

TECHNICAL REPORT



Report No:
File reference No:

FCC 1612018-02
2016-12-16

Applicant: LEADER INNOVATIONS LTD.

Product: Bluetooth receiver

Model No: 98884

Trademark: N/A

Test Standards: FCC Part 15 Subpart C, Paragraph 15.247

Test result: It is herewith confirmed and found to comply with the requirements set up by ANSI C63.10, FCC Part 15 Subpart C, Paragraph 15.247 regulations for the evaluation of electromagnetic compatibility

Approved By

Jack Chung

Jack Chung

Manager

Dated: December 16, 2016

**Results appearing herein relate only to the sample tested
The technical reports is issued errors and omissions exempt and is subject to withdrawal at**

SHENZHEN TIMEWAY TESTING LABORATORIES

Room 512-519, 5/F., East Tower, Building 4, Anhua Industrial Zone, Futian District, Shenzhen, Guangdong, China

Tel (755) 83448688, Fax (755) 83442996, E-Mail:info@timeway-lab.com



Special Statement:

The testing quality ability of our laboratory meet with "Quality Law of People's Republic of China" Clause 19.

The testing quality system of our laboratory meet with ISO/IEC-17025 requirements, which is approved by CNAL. This approval result is accepted by MRA of APLAC.

Our test facility is recognized, certified, or accredited by the following organizations:

CNAL-LAB Code: L2292

The EMC Laboratory has been assessed and in compliance with CNAL/AC01:2002 accreditation criteria for testing Laboratories (identical to ISO/IEC 17025:2005 General Requirements) for the Competence of testing Laboratories.

FCC-Registration No.: 899988

The EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications commission. The acceptance letter from the FCC is maintained in our files. Registration No.: 899988.

IC- Registration No.: IC5205A-02

The EMC Laboratory has been registered and fully described in a report filed with the (IC) Industry Canada. The acceptance letter from the IC is maintained in our files. Registration IC No.: 5205A-02.

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Test Report Conclusion

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1.0 General Details

1.1 Test Lab Details

Name : SHENZHEN TIMEWAY TESTING LABORATORIES.
Address: Room 512-519,5/F., East Tower, Building 4, Anhua Industrial Zone, Futian District, Shenzhen, Guangdong China
Telephone: (755) 83448688
Fax: (755) 83442996
Site on File with the Federal Communications Commission – United States
Registration Number: 899988
For 3m & 10 m OATS

Site Listed with Industry Canada of Ottawa, Canada
Registration Number: IC: 5205A-02
For 3m & 10 m OATS

1.2 Applicant Details

Applicant: LEADER INNOVATIONS LTD.
Address: ROOM 901, HENG FU MANSION, NO.858, FUMINGROAD, NINGBO, CHINA
Telephone: 0574-87723018
Fax: 0574-87379877

1.3 Description of EUT

Product: Bluetooth receiver
Manufacturer: LEADER INNOVATIONS LTD.
Address: ROOM 901, HENG FU MANSION, NO.858, FUMINGROAD, NINGBO, CHINA
Brand Name: N/A
Model Number: 98884
Additional Model Number: N/A
Type of Modulation: GFSK (Bluetooth BLE)
Frequency range: 2402-2480MHz
Antenna type: PCB antenna with 2dBi antenna gain
Channel Number: 40

1.4 Submitted Sample: 4 Samples

1.5 Test Duration

2016-12-02 to 2016-12-16

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1.6 Test Uncertainty

Conducted Emissions Uncertainty =3.6dB

Radiated Emissions Uncertainty =4.7dB

1.7 Test Engineer

A handwritten signature in black ink that reads "Terry Tang".

The sample tested by _____

Print Name: Terry Tang

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2.0 Test Equipments					
Instrument Type	Manufacturer	Model	Serial No.	Date of Cal.	Due Date
ESPI Test Receiver	R&S	ESPI 3	100379	2016-08-22	2017-08-21
TWO Line-V-NETW	R&S	EZH3-Z5	100294	2016-08-22	2017-08-21
TWO Line-V-NETW	R&S	EZH3-Z5	100253	2016-08-22	2017-08-21
Ultra Broadband ANT	R&S	HL562	100157	2016-08-23	2017-08-22
ESDV Test Receiver	R&S	ESDV	100008	2016-08-22	2017-08-21
Impuls-Begrenzer	R&S	ESH3-Z2	100281	2016-08-22	2017-08-21
System Controller	CT	SC100	-	--	--
Printer	EPSON	PHOTO EX3	CFNH234850	--	--
Computer	IBM	8434	1S8434KCE99BLXLO*	-	-
Loop Antenna	EMCO	6502	00042960	2016-08-23	2017-08-22
ESPI Test Receiver	R&S	ESI26	838786/013	2016-08-22	2017-08-21
3m OATS	--	--	N/A	2016-08-24	2017-08-23
Horn Antenna	R&S	BBHA 9170	BBHA9170265	2016-08-24	2017-08-23
Horn Antenna	R&S	BBHA 9120D	9120D-631	2016-08-24	2017-08-23
Power meter	Anritsu	ML2487A	6K00003613	2016-08-22	2017-08-21
Power sensor	Anritsu	MA2491A	32263	2016-08-22	2017-08-21
Bilog Antenna	Schwarebeck	VULB9163	9163/340	2016-08-23	2017-08-21
LISN	AFJ	LS16C	10010947251	2016-08-22	2017-08-21
LISN (Three Phase)	Schwarebeck	NSLK 8126	8126453	2016-08-23	2017-08-22
9*6*6 Anechoic	--	--	N/A	2016-08-24	2017-08-23
EMI Test Receiver	RS	ESCS30	100139	2016-08-22	2017-08-21

2.1 Auxiliary Equipment

Name	Model No.	Rating	Manufacturer	FCC ID/DOC
Passive Earphone	--	--	--	--

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3.0 Technical Details

3.1 Summary of test results

The EUT has been tested according to the following specifications:			
Standard	Test Type	Result	Notes
FCC Part 15, Paragraph 15.107 & 15.207	Conducted Emission Test	PASS	Complies
FCC Part 15 Subpart C Paragraph 15.247(a)(2) Limit	Spectrum bandwidth of a Orthogonal Frequency Division Multiplex System Limit: 6dB bandwidth>500kHz	PASS	Complies
FCC Part 15, Paragraph 15.247(b)	Maximum peak output power Limit: max. 30dBm	PASS	Complies
FCC Part 15, Paragraph 15.109,15.205 & 15.209	Transmitter Radiated Emission Limit: Table 15.209	PASS	Complies
FCC Part 15, Paragraph 15.247(e)	Power Spectral Density Limit: max. 8dBm	PASS	Complies
FCC Part 15, Paragraph 15.247(d)	Out of Band Emission and Restricted Band Radiation Limit: 20dB less than peak value of fundamental frequency Restricted band limit: Table 15.209	PASS	Complies

3.2 Test Standards

FCC Part 15 Subpart & Subpart C, Paragraph 15.247, ANSI C63.4 :2014 and ANSI C63.10 :2013

4.0 EUT Modification

No modification by SHENZHEN TIMEWAY TESTING LABORATORIES

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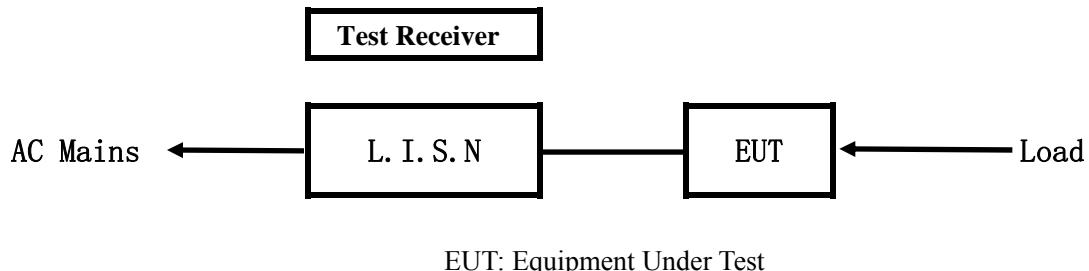
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5. Power Line Conducted Emission Test

5.1 Schematics of the test

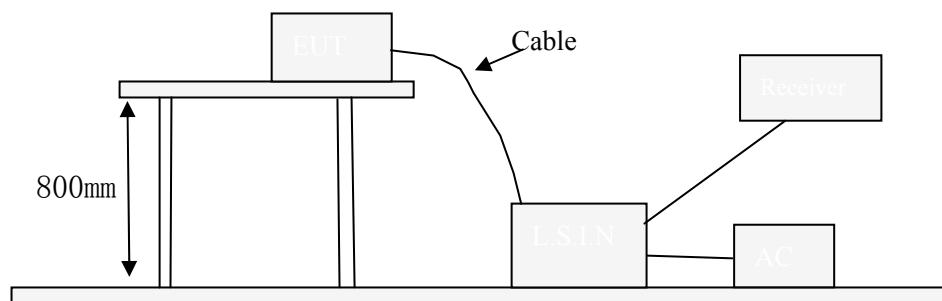


5.2 Test Method and test Procedure

The EUT was tested according to ANSI C63.4-2014. The Frequency spectrum From 0.15MHz to 30MHz was investigated. The LISN used was 50ohm/50uH as specified by section 5.1 of ANSI C63.4 –2014.

Test Voltage: 120V~, 60Hz

Block diagram of Test setup



5.3 Configuration of The EUT

The EUT was configured according to ANSI C63.4-2014. All interface ports were connected to the appropriate peripherals. All peripherals and cables are listed below.

A. EUT

Device	Manufacturer	Model	FCC ID
Bluetooth receiver	LEADER INNOVATIONS LTD.	98884	2ADW3-98884

B. Internal Device

Device	Manufacturer	Model	Rating

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C. Peripherals

Device	Manufacturer	Model	Rating
Power Supply	Smartab	TPA-9705100U1	Input: 100-240V~, 0.25A, 50/60Hz; Output: DC5V, 1A

5.4 EUT Operating Condition

Operating condition is according to ANSI C63.4 -2014.

- A Setup the EUT and simulators as shown on follow
- B Enable AF signal and confirm EUT active to normal condition

5.5 Power line conducted Emission Limit according to Paragraph 15.207 and 15.107

Frequency (MHz)	Class A Limits (dB μ V)		Class B Limits (dB μ V)	
	Quasi-peak Level	Average Level	Quasi-peak Level	Average Level
0.15 ~ 0.50	79.0	66.0	66.0~56.0*	56.0~46.0*
0.50 ~ 5.00	73.0	60.0	56.0	46.0
5.00 ~ 30.00	73.0	60.0	60.0	50.0

Notes: 1. *Decreasing linearly with logarithm of frequency.
2. The tighter limit shall apply at the transition frequencies

5.6 Test Results

The frequency spectrum from 0.15MHz to 30MHz was investigated. All reading are quasi-peak values with a resolution bandwidth of 9kHz.

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A: Conducted Emission on Live Terminal (150kHz to 30MHz)

EUT Operating Environment

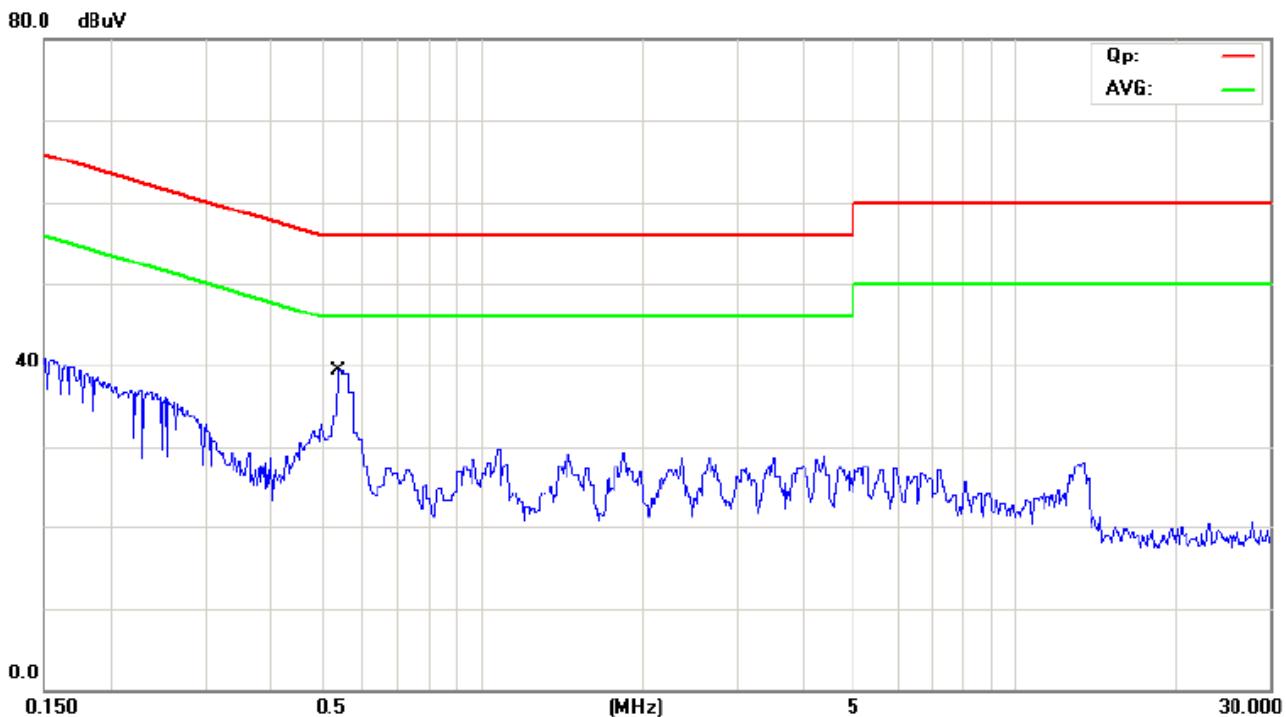
Temperature: 26°C Humidity: 65%RH Atmospheric Pressure: 101 KPa

EUT set Condition: Charging and Keep Bluetooth Transmitting

Equipment Level: Class B

Results: PASS

Please refer to following diagram for individual



No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over	Detector	Comment
			Level	Factor	ment				
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.5364	16.60	11.41	28.01	56.00	-27.99	QP	
2	*	0.5364	11.50	11.41	22.91	46.00	-23.09	AVG	

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B: Conducted Emission on Neutral Terminal (150kHz to 30MHz)

EUT Operating Environment

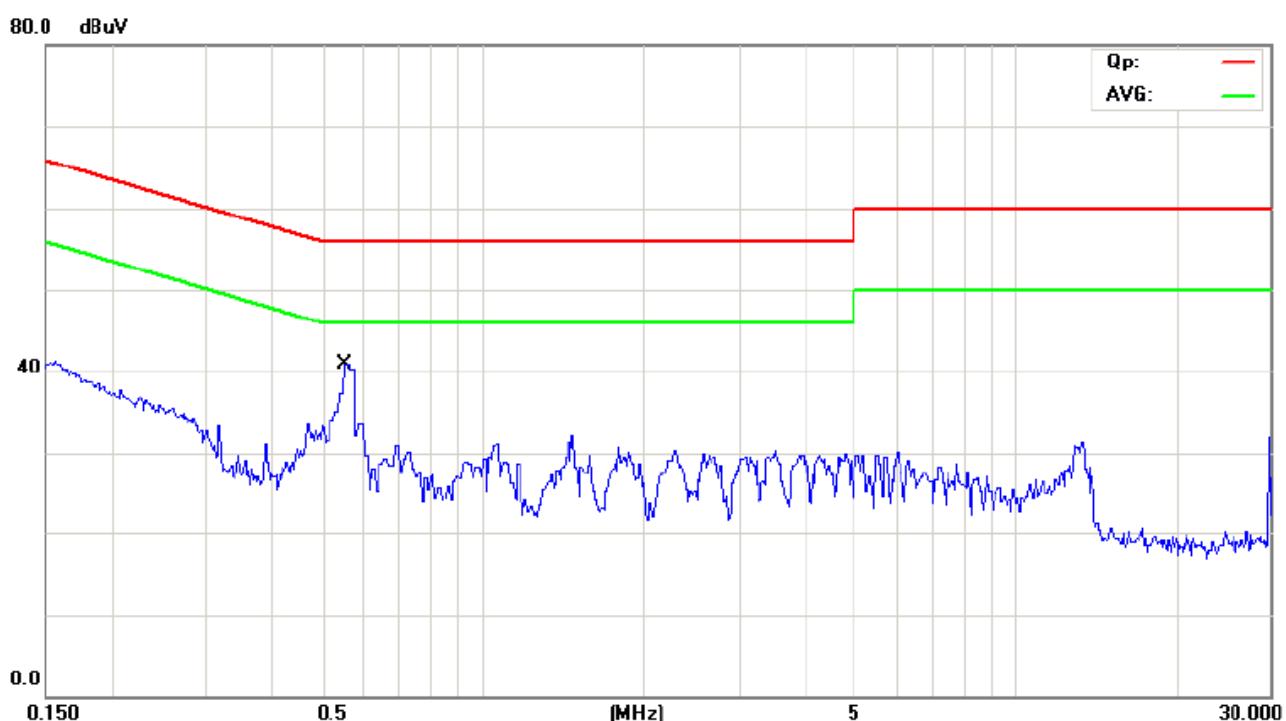
Temperature: 26°C Humidity: 65%RH Atmospheric Pressure: 101 KPa

EUT set Condition: Charging and Keep Bluetooth Transmitting

Equipment Level: Class B

Results: Pass

Please refer to following diagram for individual



No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over	Detector	Comment
			Level	Factor	ment				
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.5502	24.10	11.42	35.52	56.00	-20.48	QP	
2	*	0.5502	16.40	11.42	27.82	46.00	-18.18	AVG	

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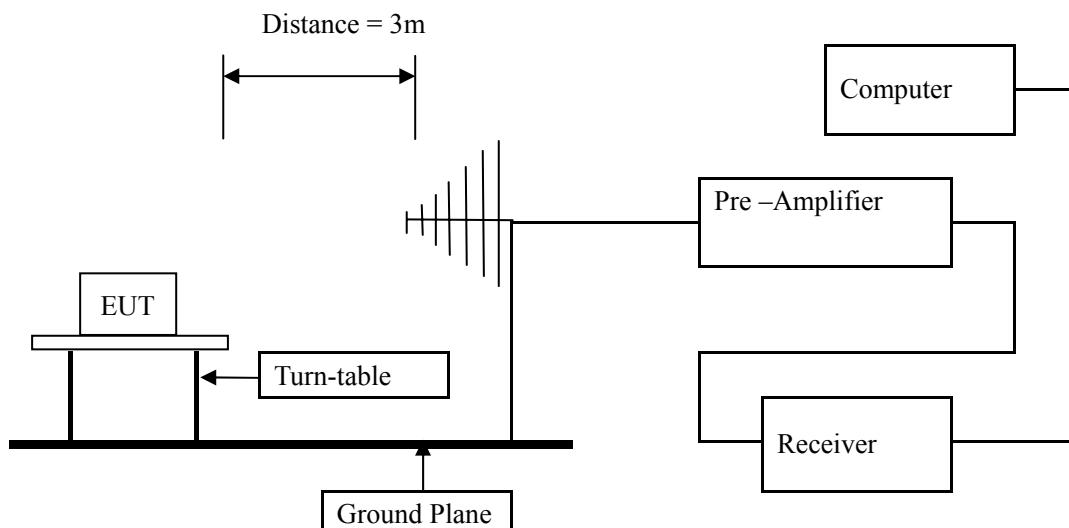


6 Radiated Emission Test

6.1 Test Method and test Procedure:

- (1) The EUT was tested according to ANSI C63.10–2013. The radiated test was performed at Timeway Laboratory. This site is on file with the FCC laboratory division, Registration No.899988
- (2) The EUT, peripherals were put on the turntable which table size is 1m x 1.5 m, table high 0.8 m. All set up is according to ANSI C63.10–2013.
- (3) The frequency spectrum from 30 MHz to 25 GHz was investigated. All readings from 30 MHz to 1 GHz are Quasi-peak values with a resolution bandwidth of 120 kHz. For measurement above 1GHz, peak values with RBW=1MHz VBW=3MHz and PK detector. AV value with RBW=1MHz, VBW=3MHz and RMS detector. Measurements were made at 3 meters.
- (4) The antenna high is varied from 1 m to 4 m high to find the maximum emission for each frequency.
- (5) Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations. All data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dB of specification limit), and are distinguished with a “QP” in the data table.
- (6) The antenna polarization : Vertical polarization and Horizontal polarization.

Block diagram of Test setup



6.2 Configuration of The EUT

Same as section 5.3 of this report

6.3 EUT Operating Condition

Same as section 5.4 of this report.

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6.4 Radiated Emission Limit

All emission from a digital device, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strength specified below:

Frequencies in restricted band are complied to limit on Paragraph 15.209 and 15.109

Frequency Range (MHz)	Distance (m)	Field strength (dB μ V/m)
30-88	3	40.0
88-216	3	43.5
216-960	3	46.0
Above 960	3	54.0

Note:

1. RF Voltage (dB μ V) = $20 \log_{10}$ RF Voltage (uV)
2. In the Above Table, the higher limit applies at the band edges.
3. Distance refers to the distance in meters between the measuring instrument antenna and the EUT
4. This is a handheld device. The radiated emissions should be tested under 3-axes position (Lying, Side, and Stand), After pre-test. It was found that the worse radiated emission was get at the lying position.

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Test result

General Radiated Emission Data and Harmonics Radiated Emission Data

Radiated Emission In Horizontal (30MHz----1000MHz)

EUT set Condition: Charging and Keep Bluetooth Transmitting

Results: Pass

Frequency (MHz)	Level@3m (dB μ V/m)	Antenna Polarity	Limit@3m (dB μ V/m)
108.000	29.41	H	43.50
228.000	33.17	H	46.00
324.000	33.67	H	46.00
107.960	24.38	V	43.50
204.000	24.03	V	43.50

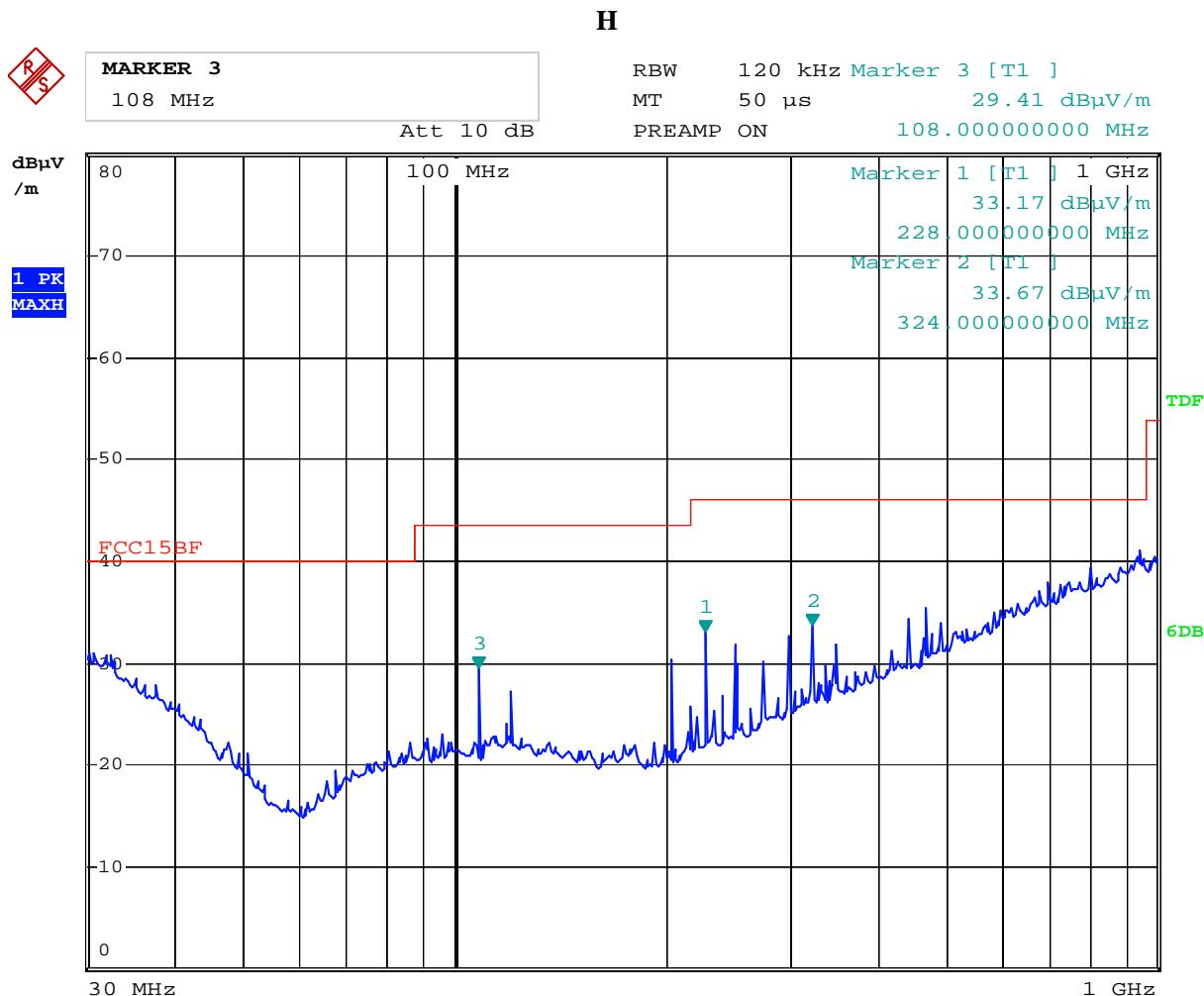
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Test Figure:



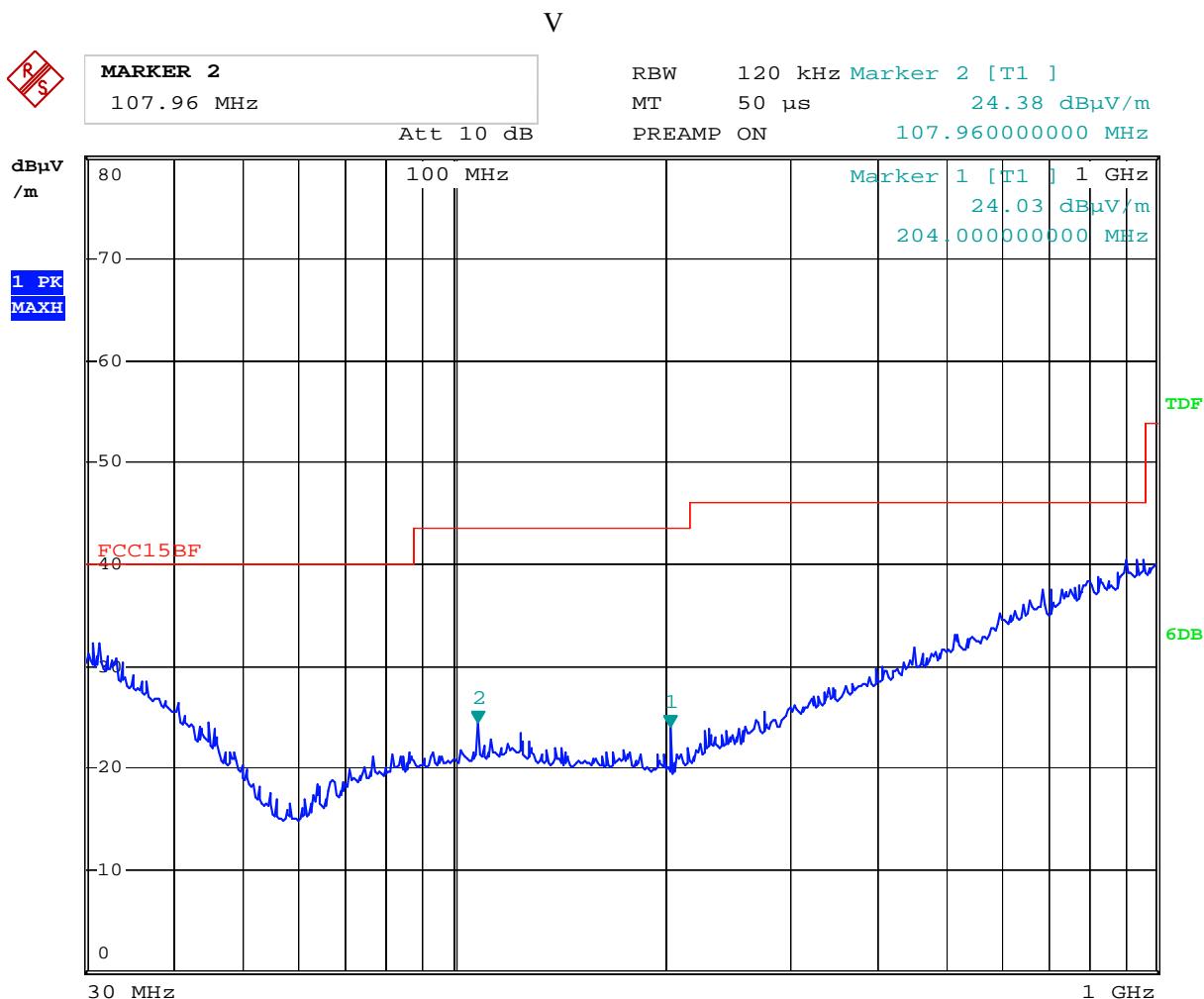
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Test Figure:



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Operation Mode: Transmitting under Low Channel (2402MHz)

Frequency (MHz)	Level@3m (dB μ V/m)	Antenna Polarity	Limit@3m (dB μ V/m)
4804	--	H/V	74(Peak)/ 54(AV)
7206	--	H/V	74(Peak)/ 54(AV)
9608	--	H/V	74(Peak)/ 54(AV)
12010	--	H/V	74(Peak)/ 54(AV)
14412	--	H/V	74(Peak)/ 54(AV)
16814	--	H/V	74(Peak)/ 54(AV)
19216	--	H/V	74(Peak)/ 54(AV)
21618	--	H/V	74(Peak)/ 54(AV)
24020	--	H/V	74(Peak)/ 54(AV)

Note: 1. Level = Reading + AF + Cable - Preamp + Filter - Dist, Margin = Level - Limit
2. Remark “---” means that the emissions level is too low to be measured

Operation Mode: Transmitting g under Middle Channel (2440MHz)

Frequency (MHz)	Level@3m (dB μ V/m)	Antenna Polarity	Limit@3m (dB μ V/m)
4880	--	H/V	74(Peak)/ 54(AV)
7320	--	H/V	74(Peak)/ 54(AV)
9760	--	H/V	74(Peak)/ 54(AV)
12200	--	H/V	74(Peak)/ 54(AV)
14640	--	H/V	74(Peak)/ 54(AV)
17080	--	H/V	74(Peak)/ 54(AV)
19520	--	H/V	74(Peak)/ 54(AV)
21960	--	H/V	74(Peak)/ 54(AV)
24400	--	H/V	74(Peak)/ 54(AV)

Note: 1. Level = Reading + AF + Cable - Preamp + Filter - Dist, Margin = Level - Limit
2. Remark “---” means that the emissions level is too low to be measured

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Operation Mode: Transmitting under High Channel (2480MHz)

Frequency (MHz)	Level@3m (dB μ V/m)	Antenna Polarity	Limit@3m (dB μ V/m)
4960	--	H/V	74(Peak)/ 54(AV)
7440	--	H/V	74(Peak)/ 54(AV)
9920	--	H/V	74(Peak)/ 54(AV)
12400	--	H/V	74(Peak)/ 54(AV)
14880	--	H/V	74(Peak)/ 54(AV)
17360	--	H/V	74(Peak)/ 54(AV)
19840	--	H/V	74(Peak)/ 54(AV)
22320	--	H/V	74(Peak)/ 54(AV)
24800	--	H/V	74(Peak)/ 54(AV)

Note: 1. Level = Reading + AF + Cable - Preamp + Filter - Dist, Margin = Level - Limit
2. Remark “---” means that the emissions level is too low to be measured

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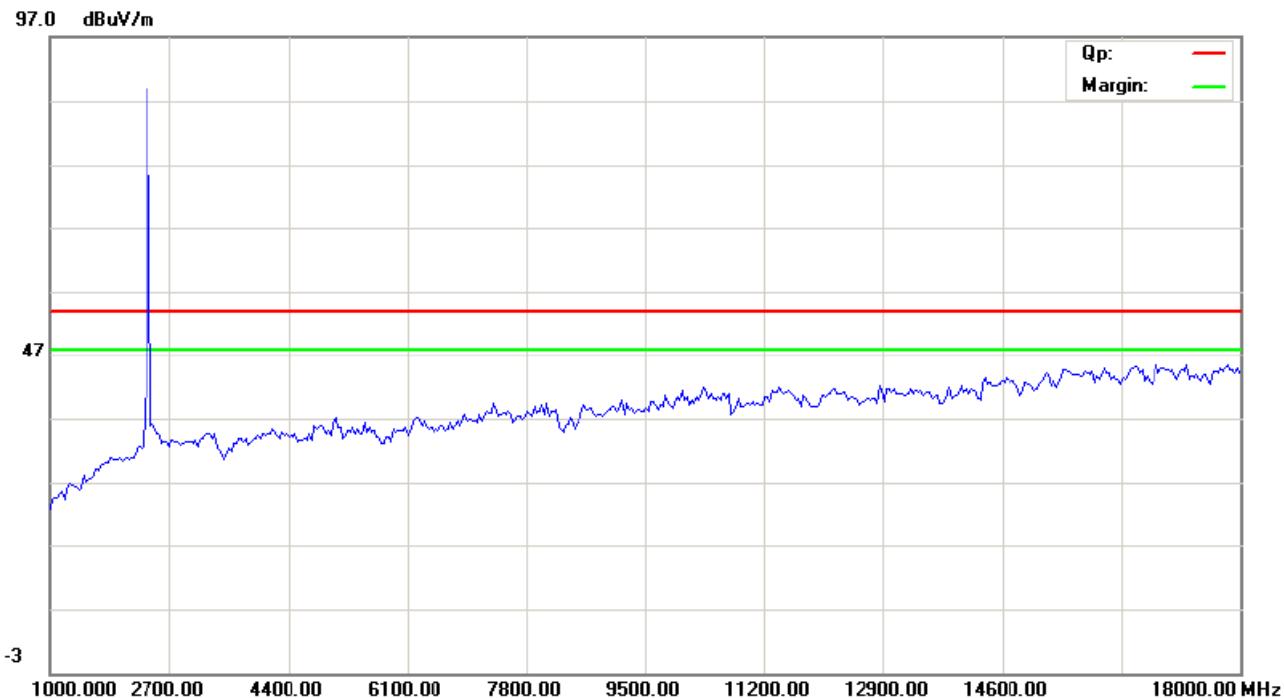
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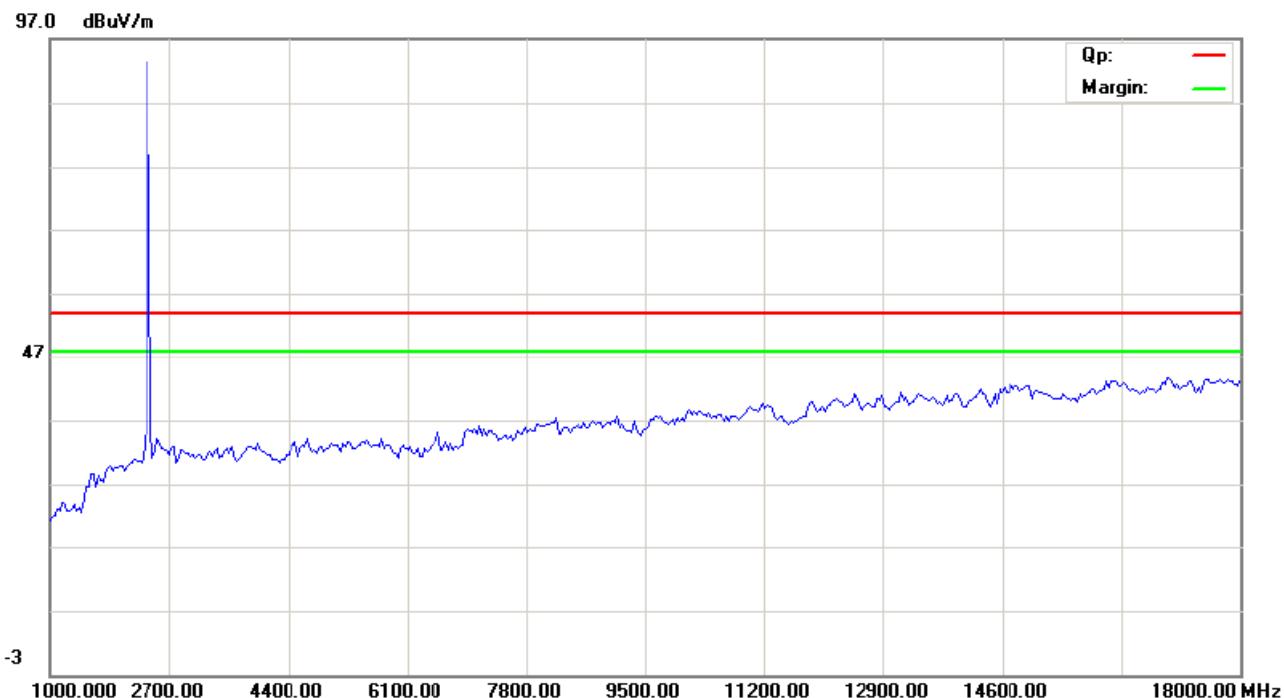


Please refer to the following test plots for details:

Low Channel: Horizontal



Low Channel : Vertical



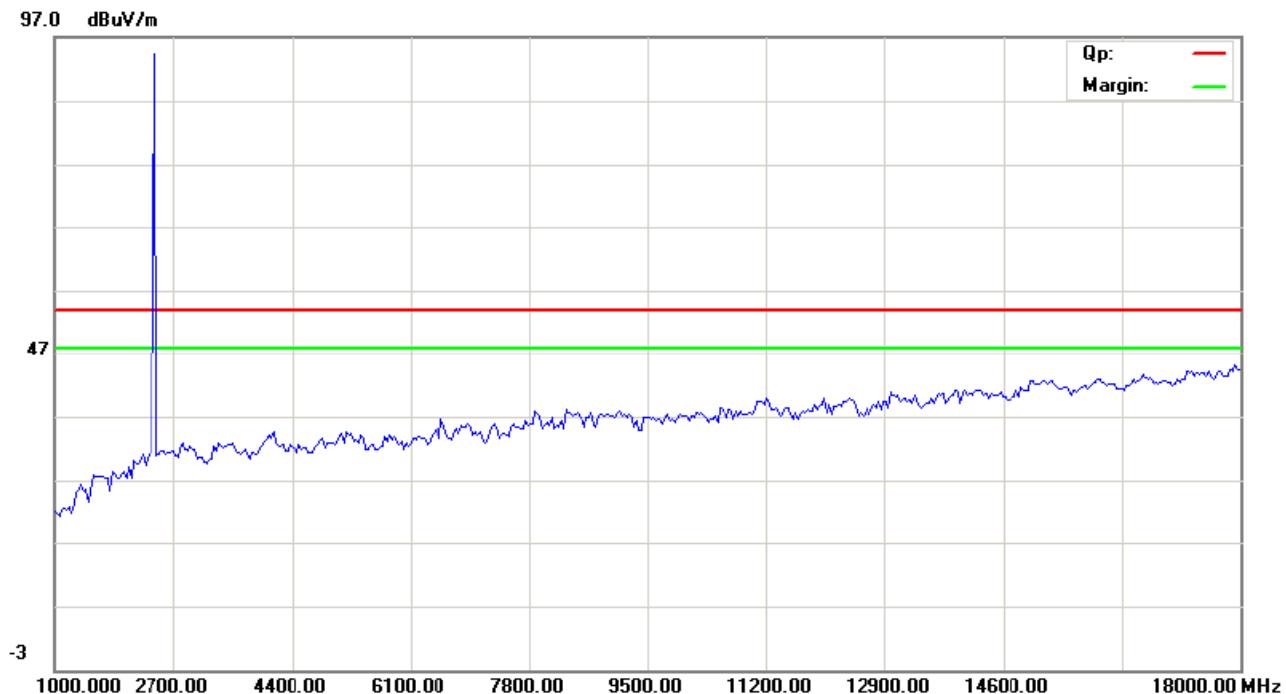
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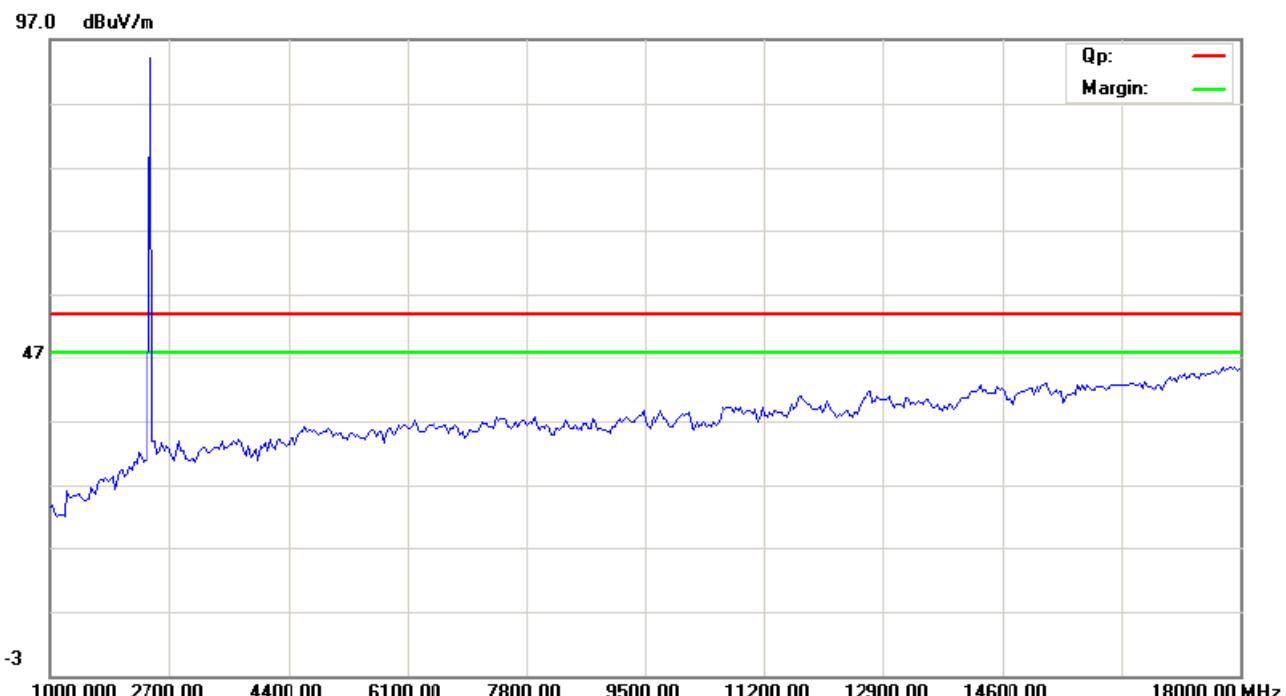
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Middle Channel : Horizontal



Middle Channel : Vertical



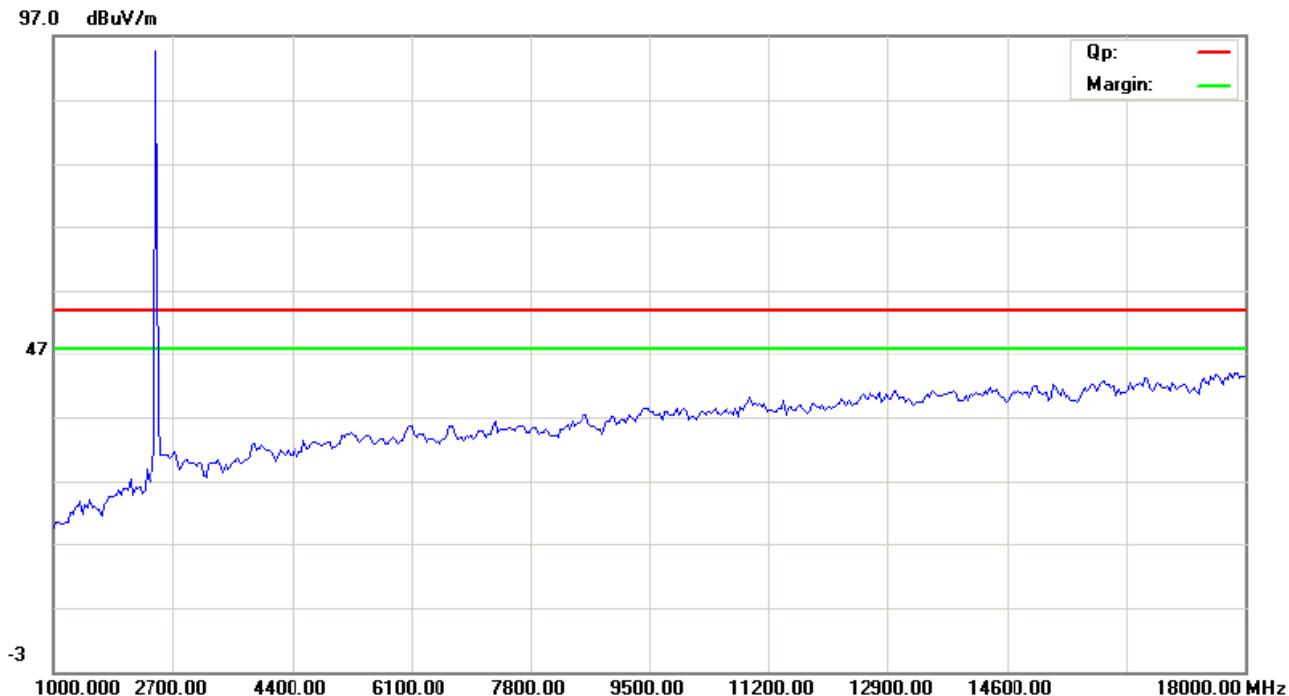
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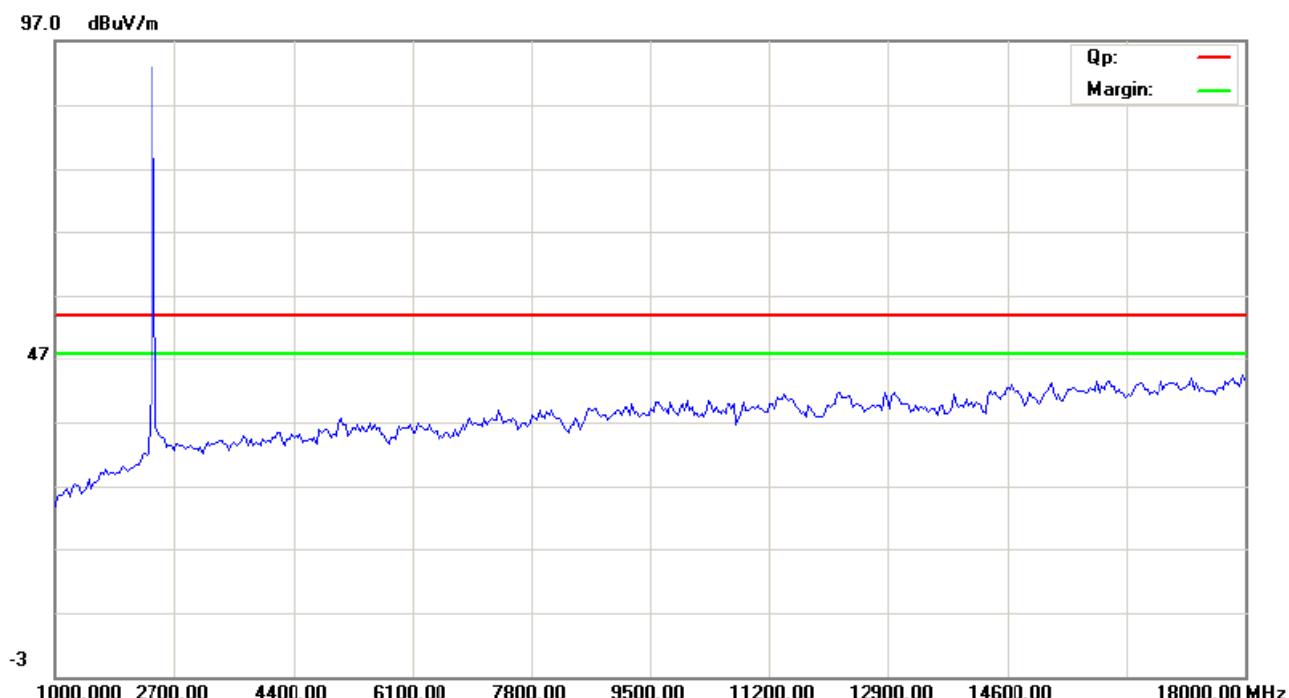
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High Channel : Horizontal



High Channel : Vertical



Note: for the radiated emissions above 18G, it is the floor noise.

The report refers only to the sample tested and does not apply to the bulk.

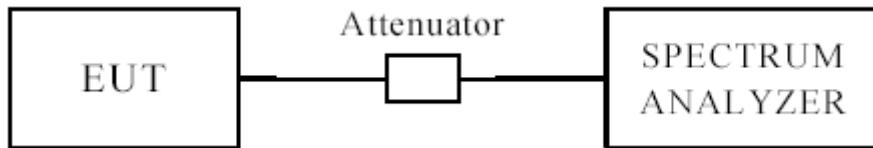
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7.0 6dB Bandwidth Measurement

7.1 Test Setup



7.2 Limits of 6dB Bandwidth Measurement

The minimum of 6dB Bandwidth Measurement is >500 kHz

7.3 Test Procedure

1. Set resolution bandwidth (RBW) = 100 kHz
2. Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

7.4 Test Result

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EUT		Bluetooth receiver	Model	98884
Mode		Keep Transmitting	Input Voltage	DC3.7V
Temperature		24 deg. C,	Humidity	56% RH
Channel	Channel Frequency (MHz)	6 dB Bandwidth (kHz)	Maximum Limit (MHz)	Pass/ Fail
Low	2402	696	0.5	Pass
Middle	2440	696	0.5	Pass
High	2480	690	0.5	Pass

The report refers only to the sample tested and does not apply to the bulk.

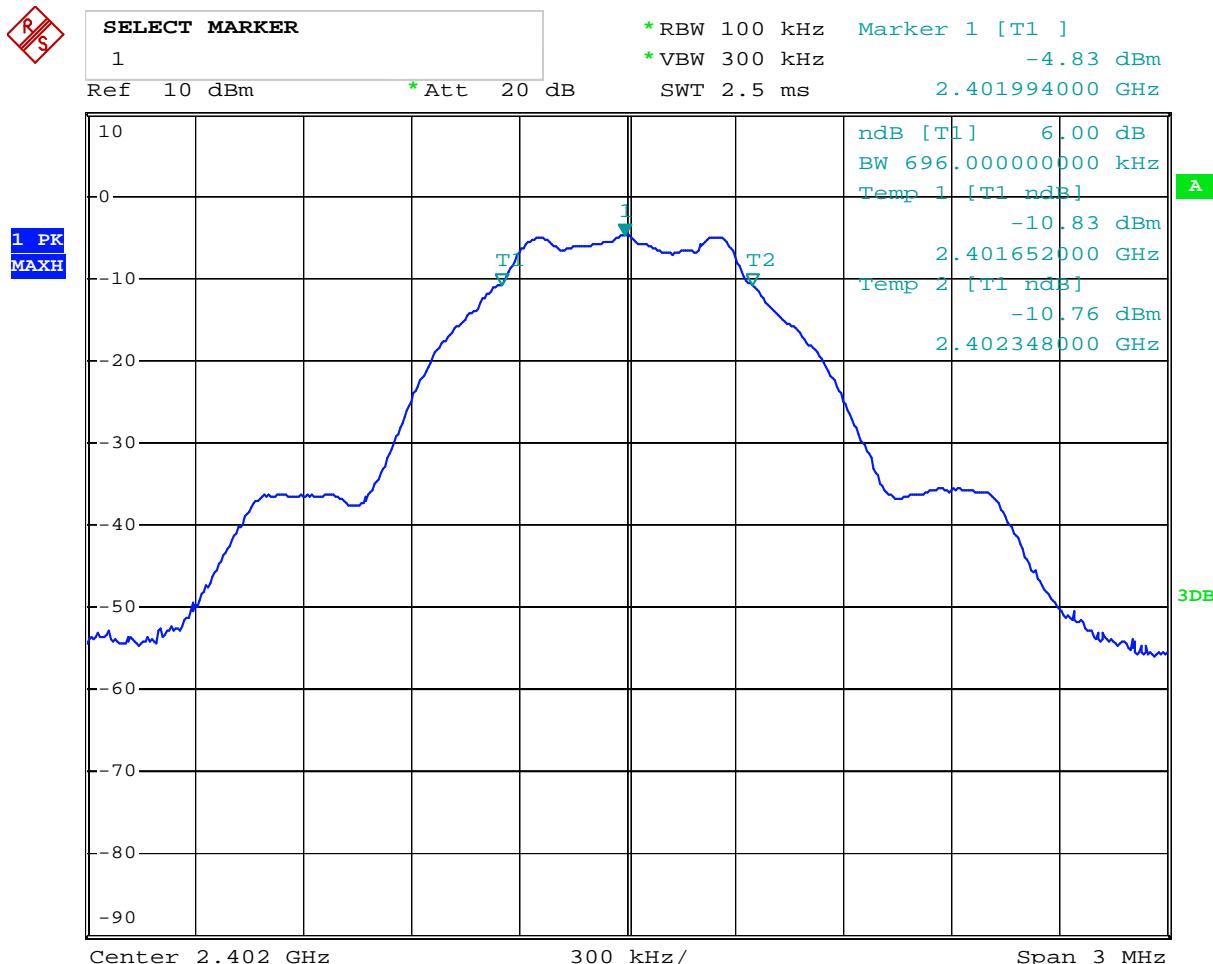
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Test Figure:

1. Condition: Low Channel



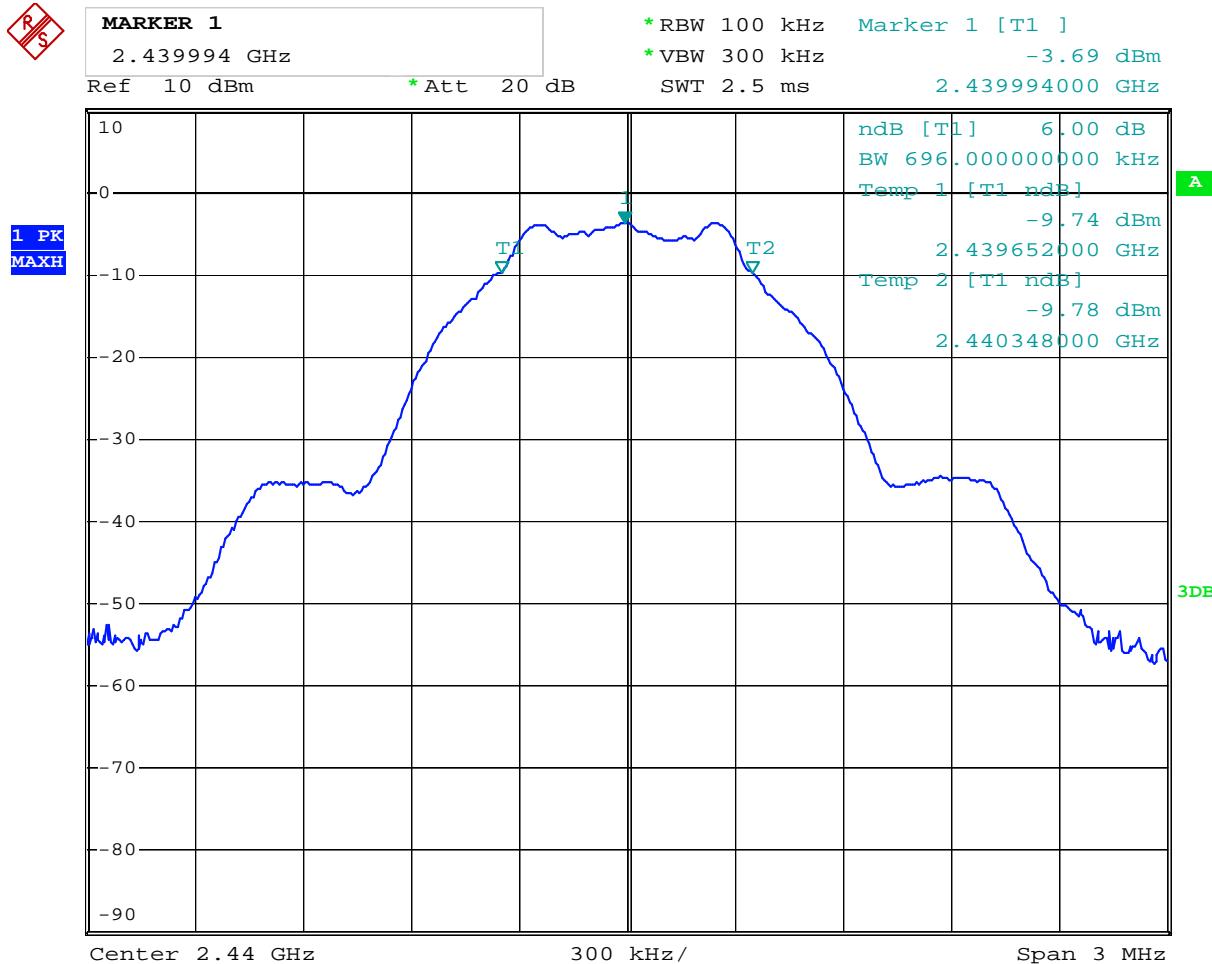
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2. Condition: Middle Channel



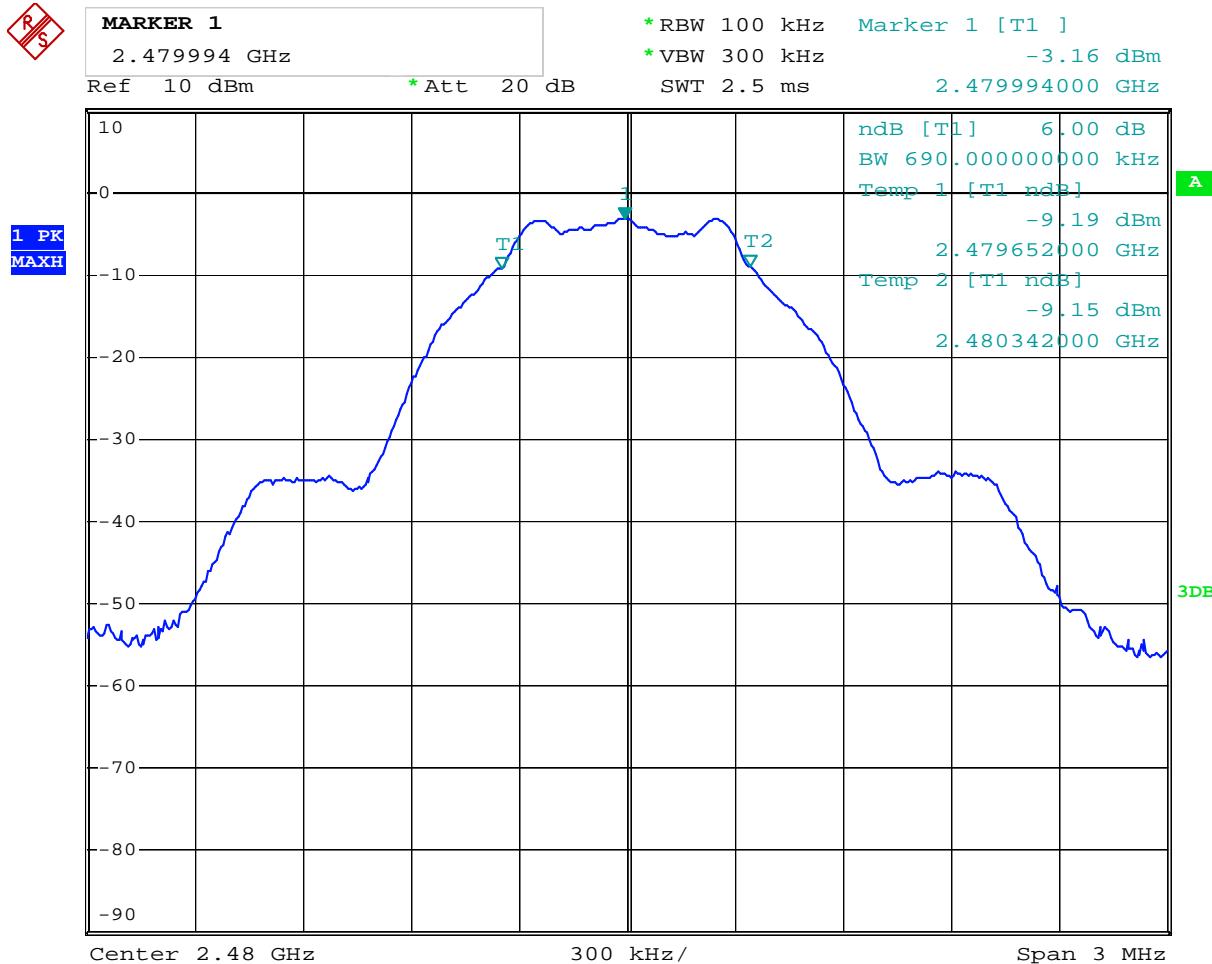
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3. High Channel



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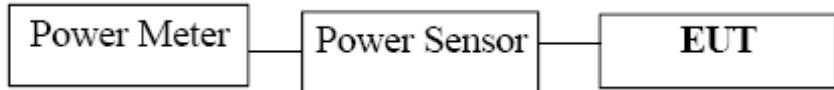
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8. Maximum Output Power

8.1 Test Setup



8.2 Limits of Maximum Output Power

The Maximum Output Power Measurement is 30dBm.

8.3 Test Procedure

The RF power output was measured with a Power meter connected to the RF Antenna connector (conducted measurement) while EUT was operating in transmit mode at the appropriate centre frequency.

Note: the Peak power were measured.

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8.4 Test Results

EUT		Bluetooth receiver	Model	98884
Mode		Keep Transmitting	Input Voltage	DC3.7V
Temperature		24 deg. C,	Humidity	56% RH
Channel	Channel Frequency (MHz)	Max. Power Output (dBm)	Power Limit (dBm)	Pass/ Fail
Low	2402	-3.84	30	Pass
Middle	2440	-2.64	30	Pass
High	2480	-2.15	30	Pass

Note: 1. the result basic equation calculation as follow:

$$\text{Max. Power Output} = \text{Power Reading} + \text{Cable loss} + \text{Attenuator}$$

The report refers only to the sample tested and does not apply to the bulk.

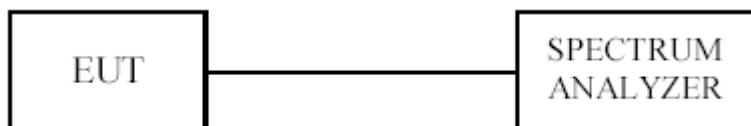
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9. Power Spectral Density Measurement

9.1 Test Setup



9.2 Limits of Power Spectral Density Measurement

The Maximum Power Spectral Density Measurement is 8dBm.

9.3 Test Procedure

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW = 10 kHz.
3. Set the VBW \geq 30 kHz.
4. Set the span to 1.5 times the DTS channel bandwidth.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.
11. The resulting peak PSD level must be \leq 8 dBm.

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9.4 Test Result

EUT		Bluetooth receiver		Model	98884		
Mode		Keep Transmitting		Input Voltage	DC3.7V		
Temperature		24 deg. C,		Humidity	56% RH		
Channel	Peak Power Reading (dBm)	Cable Loss (dB)	Final Power Spectral Density (dBm)		Maximum Limit (dBm)	Pass/ Fail	
Low	-13.64	0.2	-13.44		8	Pass	
Middle	-13.08	0.2	-12.88		8	Pass	
High	-12.53	0.2	-12.33		8	Pass	

Note: The result basic equation calculation as follow:

Peak Power Output = Peak Power Reading + Cable loss

The report refers only to the sample tested and does not apply to the bulk.

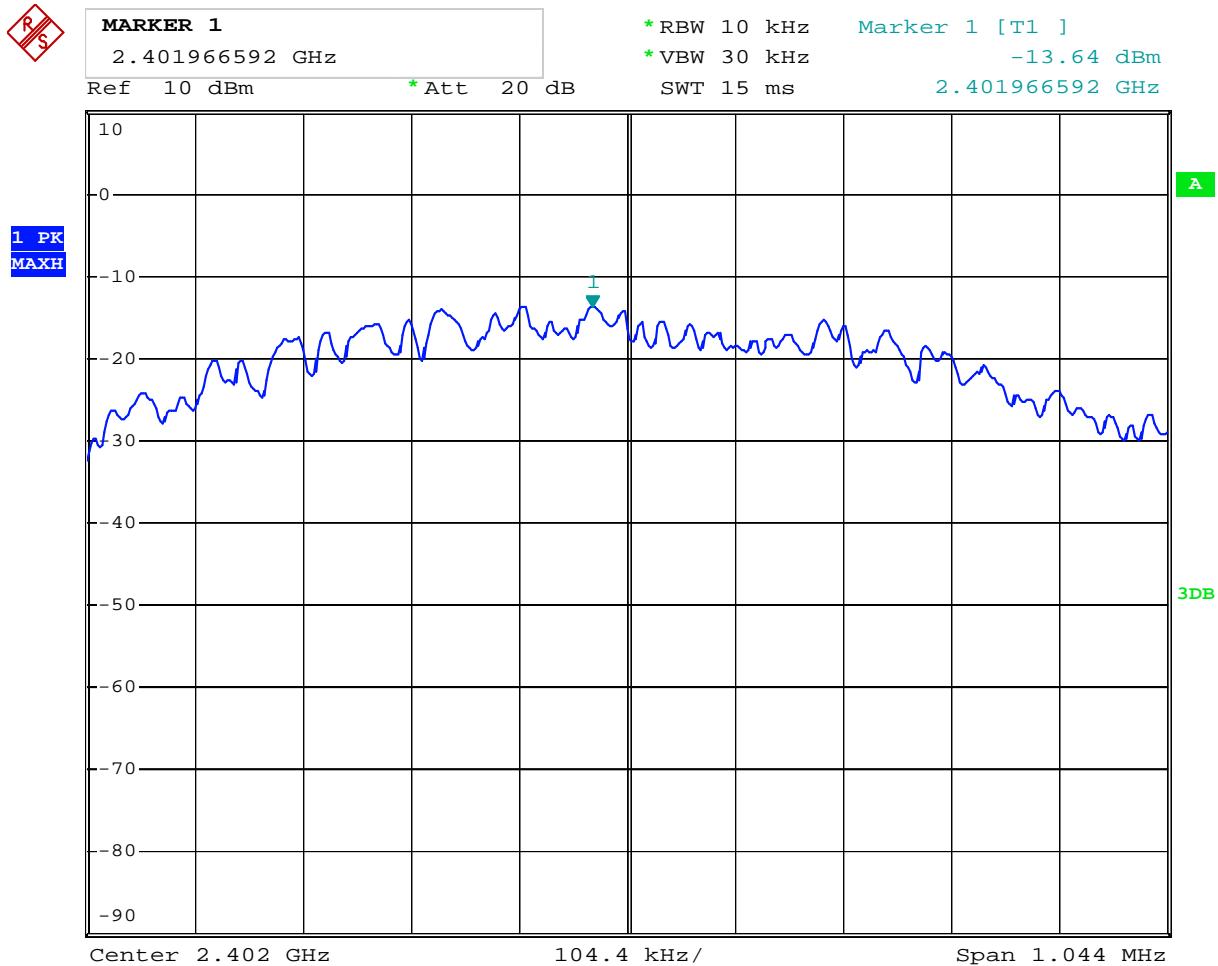
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Test Figure:

1. Condition: Low Channel



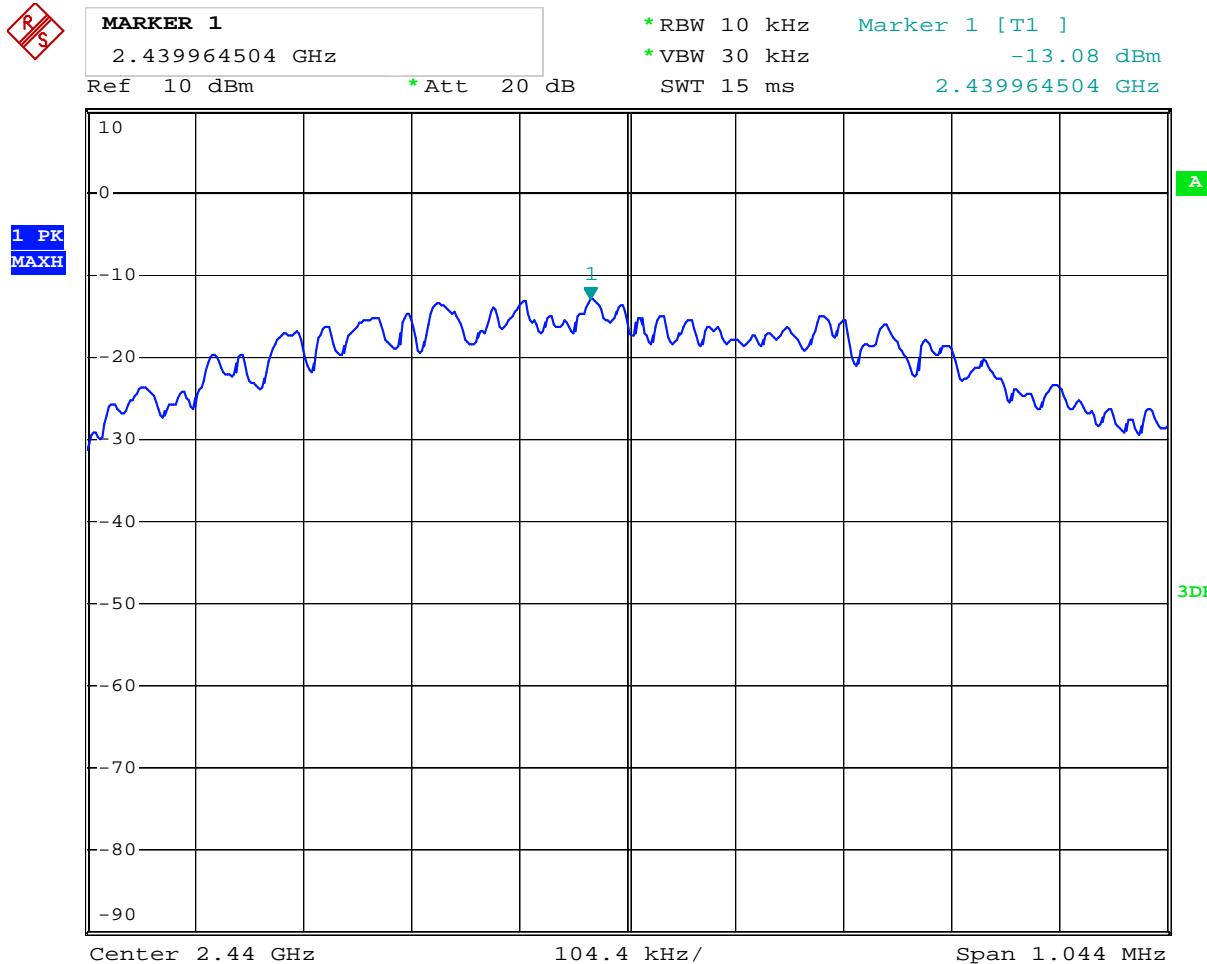
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2. Condition: Middle Channel



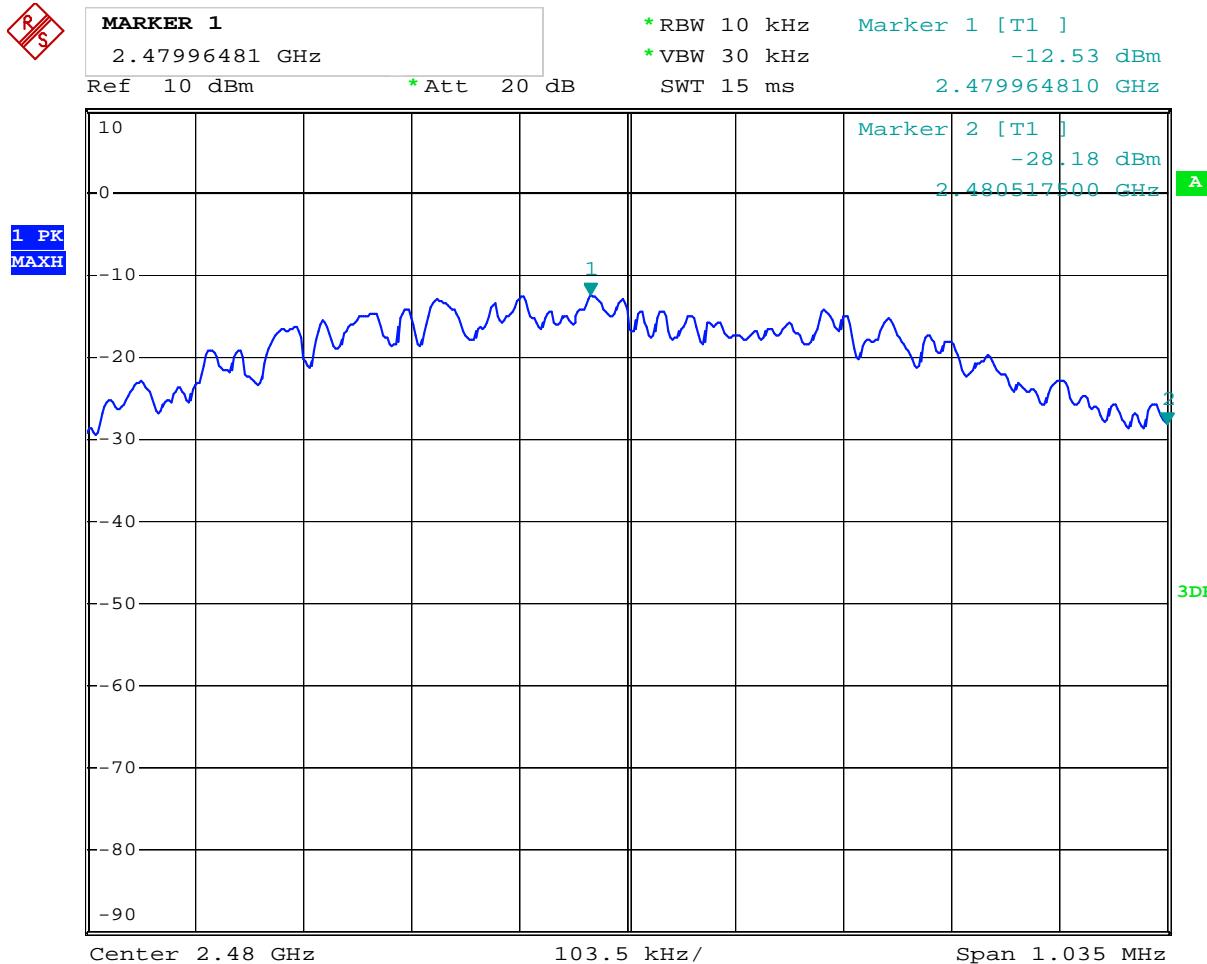
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3. High Channel



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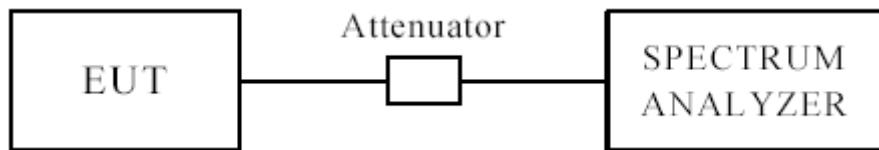
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10 Out of Band Measurement

10.1 Test Setup for band edge



The restricted band requirement based on radiated emission test; please see the clause 6 for the test setup

10.2 Limits of Out of Band Emissions Measurement

1. Below -20dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

10.3 Test Procedure

For signals in the restricted bands above and below the 2.4-2.483GHz allocated band a measurement was made of Radiated emission test. (Peak values with RBW=1MHz, VBW=3MHz and PK detector. AV value with RBW=1MHz, VBW=3MHz and RMS detector)

For bandage test, the spectrum set as follows: RBW=100 kHz, VBW=300 kHz. A conducted measurement used

10.4 Test Result

Please see next pages

Note:

1. For band-edge measurement, the frequency from 30MHz-25GHz was tested. And It met the FCC rule.
2. This is a handheld device. The radiated emissions should be tested under 3-axes position (Lying, Side, and Stand). After pre-test. It was found that the worse radiated emission was get at the lying position.
3. Horizontal and Vertical Polarity were invested and only worse case was recorded.

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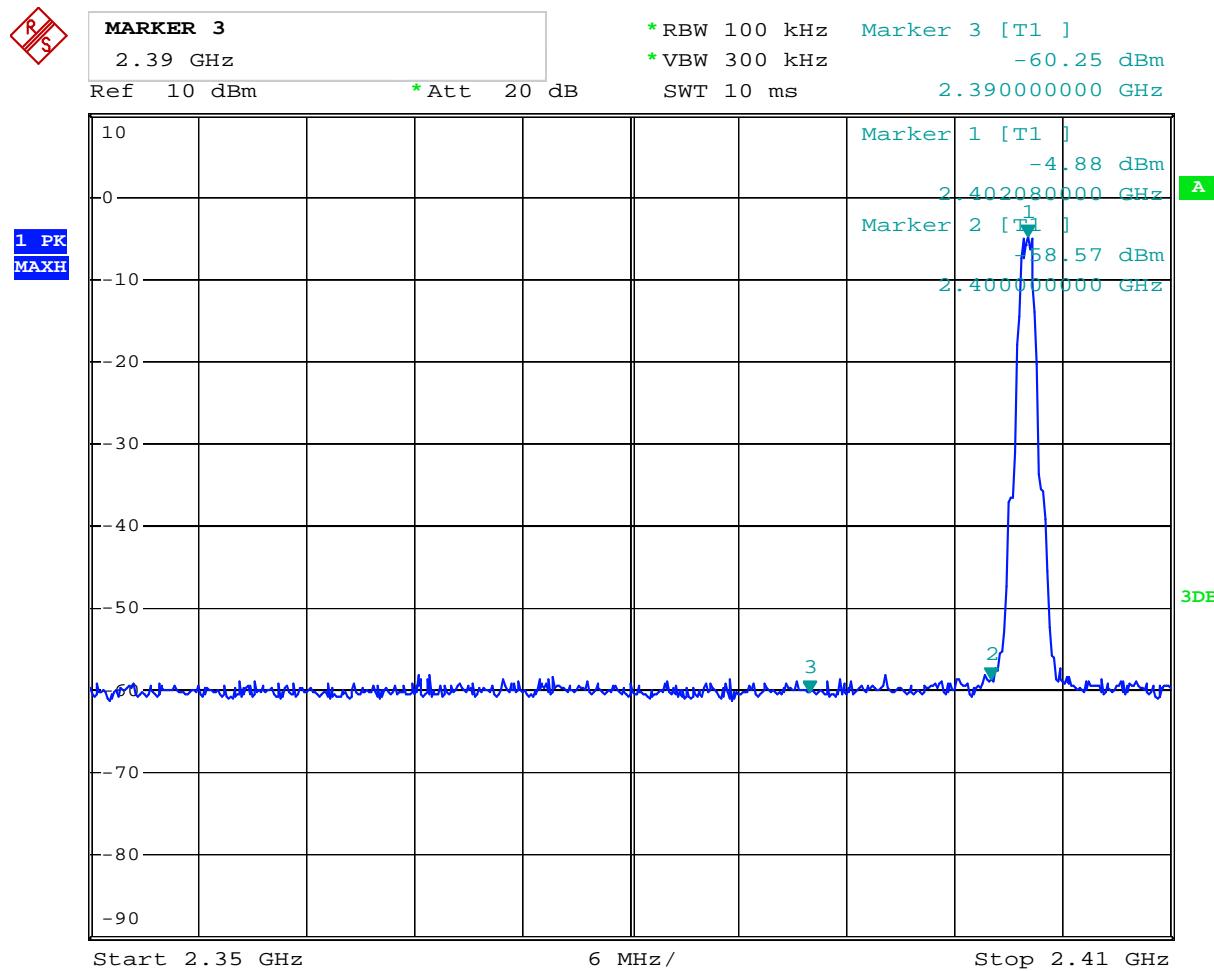
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10.4 Band-edge and Restricted band Measurement

EUT	Bluetooth receiver		Model	98884
Mode	Keep Transmitting		Input Voltage	DC3.7V
Temperature	24 deg. C,		Humidity	56% RH
Test Result:	Pass		Detector	PK
2400	PK (dB μ V/m)	44.6	Limit	74(dB μ V/m)
	AV (dB μ V/m)	--		54(dB μ V/m)
2390	PK (dB μ V/m)	40.1	Limit	74(dB μ V/m)
	AV (dB μ V/m)	--		54(dB μ V/m)

Test Figure:



Note: The Max. FS in Restrict Band are measured in conventional method.

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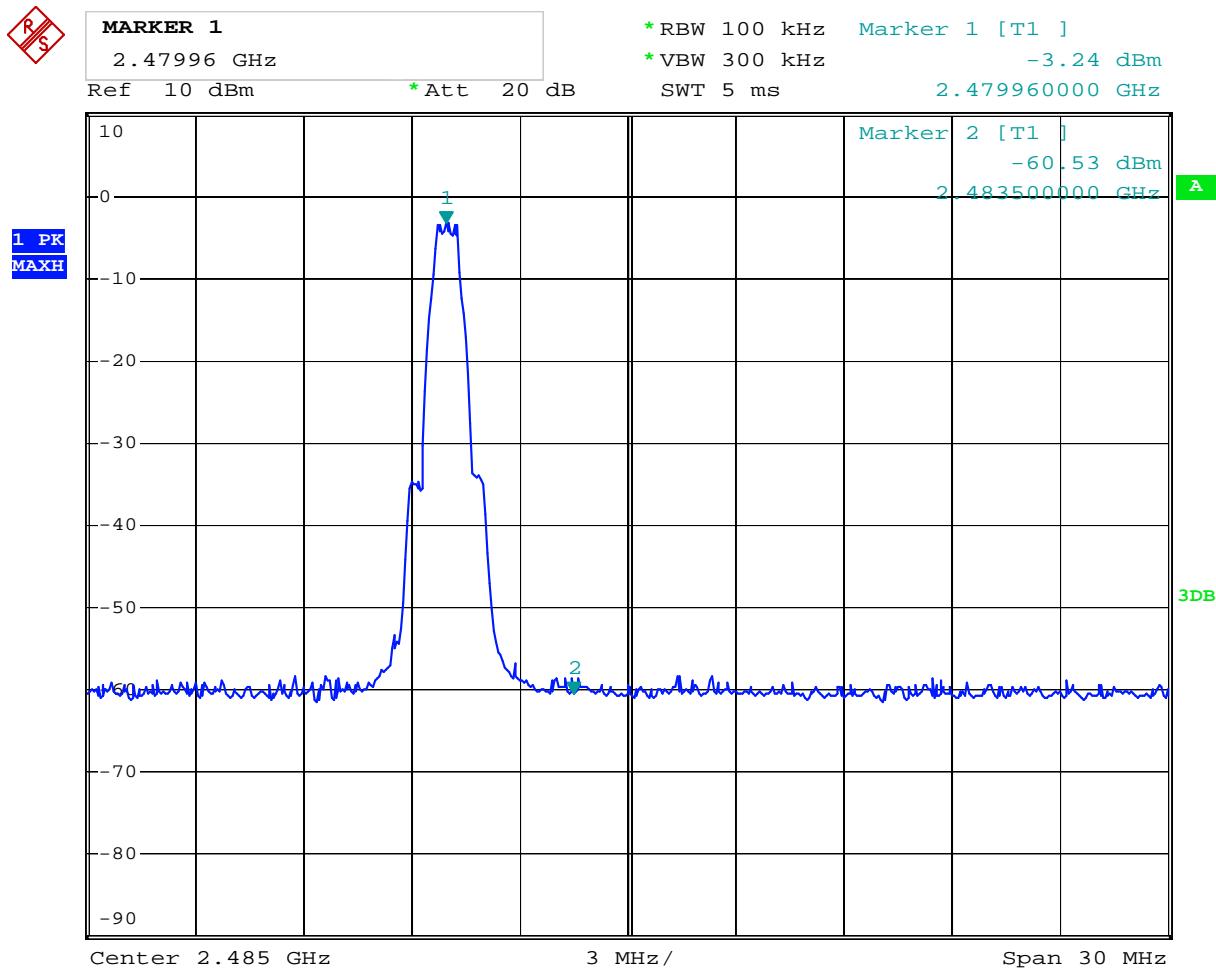
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10.4 Band-edge and Restricted band Measurement

EUT	Bluetooth receiver		Model	98884
Mode	Keeping Transmitting		Input Voltage	DC3.7V
Temperature	24 deg. C,		Humidity	56% RH
Test Result:	Pass		Detector	PK
2483.5	PK (dB μ V/m)	41.5	Limit	74(dB μ V/m)
	AV (dB μ V/m)	--		54(dB μ V/m)

Test Figure:



Note: The Max. FS in Restrict Band are measured in conventional method.

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11.0 Antenna Requirement

11.1 Standard Applicable

For intentional device, according to FCC 47 CFR 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.

And according to FCC 47 CFR Section 15.247 (b), if transmitter antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the mount in dB that the directional gain of the antenna exceeds 6 dBi.

11.2 Antenna Connected construction

PCB antenna used. The maximum Gain of the antennas is 2.0dBi.

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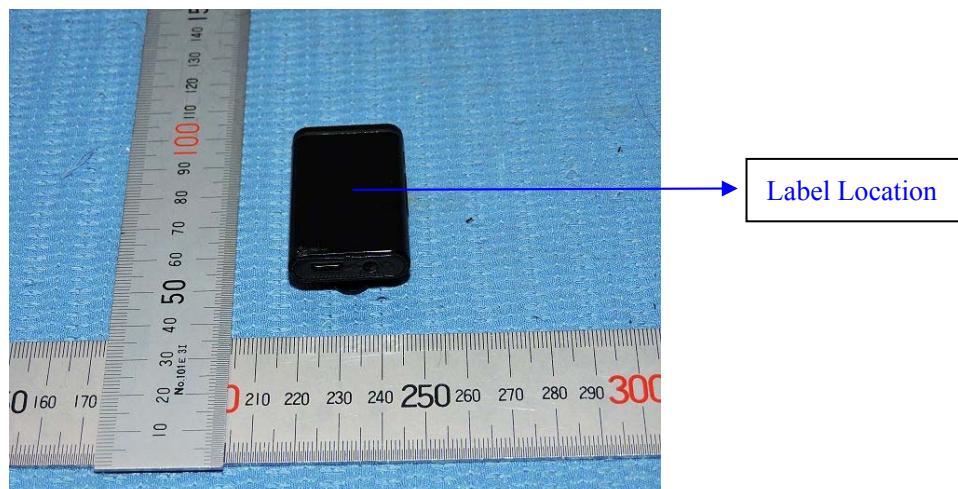


12.0 FCC ID Label

FCC ID: 2ADW3-98884

The label must not be a stick-on paper label. The label on these products must be permanently affixed to the product and readily visible at the time of purchase and must last the expected lifetime of the equipment not be readily detachable.

Mark Location:



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13.0 Photo of testing

Conducted Emission Test Setup:



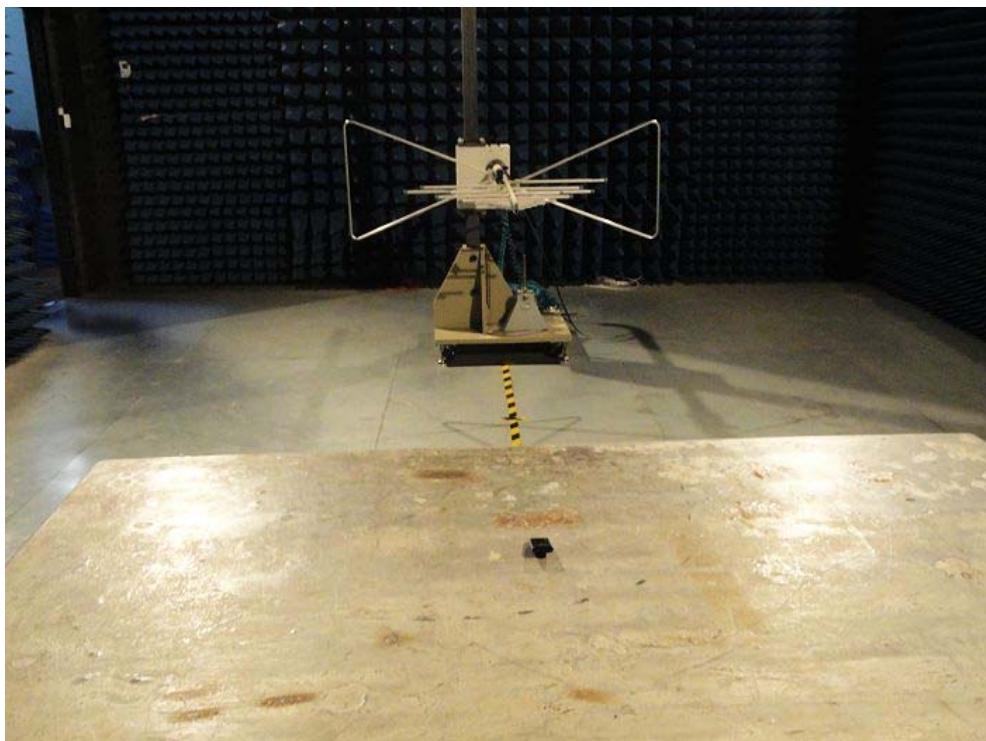
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Radiated Emission Test Setup:



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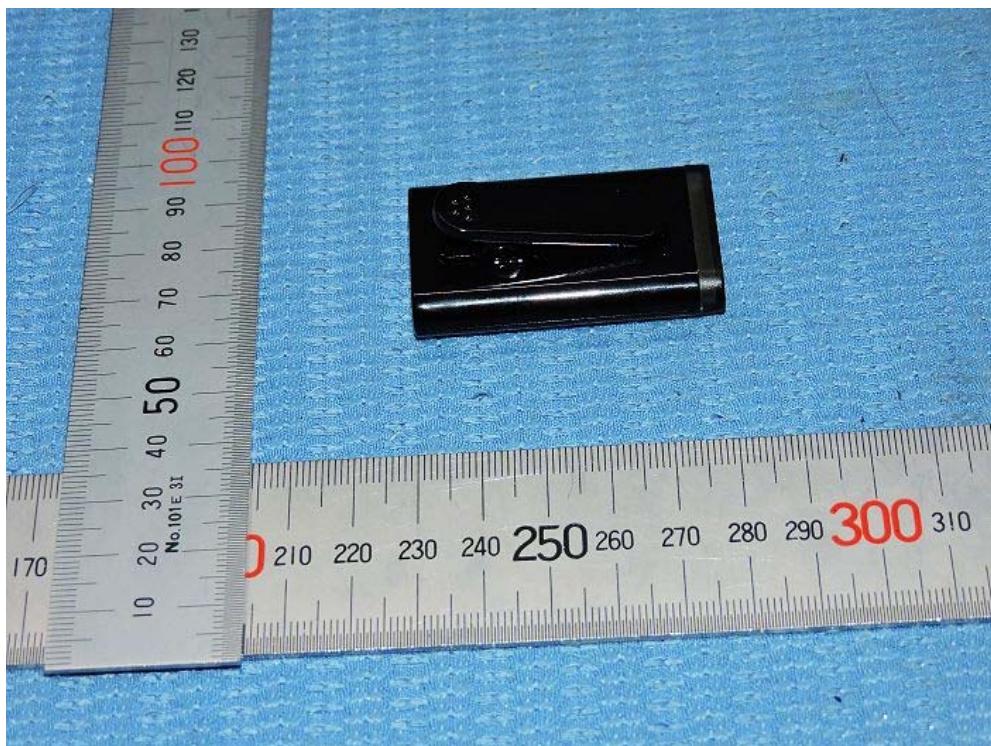
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Photographs – EUT

Outside view



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Outside view



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Outside view



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Inside view



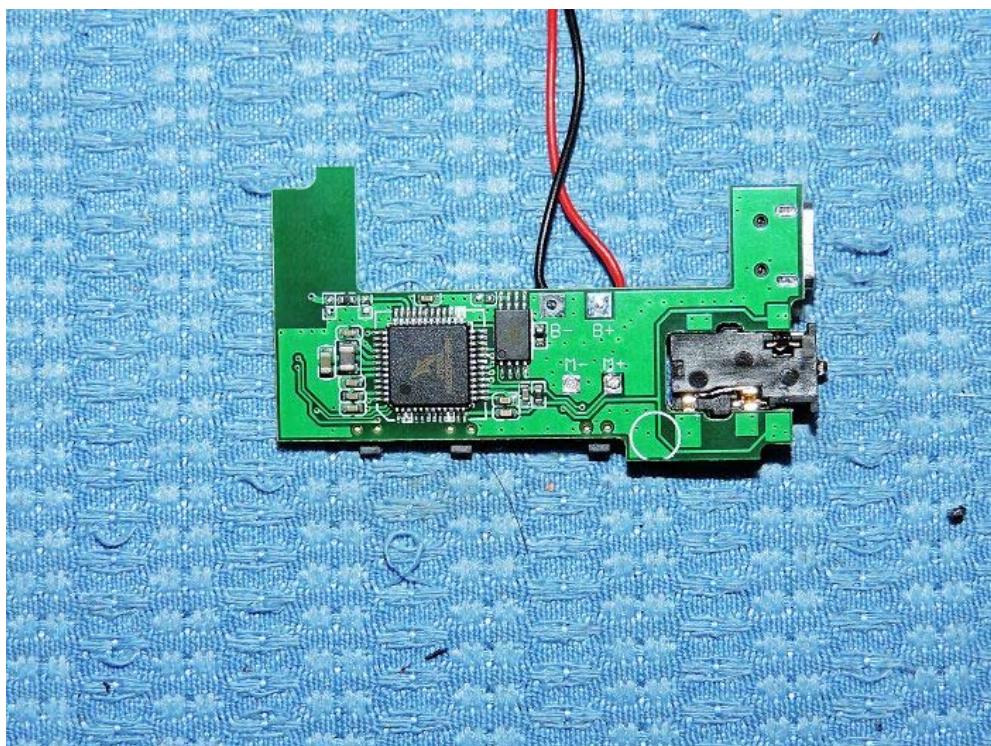
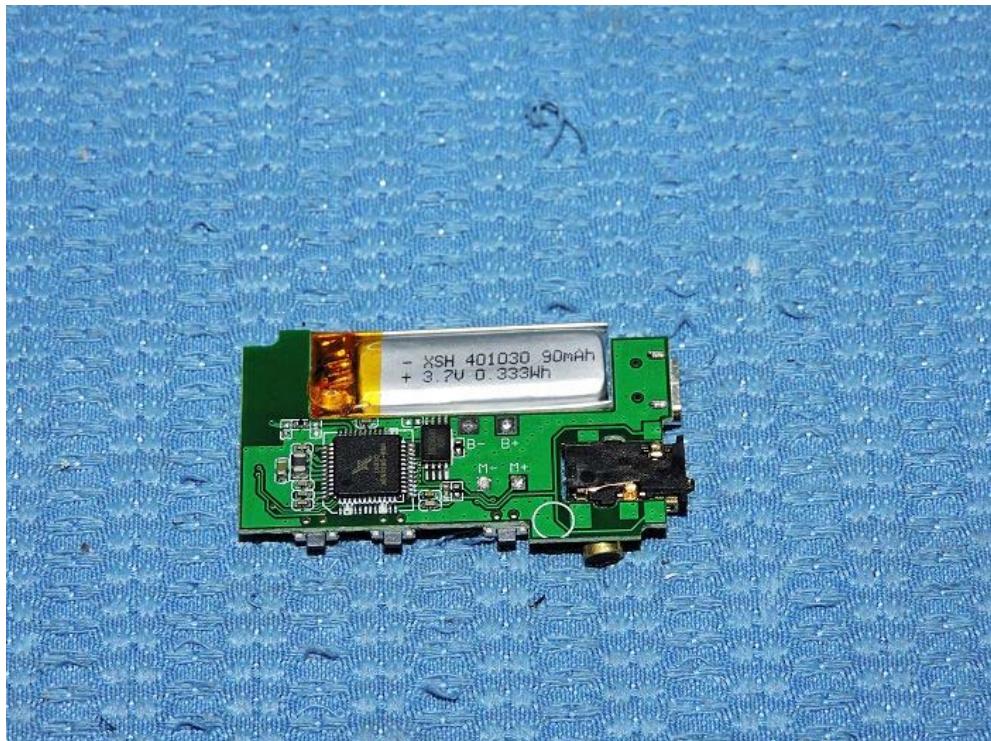
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Inside view



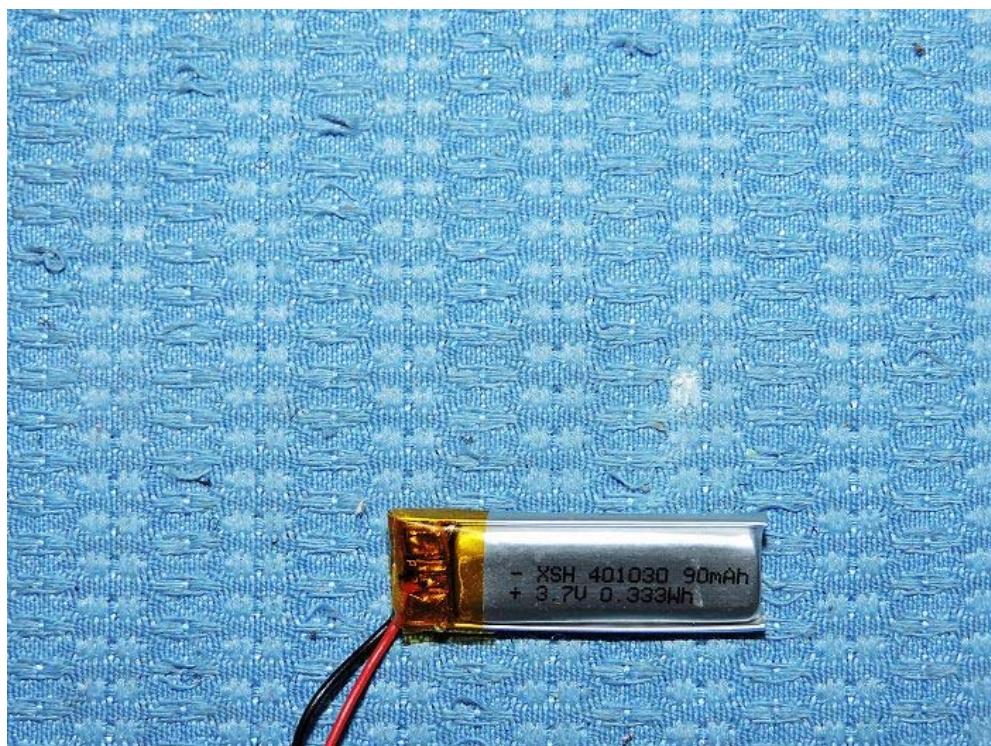
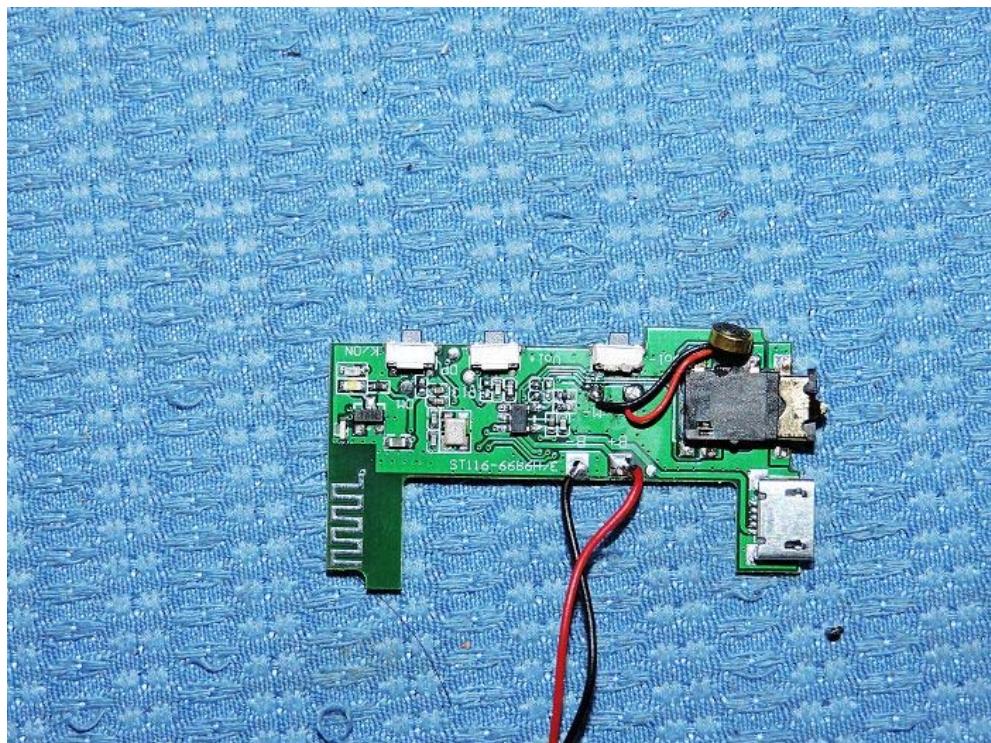
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Inside view



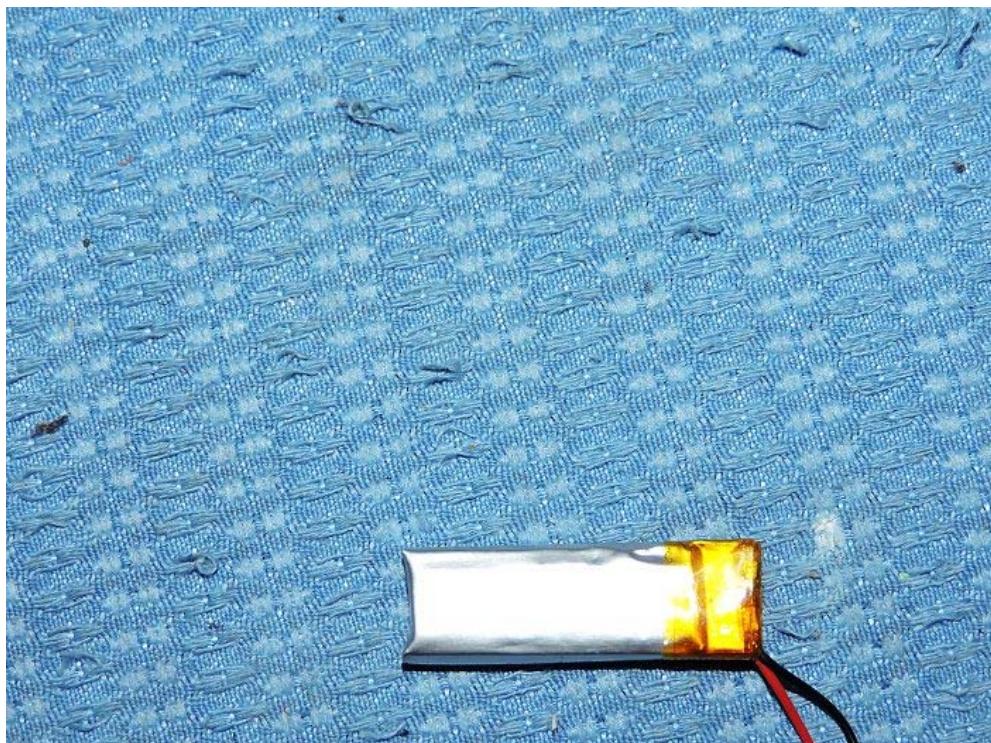
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Inside view



End of the report

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