SPECTRUM REPORT

Applicant:	Dragino Technology Co., Limited
Address of Applicant:	Room 1101, City Invest Commercial Center, No.546 QingLinRoad, LongCheng Street, LongGang District, Shenzhen 518116, China
Manufacturer/ Factory:	Dragino Technology Co., Limited
Address of Manufacturer/ Factory:	Room 1101, City Invest Commercial Center, No.546 QingLinRoad, LongCheng Street, LongGang District, Shenzhen 518116, China

Equipment Under Test (EUT)

Product Name:	LoRa loT Gateway
Model No.:	LG01, LG01-P, LG01-S, MS14N-P, MS14N-S
Applicable standards:	ETSI EN 300 220-1 V3.1.1 (2017-02), ETSI EN 300 220-2 V3.1.1 (2017-02)
Date of sample receipt:	June 15, 2017
Date of Test:	June 15-20, 2017
Date of report issue:	June 20, 2017
Test Result :	PASS *

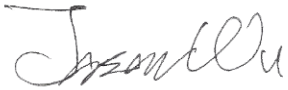
*In the configuration tested, the EUT complied with the standards specified above.

The CE mark as shown below can be used, under the responsibility of the manufacturer, after completion of an EC Declaration of Conformity and compliance with all relevant EC Directives. The protection requirements with respect to electromagnetic compatibility contained in Directive 2014/53/EU are considered.

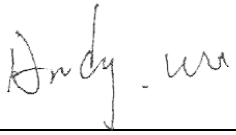
Robinson Lo
Laboratory Manager

2 Version

Version No.	Date	Description
00	*June 20, 2017*	*Original*

Prepared By:  ***Date:*** *June 20, 2017*

Project Engineer

Check By:  ***Date:*** *June 20, 2017*

Reviewer

3 Contents

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4 Test Summary

Radio Spectrum Matter (RSM) Part of Tx				
Test item	**Test Requirement**	**Test method**	**Limit/Severity**	**Result**
Operating frequency(Declared by manufacturer)	ETSI EN 300 220-2	ETSI EN 300 220-1	Annexes B or C of EN 300 220-2	Pass
Effective Radiated Power	ETSI EN 300 220-2	ETSI EN 300 220-1	Annexes B or C of EN 300 220-2	Pass
Maximum e.r.p. Spectral Density	ETSI EN 300 220-2	ETSI EN 300 220-1	Annexes B or C of EN 300 220-2	N/A
Duty cycle	ETSI EN 300 220-2	ETSI EN 300 220-1	Annexes B or C of EN 300 220-2	Pass
Occupied Bandwidth	ETSI EN 300 220-2	ETSI EN 300 220-1	Annexes B or C of EN 300 220-2	Pass
Tx Out of Band Emissions	ETSI EN 300 220-2	ETSI EN 300 220-1	Clause 5.8.2	Pass
Transmit Spurious Emmisions	ETSI EN 300 220-2	ETSI EN 300 220-1	Clause 5.9.2	Pass
Transmit Spectrum Mask	ETSI EN 300 220-2	ETSI EN 300 220-1	Clause 5.9.1.1	N/A
Transient Power	ETSI EN 300 220-2	ETSI EN 300 220-1	Clause 5.10.2	Pass
Adjacent Channel Power	ETSI EN 300 220-2	ETSI EN 300 220-1	Clause 5.11.2	N/A
TX behaviour under Low Voltage Conditions	ETSI EN 300 220-2	ETSI EN 300 220-1	Clause 5.12.2	Pass
Adaptive Power Control	ETSI EN 300 220-2	ETSI EN 300 220-1	Clause 5.13.2	N/A
Short Term Behaviour	ETSI EN 300 220-2	N/A	annex C, table C.1	N/A
FHSS Equipment Requirements	ETSI EN 300 220-2	N/A	Clause 4.3.10.2	N/A
Radio Spectrum Matter (RSM) Part of Rx				
Test item	**Test Requirement**	**Test method**	**Limit/Severity**	**Result**
Receiver sensitivity	ETSI EN 300 220-2	ETSI EN 300 220-1	Clause 5.14.2	N/A
Adjacent channel selectivity	ETSI EN 300 220-1	ETSI EN 300 220-1	Clause 5.15.2	N/A
Receiver saturation at Adjacent Channel	ETSI EN 300 220-1	ETSI EN 300 220-1	Clause 5.16.2	N/A
Spurious response rejection	ETSI EN 300 220-1	ETSI EN 300 220-1	Clause 5.17.2	N/A
Blocking	ETSI EN 300 220-2	ETSI EN 300 220-1	Clause 5.18.2	N/A
Behaviour at high wanted signal level	ETSI EN 300 220-1	ETSI EN 300 220-1	Clause 5.19.2	N/A
Clear Channel Assessment threshold	ETSI EN 300 220-2	ETSI EN 300 220-1	Clause 5.21.2.2	N/A
Polite spectrum access timing parameters	ETSI EN 300 220-2	ETSI EN 300 220-1	Clause 5.21.3.1	N/A
Adaptive Frequency Agility	ETSI EN 300 220-2	N/A	N/A	N/A
Receive Spurious emmisions	ETSI EN 300 220-2	ETSI EN 300 220-1	Clause 5.9.2	N/A
Bi-Directional Operation Verification	ETSI EN 300 220-1	ETSI EN 300 220-1	Clause 5.22.2	N/A

Pass: The EUT complies with the essential requirements in the standard.

N/A: not applicable.

5 General Information

5.1 General Description of EUT

Product Name:	LoRa IoT Gateway
Model No.:	LG01, LG01-P, LG01-S, MS14N-P, MS14N-S
Test Model No.:	LG01
Remark: *All above models are identical in the same PCB layout, interior structure and electrical circuits. The only difference is the model name for commercial purpose.*	
Operation Frequency:	868.1MHz(Declared by manufacturer)
Occupied bandwidth	200kHz(Declared by manufacturer)
Antenna type:	Integrated antenna
Antenna Gain:	2.5dBi(Declared by manufacturer)
Modulation type:	FSK(Declared by manufacturer)
Power supply:	Adapter Input: AC100-240V 50-60Hz 0.5A Output: DC12V 0.1-1.3A

5.2 Test mode

Transmitting mode	Keep the EUT in continuously transmitting mode

5.3 Test Facility

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

● **FCC —Registration No.: 600491**

Global United Technology Services Co., Ltd., Shenzhen EMC Laboratory has been registered and fuly described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in files. Registration 600491, June 22, 2016.

● **Industry Canada (IC) —Registration No.: 9079A-2**

The 3m Semi-anechoic chamber of Global United Technology Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 9079A-2, August 15, 2016.

5.4 Test Location

All tests were performed at:

Global United Technology Services Co., Ltd.
Address: No. 301-309, 3/F., Jinyuan Business Building, No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China 518102
Tel: 0755-27798480
Fax: 0755-27798960

5.5 Description of Support Units

None

5.6 Deviation from Standards

None

5.7 Abnormalities from Standard Conditions

None

5.8 Other Information Requested by the Customer

None

6 Test Instruments list

Radiated Emission:						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	3m Semi- Anechoic Chamber	ZhongYu Electron	9.2(L)*6.2(W)* 6.4(H)	GTS250	July 03 2015	July 02 2020
2	Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	GTS251	N/A	N/A
3	Spectrum Analyzer	Agilent	E4440A	GTS533	June 29 2016	June 28 2017
4	EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	June 29 2016	June 28 2017
5	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	GTS214	June 29 2016	June 28 2017
6	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	9120D-829	GTS208	June 29 2016	June 28 2017
7	Horn Antenna	ETS-LINDGREN	3160	GTS217	June 29 2016	June 28 2017
8	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
9	Coaxial Cable	GTS	N/A	GTS213	June 29 2016	June 28 2017
10	Coaxial Cable	GTS	N/A	GTS211	June 29 2016	June 28 2017
11	Coaxial cable	GTS	N/A	GTS210	June 29 2016	June 28 2017
12	Coaxial Cable	GTS	N/A	GTS212	June 29 2016	June 28 2017
13	Amplifier(100kHz-3GHz)	HP	8347A	GTS204	June 29 2016	June 28 2017
14	Amplifier(2GHz-20GHz)	HP	8349B	GTS206	June 29 2016	June 28 2017
15	Amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	June 29 2016	June 28 2017
16	Band filter	Amindeon	82346	GTS219	June 29 2016	June 28 2017
17	Power Meter	Anritsu	ML2495A	GTS540	June 29 2016	June 28 2017
18	Power Sensor	Anritsu	MA2411B	GTS541	June 29 2016	June 28 2017

7 Radio Technical Requirements Specification in ETSI EN 300 220-2

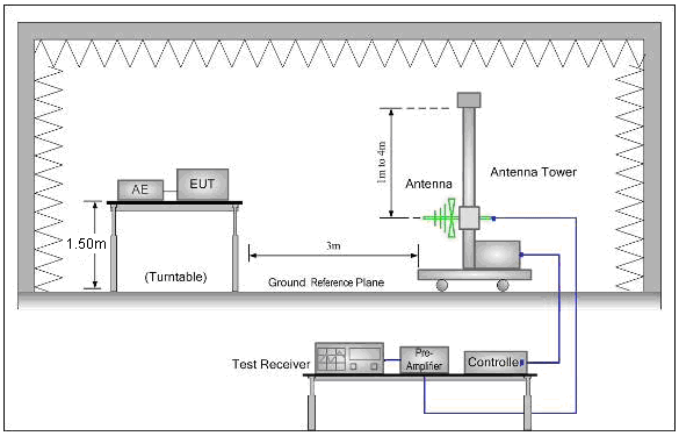
7.1.1 Test conditions

Normal conditions	Ambient:	Temperature.:	+15°C to +35°C
		relative humidity:	20 % to 75 %
	Power supply:	Battery:	Nominal
		AC mains source	Nominal
Extreme conditions	Ambient:	Temperature.:	-20°C to +55°C
	Power supply:	Battery:	0.9 and 1.3 mutiplied for lead-acid battery 0.85 and 1.15 mutiplied for"gel-cell" type batteries 0.85 and 0.9 mutiplied for lithium and nickel-cadmium type batteries For other types it may declared by manufacturer
		AC mains source	±10% of the norminal power source

7.1.2 Operation Frequency

	The Operational Frequency band was declared by the manufacturer which conforms annexes B, C or any NRI of ETSI EN 300220-2.

7.1.3 Effective Radiated Power

Test Requirement:	ETSI EN 300 220-2 clause 4.3.1
Test Method:	ETSI EN 300 220-1 clause 5.2.2
Test site:	Measurement Distance: 3m (Semi-Anechoic Chamber)
Receiver setup:	RBW=120kHz, VBW=300kHz, Detector= peak
Limit:	10mW=10dBm (Refer to Annex B of ETSI EN 300220-2)
Test setup:	
Test procedure:	Substitution method was performed to determine the actual ERP emission levels of the EUT. The following test procedure as below: 1. On the test site as test setup graph above,the EUT shall be placed at the 1.5m support on the turntable and in the position closest to normal use as declared by the provider. 2. The test antenna shall be oriented initially for vertical polarization and shall be chosen to correspond to the frequency of the transmitter.The output of the test antenna shall be connected to the measuring receiver. 3. The transmitter shall be switched on, if possible, without modulation and the measuring receiver shall be tuned to the frequency of the transmitter under test. 4. The test antenna shall be raised and lowered from 1m to 4m until a maximum signal level is detected by the measuring receiver. Then the turntable should be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver. 5. Repeat step 4 for test frequency with the test antenna polarized horizontally. 6. Remove the transmitter and replace it with a substitution antenna (the antenna should be half-wavelength for each frequency involved). The center of the substitution antenna should be approximately at the same location as the center of the transmitter. At the lower frequencies, where the substitution antenna is very long, this will be impossible to achieve when the antenna is polarized vertically. In such case the lower end of the antenna should be 0.3 m above the ground. 7. Feed the substitution antenna at the transmitter end with a signal generator connected to the antenna by means of a nonradiating cable.

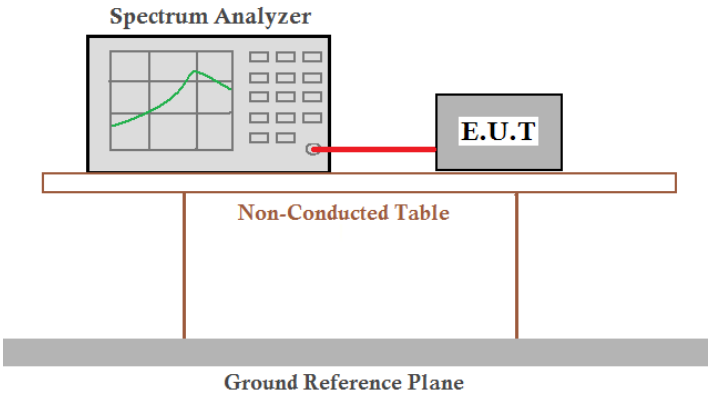
	With the antennas at both ends vertically polarized, and with the signal generator tuned to a particular test frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained. This should be done carefully repeating the adjustment of the test antenna and generator output. 8. Repeat step 7 with both antennas horizontally polarized for each test frequency. 9. Calculate power in dBm into a reference ideal half-wave dipole antenna by reducing the readings obtained in steps 7 and 8 by the power loss in the cable between the generator and the antenna, and further corrected for the gain of the substitution antenna used relative to an ideal half-wave dipole antenna by the following formula: ERP(dBm) = Pg(dBm)) + antenna gain (dBd) where: Pg is the generator output power into the substitution antenna.
Measurement Record:	Uncertainty: ± 1.5dB
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data

Test mode	Frequency (MHz)	ERP Level (dBm)	Limit (dBm)	Result
Transmitting with modulation	868.1	11.82	13.9794	Pass

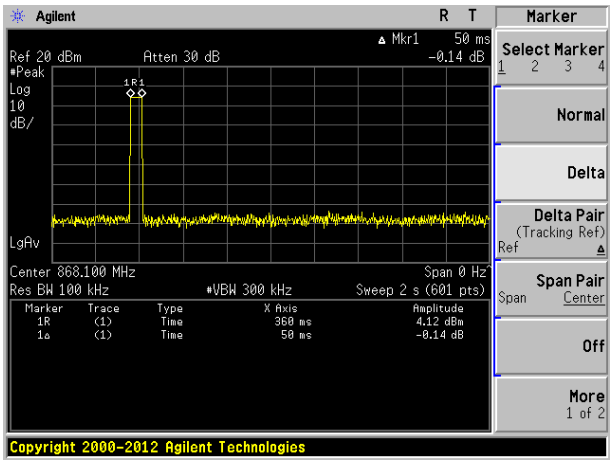
Remark:Peak value is applicable.

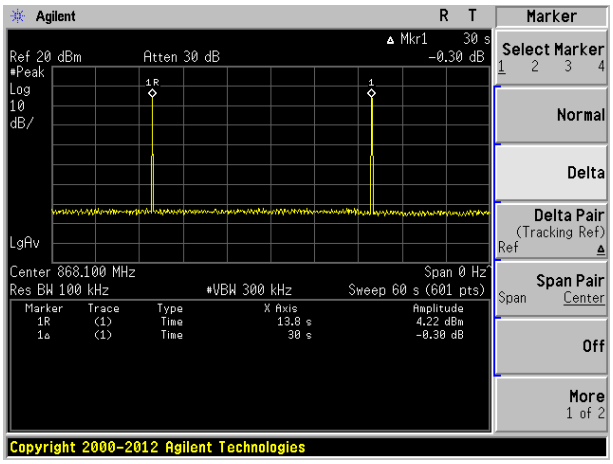
7.1.4 Duty Cycle

Test Requirement:	ETSI EN 300 220-2 clause 4.3.3
Test Method:	ETSI EN 300 220-1 clause 5.4
Limit:	1%
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

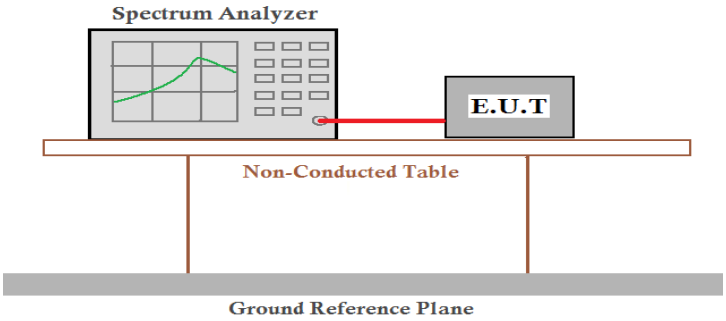
Measurement Data

Ton time(ms)	Tcycle time(s)	Dutycycle	Limit	Result
50	30	0.17%	1%	Pass





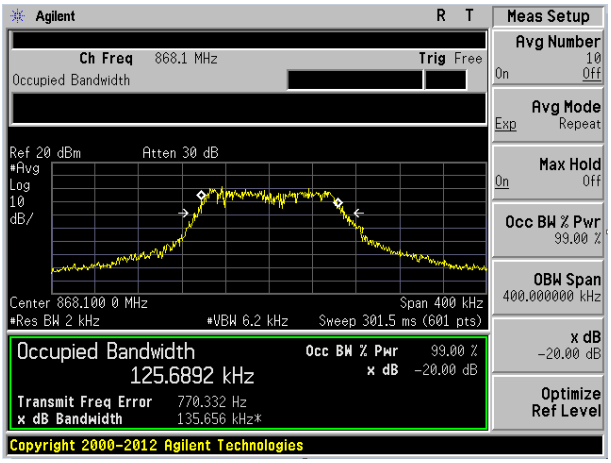
7.1.5 Occupied Bandwidth

Test Requirement:	ETSI EN 300 220-2 clause 4.3.4
Test Method:	ETSI EN 300 220-1 clause 5.6
Receive setup:	**Table 12: Test Parameters for Max Occupied Bandwidth Measurement** Setting / Value / Notes Centre frequency / The nominal Operating Frequency / The highest or lowest Operating Frequency as declared by the manufacturer RBW / 1 % to 3 % of OCW without being below 100 Hz / VBW / 3 x RBW / Nearest available analyser setting to 3 x RBW Span / At least 2 x Operating Channel width / Span should be large enough to include all major components of the signal and its side bands Detector Mode / RMS / Trace / Max hold /
Limit:	The Operating Channel shall be declared and shall reside entirely within the Operational Frequency Band. The Maximum Occupied Bandwidth at 99 % shall reside entirely within the Operating Channel defined by F_{low} and F_{high}. Note: For 865 MHz to 868 MHz FHSS equipment.The Maximum occupied bandwidth per hopping channel shell less or equal to 50kHz. For 863 MHz to 870 MHz FHSS equipment.The Maximum occupied bandwidth per hopping channel shell less or equal to 100kHz.
Test setup:	
Test Procedure:	**Step 1:** Operation of the EUT shall be started, on the highest operating frequency as declared by the manufacturer, with the appropriate test signal. The signal attenuation shall be adjusted to ensure that the signal power envelope is sufficiently above the noise floor of the analyser to avoid the noise signals on either side of the power envelope being included in the measurement. **Step 2:** When the trace is completed the peak value of the trace shall be located and the analyser marker placed on this peak. **Step 3:** The 99 % occupied bandwidth function of the spectrum analyser shall be used to measure the occupied bandwidth of the signal.
Measurement Record:	Uncertainty: ±5%
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

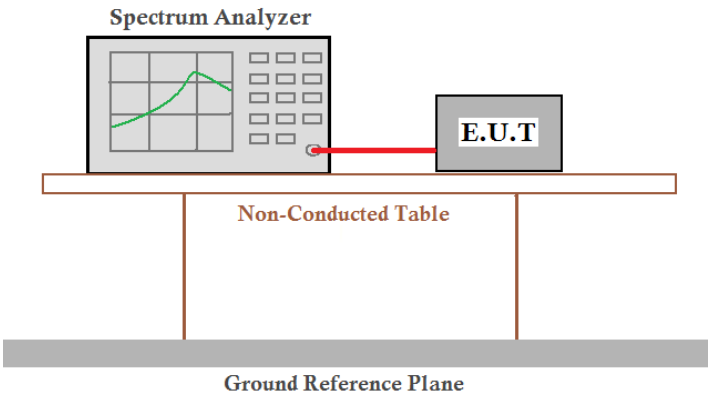
Measurement Data

99% Occupied Bandwidth(KHz)	Limit	Result
125.6892	Within the band refer to Anex B or C	Pass

Plot:



7.1.6 Frequency Error

Test Requirement:	ETSI EN 300 220-2 clause 4.3.3
Test Method:	ETSI EN 300 220-1 clause 5.7
Test setup:	
Test Procedure:	Step 1: Operation of the EUT shall be started on the nominal frequency as declared by the manufacturer under extreme high temperature and extreme voltage conditions. The frequency of the unmodulated carrier shall be measured and noted. Step 2: Operation of the EUT shall be started on the nominal frequency as declared by the manufacturer under extreme low temperature and extreme voltage conditions.
Measurement Record:	Uncertainty: ± 0.5ppm
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data

Test conditions	Frequency(MHz)	A-N(KHz)	B-N(KHz)
N(NTNV)	868.1	0.000	0.000
B(HTHV)	868.1		
A(LTLV)	868.1		

Remark:HTHV is the extreme high temperature and extreme voltage condition. LTLV is the extreme low temperature and extreme voltage condition.

7.1.7 TX Out Of Band Emissions

Test Requirement:	ETSI EN 300 220-2 clause 4.3.5
Test Method:	ETSI EN 300 220-1 clause 5.8.3
Receive setup:	**Table 16: Test Parameters for Out Of Band for Operating Channel Measurement**

Spectrum Analyser Setting	Value	Notes
Centre frequency	Operating Frequency	
Span	6 x Operating Channel width	
RBW	1 kHz (see note)	Resolution bandwidth for Out Of Band domain measurements
Detector Function	RMS	
Trace Mode	Linear AVG	Applies only for EUT generating D-M2 test signal. An appropriate number of samples should be averaged to give a stable reading
	Max Hold	Applies only for EUT generating D-M2a or D-M3 test signal.
NOTE: If the value of RBW used is different from RBW_{REF} in clause 5.8.2, use the bandwidth correction in clause 4.3.10.1.		

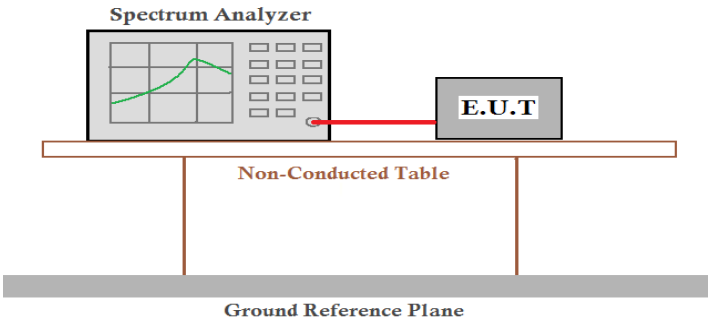
Limit:

Table 15: Emission limits in the Out Of Band domains

Domain	Frequency Range	RBW_{REF}	Max power limit
OOB limits applicable to Operational Frequency Band (See Figure 6)	$f \le f_{low\_OFB}$ - 400 kHz	10 kHz	-36 dBm
	F_{low_OFB} - 400 kHz ≤ f ≤ f_{low_OFB} - 200 kHz	1 kHz	-36 dBm
	f_{low} - 200 kHz ≤ f < f_{low_OFB}	1 kHz	See Figure 6
	$f = f_{low\_OFB}$	1 kHz	0 dBm
	$f = f_{high\_OFB}$	1 kHz	0 dBm
	F_{high_OFB} < f ≤ f_{high_OFB} + 200 kHz	1 kHz	See Figure 6
	F_{high_OFB} + 200 kHz ≤ f ≤ f_{high_OFB} + 400 kHz	1 kHz	-36 dBm
	F_{high_OFB} + 400 kHz ≤ f	10 kHz	-36 dBm
OOB limits applicable to Operating Channel (See Figure 5)	$f = f_c$ - 2.5 x OCW	1 kHz	-36 dBm
	f_c - 2,5 x OCW ≤ f ≤ f_c - 0,5 x OCW	1 kHz	See Figure 5
	$f = f_c$ - 0,5 x OCW	1 kHz	0 dBm
	$f = f_c$ + 0,5 x OCW	1 kHz	0 dBm
	f_c + 0,5 x OCW ≤ f ≤ f_c + 2,5 x OCW	1 kHz	See Figure 5
	$f = f_c$ + 2,5 x OCW	1 kHz	-36 dBm

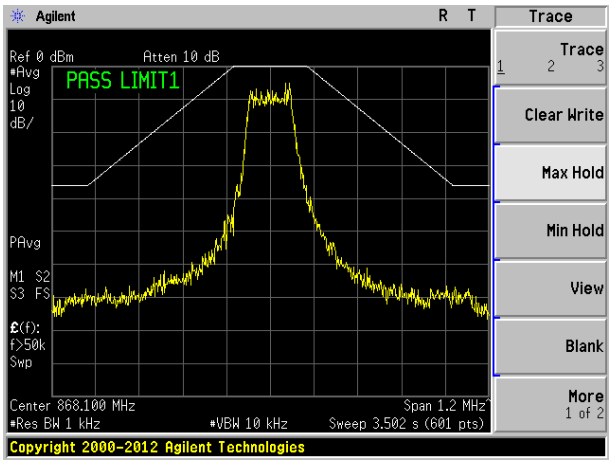
NOTE: f is the measurement frequency.
f_c is the Operating Frequency.
F_{low_OFB} is the lower edge of the Operational Frequency Band.
F_{high_OFB} is the upper edge of the Operational Frequency Band.
OCW is the operating channel bandwidth.

Test setup:



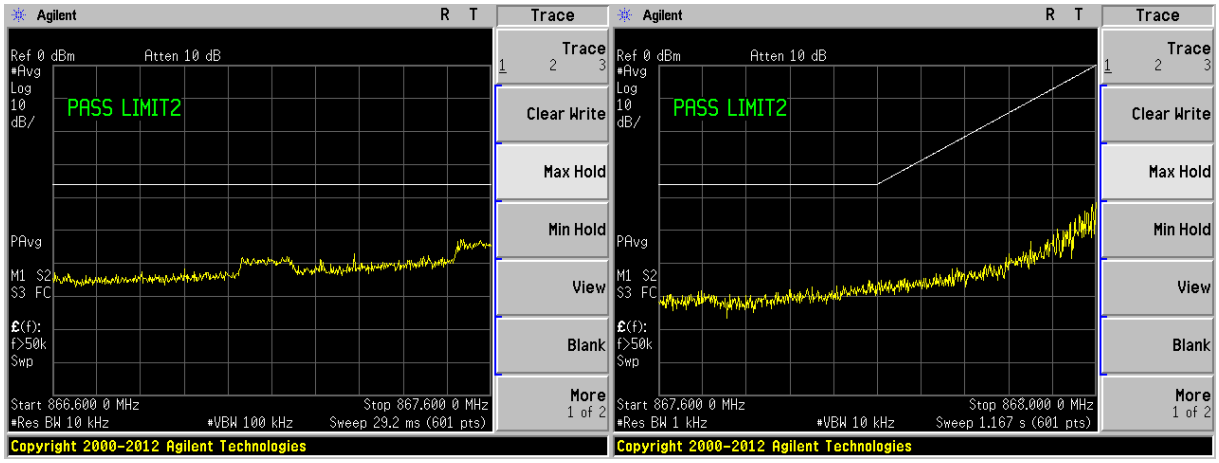
Test Procedure:	Refer to clause 5.8.3.4 of ETSI EN300220-1
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

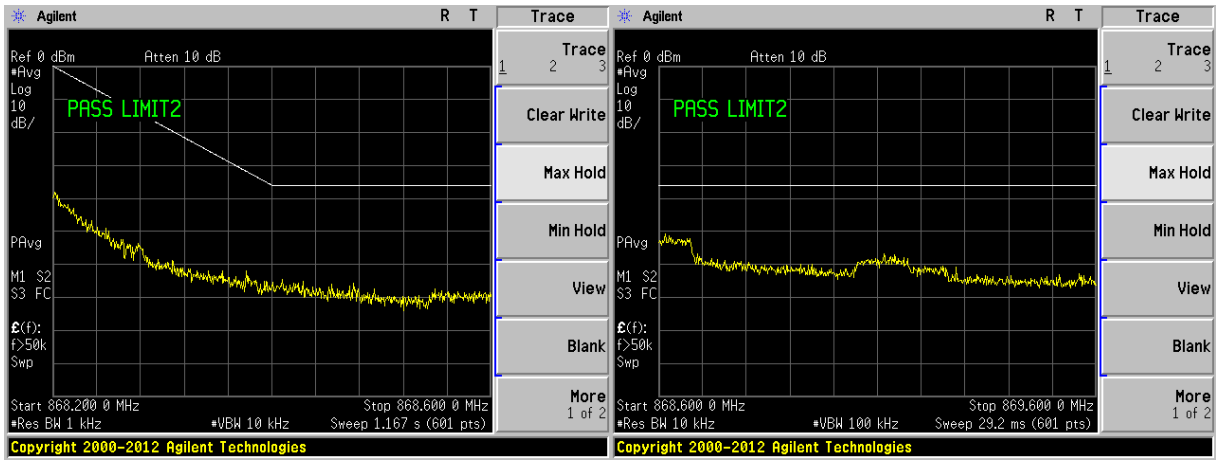
Measurement Data



OOB Data of Operational Channel

OOB Data of Operational Frequency Band





7.1.8 Transient power

Test Requirement:	ETSI EN 300 220-2 Clause 4.3.6
Test Method:	ETSI EN 300 220-1 Clause 5.10.3
Limit:	**Table 23: Transmitter Transient Power limits** Absolute offset from centre frequency: ≤ 400 kHz; RBW_{REF}: 1 kHz; Peak power limit applicable at measurement points: 0 dBm Absolute offset from centre frequency: > 400 kHz; RBW_{REF}: 1 kHz; Peak power limit applicable at measurement points: -27 dBm
Test procedure:	The output of the EUT shall be connected to a spectrum analyser or equivalent measuring equipment. The measurement shall be undertaken in zero span mode. The analyser's centre frequency shall be set to an offset from the operating centre frequency. These offset values and their corresponding RBW configurations are listed in Table 24. **Table 24: RBW for Transient Measurement** Measurement points: offset from centre frequency: -0,5 x OCW - 3 kHz, 0,5 x OCW + 3 kHz, Not applicable for OCW < 25 kHz; Analyser RBW: 1 kHz; RBW_{REF}: 1kHz Measurement points: offset from centre frequency: ±12,5 kHz or ±OCW whichever is the greater; Analyser RBW: Max (RBW pattern 1, 3, 10 kHz) ≤ Offset frequency/6 (see note); RBW_{REF}: 1 kHz Measurement points: offset from centre frequency: -0,5 x OCW - 400 kHz, 0,5 x OCW + 400 kHz; Analyser RBW: 100 kHz; RBW_{REF}: 1 kHz Measurement points: offset from centre frequency: -0,5 x OCW -1 200 kHz, 0,5 x OCW + 1 200 kHz; Analyser RBW: 300 kHz; RBW_{REF}: 1 kHz NOTE: Max (RBW pattern 1, 3, 10 kHz) means the maximum bandwidth that falls into the commonly implemented 1, 3, 10 kHz RBW filter bandwidth incremental pattern of spectrum analysers. EXAMPLE: If OCW is 25 kHz then the RBW value corresponding to one OCW offset frequency is 3 kHz. The rest of the analyser settings are listed in Table 25, and if OCW is 250 kHz then the RBW value corresponding to one OCW offset frequency is 30 kHz. **Table 25: Parameters for Transient Measurement** Spectrum Analyser Setting: VBW/RBW; Value: 10; Notes: At higher RBW values VBW may be clipped to its maximum value Spectrum Analyser Setting: Sweep time; Value: 500 ms Spectrum Analyser Setting: RBW filter; Value: Gaussian Spectrum Analyser Setting: Trace Detector Function; Value: RMS Spectrum Analyser Setting: Trace Mode; Value: Max hold Spectrum Analyser Setting: Sweep points; Value: 501 Spectrum Analyser Setting: Measurement mode; Value: Continuous sweep NOTE: The ratio between the number of sweep points and the sweep time shall be the same ratio as above if different number of sweep points is used. The used modulation shall be D-M3. The analyser shall be set to the settings of Table 25 and a measurement shall be started for each offset frequency. The EUT shall transmit at least five D-M3 test signal. The peak value shall be recorded and the measurement shall be repeated at each offset frequency mentioned in Table 24. The recorded power values shall be converted to power values measured in RBWREF by the formula in clause 4.3.10.1.
Measurement Record:	Uncertainty: ± 1.5dB
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data

Frequency offset	Peak Power level (dBm)	Limit (dBm)	Result
≤ 400 kHz	-18.22	0.00	Pass
	-17.26	0.00	
> 400 kHz	-31.25	-27.00	
	-30.25	-27.00	

7.1.9 Adjacent Channel Power

Test Requirement:	ETSI EN 300 220-2 Clause 4.3.7
Test Method:	ETSI EN 300 220-1 Clause 5.11.3
Limit:	**Table 26: Adjacent channel power limits for transmitters with OCW ≤ 25 kHz**

		Adjacent Channel power integrated over 0,7 x OCW	Alternate Adjacent Channel power integrated over 0,7 x OCW
OCW < 20 kHz	Normal test conditions	-20 dBm	-20 dBm
	Extreme test conditions	-15 dBm	-20 dBm
OCW ≥ 20 kHz	Normal test conditions	-37 dBm	-40 dBm
	Extreme test conditions	-32 dBm	-37 dBm

Test procedure:

The spectrum analyser shall be configured as appropriate for the parameters shown in Table 27.

Table 27: Test Parameters for Adjacent Channel Power

Setting	Value	Notes
Centre frequency	The nominal Operating Frequency	
RBW	100 Hz	
VBW	≥ 3 x RBW	
Span	At least 5 x Operating Channel width	Span should be large enough to include Adjacent and Alternate Adjacent Channel
Detector Mode	RMS	
Trace mode	Linear Averaging	Applies only for EUT generating D-M2 test signal An appropriate number of samples should be averaged to give a stable reading
	Max hold	Applies only for EUT generating D-M2a or D-M3 test signal
NOTE: The highest and lowest operating frequencies are declared by the manufacturer.		

Step 1:
Operation of the EUT shall be started, on the Operating Frequency as declared by the manufacturer. The modulation used shall be set according to Table 2.
The signal attenuation shall be adjusted to ensure that the signal power is not saturating the Spectrum analyser input port.

Step 2:
When the trace is completed, read the integrated power over a bandwidth of RBWREF centered to an offset from centre frequency as specified in Table 28. The spectrum analyser's ACP personality or an integrating marker may be used. If the spectrum analyser's ACP personality is used any additional filtering over the integrating bandwidth shall be disabled.

Table 28: Offset and RBW_{REF} parameters

Measurement	Offset from centre frequency	RBW_{REF}
Adjacent channel	±OCW	0,7 x OCW
Alternate channel	±2 x OCW	0,7 x OCW

For extreme test conditions, if the measurement is performed under normal conditions only, for EUT generating D-M1 test signal measurement can be performed with the following frequency offsets from centre frequency:

- +OCW - |Negative Frequency Error| / -OCW + |Positive Frequency Error| apply for the adjacent channel
- +2xOCW - |Negative Frequency Error| / -2xOCW + |Positive Frequency Error| apply for the alternate adjacent channel.

Take the higher power value from the positive and negative offsets at both the adjacent channel and alternate channel results.
Lin Averaging on the trace is an advanced SA feature. It antilogs the results averages them than takes the log again.

Measurement Record:	Uncertainty: ± 1.5dB
Test Instruments:	Refer to section 5.10 for details
Test mode:	Refer to section 5.2 for details
Test results:	N/A (Not applicable for OCW ≥ 25KHz)

7.1.10 Adaptive Power Control

Only used in 870,000 MHz to 875,800 MHz band equipment.

7.1.11 Transmit spurious emissions

Test Requirement:	ETSI EN 300 220-2 Clause 4.2.2
Test Method:	ETSI EN 300 220-1 Clause 5.9.1.2
Receiver setup:	**Table 20: Parameters for TX Spurious Radiations Measurement**

Operating Mode	Frequency Range	RBW_{REF} (see note 2)
Transmit mode	9 kHz ≤ f < 150 kHz	1 kHz
	150 kHz ≤ f < 30 MHz	10 kHz
	30 MHz ≤ f < f_c - m	100 kHz
	f_c - m ≤ f < f_c - n	10 kHz
	f_c - n ≤ f < f_c - p	1 kHz
	f_c + p < f ≤ f_c + n	1 kHz
	f_c + n < f ≤ f_c + m	10 kHz
	f_c + m < f ≤ 1 GHz	100 kHz
	1 GHz < f ≤ 6 GHz	1 MHz

NOTE 1: f is the measurement frequency.
f_c is the Operating Frequency.
m is 10 x OCW or 500 kHz, whichever is the greater.
n is 4 x OCW or 100 kHz, whichever is the greater.
p is 2,5 x OCW.
NOTE 2: If the value of RBW used for measurement is different from RBW_{REF}, use bandwidth correction from clause 4.3.10.1.

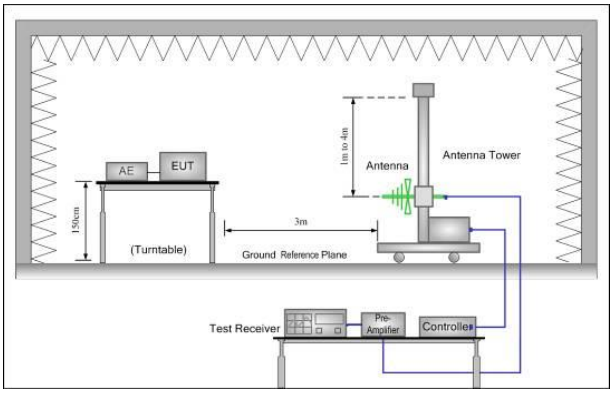
Test Frequency range:	25MHz to 6GHz

Limit:

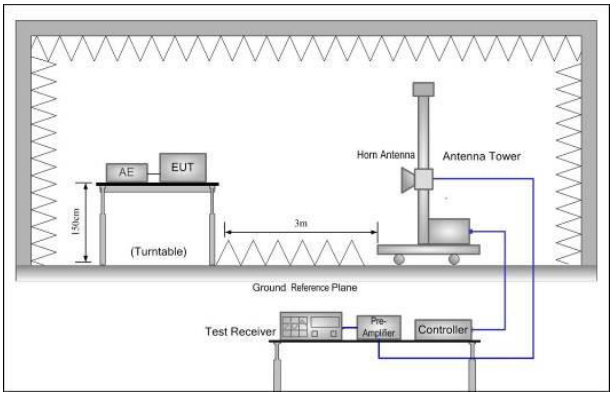
Frequency	Limit(operation)	Limit(standby)
47 MHz to 74 MHz 87.5 MHz to 118 MHz 174 MHz to 230 MHz 470 MHz to 790 MHz	4nW(-54dBm)	2nW(-57dBm)
Other frequencies below 1000 MHz	250nW(-36dBm)	2nW(-57dBm)
Above 1000 MHz	1uW(-30dBm)	20nW(-47dBm)

Test setup:

Below 1GHz



Above 1GHz

	
Test procedure:	Substitution method was performed to determine the actual ERP emission levels of the EUT. The following test procedure as below: **Below 1GHz:** 1. On the test site as test setup graph above,the EUT shall be placed at the 1.5m support on the turntable and in the position closest to normal use as declared by the provider. 2. The test antenna shall be oriented initially for vertical polarization and shall be chosen to correspond to the frequency of the transmitter.The output of the test antenna shall be connected to the measuring receiver. 3. The transmitter shall be switched on, if possible, without modulation and the measuring receiver shall be tuned to the frequency of the transmitter under test. 4. The test antenna shall be raised and lowered from 1m to 4m until a maximum signal level is detected by the measuring receiver. Then the turntable should be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver. 5. Repeat step 4 for test frequency with the test antenna polarized horizontally. 6. Remove the transmitter and replace it with a substitution antenna (the antenna should be half-wavelength for each frequency involved). The center of the substitution antenna should be approximately at the same location as the center of the transmitter. At the lower frequencies, where the substitution antenna is very long, this will be impossible to achieve when the antenna is polarized vertically. In such case the lower end of the antenna should be 0.3 m above the ground. 7. Feed the substitution antenna at the transmitter end with a signal generator connected to the antenna by means of a nonradiating cable. With the antennas at both ends vertically polarized, and with the signal generator tuned to a particular test frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained. This should be done carefully repeating the adjustment of the test antenna and generator output. 8. Repeat step 7 with both antennas horizontally polarized for each test frequency. 9. Calculate power in dBm into a reference ideal half-wave dipole antenna

	by reducing the readings obtained in steps 7 and 8 by the power loss in the cable between the generator and the antenna, and further corrected for the gain of the substitution antenna used relative to an ideal half-wave dipole antenna by the following formula: ERP(dBm) = Pg(dBm) – cable loss (dB) + antenna gain (dBd) where: Pg is the generator output power into the substitution antenna. **Above 1GHz:** Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber, and the test antenna do not need to raise from 1 to 4m, just test in 1.5m height.
Measurement Record:	Uncertainty: ± 6dB
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data

Test conditions		RBW (KHz)	Frequency (MHz)	Level (dBm)	Limit	Result
Temprature	Voltage (AC)					
25℃	230V	100	30~f_c-m	-50.77	-36dbm/100kHz	Pass
		10	f_c-m~ f_c-n	-61.54	-36dbm/10kHz	
		1	f_c-n~ f_c-p	-71.35	-36dbm/1kHz	
		1	f_{c+}p~ f_c+n	-74.24	-36dbm/1kHz	
		10	f_{c+}n~ f_c+m	-62.49	-36dbm/10kHz	
		100	f_{c+}m~ 1000	-50.91	-36dbm/100kHz	

Remark：
fc is 868.10MHz, OCW is 200kHz
M is 10*OCW, whichever is the greater. So m is 2MHz
N is 4*OCW, whichever is the greater. So n is 0.8MHz
P is 2.5*OCW, So p is 0.5MHz

Below 1GHz

Frequency (MHz)	Spurious Emission		Limit (dBm)	Test Result
	polarization	Level(dBm)		
366.64	Vertical	-80.33	-36.00	Pass
440.90	V	-77.50	-36.00	
587.90	V	-73.16	-54.00	
712.21	V	-72.28	-54.00	
856.47	V	-70.18	-54.00	
970.92	V	-67.01	-36.00	
344.35	Horizontal	-80.38	-36.00	
455.79	H	-76.94	-36.00	
532.17	H	-74.64	-54.00	
605.51	H	-72.29	-54.00	
786.80	H	-70.38	-54.00	
970.92	H	-67.03	-36.00	
Tx in standby Mode				
N/A: Not applicable, since the spurious emission of the EUT is too weak to be detected.(≤-70dBm)				

Above 1GHz

Frequency (MHz)	Spurious Emission		Limit (dBm)	Test Result
	polarization	Level(dBm)		
1144.00	Vertical	-56.36	-30.00	Pass
1687.00	V	-57.02	-30.00	
2065.00	V	-57.01	-30.00	
2998.00	V	-57.28	-30.00	
3547.00	V	-55.88	-30.00	
3946.00	V	-56.23	-30.00	
1468.00	Horizontal	-57.37	-30.00	
1864.00	H	-56.93	-30.00	
2143.00	H	-56.71	-30.00	
2494.00	H	-56.56	-30.00	
3253.00	H	-55.33	-30.00	
3778.00	H	-54.85	-30.00	
Tx in standby Mode				
N/A: Not applicable, since the spurious emission of the EUT is too weak to be detected.(≤-70dBm)				

7.1.12 TX Behaviour under Low-voltage Conditions

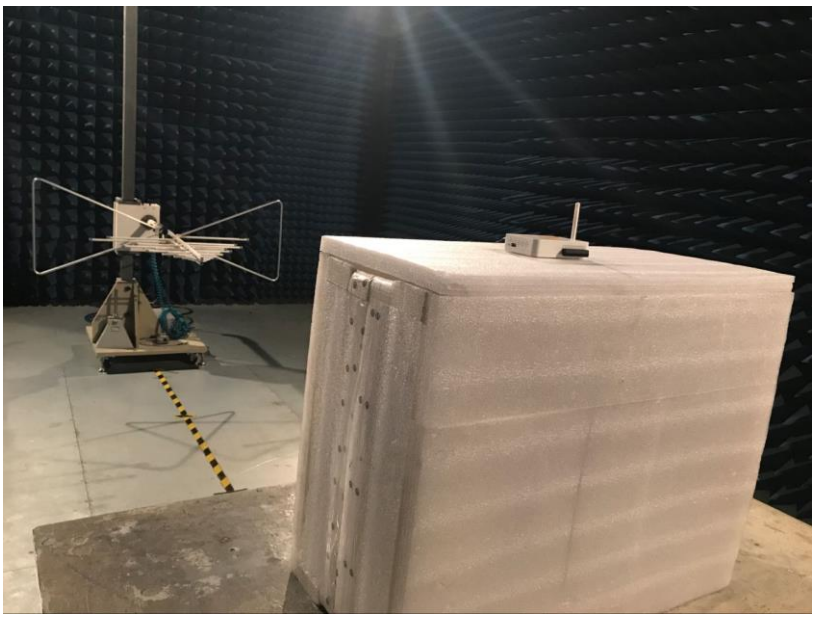
Test Requirement:	ETSI EN 300 220-2 Clause 4.3.8
Test Method:	ETSI EN 300 220-1 Clause 5.12
Receiver setup:	RBW=30Hz, VBW=100Hz, Detector= peak
Limit:	Equipment Type: channelized equipment — Limit: limits stated in clause 8.1.4 Equipment Type: non-channelized equipment — Limit: 1>.within the assigned operating frequency band. And 2>.the radiated or conducted power is greater than the spurious emission limits
Test procedure:	1. The carrier frequency shall be measured, where possible in the absence of modulation, with the transmitter connected to an artificial antenna. 2. A transmitter without a 50 Ω output connector may be placed in a test fixture connected to an artificial antenna. 3. The measurement shall be made under normal temperature and humidity conditions, 4. Transmitter shall power by a DC power source take place the original battery power source, the voltage from the test power source shall be reduced below the lower extreme test voltage limit towards zero. 5. Test the fundamental carrier frequency of the transmitter with nominal supply voltage 6. Whilst the voltage is reduced the carrier frequency shall be monitored. 7. transmitter shall be operated at the maximum rated carrier power level, under normal test conditions; 8. Record the woking frequency.
Measurement Record:	Uncertainty: ±1 x 10^{-7}
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

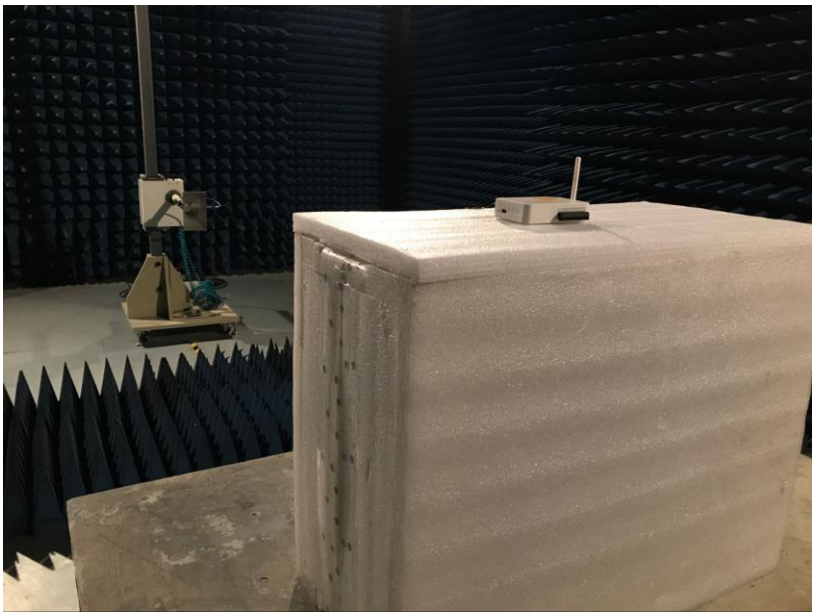
Measurement Data:

Voltage (DC)	Frequency spot (MHz)	Power (dBm)	Limit	Result
V_{normal}=230V	868.1	10.9	868.00MHz to 868.60MHz	Pass
$V_{extreme}$=207V	868.1	9.8		

Remark:
1. The EUT is belong to non-channelized equipment.
2. $V_{extreme}$ is the lowest operation voltage.

8 Test Setup Photo





9 EUT Constructional Details

Reference to the test report No. GTS201705000186E01

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