# TEST REPORT

of

# RE Directive (2014/53/EU)
# EN 301 489-1/17

| | |
|---|---|
| **Product :** | **Bluetooth 5.0 Module** |
| **Brand:** | **Fanstel** |
| **Model:** | **BT840X, BT840XE** |
| **Model Difference:** | **Please see page 5 model summaries table** |
| **Applicant:** | **Fanstel Corporation, Taipei** |
| **Address:** | **10F-10, No. 79, Sec. 1, Hsin Tai Wu Rd., Hsi-Chih, New Taipei City 221 Taiwan** |

**Test Performed by:**

**International Standards Laboratory Corp.**
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Report No.: **ISL-19LR022E489**

Issue Date : **2019/06/27**

Test results given in this report apply only to the specific sample(s) tested and are traceable to national or international standard through calibration of the equipment and evaluating measurement uncertainty herein.
This report MUST not be used to claim product endorsement by TAF, NEMKO or any agency of the Government.

# VERIFICATION OF COMPLIANCE

| | |
|---|---|
| **Applicant:** | Fanstel Corporation, Taipei |
| **Equipment Under Test:** | Bluetooth 5.0 Module |
| **Brand Name:** | Fanstel |
| **Model Number:** | BT840X, BT840XE |
| **Model Different:** | Please see page 5 model summaries table |
| **Date of Test:** | 2019/7/9 ~2019/7/11 |
| **Date of EUT Received:** | 2019/7/5 |

| APPLICABLE STANDARDS | | |
|---|---|---|
| EN301 489-1 v2.1.1: 2017 | | EN301 489-17 v3.1.1: 2017 |
| EMI: | EN 55032:2015 + COR1 2016 | |
| EMS: | EN 55024: 2010+A1:2015 | |
| | EN61000-4-2:2009 | EN 61000-4-3:2006+A1:2008 +A2:2010 |
| | | |

In the configuration tested, the EUT complied with the standards specified above.

**Remarks:**

This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. This report may only be reproduced and distributed in full. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of **International Standards Laboratory Corp.** or testing done by in connection with distribution or use of the product described in this report must be approved by **International Standards Laboratory Corp.** in writing.

***Test By:*** Jason Chao **Date:** 2019/07/12

***Jason Chao / Senior Engineer***

***Prepared By:*** Elisa Chen **Date:** 2019/07/12

***Elisa Chen / Senior Engineer***

***Approved By:*** Jerry Liu **Date:** 2019/07/12

***Jerry Liu / Technical Manager***

# Version

| Version No. | Date | Description |
|---|---|---|
| 00 | 2019/07/12 | Initial creation of document |
| | | |

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# 1. General Description

## 1.1 Description of Equipment under Test (EUT)

| | |
|---|---|
| Product Name: | Bluetooth 5.0 Module |
| Brand: | Fanstel |
| Model: | BT840X, BT840XE |
| Model different: | Please see model summaries table below |
| Power Supply: | 5Vdc |
| RF function | BT 5.0 |

## Model Summaries

| module | BT840X | BT840XE |
|---|---|---|
| SoC | nRF52840-QIAA | nRF52840-QIAA |
| Size | 15x20.8x1.9mm | 15x20.8x1.9mm |
| BT Antenna | PCB trace | PA + u.FL |
| 32.768 sleep crystal | Integrated | Integrated |
| BT range,1 Mbps, LMPI | | |
| BT range, 1Mbps, 1.52m | | |
| BT range, 125 Kbps, LMPI. | | |
| BT range, 125 kBps, 1.52m | | |
| Availability | Sample | Sample |

Remark: The above DUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

## 1.2 General Description of Applied Standards

The EUT According to the Specifications, it must comply with the requirements of the following standards:

ETSI EN301 489-1 V2.1.1: ElectroMagnetic Compatibility (EMC) standard for radio equipment and services;
Part 1: Common technical requirements; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU and the essential requirements of article 6 of Directive 2014/30/EU

ETSI EN301 489-17 V3.1.1:
Part 17: Specific conditions for Broadband Data Transmission Systems; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU

EN 55032:2015+AC:2016, CISPR 32: 2015+COR1:2016:
Electromagnetic compatibility of multimedia equipment - Emission requirements.

EN 55024:2010 – Information technology Equipment – Immunity Characteristics - Limits and methods of measurement

## 1.3 Description of Test Modes:

The transmitter shall be modulated with normal test modulation as specified for that type of equipment. Where transmitters do not have a modulation input port, the internal equipment modulation shall be used.

The wanted signals and/or controls required to establish a communications link shall be defined by the manufacturer.

The transmitter shall be operated at its maximum rated RF output power as specified for that type of equipment. The manufacturer may provide a suitable companion receiver that can be used to set up a communications link and/or to receive messages.

The tests shall be made exercising all primary functions in the most representative mode consistent with typical applications. The test sample shall be configured in a manner consistent with typical installation practice.

## Test Plan

| | | Config 1 | Config 2 |
|---|---|---|---|
| | Applicable standard | EN 301489-17 V3.1.1 | |
| | Accessories | UE | UE |
| | | + Smart phone | + Smart phone |
| | | BT link(BT840X Antenna:Ant0) | BT link(BT840XE) |
| **EN No.** | **Description** | | |
| 8.2 | radiated emission (30M-1GHz) (1-6GHz) | measured | pretest |
| 8.3 | conducted emission (DC Power) | N/A | N/A |
| 8.4 | conducted emission (AC Power) | measured | N/A |
| 8.5 | harmonic current emissions | N/A | N/A |
| 8.6 | voltage fluctuations and flicker | N/A | N/A |
| 8.7 | Conducted emission (wired network) | N/A | N/A |
| 9.2 | RF electromagnetic field (80MHz to 6GHz) | measured | measured |
| 9.3 | electrostatic discharge | measured | measured |
| 9.4 | fast transients common mode | N/A | N/A |
| 9.5 | RF common mode 0,15 MHz to 80 MHz | N/A | N/A |
| 9.6 | transients and surges | N/A | N/A |
| 9.7 | voltage dips and interruptions | N/A | N/A |
| 9.8 | surges, line to line and line to ground | N/A | N/A |

***Note 1: the test plan was accepted by the applicant***

## 1.4 Test Facility:

The 10m anechoic chamber radiated emission measurement facilities used to collect the data are located at <LT Lab.> Address: No. 120, Lane 180, Hsin Ho Rd. Lung-Tan Dist., Tao Yuan City 325, Taiwan, The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

The 966 anechoic chamber radiated emission measurement (Above 1GHz) facilities used to collect the data are located at <LT Lab.> Address: No. 120, Lane 180, Hsin Ho Rd. Lung-Tan Dist., Tao Yuan City 325, Taiwan, The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

The AC power line conducted emission, flicker and all of immunity measurement facilities used to collect the data are located at <LT Lab.> Address: No. 120, Lane 180, Hsin Ho Rd. Lung-Tan Dist., Tao Yuan City 325, Taiwan, The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

## 1.5 Modification List:

No modification by International Standards Laboratory Corp.

## 1.6 Test Condition:

Refer to EN 301 489-1, Section 4 and EN 301 489-17, Section4 for the details.

## 1.7 Equipment List:

| Location Con03 | Equipment Name | Brand | Model | S/N | Last Cal. Date | Next Cal. Date |
|---|---|---|---|---|---|---|
| Conduction 03 | EMI Receiver 11 | ROHDE & SCHWARZ | ESCI | 100568 | 07/26/2018 | 07/26/2019 |
| Conduction 03 | ISN T4 06 | Teseq GmbH | ISN T400A | 28574 | 09/14/2018 | 09/14/2019 |
| Conduction 03 | ISNT8 09 | Teseq GmbH | ISN T800 | 36190 | 09/14/2018 | 09/14/2019 |
| Conduction 03 | LISN 19 | R&S | ENV216 | 101425 | 08/07/2018 | 08/07/2019 |
| Conduction 03 | LISN 08 | FCC | FCC-LISN-50/250-25-2-01 | 07039 | 08/22/2018 | 08/22/2019 |
| Conduction 03 | Conduction 03 -1 Cable | WOKEN | CFD 300-NL | Conduction 03 -1 | 08/30/2018 | 08/30/2019 |
| Conduction 03 | Capacitive Voltage Probe | FCC | F-CVP-1 | 68 | 02/19/2019 | 02/19/2020 |
| Conduction 03 | Current Probe | SCHAFFNER | SMZ 11 | 18030 | 02/19/2019 | 02/19/2020 |

| Location Chmb12 | Equipment Name | Brand | Model | S/N | Last Cal. Date | Next Cal. Date |
|---|---|---|---|---|---|---|
| Radiation (Chamber12) | BILOG Antenna 18 | Schwarzbeck | Schwarzbeck VULB 9168+EMCI-N-6-05 | 646 | 01/29/2019 | 01/29/2020 |
| Radiation (Chamber12) | Preamplifier 26 | EMCI | EMC9135 | 980297 | 01/23/2019 | 01/23/2020 |
| Radiation (Chamber12) | Coaxial Cable Chmb 12-10M-01 | PEWC | CFD400-NL | Chmb 12-10M-01 | 08/30/2018 | 08/30/2019 |
| Radiation (Chamber12) | EMI Receiver 19 | ROHDE & SCHWARZ | ESR 3 | 102460 | 08/08/2018 | 08/08/2019 |

| Chamber 19(966) | | | | | |
|---|---|---|---|---|---|
| **Equipment Type** | **Manufacturer** | **Model Number** | **Serial Number** | **Last Cal.** | **Cal. Due.** |
| 966 Chamber | Chance Most | Chamber 19 | N/A | 08/13/2018 | 08/12/2019 |
| Spectrum analyzer | R&S | FSP40 | 100116 | 01/10/2019 | 01/09/2020 |
| EMI Receiver | R&S | ESR3 | 102461 | 08/08/2018 | 08/07/2019 |
| Loop Antenna(9K-30M) | EM | EM-6879 | 271 | 05/31/2019 | 05/30/2020 |
| Bilog Antenna (30M-1G) | SCHWARZBECK | VULB9168 w 5dB Att | 736 | 01/29/2019 | 01/28/2020 |
| Horn antenna (1G-18G) | SCHWARZBECK | 9120D | 9120D-1627 | 11/27/2017 | 11/26/2019 |
| Horn antenna (18G-26G) | Com-power | AH-826 | 081001 | 11/21/2017 | 11/20/2019 |
| Horn antenna (26G-40G) | Com-power | AH-640 | 100A | 03/29/2019 | 03/28/2021 |
| Preamplifier (9k-1000M) | HP | 8447F | 3113A06362 | 01/14/2019 | 01/13/2020 |
| Preamplifier(1G-26G) | Agilent | 8449B | 3008A02471 | 10/29/2018 | 10/28/2019 |
| Preamplifier (26G-40G) | MITEQ | JS4-26004000-27 -5A | 818471 | 05/06/2019 | 05/05/2020 |
| RF Cable (9k-18G) | HUBER SUHNER | SUCOFLEX 104A | MY1397/4A | 01/17/2019 | 01/16/2020 |
| RF cable (18G~40G) | HUBER SUHNER | Sucoflex 102 | 27963/2&37421 /2 | 11/12/2018 | 11/11/2019 |
| Turn Table | MF | Turn Table-19 | Turn Table-19 | N/A | N/A |
| Mast Tower | MF | JSDES-15A | 1308283 | N/A | N/A |
| Controller | MF | MF-7802BS | MF780208460 | N/A | N/A |
| AC power source | T-Power | TFC-1005 | 40006471 | N/A | N/A |
| Signal Generator | Anritsu | MG3692A | 20311 | 01/09/2019 | 01/08/2020 |
| 2.4G Filter | Micro-Tronics | Brm50702 | 76 | 12/25/2018 | 12/24/2019 |
| 5G Filter | Micro-Tronics | Brm50716 | 005 | 12/25/2018 | 12/24/2019 |
| Tunable Notch Filter (800 to 1000) | K&L | 3TNF-00082 | 478 | 12/25/2018 | 12/24/2019 |
| Tunable Notch Filter (1700 to 2000) | K&L | 5TNF-00082 | 335 | 12/25/2018 | 12/24/2019 |
| Band reject filter850 | WI | Wrc814-859 | 3 | 12/25/2018 | 12/24/2019 |
| Band reject filter900 | WI | Wrc860-935 | 3 | 12/25/2018 | 12/24/2019 |
| Band reject filter1800 | WI | Wrc1690-1805 | 3 | 12/25/2018 | 12/24/2019 |
| Band reject filter1900 | WI | Wrc1830-1930 | 3 | 12/25/2018 | 12/24/2019 |
| Test Software | Audix | E3 Ver:6.12023 | N/A | N/A | N/A |

| Location | Equipment Name | Brand | Model | S/N | Last Cal. Date | Next Cal. Date |
|---|---|---|---|---|---|---|
| EN61K-4-2 | ESD Gun 12 | EM TEST | Dito | P1650188689 | 05/07/2019 | 05/07/2020 |
| EN61K-4-2 | ESD Gun 07 | NoiseKen | ESS-2002EX | ESS0878638 | 01/31/2019 | 01/31/2020 |
| EN61K-4-3 | Broadband Log-Periodic Antenna | AR | AT1080 | 310698 | N/A | N/A |
| EN61K-4-3 | Horn Antenna RF-01 | AR | ATS700M11G | 0335864 | N/A | N/A |
| EN61K-4-3 | Amplifier 80Mz~1GHz 250W | AR | 250W1000A | 312494 | N/A | N/A |
| EN61K-4-3 | Amplifier 800MHz~4.2GHz 50W | AR | 50S1G4M1 | 312762 | N/A | N/A |
| EN61K-4-3 | Amplifier 4.0~8.0GHz 35W | AR | 35S4G8AM1 | 0335752 | N/A | N/A |
| EN61K-4-3 | Broadband Coupler 80M~1GHz | Amplifier Research | DC6180A | 0341805 | N/A | N/A |
| EN61K-4-3 | Coaxial Cable | INSULATED | NPS-4806-2360-NP3 | 108599.003.01.03 | N/A | N/A |
| EN61K-4-3 | Broadband Coupler 0.8G~4.26GHz | AR | DC7144A | 0335226 | N/A | N/A |
| EN61K-4-3 | Broadband Coupler 4G~8GHz | AR | DC7350A | 0335817 | N/A | N/A |
| EN61K-4-3 | Signal Generator 07 | ROHDE& SCHWARZ | SMB100A | 107780 | 10/28/2018 | 10/28/2019 |
| EN61K-4-4 | EFT and SURGE Test System | EM TEST | UCS-500 M6B | V0728102674 | 02/14/2019 | 02/14/2020 |
| EN61K-4-4 | Capacitive Coupling Clamp | EM TEST | HFK | 0907-106 | 02/14/2019 | 02/14/2020 |
| EN61K-4-5 | CDN-UTP8 ED3 | EMC-PARTNER | CDN-UTP8 | 1509 | 04/02/2019 | 04/02/2020 |
| EN61K-4-5 | SURGE-TESTER | EMC Partner | MIG0603IN3 | 523 | 04/02/2019 | 04/02/2020 |
| EN61K-4-6 | CDN M2+M3 02 | Frankonia | CDN M2+M3 | A3011024 | 08/20/2018 | 08/20/2019 |
| EN61K-4-6 | CDN T2 04 | FCC Inc. | FCC-801-T2 | 02067 | 08/17/2018 | 08/17/2019 |
| EN61K-4-6 | CDN T4 06 | FCC Inc. | FCC-801-T4 | 02068 | 06/24/2019 | 06/24/2020 |
| EN61K-4-6 | CDN T8-10_2 | Teseq GmbH | CDN T8 10 | 41241 | 03/26/2019 | 03/26/2020 |
| EN61K-4-6 | Coaxial Cable 4-6 02-1 | | | 4-6 02-1 | N/A | N/A |
| EN61K-4-6 | Conducted Immunity Test System 02 | Frankonia | CIT-10-75-DC | 126B1301/2014 | 03/25/2019 | 03/25/2020 |
| EN61K-4-6 | EM-Clamp | Schaffner | KEMZ-801 | 19215 | 11/08/2018 | 11/08/2019 |
| EN61K-4-8 | Magnetic Field Immunity Loop | FCC | F-1000-4-8-L-1M | 01037 | 05/27/2019 | 06/05/2020 |
| EN61K-4-8 | Magnetic Field Test Generator | FCC | F-1000-4-8-G-125A | 01038 | 05/27/2019 | 06/05/2020 |
| EN61K-4-11 | Voltage Dip and UP Simulator | NoiseKen | VDS-2002 | VDS0640162 | 11/06/2018 | 11/06/2019 |
| EN61K-4-34 | Voltage Dip and UP Simulator 50A | PRIMA | DRP61011CX | PR17096386 | 01/03/2019 | 01/03/2020 |
| EN61K-3-2/3, EN61K-3-11-12 | (Harmonic/Flicker) MX Series CTSH Compliance Test System | California Instruments | MX60T04GH10400 | 72793 | 08/06/2018 | 08/06/2019 |

PS: N/A => The equipment does not need calibration.

## 1.8 Configuration of Tested System

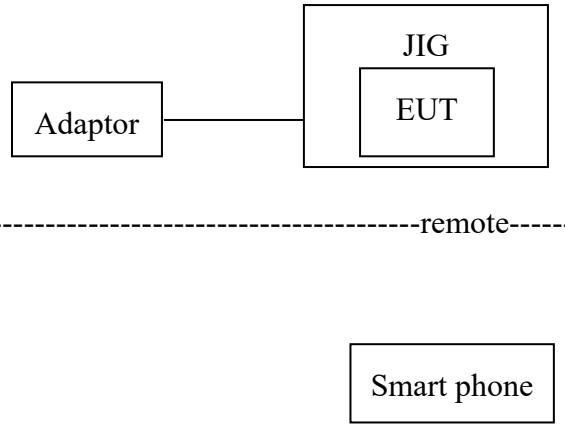



**Table 1-1 Support Equipment Used in Tested System**

| Item | Equipment | Mrf/Brand | Model name | Series No | Data Cable | Power Cable |
|---|---|---|---|---|---|---|
| 1 | adaptor | Apple | A1385 | N/A | N/A | Shielded /0.6m |
| 2 | Smart phone | hTC | PL99110 | N/A | N/A | N/A |

**I/O Cable Condition of EUT and Support Units**

| Description | Path | Cable Length | Cable Type | Connector Type |
|---|---|---|---|---|
| USB power cable | Adaptor USB port to JIG micro USB port | 0.6m | Non-Shielded | Metal Head |

**Note:** All the above equipment/cables were placed in worse case positions to maximize emission signals during emission test.

**Grounding:** Grounding was in accordance with the manufacturer's requirements and conditions for the intended use.

## 1.9 Exclusion band

**For EN301489-1**

Exclusion band for transmitters or the transmitter part of transceivers
Channelized Equipment
For channelized equipment the exclusion band shall extend 250 % of the channel width either side of the transmitter centre frequency.
NOTE: Exclusion band of 250 % is based on the ITU Radio Regulations, as the boundary between OOB and Spurious Domain.

Non-Channelized Equipment
For non-channelized equipment the exclusion band shall extend 250 % of the occupied bandwidth either side of the transmitter centre frequency.
NOTE: Exclusion band of 250 % is based on the ITU Radio Regulations , as the boundary between OOB and Spurious Domain.

Exclusion band for receivers or the receiver part of transceivers
Channelized Equipment
For channelized equipment the exclusion band shall be calculated by using the following formulae:
For the lower edge for the exclusion band:
EXband(lower) = BandRX(lower) – nChWRX
and for the upper edge of the exclusion band:
EXband(upper) = BandRX(upper) + nChWRX
Where n = number of channel widths required for exclusion band.
For equipment that support multiple channel widths the Channel Width used should be the widest support by the EUT.
Where the present document is being used in a stand-alone basis (i.e. with no reference to other relevant radio technology parts of ETSI EN 301 489 series), the value of n shall be 1.

Non-Channelized Equipment
For non-channelized equipment the exclusion band shall be calculated by using the following formula: For the lower edge for the exclusion band:
EXband(lower) = BandRX(lower) – nBWRX
and for the upper edge of the exclusion band:
EXband(upper) = BandRX(upper) + nBWRX
Where n = multiple of whole bandwidths required to define exclusion band.
Bandwidth of Receiver is the occupied bandwidth of the corresponding transmitter signal.
Where the present document is being used in a stand-alone basis (i.e. with no reference to other relevant radio technology parts of ETSI EN 301 489 series), the value of n shall be 1

**For EN301489-17**

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

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:
ower 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.

# 2. Radio Disturbance

EN 301 489-17
EN 55032 Class B

## 2.1 Test Configuration:

Refer to EN 301 489-1, Section 8.1.

## 2.2 Special Conditions:

EN301489-17
No special conditions shall apply to UE in the scope of the present document.

## 2.3 Summary of Test Results

| Test Items | Reference section | Result |
|---|---|---|
| Enclosure of ancillary equipment measured on a stand alone basis, EN55032, Class B | EN 301 489-1 Section 8.2<br>EN55032 Annex A.2 | PASS |
| DC mains power input/output ports | EN 301 489-1 Section 8.3 | N/A |
| AC mains power input/output ports EN55032, Class B | EN 301 489-1 Section 8.4<br>EN55032 Annex A.3 | PASS |
| Harmonic current emission, Class A | EN 301 489-1 Section 8.5<br>EN61000-3-2 | N/A |
| Voltage fluctuations and flicker | EN 301 489-1 Section 8.6<br>EN61000-3-3 | N/A |
| Telecommunication Port | EN 301 489-1 Section 8.7<br>EN55032 Annex B.2 | N/A |

## 2.4 Enclosure of ancillary equipment measured on a standalone basis.

### 2.4.1 Test Method:

| Standard | Date | Description |
|---|---|---|
| EN 55032 | 2015+AC: 2016 | Limits and methods of measurement of radio interference characteristics of information technology equipment. |

**Limit: Class B**

| Table clause | Frequency range MHz | Measurement | | Class B limits dB(μV/m) |
|---|---|---|---|---|
| | | Distance m | Detector type/ bandwidth | OATS/SAC (see Table A.1) |
| A4.1 | 30 – 230 | 10 | Quasi Peak / 120 kHz | 30 |
| | 230 – 1 000 | | | 37 |
| A4.2 | 30 – 230 | 3 | | 40 |
| | 230 – 1 000 | | | 47 |
| Apply only table clause A4.1 or A4.2 across the entire frequency range. | | | | |

| Table clause | Frequency range MHz | Measurement | | Class B limits dB(μV/m) |
|---|---|---|---|---|
| | | Distance m | Detector type/ bandwidth | FSOATS (see Table A.1) |
| A5.1 | 1 000 – 3 000 | 3 | Average/ 1 MHz | 50 |
| | 3 000 – 6 000 | | | 54 |
| A5.2 | 1 000 – 3 000 | | Peak/ 1 MHz | 70 |
| | 3 000 – 6 000 | | | 74 |
| Apply A5.1 and A5.2 across the frequency range from 1 000 MHz to the highest required frequency of measurement derived from Table 1. | | | | |

| Highest internal frequency ($F_x$) | Highest measured frequency |
|---|---|
| $F_x \leq 108$ MHz | 1 GHz |
| 108 MHz $< F_x \leq 500$ MHz | 2 GHz |
| 500 MHz $< F_x \leq 1$ GHz | 5 GHz |
| $F_x > 1$ GHz | $5 \times F_x$ up to a maximum of 6 GHz |
| NOTE 1 For FM and TV broadcast receivers, $F_x$ is determined from the highest frequency generated or used excluding the local oscillator and tuned frequencies.<br>NOTE 2 $F_x$ is defined in 3.1.19. | |

The highest internal source of an EUT is above 1GHz.

### 2.4.2 Test Procedure:

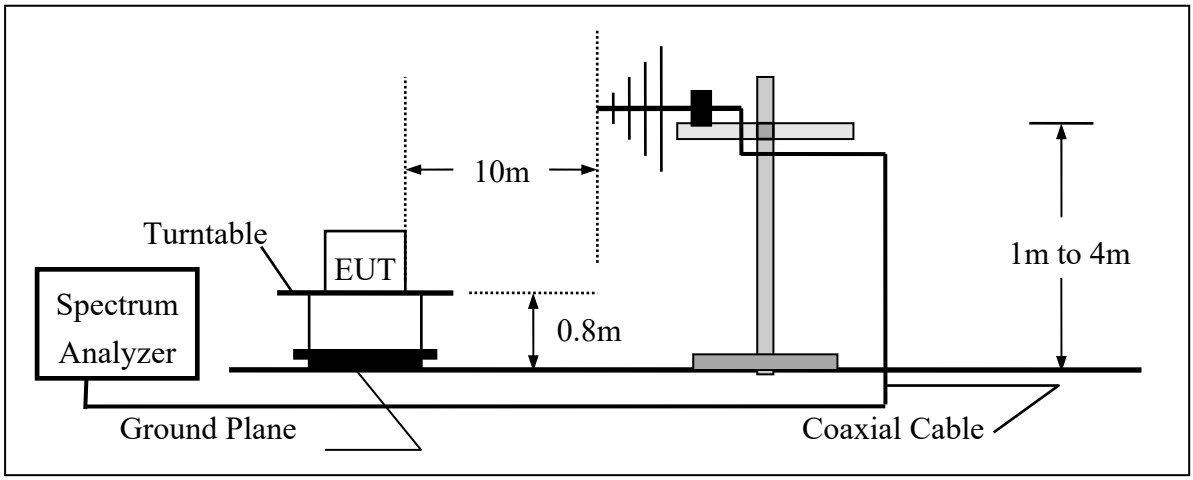
1. EUT was placed on an 0.8m wooden table.
2. Set up EUT with support units and turn on the power of all equipment.
3. Link the EUT with Telecommunication tester, setup the test mode. The transmitter operating at continuously mode and max output rated power.
4. The receive antenna is placed at 10m or 3m (3m for above 1GHz) distance from the EUT and search height from 1-4m.
5. The turntable was slowly rotated to locate the direction of maximum emission. Once maximum direction is determined, the search antenna was raised and lowered in both vertical and horizontal polarizations.

### 2.4.3 Test Instruments:

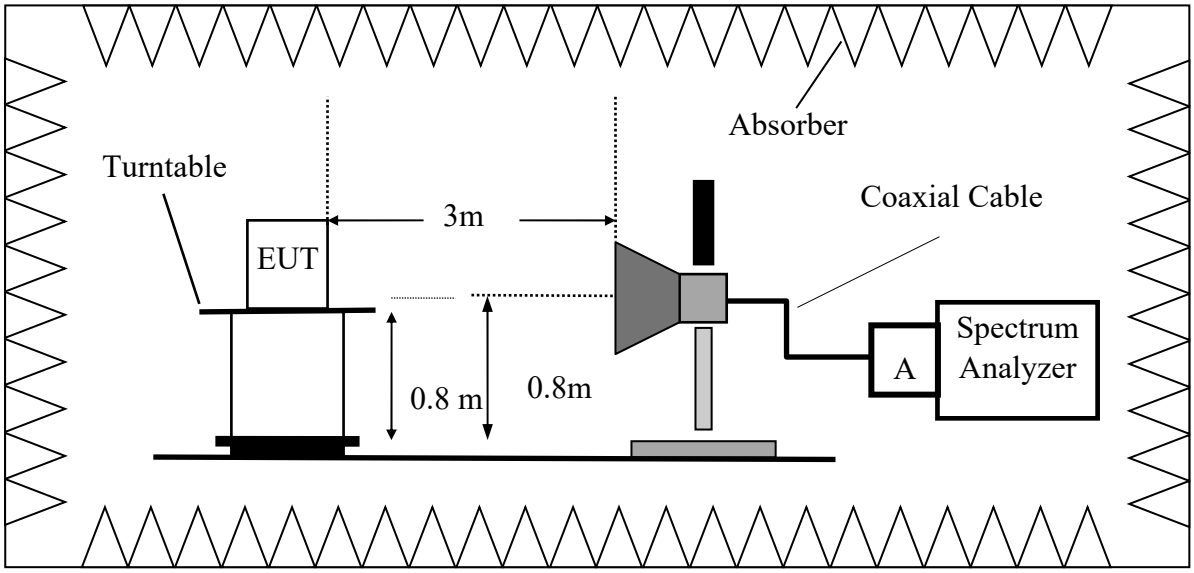
Refer to section 1.7 in this report

### 2.4.4 Test SET-UP (Block Diagram of Configuration)

(A) Radiated Emission Test Set-Up, Frequency Below 1000MHz

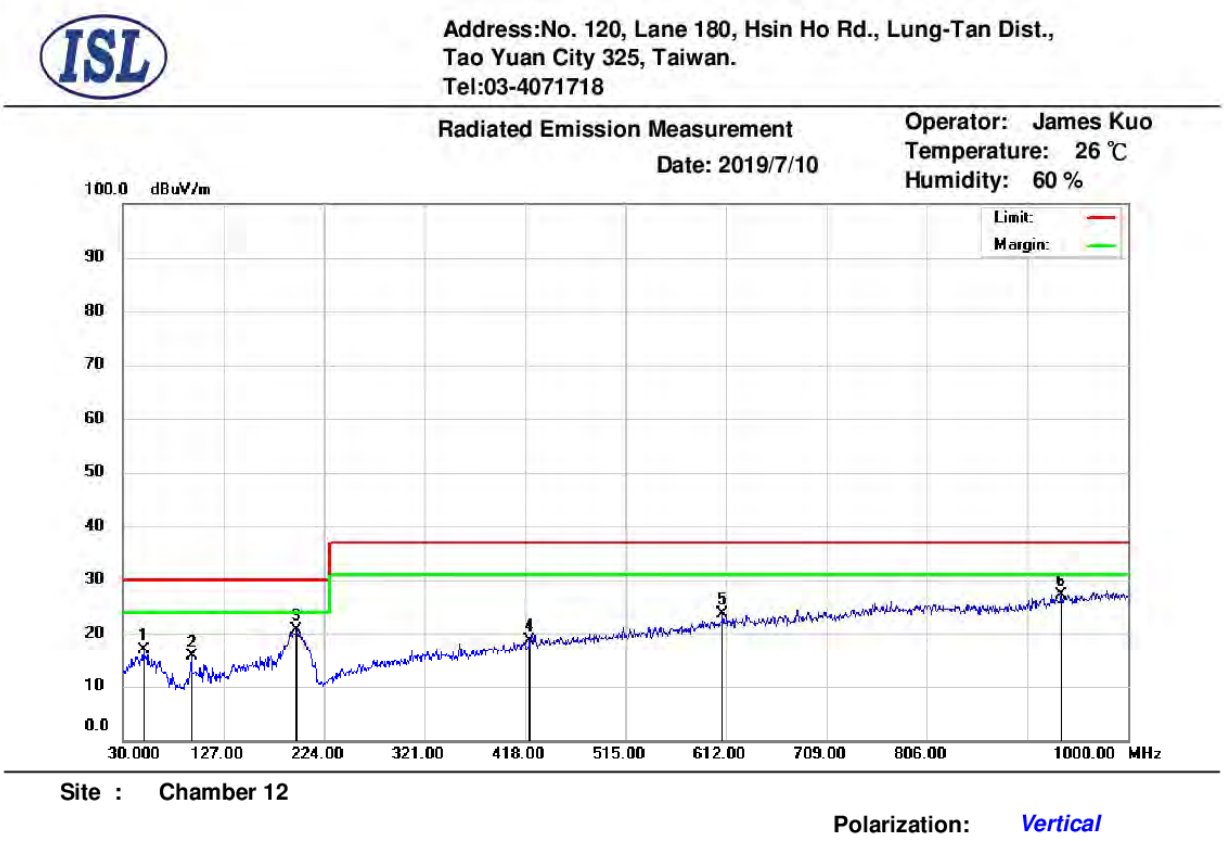



(B) Radiated Emission Test Set-UP Frequency Over 1 GHz



## Radiated Emission Measurement Data

| Operation Mode | Config 1,2 | Test Date | 2019/07/10 |
|---|---|---|---|
| Test by | Jason | Pol | Vertical |




| Mk. | Frequency (MHz) | RX_R (dBuV) | Correct Factor(dB/m) | Emission (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Ant.Pos (cm) | Tab.Pos (deg.) | Detector |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 49.40 | 33.52 | -16.65 | 16.87 | 30.00 | -13.13 | 350 | 103 | peak |
| 2 | 95.96 | 37.24 | -21.63 | 15.61 | 30.00 | -14.39 | 100 | 0 | peak |
| 3 | 197.81 | 39.07 | -18.49 | 20.58 | 30.00 | -9.42 | 100 | 306 | peak |
| 4 | 422.85 | 29.94 | -11.32 | 18.62 | 37.00 | -18.38 | 300 | 70 | peak |
| 5 | 609.09 | 31.07 | -7.34 | 23.73 | 37.00 | -13.27 | 200 | 300 | peak |
| 6 | 935.98 | 30.41 | -3.26 | 27.15 | 37.00 | -9.85 | 350 | 360 | peak |

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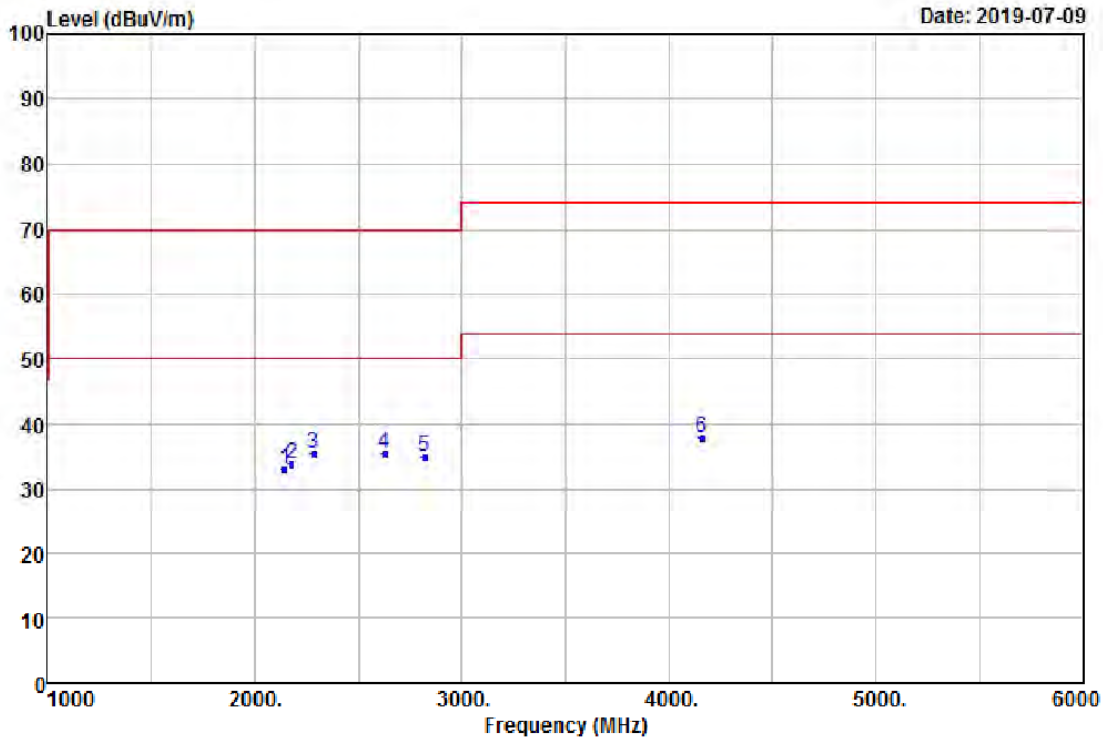
Web:www.isl.com.tw




Condition: 55022/32 B PK 3m HORIZONTAL
Site : Chamber 19

Operator : jason

| | Freq | Read Level | Factor | Level | Limit Line | Over Limit | Remark | Pol/Phase |
|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dBuV/m | dBuV/m | dB | | |
| 1 | 2145.00 | 49.38 | -16.19 | 33.19 | 70.00 | -36.81 | Peak | HORIZONTAL |
| 2 | 2180.00 | 49.72 | -15.93 | 33.79 | 70.00 | -36.21 | Peak | HORIZONTAL |
| 3 | 2285.00 | 51.09 | -15.75 | 35.34 | 70.00 | -34.66 | Peak | HORIZONTAL |
| 4 | 2625.00 | 50.88 | -15.51 | 35.37 | 70.00 | -34.63 | Peak | HORIZONTAL |
| 5 | 2820.00 | 50.20 | -15.19 | 35.01 | 70.00 | -34.99 | Peak | HORIZONTAL |
| 6 | 4160.00 | 49.58 | -11.59 | 37.99 | 74.00 | -36.01 | Peak | HORIZONTAL |

| Operation Mode | Config 1,2 | Test Date | 2019/07/10 |
|---|---|---|---|
| Test by | Jason | Pol | Horizontal |

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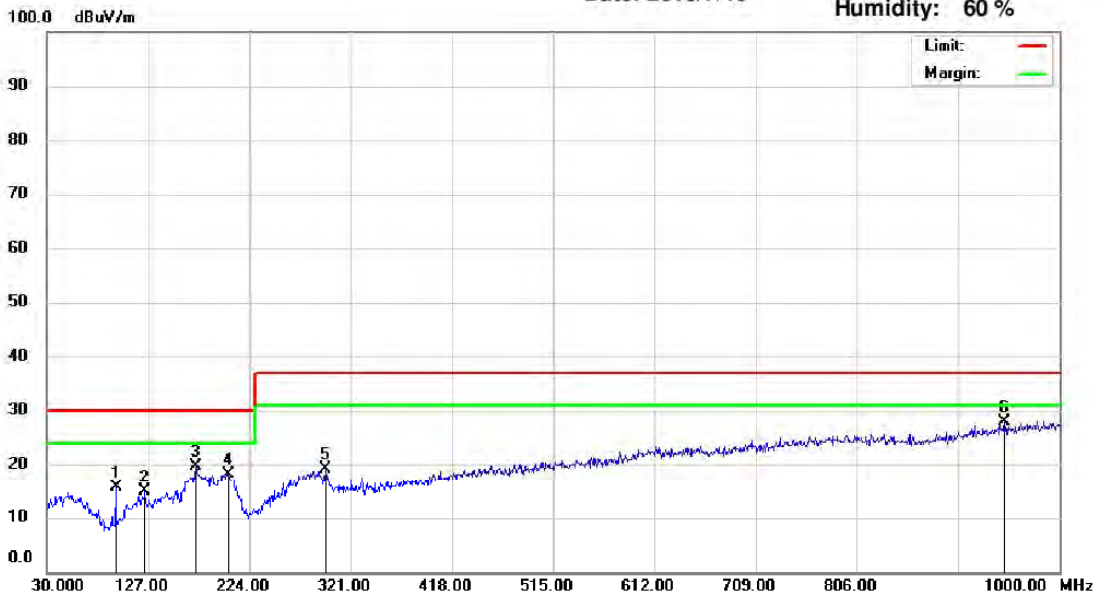
Tel:03-4071718

Radiated Emission Measurement

Operator: James Kuo
Temperature: 26 ℃
Humidity: 60 %

Date: 2019/7/10




Site : Chamber 12

Polarization: *Horizontal*

| Mk. | Frequency (MHz) | RX_R (dBuV) | Correct Factor(dB/m) | Emission (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Ant.Pos (cm) | Tab.Pos (deg.) | Detector |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 95.96 | 37.22 | -21.63 | 15.59 | 30.00 | -14.41 | 350 | 314 | peak |
| 2 | 124.09 | 32.93 | -18.06 | 14.87 | 30.00 | -15.13 | 398 | 1 | peak |
| 3 | 172.59 | 35.98 | -16.39 | 19.59 | 30.00 | -10.41 | 398 | 0 | peak |
| 4 | 203.63 | 36.86 | -18.62 | 18.24 | 30.00 | -11.76 | 397 | 360 | peak |
| 5 | 296.75 | 33.69 | -14.58 | 19.11 | 37.00 | -17.89 | 250 | 0 | peak |
| 6 | 947.62 | 30.87 | -3.10 | 27.77 | 37.00 | -9.23 | 350 | 321 | peak |

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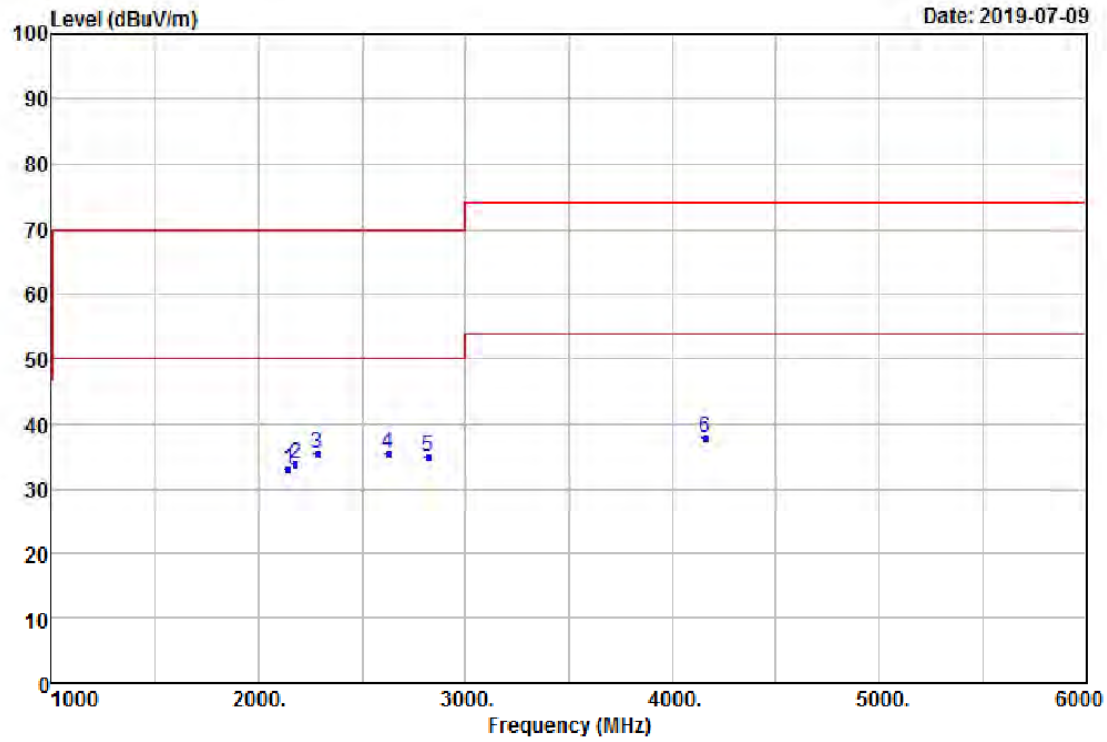



Condition: 55022/32 B PK 3m HORIZONTAL
Site : Chamber 19

Operator : jason

| | Freq | Read Level | Factor | Level | Limit Line | Over Limit | Remark | Pol/Phase |
|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dBuV/m | dBuV/m | dB | | |
| 1 | 2145.00 | 49.38 | -16.19 | 33.19 | 70.00 | -36.81 | Peak | HORIZONTAL |
| 2 | 2180.00 | 49.72 | -15.93 | 33.79 | 70.00 | -36.21 | Peak | HORIZONTAL |
| 3 | 2285.00 | 51.09 | -15.75 | 35.34 | 70.00 | -34.66 | Peak | HORIZONTAL |
| 4 | 2625.00 | 50.88 | -15.51 | 35.37 | 70.00 | -34.63 | Peak | HORIZONTAL |
| 5 | 2820.00 | 50.20 | -15.19 | 35.01 | 70.00 | -34.99 | Peak | HORIZONTAL |
| 6 | 4160.00 | 49.58 | -11.59 | 37.99 | 74.00 | -36.01 | Peak | HORIZONTAL |

## 2.5 DC power input/output ports measurement.

### 2.5.1 Test Method:

| Standard | Date | Description |
|---|---|---|
| EN 55032 | 2015+AC: 2016 | Limits and methods of measurement of radio interference characteristics of information technology equipment. |

Refer to section 8.3.2 of EN301489-1 for detail.

### 2.5.2 Limit:

| Frequency range | Limit (quasi-peak) (dBµV) | Limit (average) (dBµV) |
|---|---|---|
| 0,15 MHz to 0,5 MHz | 66 to 56 | 56 to 46 |
| > 0,5 MHz to 5 MHz | 56 | 46 |
| > 5 MHz to 30 MHz | 60 | 50 |
| NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0,15 MHz to 0,50 MHz. | | |

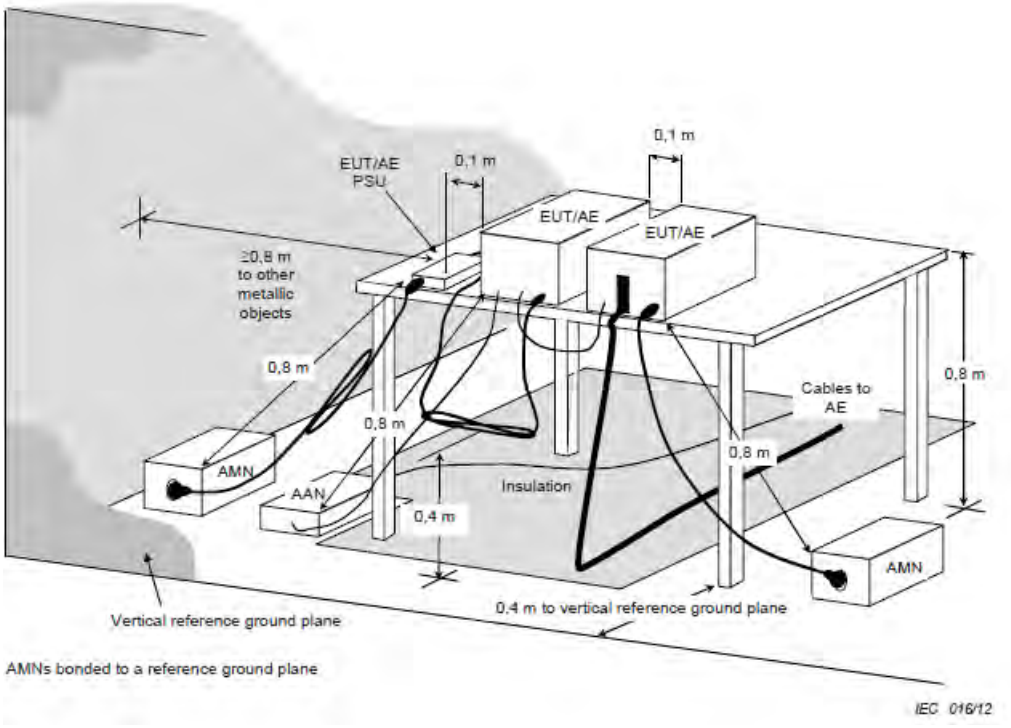
### 2.5.3 Test Procedure:

1. EUT was placed on an 0.8m wooden table above ground plane.
2. Set up EUT with support units and turn on the power of all equipment.
3. Link the EUT with Telecommunication tester, setup the test mode. The transmitter operating at continuously mode and max output rated power.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. Repeat above procedures until all frequency measured were complete.

### 2.5.4 Test Instruments:

Refer to section 1.7 in this report

### 2.5.5 Test SET-UP (Block Diagram of Configuration)




### 2.5.6 Measurement Result:

N/A,

## 2.6 AC Mains power input/output ports measurement.

### 2.6.1 Test Method:

| Standard | Date | Description |
|---|---|---|
| EN 55032 | 2015+AC:2016 | Limits and methods of measurement of radio interference characteristics of information technology equipment. |

Refer to section 8.4.2 of EN301489-1 and 55032 Annex A for detail.

### 2.6.2 Limit: Refer to 2.5.2

### 2.6.3 Test Procedure: Refer to 2.5.3

### 2.6.4 Test Instruments: Refer to 2.5.4

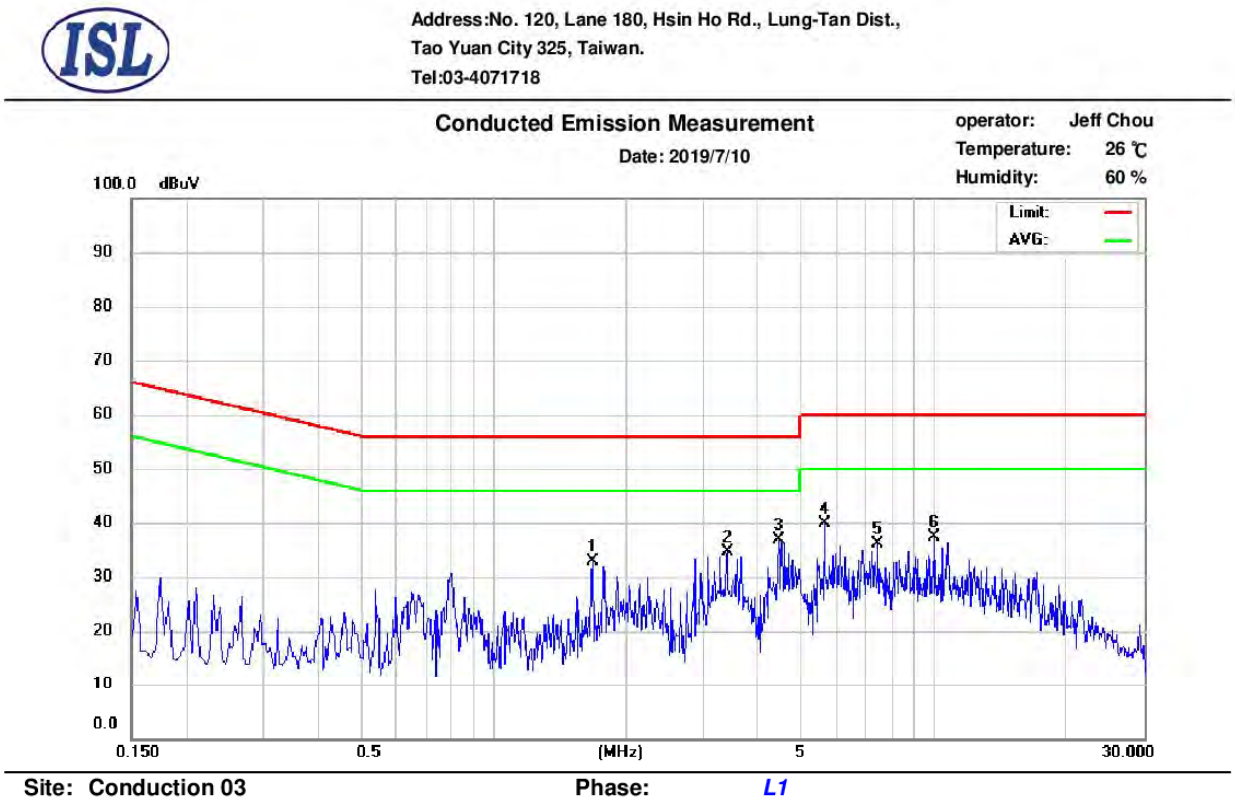
### 2.6.5 Conduction Emission Test Set-up: Refer to 2.5.5

### 2.6.6 Measurement Result:

Refer to next page for details.

### 2.6.7 Measurement Data:

| Operation Mode: | Config 1,2 | Test Date: | 2019/07/10 |
|---|---|---|---|
| Test By: | Jason | Pol.: | L1 |




| No. | Frequency (MHz) | QP_R (dBuV) | AVG_R (dBuV) | Correct Factor (dB) | QP Emission (dBuV) | QP Limit (dBuV) | QP Margin (dB) | AVG Emission (dBuV) | AVG Limit (dBuV) | AVG Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.674 | 10.58 | 0.64 | 9.76 | 20.34 | 56.00 | -35.66 | 10.40 | 46.00 | -35.60 |
| 2 | 3.386 | 15.97 | 4.50 | 9.81 | 25.78 | 56.00 | -30.22 | 14.31 | 46.00 | -31.69 |
| 3 | 4.442 | 15.96 | 4.29 | 9.83 | 25.79 | 56.00 | -30.21 | 14.12 | 46.00 | -31.88 |
| 4 | 5.638 | 17.25 | 3.10 | 9.85 | 27.10 | 60.00 | -32.90 | 12.95 | 50.00 | -37.05 |
| 5 | 7.458 | 15.79 | 4.40 | 9.89 | 25.68 | 60.00 | -34.32 | 14.29 | 50.00 | -35.71 |
| 6 | 10.042 | 13.35 | 3.14 | 9.94 | 23.29 | 60.00 | -36.71 | 13.08 | 50.00 | -36.92 |

| | | | |
|---|---|---|---|
| Operation Mode: | Config 1,2 | Test Date: | 2019/07/10 |
| Test By: | Jason | Pol.: | N |

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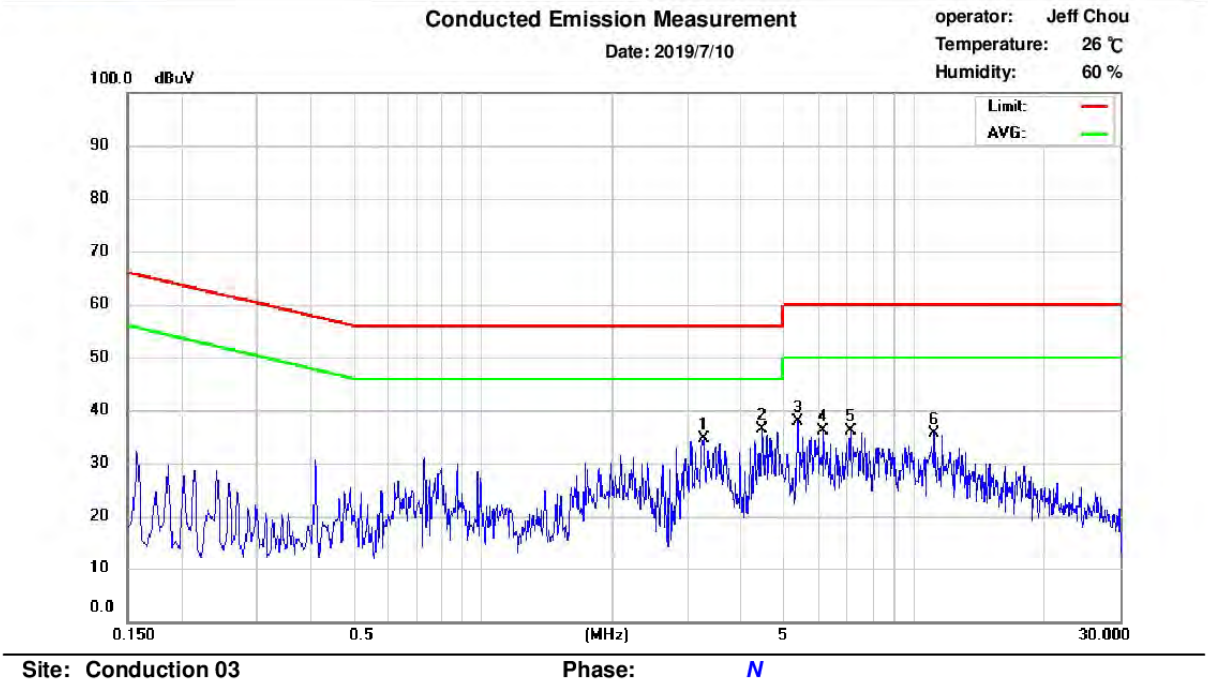



Site: Conduction 03 Phase: N

| No. | Frequency (MHz) | QP_R (dBuV) | AVG_R (dBuV) | Correct Factor (dB) | QP Emission (dBuV) | QP Limit (dBuV) | QP Margin (dB) | AVG Emission (dBuV) | AVG Limit (dBuV) | AVG Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3.258 | 17.42 | 5.04 | 9.81 | 27.23 | 56.00 | -28.77 | 14.85 | 46.00 | -31.15 |
| 2 | 4.454 | 16.95 | 4.91 | 9.85 | 26.80 | 56.00 | -29.20 | 14.76 | 46.00 | -31.24 |
| 3 | 5.386 | 14.57 | -0.68 | 9.87 | 24.44 | 60.00 | -35.56 | 9.19 | 50.00 | -40.81 |
| 4 | 6.186 | 14.80 | 4.86 | 9.89 | 24.69 | 60.00 | -35.31 | 14.75 | 50.00 | -35.25 |
| 5 | 7.122 | 16.78 | 4.89 | 9.91 | 26.69 | 60.00 | -33.31 | 14.80 | 50.00 | -35.20 |
| 6 | 11.146 | 13.72 | 2.83 | 10.00 | 23.72 | 60.00 | -36.28 | 12.83 | 50.00 | -37.17 |

**2.7 Harmonic Current Emissions (AC mains input port) measurement. Refer to EN 301 489-1 Section 8.5**

**2.7.1 Test Method: Refer to 61000-3-2:2014 and IEC 61000-3-2:2014**

**2.7.2 Limit**

**Table 1 – Limits for Class A equipment**

| Harmonic order<br>n | Maximum permissible harmonic current<br>A |
|---|---|
| **Odd harmonics** | |
| 3 | 2,30 |
| 5 | 1,14 |
| 7 | 0,77 |
| 9 | 0,40 |
| 11 | 0,33 |
| 13 | 0,21 |
| $15 \le n \le 39$ | $0,15 \frac{15}{n}$ |
| **Even harmonics** | |
| 2 | 1,08 |
| 4 | 0,43 |
| 6 | 0,30 |
| $8 \le n \le 40$ | $0,23 \frac{8}{n}$ |

**Note :For Class B equipment, the harmonics of the input current shall not exceed the values given in table 1 multiplied by a factor of 1,5.**

## Table 2 – Limits for Class C equipment

| Harmonic order<br>n | Maximum permissible harmonic currrent expressed as a percentage of the input current at the fundamental frequency<br>% |
|---|---|
| 2 | 2 |
| 3 | 30 · λ * |
| 5 | 10 |
| 7 | 7 |
| 9 | 5 |
| 11 ≤ n ≤ 39<br>(odd harmonics only) | 3 |
| * λ is the circuit power factor | |

## Table 3 – Limits for Class D equipment

| Harmonic order<br>n | Maximum permissible harmonic current per watt<br>mA/W | Maximum permissible harmonic current<br>A |
|---|---|---|
| 3 | 3,4 | 2,30 |
| 5 | 1,9 | 1,14 |
| 7 | 1,0 | 0,77 |
| 9 | 0,5 | 0,40 |
| 11 | 0,35 | 0,33 |
| 13 ≤ n ≤ 39<br>(odd harmonics only) | $\frac{3,85}{n}$ | See Table 1 |

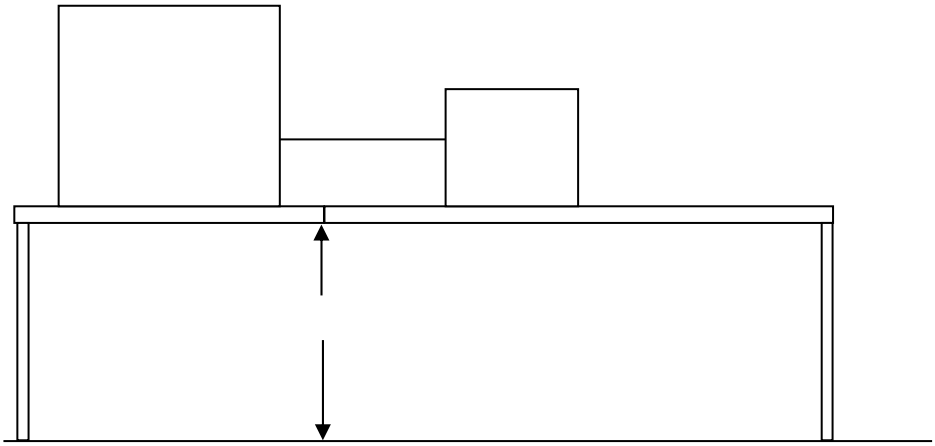
### 2.7.3 Test Procedure:

The EUT was placed on the top of a wooden table 0.8 meters above the ground and operated to produce the maximum harmonic components under normal operating conditions for each successive harmonic component in turn.

### 2.7.4 Test Instruments:

Refer to section 1.7 in this report

### 2.7.5 Test Set-up



### 2.7.6 Measurement Result:

N/A

## 2.8 Voltage Fluctuations and Flicker (AC mains input port) measurement. Refer to EN 301 489-1 Section 8.6

### 2.8.1 Test Method: Refer to EN 61000-3-3:2013 and IEC 61000-3-3:2013

### 2.8.2 Limit

| TEST ITEM | LIMIT |
|---|---|
| $P_{st}$ | 1.0 |
| $P_{lt}$ | 0.65 |
| D(t)(ms) | 500ms |
| $d_{max}$ (%) | 4% |
| dc (%) | 3.3% |

### 2.8.3 Test Procedure:

The EUT was placed on the top of a wooden table 0.8 meters above the ground and operated to produce the most unfavorable sequence of voltage changes under normal operating conditions.

### 2.8.4 Test Instruments:

Refer to section 1.7 in this report

### 2.8.5 Test Set-up

Refer to 2.7.5

### 2.8.6 Measurement Result: N/A

## 2.9 Telecommunication Port measurement. Refer to EN 301 489-1 Section 8.7

### 2.9.1 Test Method:

| Standard | Date | Description |
|---|---|---|
| EN 55032 | 2015+AC:2016 | Limits and methods of measurement of radio interference characteristics of information technology equipment. |

Refer to section 8.7.2 of EN301489-1 for detail.

### 2.9.2 Limit: Limits for conducted emissions from telecommunication ports

| Frequency range | Voltage limits | | Current limits | |
|---|---|---|---|---|
| | Quasi-peak | Average | Quasi-peak | Average |
| 0.15 MHz to 0.5 MHz | 84 dBµV to 74 dBµV | 74 dBµV to 64 dBµV | 40 dBµA to 30 dBµA | 30 dBµA to 20 dBµA |
| 0.5 MHz to 30 MHz | 74 dBµV | 64 dBµV | 30 dBµA | 20 dBµA |
| NOTE 1: The limits decrease linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.<br>NOTE 2: The current and voltage disturbance limits are derived for use with an Impedance Stabilization Network (ISN) which presents a common mode (asymmetric mode) impedance of 150 Ω to the telecommunication port under test (conversion factor is 20 log10 150/I = 44dB<br>NOTE 3: The emission requirement only applies to telecommunication ports as specified in EN 55032 . The provisional relaxation of 10 dB will be reviewed no later than 3 years after the date of withdrawal based on the results and interference cases seen in this period. Wherever possible it is recommended to comply with the limits without the provisional relaxation. | | | | |

### 2.9.3 Test Procedure: Refer to EN 55032

### 2.9.4 Test Instruments: Refer to 2.5.4

### 2.9.5 Conduction Emission Test Set-up: Refer to 2.5.5

### 2.9.6 Measurement Result: N/A

# 3.IMMUNITY

EN 301 489-17
EN55024

## 3.1 Test Configuration:

Refer to EN 301 489-1, Section 9.1.

## 3.2 Special Conditions:

**EN301489-17**

No special conditions shall apply to UE in the scope of the present document.

## 3.3 Summary of Test Results:

| Test Items | Reference Section | Result |
|---|---|---|
| Electrostatic discharge | EN 301 489-1 Section 9.3<br>EN 55024 Section 4.2.1 | PASS |
| Radio frequency electromagnetic filed (80 to 1000MHz and 1000MHz to 6000MHz) | EN 301 489-1 Section 9.2<br>EN 55024 Section 4.2.3.1 | PASS |
| Fast transients, common mode | EN 301 489-1 Section 9.4<br>EN 55024 Section 4.2.2 | N/A |
| Surges | EN 301 489-1 Section 9.8<br>EN 55024 Section 4.2.5 | N/A |
| Radio Frequency, common mode | EN 301 489-1 Section 9.5<br>EN 55024 Section 4.2.3.2 | N/A |
| Voltage Dips and interruptions | EN 301 489-1 Section 9.7 | N/A |
| Transients and surges in the vehicular environment | EN 301 489-1 Section 9.6 | N/A |
| Power Frequency Magnetic (PMF) | EN 55024 Section 4.2.4 | N/A |

## 3.4 Performance Criteria Description:

### 3.4.1 EN301 489-17

| Criteria | During test | After test |
|---|---|---|
| **A** | Shall operate as intended. (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). Shall be 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. | |

**Performance criteria for Continuous phenomena applied to Transmitters (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.

**Performance criteria for Transient phenomena applied to Transmitters (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.

**Performance criteria for Continuous phenomena applied to Receivers (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.

**Performance criteria for Transient phenomena applied to Receivers (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.

**EN55024**

**Performance criterion A**

The equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.

**Performance criterion B**

After the test, the equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed, after the application of the phenomena below a performance level specified by the manufacturer, when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is allowed. However, no change of operating state or stored data is allowed to persist after the test. If the minimum performance level (or the permissible performance loss) is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.

**Performance criterion C**

Loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls by the user in accordance with the manufacturer's instructions.
Functions, and/or information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

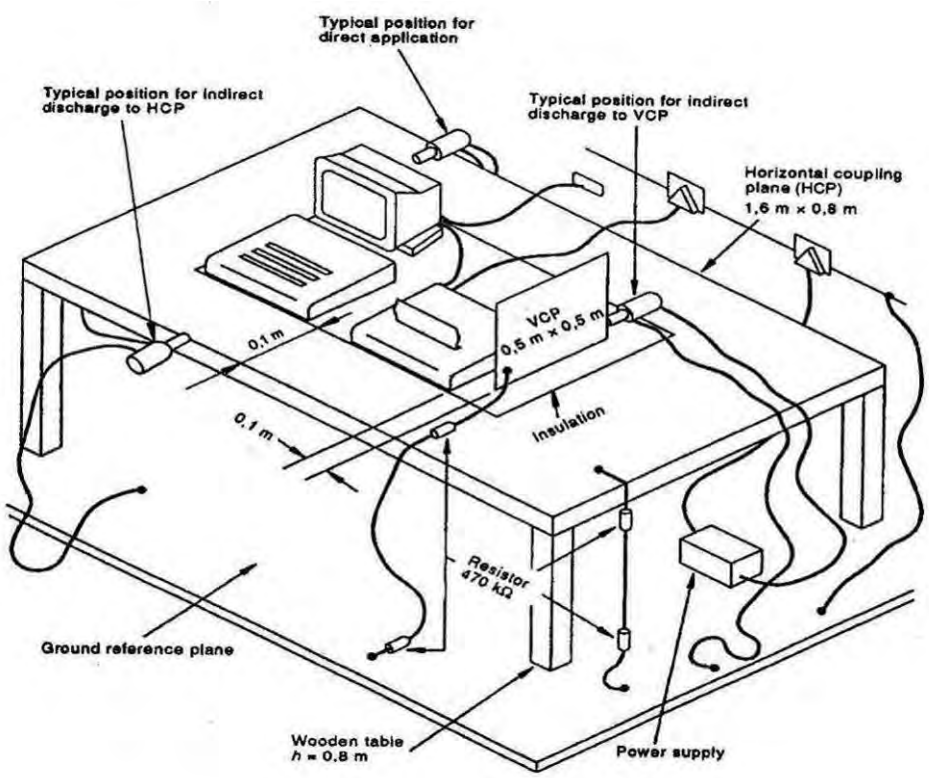
### 3.5 Electrostatic Discharge Measurement. Refer to EN 301 489-1 Section 9.3

**3.5.1 Test Method and Procedure:**
EN61000-4-2 and EN 301 489-1 Section 9.3.2.

**3.5.2 Performance criteria:**
Refer to EN 301 489-1 Section 9.3.3.
Refer to EN 55024 Section 8

**3.5.3 Test Instruments:**
Refer to section 1.7 in this report

**3.5.4 Test SET-UP (Block Diagram of Configuration)**



### 3.5.5 Measurement Result:

| | | | |
|---|---|---|---|
| Operation Mode: | Config 1,2 | Test Date: | 2019/7/11 |
| Temperature: | 25 ℃ | Humidity: | 45% |
| | | Test By: | Jason |

Basic Standard : EN61000-4-2
Discharge Impedance : 330 ohm / 150 pF
Discharge Voltage : Air Discharge:+/- 2 ~ 8 kV
Contact Discharge:+/- 2 ~ 4 kV
VCP/HCP:+/- 2 ~ 4 kV
Polarity : Positive/Negative
Number of Discharge : Minimum 10/50 times at each test point
Discharge Mode : Single Discharge
Discharge Period : 1 second minimum

Note 1:For contact discharge, the EUT shall be exposed to at least 50 discharges, 25 each at negative and positive polarity. For air discharge, A minimum of 10 single air discharges shall be applied

**Note 2:**Test point refer to test report Appendix 1

| Air Discharge | | | | | | | |
|---|---|---|---|---|---|---|---|
| Test Levels | | | | | | Results | |
| ±2kV | Performance Criterion | ±4kV | Performance Criterion | ± 8kV | Performance Criterion | Pass | Fail |
| ☐ | ☐A ☐B ☐C | ☐ | ☐A ☐B ☐C | ☐ | ☐A ☐B ☐C | ☐ | ☐ |

| Contact Discharge | | | | | | | |
|---|---|---|---|---|---|---|---|
| Test Levels | | | | | | Results | |
| ±2kV | Performance Criterion | ±4kV | Performance Criterion | ± 6kV | Performance Criterion | Pass | Fail |
| ☒ | ☒A ☐B ☐C | ☒ | ☒A ☐B ☐C | ☐ | ☐A ☐B ☐C | ☒ | ☐ |

| Discharge To VCP | | | | | | | |
|---|---|---|---|---|---|---|---|
| Test Levels | | | | | | Results | |
| ±2kV | Performance Criterion | ±4kV | Performance Criterion | ± 6kV | Performance Criterion | Pass | Fail |
| ☒ | ☒A ☐B ☐C | ☒ | ☒A ☐B ☐C | ☐ | ☐A ☐B ☐C | ☒ | ☐ |

| Discharge To HCP | | | | | | | |
|---|---|---|---|---|---|---|---|
| Test Levels | | | | | | Results | |
| ±2kV | Performance Criterion | ±4kV | Performance Criterion | ± 6kV | Performance Criterion | Pass | Fail |
| ☒ | ☒A ☐B ☐C | ☒ | ☒A ☐B ☐C | ☐ | ☐A ☐B ☐C | ☒ | ☐ |

**Remark:**

A: No degradation in the performance of the EUT was observed.

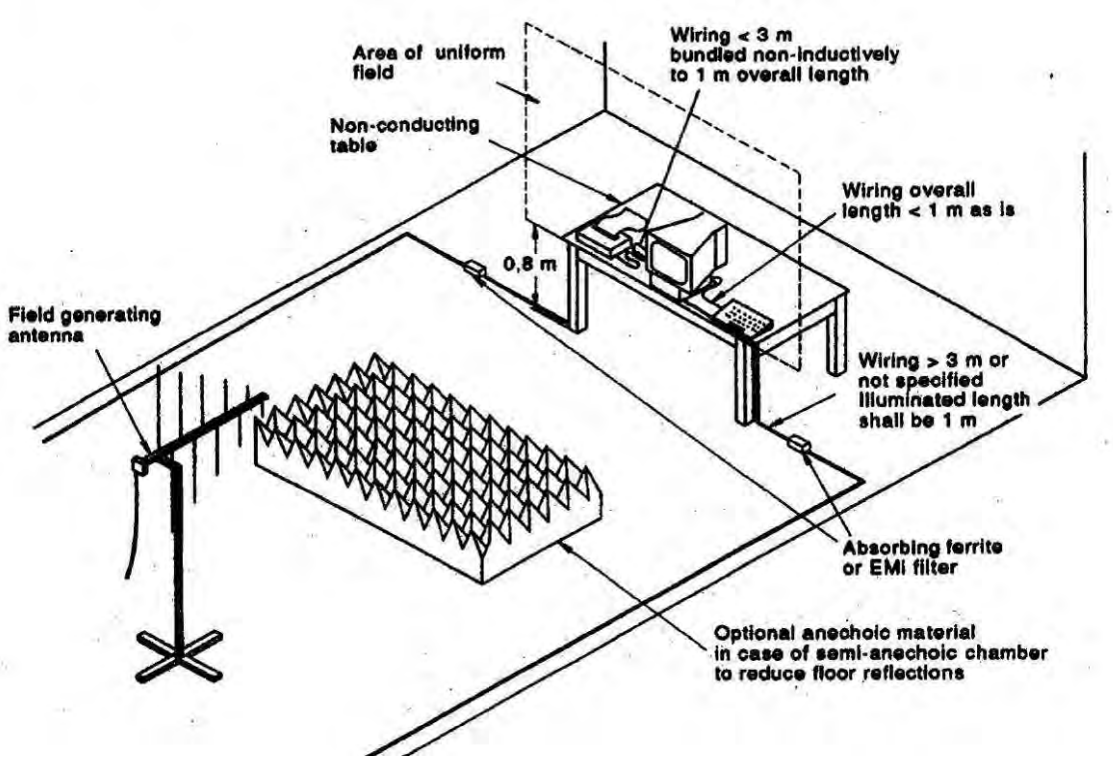
### 3.6 Radio Frequency Electromagnetic Filed (80MHz to 6GHz) Measurement. Refer to EN 301 489-1 Section 9.2

**3.6.1 Test Method and Procedure:**
EN61000-4-3 and EN 301 489-1 Section 9.2.2.

**3.6.2 Performance criteria:**
Refer to EN 301 489-1 Section 9.2.3.

**3.6.3 Test Instruments:**
Refer to section 1.7 in this report

**3.6.4 Test SET-UP (Block Diagram of Configuration):**
**Test setup**:




**3.6.5 Measurement Result:**
Refer to below for results.

### 3.6.6 Measurement Data:

| Operation Mode: | Config 1,2 | Test Date: | 2019/7/11 |
|---|---|---|---|
| Temperature: | 25 ℃ | Humidity: | 50 % |
| | | Test By: | Jason |

Basic Standard : EN61000-4-3
Frequency range : 80 to 1000MHz and 1000 to 6000 MHz
Field strength : 3 V/m
Modulation : AM 80%, 1 kHz Sinewave
Frequency step : 1 % of fundamental
Polarity of Antenna : Horizontal and Vertical
Test distance : 3 m (EUT to antenna reference point)

| No. | Frequency (MHz) | Antenna Orientation | Observation | EUT Orientation |
|---|---|---|---|---|
| 1 | 80 - 6000 | Vertical/Horizontal | CT, CR and A, the EUT to be continuously received with no timeouts | 0 degree |
| 2 | 80 - 6000 | Vertical/Horizontal | | 90 degree |
| 3 | 80 - 6000 | Vertical/Horizontal | | 180 degree |
| 4 | 80 - 6000 | Vertical/Horizontal | | 270 degree |

**Remark:**

A : No degradation in the performance of the EUT was observed.
N/A : Not Applicable.

## 3.7 Fast Transients, Common Mode Measurement. Refer to EN 301 489-1 Section 9.4

### 3.7.1 Test Method and Procedure:

EN61000-4-4: 2012, and EN 301 489-1 Section 9.4.2.

### 3.7.2 Performance criteria:

Refer to EN 301 489-1 Section 9.4.3.

### 3.7.3 Test Instruments

Refer to section 1.7 in this report

### 3.7.4 Test SET-UP (Block Diagram of Configuration):

Refer to Appendix 2 setup photo

### 3.7.5 Measurement Result:

**N/A**

## 3.8 Surges Measurement. Refer to EN 301 489-1 Section 9.8

### 3.8.1 Test Method and Procedure:

EN61000-4-5: 2014, and EN 301 489-1 Section 9.8.2.

### 3.8.2 Performance criteria:

Refer to EN 301 489-1 Section 9.8.3.
Refer to EN 55024 Section 8

### 3.8.3 Test Instruments:

Refer to section 1.7 in this report

### 3.8.4 Test SET-UP (Block Diagram of Configuration):

Refer to Appendix 2 setup photo

### 3.8.5 Measurement Result:

**N/A**

## 3.9 Radio Frequency, Common Mode Measurement. Refer to EN 301 489-1 Section 9.5

### 3.9.1 Test Method and Procedure:

EN61000-4-6: 2014+AC:2015, and EN 301 489-1 Section 9.5.2.

### 3.9.2 Performance criteria:

Refer to EN 301 489-1 Section 9.5.3.

### 3.9.3 Test Instruments:

Refer to section 1.7 in this report

### 3.9.4 Test SET-UP (Block Diagram of Configuration):

Refer to Appendix 2 setup photo

### 3.9.5 Measurement Result:

**N/A**

## 3.10 Transients and surges in the vehicular environment measurement. Refer to EN 301 489-1 Section 9.6

### 3.10.1 Test Method and Procedure:

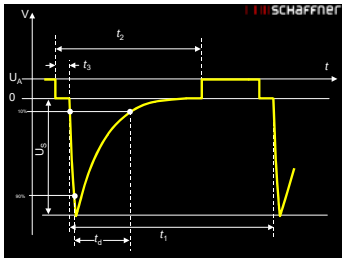
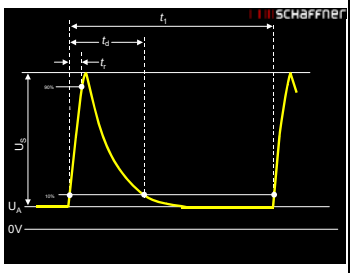
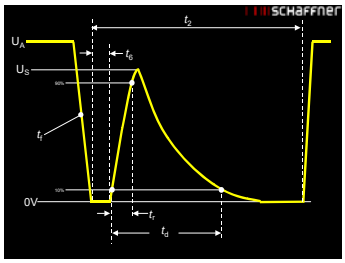
Refer to ISO 7637-2 for 12Vdc and 24Vdc equipment. , and EN 301 489-1 Section 9.6.2.

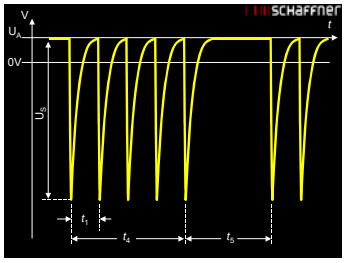
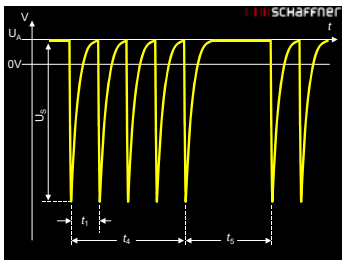
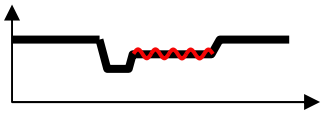
### 3.10.2 Performance criteria:

Refer to EN 301 489-1 Section 9.6.3.

### 3.10.3 Test Instruments:

Refer to section 1.7 in this report

| Pulse | Us/Vs | Ri | Test parameters | Delay | Figure |
|---|---|---|---|---|---|
| ISO 7637-2 (2004) – Pulse 1 | -450V | 50.0 Ohm | td = 1.0ms, t1 = 2.5s, t2 = 200.0m | 0.0 s |  |
| ISO 7637-2 (2004) – Pulse 2A | 37.5V | 2.0 Ohm | td = 50.0us, t1 = 3.0s | 0.0 s |  |
| ISO 7637-2 (2004) – Pulse 2B | 20.0V | 0.0 Ohm | td = 1.0s | 60.0 s |  |

| | | | | | |
|---|---|---|---|---|---|
| ISO 7637-2 (2004) – Pulse 3A | -150V | 50.0 Ohm | t1 = 100.0us, t4 = 10.0ms, t5 = 90.0ms | 0.0 s |   |
| ISO 7637-2 (2004) – Pulse 3B | 150V | 50.0 Ohm | t1 = 100.0us, t4 = 10.0ms, t5 = 90.0ms | 0.0 s |   |
| ISO 7637-2 (2004) – Pulse 4 | -12V | 0.0 Ohm | Ua = -5.0V, t7 = 70.0ms, t8 = 30.0ms, t9 + 10.0s, t10 = 10.0ms, t11 = 50.0ms | 60.0 s |  |

### 3.10.4 Test SET-UP (Block Diagram of Configuration):

Refer to Appendix 2 setup photo.

### 3.10.5 Measurement Result:

N/A.

## 3.11 Voltage Dips and Interruptions Measurement. Refer to EN 301 489-1 Section 9.7

### 3.11.1 Test Method and Procedure:

EN61000-4-11: 2004, and EN 301 489-1 Section 9.7.2.

### 3.11.2 Performance criteria:

Refer to EN 301 489-1 Section 9.7.3.
Refer to EN 55024 Section 8

### 3.11.3 Test Instruments

Refer to section 1.7 in this report

### 3.11.4 Test SET-UP:

Refer to Appendix 2 setup photo

### 3.11.5 Measurement Result:

**N/A**

## 3.12 Power Frequency Magnetic Measurement, Refer to EN55024

### 3.12.1 Test Method and Procedure:

EN61000-4-8: 2010, and EN 55024:2010.

### 3.12.2 Performance criteria:

Refer to EN 55024:2010 Section 7.

### 3.12.3 Test Instruments:

Refer to section 1.7 in this report

### 3.12.4 Test SET-UP (Block Diagram of Configuration):

Refer to Appendix 2 setup photo

### 3.12.5 Measurement Result:

**N/A**

# APPENDIX 1

# ESD TEST POINT

***Photo 1***

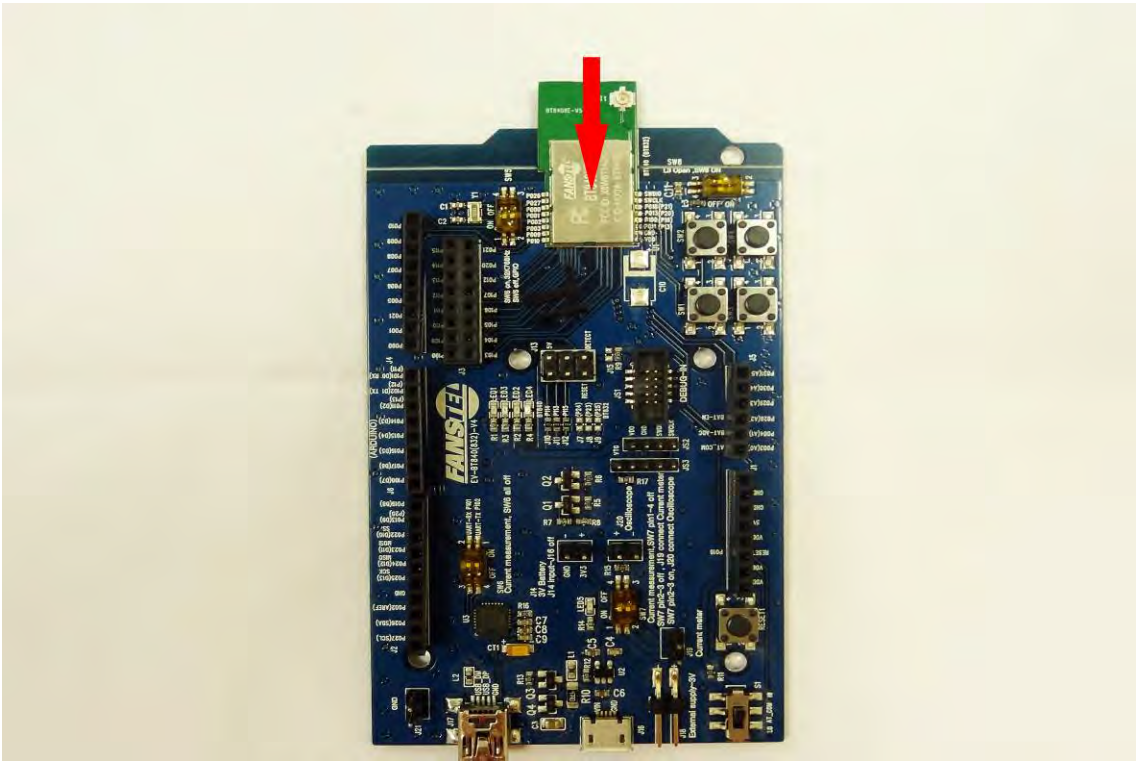
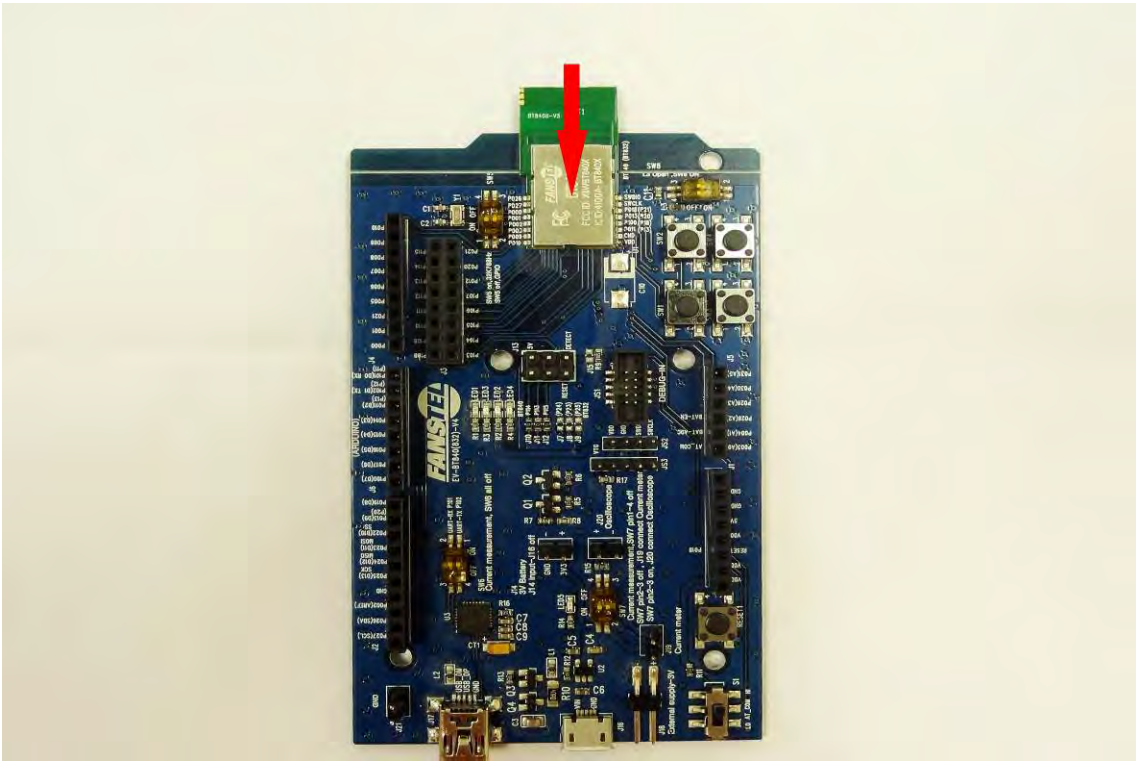


***Photo 2***

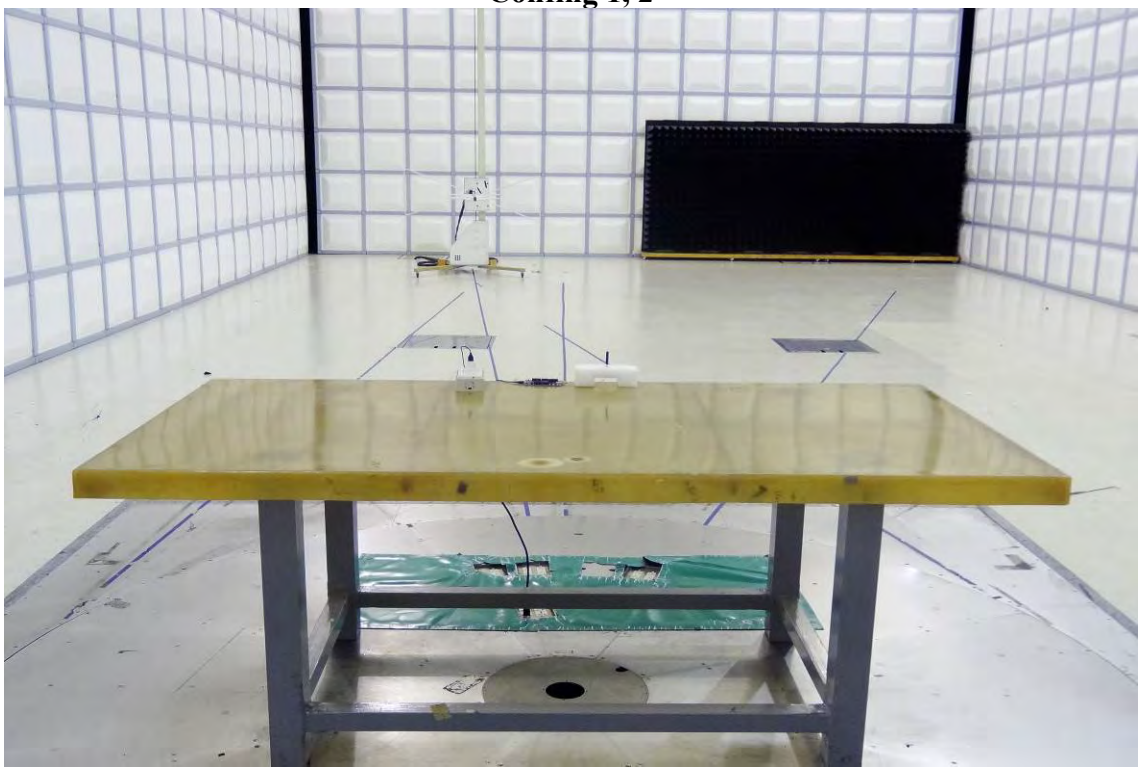


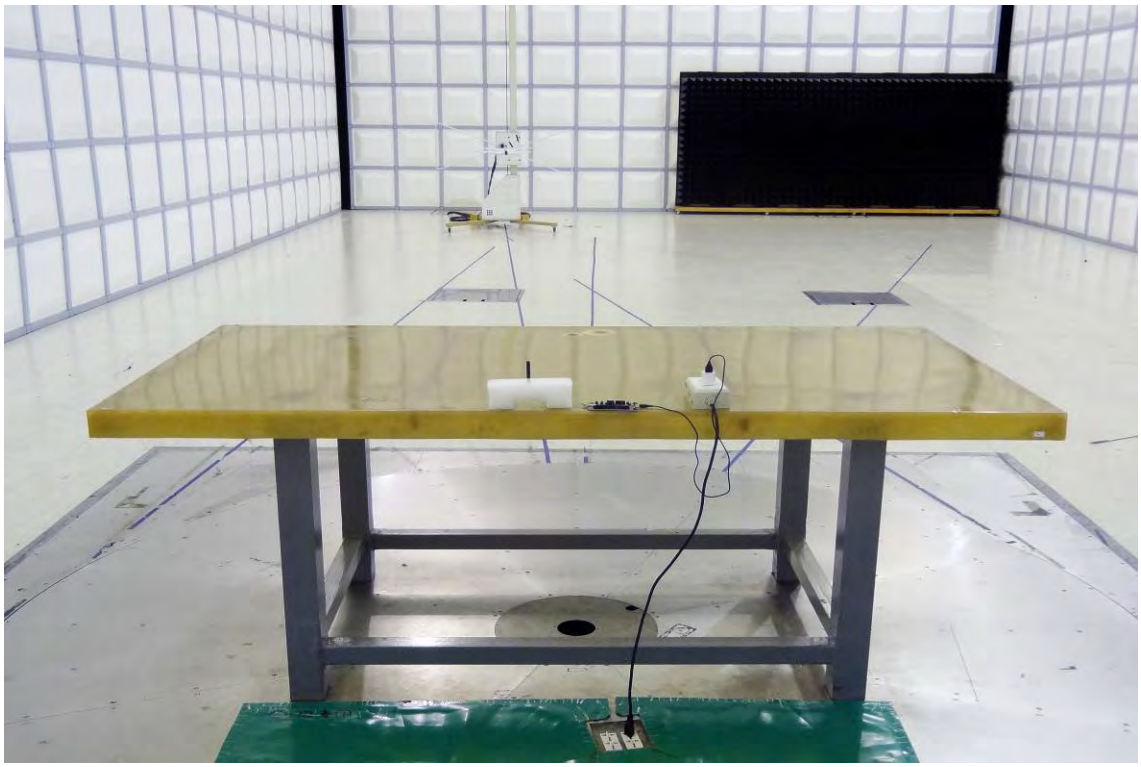
# APPENDIX 2

# PHOTOGRAPHS OF TEST SETUP

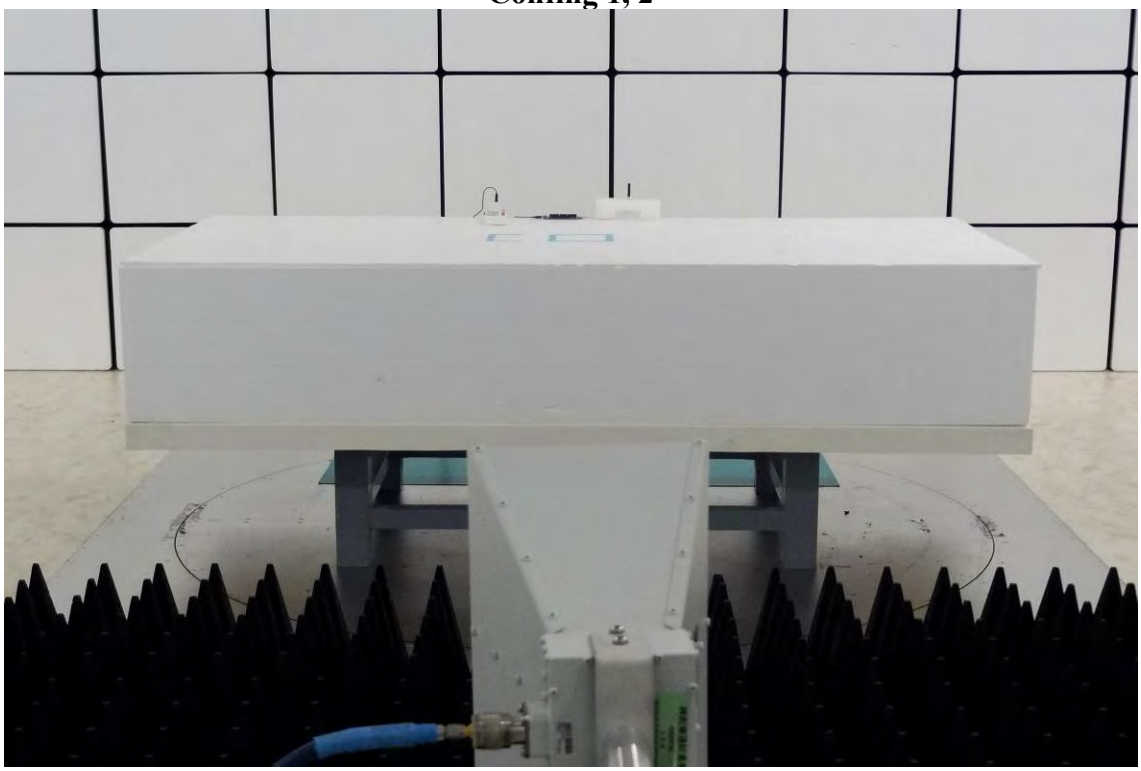
**RADIATED EMISSION TEST**

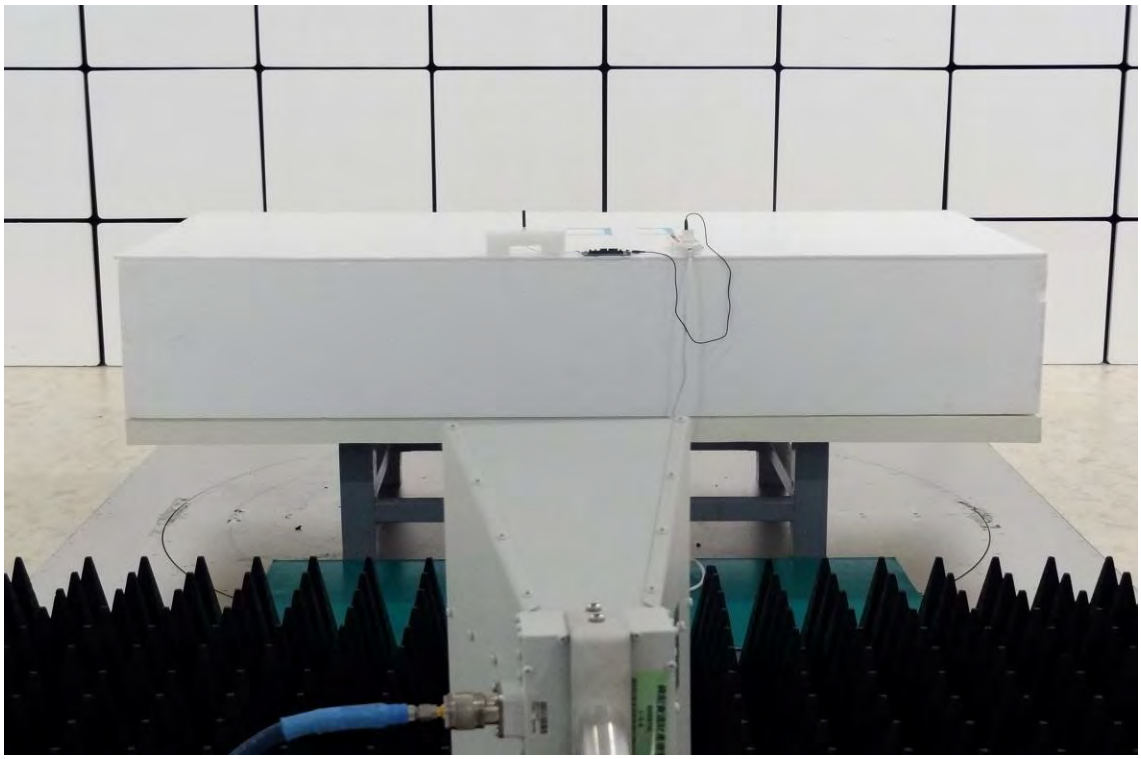
**Confing 1, 2**





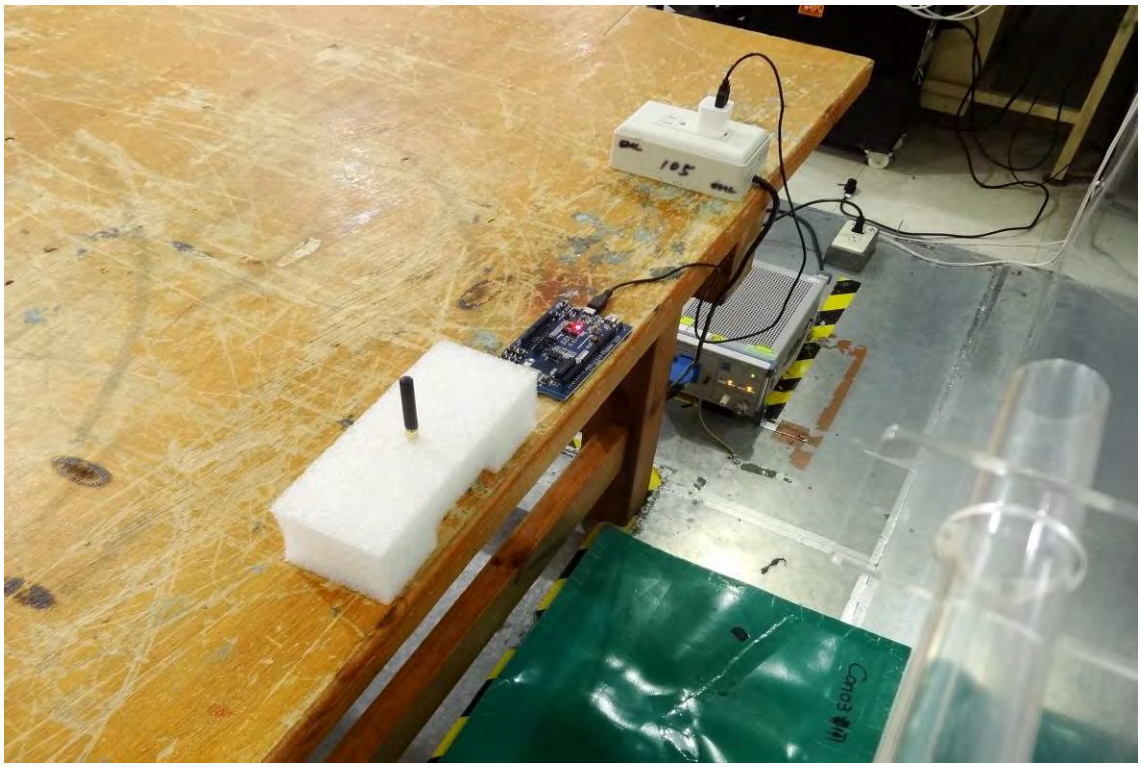
**Confing 1, 2**





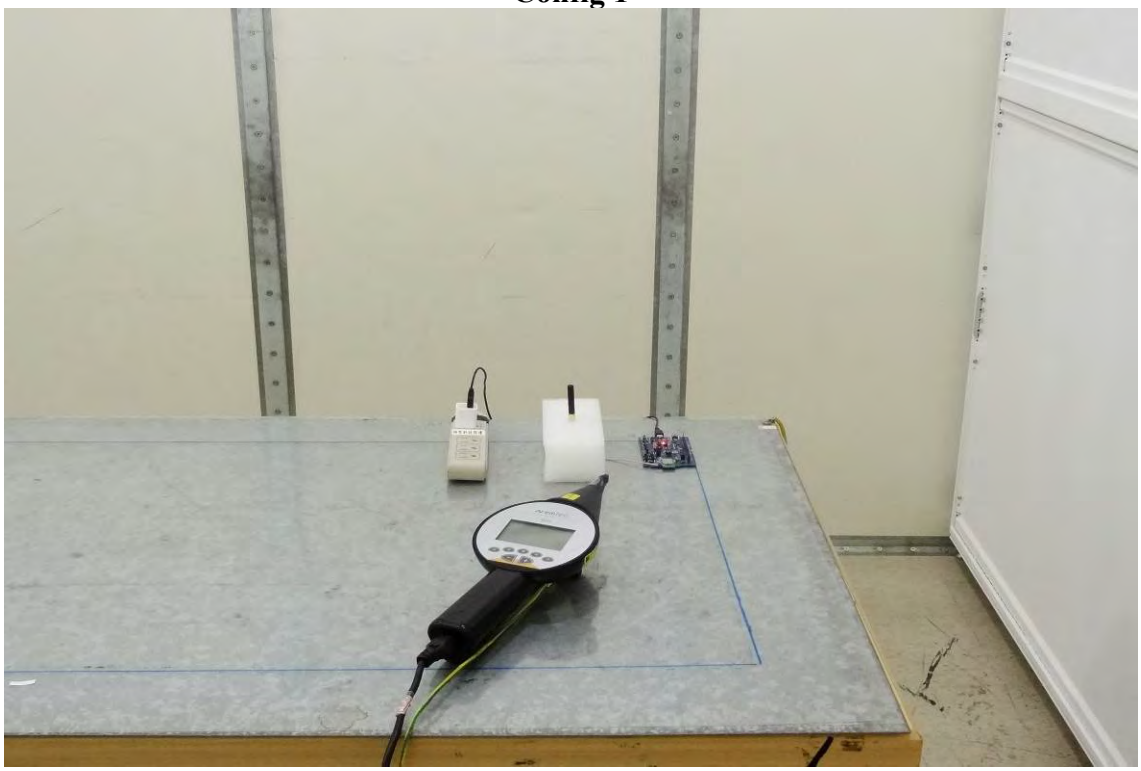
## AC POWER LINE CONDUCTED EMISSION TEST

**Config 1, 2**



**ELECTROSTATIC DISCHARGE TEST (EN 61000-4-2)**

**Config 1**

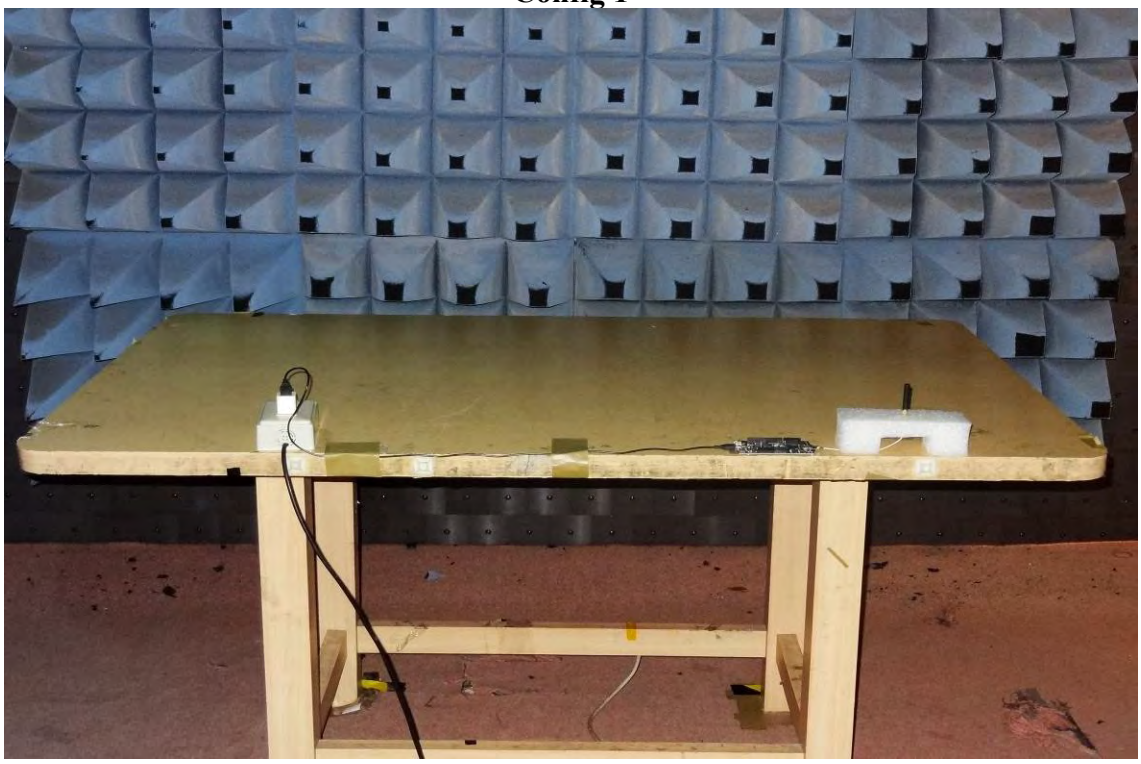


**ELECTROSTATIC DISCHARGE TEST (EN 61000-4-2)**

**Config 2**

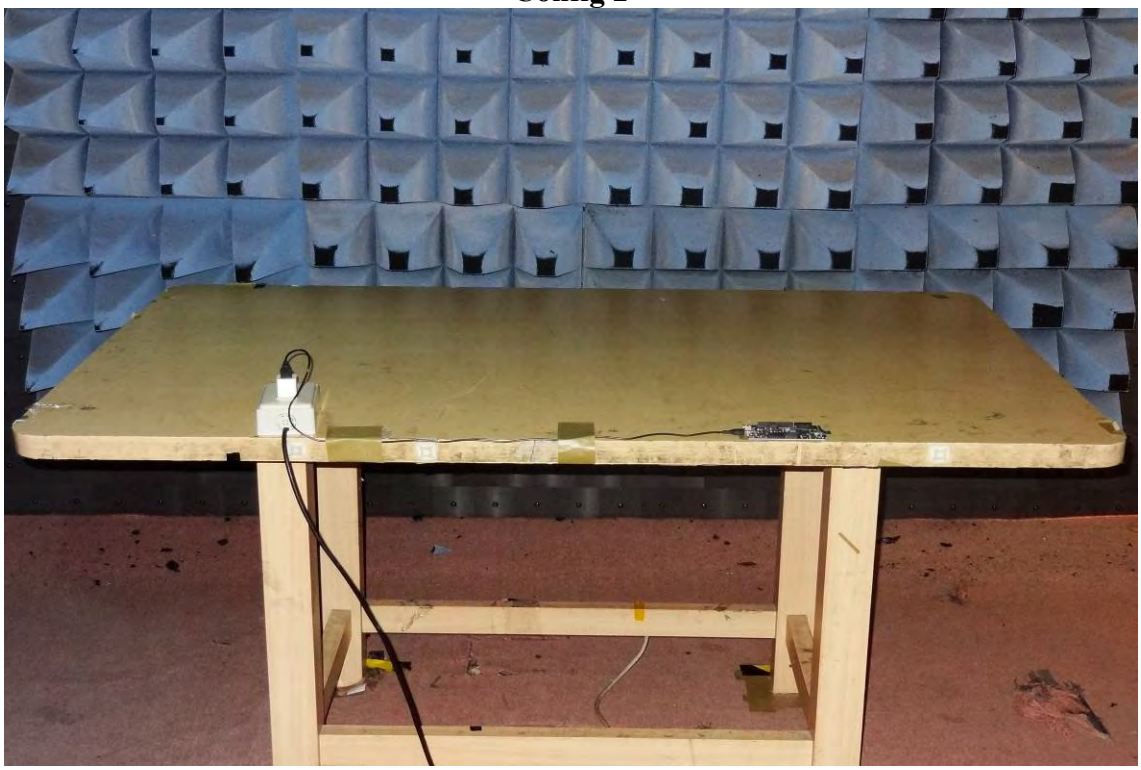
**RADIATED ELECTROMAGNETIC FIELD (EN 61000-4-3)**

**Config 1**



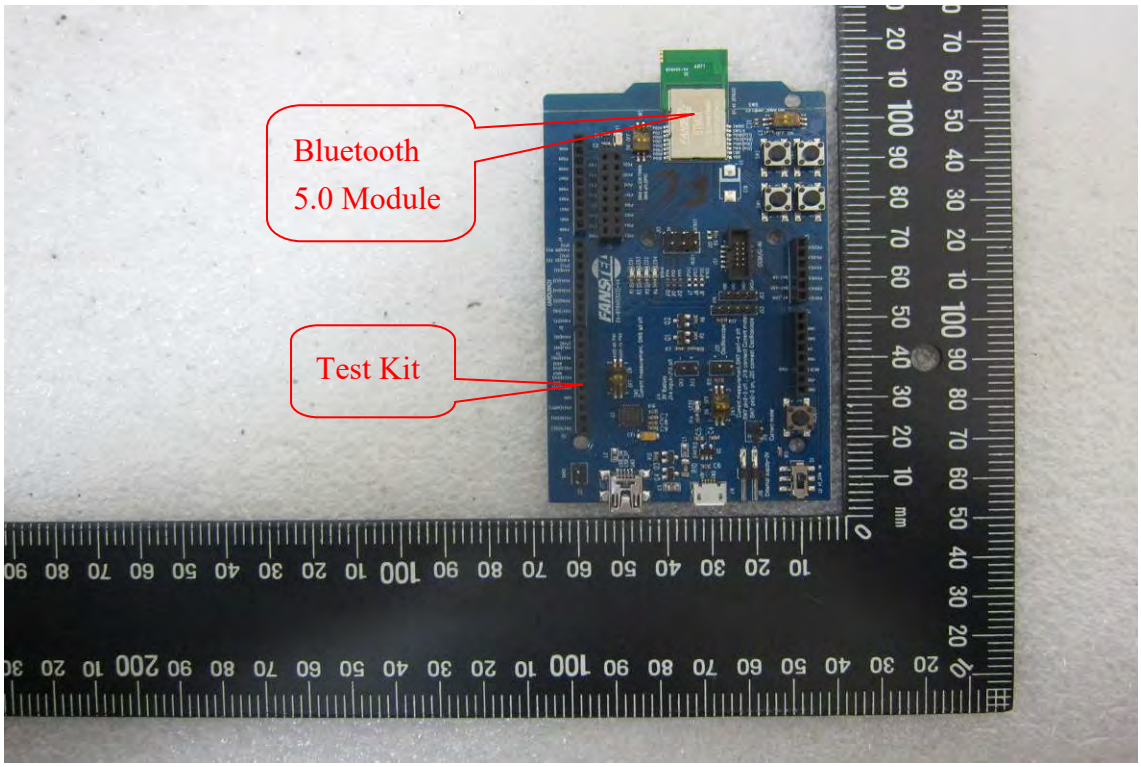
**RADIATED ELECTROMAGNETIC FIELD (EN 61000-4-3)**

**Config 2**

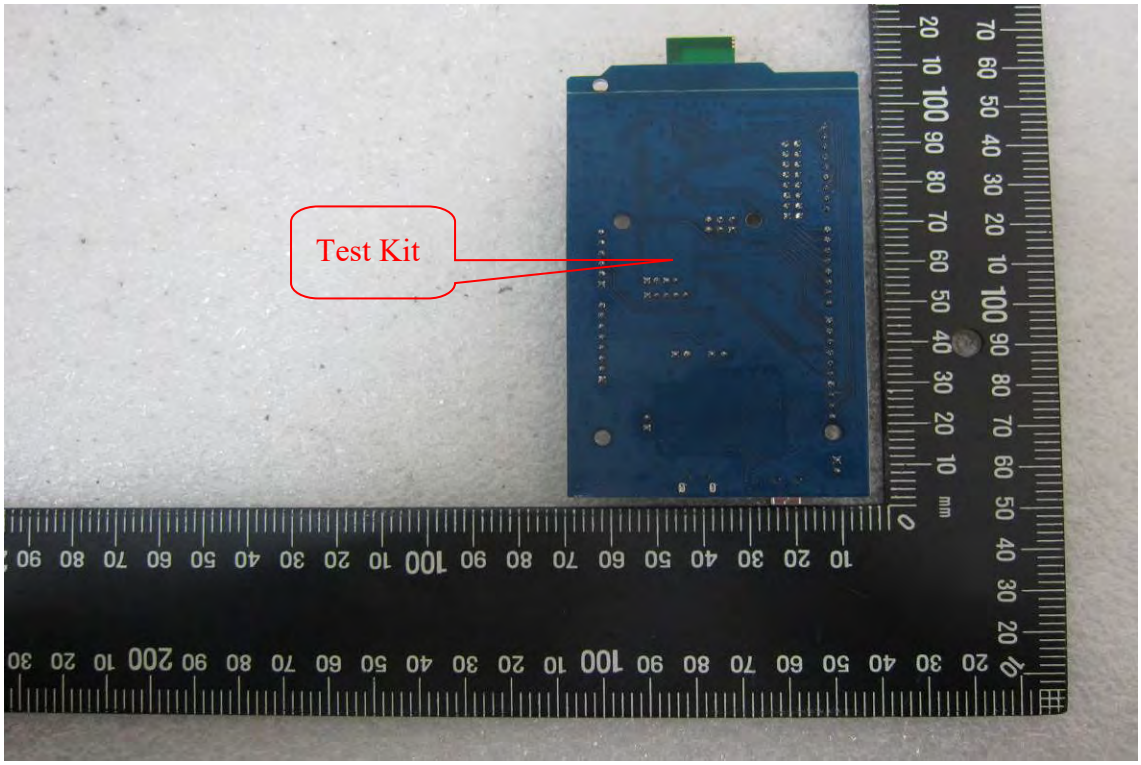


# APPENDIX 3
# PHOTOGRAPHS OF EUT

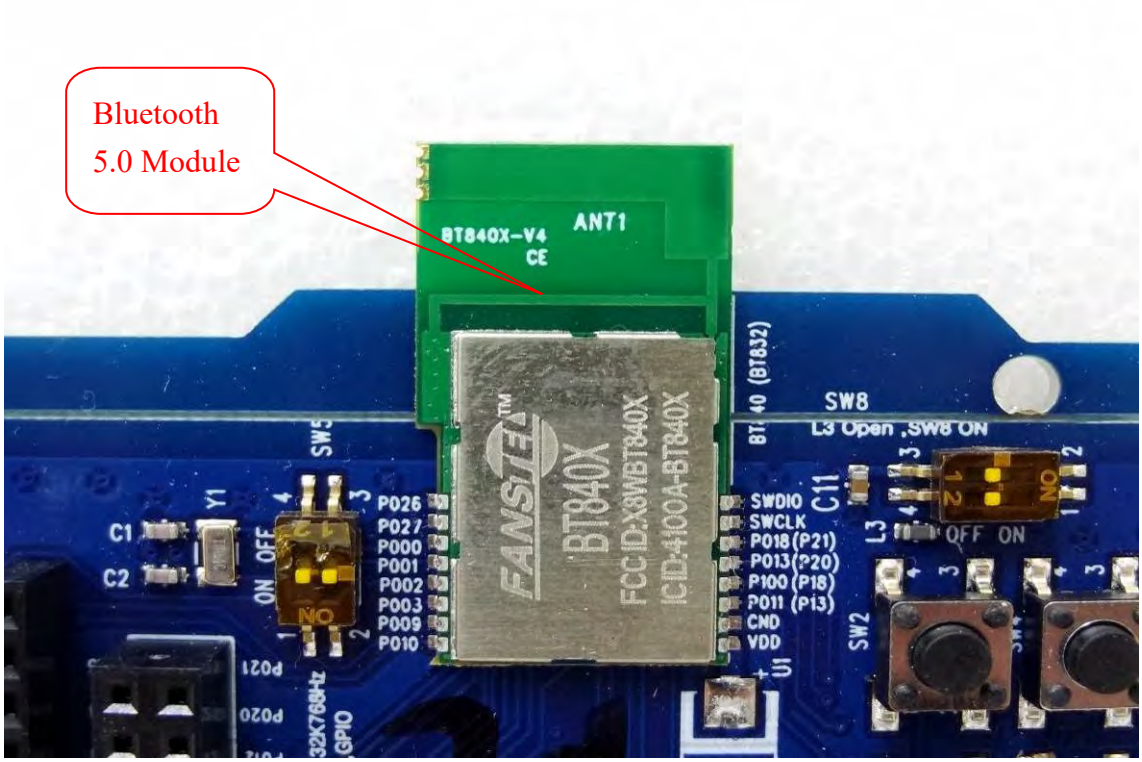
***EUT 1***



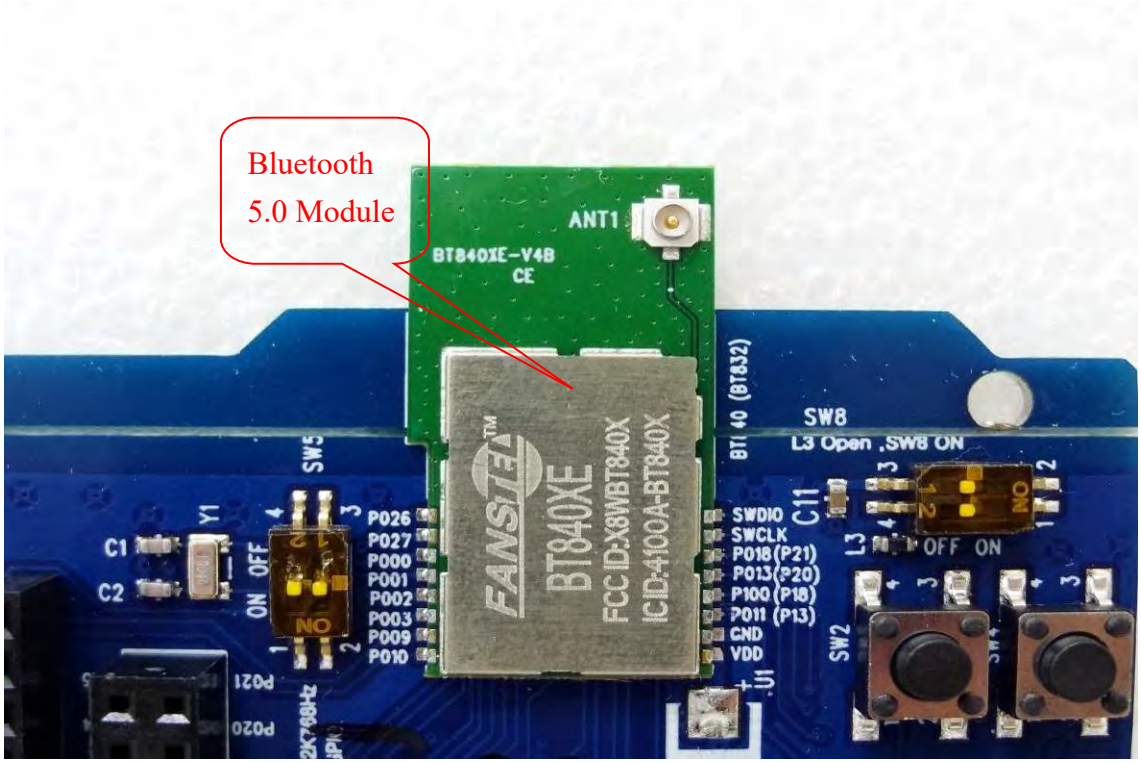

***EUT 2***



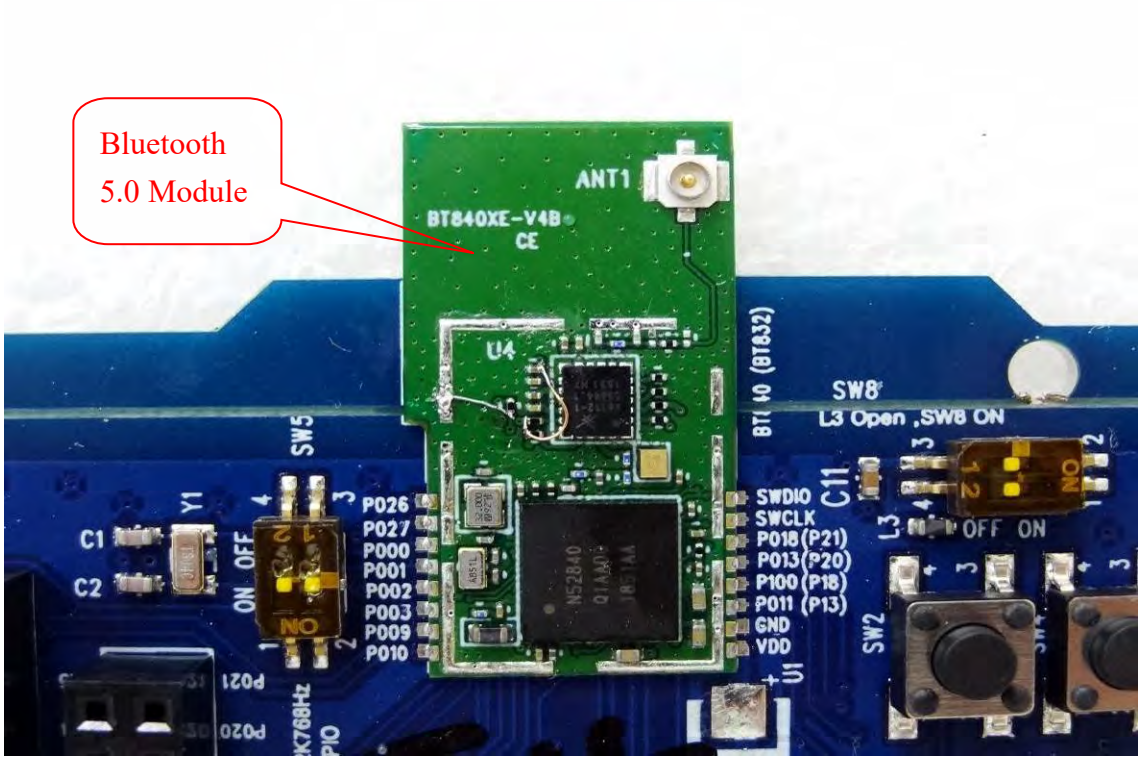
***EUT 3 BT840X***



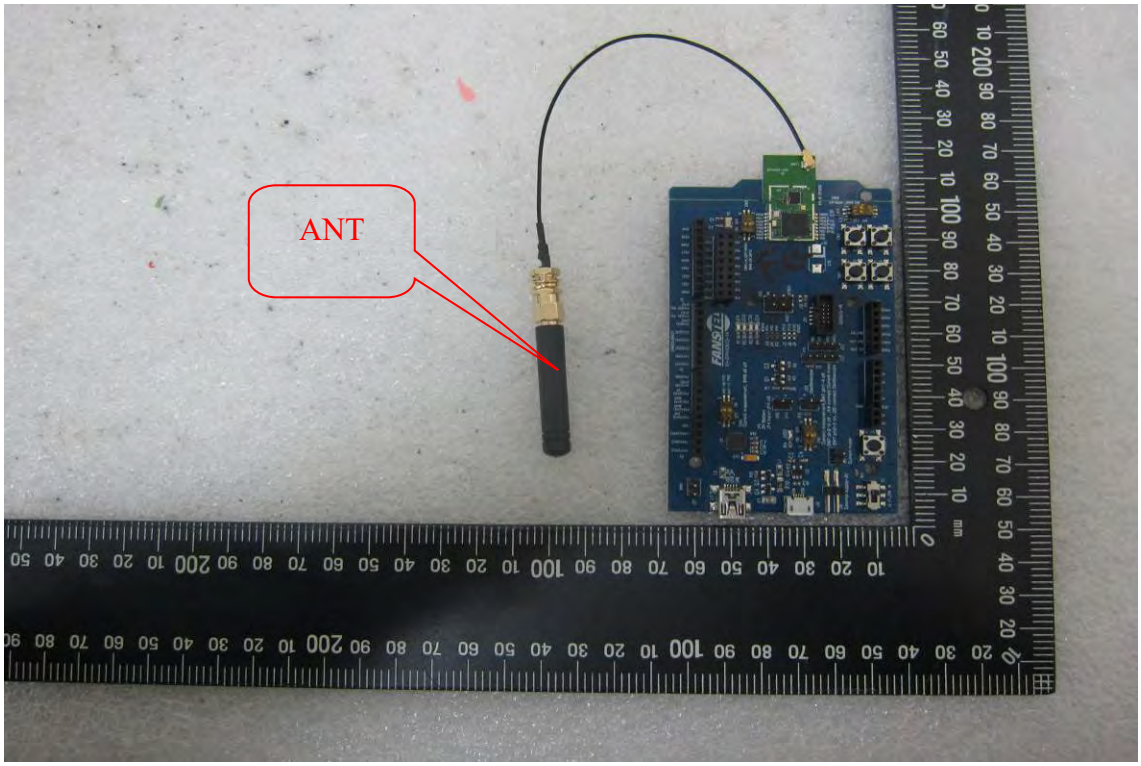

***EUT 4 BT840XE***



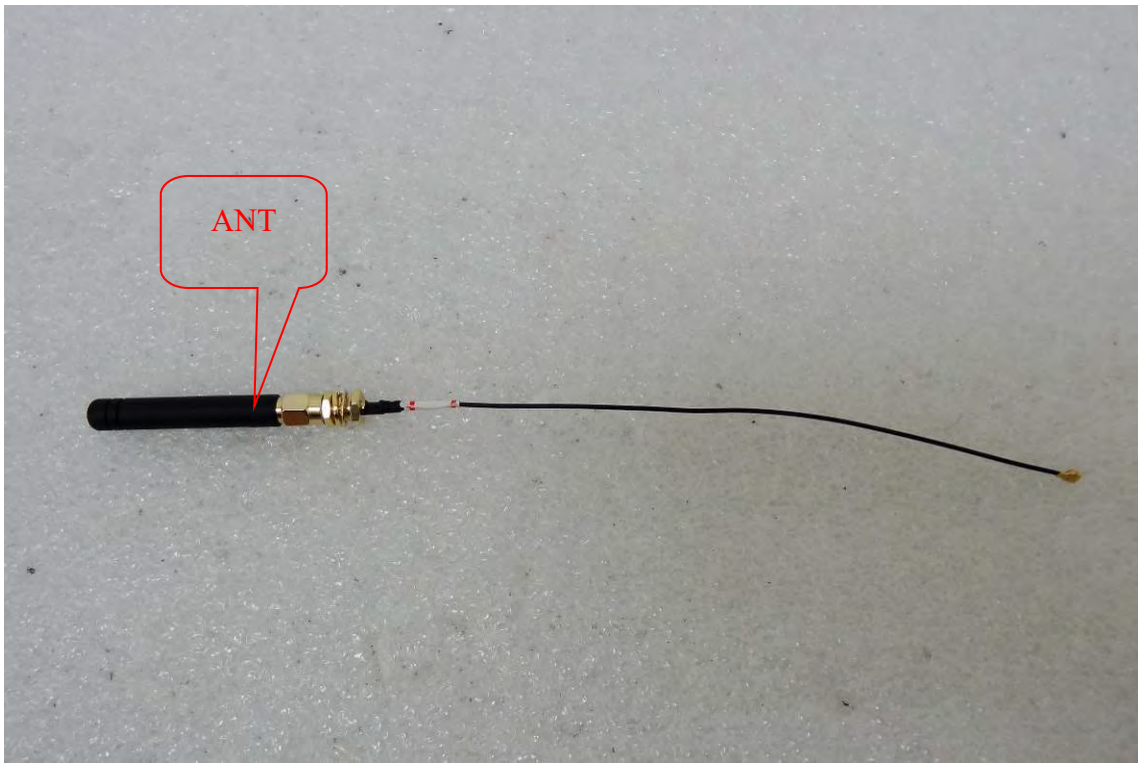
***EUT 5 BT840XE***



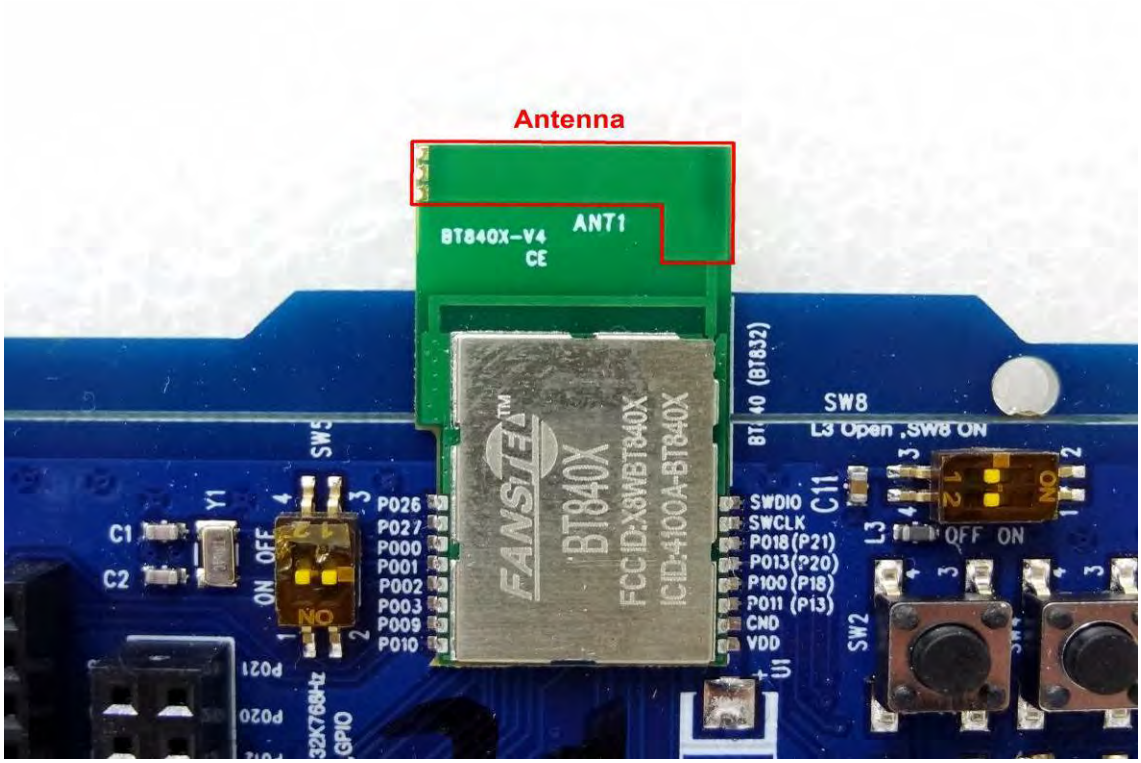

***EUT 6 BT840XE***



***EUT 7 BT840XE***




***EUT 8 BT840X***




***~ End of Report ~***