Experimental Analysis of Temperature Affects in CIR Samples from KAU data
Analysis of the Phase from KAU data

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Checking the temperature effects

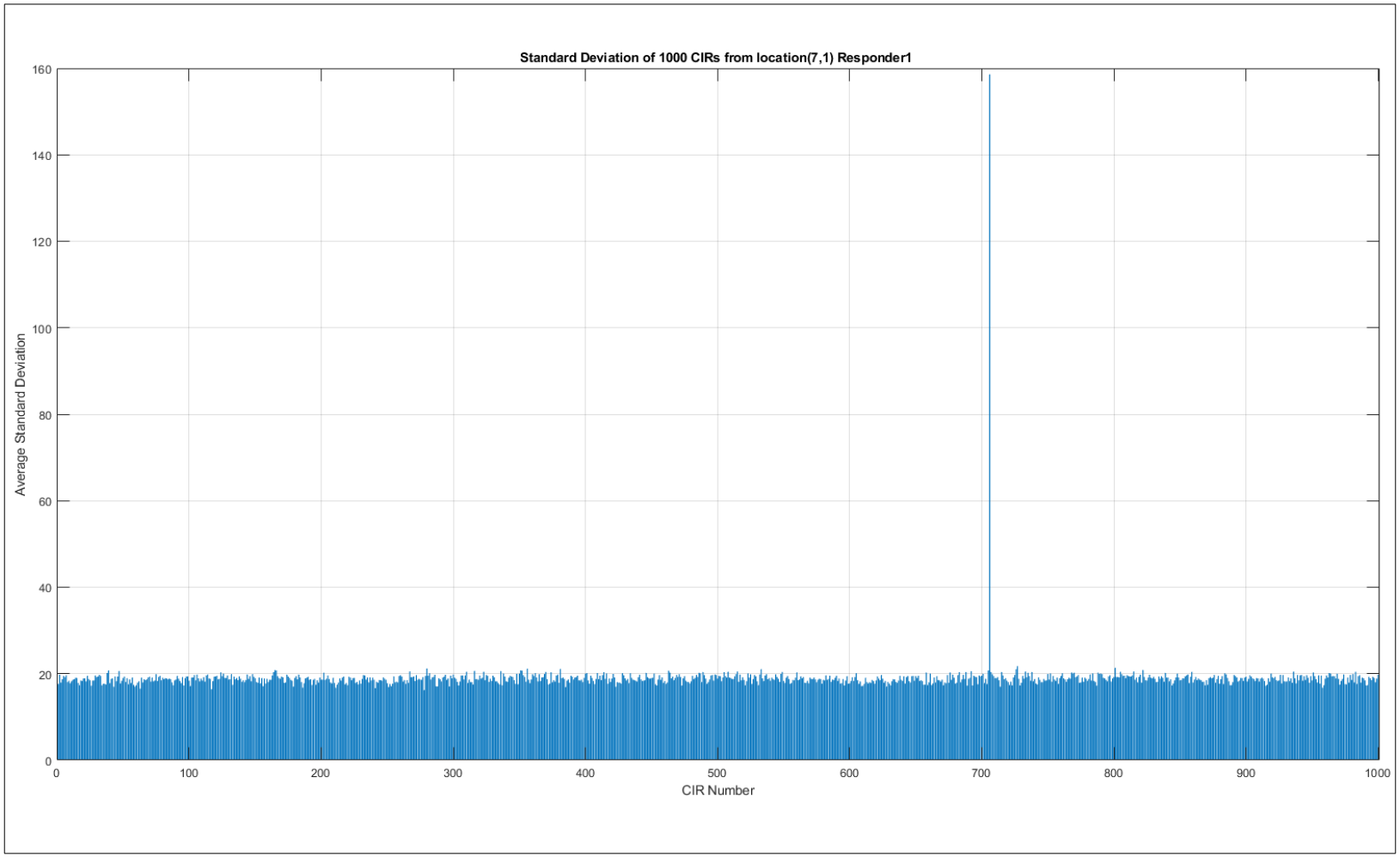
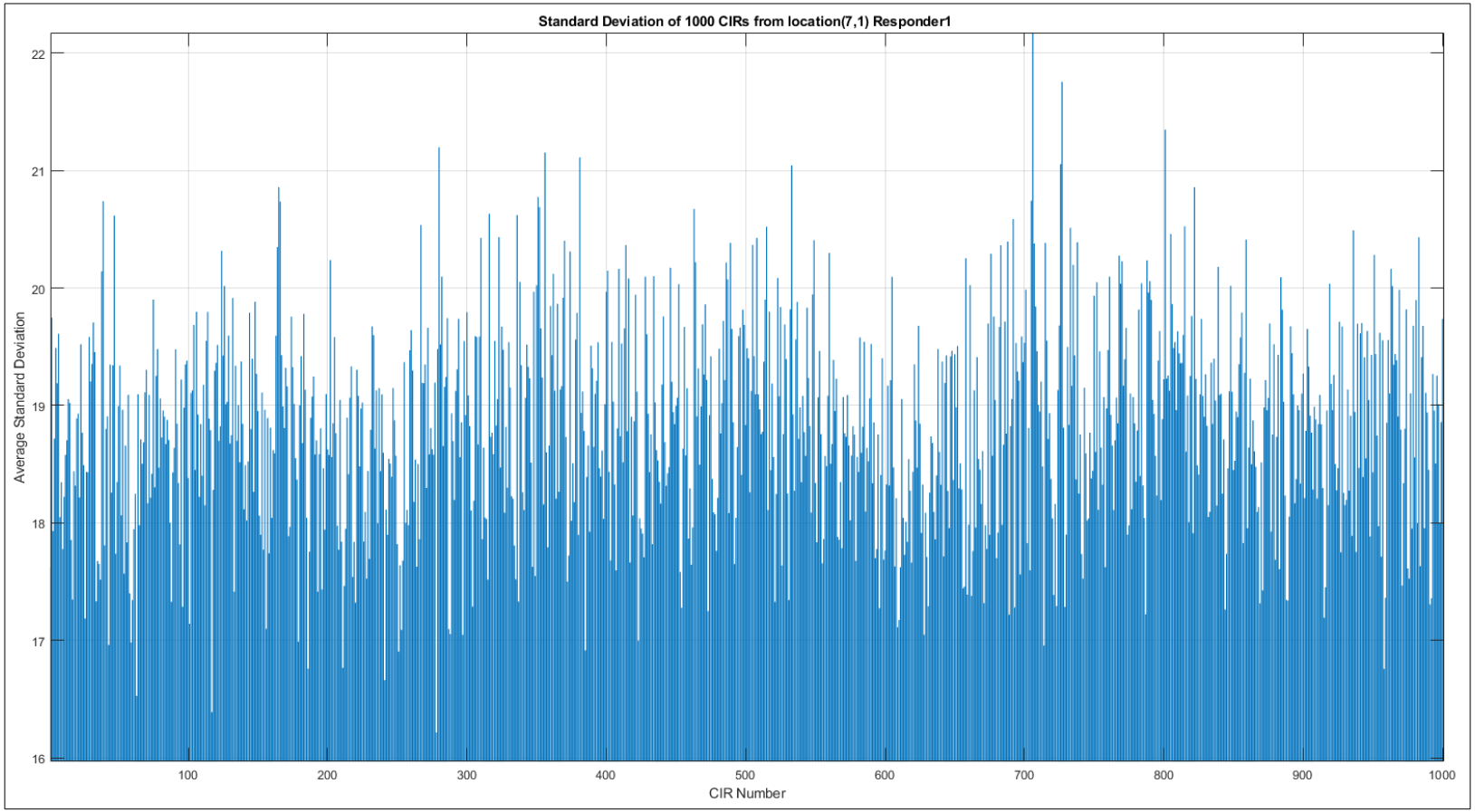


Figure: Standard deviation of the 720 first samples of 1000 CIRs from location(7,1) Responder 1

Checking the temperature effects



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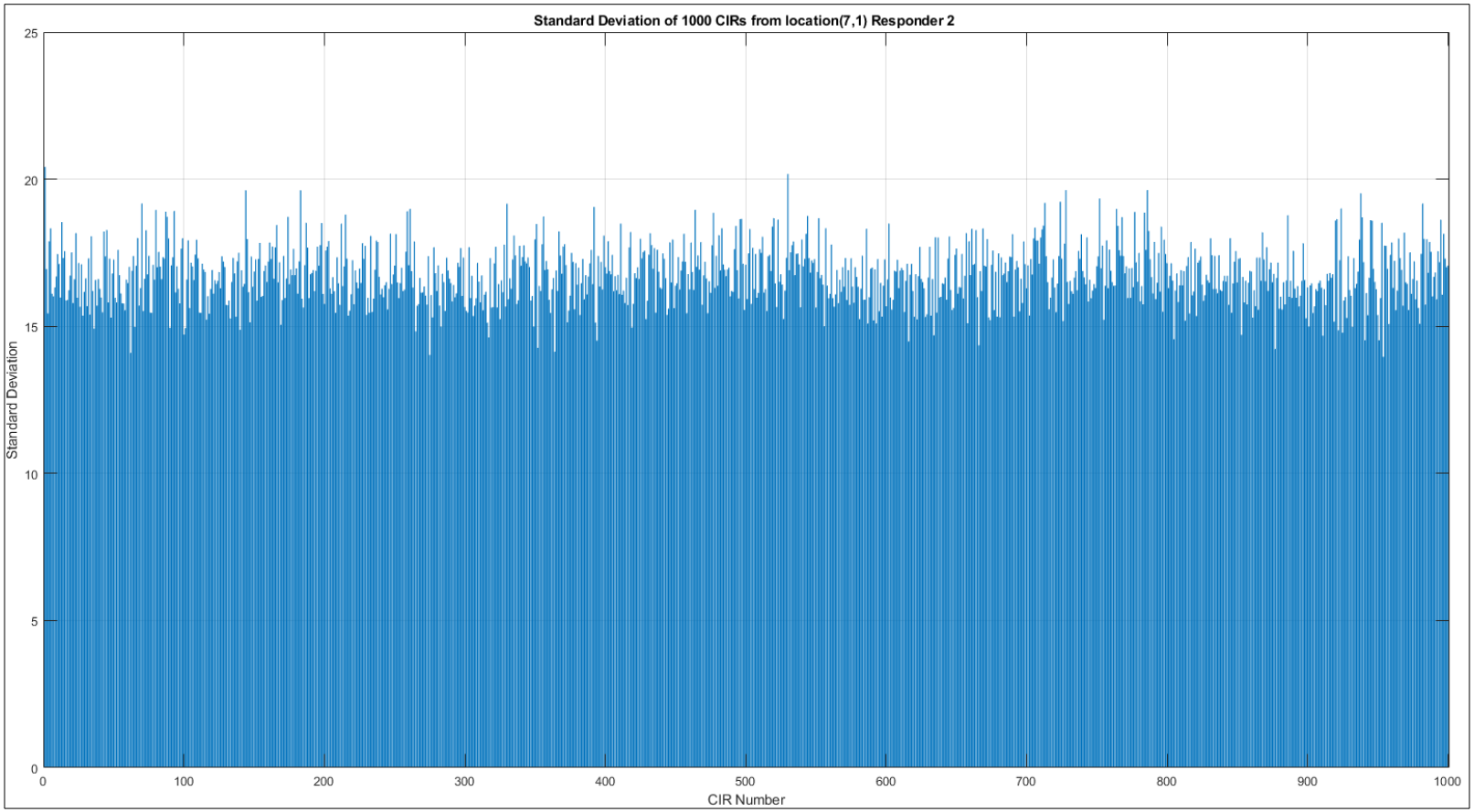


Figure: Standard deviation of the 720 first samples of 1000 CIRs from location(7,1) Responder 2

Checking the temperature effects

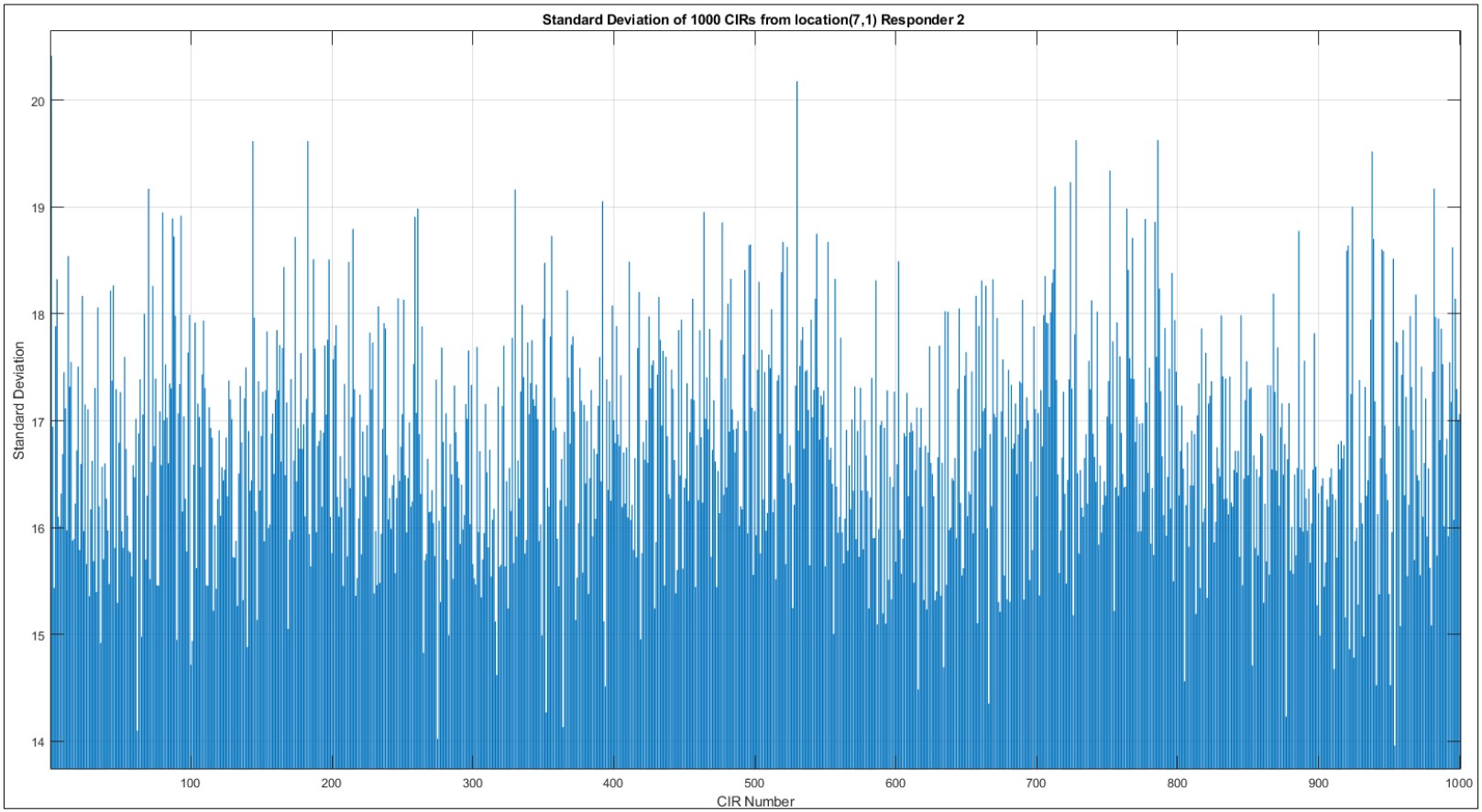


Figure: Standard deviation of the 720 first samples of 1000 CIRs from location(7,1) Responder 2

Checking the temperature effects

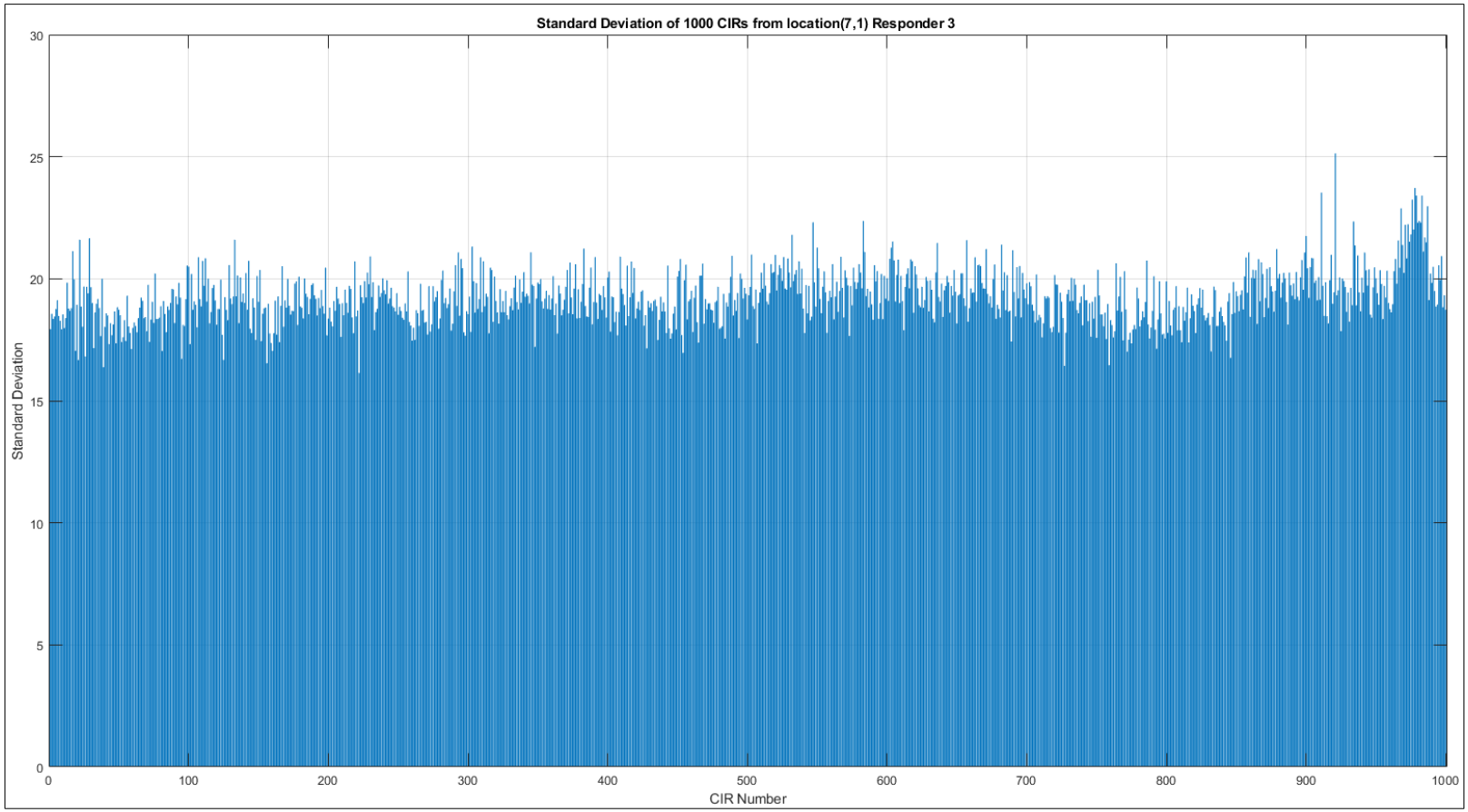


Figure: Standard deviation of the 720 first samples of 1000 CIRs from location(7,1) Responder 3

Checking the temperature effects s

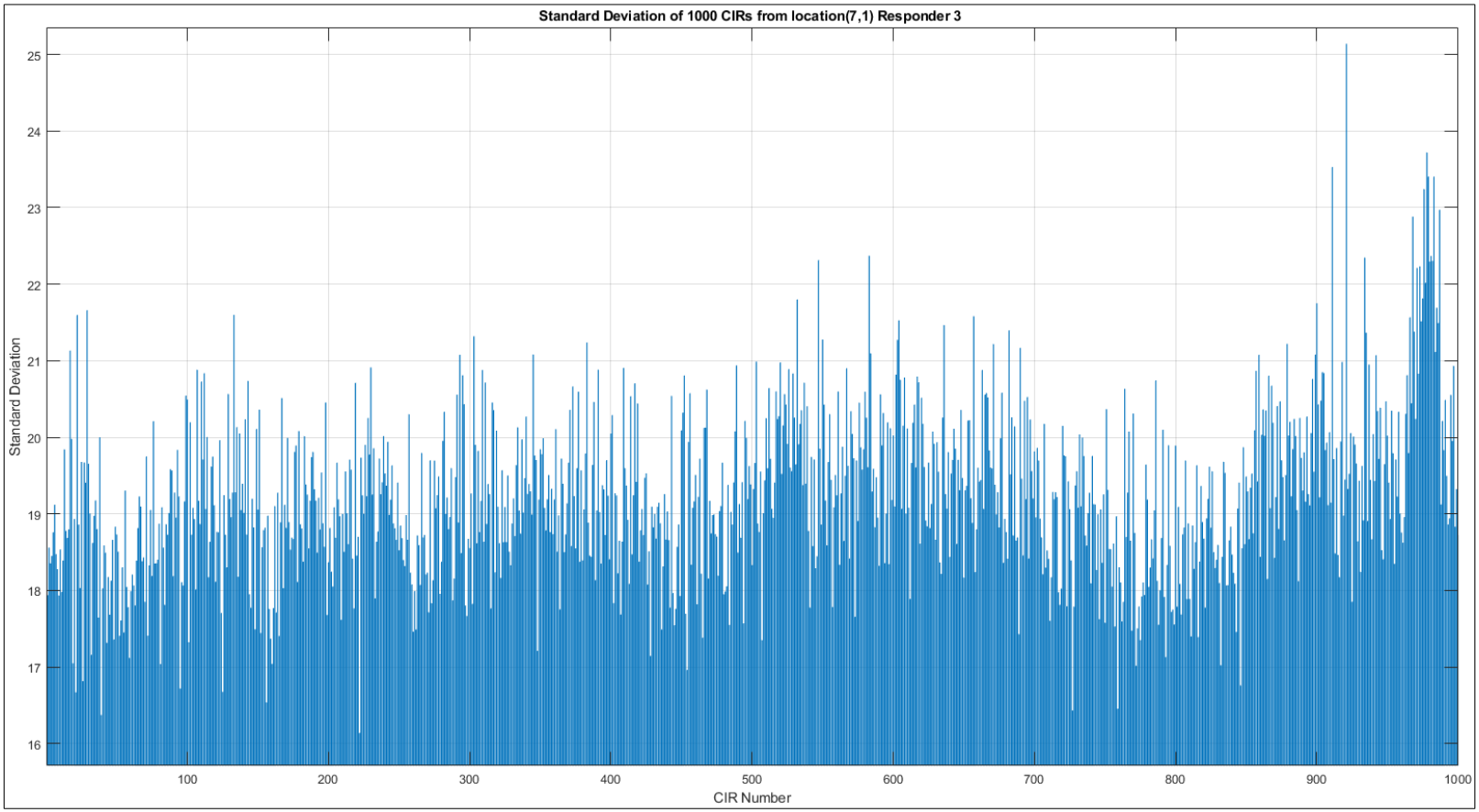


Figure: Standard deviation of the 720 first samples of 1000 CIRs from location(7,1) Responder 3

Checking the temperature effects

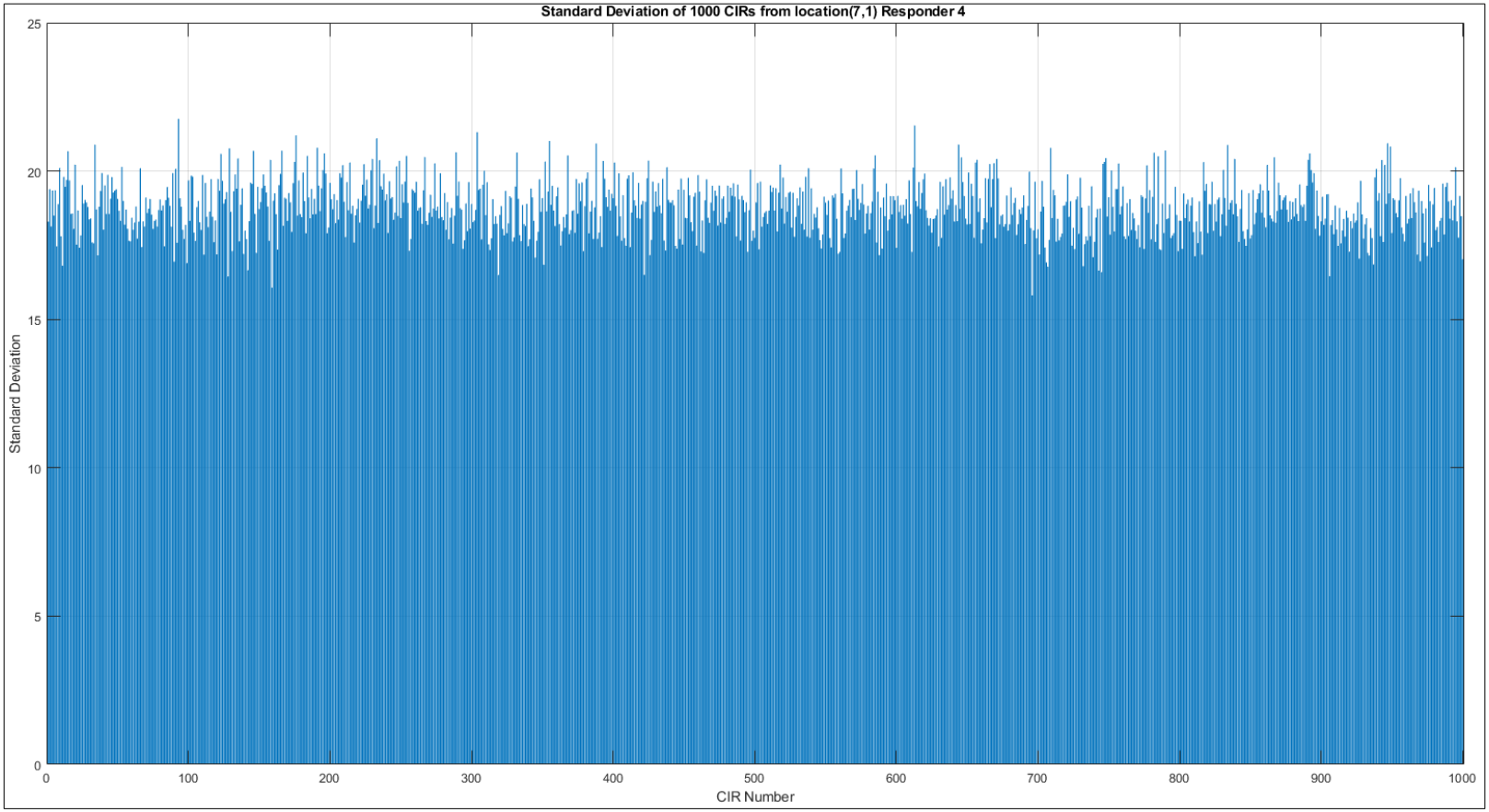


Figure: Standard deviation of the 720 first samples of 1000 CIRs from location(7,1) Responder 4

Checking the temperature effects

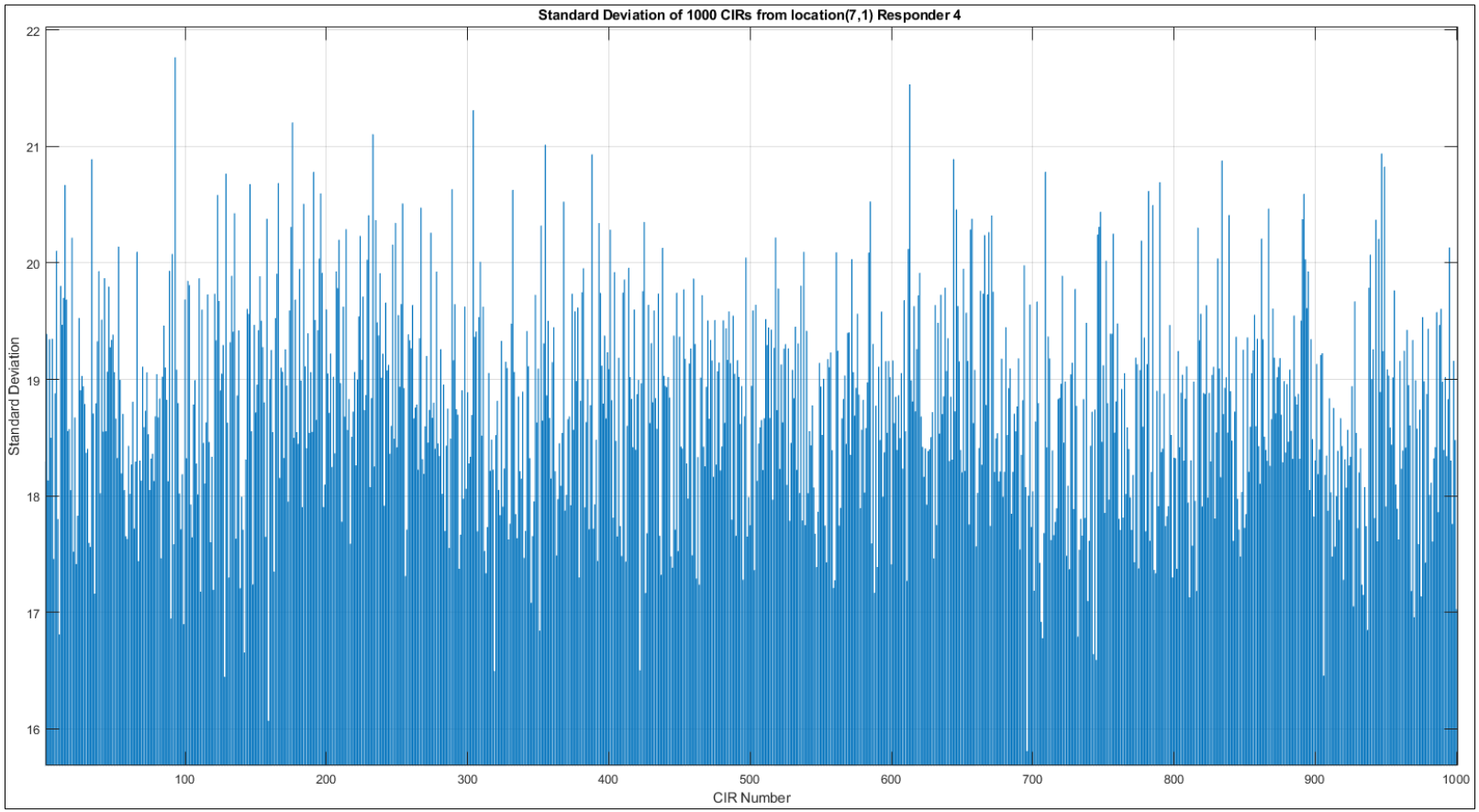


Figure: Standard deviation of the 720 first samples of 1000 CIRs from location(7,1) Responder 4

Checking the temperature effects

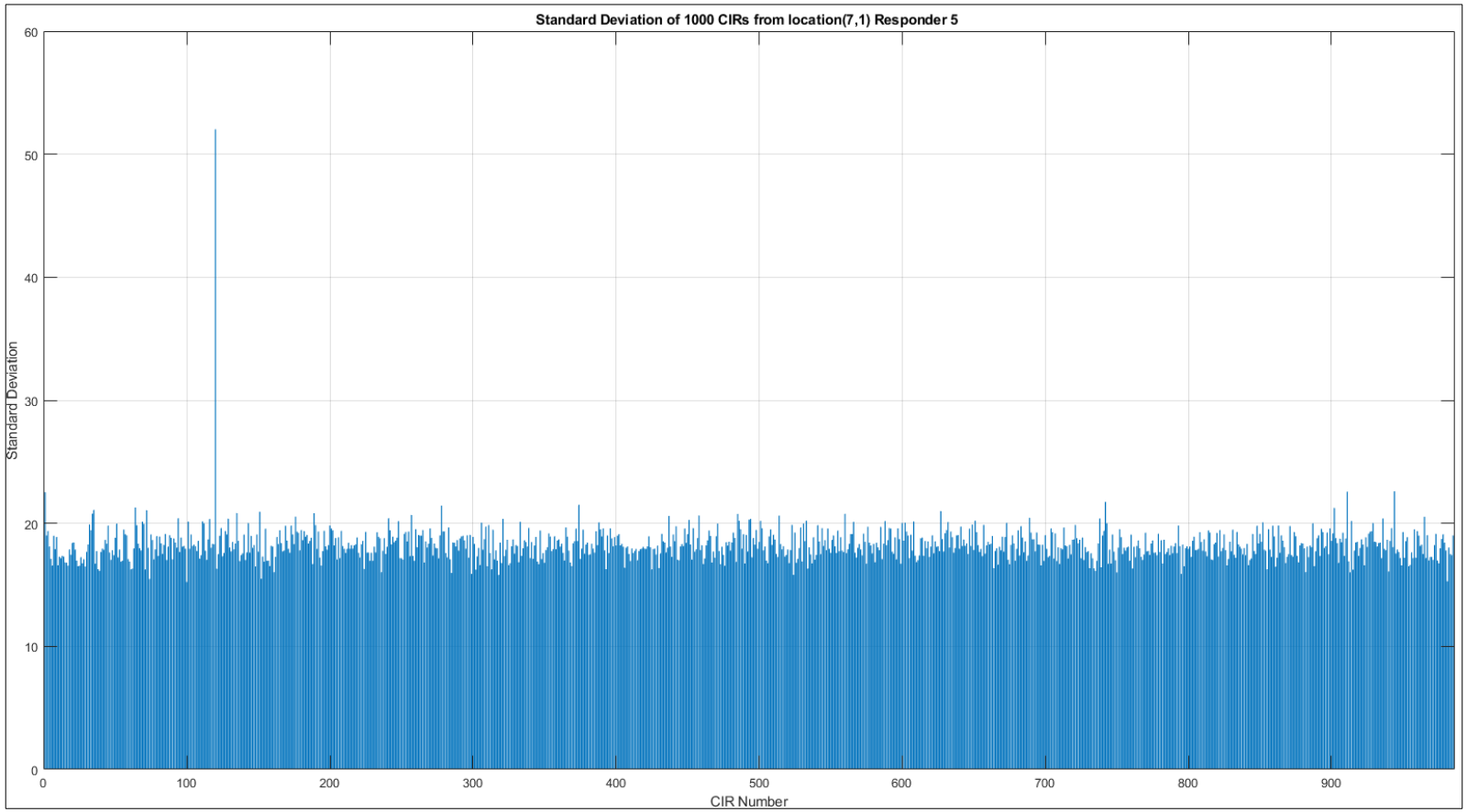


Figure: Standard deviation of the 720 first samples of 985 CIRs from location(7,1) Responder 5

Checking the temperature effects

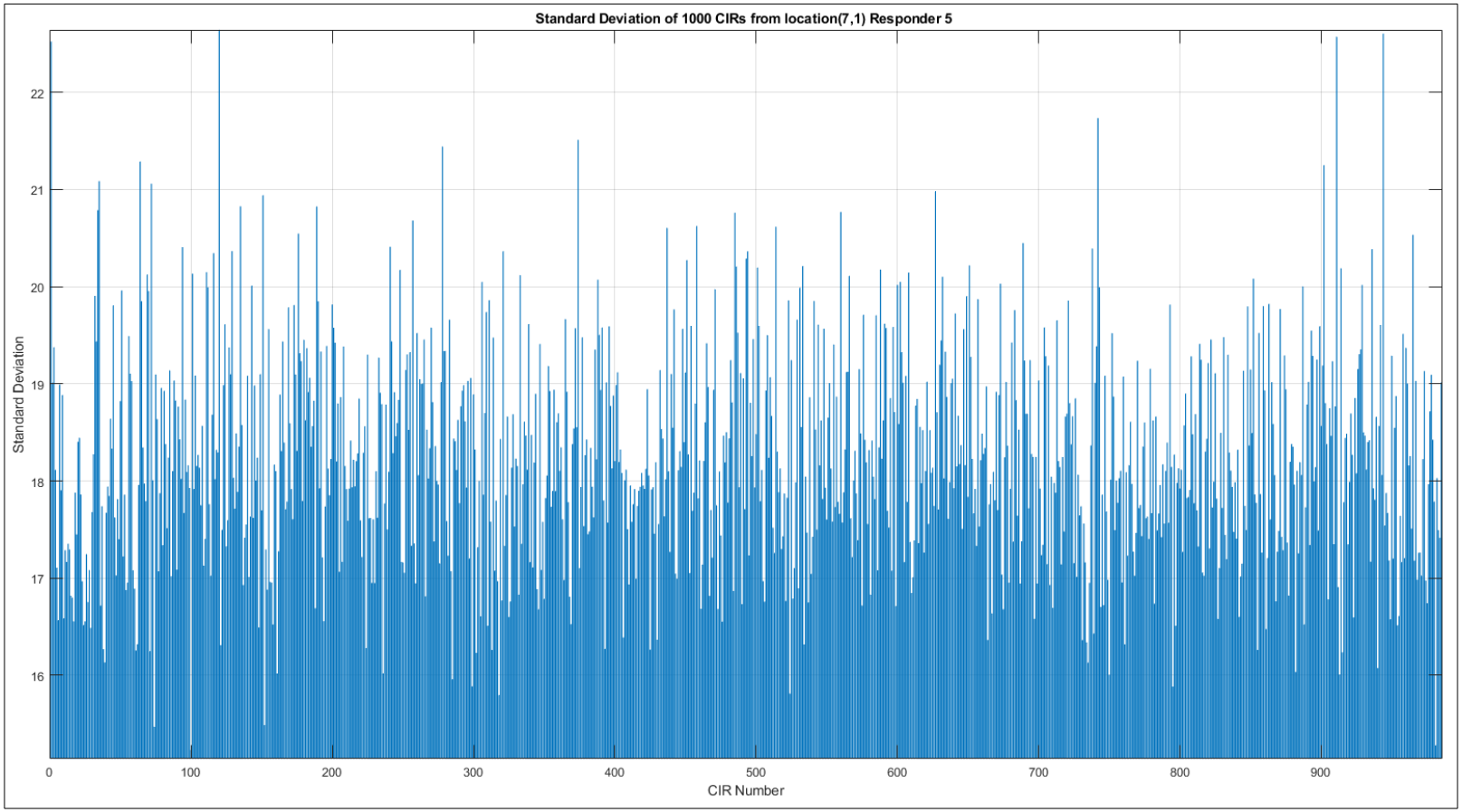


Figure: Standard deviation of the 720 first samples of 985 CIRs from location(7,1) Responder 5

Phase of CIRs


```
CIR_real_values = [4 -22 -22 -22 9 20 -15 -17 5 2 -12 -32 17 22 46 86 33 -6 -36 -18 -26 17 -46 -26 -1 3 12 1
12 38 5 10 42 30 -15 -1 -10 21 11 -36 -15 23 39 15 -24 8 20 8 -38 -19 -69 -3 -18 -42 24 54 26 -1 -36 -51 -45
10 6 44 9 19 -18 3 7 -2 2 -22 -70 -26 -36 -21 -43 -11 -22 -27 19 -2 -3 21 -10 33 27 2 3 -31 -44 -20 -11 18 9
5 -28 -24 18 4 10 0 5 -35 -57 -21 44 61 1 14 10 -22 -25 -29 -9 -18 12 24 -27 -51 -31 22 -12 28 14 20 6 3 22

CIR_imag_values = [7 32 20 3 5 25 20 23 -16 8 -8 18 0 42 69 33 31 29 24 2 -18 -9 17 -16 20 17 21 26 -27 -33
62 -56 -13 -34 -6 10 27 44 36 3 8 32 2 -27 10 46 45 -1 -12 -15 45 48 63 48 1 14 8 -6 2 16 -15 -38 -47 -37 4
6 15 29 44 8 11 6 -15 2 24 25 23 19 32 48 49 45 4 44 39 45 1 -30 -9 -11 0 0 7 16 9 9 4 -12 17 16 -19 -21 -20
-43 -22 17 4 11 -39 20 31 24 3 -40 -16 42 34 -8 -55 -23 -20 -23 -6 26 10 -27 -8 19 43 -24 -9 11 29 19 1 -13
{"Block":0, "results":[{"Addr":"0x0001","D_cm":382}],"RSSI_dBm":"-81.63","NLOS_%":0}
```


Figure: type of data

$$\phi(\text{rad}) = \arctan\left(\frac{\text{Imaginary value}}{\text{Real value}}\right) \tag{1}$$

$$\textit{Matlab}: \text{CIR\_phase} = \text{angle}(\text{CIR\_real} + i \times \text{CIR\_imag}) \tag{2}$$

Verification of LOS and NLOS phase differences by Phase ratio

num_negative_phases = 314 and num_positive_phases = 695

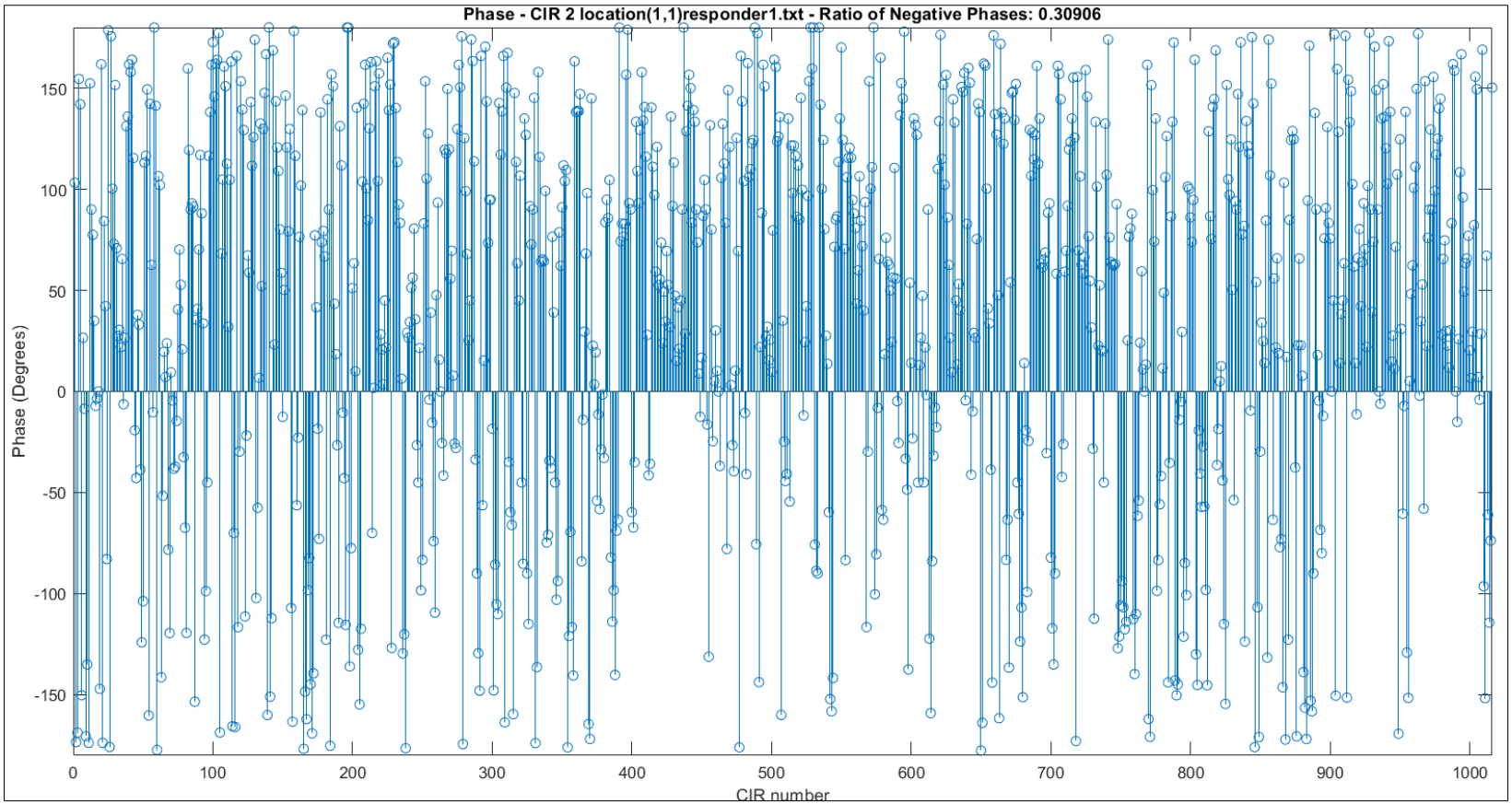
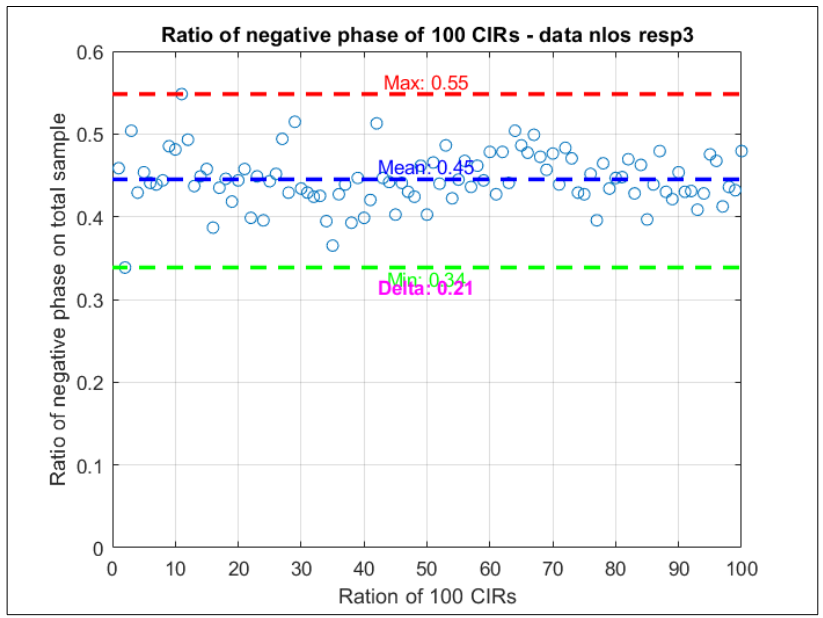


Figure: Phase Response

Verification of LOS and NLOS phase differences



NLOS Probability Group Division

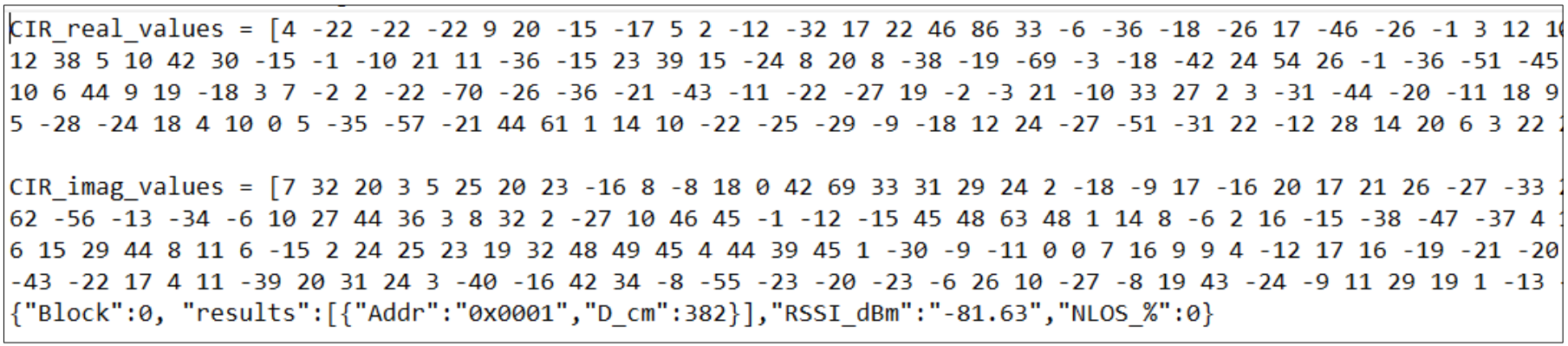


Figure: type of data

Groups division:

- 1rst Group: NLOS_% : 0% to 20 %
- 2nd Group: NLOS_% : 70% to 100 %

NLOS Probability 0 to 20%

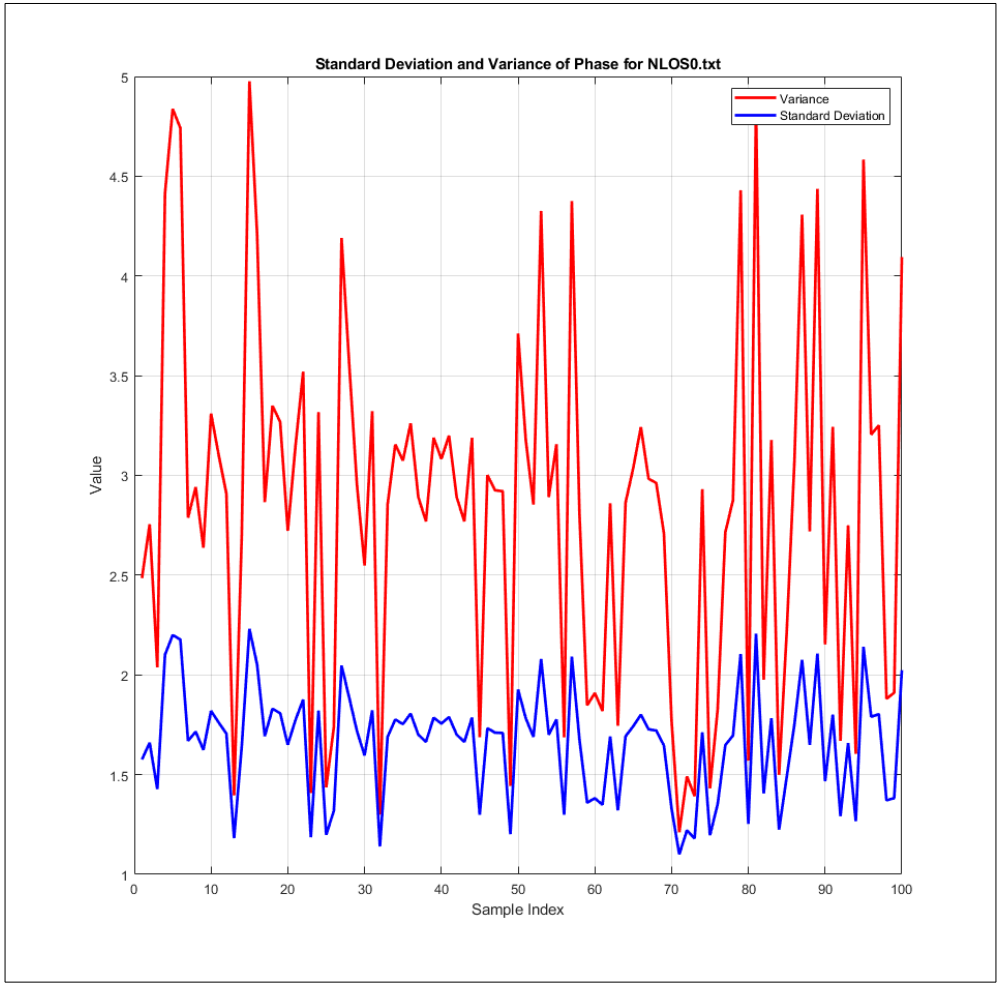


Figure: Phase Variance and Standard Deviation of 100 CIRs

NLOS Probability 70 to 100%

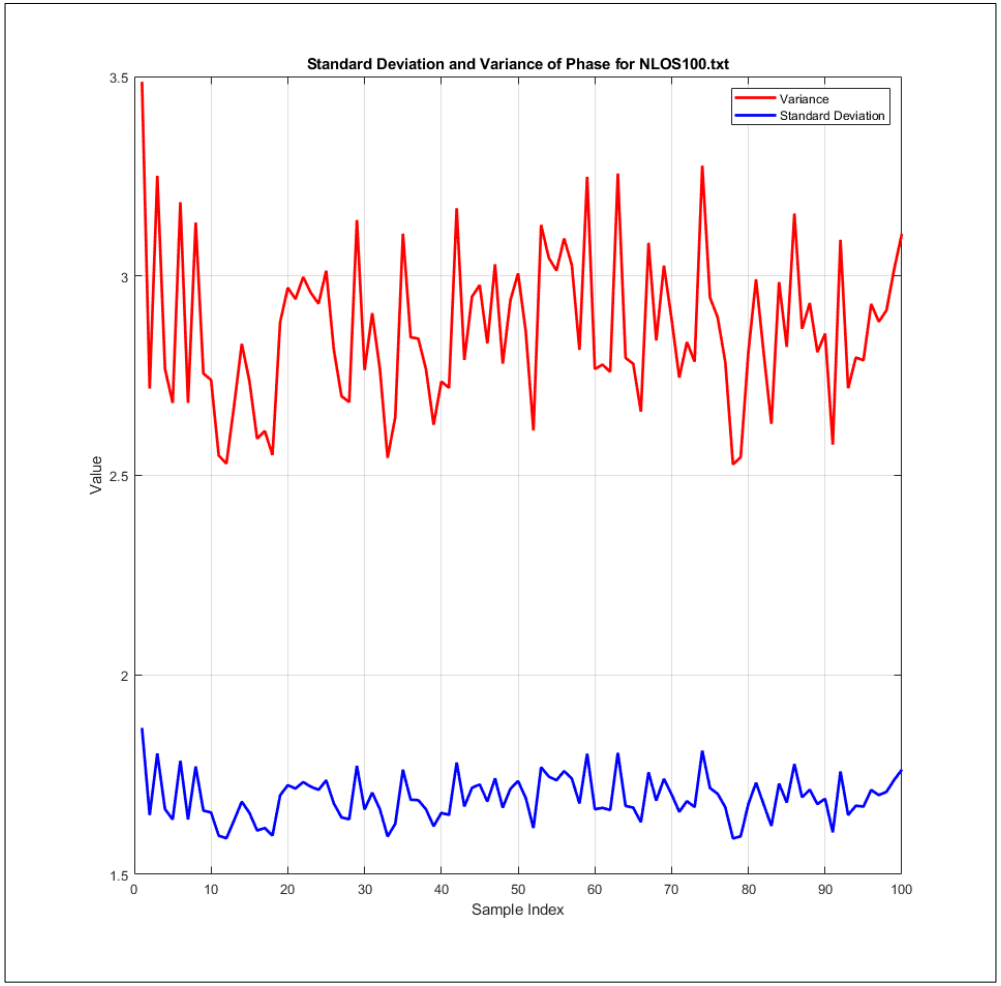


Figure: Phase Variance and Standard Deviation of 100 CIRs

Table of NLOS Probabilities for Location 5.3

File 5,3 ; Responder :		Total CIRs	0%	10-19%	20-29%	30-39%	40-49%	50-59%	70-79%	80-89%	90-99%	100%
1		984	482	159	200	52	3	0	1	0	0	1
2		1034	497	180	110	44	30	5	5	1	0	0
3		1028	262	450	125	7	5	0	0	2	0	3
4		1006	559	130	95	67	25	6	0	0	0	0
5		1032	1	36	4	42	98	120	372	162	17	35

Variance and Standard deviation of Phase for responder 1

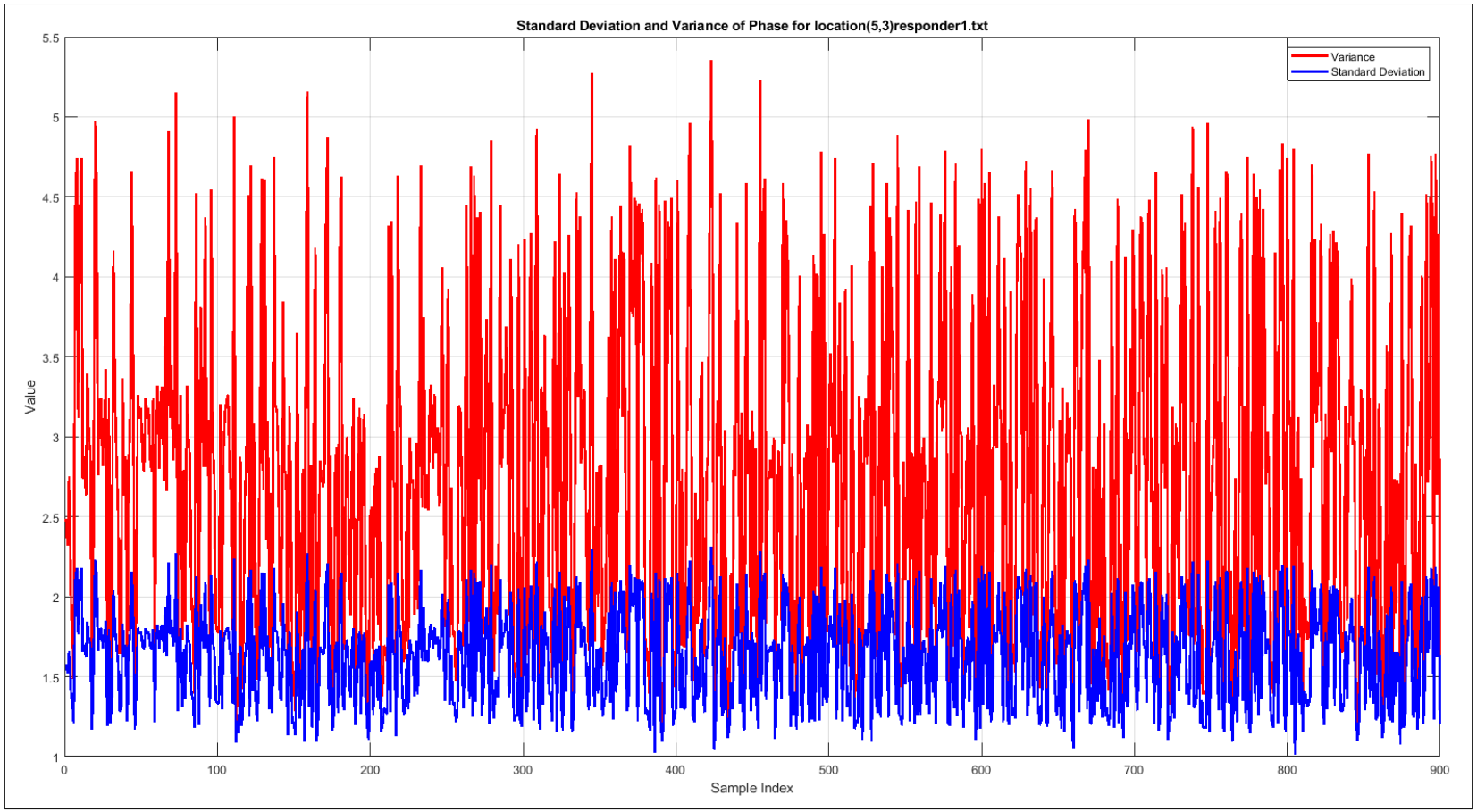


Figure: Phase Variance and Standard Deviation of 900 CIRs

Variance and Standard deviation of Phase for responder 2

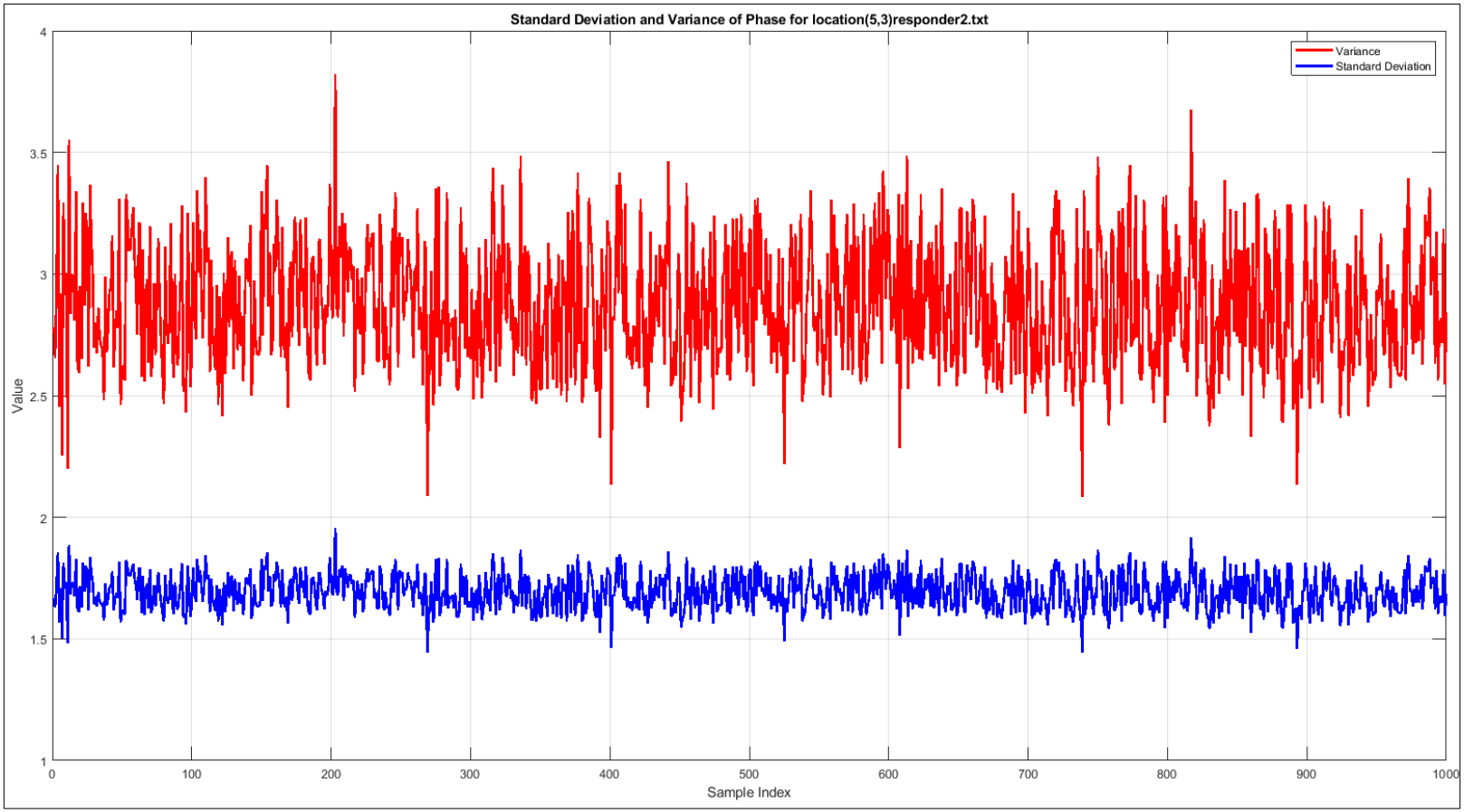


Figure: Phase Variance and Standard Deviation of 1000 CIRs

Variance and Standard deviation of Phase for responder 3

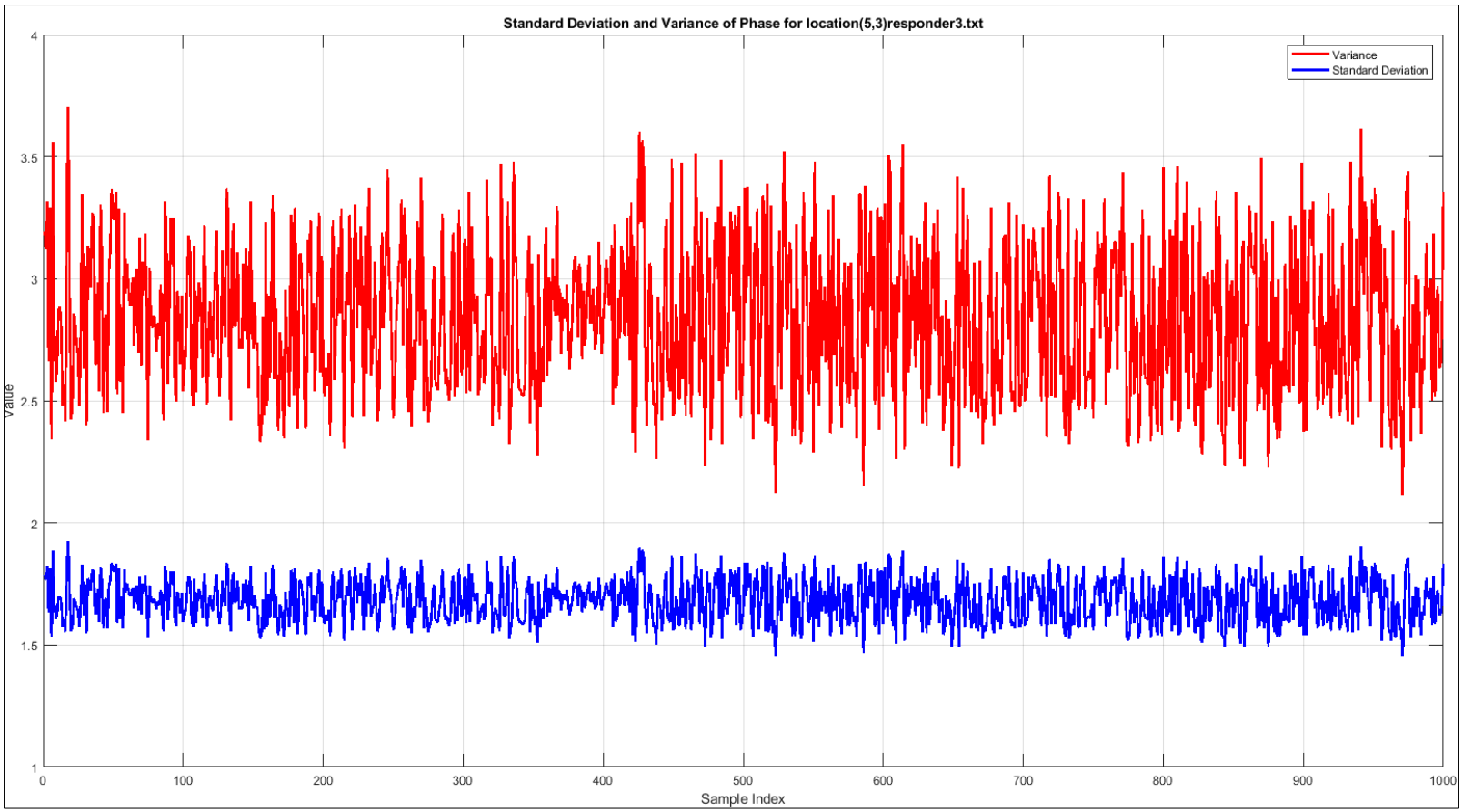


Figure: Phase Variance and Standard Deviation of 1000 CIRs

Variance and Standard deviation of Phase for responder 4

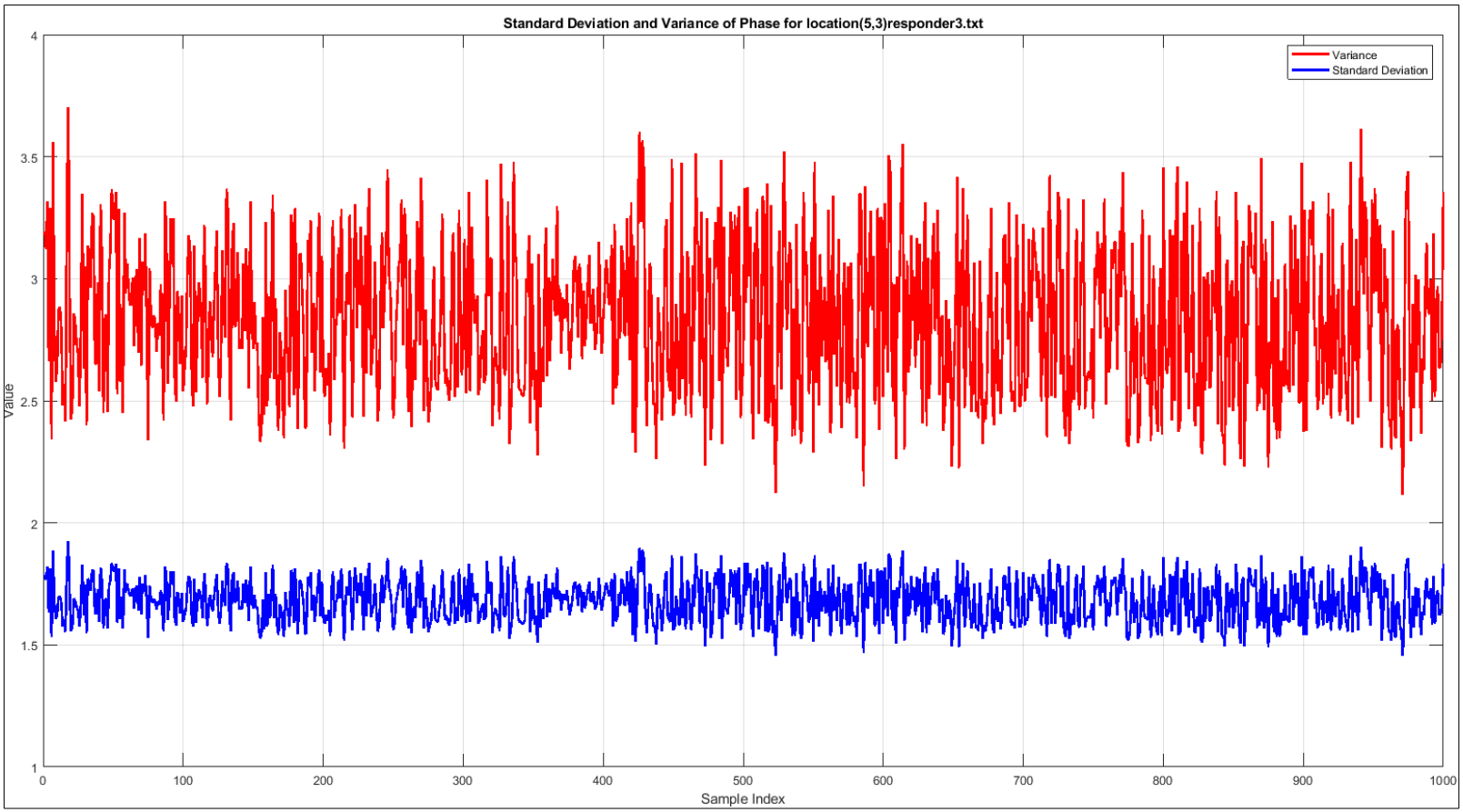


Figure: Phase Variance and Standard Deviation of 1000 CIRs

Variance and Standard deviation of Phase for responder 5

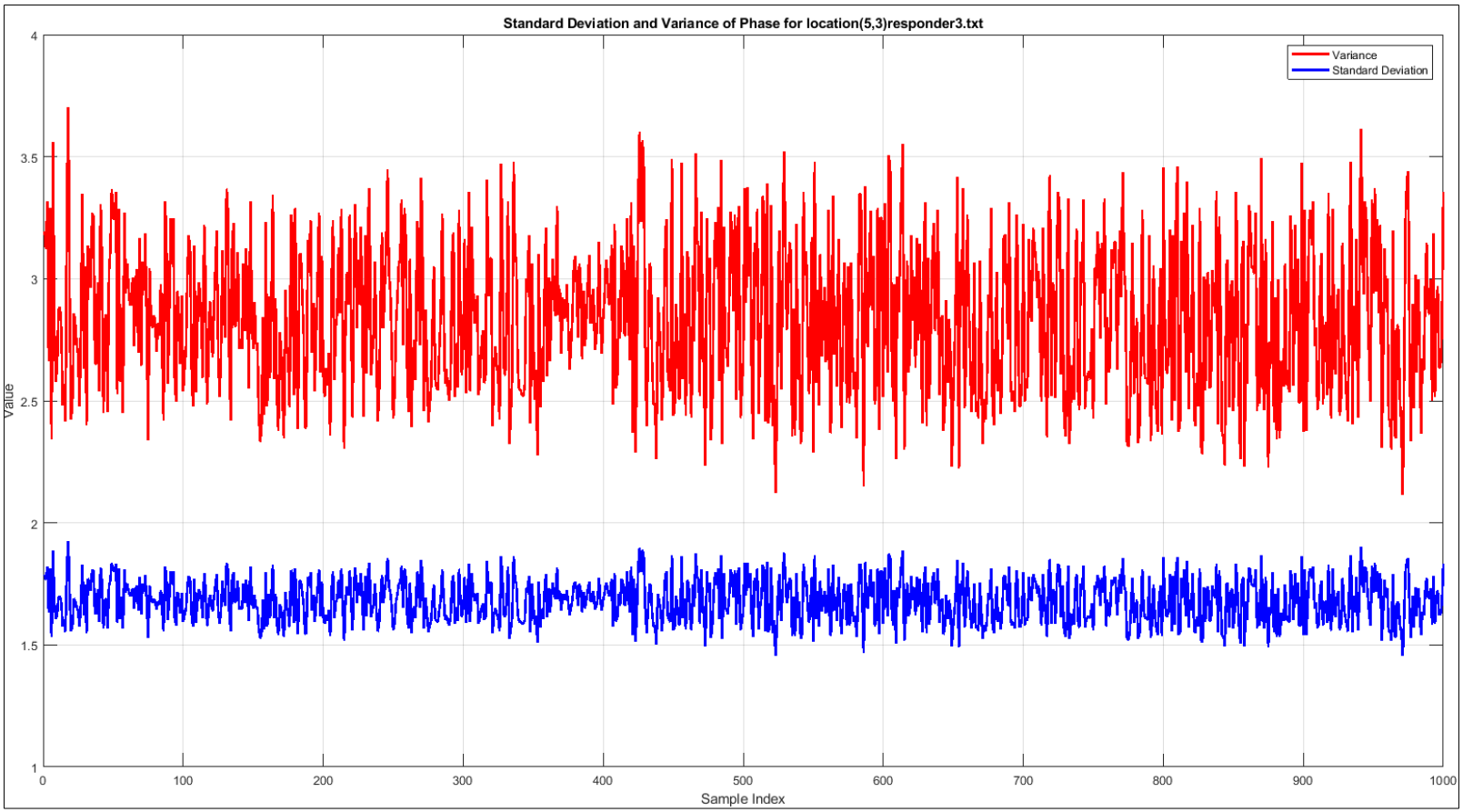


Figure: Phase Variance and Standard Deviation of 1000 CIRs