



FCC PART 15.247 TEST REPORT

For

Grandstream Networks, Inc.

126 Brookline Ave, 3rd Floor Boston, MA 02215, USA

FCC ID: YZZGVC3210RMT

Report Type: Product Type:

Original Report Bluetooth Remote Control

Report Number: RSZ171115010-00E

Report Date: 2018-01-30

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Note: This report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP* or any agency of the Federal Government. * This report may contain data that are not covered by the NVLAP accreditation and are marked with an asterisk "**"

TABLE OF CONTENTS

GENERAL INFORMATION	
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	
OBJECTIVE	
RELATED SUBMITTAL(S)/GRANT(S) TEST METHODOLOGY	
MEASUREMENT UNCERTAINTY	,
TEST FACILITY	
SYSTEM TEST CONFIGURATION	
DESCRIPTION OF TEST CONFIGURATION	
EQUIPMENT MODIFICATIONS	
EUT EXERCISE SOFTWARE	
Duty cycle	
BLOCK DIAGRAM OF TEST SETUP	
SUMMARY OF TEST RESULTS	
TEST EQUIPMENT LIST	
FCC§15.247 (i), §1.1307 (b) (1) & §2.1093 – RF EXPOSURE	
APPLICABLE STANDARD	
FCC §15.203 - ANTENNA REQUIREMENT	
APPLICABLE STANDARD	1
Antenna Connector Construction	
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS	
APPLICABLE STANDARD	
EUT SETUPEMI TEST RECEIVER & SPECTRUM ANALYZER SETUP	
TEST PROCEDURE	
CORRECTED AMPLITUDE & MARGIN CALCULATION	13
TEST RESULTS SUMMARY	
TEST DATA	
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH	
APPLICABLE STANDARD	
TEST PROCEDURE TEST DATA	
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER	
Applicable Standard	
TEST DATA	
FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE	2
Applicable Standard	
Test Procedure	
TEST DATA	23
FCC §15.247(e) - POWER SPECTRAL DENSITY	25
APPLICABLE STANDARD	
TEST PROCEDURE	
TEST DATA	25

Report No.: RSZ171115010-00E

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Grandstream Networks, Inc.'s* product, model number: *GVC3210RMT* (*FCC ID: YZZGVC3210RMT*) in this report was a *Bluetooth Remote Control*, which was measured approximately: 201 mm (L) * 42 mm (W) * 23 mm (H), rated with input voltage: DC 3.0V from battery (Every 2*AAA for series battery, and then 4*AAA for parallel).

Report No.: RSZ171115010-00E

*All measurement and test data in this report was gathered from production sample serial number: 1702517 (Assigned by BACL, Shenzhen). The EUT supplied by the applicant was received on 2017-11-15.

Objective

This report is prepared on behalf of *Grandstream Networks*, *Inc.* in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commission's rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.209 and 15.247 rules.

Related Submittal(s)/Grant(s)

Part of system with Video Conference System submission with FCC ID: YZZGVC3210

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.

And 558074 D01 DTS Meas Guidance v04

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

Para	meter	Uncertainty	
Occupied Char	nnel Bandwidth	±5%	
RF Output Power	with Power meter	±0.5dB	
RF conducted to	est with spectrum	±1.5dB	
AC Power Lines C	onducted Emissions	±1.95dB	
Emissions,	Below 1GHz	±4.75dB	
Radiated	Above 1GHz	±4.88dB	
Temp	erature	±3℃	
Humidity		±6%	
Supply	voltages	±0.4%	

FCC Part 15.247 Page 3 of 27

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.

Report No.: RSZ171115010-00E

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.: 382179, the FCC Designation No.: CN5001.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062B.

FCC Part 15.247 Page 4 of 27

SYSTEM TEST CONFIGURATION

Description of Test Configuration

For BLE mode, 40 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2442
1	2404	21	2444
2	2406	22	2446
3	2408	23	2448
4	2410	24	2450
5	2412	25	2452
6	2414	26	2454
7	2416	27	2456
8	2418	28	2458
9	2420	29	2460
10	2422	30	2462
11	2424 31		2464
12	2426 32		2466
13	2428	33	2468
14	2430	34	2470
15	2432	35	2472
16	2434	36	2474
17	2436	37	2476
18	2438	38	2478
19	2440	39	2480

Report No.: RSZ171115010-00E

EUT was tested with Channel 0, 19 and 39.

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

Software "RF test tool" was used.

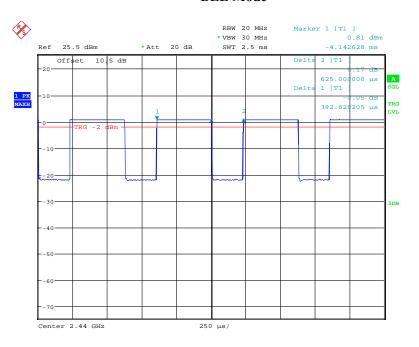
BLE test in the engineer mode and power level is default.

FCC Part 15.247 Page 5 of 27

Duty cycle

BLE Mode

Report No.: RSZ171115010-00E



Date: 20.NOV.2017 11:10:46

Band	Duty Cycle (%)	T(ms)	1/T(kHz)	VBW Setting	10log(1/x)
BLE	62.9	0.393	2.54	3kHz	2.01

FCC Part 15.247 Page 6 of 27

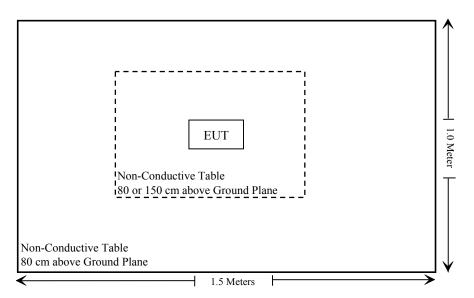
External I/O Cable

Cable Description	Length (m)	From Port	То
N/A	N/A	N/A	N/A

Report No.: RSZ171115010-00E

Block Diagram of Test Setup

For radiated emission



Note: 80cm for below 1GHz, and 150cm for above 1GHz.

FCC Part 15.247 Page 7 of 27

SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i), §1.1307 (b) (1)& §2.1093	RF Exposure	Compliance
§15.203	Antenna Requirement	Compliance
§15.207 (a)	AC Line Conducted Emissions	Not Applicable
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
§15.247 (a)(2)	6 dB Emission Bandwidth	Compliance
§15.247(b)(3)	Maximum Conducted Output Power	Compliance
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliance
§15.247(e)	Power Spectral Density	Compliance

Report No.: RSZ171115010-00E

FCC Part 15.247 Page 8 of 27

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
	Radia	ted Emission To	est		
Sunol Sciences	Horn Antenna	DRH-118	A052604	2014-12-29	2017-12-28
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2017-04-24	2018-04-24
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2017-05-21	2018-05-21
HP	Amplifier	HP8447E	1937A01046	2017-05-21	2017-11-19
Sunol Sciences	Broadband Antenna	JB1	A040904-2	2014-12-17	2017-12-16
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2016-12-07	2017-12-07
Ducommun technologies	RF Cable	UFA210A-1- 4724-30050U	MFR64369 223410-001	2017-05-21	2017-11-19
Ducommun technologies	RF Cable	104PEA	218124002	2017-05-21	2017-11-19
Ducommun technologies	RF Cable	RG-214	1	2017-05-21	2017-11-19
Ducommun technologies	RF Cable	RG-214	2	2017-05-22	2017-11-22
Ducommun Technologies	Horn Antenna	ARH-4223- 02	1007726-04	2014-12-29	2017-12-28
Ducommun Technologies	Pre-amplifier	ALN- 22093530-01	991373-01	2017-08-03	2018-08-03
Sinoscite	Band Reject Filter	BSF2402- 2480MN- 0898-001	N/A	2017-05-21	2018-05-21
	RF	Conducted Test	t		
Agilent	P-Series Power Meter	N1912A	MY5000448	2016-12-05	2017-12-05
Agilent	Wideband Power Sensor	N1921A	MY54210016	2016-12-05	2017-12-05
WEINSCHEL	10 dB Attenuator	5324	AU 3842	2017-05-23	2017-11-22
Rohde & Schwarz	EMI Test Receiver	ESR	1316.3003K03 -101746-zn	2017-08-17	2018-08-17
Ducommun technologies	RF Cable	RG-214	3	2017-05-22	2017-11-22
Rohde & Schwarz	SPECTRUM ANALYZER	FSU26	200120	2016-12-05	2017-12-05

Report No.: RSZ171115010-00E

FCC Part 15.247 Page 9 of 27

^{*} 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§15.247 (i), §1.1307 (b) (1) & §2.1093 – RF EXPOSURE

Applicable Standard

According to FCC §2.1093 and §1.1307(b) (1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

Report No.: RSZ171115010-00E

According to KDB 447498 D01 General RF Exposure Guidance

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances \leq 50 mm are determined by:

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] \cdot [$\sqrt{f(GHz)}$] \leq 3.0 for 1-g SAR and \leq 7.5 for 10-g extremity SAR, where

- 1. f(GHz) is the RF channel transmit frequency in GHz.
- 2. Power and distance are rounded to the nearest mW and mm before calculation.
- 3. The result is rounded to one decimal place for comparison.
- 4. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test Exclusion.

Measurement Result

For worst case:

Mode	Frequency (MHz)	Max Tune-up Conducted Power (dBm)	Max Tune-up Conducted Power (mW)	Calculated Distance (mm)	Calculated value	Threshold (1-g SAR)	SAR Test Exclusion
BLE	2480	0.5	1.12	5	0.4	3.0	Yes

Result: No SAR test is required

FCC Part 15.247 Page 10 of 27

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to § 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 shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

Report No.: RSZ171115010-00E

- a. Antenna must be permanently attached to the unit.
- b. Antenna must use a unique type of connector to attach to the EUT.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

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

Antenna Connector Construction

The EUT has one PCB antenna arrangement, which was permanently attached and the antenna gain is 2 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliance.

FCC Part 15.247 Page 11 of 27

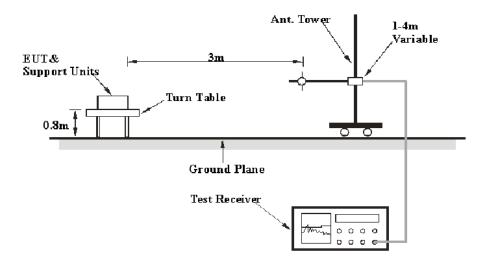
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

FCC §15.247 (d); §15.209; §15.205;

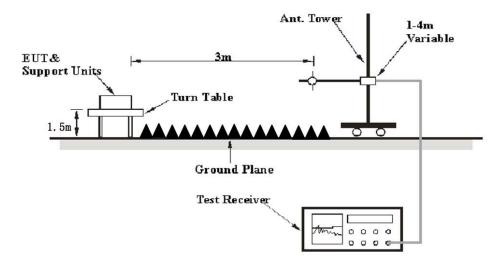
EUT Setup

Below 1 GHz:



Report No.: RSZ171115010-00E

Above 1GHz:



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 15.209, and FCC 15.247 limits.

FCC Part 15.247 Page 12 of 27

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Report No.: RSZ171115010-00E

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz Note 1	/	Average
	1MHz	>1/T Note 2	/	Average

Note 1: when duty cycle is no less than 98% Note 2: when duty cycle is less than 98%

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1 GHz, peak and Average detection modes for frequencies above 1 GHz.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Corrected Amplitude = Meter Reading + Antenna Factor + 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 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin = Limit – Corrected Amplitude

Test Results Summary

According to the recorded data in following table, the EUT complied with the <u>FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.247</u>.

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$L_{\rm m} + U_{\rm (Lm)} \leq L_{\rm lim} + U_{\rm cispr}$$

In BACL, $U_{(Lm)}$ is less than U_{cispr} , if L_m is less than L_{lim} , it implies that the EUT complies with the limit.

FCC Part 15.247 Page 13 of 27

Test Data

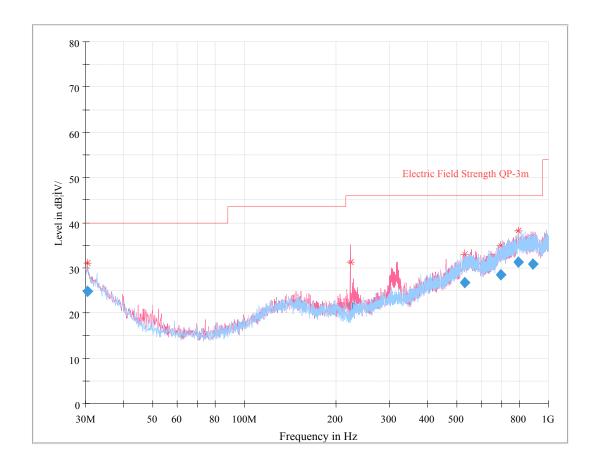
Environmental Conditions

Temperature:	26 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Vincent Zheng on 2017-11-15.

EUT operation mode: Transmitting

30 MHz~1 GHz: (Worst case at High Channel)



Report No.: RSZ171115010-00E

FCC Part 15.247 Page 14 of 27

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
30.447688	24.87	317.0	Н	216.0	0.0	40.00	15.13
222.780000	21.57	195.0	V	321.0	-6.6	46.00	24.43
529.394500	26.77	362.0	V	143.0	4.1	46.00	19.23
695.705875	28.49	297.0	V	0.0	6.5	46.00	17.51
796.705125	31.19	213.0	V	237.0	8.9	46.00	14.81
886.306000	30.94	204.0	V	123.0	9.5	46.00	15.06

Report No.: RSZ171115010-00E

1 GHz-25 GHz:

Frequency	Re	eceiver	Turntable	Rx An	itenna		Corrected		C Part //205/209
(MHz)	Reading (dBµV)	PK/QP/Ave.	Degree	Height (m)	Polar (H/V)	Factor (dB/m)	Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
			Low Ch	annel (2	2402 M	Hz)			
2402.00	62.67	PK	219	2.1	Н	33.92	96.59	/	/
2402.00	59.84	Ave.	219	2.1	Н	33.92	93.76	/	/
2402.00	61.34	PK	250	2.1	V	33.92	95.26	/	/
2402.00	58.22	Ave.	250	2.1	V	33.92	92.14	/	/
2349.52	27.58	PK	248	2.1	Н	33.83	61.41	74	12.59
2349.52	12.66	Ave.	248	2.1	Н	33.83	46.49	54	7.51
2386.55	26.74	PK	219	2.4	V	33.92	60.66	74	13.34
2386.55	11.98	Ave.	219	2.4	V	33.92	45.90	54	8.10
2488.65	26.29	PK	14	2.2	V	34.08	60.37	74	13.63
2488.65	12.38	Ave.	14	2.2	V	34.08	46.46	54	7.54
4804.00	51.59	PK	150	2.1	Н	5.84	57.43	74	16.57
4804.00	41.62	Ave.	150	2.1	Н	5.84	47.46	54	6.54
			Middle C	hannel	(2440 N	/IHz)			
2440.00	61.57	PK	211	2.0	Н	33.92	95.49	/	/
2440.00	57.33	Ave.	211	2.0	Н	33.92	91.25	/	/
2440.00	62.05	PK	52	1.1	V	33.92	95.97	/	/
2440.00	57.39	Ave.	52	1.1	V	33.92	91.31	/	/
2341.96	27.99	PK	184	1.5	Н	33.83	61.82	74	12.18
2341.96	13.06	Ave.	184	1.5	Н	33.83	46.89	54	7.11
2394.68	27.36	PK	172	1.8	V	33.92	61.28	74	12.72
2394.68	12.06	Ave.	172	1.8	V	33.92	45.98	54	8.02
2485.19	25.09	PK	326	1.7	V	34.08	59.17	74	14.83
2485.19	12.87	Ave.	326	1.7	V	34.08	46.95	54	7.05
4880.00	53.66	PK	145	1.9	Н	6.21	59.87	74	14.13
4880.00	40.82	Ave.	145	1.9	Н	6.21	47.03	54	6.97

FCC Part 15.247 Page 15 of 27

Frequency	Receiver		Turntable	Rx Antenna			Corrected	FCC Part 15.247/205/209	
(MHz)	Reading (dBµV)	PK/QP/Ave.	Degree	Height (m)	Polar (H/V)	Factor (dB/m)	Amplitude (dBμV/m)	Limit (dBµV/m)	Margin (dB)
	High Channel (2480 MHz)								
2480.00	62.13	PK	78	1.4	Н	34.08	96.21	/	/
2480.00	56.97	Ave.	78	1.4	Н	34.08	91.05	/	/
2480.00	61.83	PK	68	1.5	V	34.08	95.91	/	/
2480.00	57.46	Ave.	68	1.5	V	34.08	91.54	/	/
2368.99	28.16	PK	337	2.2	Н	33.92	62.08	74	11.92
2368.99	12.68	Ave.	337	2.2	Н	33.92	46.60	54	7.40
2486.27	26.71	PK	52	2.1	V	34.08	60.79	74	13.21
2486.27	13.05	Ave.	52	2.1	V	34.08	47.13	54	6.87
2493.14	26.94	PK	187	2.0	V	34.08	61.02	74	12.98
2493.14	12.29	Ave.	187	2.0	V	34.08	46.37	54	7.63
4960.00	52.69	PK	52	2.5	Н	7.82	60.51	74	13.49
4960.00	39.41	Ave.	52	2.5	Н	7.82	47.23	54	6.77

Report No.: RSZ171115010-00E

Note:

 $Corrected\ Factor = Antenna\ factor\ (RX) + Cable\ Loss - Amplifier\ Factor$

Corrected Amplitude = Corrected Factor + Reading

Margin = Limit - Corrected. Amplitude

The other spurious emission which is 20dB to the limit was not recorded.

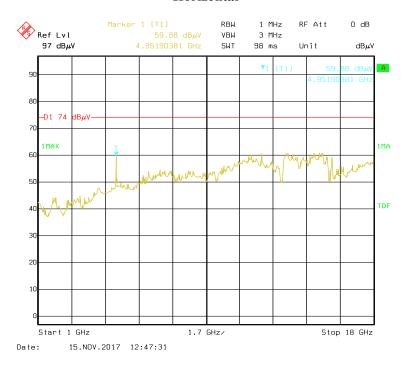
And for the pre-scan is performed with the 2400-2483.5MHz band filter.

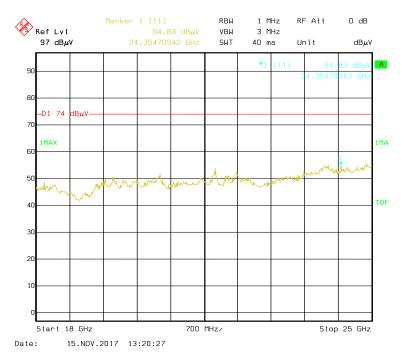
FCC Part 15.247 Page 16 of 27

Pre-scan with High channel

Report No.: RSZ171115010-00E

Horizontal

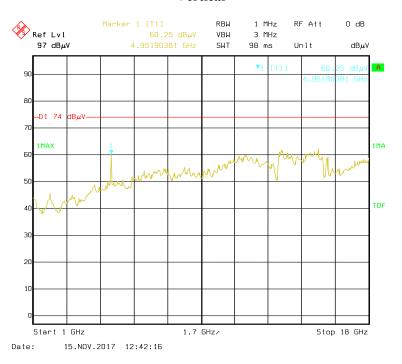




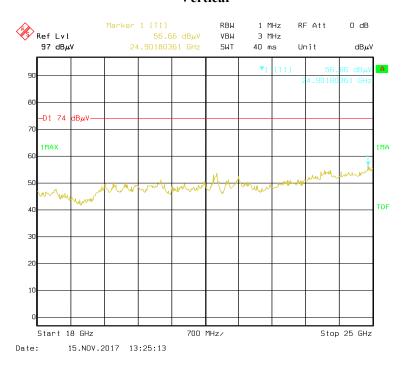
FCC Part 15.247 Page 17 of 27

Vertical

Report No.: RSZ171115010-00E



Vertical



FCC Part 15.247 Page 18 of 27

FCC $\S15.247(a)$ (2) – 6 dB EMISSION BANDWIDTH

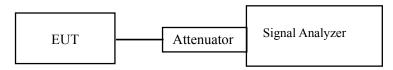
Applicable Standard

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Report No.: RSZ171115010-00E

Test Procedure

- 1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- 2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- 3. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emission bandwidth.
- 4. Repeat above procedures until all frequencies measured were complete.



Test Data

Environmental Conditions

Temperature:	26 ℃	
Relative Humidity:	56 %	
ATM Pressure:	101.0 kPa	

The testing was performed by Vincent Zheng on 2017-11-20.

Test Result: Pass.

Please refer to the following table and plots.

FCC Part 15.247 Page 19 of 27

EUT operation mode: Transmitting

Channel	Frequency (MHz)	6 dB Emission Bandwidth(MHz)	Limit (kHz)	
BLE mode				
Low	2402	0.788	≥500	
Middle	2440	0.747	≥500	
High	2480	0.769	≥500	

Report No.: RSZ171115010-00E

BLE Low Channel

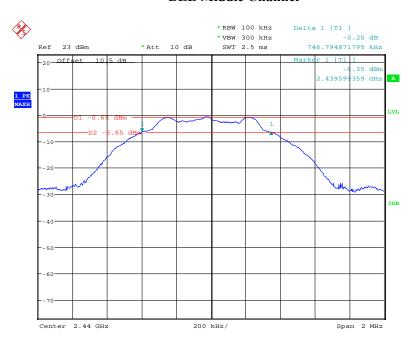


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FCC Part 15.247 Page 20 of 27

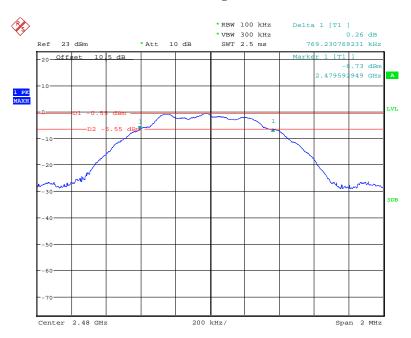
BLE Middle Channel

Report No.: RSZ171115010-00E



Date: 20.NOV.2017 10:48:35

BLE High Channel



Date: 20.NOV.2017 10:49:37

FCC Part 15.247 Page 21 of 27

FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

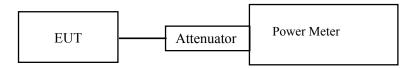
Applicable Standard

According to FCC §15.247(b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

Report No.: RSZ171115010-00E

Test Procedure

- 1. Place the EUT on a bench and set it in transmitting mode.
- 2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to one test equipment.
- 3. Add a correction factor to the display.



Test Data

Environmental Conditions

Temperature:	26 ℃	
Relative Humidity:	56 %	
ATM Pressure:	101.0 kPa	

The testing was performed by Vincent Zheng on 2017-11-20.

EUT operation mode: Transmitting

BLE mode

Channel	Frequency (MHz)	Max Peak Output Power (dBm)	Limit (dBm)	Result
Low	2402	-0.03	30	Pass
Middle	2440	0.11	30	Pass
High	2480	0.22	30	Pass

FCC Part 15.247 Page 22 of 27

FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE

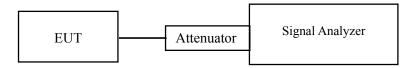
Report No.: RSZ171115010-00E

Applicable Standard

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test Procedure

- 1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- 2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
- 3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
- 4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
- 5. Repeat above procedures until all measured frequencies were complete.



Test Data

Environmental Conditions

Temperature:	26 ℃	
Relative Humidity:	56 %	
ATM Pressure:	101.0 kPa	

The testing was performed by Vincent Zheng on 2017-11-20.

EUT operation mode: Transmitting

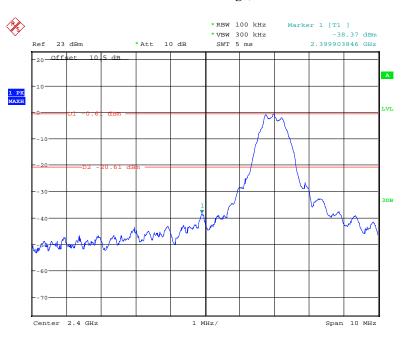
Test Result: Compliance

Please refer to the following plots.

FCC Part 15.247 Page 23 of 27

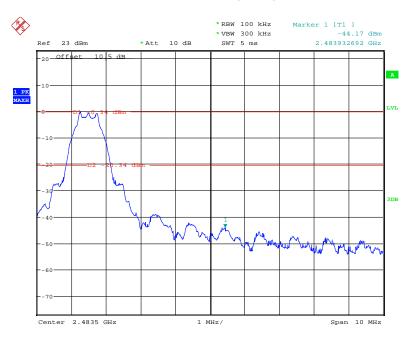
BLE: Band Edge, Left Side

Report No.: RSZ171115010-00E



Date: 20.NOV.2017 10:53:15

BLE: Band Edge, Right Side



Date: 20.NOV.2017 10:54:08

FCC Part 15.247 Page 24 of 27

FCC §15.247(e) - POWER SPECTRAL DENSITY

Applicable Standard

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

Report No.: RSZ171115010-00E

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 to: $3kHz \le RBW \le 100 \text{ kHz}$.
- 3. Set the VBW $> 3 \times RBW$.
- 4. Set the span to 1.5 times the DTS 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 within the RBW.
- 10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.



Test Data

Environmental Conditions

Temperature:	26 ℃	
Relative Humidity:	56 %	
ATM Pressure:	101.0 kPa	

The testing was performed by Vincent Zheng on 2017-11-20.

EUT operation mode: Transmitting

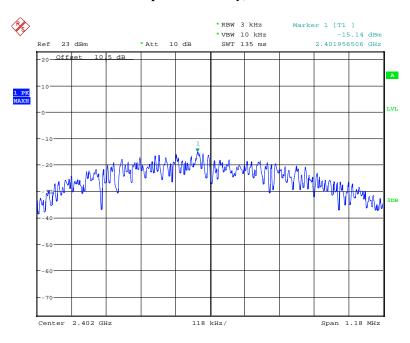
Test Result: Pass

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)		
BLE mode					
Low	2402	-15.14	≤8		
Middle	2440	-15.15	≤8		
High	2480	-14.68	≤8		

FCC Part 15.247 Page 25 of 27

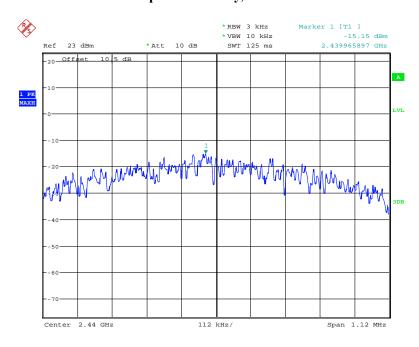
Power Spectral Density, BLE Low Channel

Report No.: RSZ171115010-00E



Date: 20.NOV.2017 11:00:53

Power Spectral Density, BLE Middle Channel

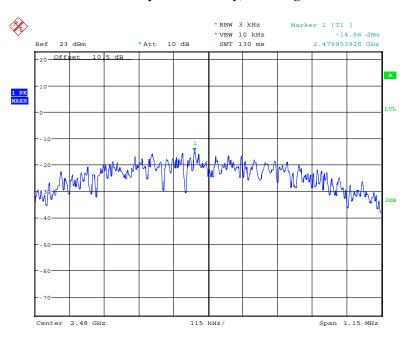


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FCC Part 15.247 Page 26 of 27

Power Spectral Density, BLE High Channel

Report No.: RSZ171115010-00E



Date: 20.NOV.2017 10:56:17

***** END OF REPORT *****

FCC Part 15.247 Page 27 of 27