

# RF TEST REPORT

**Report No.:** SET2020-14913

**Product Name:** Wireless BBQ Thermometer

**FCC ID:** 2AZCPSXH4325

**Model No.:** CH-216, CH-218

**Applicant:** SHENZHEN SHENXINHUI ELECTRONICS Co.,LTD.

**Address:** 3rd, Block B, No.1 Building, No 1 ShaJingRoad, Baoan, Shenzhen, China.

**Dates of Testing:** 12/04/2020 — 03/23/2021

**Issued by:** CCIC Southern Testing Co., Ltd.

**Lab Location:** Electronic Testing Building, No. 43 Shahe Road, Xili Street, Nanshan District, Shenzhen, Guangdong, China.

**Tel:** 86 755 26627338    **Fax:** 86 755 26627238

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## Test Report

**Product Name** .....: Wireless BBQ Thermometer

**Brand Name** .....: N/A

**Trade Name** .....: N/A

**Applicant** .....: SHENZHEN SHENXINHUI ELECTRONICS Co.,LTD

**Applicant Address** .....: 3rd, Block B, No.1 Building, No 1 ShajingRoad, Baoan, Shenzhen, China.

**Manufacturer** .....: SHENZHEN SHENXINHUI ELECTRONICS Co.,LTD

**Manufacturer Address** .....: 3rd, Block B, No.1 Building, No 1 ShajingRoad, Baoan, Shenzhen, China.

**Test Standards** .....: FCC Part 15.231

**Test Result** .....: PASS

**Tested by** .....: *Vincent*

2021.04.02

Vincent, Test Engineer

**Reviewed by** .....:

*Chris You*

2021.04.02

Chris You, Senior Engineer

**Approved by** .....:

*Shuangwen Zhang*

2021.04.02

Shuangwen Zhang, Manager

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Change History		
Issue	Date	Reason for change
1.0	2021.04.02	First edition

## 1. General Information

### 1.1. EUT Description

EUT Type	Wireless BBQ Thermometer
Hardware Version	RX_V5
Software Version	V1.0
Operation Frequency	433.92 TX
Power supply	Transmitter 2*AAA batteries, receiver 3* AAA batteries
Modulation Type	Spring antenna
Antenna Type	Internal
Antenna Gain	2dBi

Note: The EUT contains two models, they are CH-216 and CH-218. The only different is the model number.

### 1.2. Test Mode(Worst)

Radiated Emission Measurement	
Test condition	Bandedge, Emission for Unwanted and fundamental
Worst mode	433.92 Tx
Worst position	<input type="checkbox"/> Placed in fixed position
	<input checked="" type="checkbox"/> Placed in fixed position at X-Plane
	<input type="checkbox"/> Placed in fixed position at Y-Plane
	<input type="checkbox"/> Placed in fixed position at Z-Plane

Remark: The worst mode was recorded in this report. EUT pre-scaned in three axis, XYZ and two polarity, for Radiated measurement. The worst case were recorded in the report.

### 1.3. Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart C (Bluetooth, 2.4GHz ISM band radiators) for the EUT FCC ID Certification:

No.	Identity	Document Title
1	47 CFR Part 15 Subpart C	Radio Frequency Devices
2	ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices

Test detailed items/section required by FCC rules and results are as below:

No.	Section in CFR 47	Description	Result
1	15.203	Antenna Requirement	PASS
2	15.207	Conducted Emission	N/A
3	15.231(C)	Emission Bandwidth	PASS
4	15.231(e)	Fundamental Emission	PASS
5	15.231(e)	Transmitter Radiated Emission	PASS
6	15.231(e)	Operation restriction	PASS

Note: The tests were performed according to the method of measurements prescribed in ANSI C63.10- 2013.

### 1.4. EUT Operation Test Setup

For RF test items, when power on, the EUT can transmitt automatic.

## 1.5. Facilities and Accreditations

### 1.5.1. Facilities

#### **CNAS-Lab Code: L1659**

CCIC-SET is a third party testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L1659.

#### **FCC-Registration No.: CN5031**

CCIC Southern Testing Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Designation Number: CN5031, valid time is until December 31, 2020.

#### **ISED Registration: 11185A-1**

CCIC Southern Testing Co., Ltd. EMC Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 11185A-1 on Aug. 04, 2016, valid time is until Dec. 31, 2020.

#### **A2LA Lab Code: 5721.01**

CCIC-SET is a third party testing organization accredited by A2LA according to ISO/IEC17025. The accreditation certificate number is 5721.01 .

### 1.5.2. Test Environment Conditions

During the measurement, the environmental conditions were within the listed ranges:

Temperature ( °C):	15 - 35
Relative Humidity (%):	30 -60
Atmospheric Pressure (kPa):	86KPa-106KPa

## 2. 47 CFR Part 15C Requirements

### 2.1. Antenna requirement

#### 2.1.1. Applicable Standard

According to FCC §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

And according to FCC 47 CFR Section §15.247(c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

#### 2.1.2. Antenna Information

**Antenna Category:** Internal antenna

An Internal antenna was soldered to the antenna port of EUT via an adaptor cable, can't be removed.

**Antenna General Information:**

No.	EUT	Ant. Type	Working Frequency	Ant. Gain
1	Wireless BBQ Thermometer	Spring antenna	433.92MHz	2dBi

#### 2.1.3. Result: comply

The EUT has a permanently and irreplaceable attached antenna. Please refer to the EUT internal photos.

## 2.2. Emission Bandwidth

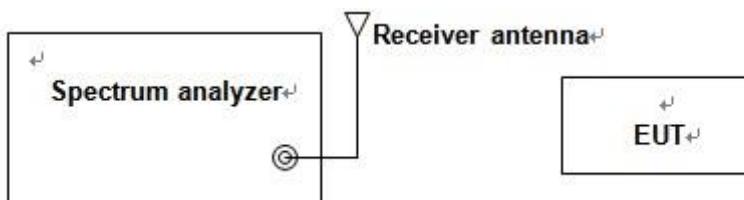
### 2.2.1. Test Limit

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz.

### 2.2.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

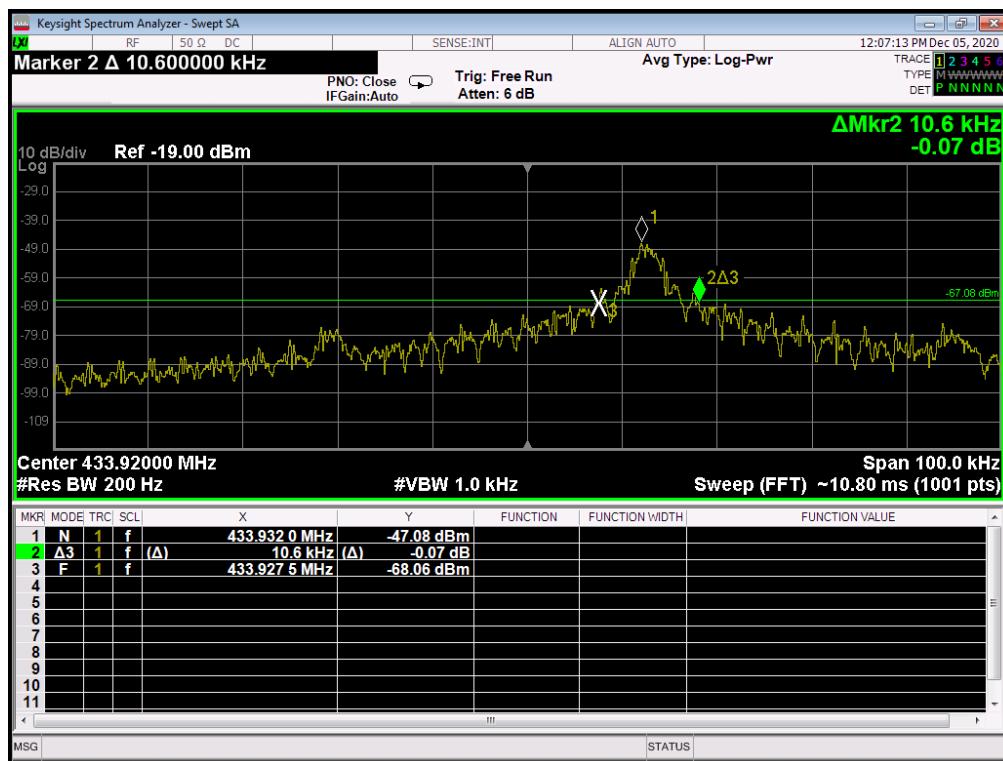
### 2.2.3. Test Setup



### 2.2.4. Test Procedure

1. The testing follows ANSI C63.10-2013 Clause 6.9.2
2. The Receiver antenna was connected to the spectrum analyzer to receive the transmission signal.
3. Using the spectrum analyzer 20dB fuction to measure emission bandwidth.
4. Record the measurement data derived from spectrum analyzer.

## 2.2.5. Test Results



Frequency (MHz)	20dB Bandwidth (KHz)	Limit (KHz)	Result
433.92	10.6	1084.8	Pass

Note: Limit=0.25%\*433.92MHz=1084.8KHz

## 2.3. Field Strength Of Fundamental

### 2.3.1. Test Limit

According to FCC §15.231(b)

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emission (microvolts/meter)
40.66-40.70	2,250	225
70-130	1,250	125
130-174	1,250 to 3,750 <sup>1</sup>	<sup>1</sup> 125 to 375 <sup>1</sup>
174-260	3,750	375
260-470	<sup>1</sup> 3,750 to 12,500 <sup>1</sup>	<sup>1</sup> 375 to 1,250
Above 470	12,500	1,250

<sup>1</sup>Linear interpolations.

For 260-470MHz:Field Strength(uV/m) = (41.67 x f) - 7083

According to FCC §15.231(e)

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emission (microvolts/meter)
40.66-40.70	1,000	100
70-130	500	50
130-174	500 to 1,500 <sup>1</sup>	50 to 150 <sup>1</sup>
174-260	1,500	150
260-470	1,500 to 5,000 <sup>1</sup>	150 to 500 <sup>1</sup>
Above 470	5,000	500

<sup>1</sup>Linear interpolations.

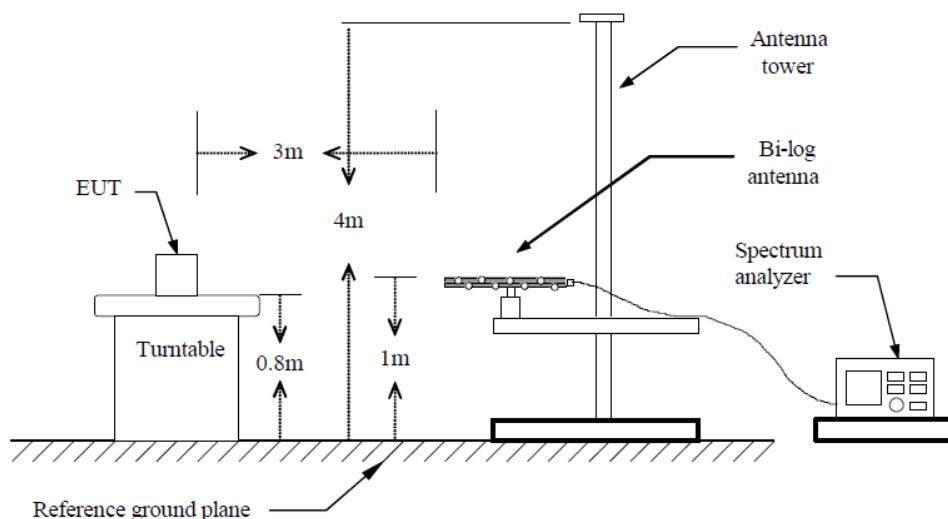
For 260-470MHz:Field Strength(uV/m) = (16.67 x f) - 2834

The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency

### 2.3.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

### 2.3.3. Test Setup



### 2.3.4. Test Procedures

The testing follows ANSI C63.10-2013 Clause 4.1.4, and clause 6.5.

Clause 4.1.4	<input checked="" type="checkbox"/> 4.1.4.2.2:Measurement Peak value
	<input type="checkbox"/> 4.1.4.2.3:Duty cycle $\geq 100\%$
	<input checked="" type="checkbox"/> 4.1.4.2.4:Measurement Average value

### 2.3.5. Test Result

Frequency (MHz)	Reading level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin	Antenna	Verdict	Remark
433.92	78.36	92.87	14.51	Horizontal	Pass	Peak
433.92	38.62	72.87	34.25	Horizontal	Pass	Average
433.92	75.43	92.87	17.44	Vertical	Pass	Peak
433.92	35.69	72.87	37.18	Vertical	Pass	Average

Remark:

1. Fundamental measured setting on spectrum, RBW=100KHz, VBW=100KHz and Detector=Peak.
2. Average result=Peak result+duty cycle factor
3. 260MHz~470MHz limit(Average) is  $16.67 \times (\text{Frequency, MHz}) - 2834.2$   
 $\text{Limit} = 16.67 \times (433.92 \text{MHz}) - 2834.2$   
 $= 4399.2464 \text{ (uV/m)}$   
 $\text{dBuV/m} = 20 \log(\text{uV/m}) = 20 \log(4399.2464 \text{ uV/m}) = 72.87 \text{ dBuV/m}$
4. Duty factor=20log(dutycycle)=-39.74, duty cycle refer to section 2.4

## 2.4. Radiated unwanted emission

### 2.4.1. Test Limit

According to FCC §15.231(e) and §15.209, §15.205

Unwanted emission limit follow the table or the FCC Part 15.209, whichever limit permit higher field strength.

According to §15.231(e)

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emission (microvolts/meter)
40.66-40.70	1,000	100
70-130	500	50
130-174	500 to 1,500 <sup>1</sup>	50 to 150 <sup>1</sup>
174-260	1,500	150
260-470	1,500 to 5,000 <sup>1</sup>	150 to 500 <sup>1</sup>
Above 470	5,000	500

<sup>1</sup>Linear interpolations.

§15.209

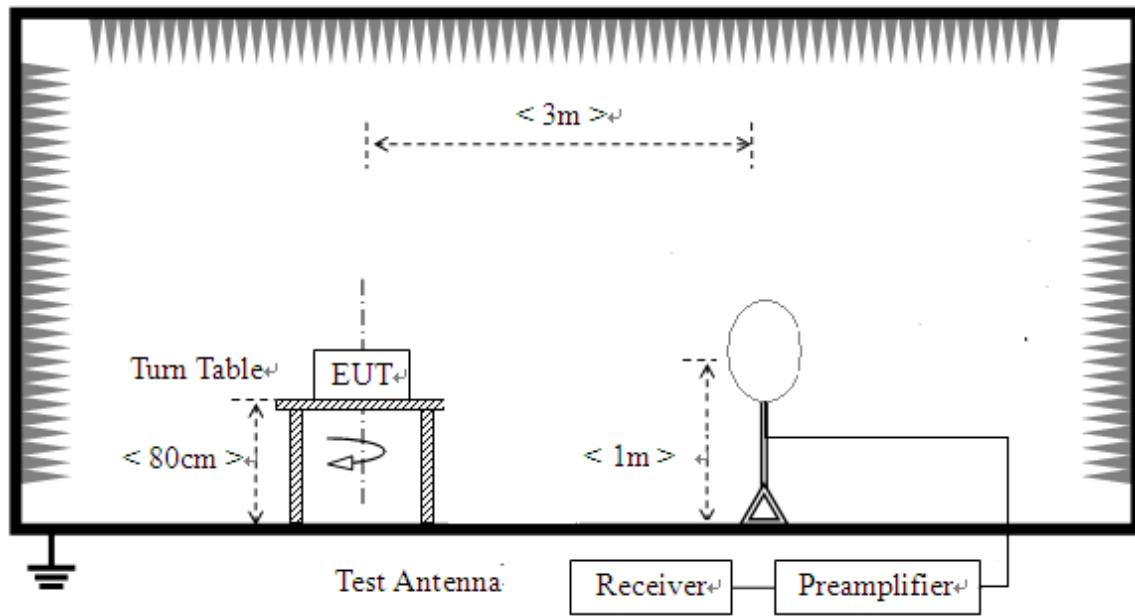
Frequency (MHz)	Field Strength ( $\mu$ V/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

### 2.4.2. Measuring Instruments

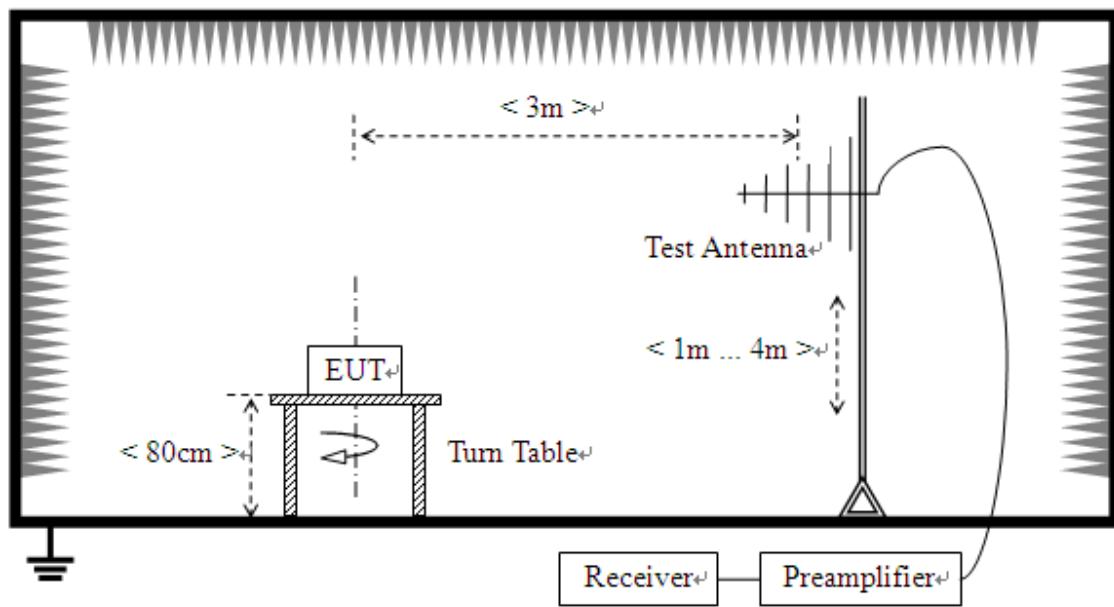
The measuring equipment is listed in the section 3 of this test report.

### 2.4.3. Test Setup

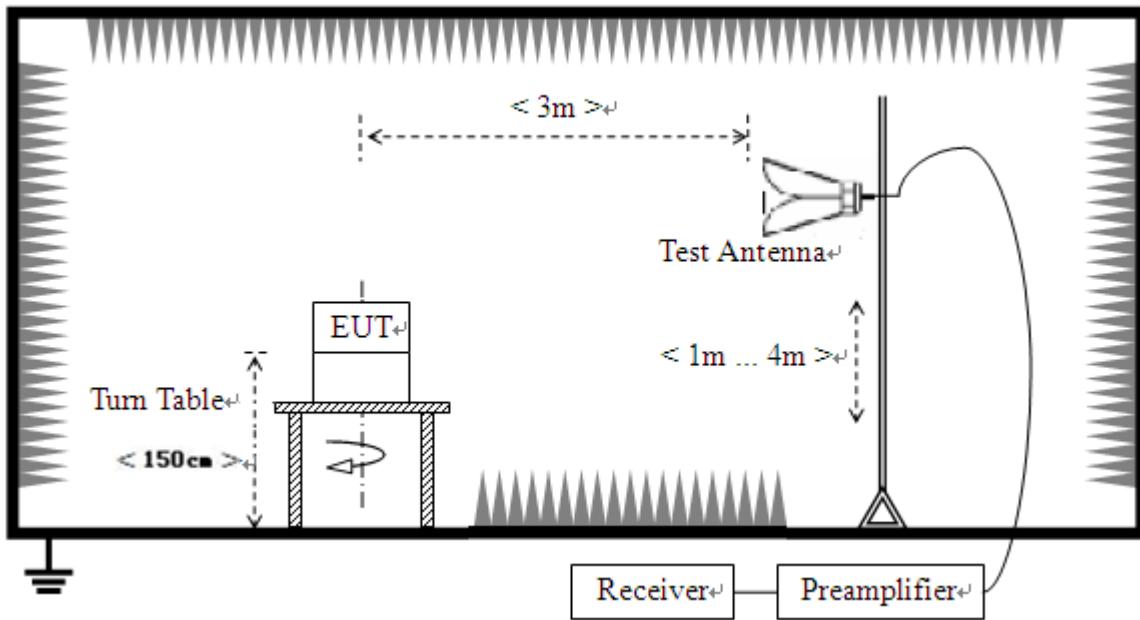
- 1) For radiated emissions from 9kHz to 30MHz



- 2) For radiated emissions from 30MHz to 1GHz



## 3) For radiated emissions above 1GHz



#### 2.4.1. Test Procedure

1. The EUT was placed on a turntable 0.8m below 1GHz and 1.5m above 1GHz above ground.
2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
3. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
4. Set to the maximum power setting and enable the EUT transmit continuously.
5. Use the following spectrum analyzer settings:
  - (1) Span shall wide enough to fully capture the emission being measured;
  - (2) Set RBW=100 kHz for  $f < 1$  GHz, RBW=1MHz for  $f > 1$  GHz ;  $VBW \geq RBW$ ; Sweep = auto; Detector function = peak; Trace = max hold for peak
  - (3) For average measurement: use duty cycle correction factor method per 15.35(c).

Duty cycle = On time/100 milliseconds

On time =  $N_1 \cdot L_1 + N_2 \cdot L_2 + \dots + N_{n-1} \cdot L_{n-1} + N_n \cdot L_n$

Where  $N_1$  is number of type 1 pulses,  $L_1$  is length of type 1 pulses, etc.

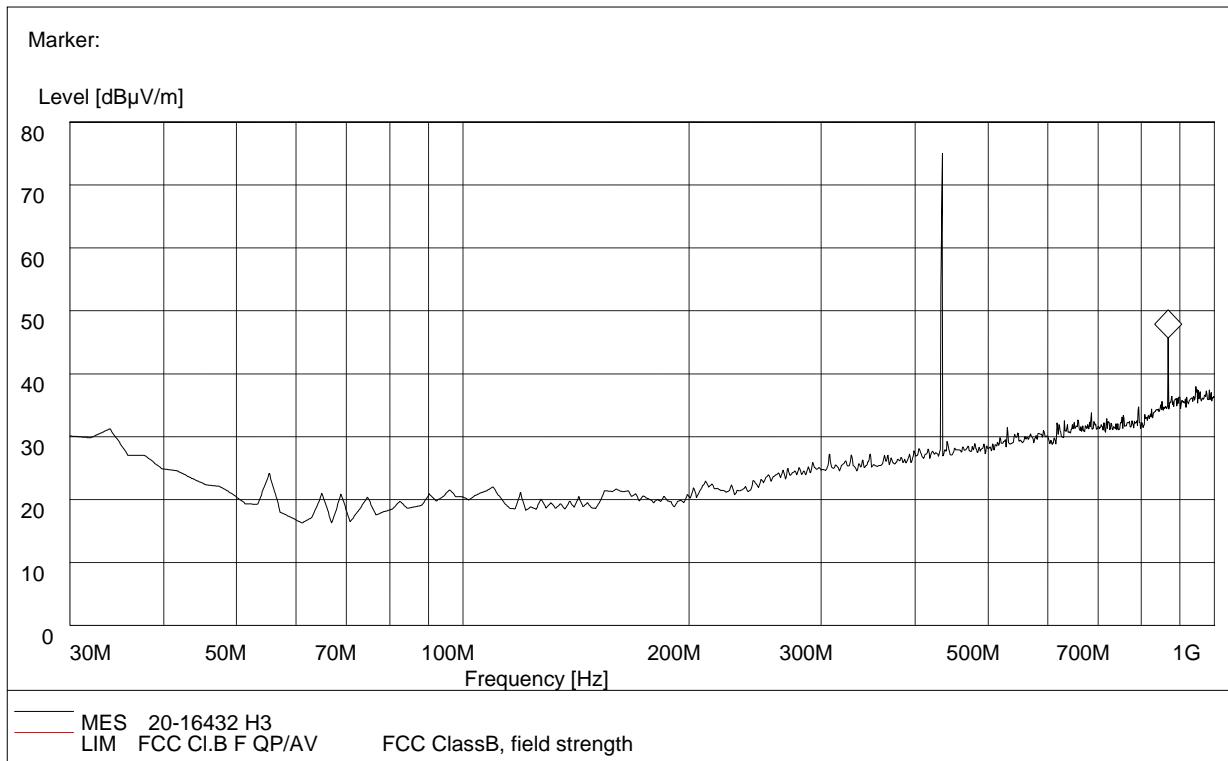
Average Emission Level = Peak Emission Level +  $20 \cdot \log(\text{Duty cycle})$
6. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

## 2.4.2. Test Results

### For 9 KHz to 30MHz

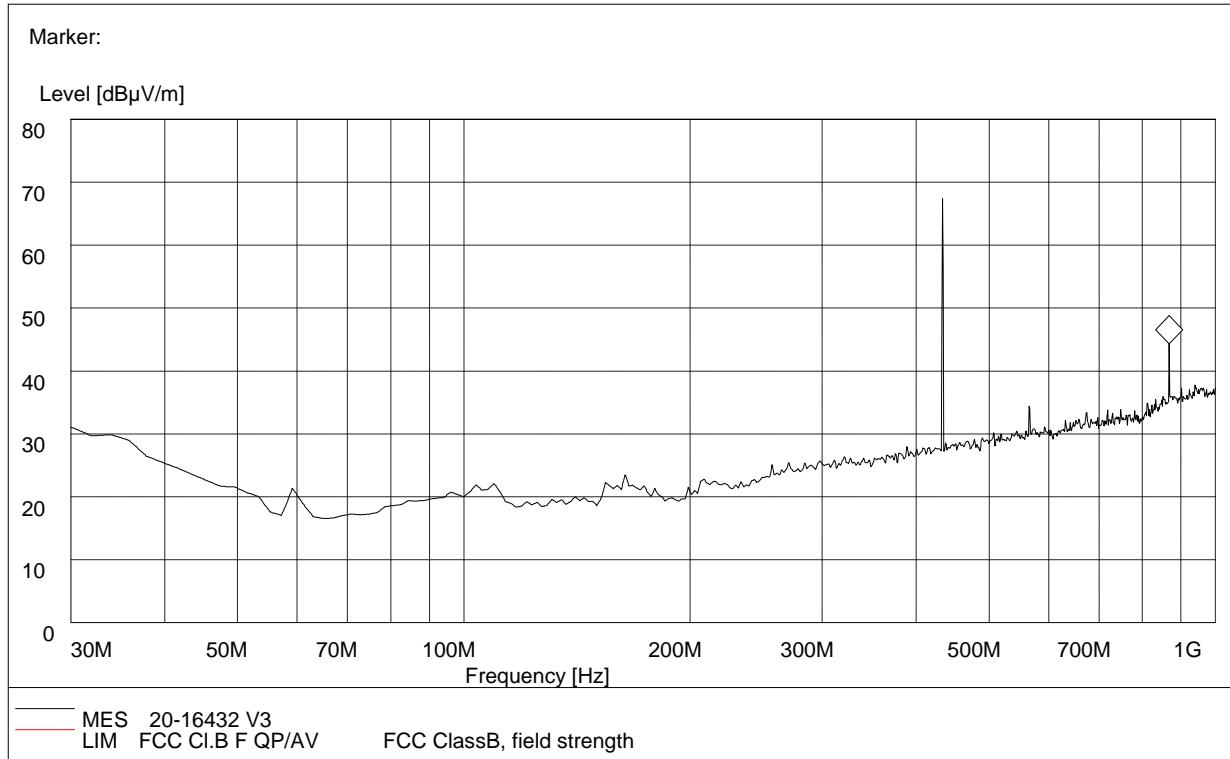
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

### For 30MHz to 1000MHz



Frequency (MHz)	Reading level (dB $\mu$ V/m)	Bandwidth (kHz)	Correction Factor (dB/m)	Antenna height (cm)	Limit (dB $\mu$ V/m)	Margin	Antenna	Verdict
33.800000	29.05	120.000	17.90	100.0	40.0	10.95	Horizontal	Pass
55.220000	22.63	120.000	8.2	100	40.0	17.37	Horizontal	Pass
64.920000	20.30	120.000	6.8	100.0	43.5	23.2	Horizontal	Pass
109.540000	21.36	120.000	9.4	100.0	43.5	22.14	Horizontal	Pass
210.420000	22.36	120.000	10.8	100.0	46.0	23.64	Horizontal	Pass
868.080000	44.32	120.000	23.9	100.0	54.0	9.68	Horizontal	Pass

(Plot A: 30MHz to 1GHz, Antenna Horizontal)



Frequency (MHz)	Reading level (dB $\mu$ V/m)	Bandwidth (kHz)	Correction Factor (dB/m)	Antenna height (cm)	Limit (dB $\mu$ V/m)	Margin	Antenna	Verdict
30.000000	28.03	120.000	17.90	100.0	40.0	11.97	Vertical	Pass
59.100000	20.63	120.000	17.90	100.0	40.0	19.37	Vertical	Pass
109.540000	22.00	120.000	10.20	100.0	43.5	21.5	Vertical	Pass
163.860000	22.69	120.000	10.6	100.0	43.5	20.81	Vertical	Pass
565.440000	31.32	120.000	24.80	100.0	46.0	14.68	Vertical	Pass
868.080000	42.63	120.000	24.80	100.0	54.0	11.37	Vertical	Pass

(Plot B: 30MHz to 1GHz, Antenna Vertical)

Above 1GHz									
NO.	Freq. [MHz]	Emission Level [dB $\mu$ V/m]	Correction Factor [dB]	Limit [dB $\mu$ V/m]	Margin [dB]	Trace	Height [cm]	Angle [°]	Polarity
1	1299.259	59.97	-13.17	74.00	14.03	PK	100	170	Horizontal
2	1299.259	20.23	-13.17	54.00	33.77	AV	100	160	Horizontal
3	1734.546	31.16	-11.21	54.00	22.84	AV	100	300	Horizontal
4	1734.546	70.90	-11.21	74.00	3.1	PK	100	300	Horizontal
5	2601.720	58.01	-6.99	74.00	15.99	PK	100	360	Horizontal
6	2601.720	18.27	-6.99	54.00	35.73	AV	100	360	Horizontal

Above 1GHz									
NO.	Freq. [MHz]	Emission Level [dB $\mu$ V/m]	Correction Factor [dB]	Limit [dB $\mu$ V/m]	Margin [dB]	Trace	Height [cm]	Angle [°]	Polarity
1	1299.259	60.24	-13.17	74.00	13.76	PK	100	30	Vertical
2	1299.259	20.5	-13.17	54.00	33.5	AV	100	50	Vertical
3	1734.546	31.18	-11.21	54.00	22.82	AV	100	330	Vertical
4	1734.546	70.92	-11.21	74.00	3.08	PK	100	340	Vertical
5	2166.433	57.32	-9.27	74.00	16.68	PK	100	230	Vertical
6	2166.433	17.58	-9.27	54.00	36.42	AV	100	240	Vertical

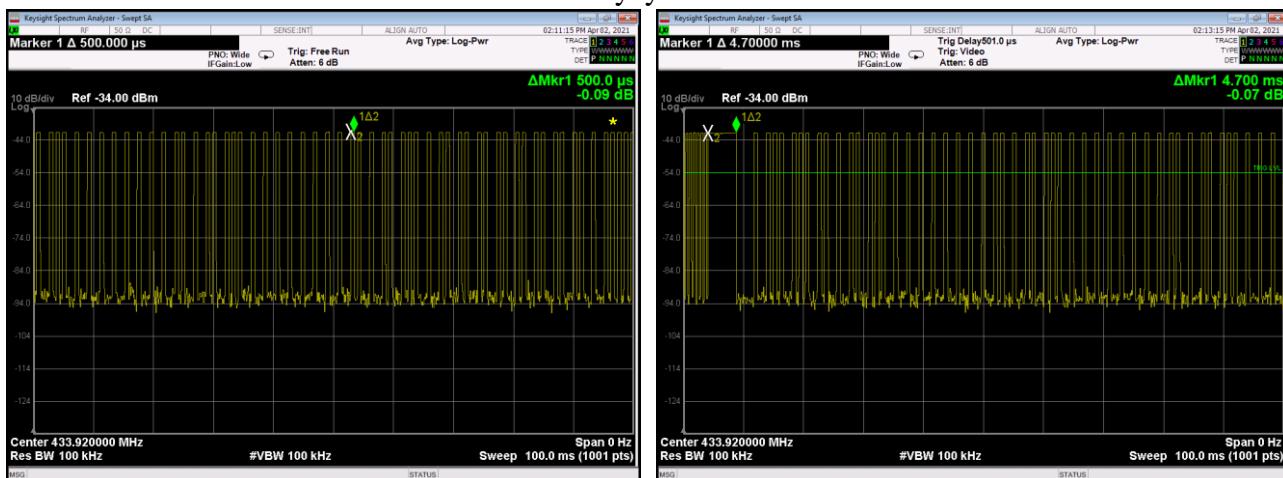
Note: 1. duty cycle factor=20log(dutycycle), Average=Peak+ duty cycle factor

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) - Pre-Amplifier Factor(dB)

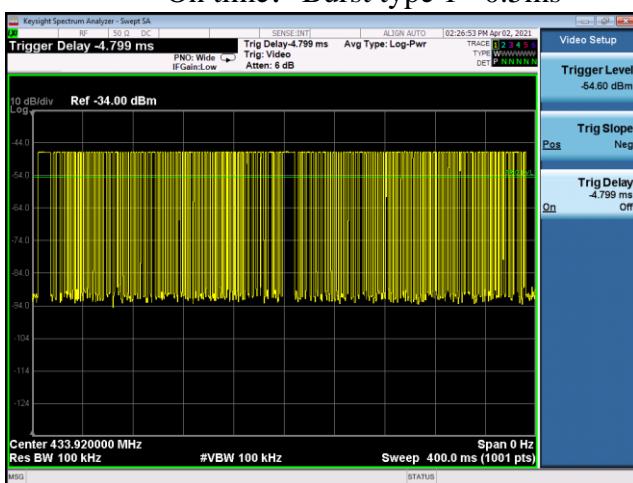
3. The other emission levels were very low against the limit.

4. Margin value = Limit value -Emission Level

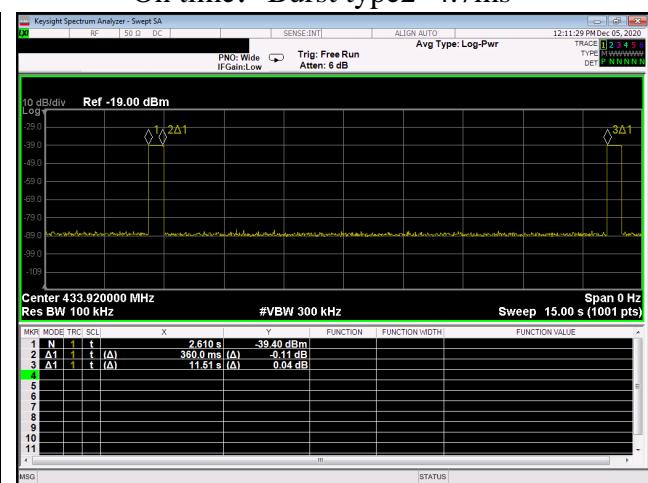
### Dutycycle:



On time: Burst type 1= 0.5ms



On time: Burst type2=4.7ms



Total number=Burst type2 numbers + Burst type1 numbers

one period time

Dutycycle=Total on time/one period=119.4/11510=0.0103

Dutycycle factor=20log(dutycycle)=-39.74

## 2.5. Operation Restriction

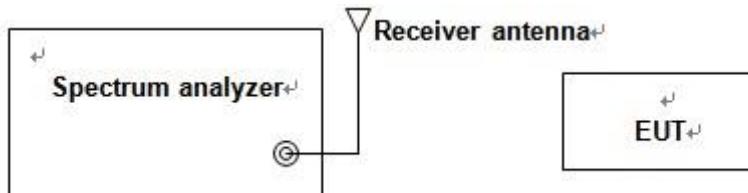
### 2.5.1. Test Limit

Operation Restriction
<input type="checkbox"/> Manually operated: A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.
<input type="checkbox"/> Activated automatically: A transmitter activated shall cease transmission within 5 seconds after activation.
<input type="checkbox"/> Periodic transmissions: Permitted with total transmission time of 2sec per hour or less
<input checked="" type="checkbox"/> Periodic transmissions(Lower field strength): each transmission is not greater than 1sec and the silent period between transmission is at least 30 times the duration of transmission but in no case less than 10sec.

### 2.5.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

### 2.5.3. Test Setup



### 2.5.4. Test Procedure

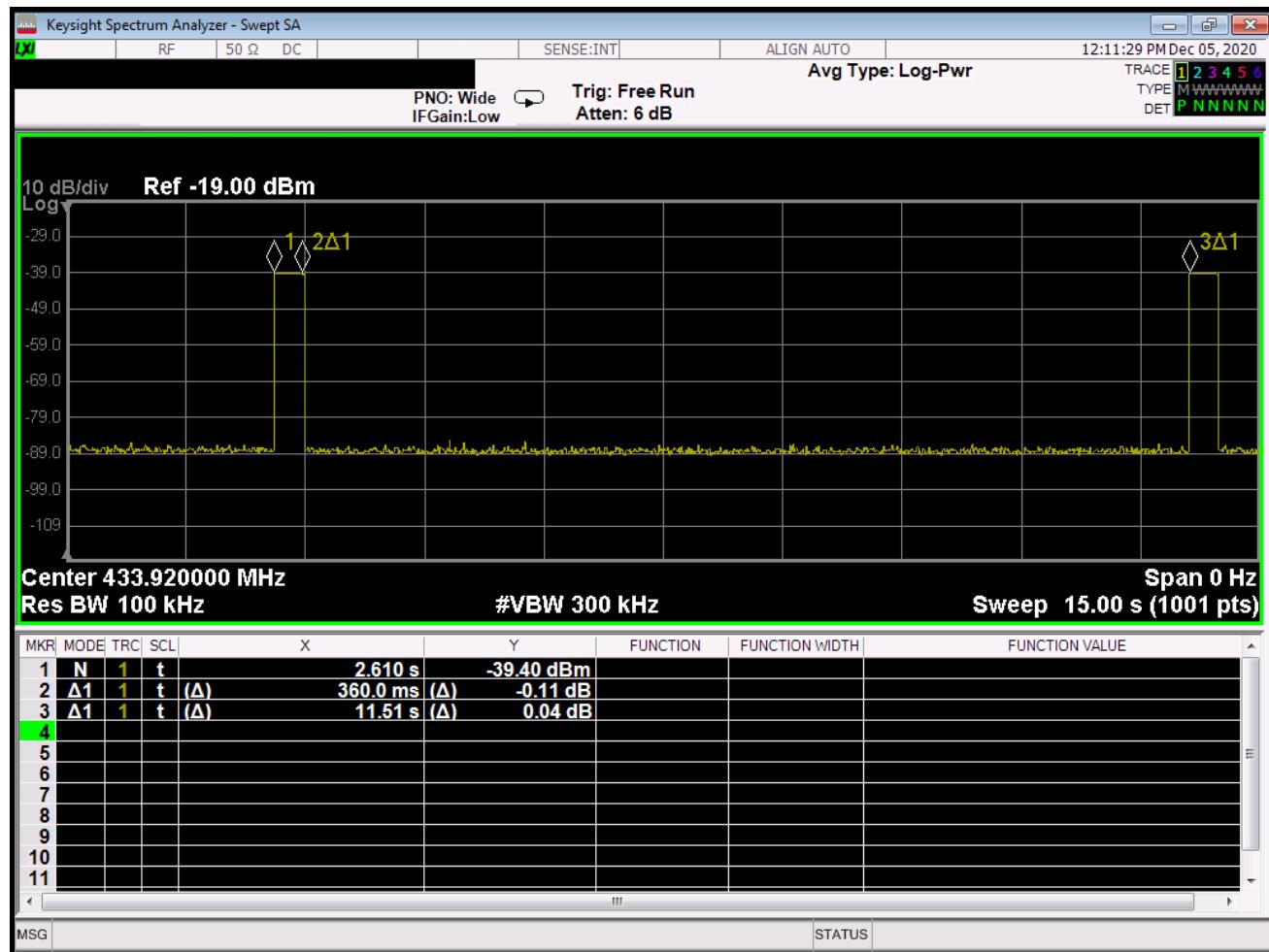
With the EUT's antenna attached, the EUT's output signal was received by the test antenna, which was connected to the spectrum analyzer. Set the center frequency to 433.92MHz, than set the spectrum analyzer to Zero Span for the release time reading. During the testing, the switch was released then the EUT automatically deactivated

## 2.5.5. Test Results

433.92MHz

Transmission Duration time (s)	Limit	Result
0.36	$\leq 1\text{sec}$	Pass
Silent period(s)	Limit	Result
11.15	$>30^* \text{ transmission Duration time}$ $>10\text{s}$	Pass

Note:  $30^* \text{ transmission Duration}=10.8\text{s}$



### 3. List of measuring equipment

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	EMI TEST RECEIVER	R&S	ESU8	A0805559	2020.04.03	2021.04.02
2	TURNTABLE	ETS	2088	2149	N/A	N/A
3	ANTENNA MAST	ETS	2075	2346	N/A	N/A
4	EMI TEST Software	R&S	ESK1	N/A	N/A	N/A
5	Horn antenna (18GHz~26.5GHz)	AR	AT4003A	325306	2020.09.16	2022.09.15
6	Amplifier 30M~1GHz	MILMEGA	80RF1000-10004	A140101634	2021.01.26	2022.01.25
7	Amplifier 1G~18GHz	MILMEGA	AS0104R-800/40 0	A160302517	2021.01.26	2022.01.25
8	Horn Antenna	R&S	HF906	A0304225	2019.04.17	2022.04.16
9	Horn Antenna	R&S	ESIB7	A0501375	2020.06.24	2021.06.23
10	ULTRA-BROADBAND ANTENNA	SCHWARZBEC K	VULB9160	A0805560	2019.05.24	2022.05.23
11	Passive Loop Antenna	R&S	HFH2-Z2	100047	2019.04.26	2022.04.25
12	Spectrum Analyzer	KEYSIGHT	N9030A	A160702554	2020.05.18	2021.05.17
13	Power Supply	R&S	ESIB26	A0304218	2020.04.29	2021.04.28

#### 4. Uncertainty of Evaluation

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013. All the measurement uncertainty value were shown with a coverage K=2 to indicate 95% level of confidence . The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

Uncertainty of Radiated Emission Measurement (30MHz~1GHz)

Measuring Uncertainty for a level of confidence of 95%( $U=2U_{c(y)}$ )	5.0dB
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Uncertainty of Radiated Emission Measurement (1GHz~18GHz)

Measuring Uncertainty for a level of confidence of 95%( $U=2U_{c(y)}$ )	5.1dB
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\*\* END OF REPORT \*\*