



VCCI Test Report

Issued date: Apr. 26, 2018

Project No.: 17Q122104

Product : Network Attached Storage

Model : TS-1232XU, TS-1232XU-RP(Refer to 3.1 for more details)

Applicant : QNAP Systems, Inc.

Address : 3F, No. 22, Zhongxing Rd, Xizhi Dist., New Taipei City, 221, Taiwan

Report No: WD-EV-R-180140-00

According to

V-3/2016.11, Class A

V-4/2012.04

Authorized Signatory :

/ Ken Huang

Wendell Industrial Co., Ltd
Wendell Electrical Testing Lab.

Add: 6F/6F-1, No.188, Baoqiao Rd., Xindian Dist., New Taipei City 23145, Taiwan R.O.C.



Table of Contents

1	Certification.....	5
1.1	Summary of Test Result	6
2	Test Configuration of Equipment Under Test	7
2.1	Test Facility	7
2.2	Measurement Uncertainty	8
2.2.1	Conducted Emission test	8
2.2.2	Conducted emission at telecom port test	8
2.2.3	Radiated Emission test	8
3	Generation Information	9
3.1	Description of EUT	9
3.2	Description of Test Modes.....	12
3.3	EUT Operating Condition	12
3.4	Description of Support Unit.....	13
3.5	Configuration of System Under Test	13
4	Emission Test	14
4.1	Conducted Emission Measurement (Frequency Range 150 KHz-30MHz)	14
4.1.1	Limit of Conducted Emission Measurement	14
4.1.2	Test Instrument	14
4.1.3	Test Procedure	15
4.1.4	Deviation from Test Standard.....	15
4.1.5	Test Setup	16
4.1.6	Test Result	17
4.1.7	Photographs of Test Configuration.....	21
4.2	Conducted Emission at Telecommunication Ports Test.....	23
4.2.1	Limit of Conducted Emission at Telecommunication Ports Test	23
4.2.2	Test Instrument	23
4.2.3	Test Procedure	24
4.2.4	Deviation from Test Standard.....	24
4.2.5	Test Setup	25
4.2.6	Test Result	26
4.2.7	Photographs of Test Configuration.....	32
4.3	Radiated Emission Measurement	34
4.3.1	Limits of Radiated Emission Measurement	34
4.3.2	Test Instrument	35
4.3.3	Test Procedure	36
4.3.4	Deviation from Test Standard.....	36
4.3.5	Test Setup	37
4.3.6	Test Result	38
4.3.7	Photographs of Test Configuration.....	46



History of this test report

Report No.	Issue date	Description
WD-EV-R-180140-00	Apr. 26, 2018	Initial Issue

Declaration

This report is for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us.



History of supplementary report

Report No.	Issue date	Description
WD-EV-R-180140-00	Apr. 26, 2018	Original report

Declaration

This report is for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us.



1 Certification

Product: Network Attached Storage
Brand Name: QNAP
Model No: TS-1232XU, TS-1232XU-RP (Refer to 3.1 for more details)
Applicant: QNAP Systems, Inc.
Tested: Mar. 14 ~ Apr. 24, 2018
Standard: V-3/2016.11, Class A
V-4/2012.04

The above equipment (Model: TS-1232XU, TS-1232XU-RP) has been tested by **Wendell Electrical Testing Lab.**, and found compliance with the requirement of the above standards. The test record, data evaluation and Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.



1.1 Summary of Test Result

The EUT has been tested according to the following specifications:

Emission				
Standard	Test Item	Limit	Result	Remark
V-3	Conducted disturbance at mains terminals	Class A	Pass	Meets the requirements
	Conducted disturbance at telecommunication ports test	Class A	Pass	Meets the requirements
	Radiated disturbance	Class A	Pass	Meets the requirements

Note: Test record contained in the referenced test report relate only to the EUT sample and test item.



2 Test Configuration of Equipment Under Test

2.1 Test Facility

Conducted disturbance at mains terminals and Conducted disturbance at telecommunication ports Tests

W01: 5F-1, No.188, Baoqiao Rd., Xindian Dist., New Taipei City 23145, Taiwan (R.O.C.)

Radiated emission Test (OATS)

W03: No.38-20, Mujiliao, Sanzhi Dist., New Taipei City 252, Taiwan (R.O.C.)

ACCREDITATIONS

The laboratories are accredited and approved by the TAF according to ISO/IEC 17025.

2.2 Measurement Uncertainty

The measurement instrumentation uncertainty consideration contained in CISPR 16-4-2.

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

2.2.1 Conducted Emission test

Test Site	Measurement Freq. Range	dB (U_{cispr})	VCCI Site Registration No.	Note
W01	150 kHz~30 MHz	3.19	C-4684	N/A

2.2.2 Conducted emission at telecom port test

Test Site	Measurement Freq. Range	dB (U_{cispr})	VCCI Site Registration No.	Note
W01	150 kHz~30 MHz	3.16	T-2224	N/A

2.2.3 Radiated Emission test

Test Site	Measurement Freq. Range	Ant	dB (U_{cispr})	VCCI Site Registration No.	Note
W03	30 MHz ~ 200 MHz	V	4.29	R-20028	N/A
	30 MHz ~ 200 MHz	H	3.35		N/A
	200 MHz ~ 1000 MHz	V	3.87		N/A
	200 MHz ~ 1000 MHz	H	3.48		N/A
W03	1 GHz ~ 3 GHz	V	4.47	G-20040	N/A
	1 GHz ~ 3 GHz	H	4.44		N/A
	3 GHz ~ 6 GHz	V	4.86		N/A
	3 GHz ~ 6 GHz	H	4.47		N/A



3 Generation Information

3.1 Description of EUT

Product	Network Attached Storage
Brand	QNAP
Model No.	TS-1232XU, TS-1232XU-RP (Refer to Note for more details)
Applicant	QNAP Systems, Inc.
Received date	Mar. 02, 2018
EUT Power Rating	Refer to Note for more details
Model Differences	Refer to Note for more details
Operating System	N/A
Data Cable Supplied	N/A
Accessory Device	N/A
I/O Port	Please refer to the User's Manual

Note:

- The following models are provided to this EUT.

Brand Name	Model No.	Difference	
		Package	Main marketing channel
QNAP	TS-1232XU	QNAP Brown Box	For household & business storage related distributors
	TS-1232XU-2G		
	TS-1232XU-4G		
	TS-1232XU-8G		
	TS-1232XU-16G		
	TS-1232XU-32G		
	TS-1232XU+		
	TS-1232XUPlus		
	TS-1232U		
	TS-1232U+		
	TS-1232AU		
	TS-1232AXU		
	TS-1232XU Pro		
	TS-1232XU R2		
	TS-1232XU II		
	TS-1232XU-RP		
	TS-1232XU-RP-2G		
	TS-1232XU-RP-4G		
	TS-1232XU-RP-8G		
	TS-1232XU-RP-16G		
	TS-1232XU-RP-32G		
	TS-1232XU-RP+		
	TS-1232XU-RPPlus		
	TS-1232U-RP		
	TS-1232U-RP+		
	TS-1232AU-RP		



TS-1232AXU-RP		
TS-1232XU-RP Pro		
TS-1232XU-RP R2		
TS-1232XU-RP II		
NAS-1232XU-G	Generic Brown Box Package (without QNAP logo)	For business storage device bidding projects and cooperation projects
NAS-1232XUG		
G1232XU		
1232XU-NAS		
NAS-1232XU II		
NAS-1232XU+		
NAS-1232XU Plus		
NAS-12bayAL324		
NAS-1232 II		
NAS-1232XU-RP-G		
NAS-1232XU-RPG		
G1232XU-RP		
1232XU-RP-NAS		
NAS-1232XU-RP II		
NAS-1232XU-RP+		
NAS-1232XU-RP Plus		
NAS-12bayAL324-R		
NAS-1232U-RP II		

2. The EUT uses the follow internal power supply:

Power Supply for TS-1232XU	
Brand	DELTA
Model	DPS-250AB-44D
Input Power	100-240Vac, 3.5A, 48~63Hz
Output Power	+3.3Vdc, 6A +5Vdc, 12A +12Vdc, 17A +5VSB, 2A -12Vdc, 0.5A MAX 250W

Power Supply for TS-1232XU-RP	
Brand	DELTA
Model	DPS-250AB-81A
Input Power	100-240Vac, 5A-2.5A, 50Hz-60Hz
Output Power	+12Vdc, 20A +5VSB, 2A MAX 250W



3. The EUT contains following components.

Item	Brand	Model	Qty.
Main board	QNAP	QZ26 REV:1.1	1
CPU	Annapurna Labs	AL324 (1.7GHz)	1
RAM	ADATA	AD4U2400J4G17-BHYA (4GB)	1
HDD	SEAGATE	ST1000VN002 (1TB)	12
HD Backplane	QNAP	QZ33 REV:1.1	1
DC Fan	AVC	DSO7025B12S	2

4. The EUT's highest operating frequency is 1.7GHz. Therefore the radiated emission is tested up to 6GHz.

3.2 Description of Test Modes

Test results are presented in the report as below.

Test Result	Test Condition
Conducted emission test	
A	TS-1232XU, Full mode
B	TS-1232XU-RP, Full mode
Conducted emission test at telecom port test	
A	TS-1232XU, Full mode, LAN(10Mbps/100Mbps/1Gbps)
B	TS-1232XU-RP, Full mode, LAN(10Mbps/100Mbps/1Gbps)
Radiated emission 30MHz ~ 1GHz test	
A	TS-1232XU, Full mode
B	TS-1232XU-RP, Full mode
Radiated emission above 1GHZ test	
A	TS-1232XU, Full mode
B	TS-1232XU-RP, Full mode

Note:

1. For conducted emission, the EUT has been pre-tested frequency was 50MHz and 60MHz, and 60MHz was the worst case for final test.
2. For conducted emission test at telecom port, the EUT has been pre-tested frequency 50MHz and 60MHz, and 60MHz was the worst case for final test.
3. For radiated emission, the EUT has been pre-tested frequency was 50MHz and 60MHz, and 60MHz was the worst case for final test.

3.3 EUT Operating Condition

- a. Placed the EUT on the test table.
- b. Prepare server PC to act as a communication partner and placed it outside of testing area.
- c. The EUT was connected to the server PC with LAN cable.
- d. The communication partner sent data to EUT by command "ping" via LAN.
- e. The EUT read and write data with Internal HDD and External HDD.

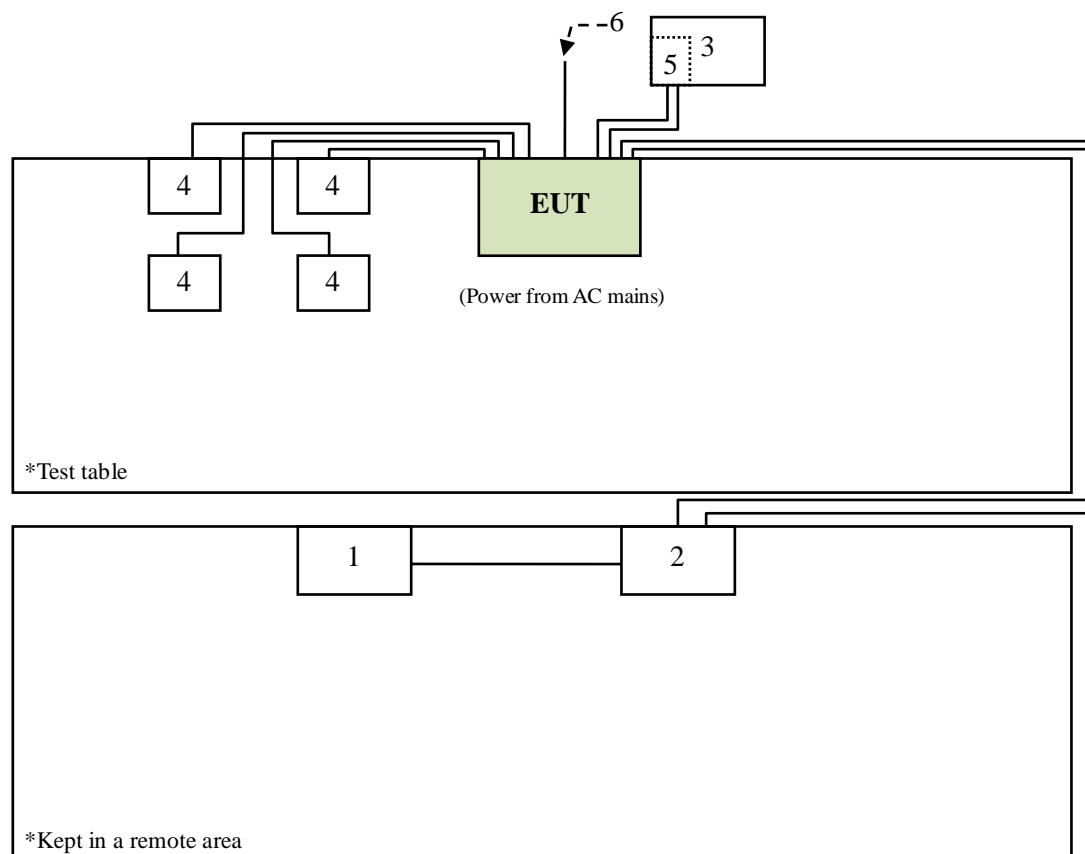
3.4 Description of Support Unit

The EUT has been conducted testing with other necessary accessories or support units.

Item	Equipment	Brand	Model No.	Serial No.	FCC ID	Data Cable	Power Cord	Remark
1	Server PC	DELL	OPTIPLEX 380	2C6742S	FCC DoC Approved	1m non-shielded RJ45 cable	1.8m non-shielded cable	-
2	Switch HUB	D-Link	DGS-1008A	QBIH2DB002031	FCC DoC Approved	20m non-shielded RJ45 cable	DC: 1.2m non-shielded cable with one core	-
3	PC	DELL	D24M	MSIP-RMM-E 2K-D24M001	PD93165NG	N/A	1.8m non-shielded cable	-
4	External Hard Drive	SONY	HD-EG5	N/A	FCC DoC Approved	0.6m shielded cable	N/A	-
5	Dual-Port 10GbE SFP+ Network Card	ONAP	LAN-10G2SF-MLX	N/A	N/A	1.5m non-shielded SFP DAC cable (x2)	N/A	Supplied by client
6	Console cable	N/A	N/A	N/A	N/A	0.93m non-shielded cable	N/A	-

Note: 1. The core(s) is(are) originally attached to the cable(s).
2. Item 1-2 acted as communication partners to transfer data.

3.5 Configuration of System Under Test



4 Emission Test

4.1 Conducted Emission Measurement (Frequency Range 150 KHz-30MHz)

4.1.1 Limit of Conducted Emission Measurement

Frequency (MHz)	Class A (dBuV)		Class B (dBuV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 to 0.5	79	66	66 to 56	56 to 46
0.50 to 5.0	73	60	56	46
5.0 to 30.0	73	60	60	50

- Note:**
1. The lower limit shall apply at the transition frequencies.
 2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.
 3. Detector function in the form: PK = Peak, QP = Quasi Peak, AV = Average
 4. The test result calculated as following:
 Measurement Value = Reading Level + Correct Factor
 Correction Factor = Insertion loss of LISN + Cable loss + Attenuator factor
 Margin Level = Measurement Value –Limit Value

4.1.2 Test Instrument

Item	Equipment	Manufacturer	Model	Meter No.	Calibration Date
1	TWO-LINE V-NETWORK	R&S	ENV216	CT-1-025-1	Apr. 01, 2017
2	EMI Test Receiver	R&S	ESCI	CT-01-024	Mar. 29, 2017
3	V-LISN	Schwarzbeck	NSLK8127	CT-1-104-1	Oct. 17, 2017
4	Test Cable	HANRUIN	5D-FB	CT-1-069-2	Jul. 26, 2017
5	50ohm Termination	N/A	N/A	CT-1-065-1	Mar. 29, 2017
6	Measurement Software	EZ-EMC	Ver: FA-03A	CT-3-012	No calibration request

- Note:**
1. The calibration interval of the above test instruments is 12 months.



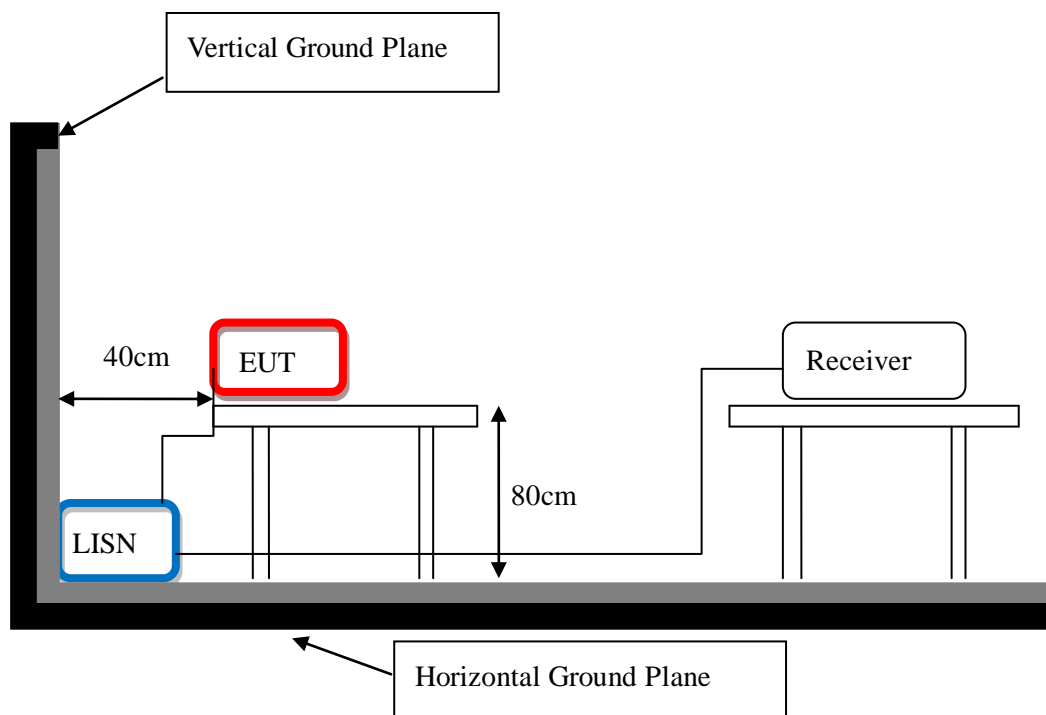
4.1.3 Test Procedure

- a. The EUT was placed 0.8 meter height wooden table from the horizontal ground plane with EUT being connected to power source through a line impedance stabilization network (LISN). The LISN at least be 80 cm from nearest chassis of EUT.
- b. The line impedance stabilization network (LISN) provides 50 ohm/50uH of coupling impedance for the measuring instrument. All other support equipments powered from additional LISN(s).
- c. Interrelating cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle. All I/O cables were positioned to simulate typical usage.
- d. All I/O cables that are not connected to a peripheral shall be bundle in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- e. The EMI test receiver connected to LISN powering the EUT. The actual test configuration, please refer to EUT test photos.
- f. The receiver scanned from 150kHz to 30MHz for emissions in each of test modes. A scan was taken on both power lines, Line and Neutral, recording at least six highest emissions.
- g. The EUT and cable configuration of the above highest emission levels were recorded. The test data of the worst case was recorded.

4.1.4 Deviation from Test Standard

No deviation

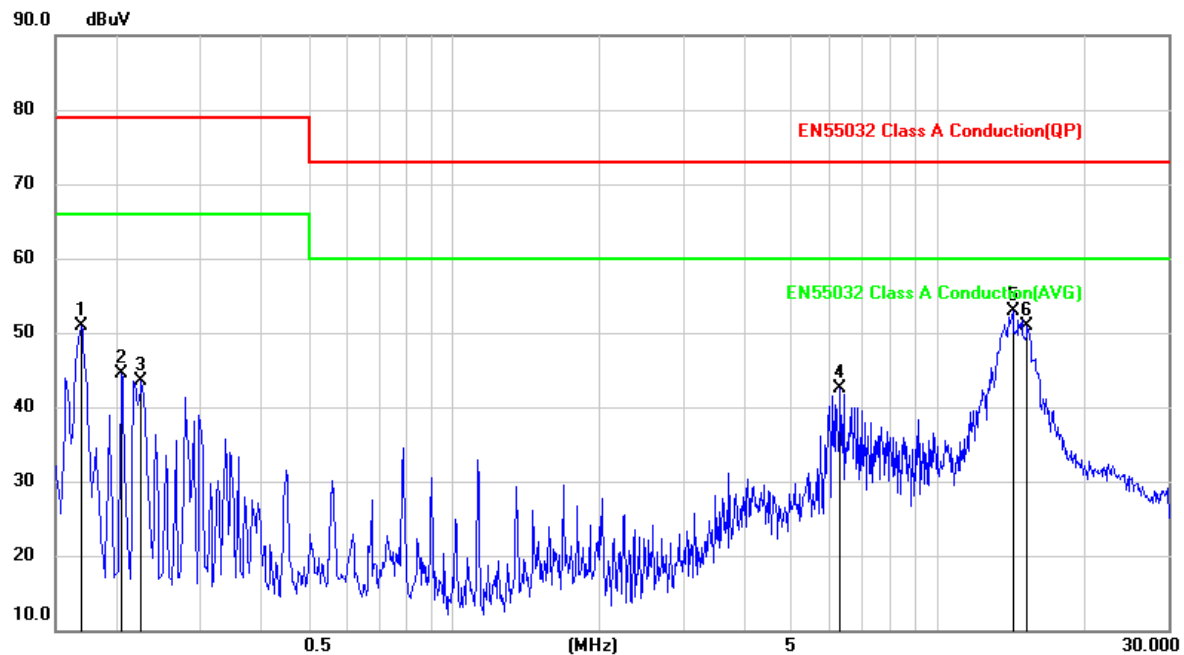
4.1.5 Test Setup



Note: Please refer to 4.1.7 for the actual test configuration.

4.1.6 Test Result

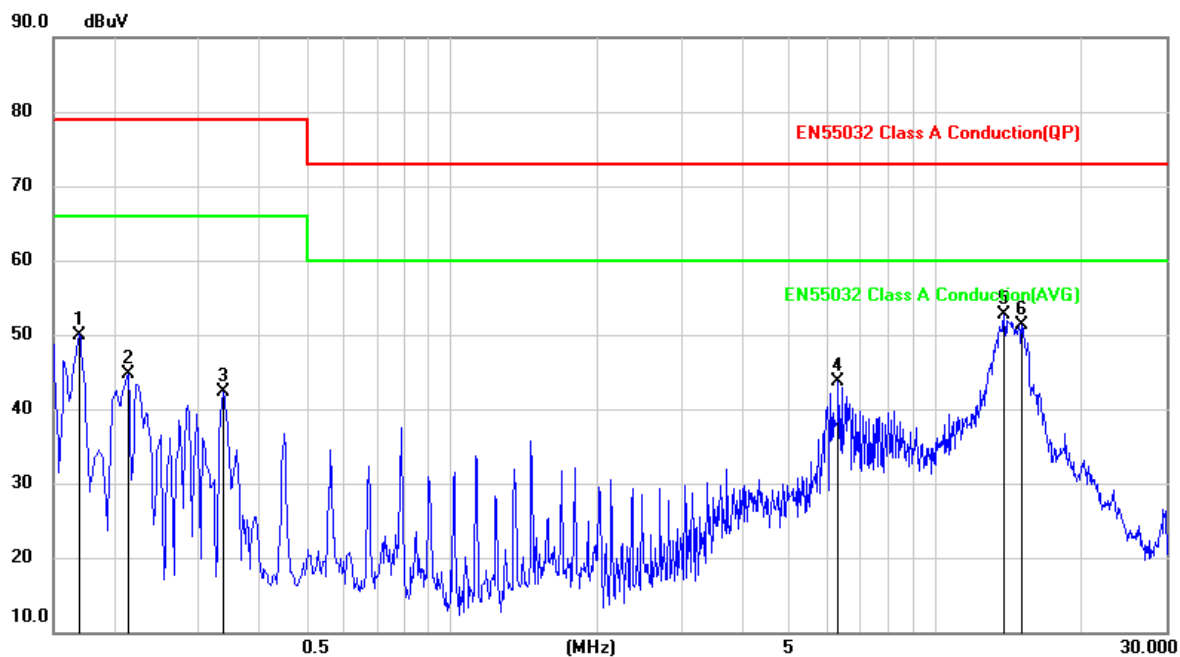
Test Voltage	100Vac, 60Hz	Frequency Range	0.15-30 MHz
Environmental Conditions	26°C, 60% RH	6dB Bandwidth	9 kHz
Test Date	2018/03/14	Phase	L
Tested by	Guanwei Liao	Test Mode	A



No.	Frequency (MHz)	Reading Level (dBuV)	Correct Factor (dB)	Measurement (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1700	41.27	9.58	50.85	79.00	-28.15	peak
2	0.2060	34.85	9.58	44.43	79.00	-34.57	peak
3	0.2260	33.96	9.58	43.54	79.00	-35.46	peak
4	6.2980	32.97	9.62	42.59	73.00	-30.41	peak
5	14.2900	43.31	9.65	52.96	73.00	-20.04	peak
6	15.3580	41.27	9.65	50.92	73.00	-22.08	peak

Remark: 1. QP = Quasi Peak, AVG = Average
2. Correction Factor = Insertion loss of LISN + Cable loss
3. Measurement Value = Reading Level + Correct Factor
4. Margin Level = Measurement Value - Limit Value

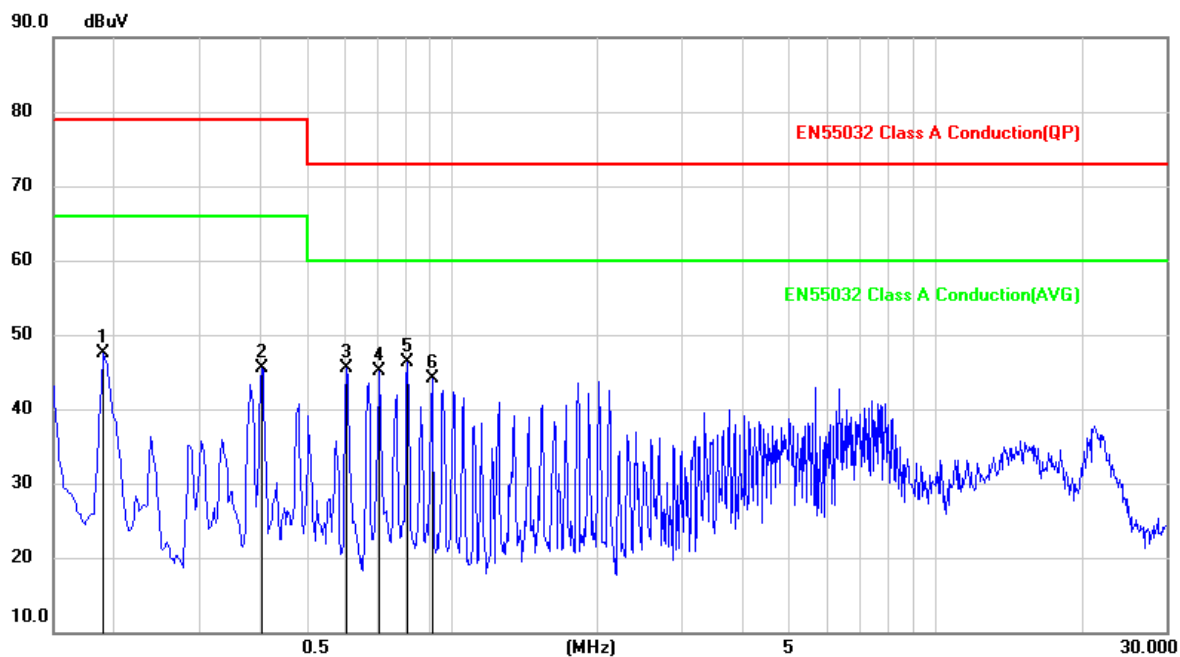
Test Voltage	100Vac, 60Hz	Frequency Range	0.15-30 MHz
Environmental Conditions	26°C, 60% RH	6dB Bandwidth	9 kHz
Test Date	2018/03/14	Phase	N
Tested by	Guanwei Liao	Test Mode	A



No.	Frequency (MHz)	Reading Level (dBuV)	Correct Factor (dB)	Measurement (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1700	40.33	9.67	50.00	79.00	-29.00	peak
2	0.2140	35.03	9.66	44.69	79.00	-34.31	peak
3	0.3379	32.66	9.66	42.32	79.00	-36.68	peak
4	6.2980	33.99	9.70	43.69	73.00	-29.31	peak
5	13.8980	42.95	9.77	52.72	73.00	-20.28	peak
6	15.0780	41.52	9.78	51.30	73.00	-21.70	peak

Remark: 1. QP = Quasi Peak, AVG = Average
2. Correction Factor = Insertion loss of LISN + Cable loss
3. Measurement Value = Reading Level + Correct Factor
4. Margin Level = Measurement Value - Limit Value

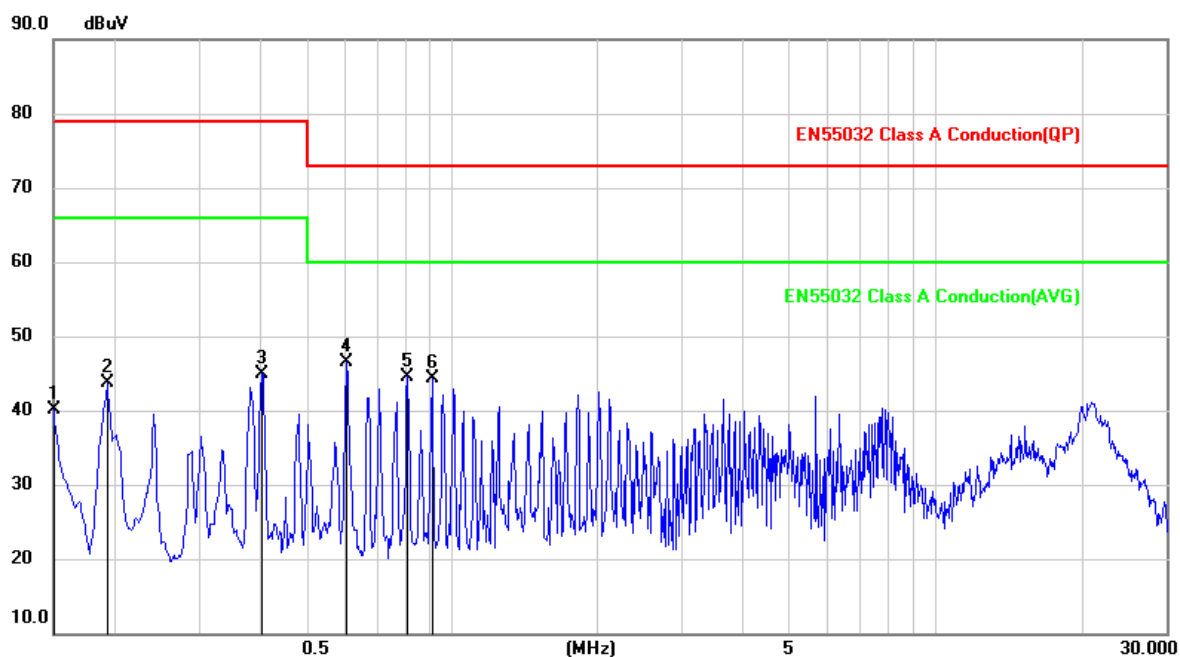
Test Voltage	100Vac, 60Hz	Frequency Range	0.15-30 MHz
Environmental Conditions	26°C, 60% RH	6dB Bandwidth	9 kHz
Test Date	2018/03/14	Phase	L
Tested by	Guanwei Liao	Test Mode	B



No.	Frequency (MHz)	Reading Level (dBuV)	Correct Factor (dB)	Measurement (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1900	38.00	9.58	47.58	79.00	-31.42	peak
2	0.4060	35.88	9.57	45.45	79.00	-33.55	peak
3	0.6058	35.95	9.57	45.52	73.00	-27.48	peak
4	0.7100	35.47	9.58	45.05	73.00	-27.95	peak
5	0.8100	36.70	9.58	46.28	73.00	-26.72	peak
6	0.9100	34.45	9.58	44.03	73.00	-28.97	peak

Remark: 1. QP = Quasi Peak, AVG = Average
2. Correction Factor = Insertion loss of LISN + Cable loss
3. Measurement Value = Reading Level + Correct Factor
4. Margin Level = Measurement Value - Limit Value

Test Voltage	100Vac, 60Hz	Frequency Range	0.15-30 MHz
Environmental Conditions	26°C, 60% RH	6dB Bandwidth	9 kHz
Test Date	2018/03/14	Phase	N
Tested by	Guanwei Liao	Test Mode	B



No.	Frequency (MHz)	Reading Level (dBuV)	Correct Factor (dB)	Measurement (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1500	30.36	9.67	40.03	79.00	-38.97	peak
2	0.1940	34.02	9.66	43.68	79.00	-35.32	peak
3	0.4060	35.29	9.66	44.95	79.00	-34.05	peak
4	0.6058	36.80	9.66	46.46	73.00	-26.54	peak
5	0.8100	34.94	9.66	44.60	73.00	-28.40	peak
6	0.9100	34.58	9.66	44.24	73.00	-28.76	peak

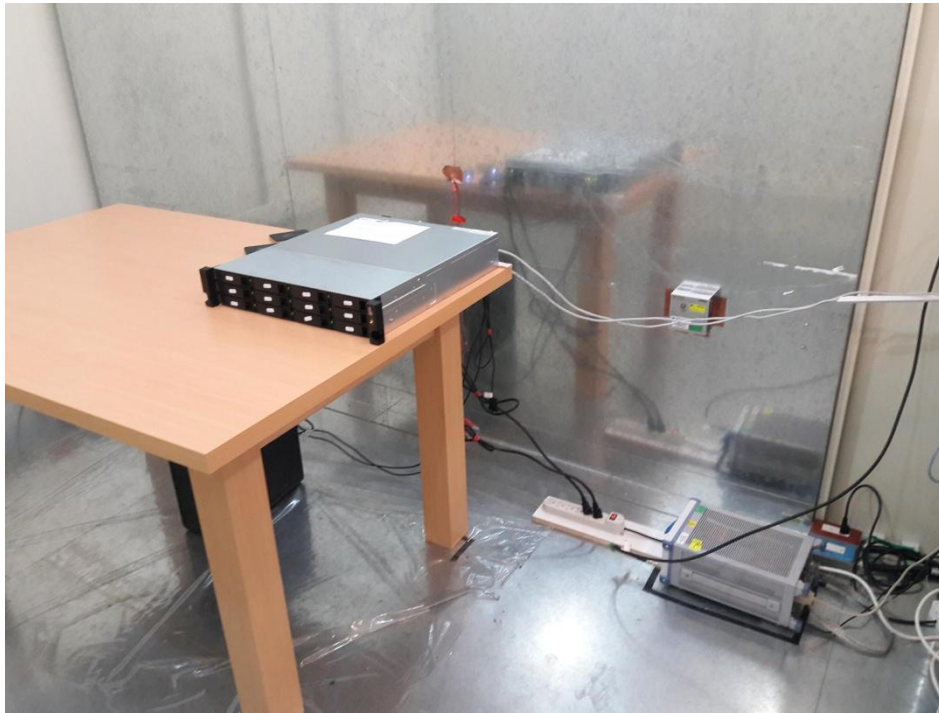
Remark: 1. QP = Quasi Peak, AVG = Average
2. Correction Factor = Insertion loss of LISN + Cable loss
3. Measurement Value = Reading Level + Correct Factor
4. Margin Level = Measurement Value - Limit Value

4.1.7 Photographs of Test Configuration

Mode A



Mode B



4.2 Conducted Emission at Telecommunication Ports Test

4.2.1 Limit of Conducted Emission at Telecommunication Ports Test

Class A equipment

Frequency (MHz)	Voltage limits dB (uV)	
	Quasi-peak	Average
0.15 to 0.5	97 to 87	84 to 74
0.5 to 30	87	74

Note: The limits decrease linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

Class B equipment

Frequency (MHz)	Voltage limits dB (uV)	
	Quasi-peak	Average
0.15 to 0.5	84 to 74	74 to 64
0.5 to 30	74	64

- Note:**
1. The lower limit shall apply at the transition frequencies.
 2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.
 3. Detector function in the form: PK = Peak, QP = Quasi Peak, AV = Average
 4. The test result calculated as following:
 Measurement Value = Reading Level + Correct Factor
 Correction Factor = Insertion loss of ISN + Cable loss
 Margin Level = Measurement Value – Limit Value

4.2.2 Test Instrument

Item	Equipment	Manufacturer	Model	Meter No.	Calibration Date
1	TWO-LINE V-NETWORK	R&S	ENV216	CT-1-025-1	Apr. 01, 2017
2	EMI Test Receiver	R&S	ESCI	CT-01-024	Mar. 29, 2017
3	Impedance Stabilization Network	TESEQ	T8-CAT6	CT-1-105	Oct. 29, 2017
4	V-LISN	Schwarzbeck	NSLK8127	CT-1-104-1	Oct. 17, 2017
5	Test Cable	HANRUIN	5D-FB	CT-1-069-1	Jul. 26, 2017
6	50ohm Termination	N/A	N/A	CT-1-065-2	Mar. 29, 2017
7	Measurement Software	EZ-EMC	Ver: FA-03A	CT-3-012	No calibration request

Note: 1. The calibration interval of the above test instruments is 12 months.



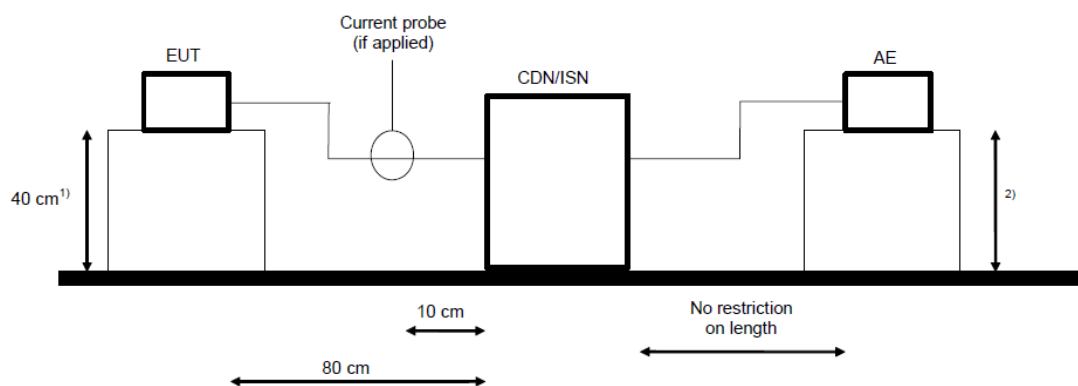
4.2.3 Test Procedure

- a. The EUT was placed 0.4 meter from the horizontal ground plane with EUT being connected to power source through a line impedance stabilization network (LISN). The LISN at least be 80 cm from nearest chassis of EUT.
- b. The line impedance stabilization network (LISN) provides 50 ohm/50uH of coupling impedance for the measuring instrument. All other support equipments powered from additional LISN(s).
- c. Interrelating cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle. All I/O cables were positioned to simulate typical usage.
- d. All I/O cables that are not connected to a peripheral shall be bundle in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- e. ISN at least 80 cm from nearest chassis of EUT. The communication function of EUT was executed in normal condition. ISN was connected between EUT and associated equipment and ISN was connected directly to reference ground plane. The actual test configuration, please refer to EUT test photos.
- f. The receiver scanned from 150kHz to 30MHz for emissions in each of test modes. The test mode included 10Mbps, 100Mbps, 1Gbps and POE mode. Emission frequency and amplitude were recorded, recording at least six highest emissions.
- g. The EUT and cable configuration of the above highest emission levels were recorded. The test data of the worst case was recorded.

4.2.4 Deviation from Test Standard

No deviation

4.2.5 Test Setup



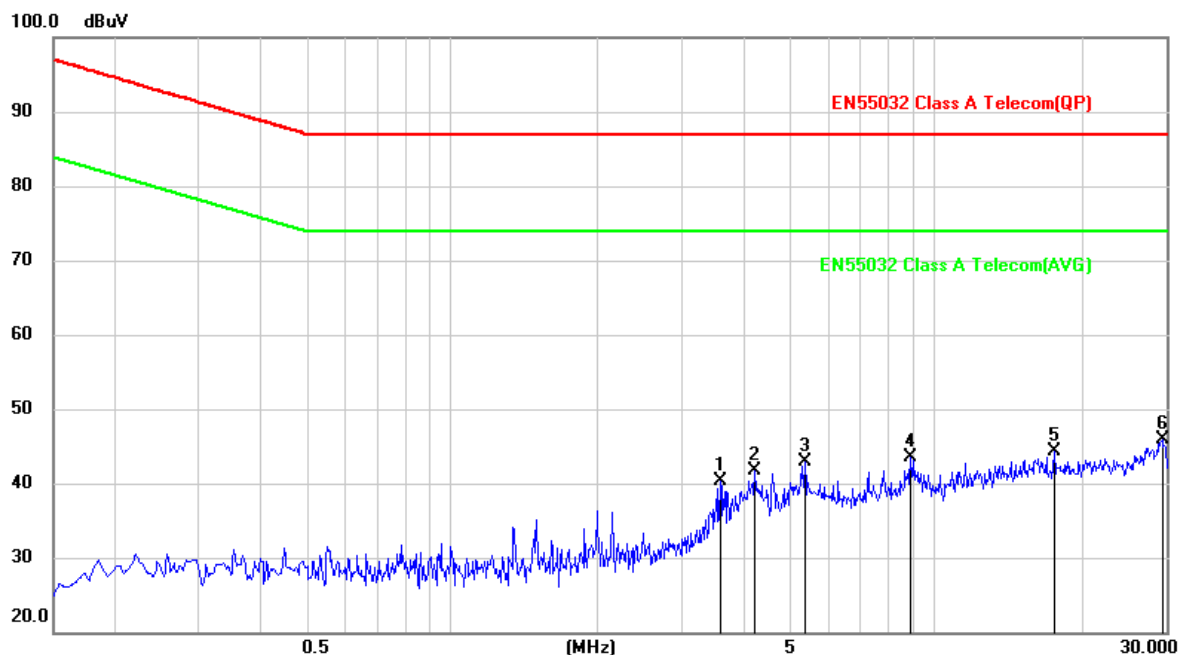
AE = Associated equipment
EUT = Equipment under test

- ¹⁾ Distance to the reference groundplane (vertical or horizontal).
- ²⁾ Distance to the reference groundplane is not critical.

Note: Please refer to the 4.2.7 for the actual test configuration.

4.2.6 Test Result

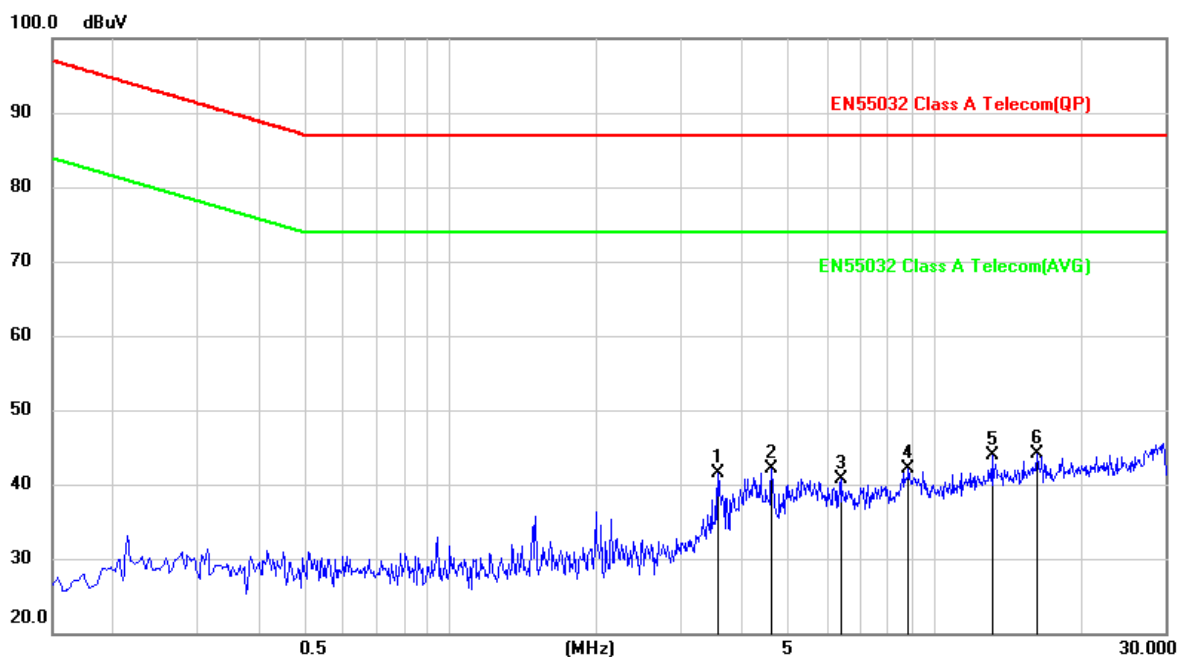
Test Voltage	100Vac, 60Hz	Frequency Range	0.15-30 MHz
Environmental Conditions	26°C, 60% RH	6dB Bandwidth	9 kHz
Test Date	2018/03/14	Test Condition	LAN port with ISN (10Mbps)
Tested by	Guanwei Liao	Test Mode	A



No.	Frequency (MHz)	Reading Level (dBuV)	Correct Factor (dB)	Measurement (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	3.5860	30.87	9.52	40.39	87.00	-46.61	peak
2	4.2460	32.22	9.52	41.74	87.00	-45.26	peak
3	5.3740	33.40	9.52	42.92	87.00	-44.08	peak
4	8.9100	33.90	9.55	43.45	87.00	-43.55	peak
5	17.6060	34.77	9.62	44.39	87.00	-42.61	peak
6	29.3860	36.12	9.73	45.85	87.00	-41.15	peak

Remark: 1. QP = Quasi Peak, AVG = Average
2. Correction Factor = Insertion loss of ISN + Cable loss
3. Measurement Value = Reading Level + Correct Factor
4. Margin Level = Measurement Value - Limit Value

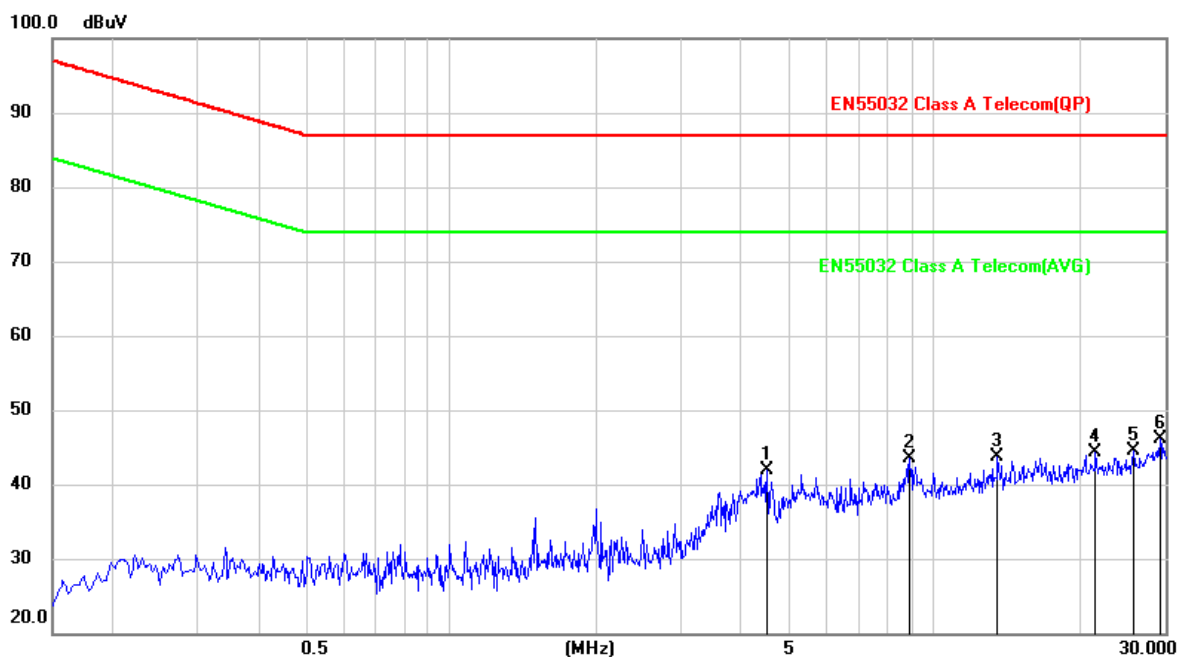
Test Voltage	100Vac, 60Hz	Frequency Range	0.15-30 MHz
Environmental Conditions	26°C, 60% RH	6dB Bandwidth	9 kHz
Test Date	2018/03/14	Test Condition	LAN port with ISN (100Mbps)
Tested by	Guanwei Liao	Test Mode	A



No.	Frequency (MHz)	Reading Level (dBuV)	Correct Factor (dB)	Measurement (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	3.5820	32.01	9.52	41.53	87.00	-45.47	peak
2	4.6220	32.52	9.52	42.04	87.00	-44.96	peak
3	6.4100	31.19	9.53	40.72	87.00	-46.28	peak
4	8.8540	32.58	9.55	42.13	87.00	-44.87	peak
5	13.1620	34.24	9.59	43.83	87.00	-43.17	peak
6	16.3900	34.40	9.61	44.01	87.00	-42.99	peak

Remark: 1. QP = Quasi Peak, AVG = Average
2. Correction Factor = Insertion loss of ISN + Cable loss
3. Measurement Value = Reading Level + Correct Factor
4. Margin Level = Measurement Value - Limit Value

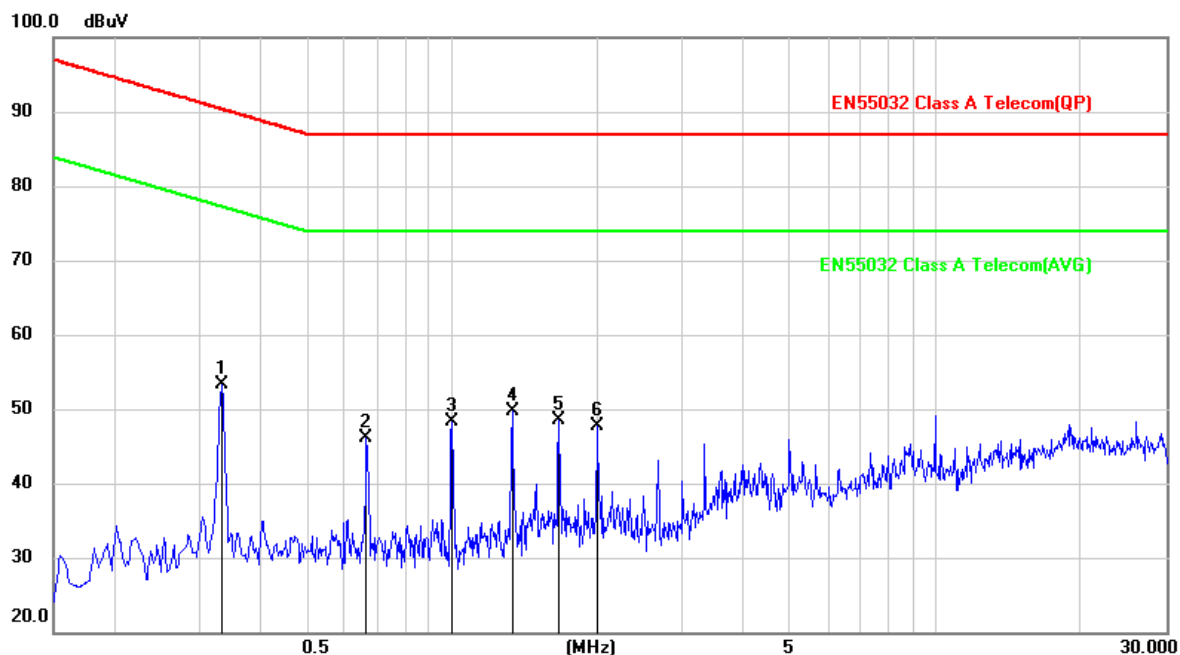
Test Voltage	100Vac, 60Hz	Frequency Range	0.15-30 MHz
Environmental Conditions	26°C, 60% RH	6dB Bandwidth	9 kHz
Test Date	2018/03/14	Test Condition	LAN port with ISN (1Gbps)
Tested by	Guanwei Liao	Test Mode	A



No.	Frequency (MHz)	Reading Level (dBuV)	Correct Factor (dB)	Measurement (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	4.5020	32.43	9.51	41.94	87.00	-45.06	peak
2	8.9060	34.01	9.55	43.56	87.00	-43.44	peak
3	13.5020	34.12	9.59	43.71	87.00	-43.29	peak
4	21.5860	34.60	9.65	44.25	87.00	-42.75	peak
5	25.7860	34.84	9.68	44.52	87.00	-42.48	peak
6	29.2540	36.31	9.73	46.04	87.00	-40.96	peak

Remark: 1. QP = Quasi Peak, AVG = Average
2. Correction Factor = Insertion loss of ISN + Cable loss
3. Measurement Value = Reading Level + Correct Factor
4. Margin Level = Measurement Value - Limit Value

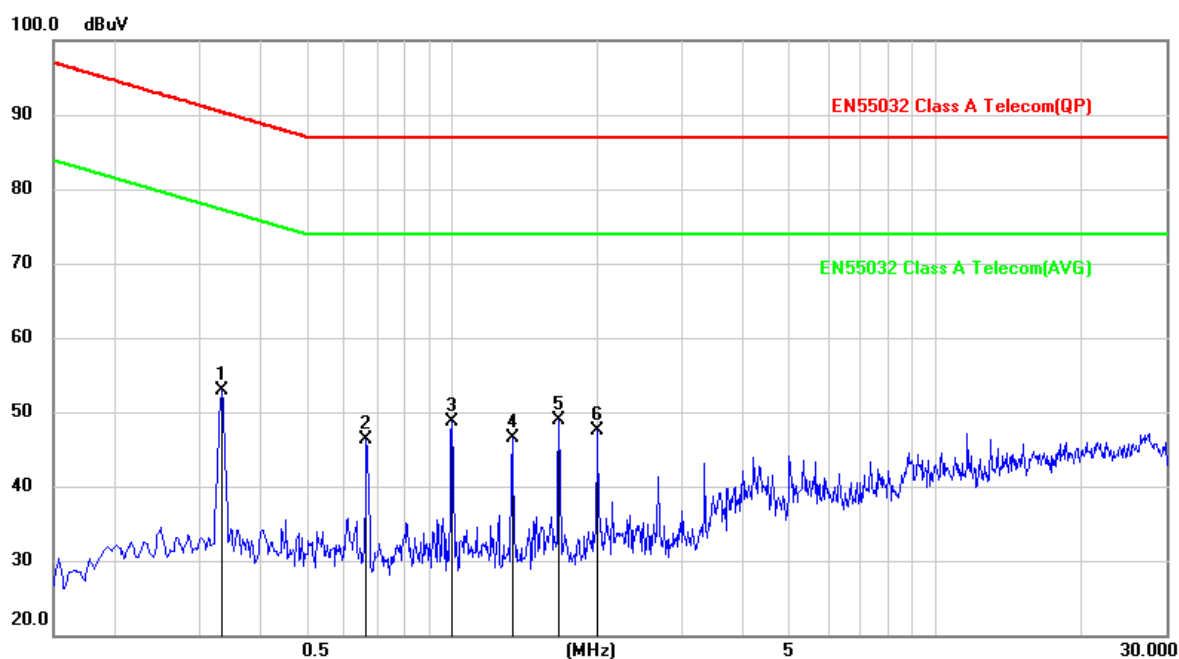
Test Voltage	100Vac, 60Hz	Frequency Range	0.15-30 MHz
Environmental Conditions	26°C, 60% RH	6dB Bandwidth	9 kHz
Test Date	2018/03/14	Test Condition	LAN port with ISN (10Mbps)
Tested by	Guanwei Liao	Test Mode	B



No.	Frequency (MHz)	Reading Level (dBuV)	Correct Factor (dB)	Measurement (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.3339	43.47	9.75	53.22	90.35	-37.13	peak
2	0.6660	36.44	9.63	46.07	87.00	-40.93	peak
3	1.0020	38.79	9.59	48.38	87.00	-38.62	peak
4	1.3340	40.06	9.58	49.64	87.00	-37.36	peak
5	1.6655	39.00	9.55	48.55	87.00	-38.45	peak
6	2.0019	38.14	9.54	47.68	87.00	-39.32	peak

Remark: 1. QP = Quasi Peak, AVG = Average
2. Correction Factor = Insertion loss of ISN + Cable loss
3. Measurement Value = Reading Level + Correct Factor
4. Margin Level = Measurement Value - Limit Value

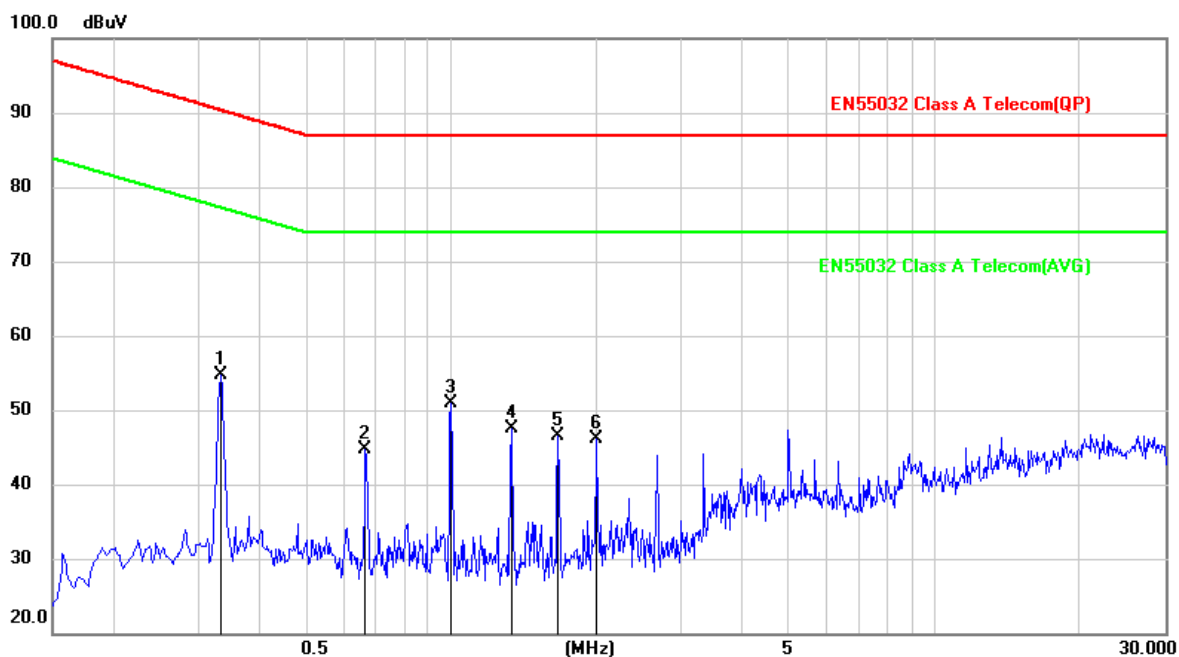
Test Voltage	100Vac, 60Hz	Frequency Range	0.15-30 MHz
Environmental Conditions	26°C, 60% RH	6dB Bandwidth	9 kHz
Test Date	2018/03/14	Test Condition	LAN port with ISN (100Mbps)
Tested by	Guanwei Liao	Test Mode	B



No.	Frequency (MHz)	Reading Level (dBuV)	Correct Factor (dB)	Measurement (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.3339	43.19	9.75	52.94	90.35	-37.41	peak
2	0.6660	36.60	9.63	46.23	87.00	-40.77	peak
3	1.0020	39.07	9.59	48.66	87.00	-38.34	peak
4	1.3340	36.92	9.58	46.50	87.00	-40.50	peak
5	1.6654	39.36	9.55	48.91	87.00	-38.09	peak
6	2.0019	38.03	9.54	47.57	87.00	-39.43	peak

Remark: 1. QP = Quasi Peak, AVG = Average
2. Correction Factor = Insertion loss of ISN + Cable loss
3. Measurement Value = Reading Level + Correct Factor
4. Margin Level = Measurement Value - Limit Value

Test Voltage	100Vac, 60Hz	Frequency Range	0.15-30 MHz
Environmental Conditions	26°C, 60% RH	6dB Bandwidth	9 kHz
Test Date	2018/03/14	Test Condition	LAN port with ISN (1Gbps)
Tested by	Guanwei Liao	Test Mode	B

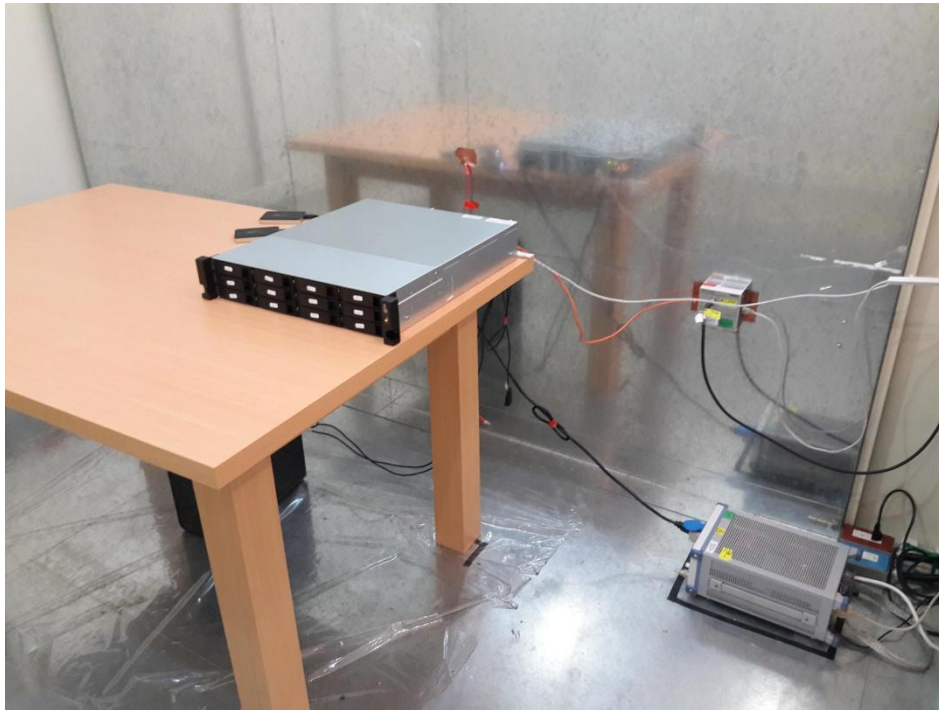


No.	Frequency (MHz)	Reading Level (dBuV)	Correct Factor (dB)	Measurement (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.3339	44.88	9.75	54.63	90.35	-35.72	peak
2	0.6660	35.02	9.63	44.65	87.00	-42.35	peak
3	1.0020	41.25	9.59	50.84	87.00	-36.16	peak
4	1.3340	37.87	9.58	47.45	87.00	-39.55	peak
5	1.6654	36.96	9.55	46.51	87.00	-40.49	peak
6	2.0019	36.64	9.54	46.18	87.00	-40.82	peak

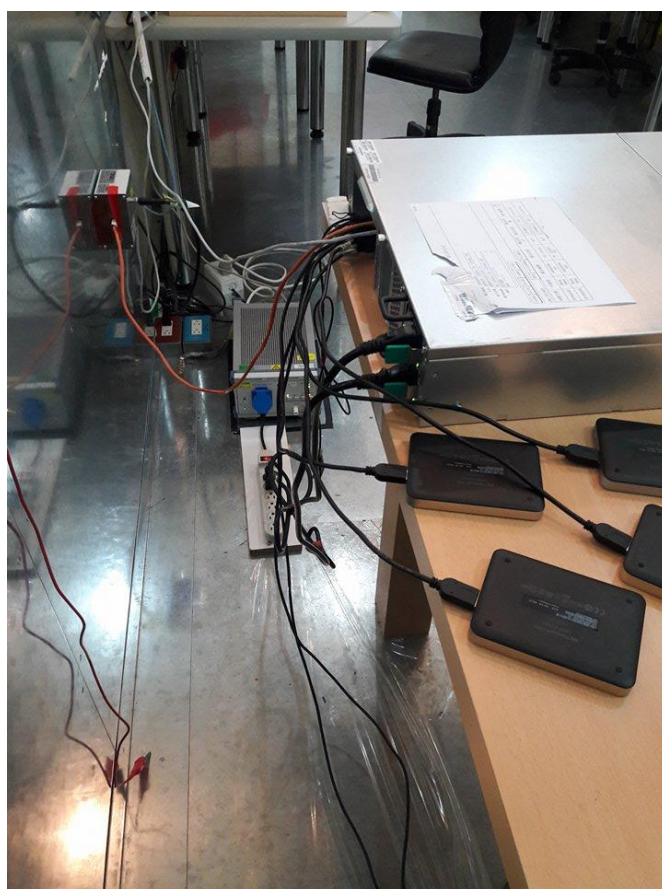
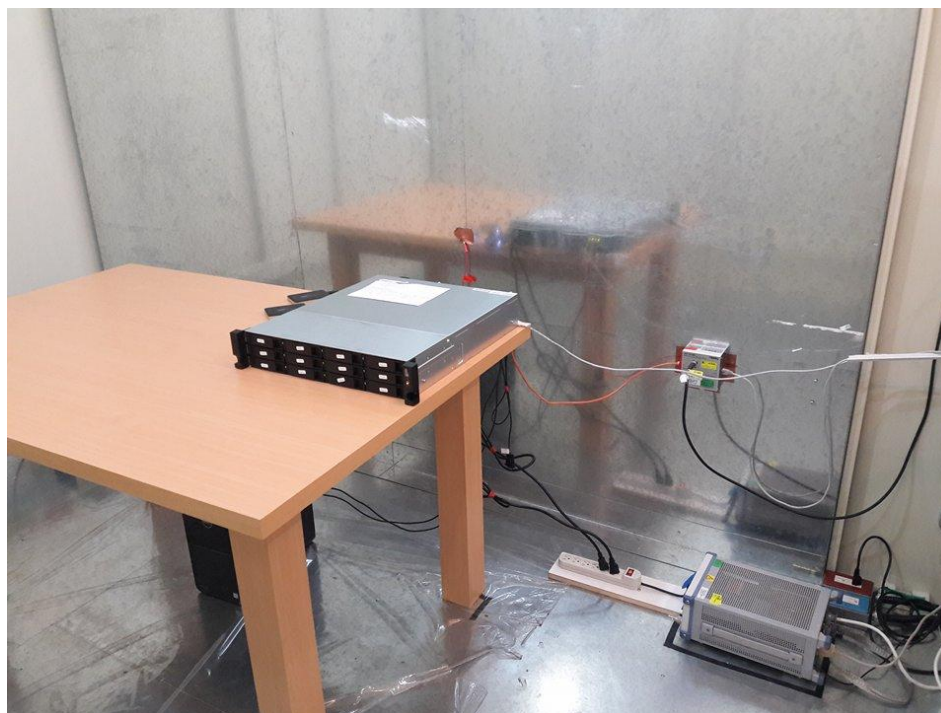
Remark: 1. QP = Quasi Peak, AVG = Average
2. Correction Factor = Insertion loss of ISN + Cable loss
3. Measurement Value = Reading Level + Correct Factor
4. Margin Level = Measurement Value - Limit Value

4.2.7 Photographs of Test Configuration

Mode A



Mode B





4.3 Radiated Emission Measurement

4.3.1 Limits of Radiated Emission Measurement

Radiated Frequency range 30 MHz to 1000 MHz

Frequency (MHz)	Class A (at 10m)	Class B (at 10m)
	dBuV/m	dBuV/m
30 to 230	40	30
230 to 1000	47	37

Note: 1. The lower limit shall apply at the transition frequency.

Radiated Frequency range above 1 GHz

Frequency (GHz)	Class A (at 3m)		Class B (at 3m)	
	Average (dBuV/m)	Peak (dBuV/m)	Average (dBuV/m)	Peak (dBuV/m)
1 to 3	56	76	50	70
3 to 6	60	80	54	74

- Note:**
1. The lower limit shall apply at the transition frequency.
 2. Detector function in the form: PK = Peak, QP = Quasi Peak, AV = Average
 3. The test result calculated as following:
 Measurement Value = Reading Level + Correct Factor
 Correction Factor = Antenna factor + Cable loss (Antenna to preamplifier) - preamplifier Gain
 + Cable loss (preamplifier to receiver)
 Margin Level = Measurement Value - Limit Value
 4. Maximum internal signal source is defined as the maximum frequency of the device under test, or EUT highest frequency tuning of the operation or in the production or use of the device under test.
 5. If the maximum frequency of the device under test is less than the internal source of 108MHz, the only measure to 1GHz.
 6. If the maximum frequency of the device between 108MHz and 500MHz maximum frequency of the device under test ranged from internal sources, you must measure to 2GHz.
 7. If the maximum frequency of the device under test between internal source of 500MHz and 1GHz, you must measure to 5GHz.
 8. If the maximum frequency of the device under test is higher than the internal source of 1GHz, it must measure up to the maximum frequency of 5 times or 6GHz, choosing the less.

4.3.2 Test Instrument

Item	Equipment	Manufacturer	Model	Meter No.	Calibration Date
1	Horn Antenna	Schwarzbeck	BBHA 9120 D	CT-1-001	Apr. 06, 2017
2	Bilog Antenna	Schwarzbeck	VULB 9168	CT-1-002-1	Apr. 05, 2017
3	OATS cable 12m	EMCI	EMCCFD400-N M-NM-12000	CT-1-111	Aug. 15, 2017
4	OATS cable 24m	EMCI	EMCCFD400-N M-NM-24000	CT-1-112	Aug. 15, 2017
5	Preamplifier	EM Electronics Corporation	EM30265	CT-1-013	Jul. 20, 2017
6	Test Cable	HARBOUR	27478-RG400	CT-1-121	Aug. 15, 2017
7	EMI Test Receiver	Keysight	N9038A	CT-9-007	Jun. 01, 2017
8	Measurement Software	Ez-EMC	Ver : FA-03A2 RE	CT-3-012	No calibration request

Note: 1. The calibration interval of the above test instruments is 12 months.



4.3.3 Test Procedure

- a. The EUT was placed on the top of a turntable 0.8 meters above the ground at a 3 m or 10 m open area test site. The table was rotated 360 degrees to determine the position of the high radiation emissions.
- b. The height of the test antenna shall vary between 1 m to 4 m. Both vertical and horizontal polarizations of the antenna were set to make the measurement.
- c. The EUT was set up as per the test configuration to simulate typical usage per the user's manual. All I/O cables were positioned to simulate typical usage. The actual test configuration, please refer to EUT test photos.
- d. The initial step in collecting radiated emission data is a Spectrum Mode scanning the measurement frequency range.

Below 1GHz:

Reading in which marked as QP or Peak means measurements by using Spectrum Mode with detector RBW=120kHz.

If the Spectrum Mode measured peak value compliance with and lower than Quasi Peak Limit, the EUT shall be deemed to meet QP Limits.

Above 1GHz:

Reading in which marked as Peak & AVG means measurements by using Spectrum Mode with setting in RBW=1MHz.

If the Spectrum Mode measured value compliance with the Peak Limits and lower than AVG Limits, the EUT shall be deemed to meet both Peak and AVG Limits.

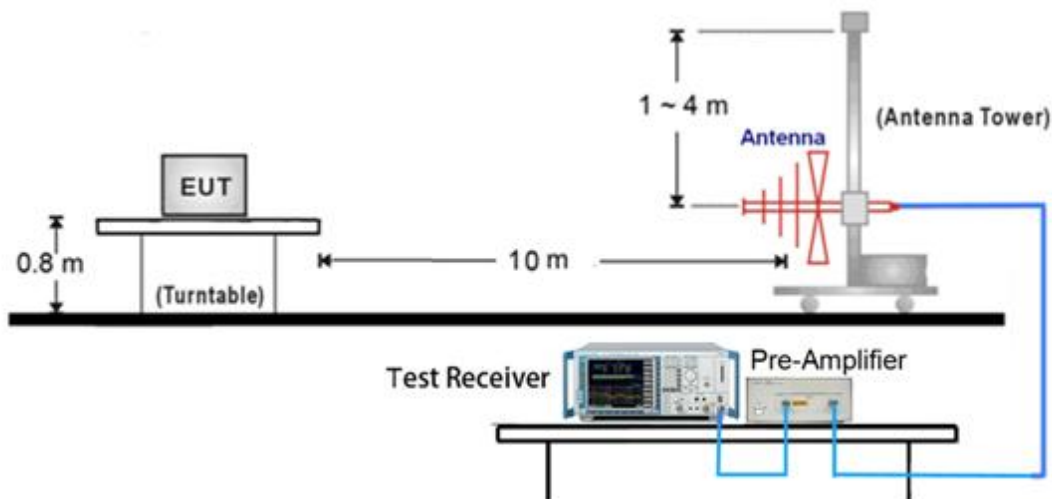
- e. Emission frequency and amplitude were recorded, recording at least six highest emissions. The EUT and cable configuration of the above highest emission levels were recorded. The test data of the worst case was recorded.

4.3.4 Deviation from Test Standard

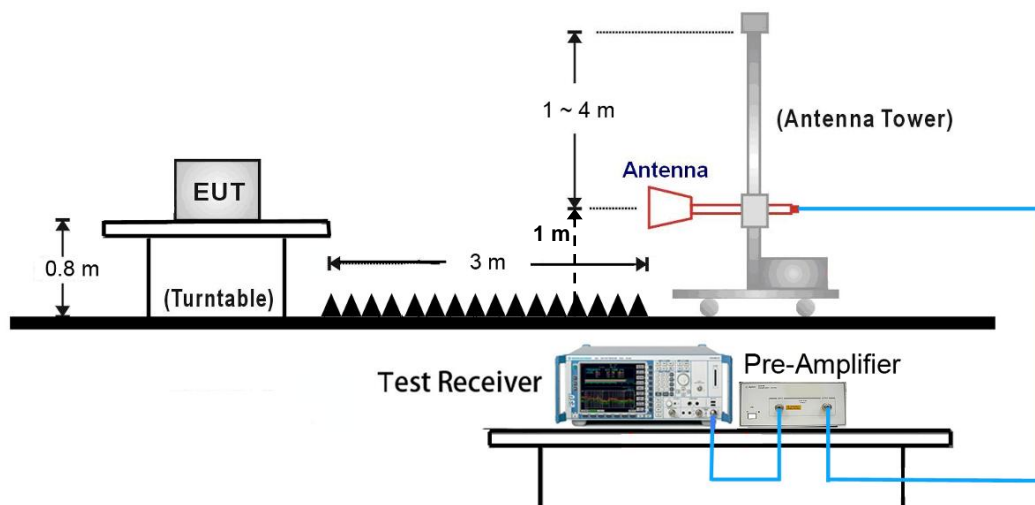
No deviation

4.3.5 Test Setup

< Radiated Emissions Frequency: 30 MHz to 1000 MHz >



< Radiated Emissions Frequency: above 1GHz >

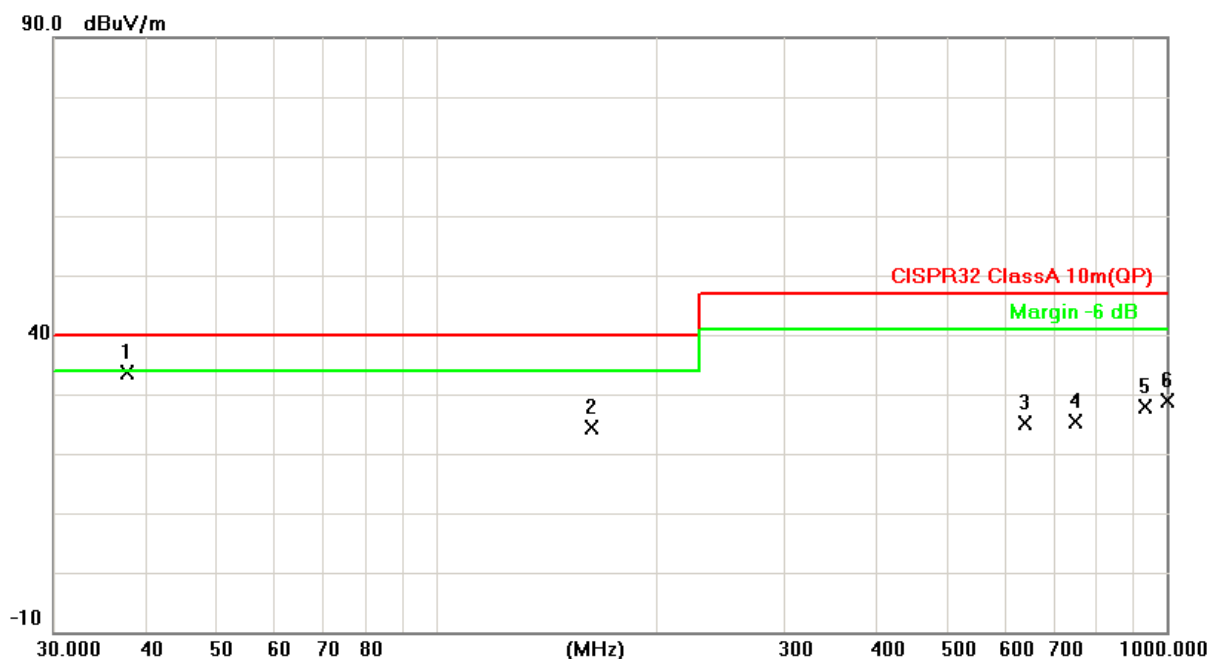


Note:

- (1) Please refer to the 4.3.7 for the actual test configuration.
- (2) The formula of measured value as: Test Result = Reading + Correction Factor
- (3) Detector function in the form: PK = Peak, QP = Quasi Peak, AV = Average
- (4) The test result calculated as following:
 Measurement Value = Reading Level + Correct Factor
 Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain (if use)
 Margin Level = Measurement Value - Limit Value

4.3.6 Test Result

Test Voltage	100Vac, 60Hz	Frequency Range	30 – 1000 MHz
Environmental Conditions	26°C, 53% RH	6dB Bandwidth	120 kHz
Test Date	2018/04/24	Test Distance	10m
Tested by	Duncan Cheng	Polarization	Vertical
Test Mode	A		



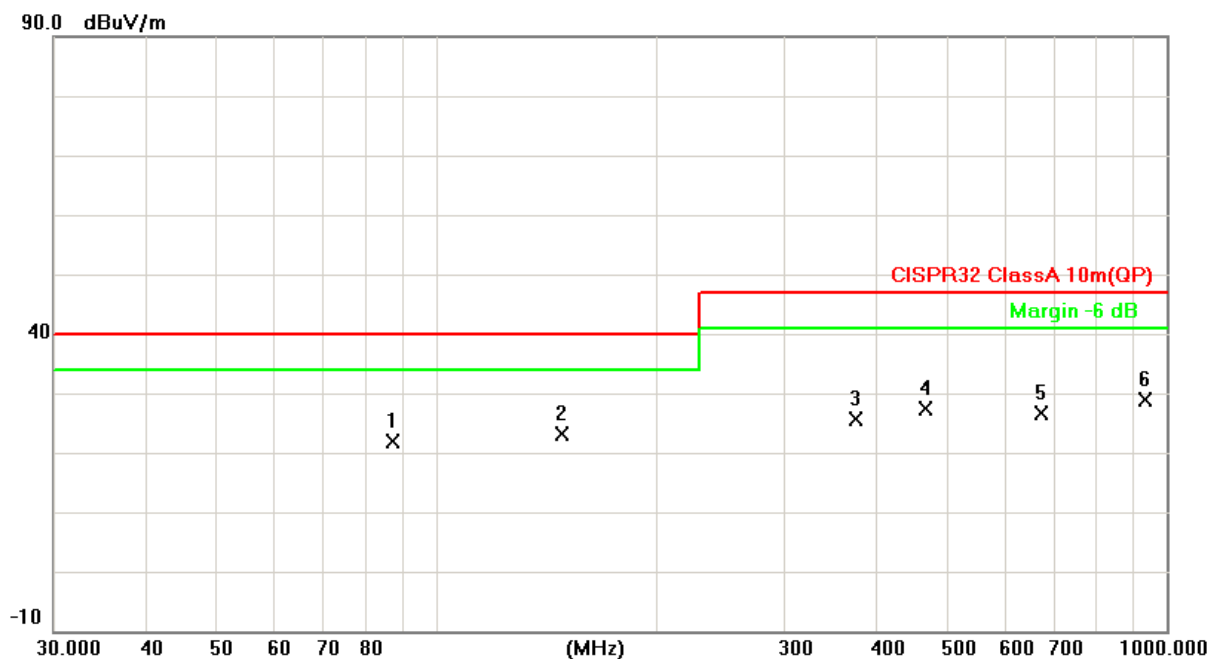
No.	Frequency (MHz)	Reading Level (dBuV)	Correct Factor (dB/m)	Measurement (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Degree (degree)
1	37.7599	51.83	-18.11	33.72	40.00	-6.28	QP	100	249
2	162.8900	44.23	-19.94	24.29	40.00	-15.71	QP	100	190
3	640.1300	38.11	-12.93	25.18	47.00	-21.82	QP	100	43
4	749.7400	36.27	-11.00	25.27	47.00	-21.73	QP	150	209
5	933.0700	36.54	-8.59	27.95	47.00	-19.05	QP	300	104
6	1000.0000	36.86	-8.02	28.84	47.00	-18.16	QP	100	160

Remark:

1. QP = Quasi Peak
2. Correction Factor = Antenna factor + Cable loss (Antenna to preamplifier) - preamplifier Gain + Cable loss (preamplifier to receiver)
3. Measurement Value = Reading Level + Correct Factor
4. Margin Level = Measurement Value - Limit Value



Test Voltage	100Vac, 60Hz	Frequency Range	30 – 1000 MHz
Environmental Conditions	26°C, 53% RH	6dB Bandwidth	120 kHz
Test Date	2018/04/24	Test Distance	10m
Tested by	Duncan Cheng	Polarization	Horizontal
Test Mode	A		

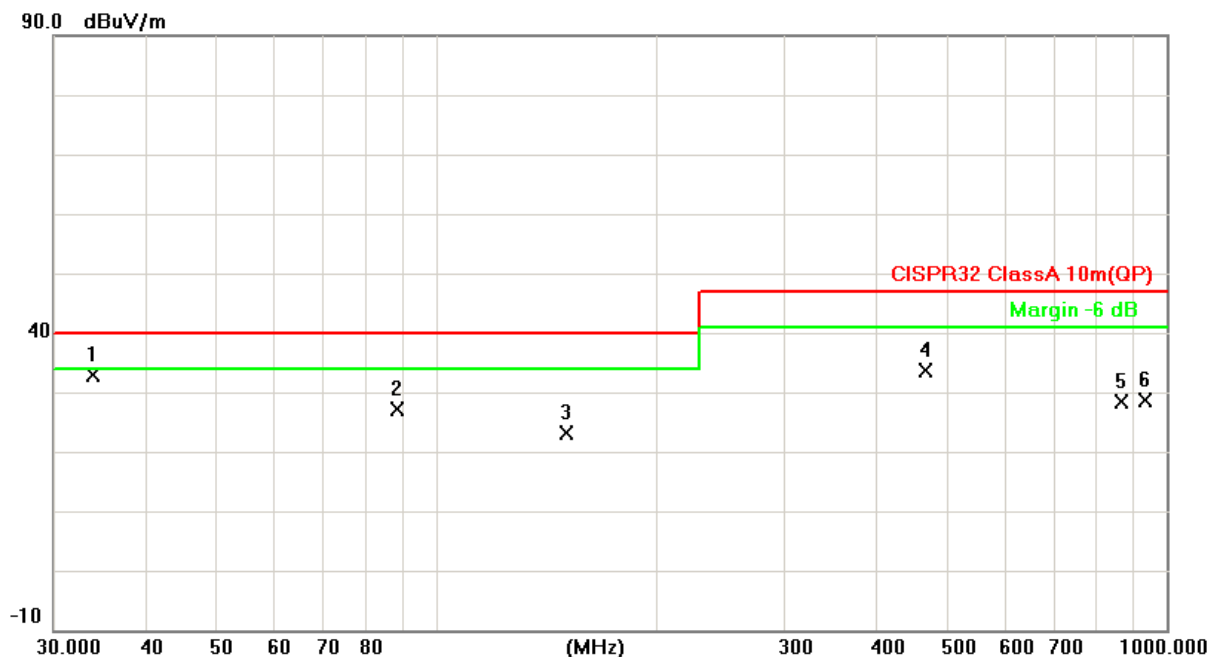


No.	Frequency (MHz)	Reading Level (dBuV)	Correct Factor (dB/m)	Measurement (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Degree (degree)
1	87.2300	46.44	-24.59	21.85	40.00	-18.15	QP	400	209
2	148.3400	43.05	-19.85	23.20	40.00	-16.80	QP	200	123
3	375.3200	44.50	-18.83	25.67	47.00	-21.33	QP	100	220
4	466.5000	43.52	-16.16	27.36	47.00	-19.64	QP	200	201
5	672.1400	39.04	-12.49	26.55	47.00	-20.45	QP	100	210
6	933.0700	37.41	-8.59	28.82	47.00	-18.18	QP	100	86

Remark: 1. QP = Quasi Peak
2. Correction Factor = Antenna factor + Cable loss (Antenna to preamplifier) - preamplifier Gain + Cable loss (preamplifier to receiver)
3. Measurement Value = Reading Level + Correct Factor
4. Margin Level = Measurement Value - Limit Value



Test Voltage	100Vac, 60Hz	Frequency Range	30 – 1000 MHz
Environmental Conditions	26°C, 53% RH	6dB Bandwidth	120 kHz
Test Date	2018/04/24	Test Distance	10m
Tested by	Duncan Cheng	Polarization	Vertical
Test Mode	B		



No.	Frequency (MHz)	Reading Level (dBuV)	Correct Factor (dB/m)	Measurement (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Degree (degree)
1	33.8800	51.10	-18.11	32.99	40.00	-7.01	QP	100	42
2	88.2000	51.90	-24.73	27.17	40.00	-12.83	QP	100	109
3	150.2800	42.95	-19.84	23.11	40.00	-16.89	QP	100	185
4	466.5000	49.78	-16.16	33.62	47.00	-13.38	QP	150	137
5	864.2000	37.92	-9.58	28.34	47.00	-18.66	QP	100	109
6	933.0700	37.30	-8.59	28.71	47.00	-18.29	QP	118	360

Remark: 1. QP = Quasi Peak

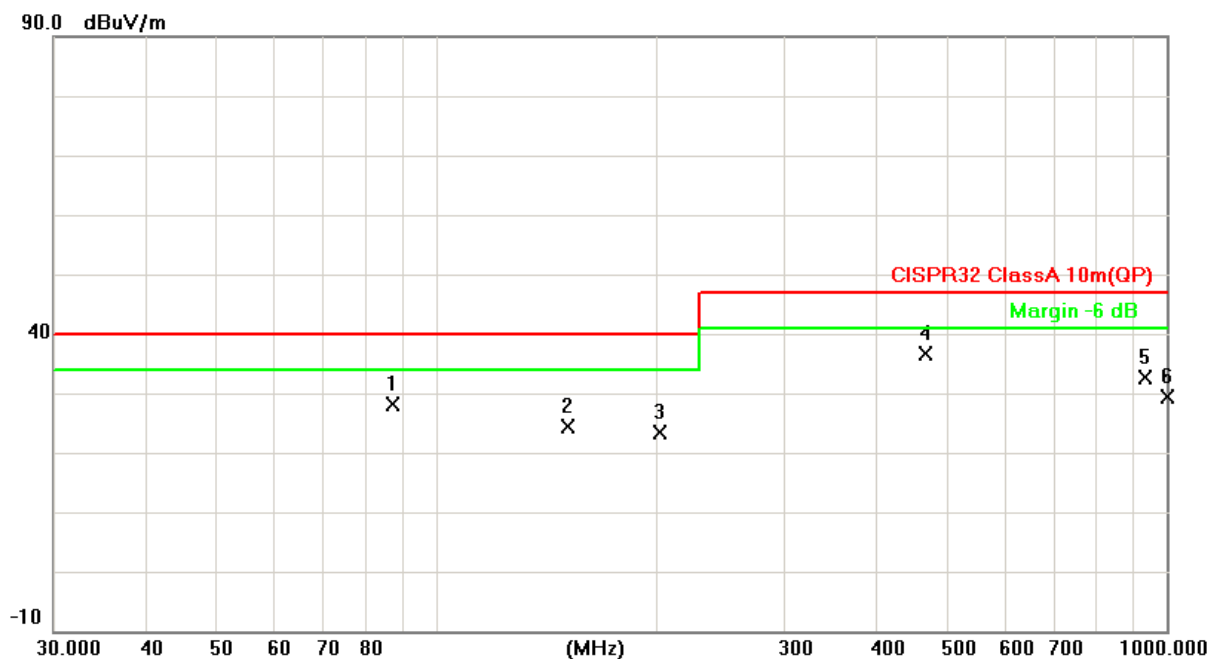
2. Correction Factor = Antenna factor + Cable loss (Antenna to preamplifier) - preamplifier Gain + Cable loss (preamplifier to receiver)

3. Measurement Value = Reading Level + Correct Factor

4. Margin Level = Measurement Value - Limit Value



Test Voltage	100Vac, 60Hz	Frequency Range	30 – 1000 MHz
Environmental Conditions	26°C, 53% RH	6dB Bandwidth	120 kHz
Test Date	2018/04/24	Test Distance	10m
Tested by	Duncan Cheng	Polarization	Horizontal
Test Mode	B		

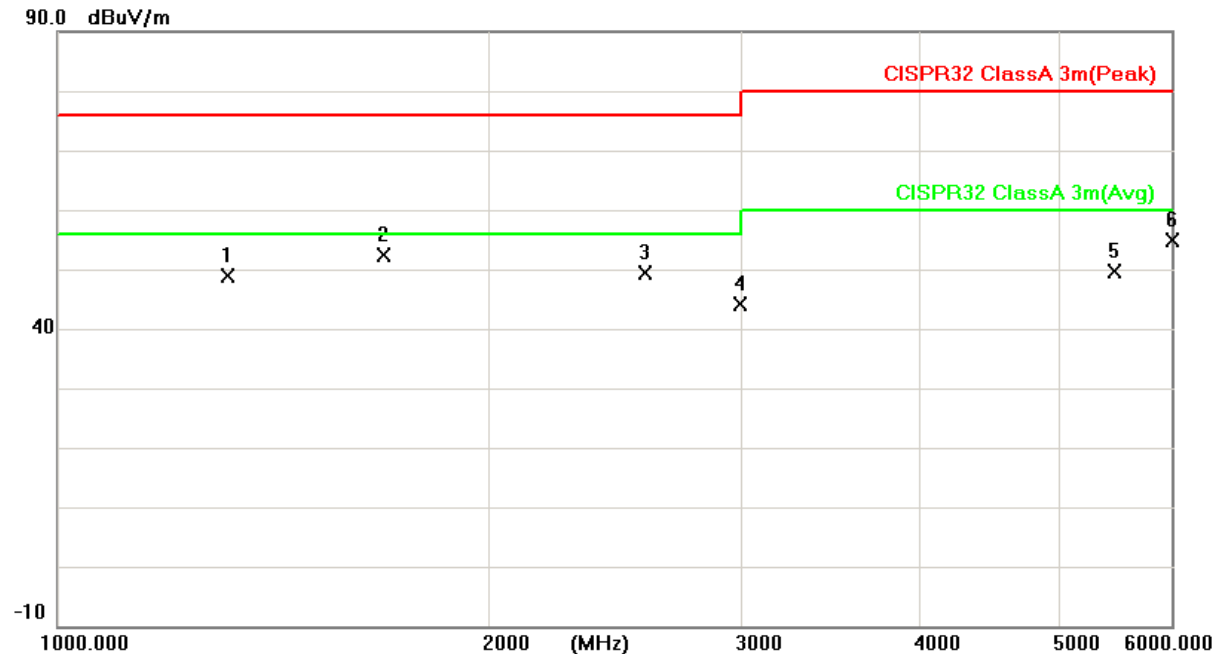


No.	Frequency (MHz)	Reading Level (dBuV)	Correct Factor (dB/m)	Measurement (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Degree (degree)
1	87.2300	52.69	-24.59	28.10	40.00	-11.90	QP	400	197
2	151.2500	44.20	-19.83	24.37	40.00	-15.63	QP	200	109
3	201.6900	48.12	-24.62	23.50	40.00	-16.50	QP	150	261
4	466.5000	52.74	-16.16	36.58	47.00	-10.42	QP	100	309
5	933.0700	41.21	-8.59	32.62	47.00	-14.38	QP	100	81
6	1000.0000	37.43	-8.02	29.41	47.00	-17.59	QP	100	81

Remark: 1. QP = Quasi Peak
2. Correction Factor = Antenna factor + Cable loss (Antenna to preamplifier) - preamplifier Gain + Cable loss (preamplifier to receiver)
3. Measurement Value = Reading Level + Correct Factor
4. Margin Level = Measurement Value - Limit Value



Test Voltage	100Vac, 60Hz	Frequency Range	1 – 6GHz
Environmental Conditions	26°C, 53% RH	6dB Bandwidth	1MHz
Test Date	2018/04/24	Test Distance	3m
Tested by	Duncan Cheng	Polarization	Vertical
Test Mode	A		

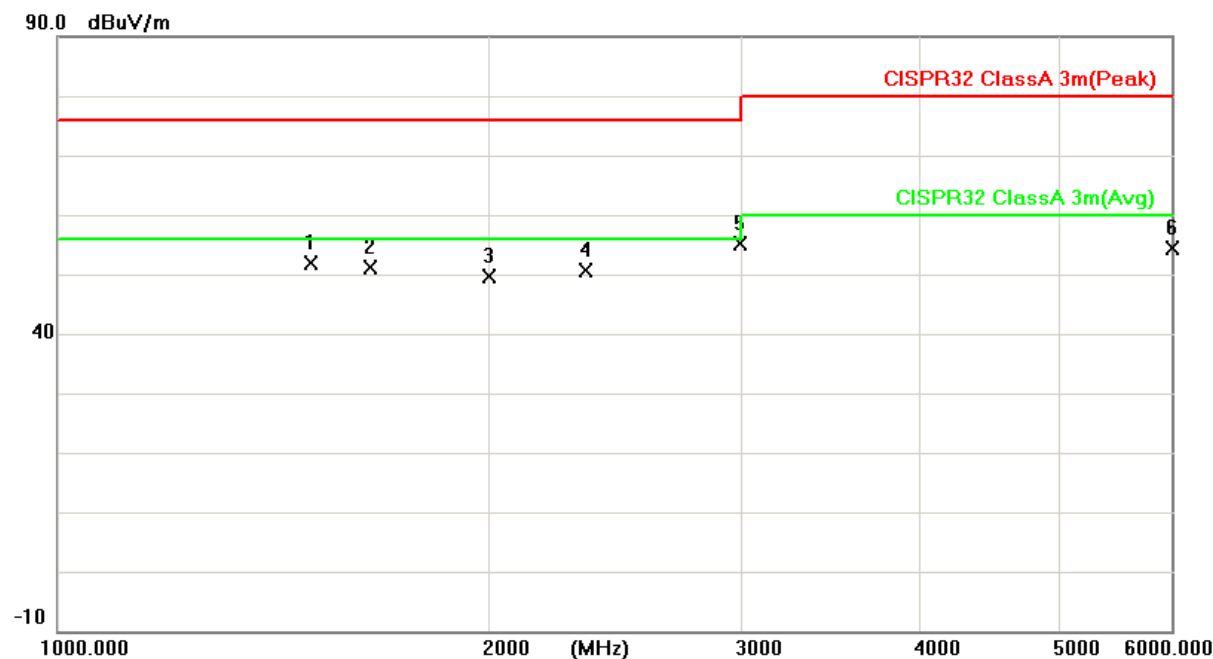


No.	Frequency (MHz)	Reading Level (dBuV)	Correct Factor (dB/m)	Measurement (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Degree (degree)
1	1315.000	61.32	-12.36	48.96	76.00	-27.04	QP	100	170
2	1690.000	62.57	-10.11	52.46	76.00	-23.54	QP	100	195
3	2570.000	55.59	-6.09	49.50	76.00	-26.50	QP	100	360
4	2995.000	48.36	-4.31	44.05	76.00	-31.95	QP	100	159
5	5460.000	45.33	4.22	49.55	80.00	-30.45	QP	100	360
6	6000.000	49.84	5.06	54.90	80.00	-25.10	QP	100	7

Remark: 1. peak = Peak, AVG = Average
2. Correction Factor = Antenna factor + Cable loss (Antenna to preamplifier) - preamplifier Gain + Cable loss (preamplifier to receiver)
3. Measurement Value = Reading Level + Correct Factor
4. Margin Level = Measurement Value - Limit Value



Test Voltage	100Vac, 60Hz	Frequency Range	1 – 6GHz
Environmental Conditions	26°C, 53% RH	6dB Bandwidth	1MHz
Test Date	2018/04/24	Test Distance	3m
Tested by	Duncan Cheng	Polarization	Horizontal
Test Mode	A		

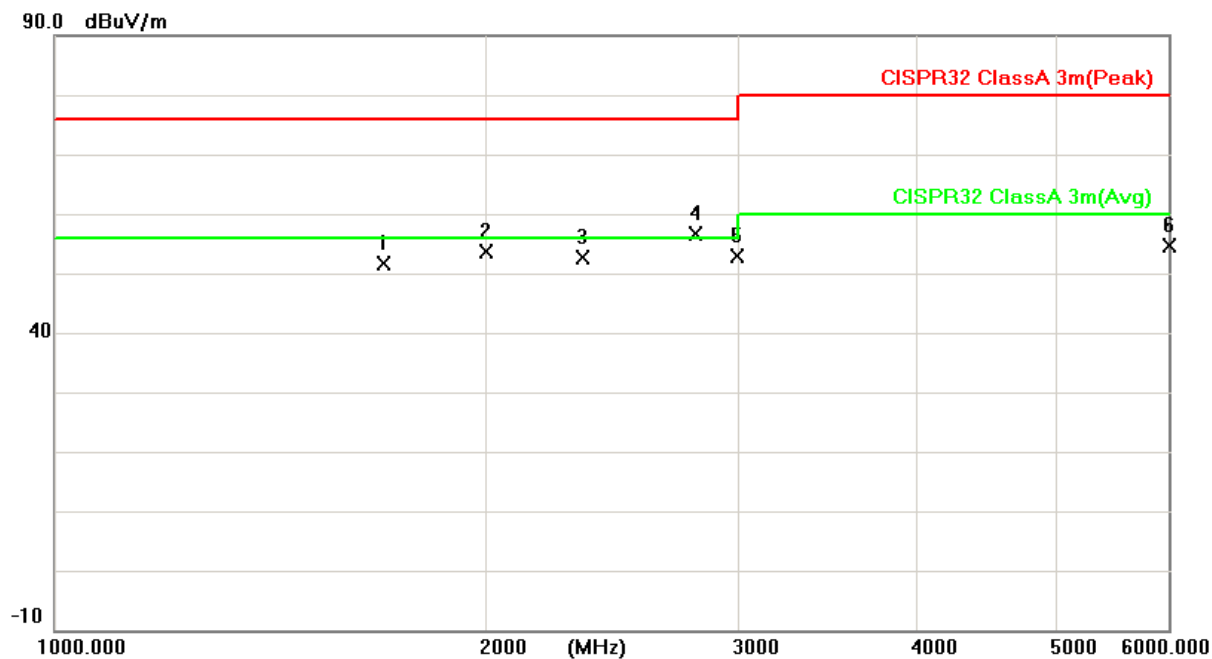


No.	Frequency (MHz)	Reading Level (dBuV)	Correct Factor (dB/m)	Measurement (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Degree (degree)
1	1500.000	62.91	-11.05	51.86	76.00	-24.14	QP	100	360
2	1650.000	61.37	-10.31	51.06	76.00	-24.94	QP	100	159
3	2000.000	58.31	-8.58	49.73	76.00	-26.27	QP	100	173
4	2335.000	57.75	-7.12	50.63	76.00	-25.37	QP	100	239
5	2995.000	59.35	-4.31	55.04	76.00	-20.96	QP	100	210
6	5995.000	49.35	5.05	54.40	80.00	-25.60	QP	100	20

Remark: 1. peak = Peak, AVG = Average
2. Correction Factor = Antenna factor + Cable loss (Antenna to preamplifier) - preamplifier Gain + Cable loss (preamplifier to receiver)
3. Measurement Value = Reading Level + Correct Factor
4. Margin Level = Measurement Value - Limit Value



Test Voltage	100Vac, 60Hz	Frequency Range	1 – 6GHz
Environmental Conditions	26°C, 53% RH	6dB Bandwidth	1MHz
Test Date	2018/04/24	Test Distance	3m
Tested by	Duncan Cheng	Polarization	Vertical
Test Mode	B		

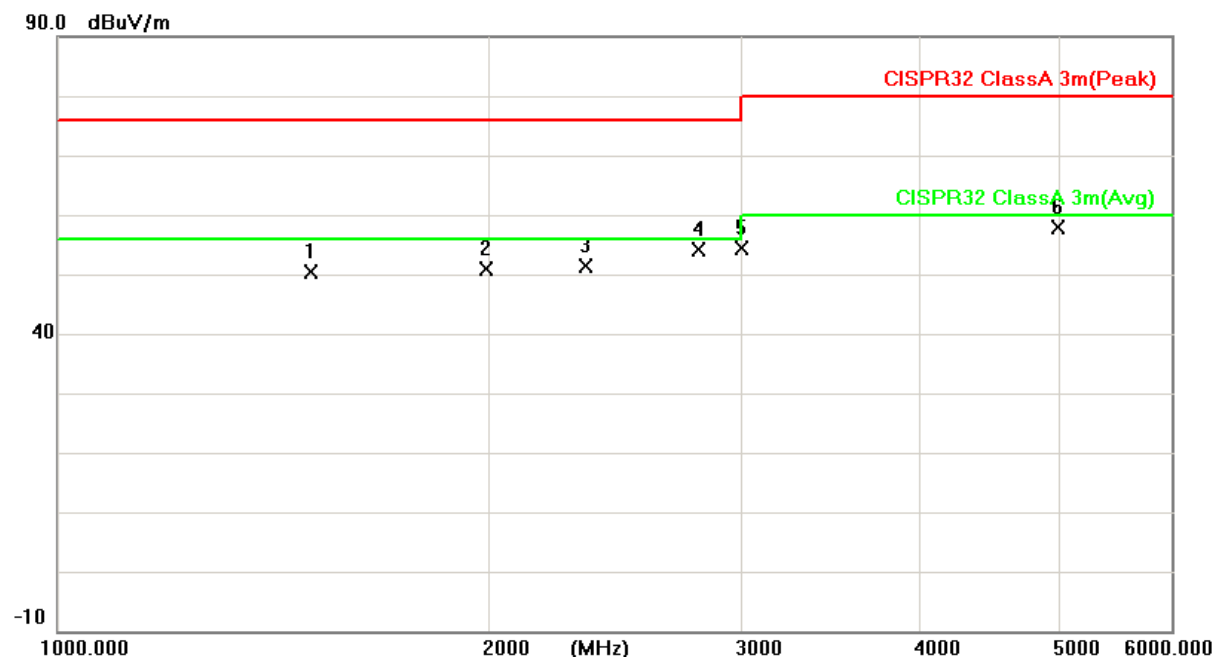


No.	Frequency (MHz)	Reading Level (dBuV)	Correct Factor (dB/m)	Measurement (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Degree (degree)
1	1695.000	61.73	-10.08	51.65	76.00	-24.35	peak	100	183
2	2000.000	62.18	-8.58	53.60	76.00	-22.40	peak	100	342
3	2335.000	59.72	-7.12	52.60	76.00	-23.40	peak	100	165
4	2800.000	61.86	-5.13	56.73	76.00	-19.27	peak	100	128
5	2995.000	57.22	-4.31	52.91	76.00	-23.09	peak	100	193
6	5990.000	49.48	5.04	54.52	80.00	-25.48	peak	100	16

Remark: 1. peak = Peak, AVG = Average
2. Correction Factor = Antenna factor + Cable loss (Antenna to preamplifier) - preamplifier Gain + Cable loss (preamplifier to receiver)
3. Measurement Value = Reading Level + Correct Factor
4. Margin Level = Measurement Value - Limit Value



Test Voltage	100Vac, 60Hz	Frequency Range	1 – 6GHz
Environmental Conditions	26°C, 53% RH	6dB Bandwidth	1MHz
Test Date	2018/04/24	Test Distance	3m
Tested by	Duncan Cheng	Polarization	Horizontal
Test Mode	B		



No.	Frequency (MHz)	Reading Level (dBuV)	Correct Factor (dB/m)	Measurement (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Degree (degree)
1	1500.000	61.33	-11.05	50.28	76.00	-25.72	peak	100	5
2	1990.000	59.61	-8.63	50.98	76.00	-25.02	peak	100	157
3	2335.000	58.47	-7.12	51.35	76.00	-24.65	peak	100	60
4	2800.000	59.22	-5.13	54.09	76.00	-21.91	peak	100	75
5	3000.000	58.62	-4.29	54.33	76.00	-21.67	peak	100	210
6	4995.000	54.47	3.45	57.92	80.00	-22.08	peak	100	220

Remark: 1. peak = Peak, AVG = Average
2. Correction Factor = Antenna factor + Cable loss (Antenna to preamplifier) - preamplifier Gain + Cable loss (preamplifier to receiver)
3. Measurement Value = Reading Level + Correct Factor
4. Margin Level = Measurement Value - Limit Value

4.3.7 Photographs of Test Configuration

Radiated Emission Test (30MHz~1GHz) Mode A



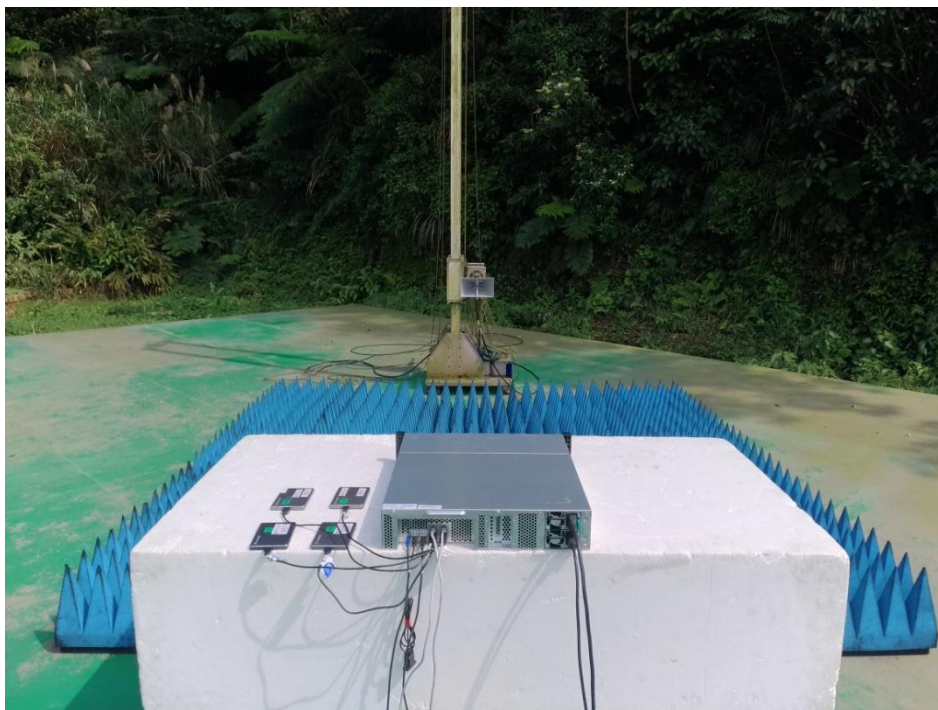
Mode B



Radiated Emission Test (Above 1GHz)
Mode A



Mode B



< End Page >