

FCC PART 15.231

TEST REPORT

For

Ningbo Shuanghe Hongsheng Electronic Technology Co.,Ltd

No.2 Binxi south Rd Dayin Industrial Park, Yuyao, Zhejiang, China

FCC ID: 2ATK8-BS201

Report Type: Original Report	Product Type: WIRELESS DIGITAL REMOTE THERMOMETER
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	WIRELESS DIGITAL REMOTE THERMOMETER
Model	BS-201
Frequency Range	433.92 MHz
Field Strength	68.49 dBuV/m@3m
Modulation Technique	ASK
Antenna Specification	0 dBi
Voltage Range	DC 3.0V from battery
Date of Test	2019-05-31
Sample serial number	190523005
Received date	2019-05-23
Sample/EUT Status	Good condition

Objective

This test report is prepared on behalf of *Ningbo Shuanghe Hongsheng Electronic Technology Co.,Ltd.* All the test measurements were performed according to the measurement procedure described in ANSI C63.10 - 2013.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, section 15.203, 15.205, 15.209, 15.35(c) and 15.231 rules.

Related Submittal(s)/Grant(s)

No related submittal(s).

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10 - 2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		±5%
RF conducted test with spectrum		±1.5dB
Radiated Emissions	Below 1GHz	±4.75dB
	Above 1GHz	±4.88dB
Temperature		±3 °C
Humidity		±6%
Supply voltages		±0.4%

Note: Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 342867, the FCC Designation No.: CN1221.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062B.

SYSTEM TEST CONFIGURATION

Justification

The system was configured for testing by manufacturer.

Special Accessories

No special accessories was used

Equipment Modifications

No modification was made to the EUT.

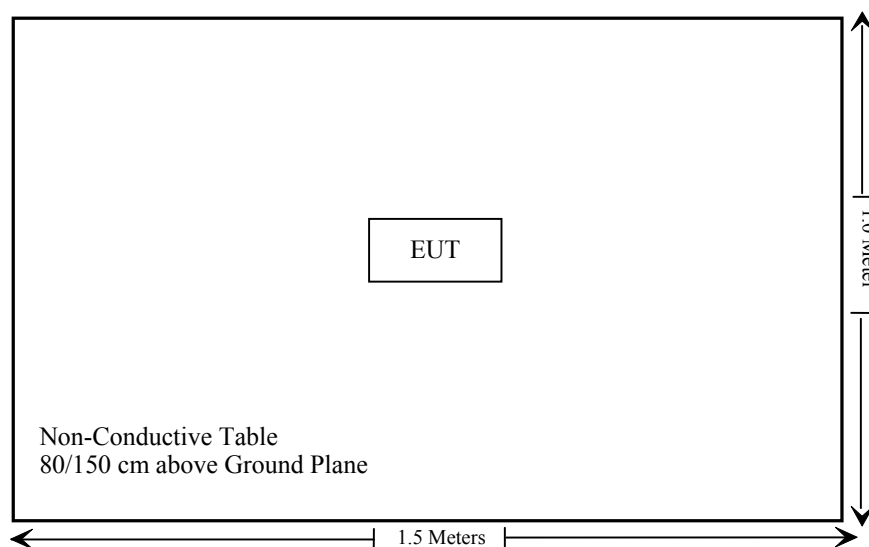
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
/	/	/	/

External I/O Cable

Cable Description	Length (m)	From / Port	To
/	/	/	/

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliance
§15.207 (a)	Conducted Emissions	Not Applicable
§15.205, §15.209, §15.231(e)	Radiated Emissions	Compliance
§15.231 (c)	20dB Emission Bandwidth	Compliance
§15.231(e)	Transmission And Silent Period Testing	Compliance

Not Applicable: The EUT was powered by battery only.

TEST EQUIPMENT LIST AND DETAILS

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
A.H. System	Horn Antenna	SAS-200/571	135	2018-09-01	2021-08-31
Rohde & Schwarz	Signal Analyzer	FSEM	845987/005	2018-06-23	2019-06-23
COM-POWER	Pre-amplifier	PA-122	181919	2018-11-12	2019-11-12
Sonoma Instrument	Amplifier	310N	186238	2018-11-12	2019-11-12
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2017-12-22	2020-12-21
Rohde & Schwarz	EMI Test Receiver	ESR	1316.3003K03 -101746-zn	2018-07-11	2019-07-11
Rohde & Schwarz	Spectrum Analyzer	FSU26	200120	2019-03-02	2020-03-01
UTiFLEX MICRO-C0AX	RF Cable	UFA147A- 2362-100100	MFR64639 231029-003	2018-11-12	2019-11-12
Ducommun Technologies	RF Cable	104PEA	218124002	2018-11-12	2019-11-12
Ducommun Technologies	RF Cable	RG-214	1	2019-05-21	2019-11-19
Ducommun Technologies	RF Cable	RG-214	2	2018-11-12	2019-11-12

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

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.

Antenna Connector Construction

The EUT has one internal antenna arrangement, which was permanently attached. And the antenna is 0dBi; fulfill the requirement of this section. Please refer to EUT photos.

Result: Compliant.

FCC §15.205, §15.209, §15.231 (e) - RADIATED EMISSIONS**Applicable Standard**

FCC §15.205, §15.209, §15.231 (e)

According to §15.231 (e), intentional radiators may operate at a periodic rate exceeding that specified in paragraph (a) of this section and may be employed for any type of operation, including operation prohibited in paragraph (a) of this section, provided the intentional radiator complies with the provisions of paragraphs (b) through (d) of this section, except the field strength table in paragraph (b) of this section is replaced by the following:

Fundamental frequency (MHz)	Field Strength of Fundamental (Microvolts /meter)	Field Strength of spurious emissions (Microvolts /meter)
40.66-40.70	1000	100
70-130	500	50
130-174	500 to 1500**	50 to 150**
174-260	1500	150
260-470	1500 to 5000**	150 to 500**
Above 470	5000	500

**Linear interpolations.

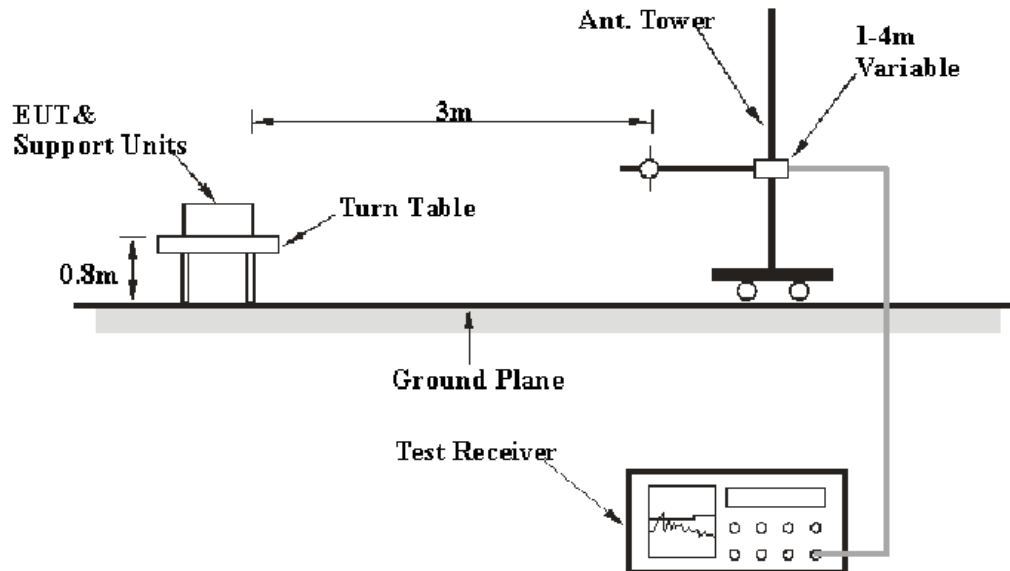
The above field strength limits are specified at a distance of 3-meters the tighter limits apply at the band edges.

Measurement Uncertainty

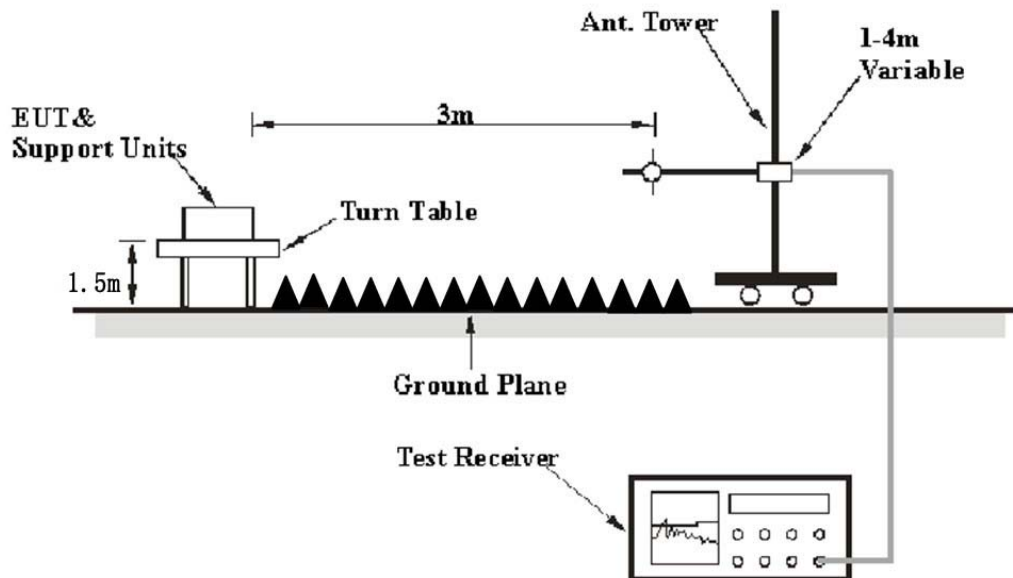
All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

EUT Setup

Below 1 GHz:



Above 1 GHz:



The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.10 - 2013. The specification used was the FCC 15 § 15.209, 15.205 and 15.231.

EMI Test Receiver Setup

The system was investigated from 30 MHz to 5 GHz.

During the radiated emission test, the test receiver was set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1 MHz	3 MHz	/	PK

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

All final data was recorded in the Quasi-peak detection mode from 30MHz to 1GHz, Peak and average detection mode above 1 GHz.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Loss and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Loss} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 5.8 dB means the emission is 5.8 dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Results Summary

According to the data in the following table, the EUT complied with the FCC §15.205, §15.209, §15.231 (e)

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$L_m + U_{(L_m)} \leq L_{\text{lim}} + U_{\text{cispr}}$$

In BACL, $U_{(L_m)}$ is less than U_{cispr} , if L_m is less than L_{lim} , it implies that the EUT complies with the limit.

Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Andy Yu on 2019-05-31.

Test mode: Transmitting

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	FCC Part 15.231(e)		
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)	Comment
433.92	56.06	PK	211	1.2	H	21.08	77.14	92.9	15.76	Fundamental
433.92	53.14	PK	283	1.5	V	21.08	74.22	92.9	18.68	Fundamental
867.84	29.92	PK	155	1.6	H	6.81	36.73	72.9	36.17	Harmonic
867.84	26.16	PK	236	1.6	V	6.81	32.97	72.9	39.93	Harmonic
1301.76	48.32	PK	220	2.1	H	-3.28	45.04	72.9	27.86	Harmonic
1301.76	46.81	PK	17	2.5	V	-3.28	43.53	72.9	29.37	Harmonic
1735.68	43.23	PK	315	1.3	H	-1.86	41.37	72.9	31.53	Harmonic
1735.68	43.57	PK	44	1.8	V	-1.86	41.71	72.9	31.19	Harmonic

Field Strength of Average							
Frequency (MHz)	Peak Measurement (dBμV/m)	Polar (H/V)	Duty Cycle Correction Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.231(e)		
					Limit (dBμV/m)	Margin (dB)	Comment
433.92	77.14	H	-5.23	71.91	72.9	0.99	Fundamental
433.92	74.22	V	-5.23	68.99	72.9	3.91	Fundamental
867.84	36.73	H	-5.23	31.50	52.9	21.40	Harmonic
867.84	32.97	V	-5.23	27.74	52.9	25.16	Harmonic
1301.76	45.04	H	-5.23	39.81	52.9	13.09	Harmonic
1301.76	43.53	V	-5.23	38.30	52.9	14.60	Harmonic
1735.68	41.37	H	-5.23	36.14	52.9	16.76	Harmonic
1735.68	41.71	V	-5.23	36.48	52.9	16.42	Harmonic

Note:

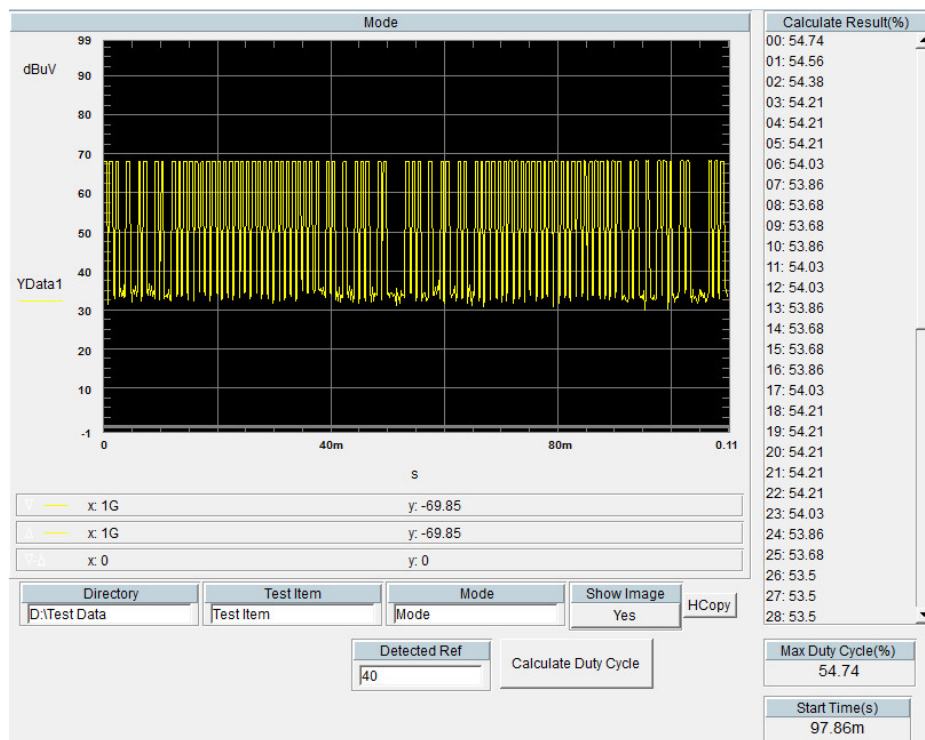
Corrected Amplitude = Corrected Factor + Reading

Corrected Factor = Antenna factor (Rx) + cable loss – amplifier factor

Margin = Limit - Corr. Amplitude

Duty Cycle Corrected Factor = $20\log(\text{Duty cycle}) = 20\log 0.5474 = -5.23$

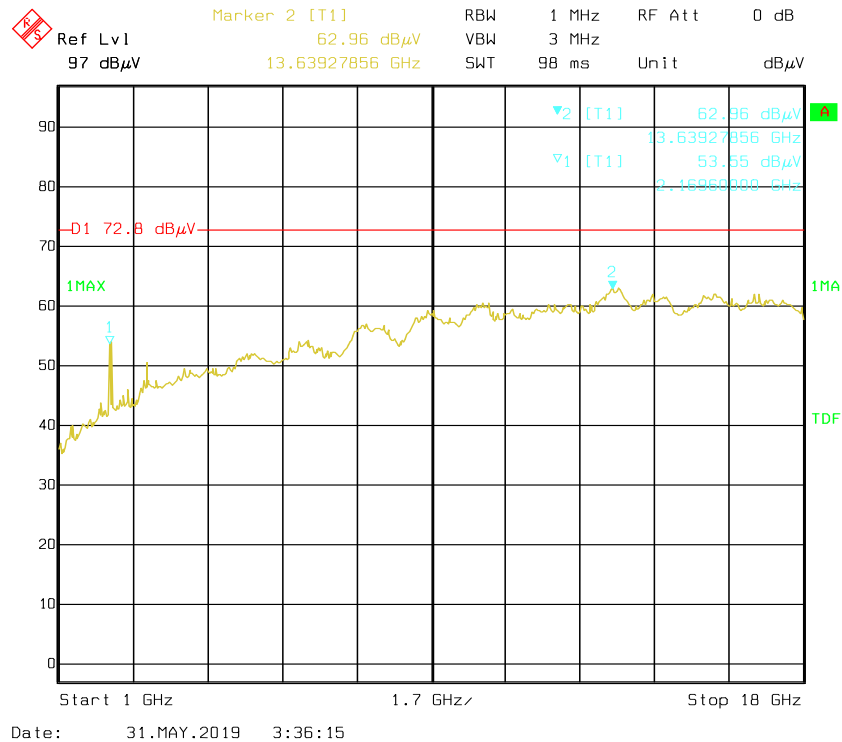
Duty Cycle



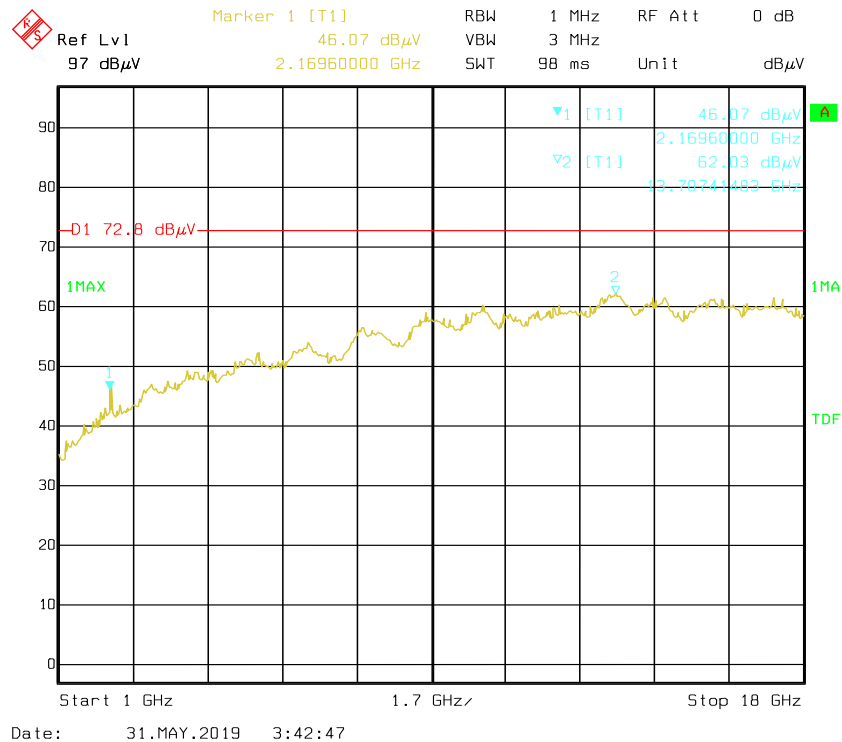
Note: Test with normal use sample for Duty cycle.

Above 1GHz

Pre-scan-Horizontal



Pre-scan - Vertical



FCC §15.231(c) – 20 dB EMISSION BANDWIDTH TESTING

Applicable Standard

Per 15.231(c), 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. Bandwidth is determined at the points 20 dB down from the modulated carrier.

Test Procedure

With the EUT's antenna attached, the waveform was received by the test antenna which was connected to the spectrum analyzer, plot the 20 dB bandwidth.

Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Andy Yu on 2019-05-31.

Test Mode: Transmitting

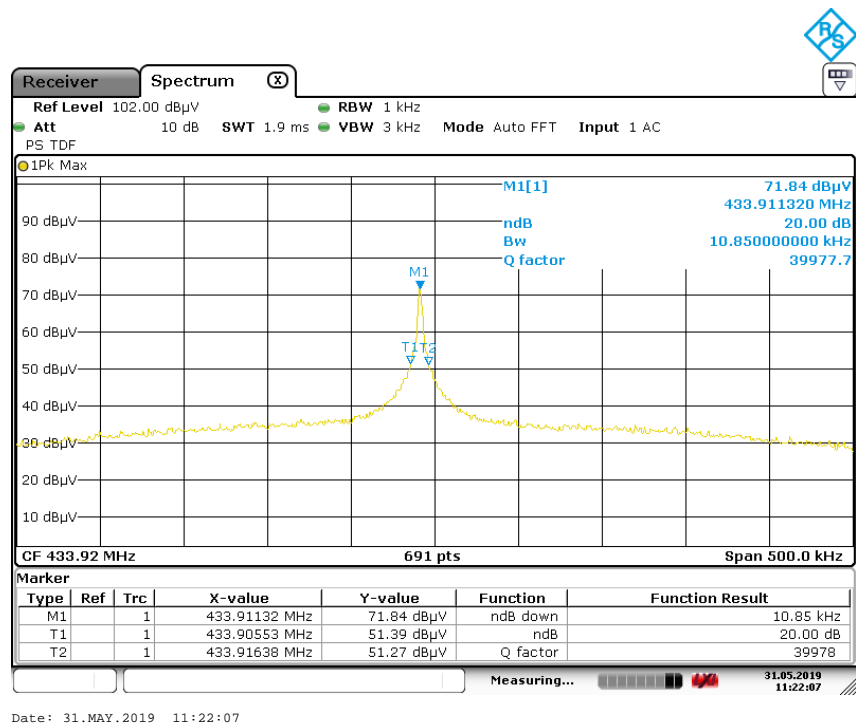
Please refer to following table and plots.

Channel Frequency (MHz)	20 dB Emission Bandwidth (kHz)	<Limit (MHz)	Result
433.92	10.85	1.0848	Pass

Note:

Limit = 0.25% * center frequency = 0.25% * 433.92 MHz = 1.0848 MHz
 20dB bandwidth = 50 kHz < 1.0848 MHz

20 dB Emission Bandwidth



FCC §15.231(e) – TRANSMISSION AND SILENT PERIOD TESTING**Applicable Standard**

Per FCC §15.231(e), devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

Test Procedure

1. Set the EUT into the chamber.
2. Set center frequency of spectrum analyzer=operating frequency.
3. Set the spectrum analyzer as RBW=1MHz, VBW=3MHz, Span=0Hz.

Test Data**Environmental Conditions**

Temperature:	25 °C
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Andy Yu on 2019-05-31.

Test Mode: Transmitting

Deactivation

Transmission period (s)	Limit (s)	Result
0.171	< 1	Pass

Silent period

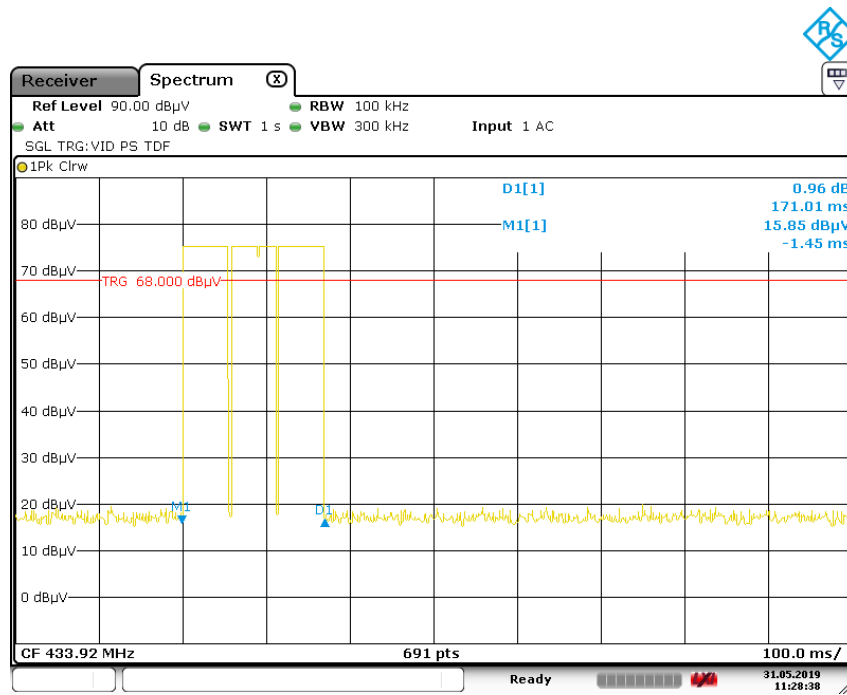
Silent period (s)	Limit (s)	Result
11.736	> 10	Pass

Note: The silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

The duration time is 0.171s, $0.171 \times 30 = 5.13\text{s}$

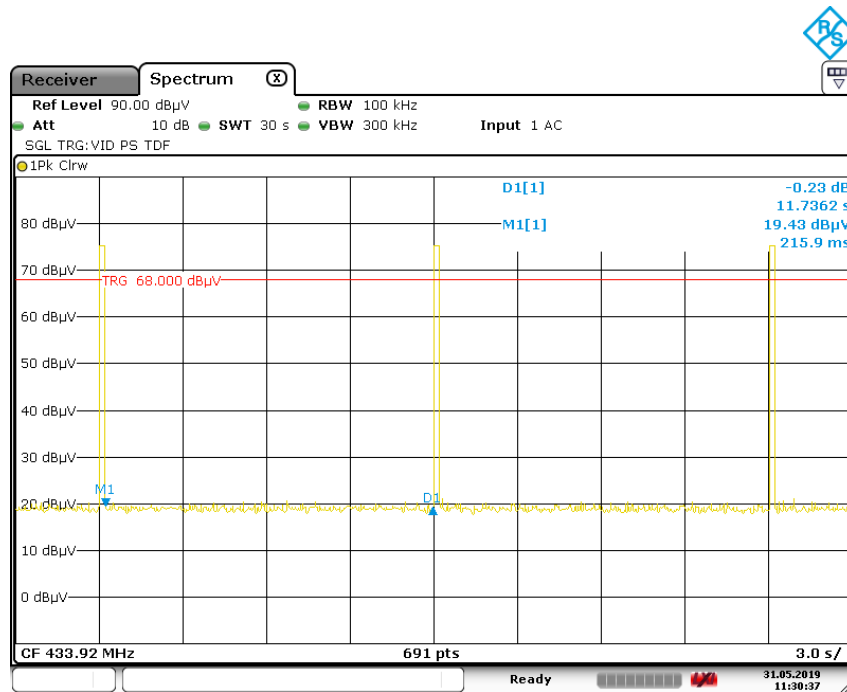
Test Result: Compliant, please refer to following plot

Transmission period



Date: 31.MAY.2019 11:28:39

Silent period



Date: 31.MAY.2019 11:30:38

***** END OF REPORT *****