CE EMC TEST REPORT

Equipment	:	**CC2651R3SIPA SimpleLink™ Multiprotocol 2.4-GHz Wireless System-in-Package Module with Integrated Antenna & 352-KB Memory**
Brand Name	:	**Texas Instruments**
Model Name	:	**CC2651R3SIPAT0MOUR**
Marketing Name	:	**CC2651R3SIPA SimpleLink™ Multiprotocol 2.4-GHz Wireless System-in-Package Module with Integrated Antenna & 352-KB Memory**
Applicant	:	**Texas Instruments Incorporated 12500 TI BLVD., Dallas, Texas, 75243**
Manufacturer	:	**Texas Instruments Incorporated 12500 TI BLVD., Dallas, Texas, 75243**
Standard	:	**ETSI EN 301489-1 V2.2.3, ETSI EN 301 489-17 V3.2.4 (2020-09)**

The product was received on Apr. 26, 2022, and testing was performed from May 06, 2022 to Jun. 14, 2022. We, Sporton International Inc. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ETSI EN 301 489-17 V3.2.4 (2020-09); and shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval from Sporton International Inc. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu

Sporton International Inc. EMC & Wireless Communications Laboratory

No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)

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History of this test report

Report No.	Version	Description	Issue Date
EW242614	01	Initial issue of report	Jul. 15, 2022

Summary of Test Result

ETSI EN 301 489-17 V3.2.4 (2020-09)						
Report Clause	**Ref 301 489-1 V2.2.3 Std. Clause**	**301 489-1 V2.2.3 Test Standard**	**Standard for Customer Requirement**	**Test Items**	**Result (PASS/FAIL)**	**Remark**
A1	8.2	EN 55032:2015 Class B	EN 55032:2015+A11:2020 Class B	Radiatled Emission	PASS	7.59 dB under the limit at 193.890 MHz for Quasi-Peak
-	8.3/8.4/8.7	EN 55032:2015 Class B	EN 55032:2015+A11:2020 Class B	Conducted Emission	Not Required	-
-	8.5	EN 61000-3-2:2014 Class A	EN 61000-3-2:2014 Class A	Harmonic Current Emissions	Not Required	-
-	8.6	EN 61000-3-3:2013	EN 61000-3-3:2013	Voltage Fluctuations and Flicker	Not Required	-
A5	9.2	EN 61000-4-3: 2006+A1:2008+A2:2010	EN 61000-4-3: 2006+A1:2008+A2:2010	RF Electromagnetic Field	PASS	-
A6	9.3	EN 61000-4-2:2009	EN 61000-4-2:2009	Electrostatic Discharge	PASS	-
-	9.4	EN 61000-4-4:2012	EN 61000-4-4:2012	Fast Transients, Common Mode	Not Required	-
-	9.5	EN 61000-4-6:2014	EN 61000-4-6:2014	Radio frequency, Common Mode	Not Required	-
-	9.6	ISO 7637-2:2004	ISO 7637-2:2004	Transients and Surges in the vehicular environment	Not Required	-
-	9.7	EN 61000-4-11:2004	EN 61000-4-11:2004	Voltage Dips and Interruptions	Not Required	-
-	9.8	EN 61000-4-5: 2014+A1:2017	EN 61000-4-5: 2014+A1:2017	Surges	Not Required	-

Note: Not required means after assessing, test items are not necessary to carry out.

Declaration of Conformity:

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
   It's means measurement values may risk exceeding the limit of regulation standards, if measurement uncertainty is include in test results.
2. The measurement uncertainty please refer to each test result in appendix A.
3. There is no additional test requirement for this EUT, when EN 55032:2015 is updated to EN 55032:2015+A11:2020 versions.
4. After assessing, the difference between the basic standard which was listed in the standard for customer requirement above and the product standard 301 489-17 which was reference of 301 489-1 V2.2.3 will not affect the test results.

Comments and Explanations:

The product specifications of the EUT presented in the report are declared by the manufacturer who shall take full responsibility for the authenticity.

Reviewed by: Danny Lee

Report Producer: Clio Lo

1. General Description

1.1 Product Feature of Equipment Under Test

Bluetooth LE (125 kbps, 500 kbps, 1Mbps, 2Mbps) and Zigbee (OQPSK DSSS1:8, 250 kbps)

Antenna Information				
	Brand	**Antenna Type**	**Model**	**2.4 GHz Gain**
1	Texas Instruments	Inverted F - PCB	Custom Antenna	3.3 dBi
2		CC2651R3SIPA integrated antenna – PCB	Custom Antenna	1.5 dBi
3	Ethertronics	Dipole	1000423	-0.6dBi
4	LSR	Rubber Whip / Dipole	001-0012	2dBi
5			080-0013	2dBi
6			080-0014	2dBi
7		PIFA	001-0016	2.5dBi
8			001-0021	2.5dBi
9	Laird	PCB	CAF94504	2dBi
10			CAF9405	2dBi
11	Pulse	Ceramic Chip	W3006	3.2dBi
12	ACX	Multilayer Chip	AT3216-BR2R7HAA	0.5dBi
13			AT312-T2R4PAA	1.5dBi
14	TDK	Multilayer Ceramic Chip Antenna	ANT016008LCD2442MA1	1.6dBi
15			ANT016008LCD2442MA2	2.5dBi
16	Mitsubishi Material	Chip Antenna	AM03DP-ST01	1.6dBi
17		Antenna Unit	UB18CP-100ST01	-1.0dBi
18	Taiyo Yuden	Chip Antenna / Helical Monopole	AF216M245001	1.5dBi
19		Chip Antenna /Monopole Type	AH212M245001	1.3dBi
20			AH316M245001	1.9dBi
21	Antenna Technology	Dipole	AA2402SPU	2.0dBi
22			AA2402RSPU	2.0dBi
23			AA2402A-UFLLP	2.0dBi
24			AA2402AU-UFLLP	2.0dBi

Antenna Information				
	Brand	Antenna Type	Model	2.4 GHz Gain
25	Staf	Mono-pole	1019-016	2.14dBi
26			1019-017	2.14dBi
27			1019-018	2.14dBi
28			1019-019	2.14dBi
29	Map Electronics	Rubber Whip	MEIWX-2411SAXX-2400	2.0dBi
30			MEIWX-2411RSXX-2400	2.0dBi
31			MEIWX-282XSAXX-2400	2.0dBi
32			MEIWX-282XRSXX-2400	2.0dBi
33			MEIWF-HP01RS2X-2400	2.0dBi
34	Yageo	Chip	ANT3216A063R2400A	1.69dBi
35	Mag Layers Scientific	Chip	LTA-3216-2G4S3-A1	1dBi
36			LTA-3216-2G4S3-A3	2dBi
37	Advantech	Rubber Whip / Dipole	AN2450-5706RS	2.38dBi
38			R-AN2400-5701RS	3.3dBi

Remark:

1. The EUT uses the PCB antenna from Texas Instruments (Antenna #2).
2. The EUT's information above is declared by manufacturer. Please refer to Comments and Explanations in report summary.

1.2 Modification of EUT

No modifications made to the EUT during the testing.

1.3 Applied Standards

According to the specifications of the manufacturer, the EUT must complies with the requirements of

- **ETSI EN 301489-1 V2.2.3, ETSI EN 301 489-17 V3.2.4 (2020-09)**

2. Assess Test for Equipment under Test (EUT)

2.1 Requirements of Limit and EUT Performance Criteria for all Immunity Test Items

Test limit including test level, test frequency range, pulse type, test duration…etc. requirements.
This section is intended to integrate requirements of limit, and required performance criteria for all immunity test Items.

In subsection 2.1.1, includes two parts:

1. Subsection 2.1.1: Support ports list of EUT, accessary, and cable record, where EUT intended to use in. These information will be used for decide test items and test limit
   (1) Supported ports list of EUT: Because test limit are based on supported ports of EUT, this is necessary information.
   (2) Accessary: include adapter type and remark EUT has battery or not.
   (3) Cable Record: includes cable type, cable length, indoor/outdoor. These parameters will decide tests shall be carrying out or not.
2. In subsection 2.5, required performance criteria of EUT per EN301489 series standards
   Integrated required performance criteria of EN301489 series standards, they are used for all immunity test of this report.

2.1.1 Information of Supported Ports of EUT, Accessary and Cable Record

1. Supported ports of EUT are listed as below (symbol ■ means supported port):

■	Enclosure Port
□	Input AC power port
□	Input DC power port
□	Telecommunication port

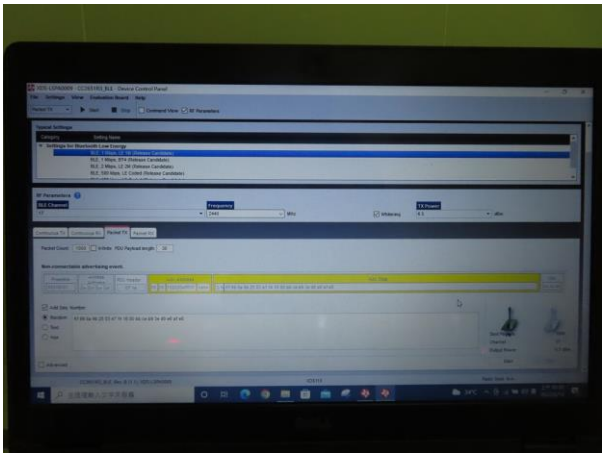
2.1.2 Detailed Test Modes of EUT

Assess test modes of EUT according to recorded information of section 2.1.
The detailed test modes of each test items are shown in Appendix A.

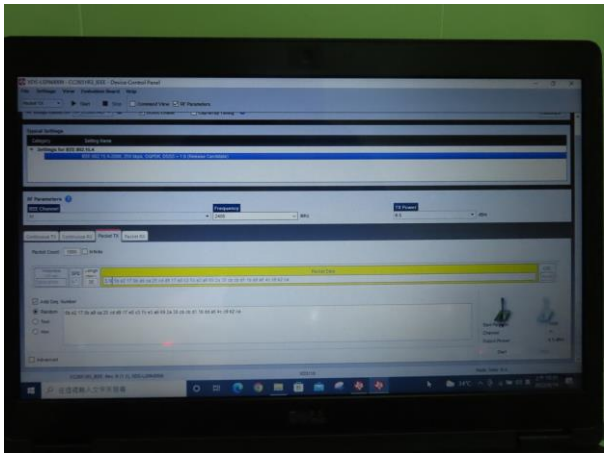
2.2 EUT Operation Test Setup

The EUT was set in below conditions during EMI and EMS testing.

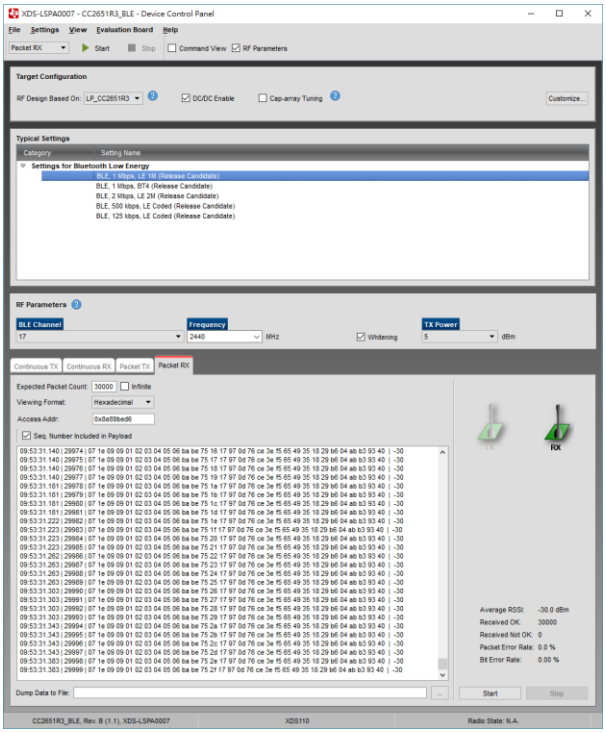
The RF utility, “SmartRF Studio 7” was installed in the notebook in order to make the EUT provide functions for continuous transmitting and receiving signals from Bluetooth - LE, and Zigbee.



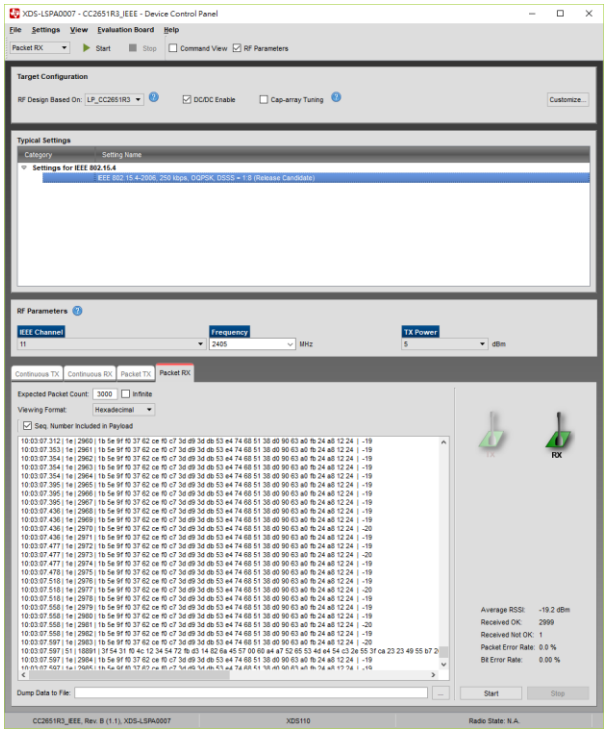
Monitor the Bluetooth _LE function



Monitor the Zigbee function



Monitor the Bluetooth - LE (PER)



Monitor the Zigbee (PER)

2.3 Test Conditions of 301 489 Series Standards

2.3.1 Special Conditions of Applied Standards for EUT

Below each section is special condition applied for each application of EUT.

2.3.2 Emission

EN301 489-17
No special conditions shall apply to UE in the scope of the present document.

2.3.3 Immunity

EN301 489-17
No special conditions are relevant for products covered in the present document.

2.4 RF Exclusion Band of Radio Equipment

- **EN 301 489-1**

Exclusion band for transmitters or the transmitter part of transceivers

a. General
Exclusion bands shall not be applied when measuring transmitters in standby mode.

b. Channelised Equipment
For channelised 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.

c. Non-Channelised Equipment
For non-channelised 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

a. Applicability
Exclusion bands are not applied when testing emissions of receivers or receiver part of transceivers.

b. Channelised Equipment
For channelised 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.

c. Non-Channelised 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.

- **EN 301 489-17**

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.

For EUT that operate above 6 GHz there is no exclusion band specified as test ranges stop at 6 GHz.

The exclusion band for immunity testing of equipment operating in the 2.4GHz band shall be:
- lower limit of exclusion band = lowest allocated band edge frequency -120MHz, i.e. 2 280MHz;
- upper limit of exclusion band = highest allocated band edge frequency +120MHz, i.e. 2 603.5MHz.

Note: This is based upon a channel size of 40 MHz and a value of n = 3.

The exclusion band for immunity testing of equipment operating in the 5GHz WiFi band shall be:
- lower limit of exclusion band = lowest allocated band edge frequency -320MHz, i.e. 4 830MHz;
- As the immunity requirements have an upper frequency range of 6 GHz and any upper edge exclusion band would be greater than this for both the 5 470 MHz - 5 725 MHz and 5 725 MHz - 5 850 MHz bands. Therefore the test stops at the lower limit of exclusion band (i.e. 4 830 MHz).

Note: This is based upon a channel size of 80 MHz and a value of n = 4.

The exclusion band for immunity testing of equipment operating in the 5.8GHz band shall be:
- lower limit of exclusion band = lowest allocated band edge frequency -440MHz, i.e. 5 285MHz;
- 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. Therefore the test stops at the lower limit of exclusion band (i.e. 5 285 MHz).

Note: This is based upon a channel size of 40 MHz and a value of n = 11

2.5 Required Performance Criteria of EUT per EN 301 489 series standards

Criteria	Performance criteria
CT/CR	During and after the test, the apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer when the apparatus is used as intended. At the conclusion of the test, the EUT shall operate as intended with no loss of user control functions or stored data, and the communication link shall have been maintained. In addition to confirming the above performance during a call, the test shall also be performed in idle mode, and the transmitter shall not unintentionally operate. The EUT shall operate as its intended operating condition during and after the test.
TT/TR	After the test, the apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer, when the apparatus is used as intended. At the conclusion of each exposure the EUT shall operate with no user noticeable loss of the communication link. At the conclusion of the total test comprising the series of individual exposures, the EUT shall operate as intended with no loss of user control functions or stored data, as declared by the manufacturer, and the communication link shall have been maintained. In addition to confirming the above performance during a call, the test shall also be performed in idle mode, and the transmitter shall not unintentionally operate.

Criteria	Performance criteria
Continuous Phenomena	During the test, the equipment shall: ♦ continue to operate as intended ♦ not unintentionally transmit ♦ not unintentionally change its operating state ♦ not unintentionally change critical stored data
Transient Phenomena	For all ports and transient phenomena with the exception described below, the following applies: ♦ The application of the transient phenomena shall not result in a change of the mode of operation (e.g. unintended transmission) or the loss of critical stored data. ♦ After application of the transient phenomena, the equipment shall operate as intended. For surges applied to symmetrically operated wired network ports intended to be connected directly to outdoor lines the following criteria applies: ♦ For products with only one symmetrical port intended for connection to outdoor lines, loss of function is allowed, provided the function is self-recoverable, or can be otherwise restored. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost. ♦ For products with more than one symmetrical port intended for connection to outdoor lines, loss of function on the port under test is allowed, provided the function is self-recoverable. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

Performance requirements table of 301 489-17

CLAUSE 6.2 of EN 301 489-17		
Criteria	**During test**	**After test**
A	Shall operate as intended. (see note). Shall be no loss of function. Shall be no unintentional transmissions.	Shall operate as intended. Shall be no degradation of performance. Shall be no loss of function. Shall be no loss of critical stored data.
B	May be loss of function.	Functions shall be self-recoverable. Shall operate as intended after recovering. Shall be no loss of critical stored data.
C	May be loss of function.	Functions shall be recoverable by the operator. Shall operate as intended after recovering. Shall be no loss of critical stored data.
Note: Operate as intended during the test allows a level of degradation in accordance with clause 6.2.2.		

Minimum performance level:
For equipment that supports a PER or FER, the minimum performance level shall be a PER or FER less than or equal to 10 %.

For equipment that does not support a PER or a FER, the minimum performance level shall be no loss of the wireless transmission function needed for the intended use of the equipment.

CLAUSE 6.3 to 6.4 of EN 301 489-17	
Criteria	**Performance criteria**
CP	The performance criteria A shall apply. Where the EUT is a transmitter in standby mode, unintentional transmission shall not occur during the test. Where the EUT is a transceiver in receive mode, unintentional transmission shall not occur during the test.
TP	The performance criteria B shall apply, except for voltage dips greater than or equal to 100 ms and voltage interruptions of 5 000 ms duration, for which performance criteria C shall apply. Where the EUT is a transmitter in standby mode, unintentional transmission shall not occur as a result of the application of the test. Where the EUT is a transceiver in receive mode, unintentional transmission shall not occur as a result of the application of the test.

Appendix A. Test Requirements and Test Results

Test requirements and rest results include

- Information of testing environment : temperature, humidity, test site, test engineer, test date, measurement uncertainty, test software.
- Summary : worst mode, EUT operated voltage during test, test parameter, EUT performance criteria and test result
- Detailed test modes of EUT
- Test setup
- Test procedures
- Connection diagram of test system
- Supported unit used in test configuration and system
- List of measuring equipment
- Setup photograph
- Test raw data

Above contents have been corresponded to each test items. They are shown as below table “Contents of Appendix A.”

After assessing, below test items which mark “■” are necessary to carry out.

Contents of Appendix A		
■	A1	Radiated Emission Test
□	A2	Conducted Emission Test
□	A3	Harmonics Current Emission Test
□	A4	Voltage Fluctuation and Flicker Test
■	A5	Radio Frequency Electromagnetic Field (RS) Test
■	A6	Electrostatic Discharge (ESD) Test
□	A7	Fast Transients, Common Mode (EFT/BURST) Test
□	A8	Radio Frequency, Common Mode (CS) Test
□	A9	Voltage Dips and Interruptions Test
□	A10	Surges Test
□	A11	Transients and Surges in the Vehicular Environment Test

Following pages are detailed testing contents of each test items.

A1. Test Results of Radiated Emission Test

Information of Testing Environment			
Temperature	24~27 ℃	**Humidity**	44~47 %
Test Site (30MHz ~ 6GHz)	03CH06-HY	**Test Engineer**	YouXian Chen and Howard Huang
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)		
Test Date	May 06, 2022		
Measurement Uncertainty Level of Confidence of 95% (U=2Uc(y))	30 MHz ~ 1000 MHz : 5.2 dB 1000 MHz ~ 6000 MHz : 5.4 dB		
Test Software and its version	Test Software: e3 , Version: 6.2009-8-24(K5)(sporton)		

A1.1. Summary

Worst Mode	Mode 1		
EUT Operated Voltage During Test	From system		
Frequency	193.890 MHz	**Detector**	Quasi-Peak
Level	32.41 dBμV	**Margin**	Under 7.59 dB
Result	PASS		

Remark: Only data of worst mode was reported in test result.

A1.2. Details of EUT Test Modes

Details of Test line Items
Radiated Emission
Mode 1: Bluetooth - LE RX + USB Cable (Charging from Notebook)
Mode 2: Zigbee RX + USB Cable (Charging from Notebook)

A1.3. Test Limit

<Class B limit>

Frequency Range (MHz)	Measurement		Class B limits dB (μV/m)
	Distance (m)	Detector Type/ Bandwidth	OATS/SAC
30 ~ 230	10	Quasi Peak / 120 kHz	30
230 ~ 1000			37
30 ~ 230	3		40
230 ~ 1000			47

Frequency Range (MHz)	Measurement		Class B limits dB(μV/m)
	Distance (m)	Detector Type/ Bandwidth	FSOATS
1000 ~ 3000	3	Average / 1 MHz	50
3000 ~ 6000			54
1000 ~ 3000		Peak / 1 MHz	70
3000 ~ 6000			74

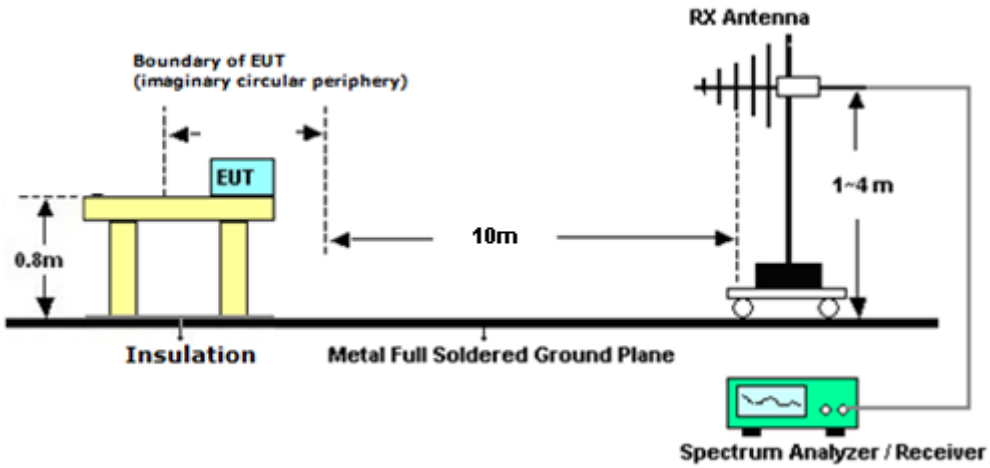
Frequency Range (MHz)	Measurement		Class B limits dB(μV/m)	
	Distance (m)	Detector Type/ Bandwidth	Fundamental	Harmonics
			OATS/SAC	OATS/SAC
30 ~ 230	10	Quasi peak/ 120 kHz	50	42
230 ~ 300				42
300 ~ 1000				46
30 ~ 230	3		60	52
230 ~ 300				52
300 ~ 1000				56

Conditional testing frequency:

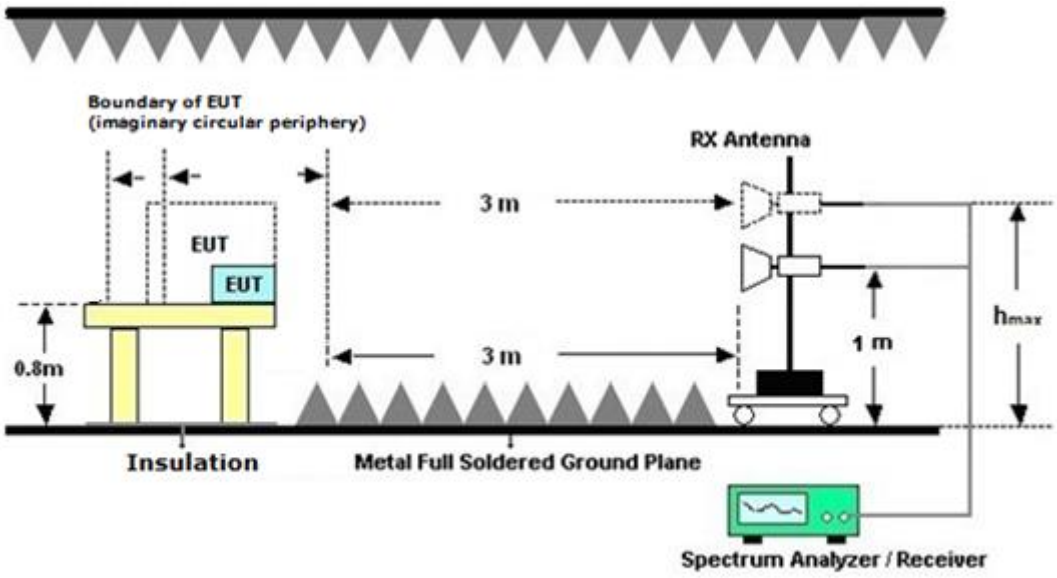
Highest measured frequency	Highest measured frequency
Fx ≤ 108 MHz	1 GHz
108 MHz < Fx ≤ 500 MHz	2 GHz
500 MHz < Fx ≤ 1 GHz	5 GHz
Fx > 1 GHz	5 x Fx up to a maximum of 6 GHz
NOTE: For FM and TV broadcast receivers, Fx is determined from the highest frequency generated or used excluding the local oscillator and tuned frequencies.	

A1.4. Test Setup

<Radiated Emissions Frequency: 30 MHz to 1000 MHz>

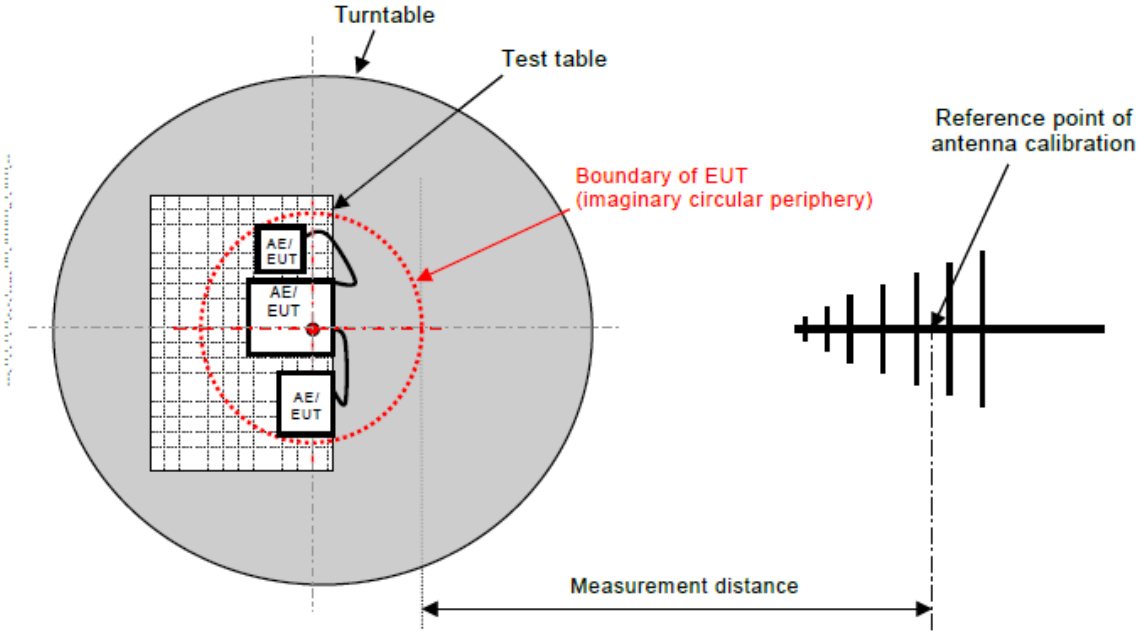


<Radiated Emissions Frequency: 1000 MHz to 6000 MHz>



Remark: When EUT's height is over 172cm, h_{max} = top of EUT

< Radiated Emissions Setup Configuration >



A1.5. Test Procedures

a. The EUT shall be placed upon a non-conductive table 0.8 m above the horizontal ground reference plane of the test site.

b. The boundary of EUT was set 3 meters from the receiving antenna which was mounted on the top of a variable height antenna tower. Cables connecting to outside area is directly dropped to, but with an insulation holder less than 150mm height, the reference ground plane.

c. The table was rotated 360 degrees to determine the position of the highest radiation.

d. The height of the antenna is varied between 1 m and 4 m above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.

e. For each suspected emission, the EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading values.

f. Ideally, the central point of the arrangement shall be positioned at the centre of the turntable and the rear of the arrangement shall be flush with the back of the supporting tabletop unless that would not be possible or typical of normal use.

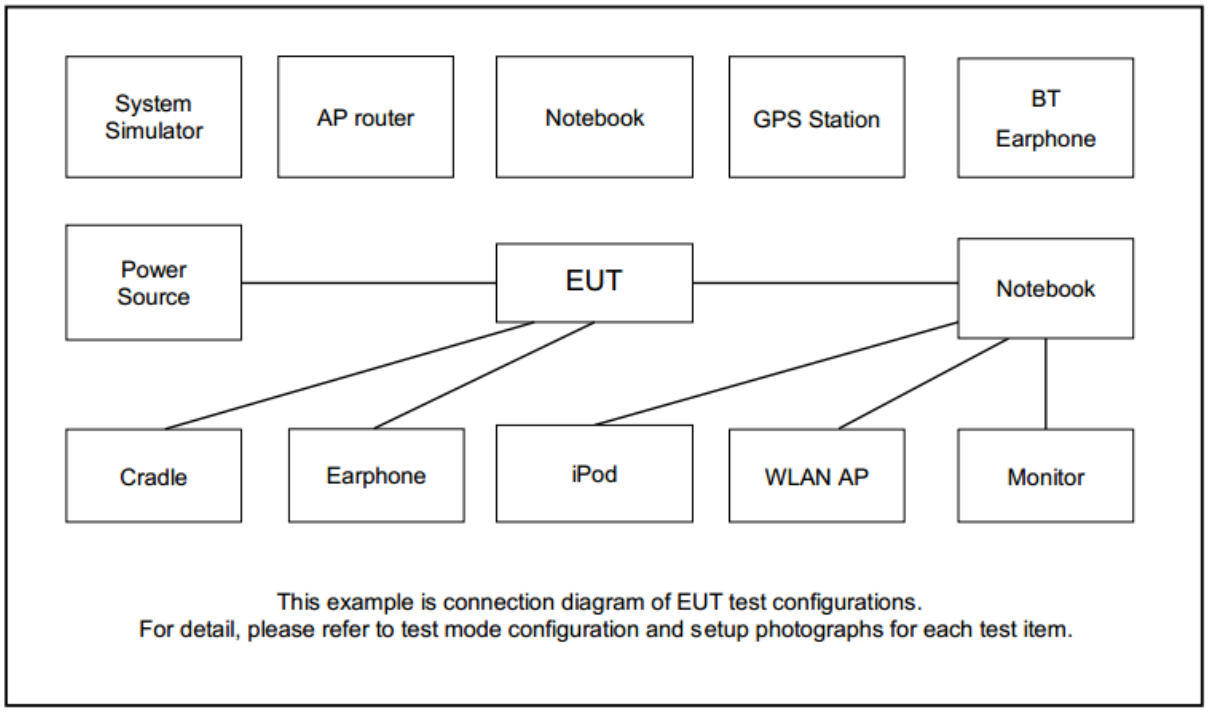
g. All units of equipment forming the system under test (includes the EUT as well as connected peripherals and associated equipment or devices) shall be arranged such that a nominal 0.1 m separation is achieved between the neighboring units.

h. Where the mains cable supplied by the manufacturer is longer than 1 m, the excess should be folded at the centre into a bundle no longer than 0.4 m, so that its length is shortened to 1 m.

i. If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, peak values of EUT will be reported. Otherwise, the emission will be repeated by using the quasi-peak method and reported for frequency range below 1GHz.

j. If emission level of the EUT in Peak measurement mode is 20dB lower than average limit line (that means the emission level in Peak measurement mode complies with both Peak and Average limit lines), then only Peak measurement result is reported. Otherwise, emissions in Average measurement mode shall be measured, and reported.

A1.6. Connection Diagram of Test System



A1.7. Supported Unit Used in Test Configuration and System

Equipment	Brand Name	Model Name	FCC ID	Data Cable	Power Cord
WLAN AP	ASUS	RT-AC66U	MSQ-RTAC66U	N/A	Unshielded, 1.8m
Notebook	Dell	Latitude 3400	FCC DoC	N/A	AC I/P： Unshielded, 1.2m DC O/P： Shielded, 1.8m
iPod	Apple	A1285	FCC DoC	Shielded, 1.0m	N/A

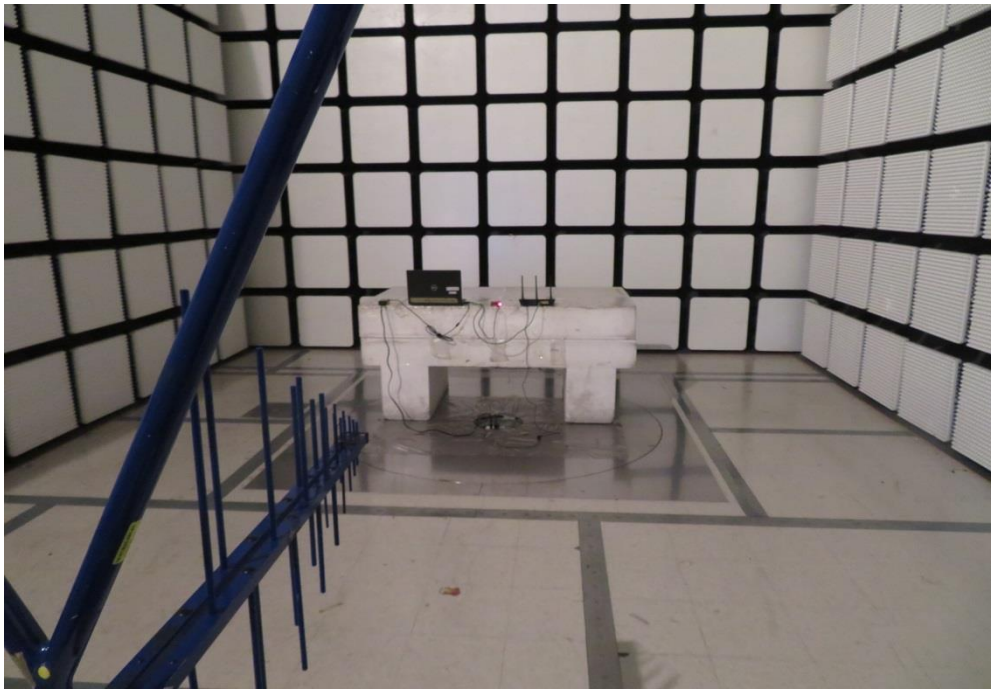
A1.8. List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Amplifier	SONOMA	310N	186713	9kHz~1GHz	Apr. 28, 2022	May 06, 2022	Apr. 27, 2023	Radiation (03CH06-HY)
Bilog Antenna	Schaffner	CBL 6111C & N-6-06	2725 & AT-N0601	30MHz~1GHz	Nov. 11, 2021	May 06, 2022	Nov. 10, 2022	Radiation (03CH06-HY)
EMI Test Receiver	Rohde & Schwarz	ESU26	100390	20Hz~26.5GHz	May 22, 2021	May 06, 2022	May 21, 2022	Radiation (03CH06-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1156	1GHz~18GHz	Sep. 27, 2021	May 06, 2022	Sep. 26, 2022	Radiation (03CH06-HY)
Preamplifier	Agilent	8449B	3008A01917	1GHz~26.5GHz	Apr. 22, 2022	May 06, 2022	Apr. 21, 2023	Radiation (03CH06-HY)
RF Cable	HUBER + SUHNER	SF102_7000mm	532299/2	30MHz to 40GHz	Jul. 05, 2021	May 06, 2022	Jul. 04, 2022	Radiation (03CH06-HY)
RF Cable	HUBER + SUHNER	SF102_3000mm	532422/2	30MHz to 40GHz	Jul. 05, 2021	May 06, 2022	Jul. 04, 2022	Radiation (03CH06-HY)
RF Cable	HUBER + SUHNER	SF102_2000mm	532421/2	30MHz to 40GHz	Jul. 05, 2021	May 06, 2022	Jul. 04, 2022	Radiation (03CH06-HY)
Antenna Mast	MF	MF-7802	MF780208212	1m~4m	N/A	May 06, 2022	N/A	Radiation (03CH06-HY)
Turn Table	INN-CO	DS2000	420/650/00	0-360 degree	N/A	May 06, 2022	N/A	Radiation (03CH06-HY)
Software	Audix	E3 6.2009-8-24(k5)	N/A	N/A	N/A	May 06, 2022	N/A	Radiation (03CH06-HY)

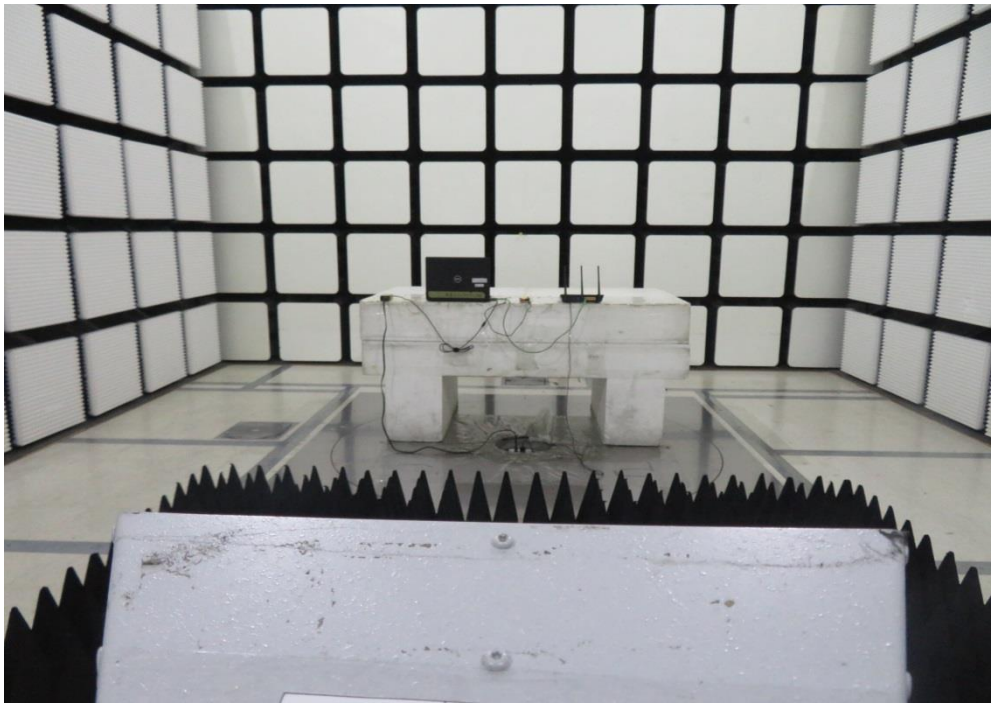
A1.9. Setup Photograph

Mode 1

Frequency: 30 MHz to 1000 MHz



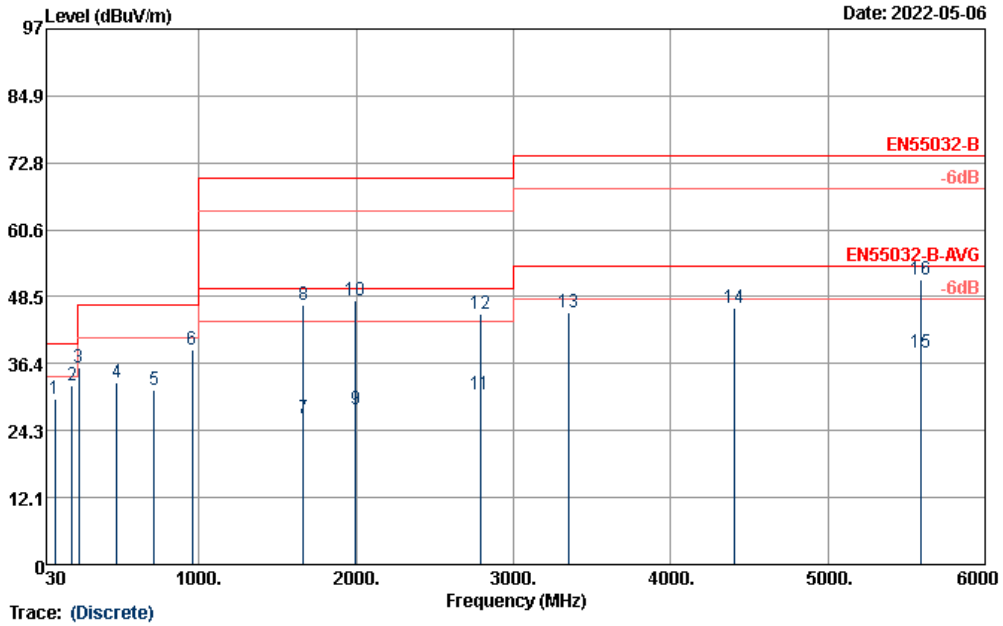
Frequency: 1000 MHz to 6000 MHz



A1.10.Test Raw Data

Test Mode :	Mode 1

■ Emission level (dBμV/m) = 20 log Emission level (μV/m)
■ Factor(dB) = Antenna Factor + Cable Loss + Filter loss – Preamp Factor
■ Corrected Reading: Factor(dB) + Read Level = Level
■ The test that passed at the minimum margin was arked by the frame in the following test record



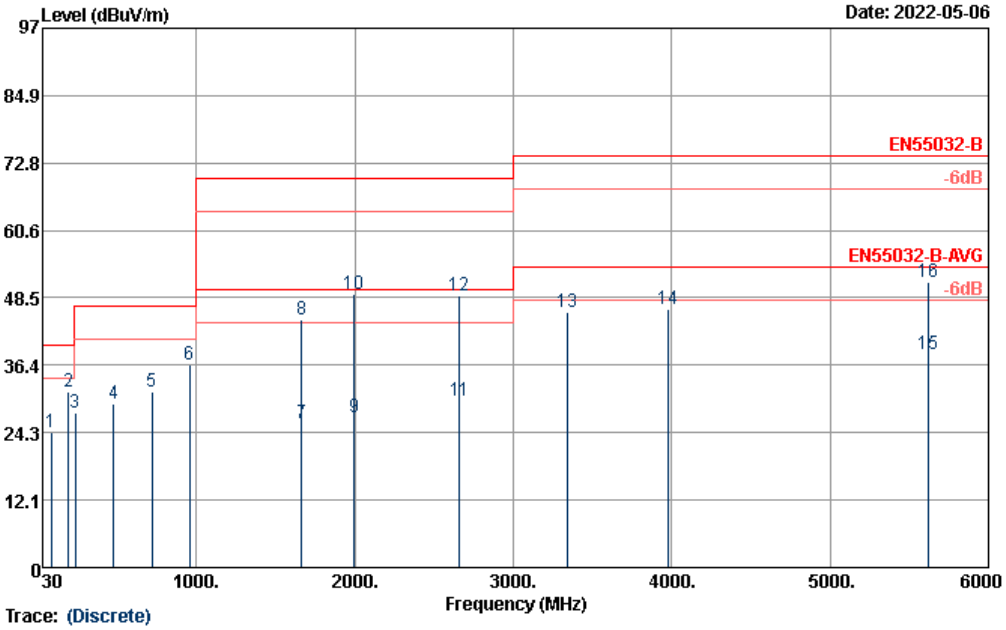
Trace: (Discrete)

Site : 03CH06-HY
Condition : EN55032-B 3m 9120D_1156 HORIZONTAL
Project : 242614
Power : From System
Memo : Mode 1

	Freq	Level	Over Limit	Limit Line	Read Level	Factor	A/Pos	T/Pos	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	cm	deg	
1	86.16	29.91	-10.09	40.00	45.59	-15.68	220	344	QP
2	193.89	32.41	-7.59	40.00	46.70	-14.29	139	287	QP
3	237.09	35.77	-11.23	47.00	47.60	-11.83	---	---	Peak
4	479.20	32.85	-14.15	47.00	37.24	-4.39	---	---	Peak
5	717.20	31.75	-15.25	47.00	31.88	-0.13	---	---	Peak
6	960.10	38.88	-8.12	47.00	33.35	5.53	---	---	Peak
7	1666.00	26.36	-23.64	50.00	29.80	-3.44	100	290	Average
8	1666.00	46.96	-23.04	70.00	50.40	-3.44	100	290	Peak
9	1996.00	28.23	-21.77	50.00	29.70	-1.47	100	45	Average
10	1996.00	47.73	-22.27	70.00	49.20	-1.47	100	45	Peak
11	2790.00	30.84	-19.16	50.00	29.00	1.84	100	300	Average
12	2790.00	45.48	-24.52	70.00	43.64	1.84	100	300	Peak
13	3351.00	45.78	-28.22	74.00	42.86	2.92	---	---	Peak
14	4401.00	46.49	-27.51	74.00	39.21	7.28	---	---	Peak
15	5595.00	38.32	-15.68	54.00	28.38	9.94	---	---	Average
16	5595.00	51.62	-22.38	74.00	41.68	9.94	---	---	Peak

Test Mode :	Mode 1

■ Emission level (dBμV/m) = 20 log Emission level (μV/m)
■ Factor(dB) = Antenna Factor + Cable Loss + Filter loss – Preamp Factor
■ Corrected Reading: Factor(dB) + Read Level = Level
■ The test that passed at the minimum margin was arked by the frame in the following test record



Trace: (Discrete)

Site : 03CH06-HY
Condition : EN55032-B 3m 9120D_1156 VERTICAL
Project : 242614
Power : From System
Memo : Mode 1

	Freq	Level	Over Limit	Limit Line	Read Level	Factor	A/Pos	T/Pos	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	cm	deg	
1	86.43	24.29	-15.71	40.00	39.95	-15.66	---	---	Peak
2	194.16	31.71	-8.29	40.00	46.00	-14.29	100	106	QP
3	236.82	27.76	-19.24	47.00	39.63	-11.87	---	---	Peak
4	479.20	29.54	-17.46	47.00	33.93	-4.39	---	---	Peak
5	720.00	31.51	-15.49	47.00	31.50	0.01	---	---	Peak
6	960.10	36.60	-10.40	47.00	31.07	5.53	---	---	Peak
7	1664.00	26.06	-23.94	50.00	29.50	-3.44	350	100	Average
8	1664.00	44.64	-25.36	70.00	48.08	-3.44	350	100	Peak
9	1998.00	27.04	-22.96	50.00	28.49	-1.45	100	355	Average
10	1998.00	49.14	-20.86	70.00	50.59	-1.45	100	355	Peak
11	2662.00	30.01	-19.99	50.00	28.81	1.20	100	350	Average
12	2662.00	48.81	-21.19	70.00	47.61	1.20	100	350	Peak
13	3342.00	45.81	-28.19	74.00	42.92	2.89	---	---	Peak
14	3981.00	46.51	-27.49	74.00	40.61	5.90	---	---	Peak
15	5619.00	38.32	-15.68	54.00	28.40	9.92	---	---	Average
16	5619.00	51.22	-22.78	74.00	41.30	9.92	---	---	Peak

A5. Test Results of RS Test

Information of Testing Environment			
Temperature	20~24℃	**Humidity**	43~54%
Test Site	RS02-HY	**Test Engineer**	Fred Tseng
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)		
Test Date	Jun. 13, 2022		
Test Software and its Version	Test Software: EMC32 , version: 10.50.40		

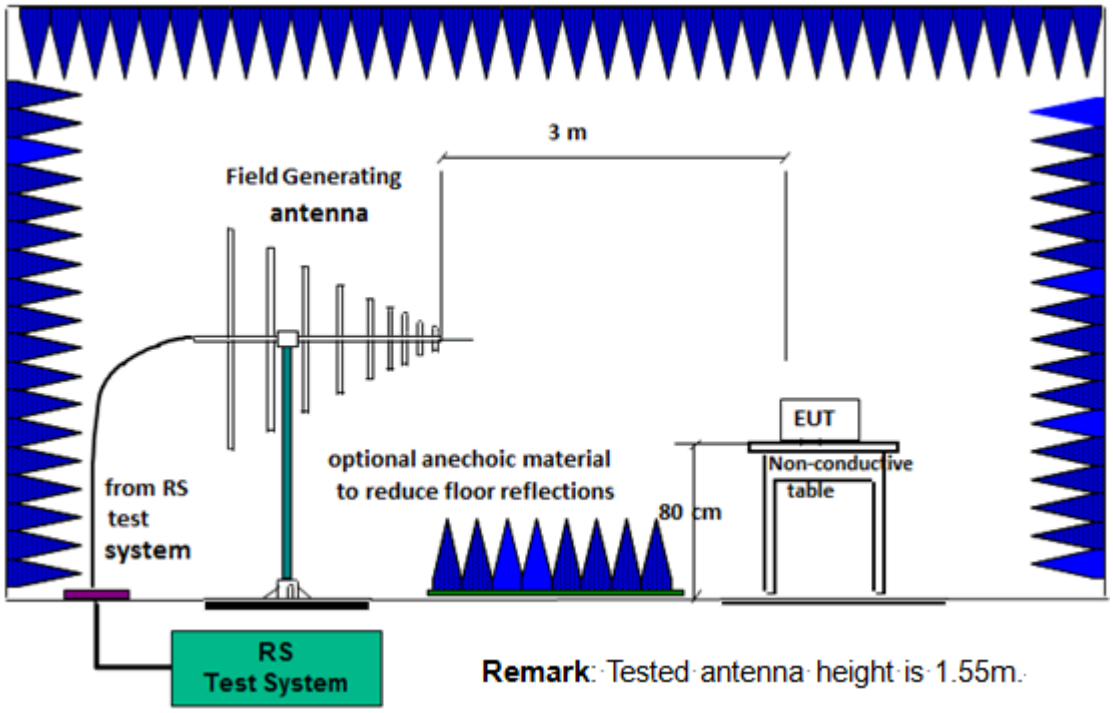
A5.1. Summary

Worst Mode	Mode 1
EUT Operated Voltage During Test	From system
Frequency Range	80MHz ~ 6000MHz
Test Level	3 V/m
Frequency Step Size	1% increment
Modulation	80% AM (1kHz)
Dwell Time	3 seconds
Polarity	Horizontal and Vertical
Azimuth	0°, 180°
Required Performance Criteria	CT/CR
EUT Performance Criteria	CT/CR
Result	PASS

A5.2. Details of EUT Test Modes

Details of Test line Items
Radio Frequency Electromagnetic Field
Mode 1: Bluetooth - LE (PER) Link + USB Cable (Charging from Notebook)
Mode 2: Zigbee (PER) Link + USB Cable (Charging from Notebook)
Mode 3: Bluetooth - LE RX + USB Cable (Charging from Notebook)
Mode 4: Zigbee RX + USB Cable (Charging from Notebook)

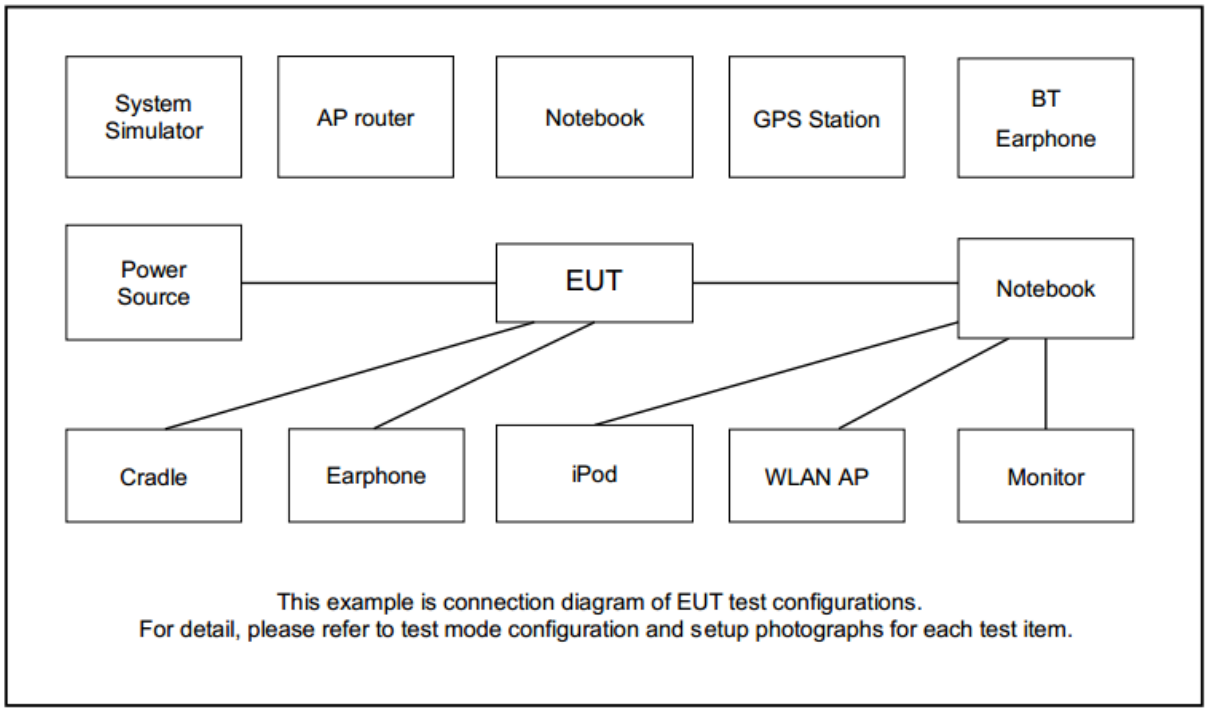
A5.3. Test Setup



A5.4. Test Procedures

The required field strength is pre-calibrated and complies with the uniform field area requirement lay down in the position which required in IEC/EN 61000-4-3.

A5.5. Connection Diagram of Test System



A5.6. Supported unit used in test configuration and system

Equipment	Brand Name	Model Name	FCC ID	Data Cable	Power Cord
Notebook	Dell	Latitude 3400	FCC DoC	N/A	AC I/P： Unshielded, 1.2m DC O/P： Shielded, 1.8m

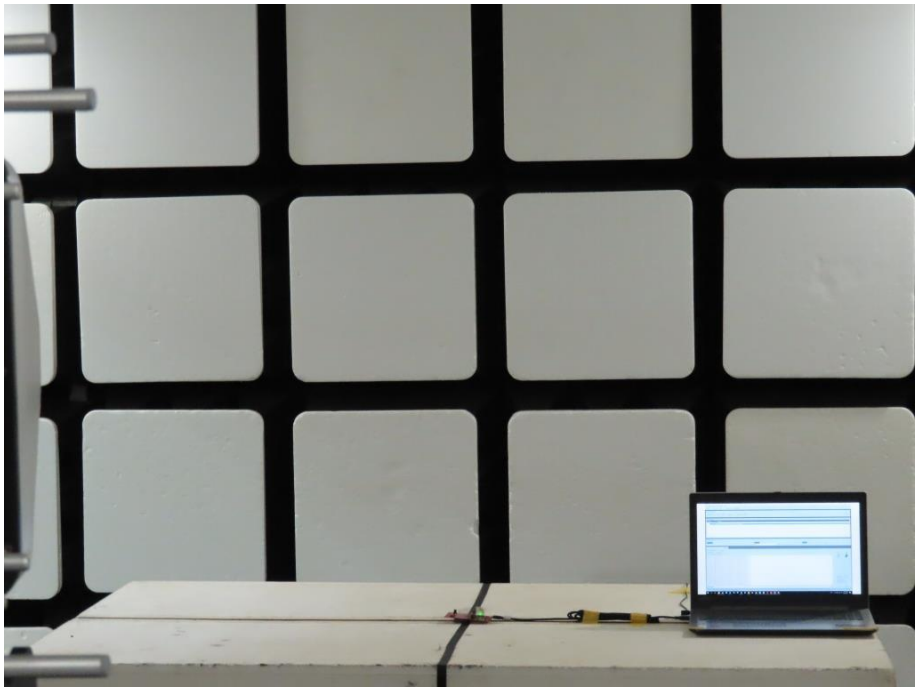
A5.7. List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Power Sensor	Rohde & Schwarz	NRP6A	101208	9kHz~6GHz	Jun. 15, 2021	Jun. 13, 2022	Jun. 14, 2022	RS (RS02-HY)
Power Sensor	Rohde & Schwarz	NRP6A	101209	9kHz~6GHz	Jun. 15, 2021	Jun. 13, 2022	Jun. 14, 2022	RS (RS02-HY)
Signal Generator	Rohde & Schwarz	SMB100A	114307	9kHz~6GHz	Aug. 01, 2021	Jun. 13, 2022	Jul. 31, 2022	RS (RS02-HY)
Antenna	Rohde & Schwarz	STLP 9129	00026	70MHz ~ 10GHz	N/A	Jun. 13, 2022	N/A	RS (RS02-HY)
Amplifier	Rohde & Schwarz	BBA100	103435	80MHz~1GHz	N/A	Jun. 13, 2022	N/A	RS (RS02-HY)
Amplifier	Rohde & Schwarz	BBA150	102670	0.69GHz~3.2GHz 2.5GHz~6GHz	N/A	Jun. 13, 2022	N/A	RS (RS02-HY)
Test Software	Rohde & Schwarz	EMC32	V10.50.40	N/A	N/A	Jun. 13, 2022	N/A	RS (RS02-HY
Field Sensor	A. R.	FL7006	0343231	100kHz~6GHz	Aug. 31, 2021	Jun. 13, 2022	Aug. 30, 2022	RS (RS02-HY)
Software	EMC32	V10.50.40	N/A	N/A	N/A	Jun. 13, 2022	N/A	RS (RS02-HY)

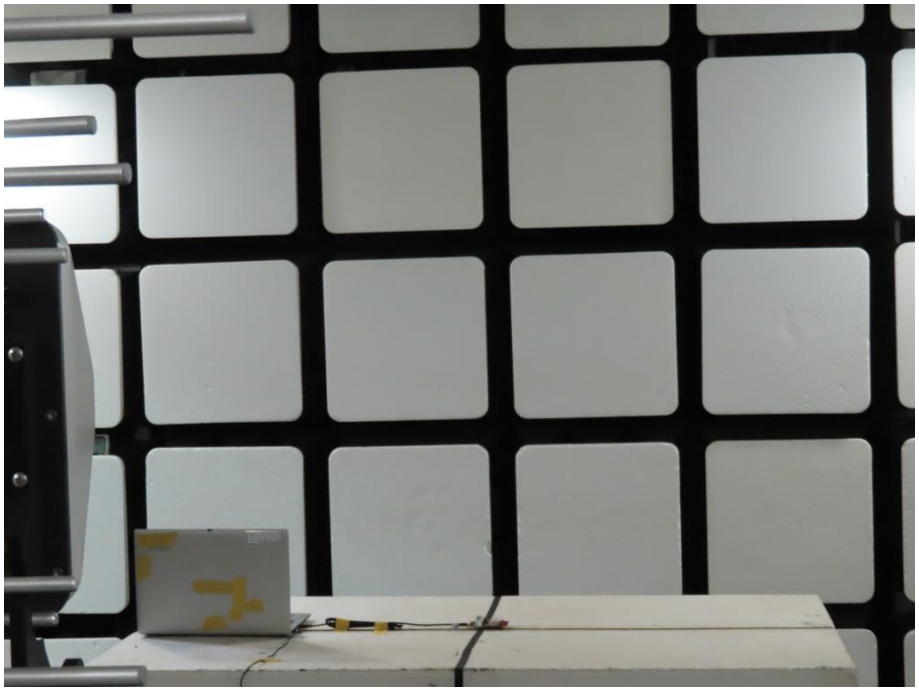
A5.8. Setup Photograph

Mode 1

Position 0°
(Front View)

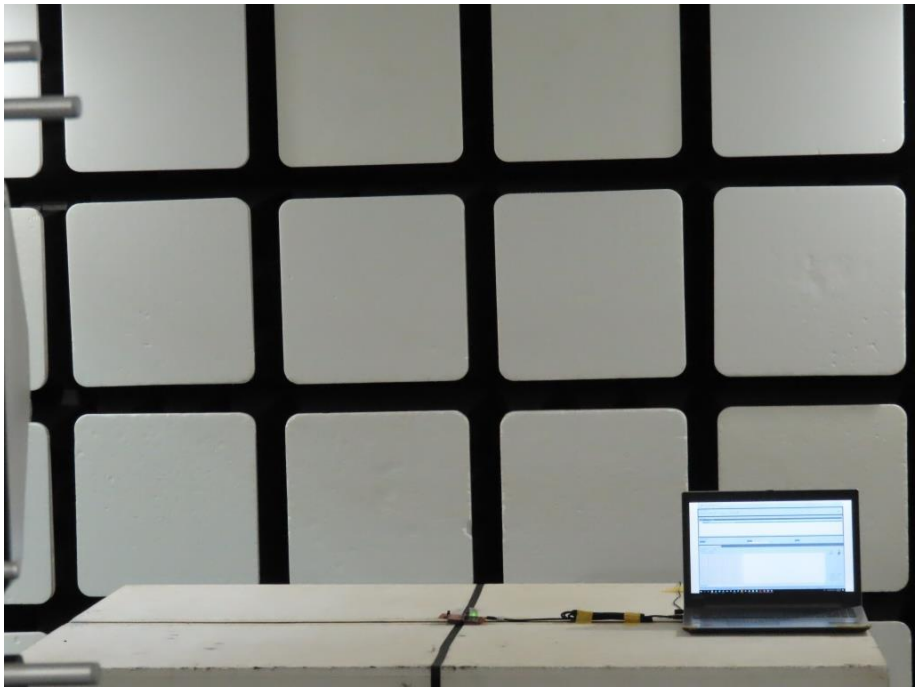


Position 180°
(Front View)



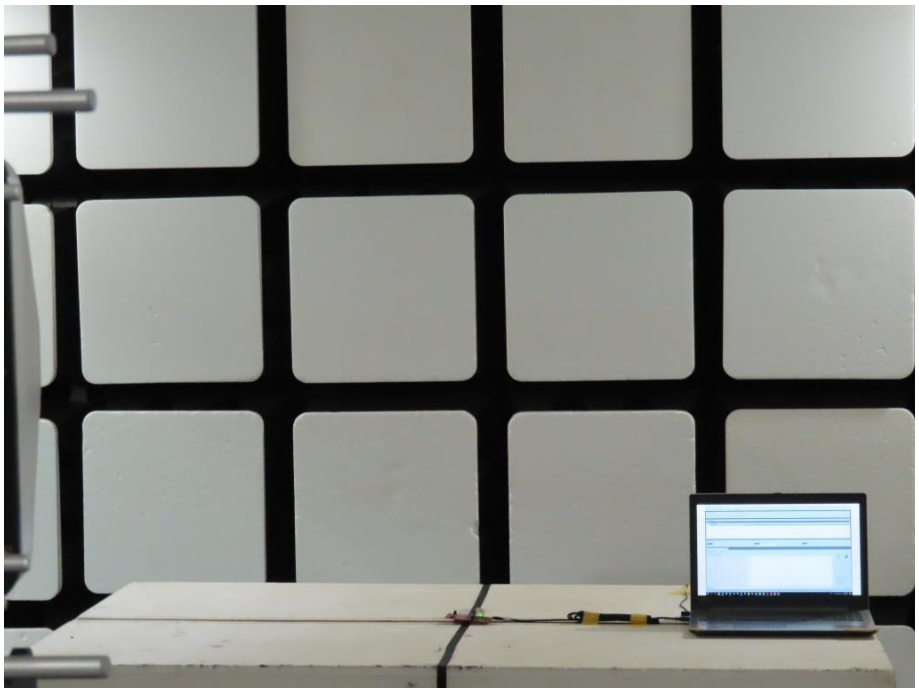
Mode 2

Position 0°
(Front View)



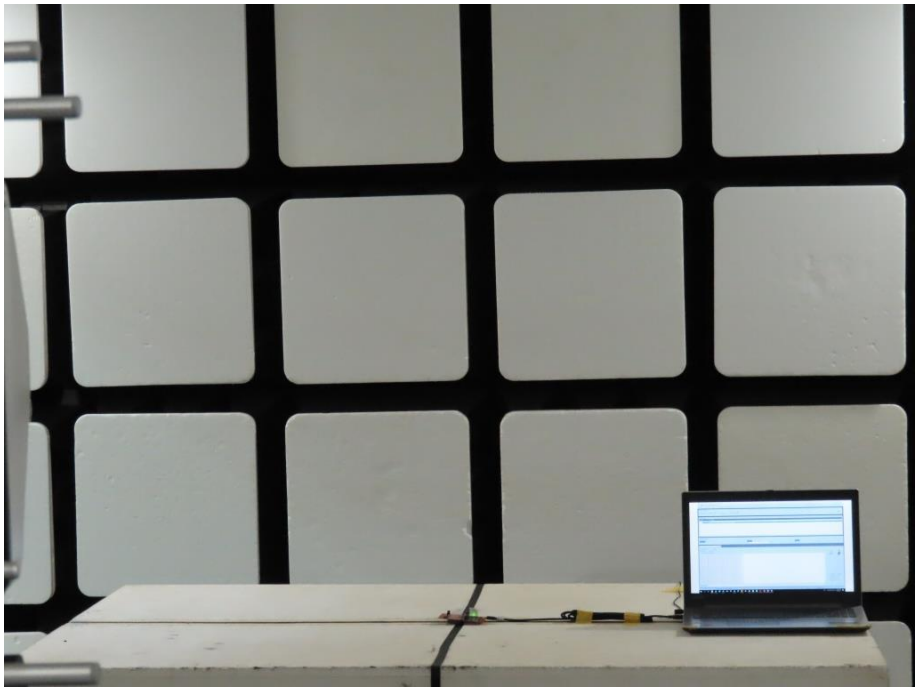
Mode 3

Position 0°
(Front View)



Mode 4

Position 0°
(Front View)



A5.9. Test Raw Data

None

A6. Test Results of ESD Test

Information of Testing Environment			
Temperature	21.8 ~ 25.1 ℃	**Humidity**	40.9 ~ 45.1 %
Atmospheric Pressure	98kPa	**ESD Generator**	Noiseken
Test Site	ES04-HY	**Test Engineer**	Giant Chen
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)		
Test Date	Jun. 14, 2022		

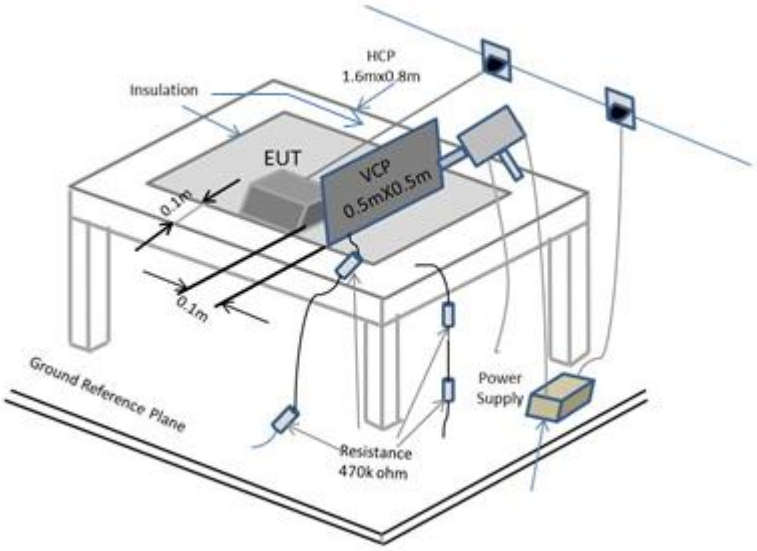
A6.1. Summary

Worst Mode	Mode 1
EUT Operated Voltage During Test	From system
Test Level	±2 / ±4 / ±8 kV for air discharge
	±2 / ±4 kV for contact discharge
Test Times of Each Test Point	Air discharge：10
	Contact discharge：10
Time Interval between Successive Single Discharges	1 s
Required Performance Criteria	TT/TR
EUT Performance Criteria	CT/CR
Result	PASS

A6.2. Details of EUT Test Modes

Details of Test line Items
Electrostatic Discharge
Mode 1: Bluetooth - LE (PER) Link + USB Cable (Charging from Notebook)
Mode 2: Zigbee (PER) Link + USB Cable (Charging from Notebook)
Mode 3: Bluetooth - LE RX + USB Cable (Charging from Notebook)
Mode 4: Zigbee RX + USB Cable (Charging from Notebook)

A6.3. Test Setup



A distance of 1m minimum was provided between the EUT and the wall or any other metallic structure. In cases where this length exceeds the length necessary to apply the discharges to the selected points, the excess length shall, where possible, be placed non-inductively off the ground reference plane and shall not be less than 0.2m to other conductive parts in the test setup.

The coupling plane is placed parallel to, and positioned at a distance of 0.1 m from the EUT.

A6.4. Test Procedure

EUT and auxiliary instrument necessary to perform DIRECT and INDIRECT application of discharges to the EUT, in the following manner:

- CONTACT DISCHARGE to the conductive surfaces and to the coupling plane;
- AIR DISCHARGE at insulating surfaces.

a. Contact Discharges to the conductive surfaces and to coupling planes:

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

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.

b. Air Discharge to apertures and insulation surfaces:

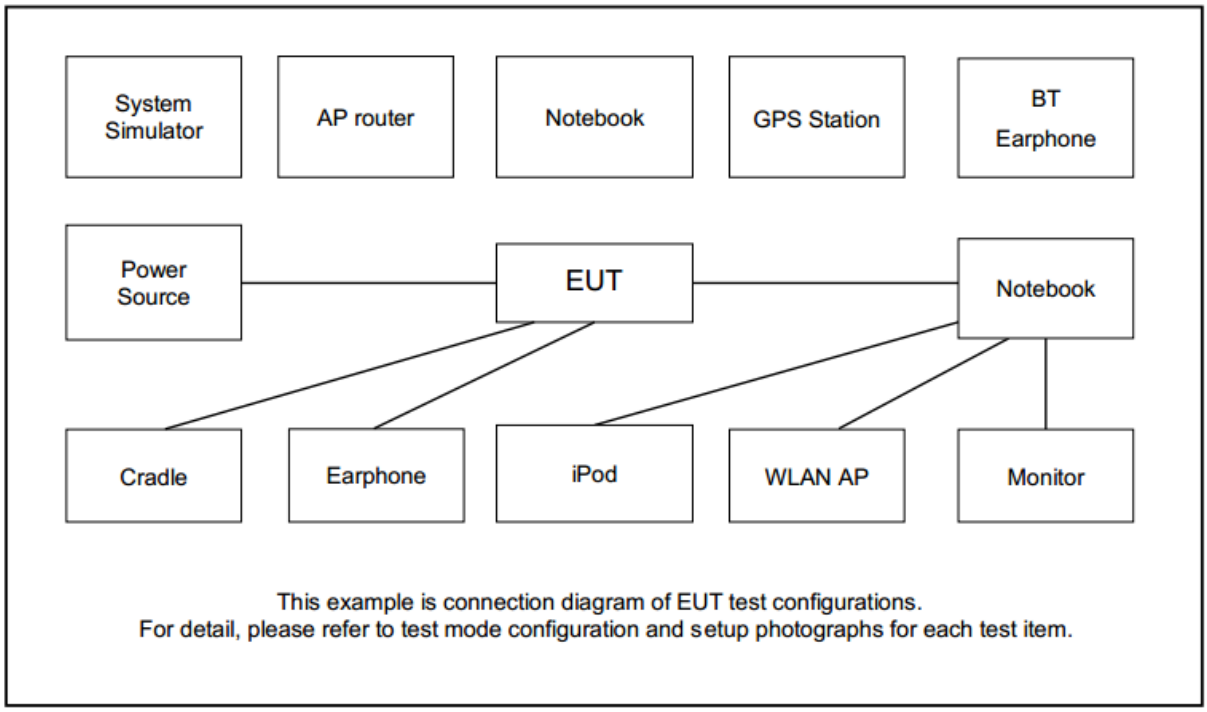
In the case of air discharges, the round discharge tip of the discharge electrode shall be approached as fast as possible (without causing mechanical damage) to touch the EUT. After each discharge, the ESD generator (discharge electrode) shall be removed from the EUT. The generator is then retriggered 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.

c. Ensure that the applied charge on the EUT has been dis-charged before next ESD pulse.

A6.5. Photos for Identification of ESD Test Points

Remark: Only carry out HCP/ VCP test.

A6.6. Connection Diagram of Test System



A6.7. Supported Unit Used in Test Configuration and System

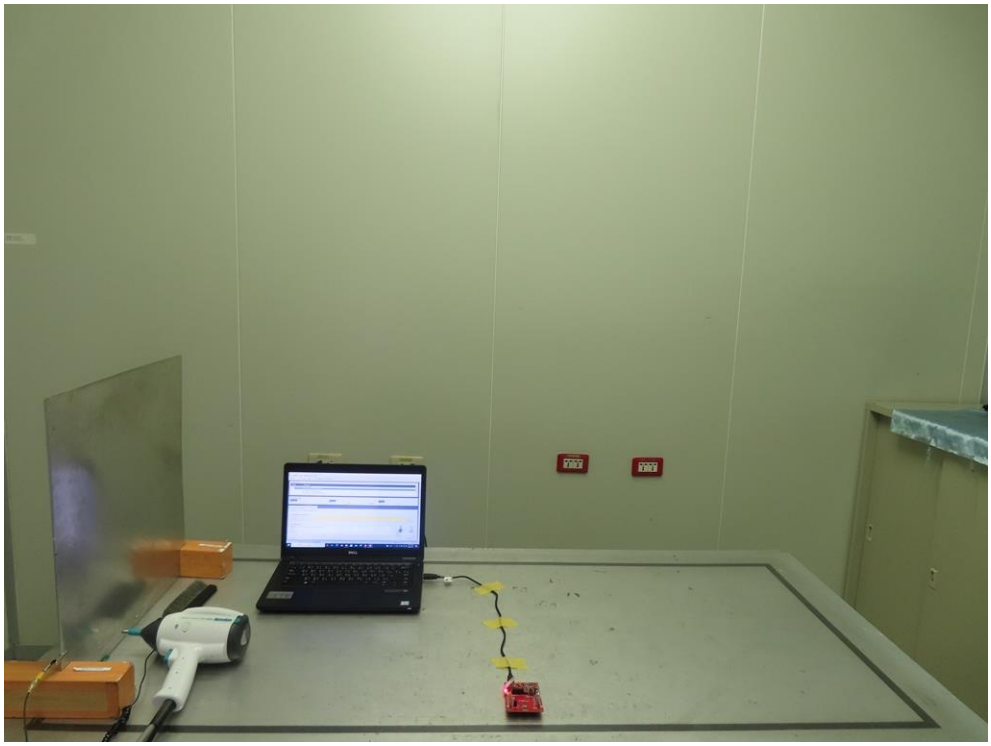
Equipment	Brand Name	Model Name	FCC ID	Data Cable	Power Cord
Notebook	Dell	Latitude 5480	FCC DoC	N/A	AC I/P：Unshielded, 1.2m DC O/P：Shielded, 1.8m
Notebook	Dell	Latitude 3400	FCC DoC	N/A	AC I/P：Unshielded, 1.2m DC O/P：Shielded, 1.8m

A6.8. List of Measuring Equipment

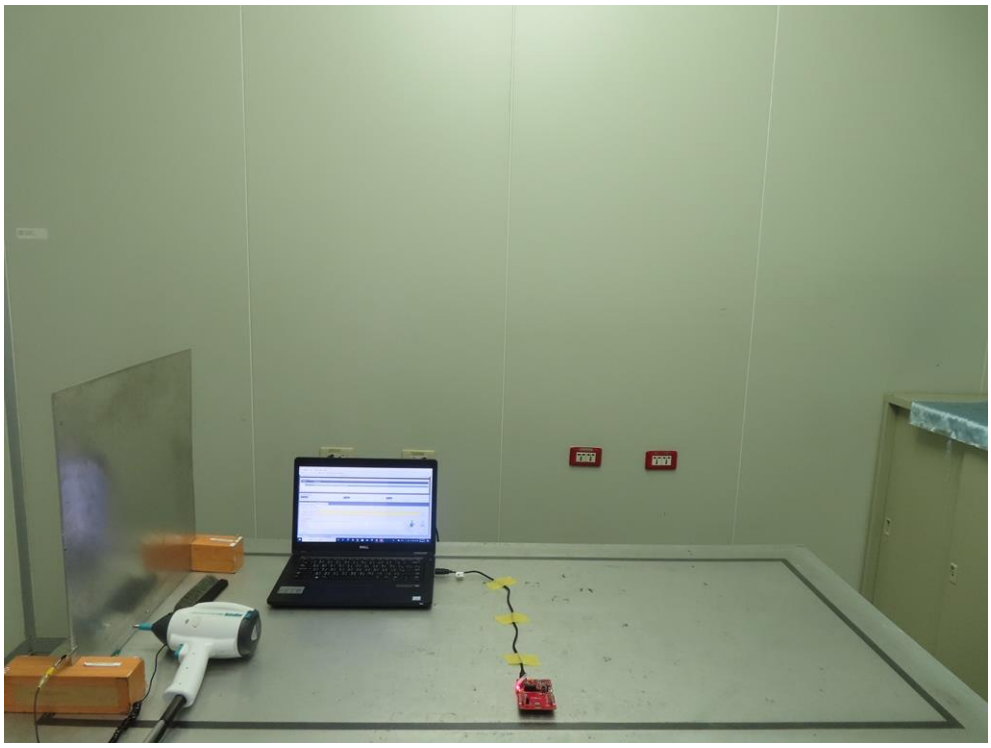
Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
ESD Simulator	NoiseKen	ESS-B3011A	ESS1766201	±0.2 kV ~±30 kV	Apr. 25, 2022	Jun. 14, 2022	Apr. 24, 2023	ESD (ES04-HY)
Anti-Static Dust Removal Brush	VORTEX	914	N/A	N/A	N/A	Jun. 14, 2022	N/A	ESD (ES04-HY)
Electrostatic Voltmeter	Trek	520	N/A	0~±2kV	N/A	Jun. 14, 2022	N/A	ESD (ES04-HY)

A6.9. Setup Photograph

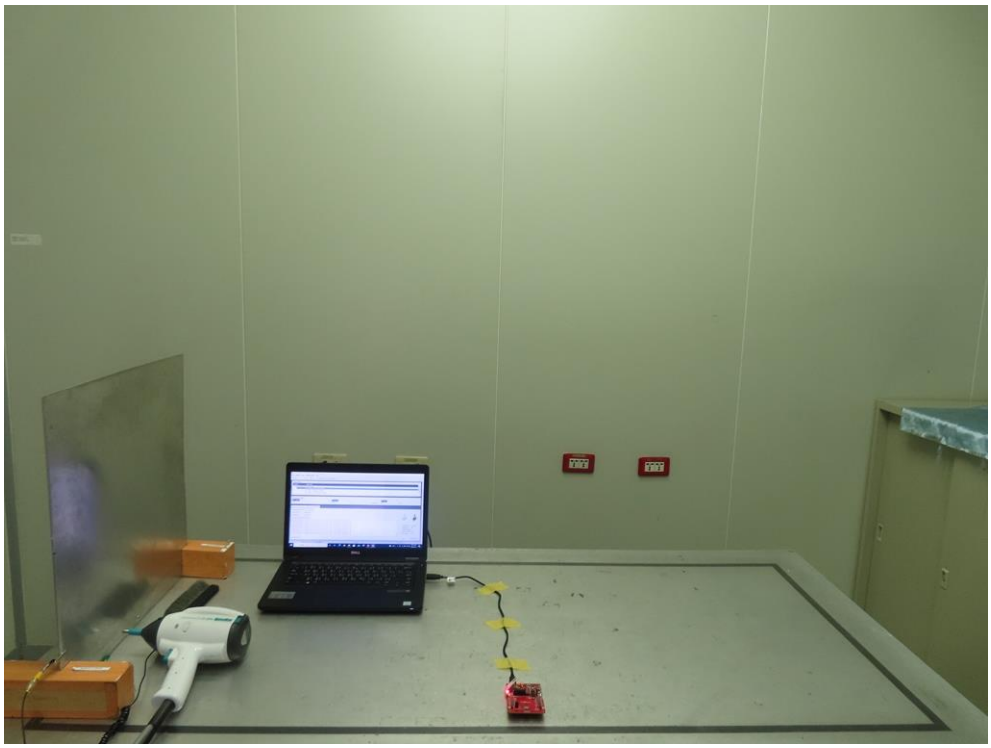
Mode 1



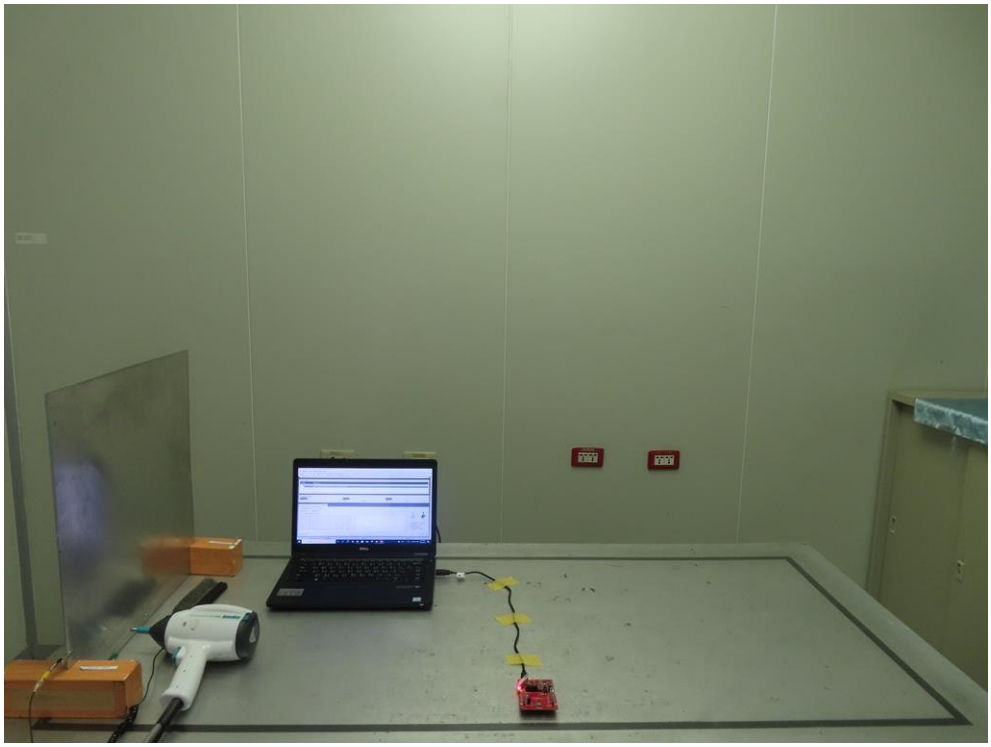
Mode 2



Mode 3



Mode 4



———THE END———