CE EMC Test Report

Equipment	:	**Bluetooth Dual Mode UART AT featuring smartBASIC**
Model No.	:	**BT900-SA, BT900-SC**
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. 07, 2017**
Tested Date	:	**Apr. 30, 2014 (for original test)** **Apr. 08 ~ Apr. 10, 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:

Peter Lin / Supervisor

Eason Chang / Assistant Manager

Approved by:

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Testing Laboratory 2732

Table of Contents

Release Record

Report No.	Version	Description	Issued Date
EH442807-06	Rev. 01	Initial issue	May 02, 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, Class B	Conducted Emissions from the AC mains power ports	-11.80 QP@ 0.150MHz.	Pass
8.7	EN 55032:2015, Class B	Asymmetric Mode Conducted Emissions	Note[1]	N/A
8.2	EN 55032:2015, 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 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)		A	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
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. EH442807. The difference is concerned with following items:

- ✧ Updating standard to latest version.
- ✧ New applicant address for above change

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 Product Details

The following models are provided to this EUT.

Brand Name	Model Name	Product Name	Description
Laird Technologies	BT900-SA	Bluetooth Dual Mode UART AT featuring smartBASIC	Integrated antenna onboard
	BT900-SC		No integrated antenna, only IPEX connector for external antenna

1.1.2 Specification of the Equipment under Test (EUT)

Operating Frequency	2402 MHz ~ 2480 MHz
Antenna Type	Refer to section 1.1.3
Modulation Type	GFSK

1.1.3 Antenna Details

Ant. No.	EUT Model	Type	Ant. Brand / Model	Gain (dBi)	Connector
1	BT900-SC	Dipole	Nearson S181FL-L-RMM-2450S	2	UFL
2		PCB Dipole	Laird EBL2449A1-15UFL	2	
3		Dipole	Laird MAF94190	2	
4		Dipole	Laird WRR2400- IP04-B(MAF94019)	1.5	
5	BT900-SA	Chip	ACX AT3216-B2R7HAA_3216	0.5	N/A

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

Power Supply Type	3.3Vdc from host.

1.2 Test Equipment and Calibration Data

Test Item	Conducted Emission				
Test Site	Conduction room 1 / (CO01-WS)				
Tested Date	Apr. 10, 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
LISN (Support Unit)	SCHWARZBECK	Schwarzbeck 8127	8127-666	Nov. 25, 2016	Nov. 24, 2017
RF Cable-CON	EMC	EMCCFD300-BM-BM-6000	50821	Dec. 20, 2016	Dec. 19, 2017
50 ohm terminal (Support Unit)	NA	50	04	Apr. 12, 2016	Apr. 11, 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	Apr. 30, 2014				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
ESD Generator	EMTest	Dito	V1248114239	Aug. 19, 2013	Aug. 18, 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. 08, 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
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	22°C/57%	Howard Huang
ESD	ES01-WS	25°C/55%/ 97kPa	JN Chen
RS	RS01-WS	24°C/60%/101kPa	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	BT900-SC with Antenna 1, 230V/50Hz
2	BT900-SC with Antenna 2, 110V/60Hz
3	BT900-SC with Antenna 3, 230V/50Hz
4	BT900-SC with Antenna 4, 110V/60Hz
5	BT900-SC with Antenna 5, 230V/50Hz
ESD & RS Tests	
Test Mode	**Operating Description**
1	BT900-SC with Antenna 1
2	BT900-SC with Antenna 2
3	BT900-SC with Antenna 3
4	BT900-SC with Antenna 4
5	BT900-SA with Antenna 5

2.3 Local Support Equipment List

Support Equipment List (EMI)					
No.	**Equipment**	**Brand**	**Model**	**S/N**	**Signal cable / Length (m)**
1	Notebook 01	DELL	Latitude E5430	6R4RWW1	---
2	Printer	EPSON	XP-30	QSDK002410	USB, 1.8m shielded w/o core.
3	USB 3.0 HDD	WD	WDBKXH5000ABK	WX31AB210213	USB, 0.5m shielded w/o core.
4	Mouse	DELL	MS111-L	2C3-00MM	USB, 1.8m shielded w/o core.
5	Notebook 02	DELL	Latitude E5430	264RWW1	---
6	BT Dongle	Aibo	LY-MIC-BT001-V4	---	---

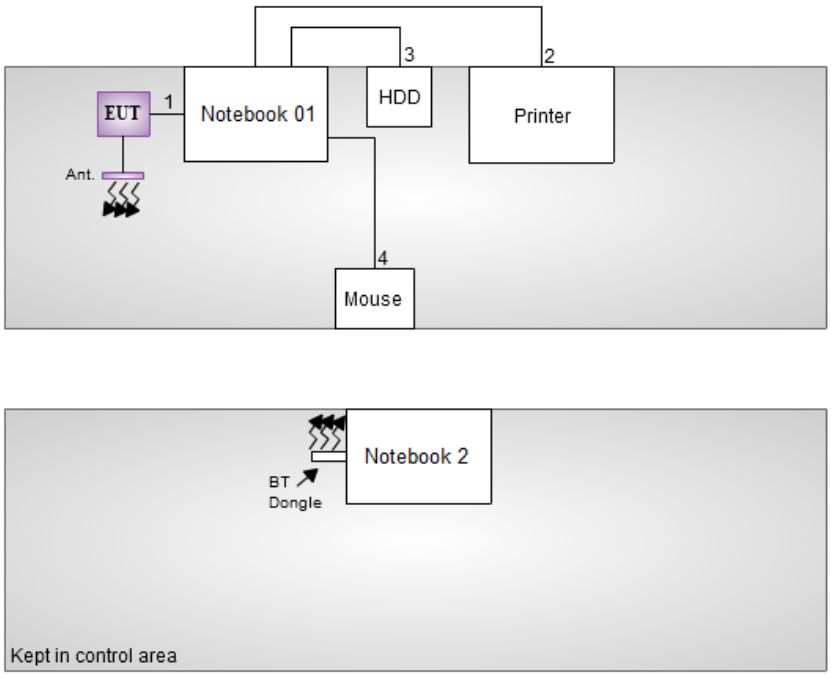
Note: No.6 was supplied by applicant.

Support Equipment List (EMS)					
No.	**Equipment**	**Brand**	**Model**	**S/N**	**Signal cable / Length (m)**
1	Notebook 01	DELL	Latitude E5430	6R4RWW1	---
2	Notebook 02	DELL	Latitude E5430	264RWW1	---
3	BT Dongle	Aibo	LY-MIC-BT001-V4	---	---

Note: No.3 was supplied by applicant.

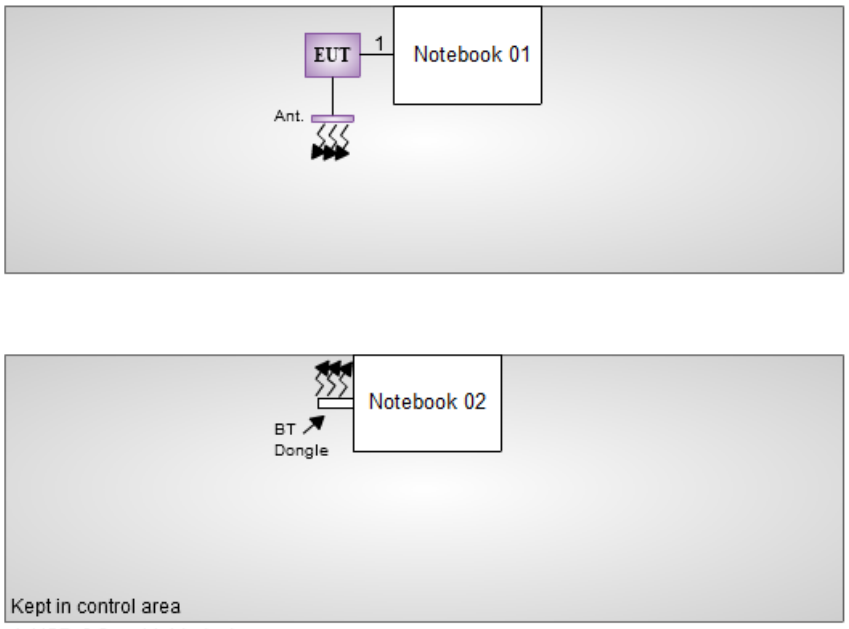
2.4 Test Setup Chart

Test Setup Diagram (EMI)_Model: BT900-SC



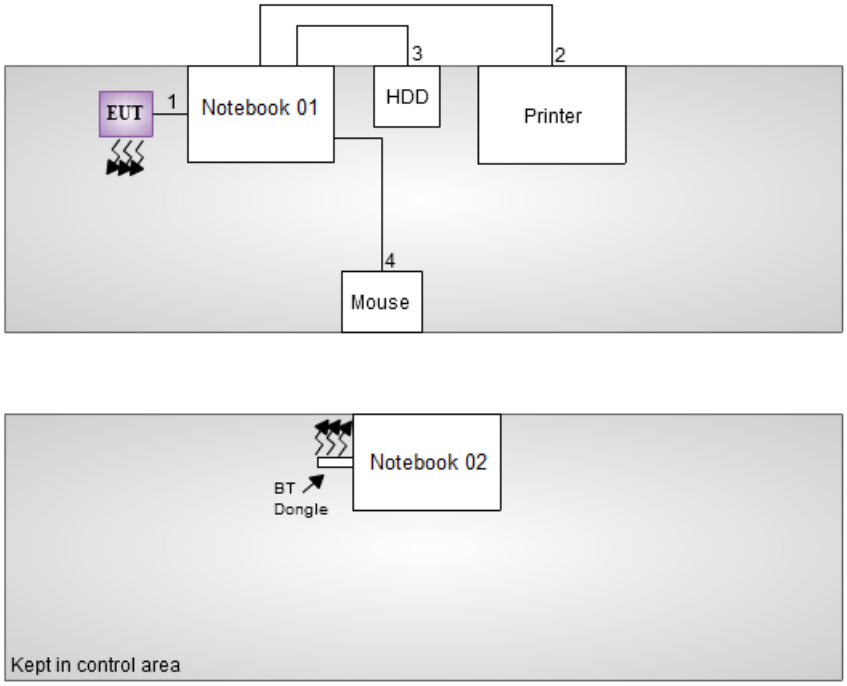
1. USB, 0.2m shielded w/o core.
2. USB, 1.8m shielded w/o core.
3. USB, 0.5m shielded w/o core.
4. USB, 1.8m shielded w/o core.

Test Setup Diagram (EMS)_Model: BT900-SC



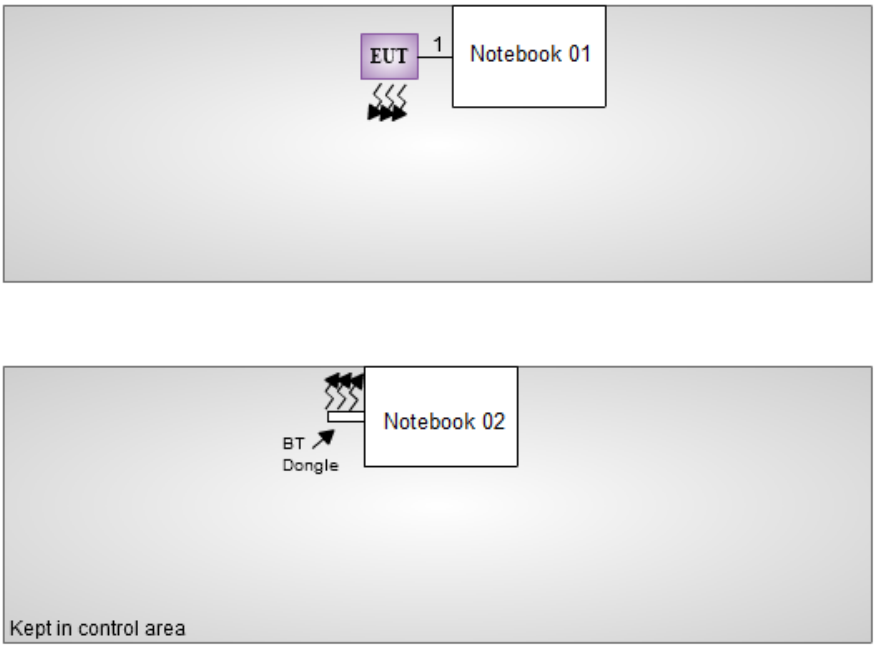
1. USB, 0.2m shielded w/o core.

Test Setup Diagram (EMI)_Model: BT900-SA



1. USB, 0.2m shielded w/o core.
2. USB, 1.8m shielded w/o core.
3. USB, 0.5m shielded w/o core.
4. USB, 1.8m shielded w/o core.

Test Setup Diagram (EMS)_Model: BT900-SA



1. USB, 0.2m shielded w/o core.

2.5 Test Software and Operating Condition

EMI

a. To enable all functions of test system.
b. The support notebook 01 enabled BT dongle and executed “Teraterm.exe” to type any character to EUT by BT.
c. The support notebook 01 executed “WinEMC.exe” to send “H” patterns to the printer.
d. The support notebook 01 executed “WinEMC.exe” to read and wrote data from USB 3.0 HDD.
e. The support notebook 01 executed “Media player.exe” to play colorbar video.
f. The support notebook 02 communicates with EUT executed “Teraterm.exe” to receive any character by BT

EMS

a. To enable all functions of test system.
b. The support notebook 01 enabled BT dongle and executed “Teraterm.exe” to type any character to EUT by BT.
c. The support notebook 02 communicates with EUT executed “Teraterm.exe” to receive any character by BT

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.

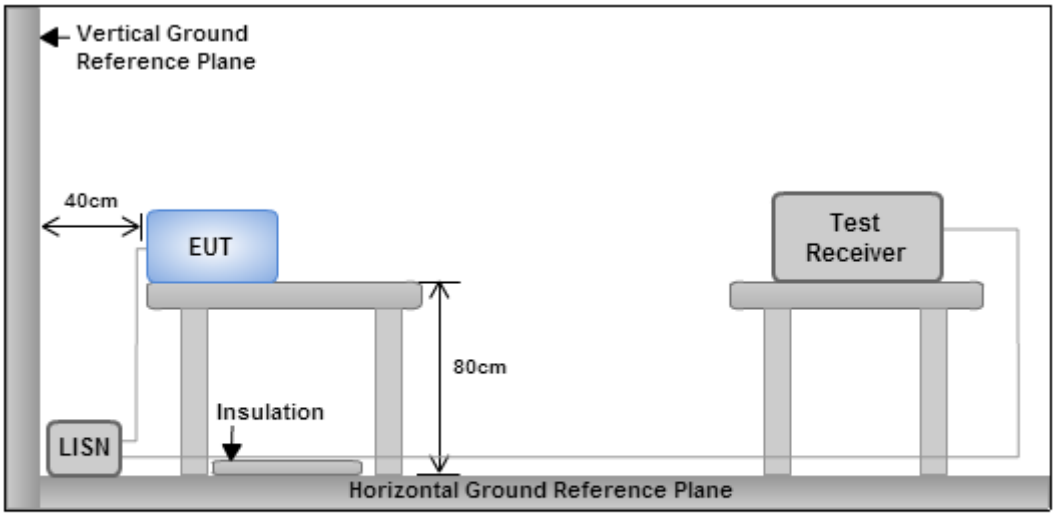
f. The CISPR states that a 50 ohm, 50 microhenry LISN should be used.

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

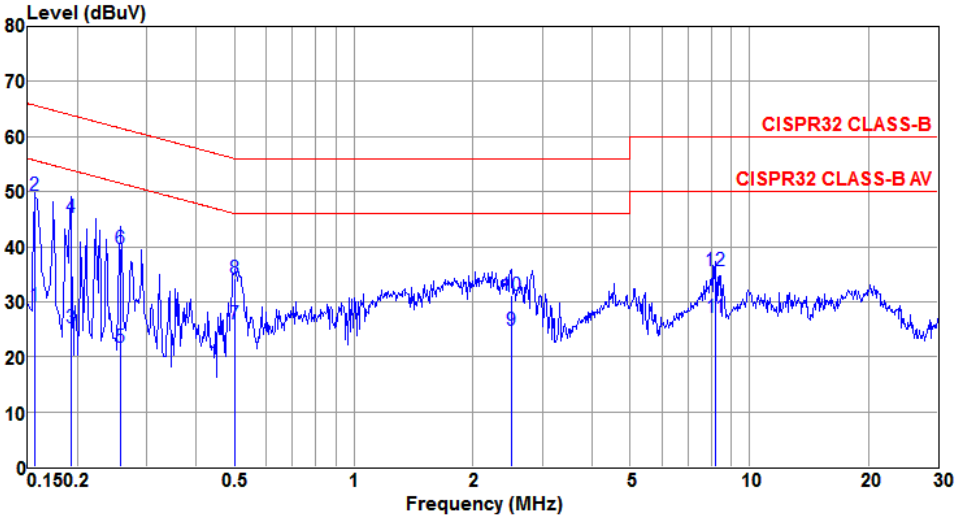


Note: 1. Support units were connected to second LISN.

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

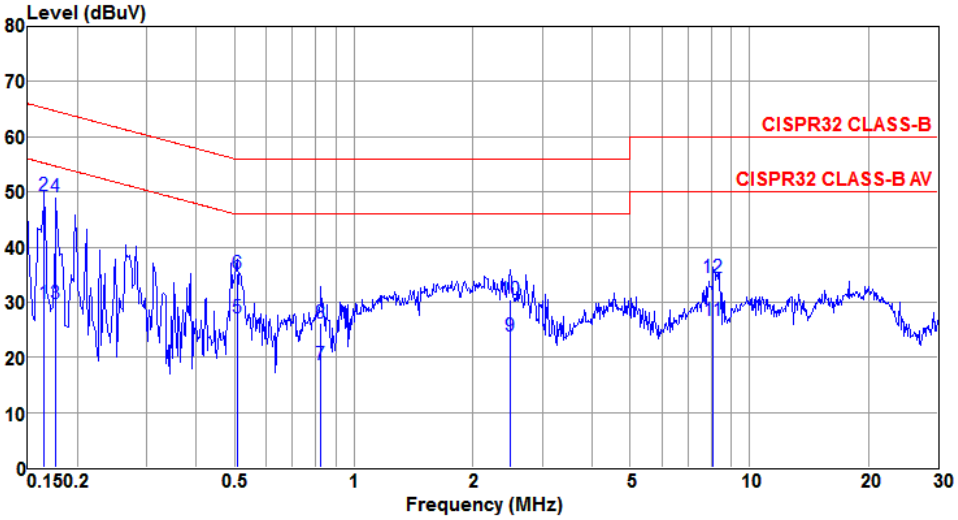
Power Phase	Line	Test Mode	1



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1	0.156	29.38	55.69	-26.31	29.27	0.07	0.04	Average
2@	0.156	49.41	65.69	-16.28	49.30	0.07	0.04	QP
3	0.192	25.29	53.93	-28.64	25.15	0.10	0.04	Average
4	0.192	45.43	63.93	-18.50	45.29	0.10	0.04	QP
5	0.258	21.81	51.51	-29.70	21.68	0.09	0.04	Average
6	0.258	39.63	61.51	-21.88	39.50	0.09	0.04	QP
7	0.502	25.92	46.00	-20.08	25.82	0.06	0.04	Average
8	0.502	34.29	56.00	-21.71	34.19	0.06	0.04	QP
9	2.500	24.80	46.00	-21.20	24.58	0.14	0.08	Average
10	2.500	31.17	56.00	-24.83	30.95	0.14	0.08	QP
11	8.235	27.23	50.00	-22.77	26.83	0.19	0.21	Average
12	8.235	35.65	60.00	-24.35	35.25	0.19	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).

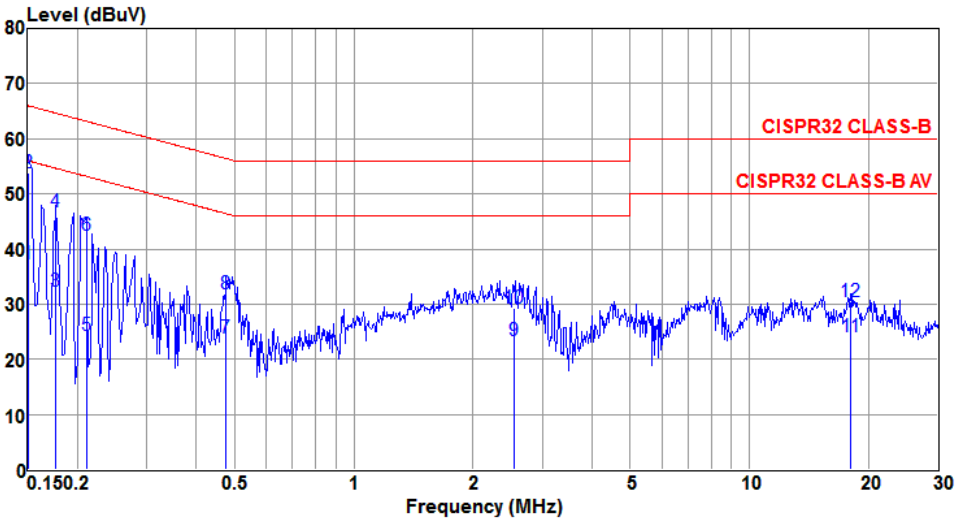
Power Phase	Neutral	Test Mode	1



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1	0.165	29.86	55.21	-25.35	29.72	0.10	0.04	Average
2	0.165	49.42	65.21	-15.79	49.28	0.10	0.04	QP
3	0.177	29.63	54.64	-25.01	29.50	0.09	0.04	Average
4@	0.177	49.02	64.64	-15.62	48.89	0.09	0.04	QP
5	0.507	27.07	46.00	-18.93	26.91	0.12	0.04	Average
6	0.507	35.09	56.00	-20.91	34.93	0.12	0.04	QP
7	0.826	18.66	46.00	-27.34	18.52	0.10	0.04	Average
8	0.826	26.19	56.00	-29.81	26.05	0.10	0.04	QP
9	2.487	23.90	46.00	-22.10	23.67	0.15	0.08	Average
10	2.487	30.55	56.00	-25.45	30.32	0.15	0.08	QP
11	8.105	26.66	50.00	-23.34	26.18	0.27	0.21	Average
12	8.105	34.46	60.00	-25.54	33.98	0.27	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).

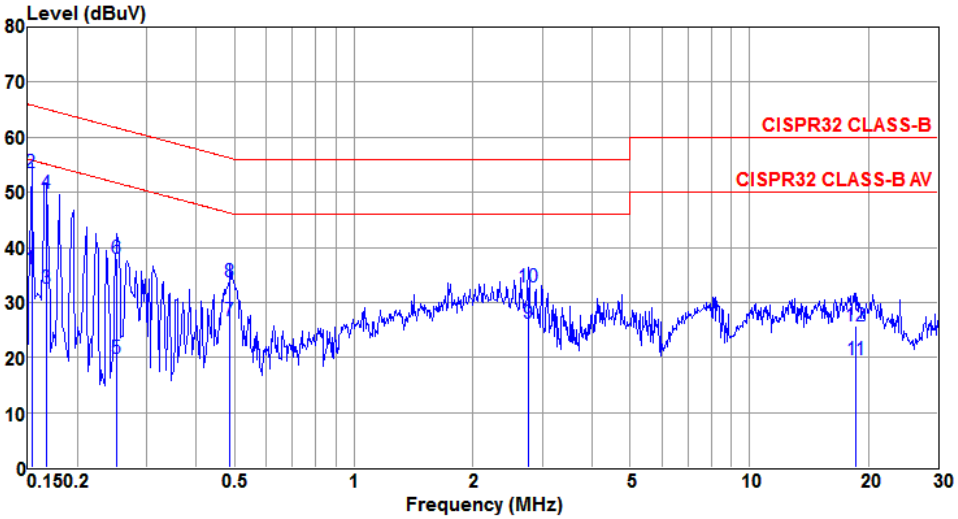
Power Phase	Line	Test Mode	2



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1	0.150	37.25	56.00	-18.75	37.14	0.07	0.04	Average
2@	0.150	53.90	66.00	-12.10	53.79	0.07	0.04	QP
3	0.177	32.31	54.64	-22.33	32.18	0.09	0.04	Average
4	0.177	46.80	64.64	-17.84	46.67	0.09	0.04	QP
5	0.211	24.32	53.18	-28.86	24.18	0.10	0.04	Average
6	0.211	42.54	63.18	-20.64	42.40	0.10	0.04	QP
7	0.476	23.85	46.41	-22.56	23.75	0.06	0.04	Average
8	0.476	31.79	56.41	-24.62	31.69	0.06	0.04	QP
9	2.536	23.42	46.00	-22.58	23.20	0.14	0.08	Average
10	2.536	29.33	56.00	-26.67	29.11	0.14	0.08	QP
11	18.039	23.98	50.00	-26.02	23.36	0.37	0.25	Average
12	18.039	30.35	60.00	-29.65	29.73	0.37	0.25	QP

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

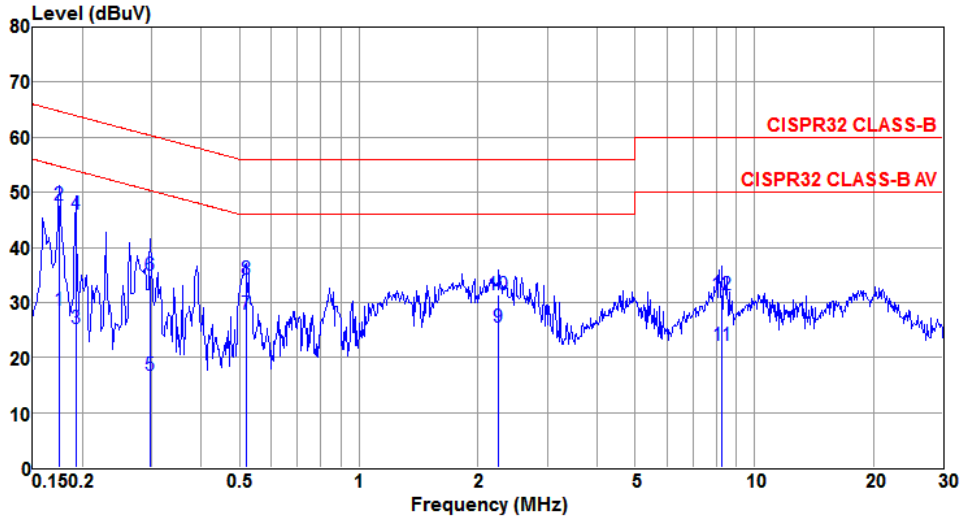
Power Phase	Neutral	Test Mode	2



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1	0.153	36.19	55.82	-19.63	36.05	0.10	0.04	Average
2@	0.153	53.49	65.82	-12.33	53.35	0.10	0.04	QP
3	0.168	32.46	55.08	-22.62	32.32	0.10	0.04	Average
4	0.168	49.85	65.08	-15.23	49.71	0.10	0.04	QP
5	0.252	19.94	51.69	-31.75	19.80	0.10	0.04	Average
6	0.252	38.04	61.69	-23.65	37.90	0.10	0.04	QP
7	0.486	26.56	46.23	-19.67	26.40	0.12	0.04	Average
8	0.486	33.65	56.23	-22.58	33.49	0.12	0.04	QP
9	2.765	26.22	46.00	-19.78	25.97	0.15	0.10	Average
10	2.765	32.82	56.00	-23.18	32.57	0.15	0.10	QP
11	18.622	19.65	50.00	-30.35	19.00	0.40	0.25	Average
12	18.622	25.73	60.00	-34.27	25.08	0.40	0.25	QP

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

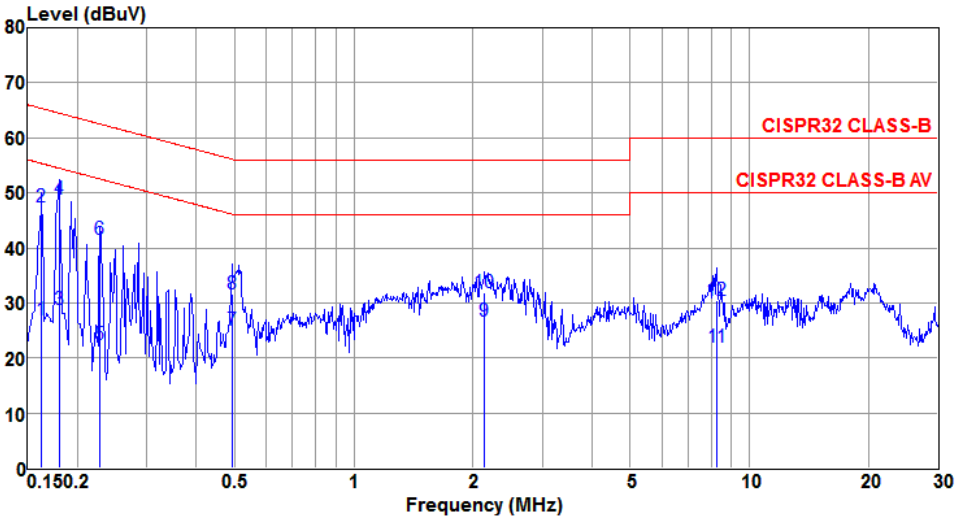
Power Phase	Line	Test Mode	3



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1	0.175	28.68	54.72	-26.04	28.55	0.09	0.04	Average
2@	0.175	47.70	64.72	-17.02	47.57	0.09	0.04	QP
3	0.192	25.28	53.93	-28.65	25.14	0.10	0.04	Average
4	0.192	46.02	63.93	-17.91	45.88	0.10	0.04	QP
5	0.297	16.67	50.32	-33.65	16.55	0.08	0.04	Average
6	0.297	34.86	60.32	-25.46	34.74	0.08	0.04	QP
7	0.518	27.83	46.00	-18.17	27.73	0.06	0.04	Average
8	0.518	34.17	56.00	-21.83	34.07	0.06	0.04	QP
9	2.261	25.39	46.00	-20.61	25.19	0.14	0.06	Average
10	2.261	31.32	56.00	-24.68	31.12	0.14	0.06	QP
11	8.279	22.28	50.00	-27.72	21.88	0.19	0.21	Average
12	8.279	31.32	60.00	-28.68	30.92	0.19	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).

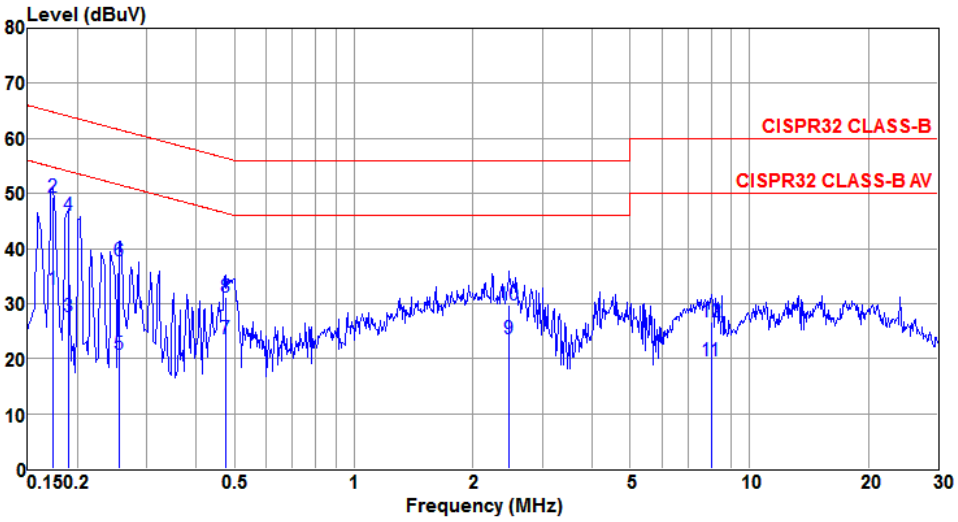
Power Phase	Neutral	Test Mode	3



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1	0.162	26.84	55.34	-28.50	26.70	0.10	0.04	Average
2	0.162	47.48	65.34	-17.86	47.34	0.10	0.04	QP
3	0.180	28.74	54.50	-25.76	28.61	0.09	0.04	Average
4@	0.180	48.75	64.50	-15.75	48.62	0.09	0.04	QP
5	0.228	22.52	52.52	-30.00	22.38	0.10	0.04	Average
6	0.228	41.49	62.52	-21.03	41.35	0.10	0.04	QP
7	0.491	24.95	46.14	-21.19	24.79	0.12	0.04	Average
8	0.491	31.72	56.14	-24.42	31.56	0.12	0.04	QP
9	2.144	26.66	46.00	-19.34	26.45	0.16	0.05	Average
10	2.144	31.82	56.00	-24.18	31.61	0.16	0.05	QP
11	8.279	21.84	50.00	-28.16	21.36	0.27	0.21	Average
12	8.279	30.49	60.00	-29.51	30.01	0.27	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).

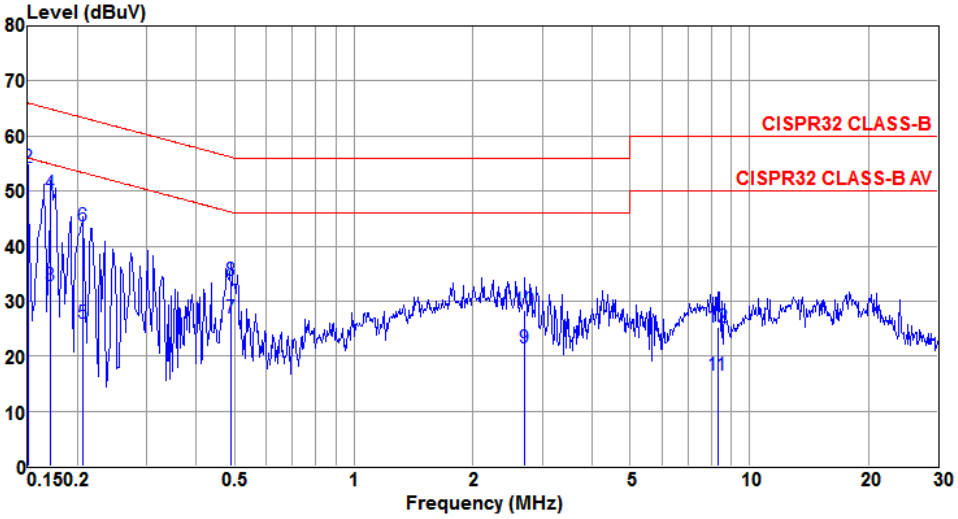
Power Phase	Line	Test Mode	4



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1	0.174	32.47	54.77	-22.30	32.34	0.09	0.04	Average
2@	0.174	49.31	64.77	-15.46	49.18	0.09	0.04	QP
3	0.189	27.59	54.06	-26.47	27.46	0.09	0.04	Average
4	0.189	45.96	64.06	-18.10	45.83	0.09	0.04	QP
5	0.255	20.70	51.60	-30.90	20.57	0.09	0.04	Average
6	0.255	37.72	61.60	-23.88	37.59	0.09	0.04	QP
7	0.474	23.72	46.45	-22.73	23.62	0.06	0.04	Average
8	0.474	31.20	56.45	-25.25	31.10	0.06	0.04	QP
9	2.474	23.50	46.00	-22.50	23.28	0.14	0.08	Average
10	2.474	29.74	56.00	-26.26	29.52	0.14	0.08	QP
11	8.020	19.48	50.00	-30.52	19.08	0.19	0.21	Average
12	8.020	26.63	60.00	-33.37	26.23	0.19	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).

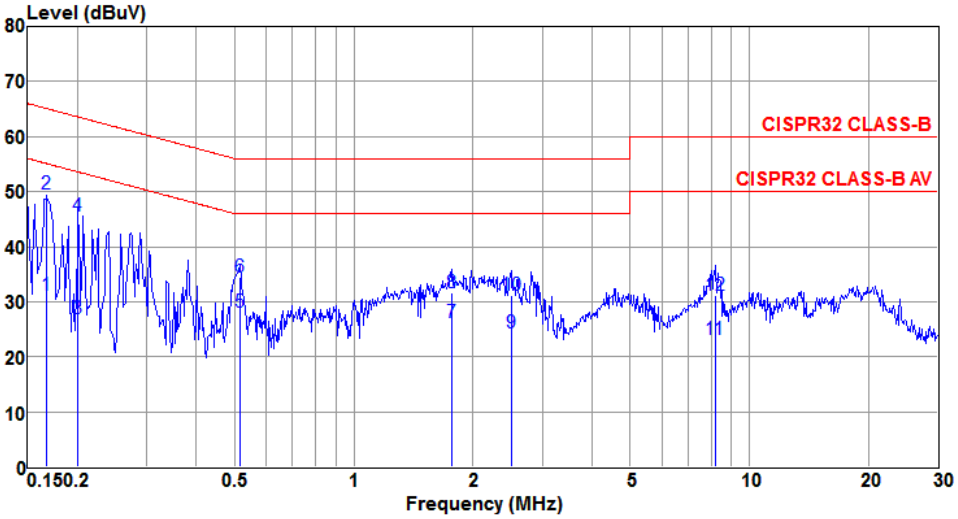
Power Phase	Neutral	Test Mode	4



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1	0.150	36.89	56.00	-19.11	36.75	0.10	0.04	Average
2@	0.150	54.20	66.00	-11.80	54.06	0.10	0.04	QP
3	0.171	32.86	54.90	-22.04	32.72	0.10	0.04	Average
4	0.171	49.50	64.90	-15.40	49.36	0.10	0.04	QP
5	0.207	25.92	53.32	-27.40	25.79	0.09	0.04	Average
6	0.207	43.60	63.32	-19.72	43.47	0.09	0.04	QP
7	0.489	26.83	46.19	-19.36	26.67	0.12	0.04	Average
8	0.489	33.78	56.19	-22.41	33.62	0.12	0.04	QP
9	2.707	21.48	46.00	-24.52	21.24	0.15	0.09	Average
10	2.707	28.31	56.00	-27.69	28.07	0.15	0.09	QP
11	8.323	16.57	50.00	-33.43	16.08	0.28	0.21	Average
12	8.323	25.35	60.00	-34.65	24.86	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).

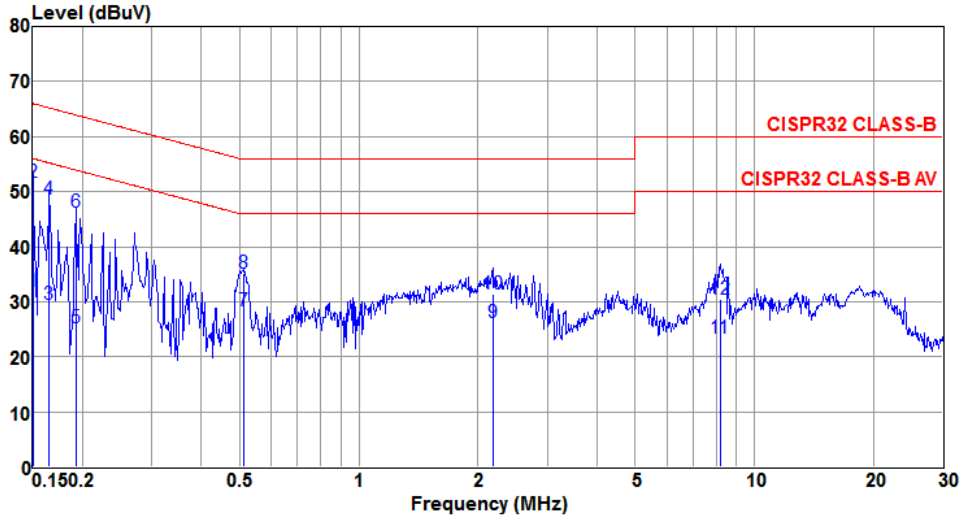
Power Phase	Line	Test Mode	5



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1	0.168	31.20	55.08	-23.88	31.08	0.08	0.04	Average
2@	0.168	49.67	65.08	-15.41	49.55	0.08	0.04	QP
3	0.201	26.80	53.58	-26.78	26.66	0.10	0.04	Average
4	0.201	45.61	63.58	-17.97	45.47	0.10	0.04	QP
5	0.516	28.18	46.00	-17.82	28.08	0.06	0.04	Average
6	0.516	34.44	56.00	-21.56	34.34	0.06	0.04	QP
7	1.772	26.10	46.00	-19.90	25.94	0.12	0.04	Average
8	1.772	31.67	56.00	-24.33	31.51	0.12	0.04	QP
9	2.500	24.38	46.00	-21.62	24.16	0.14	0.08	Average
10	2.500	31.22	56.00	-24.78	31.00	0.14	0.08	QP
11	8.192	23.24	50.00	-26.76	22.84	0.19	0.21	Average
12	8.192	31.23	60.00	-28.77	30.83	0.19	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	Neutral	Test Mode	5



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1	0.150	31.83	56.00	-24.17	31.69	0.10	0.04	Average
2@	0.150	51.58	66.00	-14.42	51.44	0.10	0.04	QP
3	0.165	29.59	55.21	-25.62	29.45	0.10	0.04	Average
4	0.165	48.56	65.21	-16.65	48.42	0.10	0.04	QP
5	0.192	25.18	53.93	-28.75	25.05	0.09	0.04	Average
6	0.192	46.31	63.93	-17.62	46.18	0.09	0.04	QP
7	0.513	28.35	46.00	-17.65	28.19	0.12	0.04	Average
8	0.513	35.08	56.00	-20.92	34.92	0.12	0.04	QP
9	2.178	26.24	46.00	-19.76	26.02	0.16	0.06	Average
10	2.178	31.31	56.00	-24.69	31.09	0.16	0.06	QP
11	8.192	23.32	50.00	-26.68	22.84	0.27	0.21	Average
12	8.192	30.51	60.00	-29.49	30.03	0.27	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).

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	
A	Without any transmit delay or any character error or any degradation of performance.
B	Any transmit delay or any character error. 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.

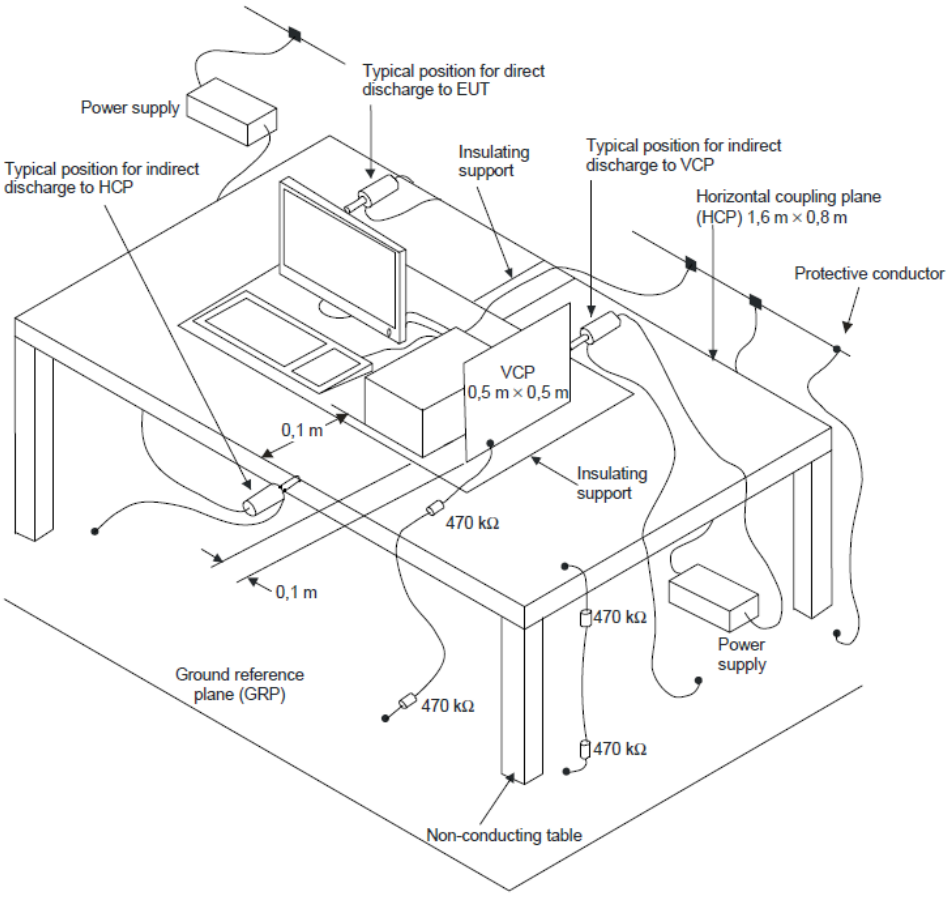
e. For the time interval between successive single discharges an initial value of one second is recommended. Longer intervals may be determined whether a system failure has occurred.

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, 4				
Direct Application					
Test Voltage (kV)	**Polarity**	**Test Point**	**Contact Discharge**	**Air Discharge**	**Performance Criteria**
2, 4, 8	+/-	1	-	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.

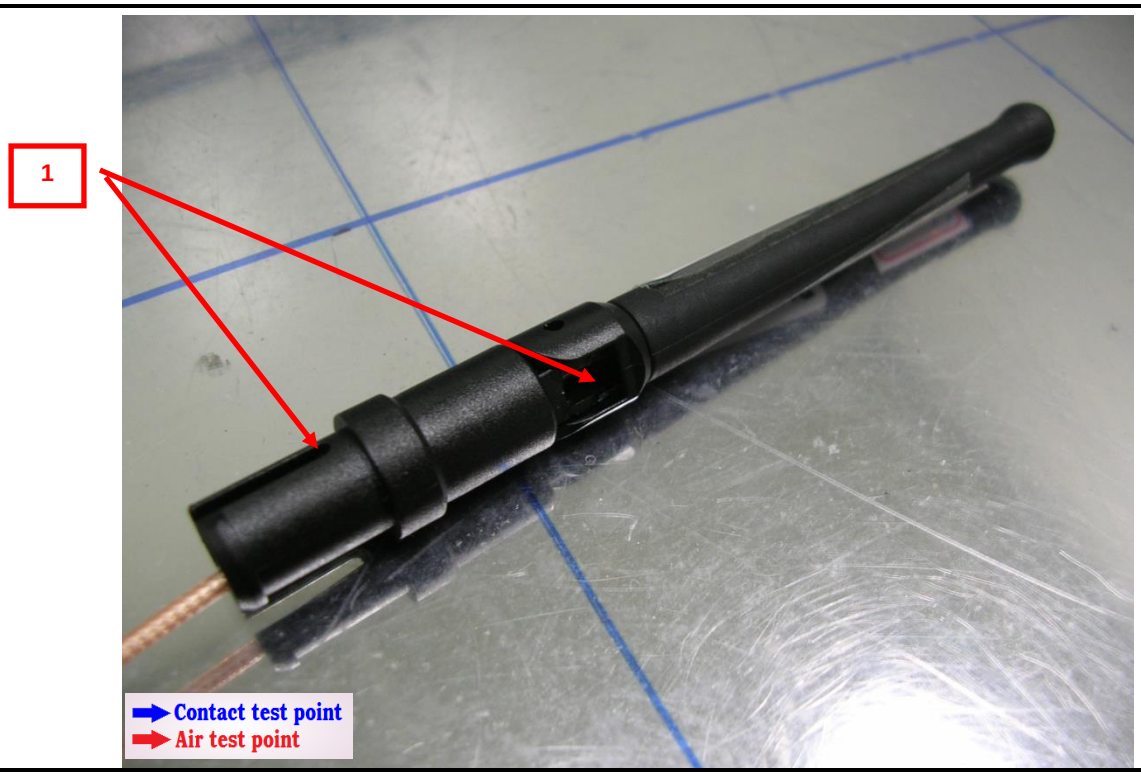
Test Mode	2, 5				
Indirect Application					
Test Voltage (kV)	**Polarity**	**Test Point**	**Horizontal Coupling Plane (HCP)**	**Vertical Coupling Plane (VCP)**	**Performance Criteria**
2, 4	+/-	At front, rear, left and right side	Note	Note	A

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

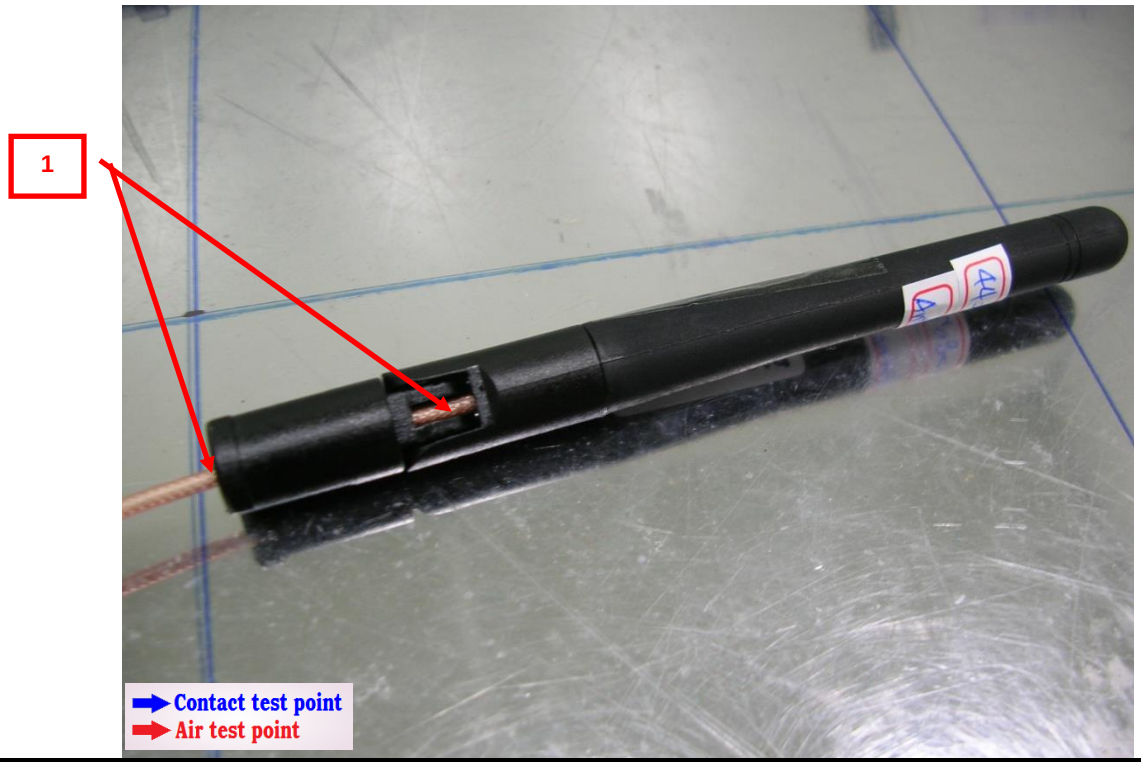
4.3.5 Test Point Photo

Test Mode 1

Test Mode 3



Test Mode 4



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:

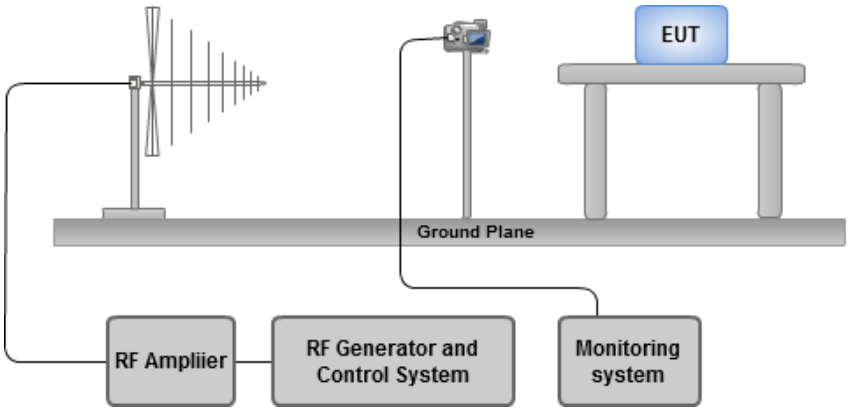
- lower limit of exclusion band = lowest allocated band edge frequency -270 MHz, i.e. 4 880 MHz;
- upper limit of exclusion band = highest allocated band edge frequency +270 MHz, i.e. 5 995 MHz.

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.

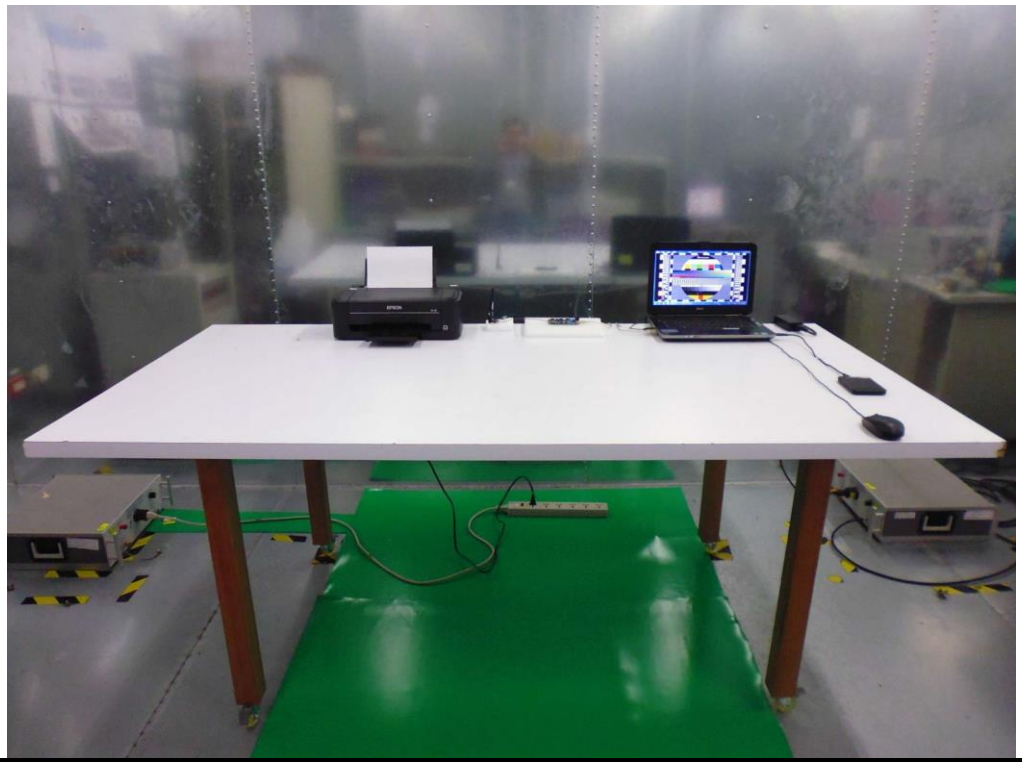
4.4.5 Test Result of Radio Frequency Electromagnetic Field (RS)

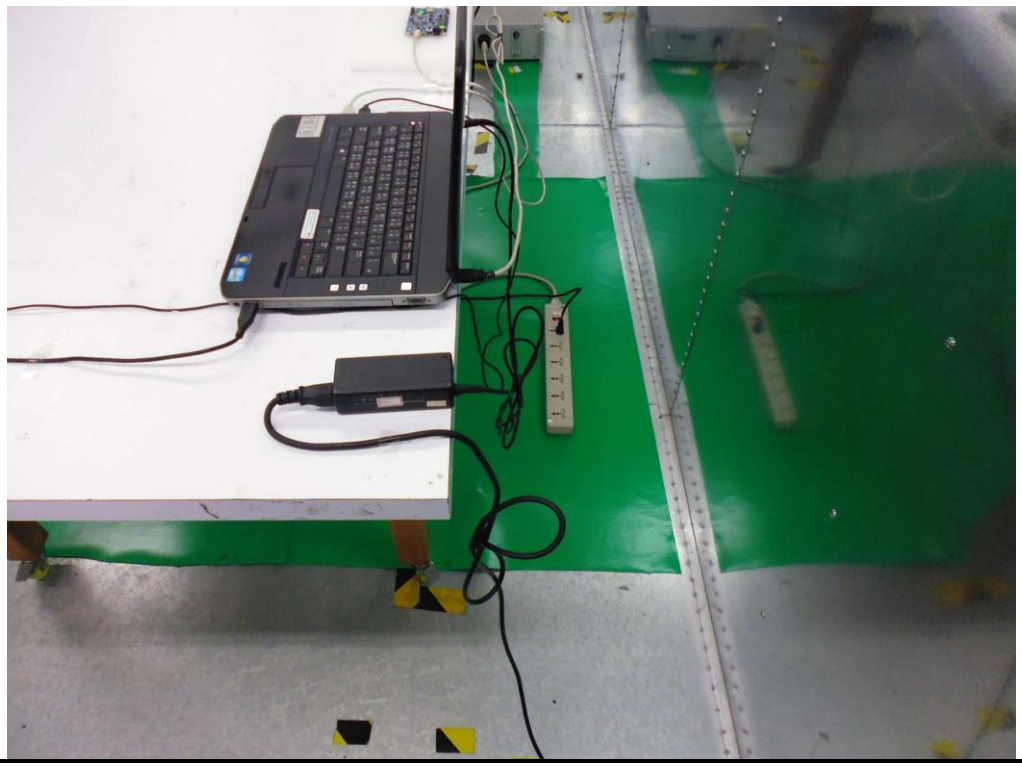
Test Mode	1, 2, 3, 4, 5				
Frequency Range (MHz)	**Azimuth**	**Polarity**	**Test Field Strength (V/m)**	**Observation**	**Performance Criteria**
80 - 6000	0	V&H	3	Note	A
80 - 6000	90	V&H	3	Note	A
80 - 6000	180	V&H	3	Note	A
80 - 6000	270	V&H	3	Note	A

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

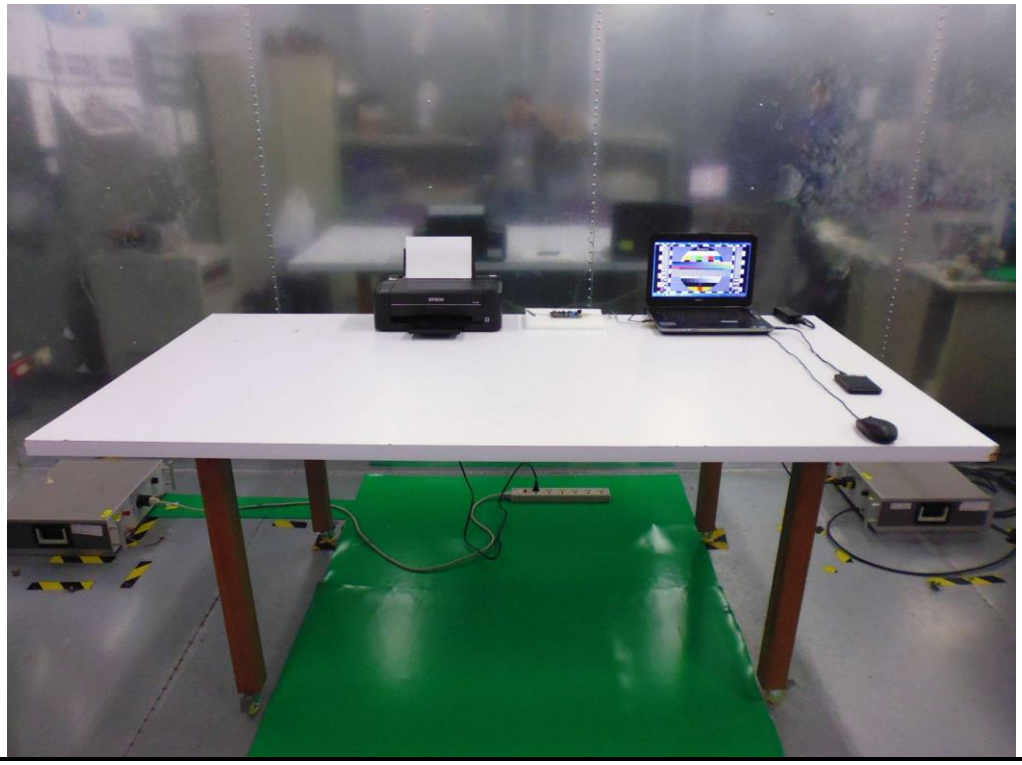
5 Photographs of the Test Configuration

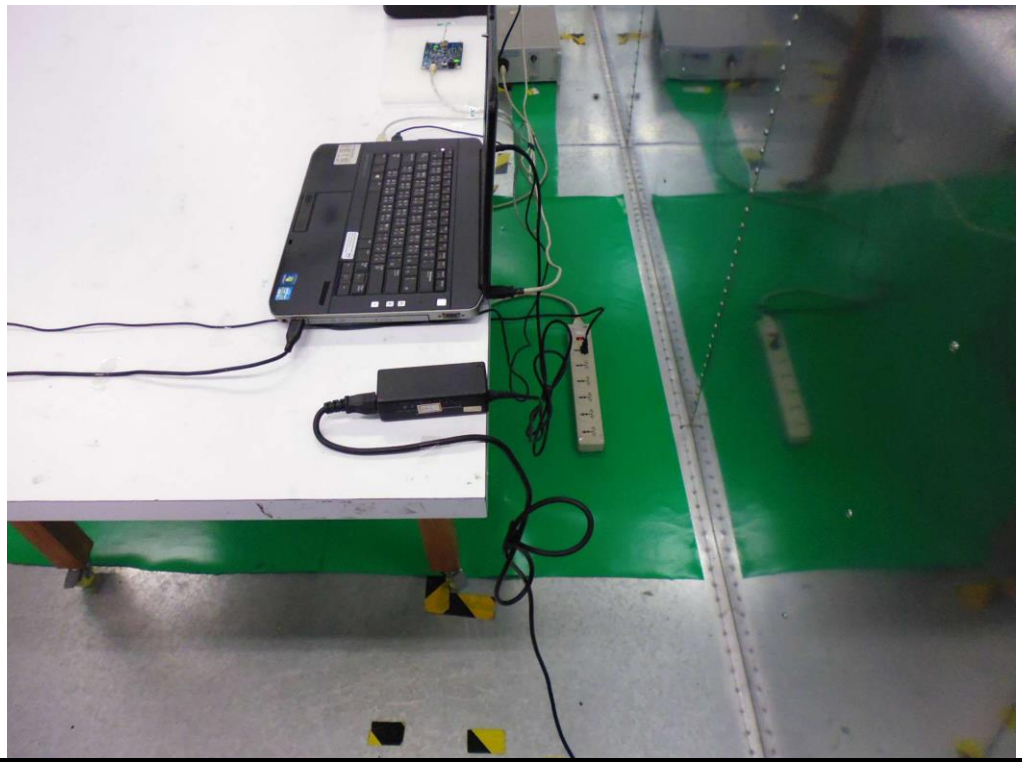
Conducted Emissions from the AC mains power ports (Test Mode 1)



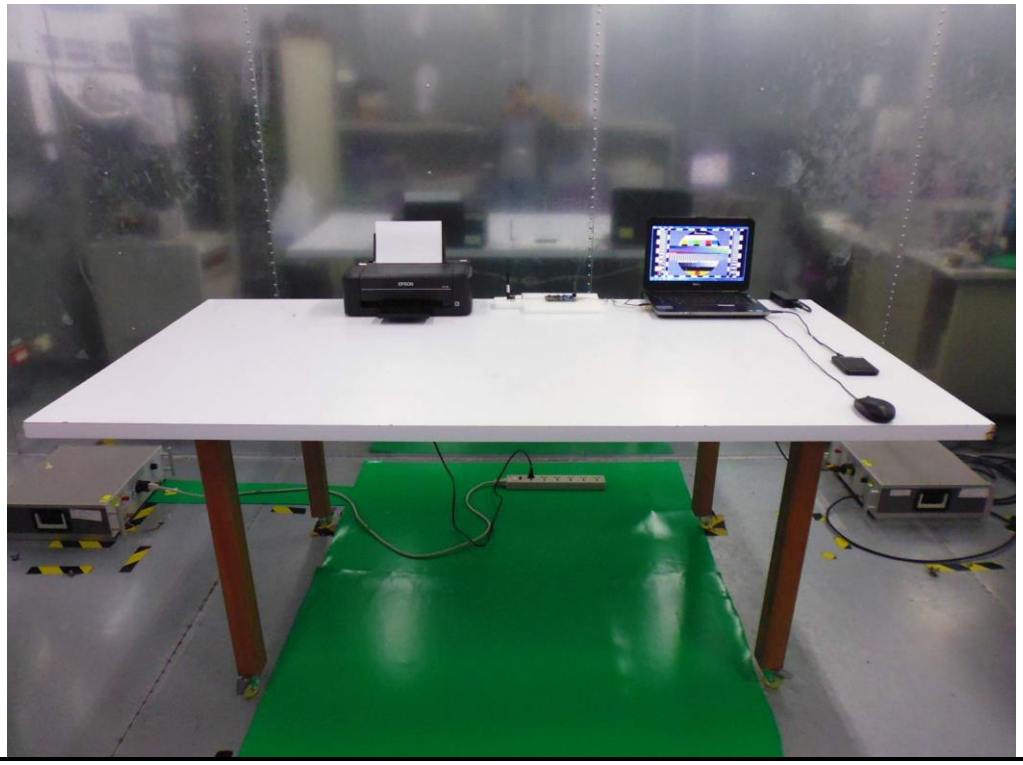


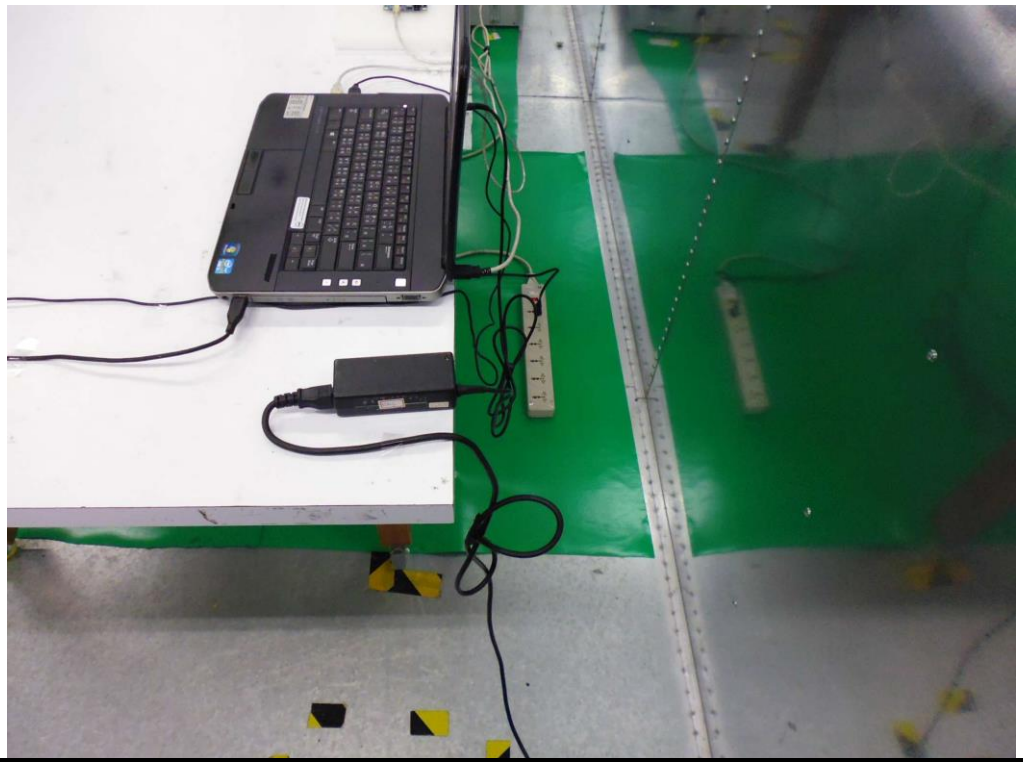
Conducted Emissions from the AC mains power ports (Test Mode 2)



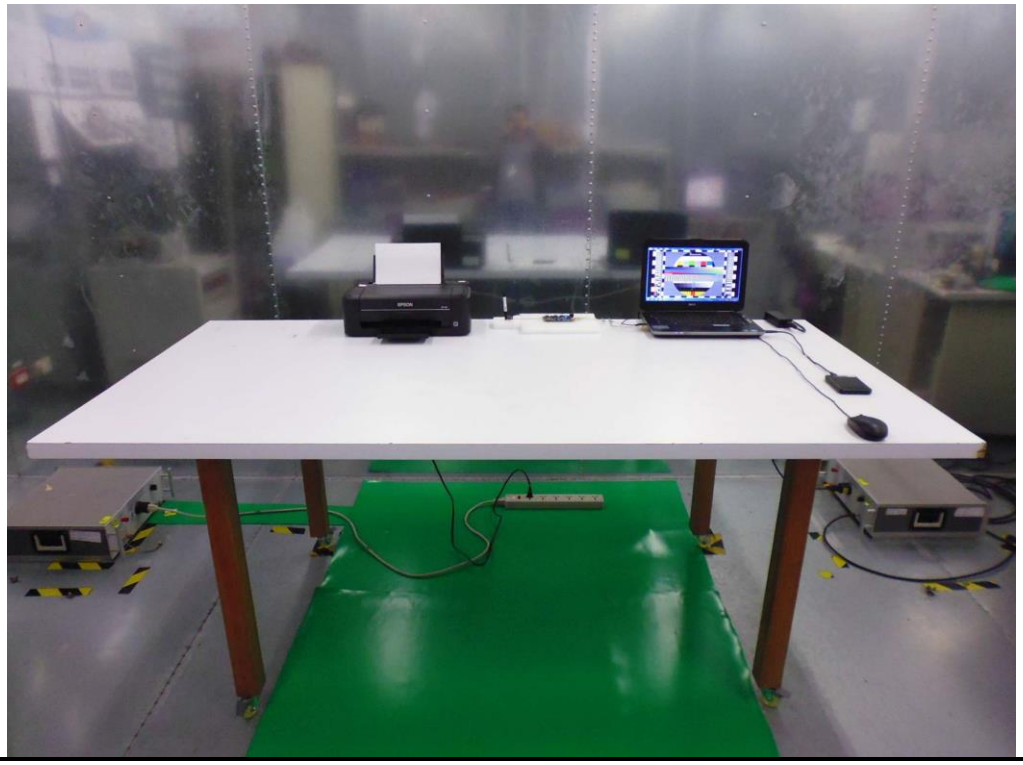


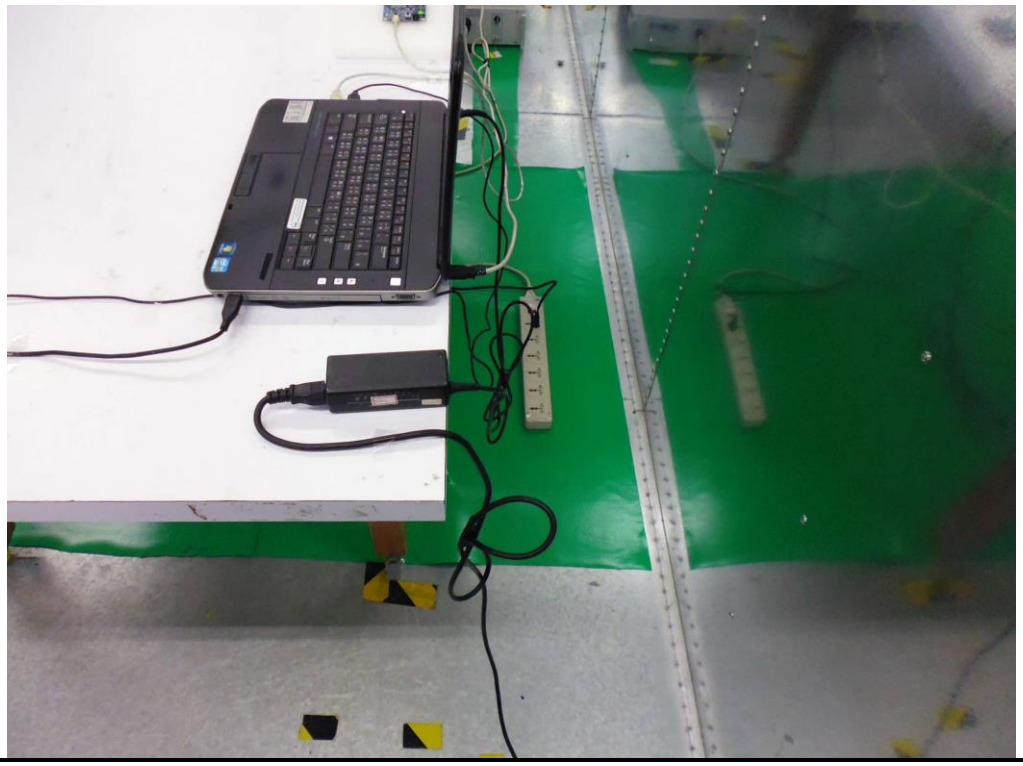
Conducted Emissions from the AC mains power ports (Test Mode 3)



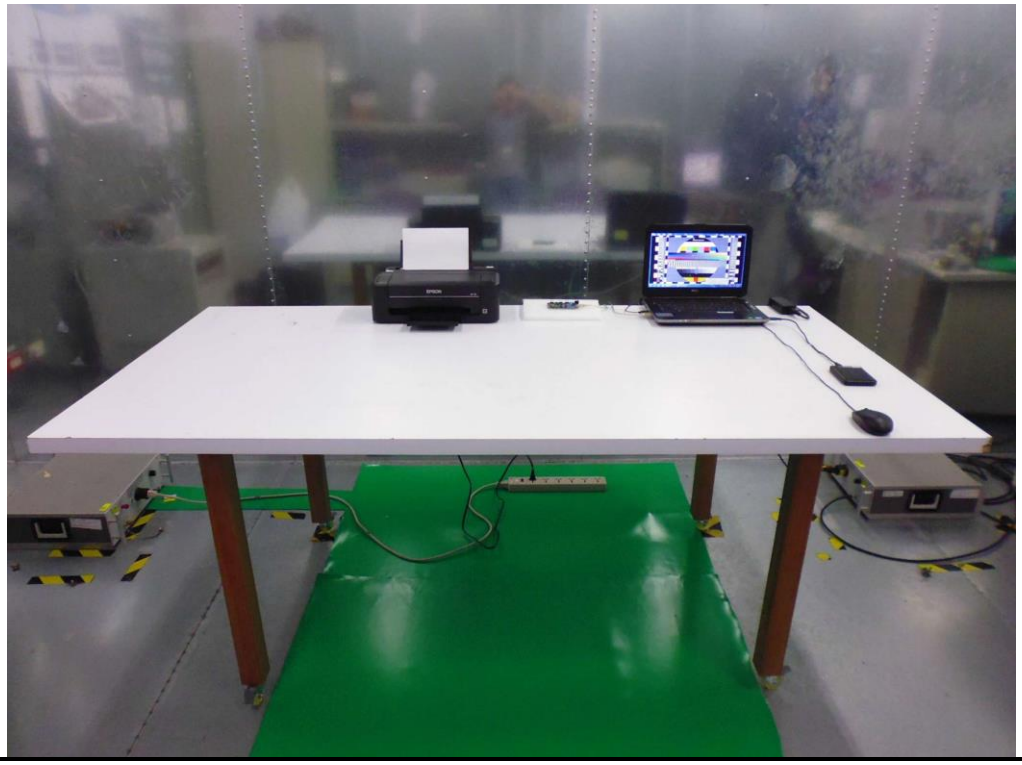


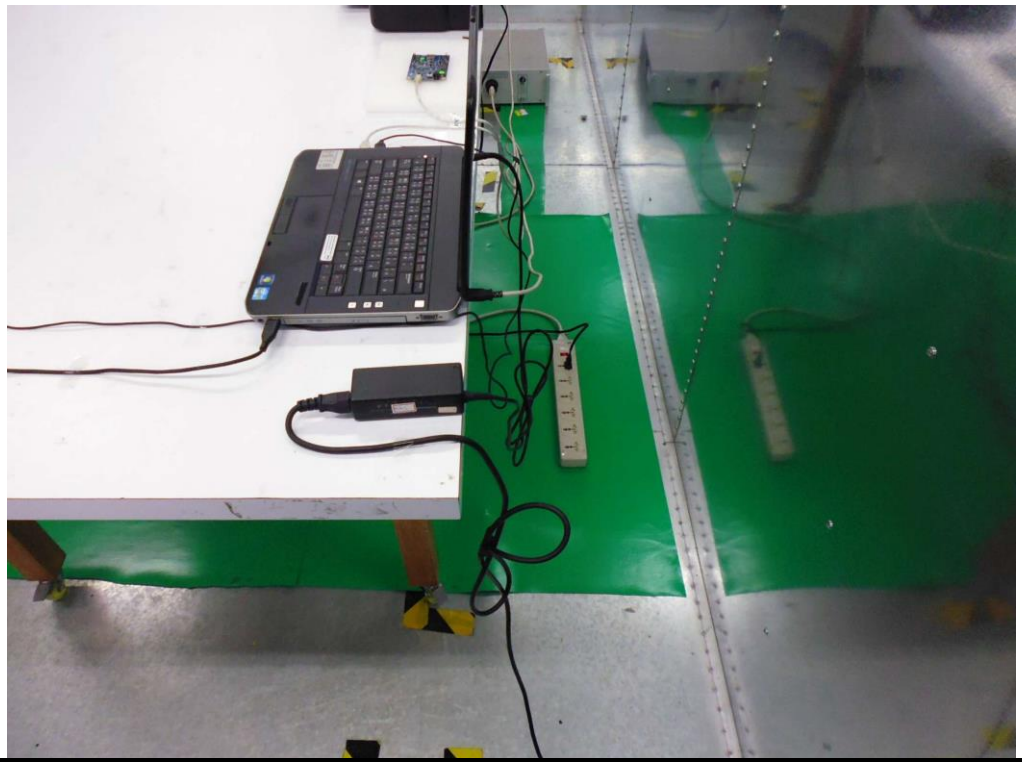
Conducted Emissions from the AC mains power ports (Test Mode 4)



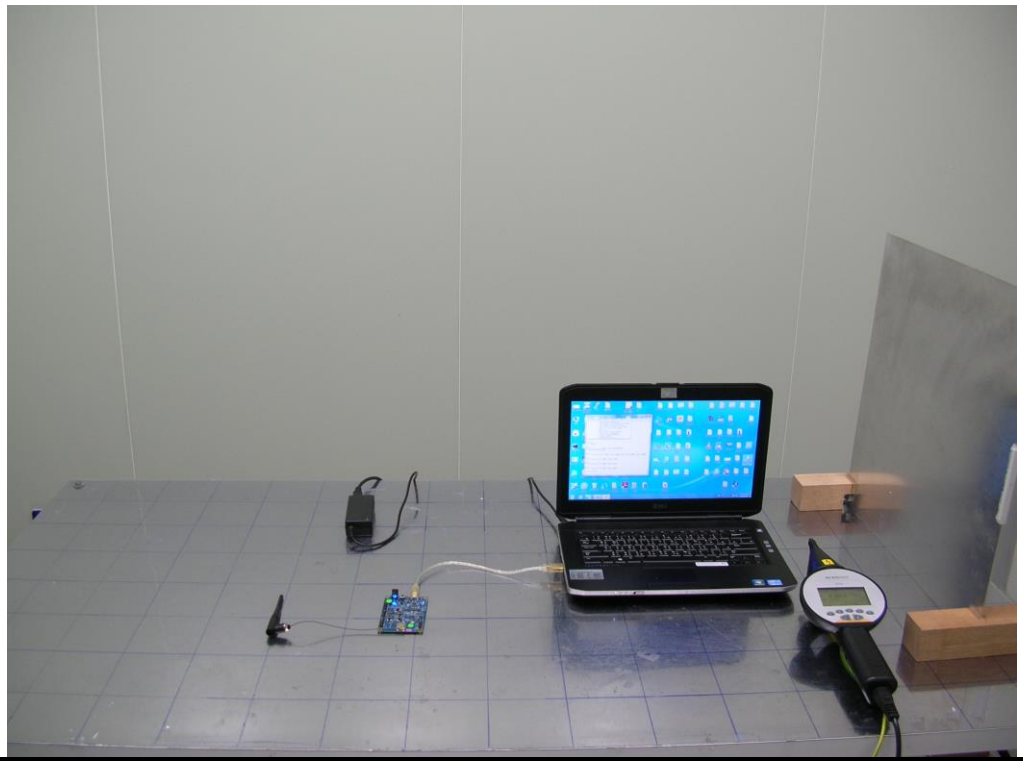


Conducted Emissions from the AC mains power ports (Test Mode 5)



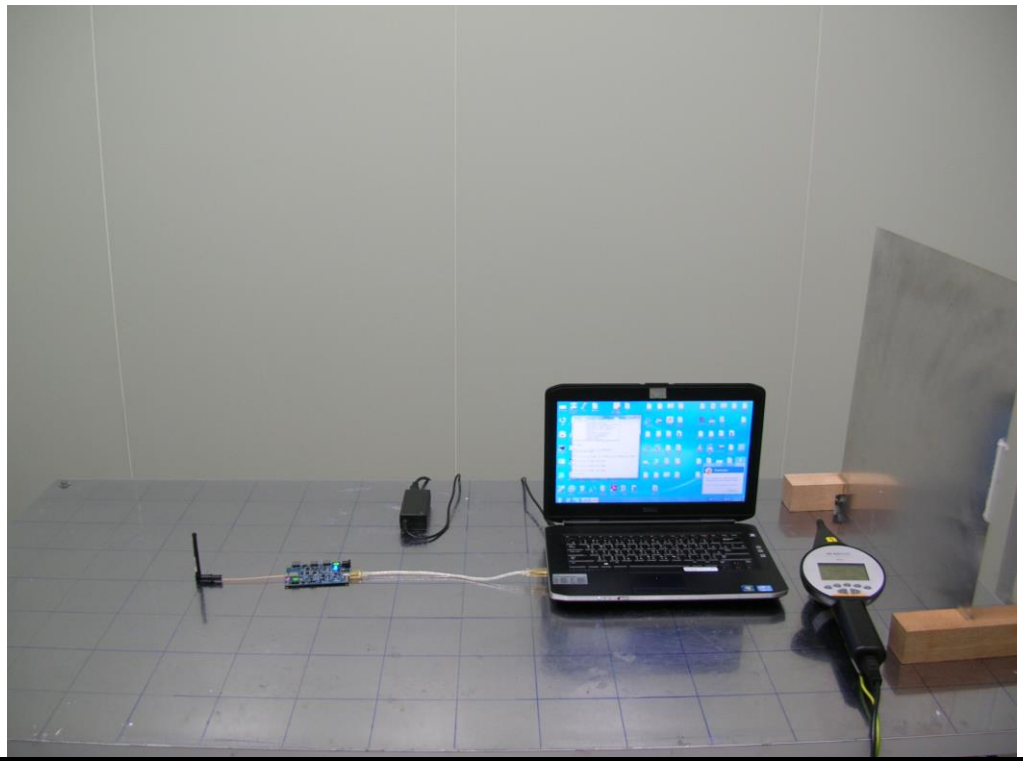


ESD Test (Test Mode 1)

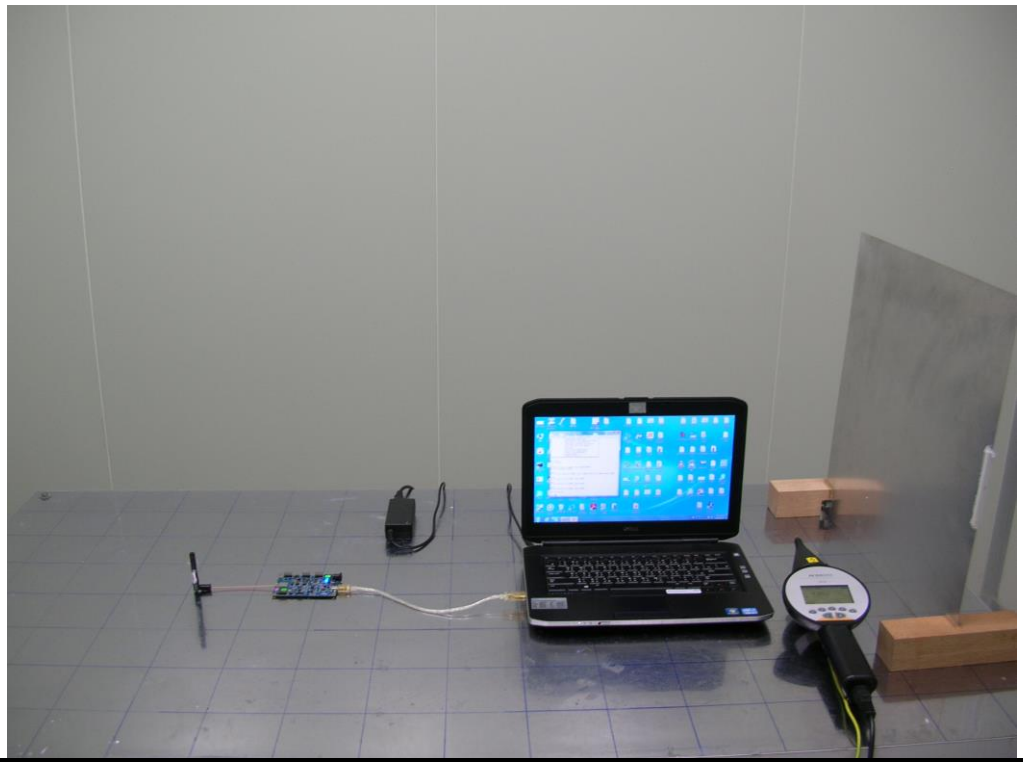


ESD Test (Test Mode 2)

ESD Test (Test Mode 3)

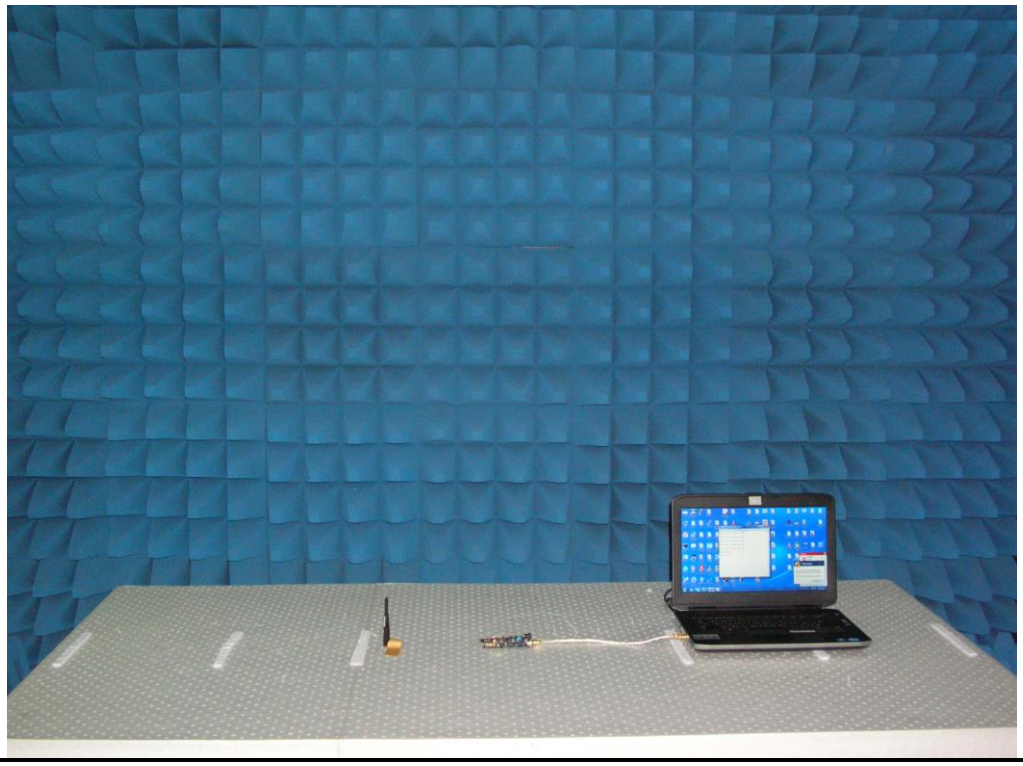


ESD Test (Test Mode 4)

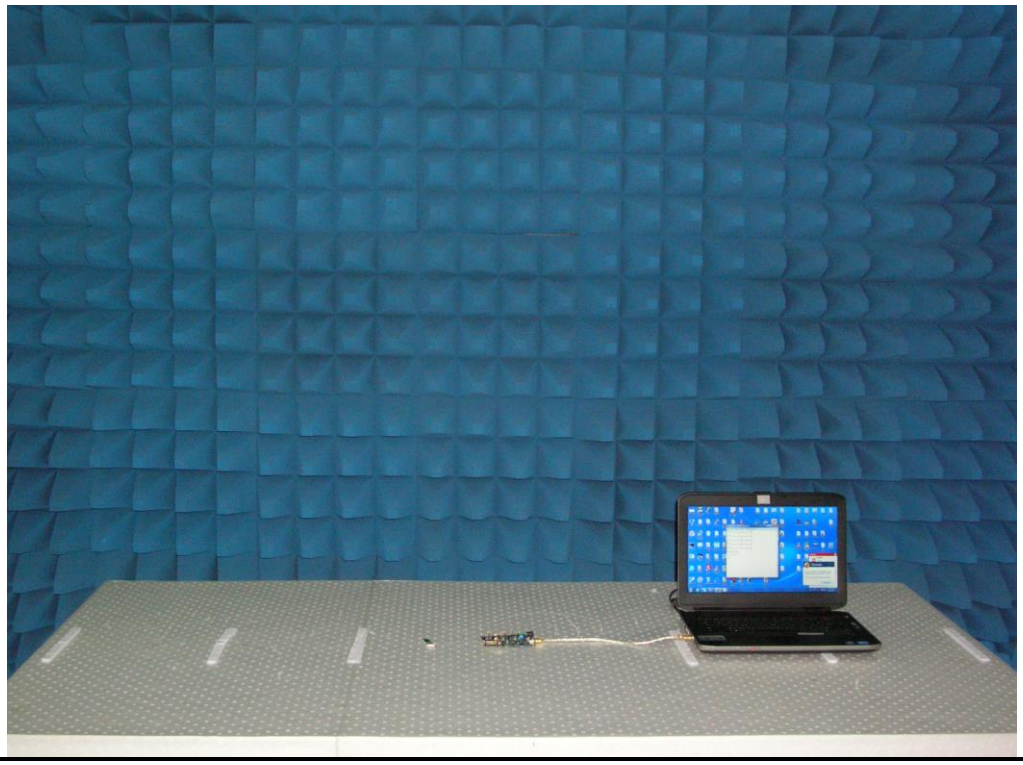


ESD Test (Test Mode 5)

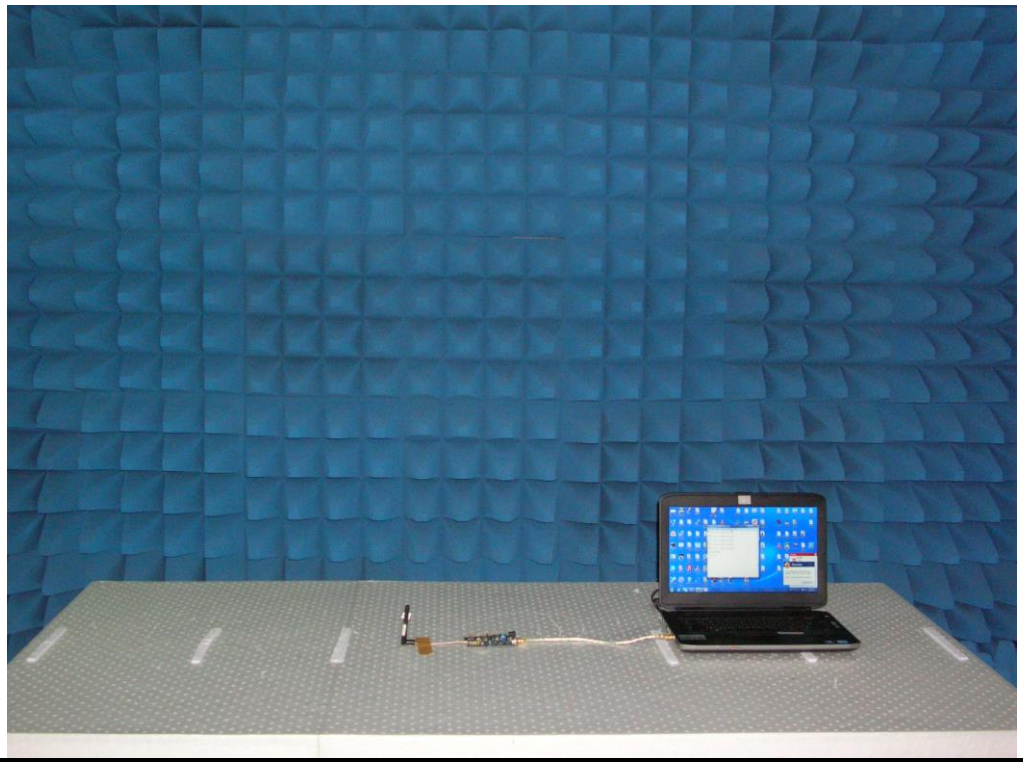
RS Test (Test Mode 1)



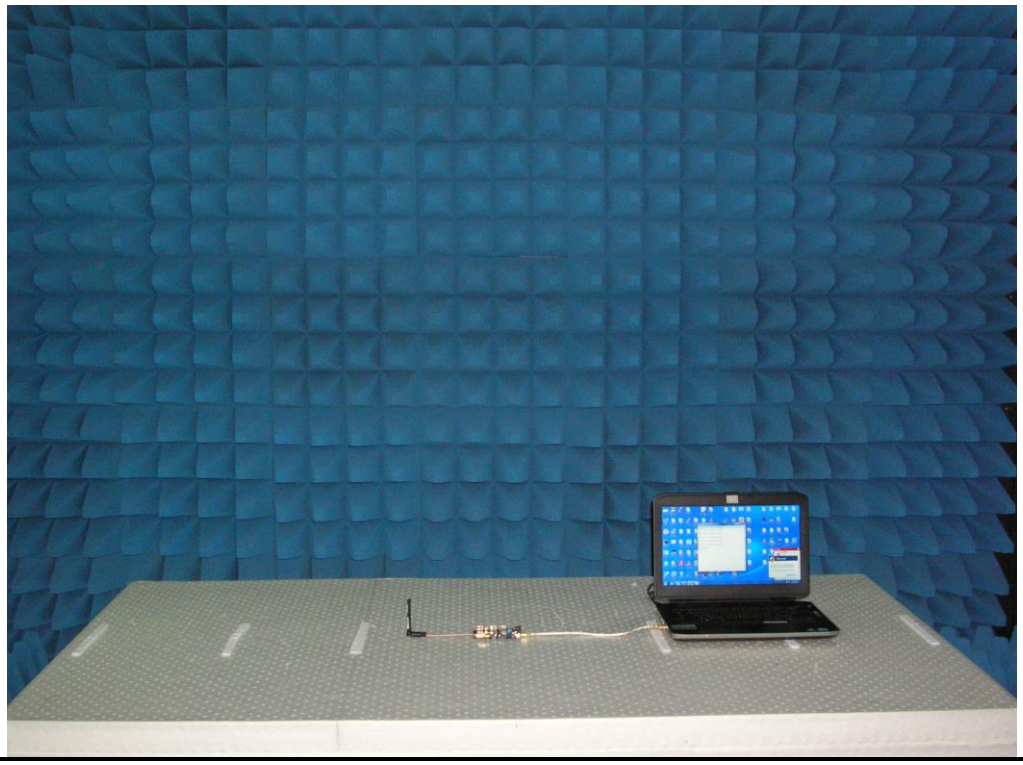
RS Test (Test Mode 2)



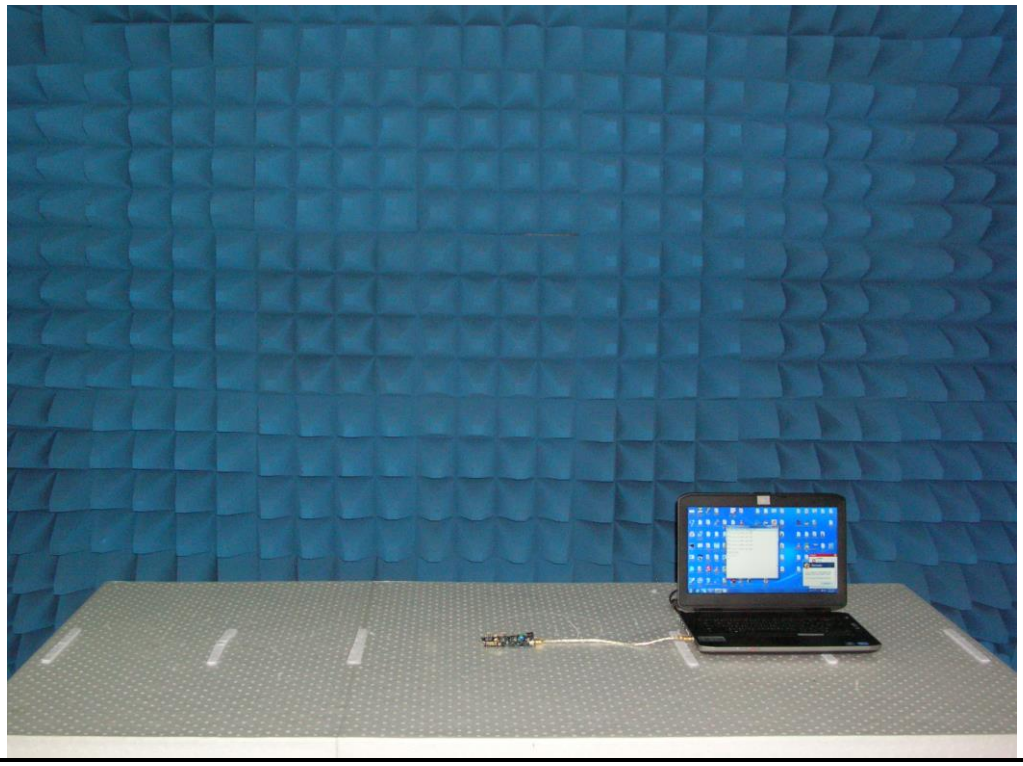
RS Test (Test Mode 3)



RS Test (Test Mode 4)



RS Test (Test Mode 5)



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

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Email: ICC_Service@icertifi.com.tw

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