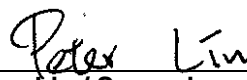


# CE EMC Test Report

**Equipment** : Bluetooth v4.0 Dual-Mode UART HCI Module  
**Model No.** : BT830-SA, BT830-ST  
(Please refer to item 1.1.1 for more details.)  
**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** : May 15, 2014 (for original test)  
Apr. 20, ~ May 02, 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:

  
Kent Chen / Assistant Manager



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## Release Record

| Report No.  | Version | Description   | Issued Date  |
|-------------|---------|---------------|--------------|
| EH442804-02 | 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 | -14.11dB QP@ 2.608MHz. | Pass   |
| 8.7  | EN 55032:2015/AC:2016, Class B | Asymmetric Mode Conducted Emissions               | Note <sup>1</sup>      | N/A    |
| 8.2  | EN 55032:2015/AC:2016, Class B | Radiated Emissions                                | Note <sup>2</sup>      | N/A    |
| 8.5  | EN 61000-3-2:2014, Class A     | Harmonic Current Emissions                        | Note <sup>3</sup>      | N/A    |
| 8.6  | EN 61000-3-3:2013              | Voltage Fluctuations and Flicker                  | Note <sup>3</sup>      | N/A    |
| <p>N/A means Not Applicable.<br/>           Note<sup>1</sup>: The EUT w/o telecom port.<br/>           Note<sup>2</sup>: According to Clause 7.1 of Draft EN 301 489-1, the test is not required.<br/>           Note<sup>3</sup>: The EUT consumes DC power, so the test is not required.</p> |                                |   |                        |        |

| 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 <sup>1</sup> | N/A    |
| 9.8   | EN 61000-4-5:2014                 | Surge                                      |   | Note <sup>2</sup> | N/A    |
| 9.5   | EN 61000-4-6:2014                 | Conducted Disturbances (CS)                |   | Note <sup>1</sup> | N/A    |
| 9.7   | EN 61000-4-11:2004                | Voltage Dips                               | 0% residual for 0.5 cycle                       | Note <sup>2</sup> | N/A    |
|   |                                   |  | 0% residual for 1 cycle                         | Note <sup>2</sup> | N/A    |
|   |                                   |  | 70% residual for 25 cycle                       | Note <sup>2</sup> | N/A    |
|   |                                   | Voltage Interruption                       | 0% residual for 250 cycle (w/o battery back-up) | Note <sup>2</sup> | N/A    |
| N/A means Not Applicable.<br>Note <sup>1</sup> : 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.<br>Note <sup>2</sup> : 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. EH442804. The modification is concerned with updating standard to latest version.

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 | BT830-SA   | Bluetooth v4.0 Dual-Mode UART HCI Module | chip antenna              |
|                    | BT830-ST   | Bluetooth v4.0 Dual-Mode UART HCI Module | trace to external antenna |

### 1.1.2 Specification of the Equipment under Test (EUT)

|                     |   |
|---------------------|---|
| Operating Frequency | 2402 MHz ~ 2480 MHz   |
| Modulation Type     | Bluetooth 4.0 LE: GFSK<br>Bluetooth BR(1Mbps): GFSK<br>Bluetooth EDR (2Mbps): $\pi/4$ -DQPSK<br>Bluetooth EDR (3Mbps): 8-DPSK |

### 1.1.3 Antenna Details

| Ant. No. | EUT Model | Type       | Ant. Brand / Model                 | Gain (dBi) | Connector |
|----------|-----------|------------|------------------------------------|------------|-----------|
| 1        | BT830-SA  | Chip       | ACX<br>AT3216-B2R7HAA_3216         | 0.5        | N/A       |
| 2        | BT830-ST  | Dipole     | Nearson<br>S181FL-L-RMM-2450S      | 2.0        | UFL       |
| 3        | BT830-ST  | PCB Dipole | Laird<br>EBL2449A1-15UFL           | 2.0        | UFL       |
| 4        | BT830-ST  | Dipole     | Laird<br>MAF94190                  | 2.0        | UFL       |
| 5        | BT830-ST  | Dipole     | Laird<br>WRR2400- IP04-B(MAF94019) | 1.5        | UFL       |

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

|                          |                   |
|--------------------------|-------------------|
| <b>Power Supply Type</b> | 3.3Vdc from host. |
|--------------------------|-------------------|

### 1.1.5 Accessories

N/A

## 1.2 Test Equipment and Calibration Data

|   |                               |                          |                   |                         |                          |
|---|-------------------------------|--------------------------|-------------------|-------------------------|--------------------------|
| <b>Test Item</b>  | Conducted Emission            |                          |                   |                         |                          |
| <b>Test Site</b>  | Conduction room 1 / (CO01-WS) |                          |                   |                         |                          |
| <b>Tested Date</b>  | Apr. 20, 2017                 |                          |                   |                         |                          |
| <b>Instrument</b>   | <b>Manufacturer</b>           | <b>Model No.</b>         | <b>Serial No.</b> | <b>Calibration Date</b> | <b>Calibration Until</b> |
| Receiver  | R&S                           | ESR3                     | 101657            | Dec. 21, 2016           | Dec. 20, 2017            |
| LISN  | SCHWARZBECK                   | Schwarzbeck 8127         | 8127-667          | Nov. 08, 2016           | Nov. 07, 2017            |
| LISN<br>(Support Unit)  | SCHWARZBECK                   | Schwarzbeck 8127         | 8127-666          | Nov. 25, 2016           | Nov. 24, 2017            |
| RF Cable-CON  | EMC                           | EMCCFD300-BM-B<br>M-6000 | 50821             | Dec. 20, 2016           | Dec. 19, 2017            |
| 50 ohm terminal<br>(Support Unit)                                   | NA                            | 50                       | 02                | Apr. 07, 2017           | Apr. 06, 2018            |
| Measurement<br>Software   | AUDIX                         | e3                       | 6.120210k         | NA                      | NA                       |
| Note: Calibration Interval of instruments listed above is one year. |                               |                          |                   |                         |                          |

|   |                        |                  |                   |                         |                          |
|---|------------------------|------------------|-------------------|-------------------------|--------------------------|
| <b>Test Item</b>  | ESD                    |                  |                   |                         |                          |
| <b>Test Site</b>  | ESD room 1 / (ES01-WS) |                  |                   |                         |                          |
| <b>Tested Date</b>  | May 15, 2014           |                  |                   |                         |                          |
| <b>Instrument</b>   | <b>Manufacturer</b>    | <b>Model No.</b> | <b>Serial No.</b> | <b>Calibration Date</b> | <b>Calibration Until</b> |
| ESD Generator   | EMTest                 | Dito             | V1248114239       | Aug. 19, 2013           | Aug. 18, 2014            |
| Note: Calibration Interval of instruments listed above is one year. |                        |                  |                   |                         |                          |

|   |                                    |                       |                   |                         |                          |
|---|------------------------------------|-----------------------|-------------------|-------------------------|--------------------------|
| <b>Test Item</b>  | Radiated Immunity (80 MHz - 6 GHz) |                       |                   |                         |                          |
| <b>Test Site</b>  | RS room 1 / (RS01-WS)              |                       |                   |                         |                          |
| <b>Tested Date</b>  | May 02, 2017                       |                       |                   |                         |                          |
| <b>Instrument</b>   | <b>Manufacturer</b>                | <b>Model No.</b>      | <b>Serial No.</b> | <b>Calibration Date</b> | <b>Calibration Until</b> |
| Signal Generator  | R & S                              | SMB100A               | 103294HA          | Oct. 29, 2013           | Oct. 28, 2014            |
| Power Sensor  | R & S                              | NRP-Z91               | 101094-UL         | Nov. 01, 2013           | Oct. 31, 2014            |
| Power Sensor  | R & S                              | NRP-Z91               | 101095-KY         | Nov. 01, 2013           | Oct. 31, 2014            |
| Power Amplifier   | BONN                               | BLWA<br>0810-160/100D | 107972A           | N/A                     | N/A                      |
| Power Amplifier   | BONN                               | BLMA 1060-100D        | 107972B           | 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 | $\pm 2.90$ 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   | 25°C/54%/ 97kPa   | JN Chen   |
| RS  | RS01-WS   | 23°C/59%/59kPa    | JN Chen   |

### 2.2 The Worst Case Measurement Configuration

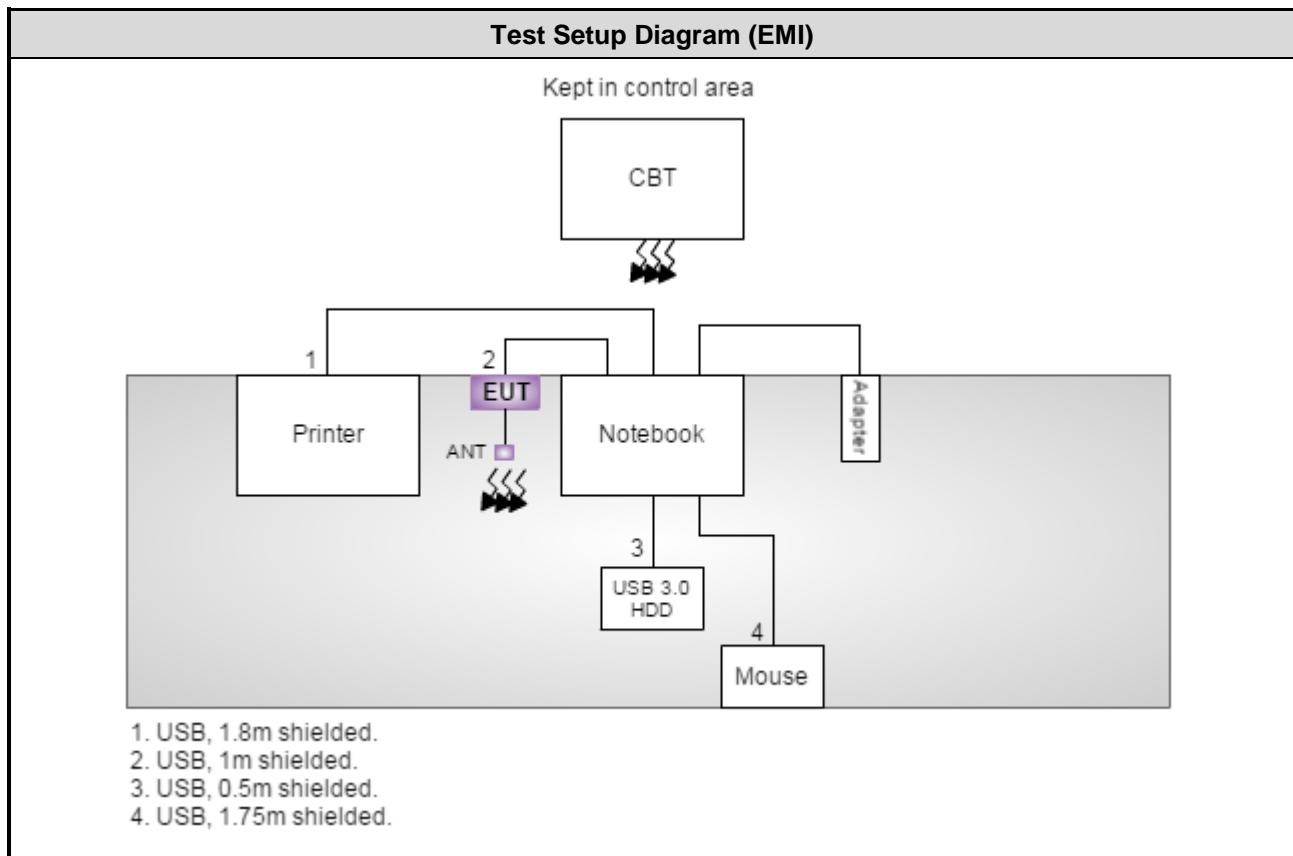
| The Determined Worst Case Configurations          |   |
|---|---|
| Conducted Emissions from the AC mains power ports |   |
| Test Mode   | Operating Description                       |
| 1   | BT830-SA with Antenna 1, BT link, 230V/50Hz |
| 2   | BT830-ST with Antenna 2, BT link, 230V/50Hz |
| 3   | BT830-ST with Antenna 3, BT link, 230V/50Hz |
| 4   | BT830-ST with Antenna 4, BT link, 110V/60Hz |
| 5   | BT830-ST with Antenna 5, BT link, 110V/60Hz |
| ESD, RS Tests                                     |   |
| Test Mode   | Operating Description                       |
| 1   | BT830-SA with Antenna 1, BT link            |
| 2   | BT830-ST with Antenna 2, BT link            |
| 3   | BT830-ST with Antenna 3, BT link            |
| 4   | BT830-ST with Antenna 4, BT link            |
| 5   | BT830-ST with Antenna 5, BT link            |

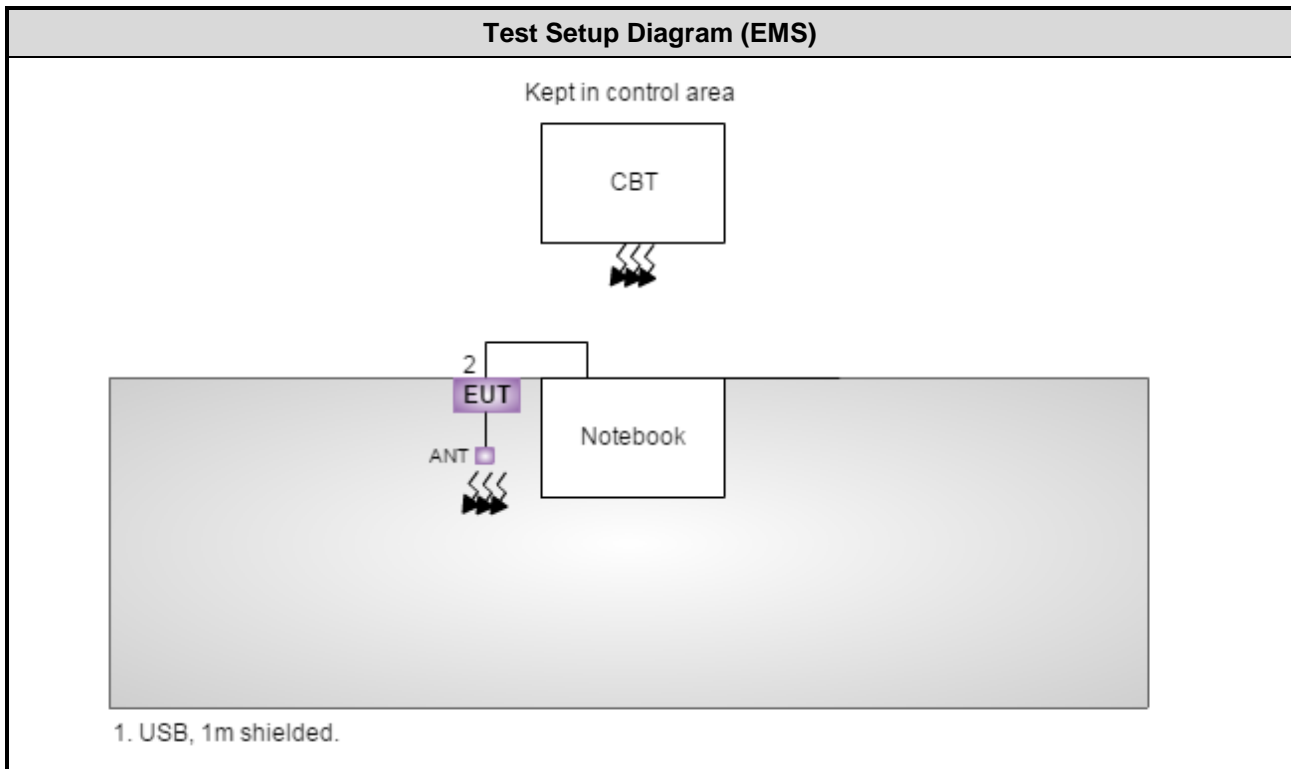
## 2.3 Local Support Equipment List

| Support Equipment List (EMI) |                  |                |                |               |                           |
|------------------------------|------------------|----------------|----------------|---------------|---------------------------|
| No.                          | Equipment        | Brand          | Model          | S/N           | Signal cable / Length (m) |
| 1                            | Notebook         | DELL           | Latitude E5430 | 6R4RWW1       | USB, 1m shielded.         |
| 2                            | Printer          | EPSON          | XP-30          | QSDK002410    | USB, 1.8m shielded.       |
| 3                            | USB 3.0 HDD      | WD             | WDBKXH5000 ABK | WX31AB2102 13 | USB, 0.5m shielded..      |
| 4                            | Mouse            | DELL           | MS111-L        | 2C3-00MM      | USB, 1.75m shielded.      |
| 5                            | Bluetooth Tester | ROHDE&SCH WARZ | CBT            | 100959        | ---                       |

| Support Equipment List (EMS) |                  |                |                |         |                            |
|------------------------------|------------------|----------------|----------------|---------|----------------------------|
| No.                          | Equipment        | Brand          | Model          | S/N     | Signal cable / Length (m)  |
| 1                            | Notebook         | DELL           | Latitude E5430 | 6R4RWW1 | USB, 1m shielded w/o core. |
| 2                            | Bluetooth Tester | ROHDE&SCH WARZ | CBT            | 100959  | ---                        |

## 2.4 Test Setup Chart





## 2.5 Test Software and Operating Condition

### EMI

- a. The support notebook executed "Blue Test 3.exe" to transmit and receive data to EUT by BT link.
- b. Monitor the PER status of BT connection from support CBT.
- c. The support notebook executed "WinEMC.exe" to send "H" patterns to the printer.
- d. The notebook executed "WinEMC.exe" to read and write data from USB 3.0 HDD.
- e. The notebook executed "Windows media player.exe" to play colorbar video.

### EMS

- a. The support notebook executed "Blue Test 3.exe" to transmit and receive data to EUT by BT link.
- b. Monitor the PER status of BT connection from support CBT.

### 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

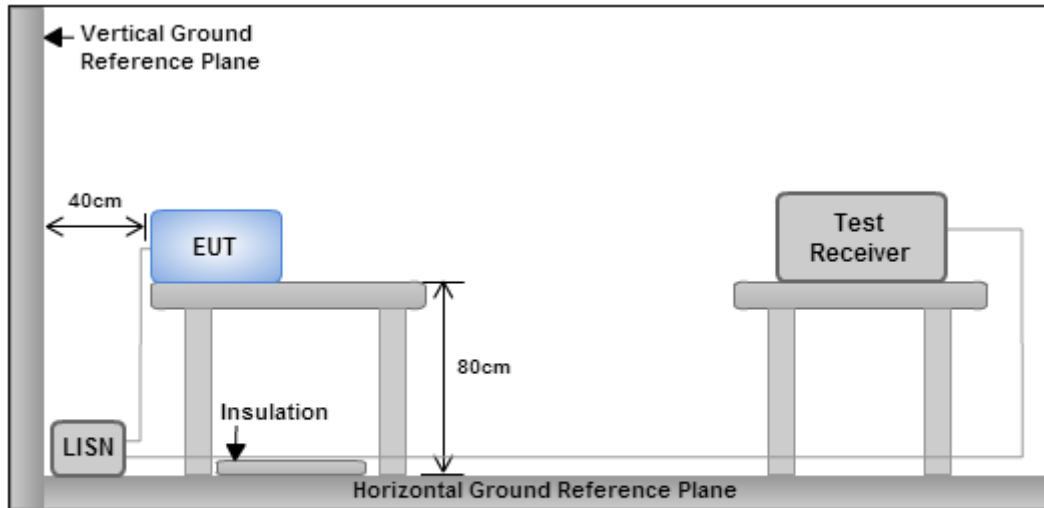
| Frequency range<br>(MHz) | Limits values (dB $\mu$ V) |         |            |            |
|--------------------------|----------------------------|---------|------------|------------|
|                          | Class A                    |         | Class B    |            |
|                          | 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  $\leq 0.15$ 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

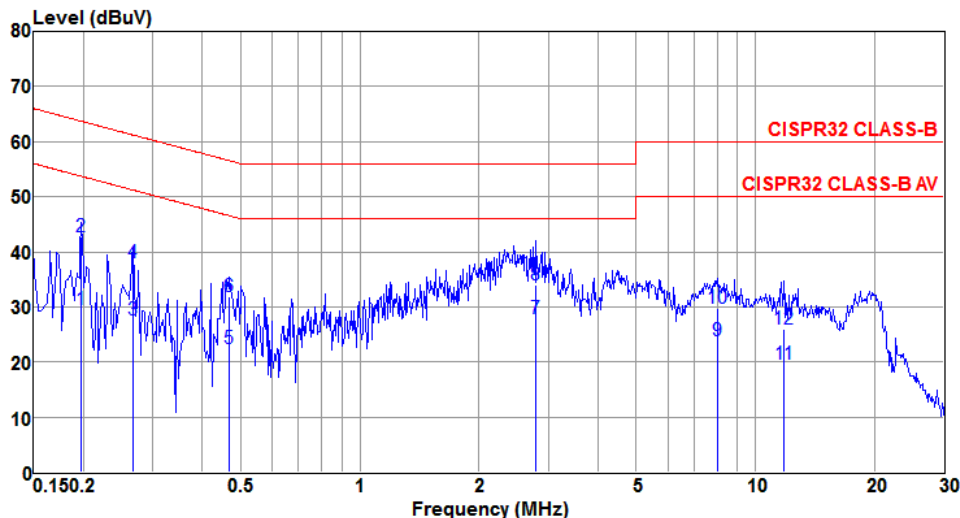


- Note: 1. Support units were connected to second LISN.  
2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

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

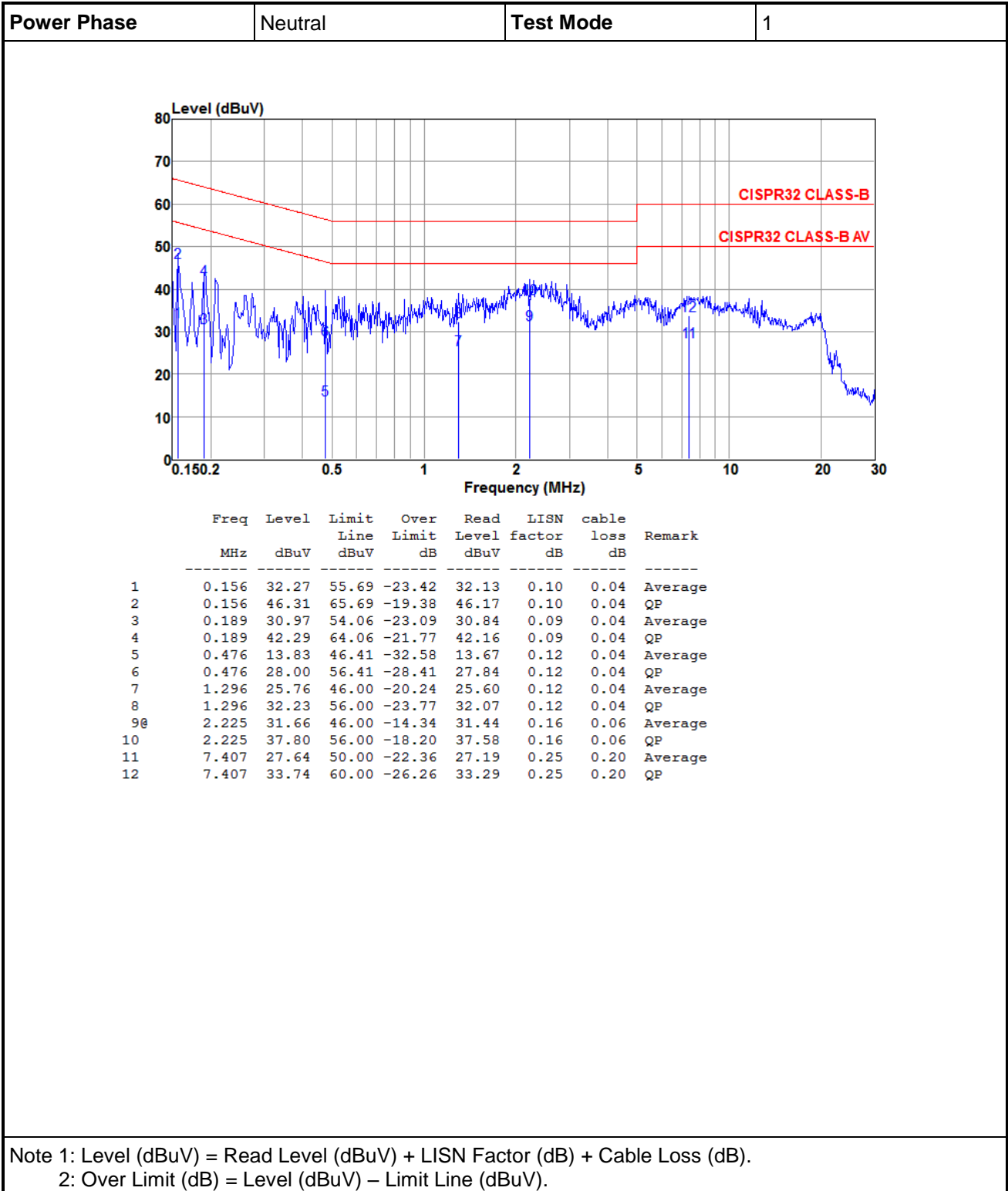
| Power Phase | Line | Test Mode | 1 |
|-------------|------|-----------|---|
|-------------|------|-----------|---|

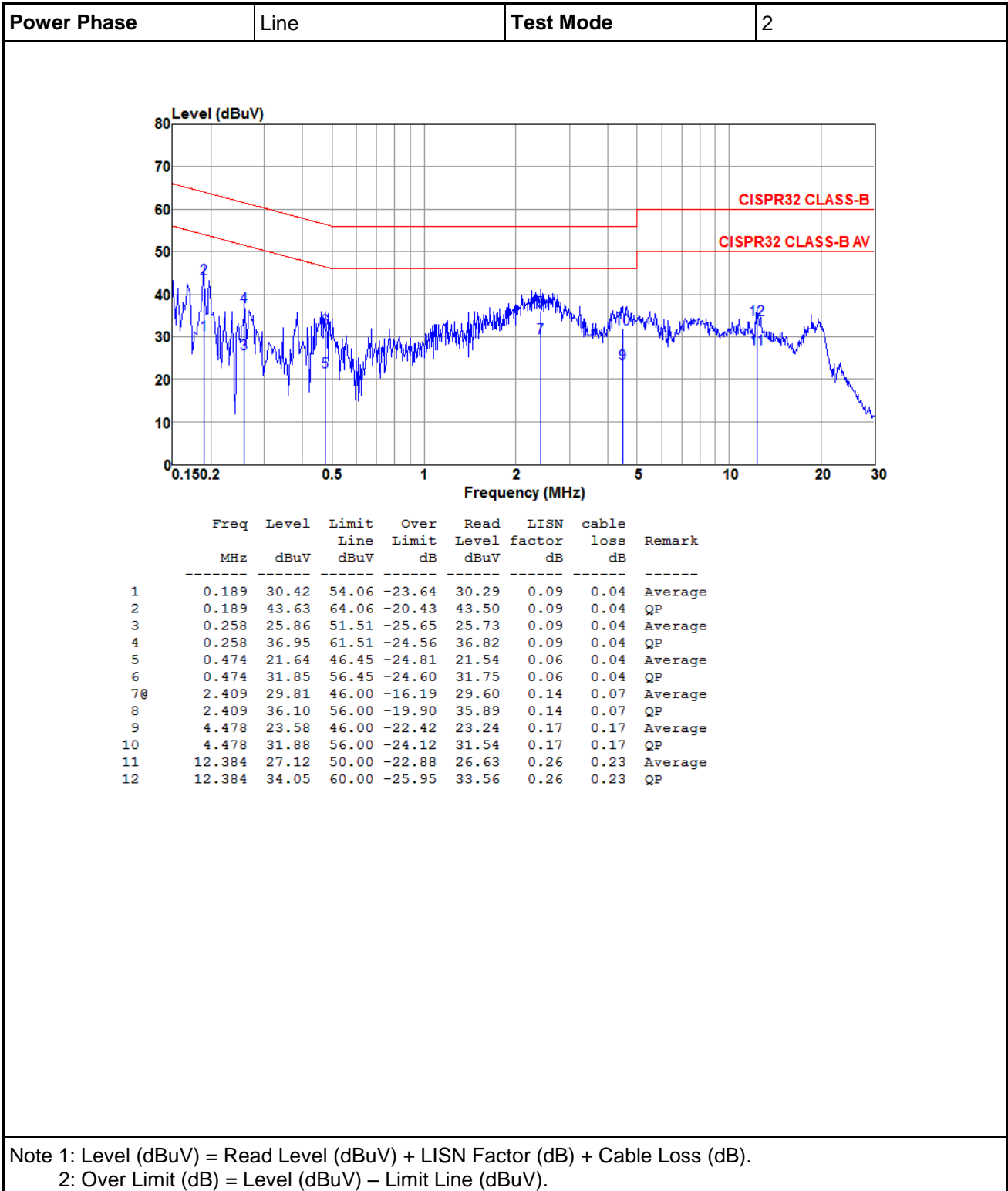
  



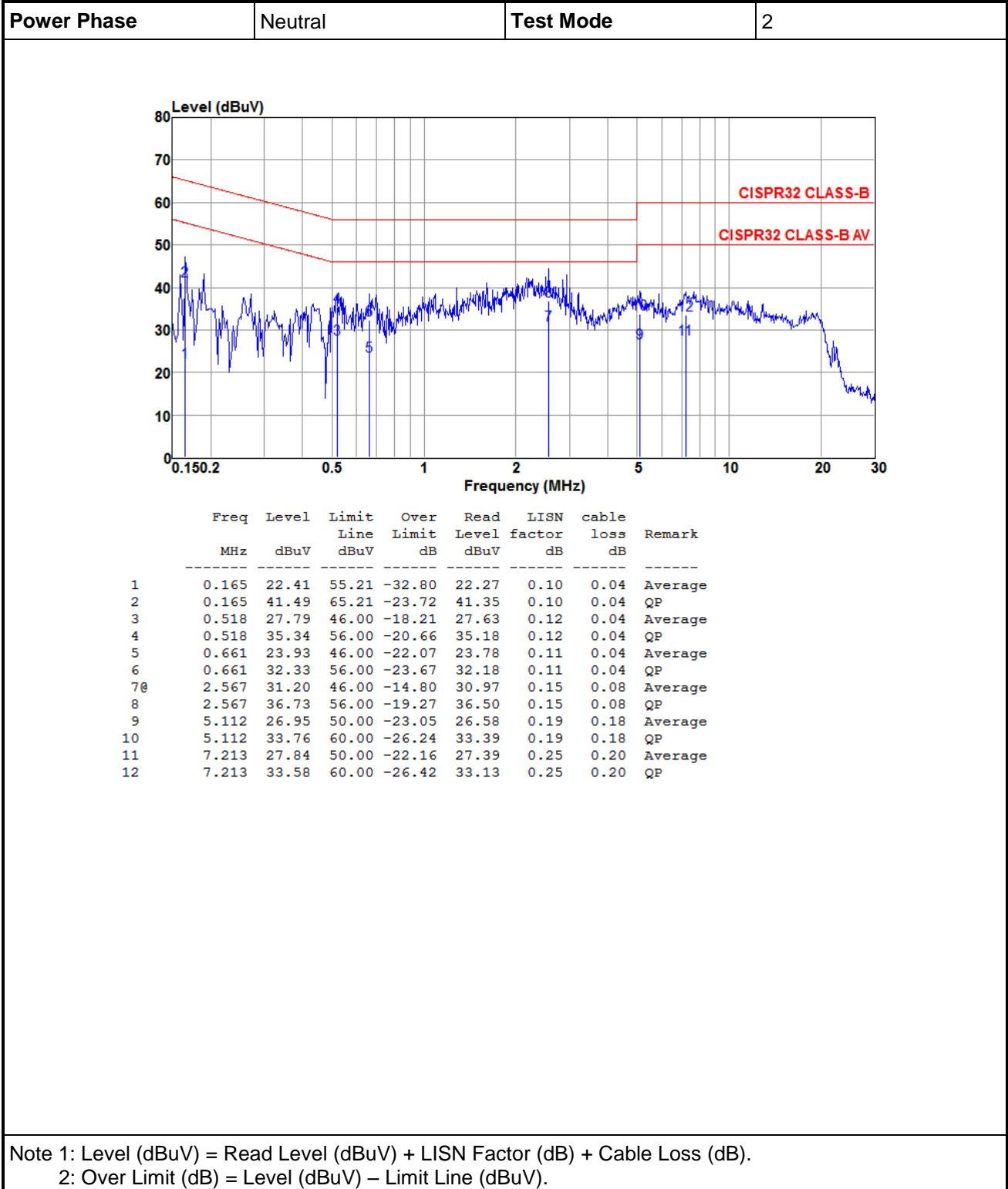
|    | Freq   | Level | Limit | Over   | Read  | LISN   | cable | Remark  |
|----|--------|-------|-------|--------|-------|--------|-------|---------|
|    | MHz    | dBuV  | Line  | Limit  | Level | factor | loss  |         |
|    |        |       | dBuV  | dB     | dBuV  | dB     | dB    |         |
| 1  | 0.198  | 29.51 | 53.71 | -24.20 | 29.37 | 0.10   | 0.04  | Average |
| 2  | 0.198  | 42.61 | 63.71 | -21.10 | 42.47 | 0.10   | 0.04  | QP      |
| 3  | 0.267  | 27.51 | 51.20 | -23.69 | 27.39 | 0.08   | 0.04  | Average |
| 4  | 0.267  | 38.02 | 61.20 | -23.18 | 37.90 | 0.08   | 0.04  | QP      |
| 5  | 0.469  | 22.48 | 46.54 | -24.06 | 22.38 | 0.06   | 0.04  | Average |
| 6  | 0.469  | 31.82 | 56.54 | -24.72 | 31.72 | 0.06   | 0.04  | QP      |
| 7@ | 2.779  | 27.80 | 46.00 | -18.20 | 27.55 | 0.15   | 0.10  | Average |
| 8  | 2.779  | 34.08 | 56.00 | -21.92 | 33.83 | 0.15   | 0.10  | QP      |
| 9  | 8.020  | 23.73 | 50.00 | -26.27 | 23.33 | 0.19   | 0.21  | Average |
| 10 | 8.020  | 29.66 | 60.00 | -30.34 | 29.26 | 0.19   | 0.21  | QP      |
| 11 | 11.807 | 19.53 | 50.00 | -30.47 | 19.06 | 0.25   | 0.22  | Average |
| 12 | 11.807 | 25.90 | 60.00 | -34.10 | 25.43 | 0.25   | 0.22  | QP      |

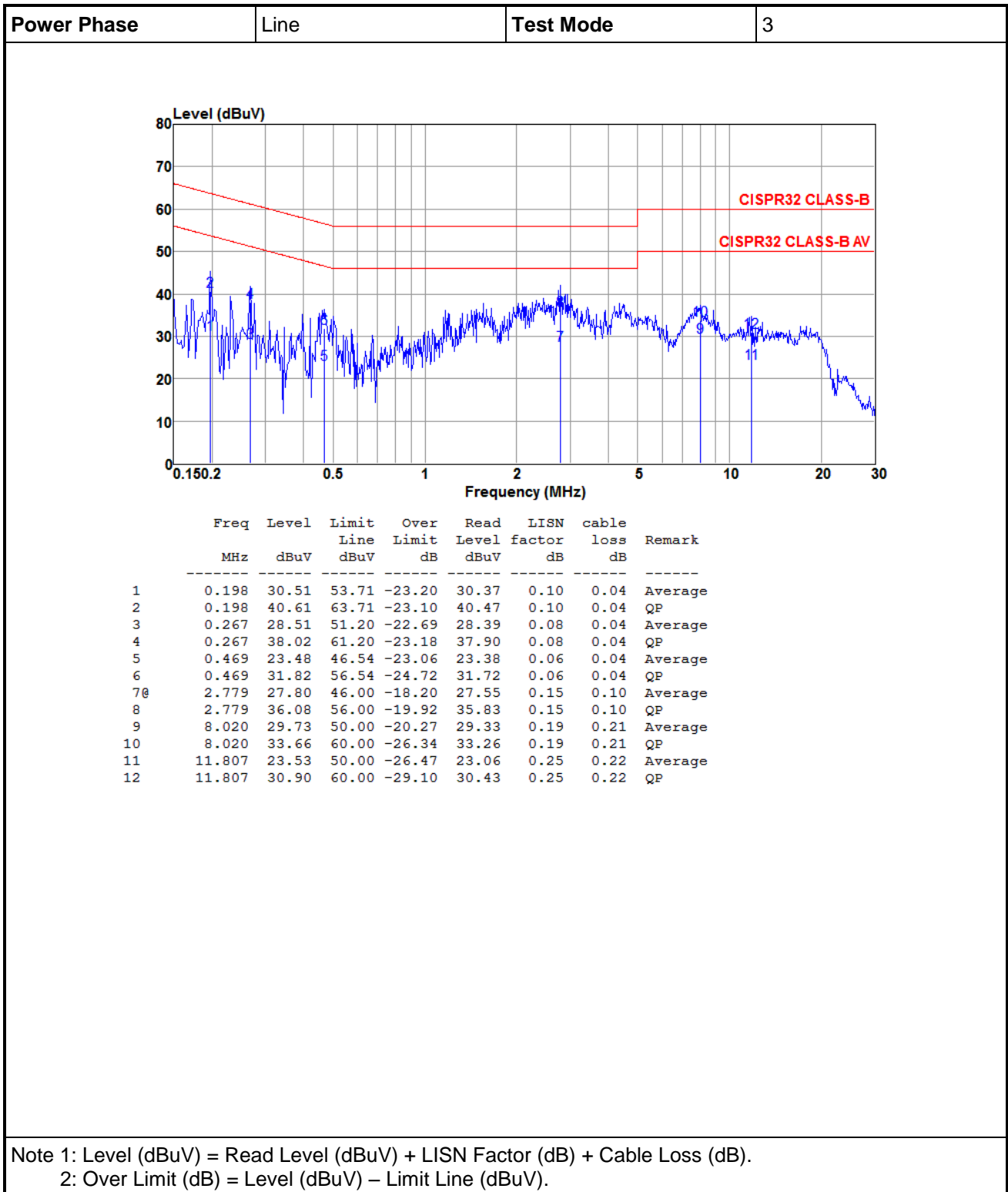
Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).  
 2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).





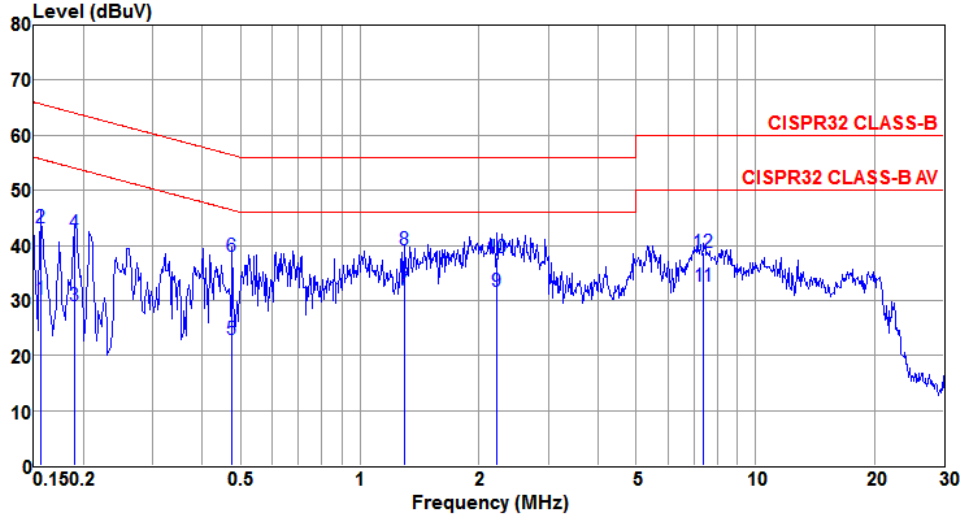






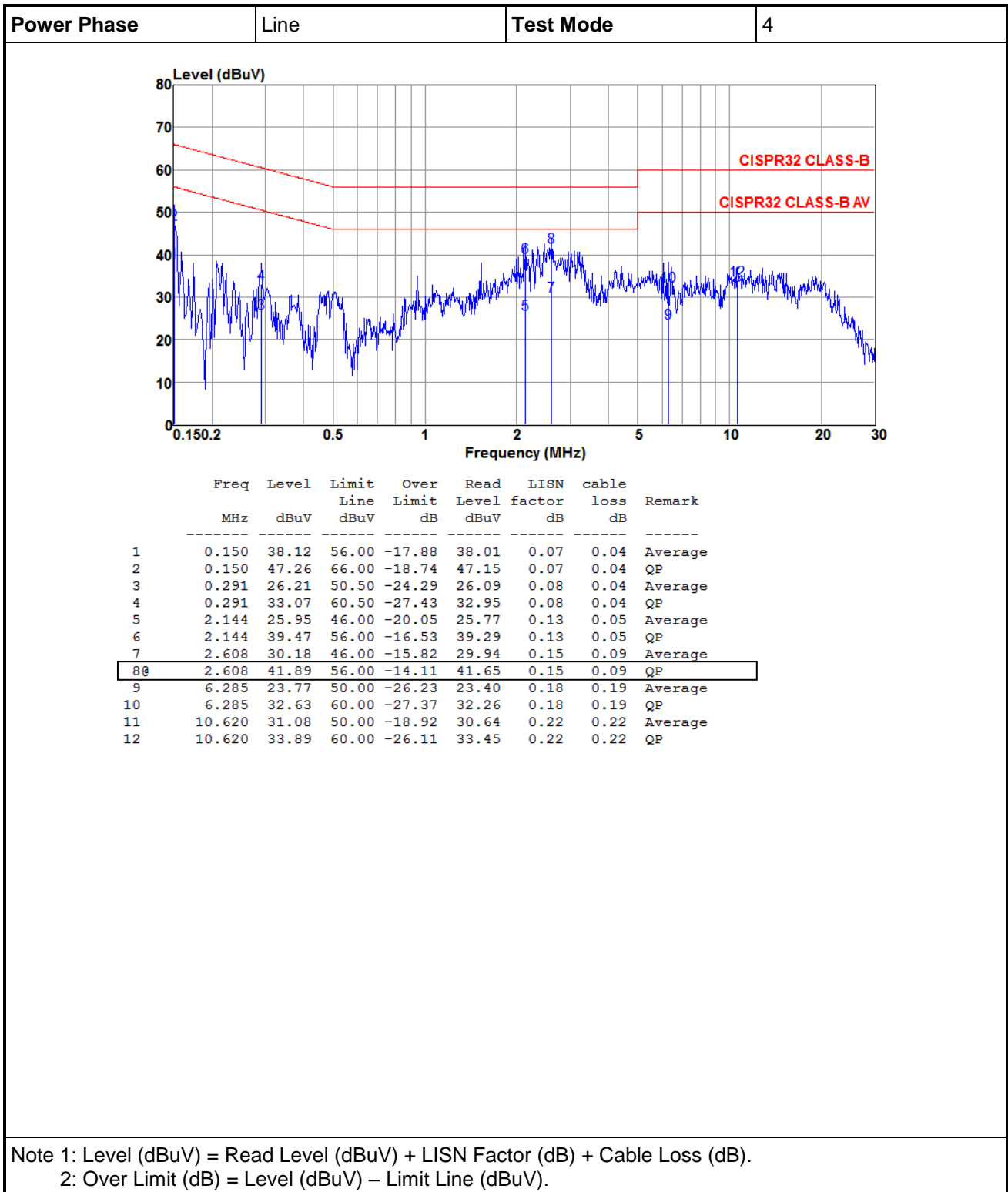
| Power Phase |  | Neutral | Test Mode |  | 3 |
|-------------|--|---------|-----------|--|---|
|-------------|--|---------|-----------|--|---|

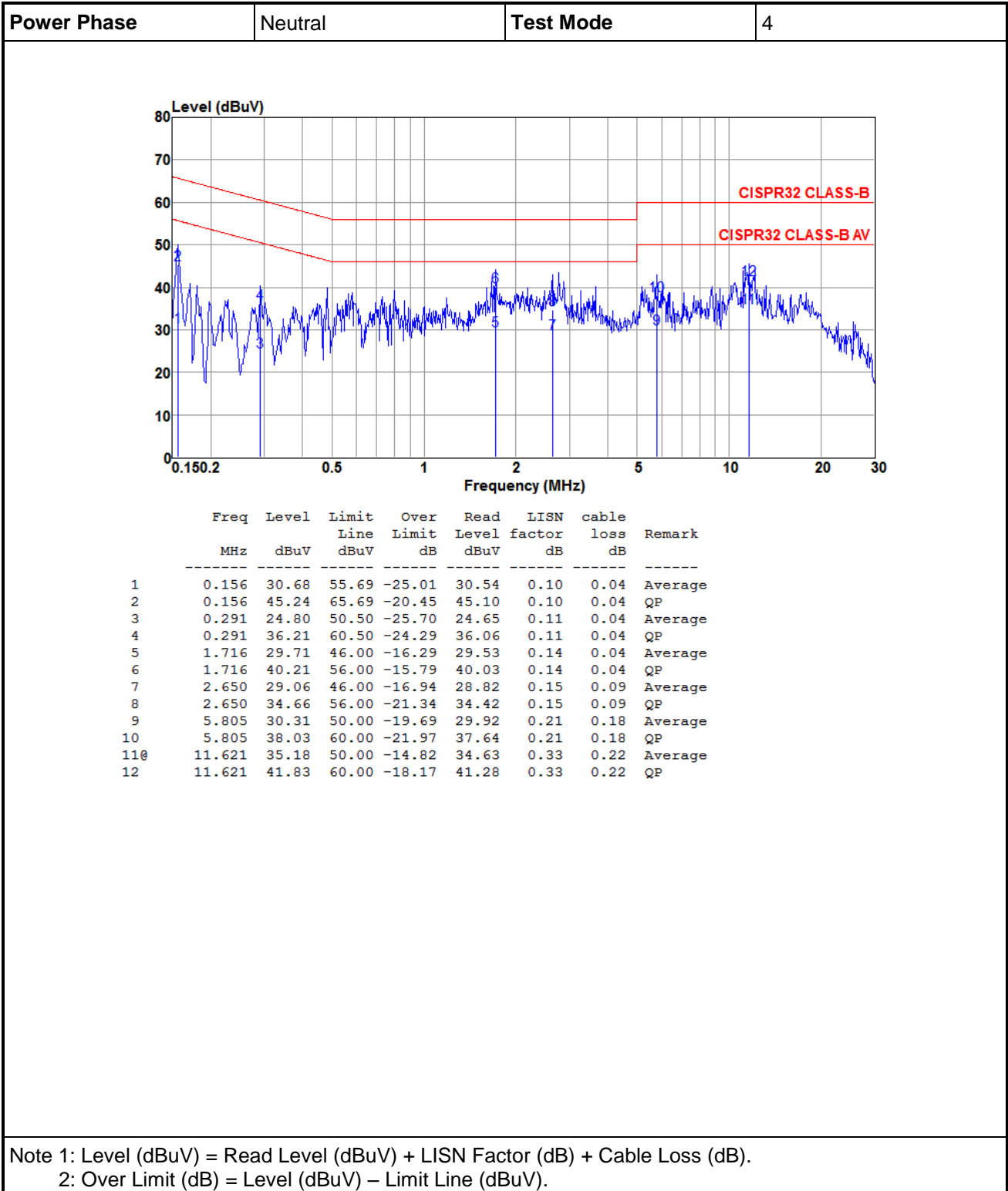
  

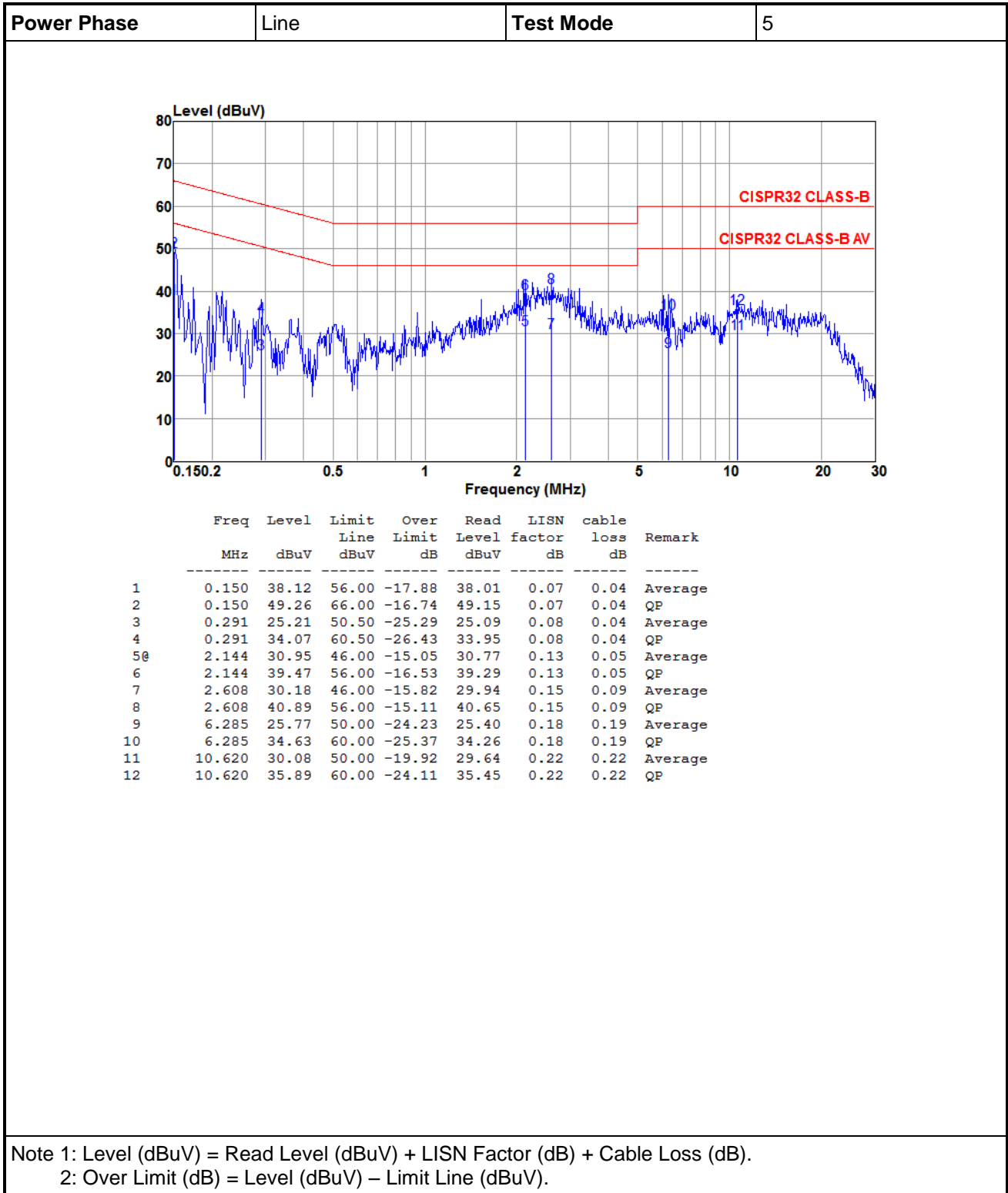


|    | Freq  | Level | Limit | Over   | Read  | LISN   | cable | Remark  |
|----|-------|-------|-------|--------|-------|--------|-------|---------|
|    | MHz   | dBuV  | dBuV  | Limit  | Level | factor | loss  |         |
|    |       |       |       | dB     | dBuV  | dB     | dB    |         |
| 1  | 0.156 | 30.27 | 55.69 | -25.42 | 30.13 | 0.10   | 0.04  | Average |
| 2  | 0.156 | 43.31 | 65.69 | -22.38 | 43.17 | 0.10   | 0.04  | QP      |
| 3  | 0.189 | 28.97 | 54.06 | -25.09 | 28.84 | 0.09   | 0.04  | Average |
| 4  | 0.189 | 42.29 | 64.06 | -21.77 | 42.16 | 0.09   | 0.04  | QP      |
| 5  | 0.476 | 22.83 | 46.41 | -23.58 | 22.67 | 0.12   | 0.04  | Average |
| 6  | 0.476 | 38.00 | 56.41 | -18.41 | 37.84 | 0.12   | 0.04  | QP      |
| 7@ | 1.296 | 31.76 | 46.00 | -14.24 | 31.60 | 0.12   | 0.04  | Average |
| 8  | 1.296 | 39.23 | 56.00 | -16.77 | 39.07 | 0.12   | 0.04  | QP      |
| 9  | 2.225 | 31.66 | 46.00 | -14.34 | 31.44 | 0.16   | 0.06  | Average |
| 10 | 2.225 | 37.80 | 56.00 | -18.20 | 37.58 | 0.16   | 0.06  | QP      |
| 11 | 7.407 | 32.64 | 50.00 | -17.36 | 32.19 | 0.25   | 0.20  | Average |
| 12 | 7.407 | 38.74 | 60.00 | -21.26 | 38.29 | 0.25   | 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 | Neutral | Test Mode | 5 |
|-------------|---------|-----------|---|

Level (dBuV)

Frequency (MHz)

|    | Freq   | Level | Limit | Over   | Read  | LISN | cable | Remark  |
|----|--------|-------|-------|--------|-------|------|-------|---------|
|    | MHz    | dBuV  | dBuV  | dB     | dBuV  | dB   | dB    |         |
| 1  | 0.156  | 32.68 | 55.69 | -23.01 | 32.54 | 0.10 | 0.04  | Average |
| 2  | 0.156  | 48.24 | 65.69 | -17.45 | 48.10 | 0.10 | 0.04  | QP      |
| 3  | 0.291  | 26.80 | 50.50 | -23.70 | 26.65 | 0.11 | 0.04  | Average |
| 4  | 0.291  | 35.21 | 60.50 | -25.29 | 35.06 | 0.11 | 0.04  | QP      |
| 5  | 1.716  | 27.71 | 46.00 | -18.29 | 27.53 | 0.14 | 0.04  | Average |
| 6  | 1.716  | 34.21 | 56.00 | -21.79 | 34.03 | 0.14 | 0.04  | QP      |
| 7  | 2.650  | 30.06 | 46.00 | -15.94 | 29.82 | 0.15 | 0.09  | Average |
| 8  | 2.650  | 36.66 | 56.00 | -19.34 | 36.42 | 0.15 | 0.09  | QP      |
| 9  | 5.805  | 24.31 | 50.00 | -25.69 | 23.92 | 0.21 | 0.18  | Average |
| 10 | 5.805  | 32.03 | 60.00 | -27.97 | 31.64 | 0.21 | 0.18  | QP      |
| 11 | 11.621 | 27.18 | 50.00 | -22.82 | 26.63 | 0.33 | 0.22  | Average |
| 12 | 11.621 | 33.83 | 60.00 | -26.17 | 33.28 | 0.33 | 0.22  | QP      |

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

Note 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: $\pm 4$ kV<br>Air Discharge: $\pm 8$ kV         | B                    |
| EN 61000-4-3 (RS)   | 80 MHz to 6000 MHz<br>3 V/m, 1 kHz Sine Wave<br>80%, AM Modulation | A                    |



## 4.2 Performance Criteria Description

| Draft EN 301 489-17  |   |   |
|--|---|---|
| Criteria   | During test   | After test  |
| A  | <p>Shall operate as intended.</p> <p>May show degradation of performance (see note 1).</p> <p>Shall be no loss of function.</p> <p>Shall be no unintentional transmissions.</p> | <p>Shall operate as intended.</p> <p>Shall be no degradation of performance (see note 3).</p> <p>Shall be no loss of function.</p> <p>Shall be no loss of stored data or user programmable functions.</p>                         |
| B  | <p>May show loss of function (one or more).</p> <p>May show degradation of performance (see note 2).</p> <p>No unintentional transmissions.</p>                                 | <p>Functions shall be self-recoverable.</p> <p>Shall operate as intended after recovering.</p> <p>Shall be no degradation of performance (see note 3).</p> <p>Shall be no loss of stored data or user programmable functions.</p> |
| C  | <p>May be loss of function (one or more).</p>   | <p>Functions shall be recoverable by the operator.</p> <p>Shall operate as intended after recovering.</p> <p>Shall be no degradation of performance (see note 3).</p>   |
| <p>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.</p>   |   |   |
| <p>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.</p>  |   |   |
| <p>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.</p> |   |   |

**Draft EN 301 489-17 Performance Criteria**

|    |   |
|----|---|
| CT | The performance criteria A shall apply.<br>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.<br>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.<br>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.<br>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 BT PER loss or any degradation of performance.           |
| B | Any BT PER loss. Functions shall be self-recoverable after the test. |

## 4.3 Electrostatic Discharge (ESD)

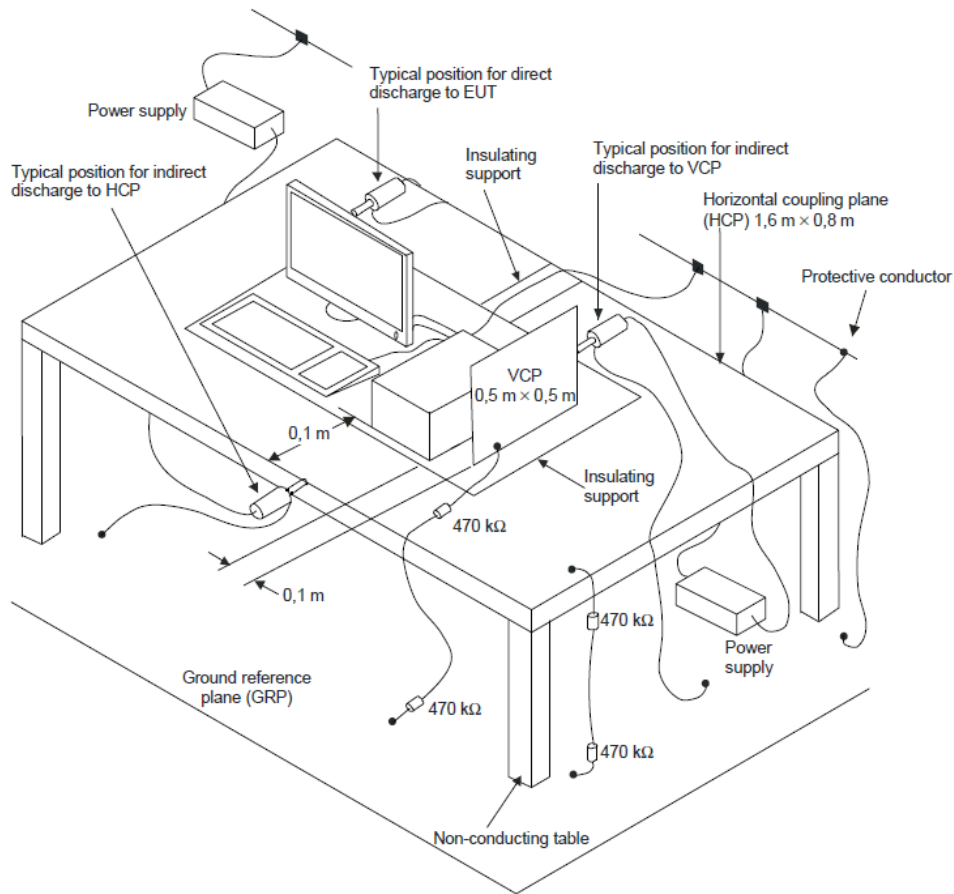
### 4.3.1 Test Specification of Electrostatic Discharge (ESD)

|                            |  |
|----------------------------|--|
| <b>Basic Standard</b>      | EN 61000-4-2   |
| <b>Discharge Voltage</b>   | Contact Discharge: $\pm 2$ kV / $\pm 4$ kV<br>Air Discharge: $\pm 2$ kV / $\pm 4$ kV / $\pm 8$ kV            |
| <b>Discharge Impedance</b> | 330 ohm / 150 pF   |
| <b>Number of Discharge</b> | Air Discharge: minimum 20 times at each test point<br>Contact Discharge: minimum 20 times at each test point |
| <b>Discharge Mode</b>      | Single Discharge   |
| <b>Discharge Period</b>    | 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, 3     |                                     |                                 |                               |                      |
| 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, 4, 5  |                                     |                                 |                               |                      |
| 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                    |

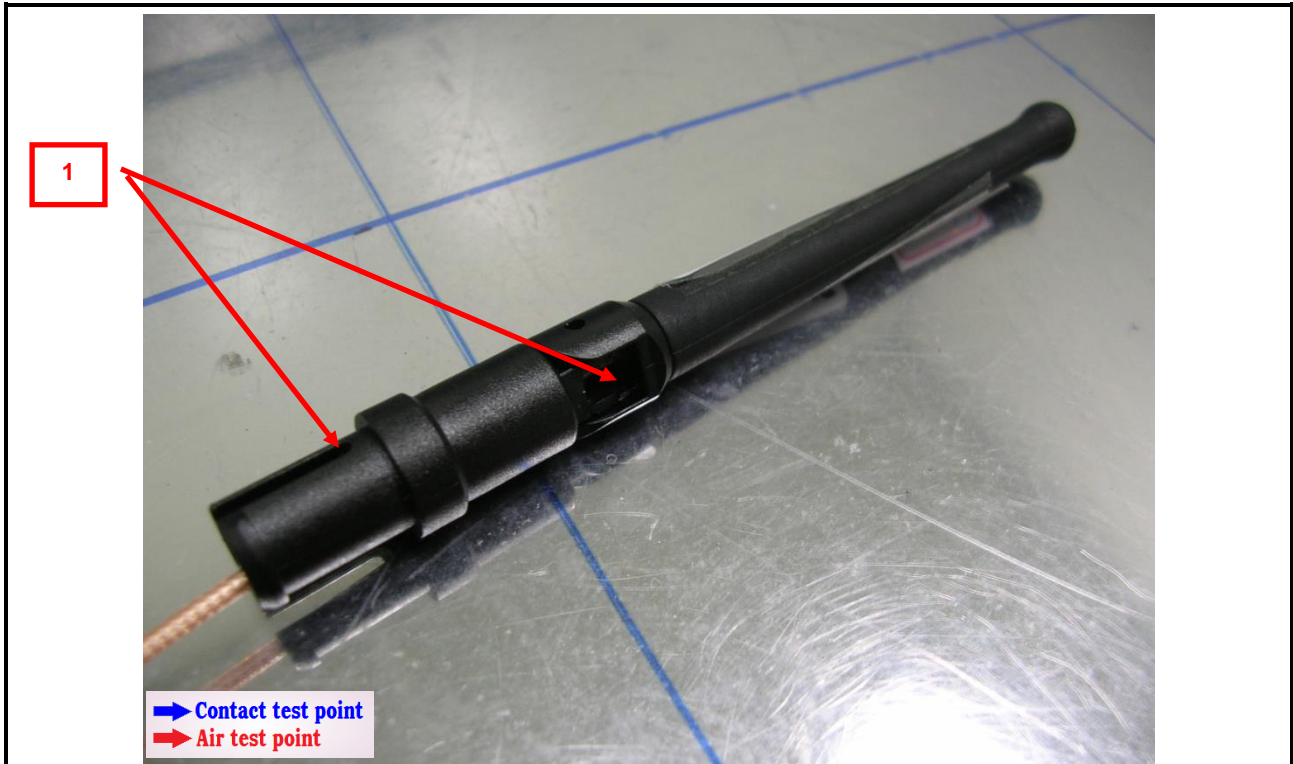
Note: There was no abnormal situation during the test compared with initial operation.

#### 4.3.5 Test Point Photo

##### Test mode 2

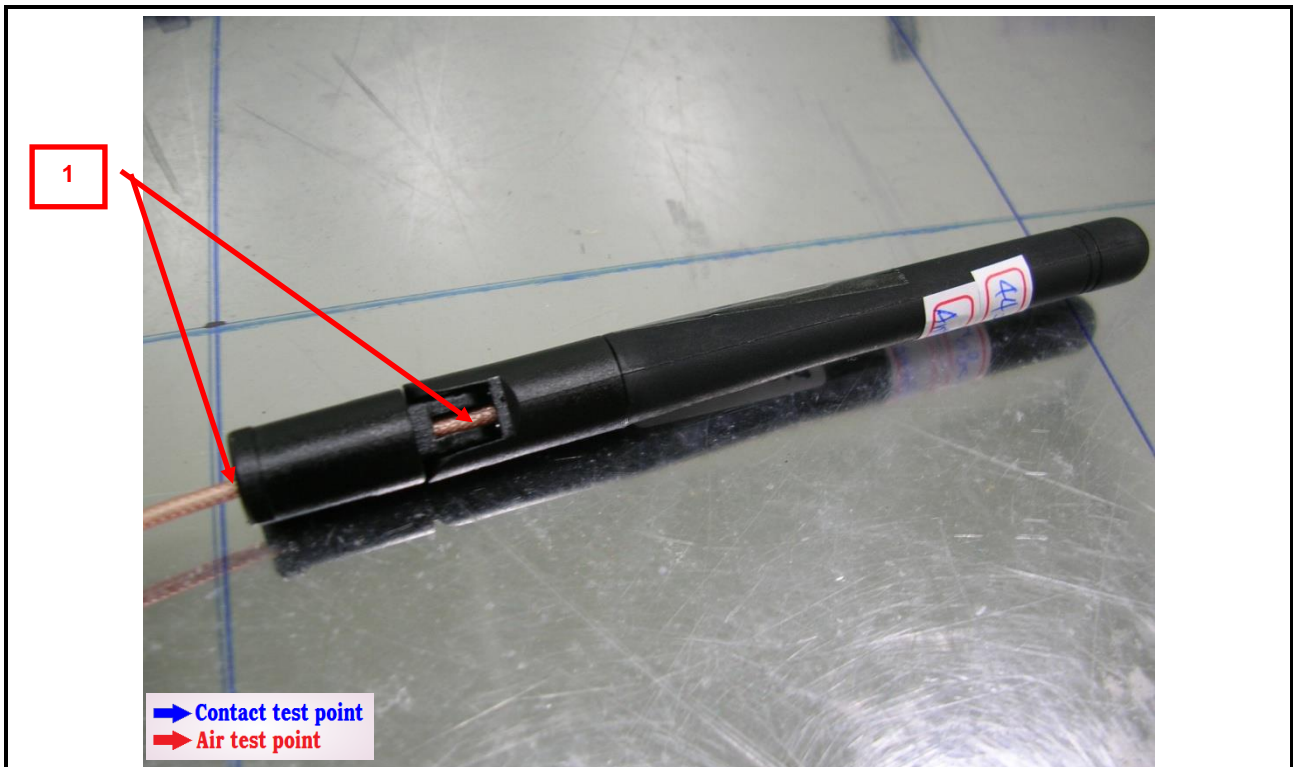


##### Test mode 4





**Test mode 5**



## 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<br>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:

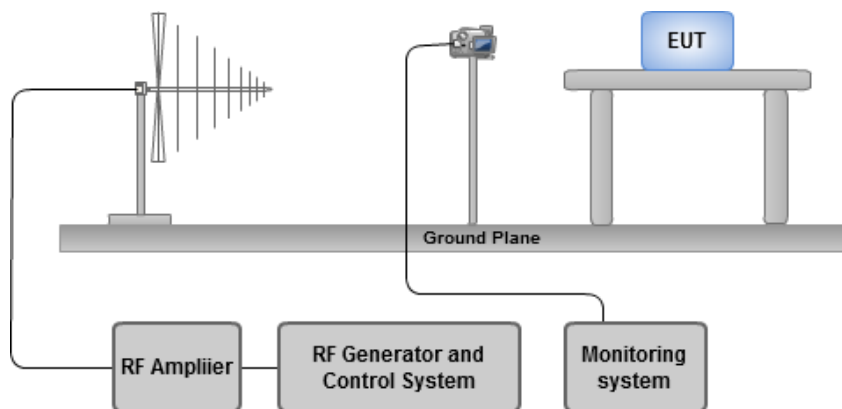
- lower limit of exclusion band = lowest allocated band edge frequency -270 MHz, i.e. 4 880 MHz;
- upper limit of exclusion band = highest allocated band edge frequency +270 MHz, i.e. 5 995 MHz.

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.

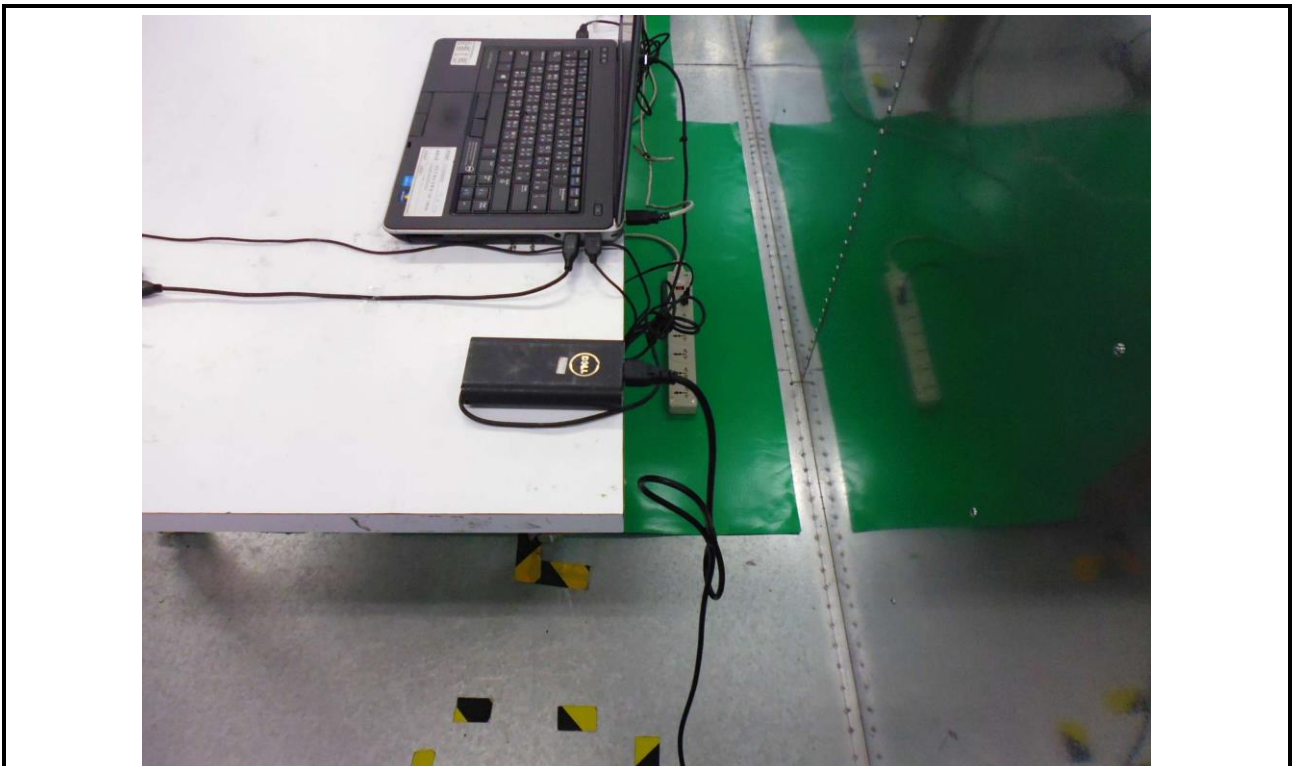
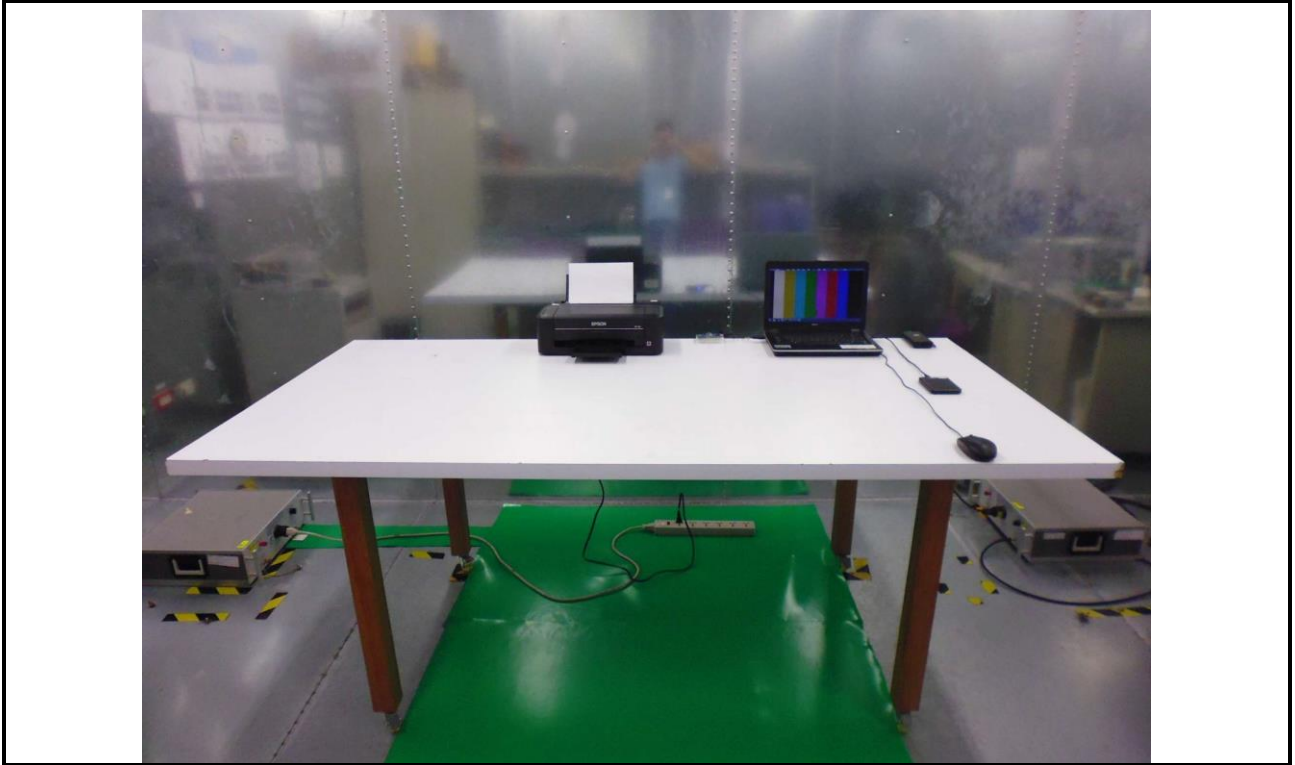
#### 4.4.5 Test Result of Radio Frequency Electromagnetic Field (RS)

| Test Mode             | 1, 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                    |

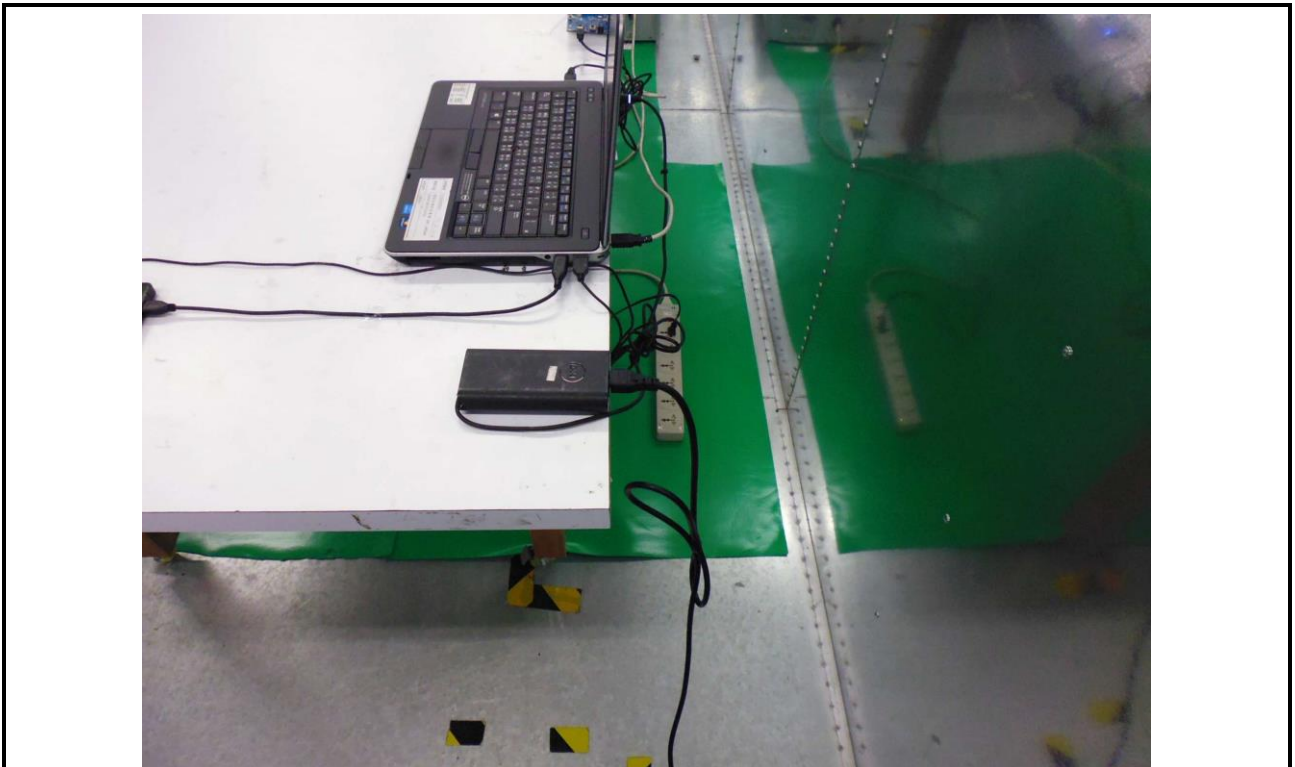
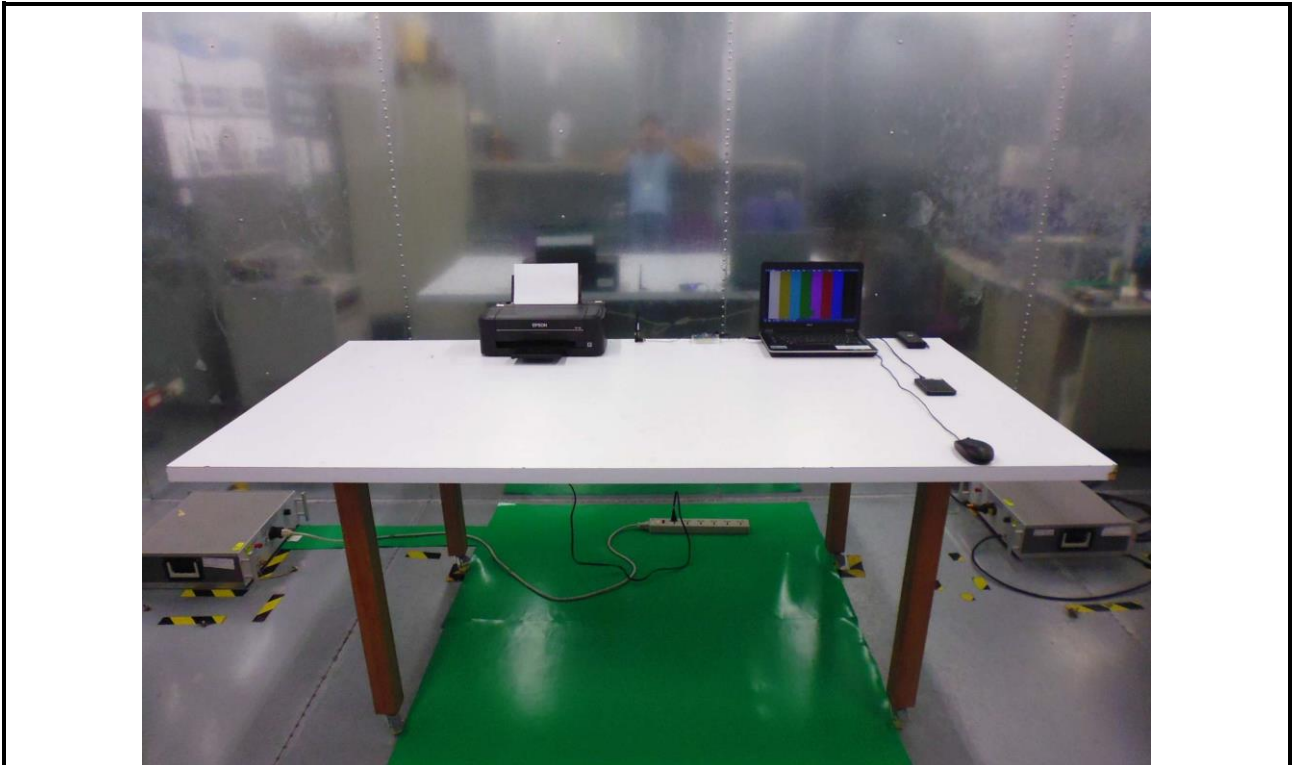
Note: There was no abnormal situation during the test compared with initial operation.

## 5 Photographs of the Test Configuration

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

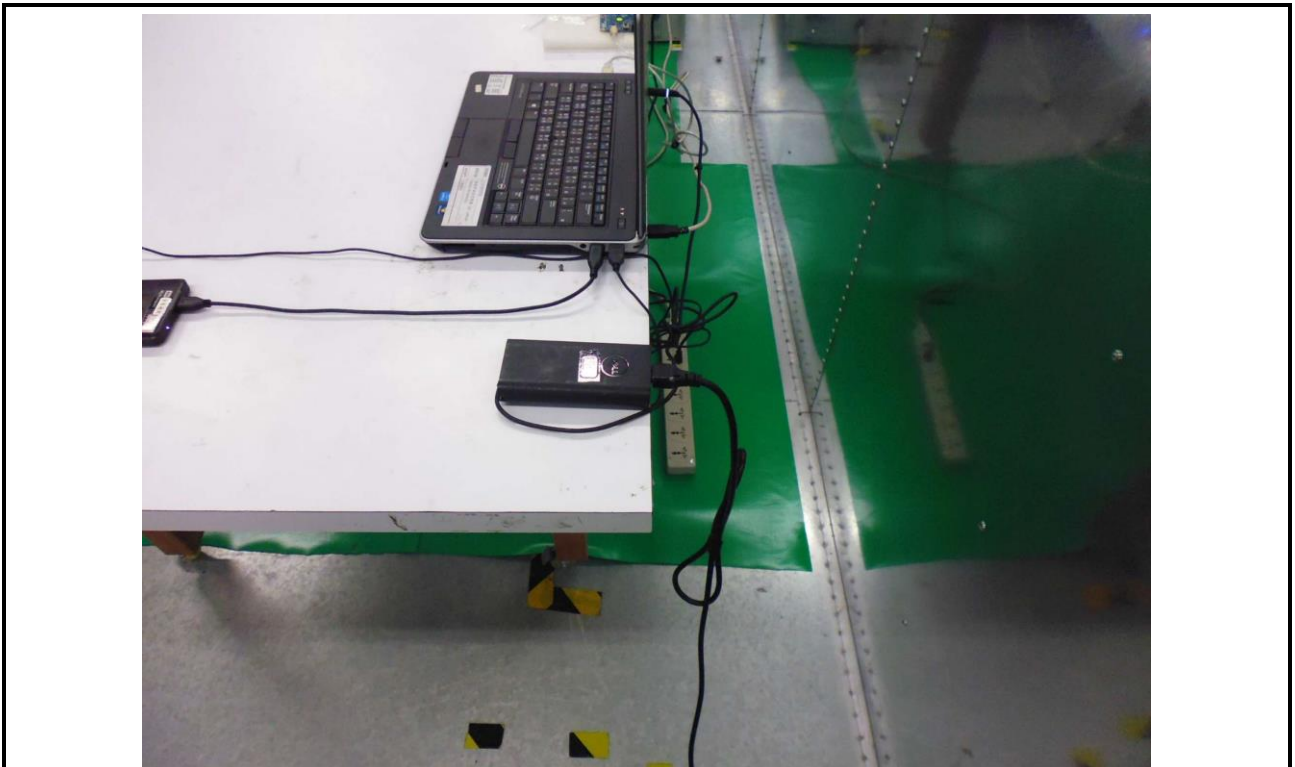
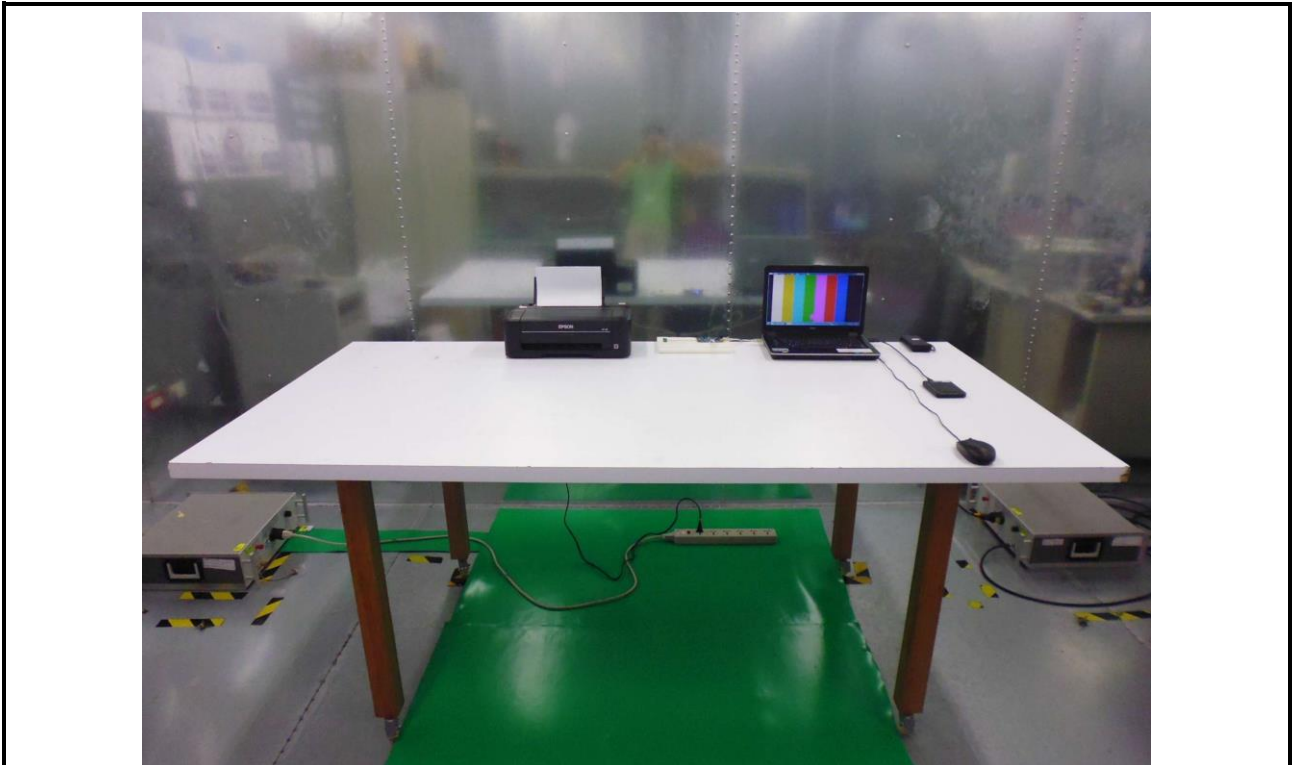


**Conducted Emissions from the AC mains power ports (Test Mode 2)**

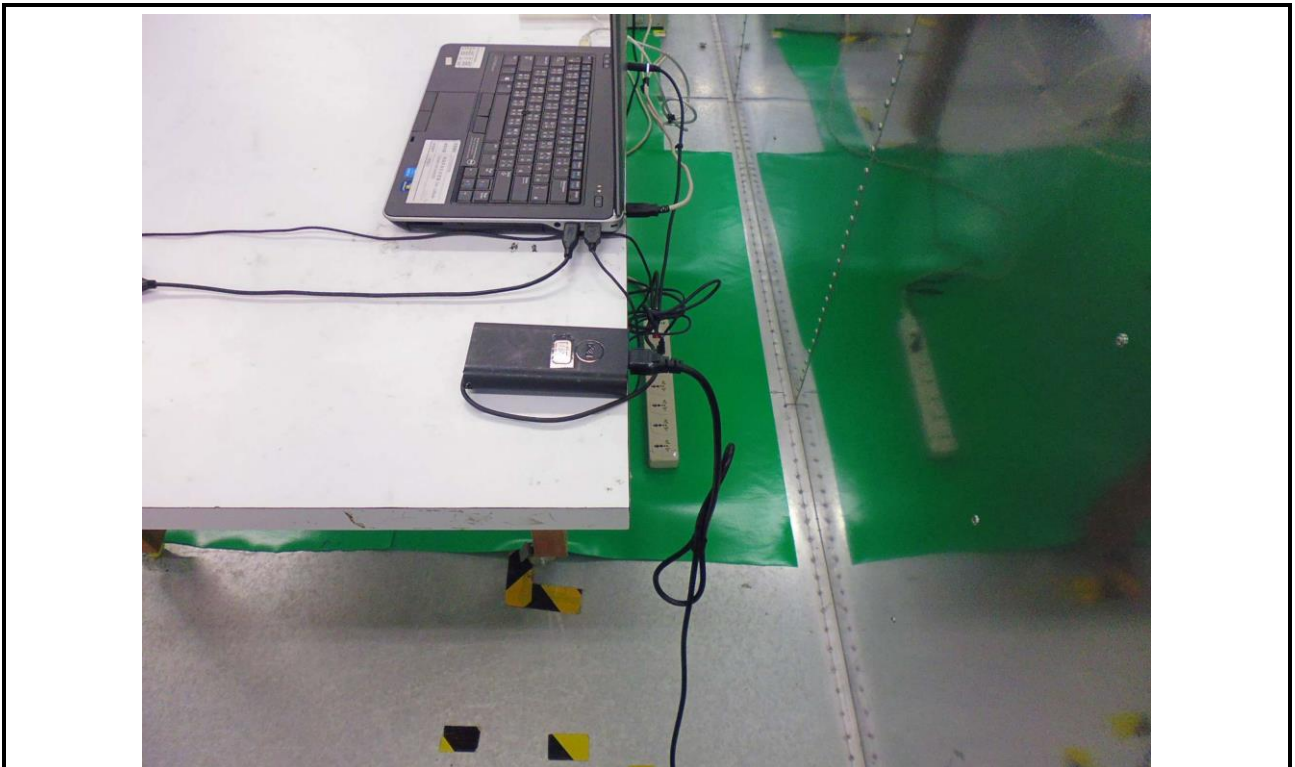




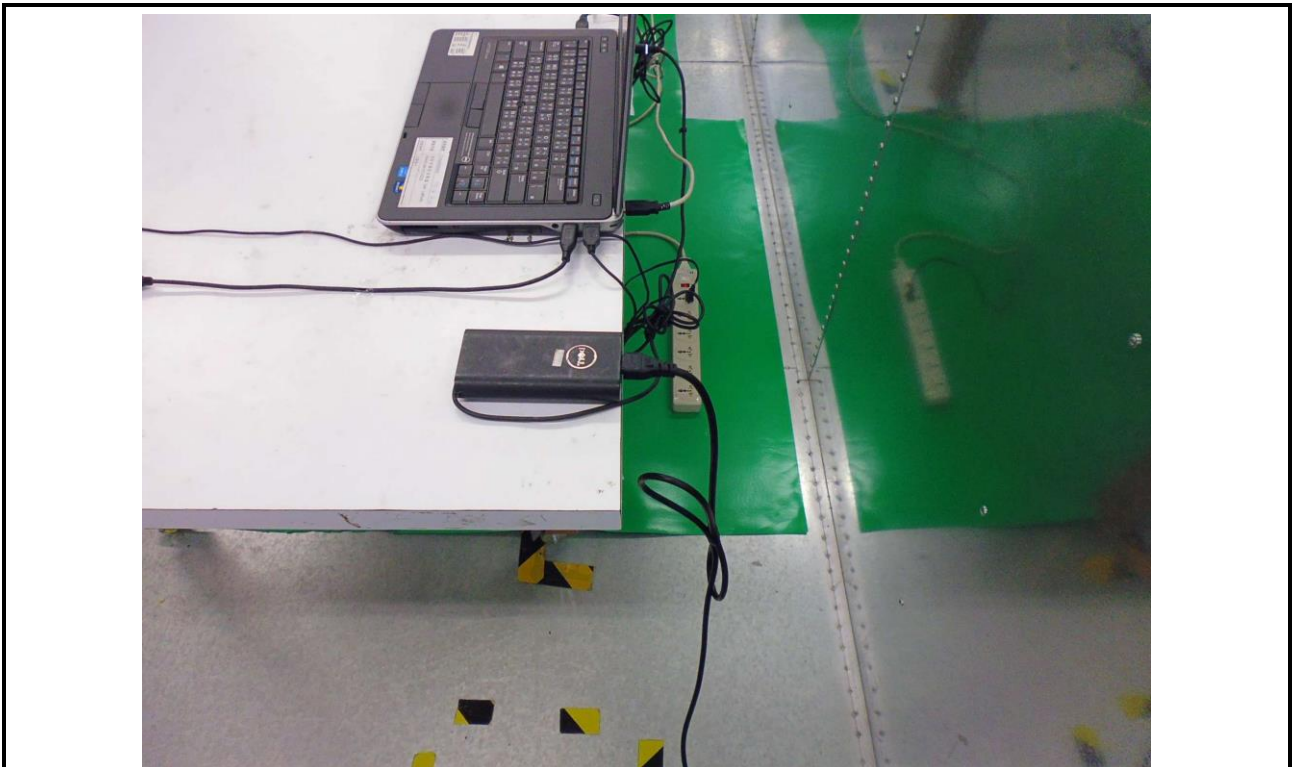
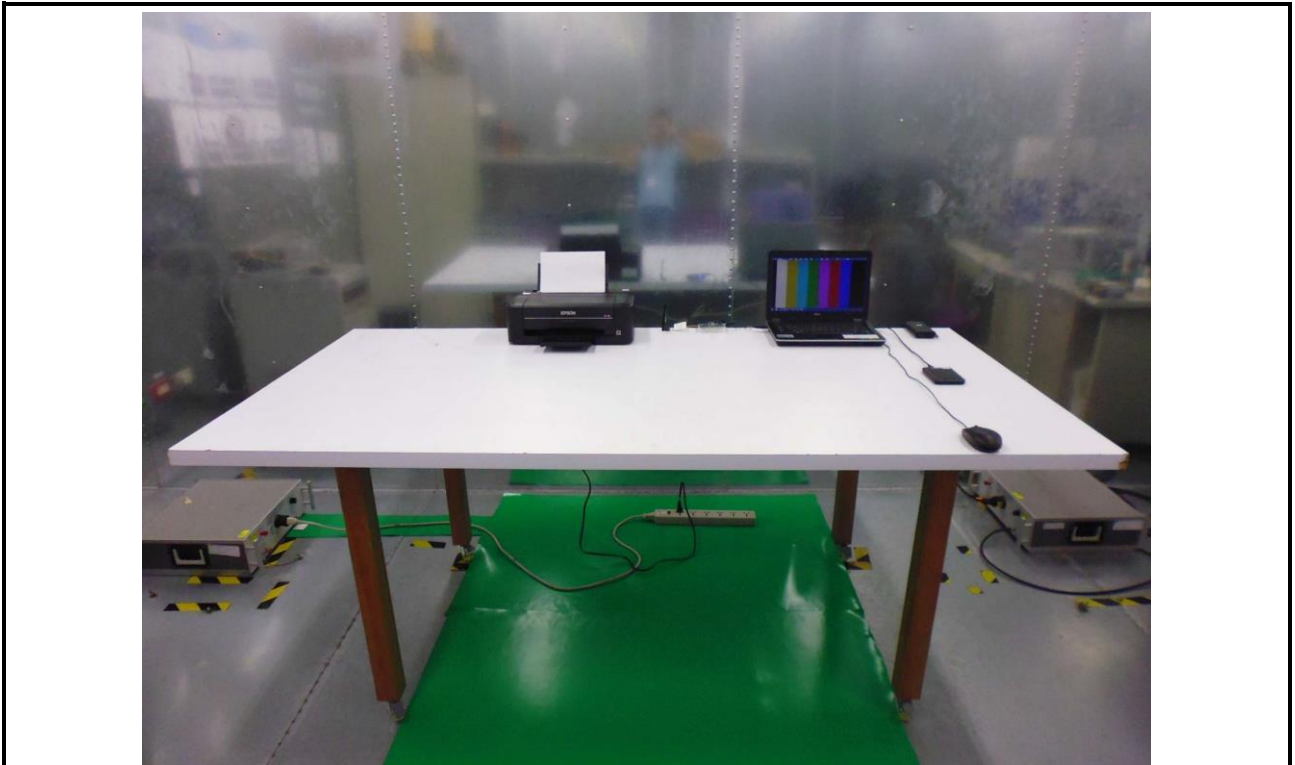
**Conducted Emissions from the AC mains power ports (Test Mode 3)**



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

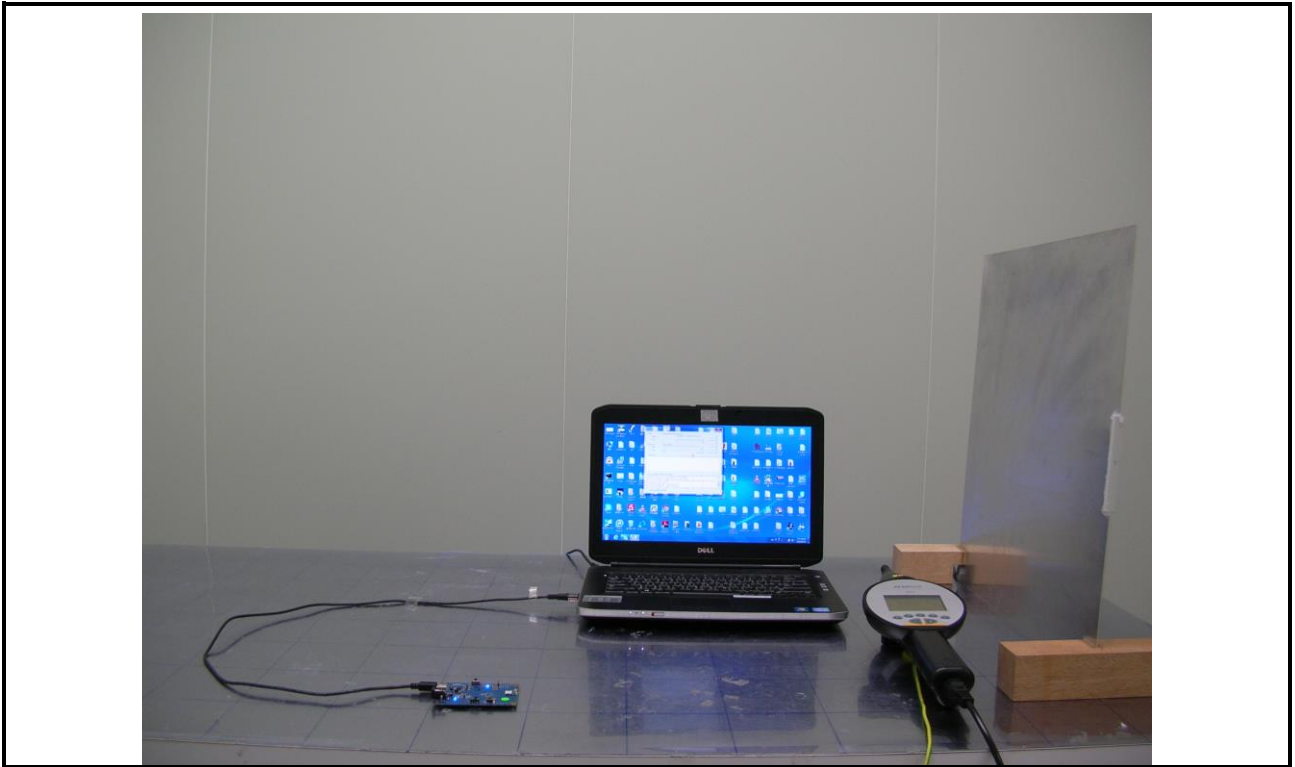


**Conducted Emissions from the AC mains power ports (Test Mode 5)**

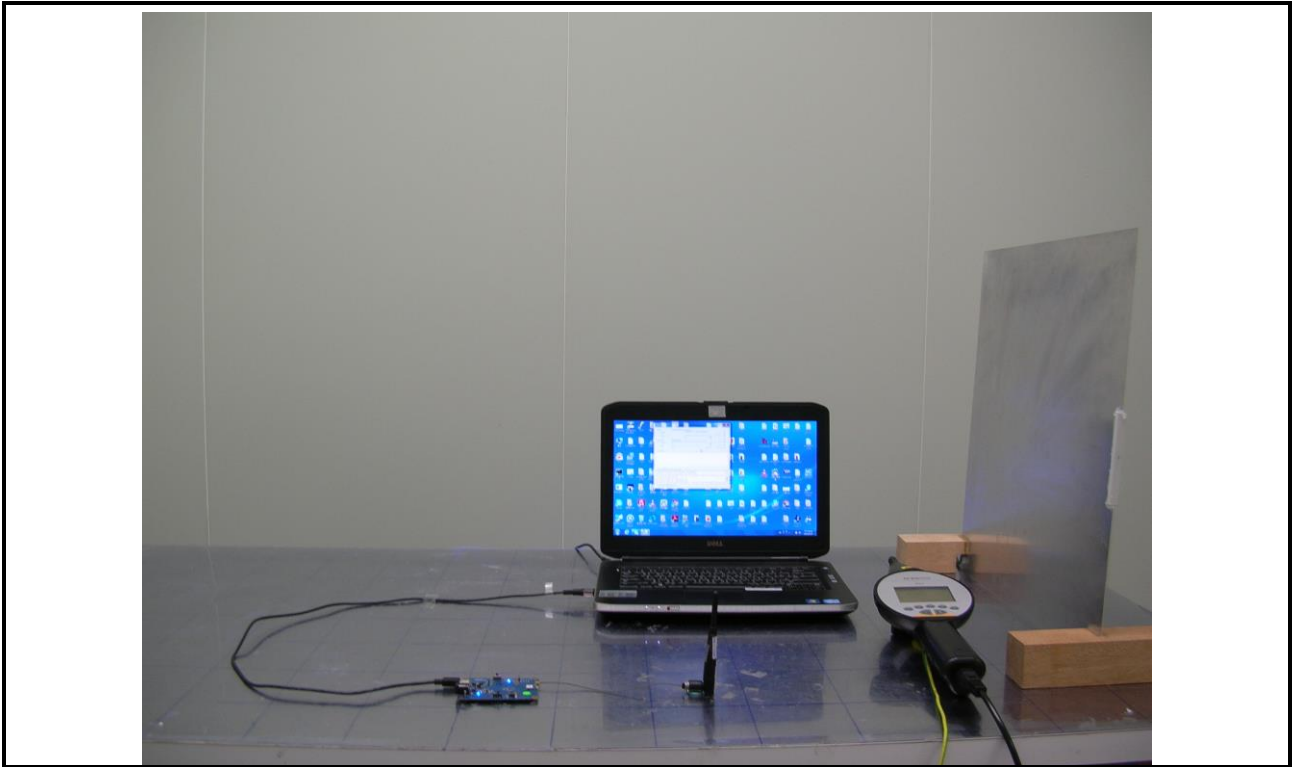




**ESD Test (Test Mode 1)**

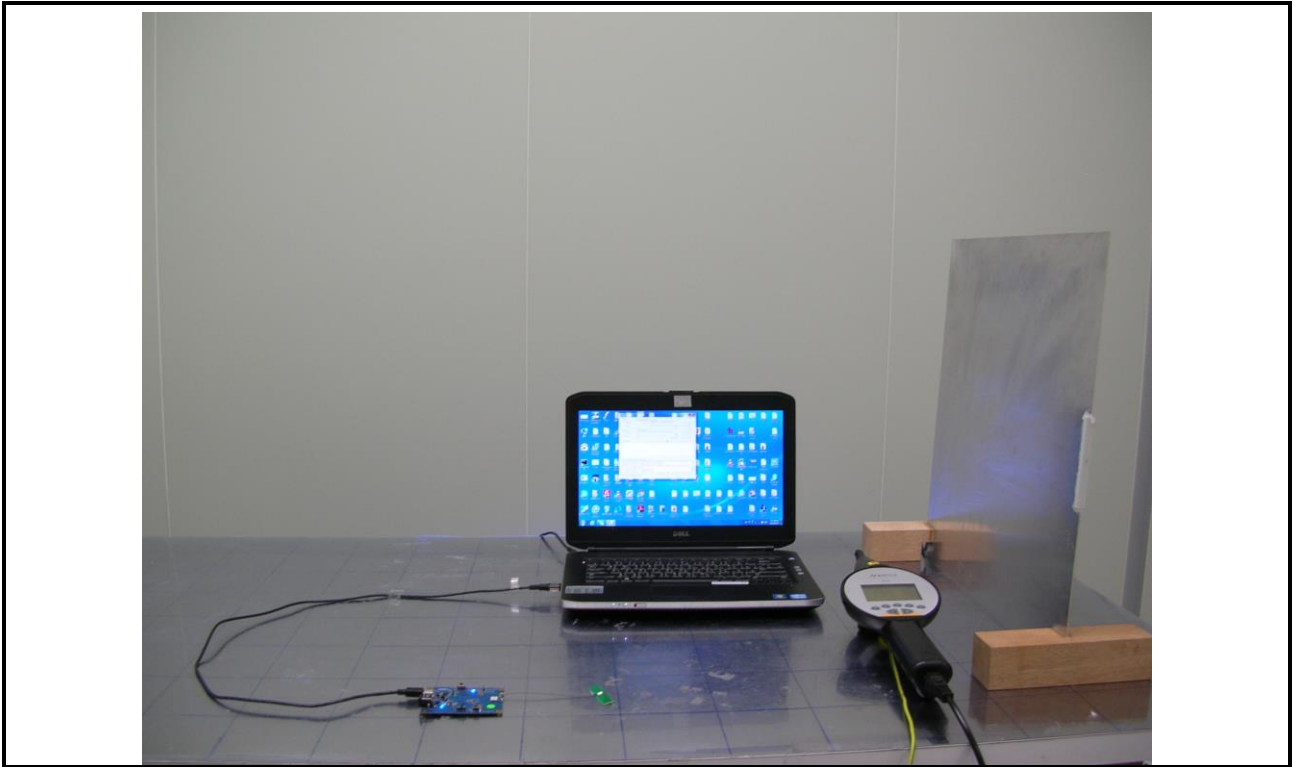


**ESD Test (Test Mode 2)**

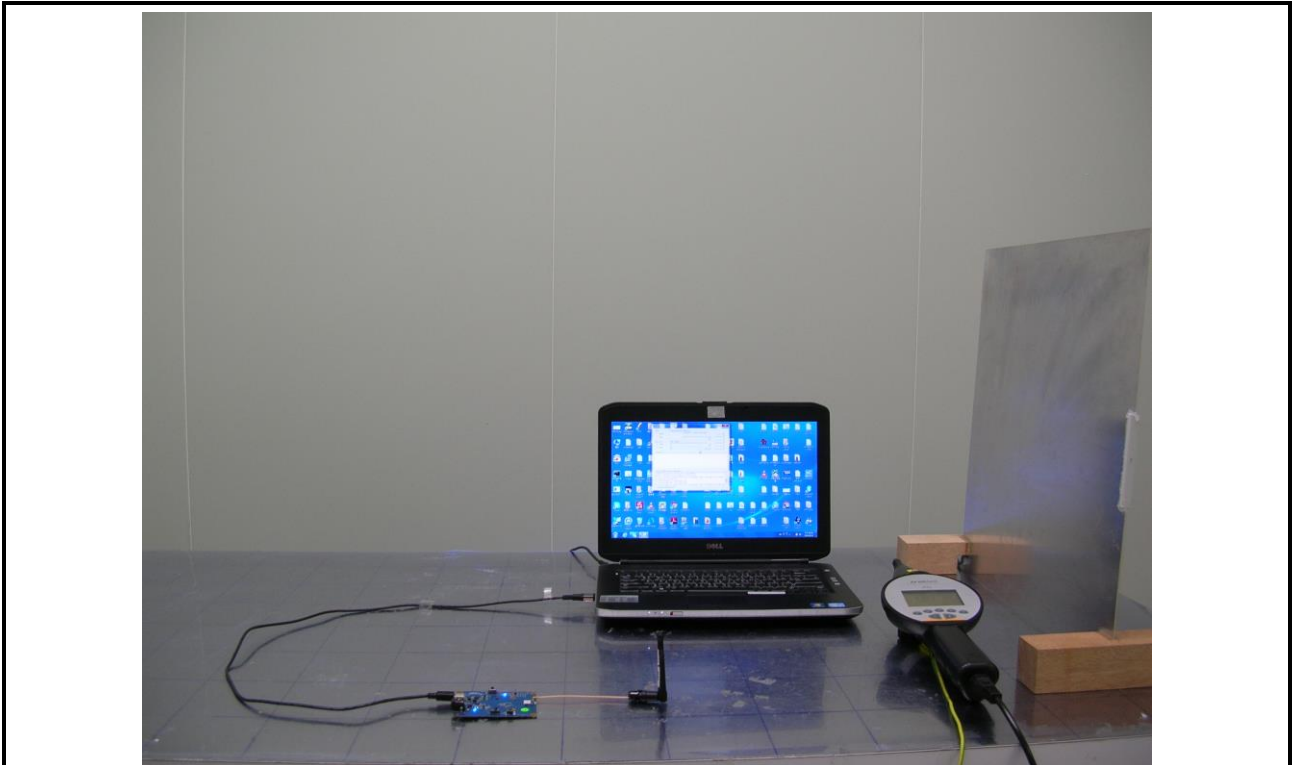




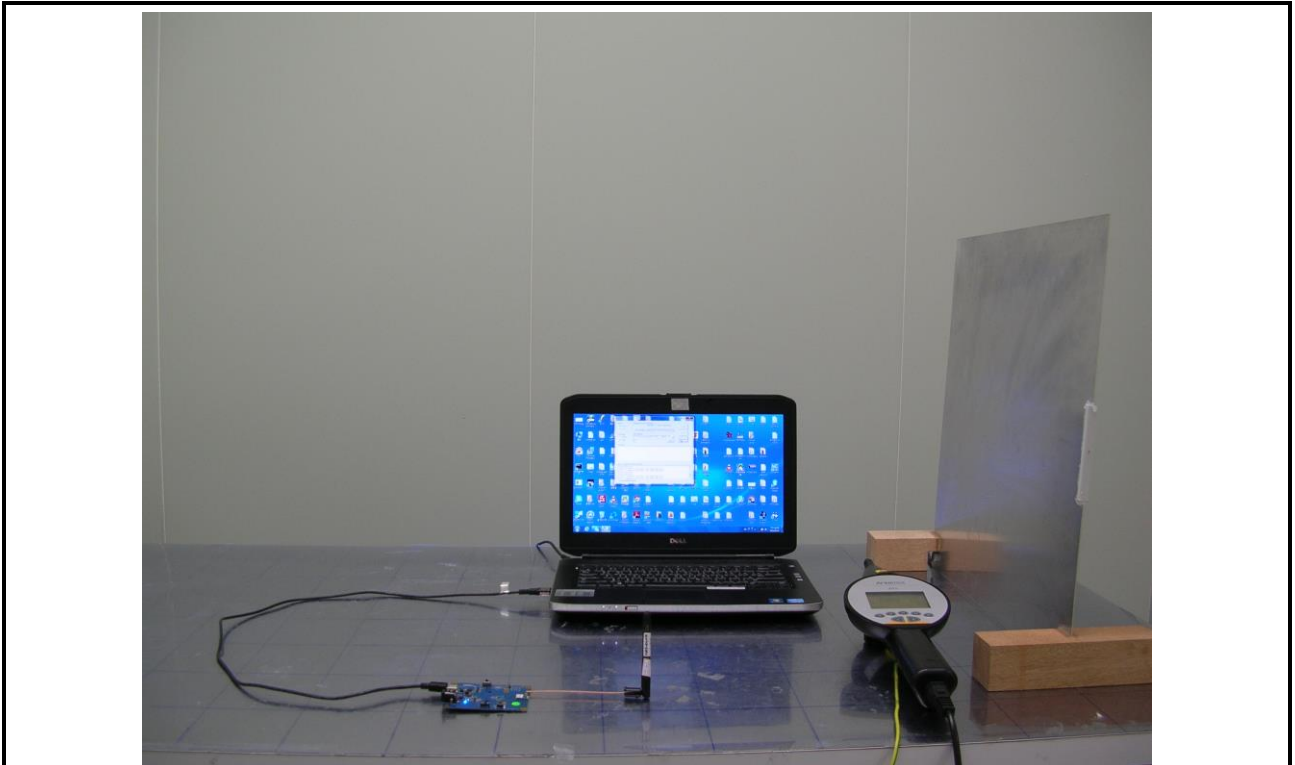
**ESD Test (Test Mode 3)**



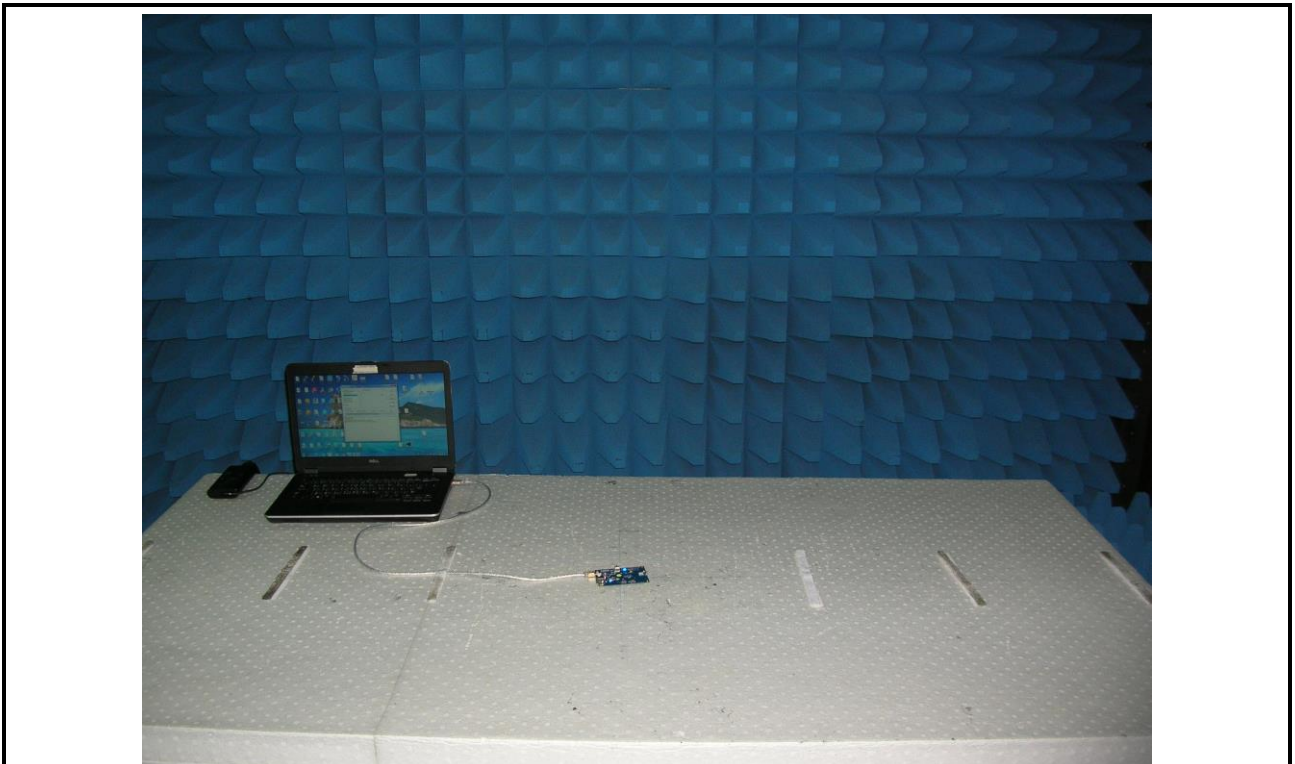
**ESD Test (Test Mode 4)**



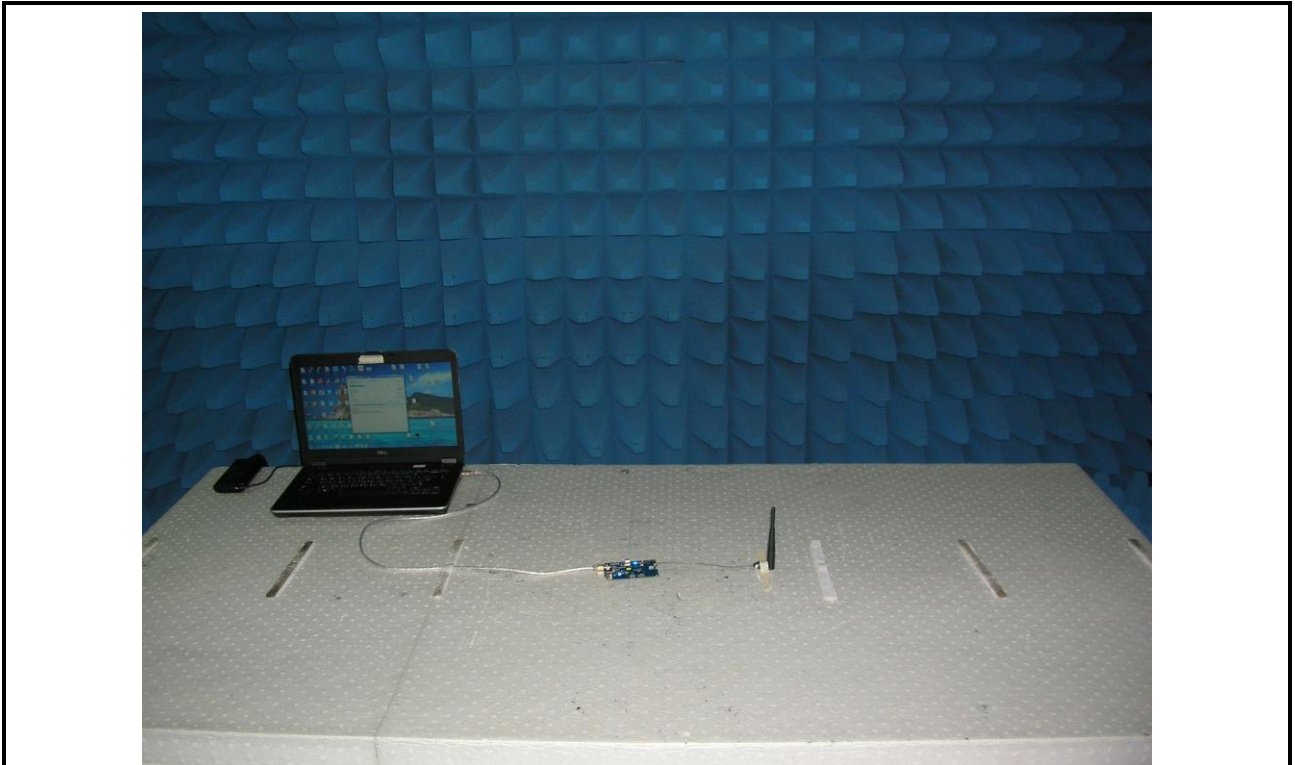
**ESD Test (Test Mode 5)**



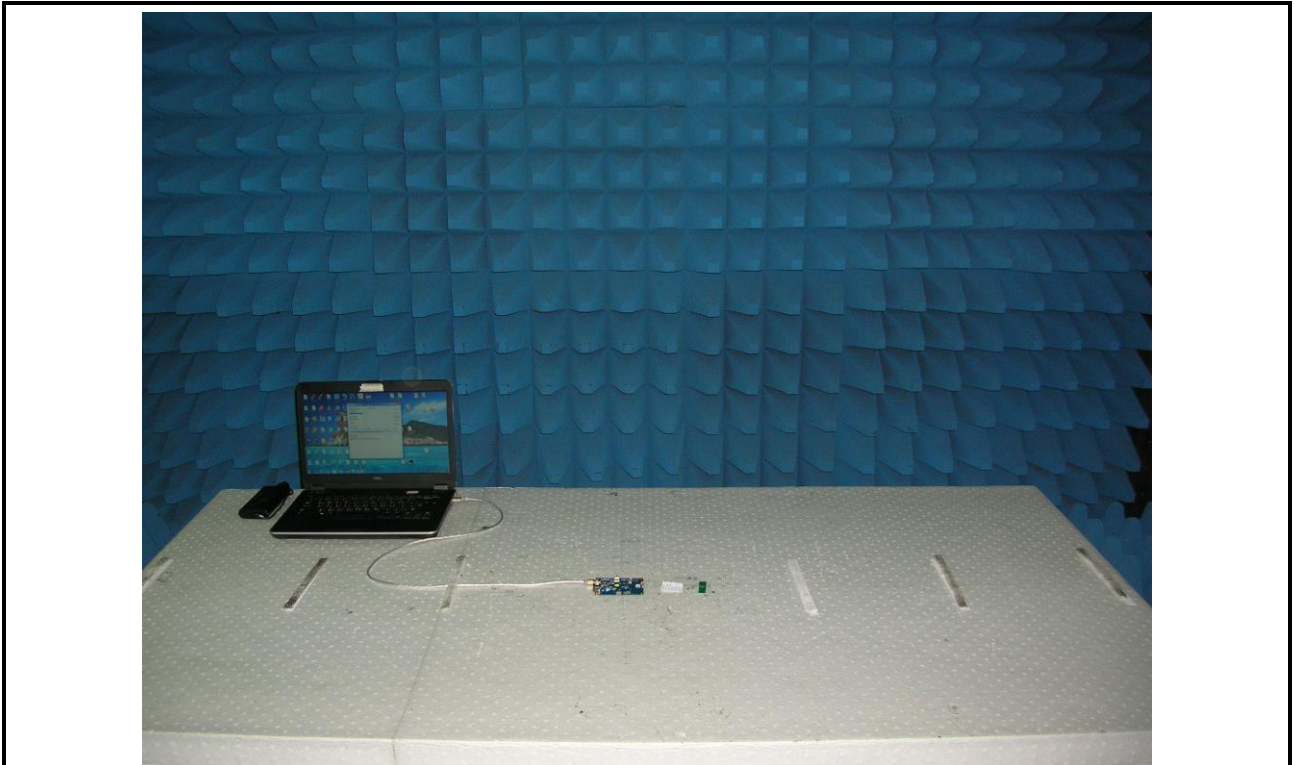
**RS Test (Test Mode 1)**



**RS Test (Test Mode 2)**

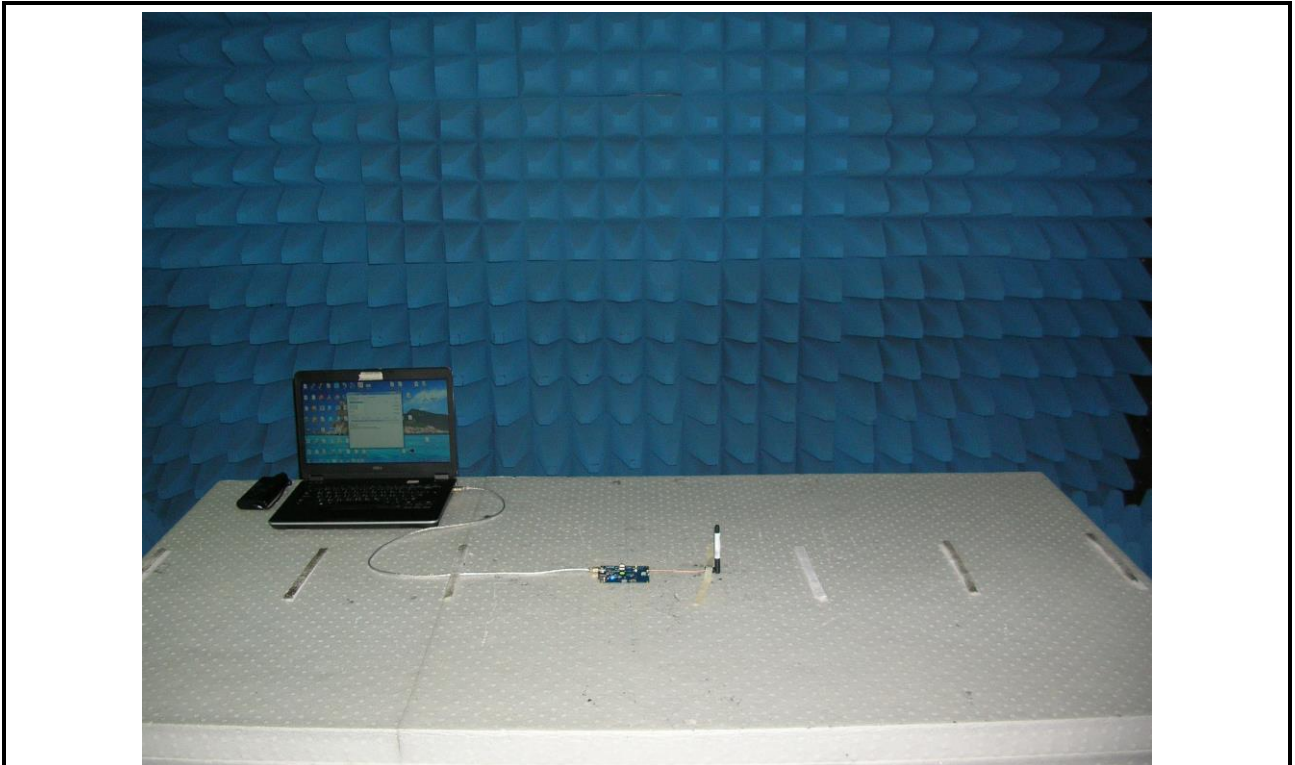


**RS Test (Test Mode 3)**

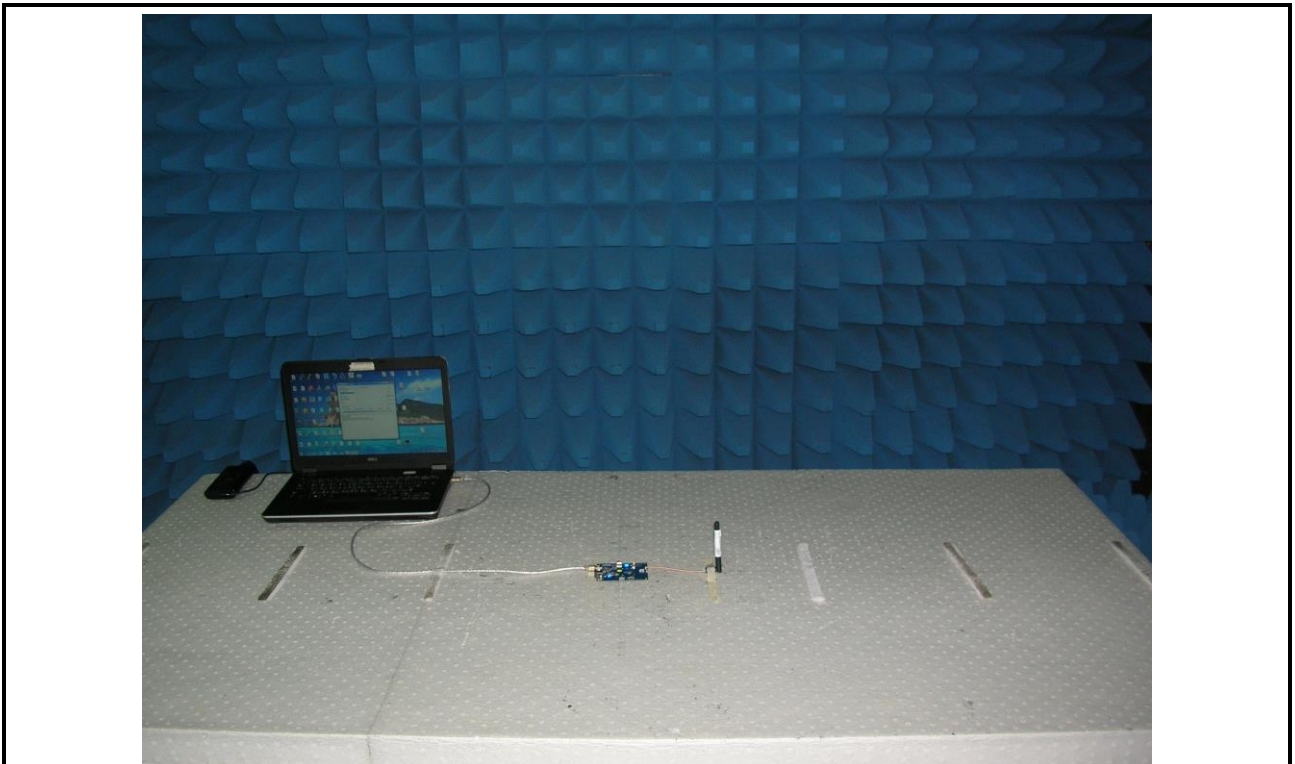




**RS Test (Test Mode 4)**



**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>.

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No. 3-1, Lane 6, Wen San 3rd  
St., Kwei Shan District, Tao Yuan  
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### **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

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==END==