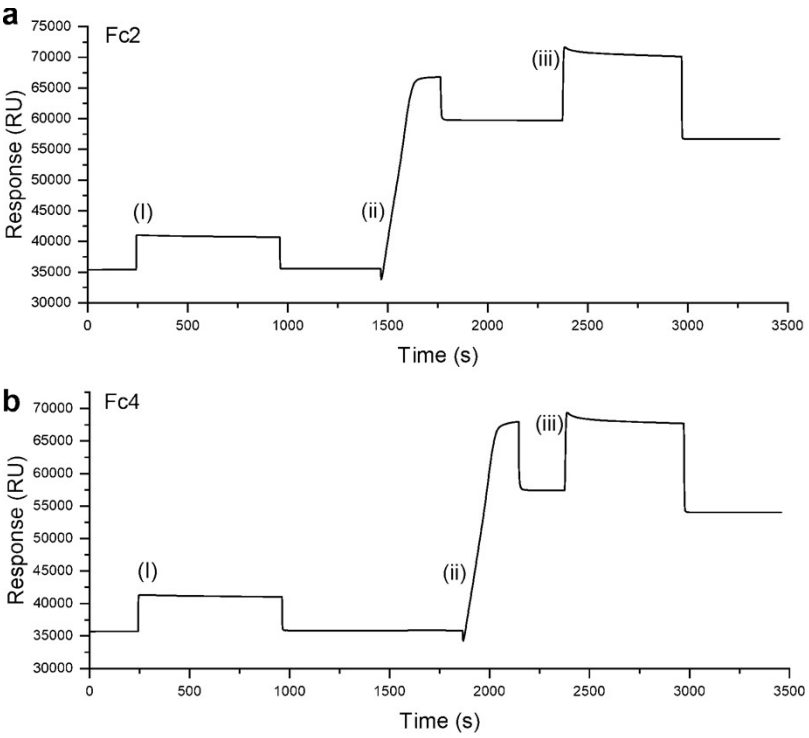
Supplementary materials for

Data storage based on the absence of nucleotides using a bacteriophage abortive infection system reverse transcriptase

SM include:



Supplementary Figure 1: Amine-coupling immobilization profile of the bacteriophage abortive infection system reverse transcriptase AbiK on a CM5 chip. a, Immobilization of AbiK on flow cell 2. **b**, immobilization of AbiK on flow cell 4. (i) surface activation using a mixture of 1-ethyl-3-(3-dimethylpropyl)-carbodiimide and N-hydroxysuccinimide, (ii) AbiK coupling, and (iii) surface blocking by ethanol amine. AbiK was injected at 50 µg/mL in sodium acetate buffer (pH 5.0). Next, 21,160 response units (RU) and 18,150 RU of AbiK were immobilized on flow cell 2 (Fc2) and flow cell 4 (Fc4), respectively.

Supplementary Table 1: The three-nucleotide code used to encode information using the bacteriophage abortive infection system reverse transcriptase AbiK

Three-nucleotide mix	Number assigned to the combination
ATC	1
ATG	2
TCG	3
ACG	4

Letter of the alphabet	Numerical code
A	123
B	124
C	132
D	134
E	142
F	143
G	213
H	214
I	231
J	234
K	241
L	243
M	312
N	314
O	321
P	324
Q	341
R	342
S	412
T	413
U	421
V	423
W	431
X	432
Y (Q+Q)	341341
Z (X+X)	432432
space	dNTP mix

Supplementary Table 2: Nucleotide sequences of synthetic DNA fragments produced by the bacteriophage abortive infection system reverse transcriptase AbiK. The DNA segments are color-coded according to the nucleotide triplet: ATC in green, TCG in blue, ACG in orange, and ATG in red. Shaded in gray is the DNA region containing the nucleotide base guanine, which was inserted between the sequences encoding the word "DNA." The section of DNA corresponding to the three letters ("D," "N," and "A") or the word "DNA" is underlined; the corresponding numerical code with the codec is shown in Supplementary Table 1. Each sequence is shown together with the Microsynth identifier, raw sequences, and quality of the sequencing reads in Supplementary Data 1.

Sequence number	Microsynth identifier	Sequence (5'-3')	Numeric code	Word/letters
1	@27c19470-5460-4ade-b32a-6485c2a9855b	AATATCAAAAAAATATCCAAACAAAATATACTCACACATATAAACCTGTGTG TTGCGTGGAAAGAGAAAGAAGAAAGAGCGCGCGCGCTGTGCGTCCCTCGC TGTGTCACAAAATACCCAATACTCAAATAATAAACAAAATCAATAAAATAA AAAGGAAGAACGAAAGAGCGAAGAGAGAGAAAGAAAAGAGAAAGAAGA ATCTTTTACAACACCCAAAATTAATACCCATATATCAAACCATATATAAACA CAACATAAAGAGTGAGAGAGTTTGAAGGAGAAGGAAGGAAGGATGGATA AGAATGGGAGAGAGAAATGAATAGGTAGAAATAATTGGGAAAAAAGAAT AAAAAGAAGTTAGAATAAAGATGAAGTGAAAGTTGAGAAGAGAGAGAAA GTGAAATGAGAGGGAGGGAGAATAATAAGAGAGTAAAAAGGAGCGCGG CTAG	13431412 3	DNA
2	@6fbfdb44-ad7a-4b6e-b329-c68b1f100fbe	CATCAATAAAAACACAAAAACACCCAACAATAAAAAAAAAATATAAATAAA AACAAAAATATCAAAAAAACCTTTACATAAATAAAAAACTATTAAAACCTTA AAACTCATACAAATTCGCGTCGCTGCTGTCCGGCGTCGGGGGGGGGGGGG GGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGACATT TTACATACCAAACATTATCCAACCTACCATTATTCAACTACCAATCCACCAAA TACCAACCTTAATCACAAACCAATAAAAACTACCACAGGTTCGTGGCGTCC GCGCGTGCTCCGCGGGCAGTTGTCTGTTCGCCGCTCGTGCCGACGCCACGA GACCTATAGTAGTTTTATTGGTTTTATAATTGTGGTATTTGTCGTAGAATTG GTCATTGATAAGATGGTTAAGTTGGATATGTTTTAATGT	13-GGG- 1342	D
3	@4653de13-20da-47f6-b9e9-a51304021a5c	AATAAAAATACCAAAAACATAATAACTCACAAAAAAAACAAAAAAAAAACA ACTATTAATAAAACAACCCAAACCATCATAAAACAAGCAGAGAAACGCAGC AGGGTTCTCCAAAATAAAACCCCAAATTTAGAACATACACACTCCAATCAA AACACCAAAATTCAAACACATAAAACATCCACCCCTTCATTCAAACCTATAA TAATCTATTAACATTCACACATACACAATCATTTTACAATATATACATAAATA CAACACAACTAAATACAACTTATATTACAACTACCAACACACACAAAGCCCA AACCAACACATTATTAACTAATTCTAAACAAAAAATATACCAACCCTAAAAT AAAACAAAAACAAAAACTTAAATTAACCAATCCAAATCAATTTAATATAACT ATAATCACATCCACCTCTTAAATACAATAAACATTTAACACACACCAACTCTC CATCTCTAAATCATACACTAATTAATTATACCAATAATAATTCCACTAAACAT GGTACCTGGGCTGCCGGGCGCGGCTTGTGCGTCGTGACGAAGGGGCAAG GGAGGGAGCGGGCGGTGTGGGGGCGCCCGTTCGCTGTGTGCCCCGCCGG TGGCTGCTAAACAAAATAATAAAAATAAAAATATTCAAAATCCAAAAAATT AATATTTACACATAACCATATGAACTAAAACTCTACCCTCATCAAAACAAAA CATAAAAAAAAATACAAAAACCCTACCATATACAAAAATTCCAAATAAATC ATAAAAAATAATATTAACCAAACTATCATACACAACCAAATAACACCTCCTA TTAAAAAAAAACCAATAACAATAAACACCTCCGAAAAGAGAGAAGCGGAA CCTTTACCCCTCAACATAACCAAAAACAAAATCCCCTATAGTATGATATCTA AAACCTCCTTTATAAACAAAAAAAAAATCTTAACCCACAAAAAACTATACA TATAAATCCATCATACCAATAAAAACTCTCAACTTCTACAAACAAATAAAAA TTACAAATCAAAATAAAAAACACCACAACCCAAATTACCATAATAAACAAC ACGCCGCACAAGCCGCGCCCCGGGCAGCCCAGAGAAATTTATGTTAGTGG	14134314 1214232	DN and 2/3 A

		AATTAATTTATTGGTATAGTTTAATTAGTGTATGATTTAGAGATGGGTATTA GTTGGTGTGTGTTAAATGTTATTGTATTTTAGAGGTGGATGTGTGATTAAT AGTTATATTAAATTGATTTGGATTGGTTAATTTAAAGTTTTTGTTTTTGTTTT ATTTTAGGGTAGATCTTTTTGTTTAGAATTAGTTAATGTGTTGGTTTGGGGT TTTTGGGTGTGTTGGTAGTTGTAATATAAGTTGTATTTCGTTGTGTTGTATG TATATATTGTAAAATGATTGTGTATGTGTGAATGTTAATAGATTATTATCGT AAATGAAGGGGTGGATGTTTTATGTGTTTGAATTTTGGTGTTTTGATTTTGG GAGAGTGTGTAATGTTGAAATTTGGGGTTTATTTTGGAGAACCCTGCTGCG TTTCTCTGCTTGTTTTATGATGGTTTGGGTTGTTTATTAATAGTTGTTTTTTT GTTTTTTTTTGCCTAAGTTAGTTATCTTTTGGTGAT		
4	**@2fc4e38e-fd28-4457-8056-bf6193a7fdfa**	CTTGCCGGGGTTTGGGGCGTCCGCGGGGGTGGCGGGGCCGGGGCGGTTG GCGTGCCGGGCGCGTCCGTCGTCCGCGCGCGCGTCTTGCCGCGGTTTTGGT CGTTGGGCGTGGGGCGCTCGTGCGCGTGTCGAAGCAGGGACGAGAGCGC GACAAGAGAAGAGAAAACCAAAAGAGACGAAGAGAAAGGAGCGGGGAA AGACGGGCGCAAAAAGGAGAGAGAGCAAGAAGGGAGAAAGGAGAAAAC ACACAAAAAAAGAACCGGCAGAGGGGAAAGAACGAGAACGAACCGCACA CGGAAAGCGCACAAAATATAAACAAAAAATTCTAACACTAACTATAAAACA CAACAACTCTCACTACACCTTAAAACCCACTAAAACAAATAAAAAATACAAT AAACACTTAATCCAAAAAAAAAACTACCACATAAAACATTAAAAAATATAC TTCTATATTAATTAAAAAACAACAACTAAAAAAAACGAAGAGAAAGAACG GGACAAAAAACCAACAAAATATAAACCTTATTCAACCCAAATCGGGTTAAA AGGTTATGGAGTATAATAAGATACGTCGGTGTGGGTGGTGGTCCGGGGCG TGGCGCTGGCCGCCGCGCCGGACCCACCGCCCACCGACATATCTTATTATA CTCCATAACCTTTTAACCCGATTTGGTTGAATAAGGTTTATATTTTGTTGGTT TTTTGTCCCGTTTCTCTTCGTTTTTTTCAGGTACTTCTTTTAATTAATATAGAA GTATATTTTTTAATGTGATGTGGTAGTTTTTTGAGATAAAATATTTTATTGTA TTTTTTATTTGTTTAGTGGGGTAAGAGTGTAGTGAGAGTTGTTGTGTTTTAT AGTTAGTGTTAGAATTTTTTGTTTATATTTTGTGCGCTTTCCGTGTGGGTCC GTTCTCGTTCTGCCGGTTCTTTTTTTGTGTGTTTTCTCCTTTCTCCTCTTCCTC CTCCTTCTTTTTTGCGCCCGTCTTTCCCCGCTCCTTTCTCTTCGTCTCTTTTGG TTTTCTCTTCTTCCTCTGTCGCGCTCTCGTCCTGCTTCGACACGCGCACGAGC GCCCGCAACAAACCAAAACCGCGGCA	34141234 123234	**2/3N and A**
5	**@8679d127-966d-40ec-bf4c-4526686d2ed2**	GACCTACCAAAACCCATATAAACATACATATAATACAACAACATAAAAATTA CCCAAATCTAAACTTAATCTCTCCCCCACATTTAACACCAATATTATAAAATT TCCACTAAATATACCGGCGCGCCGTGTGCGCGTGTGCCGTGGGGGGCCTG CTCAACTATAACAATCAATAAACACCCCATATCATTTCAATAACATCATACTA CCAATCCATTACCACACCAACTAAAACATATTATACCATATAACAAACATAA ATAAATCTACATCCAACGAAAGAAGGGGAAAACGAAAAGCGAAAAAAAG AGAAAGCACACGAAGAGAAGCGAGGGGCGAAATCTAAACATATCTCACAA AAAAACATAAACCCAAAATATAACCTTAACCTCTATCTAAAAAACAACAAAC CACAACCTTACCAAAAATAAATCAAAACCACCACTAACAATAACAAACAAA ATATATTTGTGTTATATGAGTTTCCGGAAGTATATTTAGAAATGGGCCCCTC ACTCTCTTTCGTGTGCTTTCTCTTTTTTTCGCTTTTCGTTTTCCCTCTTCTTTCG TTGGATGTCAGATTTATTTATGTTTGTTATATGGTATAATATGTTTTAGTTGG TGTGGTAATGGATTGGTAGTATAATGTACTGAAATAAATAATATGGGGTGT TTATTGATTGTTATA	13141212	N and 2/3 of an A
6	**@71f23883-34ab-4c44-a1e6-a1e809471d1e**	CCGGGCAAAAGGACACCACTTACTTAATCTACAATTTCTCTCTCTCTCTCTTT CTACCCCTTCCATCAATGCCTCTTCAACGCAACACAGCAACGCCACGGCGG AATTAATTACTTAATTCCGCCGTGGCGTTGCTCTGTTGCGTTGAAGAGGCAT TGATGGAAGGGGTAGAAGAGAGAATGAGGAAATTGTGGTTGACGGTGGT CCTTTTGCCGGGGCGGCGCCGGGGGGCAAAAATCTTATTTCTACTTTCTAA CTATCTATATCACCAAAATACAAACTGGAACTTTTCCTACCAACCCCTAACA	41413231 42	**N**

		ACAATGCCTCTTCAACGCAACACAGCAACGCCACGGCGGAATTAAGTAATT AATTGTTATGGATTTTTAGTTTGTATTAATGGTGTTGGTATATTTTTATGGGT GTATTTTTATGTTTGTTTGAGGTATTTTTAGTGAGTTATTGTAGTGGAGGGT TTGATAGTGTTATA		
7	@6d18625c-507c-44ff-800a-c2fce6644846	CCTCAAAAAAAATAAAAAAAATTAATAATCCACCCAATCTCATCCCACTCTA ATCAAAAAACAAAAAAAAACCCCAACATAAAAAACCATCTCTCCAAACAAT AAAATAAAAAACAAAATAAAAATAAAAATTCACAAAAAACACTAAACACAC AAAAACAACCCAAAACAAAAAACAAAAAATACGGAGAAGCAAACACAAAG CGCGCAGAAAAAAAAAACAAATTTAAAAATCAACATAATATAATCAAAAAA AAAAACAACAAAATAAACATTTAAAAACAAACAAAAATAACAAATACCCAC AATCCACAAATTACAAGGGAAGATGGTTGCATGGTATGT	1412	2/3 of N and 2/3 of A
8	@03d2ad1c-6bee-4055-8039-eecd29116565	CAAACAAAAAACAAAACTCAAATAAAAAACCCAATCACATCAACAACTAAA ATGCGCGTCCGCGCCCTAAAATTCATCATACACAATTAACAACACCTTCTCA CAAATATCTTTAAATCTTTACACATTTATTATATAATATAAATAACAACACAC CATACAAAAATAAAAAATTTATCAAACTTCACAAAAAAAAACAGCGAAGCA AAGGAGGAAAAACAGAACCAACCCATAACCAGCGAGGAGCAGAGAATAT ATAGAAGGTAATTAGAAGAGGAGGTTATTGAAAAAGAAGGGGAATAGTA GAATACATGACAGGCGGGTTTCGGGTGGTCGTTTCGTCTCTCGGCGCGCG GGGCTCTTCATGT	131423	N
9	@96c85ce0-307a-426e-94c4-5a584458e348	CAAATAAAAATAAAAACCCAACAAAACTCACCAAAACAAAAAATAATACAA AAACAATCTTCATCCAAATAACCAATATAAACACTAACCCAATACGGCGTTG CGCGAGAGAAAGGACAAGGGAGGAAGAACAGGCGGCCCGAGGCACGAG CAAGGGGAGGGCGGGGGGCGAGCAACAGGAAACGGGCCCAGAGGAGAA GGGCAGGGTGGGCTGTTGCCGTGCGCTGGGCCCCTAGCTCGTCGGTGTGG GCGCTGCCGGCGGGTGCGTGGTATCTATTCAACATAAAACAAAACATTATA CTTATCACCTAAAAAACTATAACTAATACACACACCTATCATTTATACTCCTA AACCCCCTCTCGTATACCAACCAACGACGCAGAAAGAGGAACGGAGAAAA ACGCGGGAGGAGCAGCAAAGGAGGAACAGACAGGAGCAAAAGAGACCA GCGAAGAGAAGGCAGGAACCGAAAAAGCTAAACAACAAATCAAATTACCT CAAAAAAAAAACTTTAACATATAAACTACAAAAAAAACCTAAACCGAAGAG AATGGAAGATGTTTTGGATGCGAAAGAGAAAACAGCAGAGAGGGCGCGC AACCCACACAAAGCCGCCCAAAGCGAACGGGGGGCATTAAAATAACTACC TCAAATACAACCATACGAAGAGGAAGAAGCGAGAGGGCAACAAGAAGAG GAGAAAGGAGGAAAGAGCAAAAAAGAGAACAAAGAAAAAAAGAAGAGA AAAGAAGAAAGCAAGGGCAAAAAAACCAGACGACAAGGACGCGAGAAG GCAGAAGGCAAATAACACATAAAAACCTCTAAAATCACAACGTTCCCCAAA ACAGAAAAATGTTGAATAATGGATGAGAAGAAAAAGGGAGGAAGATTGA TCTGCCGGTGCGTTGTTGCTGGCGGGAAACGAGCACACGCCGCAGCAAGT TACAGATGCCGGCGAGAACGGGATATG	13431412 4141234	D, N and 2/3 of A
10	@9dd8ac2b-8e8c-4423-adc5-d36b0218d9cb	CCGGTGACAAATAAAAAACTCAATATAAACAATTAAACCAAAAATATCACT TTTTAATAAAAACAACACAAACAACTAACAAATCTTCTAAAAAACCACCTTT CAATAAATAAAATCTAAAAACTTTAAATAAAACTATCAAATCCCCAATATCG AGAGAGAGGACGGGAAAAGGGCATTGTTGAATTTTTGTTGTTGGTTAATTT TTAAAGTTTTGTTTTTTATGGCTTTTTTCTCGTTCTCAAGTGTTGTGTT	314232	N
11	@fd939ea1-889d-4f4b-9d8d-56f737ca43fe	CCTATAAAAAAAAATTATAACTACTAATCAATAAACACATTTACCATCTCCA AAATAACCCAAACAAAACAAACATCATACATCTAAAACTCCAACCAACCTTC TTCAAAAAACACACTATCATTAAACACCTTCAACTAAAAAAGGGGGAAATG AAGGTGAGAGGGAGTGGATTCAAGAGCCGCAGCTTGCCAAGTAACTATGG TAAAGAGGCAGAGTTTCAAAGAGCGCAGCATACGACACGCGAGCAGTCCC GGCTTCTCGTCCGTTTTGGGTAAATTTGGTGGGATTATTGAGTAGTTGGAT	13424324 1	D

		ATTTTGGAAAGAGTATTTTTTTGATAAATGATGGGTTGTGTGTTTAGTGATA GTAATGATGTATTGTTTAGGCAAGCAAGCGCGAGGCCAGCTTTCCTATCTT CATTTTTTTCTATTATTTCTATCTTCTTCCATTTTTTTTAGATT		
12	**@2cc48fef-3059-4a59-86ad-dfe92473d4a0**	AATCAATATCATCCAAAACAAAATAAATTAATCAAAAAACCAAAAACAAAA ACAAATTAACAAAAAATCACATTTCCCAAACTAACCCTATAAATACAACAAC ATTAAATAATTCACCAACTAAATCAACTACAACCAAAACTAAATTAACCAAA ACTTAAAACAAATTTTATGCTTTGCTGTGCCGTCTCGTCGCGGTGCGGCGCT CGCAAAGAAAAGCGCAAAAGCAAACAAAGGAGAAAGAGAGAAAGAAGA ACGCACAGGGCGAGAACGAAAAGCGAGAGCAAGGGGAGAGAGAGCGCT GCCGTTTGGTGTGTCGGGTCGTGTATATAGATATTGTTTTCGGTGTCGTGT GTT	134323	**D**
13	**@e8b63abc-adcd-4e8c-be66-e06fe415077a**	ACTACTTCAAAAATATCTACATACACAAATACAAAACTCCACTAAAACTAAA AAAAATACAAACCCTTCAATTCAAAACCTAAACACAAAAAAAACACCACCA ATAATCTCATTCCAAAAAAAAAATATAAATACATCACGACAAAACCCGGGA AAAGCAACGCGAAGAGAAAAGAAGAAAACCGAAAGAAAAGAGAGCAAA GAACAAGCGAAAGAAGGAAAGGAGCAATCATTAAACAAACCCAATAAAAA AAAAACCTAAATAATCACAAACCTCAAATAATTAACTACTATAATTCACAAT TAAAAAATTTAATCAAAAAATAAGGAGTATAGGTAGGATATGGGGGAATA GAAGAGAAGTAGTGGATAAGTGAAGAGGAGTAAGTAAAAGTTAATAAGT AGTGAGGAGGTGAGAAGGGAGGGTGAATGTTTCGTGGTGCGTGTGTGTT GCTTGCGCTGTT	14123	2/3 of N and A
14	**@6412fafe-19e2-4486-8fba-d3b4322323 38**	ACGGAGGACACCAAGACCACACGAGGCGTCTCTTTTTCTCTACTTCTATCTT ATCTTTACATCATTCAGATTGTGTGTTATTTTGTTGATTTGTTTGTTTGTTGG ATGGTTTGTATTATTGTGTGTTGGTTTGTAGTTTTGAATTGGTTTGATTTTTA GATATTCCGGCTCCCTTTTTTTGCTGTGCCTCTGGTCTTCTTTTTTTCGCTGTC GTCTTTTTCTTCGGAATATGATTGTTGTGTGAGTGTATTATTGATCGCCGGC TGCTCTTTTCCGGTTTGCCGTCTCCTTTTTGTCCTCGGCGGCTTCGCCTTTCG CTTCTCTCTCTTTGCCCTCT	412323	**A**