Zhejiang Kezheng Electronic Product Inspection
Building 5, No. 316, Jianghong South Road Binjiang District, Hangzhou 310052, China
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TEST REPORT

Certificate Number 4749.01

Report No.....:	**2019-9063**
FCC ID·····:	**2AD33-T517KBU**
Applicant.....:	FLYBALL ELECTRONIC (SHENZHEN) CO. LTD
Address.....:	5-6 Building, Zhiji Industrial Park, Shenzhen, China
Manufacturer.....:	FLYBALL ELECTRONIC (SHENZHEN) CO. LTD
Address.....:	5-6 Building, Zhiji Industrial Park, Shenzhen, China
Product Name.....:	**AUDIO REPUBLIC BLUETOOTH SPEAKER**
Trade Mark.....:	Audio Republic
Model/Type reference.....:	ARBSX1
Listed Model(s).....:	T517KBU
Standard.....:	**FCC CFR Title 47 Part 15 Subpart C Section 15.247**
Date of Receipt.....:	Sept.05, 2019
Date of Test Date.....:	Sept.05, 2019-Sept.17, 2019
Date of issue.....:	Sept.17, 2019
Test result.....:	**Pass**

Compiled by: (Printed name+signature)	Liu Wei	Liu Wei
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Approved by: (Printed name+signature)	Wang Weixiong	Wang Weixiong

Testing Laboratory Name.....:	**Zhejiang Kezheng Electronic Product Inspection**
Address.....:	Building 5, No. 316, Jianghong South Road Binjiang District, Hangzhou 310052, China

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1. TEST SUMMARY

1.1. Test Standards

The tests were performed according to following standards:

FCC Rules Part 15.247: Operation within the bands of 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz.

ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.

1.2. Report version

Revised No.	Date of issue	Description
01	Sept.17, 2019	Original

1.3. Test Description

FCC Part 15 Subpart C(15.247)			
Test Item	Standard Section	Result	Test Engineer
	FCC		
Antenna Requirement	15.203	Pass	John Xie
Conducted Emission	15.207	Pass	John Xie
Restricted Bands	15.205	Pass	John Xie
Hopping Channel Separation	15.247(a)(1)	Pass	John Xie
Dwell Time	15.247(a)(1)	Pass	John Xie
Peak Output Power	15.247(b)(1)	Pass	John Xie
Number of Hopping Frequency	15.247(b)(1)	Pass	John Xie
Band Edge Emissions	15.247(d)	Pass	John Xie
Radiated Spurious Emission	15.247(d)&15.209	Pass	John Xie
99% Occupied Bandwidth & 20dB Bandwidth	15.247(a)	Pass	John Xie
Pseudorandom Frequency Hopping Sequence	15.247 (a)(1)	Pass	John Xie

Note: The measurement uncertainty is not included in the test result.

1.4. Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to TR-100028-01" Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 2 " and is documented in the Zhejiang Kezheng Electronic Product Inspection quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device. Below is the best measurement capability for Zhejiang Kezheng Electronic Product Inspection.

Test Items	Measurement Uncertainty	Notes
Transmitter power conducted	0.42 dB	(1)
Transmitter power Radiated	2.14 dB	(1)
Conducted spurious emissions 9kHz~40GHz	1.60 dB	(1)
Radiated spurious emissions 9kHz~40GHz	2.20 dB	(1)
Conducted Emissions 9kHz~30MHz	3.20 dB	(1)
Radiated Emissions 30~1000MHz	4.70 dB	(1)
Radiated Emissions 1~18GHz	5.00 dB	(1)
Radiated Emissions 18~40GHz	5.54 dB	(1)
Occupied Bandwidth	2.80 dB	(1)

Note (1): This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

1.5. Environmental conditions

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

Temperature:	15~35°C
Relative Humidity:	30~60 %
Air Pressure:	950~1050mba

2. GENERAL INFORMATION

2.1. Client Information

Applicant:	FLYBALL ELECTRONIC (SHENZHEN) CO. LTD
Address:	5-6 Building, Zhiji Industrial Park, Shenzhen, China
Manufacturer:	FLYBALL ELECTRONIC (SHENZHEN) CO. LTD
Address:	5-6 Building, Zhiji Industrial Park, Shenzhen, China

2.2. General Description of EUT

Product Name:	AUDIO REPUBLIC BLUETOOTH SPEAKER
Model/Type reference:	ARBSX1
Marketing Name:	Audio Republic
Listed Model(s):	T517KBU
Model Difference:	All these models are identical in the same structure, electrical circuits and components, the only difference is appearance color.
Power Source:	120V~ 60Hz 100W
Hardware version:	V2.1
Software version:	V4.2.25
BT3.0	
Modulation:	FHSS
Operation frequency:	2402MHz~2480MHz
Max Peak Output Power:	-0.55dBm
Channel number:	79
Channel separation:	1MHz
Antenna type:	PCB antenna
Antenna gain:	1.2dBi

2.3. Operation state

Operation Frequency List: The EUT has been tested under typical operating condition. The Applicant provides communication tools software to control the EUT for staying in continuous transmitting and receiving mode for testing. BT BDR, 79 channels are provided to the EUT. Channels 00/39/78 were selected for testing.

Operation Frequency List:

Channel	Frequency (MHz)
00	**2402**
01	2403
⋮	⋮
38	2440
39	**2441**
40	2442
⋮	⋮
77	2479
78	**2480**

Note: The display in grey were the channel selected for testing.

Test mode

For RF test items:
The engineering test program was provided and enabled to make EUT continuous transmit
For AC power line conducted emissions:
The EUT was set to connect with the Bluetooth instrument under large package sizes transmission.
For Radiated spurious emissions test item:
The engineering test program was provided and enabled to make EUT continuous transmit. The EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.

2.4. Measurement Instruments List

Tonscend JS0806-2 Test system					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Until
1	Spectrum Analyzer	R&S	FSV40-N	101798	Sept. 09, 2020
2	Vector Signal Generator	Agilent	N5182A	MY50142520	Sept. 09, 2020
3	Analog Signal Generator	HP	83752A	3344A00337	Sept. 09, 2020
4	Power Sensor	Agilent	E9304A	MY50390009	Sept. 09, 2020
5	Power Sensor	Agilent	E9300A	MY41498315	Sept. 09, 2020
6	Wideband Radio Communication Tester	R&S	CMU200	115297	Sept. 09, 2020
7	Climate Chamber	Angul	AGNH80L	1903042120	Sept. 09, 2020
8	Dual Output DC Power Supply	Agilent	E3646A	MY40009992	Sept. 09, 2020
9	RF Control Unit	Tonscend	JS0806-2	/	Sept. 09, 2020

Transmitter spurious emissions & Receiver spurious emissions					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	EMI Test Receiver	R&S	ESR	102525	Sept. 09, 2020
2	High Pass Filter	Chengdu E-Microwave	OHF-3-18-S	0E01901038	Sept. 09, 2020
3	High Pass Filter	Chengdu E-Microwave	OHF-6.5-18-S	0E01901039	Sept. 09, 2020
4	Spectrum Analyzer	HP	8593E	3831U02087	Sept. 09, 2020
5	Ultra-Broadband logarithmic period Antenna	Schwarzbeck	VULB 9163	01230	Sept. 09, 2020
6	Loop Antenna	Beijin ZHINAN	ZN30900C	18050	Sept. 09, 2020
7	Horn Antenna	R&S	Sep-60	69483	Sept. 09, 2020
8	Spectrum Analyzer	R&S	FSV40-N	101798	Sept. 09, 2020
9	Horn Antenna	Schwarzbeck	BBHA 9120 D	2023	Sept. 09, 2020
10	Pre-Amplifier	Schwarzbeck	BBV 9745	9745#129	Sept. 09, 2020
11	Pre-Amplifier	EMCI	EMC051835SE	980662	Sept. 09, 2020
12	Power Meter	Agilent	E4419B	GB41293710	Sept. 09, 2020

Note:
1)The Cal. Interval was one year.
2)The cable loss has calculated in test result which connection between each test instruments.

2.5. Test Software

Software name	Model	Version
Conducted emission Measurement Software	EZ-EMC	EMC-Con 3A1.1
Radiated emission Measurement Software	EZ-EMC	FA-03A.2.RE
Bluetooth and WIFI Test System	JS1120-3	2.5.77.0418
AppoTech RF Control Kit	CW6686	V4.2.25

3. TEST ITEM AND RESULTS

3.1. Antenna requirement

Requirement

FCC CFR Title 47 Part 15 Subpart C Section 15.203:

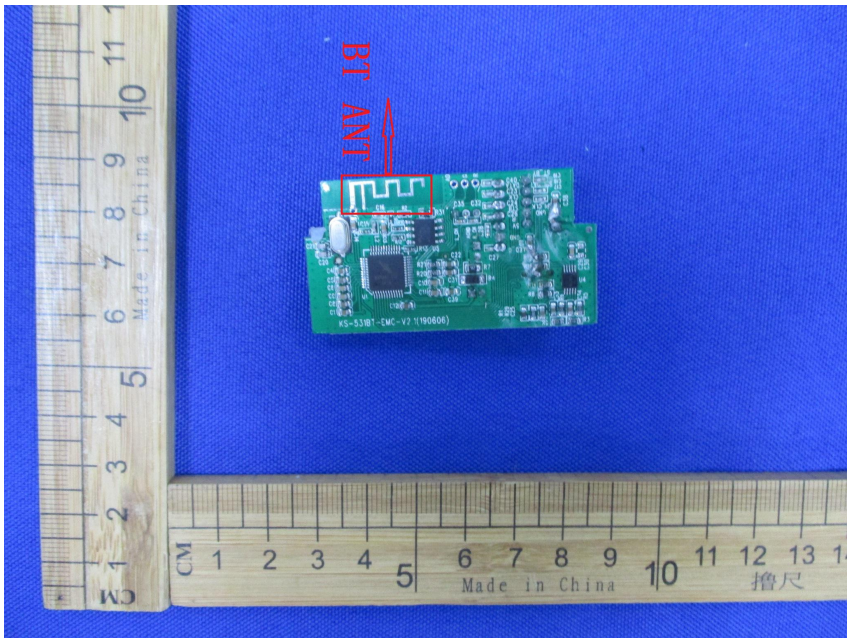
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

FCC CFR Title 47 Part 15 Subpart C Section 15.247(c) (1)(i):

(i) Systems operating in the 2400~2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

Test Result

The directional gain of the antenna less than 6dBi, please refer to the EUT internal photographs antenna photo.



3.2. Conducted Emission

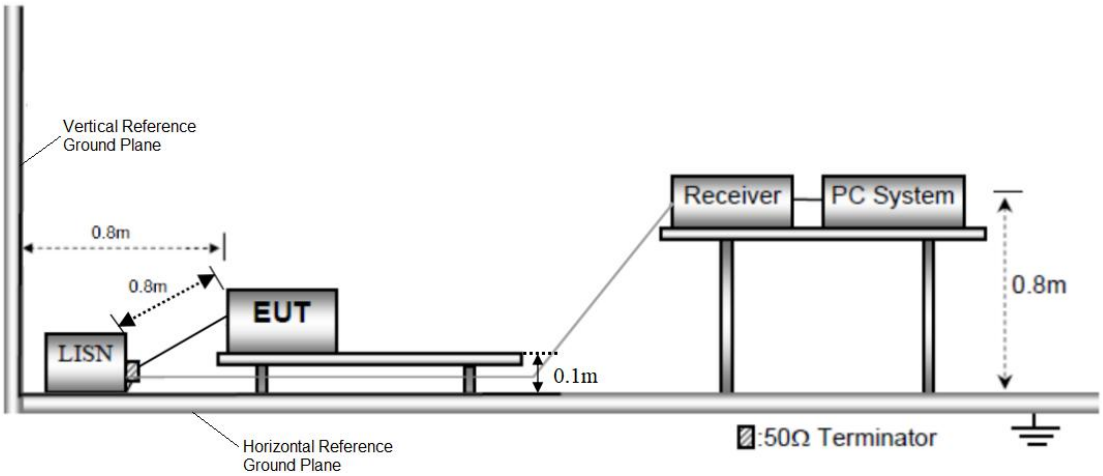
Limit

Conducted Emission Test Limit

Frequency	Maximum RF Line Voltage (dBμV)	
	Quasi-peak Level	Average Level
150kHz~500kHz	66 ~ 56 *	56 ~ 46 *
500kHz~5MHz	56	46
5MHz~30MHz	60	50

Notes:
(1) *Decreasing linearly with logarithm of the frequency.
(2) The lower limit shall apply at the transition frequencies.
(3) The limit decrease in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

Test Configuration



Test Procedure

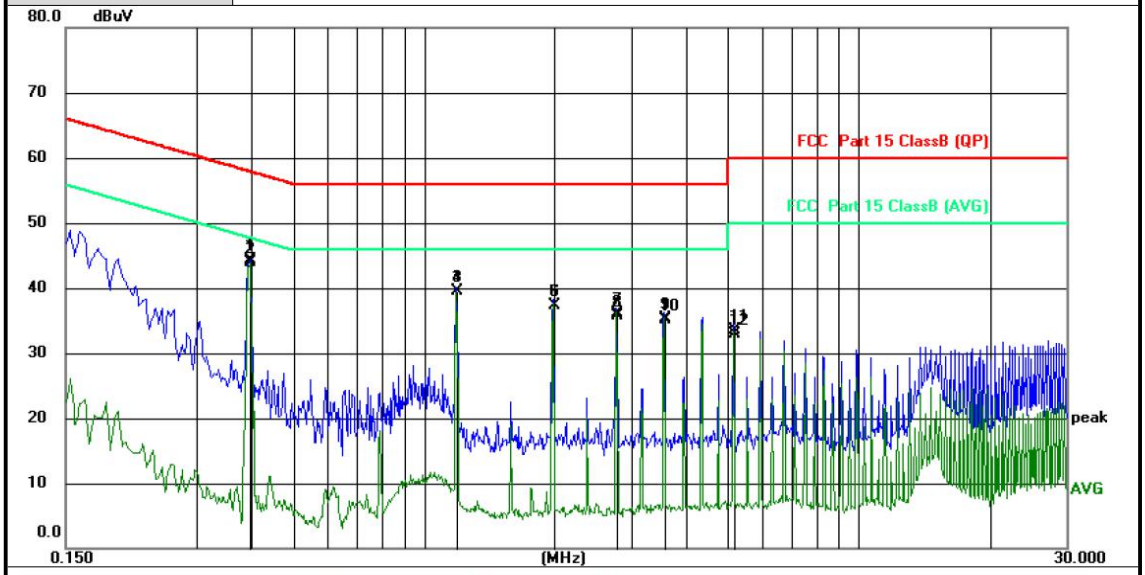
1. The EUT was setup according to ANSI C63.10:2013 requirements.
2. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 0.1m above the conducting ground plane. The vertical conducting plane was located 80 cm to the rear of the EUT. All other surfaces of EUT were at least 0.8m from any other grounded conducting surface.
3. The EUT and simulators are connected to the main power through a line impedances stabilization network (LISN). The LISN provides a 50ohm /50uH coupling impedance for the measuring equipment.
   The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs)
4. Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.
5. The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.
6. Conducted Emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.
7. During the above scans, the emissions were maximized by cable manipulation.

Test Mode:

Please refer to the clause 2.3.

Test Results

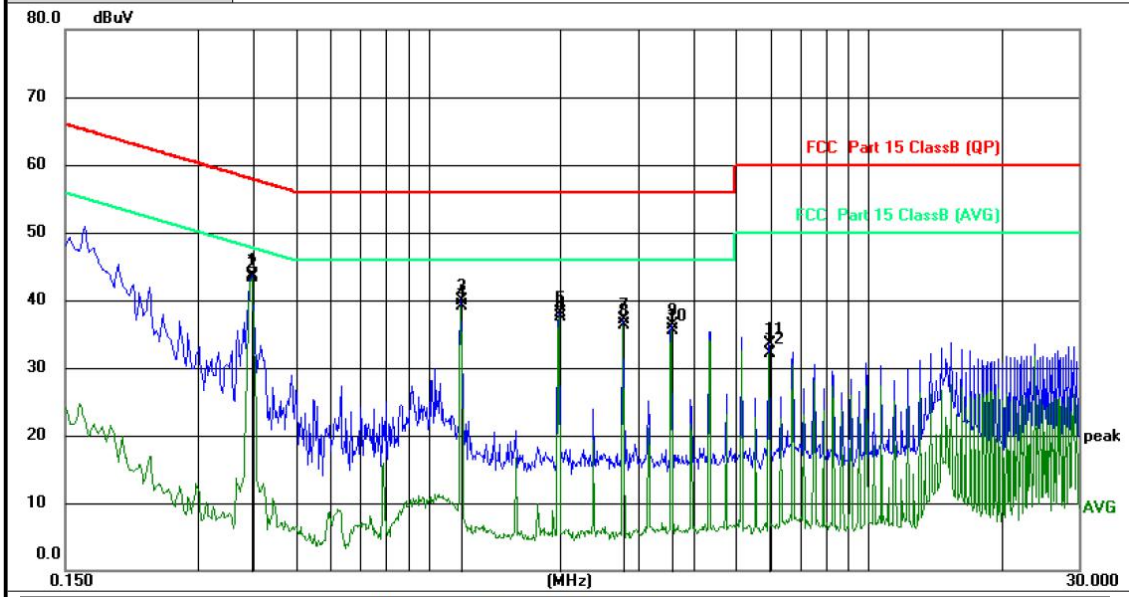
Test Voltage:	AC 120V/60 Hz
Terminal:	Line



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.3980	34.56	9.71	44.27	57.90	-13.63	QP
2	*	0.3980	34.25	9.71	43.96	47.90	-3.94	AVG
3		1.1892	29.61	9.84	39.45	56.00	-16.55	QP
4		1.1892	29.62	9.84	39.46	46.00	-6.54	AVG
5		1.9809	27.44	9.94	37.38	56.00	-18.62	QP
6		1.9809	27.43	9.94	37.37	46.00	-8.63	AVG
7		2.7732	26.08	9.96	36.04	56.00	-19.96	QP
8		2.7732	25.79	9.96	35.75	46.00	-10.25	AVG
9		3.5662	25.29	9.98	35.27	56.00	-20.73	QP
10		3.5662	25.19	9.98	35.17	46.00	-10.83	AVG
11		5.1530	23.41	10.02	33.43	60.00	-26.57	QP
12		5.1530	22.80	10.02	32.82	50.00	-17.18	AVG

Remarks:
1.Measurement = Reading Level+ Correct Factor
2.Over = Measurement -Limit

Test Voltage:	AC 120V/60 Hz
Terminal:	Neutral



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.3980	33.95	9.71	43.66	57.90	-14.24	QP
2	*	0.3980	33.58	9.71	43.29	47.90	-4.61	AVG
3		1.1900	30.02	9.84	39.86	56.00	-16.14	QP
4		1.1900	29.35	9.84	39.19	46.00	-6.81	AVG
5		1.9819	28.11	9.94	38.05	56.00	-17.95	QP
6		1.9819	27.50	9.94	37.44	46.00	-8.56	AVG
7		2.7740	27.09	9.96	37.05	56.00	-18.95	QP
8		2.7740	26.35	9.96	36.31	46.00	-9.69	AVG
9		3.5659	26.28	9.98	36.26	56.00	-19.74	QP
10		3.5659	25.47	9.98	35.45	46.00	-10.55	AVG
11		5.9419	23.42	10.03	33.45	60.00	-26.55	QP
12		5.9419	22.04	10.03	32.07	50.00	-17.93	AVG

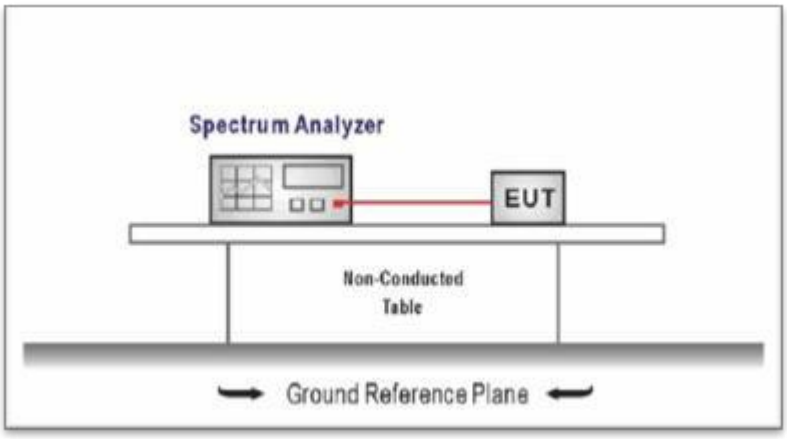
Remarks:
1.Measurement = Reading Level+Correct Factor
2.Over = Measurement -Limit

3.3. Peak Output Power

Limit

Test Item	Limit	Frequency Range(MHz)
Peak Output Power	Hopping Channels>75 Power<1W(30dBm) Other <125mW(21dBm)	2400~2483.5

Test Configuration



Test Procedure

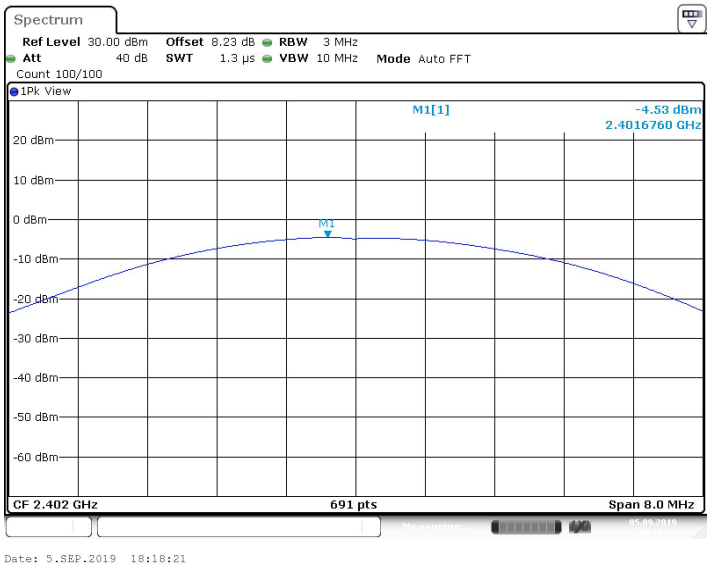
1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. Spectrum Setting:
   Peak Detector: RBW=1 MHz, VBW=3 MHz for bandwidth less than 1MHz.
   RBW=3 MHz, VBW=10 MHz for bandwidth more than 1MHz.

Test Mode

Please refer to the clause 2.3

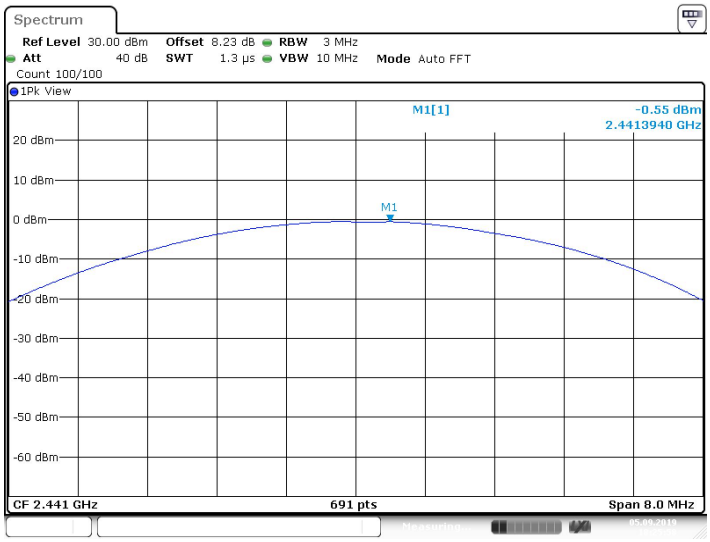
Test Result

Test Mode:	FHSS Mode	
Channel frequency (MHz)	**Test Result (dBm)**	**Limit (dBm)**
2402	-4.53	**21**
2441	-0.55	
2480	-0.85	
FHSS Mode		
2402 MHz		



FHSS Mode

2441 MHz



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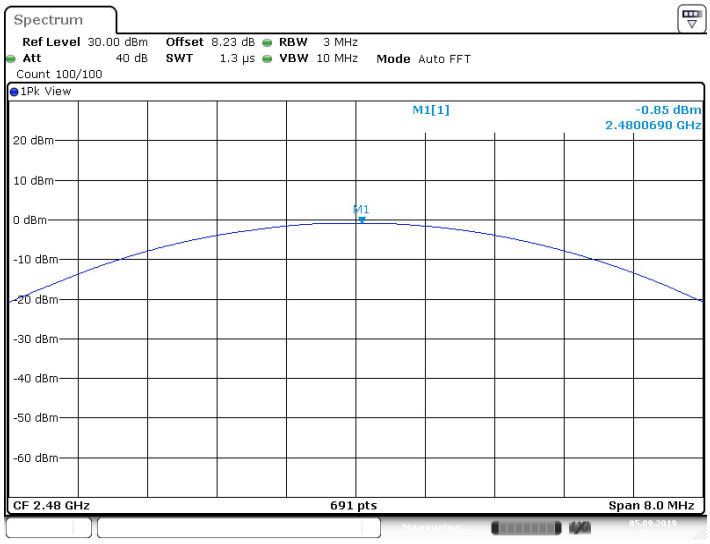
FHSS Mode

2480 MHz



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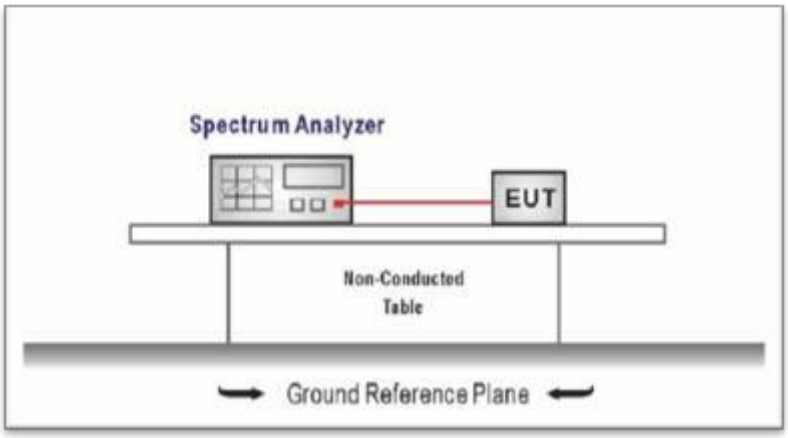
3.4. 99% Occupied Bandwidth & 20dB Bandwidth

Limit

Test Item	Limit	Frequency Range(MHz)
Bandwidth	<=1 MHz (20dB bandwidth)	2400~2483.5

Test Configuration



Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. Spectrum Setting:

   20dB Bandwidth
   (1) Set RBW = 30 kHz.
   (2) Set the video bandwidth (VBW) ≥ 3 RBW.
   (3) Detector = Peak.
   (4) Trace mode = Max hold.
   (5) Sweep = Auto couple.

   99% Occupied Bandwidth
   (1) Set RBW = 20 kHz.
   (2) Set the video bandwidth (VBW) =100 kHz.
   (3) Detector = Peak.
   (4) Trace mode = Max hold.
   (5) Sweep = Auto couple.

NOTE: The EUT was set to continuously transmitting in each mode and low, Middle and high channel for the test.

Test Mode

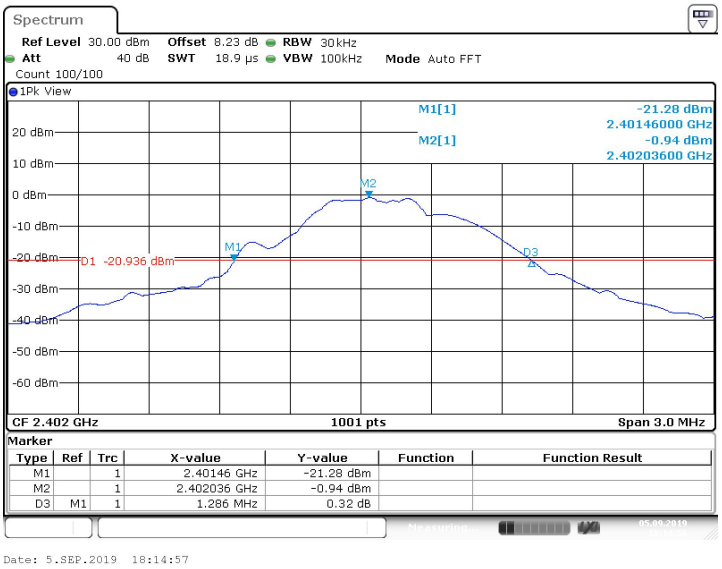
Please refer to the clause 2.3.

Test Results

Test Mode:	FHSS Mode			
Channel frequency (MHz)	20dB Bandwidth [MHz]	FL[MHz]	FH[MHz]	Verdict
2402	1.286	2401.460	2402.726	PASS
2441	1.326	2440.466	2441.762	PASS
2480	1.286	2479.466	2480.732	PASS

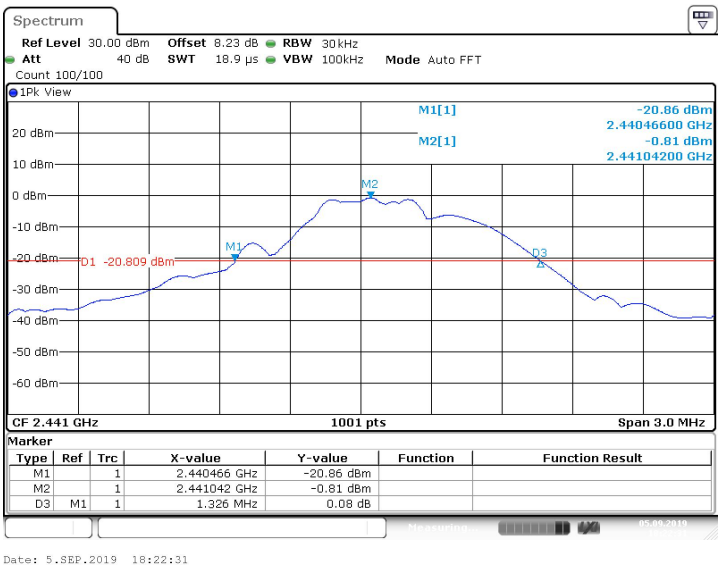
FHSS Mode

2402 MHz



FHSS Mode

2441 MHz



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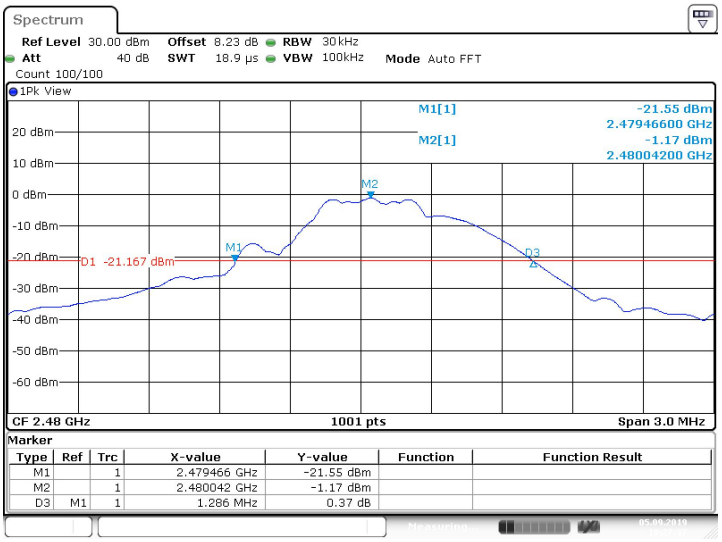
FHSS Mode

2480 MHz

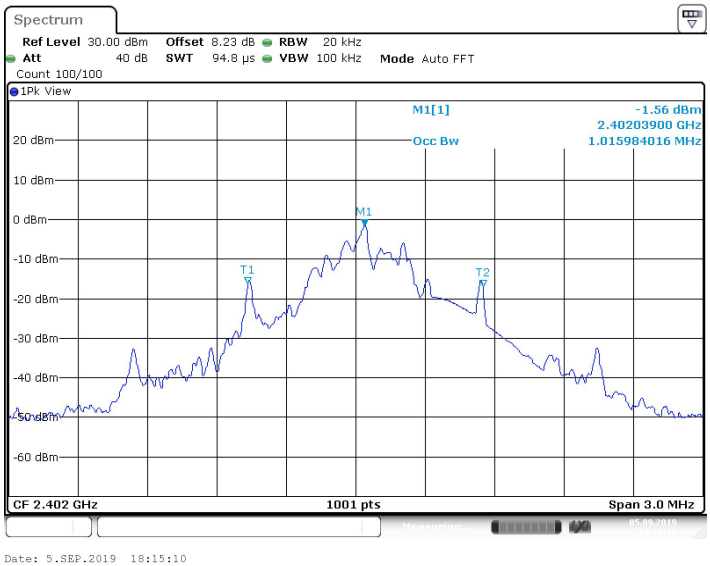


Date: 5.SEP.2019 18:27:37

Test Mode:	FHSS Mode			
Channel frequency (MHz)	99%OCB [MHz]	FL[MHz]	FH[MHz]	Verdict
2402	1.016	2401.532	2402.548	PASS
2441	1.007	2440.538	2441.545	PASS
2480	1.001	2479.541	2480.542	PASS

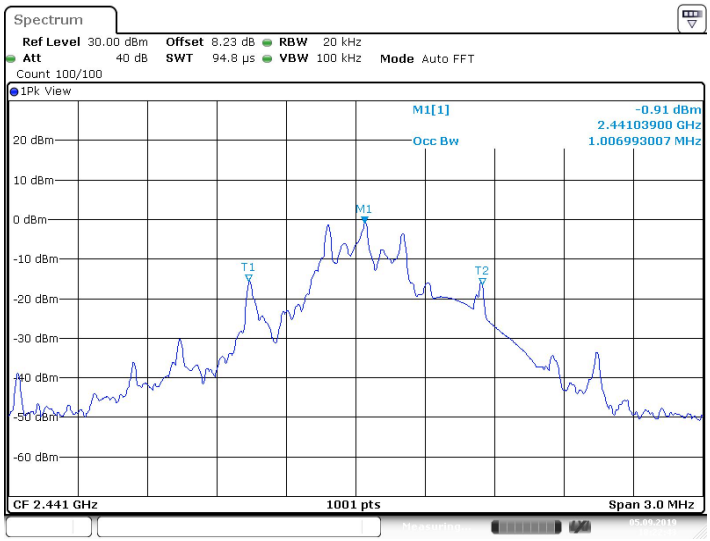
FHSS Mode

2402 MHz



FHSS Mode

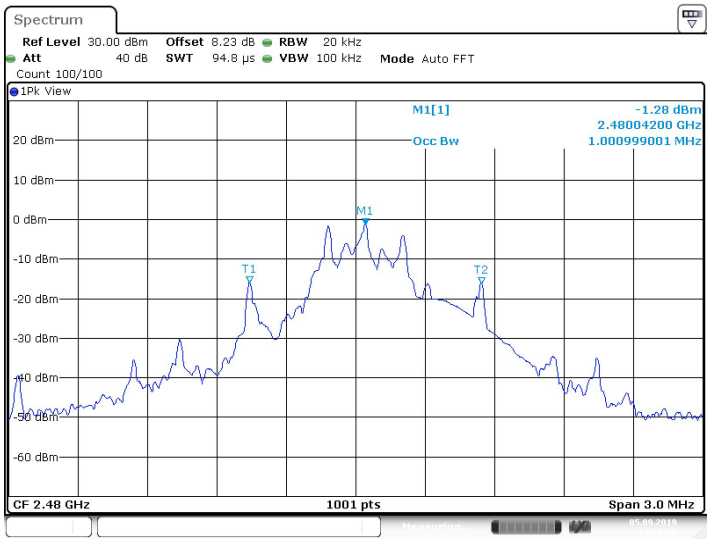
2441 MHz



Date: 5.SEP.2019 18:22:43

FHSS Mode

2480 MHz



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