Electronic Supporting information for

Enzymatic synthesis of base-modified RNA by T7 RNA polymerase. A systematic study and comparison of 5-substituted pyrimidine and 7-substituted 7-deazapurine nucleoside triphosphates as substrates

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Contents

I Complete experimental part 2

Synthetic methods 2

Biochemistry 11

II Sequences of DNA templates and RNA transcripts 13

III Copies of PAGE GELS 15

IV Copies of MALDI spectra 27

VI Copies of NMR spectra 67

V References 101

I Complete experimental part
Synthetic methods

General chemistry

NMR spectra were measured on a 500 MHz (499.8 or 500 MHz for ^{1}H, 202.3 or 202.4 MHz for ^{31}P, 125.7 MHz for ^{13}C) or a 600 MHz (600.1 MHz for ^{1}H, 150.9 MHz for ^{13}C) spectrometers in D_2O (referenced to dioxane as internal standard, δ_H = 3.75 ppm, δ_C = 69.30 ppm); in CD_3OD (referenced to solvent signal, δ_H = 3.31 ppm, δ_C = 49.00 ppm); or DMSO-d6 (referenced to solvent signal, δ_H = 2.50 ppm, δ_C = 39.70 ppm). Chemical shifts are given in ppm (δ scale), coupling constants (*J*) in Hz. Complete assignment of all NMR signals was achieved by using a combination of H,H-COSY, H,C-HSQC and H,C-HMBC experiments. Mass spectra and high resolution mass spectra were measured by ESI ionization technique. The separation of nucleoside was performed by preparative flash chromatography on reverse phase (C18 RediSep column on a CombiFlash Teledyne ISCO system). Semi-preparative separation of nucleoside triphosphate was performed by HPLC on a column packed with 10 μm C18 reversed phase (Phenomenex, Luna C18. Syntheses and characterization data for nucleosides **A^{I}**,[1] **G^{I}**,[2] **U^{I}**[3] and 2',3',5'-tris-(*O*-benzoyl)-*N*^{2}-pivaloyl-7-iodo-7-deazaguanosine,[4] **A^{E}**,[5] **C^{E}**,[6] **U^{E}**,[6] **G^{Ph}**,[7] G^{BF}[7] and **G^{TMS}**[7] and for the triphosphates **A^{I}TP**,[5] **A^{Ph}TP**,[5] **C^{I}TP**,[8] **U^{I}TP**,[9] **U^{Ph}TP**[10] and **U^{BF}TP**[11] were previously reported. **C^{I}** nucleoside was purchased from commercial supplier (Carbosynth Ltd.).

Synthesis of modified nucleosides:

7-Methyl-7-deazaadenosine (A^{Me})

7-Iodo-7-deazaadenosine (300 mg, 0.76 mmol) and ammonium sulfate (0.076 mmol, 10 mg) were coevaporated with hexamethyldisilazane (7.6 mmol, 1.5 mL) at 40°C. Argon purged solution of $Pd(PPh_3)_4$ (0.03 mmol, 44 mg) in 5 mL of anhydrous THF was rapidly added to the residue, followed by the addition of $AlMe_3$ (2M solution in hexanes) (9.1 mmol, 4.5 mL). The reaction mixture was refluxed at 80°C for 2h. After cooling down to room temperature, the reaction mixture was slowly poured to saturated ice-cold solution of NaH_2PO_4. Resulting suspension was evaporated *in vacuo*, resuspended in methanol, coevaporated with silica gel and purified by high performance reverse phase flash chromatography (0 →100% MeOH in water) using C18RediSep column on a CombiFlash Teledyne ISCO system. Product was isolated as a white solid (130 mg, 60%). ^{1}H NMR (500.0 MHz, DMSO-d_6): 2.33 (s, 3H, CH_3); 3.47 (m, 1H, H-5′b); 3.58 (m, 1H, H-5′a); 3.86 (m, 1H, H-4′); 4.05 (dd, 1H, $J_{3',2'}$ = 5.3, $J_{3',4'}$ = 2.6, H-3′); 4.36 (dd, 1H, $J_{2',1'}$ = 7.1, $J_{2',3'}$ = 5.3, H-2′); 5.07 (d, 1H, J = 4.7, OH-2'); 5.21 (bs, 2H, OH-3' and OH-5'); 5.97 (d, 1H, $J_{1',2'}$ = 7.1, H-1′); 6.60 (bs, 2H, -NH_2); 7.08 (s, 1H, H-6); 8.01 (s, 1H, H-2). ^{13}C NMR (125.7 MHz, DMSO-d_6): 12.38 (CH_3); 62.35 (CH_2-5′); 71.19 (CH-3′); 73.97 (CH-2′); 85.33 (CH-4′); 87.23 (CH-1′); 103.33 (C-4a); 110.19 (C-5); 120.13 (CH-6); 151.14 (C-7a); 151.83 (C-2); 158.38 (C-4). MS (ESI) m/z (%): 302 (100) [M+Na], 281 (65) [M+H]. HRMS-ESI $[M+H]^+$ calcd for $C_{12}H_{17}O_4N_4$: 281.12439, found: 281.12443.

7-Methyl-7-deazaguanosine (G^{Me})

A solution of protected 2',3',5'-tris-(*O*-benzoyl)-*N*^{2}-pivaloyl-7-iodo-7-deazaguanosine (1 g, 1.2 mmol), CsOAc (700 mg, 3.6 mmol), DABCO (136 mg, 1.2 mmol) and triethylamine (0.5 mL, 3.6 mmol) in anhydrous DMF (10 mL) was stirred at room temperature for 2 hours. The reaction

mixture was then poured into water (100 mL) and the resulting suspension was extracted with chloroform. Organic phase was dried over $MgSO_4$ and purified by column chromatography (0 → 30% MeOH in $CHCl_3$). The product (700 mg, 72%) was obtained as a white foam. Spectral data are in accordance with those reported in literature.[4] Protected oxo derivative obtained in the previous step (500 mg, 0.6 mmol) and ammonium sulfate (8 mg, 0.06 mmol) were coevaporated with hexamethyldisilazane (10 mL) and THF (10 mL) at 40°C. Argon purged solution of $Pd(PPh_3)_4$ (0.03 mmol, 35 mg) in 5 mL of anhydrous THF was rapidly added to the dry residue, followed by the addition of $AlMe_3$ (2M solution in hexanes) (4 mL, 7.4 mmol). The reaction mixture was refluxed at 80°C for 2h. After cooling down to room temperature, the reaction mixture was slowly poured to saturated ice-cold solution of methanol. Resulting suspension was evaporated *in vacuo*, resuspended in methanol, coevaporated with silica gel and purified on SiO_2 column (0→30%, ethyl acetate in petroleum ether). 200 mg of an inseparable mixture of methylated product and the dehalogenated derivative were obtained in the form of white foam. The crude mixture was subsequently dissolved in 10 mL of 1M solution of NaOMe in MeOH and left stirring over night at 80°C and then neutralized with 0.5 mL of glacial AcOH. After several coevaporations with water, the residue was dissolve in 3:1 mixture of water/methanol and purified by HPLC (C-18 column, 0 → 100% MeOH in water). The product was obtained as a white solid (45 mg, 17% overall yield). ^{1}H NMR (500.0 MHz, MeOD): 2.35 (d, 3H, $J_{CH3,6}$ = 1.2, CH_3); 3.51 (m, H-5′b); 3.60 (m, H-5′a); 3.86 (m, 1H, H-4′); 4.06 (dd, 1H, $J_{3',2'}$ = 5.3, $J_{3',4'}$ = 2.6, H-3′); 4.60 (dd, 1H, $J_{2',1'}$ = 7.1, $J_{2',3'}$ = 5.3, H-2′); 5.07 (d, 1H, J = 4.7, OH-2’); 5.21 (bs, 2H, OH-3’ and OH-5’); 5.82 (d, 1H, J = 6.4, H-1’), 6.17 (bs, 2H, -NH_2); 6.63 (s, 1H, H-6). ^{13}C NMR (125.7 MHz, MeOD) 10.11 (CH_3); 62.05 (CH_2-5′); 70.97 (CH-3′); 73.89 (CH-2′); 84.91 (CH-4′); 88.25 (CH-1′); 100.53 (C-4a); 114.52 (CH-6); 116.07 (C-5); 151.19 (C-7a); 152.29 (C-2); 160.96 (C-4). MS (ESI) m/z (%): 319 (100) [M+Na], 297 (95) [M+H]. HRMS-ESI $[M+H]^+$ calcd for $C_{12}H_{17}O_5N_4$: 297.11498, found: 297.11935.

General procedure A: Suzuki cross-coupling on iodinated nucleosides

Water/ACN mixture (2:1, 15 mL) was added through septum to an argon purged vial containing iodinated nucleoside (0.2 mmol), corresponding boronic acid and Cs_2CO_3 (399 mg, 1.2 mmol), followed by the addition of the degassed solution of $Pd(OAc)_2$ (7 mg, 0.02 mmol) and TPPTS ligand (69 mg, 0.12 mmol) in water/ACN (2:1, 10 mL). After argon/vacuum exchange, the reaction mixture was left stirring at 100°C overnight. The mixture was cooled to the room temperature, coevaporated with silica gel and purified by high performance reverse phase flash chromatography (0 →100% MeOH in water)

7-(Dibenzofuran-4-yl)-7-deazaguanosine (G^{DB})

Prepared from $\mathbf{G^I}$ (80 mg) and dibenzofuran-4-ylboronic acid (390 mg, 1.8 mmol) according to general procedure A. The product was isolated as a white solid (58 mg, 67%). ^{1}H NMR (500.0 MHz, MeOD): 4.12 (m, 1H, H-5′b); 4.22 (m, 1H, H-5′a); 4.36 (m, 1H, H-4′); 4.58 (m, 1H, H-3′); 4.77 (dd, 1H, $J_{2',1'}$ = 6.8, $J_{2',3'}$ = 5.5, H-2′); 6.04 (d, 1H, $J_{1',2'}$ = 6.8, H-1′); 7.38 (m, 1H, H-1-dibenzofuryl and H-2-dibenzofuryl); 7.44-7.50 (m, 2H, H-8-dibenzofuryl and H6); 7.60 (m, 1H, H7-dibenzofuryl); 7.71 (m, 1H, H-6-dibenzofuryl); 7.96 (m, 1H, H-3-dibenzofuryl); 8.03 (m, 1H, H-9-dibenzofuryl). ^{13}C NMR (125.7 MHz, MeOD): 62.05 (CH_2-5′); 71.16 (CH-3′); 74.57 (CH-2′); 85.08 (CH-4′); 86.77(CH-1′); 98.31 (C-4a) 112.30 (C-5); 114.41 (CH-6-dibenzofuryl); 118.71 (C-4-dibenzofuryl); 119.04 (CH-3-dibenzofuryl); 119.73 (CH-9-dibenzofuryl); 121.42 (CH-6);

123.25 (CH-8-dibenzofuryl); 123.46 (CH-2-dibenzofuryl); 123.74 (C-9b-dibenzofuryl); 124.29 (C-9a-dibenzofuryl); 127.61 (CH-7-dibenzofuryl); 129.19 (CH-1-dibenzofuryl) 152.71 (C-4a-dibenzofuryl); 152.88 (C-7a); 153.22 (C-2); 155.60 (C-5a-dibenzofuryl); 159.33 (C-4). MS (ESI) m/z (%): 471 (100) [M+Na], 449 (65) [M+H]. HRMS-ESI $[M+H]^+$ calcd for $C_{23}H_{21}O_6N_4$: 449.14572, found: 449.14556.

5-(Benzofuran-2-yl)-uridine (U^{BF}) (a known compound previously prepared by the Stille coupling - ref.[11])

Prepared according to the general procedure from **U^{I}** (80 mg) and benzofuran-2-yl boronic acid (87 mg, 0.4 mmol). Product was isolated as a white solid (55 mg, 70%). ^{1}H NMR (500.0 MHz, DMSO): 3.74 (m, 1H, H-5′b+H-5'a); 3.96 (d, J = 4.8 Hz, H-4'); 4.13 (m, 2H, H-2′ and H-3'); 5.89 (d, 1H, J = 4.3 Hz, H-1'); 7.22 (m, 2H, H-5,6-benzofuryl); 7.35 (m, 1H, H-7-benzofuryl); 7.59 (m, 1H, H-4-benzofuryl); 8.80 (s, 1H, H6). 60.67 (CH_2-5′); 69.92 (CH-3′); 74.77 (CH-2′); 85.01 (CH-4′); 89.32 (CH-1′); 104.12 (C-5); 105.14 (CH-3-benzofuryl); 111.19 (CH-7-benzofuryl); 121.35 (CH-4-benzofuryl); 123.39 (CH-5-benzofuryl); 124.55 (CH-6-benzofuryl); 129.33 (C-3a-benzofuryl); 137.64 (CH-6); 149.98 (C-2-benzofuryl); 150.83 (C-7a-benzofuryl); 153.44 (C-2); 161.81 (C-4). MS (ESI) m/z (%): 383 (100) [M+Na], 361 (2) [M+H] HRMS-ESI $[M+Na]^+$ calcd for $C_{17}H_{16}O_7N_2Na$: 383.08524, found: 383.08497.

General procedure B: phosphorylation of modified nucleosides

Modified nucleoside (1 eq.) was dried at 60°C overnight under vacuum. It was then suspended in $PO(OMe)_3$, stirred at room temperature for 15 minutes, followed by cooling to 0°C and addition of $POCl_3$ (1.2 eq.). The reaction mixture was left stirring at 0°C (1.5 - 24h) and then ice cold solution of $(NHBu_3)_2H_2P_2O_7$ (5 eq.) and tributyl amine (5 eq.) in anhydrous DMF (1-5 mL) was added. The reaction mixture was stirred at 0°C for another hour. Then aqueous solution of TEAB (2M, 2 mL, 4 mmol) was added and the mixture was evaporated under reduced pressure. The residue was coevaporated several times with water. The product was purified by chromatography on DEAE Sephadex column (0→1.2M aq. TEAB) and then by HPLC (C-18 column, 0.1M TEAB in water to 0.1M TEAB in 50% aq. MeOH), it was coevaporated several times with water and, where possible, converted to the sodium salt form (Dowex 50 in Na+ cycle).

7-Methyl-7-deazaadenosine 5'-*O*-triphosphate sodium salt ($A^{Me}TP$)

$A^{Me}TP$ was prepared according to general procedure B by dissolving **A^{Me}** (30 mg, 0.11 mmol) in $PO(OMe)_3$ (300 µl) and stirring with $POCl_3$ (14 µL, 0.14mmol) for 1.5h, followed by the addition of solution of $(NHBu_3)_2H_2P_2O_7$ (293 mg, 0.54 mmol) and tributyl amine (110 µL, 0.48 mmol) in anhydrous DMF (1 mL) and stirring for another hour. Triphosphate (25 mg, 30 %) was obtained as a white lyophilizate (water). ^{1}H NMR (500.0 MHz, D_2O): 2.42 (d, 3H, $J_{CH3,6}$ = 1.2, CH_3); 4.11 (ddd, 1H, J_{gem} = 11.6, $J_{H,P}$ = 4.5, $J_{5'b,4'}$ = 3.2, H-5′b); 4.24 (ddd, 1H, J_{gem} = 11.6, $J_{H,P}$ = 6.5, $J_{5'a,4'}$ = 2.9, H-5′a); 4.31 (m, 1H, H-4′); 4.57 (dd, 1H, $J_{3',2'}$ = 5.3, $J_{3',4'}$ = 2.6, H-3′); 4.70 (dd, 1H, $J_{2',1'}$ = 7.1, $J_{2',3'}$ = 5.3, H-2′); 6.22 (d, 1H, $J_{1',2'}$ = 7.1, H-1′); 7.32 (q, 1H, $J_{6,CH3}$ = 1.2, H-6); 8.10 (s, 1H, H-2). ^{13}C NMR (125.7 MHz, D_2O): 13.75 (CH_3); 68.19 (d, $J_{C,P}$ = 5.7, CH_2-5′); 73.43 (CH-3′); 76.10 (CH-2′); 86.31 (d, $J_{C,P}$ = 9.1, CH-4′); 87.93 (CH-1′); 106.27 (C-4a); 115.56 (C-5); 122.00 (CH-6); 153.28 (C-7a); 153.84 (C-2); 160.48 (C-4). ^{31}P NMR (202.3 MHz, D_2O): -22.39 (t, J = 19.8, P_b); -11.23 (d, J = 19.8, P_a); -7.43 (bd, J = 19.8, P_g).. MS (ESI) m/z (%): 439 (100) [M-H_2PO_3-H], 461

(65) [M-H_2PO_3-2H+Na], 519 (12) [M-H], 541 (23) [M-2H+Na], 563 (23) [M-3H+2Na]. HRMS-ESI [M-2H+Na]$^-$ calcd for $C_{12}H_{17}O_{13}N_4NaP_3$: 540.99032, found: 540.99081.

7-Ethynyl-7-deazaadenosine 5'-*O*-triphosphate sodium salt (A^ETP)

A^ETP was prepared according to general procedure B by dissolving **A^E** (30 mg, 0.10 mmol) in $PO(OMe)_3$ (300 µl) and stirring with $POCl_3$ (14 µL, 0.14mmol) for 1.5h , followed by the addition of solution of $(NHBu_3)_2H_2P_2O_7$ (284 mg, 0.5 mmol) and tributyl amine (110 µL, 0.48mmol) in anhydrous DMF (1 mL) and stirring for another hour. Triphosphate (5 mg, 8 %) was obtained as a white lyophilizate (water). ^{1}H NMR (500.0 MHz, D_2O): 3.70 (s, 1H, HC≡C-); 4.16 (ddd, 1H, J_{gem} = 11.6, $J_{H,P}$ = 4.8, $J_{5'b,4'}$ = 3.2, H-5′b); 4.27 (ddd, 1H, J_{gem} = 11.6, $J_{H,P}$ = 6.6, $J_{5'a,4'}$ = 3.1, H-5′a); 4.35 (m, 1H, H-4′); 4.56 (dd, 1H, $J_{3',2'}$ = 5.3, $J_{3',4'}$ = 2.7, H-3′); 4.67 (dd, 1H, $J_{2',1'}$ = 6.7, $J_{2',3'}$ = 5.3, H-2′); 6.22 (d, 1H, $J_{1',2'}$ = 6.7, H-1′); 7.82 (s, 1H, H-6); 8.13 (s, 1H, H-2). ^{13}C NMR (125.7 MHz, D_2O): 68.11 (d, $J_{C,P}$ = 5.6, CH_2-5′); 73.19 (CH-3′); 76.58 (CH-2′); 78.99 (-**C**≡CH); 84.53 (H**C**≡C-); 86.47 (d, $J_{C,P}$ = 9.0, CH-4′); 88.57 (CH-1′); 98.78 (C-5); 105.82 (C-4a); 129.78 (CH-6); 151.91 (C-7a); 155.08 (C-2); 160.08 (C-4). ^{31}P NMR (202.3 MHz, D_2O): -21.47 (t, J = 19.6, P_b); -10.40 (d, J = 19.6, P_a); -7.03 (d, J = 19.6, P_g). MS (ESI) m/z (%): 449 (100) [M-H_2PO_3-H], 471 (50) [M-H_2PO_3-2H+Na], 529 (10) [M-H], 551 (26) [M-2H+Na], 573 (34) [M-3H+2Na]. HRMS-ESI [M-2H+Na]$^-$ calcd for $C_{13}H_{15}O_{13}N_4NaP_3$: 550.97559, found: 550.97516.

5-Ethynylcytidine 5'-*O*-triphosphate triethylammonium salt (C^ETP)

C^ETP was prepared according to general procedure B by dissolving **C^E** (40 mg, 0.14 mmol) in $PO(OMe)_3$ (500 µl) and stirring with $POCl_3$ (20 µL, 0.22mmol) for 1.5h, followed by the addition of solution of $(NHBu_3)_2H_2P_2O_7$ (524 mg, 0.95 mmol) and tributyl amine (220 µL, 0.95 mmol) in anhydrous DMF (1 mL) and stirring for another hour. Triphosphate (10 mg, 9 %) was obtained as a glassy lyophilizate (water). ^{1}H NMR (500.0 MHz, D_2O): 1.28 (t, 9H, J_{vic} = 7.3, C**H**$_3$$CH_2N$); 3.20 (q, 6H, J_{vic} = 7.3, CH_3C**H**$_2$N); 3.60 (s, 1H, HC≡C-); 4.27 (m, 3H, H-4' and H-5′); 4.40 (m, 2H, H-3' and H-4′); 5.97 (d, 1H, $J_{1',2'}$ = 4.9, H-1′); 8.24 (s, 1H, H-6).): ^{13}C NMR (125.7 MHz, D_2O): 10.48 (**C**H_3CH_2N); 49.38 (CH_3**C**H_2N); 67.39 (d, $J_{C,P}$= 5.9 Hz; CH_2-5'); 71.67 (CH-3'); 76.69 (CH-2′); 77.05 (-**C**≡CH); 85.42 (d, $J_{C,P}$ = 9.1, CH-4'); 87.99 (H**C**≡C-); 92.23 (CH-1'); 94.62 (C-5); 148.08 (CH-6); 158.85 (C-2); 167.83 ppm (C-4). ^{31}P NMR (202.3 MHz, D_2O): -23.06 (bs, P_b); -11.45 (d, J = 19.9, P_a); -10.59 (d, J = 19.9, P_g). MS (ESI) m/z (%): 426 (100) [M-H_2PO_3-H], 448 (21) [M-H_2PO_3-2H+Na], 506 (26) [M-H], 527 (17) [M-2H+Na]. HRMS-ESI [M-H]$^-$ calcd for $C_{11}H_{15}O_{14}N_3P_3$: 505.97610, found: 505.97723.

5-Ethynyluridine 5'-*O*-triphosphate triethylammonium salt (U^ETP)

U^ETP was prepared according to general procedure B by dissolving **U^E** (40 mg, 0.19 mmol), proton sponge (80 mg, 0.38 mmol) in $PO(OMe)_3$ (500 µl) and stirring with $POCl_3$ (20 µL, 0.22mmol) for 1.5h, followed by the addition of solution of $(NHBu_3)_2H_2P_2O_7$ (524 mg, 0.95 mmol) and tributyl amine (220 µL, 0.95 mmol) in anhydrous DMF (1 mL) and stirring for another hour. Triphosphate (20 mg, 18 %) was obtained as a glassy lyophilizate (water). ^{1}H NMR (500.0 MHz, D_2O): 1.28 (t, 20H, J_{vic} = 7.3, C**H**$_3$$CH_2N$); 3.20 (q, 13H, J_{vic} = 7.3, CH_3C**H**$_2$N); 3.60, s, 1H, (HC≡C-); 4.27 (m, 3H, H-4' and H-5′); 4.40 (m, 2H, H-3' and H-4′); 5.97 (d, 1H, $J_{1',2'}$ = 4.9, H-1′); 8.24 (s, 1H, H-6). ^{13}C NMR (125.7 MHz, D_2O): 10.95 (**C**H_3CH_2N); 49.38 (CH_3**C**H_2N); 67.59 (d, $J_{C,P}$ = 5.5, CH_2-5′); 72.09 (CH-3′); 76.57 (CH-2′); 79.96 (-**C**≡CH); 86.06 (d, $J_{C,P}$ = 9.1, CH-4'); 86.21 (H**C**≡C-); 91.40 (CH-1′); 101.71 (C-5); 147.98 (CH-6); 153.49 (C-2); 167.38 (C-4). ^{31}P NMR (202.3 MHz, D_2O): -23.06 (t, J = 19.9, P_b); -11.59 (d, J = 19.9, P_a); -9.92 (bs, P_g). MS (ESI) m/z (%): 427 (100)

[M-H_2PO_3-H], 449 (50) [M-H_2PO_3-2H+Na], 507 (13) [M-H], 529 (30) [M-2H+Na], 551 (17) [M-3H+2Na]. HRMS-ESI [M-2H+Na]$^-$ calcd for $C_{11}H_{13}O_{15}N_3NaP_3$: 528.94311, found: 528.94319.

7-Methyl-7-deazaguanosine- 5'-*O*-triphosphate sodium salt ($G^{Me}TP$)

$G^{Me}TP$ was prepared according to general procedure B by dissolving **G^{Me}** (20 mg, 0.06 mmol) in trimethyl phosphate (300 µl) and stirring with $POCl_3$ (12 µL, 0.12mmol) overnight followed by the addition of solution of $(NHBu_3)_2H_2P_2O_7$ (184 mg, 0.33 mmol) and tributyl amine (70 µL, 0.28 mmol) in anhydrous DMF (1 mL) and stirring for another four hours. Triphosphate (25 mg, 62 %) was obtained as a white lyophilizate (water). ^{1}H NMR (500.0 MHz, D_2O): 2.27 (d, 3H, $J_{CH3,6}$ = 1.2, CH_3); 4.11 (ddd, 1H, J_{gem} = 11.6, $J_{H,P}$ = 5.0, $J_{5'b,4'}$ = 3.6, H-5′b); 4.22 (ddd, 1H, J_{gem} = 11.6, $J_{H,P}$ = 6.7, $J_{5'a,4'}$ = 3.3, H-5′a); 4.27 (m, 1H, H-4′); 4.54 (dd, 1H, $J_{3',2'}$ = 5.3, $J_{3',4'}$ =2.7, H-3′); 4.64 (dd, 1H, $J_{2',1'}$ = 7.0, $J_{2',3'}$ = 5.3, H-2′); 6.00 (d, 1H, $J_{1',2'}$ = 7.0, H-1′); 6.91 (q, 1H, $J_{6,CH3}$ = 1.2, H-6). ^{13}C NMR (125.7 MHz, D_2O): 13.39 (CH_3); 68.14 (d, $J_{C,P}$ = 5.4, CH_2-5′); 73.25 (CH-3′); 75.77 (CH-2′); 86.08 (d, $J_{C,P}$ = 9.1, CH-4′); 88.04 (CH-1′); 103.00 (C-4a); 118.33 (CH-6); 118.63 (C-5); 154.90 (C-7a); 155.42 (C-2); 164.65 (C-4).^{31}P NMR (202.3 MHz, D_2O): -21.25 (t, J = 19.6, P_b); -10.38 (d, J = 19.6, P_a); -5.50 (bd, J = 19.6, P_g). MS (ESI) m/z (%): 455 (100) [M-H_2PO_3-H], 477 (50) [M-H_2PO_3-2H+Na], 535 (13) [M-H], 557 (15) [M-2H+Na], 579 (20) [M-3H+2Na]. HRMS-ESI [M-2H+Na]$^-$ calcd for $C_{12}H_{17}O_{14}N_4P_3$: 556.98547, found: 556.98573.

7-Ethynyl-7-deazaguanosine 5'-*O*-triphosphate triethylammonium salt ($G^{E}TP$)

$G^{E}TP$ was prepared according to general procedure B by dissolving **G^{TMS}** (40 mg, 0.11 mmol), proton sponge (68 mg, 0.33 mmol) in $PO(OMe)_3$ (400 µl) and stirring with $POCl_3$ (freshly distilled!, 12 µL, 0.12mmol) for 4h, followed by the addition of solution of $(NHBu_3)_2H_2P_2O_7$ (290 mg, 0.53 mmol) and tributyl amine (120 µL, 0.53 mmol) in anhydrous DMF (1 mL) and stirring for another hour. Triphosphate (5 mg, 8 %) was obtained as a yellowish glassy lyophilizate (water). ^{1}H NMR (500.0 MHz, D_2O): 1.26 (t, 9H, J_{vic} = 7.3, C**H**$_3$$CH_2N$); 3.18 (q, 6H, J_{vic} = 7.3, CH_3C**H**$_2$N); 3.52 (s, 1H, HC≡C-); 4.15 (ddd, 1H, J_{gem} = 11.6, $J_{H,P}$ = 4.5, $J_{5'b,4'}$ = 3.4, H-5′b); 4.22 (ddd, 1H, J_{gem} = 11.6, $J_{H,P}$ = 6.2, $J_{5'a,4'}$ = 3.4, H-5′a); 4.30 (m, 1H, H-4′); 4.50 (dd, 1H, $J_{3',2'}$ = 5.3, $J_{3',4'}$ =2.7, H-3′); 4.64 (dd, 1H, $J_{2',1'}$ = 7.0, $J_{2',3'}$ = 5.3, H-2′); 6.01 (d, 1H, $J_{1',2'}$ = 7.0, H-1′); 7.46 (s, 1H, H-6). ^{13}C NMR (125.7 MHz, D_2O): 10.95 (**C**H_3CH_2N); 49.38 (CH_3**C**H_2N); 67.61 (d, $J_{C,P}$ = 5.5, CH_2-5′); 72.09 (CH-3′); 76.10 (CH-2′); 79.42 (-**C**≡CH); 83.08 (H**C**≡C-); 86.37 (d, $J_{C,P}$ = 9.1, CH-4′); 88.66 (CH-1′); 101.10 (C-5); 103.00 (C-4a); 127.41 (CH-6); 154.17 (C-7a); 156.11 (C-2); 163.60 (C-4). ^{31}P NMR (202.3 MHz, D_2O): -22.36 (bs, P_b); -10.59, -10.05 (2 × bs, $P_{a,b}$). MS (ESI) m/z (%): 465 (100) [M-H_2PO_3-H], 485 (16) [M-H_2PO_3-2H+Na], 545 (28) [M-H], 565 (5) [M-2H+Na]. HRMS-ESI [M-2H+Na]$^-$ calcd for $C_{13}H_{16}O_{14}N_4P_3$: 544.98832, found: 544.98813.

7-Phenyl-7-deazaguanosine 5'-*O*-triphosphate sodium salt ($G^{Ph}TP$)

$G^{Ph}TP$ was prepared according to general procedure B by dissolving **G^{Ph}** (30 mg, 0.11 mmol), in $PO(OMe)_3$ (400 µl) and stirring with $POCl_3$ (9 µL, 0.10 mmol) for 1h, followed by the addition of solution of $(NHBu_3)_2H_2P_2O_7$ (183 mg, 0.33 mmol) and tributyl amine (84 µL, 0.35 mmol) in anhydrous DMF (1 mL) and stirring for another hour. Triphosphate (17 mg, 30 %) was obtained as a white lyophilizate (water). Triphosphate (17 mg, 30 %) was obtained as a white lyophilizate (water). ^{1}H NMR (500.0 MHzD_2O): 4.16 (ddd, 1H, J_{gem} = 11.5, $J_{H,P}$ = 5.1, $J_{5'b,4'}$ = 3.6, H-5′b); 4.24 (ddd, 1H, J_{gem} = 11.5, $J_{H,P}$ = 6.3, $J_{5'a,4'}$ = 3.4, H-5′a); 4.32 (dddd, 1H, $J_{4',5'}$ = 3.6, 3.4, $J_{4',3'}$ = 2.6, $J_{H,P}$ = 2.1, H-4′); 4.54 (dd, 1H, $J_{3',2'}$ = 5.4, $J_{3',4'}$ =2.6, H-3′); 4.73 (dd, 1H, $J_{2',1'}$ = 7.0, $J_{2',3'}$ = 5.4, H-2′); 6.11 (d, 1H, $J_{1',2'}$ = 7.0, H-1′); 7.31 (s, 1H, H-6); 7.35 (m, 1H, H-*p*-Ph); 7.45 (m, 2H, H-*m*-Ph); 7.74

(m, 2H, H-*o*-Ph). ^{13}C NMR (125.7 MHz, D_2O): 68.30 (d, $J_{C,P}$ = 5.7, CH_2-5′); 73.36 (CH-3′); 75.91 (CH-2′); 86.20 (d, $J_{C,P}$ = 9.1, CH-4′); 88.42 (CH-1′); 100.88 (C-4a); 118.99 (CH-6); 124.11 (C-5); 129.76 (CH-*p*-Ph); 131.09 (CH-*o*-Ph); 131.20 (CH-*m*-Ph); 136.03 (C-*i*-Ph); 155.61 (C-2,7a); 163.86 (C-4). ^{31}P NMR (202.3 MHz, D_2O): -22.26 (t, J = 19.9, P_b); -10.66 (d, J = 19.9, P_a); -9.39 (bd, J = 19.9, P_g). MS (ESI) m/z (%): 517 (100) [M-H_2PO_3-H], 539 (45) [M-H_2PO_3-2H+Na], 597 (12) [M-H], 619 (15) [M-2H+Na], 641 (11) [M-3H+2Na]. HRMS-ESI [M-2H+Na]$^-$ calcd for $C_{17}H_{19}O_{14}N_4NaP_3$: 619.00151, found: 619.00138.

7-(Benzofuran-2-yl)-7-deazaguanosine 5'-*O*-triphosphate sodium salt ($G^{BF}TP$)

$G^{BF}TP$ was prepared according to general procedure B by dissolving **G^{BF}** (30 mg, 0.07 mmol), in $PO(OMe)_3$ (200 µl) and stirring with $POCl_3$ (8 µL, 0.09 mmol) overnight, followed by the addition of solution of $(NHBu_3)_2H_2P_2O_7$ (165 mg, 0.30 mmol) and tributylamine (75 µL, 0.30 mmol) in anhydrous DMF (1 mL) and stirring for another hour. Triphosphate (14 mg, 26 %) was obtained as a white lyophilizate (water). ^{1}H NMR (500.0 MHz, D_2O): 4.19 (ddd, 1H, J_{gem} = 11.6, $J_{H,P}$ = 5.3, $J_{5'b,4'}$ = 3.9, H-5′b); 4.28 (ddd, 1H, J_{gem} = 11.6, $J_{H,P}$ = 6.8, $J_{5'a,4'}$ = 3.5, H-5′a); 4.34 (dddd, 1H, $J_{4',5'}$ = 3.9, 3.5, $J_{4',3'}$ = 3.0, $J_{H,P}$ = 1.7, H-4′); 4.61 (dd, 1H, $J_{3',2'}$ = 5.4, $J_{3',4'}$ = 3.0, H-3′); 4.75 (dd, 1H, $J_{2',1'}$ = 6.8, $J_{2',3'}$ = 5.4, H-2′); 6.08 (d, 1H, $J_{1',2'}$ = 6.8, H-1′); 7.27 (td, 1H, $J_{5,4}$ = $J_{5,6}$ = 7.5, $J_{5,7}$ = 1.2, H-5-benzofuryl); 7.33 (ddd, 1H, $J_{6,7}$ = 8.3, $J_{6,5}$ = 7.5, $J_{6,4}$ = 1.3, H-6-benzofuryl); 7.48 (d, 1H, $J_{3,7}$ = 0.8, H-3-benzofuryl); 7.57 (ddt, 1H, $J_{7,6}$ = 8.3, $J_{7,5}$ = 1.2, $J_{7,3}$ = $J_{7,4}$ = 0.8, H-7-benzofuryl); 7.63 (ddd, 1H, $J_{4,5}$ = 7.5, $J_{4,6}$ = 1.3, $J_{4,7}$ = 0.8, H-4-benzofuryl); 7.66 (s, 1H, H-6). ^{13}C NMR (125.7 MHz, D_2O): 68.16 (d, $J_{C,P}$ = 4.9, CH_2-5′); 73.07 (CH-3′); 75.91 (CH-2′); 86.22 (d, $J_{C,P}$ = 9.0, CH-4′); 88.70 (CH-1′); 100.08 (C-4a); 106.46 (CH-3-benzofuryl); 113.53 (C-5); 113.57 (CH-7-benzofuryl); 119.81 (CH-6); 123.61 (CH-4-benzofuryl); 125.65 (CH-5-benzofuryl); 126.87 (CH-6-benzofuryl); 131.98 (C-3a-benzofuryl); 153.43 (C-2-benzofuryl); 155.70 (C-7a); 155.95 (C-2); 156.73 (C-7a-benzofuryl); 163.66 (C-4).^{31}P NMR (202.3 MHz, D_2O): -21.64 (t, J = 19.4, P_b); -10.33 (d, J = 19.4, P_a);MS (ESI) m/z (%): 557 (100) [M-H_2PO_3-H], 579 (46) [M-H_2PO_3-2H+Na], 637 (5) [M-H], 659 (8) [M-2H+Na], 681 (10) [M-3H+2Na]. HRMS-ESI [M-2H+Na]$^-$ calcd for $C_{19}H_{19}O_{15}N_4P_3$: 658.99561, found: 658.99629.

7-(Dibenzofuran-4-yl)-7-deazaguanosine 5'-*O*-triphosphate sodium salt ($G^{DB}TP$)

$G^{DB}TP$ was prepared according to general procedure B by dissolving **G^{DB}** (30 mg, 0.06 mmol), in $PO(OMe)_3$ (200 µl) and stirring with $POCl_3$ (7 µL, 0.08 mmol) overnight, followed by the addition of solution of $(NHBu_3)_2H_2P_2O_7$ (147 mg, 0.28 mmol) and tributylamine (67 µL, 0.28 mmol) in anhydrous DMF (1 mL) and stirring for another hour. Triphosphate (5 mg, 10 %) was obtained as a white lyophilizate (water). ^{1}H NMR (500.0 MHz, D_2O, ref(dioxane) = 3.75 ppm): 4.12 (ddd, 1H, J_{gem} = 11.6, $J_{H,P}$ = 5.2, $J_{5'b,4'}$ = 3.6, H-5′b); 4.22 (ddd, 1H, J_{gem} = 11.6, $J_{H,P}$ = 6.9, $J_{5'a,4'}$ = 3.8, H-5′a); 4.36 (dddd, 1H, $J_{4',5'}$ = 3.8, 3.6, $J_{4',3'}$ = 3.2, $J_{H,P}$ = 1.6, H-4′); 4.58 (dd, 1H, $J_{3',2'}$ = 5.5, $J_{3',4'}$ = 3.2, H-3′); 4.77 (dd, 1H, $J_{2',1'}$ = 6.8, $J_{2',3'}$ = 5.5, H-2′); 6.04 (d, 1H, $J_{1',2'}$ = 6.8, H-1′); 7.38 (m, 1H, H-1-dibenzofuryl and H-2-dibenzofuryl); 7.44-7.50 (m, 2H, H-8-dibenzofuryl and H6); 7.60 (m, 1H, H7-dibenzofuryl); 7.71 (m, 1H, H-6-dibenzofuryl); 7.96 (m, 1H, H-3-dibenzofuryl); 8.03 (m, 1H, H-9-dibenzofuryl). ^{13}C NMR (125.7 MHz, D_2O, ref(dioxane) = 69.3 ppm): 68.16 (d, $J_{C,P}$ = 4.9, CH_2-5′); 73.07 (CH-3′); 75.91 (CH-2′); 86.22 (d, $J_{C,P}$ = 9.0, CH-4′); 88.70 (CH-1′); 101.92 (C-4a) 114.56 (C-5); 114.36 (CH-6-dibenzofuryl); 119.91 (C-4-dibenzofuryl); 122.76 (CH-3-dibenzofuryl); 123.70 (CH-9-dibenzofuryl); 124.23 (CH-6); 125.92 (CH-8-dibenzofuryl); 126.15 (CH-2-dibenzofuryl); 126.44 (C-9b-dibenzofuryl); 126.95 (C-9a-dibenzofuryl); 130.37 (CH-7-dibenzofuryl); 130.77 (CH-1-dibenzofuryl)155.22 (C-4a-dibenzofuryl); 155.73 (C-7a); 156.04 (C-

2); 158.39 (C-5a-dibenzofuryl) 163.71 (C-4). ^{31}P NMR (202.3 MHz, D_2O): -21.64 (t, J = 19.4, P_b); -10.33 (d, J = 19.4, P_a); -6.65 (bs, P_g). MS (ESI) m/z (%): 607 (100) [M-H_2PO_3-H], 629 (34) [M-H_2PO_3-2H+Na], 687 (5) [M-H], 709 (10) [M-2H+Na], 731 (15) [M-3H+2Na]. HRMS-ESI [M-2H+Na]$^-$ calcd for $C_{21}H_{20}O_{16}N_4NaP_3$: 709.01062, found: 709.01194.

General procedure C: Suzuki cross-coupling on iodinated triphosphates:

Degassed solution of $Pd(Ac)_2$ (0.5 mg, 0.002 mmol) and TPPTS (6 mg, 0.01 mmol) in water/ACN (2 mL, 2:1) was added to the water/ACN (5 mL, 2:1) solution of **N^{I}TP** (30 mg, 0.04 mmol.), corresponding boronic acid (0.11 mmol) and Cs_2CO_3 (70 mg, 0.2 mmol). The reaction mixture was left stirring for 30 min at 100°C. After cooling to the room temperature, the mixture was concentrated under reduced pressure and the product was purified by HPLC (C-18 column, 0.1M TEAB in water to 0.1M TEAB in 50% aq. MeOH), coevaporated several times with water and, where possible, converted to a sodium salt form (Dowex 50 in Na+ cycle).

7-(Benzofuran-2-yl)-7-deazaadenosine 5'-*O*-triphosphate sodium salt (A^{BF}TP)

Prepared from **A^{I}TP** (30 mg) and benzofuran-2-ylboronic acid (17 mg, 0.11 mmol) according to general procedure C. Triphosphate (17 mg, 58 %) was obtained as a white lyophilizate (water). Triphosphate (17 mg, 58 %) was obtained as a white lyophilizate (water). ^{1}H NMR (500.0 MHz, D_2O): 4.20 (ddd, 1H, J_{gem} = 11.6, $J_{H,P}$ = 4.8, $J_{5'b,4'}$ = 3.3, H-5′b); 4.31 (ddd, 1H, J_{gem} = 11.6, $J_{H,P}$ = 6.5, $J_{5'a,4'}$ = 3.1, H-5′a); 4.35 (dddd, 1H, $J_{4',5'}$ = 3.3, 3.1, $J_{4',3'}$ = 3.2, $J_{H,P}$ = 2.2, H-4′); 4.63 (dd, 1H, $J_{3',2'}$ = 5.3, $J_{3',4'}$ = 3.2, H-3′); 4.74 (dd, 1H, $J_{2',1'}$ = 6.5, $J_{2',3'}$ = 5.3, H-2′); 6.19 (d, 1H, $J_{1',2'}$ = 6.5, H-1′); 7.08 (s, 1H, H-3-benzofuryl); 7.16 – 7.28 (m, 2H, H-5,6-benzofuryl); 7.46 (m, 1H, H-7-benzofuryl); 7.54 (m, 1H, H-4-benzofuryl); 7.99 (s, 1H, H-2); 8.00 (s, 1H, H-6). ^{13}C NMR (125.7 MHz, D_2O): 68.04 (d, $J_{C,P}$ = 5.3, CH_2-5′); 73.10 (CH-3′); 76.51 (CH-2′); 86.32 (d, $J_{C,P}$ = 8.9, CH-4′); 88.64 (CH-1′); 102.57 (C-4a); 104.80 (CH-3-benzofuryl); 110.37 (C-5); 113.47 (CH-7-benzofuryl); 123.55 (CH-4-benzofuryl); 123.69 (CH-6); 126.07 (CH-5-benzofuryl); 126.66 (CH-6-benzofuryl); 131.41 (C-3a-benzofuryl); 152.74 (C-2-benzofuryl); 153.15 (C-7a); 154.34 (CH-2); 156.46 (C-7a-benzofuryl); 159.78 (C-4).^{31}P NMR (202.3 MHz, D_2O): -21.06 (dd, J = 20.0, 19.6, P_b); -10.35 (d, J = 19.6, P_a); -6.65 (d, J = 20.0, P_g). MS (ESI) m/z (%): 541 (100) [M-H_2PO_3-H], 563 (56) [M-H_2PO_3-2H+Na], 621 (5) [M-H], 643 (23) [M-2H+Na], 665 (20) [M-3H+2Na]. HRMS-ESI [M-2H+Na]$^-$ calcd for $C_{19}H_{19}O_{14}N_4NaP_3$: 643.00082, found: 643.00138.

7-(Dibenzofuran-4-yl)-7-deazaadenosine 5'-O-triphosphate sodium salt (A^{DB}TP)

Prepared from **A^{I}TP** (30 mg) and dibenzofuran-4-ylboronic acid (22 mg, 0.11 mmol) according to general procedure C. Triphosphate (14 mg, 45 %) was obtained as a white lyophilizate (water). ^{1}H NMR (500.0 MHz, D_2O): 4.12 (ddd, 1H, J_{gem} = 11.6, $J_{H,P}$ = 5.2, $J_{5'b,4'}$ = 3.6, H-5′b); 4.22 (ddd, 1H, J_{gem} = 11.6, $J_{H,P}$ = 6.9, $J_{5'a,4'}$ = 3.8, H-5′a); 4.36 (dddd, 1H, $J_{4',5'}$ = 3.8, 3.6, $J_{4',3'}$ = 3.2, $J_{H,P}$ = 1.6, H-4′); 4.58 (dd, 1H, $J_{3',2'}$ = 5.5, $J_{3',4'}$ = 3.2, H-3′); 4.77 (dd, 1H, $J_{2',1'}$ = 6.8, $J_{2',3'}$ = 5.5, H-2′); 6.28 (d, 1H, $J_{1',2'}$ = 6.8, H-1′); 7.28 (m, 1H, H-2-dibenzofuryl); 7.40 (m, 1H, H-1-dibenzofuryl); 7.44 (m, 1H, H-8-dibenzofuryl); 7.49 – 7.54 (m, 2H, H-6,7-dibenzofuryl); 7.61 (s, 1H, H-6); 7.71 (m, 1H, H-3-dibenzofuryl); 8.01 (m, 1H, H-9-dibenzofuryl); 8.08 (s, 1H, H-2). ^{13}C NMR (125.7 MHz, D_2O): 68.11 (d, $J_{C,P}$ = 5.4, CH_2-5′); 73.04 (CH-3′); 75.97 (CH-2′); 86.17 (d, $J_{C,P}$ = 8.8, CH-4′); 88.45 (CH-1′); 104.29 (C-4a); 114.32 (C-5); 114.36 (CH-6-dibenzofuryl); 119.91 (C-4-dibenzofuryl); 122.76 (CH-3-dibenzofuryl); 123.70 (CH-9-dibenzofuryl); 124.23 (CH-6); 125.92 (CH-8-dibenzofuryl); 126.15 (CH-2-dibenzofuryl); 126.44 (C-9b-dibenzofuryl); 126.95 (C-9a-dibenzofuryl); 130.37 (CH-7-dibenzofuryl); 130.77 (CH-1-dibenzofuryl); 152.96 (C-7a); 154.16

(CH-2); 155.62 (C-4a-dibenzofuryl); 158.32 (C-5a-dibenzofuryl); 159.72 (C-4). ^{31}P NMR (202.3 MHz, D_2O): -21.13 (dd, J = 19.9, 19.3, P_b); -10.32 (d, J = 19.3, P_a); -5.50 (d, J = 19.9, P_g). MS (ESI) m/z (%): 591 (100) [M-H_2PO_3-H], 613 (86) [M-H_2PO_3-2H+Na], 671 (6) [M-H], 693 (26) [M-2H+Na], 715 (27) [M-3H+2Na]. HRMS-ESI [M-2H+Na]$^-$ calcd for $C_{23}H_{21}O_{14}N_4NaP_3$: 693.01611, found: 693.01703.

5-Phenylcytidine 5'-*O*-triphosphate triethylammonium salt ($C^{Ph}TP$)

Prepared from **$C^{I}TP$** (15 mg) and phenylboronic acid (13 mg, 0.11 mmol) according to general procedure C. Triphosphate (9 mg, 64 %) was obtained as a glassy lyophilizate (water). ^{1}H NMR (500.0 MHz, D_2O): 1.28 (t, 9H, J_{vic} = 7.3, C**H$_3$**CH_2N); 3.20 (q, 6H, J_{vic} = 7.3, CH_3C**H$_2$**N); 4.07 (ddd, 1H, J_{gem} = 11.5, $J_{H,P}$ = 5.1, $J_{5'b,4'}$ = 3.6, H-5′b); 4.13 (ddd, 1H, J_{gem} = 11.5, $J_{H,P}$ = 6.3, $J_{5'a,4'}$ = 3.4, H-5′a); 4.18 (m, H-4′); 4.33 (m, 2H, H-3′ and H-2'); 5.97 (d, $J_{1',2'}$ = 5.0, 1H, H-1'); 7.37 (m, 2H, H-*o*-Ph); 7.41 (m, 1H, H-*p*-Ph); 7.47 (m, 2H, H-*m*-Ph); 7.69 (s, 1H, H-6). ^{13}C NMR (125.7 MHz, D_2O): 10.95 (**C**H_3CH_2N); 49.35 (CH_3**C**H_2N); 67.71 (d, $J_{C,P}$ = 5.7, CH_2-5′); 72.18 (CH-3′); 76.48 (CH-2′); 85.82 (d, $J_{C,P}$ = 9.1, CH-4′); 91.64 (CH-1′); 113.76 (C-5); 131.53 (CH-*p*-Ph); 132.07 (CH-*m*-Ph); 132.09 (CH-*o*-Ph); 134.71 (C-*i*-Ph); 142.31 (CH-6); 160.13 (C-2); 167.47 (C-4). ^{31}P NMR (202.3 MHz, D_2O): -22.89 (t, J = 19.6, P_b); -11.64 (d, J = 19.6, P_a); -7.98 (bd, J = 19.6, P_g). MS (ESI) m/z (%): 478 (70) [M-H_2PO_3-H], 540 (2) [M-H_2PO_3-2H+Na], 558 (100) [M-H]. HRMS-ESI [M-2H+Na]$^-$ calcd for $C_{15}H_{18}O_{14}N_3NaP_3$: 579.98956, found: 579.99048.

5-(Benzofuran-2-yl)-cytidine 5'-*O*-triphosphate sodium salt ($C^{BF}TP$)

Prepared from **$C^{I}TP$** (30 mg) and benzofuran-2-ylboronic acid (17 mg, 0.11 mmol) according to general procedure C. Triphosphate (11 mg, 37 %) was obtained as a white lyophilizate (water). ^{1}H NMR (500.0 MHz, D_2O): 4.25 – 4.36 (m, 3H, H-4′,5′); 4.45 (dd, 1H, $J_{3',2'}$ = 5,2, $J_{3',4'}$ = 4,8, H-3′); 4.49 (dd, 1H, $J_{2',3'}$ = 5.2, $J_{2',1'}$ = 4.6, H-2′); 6.04 (d, 1H, $J_{1',2'}$ = 4.6, H-1′); 7.24 (d, 1H, $J_{3,7}$ = 1.0, H-3-benzofuryl); 7.33 (td, 1H, $J_{5,4}$ = $J_{5,6}$ = 7.6, $J_{5,7}$ = 1.1, H-5-benzofuryl); 7.38 (ddd, 1H, $J_{6,7}$ = 8.3, $J_{6,5}$ = 7.6, $J_{6,4}$ = 1.5, H-6-benzofuryl); 7.62 (dq, 1H, $J_{7,6}$ = 8.3, $J_{7,3}$ = $J_{7,4}$ = $J_{7,5}$ = 1.1, H-7-benzofuryl); 7.74 (ddd, 1H, $J_{4,5}$ = 7.6, $J_{4,6}$ = 1.5, $J_{4,7}$ = 1.1, H-4-benzofuryl); 8.31 (s, 1H, H-6). ^{13}C NMR (125.7 MHz, D_2O): 67.47 (d, $J_{C,P}$ = 5.4, CH_2-5′); 71.87 (CH-3′); 77.0 (CH-2′); 85.90 (d, $J_{C,P}$ = 9.1, CH-4′); 92.23 (CH-1′); 103.36 (C-5); 107.60 (CH-3-benzofuryl); 114.04 (CH-7-benzofuryl); 124.28 (CH-4-benzofuryl); 126.09 (CH-5-benzofuryl); 127.50 (CH-6-benzofuryl); 131.02 (C-3a-benzofuryl); 143.73 (CH-6); 151.66 (C-2-benzofuryl); 157.18 (C-7a-benzofuryl); 159.40 (C-2); 165.72 (C-4). ^{31}P NMR (202.4 MHz, D_2O): -22.19 (t, J = 19.8, P_b); -11.36 (d, J = 19.8, P_a); -6.81 (bd, J = 19.8, P_g).. MS (ESI) m/z (%): 518 (100) [M-H_2PO_3-H], 540 (76) [M-H_2PO_3-2H+Na], 598 (8) [M-H], 620 (30) [M-2H+Na], 642 (45) [M-3H+2Na]. HRMS-ESI [M-2H+Na]$^-$ calcd for $C_{17}H_{20}O_{15}N_3NaP_3$: 619.98520, found: 619.98539.

5-(Dibenzofuran-4-yl)-cytidine 5'-*O*-triphosphate sodium salt ($C^{DB}TP$)

Prepared from **$C^{I}TP$** (30 mg) and dibenzofuran-4-ylboronic acid (22 mg, 0.11 mmol) according to general procedure C. Triphosphate (11 mg, 37 %) was obtained as a white lyophilizate (water). ^{1}H NMR (500.0 MHz, D_2O): 4.16 – 4.21 (m, 2H, H-5′); 4.29 (dtd, 1H, $J_{4',3'}$ = 5.1, $J_{4',5'}$ = 3.4, $J_{H,P}$ = 1.7, H-4′); 4.39 (t, 1H, $J_{3',2'}$ = $J_{3',4'}$ = 5.1, H-3′); 4.43 (dd, 1H, $J_{2',3'}$ = 5.1, $J_{2',1'}$ = 4.9, H-2′); 6.06 (d, 1H, $J_{1',2'}$ = 4.9, H-1′); 7.44 (ddd, 1H, $J_{8,9}$ = 7.8, $J_{8,7}$ = 7.3, $J_{8,6}$ = 1.1, H-8-dibenzofuryl); 7.50 – 7.54 (m, 2H, H-1,2-dibenzofuryl); 7.55 (ddd, 1H, $J_{7,6}$ = 8.5, $J_{7,8}$ = 7.3, $J_{7,9}$ = 1.3, H-7-dibenzofuryl);

7.62 (ddd, 1H, $J_{6,7}$ = 8.5, $J_{6,8}$ = 1.1, $J_{6,9}$ = 0.7, H-6-dibenzofuryl); 7.96 (s, 1H, H-6); 8.10 (ddd, 1H, $J_{9,8}$ = 7.8, $J_{9,7}$ = 1.3, $J_{9,6}$ = 0.7, H-9-dibenzofuryl); 8.14 (dd, 1H, $J_{3,2}$ = 6.5, $J_{3,1}$ = 2.5, H-3-dibenzofuryl). ^{13}C NMR (125.7 MHz, D_2O): 67.80 (d, $J_{C,P}$ = 5.5, CH_2-5′); 72.75 (CH-3′); 76.60 (CH-2′); 85.68 (d, $J_{C,P}$ = 8.9, CH-4′); 92.23 (CH-1′); 108.25 (C-5); 114.45 (CH-6-dibenzofuryl); 118.57 (C-4-dibenzofuryl); 123.83 (CH-9-dibenzofuryl); 124.58 (CH-3-dibenzofuryl); 126.02 (CH-8-dibenzofuryl); 126.43 (C-9a-dibenzofuryl); 126.68 (CH-2-dibenzofuryl); 127.14 (C-9b-dibenzofuryl); 130.52 (CH-7-dibenzofuryl); 131.83 (CH-1-ibenzofuryl); 143.99 CH-6); 156.22 (C-4a-dibenzofuryl); 158.41 (C-5a-dibenzofuryl); 160.06 (C-2); 167.08 (C-4).^{31}P NMR (202.4 MHz, D_2O): -22.82 (t, J = 19.7, P_b); -11.59 (d, J = 19.7, P_a); -9.54 (bd, J = 19.7, P_g). MS (ESI) m/z (%): 568 (100) [M-H_2PO_3-H], 590 (47) [M-H_2PO_3-2H+Na], 648 (10) [M-H], 670 (25) [M-2H+Na], 692 (17) [M-3H+2Na]. HRMS-ESI [M-2H+Na]$^-$ calcd for $C_{21}H_{20}O_{15}N_3NaP_3$: 670.00190, found: 670.00104.

5-(Dibenzofuran-4-yl)-uridine 5'-*O*-triphosphate triethylammonium salt ($U^{DB}TP$)

Prepared from **$U^{I}TP$** (30 mg) and dibenzofuran-4-ylboronic acid (22 mg, 0.11 mmol) according to general procedure C. Triphosphate (10 mg, 33 %) was obtained as a white lyophilizate (water). ^{1}H NMR (500.0 MHz, D_2O): 1.28 (t, 9H, J_{vic} = 7.3, C**H$_3$**CH_2N); 3.20 (q, 6H, J_{vic} = 7.3, CH_3C**H$_2$**N); 4.27 (m, 3H, H-4' and H-5′); 4.40 (m, 2H, H-3' and H-4′); 5.97 (d, 1H, $J_{1',2'}$ = 4.9, H-1′); 7.34 (m, 2H, H-1-dibenzofuryl and H-2-dibenzofuryl); 7.46(m, 2H, H-8-dibenzofuryl and H-7-dibenzofuryl); 7.52 (m, 1H, H-6-dibenzofuryl); 7.95-7.98 (m, 3H, H-3-dibenzofuryl and H-9 dibenzofuryl and H-6). ^{13}C NMR (125.7 MHz, D_2O): 10.95 (**C**H_3CH_2N); 49.34 (CH_3**C**H_2N); 68.13 (d, $J_{C,P}$ = 5.5, CH_2-5′); 72.65 (CH-3′); 76.22 (CH-2′); 86.14 (d, $J_{C,P}$ = 9.1, CH-4'); 91.83 (CH-1′); 114.16 (C-5); 114.49 (CH-6-dibenzofuryl); 118.78 (C-4-dibenzofuryl); 123.72 (CH-9-dibenzofuryl); 124.00 (CH-3-dibenzofuryl); 126.00 (CH-8); 126.22 (CH-9a-dibenzofuryl); 126.38 (CH-2-dibenzofuryl); 126.82 (C-9b-dibenzofuryl); 130.50 (CH-7-dibenzofuryl); 131.18 (CH-1-dibenzofuryl); 143.18 (CH-6); 154.13 (C-2); 155.98 (C-4a-dibenzofuryl); 158.28 (C-5a-dibenzofuryl); 166.27 (C-4). ^{31}P NMR (202.3 MHz, D_2O): -20.68 (t, J = 19.9, $P_{\square}$); -9.12 (d, J = 19.9, $P_{\square}$); -8.30 (d, J = 19.9, $P_{\square}$). MS (ESI) m/z (%): 649 (100) [M-H], 569 [M-H_2PO_3-H]. HRMS-ESI [M-H] calcd for $C_{21}H_{20}O_{16}N_2P_3$: 670.00312, found: 670.00378.

Biochemistry

In vitro transcription with modified NTPs

A solution of template oligonucleotides (100 μM each) in annealing buffer [Tris (10 mM), NaCl (50 mM), EDTA (1 mM), pH 7.8] was heated to 95°C for 5 minutes and slowly cooled to 25°C over a period of 45 minutes. The resulting DNA (50 μM) was used as a template for transcription reactions. *In vitro* transcription reactions were performed in the total volume of 20 μL in 40 mM Tris buffer (pH 7.9) containing modified NTP (2 mM), three natural NTPs (2 mM), DTT (10 mM), $MgCl_2$ (25 mM), Ribolock RNase inhibitor (1U/μL), Triton X-100 (0.1%), dsDNA template (0.625 μM), T7 RNA polymerase (2U/μL, Thermoscientific) and [α-^{32}P]-GTP (111 TBq/mmol, 370 MBq/mL, 0.4 μL) or [α-^{32}P]-ATP (111 TBq/mmol, 370 MBq/mL, 0.4 μL) if transcription is done with modified GTPs. In the negative control experiment, water was used instead of the solution of modified NTP, and in the positive control the natural NTP (2 mM) was used instead. The transcription reactions were performed at 37°C for 2-4 h. The samples (2 μL) were mixed with RNA loading dye (2 μL, Thermoscientific), heated to 75°C for 10 minutes and cooled on ice. The samples were then analyzed by gel electrophoresis on 12.5% denaturing polyacrylamide gel containing 1xTBE buffer (pH 8) and urea (7 M) at 42 mA for 45 minutes. The gels were dried (85°C, 75 minutes), autoradiographed and visualized by phosphoimager (Typhoon 9410, Amersham Biosciences). Transcription efficiencies were deteremined densitometrically from three independent experiments using QuantityOne software. Transcriptions with modified adenosines were performed according to this general condition, with 2h transcription and twofold excess modified ATPs or natural ATP in positive control (4 mM). RNA_3A^R was transcribed with reduced concentration of $MgCl_2$ (15 mM) to reduce misincorporations.

Modified cytidines and uridines were transcribed according to the protocol for 3h and 4h respectively.

In vitro transcription with modified GTPs in the presence of GMP

A solution of template oligonucleotides (100 μM each) in annealing buffer [Tris (10 mM), NaCl (50 mM), EDTA (1 mM), pH 7.8] was heated to 95°C for 5 minutes and slowly cooled to 25°C over a period of 45 minutes. The resulting DNA (50 mM) was used as a template for transcription reactions. *In vitro* transcription reactions were performed in the total volume of 20 μL in 40 mM Tris buffer (pH 7.9) containing modified GTP (2 mM), GMP (30 mM), CTP (2 mM), UTP (2 mM), ATP (2 mM), DTT (10 mM), $MgCl_2$ (25 mM), Ribolock RNase inhibitor (1U/μL), Triton X-100 (0.1%), dsDNA template (0.625 μM), T7 RNA polymerase (3U/μL, Thermoscientific) and [α-^{32}P]-ATP (111 TBq/mmol, 370 MBq/mL, 0.4 μL). In the negative control experiment, water was used instead of the solution of modified GTP, and in the positive control the natural GTP (2 mM) was used instead. The transcription reactions were performed at 37°C for 4h. The samples (2 μL) were mixed with RNA loading dye (2 μL, Thermoscientific), heated to 75°C for 10 minutes and cooled on ice. The samples were then analyzed by gel electrophoresis on 12.5% denaturing polyacrylamide gel containing 1xTBE buffer (pH 8) and urea (7 M) at 42 mA for 45 minutes. The gels were dried (85°C, 75 minutes), autoradiographed and visualized by phosphoimager (Typhoon

9410, Amersham Biosciences). Transcription efficiency was deteremined densitometrically from three independent experiments using QuantityOne software.

MALDI-TOF analysis of modified RNAs

A solution of template oligonucleotides (100 μM each) in annealing buffer [Tris (10 mM), NaCl (50 mM), EDTA (1 mM), pH 7.8] was heated to 95°C for 5 minutes and slowly cooled to 25°C over a period of 45 minutes. The resulting DNA (50 μM) was used as a template for transcription reactions. *In vitro* transcription reactions were performed in the total volume of 50 μL in 40 mM Tris buffer (pH 7.9) containing modified NTP (2 mM or 4 mM for modified CTPs), three natural NTPs (2 mM), DTT (10 mM), $MgCl_2$ (25 mM), Ribolock RNase inhibitor (1U/μL), Triton X-100 (0.1%), dsDNA template (1.25 μM), T7 RNA polymerase (3U/μL, Thermoscientific). The transcription reactions were performed at 37°C for 2-4h. Then, DNAse I (2U, Thermoscientific) was added and samples were incubated for further 15 minutes. The samples were then purified on NucAway spin colums (Ambion, elution done in DEPC treated water) as per supplier's protocol. Purified samples were analyzed by MALDI-TOF mass spectrometry. The MALDI-TOF spectra were measured on a MALDI-TOF/TOF mass spectrometer with 1 kHz smartbeam II laser. The measurements were done in reflectron mode by droplet technique, with the mass range up to 30 kDa. The matrix consisted of 3-hydroxypicolinic acid (HPA)/picolinic acid (PA)/ ammonium tartrate in ratio 9/1/1. The matrix (1 μL) was applied on the target (ground steel) and dried down at room temperature. The sample (1 μL) and matrix (1 μL) were mixed and added on the top of the dried matrix preparation spot and dried at room temperature.

II Sequences of DNA templates and RNA transcripts

Table S1. Sequences of ds DNA template and RNA transcripts

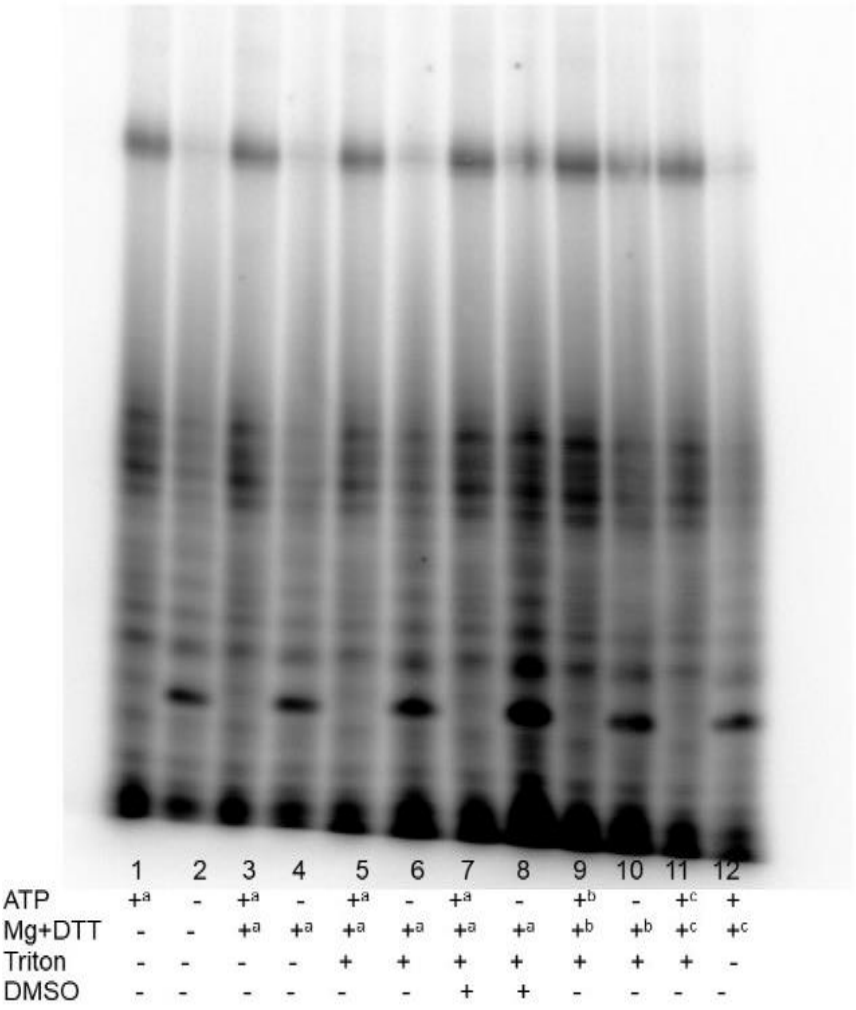
DNA_1A^R	5’TAATACGACTCACTATAGGGCCCCTATTGTCTCTCTCTTCTCTGCTGTTTCC3’ 3’ATTATGCTGAGTGATATCCCGGGGATAACAGAGAGAGAAGAGACGACAAAG(2'MeO)G5’
RNA_1A^R	pppGGGCCCCUAUUGUCUCUCUCUUCUCUGCUGUUUCC
DNA_3A^R	5’TAATACGACTCACTATAGGGCCCGTATGTTACTTGCTCTTATCGTCTCTCGC3’ 3’ATTATGCTGAGTGATATCCCGGGCATACAATGAACGAGAATAGCAGAGAGC(2'MeO)G5’
RNA_3A^R	pppGGGCCCGUAUGUUACUUGCUCUUAUCGUCUCUCGC
DNA_7A^R	5’TAATACGACTCACTATAGGGCTTGCACGTGAATCGCTCTTAATGGATCGCGA3’ 3’ATTATGCTGAGTGATATCCCGAACGTGCACTTAGCGAGAATTACCTAGCGC(2'MeO)T5’
RNA_7A^R	pppGGGCUUGCACGUGAAUCGCUCUUAAUGGAUCGCGA
DNA_1C^R	5’TAATACGACTCACTATAGGGAGGGACTGTGAGTGGAGATTGTAGGATTGAGG3’ 3’ATTATGCTGAGTGATATCCCTCCCTGACACTCACCTCTAACATCCTAACTC(2'MeO)C5’
RNA_1C^R	pppGGGAGGGACUGUGAGUGGAGAUUGUAGGAUUGAGG
DNA_3C^R	5’TAATACGACTCACTATAGGGAGGATCAGTACAGAGGTATGCTGGGATAGGGA3’ 3’ATTATGCTGAGTGATATCCCTCCTAGTCATGTCTCCATACGACCCTATCCC(2'MeO)T5’
RNA_3C^R	pppGGGAGGAUCAGUACAGAGGUAUGCUGGGAUAGGGA
DNA_7C^R	5’TAATACGACTCACTATAGGGATTGACAGTGCCTAGATATTCCGGGCTAGGGC3’ 3’ATTATGCTGAGTGATATCCCTAACTGTCACGGATCTATAAGGCCCGATCCC(2'MeO)G5’
RNA_7C^R	pppGGGAUUGACAGUGCCUAGAUAUUCCGGGCUAGGGC
DNA_1U^R	5’TAATACGACTCACTATAGGGCCAGCTCAAGCCACGCACCCCACGGCACACAC3’ 3’ATTATGCTGAGTGATATCCCGGTCGAGTTCGGTGCGTGGGGTGCCGTGTGT(2'MeO)G5’
RNA_1U^R	pppGGGCCAGCUCAAGCCACGCACCCCACGGCACACAC
DNA3U^{R}3gG^R	5’TAATACGACTCACTATAGGGCCAGCTCACATCAAAGACACTACGACACACAC3’ 3’ATTATGCTGAGTGATATCCCGGTCGAGTGTAGTTTCTGTGATGCTGTGTGT(2'MeO)G5’
RNA_3U^R **RNA_3gG^R**	pppGGGCCAGCUCACAUCAAAGACACUACGACACACAC pppGGGCCAGCUCACAUCAAAGACACUACGACACACAC
DNA_7U^R	5’TAATACGACTCACTATAGGGCCAGCTCAAGTTACGCACCCTTCGGTACAAAT3’ 3’ATTATGCTGAGTGATATCCCGGTCGAGTTCAATGCGTGGGAAGCCATGTTT(2'MeO)A5’
RNA_7U^R	pppGGGCCAGCUCAAGUUACGCACCCUUCGGUACAAAU
DNA_1aG^R	5’TAATACGACTCACTATTAAACCAATGCACCCTCCTCATCCTCCACCACACCA3’ 3’ATTATGCTGAGTGATAATTTGGTTACGTGGGAGGAGTAGGAGGTGGTGTGG(2'MeO)T5’
RNA_1aG^R	pppAAACCAAUGCACCCUCCUCAUCCUCCACCACACCA
DNA_3aG^R	5’TAATACGACTCACTATTAAACCAATGCACAGCACTCCTCCGACACCACACCA3’ 3’ATTATGCTGAGTGATAATTTGGTTACGTGTCGTGAGGAGGCTGTGGTGTGG(2'MeO)T5’
RNA_3aG^R	pppAAACCAAUGCACAGCACUCCUCCGACACCACACCA
DNA_7aG^R	5’TAATACGACTCACTATTAAACCAATGCACAGGACTCATCCGGCAGACCACCG3’ 3’ATTATGCTGAGTGATAATTTGGTTACGTGTCCTGAGTAGGCCGTTCTGTGG(2'MeO)C5’
RNA_7aG^R	pppAAACCAAUGCACAGGACUCAUCCGGCAGACCACCG
DNA_8G^R	5’TAATACGACTCACTATAGCAAACCAGTCCAGGAACATCAGGTACAGTCTCTG3’ 3’ATTATGCTGAGTGATATCGTTTGGTCAGGTCCTTGTAGTCCATGTCAGAG(2'MeO)A(2'MeO)C5’
DNA_8G^R	pGCAAACCAGUCCAGGAACAUCAGGUACAGUCUCUG

Promoter regions in the antisense strand are underlined. The one or two 5’-terminal nucleotides in the antisense strand was 2’-MeO ribonucleotide to minimize non-templated nucleotide addition.[12]

The first base after the promoter region is marked in magenta, while those that are directing transcription of modified bases are marked in blue, whereas the modified bases in the transcripts are marked in red. In the case of template **DNA_3U^{R}gG^{R}** which is used either for synthesis of RNA containing modified Us or Gs, when it is used to yield RNA with modified uridines complementary adenines are marked green, while when used for the incorporation of modified guanosines, the complementary cytosines are marked blue.

III Copies of PAGE GELS

Figure S1. Optimization of conditions for modified ATPs. Template: DNA_3A^{R}

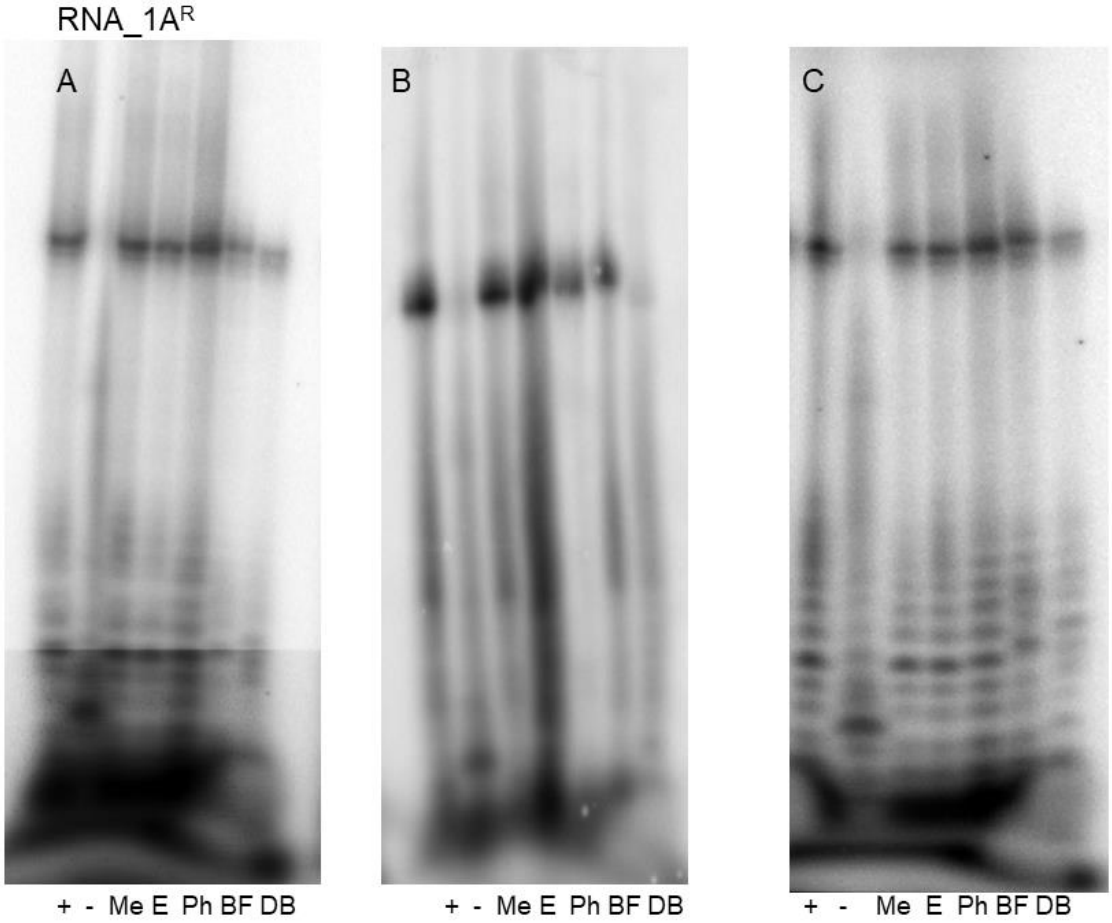


Lanes 1-8: influence of additives a) 2 mM ATP, 10 mM $MgCl_2$, 0.1% DTT, 5%DMSO, 0.1%Triton X-100
Lanes 9-12: fine tuning of Mg^{2+}: b) 2 mM ATP, 25 mM $MgCl_2$ c) 4 mM ATP, 15 mM $MgCl_2$

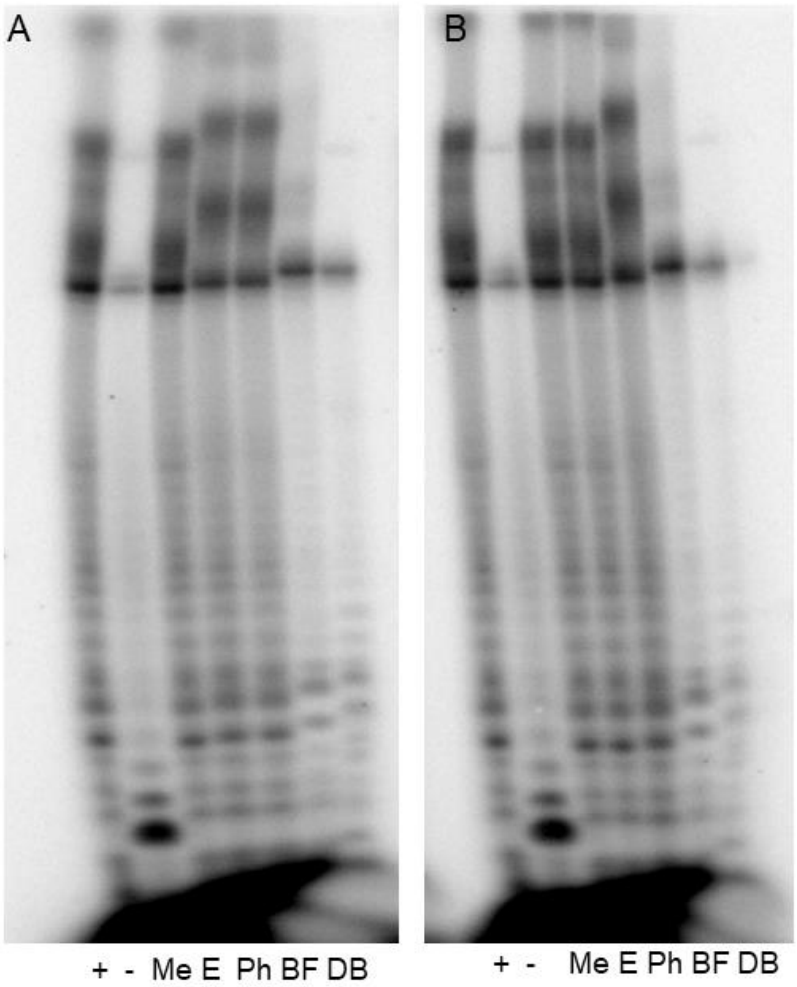
In vitro transcription reactions were performed in the total volume of 20 μL in 40 mM Tris buffer (pH 7.9) containing modified ATP, three natural NTPs (2 mM) , Ribolock RNase inhibitor (1U/μL), dsDNA template (0.625 μM), T7 RNA polymerase (2U/μL, Thermoscientific) and [α-^{32}P]-GTP (111 TBq/mmol, 370 MBq/mL, 0.4 μL). In the negative control experiment, water was used instead of the solution of modified **A^{R}TP**, and in the positive control the natural ATP was used instead. Reactions were incubated at 37°C for 2 h. . The use of additives gives the optimal yields while keeping the misincorporations minimal for most of the templates and these conditions

were used as standard for majority of experiments. Transcription of DNA_3A^{R} under these conditions gives higher amount of RNA but misincorporations are also significant (lanes 9,10), so this template was also transcribed in presence of additives but with lower concentration of Mg^{2+} to reduce misincorporations (lanes 11, 12)

Figure S2. Transcription with modified ATPs



RNA_3A^{R}



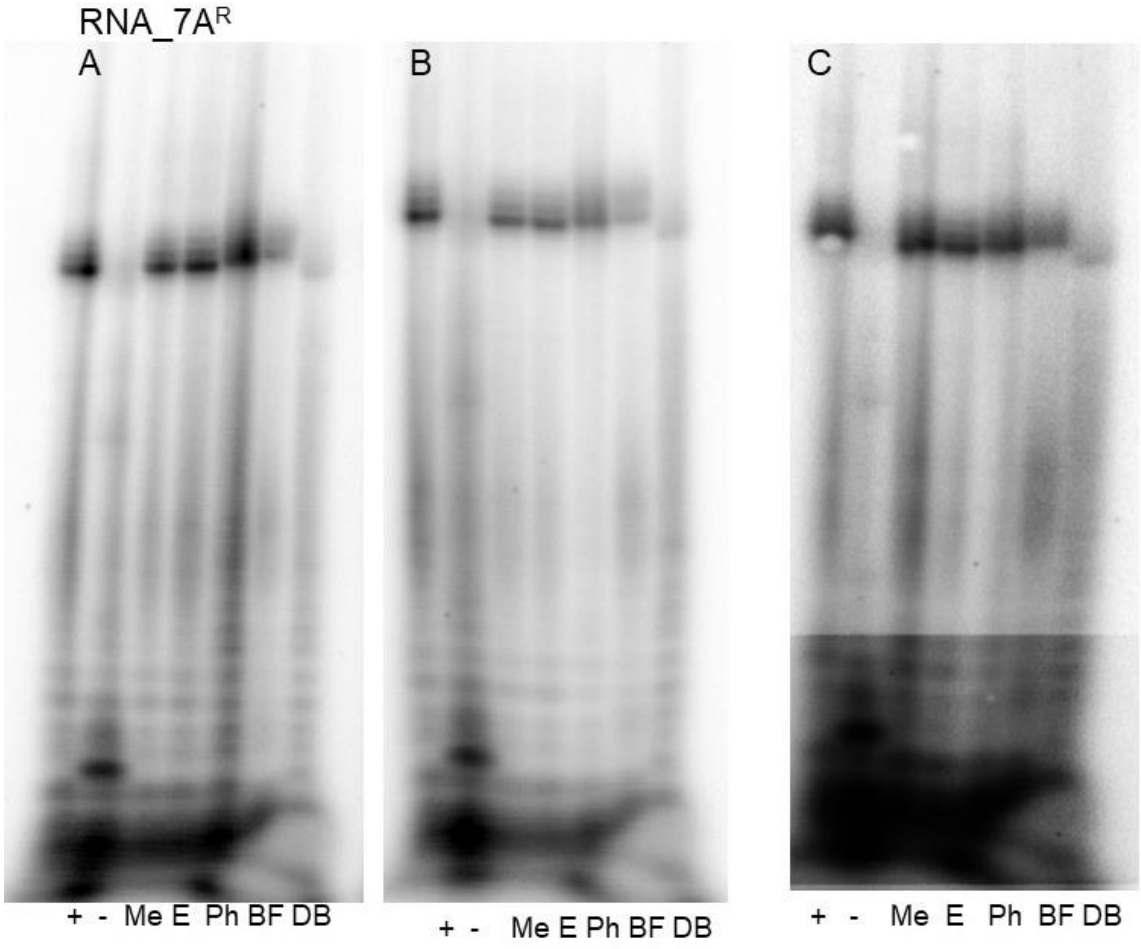
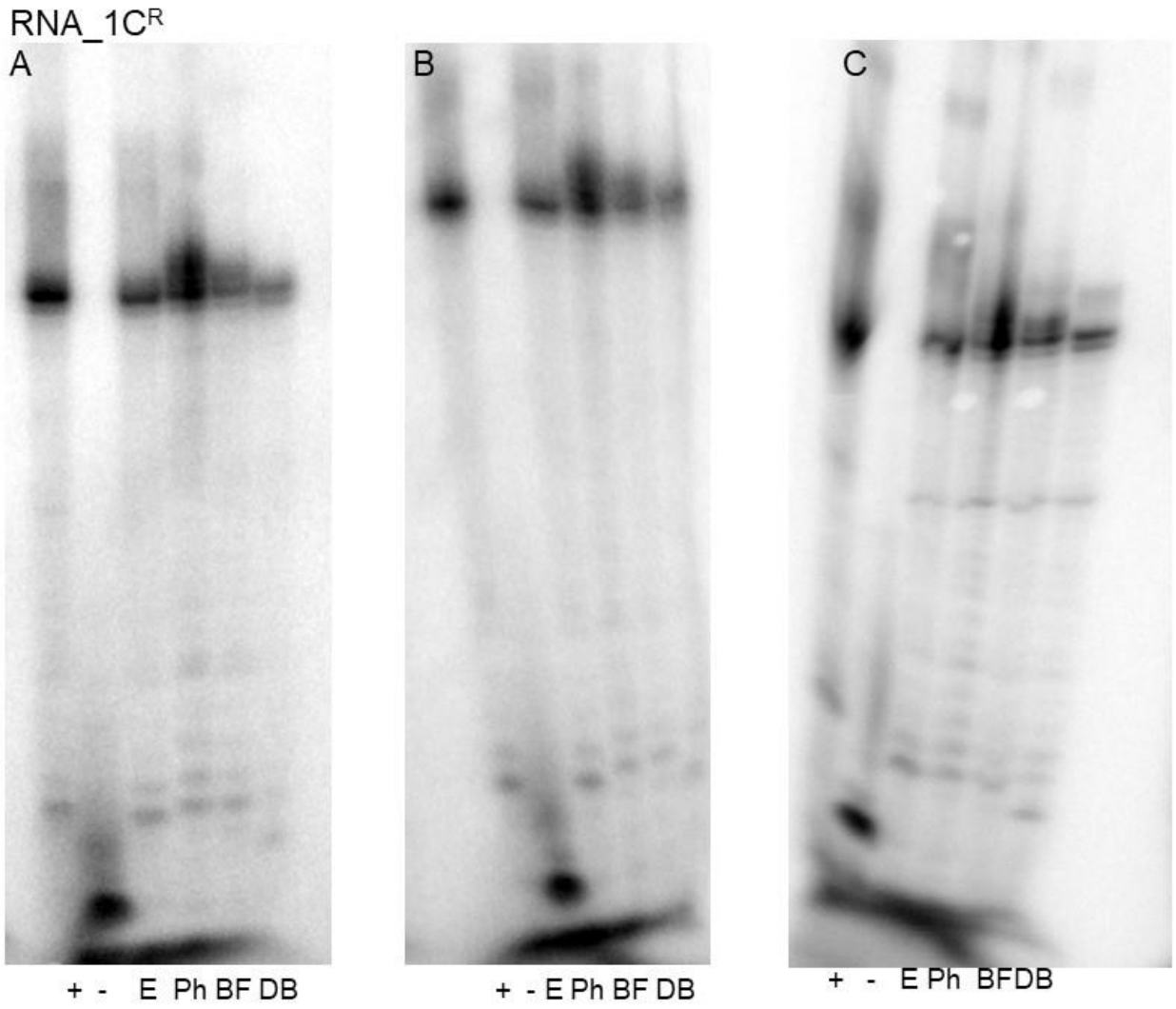
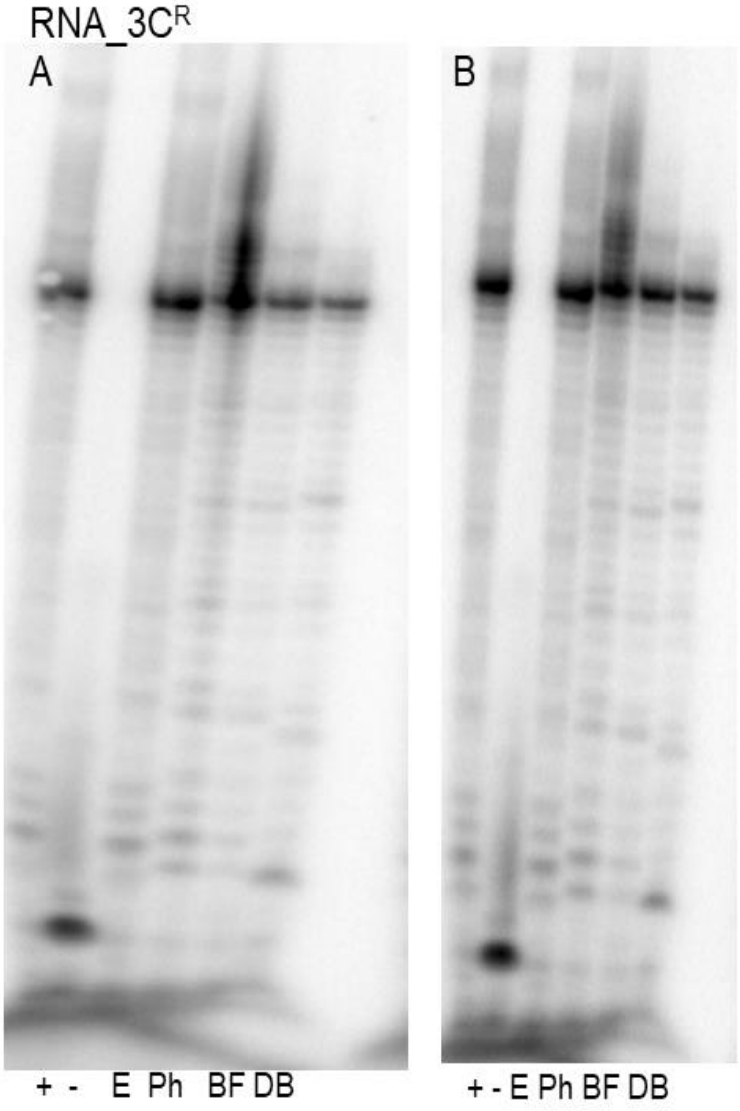

RNA_7A^R
A
B
C
+ - Me E Ph BF DB
+ - Me E Ph BF DB
+ - Me E Ph BF DB

Figure S3. Transcription with modified CTPs




RNA_3C^R
A
B
+ - E Ph BF DB
+ - E Ph BF DB

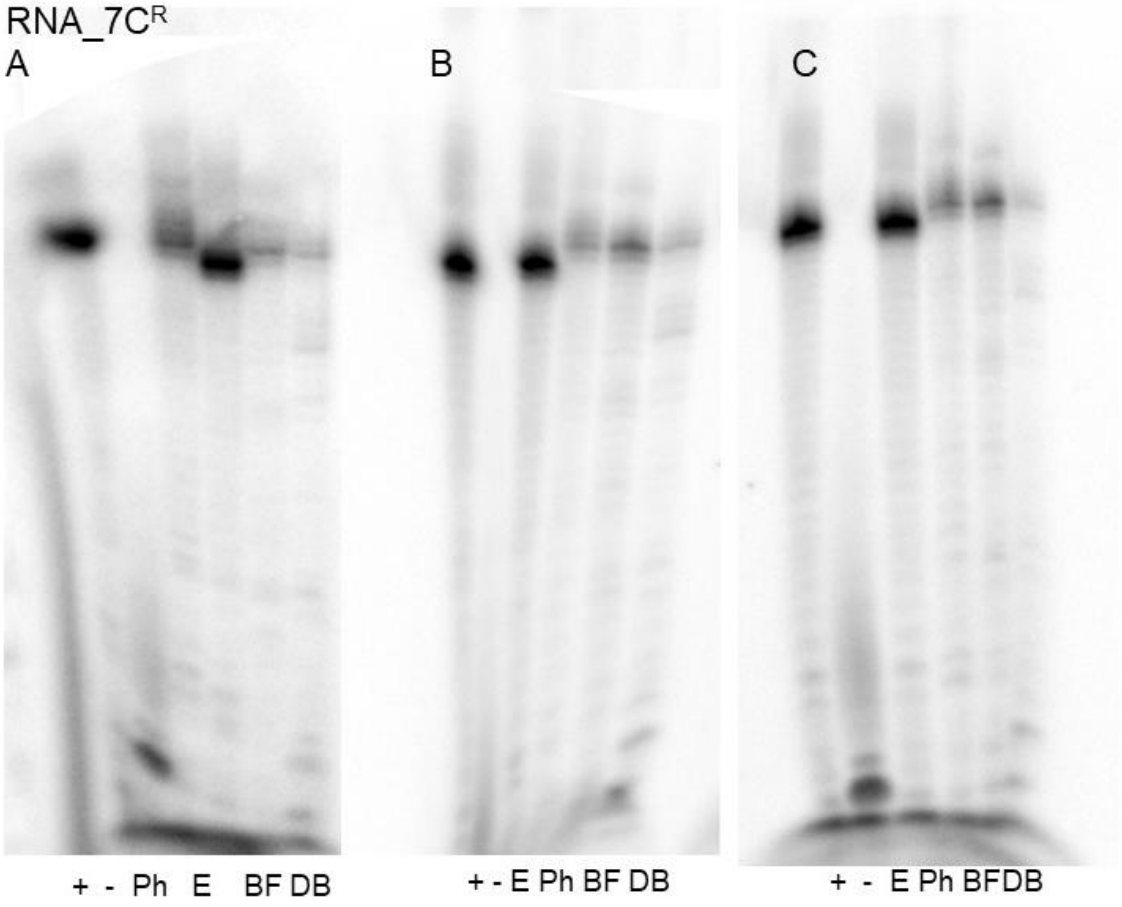
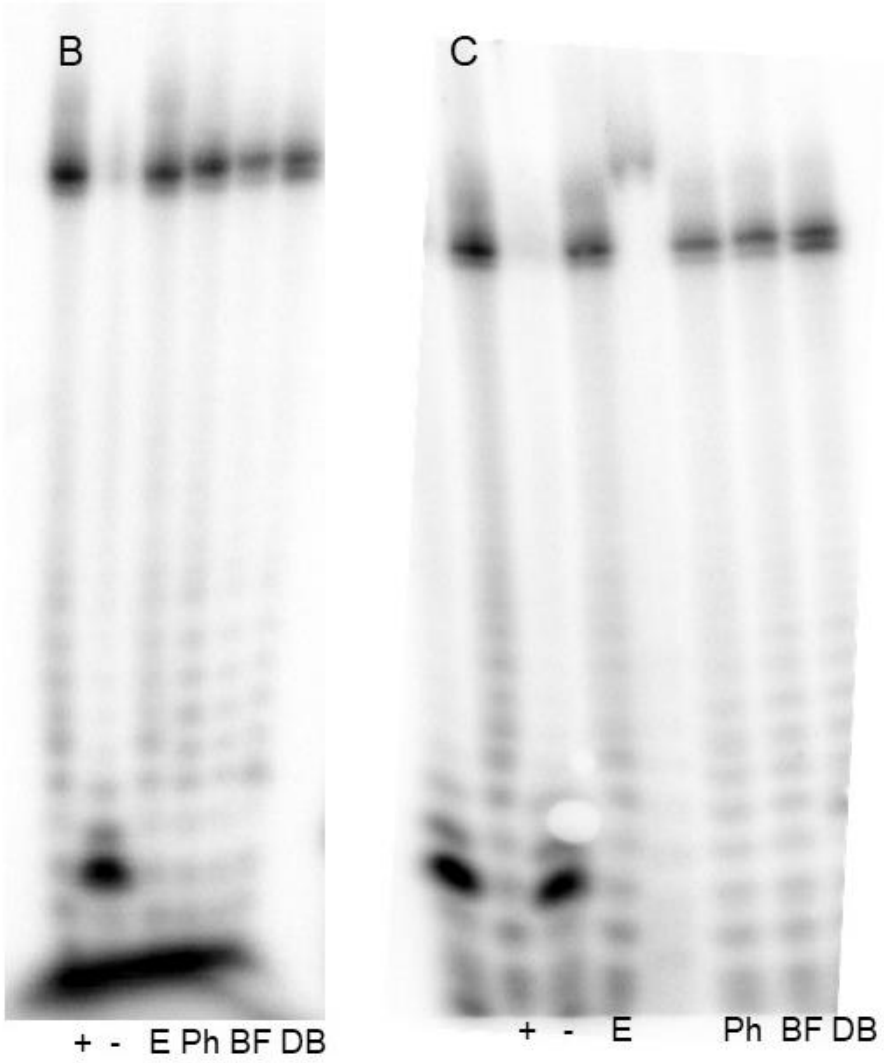
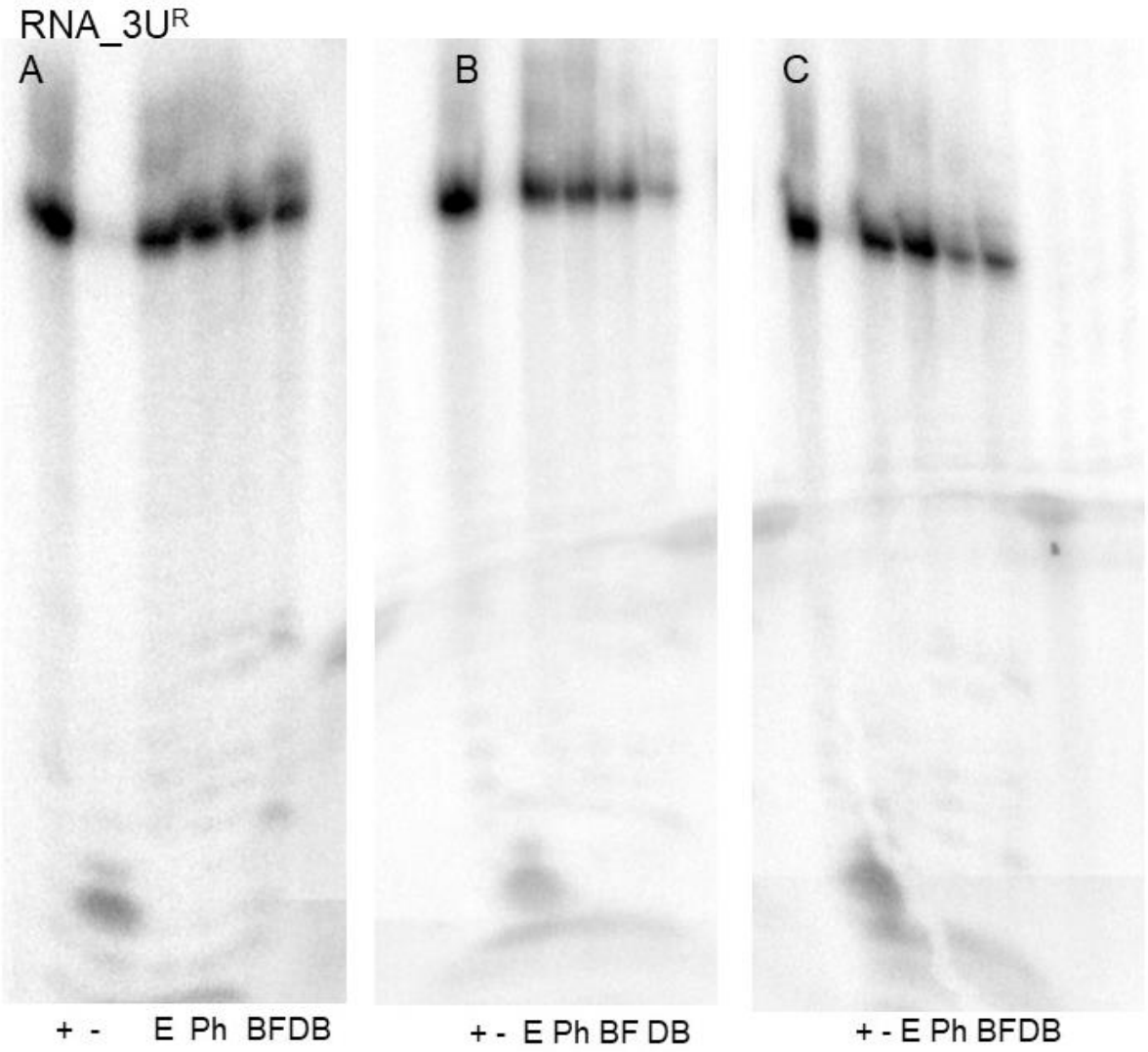

RNA_7C^R
A
B
C
+ - Ph E BF DB
+ - E Ph BF DB
+ - E Ph BFDB

Figure S4. Transcription with modified UTPs




RNA_3U^R
A
B
C
+ - E Ph BFDB
+ - E Ph BF DB
+ - E Ph BFDB

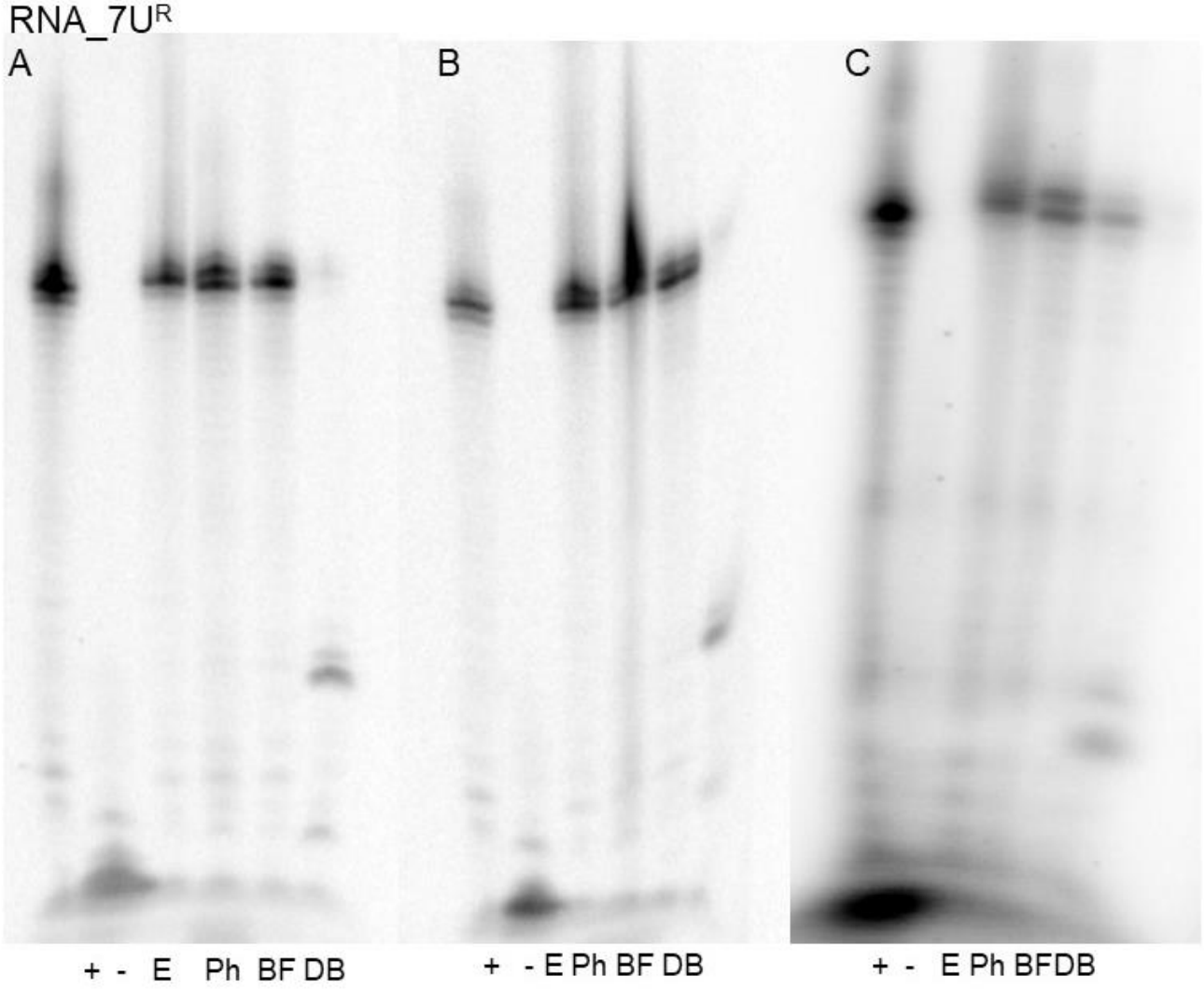

RNA_7U^R
A
B
C
+ - E Ph BF DB
+ - E Ph BF DB
+ - E Ph BFDB

Figure S5. Transcription with modified GTPs

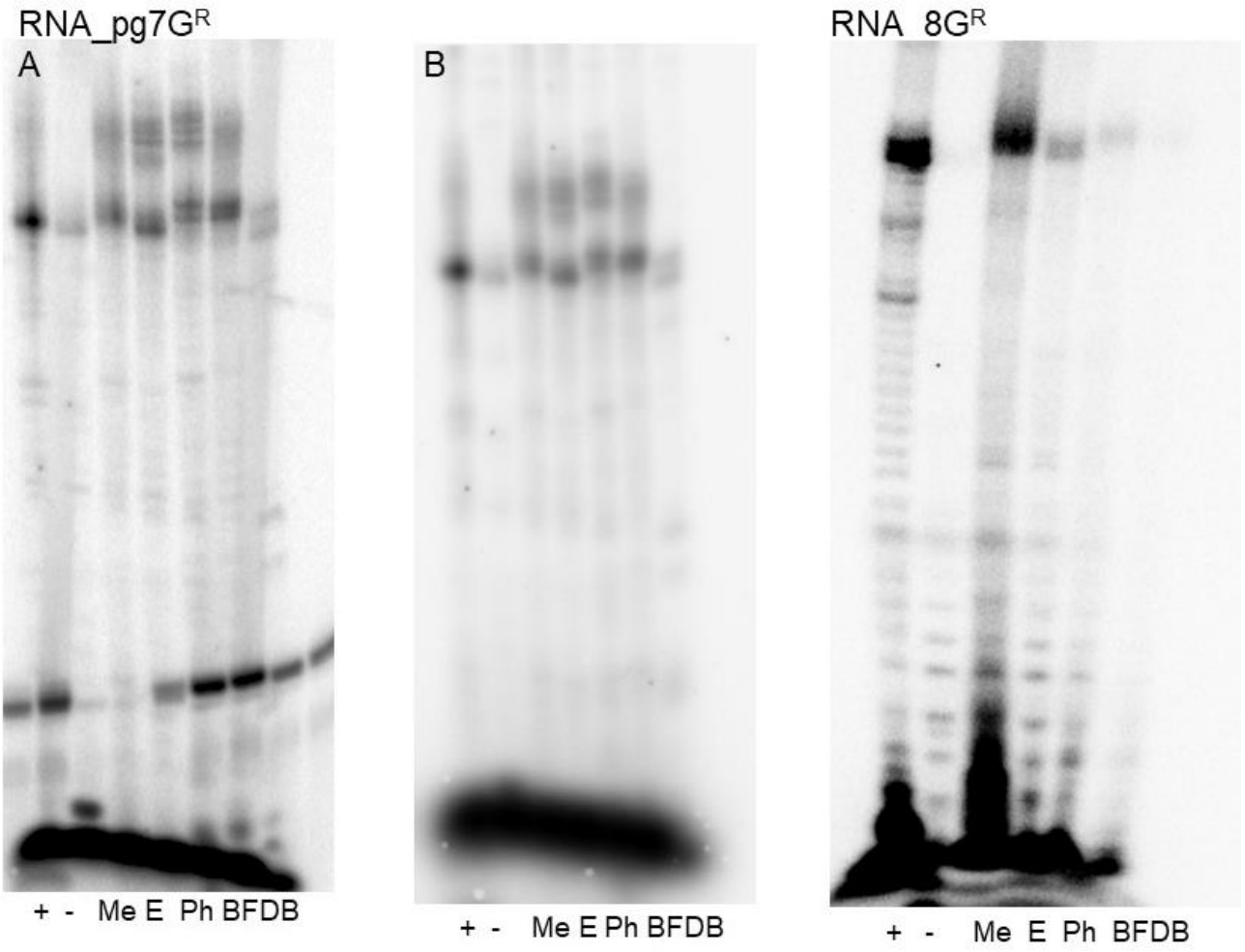


Table S2. Densitometric quantification of RNA transcripts

Transcript	Rel.yield (%)	SD
RNA_1A^{Me}	107	8
RNA_1A^{E}	89	6
RNA_1A^{Ph}	75	4
RNA_1A^{BF}	42	11
RNA_3A^{Me}	84	2
RNA_3A^{E}	77	6
RNA_3A^{Ph}	81	3
RNA_3A^{BF}	70	5
RNA_7A^{Me}	90	13
RNA_7A^{E}	86	10
RNA_7A^{Ph}	70	10
RNA_7A^{BF}	28	4
RNA_1C^{E}	70	4
RNA_1C^{Ph}	91	10
RNA_1C^{BF}	50	3
RNA_1C^{DB}	35	6
RNA_3C^{E}	98	1
RNA_3C^{Ph}	89	8
RNA_3C^{BF}	89	3
RNA_3C^{DB}	64	2
RNA_7C^{E}	97	11
RNA_7C^{Ph}	21	6
RNA_7C^{BF}	21	8
RNA_7C^{DB}	5	1
RNA_1U^{E}	80	12
RNA_1U^{Ph}	72	4
RNA_1U^{BF}	52	1
RNA_1U^{DB}	54	7
RNA_3U^{E}	59	9
RNA_3U^{Ph}	66	10
RNA_3U^{BF}	43	9
RNA_3U^{DB}	30	12
RNA_7U^{E}	55	6
RNA_7U^{Ph}	50	15
RNA_7U^{BF}	53	15
RNA_8G^{Me}	46	11
RNA_8G^{E}	54	11
RNA_8G^{Ph}	32	1
RNA_8G^{BF}	48	1

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Table S3. Molecular masses of obtained transcripts (MALDI)

Transcript	M calculated	M observed
RNA_1A^{Me}	11151.3	11152.8
RNA_1A^{E}	11161.3	11161.7
RNA_1A^{Ph}	11213.4	11214.1
RNA_1A^{BF}	11253.4	11252.3
RNA_3A^{Me}	11303.6	11646.9 (M+A^{Me}MP)
RNA_3A^{E}	11333.5	11684.7 (M+A^{E}MP)
RNA_3A^{Ph}	11489.8	11864.0 (M+ A^{Ph}MP)
RNA_3A^{BF}	11609.8	12055 (M+ A^{BF}MP)
RNA_7A^{Me}	11568.0	11567.1
RNA_7A^{E}	11637.9	11989.5 (M+A^{E}MP)
RNA_7A^{Ph}	12002.5	12406.1(M+A^{Ph}MP)
RNA_7A^{BF}	12282.6	12726 (M + A^{BF}MP)
RNA_1C^{E}	11803.9	12131.1 M (+AMP)
RNA_1C^{Ph}	11856.0	12183.1 (M+AMP)
RNA_1C^{BF}	11896.0	11895.8
RNA_1C^{DB}	11946.1	11943.0
RNA_3C^{E}	11818.0	12143.6 (M+AMP)
RNA_3C^{Ph}	11974.2	12302.4 (M+AMP)
RNA_3C^{BF}	12094.3	12421.2 (M+AMP)
RNA_3C^{DB}	12244.5	12.571 (M+AMP)
RNA_7C^{E}	11723.9	11724.0
RNA_7C^{Ph}	12088.4	12086.4
RNA_7C^{BF}	12366.6	12748 (M+GMP+K-H)
RNA_7C^{DB}	12719.0	12715.7
RNA_1U^{E}	11421.1	11418.8
RNA_1U^{Ph}	11473.0	11472.1
RNA_1U^{BF}	11513.0	11511.9
RNA_1U^{DB}	11563.0	11562.0
RNA_3U^{E}	11486.1	11486.0
RNA_3U^{Ph}	11643.0	11641.1
RNA_3U^{BF}	11760.6	11759.1
RNA_3U^{DB}	1907.6	11909.5
RNA_7U^{E}	11570.	11898.9 (M+AMP)
RNA_7U^{Ph}	11929.6	11930.4
RNA_7U^{BF}	12215.1	12211.7
RNA_8G^{Me}	11380.1	11380.0
RNA_8G^{E}	11450.1	11471 (M+2Na-1H)
RNA_8G^{Ph}	11814.6	11816.1
RNA_8G^{BF}	12094.7	12094.1

Figure S6. MALDI-TOF spectrum of RNA_1A^{Me}

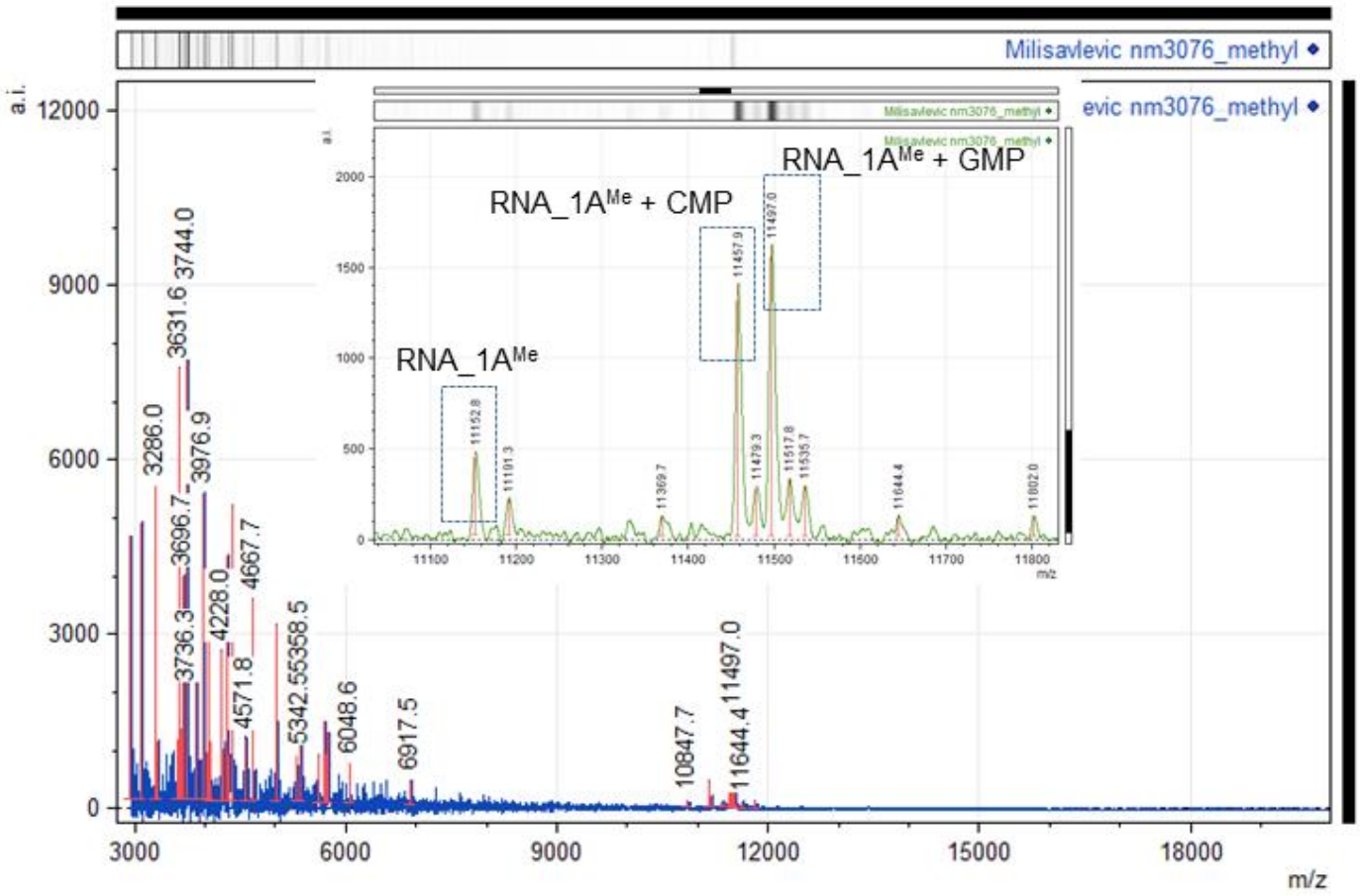


Figure S7. MALDI-TOF spectrum of **RNA_1A^{E}**

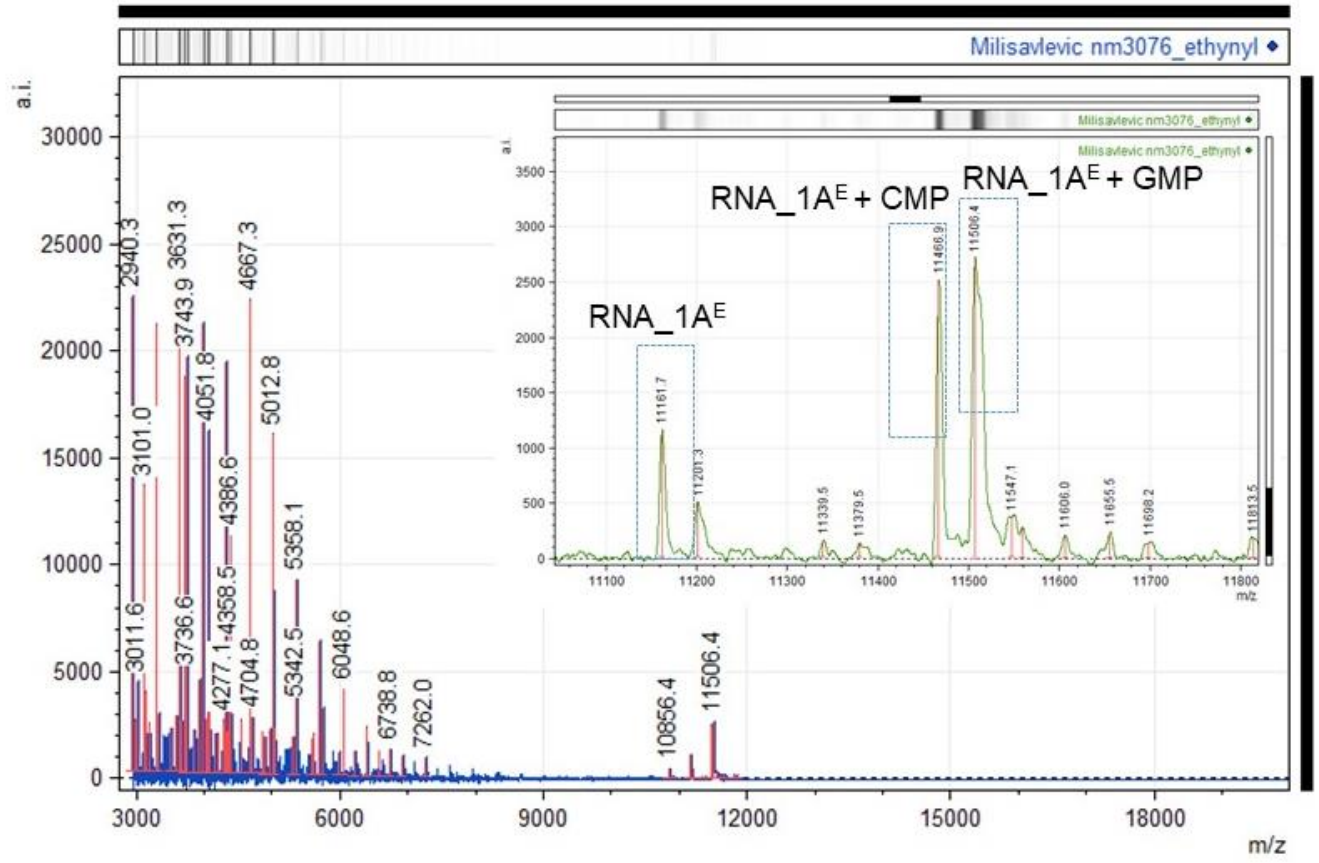


Figure S8. MALDI-TOF spectrum of **RNA_1A^{Ph}**

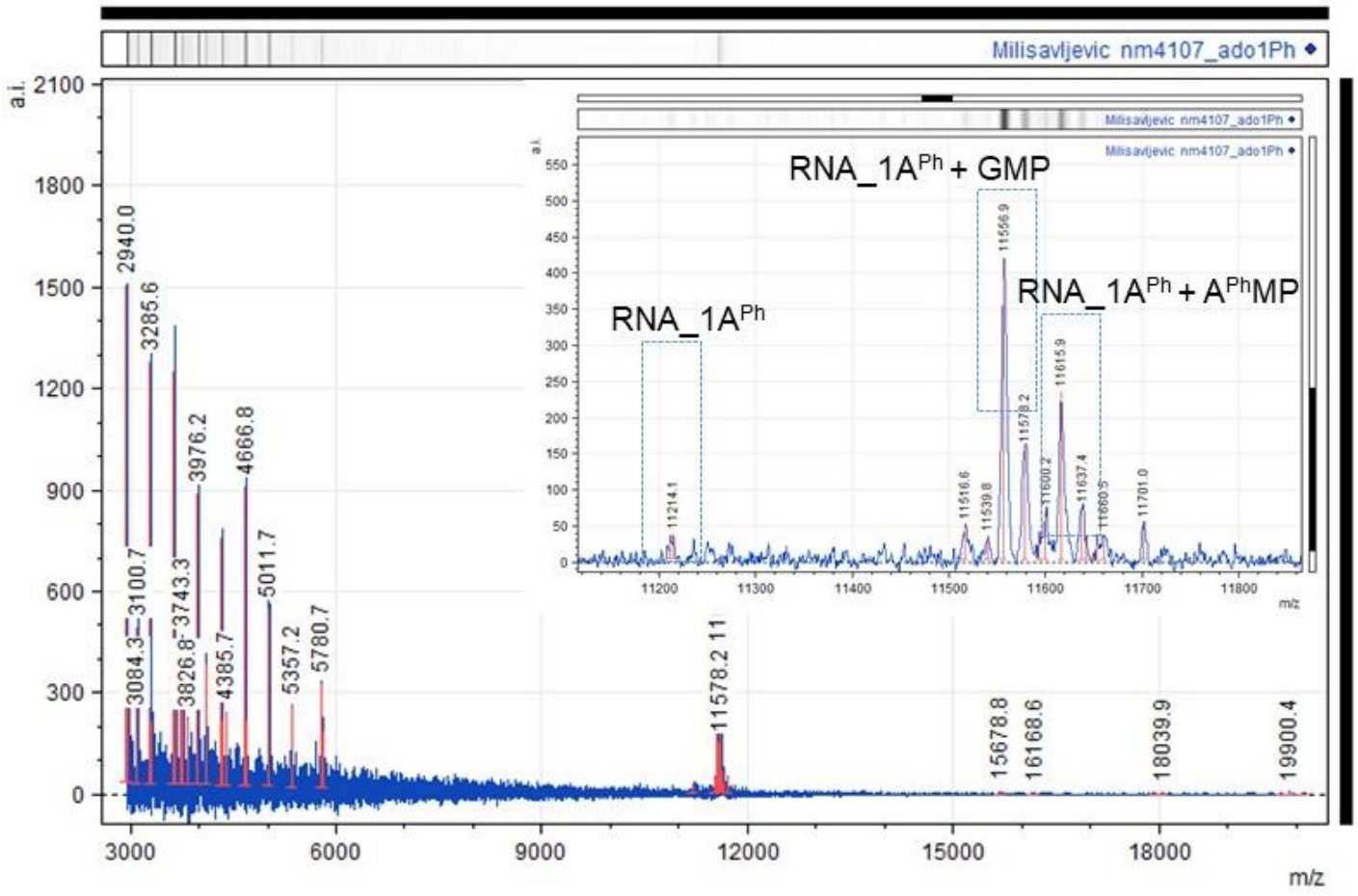


Figure S9. MALDI-TOF spectrum of **RNA_1A^{BF}**

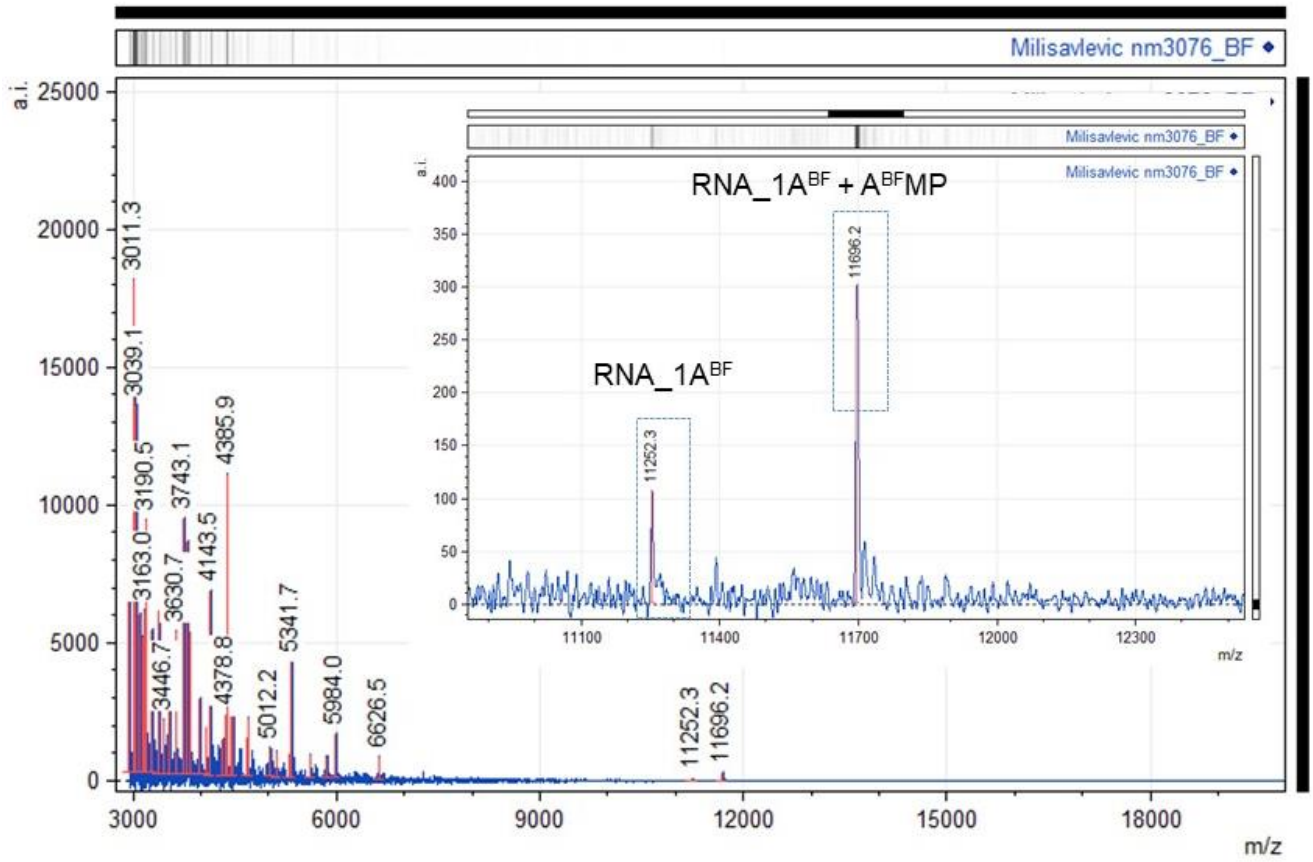


Figure S10. MALDI-TOF spectrum of **RNA_3A^{BF}**

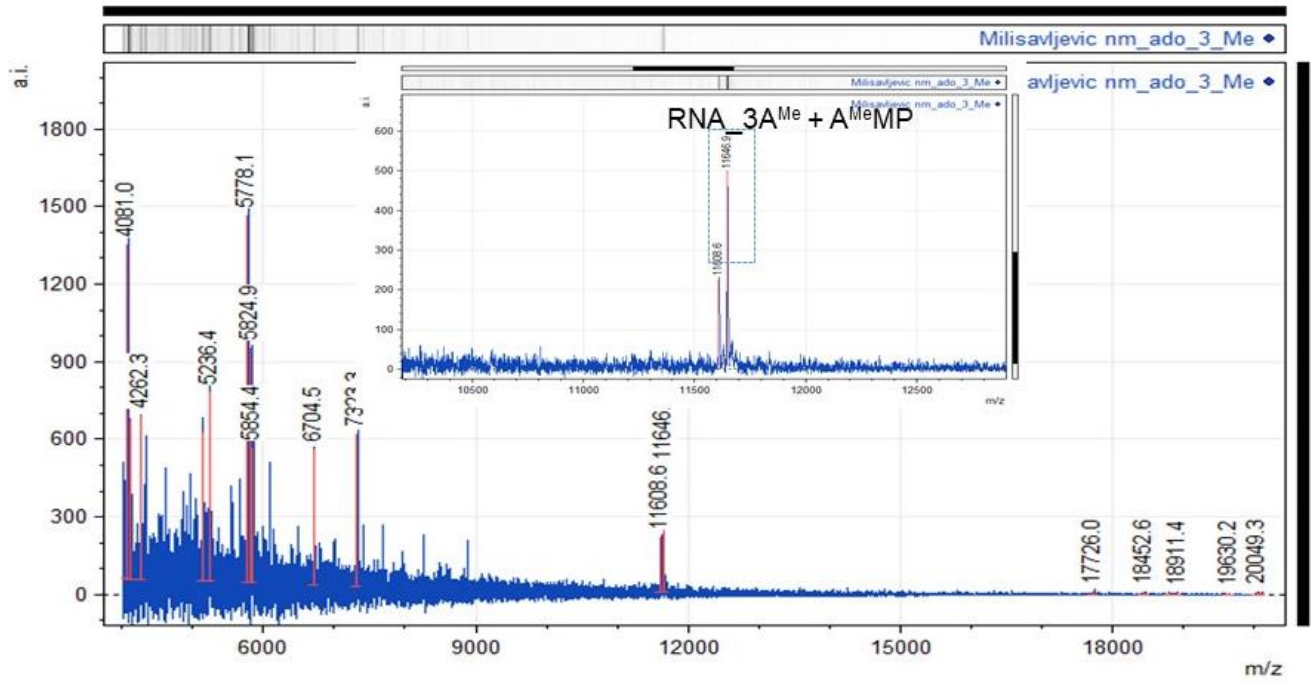


Figure S11. MALDI-TOF spectrum of **RNA_3A^{E}**

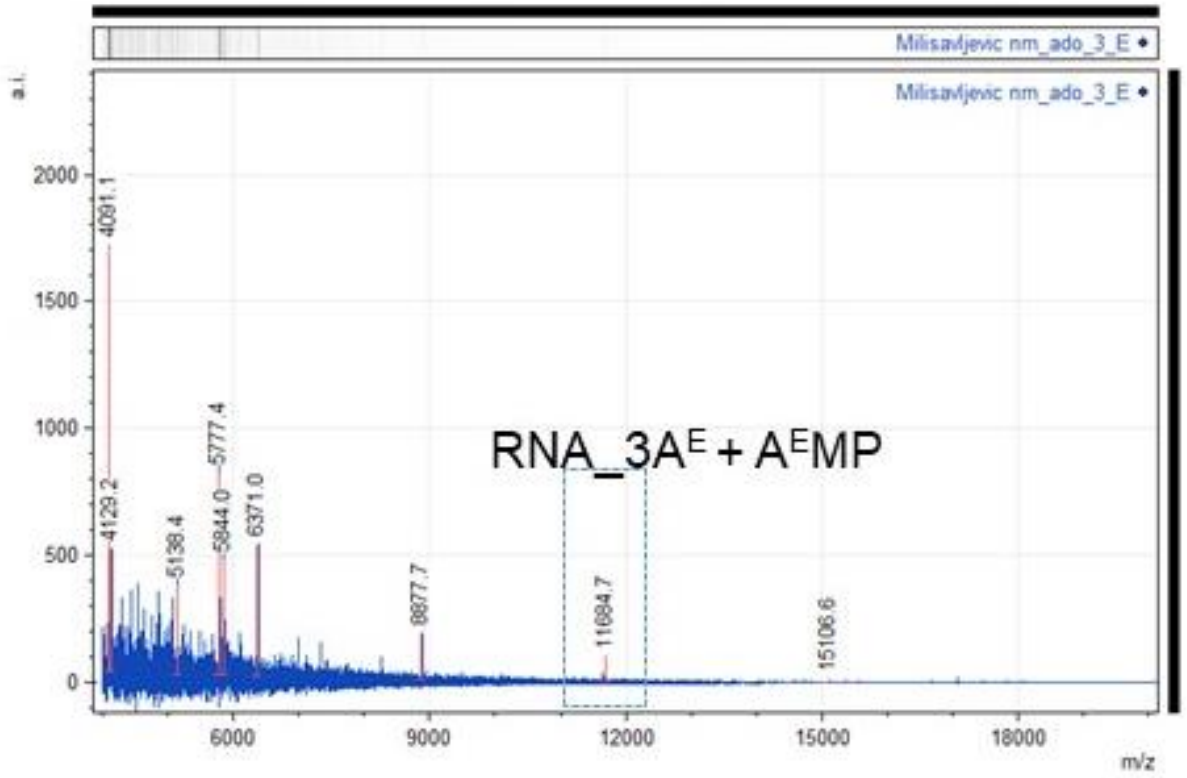


Figure S12. MALDI-TOF spectrum of **RNA_3A^{Ph}**

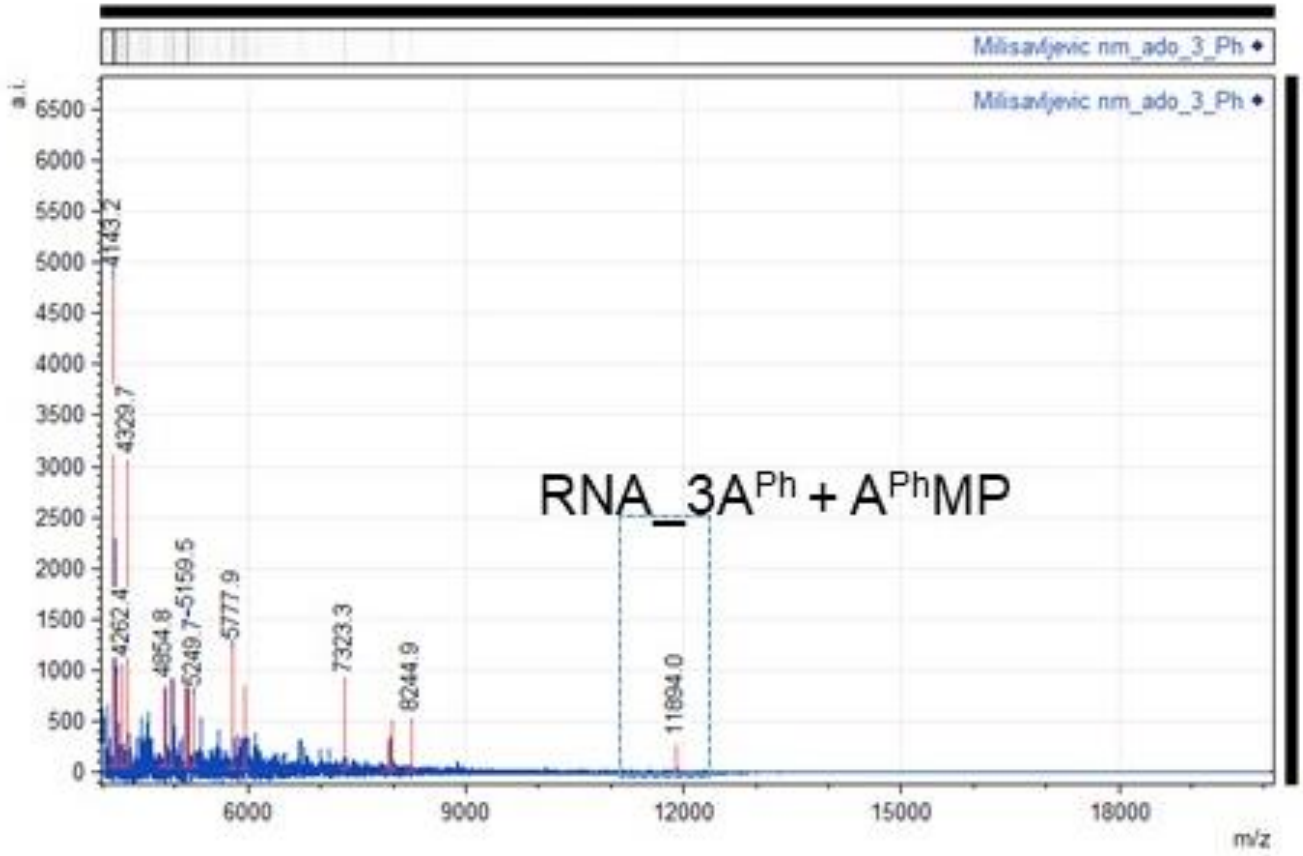


Figure S13. MALDI-TOF spectrum of **RNA_3A^{BF}**

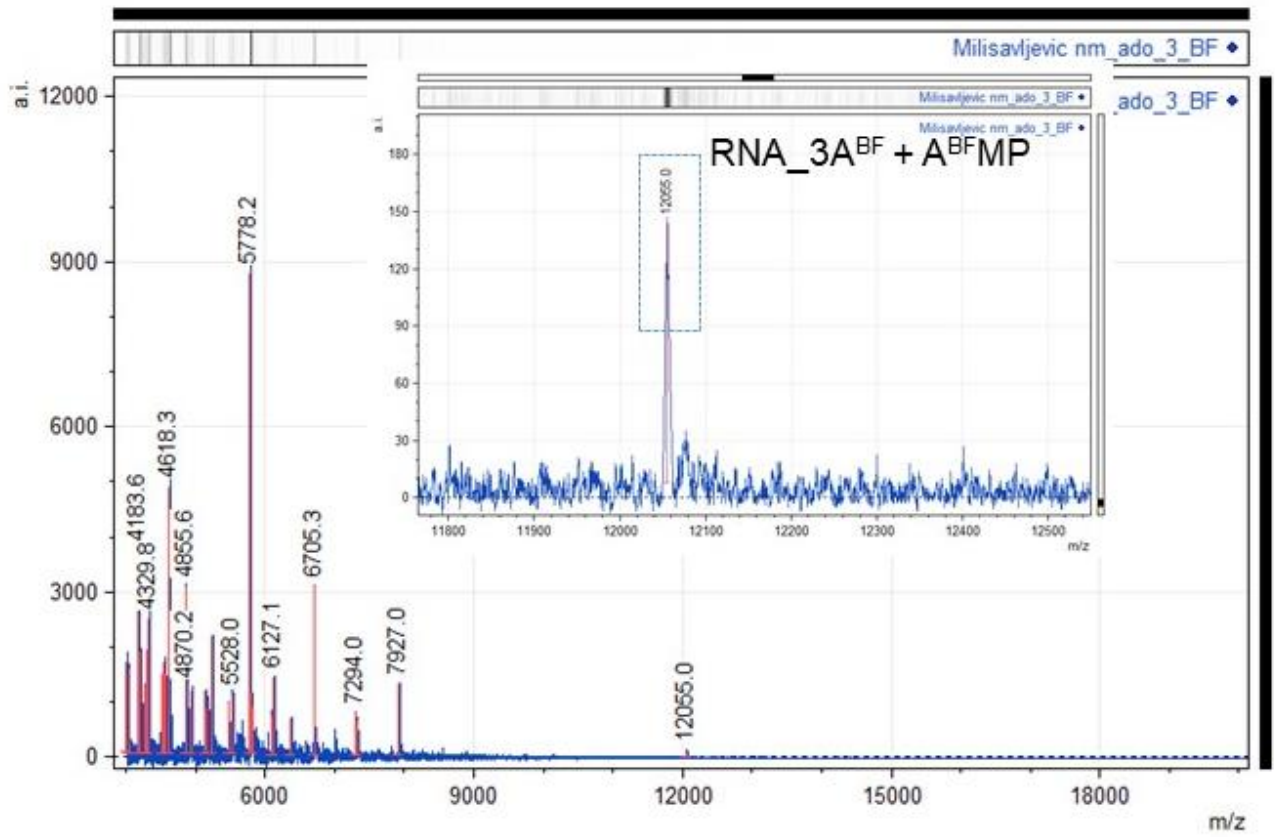


Figure S14. MALDI-TOF spectrum of **RNA_7A^{Me}**

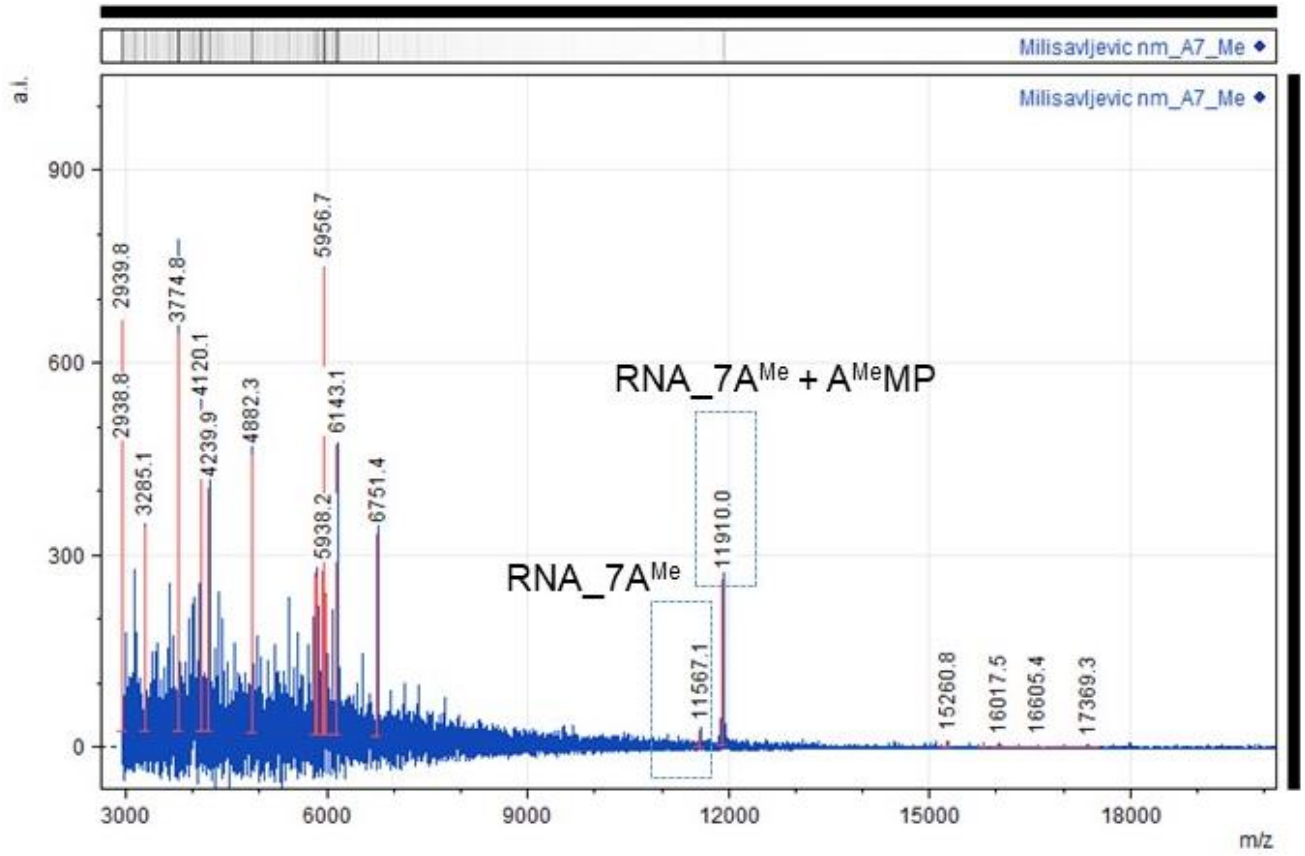


Figure S15. MALDI-TOF spectrum of **RNA_7A^{E}**

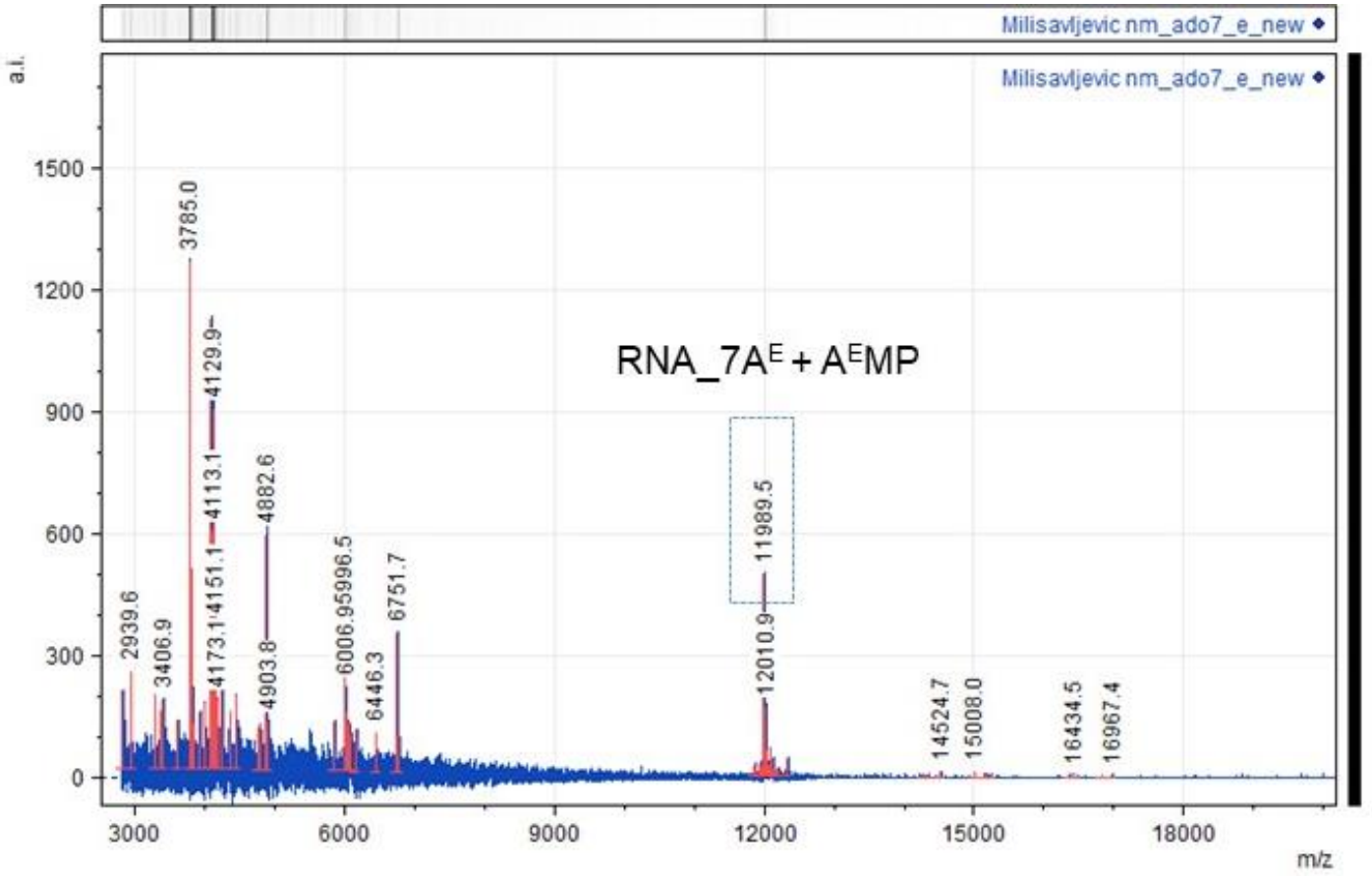


Figure S16. MALDI-TOF spectrum of **RNA_7A^{Ph}**

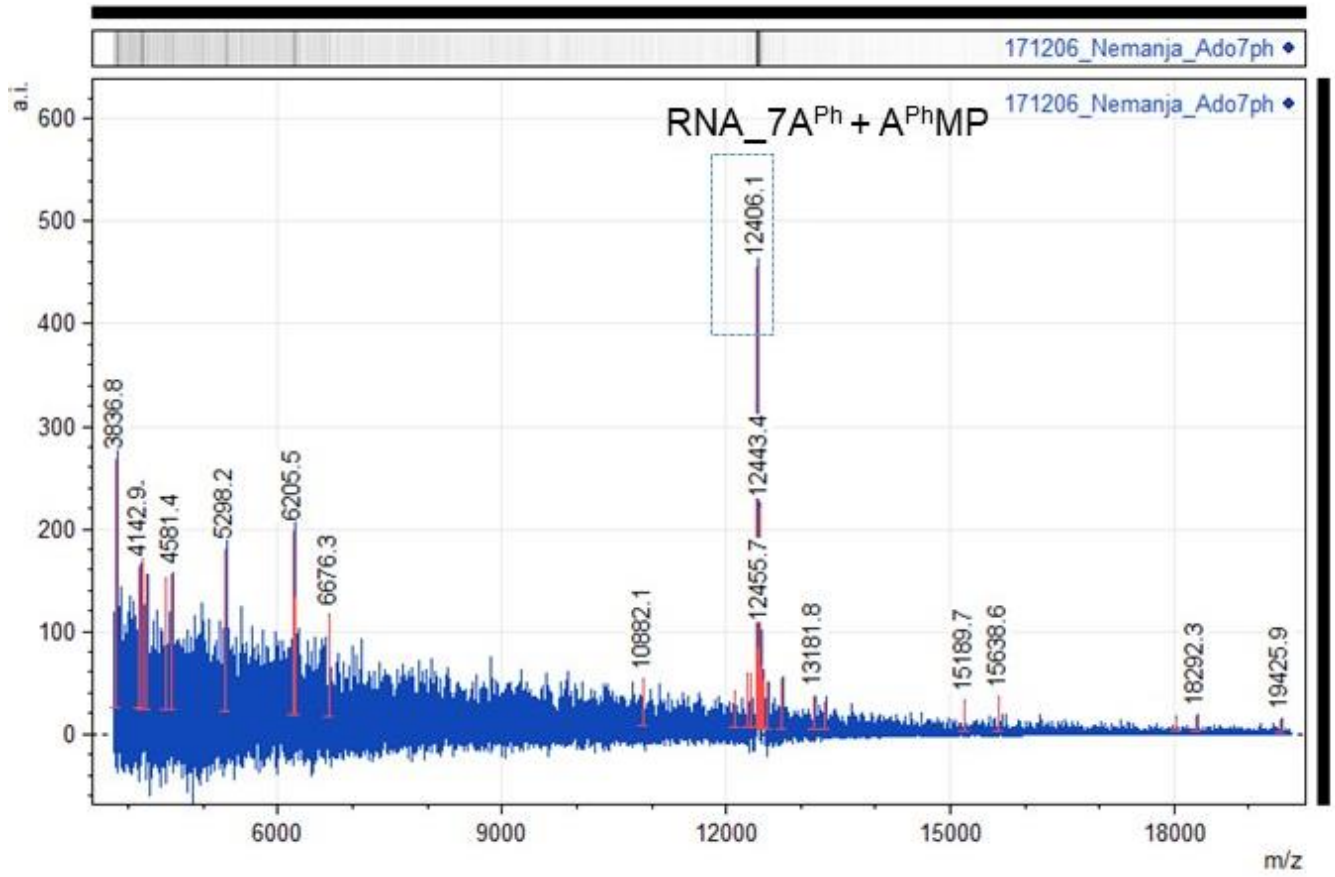


Figure S17. MALDI-TOF spectrum of **RNA_7A^{BF}**

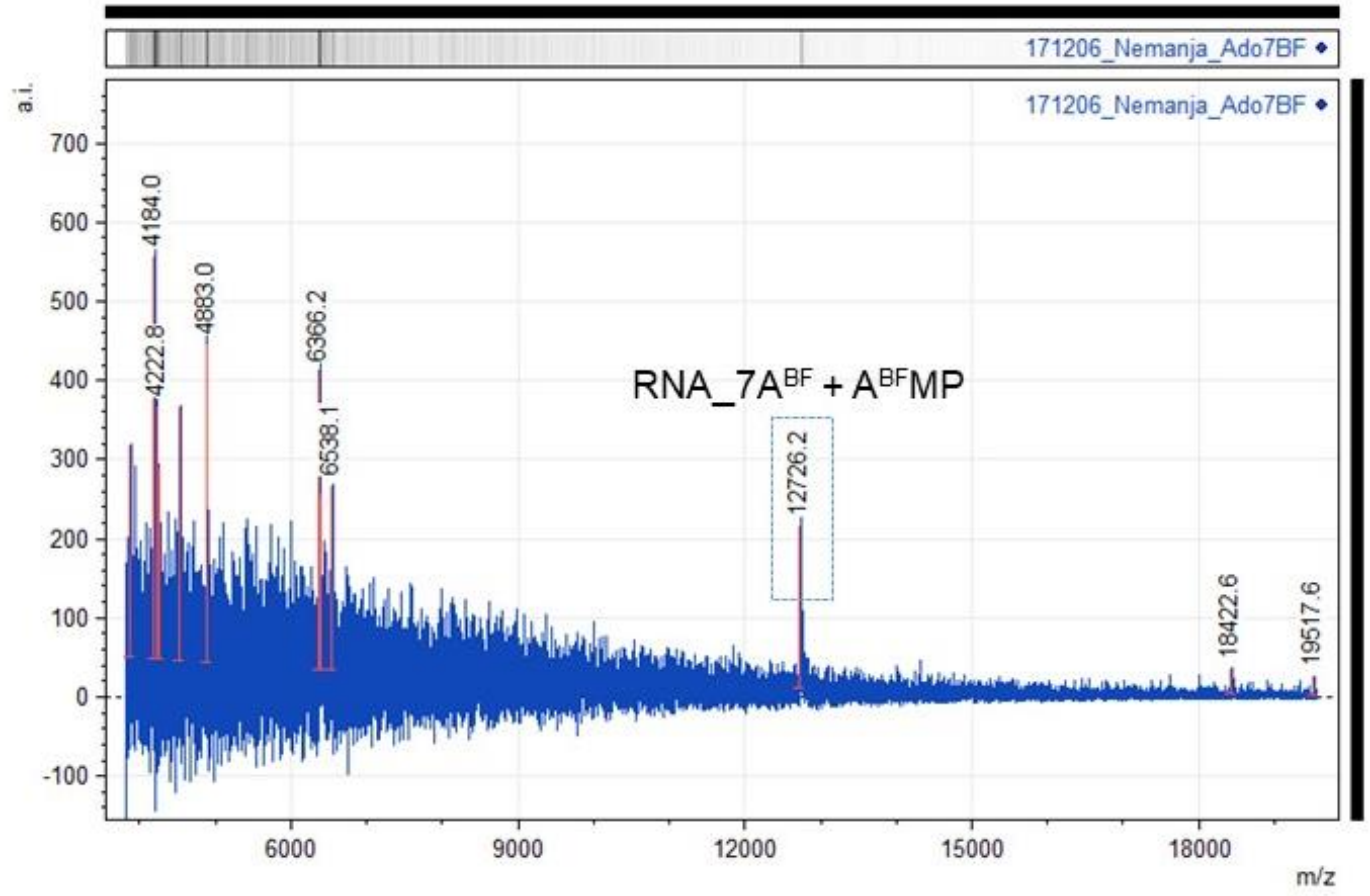


Figure S18. MALDI-TOF spectrum of **RNA_1C^{E}**

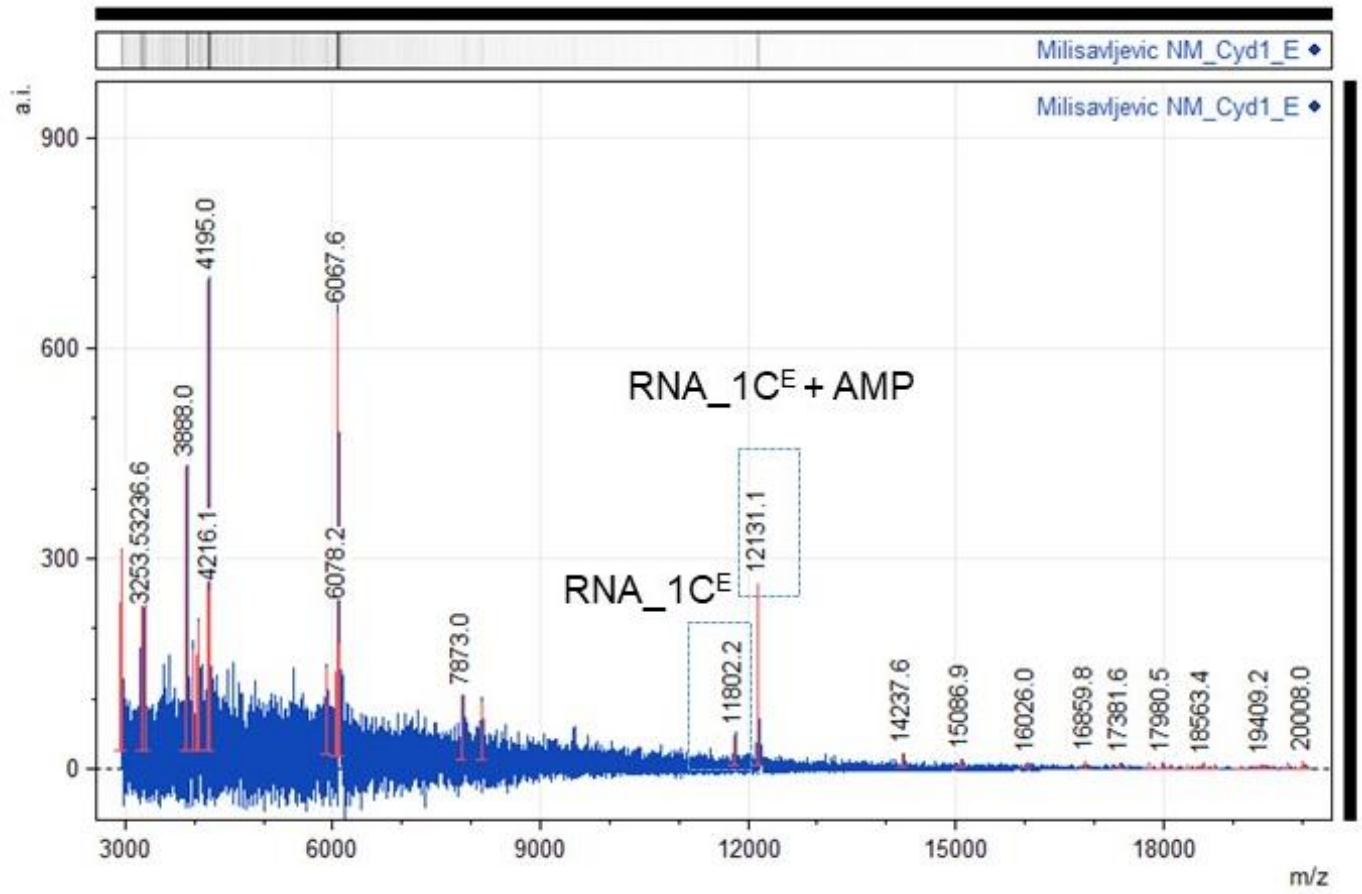


Figure S19. MALDI-TOF spectrum of **RNA_1C^{Ph}**

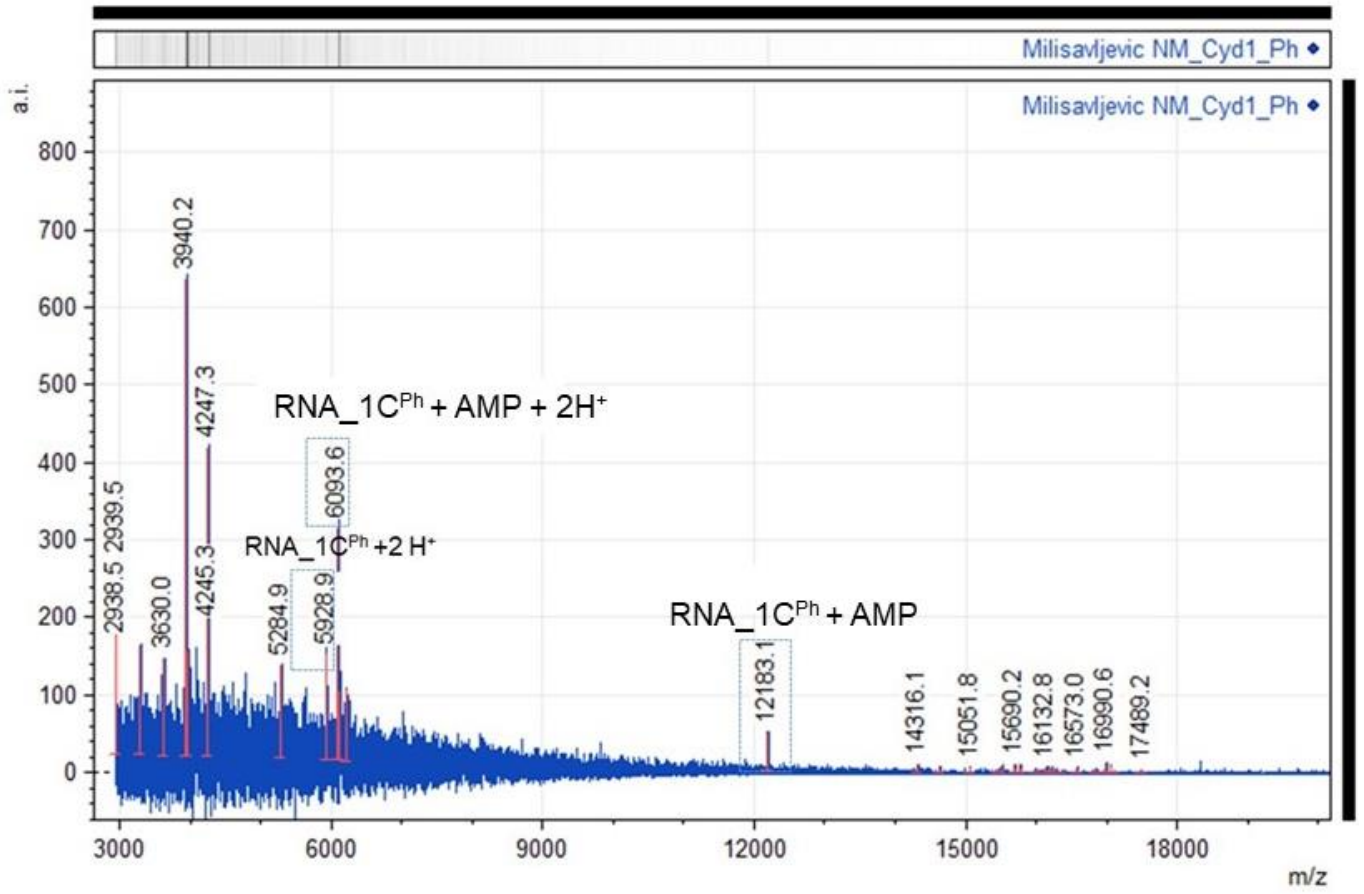


Figure S20. MALDI-TOF spectrum of **RNA_1C^{BF}**

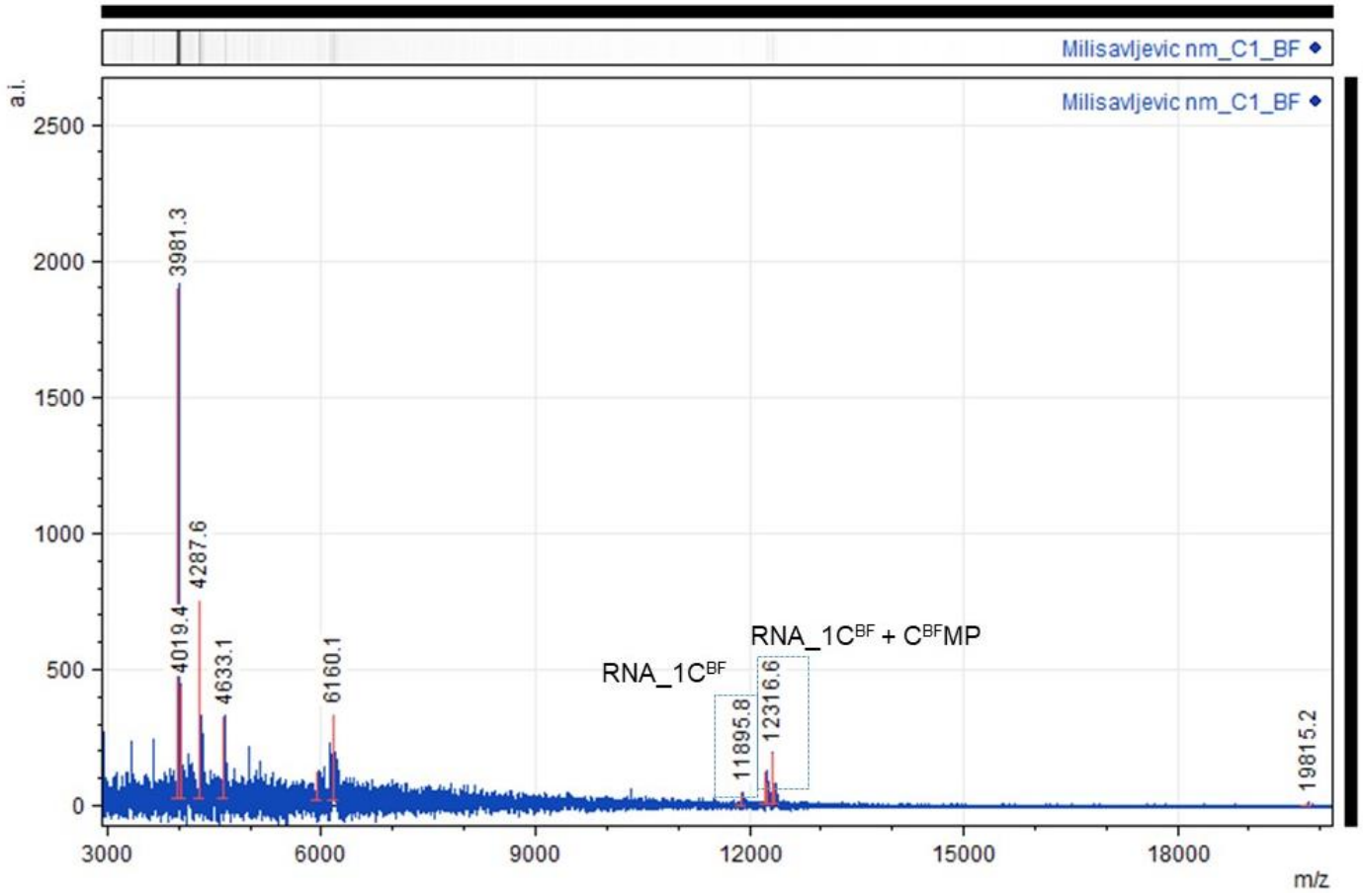


Figure S21. MALDI-TOF spectrum of **RNA_1C^{DB}**

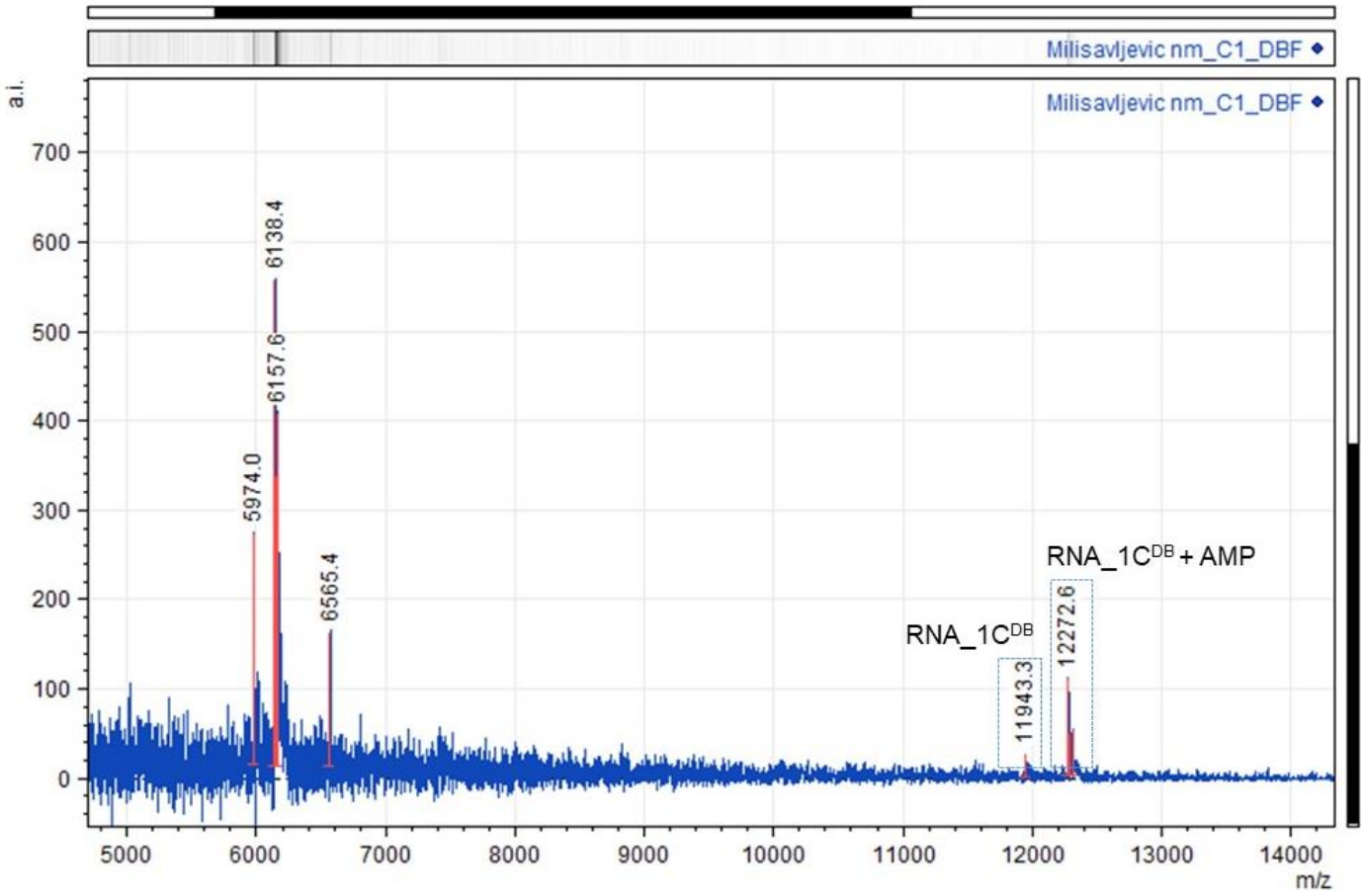


Figure S22. MALDI-TOF spectrum of **RNA_3C^{E}**

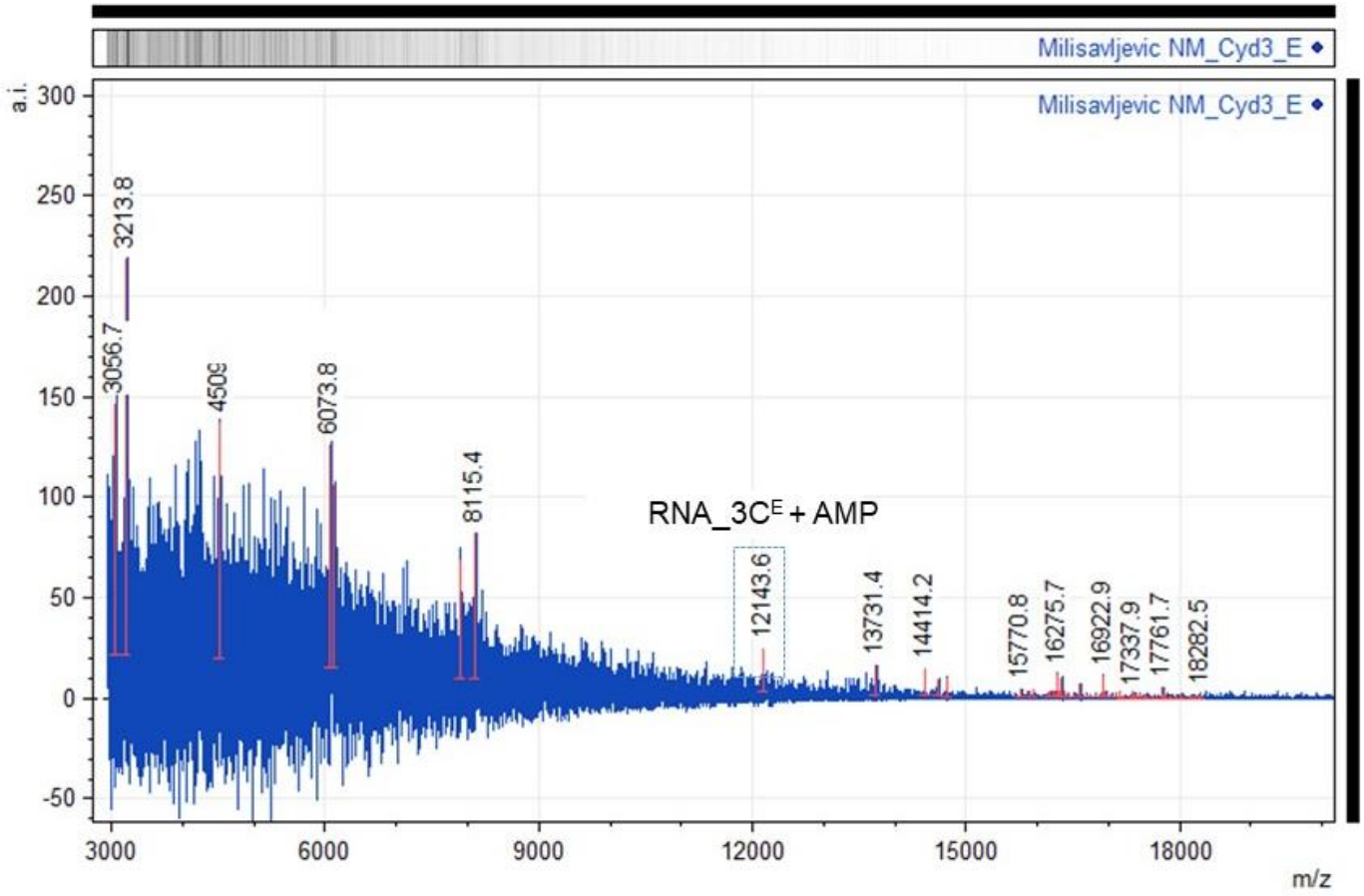


Figure S23. MALDI-TOF spectrum of RNA_3C^{Ph}

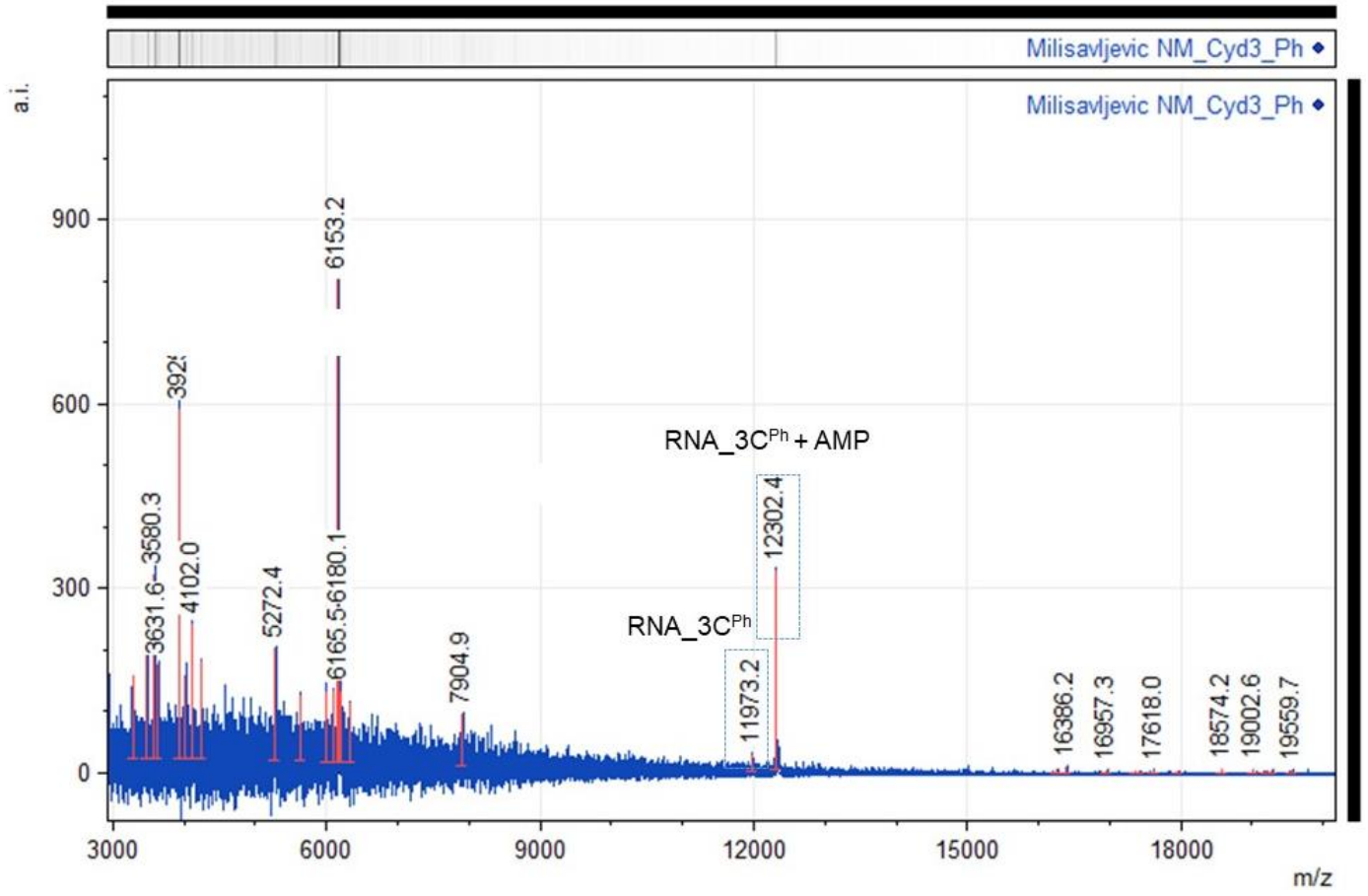


Figure S24. MALDI-TOF spectrum of RNA_3C^{BF}

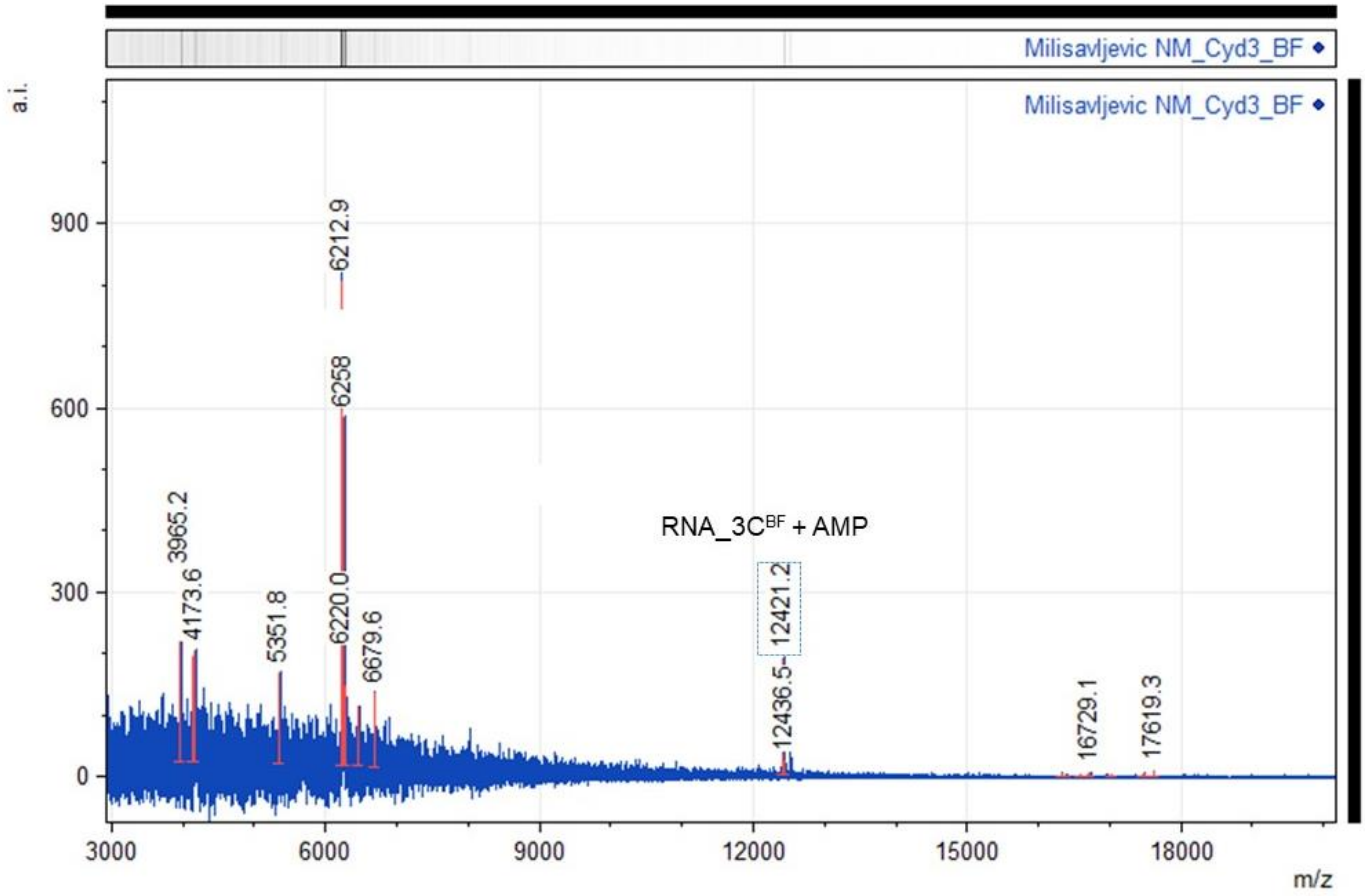


Figure S25. MALDI-TOF spectrum of **RNA_3C^{DB}**

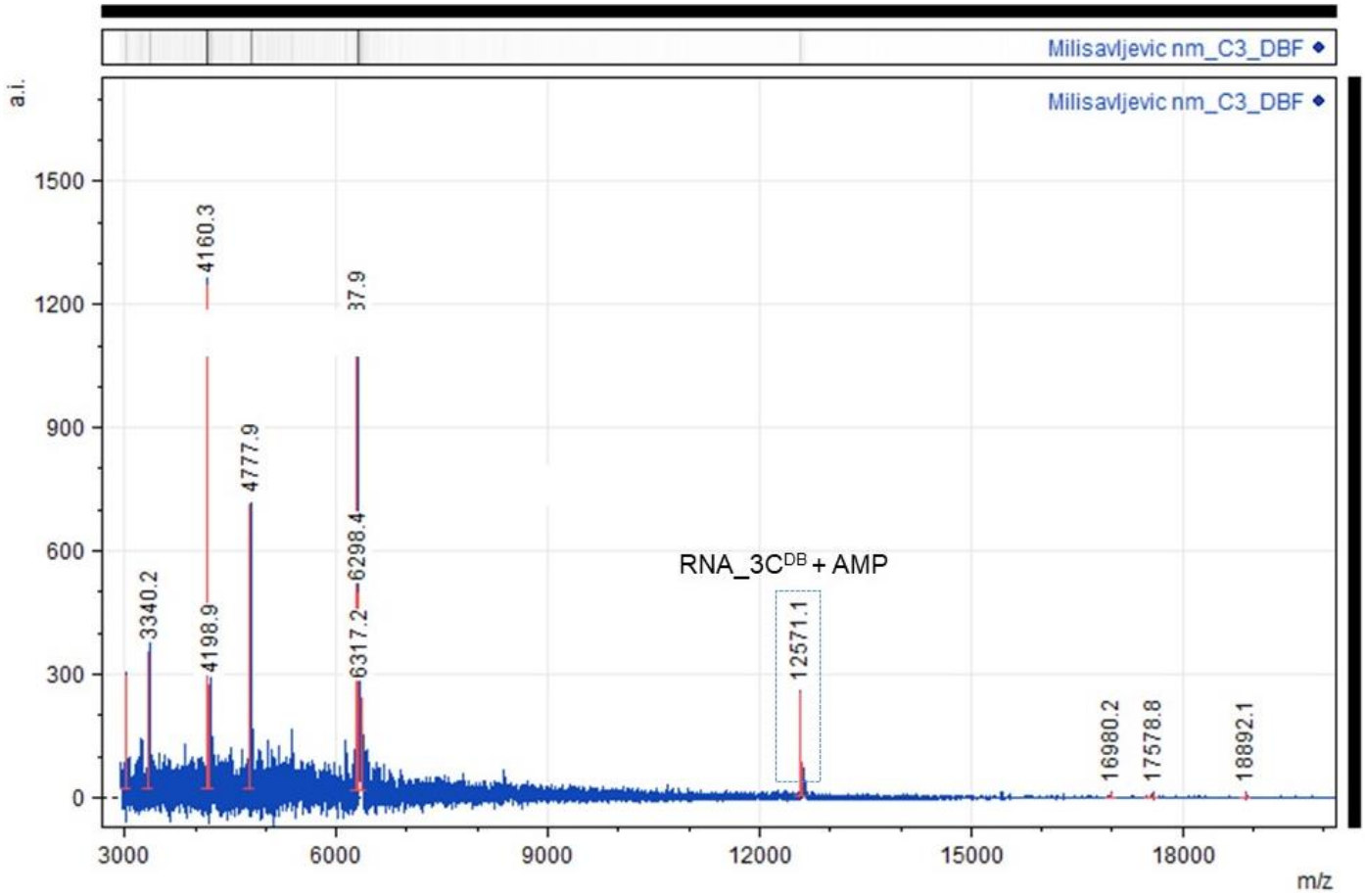


Figure S26. MALDI-TOF spectrum of **RNA_7C^{E}**

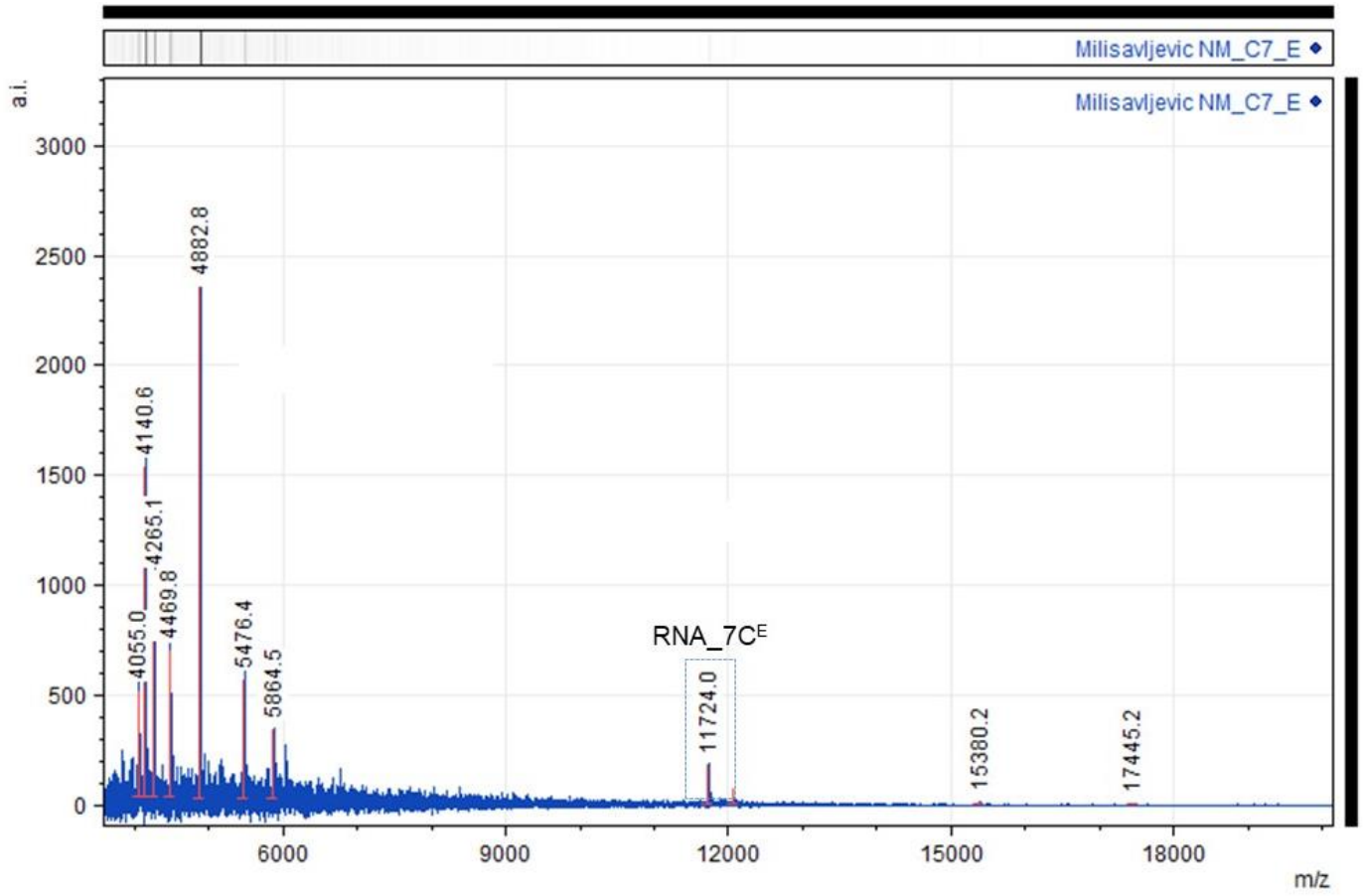


Figure S27. MALDI-TOF spectrum of **RNA_7C^{Ph}**

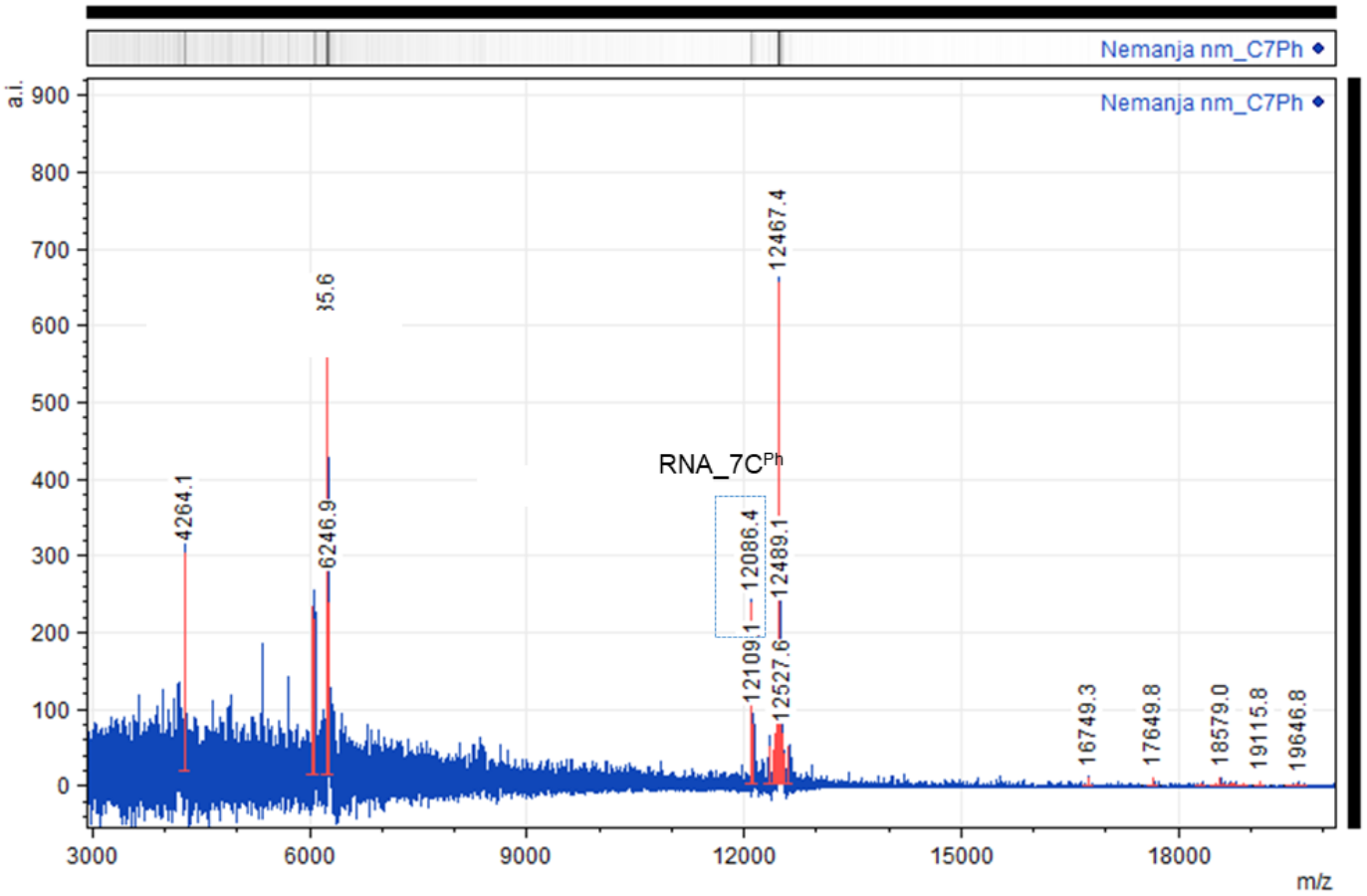


Figure S28. MALDI-TOF spectrum of **RNA_7C^{BF}**

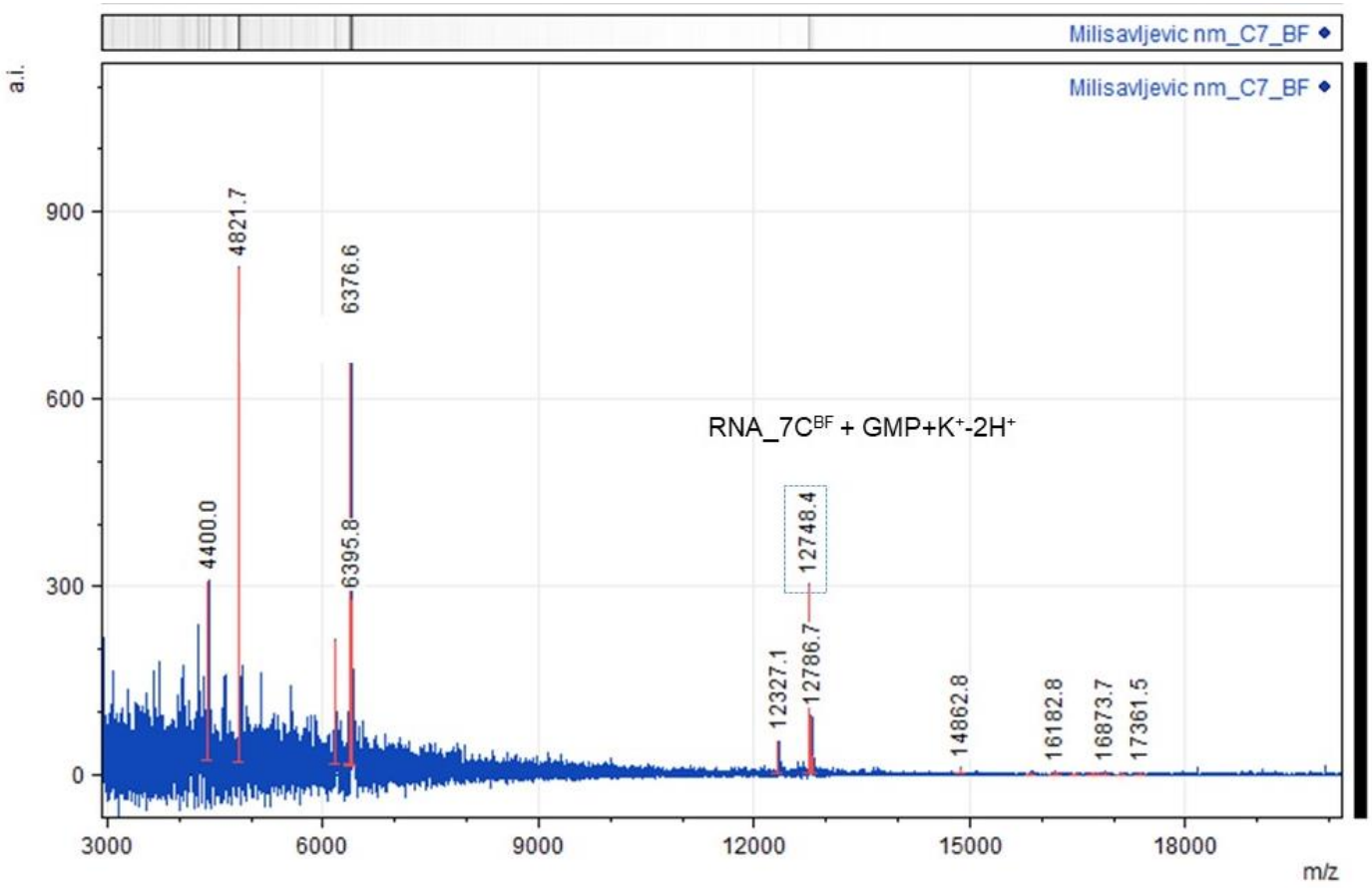


Figure S29. MALDI-TOF spectrum of **RNA_7C^{DB}**

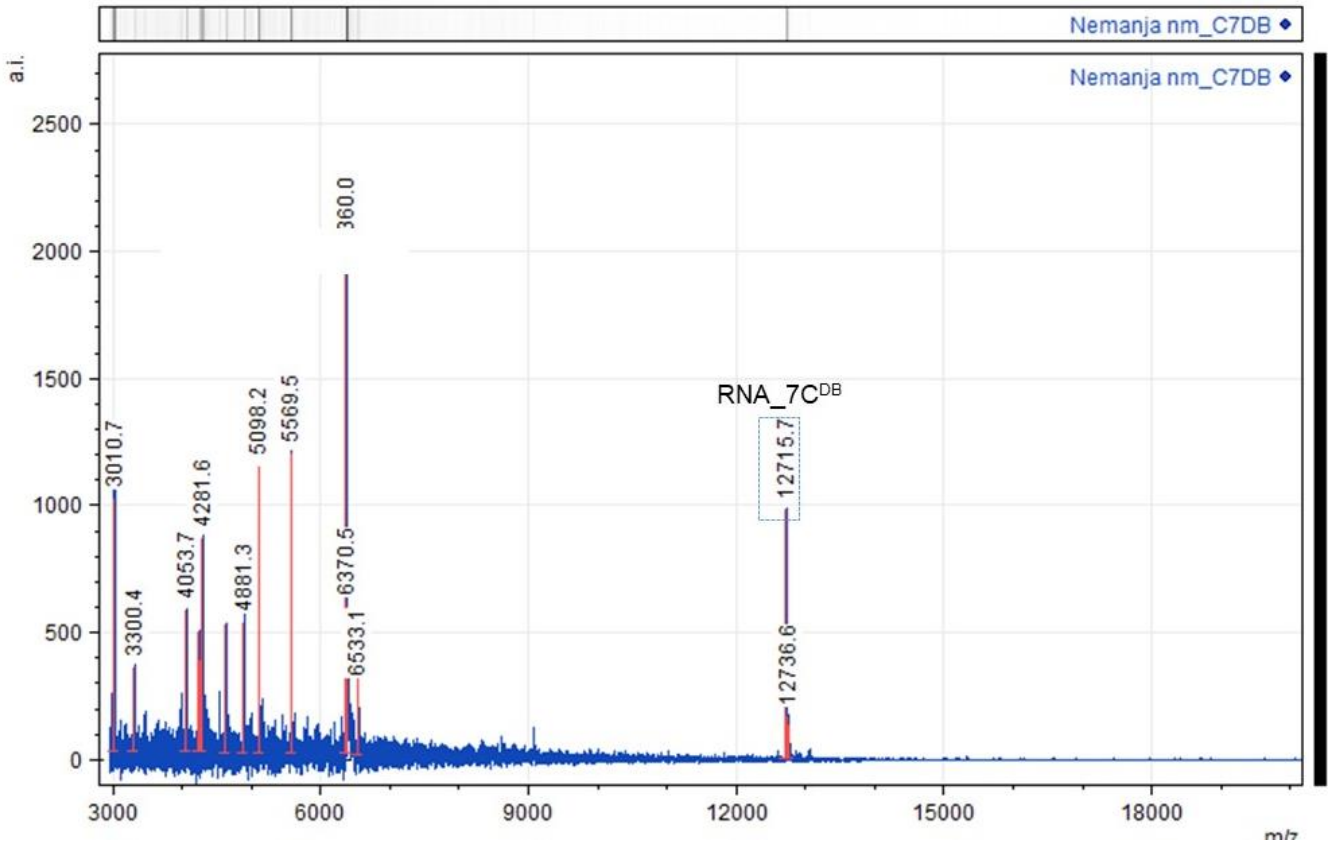


Figure S30. MALDI-TOF spectrum of **RNA_1U^{E}**

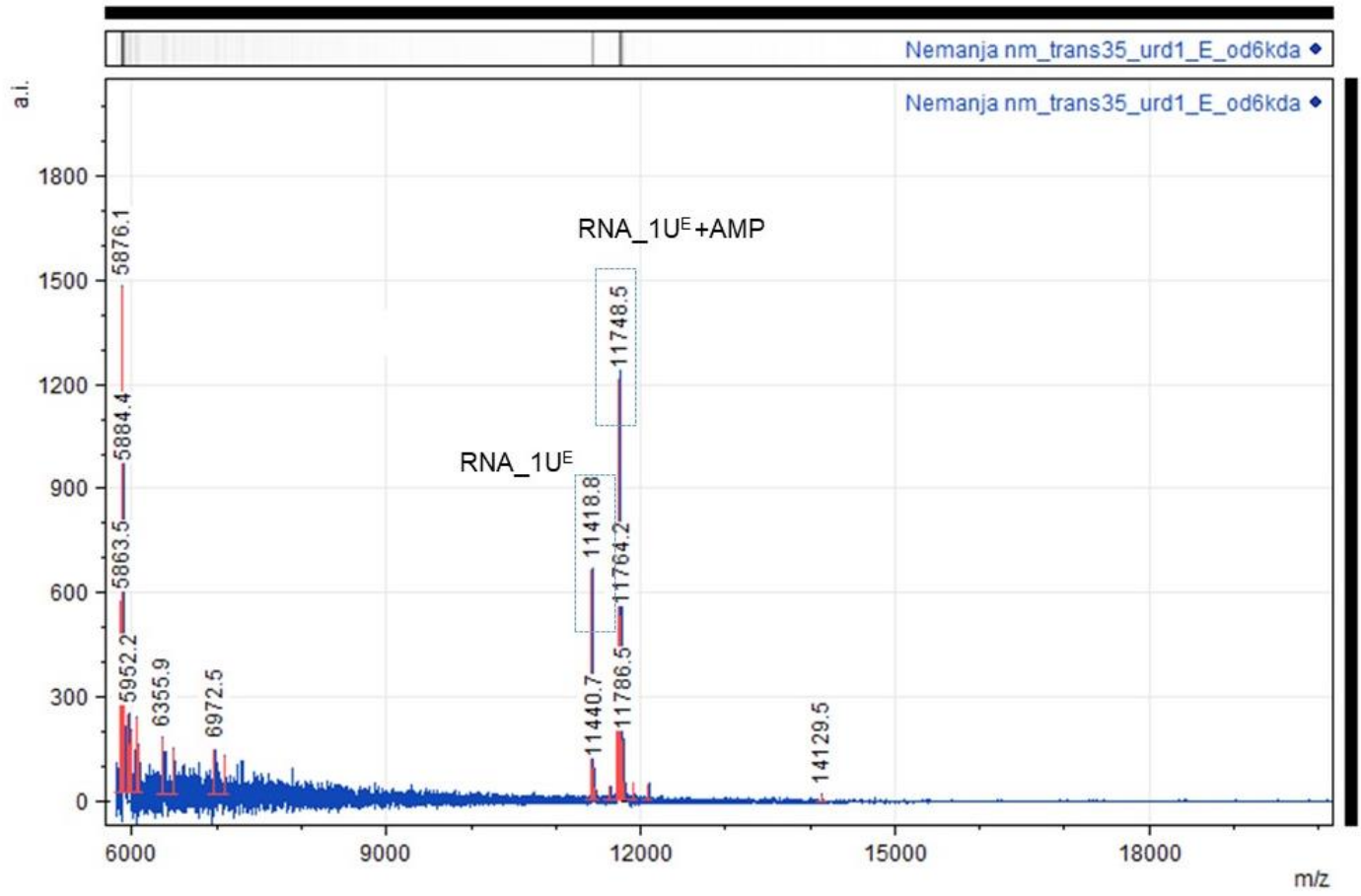


Figure S31. MALDI-TOF spectrum of **RNA_1U^{Ph}**

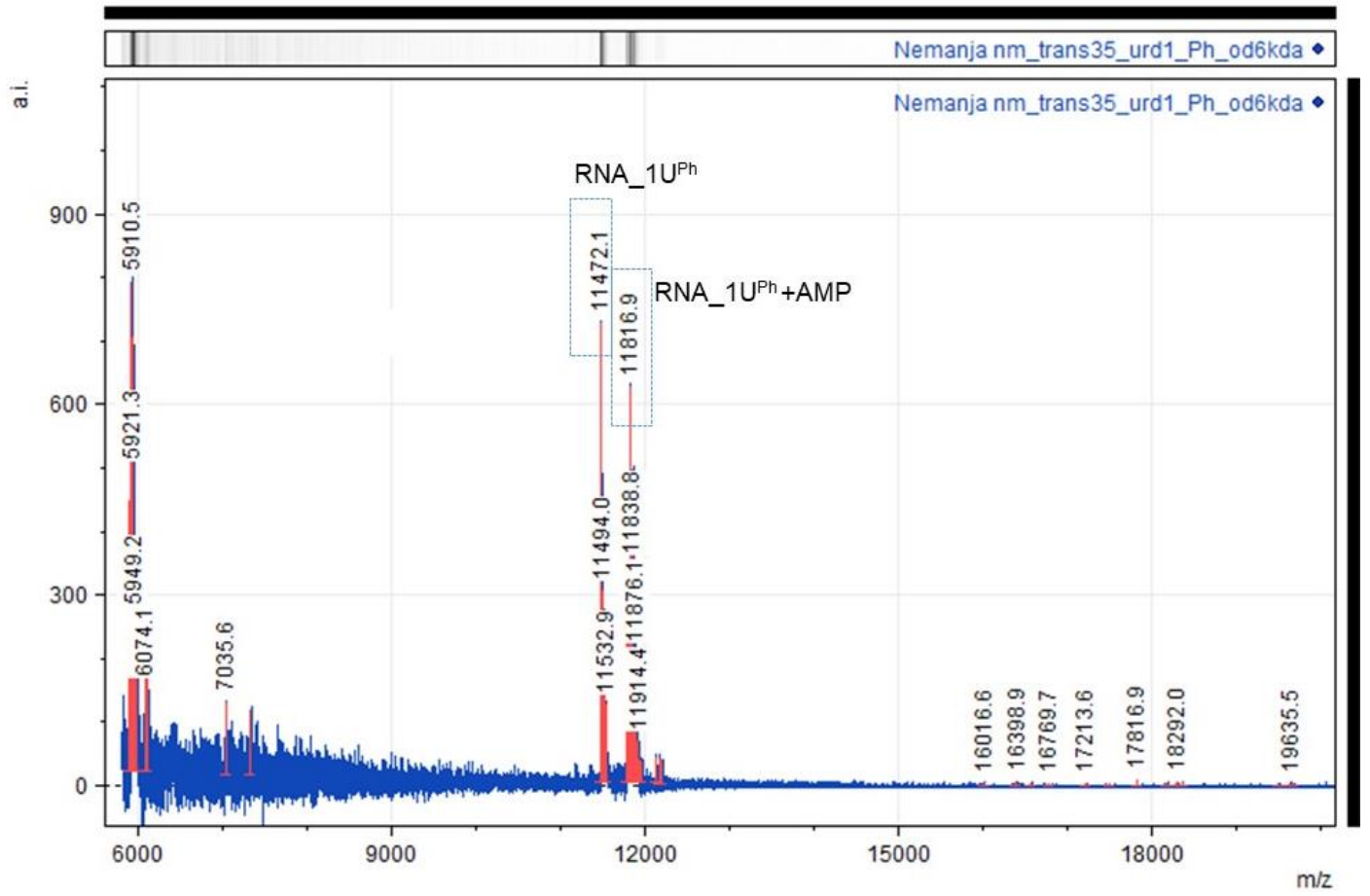


Figure S32. MALDI-TOF spectrum of **RNA_1U^{BF}**

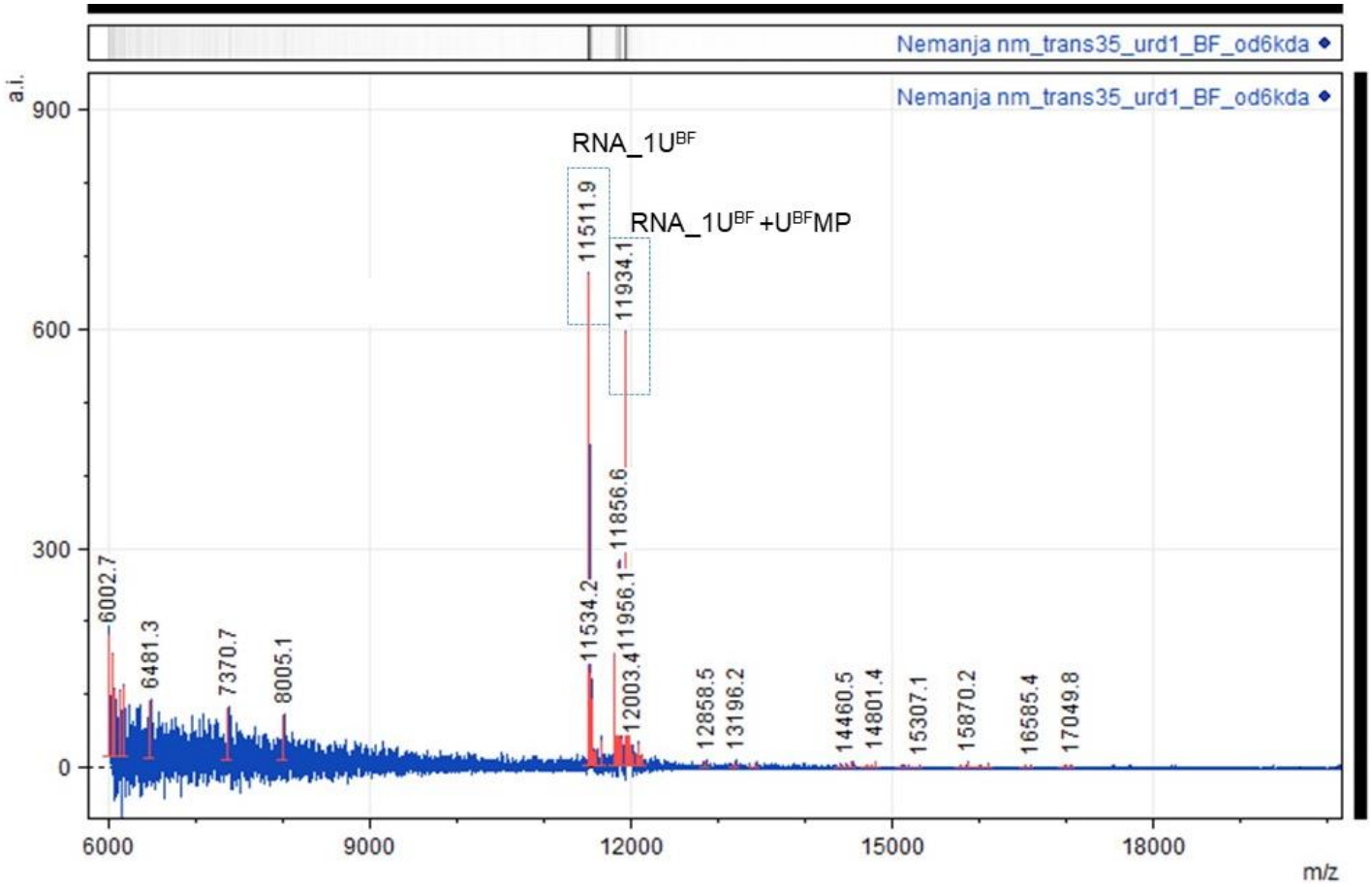


Figure S33. MALDI-TOF spectrum of **RNA_1U^{DB}**

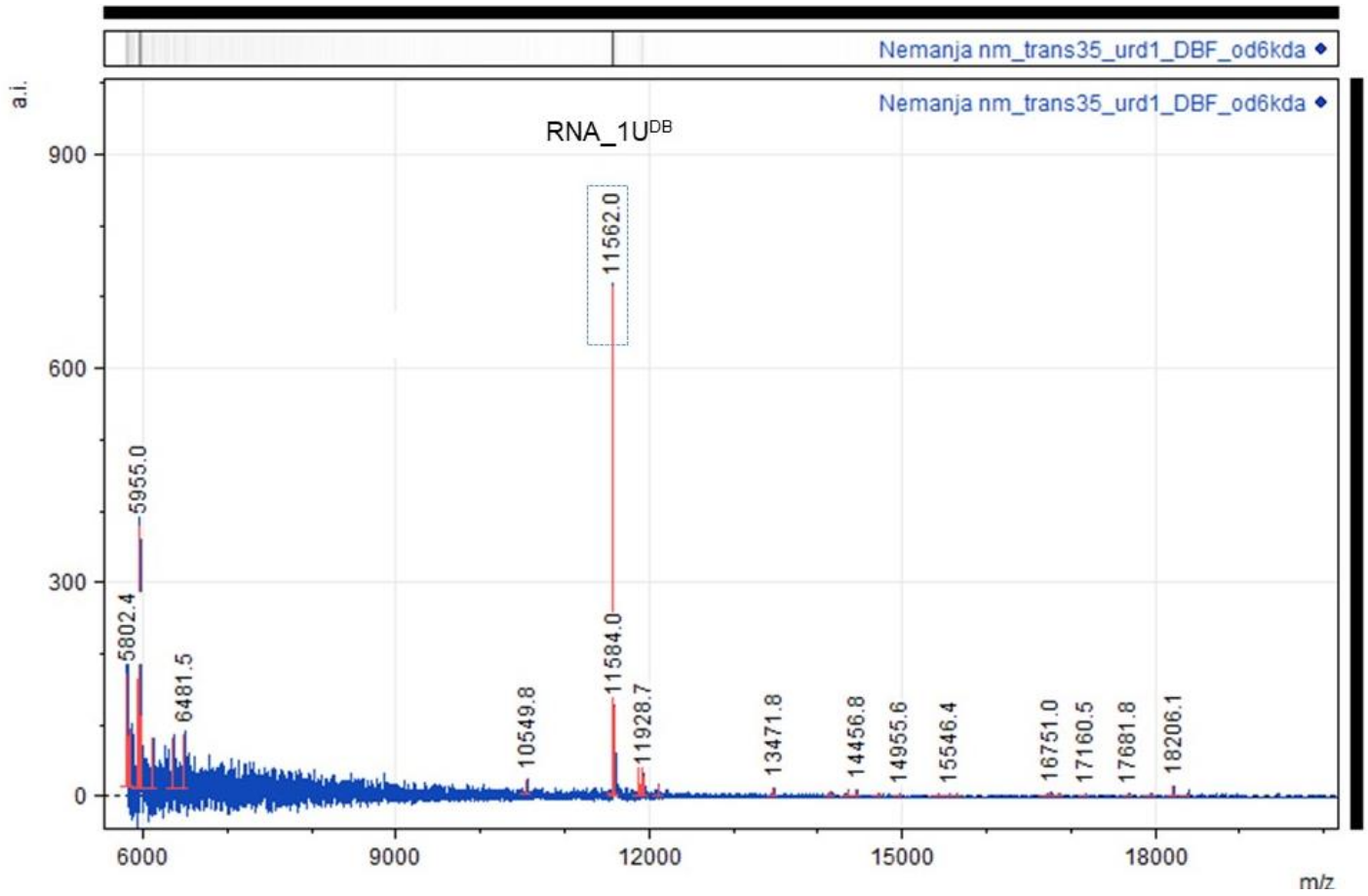


Figure S34. MALDI-TOF spectrum of **RNA_3U^{E}**

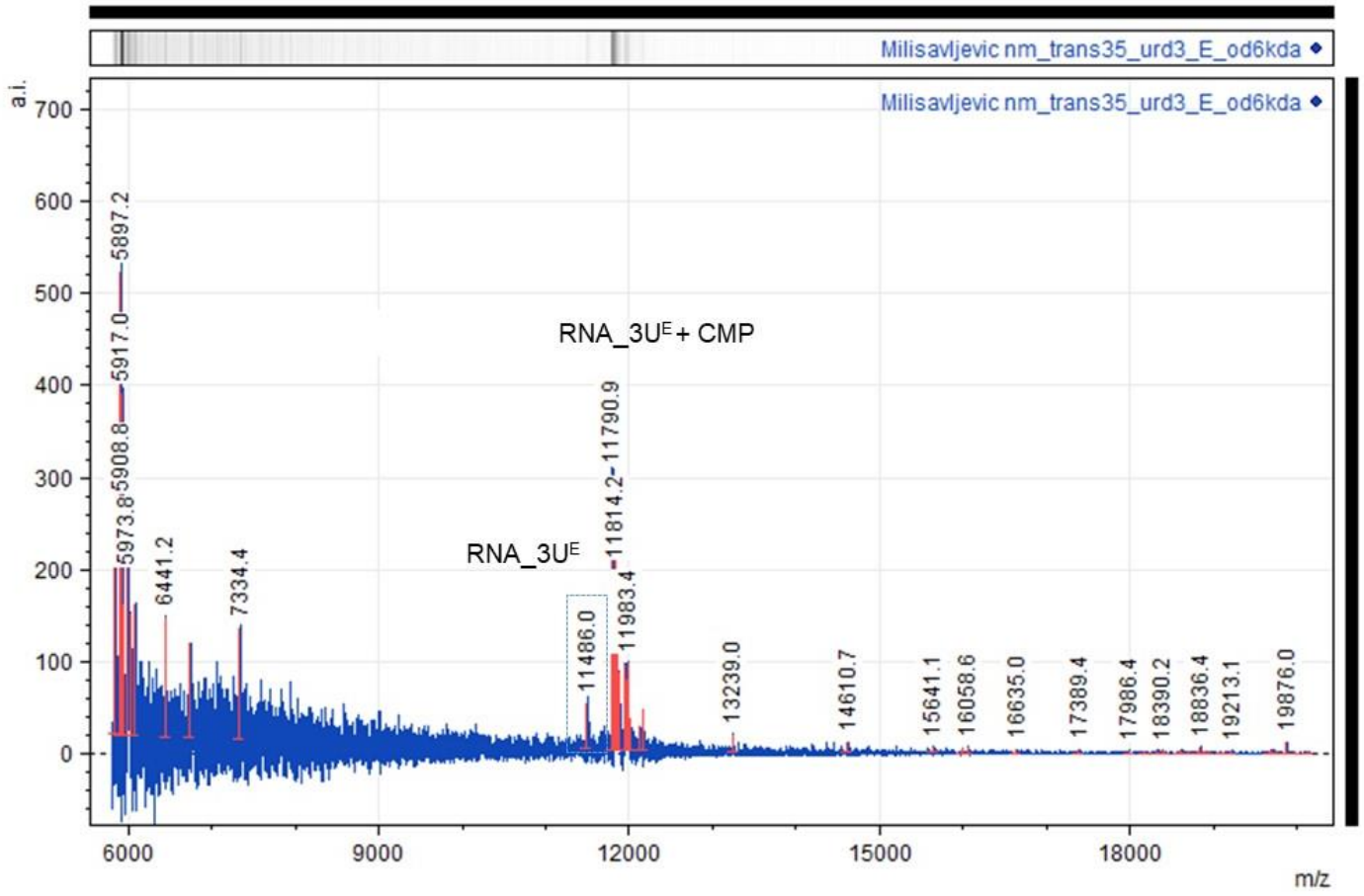


Figure S35. MALDI-TOF spectrum of **RNA_3U^{Ph}**

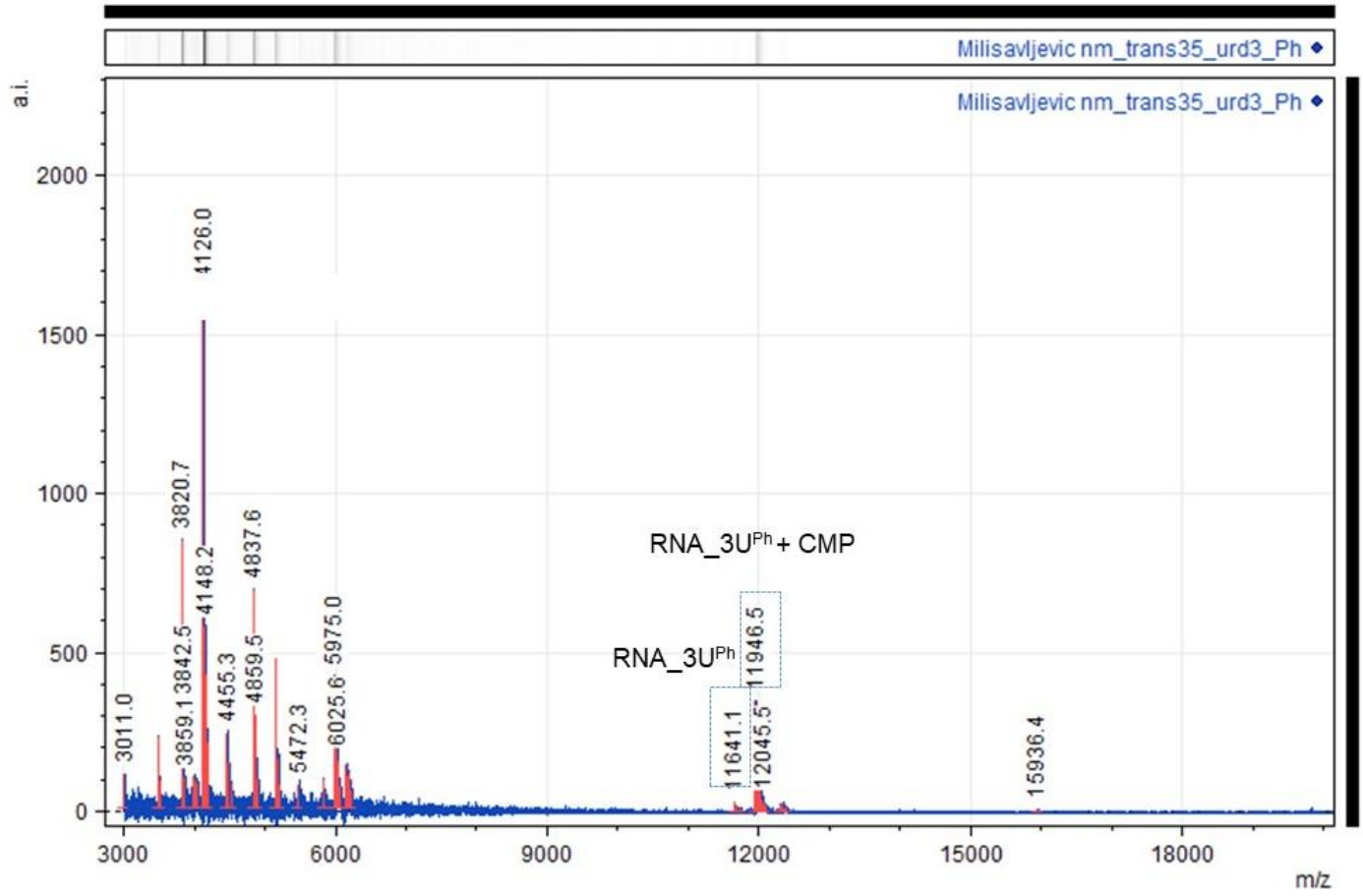


Figure S36. MALDI-TOF spectrum of **RNA_3U^{BF}**

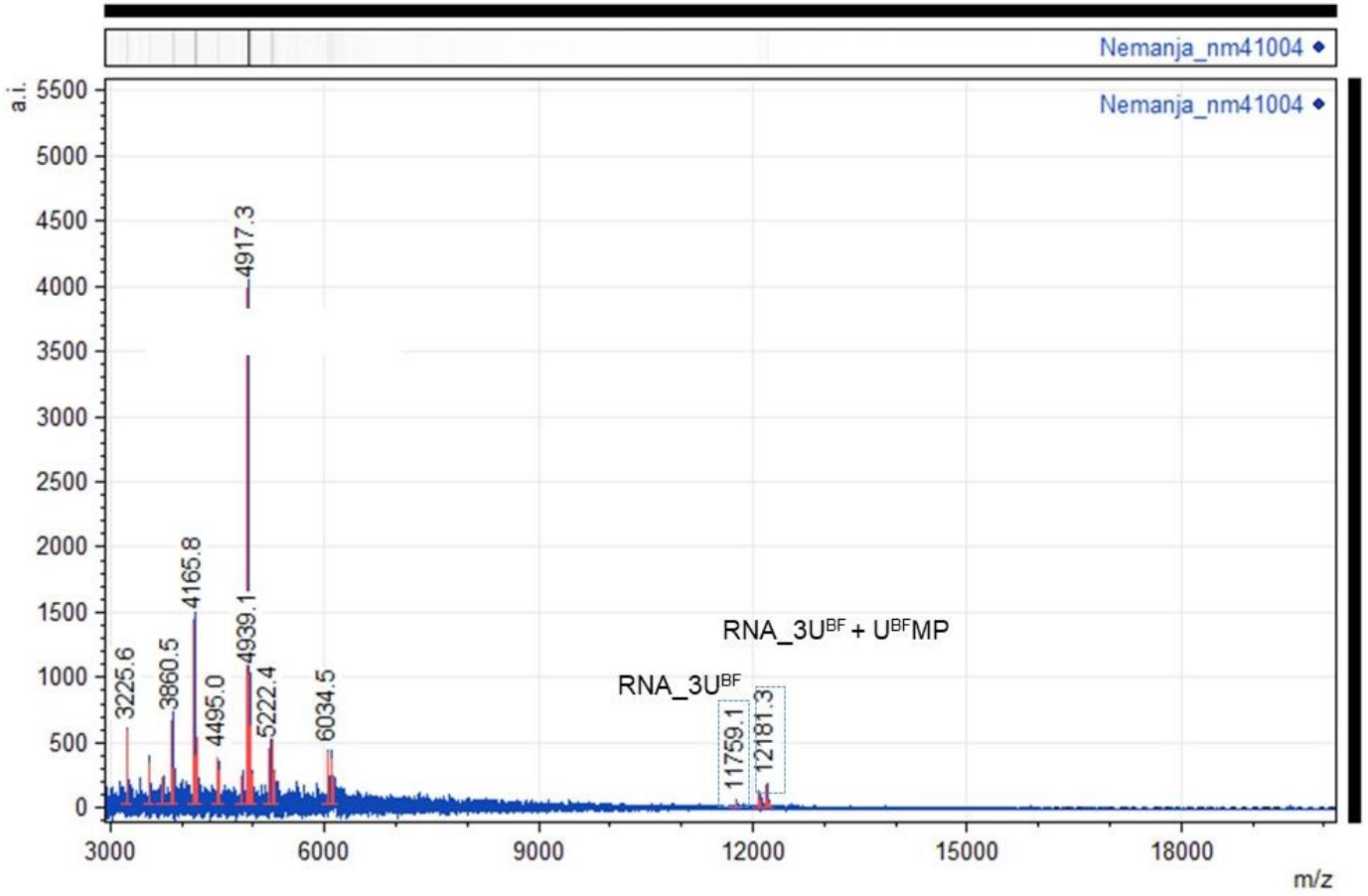


Figure S37. MALDI-TOF spectrum of **RNA_3U^{DB}**

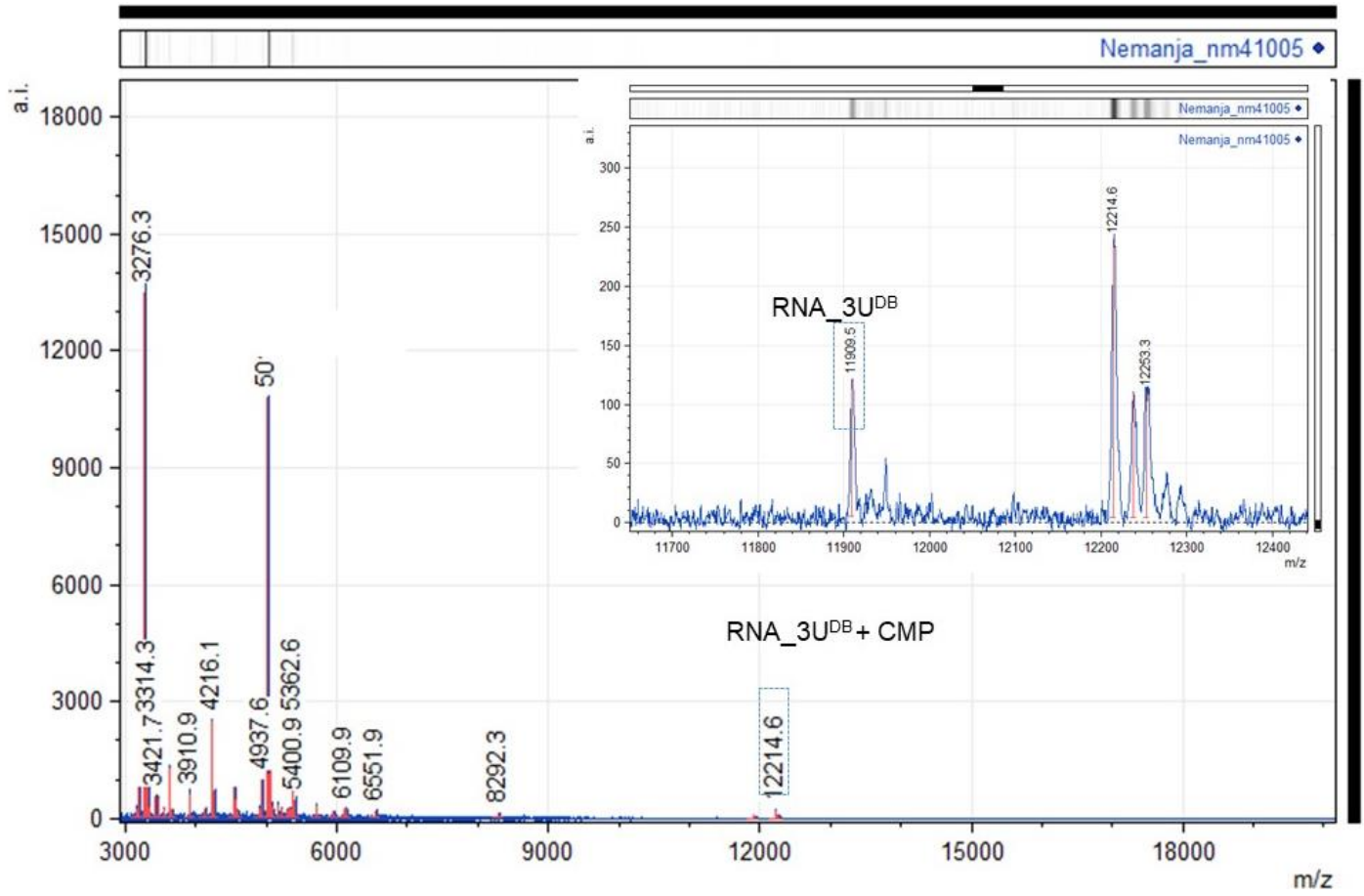


Figure S38. MALDI-TOF spectrum of **RNA_7U^{E}**

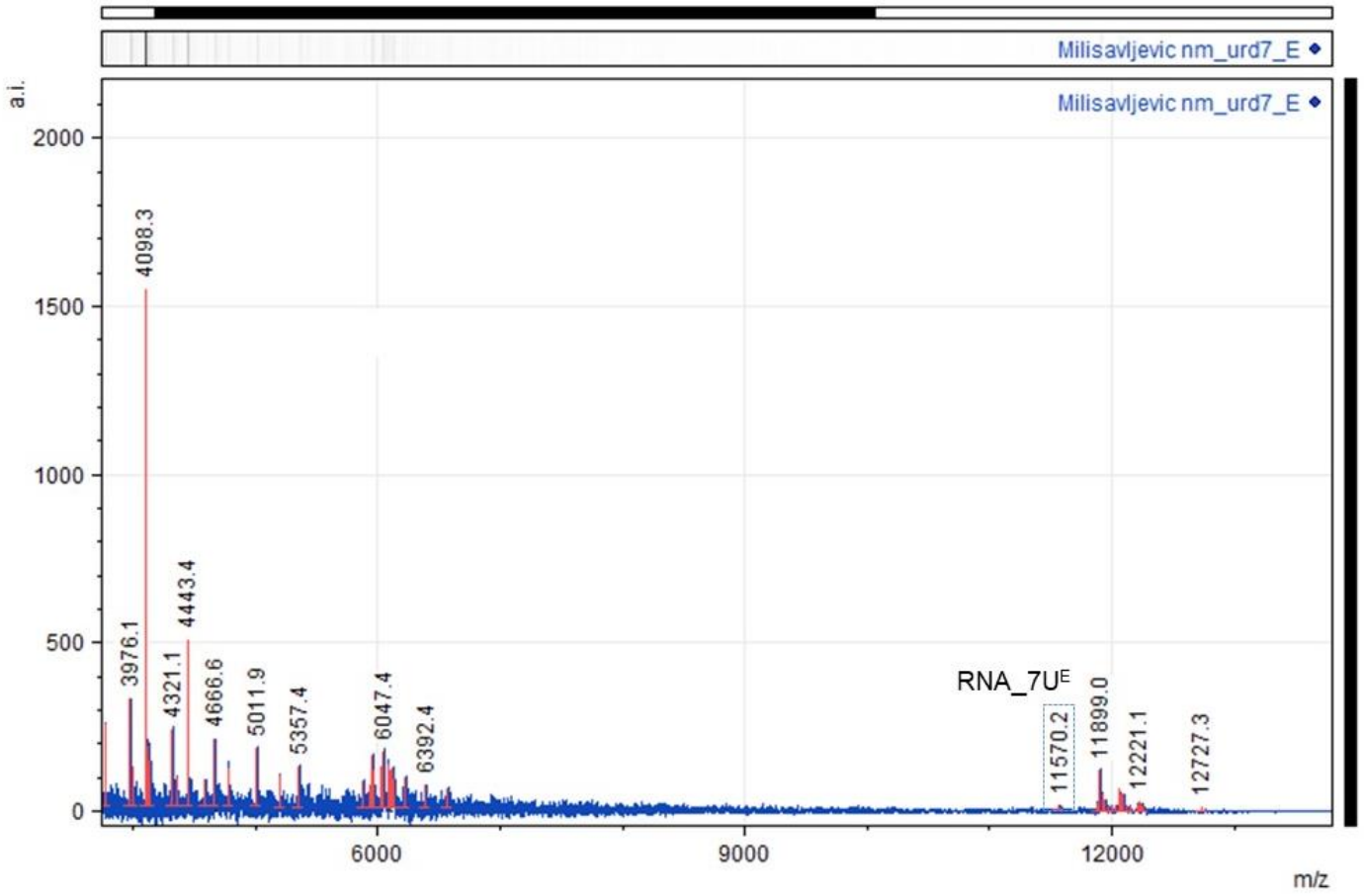


Figure S39. MALDI-TOF spectrum of **RNA_7U^{Ph}**

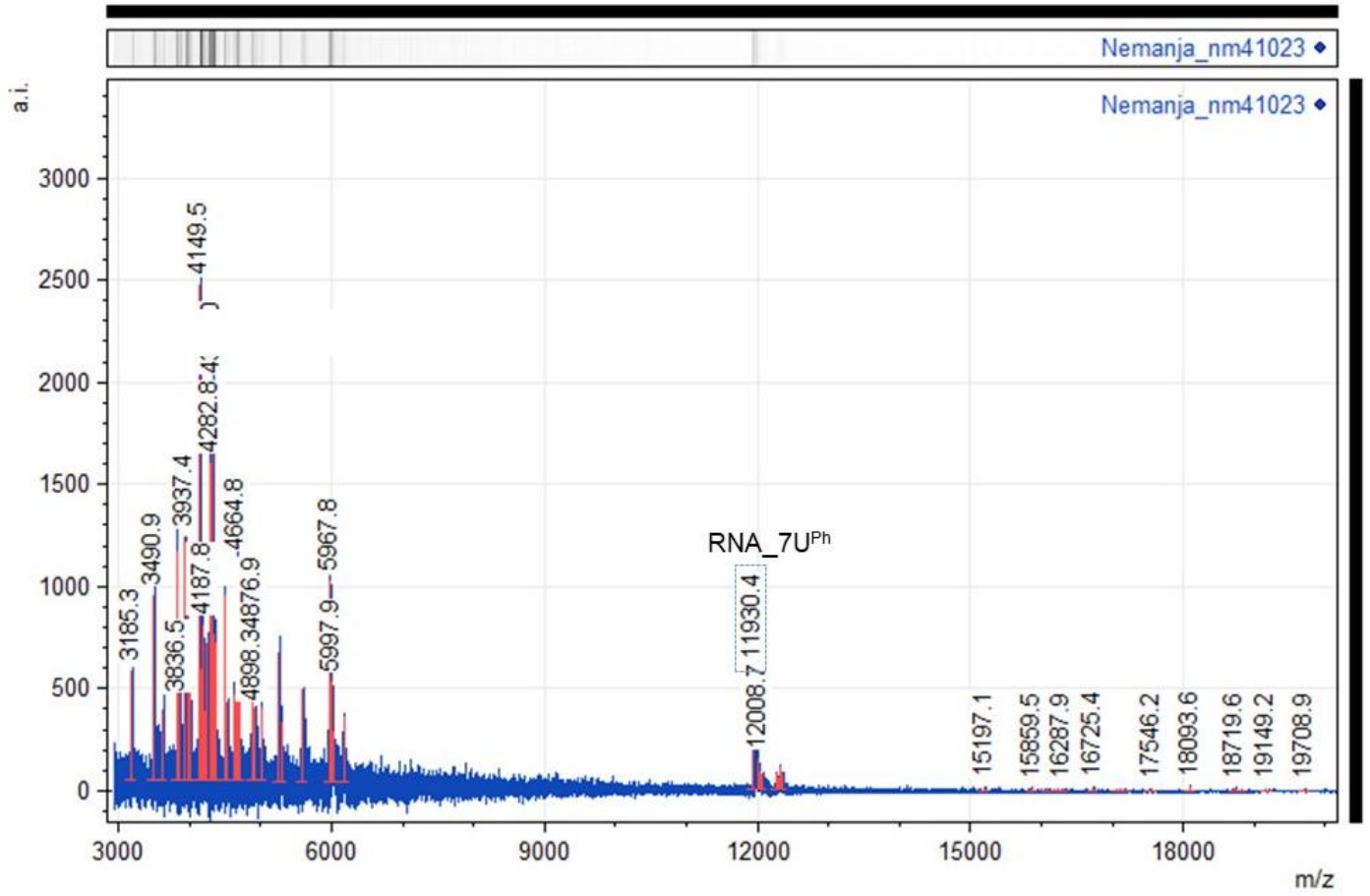


Figure S40. MALDI-TOF spectrum of **RNA_7U^{BF}**

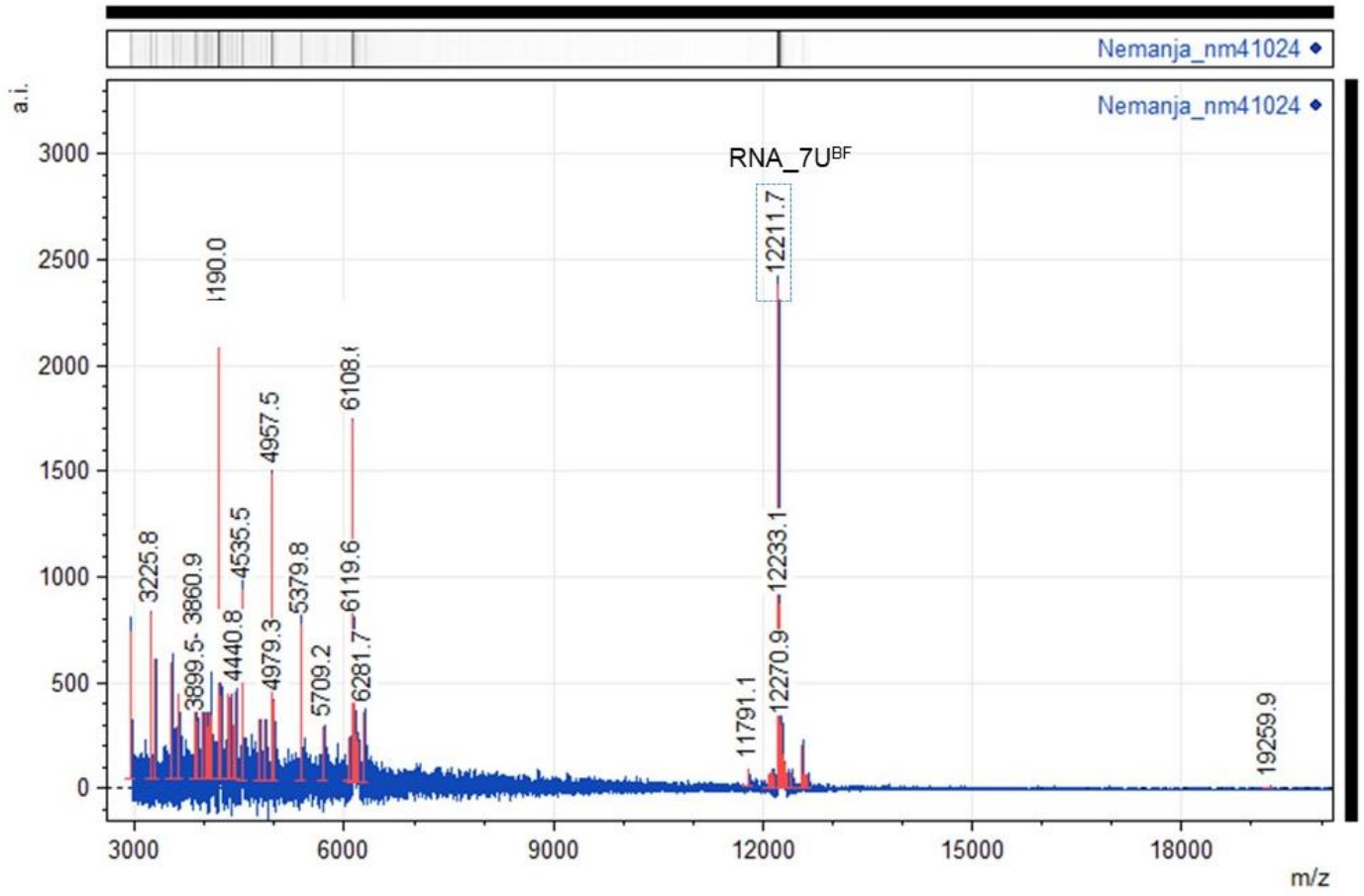


Figure S41. MALDI-TOF spectrum of **RNA_8G^{Me}**

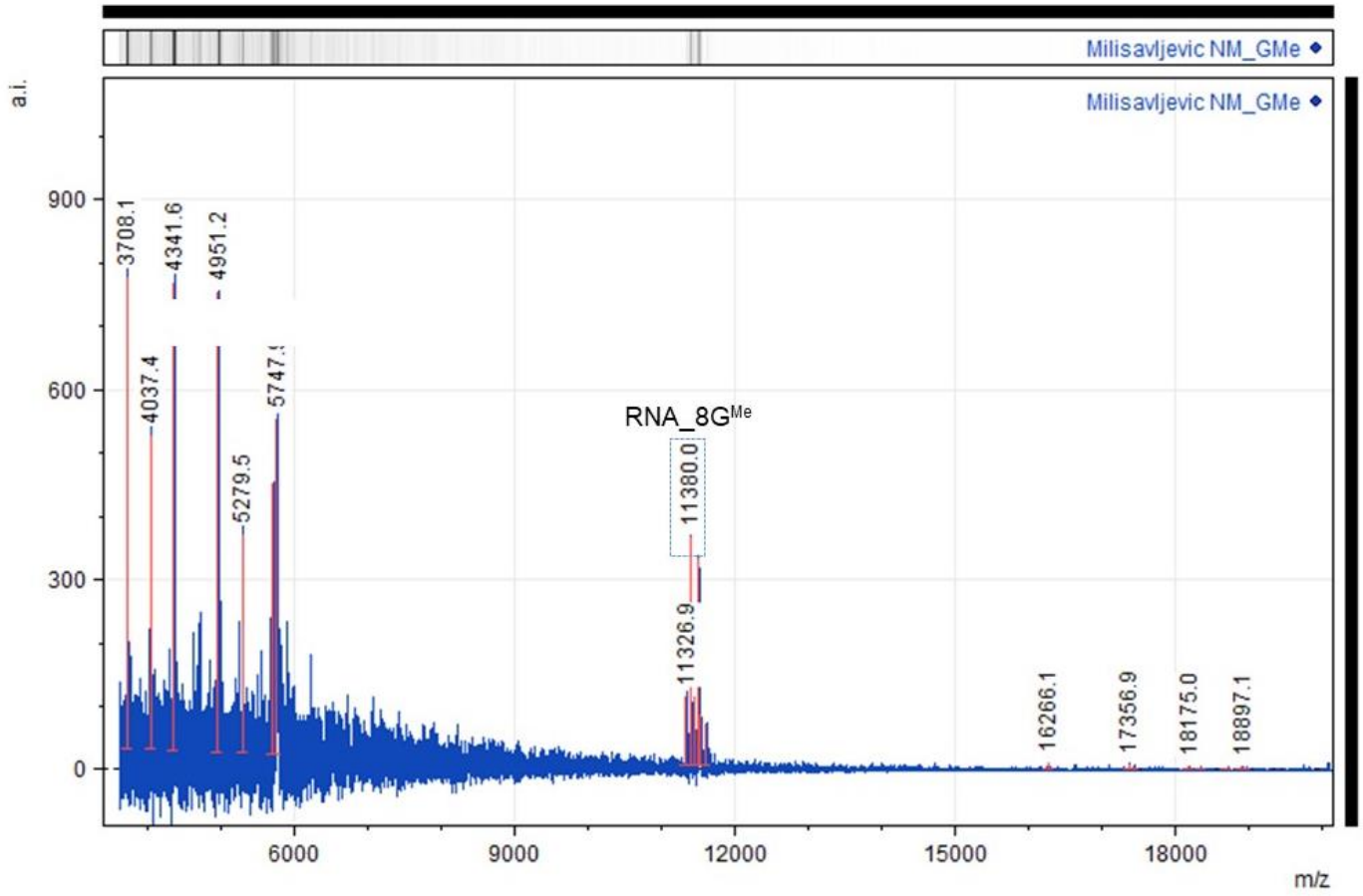


Figure S42. MALDI-TOF spectrum of **RNA_8G^{E}**

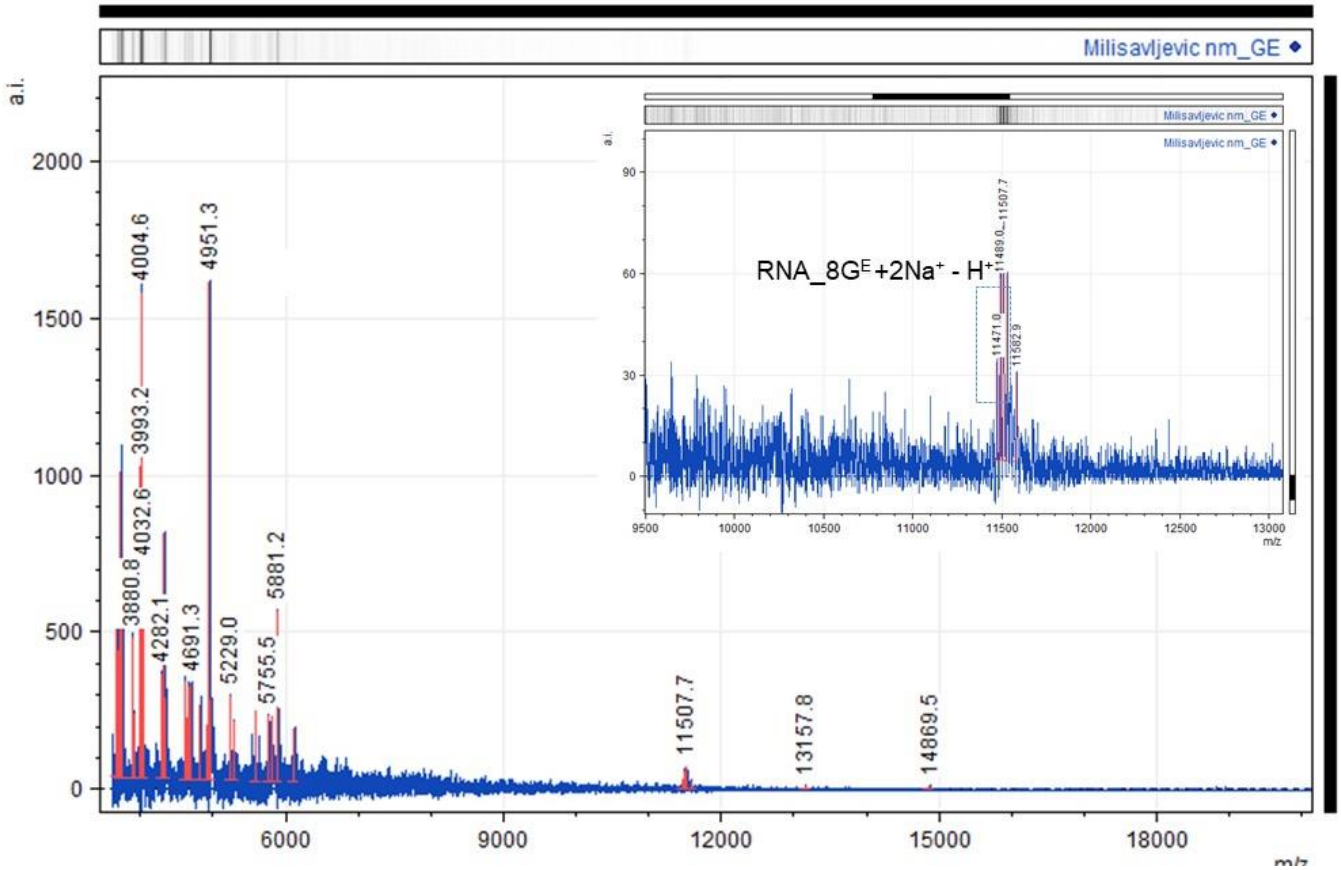


Figure S43. MALDI-TOF spectrum of **RNA_8G^{Ph}**

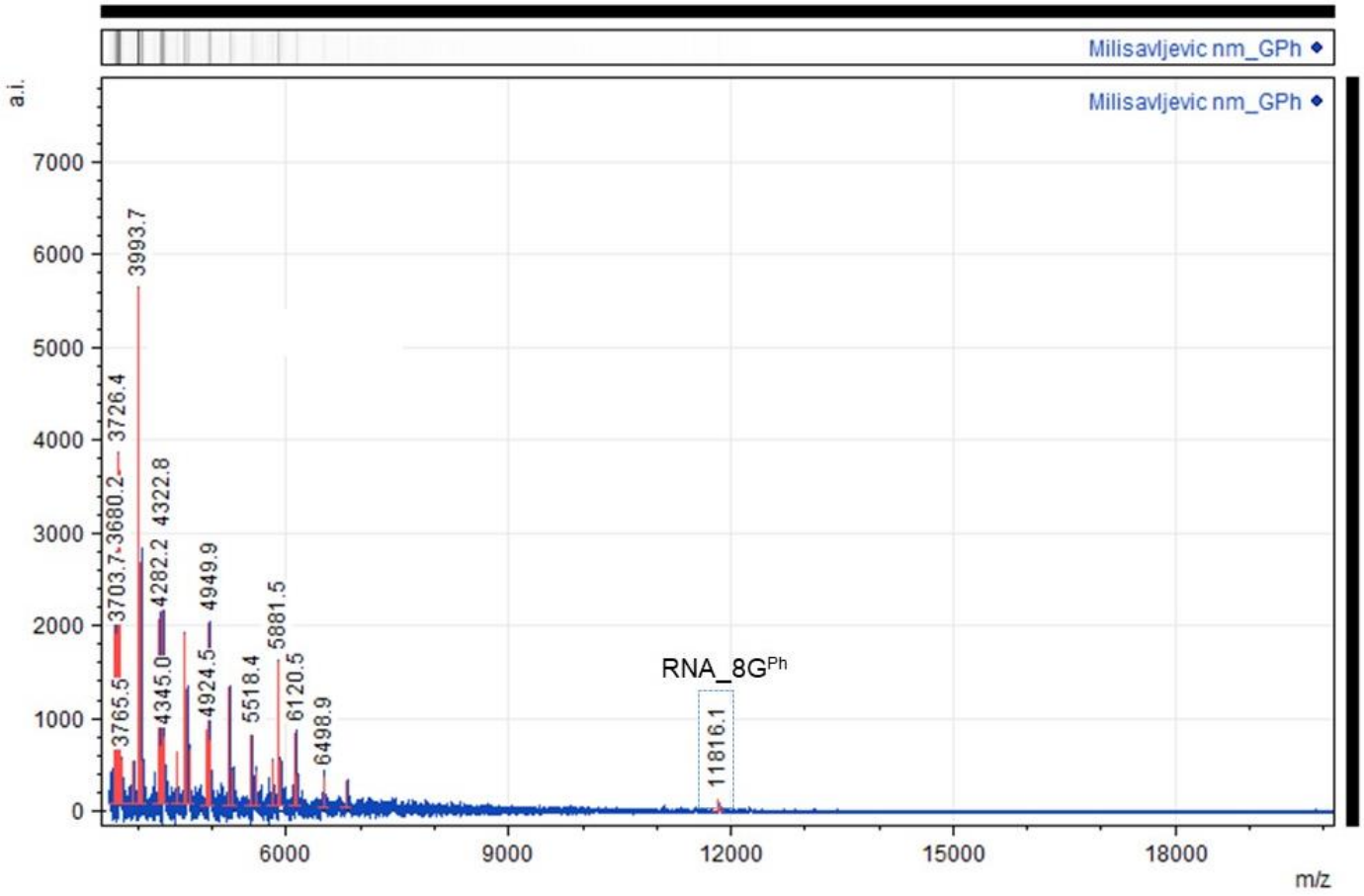
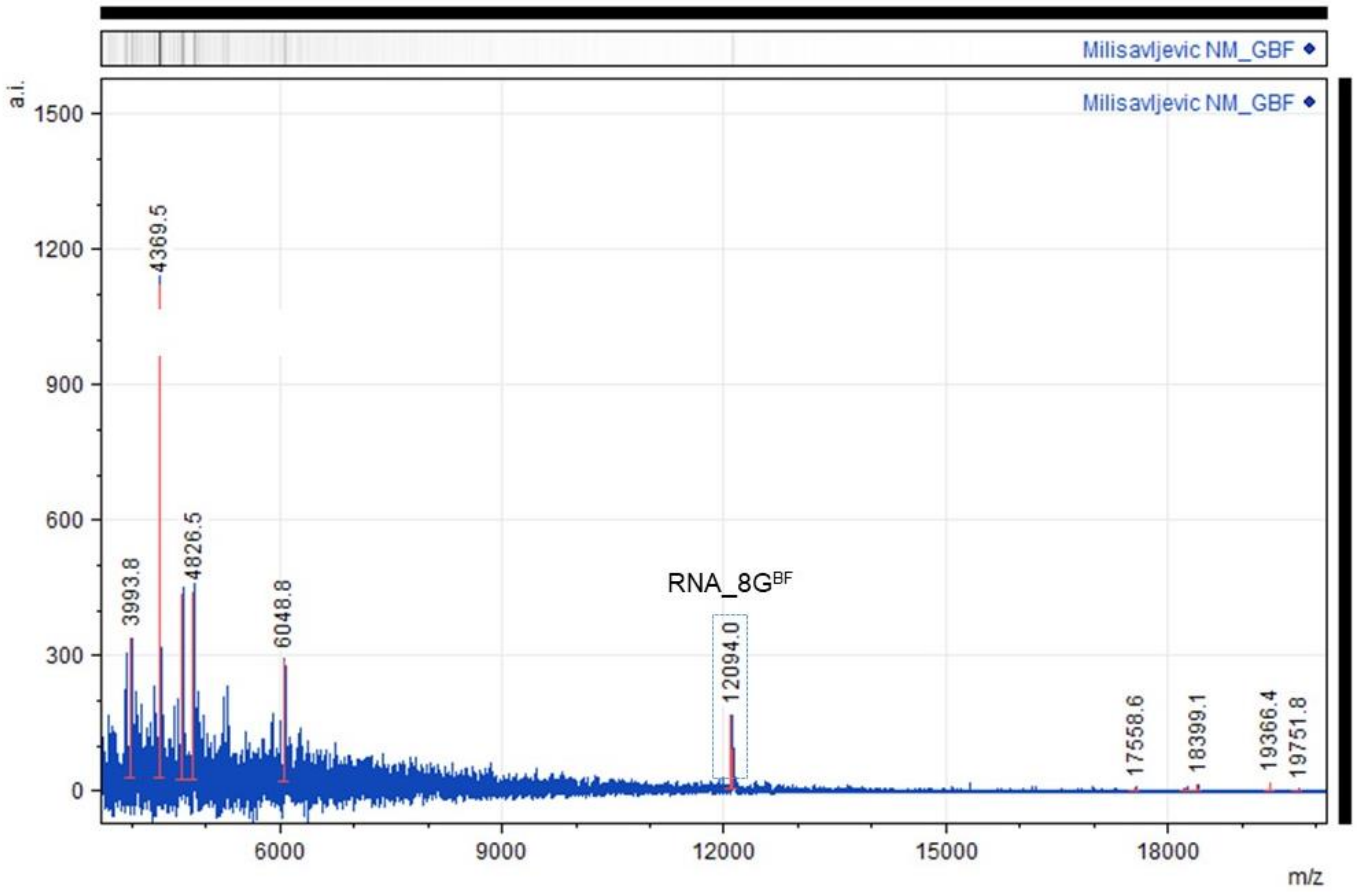
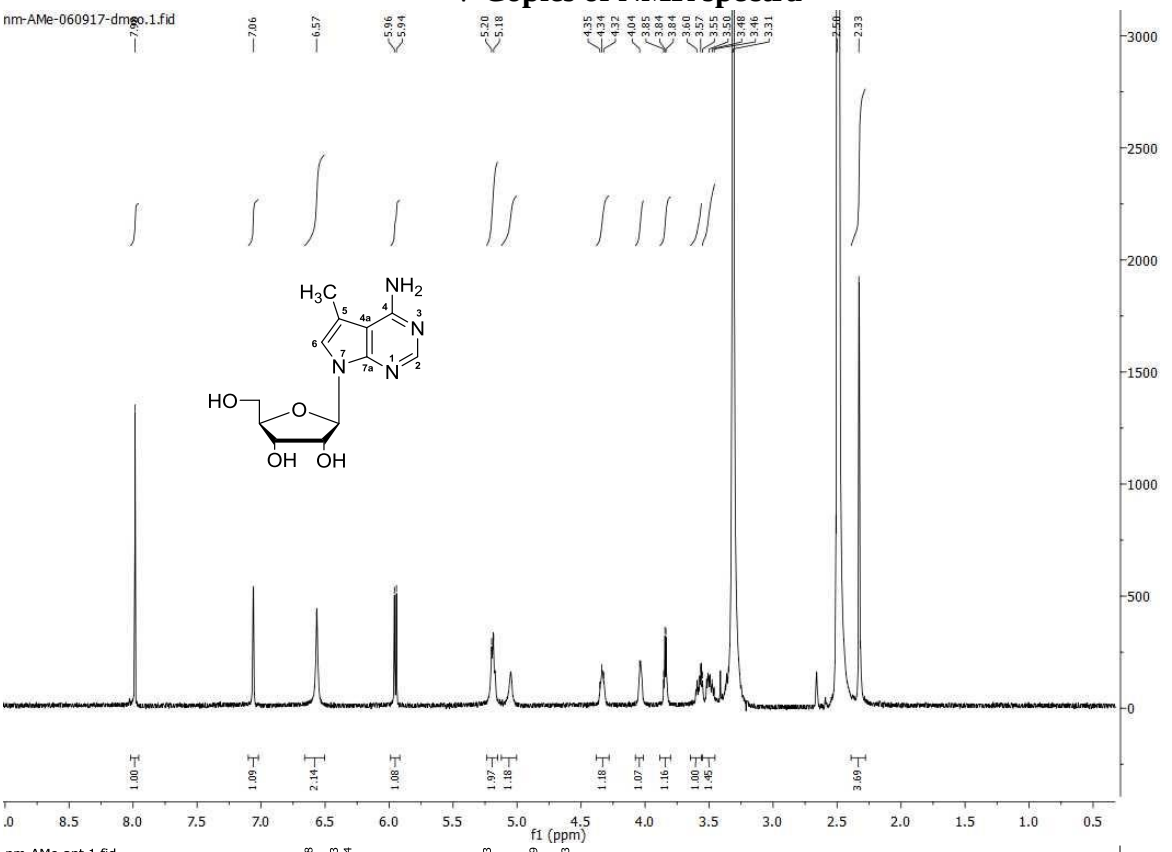
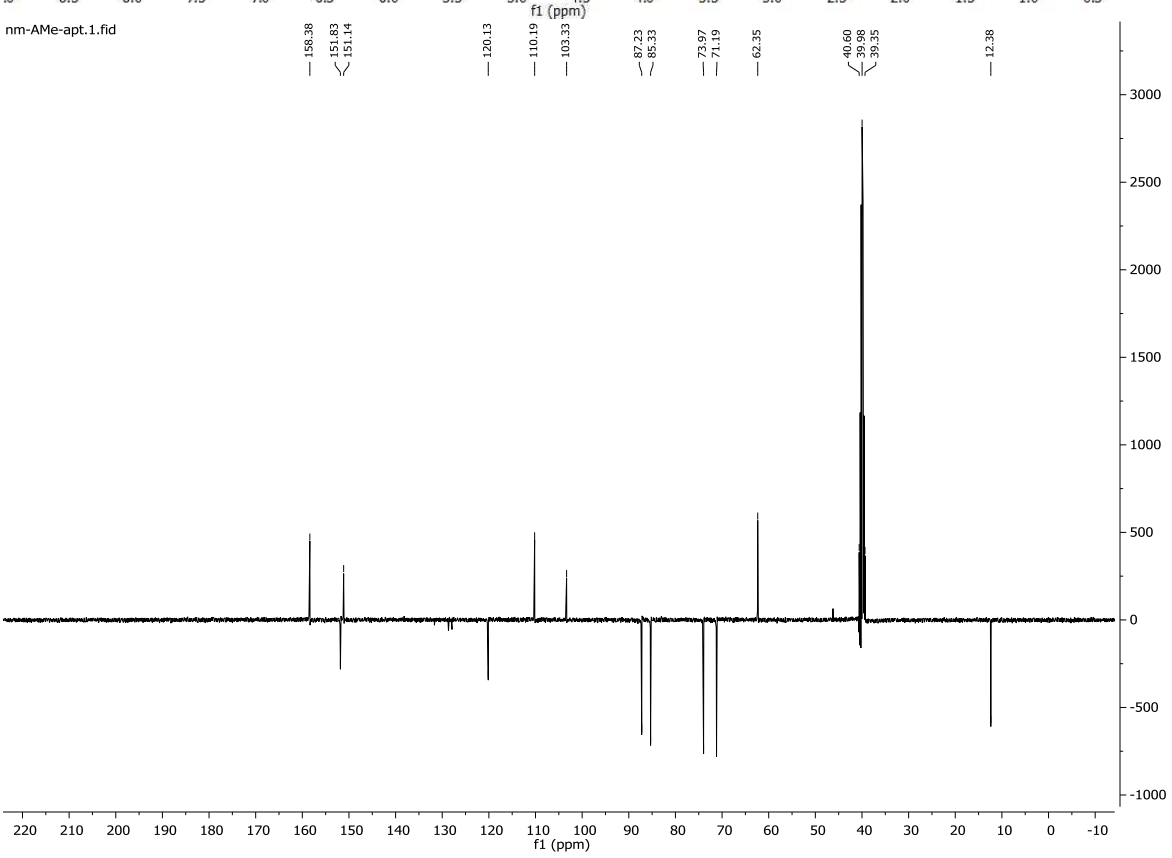


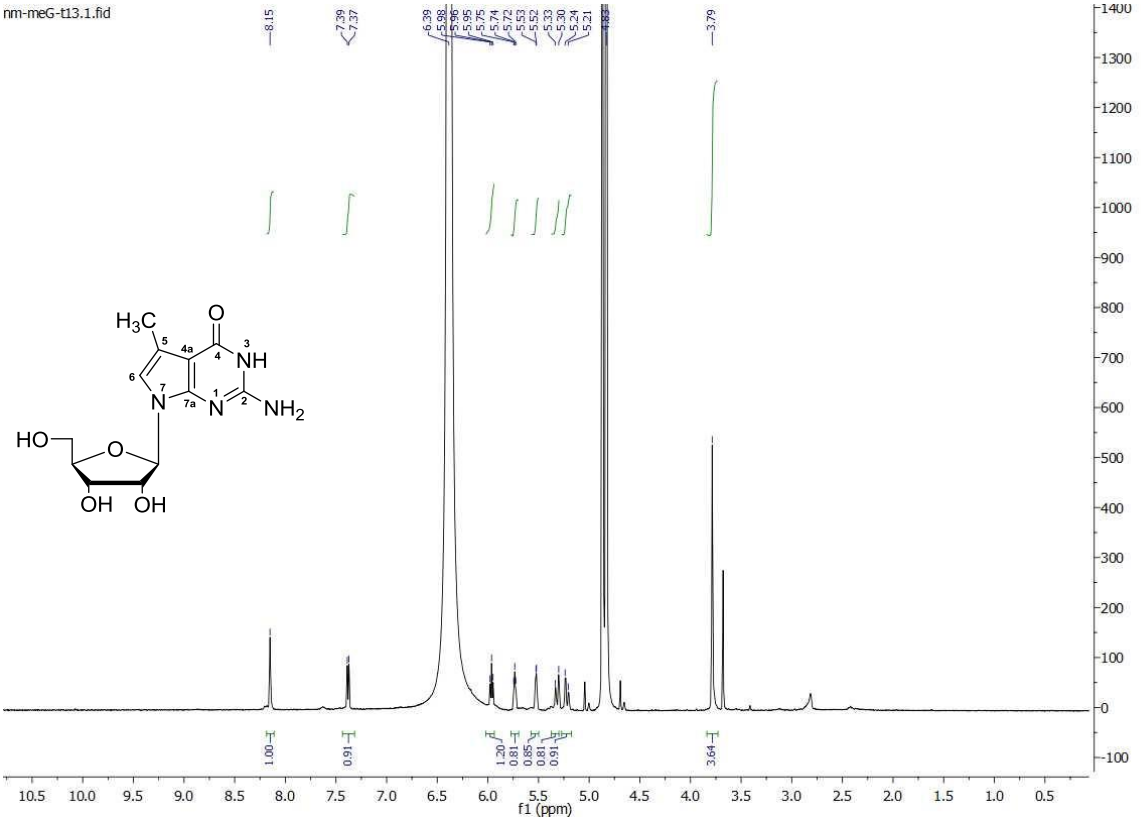
Figure S44. MALDI-TOF spectrum of **RNA_8G^{BF}**

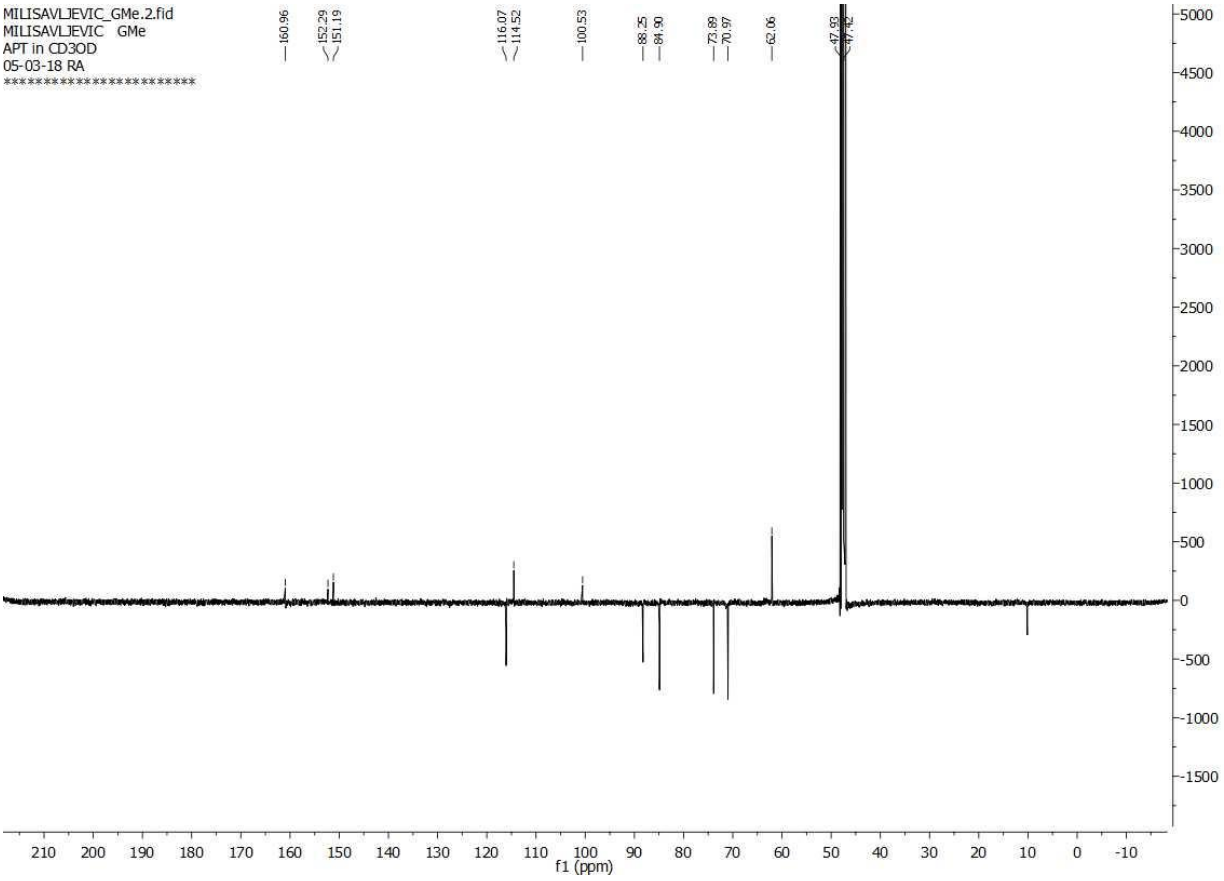


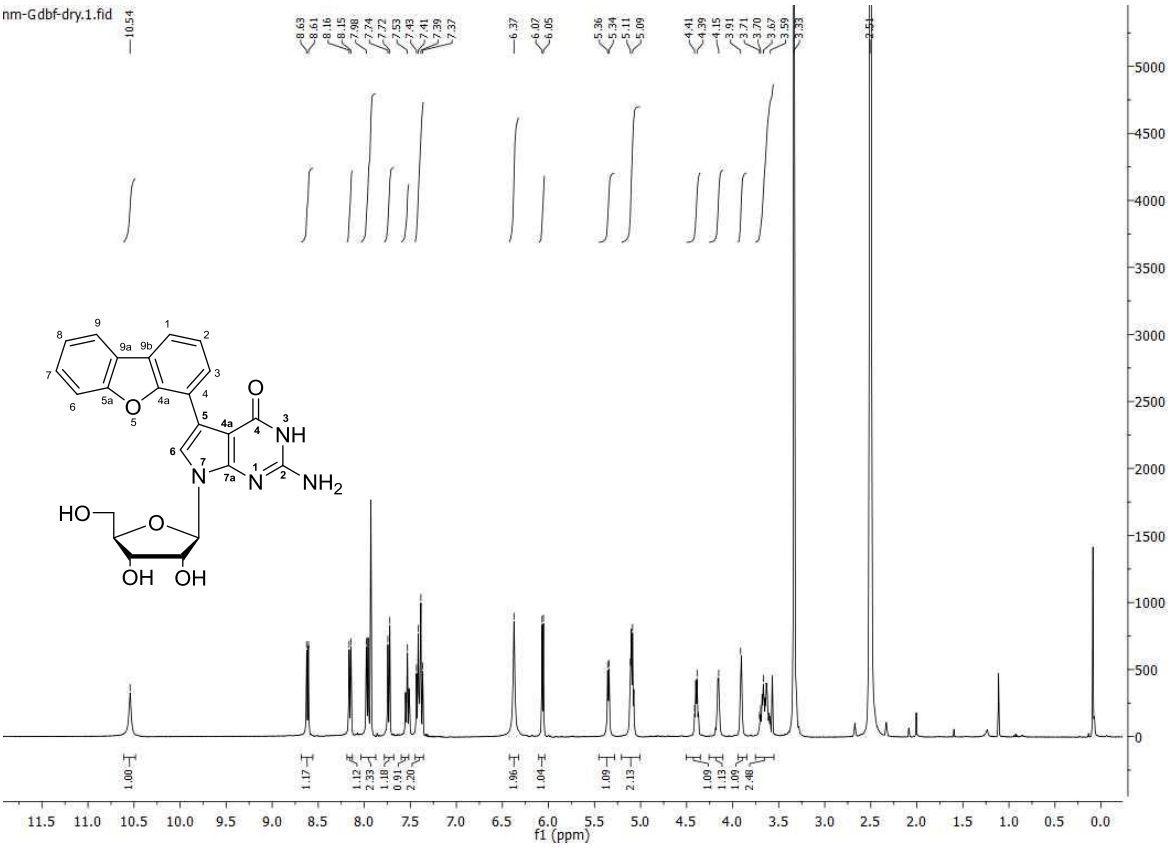
V Copies of NMR spectra

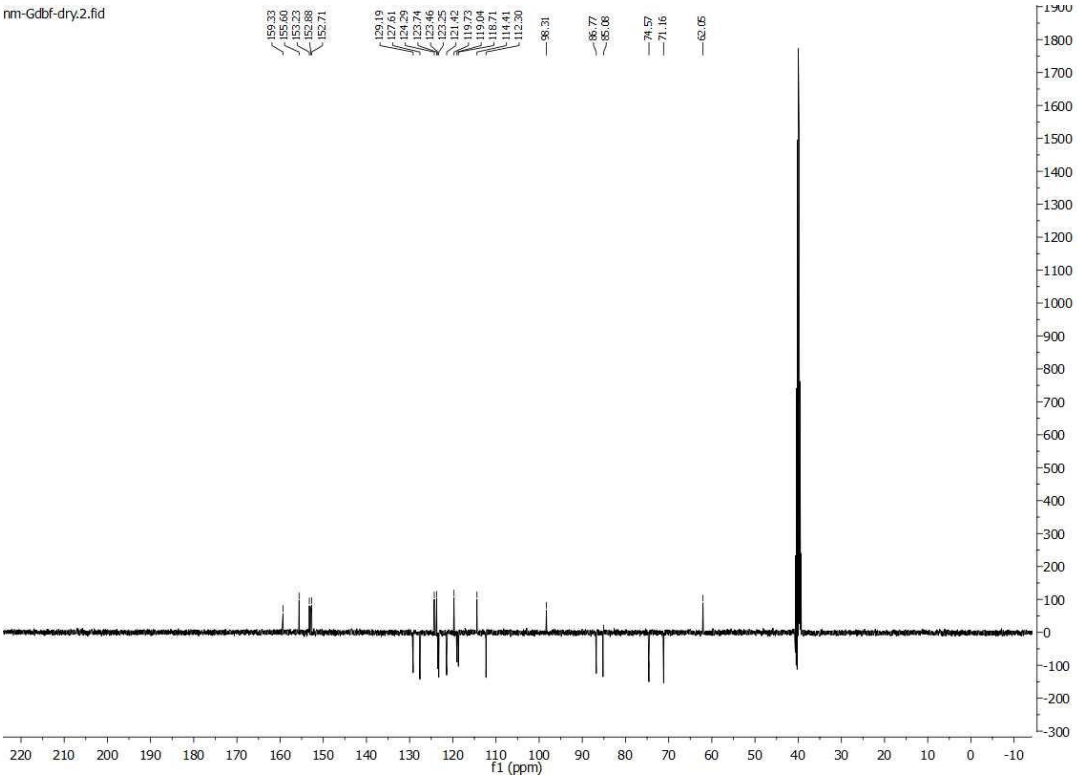


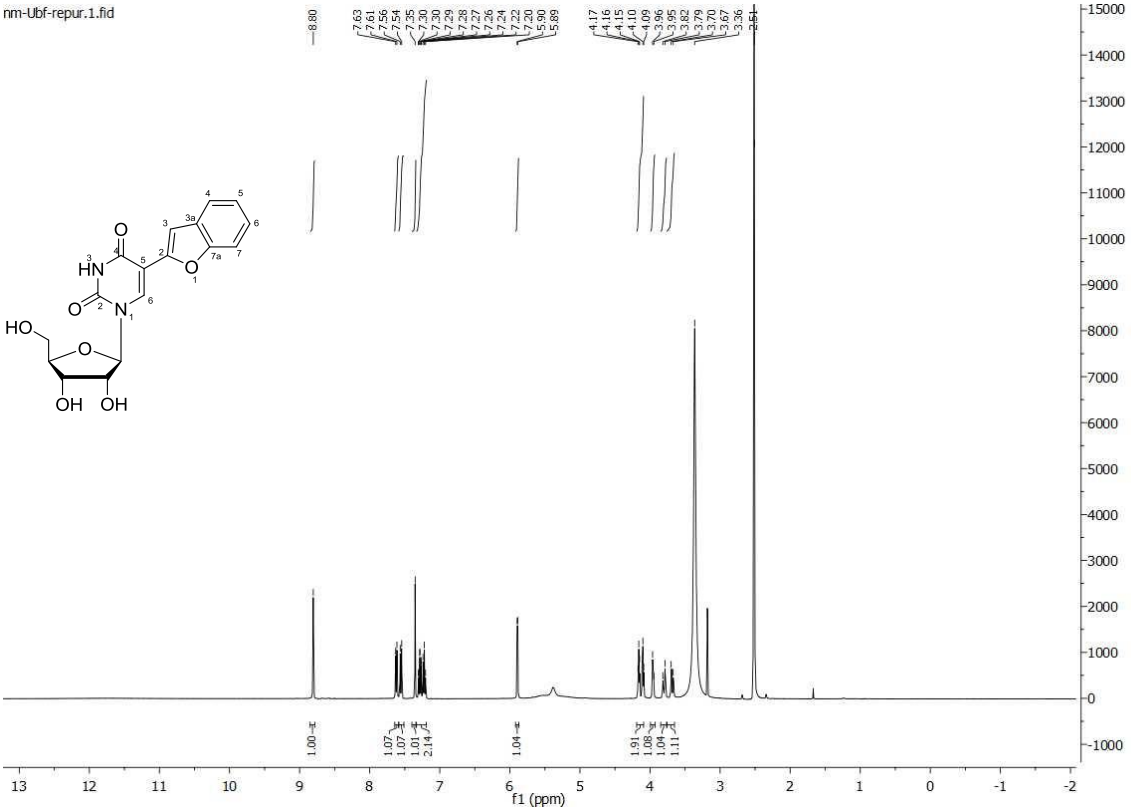



nm-meG-t13.1.fid
8.15
7.39
7.37
6.39
5.98
5.95
5.75
5.74
5.72
5.53
5.52
5.33
5.30
5.24
5.21
4.83
3.79
1.00
0.91
1.20
0.81
0.85
0.81
0.91
3.64
f1 (ppm)


MILISAVLJEVIC_GMe.2.fid
MILISAVLJEVIC GMe
APT in CD3OD
05-03-18 RA
160.96
152.29
151.19
116.07
114.52
100.53
88.25
84.90
73.89
70.97
62.06
47.83
47.42
f1 (ppm)


nm-Gdbf-dry.1.fid
10.54
8.63
8.61
8.16
8.15
7.98
7.74
7.72
7.53
7.43
7.41
7.39
7.37
6.37
6.07
6.05
5.36
5.34
5.11
5.09
4.41
4.39
4.15
3.91
3.71
3.70
3.67
3.59
3.33
2.51
HO
O
OH
OH
NH
NH2
f1 (ppm)


nm-Gdbf-dry.2.fid
159.33
155.60
153.23
152.88
152.71
129.19
127.61
124.29
123.74
123.46
123.25
111.42
119.73
119.04
118.71
114.41
112.30
98.31
86.77
85.08
74.57
71.16
62.05
f1 (ppm)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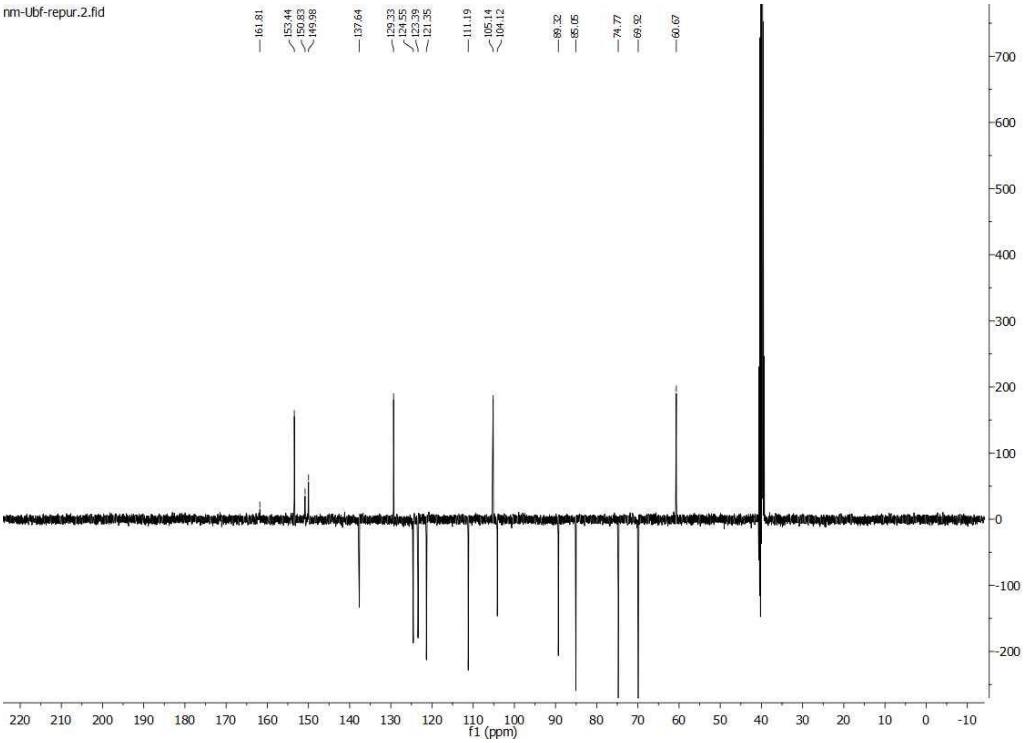
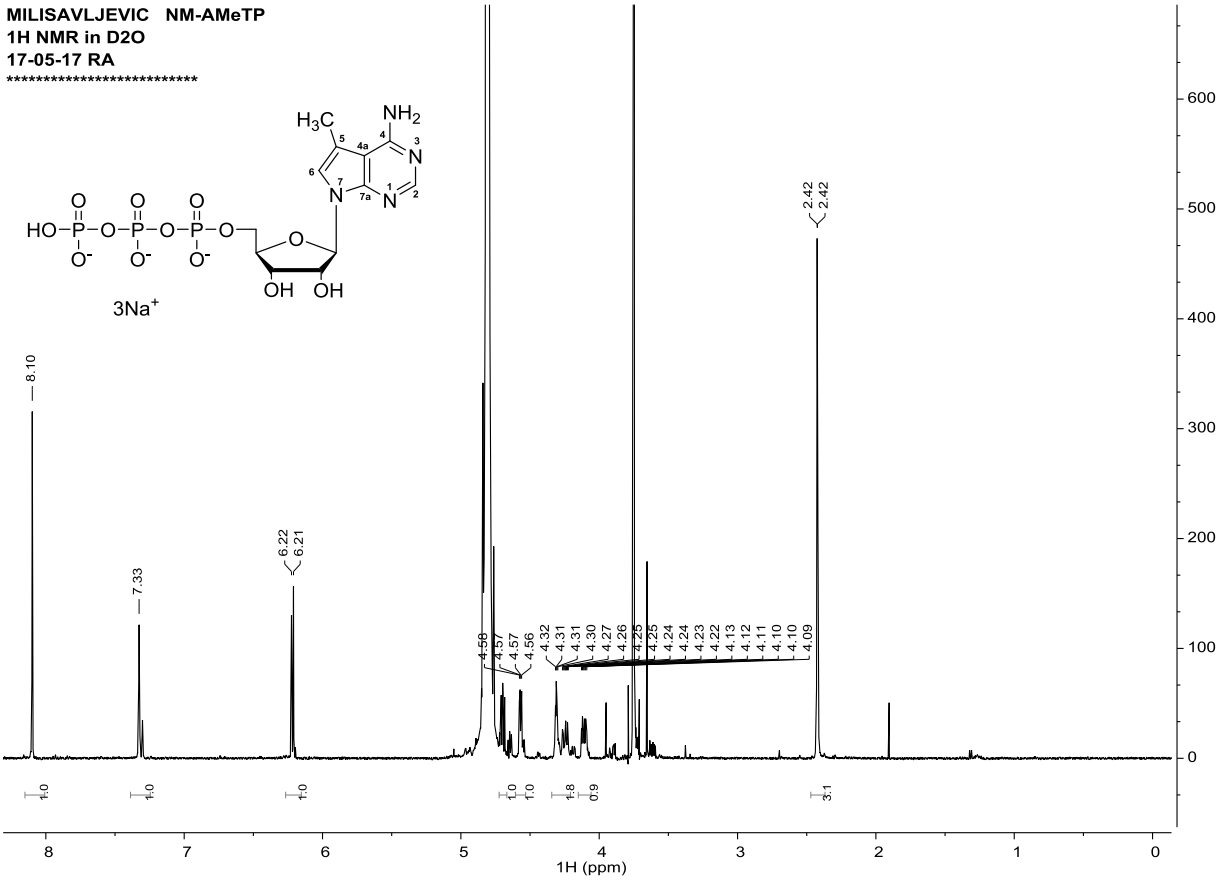
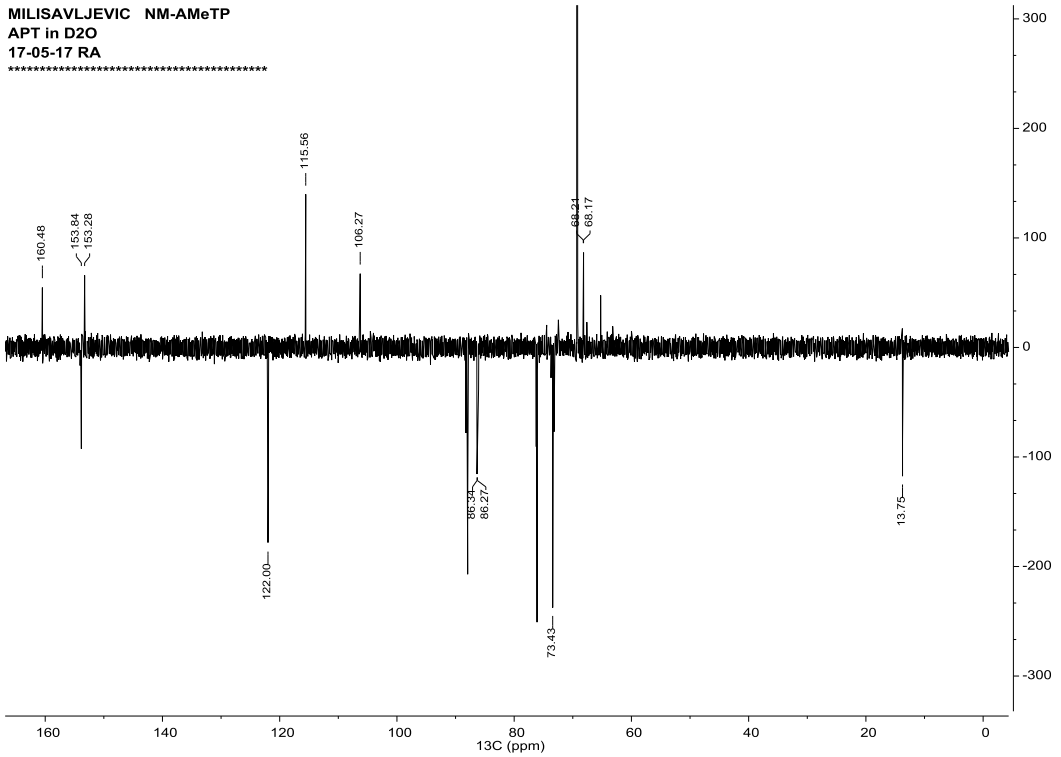
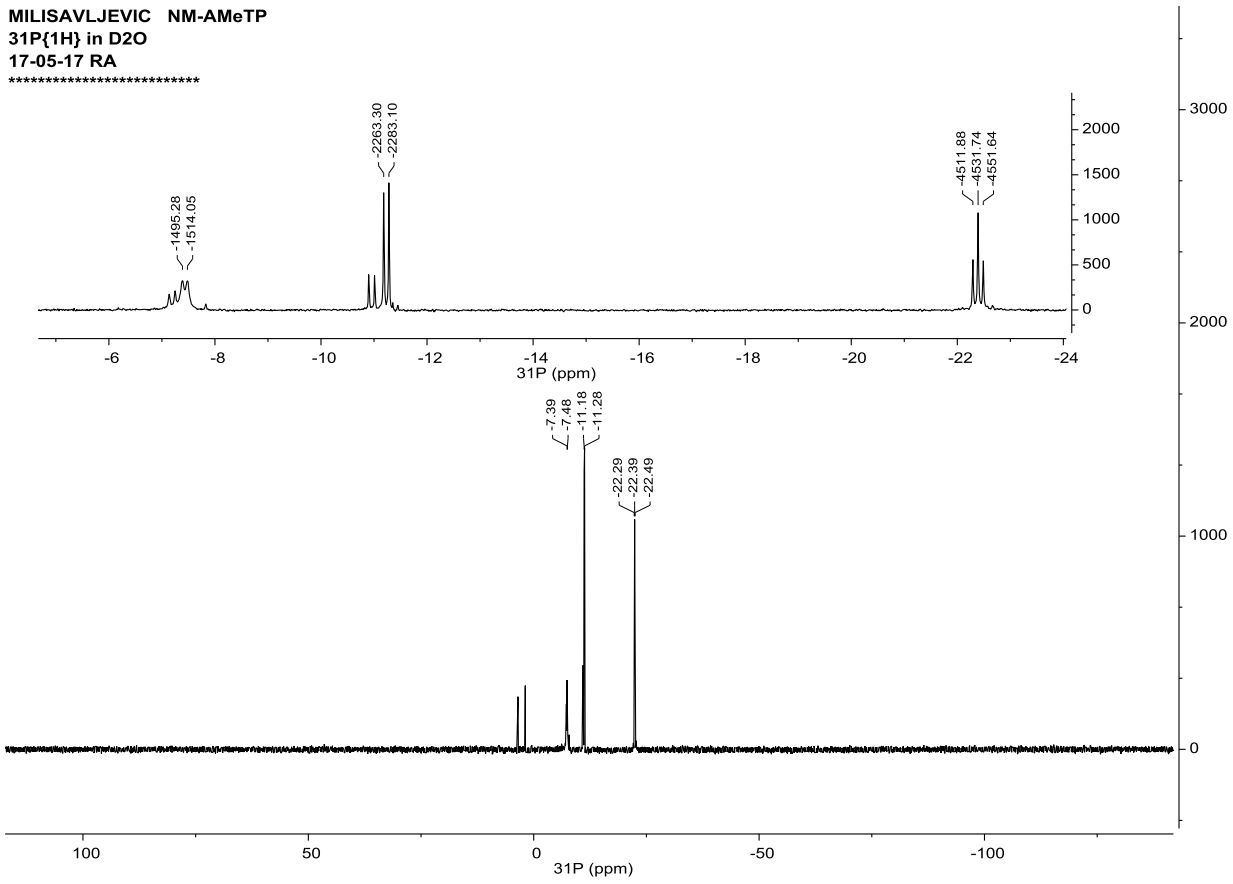
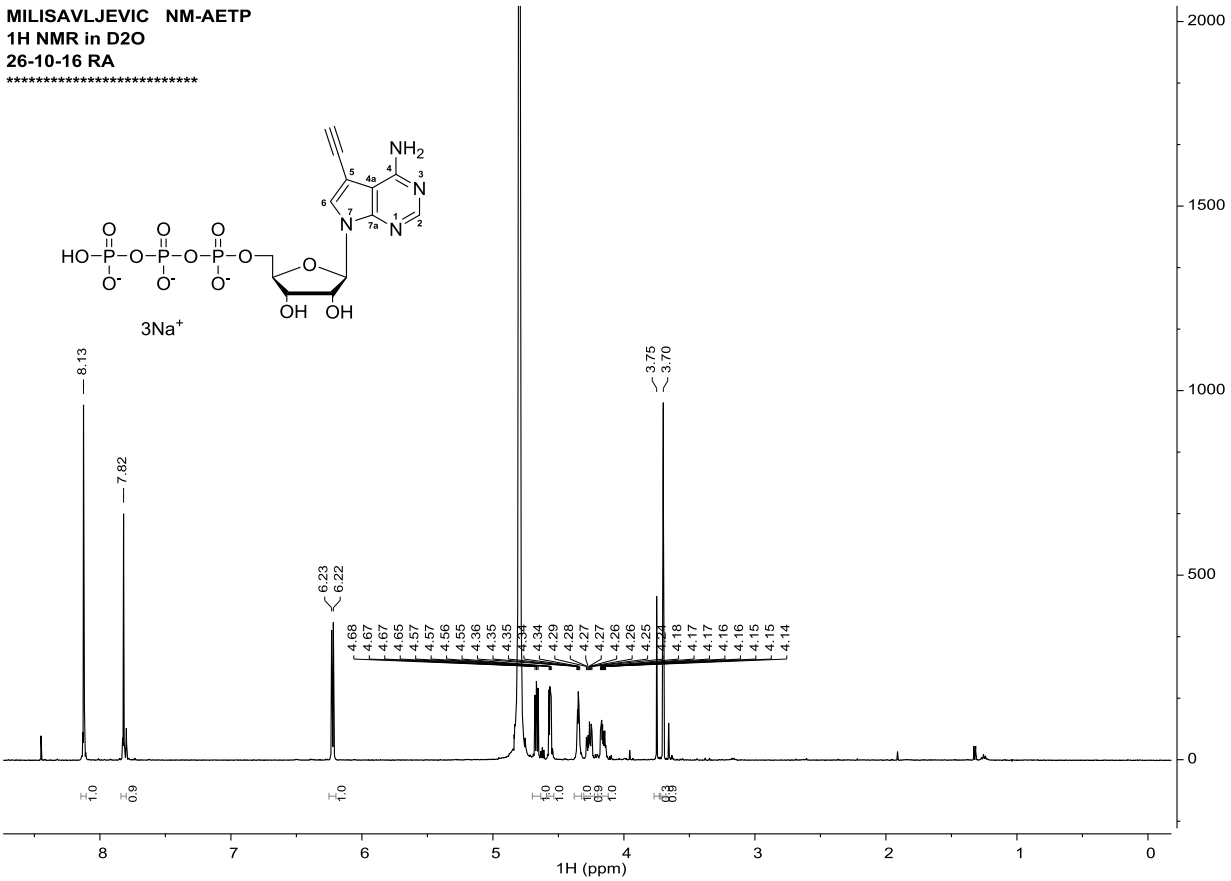
f1 (ppm)

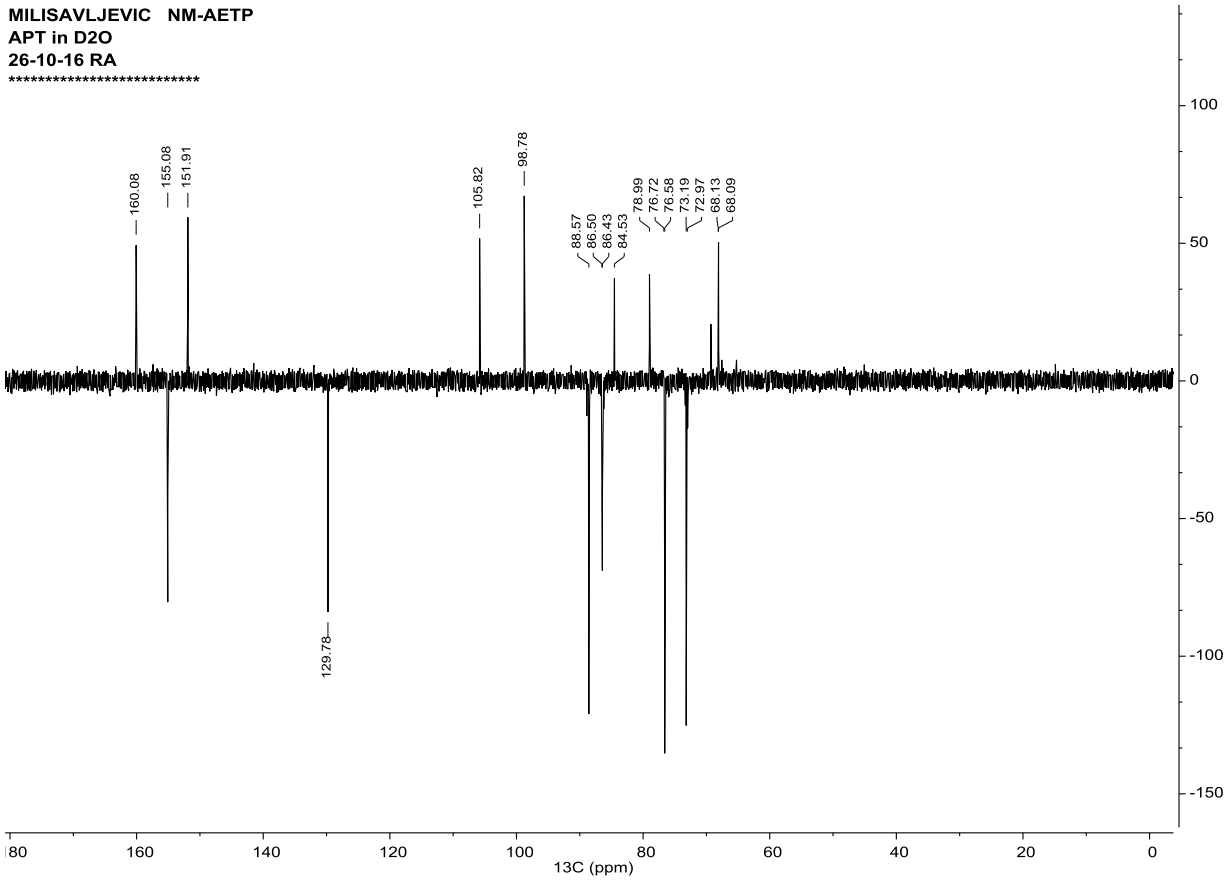

nm-Ubf-repur.2.fid
f1 (ppm)

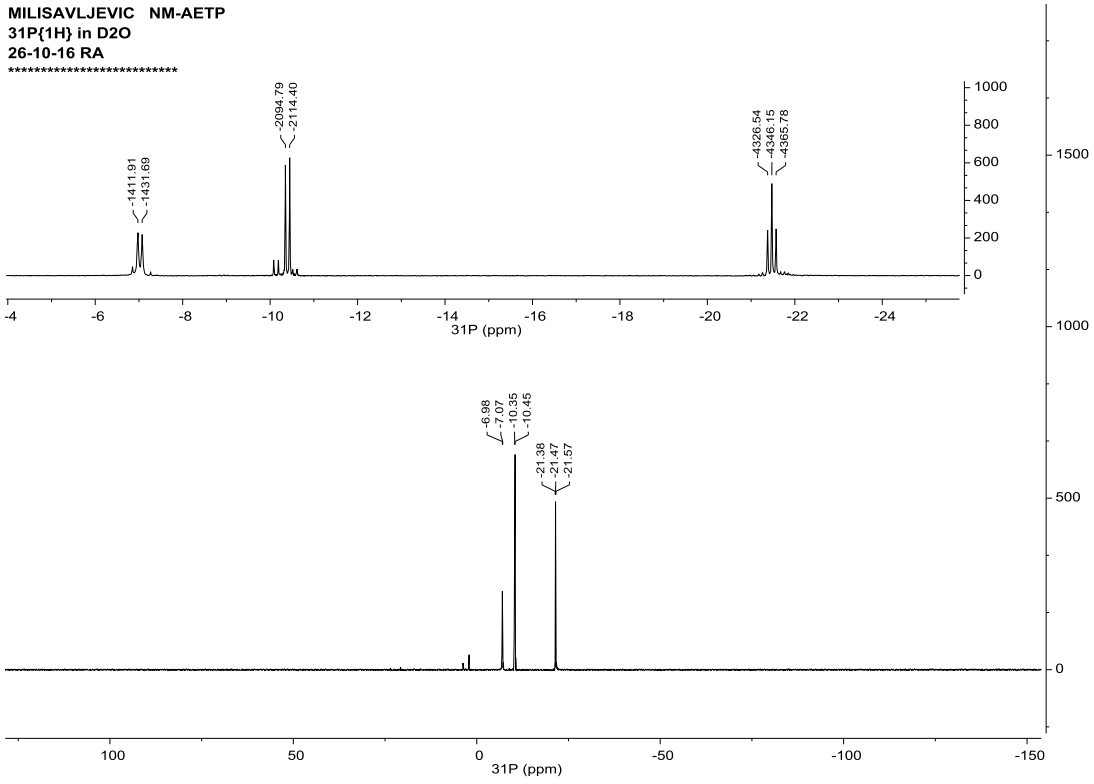

MILISAVLJEVIC NM-AMeTP
1H NMR in D2O
17-05-17 RA
****
3Na+
8.10
7.33
6.22
6.21
4.58
4.57
4.57
4.56
4.32
4.31
4.31
4.30
4.27
4.26
4.25
4.25
4.24
4.24
4.23
4.22
4.13
4.12
4.11
4.10
4.10
4.09
2.42
2.42
1.0
1.0
1.0
1.0
1.8
0.9
3.1
1H (ppm)

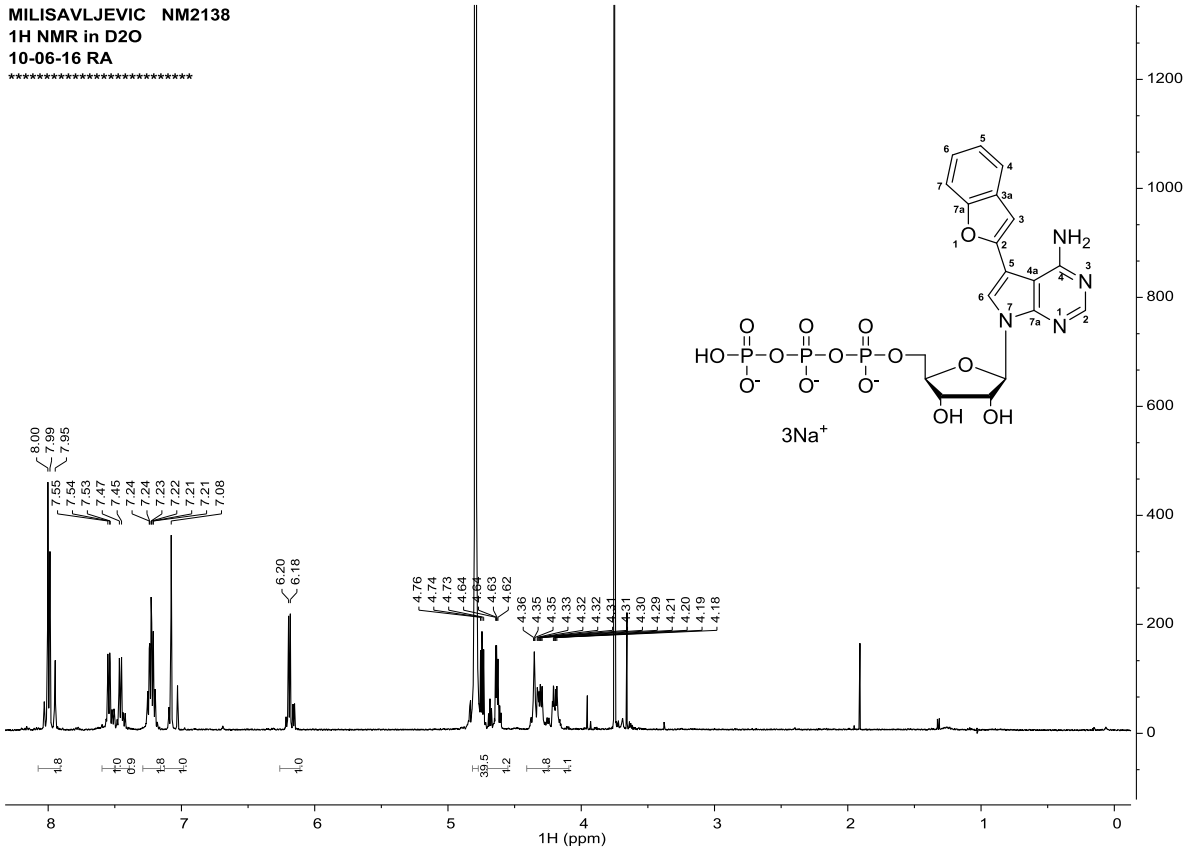

MILISAVLJEVIC NM-AMeTP
APT in D2O
17-05-17 RA
160.48
153.84
153.28
115.56
106.27
68.21
68.17
86.34
86.27
122.00
73.43
13.75
13C (ppm)

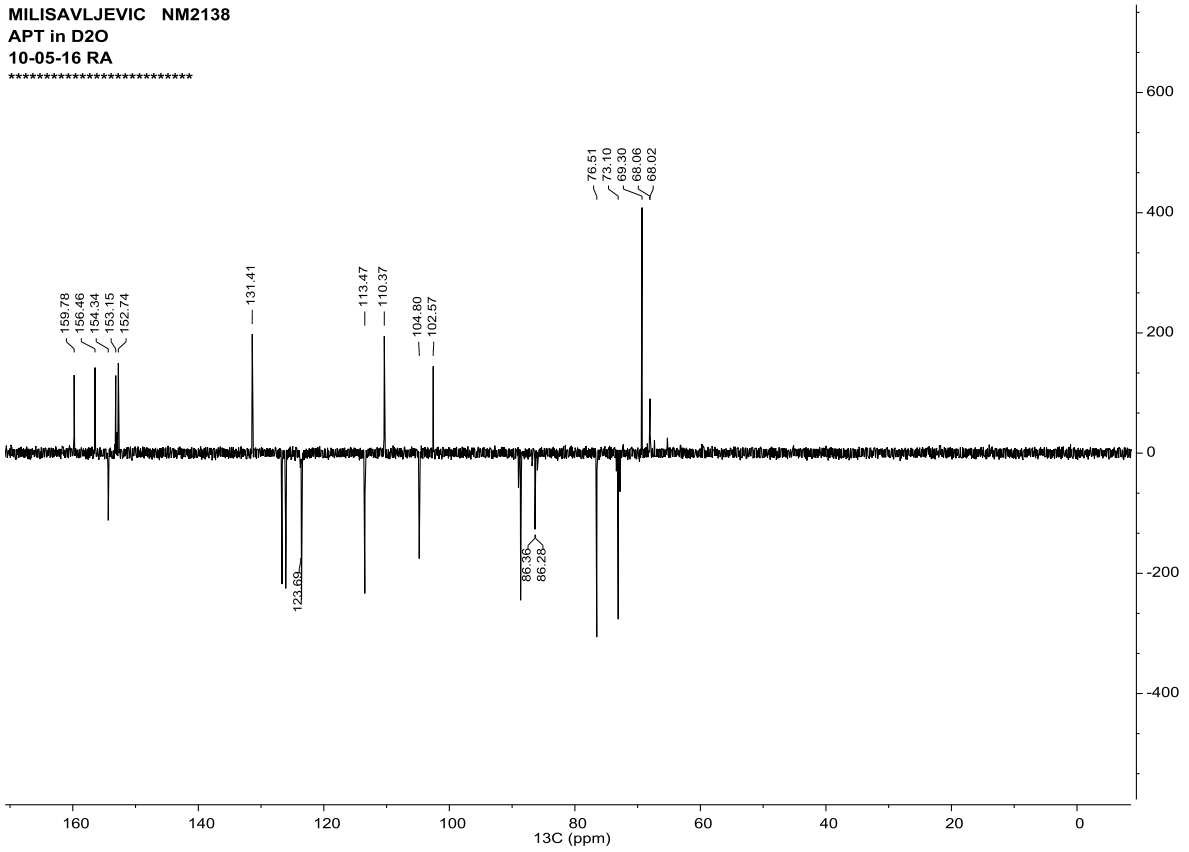

MILISAVLJEVIC NM-AMeTP
31P{1H} in D2O
17-05-17 RA
-1495.28
-1514.05
-2263.30
-2283.10
-4511.88
-4531.74
-4551.64
31P (ppm)
-7.39
-7.48
-11.18
-11.28
-22.29
-22.39
-22.49
31P (ppm)

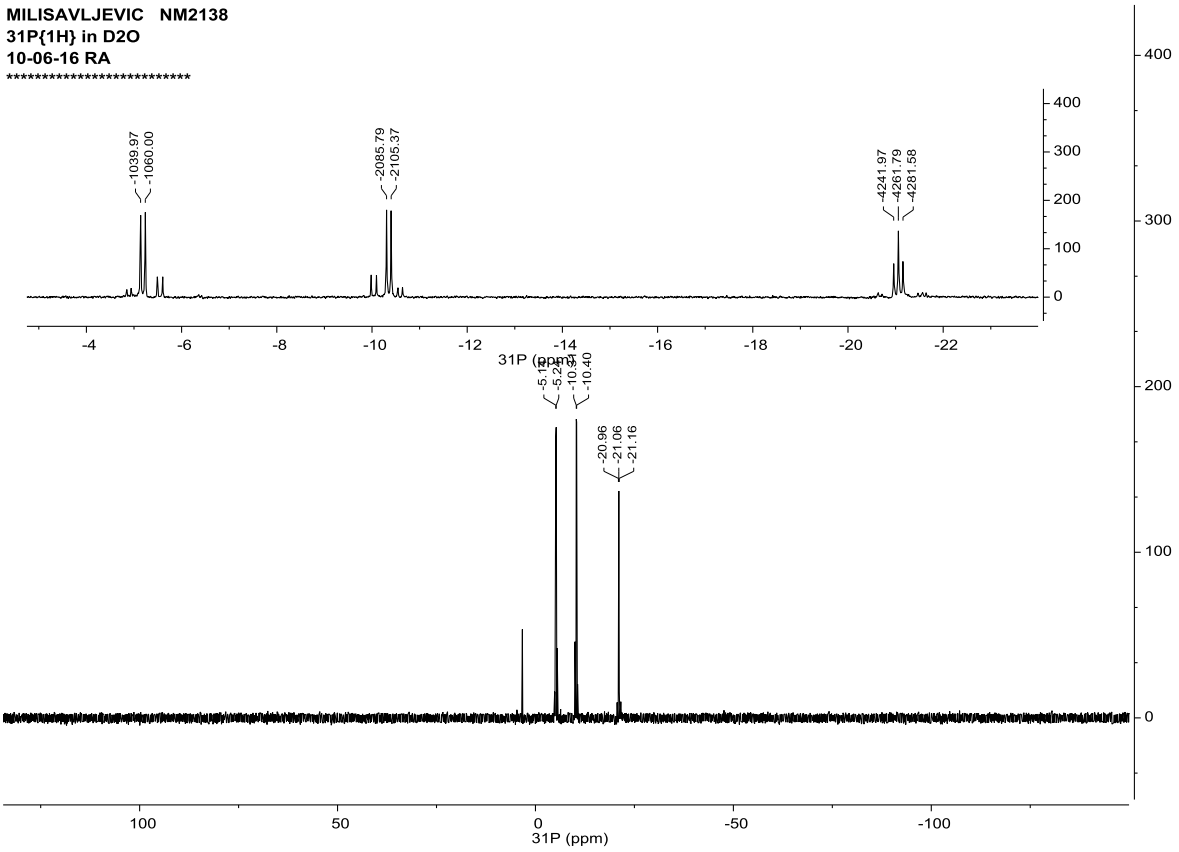

MILISAVLJEVIC NM-AETP
1H NMR in D2O
26-10-16 RA
****
NH2
HO–P–O–P–O–P–O
OH OH
3Na+
8.13
7.82
6.23
6.22
3.75
3.70
1H (ppm)

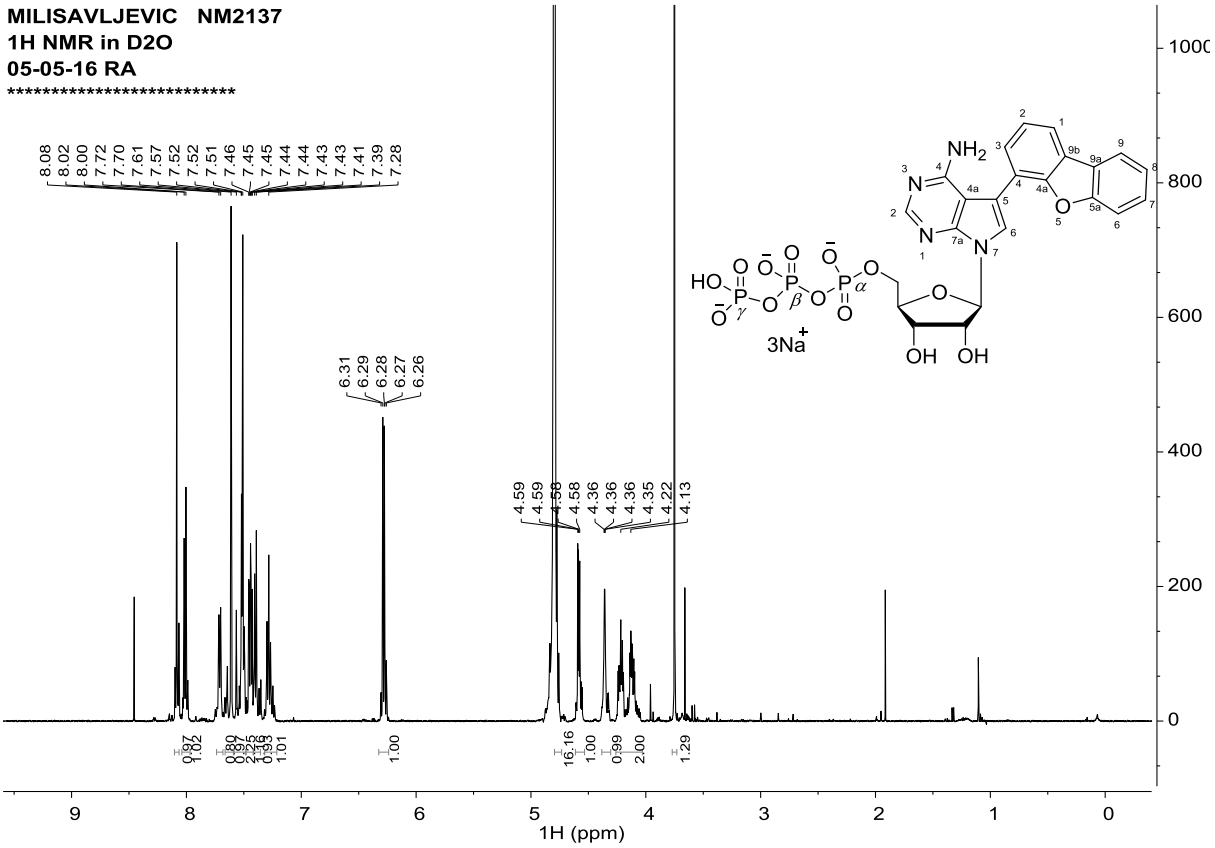

MILISAVLJEVIC NM-AETP
APT in D2O
26-10-16 RA
****
160.08
155.08
151.91
129.78
105.82
98.78
88.57
86.50
86.43
84.53
78.99
76.72
76.58
73.19
72.97
68.13
68.09
13C (ppm)

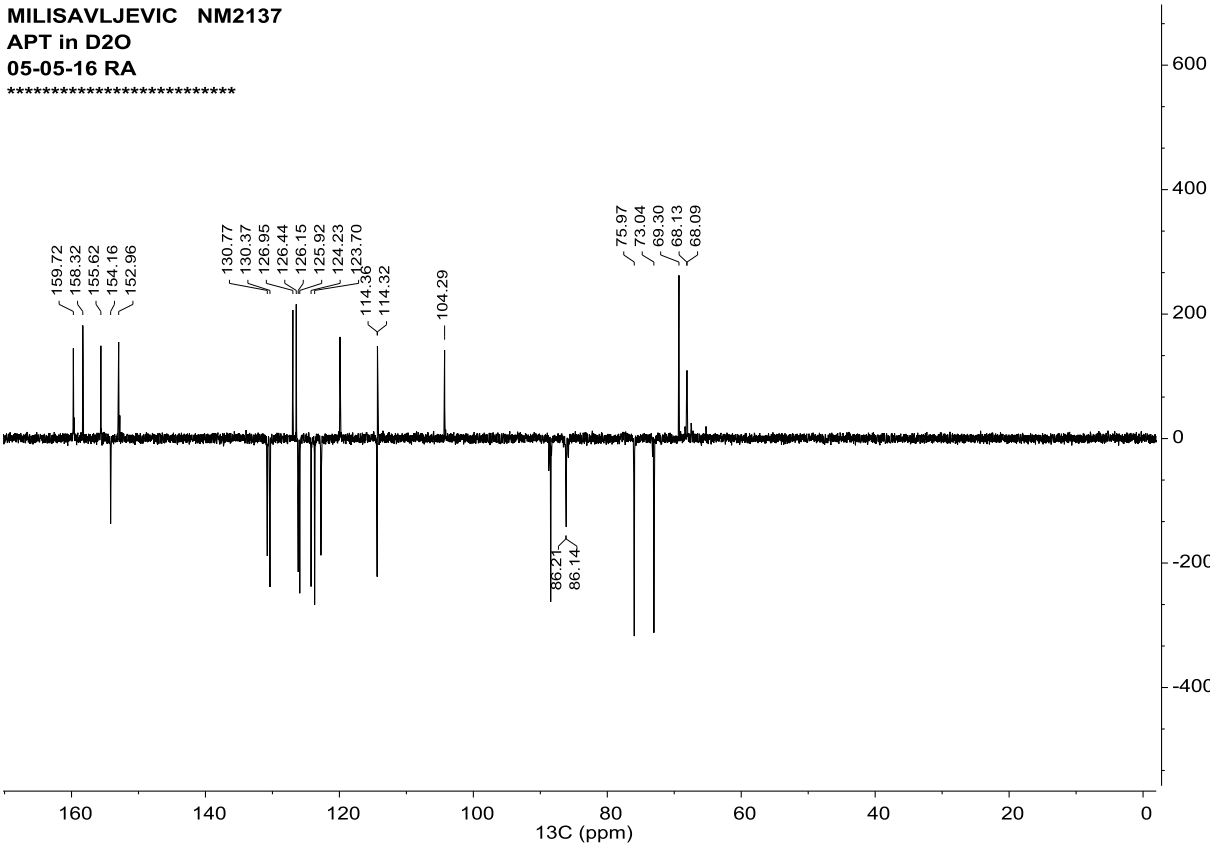

MILISAVLJEVIC NM-AETP
31P{1H} in D2O
26-10-16 RA
****
-1411.91
-1431.69
-2094.79
-2114.40
-4326.54
-4346.15
-4365.78
31P (ppm)
-6.98
-7.07
-10.35
-10.45
-21.38
-21.47
-21.57
31P (ppm)

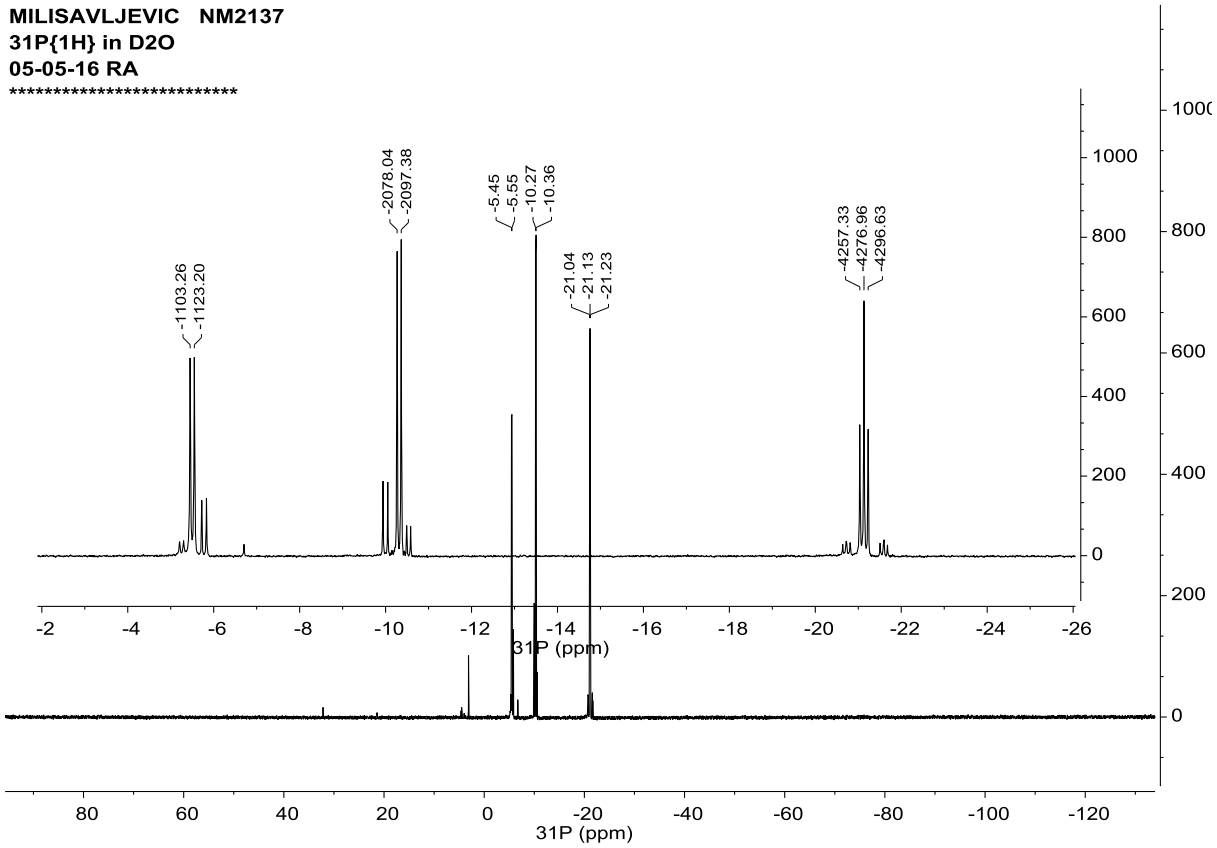

MILISAVLJEVIC NM2138
1H NMR in D2O
10-06-16 RA
****
8.00
7.99
7.95
7.55
7.54
7.53
7.47
7.45
7.24
7.24
7.23
7.22
7.21
7.21
7.08
6.20
6.18
4.76
4.74
4.73
4.64
4.64
4.63
4.62
4.36
4.35
4.35
4.33
4.32
4.32
4.31
4.31
4.30
4.29
4.21
4.20
4.19
4.18
1.8
1.0
0.9
1.8
1.0
1.0
39.5
1.2
1.8
1.1
1H (ppm)
3Na+

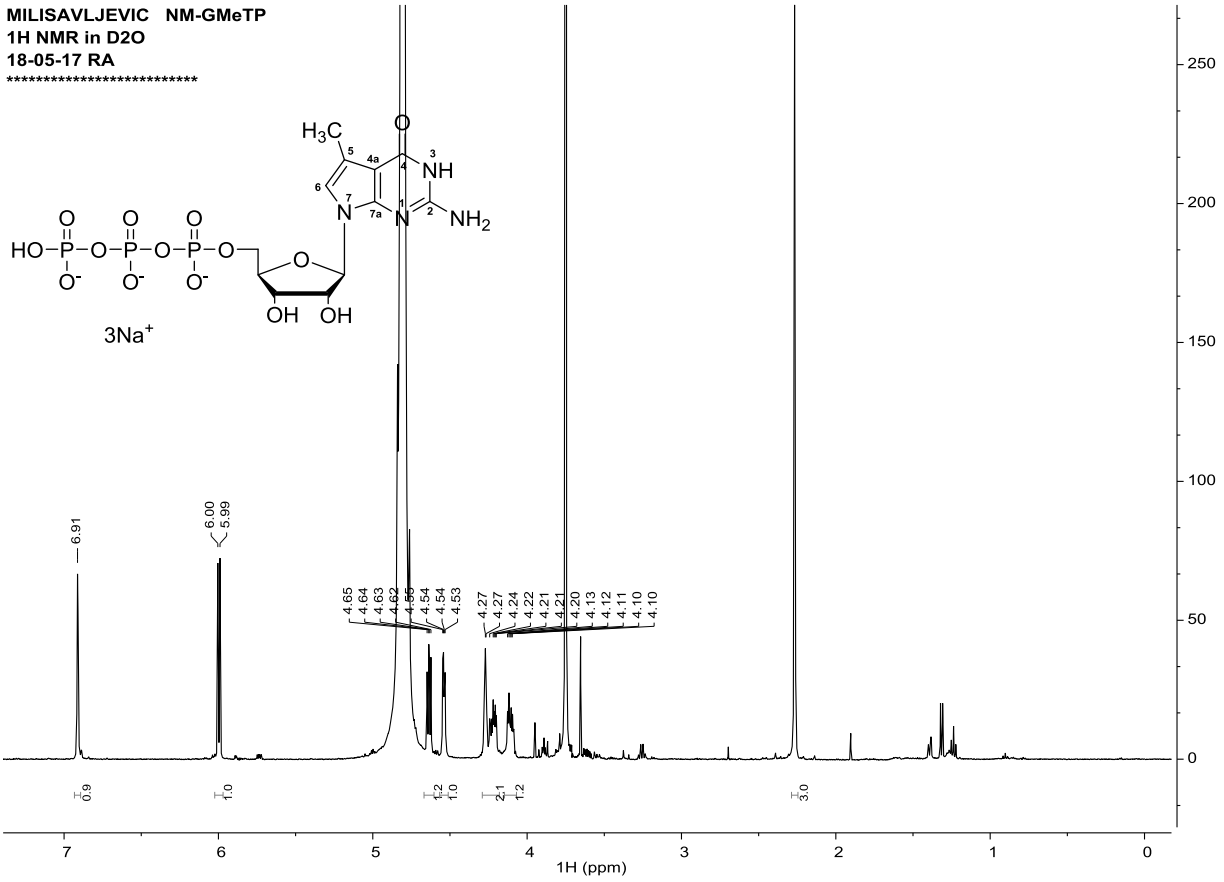

MILISAVLJEVIC NM2138
APT in D2O
10-05-16 RA
****
159.78
156.46
154.34
153.15
152.74
131.41
123.69
113.47
110.37
104.80
102.57
86.36
86.28
76.51
73.10
69.30
68.06
68.02
13C (ppm)

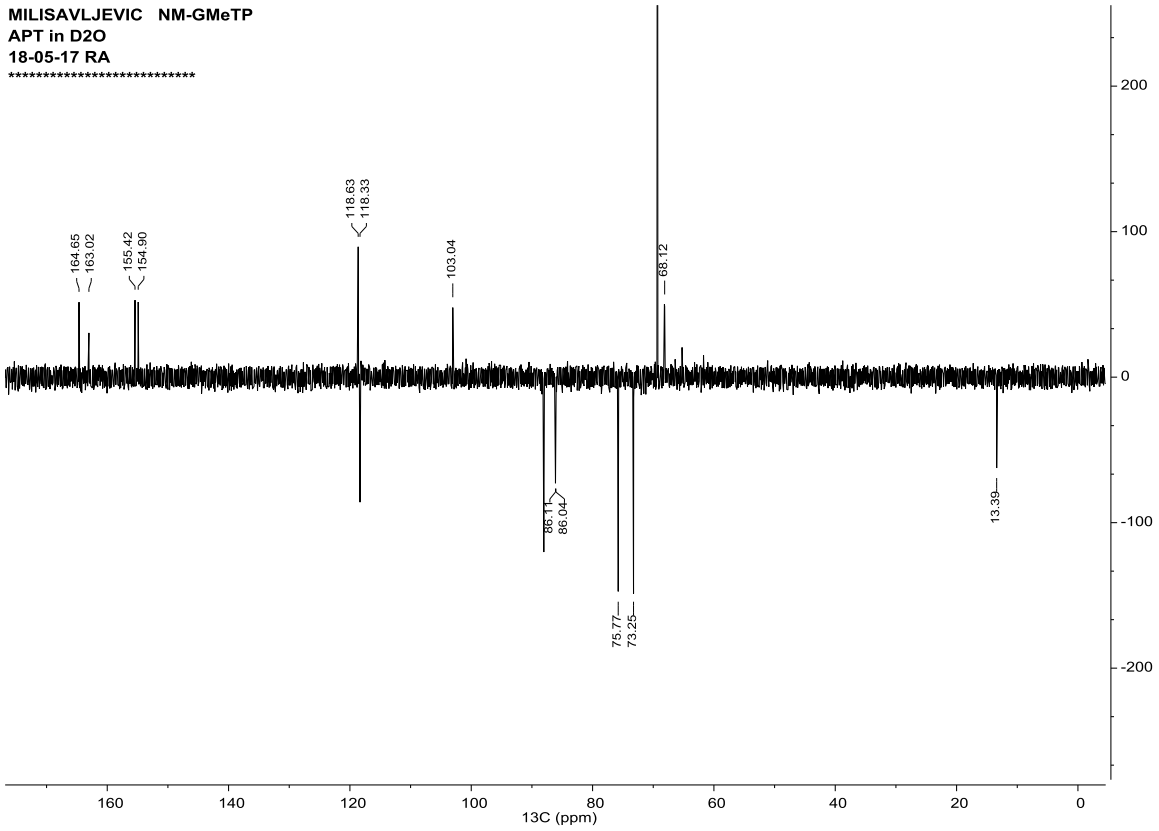

MILISAVLJEVIC NM2138
31P{1H} in D2O
10-06-16 RA
****
-1039.97
-1060.00
-2085.79
-2105.37
-4241.97
-4261.79
-4281.58
31P (ppm)
-5.11
-5.24
-10.34
-10.40
-20.96
-21.06
-21.16
31P (ppm)

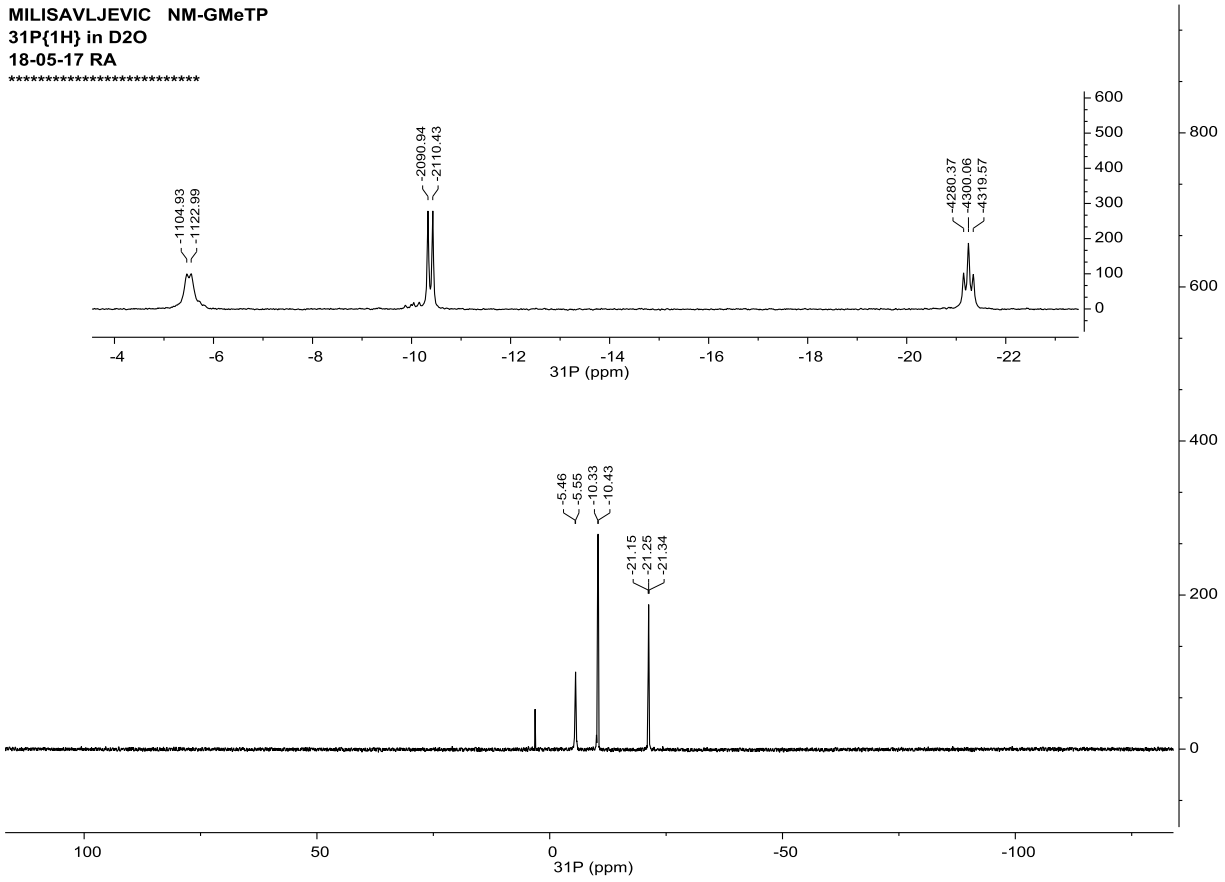

MILISAVLJEVIC NM2137
1H NMR in D2O
05-05-16 RA
****
8.08
8.02
8.00
7.72
7.70
7.61
7.57
7.52
7.52
7.51
7.46
7.45
7.45
7.44
7.44
7.43
7.43
7.41
7.39
7.28
6.31
6.29
6.28
6.27
6.26
4.59
4.59
4.58
4.58
4.36
4.36
4.36
4.35
4.22
4.13
0.97
1.02
1.80
0.97
2.25
0.93
1.01
1.00
16.16
1.00
0.99
2.00
1.29
NH2
HO
3Na+
OH
OH
1H (ppm)

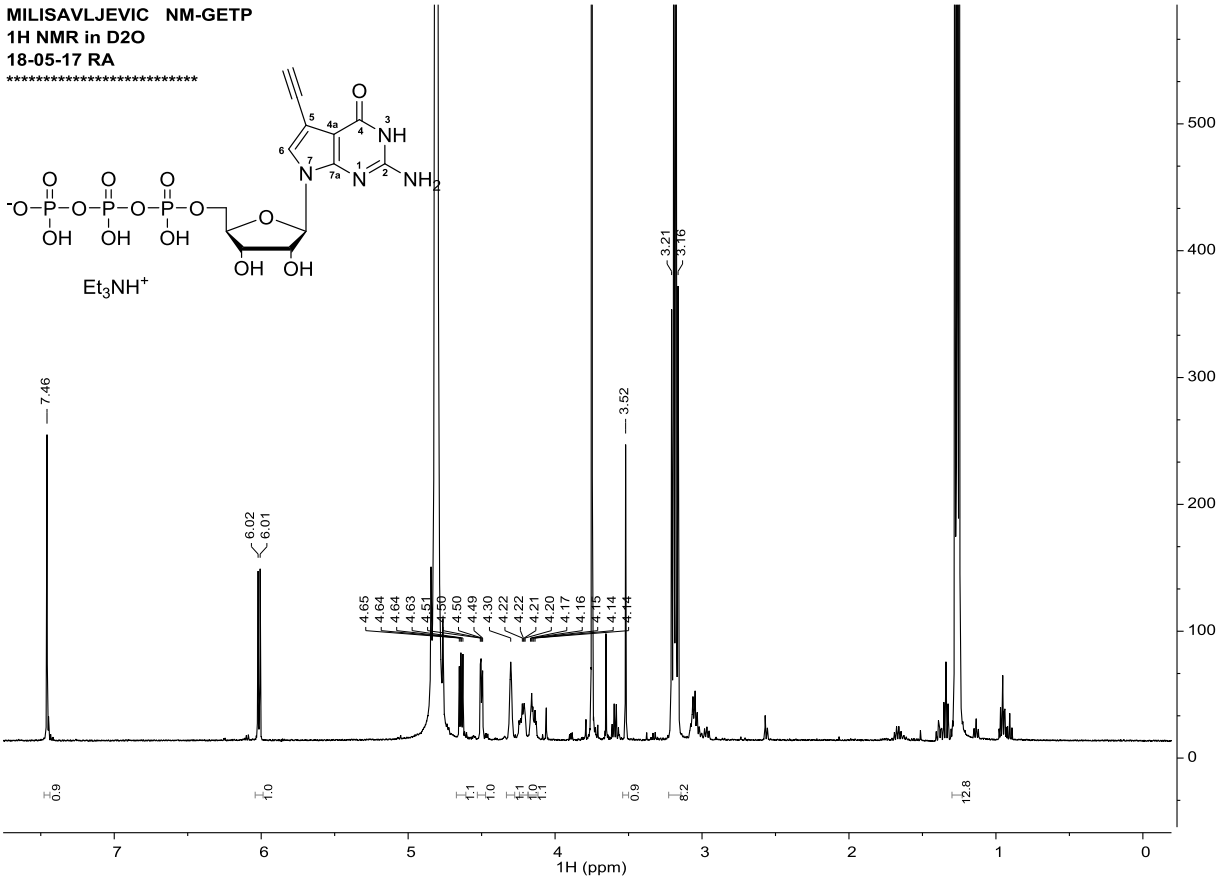

MILISAVLJEVIC NM2137
APT in D2O
05-05-16 RA
****
159.72
158.32
155.62
154.16
152.96
130.77
130.37
126.95
126.44
126.15
125.92
124.23
123.70
114.36
114.32
104.29
75.97
73.04
69.30
68.13
68.09
86.21
86.14
13C (ppm)

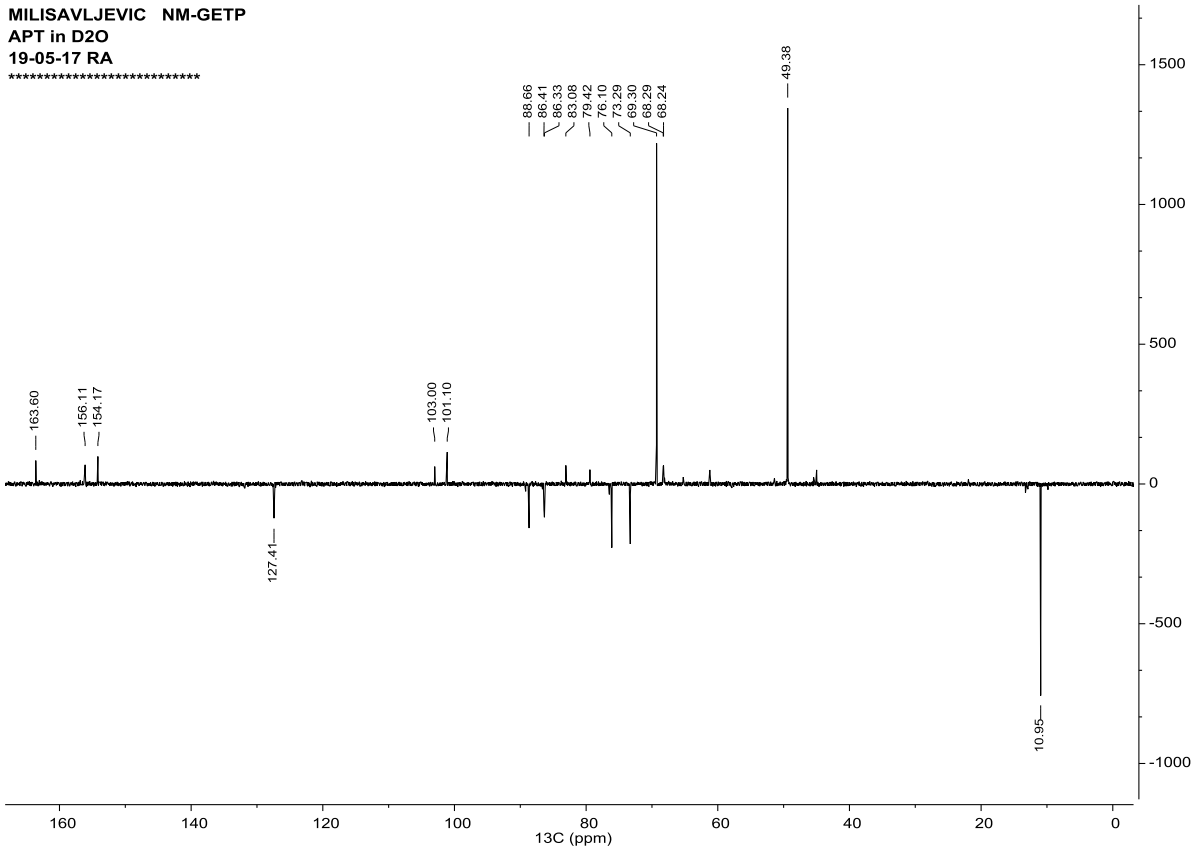

MILISAVLJEVIC NM2137
31P{1H} in D2O
05-05-16 RA
****
-1103.26
-1123.20
-2078.04
-2097.38
-5.45
-5.55
-10.27
-10.36
-21.04
-21.13
-21.23
-4257.33
-4276.96
-4296.63
31P (ppm)
31P (ppm)

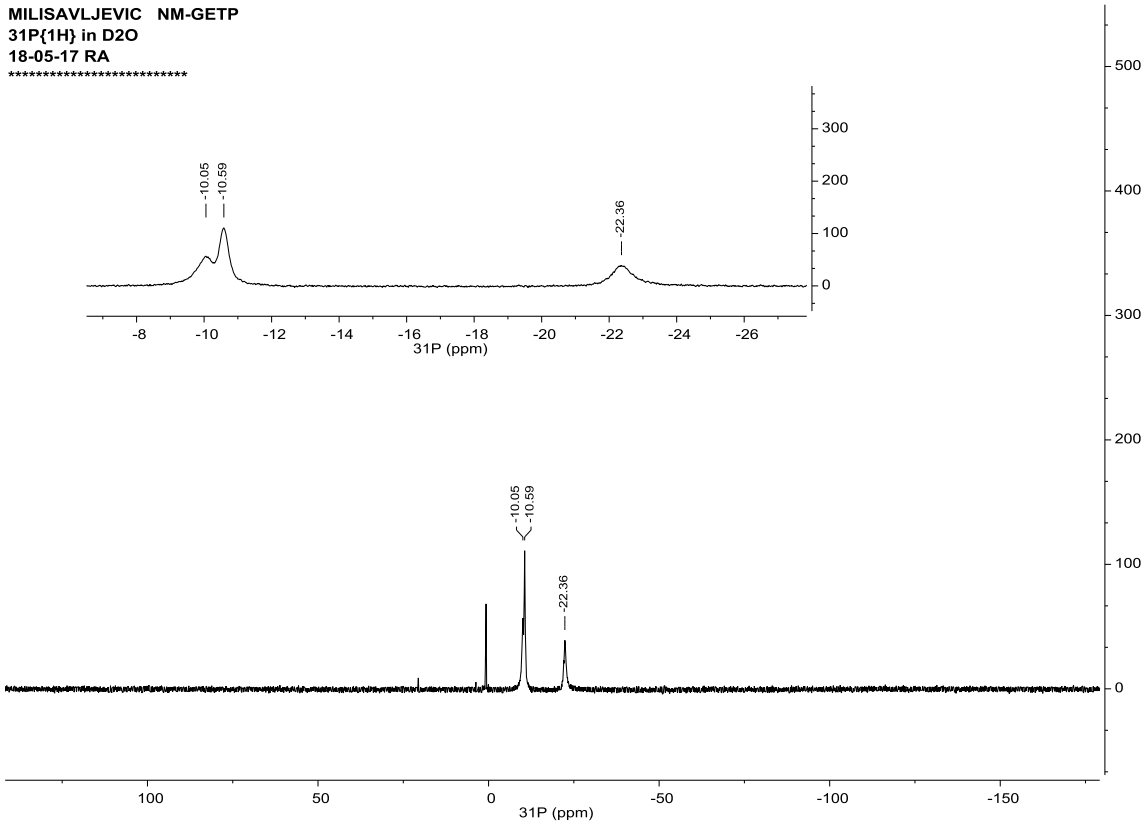

MILISAVLJEVIC NM-GMeTP
1H NMR in D2O
18-05-17 RA
****
3Na+
6.91
6.00
5.99
4.65
4.64
4.63
4.62
4.55
4.54
4.54
4.53
4.27
4.27
4.24
4.22
4.21
4.21
4.20
4.13
4.12
4.11
4.10
4.10
1H (ppm)

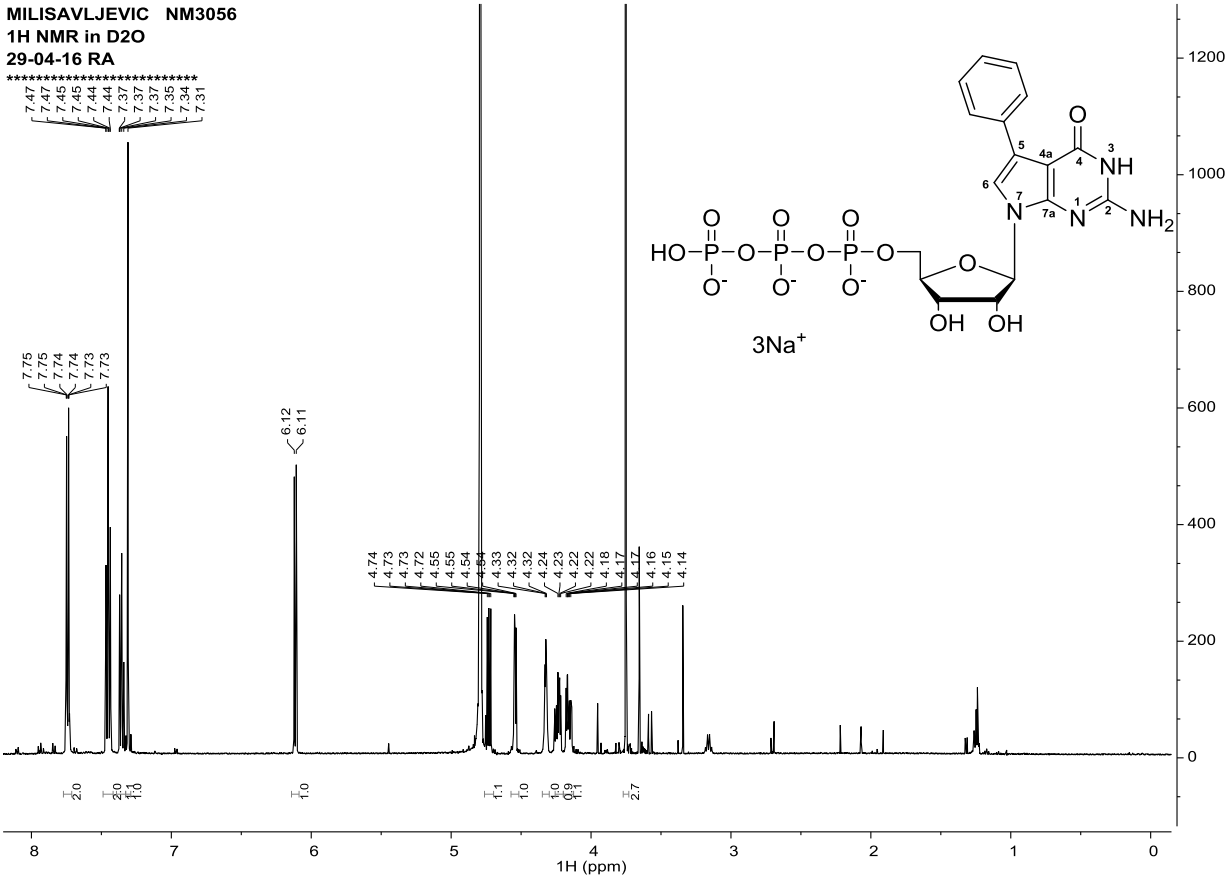

MILISAVLJEVIC NM-GMeTP
APT in D2O
18-05-17 RA
****
164.65
163.02
155.42
154.90
118.63
118.33
103.04
88.12
86.11
86.04
75.77
73.25
13.39
13C (ppm)

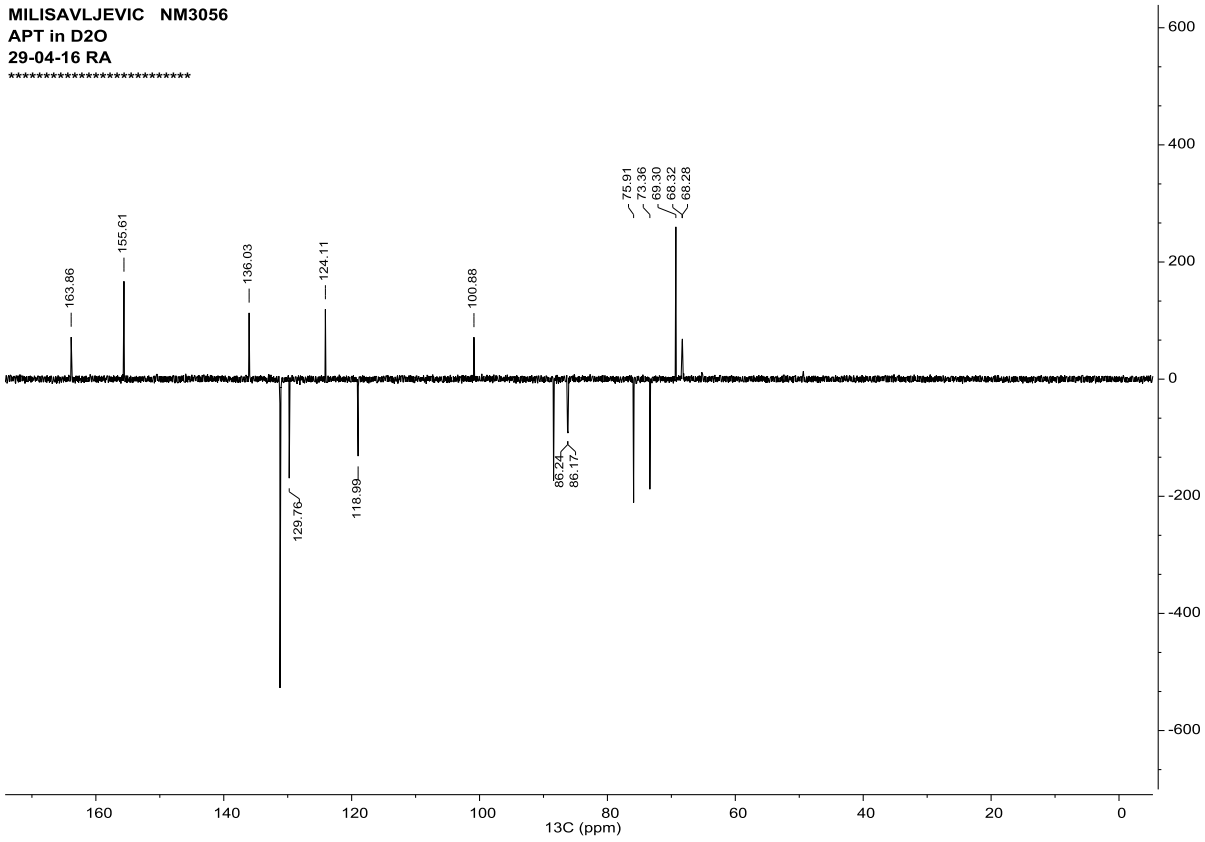

MILISAVLJEVIC NM-GMeTP
31P{1H} in D2O
18-05-17 RA
****
-1104.93
-1122.99
-2090.94
-2110.43
-4280.37
-4300.06
-4319.57
31P (ppm)
-5.46
-5.55
-10.33
-10.43
-21.15
-21.25
-21.34
31P (ppm)

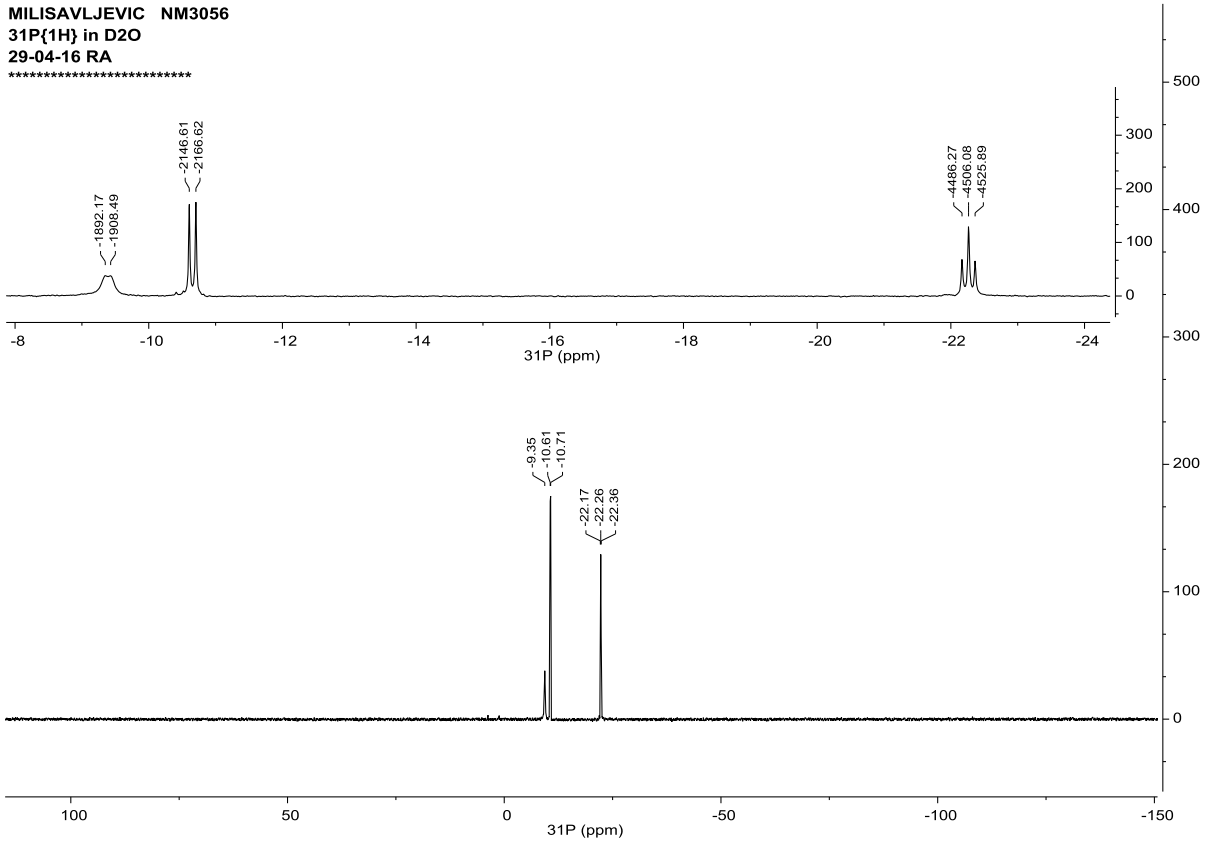

MILISAVLJEVIC NM-GETP
1H NMR in D2O
18-05-17 RA
****
Et3NH+
7.46
6.02
6.01
4.65
4.64
4.64
4.63
4.51
4.50
4.49
4.30
4.22
4.22
4.21
4.20
4.17
4.16
4.15
4.14
4.14
3.52
3.21
3.16
0.9
1.0
2.1
1.0
2.1
2.0
1.1
0.9
8.2
12.8
1H (ppm)

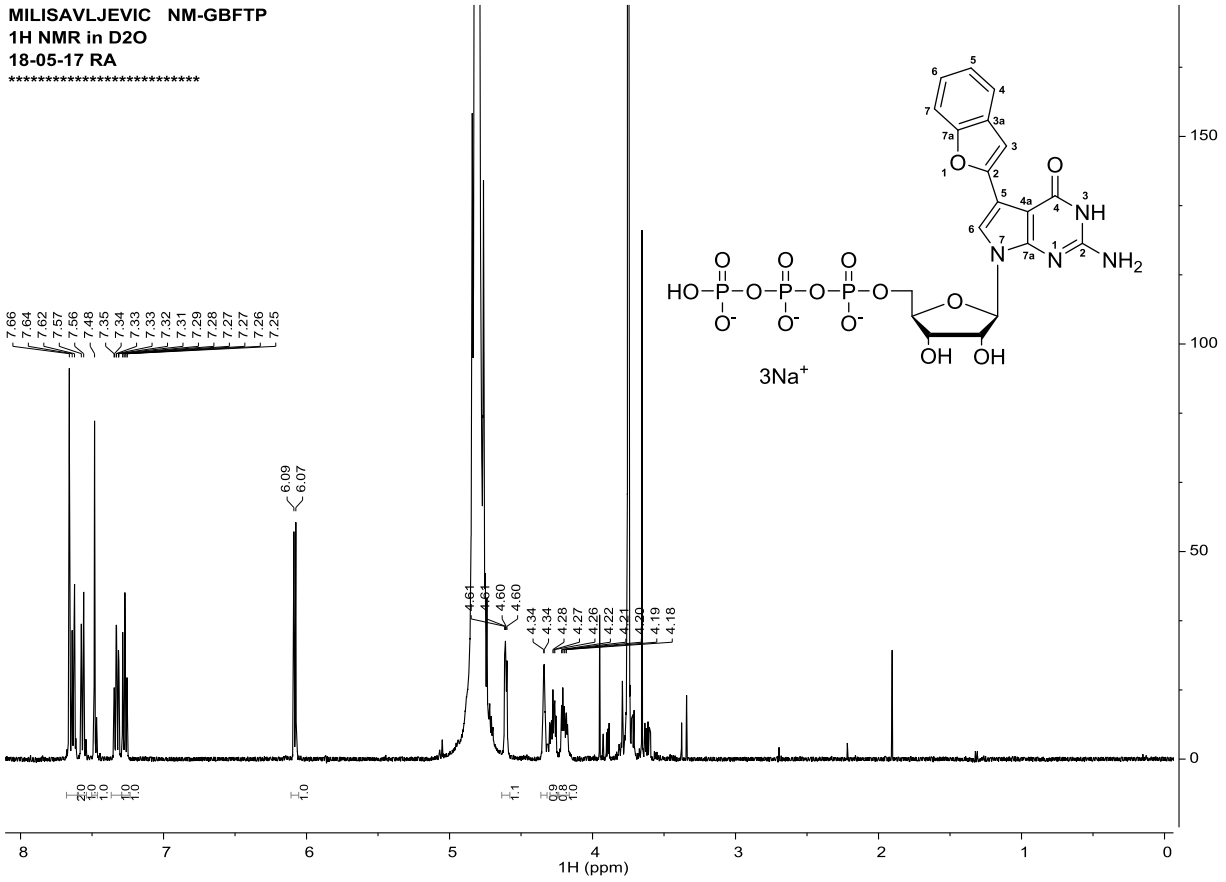

MILISAVLJEVIC NM-GETP
APT in D2O
19-05-17 RA
****
88.66
86.41
86.33
83.08
79.42
76.10
73.29
69.30
68.29
68.24
49.38
163.60
156.11
154.17
103.00
101.10
127.41
10.95
1500
1000
500
0
-500
-1000
160
140
120
100
80
60
40
20
0
13C (ppm)

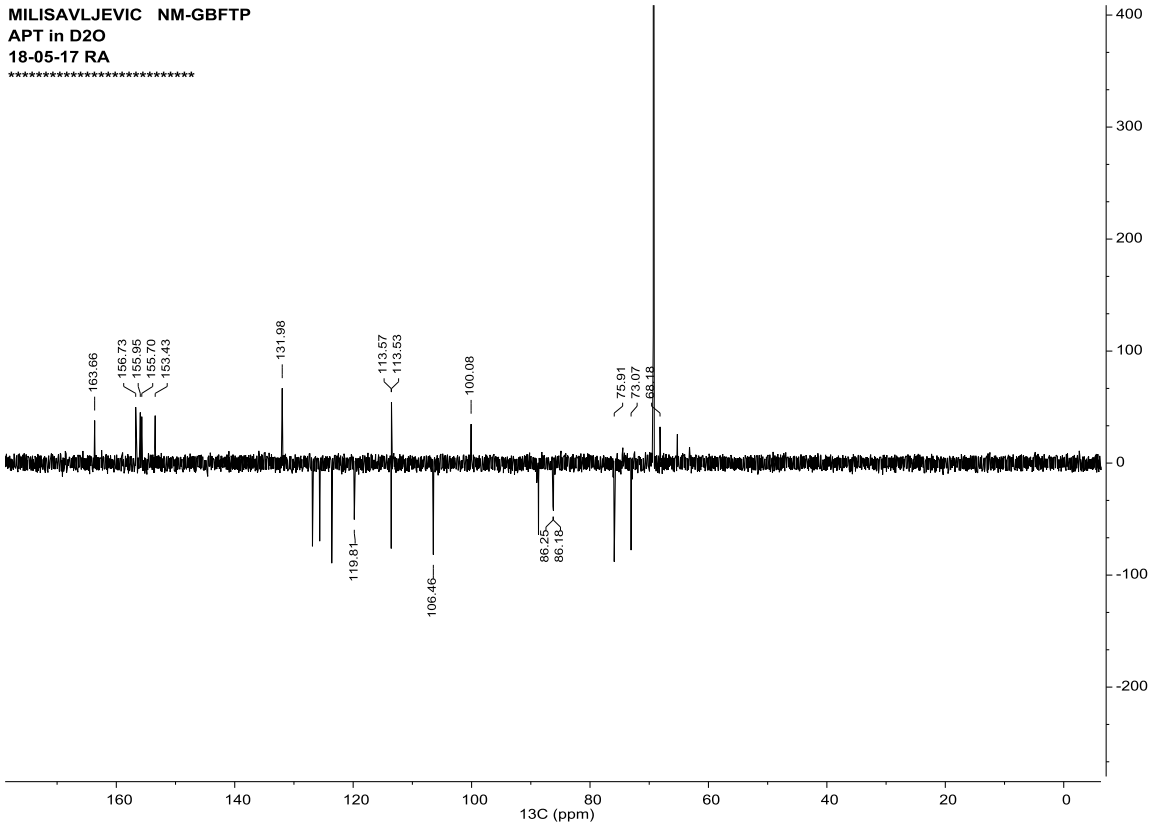

MILISAVLJEVIC NM-GETP
31P{1H} in D2O
18-05-17 RA
****
-10.05
-10.59
-22.36
300
200
100
0
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
31P (ppm)
500
400
300
200
100
0
100
50
0
-50
-100
-150
31P (ppm)

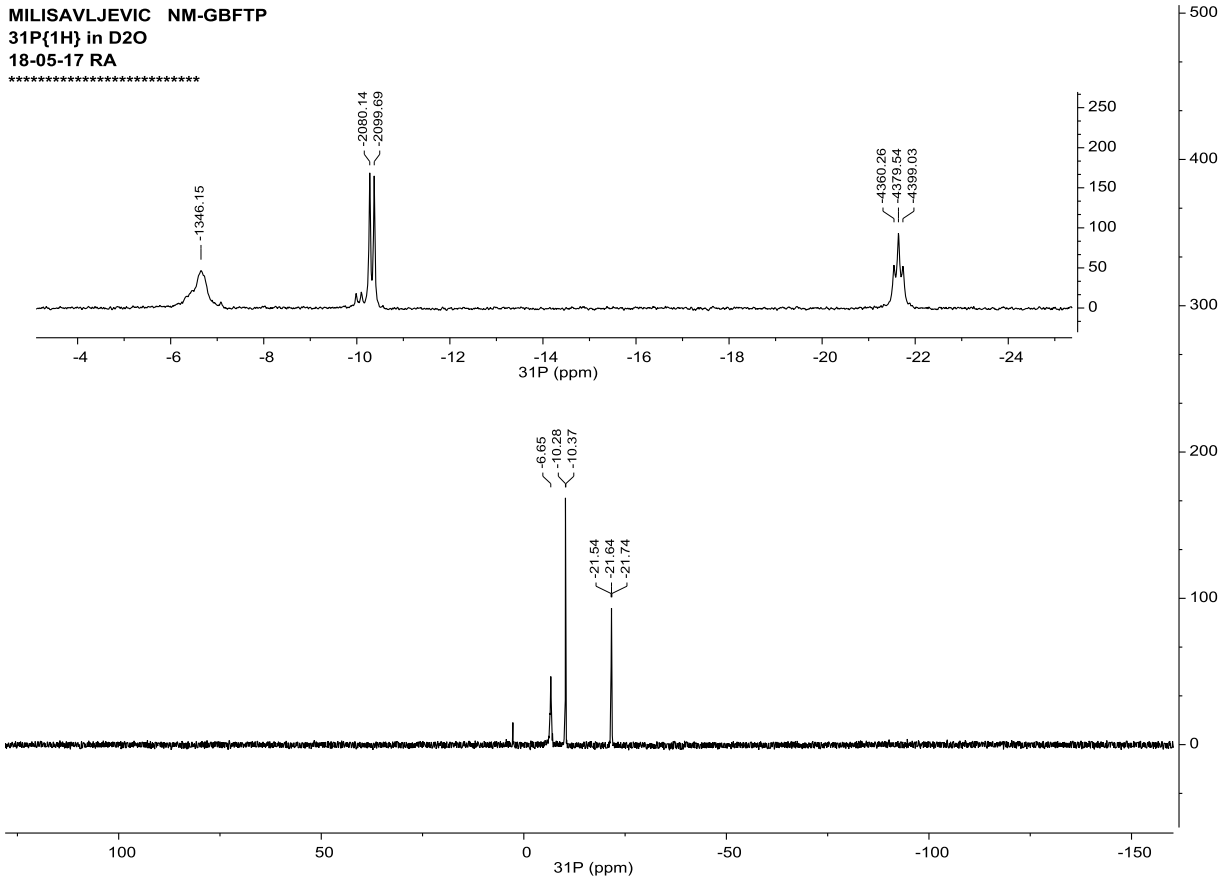

MILISAVLJEVIC NM3056
1H NMR in D2O
29-04-16 RA
****
7.47
7.47
7.45
7.45
7.44
7.44
7.37
7.37
7.37
7.35
7.34
7.31
7.75
7.75
7.74
7.74
7.73
7.73
6.12
6.11
4.74
4.73
4.73
4.72
4.55
4.55
4.54
4.54
4.33
4.32
4.32
4.24
4.23
4.22
4.22
4.18
4.17
4.17
4.16
4.15
4.14
2.0
2.0
1.1
1.0
1.0
1.1
1.0
1.0
0.9
1.1
2.7
1200
1000
800
600
400
200
0
8
7
6
5
4
3
2
1
0
1H (ppm)
HO
P
O
O-
3Na+
OH
OH
NH
NH2
N

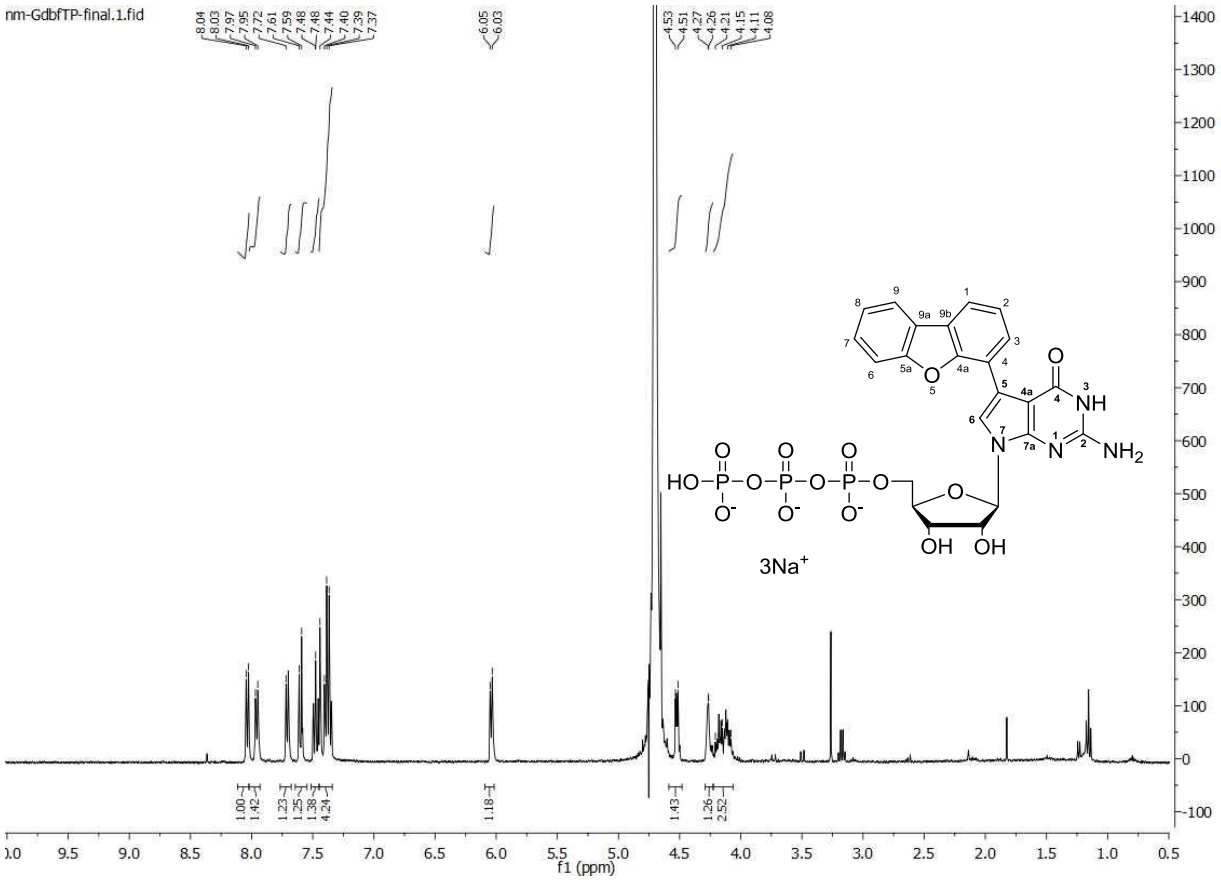

MILISAVLJEVIC NM3056
APT in D2O
29-04-16 RA
****
163.86
155.61
136.03
124.11
100.88
75.91
73.36
69.30
68.32
68.28
129.76
118.99
86.24
86.17
13C (ppm)

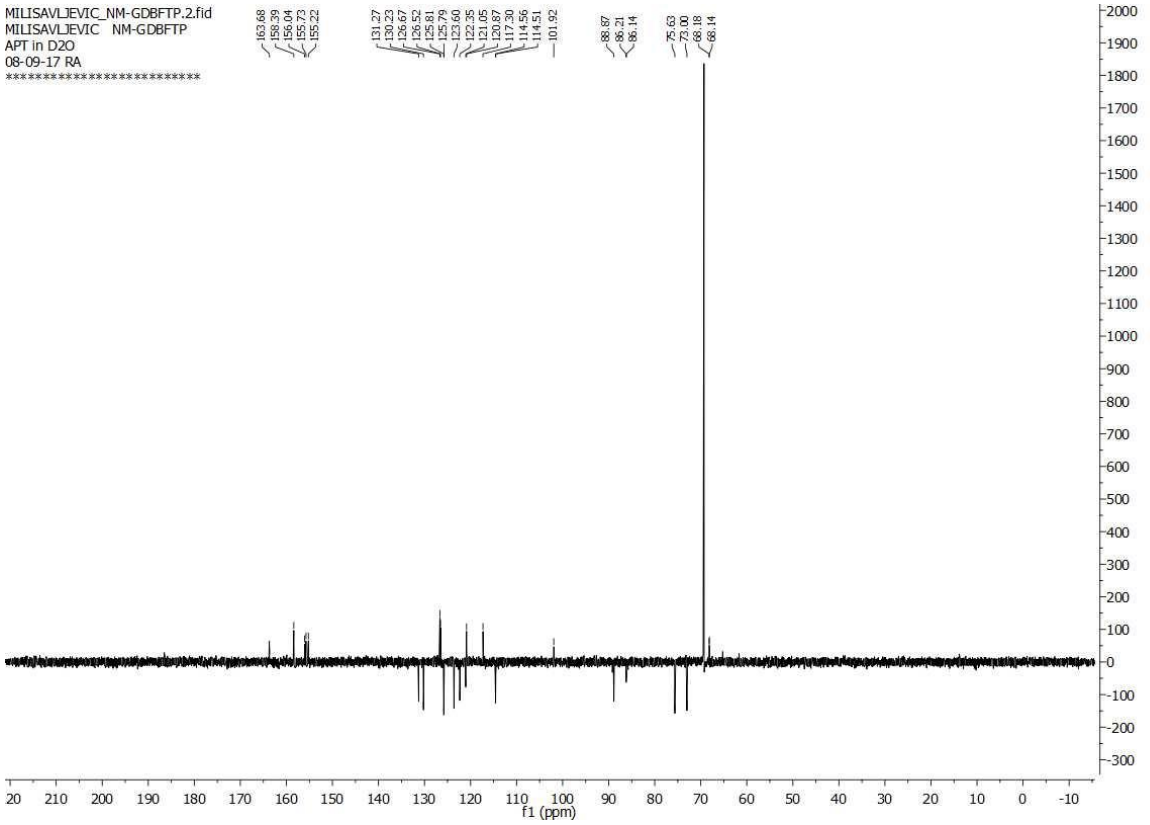

MILISAVLJEVIC NM3056
31P{1H} in D2O
29-04-16 RA
****
-1892.17
-1908.49
-2146.61
-2166.62
-4486.27
-4506.08
-4525.89
31P (ppm)
-9.35
-10.61
-10.71
-22.17
-22.26
-22.36
31P (ppm)

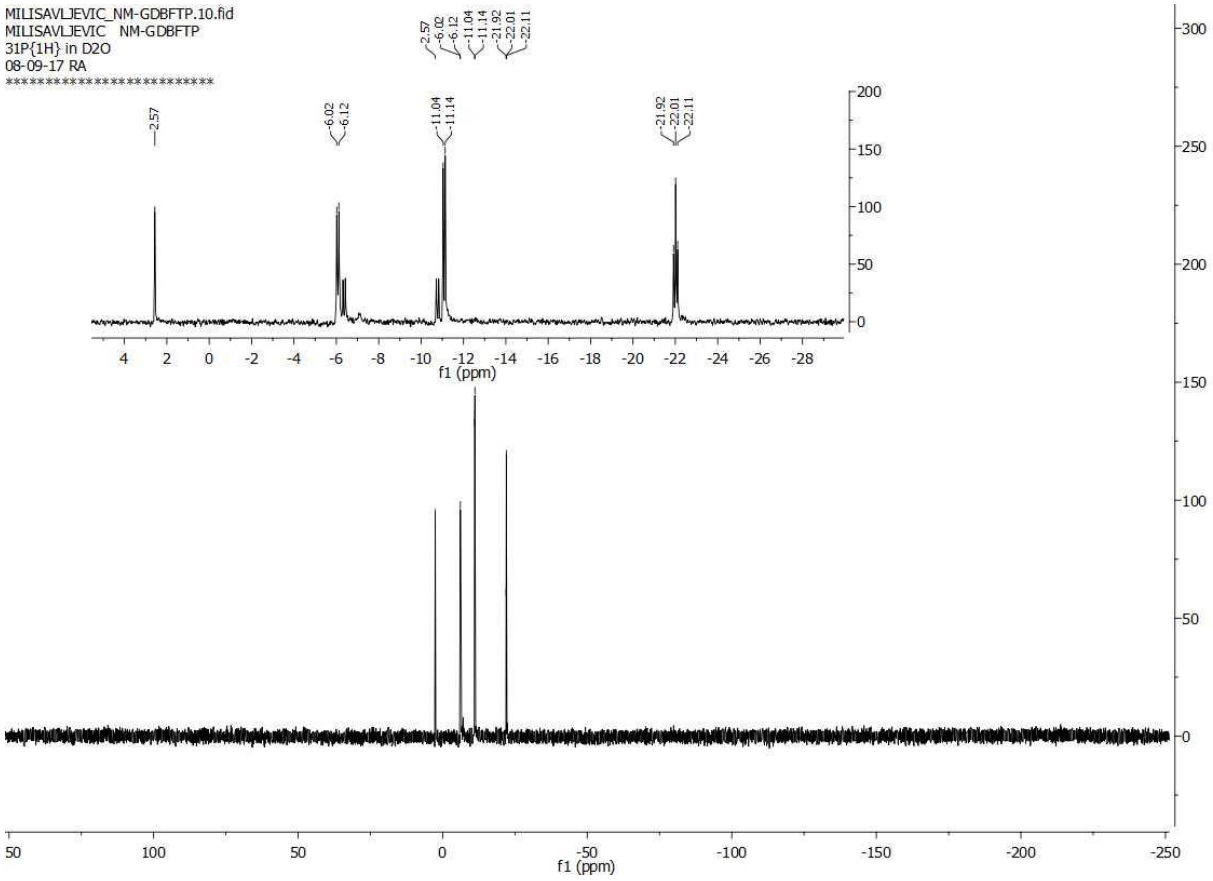

MILISAVLJEVIC NM-GBFTP
1H NMR in D2O
18-05-17 RA
****
7.66
7.64
7.62
7.57
7.56
7.48
7.35
7.34
7.33
7.33
7.32
7.31
7.29
7.28
7.27
7.27
7.26
7.25
6.09
6.07
4.61
4.61
4.60
4.60
4.34
4.34
4.28
4.27
4.26
4.22
4.21
4.20
4.19
4.18
2.0
1.0
1.0
1.0
1.0
1.0
1.1
0.9
0.8
1.0
3Na+
OH OH
1H (ppm)

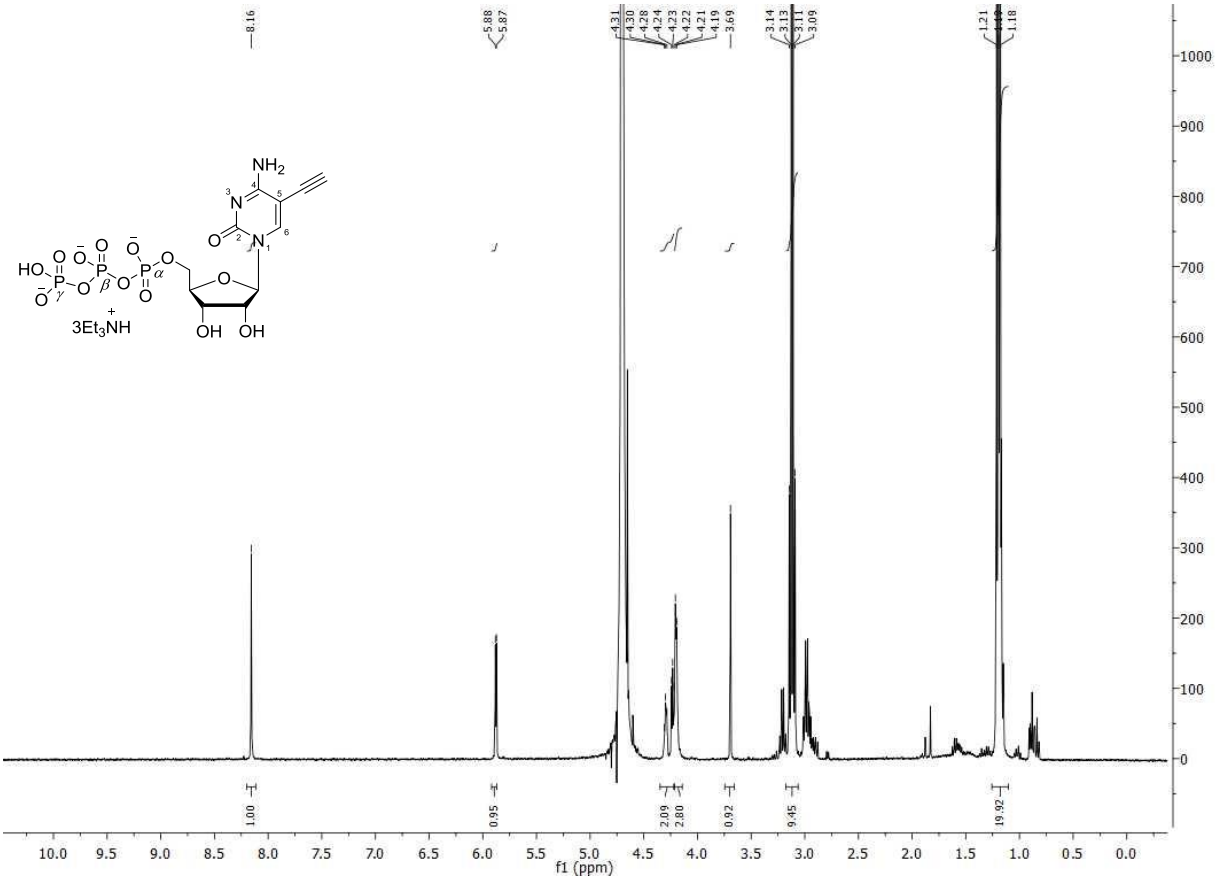

MILISAVLJEVIC NM-GBFTP
APT in D2O
18-05-17 RA
****
163.66
156.73
155.95
155.70
153.43
131.98
113.57
113.53
100.08
75.91
73.07
68.18
119.81
106.46
86.25
86.18
13C (ppm)

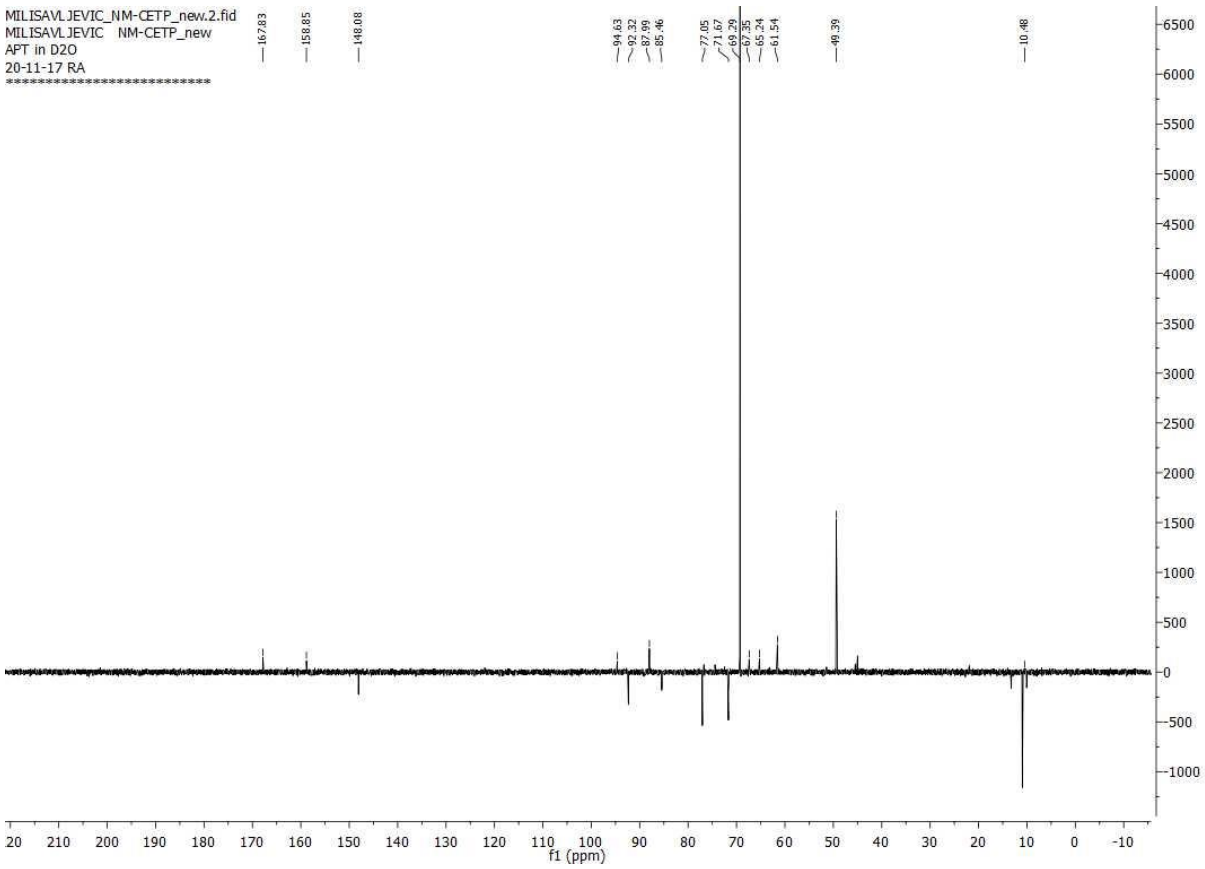

MILISAVLJEVIC NM-GBFTP
31P{1H} in D2O
18-05-17 RA
****
-1346.15
-2080.14
-2099.69
-4360.26
-4379.54
-4399.03
31P (ppm)
-6.65
-10.28
-10.37
-21.54
-21.64
-21.74
31P (ppm)

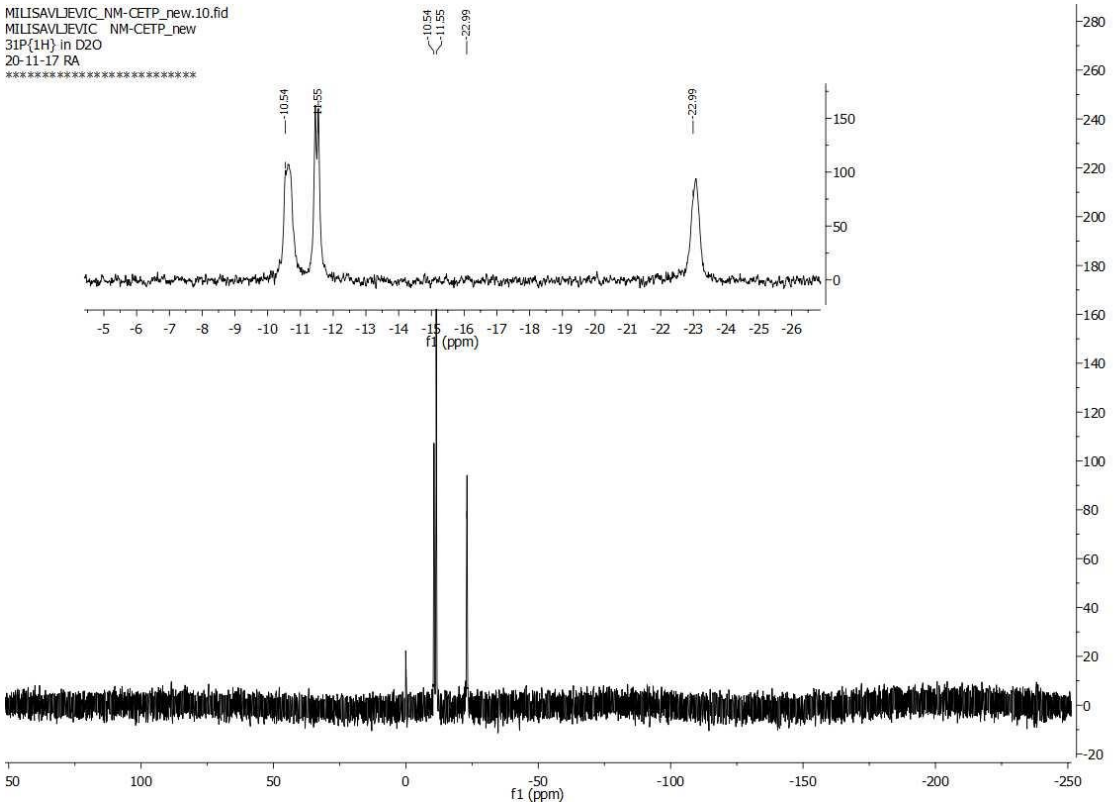

nm-GdbfTP-final.1.fid
8.04
8.03
7.97
7.95
7.72
7.61
7.59
7.48
7.48
7.44
7.40
7.39
7.37
6.05
6.03
4.53
4.51
4.27
4.26
4.21
4.15
4.11
4.08
1.00
1.42
1.23
1.25
1.38
4.24
1.18
1.43
1.26
2.52
f1 (ppm)
HO
P
O
O-
NH
NH2
OH
OH
3Na+

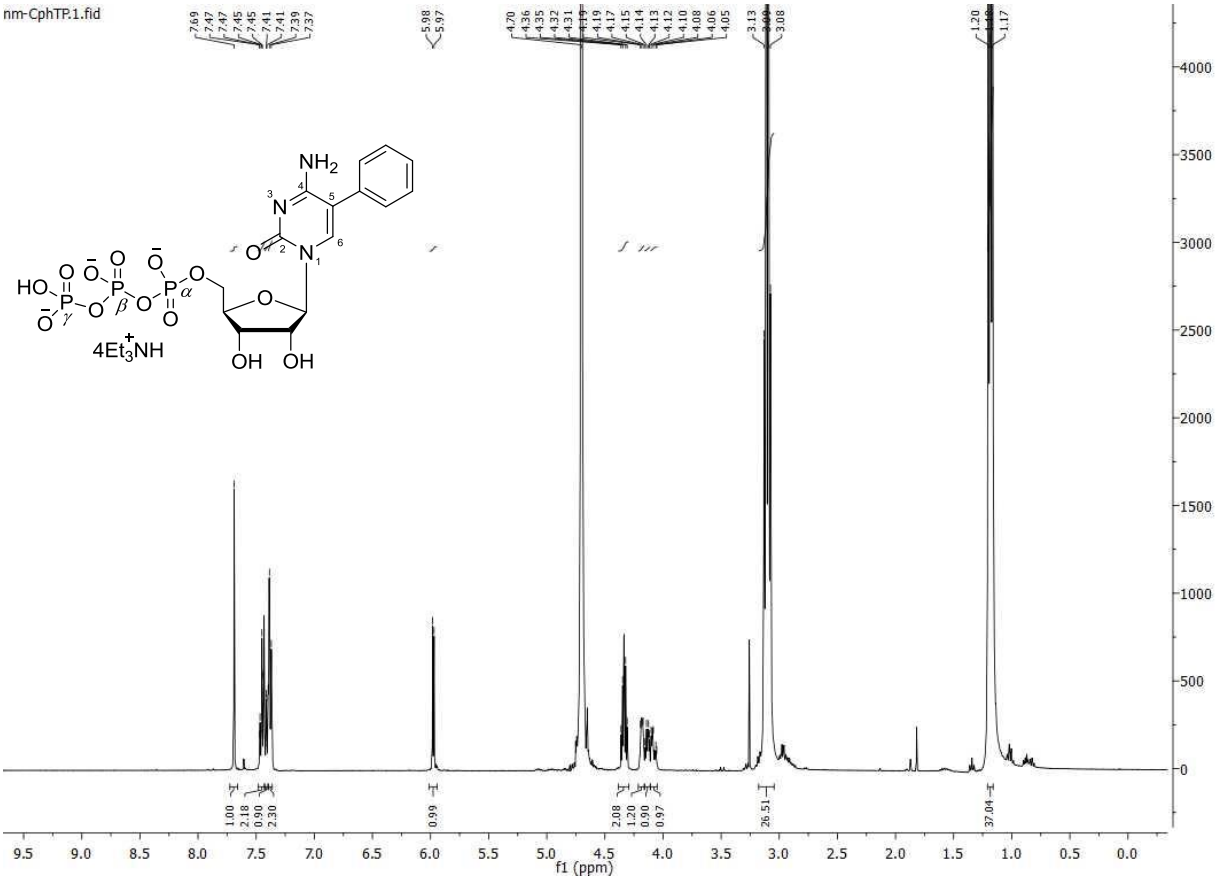

MILISAVLJEVIC_NM-GDBFTP.2.fid
MILISAVLJEVIC NM-GDBFTP
APT in D2O
08-09-17 RA
****
163.68
158.39
156.04
155.73
155.22
131.27
130.23
126.67
126.52
125.91
125.79
123.66
122.35
121.05
120.87
117.30
114.56
114.51
101.92
88.87
86.21
86.14
75.63
73.00
68.18
68.14
f1 (ppm)

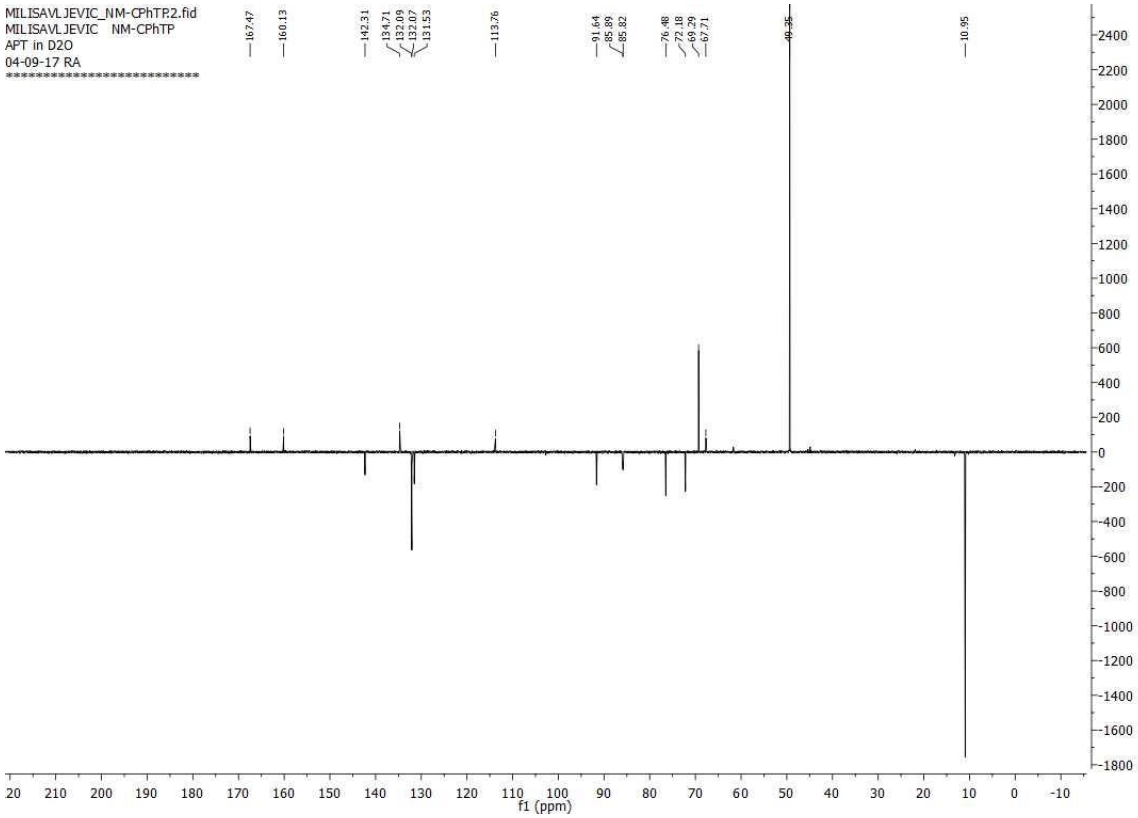

MILISAVLJEVIC_NM-GDBFTP.10.fid
MILISAVLJEVIC NM-GDBFTP
31P{1H} in D2O
08-09-17 RA
****
2.57
-6.02
-6.12
-11.04
-11.14
-21.92
-22.01
-22.11
f1 (ppm)

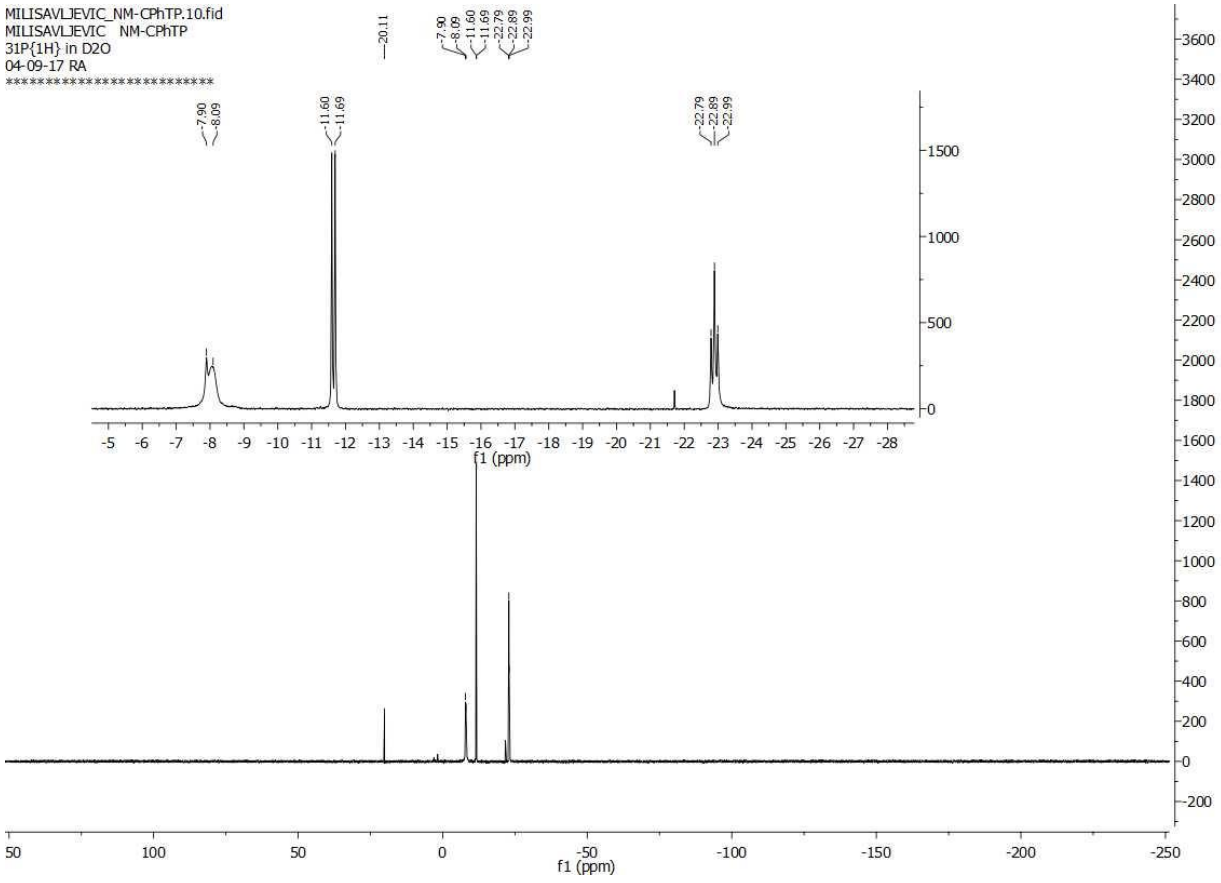

8.16
5.88
5.87
4.31
4.30
4.28
4.24
4.23
4.22
4.21
4.19
3.69
3.14
3.13
3.11
3.09
1.21
1.18
NH2
HO
OH
OH
3Et3NH
1.00
0.95
2.09
2.80
0.92
9.45
19.92
f1 (ppm)

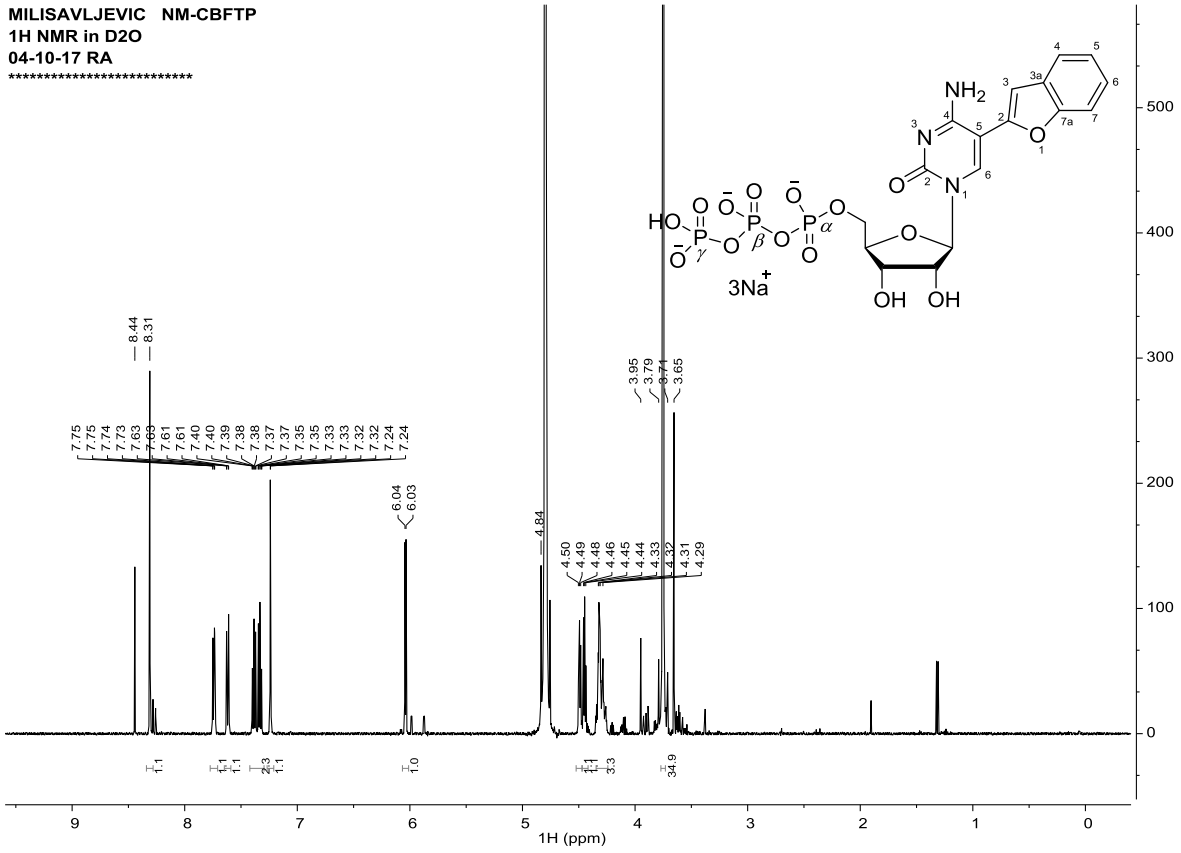

MILISAVLJEVIC_NM-CETP_new.2.fid
MILISAVLJEVIC NM-CETP_new
APT in D2O
20-11-17 RA
16.83
158.85
148.08
94.63
92.32
87.99
85.46
77.05
71.67
69.29
67.35
65.24
61.54
49.39
10.48
f1 (ppm)

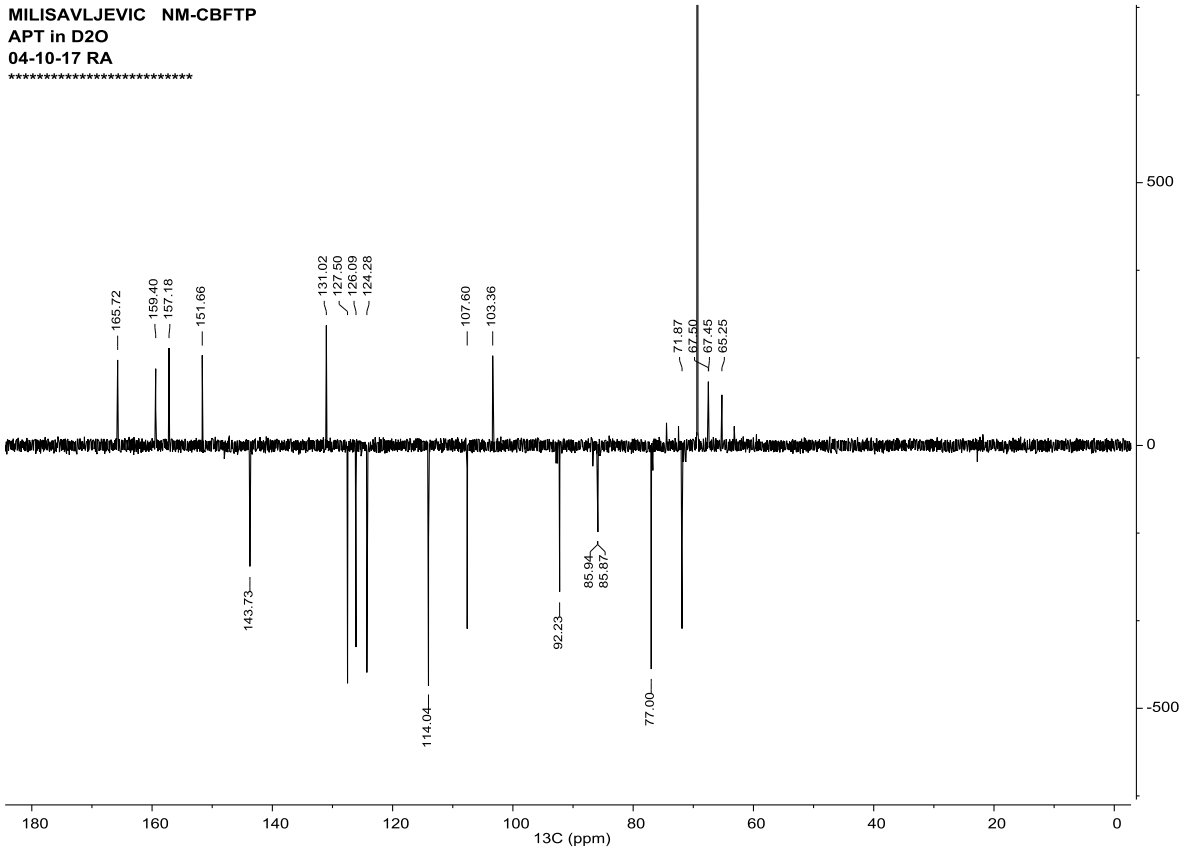

MILISAVLJEVIC_NM-CETP_new.10.fid
MILISAVLJEVIC NM-CETP_new
31P{1H} in D2O
20-11-17 RA
10.54
11.55
22.99
f1 (ppm)

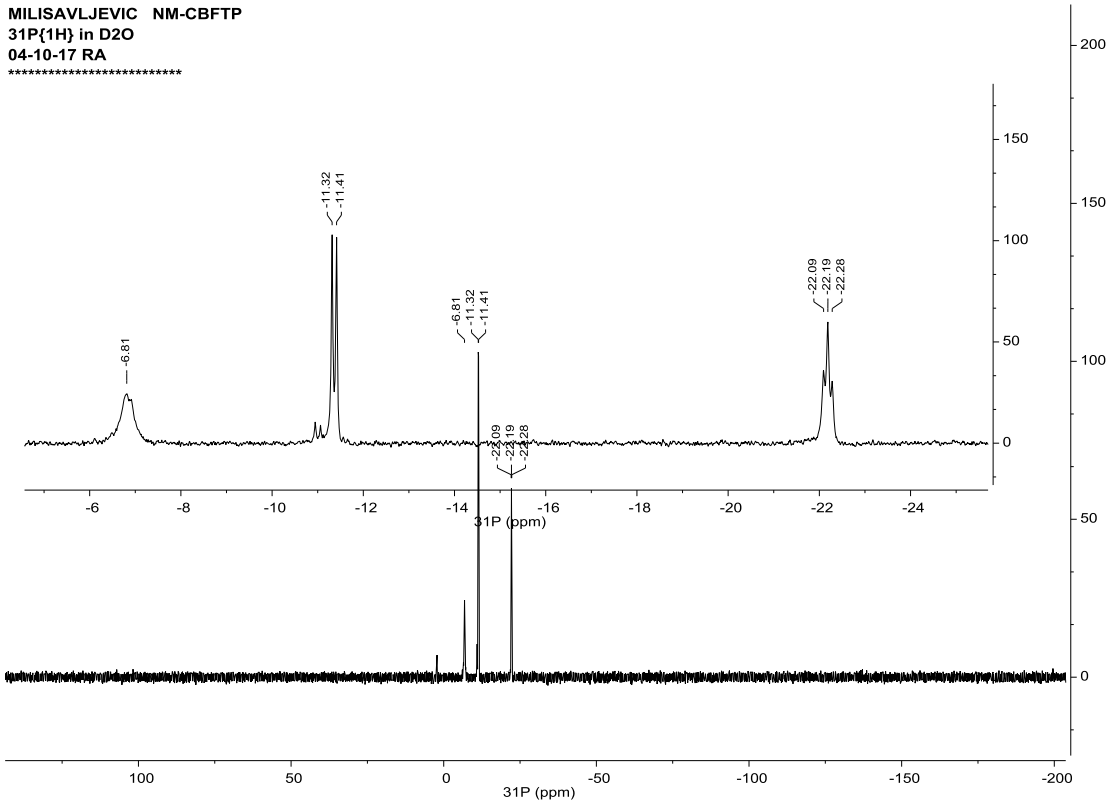

nm-CphTP.1.fid
NH2
OH OH
4Et3NH
f1 (ppm)

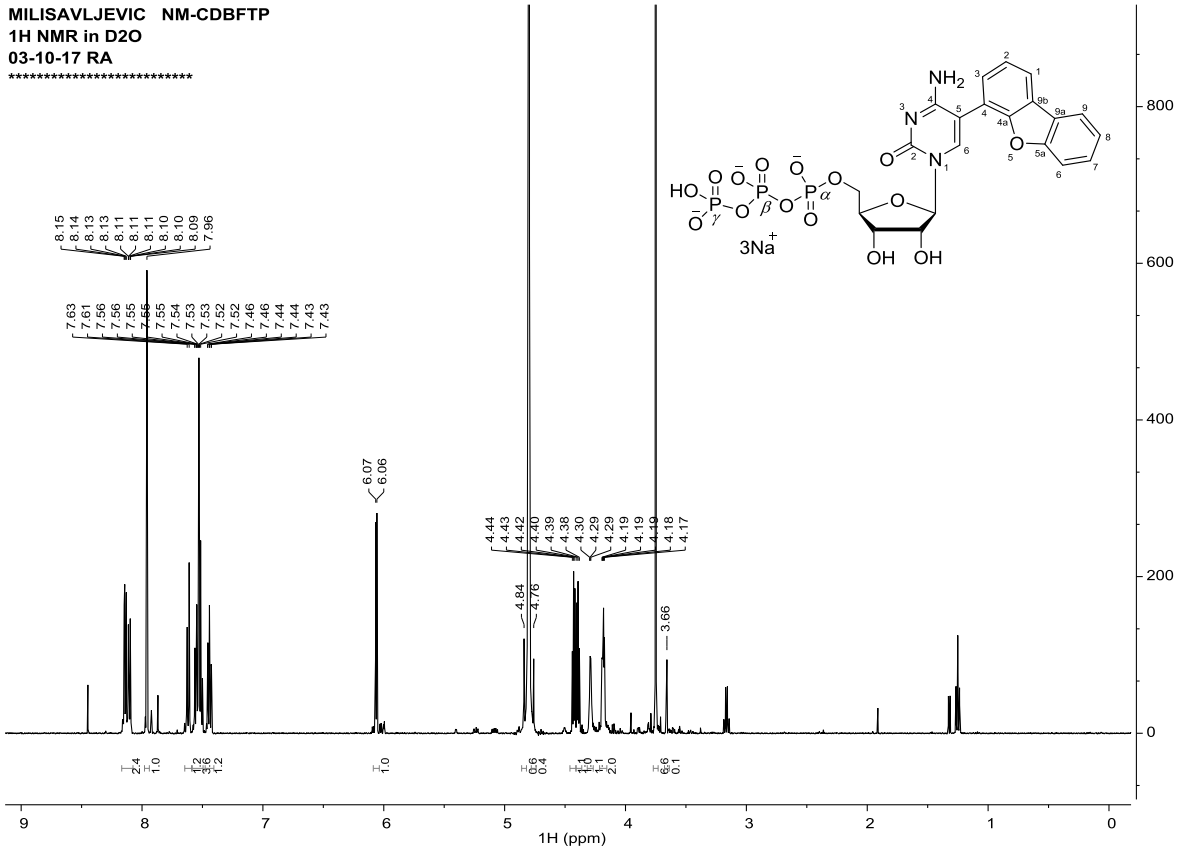

MILISAVLJEVIC_NM-CPhTP.2.fid
MILISAVLJEVIC NM-CPhTP
APT in D2O
04-09-17 RA
167.47
160.13
142.31
134.71
132.09
132.07
131.53
113.76
91.64
85.89
85.82
76.48
72.18
69.29
67.71
49.35
10.95
f1 (ppm)

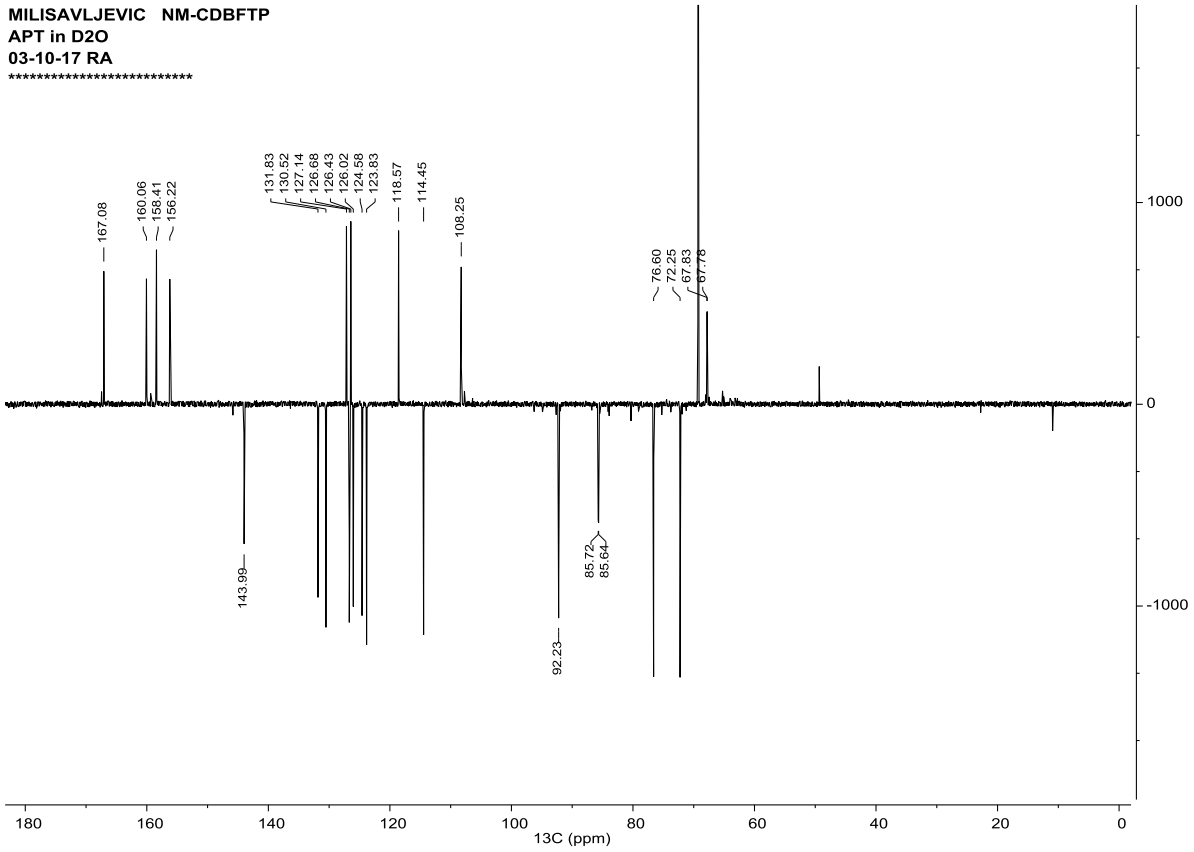

MILISAVLJEVIC_NM-CPhTP.10.fid
MILISAVLJEVIC NM-CPhTP
31P{1H} in D2O
04-09-17 RA
20.11
7.90
8.09
11.60
11.69
22.79
22.89
22.99
f1 (ppm)

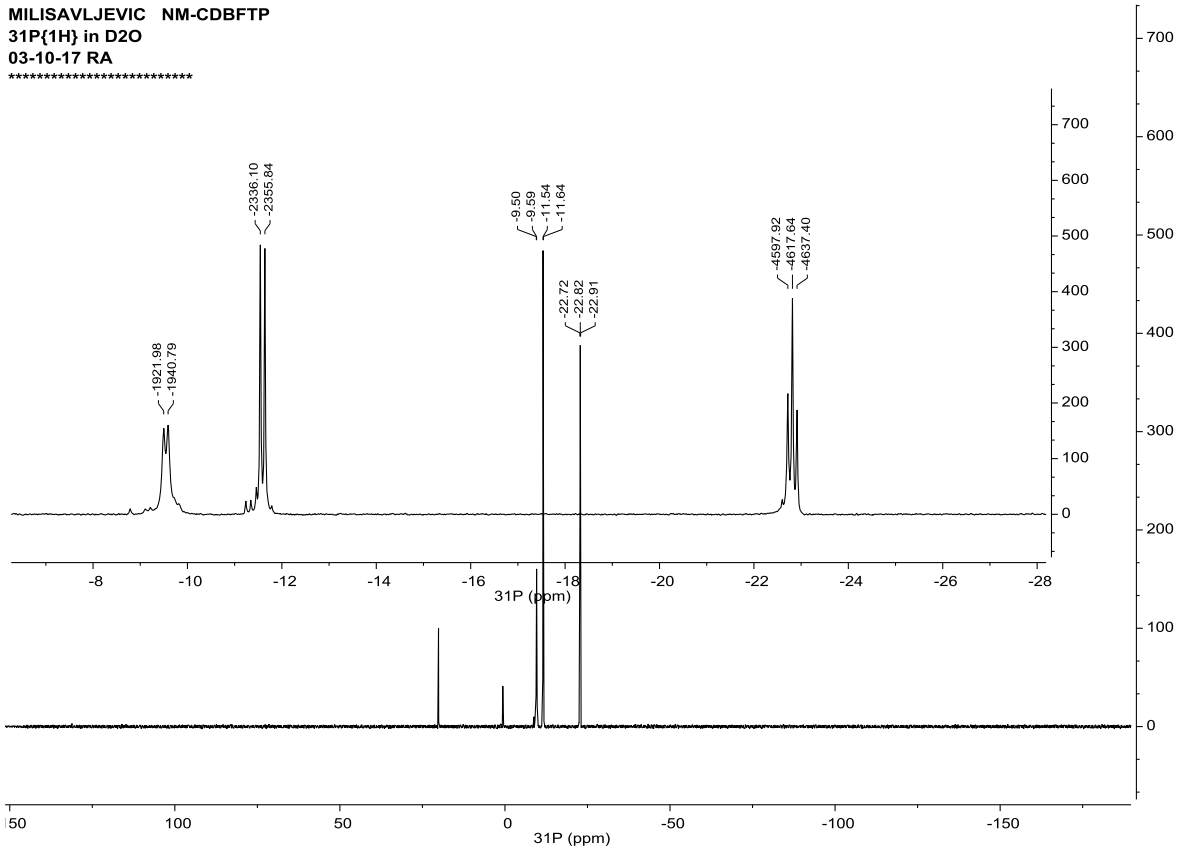

MILISAVLJEVIC NM-CBFTP
1H NMR in D2O
04-10-17 RA
****
8.44
8.31
7.75
7.75
7.74
7.73
7.63
7.63
7.61
7.61
7.40
7.40
7.39
7.38
7.38
7.37
7.37
7.35
7.35
7.33
7.33
7.32
7.32
7.24
7.24
6.04
6.03
4.84
4.50
4.49
4.48
4.46
4.45
4.44
4.33
4.32
4.31
4.29
3.95
3.79
3.71
3.65
1.1
1.1
1.1
2.3
1.1
1.0
1.1
1.1
3.3
34.9
NH2
3Na+
OH
OH
1H (ppm)

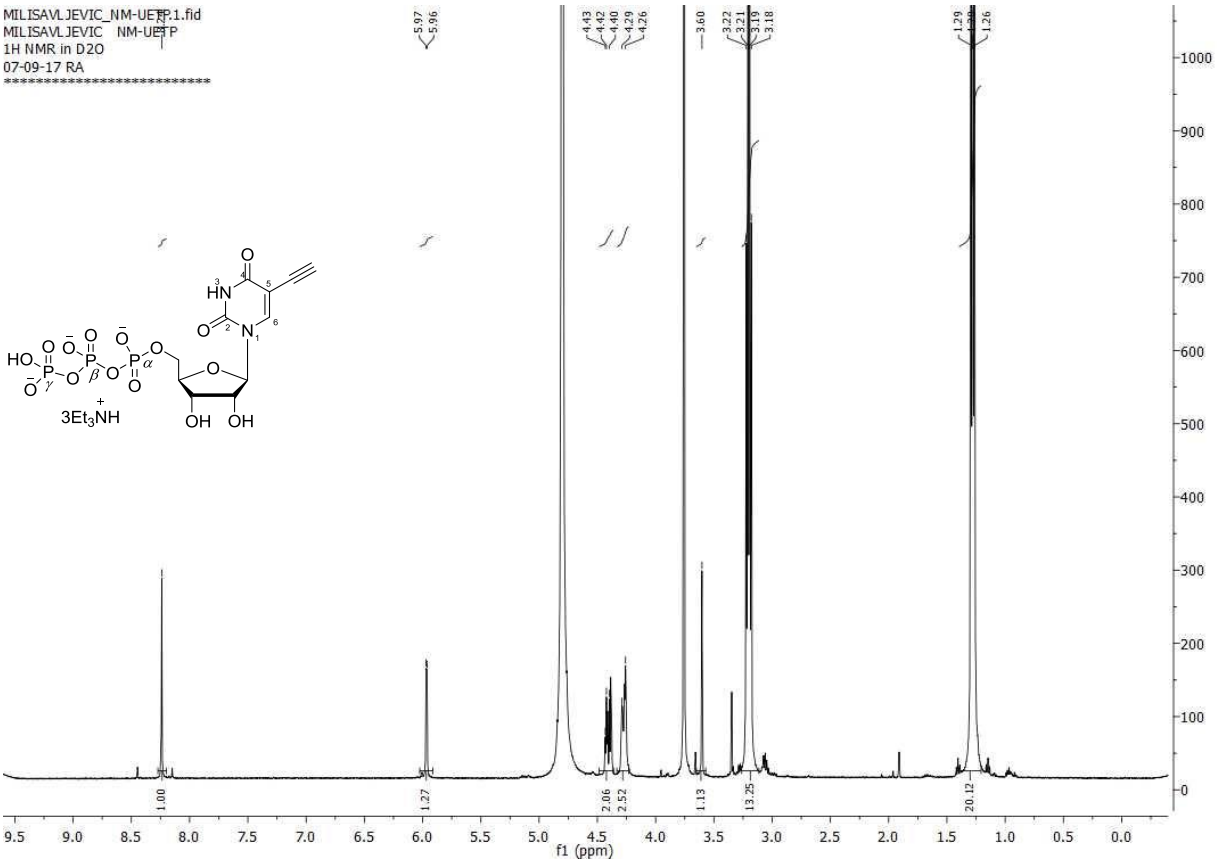

MILISAVLJEVIC NM-CBFTP
APT in D2O
04-10-17 RA
****
165.72
159.40
157.18
151.66
131.02
127.50
126.09
124.28
107.60
103.36
71.87
67.50
67.45
65.25
143.73
114.04
92.23
85.94
85.87
77.00
500
0
-500
180
160
140
120
100
80
60
40
20
0
13C (ppm)

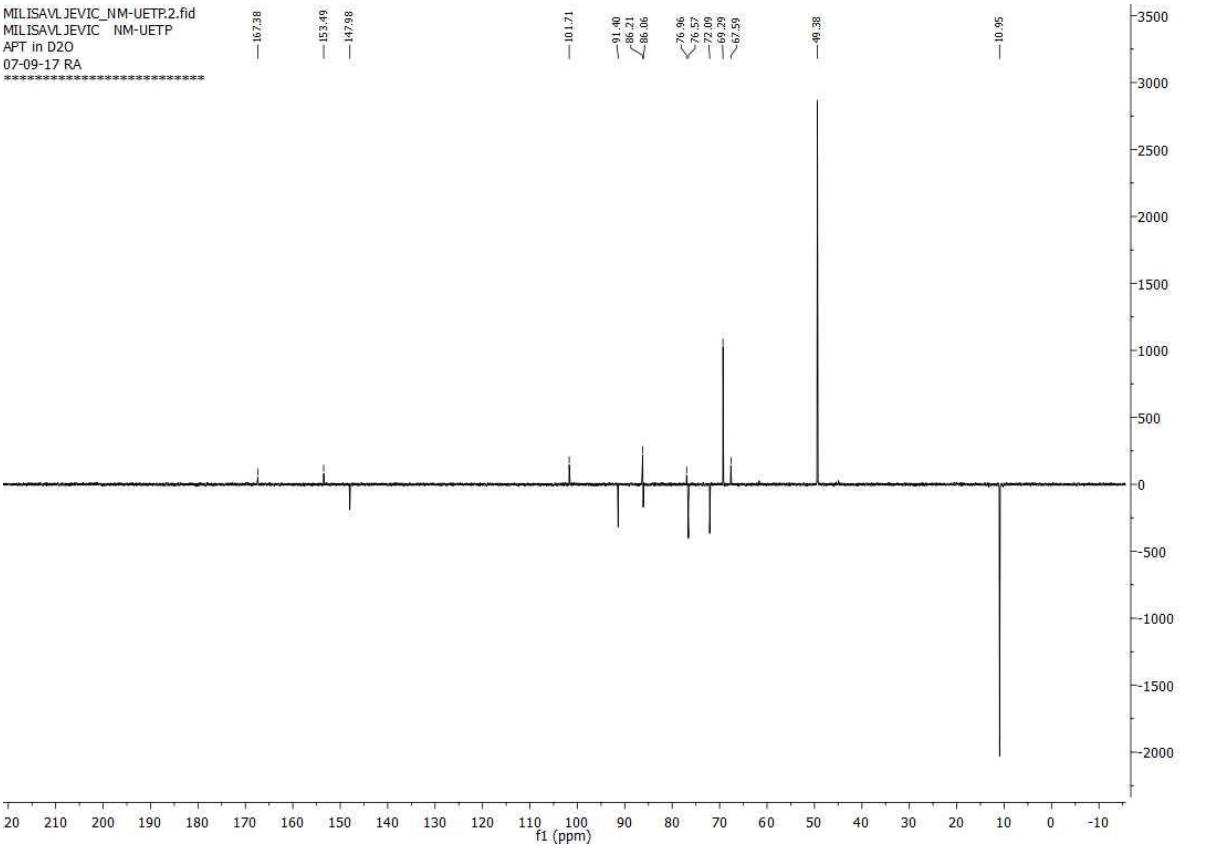

MILISAVLJEVIC NM-CBFTP
31P{1H} in D2O
04-10-17 RA
****
-6.81
-11.32
-11.41
-22.09
-22.19
-22.28
200
150
100
50
0
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
31P (ppm)
100
50
0
-50
-100
-150
-200
31P (ppm)

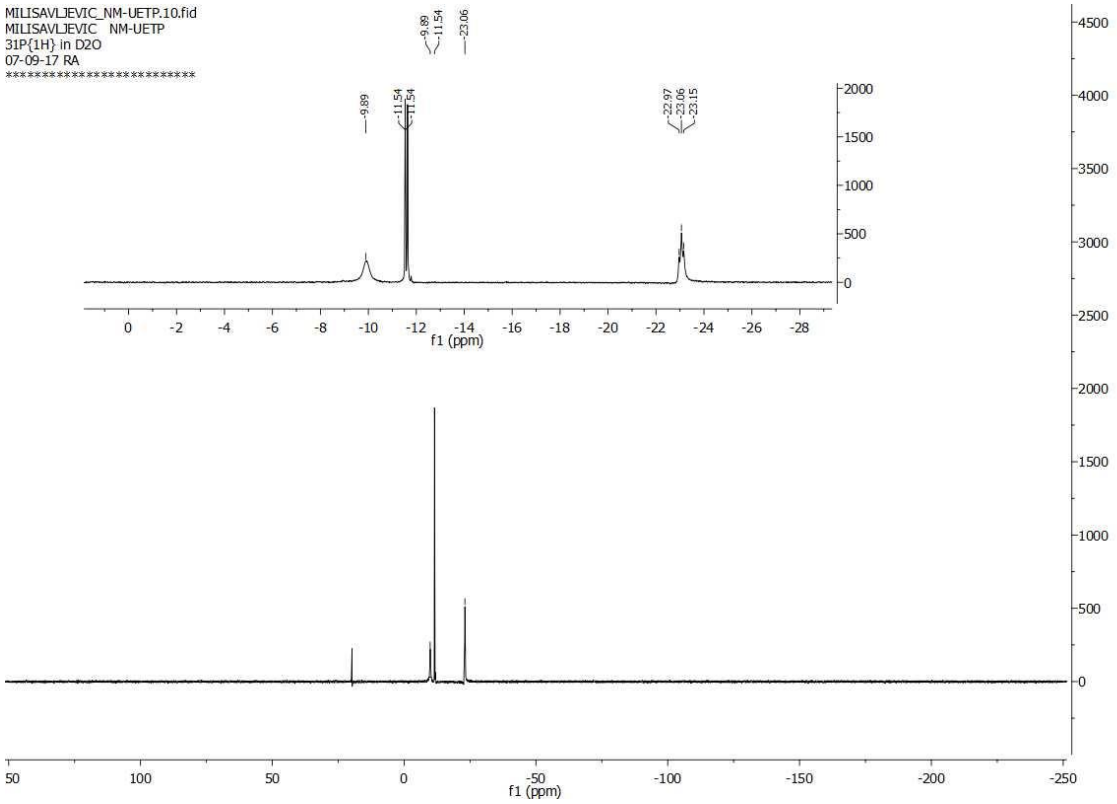

MILISAVLJEVIC NM-CDBFTP
1H NMR in D2O
03-10-17 RA
****
8.15
8.14
8.13
8.13
8.11
8.11
8.11
8.10
8.10
8.09
7.96
7.63
7.61
7.56
7.56
7.55
7.55
7.55
7.54
7.53
7.53
7.52
7.52
7.46
7.46
7.44
7.44
7.43
7.43
6.07
6.06
4.44
4.43
4.42
4.40
4.39
4.38
4.30
4.29
4.29
4.19
4.19
4.19
4.18
4.17
4.84
4.76
3.66
2.4
1.0
2.6
1.2
1.0
0.6
0.4
1.1
1.0
2.1
2.0
6.6
0.1
800
600
400
200
0
9
8
7
6
5
4
3
2
1
0
1H (ppm)
NH2
HO
3Na+
OH
OH

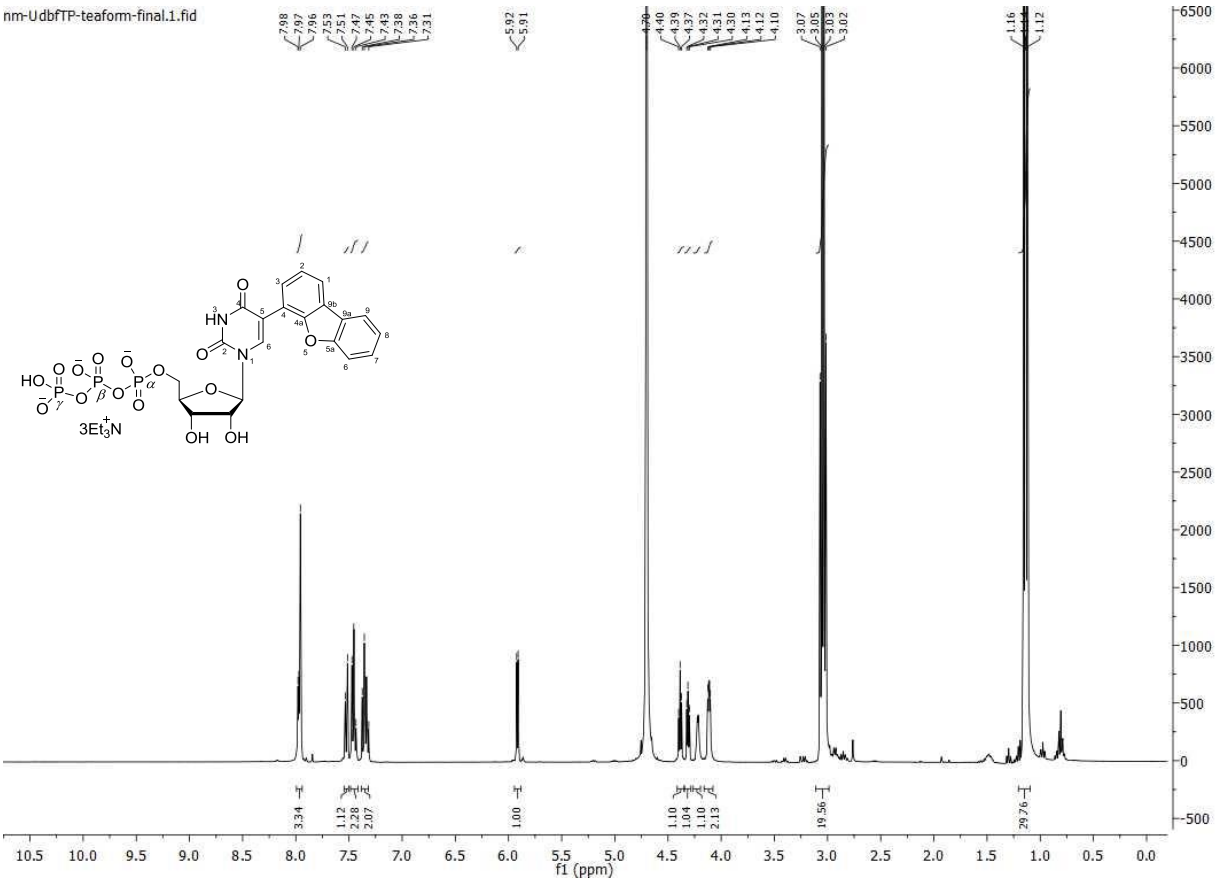

MILISAVLJEVIC NM-CDBFTP
APT in D2O
03-10-17 RA
****
167.08
160.06
158.41
156.22
131.83
130.52
127.14
126.68
126.43
126.02
124.58
123.83
118.57
114.45
108.25
76.60
72.25
67.83
67.78
143.99
92.23
85.72
85.64
1000
0
-1000
180
160
140
120
100
80
60
40
20
0
13C (ppm)

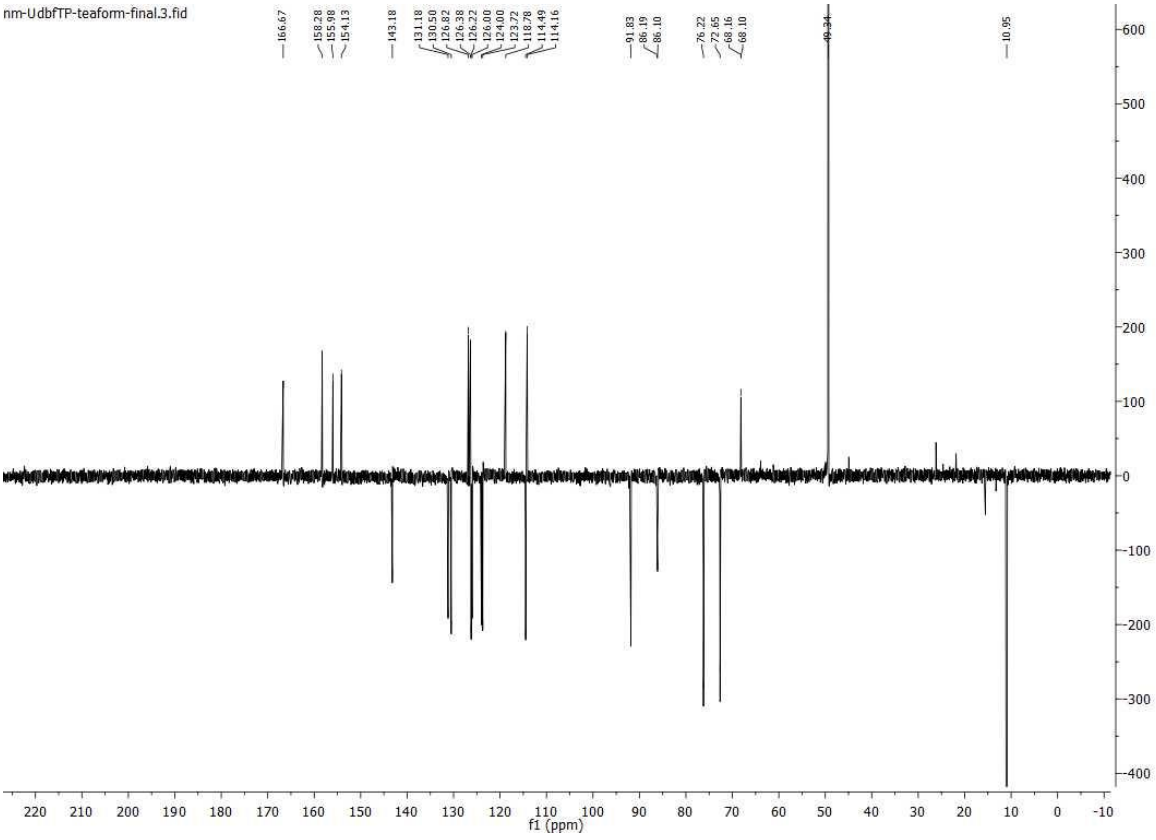

MILISAVLJEVIC NM-CDBFTP
31P{1H} in D2O
03-10-17 RA
****
-1921.98
-1940.79
-2336.10
-2355.84
-9.50
-9.59
-11.54
-11.64
-22.72
-22.82
-22.91
-4597.92
-4617.64
-4637.40
700
600
500
400
300
200
100
0
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
31P (ppm)
150
100
50
0
-50
-100
-150
31P (ppm)


MILISAVLJEVIC_NM-UETP.1.fid
MILISAVLJEVIC NM-UETP
1H NMR in D2O
07-09-17 RA
5.97
5.96
4.43
4.42
4.40
4.29
4.26
3.60
3.22
3.21
3.19
3.18
1.29
1.26
1.00
1.27
2.06
2.52
1.13
13.25
20.12
f1 (ppm)


MILISAVLJEVIC_NM-UETP.2.fid
MILISAVLJEVIC NM-UETP
APT in D2O
07-09-17 RA
167.38
153.49
147.98
101.71
91.40
86.21
86.06
76.96
76.57
72.09
69.29
67.59
49.38
10.95
f1 (ppm)


MILISAVLJEVIC_NM-UETP.10.fid
MILISAVLJEVIC NM-UETP
31P{1H} in D2O
07-09-17 RA
****
-9.89
-11.54
-11.54
-23.06
-22.97
-23.06
-23.15
f1 (ppm)
f1 (ppm)


nm-UdbfTP-teaform-final.1.fid
7.98
7.97
7.96
7.53
7.51
7.47
7.45
7.43
7.38
7.36
7.31
5.92
5.91
4.40
4.39
4.37
4.32
4.31
4.30
4.13
4.12
4.10
3.07
3.05
3.03
3.02
1.16
1.14
1.12
3.34
1.12
2.28
2.07
1.00
1.10
1.04
1.10
2.13
19.56
29.76
f1 (ppm)


nm-UdbfTP-teaform-final.3.fid
166.67
158.28
155.98
154.13
143.18
131.18
130.50
126.82
126.38
126.22
126.00
124.00
123.72
118.78
114.49
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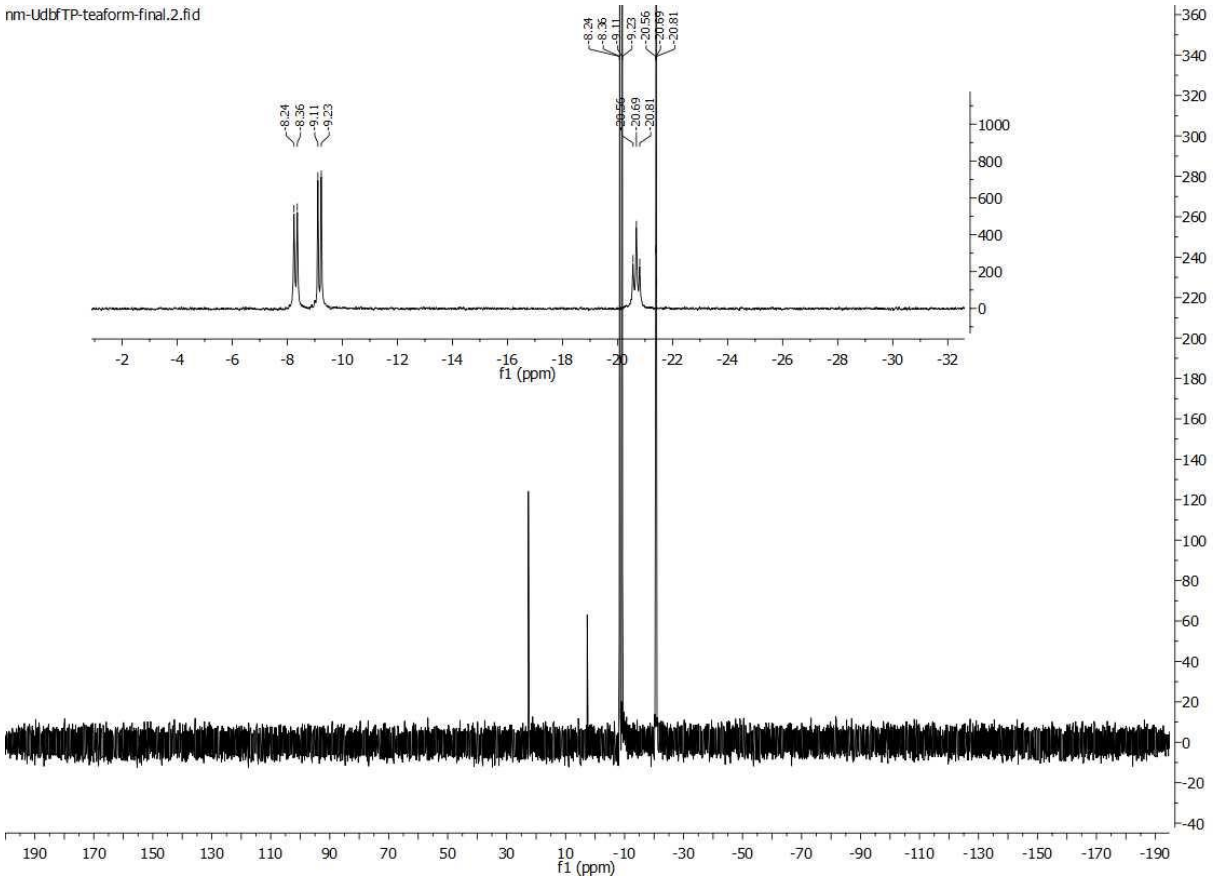
86.10
76.22
72.65
68.16
68.10
49.34
10.95
f1 (ppm)


nm-UdbfTP-teaform-final.2.fid
-8.24
-8.36
-9.11
-9.23
-20.56
-20.69
-20.81
f1 (ppm)
f1 (ppm)

VI References

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