

RADIO TEST REPORT  
For  
Shenzhen Sonoff Technologies Co., Ltd.  
433MHz RF Bridge  
Test Model: RF Bridge  
Additional Model No.: /

Prepared for	: Shenzhen Sonoff Technologies Co., Ltd.
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Date of receipt of test sample	: March 13, 2020
Number of tested samples	: 1
Serial number	: Prototype
Date of Test	: March 13, 2020 ~ March 26, 2020
Date of Report	: March 26, 2020



# **RADIO TEST REPORT** **ETSI EN 300 220-2 V3.1.1 (2017-02)**

Short Range Devices (SRD) operating in the frequency range 25 MHz to 1 000 MHz; Part 2:  
 Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU for  
 non-specific radio equipment.

**Report Reference No.** ..... : **LCS200116005AEC**

**Sample No.** ..... : 200116005A

**Date of Issue** ..... : March 26, 2020

**Testing Laboratory Name** ..... : **Shenzhen LCS Compliance Testing Laboratory Ltd.**

**Address** ..... : Room 101, 201, Building A and Room 301, Building C, Juji Industrial Park, Yabianxueziwei, Shajing Street, Bao'an District, Shenzhen, Guangdong, China

**Testing Location/ Procedure** ..... : Full application of Harmonised standards ☒  
 Partial application of Harmonised standards ☐  
 Other standard testing method ☐

**Applicant's Name**..... : **Shenzhen Sonoff Technologies Co., Ltd.**

**Address** ..... : 1001, BLDG8, Lianhua Industrial Park, shenzhen, GD, China

## **Test Specification**

**Standard** ..... : ETSI EN 300 220-1 V3.1.1(2017-02)  
 ETSI EN 300 220-2 V3.1.1(2017-02)

**Test Report Form No.** ..... : LCSEMC-1.0


**TRF Originator** ..... : Shenzhen LCS Compliance Testing Laboratory Ltd.

**Master TRF** ..... : Dated 2017-06

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**Test Item Description.** ..... : 433MHz RF Bridge

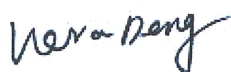
**Trade Mark** ..... : 

**Test Model** ..... : RF Bridge

**Ratings** ..... : Input: 5V $\overline{=}$ 1A

**Result** ..... : **Positive**

**Compiled by:**



Vera Deng / Administrators

**Supervised by:**



Jin Wang/ Technique principal

**Approved by:**



Gavin Liang/ Manager

**RADIO -- TEST REPORT****Test Report No. : LCS200116005AEC**March 26, 2020

Date of issue

Test Model..... : RF Bridge

EUT..... : 433MHz RF Bridge

**Applicant..... : Shenzhen Sonoff Technologies Co., Ltd.**

Address..... : 1001, BLDG8, Lianhua Industrial Park, shenzhen, GD, China

Telephone..... : /

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**Manufacturer..... : Shenzhen Sonoff Technologies Co., Ltd.**

Address..... : 1001, BLDG8, Lianhua Industrial Park, shenzhen, GD, China

Telephone..... : /

Fax..... : /

**Factory..... : /**

Address..... : /

Telephone..... : /

Fax..... : /

**Test Result****Positive**

The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

## Revision History

Revision	Issue Date	Revisions	Revised By
000	March 26, 2020	Initial Issue	Gavin Liang

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## 1. GENERAL INFORMATION

### 1.1. Product Description for Equipment Under Test (EUT)

EUT	: 433MHz RF Bridge
Test Model	: RF Bridge
List Model No.	: /
Model Declaration	: /
Power Supply	: Input: 5V=1A
Hardware Version	: 433RFBRIGE R2 V1.0
Software Version	: FWRF-BG85-BRIDGE-8285-V2.7.0
WIFI(2.4G Band)	:
Frequency Range	: 2412MHz ~ 2472MHz
Channel Spacing	: 5MHz
Channel Number	: 13 Channel for 20MHz bandwidth(2412~2472MHz)
Modulation Type	: 802.11b: DSSS; 802.11g/n: OFDM
Antenna Description	: PCB Antenna, 1.0dBi(Max.)
SRD	:
Frequency Range	: 433.92MHz
Channel Number	: 1
Modulation Type	: GFSK
Antenna Description	: Internal Antenna, 2.0dBi(Max.)

## 1.2. Objective

The following report of is prepared on behalf of the **Shenzhen Sonoff Technologies Co., Ltd.** in accordance with ETSI EN 300 220-2 V3.1.1 (2017-02), Short Range Devices (SRD) operating in the frequency range 25 MHz to 1 000 MHz; Part 2: Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU for non-specific radio equipment.

The objective is to determine compliance with ETSI EN 300 220-2 V3.1.1 (2017-02).

## 1.3. Test Methodology

All measurements contained in this report were conducted with ETSI EN 300 220-1 V3.1.1 (2017-02).

## 1.4. Description of Test Facility

FCC Registration Number is 254912.

Industry Canada Registration Number is 9642A.

EMSD Registration Number is ARCB0108.

UL Registration Number is 100571-492.

TUV SUD Registration Number is SCN1081.

TUV RH Registration Number is UA 50296516-001.

NVLAP Accreditation Code is 600167-0.

FCC Designation Number is CN5024.

CAB identifier: CN0071.

## 1.5. Equipment

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements. Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

## 1.6. Host System Configuration List and Details

Manufacturer	Description	Model	Serial Number	Certificate
BESTGK	Power Adapter	K-T10B050100 0E	---	CE

## 1.7. External I/O

I/O Port Description	Quantity	Cable
Micro USB Port	1	N/A



**1.8. Measurement Uncertainty (95% confidence levels, k=2)**

Item	MU	Remark
Uncertainty for Power point Conducted Emissions Test	2.42dB	
Uncertainty for Radiation Emission test in 3m chamber (30MHz to 1GHz)	3.54dB	Polarize: V
	4.10dB	Polarize: H
Uncertainty for Radiation Emission test in 3m chamber (1GHz to 25GHz)	2.08dB	Polarize: H
	2.56dB	Polarize: V

**1.9. Test Conditions**

Conditions	Temperature	Voltage
Normal	21-25℃	DC 5.0V
Low extreme temperature/low extreme voltage (LT/LV);	-10℃	DC 4.5V
Low extreme temperature/high extreme voltage (LT/HV);	-10℃	DC 5.5V
High extreme temperature/low extreme voltage (HT/LV);	+40℃	DC 4.5V
High extreme temperature/high extreme voltage (HT/HV).	+40℃	DC 5.5V
Note1: For all conditions, the humidity range is:40-75%, the pressure range is 86-106kPa. The High Voltage DC 5.5V and Low Voltage DC 4.5V was declared by manufacturer		

## **2. SYSTEM TEST CONFIGURATION**

### **2.1. EUT Exercise Software**

N/A.

### **2.2. Special Accessories**

N/A.

### **2.3. Equipment Modifications**

No modifications were made to the unit tested.

### **2.4. External I/O Cable**

N/A.

### **2.5. Configuration of Test Setup**

Please refer to the test setup photo.

### 3. SUMMARY OF TEST RESULTS

ETSI EN 300220-2 V3.1.1 (2017-02)		
RULE	DESCRIPTION OF TEST	RESULT
§4.3.1	EFFECTIVE RADIATED POWER	COMPLIANT
§4.3.2	MAXIMUM EFFECTIVE RADIATED POWER SPECTRAL DENSITY	N/A
§4.3.3	DUTY CYCLE	COMPLIANT
§4.3.4	OCCUPIED BANDWIDTH	COMPLIANT
§4.3.5	TX OUT OF BAND EMISSIONS	COMPLIANT
§4.3.6	TRANSIENT POWER	COMPLIANT
§4.3.7	ADJACENT CHANNEL POWER	COMPLIANT
§4.3.8	TX BEHAVIOUR UNDER LOW VOLTAGE CONDITIONS	COMPLIANT
§4.3.9	ADAPTIVE POWER CONTROL	N/A
§4.3.10	FHSS EQUIPMENT	N/A
§4.3.11	SHORT TERM BEHAVIOUR	N/A
§4.2.2	UNWANTED EMISSIONS IN THE SPURIOUS DOMAIN	COMPLIANT
§4.4.2	BLOCKING (REVEIVER REQUIREMENTS)	COMPLIANT
§4.2.2	RECEIVER SPURIOUS RADIATION	COMPLIANT

## 4. EFFECTIVE RADIATED POWER

### 4.1. Standard Applicable

According to ETSI EN 300 220-2 V3.1.1 (2017-02) section 4.3.1, the effective radiated power shall not exceed the power class value given in table 5:

**Table 5: Maximum radiated power limit, e.r.p., channel spacing, spectrum access and mitigation requirements**

Operational Frequency Band		Maximum effective radiated power, e.r.p.	Maximum occupied bandwidth	Channel access and occupation rules (e.g. Duty cycle or LBT + AFA)
H	433,050 MHz to 434,790 MHz	10 mW	The whole band	10%

**NOTE 1:** When either a duty cycle, Listen Before Talk (LBT) or equivalent technique applies then it shall not be user dependent/adjustable and shall be guaranteed by appropriate technical means. For LBT devices without Adaptive Frequency Agility (AFA) or equivalent techniques, the duty cycle limit applies.

**NOTE 2:** Devices supporting audio and video applications shall use a digital modulation method with a maximum bandwidth of 300 kHz. Devices supporting analogue and/or digital voice shall have a maximum bandwidth not exceeding 25 kHz.

### 4.2. Test Procedure

According to ETSI EN 300 220-1 V3.1.1 (2017-02) section 5.2.2

#### **Effective Radiated Power (conducted measurement):**

This method applies only to EUT with a permanent external antenna connector.

#### **Test conditions:**

- 1) The measurement shall be performed on the lowest and the highest Operating Frequencies declared by the manufacturer. Additional frequencies may be tested.
- 2) 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. D-M1 test signal (unmodulated carrier) shall not be used for equipment with non-constant envelope modulation.
- 3) The RBW of the spectrum analyser shall be wide enough to cover the complete power envelope ( $\geq$  OCW) of the signal of the EUT.

#### **Measurement procedure:**

The transmitter shall be connected to a dummy load as described in clause 4.3.7 and the conducted power delivered shall be measured with a measurement receiver according to clause 4.3.10.

In the case of non-constant envelope modulation, a peak detector shall be used. The maximum gain of the antenna to be used together with the equipment shall be declared by the manufacturer and this shall be recorded in the test report.

Perp, the radiated power (e.r.p.) limit applies to the maximum measured conducted power ( $P_{\text{conducted}}$ ) value adjusted by the antenna gain (relative to a dipole) ( $P_{\text{erp}} = P_{\text{conducted}} + \text{antenna gain}$ ).

#### **Effective radiated power (radiated measurement):**

This measurement method applies to EUT other than those measured using clause 5.2.2.1 in ETSI EN 300 220-1 V3.1.1 (2017-02).

#### **Test conditions:**

- 1) The measurement shall be performed on the lowest and the highest Operating Frequencies declared by the manufacturer. Additional frequencies may be tested.
- 2) These measurements shall be performed at the highest power level at which the transmitter is intended to operate.
- 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. D-M1 test signal (unmodulated carrier) shall not be used for equipment with non-constant envelope modulation.
- 4) The RBW of the spectrum analyser shall be wide enough to cover the complete power envelope ( $\geq$  OCW) of the signal of the EUT.

- 5) In the case of a removable antenna, the antenna shall be fitted in a manner representative of normal use.  
 6) For measurement in extreme temperature conditions, it is preferable to use an internal or a temporary connector rather than a test fixture.

**Measurement procedure:**

A suitable test site shall be selected from those described in clause C.1 and the radiated power established using the procedures described in clause C.5.1 (or clause C.5.2) depending on the test site, followed by clause C.5.3.

In the case of non-constant envelope modulation, a peak detector shall be used.

**4.3. Test Data****Environmental Conditions**

<b>Temperature:</b>	23.7°C
<b>Relative Humidity:</b>	53.5%
<b>ATM Pressure:</b>	100.0 kPa

**Test Mode:** Transmitting

Freq.	Ant.Pol.	SGO/P	Ant.	Dipole	Cable	Corrected		Limit
(MHz)	H/V	(dBm)	Gain (dB)	Gain (dB)	(dB)	power ERP		ERP
						(dBm)	(mW)	(mW)
433.92	V	5.61	2.0	0	0.64	<b>6.97</b>	4.98	10
433.92	H	5.44	2.0	0	0.64	6.80	4.79	10

**Remark:**

(1) Corrected Power (dBm) = SG O/P-Cable + Ant Gain

**Test Result:** Compliant.

## **5. MAXIMUM EFFECTIVE RADIATED POWER SPECTRAL DENSITY**

**Not applicable:** This device is neither applies to transmitters using annex B bands I, L nor using DSSS or wideband techniques other than FHSS modulation, in annex C band X.  
Annex B and C are in ETSI EN 300 220-2 V3.1.1 (2017-02).

## 6. DUTY CYCLE

### 6.1. Standard Applicable

In a period of 1 hour the duty cycle shall not exceed the following values given in table below.

Operational Frequency Band		Maximum effective radiated power, e.r.p.	Maximum occupied bandwidth	Channel access and occupation rules (e.g. Duty cycle or LBT + AFA)
H	433,050 MHz to 434,790 MHz	10 mW	The whole band	10%

### 6.2. Test Procedure

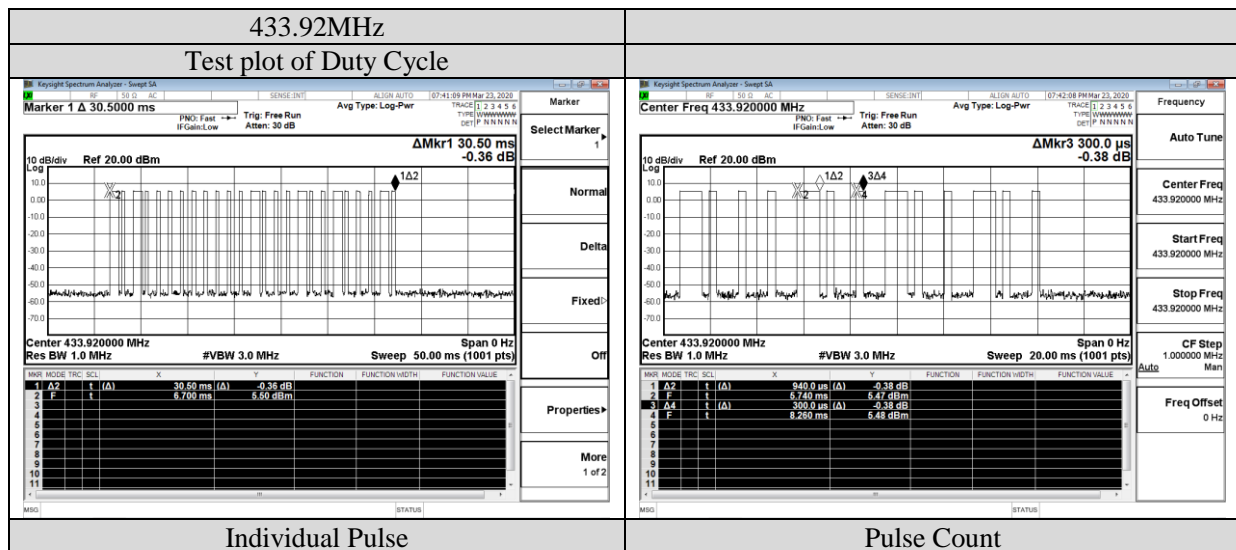
- (1) Put the EUT on the support in its standard position and switched on.
- (2) Find the transmit signal and marker to the center frequency.
- (3) Use the zero span of spectrum analyzer to read out the “message” on and off time in any one period.

### 6.3. Test Data

for a signal burst of each transmit time, please refer to the following page.

Frequency (MHz)	Transmit On time (ms)	Duty Cycle	Limit
433.92	11.34	0.019%	10%

Note: The duty cycle is calculated as follow:  
Duty cycle= Transmit On time (s)/3600\*100%



## 7. OCCUPIED BANDWIDTH

### 7.1. Standard Applicable

According to ETSI EN 300 220-1 V3.1.1 (2017-02) clause 5.6.

The occupied bandwidth (OBW) is the Frequency Range in which 99 % of the total mean power of a given emission falls. The residual part of the total power being denoted as  $\beta$ , which, in cases of symmetrical spectra, splits up into  $\beta/2$  on each side of the spectrum. Unless otherwise specified,  $\beta/2$  is taken as 0.5 % as described in Figure 1.

The maximum occupied bandwidth includes all associated side bands above the appropriate emissions level and the frequency error or drift under extreme test conditions.

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  $F_{\text{low}}$  and  $F_{\text{high}}$ .

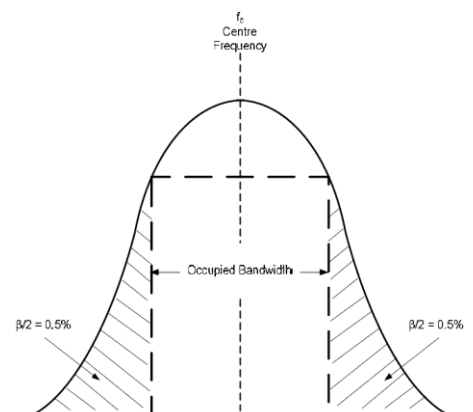


Figure 1: Signal occupied bandwidth

### 7.2. Test Procedure

- 1) The measurement shall be performed on the lowest and the highest Operating Frequencies declared by the manufacturer. Additional frequencies may be tested.
- 2) The measurement shall be performed with a spectrum analyser.
- 3) For devices with e.r.p.  $\leq -30$  dBm, OBW may be either measured or taken as equal to the OCW within the operational frequency band.

#### Radiated measurement:

A suitable test site shall be selected from those described in clause C.1 and the measurements in clause 5.6.3.4 shall be performed using corresponding radiated measurement methods described in clause C.5.

#### Conducted measurement:

The EUT shall be connected to an artificial antenna which shall be connect to the test equipment via an appropriate attenuator.

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

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*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	



If the equipment is capable of producing an unmodulated carrier and the test in ETSI EN 300 220-1 V3.1.1 (2017-02) clause 5.7 is performed, then the OBW measurements need only be performed under normal test conditions. Any required results for Maximum OBW under extreme conditions are obtained by addition and subtraction of the upper and lower frequency error results to each bandwidth measurement obtained in this test.

#### 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.

### 7.3. Test Data

#### Environmental Conditions

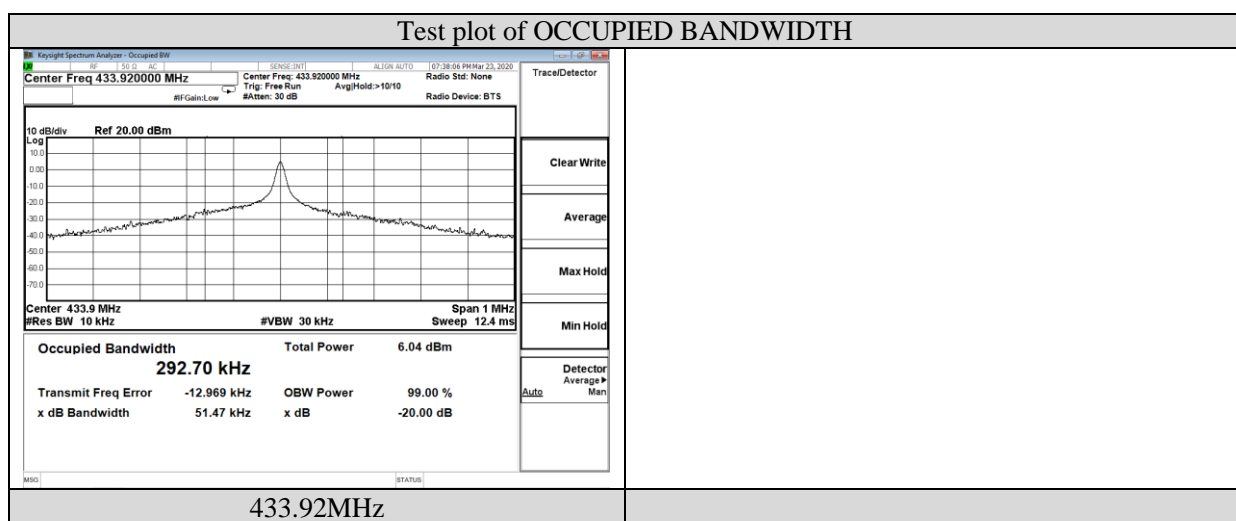
<b>Temperature:</b>	23.7°C
<b>Relative Humidity:</b>	53.5%
<b>ATM Pressure:</b>	100.0 KPa

#### Test Mode: Transmitting

Test signal	Centre Frequency (MHz)	Occupied Bandwidth (KHz)	Maximum Occupied Bandwidth (KHz)
D-M2	433.92	292.70	/

Note: The test signal used. Please refer to the Table 2 in ETSI EN 300 220-1 V3.1.1 (2017-02).

Highest measured OBW value or if the measurement is only performed at normal temperature conditions, the upper and lower frequency error results have to be added and subtracted to measured OBW to calculate the Maximum Occupied Bandwidth.



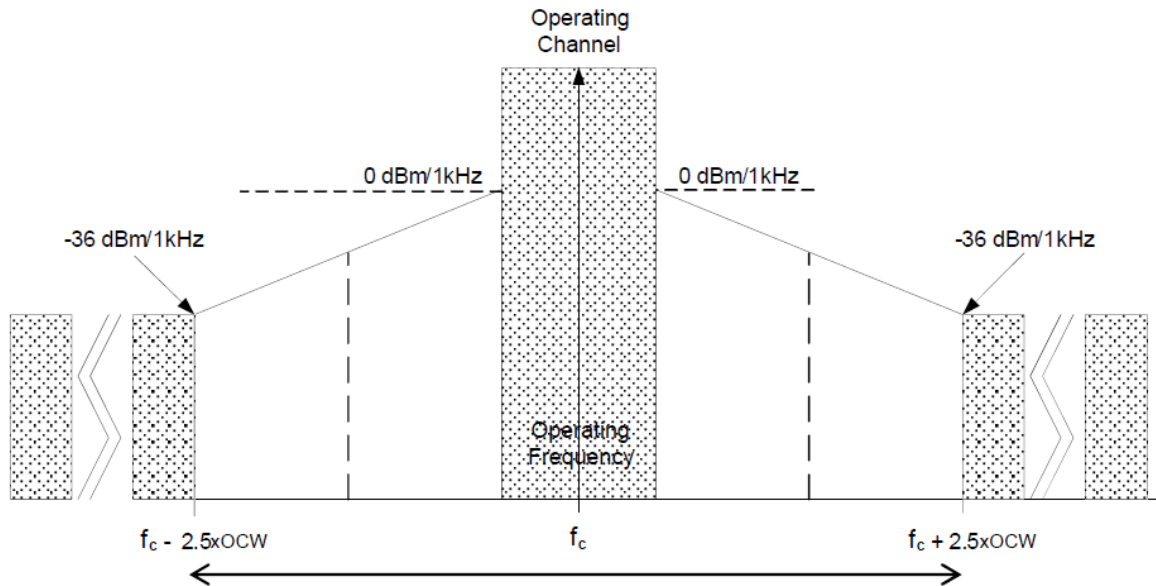
## 8. TX OUT OF BAND EMISSIONS

### 8.1. Standard Applicable

According to ETSI EN 300 220-1 V3.1.1 (2017-02) clause 5.8.

Two OOB domains are defined, one for OC (see Figure 2) and one for Operational Frequency band (see Figure 3).

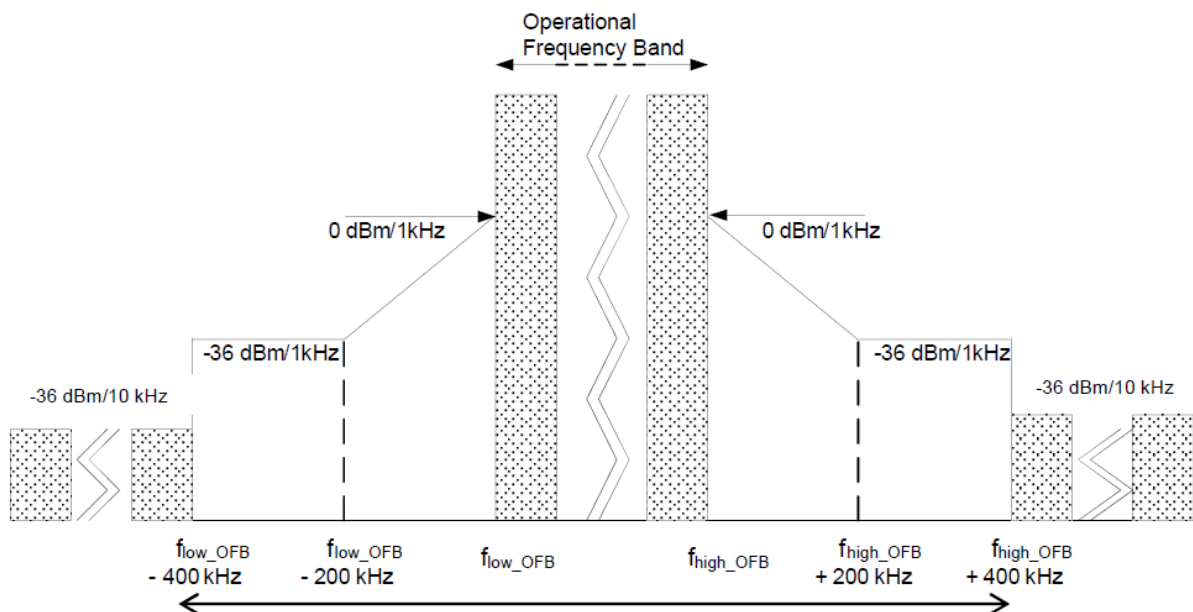
The spectrum masks for these two OOB domains may overlap.



**Figure 2: Out Of Band Domain for Operating Channel with reference BW**

Unwanted emissions in the Out Of Band domain are those falling in the frequency range immediately below the lower, and above the upper, frequency of the Operating Channel. The OOB domain includes both frequencies outside the Operating Channel within the Operational Frequency Band and frequencies outside the Operational Frequency Band.

The relevant Out Of Band domain is shown in Figure 2 and applies within the Operational Frequency Band.



**Figure 3: Out Of Band Domain for Operational Frequency Band with reference BW**

Specific limits apply at frequencies immediately above and below the Operational Frequency Band as shown in Figure 3.

NOTE:  $f_{low\_OFB}$  is the lower edge of the Operational Frequency Band.

$f_{high\_OFB}$  is the upper edge of the Operational Frequency Band.

The EUT emissions level in OOB domains for the Operating Channel and the Operational Frequency Band shall be less or equal to Table 1 spectrum mask.

**Table 1: Emission limits in the Out Of Band domains**

Domain	Frequency Range	RBW <sub>REF</sub>	Max power limit
OOB limits applicable to Operational Frequency Band (See Figure 3)	$f \leq f_{\text{low\_OFB}} - 400 \text{ kHz}$	10KHz	-36dBm
	$F_{\text{low\_OFB}} - 400 \text{ kHz} \leq f \leq f_{\text{low\_OFB}} - 200 \text{ kHz}$	1KHz	-36 dBm
	$f_{\text{low}} - 200 \text{ kHz} \leq f < f_{\text{low\_OFB}}$	1KHz	See Figure 3
	$f = f_{\text{low\_OFB}}$	1KHz	0 dBm
	$f = f_{\text{high\_OFB}}$	1KHz	0 dBm
	$F_{\text{high\_OFB}} < f \leq f_{\text{high\_OFB}} + 200 \text{ kHz}$	1KHz	See Figure 3
	$F_{\text{high\_OFB}} + 200 \text{ kHz} \leq f \leq f_{\text{high\_OFB}} + 400 \text{ kHz}$	1KHz	-36 dBm
	$F_{\text{high\_OFB}} + 400 \text{ kHz} \leq f$	10KHz	-36 dBm
OOB limits applicable to Operating Channel (See Figure 2)	$f = f_c - 2.5 \times \text{OCW}$	1KHz	-36 dBm
	$f_c - 2.5 \times \text{OCW} \leq f \leq f_c - 0.5 \times \text{OCW}$	1KHz	See Figure 2
	$f = f_c - 0.5 \times \text{OCW}$	1KHz	0 dBm
	$f = f_c + 0.5 \times \text{OCW}$	1KHz	0 dBm
	$f_c + 0.5 \times \text{OCW} \leq f \leq f_c + 2.5 \times \text{OCW}$	1KHz	See Figure 2
	$f = f_c + 2.5 \times \text{OCW}$	1KHz	-36 dBm

NOTE: f is the measurement frequency.  
 $f_c$  is the Operating Frequency.  
 $F_{\text{low\_OFB}}$  is the lower edge of the Operational Frequency Band.  
 $F_{\text{high\_OFB}}$  is the upper edge of the Operational Frequency Band.  
 OCW is the operating channel bandwidth.

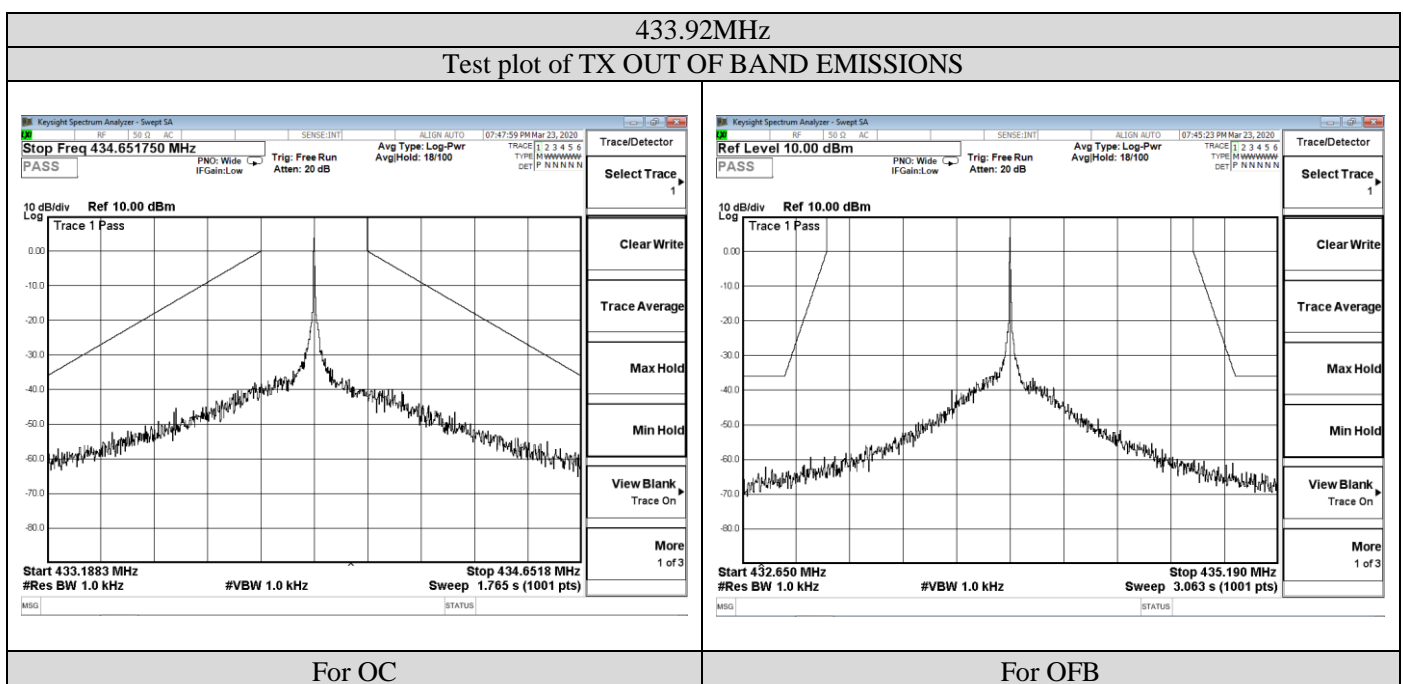
## 8.2. Test Procedure

Please refer to ETSI EN 300 220-1 V3.1.1 (2017-02) clause 5.8.3 for the measurement method.

## 8.3. Test Data

### Environmental Conditions

Temperature:	23.7°C
Relative Humidity:	53.5%
ATM Pressure:	100.0 kPa



Note: 1. OC is the operating channel;  
 2. OFB is the Operational Frequency Band.

## 9. TRANSIENT POWER

### 9.1. Standard Applicable

According to ETSI EN 300 220-1 V3.1.1 (2017-02) clause 5.10.

Transmitter transient power is power falling into frequencies other than the operating channel as a result of the transmitter being switched on and off.

The transient power shall not exceed the values given in Table 4.

**Table 4: Transmitter Transient Power limits**

Absolute offset from centre frequency	RBW <sub>REF</sub>	Peak power limit applicable at measurement points
$\leq 400$ kHz	1KHz	0dBm
$> 400$ kHz	1KHz	-27dBm

### 9.2. Test Procedure

Please refer to ETSI EN 300 220-1 V3.1.1 (2017-02) clause 5.10.3 for the measurement method.

### 9.3. Test Data

#### Environmental Conditions

<b>Temperature:</b>	23.7°C
<b>Relative Humidity:</b>	53.5%
<b>ATM Pressure:</b>	100.0 kPa

**Test Mode:** Transmitting

Test condition		Transient power(dBm/dBc)	
		CH1	CH2
Alternate channel	433.92MHz	-0.758	/
Text result(pass/fail)		PASS	

## 10. ADJACENT CHANNEL POWER

### 10.1. Standard Applicable

According to ETSI EN 300 220-1 V3.1.1 (2017-02) clause 5.11.

Adjacent channel power is power incidental to proper operation of a transmitter falling into the neighbouring channels.

Where the operating channel width is less than or equal to 25 kHz, the power in the adjacent channels shall not exceed the values given in Table 5.

**Table 5: Adjacent channel power limits for transmitters with  $OCW \leq 25$  kHz**

		Adjacent Channel power integrated over $0,7 \times OCW$	Alternate Adjacent Channel power integrated over $0,7 \times$ $OCW$
OCW < 20 kHz	Normal test conditions	-20 dBm	-20 dBm
	Extreme test conditions	-15 dBm	-20 dBm
OCW $\geq$ 20 kHz	Normal test conditions	-37 dBm	-40 dBm
	Extreme test conditions	-32 dBm	-37 dBm

### 10.2. Test Procedure

Please refer to ETSI EN 300 220-1 V3.1.1 (2017-02) clause 5.11.3 for the measurement method.

### 10.3. Test Data

**Not applicable:** EUT No requirement.

Because the OCW of this EUT was great than 25 KHz.

## 11. TX BEHAVIOUR UNDER LOW VOLTAGE CONDITIONS

### 11.1. Standard Applicable

According to ETSI EN 300 220-1 V3.1.1 (2017-02) clause 5.12.

The TX behaviour under low voltage condition is the ability of the equipment to maintain its operating frequency and not produce emissions which exceed any relevant limit when the battery voltage falls below the lower extreme voltage level.

The equipment shall either:

- a) remain in the Operating Channel OC without exceeding any applicable limits (e.g. Duty Cycle); or
- b) reduce its effective radiated power below the Spurious Emission limits without exceeding any applicable limits(e.g. Duty Cycle); or
- c) shut down, (ceasing function); as the voltage falls below the manufacturers declared operating voltage. as the voltage falls below the manufacturers declared operating voltage.

### 11.2. Test Procedure

#### Step 1:

Operation of the EUT shall be started, on Operating Frequency as declared by the manufacturer, with the appropriate test signal and with the EUT operating at nominal operating voltage.

The centre frequency of the transmitted signal shall be measured and noted.

#### Step 2:

The operating voltage shall be reduced by appropriate steps until the voltage reaches zero.

The centre frequency of the transmitted signal shall be measured and noted.

Any abnormal behaviour shall be noted.

### 11.3. Test Data

#### Environmental Conditions

<b>Temperature:</b>	23.7°C
<b>Relative Humidity:</b>	53.5%
<b>ATM Pressure:</b>	100.0 kPa

**Test Mode:** Transmit (433.92MHz, Transmitter)

Voltage Supply (Vac)	Measurement Frequency (MHz)	ERP (dBm)	Duty Cycle	Limit	Result
230	433.92	<-36	0.019%	10%	Pass
207	433.92	<-36	0.019%	10%	Pass
150	433.92	<-36	0.019%	10%	Pass
110	433.92	<-36	0.019%	10%	Pass
100	433.92	<-36	0.019%	10%	Pass
0	433.92	0	0	10%	Pass

## 12. ADAPTIVE POWER CONTROL

### 12.1. Standard Applicable

According to ETSI EN 300 220-1 V3.1.1 (2017-02) clause 5.13.

The peak power measured when active APC function at its minimum setting shall not exceed the value shown in Table 6.

Table 6: APC power limit

Parameter	Limit
Transmitted e.r.p.	+7 dBm

### 12.2. Test Procedure

Please refer to ETSI EN 300 220-1 V3.1.1 (2017-02) clause 5.13.3 for the measurement method.

### 12.3. Test Data

**Not applicable:** EUT No requirement.

## 13. FHSS EQUIPMENT

### 13.1. Standard Applicable

According to ETSI EN 300 220-2 V3.1.1 (2017-02) clause 4.3.10.

### 13.2. Test Procedure

Please refer to ETSI EN 300 220-2 V3.1.1 (2017-02) clause 4.3.10 for the measurement method.

### 13.3. Test Data

**Not applicable:** EUT No requirement.

## 14. SHORT TERM BEHAVIOUR

### 14.1. Standard Applicable

According to ETSI EN 300 220-2 V3.1.1 (2017-02) clause 4.3.11.

### 14.2. Test Procedure

Please refer to ETSI EN 300 220-2 V3.1.1 (2017-02) clause 4.3.11 for the measurement method.

### 14.3. Test Data

**Not applicable:** EUT No requirement.

## 15. UNWANTED EMISSIONS IN THE SPURIOUS DOMAIN

### 15.1. Standard Applicable

According to ETSI EN 300 220-1 V3.1.1 (2017-02) clause 5.9.2.

The power of any unwanted emission in the spurious domain shall not exceed the values given in Table 7.

**Table 19: Spurious domain emission limits**

Frequency State	47 MHz to 74 MHz 87,5 MHz to 118 MHz 174 MHz to 230 MHz 470 MHz to 790 MHz	Other frequencies below 1000 MHz	above 1000 MHz
<b>TX mode</b>	-54 dBm	-36 dBm	-30 dBm
<b>RX and all other modes</b>	-57 dBm	-57 dBm	-47 dBm

### 15.2. Test Procedure

Please refer to ETSI EN 300 220-1 V3.1.1 (2017-02) clause 5.9.3 for the measurement method.

### 15.3. Test Data

#### Environmental Conditions

<b>Temperature:</b>	23.7°C
<b>Relative Humidity:</b>	53.5%
<b>ATM Pressure:</b>	100.0 kPa

**Test Mode:** TX 433.92MHz

Frequency (MHz)	Antenna Polarization	S.G. (dBm)	Cable loss (dB)	Ant.Gain (dB)	Emission level (dBm)	Limit (dBm)	Margin (dB)
635.38	V	-84.63	1.40	21.10	-64.93	-54.00	-10.93
1830.53	V	-68.78	2.79	24.40	-47.17	-30.00	-17.17
2745.33	V	-75.92	2.74	27.20	-51.46	-30.00	-21.46
3660.29	V	-78.39	2.86	28.70	-52.55	-30.00	-22.55
4575.58	V	-77.77	2.84	33.30	-47.31	-30.00	-17.31
629.81	H	-82.68	1.40	21.10	-62.98	-54.00	-8.98
1830.18	H	-67.71	2.79	24.40	-46.10	-30.00	-16.10
2745.58	H	-74.51	2.74	27.20	-50.05	-30.00	-20.05
3660.24	H	-77.29	2.86	28.70	-51.45	-30.00	-21.45
4575.71	H	-77.91	2.84	33.30	-47.45	-30.00	-17.45



**Test Mode: Standby**

Frequency (MHz)	Antenna Polarization	S.G. (dBm)	Cable loss (dB)	Ant.Gain (dB)	Emission level (dBm)	Limit (dBm)	Margin (dB)
87.09	V	-92.75	1.40	21.10	-73.05	-57.00	-16.05
187.49	V	-91.97	2.79	24.40	-70.36	-57.00	-13.36
2532.31	V	-94.04	2.74	27.20	-69.58	-57.00	-12.58
3835.91	V	-87.31	2.86	28.70	-61.47	-57.00	-14.47
83.55	V	-96.85	2.84	33.30	-66.39	-57.00	-9.39
190.45	H	-86.92	1.40	21.10	-67.22	-57.00	-10.22
2534.29	H	-85.40	2.79	24.40	-63.79	-57.00	-16.79
3841.03	H	-91.85	2.74	27.20	-67.39	-57.00	-20.39
636.84	H	-90.69	2.86	28.70	-64.85	-57.00	-7.85
761.82	H	-94.22	2.84	33.30	-63.76	-57.00	-6.76

**Remark:**

- (1) Corrected Power (dBm) = SG O/P-Cable + Ant Gain
- (2) Measuring frequencies from 25 MHz to the 6GHz.
- (3) Data of measurement within this frequency range shown "--" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

## 16. BLOCKING (REVEIVER REQUIREMENTS)

### 16.1. Standard Applicable

According to ETSI EN 300 220-1 V3.1.1 (2017-02) clause 5.9.2.

The blocking levels at the specified frequency offsets shall be equal to or greater than the limits in the following Table, except at frequencies where spurious responses are found.

**Blocking level parameters for RX category 1**

Requirement	Limits
	Receiver category 1
Blocking at $\pm 2$ MHz from Centre Frequency	$\geq -20$ dBm
Blocking at $\pm 10$ MHz from Centre Frequency	$\geq -20$ dBm
Blocking at $\pm 5$ % of Centre Frequency or 15 MHz, whichever is the greater	$\geq -20$ dBm

**Blocking level parameters for RX category 1.5**

Requirement	Limits
	Receiver category 1.5
Blocking at $\pm 2$ MHz from Centre Frequency	$\geq -43$ dBm
Blocking at $\pm 10$ MHz from Centre Frequency	$\geq -33$ dBm
Blocking at $\pm 5$ % of Centre Frequency or 15 MHz, whichever is the greater	$\geq -33$ dBm

**Blocking level parameters for RX category 2**

Requirement	Limits
	Receiver category 2
Blocking at $\pm 2$ MHz from Centre Frequency	$\geq -69$ dBm
Blocking at $\pm 10$ MHz from Centre Frequency	$\geq -44$ dBm
Blocking at $\pm 5$ % of Centre Frequency or 15 MHz, whichever is the greater	$\geq -44$ dBm

**Blocking level parameters for RX category 3**

Requirement	Limits
	Receiver category 3
Blocking at $\pm 2$ MHz from Centre Frequency	$\geq -80$ dBm
Blocking at $\pm 10$ MHz from Centre Frequency	$\geq -60$ dBm
Blocking at $\pm 5$ % of Centre Frequency or 15 MHz, whichever is the greater	$\geq -60$ dBm

### 16.2. Test Procedure

Please refer to ETSI EN 300 220-1 V3.1.1 (2017-02) clause 5.18.6 for the measurement method.

**16.3. Test Data****Environmental Conditions**

<b>Temperature:</b>	23.7° C
<b>Relative Humidity:</b>	53.5%
<b>ATM Pressure:</b>	100.0 kPa

**Test Mode:** Receiving (433.92MHz)**This receiver is belongs to RX category 2**

Wanted Signal Channel (MHz)	Unwanted Signal Frequency (MHz)	Blocking level ( dBm )	Limit ( dBm )	Result
433.92MHz	433.92+2	-53	At least -69	Pass
433.92MHz	433.92+10	-37	At least -44	Pass
433.92MHz	433.92+15	-37	At least -44	Pass

Wanted Signal Channel (MHz)	Unwanted Signal Frequency (MHz)	Blocking level ( dBm )	Limit ( dBm )	Result
433.92MHz	433.92-2	-55	At least -69	Pass
433.92MHz	433.92-10	-41	At least -44	Pass
433.92MHz	433.92-15	-38	At least -44	Pass

## 17. RECEIVER SPURIOUS RADIATION

### 17.1. Standard Applicable

According to ETSI EN 300 220-1 V3.1.1 (2017-02) clause 5.9.2.

The power of any spurious emission, radiated or conducted, shall not exceed the values given below. The limits are applicable to all receiver categories:

- -57dBm below 1 000 MHz;
- -47dBm above 1 000 MHz.

### 17.2. Test Procedure

Please refer to ETSI EN 300 220-1 V3.1.1 (2017-02) clause 5.18.6 for the measurement method.

### 17.3. Test Data

#### Environmental Conditions

<b>Temperature:</b>	23..7° C
<b>Relative Humidity:</b>	53.5%
<b>ATM Pressure:</b>	100.0 kPa

**Test Result: Pass**

**Test Mode: Receiving (433.92MHz)**

Frequency (MHz)	Antenna Polarization	S.G. (dBm)	Cable loss (dB)	Ant.Gain (dB)	Emission level (dBm)	Limit (dBm)	Margin (dB)
75.99	V	-100.39	1.40	21.10	-80.69	-57.00	-23.69
259.07	V	-93.43	2.79	24.40	-71.82	-57.00	-14.82
509.63	V	-95.04	2.74	27.20	-70.58	-57.00	-13.58
641.98	V	-93.25	2.86	28.70	-67.41	-57.00	-10.41
766.32	V	-99.00	2.84	33.30	-68.54	-57.00	-11.54
73.09	H	-91.22	1.40	21.10	-71.52	-57.00	-14.52
250.17	H	-86.73	2.79	24.40	-65.12	-57.00	-8.12
498.79	H	-91.38	2.74	27.20	-66.92	-57.00	-9.92
635.15	H	-92.35	2.86	28.70	-66.51	-57.00	-9.51
768.94	H	-92.04	2.84	33.30	-61.58	-57.00	-4.58

#### Remark:

- (1) Corrected Power (dBm) = SG O/P-Cable + Ant Gain
- (2) Measuring frequencies from 25 MHz to the 4GHz.
- (3) Data of measurement within this frequency range shown "--" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

## 18. LIST MEASURING EQUIPMENT

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	MXA Signal Analyzer	Agilent	N9020A	MY49100060	2019-11-14	2020-11-13
2	DC Power Supply	Agilent	E3642A	N/A	2019-11-14	2020-11-13
3	Temperature & Humidity Chamber	GUANGZHOU GOGN WEN	GDS-100	70932	2019-10-09	2020-10-08
4	EMI Test Software	AUDIX	E3	/	2019-06-15	2020-06-14
5	3m Full Anechoic Chamber	MRDIANZI	FAC-3M	MR009	2019-09-27	2020-09-26
6	Positioning Controller	MF	MF-7082	/	2019-06-15	2020-06-14
7	Active Loop Antenna	SCHWARZBEC K	FMZB 1519B	00005	2019-07-25	2020-07-24
8	By-log Antenna	SCHWARZBEC K	VULB9163	9163-470	2019-07-25	2020-07-24
9	Horn Antenna	SCHWARZBEC K	BBHA 9120D	9120D-1925	2019-07-01	2020-06-30
10	EMI Test Receiver	R&S	ESR 7	101181	2019-06-15	2020-06-14
11	RS SPECTRUM ANALYZER	R&S	FSP40	100503	2019-11-14	2020-11-13
12	AMPLIFIER	QuieTek	QTK	CHM/0809065	2019-11-14	2020-11-13
13	RF Cable-R03m	Jye Bao	RG142	CB021	2019-06-15	2020-06-14
14	RF Cable-HIGH	SUHNER	SUCOFLEX 106	03CH03-HY	2019-06-15	2020-06-14

Note: All equipment is calibrated through GUANGZHOU LISAI CALIBRATION AND TEST CO.,LTD.

## 19.TEST SETUP PHOTOGRAPHS

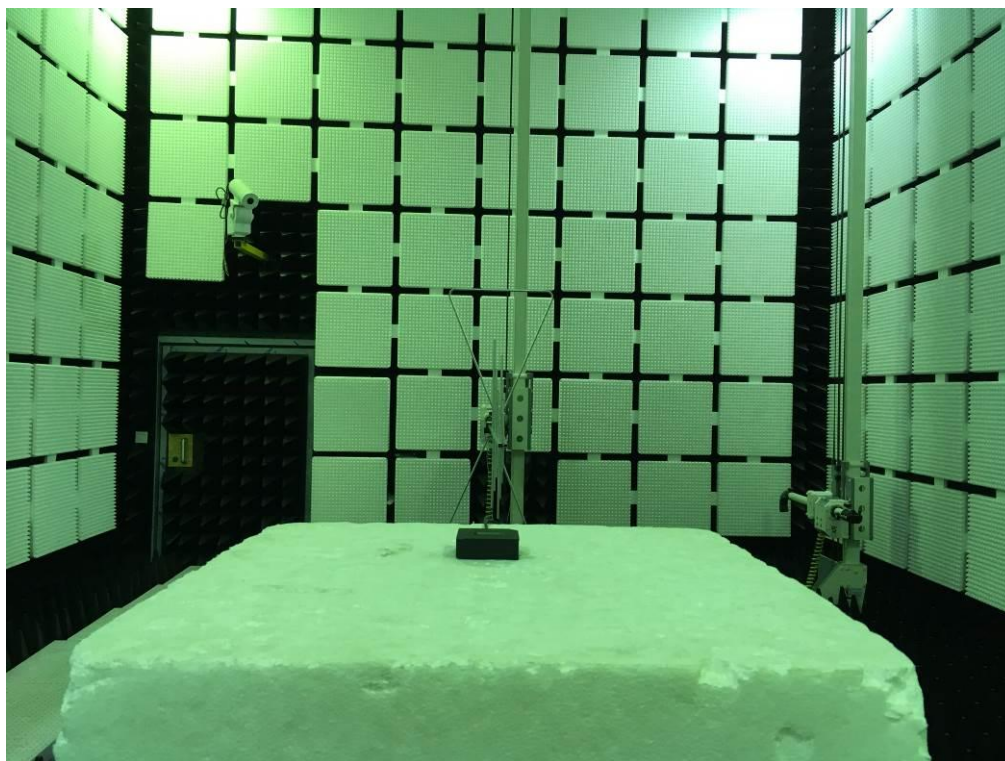


Fig.1

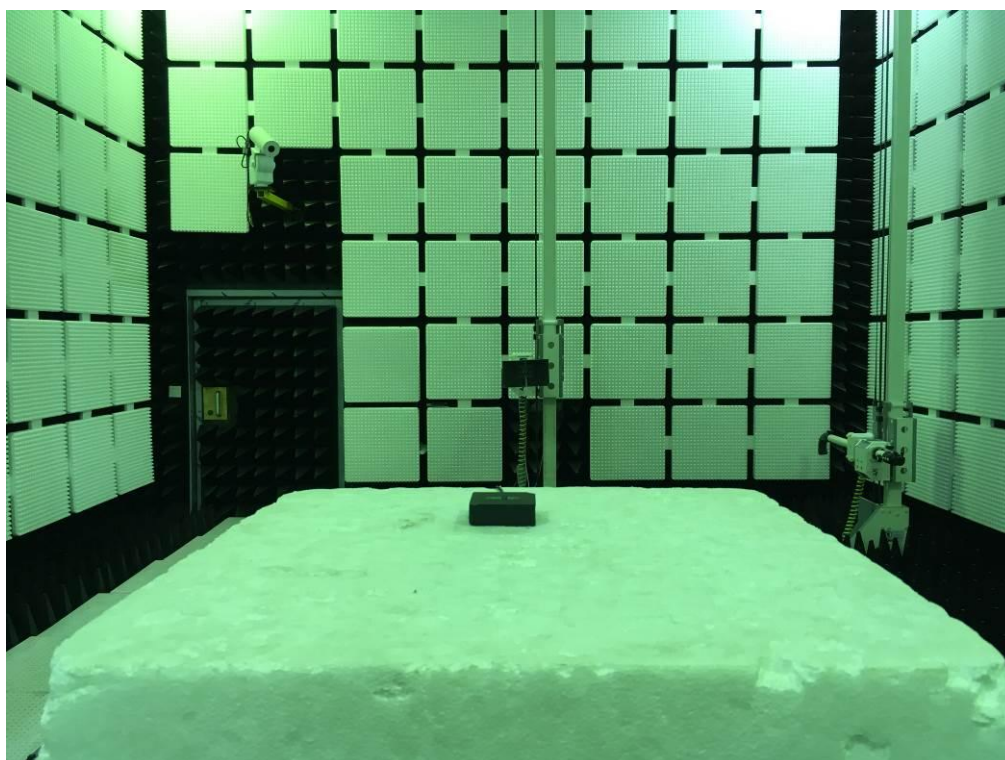


Fig.2

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