 4.09 – 3.98 (m, 1H), 3.49 (s, 3H), 3.42 – 3.35 (m, 1H), 3.32 (s, 3H), 3.29 (s, 3H), 2.99 (dd, *J* = 14.3, 5.0 Hz, 1H), 2.87 (dd, *J* = 14.3, 8.7 Hz, 1H), 2.31-2.15 (d, *J* = 13.2 Hz, 2H), 2.10 (brs, 1H), 1.78 – 1.53 (m, 3H), 1.50 – 1.11 (m, 5H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 176.0, 157.6, 136.0, 127.3, 122.6, 122.2, 119.6, 118.4, 111.2, 111.0, 102.9, 55.8, 55.7, 55.4, 55.2, 51.9, 50.1, 36.0, 35.5, 30.3, 25.1, 22.2, 21.9.



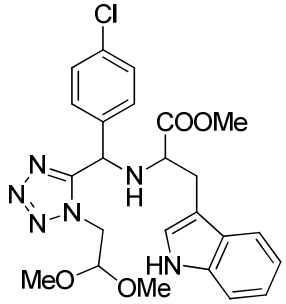
4h: methyl 7',12',12b',13'-tetrahydro-6'H-spiro[cyclohexane-1,4'-tetrazolo [1'',5'':4',5']pyrazino[1',2':1,2]pyrido[3,4-b]indole]-6'-carboxylate

The product was obtained using procedure **C,** 227 mg, 58 % as white solid, m.p.: 235-237 ^{o}C; HRMS (ESI) m/z calcd for $C_{21}H_{25}N_6O_2$ $[M+H]^+$: 393.2034; found: 393.2033; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.51 (s, 1H), 7.50 (d, *J* = 8.0 Hz, 1H), 7.29 (d, *J* = 8.0 Hz, 1H), 7.17 (t, *J* = 7.5 Hz, 1H), 7.12 (t, *J* = 7.5 Hz, 1H), 5.30 (d, *J* = 9.6 Hz, 1H), 5.00 (dd, *J* = 12.1, 3.1 Hz, 1H), 4.51 (d, *J* = 4.5 Hz, 1H), 3.91 (t, *J* = 11.4 Hz, 1H), 3.56 (s, 3H), 3.27 (d, *J* = 15.1 Hz, 1H), 3.16 (dd, *J* = 15.1, 4.5 Hz, 1H), 2.47 – 2.24 (m, 2H), 2.15-2.00 (m, 2H), 1.91 – 1.87 (m, 1H), 1.74 – 1.58 (m, 3H), 1.45 (td, *J* = 13.1, 4.1 Hz, 1H), 1.28 – 1.15 (m, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 175.2, 156.1, 136.7, 131.3, 126.5, 122.2, 119.7, 118.2, 111.4, 106.8, 60.1, 52.4, 52.0, 51.5, 48.1, 35.6, 32.3, 27.5, 25.1, 22.0, 21.8.



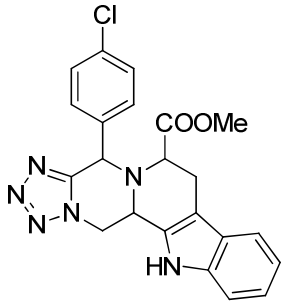
14i: methyl 2-(((4-chlorophenyl)(1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)methyl) amino)-3-(1H-indol-3-yl)propanoate

The product was obtained using procedure **A,** 847 mg, 85 % as colorless liquid; HRMS (ESI) m/z calcd for $C_{24}H_{28}ClN_6O_4$ $[M+H]^+$: 499.1855; found: 499.1855; ^{1}H NMR (500 MHz, $CDCl_3$) (*major diastereomer*) δ 8.25 (s, 1H), 7.38-7.30 (m, 2H), 7.27 – 7.17 (m, 4H), 7.06 – 6.95 (m, 2H), 6.90 (s, 1H), 5.23 (s, 1H), 4.63 – 4.55 (m, 2H), 4.43 – 4.33 (m, 1H), 4.12 – 4.05 (m, 1H), 3.74 (s, 3H), 3.39 (s, 3H), 3.30 – 3.20 (m, 4H), 2.99 (dd, *J* = 14.2, 9.4 Hz, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) (*major diastereomer*) δ 174.1, 156.2, 136.0, 134.9, 134.3, 129.1, 128.7, 126.9, 123.3, 122.4, 119.6, 118.5, 111.3, 110.4, 102.7, 57.7, 55.7, 55.3, 54.3, 52.1, 49.0, 29.4. *diastereomeric* ratio = 3:2



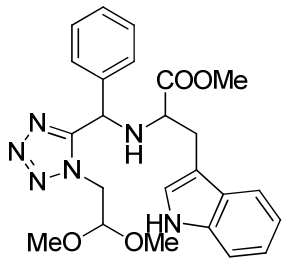
4i: methyl 4-(4-chlorophenyl)-4,6,7,12,12b,13-hexahydrotetrazolo [1'',5'':4',5']pyrazino[1',2':1,2]pyrido[3,4-b]indole-6-carboxylate

The product was obtained using procedure **C,** 369 mg, 85 % as pale yellow solid, m.p.: 170-172 ^{o}C; HRMS (ESI) m/z calcd for $C_{22}H_{20}N_6O_2$ $[M+H]^+$: 435.1331; found: 435.1331; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.79 (s, 1H), 7.51 (d, *J* = 7.5 Hz, 1H), 7.40 – 7.28 (m, 5H), 7.21 (t, *J* = 7.5 Hz, 1H), 7.14 (t, *J* = 7.5 Hz, 1H), 5.82 (s, 1H), 5.14 (d, *J* = 9.7 Hz, 2H), 4.21 (t, *J* = 12.0 Hz, 1H), 3.82 (d, *J* = 5.0 Hz, 1H), 3.57 (s, 3H), 3.27 (d, *J* = 15.3 Hz, 1H), 3.04 (dd, *J* = 15.3, 5.3 Hz, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 172.2, 153.8, 136.9, 135.4, 135.3, 129.9, 129.7, 128.7, 126.2, 122.5, 119.7, 118.3, 111.5, 107.4, 60.5, 55.3, 51.9, 51.3, 50.8, 25.0. *diastereomeric* ratio = 9:1



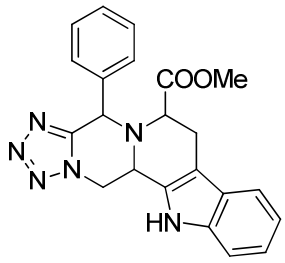
14j: methyl 2-(((1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)(phenyl)methyl) amino)-3-(1H-indol-3-yl)propanoate

The product was obtained using procedure **A,** 798 mg, 86 % as white solid, m.p.: 63-65 ^{o}C; HRMS (ESI) m/z calcd for $C_{24}H_{29}N_6O_4$ $[M+H]^+$: 465.2245; found: 465.2246; ^{1}H NMR (500 MHz, $CDCl_3$) (*major diastereomer*) δ 8.32 (s, 1H), 7.38 – 7.25 (m, 3H), 7.20 – 7.14 (m, 2H), 7.13 – 7.06 (m, 2H), 7. 04 - 6.98 (m, 2H), 5.29 (s, 1H), 4.54 – 4.46 (m, 2H), 4.34 – 4.27 (m, 1H), 4.07 (dd, *J* = 8.5, 5.5 Hz, 1H), 3.70 (s, 3H), 3.35 (s, 3H), 3.28 (dd, *J* = 14.2, 4.8 Hz, 1H), 3.24 (s, 3H), 3.05 (dd, *J* = 14.4, 8.6 Hz, 1H), 2.68 (brs, 1H); ^{13}C NMR (126 MHz, $CDCl_3$) (*major diastereomer*) δ 174.2, 156.5, 136.5, 136.3, 128.7, 128.4, 127.8, 127.1, 123.3, 122.1, 119.5, 118.5, 111.3, 110.4, 102.5, 59.7, 57.9, 55.4, 55.0, 52.0, 48.9, 29.1. *diastereomeric* ratio = 2:1



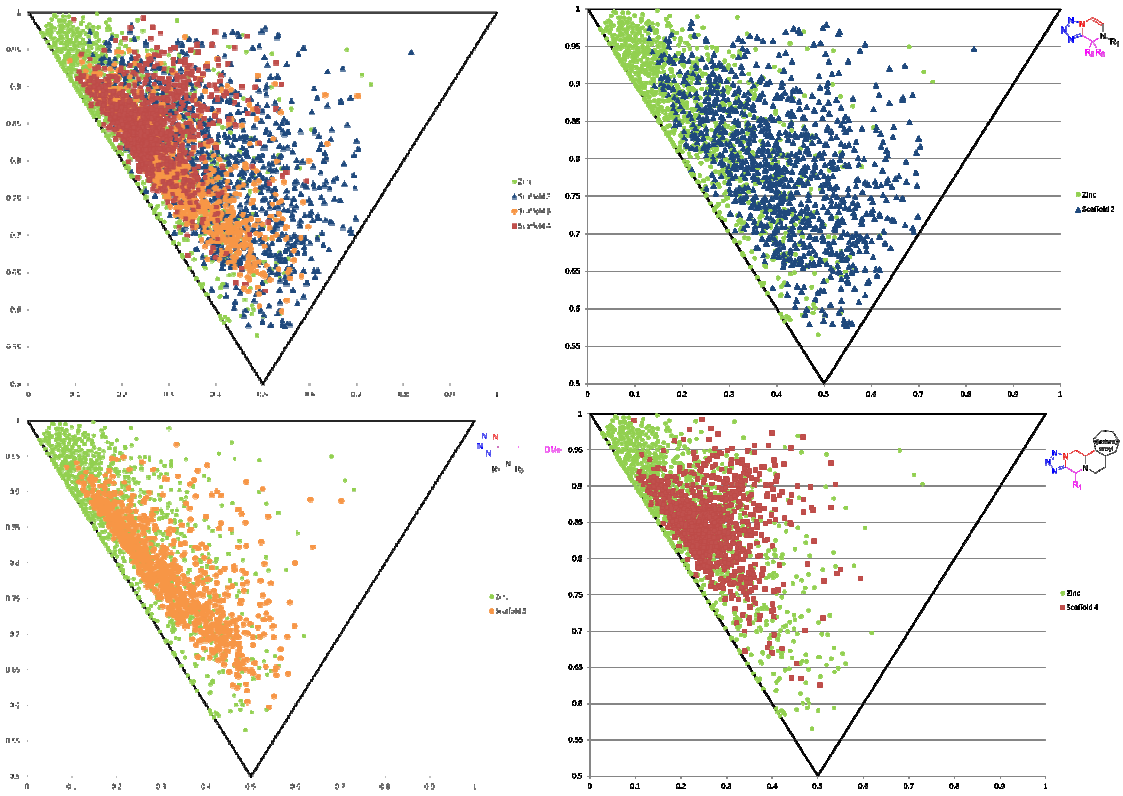
4j: methyl 4-phenyl-4,6,7,12,12b,13-hexahydrotetrazolo[1'',5'':4',5'] pyrazino[1',2':1,2]pyrido[3,4-b]indole-6-carboxylate

The product was obtained using procedure **C,** 296 mg, 74 % as white solid, m.p.: 165-167 ^{o}C; HRMS (ESI) m/z calcd for $C_{22}H_{21}N_6O_2$ $[M+H]^+$: 401.1721; found: 401.1719; ^{1}H NMR (500 MHz, $CDCl_3$) (*major diastereomer*) δ 8.28 (s, 1H), 7.72 (d, *J* = 7.7 Hz, 1H), 7.77-7.30 (m, 5H), 7.25-7.10 (m, 3H), 5.83 (s, 1H), 5.16 (d, *J* = 10.2 Hz, 1H), 5.06 (d, *J* = 12.2 Hz, 1H), 4.34 – 4.22 (m, 1H), 3.89 (d, *J* = 4.9 Hz, 1H), 3.58 (s, 3H), 3.25 (d, *J* = 15.4 Hz, 1H), 3.05 (dd, *J* = 15.4, 5.5 Hz, 1H); ^{13}C NMR (126 MHz, $CDCl_3$)) (*major diastereomer*) δ 172.3, 154.2, 136.9, 136.5, 129.3, 129.2, 128.9, 128.6, 126.2, 122.2, 119.5, 118.1, 111.5, 107.2, 61.0, 58.1, 51.6, 51.2, 46.4, 22.6. *diastereomeric* ratio = 2:1

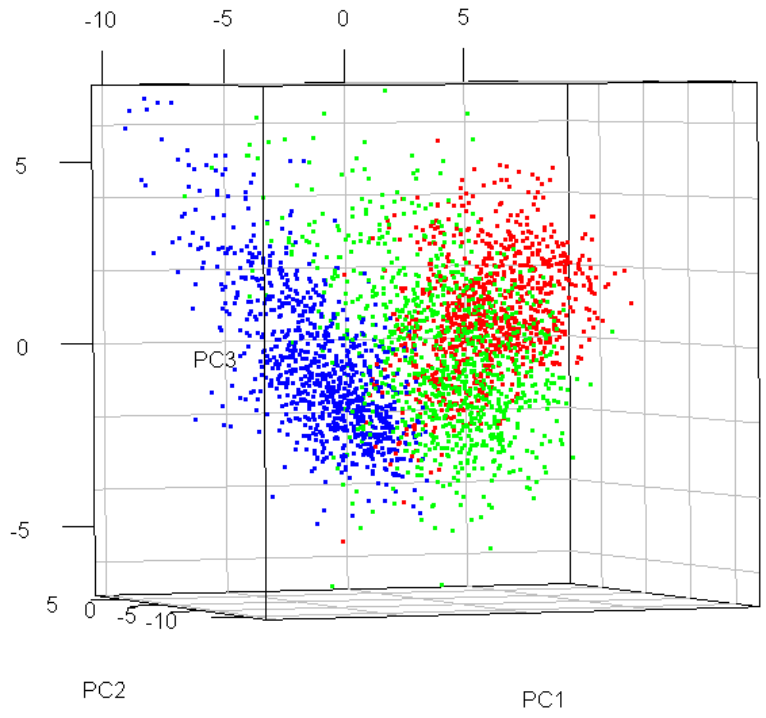


Computational Chemical Descriptors

A virtual library of 100,000 randomly generated compounds were made for each library using previously described methods (Koes, D. et al. PLoS One 2012, 7, e32839.). 1000 compounds of each reaction were randomly selected and physiochemical properties relating to drug likeness were analyzed via ChemAxon's Instant JChem Software (Instant JChem 5.9.2, 2012, ChemAxon http://www.chemaxon.com). Principal moment of inertia was calculated using Schrodinger's Maestro V 9.3(Suite 2012: Maestro, version 9.3, Schrödinger, LLC, New York, NY, 2012.)



SI Figure 1: Principal component analysis of our three scaffolds described in this paper and 1000 randomly selected compounds from the zinc database. (Top left) Overlap of all three scaffolds and ZINC compounds. (Top right) Overlap of Scaffold 2 and ZINC database. (Bottom left) Overlap of Scaffold 3 and ZINC database. (Bottom right) Overlap of Scaffold 4 and ZINC database.



SI Figure 2: 3D PCA of 1000 randomly selected compounds of all three scaffolds (green = scaffold 2, blue = scaffold 3, red = scaffold 4).

PCA Data:

Importance of components:

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10
Standard deviation	3.6154	2.64	1.9758	1.75386	1.2311	1.14611	1.03285	0.99559	0.81857	0.77989
Proportion of Variance	0.3735	0.1991	0.1115	0.08789	0.0433	0.03753	0.03048	0.02832	0.01914	0.01738
Cumulative Proportion	0.3735	0.5726	0.6841	0.77202	0.8153	0.85285	0.88333	0.91165	0.9308	0.94817

Rotation:

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10
Mass	0.0867	0.3379	-0.0188	0.1163	-0.0143	0.0370	-0.0348	0.0192	-0.0048	0.0789
donorcount	-0.0889	0.0742	0.3558	0.1071	-0.3184	0.0217	0.2822	-0.1332	0.0138	-0.2980
donsitecount	-0.0910	0.0719	0.3551	0.1079	-0.3126	0.0202	0.2780	-0.1317	0.0138	-0.3195
acceptorcount	-0.1659	0.2060	0.1546	0.0366	0.0189	0.0657	-0.3990	0.1346	0.0203	0.1570
accsitecount	-0.1748	0.2053	0.1387	0.0547	-0.0156	0.0740	-0.3746	0.1253	0.0202	0.1389
logP	0.1546	0.0694	-0.3528	0.1100	-0.1685	0.0158	0.0958	-0.0545	0.0218	-0.0125
pH0	0.1285	0.0342	-0.1990	0.2709	-0.2378	0.0979	-0.0021	0.0261	0.0104	0.2424
pH7	0.1590	0.0413	-0.3411	0.0611	-0.2063	0.0216	0.0805	-0.0695	0.0234	0.0671
pH14	0.2164	-0.0098	-0.2576	0.0377	0.1031	-0.0268	0.1176	-0.0068	0.0118	-0.0498
PSA	-0.0652	0.1827	0.3486	0.1636	-0.0125	0.0744	-0.0686	0.1056	-0.0160	0.1972
Atomcount	0.0131	0.3490	-0.1024	-0.0430	0.1202	-0.0353	0.1541	-0.0322	0.0043	-0.1359
AliphaticAtomCount	-0.2140	0.1956	-0.0848	-0.1381	0.0694	-0.0189	0.1052	-0.0217	0.0055	0.0325
AromaticAtomCount	0.2455	0.0893	0.0606	0.1780	-0.0738	0.0437	-0.1052	0.0247	-0.0106	0.0010
BondCount	0.0451	0.3496	-0.0839	-0.0591	0.0991	-0.0263	0.1427	-0.0338	-0.0004	-0.1247
AliphaticBond Count	-0.1816	0.2415	-0.0856	-0.1735	0.0576	-0.0046	0.0795	-0.0212	-0.0015	0.0366
AromaticBond Count	0.2478	0.0889	0.0721	0.1655	-0.0779	0.0396	-0.0800	0.0173	-0.0108	0.0028
RotatableBond Count	-0.1641	0.1958	-0.0780	0.2371	0.1640	0.0106	0.1159	-0.0170	-0.0535	0.0260
RingCount	0.2329	0.1592	0.0863	-0.1333	-0.0963	0.0477	-0.0123	-0.0260	-0.0311	0.0191
AliphaticRingCount	-0.0329	0.1499	-0.0199	-0.4976	-0.0762	0.0419	0.0114	-0.0657	-0.0291	-0.0171
AromaticRingCount	0.2527	0.0762	0.0979	0.1446	-0.0542	0.0245	-0.0188	0.0106	-0.0150	0.0288
HeteroRingCount	0.2252	0.0256	0.1907	-0.1291	0.2155	-0.0752	0.1109	0.0286	0.0110	0.1289
HeteroaliphaticRingCount	0.1248	0.1218	0.0887	-0.3805	0.2190	-0.0908	-0.0447	-0.0084	0.0695	-0.0910
HeteroaromaticRingCount	0.2248	-0.0392	0.2005	0.0570	0.1552	-0.0455	0.1746	0.0432	-0.0272	0.2264
RingAtomCount	0.2260	0.1785	0.0185	-0.0772	-0.1504	0.0611	-0.1412	0.0231	-0.0125	0.0054
RingBondCount	0.2272	0.1803	0.0452	-0.1161	-0.1454	0.0427	-0.0894	0.0042	-0.0024	-0.0059
ChainAtomCount	-0.2070	0.1505	-0.0405	0.2166	0.1865	-0.0412	0.1699	-0.0216	0.0078	0.0370
ChainBondCount	-0.1863	0.1793	-0.0626	0.2677	0.1871	-0.0076	0.1163	-0.0043	-0.0176	0.0651
SmallestRingSize	0.0044	0.0478	0.0187	0.0793	-0.0964	-0.6832	-0.0868	-0.0028	0.6961	0.0308
LargestRingSize	-0.1756	0.0788	-0.1144	-0.1618	-0.4112	0.0002	0.0209	0.0360	0.0046	0.2064
RingCountofSize4	-0.0003	-0.0445	0.0118	-0.0576	0.0985	0.6748	0.1512	0.0189	0.7040	0.0590
RingCountofSize5	0.1622	0.0200	0.2161	-0.1284	-0.0077	-0.1114	0.3838	-0.0847	-0.0608	0.5636
RingCountofSize6	0.2365	0.1268	0.0180	0.0046	0.0481	0.0264	-0.2228	0.0196	0.0407	-0.3503
RingCountofSize7	-0.2007	0.0830	-0.0955	-0.1535	-0.3610	0.0079	-0.0496	-0.1125	0.0008	0.1794
RingCountofSize8	-0.0091	0.0023	-0.0413	-0.0694	-0.1296	-0.0479	0.2559	0.9359	-0.0166	-0.1073
VDWVol	0.0458	0.3619	-0.0857	0.0467	0.0585	-0.0033	0.0647	-0.0094	0.0020	-0.0511

Single Crystal X-Ray Structure Determination of Compounds 3C, 2E and 4F

General:

Data were collected on an X-ray single crystal diffractometer equipped with a CCD detector (APEX II, κ–CCD), a rotating anode (Bruker AXS, FR591) with MoK_α radiation (λ = 0.71073 Å) and a MONTEL-type focusing optic (compound **4F**) or a fine-focussed sealed tube (Bruker AXS, D8), respectively (compounds **3C** and **2E**) and a graphite monochromator by using the SMART software package. [1] The measurements were performed on single crystals coated with perfluorinated ether. The crystals were fixed on the top of a cactus prickle (Opuntia ficus-india) and transferred to the diffractometer. The crystals were frozen under a stream of cold nitrogen. A matrix scan was used to determine the initial lattice parameters. Reflections were merged and corrected for Lorenz and polarization effects, scan speed, and background using SAINT. [2] Absorption corrections, including odd and even ordered spherical harmonics were performed using SADABS. [2] Space group assignments were based upon systematic absences, *E* statistics, and successful refinement of the structures. Structures were solved by direct methods with the aid of successive difference Fourier maps, and were refined against all data using WinGX [7] based on SIR-92. [3] If not mentioned otherwise, non-hydrogen atoms were refined with anisotropic displacement parameters. Hydrogen atoms could be located in the difference Fourier maps and were allowed to refine freely (compounds **2E** and **4F.** Unless otherwise noticed, methyl hydrogen atoms were refined as part of rigid rotating groups, with a C–H distance of 0.98 Å and $U_{iso(H)} = 1.5 \cdot U_{eq(C)}$. Other H atoms were placed in calculated positions and refined using a riding model, with methyne, methylene and aromatic C–H distances of 1.00, 0.99 and 0.95 Å, respectively, and $U_{iso(H)} = 1.2 \cdot U_{eq(C)}$. (compound **3C**). Full-matrix least-squares refinements were carried out by minimizing $\Sigma w(F_o^2-F_c^2)^2$ with

SHELXL-97 [5] weighting scheme. Neutral atom scattering factors for all atoms and anomalous dispersion corrections for the non-hydrogen atoms were taken from *International Tables for Crystallography*. [4] Images of the crystal structures were generated by PLATON. [6] CCDC 1017121 (**2E**), CCDC 1017122 (**4F**), and CCDC 1017123 (**3C**) contains the supplementary crystallographic data for this compound. This data can be obtained free of charge from The Cambridge Crystallographic Data Centre via www.ccdc.cam.ac.uk/data_request/cif or via https://www.ccdc.cam.ac.uk/services/structure_deposit/

Special:

3C: Full refinement was possible without running into problems. The hydrogen atom bound to N5 was allowed to refine freely.

2E: Full refinement was possible without running into problems.

4F: Full refinement was possible without running into problems. Small extinction effects were cured with the SHELXL procedure.

Compound 3C

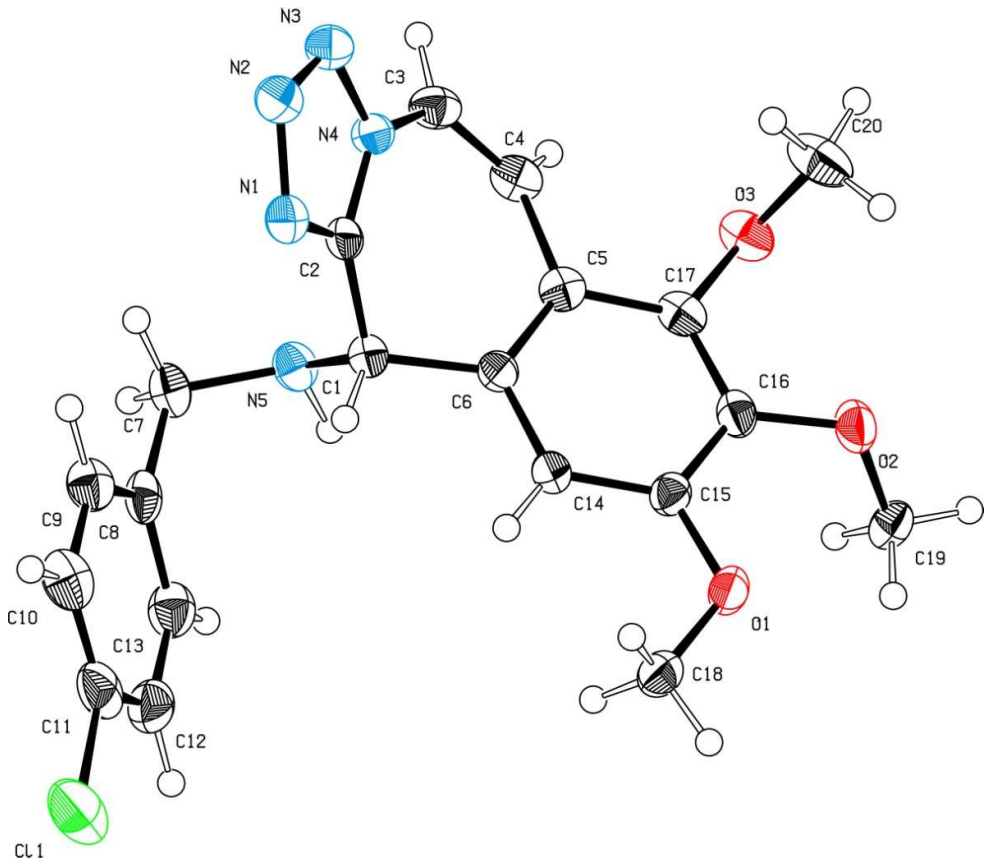


Figure F1 – Ortep drawing of compound **3C** with 50% ellipsoids. [6]

Operator:	*** Herdtweck ***
Molecular Formula:	$C_{20}\ H_{20}\ Cl\ N_5\ O_3$
Crystal Color / Shape	Colorless fragment
Crystal Size	Approximate size of crystal fragment used for data collection:
	$0.10 \times 0.25 \times 0.33$ mm
Molecular Weight:	413.86 a.m.u.
F_{000}:	432
Systematic Absences:	none
Space Group:	Triclinic $P\bar{1}$ (I.T.-No.: 2)

Cell Constants:	Least-squares refinement of 9874 reflections with the programs "APEX suite" and "SAINT" [1,2]; theta range 1.84° < θ < 25.38°; Mo(K$\overline{\alpha}$); λ = 0.71073 Å			
	a =	9.7930(3) Å	α =	76.4624(14)°
	b =	10.1156(3) Å	β =	89.7725(14)°
	c =	11.4745(3) Å	γ =	61.9039(15)°
	V = 967.37(5)· Å^3; Z = 2; D_{calc} = 1.421 g cm^{-3}; Mos. = 0.77			
Diffractometer:	Kappa APEX II (Area Diffraction System; BRUKER AXS); sealed tube; graphite monochromator; 50 kV; 30 mA; λ = 0.71073 Å; Mo(K$\overline{\alpha}$)			
Temperature:	(-150±1) °C; (123±1) K			
Measurement Range:	1.84° < θ < 25.38°; h: -11/11, k: -12/12, l: -13/13			
Measurement Time:	2 × 15 s per film			
Measurement Mode:	measured: 7 runs; 1698 films / scaled: 7 runs; 1698 films			
	φ– and ω–movement; Increment: $\Delta\varphi/\Delta\omega$ = 1.00°; dx = 40.0 mm			
LP - Correction:	Yes [2]			
Intensity Correction	No/Yes; during scaling [2]			
Absorption Correction:	Multi-scan; during scaling; μ = 0.231 mm^{-1} [2]			
	Correction Factors:	T_{min} = 0.7056	T_{max} = 0.7452	
Reflection Data:	28405	reflections were integrated and scaled		
	28405	reflections to be merged		
	3553	independent reflections		
	0.022	R_{int}: (basis F_o^2)		
	3553	independent reflections (all) were used in refinements		
	3077	independent reflections with $I_o > 2\sigma(I_o)$		
	99.7 %	completeness of the data set		
	269	parameter full-matrix refinement		
	13.2	reflections per parameter		

Solution:	Direct Methods [3, 7]; Difference Fourier syntheses
Refinement Parameters:	In the asymmetric unit:
	29 Non-hydrogen atoms with anisotropic displacement parameters
	1 Hydrogen atoms with isotropic displacement parameters
Hydrogen Atoms:	The N-hydrogen atom positions was found in the difference and was refined with an individual isotropic displacement parameters.
Hydrogen Atoms:	All other hydrogen atoms were placed in calculated positions (d_{C-H} = 0.95, 0.98, 0.99, 1.00 Å). Isotropic displacement parameters were calculated from the parent carbon atom (U_H = 1.2/1.5 U_C). The hydrogen atoms were included in the structure factor calculations but not refined.
Atomic Form Factors:	For neutral atoms and anomalous dispersion [4, 5, 7]
Extinction Correction:	no
Weighting Scheme:	$w^{-1} = \sigma^2(F_o^2)+(a*P)^2+b*P$
	with a: 0.0435; b: 1.8951; P: [Maximum(0 or F_o^2)+2$*F_c^2$]/3
Shift/Err:	Less than 0.001 in the last cycle of refinement:
Resid. Electron Density:	+1.07 $e_{0;}^-$/Å^3; -0.66 $e_{0;}^-$/Å^3
R1:	$\Sigma(\lvert\lvert F_o\rvert-\lvert F_c\rvert\rvert)/\Sigma\lvert F_o\rvert$
[$F_o > 4\sigma(F_o)$; N=3077]:	= 0.0584
[all reflctns; N=3553]:	= 0.0672
wR2:	$[\Sigma w(F_o^2-F_c^2)^2/\Sigma w(F_o^2)^2]^{1/2}$
[$F_o > 4\sigma(F_o)$; N=3077]:	= 0.1347
[all reflctns; N=3553]:	= 0.1406
Goodness of fit:	$[\Sigma w(F_o^2-F_c^2)^2/(NO-NV)]^{1/2}$ = 1.064
Remarks:	Refinement expression $\Sigma w(F_o^2-F_c^2)^2$

Compound 2E

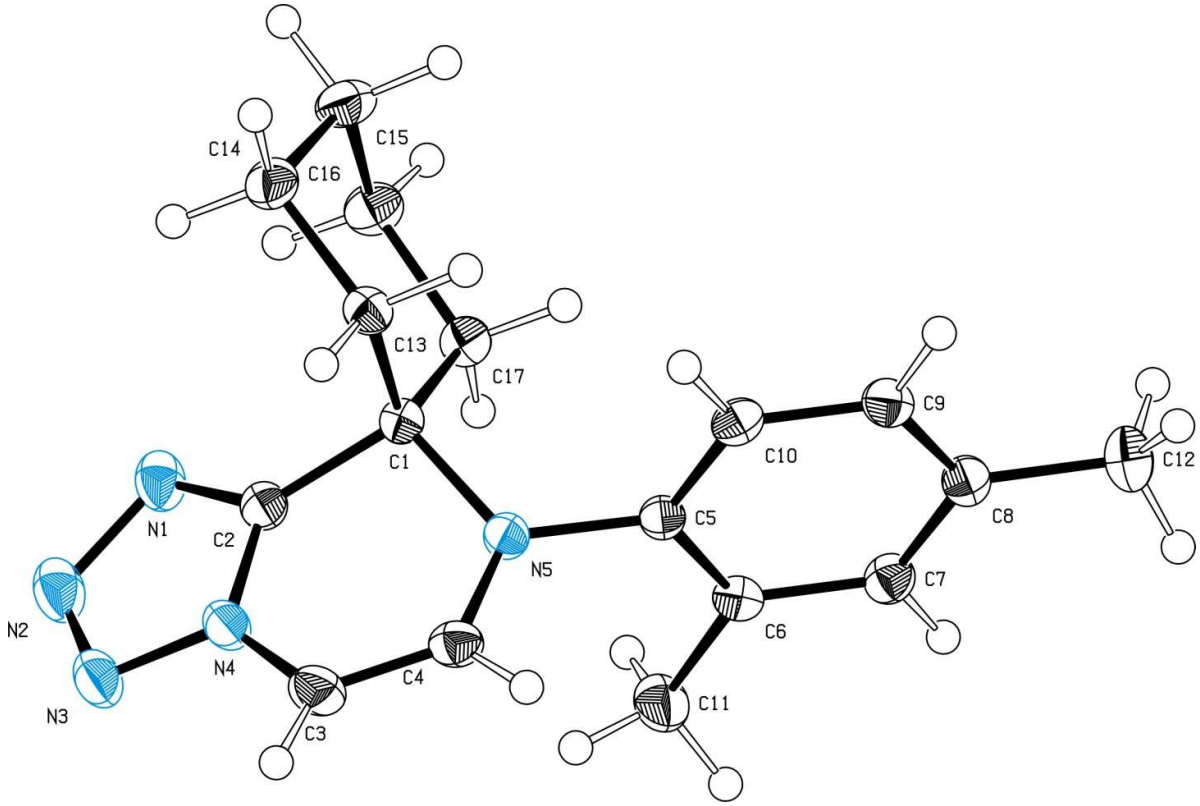


Figure F2 – Ortep drawing of compound **2E** with 50% ellipsoids. [6]

Operator:	*** Herdtweck ***
Molecular Formula:	$C_{17}\ H_{21}\ N_5$
Crystal Color / Shape	Colorless fragment
Crystal Size	Approximate size of crystal fragment used for data collection:
	$0.30 \times 0.30 \times 0.30$ mm
Molecular Weight:	295.39 a.m.u.
F_{000}:	632
Systematic Absences:	h0l: h+l≠2n; 0k0: k≠2n
Space Group:	Monoclinic $P\ 2_1/n$ (I.T.-No.: 14)

Cell Constants:	Least-squares refinement of 9927 reflections with the programs "APEX suite" and "SAINT" [1,2]; theta range 2.14° < θ < 25.39°; Mo(K$\overline{\alpha}$); λ = 0.71073 Å
	a = 8.2232(2) Å
	b = 15.4975(5) Å β = 104.8288(12)°
	c = 12.4813(4) Å
	V = 1537.63(8)· Å^3; Z = 4; D_{calc} = 1.276 g cm^{-3}; Mos. = 0.63
Diffractometer:	Kappa APEX II (Area Diffraction System; BRUKER AXS); sealed tube; graphite monochromator; 50 kV; 30 mA; λ = 0.71073 Å; Mo(K$\overline{\alpha}$)
Temperature:	(-150±1) °C; (123±1) K
Measurement Range:	2.14° < θ < 25.39°; h: -9/9, k: -18/18, l: -14/15
Measurement Time:	2 × 10 s per film
Measurement Mode:	measured: 12 runs; 3494 films / scaled: 12 runs; 3494 films
	φ– and ω–movement; Increment: $\Delta\varphi/\Delta\omega$ = 0.50°; dx = 35.0 mm
LP - Correction:	Yes [2]
Intensity Correction	No/Yes; during scaling [2]
Absorption Correction:	Multi-scan; during scaling; μ = 0.080 mm^{-1} [2]
	Correction Factors: T_{min} = 0.6914 T_{max} = 0.7452
Reflection Data:	59840 reflections were integrated and scaled
	1408 reflections systematic absent and rejected
	58432 reflections to be merged
	2820 independent reflections
	0.027 R_{int}: (basis F_o^2)
	2820 independent reflections (all) were used in refinements
	2610 independent reflections with $I_o > 2\sigma(I_o)$
	99.9 % completeness of the data set
	283 parameter full-matrix refinement

	10.0	reflections per parameter
Solution:	Direct Methods [3, 7]; Difference Fourier syntheses	
Refinement Parameters:	In the asymmetric unit:	
	22	Non-hydrogen atoms with anisotropic displacement parameters
	21	Hydrogen atoms with isotropic displacement parameters
Hydrogen Atoms:	All hydrogen atom positions were found in the difference map calculated from the model containing all non-hydrogen atoms. The hydrogen positions were refined with individual isotropic displacement parameters.	
Atomic Form Factors:	For neutral atoms and anomalous dispersion [4, 5, 7]	
Extinction Correction:	no	
Weighting Scheme:	$w^{-1} = \sigma^2(F_o^2)+(a*P)^2+b*P$	
	with a: 0.0441; b: 0.6040; P: [Maximum(0 or F_o^2)+2$*F_c^2$]/3	
Shift/Err:	Less than 0.001 in the last cycle of refinement:	
Resid. Electron Density:	+0.25 $e_{0;}^{-}$/Å^3; -0.18 $e_{0;}^{-}$/Å^3	
R1:	$\Sigma(\lvert\lvert F_o\rvert-\lvert F_c\rvert\rvert)/\Sigma\lvert F_o\rvert$	
[$F_o > 4\sigma(F_o)$; N=2610]:		= 0.0338
[all reflctns; N=2820]:		= 0.0368
wR2:	$[\Sigma w(F_o^2-F_c^2)^2/\Sigma w(F_o^2)^2]^{1/2}$	
[$F_o > 4\sigma(F_o)$; N=2610]:		= 0.0873
[all reflctns; N=2820]:		= 0.0901
Goodness of fit:	$[\Sigma w(F_o^2-F_c^2)^2/(NO-NV)]^{1/2}$	= 1.056
Remarks:	Refinement expression $\Sigma w(F_o^2-F_c^2)^2$	

Compound 4F

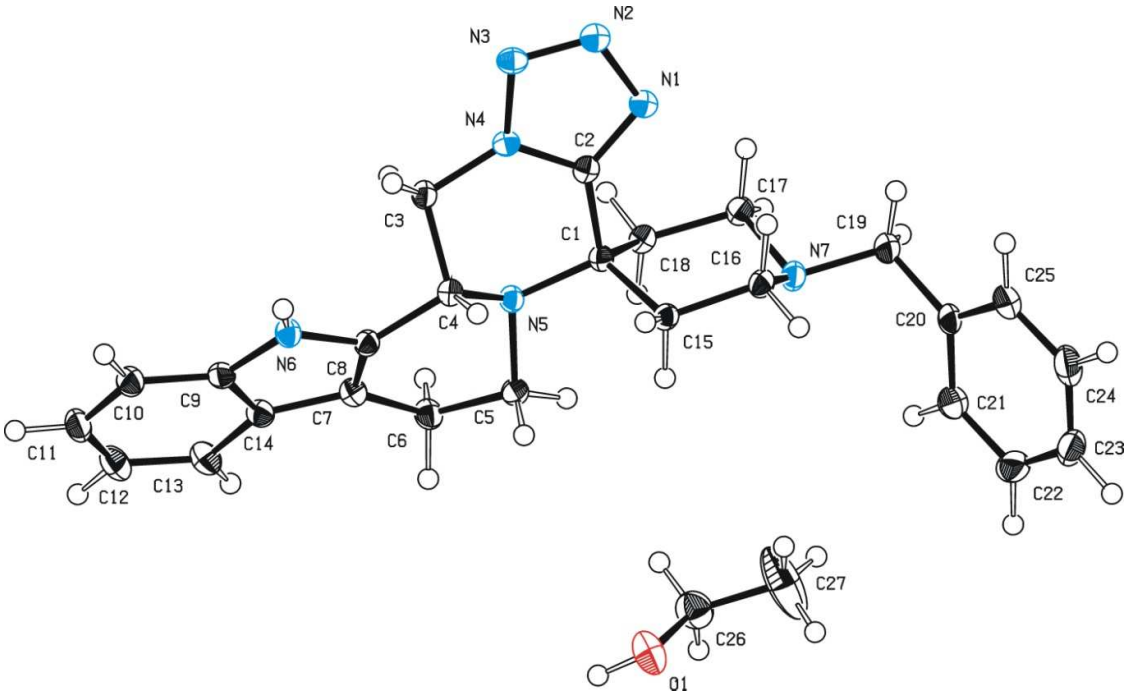


Figure F3– Ortep drawing of compound **4F** with 50% ellipsoids. [6]

Operator:	*** Herdtweck ***
Molecular Formula:	$C_{27}\ H_{33}\ N_7\ O$
	$(C_{25}\ H_{27}\ N_7)$, $(C_2\ H_6\ O)$
Crystal Color / Shape	Colorless plate
Crystal Size	Approximate size of crystal fragment used for data collection:
	$0.11 \times 0.26 \times 0.35$ mm
Molecular Weight:	471.60 a.m.u.
F_{000}:	504
Systematic Absences:	none
Space Group:	Triclinic $P\bar{1}$ (I.T.-No.: 2)
Cell Constants:	Least-squares refinement of 9987 reflections with the programs "APEX suite" and "SAINT" [1,2]; theta range 1.42° < θ < 25.45°; Mo($K\overline{\alpha}$); λ = 71.073 pm

a =	858.12(6) pm	α =	86.569(3)°
b =	1014.11(7) pm	β =	89.634(3)°
c =	1431.89(10) pm	γ =	79.327(3)°

V = 1222.31(15)· 10^6 pm^3; Z = 2; D_{calc} = 1.281 g cm^{-3}; Mos. = 0.63

Diffractometer: Kappa APEX II (Area Diffraction System; BRUKER AXS); rotating anode; graphite monochromator; 50 kV; 60 mA; λ = 71.073 pm; Mo(K$\overline{\alpha}$)

Temperature: (-173±1) °C; (100±1) K

Measurement Range: 1.42° < θ < 25.45°; h: -10/10, k: -12/12, l: -17/17

Measurement Time: 2 × 5 s per film

Measurement Mode: measured: 15 runs; 6018 films / scaled: 15 runs; 6018 films

φ– and ω–movement; Increment: $\Delta\varphi/\Delta\omega$ = 0.50°; dx = 35.0 mm

LP - Correction: Yes [2]

Intensity Correction: No/Yes; during scaling [2]

Absorption Correction: Multi-scan; during scaling; μ = 0.082 mm^{-1} [2]

Correction Factors: T_{min} = 0.7027 T_{max} = 0.7452

Reflection Data:

30230	reflections were integrated and scaled
30230	reflections to be merged
4504	independent reflections
0.028	R_{int}: (basis F_o^2)
4504	independent reflections (all) were used in refinements
4167	independent reflections with $I_o > 2\sigma(I_o)$
99.5 %	completeness of the data set
449	parameter full-matrix refinement
10.0	reflections per parameter

Solution: Direct Methods [3]; Difference Fourier syntheses

Refinement Parameters: In the asymmetric unit:

	35	Non-hydrogen atoms with anisotropic displacement parameters
	33	Hydrogen atoms with isotropic displacement parameters

Hydrogen Atoms: All hydrogen atom positions were found in the difference map calculated from the model containing all non-hydrogen atoms. The hydrogen positions were refined with individual isotropic displacement parameters.

Atomic Form Factors: For neutral atoms and anomalous dispersion [4]

Extinction Correction: F_c (korr) = kF_c[1+ 0.001 · ε · F_c^2 · λ^3/sin(2Θ)]$^{-1/4}$ SHELXL-97 [5]

ε refined to ε = 0.014(2)

Weighting Scheme: $w^{-1} = \sigma^2(F_o^2)+(a*P)^2+b*P$

with a: 0.0368; b: 0.6392; P: [Maximum(0 or F_o^2)+2*F_c^2]/3

Shift/Err: Less than 0.001 in the last cycle of refinement:

Resid. Electron Density: +0.28 $e_{0;}^-$/Å^3; -0.22 $e_{0;}^-$/Å^3

R1: $\Sigma(||F_o|-|F_c||)/\Sigma|F_o|$

[$F_o > 4\sigma(F_o)$; N=4167]: = 0.0357

[all reflctns; N=4504]: = 0.0385

wR2: $[\Sigma w(F_o^2-F_c^2)^2/\Sigma w(F_o^2)^2]^{1/2}$

[$F_o > 4\sigma(F_o)$; N=4167]: = 0.0882

[all reflctns; N=4504]: = 0.0909

Goodness of fit: $[\Sigma w(F_o^2-F_c^2)^2/(NO-NV)]^{1/2}$ = 1.057

Remarks: Refinement expression $\Sigma w(F_o^2-F_c^2)^2$

Crystal Structure References:

[1] APEX suite of crystallographic software. APEX 2 Version 2008.4. Bruker AXS Inc., Madison, Wisconsin, USA (2008).

[2] SAINT, Version 7.56a and SADABS Version 2008/1. Bruker AXS Inc., Madison, Wisconsin, USA (2008).

[3] Altomare, A.; Cascarano, G.; Giacovazzo, C.; Guagliardi, A.; Burla, M. C.; Polidori, G.; Camalli M. "**SIR92**", *J. Appl. Cryst.* **1994**, *27*, 435-436.

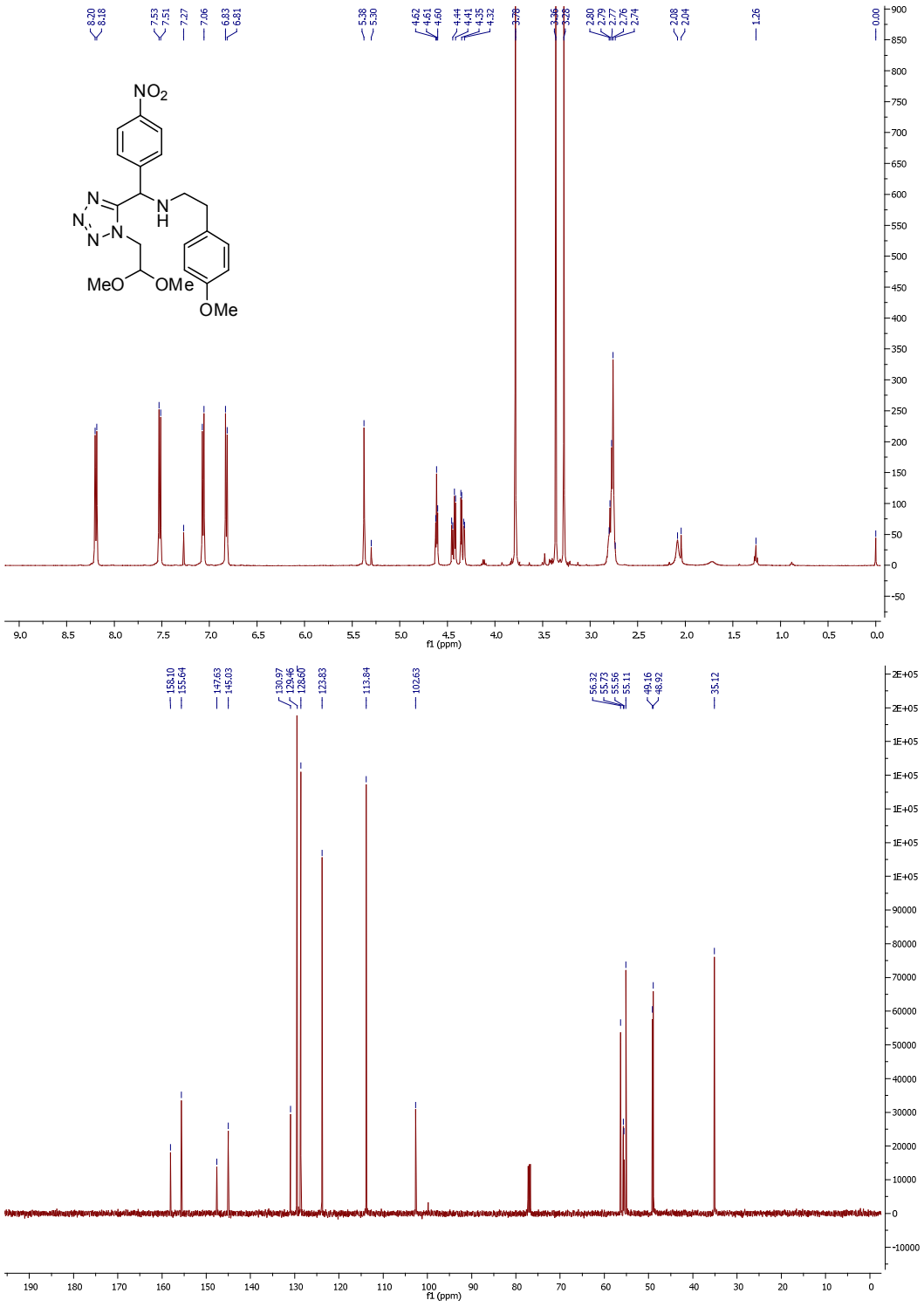
[4] International Tables for Crystallography, Vol. C, Tables 6.1.1.4 (pp. 500-502), 4.2.6.8 (pp. 219-222), and 4.2.4.2 (pp. 193-199), Wilson, A. J. C., Ed., Kluwer Academic Publishers, Dordrecht, The Netherlands, 1992.

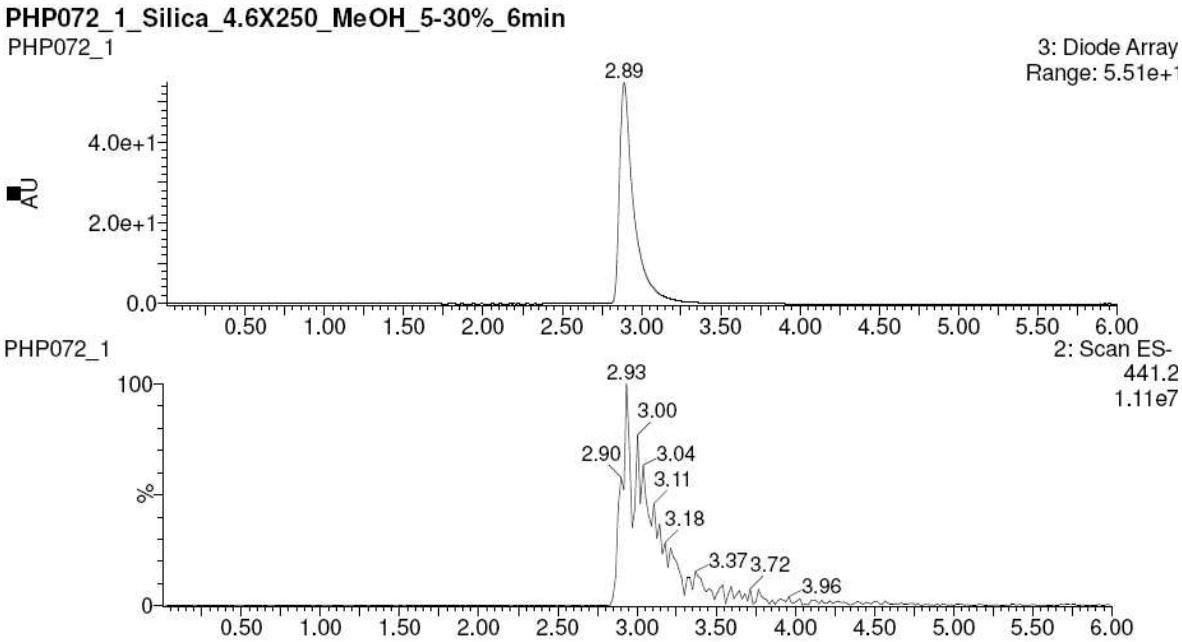
[5] Sheldrick, G. M. "**SHELXL-97**", University of Göttingen, Göttingen, Germany, (1998).

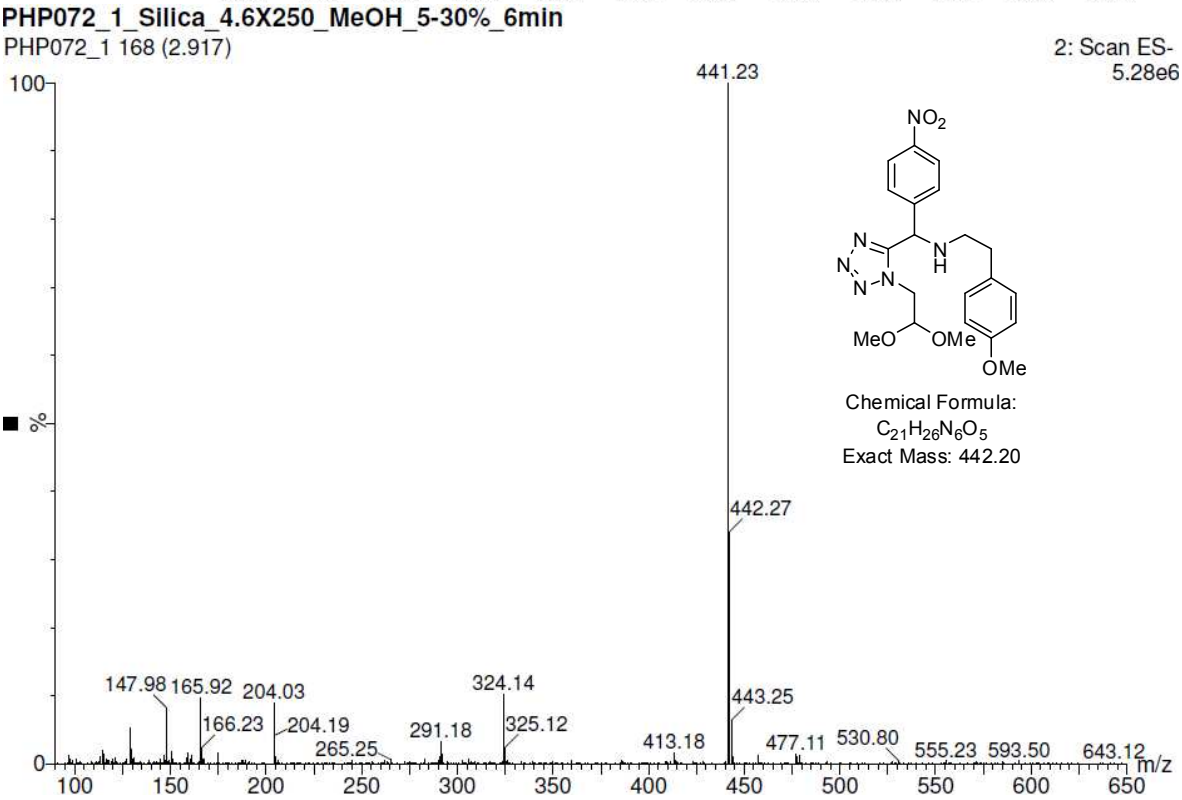
[6] Spek, A. L. "**PLATON**", A Multipurpose Crystallographic Tool, Utrecht University, Utrecht, The Netherlands, (2010).

[7] L. J. Farrugia, "**WinGX** (Version 1.70.01 January 2005) ", *J. Appl. Cryst.* **1999**, *32*, 837-838.

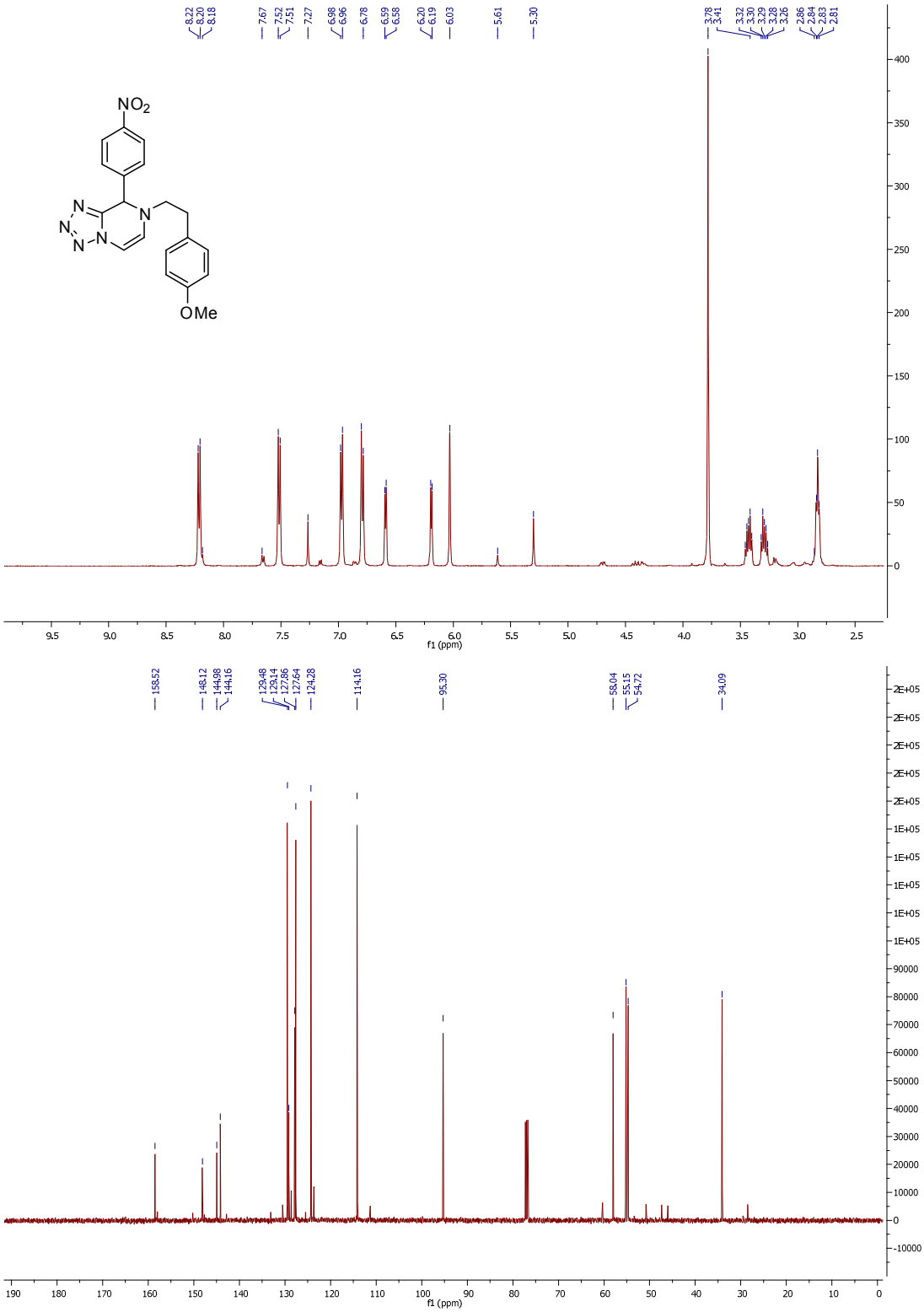
8a: N-((1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)(4-nitrophenyl)methyl)-2-(4-methoxyphenyl)ethanamine



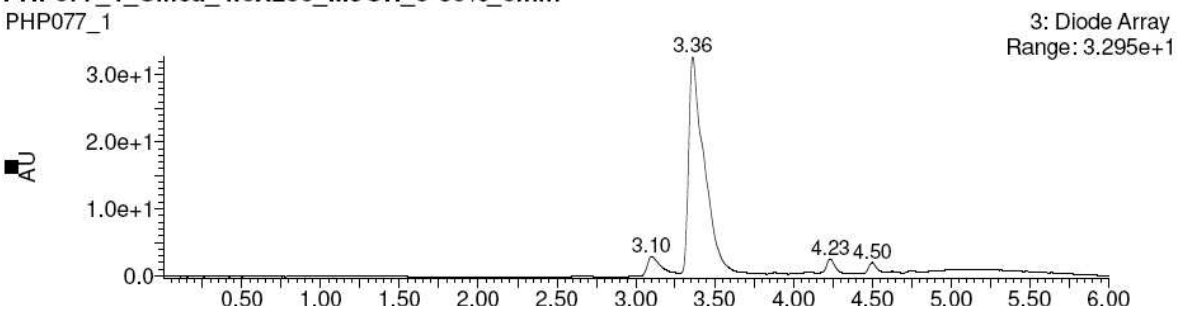

PHP072_1_Silica_4.6X250_MeOH_5-30%_6min
PHP072_1
3: Diode Array
Range: 5.51e+
2.89
4.0e+1
2.0e+1
0.0
AU
0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 6.00
PHP072_1
2: Scan ES-
441.2
1.11e7
100
%
0
2.93
3.00
2.90
3.04
3.11
3.18
3.37
3.72
3.96
0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 6.00

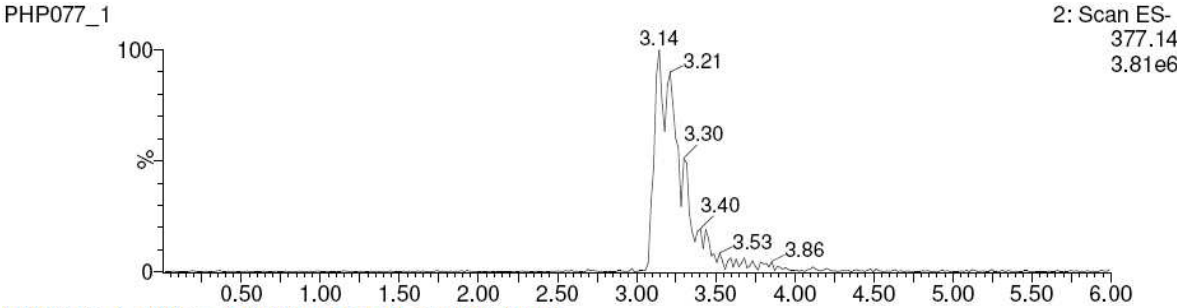

PHP072_1_Silica_4.6X250_MeOH_5-30%_6min
PHP072_1 168 (2.917)
2: Scan ES-
5.28e6
100
%
0
441.23
442.27
443.25
147.98
165.92
204.03
166.23
204.19
265.25
291.18
324.14
325.12
413.18
477.11
530.80
555.23
593.50
643.12
100 150 200 250 300 350 400 450 500 550 600 650
m/z
NO2
N
N
N
N
H
MeO
OMe
OMe
Chemical Formula:
C21H26N6O5
Exact Mass: 442.20

2a: 7-(4-methoxyphenethyl)-8-(4-nitrophenyl)-7,8-dihydrotetrazolo[1,5-a]pyrazine.

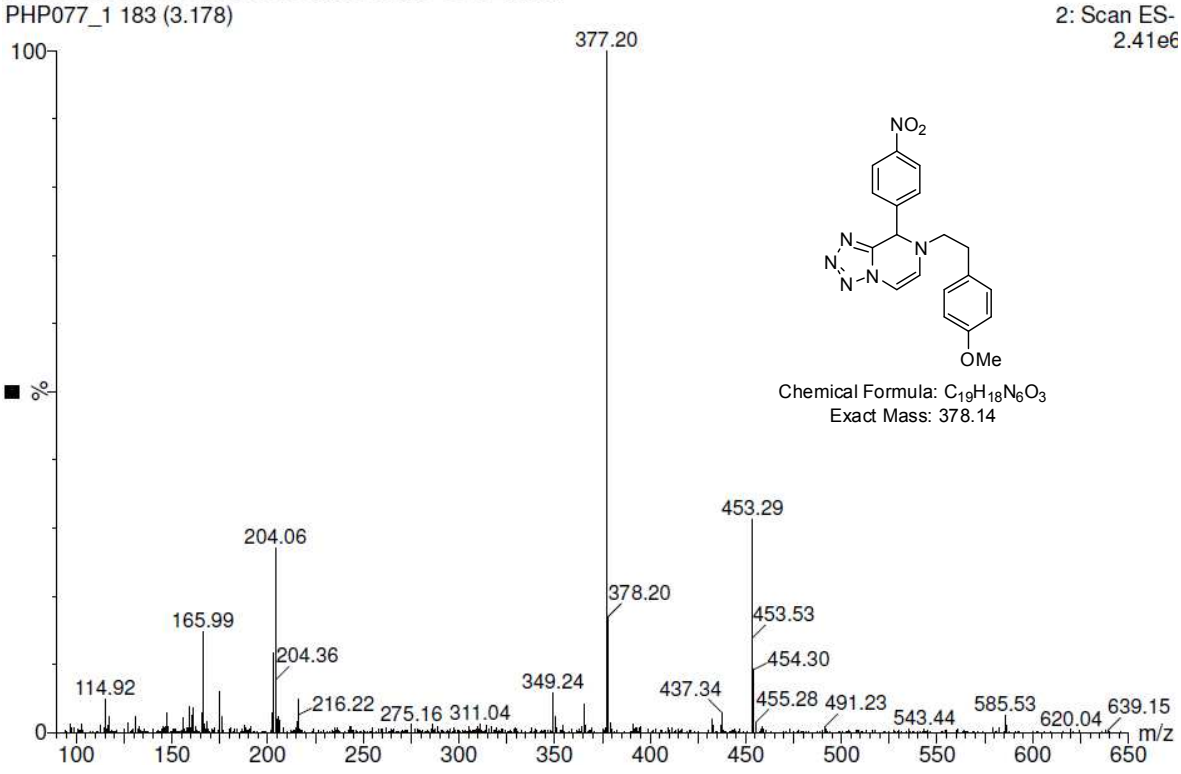


PHP077_1_Silica_4.6X250_MeOH_5-30%_6min

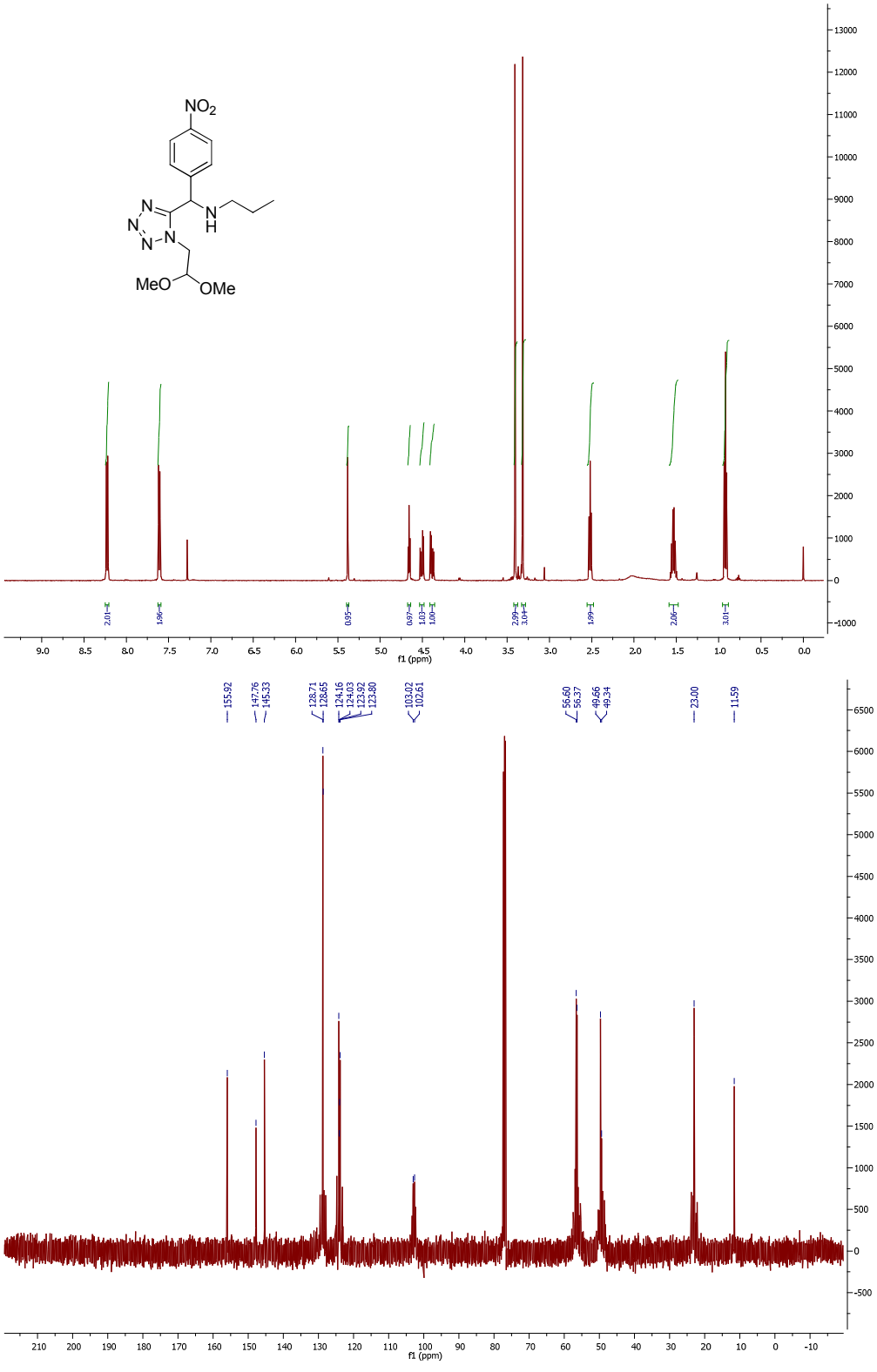


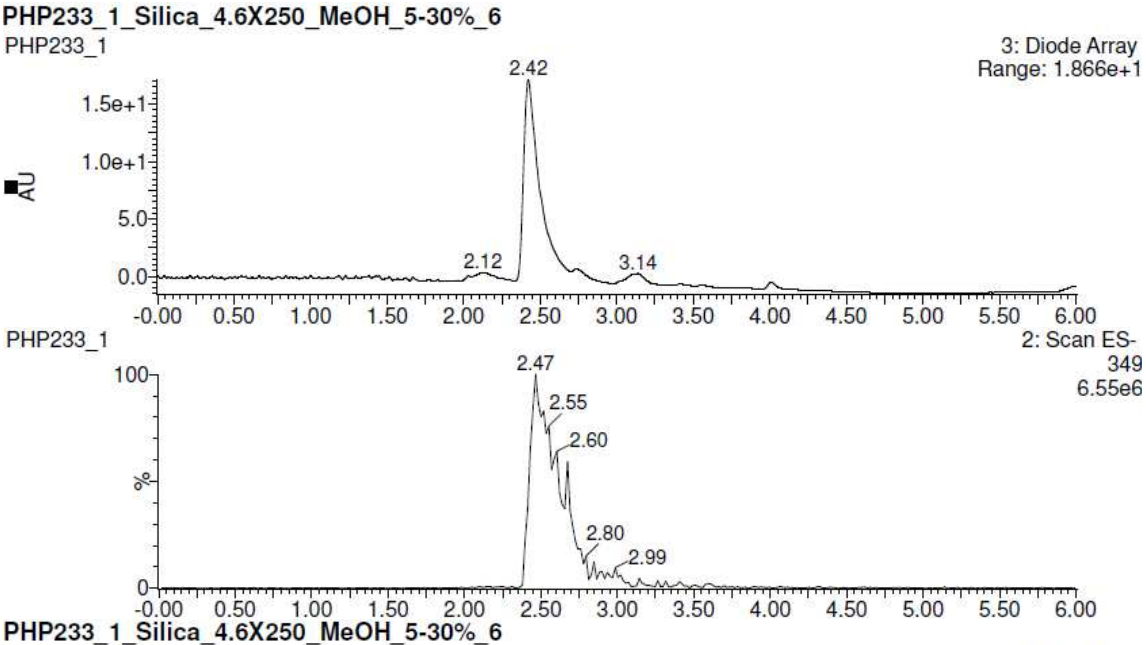


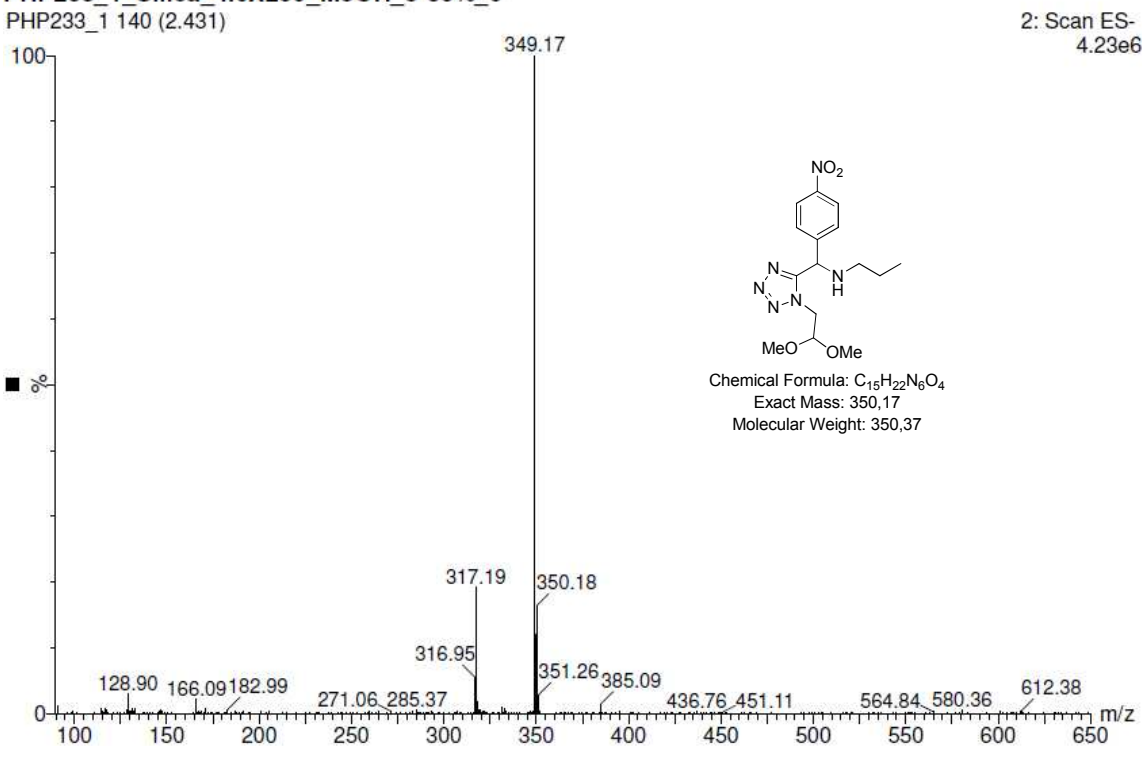
PHP077_1_Silica_4.6X250_MeOH_5-30%_6min



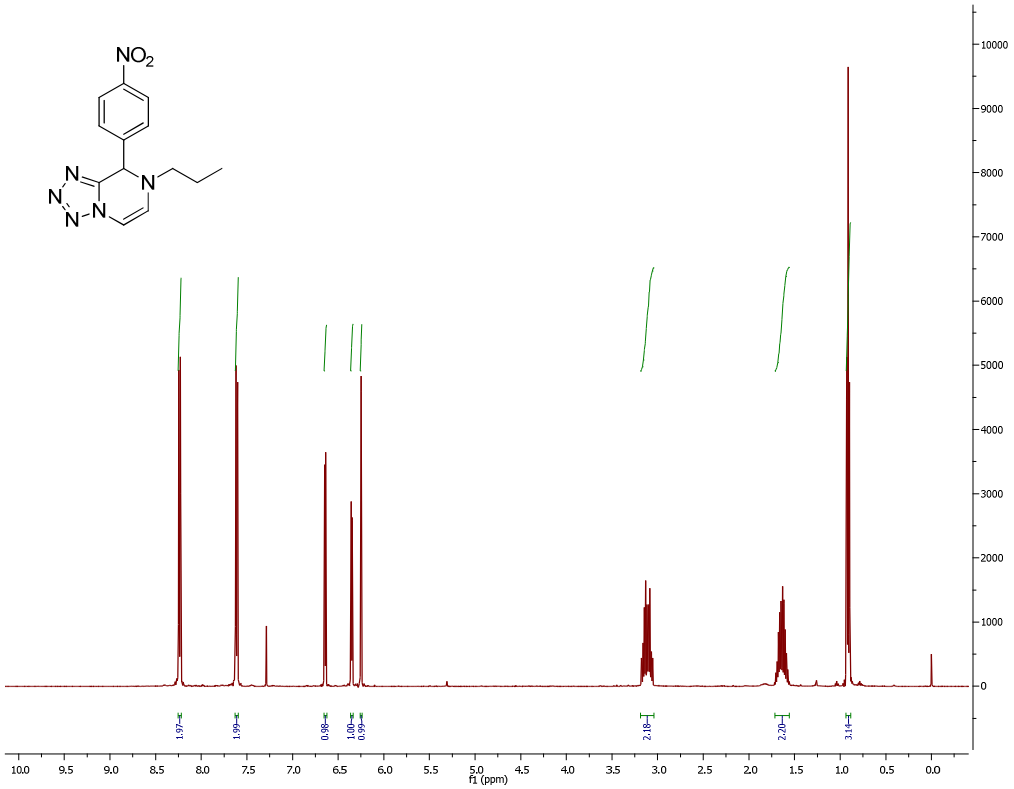
8b: N-((1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)(4-nitrophenyl)methyl)propan-1-amine.

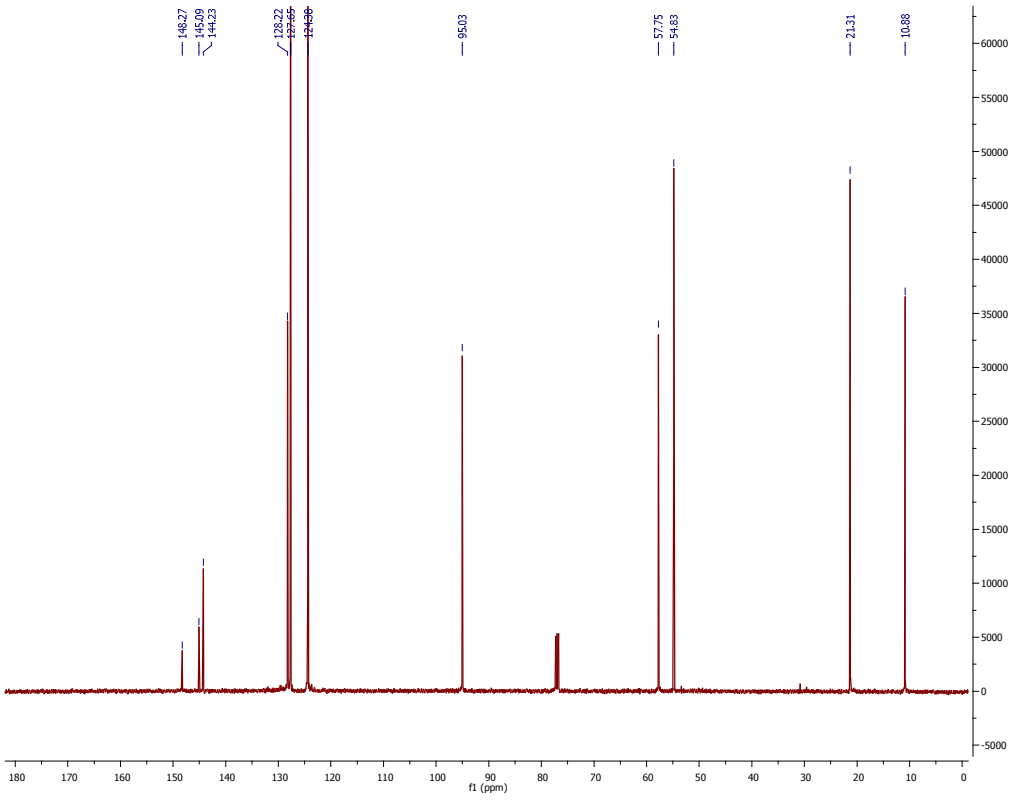



PHP233_1_Silica_4.6X250_MeOH_5-30%_6
PHP233_1
3: Diode Array
Range: 1.866e+1
2.42
2.12
3.14
AU
PHP233_1
2: Scan ES-
349
6.55e6
2.47
2.55
2.60
2.80
2.99
%

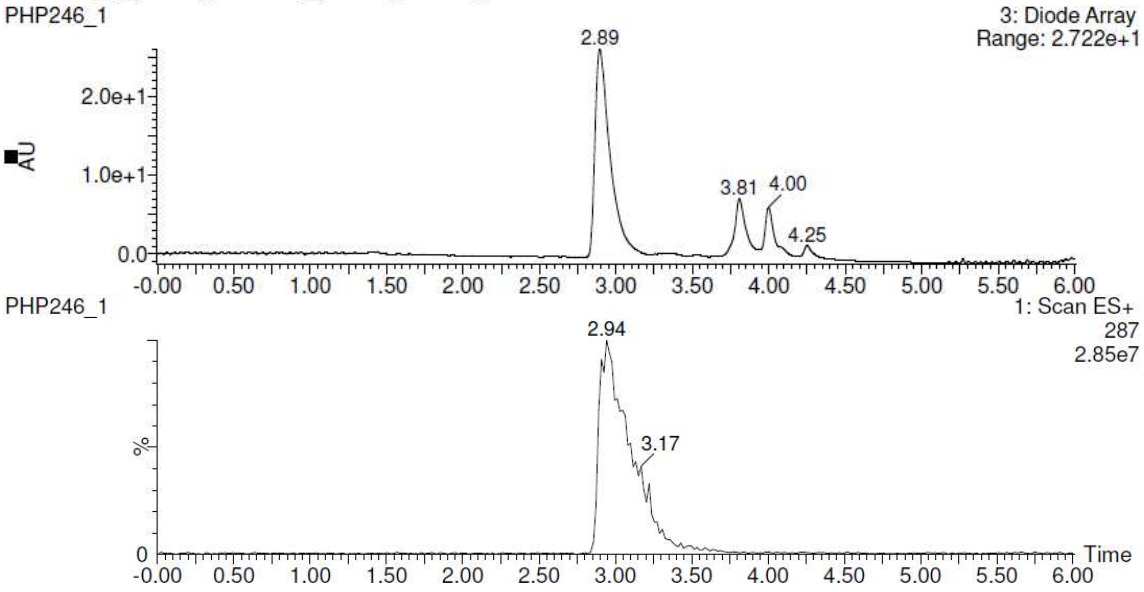

PHP233_1_Silica_4.6X250_MeOH_5-30%_6
PHP233_1 140 (2.431)
2: Scan ES-
4.23e6
349.17
317.19
350.18
316.95
351.26
385.09
128.90
166.09
182.99
271.06
285.37
436.76
451.11
564.84
580.36
612.38
m/z
NO2
N
H
MeO
OMe
Chemical Formula: C15H22N6O4
Exact Mass: 350,17
Molecular Weight: 350,37

2b: 8-(4-nitrophenyl)-7-propyl-7,8-dihydrotetrazolo[1,5-a]pyrazine.

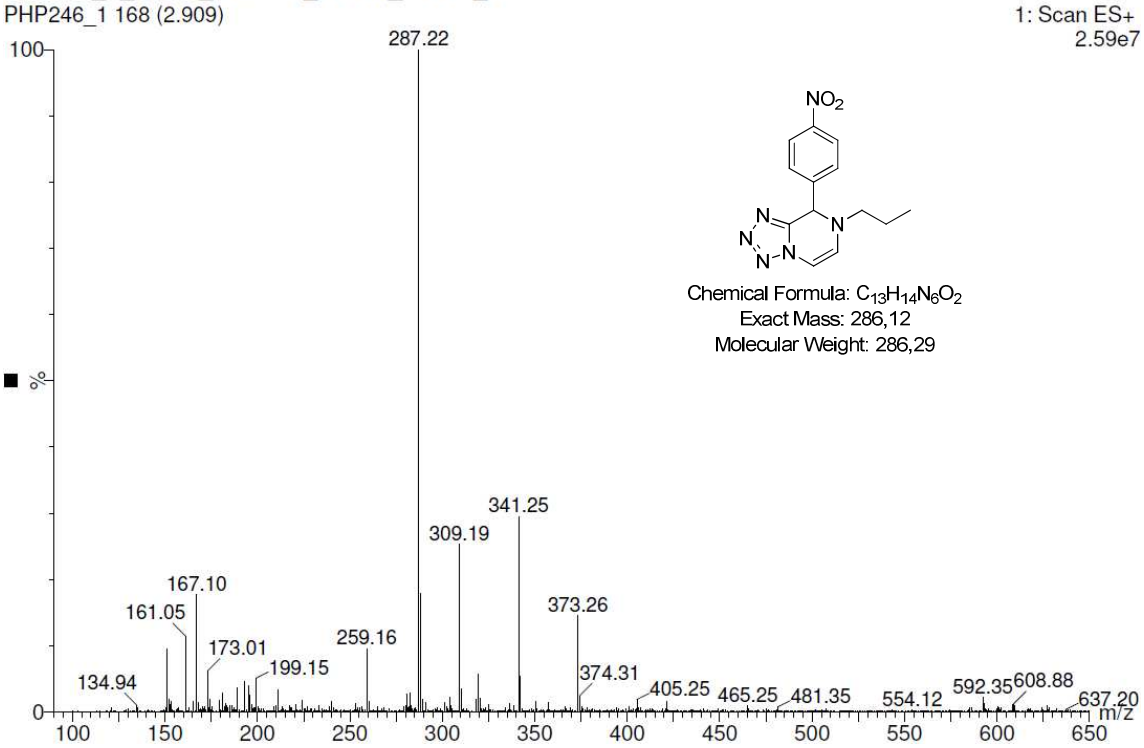




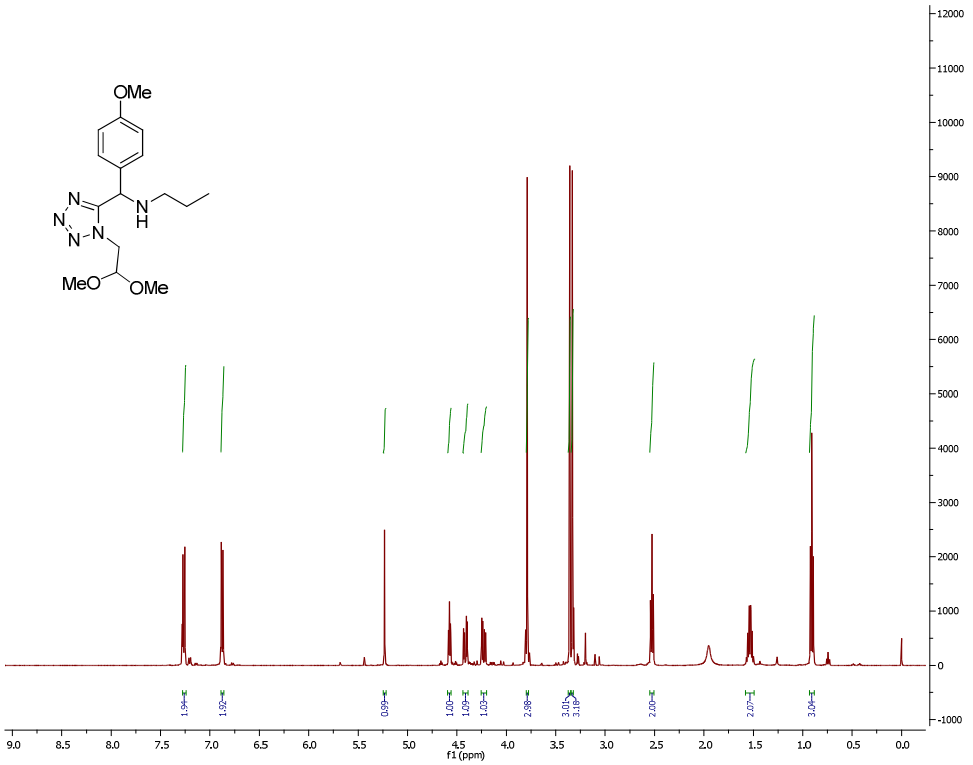
PHP246_1_Silica_4.6X250_MeOH_5-30%_6

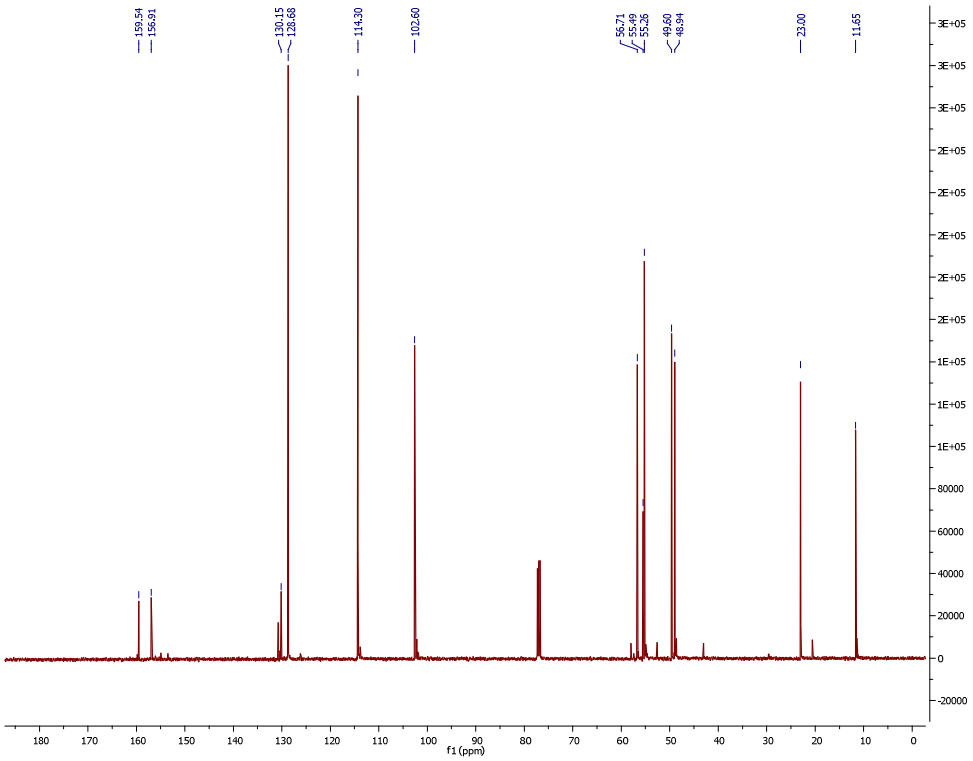


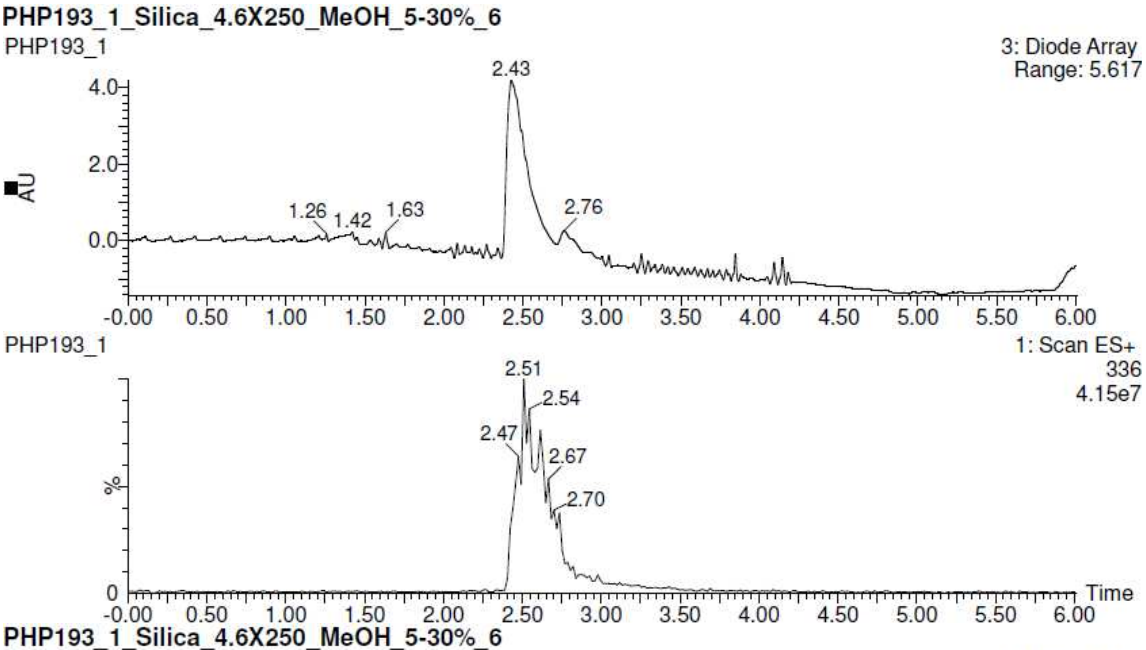
PHP246_1_Silica_4.6X250_MeOH_5-30%_6

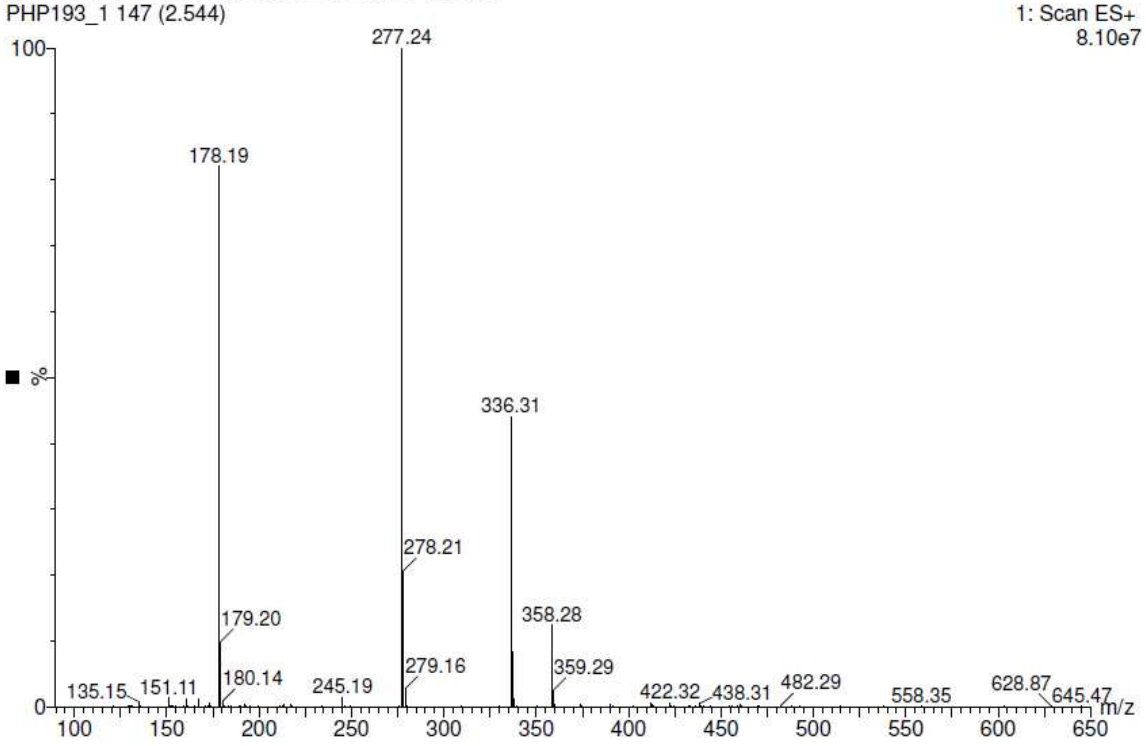


8c: N-((1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)(4-methoxyphenyl) methyl)propan-1-amine.

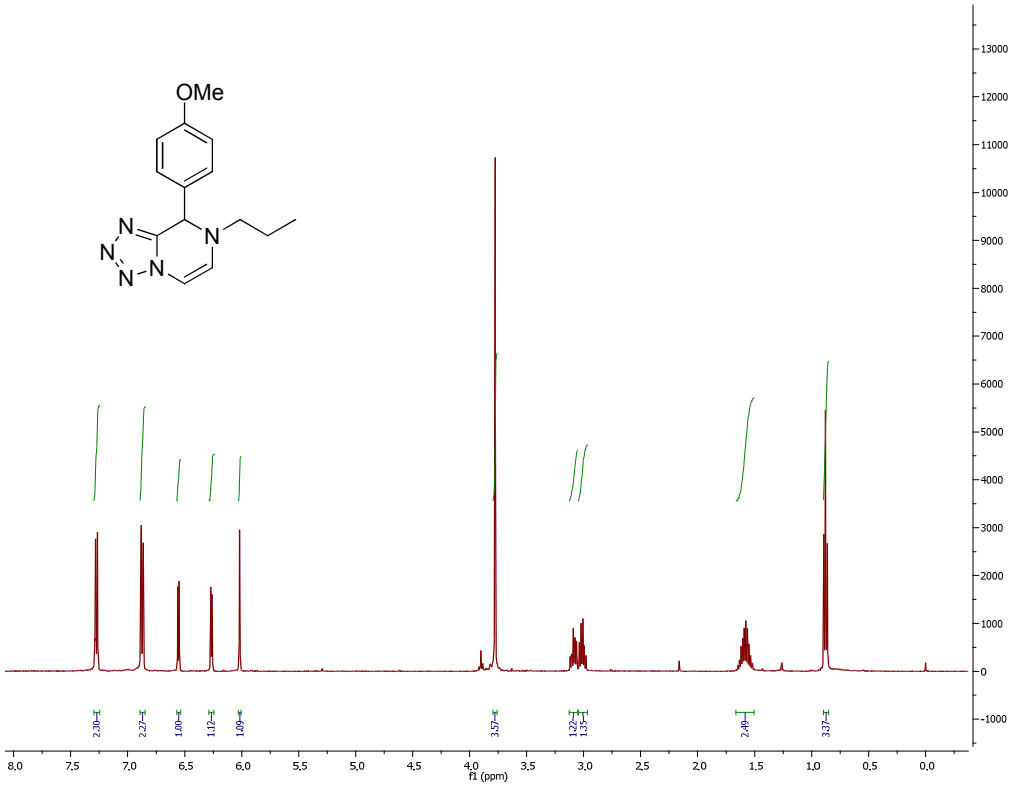


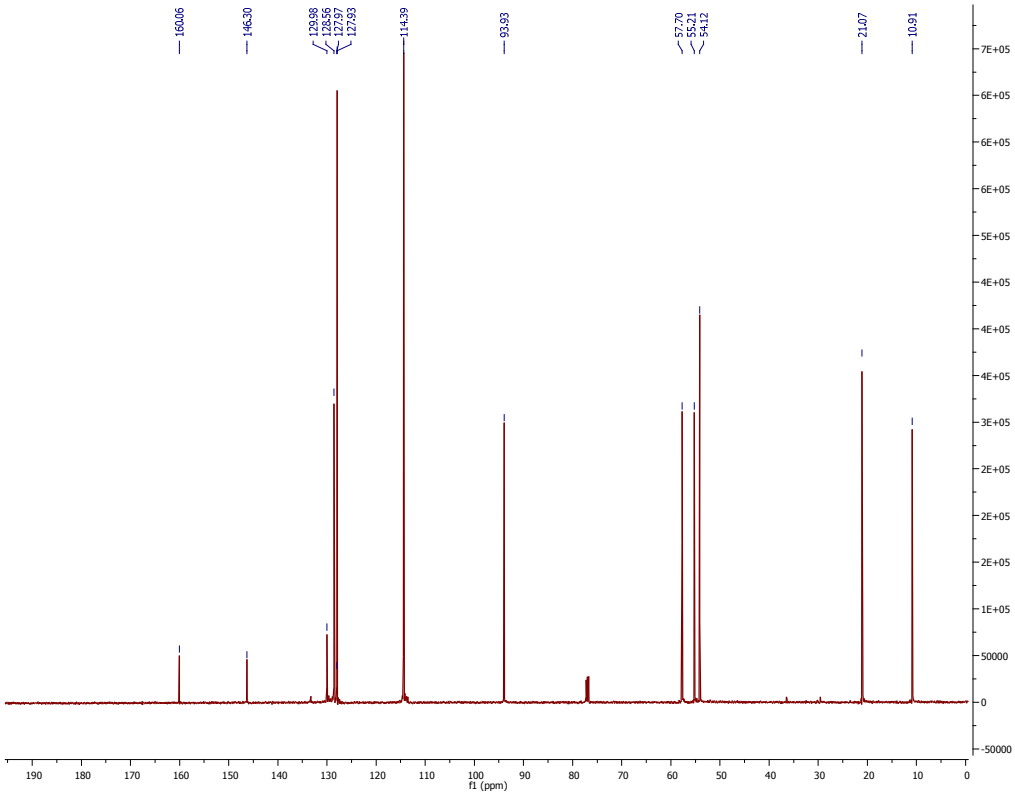


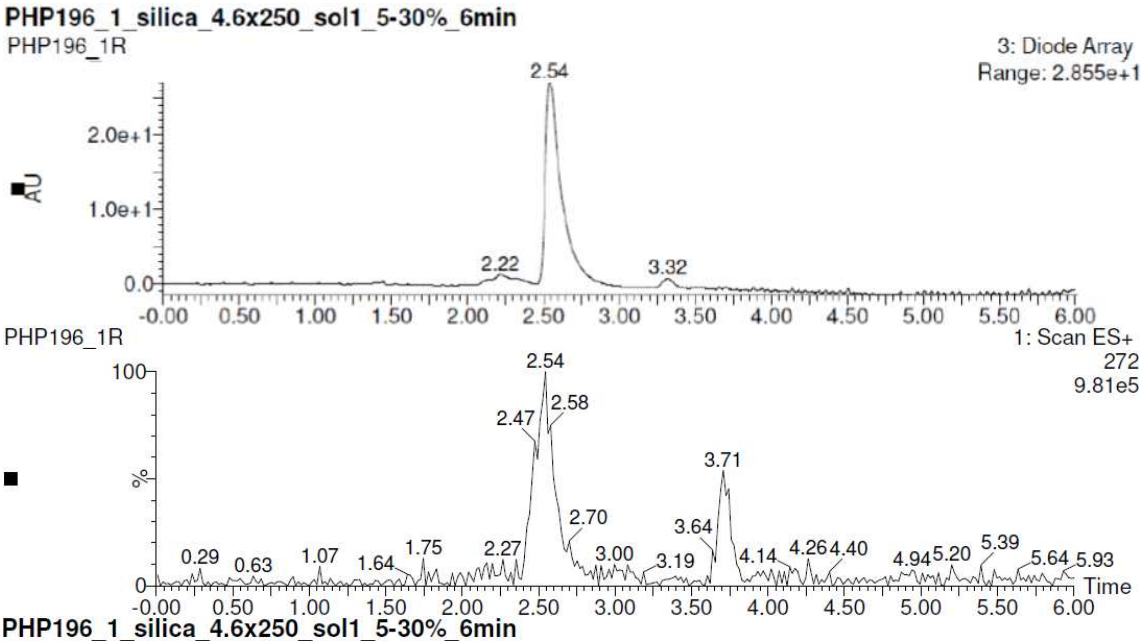

PHP193_1_Silica_4.6X250_MeOH_5-30%_6
PHP193_1
3: Diode Array
Range: 5.617
AU
2.43
1.26
1.42
1.63
2.76
PHP193_1
1: Scan ES+
336
4.15e7
%
2.51
2.54
2.47
2.67
2.70
Time

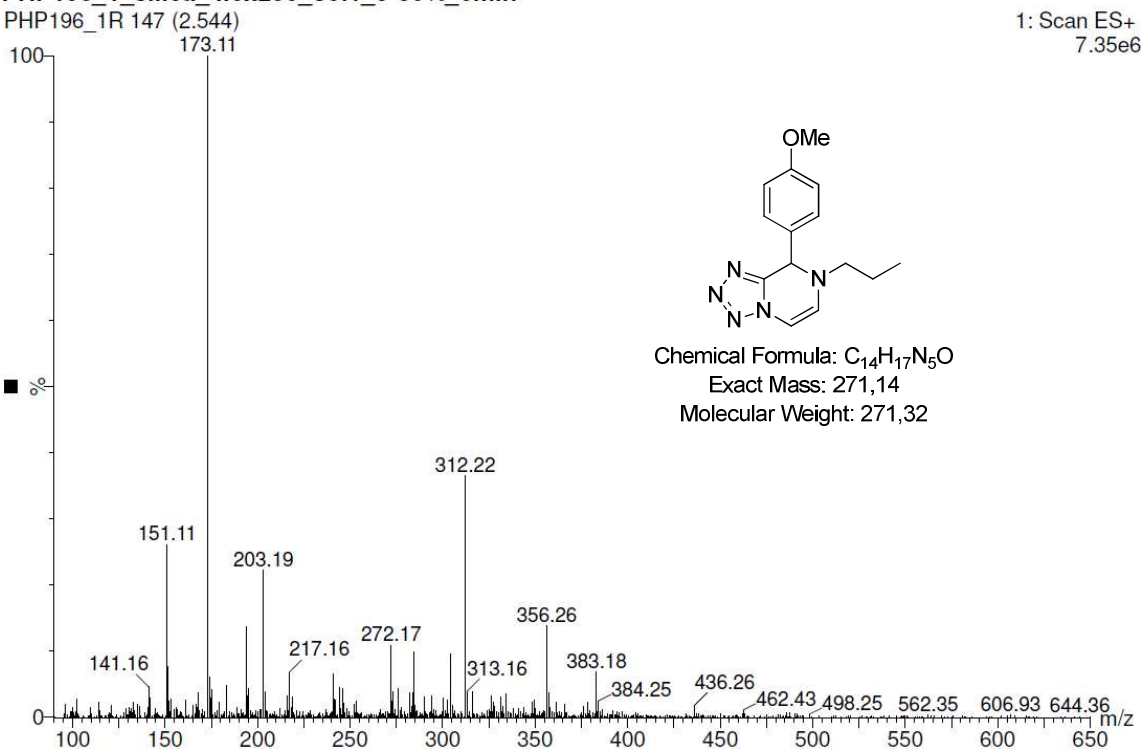

PHP193_1_Silica_4.6X250_MeOH_5-30%_6
PHP193_1 147 (2.544)
1: Scan ES+
8.10e7
%
277.24
178.19
336.31
278.21
179.20
358.28
279.16
359.29
135.15
151.11
180.14
245.19
422.32
438.31
482.29
558.35
628.87
645.47
m/z

2c: 8-(4-methoxyphenyl)-7-propyl-7,8-dihydrotetrazolo[1,5-a]pyrazine.



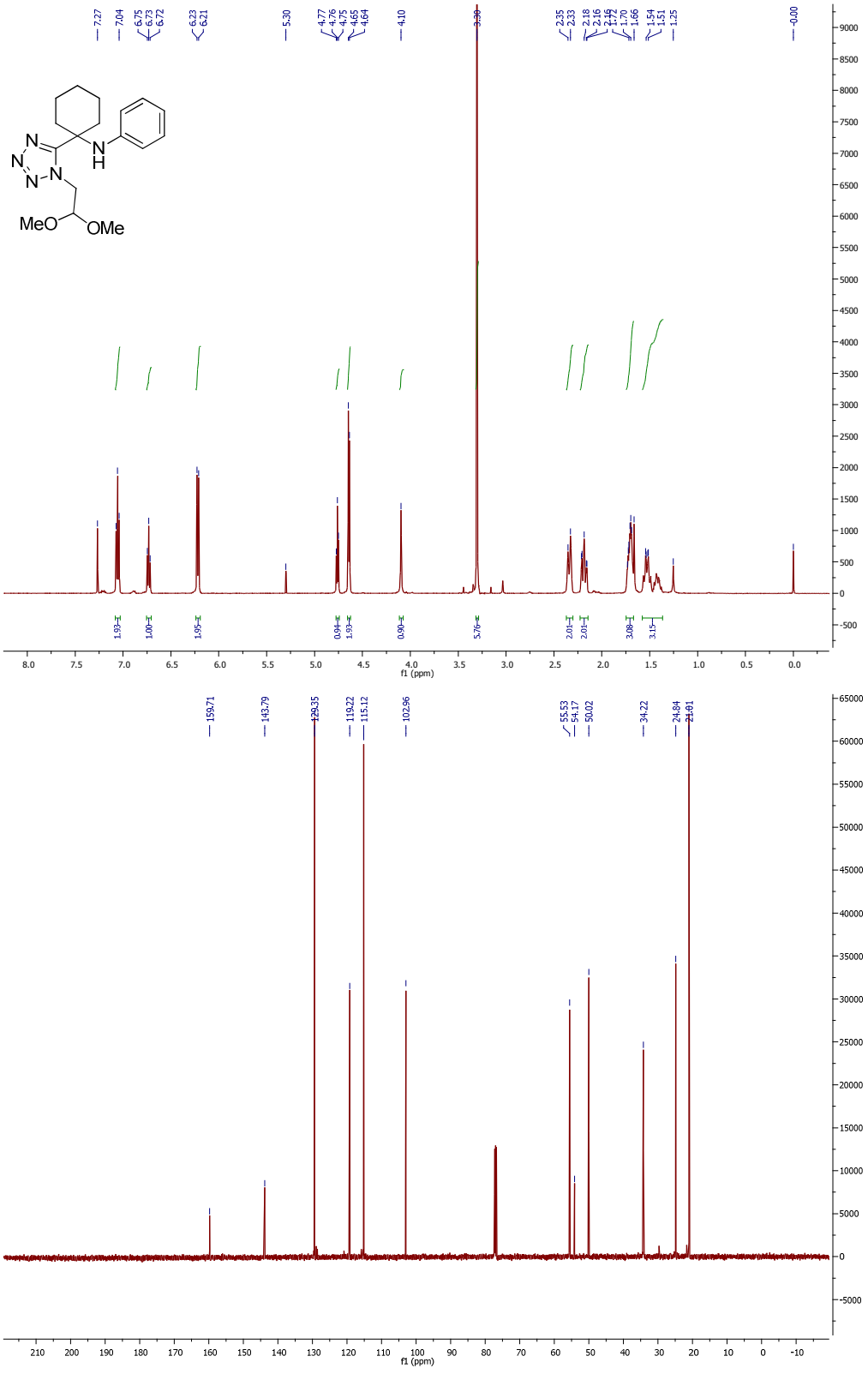


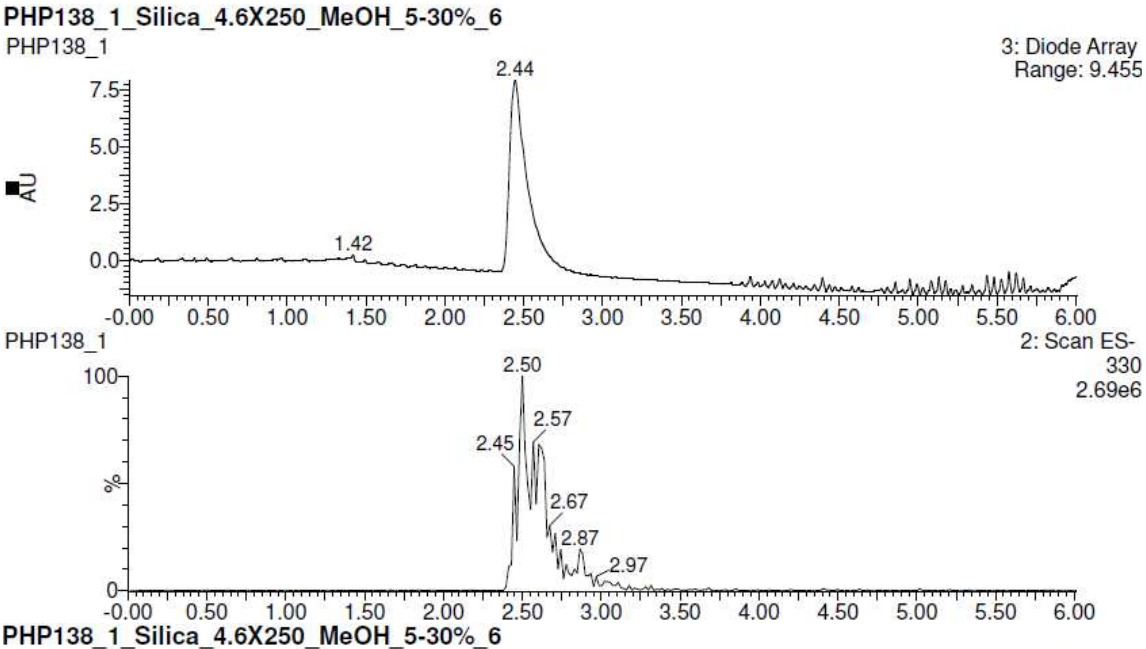


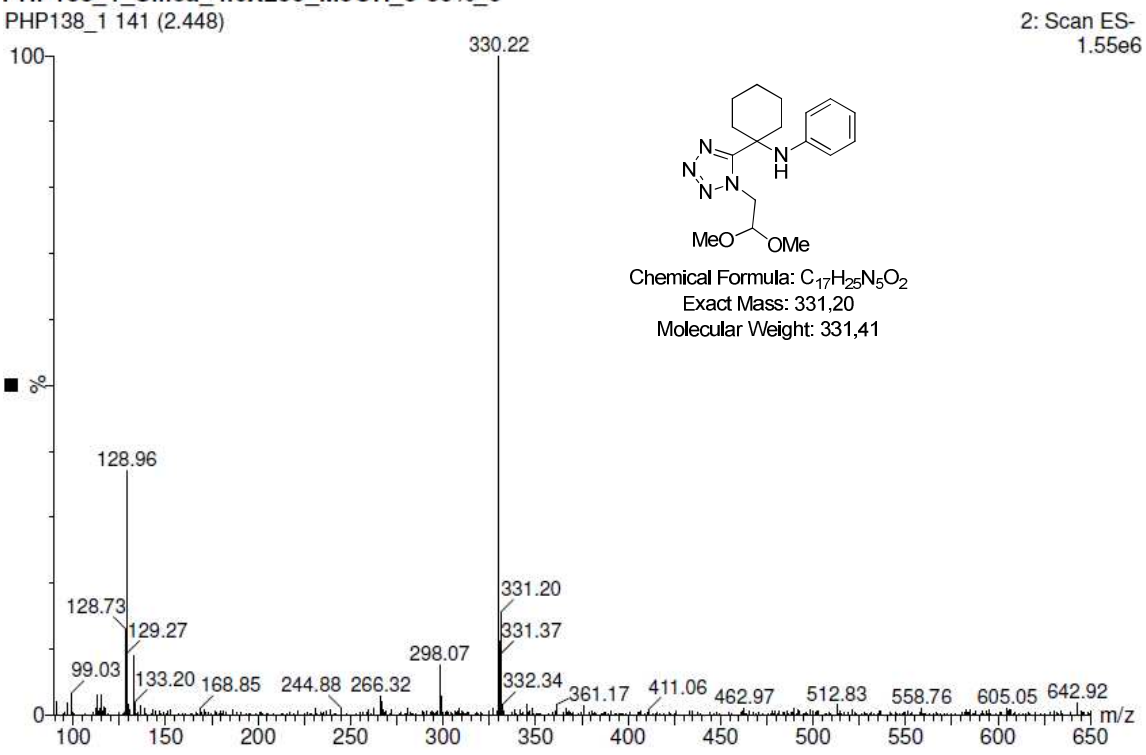


Chemical Formula: $C_{14}H_{17}N_5O$
Exact Mass: 271,14
Molecular Weight: 271,32

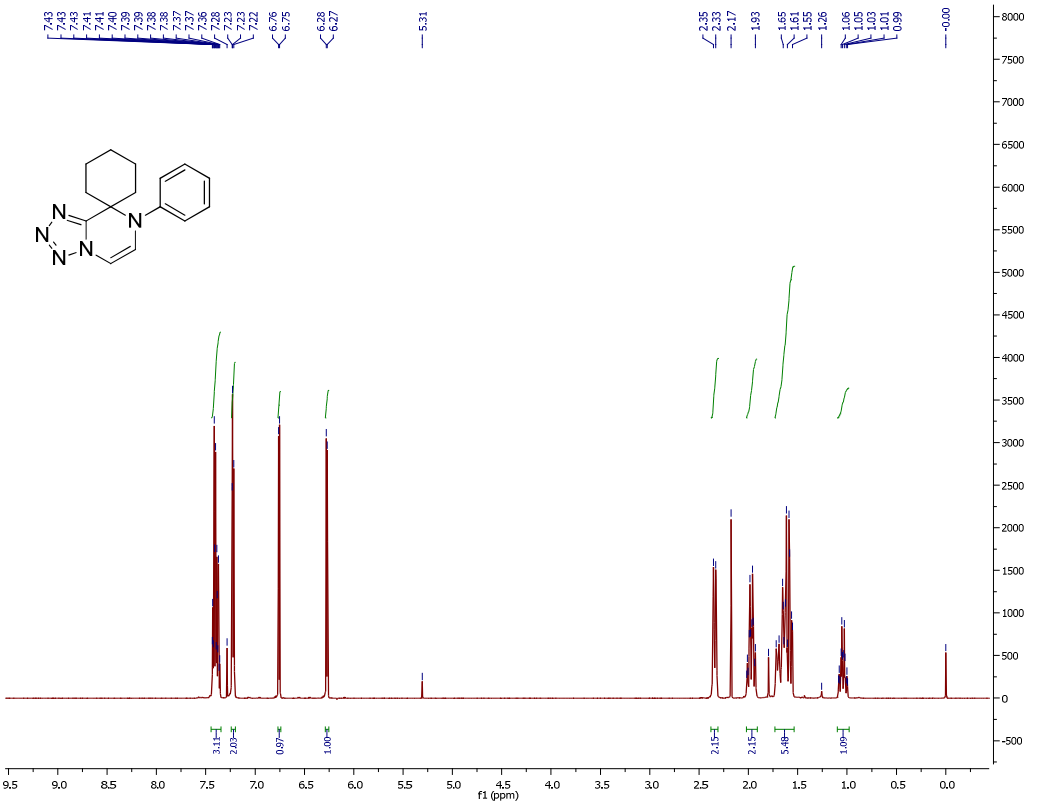
8d: N-(1-(1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)cyclohexyl)aniline.

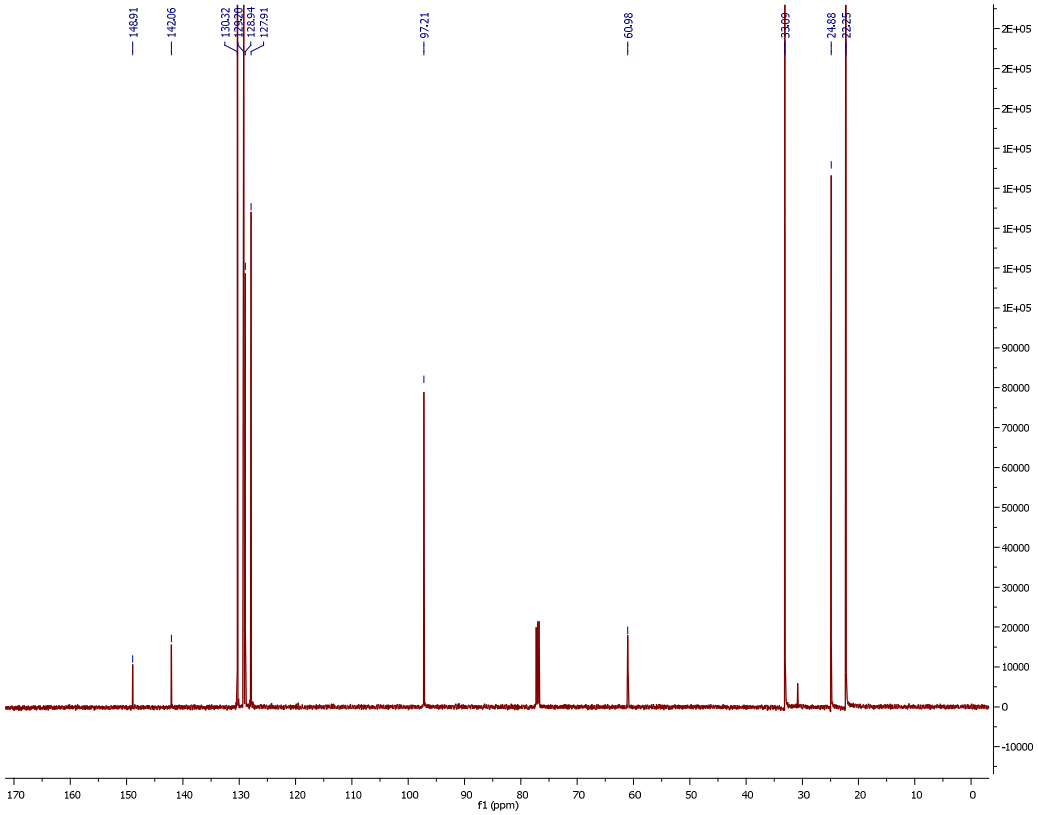


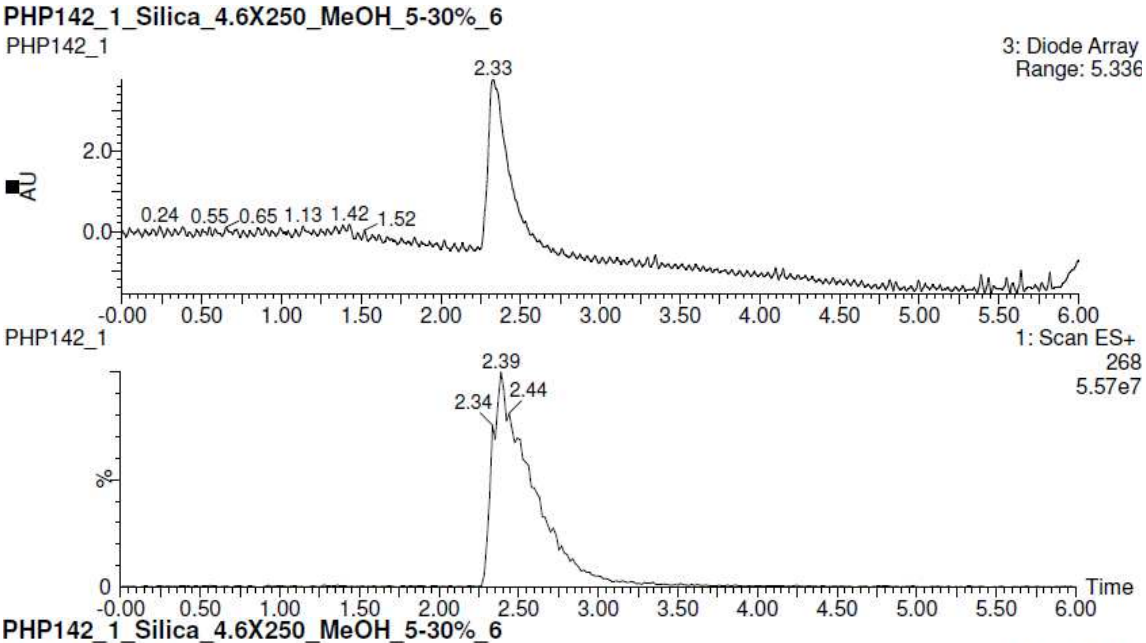

PHP138_1_Silica_4.6X250_MeOH_5-30%_6
PHP138_1
3: Diode Array
Range: 9.455
2.44
1.42
AU
PHP138_1
2: Scan ES-
330
2.69e6
2.50
2.57
2.45
2.67
2.87
2.97
%

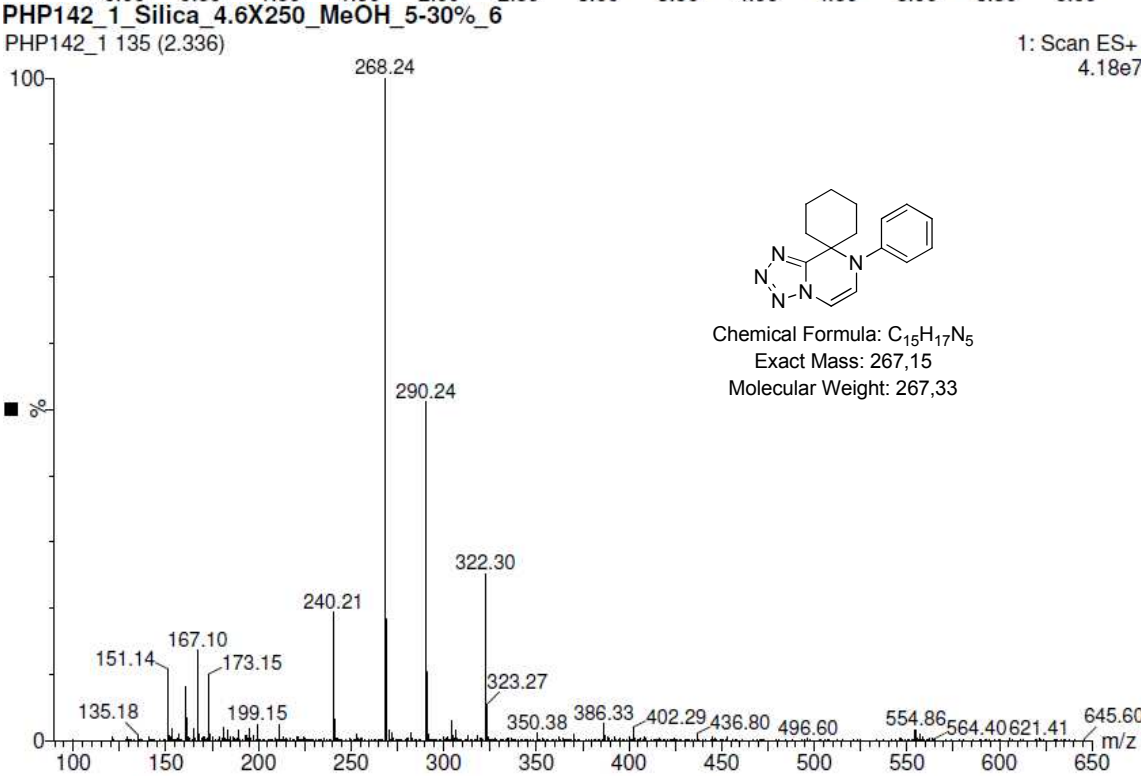

PHP138_1_Silica_4.6X250_MeOH_5-30%_6
PHP138_1 141 (2.448)
2: Scan ES-
1.55e6
330.22
128.96
128.73
129.27
99.03
133.20
168.85
244.88
266.32
298.07
331.20
331.37
332.34
361.17
411.06
462.97
512.83
558.76
605.05
642.92
m/z
MeO
OMe
Chemical Formula: C17H25N5O2
Exact Mass: 331,20
Molecular Weight: 331,41

2d: 7'-phenyl-7'H-spiro[cyclohexane-1,8'-tetrazolo[1,5-a]pyrazine].



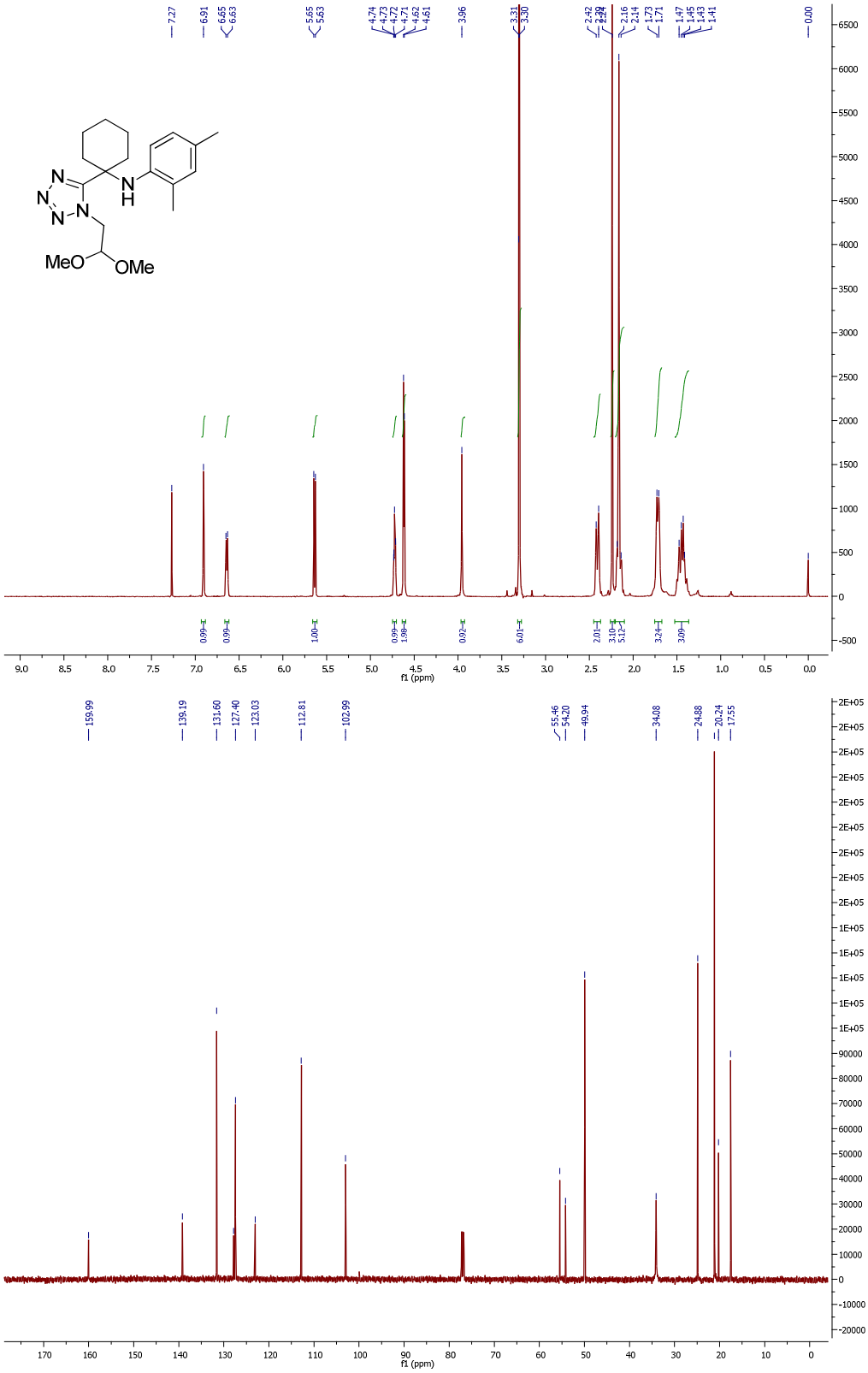


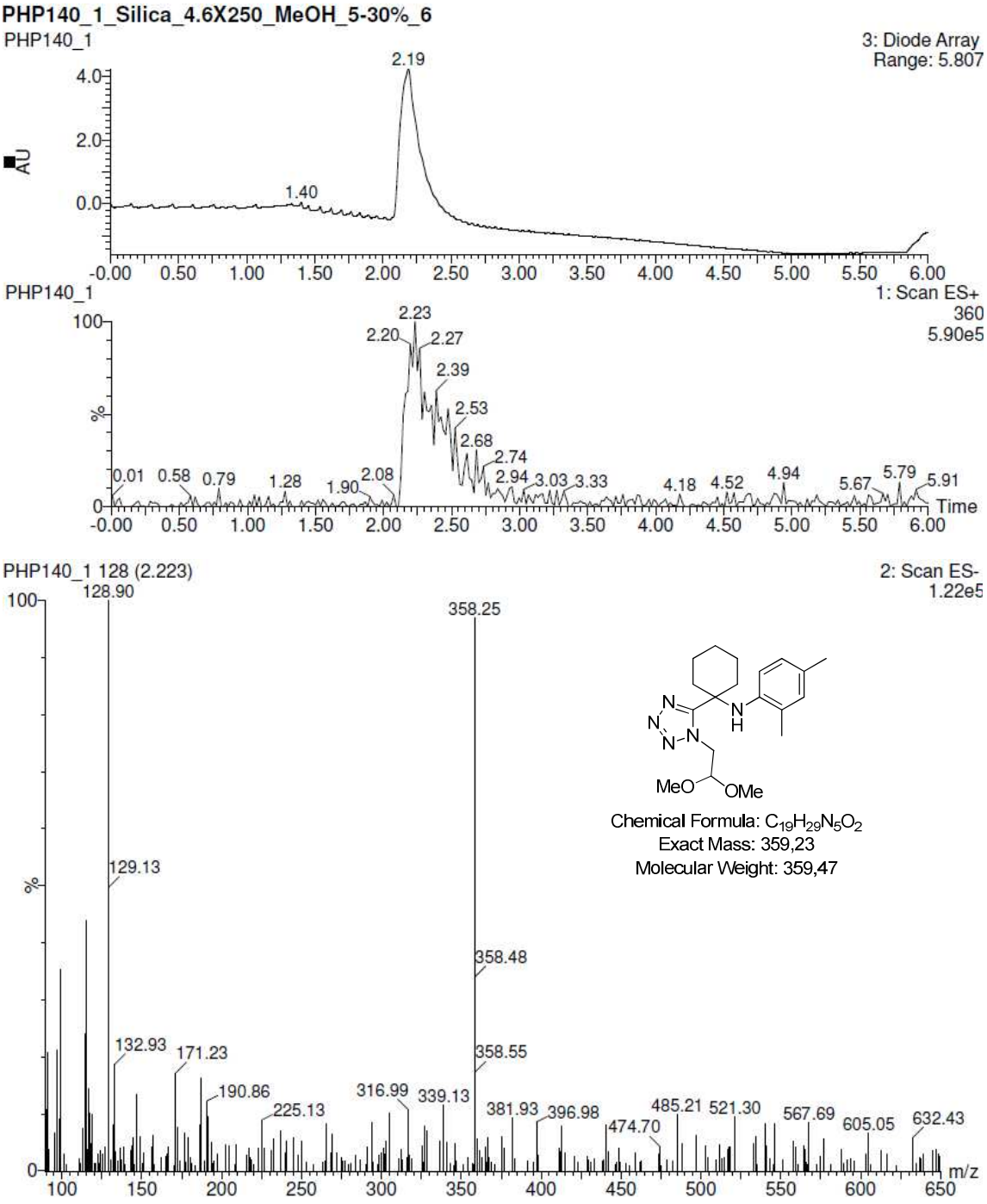




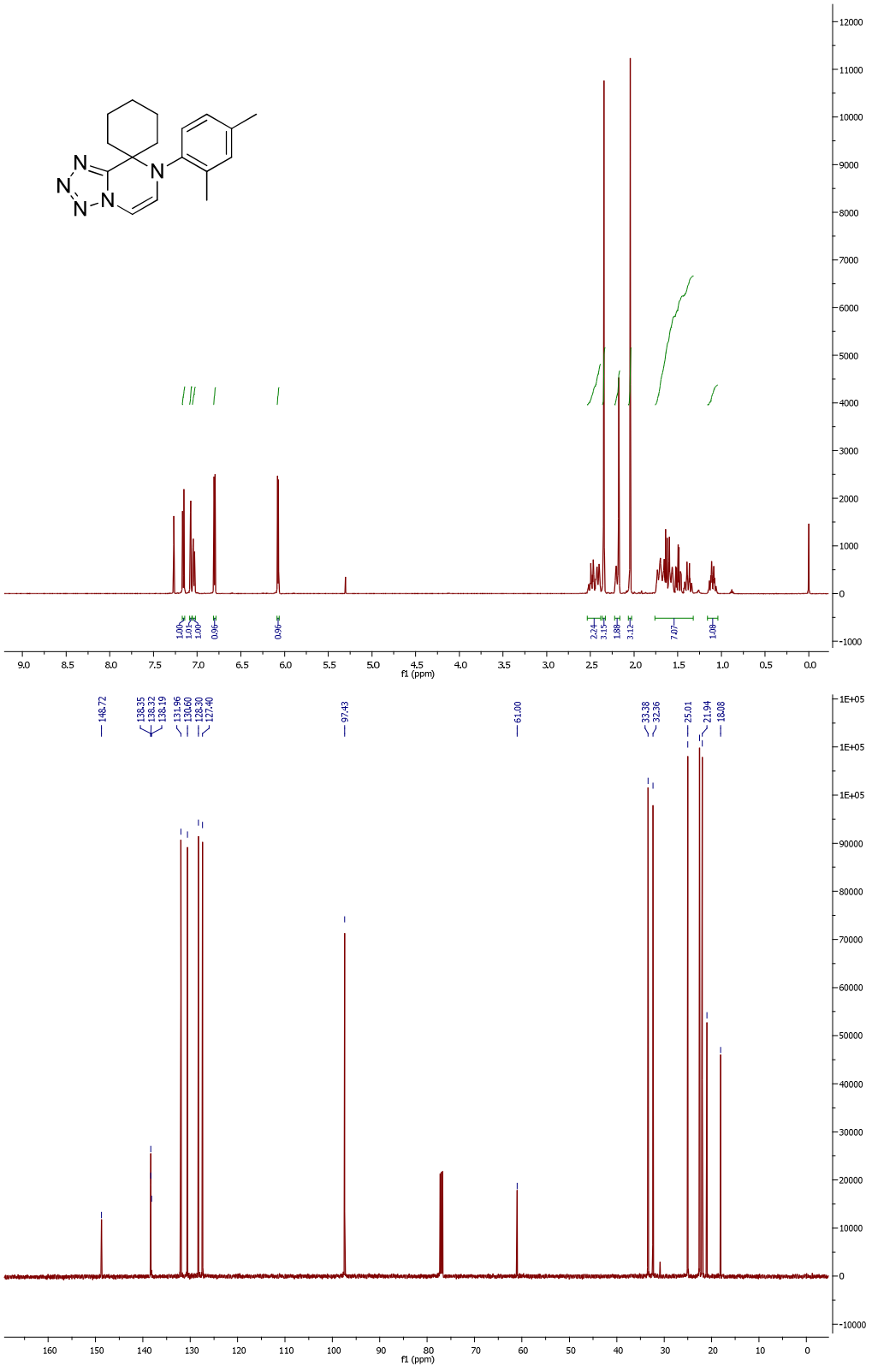
Chemical Formula: $C_{15}H_{17}N_5$
Exact Mass: 267,15
Molecular Weight: 267,33

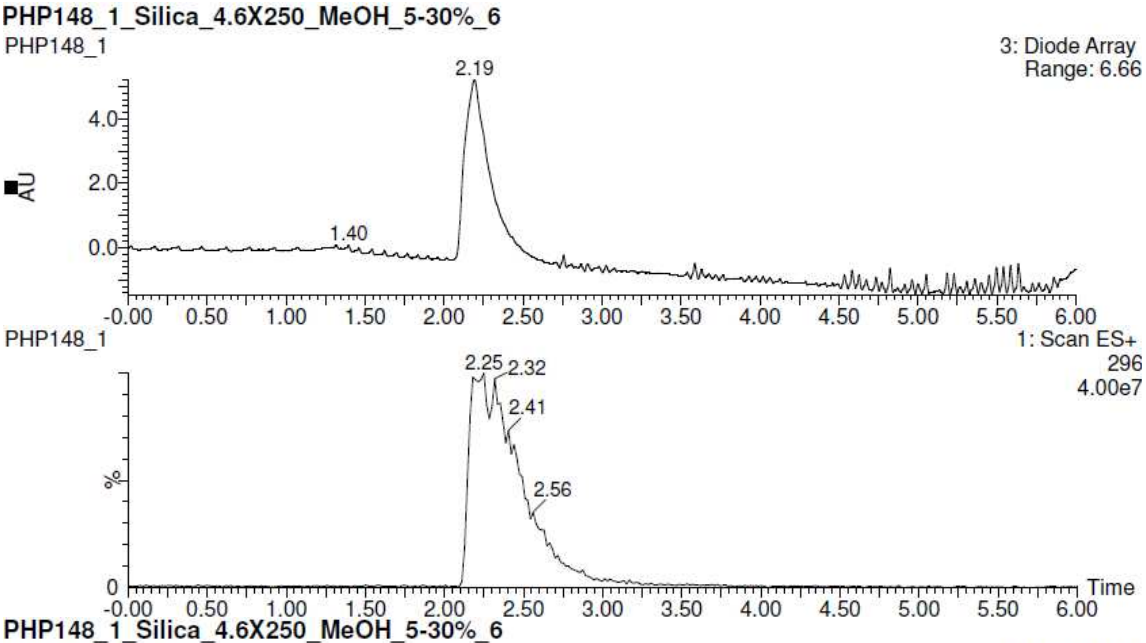
8e: N-(1-(1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)cyclohexyl)-2,4-dimethylaniline.

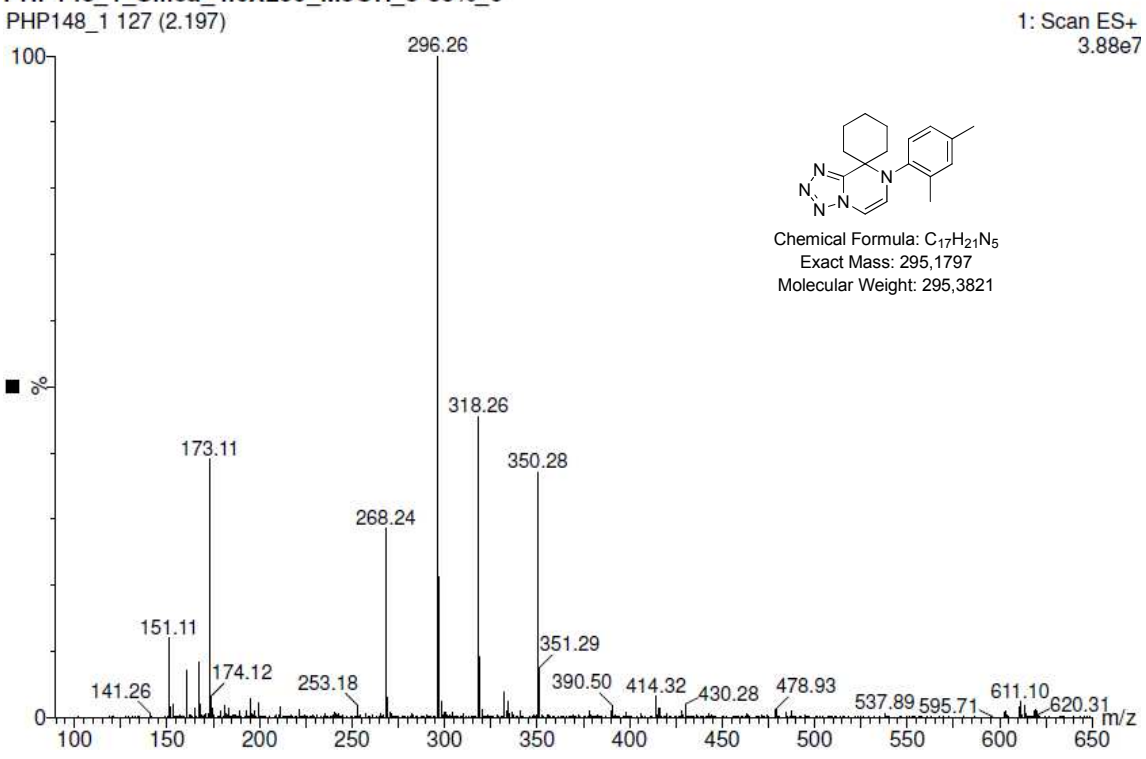



PHP140_1_Silica_4.6X250_MeOH_5-30%_6
PHP140_1
3: Diode Array
Range: 5.807
2.19
1.40
AU
PHP140_1
1: Scan ES+
360
5.90e5
2.23
2.20
2.27
2.39
2.53
2.68
2.74
2.94
3.03
3.33
4.18
4.52
4.94
5.67
5.79
5.91
0.01
0.58
0.79
1.28
1.90
2.08
Time
PHP140_1 128 (2.223)
2: Scan ES-
1.22e5
128.90
358.25
129.13
358.48
358.55
132.93
171.23
190.86
225.13
316.99
339.13
381.93
396.98
474.70
485.21
521.30
567.69
605.05
632.43
m/z
MeO
OMe
Chemical Formula: C19H29N5O2
Exact Mass: 359,23
Molecular Weight: 359,47

2e: 7'-(2,4-dimethylphenyl)-7'H-spiro[cyclohexane-1,8'-tetrazolo[1,5-a]pyrazine].

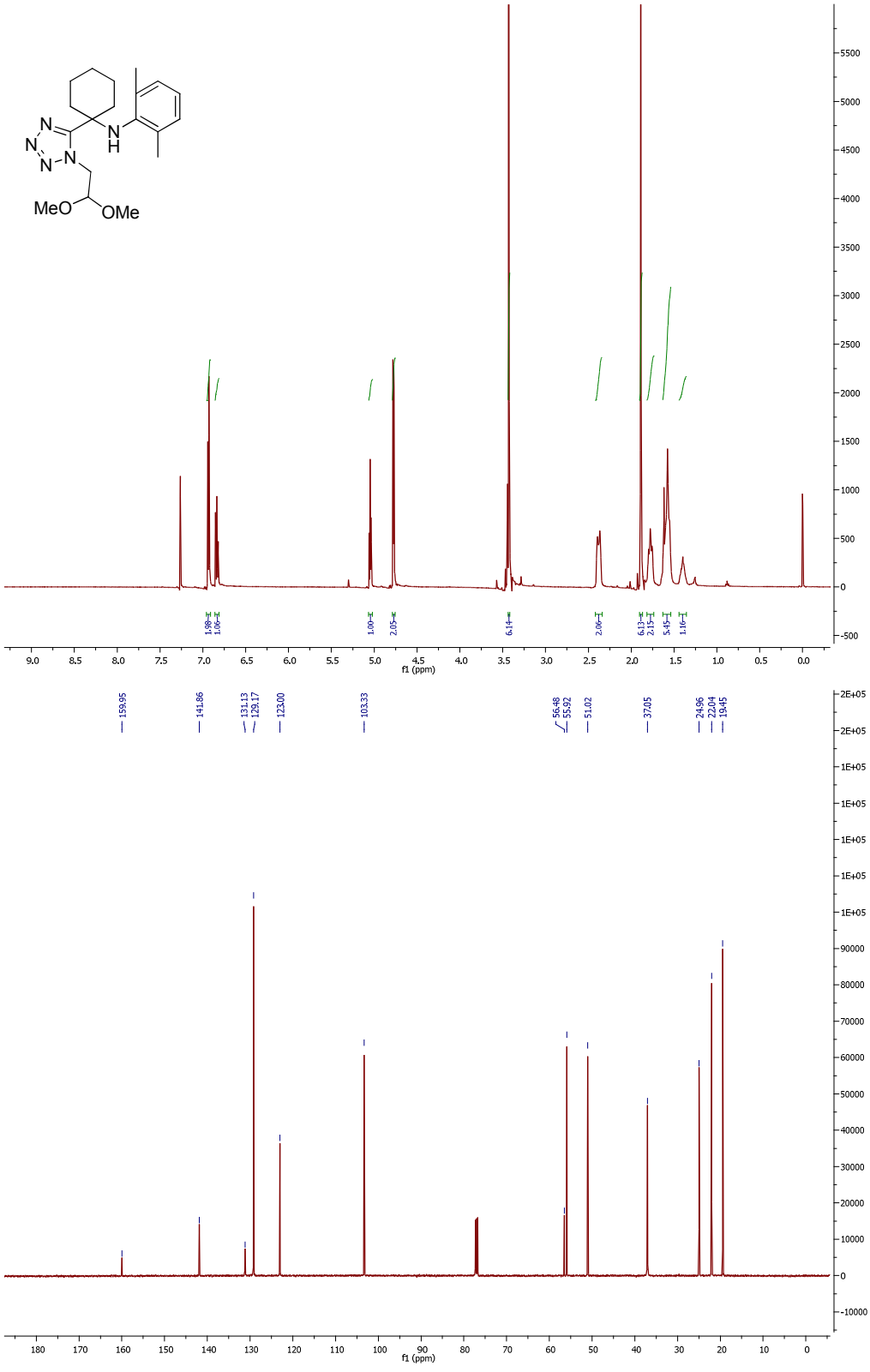


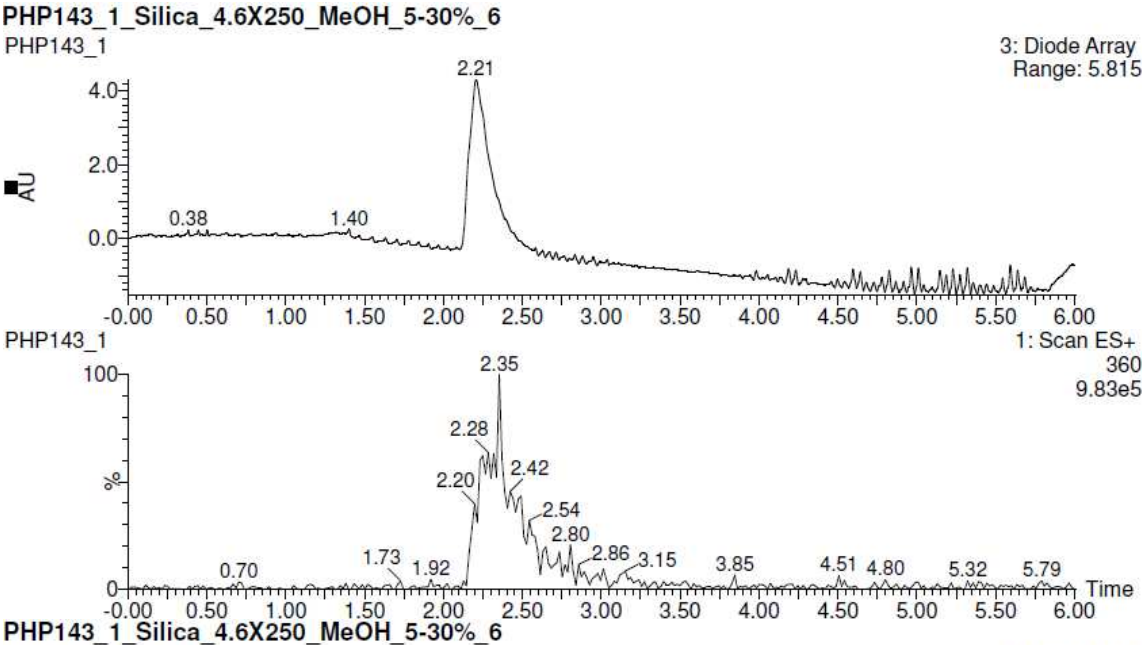


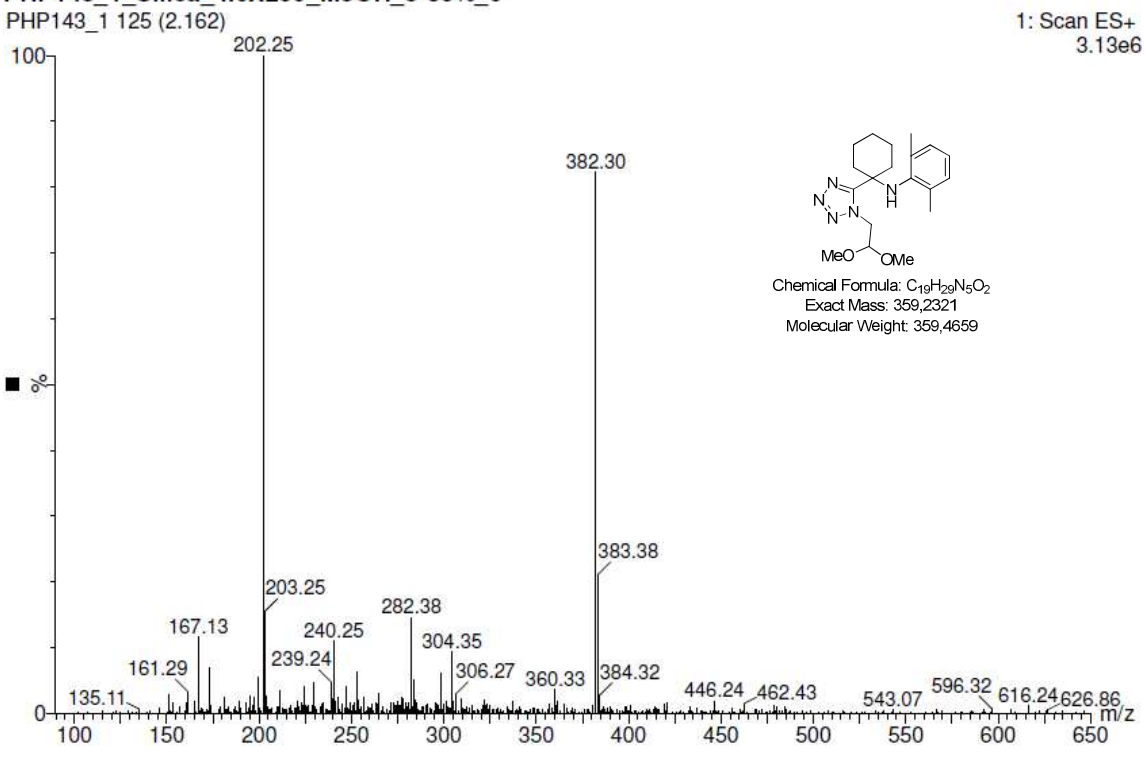


Chemical Formula: $C_{17}H_{21}N_5$
Exact Mass: 295,1797
Molecular Weight: 295,3821

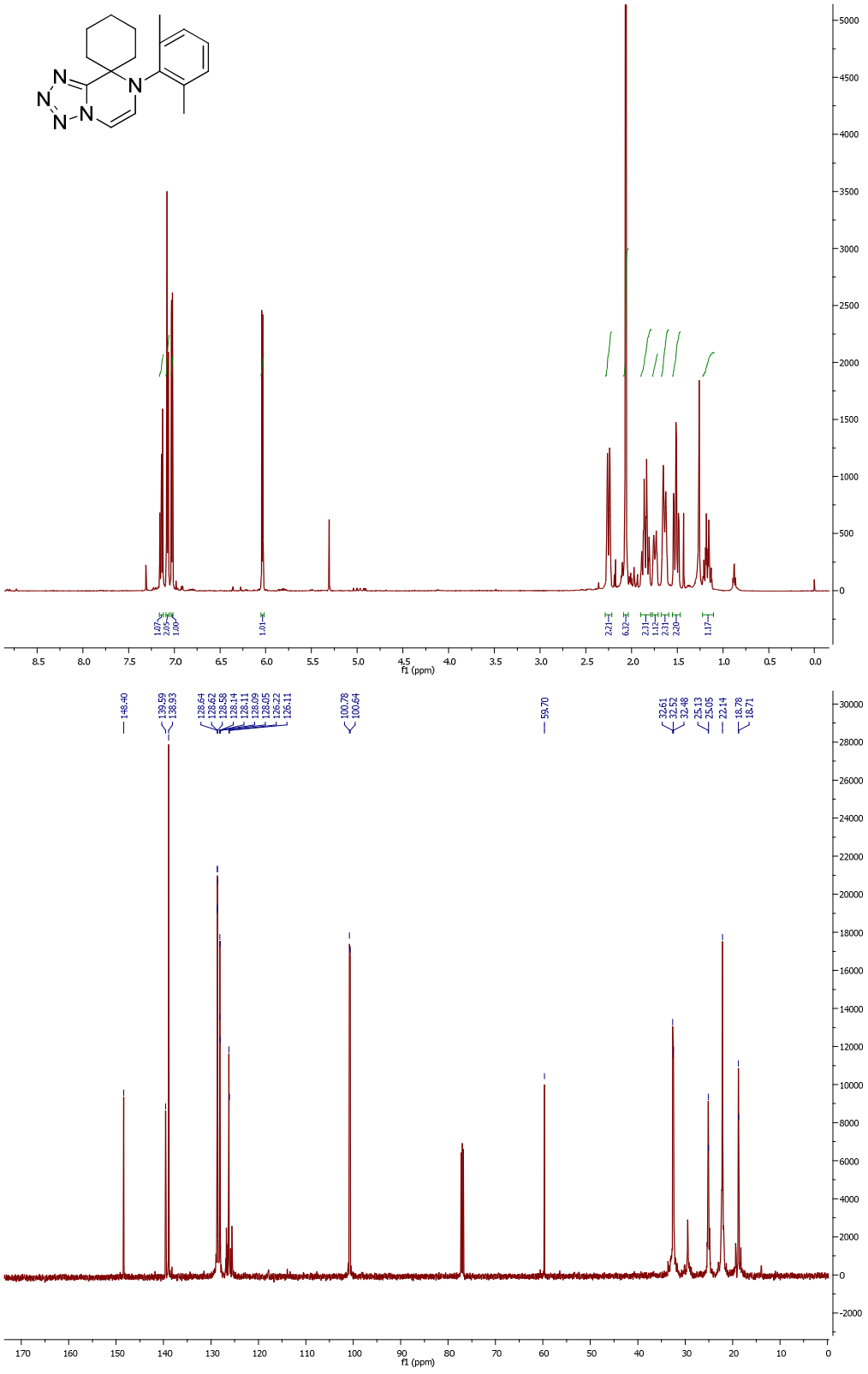
8f: N-(1-(1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)cyclohexyl)-2,6-dimethylaniline.

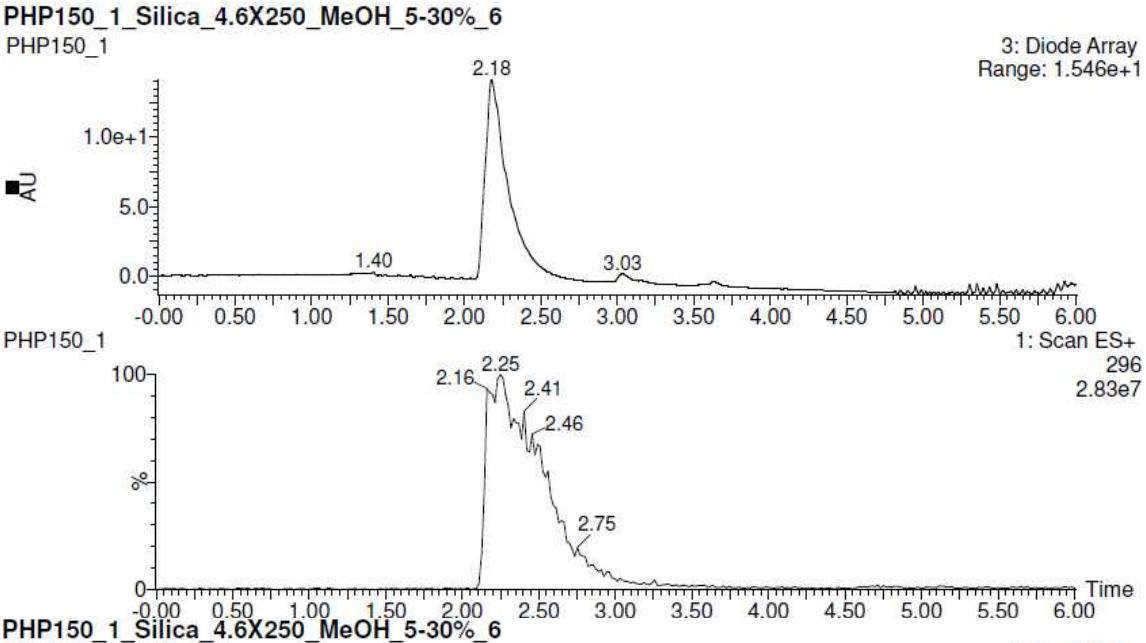


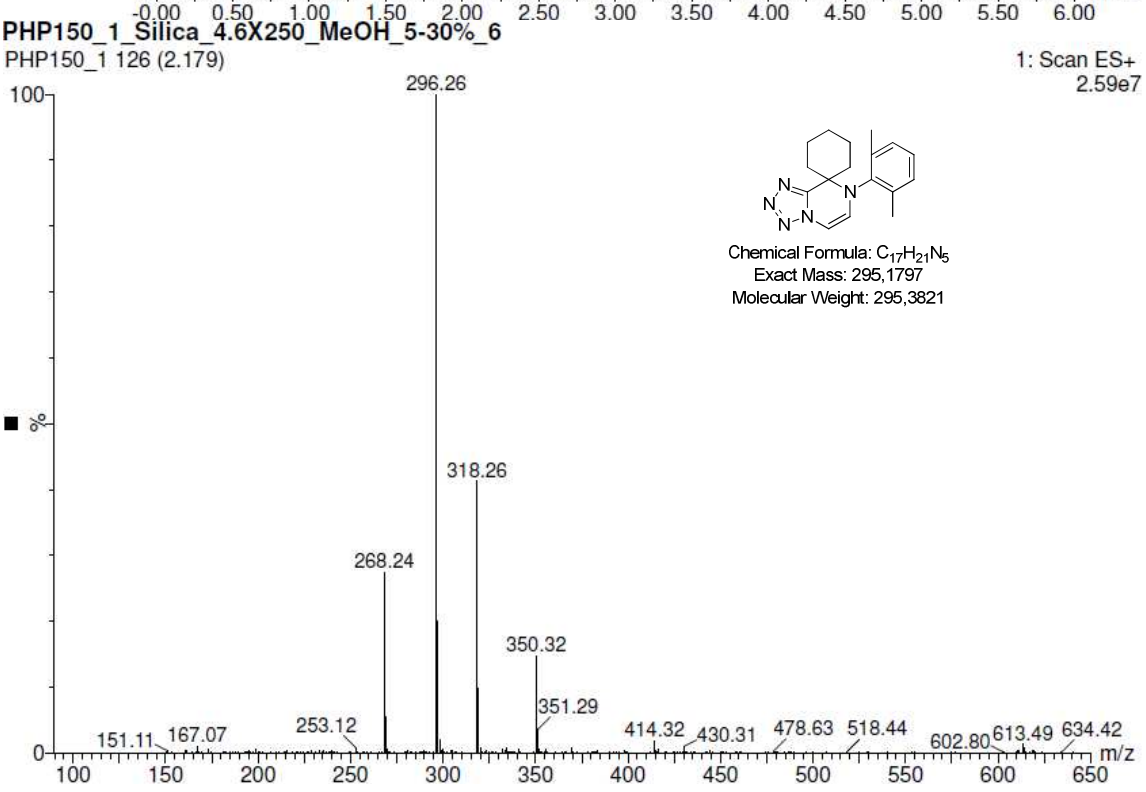

PHP143_1_Silica_4.6X250_MeOH_5-30%_6
PHP143_1
3: Diode Array
Range: 5.815
2.21
4.0
2.0
0.0
AU
0.38
1.40
-0.00 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 6.00
PHP143_1
1: Scan ES+
360
9.83e5
100
%
0
2.35
2.28
2.20
2.42
2.54
2.80
2.86
3.15
3.85
4.51
4.80
5.32
5.79
0.70
1.73
1.92
Time
-0.00 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 6.00


PHP143_1_Silica_4.6X250_MeOH_5-30%_6
PHP143_1 125 (2.162)
1: Scan ES+
3.13e6
100
%
0
202.25
382.30
383.38
203.25
282.38
167.13
240.25
304.35
161.29
239.24
306.27
360.33
384.32
135.11
446.24
462.43
543.07
596.32
616.24
626.86
m/z
100 150 200 250 300 350 400 450 500 550 600 650
MeO
OMe
Chemical Formula: C19H29N5O2
Exact Mass: 359,2321
Molecular Weight: 359,4659

2f: 7'-(2,6-dimethylphenyl)-7'H-spiro[cyclohexane-1,8'-tetrazolo[1,5-a]pyrazine].

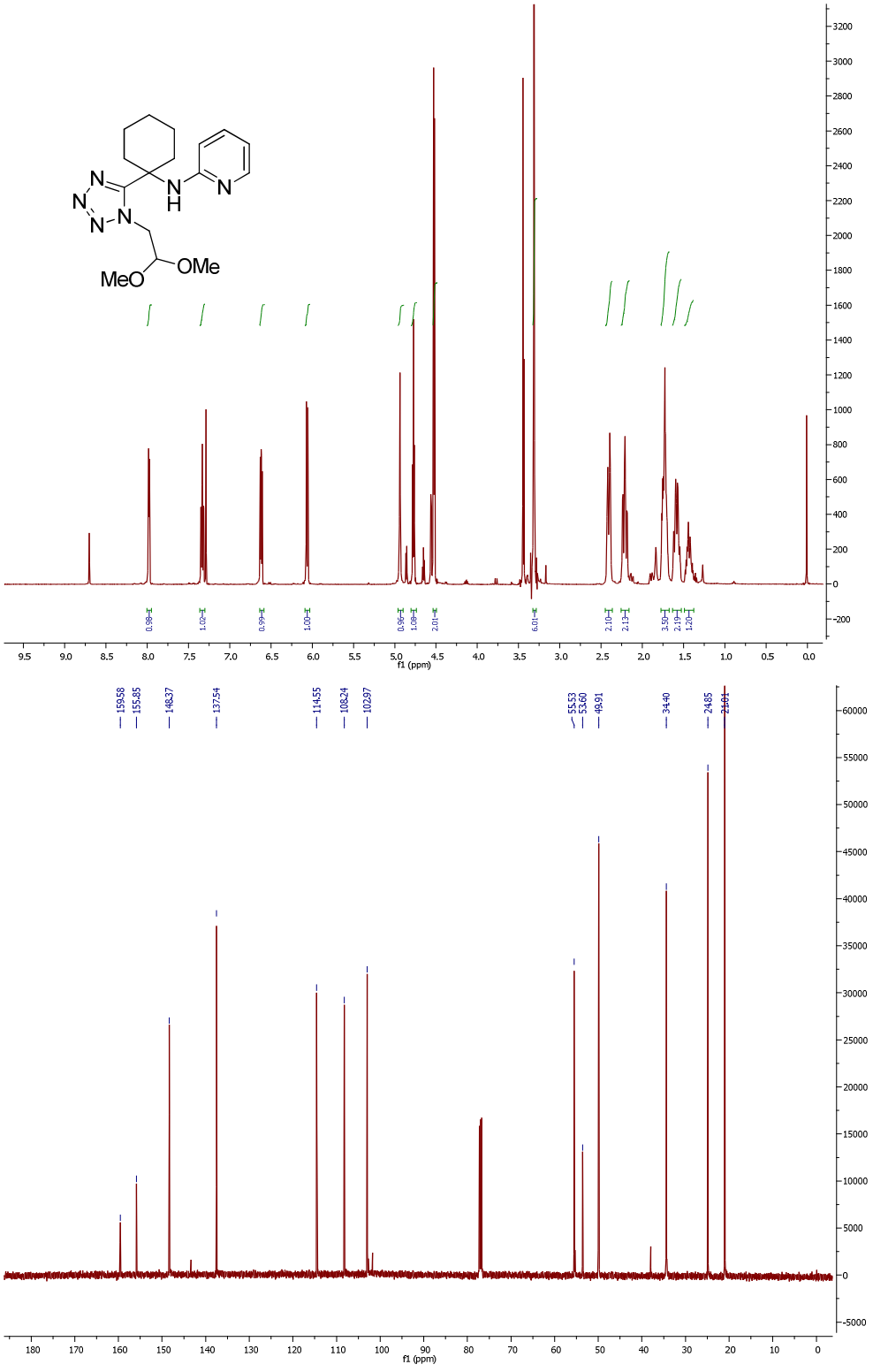


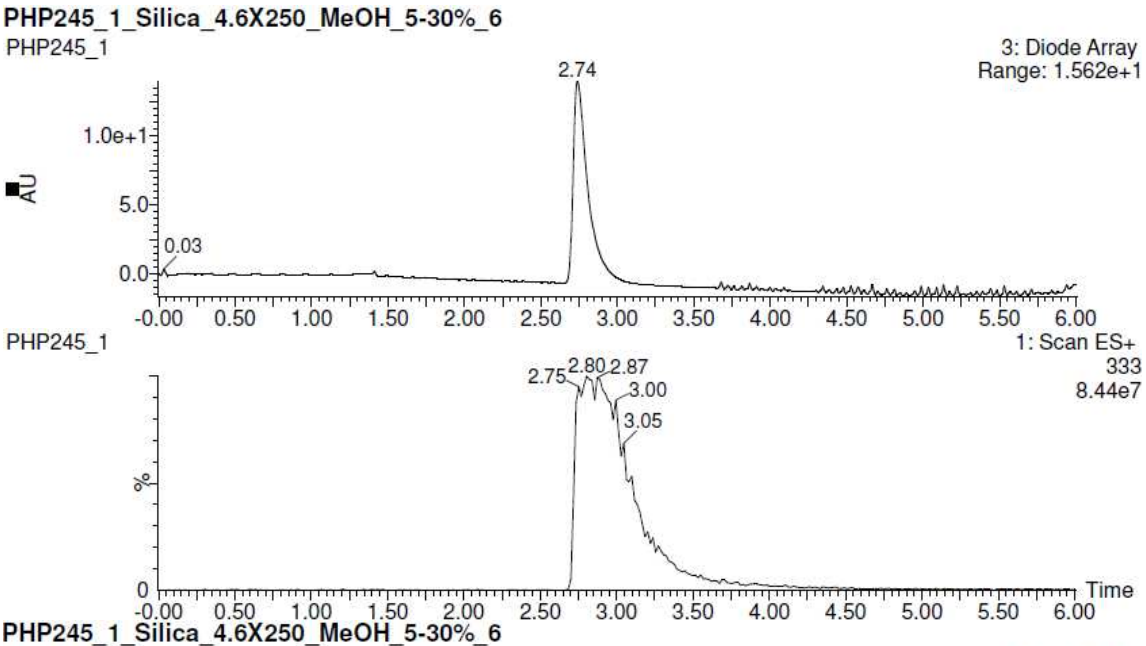


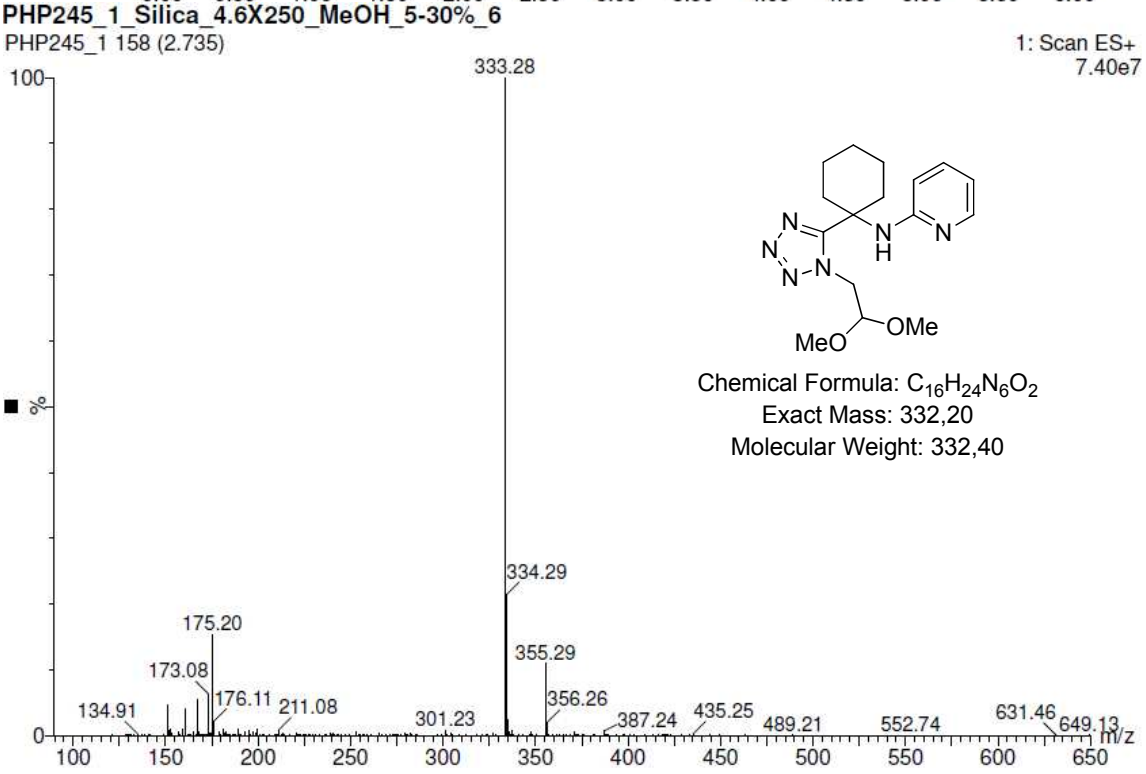


Chemical Formula: $C_{17}H_{21}N_5$
Exact Mass: 295,1797
Molecular Weight: 295,3821

8g: N-(1-(1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)cyclohexyl)pyridin-2-amine.

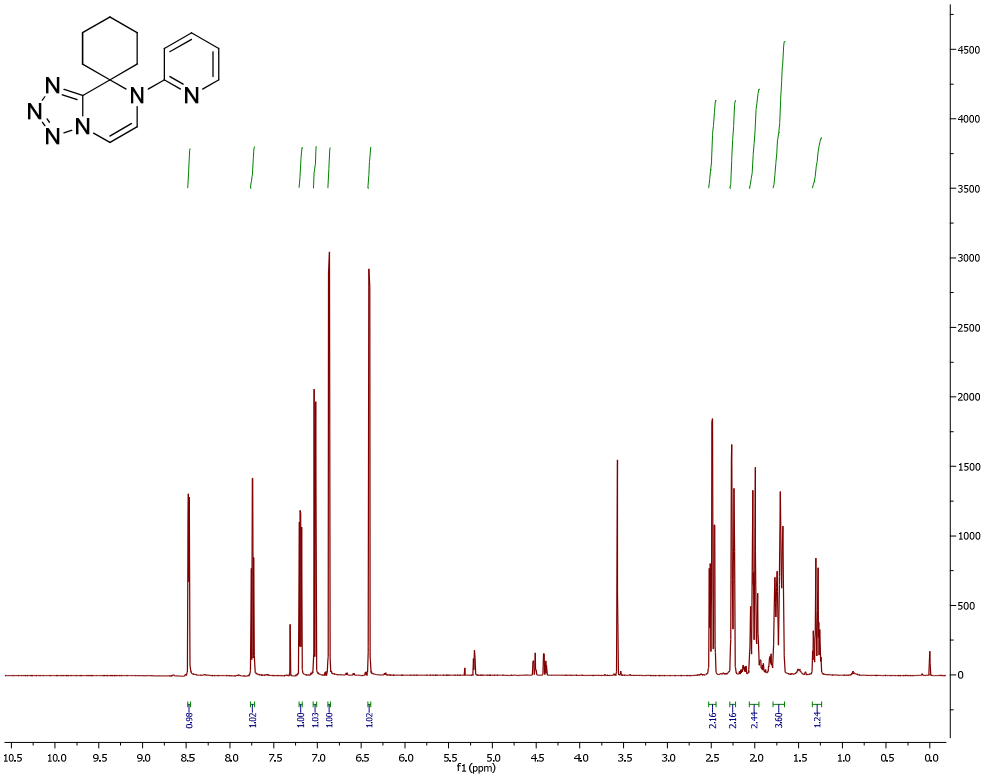


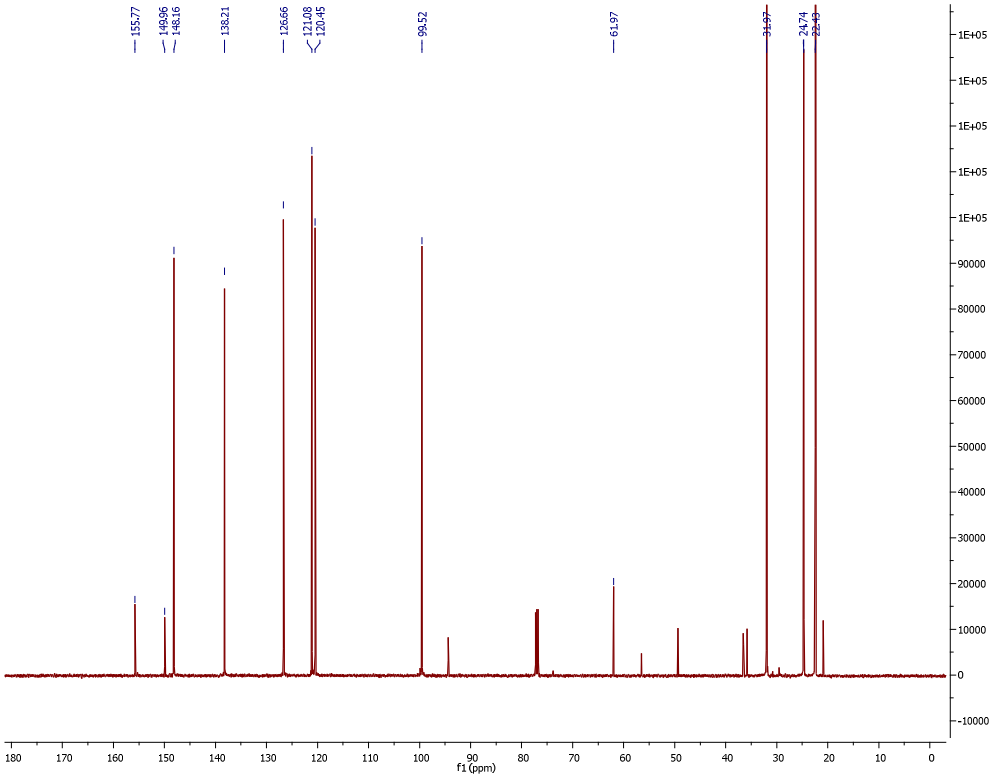


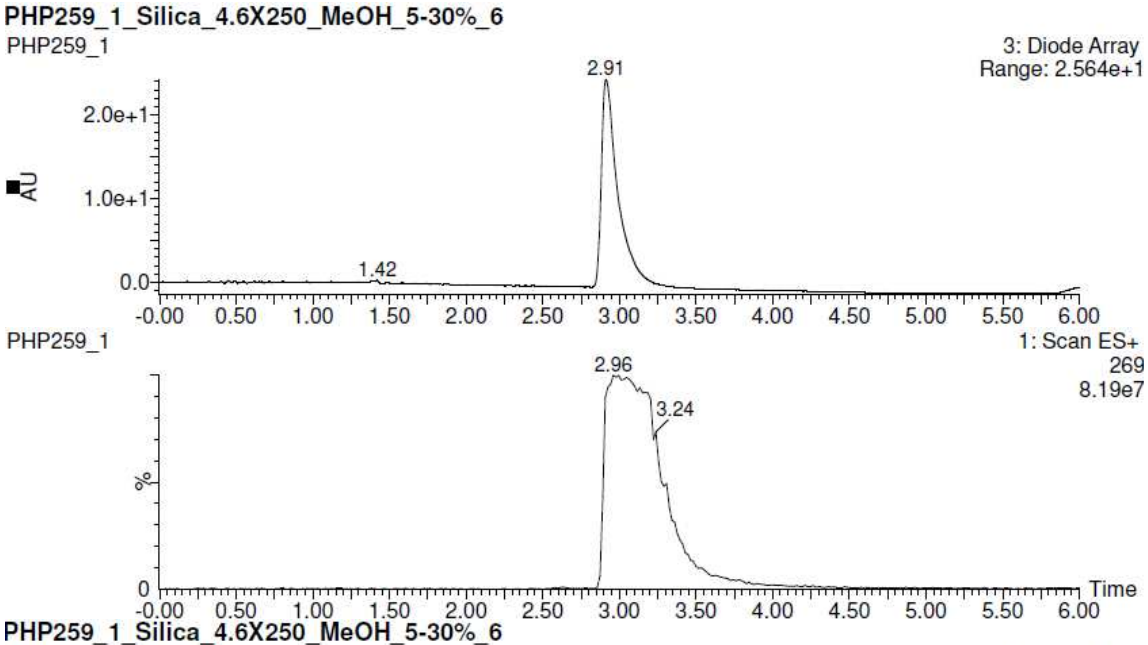


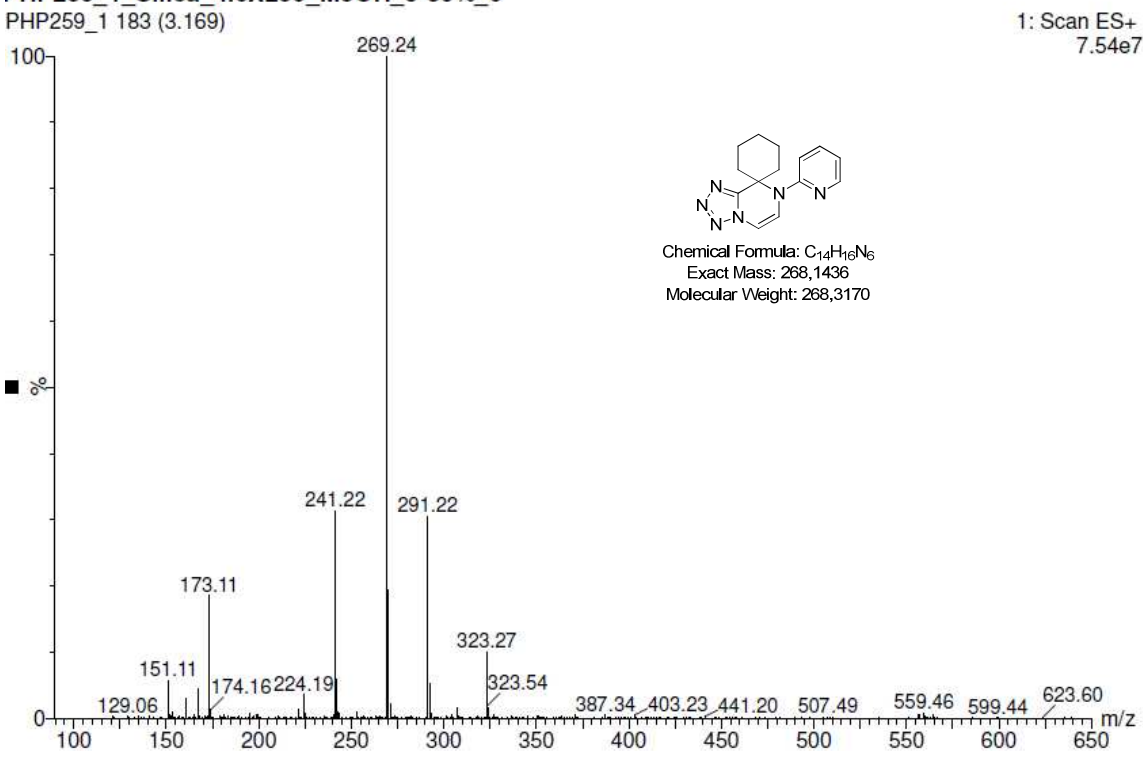
Chemical Formula: $C_{16}H_{24}N_6O_2$
Exact Mass: 332,20
Molecular Weight: 332,40

2g: 7'-(pyridin-2-yl)-7'H-spiro[cyclohexane-1,8'-tetrazolo[1,5-a]pyrazine].



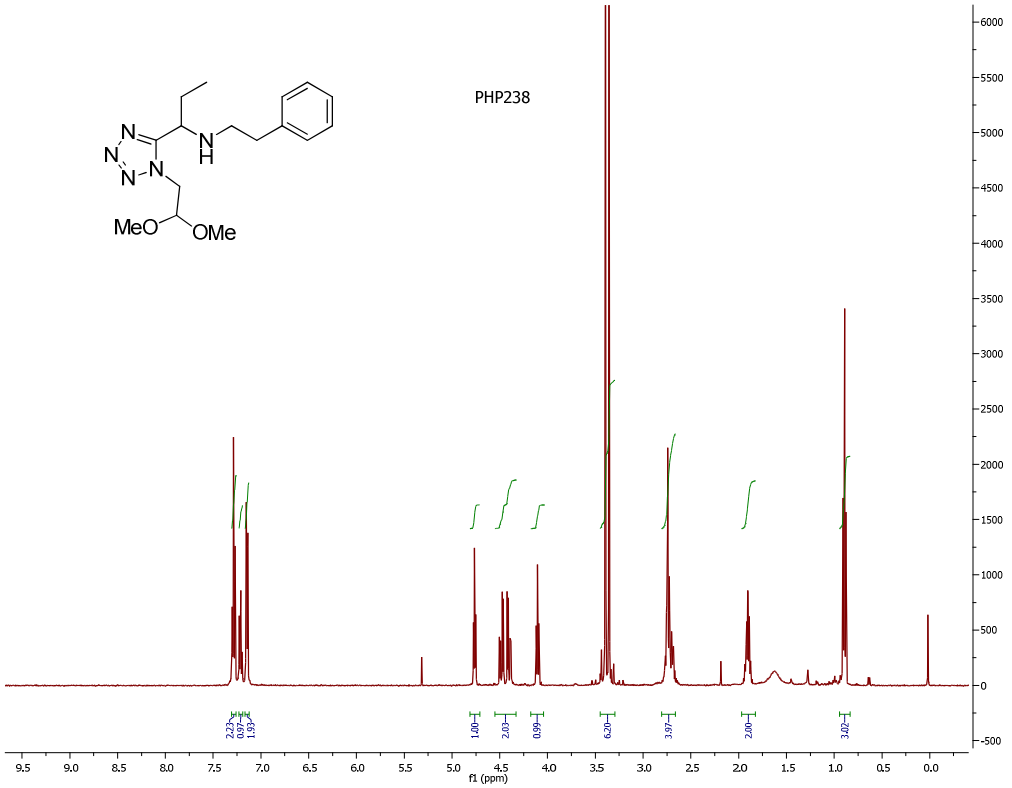


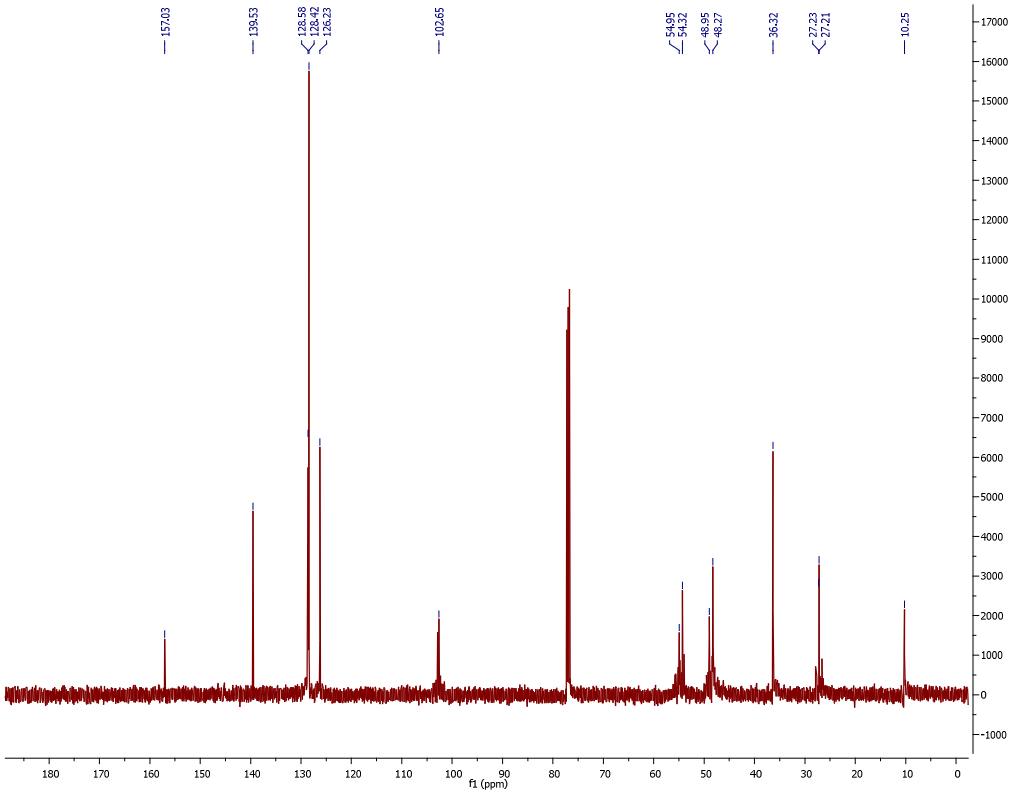


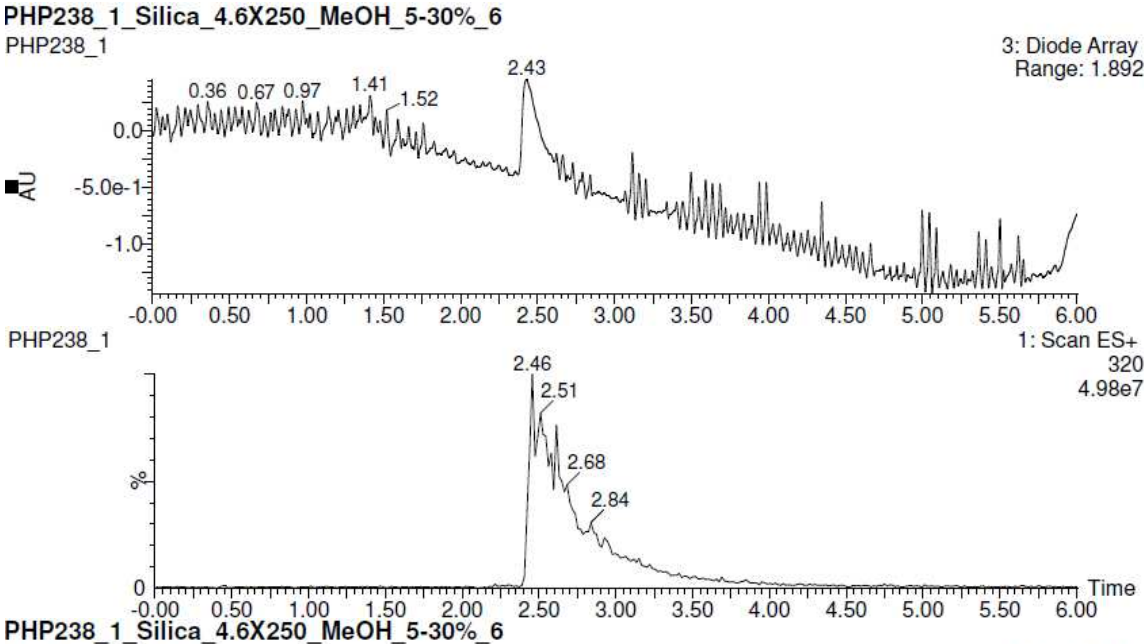


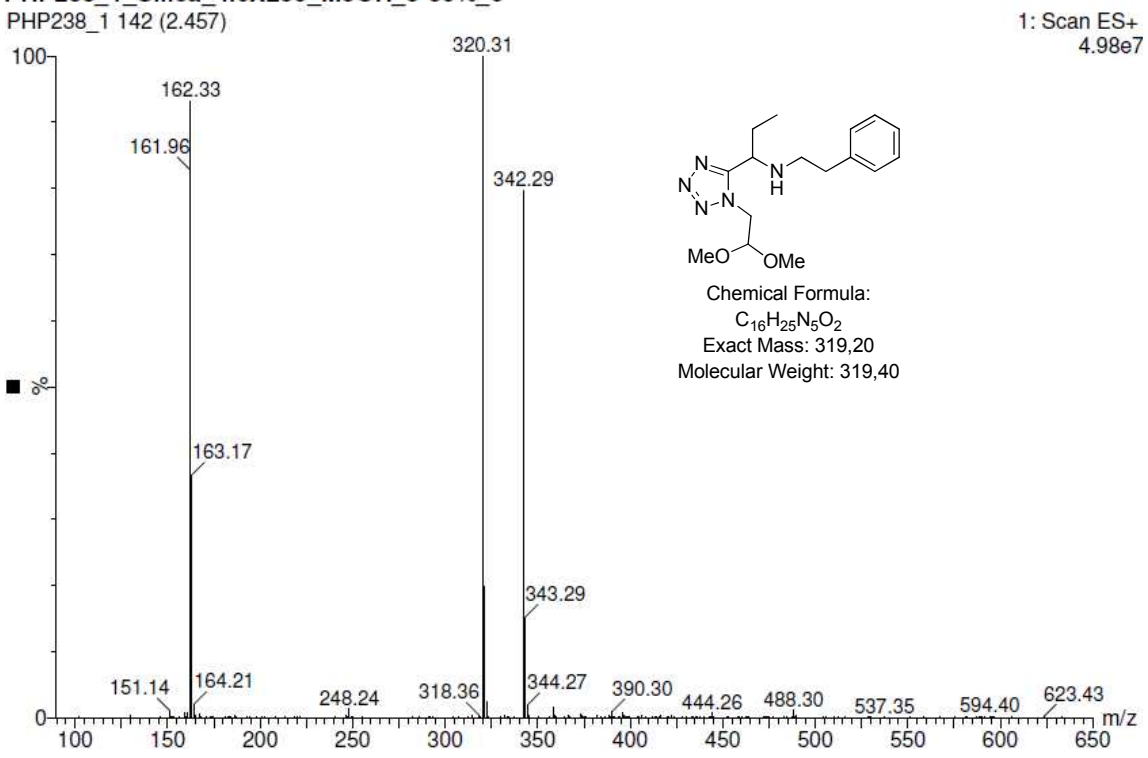
Chemical Formula: $C_{14}H_{16}N_6$
Exact Mass: 268,1436
Molecular Weight: 268,3170

8h: 1-(1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)-N-phenethylpropan-1-amine.

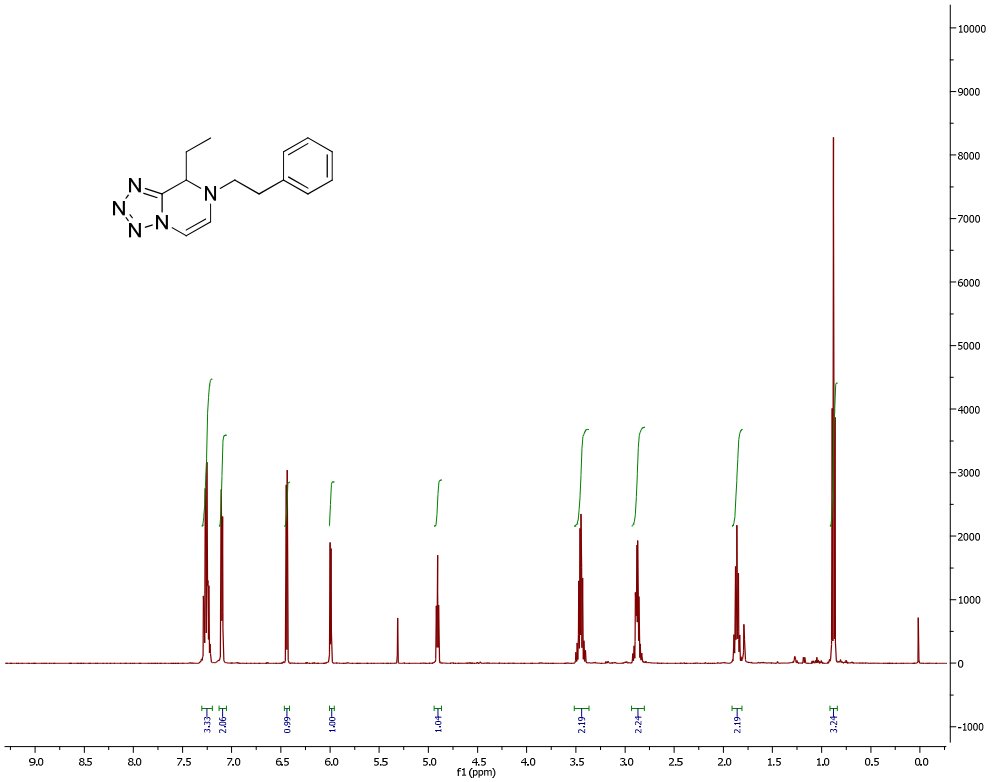


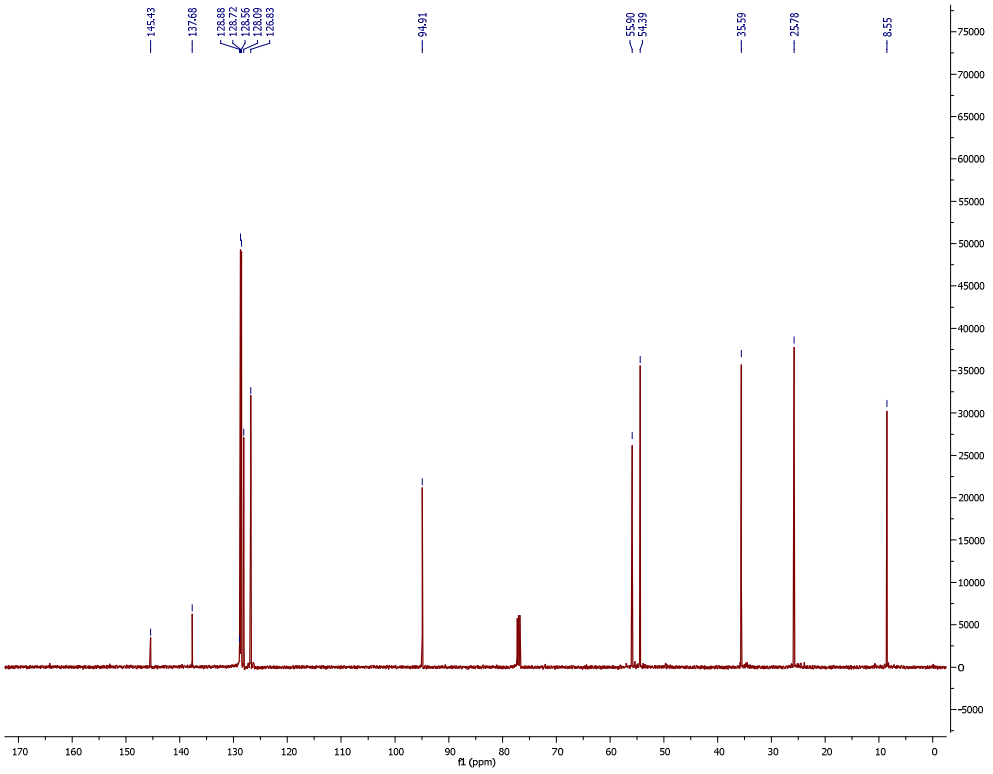


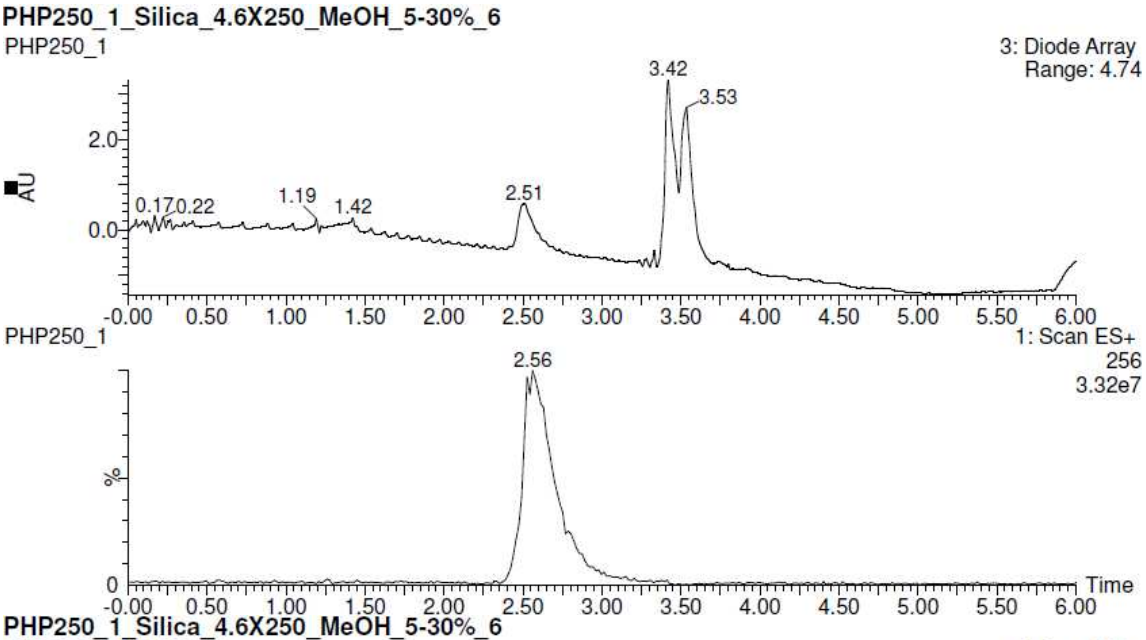

PHP238_1_Silica_4.6X250_MeOH_5-30%_6
PHP238_1
3: Diode Array
Range: 1.892
2.43
0.36 0.67 0.97 1.41 1.52
AU
0.0
-5.0e-1
-1.0
-0.00 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 6.00
PHP238_1
1: Scan ES+
320
4.98e7
2.46
2.51
2.68
2.84
%
0
Time
-0.00 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 6.00

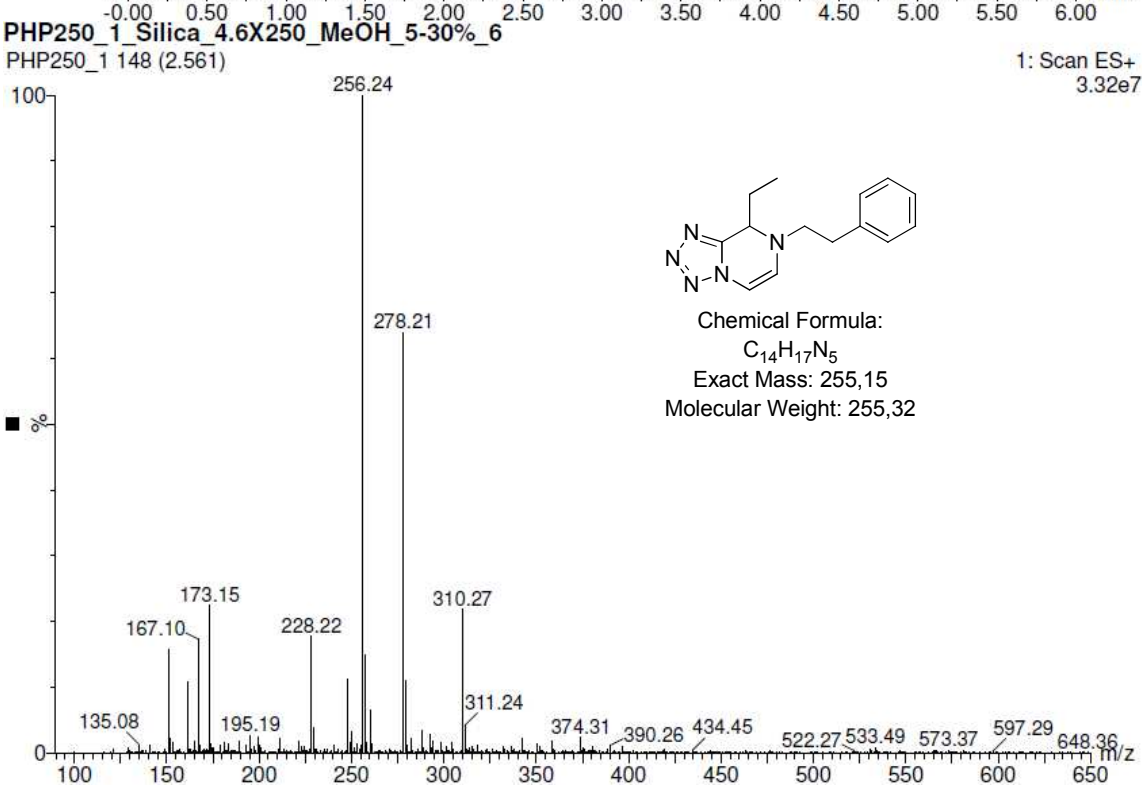

PHP238_1_Silica_4.6X250_MeOH_5-30%_6
PHP238_1 142 (2.457)
1: Scan ES+
4.98e7
100
320.31
162.33
161.96
342.29
%
163.17
343.29
151.14
164.21
248.24
318.36
344.27
390.30
444.26
488.30
537.35
594.40
623.43
0
m/z
100 150 200 250 300 350 400 450 500 550 600 650
N
N
N
N
H
MeO
OMe
Chemical Formula:
C16H25N5O2
Exact Mass: 319,20
Molecular Weight: 319,40

2h: 8-ethyl-7-phenethyl-7,8-dihydrotetrazolo[1,5-a]pyrazine.



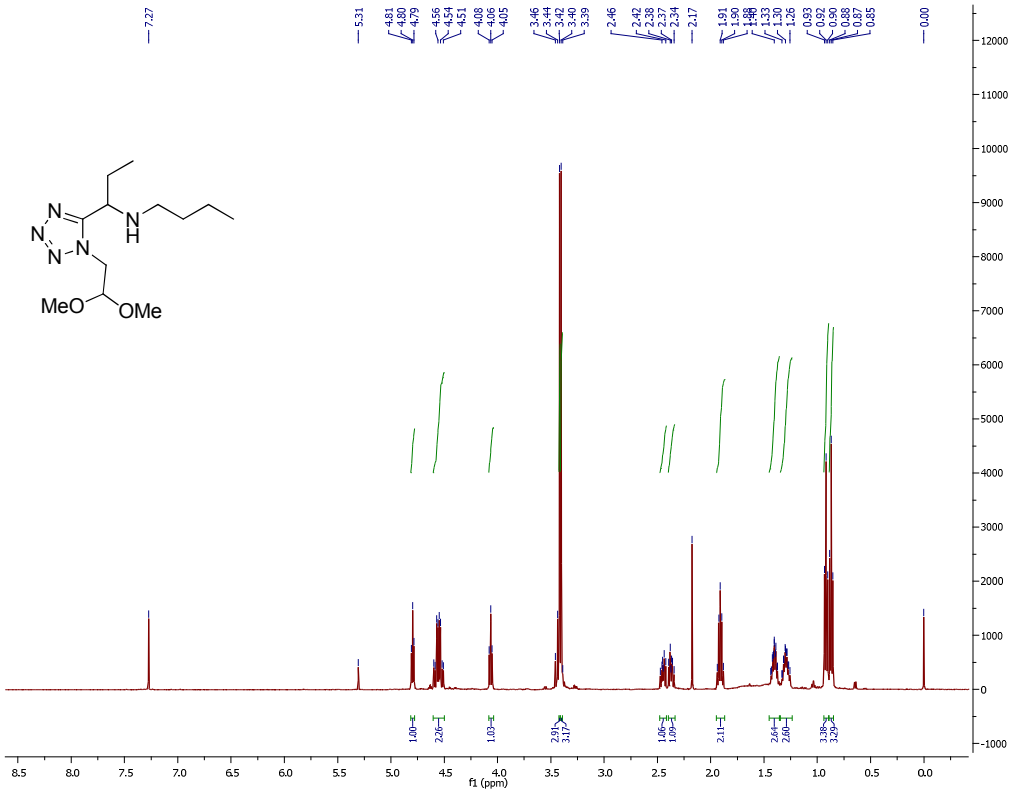


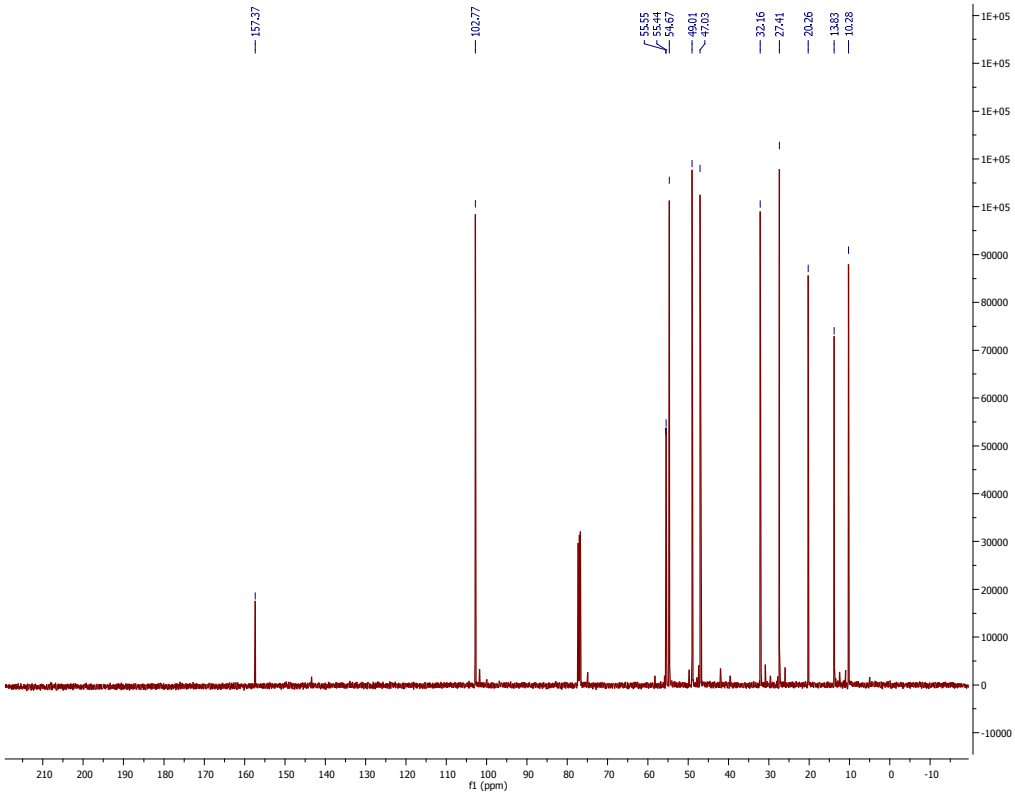


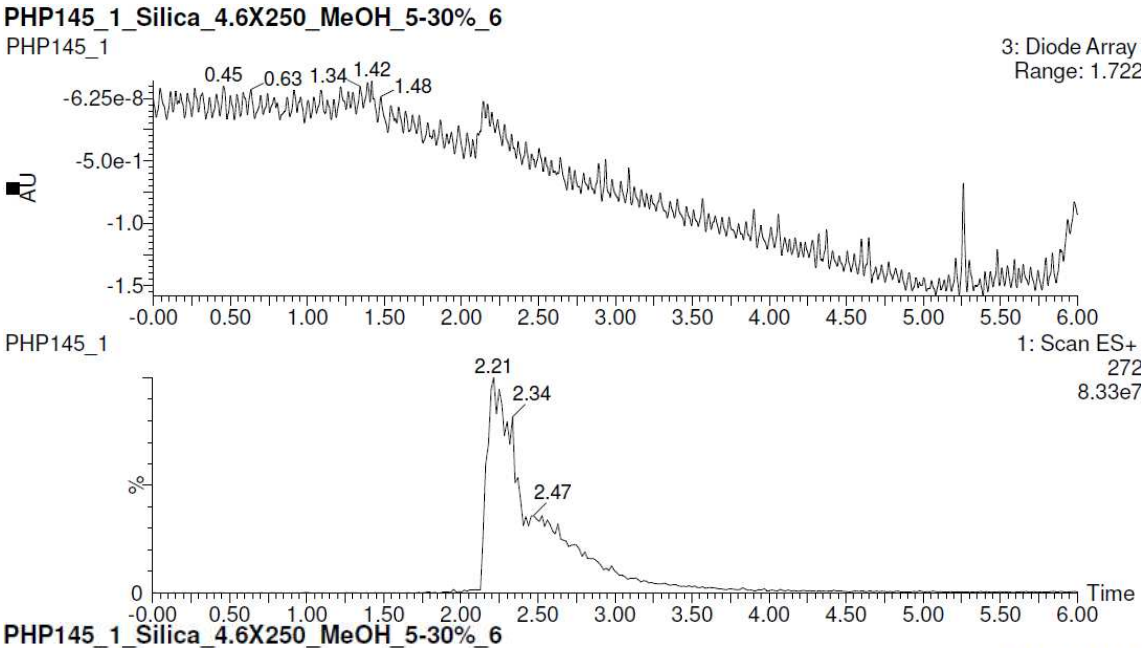


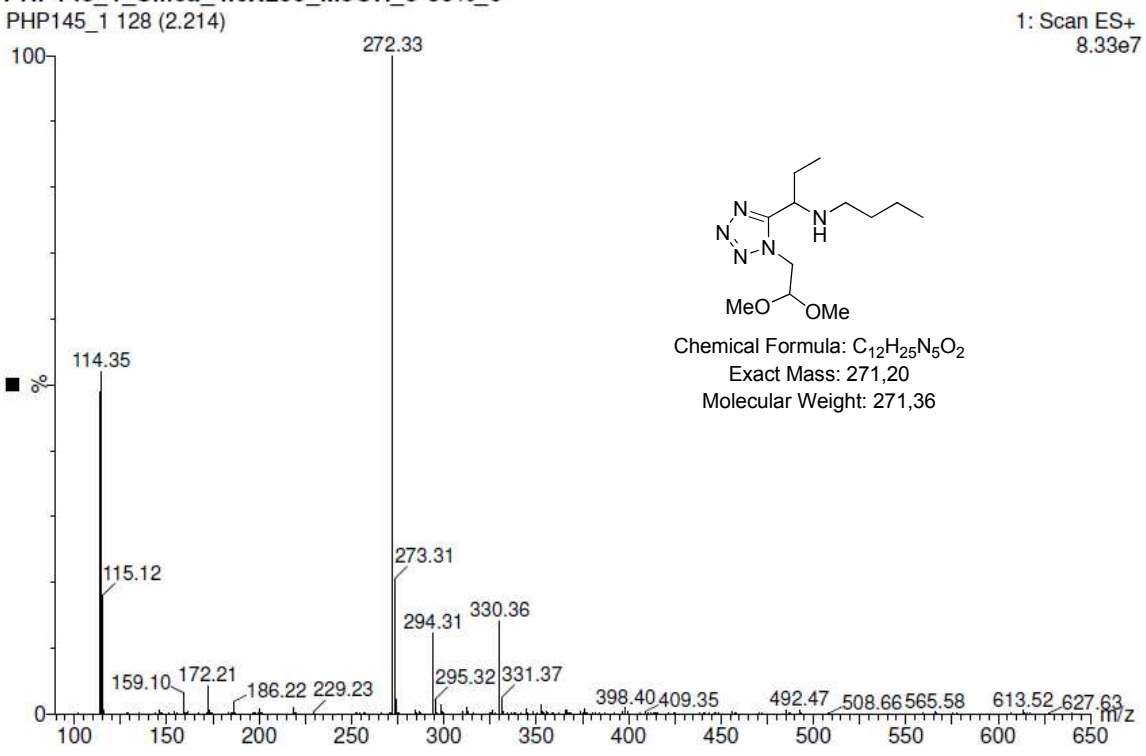
Chemical Formula:
$C_{14}H_{17}N_5$
Exact Mass: 255,15
Molecular Weight: 255,32

8i: N-(1-(1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)propyl)butan-1-amine.



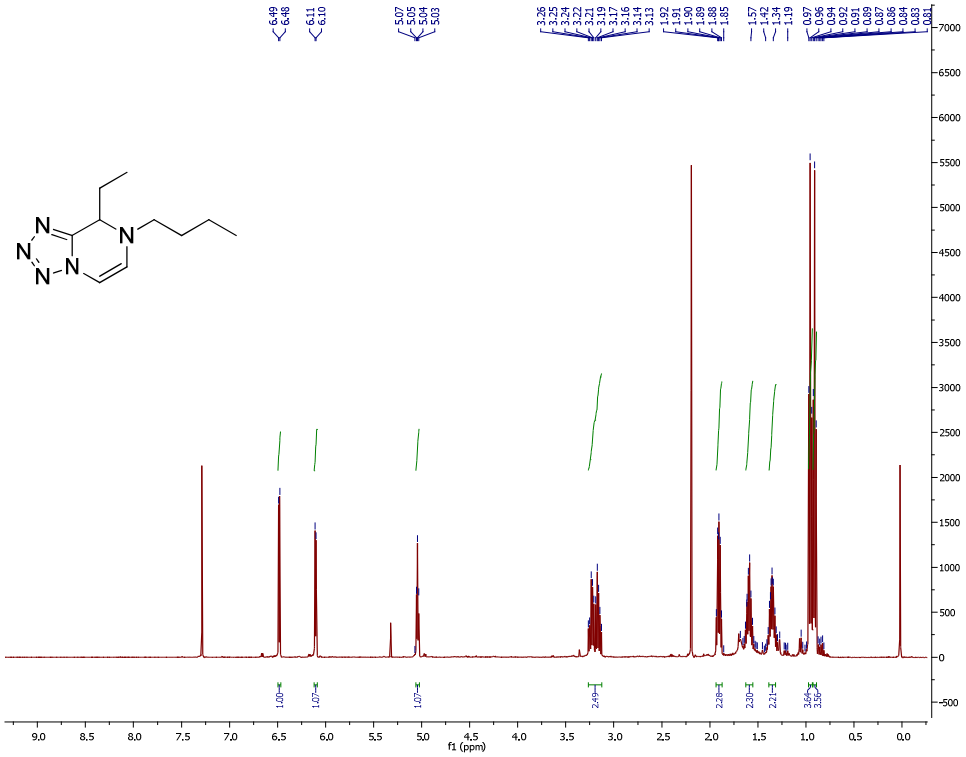


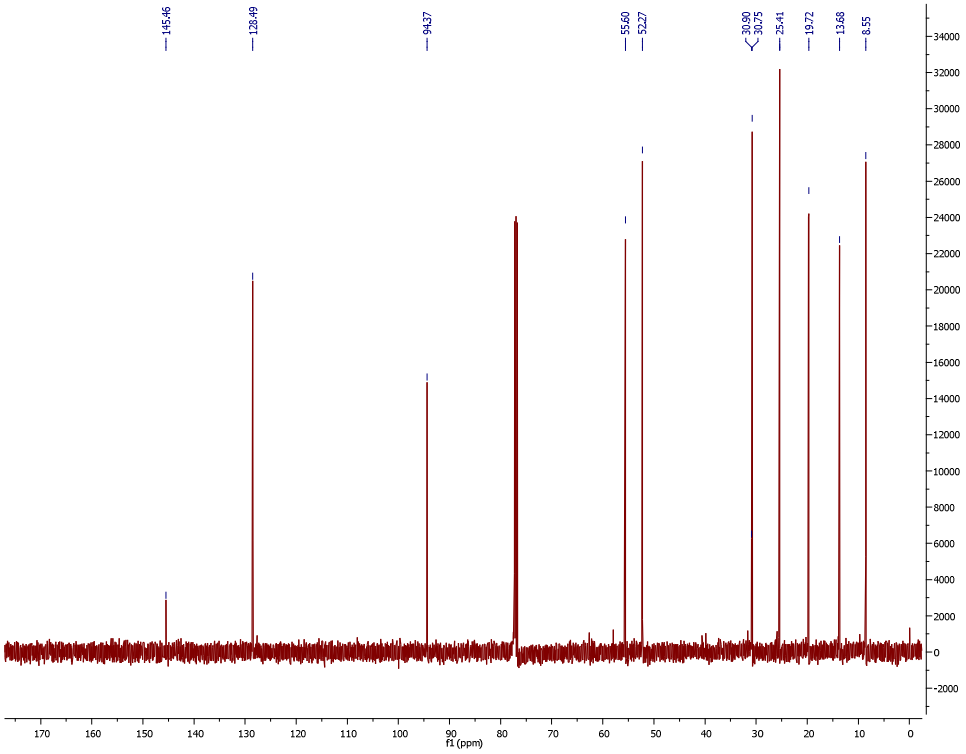


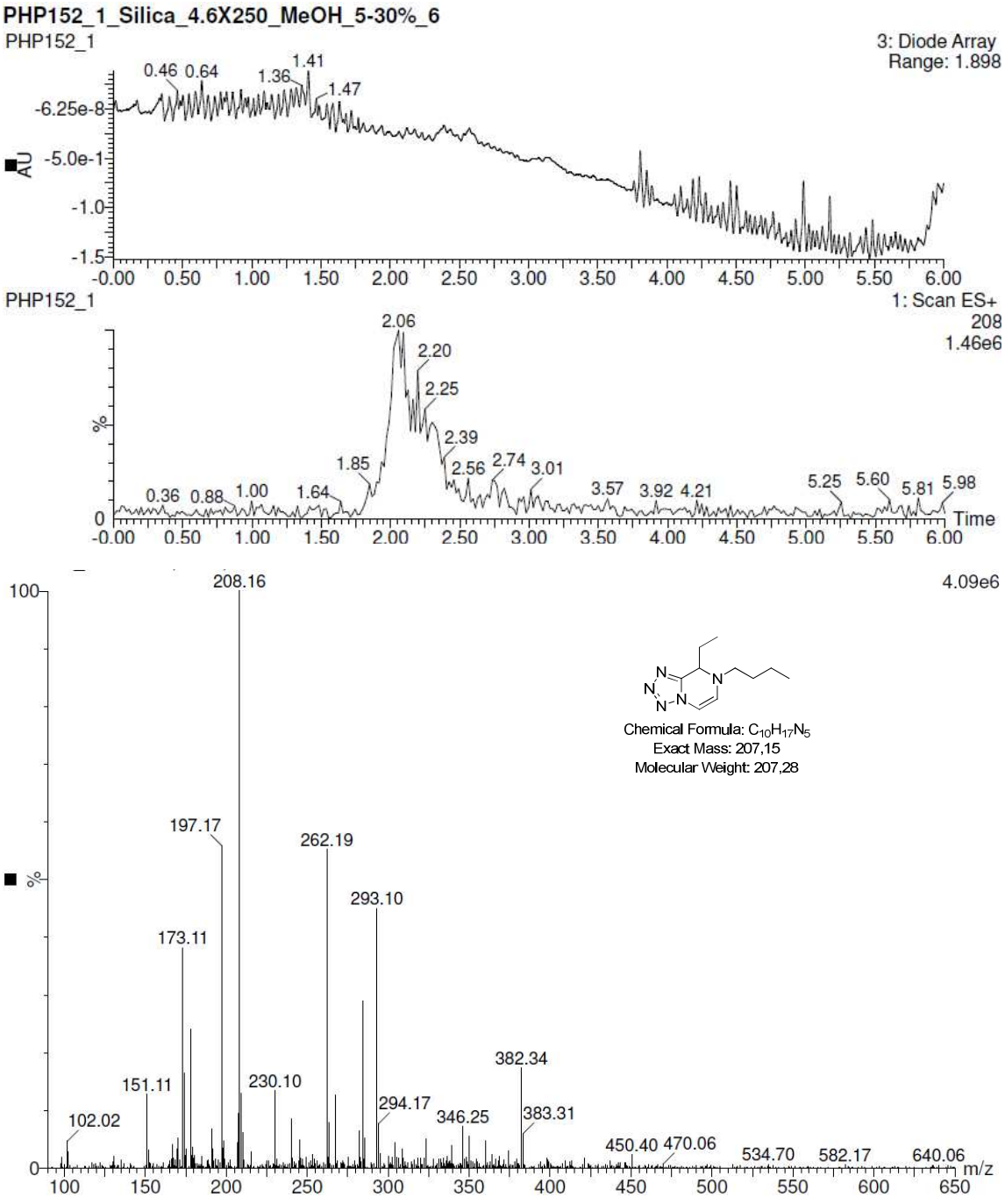


Chemical Formula: $C_{12}H_{25}N_5O_2$
Exact Mass: 271,20
Molecular Weight: 271,36

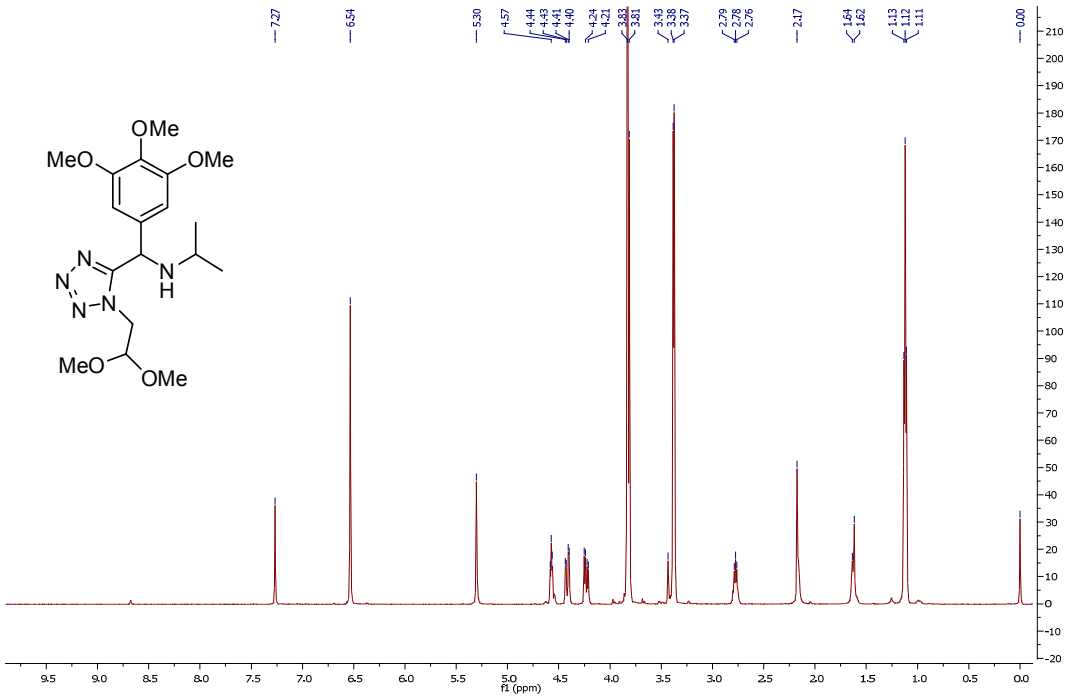
2i: 7-butyl-8-ethyl-7,8-dihydrotetrazolo[1,5-a]pyrazine.

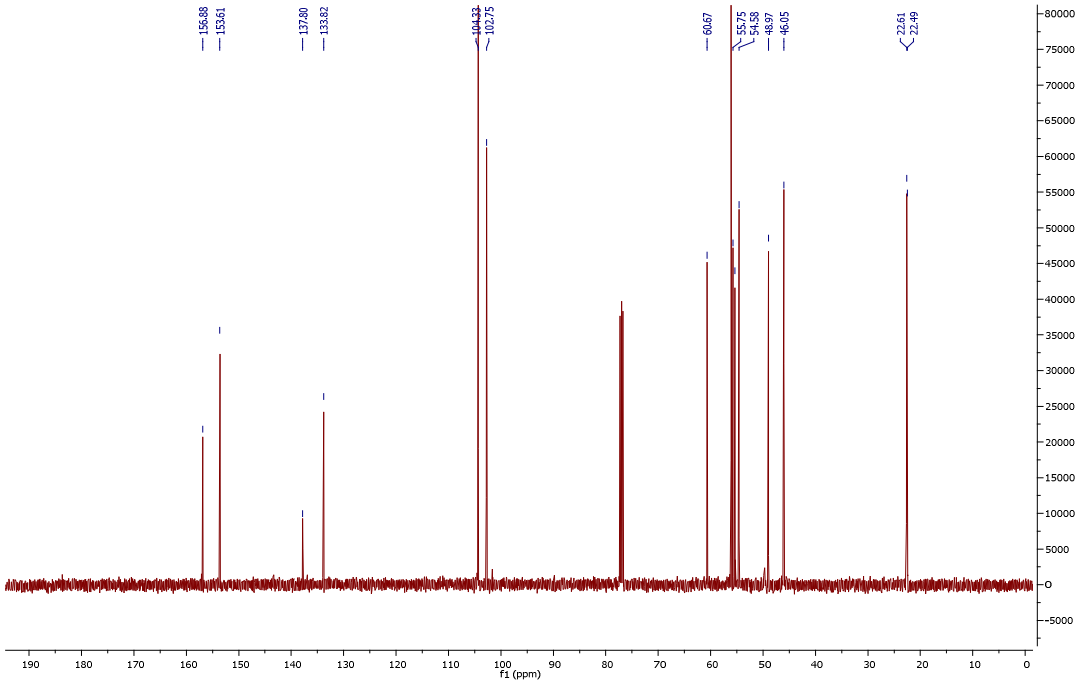


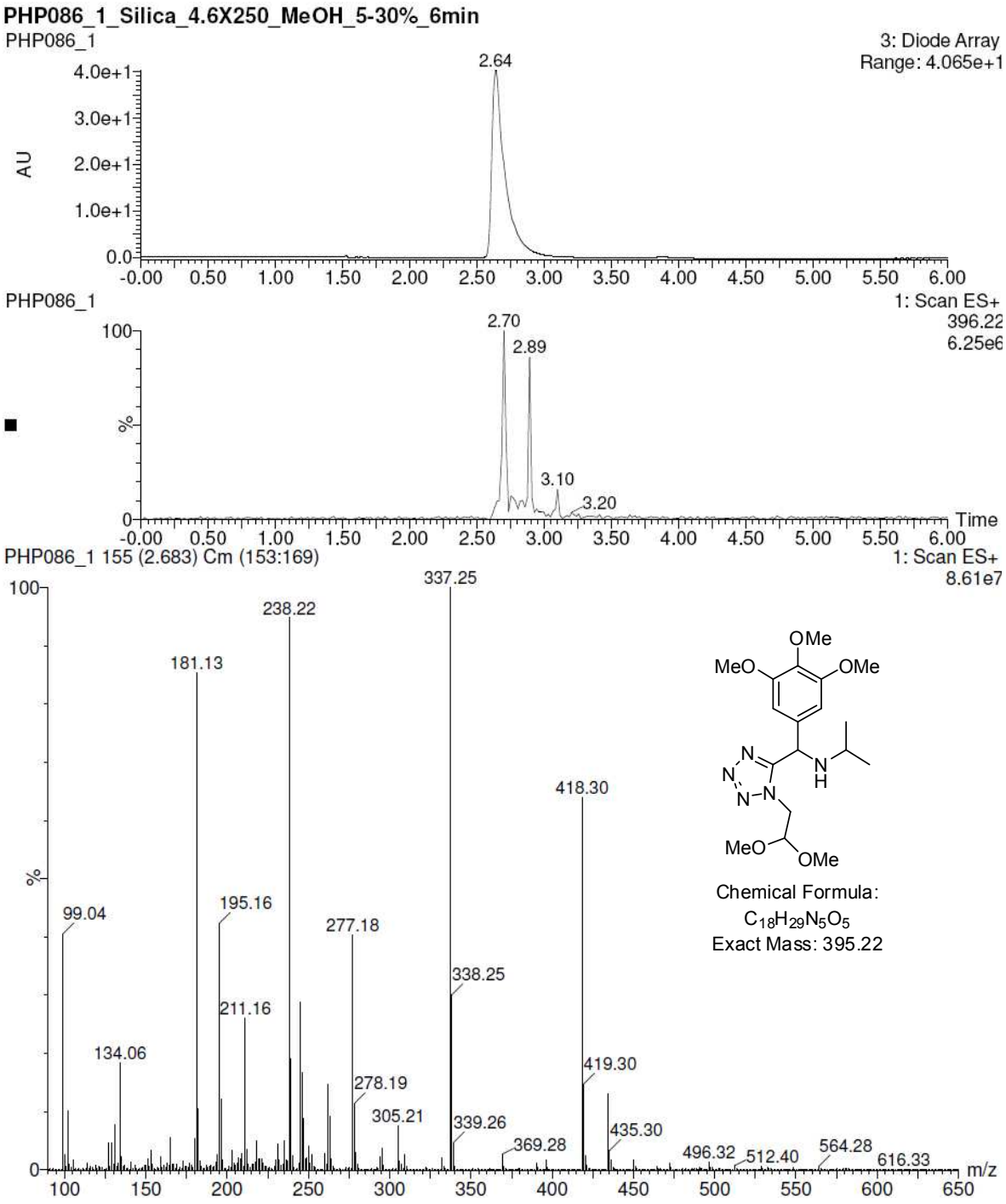



PHP152_1_Silica_4.6X250_MeOH_5-30%_6
PHP152_1
3: Diode Array
Range: 1.898
AU
0.46 0.64 1.36 1.41 1.47
PHP152_1
1: Scan ES+
208
1.46e6
%
2.06 2.20 2.25 2.39 1.85 2.56 2.74 3.01 0.36 0.88 1.00 1.64 3.57 3.92 4.21 5.25 5.60 5.81 5.98
Time
4.09e6
208.16
197.17
262.19
293.10
173.11
382.34
151.11
230.10
294.17
346.25
383.31
102.02
450.40 470.06
534.70
582.17
640.06
m/z
Chemical Formula: C10H17N5
Exact Mass: 207,15
Molecular Weight: 207,28

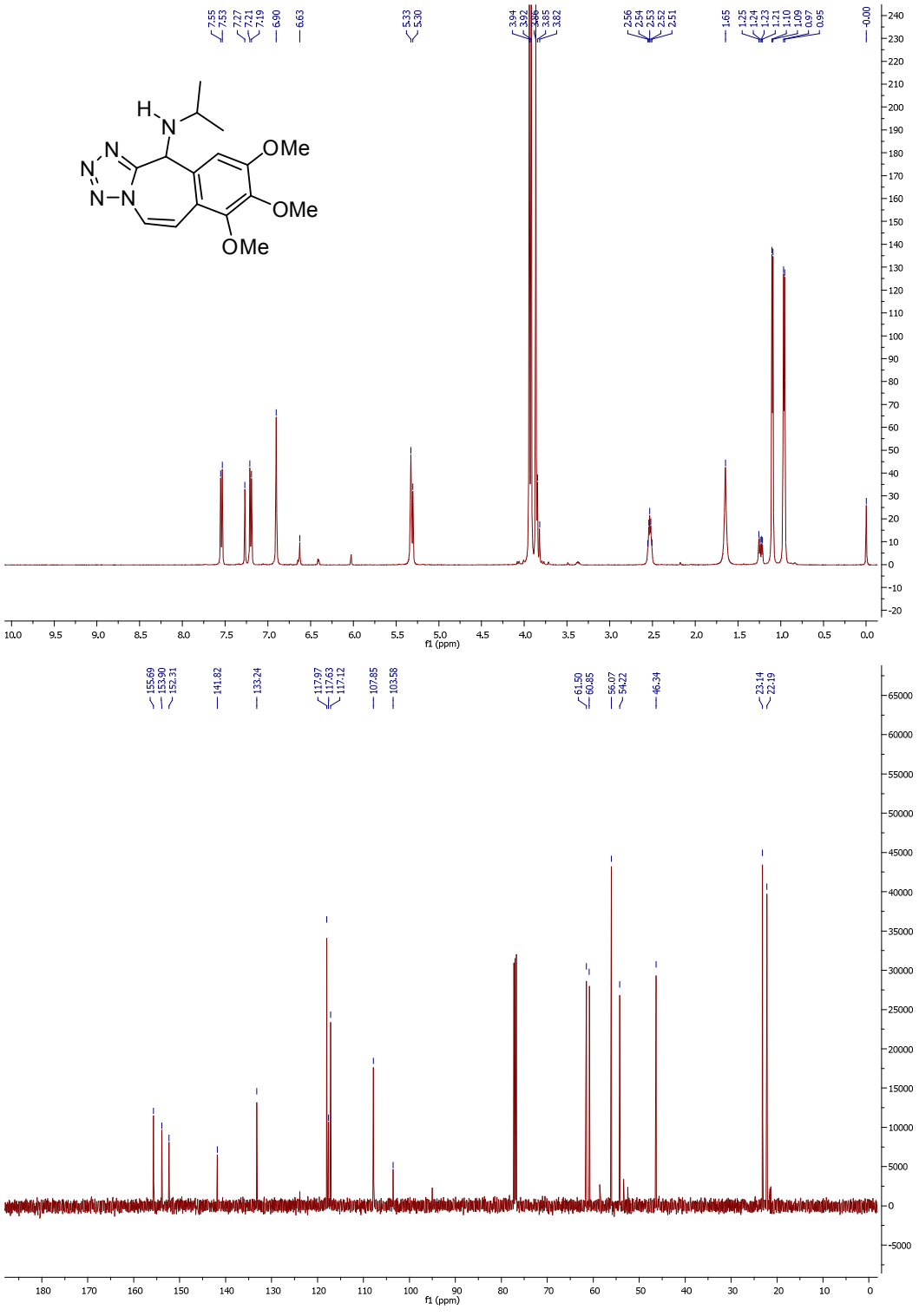
11a: N-((1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)(3,4,5-trimethoxyphenyl) methyl)propan-2-amine.

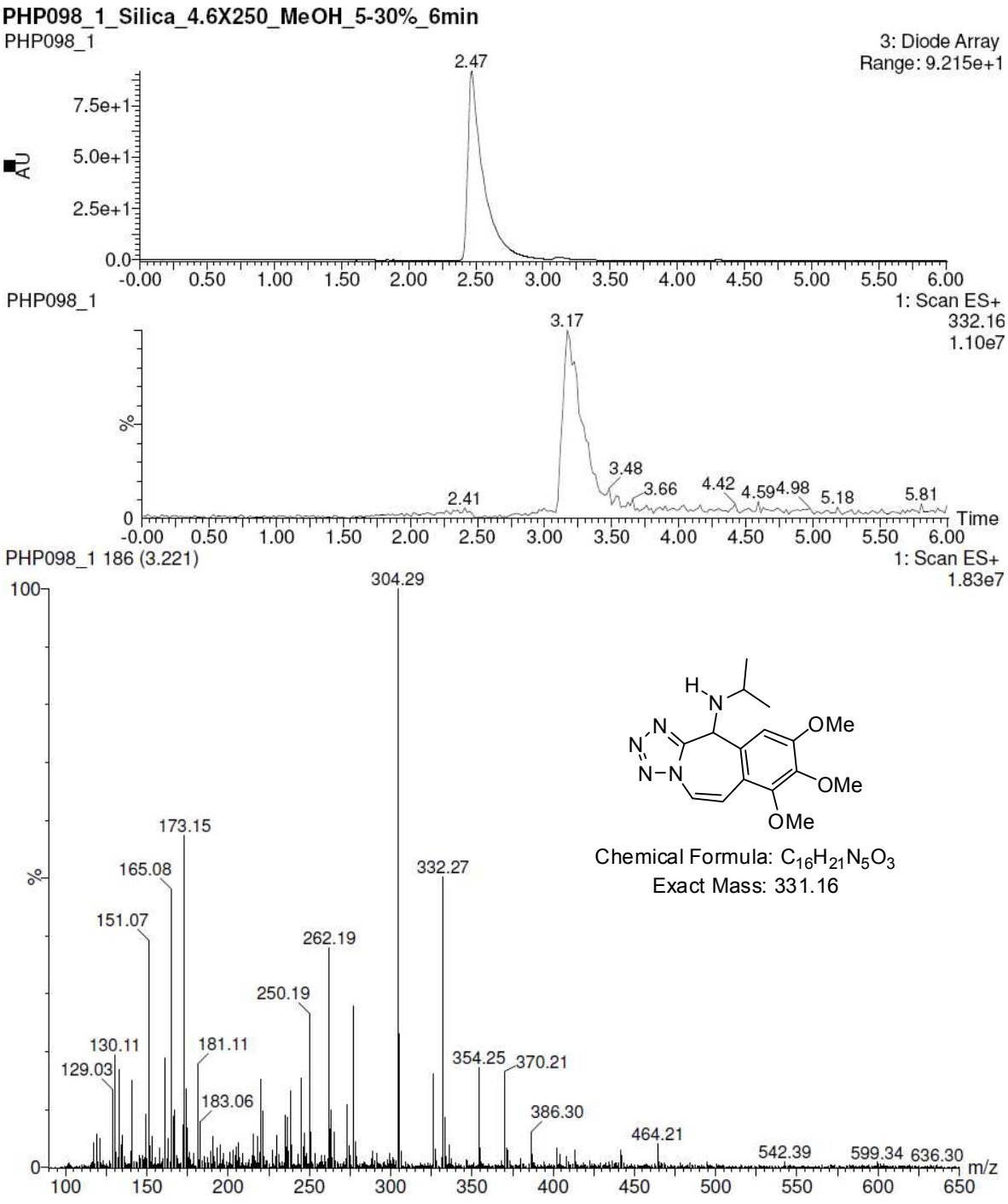




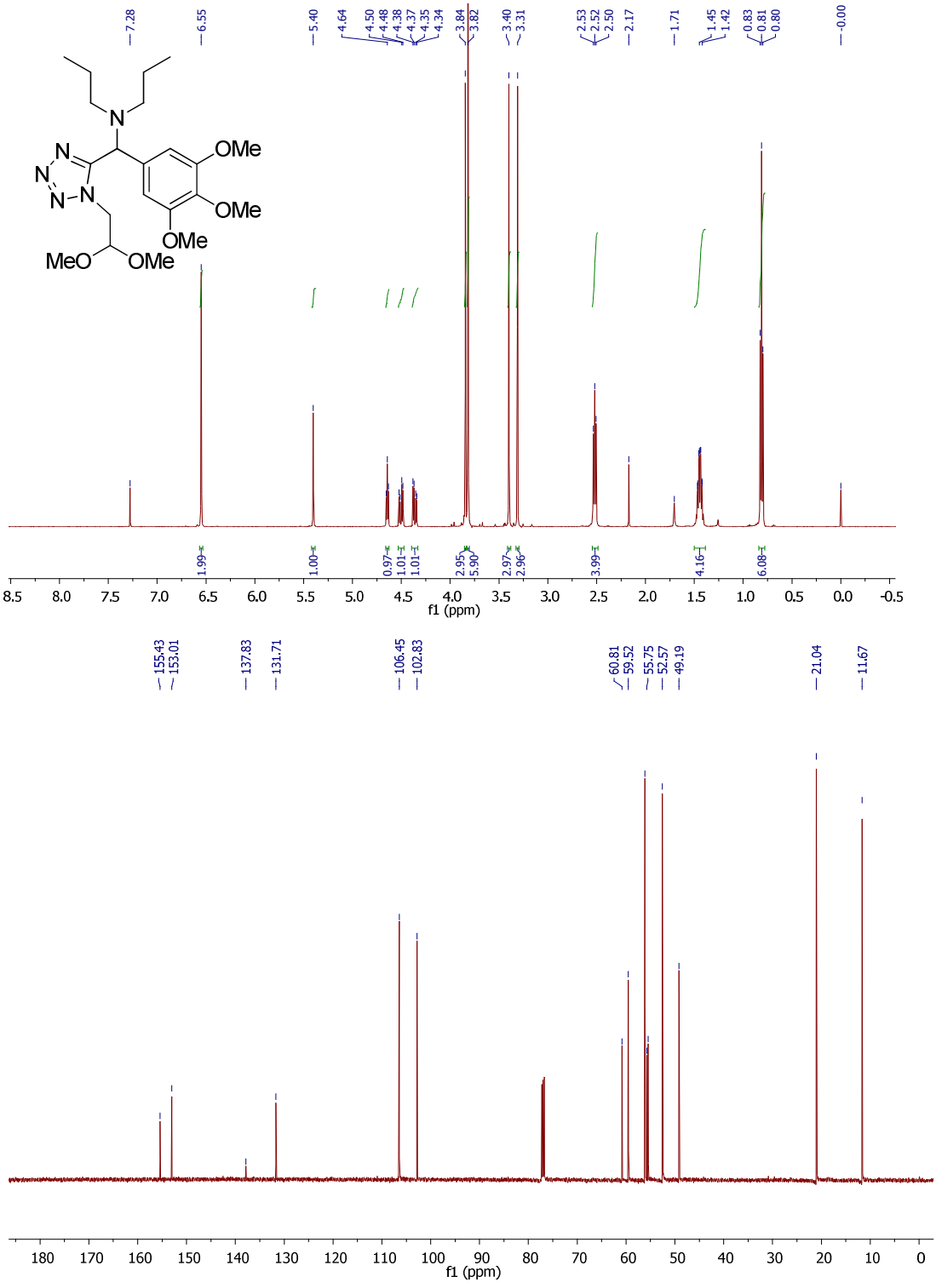

PHP086_1_Silica_4.6X250_MeOH_5-30%_6min
PHP086_1
3: Diode Array
Range: 4.065e+1
2.64
AU
PHP086_1
1: Scan ES+
396.22
6.25e6
2.70
2.89
3.10
3.20
Time
PHP086_1 155 (2.683) Cm (153:169)
1: Scan ES+
8.61e7
337.25
238.22
181.13
418.30
99.04
195.16
277.18
338.25
211.16
134.06
419.30
278.19
305.21
339.26
435.30
369.28
496.32
512.40
564.28
616.33
m/z
OMe
MeO
OMe
N
N
N
N
H
MeO
OMe
Chemical Formula:
C18H29N5O5
Exact Mass: 395.22

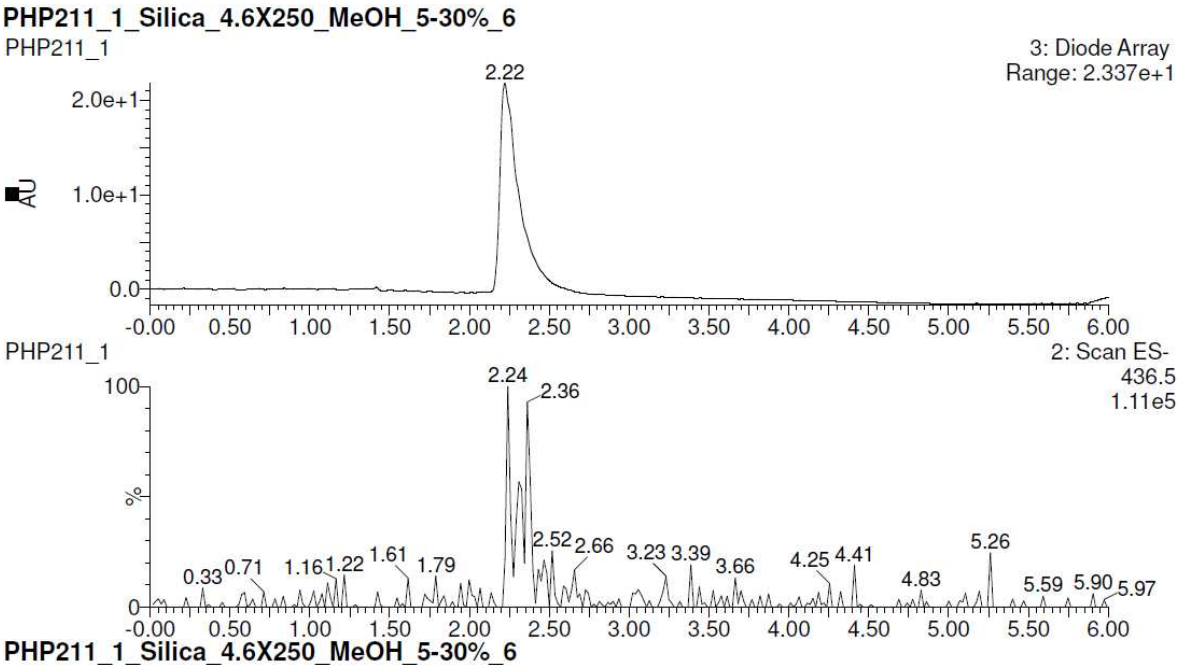
3a: N-isopropyl-7,8,9-trimethoxy-11H-benzo[d]tetrazolo[1,5-a]azepin-11-amine

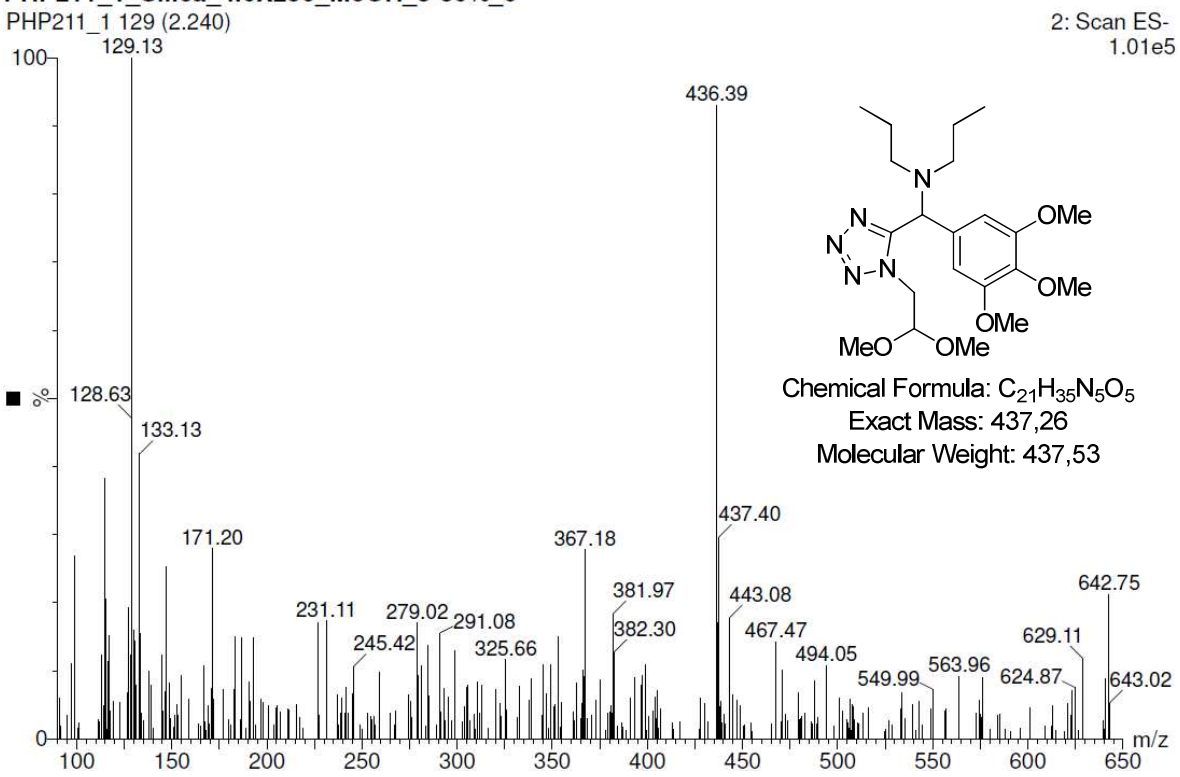



PHP098_1_Silica_4.6X250_MeOH_5-30%_6min
PHP098_1
3: Diode Array
Range: 9.215e+1
2.47
AU
PHP098_1
1: Scan ES+
332.16
1.10e7
3.17
3.48
3.66
4.42
4.59
4.98
5.18
5.81
2.41
Time
PHP098_1 186 (3.221)
1: Scan ES+
1.83e7
304.29
173.15
165.08
332.27
151.07
262.19
250.19
130.11
181.11
129.03
183.06
354.25
370.21
386.30
464.21
542.39
599.34
636.30
m/z
OMe
OMe
OMe
Chemical Formula: C16H21N5O3
Exact Mass: 331.16

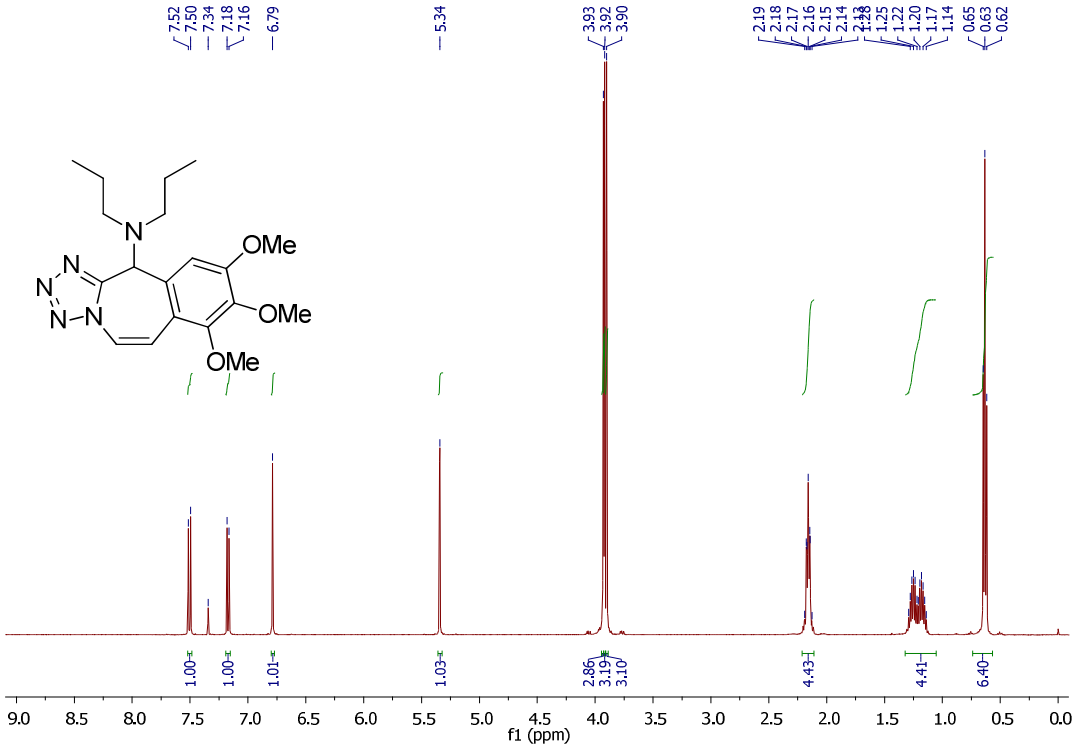
11b: N-((1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)(3,4,5-trimethoxyphenyl)methyl)-N-propylpropan-1-amine.

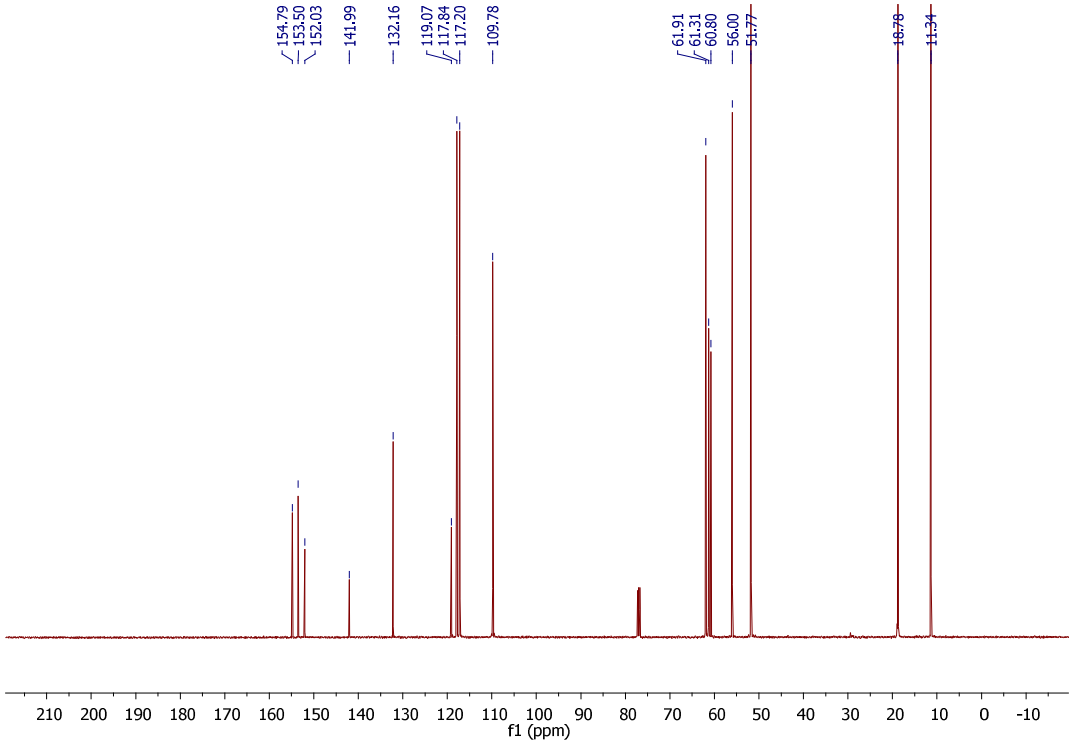


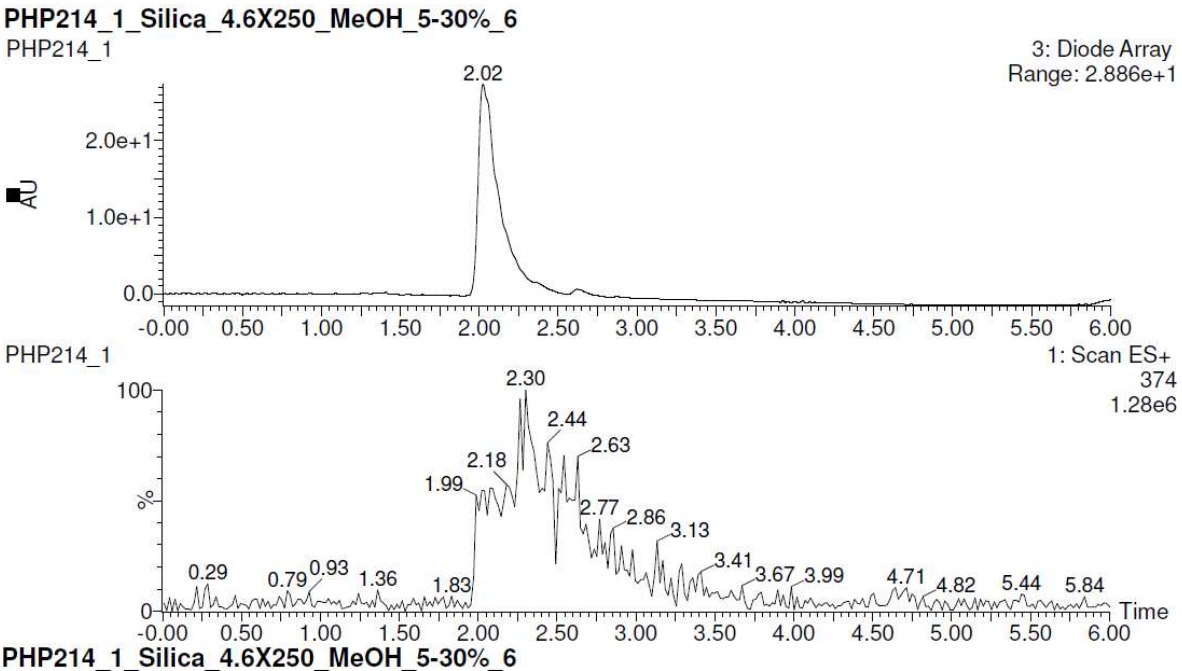

PHP211_1_Silica_4.6X250_MeOH_5-30%_6
PHP211_1
3: Diode Array
Range: 2.337e+1
2.22
2.0e+1
1.0e+1
0.0
AU
-0.00 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 6.00
PHP211_1
2: Scan ES-
436.5
1.11e5
100
%
2.24
2.36
0.33 0.71 1.16 1.22 1.61 1.79 2.52 2.66 3.23 3.39 3.66 4.25 4.41 4.83 5.26 5.59 5.90 5.97
0
-0.00 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 6.00

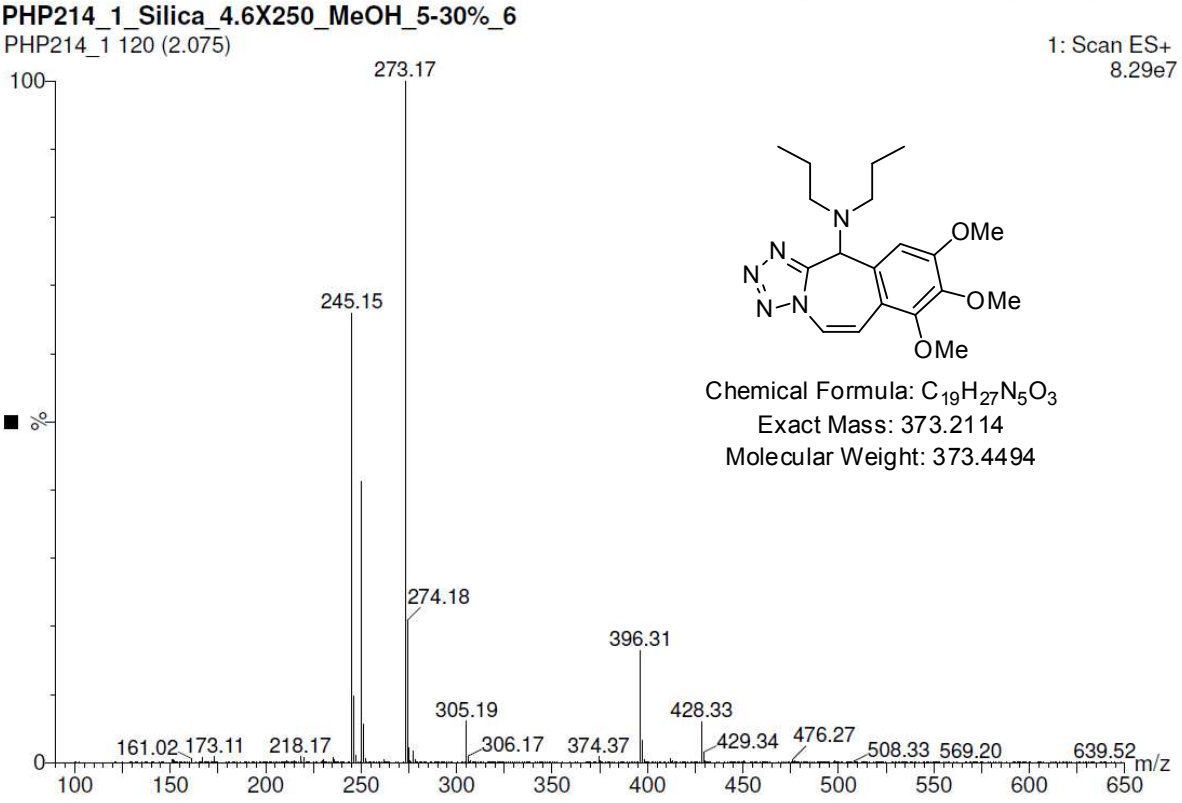

PHP211_1_Silica_4.6X250_MeOH_5-30%_6
PHP211_1 129 (2.240)
2: Scan ES-
1.01e5
100
129.13
436.39
128.63
133.13
171.20
231.11
279.02
291.08
245.42
325.66
367.18
381.97
382.30
437.40
443.08
467.47
494.05
549.99
563.96
624.87
629.11
642.75
643.02
%
0
m/z
100 150 200 250 300 350 400 450 500 550 600 650
N
N
N
N
OMe
OMe
OMe
MeO
OMe
Chemical Formula: C21H35N5O5
Exact Mass: 437,26
Molecular Weight: 437,53

3b: **7,8,9-trimethoxy-N,N-dipropyl-11H-benzo[d]tetrazolo[1,5-a]azepin-11-amine.**



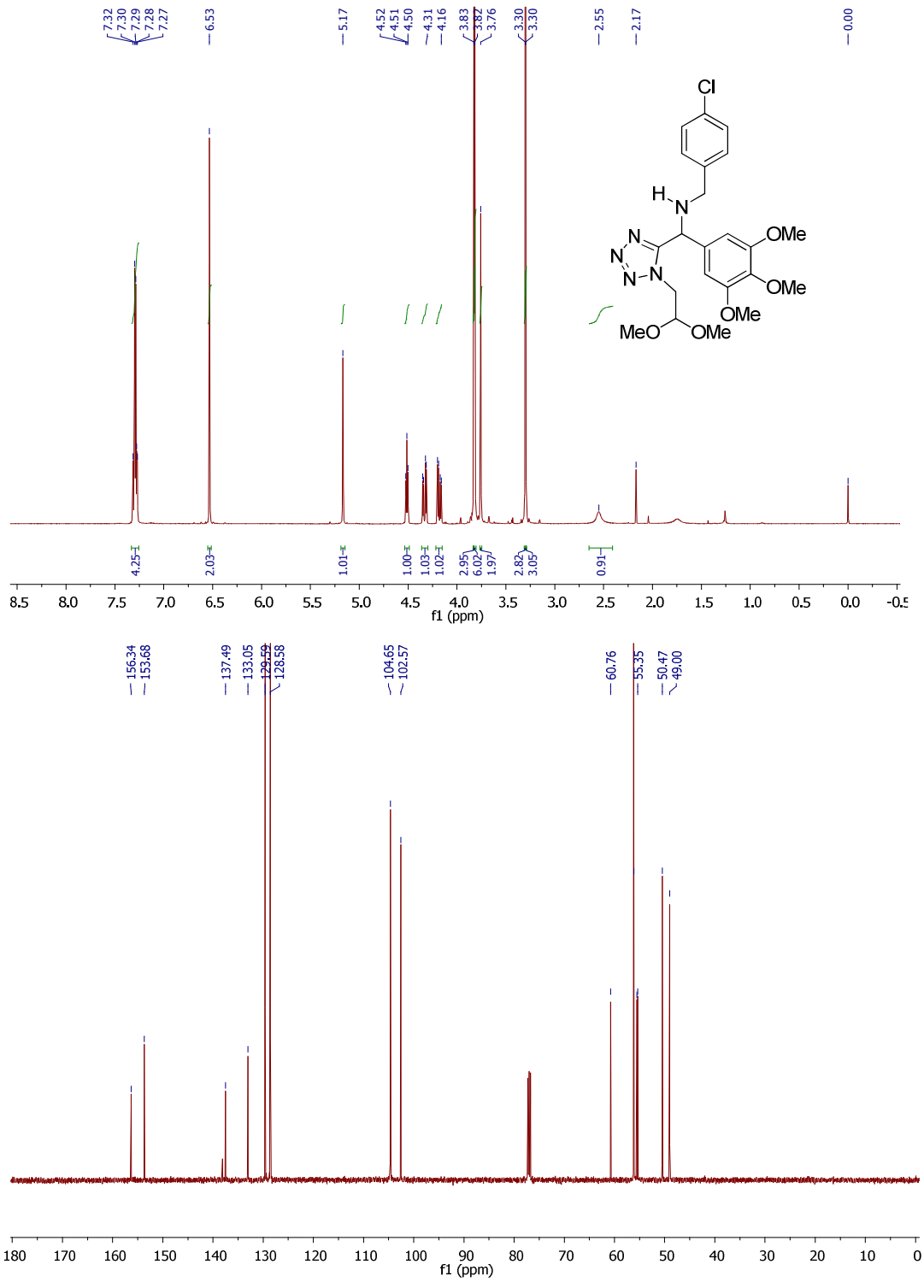




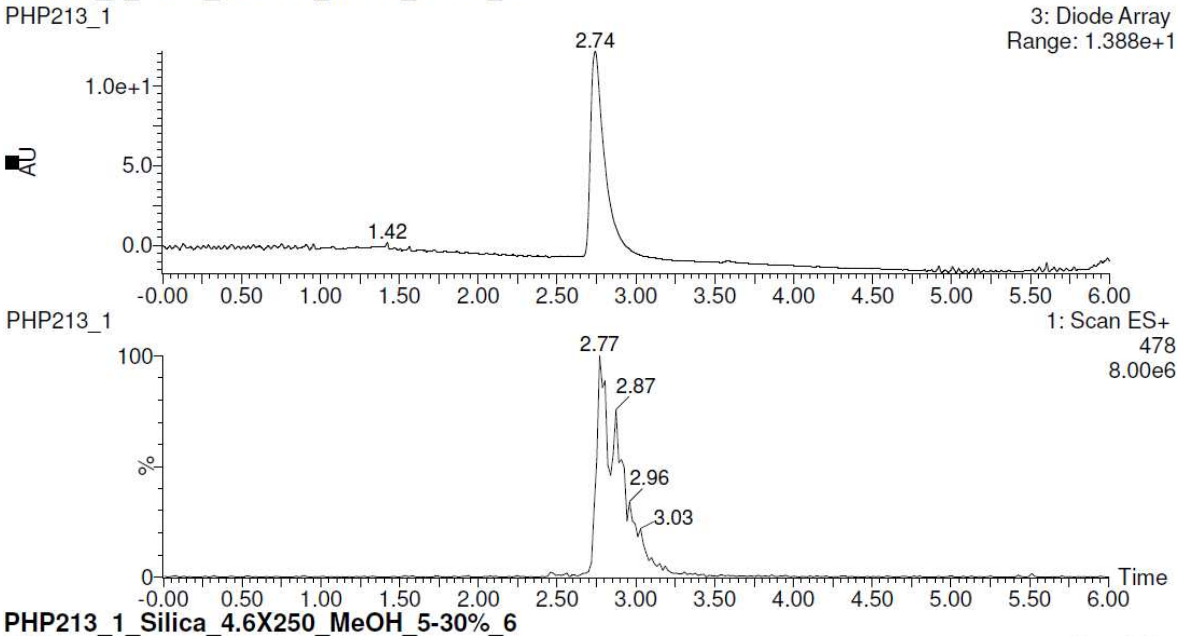


Chemical Formula: $C_{19}H_{27}N_5O_3$
Exact Mass: 373.2114
Molecular Weight: 373.4494

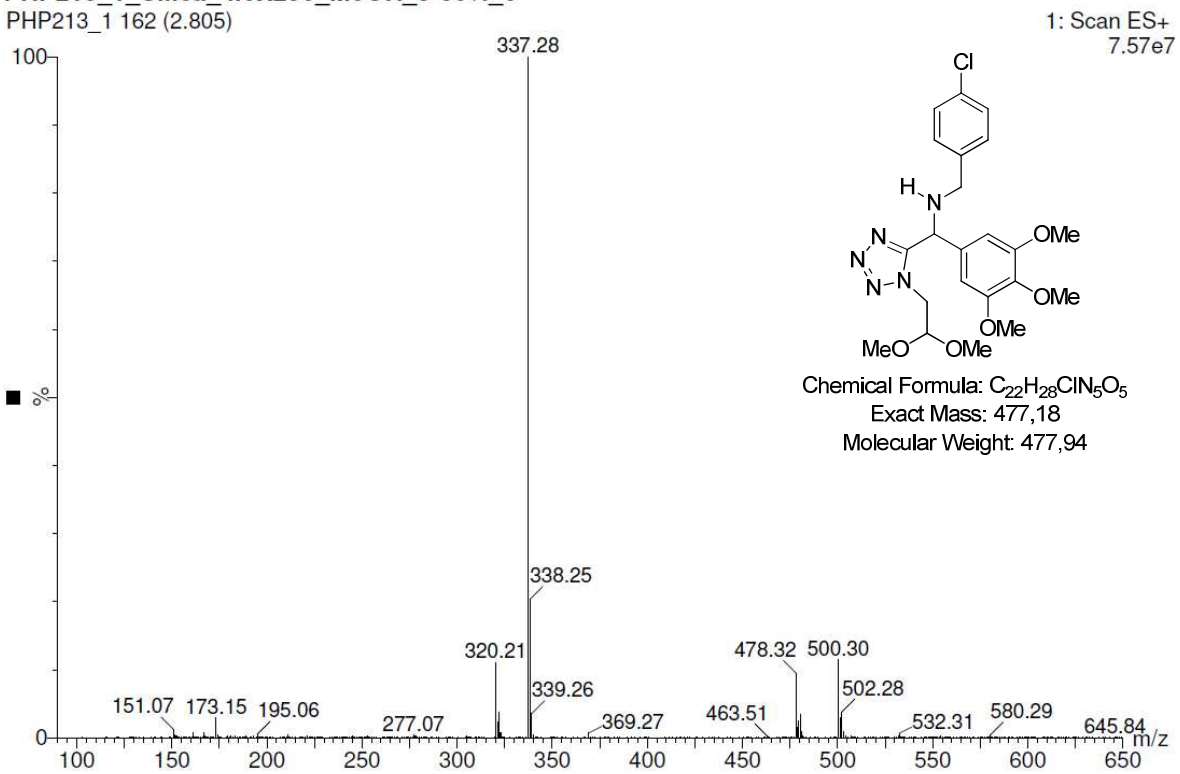
11c: N-(4-chlorobenzyl)-1-(1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)-1-(3,4,5-trimethoxyphenyl)methanamine.



PHP213_1_Silica_4.6X250_MeOH_5-30%_6

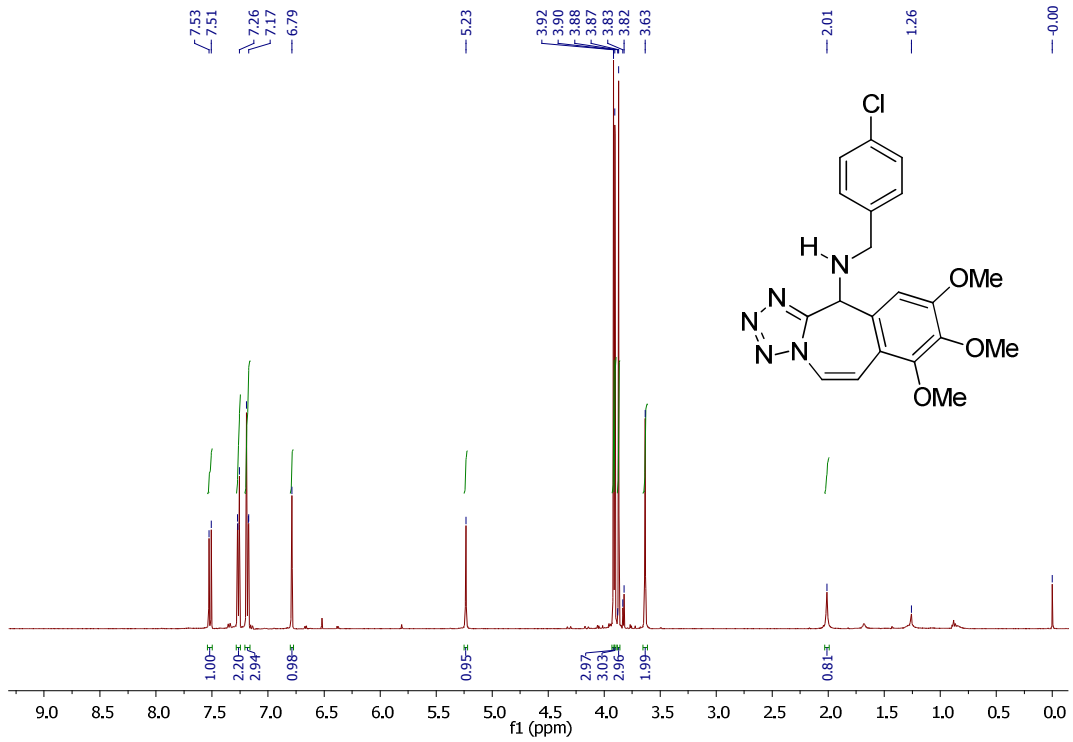


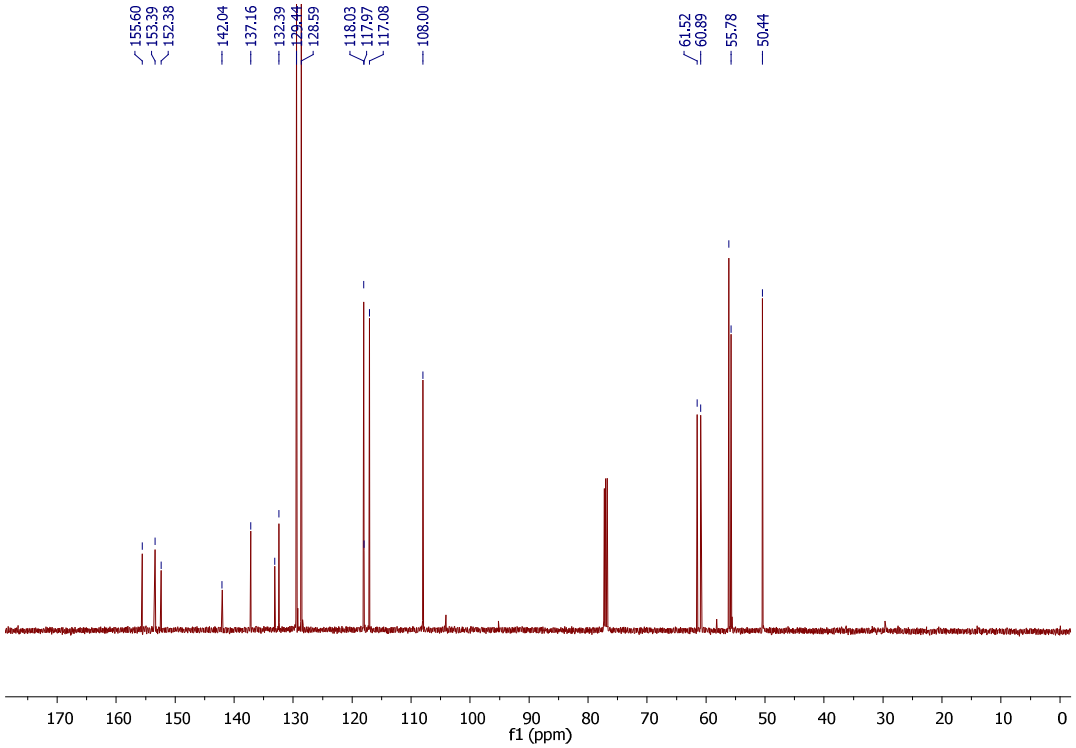
PHP213_1_Silica_4.6X250_MeOH_5-30%_6

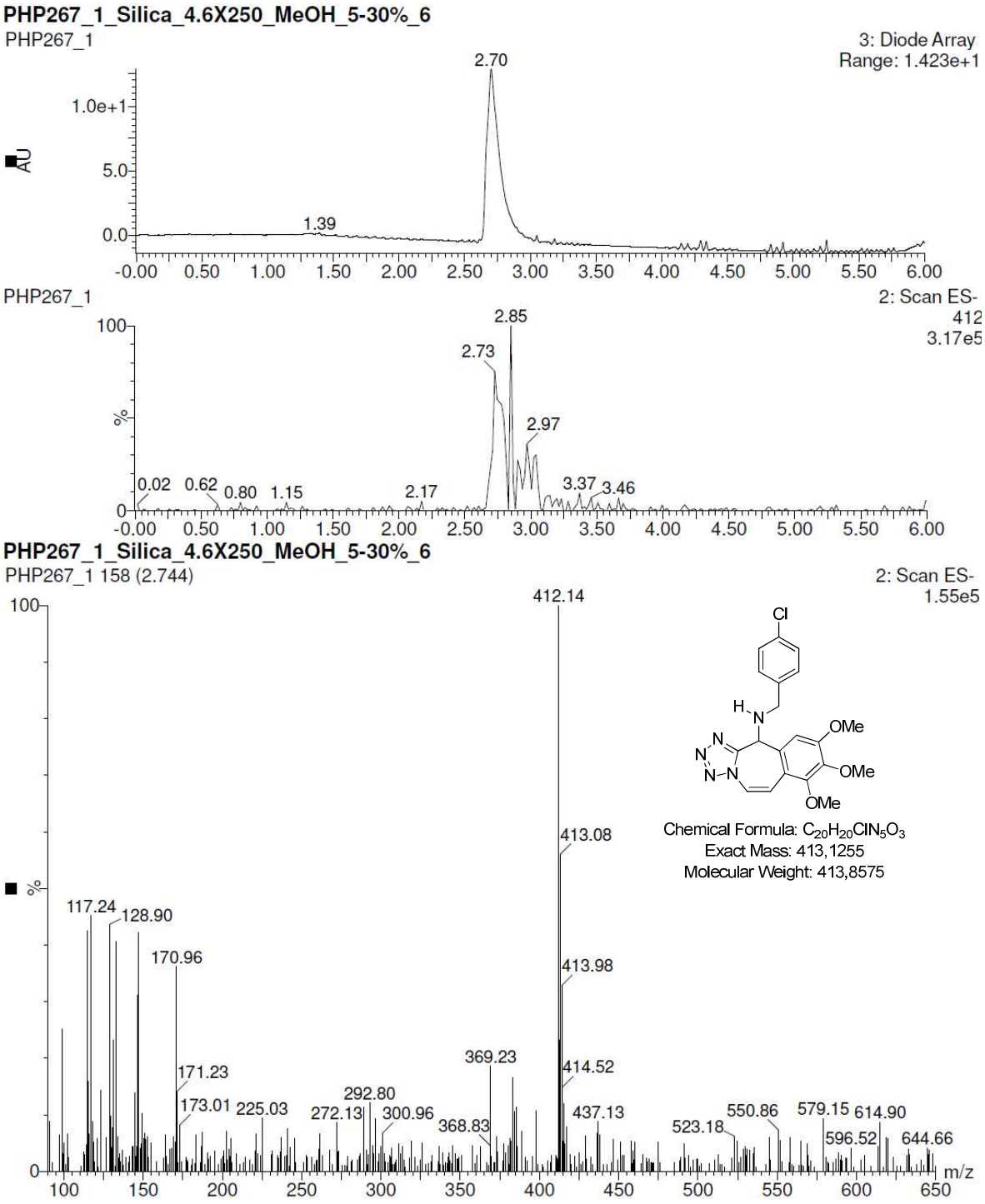


Chemical Formula: $C_{22}H_{28}ClN_5O_5$
Exact Mass: 477,18
Molecular Weight: 477,94

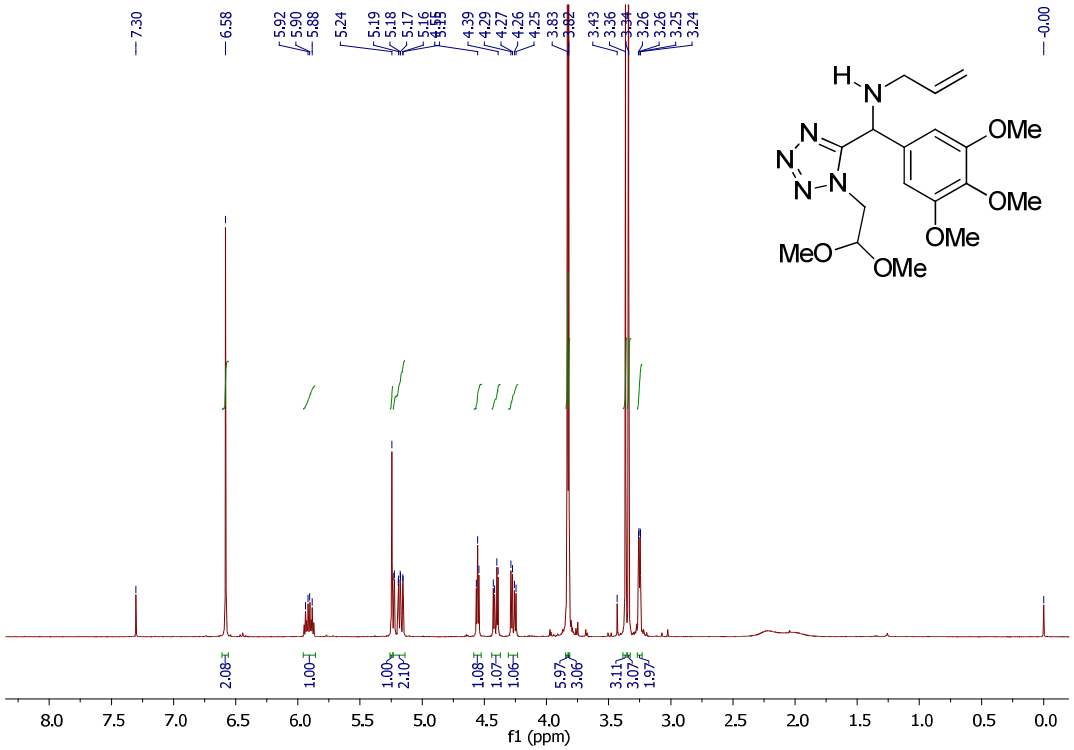
3c: **N-(4-chlorobenzyl)-7,8,9-trimethoxy-11H-benzo[d]tetrazolo[1,5-a]azepin-11-amine.**

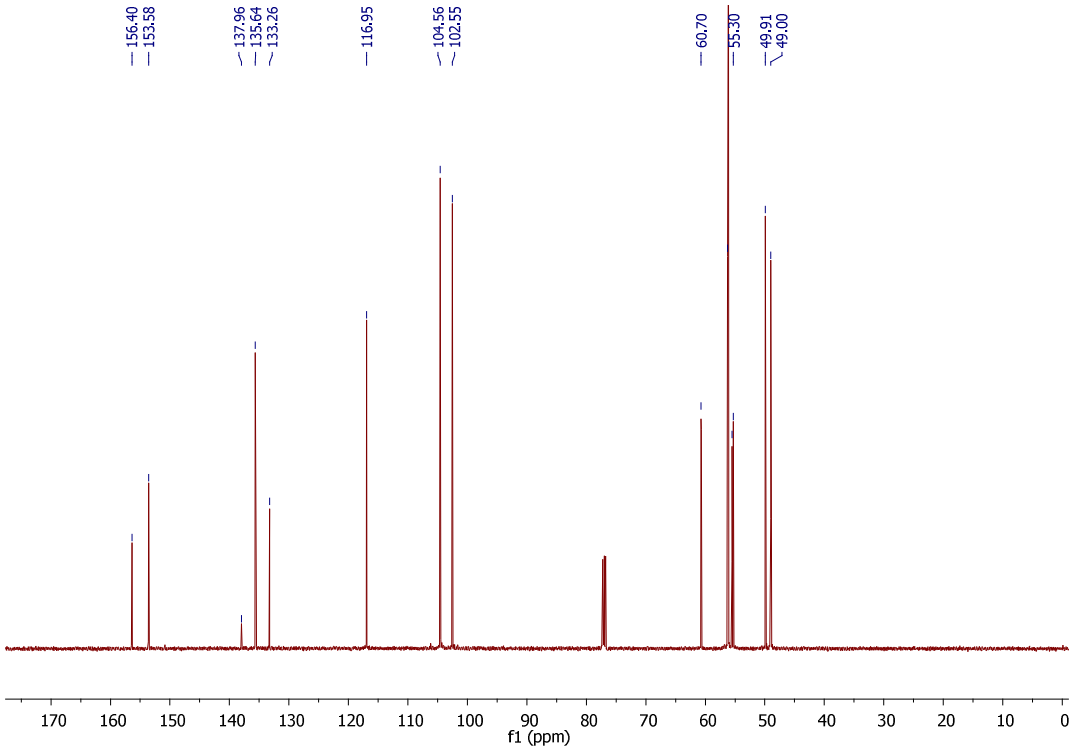


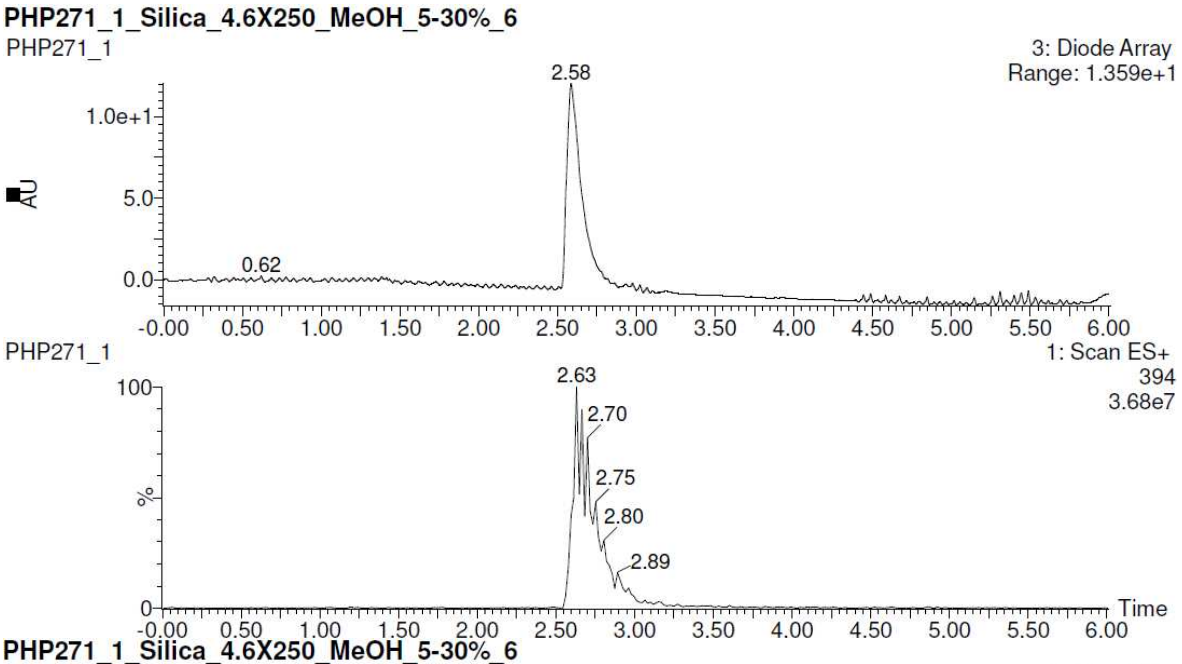


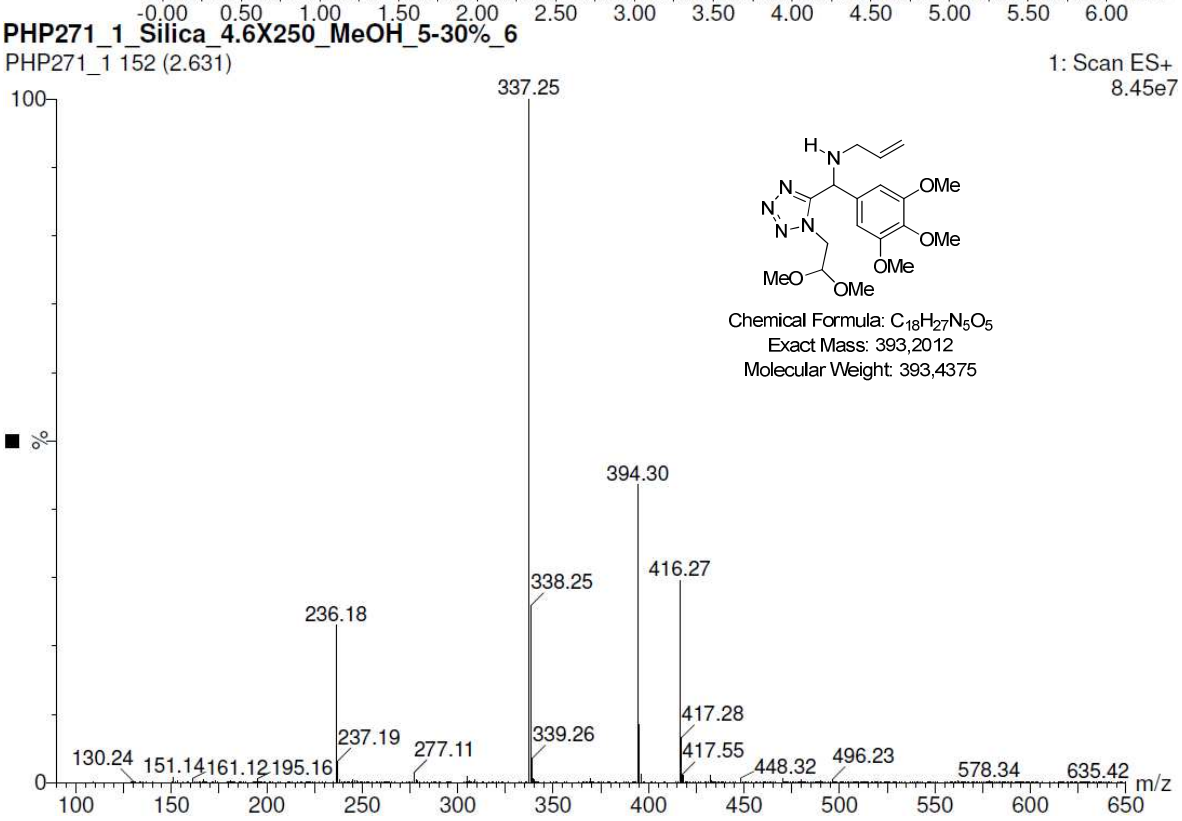

PHP267_1_Silica_4.6X250_MeOH_5-30%_6
PHP267_1
3: Diode Array
Range: 1.423e+1
2.70
1.39
AU
PHP267_1
2: Scan ES-
412
3.17e5
2.85
2.73
2.97
3.37
3.46
0.02
0.62
0.80
1.15
2.17
%
PHP267_1_Silica_4.6X250_MeOH_5-30%_6
PHP267_1 158 (2.744)
2: Scan ES-
1.55e5
412.14
413.08
413.98
414.52
117.24
128.90
170.96
171.23
173.01
225.03
272.13
292.80
300.96
368.83
369.23
437.13
523.18
550.86
579.15
596.52
614.90
644.66
m/z
Cl
OMe
OMe
OMe
Chemical Formula: C20H20ClN5O3
Exact Mass: 413,1255
Molecular Weight: 413,8575

11d: N-((1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)(3,4,5-trimethoxyphenyl)methyl) prop-2-en-1-
amine.

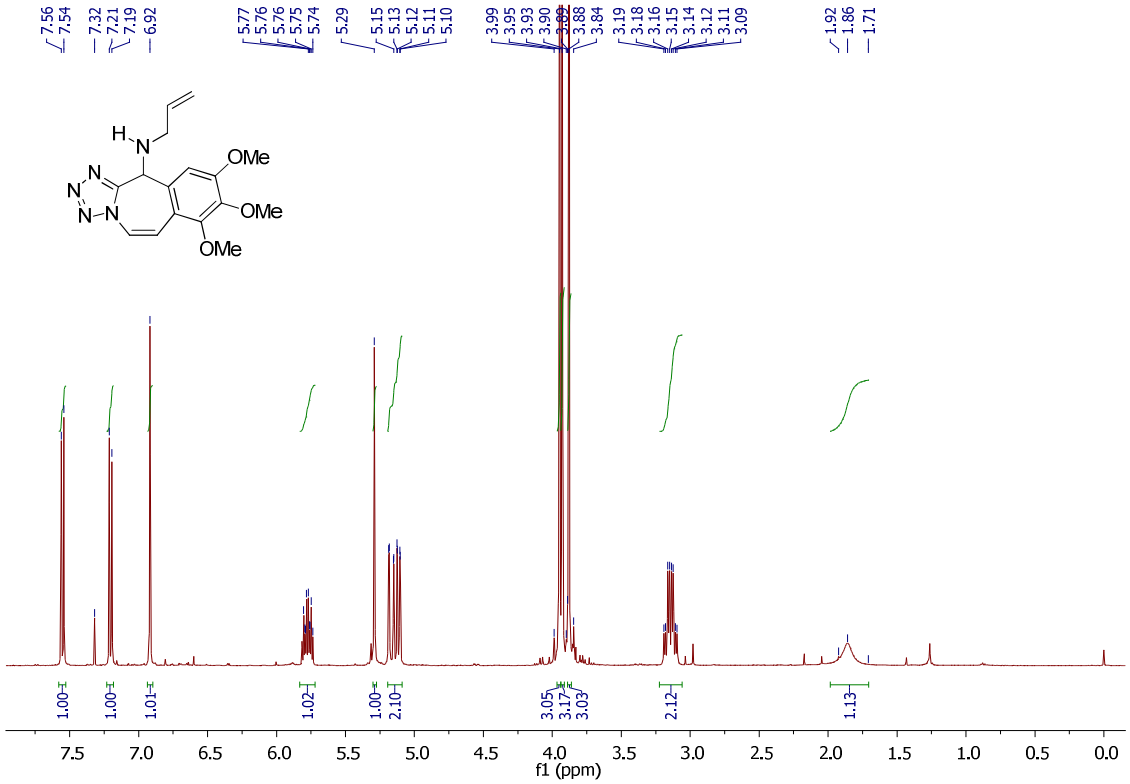


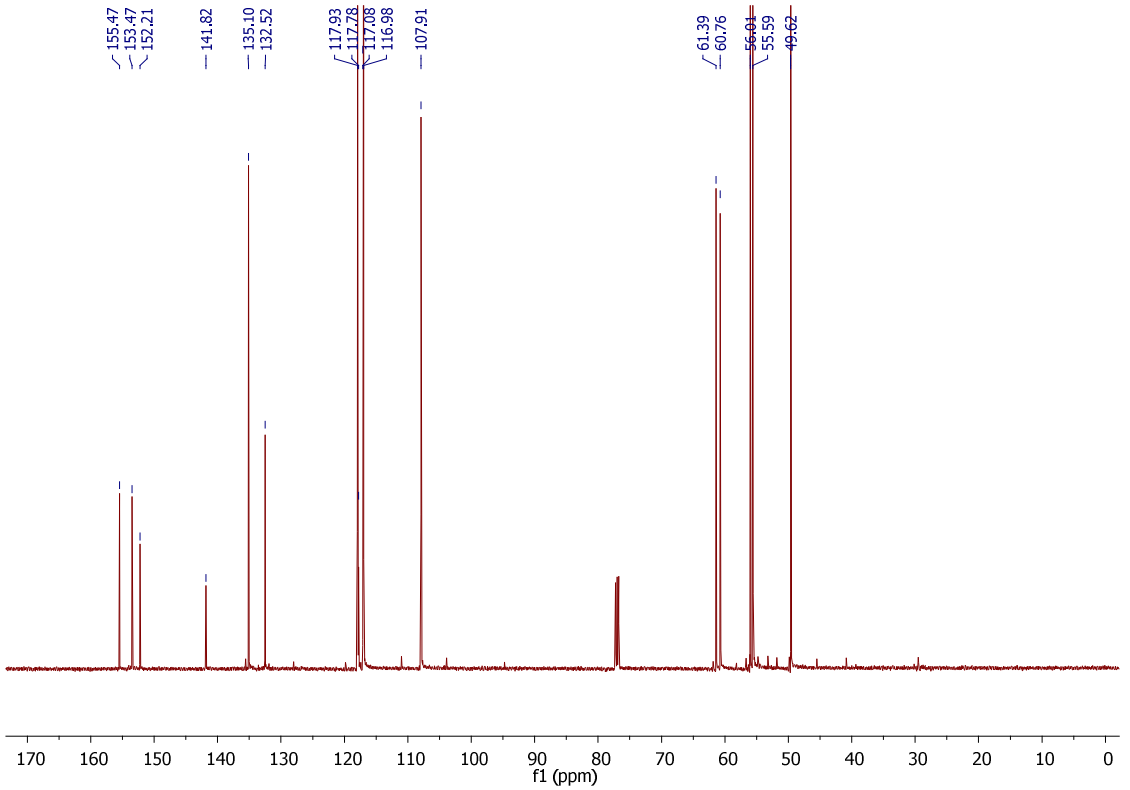



PHP271_1_Silica_4.6X250_MeOH_5-30%_6
PHP271_1
3: Diode Array
Range: 1.359e+1
2.58
1.0e+1
5.0
0.0
AU
0.62
-0.00 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 6.00
PHP271_1
1: Scan ES+
394
3.68e7
100
%
0
2.63
2.70
2.75
2.80
2.89
Time
-0.00 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 6.00

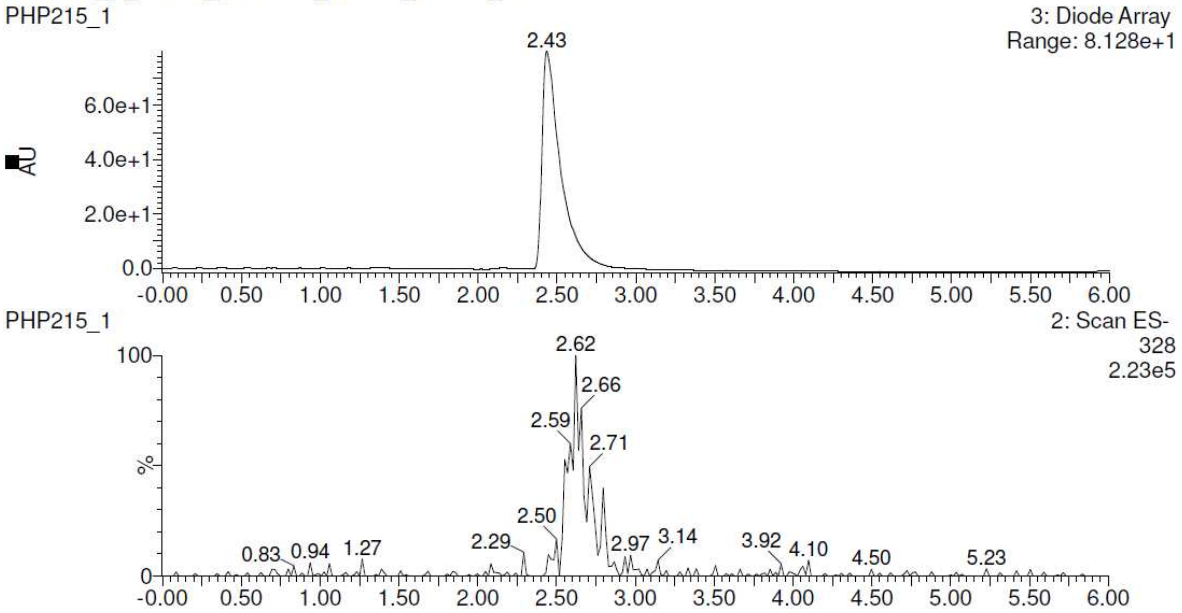

PHP271_1_Silica_4.6X250_MeOH_5-30%_6
PHP271_1 152 (2.631)
1: Scan ES+
8.45e7
100
%
0
337.25
394.30
416.27
338.25
236.18
417.28
417.55
237.19
339.26
277.11
130.24
151.14
161.12
195.16
448.32
496.23
578.34
635.42
m/z
100 150 200 250 300 350 400 450 500 550 600 650
OMe
OMe
OMe
MeO
OMe
Chemical Formula: C18H27N5O5
Exact Mass: 393,2012
Molecular Weight: 393,4375

3d: N-allyl-7,8,9-trimethoxy-11H-benzo[d]tetrazolo[1,5-a]azepin-11-amine.

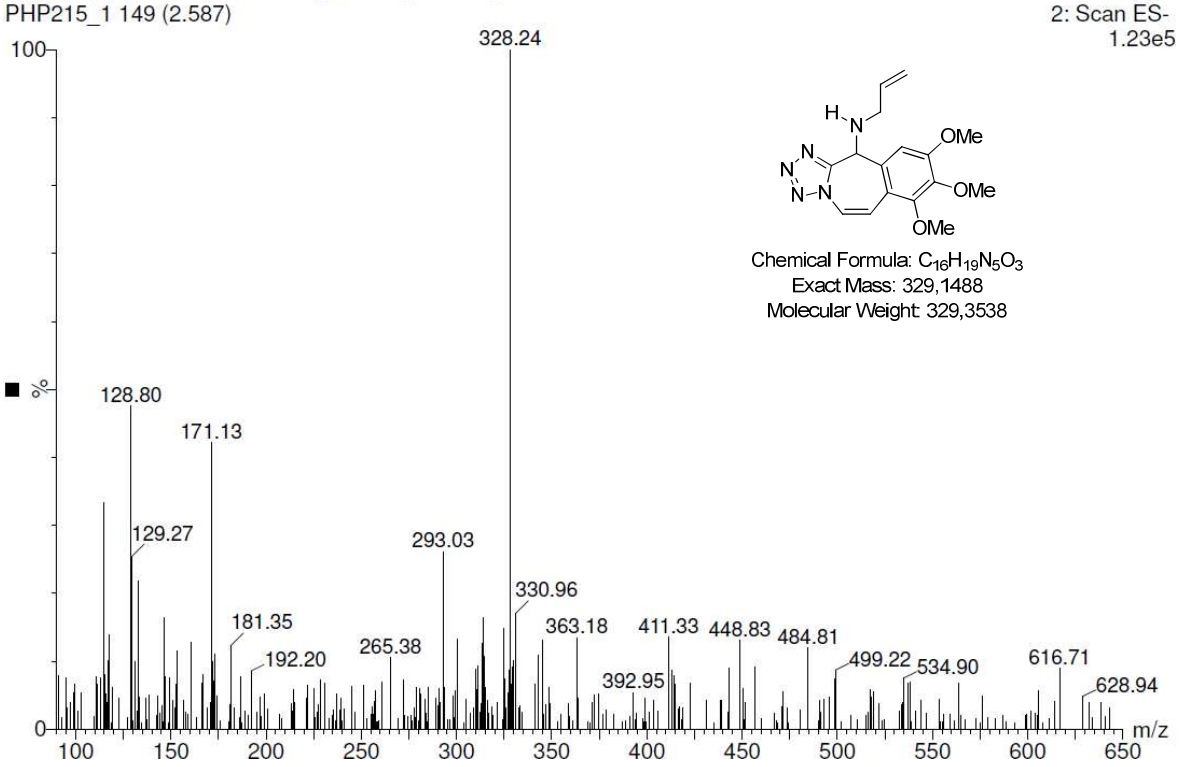




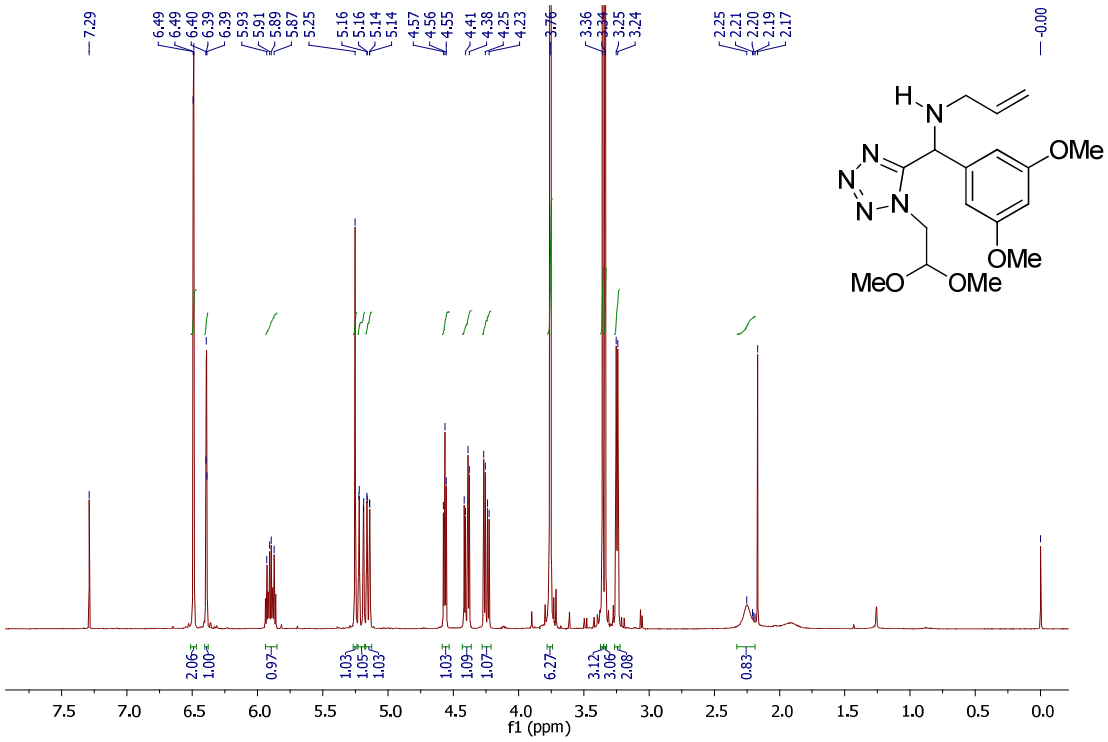
PHP215_1_Silica_4.6X250_MeOH_5-30%_6

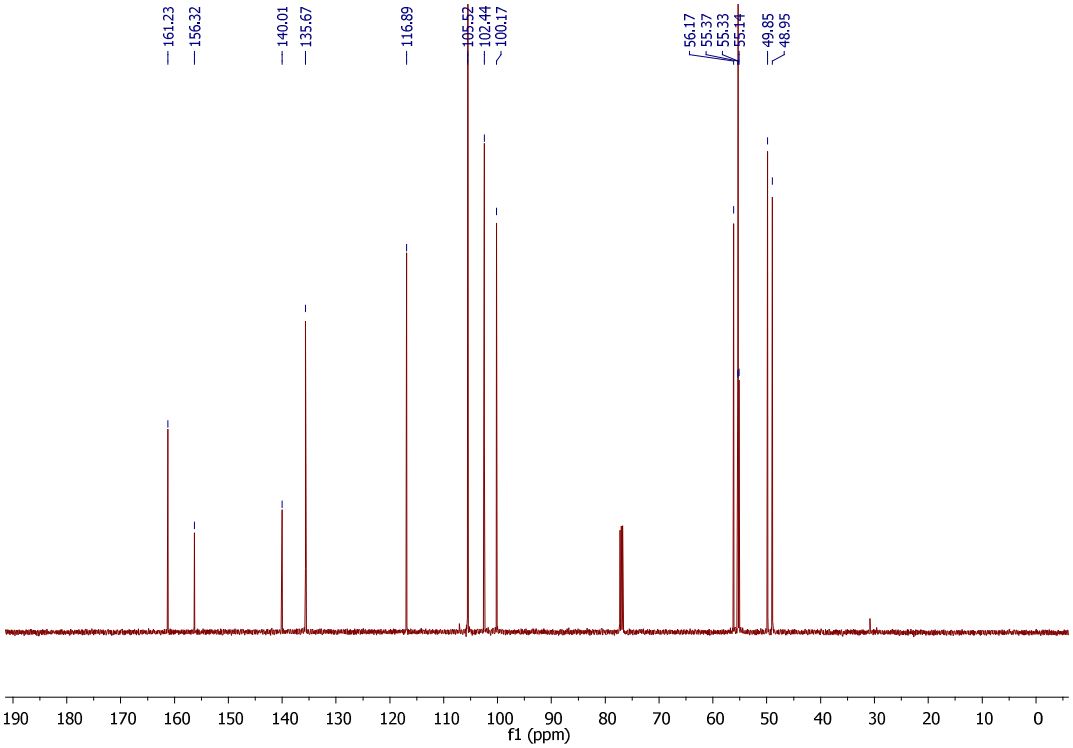


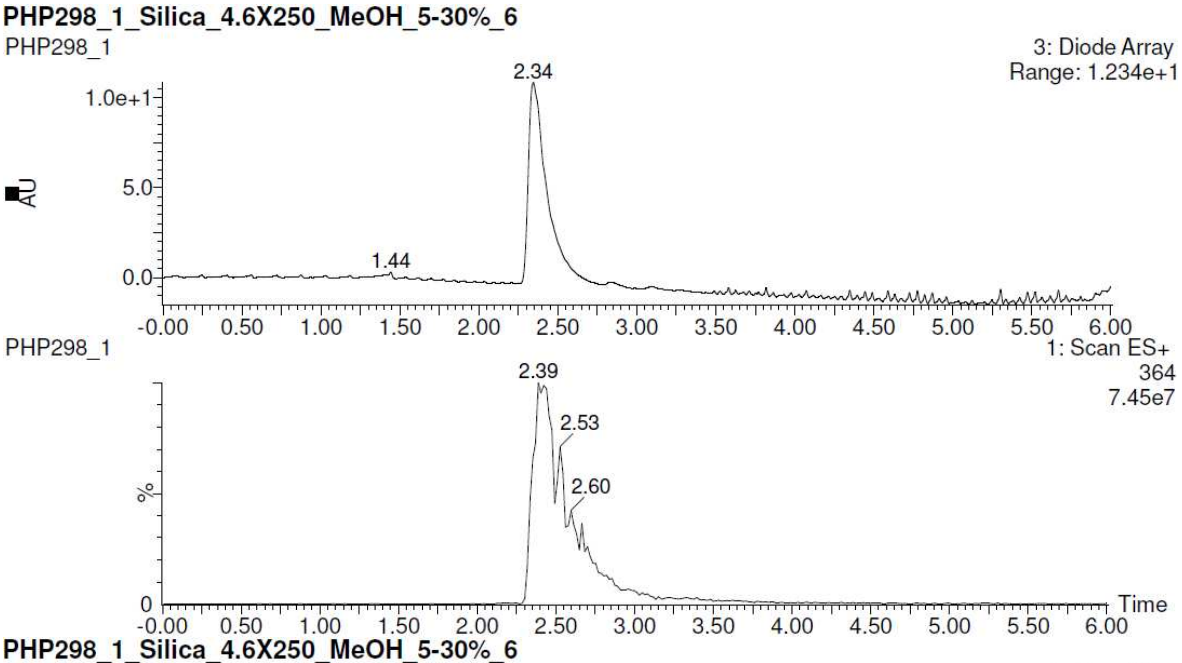
PHP215_1_Silica_4.6X250_MeOH_5-30%_6

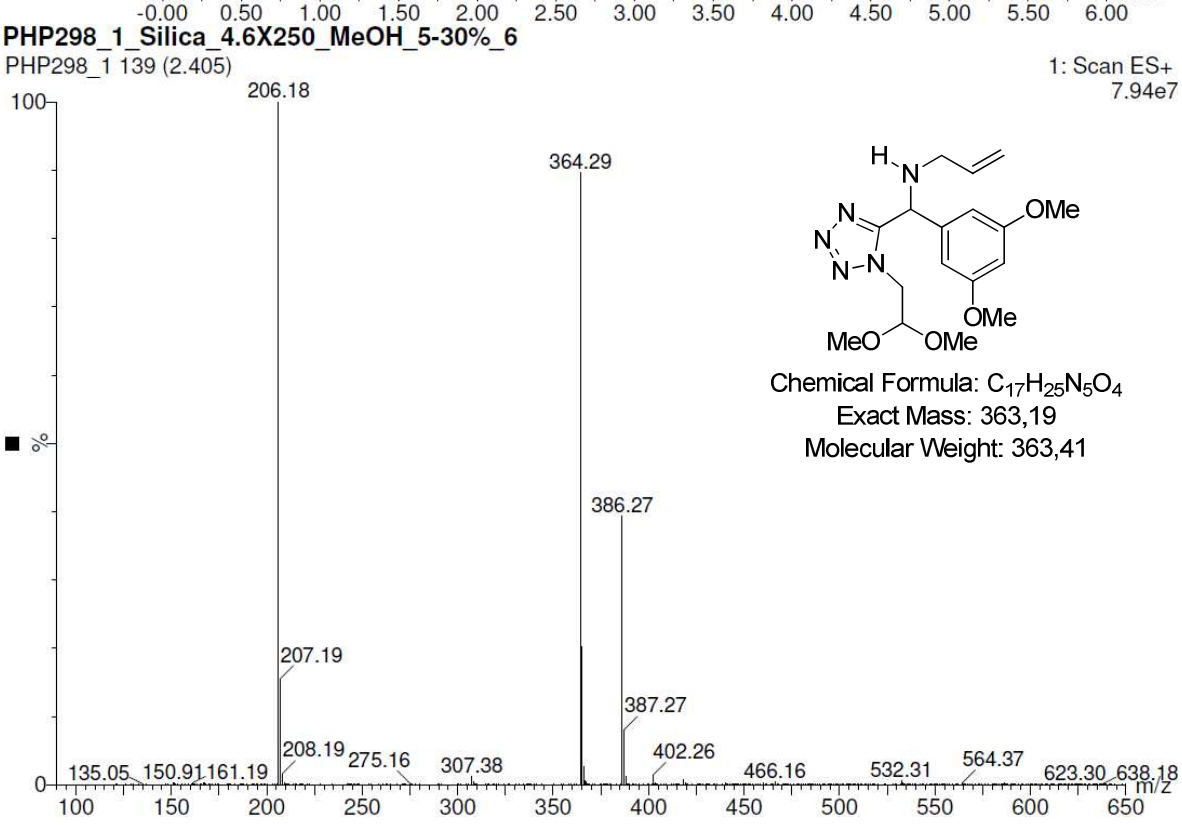


11e: N-((1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)(3,5-dimethoxyphenyl)methyl)prop-2-en-1-amine.

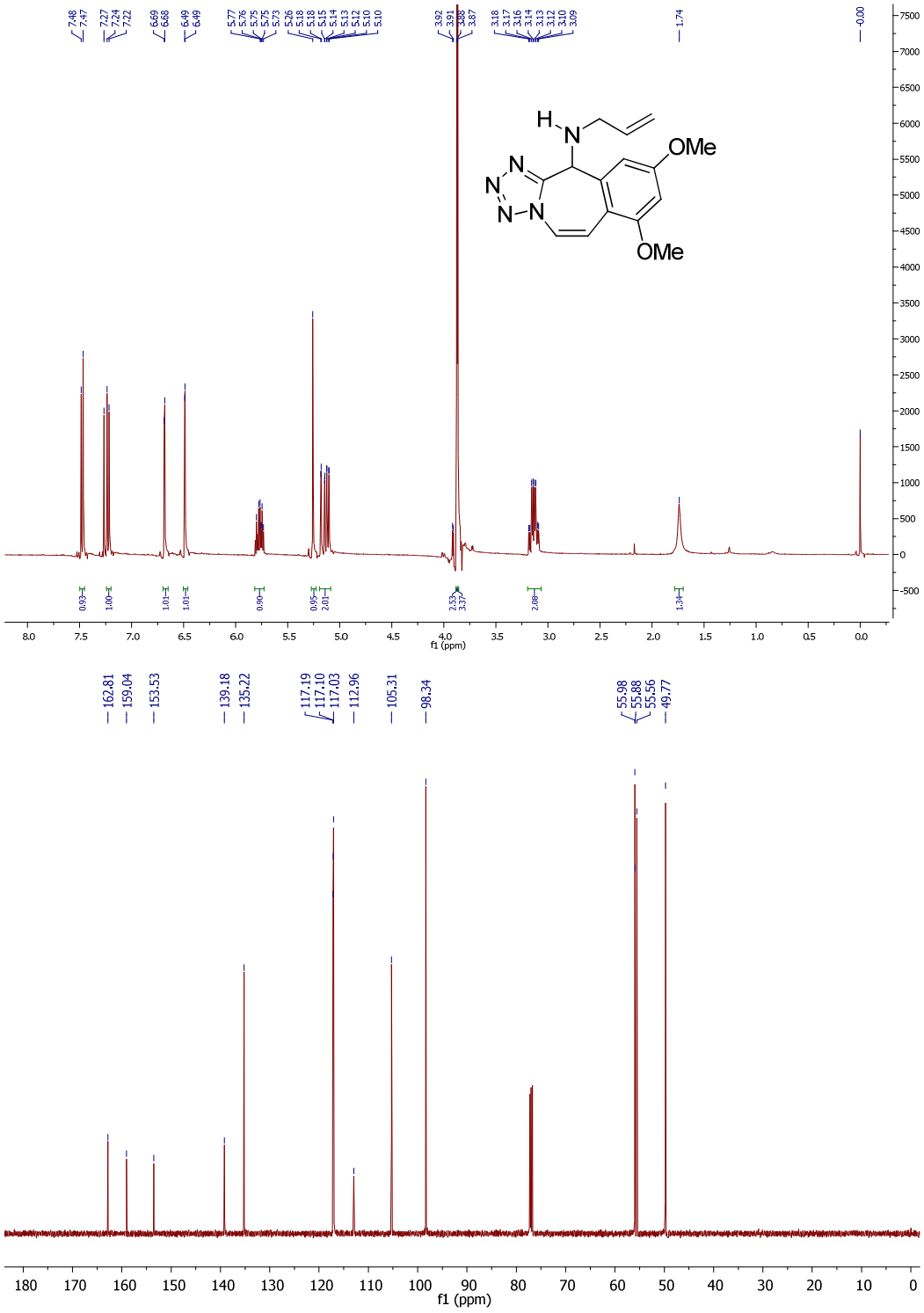


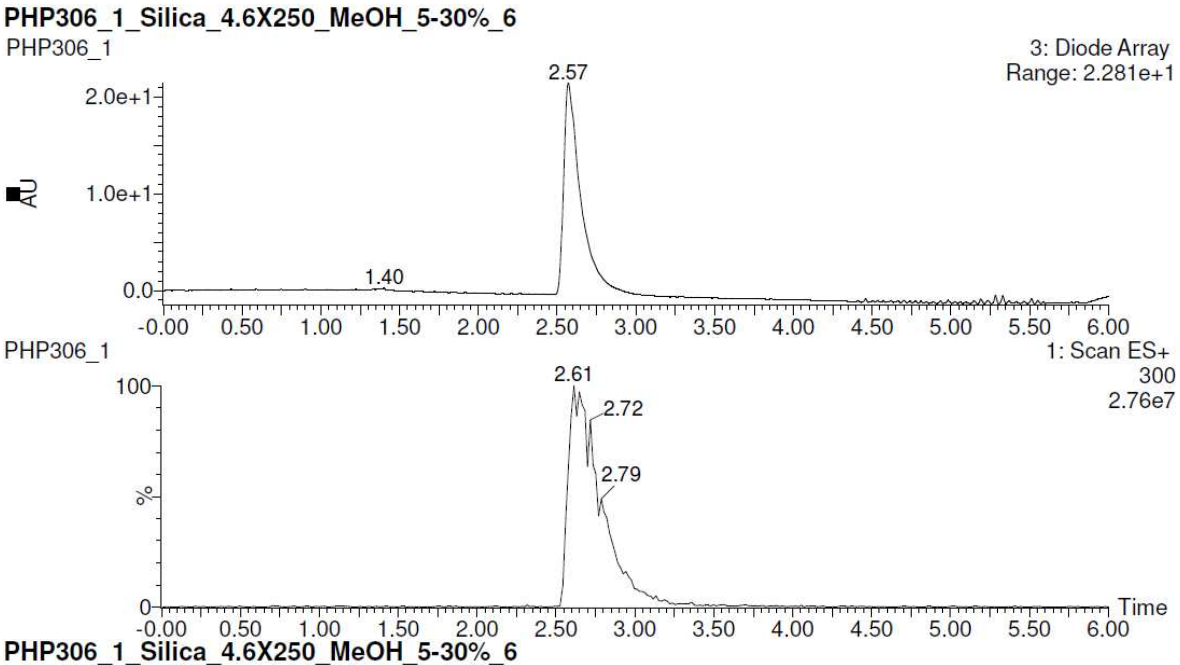


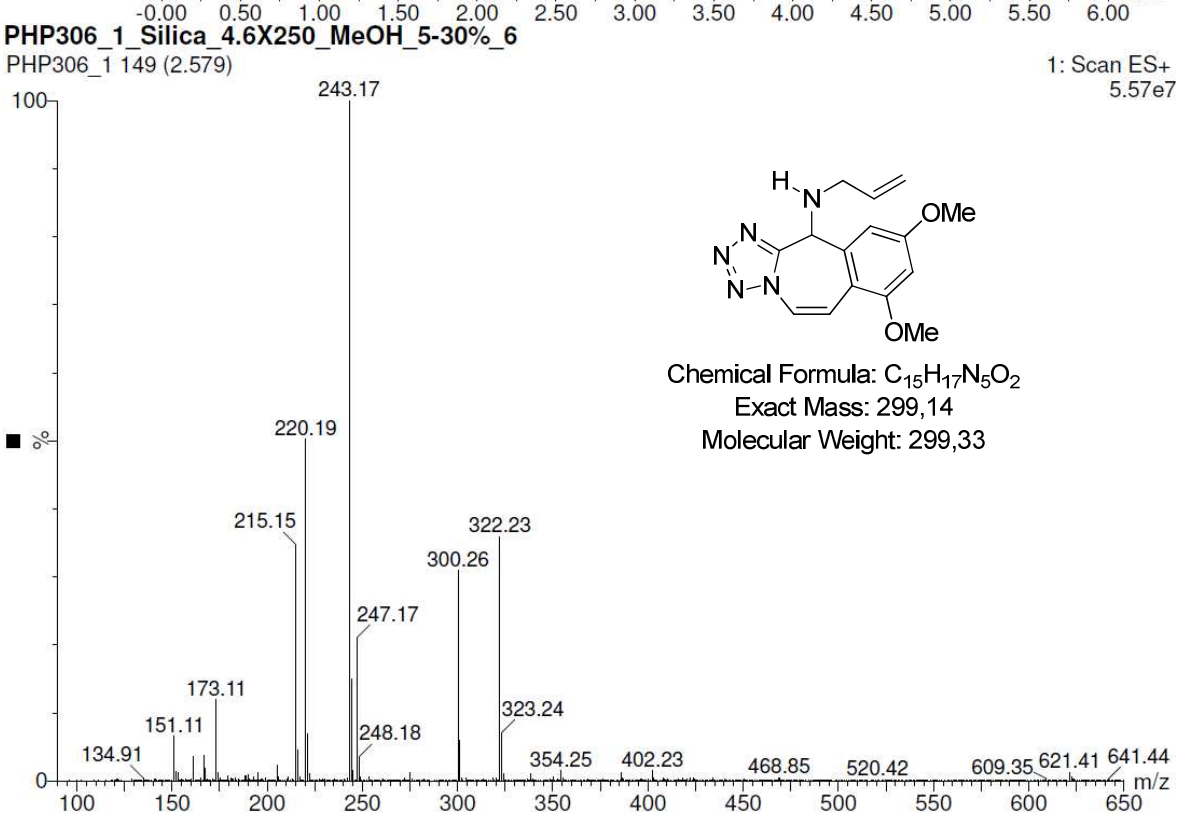

PHP298_1_Silica_4.6X250_MeOH_5-30%_6
PHP298_1
3: Diode Array
Range: 1.234e+1
2.34
1.44
AU
PHP298_1
1: Scan ES+
364
7.45e7
2.39
2.53
2.60
%
Time


PHP298_1_Silica_4.6X250_MeOH_5-30%_6
PHP298_1 139 (2.405)
1: Scan ES+
7.94e7
206.18
364.29
386.27
207.19
387.27
208.19
275.16
307.38
402.26
466.16
532.31
564.37
623.30
638.18
135.05
150.91
161.19
%
m/z
Chemical Formula: C17H25N5O4
Exact Mass: 363,19
Molecular Weight: 363,41

3e: N-allyl-7,9-dimethoxy-11H-benzo[d]tetrazolo[1,5-a]azepin-11-amine.

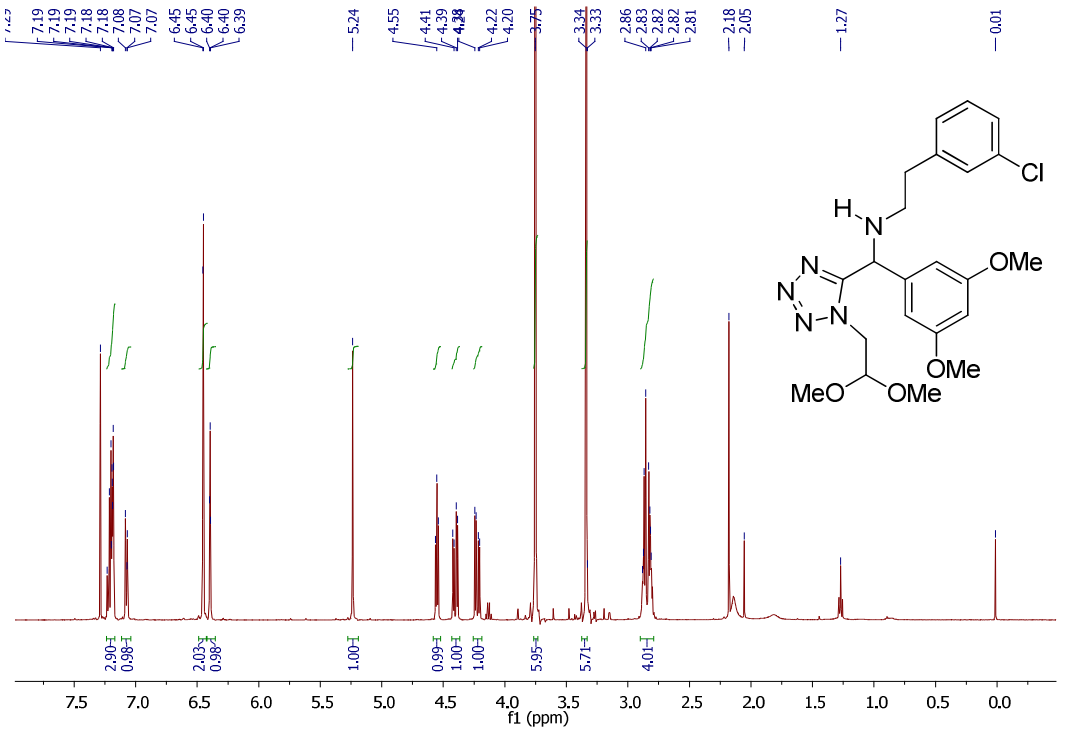


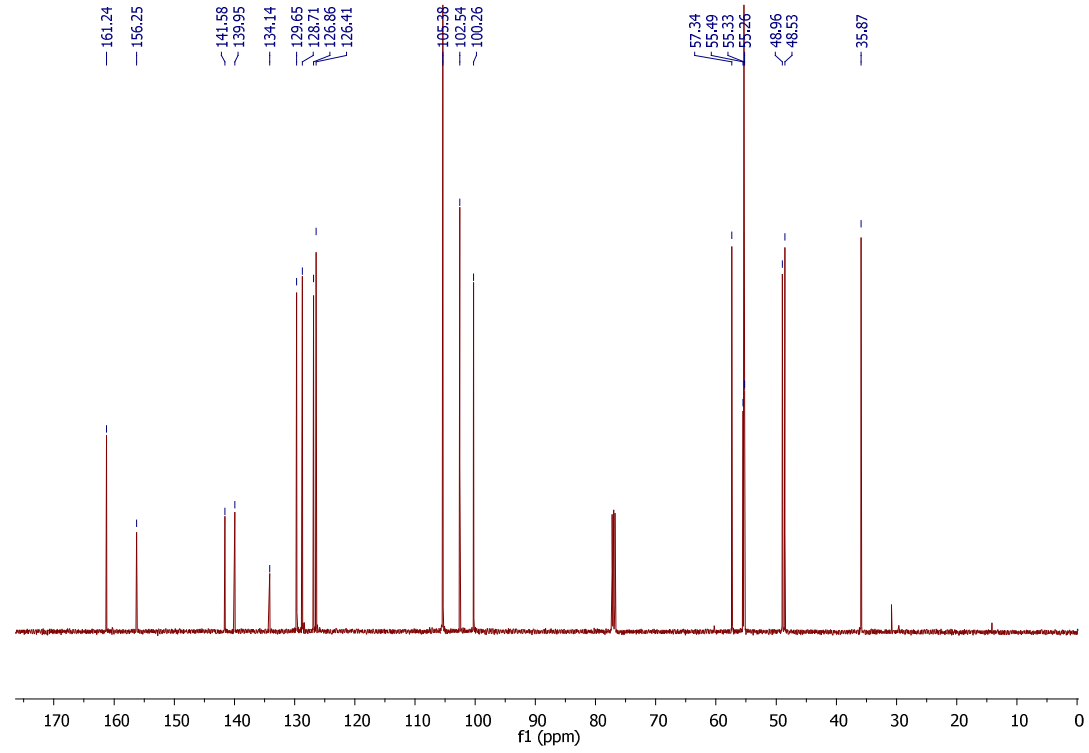


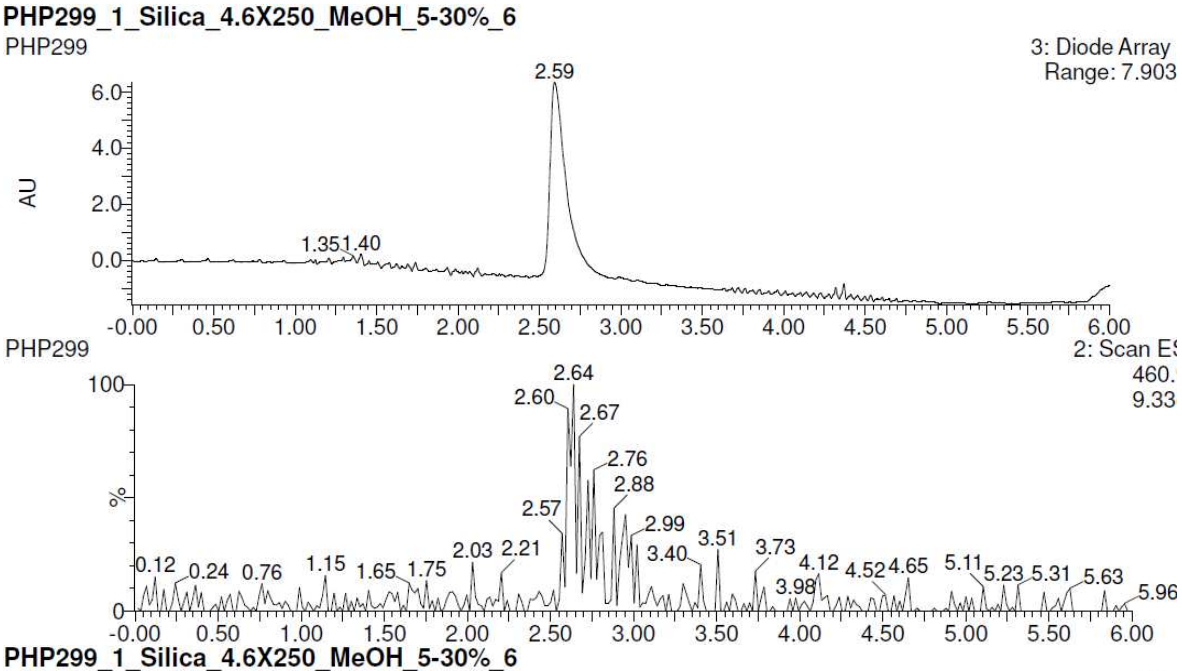


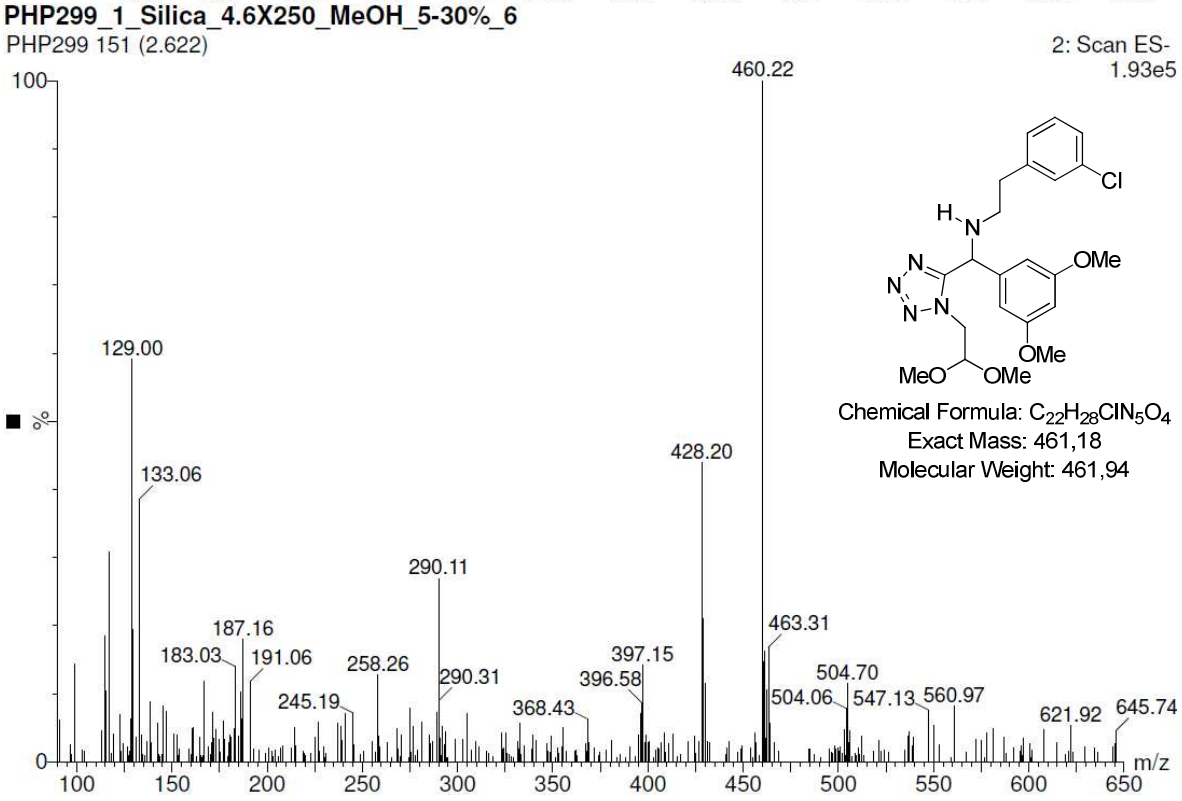
Chemical Formula: $C_{15}H_{17}N_5O_2$
Exact Mass: 299,14
Molecular Weight: 299,33

11f: 2-(3-chlorophenyl)-N-((1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)(3,5-dimethoxyphenyl)methyl)ethanamine.

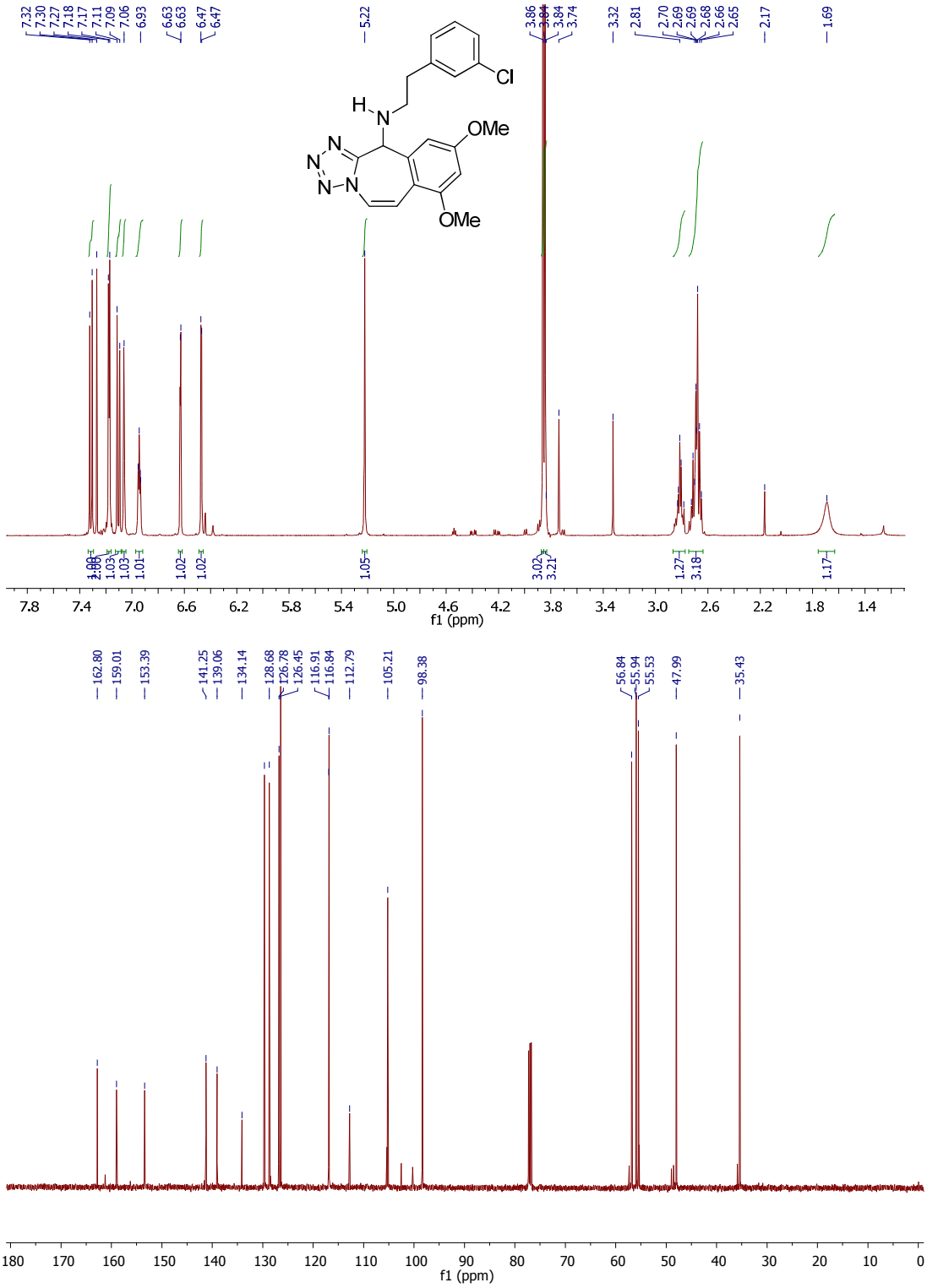


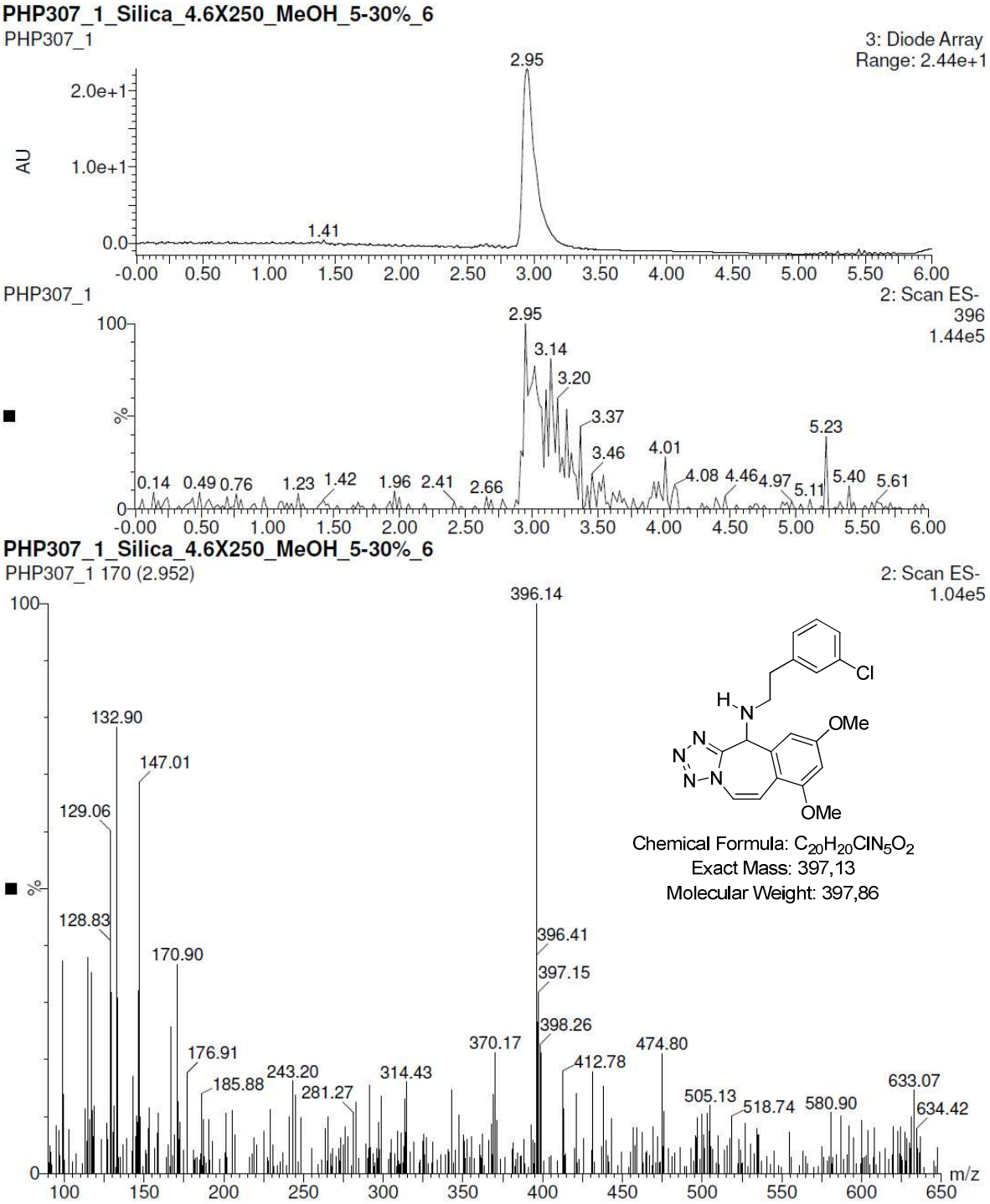



PHP299_1_Silica_4.6X250_MeOH_5-30%_6
PHP299
3: Diode Array
Range: 7.903
AU
2.59
1.35
1.40
PHP299
2: Scan ES
460.
9.33
%
2.64
2.60
2.67
2.76
2.88
2.57
2.99
3.40
3.51
3.73
4.12
4.52
4.65
5.11
5.23
5.31
5.63
5.96
0.12
0.24
0.76
1.15
1.65
1.75
2.03
2.21
3.98

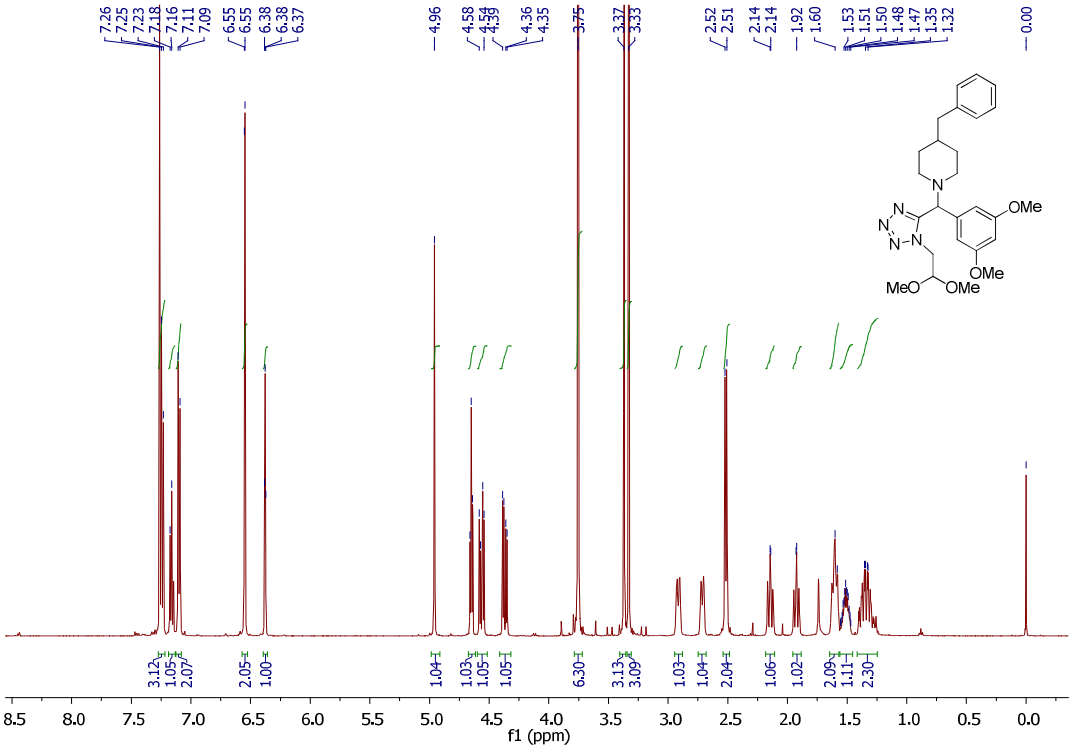

PHP299_1_Silica_4.6X250_MeOH_5-30%_6
PHP299 151 (2.622)
2: Scan ES-
1.93e5
460.22
129.00
133.06
428.20
290.11
187.16
183.03
191.06
258.26
290.31
245.19
368.43
397.15
396.58
463.31
504.70
504.06
547.13
560.97
621.92
645.74
m/z
Cl
H
N
OMe
OMe
MeO
OMe
Chemical Formula: C22H28ClN5O4
Exact Mass: 461,18
Molecular Weight: 461,94

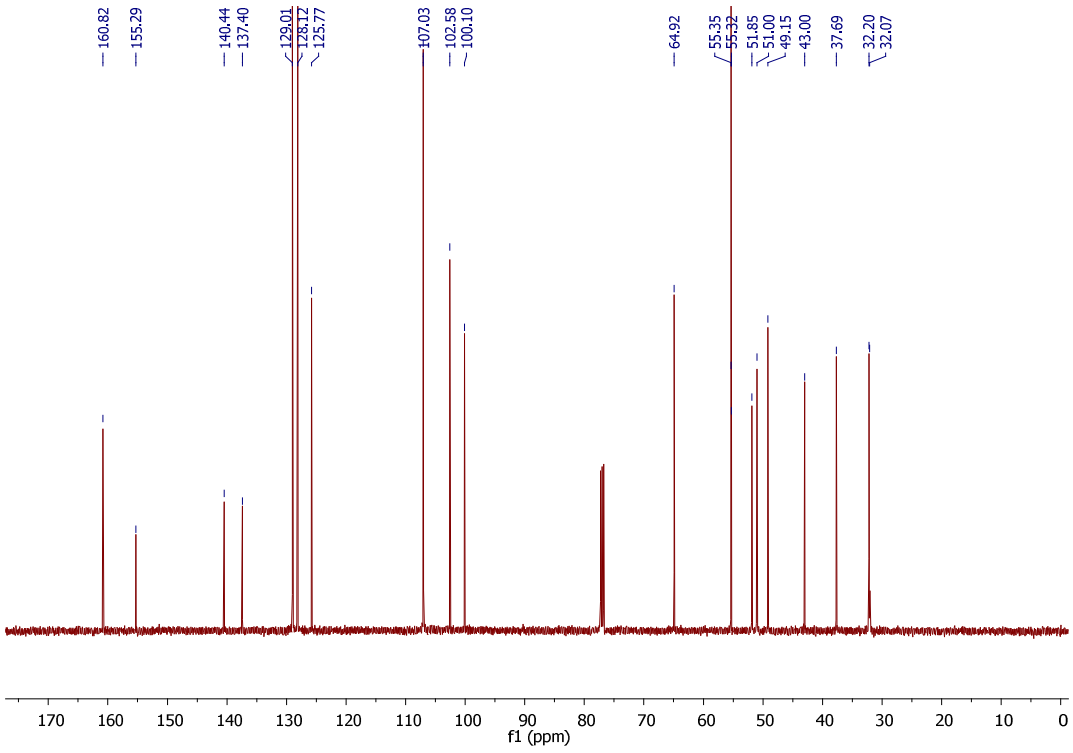
3f: N-(3-chlorophenethyl)-7,9-dimethoxy-11H-benzo[d]tetrazolo[1,5-a]azepin-11-amine.

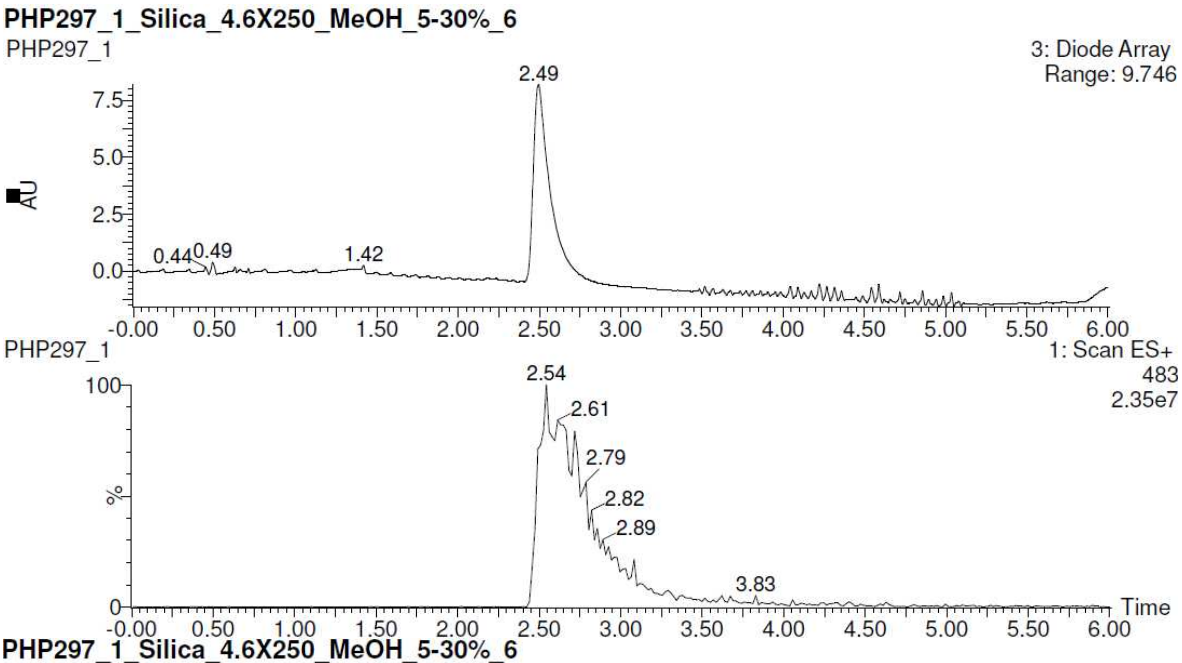


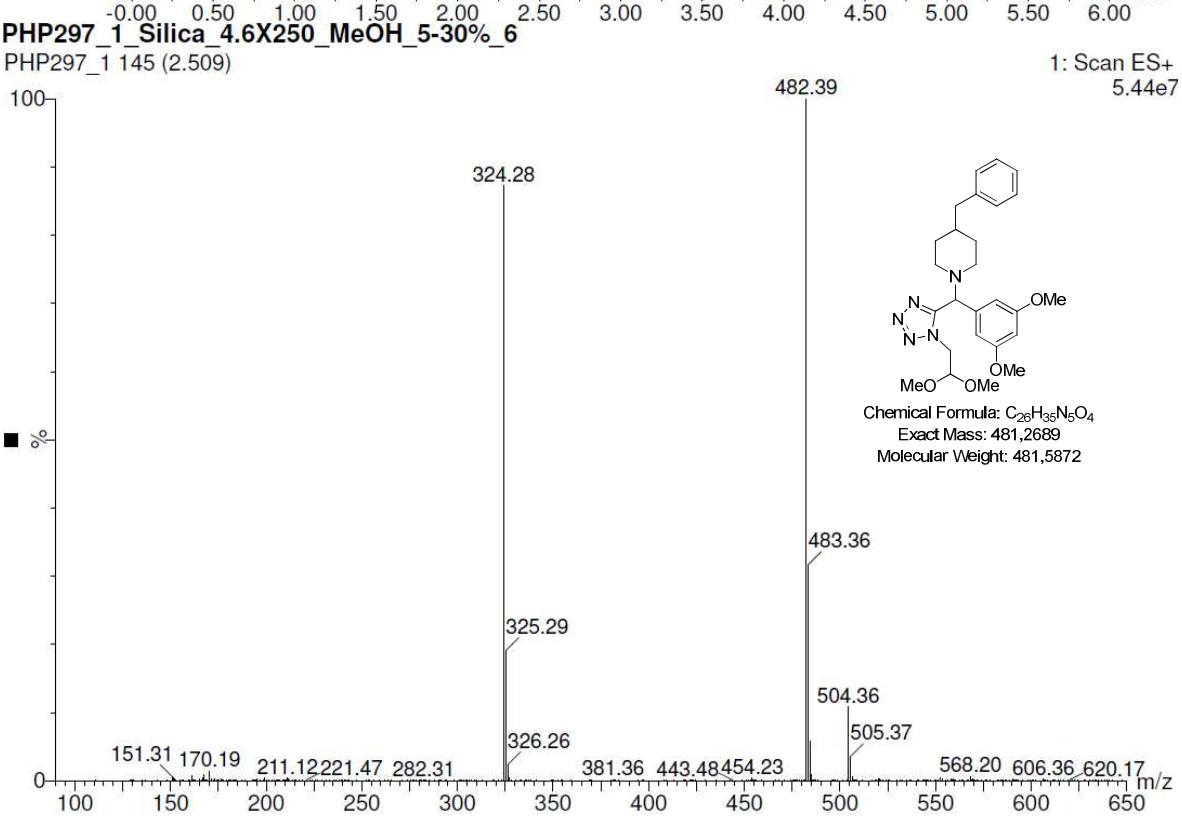

PHP307_1_Silica_4.6X250_MeOH_5-30%_6
PHP307_1
3: Diode Array
Range: 2.44e+1
AU
2.95
1.41
PHP307_1
2: Scan ES-
396
1.44e5
%
2.95
3.14
3.20
3.37
3.46
4.01
5.23
0.14 0.49 0.76 1.23 1.42 1.96 2.41 2.66 4.08 4.46 4.97 5.11 5.40 5.61
PHP307_1_Silica_4.6X250_MeOH_5-30%_6
PHP307_1 170 (2.952)
2: Scan ES-
1.04e5
396.14
132.90
147.01
129.06
128.83
170.90
396.41
397.15
398.26
370.17
176.91
185.88
243.20
281.27
314.43
412.78
474.80
505.13
518.74
580.90
633.07
634.42
m/z
Cl
H
N
OMe
OMe
Chemical Formula: C20H20ClN5O2
Exact Mass: 397,13
Molecular Weight: 397,86

11g: 4-benzyl-1-((1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)(3,5-dimethoxyphenyl) methyl)piperidine.

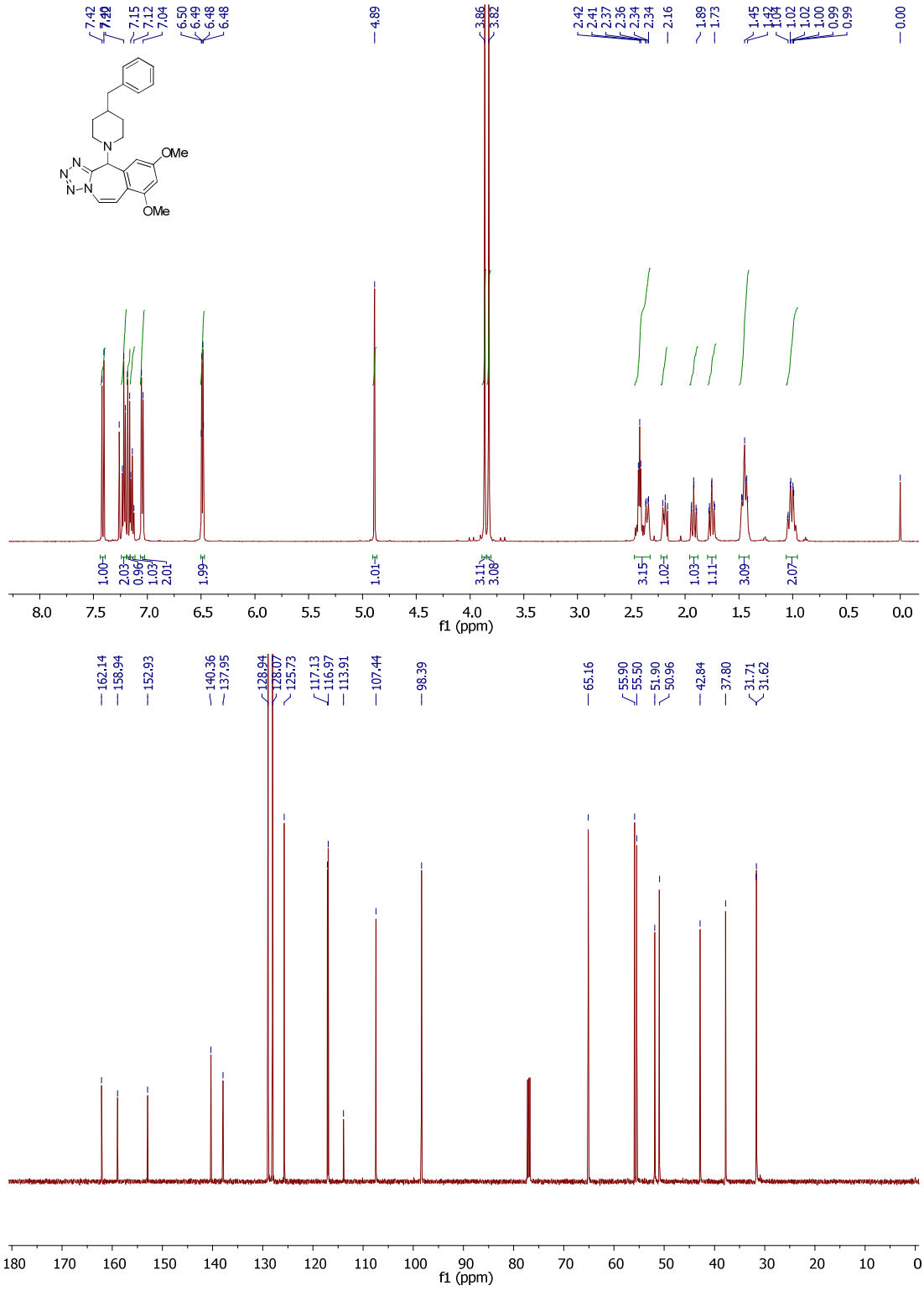


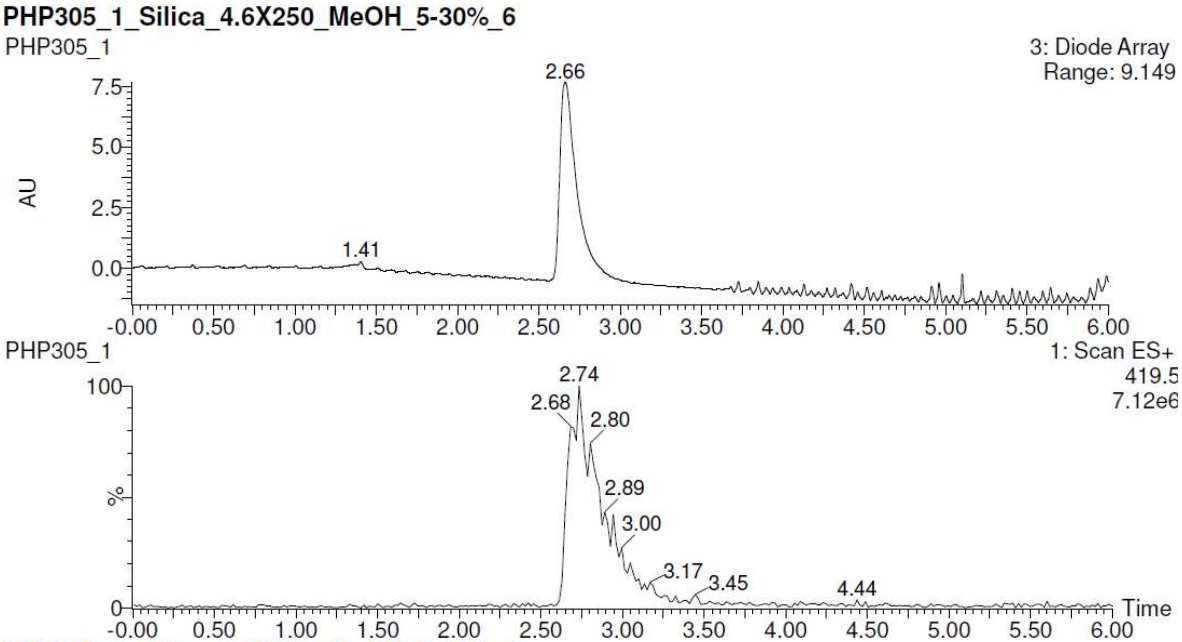


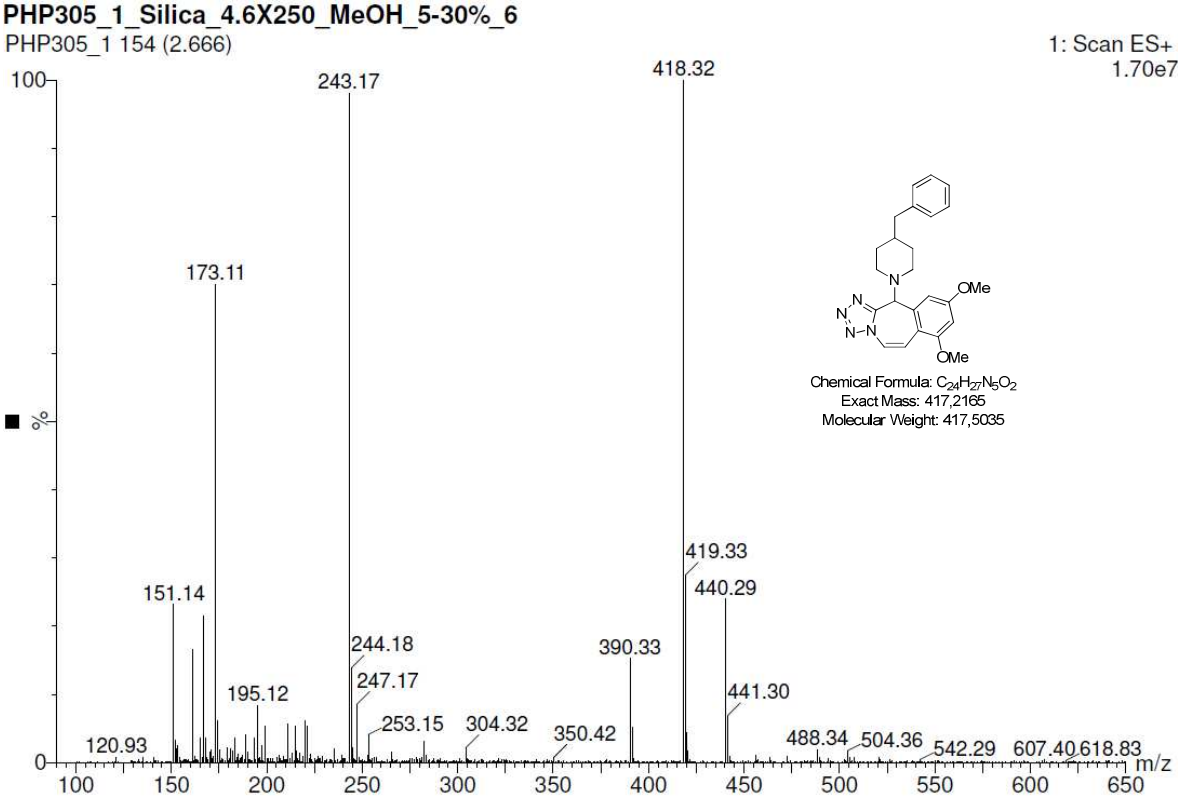

PHP297_1_Silica_4.6X250_MeOH_5-30%_6
PHP297_1
3: Diode Array
Range: 9.746
AU
2.49
0.44
0.49
1.42
PHP297_1
1: Scan ES+
483
2.35e7
%
2.54
2.61
2.79
2.82
2.89
3.83
Time


PHP297_1_Silica_4.6X250_MeOH_5-30%_6
PHP297_1 145 (2.509)
1: Scan ES+
5.44e7
%
482.39
324.28
483.36
325.29
504.36
505.37
326.26
151.31
170.19
211.12
221.47
282.31
381.36
443.48
454.23
568.20
606.36
620.17
m/z
OMe
OMe
MeO
OMe
Chemical Formula: C26H35N5O4
Exact Mass: 481,2689
Molecular Weight: 481,5872

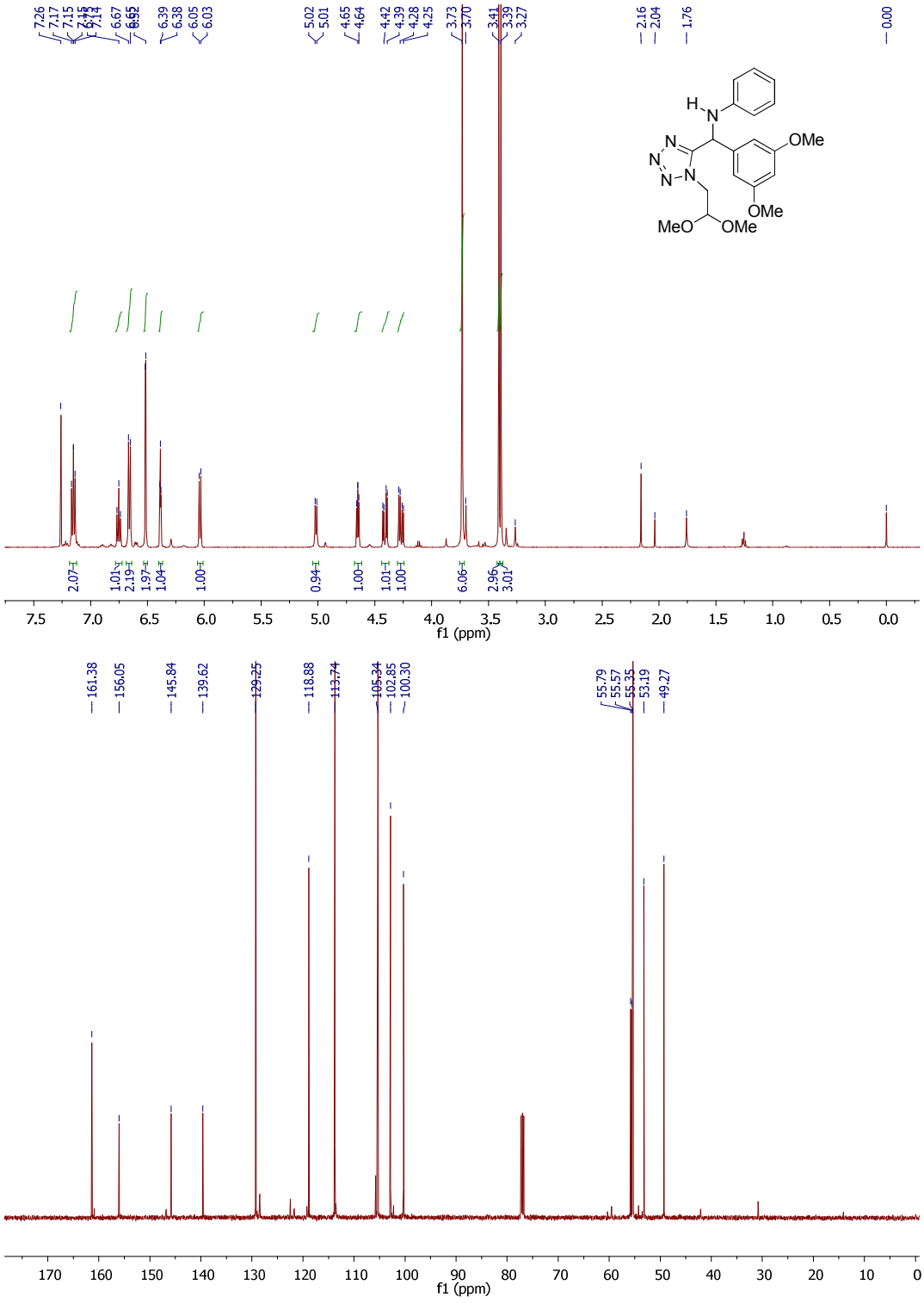
3g: 11-(4-benzylpiperidin-1-yl)-7,9-dimethoxy-11H-benzo[d]tetrazolo[1,5-a]azepine.

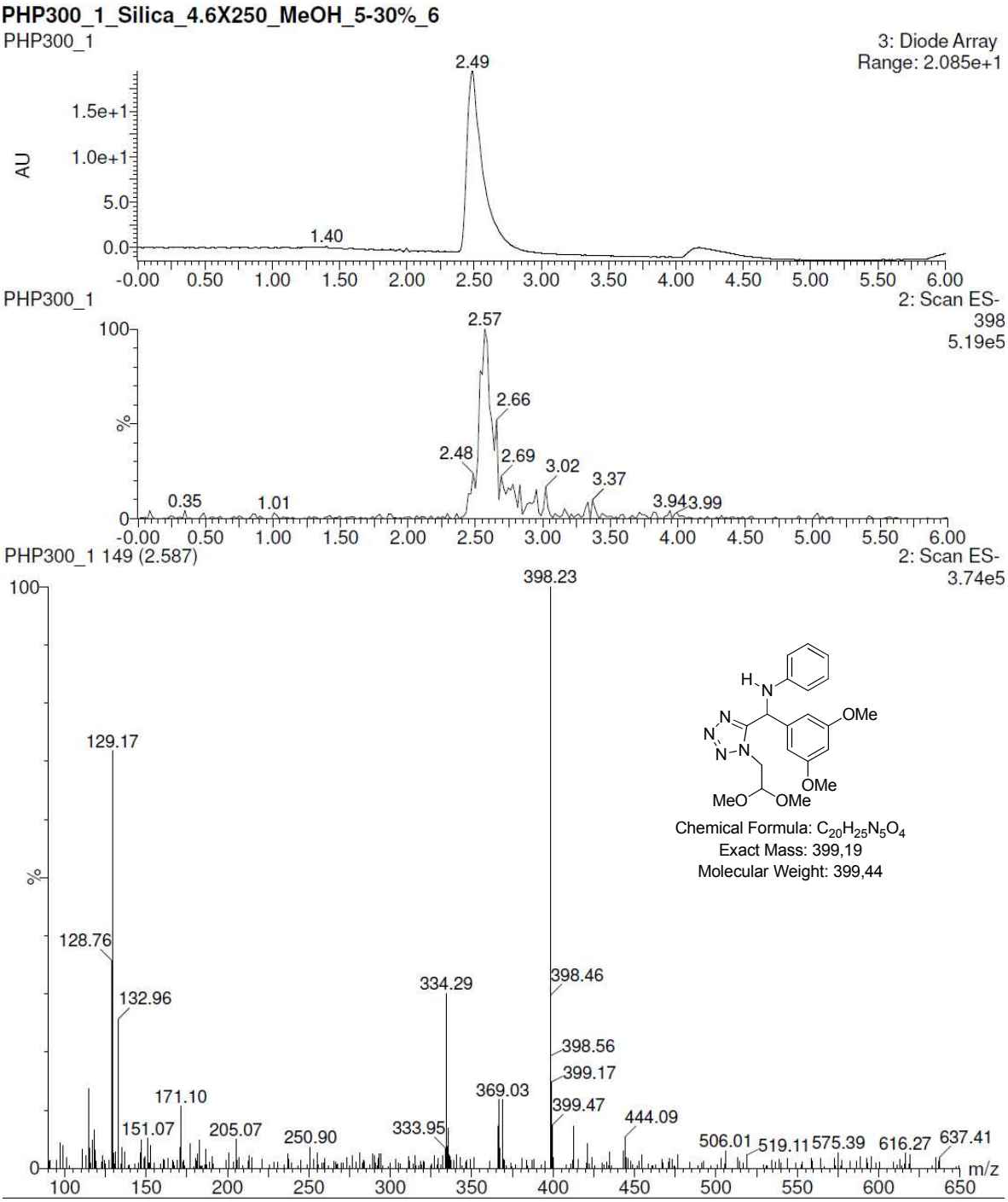



PHP305_1_Silica_4.6X250_MeOH_5-30%_6
PHP305_1
3: Diode Array
Range: 9.149
AU
2.66
1.41
PHP305_1
1: Scan ES+
419.5
7.12e6
%
2.74
2.68
2.80
2.89
3.00
3.17
3.45
4.44
Time

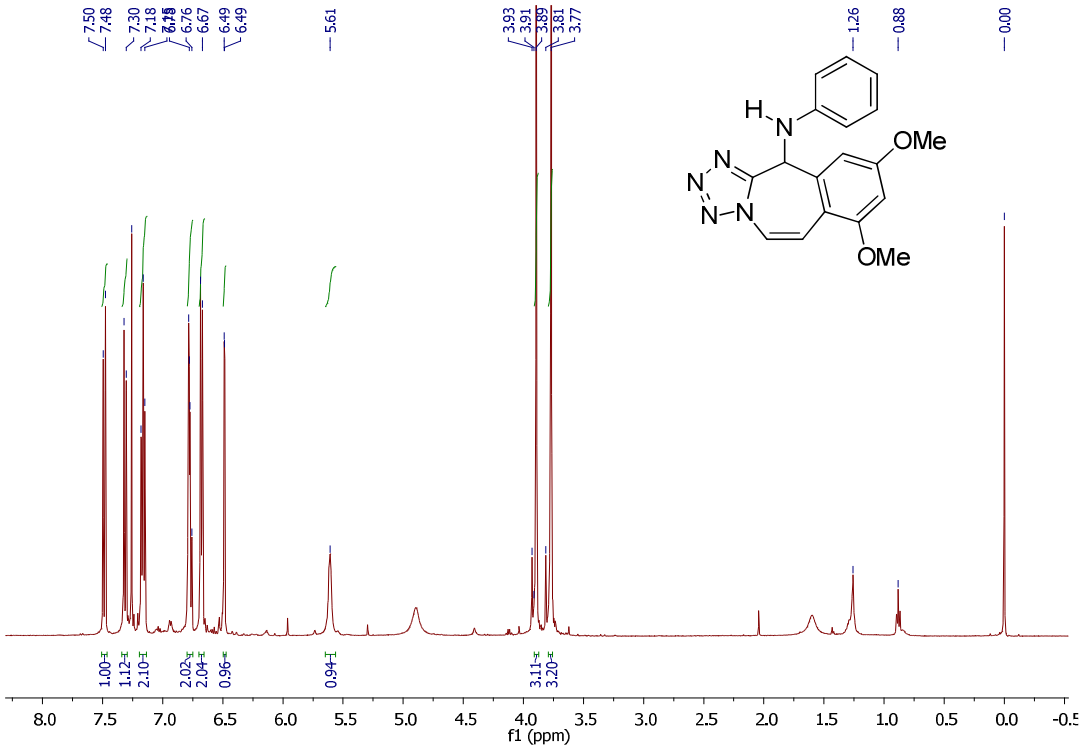

PHP305_1_Silica_4.6X250_MeOH_5-30%_6
PHP305_1 154 (2.666)
1: Scan ES+
1.70e7
%
243.17
418.32
173.11
419.33
440.29
151.14
244.18
390.33
247.17
441.30
195.12
253.15
304.32
350.42
120.93
488.34
504.36
542.29
607.40
618.83
m/z
OMe
OMe
Chemical Formula: C24H27N5O2
Exact Mass: 417,2165
Molecular Weight: 417,5035

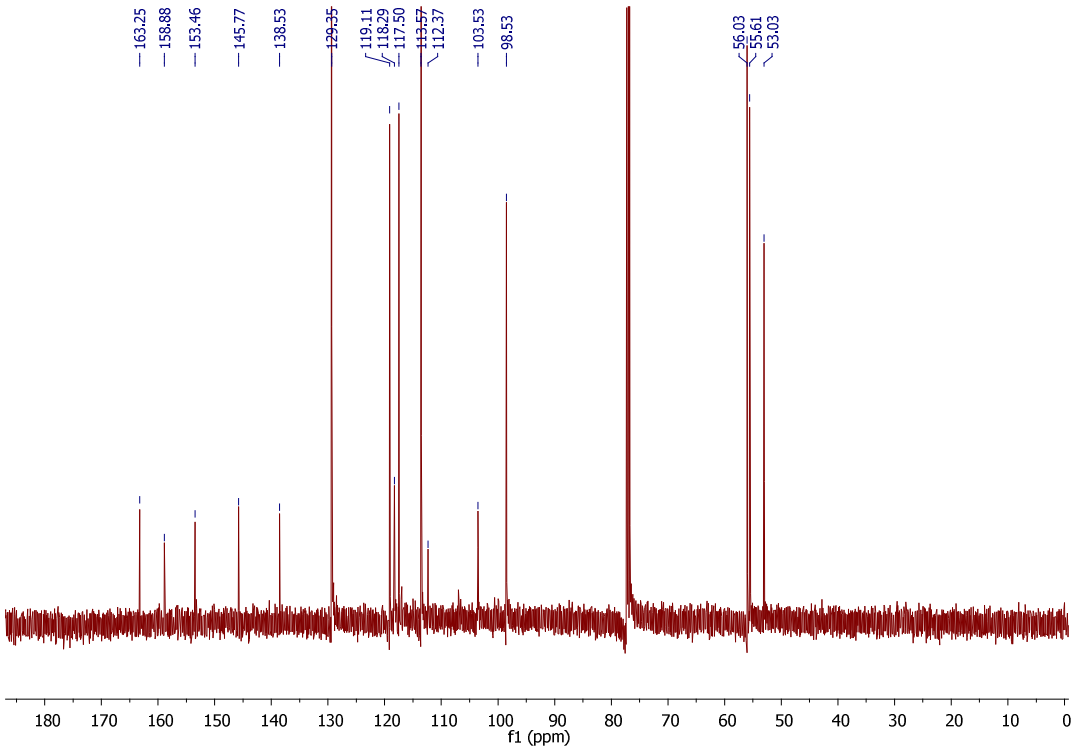
11h: N-((1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)(3,5-dimethoxyphenyl)methyl)aniline.

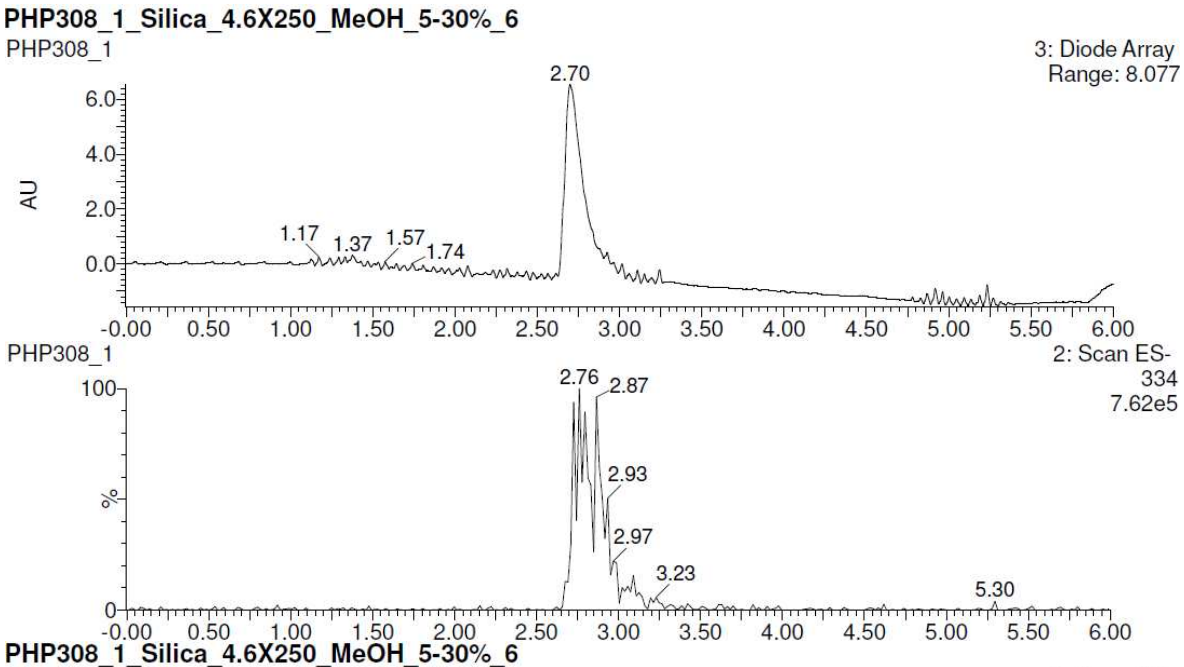


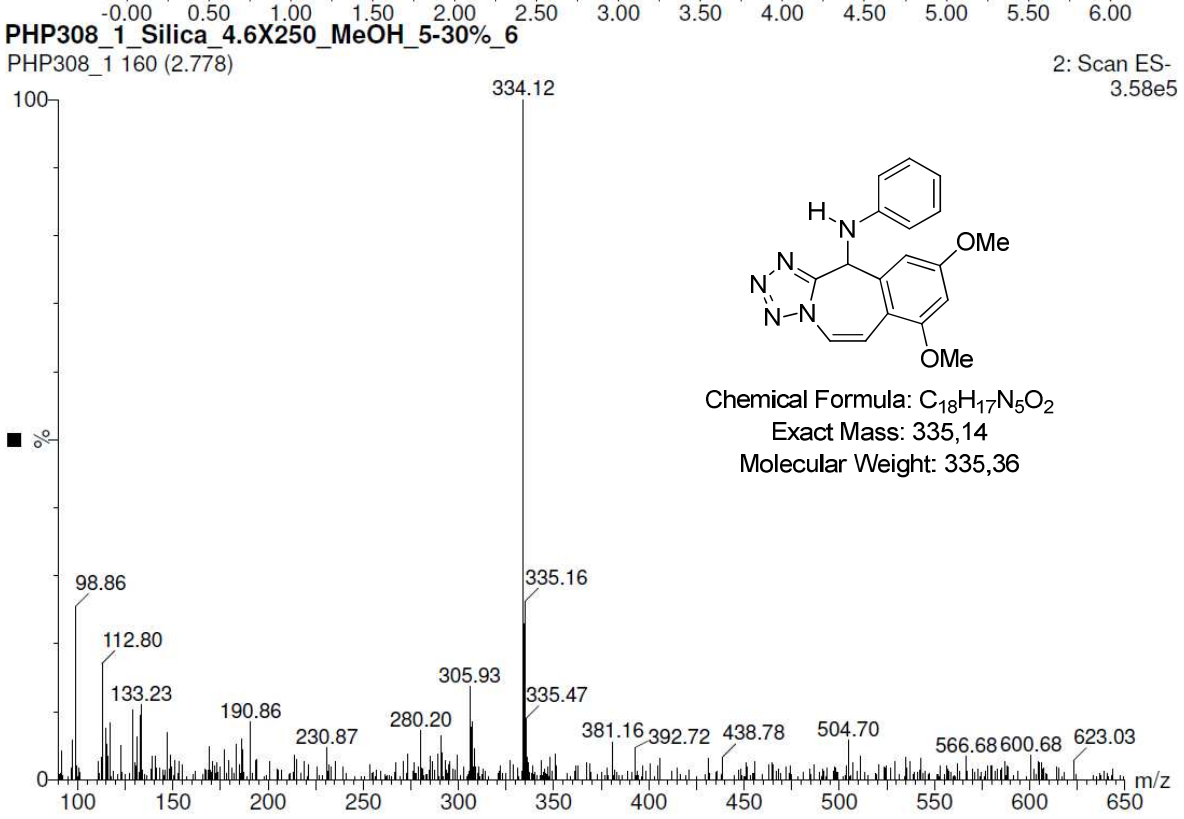

PHP300_1_Silica_4.6X250_MeOH_5-30%_6
PHP300_1
3: Diode Array
Range: 2.085e+1
AU
2.49
1.40
PHP300_1
2: Scan ES-
398
5.19e5
%
2.57
2.66
2.48
2.69
3.02
3.37
0.35
1.01
3.94
3.99
PHP300_1 149 (2.587)
2: Scan ES-
3.74e5
398.23
129.17
128.76
132.96
334.29
398.46
398.56
399.17
369.03
399.47
171.10
151.07
205.07
250.90
333.95
444.09
506.01
519.11
575.39
616.27
637.41
m/z
Chemical Formula: C20H25N5O4
Exact Mass: 399,19
Molecular Weight: 399,44

3h: 7,9-dimethoxy-N-phenyl-11H-benzo[d]tetrazolo[1,5-a]azepin-11-amine.



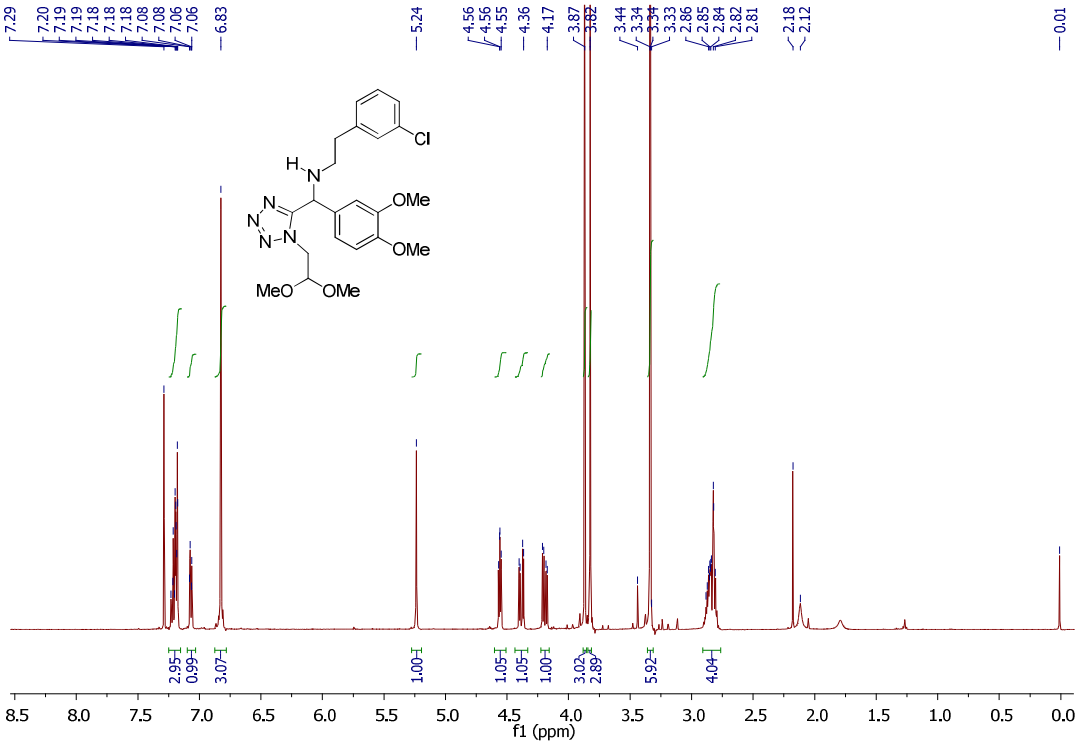


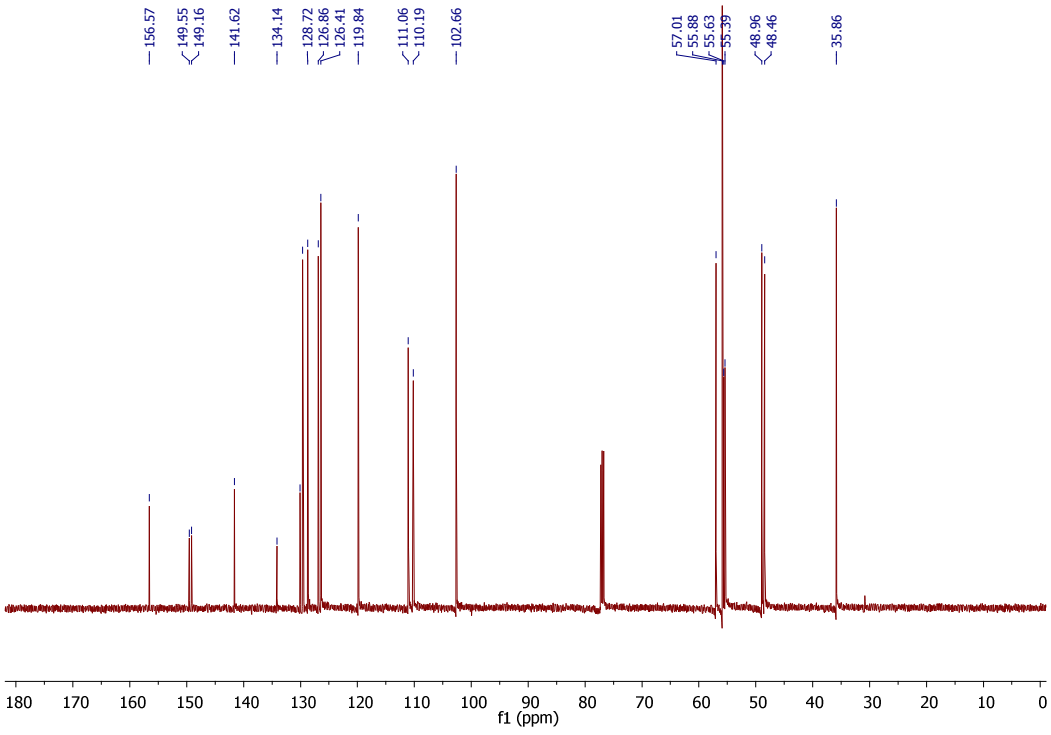


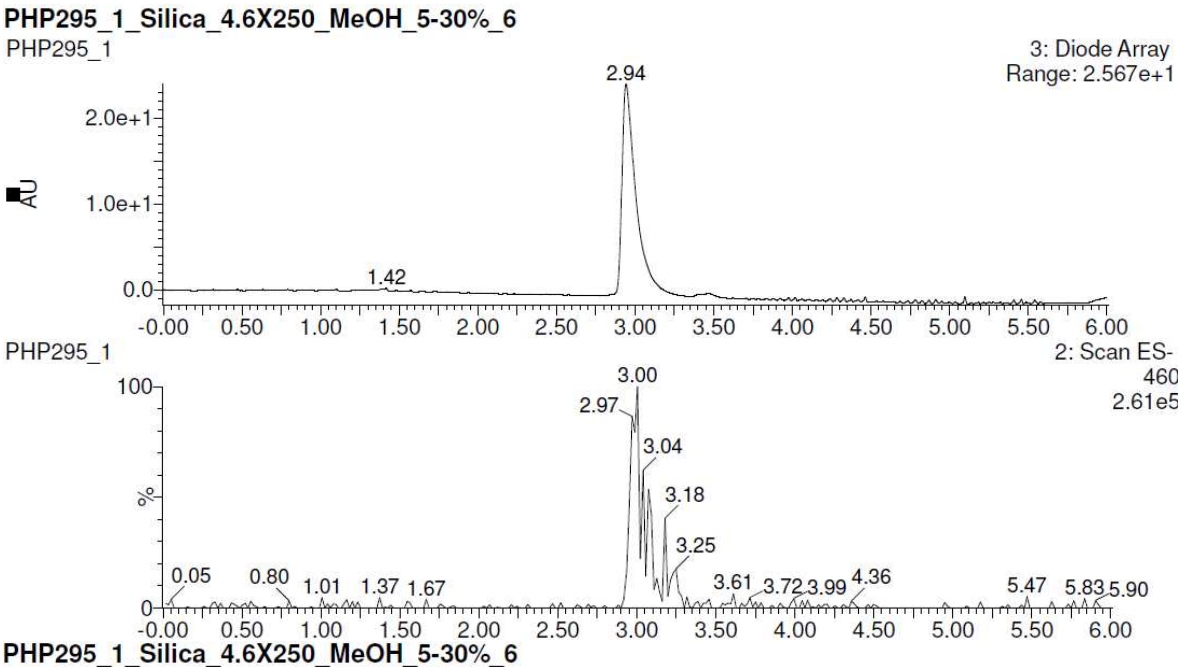


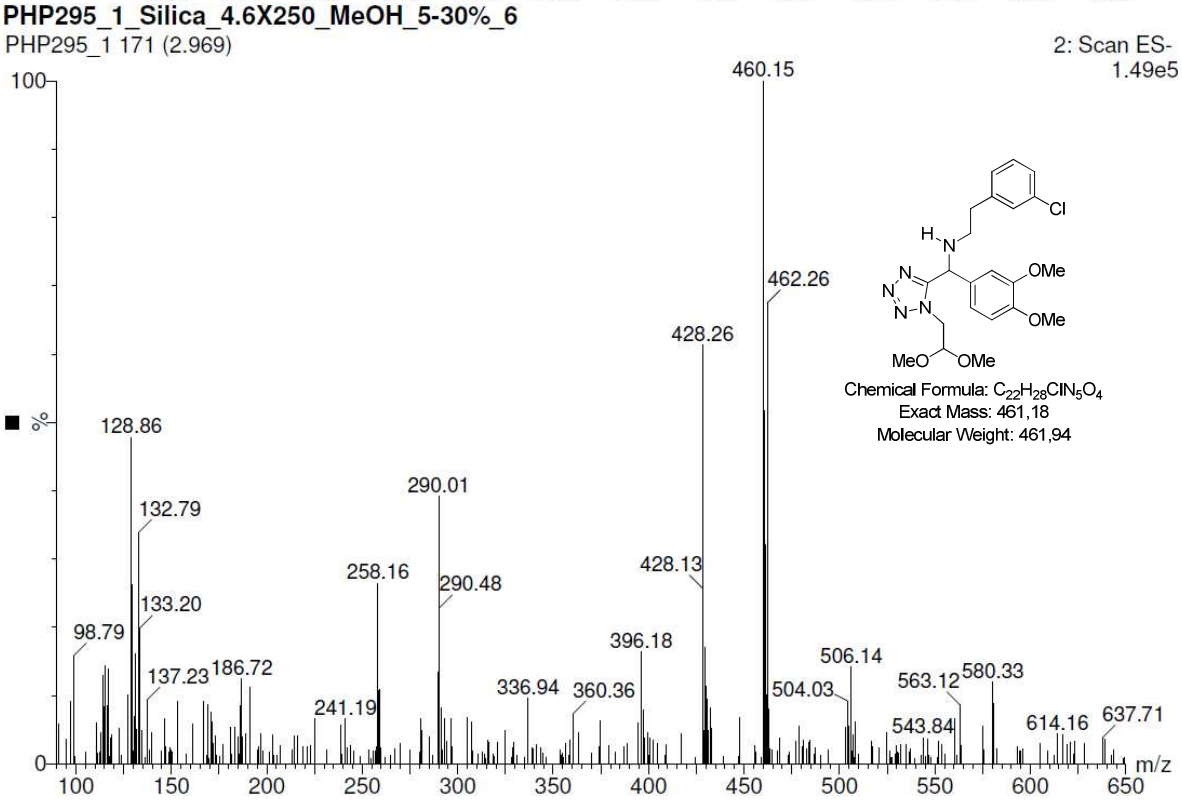
Chemical Formula: $C_{18}H_{17}N_5O_2$
Exact Mass: 335,14
Molecular Weight: 335,36

11i: 2-(3-chlorophenyl)-N-((1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)(3,4-dimethoxyphenyl)methyl)ethanamine.

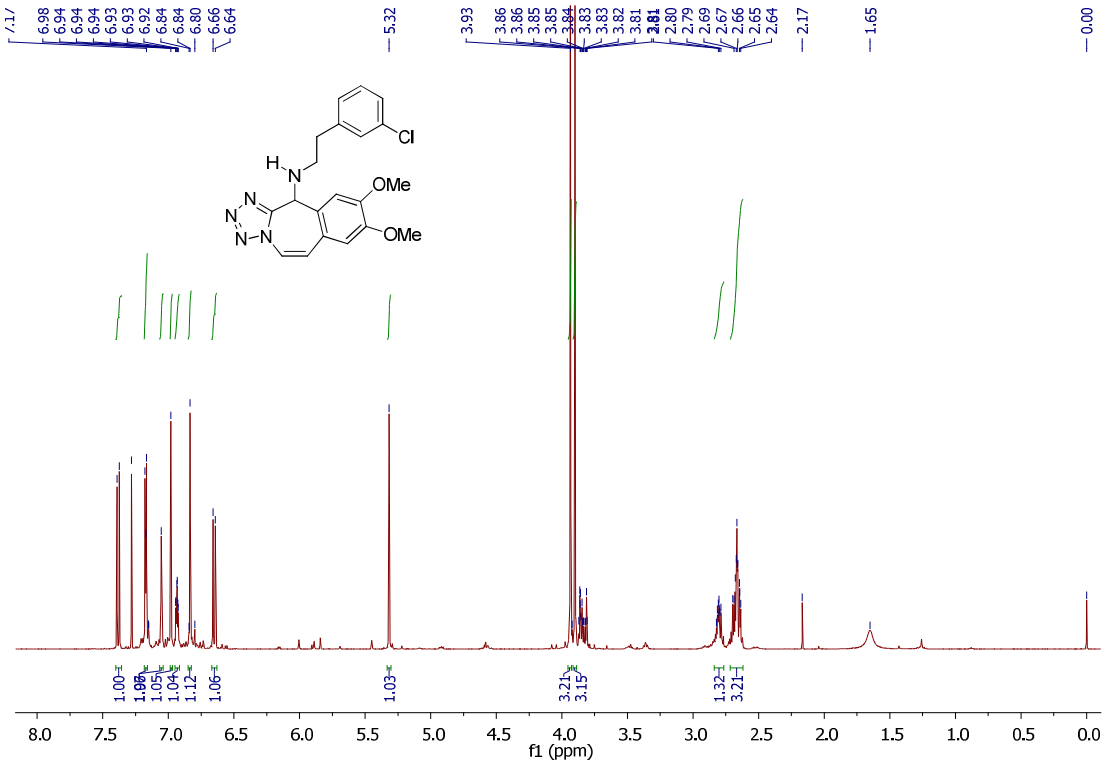


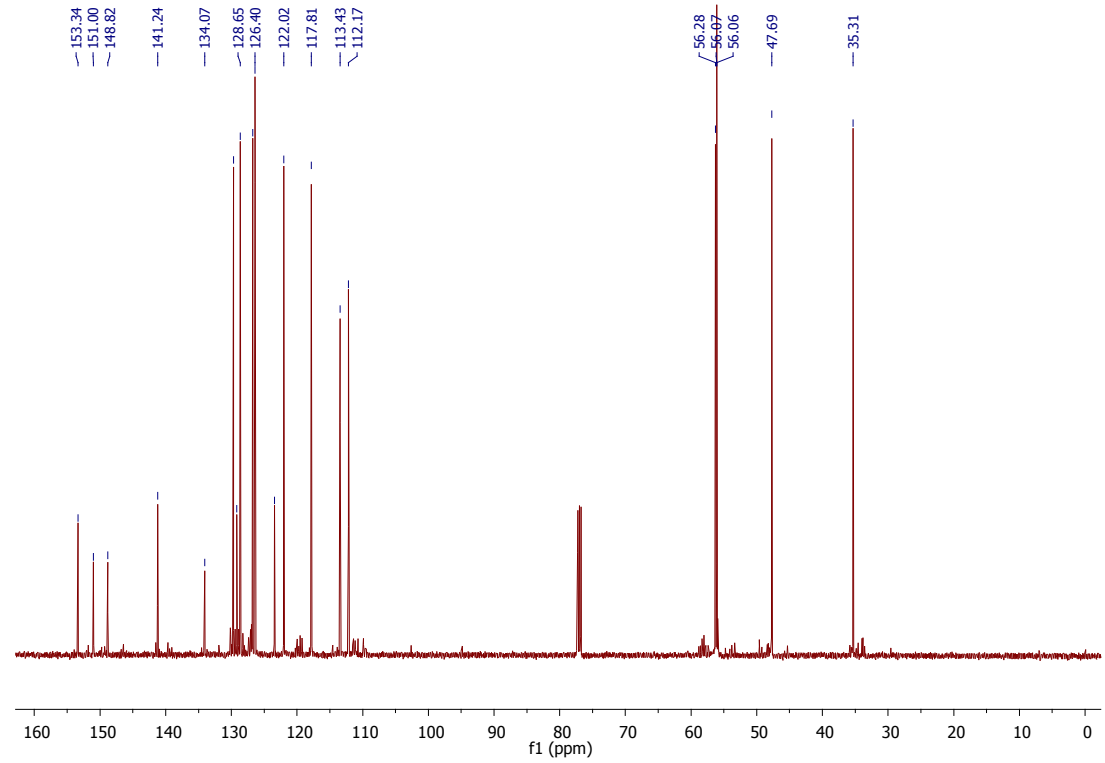


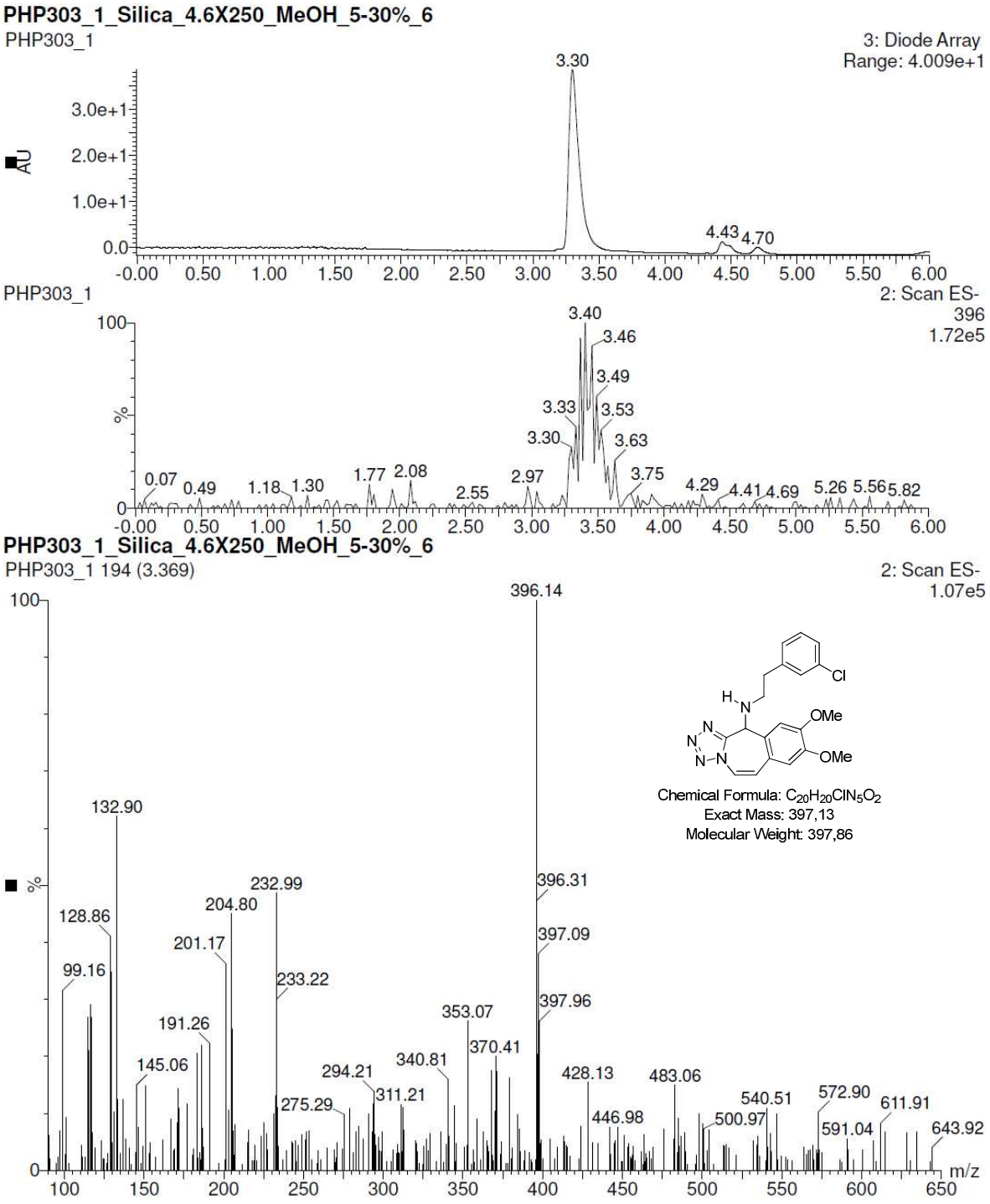

PHP295_1_Silica_4.6X250_MeOH_5-30%_6
PHP295_1
3: Diode Array
Range: 2.567e+1
2.94
1.42
AU
PHP295_1
2: Scan ES-
460
2.61e5
3.00
2.97
3.04
3.18
3.25
0.05
0.80
1.01
1.37
1.67
3.61
3.72
3.99
4.36
5.47
5.83
5.90
%
min


PHP295_1_Silica_4.6X250_MeOH_5-30%_6
PHP295_1 171 (2.969)
2: Scan ES-
1.49e5
460.15
462.26
428.26
428.13
290.01
290.48
258.16
128.86
132.79
133.20
98.79
137.23
186.72
241.19
336.94
360.36
396.18
504.03
506.14
543.84
563.12
580.33
614.16
637.71
Cl
H
N
OMe
OMe
MeO
OMe
Chemical Formula: C22H28ClN5O4
Exact Mass: 461,18
Molecular Weight: 461,94
%
m/z

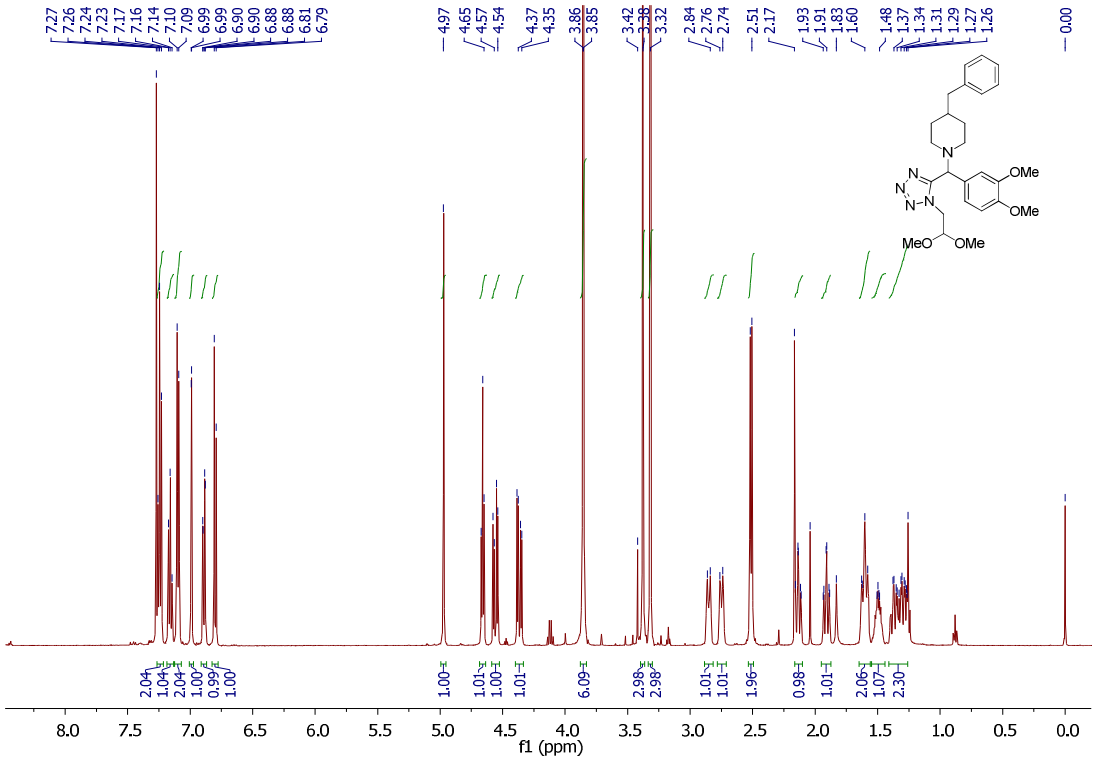
3i: N-(3-chlorophenethyl)-8,9-dimethoxy-11H-benzo[d]tetrazolo[1,5-a]azepin-11-amine.

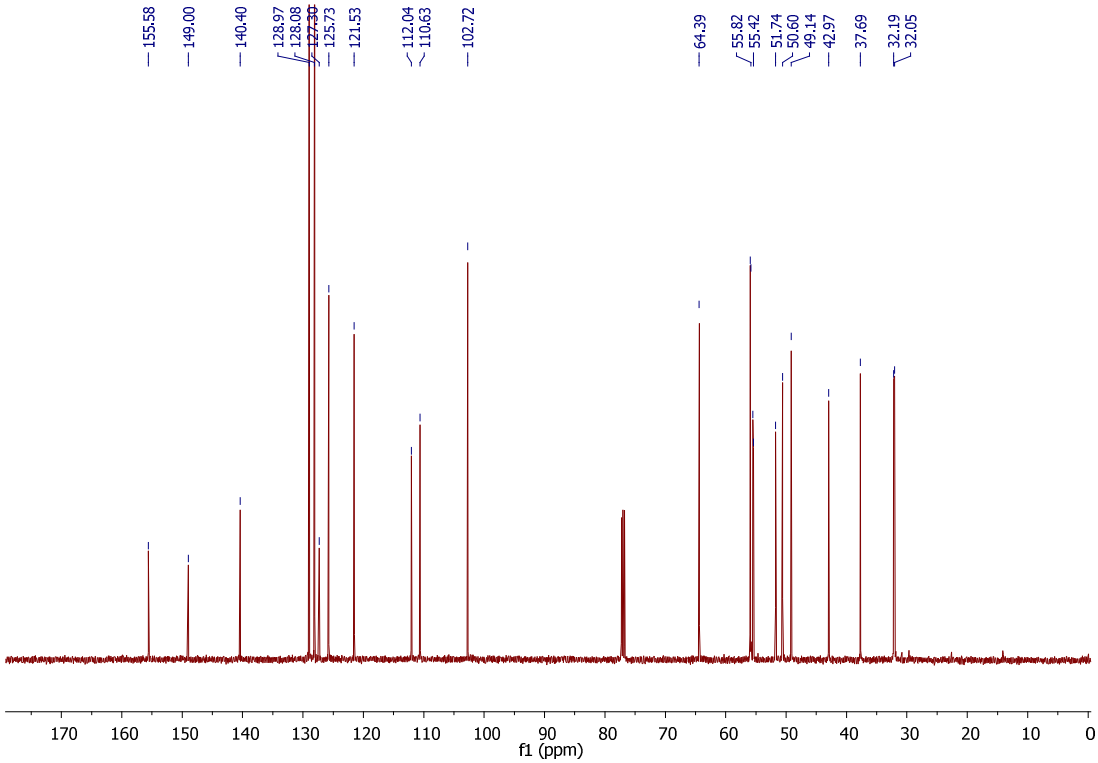


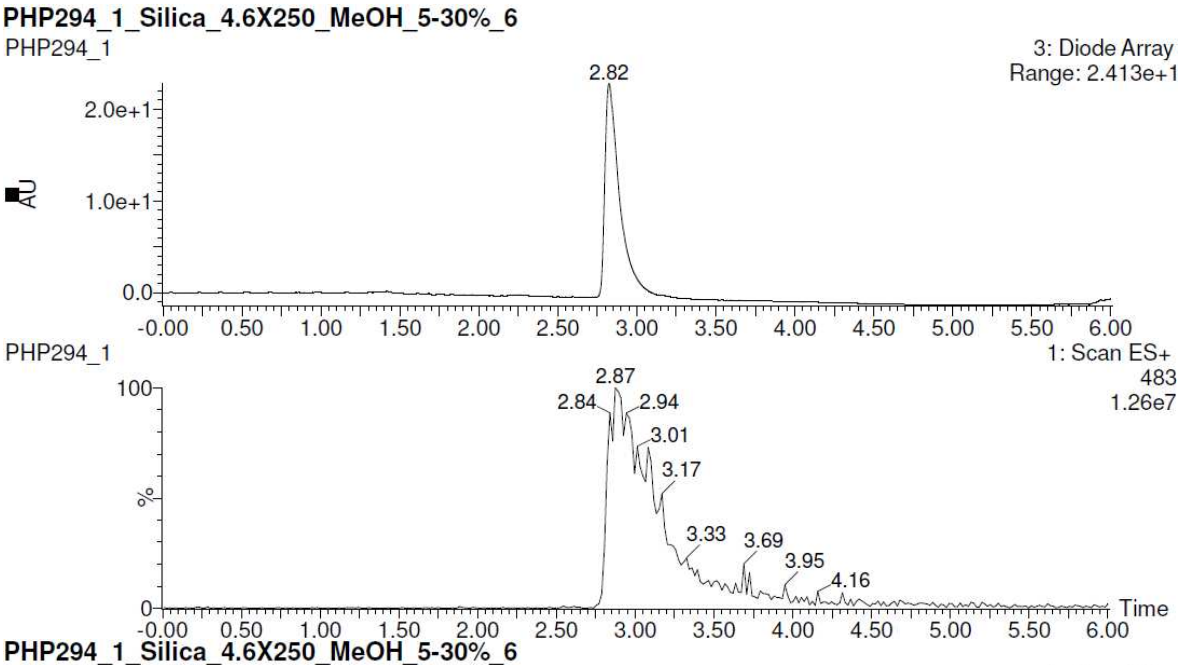


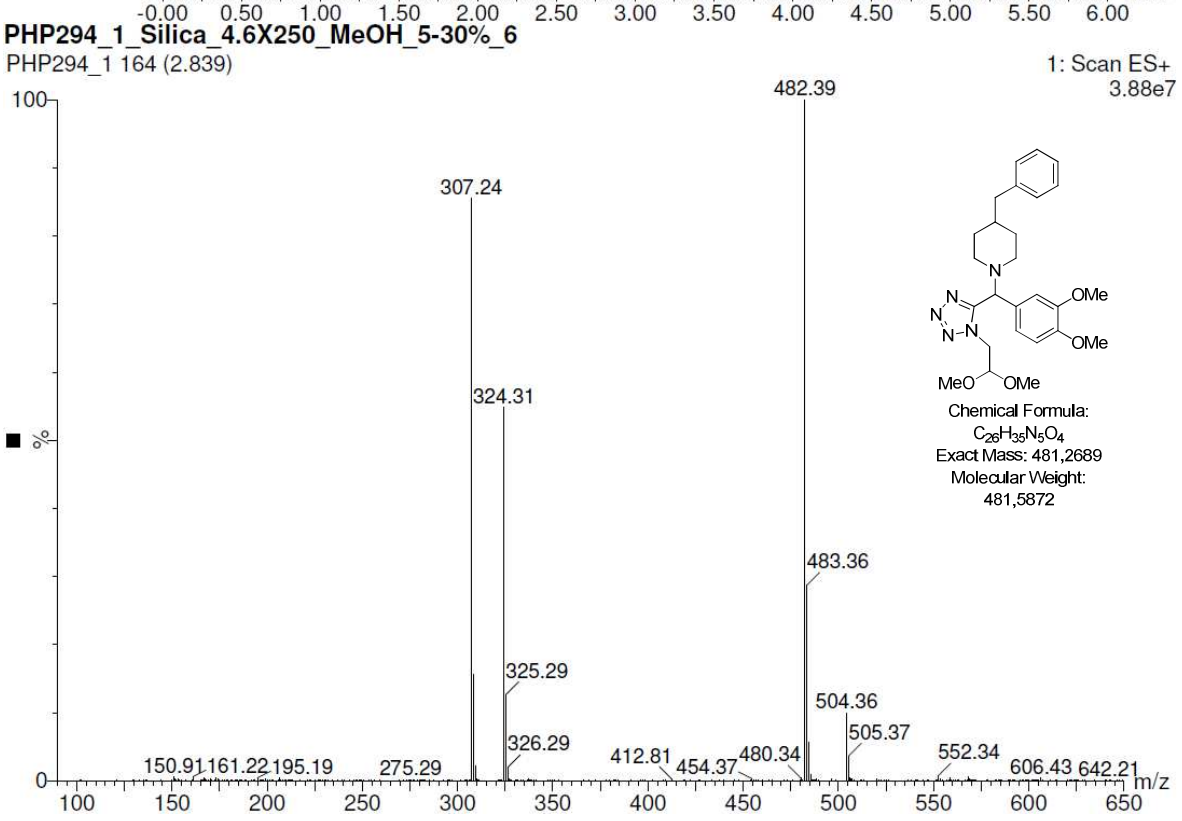

PHP303_1_Silica_4.6X250_MeOH_5-30%_6
PHP303_1
3: Diode Array
Range: 4.009e+1
AU
3.30
4.43
4.70
PHP303_1
2: Scan ES-
396
1.72e5
%
3.40
3.46
3.49
3.33
3.53
3.30
3.63
3.75
0.07
0.49
1.18
1.30
1.77
2.08
2.55
2.97
4.29
4.41
4.69
5.26
5.56
5.82
PHP303_1_Silica_4.6X250_MeOH_5-30%_6
PHP303_1 194 (3.369)
2: Scan ES-
1.07e5
396.14
Cl
H
N
OMe
OMe
Chemical Formula: C20H20ClN5O2
Exact Mass: 397,13
Molecular Weight: 397,86
132.90
232.99
204.80
128.86
201.17
99.16
233.22
396.31
397.09
397.96
191.26
353.07
370.41
145.06
294.21
340.81
428.13
483.06
275.29
311.21
446.98
500.97
540.51
572.90
611.91
591.04
643.92
m/z

11j: 4-benzyl-1-((1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)(3,4-dimethoxyphenyl)methyl) piperidine.

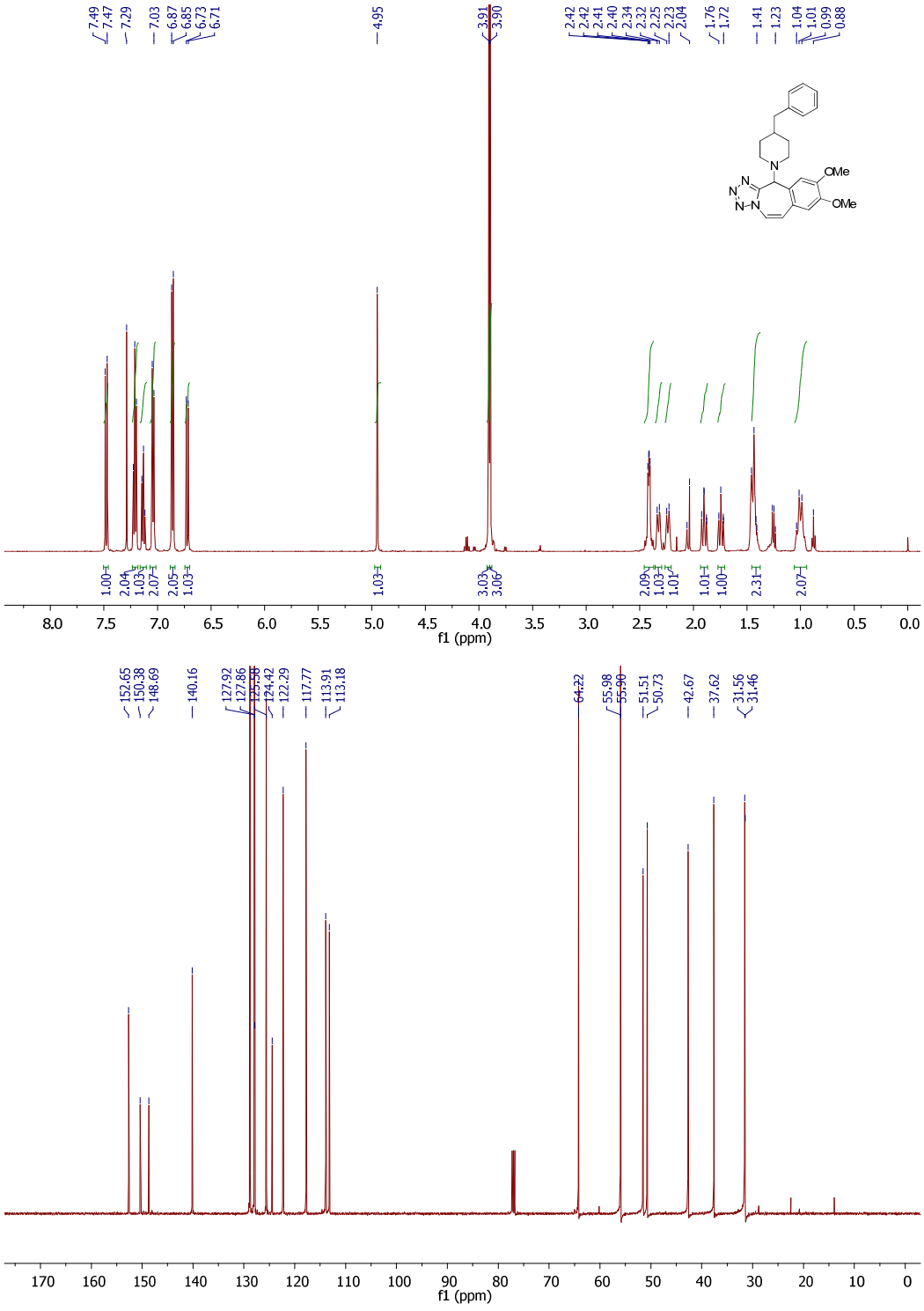


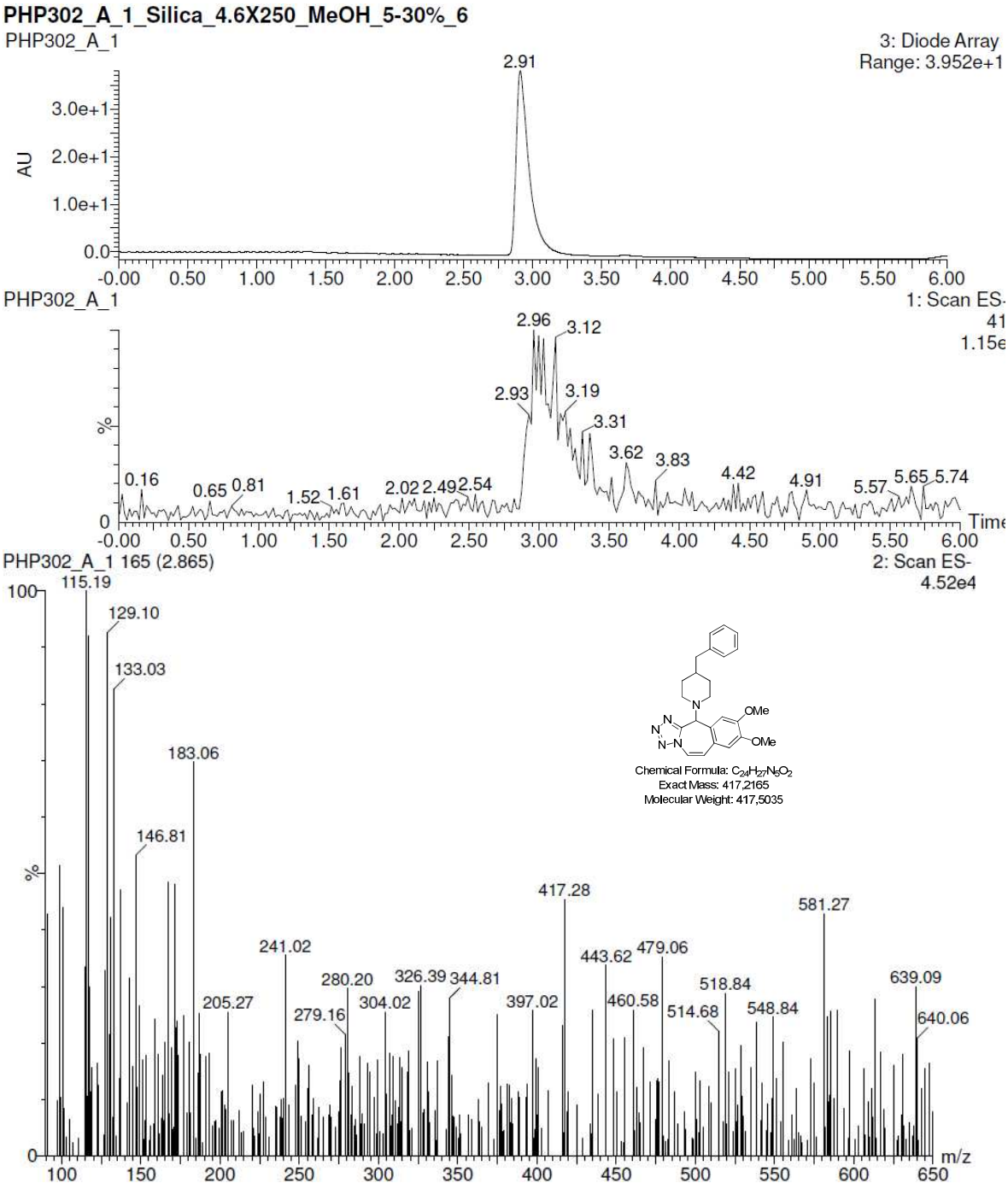



PHP294_1_Silica_4.6X250_MeOH_5-30%_6
PHP294_1
3: Diode Array
Range: 2.413e+1
2.82
2.0e+1
1.0e+1
0.0
AU
-0.00 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 6.00
PHP294_1
1: Scan ES+
483
1.26e7
100
%
0
2.87
2.84
2.94
3.01
3.17
3.33
3.69
3.95
4.16
Time
-0.00 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 6.00

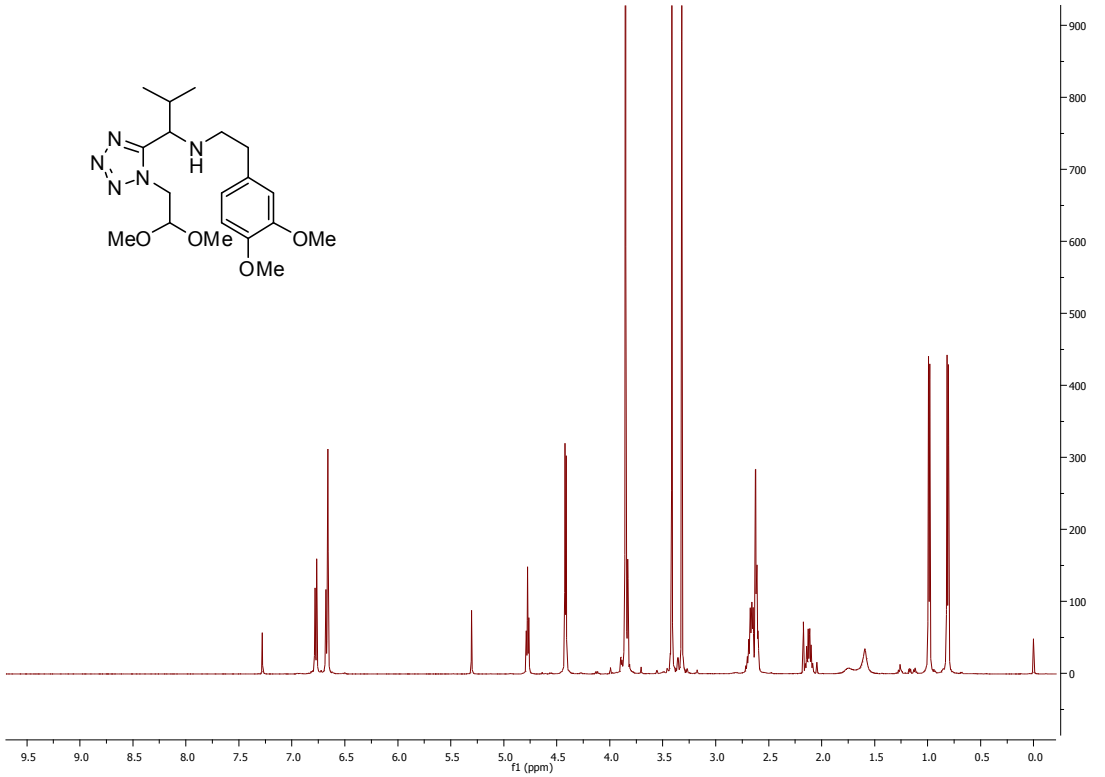

PHP294_1_Silica_4.6X250_MeOH_5-30%_6
PHP294_1 164 (2.839)
1: Scan ES+
3.88e7
100
%
0
482.39
307.24
324.31
483.36
325.29
504.36
505.37
326.29
552.34
412.81
454.37
480.34
606.43
642.21
150.91
161.22
195.19
275.29
m/z
100 150 200 250 300 350 400 450 500 550 600 650
OMe
OMe
MeO
OMe
Chemical Formula:
C26H35N5O4
Exact Mass: 481,2689
Molecular Weight:
481,5872

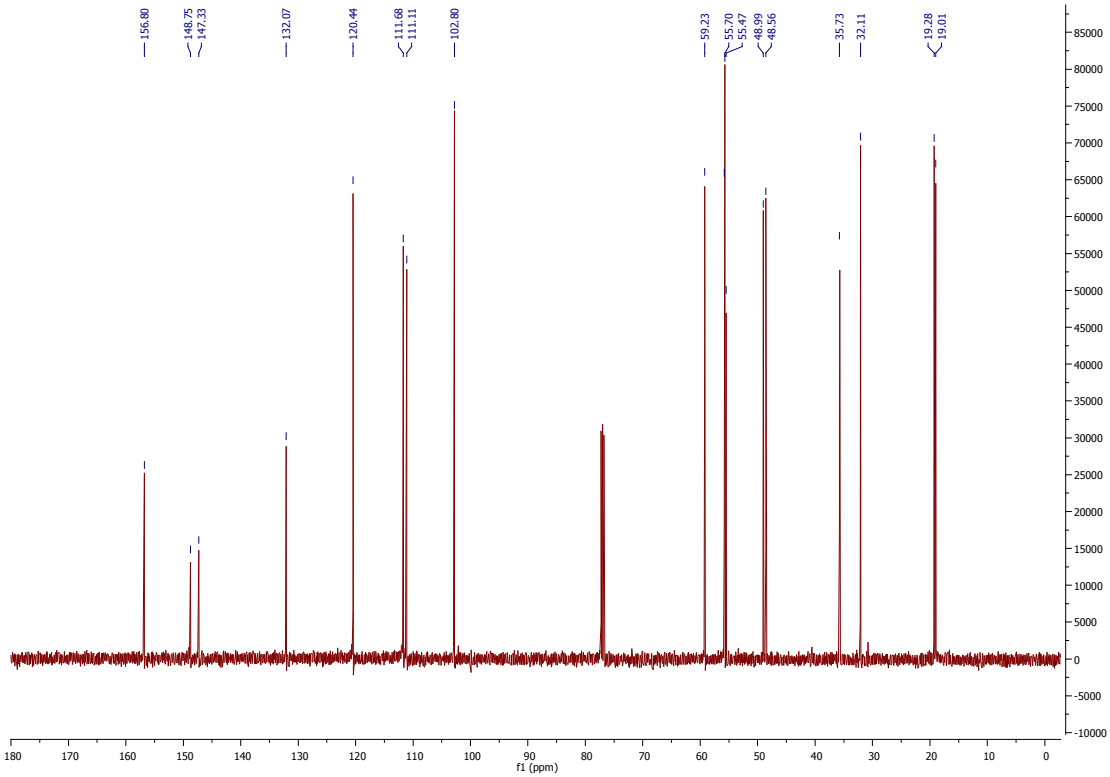
3j: 11-(4-benzylpiperidin-1-yl)-8,9-dimethoxy-11H-benzo[d]tetrazolo[1,5-a]azepine.

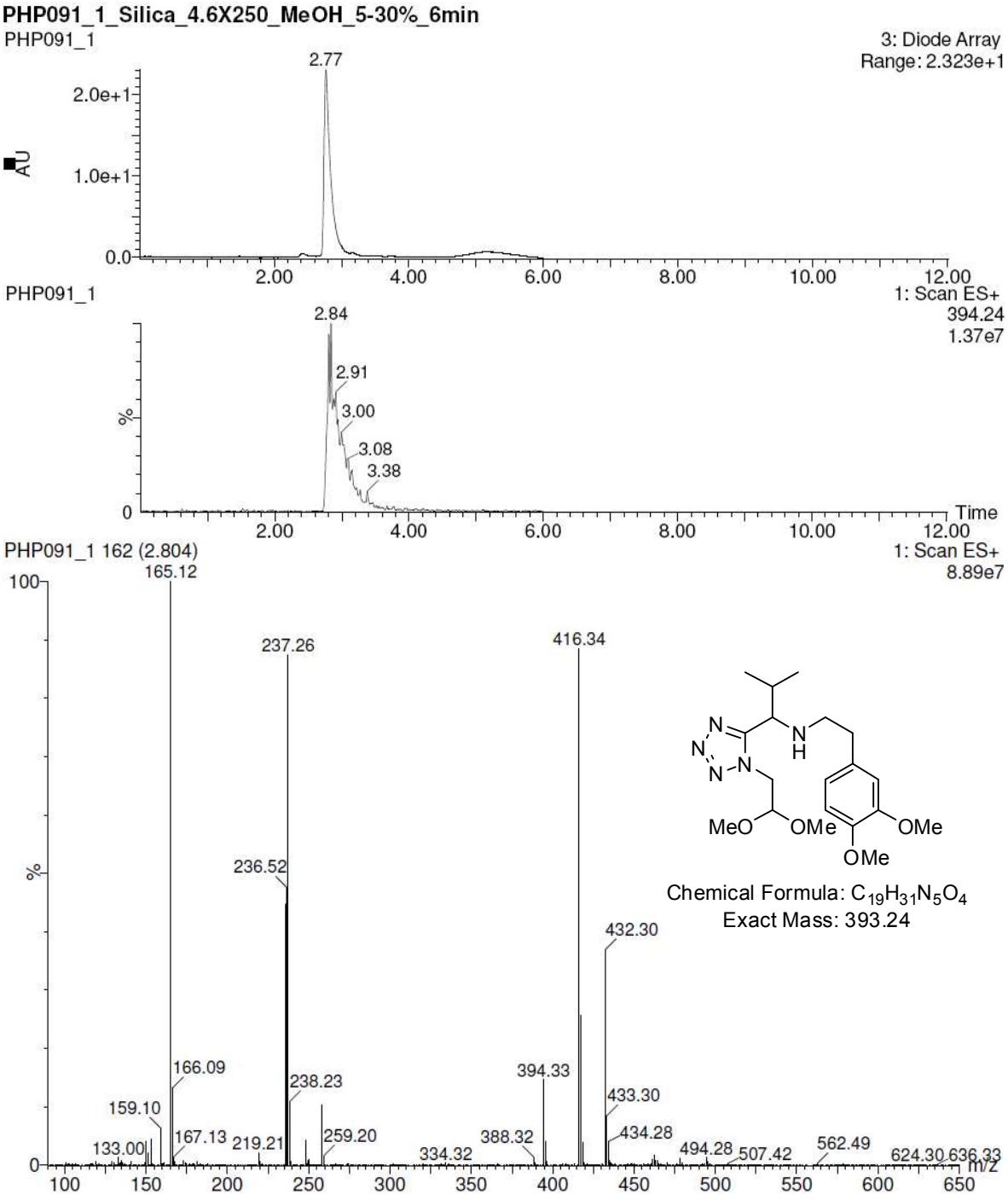



PHP302_A_1_Silica_4.6X250_MeOH_5-30%_6
PHP302_A_1
3: Diode Array
Range: 3.952e+1
2.91
AU
3.0e+1
2.0e+1
1.0e+1
0.0
-0.00 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 6.00
PHP302_A_1
1: Scan ES-
41
1.15e
2.96
3.12
2.93
3.19
3.31
3.62
3.83
4.42
4.91
5.57
5.65
5.74
0.16
0.65
0.81
1.52
1.61
2.02
2.49
2.54
%
0
Time
-0.00 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 6.00
PHP302_A_1 165 (2.865)
2: Scan ES-
4.52e4
100
115.19
129.10
133.03
183.06
146.81
417.28
581.27
241.02
443.62
479.06
639.09
280.20
326.39
344.81
518.84
205.27
304.02
397.02
460.58
548.84
279.16
514.68
640.06
%
0
m/z
100 150 200 250 300 350 400 450 500 550 600 650
OMe
OMe
Chemical Formula: C24H27N5O2
Exact Mass: 417,2165
Molecular Weight: 417,5035

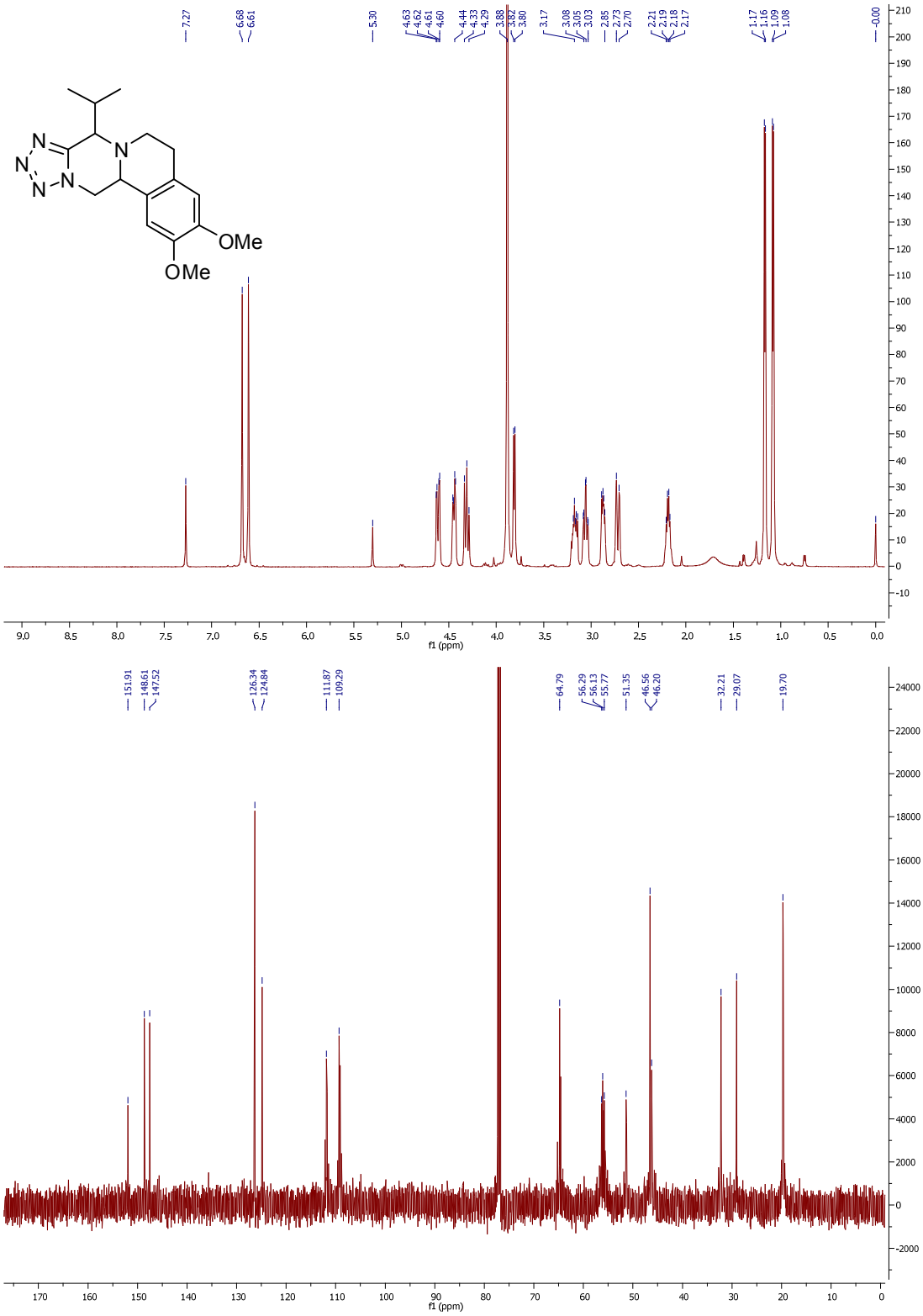
14a: 1-(1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)-N-(3,4-dimethoxyphenethyl)-2-methylpropan-1-amine

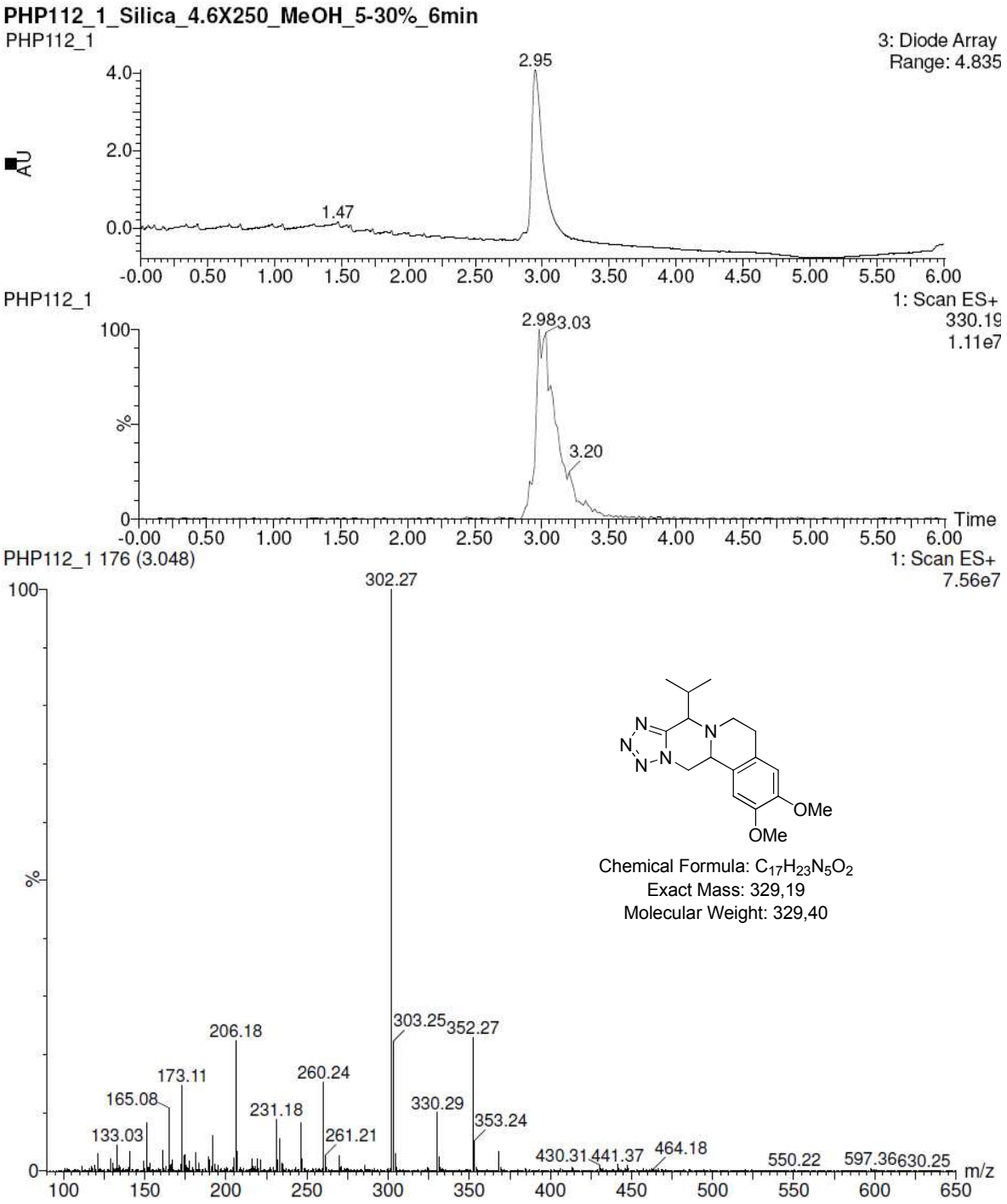




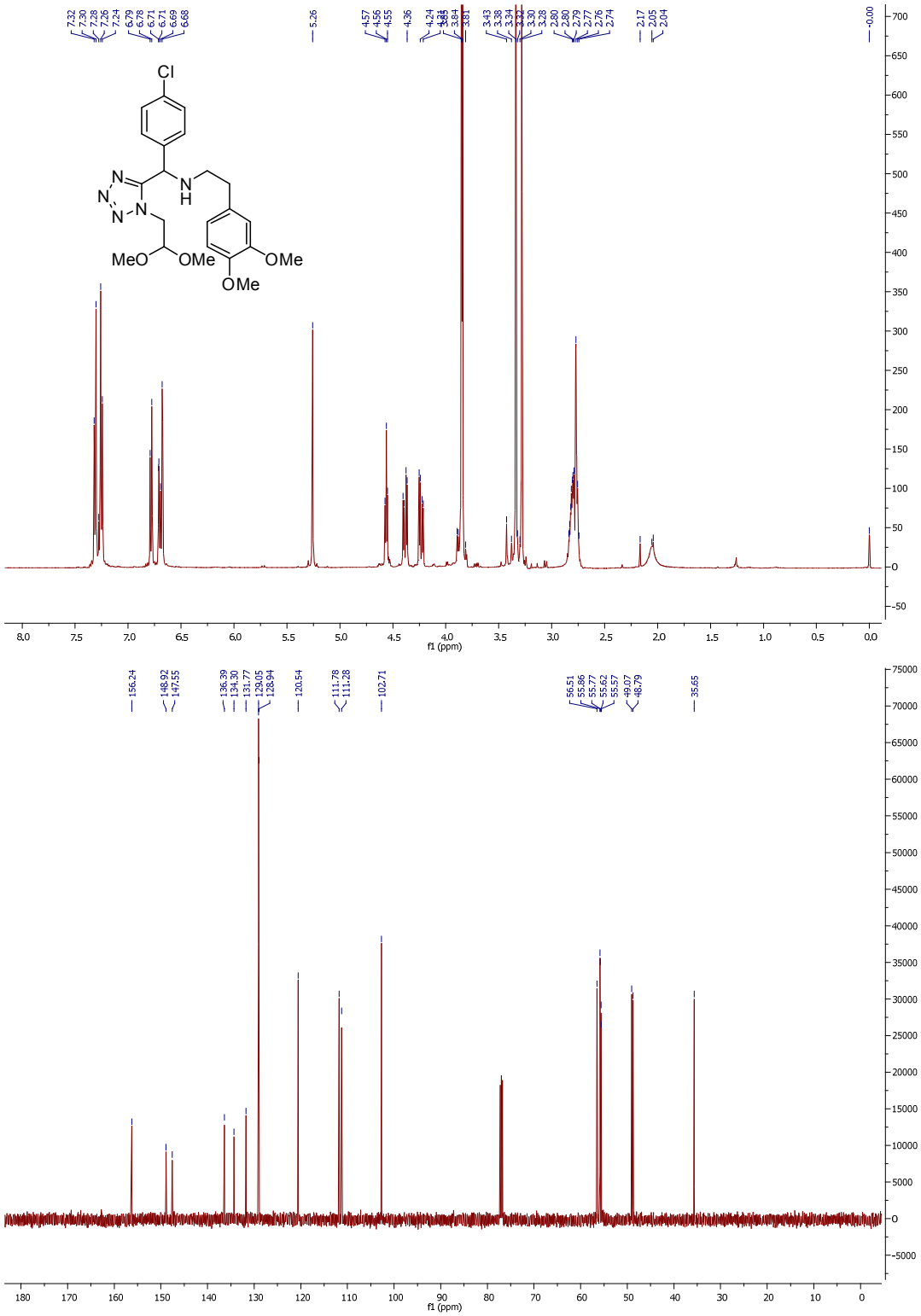

PHP091_1_Silica_4.6X250_MeOH_5-30%_6min
PHP091_1
3: Diode Array
Range: 2.323e+1
2.77
AU
PHP091_1
1: Scan ES+
394.24
1.37e7
2.84
2.91
3.00
3.08
3.38
%
Time
PHP091_1 162 (2.804)
1: Scan ES+
8.89e7
165.12
237.26
416.34
236.52
432.30
166.09
238.23
394.33
159.10
433.30
167.13
219.21
259.20
388.32
434.28
133.00
334.32
494.28
507.42
562.49
624.30
636.33
m/z
Chemical Formula: C19H31N5O4
Exact Mass: 393.24

4a: 8-isopropyl-2,3-dimethoxy-6,8,13,13a-tetrahydro-5H-tetrazolo[1',5':4,5]pyrazino[2,1-a]isoquinoline

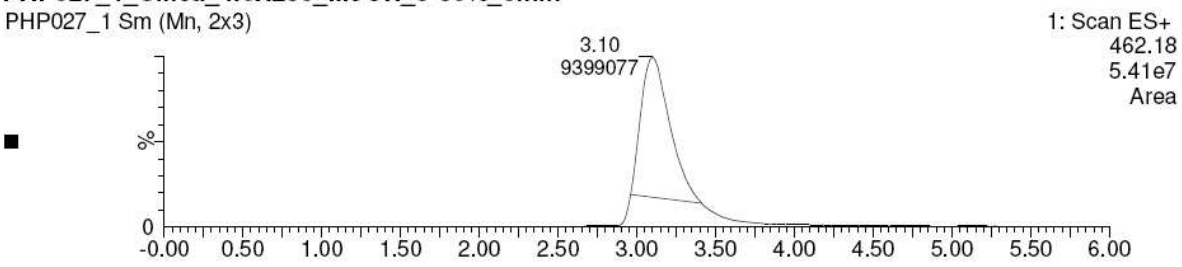


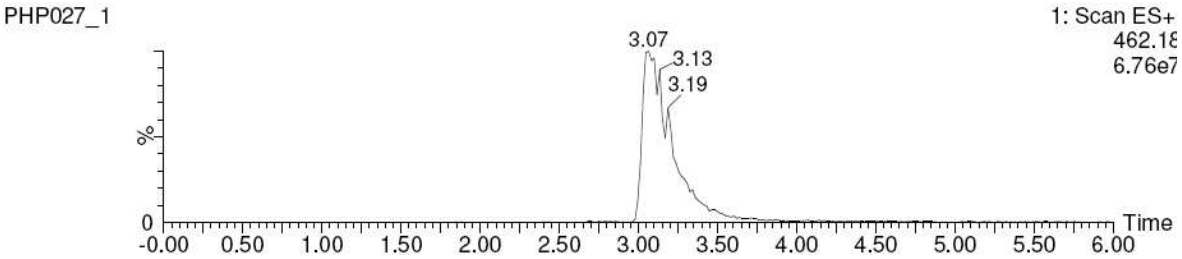

PHP112_1_Silica_4.6X250_MeOH_5-30%_6min
PHP112_1
3: Diode Array
Range: 4.835
AU
2.95
1.47
PHP112_1
1: Scan ES+
330.19
1.11e7
2.98
3.03
3.20
%
Time
PHP112_1 176 (3.048)
1: Scan ES+
7.56e7
302.27
206.18
303.25
352.27
173.11
260.24
165.08
231.18
330.29
353.24
133.03
261.21
430.31
441.37
464.18
550.22
597.36
630.25
m/z
OMe
OMe
Chemical Formula: C17H23N5O2
Exact Mass: 329,19
Molecular Weight: 329,40

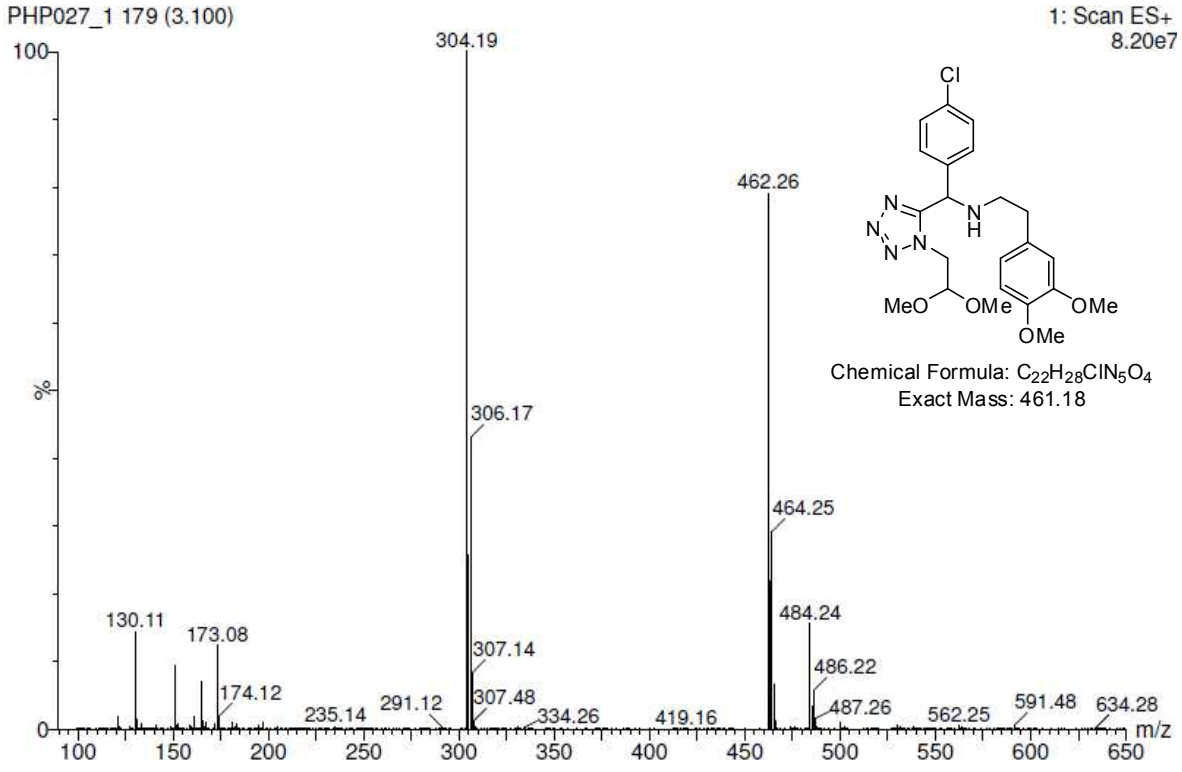
14b: N-((4-chlorophenyl)(1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)methyl)-2-(3,4-dimethoxyphenyl)ethanamine



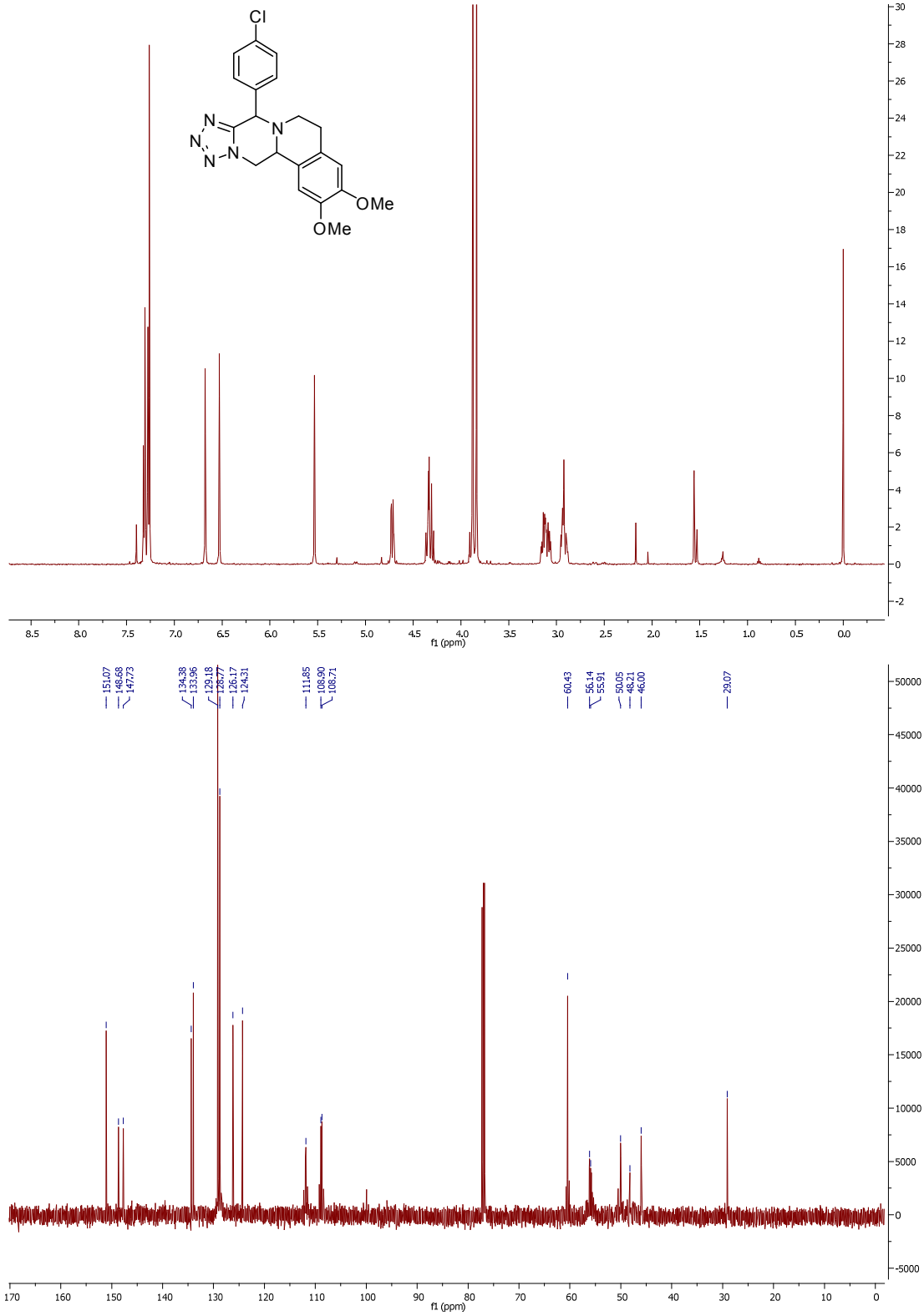
PHP027_1_Silica_4.6X250_MeOH_5-30%_6min

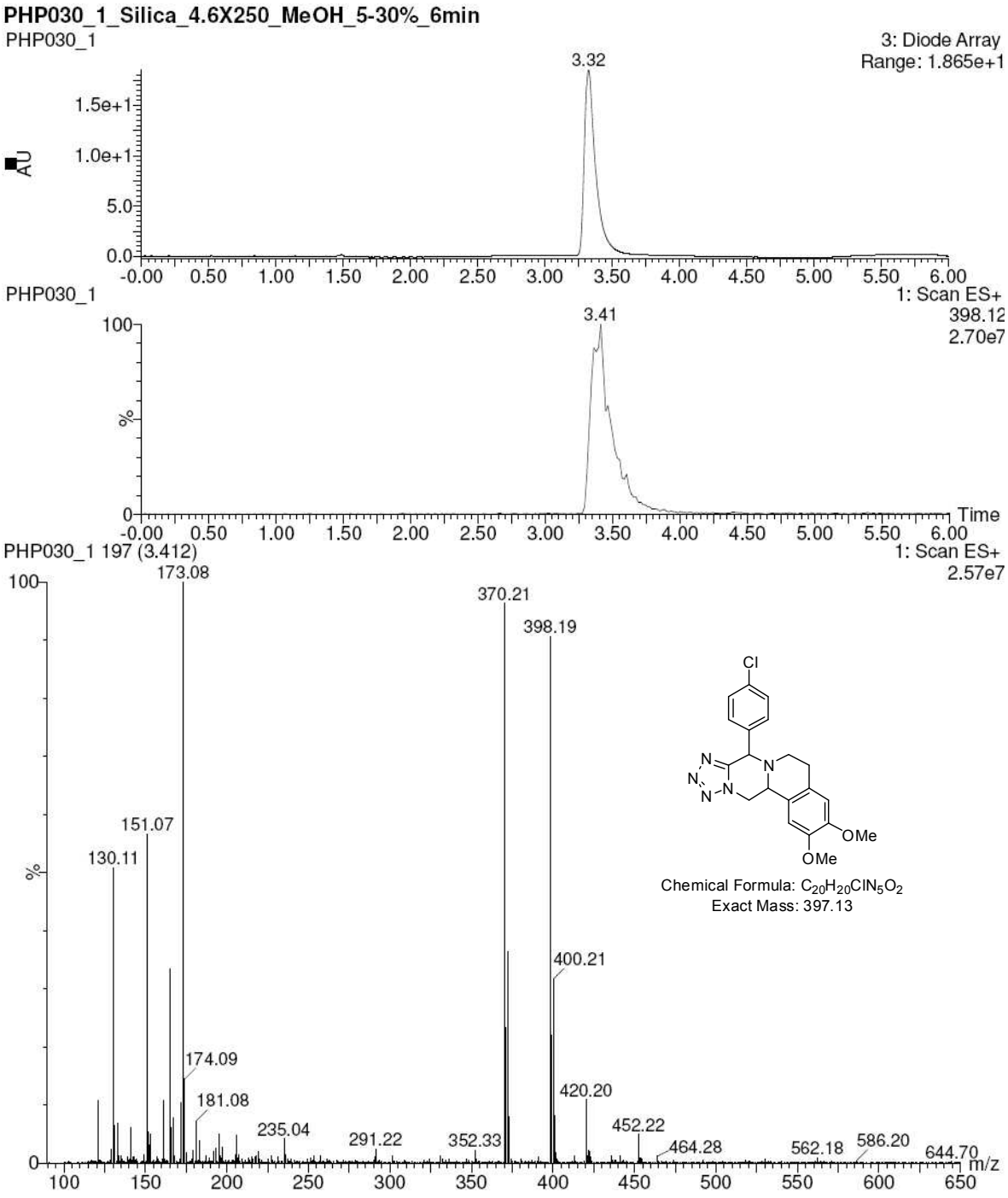




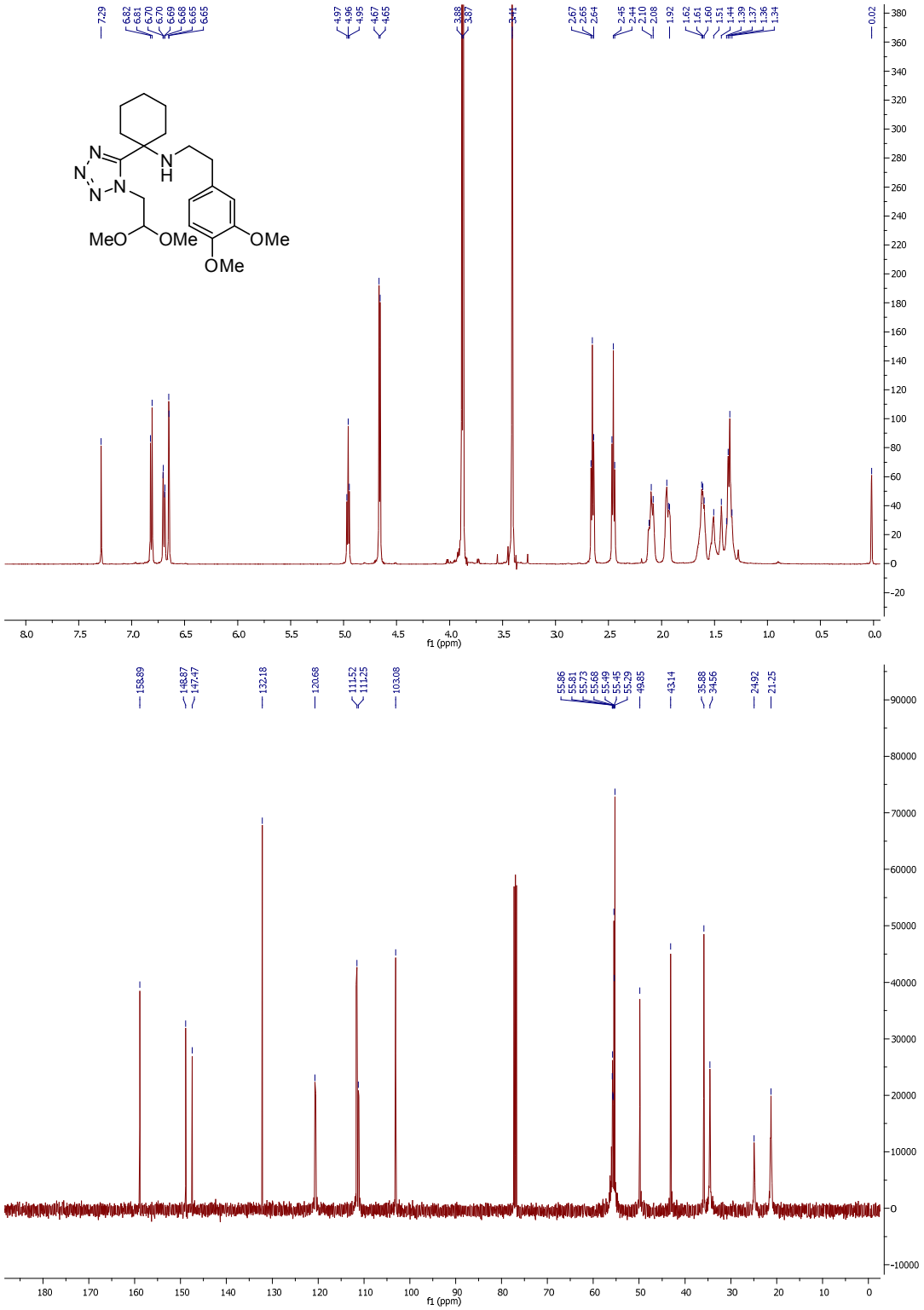


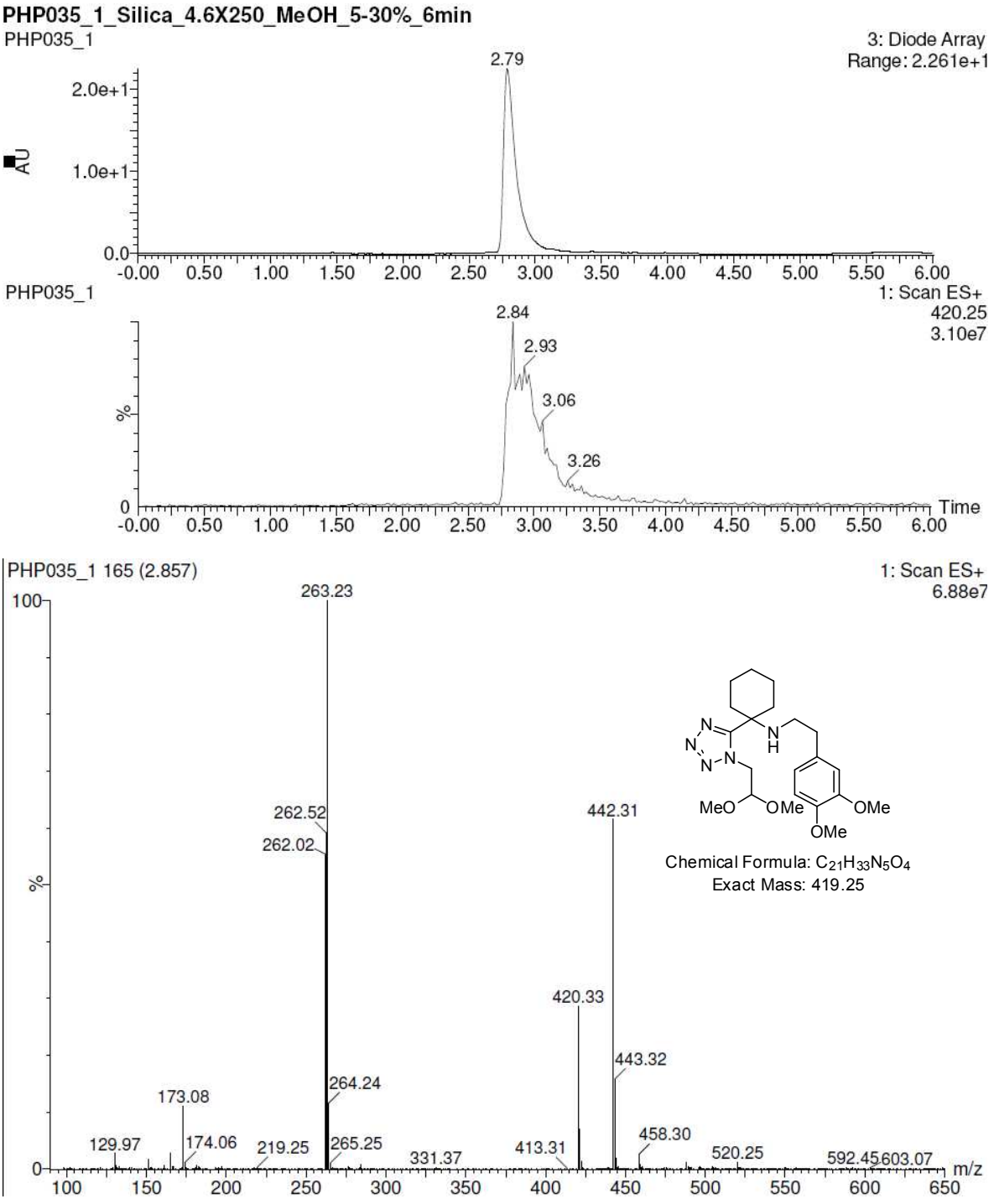
4b: 8-(4-chlorophenyl)-2,3-dimethoxy-6,8,13,13a-tetrahydro-5H-tetrazolo[1',5':4,5] pyrazino[2,1-a]isoquinoline



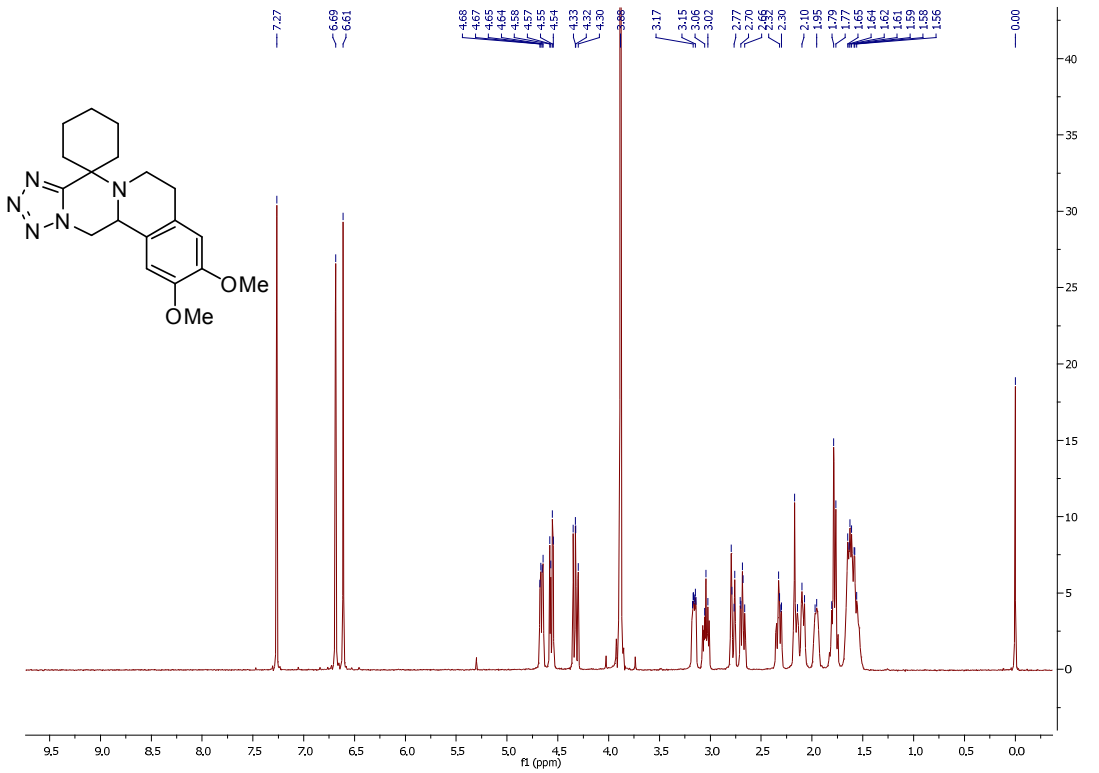

PHP030_1_Silica_4.6X250_MeOH_5-30%_6min
PHP030_1
3: Diode Array
Range: 1.865e+1
3.32
AU
PHP030_1
1: Scan ES+
398.12
2.70e7
3.41
%
Time
PHP030_1 197 (3.412)
1: Scan ES+
2.57e7
173.08
370.21
398.19
151.07
130.11
400.21
174.09
420.20
181.08
452.22
235.04
291.22
352.33
464.28
562.18
586.20
644.70
m/z
Cl
OMe
OMe
Chemical Formula: C20H20ClN5O2
Exact Mass: 397.13

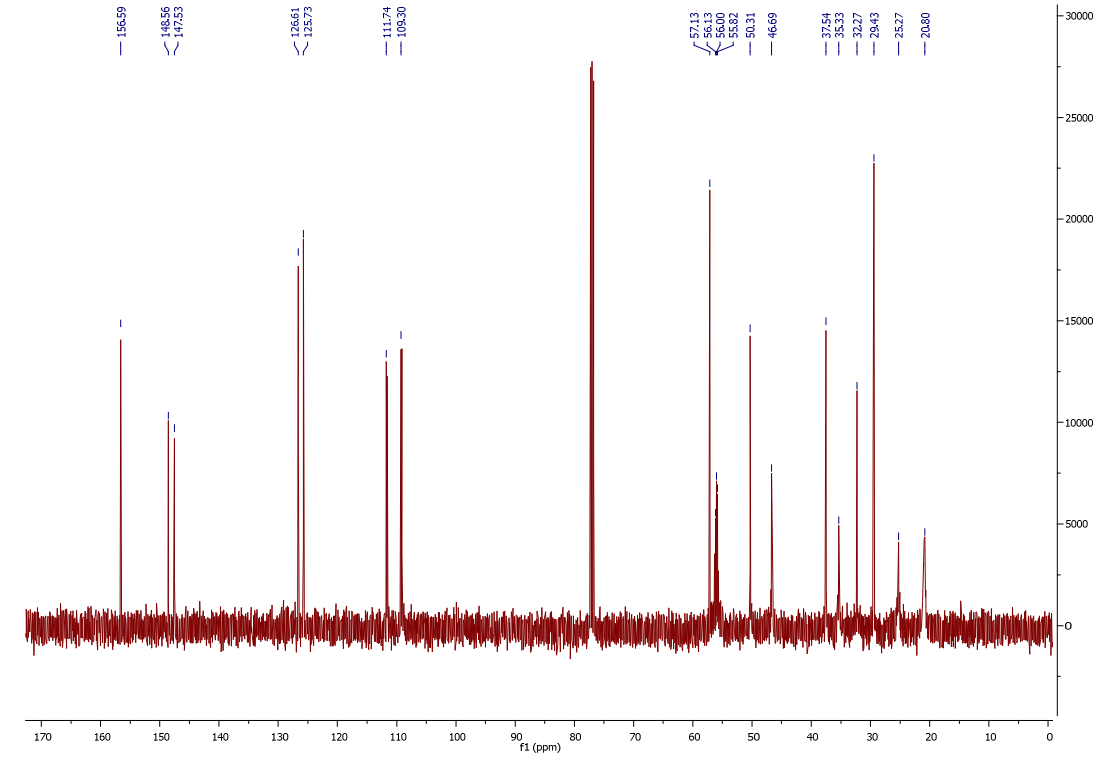
14c: 1-(1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)-N-(3,4-dimethoxyphenethyl)cyclohexanamine

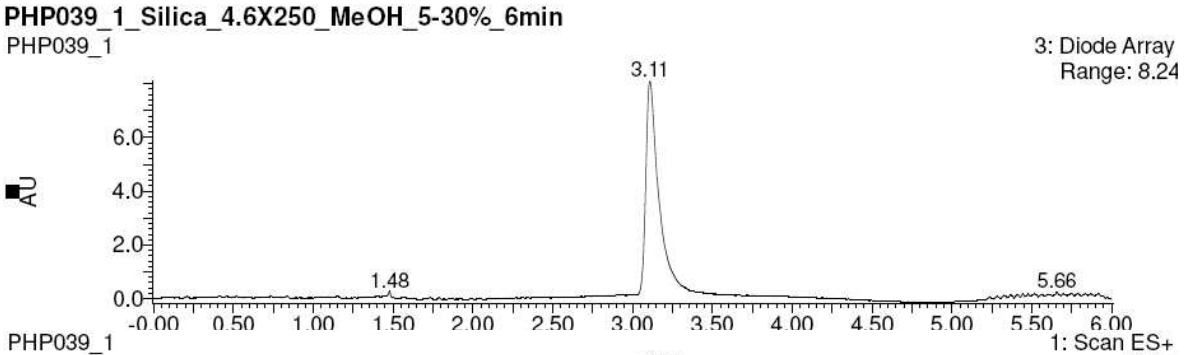


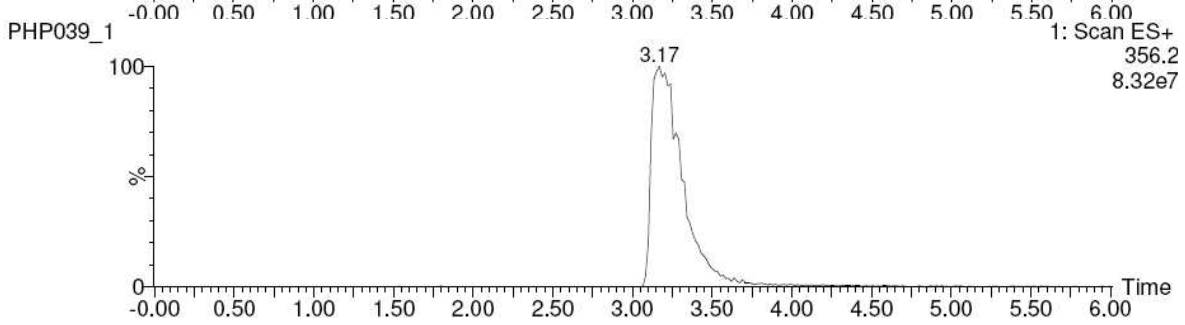

PHP035_1_Silica_4.6X250_MeOH_5-30%_6min
PHP035_1
3: Diode Array
Range: 2.261e+1
2.79
AU
PHP035_1
1: Scan ES+
420.25
3.10e7
2.84
2.93
3.06
3.26
%
Time
PHP035_1 165 (2.857)
1: Scan ES+
6.88e7
263.23
262.52
262.02
442.31
420.33
443.32
264.24
173.08
458.30
129.97
174.06
219.25
265.25
331.37
413.31
520.25
592.45
603.07
m/z
Chemical Formula: C21H33N5O4
Exact Mass: 419.25

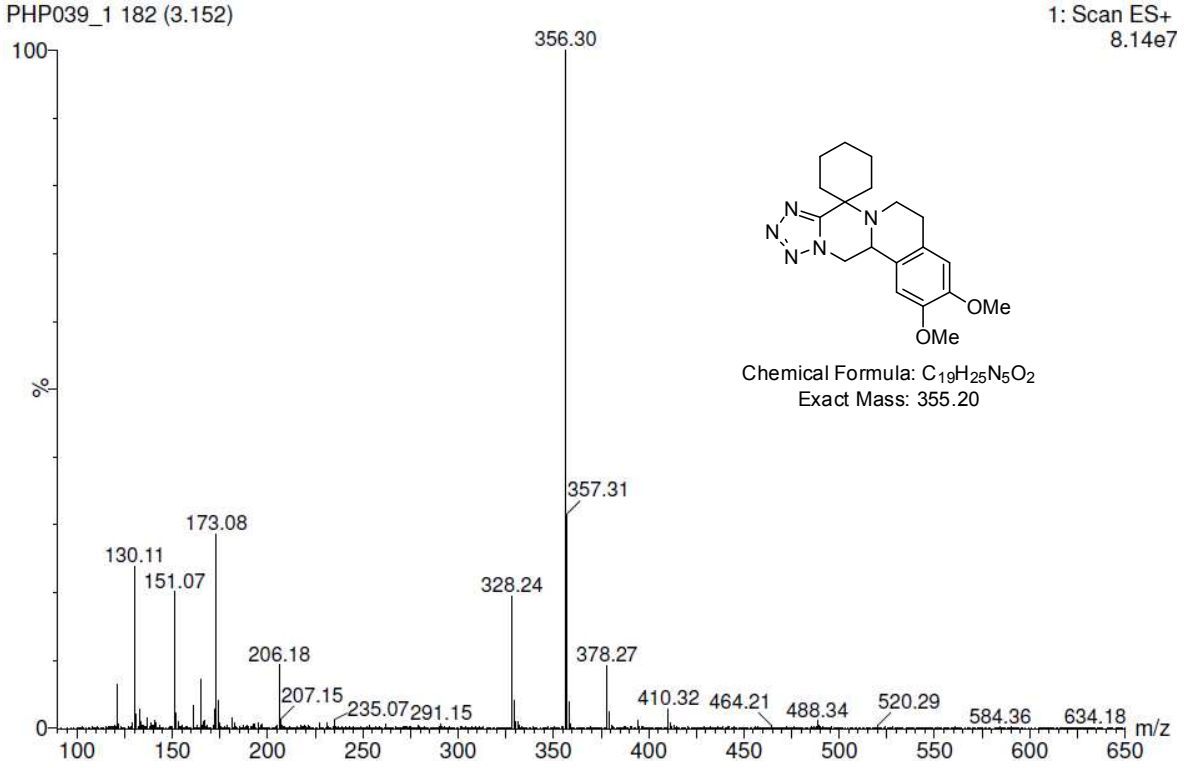
4c: 2',3'-dimethoxy-5',6',13',13a'-tetrahydrospiro[cyclohexane-1,8'-tetrazolo [1',5':4,5]pyrazino[2,1-a]isoquinoline]





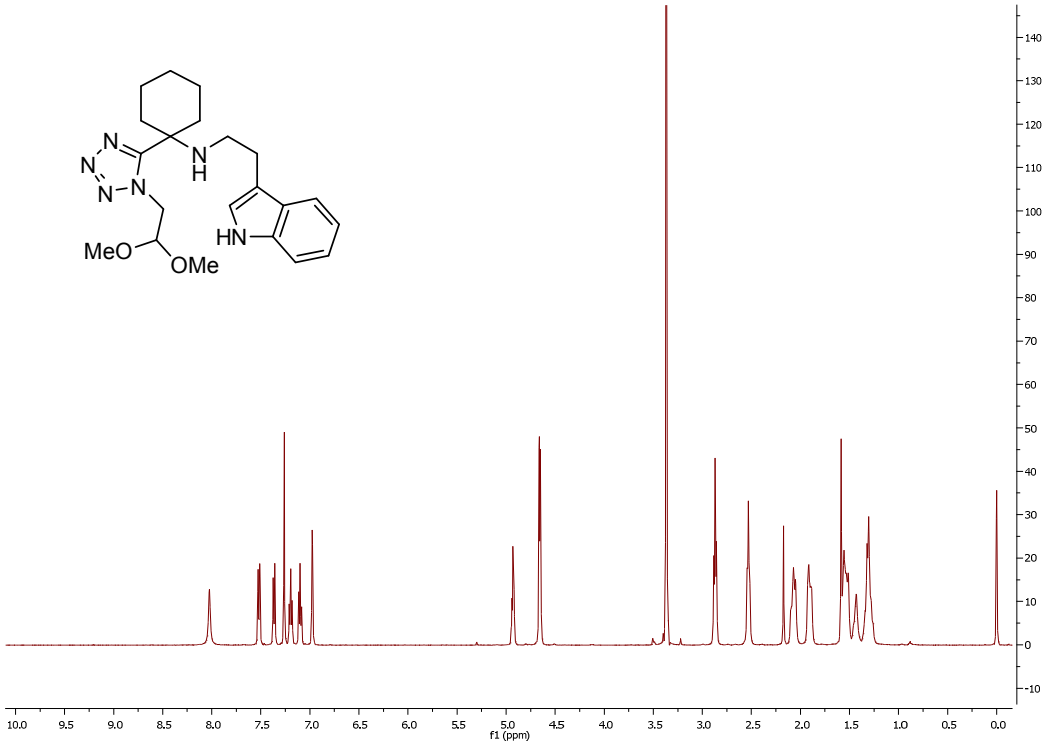


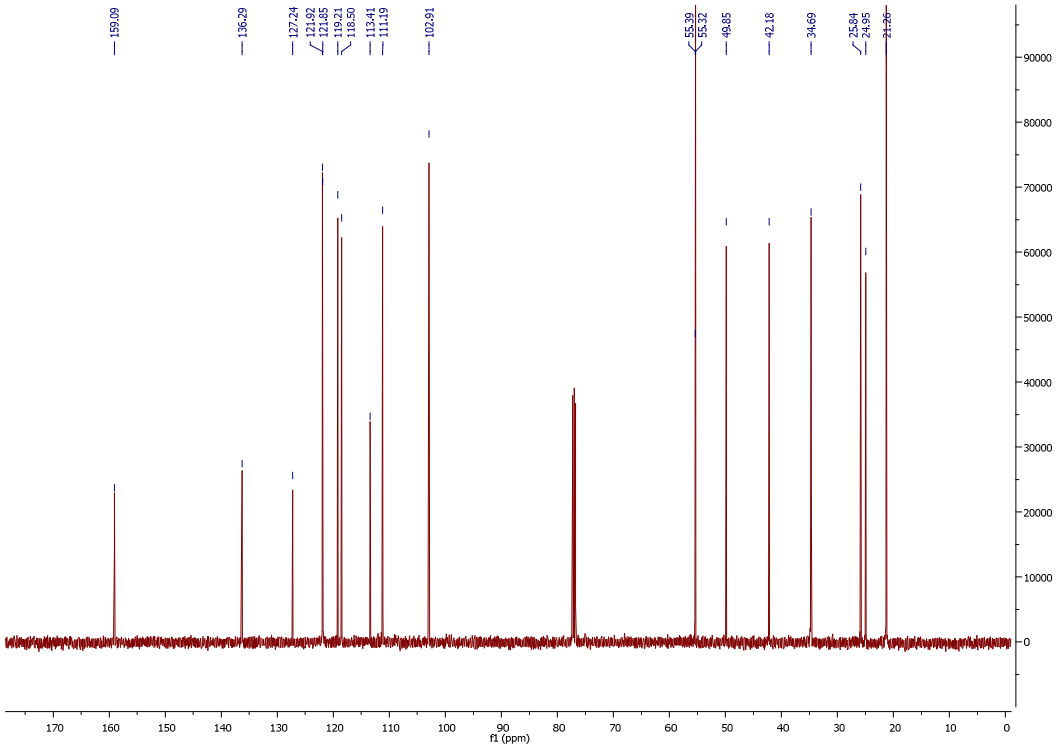


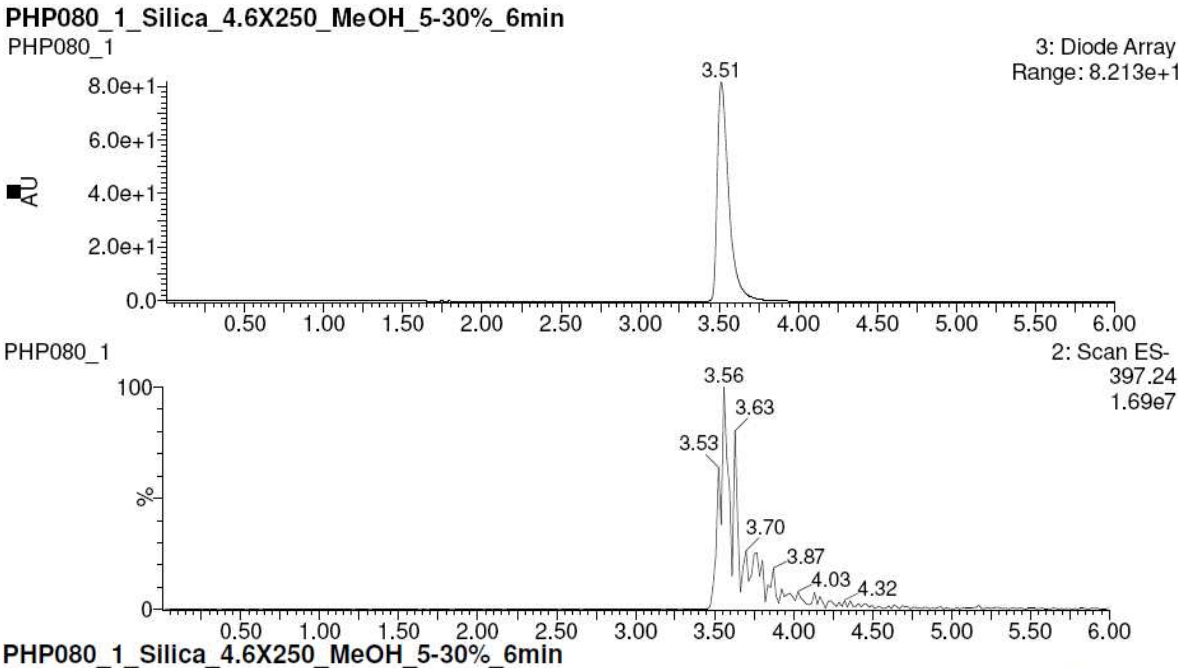


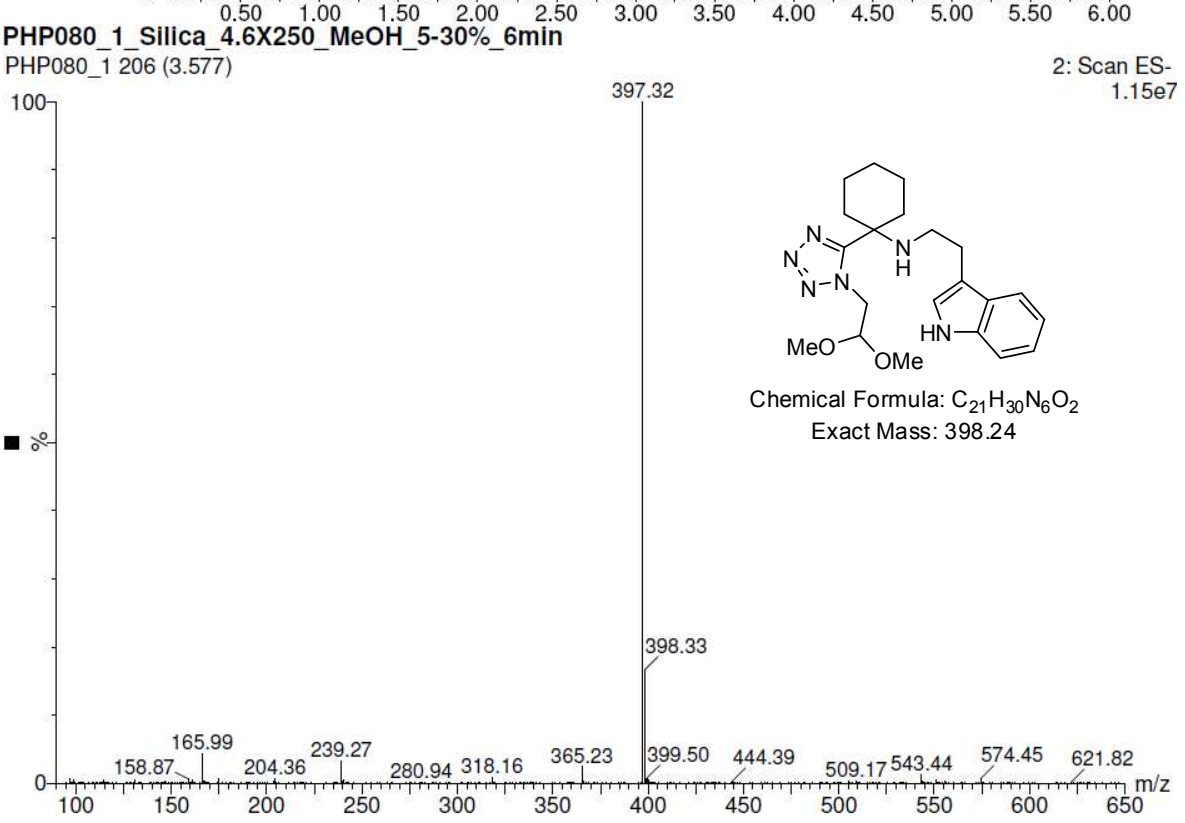
Chemical Formula: $C_{19}H_{25}N_5O_2$
Exact Mass: 355.20

14d: N-(2-(1H-indol-3-yl)ethyl)-1-(1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl) cyclohexanamine.



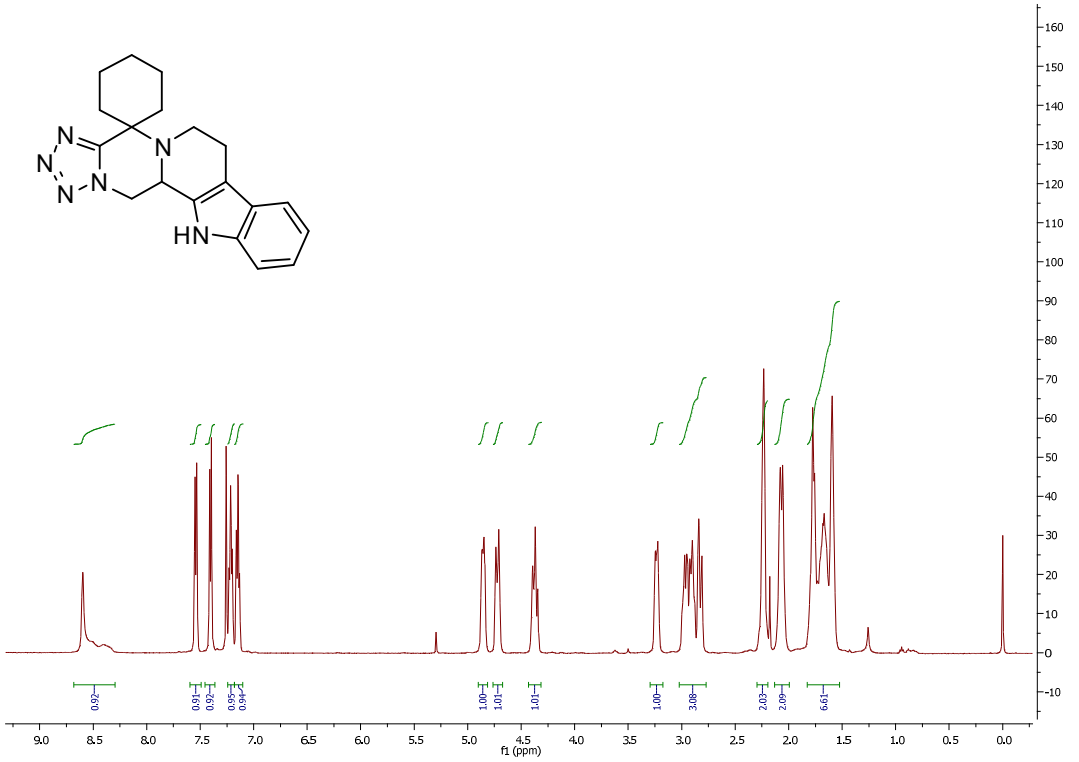


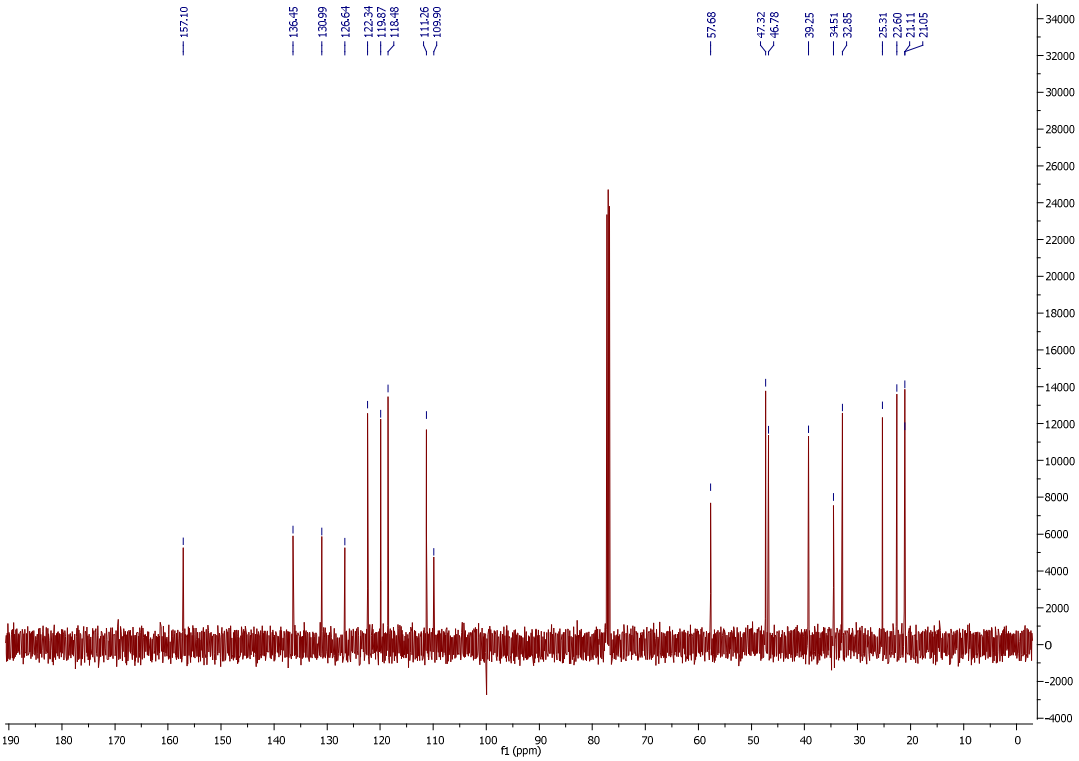


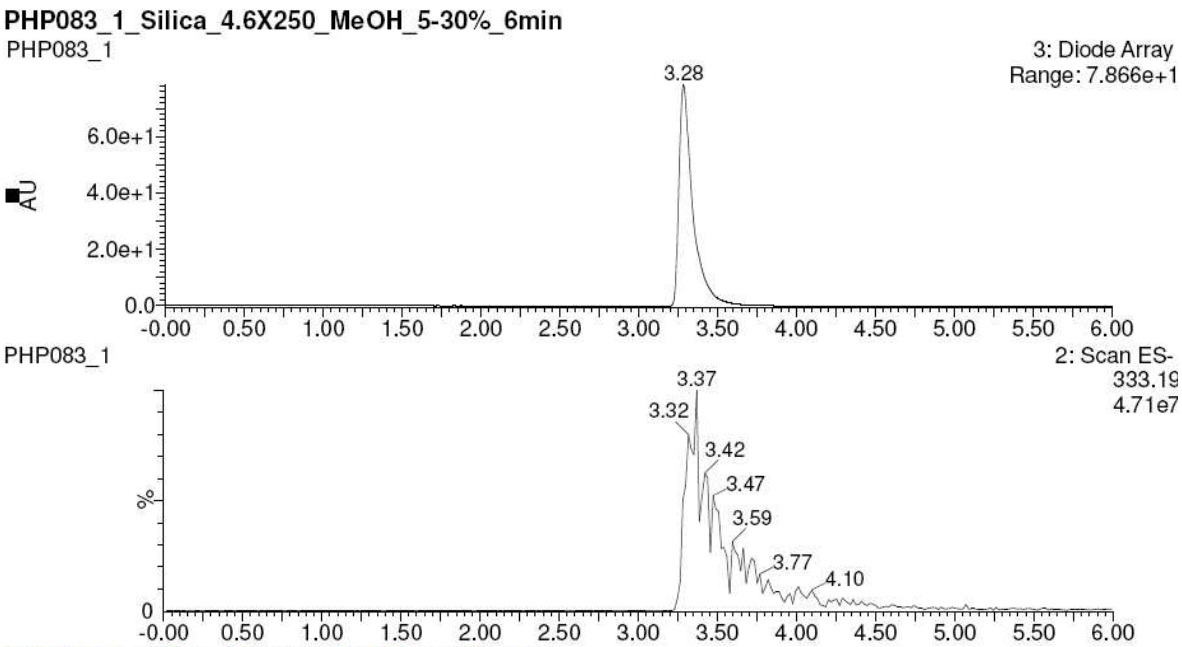


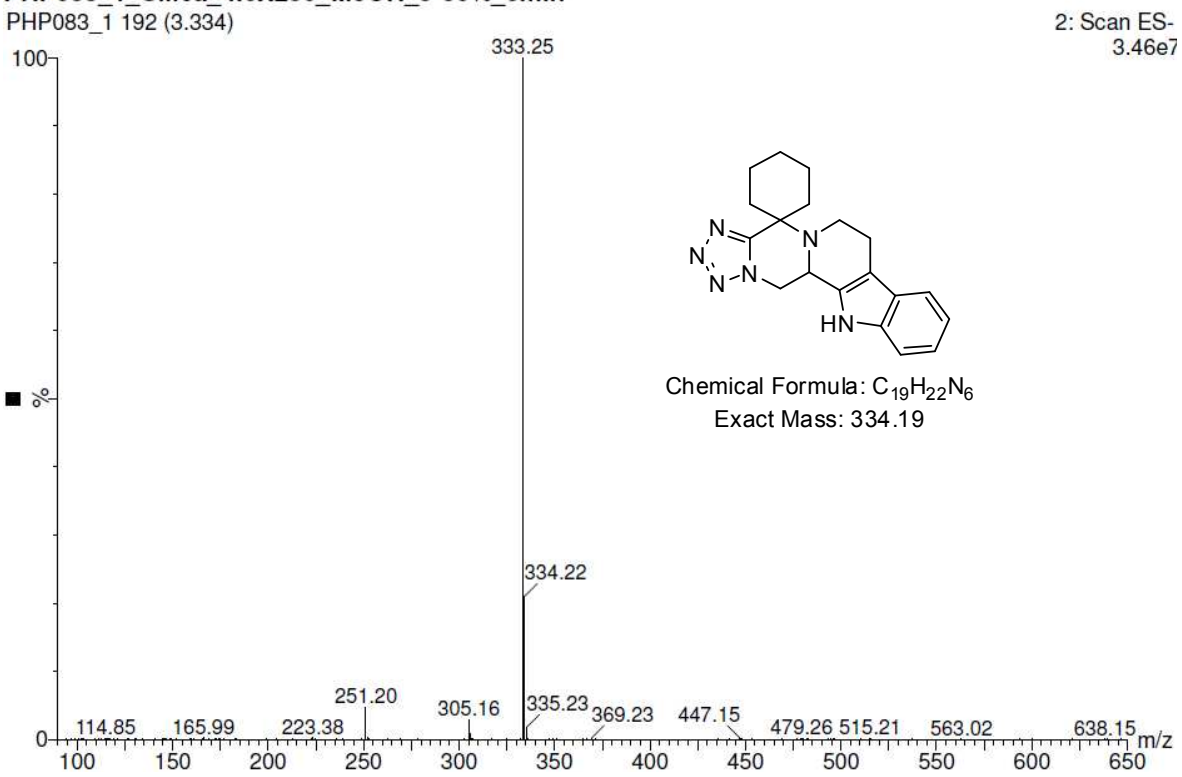
Chemical Formula: $C_{21}H_{30}N_6O_2$
Exact Mass: 398.24

4d: 7',12',12b',13'-tetrahydro-6'H-spiro[cyclohexane-1,4'-tetrazolo[1'',5'':4',5'] pyrazino[1',2':1,2]pyrido[3,4-b]indole]



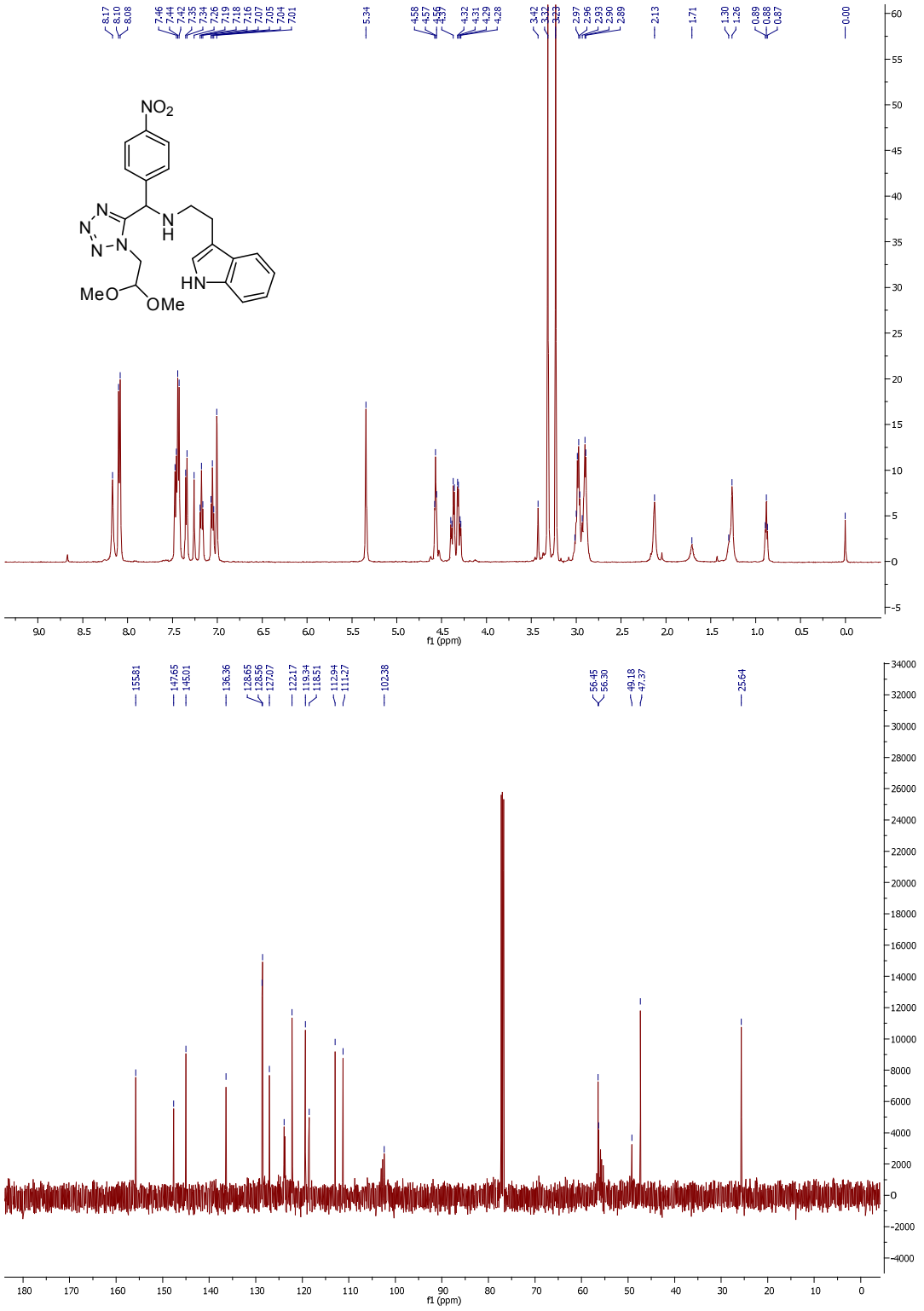


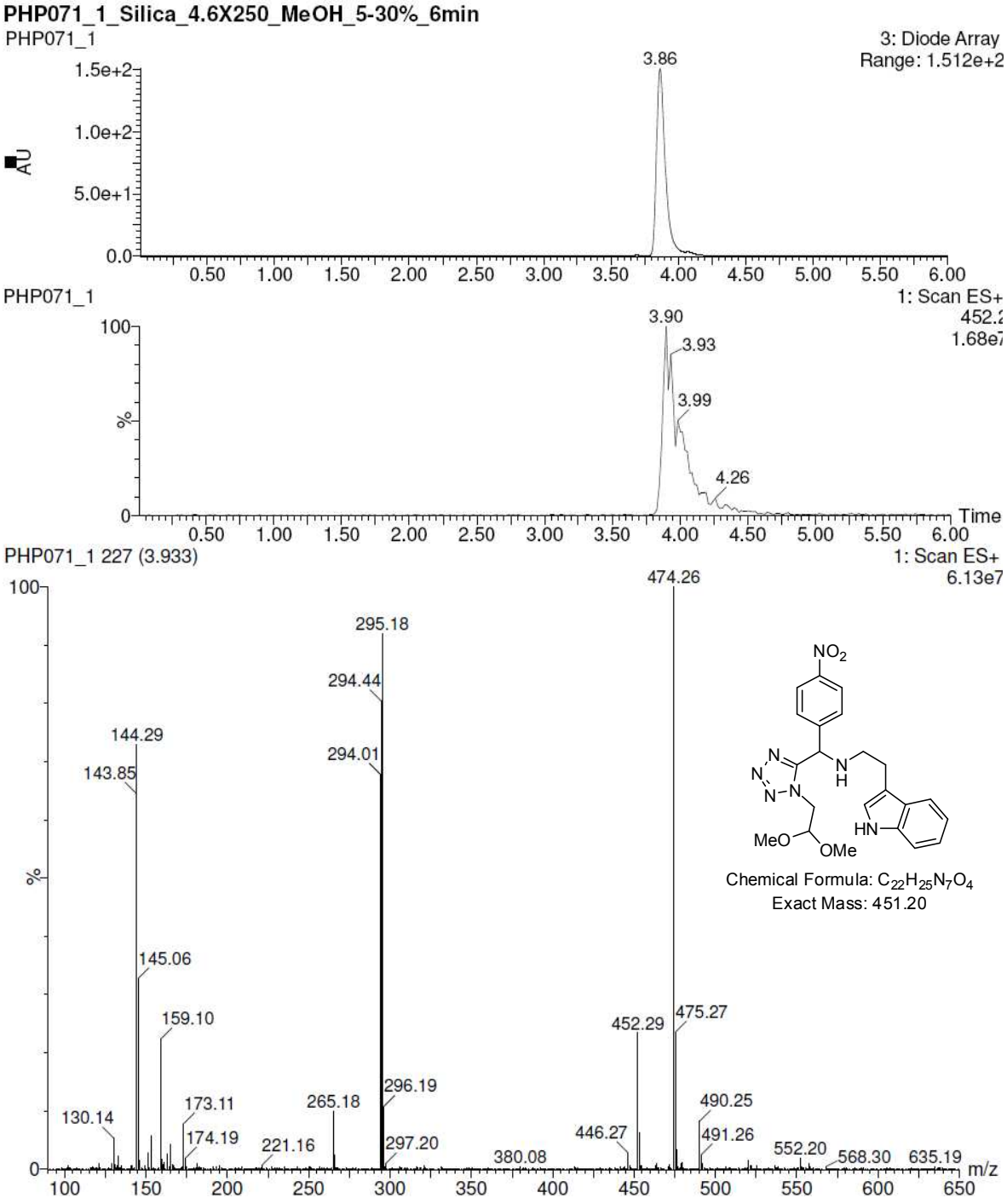




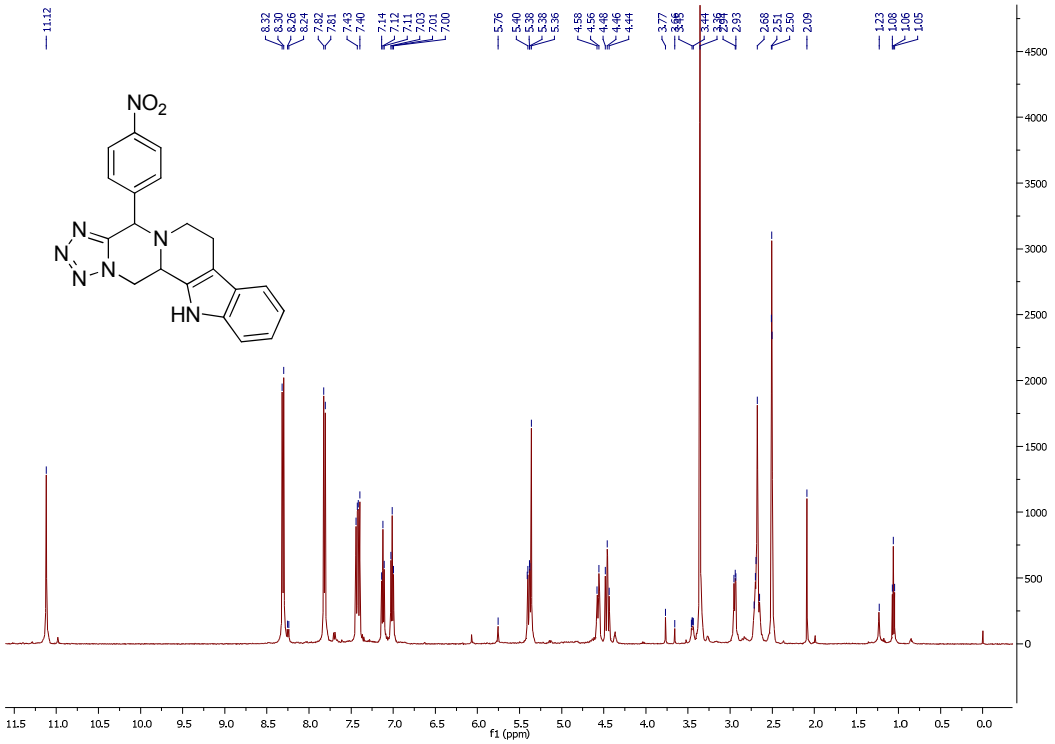
Chemical Formula: $C_{19}H_{22}N_6$
Exact Mass: 334.19

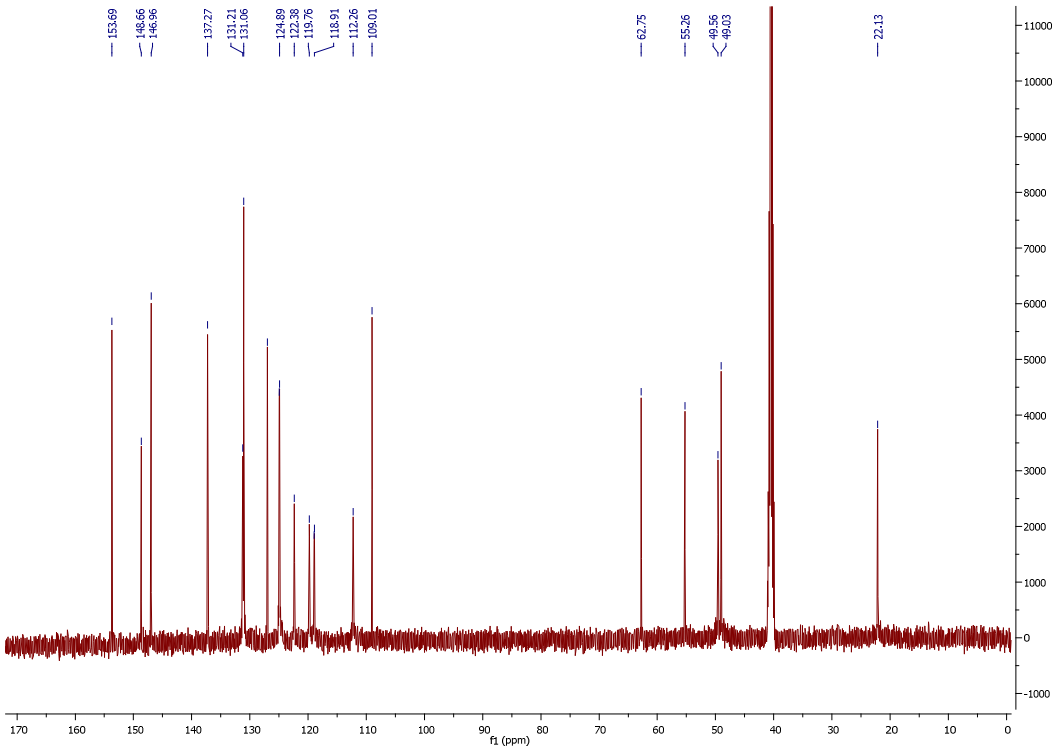
14e: N-((1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)(4-nitrophenyl)methyl)-2-(1H-indol-3-yl)ethanamine

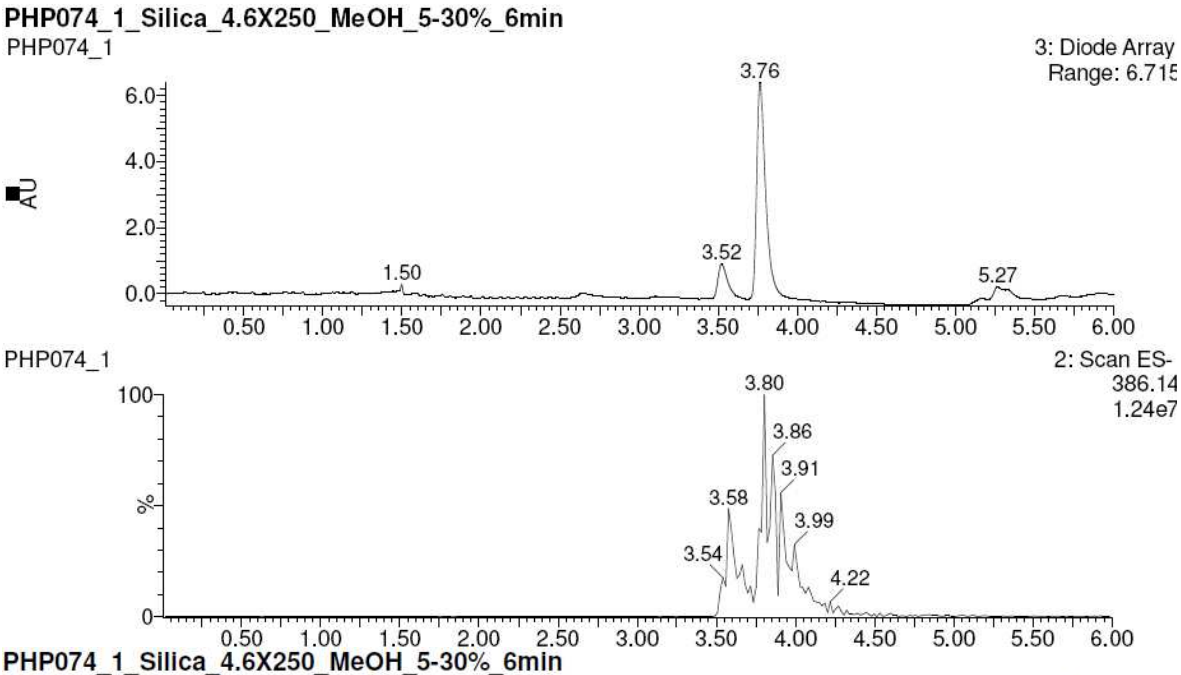


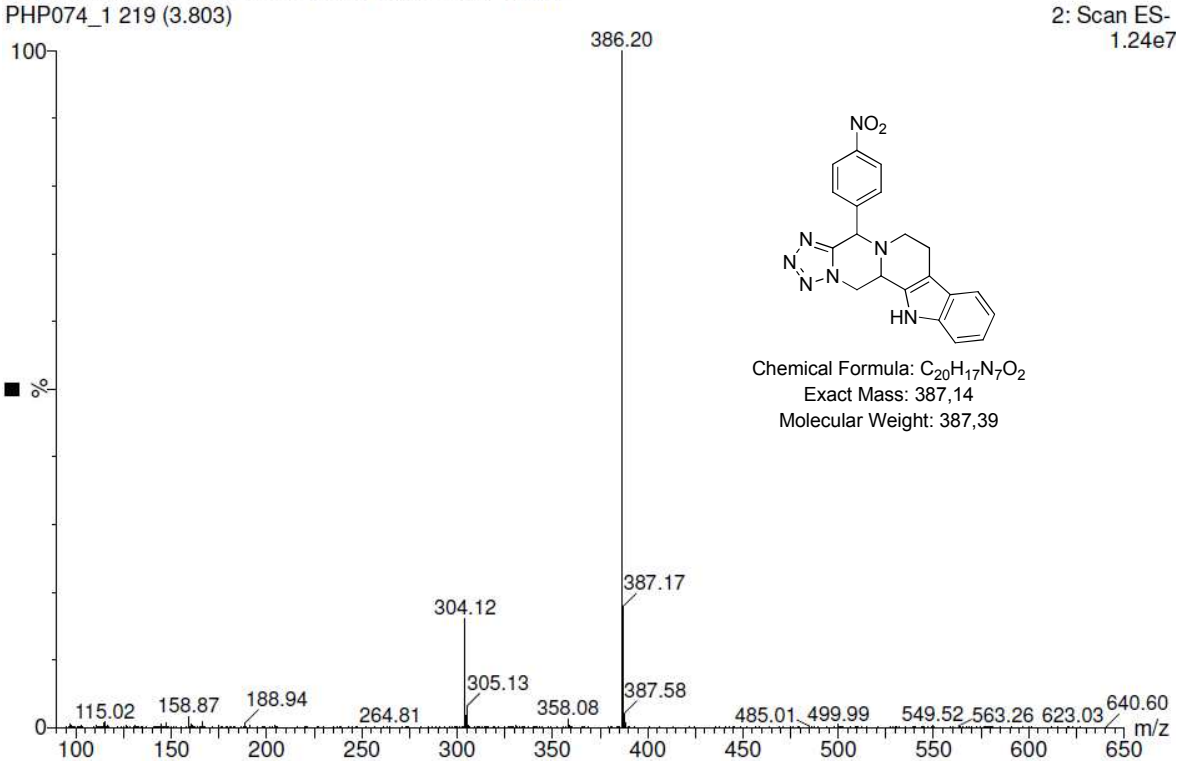

PHP071_1_Silica_4.6X250_MeOH_5-30%_6min
PHP071_1
3: Diode Array
Range: 1.512e+2
3.86
AU
PHP071_1
1: Scan ES+
452.2
1.68e7
3.90
3.93
3.99
4.26
%
Time
PHP071_1 227 (3.933)
1: Scan ES+
6.13e7
474.26
295.18
294.44
294.01
144.29
143.85
145.06
159.10
173.11
174.19
130.14
221.16
265.18
296.19
297.20
380.08
446.27
452.29
475.27
490.25
491.26
552.20
568.30
635.19
m/z
Chemical Formula: C22H25N7O4
Exact Mass: 451.20

4e: 4-(4-nitrophenyl)-4,6,7,12,12b,13-hexahydrotetrazolo[1'',5'':4',5']pyrazino [1',2':1,2]pyrido[3,4-b]indole



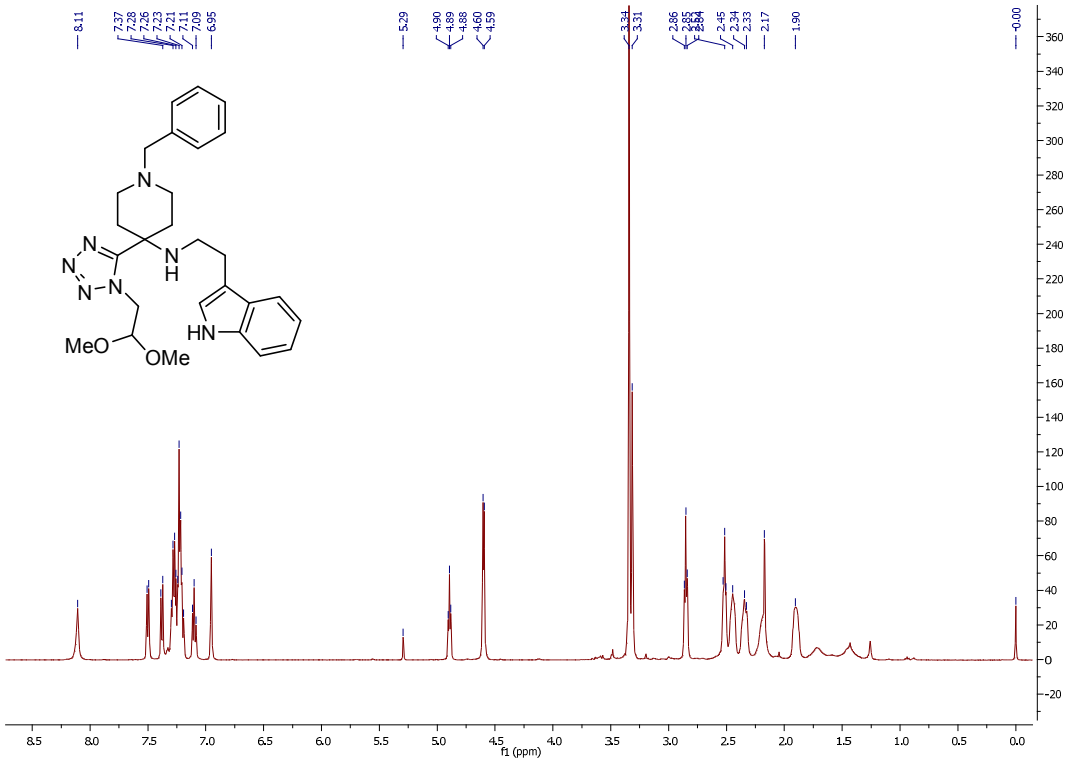


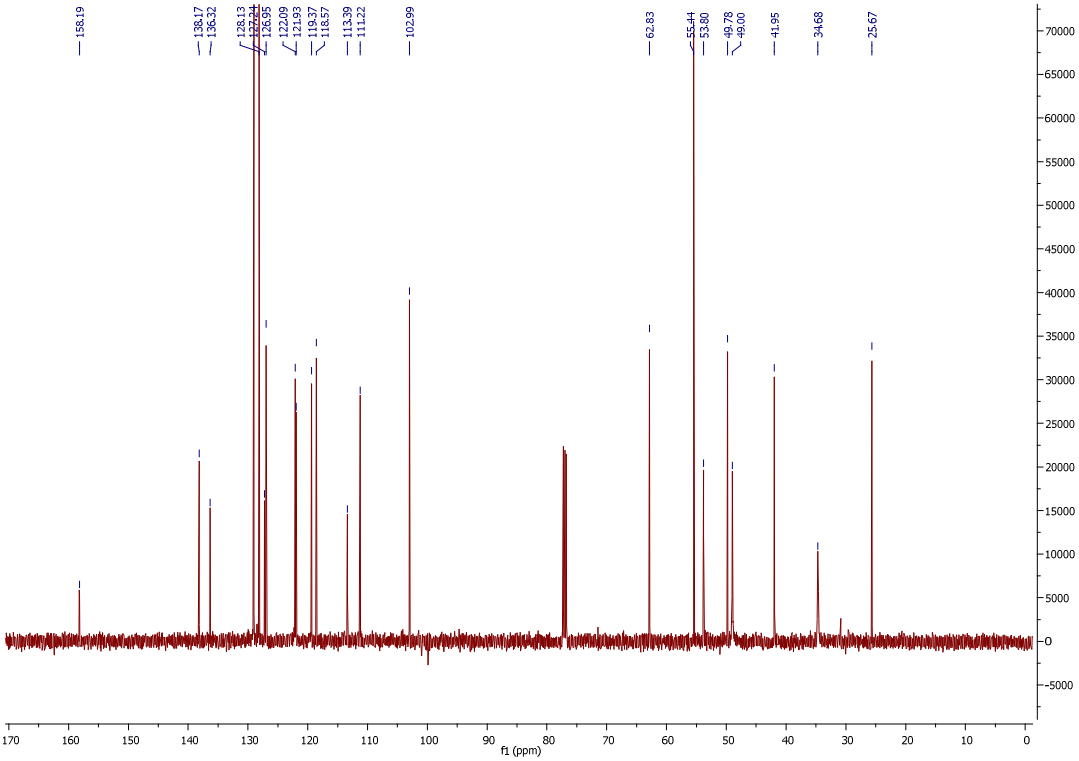


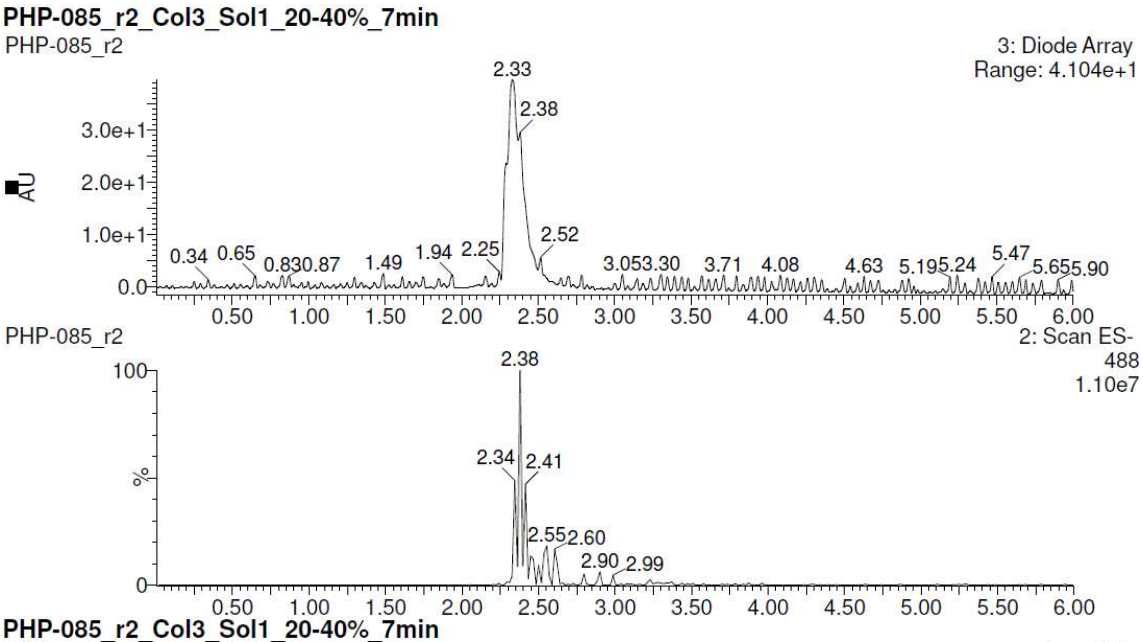


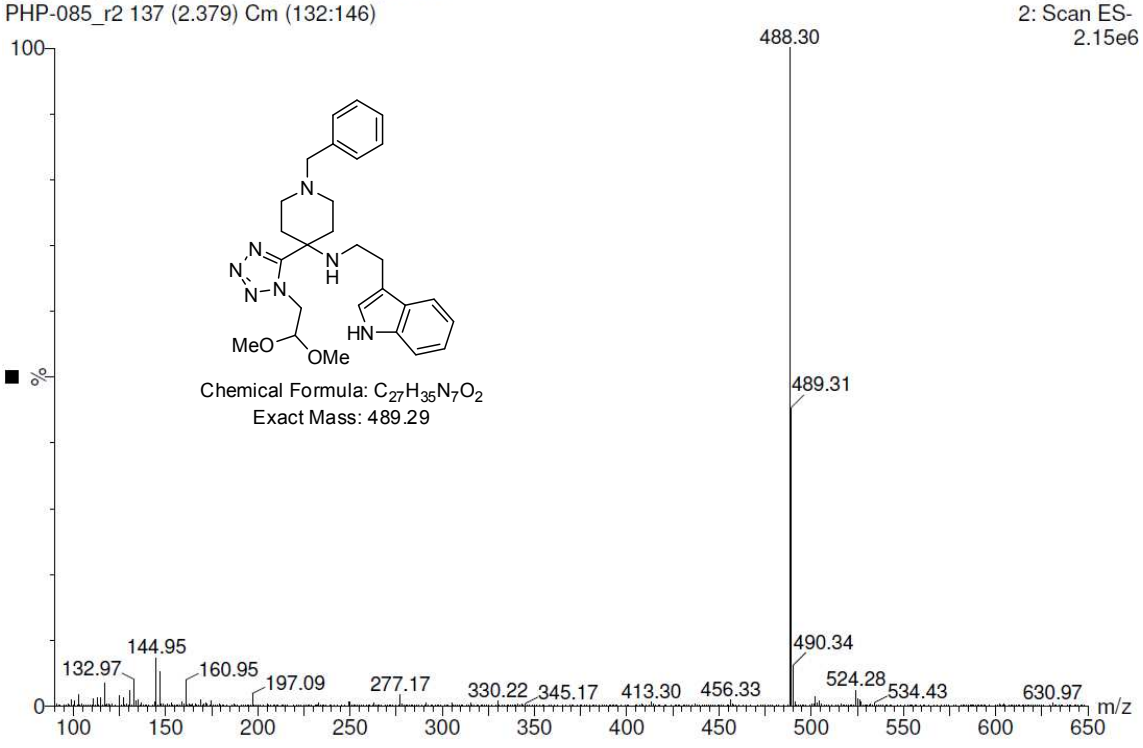
Chemical Formula: $C_{20}H_{17}N_7O_2$
Exact Mass: 387,14
Molecular Weight: 387,39

14f: N-(2-(1H-indol-3-yl)ethyl)-1-benzyl-4-(1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)piperidin-4-amine

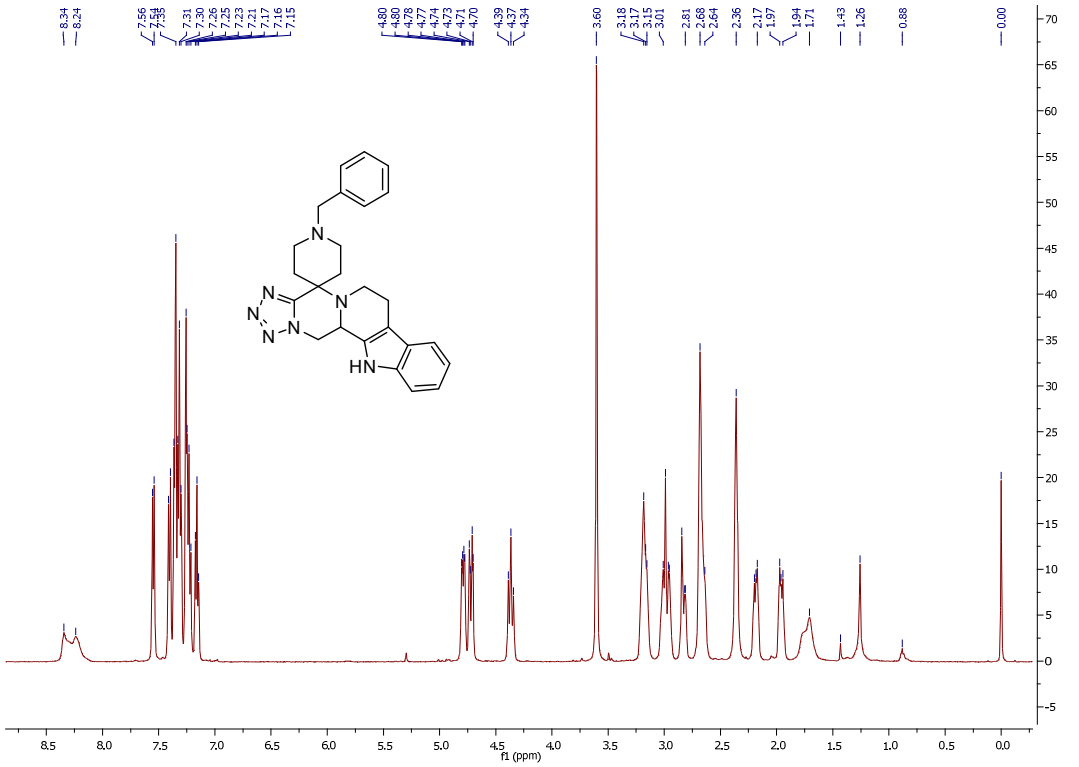


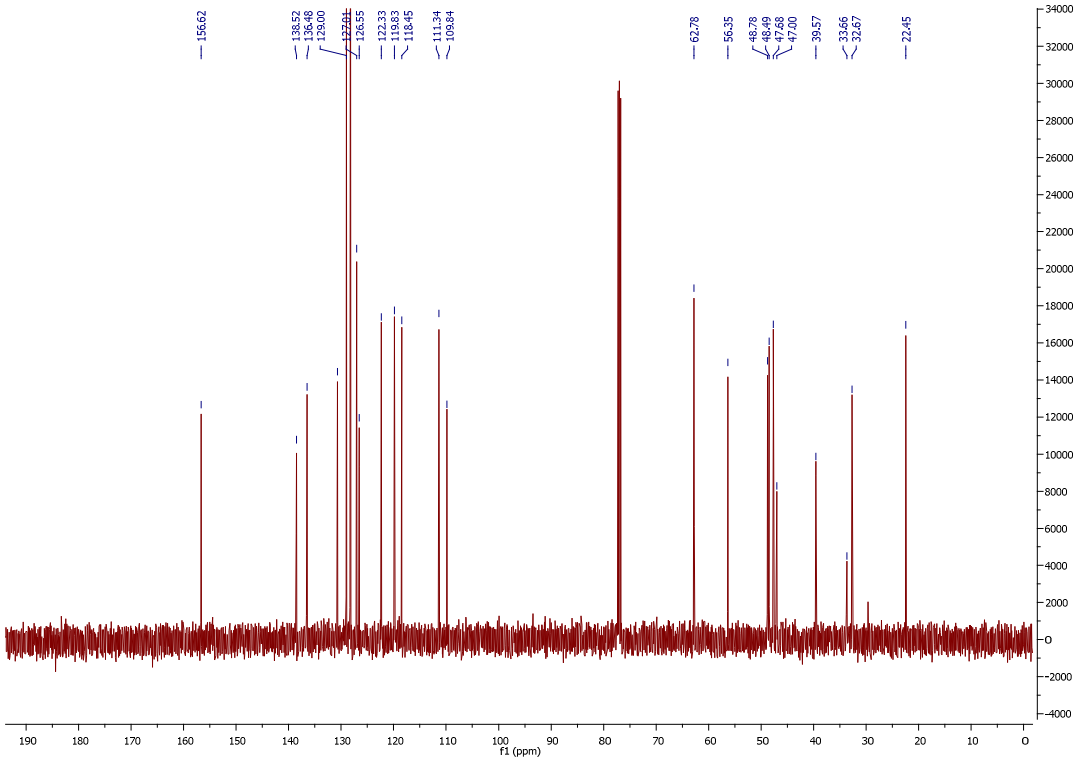


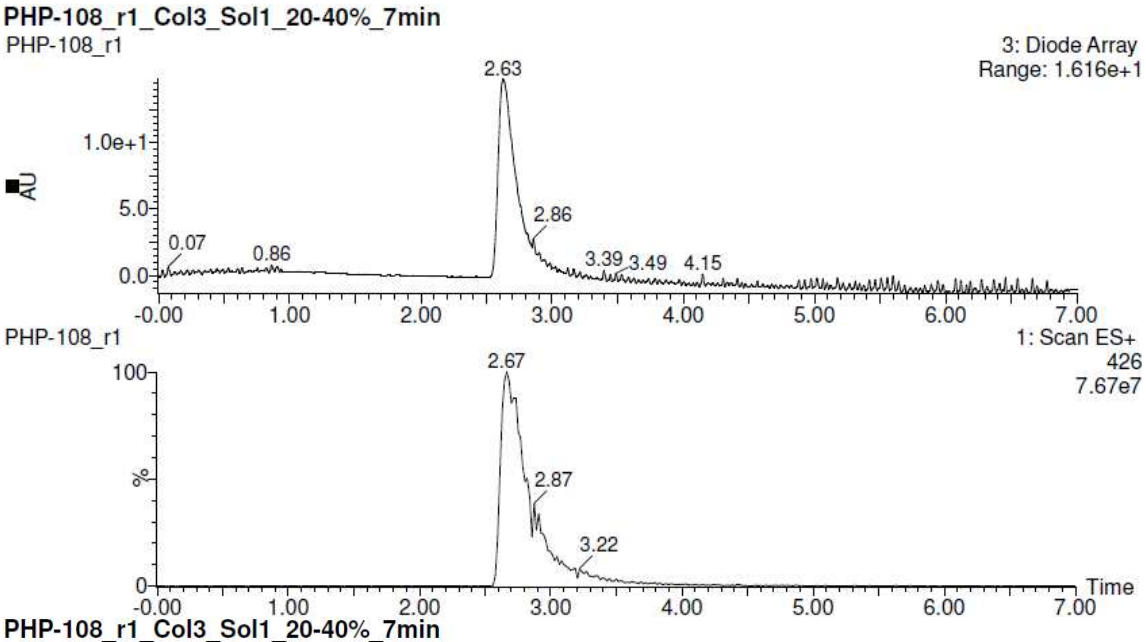

PHP-085_r2_Col3_Sol1_20-40%_7min
PHP-085_r2
3: Diode Array
Range: 4.104e+1
AU
2.33
2.38
2.52
PHP-085_r2
2: Scan ES-
488
1.10e7
%
2.38
2.34
2.41
2.55
2.60
2.90
2.99

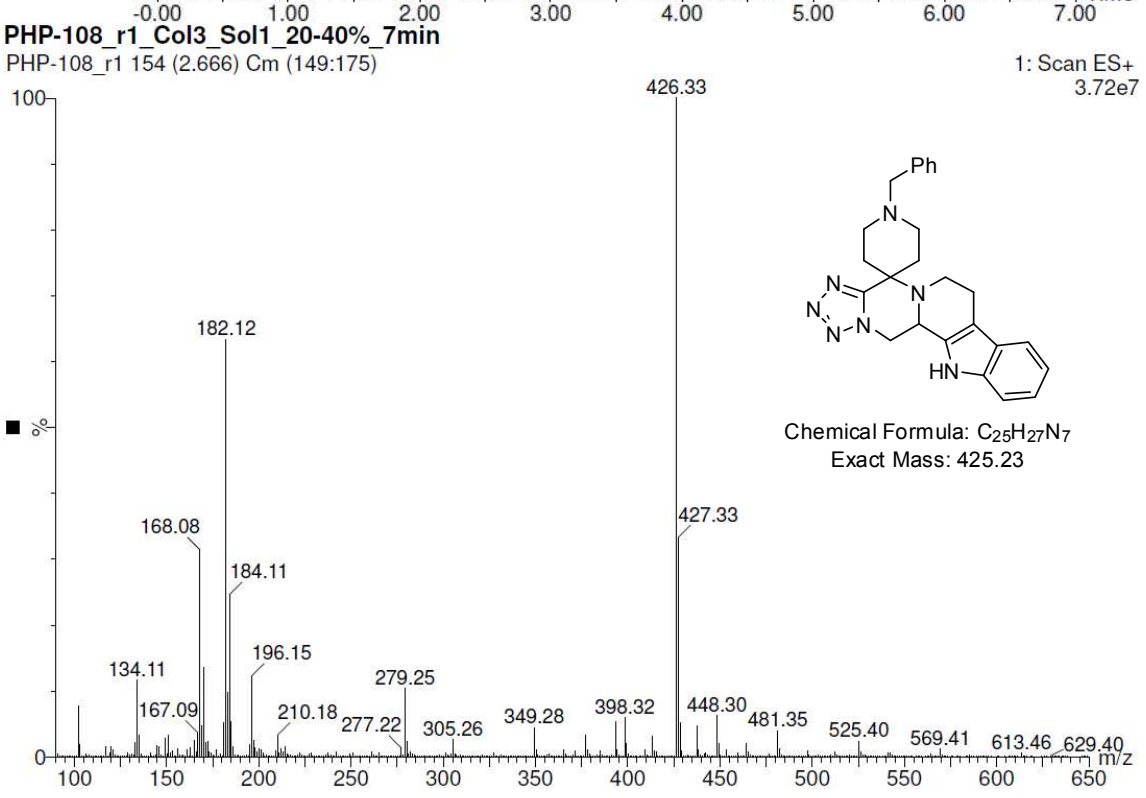

PHP-085_r2_Col3_Sol1_20-40%_7min
PHP-085_r2 137 (2.379) Cm (132:146)
2: Scan ES-
2.15e6
488.30
489.31
490.34
144.95
132.97
160.95
197.09
277.17
330.22
345.17
413.30
456.33
524.28
534.43
630.97
m/z
MeO
OMe
HN
Chemical Formula: C27H35N7O2
Exact Mass: 489.29

4f: 1-benzyl-7',12',12b',13'-tetrahydro-6'H-spiro[piperidine-4,4'-tetrazolo[1'',5'':4',5']pyrazino[1',2':1,2]pyrido[3,4-b]indole]



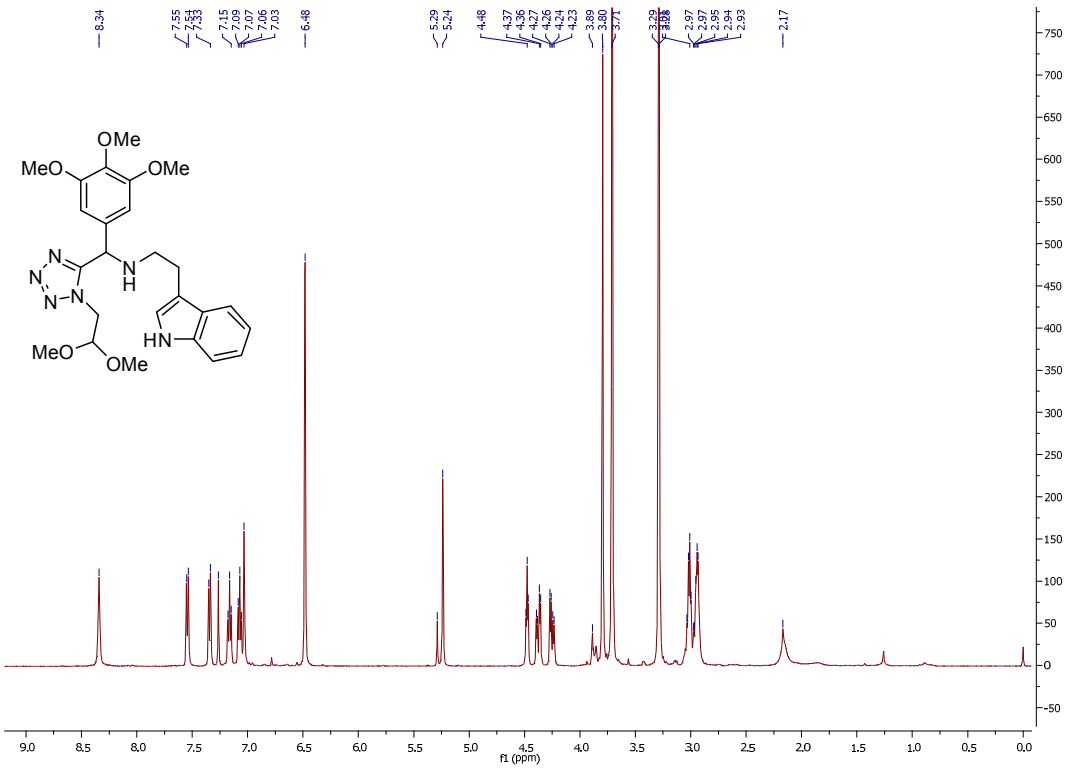


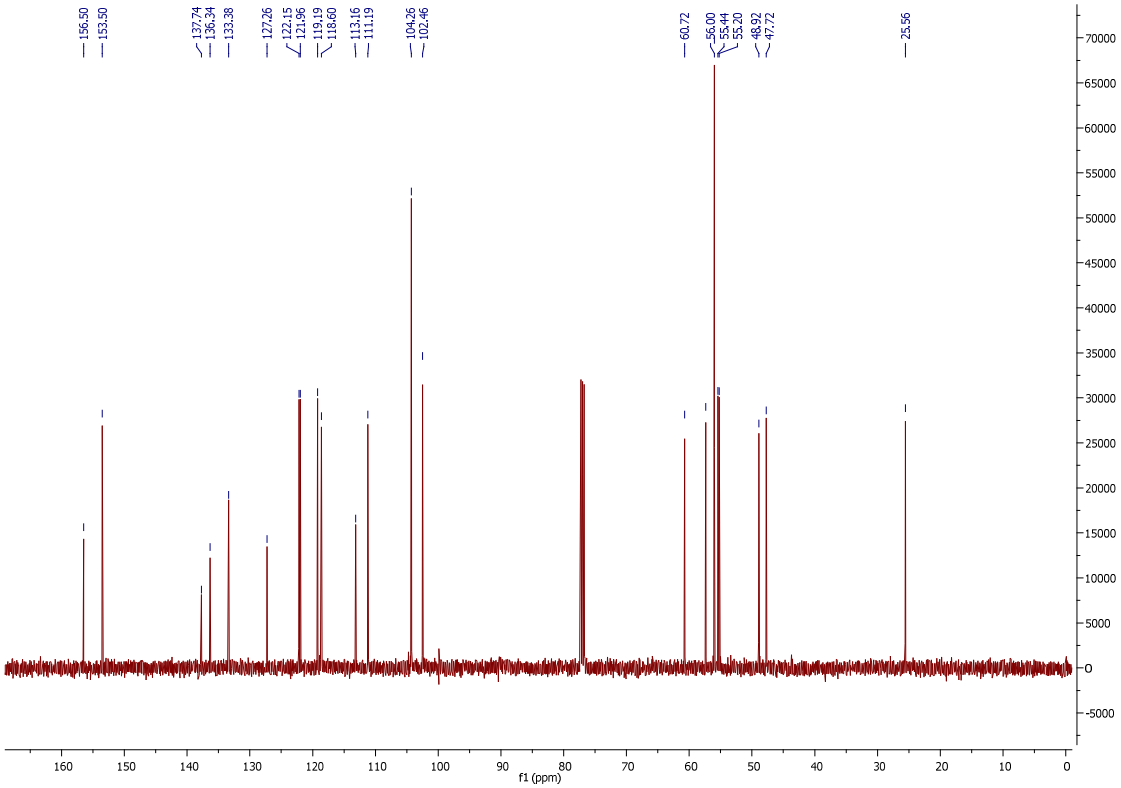


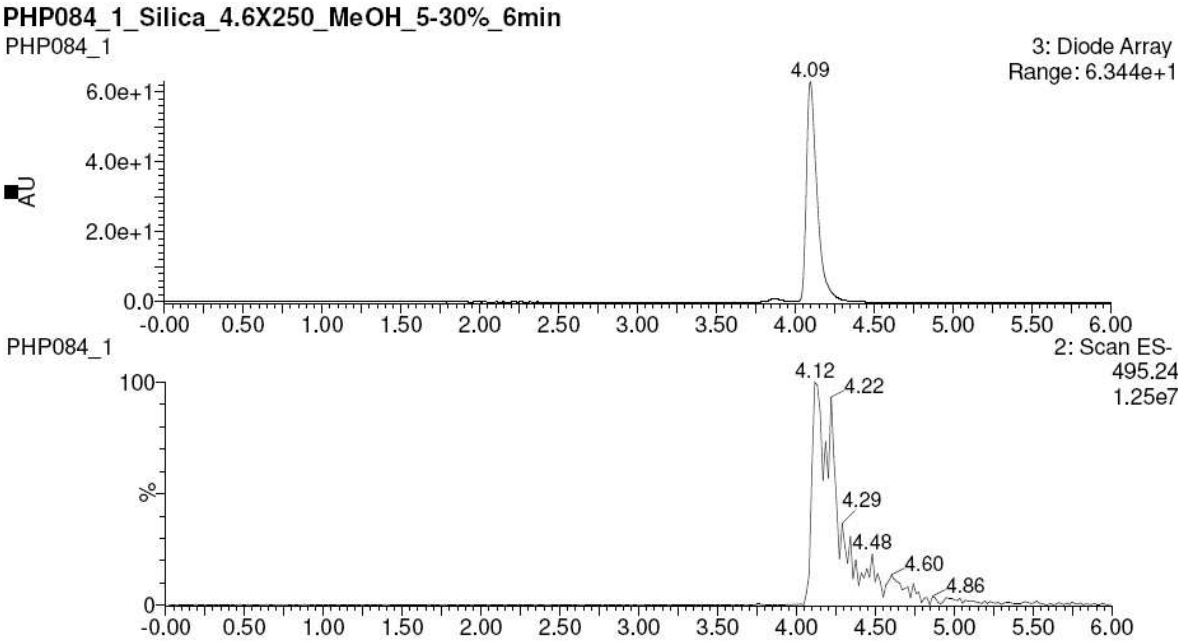


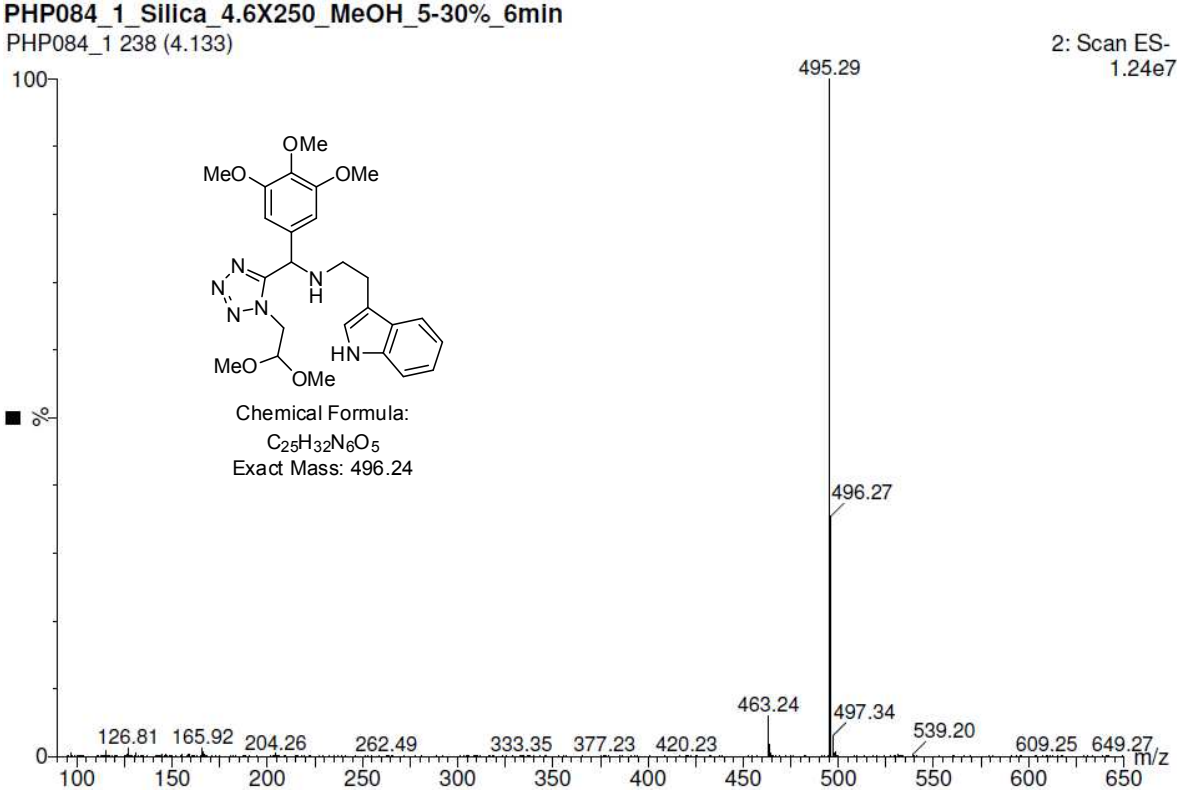
Chemical Formula: $C_{25}H_{27}N_7$
Exact Mass: 425.23

14g: N-((1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)(3,4,5-trimethoxyphenyl)methyl)-2-(1H-indol-3-yl)ethanamine

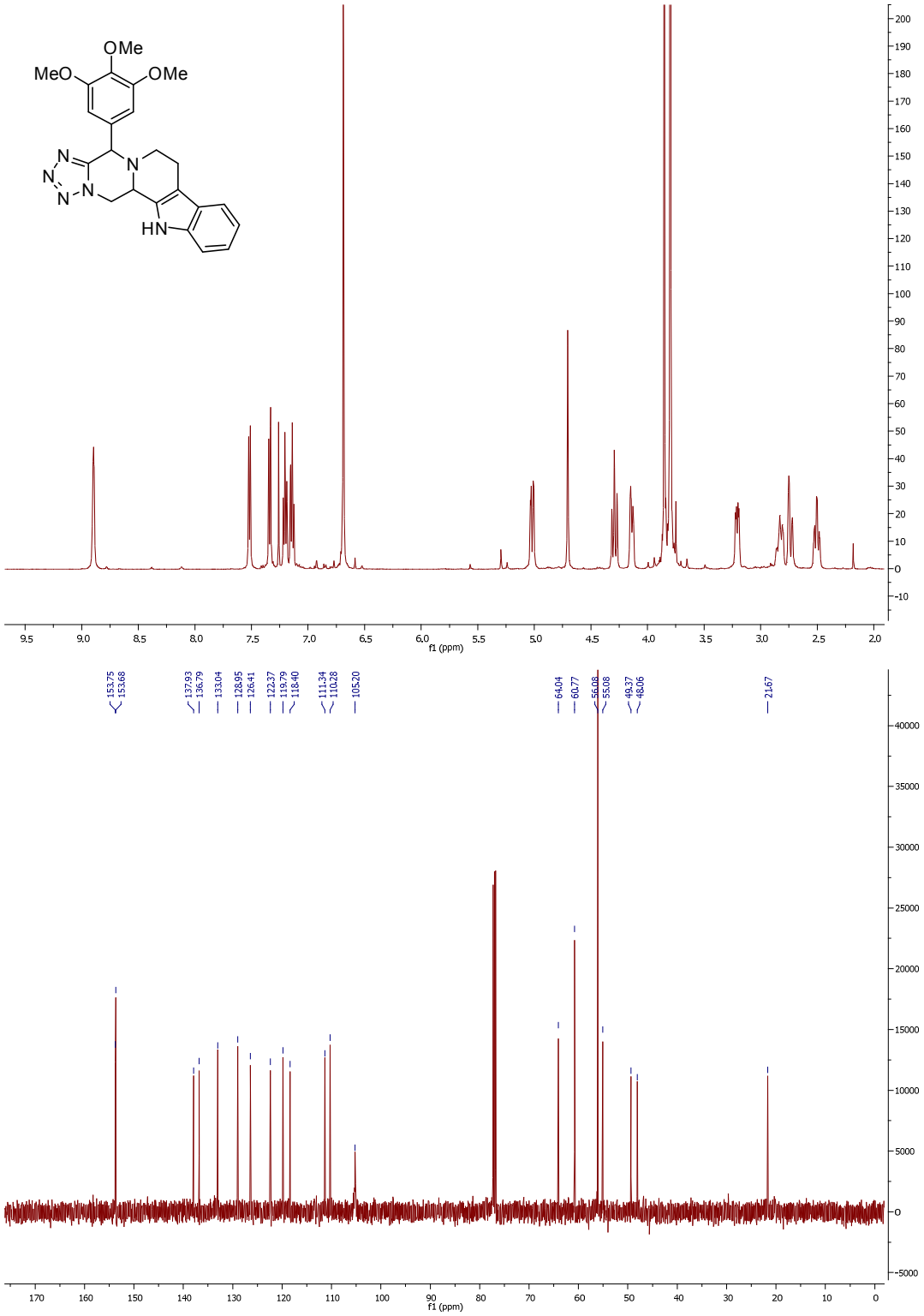


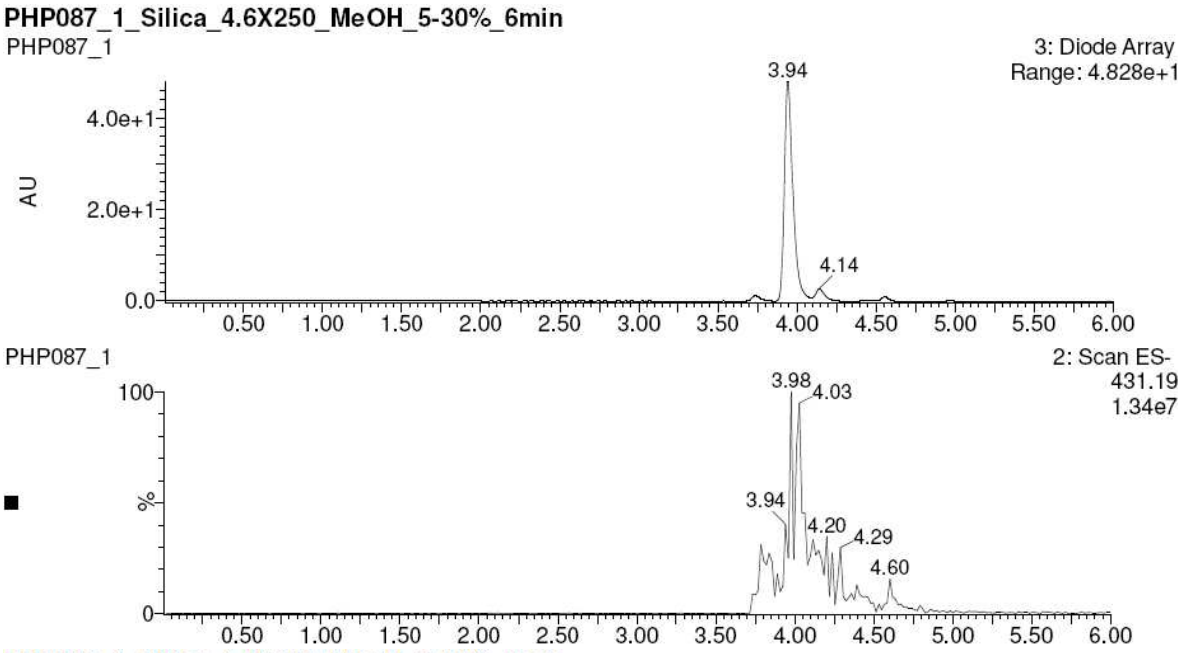


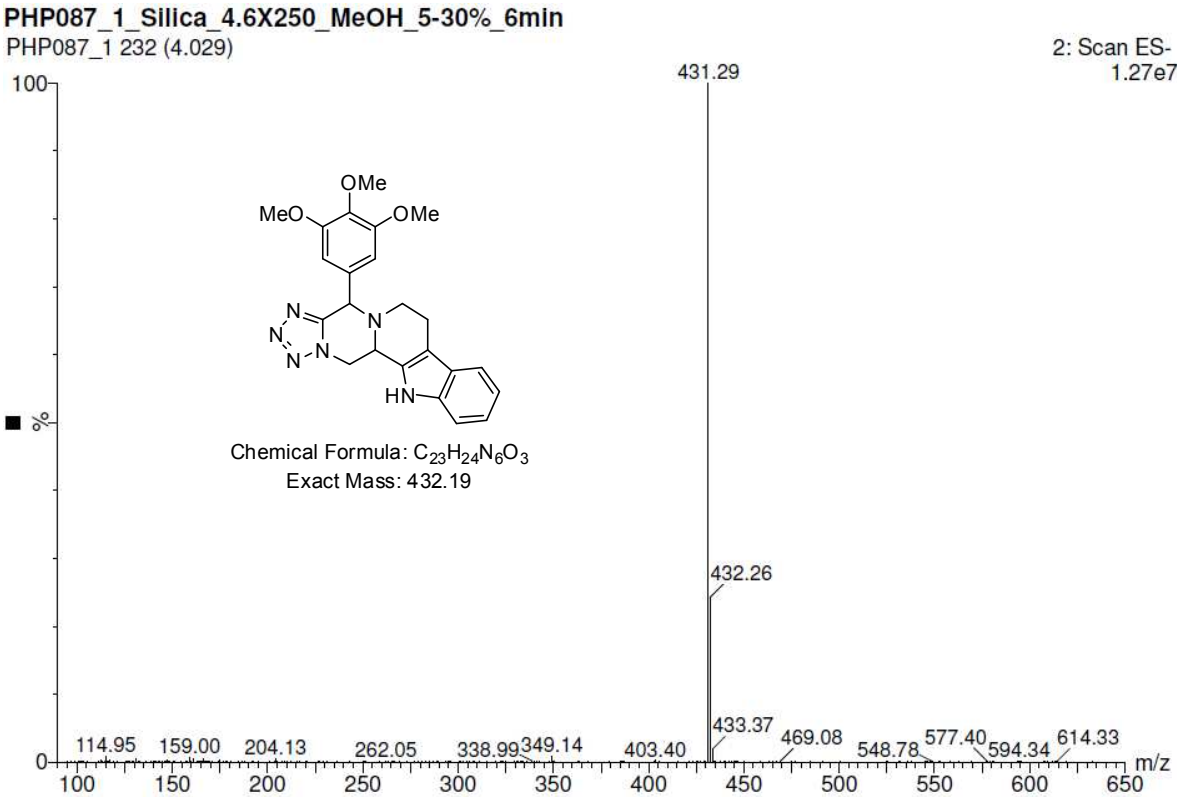

PHP084_1_Silica_4.6X250_MeOH_5-30%_6min
PHP084_1
3: Diode Array
Range: 6.344e+1
4.09
6.0e+1
4.0e+1
2.0e+1
0.0
AU
-0.00 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 6.00
PHP084_1
2: Scan ES-
495.24
1.25e7
100
%
0
4.12
4.22
4.29
4.48
4.60
4.86
-0.00 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 6.00


PHP084_1_Silica_4.6X250_MeOH_5-30%_6min
PHP084_1 238 (4.133)
2: Scan ES-
1.24e7
495.29
100
%
0
OMe
MeO
OMe
N
N
N
N
H
MeO
OMe
HN
Chemical Formula:
C25H32N6O5
Exact Mass: 496.24
496.27
463.24
497.34
539.20
126.81 165.92 204.26 262.49 333.35 377.23 420.23
609.25 649.27
m/z
100 150 200 250 300 350 400 450 500 550 600 650

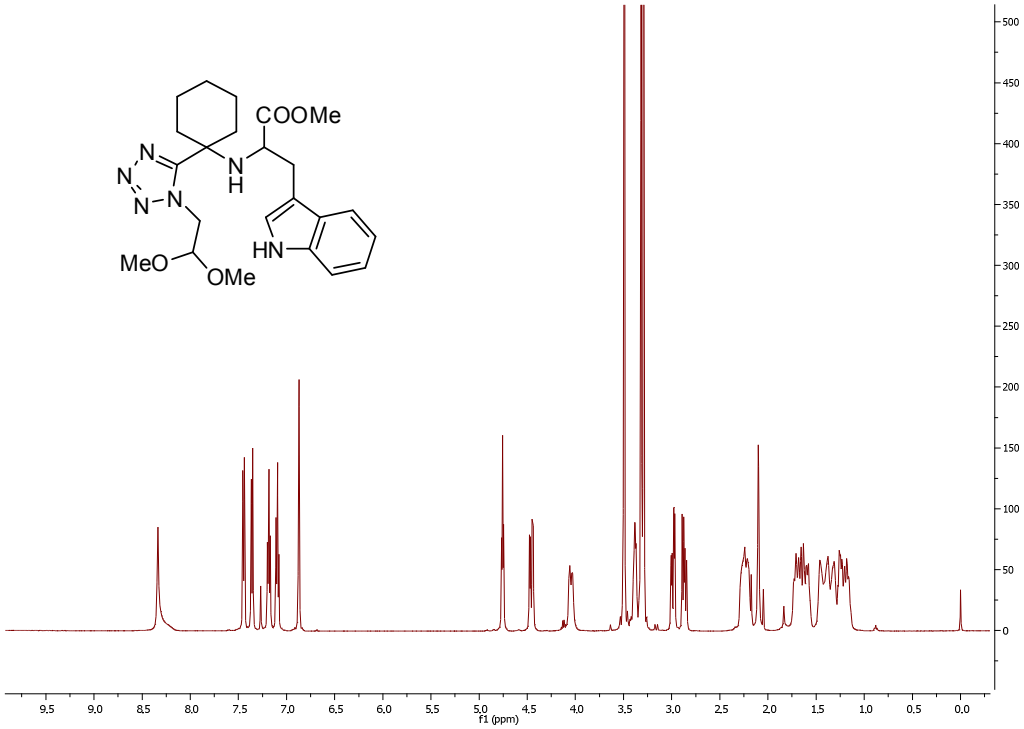
4g: 4-(3,4,5-trimethoxyphenyl)-4,6,7,12,12b,13-hexahydrotetrazolo[1'',5'':4',5'] pyrazino[1',2':1,2]pyrido[3,4-b]indole

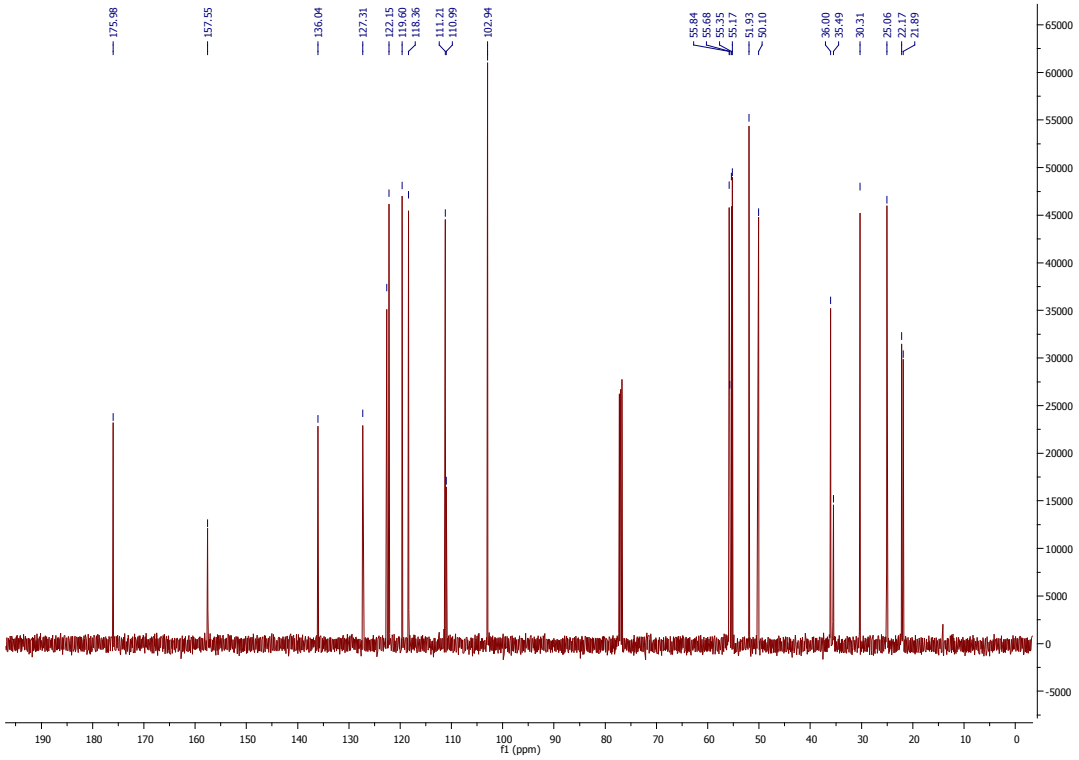


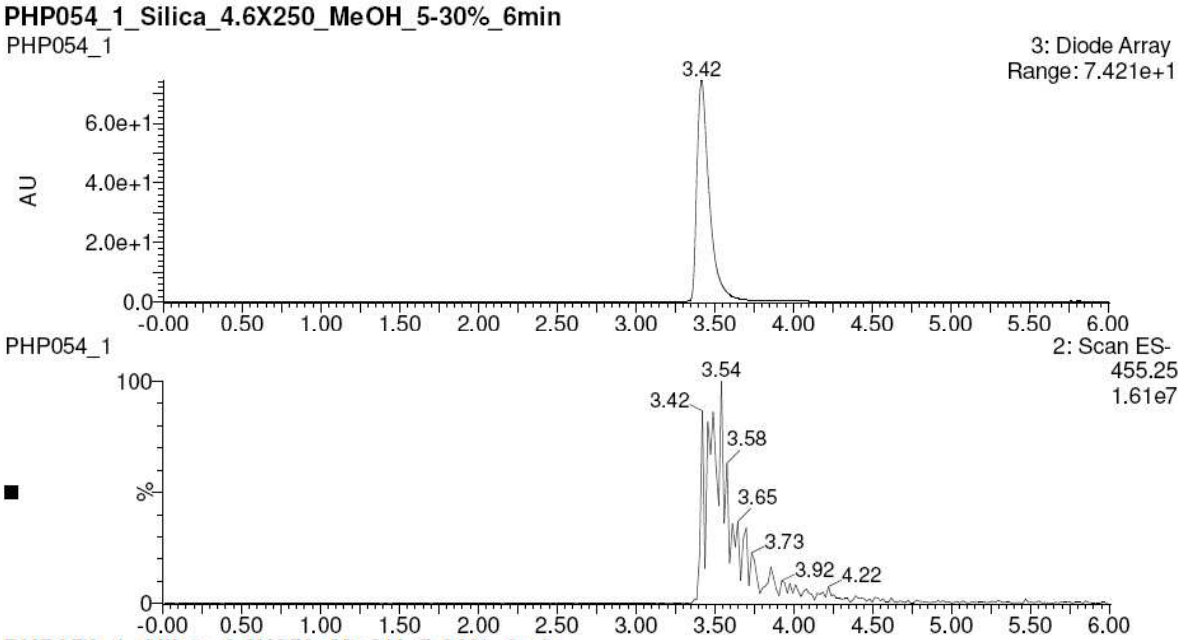

PHP087_1_Silica_4.6X250_MeOH_5-30%_6min
PHP087_1
3: Diode Array
Range: 4.828e+1
3.94
4.14
AU
4.0e+1
2.0e+1
0.0
0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 6.00
PHP087_1
2: Scan ES-
431.19
1.34e7
100
%
0
3.98
4.03
3.94
4.20
4.29
4.60
0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 6.00

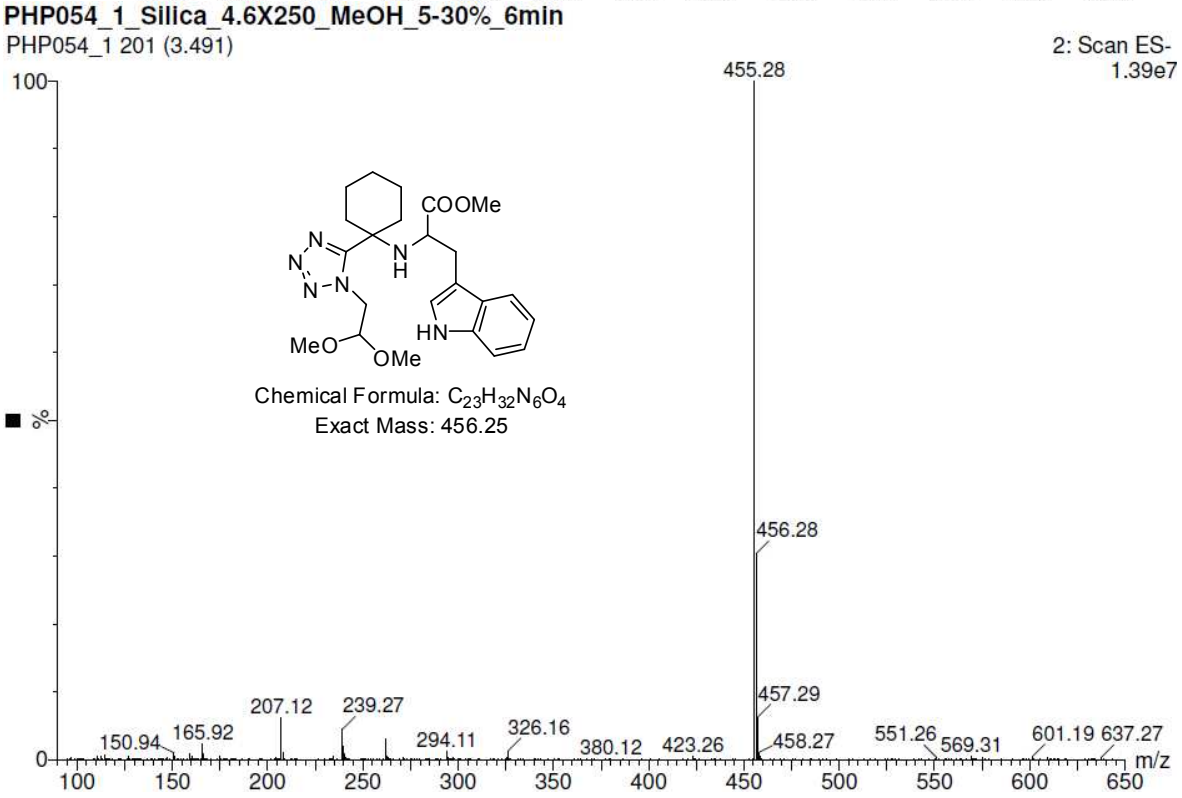

PHP087_1_Silica_4.6X250_MeOH_5-30%_6min
PHP087_1 232 (4.029)
2: Scan ES-
1.27e7
100
%
0
431.29
OMe
MeO
OMe
N
N
N
N
HN
Chemical Formula: C23H24N6O3
Exact Mass: 432.19
432.26
433.37
114.95
159.00
204.13
262.05
338.99
349.14
403.40
469.08
548.78
577.40
594.34
614.33
m/z
100 150 200 250 300 350 400 450 500 550 600 650

14h: methyl 2-((1-(1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)cyclohexyl)amino)-3-(1H-indol-3-yl)propanoate

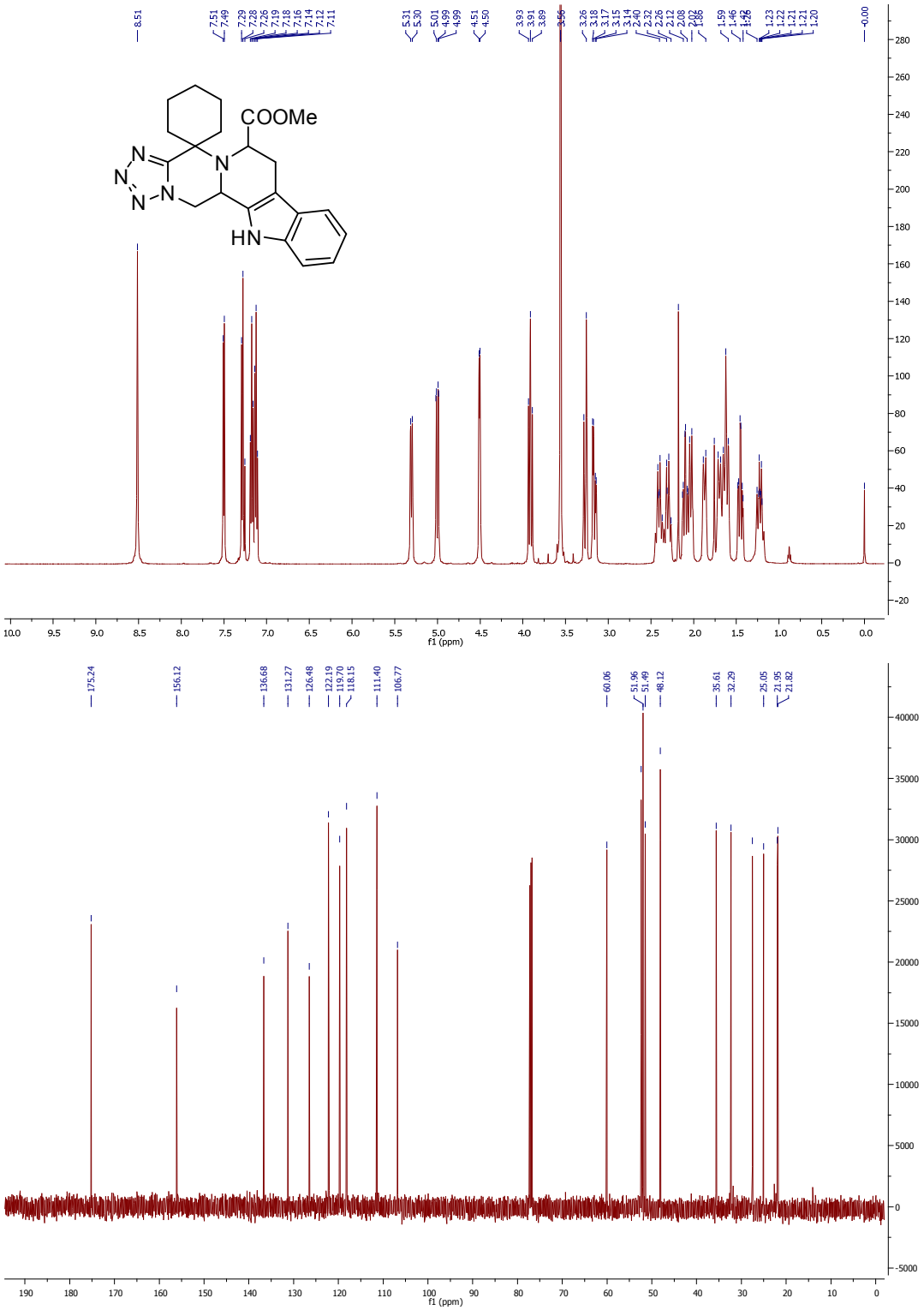




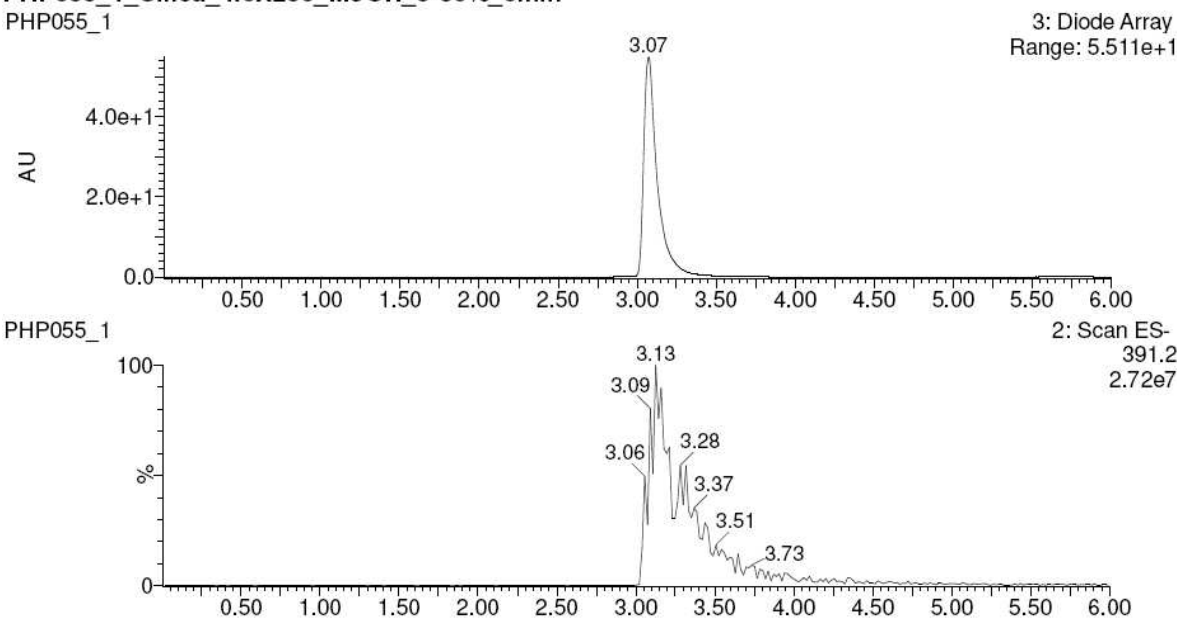

PHP054_1_Silica_4.6X250_MeOH_5-30%_6min
PHP054_1
3: Diode Array
Range: 7.421e+1
3.42
AU
6.0e+1
4.0e+1
2.0e+1
0.0
-0.00 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 6.00
PHP054_1
2: Scan ES-
455.25
1.61e7
3.54
3.42
3.58
3.65
3.73
3.92
4.22
100
%
0
-0.00 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 6.00


PHP054_1_Silica_4.6X250_MeOH_5-30%_6min
PHP054_1 201 (3.491)
2: Scan ES-
1.39e7
455.28
100
%
0
COOMe
N
H
N
N
N
HN
MeO
OMe
Chemical Formula: C23H32N6O4
Exact Mass: 456.25
456.28
457.29
207.12
239.27
150.94
165.92
294.11
326.16
380.12
423.26
458.27
551.26
569.31
601.19
637.27
m/z
100 150 200 250 300 350 400 450 500 550 600 650

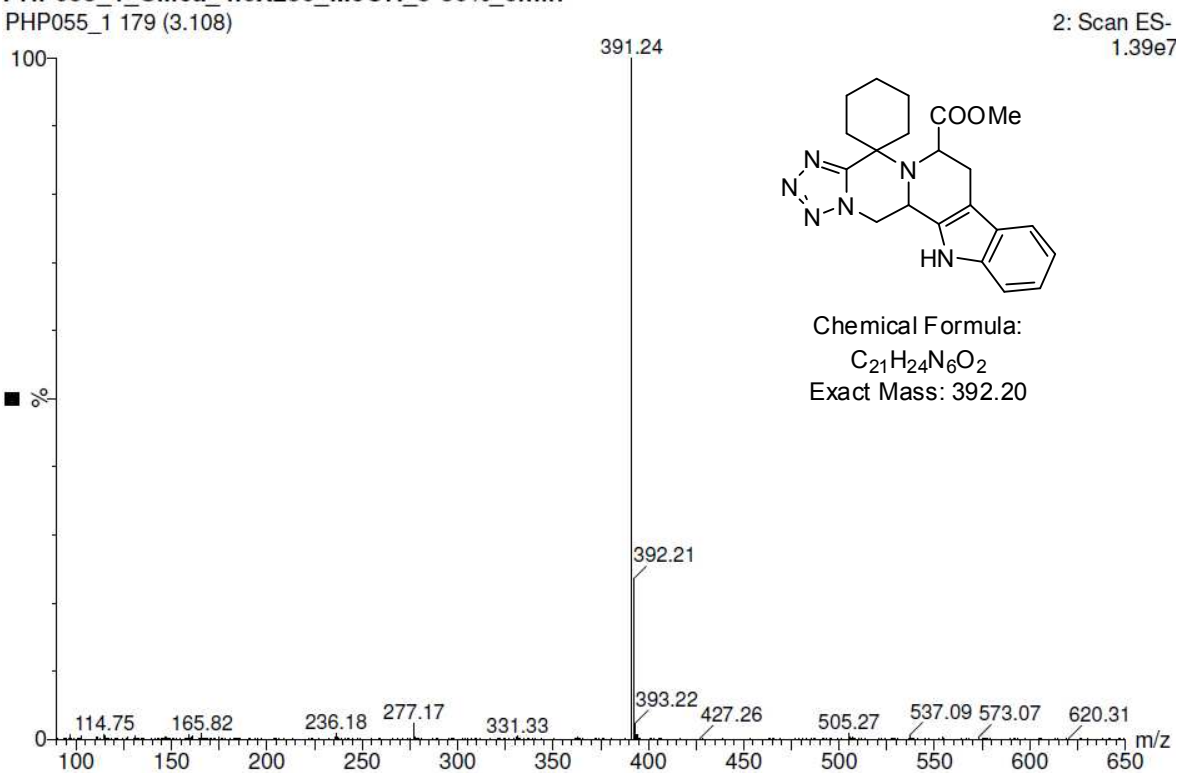
4h: methyl 7',12',12b',13'-tetrahydro-6'H-spiro[cyclohexane-1,4'-tetrazolo [1'',5'':4',5']pyrazino[1',2':1,2]pyrido[3,4-b]indole]-6'-carboxylate



PHP055_1_Silica_4.6X250_MeOH_5-30%_6min

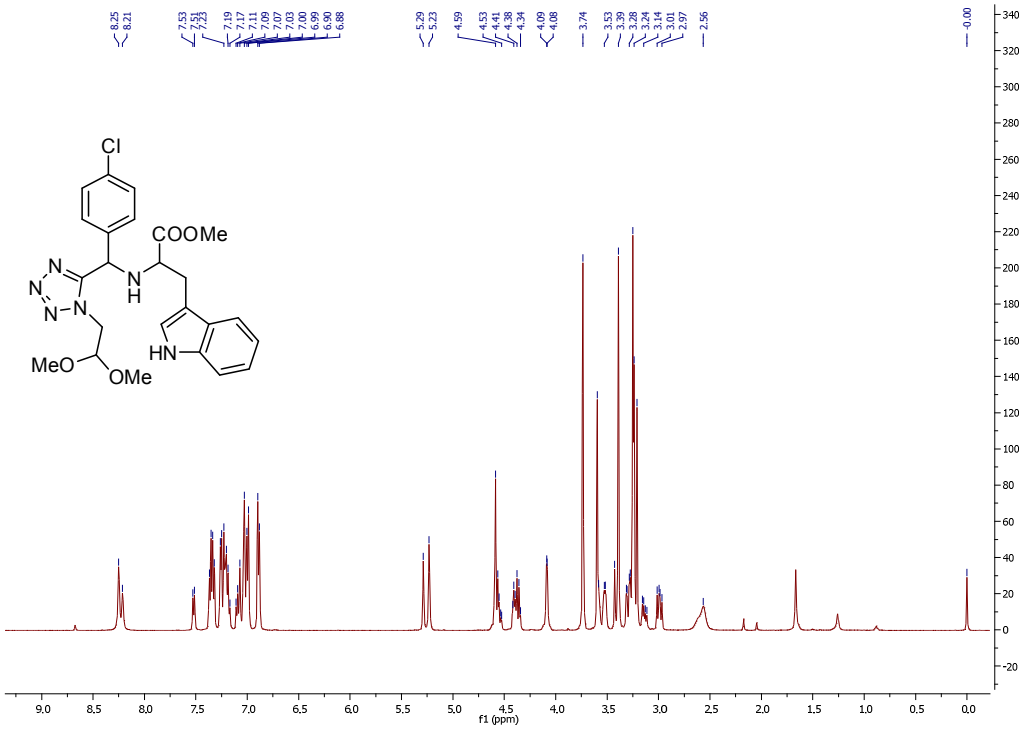


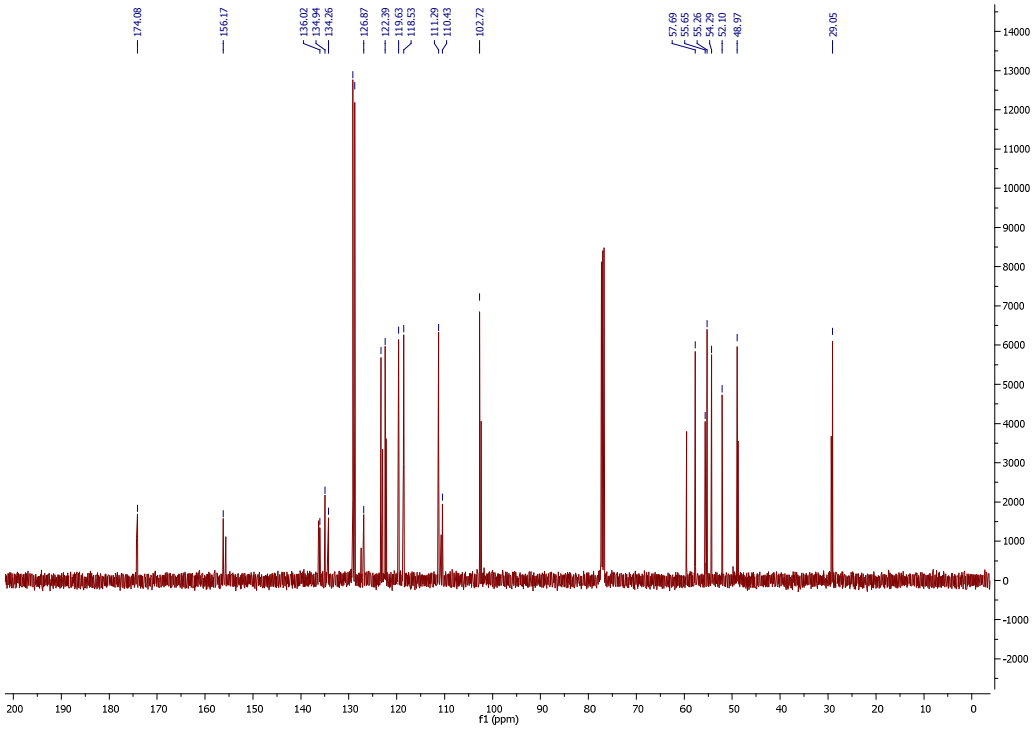
PHP055_1_Silica_4.6X250_MeOH_5-30%_6min

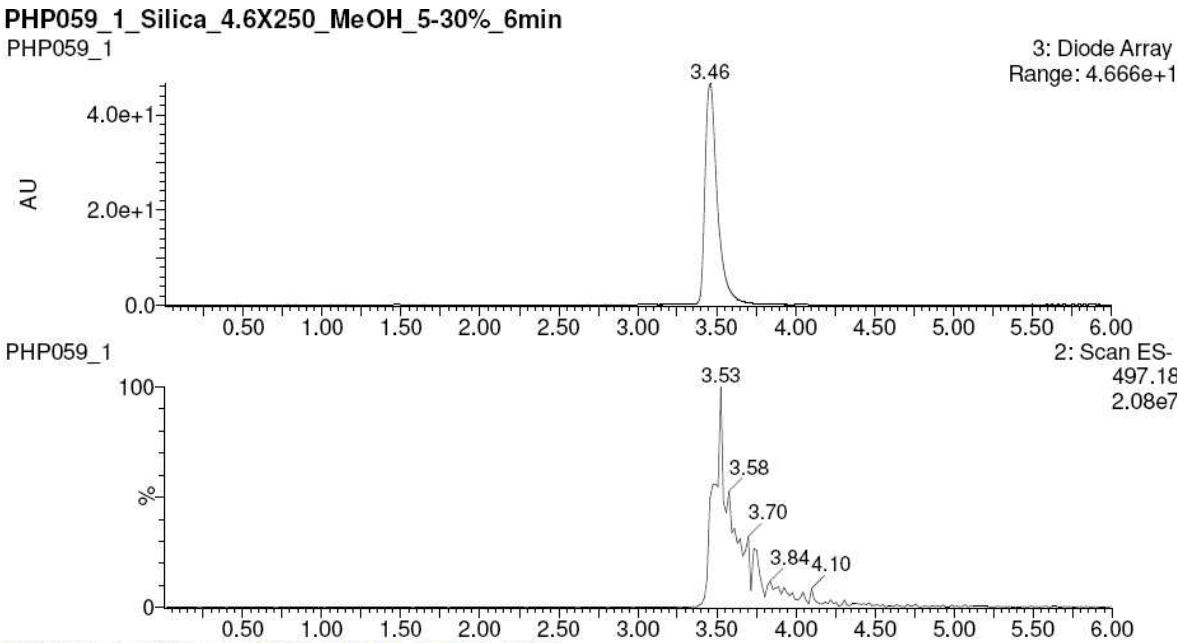


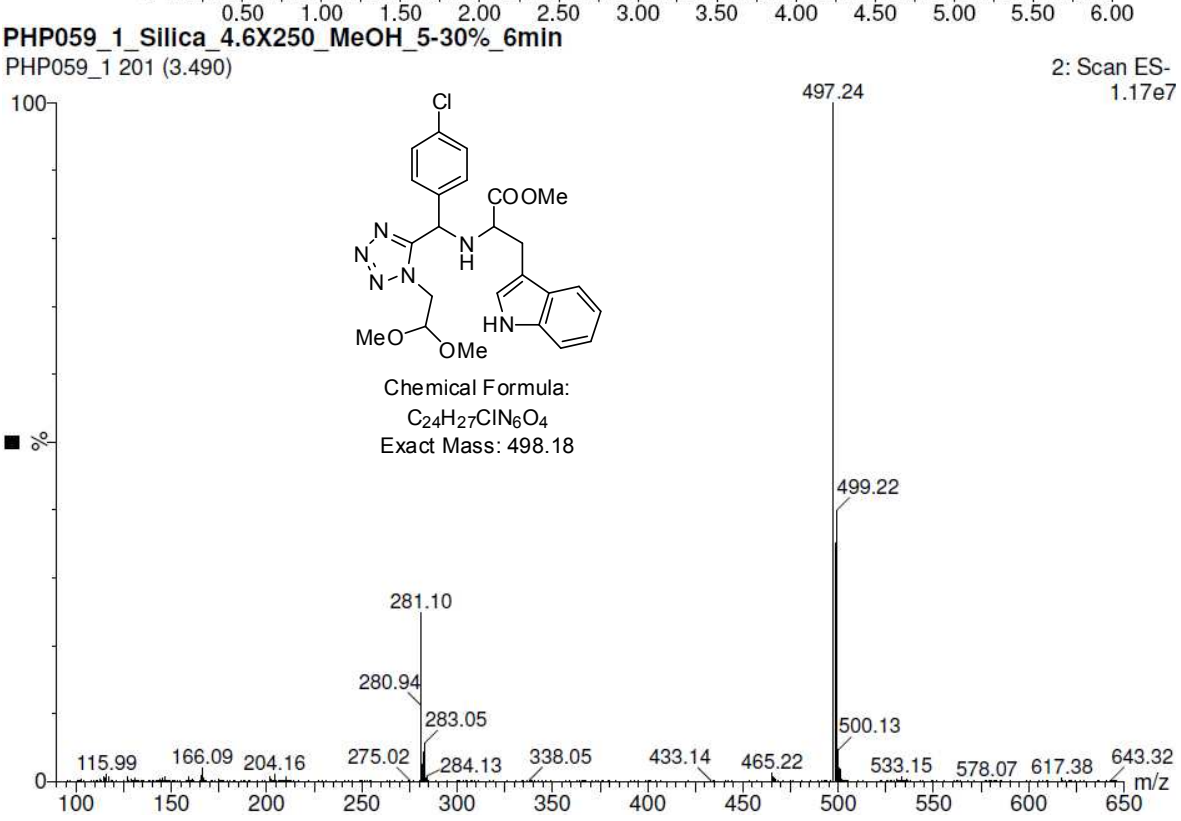
Chemical Formula:
$C_{21}H_{24}N_6O_2$
Exact Mass: 392.20

14i: methyl 2-(((4-chlorophenyl)(1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)methyl) amino)-3-(1H-indol-3-yl)propanoate

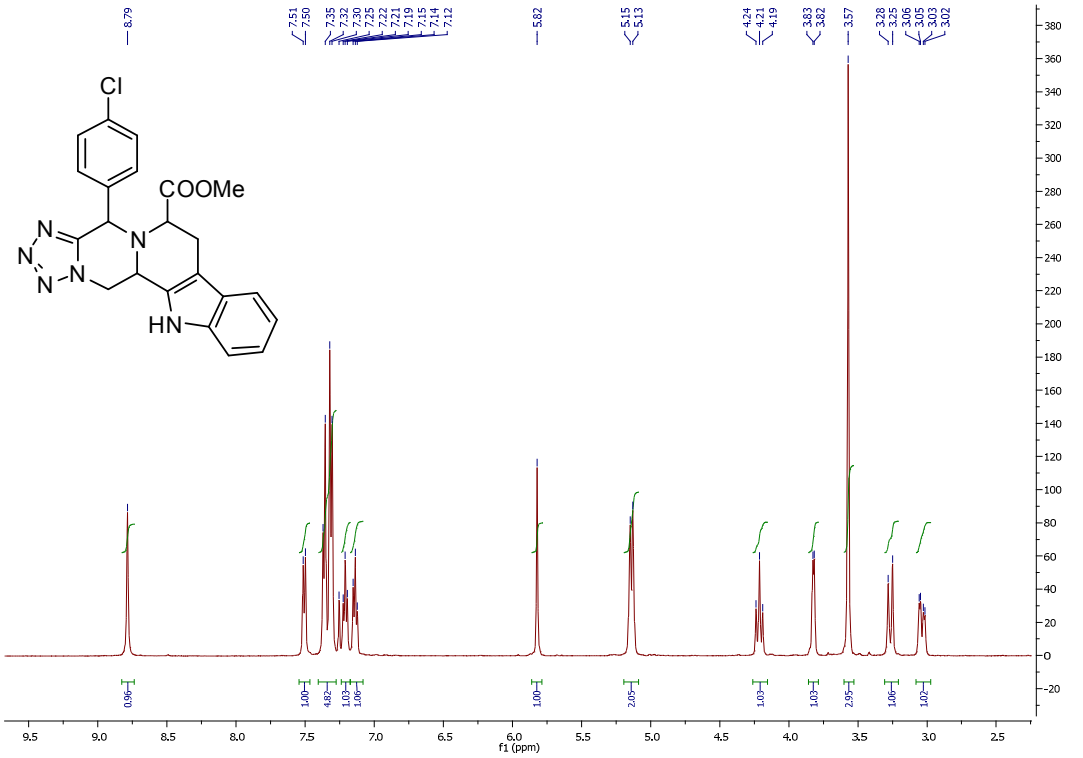


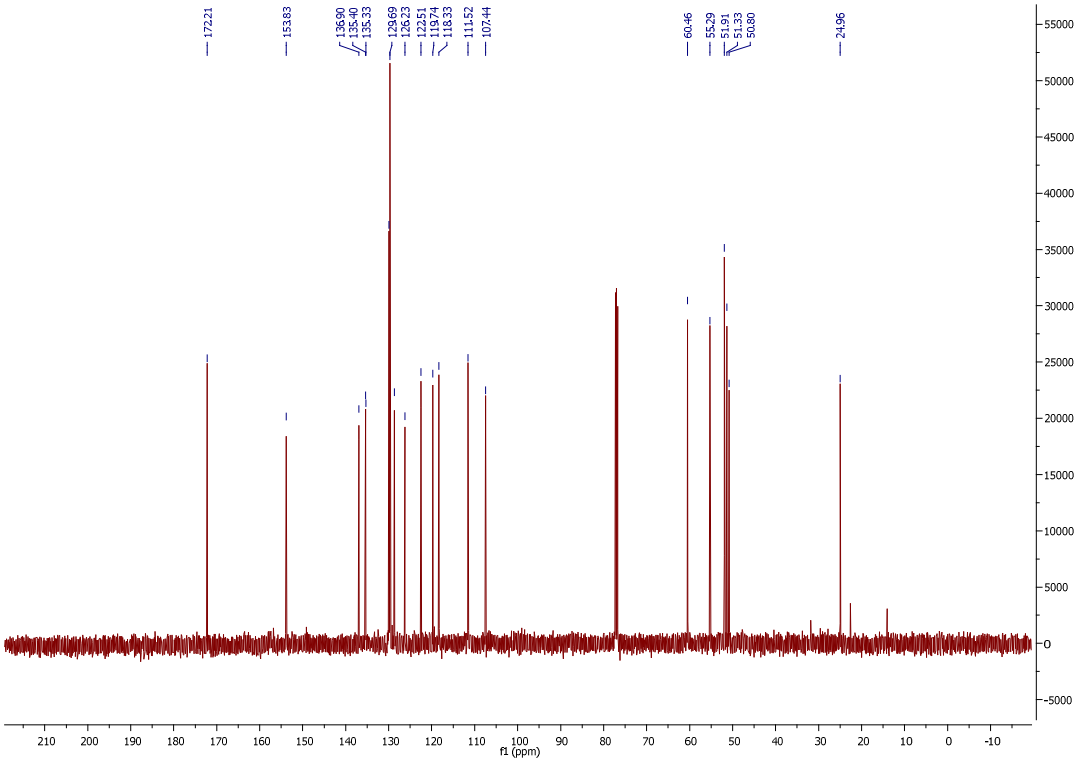


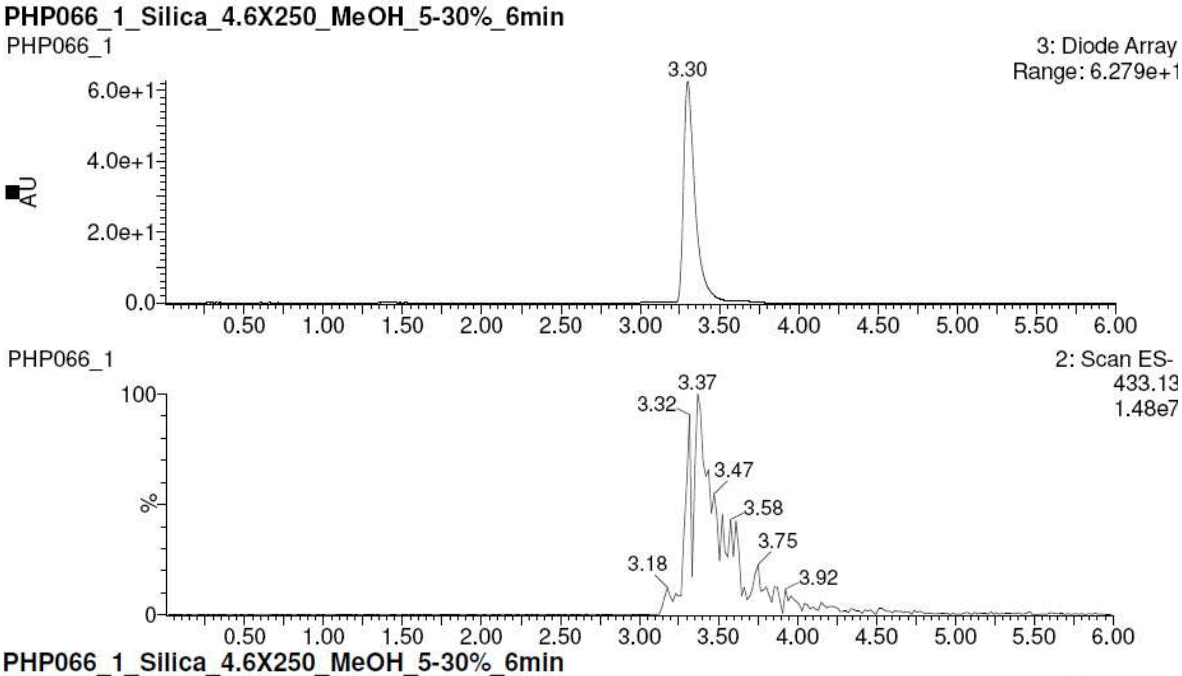

PHP059_1_Silica_4.6X250_MeOH_5-30%_6min
PHP059_1
3: Diode Array
Range: 4.666e+1
3.46
AU
4.0e+1
2.0e+1
0.0
0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 6.00
PHP059_1
2: Scan ES-
497.18
2.08e7
3.53
3.58
3.70
3.84
4.10
%
100
0
0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 6.00

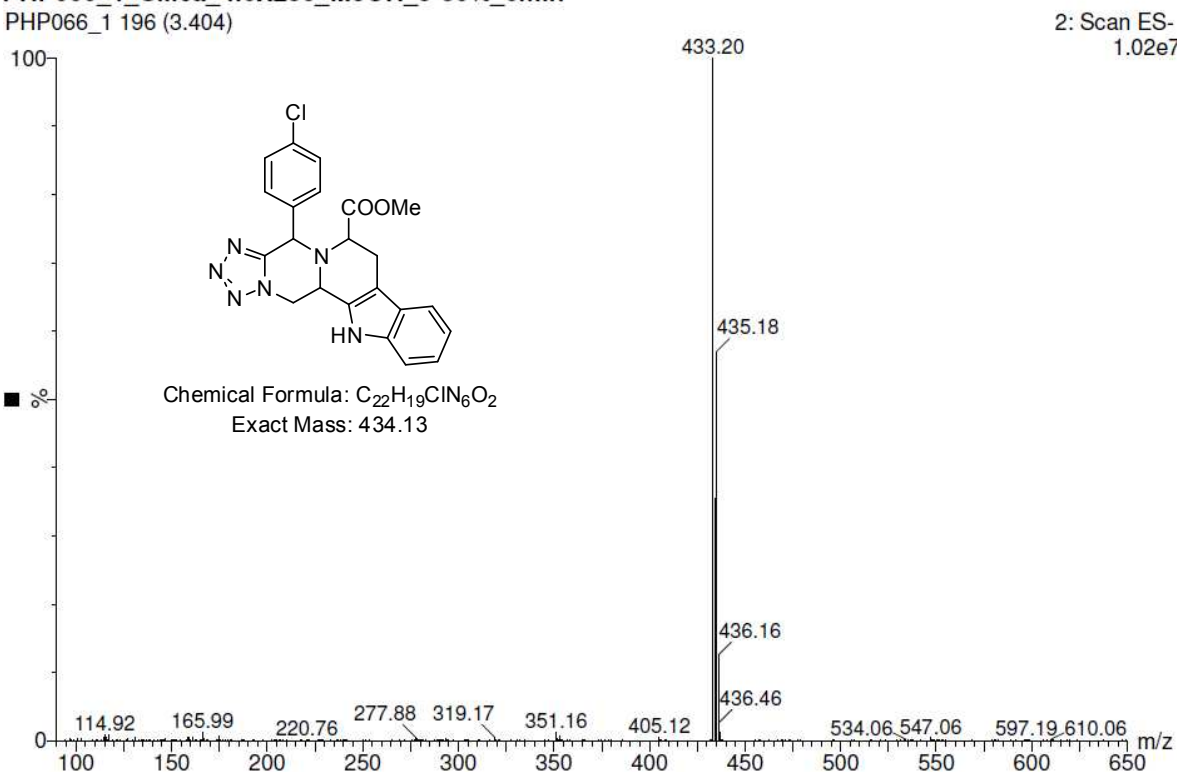

PHP059_1_Silica_4.6X250_MeOH_5-30%_6min
PHP059_1 201 (3.490)
2: Scan ES-
1.17e7
100
%
0
Cl
COOMe
N
H
N
N
N
MeO
OMe
HN
Chemical Formula:
C24H27ClN6O4
Exact Mass: 498.18
497.24
499.22
281.10
280.94
283.05
500.13
115.99
166.09
204.16
275.02
284.13
338.05
433.14
465.22
533.15
578.07
617.38
643.32
m/z
100 150 200 250 300 350 400 450 500 550 600 650

4i: methyl 4-(4-chlorophenyl)-4,6,7,12,12b,13-hexahydrotetrazolo[1'',5'':4',5'] pyrazino[1',2':1,2]pyrido[3,4-b]indole-6-carboxylate

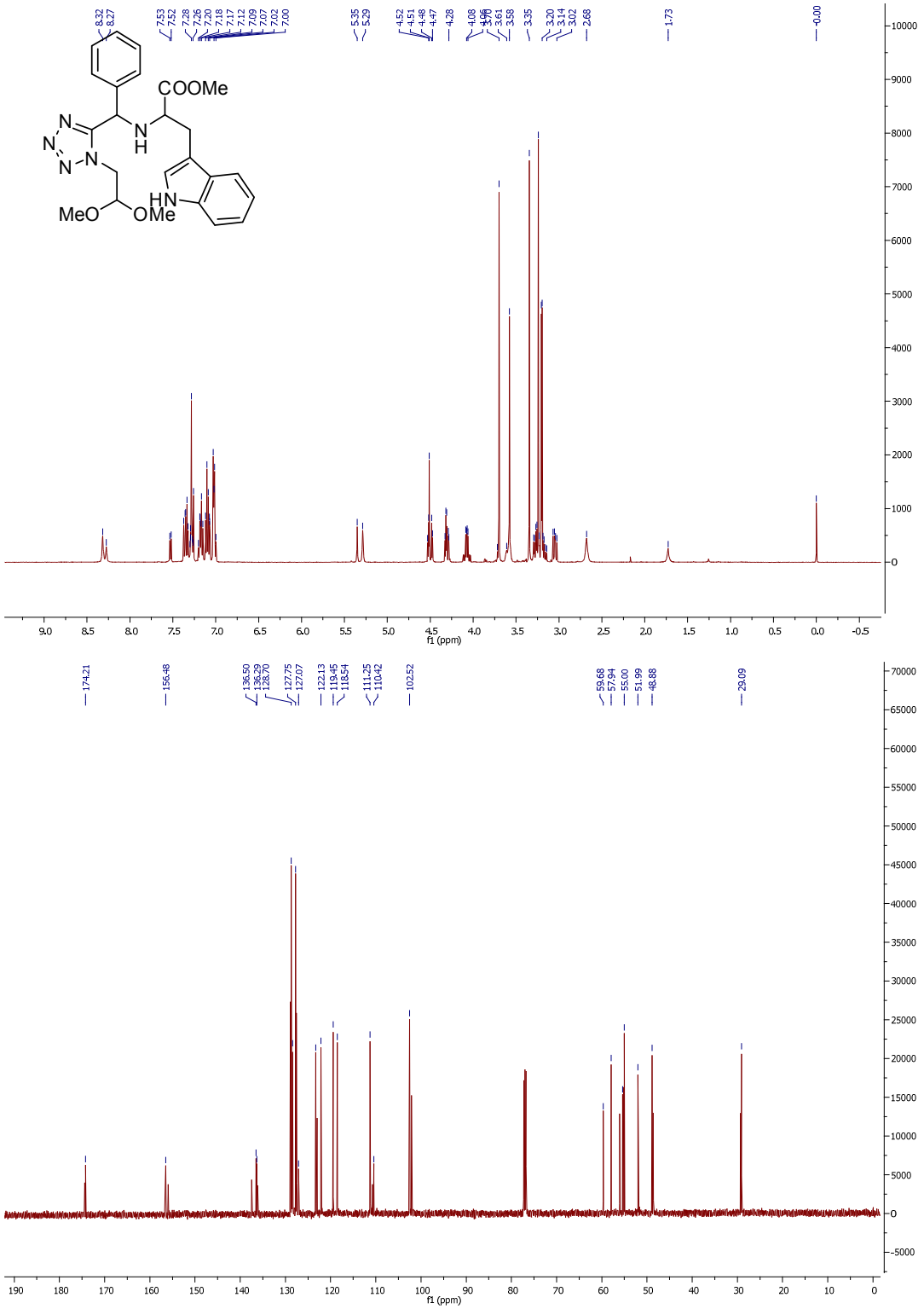




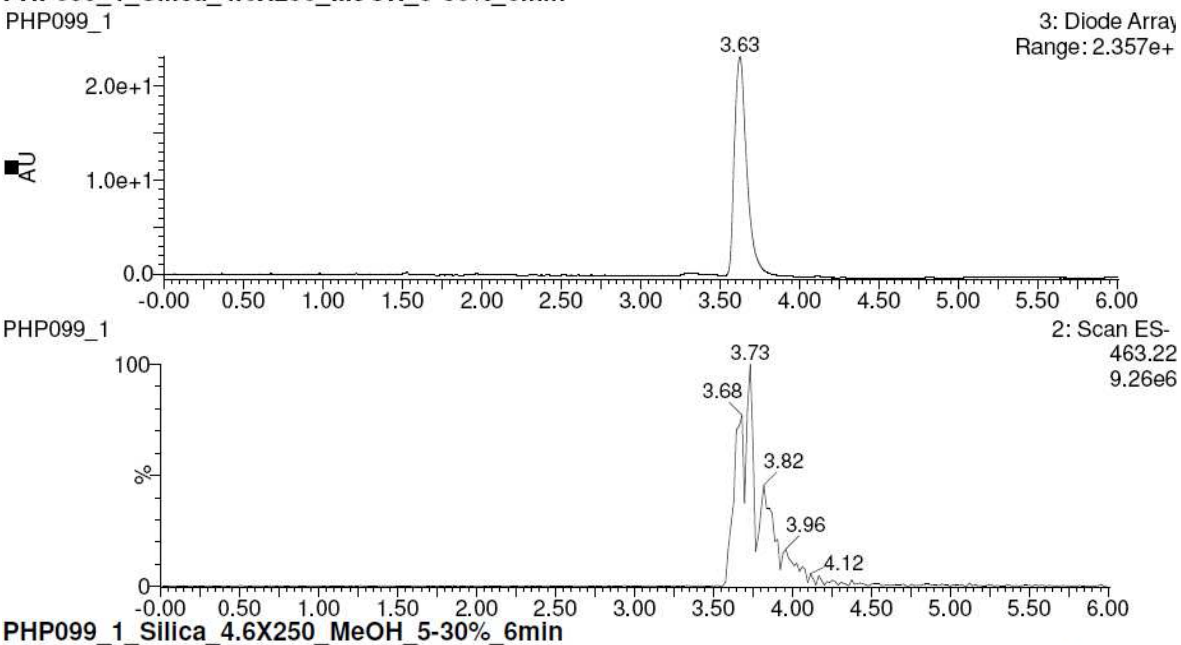

PHP066_1_Silica_4.6X250_MeOH_5-30%_6min
PHP066_1
3: Diode Array
Range: 6.279e+1
3.30
6.0e+1
4.0e+1
2.0e+1
0.0
AU
0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 6.00
PHP066_1
2: Scan ES-
433.13
1.48e7
3.37
3.32
3.47
3.58
3.75
3.18
3.92
100
%
0
0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 6.00


PHP066_1_Silica_4.6X250_MeOH_5-30%_6min
PHP066_1 196 (3.404)
2: Scan ES-
1.02e7
433.20
100
Cl
COOMe
N
N
N
N
HN
435.18
%
Chemical Formula: C22H19ClN6O2
Exact Mass: 434.13
436.16
436.46
114.92
165.99
220.76
277.88
319.17
351.16
405.12
534.06 547.06
597.19 610.06
0
m/z
100 150 200 250 300 350 400 450 500 550 600 650

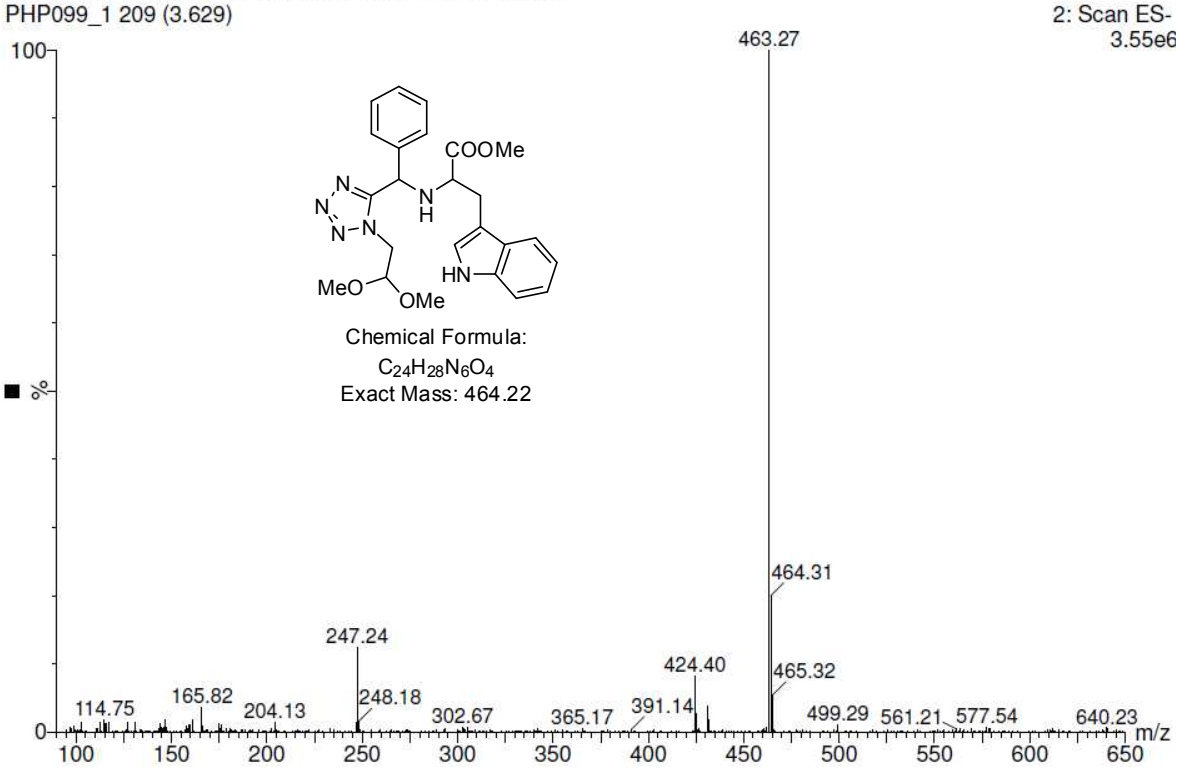
14j: methyl 2-(((1-(2,2-dimethoxyethyl)-1H-tetrazol-5-yl)(phenyl)methyl)amino)-3-(1H-indol-3-yl)propanoate



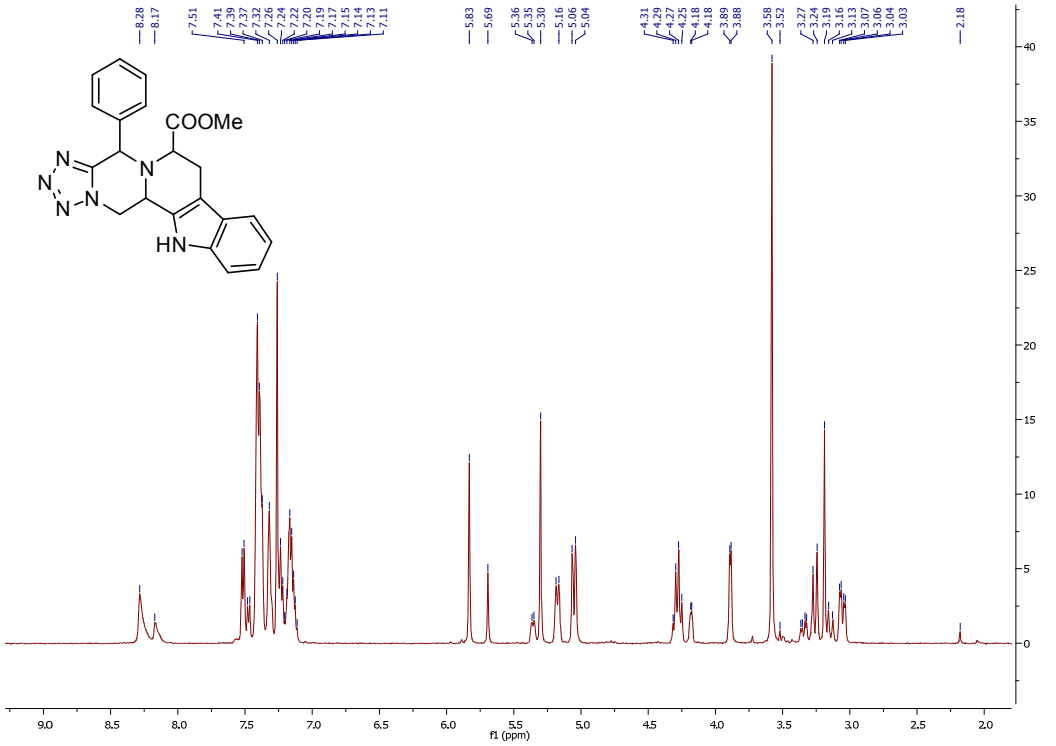
PHP099_1_Silica_4.6X250_MeOH_5-30%_6min

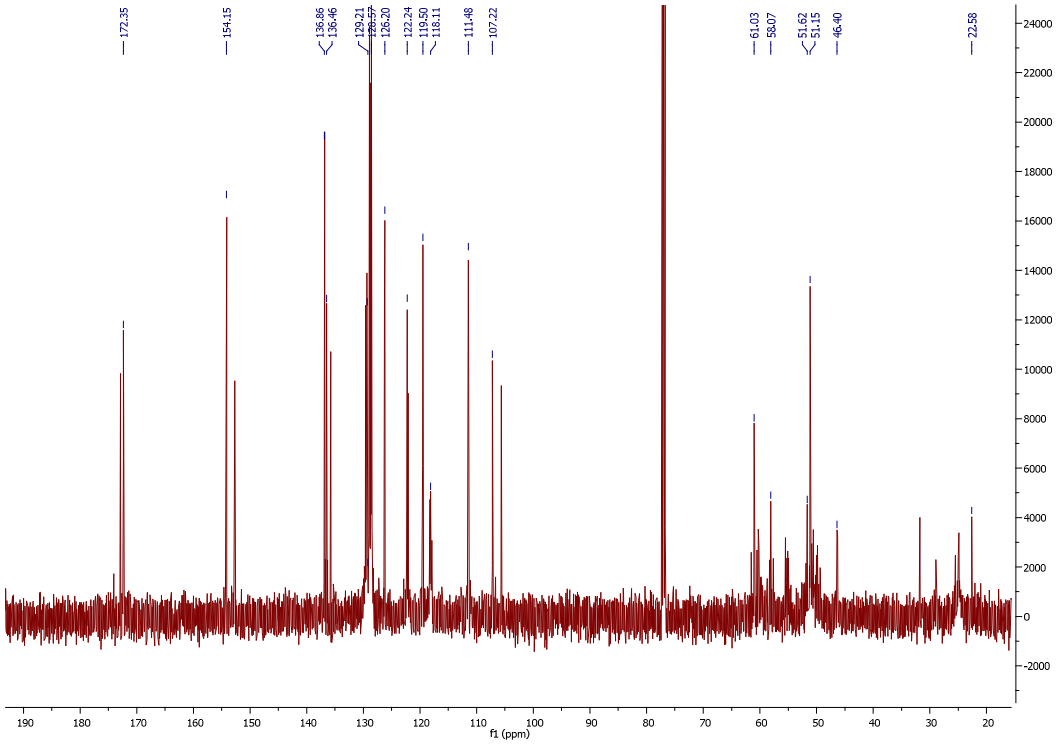


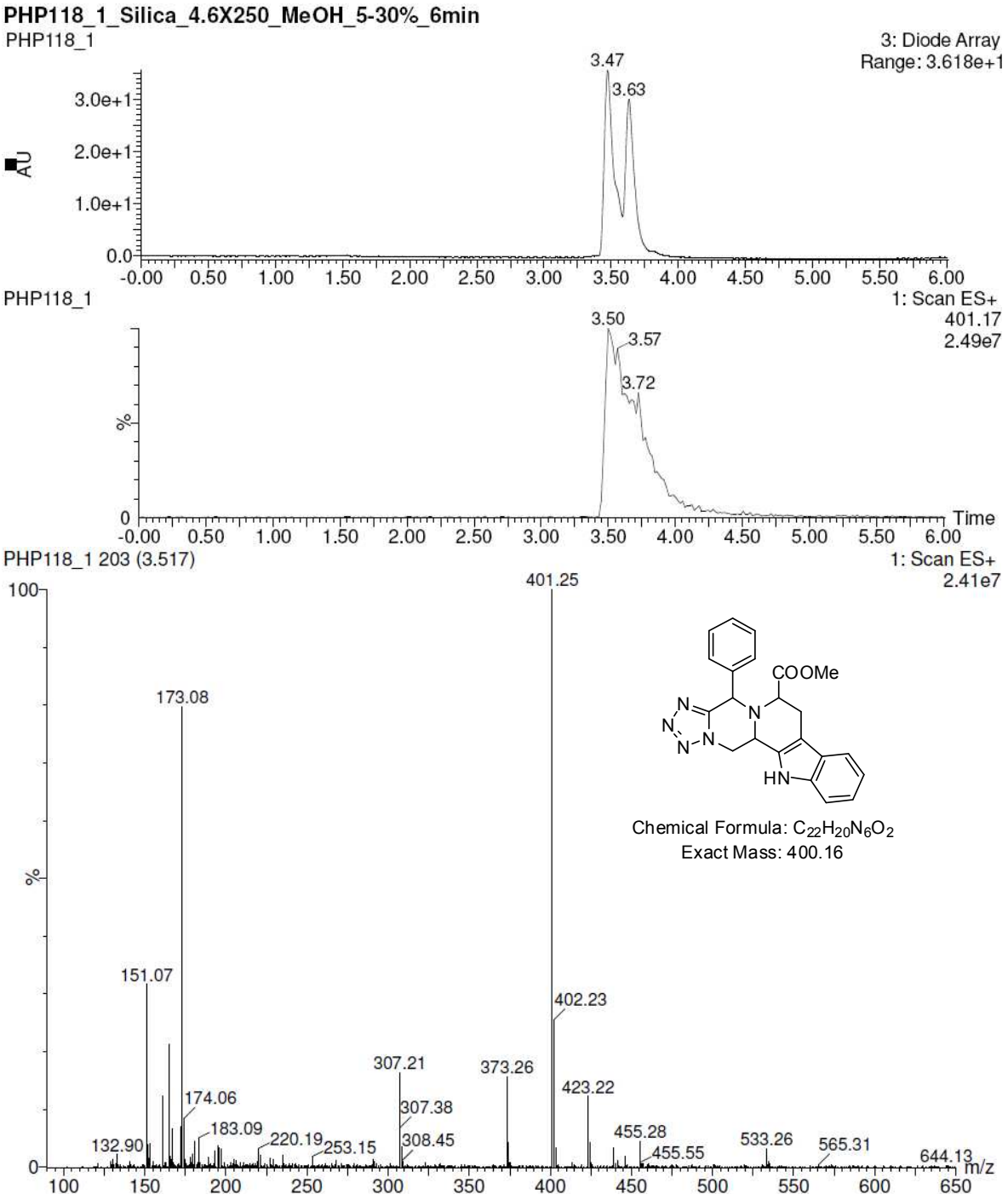
PHP099_1_Silica_4.6X250_MeOH_5-30%_6min



4j: methyl 4-phenyl-4,6,7,12,12b,13-hexahydrotetrazolo[1'',5'':4',5']pyrazino [1',2':1,2]pyrido[3,4-b]indole-6-carboxylate






PHP118_1_Silica_4.6X250_MeOH_5-30%_6min
PHP118_1
3: Diode Array
Range: 3.618e+1
3.47
3.63
AU
PHP118_1
1: Scan ES+
401.17
2.49e7
3.50
3.57
3.72
%
Time
PHP118_1 203 (3.517)
1: Scan ES+
2.41e7
401.25
173.08
151.07
402.23
307.21
373.26
423.22
174.06
307.38
183.09
455.28
220.19
253.15
308.45
455.55
533.26
565.31
644.13
132.90
m/z
COOMe
HN
Chemical Formula: C22H20N6O2
Exact Mass: 400.16