

ISSUED BY Shenzhen BALUN Technology Co., Ltd.



FOR

Neck Massager

ISSUED TO Wear Future Technologies Co., LTD

23A Floor, Building 3, Zhongke R & D Park, No.009, Gaoxin South 1st Road, High-tech Zone Community, Yuehai Street, Nanshan District, Shenzhen





FCC ID: Test Conclusion: Pass

2AYVT-K5-2EN

Test Date: Jan. 25, 2021 ~ Feb. 02, 2021 Date of Issue: Mar. 18, 2021

NOTE: This test report of test results only related to testing samples, which can be duplicated completely for the legal use with the approval of the applicant; it shall not be reproduced except in full, without the written approval of Shenzhen BALUN Technology Co., Ltd. Any objections should be raised within thirty days from the date of issue. To validate the report, please contact us.

Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong, P. R. China 518055 TEL: +86-755-66850100, FAX: +86-755-61824271 Email: qc@baluntek.com 1 / 67 www.baluntek.com



Revision History

Vers	ion
Rev.	01

Issue Date <u>Mar. 18, 2021</u> Revisions Content Initial Issue

TABLE OF CONTENTS

1	ADMIN	ISTRATIVE DATA (GENERAL INFORMATION)	5		
	1.1	Identification of the Testing Laboratory5			
	1.2	Identification of the Responsible Testing Location5			
	1.3	Laboratory Condition			
	1.4	1.4 Announce			
2	PRODL	JCT INFORMATION	6		
	2.1	Applicant Information	6		
	2.2	Manufacturer Information	6		
	2.3	Factory Information	6		
	2.4	General Description for Equipment under Test (EUT)	6		
	2.5	Technical Information	7		
	2.6	Additional Instructions	8		
3	SUMM	ARY OF TEST RESULTS	9		
	3.1	Test Standards	9		
	3.2	Verdict	9		
4	GENEF	RAL TEST CONFIGURATIONS	.10		
	4.1	Test Environments	.10		
	4.2	Test Equipment List	.10		
	4.3	Measurement Uncertainty	.11		
	4.4	Description of Test Setup	.12		
	4.4.1	For Antenna Port Test	.12		
	4.4.2	4.4.2 For AC Power Supply Port Test			
	4.4.3	.3 For Radiated Test (Below 30 MHz)13			
	4.4.4	For Radiated Test (30 MHz-1 GHz)	.13		
	4.4.5	For Radiated Test (Above 1 GHz)	.14		
	4.5	Measurement Results Explanation Example	.15		
	4.5.1	For conducted test items:	.15		



	4.5.2	For radiated band edges and spurious emission test:	.15
5	TEST I	TEMS	.16
5	5.1	Antenna Requirements	.16
	5.1.1	Relevant Standards	.16
	5.1.2	Antenna Anti-Replacement Construction	.16
	5.1.3	Antenna Gain	.16
5	5.2	Output Power	.17
	5.2.1	Test Limit	.17
	5.2.2	Test Setup	.17
	5.2.3	Test Procedure	.17
	5.2.4	Test Result	.18
5	5.3	Occupied Bandwidth	.19
	5.3.1	Limit	.19
	5.3.2	Test Setup	.19
	5.3.3	Test Procedure	.19
	5.3.4	Test Result	.19
5	5.4	Conducted Spurious Emission	.20
	5.4.1	Limit	.20
	5.4.2	Test Setup	.20
	5.4.3	Test Procedure	.20
	5.4.4	Test Result	.21
5	5.5	Band Edge (Authorized-band band-edge)	.22
	5.5.1	Limit	.22
	5.5.2	Test Setup	.22
	5.5.3	Test Procedure	.22
	5.5.4	Test Result	.22
5	5.6	Conducted Emission	.23
	5.6.1	Limit	.23
	5.6.2	Test Setup	.23
	5.6.3	Test Procedure	.23
	5.6.4	Test Result	.23
5	5.7	Radiated Spurious Emission	.24
	5.7.1	Limit	.24



5.7.2	Test Setup	24
5.7.3	Test Procedure	24
5.7.4	Test Result	27
5.8	Band Edge (Restricted-band band-edge)	28
5.8.1	Limit	28
5.8.2	Test Setup	28
5.8.3	Test Procedure	
1.1.1	Test Result	
5.9	Power Spectral density (PSD)	29
5.9.1	Limit	29
5.9.2	Test Setup	29
5.9.3	Test Procedure	29
5.9.4	Test Result	29
ANNEX A	TEST RESULT	
A.1	Output Power, Duty Cycle	
A.2	Occupied Bandwidth	33
A.3	Conducted Spurious Emissions	37
A.4	Band Edge (Authorized-band band-edge)	42
A.5	Conducted Emissions	
A.6	Radiated Spurious Emission	48
A.7	Band Edge (Restricted-band band-edge)	62
A.8	Power Spectral Density (PSD)	
ANNEX B	INEX B TEST SETUP PHOTOS	
ANNEX C	ANNEX C EUT EXTERNAL PHOTOS	
ANNEX D	EUT INTERNAL PHOTOS	67



1 ADMINISTRATIVE DATA (GENERAL INFORMATION)

1.1 Identification of the Testing Laboratory

Company Name	npany Name Shenzhen BALUN Technology Co., Ltd.	
Address	Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road,	
Address	Nanshan District, Shenzhen, Guangdong Province, P. R. China	
Phone Number	+86 755 6685 0100	

1.2 Identification of the Responsible Testing Location

Test Location	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road,
Address	Nanshan District, Shenzhen, Guangdong Province, P. R. China
	All measurement facilities used to collect the measurement data are
Description	located at Block B, FL 1, Baisha Science and Technology Park, Shahe
Description	Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R.
	China 518055

1.3 Laboratory Condition

Ambient Temperature	20°⊂ to 25°⊂
Ambient Relative Humidity	45% to 55%
Ambient Pressure	100 kPa to 102 kPa

1.4 Announce

- (1) The test report reference to the report template version v6.9.
- (2) The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.
- (3) The test report is invalid if there is any evidence and/or falsification.
- (4) The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein.
- (5) This document may not be altered or revised in any way unless done so by BALUN and all revisions are duly noted in the revisions section.
- (6) Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.
- (7) The laboratory is only responsible for the data released by the laboratory, except for the part provided by the applicant.



2 PRODUCT INFORMATION

2.1 Applicant Information

Applicant	Wear Future Technologies Co., LTD
	23A Floor, Building 3, Zhongke R & D Park, No.009, Gaoxin South
Address	1st Road, High-tech Zone Community, Yuehai Street, Nanshan
	District, Shenzhen

2.2 Manufacturer Information

Manufacturer	Wear Future Technologies Co., LTD
	23A Floor, Building 3, Zhongke R & D Park, No.009, Gaoxin South
Address	1st Road, High-tech Zone Community, Yuehai Street, Nanshan
	District, Shenzhen

2.3 Factory Information

Factory	N/A
Address	N/A

2.4 General Description for Equipment under Test (EUT)

EUT Name	Neck Massager
Model Name Under Test	K5-2EN
Series Model Name	N/A
Description of Model	N/A
name differentiation	
Serial Number	N/A
Hardware Version	V2
Software Version	V10A
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A



2.5 Technical Information

	Network and Wireless connectivity	Bluetooth BLE
The req	The requirement for the following technical information of the EUT was tested in this report:	
	Modulation Technology	DTS
	Modulation Type	GFSK
		Mobile
	Product Type	⊠ Portable
		Fix Location
	Transfer Rate	1 Mbps, 2 Mbps
	Frequency Range	The frequency range used is 2400 MHz to 2483.5 MHz.
	Number of Channel	40 (at intervals of 2 MHz)
	Tested Channel	0 (2402 MHz), 19 (2440 MHz), 39 (2480 MHz)
	Antenna Type	Chip Antenna
	Antonno Coin	1.5 dBi (In test items related to antenna gain, the final results reflect
	Antenna Gain	this figure. This value is provided by the applicant.)
	Antenna Impedance	50Ω
	Antenna System	N/A
	(MIMO Smart Antenna)	N/A



2.6 Additional Instructions

EUT Software Settings:

	Special software is used.
Mode	The software provided by client to enable the EUT under
Mode	transmission condition continuously at specific channel frequencies
	individually.

During testing. Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

Power level setup in software				
Test Software Version	BG_TOOL			
Support Units	Description	Manufacturer	Model	
(Software installation media)	Notebook	Lenovo	X220	
Mode	Channel	Frequency (MHz)	Soft Set	
	CH0	2402	Dower peremeter Settings	
GFSK	CH19	2440	Power parameter Settings is 0	
	CH39	2480	15 0	

Run Software

BGTool	×
e Kit Connection View Help סובונעות במס	
RF test mode for regulatory testing	
Bluetooth Low Energy	
Transmit power: O Set	
Select frequency:	
Select PHY: 1M 2M 125k Coded 500k Coded	
Low energy transmit	
PRBS9 (GFSK) 1111000 101010 1111111 0000000 00001111 0101011 PN9 continuously modulated output Unmodulated carrier Packet length: 37	B
	-
Log Settings 👻	
19:01:24,0890 gecko_rsp_test_dtm_tx result0x0000 'Command completed succesfully' 19:01:24,0900 gecko_evt_test_dtm_completed number_of_packets: 0(0x0000)	
BGAPI commands Send Save Clear	



3 SUMMARY OF TEST RESULTS

3.1 Test Standards

No.	Identity	Document Title
1	47 CFR Part 15, Subpart C (10-1-17 Edition)	Miscellaneous Wireless Communications Services
2	KDB 558074 D01 15.247 Meas Guidance v05r02	Guidance for compliance measurements on digital transmission system, frequency hopping spread spectrum system, and hybrid system devices operating under section 15.247 of the FCC rules
3	ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices

3.2 Verdict

No.	Description	FCC Part No.	Channel	Test Result	Verdict
1	Antenna Requirement	15.203	N/A		Pass ^{Note1}
2	Output Power	15.247(b)	Low/Middle/High	ANNEX A.1	Pass
3	Occupied Bandwidth	15.247(a)	Low/Middle/High	ANNEX A.2	Pass
4	Conducted Spurious Emission	15.247(d)	Low/Middle/High	ANNEX A.3	Pass
5	Band Edge(Authorized- band band-edge)	15.247(d)	Low/ High	ANNEX A.4	Pass
6	Conducted Emission	15.207	Low/Middle/High	ANNEX A.5	Pass
7	Radiated Spurious Emission	15.209 15.247(d)	Low/Middle/High	ANNEX A.6	Pass
8	Band Edge(Restricted- band band-edge)	15.209 15.247(d)	Low/Middle/High	ANNEX A.7	Pass
9	Power spectral density (PSD)	15.247(e)	Low/Middle/High	ANNEX A.8	Pass
10	Receiver Spurious Emissions			N/A	N/A ^{Note2}
Note ¹ : The EUT has a permanently and irreplaceable attached antenna, which complies with the					

Note ': The EUT has a permanently and irreplaceable attached antenna, which complies with the requirement FCC 15.203.

Note ²: Only radio communication receivers operating in stand-alone mode within the band 30-960 MHz, as well as scanner receivers, are subject to Industry Canada requirements, so this test is not applicable.



4 GENERAL TEST CONFIGURATIONS

4.1 Test Environments

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

Relative Humidity	45% to 55%		
Atmospheric Pressure	100 kPa to 102 kPa		
Temperature	NT (Normal Temperature)	+22℃ to +25℃	
Working Voltage of the EUT	NV (Normal Voltage)	3.7 V	

4.2 Test Equipment List

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer	ROHDE&SCHWARZ	FSV-30	103118	2020.06.08	2021.06.07
Switch Unit with OSP- B157	ROHDE&SCHWARZ	OSP120	101270	2020.06.08	2021.06.07
EMI Receiver	KEYSIGHT	N9038A	MY53220118	2020.06.09	2021.06.08
EMI Receiver	ROHDE&SCHWARZ	ESRP	101036	2020.06.09	2021.06.08
LISN	SCHWARZBECK	NSLK 8127	8127-687	2020.06.09	2021.06.08
Bluetooth Tester	ROHDE&SCHWARZ	CBT	101005	2020.06.08	2021.06.07
Bluetooth Signaling Unit	ROHDE&SCHWARZ	CMW270	100607	2020.06.08	2021.06.07
Bluetooth Signaling Unit	ROHDE&SCHWARZ	CMW500	142028	2020.06.08	2021.06.07
DC Power Supply	ROHDE&SCHWARZ	HMP2020	018141664	2020.06.08	2021.06.07
Power Splitter	KMW	DCPD-LDC	1305003215		
Power Sensor	ROHDE&SCHWARZ	NRP-Z21	103971	2020.06.08	2021.06.07
Attenuator (20 dB)	KMW	ZA-S1-201	110617091		
Attenuator (6 dB)	KMW	ZA-S1-61	1305003189		
Temperature Chamber	AHK	SP20	1412	2020.06.10	2021.06.09
Test Antenna- Loop(9 kHz-30 MHz)	SCHWARZBECK	FMZB 1519	1519-037	2019.10.29	2021.10.28
Test Antenna- Bi-Log(30 MHz-3 GHz)	SCHWARZBECK	VULB 9163	9163-624	2019.07.02	2021.07.01
Test Antenna- Horn(1-18 GHz)	SCHWARZBECK	BBHA 9120D	9120D-1917	2019.07.02	2021.07.01
Test Antenna- Horn (18-40 GHz)	A-INFO	LB- 180400KF	J211060273	2021.01.05	2023.01.04
Anechoic Chamber	RAINFORD	9m*6m*6m	N/A	2017.02.21	2022.02.20
Anechoic Chamber	EMC Electronic Co., Ltd	20.10*11.60 *7.35m	N/A	2018.08.08	2021.08.07
Shielded Enclosure	ChangNing	CN-130701	130703		
Signal Generator	ROHDE&SCHWARZ	SMB100A	177746	2020.06.08	2021.06.07
Power Amplifier	OPHIR RF	5225F	1037	2020.02.19	2021.02.18
Power Amplifier	OPHIR RF	5273F	1016	2020.02.19	2021.02.18
Directional Coupler	Werlantone	C5982-10	109275	N/A	N/A
Directional Coupler	Werlantone	CHP-273E	S00801z-01	N/A	N/A
Sound Level Meter	B&K	NL-20	00844023	2020.10.23	2021.10.22
Ear Simulator	B&K	4192-L-001	3038758	2020.02.19	2021.02.18



Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Audio analyzer	B&K	UPL 16	100129	2020.02.28	2021.02.27

4.3 Measurement Uncertainty

The following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2.

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Measurement	Value
Occupied Channel Bandwidth	±4%
RF output power, conducted	±1.4 dB
Power Spectral Density, conducted	±2.5 dB
Unwanted Emissions, conducted	±2.8 dB
All emissions, radiated	±5.4 dB
Temperature	±1°C
Humidity	±4%

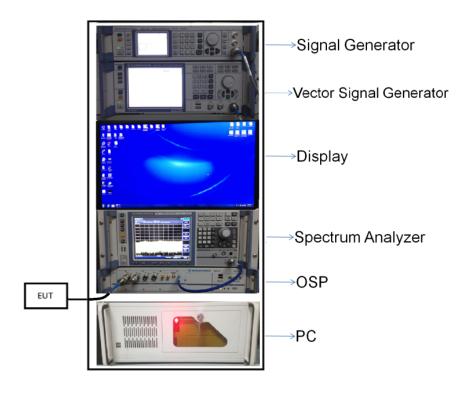


4.4 Description of Test Setup

4.4.1 For Antenna Port Test

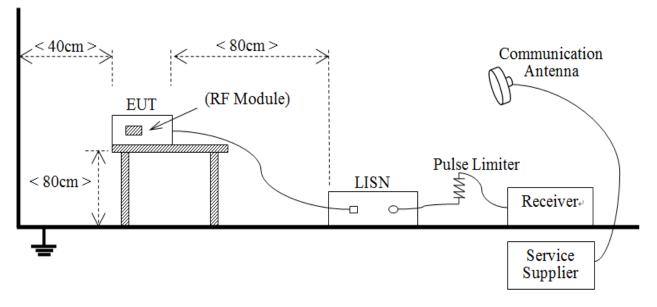
Conducted value (dBm) = Measurement value (dBm) + cable loss (dB)

For example: the measurement value is 10 dBm and the cable loss is 0.5dB, then the conducted value (dBm) = 10 dBm + 0.5 dB = 10.5 dBm



(Diagram 1)

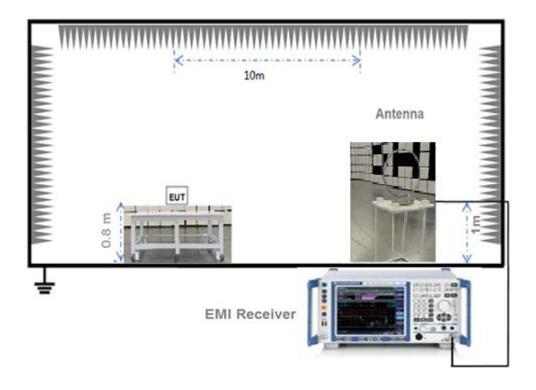




(Diagram 2)

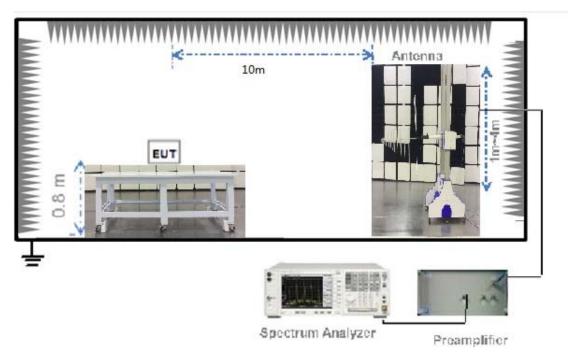


4.4.3 For Radiated Test (Below 30 MHz)



(Diagram 3)

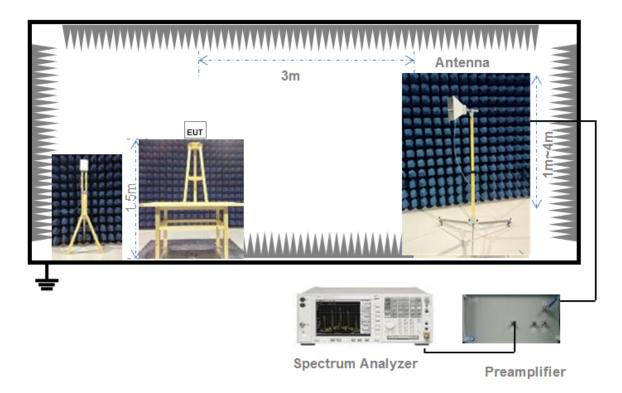
4.4.4 For Radiated Test (30 MHz-1 GHz)







4.4.5 For Radiated Test (Above 1 GHz)



(Diagram 5)





4.5 Measurement Results Explanation Example

4.5.1 For conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

4.5.2 For radiated band edges and spurious emission test:

E = EIRP – 20log D + 104.8

where:

E = electric field strength in $dB\mu V/m$,

EIRP = equivalent isotropic radiated power in dBm

D = specified measurement distance in meters.



5 TEST ITEMS

5.1 Antenna Requirements

5.1.1 Relevant Standards

FCC §15.203 & 15.247(b); RSS-247, 5.4 (f)

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 use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of § 15.211, § 15.213, § 15.217, § 15.219, or § 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

If directional gain of transmitting antennas is greater than 6 dBi, the power shall be reduced by the same level in dB comparing to gain minus 6 dBi. For the fixed point-to-point operation, the power shall be reduced by one dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi. 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 FCC rule.

5.1.2 Antenna Anti-Replacement Construction

The Antenna Anti-Replacement as following method:

Protected Method	Description
The antenna is embedded in the	An embedded-in antenna design is used.
product.	

Reference Documents	Item
Photo	Please refer to the EUT Photo documents.

5.1.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.



5.2.1 Test Limit

5.2 Output Power

FCC § 15.247(b)

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 antennas and antennas and antennas and antennas elements.

RSS-247, 5.4 (d)

For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. Except as provided in Section 5.4(5), the e.i.r.p. shall not exceed 4 W.

5.2.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.2.3 Test Procedure

a) Maximum peak conducted output power

This procedure shall be used when the measurement instrument has available a resolution bandwidth that is greater than the DTS bandwidth.

Set the RBW \geq DTS bandwidth.

Set VBW \geq 3 x RBW.

Set span ≥ 3 x RBW

Sweep time = auto couple.

Detector = peak.

Trace mode = max hold.

Allow trace to fully stabilize.

Use peak marker function to determine the peak amplitude level.

b) Measurements of duty cycle

The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal.

Set the center frequency of the instrument to the center frequency of the transmission.

Set RBW \geq OBW if possible; otherwise, set RBW to the largest available value.

Set VBW \geq RBW. Set detector = peak or average.

The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T \leq 16.7 microseconds.)



Report No.: BL-SZ2110505-601

5.2.4 Test Result

Please refer to ANNEX A.1.



5.3 Occupied Bandwidth

5.3.1 Limit

FCC §15.247(a); RSS-247, 5.2 (a); RSS-GEN, 6.7

Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. In order to make an accurate measurement, set the span greater than RBW. The 6 dB bandwidth must be greater than 500 kHz.

5.3.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.3.3 Test Procedure

Use the following spectrum analyzer settings:

Set RBW = 100 kHz.

Set the video bandwidth (VBW) \geq 3 RBW.

Detector = Peak.

Trace mode = max hold.

Sweep = auto couple.

Allow the trace to stabilize.

Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

5.3.4 Test Result

Please refer to ANNEX A.2.



5.4 Conducted Spurious Emission

5.4.1 Limit

FCC §15.247(d); RSS-247, 5.5

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.

5.4.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.4.3 Test Procedure

The DTS rules specify that in any 100 kHz bandwidth outside of the authorized frequency band, the power shall be attenuated according to the following conditions:

a) If the maximum peak conducted output power procedure was used to demonstrate compliance as described in 9.1, then the peak output power measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 20 dBc).

b) If maximum conducted (average) output power was used to demonstrate compliance as described in 9.2, then the peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 30 dBc).

c) In either case, attenuation to levels below the 15.209 general radiated emissions limits is not required.

The following procedures shall be used to demonstrate compliance to these limits. Note that these procedures can be used in either an antenna-port conducted or radiated test set-up. Radiated tests must conform to the test site requirements and utilize maximization procedures defined herein.

Reference level measurement:

Establish a reference level by using the following procedure:

Set instrument center frequency to DTS channel center frequency.

Set the span to \geq 1.5 times the DTS bandwidth.

Set the RBW = 100 kHz.

Set the VBW \geq 3 x RBW.

Detector = peak.

Sweep time = auto couple.

Trace mode = max hold.

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum PSD level.



Emission level measurement:

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.

Set the RBW = 100 kHz.

Set the VBW \geq 3 x RBW.

Detector = peak.

Sweep time = auto couple.

Trace mode = max hold.

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum amplitude level.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in 11.1 a) or 11.1 b). Report the three highest emissions relative to the limit.

5.4.4 Test Result

Please refer to ANNEX A.3.



5.5 Band Edge (Authorized-band band-edge)

5.5.1 Limit

FCC §15.247(d); RSS-247, 5.5

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.

5.5.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.5.3 Test Procedure

The following procedures may be used to determine the peak or average field strength or power of an unwanted emission that is within 2 MHz of the authorized band edge. If a peak detector is utilized, use the procedure described in 13.2.1. Use the procedure described in 13.2.2 when using an average detector and the EUT can be configured to transmit continuously (i.e., duty cycle \ge 98%). Use the procedure described in 13.2.3 when using an average detector and the EUT can be configured to transmit continuously (i.e., duty cycle \ge 98%). Use the procedure described in 13.2.3 when using an average detector and the EUT cannot be configured to transmit continuously but the duty cycle is constant (i.e., duty cycle variations are less than \pm 2 percent). Use the procedure described in 13.2.4 when using an average detector for those cases where the EUT cannot be configured to transmit continuously and the duty cycle is not constant (duty cycle variations equal or exceed 2 percent).

When using a peak detector to measure unwanted emissions at or near the band edge (within 2 MHz of the authorized band), the following integration procedure can be used.

Set instrument center frequency to the frequency of the emission to be measured (must be within 2 MHz of the authorized band edge).

Set span to 2 MHz

RBW = 100 kHz.

VBW \geq 3 x RBW.

Detector = peak.

Sweep time = auto.

Trace mode = max hold.

Allow sweep to continue until the trace stabilizes (required measurement time may increase for low duty cycle applications)

Compute the power by integrating the spectrum over 1 MHz using the analyzer's band power measurement function with band limits set equal to the emission frequency (femission) \pm 0.5 MHz. If the instrument does not have a band power function, then sum the amplitude levels (in power units) at 100 kHz intervals extending across the 1 MHz spectrum defined by femission \pm 0.5 MHz.

5.5.4 Test Result

Please refer to ANNEX A.4.



5.6 Conducted Emission

5.6.1 Limit

FCC §15.207; RSS-GEN, 8.8

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50μ H/ 50Ω line impedance stabilization network (LISN).

Frequency range	Conducted Limit (dBµV)		
(MHz)	Quai-peak	Average	
0.15 - 0.50	66 to 56 56 to 46		
0.50 - 5	56	46	
0.50 - 30	60 50		

5.6.2 Test Setup

See section 4.4.2 for test setup description for the AC power supply port. The photo of test setup please refer to ANNEX B.

5.6.3 Test Procedure

The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Refer to recorded points and plots below.

Devices subject to Part 15 must be tested for all available U.S. voltages and frequencies (such as a nominal 120 VAC, 50/60 Hz and 240 VAC, 50/60 Hz) for which the device is capable of operation. A device rated for 50/60 Hz operation need not be tested at both frequencies provided the radiated and line conducted emissions are the same at both frequencies.

5.6.4 Test Result

Please refer to ANNEX A.5.



5.7 Radiated Spurious Emission

5.7.1 Limit

FCC §15.209&15.247(d); RSS-GEN, 8.9; RSS-247, 5.5

Radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

Note:

- 1. Field Strength (dB μ V/m) = 20*log[Field Strength (μ V/m)].
- 2. In the emission tables above, the tighter limit applies at the band edges.
- 3. For Above 1000 MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
- 4. For above 1000 MHz, limit field strength of harmonics: 54dBuV/m@3m (AV) and 74dBuV/m@3m (PK).

5.7.2 Test Setup

See section 4.4.3 to 4.4.5 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.7.3 Test Procedure

Since the emission limits are specified in terms of radiated field strength levels, measurements performed to demonstrate compliance have traditionally relied on a radiated test configuration. Radiated measurements remain the principal method for demonstrating compliance to the specified limits; however antenna-port conducted measurements are also now acceptable to demonstrate compliance (see below for details). When radiated measurements are utilized, test site requirements and procedures for maximizing and measuring radiated emissions that are described in ANSI C63.10 shall be followed.

Antenna-port conducted measurements may also be used as an alternative to radiated measurements for demonstrating compliance in the restricted frequency bands. If conducted measurements are performed, then proper impedance matching must be ensured and an additional radiated test for cabinet/case spurious emissions is required.



General Procedure for conducted measurements in restricted bands:

a) Measure the conducted output power (in dBm) using the detector specified (see guidance regarding measurement procedures for determining quasi-peak, peak, and average conducted output power, respectively).

b) Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level (see guidance on determining the applicable antenna gain)

c) Add the appropriate maximum ground reflection factor to the EIRP level (6 dB for frequencies \leq 30 MHz, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies > 1000 MHz).

d) For devices with multiple antenna-ports, measure the power of each individual chain and sum the EIRP of all chains in linear terms (e.g., Watts, mW).

e) Convert the resultant EIRP level to an equivalent electric field strength using the following relationship:

E = EIRP - 20log D + 104.8

where:

E = electric field strength in $dB\mu V/m$,

EIRP = equivalent isotropic radiated power in dBm

D = specified measurement distance in meters.

f) Compare the resultant electric field strength level to the applicable limit.

g) Perform radiated spurious emission test.

Quasi-Peak measurement procedure

The specifications for measurements using the CISPR quasi-peak detector can be found in Publication 16 of the International Special Committee on Radio Frequency Interference (CISPR) of the International Electrotechnical Commission.

As an alternative to CISPR quasi-peak measurement, compliance can be demonstrated to the applicable emission limits using a peak detector.

Peak power measurement procedure:

Peak emission levels are measured by setting the instrument as follows:

a) RBW = as specified in Table 1.

b) VBW \geq 3 x RBW.

c) Detector = Peak.

d) Sweep time = auto.

e) Trace mode = max hold.

f) Allow sweeps to continue until the trace stabilizes. (Note that the required measurement time may be longer for low duty cycle applications).



Table 1—RBW as a function of frequency

Frequency	RBW
9-150 kHz	200-300 Hz
0.15-30 MHz	9-10 kHz
30-1000 MHz	100-120 kHz
> 1000 MHz	1 MHz

If the peak-detected amplitude can be shown to comply with the average limit, then it is not necessary to perform a separate average measurement.

Trace averaging across on and off times of the EUT transmissions followed by duty cycle correction:

If continuous transmission of the EUT (i.e., duty cycle \geq 98 percent) cannot be achieved and the duty cycle is constant (i.e., duty cycle variations are less than ± 2 percent), then the following procedure shall be used:

a) The EUT shall be configured to operate at the maximum achievable duty cycle.

b) Measure the duty cycle, x, of the transmitter output signal as described in section 6.0.

c) RBW = 1 MHz (unless otherwise specified).

d) VBW \geq 3 x RBW.

e) Detector = RMS, if span/(# of points in sweep) \leq (RBW/2). Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied, then the detector mode shall be set to peak.

f) Averaging type = power (i.e., RMS).

1) As an alternative, the detector and averaging type may be set for linear voltage averaging.

2) Some instruments require linear display mode in order to use linear voltage averaging. Log or dB averaging shall not be used.

g) Sweep time = auto.

h) Perform a trace average of at least 100 traces.

i) A correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:

1) If power averaging (RMS) mode was used in step f), then the applicable correction factor is $10 \log(1/x)$, where x is the duty cycle.

2) If linear voltage averaging mode was used in step f), then the applicable correction factor is $20 \log(1/x)$, where x is the duty cycle.

3) If a specific emission is demonstrated to be continuous (\geq 98 percent duty cycle) rather than turning on and off with the transmit cycle, then no duty cycle correction is required for that emission.

NOTE: Reduction of the measured emission amplitude levels to account for operational duty factor is not permitted. Compliance is based on emission levels occurring during transmission - not on an average across on and off times of the transmitter.

Determining the applicable transmit antenna gain:



A conducted power measurement will determine the maximum output power associated with a restricted band emission; however, in order to determine the associated EIRP level, the gain of the transmitting antenna (in dBi) must be added to the measured output power (in dBm).

Since the out-of-band characteristics of the EUT transmit antenna will often be unknown, the use of a conservative antenna gain value is necessary. Thus, when determining the EIRP based on the measured conducted power, the upper bound on antenna gain for a device with a single RF output shall be selected as the maximum in-band gain of the antenna across all operating bands, or 2 dBi, whichever is greater. However, for devices that operate in multiple frequency bands while using the same transmit antenna, the highest gain of the antenna within the operating band nearest in frequency to the restricted band emission being measured may be used in lieu of the overall highest gain when the emission is at a frequency that is within 20 percent of the nearest band edge frequency, but in no case shall a value less than 2 dBi be used.

See KDB 662911 for guidance on calculating the additional array gain term when determining the effective antenna gain for a EUT with multiple outputs occupying the same or overlapping frequency ranges in the same band.

Radiated spurious emission test:

An additional consideration when performing conducted measurements of restricted band emissions is that unwanted emissions radiating from the EUT cabinet, control circuits, power leads, or intermediate circuit elements will likely go undetected in a conducted measurement configuration. To address this concern, a radiated test shall be performed to ensure that emissions emanating from the EUT cabinet (rather than the antenna port) also comply with the applicable limits.

For these cabinet radiated spurious emission measurements the EUT transmit antenna may be replaced with a termination matching the nominal impedance of the antenna. Procedures for performing radiated measurements are specified in ANSI C63.10. All detected emissions shall comply with the applicable limits.

The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The Turn Table is actuated to turn from 0° to 360°, and both horizontal and vertical polarizations of the Test Antenna are used to find the maximum radiated power. Mid channels on all channel bandwidth verified. Only the worst RB size/offset presented.

The power of the EUT transmitting frequency should be ignored.

All Spurious Emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured RBW = 1 MHz for $f \ge 1$ GHz, 100 kHz for f < 1 GHz VBW \ge RBW Sweep = auto Detector function = peak Trace = max hold

5.7.4 Test Result

Please refer to ANNEX A.6.



5.8 Band Edge (Restricted-band band-edge)

5.8.1 Limit

FCC §15.209&15.247(d); RSS-GEN, 8.10; RSS-247, 5.5

Radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

5.8.2 Test Setup

See section 4.4.3 to 4.4.5 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.8.3 Test Procedure

The measurement frequency range is from 9 kHz to the 10th harmonic of the fundamental frequency. The Turn Table is actuated to turn from 0° to 360°, and both horizontal and vertical polarizations of the Test Antenna are used to find the maximum radiated power. Mid channels on all channel bandwidth verified. Only the worst RB size/offset presented.

The power of the EUT transmitting frequency should be ignored.

All Spurious Emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured RBW = 1 MHz for $f \ge 1$ GHz, 100 kHz for f < 1 GHz VBW \ge RBW Sweep = auto Detector function = peak Trace = max hold

For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported, Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

For transmitters operating above 1 GHz repeat the measurement with an average detector.

1.1.1 Test Result

Please refer to ANNEX A.7.



5.9 Power Spectral density (PSD)

5.9.1 Limit

FCC §15.247(e); RSS-247, 5.2 (b)

The same method of determining the conducted output power shall be used to determine the power spectral density. If a peak output power is measured, then a peak power spectral density measurement is required. If an average output power is measured, then an average power spectral density measurement should be used.

The transmitter power spectral density conducted from the transmitter 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 Section 5.4(4), (i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power).

5.9.2 Test Setup

See section 4.4.1 (Diagram 1) for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.9.3 Test Procedure

Set analyzer center frequency to DTS channel center frequency.

Set the span to 1.5 times the DTS bandwidth.

Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.

Set the VBW \geq 3 RBW.

Detector = peak.

Sweep time = auto couple.

Trace mode = max hold.

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum amplitude level within the RBW.

If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

5.9.4 Test Result

Please refer to ANNEX A.7.



ANNEX A TEST RESULT

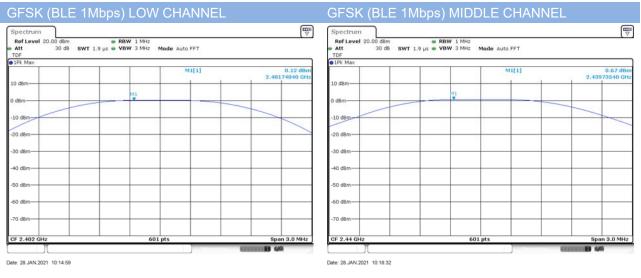
A.1 Output Power, Duty Cycle

Peak Power Test Data

	Measured Output Peak Power		Limit			
Channel	GFSK (BLI	E 1Mbps)	dPm	mW	Verdict	
	dBm	mW	dBm	mvv		
Low	0.12	1.03			Pass	
Middle	0.67	1.17	30	1000	Pass	
High	0.70	1.17			Pass	

	Measured Output Peak Power		Limit			
Channel	GFSK (BLE	GFSK (BLE 2Mbps) dBm		mW	Verdict	
	dBm	mW	UDIII	IIIVV		
Low	0.68	1.17			Pass	
Middle	0.79	1.20	30	1000	Pass	
High	0.49	1.12			Pass	

Test plots

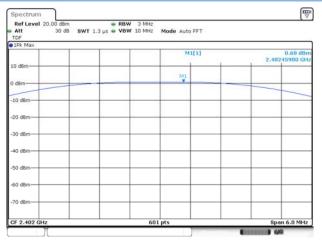




GFSK (BLE 1Mbps) HIGH CHANNEL



GFSK (BLE 2Mbps) LOW CHANNEL



GFSK (BLE 2Mbps) MIDDLE CHANNEL

1Pk Max		 		
		MI	[1]	0.79 dB 2.44031900 G
LO dBm				
) d8m	-	 M1		
10 dBm	-			
20 dBm		 		_
30 dBm				
40 dBm				
50 dBm				
60 dBm				
70 dBm	_			

GFSK (BLE 2Mbps) HIGH CHANNEL

Ref Level 20.00 dBm Att 30 dB TDF	SWT 1.3 µs SWBW		25.0
1Pk Max			
		M1[1]	0.49 dBr 2.48030900 GH
10 dBm		MI	
0 d8m			
-10 dBm			
20 dBm			
30 dBm			
40 dBm			
50 dBm			
60 dBm			
-70 dBm			

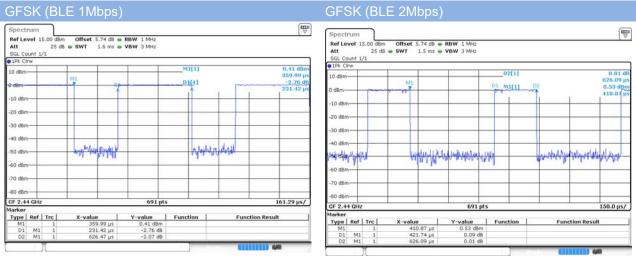


Report No.: BL-SZ2110505-601

Duty Cycle Test Data

Band	On Time	On+Off Time	Duty Cycle
Dalia	(ms)	(ms)	(%)
GFSK (BLE 1Mbps)	0.39505	0.62647	63.06%
GFSK (BLE 2Mbps)	0.20435	0.62609	32.64%

Test plots



Date: 28 JAN 2021 10:19:53



A.2 Occupied Bandwidth

Test Data

Test Mode	GFSK (BLE 1Mbps)				
Channel	6 dB Bandwidth	99% Bandwidth	6 dB Bandwidth		
	(kHz)	(kHz)	Limits (kHz)		
Low Channel	656.494	1020.260	≥500		
Middle Channel	652.100	1015.919	≥500		
High Channel	652.100	1020.260	≥500		

Test Mode	GFSK (BLE 2Mbps)				
Channel	6 dB Bandwidth	99% Bandwidth	6 dB Bandwidth		
	(kHz)	(kHz)	Limits (kHz)		
Low Channel	1165.283	2016.000	≥500		
Middle Channel	1165.283	2016.000	≥500		
High Channel	1165.283	2022.000	≥500		

Test plots

6 dB Bandwidth



Date: 28 JAN 2021 10:15:05

GFSK (BLE 1Mbps) HIGH CHANNEL



Date: 28 JAN 2021 10:20:35

GFSK (BLE 1Mbps) MIDDLE CHANNEL



Date: 28 JAN 2021 10:18:38

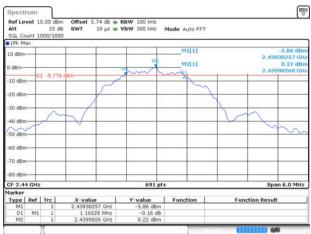


Report No.: BL-SZ2110505-601

GFSK (BLE 2Mbps) LOW CHANNEL

GFSK (BLE 2Mbps) MIDDLE CHANNEL





GFSK (BLE 2Mbps) HIGH CHANNEL





99% Bandwidth



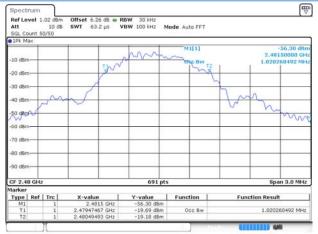


Ref Level Att SGL Count	1.14 dBm 10 dB	Offset 5.74 dB 🗰 R SWT 63.2 µs V		Node Auto FFT		
• 1Pk Max	30/30					
-10 dBm			m	M1[1]	2	-55,62 dB 2,44150000 G 1,015918958 M
-20 d8m-	-	The second		ma	<u> </u>	
-30 dBm					5	
-40 dBm	m		-		har	M
-50 dag						mon
-60 d8m-				-	-	
-70 dBm						
-80 dBm					_	
-90 dBm				_		
CF 2.44 G	-lz		691 pts	5		Span 3.0 MH
Marker						
Type Re M1	f Trc	2.4415 GHz	-55,62 dBm	Function	Fund	tion Result
T1	1	2.43947467 GHz	-18.45 dBm	Occ Bw		1.015918958 MH
T2	1	2.44049059 GHz	-19.11 dBm	200 011		

Date: 28 JAN 2021 10:18:44

Date: 28 JAN 2021 10:15:11

GFSK (BLE 1Mbps) HIGH CHANNEL



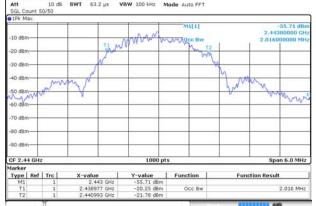
Date: 28 JAN 2021 10:20:41

GFSK (BLE 2Mbps) LOW CHANNEL



αρτούτυπη Ref Level 1.27 dBm Offset 5.74 dB RBW 30 kHz Att 10 dB SWT 63.2 μs VBW 100 kHz Mode Auto FFT SQL Count S0/50 91Pk Max

Emi ▽





GFSK (BLE 2Mbps) HIGH CHANNEL

Ref Level Att SGL Count	10 d		RBW 30 kHz VBW 100 kHz M	ode Auto FFT		
10 dBm		Tfur	WWW	M1[1]	2	-56,57 dBm 2,48300000 GH 2,022000000 MH;
30 d8m	~^	my m			m m	Mynym
70 dBm						
CF 2.48 GH	łz		1000 pt:			Span 6.0 MHz
Type Re M1 T1 T2	f Trc 1	X-value 2.483 GHz 2.478983 GHz 2.481005 GHz	Y-value -56.57 dBm -22.28 dBm -22.31 dBm	Function Occ 8w	Func	tion Result 2.022 MHz



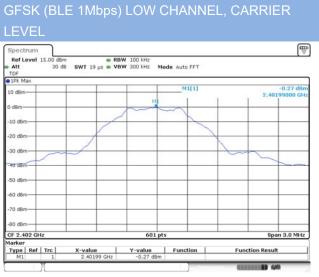
A.3 Conducted Spurious Emissions

<u>Test Data</u>

	GF	SK (BLE 1Mbps)		
	Maggurad May, Out of	Limit (
Channel	Measured Max. Out of Band Emission (dBm)	Carrier Level	Calculated	Verdict
			20 dBc Limit	
Low	-34.00	-0.27	-20.27	Pass
Middle	-34.99	0.28	-19.72	Pass
High	-34.04	0.30	-19.70	Pass

	GF	SK (BLE 2Mbps)		
	Monourod Mox. Out of	Limit (
Channel	Measured Max. Out of	Carrier Level	Calculated	Verdict
	Band Emission (dBm)	Carrier Lever	20 dBc Limit	
Low	-34.30	0.20	-19.80	Pass
Middle	-34.29	-34.29 0.29		Pass
High	-36.13	-0.01	-20.01	Pass

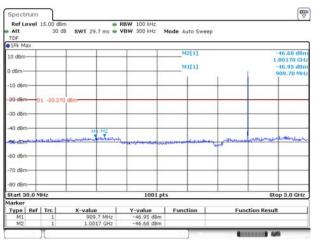
Test Plots



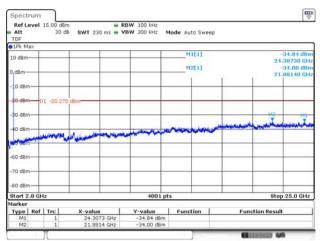
Date: 28.JAN.2021 10:15:25



GFSK (BLE 1Mbps) LOW CHANNEL, SPURIOUS



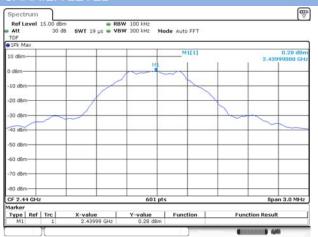
GFSK (BLE 1Mbps) LOW CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



Date: 28 JAN 2021 10 16 05

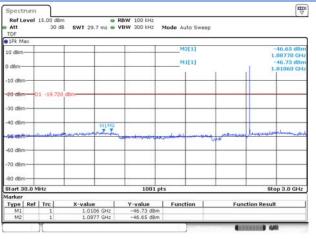
Date: 28 JAN 2021 10:15:53

GFSK (BLE 1Mbps) MIDDLE CHANNEL, CARRIER LEVEL



Date: 28.JAN.2021 10:18:55

GFSK (BLE 1Mbps) MIDDLE CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



Date: 28.JAN 2021 10:19:23

GFSK (BLE 1Mbps) MIDDLE CHANNEL, SPURIOUS 2 GHz ~ 25 GHz

1Pk M	the contract of the second sec								
10 dBm	1	-				M1[1]		16.5	7.31 dB/ 2950 GH
0,d8m-	_	_	_	_		M2[1]			4.99 dB
-10 dBm		_	_			-	1		0980 Gi
-20 dBm	01 -19	720 dBin-	_	_		-	-		
1.000									
-30 dBm	-	_				MI	-		M2
1.000						M1	منابعود سویل	-	M2
-30 dBn -40 dBn			مەرىلانى <i>م</i> ىمىرى	-	unu	M1	مندلامین الم	henripheren	M2
1.000		-	, second de la compansa	-	unu	M12		han i present	M2
O dBm	www.	-	and the second	فيحتمين	and the second	Ma .	مەر مەر يەر ب ور دىمەر مەر يەر مەر يەر يەر يەر يەر يەر يەر يەر يەر يەر ي		M2
O dBm	www.	www		and the second second	-	M12			112 Lutzoitus
O dBr NG Gon -60 dBr		-				Mi Land			M2-
0 dBm -60 dBm -70 dBm				4001		M3		Stop	142 1412 1412 1412 1412 1412 1412
	.0 GHz				1 pts				142- 25.0 GH
		X-v	alue 6.5295 GHz		1 pts	ction	Fun	Stop :	112 2.412 miles



GFSK (BLE 1Mbps) HIGH CHANNEL, CARRIER



Date: 28.JAN.2021 10:20:53

GFSK (BLE 1Mbps) HIGH CHANNEL, SPURIOUS 30 MHz ~ 3 GHz

Ref Level	15.00 dB			RBW 100 kHz VBW 300 kHz	Iode Auto Swe	00	
TDF		5 UNI 25		DI GOD MIL I	Note Hoto She	ah.	
1Pk Max							
10 dBm		-			M1[1]		-46.68 dBm 1.04320 GHz
1000		1			M2[1]		-46.44 dBm
0 dBm		-	-		control and		1.00470 GHz
10000					1	1 1	
-10 dBm		1		2	2		
-20 dBm-0	1 -19.70	0 dBm					
000000							
-30 dBm-		+	-			-	
3535							
-40 dBm-		-	MMI			-	
to daminate	12 Minor	- Autorian and	within		معاملين بلمعيدين	all more las	and any and a strategic the
-uu uum					Contraction of the second	ww	
-60 dBm						-	
		1					
-70 d8m-		1	1				
-80 dBm-							
Start 30.0 N				1001 pt		1	Stop 3.0 GHz
Start 30.0 Marker	IHZ			1001 pt			stop 3.0 GHZ
	Trc	X-value	. 1	Y-value	Function	Euro	tion Result
M1	1		32 GHz	~46.68 dBm	- unschutt	Func	AND ROAM
M2	1	1.00	47 GHz	-46.44 dBm			

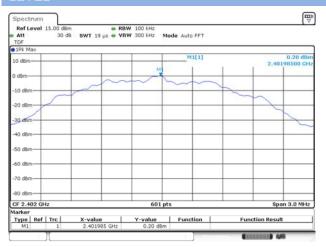
GFSK (BLE 1Mbps) HIGH CHANNEL, SPURIOUS 2 GHz ~ 25 GHz

Ref Lev	el 15.00 dB 30 d			BW 100 kHz BW 300 kHz					
TDF	30 0	o owi 2	30 ms - •	544 300 KH2	Mode Auto	Sweep			
1Pk Max	S								
10 d8m-	-	-	-	-	M2[1]			-34.04 dBm
					MIE	11			-35.04 dBm
0 d8m	-					-			.65200 GH
1000									1
-10 dBm-	-								
-20 d8m-	D1 -19.70	0 dBm	-	-					
1.000		1							
-30 d8m-			-						MI
				-			مىلىرىمى	-	-
-30 d8m-	معيدادان		معدر بن بالحد	مريني المسالية الماريني . المرينية المارينية ال	min	marini parti	مناطبيهم	wind	-
-40 dBm		and the state of the state		an shine was	m	nethicall	ميتجنيطي	min	-
-40 dBm-	an and the second	and the state of the	- distance	-	white	n si ta nati	ality-spaces		in mi
-40 dBm-	ameteriany	and the second second	مان بان بان م		-	neticipatt	مىلىرىيى مىلىرىيى		MI MI
-40 dBm-		and a second second	میرانی، ا		chicke	netiti yah	and the second		land in Strate
-40 dBm-		and the second s				net this with	aller and a second		lunin ja seede
-40 dBm-		in the section of the	-		~~~~	mathic	and and a second se		
-10 dBm- -60 dBm- -70 dBm-		and the second sec	-	4001 p		ner this said		Sto	p 25.0 GHz
-10 dBm- -60 dBm- -70 dBm- -80 dBm- Start 2.0 Marker	GHz	and the second sec				n.5056,24 ⁴⁴		1.02	
-40 dBm- -60 dBm- -70 dBm- -80 dBm-	GHz	X-valu			nts		Fun	Sto	

Date: 28 JAN 2021 10:21:26

Date: 28 JAN 2021 10:21:40

GFSK (BLE 2Mbps) LOW CHANNEL, CARRIER





Report No.: BL-SZ2110505-601

GFSK (BLE 2Mbps) LOW CHANNEL, SPURIOUS

Spectrum Ref Level 15.00 dBm @ RBW 100 kHz Att 30 dB SWT 29.7 ms VBW 300 kHz Mode Auto Sweep TDF • 1Pk Mao M2[1] 46.64 dt 10 dBm 995,80 M -46.64 d M1[1] 0 dên 10 dBm -20 dBm 01 -19.8 -30 dBm -40 d8rr Mai 50-d8 -60 dBm -70 dBm -80 dBm Start 30.0 MHz 1001 pts Stop 3.0 GHz Type Ref Trc X-value 1.0254 GHz 995.8 MHz Y-value 2 -46.64 dBm 2 -46.64 dBm Function Function Result M2

GFSK (BLE 2Mbps) LOW CHANNEL, SPURIOUS 2 GHz ~ 25 GHz

	evel :	15.00 dB			8W 100 kHz			
TDF		30 d	B SWT 23	10 ms 🖷 V	BW 300 kHz	Mode Auto Swee	P	
1Pk M	ax							
10 dBm	_			-		M1[1]		-39.57 dBn
						M2[1]		12.88490 GH -34.30 dBn
-m8b 0	-		-	-	-	(instal		24,39350 GH
1								1.000
0 dBn	1							
20 dbn	-0	1 -19.80	0 dBm		-			
12,226								
-30 dBn	-						_	- M2
122					MI	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		م الالا يستين الما الم الم الم
0 dBn		-	A	110 all all all all all all all all all al	الرالي المصادم ومعالي	The second country		
de den	-	where a	-	مانويانلية الله	man	No. a real frame		
		-	- Annor	-	- Contraction	Ma a series and		
		www.	and and the second	-				
60 dBn		working		-				
-60 dBn		*****	-					
-10 dBn -60 dBn -70 dBn -80 dBn		*****						
-60 dBn -70 dBn -80 dBn		z			4001			Stop 25.0 GHz
-60 dBn -70 dBn -80 dBn Start 2 Jarker	.0 GH				4001	pts		
-60 dBn -70 dBn	.0 GH		X-valu			pts		Stop 25.0 GHz

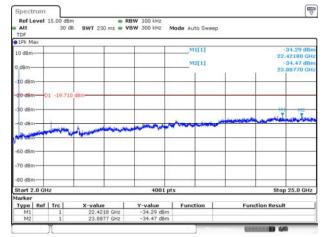
GFSK (BLE 2Mbps) MIDDLE CHANNEL, CARRIER LEVEL



GFSK (BLE 2Mbps) MIDDLE CHANNEL, SPURIOUS 30 MHz ~ 3 GHz

Ref Lev Att	vel 15.00			RBW 100 kHz VBW 300 kHz	Mode Au	ito Swee	ep		
1 Pk Max	e ::								
10 dBm-		-			M	1[1]			46.62 dBm
10.00111									.02540 GH
0 d8m-		_			M	2[1]			-46.80 dBn .11450 GH
						1	1	1 1	111100 011
-10 dBm-	-			-					
-20 dBm-	01 10	.710 dBm							
-20 dBm-	01 -15	17 10 dBm							
-30 dBm-	_	_	_						
-40 d8m-	1	-	M1 M2	12 - 12 F					
50 dent	un and an	- alexander	markinde			and loss	and strength	Joanster	in million
Contraction of the second	2				-		ww	1.1	
-60 dBm-	-	_	-				_		
-70 dBm-	-	_	-	-				-	-
-80 dBm-									
								1	1
Start 30 Marker	.0 MHZ			1001 pt	5			st	op 3.0 GHz
	Ref Trc	1 X-va	due 1	Y-value	Fund	tion 1	Eur	ction Resul	
M1	1		.0254 GHz	-46.62 dBm	· unc			action rep star	
M2	1	1	.1145 GHz	-46.80 dBm					

GFSK (BLE 2Mbps) MIDDLE CHANNEL, SPURIOUS 2 GHz ~ 25 GHz





GFSK (BLE 2Mbps) HIGH CHANNEL, CARRIER



GFSK (BLE 2Mbps) HIGH CHANNEL, SPURIOUS 30 MHz ~ 3 GHz

RefLe	vel 1	5.00 dBm	13		RBW 100 kHz			
Att		30 dB	SWT 29	.7 ms 🖷	VBW 300 kHz	Mode Auto Sv	weep	
TDF 1Pk Ma							1.143243	
10 dBm-	1					M1[1]		-46.94 dBm
10 dBm-								257.00 MH
-m8b 0					_	M2[1]		-47.45 dBn
						1	- Ci	903.80 MH
-10 dBm	+		-	-	-			
-20 dBm	-D1	-20.010	dBm	-				
-30 dBm								
-30 0011								
-40 dBm	-	_	M		-			
			- determined	Lenner	Hannahman		Contraction of the second	a manufarment
ABOAdefh	and and	-spines	A Manual Control of the Pro-		Hannahman	And the state of t	and particular	
-60 dBm	_							
-00 0011								
-70 dBm	-			-	-			
-80 dBm	-							
Start 3	0.0 MH	lz			1001 p	ts		Stop 3.0 GHz
						21		
Marker	Ref		X-value	.0 MHz	-46.94 dBm	Function	Fu	nction Result
Type M1		1						

GFSK (BLE 2Mbps) HIGH CHANNEL, SPURIOUS 2 GHz ~ 25 GHz

Att SGL TO		30 d	B SWI 2	30 ms 🖝 🗸	BW 300 kHz M	lode Auto Swee	P	
1Pk M	ax							
10 dBm	-			-	-	M2[1]		-36.13 dBn 24.26710 GH
			1			M1[1]		-36.16 dBn
-m8b 0	-		-	-		out of		23,49680 GH
40.000				1		1	1	1
-10 dBn				-				
-20 dbn	_	1 -20.01	d dam					
20 000	1	1 -20-01	o dein					
-30 dBn								
-30 dBn	-						-	M1 M2
-30 dBn -40 dBn					and a sector state	A as the second	-	
		a have been	1	-	المراجعة والمحالية والجوالي	Mary Harrison	-	
		adain you	-	neshy havin	he for the state of the state o	Personal States	nt of the second second	
-40 dBn		adain the second	-	read _a transfer	hebe in class in a left of the	Prosidential and		
		a laint prov		ne hann	han an a	prosition and the		
-40 dBn -50 dBn	-	AND MAN			an a	province and the	and the second second	
-40 dBn	-	a deside the			and the second second second	Marjika welira,		
-40 dBn pol dBn -60 dBn	, , ,	alasista	-	(deally) in the	en e	Arriteruneire,		
-40 dBn -60 dBn -70 dBn -80 dBn Start 2		a da interimenta da i I z	-		4001 pt;			
-10 dBn -60 dBn -70 dBn -80 dBn Start 2 Marker	.0 GH				4001 pt:	5		Stop 25.0 GHz
-40 dBn -60 dBn -70 dBn			X-valu					a _{n an} an initial of the party



A.4 Band Edge (Authorized-band band-edge)

Note: The lowest and highest channels are tested to verify the band edge emissions. Please refer to the following the plots for emissions values.

BLE 1Mbps

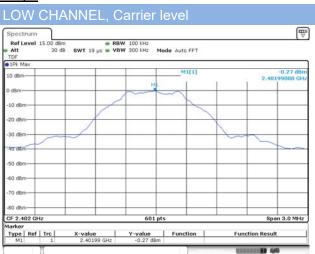
	Measured Max. Band	Limit	(dBm)	
Channel	Edge Emission (dBm)	Carrier Level	Calculated 20 dBc Limit	Verdict
Low Channel	-32.96	-0.27	-20.27	Pass
High Channel	-41.23	0.30	-19.70	Pass

BLE 2Mbps

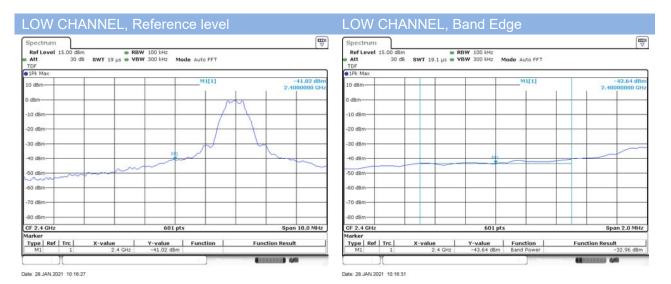
	Measured Max. Band	Limit	(dBm)	
Channel	Edge Emission (dBm)	Carrier Level	Calculated 20 dBc Limit	Verdict
Low Channel	-23.27	0.20	-19.80	Pass
High Channel	-42.48	-0.01	-20.01	Pass

Test Plots

BLE 1Mbps



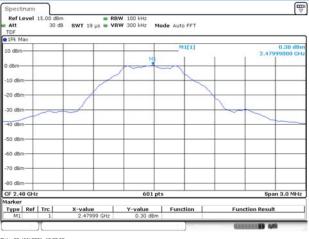
Date: 28.JAN.2021 10:15:25



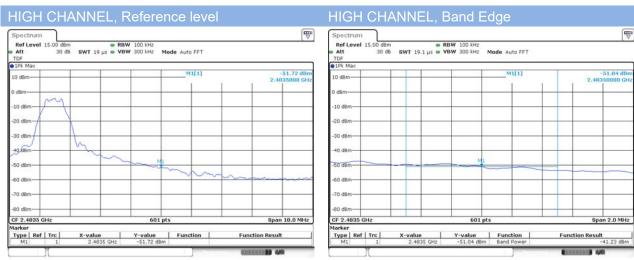


(♥

51.04 dB



Date: 28.JAN.2021 10:20:53



Date: 28 JAN 2021 10:21:48

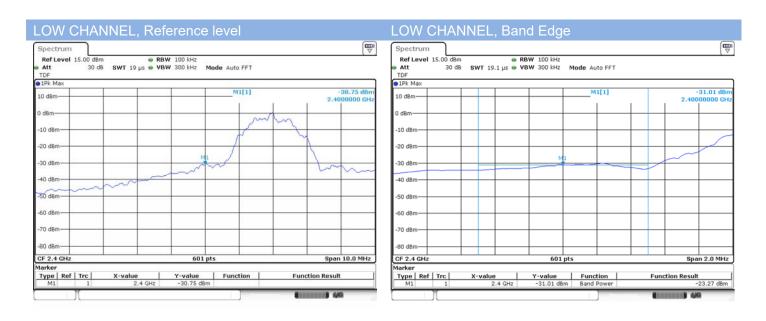
Date: 28 JAN 2021 10:21:53



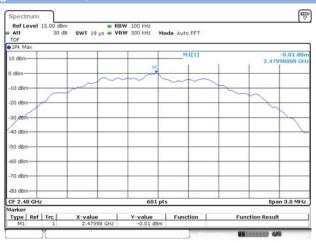
BLE 2Mbps

LOW CHANNEL, Carrier level

Ref Level 15.00 dBn Att 30 dB		W 100 kHz W 300 kHz M	ode Auto FFT		
TDF 1Pk Max					
10 d8m			M1[1]		0.20 dBr 2.40198500 GH
0 d8m		M			
-10 dBm					
-20 d8m					
30 dBm					
40 dBm					
50 dBm					
60 dBm					
70 dBm					
80 dBm					
CF 2.402 GHz larker		601 p	ts		Span 3.0 MHz
larker Type Ref Trc	X-value	Y-value	Function	Function	Result



High CHANNEL, Carrier level





HIGH CHANNEL, Reference level



Spectrum					(U
RefLevel 15.00 dB		RBW 100 kHz	Mode Auto FFT		
TDF	on maps				
• 1Pk Max					
10 dBm			M1[1]	2.4	-52.66 dBi B350000 GH
0 dBm					+
-10 dBm-	-	_			
-20 dBm					
-30 dBm					-
-40 dBm					
-50 dBm		MI			
-60 dBm		_			
-70 dBm		_			
-80 dBm					
CF 2.4835 GHz	ci edit do	601 p	ts	SI	pan 2.0 MHz
Marker Type Ref Trc	X-value	Y-value	Function	Function Resu	

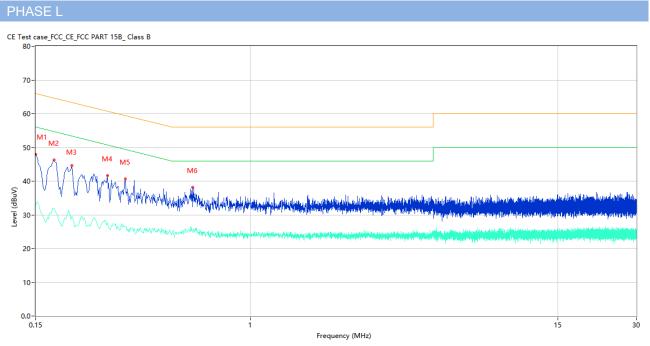


A.5 Conducted Emissions

Note ¹: The EUT is working in the Normal link mode. All modes have been tested and normal link mode is worst. Note ²: Devices subject to Part 15 must be tested for all available U.S. voltages and frequencies (such as a nominal 120 VAC, 60 Hz and 240 VAC, 50 Hz) for which the device is capable of operation. So, The configuration 120 VAC, 60 Hz and 240 VAC, 50 Hz were tested respectively, but only the worst configuration (120 VAC, 60 Hz) shown here.

Note ³: Results (dBuV) = Original reading level of Spectrum Analyzer (dBuV) + Factor (dB)

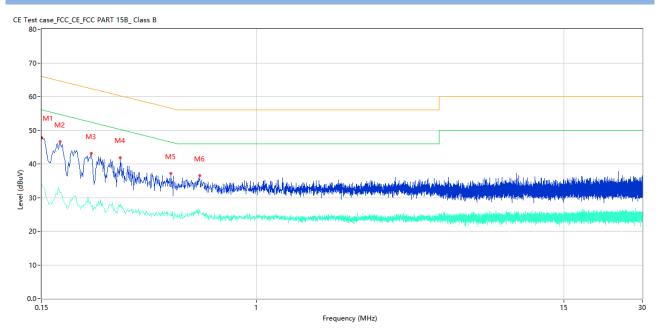
Test Data and Plots



No.	Frequency	Results	Factor	Limit	Over Limit	Detector	Line	Verdict
	(MHz)	(dBuV)	(dB)	(dBuV)	(dB)			
1	0.150	47.94	10.41	66.00	-18.06	Peak	L	Pass
1**	0.150	32.94	10.41	56.00	-23.06	AV	L	Pass
2	0.176	46.29	10.39	64.67	-18.38	Peak	L	Pass
2**	0.176	31.87	10.39	54.67	-22.80	AV	L	Pass
3	0.206	44.58	10.38	63.37	-18.79	Peak	L	Pass
3**	0.206	29.65	10.38	53.37	-23.72	AV	L	Pass
4	0.282	41.60	10.34	60.76	-19.16	Peak	L	Pass
4**	0.282	27.62	10.34	50.76	-23.14	AV	L	Pass
5	0.330	40.69	10.33	59.45	-18.76	Peak	L	Pass
5**	0.330	26.40	10.33	49.45	-23.05	AV	L	Pass
6	0.600	38.14	10.28	56.00	-17.86	Peak	L	Pass
6**	0.600	24.86	10.28	46.00	-21.14	AV	L	Pass



PHASE N



No.	Frequency	Results	Factor	Limit	Over Limit	Detector	Line	Verdict
	(MHz)	(dBuV)	(dB)	(dBuV)	(dB)			
1	0.150	47.70	10.41	66.00	-18.30	Peak	Ν	Pass
1**	0.150	34.13	10.41	56.00	-21.87	AV	N	Pass
2	0.176	46.57	10.39	64.67	-18.10	Peak	N	Pass
2**	0.176	31.42	10.39	54.67	-23.25	AV	N	Pass
3	0.232	43.09	10.36	62.38	-19.29	Peak	N	Pass
3**	0.232	27.28	10.36	52.38	-25.10	AV	N	Pass
4	0.300	41.88	10.33	60.24	-18.36	Peak	N	Pass
4**	0.300	28.13	10.33	50.24	-22.11	AV	N	Pass
5	0.468	37.17	10.30	56.55	-19.38	Peak	N	Pass
5**	0.468	25.92	10.30	46.55	-20.63	AV	N	Pass
6	0.606	36.56	10.28	56.00	-19.44	Peak	Ν	Pass
6**	0.606	25.82	10.28	46.00	-20.18	AV	Ν	Pass



A.6 Radiated Spurious Emission

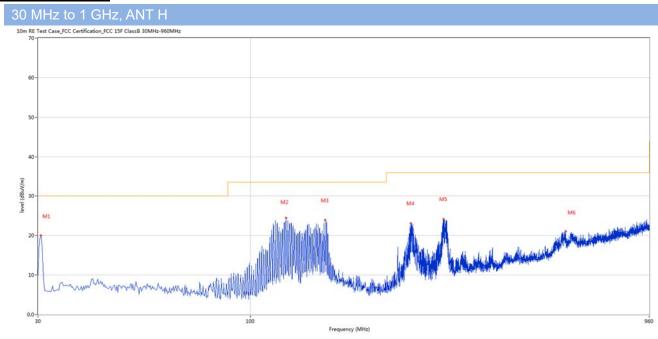
Note ¹: The symbol of "--" in the table which means not application.

Note²: For the test data above 1 GHz, according the ANSI C63.4-2014, where limits are specified for both average and peak (or quasi-peak) detector functions, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement.

Note ³: The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

Note ⁴: The EUT is working in the Normal link mode below 1 GHz. All modes have been tested and BLE 2M-High channel mode is the worst.

Note ⁵: Results (dBuV/m) = Original reading level of Spectrum Analyzer (dBuV/m) + Factor (dB)

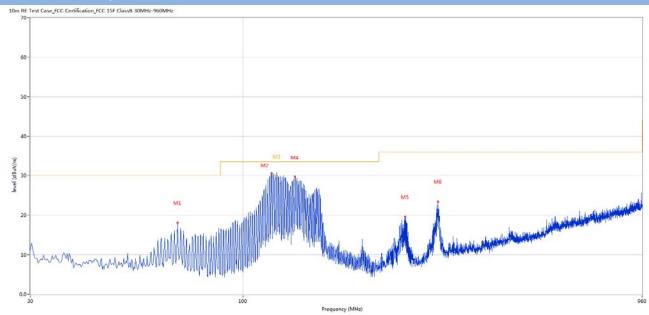


No.	Frequency	Results	Factor	Limit	Over Limit	Detector	Table	Height	Antenna	Verdict
	(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dB)		(Degree)	(cm)		
1	30.465	19.96	-27.46	30.0	-10.04	Peak	360.00	200	Horizontal	Pass
2	122.512	24.39	-27.86	33.5	-9.11	Peak	14.00	200	Horizontal	Pass
3	152.729	23.87	-25.93	33.5	-9.63	Peak	192.00	200	Horizontal	Pass
4	248.495	23.07	-27.44	36.0	-12.93	Peak	306.00	200	Horizontal	Pass
5	299.400	24.13	-25.88	36.0	-11.87	Peak	123.00	200	Horizontal	Pass
6	598.320	21.06	-17.94	36.0	-14.94	Peak	192.00	200	Horizontal	Pass

Test Data and Plots



30 MHz to 1 GHz, ANT V



No.	Frequency	Results	Factor	Limit	Over Limit	Detector	Table	Height	Antenna	Verdict
	(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dB)		(Degree)	(cm)		
1	69.050	18.06	-29.55	30.0	-11.94	Peak	130.00	100	Vertical	Pass
2	117.631	30.50	-28.26	33.5	-3.00	Peak	148.00	100	Vertical	Pass
3	121.214	31.22	-27.88	33.5	-2.28	Peak	104.00	139	Vertical	N/A
3*	121.214	29.91	-27.88	33.5	-3.59	QP	104.00	139	Vertical	Pass
4	134.366	29.66	-26.93	33.5	-3.84	Peak	199.00	100	Vertical	Pass
5	250.820	19.55	-27.37	36.0	-16.45	Peak	325.00	100	Vertical	Pass
6	301.725	23.38	-25.63	36.0	-12.62	Peak	360.00	200	Vertical	Pass



Note 1: The marked spikes near 2400 MHz with circle should be ignored because they are Fundamental signal.

Note 2: The spurious from 18GHz-25GHz is noise only, do not show on the report.

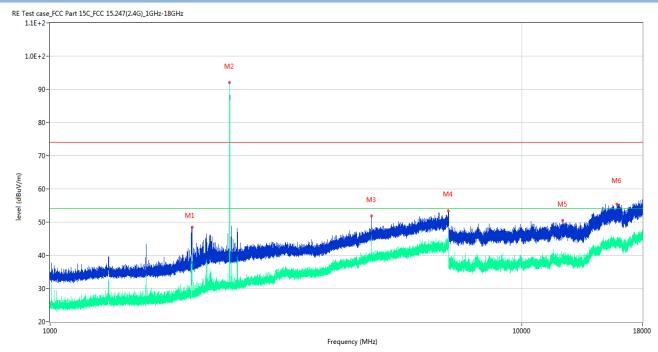
GFSK (BLE 1Mbps) LOW CHANNEL 1 GHz to 18 GHz, ANT H



No.	Frequency	Results	Factor	Limit	Over Limit	Detector	Table	Height	Antenna	Verdict
	(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dB)		(Degree)	(cm)		
1	1596.600	43.32	-15.25	74.0	-30.68	Peak	231.00	150	Horizontal	Pass
1**	1596.600	30.13	-15.25	54.0	-23.87	AV	231.00	150	Horizontal	Pass
2	2401.800	95.24	-10.61	74.0	21.24	Peak	315.00	150	Horizontal	N/A
2**	2401.800	94.02	-10.61	54.0	40.02	AV	315.00	150	Horizontal	N/A
3	4803.600	50.03	-1.22	74.0	-23.97	Peak	179.00	150	Horizontal	Pass
3**	4803.600	42.73	-1.22	54.0	-11.27	AV	179.00	150	Horizontal	Pass
4	6925.000	53.10	4.19	74.0	-20.90	Peak	319.00	150	Horizontal	Pass
4**	6925.000	42.71	4.19	54.0	-11.29	AV	319.00	150	Horizontal	Pass
5	12360.150	50.86	19.63	74.0	-23.14	Peak	183.00	150	Horizontal	Pass
5**	12360.150	39.22	19.63	54.0	-14.78	AV	183.00	150	Horizontal	Pass
6	17325.375	56.97	24.22	74.0	-17.03	Peak	165.00	150	Horizontal	Pass
6**	17325.375	45.72	24.22	54.0	-8.28	AV	165.00	150	Horizontal	Pass



GFSK (BLE 1Mbps) LOW CHANNEL 1 GHz to 18 GHz, ANT V



No.	Frequency	Results	Factor	Limit	Over Limit	Detector	Table	Height	Antenna	Verdict
	(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dB)		(Degree)	(cm)		
1	1998.600	48.52	-13.51	74.0	-25.48	Peak	132.00	150	Vertical	Pass
1**	1998.600	33.61	-13.51	54.0	-20.39	AV	132.00	150	Vertical	Pass
2	2401.700	91.98	-10.62	74.0	17.98	Peak	214.00	150	Vertical	N/A
2**	2401.700	89.69	-10.62	54.0	35.69	AV	214.00	150	Vertical	N/A
3	4804.600	51.91	-1.18	74.0	-22.09	Peak	150.00	150	Vertical	Pass
3**	4804.600	45.95	-1.18	54.0	-8.05	AV	150.00	150	Vertical	Pass
4	6981.800	53.41	4.75	74.0	-20.59	Peak	69.00	150	Vertical	Pass
4**	6981.800	44.00	4.75	54.0	-10.00	AV	69.00	150	Vertical	Pass
5	12203.750	50.46	20.44	74.0	-23.54	Peak	360.00	150	Vertical	Pass
5**	12203.750	39.36	20.44	54.0	-14.64	AV	360.00	150	Vertical	Pass
6	15903.938	55.37	23.34	74.0	-18.63	Peak	33.00	150	Vertical	Pass
6**	15903.938	43.04	23.34	54.0	-10.96	AV	33.00	150	Vertical	Pass





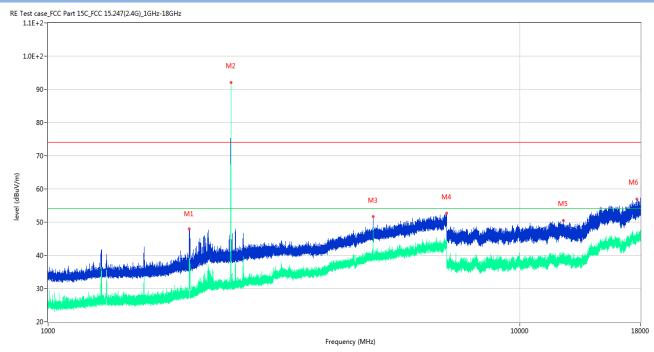
GFSK (BLE 1Mbps) MIDDLE CHANNEL 1 GHz to 18 GHz, ANT H



No.	Frequency	Results	Factor	Limit	Over Limit	Detector	Table	Height	Antenna	Verdict
	(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dB)		(Degree)	(cm)		
1	1598.200	43.59	-15.15	74.0	-30.41	Peak	47.00	150	Horizontal	Pass
1**	1598.200	25.64	-15.15	54.0	-28.36	AV	47.00	150	Horizontal	Pass
2	2439.700	94.80	-10.34	74.0	20.80	Peak	317.00	150	Horizontal	N/A
2**	2439.700	92.78	-10.34	54.0	38.78	AV	317.00	150	Horizontal	N/A
3	4879.800	50.24	-1.26	74.0	-23.76	Peak	170.00	150	Horizontal	Pass
3**	4879.800	44.84	-1.26	54.0	-9.16	AV	170.00	150	Horizontal	Pass
4	6974.600	52.65	5.18	74.0	-21.35	Peak	347.00	150	Horizontal	Pass
4**	6974.600	43.33	5.18	54.0	-10.67	AV	347.00	150	Horizontal	Pass
5	10522.450	50.50	18.32	74.0	-23.50	Peak	54.00	150	Horizontal	Pass
5**	10522.450	37.74	18.32	54.0	-16.26	AV	54.00	150	Horizontal	Pass
6	17680.275	57.11	24.45	74.0	-16.89	Peak	66.00	150	Horizontal	Pass
6**	17680.275	45.89	24.45	54.0	-8.11	AV	66.00	150	Horizontal	Pass



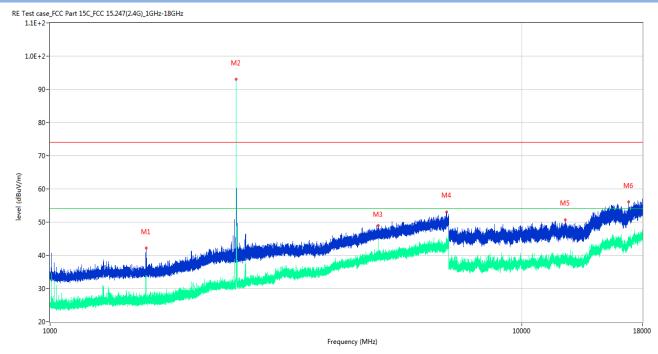
GFSK (BLE 1Mbps) MIDDLE CHANNEL 1 GHz to 18 GHz, ANT V



No.	Frequency	Results	Factor	Limit	Over Limit	Detector	Table	Height	Antenna	Verdict
	(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dB)		(Degree)	(cm)		
1	1991.800	48.00	-13.61	74.0	-26.00	Peak	129.00	150	Vertical	Pass
1**	1991.800	35.24	-13.61	54.0	-18.76	AV	129.00	150	Vertical	Pass
2	2440.200	91.99	-10.37	74.0	17.99	Peak	206.00	150	Vertical	N/A
2**	2440.200	91.32	-10.37	54.0	37.32	AV	206.00	150	Vertical	N/A
3	4880.200	51.78	-1.24	74.0	-22.22	Peak	151.00	150	Vertical	Pass
3**	4880.200	46.54	-1.24	54.0	-7.46	AV	151.00	150	Vertical	Pass
4	6989.400	52.73	4.62	74.0	-21.27	Peak	320.00	150	Vertical	Pass
4**	6989.400	43.79	4.62	54.0	-10.21	AV	320.00	150	Vertical	Pass
5	12350.662	50.52	19.71	74.0	-23.48	Peak	103.00	150	Vertical	Pass
5**	12350.662	39.09	19.71	54.0	-14.91	AV	103.00	150	Vertical	Pass
6	17671.612	57.03	24.36	74.0	-16.97	Peak	350.00	150	Vertical	Pass
6**	17671.612	45.49	24.36	54.0	-8.51	AV	350.00	150	Vertical	Pass



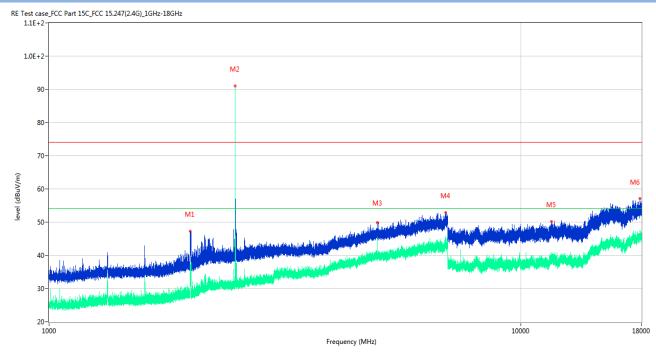
GFSK (BLE 1Mbps) HIGH CHANNEL 1 GHz to 18 GHz, ANT H



No.	Frequency	Results	Factor	Limit	Over Limit	Detector	Table	Height	Antenna	Verdict
	(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dB)		(Degree)	(cm)		
1	1599.500	42.12	-15.19	74.0	-31.88	Peak	353.00	150	Horizontal	Pass
1**	1599.500	26.79	-15.19	54.0	-27.21	AV	353.00	150	Horizontal	Pass
2	2479.700	93.06	-10.27	74.0	19.06	Peak	16.00	150	Horizontal	N/A
2**	2479.700	90.25	-10.27	54.0	36.25	AV	16.00	150	Horizontal	N/A
3	4959.400	48.93	-1.77	74.0	-25.07	Peak	180.00	150	Horizontal	Pass
3**	4959.400	40.83	-1.77	54.0	-13.17	AV	180.00	150	Horizontal	Pass
4	6921.000	53.03	4.51	74.0	-20.97	Peak	353.00	150	Horizontal	Pass
4**	6921.000	43.31	4.51	54.0	-10.69	AV	353.00	150	Horizontal	Pass
5	12348.075	50.69	19.72	74.0	-23.31	Peak	289.00	150	Horizontal	Pass
5**	12348.075	39.16	19.72	54.0	-14.84	AV	289.00	150	Horizontal	Pass
6	16837.650	56.16	23.39	74.0	-17.84	Peak	74.00	150	Horizontal	Pass
6**	16837.650	44.44	23.39	54.0	-9.56	AV	74.00	150	Horizontal	Pass



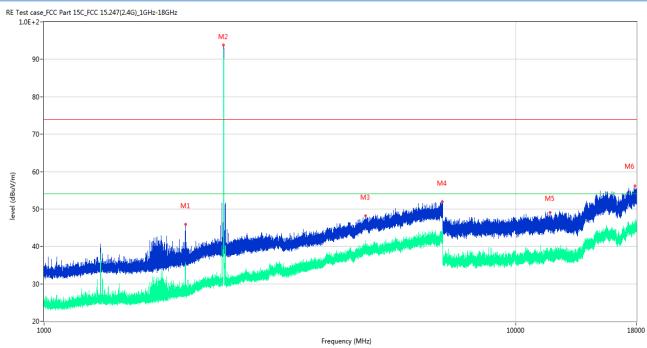
GFSK (BLE 1Mbps) HIGH CHANNEL 1 GHz to 18 GHz, ANT V



No.	Frequency	Results	Factor	Limit	Over Limit	Detector	Table	Height	Antenna	Verdict
	(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dB)		(Degree)	(cm)		
1	1991.500	47.32	-13.61	74.0	-26.68	Peak	125.00	150	Vertical	Pass
1**	1991.500	37.16	-13.61	54.0	-16.84	AV	125.00	150	Vertical	Pass
2	2479.700	90.97	-10.27	74.0	16.97	Peak	208.00	150	Vertical	N/A
2**	2479.700	88.47	-10.27	54.0	34.47	AV	208.00	150	Vertical	N/A
3	4960.400	49.83	-1.70	74.0	-24.17	Peak	152.00	150	Vertical	Pass
3**	4960.400	45.08	-1.70	54.0	-8.92	AV	152.00	150	Vertical	Pass
4	6919.800	52.95	4.51	74.0	-21.05	Peak	142.00	150	Vertical	Pass
4**	6919.800	42.87	4.51	54.0	-11.13	AV	142.00	150	Vertical	Pass
5	11596.838	50.21	20.09	74.0	-23.79	Peak	107.00	150	Vertical	Pass
5**	11596.838	39.84	20.09	54.0	-14.16	AV	107.00	150	Vertical	Pass
6	17882.663	57.09	24.44	74.0	-16.91	Peak	0.00	150	Vertical	Pass
6**	17882.663	45.99	24.44	54.0	-8.01	AV	0.00	150	Vertical	Pass



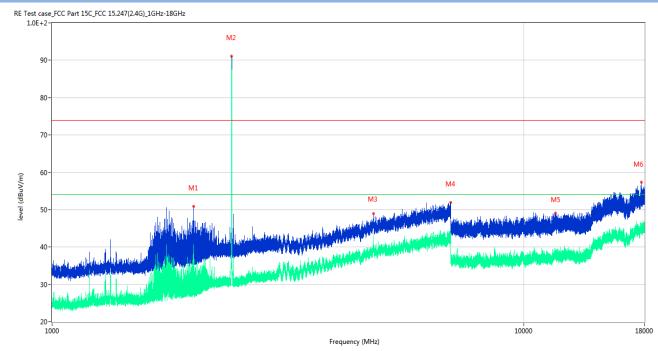
GFSK (BLE 2Mbps) LOW CHANNEL 1 GHz to 18 GHz, ANT H



No.	Frequency	Results	Factor	Limit	Over Limit	Detector	Table	Height	Antenna	Verdict
	(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dB)		(Degree)	(cm)		
1	1995.900	45.97	-13.58	74.0	-28.03	Peak	138.00	150	Horizontal	Pass
1**	1995.900	27.91	-13.58	54.0	-26.09	AV	138.00	150	Horizontal	Pass
2	2401.600	93.76	-10.63	74.0	19.76	Peak	336.00	150	Horizontal	N/A
2**	2401.600	90.79	-10.63	54.0	36.79	AV	336.00	150	Horizontal	N/A
3	4805.000	48.15	-1.19	74.0	-25.85	Peak	335.00	150	Horizontal	Pass
3**	4805.000	41.59	-1.19	54.0	-12.41	AV	335.00	150	Horizontal	Pass
4	6985.200	51.91	4.65	74.0	-22.09	Peak	273.00	150	Horizontal	Pass
4**	6985.200	43.26	4.65	54.0	-10.74	AV	273.00	150	Horizontal	Pass
5	11812.750	49.02	18.45	74.0	-24.98	Peak	103.00	150	Horizontal	Pass
5**	11812.750	37.45	18.45	54.0	-16.55	AV	103.00	150	Horizontal	Pass
6	17877.938	56.20	24.41	74.0	-17.80	Peak	174.00	150	Horizontal	Pass
6**	17877.938	45.53	24.41	54.0	-8.47	AV	174.00	150	Horizontal	Pass



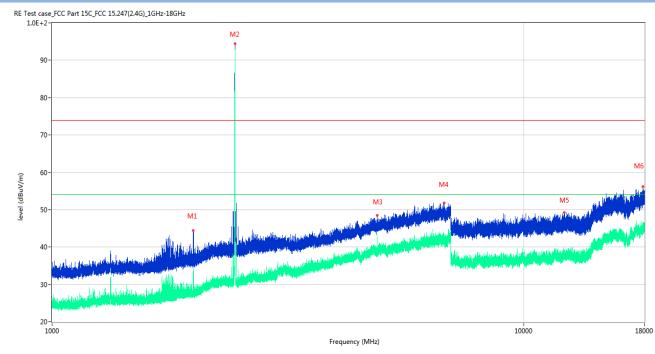
GFSK (BLE 2Mbps) LOW CHANNEL 1 GHz to 18 GHz, ANT V



No.	Frequency	Results	Factor	Limit	Over Limit	Detector	Table	Height	Antenna	Verdict
	(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dB)		(Degree)	(cm)		
1	1994.100	50.93	-13.60	74.0	-23.07	Peak	116.00	150	Vertical	Pass
1**	1994.100	37.42	-13.60	54.0	-16.58	AV	116.00	150	Vertical	Pass
2	2401.500	91.07	-10.65	74.0	17.07	Peak	17.00	150	Vertical	N/A
2**	2401.500	87.55	-10.65	54.0	33.55	AV	17.00	150	Vertical	N/A
3	4804.800	48.99	-1.18	74.0	-25.01	Peak	81.00	150	Vertical	Pass
3**	4804.800	39.75	-1.18	54.0	-14.25	AV	81.00	150	Vertical	Pass
4	6989.800	51.99	4.58	74.0	-22.01	Peak	264.00	150	Vertical	Pass
4**	6989.800	42.55	4.58	54.0	-11.45	AV	264.00	150	Vertical	Pass
5	11672.738	49.12	20.14	74.0	-24.88	Peak	213.00	150	Vertical	Pass
5**	11672.738	37.43	20.14	54.0	-16.57	AV	213.00	150	Vertical	Pass
6	17724.901	57.39	24.09	74.0	-16.61	Peak	208.00	150	Vertical	Pass
6**	17724.901	44.71	24.09	54.0	-9.29	AV	208.00	150	Vertical	Pass



GFSK (BLE 2Mbps) MIDDLE CHANNEL 1 GHz to 18 GHz, ANT H

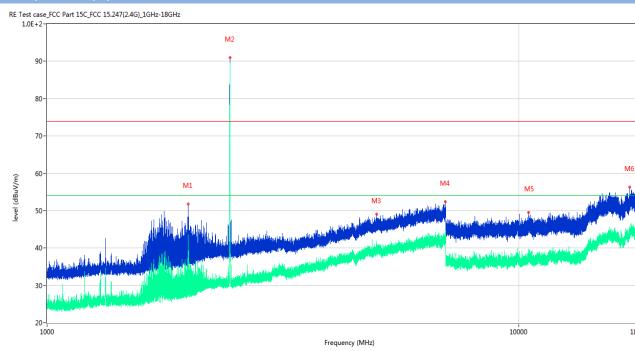


No.	Frequency	Results	Factor	Limit	Over Limit	Detector	Table	Height	Antenna	Verdict
	(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dB)		(Degree)	(cm)		
1	1991.700	44.39	-13.61	74.0	-29.61	Peak	80.00	150	Horizontal	Pass
1**	1991.700	28.70	-13.61	54.0	-25.30	AV	80.00	150	Horizontal	Pass
2	2439.500	94.35	-10.35	74.0	20.35	Peak	339.00	150	Horizontal	N/A
2**	2439.500	91.10	-10.35	54.0	37.10	AV	339.00	150	Horizontal	N/A
3	4881.200	48.50	-1.19	74.0	-25.50	Peak	97.00	150	Horizontal	Pass
3**	4881.200	42.00	-1.19	54.0	-12.00	AV	97.00	150	Horizontal	Pass
4	6765.400	51.82	4.02	74.0	-22.18	Peak	97.00	150	Horizontal	Pass
4**	6765.400	43.68	4.02	54.0	-10.32	AV	97.00	150	Horizontal	Pass
5	12158.037	49.30	20.02	74.0	-24.70	Peak	11.00	150	Horizontal	Pass
5**	12158.037	37.98	20.02	54.0	-16.02	AV	11.00	150	Horizontal	Pass
6	17871.901	56.23	24.35	74.0	-17.77	Peak	61.00	150	Horizontal	Pass
6**	17871.901	44.68	24.35	54.0	-9.32	AV	61.00	150	Horizontal	Pass



18000

GFSK (BLE 2Mbps) MIDDLE CHANNEL 1 GHz to 18 GHz, ANT V

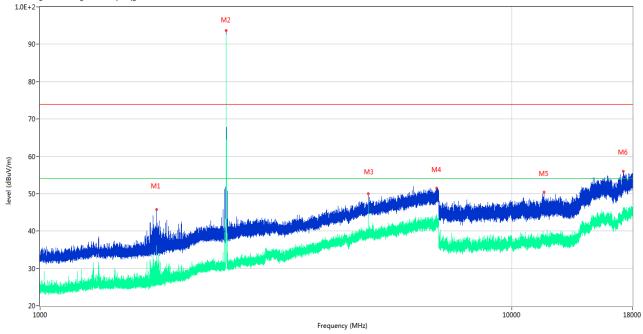


No.	Frequency	Results	Factor	Limit	Over Limit	Detector	Table	Height	Antenna	Verdict
	(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dB)		(Degree)	(cm)		
1	1991.400	51.75	-13.62	74.0	-22.25	Peak	125.00	150	Vertical	Pass
1**	1991.400	34.41	-13.62	54.0	-19.59	AV	125.00	150	Vertical	Pass
2	2440.500	90.94	-10.39	74.0	16.94	Peak	22.00	150	Vertical	N/A
2**	2440.500	87.57	-10.39	54.0	33.57	AV	22.00	150	Vertical	N/A
3	5001.600	49.09	-0.88	74.0	-24.91	Peak	2.00	150	Vertical	Pass
3**	5001.600	39.37	-0.88	54.0	-14.63	AV	2.00	150	Vertical	Pass
4	6969.600	52.41	5.13	74.0	-21.59	Peak	243.00	150	Vertical	Pass
4**	6969.600	42.44	5.13	54.0	-11.56	AV	243.00	150	Vertical	Pass
5	10487.663	49.54	18.51	74.0	-24.46	Peak	195.00	150	Vertical	Pass
5**	10487.663	37.56	18.51	54.0	-16.44	AV	195.00	150	Vertical	Pass
6	17184.150	56.34	23.65	74.0	-17.66	Peak	152.00	150	Vertical	Pass
6**	17184.150	44.14	23.65	54.0	-9.86	AV	152.00	150	Vertical	Pass



GFSK (BLE 2Mbps) HIGH CHANNEL 1 GHz to 18 GHz, ANT H



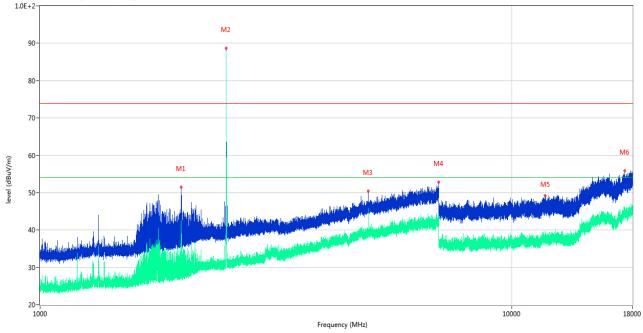


No.	Frequency	Results	Factor	Limit	Over Limit	Detector	Table	Height	Antenna	Verdict
	(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dB)		(Degree)	(cm)		
1	1765.800	45.72	-14.73	74.0	-28.28	Peak	46.00	150	Horizontal	Pass
1**	1765.800	26.41	-14.73	54.0	-27.59	AV	46.00	150	Horizontal	Pass
2	2479.500	93.75	-10.29	74.0	19.75	Peak	336.00	150	Horizontal	N/A
2**	2479.500	90.83	-10.29	54.0	36.83	AV	336.00	150	Horizontal	N/A
3	4959.800	49.91	-1.76	74.0	-24.09	Peak	346.00	150	Horizontal	Pass
3**	4959.800	41.41	-1.76	54.0	-12.59	AV	346.00	150	Horizontal	Pass
4	6921.600	51.53	4.46	74.0	-22.47	Peak	272.00	150	Horizontal	Pass
4**	6921.600	41.96	4.46	54.0	-12.04	AV	272.00	150	Horizontal	Pass
5	11686.825	50.49	19.98	74.0	-23.51	Peak	41.00	150	Horizontal	Pass
5**	11686.825	37.39	19.98	54.0	-16.61	AV	41.00	150	Horizontal	Pass
6	17228.775	56.08	24.06	74.0	-17.92	Peak	234.00	150	Horizontal	Pass
6**	17228.775	44.46	24.06	54.0	-9.54	AV	234.00	150	Horizontal	Pass



GFSK (BLE 2Mbps) HIGH CHANNEL 1 GHz to 18 GHz, ANT V





No.	Frequency	Results	Factor	Limit	Over Limit	Detector	Table	Height	Antenna	Verdict
	(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dB)		(Degree)	(cm)		
1	1991.400	51.46	-13.62	74.0	-22.54	Peak	109.00	150	Vertical	Pass
1**	1991.400	33.41	-13.62	54.0	-20.59	AV	109.00	150	Vertical	Pass
2	2479.500	88.64	-10.29	74.0	14.64		0.00	150	Vertical	N/A
2**	2479.500	86.52	-10.29	54.0	32.52	AV	0.00	150	Vertical	N/A
3	4959.200	50.42	-1.77	74.0	-23.58	Peak	135.00	150	Vertical	Pass
3**	4959.200	44.22	-1.77	54.0	-9.78	AV	135.00	150	Vertical	Pass
4	6989.800	52.82	4.58	74.0	-21.18	Peak	155.00	150	Vertical	Pass
4**	6989.800	42.89	4.58	54.0	-11.11	AV	155.00	150	Vertical	Pass
5	11756.975	49.26	18.88	74.0	-24.74	Peak	-1.00	150	Vertical	Pass
5**	11756.975	37.45	18.88	54.0	-16.55	AV	-1.00	150	Vertical	Pass
6	17324.587	55.80	24.24	74.0	-18.20	Peak	197.00	150	Vertical	Pass
6**	17324.587	44.72	24.24	54.0	-9.28	AV	197.00	150	Vertical	Pass



A.7 Band Edge (Restricted-band band-edge)

Note ¹: The lowest and highest channels are tested to verify the band edge emissions. Please refer to the following the plots for emissions values.

Note ²: The test data all are tested in the vertical and horizontal antenna which the trace is max hold. So these plots have shown the worst case.

Note ³: According the ANSI C63.10-2013, where limits are specified for both average and peak (or quasi-peak) detector functions, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement.

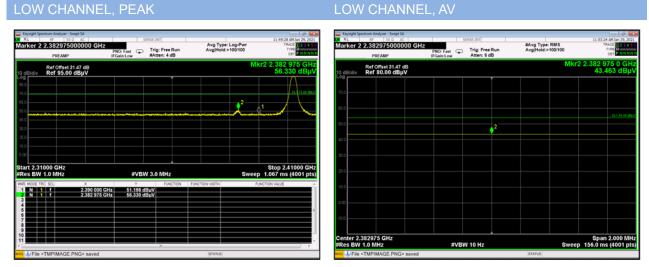
Note ⁴: The Level (dBuV/m) has been corrected by factor.

Test Mode	Test Channel	Frequency (MHz)	Level (dBuV/m)	Factor (dB)	Limit Line (dBuV/m)	Margin (dB)	Remark	Verdict
GFSK	1	2390	56.330	31.47	74	17.670	PEAK	Pass
(BLE 1Mbps)	Low	2390	43.463	31.47	54	10.537	AVERAGE	Pass
GFSK		2483.5	57.885	31.40	74	16.115	PEAK	Pass
(BLE 1Mbps)	HIGH	2483.5	43.808	31.40	54	10.192	AVERAGE	Pass
GFSK	Low	2390	55.561	31.47	74	18.439	PEAK	Pass
(BLE 2Mbps)	Low	2390	43.436	31.47	54	10.564	AVERAGE	Pass
GFSK	шец	2483.5	60.366	31.40	74	13.634	PEAK	Pass
(BLE 2Mbps)	HIGH	2483.5	45.751	31.40	54	8.249	AVERAGE	Pass

<u>Test Data</u>

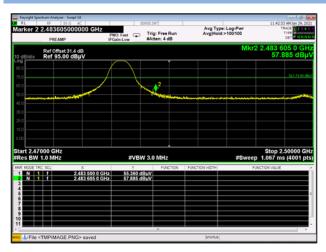
Test plots

<u>BLE 1Mbps</u>





HIGH CHANNEL, PEAK



HIGH CHANNEL, AV

RL RL Marker 1	RL NF 50.0 AC		PNO: Fast	SENSE DVT Trig: Free F Atten: 6 dB	Run	#Avg Type: Avg[Hold:>	RMS	TF	AM Jan 29, 2021
0 dB/div	Ref Offset 31.4 dE Ref 80.00 dBµ	3	IFGain:Low Atten: 6 dB			Mkr1 2.483 500 0 0 43.344 dE			
70.0									
0.0									DL1 54.00 dby
0.0) ¹				
0.0									
0.0									
	483500 GHz 1.0 MHz			W 10 Hz				Span	2.000 MH
	TMPIMAGE.PNG>	enued	#VB	W 10 HZ		STATUS	Sweep	156.0 ms	s (4001 pts

HIGH CHANNEL, AV2

larker 2	2.483605000 PREAMP	0000 GH2	PNO: Fast G	Trig: Free Run Atten: 6 dB	#Avg Type: RMS Avg Hold:>100/100	TRACE 2 3 4 5 TYPE N WWWWW DET P NNNN			
0 dB/div	Ref Offset 31.4 Ref 80.00 dB	dB IµV			Mkr2 2.483 605 0 GH 43.808 dBµ				
70.0									
50.0						0.154.00 dB			
50.0				2					
0.0									
0.0									
10.0									
.00									
0.0									
enter 2.4 Res BW	483605 GHz 1.0 MHz		#VI	3W 10 Hz	Swee	Span 2.000 MH p 156.0 ms (4001 pt			

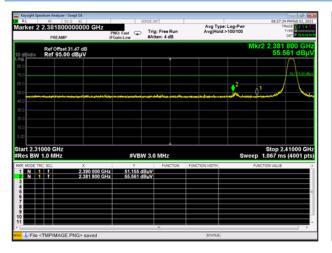




BLE 2Mbps

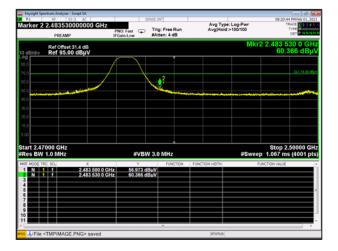
LOW CHANNEL, PEAK

OW CHANNEL, A





HIGH CHANNEL, PEAK



HIGH CHANNEL, AV1

arker 1	2.48350000000 GH	PNO: Fast G	Trig: Free Run Atten: 6 dB	#Avg Type: RMS Avg[Hold:>100/100	TRACE 2 3 4 5 TYPE NUMBER DET P NUNN
dB/div	Ref Offset 31.4 dB Ref 80.00 dBµV			Mki	1 2.483 500 0 GH 45.751 dBµ
			Ĭ		
~					
1.0					DL1 54.00 db
0.0			¹		
Ĩ					
	483500 GHz 1.0 MHz	#VB	w 10 Hz	Swee	Span 2.000 MH p 156.0 ms (4001 pt

HIGH CHANNEL, AV2





A.8 Power Spectral Density (PSD)

Test Data

BLE 1Mbps

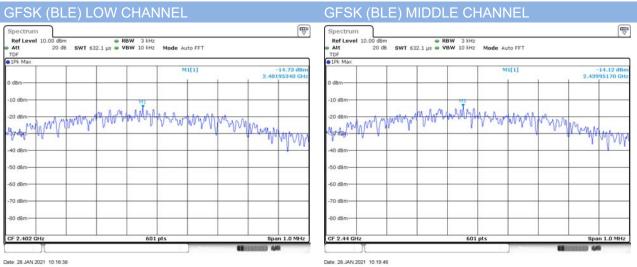
Channel	Spectral power density (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
Low Channel	-14.73	8	Pass
Middle Channel	-14.12	8	Pass
High Channel	-14.11	8	Pass

BLE 2Mbps

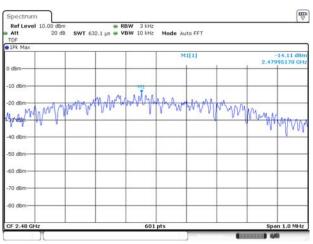
Channel	Spectral power density (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
Low Channel	-17.45	8	Pass
Middle Channel	-17.28	8	Pass
High Channel	-17.57	8	Pass

<u>Test plots</u>

BLE 1Mbps



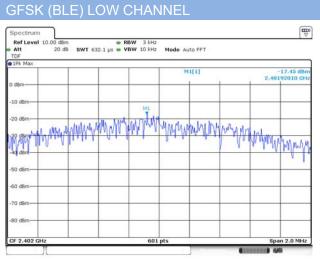
GFSK (BLE) HIGH CHANNEL



Date: 28 JAN 2021 10:22:01



BLE 2Mbps



Att	0.00 dBm		- RI	W 3 kHz					E C
TDF	20 dB	SWT 632.	1 µs 🖷 VI	BW 10 kHz	Mode A	ito FFT			
1Pk Max									
					M	1[1]			-17.28 dB
0 d8m						-			-
-10 d8m-				M1					
-20 dBm-			- Lost						L
	MAN AN	WAAM	An/Y h	WVV~V	MMJAN	mily M	wasda	1.1	
39 fan 41		11 P 1	1.1		1.1.14	14.10	1	ALC: NO YEAR	A Mar La
-40 dBm	v 1.					1.1	V 1	W	1 WIMM
- to don									0
-50 dBm					-				-
-60 dBm		-							
-70 dBm									

GFSK (BLE) HIGH CHANNEL

TDF		● R 32.1 µs ● V		Mode Au	to FFT				
1Pk Max					M1[1]			-17.57 dBr 2.47992010 GH	
m8b 0	_	-							
-10 d8m	-	-	1000	-			-		
20 d8m	_	a tut	MI						
20 march 18	walking w	MADAY	Wind	MMMAN	WAUM	WWAM	61.		
a water that a	Al. Al			1.1.	4.4.1	l V	Property P	Mart	
40 dBm						-		0.1	
50 dBm		-		-					
60 dBm	_								
70 dBm									
80 dBm									
CF 2.48 GHz			601	pts			Spa	n 2.0 MHz	



ANNEX B TEST SETUP PHOTOS

Please refer the document "BL-SZ2110505-AR.PDF".

ANNEX C EUT EXTERNAL PHOTOS

Please refer the document "BL-SZ2110105-AW.PDF".

ANNEX D EUT INTERNAL PHOTOS

Please refer the document "BL-SZ2110105-AI.PDF".

--END OF REPORT--