Hi3516DV300 DDR4 Test Report

System History

Date	Contents	Remarks
2019-3-16	The test is performed based on the DDR4 1866MHz standard	
Note: All the test data in this report is the test result of the HiSilicon test sample and is only for reference. Note that the tests conducted by HiSilicon cannot replace customers' related tests.		

Information

Chipset	Hi3516DV300
Board Name	HI3516DV300MEBLITE VER.A
DRAM Part Number	MT41K256M16TW-093:P
Oscilloscope	DSA72004C TEKTRONIX
Temperature	25ºC
DRAM Operating Frequency	900MHz(DDR4)
VPP/Vdd/Vref_CA/Vref_DQ/Vcore	1.2V/0.6V/Trainning/0.9V
DRAM_ODT	120ohm
SOC_ODT	120ohm
DRAM_RON	40ohm
SOC_RON	CK=34ohm 1T(CS/CKE/ODT)=34ohm 2T=34ohm DQ=40ohm DQS=40ohm

Signal Integrity Summary& Conclusion

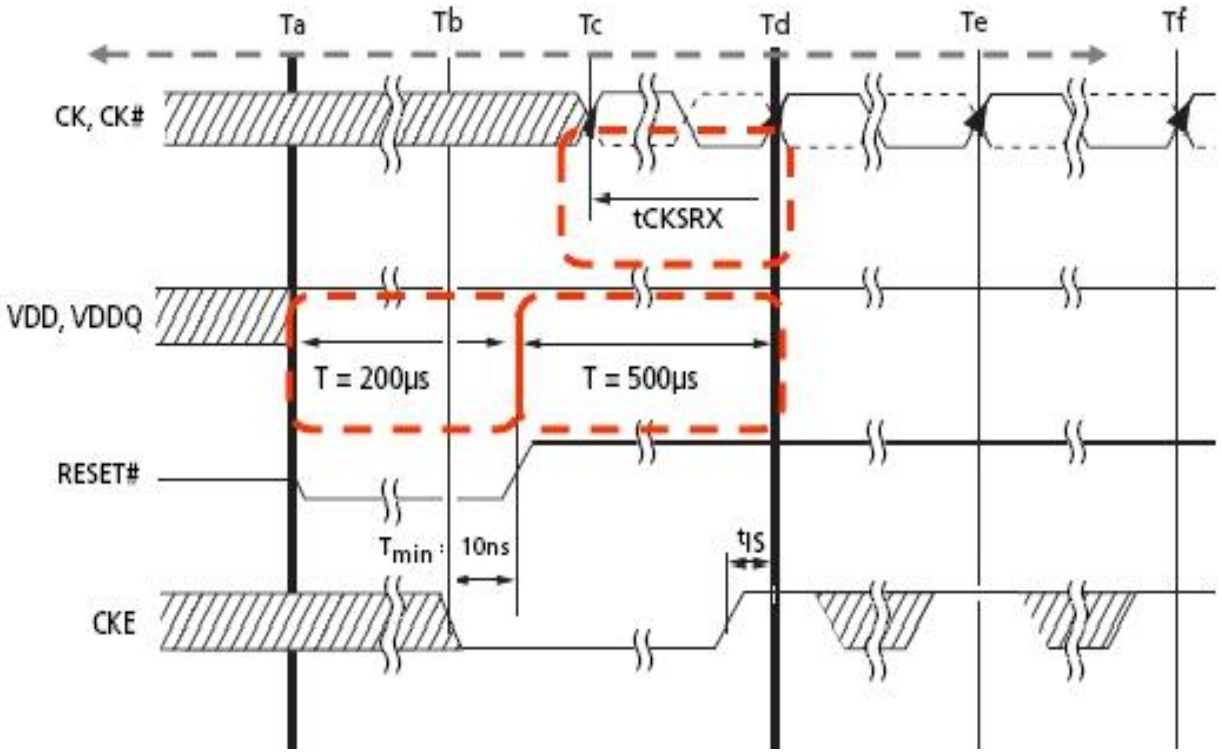
Judgment&Summary
1.tDQSH、tDQSL fail。 Impact: This indicator affects the window size in the write direction of the DQ. The margin of the measured window is sufficient. The risk of this indicator failure is low.

Measurement Item	Result	Remark
Sequence Check	PASS	
Power Check	PASS	
Signal Integrity Check	FAIL	

Power Up Initialization Sequence Check Result

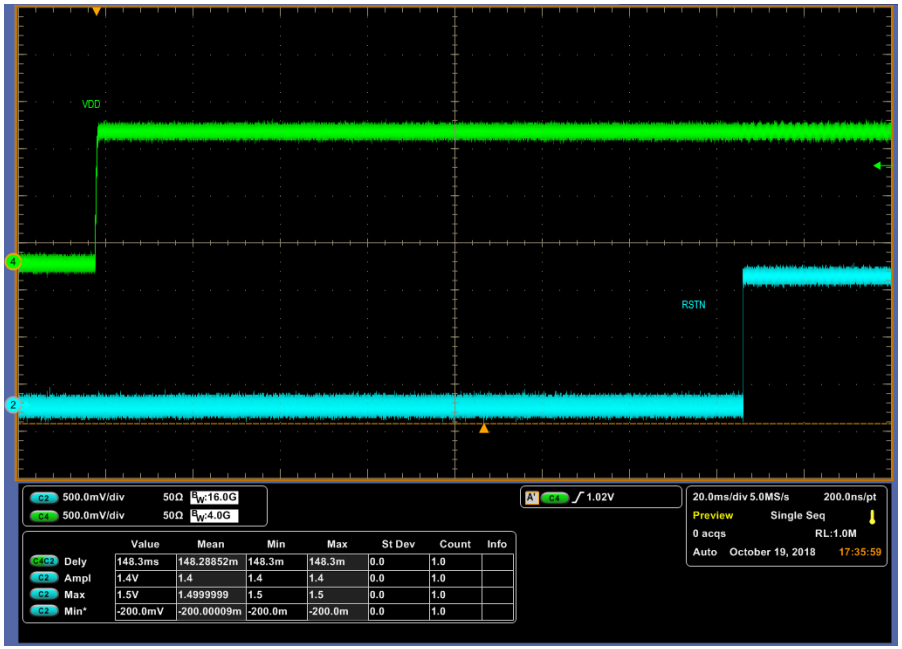
- **SPEC**

3.3.1 Power-up Initialization Sequence (Cont'd)



Power Up Initialization Sequence Check Result

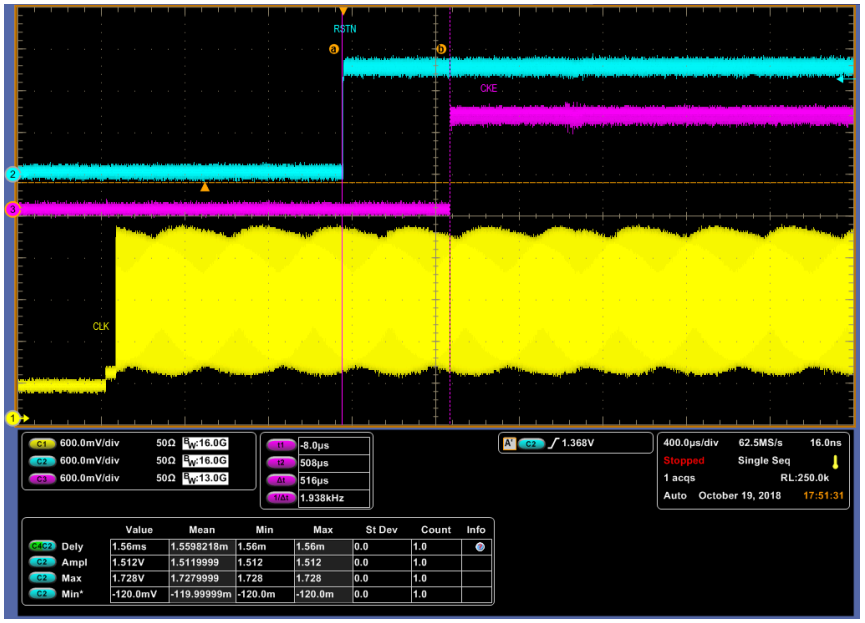
- **Stable VDD to /Reset Up**



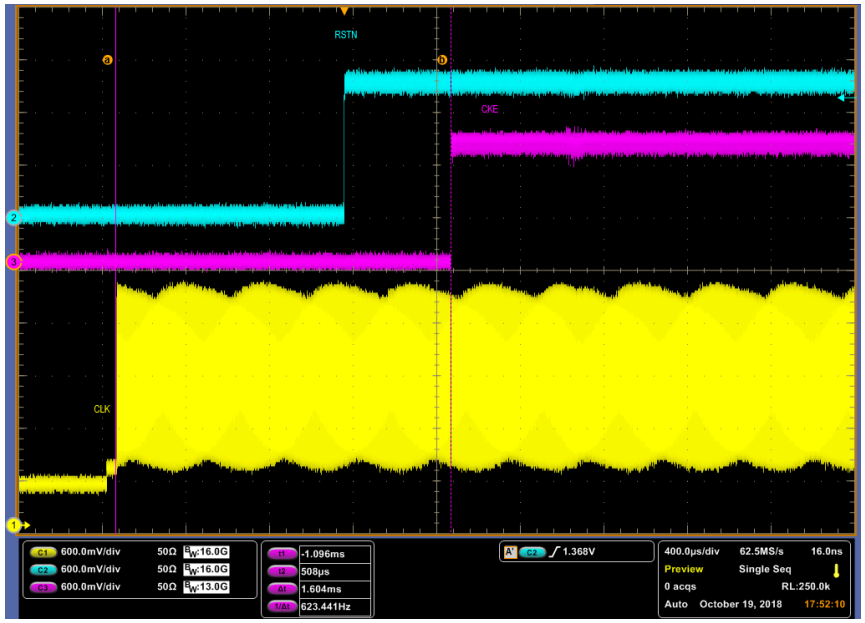
Parameter	Time	Spec	Result	Remark
Stable VDD to /Reset Up	148.3ms	Min:200us	**PASS**	RESET_n needs to be maintained for minimum 200us with stable power

Power Up Initialization Sequence Check Result

- /Reset Up To CKE Up



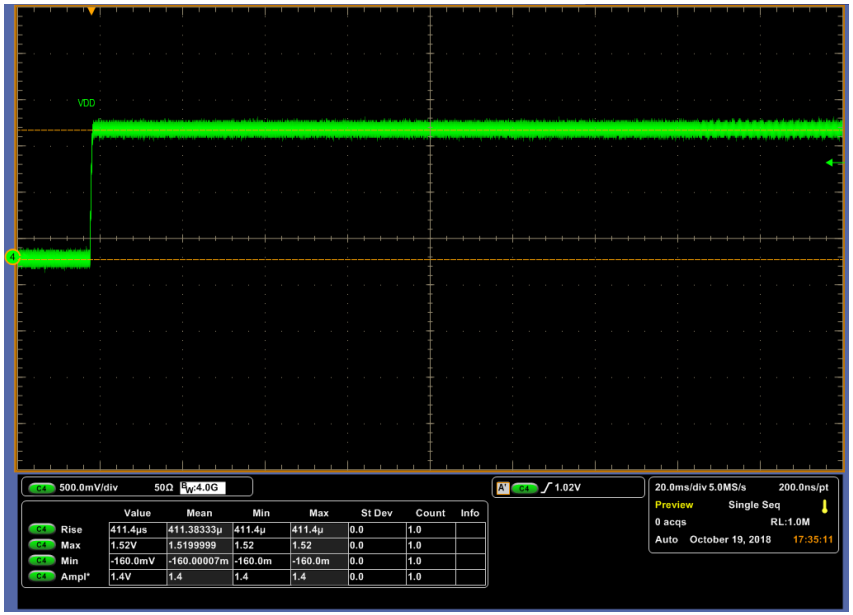
- tCKSRX



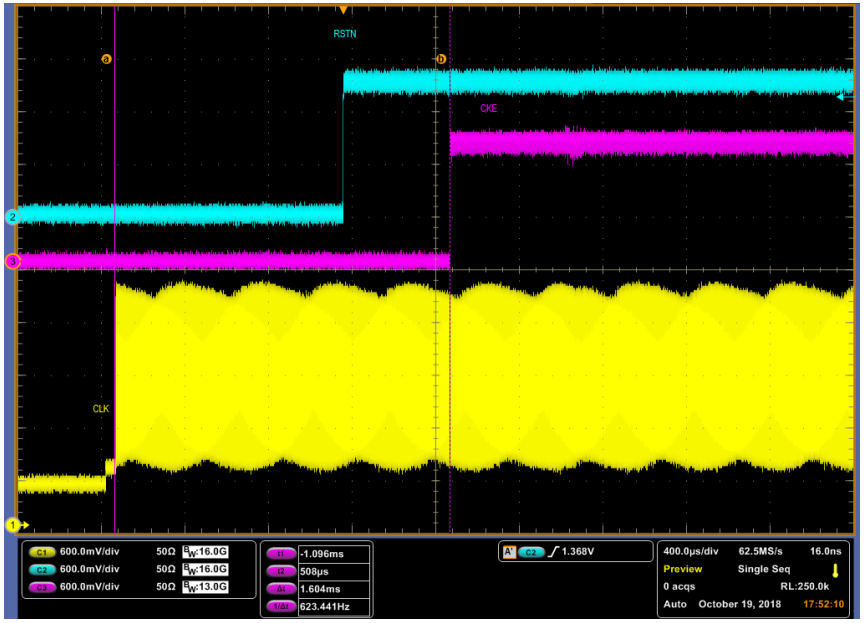
Parameter	Time	Spec	Result	Remark
/Reset Up To CKE Up	516us	Min:500us	PASS	After /RESET is de-asserted. Wait for another 500us until CKE becomes active.(JEDEC spec.)
tCKSRX	1.604ms	Min:Max(5nCK,10ns)	PASS	Clocks (CK, CK#) need to be started and stabilized for at least 10 ns or 5 tCK (which is larger) before CKE goes active.(JEDEC spec.)

Power Up Initialization Sequence Check Result

VDD Rising Time



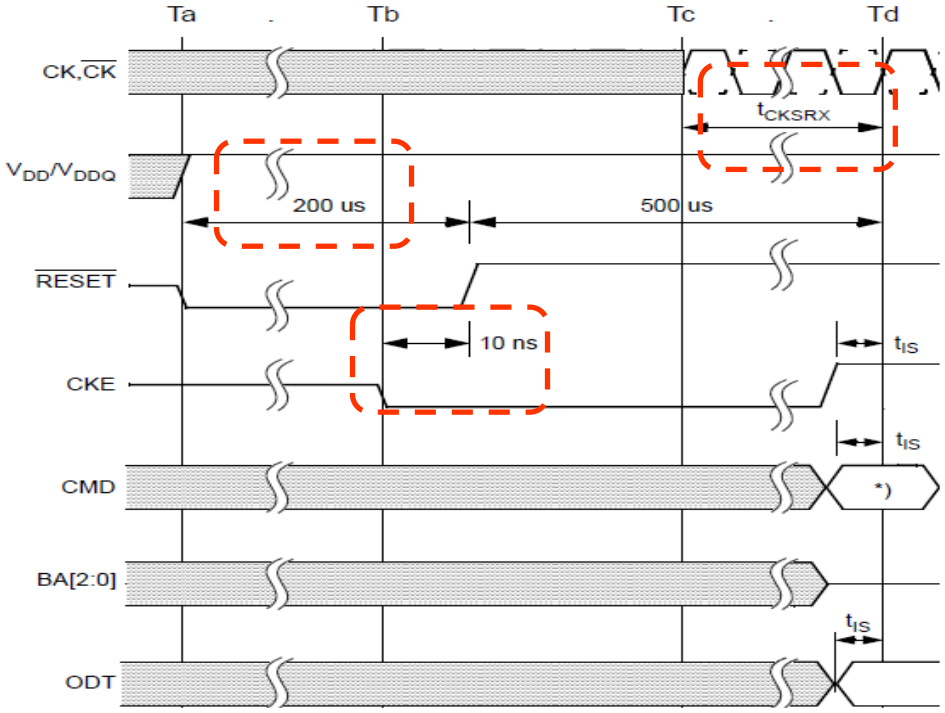
CKE Hold LOW Time To Reset Rising Edge



Parameter	Time	Spec	Result	Remark
VDD Rising Time	414us	Max:200ms	PASS	The power voltage ramp time between 300 mv to VDDmin must be no greater than 200 ms. (JEDEC spec.)
CKE Falling Edge to Reset Rising Edge	＞10ns	Min:10ns	PASS	CKE is pulled “Low” anytime before RESET# being de-asserted (min. time 10 ns).

Reset Initialization Sequence Check Result

SPEC

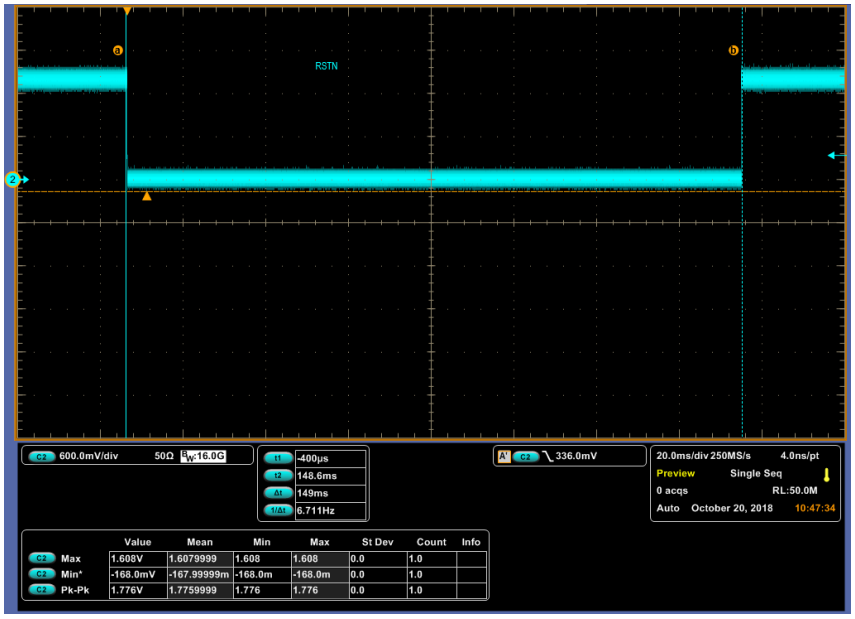


CKE Hold LOW TimeTo Reset Rising Edge_DDR

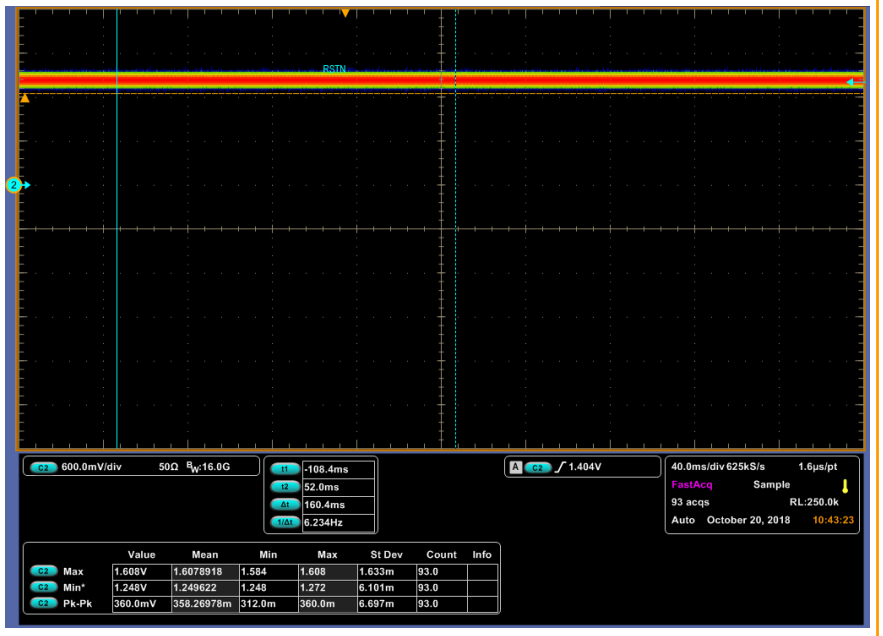
Parameter	Time	Spec	Result	Remark
CKE Falling Edge To Reset Rising Edge	> 10ns	Min:10ns	PASS	CKE is pulled “Low” anytime before RESET# being de-asserted (min. time 10 ns).

Reset Initialization Sequence Check Result

Reset Low Level Voltage



Reset High Level Voltage



Parameter	Voltage	Spec	Result	Remark
Reset Low Level Voltage	80mV	Max:300mV	PASS	Reset Low Level Voltage must be within 300mV.
Reset High Level Voltage	1.608V	Min:1.2V	PASS	Reset High Level Voltage must be above 1.2V.

Average Periodic Refresh Interval Check Result

SPEC

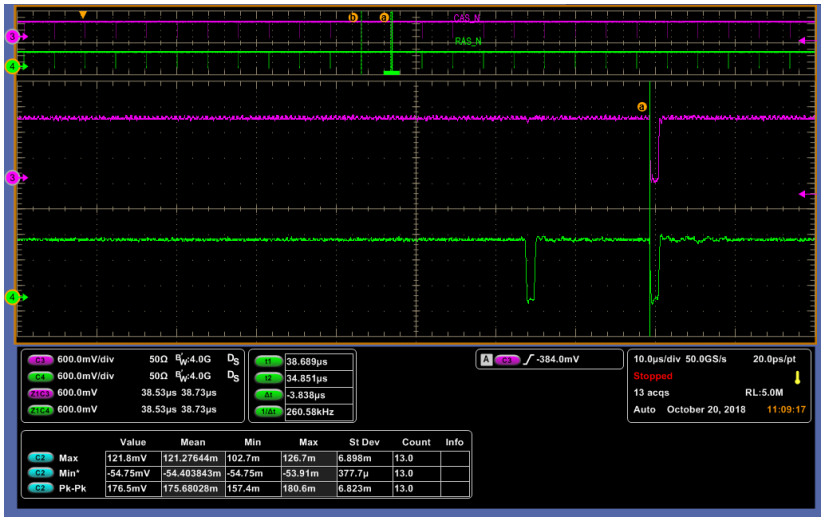
12.2 Refresh parameters by device density

Table 61 — Refresh parameters by device density

Parameter	Symbol		512Mb	1Gb	2Gb	4Gb	8Gb	Units	Notes
REF command to ACT or REF command time	tRFC		90	110	160	300	350	ns	
Average periodic refresh interval	tREFI	0 °C ≤ T_{CASE} ≤ 85 °C	7.8	7.8	7.8	7.8	7.8	µs	
		85 °C < T_{CASE} ≤ 95 °C	3.9	3.9	3.9	3.9	3.9	µs	1

NOTE 1. Users should refer to the DRAM supplier data sheet and/or the DIMM SPD to determine if DDR3 SDRAM devices support the following options or requirements referred to in this material.

Average Periodic Refresh Interval



Parameter	Time	Spec	Result	Remark
tREFI	3.838us	Max:7.8us	PASS	

Power Check Result

AC Peak-Peak Noise Check Result

Parameter	Spec (PK-PK)	Value (PK-PK)	Unit	Result	Position	Test Point
VDD_IO	NA	71.2	mV	NA	DRAM	C282
VREFCA	30	17.8	mV	PASS	DRAM	C153
VREFDQ	30	20.8	mV	PASS	DRAM	C161

▣ **VDD_IO Supply Voltage**

Parameter	Spec	Value	Unit	Result	Position	Test Point
VDD_IO	Min:1.283 Max:1.45	1.341	V	PASS	SOC	C3
		1.342	V	PASS	DDR	C157

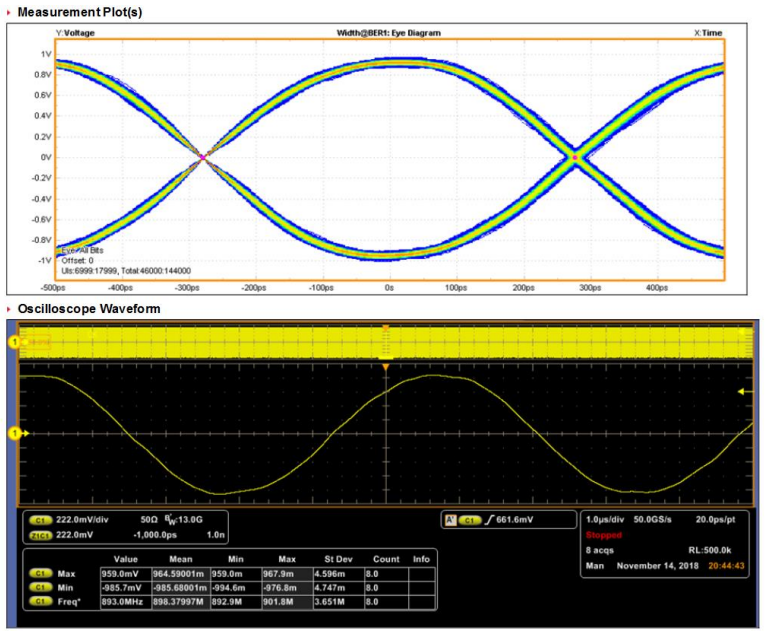
Signal Integrity Test Result (Clock)

- **Clock Signal Integrity Test Result**

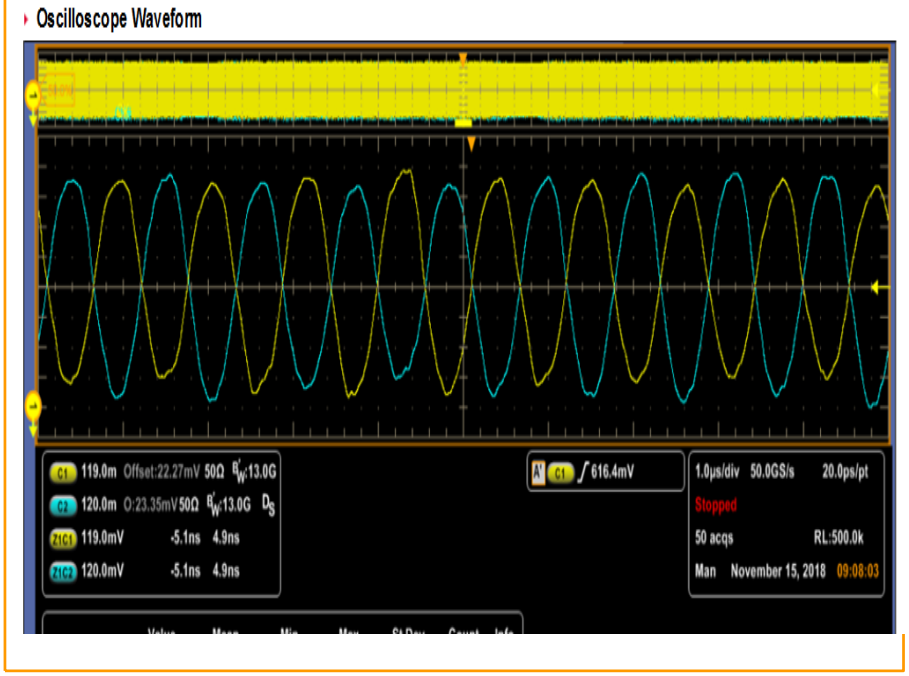
Parameter	Spec (Min)	Spec (Max)	Measurement data (Min)	Measurement data (Max)	Unit	Remark
Vix	-150	150	-110.96	25.51	mV	PASS
tCK(avg)	1.07	1.25	1.1108	1.1114	ps	PASS
tCH(avg)	470	530	498.44	501.98	mtCK(avg)	PASS
tCL(avg)	470	530	497.95	501.54	mtCK(avg)	PASS
tJIT(per)	-70	70	-17.288	18.08	ps	PASS
tJIT(cc)	-140	140	-30.073	28.823	ps	PASS
InputSlew-Diff-Rise	-	-	-	6.568	V/ns	-
InputSlew-Diff-Fall	-	-	-	-6.6804	V/ns	-

Signal Integrity Test Result (Clock)

CLK Different modle signal

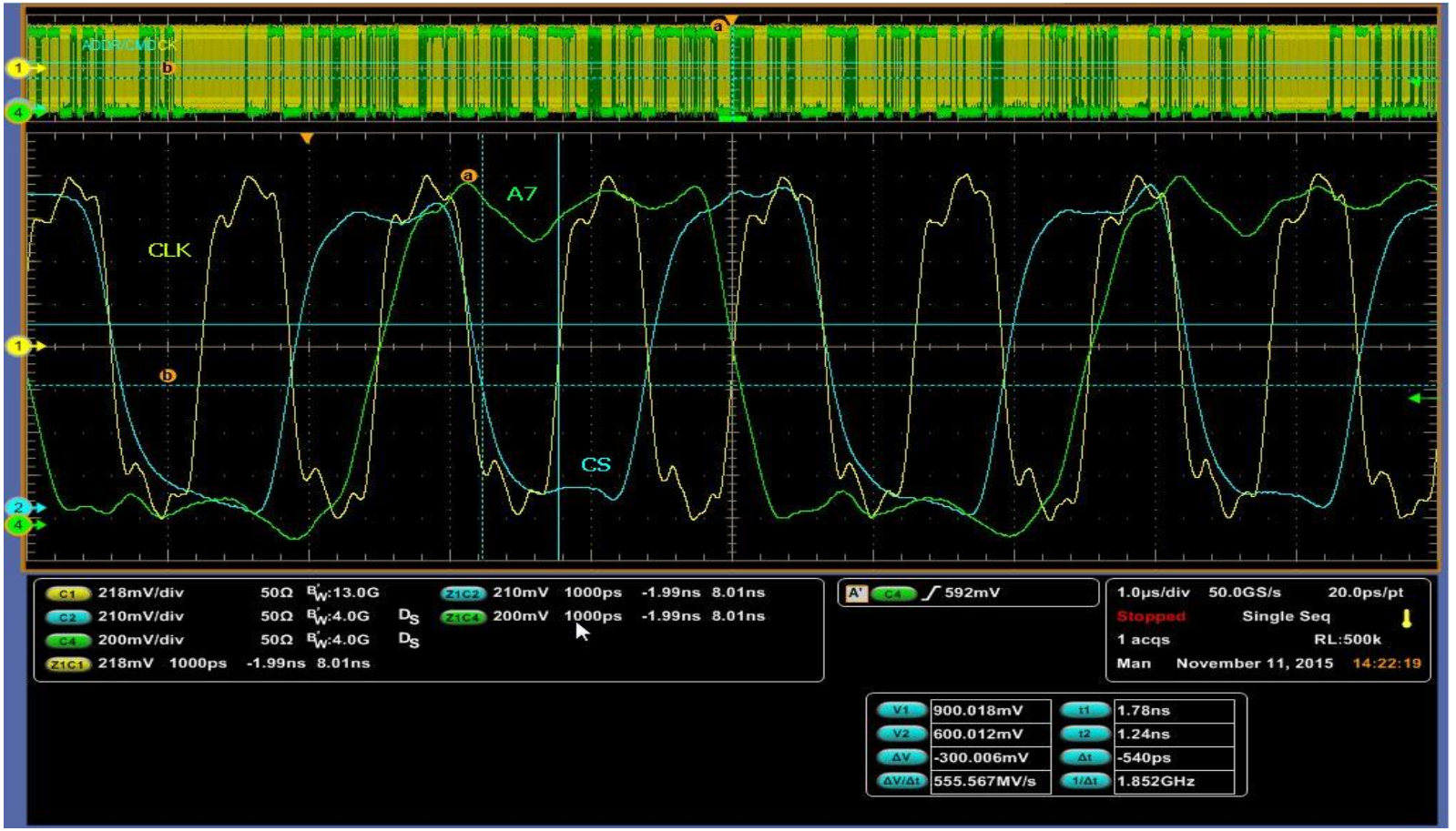


CLK Single signal



About 1T&2T signal test

1 T signal include: CS, ODT, CKE; other address and cmd signal are 2T signal. For 1T signal，you can test the signal using DDR3 test analysis module, but for 2T signal you can't test using the test module.



Signal Integrity Test Result (CMD&ADDR)

- **SPEC**

Symbol	Reference	DDR3-800	DDR3-1066	DDR3-1333	DDR3-1600	DDR3-1866	DDR3-2133	Units
tIS(base) AC175	$V_{IH/L(ac)}$	200	125	65	45	-	-	ps
tIS(base) AC150	$V_{IH/L(ac)}$	350	275	190	170	-	-	ps
tIS(base) AC135	$V_{IH/L(ac)}$	-	-	-	-	65	60	ps
tIS(base) AC125	$V_{IH/L(ac)}$	-	-	-	-	150	135	ps
tIH(base) DC100	$V_{IH/L(dc)}$	275	200	140	120	100	95	ps

ΔtIS, ΔtIH derating in [ps] AC/DC based Alternate AC125 Threshold -> VIH(ac)=VREF(dc)+135mV, VIL(ac)=VREF(dc)-135mV																	
		CK,CK# Differential Slew Rate															
		4.0 V/ns		3.0 V/ns		2.0 V/ns		1.8 V/ns		1.6 V/ns		1.4 V/ns		1.2 V/ns		1.0 V/ns	
		ΔtIS	ΔtIH	ΔtIS	ΔtIH	ΔtIS	ΔtIH	ΔtIS	ΔtIH	ΔtIS	ΔtIH	ΔtIS	ΔtIH	ΔtIS	ΔtIH	ΔtIS	ΔtIH
CMD/ ADD Slew rate V/ns	2.0	68	50	68	50	68	50	76	58	84	66	92	74	100	84	108	100
	1.5	45	34	45	34	45	34	53	42	61	50	69	58	77	68	85	84
	1.0	0	0	0	0	0	0	8	8	16	16	24	24	32	34	40	50
	0.9	2	-4	2	-4	2	-4	10	4	18	12	26	20	34	30	42	46
	0.8	3	-10	3	-10	3	-10	11	-2	19	6	27	14	35	24	43	40
	0.7	6	-16	6	-16	6	-16	14	-8	22	0	30	8	38	18	46	34
	0.6	9	-26	9	-26	9	-26	17	-18	25	-10	33	-2	41	8	49	24
	0.5	5	-40	5	-40	5	-40	13	-32	21	-24	29	-16	37	-6	45	10
	0.4	-3	-60	-3	-60	-3	-60	6	-52	14	-44	22	-36	30	-26	38	-10

Signal Integrity Test Result (CMD&ADDR)

- **Command Signal Integrity Test Result**

CMD /ADD	Input SetupTime (tIS)@AC150 tIS(min)(ps）	Input Hold Time (tIH)@DC100 tIH(min)（ps）	Input Slew Rate (RisingTime)（V/ns）	Input Slew Rate (FallingTime)（V/ns）
SPEC	133	150		
CS_N	616.35	295.46	4.3141	-4.3011
ODT	588.71	390.77	3.9206	-3.4875

Signal Integrity Test Result (CMD&ADDR)

- 1T_CMD_ADDR CS#

- 1T_CMD_ADDR ODT

Signal Integrity Test Result (CMD&ADDR)

Address Signal Integrity Test Result

CMD /ADD	Input SetupTime (tIS)@AC150 tIS(min)(ps）	Input Hold Time (tIH)@DC100 tIH(min)（ps）	Input Slew Rate (RisingTime)（V/ns）	Input Slew Rate (FallingTime)（V/ns）
SPEC	133	150		
A7	893.48	1033.5	3.2578	-3.6947
A13	958.5	1020.8	3.3281	-3.5203

Signal Integrity Test Result (CMD&ADDR)

- 2T_CMD_ADDR A7

- 2T_CMD_ADDR A13

Signal Integrity Test Result (DATA)

- **SPEC**

Symbol	Reference	DDR3-800	DDR3-1066	DDR3-1333	DDR3-1600	DDR3-1866	DDR3-2133	Units	Notes
tDS(base) AC175	$V_{IH/L(ac)}$ SR=1V/ns	75	25	-	-	-	-	ps	2
tDS(base) AC150	$V_{IH/L(ac)}$ SR=1V/ns	125	75	30	10	-	-	ps	2
tDS(base) AC135	$V_{IH/L(ac)}$ SR=1V/ns	165	115	60	40			ps	2, 3
tDS(base) AC135	$V_{IH/L(ac)}$ SR=2V/ns	-	-	-	-	68	53	ps	1
tDH(base) DC100	$V_{IH/L(dc)}$ SR=1V/ns	150	100	65	45	-	-	ps	2
tDH(base)DC100	$V_{IH/L(dc)}$ SR=2V/ns					70	55	ps	1

ΔtDS, ΔtDH derating in [ps] AC/DC based
Alternate AC135 Threshold -> VIH(ac)=VREF(dc)+135mV, VIL(ac)=VREF(dc)-135mV
Alternate DC 100 Threshold -> VIH(dc)=VREF(dc)+100mV, VIL(dc)=VREF(dc)-100mV

		DQS,DQS# Differential Slew Rate																					
		8.0 V/ns		7.0 V/ns		6.0 V/ns		5.0 V/ns		4.0 V/ns		3.0 V/ns		2.0 V/ns		1.8 V/ns		1.6 V/ns		1.4 V/ns		1.2 V/ns		1.0 V/ns	
		ΔtDS	ΔtDH	ΔtDS	ΔtDH	ΔtDS	ΔtDH	ΔtDS	ΔtDH	ΔtDS	ΔtDH	ΔtDS	ΔtDH	ΔtDS	ΔtDH	ΔtDS	ΔtDH	ΔtDS	ΔtDH	ΔtDS	ΔtDH	ΔtDS	ΔtDH	ΔtDS	ΔtDH
DQS Slew rate V/ns	4.0	34	25	34	25	34	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3.5	29	21	29	21	29	21	29	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3.0	23	17	23	17	23	17	23	17	23	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2.5	-	-	14	10	14	10	14	10	14	10	14	10	-	-	-	-	-	-	-	-	-	-	-	-
	2.0	-	-	-	-	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	-	-	-	-
	1.5	-	-	-	-	-	-	-23	-17	-23	-17	-23	-17	-23	-17	-15	-9	-	-	-	-	-	-	-	-
	1.0	-	-	-	-	-	-	-	-	-68	-50	-68	-50	-68	-50	-60	-42	-52	-34	-	-	-	-	-	-
	0.9	-	-	-	-	-	-	-	-	-	-	-66	-54	-66	-54	-58	-46	-50	-38	-42	-30	-	-	-	-
	0.8	-	-	-	-	-	-	-	-	-	-	-	-	-64	-60	-56	-52	-48	-44	-40	-36	-32	-26	-	-
	0.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-53	-59	-45	-51	-37	-43	-29	-33	-21	-17
	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-43	-61	-35	-53	-27	-43	-19	-27
	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-39	-66	-31	-56	-23	-40
	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-38	-76	-30	-60

Signal Integrity Test Result (DATA)

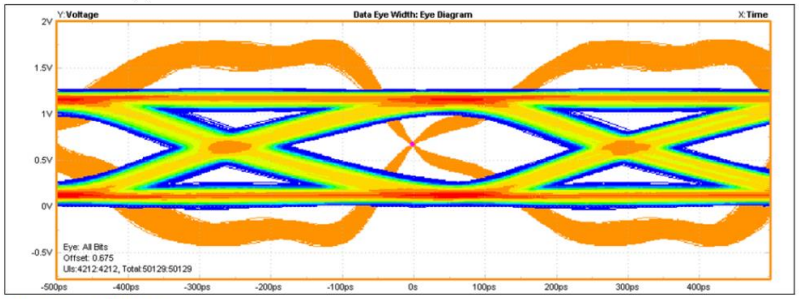
- **Data Signal Integrity Test Result**

Parameter	Spec	Unit	DQ10	DQ12	Remarks
Input Slew Rate(Setup-time)	-	V/ns	2.6952	3.0897	-
Input Slew Rate(Hold-time)	-	V/ns	-3.079	-3.5422	-
Input Setup-Time(tDS)@AC135 [tDS(base)=68ps]	min:91	ps	101.07	98.945	PASS
Input Hold-Time(tDH)@DC100 [tDH(base)=70ps]	min:87	ps	174.77	208.58	PASS

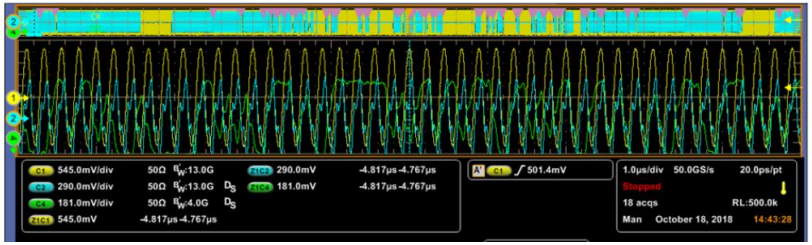
Signal Integrity Test Result (DATA)

DDR0-DQ10

Measurement Plot(s)

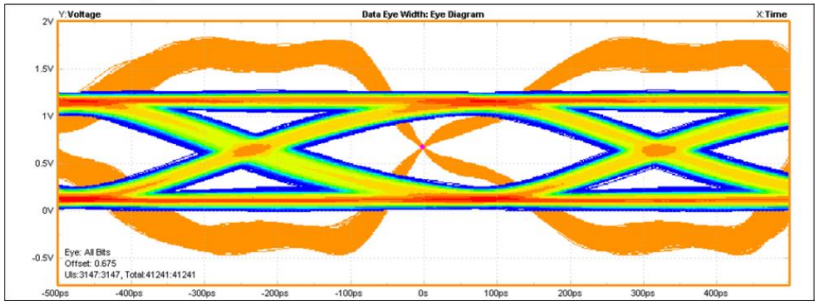


Oscilloscope Waveform

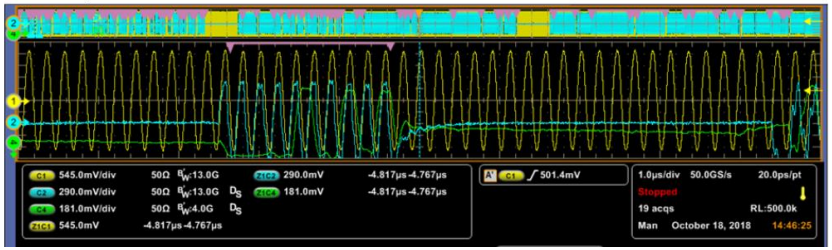


DDR0-DQ12

Measurement Plot(s)



Oscilloscope Waveform



Signal Integrity Test Result (DATA)

- tDQSH，tDQSL fail

Pass/Fail Information

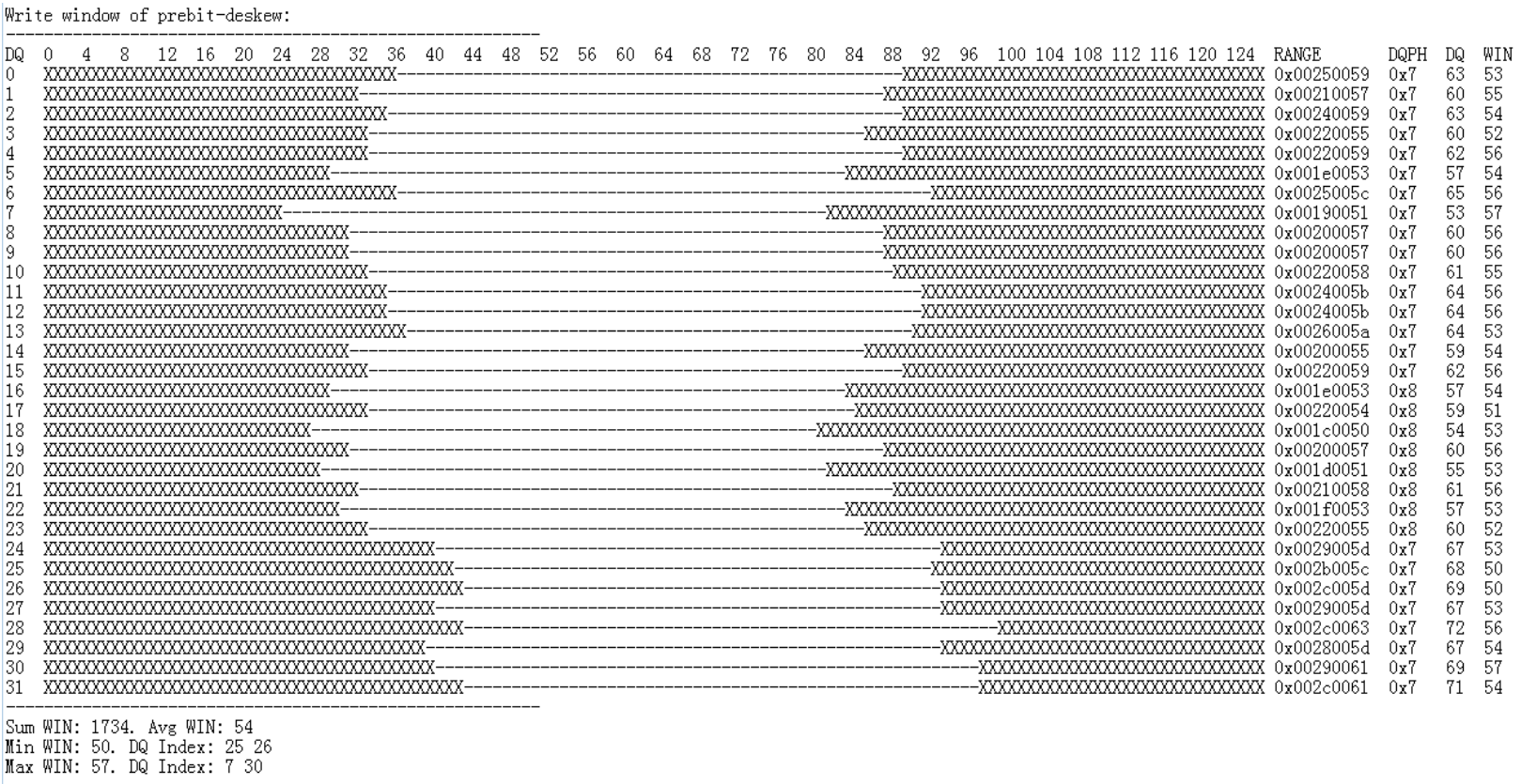
Measurement	tDQSH			
Source1	DQS(Ch2)			
	Value	High Limit	Low Limit	Pass Fail
Min	496.82mtCK(avg)		450.00mtCK(avg)	Pass
Max	579.24mtCK(avg)	550.00mtCK(avg)		Fail

Pass/Fail Information

Measurement	tDQSL			
Source1	DQS(Ch2)			
	Value	High Limit	Low Limit	Pass Fail
Min	478.36mtCK(avg)		450.00mtCK(avg)	Pass
Max	551.28mtCK(avg)	550.00mtCK(avg)		Fail

DDR training window

- **DDR Training write window**



```
Write window of prebit-deskew:
-------------------------------------------------------------
DQ  0   4   8   12  16  20  24  28  32  36  40  44  48  52  56  60  64  68  72  76  80  84  88  92  96  100 104 108 112 116 120 124  RANGE       DQPH  DQ  WIN
0   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x00250059  0x7   63  53
1   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX--------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x00210057  0x7   60  55
2   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x00240059  0x7   63  54
3   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX--------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x00220055  0x7   60  52
4   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX--------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x00220059  0x7   62  56
5   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX------------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x001e0053  0x7   57  54
6   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x0025005c  0x7   65  56
7   XXXXXXXXXXXXXXXXXXXXXXXXXXXXX------------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x00190051  0x7   53  57
8   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX--------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x00200057  0x7   60  56
9   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX--------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x00200057  0x7   60  56
10  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x00220058  0x7   61  55
11  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x0024005b  0x7   64  56
12  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x0024005b  0x7   64  56
13  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x0026005a  0x7   64  53
14  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x00200055  0x7   59  54
15  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x00220059  0x7   62  56
16  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX--------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x001e0053  0x8   57  54
17  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x00220054  0x8   59  51
18  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX------------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x001c0050  0x8   54  53
19  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x00200057  0x8   60  56
20  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX--------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x001d0051  0x8   55  53
21  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x00210058  0x8   61  56
22  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX--------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x001f0053  0x8   57  53
23  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x00220055  0x8   60  52
24  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX--------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x0029005d  0x7   67  53
25  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x002b005c  0x7   68  50
26  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX-----------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x002c005d  0x7   69  50
27  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX--------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x0029005d  0x7   67  53
28  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x002c0063  0x7   72  56
29  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX--------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x0028005d  0x7   67  54
30  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x00290061  0x7   69  57
31  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX--------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x002c0061  0x7   71  54
-------------------------------------------------------------
Sum WIN: 1734. Avg WIN: 54
Min WIN: 50. DQ Index: 25 26
Max WIN: 57. DQ Index: 7 30
```

DDR training window

- **DDR Training-read window**

```
Read window of prebit-deskew:
--------------------------------------------------
DQ  0   4   8   12  16  20  24  28  32  36  40  44  48  52  56  60  64  68  72  76  80  84  88  92  96  100 104 108 112 116 120 124  RANGE       DQS   DQ  WIN
0   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x00280060  0x30  68  57
1   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX--------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x0028005a  0x30  65  51
2   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x0028005e  0x30  67  55
3   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x00240058  0x30  62  53
4   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x0025005b  0x30  64  55
5   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x001e0055  0x30  58  56
6   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x002b005f  0x30  69  53
7   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x001e0053  0x30  57  54
8   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x00250057  0x30  62  51
9   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x0028005c  0x30  66  53
10  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x00240057  0x30  62  52
11  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x002c005e  0x30  69  51
12  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x0026005c  0x30  65  55
13  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x0028005c  0x30  66  53
14  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x00220055  0x30  60  52
15  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x0029005c  0x30  67  52
16  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x00240057  0x2b  62  52
17  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x0029005a  0x2b  66  50
18  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x00260057  0x2b  63  50
19  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x0028005b  0x2b  66  52
20  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x00240056  0x2b  61  51
21  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x0029005e  0x2b  68  54
22  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x00240058  0x2b  62  53
23  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x0027005b  0x2b  65  53
24  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x00240057  0x2d  62  52
25  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x00250058  0x2d  63  52
26  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x00250058  0x2d  63  52
27  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x00250058  0x2d  63  52
28  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x0028005b  0x2d  66  52
29  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x00200058  0x2d  60  57
30  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x00290058  0x2d  65  48
31  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX----------------------------------------------------------XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 0x0028005b  0x2d  66  52
--------------------------------------------------
Sum WIN: 1685. Avg WIN: 52
Min WIN: 48. DQ Index: 30
Max WIN: 57. DQ Index: 0 29
```

Thank you