

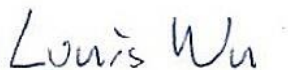


CE EMC TEST REPORT

Equipment : Blues Wireless for Arduino Opta
Brand Name : Blues
Model Name : Blues Wireless for Arduino Opta – Cellular Edition (LTE Cat 1 EMEA)
Applicant : Blues Wireless Inc.
50 Harbor Street, Manchester by the Sea, MA 01944, United States
Manufacturer : Blues Wireless Inc.
50 Harbor Street, Manchester by the Sea, MA 01944, United States
Standard : ETSI EN 301 489-1 V2.2.3, ETSI EN 301 489-17 V3.3.1 (2024-09)
ETSI EN 301 489-1 V2.2.3, ETSI EN 301 489-52 V1.3.1 (2024-11)

The product was received on Sep. 18, 2024, and testing was performed from Nov. 17, 2024 to Nov. 28, 2024. 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 V3.3.1 (2024-09), ETSI EN 301 489-52 V1.3.1 (2024-11); 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.



Approved by: Louis Wu

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Appendix A. Test Requirements and Test Results

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

Contents of Appendix A		
	Items	Page number of each appendix
■	A Test Requirements and Test Results	A-1 ~ A-1
■	A1 Radiated Emission Test	A1-1 ~ A1-12
<input type="checkbox"/>	A2 Conducted Emission Test	-
<input type="checkbox"/>	A3 Harmonics Current Emission Test	-
<input type="checkbox"/>	A4 Voltage Fluctuation and Flicker Test	-
■	A5 Radio Frequency Electromagnetic Field (RS) Test	A5-1 ~ A5-9
■	A6 Electrostatic Discharge (ESD) Test	A6-1 ~ A6-6
<input type="checkbox"/>	A7 Fast Transients, Common Mode (EFT/BURST) Test	-
<input type="checkbox"/>	A8 Radio Frequency, Common Mode (CS) Test	-
<input type="checkbox"/>	A9 Voltage Dips and Interruptions Test	-
<input type="checkbox"/>	A10 Surges Test	-
<input type="checkbox"/>	A11 Transients and Surges in the Vehicular Environment Test	-

Following pages are detailed testing contents of each test items.



Summary of Test Result

ETSI EN 301 489-17 V3.3.1 (2024-09) ETSI EN 301 489-52 V1.3.1 (2024-11)						
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+A1:2020 Class B	Radiated Emission	PASS	1.09 dB under the limit at 575.10 MHz for Quasi-Peak
-	8.3/8.4/8.7	EN 55032:2015 Class B	EN 55032:2015+A1:2020 Class B	Conducted Emission	Not Required	-
-	8.5	EN 61000-3-2 : 2014 Class A	EN IEC 61000-3-2:2019 + A1:2021+A2:2024 Class A	Harmonic Current Emissions	Not Required	-
-	8.6	EN 61000-3-3:2013	EN 61000-3-3 : 2013 + A2 : 2021 + AC : 2022-01	Voltage Fluctuations and Flicker	Not Required	-
A5	9.2	EN 61000-4-3: 2006+A1:2008+A2:2010	EN IEC 61000-4-3:2020	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 IEC 61000-4-6:2023	Radio frequency, Common Mode	Not Required	-
-	9.6	ISO 7637-2:2004	ISO 7637-2:2011	Transients and Surges in the vehicular environment	Not Required	-
-	9.7	EN 61000-4-11:2004	EN IEC 61000-4-11: 2020+AC:2022-10	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.

Conformity Assessment Condition:

The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacturer who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account. Please refer to each test results in Appendix A for measurement uncertainty.

Disclaimer:

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

Reviewed by: Jin Peng

Report Producer: Michelle Chen

1. General Description

1.1 Product Feature of Equipment Under Test

Product Feature
General Specs GSM/WCDMA/LTE and Wi-Fi 2.4GHz 802.11b/g/n.
Antenna Type WWAN: Omni-directional Antenna WLAN: Omni-directional Antenna

Remark: The EUT's information above is declared by manufacturer. Please refer to Disclaimer 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 301 489-1 V2.2.3, ETSI EN 301 489-17 V3.3.1 (2024-09)
- ETSI EN 301 489-1 V2.2.3, ETSI EN 301 489-52 V1.3.1 (2024-11)

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, accessory, 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) Accessory: 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, Accessory and Cable Record

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

<input checked="" type="checkbox"/>	Enclosure Port
<input type="checkbox"/>	Input AC power port
<input checked="" type="checkbox"/>	Input DC power port
<input type="checkbox"/>	Telecommunication port

2. Accessory (symbol means have used with EUT during test)

<input checked="" type="checkbox"/>	<input type="checkbox"/> AC Adapter	Pins : <input type="checkbox"/> 2pins <input type="checkbox"/> 3pins
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> DC Adapter	Cable Length : <input type="checkbox"/> >3m <input checked="" type="checkbox"/> <3m
<input type="checkbox"/>	<input type="checkbox"/> Car charger	
<input type="checkbox"/>	<input type="checkbox"/> PoE adapter	
<input checked="" type="checkbox"/>	Battery	

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.

WLAN

1. Enable WLAN function of the EUT.
2. The EUT links with supported units
3. Playing WiFi streaming video.
4. Execute “PING IP” function under the “ cmd “ of Window system to transfer packet bi-directionally between the EUT and supported units.
5. Monitor the packet loss and WLAN radio performance.

WLAN packet error rates

1. For equipment that supports a PER or FER, the minimum performance level shall be a PER or FER less than or equal to 10 %.
2. Packet error rate (PER) is calculated from the number of packets sent by the system simulator (CMW270) and the number of packets correctly received by the EUT.
3. The formula of PER = (packets sent - packets correctly received) / packets sent. For example, PER = (10000 – 9673) / 10000 = 0.0327 = 3.27%

LTE Link

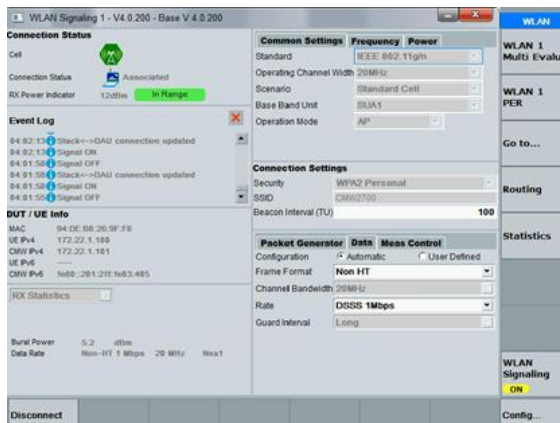
1. The alternative method specified in the EN 301 489-52 Clause 4.2.1 is used with parameters.
2. The LTE (LTE: QPSK, Full RB, Max. BW) radio function is linked with system simulator, and set all up bits for maximum output power, and the DTX is disabled.

LTE Idle

1. For Idle mode, the connection between EUT and LTE system simulator is established.

WLAN Idle

1. For Idle mode, the connection between EUT and companion device is established and monitored the signal by spectrum analyzer, unintentional transmission shall not occur during the test.



Monitor the WLAN (2.4GHz) function

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 are relevant for products covered in the present document.

EN301 489-52

As per section 7.2.2 of DRAFT ETSI EN 301 489-52 V1.3.1 (2024-11)

Reference to clauses in EN 301 489-1	Special product-related conditions, additional to or modifying the test conditions in EN 301 489-1, clause 8.2
8.2 Enclosure port of ancillary equipment	According to typical of intended use of radio equipment, ancillary equipment can also be measured in combination with the radio equipment under test. When the ancillary equipment is measured in combination with the radio equipment, radiated emissions from the transmitter/transceiver shall be ignored, but recorded in the test report.

2.3.3 Immunity

EN301 489-17

As per section 7.2.2 of ETSI EN 301 489-17 V3.3.1 (2024-09)

Reference to clauses in ETSI EN 301 489-1	Special product-related conditions, additional to or modifying the test conditions in ETSI EN 301 489-1, clause 9
9.8.2 Surge	9.8.2.0 General Where the surge coupling network for the 10/700 (5/320) μ s waveform affects the functioning of high-speed data ports, the test shall be carried out using a 1,2/50 (8/20) μ s waveform and appropriate coupling network.

EN301 489-52

As per section 7.3.2 of ETSI EN 301 489-52 V1.3.1 (2024-11)

Reference to clauses in EN 301 489-1	Special product-related conditions, additional to or modifying the test conditions in EN 301 489-1, clause 9
9.3 Electrostatic discharge	When applying direct discharge to a portable or handheld battery-powered EUT with a display screen, it may not be possible to observe the screen for a given EUT orientation. If observation of the screen is necessary during the test, the EUT shall be mounted vertically using non-metallic supports as specified in the last paragraph of clause 4.2.1 of EN 55035.

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:-

$$\text{EXband(lower)} = \text{BandRX(lower)} - n\text{ChWRX}$$

and for the upper edge of the exclusion band:-

$$\text{EXband(upper)} = \text{BandRX(upper)} + n\text{ChWRX}$$

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:-

$$\text{EXband(lower)} = \text{BandRX(lower)} - n\text{BWRX}$$

and for the upper edge of the exclusion band:-

$$\text{EXband(upper)} = \text{BandRX(upper)} + n\text{BWRX}$$

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 standalone receiver under test, and/or associated ancillary equipment.

For EUT that is only able to operate above 6 GHz there is no exclusion band specified as both emissions and immunity requirements only extend as far as 6 GHz.

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. 2 603,5 MHz.

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 5 GHz RLAN band shall be:

- lower limit of exclusion band = lowest allocated band edge frequency -320 MHz, i.e. 4 830 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 both the 5 470 MHz to 5 725 MHz and 5 725 MHz to 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 wireless access systems operating in the 5,8 GHz band shall be:

- lower limit of exclusion band = lowest allocated band edge frequency -440 MHz, i.e. 5 285 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. 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 $n = 11$

The exclusion band for immunity testing of equipment operating in 6 GHz WLAN band shall be:

- lower limit of exclusion band = lowest allocated band edge frequency -480 MHz, i.e. 5 465 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 5 945 MHz to 6 425 MHz band. Therefore, the test stops at the lower limit of exclusion band (i.e. 5 465 MHz).

Note: This is based upon a channel size of 160 MHz and a value of $n = 3$

- **EN 301 489-52**

GSM Transmitter exclusion band

The exclusion band for transmitters is as defined in clause 4.3.2.2 of ETSI EN 301 489-1, 250 % of the channel width either side of the nominal operating frequency of the transmitter.

GSM Receiver exclusion band

The exclusion band for receivers and receiver sections of transceivers is the band of frequencies over which no immunity tests with radiated RF are made as defined in clause 4.3.3 of ETSI EN 301 489-1 where $n = 1$ and Channel Width is 200 kHz.

UTRA and E-UTRA Transmitter exclusion band

The frequency bands, including in-band emissions and out-of-band emissions, are covered by the RF spectral mask specification and need no further consideration.

For the purpose of EMC specifications, there shall be a transmitter exclusion band as defined in clause 4.3.2.2 of ETSI EN 301 489-1 where BW Channel is the channel bandwidth as defined in clause 5.6 of ETSI TS 136 101.

UTRA and E-UTRA Receiver exclusion band

As defined in clause 4.3.3 of ETSI EN 301 489-1 where $n = 1$ and the considered Channel Width for calculation of the exclusion band is as follows:

- UTRA Channel Width 5MHz.
- E-UTRA Channel Width 20MHz.

NR FR1 Transmitter exclusion band

For the purpose of EMC specifications, there shall be a transmitter exclusion band as defined in clause 4.3.2.2 of ETSI EN 301 489-1 [1] where BW Channel is the channel bandwidth as defined in clause 5.3 of ETSI TS 138 101-1.

NR FR1 Receiver exclusion band

As defined in clause 4.3.3 of ETSI EN 301 489-1 where $n = 1$ and the considered Channel Width for calculation of the exclusion band is as follows:

- NR Channel Width 100 MHz.
- E-UTRA Channel Width 20 MHz

NR FR2 Transmitter exclusion band

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

NR FR2 Receiver exclusion band

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

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

Criteria	Performance criteria
<p align="center">CT/CR</p>	<p>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.</p> <p>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.</p> <ul style="list-style-type: none"> ♦ The EUT shall operate as its intended operating condition during and after the test. ♦ LTE: The Throughput of the LTE shall be $\geq 95\%$ of the maximum throughput of the reference measurement channel, and measure during each individual exposure in the test sequence.
<p align="center">TT/TR</p>	<p>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.</p> <p>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.</p>

<ETSI EN 301 489-1 V2.2.3>

Criteria	Performance criteria
<p>Continuous Phenomena</p>	<p>During the test, the equipment shall:</p> <ul style="list-style-type: none"> ♦ continue to operate as intended ♦ not unintentionally transmit ♦ not unintentionally change its operating state ♦ not unintentionally change critical stored data
<p>Transient Phenomena</p>	<p>For all ports and transient phenomena with the exception described below, the following applies:</p> <ul style="list-style-type: none"> ♦ 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. <p>For surges applied to symmetrically operated wired network ports intended to be connected directly to outdoor lines the following criteria applies:</p> <ul style="list-style-type: none"> ♦ 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.
<p>NOTE: Operate as intended during the test shall be considered as:</p> <ul style="list-style-type: none"> • 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, (e.g. audio equipment and equipment transmitting sporadic messages) 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 for transient phenomena, except for voltage dips greater than or equal to 100 ms, voltage interruptions of 5 000 ms duration, and surges of 10/700 µs for which performance criteria C shall apply. Where the EUT is a transmitter in standby mode, unintentional transmission shall not occur as result of the application of the test. Where the EUT is a transceiver in receive mode, unintentional transmission shall not occur as result of the application of the test.

• Performance requirements table of 301489-52

CLAUSE 6.1 of EN301489-52	
Criteria	Performance criteria
CP	<p>GSM and voice call (CT) With a link established, during the test, the uplink speech output level shall be at least 35 dB less than the previously recorded reference levels, when measured through an audio band pass filter of width 200 Hz, centred on 1 kHz (audio breakthrough check).</p> <p>NOTE: When there is a high-level background noise present, the filter bandwidth may be reduced to a minimum of 40 Hz.</p> <p>In idle mode, the transmitter shall not operate unintentionally.</p> <p>At the conclusion of the test, the EUT shall operate as intended with no loss of user control functions or critical stored data, and the communication link shall have been maintained.</p>
	<p>GSM and voice call (CR) During the test, the RXQUAL of the downlink shall not exceed the value of three, measured during each individual exposure in the test sequence.</p> <p>In the case of narrow-band responses, the procedure in clause 4.4.1 shall be followed.</p> <p>During the test, the downlink speech output level shall be at least 35 dB less than the previously recorded reference levels, when measured through an audio band pass filter of width 200 Hz, centred on 1 kHz (audio breakthrough check).</p> <p>NOTE: When there is a high-level background noise present, the filter bandwidth may be reduced to a minimum of 40 Hz.</p> <p>At the conclusion of the test, the EUT shall operate as intended with no loss of user control functions or critical stored data, and the communication link shall have been maintained.</p>
	<p>UTRA: In the data transfer mode, the performance criteria can be one of the following:</p> <ul style="list-style-type: none"> · if the BER (as referred in clause 5.3.1 of ETSI TS 134 109) is used, it shall not exceed 0,001 during the test sequence; · if the BLER (as referred in ETSI TS 134 109) is used, it shall not exceed 0,01 during the test sequence. <p>The BLER calculation shall be based on evaluating the CRC on each transport block. Details are specified in annex C.</p> <p>In the case of narrow band responses, the procedure in clause 4.4.2.1 shall be followed.</p> <p>When testing a voice call, the performance criteria in clause 6.1.1 shall apply.</p>

CLAUSE 6.1 of EN301489-52	
Criteria	Performance criteria
CP	<p>E-UTRA, E-UTRA with LAA, inband or guard band NB-IoT, Standalone NB-IoT: In data transfer mode, the data throughput of the EUT shall not fall below 95 % of the maximum data throughput. Details are specified in annex C.</p> <p>In the case of narrow band responses, the procedure in clause 4.4.2.2 shall be followed.</p> <p>When testing a voice call, the performance criteria in clause 6.1.1 shall apply.</p> <p>NR: In the data transfer mode of both FR1 and FR2, the data throughput of the EUT shall not fall below 95 % of the maximum data throughput. Details are specified in annex C.</p> <p>In the case of narrow-band responses, the procedure in clause 4.4.3 shall be followed.</p> <p>When testing a voice call, the performance criteria in clause 6.1.1 shall apply</p>

CLAUSE 6.2 of EN301489-52	
Criteria	Performance criteria
TP	<p>At the conclusion of each exposure of the transient phenomena, the EUT shall operate without loss of the communication link.</p> <p>At the conclusion of the total test comprising the series of individual exposures, the EUT shall operate as intended without loss of user control functions or critical stored data.</p> <p>In addition where the EUT supports idle mode it should be verified that the transmitter shall not unintentionally operate when transient phenomena are applied.</p>



Appendix A. Test Requirements and Test Results

Test requirements and test 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.



A1. Test Results of Radiated Emission Test

Information of Testing Environment			
Temperature	23~26 °C	Humidity	43~47 %
Test Site (30MHz ~ 6GHz)	03CH06-HY	Test Engineer	Bor-Shiang,Huang
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)		
Test Date	Nov. 17, 2024		
Measurement Uncertainty	30 MHz ~ 1000 MHz : 5.8 dB		
Level of Confidence of 95% (U=2Uc(y))	1000 MHz ~ 6000 MHz : 4.8 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	DC12V		
Frequency	575.10 MHz	Detector	Quasi-Peak
Level	45.91 dBμV	Margin	Under 1.09 dB
Result	PASS		

A1.2. Details of EUT Test Modes

Details of Test line Items	
Radiated Emission	
Mode 1:	LTE Band 3 Link + DC power
Mode 2:	LTE Band 7 Link + DC power
Mode 3:	WLAN (2.4GHz) Link + DC power
Mode 4:	WLAN (2.4GHz) Idle + DC power
Mode 5:	LTE Band 3 Idle + DC power

A1.3. Test Limit

<Class B limit>

<30MHz ~ 1000MHz>

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

<1000MHz ~ 6000MHz>

<EN 55032 : 2015>

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

<EN 55032 : 2015 + A1:2020>

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

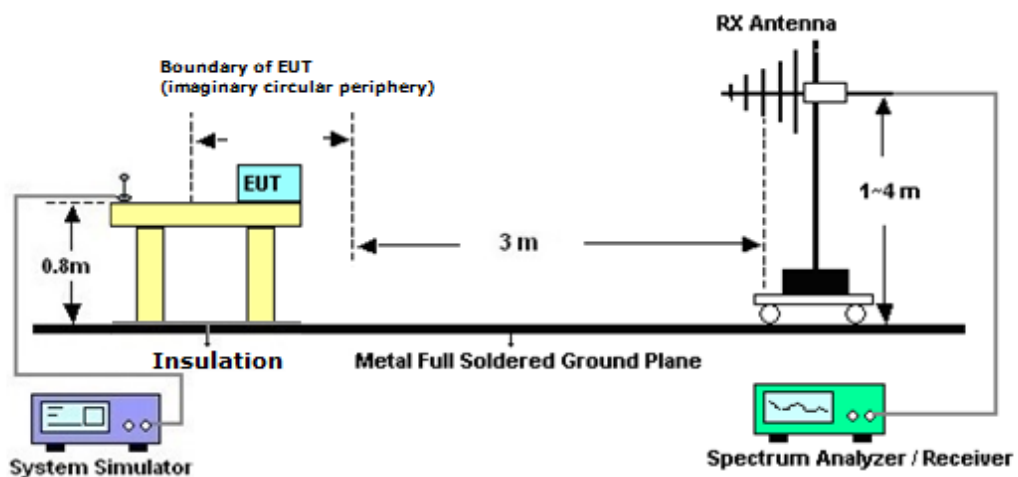
Conditional testing frequency:

Highest measured frequency	Highest measured frequency
$F_x \leq 108 \text{ MHz}$	1 GHz
$108 \text{ MHz} < F_x \leq 500 \text{ MHz}$	2 GHz
$500 \text{ MHz} < F_x \leq 1 \text{ GHz}$	5 GHz
$F_x > 1 \text{ GHz}$	5 x F_x up to a maximum of 6 GHz

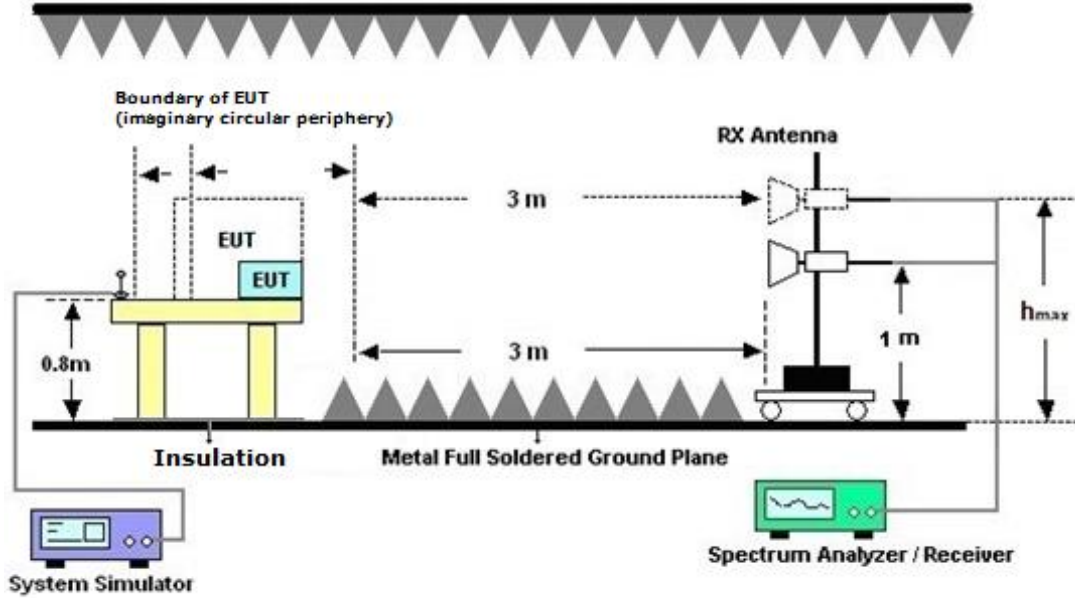
NOTE: For FM and TV broadcast receivers, F_x is determined from the highest frequency generated or used excluding the local oscillator and tuned frequencies.

A1.4. Test Setup

<Radiated Emissions Frequency: 30 MHz to 1000 MHz>

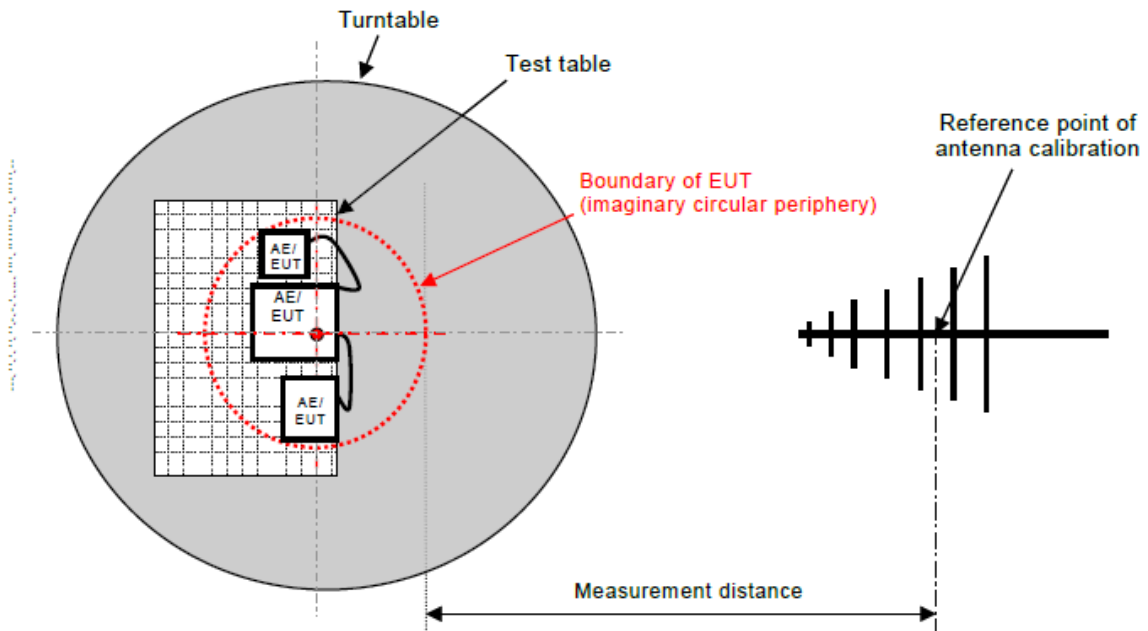


<Radiated Emissions Frequency: 1000 MHz to 6000 MHz>



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

<Radiated Emissions Setup Configuration>

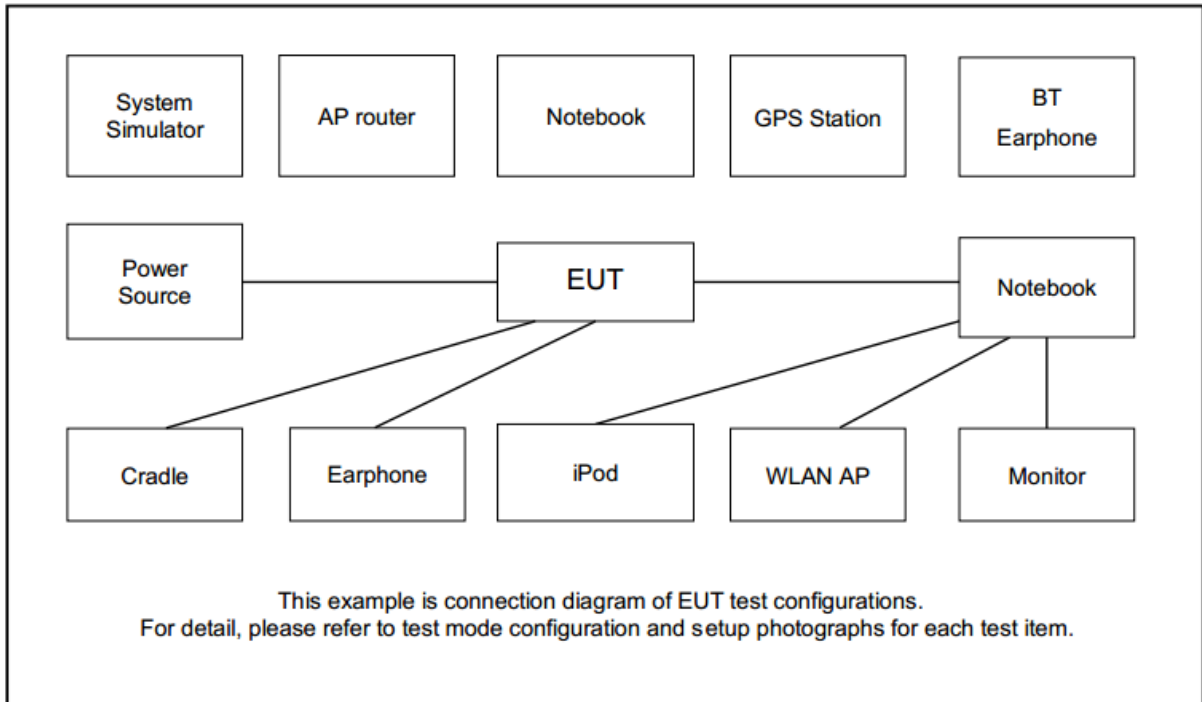




A1.5. Test Procedures

- 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. For frequencies below 1GHz, the Quasi-peak detector is employed as the limit. If the emission level of the Equipment Under Test (EUT) in peak mode is 3 dB lower than the specified limit, the peak values of the EUT will be reported. In cases where the emission level exceeds this threshold, the measurement will be repeated using the quasi-peak method, and the results will be reported for the frequency range below 1GHz.
- j. If emission level of the EUT in Peak measurement mode is 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
System Simulator	Anritsu	MT8820C	N/A	N/A	Unshielded, 1.8m
System Simulator	R&S	CMW 500	N/A	N/A	Unshielded, 1.8m
DC Power Supply	GW Instek	GEU810960	FCC DoC	N/A	N/A

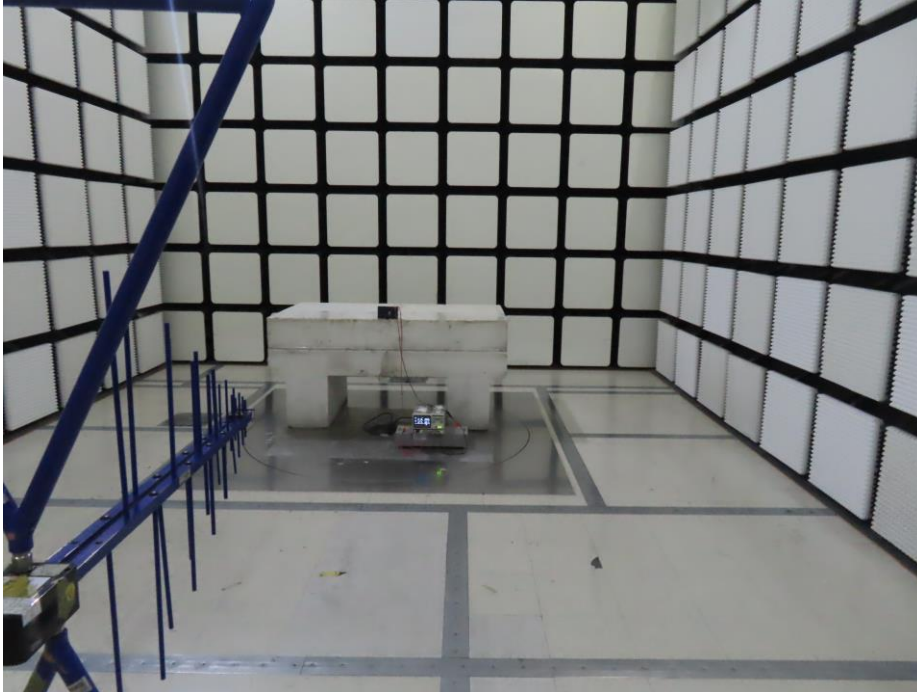
**A1.8. List of Measuring Equipment**

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Amplifier	SONOMA	310N	186713	9kHz~1GHz	Apr. 16, 2024	Nov. 17, 2024	Apr. 15, 2025	Radiation (03CH06-HY)
Bilog Antenna	TESEQ	CBL 6111D & N-6-06	35414 & AT-N0602	30MHz~1GHz	Oct. 05, 2024	Nov. 17, 2024	Oct. 04, 2025	Radiation (03CH06-HY)
EMI Test Receiver	Rohde & Schwarz	ESU26	100472	20Hz~26.5GHz	Feb. 01, 2024	Nov. 17, 2024	Jan. 31, 2025	Radiation (03CH06-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-02037	1GHz~18GHz	Dec. 28, 2023	Nov. 17, 2024	Dec. 27, 2024	Radiation (03CH06-HY)
Preamplifier	Agilent	8449B	3008A01917	1GHz~26.5GHz	Jan. 31, 2024	Nov. 17, 2024	Jan. 30, 2025	Radiation (03CH06-HY)
RF Cable	HUBER + SUHNER	SF102_2000mm SF102_3000mm SF102_7000mm	532421/2 532422/2 532299/2	30MHz to 40GHz	Jul. 02, 2024	Nov. 17, 2024	Jul. 01, 2025	Radiation (03CH06-HY)
Hygrometer	TECPEL	DTM-303B	TP210018	N/A	Oct. 14, 2024	Nov. 17, 2024	Oct. 13, 2025	Radiation (03CH06-HY)
Controller	INN-CO	EM1000	060782	Control Turn table & Ant Mast	N/A	Nov. 17, 2024	N/A	Radiation (03CH06-HY)
Antenna Mast	MF	MF-7802	MF780208212	1m~4m	N/A	Nov. 17, 2024	N/A	Radiation (03CH06-HY)
Turn Table	INN-CO	DS2000	420/650/00	0-360 degree	N/A	Nov. 17, 2024	N/A	Radiation (03CH06-HY)
Software	Audix	E3 6.2009-8-24(k5)	N/A	N/A	N/A	Nov. 17, 2024	N/A	Radiation (03CH06-HY)

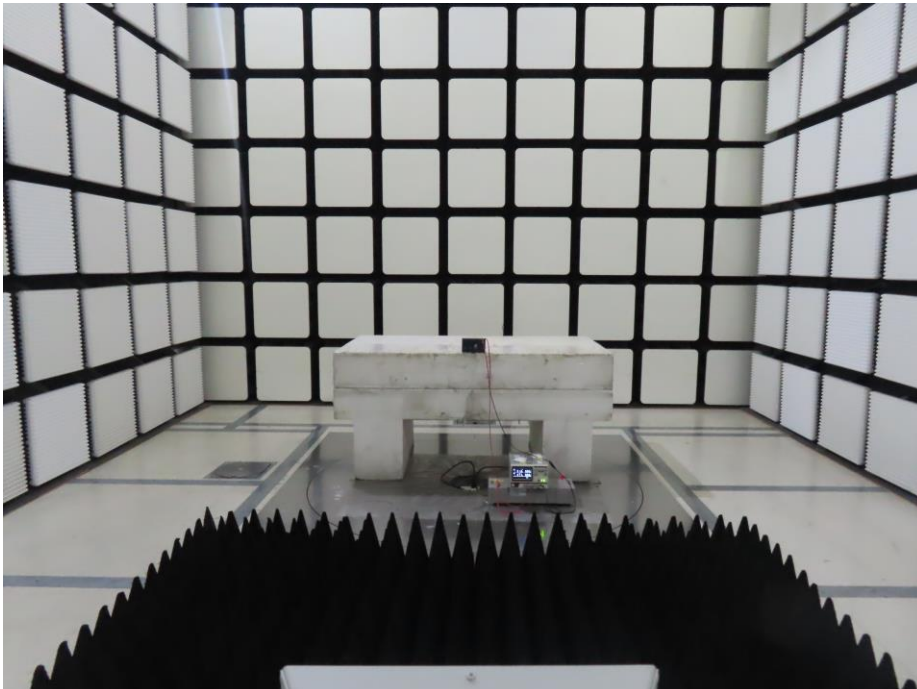
A1.9. Setup Photograph

Mode 1

Frequency: 30 MHz to 1000 MHz



Frequency: 1000 MHz to 6000 MHz



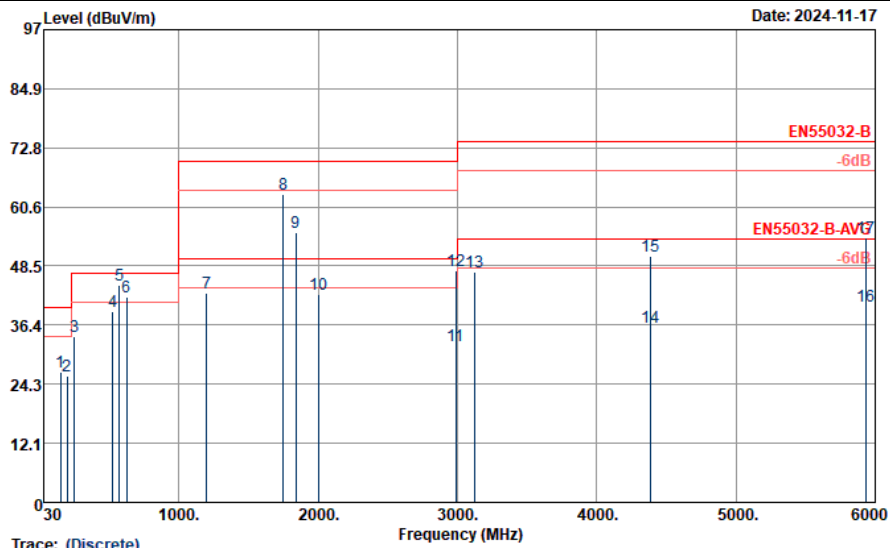


A1.10.Test Raw Data

<EN 55032 : 2015>

Test Mode :	Mode 1
Remark :	#8 is mobile station signal which can be ignored. #9 is system simulator signal which can be ignored.

- 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



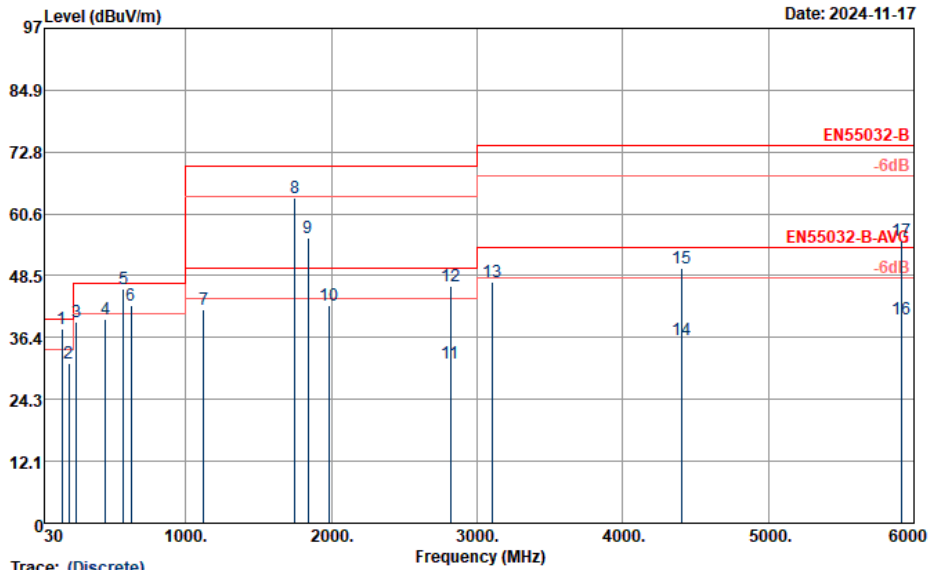
Trace: (Discrete)
 Site : 03CH06-HY
 Condition : EN55032-B 3m 9120D_02037 HORIZONTAL
 Project : 491806
 Power : DC 12V/2A
 Memo : Mode 1

	Freq	Level	Over	Limit	Read	A/Pos	T/Pos	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	cm	deg
1	149.88	26.83	-13.17	40.00	39.25	-12.42	---	Peak
2	200.10	25.89	-14.11	40.00	40.12	-14.23	---	Peak
3	250.05	33.97	-13.03	47.00	44.51	-10.54	---	Peak
4	524.70	39.31	-7.69	47.00	43.16	-3.85	---	Peak
5 !	575.10	44.50	-2.50	47.00	45.98	-1.48	100	110 QP
6 !	624.80	42.10	-4.90	47.00	43.36	-1.26	150	230 QP
7	1200.00	42.86	-27.14	70.00	46.14	-3.28	---	Peak
8	1748.00	63.33	-6.67	70.00	65.80	-2.47	---	Peak
9	1842.00	55.32	-14.68	70.00	57.40	-2.08	---	Peak
10	2002.00	42.76	-27.24	70.00	42.89	-0.13	---	Peak
11	2988.00	32.19	-17.81	50.00	27.90	4.29	100	78 Average
12	2988.00	47.58	-22.42	70.00	43.29	4.29	100	78 Peak
13	3120.00	47.35	-26.65	74.00	42.36	4.99	---	Peak
14	4386.00	35.98	-18.02	54.00	26.60	9.38	100	142 Average
15	4386.00	50.51	-23.49	74.00	41.13	9.38	100	142 Peak
16	5937.00	40.27	-13.73	54.00	26.19	14.08	100	87 Average
17	5937.00	54.30	-19.70	74.00	40.22	14.08	100	87 Peak



Test Mode :	Mode 1
Remark :	#8 is mobile station signal which can be ignored. #9 is system simulator signal which can be ignored.

- 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



Trace: (Discrete)

Site : 03CH06-HY
 Condition : EN55032-B 3m 9120D_02037 VERTICAL
 Project : 491806
 Power : DC 12V/2A
 Memo : Mode 1

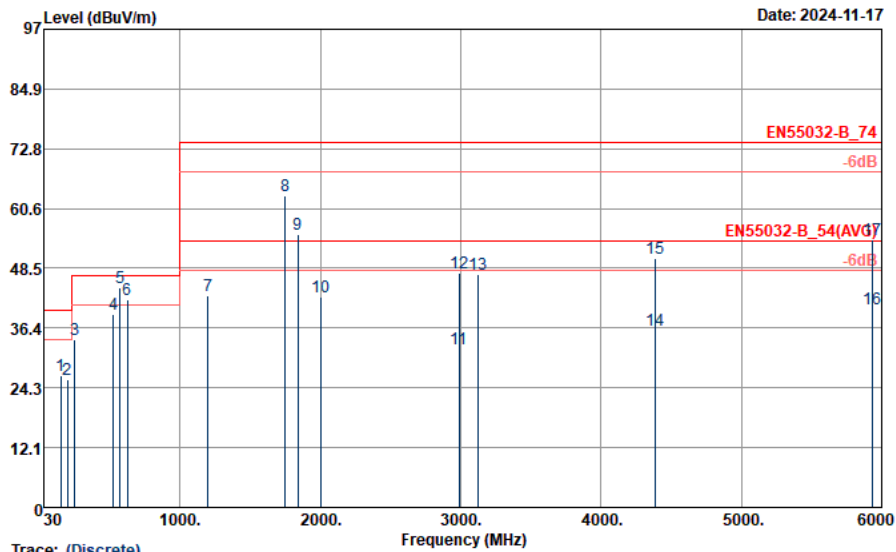
	Freq	Level	Over	Limit	Read	A/Pos	T/Pos	Remark
	MHz	dBuV/m	Limit	Line	Level	Factor	cm	deg
			dB	dBuV/m	dBuV	dB/m		
1 !	149.88	38.08	-1.92	40.00	50.50	-12.42	100	250 QP
2	200.10	31.39	-8.61	40.00	45.62	-14.23	---	--- Peak
3	250.05	39.34	-7.66	47.00	49.88	-10.54	---	--- Peak
4	449.80	39.88	-7.12	47.00	44.76	-4.88	---	--- Peak
5 !	575.10	45.91	-1.09	47.00	47.39	-1.48	100	35 QP
6 !	624.80	42.63	-4.37	47.00	43.89	-1.26	100	20 QP
7	1126.00	41.76	-28.24	70.00	45.34	-3.58	---	--- Peak
8	1748.00	63.74	-6.26	70.00	66.21	-2.47	---	--- Peak
9	1842.00	55.92	-14.08	70.00	58.00	-2.08	---	--- Peak
10	1982.00	42.59	-27.41	70.00	42.99	-0.40	---	--- Peak
11	2816.00	31.46	-18.54	50.00	28.00	3.46	100	286 Average
12	2816.00	46.50	-23.50	70.00	43.04	3.46	100	286 Peak
13	3105.00	47.26	-26.74	74.00	42.36	4.90	---	--- Peak
14	4410.00	35.81	-18.19	54.00	26.40	9.41	100	77 Average
15	4410.00	50.02	-23.98	74.00	40.61	9.41	100	77 Peak
16	5916.00	39.87	-14.13	54.00	26.00	13.87	100	181 Average
17	5916.00	55.26	-18.74	74.00	41.39	13.87	100	181 Peak



<EN 55032 : 2015 + A1:2020>

Test Mode :	Mode 1
Remark :	#8 is mobile station signal which can be ignored. #9 is system simulator signal which can be ignored.

- 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



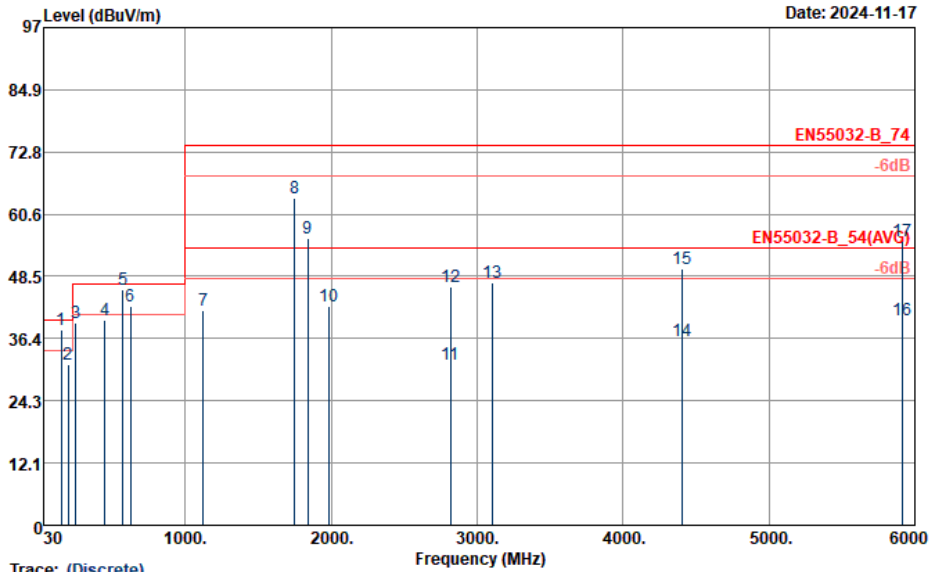
Trace: (Discrete)
 Site : 03CH06-HY
 Condition : EN55032-B_74 3m 9120D_02037 HORIZONTAL
 Project : 491806
 Power : DC 12V/2A
 Memo : Mode 1

	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	149.88	26.83	-13.17	40.00	39.25	-12.42	---	---	Peak
2	200.10	25.89	-14.11	40.00	40.12	-14.23	---	---	Peak
3	250.05	33.97	-13.03	47.00	44.51	-10.54	---	---	Peak
4	524.70	39.31	-7.69	47.00	43.16	-3.85	---	---	Peak
5 !	575.10	44.50	-2.50	47.00	45.98	-1.48	100	110	QP
6 !	624.80	42.10	-4.90	47.00	43.36	-1.26	150	230	QP
7	1200.00	42.86	-31.14	74.00	46.14	-3.28	---	---	Peak
8	1748.00	63.33	-10.67	74.00	65.80	-2.47	---	---	Peak
9	1842.00	55.32	-18.68	74.00	57.40	-2.08	---	---	Peak
10	2002.00	42.76	-31.24	74.00	42.89	-0.13	---	---	Peak
11	2988.00	32.19	-21.81	54.00	27.90	4.29	100	78	Average
12	2988.00	47.58	-26.42	74.00	43.29	4.29	100	78	Peak
13	3120.00	47.35	-26.65	74.00	42.36	4.99	---	---	Peak
14	4386.00	35.98	-18.02	54.00	26.60	9.38	100	142	Average
15	4386.00	50.51	-23.49	74.00	41.13	9.38	100	142	Peak
16	5937.00	40.27	-13.73	54.00	26.19	14.08	100	87	Average
17	5937.00	54.30	-19.70	74.00	40.22	14.08	100	87	Peak



Test Mode :	Mode 1
Remark :	#8 is mobile station signal which can be ignored. #9 is system simulator signal which can be ignored.

- 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



Trace: (Discrete)

Site : 03CH06-HY
 Condition : EN55032-B_74 3m 9120D_02037 VERTICAL
 Project : 491806
 Power : DC 12V/2A
 Memo : Mode 1

	Freq	Level	Over	Limit	Read	Factor	A/Pos	T/Pos	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	cm	deg	
1 !	149.88	38.08	-1.92	40.00	50.50	-12.42	100	250	QP
2	200.10	31.39	-8.61	40.00	45.62	-14.23	---	---	Peak
3	250.05	39.34	-7.66	47.00	49.88	-10.54	---	---	Peak
4	449.80	39.88	-7.12	47.00	44.76	-4.88	---	---	Peak
5 !	575.10	45.91	-1.09	47.00	47.39	-1.48	100	35	QP
6 !	624.80	42.63	-4.37	47.00	43.89	-1.26	100	20	QP
7	1126.00	41.76	-32.24	74.00	45.34	-3.58	---	---	Peak
8	1748.00	63.74	-10.26	74.00	66.21	-2.47	---	---	Peak
9	1842.00	55.92	-18.08	74.00	58.00	-2.08	---	---	Peak
10	1982.00	42.59	-31.41	74.00	42.99	-0.40	---	---	Peak
11	2816.00	31.46	-22.54	54.00	28.00	3.46	100	286	Average
12	2816.00	46.50	-27.50	74.00	43.04	3.46	100	286	Peak
13	3105.00	47.26	-26.74	74.00	42.36	4.90	---	---	Peak
14	4410.00	35.81	-18.19	54.00	26.40	9.41	100	77	Average
15	4410.00	50.02	-23.98	74.00	40.61	9.41	100	77	Peak
16	5916.00	39.87	-14.13	54.00	26.00	13.87	100	181	Average
17	5916.00	55.26	-18.74	74.00	41.39	13.87	100	181	Peak



A5. Test Results of RS Test

Information of Testing Environment			
Temperature	23.2~24.1 °C	Humidity	40.1~50.7 %
Test Site	RS05-HY (TAF Code: 3786)	Test Engineer	Timothy Chung
Test Site Location	No.58 , Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.)		
Test Date	Nov. 27, 2024		
Test Software and its Version	Test Software: EMC32, version: 10.30.00		
Remark	The Radiated Emission test item subcontracted to Sporton International Inc. Wensan Laboratory.		

A5.1. Summary

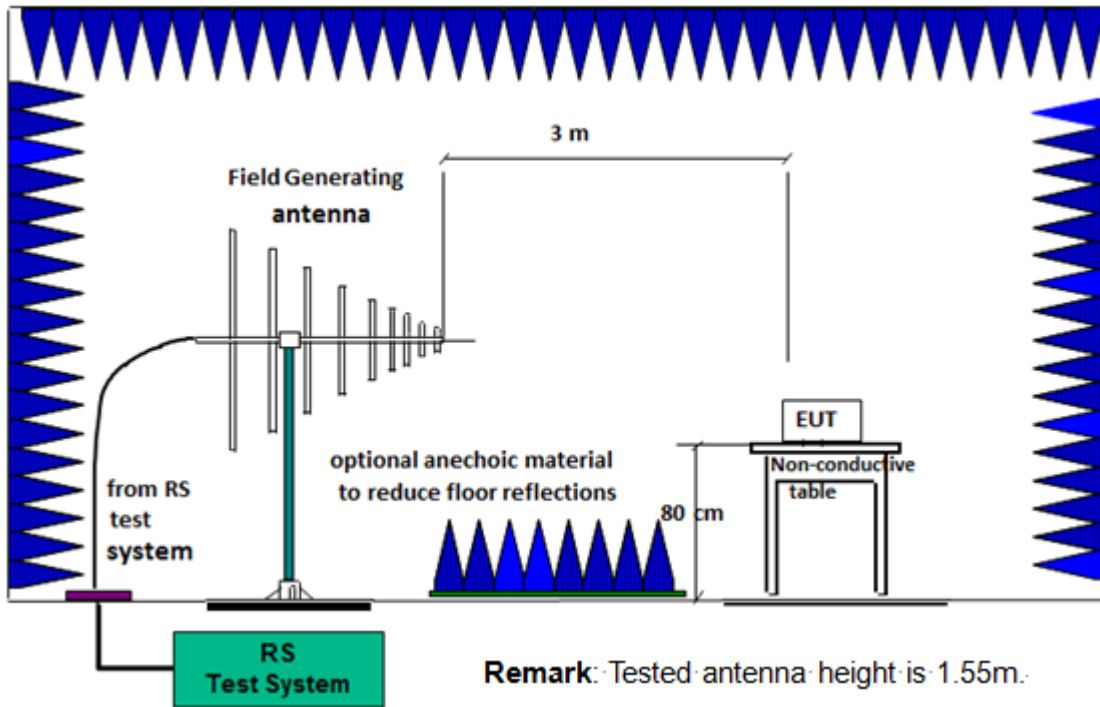
Worst Mode	Mode 3
EUT Operated Voltage During Test	DC 12V
Frequency Range	80-6000 MHz
Test Level	3 V/m
Frequency Step Size	1% increment
Modulation	80% AM (1kHz)
Dwell Time	3 seconds
Polarity	Horizontal and Vertical
Azimuth	0°, 180°
Performance Criteria(limit)	CT/CR
Result	CT/CR, PASS

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

A5.2. Details of EUT Test Modes

Details of Test line Items
RF Electromagnetic Field
Mode 1: LTE Band 3 Link (Throughput) + DC 12V
Mode 2: LTE Band 7 Link (Throughput) + DC 12V
Mode 3: WLAN (2.4GHz) Link (PER) + DC 12V
Mode 4: LTE Band 7 Idle + WLAN (2.4GHz) Idle + DC 12V

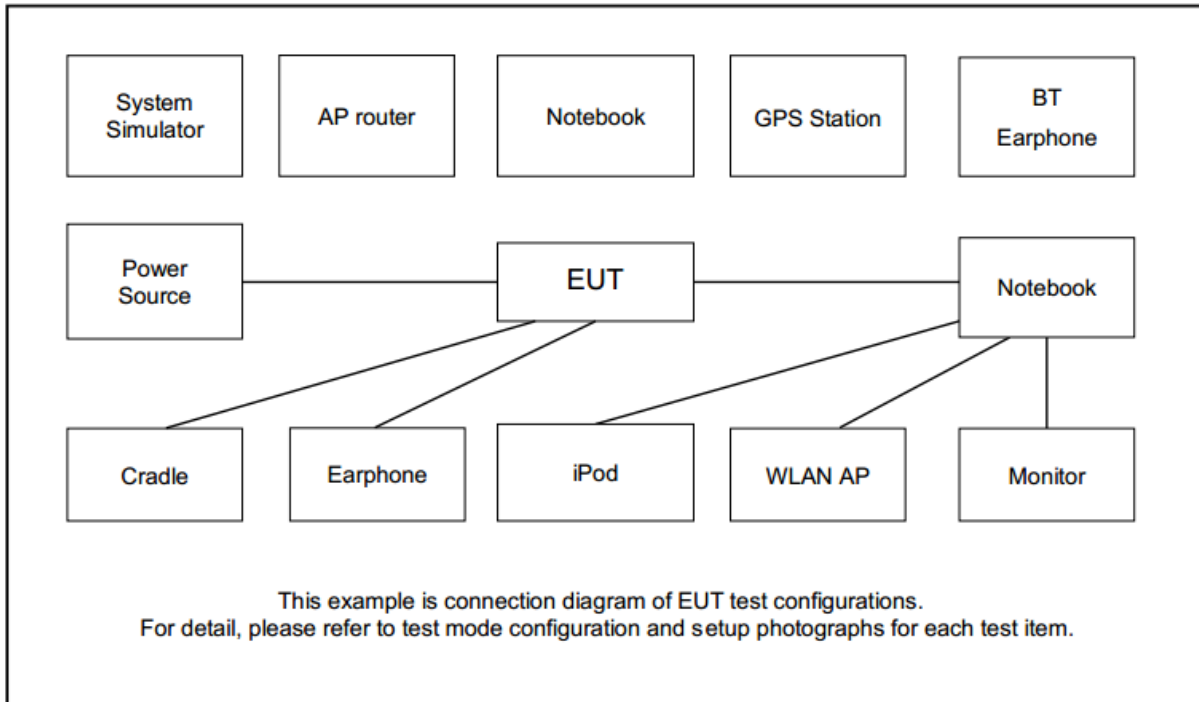
A5.3. Test Setup



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	Lenovo	81DE	FCC DoC	N/A	AC I/P : Unshielded, 1.2m DC O/P : Shielded, 1.8m
DC Power Supply	GWInstek	SPS-060	GEO835522	N/A	Unshielded, 1.8m

**A5.7. List of Measuring Equipment**

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Amplifier	Rohde & Schwarz	BBA100-B250 C125	101748-1	80MHz ~ 400MHz(250W)/250MHz ~ 1GHz(125W)	N/A	Nov. 27, 2024	N/A	RS (RS05-HY)
POWER AMPLIFIER	Rohde & Schwarz	BBA 150	105798	0.69GHz~3.2GHz(110W), 2.5GHz~6GHz(100W)	N/A	Nov. 27, 2024	N/A	RS (RS05-HY)
Antenna	SCHWARZBECK	STLP 9149	9149-274	0.7GHz-9GHz	N/A	Nov. 27, 2024	N/A	RS (RS05-HY)
Antenna	Rohde & Schwarz	HL046E	100167	80MHz ~ 3GHz	N/A	Nov. 27, 2024	N/A	RS (RS05-HY)
Field Sensor	A. R.	FL7006	0343231	100kHz~6GHz	Mar. 14, 2024	Nov. 27, 2024	Mar. 13, 2025	RS (RS05-HY)
Power Sensor	Rohde & Schwarz	NRP-Z91	102726	9kHz~6GHz	Aug. 21, 2024	Nov. 27, 2024	Aug. 20, 2025	RS (RS05-HY)
Power Sensor	Rohde & Schwarz	NRP-Z91	102727	9kHz~6GHz	Aug. 21, 2024	Nov. 27, 2024	Aug. 20, 2025	RS (RS05-HY)
Signal Generator	Rohde & Schwarz	SMB100A	108749	9kHz~6GHz	Oct. 23, 2024	Nov. 27, 2024	Oct. 22, 2025	RS (RS05-HY)
Software	Rohde & Schwarz	EMC32	N/A	N/A	N/A	Nov. 27, 2024	N/A	RS (RS05-HY)
Hygrometer	TECPEL	DTM-303A	TP182674	N/A	Oct. 08, 2024	Nov. 27, 2024	Oct. 07, 2025	RS (RS05-HY)
Intergrated Measurement System	Sporton	IMS	N/A	80MHz~6GHz 3V/m	Jul. 12, 2024	Nov. 27, 2024	Jul. 11, 2025	RS (RS05-HY)
CMW270 WIRELESS CONN. TESTER	Rohde & Schwarz	CMW270	102370	WiFi / Bluetooth	Sep. 06, 2024	Nov. 27, 2024	Sep. 05, 2025	RS (RS05-HY)
Base Station(Measure)	Rohde & Schwarz	CMW500	149637	GSM/GPRS/WCDMA/LTE(FDD/TDD 42~44) /IP TPUT/ Volte(Audio)	Sep. 13, 2024	Nov. 27, 2024	Sep. 12, 2025	RS (RS05-HY)

A5.8. Setup Photograph

Mode 3

Position 0°
(Remote View)



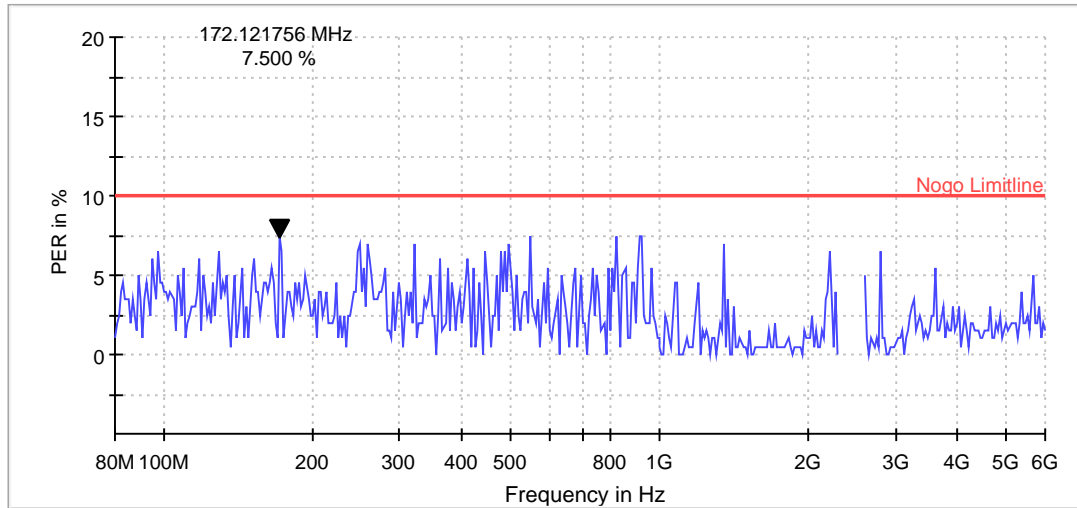
Position 180°
(Remote View)



A5.9. Test Raw Data

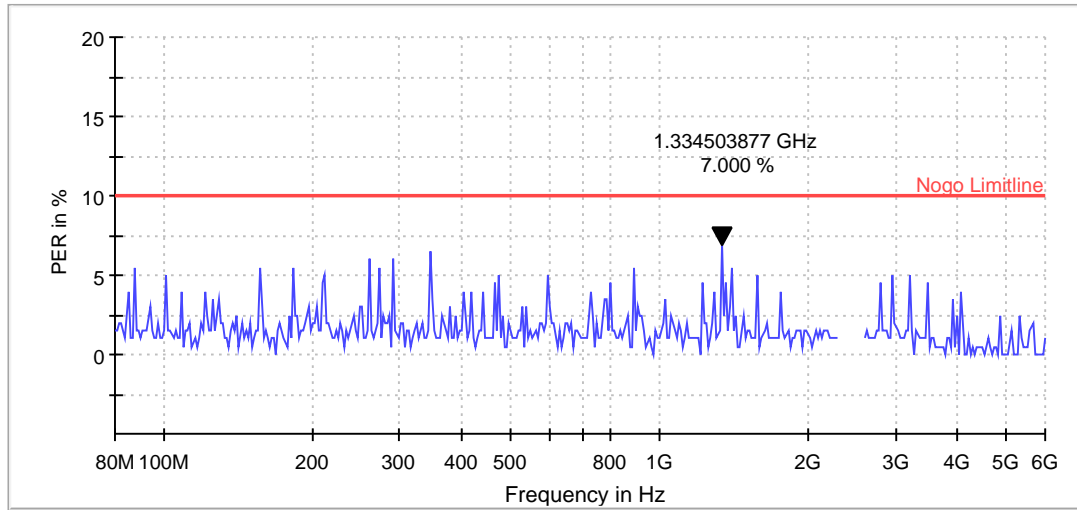
EUT Information

Report No: 491806
Test Mode: Mode3
Field strength: 3 V/m
Field Polar: Horizontal
Test position: 0



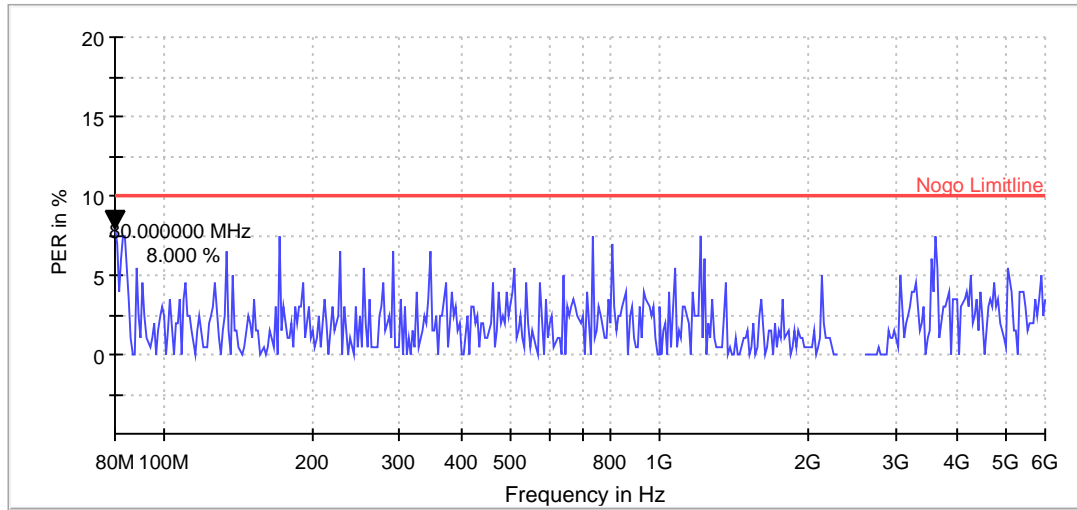
EUT Information

Report No: 491806
Test Mode: Mode3
Field strength: 3 V/m
Field Polar: Vertical
Test position: 0



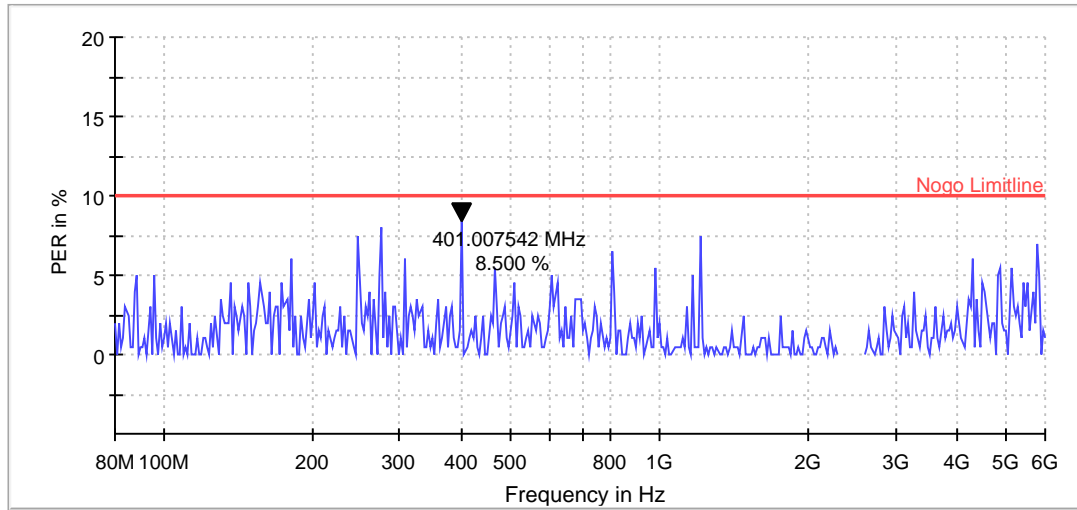
EUT Information

Report No: 491806
Test Mode: Mode3
Field strength: 3 V/m
Field Polar: Horizontal
Test position: 180



EUT Information

Report No: 491806
Test Mode: Mode3
Field strength: 3 V/m
Field Polar: Vertical
Test position: 180



A6. Test Results of ESD Test

Information of Testing Environment			
Temperature	22.5 ~ 24.4 °C	Humidity	45.3 ~ 55.9 %
Atmospheric Pressure	98kPa	ESD Generator	Noiseken
Test Site	ES05-HY	Test Engineer	HAO QUN LEE
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)		
Test Date	Nov. 28, 2024		

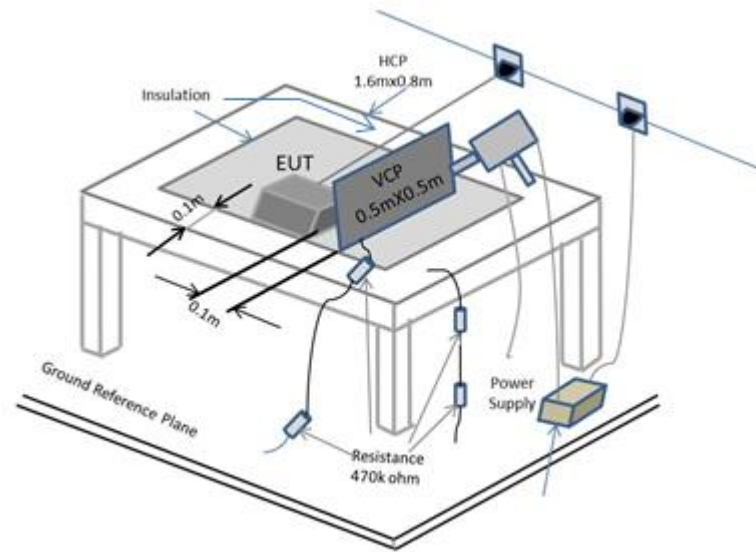
A6.1. Summary

Worst Mode	Mode 1
EUT Operated Voltage During Test	230Vac / 50Hz
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
Performance criteria (Limit)	TT/TR
Result	CT/CR, PASS

A6.2. Details of EUT Test Modes

Details of Test line Items
Electrostatic Discharge
Mode 1: LTE Band 3 Link + DC power
Mode 2: LTE Band 7 Link + DC power
Mode 3: WLAN (2.4GHz) Link + DC power
Mode 4: LTE Band 3 Link + WLAN (2.4GHz) Idle + DC power

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:

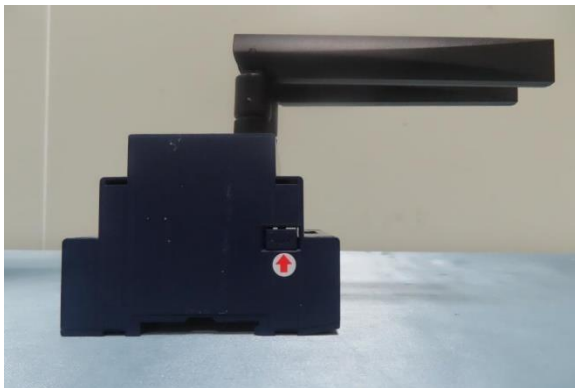
In the case of air discharges, the round discharge tip of the discharge electrode shall be approached as fast as possible (without causing mechanical damage) to touch the EUT. After each discharge, the ESD generator (discharge electrode) shall be removed from the EUT. The generator is then retriggered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

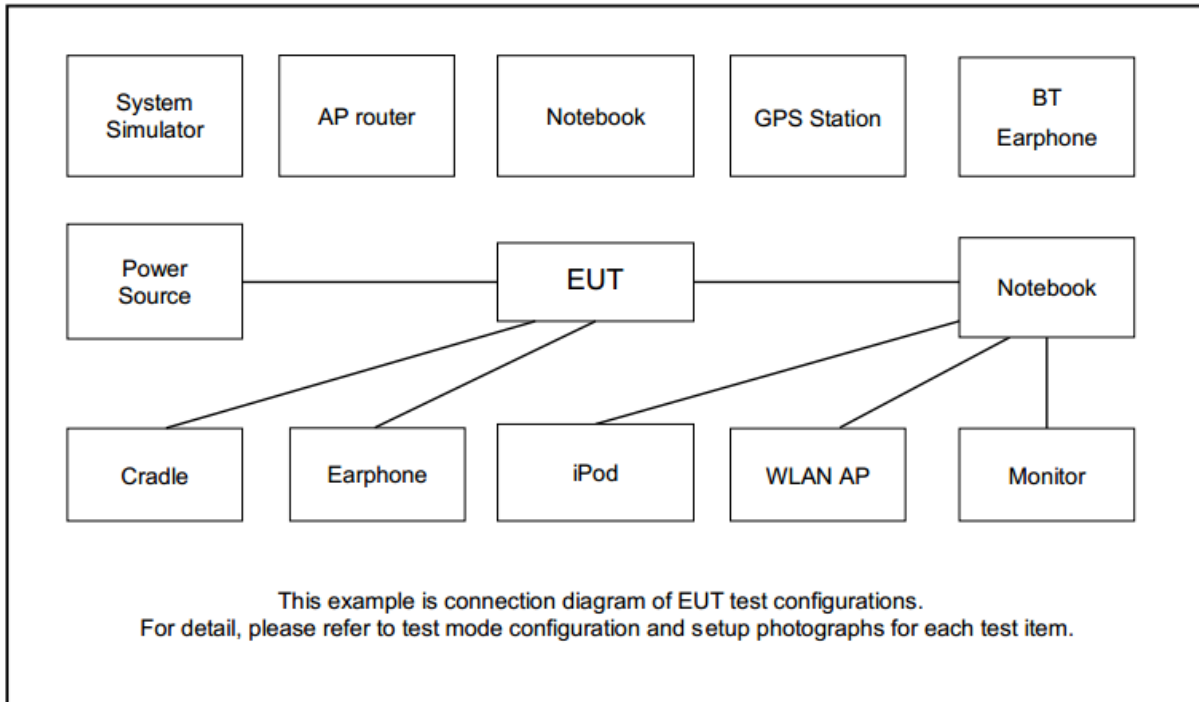
A6.5. Photos for Identification of ESD Test Points

Remark: Air Discharge refer to the red arrow on the photo, Contact Discharge refer to the blue arrow on the photo.

Mode 1~4



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	Latitude5480	FCC DoC	N/A	AC I/P : Unshielded, 1.2m DC O/P : Shielded, 1.8m
System Simulator	R&S	CMW 500	N/A	N/A	Unshielded, 1.8m
System Simulator	Anritsu	MT8821C	N/A	N/A	Unshielded, 1.8m
DC Power supply	Chroma	62024P-100-50	N/A	N/A	Unshielded, 1.8m
EMI Test Receiver	R&S	ESCI 7	N/A	N/A	Unshielded, 1.8m

A6.8. List of Measuring Equipment

Instrument	Brand Name	Model Name	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
ESD Simulator	NoiseKen	ESS-B3011	ESS12X44 59	±2 kV ~ ±30 kV	Dec. 19, 2023	Nov. 28, 2024	Dec. 18, 2024	ESD (ES05-HY)
Hygrometer	Testo	608-H1	34913904	N/A	Aug. 09, 2024	Nov. 28, 2024	Aug. 08, 2025	ESD (ES05-HY)
Anti-Static Dust Removal Brush	VORTEX	914	N/A	N/A	N/A	Nov. 28, 2024	N/A	ESD (ES05-HY)

A6.9. Setup Photograph

Mode 1~4



————THE END————