## **Supplementary file 1**

## Oligonucleotide sequences

|  |  |  |  |
| --- | --- | --- | --- |
| ***Oligo name*** | ***Seq. (5' to 3')*** | ***type*** | ***Notes:*** |
| **Templates** |   |   |   |
| 12GAA-p (termed sc12GAA-p when circularized) | /5Phos/UUC UUC UUC UUC UUC UUC UUC UUC UUC UUC UUC UUC | RNA |  /5Phos/ indicated that the RNA is 5’-phosphorylated |
| sc12GAC-p | GATCGATCTCGCCCGCGAAATTAATACGACTCACTATA-GTCGTCGTCGTCGTCGTCGTCGTCGTCGTCGTCGTC-GGGTCGGCATGGCATC | DNA | Fill-in with HDVrt (as back (Ba) primer) and *in vitro* transcribe |
| sc12CGG-p | GATCGATCTCGCCCGCGAAATTAATACGACTCACTATA-GGCGGCGGCGGCGGCGGCGGCGGCGGCGGCGGCGGC-GGGTCGGCATGGCATC | DNA | Fill-in with HDVrt (as Ba primer) and *in vitro* transcribe |
| scGAA8 | GATCGATCTCGCCCGCGAAATTAATACGACTCACTATAGGCAGTTCTTCTTCTTCTTCTTCTTCTTCCGGTTGGGTCGGCATGGCATC | DNA | Fill-in with HDVrt (as Ba primer) and *in vitro* transcribe |
| scGAA9 | GATCGATCTCGCCCGCGAAATTAATACGACTCACTATAGGCAGTTCTTCTTCTTCTTCTTCTTCTTCTTCCGGTTGGGTCGGCATGGCATC | DNA | Fill-in with HDVrt (as Ba primer) and *in vitro* transcribe |
| scGAA10 | GATCGATCTCGCCCGCGAAATTAATACGACTCACTATAGGCAGTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCCGGTTGGGTCGGCATGGCATC | DNA | Fill-in with HDVrt (as Ba primer) and *in vitro* transcribe |
| scGAA11 | GATCGATCTCGCCCGCGAAATTAATACGACTCACTATAGGCAGTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCCGGTTGGGTCGGCATGGCATC | DNA | Fill-in with HDVrt (as Ba primer) and *in vitro* transcribe |
| scGAA12 | GATCGATCTCGCCCGCGAAATTAATACGACTCACTATAGGCAGTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCCGGTTGGGTCGGCATGGCATC | DNA | Fill-in with HDVrt (as Ba primer) and *in vitro* transcribe |
| scGAA16 | GATCGATCTCGCCCGCGAAATTAATACGACTCACTATAGGCAGTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCCGGTTGGGTCGGCATGGCATC | DNA | Fill-in with HDVrt (as Ba primer) and *in vitro* transcribe |
| scGAA24 | GATCGATCTCGCCCGCGAAATTAATACGACTCACTATAGGCAGTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCCGGTTGGGTCGGCATGGCATC | DNA | Fill-in with HDVrt (as Ba primer) and *in vitro* transcribe |
| sc8211 | /5Phos/UUC UUC **GCG** UUC UUC **CAG** UUC UUC **UAU**UUC UUC **CAG** | RNA |   |
| A (*8+4 A)*(termed scA when circularized) | /5Phos/**GGG** UUC UUC **UGG** UUC UUC **UAU** UUC UUC **CAG** UUC UUC | RNA |   |
| scB (*8+4 B)*(termed scB when circularized) | /5Phos/**CCC** UUC UUC **GUG** UUC UUC **UUU** UUC UUC **CAG** UUC UUC | RNA |   |
| scC *(8+4 C)*(termed scC when circularized) | /5Phos/**GCC** UUC UUC **GGA** UUC UUC **UAA** UUC UUC **CAG** UUC UUC | RNA |   |
| scD *(8+4 D)*(termed scD when circularized) | /5Phos/**GCG** UUC UUC **AUC** UUC UUC **GAU** UUC UUC **CAG** UUC UUC | RNA |   |
| scHHz\_temp (HHzCtemp\_alt7) | /5Phos/GAC CGU UUC GCU CAC GCU CAU CAG GAA CUG GUC CAG UUC | RNA | Template for synthesis of micro HHz |
| **Primers for primer extension assay** |   |   |   |
| F8 | FITC-AA GAA CUG | RNA |   |
| F8+Adap | FITC-CAGUCGUGACCUAAUG-AA GAA CUG | RNA |   |
| P91 (F9) | /56-FAM/GAA GAA CUG | RNA |   |
| P91+Adap (*F9+Adap)* | /56-FAM/CAGUCGUGACCUAAUG-GAA GAA CUG | RNA |   |
| P9 *(F9(GAA))* | /56-FAMN/GAA GAA GAA | RNA |   |
| P9(GAC) *(F9(GAC))* | /56-FAMN/GAC GAC GAC | RNA |   |
| P9(CGG) *(F9(CGG))* | /56-FAMN/CGG CGG CGG | RNA |   |
| P10 *(F10)* | /56-FAM/CUGCCAACCG | RNA |   |
| P10+3 *(10+3GAA)* | /56-FAM/CUGCCAACCG-GAA GAA GAA | RNA |   |
| PHHz (HHz\_p12) | GAA C/iFluodT/G GAC CAG | RNA | Primer for HHz circular template |
| **Compeating oligoes** |   |   |   |
| cmp16GAA-p | GATCGATCTCGCCCGCGAAATTAATACGACTCACTATA-GAAGAAGAAGAAGAAGAAGAAGAAGAAGAAGAAGAAGAAGAAGAAGAA-GGGTCGGCATGGCATC | DNA | Fill-in with HDVrt (as Ba primer) and *in vitro* transcribe |
| cmp16GAC-p | GATCGATCTCGCCCGCGAAATTAATACGACTCACTATA-GACGACGACGACGACGACGACGACGACGACGACGACGACGACGACGAC-GGGTCGGCATGGCATC | DNA | Fill-in with HDVrt (as Ba primer) and *in vitro* transcribe |
| cmp16CGG-p | GATCGATCTCGCCCGCGAAATTAATACGACTCACTATA-GGCGGCGGCGGCGGCGGCGGCGGCGGCGGCGGCGGCGGCGGCGGCGGC-GGGTCGGCATGGCATC | DNA | Fill-in with HDVrt (as Ba primer) and in vitro transcribe |
| cmp16GAA | TTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCCGGTTGGCAGCUUCCTATAGTGAGTCGTATTAATTTC | DNA | Fill-in with 5T7 (as forward (Fo) primer) and *in vitro* transcribe |
| cmpCTGAA42 | TTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCTTCCGGTTGGCAGCUUCCTATAGTGAGTCGTATTAATTTC | DNA | Fill-in with 5T7 (as Fo primer) and *in vitro* transcribe |
| Cmp8211\_3ddOx  | UGG**G**AGAAAUAGAAGAACUGGAAGAACGCGAAGAA/3ddC/ | RNA |   |
| Cmp8+4A\_3ddOx  | **UG**GAAGAA**AUA**GAAGAA**CCA**GAAGAA**CCC**GAAGAA /3ddC/ | RNA |  |
| Cmp8+4B\_3ddOx  | **UG**GGAGAA**AAA**GAAGAA**CAC**GAAGAA**GGG**GAAGAA /3ddC/ | RNA |  |
| Cmp8+4C\_3ddOx  | **UG**GAAGAA**UUA**GAAGAA**UCC**GAAGAA**GGC**GAAGAA /3ddC/ | RNA |  |
| Cmp8+4D\_3ddOx  | **UG**GAAGAA**AUC**GAAGAA**GAU**GAAGAA**CGC**GAAGAA /3ddC/ | RNA |  |
| CmpHHz\_alt7 | ACCGTTTCGCTCACGCTCATCAGGAACTGGTCCAGTTCTACCGTTTCGCTCACGCTCATCAGGAACTGGTCCAG-CCTATAGTGAGTCGTATTAATTTCGCGGGCGAGATCGATC | DNA | Fill-in with 5T7 (as Fo primer) and *in vitro* transcribe |
|   |   |   |   |
| Splint | CUGCCAACCG | RNA | Splint used for ligation with T4RNA ligase 2 |
| HHzalt7-F | GAA C/iFluroT/G GAC CAG UUC CUG AUG AGC GUG AGC GAA ACG GUC - GAA CUG G | RNA | chemically synthesised self-circularizing micro Hammerhead ribozyme |
| **Oligonucleotides for synthesis of ribozyme polymerase**  |   |   |   |
| 5TU (Fo fill-in) | GGATCTTCTCGATCTAACAAAAAAGACAAATCTGCCACAAAGCTTGAGAGCATCTTCGGATGCAGAGGCGGCAGCCTTCGGTGGCGCGATAGCGCCAACGTTCTCAACTATGACACGCAA | DNA |   |
| 5TU (Ba fill-in) | CTTCTCCCTTAGCCTACCGAAGTAGCCCAGGTCGGACCGCGAGGAGGTGGAGATGCCATGCCGACCCCATGATAAACTCCATTCAACGGAGCACGCGTTTTGCGTGTCATAGTTGAGAAC | DNA |   |
| t1 (Fo fill-in) | GACCAATCTGCCCTCAGAGCTCGAGAACATCTTCGGATGCAGAGGAGGCAGGCTTCGGTGGCGCGATAGCGCCAACGTCCTCAACCTCCAATGCATCCCACCACATGATGATGCCTGAAG | DNA |   |
| t1 (Ba fill-in) | CTTCTCCCTTAGCCTACCGAAGTAGCCCAGGTCGGACCGCGAGGAGGTGGAGATGCCATGCCGACCCCAAAAAACCAAGGCTCTTCAGGCATCATCATGTG | DNA |   |
| t5T7pFo | GATCGATCTCGCCCGCGAAATTAATACGACTCACTATAGGATCTTCTCGATCTAAC | DNA |   |
| t1T7pFo | GATCGATCTCGCCCGCGAAATTAATACGACTCACTATAGACCAATCTGCCCTCAG | DNA |   |
|   |   |   |   |
| 5T7 (Fo) | GATCGATCTCGCCCGCGAAATTAATACGACTCACTATA | DNA |   |
| HDVrt (Ba) | CTTCTCCCTTAGCCTACCGAAGTAGCCCAGGTCGGACCGCGAGGAGGTGGAGATGCCATGCCGACCC | DNA |   |
|   |   |   |   |
| 5TU (final RNA product) | GGAUCUUCUCGAUCUAACAAAAAAGACAAAUCUGCCACAAAGCUUGAGAGCAUCUUCGGAUGCAGAGGCGGCAGCCUUCGGUGGCGCGAUAGCGCCAACGUUCUCAACUAUGACACGCAAAACGCGUGCUCCGUUGAAUGGAGUUUAUCAUG | RNA | To make: Fill-in with 5TU Fo and Ba fill-in primers then PCR with t5T7pFo and HDVrt |
| t1 (final RNA product) | GACCAAUCUGCCCUCAGAGCUCGAGAACAUCUUCGGAUGCAGAGGAGGCAGGCUUCGGUGGCGCGAUAGCGCCAACGUCCUCAACCUCCAAUGCAUCCCACCACAUGAUGAUGCCUGAAGAGCCUUGGUUUUUUG | RNA | To make: Fill-in with t1 Fo and Ba fill-in primers then PCR with t1T7pFo and HDVrt |
| **Oligonucleotides for extension product sequencing** |   |   |   |
| PCRp3 (Fo): | CAGTCGTGACCTAATG | DNA |   |
| RTp1 (ba): | CCGTACGGATATTCGAC | DNA |   |
| Adap1:  | pGTCGAATATCCGTACG-SpcC3 | DNA | Adap1 was 5'adenylated for later adaptor ligation |
| pGEM\_T7\_Fo:  | GTAATACGACTCACTATAGGGC | DNA |   |
| pGEM\_SP6\_Ba:  | TTTAGGTGACACTATAGAATACTC | DNA |   |
| Ill\_Ba: | CAA GCA GAA GAC GGC ATA CGA GAT GTG ACT GGA GTT CAG ACG TGT GCT CTT CCG ATC CCG TAC GGA TAT TCG AC | DNA |   |
| Ill1\_Fo: | AAT GAT ACG GCG ACC ACC GAG ATC TAC ACT CTT TCC CTA CAC GAC GCT CTT CCG ATC T - NNN – CTGGAC GCAGUCGUGACCUAAUG | DNA |   |
| Ill2\_Fo: | AAT GAT ACG GCG ACC ACC GAG ATC TAC ACT CTT TCC CTA CAC GAC GCT CTT CCG ATC T - NNN – ATACCT GCAGUCGUGACCUAAUG | DNA |   |
| Ill3\_Fo: | AAT GAT ACG GCG ACC ACC GAG ATC TAC ACT CTT TCC CTA CAC GAC GCT CTT CCG ATC T - NNN – GTAGCG GCAGUCGUGACCUAAUG | DNA |   |
| Ill4\_Fo: | AAT GAT ACG GCG ACC ACC GAG ATC TAC ACT CTT TCC CTA CAC GAC GCT CTT CCG ATC T - NNN – CGCTCC GCAGTCGTGACCTAATG | DNA |   |
| Ill5\_Fo: | AAT GAT ACG GCG ACC ACC GAG ATC TAC ACT CTT TCC CTA CAC GAC GCT CTT CCG ATC T - NNN – TATCTT GCAGTCGTGACCTAATG | DNA |   |
| Ill6\_Fo: | AAT GAT ACG GCG ACC ACC GAG ATC TAC ACT CTT TCC CTA CAC GAC GCT CTT CCG ATC T - NNN – AGCTAC GCAGTCGTGACCTAATG | DNA |   |
| Ill7\_Fo: | AAT GAT ACG GCG ACC ACC GAG ATC TAC ACT CTT TCC CTA CAC GAC GCT CTT CCG ATC T - NNN – CCACCA GCAGTCGTGACCTAATG | DNA |   |
| Ill8\_Fo: | AAT GAT ACG GCG ACC ACC GAG ATC TAC ACT CTT TCC CTA CAC GAC GCT CTT CCG ATC T - NNN – AGGATA GCAGTCGTGACCTAATG | DNA |   |
| Ill9\_Fo: | AAT GAT ACG GCG ACC ACC GAG ATC TAC ACT CTT TCC CTA CAC GAC GCT CTT CCG ATC T - NNN – ACAAGT GCAGTCGTGACCTAATG | DNA |   |
| Ill10\_Fo: | AAT GAT ACG GCG ACC ACC GAG ATC TAC ACT CTT TCC CTA CAC GAC GCT CTT CCG ATC T - NNN – TACTGT GCAGTCGTGACCTAATG | DNA |   |
| Ill11\_Fo: | AAT GAT ACG GCG ACC ACC GAG ATC TAC ACT CTT TCC CTA CAC GAC GCT CTT CCG ATC T - NNN – ATTAAC GCAGTCGTGACCTAATG | DNA |   |
| Ill12\_Fo: | AAT GAT ACG GCG ACC ACC GAG ATC TAC ACT CTT TCC CTA CAC GAC GCT CTT CCG ATC T - NNN – CACTAT GCAGTCGTGACCTAATG | DNA |   |
| Ill13\_Fo: | AAT GAT ACG GCG ACC ACC GAG ATC TAC ACT CTT TCC CTA CAC GAC GCT CTT CCG ATC T - NNN – TGTCGC GCAGTCGTGACCTAATG | DNA |   |
| Ill14\_Fo: | AAT GAT ACG GCG ACC ACC GAG ATC TAC ACT CTT TCC CTA CAC GAC GCT CTT CCG ATC T - NNN – ACAGTG GCAGTCGTGACCTAATG | DNA |   |
| Ill15\_Fo: | AAT GAT ACG GCG ACC ACC GAG ATC TAC ACT CTT TCC CTA CAC GAC GCT CTT CCG ATC T - NNN – AGCGCC GCAGTCGTGACCTAATG | DNA |   |