R&TTE (Radio) TEST REPORT
for
Jinan USR IOT Technology Limited

WIFI Remote control device
Model No.: USR-WP1, USR-WM1s, USR-WM1h,
USR-WL1, USR-WP3, USR-HTW, USR-WIFIIO-83,
USR-WSA, USR-WSC, USR-R16

Prepared for	:	Jinan USR IOT Technology Limited
Address	:	#1-724~729, Huizhan Guoji Cheng, Gaoxin District, Jinan City, Shandong Province, 250101, China

Prepared By	:	Shenzhen Anbotek Compliance Laboratory Limited
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Report Number	:	R011408276T
Date of Test	:	Aug. 21~ Sept. 26, 2014
Date of Report	:	Sept. 28, 2014

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TEST REPORT

Applicant	:	Jinan USR IOT Technology Limited
Manufacturer	:	Jinan USR IOT Technology Limited
EUT	:	WIFI Remote control device
Model No.	:	USR-WP1, USR-WM1s, USR-WM1h, USR-WL1, USR-WP3, USR-HTW, USR-WIFIIO-83, USR-WSA, USR-WSC, USR-R16
Serial No.	:	N.A.
Trade Mark	:	USR IOT
Rating	:	AC 100-240V, 50/60Hz, 10A

Measurement Procedure Used:

ETSI EN 300 328 V1.8.1 (2012-06)

The device described above is tested by Shenzhen Anbotek Compliance Laboratory Limited to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and Shenzhen Anbotek Compliance Laboratory Limited is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the EN 300 328 requirements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of Shenzhen Anbotek Compliance Laboratory Limited.

Date of Test : Aug. 21~ Sept. 26, 2014

Prepared by : (Engineer / Rock Zeng)

Reviewer : (Project Manager/Amy Ding)

Approved & Authorized Signer : (Manager/Tom Chen)

1. GENERAL INFORMATION

1.1. Description of Device (EUT)

EUT	:	WIFI Remote control device
Model Number	:	USR-WP1, USR-WM1s, USR-WM1h, USR-WL1, USR-WP3, USR-HTW, USR-WIFIIO-83, USR-WSA, USR-WSC, USR-R16 (Note: All samples are the same except the model number and appearance, so we prepare "USR-WP1" for EMC test only.)
Test Voltage	:	AC 230V, 50Hz
Frequency	:	2412-2472MHz(802.11b/g/n)
Channels	:	802.11b, 802.11g, 802.11n,(HT20) 13 Channels 802.11n(HT40) 9 Channels
Antenna Gain	:	1.5 dBi
Applicant	:	Jinan USR IOT Technology Limited
Address	:	#1-724~729, Huizhan Guoji Cheng, Gaoxin District, Jinan City, Shandong Province, 250101, China
Manufacturer	:	Jinan USR IOT Technology Limited
Address	:	#1-724~729, Huizhan Guoji Cheng, Gaoxin District, Jinan City, Shandong Province, 250101, China
Factory	:	Jinan USR IOT Technology Limited
Address	:	#1-724~729, Huizhan Guoji Cheng, Gaoxin District, Jinan City, Shandong Province, 250101, China
Date of receipt	:	Aug. 21, 2014
Date of Test	:	Aug. 21~ Sept. 26, 2014

1.2. Auxiliary Equipment Used during Test

N/A

1.3. Description of Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

CNAS - LAB Code: L3503
Shenzhen Anbotek Compliance Laboratory Limited., Laboratory has been assessed and in compliance with CNAS/CL01: 2006 accreditation criteria for testing laboratories (identical to ISO/IEC 17025:2005 General Requirements) for the Competence of Testing Laboratories.

FCC-Registration No.: 752021
Shenzhen Anbotek Compliance Laboratory Limited, EMC Laboratory has been registed and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 752021, July 10, 2013.

IC-Registration No.: 8058A-1
Shenzhen Anbotek Compliance Laboratory Limited., EMC Laboratory has been registered and fully described in a report filed with the (IC) Industry Canada. The acceptance letter from the IC is maintained in our files. Registration 8058A, February 22, 2013.

Test Location
All Emissions tests were performed at
Shenzhen Anbotek Compliance Laboratory Limited. at 1/F., Building 1, SEC Industrial Park, No.0409 Qianhai Road, Nanshan District, Shenzhen, Guangdong, China

1.4. Measurement Uncertainty

Radiation Uncertainty	:	Ur = 4.3dB
Conduction Uncertainty	:	Uc = 3.4dB

1.5. Test Standards

ETSI EN 300 328 V1.8.1 (2012-06) Electromagnetic compatibility and Radio spectrum Matters (ERM); wideband transmission systems; Data transmission equipment operating in the 2,4GHz ISM band and using wide band modulation techniques; Harmonized EN covering essential requirements under article 3.2 of the R&TTE Directive

2. Technical Test

2.1. Summary of Test Results

No Deviations from the technical specification(s) were ascertained in the course of the tests Performed	
Final Verdict: (only “Passed” if all single measurements are “Passed”)	Passed

2.2. Test Report

Test Report Reference

List of Measurements		
Description of Test	Reference: Clause No.	Result
RF Output Power	4.3.1.1 or 4.3.2.1	Complies
Power Spectral Density	4.3.2.2	Complies
Duty Cycle, TX-Sequence, TX-gap	4.3.1.2 or 4.3.2.3	N/A Note (3)
Dwell Time, Minimum Frequency Occupation & Hopping Sequence	4.3.1.3	N/A
Hopping Frequency Separation	4.3.1.4	N/A
Medium Utilisation	4.3.1.5 or 4.3.2.4	N/A
Adaptivity	4.3.1.6 or 4.3.2.5	Complies
Occupied Channel Bandwidth	4.3.1.7 or 4.3.2.6	Complies
Transmitter Unwanted Emissions in Out-Of-Band Domain	4.3.1.8 or 4.3.2.7	Complies
Transmitter Unwanted Emissions in the Spurious Domain	4.3.1.9 or 4.3.2.8	Complies
Receiver Spurious Emissions	4.3.1.10 or 4.3.2.9	Complies
Receiver Blocking	4.3.1.11 or 4.3.2.10	N/A

Note:
(1) “N/A”: indicates test is not applicable in this Test Report.
(2) This requirement does not apply for equipment with a maximum declared RF Output power level of less than 10 dBm e.i.r.p. for equipment when operating in a mode where the RF Output power is less than 10 dBm e.i.r.p.
(3) This requirement applies to non-adaptive equipment or to adaptive equipment when operating in a non-adaptive mode.
(4) This requirement does not apply to adaptive equipment unless operating in non-adaptive mode.

2.3. Description of Test Modes

The EUT has been tested under operating condition.
Software used to control the EUT for staying in continuous transmitting and receiving mode isprogrammed.

IEEE802.11b: Channel 1(2412MHz), Channel 7(2442MHz) and Channel 13(2472MHz) with 1Mbps Worst data rate (worst case) are chosen for the final testing.
IEEE802.11g: Channel 1(2412MHz), Channel 7(2442MHz) and Channel 13(2472MHz) with 6Mbps data rate (the worst case) are chosen for the final testing.
IEEE802.11n(HT20): Channel 1(2412MHz), Channel 7(2442MHz) and Channel 13(2472MHz) with 54Mbps Worst data rate (worst case) are chosen for the final testing.
IEEE802.11n(HT40): Channe3(2422MHz), Channel 7(2442MHz) and Channel 11 (2462MHz) with 108Mbps data rate (the worst case) are chosen for the final testing.

3. RF Output Power

Applicable Standard

According to ETSI EN 300 328 §4.3.2.1, For adaptive equipment using wide band modulations other than FHSS, the maximum RF output power shall be 20dBm.
The maximum RF output power for non-adaptive equipment shall be declared by the supplier and shall not exceed 20dBm. See clause 5.3.1m). For non-adaptive equipemt using wide band modulations other than FHSS, the maximum RF output power shall be equal to or less than the value declared by the supplier.
This limit shall apply for any combination of power level and intended antenna assembly.

Test Equipment

Radiated Emission Measurement (RF)

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Spectrum Analysis	Agilent	E4407B	US39390582	Aug. 09, 2014	1 Year
2.	Preamplifier	Instruments corporation	EMC011830	980100	Aug. 09, 2014	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESPI	101604	Apr. 23, 2014	1 Year
4.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Aug. 09, 2013	3 Year
5.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Apr. 23, 2013	3 Year
6.	Pre-amplifier	SONOMA	310N	186860	Apr. 23, 2014	1 Year
7.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A

Radiation Uncertainty : Ur = 4.3dB

Test Procedure

The measurement shall be performed using normal operation of the equipment with modulation, using the test data sequence, applied. The test procedure shall be as follows:

Step 1:
using a suitable means, the output of the transmitter shall be coupled to a diode detector;
the output of the diode detector shall be connected to the vertical channel of an oscilloscope;
the combination of the diode detector and the oscilloscope shall be capable of faithfully reproducing the envelope peaks and the duty cycle of the transmitter output signal.
The observed duty cycle of the transmitter (Tx on(Tx on + Tx off)) shall be noted as x, (0<x<1) and recorded in the test report. For the purpose of testing, the equipment shall be operated with a duty cycle that is equal to or more than 0.1.

Step 2
the average output power of the transmitter shall be determined using a wideband, calibrated RF power meter with a thermocouple detector or an equivalent thereof and, where applicable, with an integration period that exceeds the repetition period of the transmitter by a factor 5 or more. The observed value shall be recorded as “A” (in dBm);
the e.i.r.p. shall be calculated from the above measured power output A, the observed duty cycle x, and the applicable antenna assembly gain “G” in dBi, according to the formula:

P = A+G+10log(1/x)
P shall not exceed the value specified for Effective radiated power.

Step 3
the measurement set up as given under step 1 shall be used to determine on the oscilloscope the peak of the envelope of the output signal of the transmitter.
The maximum deviation of the Y-trace of the oscilloscope shall be recorded as “B”;

Step 4
the transmitter shall be replaced by a signal generator. The output frequency of the signal shall be made equal to the center of the frequency range occupied by the transmitter;
the signal generator shall be unmodulated. The output power of the signal generator shall be raised to a level such that the deviation of the Y-trace of the oscilloscope reaches level B, as indicated in step 3;
this output power level “C” (in dBm) of the signal generator shall be determined using a wideband, calibrated RF power meter with a thermocouple detector or an equivalent thereof;
level C shall not exceed by more than 3 dB the value specified for effective radiated power minus the applicable antenna assembly gain G in dBi.

Test Data

Environmental Conditions

Temperature:	25 ° C
Relative Humidity:	56%
ATM Pressure:	100.9 kPa

Duty Cycle Measurement X: (Ton/Ton+Toff) =	1
Antenna Assembly Gain G:	1.5 dBi
Cable Loss C=	0.6 dB
P=A + C+G + 10 log (1/x)	

The range of temperature is tested according to the applicant's requirement.

Test Mode: IEEE 802.11 b

Test Conditions			Low Freq. (2412MHz)	Mid Freq. (2442MHz)	High Freq. (2472MHz)
Tmin(-10)℃	Vmin(207V)	Measured Power	17.23	16.95	16.63
		EIRP	19.33	19.05	18.73
	Vmax(253V)	Measured Power	17.26	16.93	16.65
		EIRP	19.36	19.03	18.75
Tnom(+25)℃	Vnom(230V)	Measured Power	17.28	16.96	16.62
		EIRP	**19.38**	19.06	18.72
Tmax(+55)℃	Vmin(207V)	Measured Power	17.24	16.91	16.60
		EIRP	19.34	19.01	18.70
	Vmax(253V)	Measured Power	17.21	16.88	16.57
		EIRP	19.31	18.98	18.67
Limit		Average Limit = 20 dBm			

Test Mode: IEEE 802.11g

Test Conditions			Low Freq. (2412MHz)	Mid Freq. (2442MHz)	High Freq. (2472MHz)
Tmin(-10)℃	Vmin(207V)	Measured Power	15.35	15.04	14.73
		EIRP	17.45	17.14	16.83
	Vmax(253V)	Measured Power	15.37	15.06	14.76
		EIRP	17.47	17.16	16.86
Tnom(+25)℃	Vnom(230V)	Measured Power	15.32	15.02	14.77
		EIRP	17.42	17.12	16.87
Tmax(+55)℃	Vmin(207V)	Measured Power	15.30	14.96	14.72
		EIRP	17.40	17.06	16.82
	Vmax(253V)	Measured Power	15.28	14.94	14.71
		EIRP	17.38	17.04	16.81
Limit		Average Limit = 20 dBm			

Test Mode: IEEE 802.11 n(HT20)

Test Conditions			Low Freq. (2412MHz)	Mid Freq. (2442MHz)	High Freq. (2472MHz)
Tmin(-10)℃	Vmin(207V)	Measured Power	14.53	14.24	13.96
		EIRP	16.63	16.34	16.06
	Vmax(253V)	Measured Power	14.54	14.27	13.94
		EIRP	16.64	16.37	16.04
Tnom(+25)℃	Vnom(230V)	Measured Power	14.56	14.25	13.90
		EIRP	16.66	16.35	16.00
Tmax(+55)℃	Vmin(207V)	Measured Power	14.52	14.20	13.88
		EIRP	16.62	16.30	15.98
	Vmax(253V)	Measured Power	14.50	14.18	13.86
		EIRP	16.60	16.28	15.96
Limit		Average Limit = 20 dBm			

Test Mode: IEEE 802.11n (HT40)

Test Conditions			Low Freq. (2422MHz)	Mid Freq. (2442MHz)	High Freq. (2462MHz)
Tmin(-10)℃	Vmin(207V)	Measured Power	13.41	13.15	12.87
		EIRP	15.51	15.25	14.97
	Vmax(253V)	Measured Power	13.43	13.14	12.86
		EIRP	15.53	15.24	14.96
Tnom(+25)℃	Vnom(230V)	Measured Power	13.46	13.12	12.82
		EIRP	15.56	15.22	14.92
Tmax(+55)℃	Vmin(207V)	Measured Power	13.42	13.10	12.79
		EIRP	15.52	15.20	14.89
	Vmax(253V)	Measured Power	13.40	13.07	12.77
		EIRP	15.50	15.17	14.87
Limit		Average Limit = 20 dBm			

4. Power Spectral Density

Applicable Standard

According to ETSI EN **300 328** §4.3.2.2, for wide band modulations other then FHSS (e.g. DSSS, OFDM, etc.), the maximum power spectrum density is limited to 10 mW per MHz.

Test Equipment

Radiated Emission Measurement (RF)

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Spectrum Analysis	Agilent	E4407B	US39390582	Aug. 09, 2014	1 Year
2.	Preamplifier	Instruments corporation	EMC011830	980100	Aug. 09, 2014	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESPI	101604	Apr. 23, 2014	1 Year
4.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Aug. 09, 2013	3 Year
5.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Apr. 23, 2013	3 Year
6.	Pre-amplifier	SONOMA	310N	186860	Apr. 23, 2014	1 Year
7.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A

Radiation Uncertainty : Ur = 4.3dB

Test Procedure

Step 1
the measurement setup shall be calibrated with a CW signal from a calibrated source; the reference signal should have a strength of 10 dBm;
the settings of the spectrum analyzer shall be:
center frequency : equal to the signal source;
resolution BW: 100kHz for FHSS, 1 MHz for DSSS;
video BW: Same;
detector mode: positive peak;
averaging: off;
span: zero Hz;
amplitude: adjust for middle of the instrument's range.

Step 2
the calibrating signal power shall be reduced to 0 dBm and it shall be verified that the power meter reading also reduces by 10 dB.

Step 3
connect the equipment to be measured. Using the following settings of the spectrum analyzer in combination with "max hold" function, find the frequency of highest power output in the power envelope;
center Frequency: equal to operating frequency;

resolution BW: 100kHz for FHSS, 1 MHz for DSSS;
video BW: same;
detector mode: positive peak;
averaging: off;
Span: 3 times the spectrum width;
Amplitude: adjust for middle of the instrument's range.
the frequency found shall be recorded in the test report.

Step 4
set the center frequency of the spectrum analyzer to the found frequency and switch to zero span. The power meter indicates the measured power density. The power density e.i.r.p. is calculated from the measured power density and the declared antenna assembly gain(s).

Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	53 %
ATM Pressure:	100.9 kPa

Test Mode: Transmitting
Test Result: PASS
Test dates see the following pages

Test mode	Transmitting frequency	Measured (dBm/ MHz)	Limit (dBm/ MHz)	Test Result
802.11b	2412	-8.12	10	Pass
	2442	-7.52	10	Pass
	2472	-7.01	10	Pass
802.11g	2412	-6.64	10	Pass
	2442	-5.46	10	Pass
	2472	-4.52	10	Pass
802.11n(HT20)	2412	-4.11	10	Pass
	2442	-3.69	10	Pass
	2472	-3.87	10	Pass
802.11n(HT40)	2422	-6.03	10	Pass
	2442	-6.37	10	Pass
	2462	-6.81	10	Pass

5. Adaptivity

Applicable Standard

This requirement does not apply to non-adaptive equipment or adaptive equipment operating in a non-adaptive mode providing the equipment complies with the requirements and/or restrictions applicable to non-adaptive equipment.
In addition, this requirement does not apply for equipment with a maximum declared RF Output power level of less than 10 dBm e.i.r.p. or for equipment when operating in a mode where the RF Output power is less than 10 dBm e.i.r.p.
Adaptive equipment using modulations other than FHSS is allowed to operate in a non-adaptive mode providing it complies with the requirements applicable to non-adaptive equipment.
An adaptive equipment using modulations other than FHSS is equipment that uses a mechanism by which it can adapt to its environment by identifying other transmissions present within its Occupied Channel Bandwidth.
Adaptive equipment using modulations other than FHSS shall implement either of the Detect and Avoid mechanisms provided in clauses 4.3.2.5.1 or 4.3.2.5.2. Adaptive systems are allowed to switch dynamically between different adaptive modes.

Test Equipment

Radiated Emission Measurement (RF)

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Spectrum Analysis	Agilent	E4407B	US39390582	Aug. 09, 2014	1 Year
2.	Preamplifier	Instruments corporation	EMC011830	980100	Aug. 09, 2014	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESPI	101604	Apr. 23, 2014	1 Year
4.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Aug. 09, 2013	3 Year
5.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Apr. 23, 2013	3 Year
6.	Pre-amplifier	SONOMA	310N	186860	Apr. 23, 2014	1 Year
7.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A

Non-LBT based Detect and Avoid

Equipment using a modulation other than FHSS and using the non-LBT based Detect and Avoid mechanism, shall comply with the following minimum set of requirements:

1) During normal operation, the equipment shall evaluate the presence of a signal on its current operating channel. If it is determined that a signal is present with a level above the detection threshold defined in 4). the channel shall be marked as 'unavailable'.
2) The channel shall remain unavailable for a minimum time equal to 1 s after which the channel may be considered again as an 'available' channel.
3) The total time during which an equipment has transmissions on a given channel without re-evaluating the availability of that channel, is defined as the Channel Occupancy Time.
4) The Channel Occupancy Time shall be less than 40 ms. Each such transmission sequence shall be followed with an Idle Period (no transmissions) of minimum 5 % of the Channel Occupancy Time with a minimum of 100 µs. After this, the procedure as in step 1 needs to be repeated.

5) The detection threshold shall be proportional to the transmit power of the transmitter: for a 20 dBm e.i.r.p. transmitter the detection threshold level (TL) shall be equal or lower than -70 dBm/MHz at the input to the receiver (assuming a 0 dBi receive antenna). For power levels below 20 dBm e.i.r.p., the detection threshold level may be relaxed to TL = -70 dBm/MHz + 20 - Pout e.i.r.p. (Pout in dBm).

LBT based Detect and Avoid

The present document defines 2 types of adaptive equipment using wide band modulations other than FHSS and that uses an LBT based Detect and Avoid mechanism: Frame Based Equipment and Load Based Equipment.

Adaptive equipment which is capable of operating as either Load Based Equipment or as Frame Based Equipment is allowed to switch dynamically between these types of operation.

Short Control Signalling Transmissions

If implemented, Short Control Signalling Transmissions of adaptive equipment using wide band modulations other than FHSS shall have a maximum duty cycle of 10 % within an observation period of 50 ms.

Test Results

Complies.

6. Occupied Channel Bandwidth

Definition and Requirement

The Occupied Channel Bandwidth shall fall completely within the band given in clause 1. In addition, for non-adaptive system using wide band modulations other than FHSS and with e.i.r.p. greater than 10dBm, the occupied channel bandwidth shall be less than 20MHz.

Test Equipment

Radiated Emission Measurement (RF)

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Spectrum Analysis	Agilent	E4407B	US39390582	Aug. 09, 2014	1 Year
2.	Preamplifier	Instruments corporation	EMC011830	980100	Aug. 09, 2014	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESPI	101604	Apr. 23, 2014	1 Year
4.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Aug. 09, 2013	3 Year
5.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Apr. 23, 2013	3 Year
6.	Pre-amplifier	SONOMA	310N	186860	Apr. 23, 2014	1 Year
7.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A

Radiation Uncertainty : Ur = 4.3dB

Test Result

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	53 %
ATM Pressure:	100.9 kPa

Test Mode: Transmitting
Test Result: PASS

Test dates see the following pages

Test mode	Transmitting frequency	Measured (MHz)	Test Result
802.11b	2412	14.16	Pass
	2442	14.16	Pass
	2472	14.16	Pass
802.11g	2412	16.40	Pass
	2442	16.32	Pass
	2472	16.40	Pass
802.11n(HT20)	2412	17.44	Pass
	2442	17.44	Pass
	2472	17.52	Pass
802.11n(HT40)	2422	35.64	Pass
	2442	35.64	Pass
	2462	35.64	Pass

7. Transmitter Unwanted Emissions in the out-of-band Domain

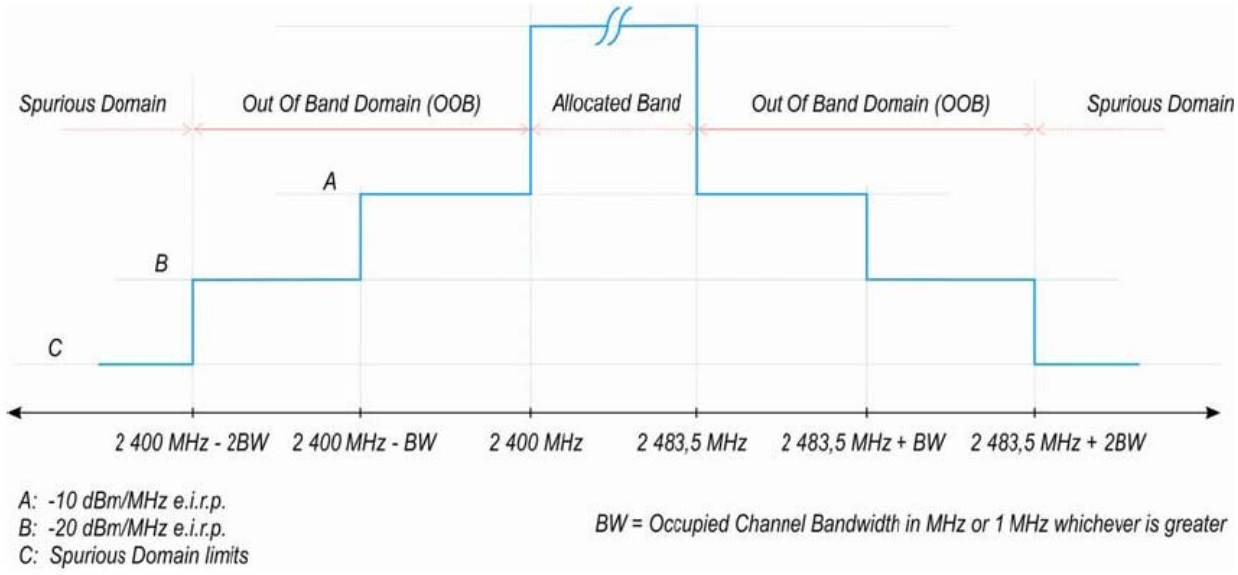
Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Spectrum Analysis	Agilent	E4407B	US39390582	Aug. 09, 2014	1 Year
2.	Preamplifier	Instruments corporation	EMC011830	980100	Aug. 09, 2014	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESPI	101604	Apr. 23, 2014	1 Year
4.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Aug. 09, 2013	3 Year
5.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Apr. 23, 2013	3 Year
6.	Pre-amplifier	SONOMA	310N	186860	Apr. 23, 2014	1 Year
7.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A

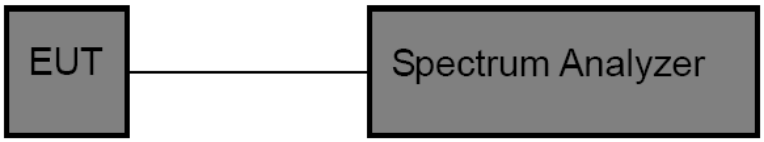
Test Limit

The transmitter unwanted emissions in the out-of-band domain but outside the allocated band, shall not exceed the values provided by the mask in figure 3.

Note: Within the 2400MHz to 2483.5MHz band, the Out-of band emissions are fulfilled by compliance with the Occupied Channel Bandwidth requirement in clause 4.3.2.6.



Test Setup



Test Procedure

Step 1:
The transmitter output was connected to the spectrum analyzer.
Set the spectrum analyzer as following:
-Centre Frequency: 2484 MHz.
-Span: 0 Hz
-Resolution BW : 1 MHz
-Filter mode: Channel filter
-Video BW : 3 MHz
-Detector Mode: RMS
-Trace Mode : Clear / Write
-Sweep Mode: Continuous
-Sweep Points : 5000
-Trigger Mode: Video trigger
-Sweep Time: Suitable to capture one transmission burst

Step 2 (2483.5 MHz to 2483.5 MHz +BW):
Adjust trigger level to select the transmissions with the highest power level.
The highest power level shall be selected.
Set a window to match with the start and end of the burst and in which the RMS Power shall be measured using the Time Domain Power Function.
RMS Power within this 1 MHz segment (2483.5 MHz to 2484.5 MHz). Compare this value the applicable limit provided by the mask.
Increase the centre frequency in steps of 1 MHz and repeat this measurement for every 1 MHz segment within the range 2483.5 MHz to 2483.5 MHz+BW. The centre frequency of the last 1 MHz segment within the range 2483.5 MHz to 2483.5 MHz +BW. The centre frequency of the last 1 MHz segment shall be set to 2483.5 MHz+BW-0.5 MHz (which means this may partly overlap with the previous 1 MHz segment).

Step 3 (2483.5 MHz +BW to 2483.5 MHz +2BW):
Change the centre frequency of the analyzer to 2484MHz + BW and perform the measurement for the first 1MHz segment within range 2483.5MHz +BW to 2483.5 MHz +2BW. Increase the centre frequency in 1MHz steps and repeat the measurements to cover this whole range. The centre frequency of the last 1 MHz segment shall be set to 2483.5 MHz+ 2BW-0.5 MHz.

Step 4 (2400 MHz-BW to 2400 MHz):
Change the centre frequency of the analyzer to 2399.5MHz and perform the measurement for the first 1MHz segment within range 2400 MHz -BW to 2400 MHz Reduce the centre frequency in 1MHz steps and repeat the measurement to cover this whole range. The centre frequency of the last 1 MHz segment shall be set to 2400 MHz -BW+ 0.5 MHz.

Step 5 (2400 MHz-BW to 2400 MHz):
Change the centre frequency of the analyzer to 2399.5MHz-BW and perform the measurement for the first 1MHz segment within range 2400 MHz -2BW to 2400 MHz –BW. Reduce the centre frequency in 1MHz steps and repeat the measurement to cover this whole range. The centre frequency of the last 1 MHz segment shall be set to 2400 MHz -2BW+ 0.5 MHz.

Test Results

PASS. Please refer to the following data.

Test Item	:	Spurious Emissions	Test Mode	:	Transmitter Operating
Test Voltage	:	AC 230V	Temperature	:	25℃
Test Result	:	PASS	Humidity	:	54%RH

802.11b:

Frequency Band	Maximum Level	Limit	Result
[2483.5 MHz, 2483.5 MHz+ BW]	-38.02	-10 dBm/MHz	Pass
[2483.5 MHz+ BW, 2483.5 MHz+ 2BW]	-48.34	-20 dBm/MHz	Pass
[2400 MHz- BW, 2400 MHz]	-26.23	-10 dBm/MHz	Pass
[2400 MHz- 2BW, 2400 MHz- BW]	-36.57	-20 dBm/MHz	Pass

802.11g

[2483.5 MHz, 2483.5 MHz+ BW]	-39.84	-10 dBm/MHz	Pass
[2483.5 MHz+ BW, 2483.5 MHz+ 2BW]	-50.26	-20 dBm/MHz	Pass
[2400 MHz- BW, 2400 MHz]	-25.69	-10 dBm/MHz	Pass
[2400 MHz- 2BW, 2400 MHz- BW]	-40.67	-20 dBm/MHz	Pass

802.11n(HT20):

Frequency Band	Maximum Level	Limit	Result
[2483.5 MHz, 2483.5 MHz+ BW]	-36.45	-10 dBm/MHz	Pass
[2483.5 MHz+ BW, 2483.5 MHz+ 2BW]	-44.12	-20 dBm/MHz	Pass
[2400 MHz- BW, 2400 MHz]	-26.74	-10 dBm/MHz	Pass
[2400 MHz- 2BW, 2400 MHz- BW]	-36.36	-20 dBm/MHz	Pass

802.11n(HT40)

[2483.5 MHz, 2483.5 MHz+ BW]	-35.90	-10 dBm/MHz	Pass
[2483.5 MHz+ BW, 2483.5 MHz+ 2BW]	-46.28	-20 dBm/MHz	Pass
[2400 MHz- BW, 2400 MHz]	-27.31	-10 dBm/MHz	Pass
[2400 MHz- 2BW, 2400 MHz- BW]	-38.59	-20 dBm/MHz	Pass

8. Transmitter unwanted emissions in the spurious domain

Standard Application

According to ETSI EN 300 328 V1.8.1, spurious emissions are emissions outside the frequency range as defined in frequency range. The level of spurious emissions shall be measured as:

Either: a. Their power in a specified load (conducted spurious emissions);
and b. Their effective radiated power when radiated by the cabinet or structure of the equipment (cabinet radiation);
or c. Their effective radiated power when radiated by cabinet and antenna.

The spurious emissions of the transmitter shall not exceed the values in following tables

Frequency range	Maximum power, e.r.p. (≤ 1 GHz) e.i.r.p. (> 1 GHz)	Bandwidth
30 MHz to 47 MHz	-36 dBm	100 kHz
47 MHz to 74 MHz	-54 dBm	100 kHz
74 MHz to 87,5 MHz	-36 dBm	100 kHz
87,5 MHz to 118 MHz	-54 dBm	100 kHz
118 MHz to 174 MHz	-36 dBm	100 kHz
174 MHz to 230 MHz	-54 dBm	100 kHz
230 MHz to 470 MHz	-36 dBm	100 kHz
470 MHz to 862 MHz	-54 dBm	100 kHz
862 MHz to 1 GHz	-36 dBm	100 kHz
1 GHz to 12,75 GHz	-30 dBm	1 MHz

Test Equipment

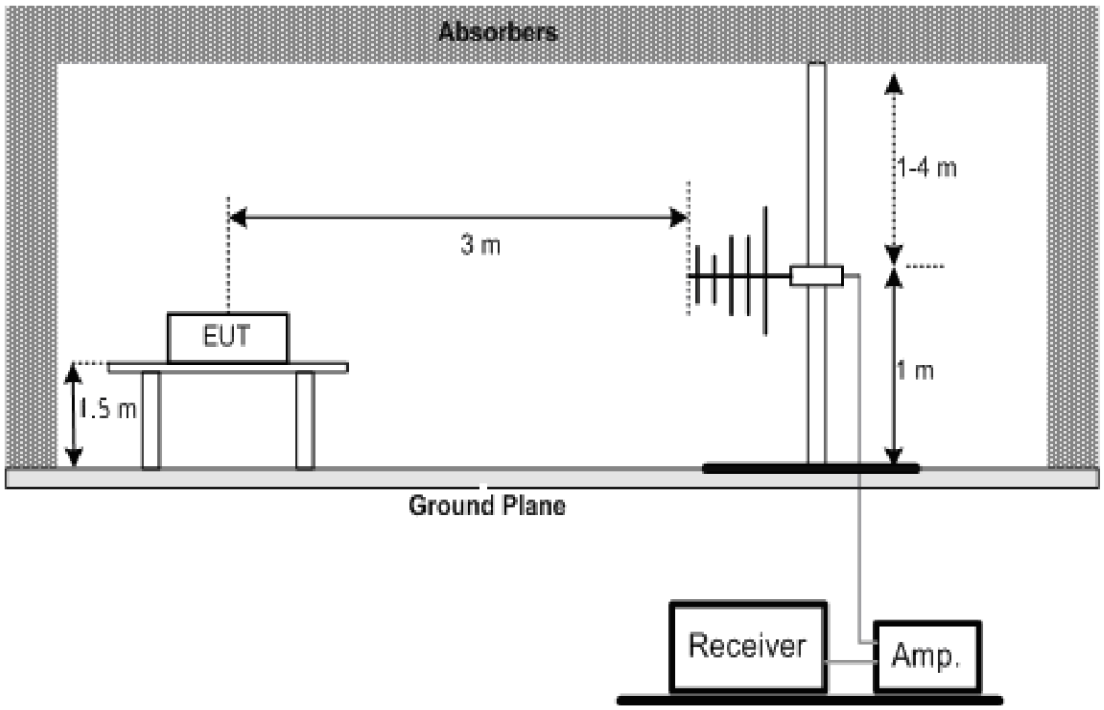
Radiated Emission Measurement(RF)

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Spectrum Analysis	Agilent	E4407B	US39390582	Aug. 09, 2014	1 Year
2.	Preamplifier	Instruments corporation	EMC011830	980100	Aug. 09, 2014	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESPI	101604	Apr. 23, 2014	1 Year
4.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Aug. 09, 2013	3 Year
5.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Apr. 23, 2013	3 Year
6.	Pre-amplifier	SONOMA	310N	186860	Apr. 23, 2014	1 Year
7.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A

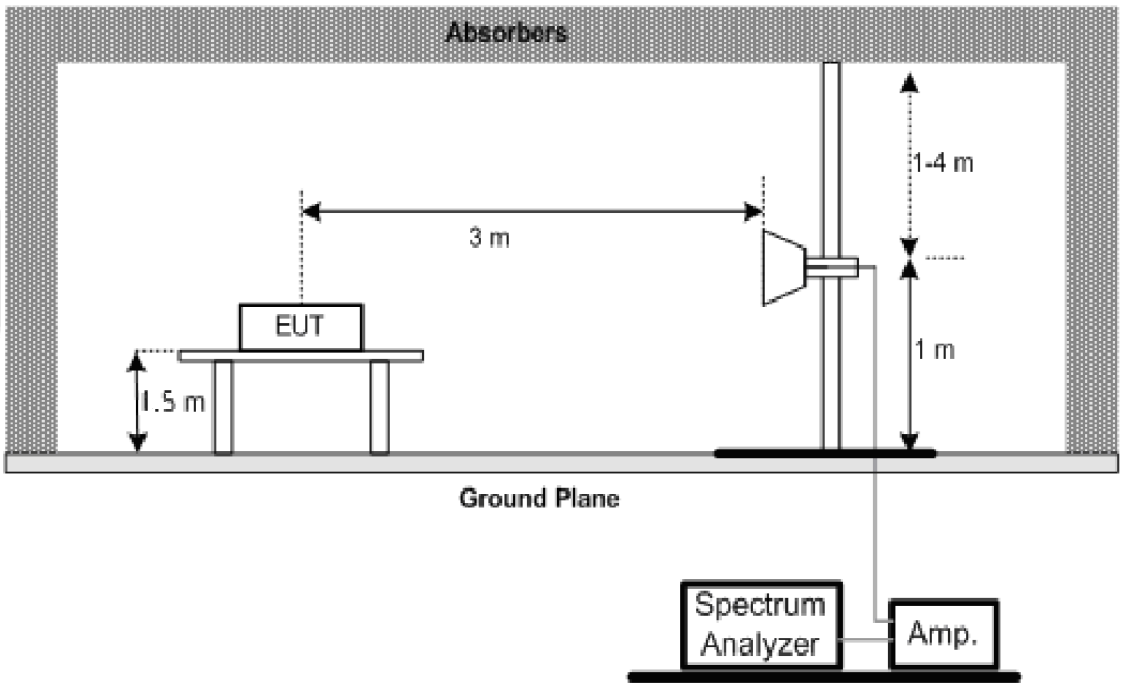
Radiation Uncertainty : Ur = 4.3dB

Test Setup

(A) Radiated Emission Test Set-Up Frequency Bellow 1 GHz.



(B) Radiated Emission Test Set-Up Frequency Above 1 GHz.



Test Procedure

The EUT was placed on the top of the turntable in chamber.
The test shall be made in the transmitting mode. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
Set the spectrum analyzer as follows to measure the emissions (Bellow 1 GHz):
-Resolution BW : 100 kHz.
-Resolution BW :300 kHz.
-Detector : RMS.
-Trace Mode : Max Hold.
-Sweep time : 1s.
-Span :100M.
-Amplitude :Adjust for middle of the instrument’ s range.

Set the spectrum analyzer as follows to measure the emissions (Above 1 GHz):
-Resolution BW : 1 MHz.
-Resolution BW :3 MHz.
-Detector : RMS.
-Trace Mode : Max Hold.
-Sweep time : 1s.
-Span :100M.
-Amplitude :Adjust for middle of the instrument’s range.

For 30~1000MHz spurious emissions measurement, the broad band bi-log receiving antenna was placed 3 meters far away from the turntable. .

The broadband receiving antenna was fixed on the same height with the EUT to find each suspected emissions of both horizontal and vertical polarization. Each recorded suspected value is indicated as Read Level (Raw).

Replace the EUT by standard antenna and feed the RF port by signal generator.
Adjust the frequency of the signal generator to the suspected emission and slightly rotate the turntable to locate the position with maximum reading.

Adjust the power level of the signal generator to reach the same reading with Read Level (Raw).
The level of the spurious emission is the power level of (g) plus the gain of the standard antenna in dBi and minus the loss of the cable used between the signal generator and the standard antenna.

If the measuring emissions that exceed the level of 6 dB below the applicable limit, the resolution bandwidth shall be switched to 30 kHz and the span shall be adjusted accordingly. If the level does not change by more than 2 dB, it is a narrowband emission; the observed value shall be recorded. If the level changes by more than 2 dB, the emission is a wideband emission and its level shall be measured and recorded.
The measurement shall be repeated at the lowest and the highest channel of the stated frequency range.

Test Results

PASS. Please refer to the following data.

Test Item	:	Spurious Emissions	Test Mode	:	Transmitter Operating
Test Voltage	:	AC 230V	Temperature	:	25℃
Test Result	:	PASS	Humidity	:	54%RH

Bellow 1GHz:

The worst case: 802.11b, 2412MHz

Frequency (MHz)	Ant H / V	TX/RX	Measured (dBm)	Limits (dBm)	Margins
276.840	V	TX	-76.52	-36.00	-40.52
---	V	TX	---	---	---
---	V	TX	---	---	---
---	V	TX	---	---	---
---	V	TX	---	---	---
---	V	TX	---	---	---

Frequency (MHz)	Ant H / V	TX/RX	Measured (dBm)	Limits (dBm)	Margins
626.560	H	TX	-76.32	-54.00	-22.32
---	H	TX	---	---	---
---	H	TX	---	---	---
---	H	TX	---	---	---
---	H	TX	---	---	---
---	H	TX	---	---	---

Above 1GHz:

The worst case: 802.11b, 2412MHz

Frequency (MHz)	Ant H / V	TX/RX	Measured (dBm)	Limits (dBm)	Margins
4641.320	V	TX	-46.29	-30.00	-16.29
7348.640	V	TX	-48.31	-30.00	-18.31
---	V	TX	---	---	---
---	V	TX	---	---	---
---	V	TX	---	---	---
---	V	TX	---	---	---

Frequency (MHz)	Ant H / V	TX/RX	Measured (dBm)	Limits (dBm)	Margins
4641.450	H	TX	-36.81	-30.00	-6.81
---	H	TX	---	---	---
---	H	TX	---	---	---
---	H	TX	---	---	---
---	H	TX	---	---	---
---	H	TX	---	---	---

9. Receiver Spurious Emissions

Standard Application

According to ETSI EN 300 328

The spurious emissions of the receiver shall not exceed the values in following tables

Frequency range	Maximum power, e.r.p.	Measurement bandwidth
30 MHz to 1 GHz	-57 dBm	100 kHz
1 GHz to 12,75 GHz	-47 dBm	1 MHz

Test Equipment

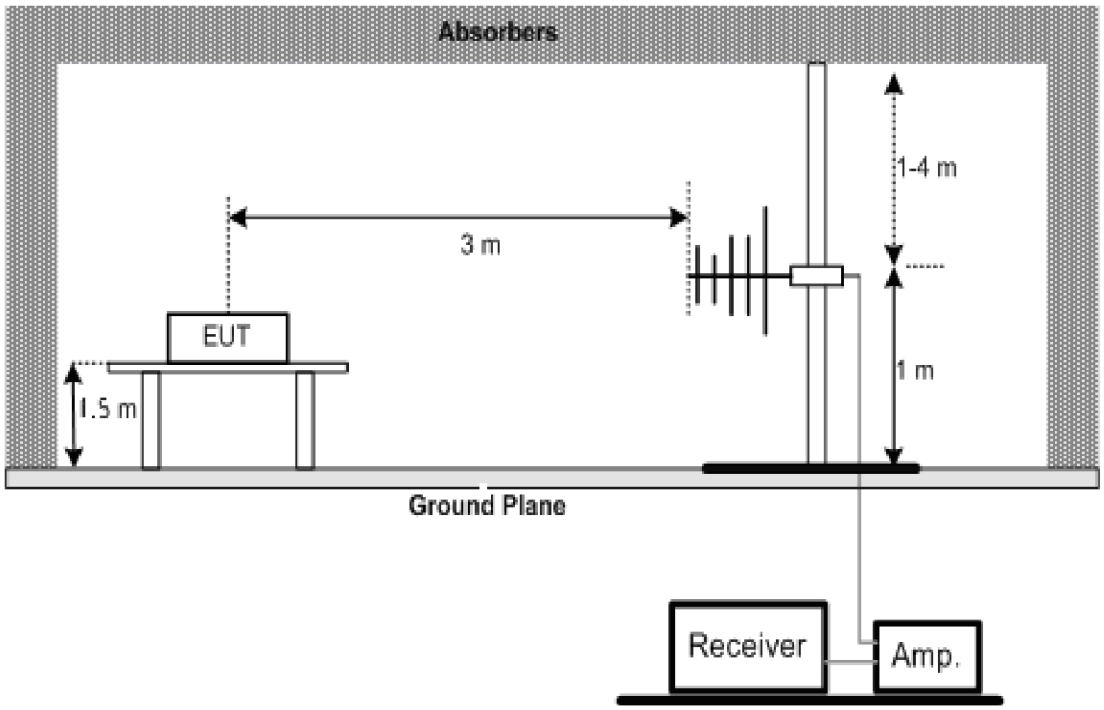
Radiated Emission Measurement (RF)

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Spectrum Analysis	Agilent	E4407B	US39390582	Aug. 09, 2014	1 Year
2.	Preamplifier	Instruments corporation	EMC011830	980100	Aug. 09, 2014	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESPI	101604	Apr. 23, 2014	1 Year
4.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Aug. 09, 2013	3 Year
5.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Apr. 23, 2013	3 Year
6.	Pre-amplifier	SONOMA	310N	186860	Apr. 23, 2014	1 Year
7.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A

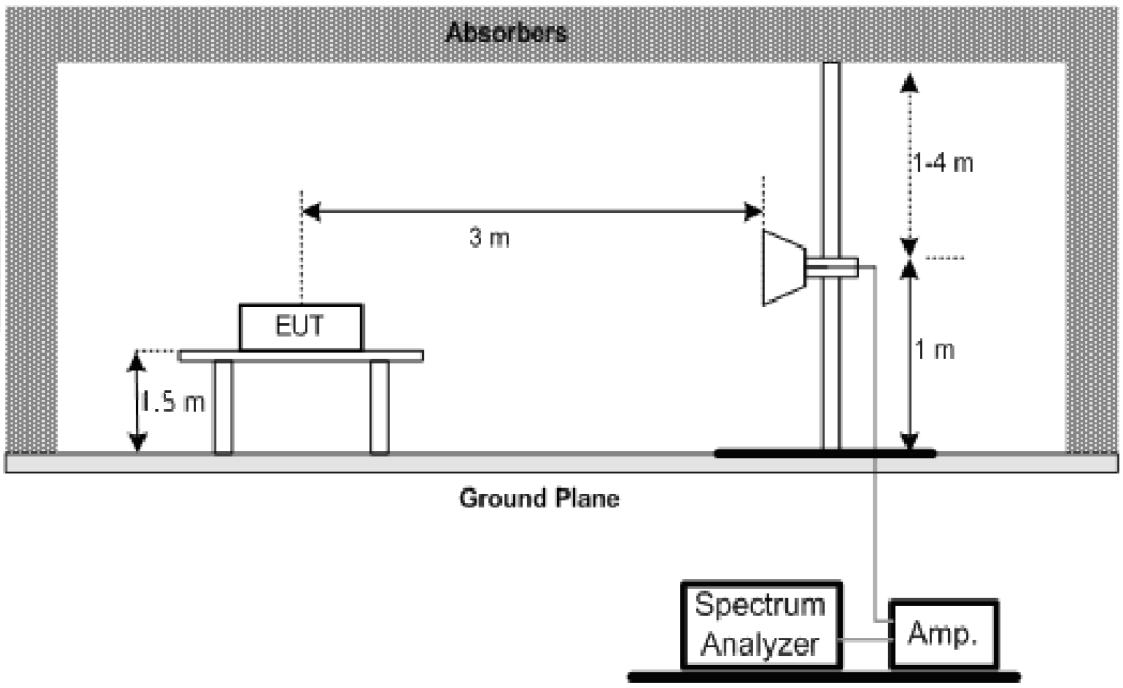
Radiation Uncertainty : Ur = 4.3dB

Test Setup

(A) Radiated Emission Test Set-Up Frequency Bellow 1 GHz.



(B) Radiated Emission Test Set-Up Frequency Above 1 GHz.



Test Procedure

The EUT was placed on the top of the turntable in chamber.
The test shall be made in the transmitting mode. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
Set the spectrum analyzer as follows to measure the emissions (Bellow 1 GHz):
-Resolution BW : 100 kHz.
-Resolution BW :300 kHz.
-Detector : RMS.
-Trace Mode : Max Hold.
-Sweep time : 1s.
-Span :100M.
-Amplitude :Adjust for middle of the instrument’ s range.

Set the spectrum analyzer as follows to measure the emissions (Above 1 GHz):
-Resolution BW : 1 MHz.
-Resolution BW :3 MHz.
-Detector : RMS.
-Trace Mode : Max Hold.
-Sweep time : 1s.
-Span :100M.
-Amplitude :Adjust for middle of the instrument’s range.

For 30~1000MHz spurious emissions measurement, the broad band bi-log receiving antenna was placed 3 meters far away from the turntable. .

The broadband receiving antenna was fixed on the same height with the EUT to find each suspected emissions of both horizontal and vertical polarization. Each recorded suspected value is indicated as Read Level (Raw).

Replace the EUT by standard antenna and feed the RF port by signal generator.
Adjust the frequency of the signal generator to the suspected emission and slightly rotate the turntable to locate the position with maximum reading.

Adjust the power level of the signal generator to reach the same reading with Read Level (Raw).
The level of the spurious emission is the power level of (g) plus the gain of the standard antenna in dBi and minus the loss of the cable used between the signal generator and the standard antenna.

If the measuring emissions that exceed the level of 6 dB below the applicable limit, the resolution bandwidth shall be switched to 30 kHz and the span shall be adjusted accordingly. If the level does not change by more than 2 dB, it is a narrowband emission; the observed value shall be recorded. If the level changes by more than 2 dB, the emission is a wideband emission and its level shall be measured and recorded.
The measurement shall be repeated at the lowest and the highest channel of the stated frequency range.

Test Results

PASS. Please refer to the following data.

Test Item	:	Spurious Emissions	Test Mode	:	RX
Test Voltage	:	AC 230V	Temperature	:	25℃
Test Result	:	PASS	Humidity	:	54%RH

Bellow 1GHz:

Frequency (MHz)	Ant H / V	TX/RX	Measured (dBm)	Limits (dBm)	Margins
735.360	V	RX	-83.52	-57.00	-26.52
---	V	RX	---	---	---
---	V	RX	---	---	---
---	V	RX	---	---	---
---	V	RX	---	---	---
---	V	RX	---	---	---

Frequency (MHz)	Ant H / V	TX/RX	Measured (dBm)	Limits (dBm)	Margins
992.450	H	RX	-78.03	-57.00	-21.03
---	H	RX	---	---	---
---	H	RX	---	---	---
---	H	RX	---	---	---
---	H	RX	---	---	---
---	H	RX	---	---	---

Above 1GHz:

Frequency (MHz)	Ant H / V	TX/RX	Measured (dBm)	Limits (dBm)	Margins
1638.170	V	RX	-64.04	-47.00	-17.04
---	V	RX	---	---	---
---	V	RX	---	---	---
---	V	RX	---	---	---
---	V	RX	---	---	---
---	V	RX	---	---	---

Frequency (MHz)	Ant H / V	TX/RX	Measured (dBm)	Limits (dBm)	Margins
1635.460	H	RX	-53.47	-47.00	-6.47
---	H	RX	---	---	---
---	H	RX	---	---	---
---	H	RX	---	---	---
---	H	RX	---	---	---
---	H	RX	---	---	---

APPENDIX I (TEST PHOTOGRAPHS)

1. Photo of Emission Test