CE EMC Test Report

Equipment	:	**802.11 abgn 1x with BT**
Model No.	:	**SDC-MSD40NBT**
Brand Name	:	**Laird Technologies**
Applicant	:	**Laird Technologies**
Address	:	**W66N220 Commerce Court, Cedarburg, Wisconsin 53012, USA**
Standard	:	**Draft EN 301 489-1 V2.2.0 (2017-03)** **Draft EN 301 489-17 V3.2.0 (2017-03)**
Received Date	:	**Apr. 06, 2017**
Tested Date	:	**Jul. 08 ~ Aug. 19, 2013 (for original test)** **Apr. 20 ~ Apr. 24, 2017 (for new test)**

We, International Certification Corp., would like to declare that the tested sample has been evaluated and in compliance with the requirement of the above standards. It may be duplicated completely for legal use with the approval of the applicant. It shall not be reproduced except in full without the written approval of our laboratory.

Reviewed by:

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Kent Chen / Assistant Manager

Testing Laboratory 2732

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Release Record

Report No.	Version	Description	Issued Date
EH442902-02	Rev. 01	Initial issue	May 10, 2017

Summary of Test Results

Draft EN 301 489-1 Emission Tests				
Ref. Std. Clause	**Test Standard**	**Test Items**	**Measured**	**Result**
8.3/8.4	EN 55032:2015/AC:2016, Class B	Conducted Emissions from the AC mains power ports	-14.16dB AV@ 2.249MHz.	Pass
8.7	EN 55032:2015/AC:2016, Class B	Asymmetric Mode Conducted Emissions	Note[1]	N/A
8.2	EN 55032:2015/AC:2016, Class B	Radiated Emissions	Note[2]	N/A
8.5	EN 61000-3-2:2014, Class A	Harmonic Current Emissions	Note[3]	N/A
8.6	EN 61000-3-3:2013	Voltage Fluctuations and Flicker	Note[3]	N/A

N/A means Not Applicable.
Note[1]: The EUT w/o telecom port.
Note[2]: According to Clause 7.1 of Draft EN 301 489-1, the test is not required.
Note[3]: The EUT consumes DC power, so the test is not required.

Draft EN 301 489-1 Immunity Tests					
Ref. Std. Clause	**Test Standard**	**Description of Test**		**Pass Criterion**	**Result**
9.3	EN 61000-4-2:2009	Electrostatic Discharge (ESD)		B	Pass
9.2	EN 61000-4-3:2006/A1:2008/ A2:2010	Radio Frequency Electromagnetic Field (RS)		A	Pass
9.4	EN 61000-4-4:2012	Electrical Fast Transient/Burst (EFT)		Note[1]	N/A
9.8	EN 61000-4-5:2014	Surge		Note[2]	N/A
9.5	EN 61000-4-6:2014	Conducted Disturbances (CS)		Note[1]	N/A
9.7	EN 61000-4-11:2004	Voltage Dips	0% residual for 0.5 cycle	Note[2]	N/A
			0% residual for 1 cycle	Note[2]	N/A
			70% residual for 25 cycle	Note[2]	N/A
		Voltage Interruption	0% residual for 250 cycle (w/o battery back-up)	Note[2]	N/A

N/A means Not Applicable.
Note[1]: The EUT consumes DC power, and it is not intended to be used with cables longer than 3m. So this test is not carried out.
Note[2]: The EUT consumes DC power, so the test is not required.

1 General Description

1.1 Information

This report is issued as a supplementary report to original ICC report no. 362808. The difference is concerned with following items:

- ✧ Updating standard to latest version.
- ✧ Removed of Monopole antenna
- ✧ Updating brand name, product name and address.

In this report, test items of conducted emission & RS had been re-tested and presented in the following sections. Other test results are conforming to the new version of the standard since the test methods complying with new version standard requirements. No impact original test results.

1.1.1 Specification of the Equipment under Test (EUT)

WLAN	
Operating Frequency	802.11b/g/n: 2412 MHz ~ 2472 MHz 802.11a/n: 5180 MHz ~ 5240 MHz; 5260 MHz ~ 5320 MHz; 5500 MHz ~ 5700 MHz
Modulaton Type	802.11b: DSSS (DBPSK / DQPSK / CCK) 802.11a/g/n: OFDM (BPSK / QPSK / 16QAM / 64QAM)
BT	
Operating Frequency	2402 MHz ~ 2480 MHz
Modulaton Type	Bluetooth 4.0 LE: GFSK Bluetooth BR(1Mbps): GFSK Bluetooth EDR (2Mbps): π/4-DQPSK Bluetooth EDR (3Mbps): 8-DPSK

1.1.2 Antenna Details

WLAN

Ant. No.	**Model**	**Type**	**Connector**	**Operating Frequencies (MHz) / Antenna Gain (dBi)**			
				2400~2483.5	**5150~5250**	**5250~5350**	**5470~5725**
1	Cisco AIR-ANT 4941	Dipole	RP-TNC plug	2	---	---	---
2	Radiall Larsen R380.500.314	Dipole	RP-TNC plug	1.6	5		

BT

Ant. No.	**Model**	**Type**	**Connector**	**Operating Frequencies (MHz) / Antenna Gain (dBi)**
1	Cisco AIR-ANT 4941	Dipole	RP-TNC plug	2dBi
2	Radiall Larsen R380.500.314	Dipole	RP-TNC plug	1.6dBi

1.1.3 Power Supply Type of the Equipment under Test (EUT)

Power Supply Type	3.3Vdc from host

1.1.4 Accessories

N/A

1.2 Test Equipment and Calibration Data

Test Item	Conducted Emission				
Test Site	Conduction room 1 / (CO01-WS)				
Tested Date	Apr. 20, 2017				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Receiver	R&S	ESR3	101657	Dec. 21, 2016	Dec. 20, 2017
LISN	SCHWARZBECK	Schwarzbeck 8127	8127-667	Nov. 08, 2016	Nov. 07, 2017
RF Cable-CON	EMC	EMCCFD300-BM-BM-6000	50821	Dec. 20, 2016	Dec. 19, 2017
Measurement Software	AUDIX	e3	6.120210k	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

Test Item	ESD				
Test Site	ESD room 1 / (ES01-WS)				
Tested Date	Jul. 08 ~ Aug. 19, 2013				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
ESD Generator	SCHAFFNER	NSG435	005537	Apr. 02, 2013	Apr. 01, 2014
Note: Calibration Interval of instruments listed above is one year.					

Test Item	Radiated Immunity (80 MHz - 6 GHz)				
Test Site	RS room 1 / (RS01-WS)				
Tested Date	Apr. 24, 2017				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Signal Generator	R & S	SMB100A	103924HA	Oct. 19, 2016	Oct. 18, 2017
Power Sensor	R & S	NRP-Z91	101094-UL	Oct. 14, 2016	Oct. 13, 2017
Power Sensor	R & S	NRP-Z91	101095-KY	Oct. 14, 2016	Oct. 13, 2017
Power Amplifier	BONN	BLWA 0810-160/100D	107972A	N/A	N/A
Power Amplifier	BONN	BLMA 1060-100D	107972B	N/A	N/A
Antenna	SCHWARZBECK MESS-ELEKTRONIK	STLP 9149	9149-073	N/A	N/A
Antenna	R & S	HL046E	100076-Cd	N/A	N/A
UPV AUDIO ANALYZER	R & S	UPV	103144	Jan. 16, 2017	Jan. 15, 2018
Note: Calibration Interval of instruments listed above is one year.					

1.3 Testing Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

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

1.4 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)

Measurement Uncertainty		
Test Item	**Frequency**	**Uncertainty**
Conducted Emissions from the AC mains power ports	150kHz ~ 30MHz	±2.90 dB

2 Test Configuration

2.1 Testing Condition

Test Item	Test Site	Ambient Condition	Tested By
Conducted Emissions from the AC mains power ports	CO01-WS	20°C/57%	Alex Tsai
ESD	ES01-WS	22°C/50%/ 97kPa	JN Chen
RS	RS01-WS	24°C/58%/100kPa	JN Chen

2.2 The Worst Case Measurement Configuration

The Determined Worst Case Configurations	
Conducted Emissions from the AC mains power ports	
Test Mode	**Operating Description**
1	Ant. 1, BT link, 230V/50Hz
2	Ant. 2, BT link, 110V/60Hz
3	Ant. 1, WIFI 2.4G link, 230V/50Hz
4	Ant. 2, WIFI 5G link, 110V/60Hz
ESD Tests	
Test Mode	**Operating Description**
1	Ant. 1, WIFI 2.4G link
2	Ant. 1, BT link
3	Ant. 2, WIFI 5G link
4	Ant. 2, BT link
RS Tests	
1	Ant. 1, BT link
2	Ant. 2, BT link
3	Ant. 1, WIFI 2.4G link
4	Ant. 2, WIFI 5G link

2.3 Local Support Equipment List

For ESD Test (WLAN Mode)

Support Equipment List					
No.	**Equipment**	**Brand**	**Model**	**S/N**	**Signal cable / Length (m)**
1	PDA	HP	IPAQ (HSTNH-L05C-BT)	---	---
2	Notebook	DELL	Latitude E5430	6R4RWW1	RJ45, 3m non-shielded w/o core
3	AP	D-LINK	DIR-815	3000226	---

Note: No.1 was provided by client.

For ESD Test (BT Mode)

Support Equipment List					
No.	**Equipment**	**Brand**	**Model**	**S/N**	**Signal cable / Length (m)**
1	PC	DELL	Precision T1650	GDH75W1	RS232, 2.8m shielded w/o core
2	Keyboard	DELL	KB4021	315-0047	USB, 1.8m shielded w/o core
3	Mouse	DELL	MS111-L	2C3-00NB	USB, 1.8m shielded w/o core
4	Monitor	DELL	U2410f	A5WL	VGA, 1.8m shielded w/o core
5	Notebook	DELL	Latitude E5430	6R4RWW1	---
6	Fixture	---	---	---	---
7	Adapter for fixture	OEM	ADS0128-W 120100	---	DC, 1.8m shielded w/o core.

Note: No.6~7 were provided by client.

For Conducted emission & RS Test (BT Mode)

Support Equipment List					
No.	**Equipment**	**Brand**	**Model**	**S/N**	**Signal cable / Length (m)**
1	Notebook	DELL	Latitude E5430	6R4RWW1	RS232, 2.8m shielded w/o core
2	Spectrum Analyzer	R&S	FSV40	101499	---
3	Fixture	---	---	---	---
4	Adapter for fixture	OEM	ADS0128-W 120100	---	DC, 1.8m shielded w/o core.

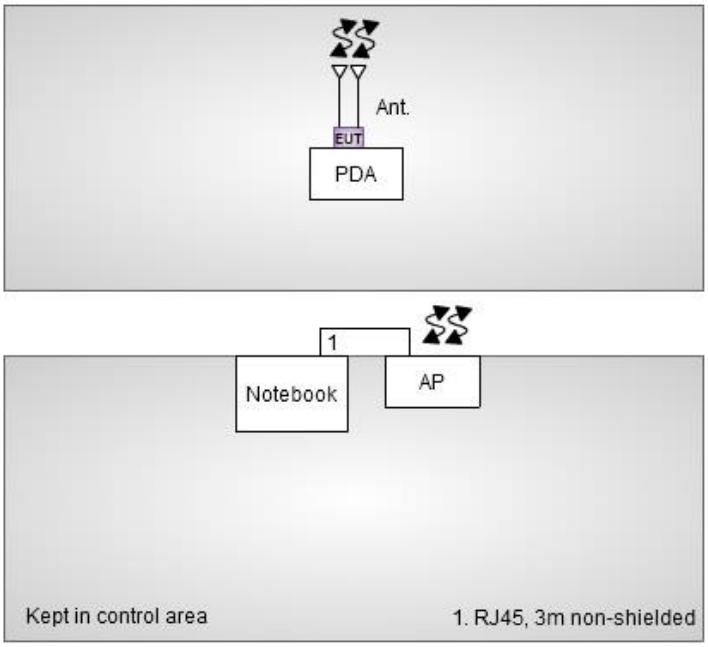
Note: No.6~7 were provided by client.

For Conducted emission & RS Test (WLAN Mode)

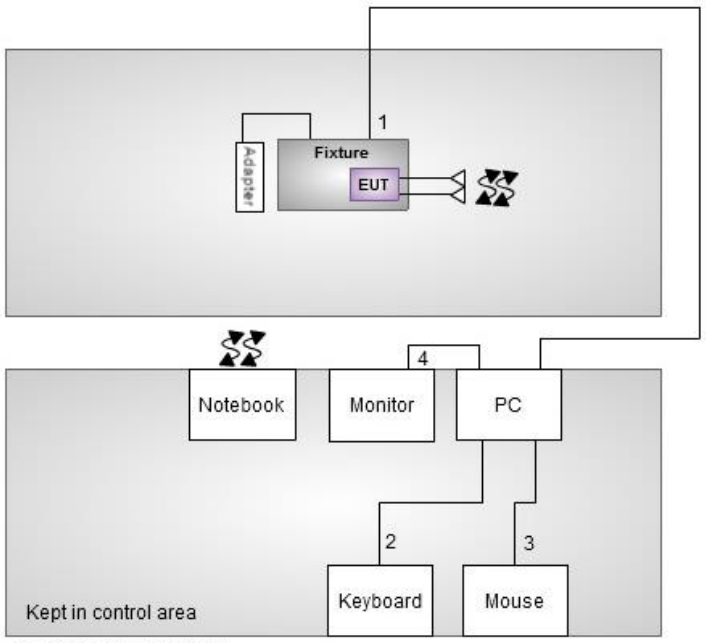
Support Equipment List					
No.	**Equipment**	**Brand**	**Model**	**S/N**	**Signal cable / Length (m)**
1	Notebook 01	DELL	Latitude E5430	6R4RWW1	RS232, 2.8m shielded w/o core.
2	Notebook 02	DELL	Latitude E5430	264RWW1	RJ45, 1m non-shielded w/o core
3	AP	D-LINK	DIR-818LW	2000849	---
4	Fixture	---	---	---	---
5	Adapter for fixture	OEM	ADS0128-W 120100	---	DC, 1.8m shielded w/o core.

2.4 Test Setup Chart

For ESD Test

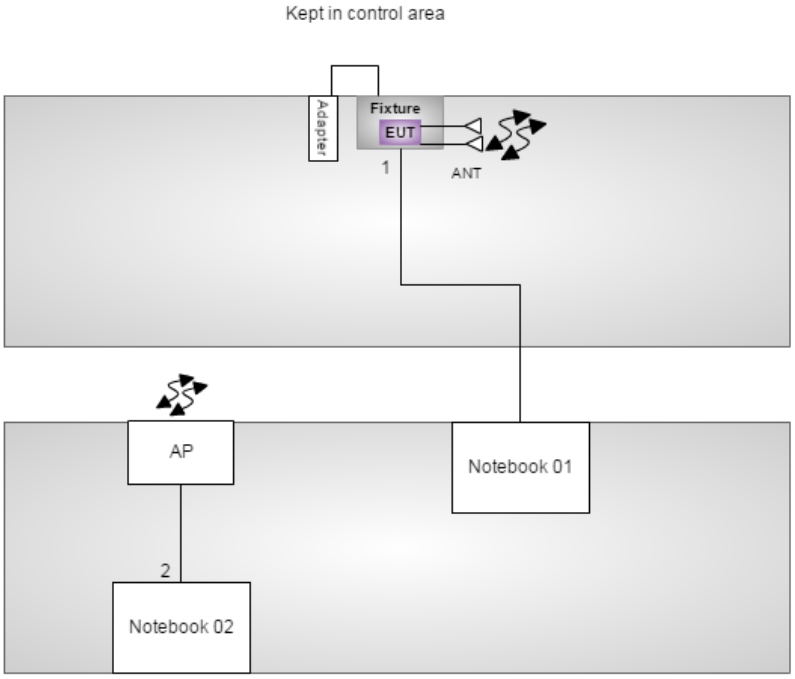
Test Setup Diagram (WLAN Mode)


For ESD Test

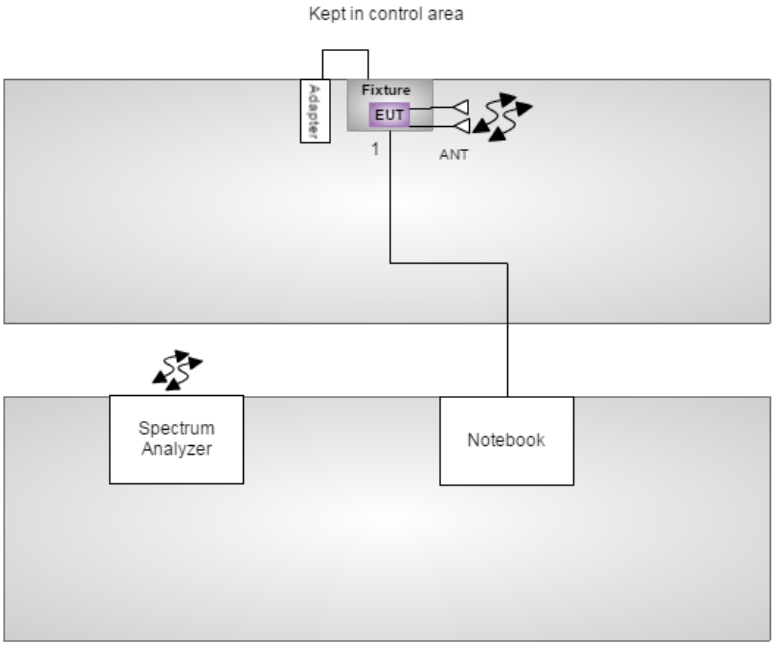
Test Setup Diagram (BT Mode)


1.RS232, 2.8m shielded
2.USB, 1.8m shielded
3.USB, 1.8m shielded
4.VGA, 1.8m shielded

For Conducted emission & RS Test

Test Setup Diagram (WLAN Mode)
 1. RS232, 2.8m shielded. 2. RJ45, 1m non-shielded.

For Conducted emission & RS Test

Test Setup Diagram (BT Mode)
 1. RS232, 2.8m shielded.

2.5 Test Software and Operating Condition

For ESD Test

<WLAN>

a. The EUT with fixture equipment connected to PDA.
b. The PDA executed “SCU” program to enable WiFi function of EUT.
c. The EUT linked with AP via WiFi.
d. The support notebook connected to AP via RJ45 cable.
e. The support notebook executed ping command to link with EUT to transmit data via AP.

<BT>

a. The EUT with fixture equipment connected to support PC via RS232 cable.
b. Enabled BT function of EUT.
c. The EUT linked with support notebook by BT.
d. The support PC executed “Teraterm” program to observe BT link value (RSSI Return Value) between the EUT and support notebook.

For Conducted emission & RS Test

<WLAN>

a. To enable all function of test system.
b. The support notebook 01 connected with EUT and executed “Teraterm” program to enable WiFi function of EUT.
c. The support notebook 02 communicated with EUT via support AP by using ping command over Wireless LAN network.

<BT>

a. To enable all function of test system.
b. The support notebook executed “Broadcom Blue tool” program to set EUT to transmit BT signal continuously.
c. Observed BT TX signal by spectrum.

3 Emission Test Results

3.1 Conducted Emissions from the AC mains power ports

3.1.1 Limits of Conducted Emissions from the AC mains power ports

Frequency range (MHz)	Limits values (dBµV)			
	Class A		Class B	
	Quasi-peak	Average	Quasi-peak	Average
0.15 to 0,50	79	66	66 to 56 *	56 to 46 *
0,50 to 5	73	60	56	46
5 to 30	73	60	60	50

Note 1: "*" Decreasing linearly with the logarithm of the frequency.
Note 2: If the limits for the average detector are met when using the quasi-peak detector, then the limits for the measurements with the average detector are considered to be met.
Note 3: The higher value measured with and without the outer conductor screen of the antenna terminal connected to earth is considered.

3.1.2 Test Procedures

a. The EUT was placed on a desk 0.8 meters height from the metal ground plane and 0.4 meter from the conducting wall of the shielding room and it was kept at least 0.8 meters from any other grounded conducting surface.

b. A thickness of ≤ 0.15m insulation should be placed between local AE and associated cabling and the RGP.

c. Connect EUT to the power mains through a line impedance stabilization network (LISN).

d. All the support units are connecting to the other LISN.

e. The LISN provides 50 ohm coupling impedance for the measuring instrument.

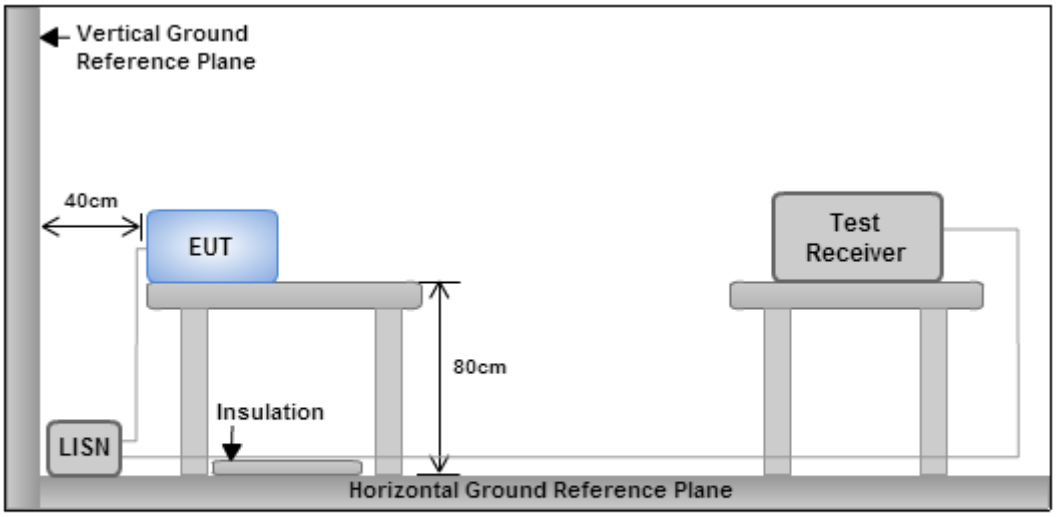
f. The CISPR states that a 50 ohm, 50 microhenry LISN should be used.

g. Both sides of AC line were checked for maximum conducted interference.

h. The frequency range from 150 kHz to 30 MHz was searched.

i. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

3.1.3 Test Setup

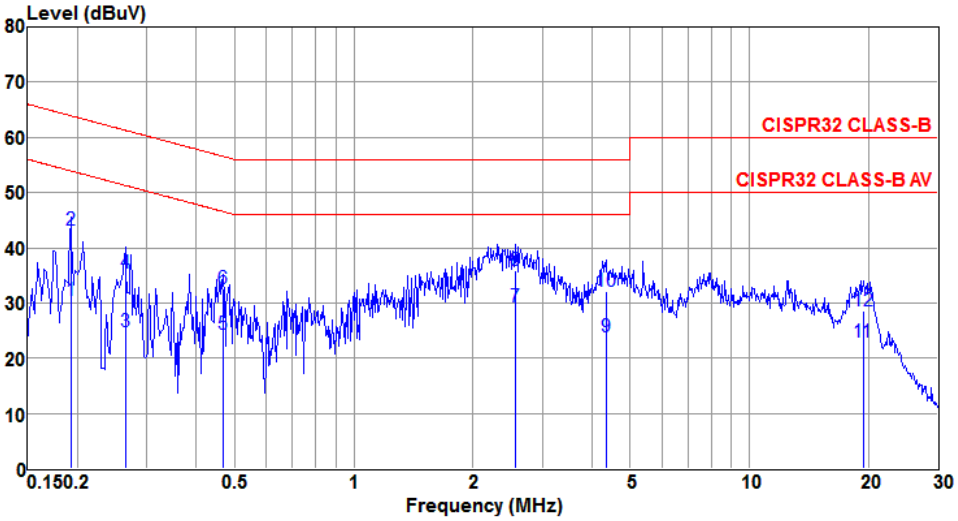


Note: 1. Support units were connected to second LISN.

2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

3.1.4 Test Result of Conducted Emissions from the AC mains power ports

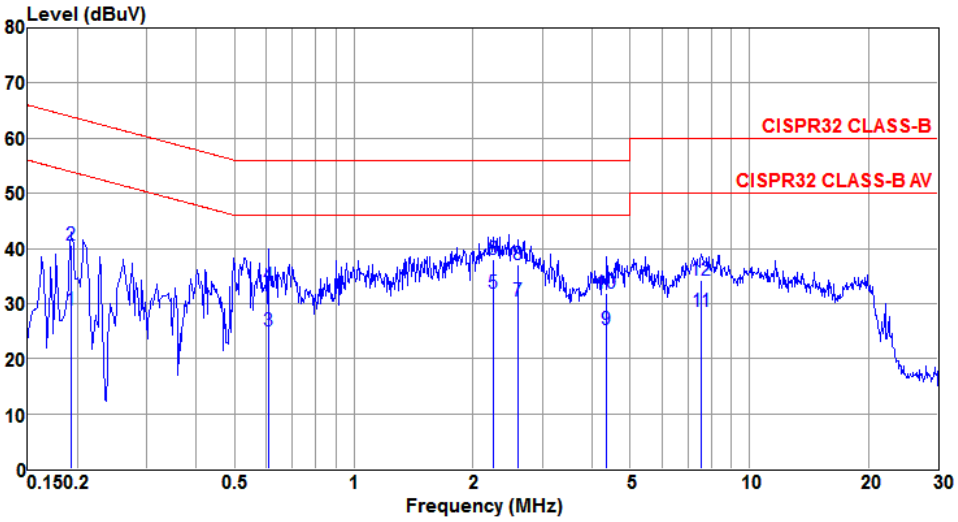
Power Phase	Line	Test Mode	1



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1	0.192	30.52	53.93	-23.41	30.38	0.10	0.04	Average
2	0.192	43.31	63.93	-20.62	43.17	0.10	0.04	QP
3	0.264	24.74	51.29	-26.55	24.62	0.08	0.04	Average
4	0.264	35.47	61.29	-25.82	35.35	0.08	0.04	QP
5	0.466	24.43	46.58	-22.15	24.33	0.06	0.04	Average
6	0.466	32.51	56.58	-24.07	32.41	0.06	0.04	QP
7@	2.554	29.26	46.00	-16.74	29.04	0.14	0.08	Average
8	2.554	35.83	56.00	-20.17	35.61	0.14	0.08	QP
9	4.338	23.86	46.00	-22.14	23.52	0.17	0.17	Average
10	4.338	32.19	56.00	-23.81	31.85	0.17	0.17	QP
11	19.428	22.99	50.00	-27.01	22.34	0.39	0.26	Average
12	19.428	28.55	60.00	-31.45	27.90	0.39	0.26	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).
2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

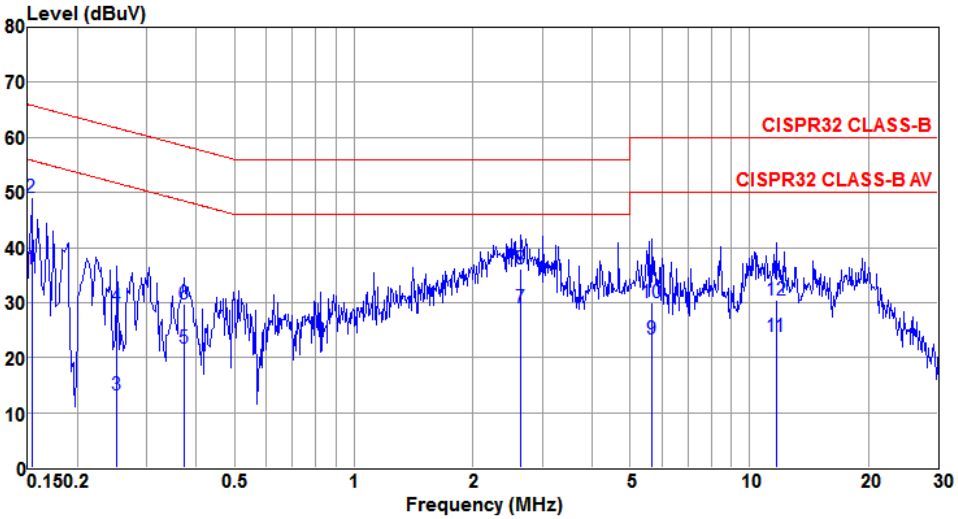
Power Phase	Neutral	Test Mode	1



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1	0.192	28.76	53.93	-25.17	28.63	0.09	0.04	Average
2	0.192	40.72	63.93	-23.21	40.59	0.09	0.04	QP
3	0.608	25.05	46.00	-20.95	24.90	0.11	0.04	Average
4	0.608	33.28	56.00	-22.72	33.13	0.11	0.04	QP
5@	2.249	31.84	46.00	-14.16	31.62	0.16	0.06	Average
6	2.249	37.91	56.00	-18.09	37.69	0.16	0.06	QP
7	2.608	30.55	46.00	-15.45	30.31	0.15	0.09	Average
8	2.608	36.96	56.00	-19.04	36.72	0.15	0.09	QP
9	4.361	25.22	46.00	-20.78	24.89	0.16	0.17	Average
10	4.361	31.76	56.00	-24.24	31.43	0.16	0.17	QP
11	7.566	28.64	50.00	-21.36	28.18	0.26	0.20	Average
12	7.566	34.27	60.00	-25.73	33.81	0.26	0.20	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).
2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

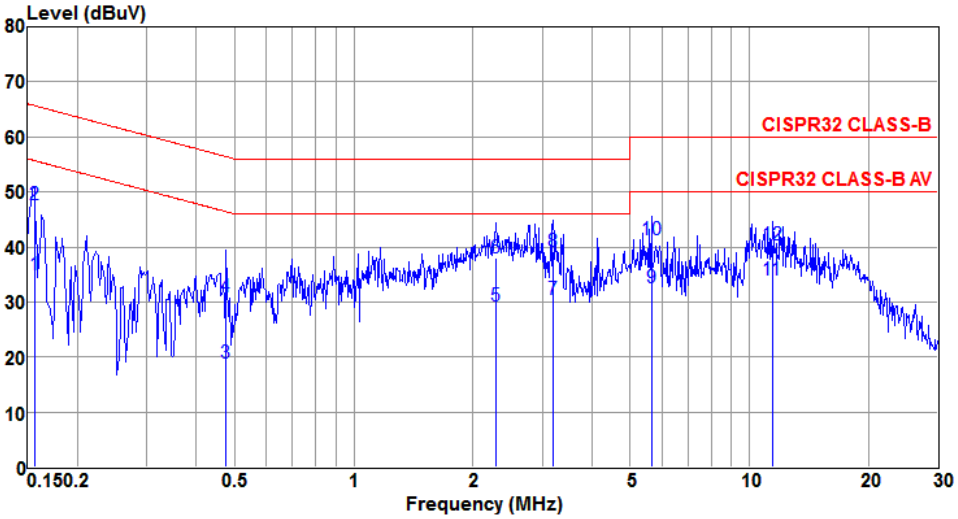
Power Phase	Line	Test Mode	2



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1	0.153	36.09	55.82	-19.73	35.98	0.07	0.04	Average
2@	0.153	49.18	65.82	-16.64	49.07	0.07	0.04	QP
3	0.252	13.29	51.69	-38.40	13.16	0.09	0.04	Average
4	0.252	29.36	61.69	-32.33	29.23	0.09	0.04	QP
5	0.371	21.80	48.47	-26.67	21.70	0.06	0.04	Average
6	0.371	29.68	58.47	-28.79	29.58	0.06	0.04	QP
7	2.650	29.07	46.00	-16.93	28.83	0.15	0.09	Average
8	2.650	36.11	56.00	-19.89	35.87	0.15	0.09	QP
9	5.683	23.46	50.00	-26.54	23.10	0.18	0.18	Average
10	5.683	29.93	60.00	-30.07	29.57	0.18	0.18	QP
11	11.683	23.94	50.00	-26.06	23.48	0.24	0.22	Average
12	11.683	30.46	60.00	-29.54	30.00	0.24	0.22	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).
2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

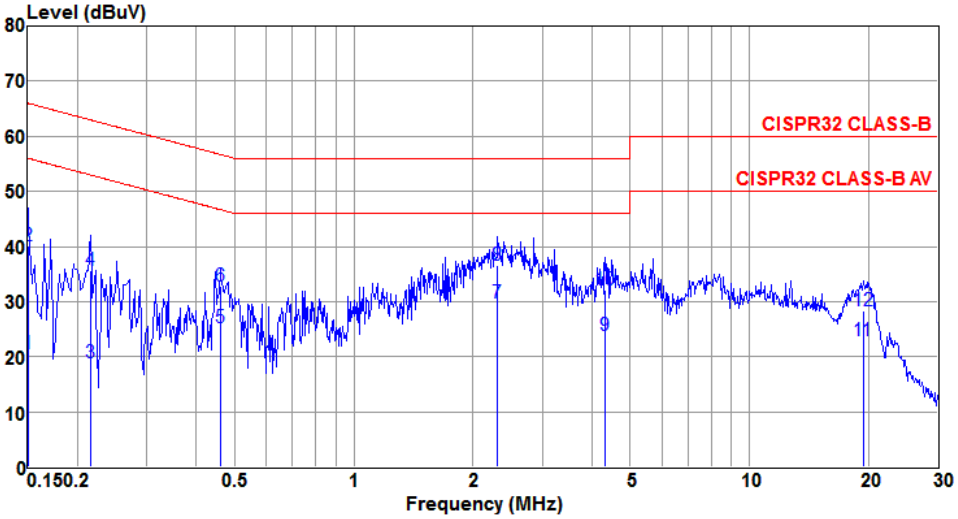
Power Phase	Neutral	Test Mode	2



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1	0.156	35.00	55.69	-20.69	34.86	0.10	0.04	Average
2	0.156	47.71	65.69	-17.98	47.57	0.10	0.04	QP
3	0.476	18.91	46.41	-27.50	18.75	0.12	0.04	Average
4	0.476	31.02	56.41	-25.39	30.86	0.12	0.04	QP
5	2.285	29.35	46.00	-16.65	29.13	0.16	0.06	Average
6	2.285	37.98	56.00	-18.02	37.76	0.16	0.06	QP
7@	3.190	30.55	46.00	-15.45	30.28	0.15	0.12	Average
8	3.190	39.15	56.00	-16.85	38.88	0.15	0.12	QP
9	5.653	32.64	50.00	-17.36	32.26	0.20	0.18	Average
10	5.653	41.21	60.00	-18.79	40.83	0.20	0.18	QP
11	11.438	33.97	50.00	-16.03	33.42	0.33	0.22	Average
12	11.438	40.38	60.00	-19.62	39.83	0.33	0.22	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).
2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

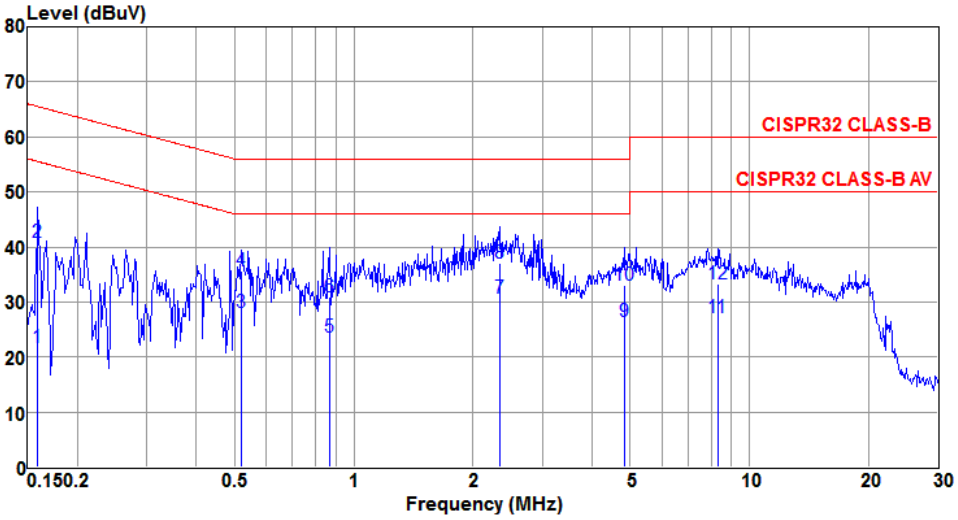
Power Phase	Line	Test Mode	3



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1	0.150	20.62	56.00	-35.38	20.51	0.07	0.04	Average
2	0.150	40.24	66.00	-25.76	40.13	0.07	0.04	QP
3	0.216	18.87	52.96	-34.09	18.73	0.10	0.04	Average
4	0.216	35.56	62.96	-27.40	35.42	0.10	0.04	QP
5	0.459	25.21	46.71	-21.50	25.11	0.06	0.04	Average
6	0.459	32.70	56.71	-24.01	32.60	0.06	0.04	QP
7@	2.309	29.68	46.00	-16.32	29.47	0.14	0.07	Average
8	2.309	36.67	56.00	-19.33	36.46	0.14	0.07	QP
9	4.315	23.94	46.00	-22.06	23.61	0.17	0.16	Average
10	4.315	32.05	56.00	-23.95	31.72	0.17	0.16	QP
11	19.428	22.93	50.00	-27.07	22.28	0.39	0.26	Average
12	19.428	28.40	60.00	-31.60	27.75	0.39	0.26	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).
2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

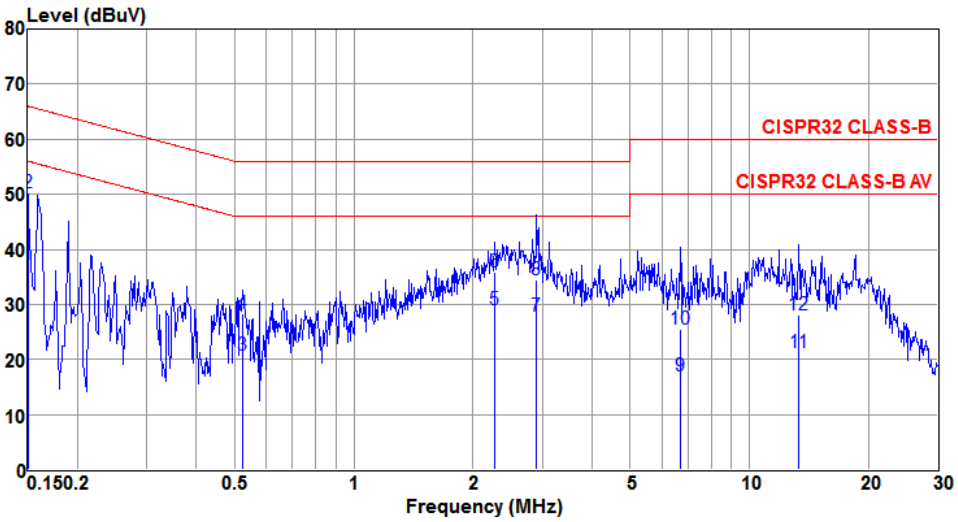
Power Phase	Neutral	Test Mode	3



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1	0.159	21.63	55.52	-33.89	21.49	0.10	0.04	Average
2	0.159	40.73	65.52	-24.79	40.59	0.10	0.04	QP
3	0.518	28.10	46.00	-17.90	27.94	0.12	0.04	Average
4	0.518	35.60	56.00	-20.40	35.44	0.12	0.04	QP
5	0.871	23.54	46.00	-22.46	23.40	0.10	0.04	Average
6	0.871	30.87	56.00	-25.13	30.73	0.10	0.04	QP
7@	2.346	30.74	46.00	-15.26	30.51	0.16	0.07	Average
8	2.346	37.11	56.00	-18.89	36.88	0.16	0.07	QP
9	4.822	26.54	46.00	-19.46	26.20	0.17	0.17	Average
10	4.822	33.15	56.00	-22.85	32.81	0.17	0.17	QP
11	8.323	27.13	50.00	-22.87	26.64	0.28	0.21	Average
12	8.323	33.25	60.00	-26.75	32.76	0.28	0.21	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).
2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

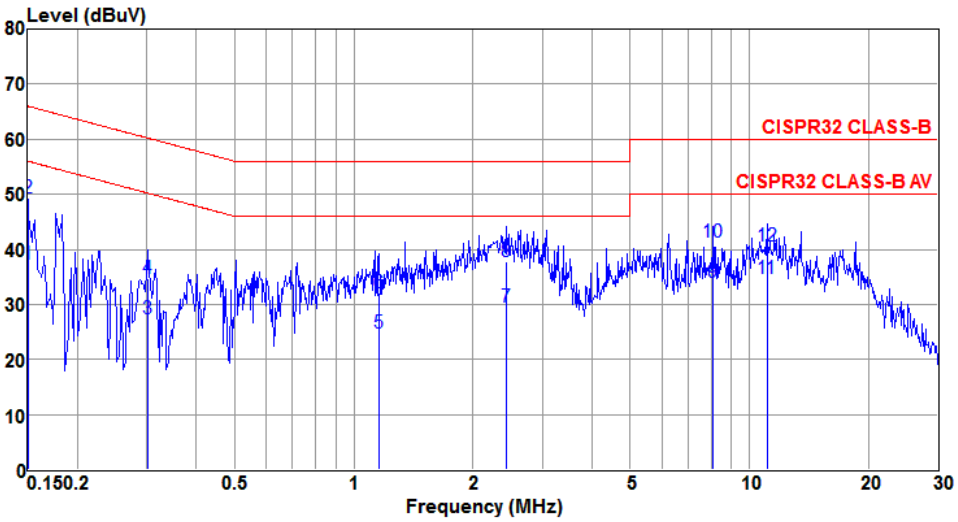
Power Phase	Line	Test Mode	4



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1	0.150	37.28	56.00	-18.72	37.17	0.07	0.04	Average
2@	0.150	50.20	66.00	-15.80	50.09	0.07	0.04	QP
3	0.524	20.87	46.00	-25.13	20.77	0.06	0.04	Average
4	0.524	28.40	56.00	-27.60	28.30	0.06	0.04	QP
5	2.273	29.04	46.00	-16.96	28.84	0.14	0.06	Average
6	2.273	35.77	56.00	-20.23	35.57	0.14	0.06	QP
7	2.900	27.78	46.00	-18.22	27.53	0.15	0.10	Average
8	2.900	34.47	56.00	-21.53	34.22	0.15	0.10	QP
9	6.698	17.04	50.00	-32.96	16.66	0.19	0.19	Average
10	6.698	25.46	60.00	-34.54	25.08	0.19	0.19	QP
11	13.337	21.31	50.00	-28.69	20.80	0.28	0.23	Average
12	13.337	28.16	60.00	-31.84	27.65	0.28	0.23	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).
2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

Power Phase	Neutral	Test Mode	4



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1	0.150	37.34	56.00	-18.66	37.20	0.10	0.04	Average
2	0.150	49.39	66.00	-16.61	49.25	0.10	0.04	QP
3	0.300	27.27	50.24	-22.97	27.12	0.11	0.04	Average
4	0.300	34.70	60.24	-25.54	34.55	0.11	0.04	QP
5	1.160	24.78	46.00	-21.22	24.64	0.10	0.04	Average
6	1.160	32.16	56.00	-23.84	32.02	0.10	0.04	QP
7	2.422	29.49	46.00	-16.51	29.27	0.15	0.07	Average
8	2.422	37.75	56.00	-18.25	37.53	0.15	0.07	QP
9	8.105	34.09	50.00	-15.91	33.61	0.27	0.21	Average
10	8.105	41.32	60.00	-18.68	40.84	0.27	0.21	QP
11@	11.080	34.72	50.00	-15.28	34.18	0.32	0.22	Average
12	11.080	40.71	60.00	-19.29	40.17	0.32	0.22	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).
2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

4 Immunity Tests

4.1 General Description

Product Standard: Draft EN 301 489-1, Draft EN 301 489-17		
Basic Standard	**Spec. Requirement**	**Performance Criteria**
EN 61000-4-2 (ESD)	Contact Discharge: ± 4 kV Air Discharge: ± 8 kV	B
EN 61000-4-3 (RS)	80 MHz to 6000 MHz 3 V/m, 1 kHz Sine Wave 80%, AM Modulation	A

4.2 Performance Criteria Description

Draft EN 301 489-17		
Criteria	**During test**	**After test**
A	Shall operate as intended. May show degradation of performance (see note1). Shall be no loss of function. Shall be no unintentional transmissions.	Shall operate as intended. Shall be no degradation of performance (see note 3). Shall be no loss of function. Shall be no loss of stored data or user programmable functions.
B	May show loss of function (one or more). May show degradation of performance (see note 2). No unintentional transmissions.	Functions shall be self-recoverable. Shall operate as intended after recovering. Shall be no degradation of performance (see note 3). Shall be no loss of stored data or user programmable functions.
C	May be loss of function (one or more).	Functions shall be recoverable by the operator. Shall operate as intended after recovering. Shall be no degradation of performance (see note 3).
Note 1:	Operate as intended during the test allows a level of degradation not below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.	
Note 2:	Degradation of performance during the test is understood as a degradation to a level not below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.	
Note 3:	No degradation of performance after the test is understood as no degradation below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. After the test no change of actual operating data or user retrievable data is allowed. If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect form the apparatus if used as intended.	

Draft EN 301 489-17 Performance Criteria	
CT	The performance criteria A shall apply. Tests shall be repeated with the EUT in standby mode (if applicable) to ensure that unintentional transmission does not occur. In systems using acknowledgement signals, it is recognized that an ACKnowledgement (ACK) or Not ACKnowledgement (NACK) transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.
TT	The performance criteria B shall apply, except for voltage dips of 100 ms and voltage interruptions of 5 000 ms duration, for which performance criteria C shall apply. Tests shall be repeated with the EUT in standby mode (if applicable) to ensure that unintentional transmission does not occur. In systems using acknowledgement signals, it is recognized that an acknowledgement (ACK) or not-acknowledgement (NACK) transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.
CR	The performance criteria A shall apply. Where the EUT is a transceiver, under no circumstances, shall the transmitter operate unintentionally during the test. In systems using acknowledgement signals, it is recognized that an ACK or NACK transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.
TR	The performance criteria B shall apply, except for voltage dips of 100 ms and voltage interruptions of 5 000 ms duration for which performance criteria C shall apply. Where the EUT is a transceiver, under no circumstances, shall the transmitter operate unintentionally during the test. In systems using acknowledgement signals, it is recognized that an ACK or NACK transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.

Performance Criteria by Manufacturer (WLAN Mode)	
A	Without any ping error (request timed out) or any degradation of performance.
B	The ping error (request timed out) or degradation of performance. Functions shall be self-recoverable after the test.

For ESD

Performance Criteria by Manufacturer (BT Mode)	
A	Without any “RSSI Return Value” loss or any degradation of performance.
B	The “RSSI Return Value” loss or degradation of performance. Functions shall be self-recoverable after the test.

For RS

Performance Criteria by Manufacturer (BT Mode)	
A	Without any BT signal loss or any degradation of performance.
B	The BT signal loss or degradation of performance. Functions shall be self-recoverable after the test.

4.3 Electrostatic Discharge (ESD)

4.3.1 Test Specification of Electrostatic Discharge (ESD)

Basic Standard	EN 61000-4-2
Discharge Voltage	Contact Discharge: ± 2 kV / ± 4 kV Air Discharge: ± 2 kV / ± 4 kV / ± 8 kV
Discharge Impedance	330 ohm / 150 pF
Number of Discharge	Air Discharge: minimum 20 times at each test point Contact Discharge: minimum 20 times at each test point
Discharge Mode	Single Discharge
Discharge Period	1 second minimum

4.3.2 Test Procedures

a. In the case of air discharge testing the climatic conditions shall be within the following ranges:
- ambient temperature: 15°C to 35°C;
- relative humidity : 30% to 60%;
- atmospheric pressure : 86 kPa (860 mbar) to 106 kPa (1060 mbar).

b. Test programs and software shall be chosen so as to exercise all normal modes of operation of the EUT. The use of special exercising software is encouraged, but permitted only where it can be shown that the EUT is being comprehensively exercised.

c. The test voltage shall be increased from the minimum to the selected test severity level, in order to determine any threshold of failure. The final severity level should not exceed the product specification value in order to avoid damage to the equipment.

d. The test shall be performed with both air discharge and contact discharge. On preselected points at least 10 single discharges (in the most sensitive polarity) shall be applied on air discharge. On preselected points at least 10 single discharges (in the most sensitive polarity) shall be applied on contact discharge.

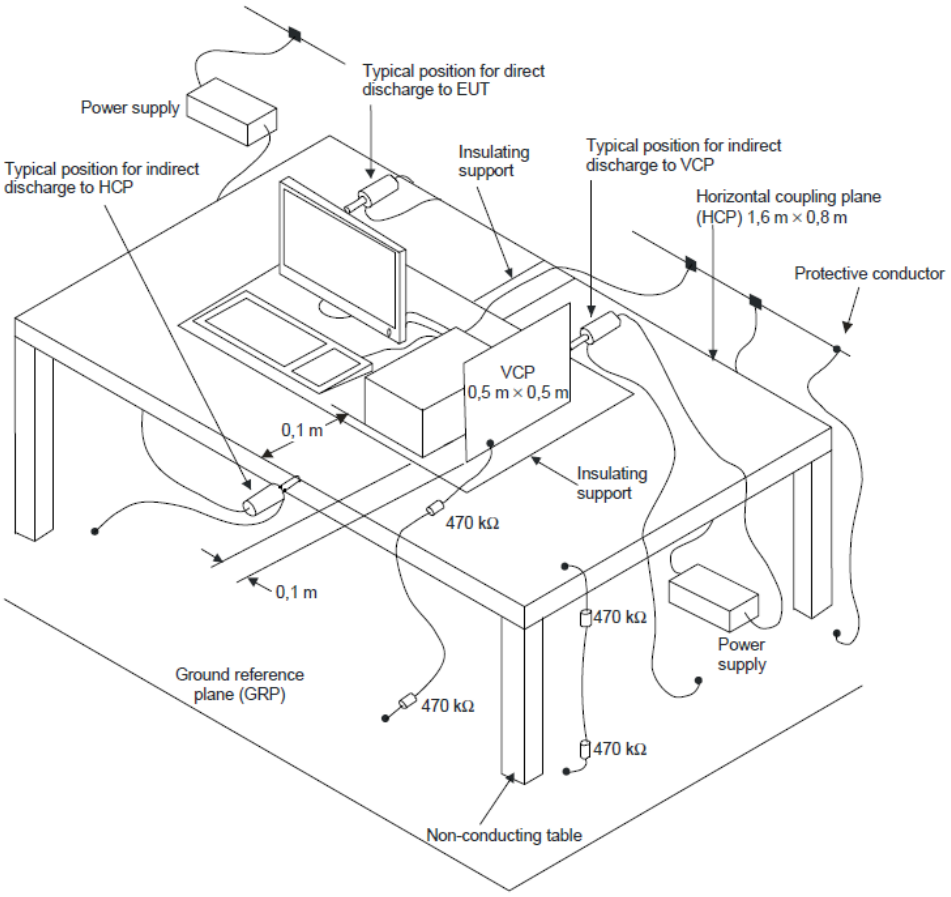
e. For the time interval between successive single discharges an initial value of one second is recommended. Longer intervals may be determined whether a system failure has occurred.

f. In the case of contact discharges, the tip of the discharge electrode shall touch the EUT before the discharge switch is operated.

g. In the case of painted surface covering a conducting substrate, the following procedure shall be adopted:
- If the coating is not declared to be an insulating coating by the equipment manufacturer, then the pointed tip of the generator shall penetrate the coating so as to make contact with the conducting substrate.
- Coating declared as insulating by the manufacturer shall only be submitted to the air discharge.
- The contact discharge test shall not be applied to such surfaces.

h. In the case of air discharges, the round discharge tip of the discharge electrode shall be approached as fast as possible (without causing mechanical damage) to touch the EUT. After each discharge, the ESD generator (discharge electrode) shall be removed from the EUT. The generator is then retriggered for a new single discharge. This procedure shall be repeated until the discharges are completed. In the case of an air discharge test, the discharge switch, which is used for contact discharge, shall be closed.

4.3.3 Test Setup



The test setup shall consist of a non-conductive table, (0.8 ± 0.08) m high, standing on the ground reference plane.

A horizontal coupling plane (HCP), (1.6 ± 0.02) m × (0.8 ± 0.02) m, shall be placed on the table. The EUT and its cables shall be isolated from the coupling plane by an insulating support (0.5 ± 0.05) mm in thickness.

4.3.4 Test Result of Electrostatic Discharge (ESD)

Test Mode	1, 3				
Direct Application					
Test Voltage (kV)	**Polarity**	**Test Point**	**Contact Discharge**	**Air Discharge**	**Performance Criteria**
2, 4	+/-	1	Note1	N/A	A
2, 4, 8	+/-	2	N/A	Note1	A
Indirect Application					
Test Voltage (kV)	**Polarity**	**Test Point**	**Horizontal Coupling Plane (HCP)**	**Vertical Coupling Plane (VCP)**	**Performance Criteria**
2	+/-	At front, rear, left and right side	Note1	Note1	A
4	+/-	At front, rear, left and right side	Note2	Note1	B

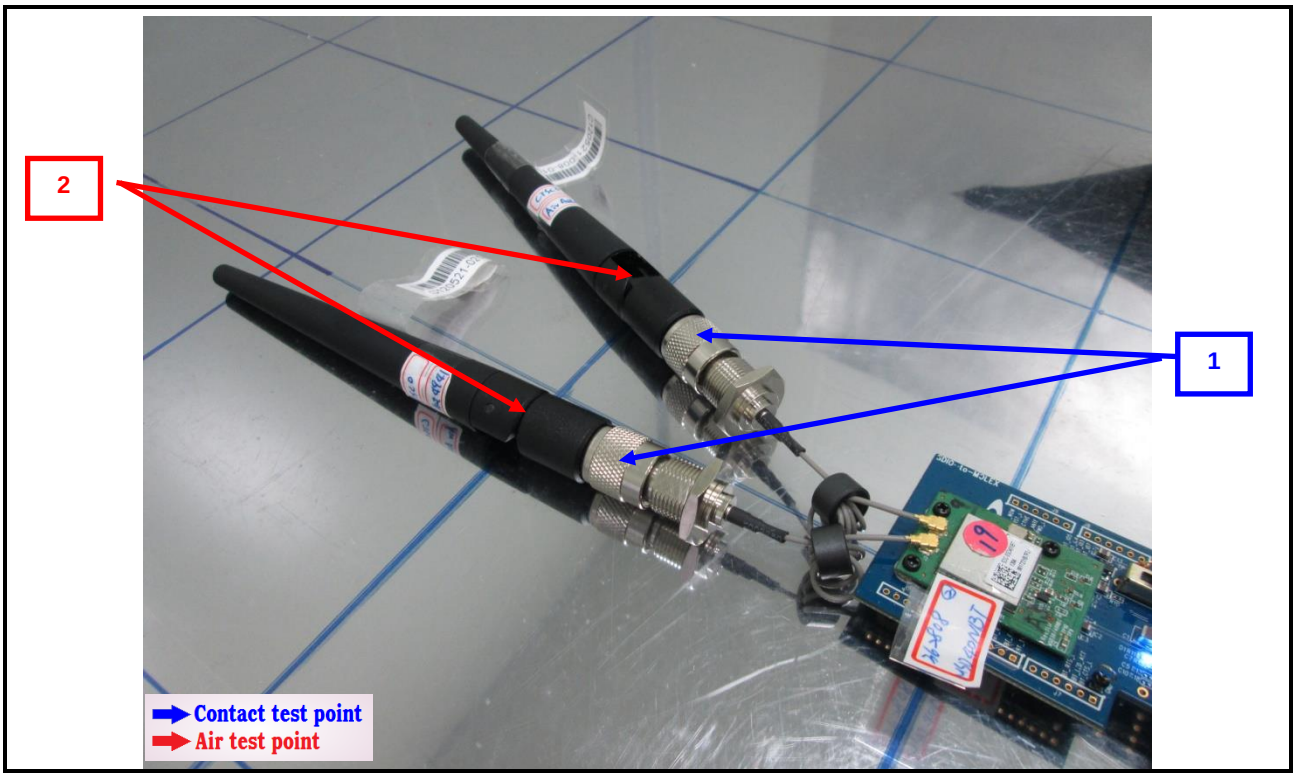
Note:
1) There was no abnormal situation during the test compared with initial operation.
2) The "request timed out" message appeared during the test. After the test, the equipment continued to operate as intended without operator intervention.

Test Mode	2, 4				
Direct Application					
Test Voltage (kV)	**Polarity**	**Test Point**	**Contact Discharge**	**Air Discharge**	**Performance Criteria**
2, 4	+/-	1	Note	N/A	A
2, 4, 8	+/-	2	N/A	Note	A
Indirect Application					
Test Voltage (kV)	**Polarity**	**Test Point**	**Horizontal Coupling Plane (HCP)**	**Vertical Coupling Plane (VCP)**	**Performance Criteria**
2, 4	+/-	At front, rear, left and right side	Note	Note	A

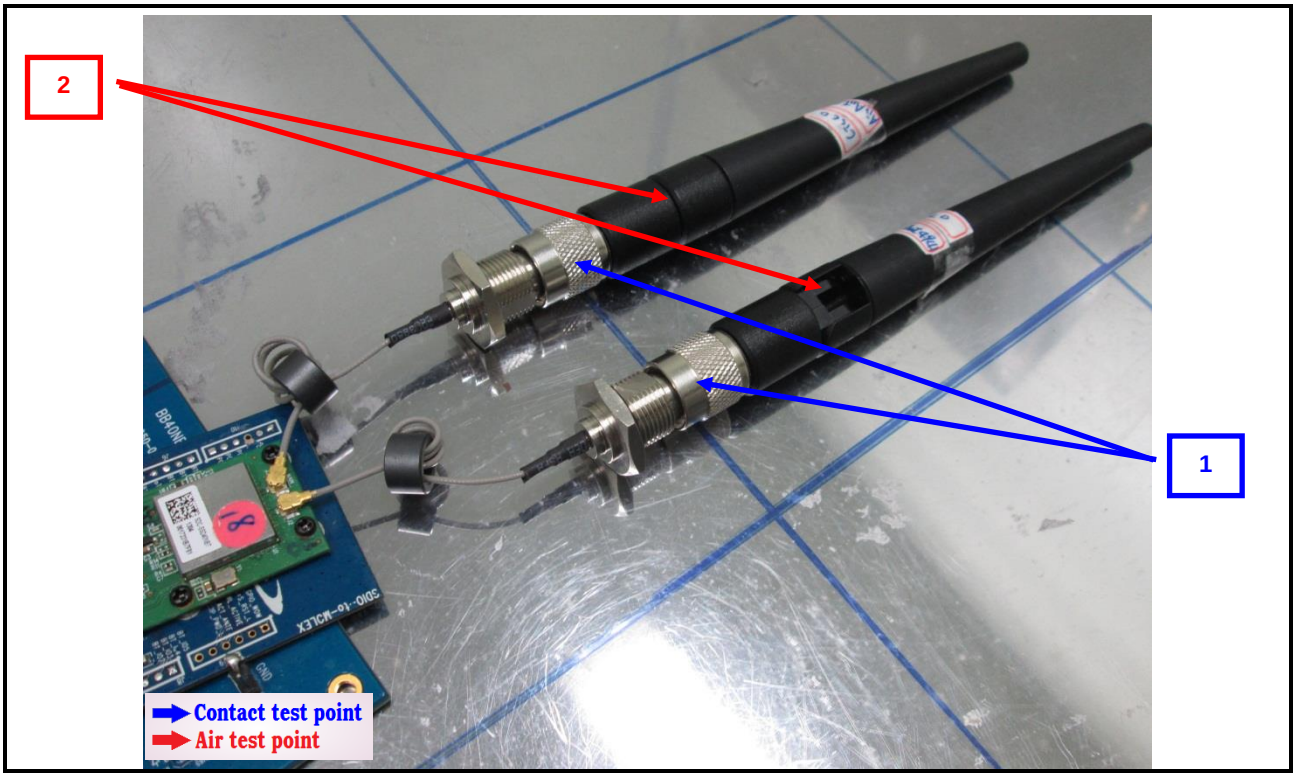
Note: There was no abnormal situation during the test compared with initial operation.

4.3.5 Test Point Photo

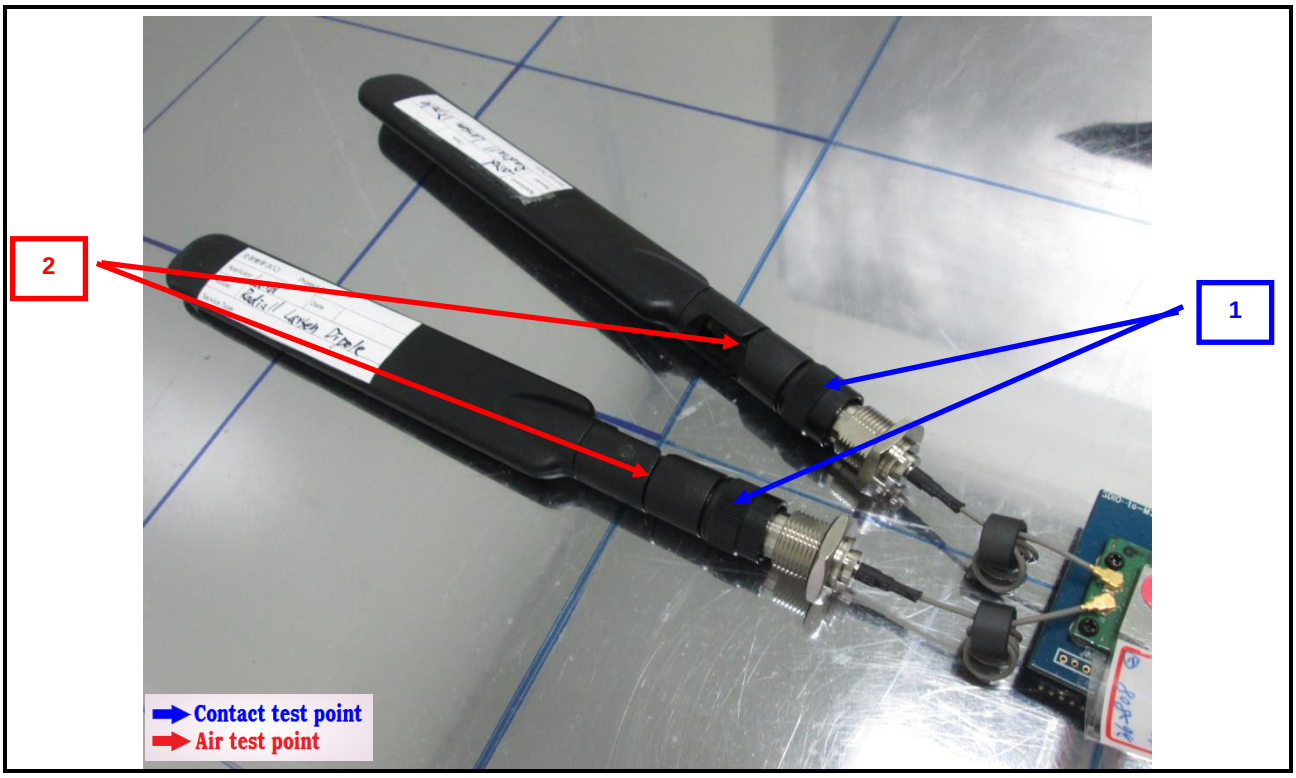
Mode 1



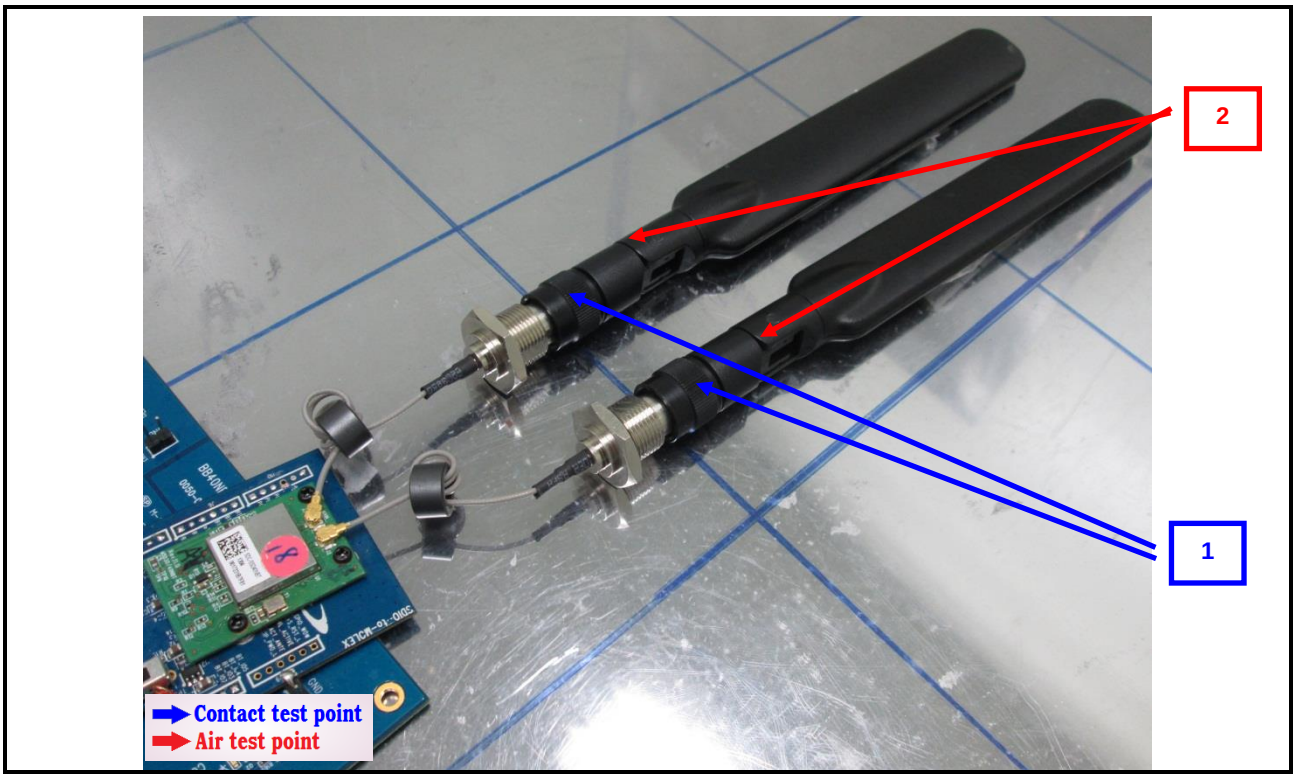
Mode 2



Mode 3


2
1
Contact test point
Air test point

Mode 4


2
1
Contact test point
Air test point

4.4 Radio Frequency Electromagnetic Field (RS)

4.4.1 Test Specification of Radio Frequency Electromagnetic Field (RS)

Basic Standard	EN 61000-4-3
Frequency Range	80 MHz ~ 6000 MHz
Field Strength	3 V/m
Modulation	1 kHz Sine Wave, 80%, AM Modulation
Frequency Step	1 % of preceding frequency value
Polarity of Antenna	Horizontal and Vertical
Antenna Height	1.5 m
Antenna Distance	80 MHz ~ 1000 MHz: 3 m 1000 MHz ~ 6000 MHz: 1 m
Dwell Time	3 seconds

4.4.2 Test Procedures

a. The test level shall be 3 V/m (measured unmodulated). The test signal shall be amplitude modulated to a depth of 80 % by a sinusoidal audio signal of 1000 Hz. If the wanted signal is modulated at 1000 Hz, then an audio signal of 400 Hz shall be used.

b. The test shall be performed over the frequency range 80 MHz to 6000 MHz with the exception of the exclusion band for transmitters, receivers and duplex transceivers, as appropriate.

c. For receivers and transmitters the stepped frequency increments shall be 1 % frequency increment of the momentary used frequency, unless specified otherwise in the part of EN 301 489 series [i.13] dealing with the relevant type of radio equipment.

d. Further product related spot frequency tests may be specified in the relevant part of EN 301 489 series [i.13] dealing with the particular type of radio equipment.

e. Responses on receivers occurring at discrete frequencies, which are narrow band responses, shall be disregarded from the test.

f. The frequencies selected and used during the test shall be recorded in the test report.

g. When testing at frequencies above 1 GHz, the test distance shall be 1 m when using the independent windows method. Compliance with the field uniformity requirement shall be verified for the selected test distance.

h. The alternative method for frequencies above 1 GHz divides the calibration area into a suitable array of 0,5 m × 0,5 m windows such that the whole area to be occupied by the face of the EUT is covered. The field uniformity shall be independently calibrated over each window.

i. During the test, at each frequency the forward power shall be applied to the field-generating antenna. The test shall be repeated with the field-generating antenna repositioned to illuminate each of the required windows in turn.

4.4.3 Exclusion bands

The frequencies on which the transmitter part of the EUT is intended to operate shall be excluded from radiated emission measurements when performed in transmit mode of operation.

There shall be no frequency exclusion band applied to emission measurements of the receiver part of transceivers or the stand alone receiver under test, and/or associated ancillary equipment.

The exclusion band for immunity testing of equipment operating in the 2,4 GHz band shall be:

- lower limit of exclusion band = lowest allocated band edge frequency -120 MHz, i.e. 2 280 MHz;
- upper limit of exclusion band = highest allocated band edge frequency +120 MHz, i.e. 2 603,5MHz.

The exclusion band for immunity testing of equipment operating in the 5 GHz Wi-Fi band shall be:

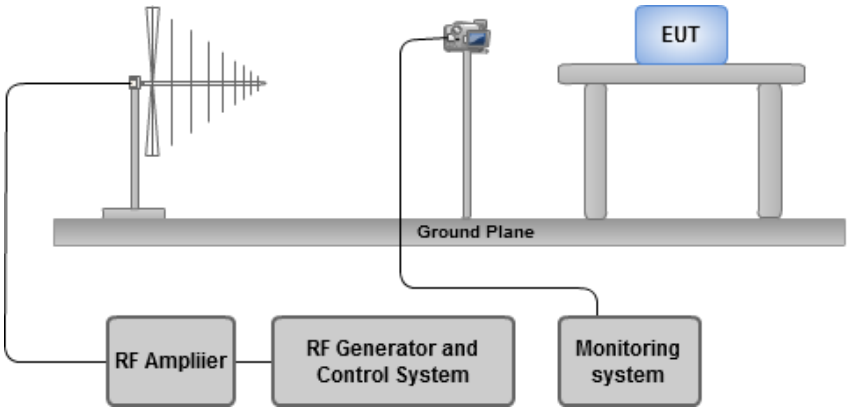
- lower limit of exclusion band = lowest allocated band edge frequency -270 MHz, i.e. 4 880 MHz;
- upper limit of exclusion band = highest allocated band edge frequency +270 MHz, i.e. 5 995 MHz.

The exclusion band for immunity testing of equipment operating in the 5,8 GHz band shall be:

- lower limit of exclusion band = lowest allocated band edge frequency -270 MHz, i.e. 5 455 MHz;
- as the immunity requirements have an upper frequency range of 6 GHz and any upper edge exclusion band would be greater than this for the 5,8 GHz band. The above frequency shall also be regarded as the upper end of the test range.

NOTE: These receiver exclusion band ranges align with the relevant blocking test ranges.

4.4.4 Test Setup



Note: The procedure defined in this part requires the generation of electromagnetic fields within which the test sample is placed and its operation observed. To generate fields that are useful for simulation of actual (field) conditions may require significant antenna drive power and the resultant high field strength levels. To comply with local regulations and to prevent biological hazards to the testing personnel, it is recommended that these tests be carried out in a shielded enclosure or semi-anechoic chamber.

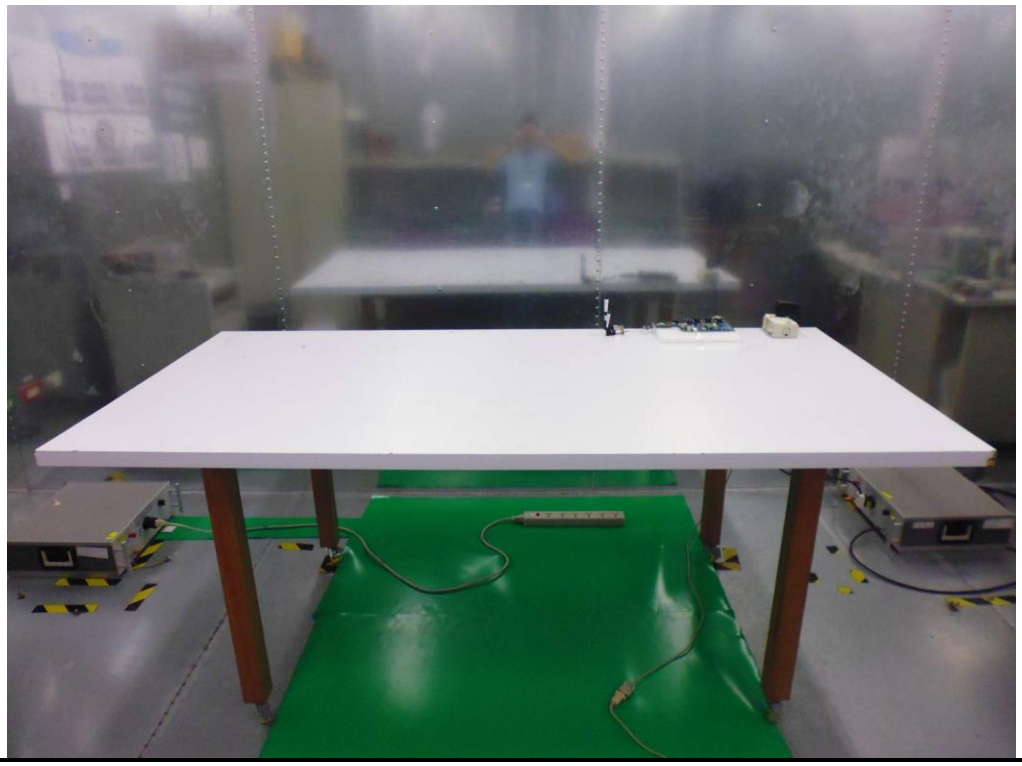
4.4.5 Test Result of Radio Frequency Electromagnetic Field (RS)

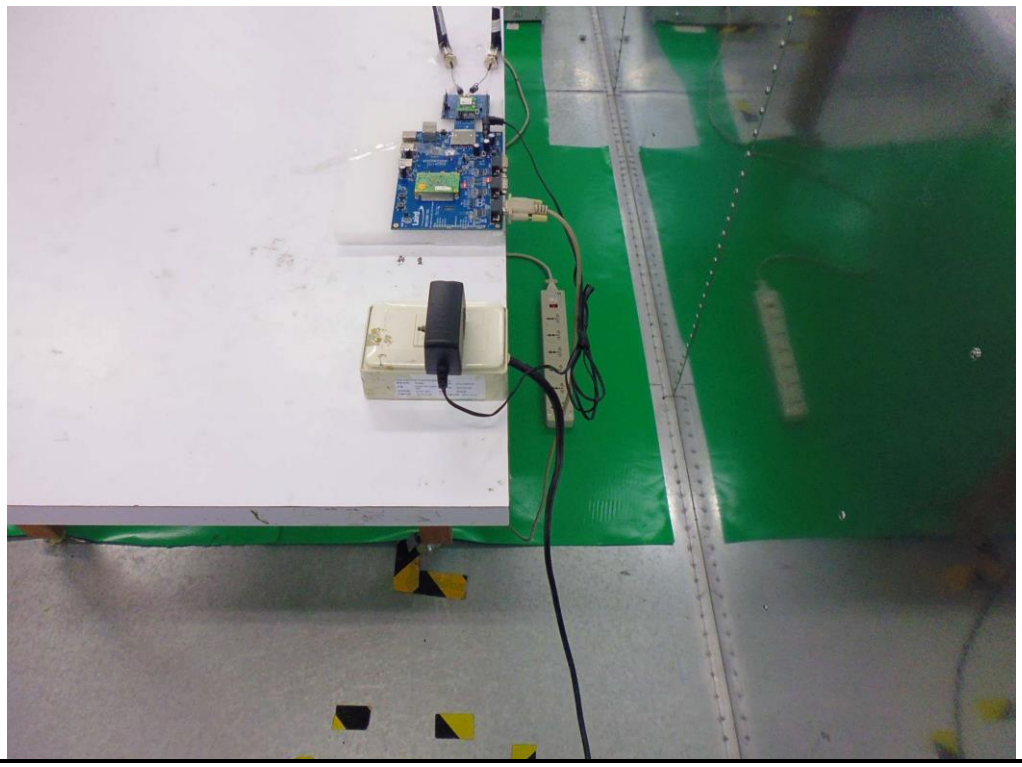
Test Mode	1, 2, 3, 4				
Frequency Range (MHz)	**Azimuth**	**Polarity**	**Test Field Strength (V/m)**	**Observation**	**Performance Criteria**
80 – 6000	0	V&H	3	Note	A
80 – 6000	90	V&H	3	Note	A
80 – 6000	180	V&H	3	Note	A
80 – 6000	270	V&H	3	Note	A

Note: There was no abnormal situation during the test compared with initial operation.

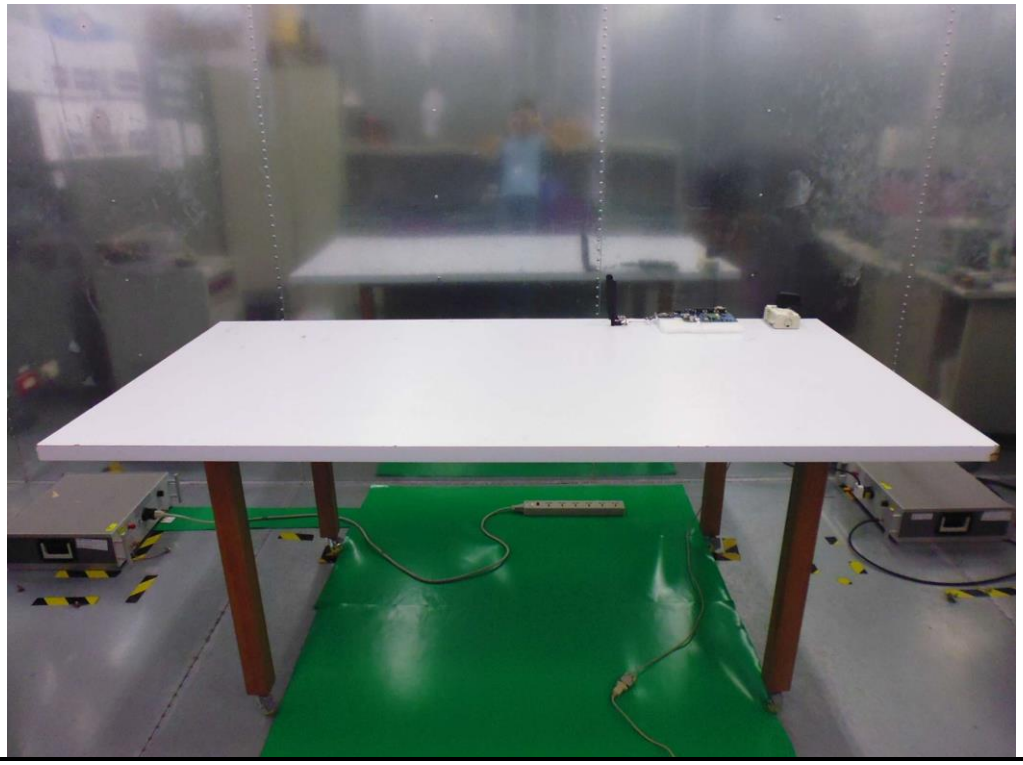
5 Photographs of the Test Configuration

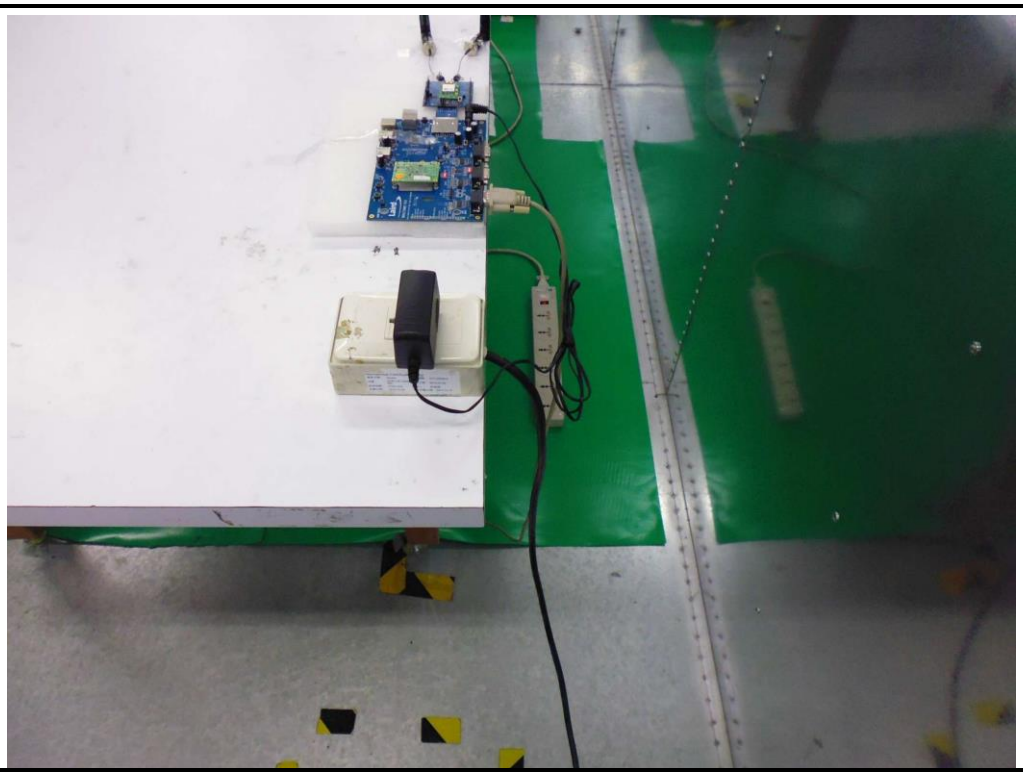
Conducted Emissions from the AC mains power ports (Test Mode 1, 3)





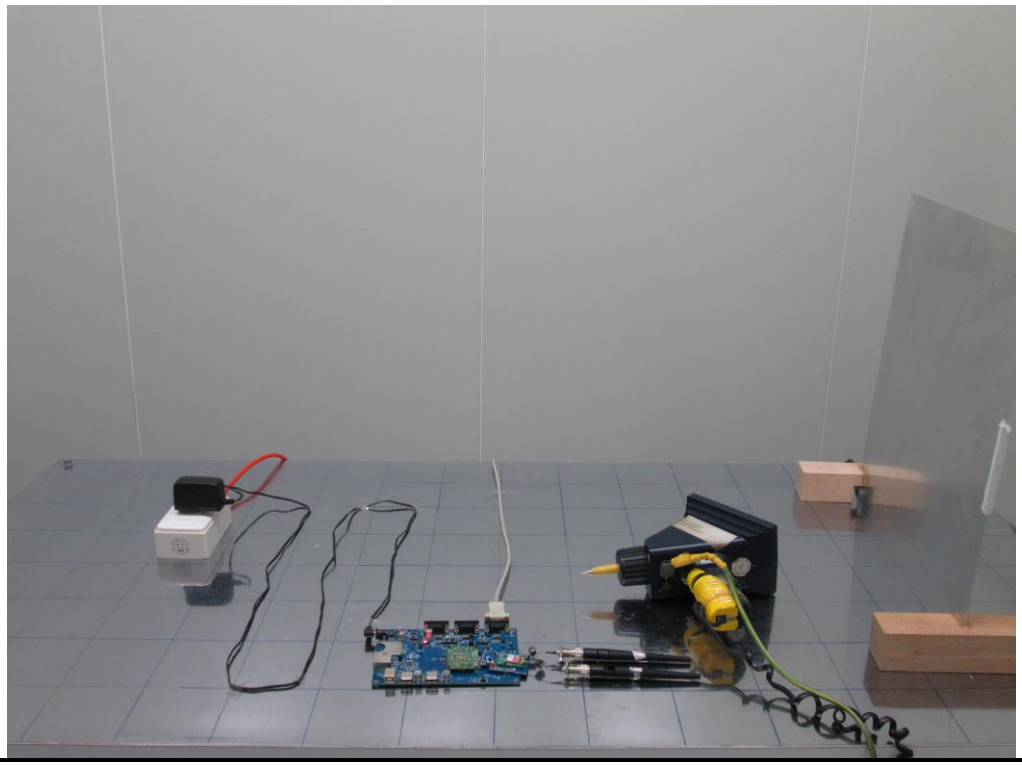
Conducted Emissions from the AC mains power ports (Test Mode 2, 4)



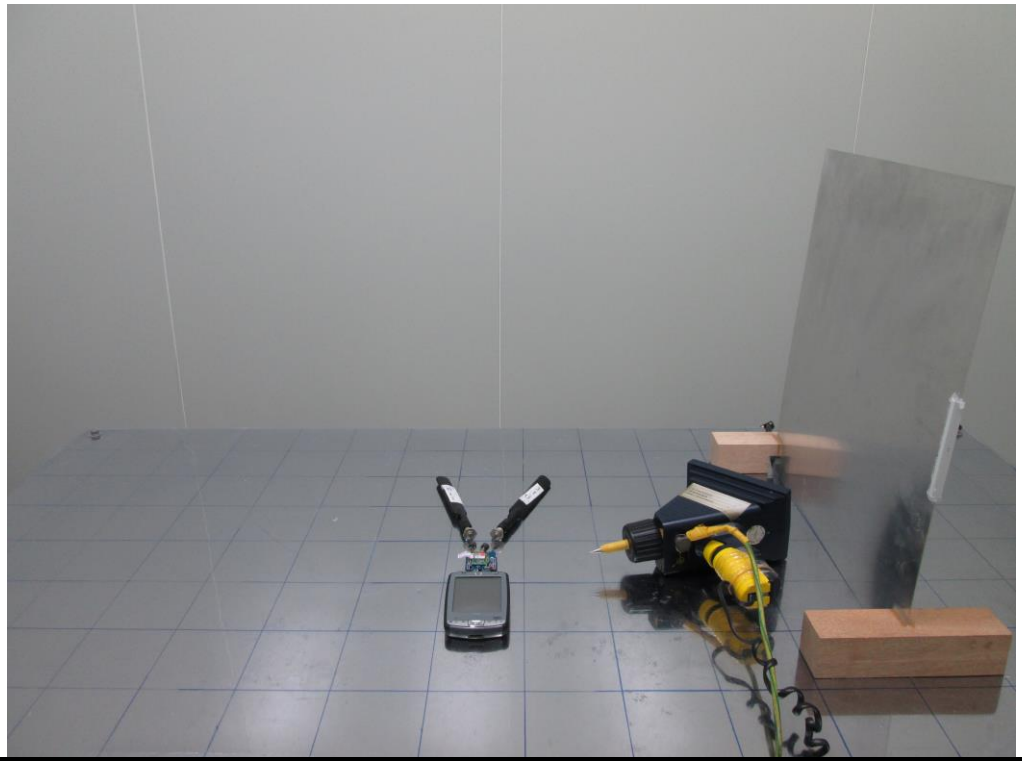


ESD Test (Mode 1)

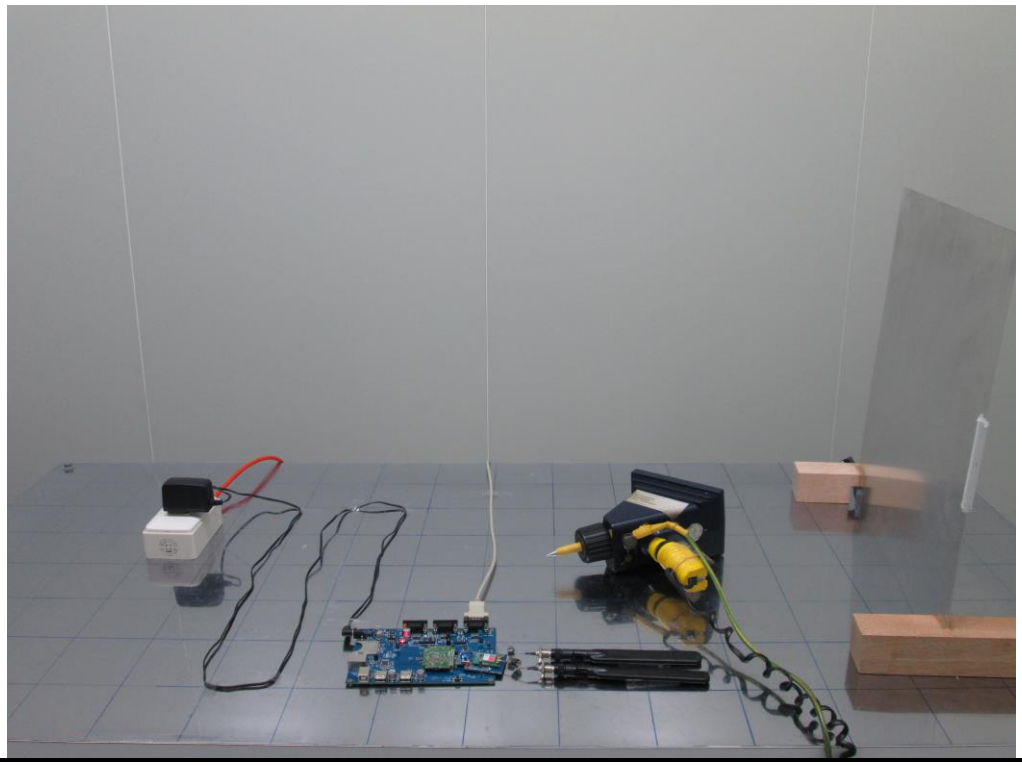
ESD Test (Mode 2)



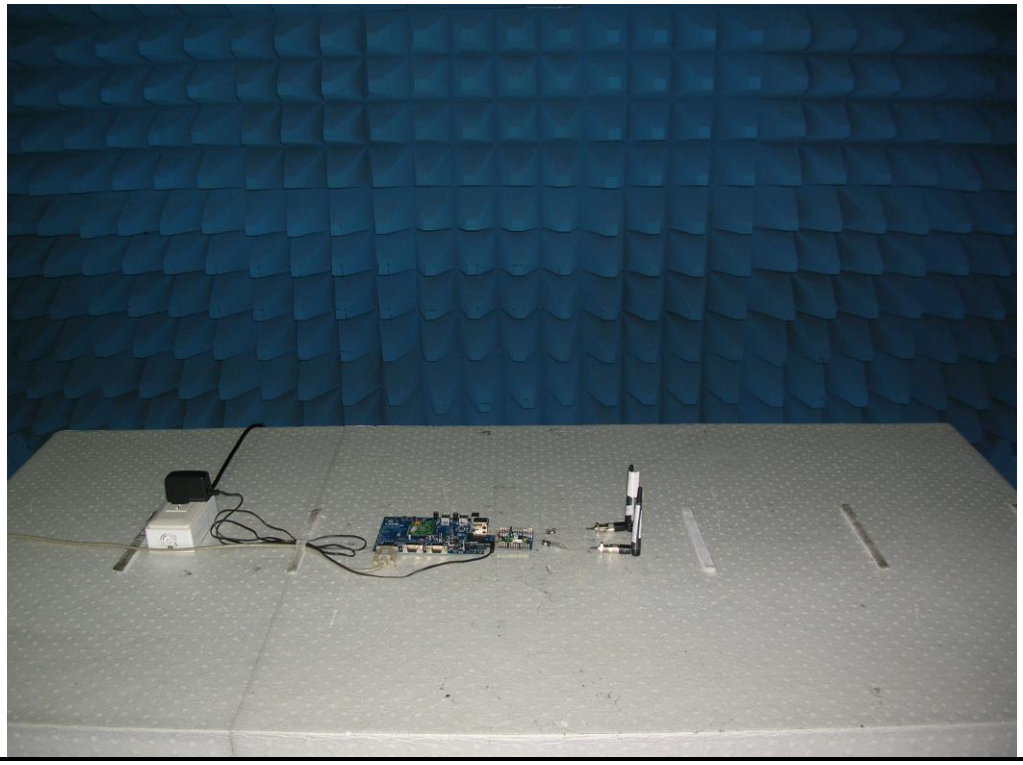
ESD Test (Mode 3)



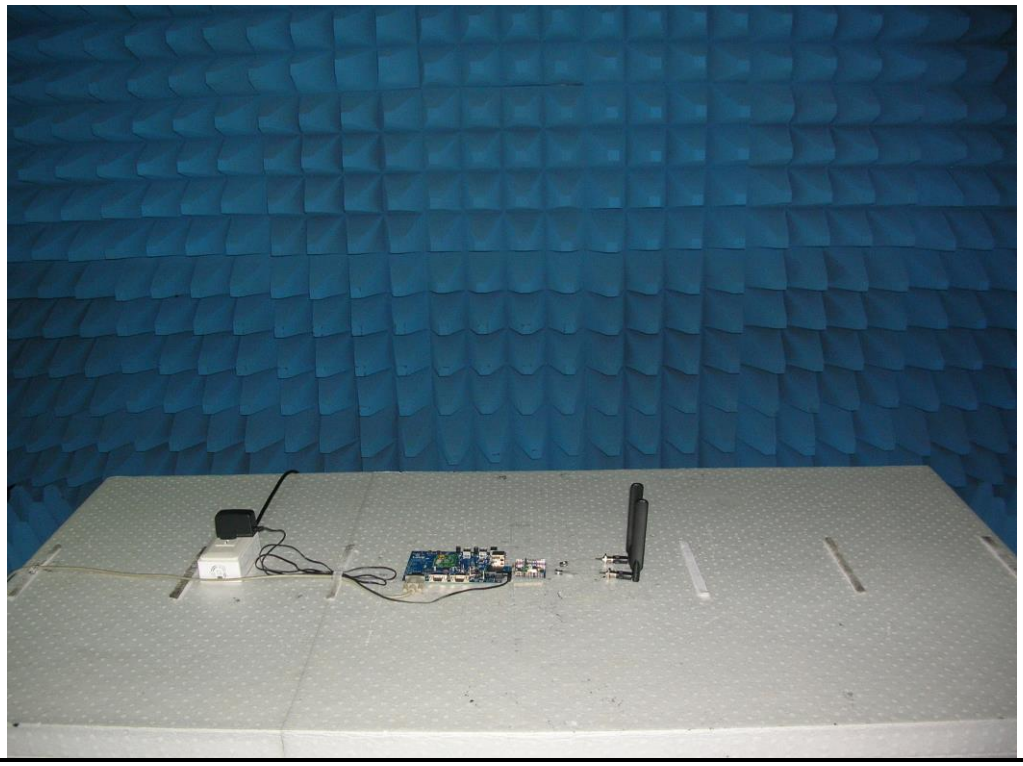
ESD Test (Mode 4)



RS Test (Mode 1, 3)



RS Test (Mode 2, 4)



6 Test laboratory information

Established in 2012, ICC provides foremost EMC & RF Testing and advisory consultation services by our skilled engineers and technicians. Our services employ a wide variety of advanced edge test equipment and one of the widest certification extents in the business.

International Certification Corp (EMC and Wireless Communication Laboratory), it is our definitive objective is to institute long term, trust-based associations with our clients. The expectation we set up with our clients is based on outstanding service, practical expertise and devotion to a certified value structure. Our passion is to grant our clients with best EMC / RF services by oriented knowledgeable and accommodating staff.

Our Test sites are located at Linkou District and Kwei Shan District. Location map can be found on our website http://www.icertifi.com.tw.

Linkou	**Kwei Shan**	**Kwei Shan Site II**
Tel: 886-2-2601-1640	Tel: 886-3-271-8666	Tel: 886-3-271-8640
No. 30-2, Ding Fwu Tsuen, Lin Kou District, New Taipei City, Taiwan, R.O.C.	No. 3-1, Lane 6, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C.	No. 14-1, Lane 19, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C.

If you have any suggestion, please feel free to contact us as below information

Tel: 886-3-271-8666
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Email: ICC_Service@icertifi.com.tw

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