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: 2ATK8SHRF

Report Type:	Product Type:
Original Report	Wireless thermometer

Report Number:	RSZ200615010-00
Report Date:	2020-07-31
Reviewed By:	Nancy Wang RF Engineer
Prepared By:	Bay Area Compliance Laboratories Corp. (Shenzhen) 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China Tel: +86-755-33320018 Fax: +86-755-33320008 www.baclcorp.com.cn

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	Wireless thermometer
Tested Model	SH-006T
Multiple Model	SH-007B, SH-074T, TX151
Model Differences	Refer to the DOS letter
Frequency Range	433.92 MHz
Modulation Technique	ASK
Antenna Specification	0dBi
Voltage Range	DC 3V from battery
Date of Test	2020-06-22 to 2020-07-08
Sample serial number	RSZ200615010-RF-S1 (Assigned by BACL, Shenzhen)
Received date	2020-06-15
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 Output Power with Power meter		±0.5dB
RF conducted test with spectrum		±1.5dB
AC Power Lines Conducted Emissions		±1.95dB
Radiated Emissions	Below 1GHz	±4.75dB
	Above 1GHz	±4.88dB
Temperature		±3℃
Humidity		±6%
Supply voltages		±0.4%

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. 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.

Operating frequency: 433.92 MHz

Special Accessories

No special accessories was used

Equipment Modifications

No modification was made to the EUT.

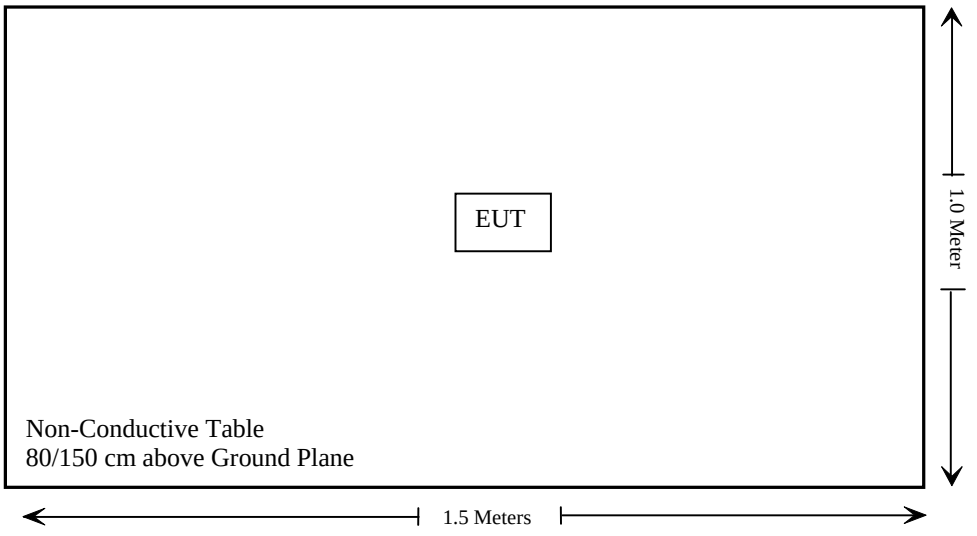
Support Equipment List and Details

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 is powered by battery only.

TEST EQUIPMENT LIST AND DETAILS

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESR3	102455	2019/7/9	2020/7/8
Sonoma instrument	Pre-amplifier	310 N	186238	2020/4/20	2021/4/20
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2017/12/22	2020/12/21
Unknown	Cable 2	RF Cable 2	F-03-EM197	2019/11/29	2020/11/28
Unknown	Cable	Chamber Cable 1	F-03-EM236	2019/11/29	2020/11/28
Unknown	Cable	Chamber Cable 4	EC-007	2019/11/29	2020/11/28
Rohde & Schwarz	Auto test software	EMC 32	V9.10	NCR	NCR
Rohde & Schwarz	Spectrum Analyzer	FSV40-N	102259	2019/7/22	2020/7/21
COM-POWER	Pre-amplifier	PA-122	181919	2019/11/29	2020/11/28
Sunol Sciences	Horn Antenna	DRH-118	A052604	2017/12/22	2020/12/21
Insulted Wire Inc.	RF Cable	SPS-2503-3150	02222010	2019/11/29	2020/11/28
Unknown	RF Cable	W1101-EQ1 OUT	F-19-EM005	2019/11/29	2020/11/28
Unknown	Signal Cable	RG-214	2	2019/11/29	2020/11/28

*** 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 gain 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.

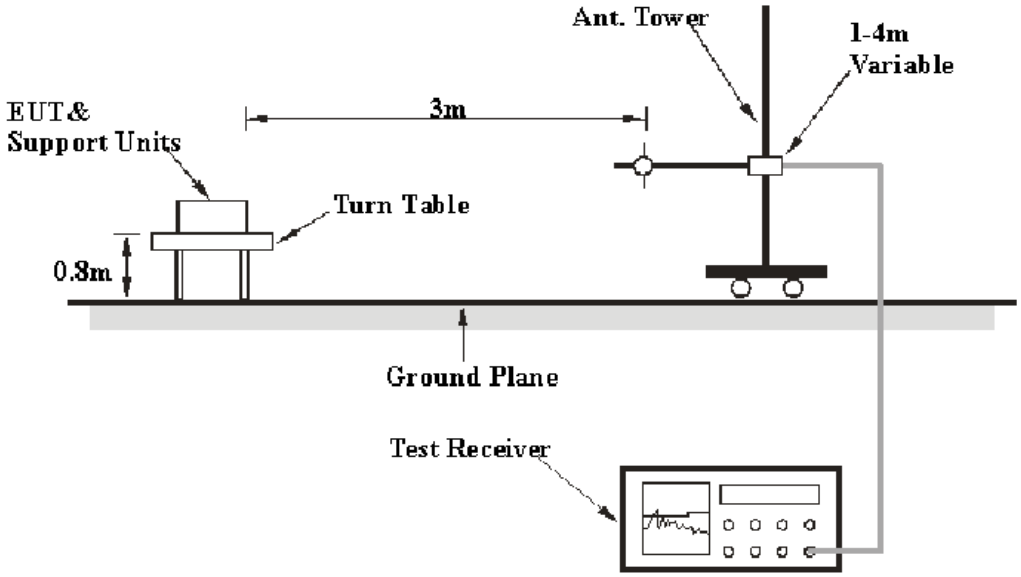
The above field strength limits are specified at a distance of 3-meters the tighter limits apply at the band edges.

Measurement Uncertainty

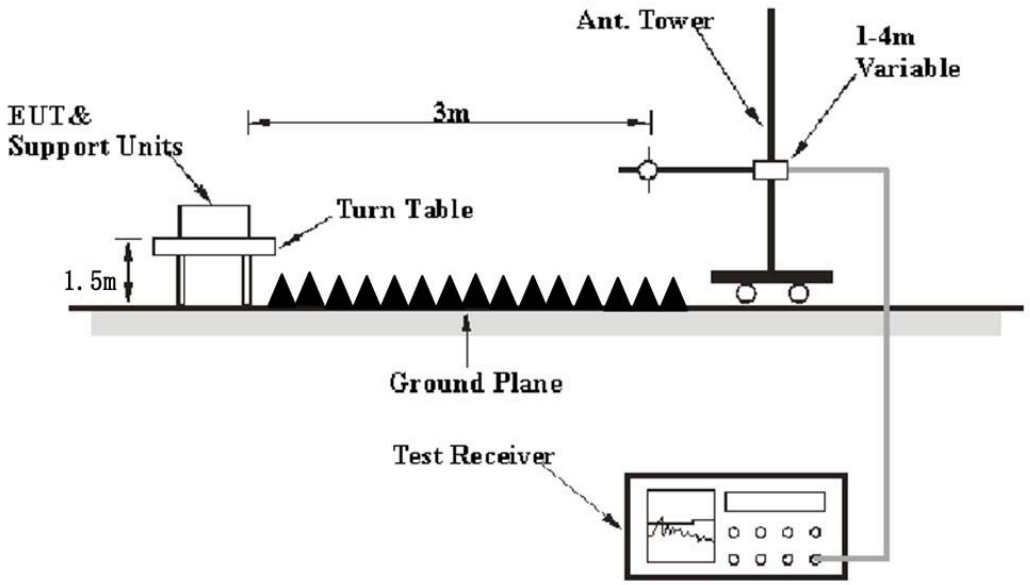
All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency 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:

Corrected Amplitude = Meter Reading + Antenna Loss + Cable Loss - 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:

Margin = Limit –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)

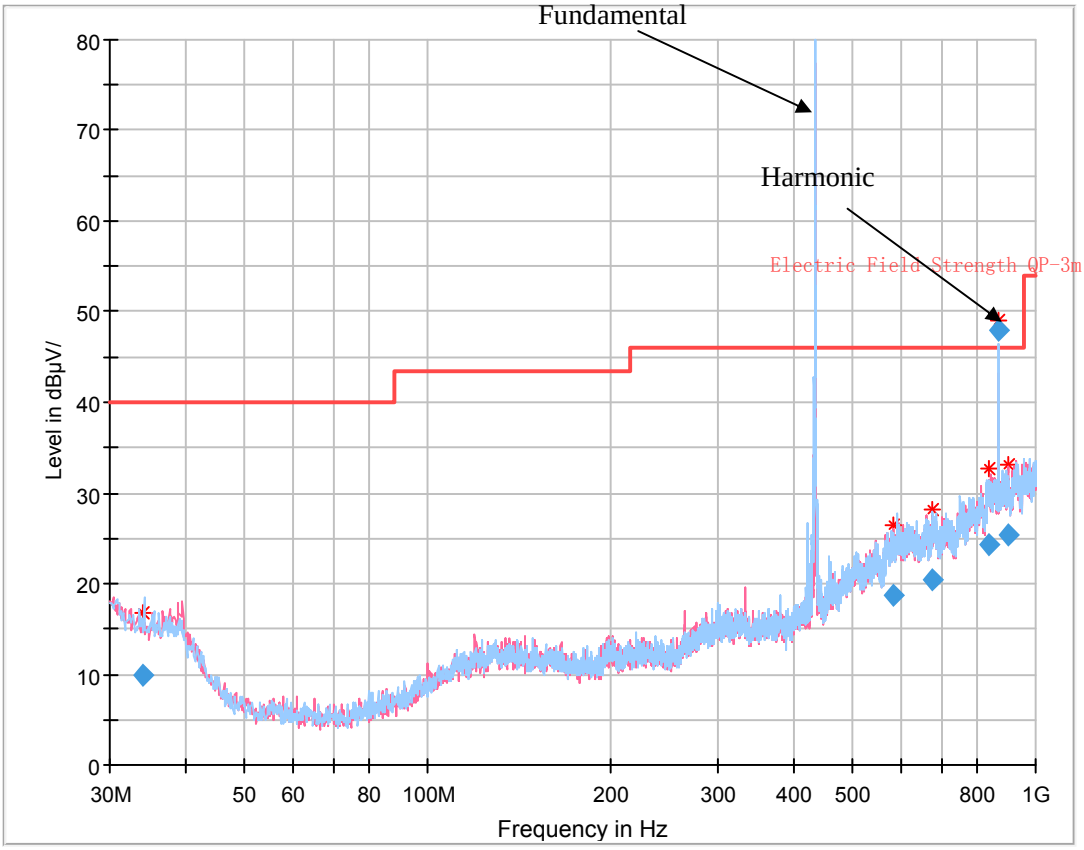
Test Data

Environmental Conditions

Temperature:	25~28 ℃
Relative Humidity:	60~68 %
ATM Pressure:	101.0 kPa

The testing was performed by Holland Yang and Charlie Cha from 2020-06-22 to 2020-07-08.

Test mode: Transmitting (Pre-scan in the X,Y and Z axes of orientation, the worst case X-axis of orientation was recorded)



Frequency (MHz)	Corrected Amplitude (dBµV/m)	PK/QP/Ave.	Antenna Height (cm)	Antenna Polarity	Turntable Position (degree)	Correction Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
33.937500	9.90	QP	339.0	H	260.0	-9.9	40.00	30.10
581.443375	18.71	QP	354.0	V	44.0	-2.5	46.00	27.29
678.566250	20.39	QP	129.0	H	24.0	-1.4	46.00	25.61
838.247375	24.36	QP	400.0	H	341.0	2.8	46.00	21.64
867.835750	47.88	QP	111.0	H	87.0	3.5	52.90	5.02
867.835750	48.91	PK	111.0	H	87.0	3.5	52.90	3.99
904.550375	25.28	QP	224.0	V	229.0	4.3	46.00	20.72

Note: the peak value can meet the limit of the average value.

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	FCC Part 15.231(e)		
	Reading (dBμV)	PK/QP/Ave.		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)	Comment
433.92	83.02	PK	201	1.3	H	-8.9	74.12	92.9	18.78	Fundamental
433.92	76.10	PK	18	1.2	V	-8.9	67.20	92.9	25.70	Fundamental
1301.76	52.32	PK	345	1.7	H	-3.28	49.04	74	24.96	Harmonic
1301.76	44.42	PK	183	2.5	V	-3.28	41.14	74	32.86	Harmonic
1735.68	61.60	PK	79	1.7	H	-1.86	59.74	72.9	13.16	Harmonic
1735.68	49.43	PK	272	2.0	V	-1.86	47.57	72.9	25.33	Harmonic
2169.60	64.26	PK	170	2.2	H	-0.06	64.20	72.9	8.70	Harmonic
2169.60	52.80	PK	335	1.8	V	-0.06	52.74	72.9	20.16	Harmonic
2603.52	50.71	PK	247	2.5	H	0.83	51.54	72.9	21.36	Harmonic
2603.52	43.19	PK	258	1.0	V	0.83	44.02	72.9	28.88	Harmonic
3037.44	57.44	PK	52	2.1	H	1.94	59.38	72.9	13.52	Harmonic
3037.44	46.06	PK	313	1.9	V	1.94	48.00	72.9	24.90	Harmonic
3471.36	47.47	PK	239	2.0	H	3.13	50.60	72.9	22.30	Harmonic
3471.36	42.72	PK	247	1.3	V	3.13	45.85	72.9	27.05	Harmonic

Field Strength of Average Emission							
Frequency (MHz)	Peak Measurement @3m (dBμV/m)	Polar (H/V)	Duty Cycle Correction Factor (dB)	Corrected Ampitude (dBμV/m)	FCC Part 15.231(e)		
					Limit (dBμV/m)	Margin (dB)	Comment
433.92	74.12	H	-15.97	58.15	72.9	14.75	Fundamental
433.92	67.20	V	-15.97	51.23	72.9	21.67	Fundamental
1301.76	49.04	H	-15.97	33.07	54	20.93	Harmonic
1301.76	41.14	V	-15.97	25.17	54	28.83	Harmonic
1735.68	59.74	H	-15.97	43.77	52.9	9.13	Harmonic
1735.68	47.57	V	-15.97	31.60	52.9	21.30	Harmonic
2169.60	64.20	H	-15.97	48.23	52.9	4.67	Harmonic
2169.60	52.74	V	-15.97	36.77	52.9	16.13	Harmonic
2603.52	51.54	H	-15.97	35.57	52.9	17.33	Harmonic
2603.52	44.02	V	-15.97	28.05	52.9	24.85	Harmonic
3037.44	59.38	H	-15.97	43.41	52.9	9.49	Harmonic
3037.44	48.00	V	-15.97	32.03	52.9	20.87	Harmonic
3471.36	50.60	H	-15.97	34.63	52.9	18.27	Harmonic
3471.36	45.85	V	-15.97	29.88	52.9	23.02	Harmonic

Note:
Corrected Amplitude = Corrected Factor + Reading
Corrected Factor = Antenna factor (Rx) + cable loss – amplifier factor
Margin = Limit - Corr. Amplitude
Ave. = PK + 20*log(Duty Cycle)

Duty Cycle:

Ton= 32*0.498ms=15.94ms

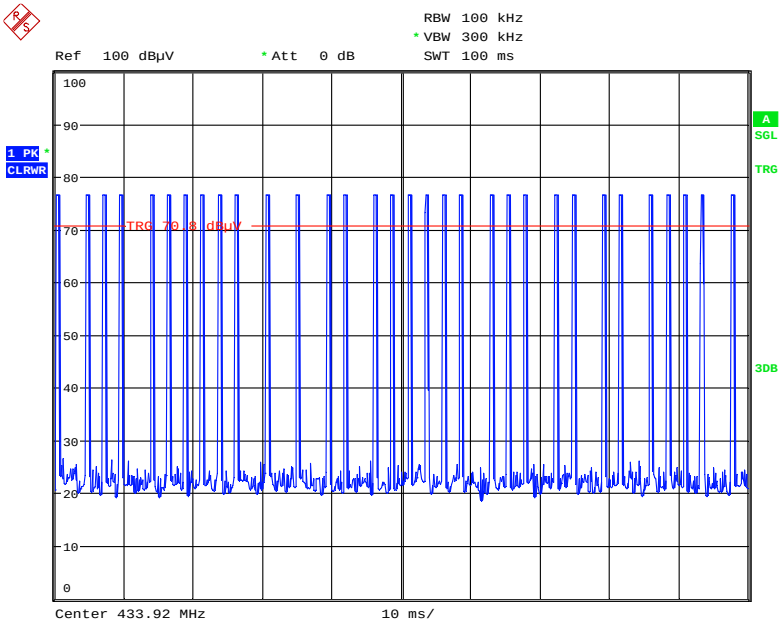
Tp = 100 ms

Duty cycle = Ton/Tp = Ton/100=0.159

Duty Cycle Corrected Factor = 20lg (Duty cycle) = 20lg0.159 = -15.97

Duty Cycle

DC-Tp



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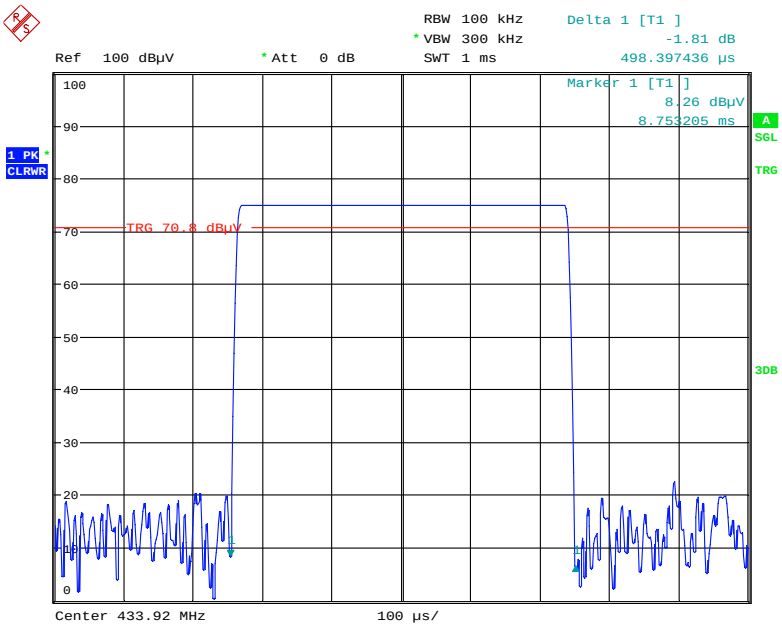
DC-Ton



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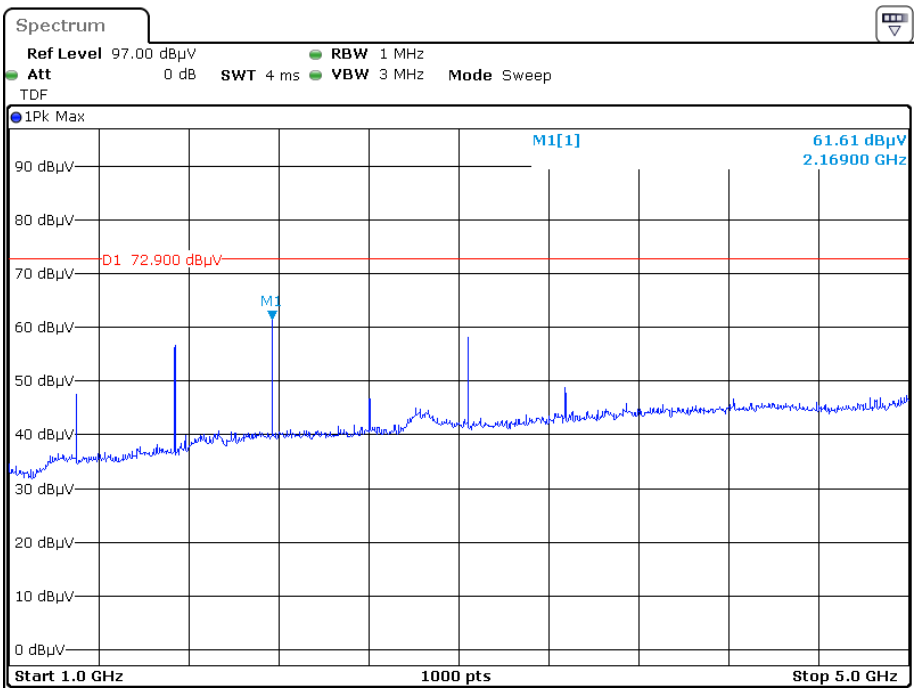
Pre-scan-Horizontal



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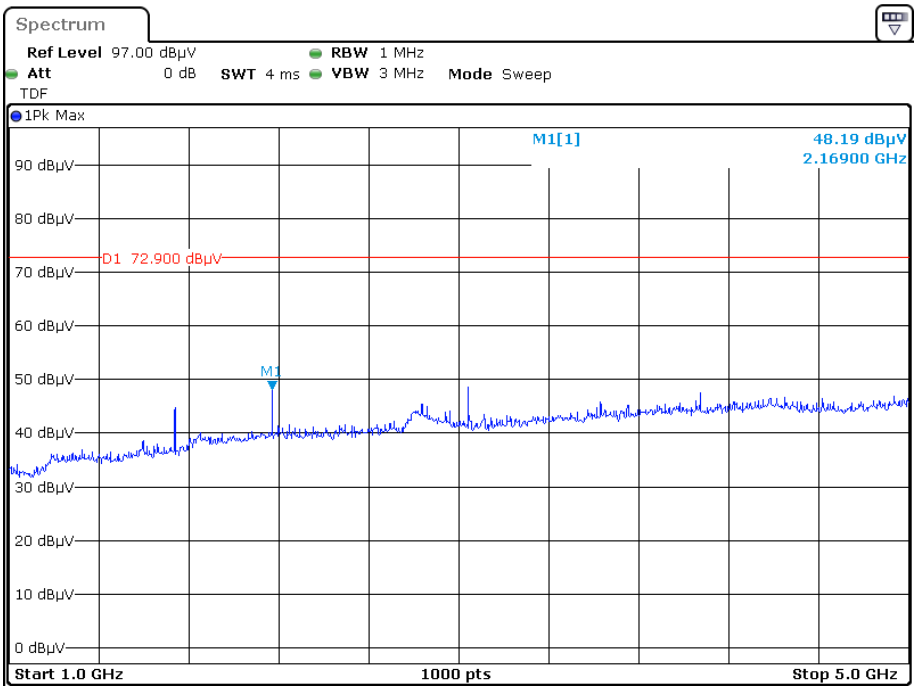
Pre-scan – Vertical



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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 waveforzm was received by the test antenna which was connected to the spectrum analyzer, plot the 20 dB bandwidth.

Test Data

Environmental Conditions

Temperature:	24 ℃
Relative Humidity:	64 %
ATM Pressure:	101.0 kPa

The testing was performed by Holland Yang on 2020-06-24.

Test Mode: Transmitting

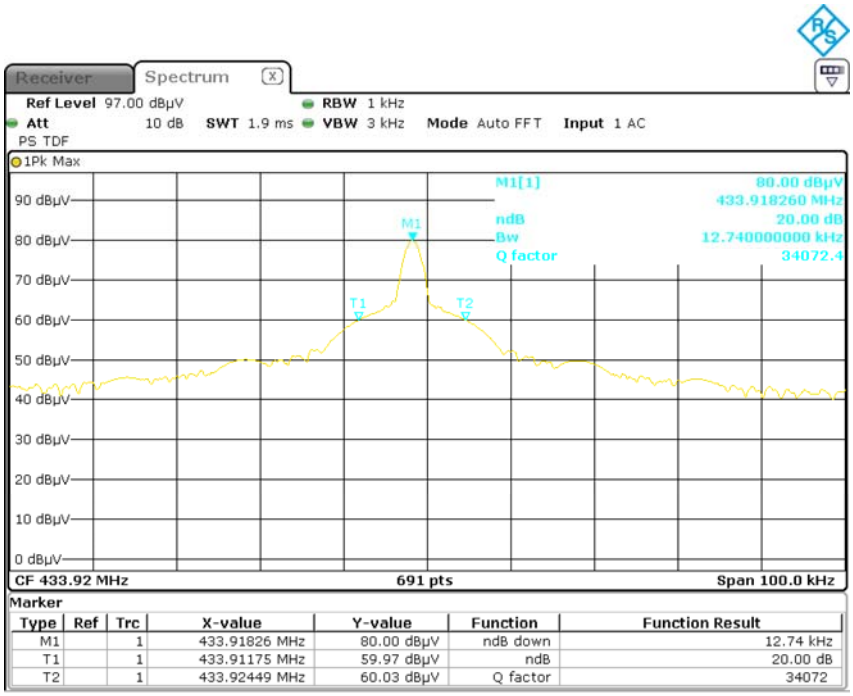
Please refer to following table and plots.

Channel Frequency (MHz)	20 dB Emission Bandwidth (kHz)	＜Limit (kHz)	Result
433.92	12.74	1085	Pass

Note:

Limit = 0.25% * center frequency = 0.25% * 433.92 MHz = 1.0848 MHz
20dB bandwidth = 12.74 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=100kHz, VBW=300kHz, Span=0Hz.

Test Data

Environmental Conditions

Temperature:	24 ℃
Relative Humidity:	64 %
ATM Pressure:	101.0 kPa

The testing was performed by Holland Yang on 2020-06-24.

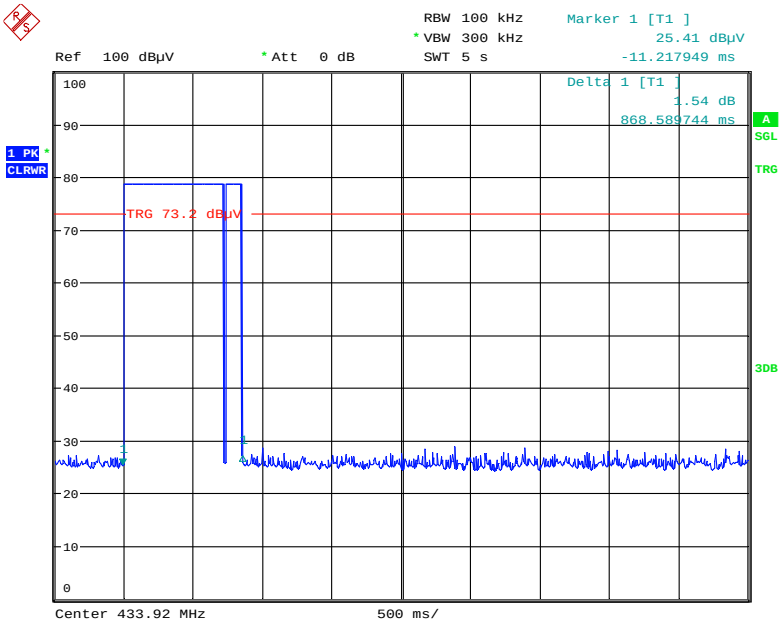
Test mode: Transmitting

Channel	Transmission period (s)	Limit (s)	Silent period (s)	Limit (s)	Result
CH1	0.869	< 1	48.91	> 26.07	Pass
CH2	0.901	< 1	51.85	> 27.03	Pass
CH3	0.893	< 1	54.74	> 26.79	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.

Test Result: Compliant, please refer to following plot

CH1-Transmission period



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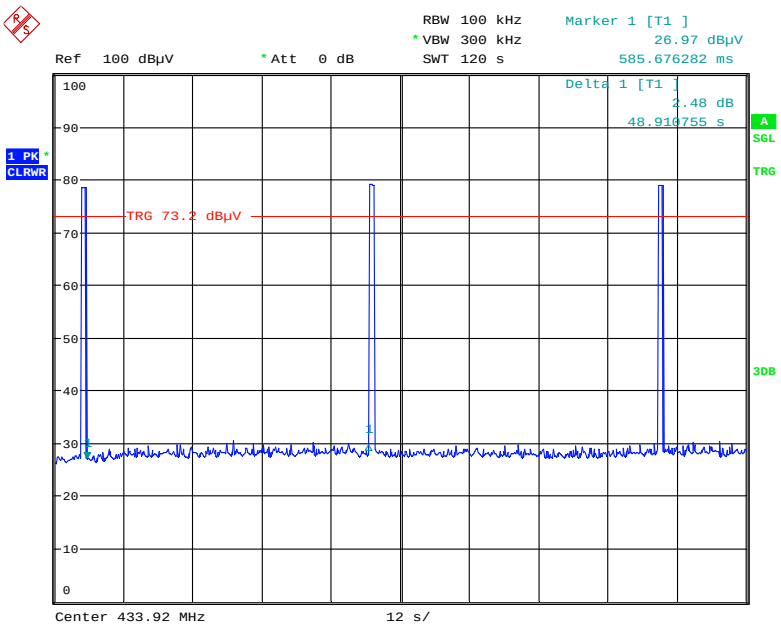
CH1-Silent period



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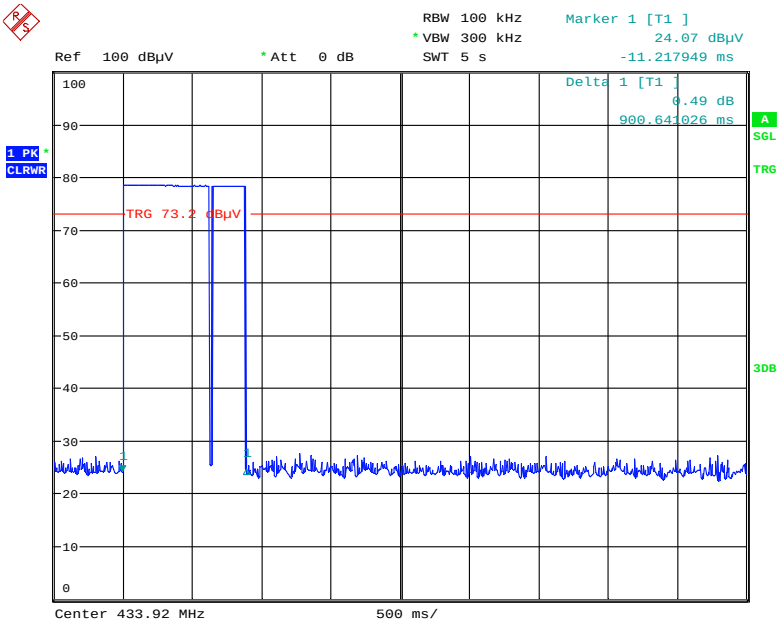
CH2-Transmission period



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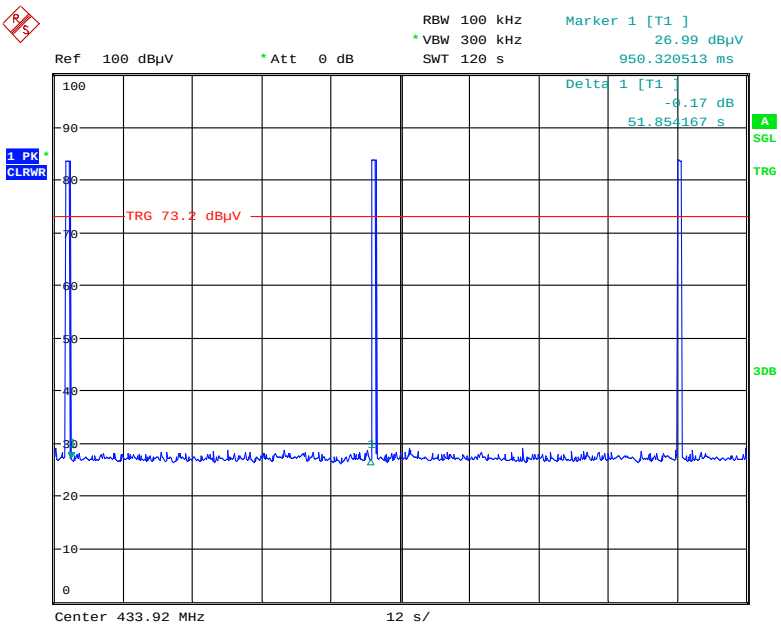
CH2-Silent period



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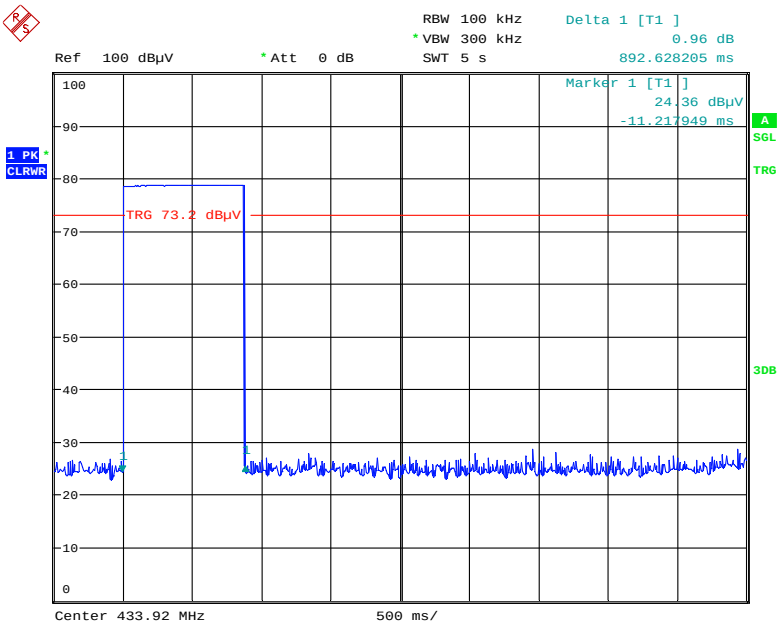
CH3-Transmission period



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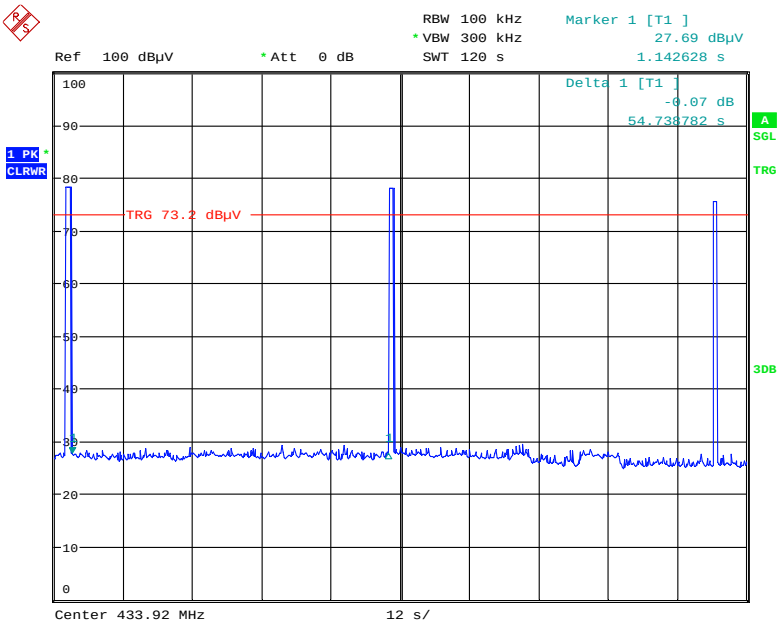
CH3-Silent period



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