



CE EMC TEST REPORT

Equipment : WiFi and Bluetooth Module
Brand Name : Texas Instruments
Model Name : WL18MODGI
Marketing Name : WL18x7MOD WiLink™ 8 Dual-Band Industrial Module –
Wi-Fi®, Bluetooth®, and Bluetooth Low Energy (LE)
Applicant : Texas Instruments Incorporated
12500 TI BLVD., Dallas Texas, 75243
Manufacturer : Texas Instruments Incorporated
12500 TI BLVD., Dallas Texas, 75243
Standard : ETSI EN 301 489-1 V2.2.3, ETSI EN 301 489-1 V2.1.1, ETSI
EN 301489-17 V3.1.1 (2017-02)

The product was received on Jul. 28, 2020. 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 301489-17 V3.1.1 (2017-02); and shown compliance with the applicable technical standards.

The test results in this variant report apply exclusively to the tested model / sample. Without written approval of 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, Taiwan (R.O.C.)



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History of this test report

Report No.	Version	Description	Issue Date
EW741330-06	01	Initial issue of report	Sep. 02, 2020

Declaration of Conformity:

1. The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
2. After assessing, the difference between the basic standard which was listed in the standard for customer requirement above and the product standard 301489-17 which was reference of 301489-1 V2.1.1 will not affect the test results.
3. EN301489-17 refer to EN301489-1 V2.1.1 by regulatory, due the customer's request and EN301489-1 V2.2.3 does not affect the test results, EN301489-17 refer to EN301489-1 V2.2.3.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Dara Chiu

Report Producer: Vivian Hsu

1. General Description

1.1 Product Feature of Equipment Under Test

Bluetooth, Wi-Fi 2.4GHz 802.11b/g/n and Wi-Fi 5GHz 802.11a/n

Antenna information					
	Brand	Antenna Type	Model	2.4GHz ~2.5GHz Gain	4.9GHz ~5.8GHz Gain
1	Ethertronics	PCB	1000423	-0.6dBi	4.5dBi
2	LSR	Rubber Whip / Dipole	001-0012	2dBi	2dBi
3			080-0013	2dBi	2dBi
4			080-0014	2dBi	2dBi
5		PIFA	001-0016	2.5dBi	3dBi
6			001-0021	2.5dBi	3dBi
7		Laird	PCB	CAF94504	2dBi
8	CAF94505			2dBi	4dBi
9	Pulse	CHIP	W3006	3.2dBi	4.2dBi
10	TDK	CHIP	ANT016008	2.4dBi	3.96dBi

Remark: This is a variant report by updating standard. Since the test result is not affected by the changes, all the test cases were performed on original report which can be referred to Sporton Report Number EH741330 as appendix A.

1.2 Modification of EUT

No modifications are made to the EUT during all test items.



Appendix A. Original Report

Please refer to Sporton report number EH741330 as below.



CE EMC Test Report

APPLICANT : Texas Instruments Incorporated
EQUIPMENT : WiFi and Bluetooth Module
BRAND NAME : Texas Instruments
MODEL NAME : WL18MODGI
MARKETING NAME : WL18x7MOD WiLink™ 8 Dual-Band Industrial Module –
Wi-Fi®, Bluetooth®, and Bluetooth Low Energy (LE)
STANDARD : ETSI EN 301 489-1 V2.1.1 (2017-02)
ETSI EN 301 489-17 V3.1.1 (2017-02)
TEST DATE(S) : Jun. 20, 2017 ~ Jun. 21, 2017

The measurement shown in this variant report is tested in accordance with the test procedures given in ETSI EN 301 489-1 V2.1.1 (2017-02) and ETSI EN 301 489-17 V3.1.1 (2017-02).

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Louis Wu

Reviewed by: Louis Wu / Manager

Jones Tsai

Approved by: Jones Tsai / Manager



SPORTON INTERNATIONAL INC.

No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan R.O.C.



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APPENDIX A. ORIGINAL REPORT



REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
EH741330	Rev. 01	Initial issue of report	Aug, 11, 2017



SUMMARY OF TEST RESULT

CLAUSE (EN301489-1)	TEST ITEMS	TEST STANDARD	RESULT (PASS/FAIL)	REMARK
EMC Emission Measurements				
8.2	Radiated Emission	EN 55032:2015/ AC: 2016 Class B	Not Required	-
8.3 / 8.4 / 8.7	Conducted Emission	EN 55032:2015/ AC: 2016 Class B	Not Required	-
8.5	Harmonic Current Emissions	EN 61000-3-2:2014 Class A	Not Required	-
8.6	Voltage Fluctuations and Flicker	EN 61000-3-3:2013	Not Required	-
EMC Immunity Tests				
9.2	RF Electromagnetic Field	EN 61000-4-3:2006+A1:2008+A2: 2010	PASS	-
9.3	Electrostatic Discharge	EN 61000-4-2:2009	Not Required	-
9.4	Fast Transients, Common Mode	EN 61000-4-4:2012	Not Required	-
9.5	Radio frequency, Common Mode	EN 61000-4-6:2009	Not Required	-
9.6	Transients and Surges in the vehicular environment	ISO 7637-2:2011	Not Required	-
9.7	Voltage Dips and Interruptions	EN 61000-4-11:2004	Not Required	-
9.8	Surges	EN 61000-4-5:2006	Not Required	-
Note: Not required means after assessing, test items are not necessary to carry out.				



APPLIED STANDARDS

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

- **ETSI EN 301 489-1 V2.1.1 (2017-02)**
- **ETSI EN 301 489-17 V3.1.1 (2017-02)**

Below are basic standards version used for all test items in this report.

Immunity Test Items	Basic Standard Version used in this report	Remark
RF Electromagnetic Field	EN 61000-4-3:2006+A1:2008+A2: 2010	-



1. General Description of Equipment under Test

1.1 Applicant

Texas Instruments Incorporated
12500 TI BLVD., Dallas Texas, 75243

1.2 Manufacturer

Texas Instruments Incorporated
12500 TI BLVD., Dallas Texas, 75243

1.3 Product Feature of Equipment Under Test

1.3.1 Specification of the Equipment Under Test

The Equipment Under Test (hereafter called: EUT) is a Wi-Fi and Bluetooth Module supporting, WLAN 802.11 b/g/n, 802.11 a/n, and Bluetooth features as below:

General Information of Equipment Under Test	
Equipment	Wi-Fi and Bluetooth Module
Brand Name	Texas Instruments
Model Name	WL18MODGI
Test Grade	07, 37
Wi-Fi Specification	802.11 b/g/n (HT20) 802.11 a/n (HT20/HT40)
Bluetooth Version	BR, EDR, LE v4.2
Power Supply	From test jig

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

1.3.2 Antenna Details

Bluetooth, Wi-Fi 2.4GHz 802.11b/g/n and Wi-Fi 5GHz 802.11a/n

Antenna information					
	Brand	Antenna Type	Model	2.4GHz ~2.5GHz Gain	4.9GHz ~5.8GHz Gain
1	Ethertronics	PCB	1000423	-0.6dBi	4.5dBi
2	LSR	Rubber Whip / Dipole	001-0012	2dBi	2dBi
3			080-0013	2dBi	2dBi
4			080-0014	2dBi	2dBi
5		PIFA	001-0016	2.5dBi	3dBi
6			001-0021	2.5dBi	3dBi
7		Laird	PCB	CAF94504	2dBi
8	CAF94505			2dBi	4dBi
9	Pulse	CHIP	W3006	3.2dBi	4.2dBi
10	TDK	CHIP	ANT016008	2.4dBi	3.96dBi

Remark:

1. This is a variant report by updating test standards to RED. All the test cases were performed on original report which can be referred to Sporton Report Number EH4O0971 as appendix A. Based on the original report, the test cases was verified.
2. The EUT used a dual band CHIP antenna (Brand: Pulse)

1.4 Modification of EUT

No modifications are made to the EUT during all test items.

2. Test Configuration of Equipment under Test

2.1 Details of EUT Test Modes

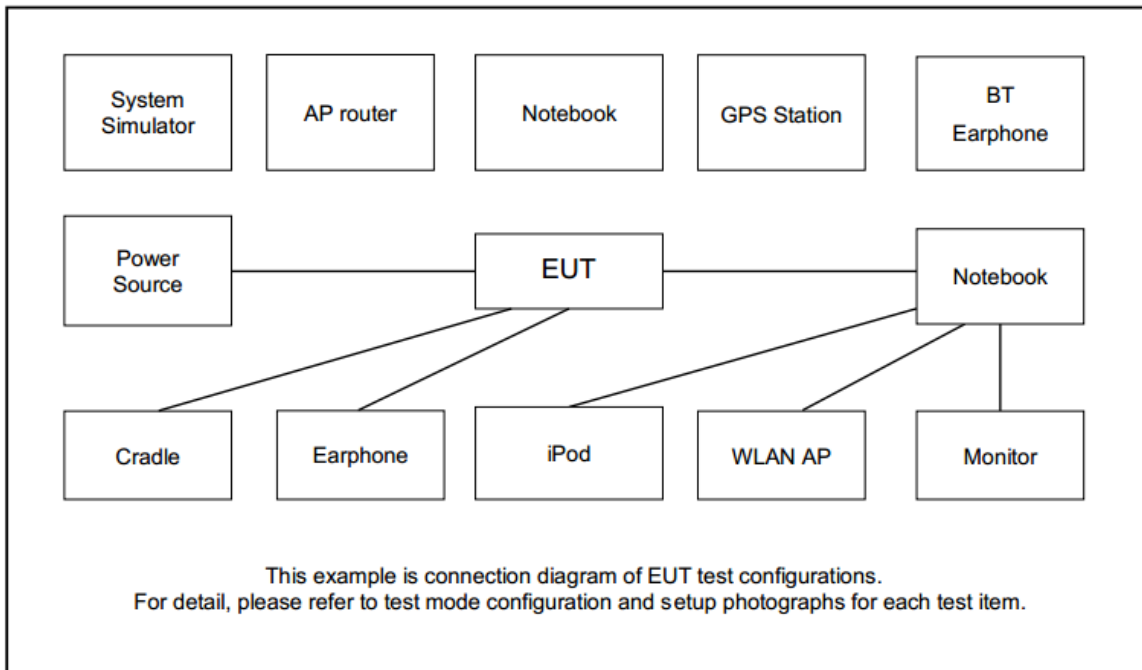
Details of Test line Items	
Radio Frequency Electromagnetic Field (Refer to EN301 489-1 Section 9.2)	
Mode 1	: WLAN (2.4GHz) Link + Fixture
Mode 2	: WLAN (5GHz) Link + Fixture
Mode 3	: Bluetooth Link + Fixture

Worst mode of all test items listed in section 2.1

Test items	Worst mode
Radio Frequency Electromagnetic Field	1

Remark: Only data of worst mode (if test item has) was reported in test result.

2.2 Connection Diagram of Test System



2.3 Supported Unit Used in Test Configuration and System

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Bluetooth Base Station	R&S	CBT32	N/A	N/A	Unshielded, 1.8 m
2.	WLAN AP	ASUS	RT-AC66U	MSQ-RTAC66U	N/A	Unshielded, 1.8 m
3.	Notebook	Lenovo	TP00034A	FCC DoC/ Contains FCC ID: QDS-BRCM1058	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
4.	Fixture (WLAN)	TI	N/A	N/A	N/A	N/A
5.	Fixture (Bluetooth)	TI	N/A	N/A	N/A	N/A

2.4 EUT Operation Test Setup

The EUT was set in below conditions during EMS testing.

WLAN

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

Bluetooth (include Bluetooth Data Link and Bluetooth Headset)

1. Link with supported unit via Bluetooth radio function.
2. Monitor the status of connection by checking the Bluetooth link performance without radio link drop.
3. Execute "Music Player" to play MP3 file.

2.5 Summary of Environment Condition, Test Date and Test Engineer for all Test Items

Test items	Ambient Temperature (°C)	Relative Humidity (%)	Atmospheric Pressure (kPa)	Test Date	Test Engineer
Radio frequency electromagnetic field (RS)	21~22	51~52	98	Jun. 20, 2017 ~ Jun. 21, 2017	Lewis Ho Jimmy Chang



3. Test Conditions of 301489 Series Standards

3.1 Special Conditions of Applied Standards for EUT

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

3.1.1 Emission

EN301 489-17

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

3.1.2 Immunity

EN301489-17

No special conditions are relevant for products covered in the present document.

3.2 RF Exclusion Band of Radio Equipment

3.2.1 EN301489-1

3.2.1.1 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.

3.2.1.2 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.

3.2.2 EN301489-17

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.

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.

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

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 -270MHz, i.e. 5 455MHz;
- As the immunity requirements have an upper frequency range of 6GHz and any upper edge exclusion band would be greater than this for the 5.8GHz band. The above frequency shall also be regarded as the upper end of the test range.

Note: These receiver exclusion band ranges align with the relevant blocking test ranges.

4. Immunity Tests

4.1 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 5.1.1, includes two parts:

1. Subsection 5.1.1.1 : 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. Subsection 5.1.1.2 : tables of immunity test level specified in EN301489 series standards and immunity test level specified by manufacturer.

If immunity test level specified by manufacturer are higher/stronger than level specified in EN301489 series standards, they will be also record in this table. Therefore anyone could distinguish requirements specified by standard or manufacturer from these tables.

In subsection 5.1.2, 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.

4.1.1 Test Limit

4.1.1.1 Information of supported ports of EUT, accessory, cable record where EUT intended to use in.

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 type="checkbox"/>	Input DC power port
<input type="checkbox"/>	Telecommunication port

As per above information, corresponded test limit (including test level, test frequency range, pulse type, test duration...etc. requirements) specified in below table 1~4 have been selected to carry out test in this report.

4.1.1.2 Tables of Immunity Test Level Specified in EN301489 series standards and Immunity Test Level Specified by Manufacturer

When immunity test level specified by manufacturer are higher (stronger) than level specified in EN301489 series standards, they will be also record in this table. But if manufacturer doesn't specify immunity test level, "N/A" is filling in table and test level of all immunity test items are following requirements of EN301489 series standards.

Table 1 - Enclosure Port

Test item	Immunity test level specified in EN301489-1	Immunity test level specified by manufacturer
Electrostatic discharge (ESD)	± 2 kV, ± 4 kV contact	N/A
	± 2 kV, ± 4 kV, ± 8 kV air	N/A
Radio frequency electromagnetic field (RS)	3 V/m	N/A
	Frequency range : 80 MHz – 6 GHz	N/A
	Modulation: 80 % AM at 1 kHz	N/A

Remark: After assessing, only RS test is carrying out.

Table 2 – Input AC Power Port (not necessary performed on EUT of this report)

Test Item	Immunity test level specified in EN301489-1	Immunity Test level specified by manufacturer
Fast transients, common mode (EFT)	± 1 kV 5 kHz repetition frequency	N/A
Surges Line-to-line	± 0,5 kV, ± 1 kV	N/A
Surges Line-to-ground	± 0,5 kV, ± 1 kV, ± 2 kV	N/A
Radio frequency, common mode (CS)	3 Vrms	N/A
	Frequency range: 0,15 MHz – 80 MHz	N/A
	Modulation: 80 % AM at 1 kHz	N/A
Voltage dips	0 % residual; 0,5 cycle , 50Hz Phase At 0°, 45°, 90°, 135°, 180°, 225°, 270° and 315°	N/A
	0 % residual; 1 cycle , 50Hz Phase At 0°, 45°, 90°, 135°, 180°, 225°, 270° and 315°	
	70 % residual; 25 cycles , 50Hz Phase At 0°, 45°, 90°, 135°, 180°, 225°, 270° and 315°	
Voltage interruptions	0 % residual; 250cycle , 50Hz	N/A

Table 3 – Input DC Power Port (not necessary performed on EUT of this report)

Test Item	Immunity test level specified in EN301489-1	Immunity Test level specified by manufacturer
Fast transients, common mode (EFT)	± 0.5 kV 5 kHz repetition frequency When cable length >3m	N/A
Radio frequency, common mode (CS)	3 Vrms When cable length >3m	N/A
	Frequency range: 0,15 MHz – 80 MHz	N/A
	Modulation: 80 % AM at 1 kHz	N/A
Transients and surges in the vehicular environment	As specified in ISO 7637-2 : Pulse type : 1, 2a, 2b, 3a, 3b, 4 Level : III	N/A

Table 4 –Telecommunication Port (not necessary performed on EUT of this report)

Test Item	Immunity test level specified in EN301489-1	Immunity Test level specified by manufacturer
Fast transients, common mode (EFT)	± 0.5 kV 5 kHz repetition frequency When cable length >3m	N/A
	± 0.5 kV 100 kHz repetition frequency for xDSL When cable length >3m	N/A
Surges Line-to-ground	± 0.5 kV for indoor cable When cable length >30m	N/A
	± 1 kV for outdoor cable	N/A
Radio frequency, common mode (CS)	3 Vrms When cable length >3m	N/A
	Frequency range: 0,15 MHz – 80 MHz	N/A
	Modulation: 80 % AM at 1 kHz	N/A

4.1.2 Required Performance Criteria of EUT per EN301489 series standards

Criteria	Performance criteria
CT/CR	<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.
TT/TR	<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>

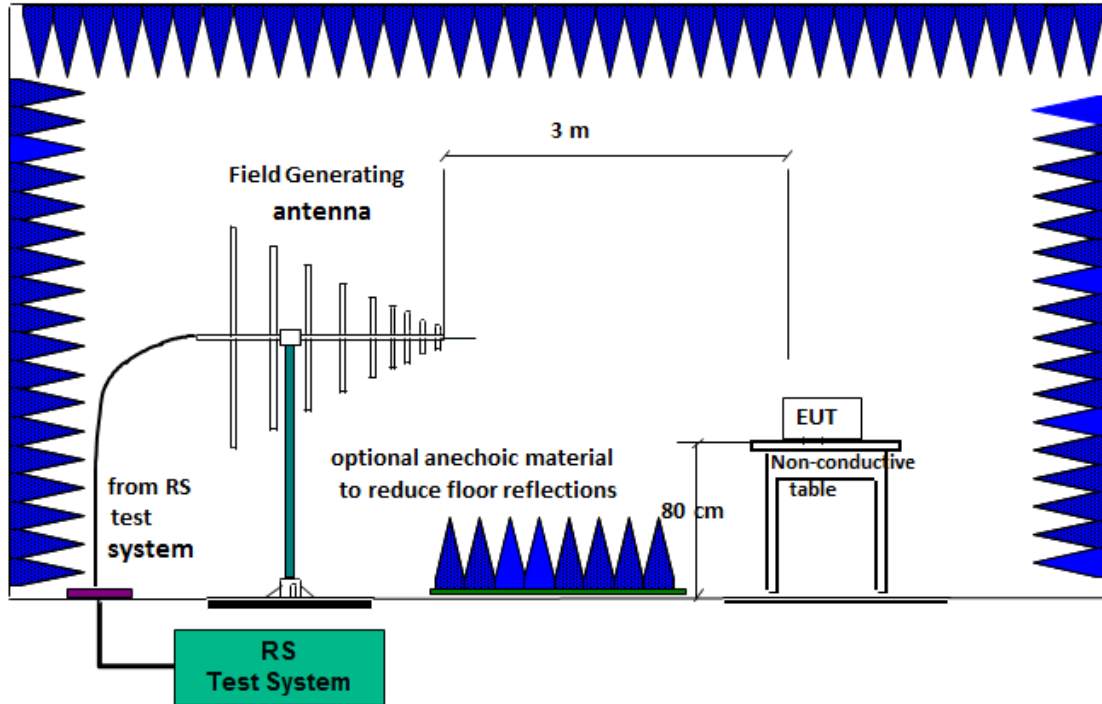
- Performance requirements table of 301489-17

CLAUSE 6.2 of EN301489-17		
Criteria	During test	After test
A	Shall operate as intended. May show degradation of performance (see note 1). Shall be no loss of function. Shall be no unintentional transmissions.	Shall operate as intended. Shall be no degradation of performance (see note 2). Shall be no loss of function. Shall be no loss of stored data or user programmable functions.
B	May show loss of function (one or more). May show degradation of performance (see note 1). No unintentional transmissions.	Functions shall be self-recoverable. Shall operate as intended after recovering. Shall be no degradation of performance (see note 2). Shall be no loss of stored data or user programmable functions.
C	May be loss of function (one or more).	Functions shall be recoverable by the operator. Shall operate as intended after recovering. Shall be no degradation of performance (see note 2).
<p>NOTE 1:</p> <p>Degradation of performance during the test is understood as a degradation to a level not below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance.</p> <p>If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.</p> <p>NOTE 2:</p> <p>No degradation of performance after the test is understood as no degradation below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. After the test no change of actual operating data or user retrievable data is allowed.</p> <p>If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.</p>		

CLAUSE 6.3 to 6.6 of EN301489-17	
Criteria	Performance criteria
CT	<p>The performance criteria A shall apply.</p> <p>Tests shall be repeated with the EUT in standby mode (if applicable) to ensure that unintentional transmission does not occur. In systems using acknowledgement signals, it is recognized that an ACKnowledgement (ACK) or Not ACKnowledgement (NACK) transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.</p>
CR	<p>The performance criteria A shall apply.</p> <p>Where the EUT is a transceiver, under no circumstances, shall the transmitter operate unintentionally during the test. In systems using acknowledgement signals, it is recognized that an ACK or NACK transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.</p>
TT	<p>The performance criteria B shall apply, except for voltage dips of 100 ms and voltage interruptions of 5 000 ms duration, for which performance criteria C shall apply.</p> <p>Tests shall be repeated with the EUT in standby mode (if applicable) to ensure that unintentional transmission does not occur. In systems using acknowledgement signals, it is recognized that an acknowledgement (ACK) or not-acknowledgement (NACK) transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.</p>
TR	<p>The performance criteria B shall apply, except for voltage dips of 100 ms and voltage interruptions of 5 000 ms duration for which performance criteria C shall apply.</p> <p>Where the EUT is a transceiver, under no circumstances, shall the transmitter operate unintentionally during the test. In systems using acknowledgement signals, it is recognized that an ACK or NACK transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.</p>

4.2 Radio frequency electromagnetic field (RS) Test (Refer to EN301 489-1 Section 9.2)

4.2.1 Test Setup



4.2.2 Test Instrument Setting

Frequency Step Size	1% increment
Modulation	80% AM (1kHz)
Dwell Time	3 seconds
Tested Antenna Height	1.55m

4.2.3 Test Procedures

The antenna is placed 3m away from the equipment. The required field strength is pre-calibrated and complies with the uniform field area requirement lay down in the IEC/EN 61000-4-3.

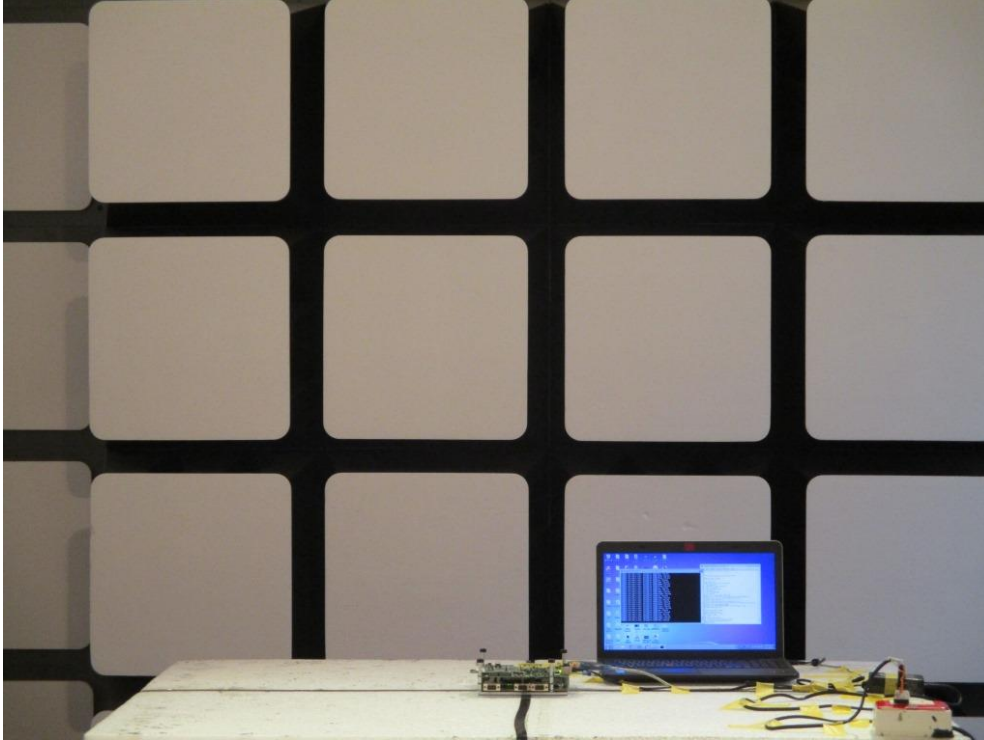


4.2.4 Test Result

Test Standard	EN 61000-4-3:2006+A1:2008+A2:2010
Product Standard	EN 301 489-1, EN 301 489-17
EUT operated voltage during test	230Vac, 50Hz
Test Frequency Range	80 MHz ~ 6 GHz
Test Level	3 V/m
Polarity	Horizontal and Vertical
Azimuth	0°, 180°
Required Performance Criteria	CT/CR
Performance Criteria of EUT	CT/CR
Test Result	PASS

4.2.5 Setup Photographs

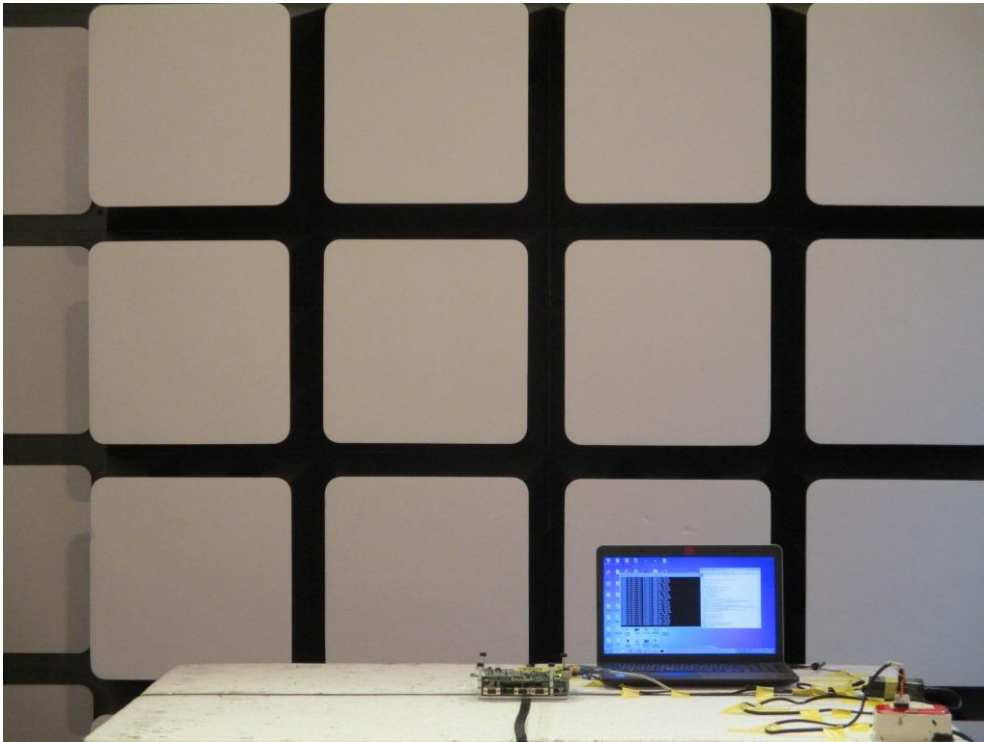
**Mode 1
Position 0°**



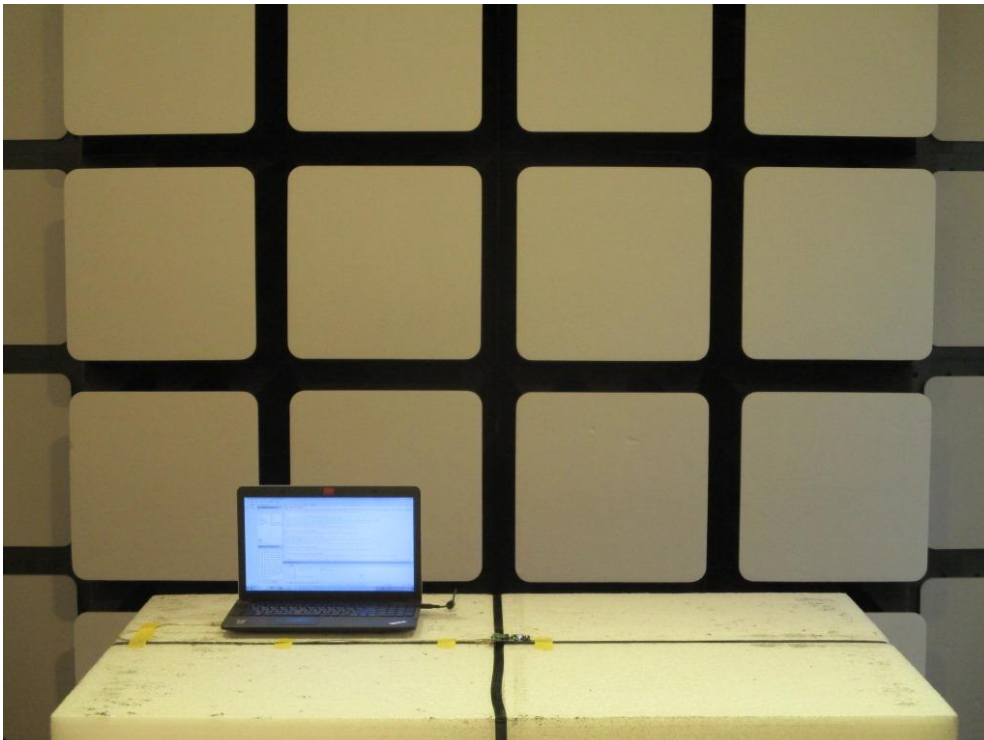
Position 180°



Mode 2



Mode 3





5. Measurement Uncertainty

Uncertainty of Radiated Susceptibility Measurement (80 MHz ~ 6000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$)	5.66
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6. Testing Facility

Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd Rd., Kwei-Shan District, Tao Yuan City, Taiwan R.O.C. TEL: +886-3-327-0868 FAX: +886-3-327-0855
Test Site No.	Sporton Site No. : RS05-HY

7. List of Measuring Equipment

<EMS>

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Antenna	Rohde & Schwarz	HL046E	100167	80MHz ~ 3GHz	N/A	Jun. 20, 2017 ~ Jun. 21, 2017	N/A	RS (RS05-HY)
Antenna	SCHWARZBECK MESS-ELEKT RONIK	STLP 9149	9149-274	0.7GHz ~ 9GHz	N/A	Jun. 20, 2017 ~ Jun. 21, 2017	N/A	RS (RS05-HY)
Amplifier	Rohde & Schwarz	BBA100-B25 0C125	101748-1	80MHz ~ 400MHz(250W) 250MHz ~ 1GHz(125W)	Calibration by system	Jun. 20, 2017 ~ Jun. 21, 2017	Calibration by system	RS (RS05-HY)
Amplifier	A. R.	100S1G6	0348138	1GHz ~ 6GHz(100W)	Calibration by system	Jun. 20, 2017 ~ Jun. 21, 2017	Calibration by system	RS (RS05-HY)
Power Sensor	Rohde & Schwarz	NRP-Z91	102724	9kHz~6GHz	Oct. 03, 2016	Jun. 20, 2017 ~ Jun. 21, 2017	Oct. 02, 2017	RS (RS05-HY)
Power Sensor	Rohde & Schwarz	NRP-Z91	102725	9kHz~6GHz	Oct. 03, 2016	Jun. 20, 2017 ~ Jun. 21, 2017	Oct. 02, 2017	RS (RS05-HY)
Signal Generator	Rohde & Schwarz	SMB 100A	108749	9kHz~6GHz	Oct. 04, 2016	Jun. 20, 2017 ~ Jun. 21, 2017	Oct. 03, 2017	RS (RS05-HY)
Field Sensor	A. R.	FL7006	0343231	100kHz~6GHz	Aug. 09, 2016	Jun. 20, 2017 ~ Jun. 21, 2017	Aug. 08, 2017	RS (RS05-HY)



Appendix A. Original Report

Please refer to Sporton report number EH4O0971 as below.



CE EMC Test Report

APPLICANT : Texas Instruments Incorporated
EQUIPMENT : WiFi and Bluetooth Module
BRAND NAME : Texas Instruments
MODEL NAME : WL18MODGI
STANDARD : ETSI EN 301 489-1 V1.9.2 (2011-09)
ETSI EN 301 489-17 V2.2.1 (2012-09)
TEST DATE(S) : Nov. 17, 2014 ~ Dec. 15, 2014

The measurements shown in this test report were made in accordance with the procedures given in ETSI EN 301 489-1 V1.9.2 (2011-09) and ETSI EN 301 489-17 V2.2.1 (2012-09).

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Louis Wu

Reviewed by: Louis Wu / Manager

Jones Tsai

Approved by: Jones Tsai / Manager



SPORTON INTERNATIONAL INC.

No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.

SPORTON INTERNATIONAL INC.

TEL : 886-3-327-3456

FAX : 886-3-328-4978

Page Number : 1 of 27

Report Issued Date : Jan. 12, 2015

Report Version : Rev. 01

Report Template No.: BU5-EW489 Version 1.0



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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
EH4O0971	Rev. 01	Initial issue of report	Jan. 12, 2015

SUMMARY OF TEST RESULT

CLAUSE (EN 301 489-1)	TEST ITEMS	TEST STANDARD	RESULT (PASS/FAIL)	REMARK
EMC Emission Measurements				
8.2	Radiated Emission	EN 55022:2010/AC:2011 Class B	Not Required	Please see the Note
8.3 / 8.4	Conducted Emission	EN 55022:2010/AC:2011 Class B	Not Required	Please see the Note
8.5	Harmonic Current Emissions	EN 61000-3-2:2006/A1:2009 and EN 61000-3-2:2006/A2:2009	Not Required	Please see the Note
8.6	Voltage Fluctuations and Flicker	EN 61000-3-3:2008	Not Required	Please see the Note
EMC Immunity Tests				
9.2	RF Electromagnetic Field	EN 61000-4-3:2006+A1:2008+A 2:2010	PASS	-
9.3	Electrostatic Discharge	EN 61000-4-2:2009	PASS	Only indirect discharge, HCP/VCP, are performed, because the EUT is module.
9.4	Fast Transients, Common Mode	EN 61000-4-4:2004+A1:2010	Not Required	Please see the Note
9.5	Radio frequency, Common Mode	EN 61000-4-6:2009	Not Required	Please see the Note
9.6	Transients and Surges in the vehicular environment	ISO 7637-2:2004	Not Required	Please see the Note
9.7	Voltage Dips and Interruptions	EN 61000-4-11:2004	Not Required	Please see the Note
9.8	Surges	EN 61000-4-5:2006	Not Required	Please see the Note

Note:

1. Testing was performed on EUT installed/operated in the test jig , only the applicable test cases for EUT were performed and reported.
2. The EN55022:2010/AC:2011 displaces the EN 55022:2006/A1:2007 which is listed as a normative reference standard in the clause 2.1 of EN301 489 -1 V1.9.2, and there is no test requirement for this EUT, because the changes do not impact between two versions.



1. General Description of Equipment under Test

1.1 Applicant

Texas Instruments Incorporated
12500 TI Boulevard, M/S 8751, Dallas, TX 75243, USA

1.2 Manufacturer

Jorjin Technologies Inc
17F, No. 239, Sec. 1, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan

1.3 Feature of Equipment under Test

The Equipment Under Test (hereafter called: EUT) is module supporting, Wi-Fi 2.4GHz 802.11b/g/n, Wi-Fi 5GHz 802.11a/n, and Bluetooth, and below is details of information.

General Information of Equipment Under Test	
Equipment	WiFi and Bluetooth Module
Brand Name	Texas Instruments
Model Name	WL18MODGI
Wi-Fi Specification	802.11a/b/g/n (HT20/HT40)
Bluetooth Version	v3.0 + EDR / v4.0 LE
Power Supply	from AC power supply

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

1.4 Details of Tested Sample (EUT) Information

Product Specification subjective to this Test Standard	
Transmitter Frequency Range	WLAN 802.11b/g/n: 2400 MHz ~ 2483.5 MHz WLAN 802.11a/n: 5150 MHz ~ 5250 MHz; 5250 MHz ~ 5350 MHz; 5470 MHz ~ 5725 MHz; Bluetooth: 2402 MHz ~ 2480 MHz
Receiver Frequency Range	WLAN 802.11b/g/n: 2400 MHz ~ 2483.5 MHz WLAN 802.11a/n: 5150 MHz ~ 5250 MHz; 5250 MHz ~ 5350 MHz; 5470 MHz ~ 5725 MHz; Bluetooth: 2402 MHz ~ 2480 MHz
Type of Modulation	Bluetooth : GFSK, $\pi/4$ -DQPSK, 8-DPSK WLAN 802.11b : DSSS (DBPSK / DQPSK / CCK) WLAN 802.11a/g/n : OFDM (BPSK / QPSK / 16QAM / 64QAM)
H/W	WG7837-T0B
EUT Stage	Identical Prototype

Antenna Information			
Antenna Type	Brand	2.4GHz~2.5GHz	4.9GHz~5.8GHz
PCB	Ethertronics	-0.6	4.5
Dipole	LSR	2	2
PCB	Laird	2	4
Chip	Pulse	3.2	4.2
PIFA	LSR	2	3
Chip	TDK	2.4	3.96

Remark: The EUT was used Chip Antenna in the WLAN (2.4GHz) test and PCB (Etheronics) Antenna in the WLAN (5GHz) test.

1.5 Modification of EUT

No modifications are made to the EUT during all test items.

1.6 Testing Facility

Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No. 52, Hwa Ya 1 st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL: +886-3-327-3456 FAX: +886-3-328-4978
Test Site No.	Sporton Site No. : ES04-HY ; RS02-HY
Test Condition	Test Voltage : DC power from test jig (AC 230V / 50Hz) Test Distance : 3 m for radio frequency electromagnetic field immunity Test Frequency : Immunity to radiated electromagnetic fields: 80 MHz ~ 1000MHz and 1400MHz~2700MHz

1.7 Applied Standards

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

- **ETSI EN 301 489-1 V1.9.2 (2011-09)**
- **ETSI EN 301 489-17 V2.2.1 (2012-09)**

EMS Test :

- **EN 61000-4-2:2009 (ESD)**
- **EN 61000-4-3:2006+A1:2008+A2:2010 (RS)**

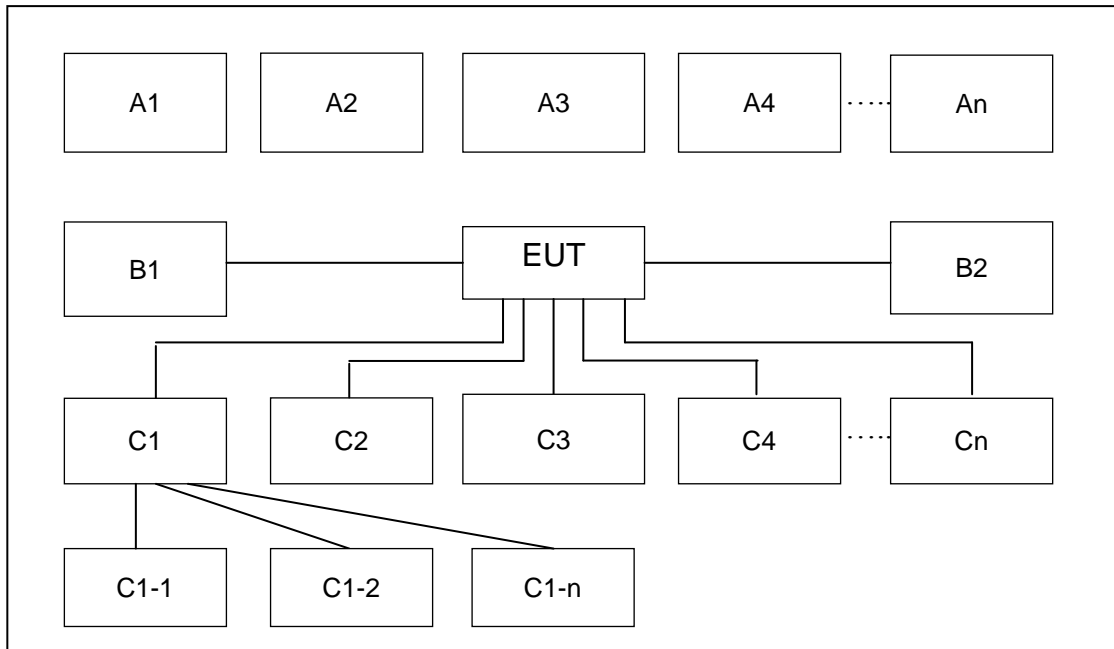
Note: All test items were verified and recorded according to the standards and without any deviation during the tests.

2. Test Configuration of Equipment under Test

2.1 Details of EUT Test Modes

Details of Test line Items	
Radio frequency electromagnetic field (Refer to EN301 489-1 Section 9.2)	
Mode 1	: WLAN (2.4GHz) Link + Bluetooth Link + Adapter
Mode 2	: WLAN (5GHz) Link + Bluetooth Link + Adapter
Electrostatic discharge (Refer to EN301 489-1 Section 9.3)	
Mode 1	: WLAN (2.4GHz) Link + Bluetooth Link + Adapter
Mode 2	: WLAN (5GHz) Link + Bluetooth Link + Adapter

2.2 Connection Diagram of Test System



RS Test Setup									
No.	Wireless Station	Connection Type	Test Mode						
			1	2	-	-	-	-	-
A1	Bluetooth Speaker	Bluetooth	X	X					
A2	Notebook	WiFi	X	X					
No.	Setup Peripherals	Connection Type	1	2	-	-	-	-	-
C1	Fixture	module I/O interface without Cable	X	X					
C1-1	SD Card	SD I/O interface without Cable	X	X					
C1-2	AC : 230V/50Hz	AC Power Cable	X	X					

ESD Test Setup									
No.	Wireless Station	Connection Type	Test Mode						
			1	2	-	-	-	-	-
A1	Bluetooth Speakers	Bluetooth	X	X					
A2	WLAN AP	WiFi	X	X					
A3	Notebook	WiFi	X	X					
No.	Setup Peripherals	Connection Type	1	2	-	-	-	-	-
C1	Fixture	module I/O interface without Cable	X	X					
C1-1	SD Card	SD I/O interface without Cable	X	X					
C1-2	AC : 230V/50Hz	AC Power Cable	X	X					

2.3 Supported Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	WLAN AP	D-Link	DIR-628	KA2DIR628A2	N/A	Unshielded, 1.8 m
2.	WLAN AP	D-Link	DIR-815	KA2DIR815A1	N/A	Unshielded, 1.8 m
3.	Notebook	DELL	P15G	WLAN Module FCC ID: PD962205ANHU	N/A	AC I/P: Unshielded, 1.2 m DC O/P:
4.	Notebook	Acer	MS2347	HLZ-BRCM1053	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
5.	Bluetooth Speaker	mi	MDZ-03-AC	FCC DoC	N/A	N/A
6.	SD Card	SanDick	MicroSD HC	FCC DoC	N/A	N/A
7.	SD Card	Transcend	SD	FCC DoC	N/A	N/A
8.	Fixture	N/A	N/A	N/A	N/A	Unshielded, 1.2 m
9.	Evaluation board	N/A	WG1300BE00	N/A	N/A	N/A

2.4 EUT Operation Test Setup

The EUT was set in below conditions during EMS testing. Power ports shall further be classified as DC power.

Before testing, the EUT is fed power from test jig and perform a functionality check as follows, and if abnormal function is found, the situation is recorded in test report,

WLAN

1. EUT is fed power from test jig, and enable WLAN function of the EUT.
2. EUT links with supported units, Wireless AP and another Laptop.
3. Execute "PING IP" function under the "cmd" of Window system to transfer packet bi-directionally between the EUT and supported units, Wireless AP and Laptop.
4. Monitor the packet loss and WLAN radio performance between EUT and notebook by seeing the window of "cmd" the Laptop display.

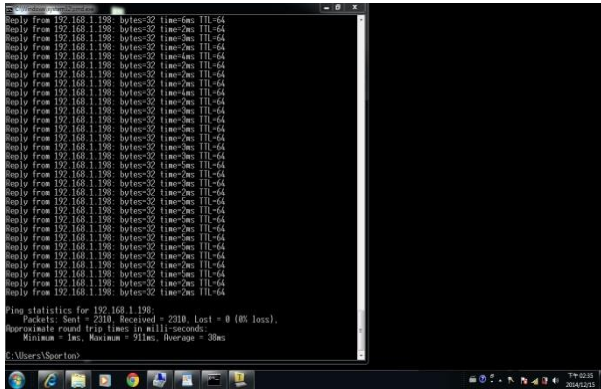
Bluetooth

1. EUT is fed power from test jig, and enable Bluetooth function of the EUT.
2. EUT Link with supported unit, Bluetooth Speaker via Bluetooth radio function.
3. Let EUT catch the Bluetooth device.
4. Monitor the status of connection by checking the Bluetooth link performance.

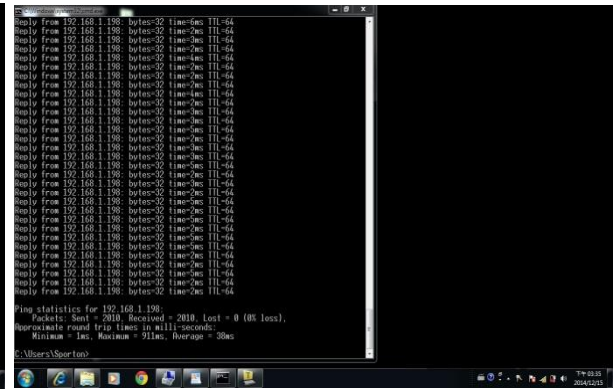
Before testing, during and after, the EUT performance criteria are under being monitored and the section 2.5 Performance Criteria of EUT is used for judgment.

```
Type : Source
Address : ADE9DB08CE45
MTU : 895
Frequency: 44100
Channels : 2
Flags : 0
AADM>
AADM: Remote Control Connected.
Address: ADE9DB08CE45
AADM>31 1
Unable to issue User Confirmation Authentication R
in progress.
Function Error.
AADM>
Remote Device Properties Changed.
```

Monitor the Bluetooth function



Monitor the WLAN (2.4GHz) packet lost (0%)



Monitor the WLAN (5GHz) packet lost (0%)

2.5 Performance Criteria of EUT

Criteria	Performance criteria
CT/CR	<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. In some cases this permissible performance level may be replaced by a permissible loss of performance.</p> <p>During the test the EUT shall not unintentionally transmit or change its actual operating state.</p> <p>The performance criteria of functions of EUT are described as below :</p> <ul style="list-style-type: none"> ♦ The EUT shall operate as its intended operating condition during and after the test. ♦ Bluetooth : The EUT shall show no loss of user control functions and the continuous transmitting shall be maintained during and after the test. ♦ WLAN : The EUT shall show no loss of user control functions and the continuous transmitting shall be maintained during and after the test.
TT/TR	<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. In some cases this permissible performance level may be replaced by a permissible loss of performance.</p> <p>During the EMC exposure to an electromagnetic phenomenon, a degradation of performance is, however, allowed. No change of the actual mode of operation (e.g. unintended transmission) or stored data is allowed.</p>

**<Performance Table>
<EN301 489-17>**

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

NOTE 1:

Degradation of performance during the test is understood as a degradation to a level not below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance.

If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.

NOTE 2:

No degradation of performance after the test is understood as no degradation below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. After the test no change of actual operating data or user retrievable data is allowed.

If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.

CLAUSE 6.3 to 6.6 of EN301489-17	
Criteria	Performance criteria
CT	<p>The performance criteria A shall apply.</p> <p>Tests shall be repeated with the EUT in standby mode (if applicable) to ensure that unintentional transmission does not occur. In systems using acknowledgement signals, it is recognized that an ACKnowledgement (ACK) or Not ACKnowledgement (NACK) transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.</p>
CR	<p>The performance criteria A shall apply.</p> <p>Where the EUT is a transceiver, under no circumstances, shall the transmitter operate unintentionally during the test. In systems using acknowledgement signals, it is recognized that an ACK or NACK transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.</p>
TT	<p>The performance criteria B shall apply, except for voltage dips of 100 ms and voltage interruptions of 5 000 ms duration, for which performance criteria C shall apply.</p> <p>Tests shall be repeated with the EUT in standby mode (if applicable) to ensure that unintentional transmission does not occur. In systems using acknowledgement signals, it is recognized that an acknowledgement (ACK) or not-acknowledgement (NACK) transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.</p>
TR	<p>The performance criteria B shall apply, except for voltage dips of 100 ms and voltage interruptions of 5 000 ms duration for which performance criteria C shall apply.</p> <p>Where the EUT is a transceiver, under no circumstances, shall the transmitter operate unintentionally during the test. In systems using acknowledgement signals, it is recognized that an ACK or NACK transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.</p>



3. Test Conditions of 301489 Series Standards

3.1 Special Conditions of Applied Standards for EUT

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

3.1.1 Immunity

EN301489-17

No special conditions are relevant for products covered in the present document.

3.2 Exclusion Band

3.2.1 301489-17

lower limit of exclusion band = lowest allocated band edge frequency -5 %;

upper limit of exclusion band = highest allocated band edge frequency +5 %.

4. Immunity Tests

4.1 Radio Frequency Electromagnetic Field Immunity Test (RS) (Refer to EN301 489-1 Section 9.2)

4.1.1 Limit of Radio Frequency Electromagnetic Field Test (RS)

Most electronic equipment is in some manner affected by electromagnetic radiation. RF immunity test entails the equipment under test to a uniform field of radiated electromagnetic energy of a specified electromagnetic field strength, and at the same time, monitoring the functionality of the device as the frequency is swept over specified frequency range. This test assesses the ability of the EUT to operate as intended in the presence of a radio frequency electromagnetic field disturbance.

The preferential range of test field strength levels for the RS test is given in following levels:
80 MHz ~ 1 GHz: 3V/m; 1.4 GHz ~ 2.7 GHz: 3V/m.

RF signal was modulated by a 1 kHz sine wave with a modulation depth of 80%.

Dwell time : 3 seconds ; Step size : 1 %

Required performance criterion is CT/CR (Continuous Phenomena for Transmitter / Receiver).

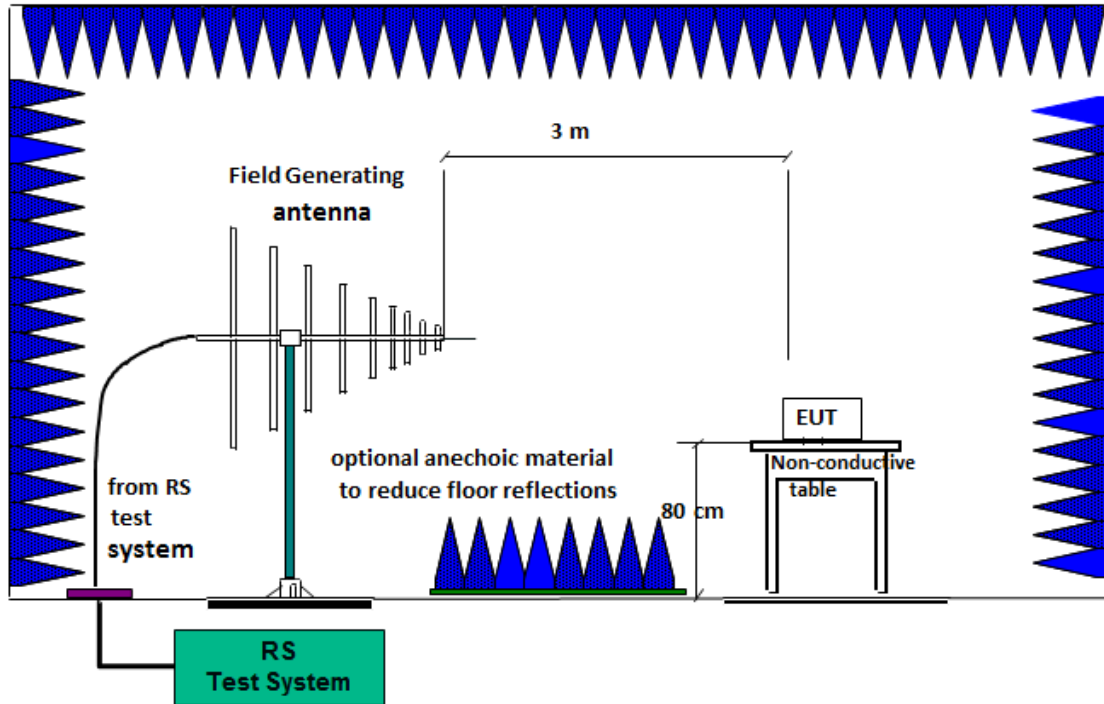
4.1.2 Measuring Instruments

The measuring equipment is listed in the section 6 of this test report.

4.1.3 Test Procedures

- a. The antenna which is enabling the complete frequency range of 80-1000 MHz and 1400-2700 MHz is placed 3m away from the equipment. The required field strength is determined by placing the field strength meter(s) on top of or directly alongside the equipment under test and monitoring the field strength meter via a remote field strength indicator outside the enclosure while adjusting the continuous-wave to the antenna.
- b. The test is performed with the antenna facing the front and back sides of the EUT with or without the headset. Both vertical and horizontal polarizations from antenna are tested.
- c. At each of the above conditions, the frequency range is swept at 80-1000 MHz and 1400-2700MHz. 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.

4.1.4 Test Setup



NOTE: The SPORTON 7m x 4m x 4m semi-anechoic chamber is in compliance with the sixteen point uniform field requirement as stated in IEC 61000-4-3 Section 6.2.

The procedure defined in this part requires the generation of electromagnetic fields within which the test sample is placed and its operation observed. To generate fields that are useful for simulation of actual (field) conditions may require significant antenna drive power and the resultant high field strength levels. To comply with local regulations and to prevent biological hazards to the testing personnel, it is recommended that these tests be carried out in a shielded enclosure or semi-anechoic chamber.

4.1.5 Test Severity Levels

Frequency Band: 80-1000 MHz and 1400-2700 MHz.

Level	Test field strength (V/m)
1	1
2	3
3	10
X	Specified

Remark: "X" is an open class.



4.1.6 Test Result

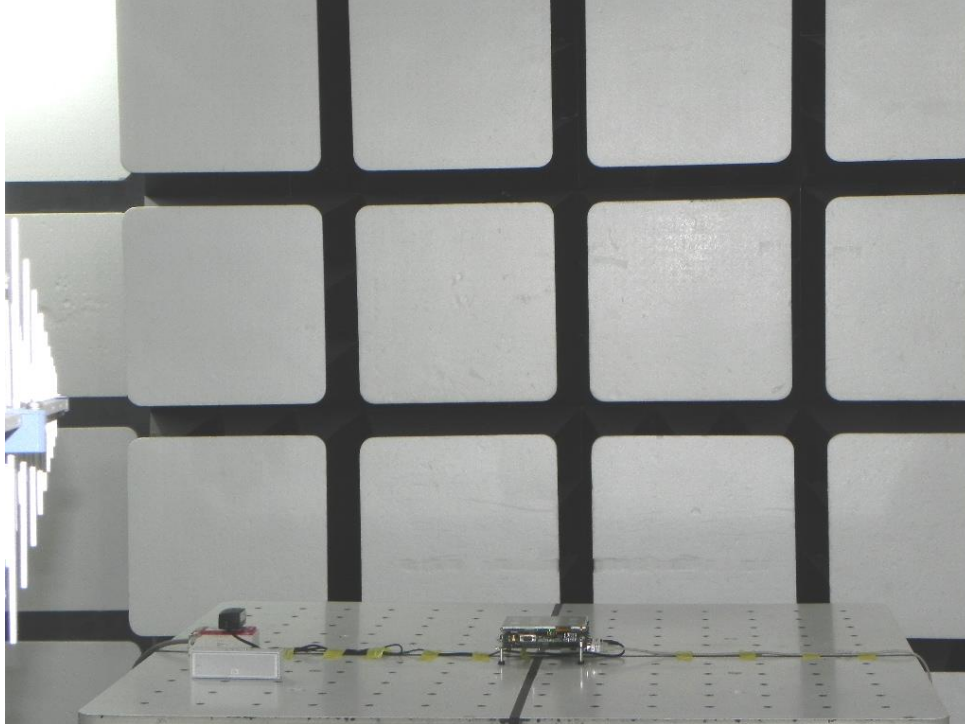
Test Standard	EN 61000-4-3:2006+A1:2008+A2:2010
Product Standard	EN 301 489-3, EN 301 489-17
Required Performance Criteria	CT/CR
EUT Performance	CT/CR
Frequency Range	80-1000 MHz, 1400-2700 MHz
Field Strength	3 V/m (Modulated 1KHz, 80% AM) - Level 2
Ambient Temperature	23~25°C
Relative Humidity	50~54%
Test Date	Dec. 12, 2014 ~ Dec. 15, 2014
Test Engineer	Andy Yang
Test Result	PASS

Remark:

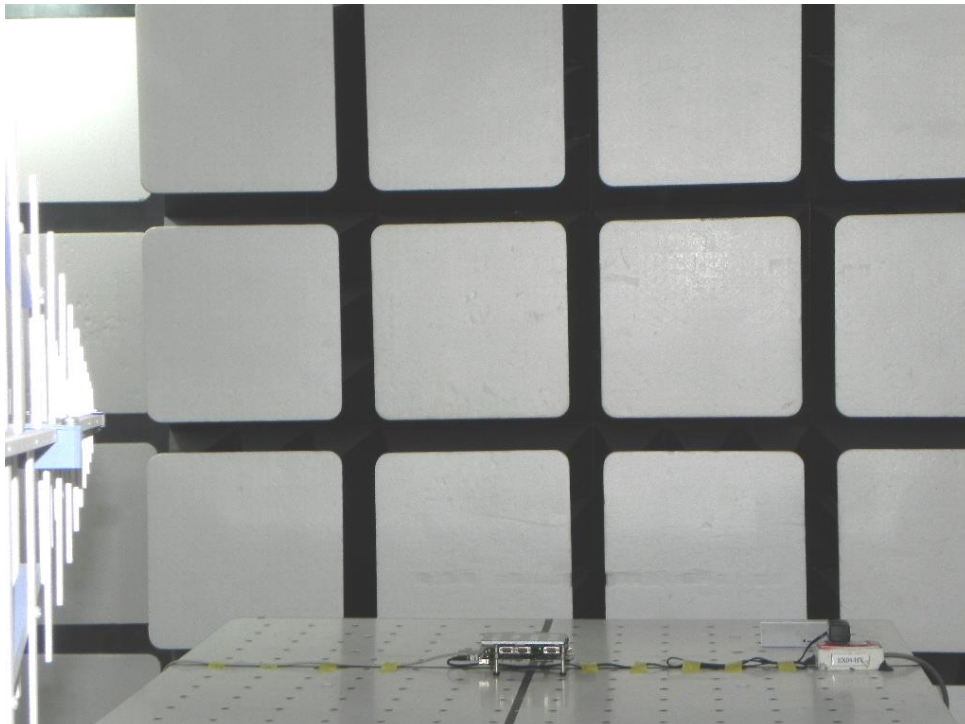
1. There is no unintentional operation during this test.
2. When the EUT was placed on the table, the all sides of EUT have almost the same separation distance away from field generation antenna. The right (90°) and left (270°) sides are under the same field strength while the EUT was tested at front (0°) and back (180°) side. Therefore, we only tested at front and back sides of EUT for RS testing.

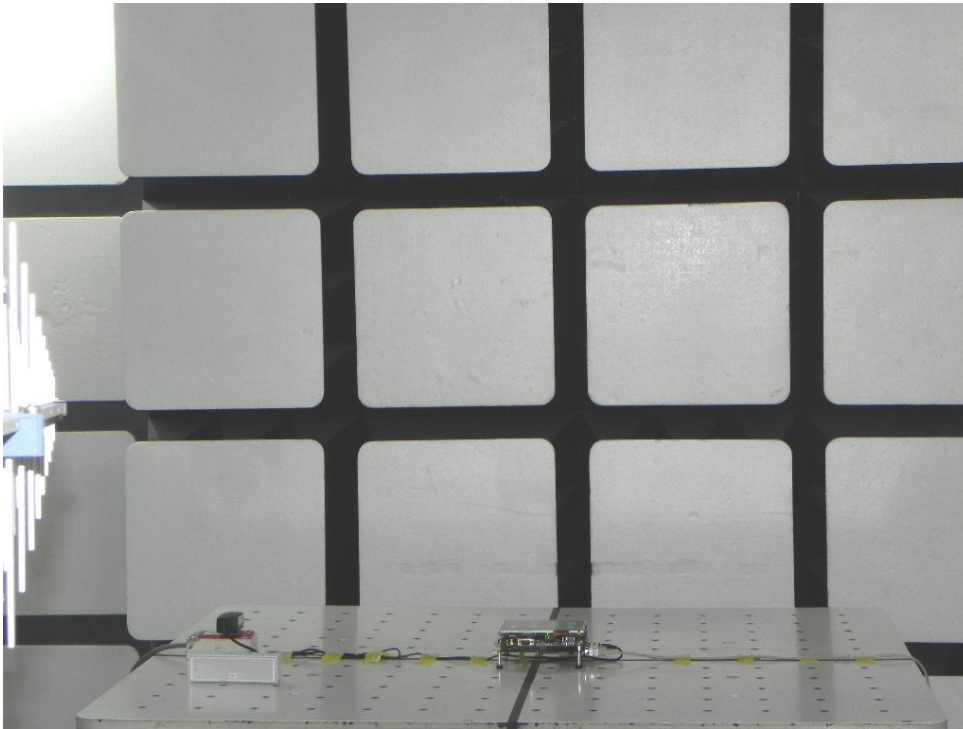
4.1.7 Setup Photographs

**Mode 1
Position 0°**



Position 180°



Mode 2

4.2 Electrostatic Discharge Test (ESD) (Refer to EN301 489-1 Section 9.3)

This test is applicable for radio equipment and associated ancillary equipment. This test shall be performed on a representative configuration of the radio equipment, the associated ancillary equipment, or a representative configuration of the combination of radio and ancillary equipment.

4.2.1 Limit of Electrostatic Discharge Test

This test assesses the ability of the EUT to operate as intended in the event of an electrostatic discharge. Air discharges and contact charges are estimated to enclosure of EUT on all connectors and conducting surfaces. The minimum number of discharges applied is depending on the EUT; for products with synchronized circuits the number of discharges should be larger.

Contact Discharges to the conductive surfaces and to coupling planes:

The test shall be performed with single discharges. On each pre-selected point at least 10 single discharges (in the most sensitive polarity) shall be applied. At least 10 single discharges (in the most sensitive polarity) shall be applied at the front edge of each HCP opposite the centre point of each unit (if applicable) of the EUT and 0,1 m from the front of the EUT. The long axis of the discharge electrode shall be in the plane of the HCP and perpendicular to its front edge during the discharge. At least 10 single discharges (in the most sensitive polarity) shall be applied to the centre of one vertical edge of the coupling plane. The coupling plane, of dimensions 0,5 m × 0,5 m, is placed parallel to, and positioned at a distance of 0,1 m from, the EUT.

Air Discharge at seam between apertures and insulation surfaces:

On those parts of the EUT where it is not possible to perform contact discharge testing, the equipment should be investigated to identify user accessible points where breakdown may occur. This investigation should be restricted to those areas normally handled by the user. A minimum of 10 single air discharges of each polarity and test level shall be applied to the selected test point for each area.

The preferential range of test levels for the ESD test is given in following levels:

Contact discharge test voltage ± 4 kV; Air discharge test voltage ± 8 kV.

Required performance criterion is the criteria TT/TR (Transient Phenomena for Transmitter / Receiver).

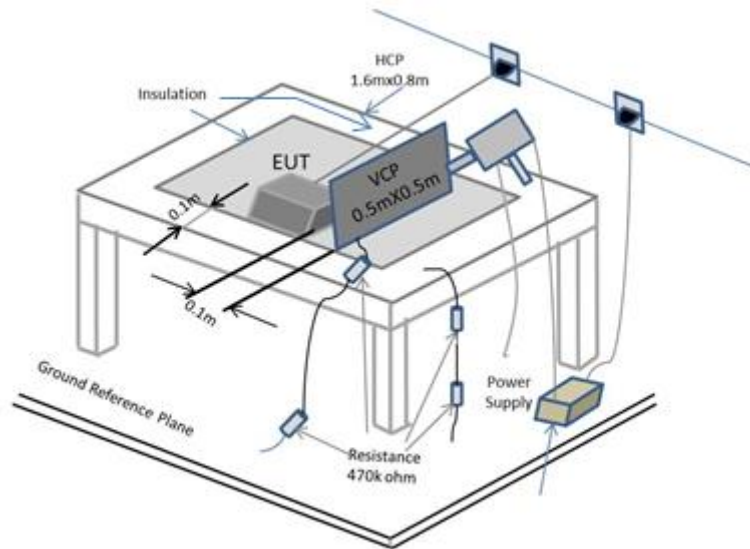
4.2.2 Measuring Instruments

The measuring equipment is listed in the section 6 of this test report.

4.2.3 Test Procedure

- a. In the case of air discharge testing, the climatic conditions shall be within the following ranges:
 - ambient temperature: 15°C to 35°C;
 - relative humidity : 30% to 60%;
 - atmospheric pressure : 86 kPa (860 mbar) to 106 kPa (1060 mbar)
- b. Test programs and software shall be chosen so as to exercise all normal modes of operation of the EUT. The use of special exercising software is encouraged, but permitted only where it can be shown that the EUT is being comprehensively exercised.
- c. In the case of contact discharges, the tip of the discharge electrode shall touch the EUT before the discharge switch is operated.
- d. 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.
- e. 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.
- f. The test voltage shall be increased from the minimum to the selected test severity level, in order to determine any threshold of failure. The final test level should not exceed the product specification value in order to avoid damage to the equipment.
- g. The test shall be performed with both air discharge and contact discharge. According to the CE severity level on pre-selected points, at least 10 single discharges (in the most sensitive polarity) shall be applied on air discharge and at least 10 single discharges (in the most sensitive polarity) shall be applied on contact discharge. For the time interval between successive single discharges, an initial value of one second is recommended. Longer intervals may be necessary to determine whether a system failure has occurred.
- h. Ensure that the applied charge on the EUT has been dis-charged before next ESD pulse.

4.2.4 Test Setup



The test setup consists of the discharge generator, EUT and auxiliary instrument necessary to perform DIRECT and INDIRECT application of discharges to the EUT, in the following manner:

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

A ground reference plane was provided on the floor of the test site. It was a metallic sheet (copper or aluminum) of 0.25 mm, minimum thickness; other metallic may be used but they shall have at least 0.65 mm thickness. In SPORTON, we provided 1 mm thickness aluminum ground reference plane or 1 mm thickness stainless steel ground reference plane. The minimum size of the ground reference plane is 1 m x 1 m, the exact size depending on the dimensions of the EUT. It was connected to the protective grounding system.

The EUT was arranged and connected according to its functional requirements. A distance of 1m minimum was provided between the EUT and the wall of the lab and 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.

Where the EUT is installed on a metal table, the table was connected to the reference plane via a cable with a 470k ohm resistor located at each end, to prevent a build-up of charge. The test setup consisted a wooden table, 0.8m high, standing on the ground reference plane. A HCP, 1.6 m x 0.8 m, was placed on the table. The EUT and cables was isolated from the HCP by an insulating support 0.5 mm thick. The VCP size is 0.5 m x 0.5 m.

4.2.5 Test Severity Levels

Level	Test Voltage (kV) of Air Discharge	Test Voltage (kV) of Contact discharge
1	±2	±2
2	±4	±4
3	±8	±6
4	±15	±8
X	Specified	Specified

Remark: "X" is an open level.

4.2.6 Test Equipment Settings

Indirect Application of The Discharge		
Test Type	Test Severity Level	Tested No.
Vertical Coupling Plane (VCP)	±2 / ±4 kV	BY 10
Horizontal Coupling Plane (HCP)	±2 / ±4 kV	BY 10

4.2.7 Test Result

Test Standard	EN 61000-4-2:2009
Product Standard	EN 301 489-3, EN 301 489-17
Required Performance Criteria	TT/TR
EUT Performance	CT/CR
Tested Voltage	±2 / ±4 kV for contact discharge - Level 2
Ambient Temperature	21~24°C
Relative Humidity	47~52%
Atmospheric Pressure	98kPa
Test Date	Nov. 17, 2014 ~ Nov. 21, 2014
Test Engineer	Ziv Huang
Test Result	PASS

Remark: Refer to following photo pages for test points.

4.2.8 Setup Photographs

Mode 1~2





5. Uncertainty Measurement

Uncertainty of Radiated Susceptibility Measurement (80 MHz ~ 1 GHz and 1.4GHz ~ 2.7GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y))	2.56
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Uncertainty of Electrostatic Discharge Measurement

	Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y)) %
Electrostatic Discharge ~ Rise Time	8.50%
Electrostatic Discharge ~ Peak Current	6.00%
Electrostatic Discharge ~ 30ns Current	6.00%
Electrostatic Discharge ~ 60ns Current	6.00%



6. List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Probe	ETS-LINDGRE N	HI-6005	00052473	0.1MHz ~ 5GHz	Feb. 05, 2014	Dec. 12, 2014 ~ Dec. 15, 2014	Feb. 04, 2015	RS (RS02-HY)
Signal Generator	R&S	SML-03	100383	9kHz ~ 3.3 GHz	Aug. 25, 2014	Dec. 12, 2014 ~ Dec. 15, 2014	Aug. 24, 2015	RS (RS02-HY)
Power Meter	Rohde & Schwarz	NRVD	102003	N/A	Feb. 19, 2014	Dec. 12, 2014 ~ Dec. 15, 2014	Feb. 18, 2015	RS (RS02-HY)
Power Sensor	R&S	URV5-Z2	100356	N/A	Feb. 19, 2014	Dec. 12, 2014 ~ Dec. 15, 2014	Feb. 18, 2015	RS (RS02-HY)
Power Sensor	R&S	URV5-Z2	100358	N/A	Feb. 19, 2014	Dec. 12, 2014 ~ Dec. 15, 2014	Feb. 18, 2015	RS (RS02-HY)
Antenna	R&S	HL562Z1	100168	30MHz ~ 3GHz	Calibrated as part of system	Dec. 12, 2014 ~ Dec. 15, 2014	Calibrated as part of system	RS (RS02-HY)
Power Amplifier	AR	60S1G3	0327591	0.8 ~ 3GHz,	Feb. 19, 2014	Dec. 12, 2014 ~ Dec. 15, 2014	Feb. 18, 2015	RS (RS02-HY)
Power Amplifier	AR	150W1200	312366	80MHz ~ 1GHz	Feb. 19, 2014	Dec. 12, 2014 ~ Dec. 15, 2014	Feb. 18, 2015	RS (RS02-HY)
ESD Simulator	TESTQ	NSG 438	877	±0.2 kV ~ 30 kV	Jan. 29, 2014	Nov. 17, 2014 ~ Nov. 21, 2014	Jan. 28, 2015	ESD (ES04-HY)
Electrostatic Voltmeter	Trek	520	N/A	0~±2kV	N/A	Nov. 17, 2014 ~ Nov. 21, 2014	N/A	ESD (ES04-HY)