

Test Report

Report No.: 200807KH001-FI

Applicant: GUANGDONG ROULE ELECTRONICS CO., LTD.

Address: No.12, Pingdong 3rd Road, Nanping Industry Community, Zhuhai City,
GuangDong, China

Manufacturer: GUANGDONG ROULE ELECTRONICS CO., LTD.

Address: No.12, Pingdong 3rd Road, Nanping Industry Community, Zhuhai City,
GuangDong, China

Product: Wireless Security Alert System

FCC ID: YI6RL-9816-1

Brand: RL

Test model(s): RL-9816B

Series Model(s): N/A

Test Date: Aug. 20,2020 ~ Sep. 14, 2020

Issued By: Hwa-Hsing (Dongguan) Testing Co., Ltd.

Address: No.101, Bld N1, Yuyuan 2Rd, Yuyuan Industrial Park, HuangJiang
Town, Dongguan, ChinaFCC Designation
Number: CN1255

Standards: FCC Part 15, Subpart C, Section 15.231a (2019-12)

The above equipment has been tested by **Hwa-Hsing (Dongguan) Testing Co., Ltd.**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by :



, Date:

Oct. 14, 2020

Scott He/ Project Engineer

Approved by :



, Date:

Oct. 14, 2020

Harry Li/ Technical Director

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Release Control Record

Issue No.	Description	Date Issued
200807KH001-FI	Original release.	Oct. 07, 2020

1 Summary of Test Results

The EUT has been tested according to the following specifications:

FCC part 15, Subpart C (section 15.231)			
Clause	Test Item	Result/Remarks	Verdict
§15.203	Antenna Requirement	Meets the requirements of Standard	Pass
§15.207 (a)	AC Power Conducted Emission	Battery only of TX	N/A
§15.209 §15.231(b)	Radiated Emission	Meets the requirements of Standard	Pass
§15.231 (a)	Deactivation Testing	Meets the requirements of Standard	Pass
§15.231(c)	Emission Bandwidth Measurement	Meets the requirements of Standard	Pass

Note:

1. There is no deviation to the applied test methods and requirements covered by the scope of this report.
2. EUT (TX) only power supply by battery, and the EMC test data please see the FCC Part 15B report (The report No.: HQ200807KH001-FS).
3. UUT use of a permanently attached antenna.

1.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUTas specified in CISPR 16-4-2:

The listed uncertainties are the worst-case uncertainty for the entire range of measurement. Please note that the uncertainty values are provided for informational purposes only and are not used in determining the PASS/FAIL results.

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.66 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	3.47 dB
Radiated Emissions above 1 GHz	Above 1GHz	4.84 dB
Temperature		±1°C
Humidity		±5.0 %
Voltages (DC)		±1.0 %
Voltages (AC, <10kHz)		±2.0 %

1.2 Modification Record

There were no modifications required for compliance.

2 General Information

2.1 General Description of EUT

Product name:	Wireless Security Alert System
Brand name:	RL
Test Model:	RL-9816B
Series Models:	N/A
Models difference:	N/A
Operating Software:	N/A
Power Supply Rating:	DC 9V from battery
Modulation type:	OOK
Operating frequency:	433.92MHz
Antenna type:	PCB Antenna
Antenna Gain (Max.)	2dBi
Cable Supplied:	N/A

1. For a more detailed features description, please refer to the manufacturer's specification or the User's Manual.
2. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.
3. Please refer to the EUT photo document (No.: 200807KH001) for detailed product photo.

2.2 Operating Modes of EUT and description of EUT

Sample	Mode	Frequency
RL-9816B	Transmitting	433.92MHz
	Receiving	433.92MHz

2.3 Test mode applicability and tested channel detail

EUT configure mode	Applicable to					Description
	RE ≥ 1G	RE < 1G	PLC	EB	DT	
1	√	√	-	√	√	DC 9V from Battery

Where:

RE ≥ 1G: Radiated Emission above 1GHz

RE < 1G: Radiated Emission below 1GHz

PLC: Power Line Conducted Emission

EB: 20dB Bandwidth measurement

DT: Deactivation Time measurement

Radiated Emission: EUT has been pre-test the positioned of each 3 axis.

Pretest mode: 433.92MHz TX

The worst case was found when positioned on **Z-plane**

X-plane	-
Y-plane	-
Z-plane	Worst mode

Radiated emission test (above 1 GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT configure mode	Available channel	Operating frequency (MHz)	Modulation type
-	1	433.92	OOK

Radiated emission test (below 1 GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT configure mode	Available channel	Operating frequency (MHz)	Modulation type
-	1	433.92	OOK

Emission bandwidth measurement:

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, packet type, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT configure mode	Available channel	Operating frequency (MHz)	Modulation type
-	1	433.92	OOK

Deactivation time measurement:

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT configure mode	Available channel	Operating frequency (MHz)	Modulation type
-	1	433.92	OOK

Test condition:

Applicable to	Environmental conditions	Test voltage	Tested by
RE≥1G	25deg. C, 62%RH	DC 9V from Battery	Tank Tan
RE<1G	25deg. C, 62%RH	DC 9V from Battery	Tank Tan
EB	24deg. C, 60%RH	DC 9V from Battery	Tank Tan
DT	24deg. C, 60%RH	DC 9V from Battery	Tank Tan

2.4 General description of applied standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

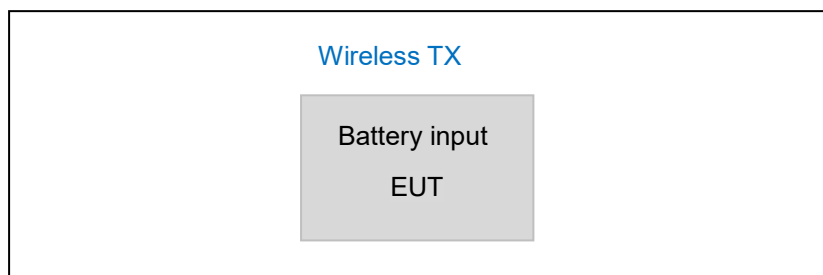
FCC Part 15, Subpart C Section 15.231a(2019-12)

ANSI C63.10-2013

All test items have been performed and recorded as per the above standards.

3 Configuration and Connections with EUT

3.1 Connection Diagram of EUT and Peripheral Devices



3.2 Configuration of Peripheral Devices and Cable Connections

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	N/A	N/A	N/A	N/A	N/A	N/A

Note:

1. N/A
2. Items E~G acted as communication partners to transfer data.

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	N/A	N/A	N/A	N/A	N/A	N/A

4 Test types and results

4.1 Radiated emission measurement

4.1.1 Limits of radiated emission measurement

Emissions radiated outside of the specified bands, shall be according to the general radiated limits in 15.209 as following:

Frequencies (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
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

According to §15.231(b), the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

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 1,250 to 3,750	¹ 125 to 375
174–260	3,750	375
260–470	¹ 3,750 to 12,500	¹ 375 to 1,250
Above 470	12,500	1,250

Note:

- ¹ Linear interpolation.
- The lower limit shall apply at the transition frequencies.
- Emission level (dBuV/m) = 20 log Emission level (uV/m).
- As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

4.1.2 Test instruments

Equipment	Manufacturer	Model No.	Serial No.	Next Cal.
Loop antenna (9kHz~30MHz)	TESEQ	HLA 6121	56735	2021/04/15
EMI Test Receiver	Rohde&Schwarz	ESCI 7	100962	2021/05/14
Broadband antenna (25MHz~2500MHz)	Schwarzbeck	VULB 9168	00937	2021/04/15
3m Semi-anechoic Chamber	MAORUI	9m*6m*6m	NSEMC003	2021/04/14
Signal Amplifier	Com-power	PAM-103	18020051	2021/04/15
Attenuator	Rohde&Schwarz	TS2GA-6dB	18101101	N/A
Test software	EZ	EZ EMC V1.1.4.2	N/A	N/A
Digital Multimeter	FLUKE	15B+	43512617WS	2021/09/16
Horn Antenna (1GHz-18GHz)	Schwarzbeck	BBHA 9170	01959	2021/04/15
Spectrum Analyzer	Rohde&Schwarz	FSV-40N	101783	2021/04/15
Broadband Coaxial Preamplifier (1GHz-18GHz)	Schwarzbeck	BBV 9718	00025	2020-10-17
Pre-Amplifier (18GHz-40GHz)	EMCI	EMC 184045	980102	2021/04/15
Spectrum (10kHz~26.5GHz)	Keysight	N9020A	MY51240612	2021/09/16

- Note:**
1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA.
 2. The test was performed in Chamber

4.1.3 Test procedures

The basic test procedure was in accordance with ANSI C63.10 (section 12).

- a. The EUT was placed on the top of a rotating table 1.5 meters (above 1GHz) and 0.8 meters (below 1GHz) above the ground at a 3 meters semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. For below 30MHz, a loop antenna with its vertical plane is place 3m from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. And the centre of the loop shall be 1m above the ground.
- g. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, For battery operated equipment, the equipment tests shall be perform using fresh batteries. The turntable was rotated to maximize the emission level.

NOTES:

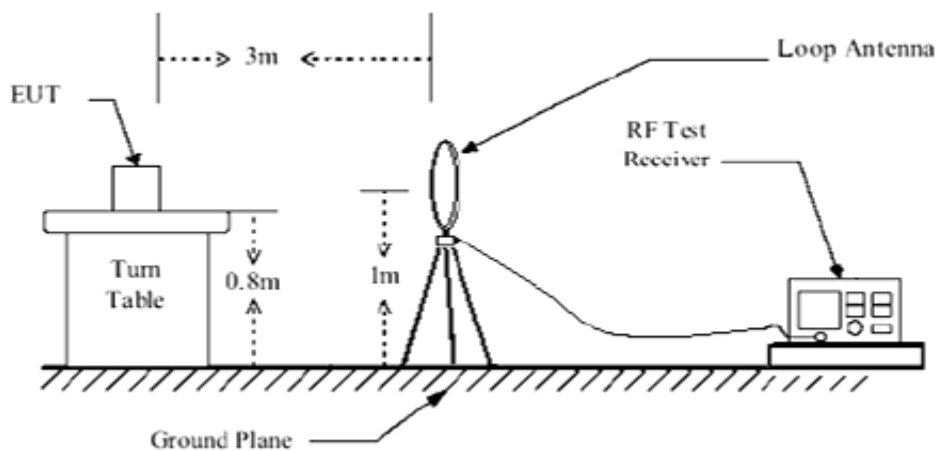
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. AV value =PK Emission +20*log (duty cycle) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.
5. The testing of the EUT was performed on all 3 orthogonal axes; the worst-case test configuration was reported on the file test setup photo.

4.1.4 Deviation from test standard

No deviation

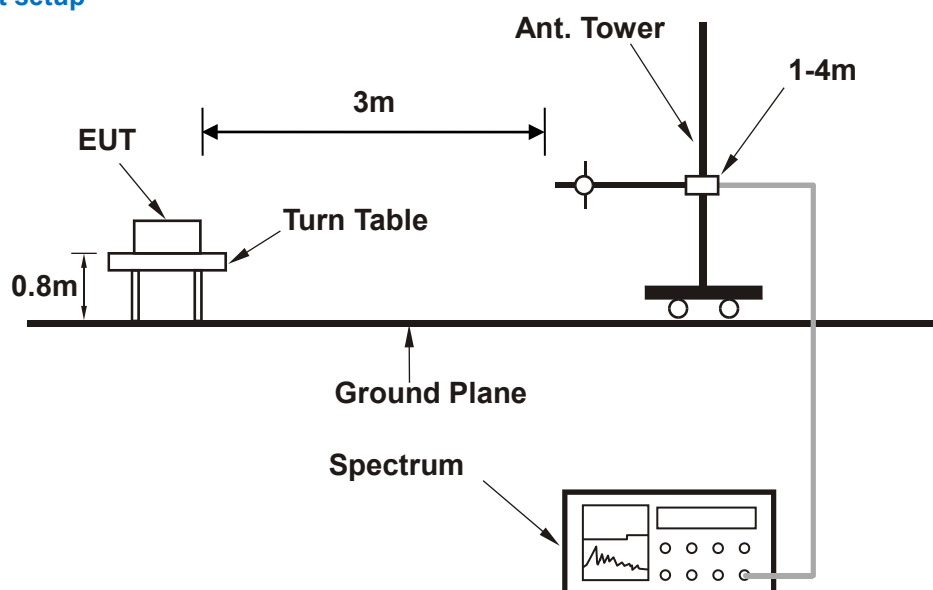
4.2 Test setup

Below 30MHz test setup



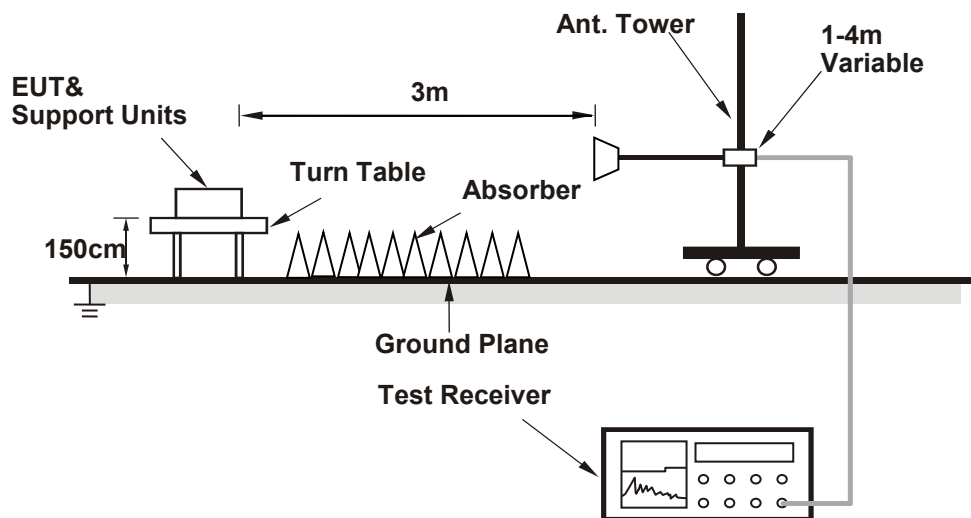
Note: For the actual test configuration, please refer to the attached file (Test Setup Photo).

Below 1GHz test setup



Note: For the actual test configuration, please refer to the attached file (Test Setup Photo).

Above 1GHz test setup



Note: For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.2.1 EUT operating conditions

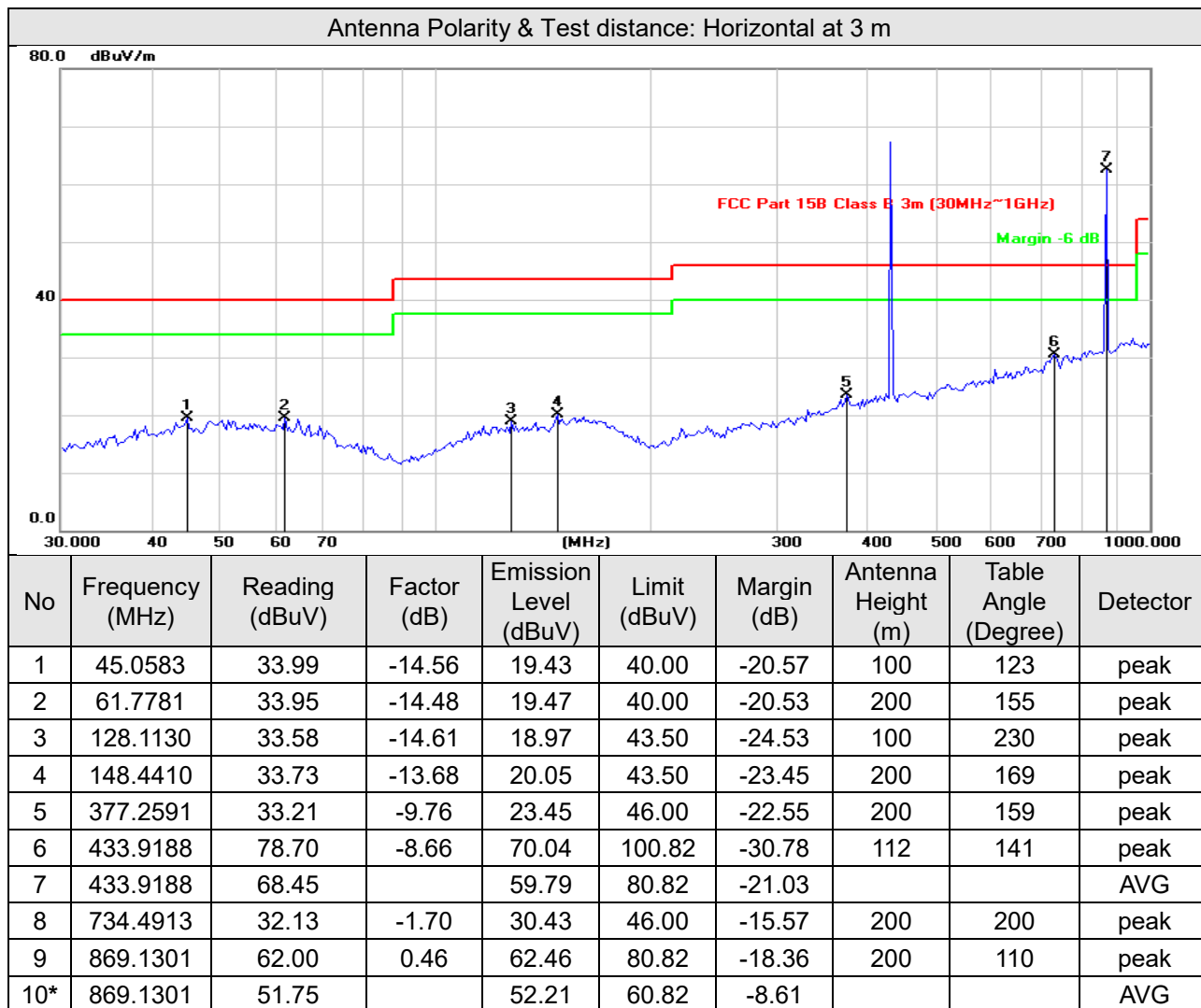
- Placed the EUT on the testing table.
- Enable EUT under transmission condition continuously at specific channel frequency.

4.2.2 Test Results

9kHz ~ 30MHz Data:

The amplitude of spurious emissions attenuated more than 20dB below the permissible value is not required to be report.

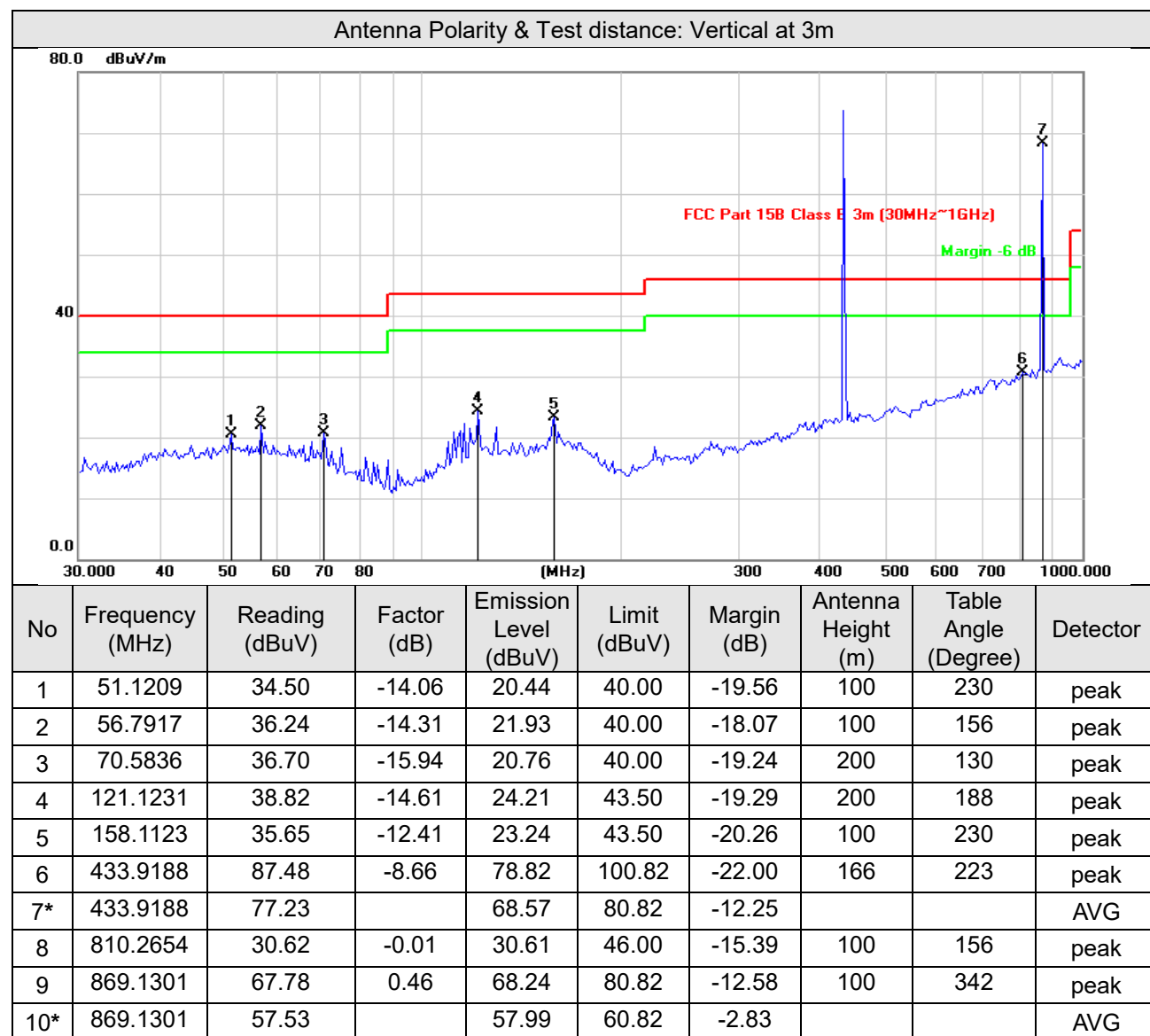
Frequency Range	25MHz ~ 1GHz (below 1GHz)		
Operation Channel	433.92MHz TX		
Tested by	Tank Tan	Test Date	2020/09/14



Remarks:

- The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Peak detection (PK) at frequency below 1GHz.
- Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
- Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
- Margin value = Emission level – Limit value.
- For the test results, the EUT had been tested from 9KHz ~5GHz. But only the worst case was shown in test report.
- *Fundamental AV value =PK Emission +20*log (duty cycle), Where the duty factor is calculated from following formula: $20 \log (\text{Duty cycle}) = 20 \log (\text{Ton}/\text{Tp}) = -10.25\text{dB}$, Please see page 18 for plotted duty.

Frequency Range	25MHz ~ 1GHz(below 1GHz)		
Operation Channel	433.92MHz TX		
Input Power	Power supply by battery	Environmental Conditions	27°C, 60%RH
Tested by	Tank Tan	Test Date	2020/09/14



Remarks:

- The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Peak detection (PK) at frequency below 1GHz.
- Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
- Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
- Margin value = Emission level – Limit value.
- For the test results, the EUT had been tested from 9KHz ~5GHz. But only the worst case was shown in test report.
- *Fundamental AV value =PK Emission +20*log (duty cycle), Where the duty factor is calculated from following formula: $20 \log (\text{Duty cycle}) = 20 \log (\text{Ton}/\text{Tp}) = -10.25\text{dB}$, Please see page 18 for plotted duty.

Frequency Range	1GHz ~ 25GHz (Above 1GHz)		
Operation Channel	433.92MHz TX		
Tested by	Tank Tan	Test Date	2019/09/14

Antenna Polarity & Test Distance: Horizontal at 3 m									
No	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Emission Level (dBuV)	Limit (dBuV)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Detector
1	2603.000	49.60	-0.07	49.53	74.00	-24.47	234	187	peak
2*	2603.000	39.35		39.28	54.00	-14.72			AVG
3	3037.000	45.65	1.33	46.98	74.00	-27.02	108	281	peak
4*	3037.000	35.40		39.22	54.00	-17.27			AVG
5	3464.000	48.74	1.63	50.37	74.00	-23.63	116	213	peak
6*	3464.000	38.49		40.12	54.00	-13.78			AVG
Antenna Polarity & Test distance: Vertical at 3m									
No	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Emission Level (dBuV)	Limit (dBuV)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Detector
1	2603.000	49.42	-0.07	49.35	74.00	-24.65	102	336	peak
2*	2603.000	39.17		39.10	54.00	-14.90			AVG
3	3037.000	49.56	1.33	50.89	74.00	-23.11	114	225	peak
4*	3037.000	39.31		40.64	54.00	-13.36			AVG
5	3464.000	43.05	1.63	44.68	74.00	-29.32	165	308	peak
6*	3464.000	32.80		34.43	54.00	-19.57			AVG

Remarks:

- 1 The resolution bandwidth of test receiver/spectrum analyzer is 1MHz for Peak detection (PK) at frequency above 1GHz.
- 2 Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
- 3 Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
- 4 Margin value = Emission level – Limit value.
- 5 * Fundamental AV value =PK Emission +20*log (duty cycle), Where the duty factor is calculated from following formula: $20 \log (\text{Duty cycle}) = 20 \log (\text{Ton}/\text{Tp}) = -10.25\text{dB}$, Please see page 18 for plotted duty.

4.3 Duty cycle

4.3.1 Limits of duty cycle

Without limit of duty cycle, only use to calculate the factor.

4.3.2 Test instruments

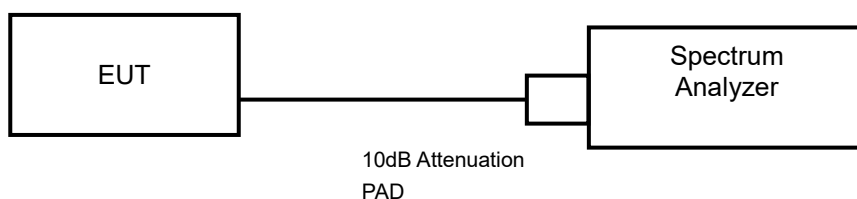
Equipment Manufacturer	Model No.	Serial No.	Cal. Due
Broadband antenna Schwarzbeck	VULB 9168	00937	2020-10-17
3m Semi-anechoic Chamber MAORUI	9m*6m*6m	NSEMC003	2020-10-18
Signal Amplifier Com-power	PAM-103	18020051	2020-10-17
Attenuator Rohde&Schwarz	TS2GA-6dB	18101101	2020-10-17
Test software FARAD	EZ_EMCV1.1.4.2	N/A	2020-10-17
Spectrum Keysight	N9020A	MY51240612	2020-10-17

- Note:** 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA.
2. The test site was performed in Chambe

4.3.3 Test procedures

The basic test procedure was in accordance with ANSI C63.10

4.3.4 Test setup



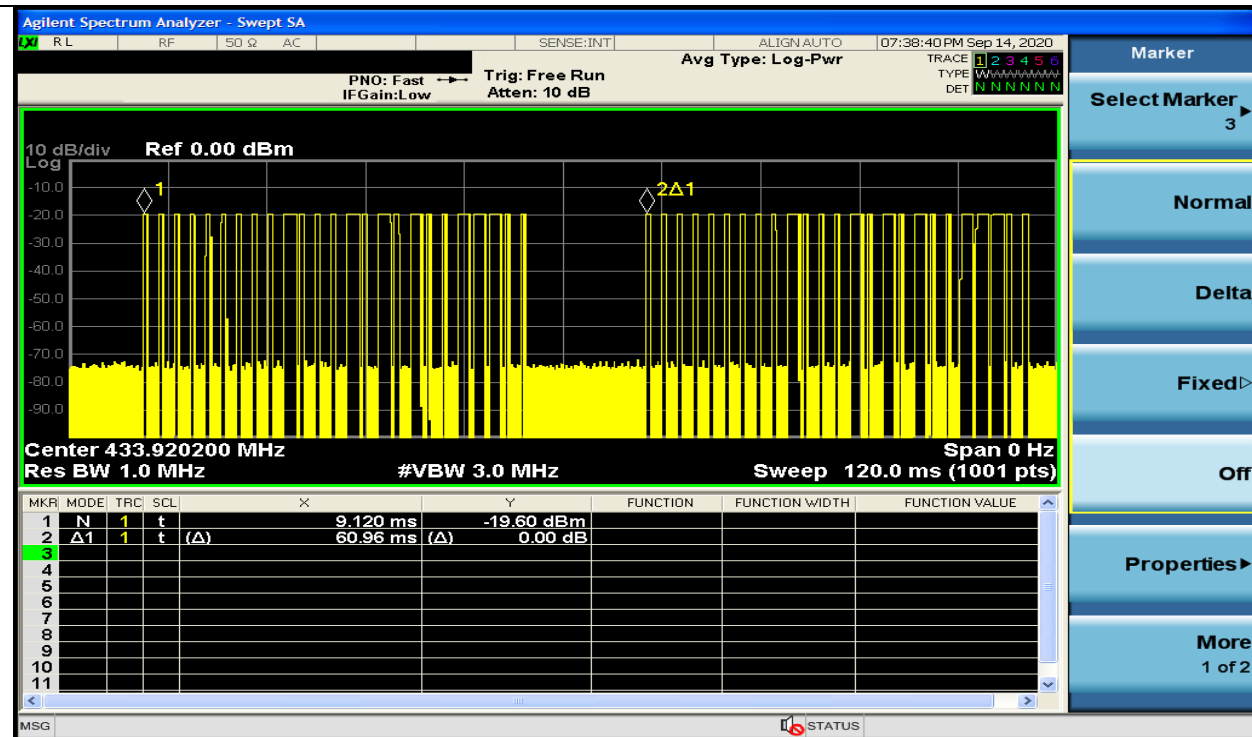
4.3.5 Test results

TX Periods =60.96ms

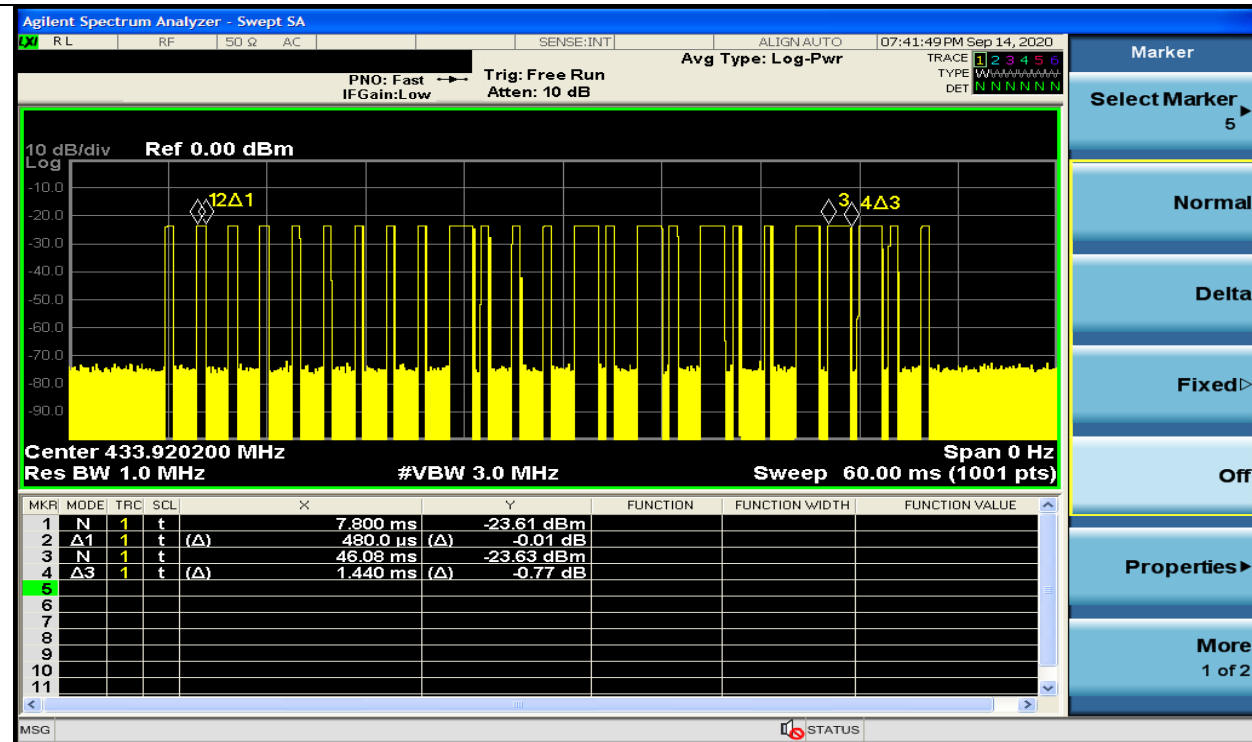
TX on=0.48*18+1.44*7=18.72ms, TX off=TP-Ton=60.96-18.72=42.248ms

Duty cycle=Ton/TP=30.71%, Factor = 20*Log (Ton/TP) = -10.25dB

TX Periods

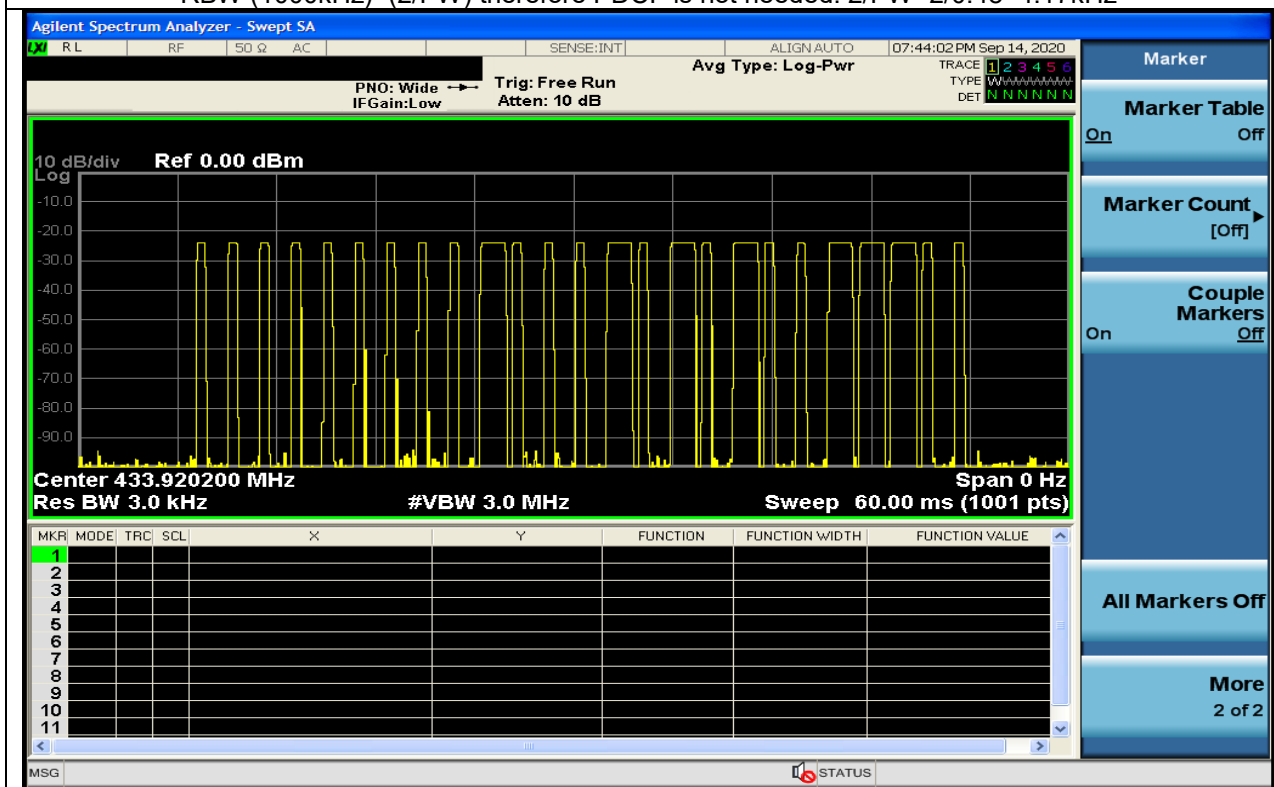


TX on=0.48*18+1.44*7=18.72ms, TX off=TP-Ton=60.96-18.72=42.248ms



The pulse desensitization correction factor:

RBW (1000kHz)>(2/PW) therefore PDCF is not needed. $2/PW=2/0.48=4.17\text{kHz}$



4.4 20dB Bandwidth measurement

4.4.1 Limit of 20dB bandwidth measurement

According to FCC 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.

Limit=Fundamental Frequency×0.25%=433.92MHz×0.25%=1084.8 kHz

4.4.2 Test instruments

Equipment Manufacturer	Model No.	Serial No.	Cal. Due
Broadband antenna Schwarzbeck	VULB 9168	00937	2021/04/15
3m Semi-anechoic Chamber MAORUI	9m*6m*6m	NSEMC003	2021/04/14
Signal Amplifier Com-power	PAM-103	18020051	2021/04/15
Attenuator Rohde&Schwarz	TS2GA-6dB	18101101	N/A
Test software FARAD	EZ_EMCV1.1.4.2	N/A	N/A
Spectrum Keysight	N9020A	MY51240612	2021/09/16

- Note:** 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA.
2. The test site was performed in Chambe

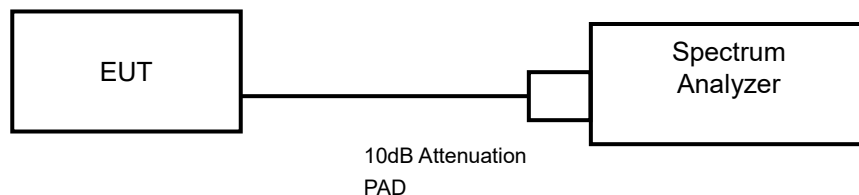
4.4.3 Test procedure

The spectrum analyzer was receiving the maximum emission level. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

4.4.4 Deviation from test standard

No deviation.

4.4.5 Test Setup

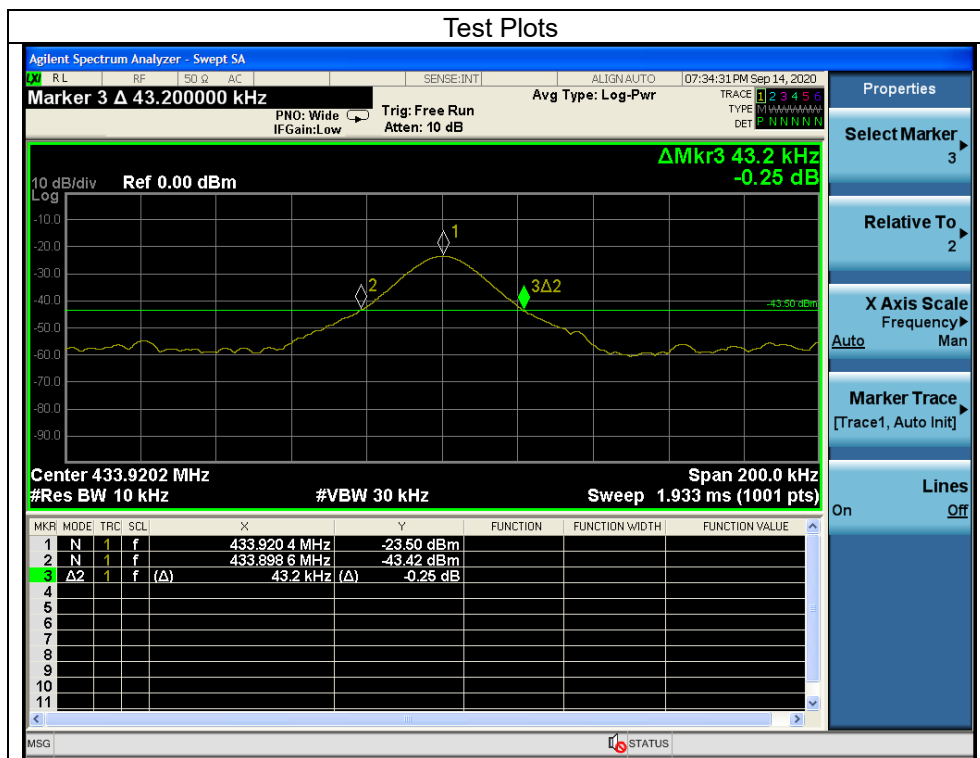


4.4.6 EUT operating conditions

- Placed the EUT on the testing table.
- Enable EUT under transmission condition continuously at specific channel frequency.

4.4.7 Test Results

Frequency (MHz)	20dB bandwidth (kHz)	Maximum limit (kHz)	Pass/Fail
433.92	43.20	1084.80	Pass



4.5 Deactivation test

4.5.1 Limits of deactivation test

15.231 (a)(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

15.231 (a)(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

4.5.2 Test instruments

Equipment Manufacturer	Model No.	Serial No.	Cal. Due
Broadband antenna Schwarzbeck	VULB 9168	00937	2020-10-17
3m Semi-anechoic Chamber MAORUI	9m*6m*6m	NSEMC003	2020-10-18
Signal Amplifier Com-power	PAM-103	18020051	2020-10-17
Attenuator Rohde&Schwarz	TS2GA-6dB	18101101	2020-10-17
Test software FARAD	EZ_EMCV1.1.4.2	N/A	2020-10-17
Spectrum Keysight	N9020A	MY51240612	2020-10-17

- Note:** 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA.
2. The test site was performed in Chambe

4.5.3 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 transmission duration was measured and recorded.

4.5.4 Deviation from test standard

No deviation.

4.5.5 Test Setup

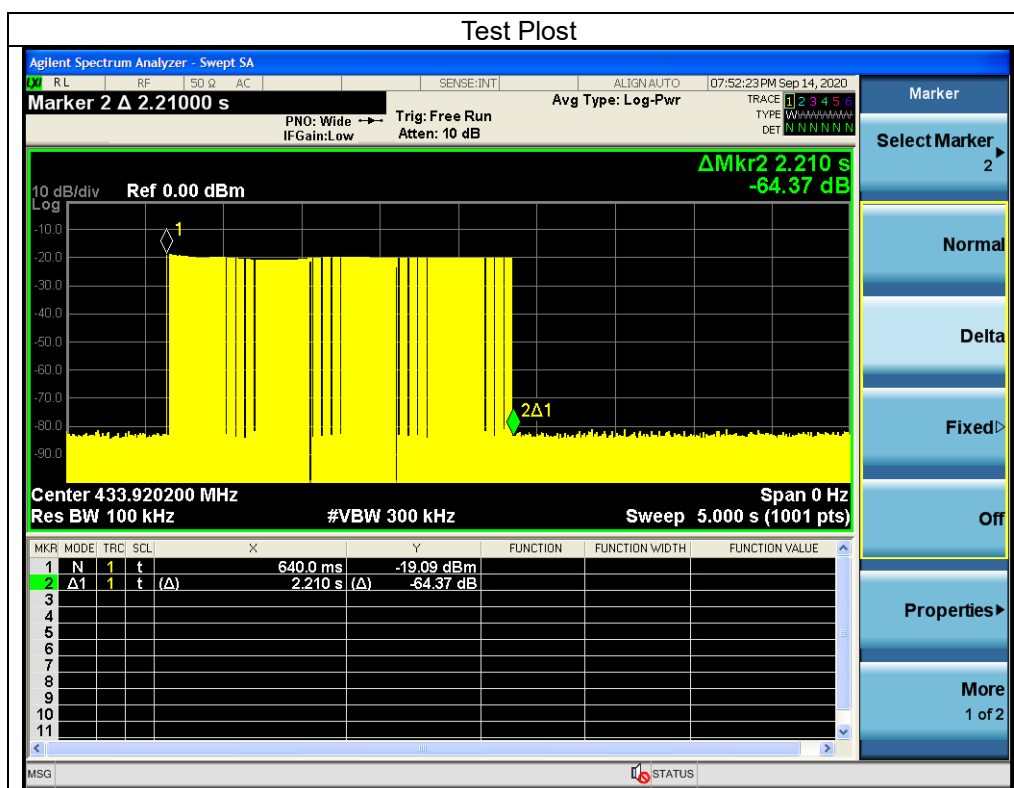


4.5.6 EUT operating conditions

- Placed the EUT on the testing table.
- Enable EUT under transmission condition continuously at specific channel frequency.

4.5.7 Test Results

Frequency (MHz)	Maximum limit (Sec.)	Deactivation Time (Sec.)	Pass/Fail
433.92	5	2.210	Pass



5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

6 Appendix – Information on the Testing Laboratories

We, [Hwa-Hsing \(Dongguan\) Co., Ltd.](#), A global provider of TESTING and CERTIFICATION services for consumer products, electronic products and wireless information technology products. Adhering to the core values "HONEST and TRUSTWORTHY, OBJECTIVE and IMPARTIALITY, RIGOROUS and AFFICIENT", commitment to provide professional, perfect and efficient comprehensive ONE-STOP solution of TESTING and CERTIFICATION services for Manufacturers, Buyers, Traders, Brands, Retailers. Assist client to better manage risk, protect their brands, reduce costs and cut time to over 150 markets in global. Our laboratories are FCC recognized accredited test firms and accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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Email: customerservice.dg@hwa-hsing.com

Web Site: www.hwa-hsing.com

The address and road map of all our labs can be found in our web site also.

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