

ETSI EN 301 489-1 V2.2.0 (2017-03)
ETSI EN 301 489-17 V3.2.0 (2017-03)

TEST REPORT

For

SHENZHEN TENDA TECHNOLOGY CO.,LTD.

6-8 Floor, Tower E3, No. 1001, Zhongshanyuan Road, Nanshan District, Shenzhen, China.
518052

Model: AC10

Report Type: Original Report	Product Type: AC1200 MU-MIMO Dual Band Gigabit WiFi Router
Report Number:	RDG171102009-02
Report Date:	2017-11-22
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Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Dongguan).

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

EUT Name:		AC1200 MU-MIMO Dual Band Gigabit WiFi Router
EUT Model:		AC10
Multiple Models:		N/A
Rated Input Voltage:		DC 12V from adapter
Nominal Adapter Information	Model:	BN036-A12012E
	Input:	100-240V~50/60Hz 0.4A
	Output:	12V,1.0A
External Dimension:		Length (27.3cm)*Width (16.2cm)*High (5.9cm) Length (27.3cm)*Width (16.2cm)*High (22.3cm) with Antenna
Serial Number:		171102009
EUT Received Date:		2017.11.03

Objective

This report is prepared on behalf of *SHENZHEN TENDA TECHNOLOGY CO.,LTD.* in accordance with ETSI EN 301 489-1 V2.2.0 (2017-03) ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU and the essential requirements of article 6 of Directive 2014/30/EU;

ETSI EN 301 489-17 V3.2.0 (2017-03) ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for Broadband Data Transmission Systems; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU.

The objective is to determine the compliance of EUT with:

ETSI EN 301 489-1 V2.2.0 (2017-03)

ETSI EN 301 489-17 V3.2.0 (2017-03).

Test Methodology

All measurements contained in this report were conducted with ETSI EN 301 489-1 V2.2.0 (2017-03) ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU and the essential requirements of article 6 of Directive 2014/30/EU.

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China

Bay Area Compliance Laboratories Corp. (Dongguan) has been accredited to ISO/IEC 17025 by CNAS(Lab code: L5662). And accredited to ISO/IEC 17025 by NVLAP(Test Laboratory Accreditation Certificate Number 500069-0), the FCC Designation No. CN5002 under the KDB 974614 D01.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 273710. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

Bay Area Compliance Laboratories Corp. (Dongguan) was registered with ISED Canada under ISED Canada Registration Number 3062D.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in Operating mode.

Equipment Modifications

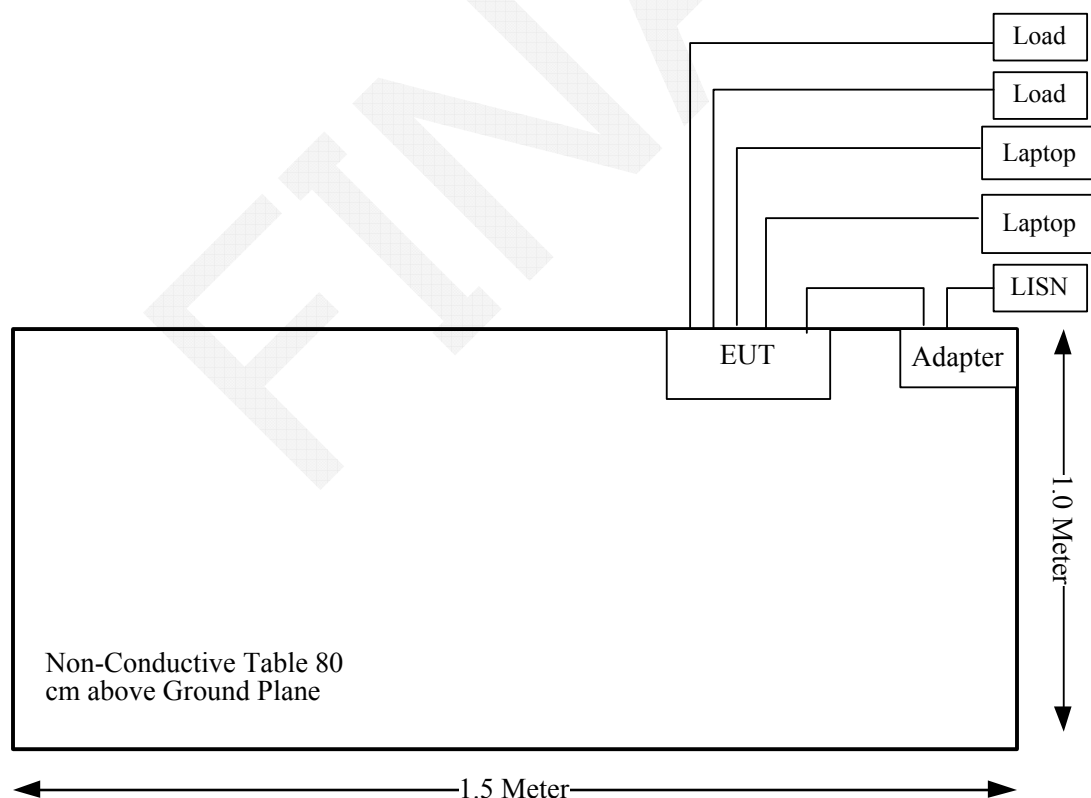
No modification was made to the EUT.

EUT Exercise Software

The EUT exercise software “Lan test.exe” was used for testing.

Test Mode	Mode Description	Test Software
Ping	Link with Laptop	Lan test.exe

Block Diagram of Test Setup



Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
DELL	Laptop	PP11L	QDS-BRCM1017
DELL	Laptop	PP11L	1CVM0C1

Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
RJ45 Cable*2	Yes	No	5.0	RJ45 Port of EUT	Laptop
RJ45 Cable*2	Yes	No	5.0	RJ45 Port of EUT	Load

Test Equipment List

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCS 30	830245/006	2016/12/8	2017/12/8
R&S	L.I.S.N	ESH2-Z5	892107/021	2017/9/25	2018/9/25
R&S	Two-line V-network	ENV 216	3560.6550.12	2016/12/8	2017/12/8
TESEQ	ISN	T8	34379	2017/5/4	2018/5/4
R&S	Test Software	EMC32	Version8.53.0	N/A	N/A
R&S	EMI Test Receiver	ESCI	100035	2017/7/28	2018/7/28
EMCO	Adjustable Dipole Antenna	3121C	9109-753	N/A	N/A
HP	Amplifier	8447F	2443A01912	2017/9/5	2018/9/5
HP	Amplifier	8447D	2727A05902	2017/9/5	2018/9/5
Agilent	Spectrum Analyzer	E4440A	SG43360054	2016/12/8	2017/12/8
ETS-Lindgren	Horn Antenna	3115	000 527 35	2016/1/5	2019/1/4
MITEQ	Amplifier	AFS42-00101800-25-S-42	2001271	2017/9/5	2018/9/5
N/A	Coaxial Cable	C-SJSJ-50	C-0800-01	2017/9/5	2018/9/5
EM TEST	Harmonic & Flicker Analyzer	DPA 500	303278	2016/12/8	2017/12/8
ELGAR	AC Power Source	1751SX	5611	2017/9/25	2018/9/25
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A
Tektronix	Digital Phosphor Oscilloscope	TDS 3054	B015264	2017/7/18	2018/7/18
SCHAFFNER	ESD Tester	NSG435	005 101	2017/7/10	2018/7/10
HP	Signal Generator	8665B	3438A00584	2017/7/18	2018/7/18
AR	Power Amplifier	100W1000M1	13410	N/A	N/A
AR	Power Amplifier	60S1G6	348711	N/A	N/A
Sunol Sciences	Antenna	JB3	A060611-2	2017/8/25	2020/8/25
ETS-Lindgren	Horn Antenna	3115	000 527 35	2016/1/5	2019/1/4
EM TEST	Auto Transformer	MV2616	0403-16	N/A	N/A
EM TEST	Ultra Compact Generator	UCS500-M6	V6016101357	2016/12/8	2017/12/8
EM TEST	EFT Clamp	N/A	300886	2016/12/8	2017/12/8
EM TEST	EM Test Coupling/Decoupling Network	CNV508 S1	311137	2017/8/31	2018/8/31
HP	Signal Generator	8648A	3246A00831	2016/12/8	2017/12/8
NARDA	Attenuator	769-6	2754	N/A	N/A
COM-POWER	CDN	M325E	521064	2016/12/8	2017/12/8

* Statement of Traceability: Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Environmental Conditions

Temperature:	24.7~27.4 °C
Relative Humidity:	31~52 %*
ATM Pressure:	100.9~101.6 kPa
Tester:	Rick Chen
Test Date:	2017.11.07-2017.11.10

SUMARY OF TEST RESULTS**ETSI EN 301 489-1 V2.2.0 (2017-03)**

Clause	Description of Test	Test Result
§8.2	Enclosure of ancillary equipment measured on a stand alone basis	Compliance
§8.3	DC power input/output ports	Not applicable ¹
§8.4	AC mains power input/output ports	Compliance
§8.5	Harmonic current emissions (AC mains input port)	Not applicable ²
§8.6	Voltage fluctuations and flicker (AC mains input port)	Compliance
§8.7	Wired network ports	Compliance
§9.2	Radio frequency electromagnetic fields (80 MHz to 6 000 MHz)	Compliance
§9.3	Electrostatic discharges	Compliance
§9.4	Fast transients, common mode	Compliance
§9.5	Radio frequency, common mode	Compliance
§9.6	Transients and surges in the vehicular environment	Not applicable ³
§9.7	Voltage dips and short interruptions	Compliance
§9.8	Surges	Compliance

Note:

1:Test voltage is AC 230V/50Hz.

2:EUT power is less than 75w.

3:EUT is not equipment intended for vehicular use.

ETSI EN 301 489-1 V2.2.0 (2017-03) §8.2 – ENCLOSURE OF ANCILLARY EQUIPMENT MEASURED ON A STAND ALONE BASIS

Measurement Uncertainty

Compliance or non-compliance with a disturbance limit shall be determined in the following manner:

If U_{lab} is less than or equal to U_{cisp} of Table 1, then:

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

If U_{lab} is greater than U_{cisp} of Table 1, then:

- compliance is deemed to occur if no measured disturbance level, increased by $(U_{lab} - U_{cisp})$, exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level, increased by $(U_{lab} - U_{cisp})$, exceeds the disturbance limit.

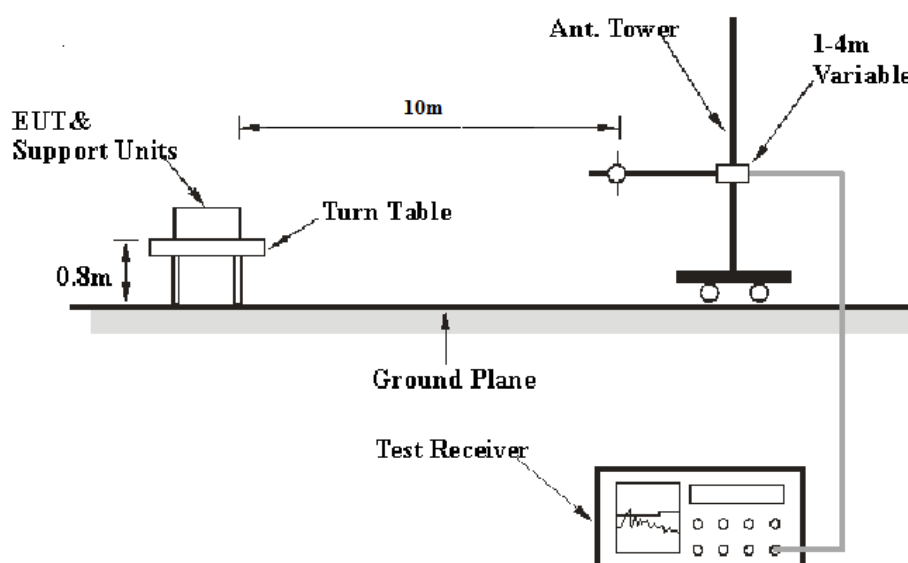
Based on CISPR 16-4-2: 2011, measurement uncertainty of radiated emission at a distance of 10m at Bay Area Compliance Laboratories Corp. (Dongguan) is: 30M~200MHz: 4.55 dB for Horizontal, 4.57 dB for Vertical; 200M~1GHz: 4.66 dB for Horizontal, 4.56 dB for Vertical; measurement uncertainty of radiated emission at a distance of 3m at Bay Area Compliance Laboratories Corp. (Dongguan) is: 30M~200MHz: 4.58 dB for Horizontal, 4.59 dB for Vertical; 200M~1GHz: 4.83 dB for Horizontal, 5.85 dB for Vertical; 1G~6GHz: 4.45 dB, 6G~18GHz: 5.23 dB

Table 1 – Values of U_{cisp}

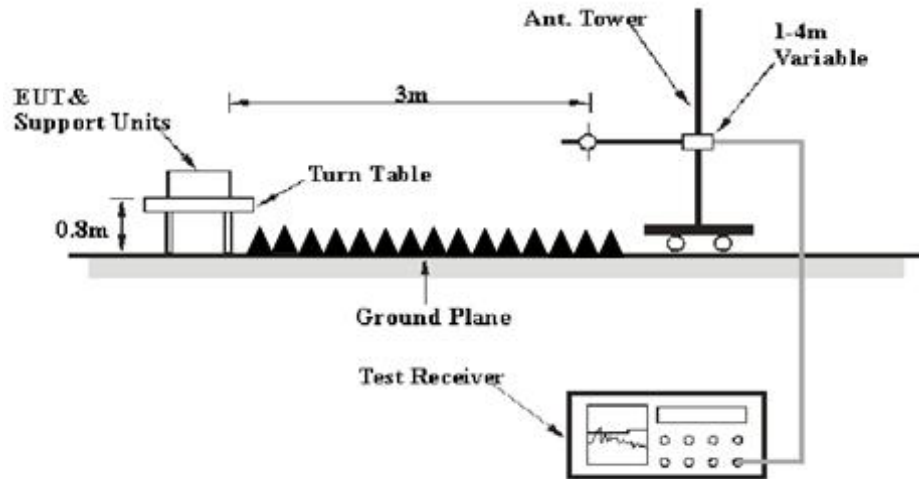
Measurement	U_{cisp}
Radiated disturbance (electric field strength at an OATS or in a SAC) (30 MHz to 1000 MHz)	6.3 dB
Radiated disturbance (electric field strength in a FAR) (1 GHz to 6 GHz)	5.2 dB
Radiated disturbance (electric field strength in a FAR) (6 GHz to 18 GHz)	5.5 dB

Test System Setup

Below 1GHz:



Above 1GHz:



The radiated emission tests below 1GHz were performed in 10 meters, above 1GHz were performed in the 3 meters. The specification used was EN 55032 Class B limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle. The spacing between the peripherals was 10 cm.

EMI Test Receiver Setup

The system was investigated from 30 MHz to 6 GHz.

During the radiated emission test, the EMI test receiver Setup was set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	Peak
	1MHz	10 Hz	/	Ave.

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

All data was recorded in the Quasi-peak detection mode from 30MHz to 1GHz, Peak and average detection mode above 1 GHz.

Corrected Amplitude & Margin Calculation

The basic equation is as follows:

Result = Meter Reading+ Corrected

Note:

Corrected = Antenna Factor + Cable Loss - Amplifier Gain

or

Corrected = Antenna Factor + Cable Loss + Insertion loss of attenuator - Amplifier Gain

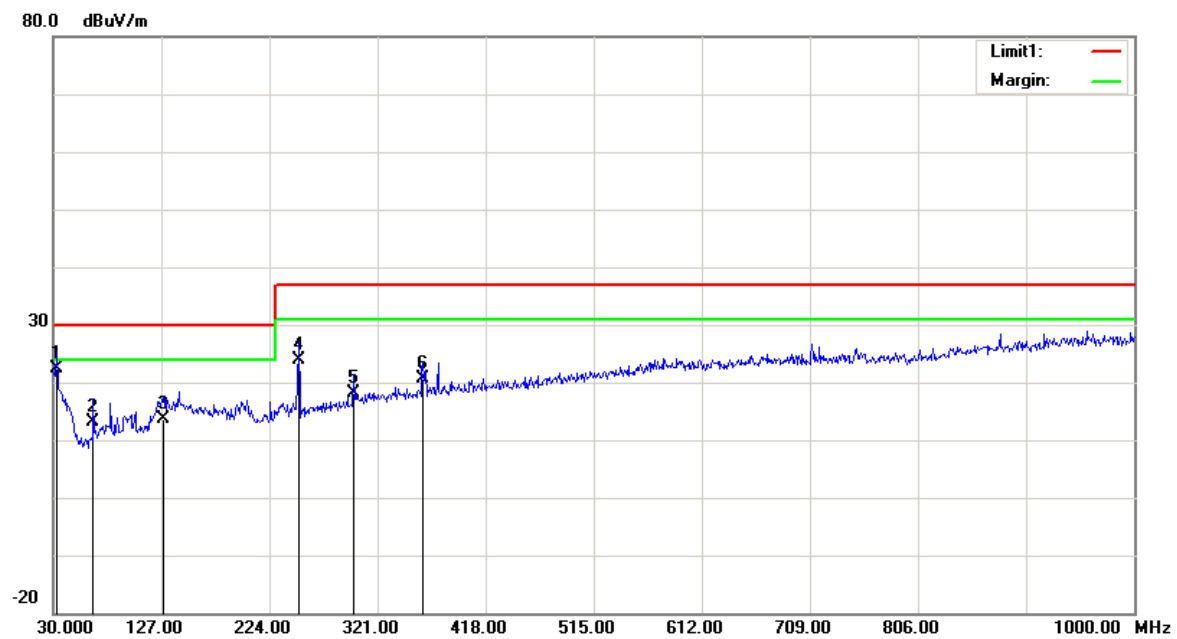
The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin = Limit – Result

Test Data

Please refer to following table and plots:

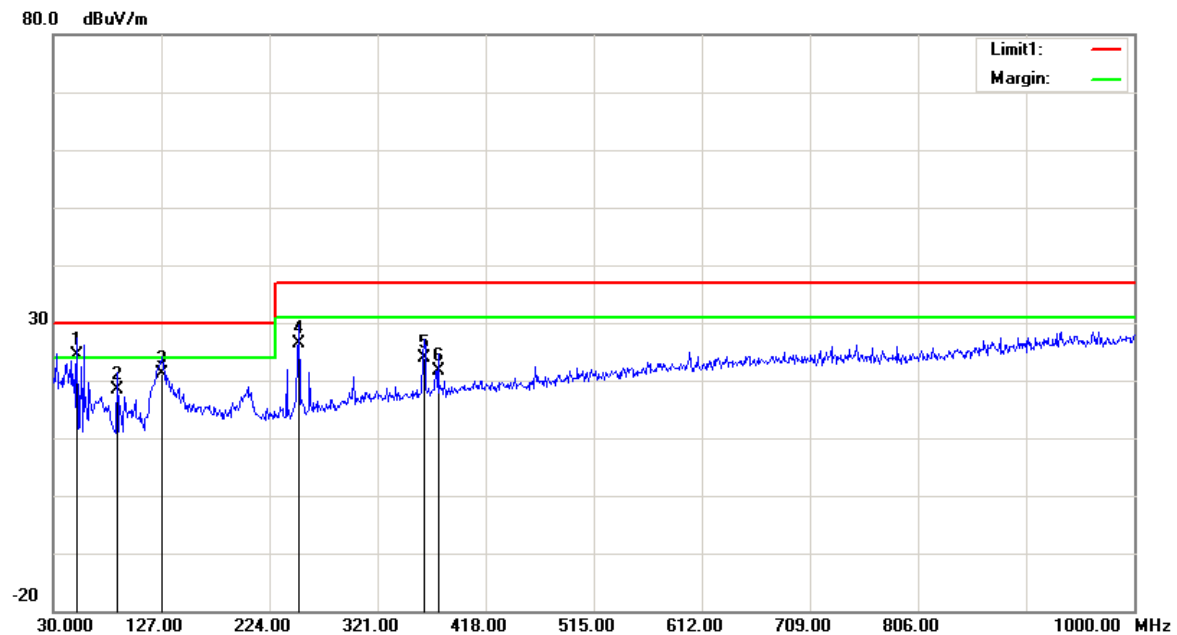
Condition:	EN301489	Polarization:	Horizontal
EUT:	AC1200 MU-MIMO Dual Band Gigabit WiFi Router	Power:	AC 230V/50Hz
Model:	AC10	Distance:	10m
Test Mode:	Operating		
Note:			



No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected dB/m	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1	32.9100	31.47	QP	-9.17	22.30	30.00	7.70
2	65.8900	32.92	QP	-19.82	13.10	30.00	16.90
3	128.9400	26.99	QP	-13.39	13.60	30.00	16.40
4	250.1900	37.12	QP	-13.12	24.00	37.00	13.00
5	299.6600	28.81	QP	-10.61	18.20	37.00	18.80
6	361.7400	29.85	QP	-9.15	20.70	37.00	16.30

Condition: EN301489
EUT: AC1200 MU-MIMO Dual Band Gigabit WiFi Router
Model: AC10
Test Mode: Operating
Note:

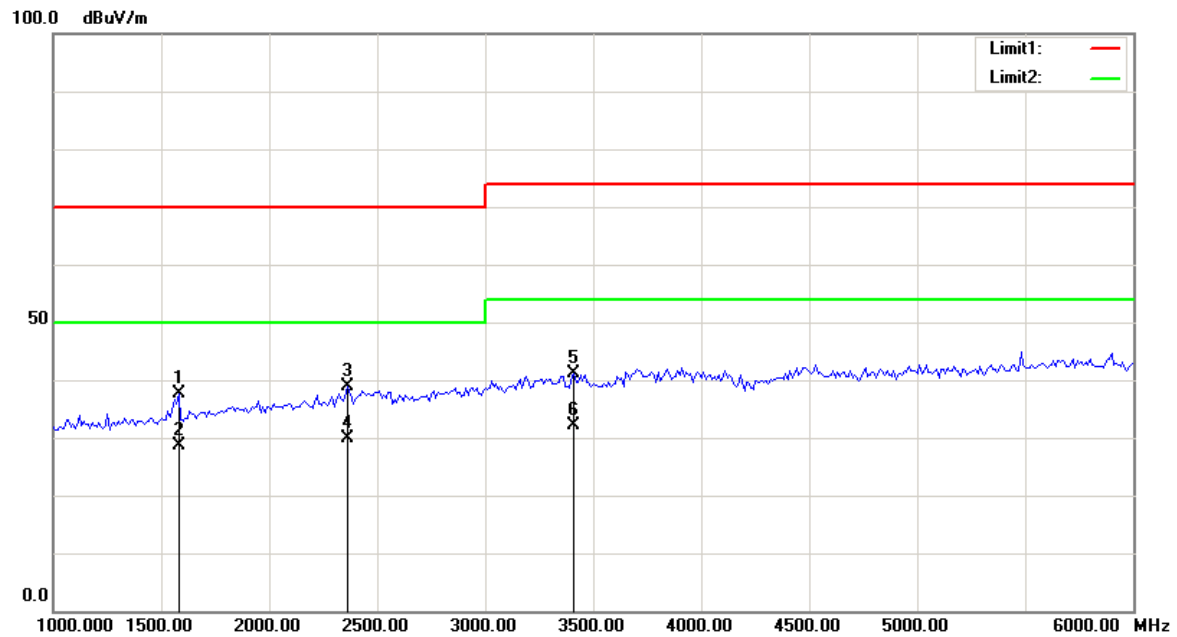
Polarization: Vertical
Power: AC 230V/50Hz
Distance: 10m



No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected dB/m	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1	51.3400	43.36	QP	-19.06	24.30	30.00	5.70
2	87.2300	36.89	QP	-18.59	18.30	30.00	11.70
3	127.0000	35.21	QP	-14.01	21.20	30.00	8.80
4	250.1900	39.62	QP	-13.12	26.50	37.00	10.50
5	362.7100	33.13	QP	-9.13	24.00	37.00	13.00
6	375.3200	30.36	QP	-8.76	21.60	37.00	15.40

Condition: EN 301489 Class B(PeaK)
EUT: AC1200 MU-MIMO Dual Band Gigabit WiFi Router
Model: AC10
Test Mode: Operating
Note:

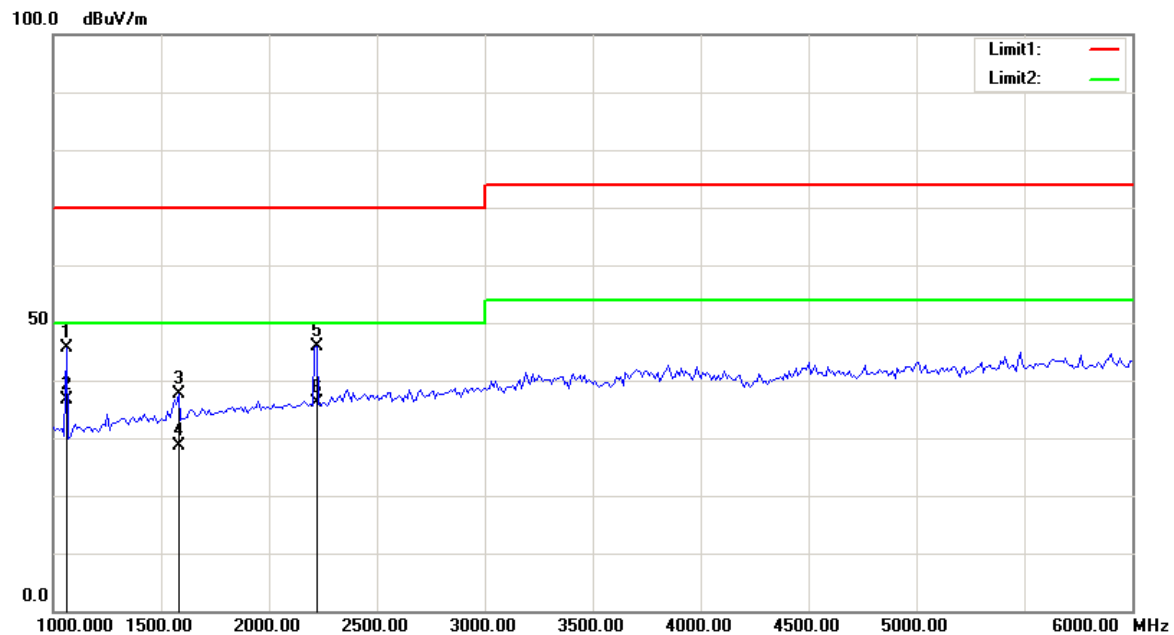
Polarization: Horizontal
Power: AC 230V/50Hz
Distance: 3m



No.	Frequency (MHz)	Reading (dB μ V)	Detector	Corrected dB/m	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
1	1580.000	46.50	peak	-8.80	37.70	70.00	32.30
2	1580.000	37.48	AVG	-8.80	28.68	50.00	21.32
3	2360.000	45.46	peak	-6.62	38.84	70.00	31.16
4	2360.000	36.51	AVG	-6.62	29.89	50.00	20.11
5	3410.000	44.62	peak	-3.44	41.18	74.00	32.82
6	3410.000	35.48	AVG	-3.44	32.04	54.00	21.96

Condition: EN 301489 Class B(PeaK)
EUT: AC1200 MU-MIMO Dual Band Gigabit WiFi Router
Model: AC10
Test Mode: Operating
Note:

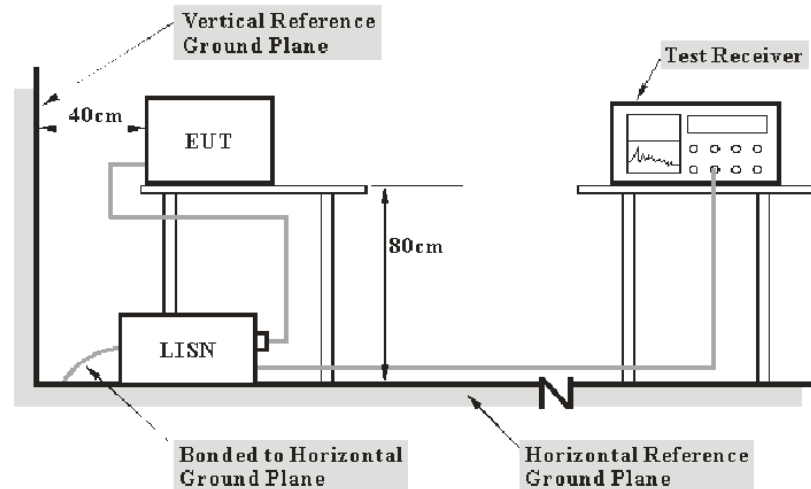
Polarization: Vertical
Power: AC 230V/50Hz
Distance: 3m



No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected dB/m	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1	1060.000	56.21	peak	-10.49	45.72	70.00	24.28
2	1060.000	47.12	AVG	-10.49	36.63	50.00	13.37
3	1580.000	46.50	peak	-8.80	37.70	70.00	32.30
4	1580.000	37.39	AVG	-8.80	28.59	50.00	21.41
5	2220.000	52.54	peak	-6.72	45.82	70.00	24.18
6	2220.000	42.87	AVG	-6.72	36.15	50.00	13.85

ETSI EN 301 489-1 V2.2.0 (2017-03) §8.4 – AC MAINS POWER INPUT/OUTPUT PORTS

EUT Setup



Note: 1. Support units were connected to second LISN.
 2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per EN 301 489-1 measurement procedures. The specification used was with the EN 301 489-1 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

The adapter was connected to AC230V/50Hz power source.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

During the conducted emissions test, the adapter was connected to the main outlet of the first LISN and the other support equipments were connected to the outlet of the second LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

Corrected Amplitude & Margin Calculation

The basic equation is as follows:

Result (QuasiPeak or Average) = Meter Reading + Corr.

Note:

Corr. = Cable loss + Factor of coupling device

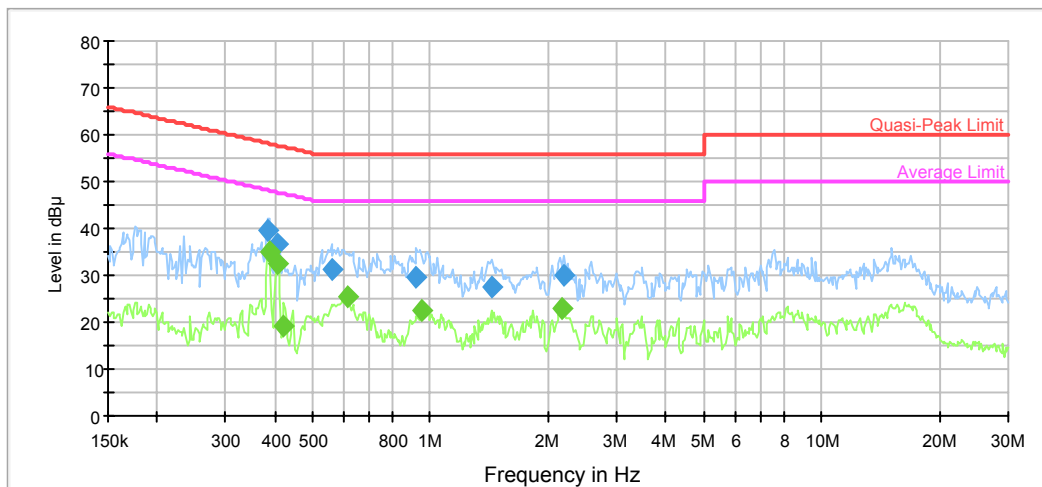
The “**Margin**” column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin = Limit – Result

Test Data

Please refer to following table and plots:

Model Number: AC10
Port: L
Test Mode: Operating
Power Source: AC 230V/50Hz



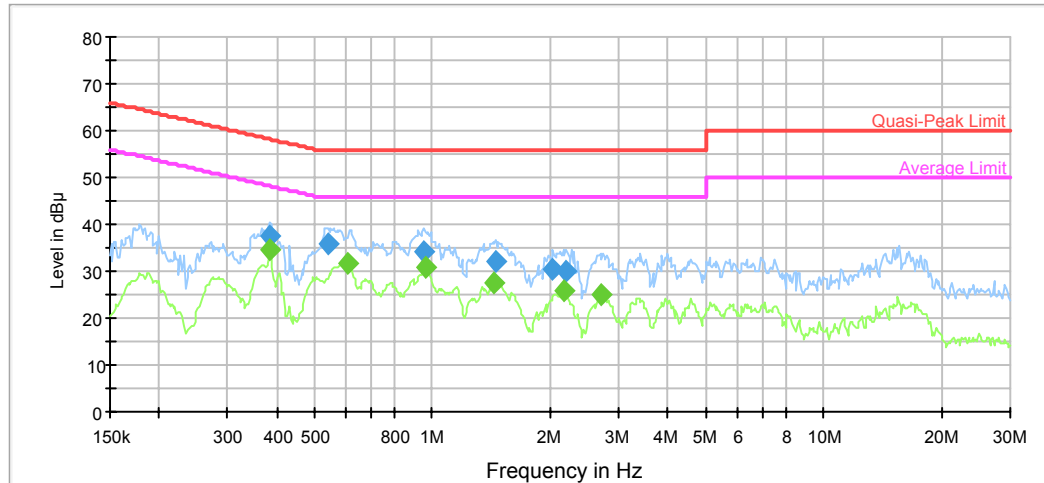
Final Result 1

Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.384091	39.5	9.000	L1	10.0	18.7	58.2
0.406123	36.7	9.000	L1	10.0	21.0	57.7
0.558572	31.3	9.000	L1	9.9	24.7	56.0
0.922769	29.4	9.000	L1	9.8	26.6	56.0
1.441726	27.4	9.000	L1	9.7	28.6	56.0
2.199332	30.0	9.000	L1	9.7	26.0	56.0

Final Result 2

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.387164	35.1	9.000	L1	10.0	13.0	48.1
0.406123	32.6	9.000	L1	10.0	15.1	47.7
0.422630	19.0	9.000	L1	10.0	28.4	47.4
0.614619	25.4	9.000	L1	9.8	20.6	46.0
0.952654	22.4	9.000	L1	9.8	23.6	46.0
2.181877	22.7	9.000	L1	9.7	23.3	46.0

Model Number: AC10
Port: N
Test Mode: Operating
Power Source: AC 230V/50Hz



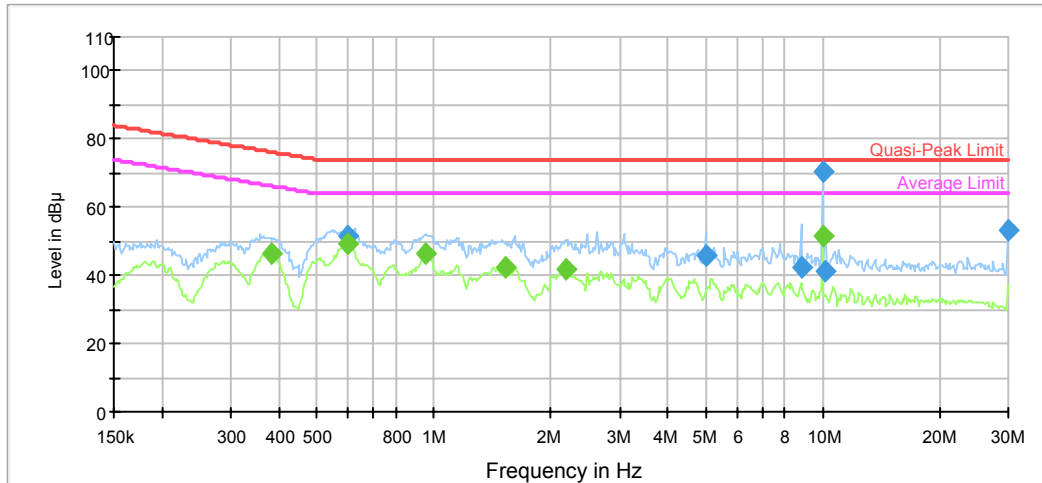
Final Result 1

Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.384091	37.6	9.000	N	10.0	20.6	58.2
0.541050	36.0	9.000	N	9.9	20.0	56.0
0.952654	34.3	9.000	N	9.8	21.7	56.0
1.453260	32.1	9.000	N	9.7	23.9	56.0
2.030886	30.5	9.000	N	9.8	25.5	56.0
2.199332	29.9	9.000	N	9.8	26.1	56.0

Final Result 2

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.384091	34.4	9.000	N	10.0	13.8	48.2
0.604902	31.6	9.000	N	9.8	14.4	46.0
0.960275	30.7	9.000	N	9.8	15.3	46.0
1.430284	27.6	9.000	N	9.7	18.4	46.0
2.164561	25.7	9.000	N	9.8	20.3	46.0
2.684134	25.0	9.000	N	9.8	21.0	46.0

Model Number: AC10
Port: RJ45-10Mbps
Test Mode: Operating
Power Source: AC 230V/50Hz



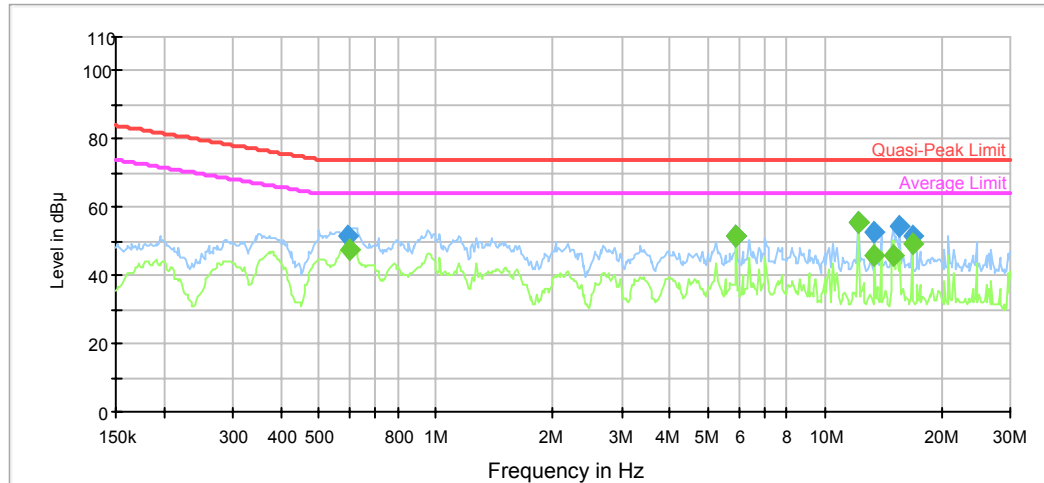
Final Result 1

Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Corr .	Margin (dB)	Limit (dBμV)
0.600100	51.6	9.000	9.7	22.4	74.0
4.997185	45.8	9.000	9.6	28.2	74.0
8.798794	42.3	9.000	9.6	31.7	74.0
9.995204	70.5	9.000	9.6	3.5	74.0
10.155767	41.1	9.000	9.6	32.9	74.0
30.000000	53.4	9.000	10.1	20.6	74.0

Final Result 2

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Corr .	Margin (dB)	Limit (dBμV)
0.381043	46.1	9.000	9.9	20.2	66.3
0.600100	49.2	9.000	9.7	14.8	64.0
0.952653	46.6	9.000	9.7	17.4	64.0
1.524425	42.6	9.000	9.6	21.4	64.0
2.181876	41.7	9.000	9.6	22.3	64.0
9.995204	51.7	9.000	9.6	12.3	64.0

Model Number: AC10
Port: RJ45-100Mbps
Test Mode: Operating
Power Source: AC 230V/50Hz



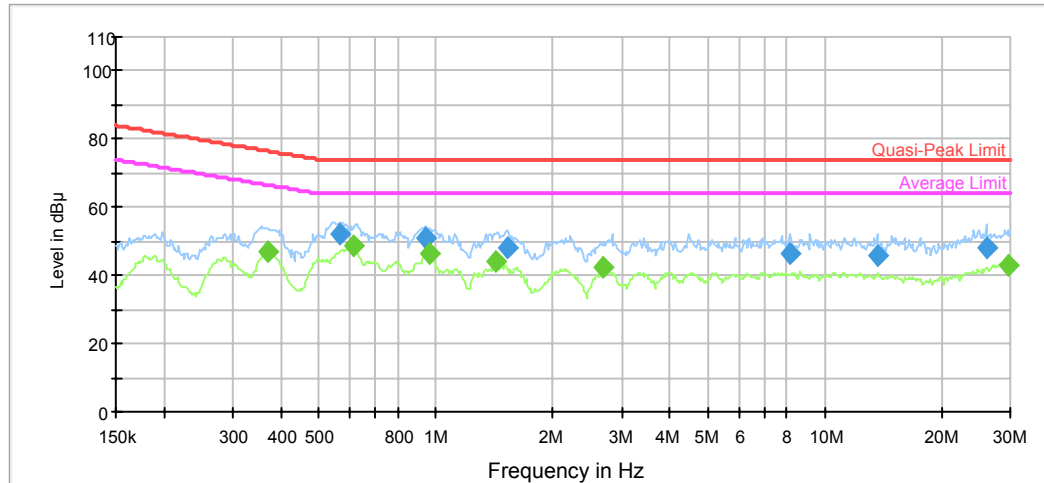
Final Result 1

Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Corr .	Margin (dB)	Limit (dBμV)
0.595338	51.7	9.000	9.8	22.3	74.0
5.907402	51.6	9.000	9.6	22.4	74.0
12.198459	55.5	9.000	9.7	18.5	74.0
13.422437	52.8	9.000	9.7	21.2	74.0
15.616420	54.5	9.000	9.7	19.5	74.0
16.777462	51.8	9.000	9.7	22.2	74.0

Final Result 2

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Corr .	Margin (dB)	Limit (dBμV)
0.600100	47.7	9.000	9.7	16.3	64.0
5.907402	51.5	9.000	9.6	12.5	64.0
12.198459	55.3	9.000	9.7	8.7	64.0
13.422437	45.9	9.000	9.7	18.1	64.0
15.006479	45.6	9.000	9.7	18.4	64.0
16.777462	49.4	9.000	9.7	14.6	64.0

Model Number: AC10
Port: RJ45-1000Mbps
Test Mode: Operating
Power Source: AC 230V/50Hz



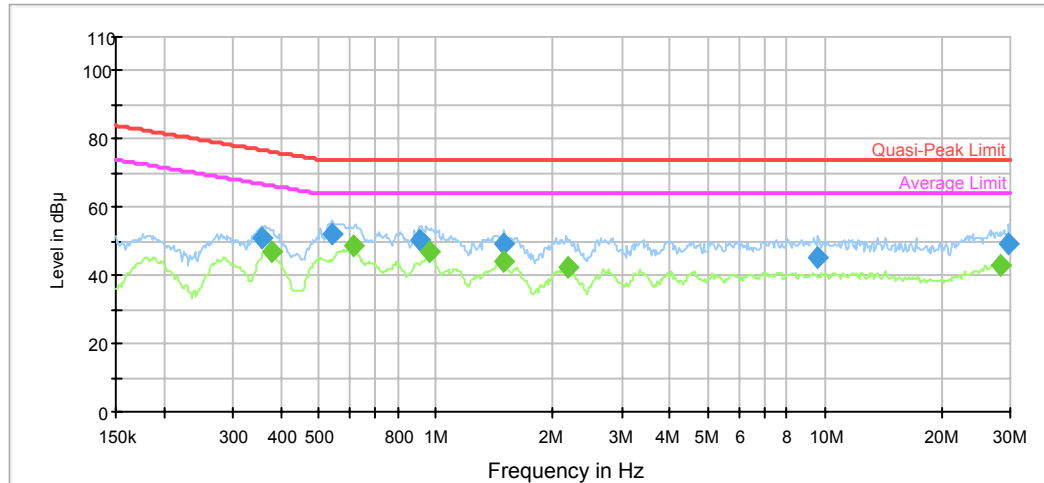
Final Result 1

Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Corr .	Margin (dB)	Limit (dBμV)
0.563040	52.3	9.000	9.8	21.7	74.0
0.937591	51.1	9.000	9.7	22.9	74.0
1.524425	48.2	9.000	9.6	25.8	74.0
8.124897	46.2	9.000	9.6	27.8	74.0
13.638055	45.9	9.000	9.7	28.1	74.0
26.004921	48.0	9.000	10.0	26.0	74.0

Final Result 2

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Corr .	Margin (dB)	Limit (dBμV)
0.369089	47.3	9.000	9.9	19.2	66.5
0.614618	48.7	9.000	9.7	15.3	64.0
0.960274	46.5	9.000	9.7	17.5	64.0
1.430283	43.8	9.000	9.6	20.2	64.0
2.684132	42.2	9.000	9.6	21.8	64.0
29.540922	43.1	9.000	10.1	20.9	64.0

Model Number: AC10
Port: RJ45-WAN
Test Mode: Operating
Power Source: AC 230V/50Hz



Final Result 1

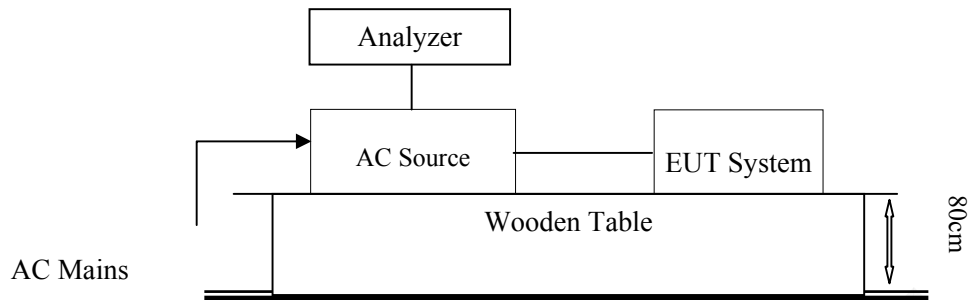
Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Corr .	Margin (dB)	Limit (dBμV)
0.354673	51.0	9.000	9.9	25.9	76.9
0.541049	52.4	9.000	9.8	21.6	74.0
0.908179	50.2	9.000	9.7	23.8	74.0
1.500324	49.2	9.000	9.6	24.8	74.0
9.604815	45.1	9.000	9.6	28.9	74.0
29.777249	49.2	9.000	10.1	24.8	74.0

Final Result 2

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Corr .	Margin (dB)	Limit (dBμV)
0.378018	46.8	9.000	9.9	19.5	66.3
0.614618	48.8	9.000	9.7	15.2	64.0
0.960274	46.7	9.000	9.7	17.3	64.0
1.488417	44.4	9.000	9.6	19.6	64.0
2.181876	42.4	9.000	9.6	21.6	64.0
28.161829	43.1	9.000	10.1	20.9	64.0

ETSI EN 301 489-1 V2.2.0 (2017-03) §8.6 – VOLTAGE FLUCTUATIONS AND FLICKER (AC MAINS INPUT PORT)

Test System Setup



Test Standard

EN 61000-3-3:2013

Flicker Test Limits :

The limits shall be applicable to voltage fluctuations and flicker at the supply terminals of the equipment under test, measured or calculated according to clause 4 under test conditions described in clause 6 and annex A. Tests made to prove compliance with the limits are considered to be type tests.

The following limits apply:

- the value of P_{st} shall not be greater than 1,0;
- the value of P_{lt} shall not be greater than 0,65;
- the value of $d(t)$ during a voltage change shall not exceed 3,3 % for more than 500 ms;
- the relative steady-state voltage change, d_c , shall not exceed 3,3 %;
- the maximum relative voltage change d_{max} , shall not exceed
 - a) 4 % without additional conditions;
 - b) 6 % for equipment which is:

- switched manually, or
 - switched automatically more frequently than twice per day, and also has either a delayed restart (the delay being not less than a few tens of seconds), or manual restart, after a power supply interruption.

Note: The cycling frequency will be further limited by the Pst and Plt limit. For example: a d_{max} of 6 % producing a rectangular voltage change characteristic twice per hour will give a Plt of about 0,65.

- c) 7 % for equipment which is
 - attended whilst in use (for example: hair dryers, vacuum cleaners, kitchen equipment such as mixers, garden equipment such as lawn mowers, portable tools such as electric drills), or
 - switched on automatically, or is intended to be switched on manually, no more than twice per day, and also has either a delayed restart (the delay being not less than a few tens of seconds) or manual restart, after a power supply interruption.

In the case of equipment having several separately controlled circuits in accordance with 6.6, limits b) and c) shall apply only if there is delayed or manual restart after a power supply interruption; for all equipment with automatic switching which is energized immediately on restoration of supply after a power supply interruption, limits a) shall apply; for all equipment with manual switching, limits b) or c) shall apply depending on the rate of switching. Pst and Plt requirements shall not be applied to voltage changes caused by manual switching. The limits shall not be applied to voltage changes associated with emergency switching or emergency interruptions.

Test Data

Please refer to following tables:

Short time (Pst):	10 min
Observation time:	10 min (1 Flicker measurement)
Test Mode:	Operating
Power Source:	AC 230V/50Hz
Test Result	PASS

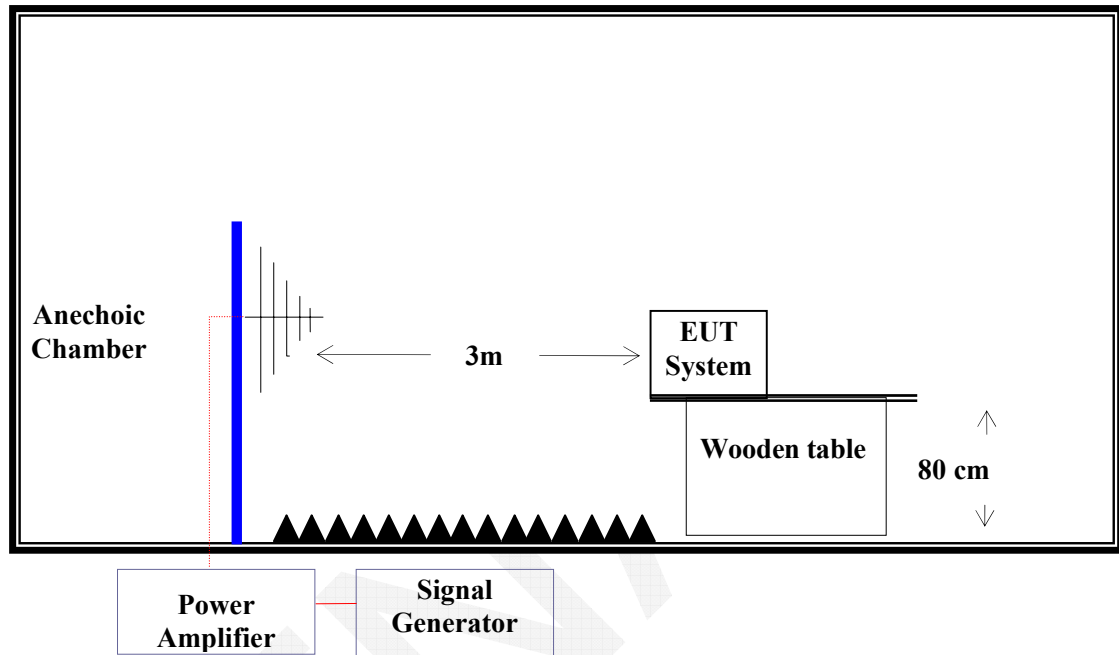
Maximum Flicker results

	EUT values	Limit	Result
Pst	0.028	1.00	PASS
Plt	0.028	0.65	PASS
dc [%]	0.011	3.30	PASS
dmax [%]	0.309	4.00	PASS
dt [s]	0.000	0.50	PASS

Test Setup Photo

ETSI EN 301 489-1 V2.2.0 (2017-03) §9.2 – RADIO FREQUENCY ELECTROMAGNETIC FIELDS (80 MHZ TO 6 000 MHZ)

Test System Setup



Test Level

Level	Field Strength V/m
1.	1
2.	3
3.	10
X.	Special

Performance Criterion: A

Test Procedure

The EUT and its simulators are placed on a turn table which is 0.8 meter above the ground. The EUT is set 3 meters away from the Receiving antenna which is mounted on an antenna tower. Both horizontal and vertical polarizations of the antenna are set on test. Each of the four sides of EUT must be faced this Receiving antenna and measured individually. In order to judge the EUT performance, a CCD camera was used to monitor the EUT.

Test Data

Please refer to following tables:

Test Mode: Operating

Note:

Condition of Test	Remarks
Field Strength	3 V/m (Test Level 2)
RF Signal	1 kHz, 80% AM, sine wave
Sweep Frequency Step	1%, logarithmic
Dwell Time	1 Sec

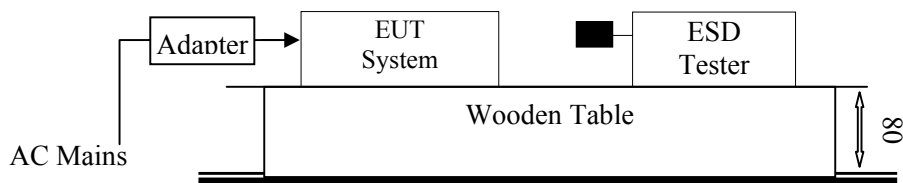
Frequency Range (MHz)	Front Side		Rear Side		Left Side		Right Side	
	VERT	HORI	VERT	HORI	VERT	HORI	VERT	HORI
80-1000	A	A	A	A	A	A	A	A
1000-6000	A	A	A	A	A	A	A	A

Test Setup Photo



ETSI EN 301 489-1 V2.2.0 (2017-03) §9.3 – ELECTROSTATIC DISCHARGES

Test System Setup



Remark: ■ is the tip of the electrode

EN 61000-4-2 specifies that a tabletop EUT shall be placed on a non-conducting table which is 80 centimeters above a ground reference plane and that floor mounted equipment shall be placed on a insulating support approximately 10 centimeters above a ground plane. During the tests, the EUT is positioned over a ground reference plane in conformance with this requirement.

For tabletop equipment, a 1.6 by 0.8-meter metal sheet (HCP) is placed on the table and connected to the ground plane via a metal strap with two 470 k Ohms resistors in series. The EUT and attached cables are isolated from this metal sheet by 0.5-millimeter thick insulating material. A Vertical Coupling Plane (VCP) grounded on the ground plane through the same configuration as in the HCP is used.

Test Level

Level	Test Voltage Contact Discharge (\pm kV)	Test Voltage Air Discharge (\pm kV)
1.	2	2
2.	4	4
3.	6	8
4.	8	15
X.	Special	Special

Test Level 3 for Air Discharge at ± 8 kV

Test Level 2 for Direct Discharge at ± 4 kV

Performance criterion: B

Test Procedure

Air Discharge:

This test is done on a non-conductive surface. The round discharge tip of the discharge electrode shall be approached as fast as possible to touch the EUT. After each discharge, the discharge electrode shall be removed from the EUT. The generator is then re-triggered for a new single discharge and repeated 10 times for each pre-selected test point. This procedure shall be repeated until all the air discharge completed.

Contact Discharge:

All the procedure shall be same as Section 8.3.1 of EN 61000-4-2, except that the tip of the discharge electrode shall touch the EUT before the discharge switch is operated.

Indirect discharge for horizontal coupling plane

At least 50 single discharges shall be applied to the horizontal coupling plane, at points on each side of the EUT. The discharge electrode positions vertically at a distance of 0.1m from the EUT and with the discharge electrode touching the coupling plane.

Indirect discharge for vertical coupling plane

At least 50 single discharges shall be applied to the center of one vertical edge of the coupling plane. The coupling plane, of dimensions 0.5m X 0.5m, is placed parallel to, and positioned at a distance of 0.1m from the EUT. Discharges shall be applied to the coupling plane, with this plane in sufficient different positions that the four faces of the EUT are completely illuminated.

Test Data

Please refer to following tables:

Test Mode: Operating

Note:

Table 1: Electrostatic Discharge Immunity (Air Discharge)

Test Points Location	Test Levels							
	-2 kV	+2 kV	-4 kV	+4 kV	-8 kV	+8 kV	-15 kV	+15 kV
Surface	A	A	A	A	A	A	/	/
Port	A	A	A	A	A	A	/	/
Seam	A	A	A	A	A	A	/	/
Button	A	A	A	A	A	A	/	/

Table 2: Electrostatic Discharge Immunity (Direct Contact)

Test Points Location	Test Levels							
	-2 kV	+2 kV	-4 kV	+4 kV	-6 kV	+6 kV	-8 kV	+8 kV
/	/	/	/	/	/	/	/	/

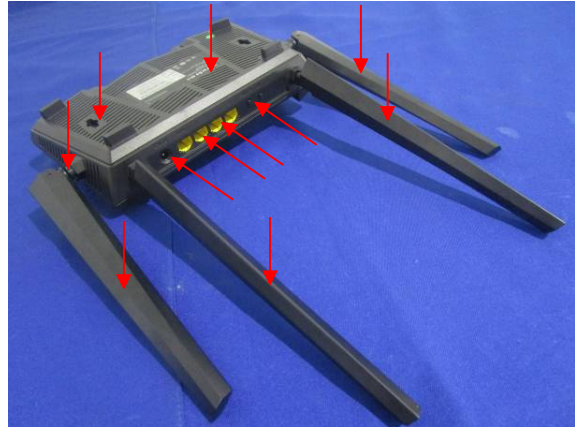
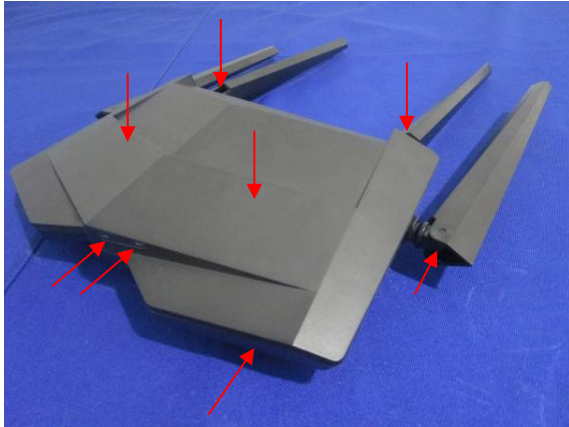
Table 3: Electrostatic Discharge Immunity (Indirect Contact HCP)


Test Points Location	Test Levels							
	-2 kV	+2 kV	-4 kV	+4 kV	-6 kV	+6 kV	-8 kV	+8 kV
Front Side	A	A	A	A	/	/	/	/
Back Side	A	A	A	A	/	/	/	/
Left Side	A	A	A	A	/	/	/	/
Right Side	A	A	A	A	/	/	/	/


Table 4: Electrostatic Discharge Immunity (Indirect Contact VCP)

Test Points Location	Test Levels							
	-2 kV	+2 kV	-4 kV	+4 kV	-6 kV	+6 kV	-8 kV	+8 kV
Front Side	A	A	A	A	/	/	/	/
Back Side	A	A	A	A	/	/	/	/
Left Side	A	A	A	A	/	/	/	/
Right Side	A	A	A	A	/	/	/	/

ESD Location Photo



Air Discharge: 

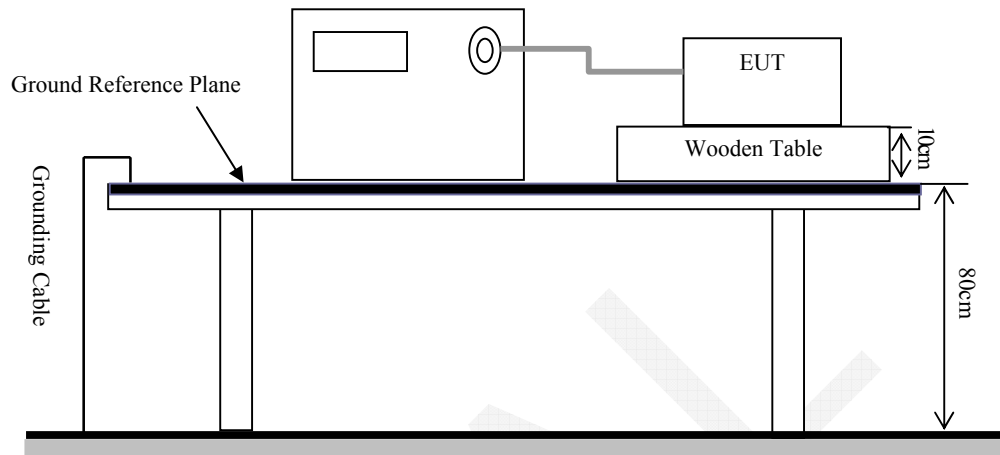
Direct Contact: 

Test Setup Photo



ETSI EN 301 489-1 V2.2.0 (2017-03) §9.4 – FAST TRANSIENTS, COMMON MODE

Test System Setup



Test Level

Open Circuit Output Test Voltage $\pm 10\%$		
Level	On Power Supply Lines	On I/O (Input/Output) Signal data and control lines
1	0.5 kV	0.25 kV
2	1 kV	0.5 kV
3	2 kV	1 kV
4	4 kV	2 kV
X	Special	Special

Test Level 2 for AC power supply lines at 1 Kv
 Test Level 1 for DC power supply lines at 0.5 kV
 Test Level 2 for signal data and control lines at 0.5 kV

Performance Criterion: B

Test Procedure

The EUT was arranged for Power Line Coupling and for I/O Line Coupling through a capacitive clamp, where applicable. (Note: The I/O coupling test using a capacitive clamp is performed on the I/O interface cables that are longer in length than 3 meters.) A metal ground plane 2.4 meter by 2.0 meter was placed between the floor and the table and is connected to the earth by a 2.0 meter ground rod. The ground rod is connected to the test facility's electrical earth.

Please refer to following tables:

Note:

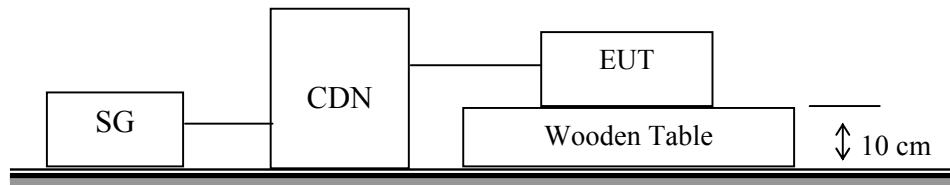
Test Points		Test Levels (kV)							
		+0.5	-0.5	+1.0	-1.0	+2.0	-2.0	+4.0	-4.0
AC mains power input ports	L	A	A	A	A	/	/	/	/
	N	A	A	A	A	/	/	/	/
	Earth	/	/	/	/	/	/	/	/
	L+N	A	A	A	A	/	/	/	/
	L + Earth	/	/	/	/	/	/	/	/
	N + Earth	/	/	/	/	/	/	/	/
	L+N+Earth	/	/	/	/	/	/	/	/
Signal ports	RJ45	A	A	/	/	/	/	/	/

Signal Port Test Setup Photo



ETSI EN 301 489-1 V2.2.0 (2017-03) §9.5 – RADIO FREQUENCY, COMMON MODE

Test Setup



Test Level

Level	Voltage Level (r.m.s.) (U_0)
1	1
2	3
3	10
X	Special

Test level 2 at 3 V (r.m.s.)

Performance Criterion: A

Test Procedure

- 1) Let the EUT work in test mode and test it.
- 2) The EUT are placed on an insulating support 0.1 m high above a ground reference plane. CDN (coupling and decoupling device) is placed on the ground plane about 0.3 m from EUT. Cables between CDN and EUT are as short as possible, and their height above the ground reference plane shall be between 30 and 50 mm (where possible).
- 3) The disturbance signal described below is injected to EUT through CDN.
- 4) The EUT operates within its operational mode(s) under intended climatic conditions after power on.
- 5) The frequency range is swept from 150 kHz to 80 MHz using 3V signal level, and with the disturbance signal 80% amplitude modulated with a 1 kHz sine wave.
- 6) Where the frequency is swept incrementally, the step size shall not exceed 1 % of the preceding frequency value. The dwell time of the amplitude modulated carrier at each frequency shall not be less than the time necessary for the EUT to be exercised and to respond, but shall in no case be less than 0.5 s.
- 7) Recording the EUT operating situation during compliance testing and decide the EUT immunity criterion.

Test Data

Please refer to following tables:

Test Mode: Operating

Note:

Table 1: AC mains power input port

Frequency range: 150 kHz to 80 MHz
☒ Modulated: Amplitude 80%, 1kHz sine wave ☐ Unmodulated ☐ Other:
 Severity Level: 3 V Un modulated, r.m.s

Level	Voltage Level (e.m.f.) U_0	Pass	Fail
1	1	/	/
2	3	A	/
3	10	/	/
X	Special	/	/

Table 2: Signal Port : RJ45

Frequency range: 150 kHz to 80 MHz
☒ Modulated: Amplitude 80%, 1kHz sine wave ☐ Unmodulated ☐ Other:
 Severity Level: 3 V Un modulated, r.m.s

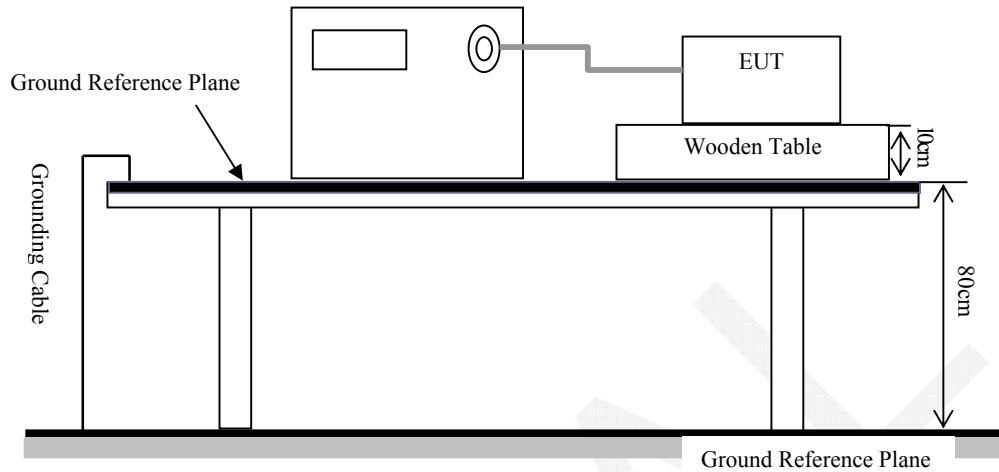
Level	Voltage Level (e.m.f.) U_0	Pass	Fail
1	1	/	/
2	3	A	/
3	10	/	/
X	Special	/	/

AC Port Test Setup Photo



Signal Port Test Setup Photo



ETSI EN 301 489-1 V2.2.0 (2017-03) §9.7 – VOLTAGE DIPS AND SHORT INTERRUPTIONS**Test Setup****Test Level and Performance Criterion**

Test Level	Voltage dip and short interruptions (%) Residual	Duration (in period)	Performance criterion
1	0	0.5	B
2	0	1	B
3	70	25	B
4	0	250	C

Test Procedure

- 1) The interruption is introduced at selected phase angles with specified duration.
- 2) Record any degradation of performance.

Test Data

Please refer to following tables:

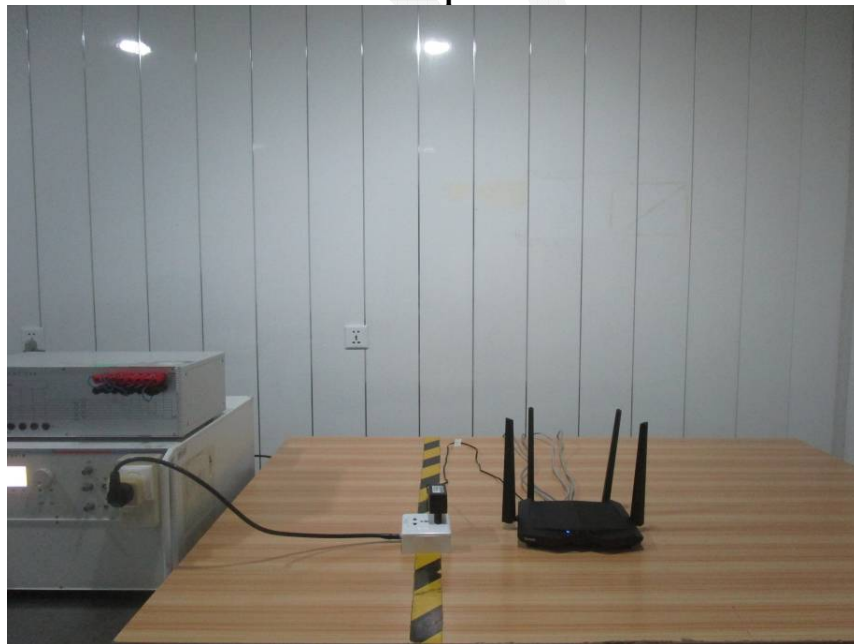
Test Mode: Operating

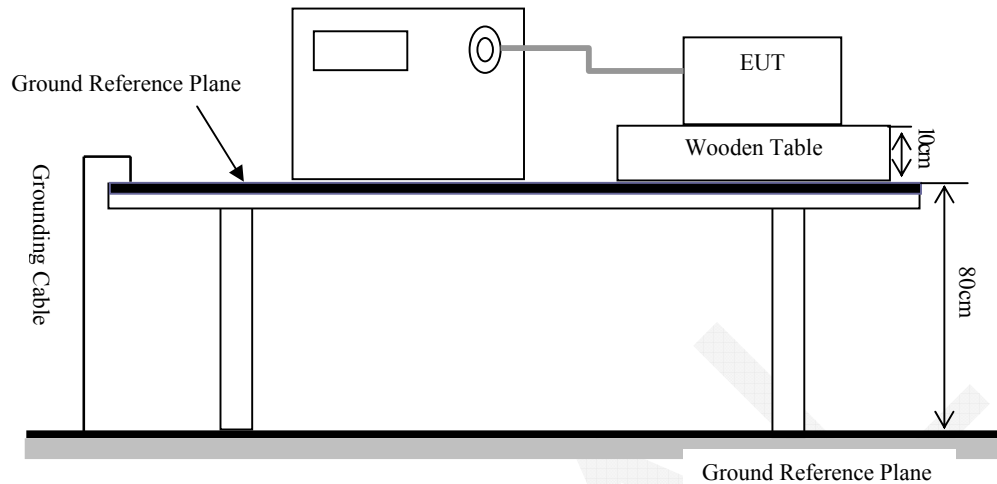
Note:

Table 1: Voltage Dips/Interruptions Test

Level	U2 (% Reduction)	Td (Periods)	Phase Angle	N	Result
1	100	0.5P	0/90/180/270	3	A
2	100	1P	0/90/180/270	3	A
3	30	25P	0/90/180/270	3	A
4	100	250P	0/90/180/270	3	B

Test Setup Photo



ETSI EN 301 489-1 V2.2.0 (2017-03) §9.8 – SURGES**Test System Setup****Test Level**

Level	Open Circuit Output Test Voltage $\pm 10\%$
1	0.5 kV
2	1 kV
3	2 kV
4	4 kV
X	Special

AC Mains: L-N: Test level 2 at 1 kV

Performance Criterion: B**Test Procedure**

- 1) For line to line coupling mode, provide a 0.5 kV 1.2/50us voltage surge (at open-circuit condition).
- 2) At least 5 positive and 5 negative (polarity) tests with a maximum 1/min repetition rate are conducted during test.
- 3) Different phase angles are done individually.
- 4) Record the EUT operating situation during compliance test and decide the EUT immunity criterion for above each test.

Test Data

Please refer to following tables:

Test Mode: Operating

Note:

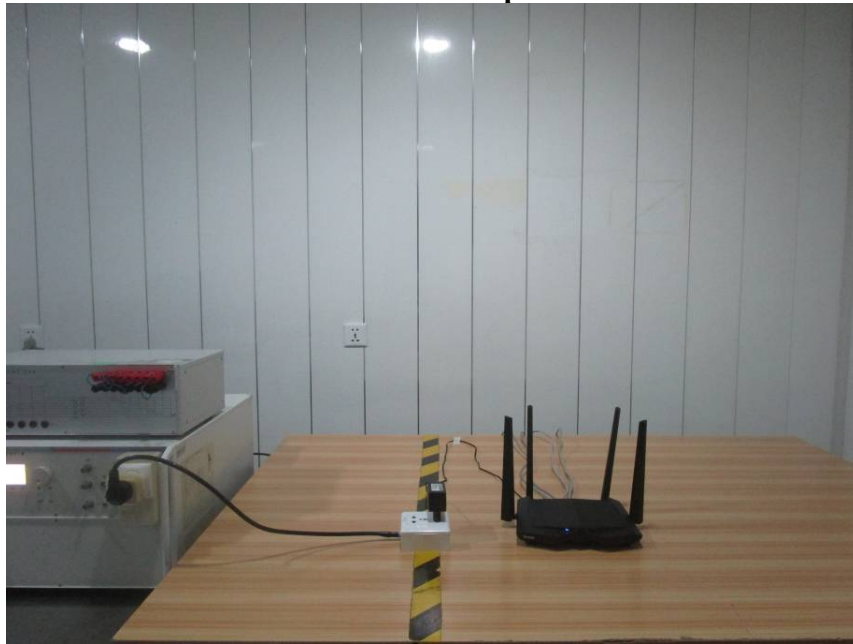
Table 1: AC mains power input port

Level	Voltage	Poll	Path	Pass	Fail
1	0.5kV	±	Line-Line	A	/
2	1kV	±	Line-Line	A	/
3	2kV	±	/	/	/
4	4kV	±	/	/	/

Table 2: RJ45 I/O Circuit and Lines

Level	Voltage	Poll	Path	Pass	Fail
1	0.5kV	±	Line-Ground	A	/
2	1kV	±	Line-Ground	A	/
3	2kV	±	/	/	/

AC Port Test Setup Photo



Signal Port Test Setup Photo

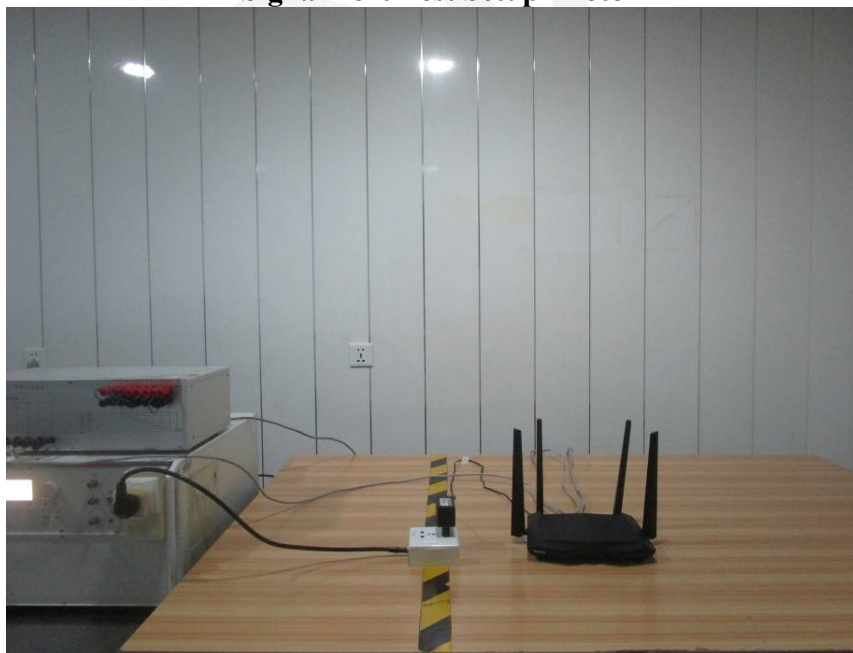
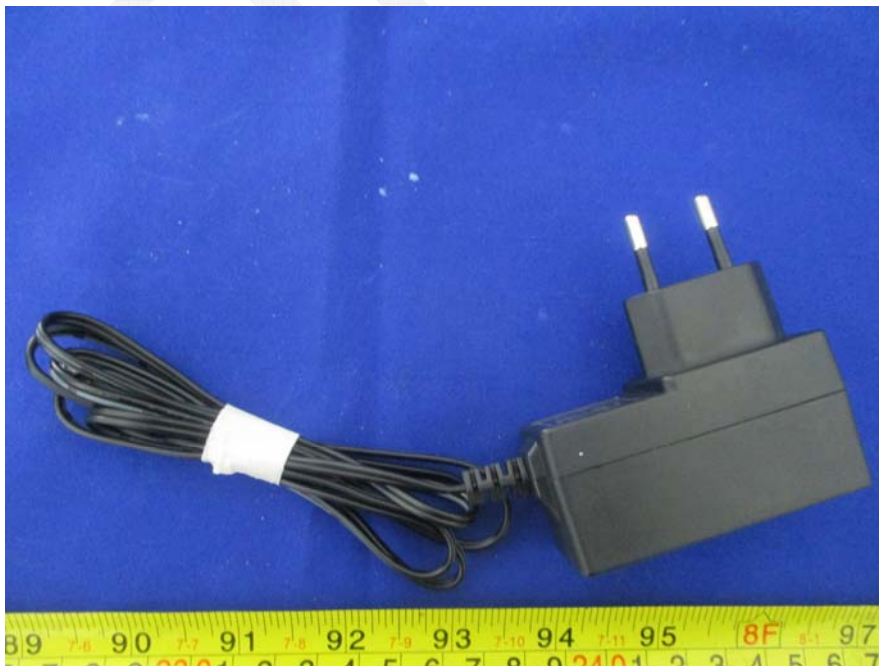


EXHIBIT A – EUT PHOTOGRAPHS

EUT – All View



EUT – Adapter Top View



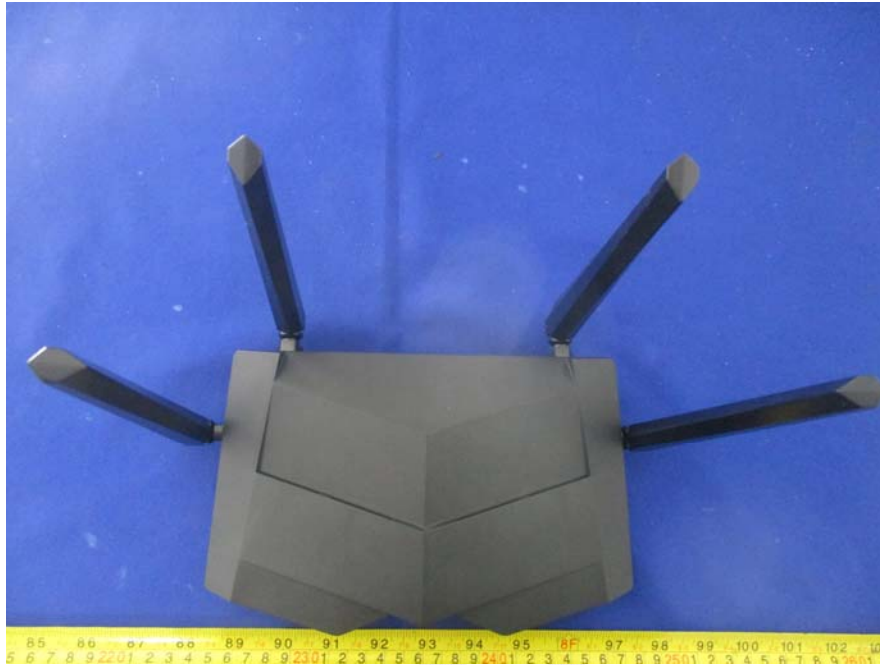
EUT – Adapter Bottom View



EUT – Adapter Label View



EUT – Top View



EUT – Bottom View



EUT – Port View



EUT – ANT View



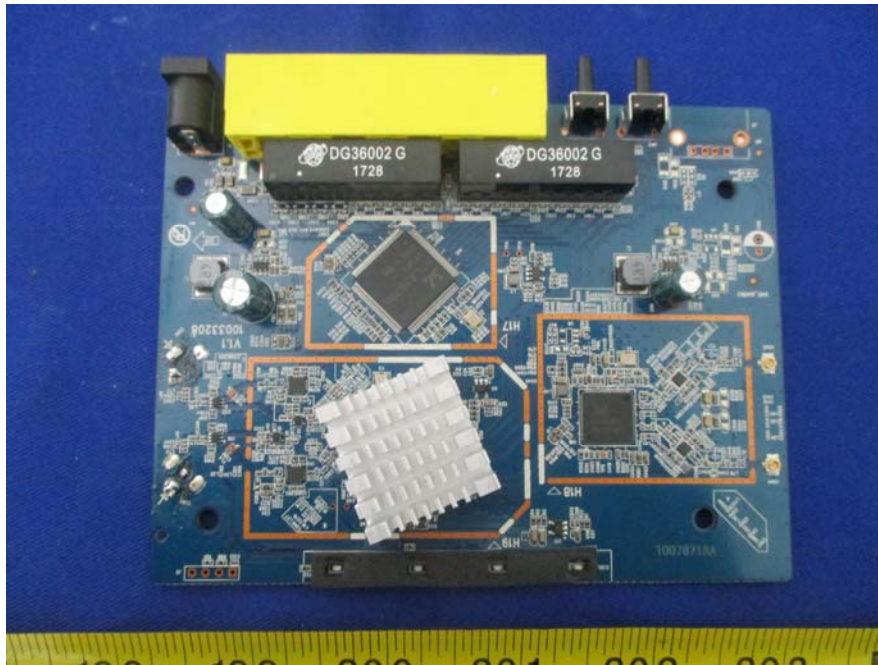
EUT – Uncover View



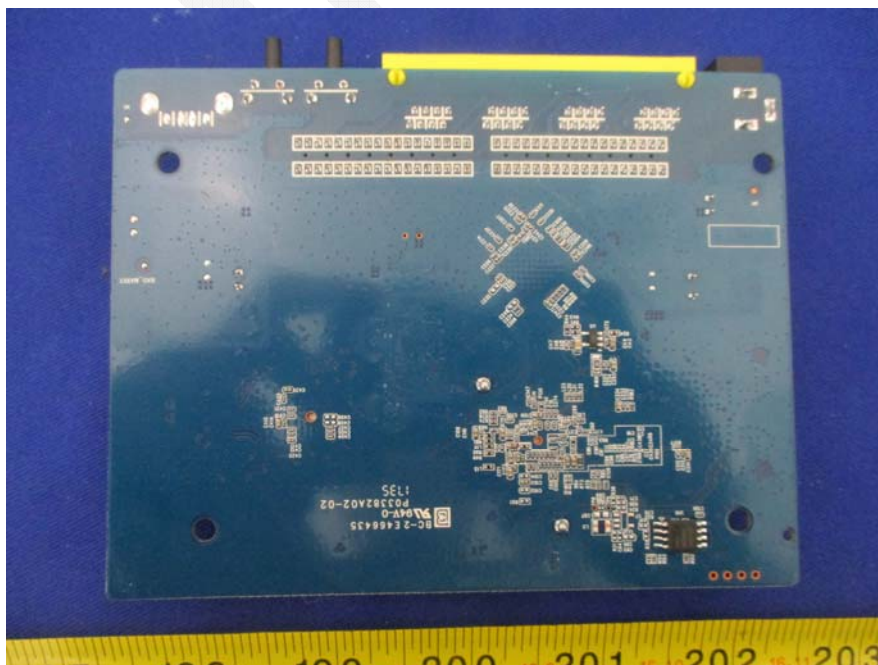
EUT – Uncover View



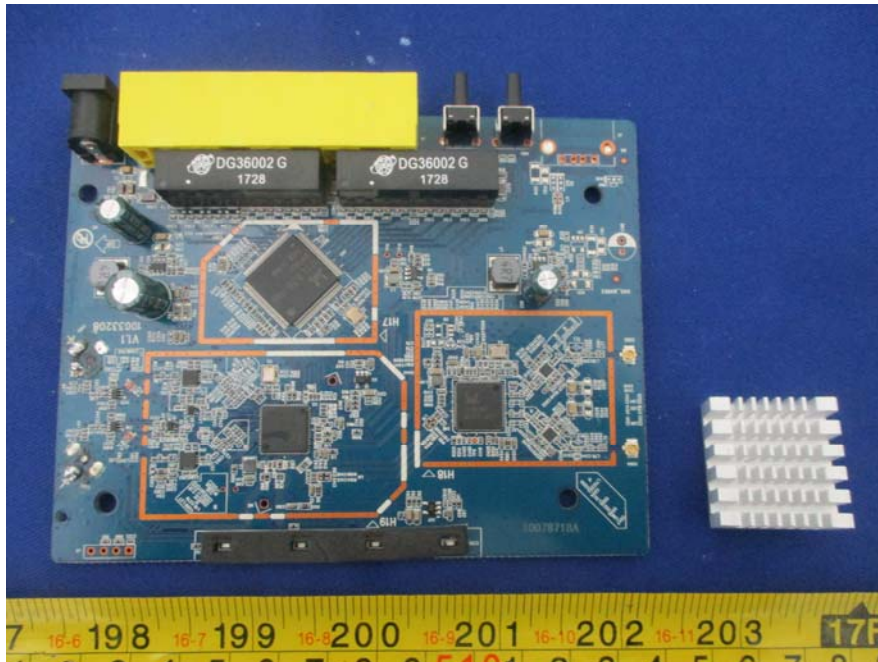
EUT – PCB Top View



EUT – PCB Bottom View



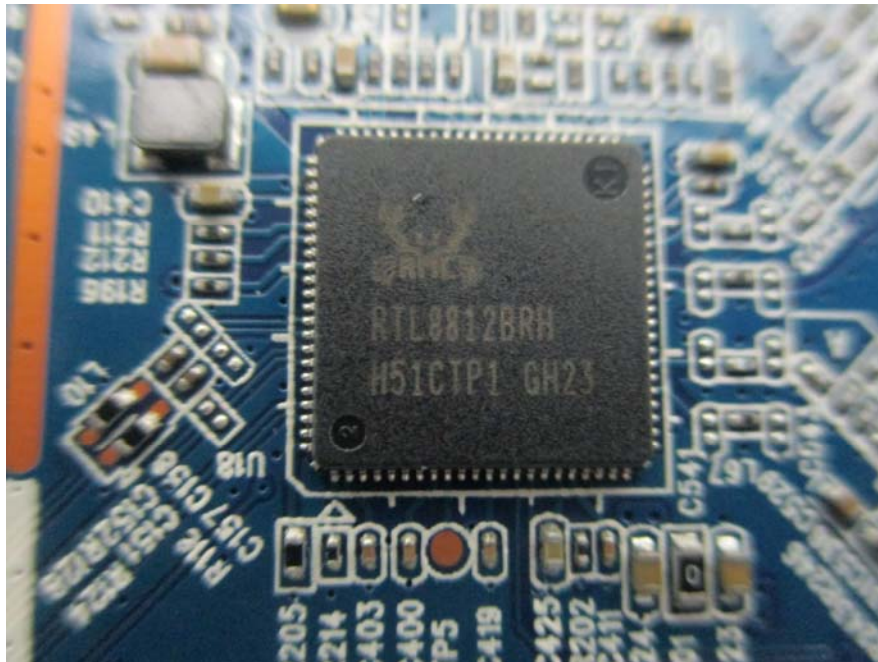
EUT – Uncover View



EUT – Main Chip View



EUT – 5G Chip View



EUT – 2.4G Chip View

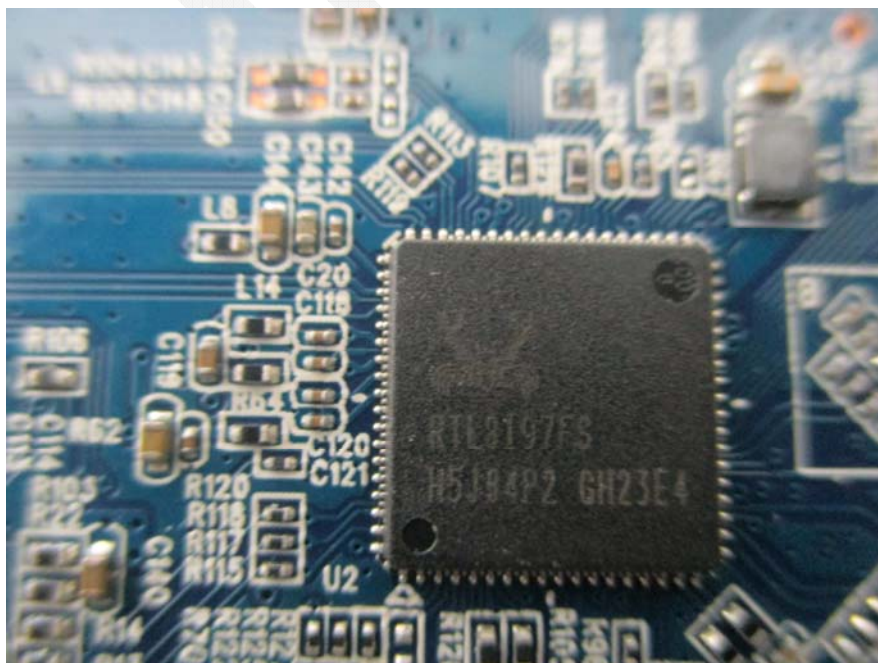


EXHIBIT B – TEST SETUP PHOTOGRAPHS

CE Front View



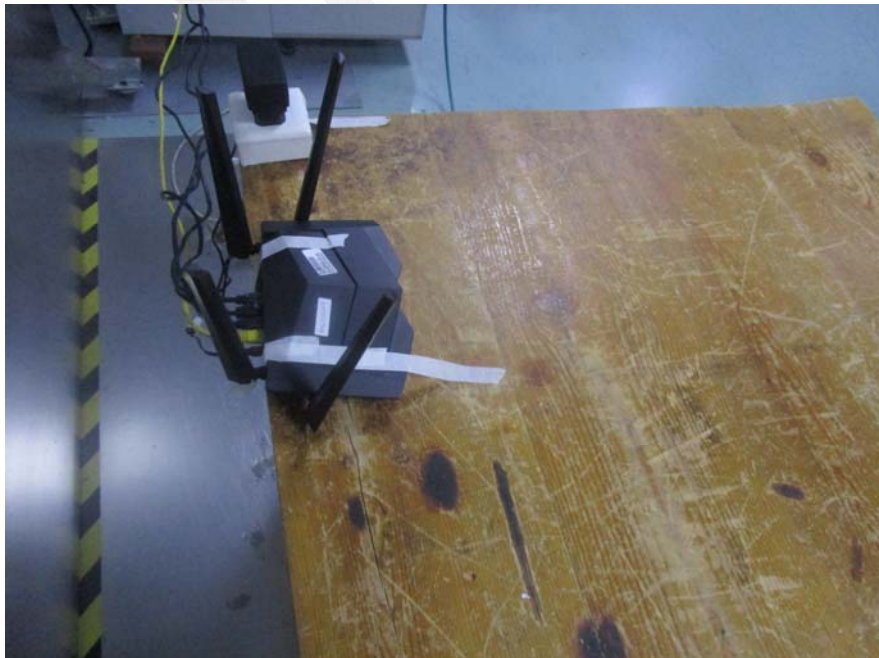
CE Side View



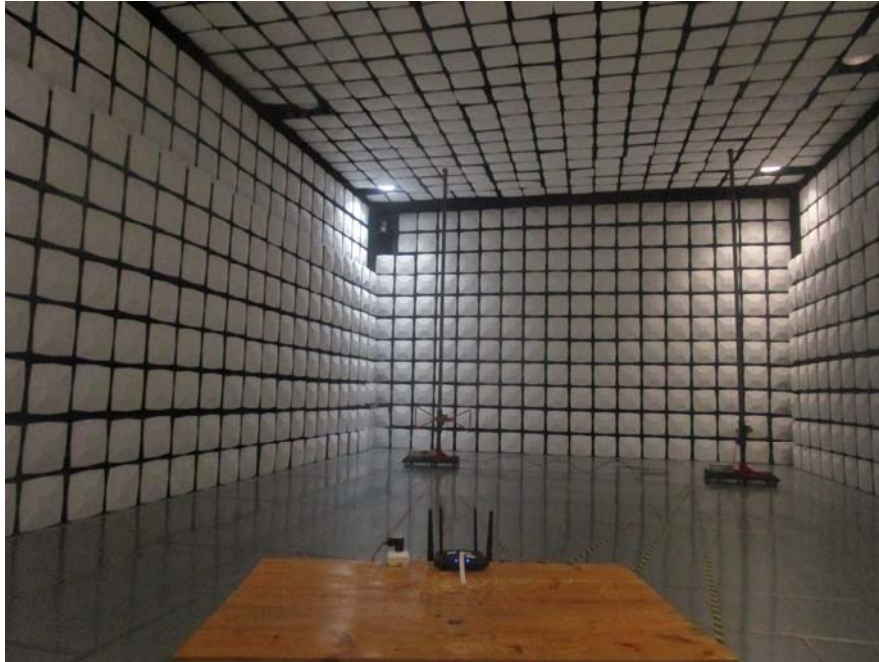
CE ISN Front View



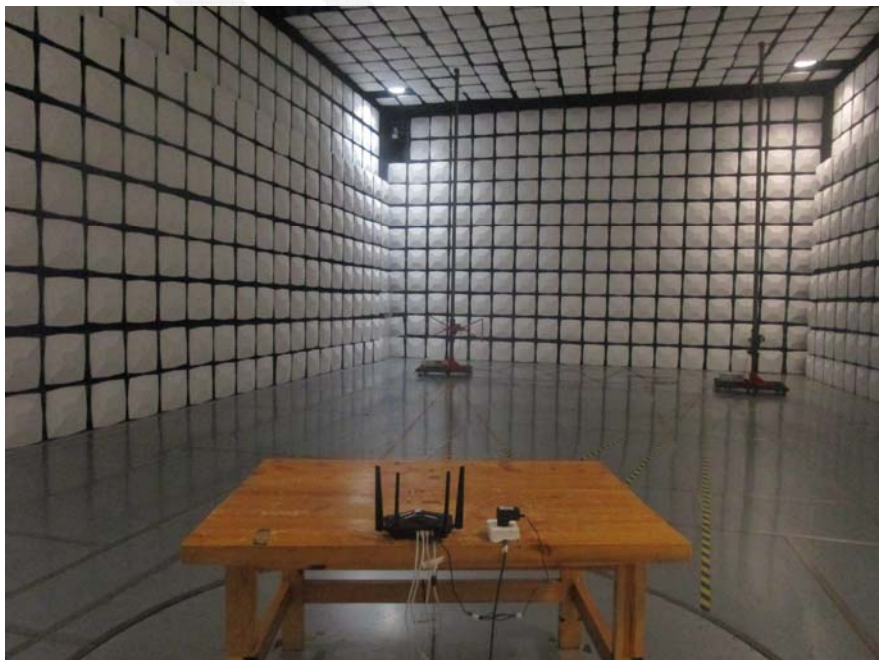
CE ISN Side View



RE Below 1GHz Front View



RE Below 1GHz Rear View



RE Above 1GHz Front View



RE Above 1GHz Rear View



*****END OF REPORT*****