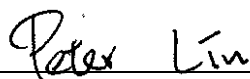


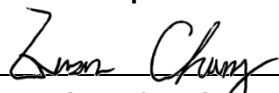
CE EMC Test Report

Equipment : 802.11ac Professional Wi-Fi + BT5.0 Module
Model No. : SU60-SOMC (453-00003),
SU60-SOMC-2G (453-00004)
Brand Name : Laird
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. 11, 2018
Tested Date : Aug. 01 ~ Aug. 13, 2018

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:

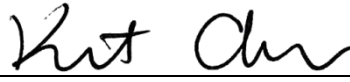

Kent Chen / Assistant Manager



Table of Contents

1	GENERAL DESCRIPTION	6
1.1	Information.....	6
1.2	Test Equipment and Calibration Data	8
1.3	Testing Applied Standards	10
1.4	Measurement Uncertainty	10
2	TEST CONFIGURATION.....	11
2.1	Testing Condition	11
2.2	The Worst Case Measurement Configuration.....	11
2.3	Local Support Equipment List	13
2.4	Test Setup Chart	14
2.5	Test Software and Operating Condition	16
3	EMISSION TEST RESULTS.....	17
3.1	Conducted Emissions from the AC mains power ports.....	17
4	IMMUNITY TESTS	31
4.1	General Description.....	31
4.2	Performance Criteria Description	32
4.3	Electrostatic Discharge (ESD).....	34
4.4	Radio Frequency Electromagnetic Field (RS).....	38
5	PHOTOGRAPHS OF THE TEST CONFIGURATION	41
6	TEST LABORATORY INFORMATION	54

Release Record

Report No.	Version	Description	Issued Date
EH841101	Rev. 01	Initial issue	Dec. 21, 2018

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	-18.63dB AV@ 0.402MHz.	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. Note¹: The EUT w/o telecom port. Note²: According to Clause 7.1 of Draft EN 301 489-1, the test is not required. Note³: The EUT consumes DC power from host, so the test is not required.				

Declaration of Conformity:

The judgement of conformity in the report is based on the measurement results excluding the measurement uncertainty.

Comments and Explanations:

None

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
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 from host, so the test is not required. “*”: Test method reported herein was performed according to the method specified by applicant.					

1 General Description

1.1 Information

1.1.1 Product Details

The following models are provided to this EUT.

Brand Name	Model Name	Product Name	Description
Laird	SU60-SOMC (453-00003)	802.11ac Professional Wi-Fi + BT5.0 Module	2G/1G MCP
	SU60-SOMC-2G (453-00004)		4G/2G MCP

1.1.2 Specification of the Equipment under Test (EUT)

BT	
Operating Frequency	2402 MHz ~ 2480 MHz
Modulation Type	Bluetooth 4.2 LE: GFSK Bluetooth BR(1Mbps): GFSK Bluetooth EDR (2Mbps): $\pi/4$ -DQPSK Bluetooth EDR (3Mbps): 8-DPSK
WIFI	
Operating Frequency	802.11b/g/n: 2412 MHz ~ 2472 MHz 802.11a/n/ac: 5180 MHz ~ 5240 MHz; 5260 MHz ~ 5320 MHz; 5500 MHz ~ 5700 MHz
Modulation Type	802.11b: DSSS (DBPSK / DQPSK / CCK) 802.11a/g/n/ac: OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM)
S/W Version	6.0.0.x

1.1.3 Antenna Details

Brand	Model	Type	Connector	Operating Frequency (MHz) / Gain (dBi)			
				2400~2483.5	5150~5250	5250~5350	5470~5725
LSR	001-0009	Dipole	IPEX U.FL	2	2		
Laird	NanoBlade-IP04	PCB Dipole	IPEX U.FL	2	3.9	3.9	4
Laird	MAF95310 Mini NanoBlade Flex	PCB Dipole	IPEX U.FL	2.79	3.38		
LSR	FlexPIFA 001-0016	PIFA	IPEX U.FL	2.5	3		
Ethertronics	WLAN_1000146	Magnetic Dipole	IPEX U.FL	2.5	3.5	3.5	3.5
Laird	MIMO FlexPIFA Antenna	PIFA	IPEX U.FL	2	3		
LSR	001-0009 (with filter)	Dipole	IPEX U.FL	2	2		

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

Power Supply Type	3.3 Vdc from host
-------------------	-------------------

1.1.5 Accessories

Accessories		
No.	Equipment	Description
1	AC Adapter	Brand Name: I.T.E POWER SUPPLY Model Name: MU12AY120100-A1 Power Rating: I/P: 100-240Vac, 50/60Hz, 0.3A O/P: 12Vdc, 1A Power Line: 1.48m non-shielded cable without core

1.2 Test Equipment and Calibration Data

Test Item	Conducted Emission				
Test Site	Conduction room 1 / (CO01-WS)				
Tested Date	Aug. 01, 2018				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Receiver	R&S	ESR3	101657	Jan. 05, 2018	Jan. 04, 2019
LISN	SCHWARZBECK	Schwarzbeck 8127	8127-667	Nov. 13, 2017	Nov. 12, 2018
LISN (Support Unit)	SCHWARZBECK	Schwarzbeck 8127	8127-666	Nov. 24, 2017	Nov. 23, 2018
RF Cable-CON	EMC	EMCCFD300-BM-B M-6000	50821	Dec. 18, 2017	Dec. 17, 2018
50 ohm terminal (Support Unit)	NA	50	04	May 22, 2018	May 21, 2019
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	Aug. 10, 2018				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
ESD Generator	EMTest	Dito	V1248114239	Aug. 16, 2017	Aug. 15, 2018
Note: Calibration Interval of instruments listed above is one year.					

Test Item	ESD				
Test Site	ESD room 1 / (ES01-WS)				
Tested Date	Oct. 11 ~ Oct. 26, 2018				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
ESD Generator	EMTest	Dito	V1248114239	Aug. 23, 2018	Aug. 22, 2019
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	Aug. 13 ~ Oct. 11, 2018				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Signal Generator	R&S	SMB100A	103924HA	Oct. 16, 2017	Oct. 15, 2018
Power Sensor	R&S	NRP-Z91	101094-UL	Oct. 16, 2017	Oct. 15, 2018
Power Sensor	R&S	NRP-Z91	101095-KY	Oct. 16, 2017	Oct. 15, 2018
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.					

Test Item	Radiated Immunity (80 MHz - 6 GHz)				
Test Site	RS room 1 / (RS01-WS)				
Tested Date	Aug. 13 ~ Oct. 25, 2018				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Signal Generator	R&S	SMB100A	103924HA	Oct. 23, 2018	Oct. 22, 2019
Power Sensor	R&S	NRP-Z91	101094-UL	Oct. 16, 2018	Oct. 15, 2019
Power Sensor	R&S	NRP-Z91	101095-KY	Oct. 16, 2018	Oct. 15, 2019
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	24°C/56%	Alex Tsai
ESD	ES01-WS	25°C/50%/100kPa	JN Chen
RS	RS01-WS	26°C/60%/100kPa	JN Chen

2.2 The Worst Case Measurement Configuration

Pretest Mode	
Pretest Mode	Operating Description
1	EUT(2Gb FLASH + 1Gb RAM): WiFi 5G & BT Link, EUT orientation: X-axis, Ant: 001-0009,
2	EUT(2Gb FLASH + 1Gb RAM): WiFi 2.4G & BT Link, EUT orientation: X-axis, Ant: NanoBlade-IP04
3	EUT(2Gb FLASH + 1Gb RAM): WiFi 5G & BT Link, EUT orientation: X-axis, Ant: MAF95310 Mini NanoBlade Flex
4	EUT(2Gb FLASH + 1Gb RAM): WiFi 2.4G & BT Link, EUT orientation: X-axis, Ant: FlexPIFA 001-0016
5	EUT(2Gb FLASH + 1Gb RAM): WiFi 5G & BT Link, EUT orientation: X-axis, Ant: MIMO FlexPIFA Antenna
6	EUT(2Gb FLASH + 1Gb RAM): WiFi 2.4G & BT Link, EUT orientation: X-axis, Ant: WLAN_1000146
7	EUT(4Gb FLASH + 2Gb RAM): WiFi 5G & BT Link, EUT orientation: X-axis, Ant: LSR/001-0009,
1) For Pretest Mode 7 is the worst case and only its data was record in this test report. 2) The EUT was pretested with 3 orientations placed on the table for the radiated emission measurement – X, Y, and Z-axis. The X-axis results were found as the worst case and were shown in this report.	

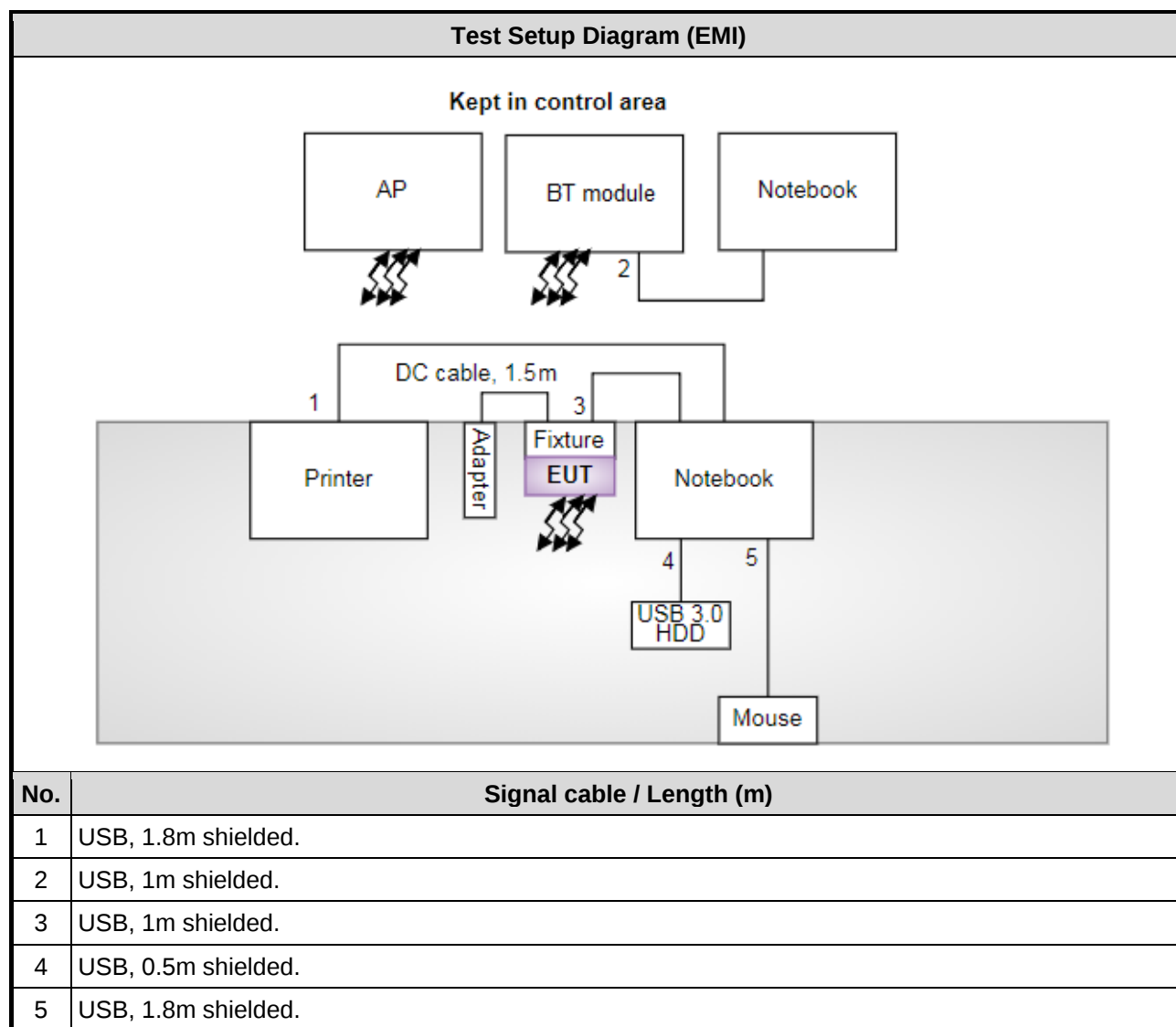
The Determined Worst Case Configurations	
Conducted Emissions from the AC mains power ports	
Test Mode	Operating Description
1	WiFi 5G & BT Link, EUT(4Gb FLASH + 2Gb RAM), EUT orientation: X-axis, Ant: 001-0009, 230V/50Hz
2	WiFi 2.4G & BT Link, EUT(4Gb FLASH + 2Gb RAM), EUT orientation: X-axis, Ant: NanoBlade-IP04, 110V/60Hz
3	WiFi 5G & BT Link, EUT(4Gb FLASH + 2Gb RAM), EUT orientation: X-axis, Ant: MAF95310 Mini NanoBlade Flex, 230V/50Hz
4	WiFi 2.4G & BT Link, EUT(4Gb FLASH + 2Gb RAM), EUT orientation: X-axis, Ant: FlexPIFA 001-0016, 110V/60Hz
5	WiFi 5G & BT Link, EUT(4Gb FLASH + 2Gb RAM), EUT orientation: X-axis, Ant: MIMO FlexPIFA Antenna, 230V/50Hz
6	WiFi 2.4G & BT Link, EUT(4Gb FLASH + 2Gb RAM), EUT orientation: X-axis, Ant: WLAN_1000146 , 110V/60Hz
ESD, RS Tests	
Test Mode	Operating Description
1	WiFi 5G & BT Link, Ant: 001-0009, EUT(4Gb FLASH + 2Gb RAM)
2	WiFi 2.4G & BT Link, Ant: NanoBlade-IP04, EUT(2Gb FLASH + 1Gb RAM)
3	WiFi 5G& BT Link, Ant: MAF95310 Mini NanoBlade Flex, EUT(2Gb FLASH + 1Gb RAM)
4	WiFi 2.4G& BT Link, Ant: FlexPIFA 001-0016, EUT(2Gb FLASH + 1Gb RAM)
5	WiFi 5G& BT Link, Ant: MIMO FlexPIFA Antenna, EUT(2Gb FLASH + 1Gb RAM)
6	WiFi 2.4G & BT Link,BT Link, Ant: WLAN_1000146, EUT(2Gb FLASH + 1Gb RAM)

2.3 Local Support Equipment List

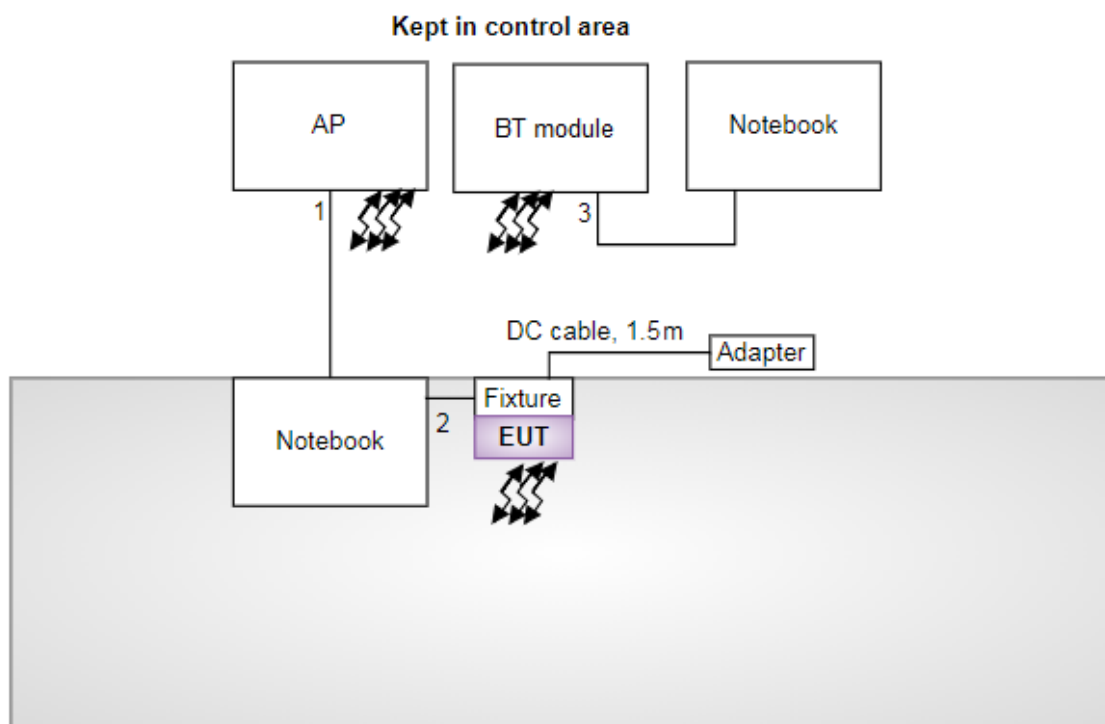
Support Equipment List (EMI)					
No.	Equipment	Brand	Model	S/N	Remarks
1	Notebook	DELL	Latitude E6440	8VXMD12	---
2	Printer	EPSON	XP-30	QSDK002410	---
3	USB 3.0 HDD	WD	WDBKXH5000 ABK	WX31AB210213	---
4	Mouse	DELL	MS111-L	2C3-00MM	---
5	AP	D-LINK	DIR-850L	RZ1Q4G6000263	---
6	Notebook	DELL	Latitude E6440	2PXMD12	---
7	Fixture	---	---	---	Provided by applicant.
8	Adapter	LEADER	MU24AY12020 0-A1	---	Provided by applicant.
9	BT module	---	BL651-SA	---	Provided by applicant.

Support Equipment List (EMS)					
No.	Equipment	Brand	Model	S/N	Remarks
1	Notebook	DELL	Latitude E5430	6R4RWW1	---
2	Notebook	DELL	Latitude E5430	264RWW1	---
3	Wireless AP	D-LINK	DIR-850L	RZ1Q4G6000263	---
4	Fixture	---	---	---	Provided by applicant.
5	Adapter	LEADER	MU24AY12020 0-A1	---	Provided by applicant.
6	BT module	---	BL651-SA	---	Provided by applicant.

2.4 Test Setup Chart



Test Setup Diagram (EMS)



No.	Signal cable / Length (m)
1	RJ45, 2.5m non-shielded.
2	USB, 1m shielded.
3	USB, 1m shielded.

2.5 Test Software and Operating Condition

EMI

- a. Enabled all function of test system.
- b. The support notebook executed "WinEMC.exe" to send "H" patterns to the printer.
- c. The support notebook executed "WinEMC.exe" to read and wrote data from USB 3.0 HDD.
- d. The notebook executed "KM player.exe" to play colorbar video.
- e. The support notebook executed putty command to link with BT Module via EUT.
- f. The support notebook communicated with the EUT by using ping command through AP to receive and transmit data by WLAN.

EMS

- a. To enable all function of test system.
- b. The support notebook executed putty command to link with BT Module via EUT
- c. The support AP communicated with support notebook via EUT by using ping command over Wireless LAN network.

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

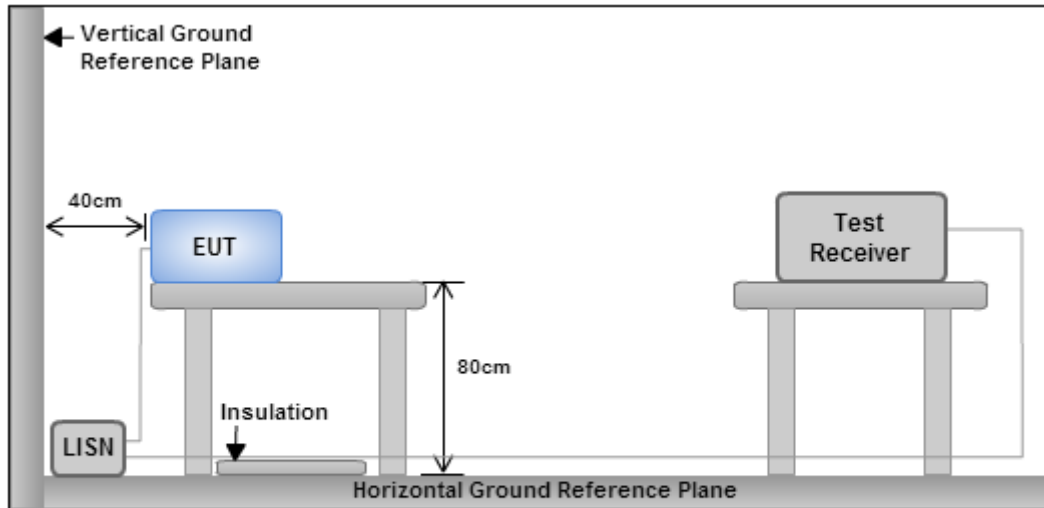
Frequency range (MHz)	Limits values (dBμV)			
	Class A		Class B	
	Quasi-peak	Average	Quasi-peak	Average
0.15 to 0,50	79	66	66 to 56 *	56 to 46 *
0,50 to 5	73	60	56	46
5 to 30	73	60	60	50

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

- 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.
- A thickness of $\leq 0.15\text{m}$ insulation should be placed between local AE and associated cabling and the RGP.
- Connect EUT to the power mains through a line impedance stabilization network (LISN).
- All the support units are connecting to the other LISN.
- The LISN provides 50 ohm coupling impedance for the measuring instrument.
- The CISPR states that a 50 ohm, 50 microhenry LISN should be used.
- Both sides of AC line were checked for maximum conducted interference.
- The frequency range from 150 kHz to 30 MHz was searched.
- Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

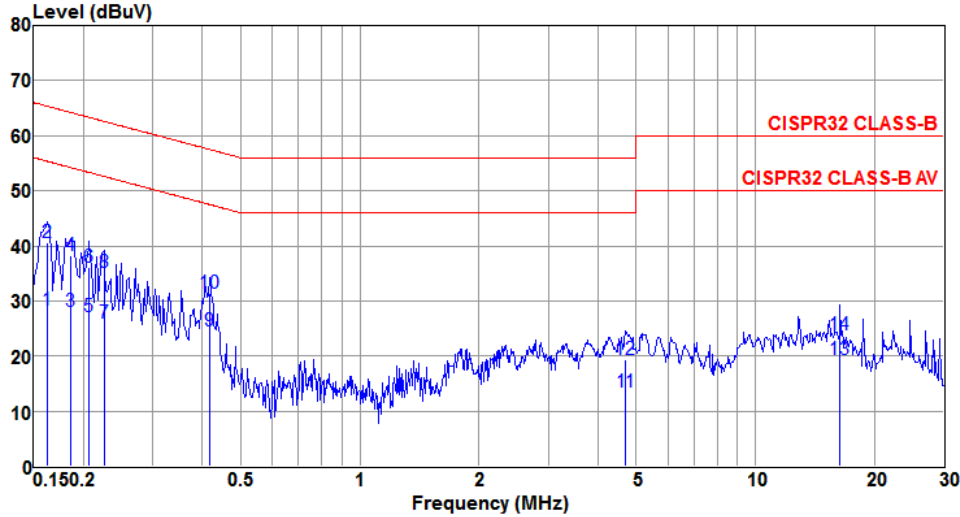
3.1.3 Test Setup



- 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

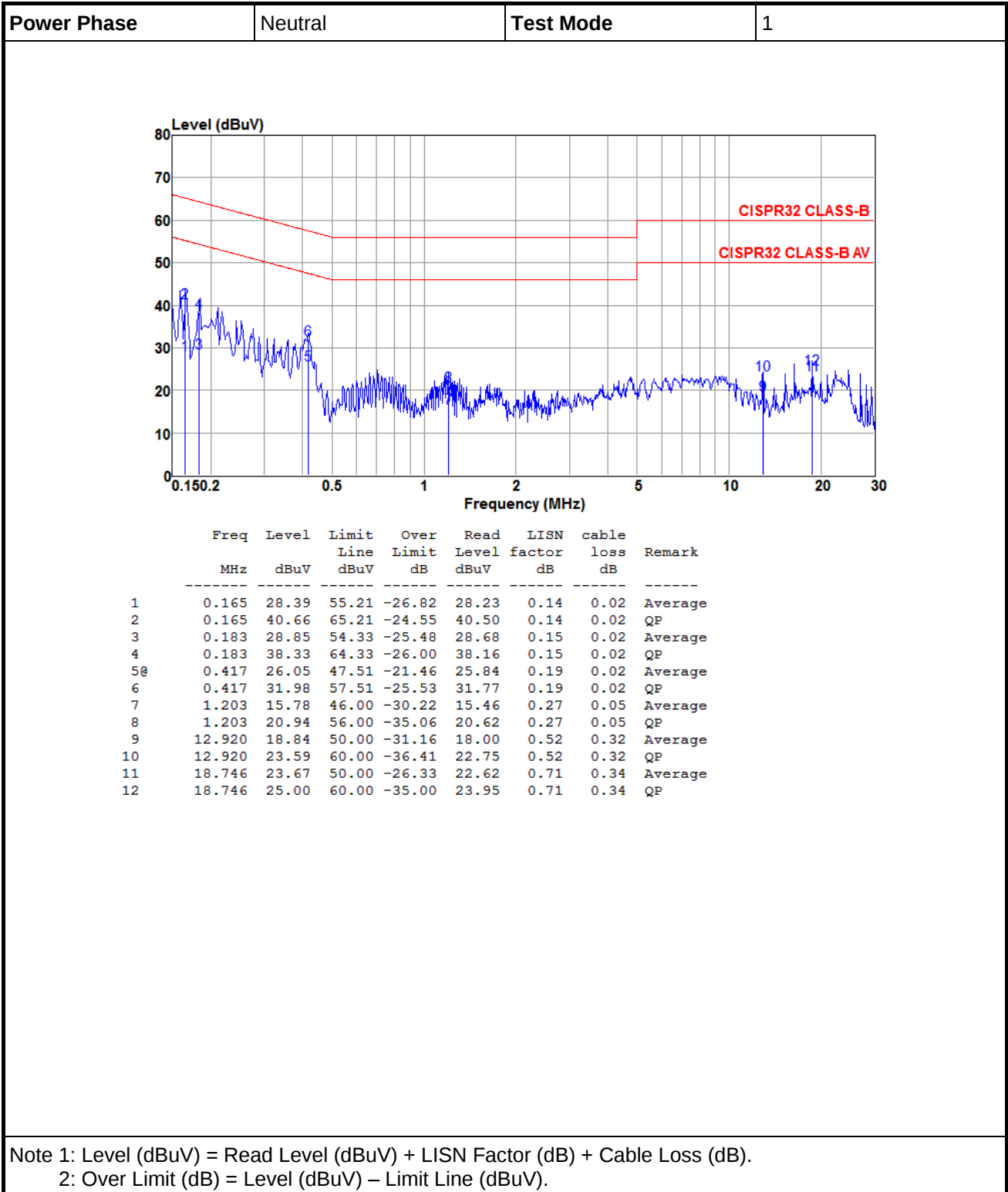
3.1.4 Test Result of Conducted Emissions from the AC mains power ports

Power Phase	Line	Test Mode	1
-------------	------	-----------	---

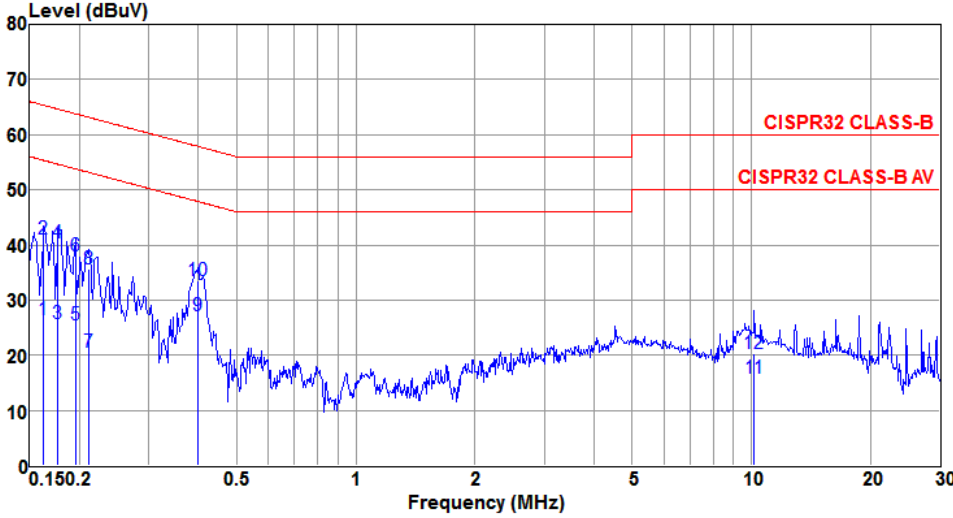


	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark
1	0.162	28.27	55.34	-27.07	27.97	0.28	0.02	Average
2	0.162	40.64	65.34	-24.70	40.34	0.28	0.02	QP
3	0.186	28.00	54.20	-26.20	27.68	0.29	0.03	Average
4	0.186	38.19	64.20	-26.01	37.87	0.29	0.03	QP
5	0.207	27.09	53.32	-26.23	26.77	0.29	0.03	Average
6	0.207	36.17	63.32	-27.15	35.85	0.29	0.03	QP
7	0.226	25.91	52.61	-26.70	25.58	0.30	0.03	Average
8	0.226	35.20	62.61	-27.41	34.87	0.30	0.03	QP
9@	0.417	24.64	47.51	-22.87	24.28	0.34	0.02	Average
10	0.417	31.29	57.51	-26.22	30.93	0.34	0.02	QP
11	4.696	13.42	46.00	-32.58	12.69	0.49	0.24	Average
12	4.696	19.35	56.00	-36.65	18.62	0.49	0.24	QP
13	16.398	19.36	50.00	-30.64	18.29	0.74	0.33	Average
14	16.398	23.79	60.00	-36.21	22.72	0.74	0.33	QP

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



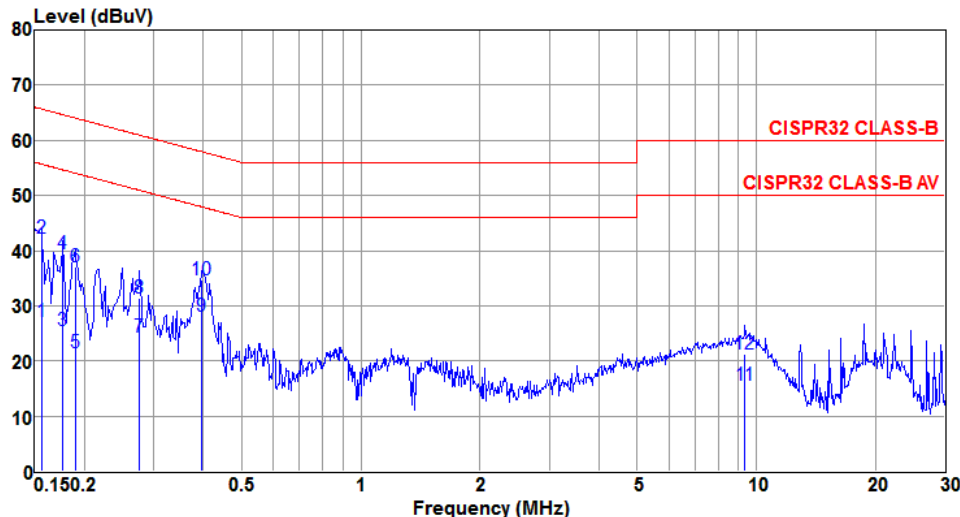
Power Phase	Line	Test Mode	2
-------------	------	-----------	---



	Freq	Level	Limit	Over	Read	LISN	cable	Remark
	MHz	dBuV	Line	Limit	Level	factor	loss	
			dBuV	dB	dBuV	dB	dB	
1	0.162	26.37	55.34	-28.97	26.07	0.28	0.02	Average
2	0.162	41.05	65.34	-24.29	40.75	0.28	0.02	QP
3	0.177	25.81	54.64	-28.83	25.51	0.28	0.02	Average
4	0.177	40.34	64.64	-24.30	40.04	0.28	0.02	QP
5	0.195	25.40	53.80	-28.40	25.08	0.29	0.03	Average
6	0.195	37.91	63.80	-25.89	37.59	0.29	0.03	QP
7	0.211	20.49	53.18	-32.69	20.17	0.29	0.03	Average
8	0.211	35.56	63.18	-27.62	35.24	0.29	0.03	QP
9@	0.400	27.11	47.86	-20.75	26.75	0.34	0.02	Average
10	0.400	33.57	57.86	-24.29	33.21	0.34	0.02	QP
11	10.179	15.82	50.00	-34.18	14.93	0.57	0.32	Average
12	10.179	20.39	60.00	-39.61	19.50	0.57	0.32	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
-------------	---------	-----------	---

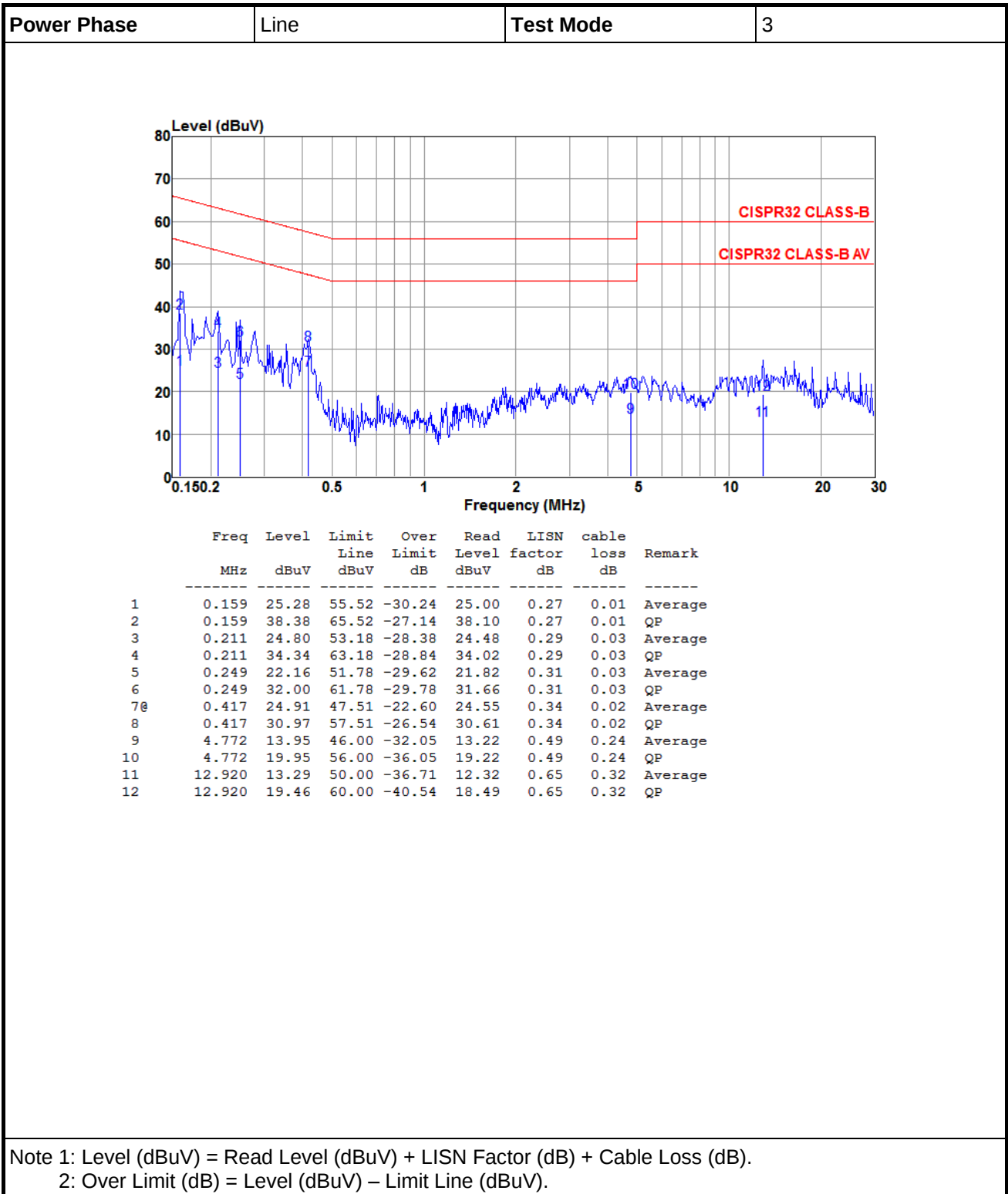


The graph plots Level (dBUV) on the y-axis (0 to 80) against Frequency (MHz) on the x-axis (0.150 to 30). Two red lines represent the CISPR32 CLASS-B and CISPR32 CLASS-B AV limits. The measured level (blue line) shows several peaks, with the highest being around 0.156 MHz (42.36 dBUV) and 0.396 MHz (34.65 dBUV). The measured level is generally below the limits, with some peaks around 0.156 MHz and 0.396 MHz.

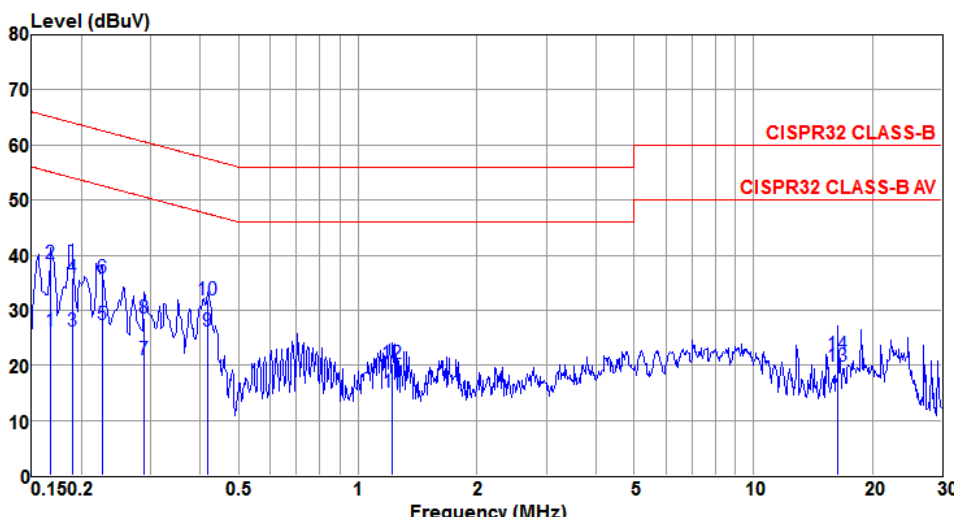
	Freq	Level	Limit	Over	Read	LISN	cable	Remark
	MHz	dBuV	Line	Limit	Level	factor	loss	
			dBuV	dB	dBuV	dB	dB	
1	0.156	27.15	55.69	-28.54	27.00	0.14	0.01	Average
2	0.156	42.36	65.69	-23.33	42.21	0.14	0.01	QP
3	0.177	25.52	54.64	-29.12	25.35	0.15	0.02	Average
4	0.177	39.39	64.64	-25.25	39.22	0.15	0.02	QP
5	0.189	21.58	54.06	-32.48	21.40	0.15	0.03	Average
6	0.189	37.01	64.06	-27.05	36.83	0.15	0.03	QP
7	0.276	24.25	50.94	-26.69	24.05	0.17	0.03	Average
8	0.276	31.50	60.94	-29.44	31.30	0.17	0.03	QP
9@	0.396	28.02	47.95	-19.93	27.81	0.19	0.02	Average
10	0.396	34.65	57.95	-23.30	34.44	0.19	0.02	QP
11	9.352	15.50	50.00	-34.50	14.74	0.45	0.31	Average
12	9.352	21.17	60.00	-38.83	20.41	0.45	0.31	QP

Note 1: Level (dBUV) = Read Level (dBUV) + LISN Factor (dB) + Cable Loss (dB).

Note 2: Over Limit (dB) = Level (dBUV) – Limit Line (dBUV).



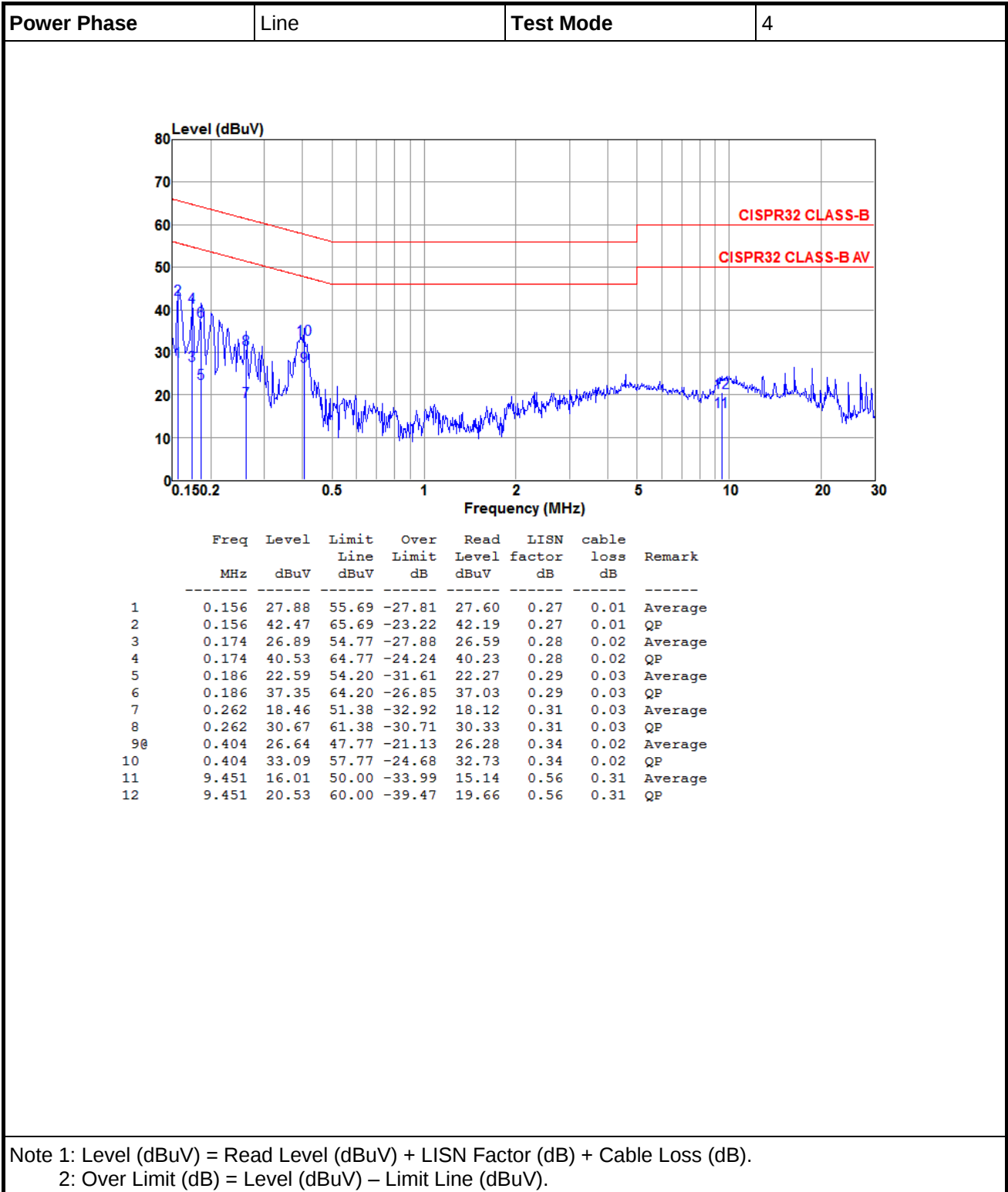
Power Phase	Neutral	Test Mode	3
-------------	---------	-----------	---



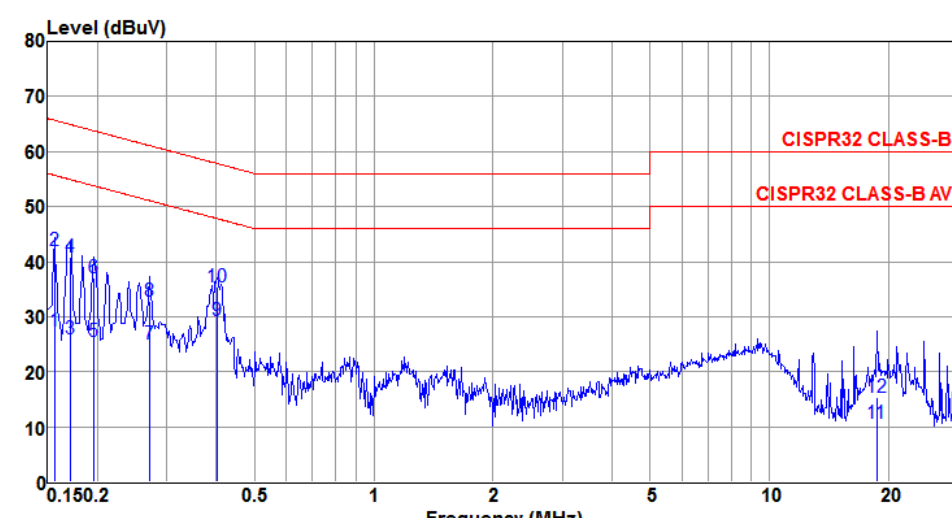
Freq	Level	Limit	Over	Read	LISN	cable	Remark	
MHz	dBuV	Line	Limit	Level	factor	loss		
		dBuV	dB	dBuV	dB	dB		
1	0.168	26.13	55.08	-28.95	25.97	0.14	0.02	Average
2	0.168	38.58	65.08	-26.50	38.42	0.14	0.02	QP
3	0.189	26.09	54.06	-27.97	25.91	0.15	0.03	Average
4	0.189	35.89	64.06	-28.17	35.71	0.15	0.03	QP
5	0.226	27.38	52.61	-25.23	27.19	0.16	0.03	Average
6	0.226	35.77	62.61	-26.84	35.58	0.16	0.03	QP
7	0.288	21.11	50.59	-29.48	20.92	0.17	0.02	Average
8	0.288	28.48	60.59	-32.11	28.29	0.17	0.02	QP
9@	0.417	26.24	47.51	-21.27	26.03	0.19	0.02	Average
10	0.417	31.87	57.51	-25.64	31.66	0.19	0.02	QP
11	1.223	15.03	46.00	-30.97	14.71	0.27	0.05	Average
12	1.223	20.26	56.00	-35.74	19.94	0.27	0.05	QP
13	16.398	19.85	50.00	-30.15	18.90	0.62	0.33	Average
14	16.398	22.06	60.00	-37.94	21.11	0.62	0.33	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).

2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).



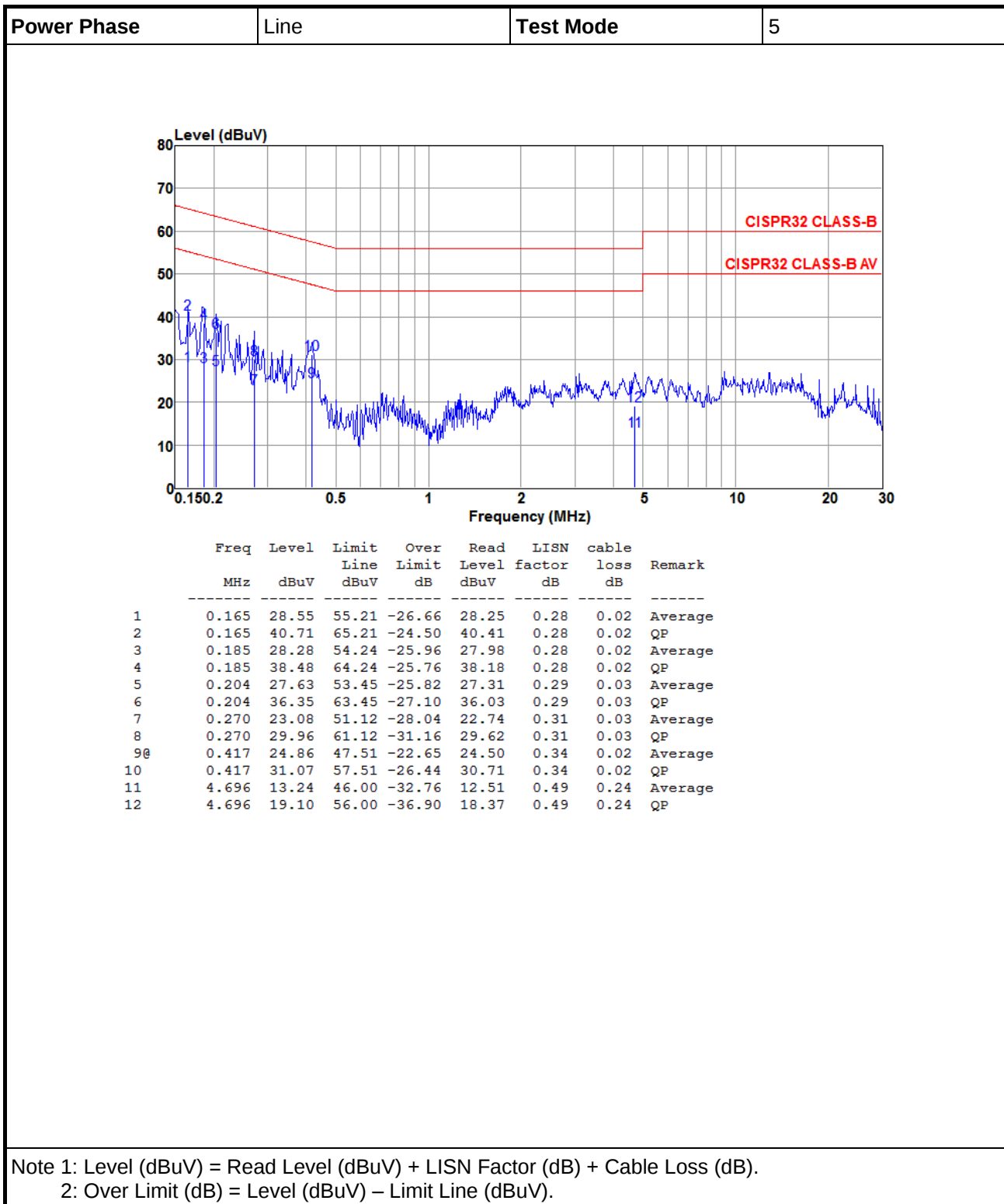
Power Phase	Neutral	Test Mode	4
-------------	---------	-----------	---

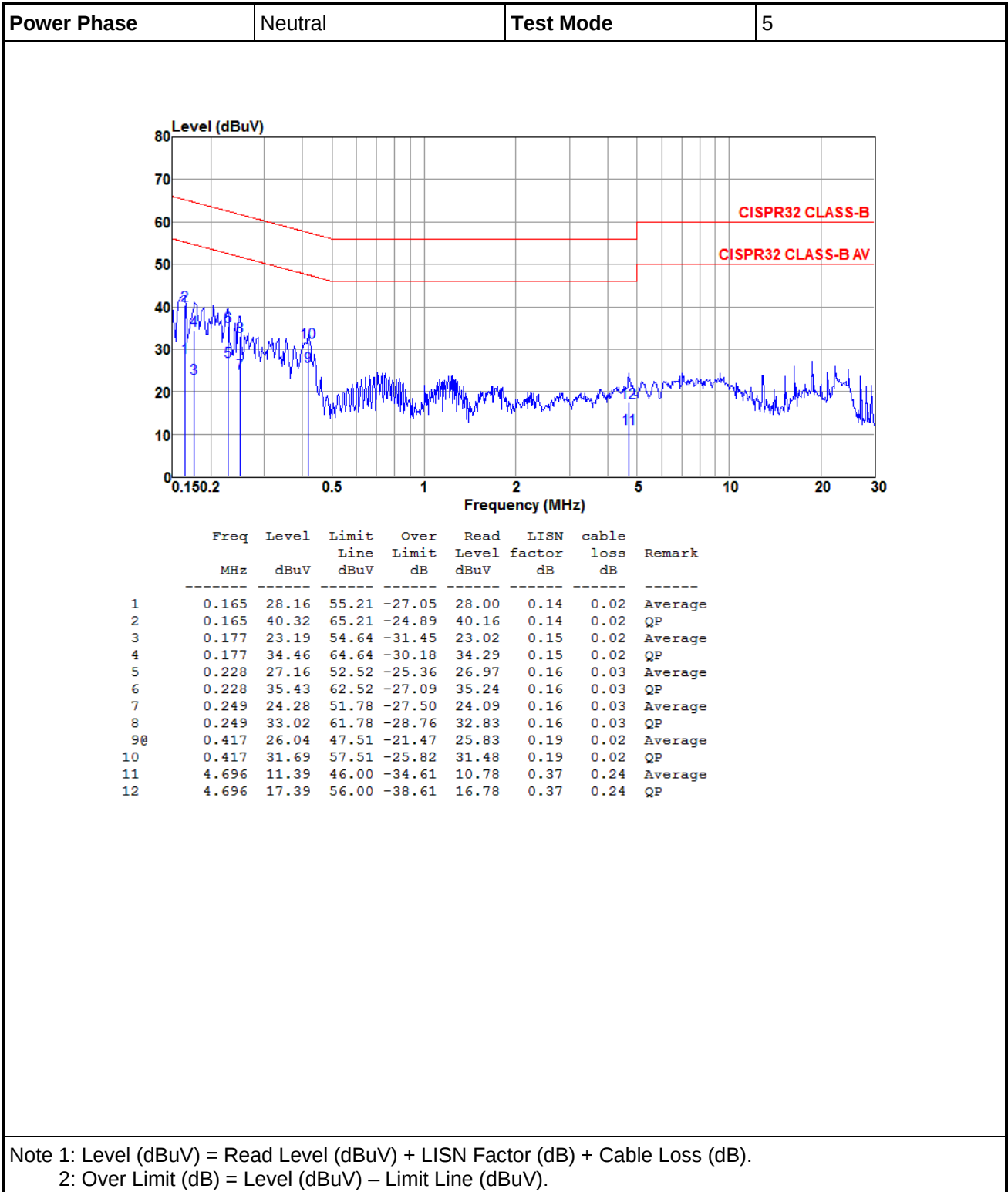


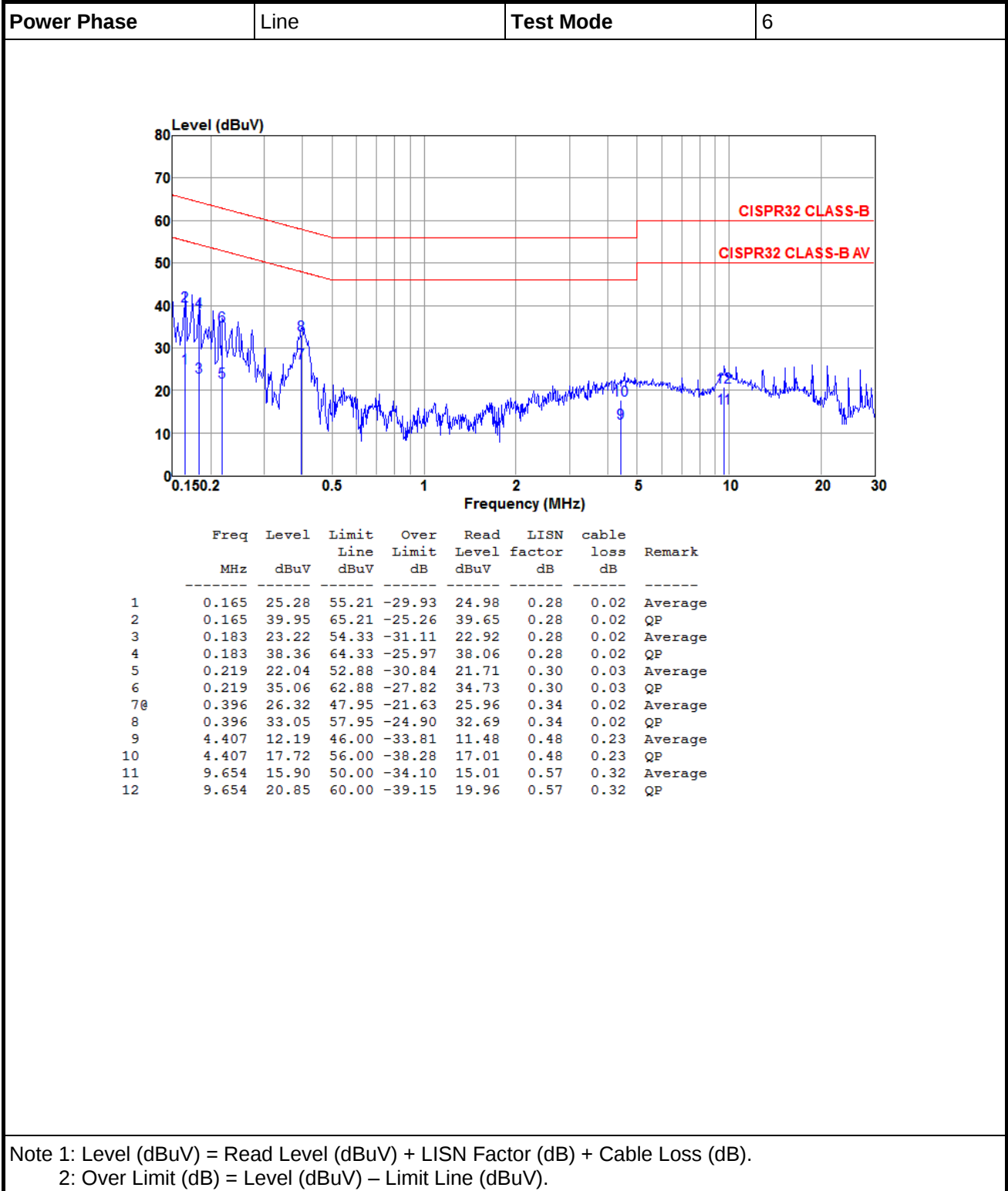
Freq	Level	Limit	Over	Read	LISN	cable	Remark	
MHz	dBuV	dBuV	Limit	Level	factor	loss		
			dB	dBuV	dB	dB		
1	0.156	27.36	55.69	-28.33	27.21	0.14	0.01	Average
2	0.156	42.00	65.69	-23.69	41.85	0.14	0.01	QP
3	0.171	25.93	54.90	-28.97	25.77	0.14	0.02	Average
4	0.171	40.72	64.90	-24.18	40.56	0.14	0.02	QP
5	0.195	25.53	53.80	-28.27	25.35	0.15	0.03	Average
6	0.195	37.03	63.80	-26.77	36.85	0.15	0.03	QP
7	0.270	25.09	51.12	-26.03	24.89	0.17	0.03	Average
8	0.270	32.71	61.12	-28.41	32.51	0.17	0.03	QP
9a	0.402	29.18	47.81	-18.63	28.97	0.19	0.02	Average
10	0.402	35.32	57.81	-22.49	35.11	0.19	0.02	QP
11	18.721	10.67	50.00	-39.33	9.62	0.71	0.34	Average
12	18.721	15.30	60.00	-44.70	14.25	0.71	0.34	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	6
-------------	---------	-----------	---

Freq	Level	Limit	Over	Read	LISN	cable		
MHz	dBuV	Line	Limit	Level	factor	loss	Remark	
		dBuV	dB	dBuV	dB	dB		
1	0.156	26.63	55.69	-29.06	26.48	0.14	0.01	Average
2	0.156	42.18	65.69	-23.51	42.03	0.14	0.01	QP
3	0.189	21.21	54.06	-32.85	21.03	0.15	0.03	Average
4	0.189	36.96	64.06	-27.10	36.78	0.15	0.03	QP
5	0.211	19.99	53.18	-33.19	19.81	0.15	0.03	Average
6	0.211	34.75	63.18	-28.43	34.57	0.15	0.03	QP
7	0.249	23.63	51.78	-28.15	23.44	0.16	0.03	Average
8	0.249	33.15	61.78	-28.63	32.96	0.16	0.03	QP
9@	0.396	28.38	47.95	-19.57	28.17	0.19	0.02	Average
10	0.396	34.65	57.95	-23.30	34.44	0.19	0.02	QP
11	9.451	15.50	50.00	-34.50	14.74	0.45	0.31	Average
12	9.451	21.28	60.00	-38.72	20.52	0.45	0.31	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 note 1). 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 from 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.

4.3 Electrostatic Discharge (ESD)

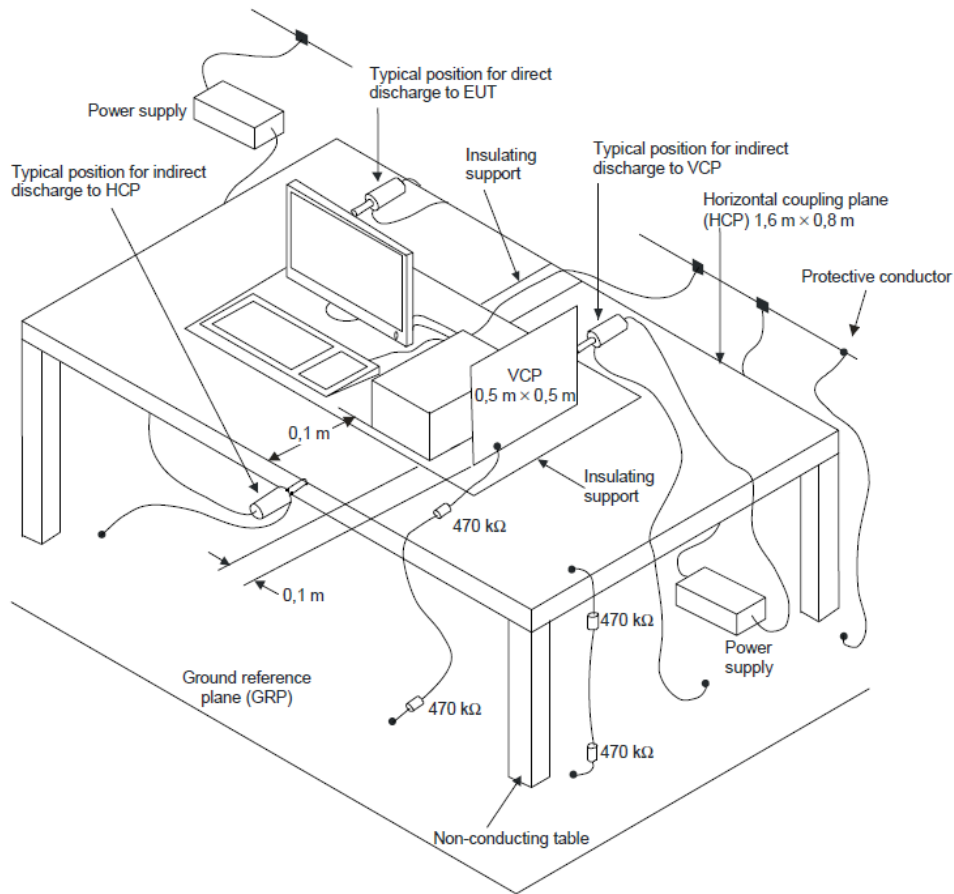
4.3.1 Test Specification of Electrostatic Discharge (ESD)

Basic Standard	EN 61000-4-2
Discharge Voltage	Contact Discharge: ± 2 kV / ± 4 kV / ± 8 kV Air Discharge: ± 2 kV / ± 4 kV / ± 8 kV / ± 15 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, $(0.8 \pm 0.08) \text{ m}$ high, standing on the ground reference plane.

A horizontal coupling plane (HCP), $(1.6 \pm 0.02) \text{ m} \times (0.8 \pm 0.02) \text{ m}$, shall be placed on the table. The EUT and its cables shall be isolated from the coupling plane by an insulating support $(0.5 \pm 0.05) \text{ mm}$ in thickness.

4.3.4 Test Result of Electrostatic Discharge (ESD)

Test Mode	1, 7				
Direct Application					
Test Voltage (kV)	Polarity	Test Point	Contact Discharge	Air Discharge	Performance Criteria
2, 4, 8, 15	+/-	1	N/A	Note*	A
2, 4, 8	+/-	2	Note*	N/A	A
Indirect Application					
Test Voltage (kV)	Polarity	Test Point	Horizontal Coupling Plane (HCP)	Vertical Coupling Plane (VCP)	Performance Criteria
2, 4, 8	+/-	At front, rear, left and right side	Note*	Note*	A

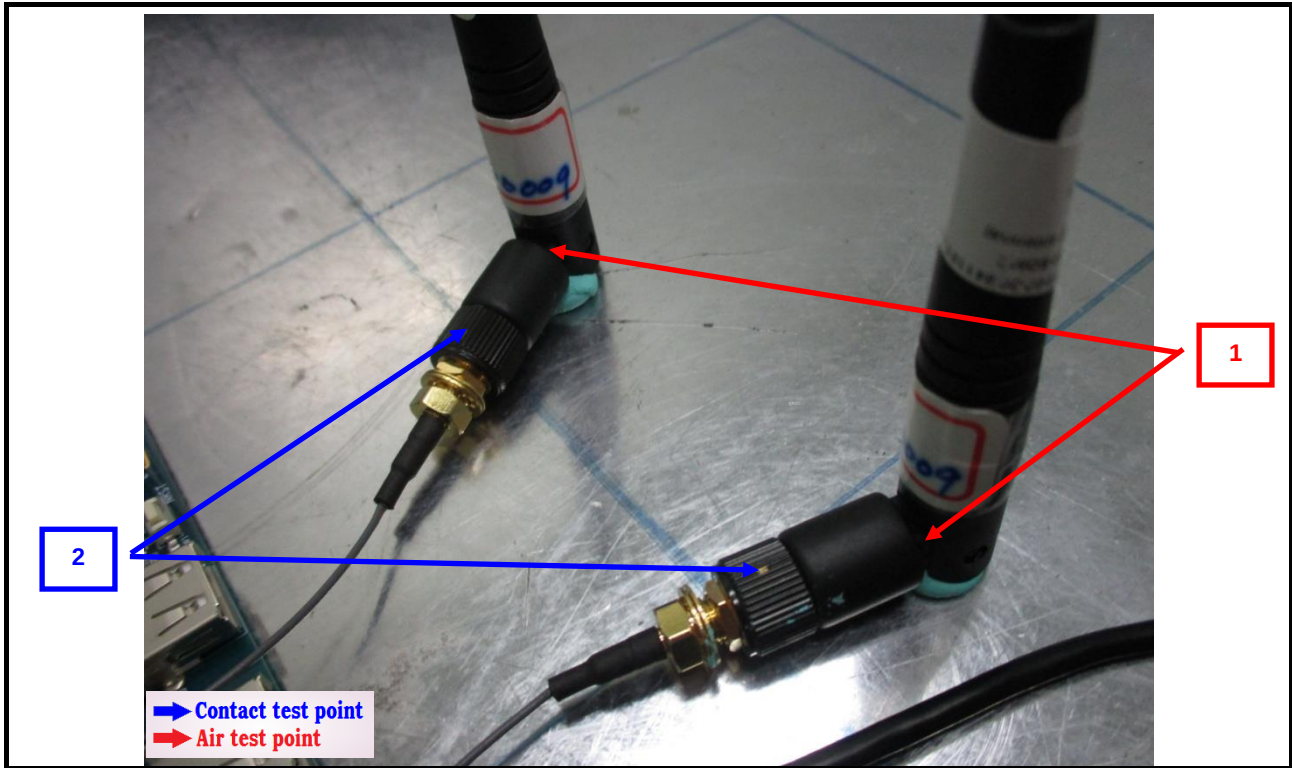
Note: There was no abnormal situation during the test compared with initial operation.

“*”: Test method reported herein was performed according to the method specified by applicant.

Test Mode	2 ~ 6				
Indirect Application					
Test Voltage (kV)	Polarity	Test Point	Horizontal Coupling Plane (HCP)	Vertical Coupling Plane (VCP)	Performance Criteria
2, 4, 8	+/-	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



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

- 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.
- 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.
- 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.
- 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.
- Responses on receivers occurring at discrete frequencies, which are narrow band responses, shall be disregarded from the test.
- The frequencies selected and used during the test shall be recorded in the test report.
- 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.
- 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.
- 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:

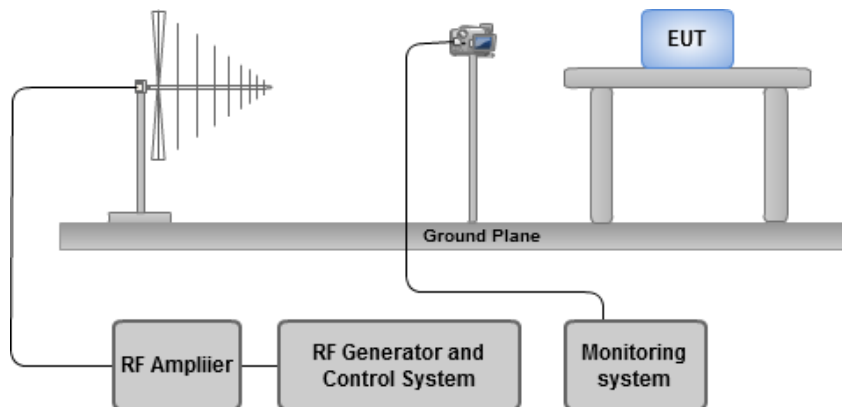
- lower limit of exclusion band = lowest allocated band edge frequency -270 MHz, i.e. 4 880 MHz;
- upper limit of exclusion band = highest allocated band edge frequency +270 MHz, i.e. 5 995 MHz.

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.

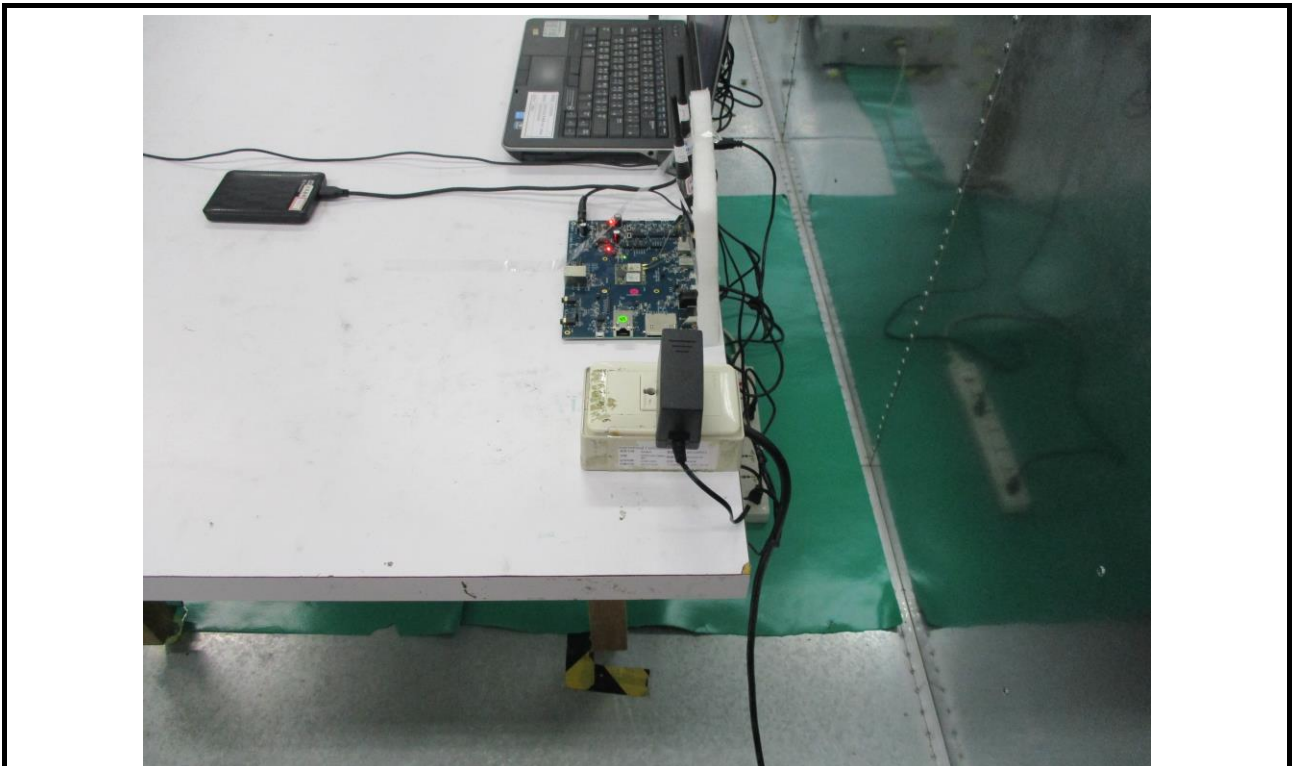
4.4.5 Test Result of Radio Frequency Electromagnetic Field (RS)

Test Mode	1 ~ 7				
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

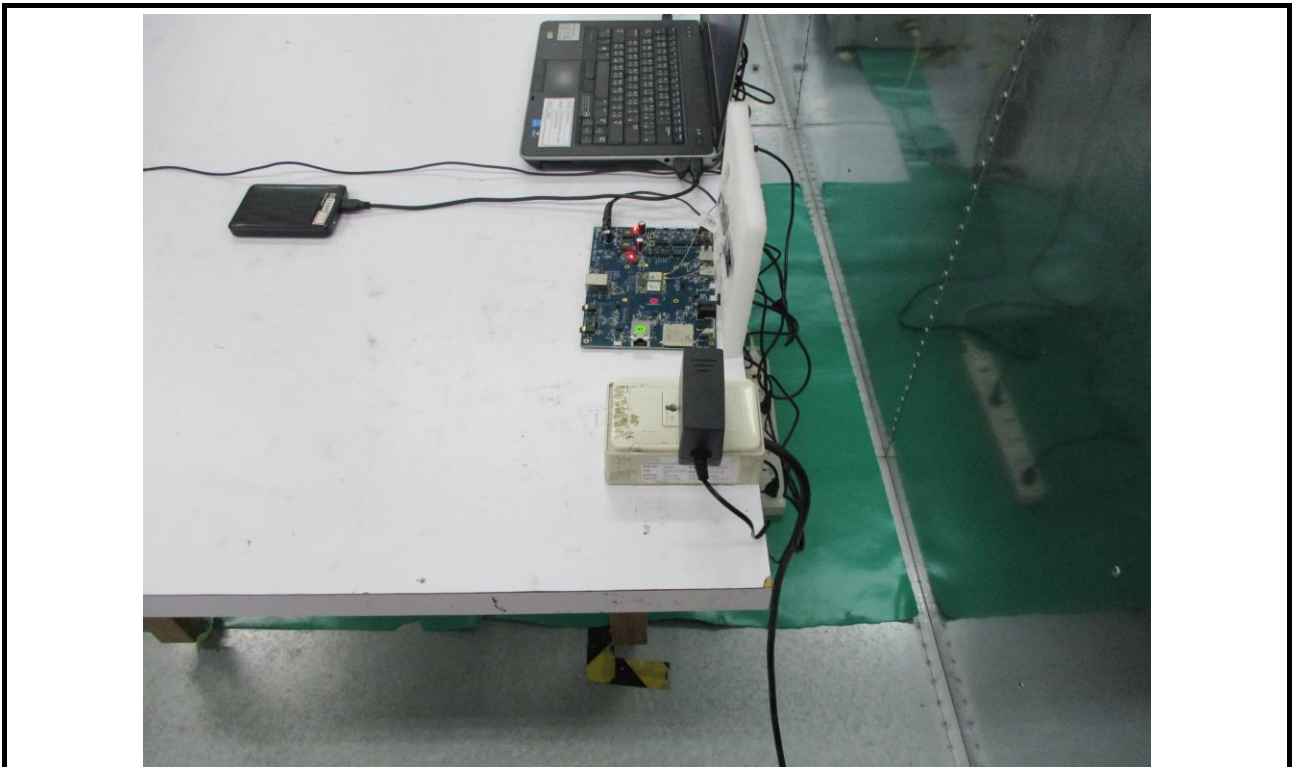
Note: There was no abnormal situation during the test compared with initial operation.

5 Photographs of the Test Configuration

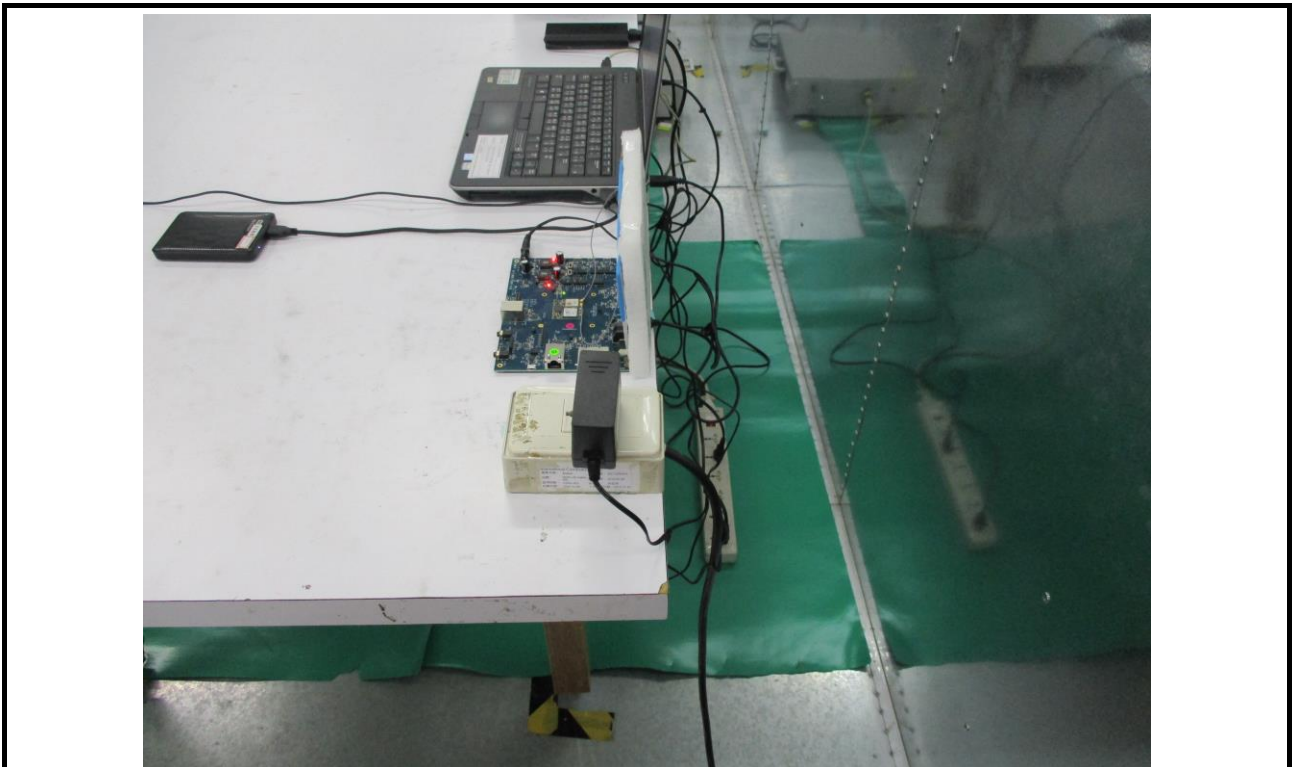
Conducted Emissions from the AC mains power ports (Antenna: 001-0009)



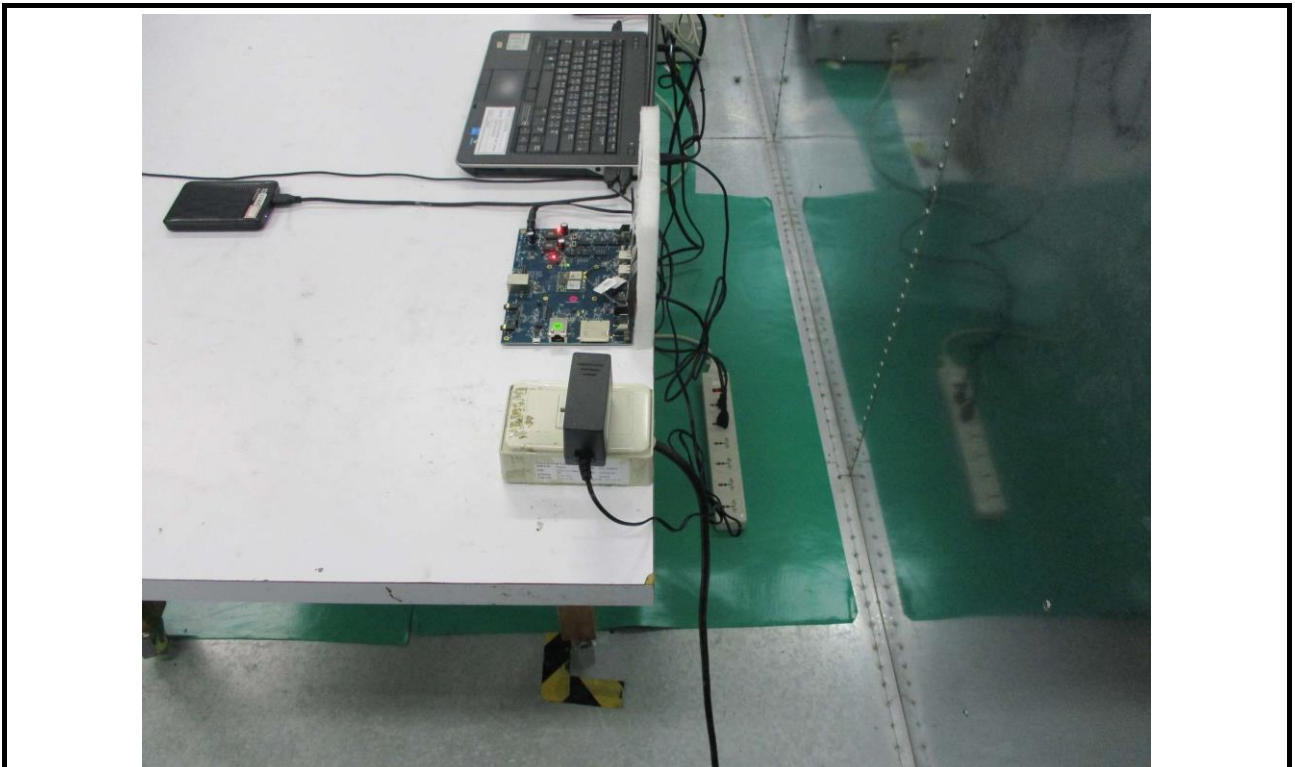
Conducted Emissions from the AC mains power ports (Antenna: NanoBlade-IP04)



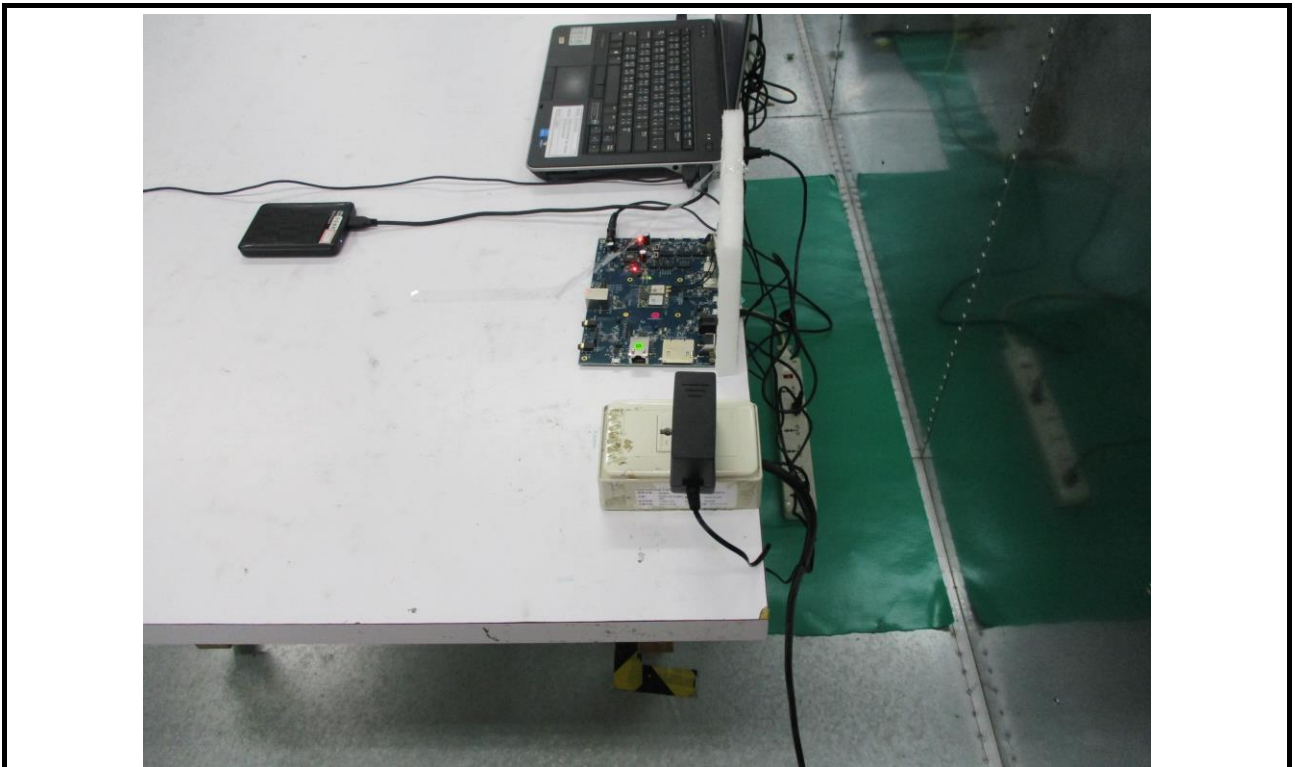
Conducted Emissions from the AC mains power ports (Antenna: MAF95310 Mini NanoBlade Flex)



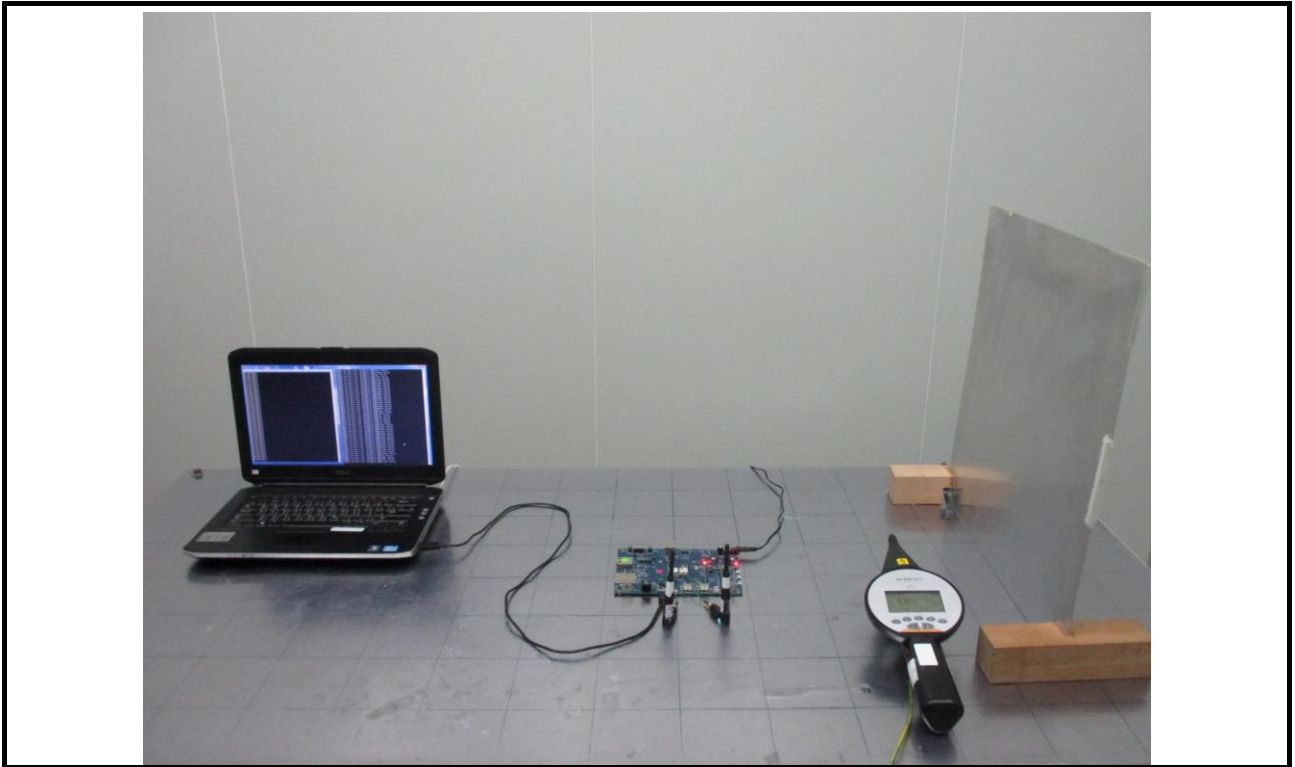
Conducted Emissions from the AC mains power ports (Antenna: FlexPIFA 001-0016)



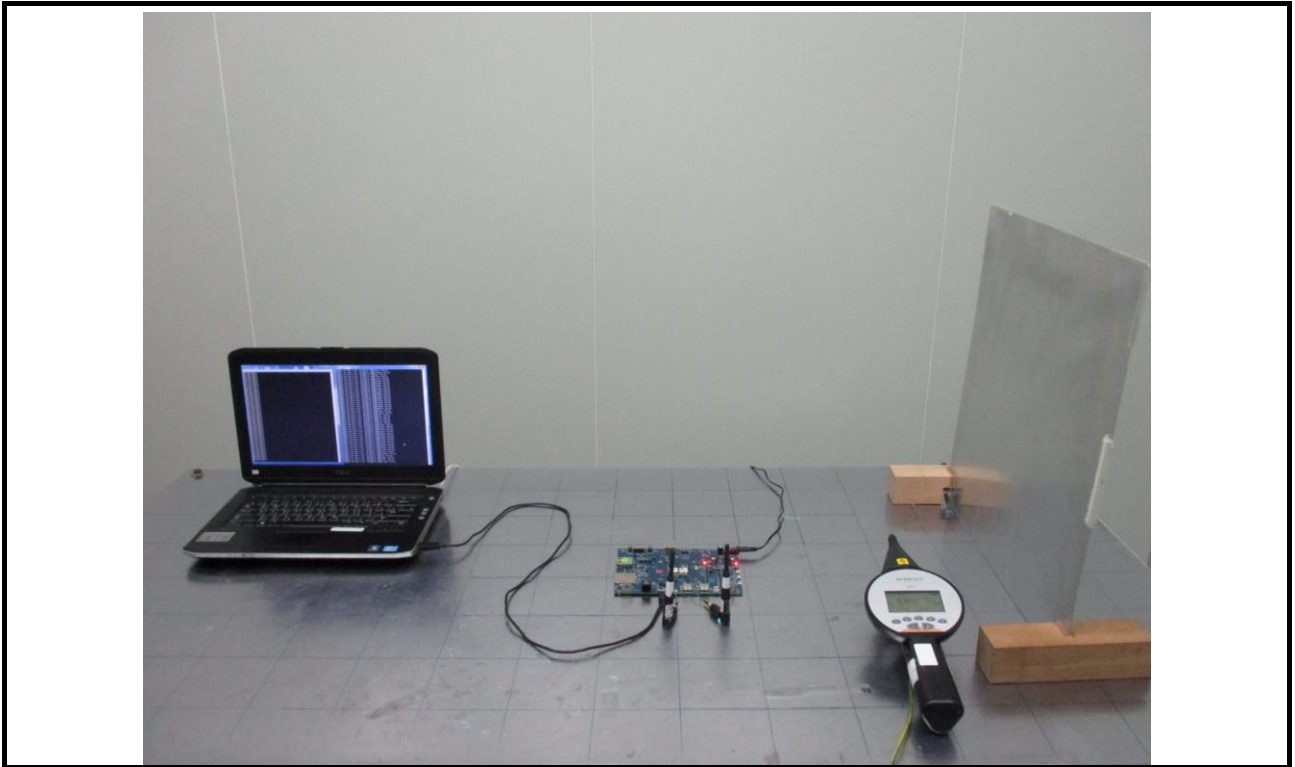
Conducted Emissions from the AC mains power ports (Antenna: WLAN_1000146)



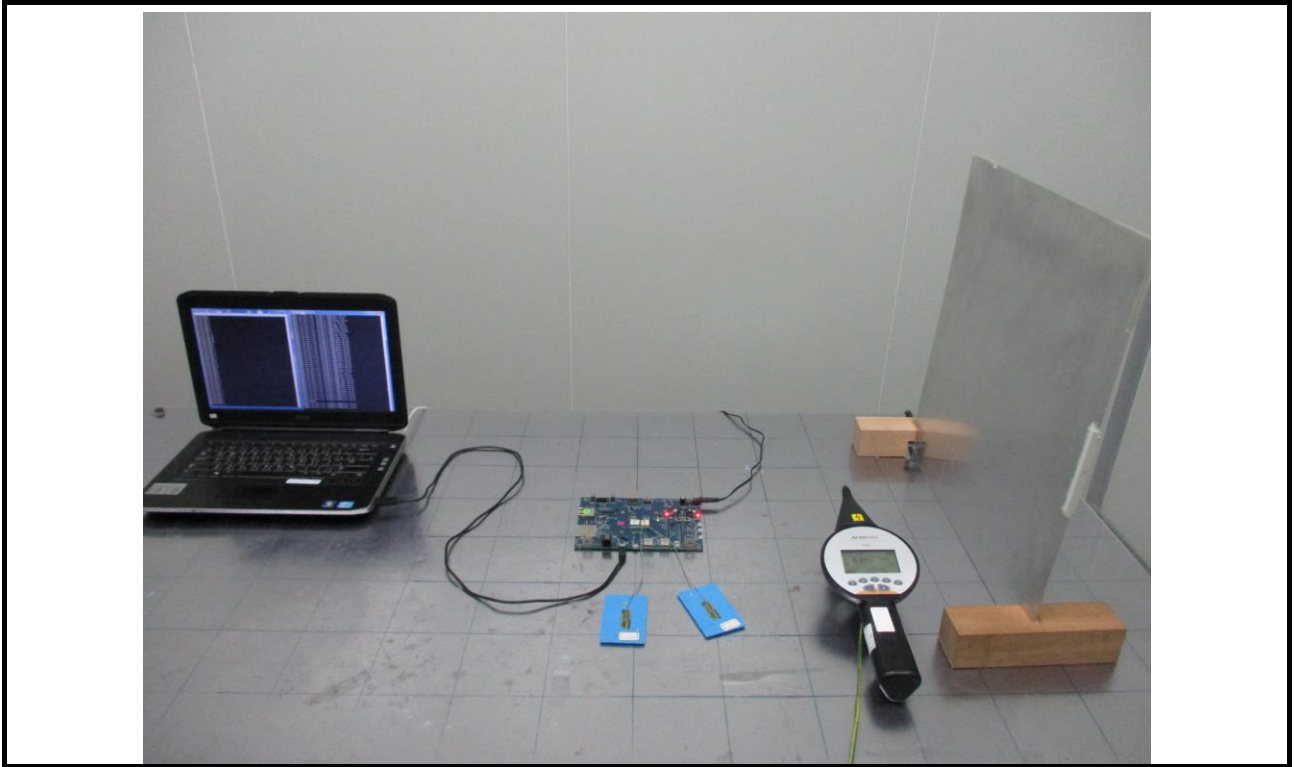
ESD Test (Antenna: 001-0009)



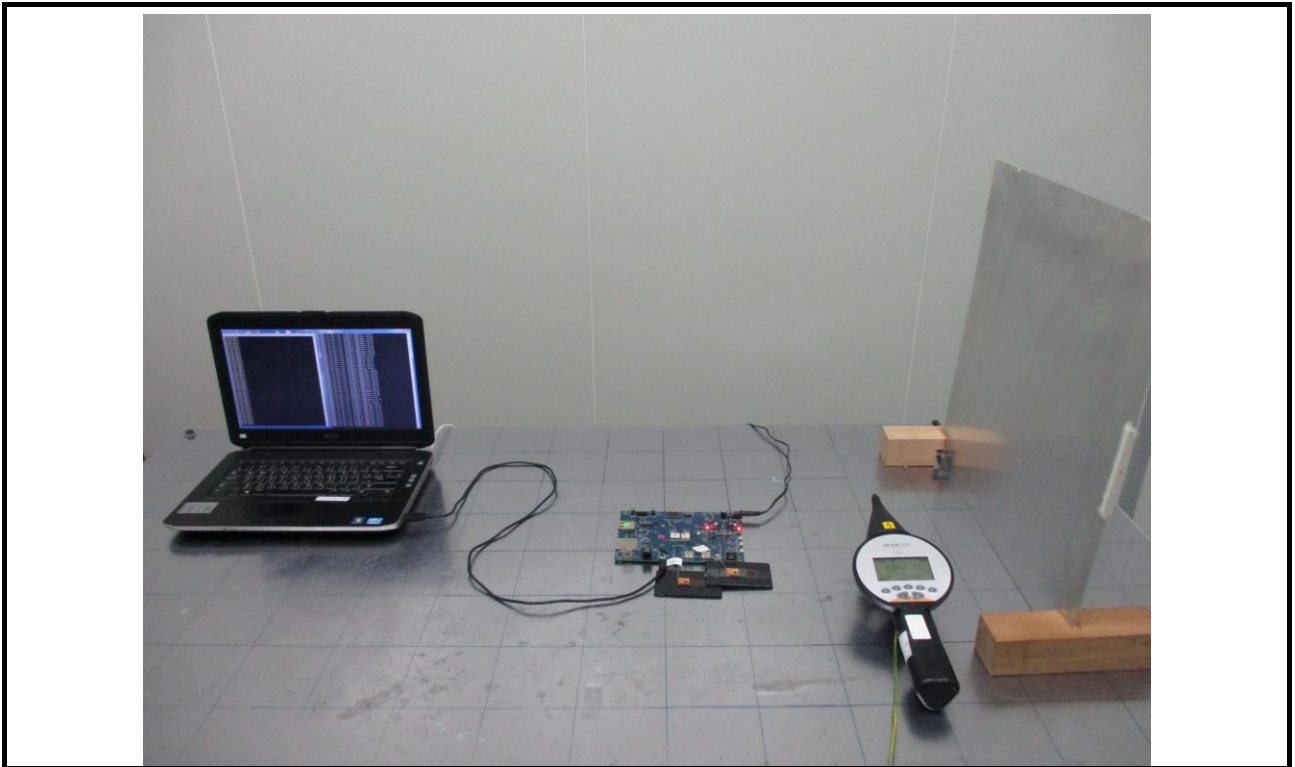
ESD Test (Antenna: NanoBlade-IP04)



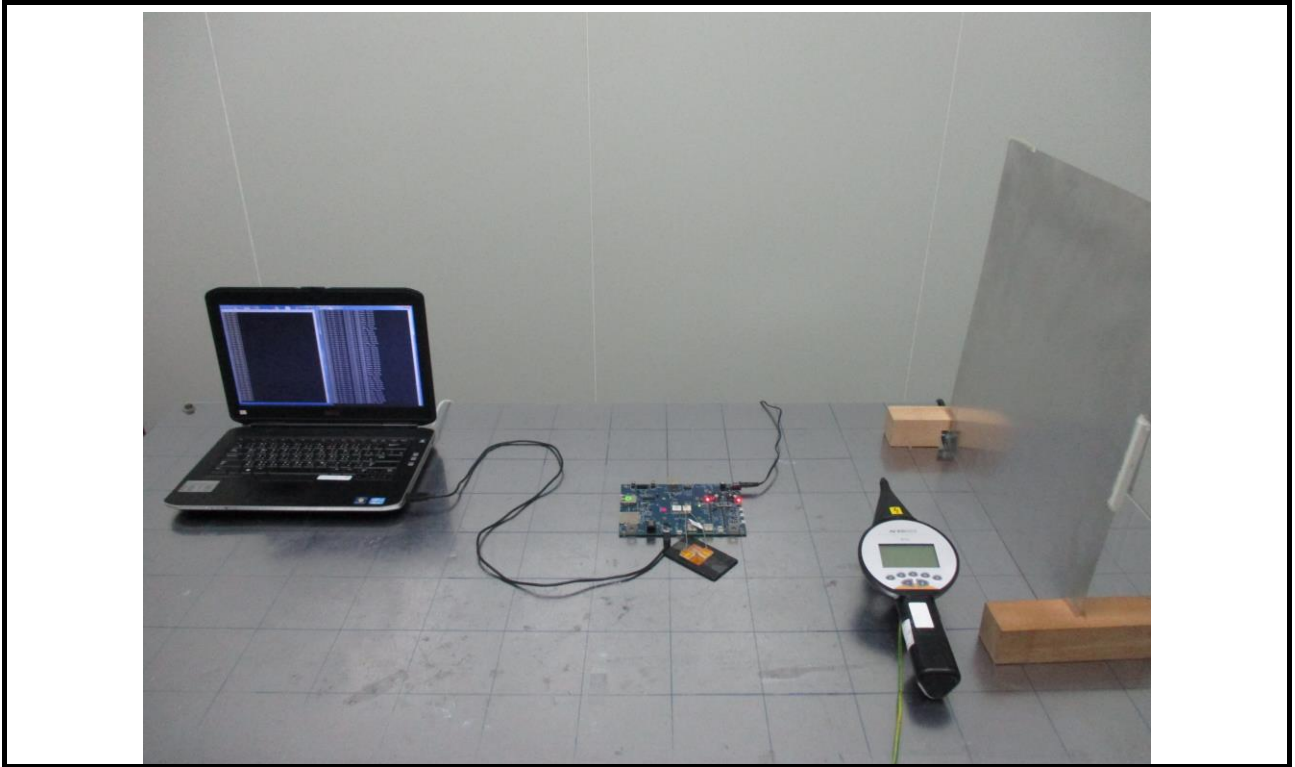
ESD Test (Antenna: MAF95310 Mini NanoBlade Flex)



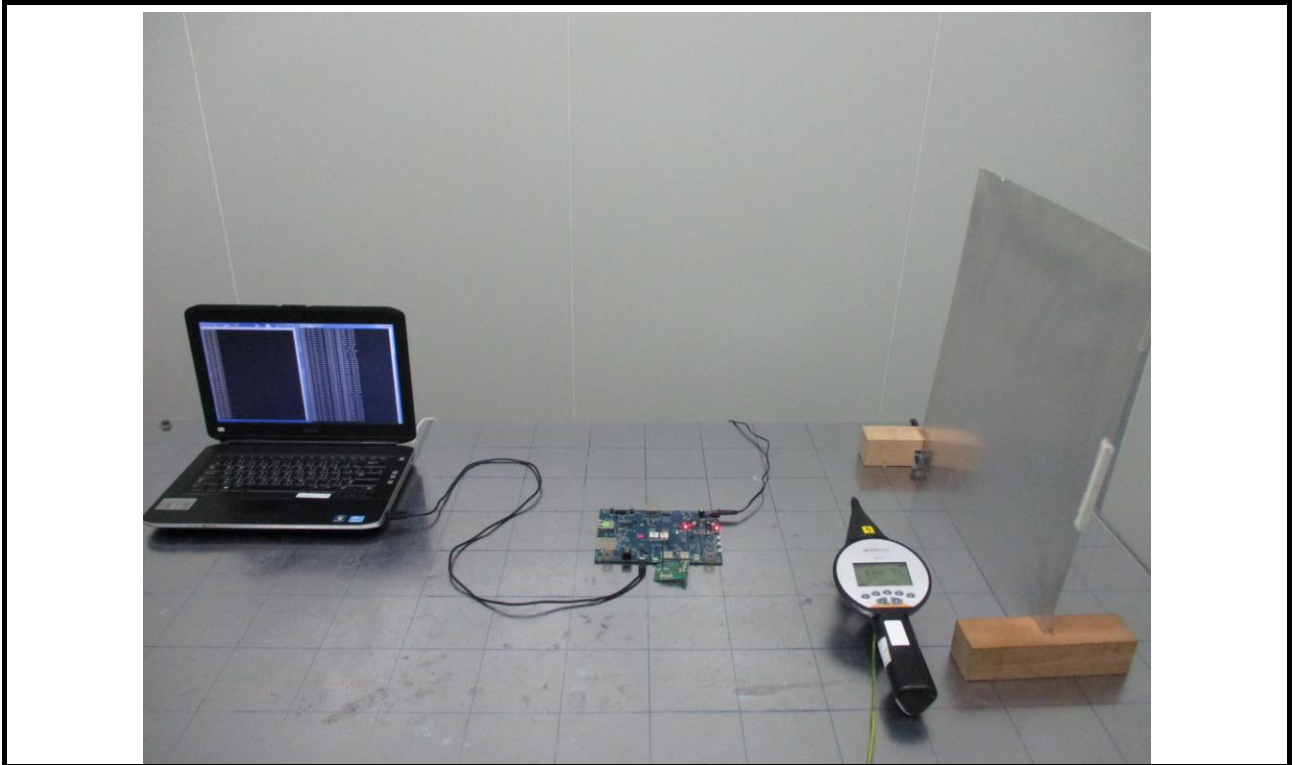
ESD Test (Antenna: FlexPIFA 001-0016)



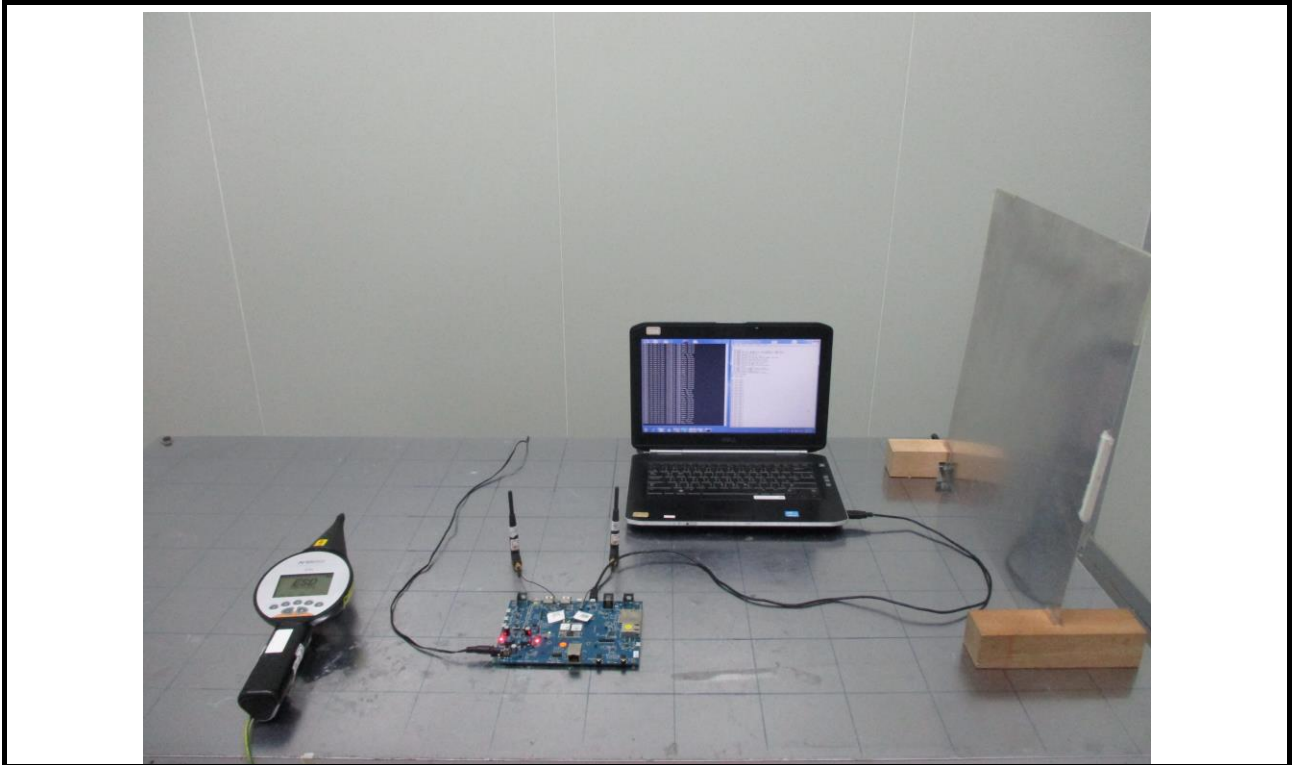
ESD Test (Antenna: MIMO FlexPIFA Antenna)



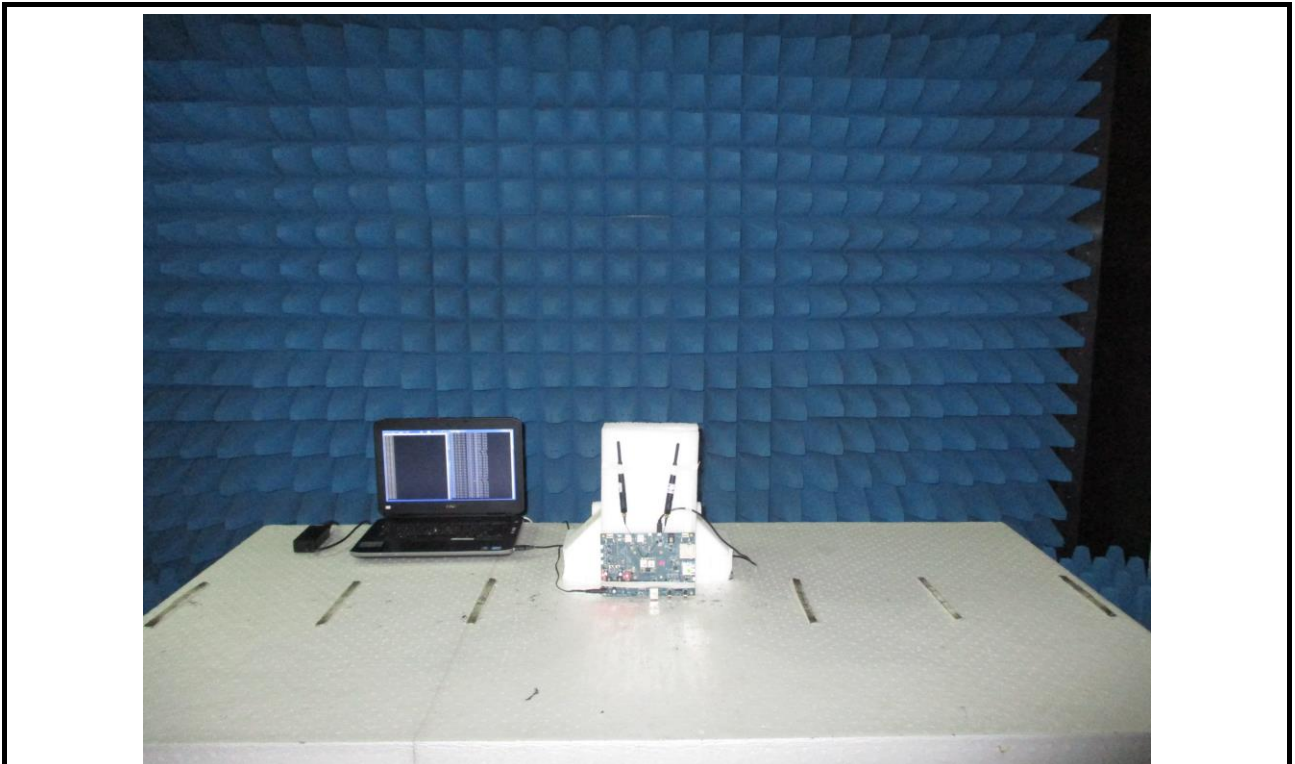
ESD Test (Antenna: WLAN_1000146)



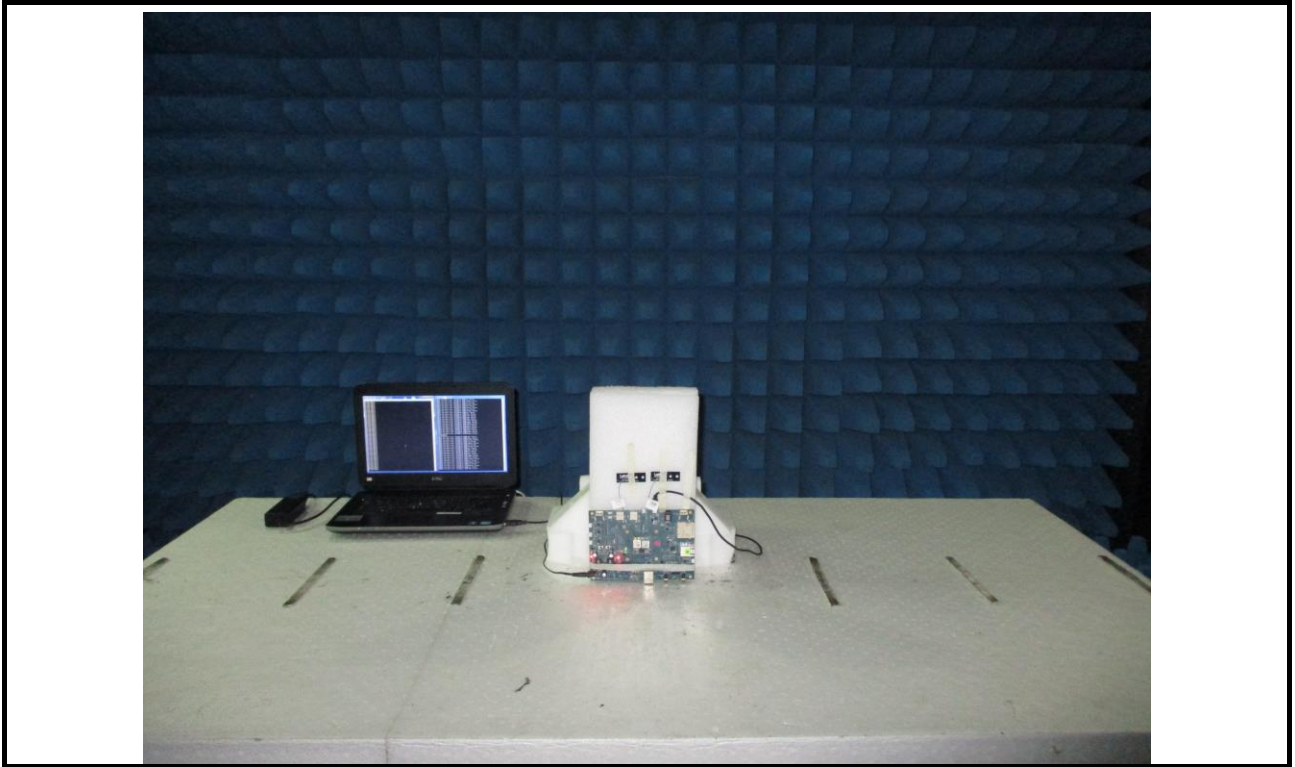
ESD Test (Antenna: 001-0009(with filter))



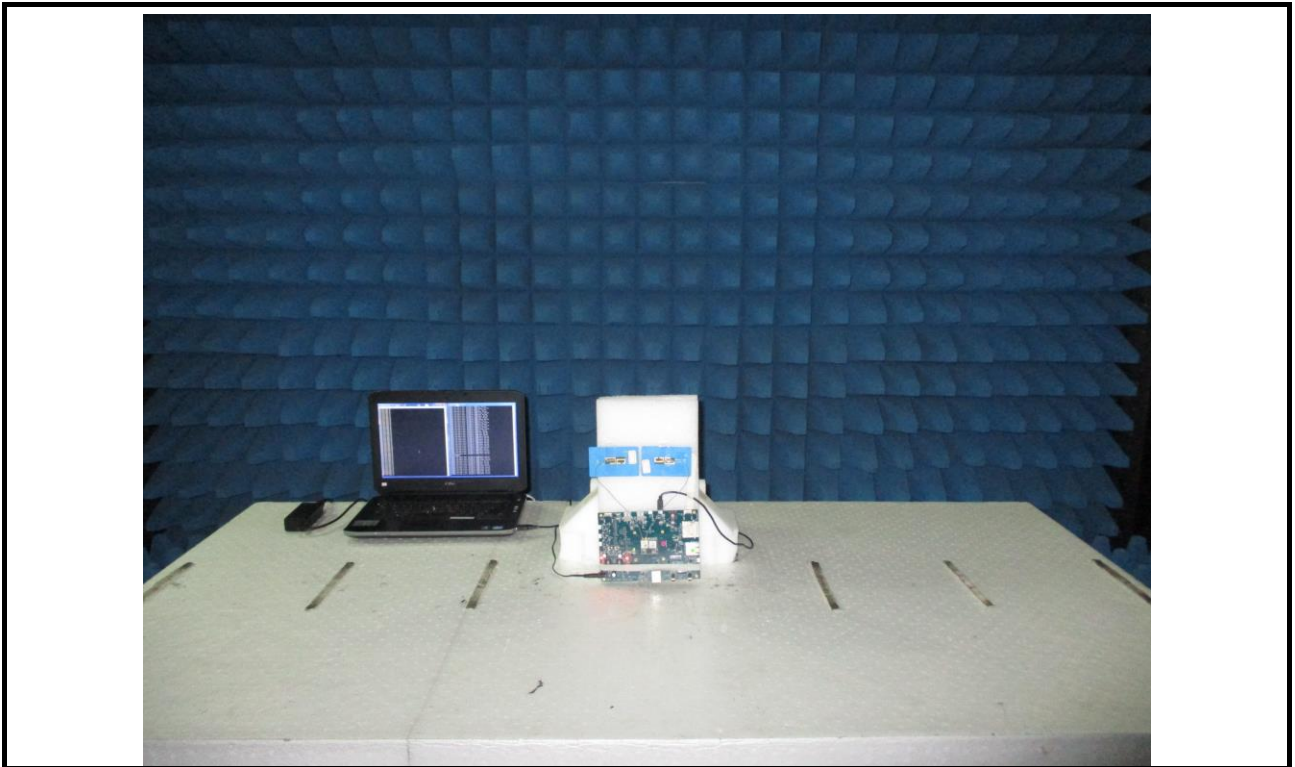
RS Test (Antenna: 001-0009)



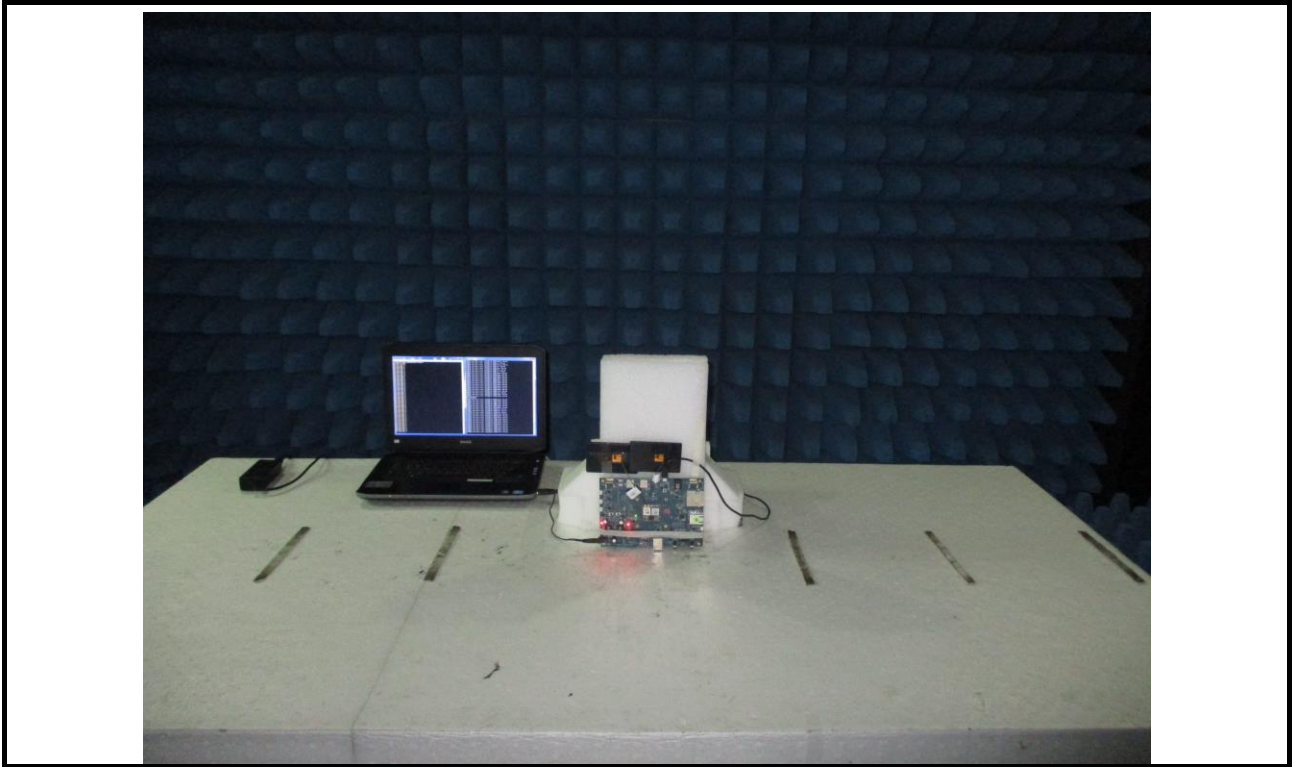
RS Test (Antenna: NanoBlade-IP04)



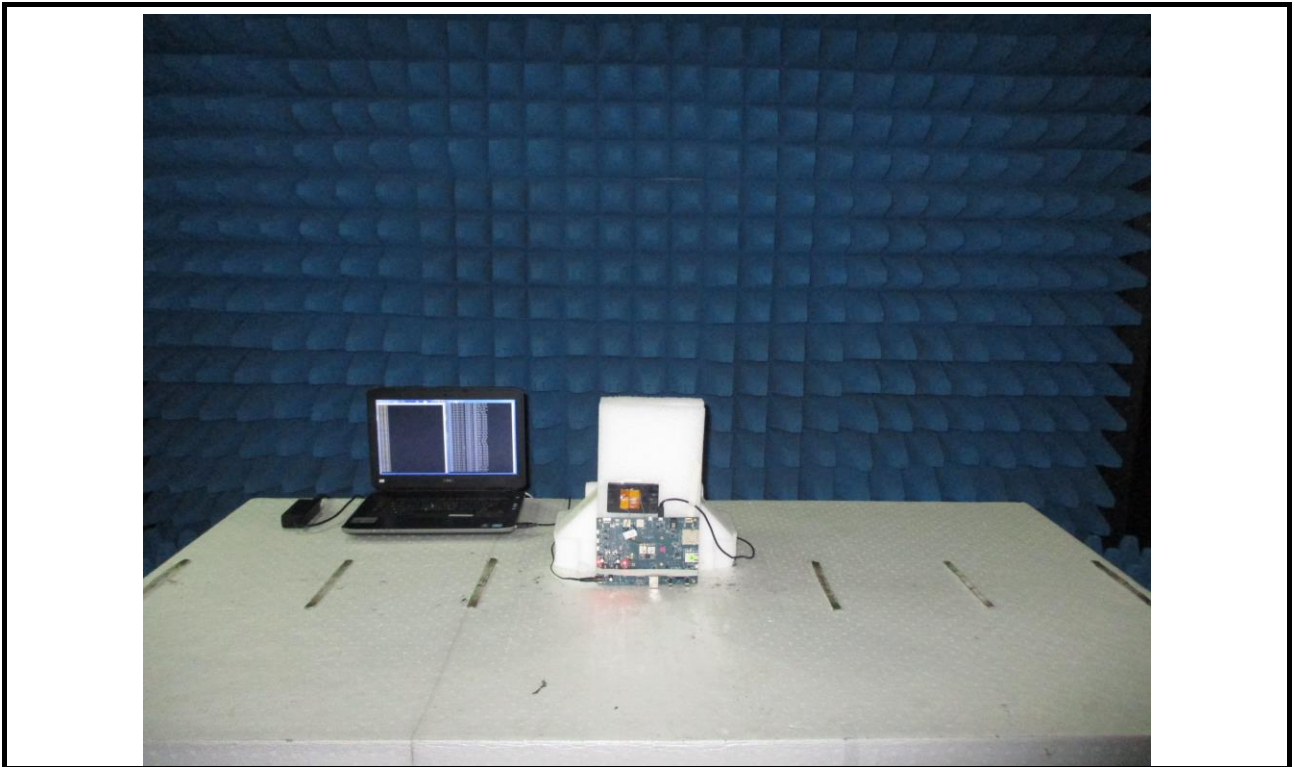
RS Test (Antenna: MAF95310 Mini NanoBlade Flex)



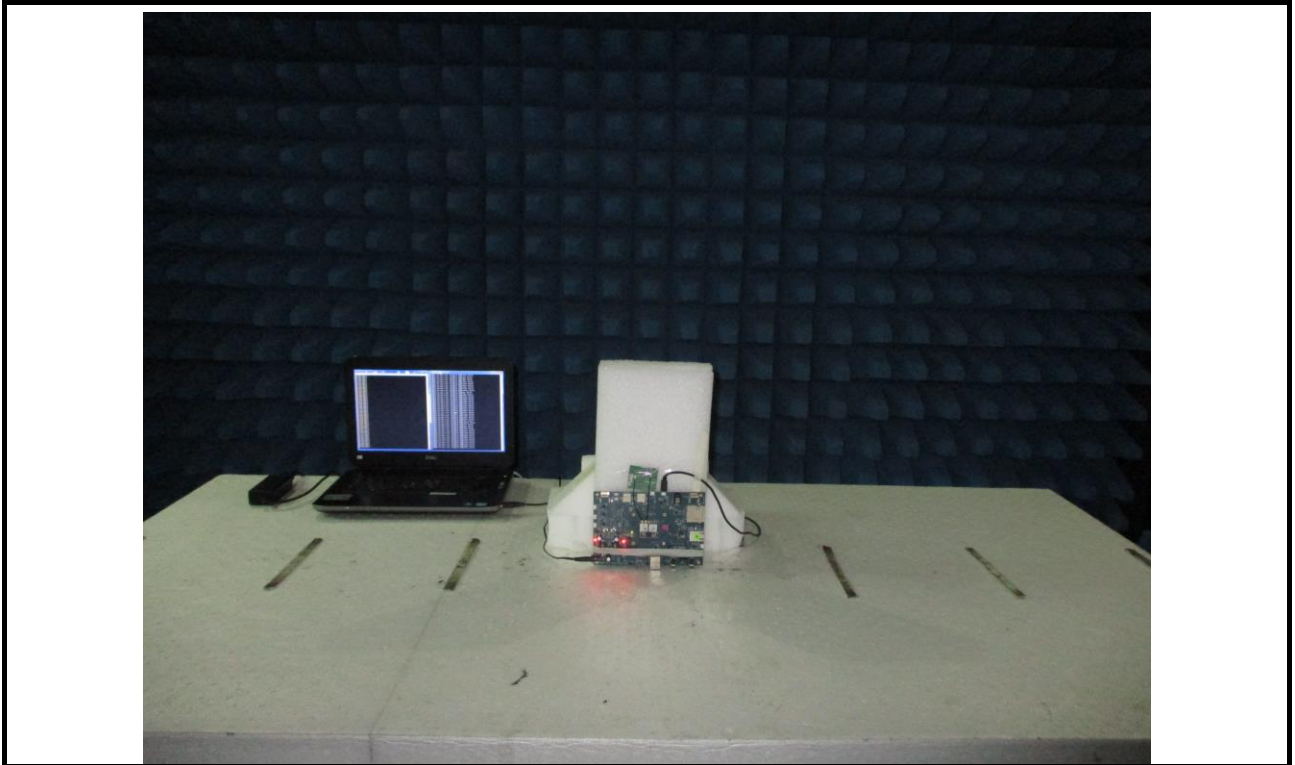
RS Test (Antenna: FlexPIFA 001-0016)



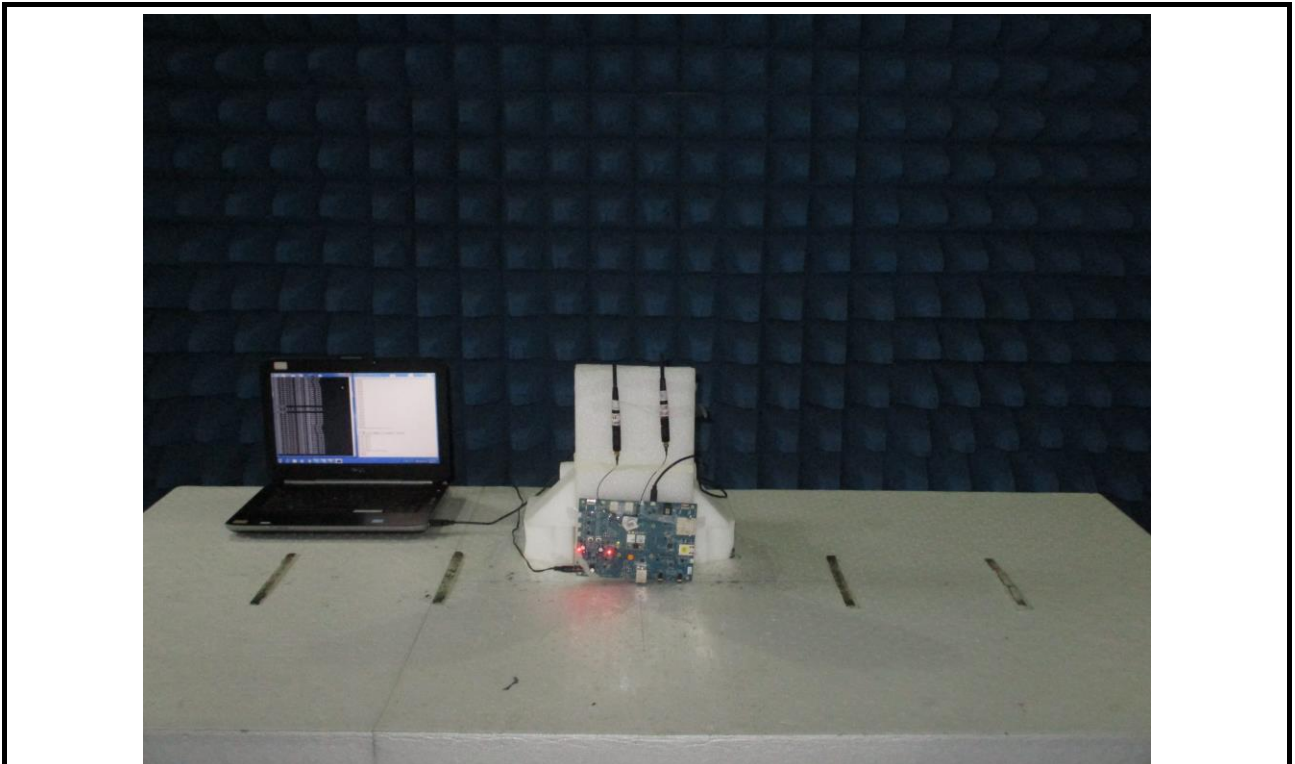
RS Test (Antenna: MIMO FlexPIFA Antenna)



RS Test (Antenna: WLAN_1000146)



RS Test (Antenna: 001-0009(with filter))



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

Tel: 886-2-2601-1640

No. 30-2, Ding Fwu Tsuen, Lin Kou
District, New Taipei City, Taiwan,
R.O.C.

Kwei Shan

Tel: 886-3-271-8666

No. 3-1, Lane 6, Wen San 3rd
St., Kwei Shan District, Tao Yuan
City 333, Taiwan, R.O.C.

Kwei Shan Site II

Tel: 886-3-271-8640

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

Fax: 886-3-318-0155

Email: ICC_Service@icertifi.com.tw

==END==