

Produkte
Products

Prüfbericht-Nr.: <i>Test Report No.:</i>	50157909 001	Auftrags-Nr.: <i>Order No.:</i>	144188130	Seite 1 von 21 <i>Page 1 of 21</i>
Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	21.06.2018	
Auftraggeber: <i>Client:</i>	Bulk Unlimited Corp. 199 Lee Ave, Suite 464, Brooklyn, NY, United States			
Prüfgegenstand: <i>Test Item:</i>	Microphone with Bluetooth Connectivity			
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	0516, 2652			
Auftrags-Inhalt: <i>Order content:</i>	FCC Certification			
Prüfgrundlage: <i>Test specification:</i>	FCC Part 15 Subpart B; FCC Part 15 Subpart C ANSI C63.4-2014; ANSI C63.10-2013			
Wareneingangsdatum: <i>Date of receipt:</i>	14.06.2018 23.08.2018			
Prüfmuster-Nr.: <i>Test sample No.:</i>	A000758558 (001-002) A000796782-001			
Prüfzeitraum: <i>Testing period:</i>	21.06.2018 – 05.09.2018			
Ort der Prüfung: <i>Place of testing:</i>	Hong Kong			
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland Hong Kong Ltd.			
Prüfergebnis*: <i>Test result*:</i>	Pass			
geprüft von / tested by:		kontrolliert von / reviewed by:		
27.09.2018 Joey Leung Project Manager 		27.09.2018 Mika Chan Project Manager 		
Datum <i>Date</i>	Name / Stellung <i>Name / Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>	Name / Stellung <i>Name / Position</i>
Sonstiges FCC ID: 2AE67-0516				
<i>Others:</i>				
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>		Prüfmuster vollständig und unbeschädigt Test item complete and undamaged		
* Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested				
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicate in extracts. This test report does not entitle to carry any test mark.</i>				

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Product information

Manufacturers declarations

	Transceiver
Operating frequency range	2402 - 2480 MHz
Type of modulation	GFSK; Pi/4 DQPSK; 8 DPSK
Number of channels	79
Channel separation	1 MHz
Type of antenna	Integral PCB Antenna
Antenna gain (dBi)	0.0
Power level	fix
Type of equipment	stand alone radio device
Connection to public utility power line	No
Nominal voltage	V _{nom} : 4.5 VDC
Independent Operation Modes	Transmit and receive

Product function and intended use

The equipment under test (EUT) is a Microphone with Bluetooth connectivity. It has internal memory for sound recording and pre-installed songs. It is powered by battery only.

FCC ID: 2AE67-0516

Models	Product description
0516	Sing With Me Bluetooth Microphone
2652	Let's Sing-Lomir Zingen Microphone

Submitted documents

Circuit Diagram
Block Diagram
Technical Description
Bill of materials
User manual
Label Artwork

www.tuv.com

Independent Operation Modes

The basic operation modes are:

- Bluetooth transmit and receive mode.
- Playing pre-installed songs and sound recording without Bluetooth

For further information refer to User Manual

Related Submittal(s) Grants

This is a single application for certification of the transmitter.

Remark

The test results in this test report are only relevant to the tested sample and does not involve any assessment in the production.

Test Set-up and Operation Mode

Principle of Configuration Selection

Emission: The EUT was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the instructions for use.

Test Operation and Test Software

Test operation should refer to test methodology.

- 1) Special software is provided by the applicant to set the device to operate in a fixed frequency channel and maximum RF output power level. The setting of the maximum RF output power shall be fixed on the final product.
- 2) Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate.

Special Accessories and Auxiliary Equipment

There is no special accessories and auxiliary equipment tested together with the product.

Countermeasures to achieve EMC Compliance

There is no countermeasures implemented during testing to achieve EMC compliance.

Test Methodology

Radiated Emission

The radiated emission measurements of the transmitter part were performed according to the procedures in ANSI C63.10-2013. The radiated emission measurements of the battery pack charging part were performed according to the procedures in ANSI C63.4-2014.

For measurement below 1GHz - the equipment under test (EUT) was placed at the middle of the 80 cm height turntable. For measurement above 1GHz - the EUT was placed at the middle of the 1.5 m height turntable and RF absorbing material was placed on ground plane between turntable and measuring antenna. During the testing, the EUT was operated standalone and arranged for maximum emissions. The EUT was tested in three orthogonal planes.

The investigation is performed with the EUT rotated 360 °, the antenna height scanned between 1m and 4m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Repeat the measurement steps until the maximum emissions were obtained.

All radiated tests were performed at an antenna to EUT with 3 meters distance, unless stated otherwise in particular parts of this test report.

Field Strength Calculation

The field strength at 3 m was established by adding the meter reading of the spectrum analyzer to the factors associated with antenna correction factor, cable loss, preamplifiers and filter attenuation.

The equation is expressed as follow:

$$FS = R + AF + CF + FA - PA$$

Where FS = Field Strength in dBuV/m at 3 meters.

R = Reading of Spectrum Analyzer in dBuV.

AF = Antenna Factor in dB.

CF = Cable Attenuation Factor in dB.

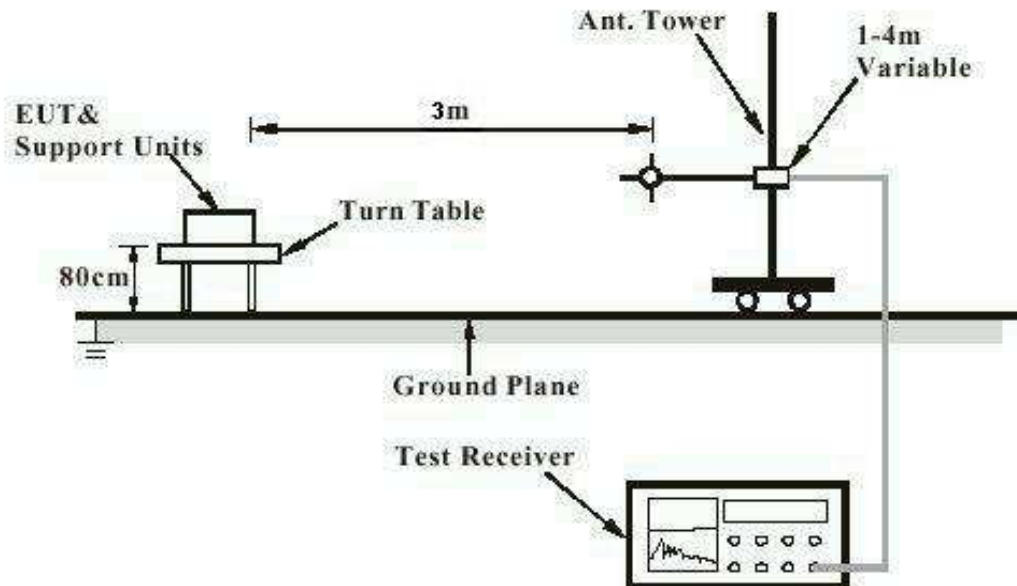
FA = Filter Attenuation Factor in dB.

PA = Preamplifier Factor in dB.

FA and PA are only be used for the measuring frequency above 1 GHz.

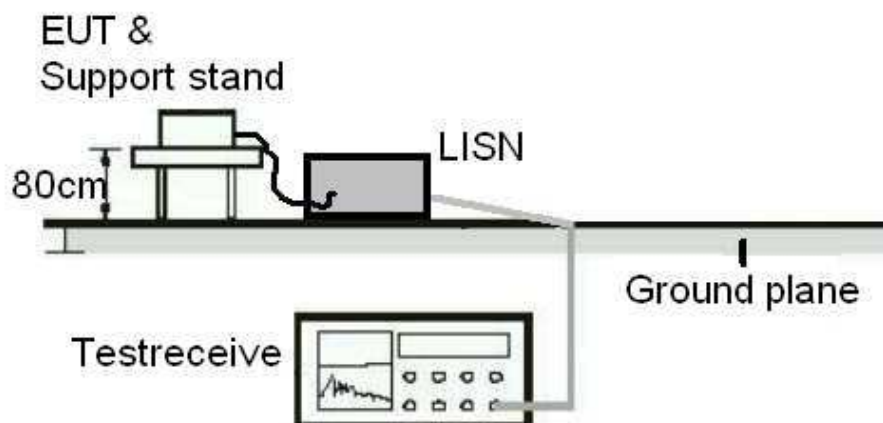
Test Setup Diagram

Diagram of Measurement Configuration for Radiated Emission Test



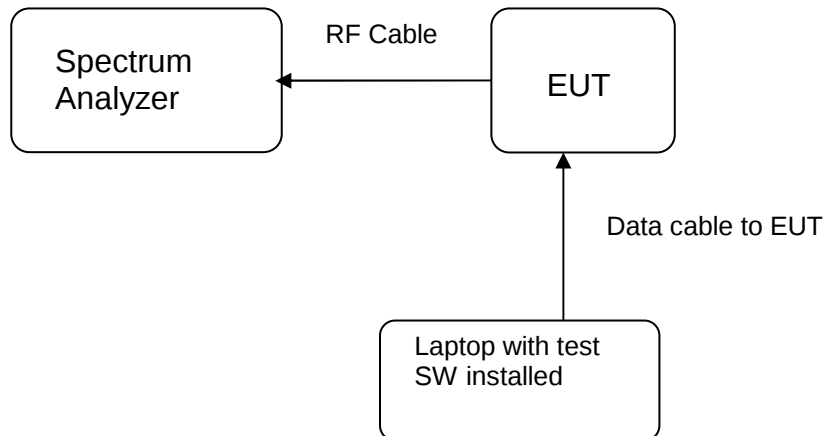
Note: Measurements above 1 GHz are done with a table height of 1.5m. In addition, there is RF absorbing material on the floor of the test site for above 1GHz measurement.

Diagram of Measurement Equipment Configuration for Mains Conduction Measurement (if applicable)



www.tuv.com

Diagram of Equipment Configuration for Antenna-port Conducted Measurement (if applicable)



Test Facility

Test Laboratory Information

TÜV Rheinland Hong Kong Ltd.

Address: 3-4, 11/F., Fou Wah Industrial Building, 10-16 Pun Shan Street, Tsuen Wan, N.T., Hong Kong

Tel.: +852 2192 1000

Fax: +852 2192 1001

Email service-gc@tuv.com

Web: www.tuv.com

The test facility is recognized or accredited by the following organizations:

FCC

Type	: Accredited Test Firm
Designation Number	: HK0013
Test Firm Registration Number	: 371735
Scope	: Intentional Radiators

Industry Canada

The 10m Semi-anechoic chamber used by TÜV Rheinland Hong Kong Ltd at Hong Kong Productivity Council has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing

Test Site Registration Number : 4780A-1

List of Test and Measurement Instruments

Hong Kong Productivity Council (FCC Registration number: 90656)

Radiated Emission

Equipment	Manufacturer	Type	S/N	Cal. Date	Cal. Due Date
Semi-anechoic Chamber	Frankonia	Nil	Nil	23 Apr 2018	23 Apr 2019
Test Receiver	R & S	ESU40	100190	12 Jun 2018	12 Jun 2019
Bi-conical Antenna	R & S	HK116	100241	21 Mar 2018	21 Mar 2020
Log Periodic Antenna	R & S	HL223	841516/017	22 Mar 2018	22 Mar 2020
Cable with I-Joint Conector	Huber+Suhner	CNM-NMCMILX800-473	A2803 #0001	11 Dec 2017	11 Dec 2019
Active Loop Antenna	EMCO	6502	9107-2651	30 Oct 2017	30 Oct 2018
Semi-anechoic Chamber (SiteVSWR)	Frankonia	Nil	Nil	17 May 2018	17 May 2019
Double-Ridged Waveguide Horn	EMCO	3116	00109210	11 Oct 2016	10 Oct 2018
Double-Ridged Waveguide Horn	EMCO	3117	00094998	30 Aug 2018	29 Aug 2020
Microwave amplifier 0.5-26.5GHz, 25dB gain	HP	83017A	3950M00241	18 Jul 2018	17 Jul 2020
Preamplifier 18GHz to 40GHz with cable (EMC656)	A.H. Systems, Inc.	PAM-1840VH	168	29 Jan 2018	29 Jan 2019
High Pass Filter (cutoff freq. =1000MHz)	Trilithic	23042	9829213	30 Oct 2017	30 Oct 2019
High Frequency Cable	Pasternack	PE3VNA4001-3M	20160707C02493	29 Jan 2018	29 Jan 2019
Horn Antenna	EMCO	3115	9002-3347	28 Mar 2018	28 Mar 2020

TÜV Rheinland Hong Kong Ltd

Radio Test

Equipment	Manufacturer	Type	S/N	Cal. Date	Cal. Due Date
Spectrum Analyzer	R & S	FSP30	100610	03 May 2018	02 May 2019

Measurement Uncertainty

The estimated combined standard uncertainty for power-line conducted emissions measurements is $\pm 2.42\text{dB}$.

The estimated combined standard uncertainty for radiated emissions measurements is $\pm 4.81\text{dB}$ (9kHz to 30MHz) and $\pm 4.62\text{dB}$ (30MHz to 200MHz) and $\pm 5.67\text{dB}$ (200MHz to 1000MHz) and is $\pm 5.07\text{dB}$ (1GHz to 8.2GHz) and $\pm 4.58\text{dB}$ (8.2GHz to 12.4GHz) and $\pm 4.78\text{dB}$ (12.4GHz to 18GHz)

The estimated combined standard uncertainty for antenna conducted emission is $\pm 2.1\text{dB}$

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor of $k=2$, which for the level of confidence is approximately 95%.

Results FCC Part 15 – Subpart B

FCC 15.107 – Conducted Emission on AC Mains	N/A
There is no AC power input or output ports on the EUT.	

FCC 15.109 – Radiated Emissions		Pass
Test Specification : ANSI C63.4-2014 Mode of operation : Pre-installed songs playing mode Port of testing : Enclosure Frequency range : 30MHz – 1GHz Supply voltage : 4.5VDC Temperature : 23°C Humidity : 50%		
Requirement:	The field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the radiated limits shown in §15.109(a).	
Results:	Pass	
Vertical Polarization		
Freq MHz	Level dBuV/m	Limit dBuV/m
357.990	33.2	46.0
423.172	26.9	46.0
Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
No peak found	---	40.0

Results FCC Part 15 – Subpart C

FCC 15.203 – Antenna Requirement 1		Pass
FCC Requirement: No antenna other than that furnished by the responsible party shall be used with the device		
Results:	a) Antenna type: b) Manufacturer and model no: c) Peak Gain:	Integral PCB antenna N/A 0 dBi
Verdict:	Pass	

FCC 15.204 – Antenna Requirement 2		N/A
FCC Requirement: An intentional radiator may be operated only with the antenna with which it is authorized. If an antenna is marketed with the intentional radiator, it shall be of a type which is authorized with the intentional radiator.		
Results:	Only one integral antenna can be used.	
Verdict:	N/A	

FCC 15.207 – Conducted Emission on AC Mains		N/A
There is no AC power input or output ports on the EUT.		

FCC 15.247 (a)(1) – 20 dB Bandwidth		Pass	
Test Specification : ANSI C63.10-2013 Test date : 09.07.2018 Mode of operation : Tx mode (2402MHz, 2441MHz, 2480MHz) Port of testing : Temporary antenna port Supply voltage : 4.5VDC Temperature : 23°C Humidity : 50%			
Results:		Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and packet types. For test protocols refer to Appendix 1.	
GFSK Modulation			
Frequency (MHz)	20 dB left (MHz)	20 dB right (MHz)	20dB bandwidth (MHz)
2402	2401.424	2402.544	1.120
2441	2440.424	2441.544	1.120
2480	2479.424	2480.544	1.120

8DPSK Modulation			
Frequency (MHz)	20 dB left (MHz)	20 dB right (MHz)	20dB bandwidth (MHz)
2402	2401.272	2402.648	1.376
2441	2440.296	2441.648	1.352
2480	2479.296	2480.648	1.352

FCC 15.247 (a)(1) – Carrier Frequency Separation		Pass
FCC Requirement: Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the $2/3 \times 20\text{dB}$ bandwidth of the hopping channel, whichever is greater.		
Test Specification : ANSI C63.10-2013 Test date : 09.07.2018 Mode of operation : Tx mode (hopping on), GFSK and 8DPSK Port of testing : Temporary antenna port Supply voltage : 4.5VDC Temperature : 23°C Humidity : 50%		
Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and packet types. The centre frequencies of the hopping channels are separated by more than the $2/3 \times 20\text{dB}$ bandwidth. For test Results plots refer to Appendix 1.		
Verdict: Pass		
GFSK Modulation		
Test Frequency (MHz)	Channel separation (MHz)	Two-third of 20dB bandwidth (MHz)
2441	1.004	0.746
8DPSK Modulation		
Test Frequency (MHz)	channel separation (MHz)	Two-third of 20dB bandwidth (MHz)
2441	1.008	0.917

FCC 15.247 (a)(1)(iii) – Number of hopping channels			Pass
FCC Requirement: Frequency hopping systems operating in the 2400MHz-2483.5MHz bands shall use at least 15 hopping frequencies.			
Test Specification : ANSI C63.10-2013 Test date : 09.07.2018 Mode of operation : Tx mode (hopping on), GFSK Port of testing : Temporary antenna port Supply voltage : 4.5VDC Temperature : 23°C Humidity : 50%			
Results: For test Results plots refer to Appendix 1.			
No. of hopping channels	Limit	Verdict	
79	15	Pass	

FCC 15.247 (a)(1)(iii) – Time of Occupancy (Dwell Time)			Pass
FCC Requirement: Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.			
Test Specification : ANSI C63.10-2013 Test date : 09.07.2018 Mode of operation : Tx mode (hopping on), DH5 packet Port of testing : Temporary antenna port Supply voltage : 4.5VDC Temperature : 23°C Humidity : 50%			
Results: Time period calculation = $0.4 \times 79 = 31.6\text{s}$ Dwell time = $76 \times 2.940 \times 10^{-3} = 223.44 \times 10^{-3} \text{ s}$ $\leq 400 \times 10^{-3} \text{ s}$			
For test protocols please refer to Appendix 1.			
Verdict:			Pass

FCC 15.247 (a) – Hopping Sequence	Pass
FCC Requirement: The system radio frequency (RF) bandwidth is equal to the channel bandwidth multiplied by the number of channels in the hopset. The hopset shall be such that the near-term distribution of frequencies appears random, with sequential hops randomly distributed in both direction and magnitude of change in the hopset, while the long-term distribution appears evenly distributed.	
As stated in the technical description, the EUT is controlled by microchip to generate Pseudorandom Frequency Hopping Sequence base on CCITT16 and distributed it over 23 hopping channels. The sequential hops are randomly distributed in both direction and magnitude of change in the hop set	

FCC 15.247 (a) – Equal Hopping Frequency Use	Pass
FCC Requirement: Each of the transmitter's hopping channels is used equally on average. The system radio frequency (RF) bandwidth is equal to the channel bandwidth multiplied by the number of channels in the hopset. The hopset shall be such that the near-term distribution of frequencies appears random, with sequential hops randomly distributed in both direction and magnitude of change in the hopset, while the long-term distribution appears evenly distributed.	
As stated in the technical description, a single data frame is transmitted on each frequency location before skipping to the next hopping frequency in the list. So each hopping channels is used equally on average in long term.	

FCC 15.247 (a) – Receiver Input Bandwidth	Pass
FCC Requirement: The associated receiver(s) complies with the requirement that its input bandwidth matches the bandwidth of the transmitted signal.	
As stated in the technical description, both receiver and transmitter are set to same bandwidth of 1MHz	

FCC 15.247 (a) – Receiver Hopping Capability	Pass
FCC Requirement: The associated receiver has the ability to shift frequencies in synchronisation with the transmitted signals.	
Both transmitter and receiver will share the same device ID so the same sequence is generated for the communication. Moreover, the microchip has a clock recovery mechanism to synchronize the timing between the transmitter and receiver. With the same hopping sequence and timing, the receiver can shift frequencies in synchronization with the transmitted signals.	

FCC 15.247 (b)(1) – Peak Output Power					Pass
Test Specification : ANSI C63.10-2013 Test date : 05.09.2018 Mode of operation : Tx mode (2402MHz, 2441MHz, 2480MHz), GFSK and 8DPSK Port of testing : Temporary antenna port Supply voltage : 4.5VDC Temperature : 23°C Humidity : 50%					
FCC Requirement: For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 Watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 Watts.					
Results: For test protocols please refer to Appendix 1.					
GFSK Modulation					
Frequency (MHz)	Maximum peak output power (dBm)	Cable attenuation (dB)	Output power (dBm)	Limit (W/dBm)	Verdict
2402	-4.54	0	-4.54	1 / 30.0	Pass
2441	-5.09	0	-5.09	1 / 30.0	Pass
2480	-5.73	0	-5.73	1 / 30.0	Pass
8DPSK Modulation					
Frequency (MHz)	Maximum peak output power (dBm)	Cable attenuation (dB)	Output power (dBm)	Limit (W/dBm)	Verdict
2402	-4.48	0	-4.48	0.125 / 21.0	Pass
2441	-5.24	0	-5.24	0.125 / 21.0	Pass
2480	-6.09	0	-6.09	0.125 / 21.0	Pass

FCC 15.247 (d) – Spurious Conducted Emissions					Pass
Test Specification : ANSI C63.10-2013 Test date : 09.07.2018 Mode of operation : Tx mode (2402MHz, 2441MHz, 2480MHz), GFSK Port of testing : Temporary antenna port Supply voltage : 4.5VDC Temperature : 23 °C Humidity : 50 %					
FCC Requirement: 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.					
Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and packet types. All three transmit frequency modes comply with the limit stated in subclause 15.247(d). For test protocols refer to Appendix 1.					
Operating frequency (MHz)	Spurious frequency (MHz)	Spurious Level (dBm)	Reference value (dBm)	Delta (dB)	Verdict
2402	No peak found	---	-5.34	---	Pass
2441	No peak found	---	-6.05	---	Pass
2480	No peak found	---	-6.85	---	Pass

FCC 15.205 – Radiated Emissions in Restricted Frequency Bands			Pass
Test Specification : ANSI C63.10 – 2013 Test date : 03.09.2018 Mode of operation : Tx mode (2402MHz, 2441MHz, 2480MHz), GFSK Port of testing : Enclosure Frequency range : 9kHz – 25GHz Supply voltage : 4.5 VDC Temperature : 23°C Humidity : 50%			
FCC Requirement: In any 100kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in section15.205(a), must also comply with the radiated emission limits specified in section 15.205(c).			
Results:		Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and packet types. All three transmit frequency modes comply with the field strength within the restricted bands. There is no spurious found below 30MHz.	
Tx frequency 2402MHz		Vertical Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
2400.000	56.9	74.0 / PK	
2400.000	33.4	54.0 / AV	
4804.003	52.9	74.0 / PK	
4804.003	42.4	54.0 / AV	
7206.004	56.7	74.0 / PK	
7206.004	44.1	54.0 / AV	
Tx frequency 2402MHz		Horizontal Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
2400.000	57.3	74.0 / PK	
2400.000	33.5	54.0 / AV	
4803.604	55.4	74.0 / PK	
4803.604	44.5	54.0 / AV	
7205.474	58.3	74.0 / PK	
7205.474	45.0	54.0 / AV	
Tx frequency 2441MHz		Vertical Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
4881.500	53.5	74.0 / PK	
4881.500	41.1	54.0 / AV	
7322.250	56.7	74.0 / PK	
7322.250	43.7	54.0 / AV	

Tx frequency 2441MHz			Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4881.948	55.1	74.0 / PK	4881.948	45.5	54.0 / AV
4881.948	45.5	54.0 / AV	7322.923	56.3	74.0 / PK
7322.923	56.3	74.0 / PK	7322.923	43.2	54.0 / AV
7322.923	43.2	54.0 / AV			
Tx frequency 2480MHz			Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2483.500	54.8	74.0 / PK	2483.500	36.4	54.0 / AV
2483.500	36.4	54.0 / AV	4959.948	55.4	74.0 / PK
4959.948	55.4	74.0 / PK	4959.948	45.7	54.0 / AV
4959.948	45.7	54.0 / AV	7439.923	53.7	74.0 / PK
7439.923	53.7	74.0 / PK	7439.923	40.1	54.0 / AV
7439.923	40.1	54.0 / AV			
Tx frequency 2480MHz			Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2483.500	59.6	74.0 / PK	2483.500	40.4	54.0 / AV
2483.500	40.4	54.0 / AV	4959.602	56.4	74.0 / PK
4959.602	56.4	74.0 / PK	4959.602	45.5	54.0 / AV
4959.602	45.5	54.0 / AV	7439.852	53.2	74.0 / PK
7439.852	53.2	74.0 / PK	7439.852	40.2	54.0 / AV
7439.852	40.2	54.0 / AV			