

TEST REPORT

Report No.:	E201903055023-5	Application No.:	E201903055023
Client:	Baolong Huf Shanghai Electronics Co., Ltd.		
Address:	1st Floor, Building 5, 5500 Shenzhuan Rd, Songjiang, Shanghai		
Sample Description:	TPMS TOOL-GJ002		
Model:	GJ002		
Adding Model:	/		
FCC ID	2ATCK-TPMSTOOL		
Test Specification:	FCC 47 CFR Part 15 Subpart C		
Test Date:	2019-04-10 to 2019-07-16		
Issue Date:	2019-07-17		
Test Result:	PASS		
Prepared By:	Reviewed By:	Approved By:	
Darry Wu / Test Engineer	Jimmy Xie / Technical Manager	Ryan Zhu / Manager	
			
Date: 2019-07-17	Date: 2019-07-17	Date: 2019-07-17	
Other Aspects:			
/			
Abbreviations: ok / P = passed; fail / F = failed; n.a. / N = not applicable			
The test result in this test report refers exclusively to the presented test sample. This report shall not be reproduced except in full, without the written approval of GRGT.			

DIRECTIONS OF TEST

1. This company carries out test task according to the national regulation of verifications which can be traced to National Primary Standards and BIPM.
2. 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.
3. If there is any objection concerning the test, the client should inform the laboratory within 15 days from the date of receiving the test report.

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1. TEST RESULT SUMMARY

FCC Part 15.231			
Standard	Item	Limit / Severity	Result
FCC Part 15, Subpart C (15.231)	Conducted Emissions	§15.203	N/A ¹⁾
	Transmission Time	§15.231 §15.231(a) (1)	PASS
	99% Bandwidth	§15.231 (c)	PASS
	Radiated Spurious Emission	§15.231(b)	PASS

Note. 1: The EUT received DC power supplied by battery.

2. GENERAL DESCRIPTION OF EUT

2.1. APPLICANT

Name: Baolong Huf Shanghai Electronics Co., Ltd.
Address: 1st Floor, Building 5, 5500 Shenzhuan Rd, Songjiang, Shanghai

2.2. MANUFACTURER

Name: Baolong Huf Shanghai Electronics Co., Ltd.
Address: 1st Floor, Building 5, 5500 Shenzhuan Rd, Songjiang, Shanghai

2.3. FACTORY

Factory
Name : Baolong Huf Shanghai Electronics Co., Ltd.
Address : 1st Floor, Building 5, 5500 Shenzhuan Rd, Songjiang, Shanghai

2.4. BASIC DESCRIPTION OF EQUIPMENT UNDER TEST

Equipment: TPMS TOOL-GJ002
Model No.: GJ002
Adding Model /
Trade Name: VALOR
Power supply DC6V(1.5V*4)Supply by the battery
Frequency Range 433.92MHz
Max Antenna gain: Monopole antenna with -10 dBi gain(Max)
Type of Modulation: FSK
Temperature Range: -20°C ~+45 °C
Hardware Version: QYGJ002-00-01PB-V07
Software Version: QYGJ002-00-02PR-V2.5
Note: DC port and RS232 port just for engineering debugging.

3. LABORATORY AND ACCREDITATIONS

3.1. LABORATORY

The tests and measurements refer to this report were performed by EMC Laboratory of GRG METROLOGY & TEST (SHENZHEN) CO., LTD

Add.: No.1301 Guanguang Road Xinlan Community, Guanlan Street, Longhua District Shenzhen, 518110, People's Republic of China

Telephone: +86-755-61180008

Fax: /

3.2. ACCREDITATIONS

A2LA	Certificate Number 2861.01
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3.3. MEASUREMENT UNCERTAINTY

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

Measurement		Frequency	Uncertainty
Radiated Emission	Horizontal	30MHz~1000MHz	4.8dB
		1GHz~26.5GHz	5.8dB
	Vertical	30MHz~1000MHz	4.8dB
		1GHz~26.5GHz	5.9dB

This uncertainty represents an expanded uncertainty factor of $k=2$.

4. LIST OF USED TEST EQUIPMENT AT GRGT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Radiated Spurious Emission& Restricted bands of operation				
ESCI Test Receiver	ROHDE&SCHWARZ	ESCI	101026	2020-01-09
EXA signal analyzer	Agilent	N9010A	MY52221469	2020-01-10
Bilog Antenna	Schwarzbeck	VULB 9160	9160-3401	2019-12-21
Horn Antenna	Schwarzbeck	BBHA9120	D286	2019-12-21
Amplifier	EM Electronics Corporation	EM330	060661	2019-12-21
High Noise Amplifier	Agilent	8449B	3008A02060	2019-12-21
Test SW	FARAD	EZ-EMC/ CCS-3A1-CE		
20 dB Bandwidth & Transmission Time				
EXA signal analyzer	Agilent	N9010A	MY52221469	2020-01-10
Transmission Time				
EXA signal analyzer	Agilent	N9010A	MY52221469	2020-01-10
Bilog Antenna	Schwarzbeck	VULB 9160	9160-3401	2019-12-21
Amplifier	EM Electronics Corporation	EM330	060661	2019-12-21

5. RADIATED SPURIOUS EMISSIONS

5.1. LIMITS

§15.231(b) In addition to the provisions of §15.205, the field strength of emissions from intentional radiators operated under this section shall not exceed 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

1. ** linear interpolations

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, uV/m at 3 meters = $56.81818(F) - 6136.3636$; for the band 260-470 MHz, uV/m at 3 meters = $41.6667(F) - 7083.3333$. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]

§15.231(b)(3) The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in §15.209, whichever limit permits a higher field strength.

Frequency (MHz)	Quasi-peak(μV/m)	Measurement distance(m)	Quasi-peak(dBμV/m)@distance 3m
0.009-0.490	2400/F(kHz)	300	53.8~88.5
0.490-1.705	24000/F(kHz)	30	43~53.8
1.705-30.0	30	30	49.5
30 ~ 88	100	3	40
88~216	150	3	43.5
216 ~ 960	200	3	46
Above 960	500	3	54

NOTE: (1) The lower limit shall apply at the transition frequencies.

5.2. TEST PROCEDURES

- 1) The EUT was placed on the top of a rotating table 0.8 meters (for below 1GHz) / 1.5 meters (for above 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.
- 2) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

- 3) Height of receiving antenna 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.
- 4) The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- 5) The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- 6) If the emission level of the EUT in peak mode was lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported.
Otherwise the emissions would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

5.3. TEST SETUP

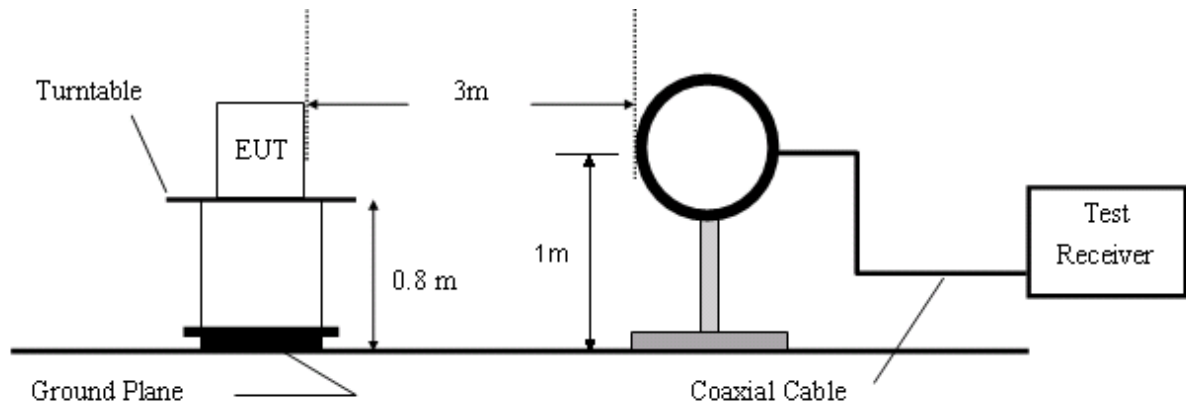


Figure 1. 9KHz to 30MHz radiated emissions test configuration

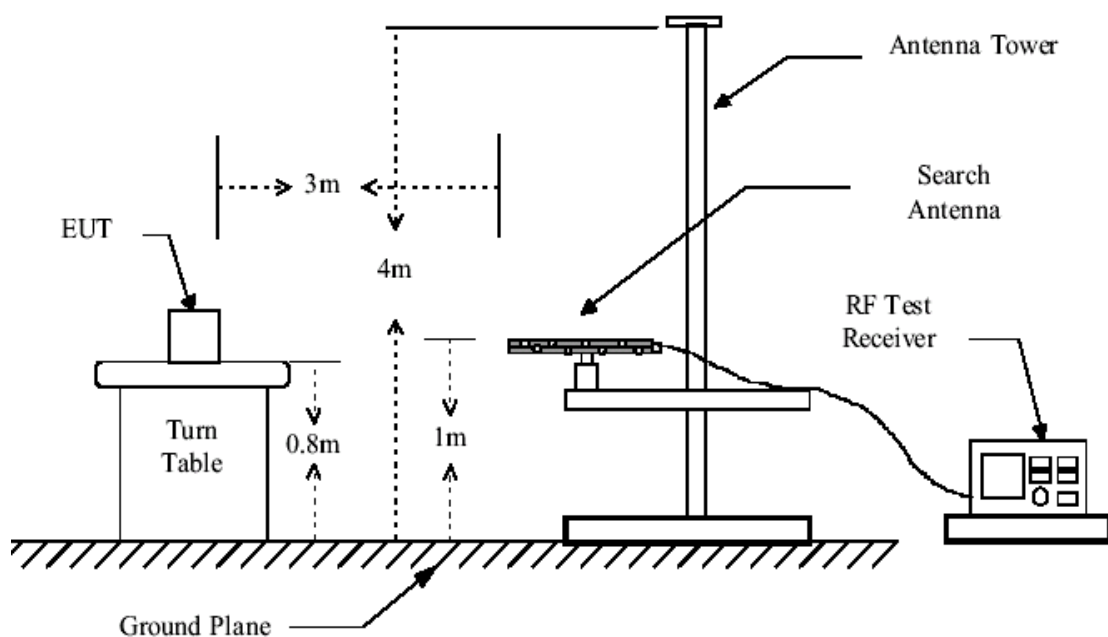


Figure 2. 30MHz to 1GHz radiated emissions test configuration

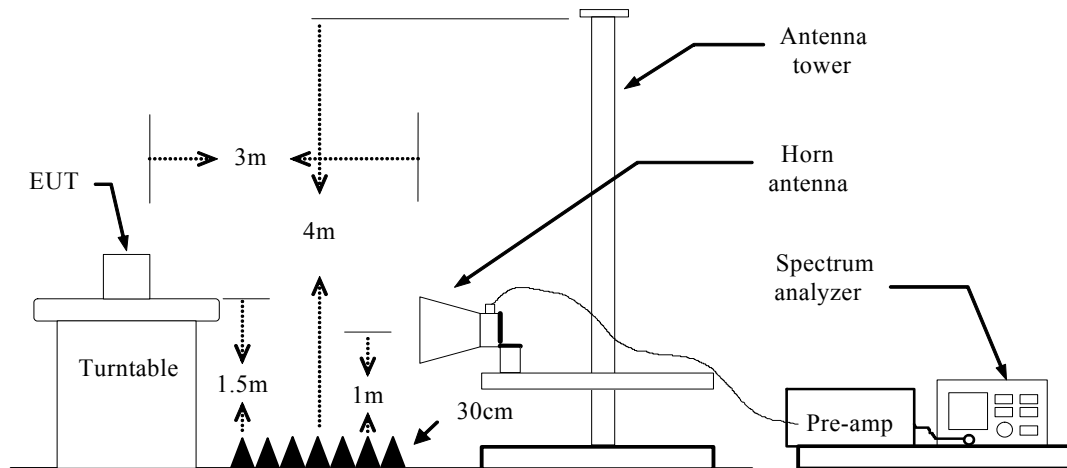


Figure 3. Above 1GHz radiated emissions test configuration

5.4. DATA SAMPLE

Below 1GHz

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
XXX.XXXX	37.47	-16.41	21.06	40.00	-18.94	V	QP

Above 1GHz

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
XXXX.XXXX	55.54	4.56	60.10	74.00	-13.90	V	Peak
XXXX.XXXX	29.66	4.56	34.22	54.00	-19.78	V	AVG

Frequency (MHz) = Emission frequency in MHz

Reading (dBuV) = Uncorrected Analyzer / Receiver reading

Correction Factor (dB/m) = Antenna factor + Cable loss – Amplifier gain

Result (dBuV/m) = Reading (dBuV) + Corr. Factor (dB/m)

Limit (dBuV/m) = Limit stated in standard

Margin (dB) = Result (dBuV/m) – Limit (dBuV/m)

Q.P. = Quasi-peak Reading

Peak = Peak Reading

AVG = Average Reading

5.5. 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.

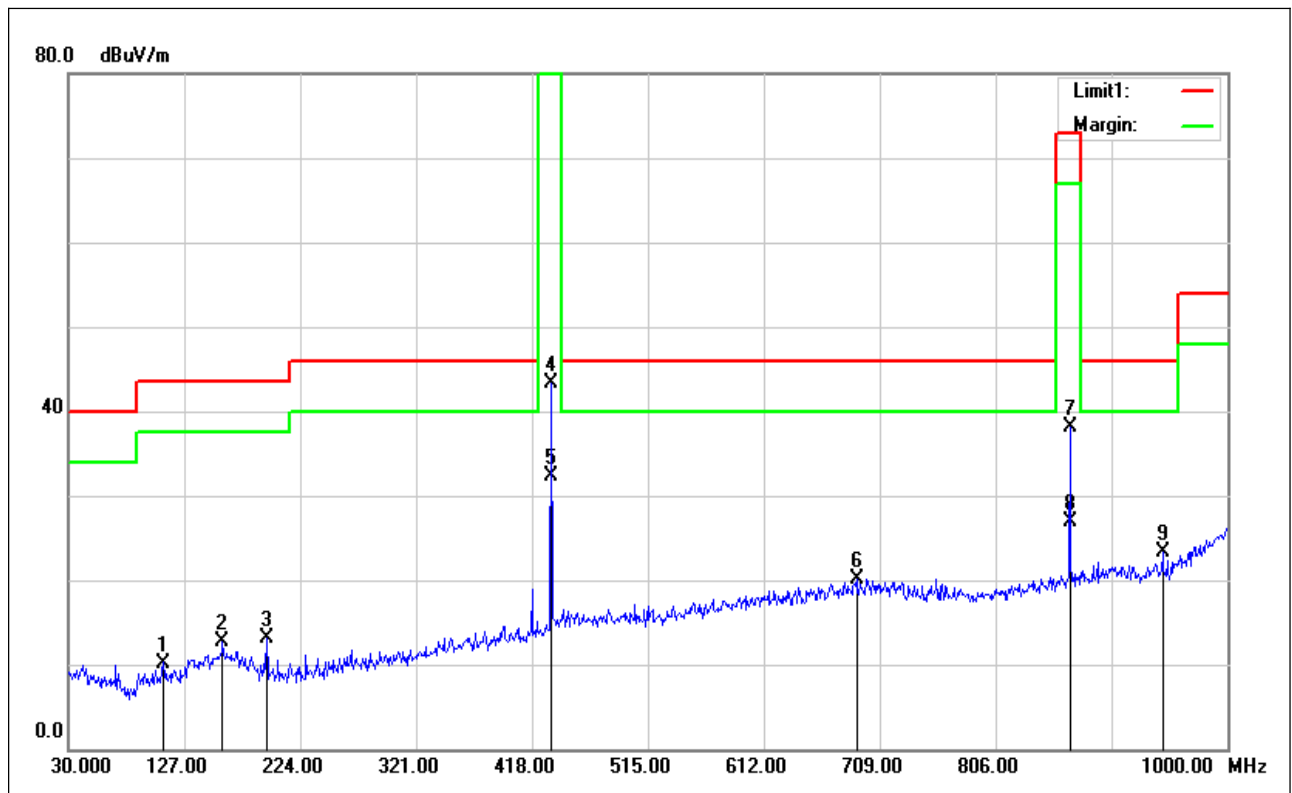
Mode: TX

Test channel (433.92 MHz)

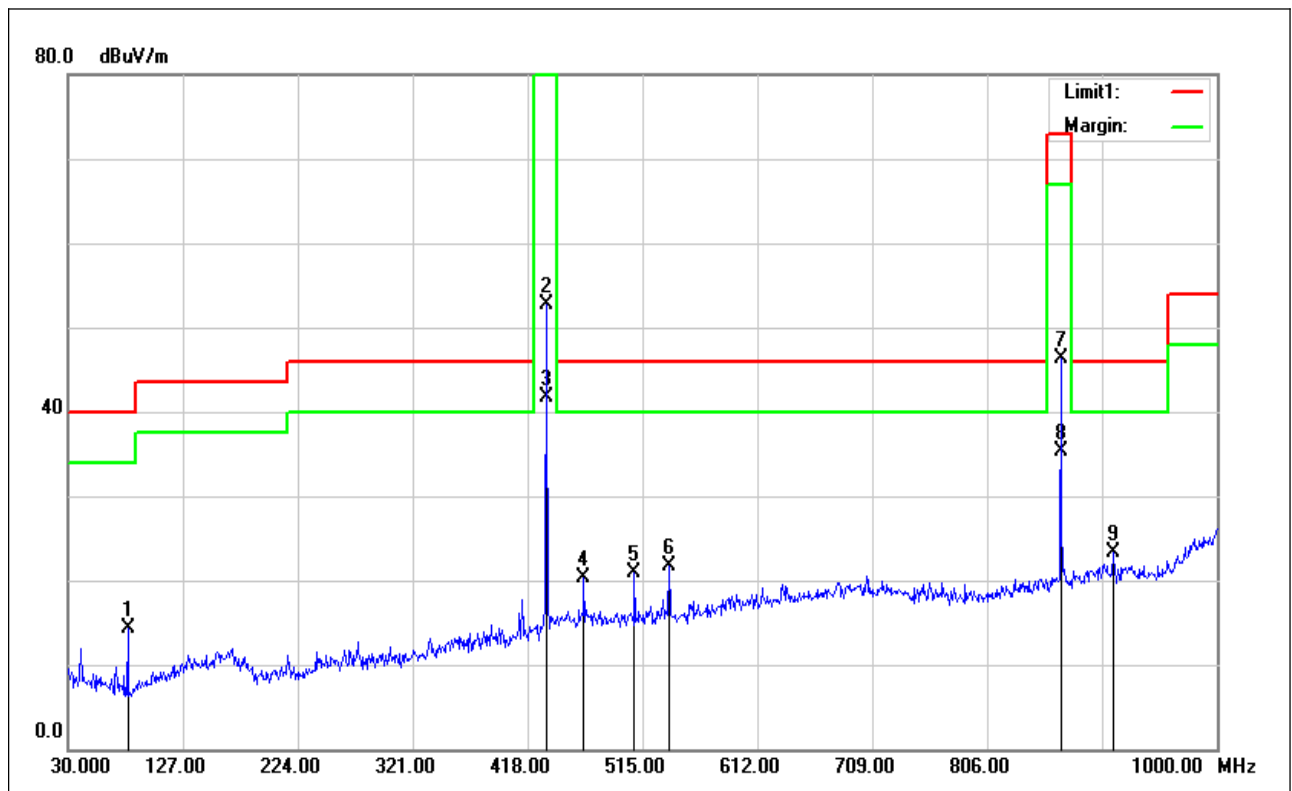
Date: 2019-4-10

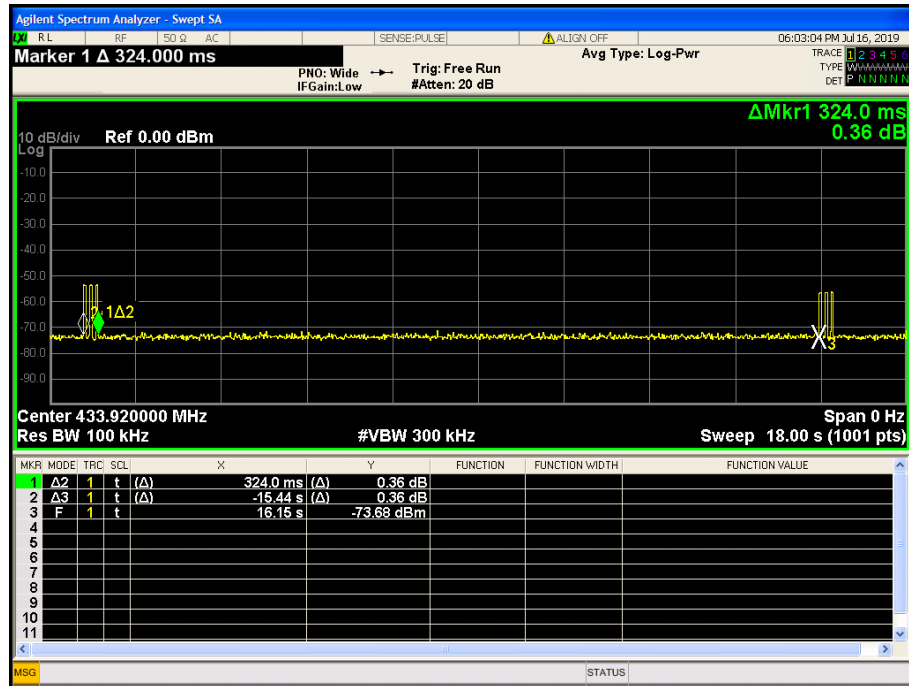
No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Pole
1	109.5400	27.78	-17.58	10.20	43.50	-33.30	peak	Vertical
2	159.0100	27.64	-14.95	12.69	43.50	-30.81	peak	Vertical
3	195.8700	31.15	-18.02	13.13	43.50	-30.37	peak	Vertical
4	433.9200	55.25	-11.87	43.38	100.83	-57.45	peak	Vertical
5	433.9200	44.19	-11.87	31.85	80.83	-48.98	AVG	Vertical
6	689.6000	26.63	-6.58	20.05	46.00	-25.95	peak	Vertical
7	868.0800	42.92	-4.91	38.01	80.83	-42.82	peak	Vertical
8	868.0800	31.86	-4.91	26.48	60.83	-34.35	AVG	Vertical
9	945.6800	27.30	-4.06	23.24	46.00	-22.76	peak	Vertical
10	80.4400	34.75	-20.52	14.23	40.00	-25.77	peak	Horizontal
11	433.9200	64.62	-11.87	52.75	100.83	-48.08	peak	Horizontal
12	433.9200	53.56	-11.87	41.22	80.83	-39.61	AVG	Horizontal
13	465.5300	31.44	-11.10	20.34	46.00	-25.66	peak	Horizontal
14	508.2100	31.74	-10.82	20.92	46.00	-25.08	peak	Horizontal
15	537.3100	31.95	-10.27	21.68	46.00	-24.32	peak	Horizontal
16	868.0800	51.29	-4.91	46.38	80.83	-34.45	peak	Horizontal
17	868.0800	40.23	-4.91	34.85	60.83	-25.98	AVG	Horizontal
18	912.7000	27.40	-4.14	23.26	46.00	-22.74	peak	Horizontal

Vertical



Horizontal





Fundamental:

Frequency	Reading	Correct	Result	Limit	Margin	Antenna Pole(V/H)	Remark
(MHz)	(dBuV/m)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)		
433.9200	55.25	-11.87	43.38	100.83	-57.45	V	peak
433.9200	44.19	-11.87	31.85	80.83	-48.98	V	AVG
433.9200	64.62	-11.87	52.75	100.83	-48.08	H	peak
433.9200	53.56	-11.87	41.22	80.83	-39.61	H	AVG

Remark: 1. AVG= Peak(Result) - Duty Cycle Correction Factor

2. Duty Cycle Correction Factor = $20 * \log(1/x) = 20 * \log(1/0.2652) = 11.53\text{dB}$

【 $x=26.52*1/100=0.2652$ 】

Emission above 1GHz:

Mode: TX

Test channel (433.92 MHz)

Date: 2019-4-10

No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Pole
1	1196.000	47.23	-13.62	33.61	74.00	-40.39	peak	Vertical
2	1488.000	46.78	-12.46	34.32	74.00	-39.68	peak	Vertical
3	1744.000	47.85	-11.04	36.81	74.00	-37.19	peak	Vertical
4	2172.000	47.39	-9.28	38.11	74.00	-35.89	peak	Vertical
5	2380.000	44.82	-8.87	35.95	74.00	-38.05	peak	Vertical
6	3736.000	42.62	-7.39	35.23	74.00	-38.77	peak	Vertical
7	1392.000	46.87	-12.84	34.03	74.00	-39.97	peak	Horizontal
8	1532.000	46.45	-12.23	34.22	74.00	-39.78	peak	Horizontal
9	1620.000	46.19	-11.74	34.45	74.00	-39.55	peak	Horizontal
10	1736.000	46.39	-11.09	35.30	74.00	-38.70	peak	Horizontal
11	2168.000	47.71	-9.29	38.42	74.00	-35.58	peak	Horizontal
12	2680.000	44.14	-8.31	35.83	74.00	-38.17	peak	Horizontal

6. 99% BANDWIDTH

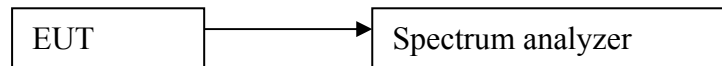
6.1. LIMITS

§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. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

6.2. TEST PROCEDURES

- 1) Set resolution bandwidth (RBW) = 10kHz. Set the video bandwidth (VBW) $\geq 3 \times$ RBW. Detector = Peak. Trace mode = max hold. Sweep = auto couple. Allow the trace to stabilize, record 20dB bandwidth value.
- 2) Repeat above procedures until all frequencies measured were complete.

6.3. TEST SETUP

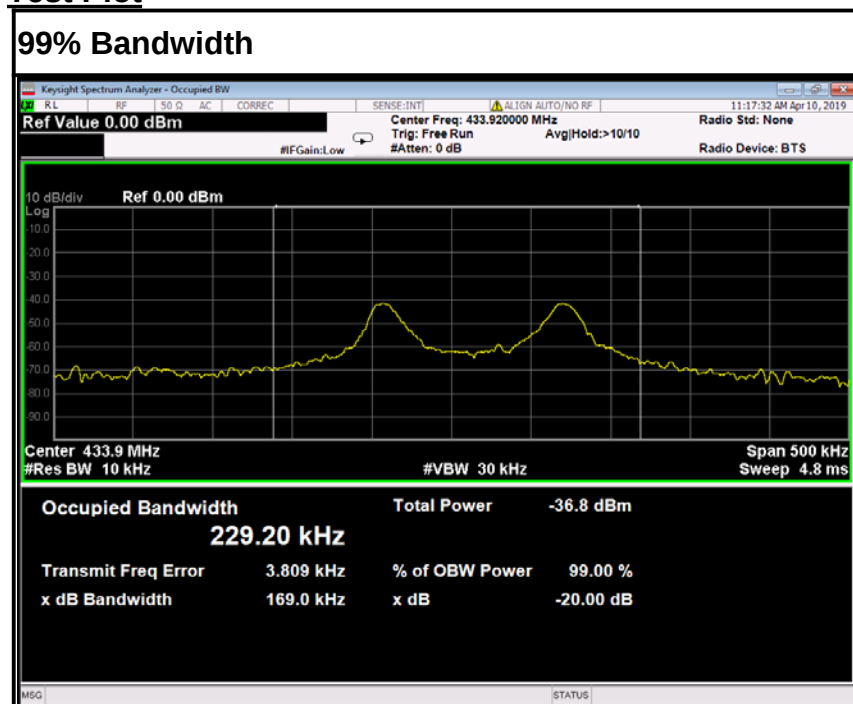


6.4. TEST RESULTS

Test mode:

Channel	Frequency (MHz)	Bandwidth (kHz)	Limit	Test Result
	433.92	229.20	0.25% of the center frequency	PASS

Test Plot



7. TRANSMISSION TIME

7.1. LIMITS

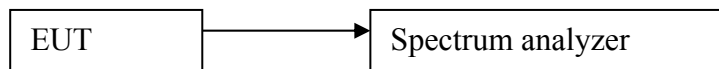
§15.231 (a) (1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

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

7.2. TEST PROCEDURES

- 1) The spectrum analyzer resolution bandwidth that is $\leq$ EBW. So we test the Maximum Conducted Output Power —Integrated band power method.
- 2) Set Set the analyzer span = 0Hz. RBW = 100kHz.Set VBW $\geq$ 3 x RBW. Detector = Peak. Sweep = Adjust according to actual conditions.
- 3) Allow the trace to stabilize, record value.

7.3. TEST SETUP



7.4. TEST RESULTS

Test Data

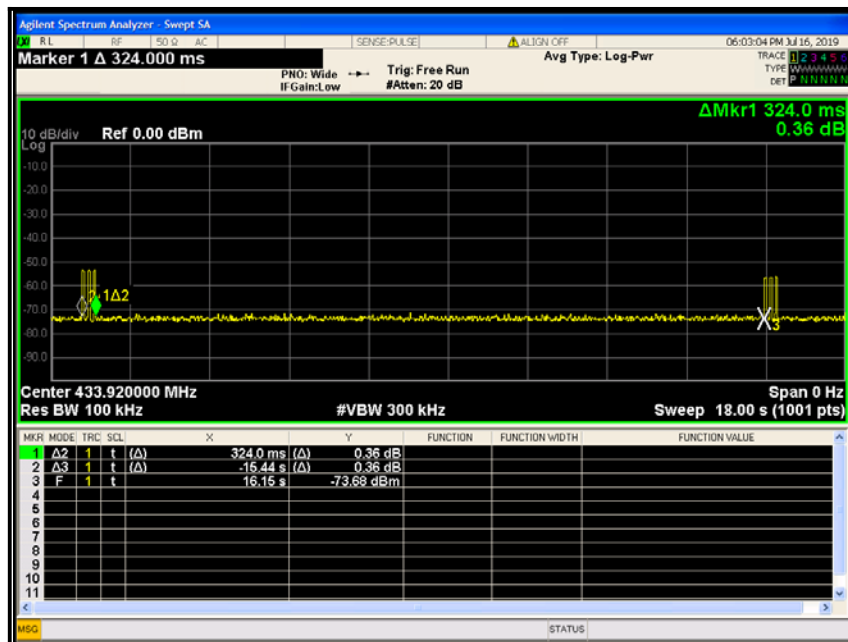
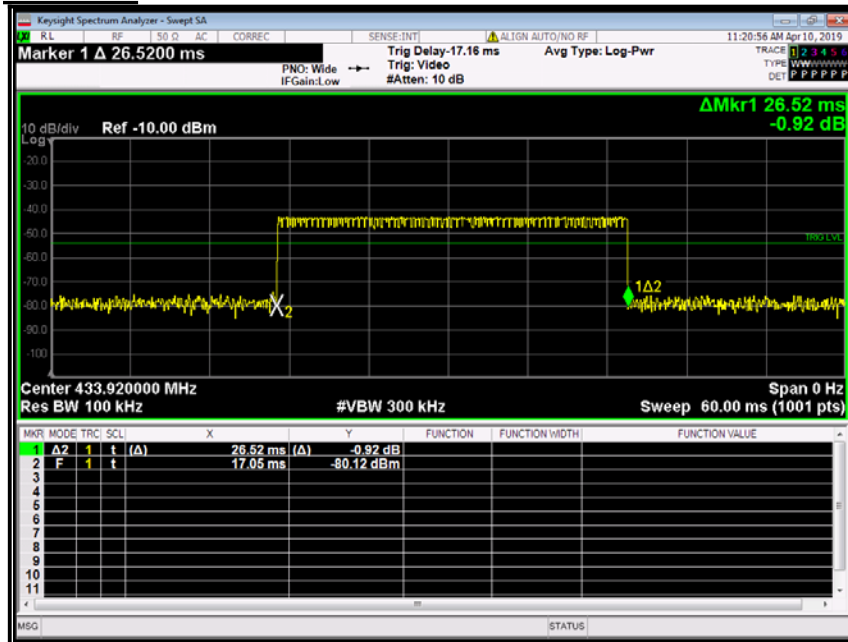
Frequency (MHz)	Transmission Time (s)	Limit (s)	Result
433.92	0.324	5	Pass

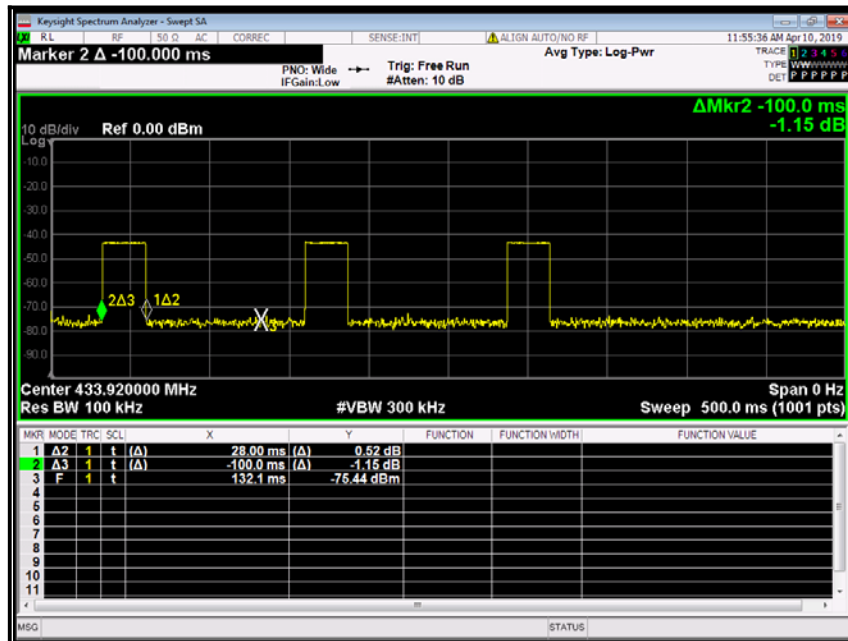
Remark:

1. Duty Cycle Correction Factor = $20 * \log (1/ x) = 20 * \log (1/0.2652) = 11.53\text{dB}$

【 $x=26.52*1/100=0.2652$ 】

Test Plot





APPENDIX A: PHOTOGRAPH OF THE TEST ARRANGEMENT

RSE (Below 1GHz)



RSE (Above 1GHz)

