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TEST REPORT

Application No.:	GZCR2204000427AT			
Applicant:	Harman International Industries, Inc			
Address of Applicant:	8500 Balboa Boulevard, Northridge, California, 91329, United States			
Manufacturer:	Harman International Industries, Inc			
Address of Manufacturer:	8500 Balboa Boulevard, Northridge, California, 91329, United States			
Factory:	Risuntek Inc			
Address of Factory:	JiuWei Industrial Zone, Qishi Town, Dongguan City, Guangdong Province, China, 523000			
Equipment Under Test (EUT)	:			
EUT Name:	BLUETOOTH HEADSET			
Model No.:	VIBE BEAM			
Trade Mark:	JBL			
Standard(s) :	47 CFR Part 15, Subpart C 15.247			
Date of Receipt:	2022-04-25			
Date of Test:	2022-04-25			
Date of Issue:	2022-04-26			
Test Result:	Pass*			

* In the configuration tested, the EUT complied with the standards specified above.

Foke. Jun

Kobe Jian EMC Laboratory Manager



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	Revision Record					
Version	Remark					
01		2022-04-26		Original		

Authorized for issue by		
	CJ Vu	
	Curry Wu/Project Engineer	
	Ridey Lin	
	Ricky Liu/Reviewer	



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2 **Test Summary**

Radio Spectrum Technical Requirement					
Item	Standard	Method	Requirement	Result	
Antenna Requirement		N/A	47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4)	Pass	
Other requirements Frequency Hopping Spread Spectrum System Hopping Sequence	47 CFR Part 15, Subpart C 15.247	N/A	47 CFR Part 15, Subpart C 15.247(a)(1),(g),(h)	Pass	

Radio Spectrum Matter Part					
Item	Standard	Method	Requirement	Result	
Conducted Peak Output Power		ANSI C63.10 (2013) Section 7.8.5	47 CFR Part 15, Subpart C 15.247(b)(1)	Pass	
20dB Bandwidth		ANSI C63.10 (2013) Section 7.8.7	47 CFR Part 15, Subpart C 15.247(a)(1)	Pass	
Carrier Frequencies Separation		ANSI C63.10 (2013) Section 7.8.2	47 CFR Part 15, Subpart C 15.247a(1)	Pass	
Hopping Channel Number		ANSI C63.10 (2013) Section 7.8.3	47 CFR Part 15, Subpart C 15.247a(1)(iii)	Pass	
Dwell Time		ANSI C63.10 (2013) Section 7.8.4	47 CFR Part 15, Subpart C 15.247a(1)(iii)	Pass	
Conducted Band Edges Measurement	47 CFR Part 15,	ANSI C63.10 (2013) Section 7.8.6	47 CFR Part 15, Subpart C 15.247(d)	Pass	
Conducted Spurious Emissions	Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.8	47 CFR Part 15, Subpart C 15.247(d)	Pass	
Radiated Emissions which fall in the restricted bands		ANSI C63.10 (2013) Section 6.10.5	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass	
Radiated Spurious Emissions		ANSI C63.10 (2013) Section 6 4 6 5 6 6	47 CFR Part 15, Subpart C 15 205 & 15 209	Pass	
(Below 1GHz)		0001011 0.4,0.0,0.0	0 10:200 0 10:200		
Radiated Spurious Emissions		ANSI C63.10 (2013)	47 CFR Part 15, Subpart	Pass	
(Above 1GHz)		000001 0.4,0.0,0.0	0 10.200 @ 10.209		

Note:

E.U.T./EUT means Equipment Under Test.

Pass means the test result passed the test standard requirement, please find the detailed decision rule in the report relative section.



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General Information 4

4.1 Details of E.U.T.

Power supply:	Left earbuds: Li-Ion Polymer Battery DC3.85V 48mAh (Charged by travel case)
	Right earbuds: Li-Ion Polymer Battery DC3.85V 48mAh (Charged by travel case)
	travel case with backup battery: Li-Ion Polymer Battery DC3.7V 530mAh (Charged by USB port)
Cable(s):	Type-C cable: 21cm unshielded
Operation Frequency:	2402MHz to 2480MHz
Bluetooth Version:	V5.2 Dual mode
Modulation Type:	GFSK, pi/4DQPSK, 8DPSK
Number of Channels:	79
Channel Spacing:	1MHz
Spectrum Spread Technology:	Frequency Hopping Spread Spectrum(FHSS)
Antenna Type:	Integral Antenna
Antenna Gain:	left earbuds: 0.85dBi; Right earbuds: 0.85dBi

4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.				
The EUT has been tested as an independent unit.							



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4.3 Measurement Uncertainty

Test Item	Measurement Uncertainty
Conducted Peak Output Power	± 0.75dB
20dB Bandwidth	± 3%
Carrier Frequencies Separation	± 7.25 x 10-8
Hopping Channel Number	± 7.25 x 10-8
Dwell Time	± 0.37%
Conducted Band Edges Measurement	± 0.75dB
Conducted Spurious Emissions	± 0.75dB
Radiated Emissions which fall in the restricted bands	±5.08dB (1GHz-6GHz); ±5.14dB (above 6GHz)
Radiated Spurious Emissions (Below 1GHz)	±5.06dB (3m);±4.46dB (10m)
Radiated Spurious Emissions (Above 1GHz)	±5.08dB (1GHz-6GHz); ±5.14dB (above 6GHz)

Remark:

The Ulab (lab Uncertainty) is less than Ucispr (CISPR Uncertainty), so the test results

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit; - non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.



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4.4 Test Location

All tests were performed at: SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou Branch EMC Laboratory, 198 Kezhu Road, Scientech Park, Guangzhou Economic & Technology Development District, Guangzhou, China 510663 Fax: +86 20 82075059 Tel: +86 20 82155555 No tests were sub-contracted.

4.5 Test Facility

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

• NVLAP (Lab Code: 200611-0)

SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou EMC Laboratory is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP/NIST). NVLAP Code: 200611-0. The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

ACMA

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory can also perform testing for the Australian/New Zealand Regulatory Compliance Mark (RCM).

• SGS UK(Certificate No.: 32), SGS-TUV SAARLAND and SGS-FIMKO

Have approved SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory as a supplier of EMC TESTING SERVICES and SAFETY TESTING SERVICES.

CNAS (Lab Code: L0167)

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been assessed and in compliance with CNAS-CL01:2018 accreditation criteria for testing laboratories (identical to ISO/IEC 17025:2017 General Requirements) for the Competence of Testing Laboratories.

• FCC Recognized Accredited Test Firm(Registration No.: 486818)

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been accredited and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Designation Number: CN5016, Test Firm Registration Number: 486818.

ISED (Registration No.: 4620B, CAB identifier: CN0052)

SGS-CSTC Standards Technical Services Co., Ltd., has been registered by Innovation Science and Economic Development Canada for Wireless Device Testing laboratories to test to Canadian radio equipment requirements. Registration No. 4620B, CAB identifier: CN0052.

VCCI (Registration No.: R-12460, C-12584, G-20107 and T-11179)

The 10m Semi-anechoic chamber, 966 Anechoic Chamber and Shielded Room of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-12460, C-12584, G-20107 and T-11179 respectively.

CBTL (Lab Code: TL129)

SGS-CSTC Standards Technical Services Co., Ltd., E&E Laboratory has been assessed and fully comply with the requirements of ISO/IEC 17025:2017, the Basic Rules, IECEE 01 and Rules of procedure IECEE 02, and the relevant IECEE CB-Scheme Operational documents.



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- 4.6 Deviation from Standards None
- 4.7 Abnormalities from Standard Conditions None





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5 **Equipment List**

Conducted Peak Output Power					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Power Meter (U2021XA_Ch2)	Agilent Technologies	U2021XA_Ch2	SEM009-02	2021-05-19	2022-05-18
EXA Signal Analzer(10Hz-44GHz)	Agilent Technologies	N9010A	EMC2138	2021-09-16	2022-09-15
6dB Attenuator	HP	8491A	EMC2062	2022-04-14	2023-04-13
MI CABLE	SGS-EMC	0.8M	EMC2136	2021-11-01	2023-11-01
Test Software	TST	V2.0	GZE100-78	N/A	N/A

20dB Bandwidth					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EXA Signal Analzer(10Hz-44GHz)	Agilent Technologies	N9010A	EMC2138	2021-09-16	2022-09-15
6dB Attenuator	HP	8491A	EMC2062	2022-04-14	2023-04-13
MI CABLE	SGS-EMC	0.8M	EMC2136	2021-11-01	2023-11-01
Test Software	TST	V2.0	GZE100-78	N/A	N/A

Carrier Frequencies Separation						
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date	
EXA Signal Analzer(10Hz-44GHz)	Agilent Technologies	N9010A	EMC2138	2021-09-16	2022-09-15	
6dB Attenuator	HP	8491A	EMC2062	2022-04-14	2023-04-13	
MI CABLE	SGS-EMC	0.8M	EMC2136	2021-11-01	2023-11-01	
Test Software	TST	V2.0	GZE100-78	N/A	N/A	

Hopping Channel Number						
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date	
EXA Signal Analzer(10Hz-44GHz)	Agilent Technologies	N9010A	EMC2138	2021-09-16	2022-09-15	
6dB Attenuator	HP	8491A	EMC2062	2022-04-14	2023-04-13	
MI CABLE	SGS-EMC	0.8M	EMC2136	2021-11-01	2023-11-01	
Test Software	TST	V2.0	GZE100-78	N/A	N/A	



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Dwell Time					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EXA Signal Analzer(10Hz-44GHz)	Agilent Technologies	N9010A	EMC2138	2021-09-16	2022-09-15
6dB Attenuator	HP	8491A	EMC2062	2022-04-14	2023-04-13
MI CABLE	SGS-EMC	0.8M	EMC2136	2021-11-01	2023-11-01
Test Software	TST	V2.0	GZE100-78	N/A	N/A

Conducted Band Edges Measurement						
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date	
EXA Signal Analzer(10Hz-44GHz)	Agilent Technologies	N9010A	EMC2138	2021-09-16	2022-09-15	
6dB Attenuator	HP	8491A	EMC2062	2022-04-14	2023-04-13	
MI CABLE	SGS-EMC	0.8M	EMC2136	2021-11-01	2023-11-01	
Test Software	TST	V2.0	GZE100-78	N/A	N/A	

Conducted Spurious Emissions						
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date	
EXA Signal Analzer(10Hz-44GHz)	Agilent Technologies	N9010A	EMC2138	2021-09-16	2022-09-15	
6dB Attenuator	HP	8491A	EMC2062	2022-04-14	2023-04-13	
MI CABLE	SGS-EMC	0.8M	EMC2136	2021-11-01	2023-11-01	
Test Software	TST	V2.0	GZE100-78	N/A	N/A	

Radiated Emissions which fall in the restricted bands						
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date	
EMI Test Receiver(20Hz- 26.5GHz)	Rohde & Schwarz	ESIB26	EMC0522	2021-12-17	2022-12-16	
Chamber cable(Above 1GHz)	Scoflex	KMKM-8.0m	EMC0545	2020-09-09	2022-09-08	
Horn Antenna(1GHz- 18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120D	EMC2026	2019-09-25	2022-09-24	
1GHz-26.5 GHz Pre-Amplifier	Agilent	8449B	EMC0521	2021-12-17	2022-12-16	
2.4GHz Filter	Micro-Tronics	BRM 50702	EMC2069	2021-12-17	2022-12-16	
966 Anechoic Chamber	C.R.T	9m x 6m x 6m	EMC2142	2020-12-20	2023-12-19	
MXE EMI Receiver(10Hz-8.4GHz)	Keysight	N9038A	EMC2139	2021-11-01	2022-10-31	
EXA Signal Analyzer(10Hz-44GHz)	Keysight	N9010A	EMC2138	2021-09-16	2022-09-15	
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A	



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Notch Filter (5150-5880)	Mico-Tronics	BRM50716	EMC2168	2021-07-29	2022-07-28
Horn Antenna(14- 40GHz)	SCHWARZBECK	BBHA 9170	EMC2041	2020-06-28	2023-06-27
Microwave Broadband Preamplifier (18-40GHz)	SCHWARZBECK	BBV 9721	EMC2172	2021-08-30	2022-08-29

Radiated Spurious Emissions (Below 1GHz)						
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date	
EMI Test Receiver(10Hz- 26.5GHz)	Rohde & Schwarz	ESIB26	EMC0522	2021-12-17	2022-12-16	
Chamber cable	HangTianXing	N/A	EMC0542	2020-09-09	2022-09-08	
Active Loop Antenna- RED	ETS-Lindgren	6502	EMC2190	2022-04-06	2023-04-05	
Trilog Broadband Antenna(25MHz-1GHz)- Lab	SCHWARZBECK MESS-ELEKTRONIK	VULB 9168	SEM003-18	2022-02-22	2023-02-21	
Amplifier(9kHz-1.3GHz)	HP	8447F	EMC2065	2021-05-19	2022-05-18	
High Pass Filter (915MHz)	FSY MICROWAVE	HM1465-9SS	EMC2079	2021-12-17	2022-12-16	
10m Semi-Anechoic Chamber	ETS	N/A	EMC0530	2019-10-20	2022-10-19	
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A	
EMI Test Receiver(1Hz- 8GHz)	Rohde & Schwarz	ESW8	EMC2220	2021-05-26	2022-05-25	

Radiated Spurious Emissions (Above 1GHz)						
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date	
EMI Test Receiver(20Hz- 26.5GHz)	Rohde & Schwarz	ESIB26	EMC0522	2021-12-17	2022-12-16	
Chamber cable(Above 1GHz)	Scoflex	KMKM-8.0m	EMC0545	2020-09-09	2022-09-08	
Horn Antenna(1GHz- 18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120D	EMC2026	2019-09-25	2022-09-24	
1GHz-26.5 GHz Pre-Amplifier	Agilent	8449B	EMC0521	2021-12-17	2022-12-16	
2.4GHz Filter	Micro-Tronics	BRM 50702	EMC2069	2021-12-17	2022-12-16	
966 Anechoic Chamber	C.R.T	9m x 6m x 6m	EMC2142	2020-12-20	2023-12-19	
MXE EMI Receiver(10Hz-8.4GHz)	Keysight	N9038A	EMC2139	2021-11-01	2022-10-31	



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EXA Signal Analyzer(10Hz-44GHz)	Keysight	N9010A	EMC2138	2021-09-16	2022-09-15
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A
Notch Filter (5150-5880)	Mico-Tronics	BRM50716	EMC2168	2021-07-29	2022-07-28
Horn Antenna(14- 40GHz)	SCHWARZBECK	BBHA 9170	EMC2041	2020-06-28	2023-06-27
Microwave Broadband Preamplifier (18-40GHz)	SCHWARZBECK	BBV 9721	EMC2172	2021-08-30	2022-08-29

General used equipmen	ıt				
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
DMM	Fluke	73	EMC0006	2021-07-05	2022-07-05
DMM	Fluke	73	EMC0007	2021-07-05	2022-07-05



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Radio Spectrum Technical Requirement 6

Antenna Requirement 6.1

6.1.1 Test Requirement:

47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4)

6.1.2 Conclusion

15.203 Requirement:

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, 15.221, or 15.236. 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.

15.247(b) (4) requirement:

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

EUT Antenna:

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is left earbuds: 0.85dBi; Right earbuds: 0.85dBi. Antenna location: Refer to internal photo.



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6.2 Other requirements Frequency Hopping Spread Spectrum System Hopping Sequence

6.2.1 Test Requirement:

Limit:

Standard Requirement:

The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

Compliance for section 15.247(a)(1):

According to Technical Specification, the pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized with nine ones.

- > Number of shift register stages: 9
- > Length of pseudo-random sequence: 29 -1 = 511 bits
- > Longest sequence of zeros: 8 (non-inverted signal)

Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:



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Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:

20 62 46 77	7 64	8 73	16 75 1
	L.J	<u>L.</u>	

Each frequency used equally on the average by each transmitter.

According to Technical Specification, the receivers are designed to have input and IF bandwidths that match the hopping channel bandwidths of any transmitters and shift frequencies in synchronization with the transmitted signals.

Compliance for section 15.247(g):

According to Technical Specification, the system transmits the packet with the pseudorandom hopping frequency with a continuous data and the short burst transmission from the Bluetooth system is also transmitted under the frequency hopping system with the pseudorandom hopping frequency system.

Compliance for section 15.247(h):

According to Technical specification, the system incorporates with an adaptive system to detect other user within the spectrum band so that it individually and independently to avoid hopping on the occupied channels.

The system is designed not have the ability to coordinated with other FHSS System in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitter.



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6.2.2 Conclusion

Standard Requirement:

The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

Compliance for section 15.247(a)(1):

According to Technical Specification, the pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized with nine ones.

- > Number of shift register stages: 9
- > Length of pseudo-random sequence: 29 -1 = 511 bits
- > Longest sequence of zeros: 8 (non-inverted signal)

Linear Feedback Shift Register for Generation of the PRBS sequence

Each frequency used equally on the average by each transmitter.

According to Technical Specification, the receivers are designed to have input and IF bandwidths that match the hopping channel bandwidths of any transmitters and shift frequencies in synchronization with the transmitted signals.

Compliance for section 15.247(g):

According to Technical Specification, the system transmits the packet with the pseudorandom hopping frequency with a continuous data and the short burst transmission from the Bluetooth system is also transmitted under the frequency hopping system with the pseudorandom hopping frequency system.

Compliance for section 15.247(h):

According to Technical specification, the system incorporates with an adaptive system to detect other user within the spectrum band so that it individually and independently to avoid hopping on the occupied channels.

The system is designed not have the ability to coordinated with other FHSS System in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitter.



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Radio Spectrum Matter Test Results 7

7.1 Conducted Peak Output Power

Test Requirement	47 CFR Part 15, Subpart C 15.247(b)(1)
Test Method:	ANSI C63.10 (2013) Section 7.8.5
Limit:	

Frequency range(MHz)	Output power of the intentional radiator(watt)
	1 for ≥50 hopping channels
902-928	0.25 for 25≤ hopping channels <50
	1 for digital modulation
	1 for ≥75 non-overlapping hopping channels
2400-2483.5	0.125 for all other frequency hopping systems
	1 for digital modulation
5725-5850	1 for frequency hopping systems and digital modulation

7.1.1 E.U.T. Operation

Operating Enviror	nment	:						
Temperature:	25	°C	Humidity:	52	% RH	Atmospheric Pressure:	1003	mbar

7.1.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	04	TX_non-Hop mode(Left earbuds)_Keep the EUT in continuously transmitting mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.
Final test	06	TX_non-Hop mode(Right earbuds)_Keep the EUT in continuously transmitting mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.



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7.1.3 Test Setup Diagram



Ground Reference Plane

7.1.4 Measurement Procedure and Data

cable loss=0.9dB

Please Refer to Appendix for Details



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7.2 20dB Bandwidth

Test Requirement 47 CFR Part 15, Subpart C 15.247(a)(1)

7.2.1 E.U.T. Operation

Operating Environment:

Temperature:	25	°C	Humidity:	52	% RH	Atmospheric Pressure:	1003	mbar
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7.2.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	04	TX_non-Hop mode(Left earbuds)_Keep the EUT in continuously transmitting mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.
Final test	06	TX_non-Hop mode(Right earbuds)_Keep the EUT in continuously transmitting mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

7.2.3 Test Setup Diagram



Ground Reference Plane

7.2.4 Measurement Procedure and Data

cable loss=0.9dB

Please Refer to Appendix for Details



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7.3 Carrier Frequencies Separation

Test Requirement	47 CFR Part 15, Subpart C 15.247a(1)
Test Method:	ANSI C63.10 (2013) Section 7.8.2
Limit:	

2/3 of the 20dB bandwidth base on the transmission power is less than 0.125W.

7.3.1 E.U.T. Operation

Operating Environment:

Temperature: 25 °C Humidity: 52 % RH

Atmospheric Pressure: 1003 mbar

7.3.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	03	TX_Hop mode(Left earbuds)_Keep the EUT in frequency hopping mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.
Final test	05	TX_Hop mode(Right earbuds)_Keep the EUT in frequency hopping mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

7.3.3 Test Setup Diagram



Ground Reference Plane

7.3.4 Measurement Procedure and Data

cable loss=0.9dB

Please Refer to Appendix for Details



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7.4 Hopping Channel Number

Test Requirement	47 CFR Part 15, Subpart C 15.247a(1)(iii)
Test Method:	ANSI C63.10 (2013) Section 7.8.3
Limit:	

Frequency range(MHz)	Number of hopping channels (minimum)
002.020	50 for 20dB bandwidth <250kHz
902-928	25 for 20dB bandwidth ≥250kHz
2400-2483.5	15
5725-5850	75

7.4.1 E.U.T. Operation

Operating Environ	ment	:						
Temperature:	25	°C	Humidity:	52	% RH	Atmospheric Pressure:	1003	mbar

7.4.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	03	TX_Hop mode(Left earbuds)_Keep the EUT in frequency hopping mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.
Final test	05	TX_Hop mode(Right earbuds)_Keep the EUT in frequency hopping mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

7.4.3 Test Setup Diagram



Ground Reference Plane



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7.4.4 Measurement Procedure and Data cable loss=0.9dB

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7.5 Dwell Time

Test Requirement	47 CFR Part 15, Subpart C 15.247a(1)(iii)
Test Method:	ANSI C63.10 (2013) Section 7.8.4
Limit:	

Frequency(MHz) Limit 0.4s within a 20s period(20dB bandwidth<250kHz) 902-928 0.4s within a 10s period(20dB bandwidth≥250kHz) 0.4s within a period of 0.4s multiplied by the number 2400-2483.5 of hopping channels 5725-5850 0.4s within a 30s period

7.5.1 E.U.T. Operation

Operating Environ	ment							
Temperature:	25	°C	Humidity:	52	% RH	Atmospheric Pressure:	1003	mbar

7.5.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	03	TX_Hop mode(Left earbuds)_Keep the EUT in frequency hopping mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.
Final test	05	TX_Hop mode(Right earbuds)_Keep the EUT in frequency hopping mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

7.5.3 Test Setup Diagram



Ground Reference Plane



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7.5.4 Measurement Procedure and Data

cable loss=0.9dB

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7.6 Conducted Band Edges Measurement

Test Requirement	47 CFR Part 15, Subpart C 15.247(d)
Test Method:	ANSI C63.10 (2013) Section 7.8.6
Limit:	

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

7.6.1 E.U.T. Operation

Operating Environment:

•	•								
Tempera	ture:	25	°C	Humidity:	52	% RH	Atmospheric Pressure:	1003	mbar

7.6.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	03	TX_Hop mode(Left earbuds)_Keep the EUT in frequency hopping mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.
Final test	04	TX_non-Hop mode(Left earbuds)_Keep the EUT in continuously transmitting mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.
Final test	05	TX_Hop mode(Right earbuds)_Keep the EUT in frequency hopping mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.
Final test	06	TX_non-Hop mode(Right earbuds)_Keep the EUT in continuously transmitting mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.



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7.6.3 Test Setup Diagram



Ground Reference Plane

7.6.4 Measurement Procedure and Data

cable loss=0.9dB

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7.7 Conducted Spurious Emissions

Test Requirement	47 CFR Part 15, Subpart C 15.247(d)
Test Method:	ANSI C63.10 (2013) Section 7.8.8
Limit:	

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

7.7.1 E.U.T. Operation

Operating Environment:

Temperature:	25	°C	Humidity:	52	% RH	Atmospheric Pressure:	1003	mbar

7.7.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	04	TX_non-Hop mode(Left earbuds)_Keep the EUT in continuously transmitting mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.
Final test	06	TX_non-Hop mode(Right earbuds)_Keep the EUT in continuously transmitting mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

7.7.3 Test Setup Diagram



Ground Reference Plane



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7.7.4 Measurement Procedure and Data

cable loss=0.9dB

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7.8 Radiated Emissions which fall in the restricted bands

Test Requirement	47 CFR Part 15, Subpart C 15.205 & 15.209
Test Method:	ANSI C63.10 (2013) Section 6.10.5
Measurement Distance:	3m
Limit:	

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
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

Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

7.8.1 E.U.T. Operation

Operating Environ	ment	:						
Temperature:	25	°C	Humidity:	52	% RH	Atmospheric Pressure:	1003	mbar

7.8.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	04	TX_non-Hop mode(Left earbuds)_Keep the EUT in continuously transmitting mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.
Final test	06	TX_non-Hop mode(Right earbuds)_Keep the EUT in continuously transmitting mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.



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7.8.3 Test Setup Diagram



7.8.4 Measurement Procedure and Data

a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

h. Test the EUT in the lowest channel, the Highest channel.

i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

j. Repeat above procedures until all frequencies measured was complete.

Remark 1: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

Remark 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.



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Test Mode: 04; Polarity: Horizontal; Modulation:GFSK; ; Channel:Low





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Test Mode: 04; Polarity: Vertical; Modulation:GFSK; ; Channel:Low







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Test Mode: 04; Polarity: Horizontal; Modulation:GFSK; ; Channel:High





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Test Mode: 04; Polarity: Vertical; Modulation:GFSK; ; Channel:High





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Test Mode: 06; Polarity: Horizontal; Modulation:GFSK; ; Channel:Low





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Test Mode: 06; Polarity: Vertical; Modulation:GFSK; ; Channel:Low



1	2389.659	53.08	27.33	3.48	37.59	46.30	74.00	-27.70	VERTICAL	Peak
2	2390.000	52.05	27.33	3.48	37.59	45.27	74.00	-28.73	VERTICAL	Peak
3 *	2402.000	106.80	27.35	3.50	37.59	100.06	74.00	26.06	VERTICAL	Peak



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Test Mode: 06; Polarity: Horizontal; Modulation:GFSK; ; Channel:High





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Test Mode: 06; Polarity: Vertical; Modulation:GFSK; ; Channel:High





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7.9 Radiated Spurious Emissions (Below 1GHz)

Test Requirement	47 CFR Part 15, Subpart C 15.205 & 15.209
Test Method:	ANSI C63.10 (2013) Section 6.4,6.5,6.6
Limit:	

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
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

Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

7.9.1 E.U.T. Operation

Operating Enviror	nment	::						
Temperature:	25	°C	Humidity:	52	% RH	Atmospheric Pressure:	1003	mbar

7.9.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	04	TX_non-Hop mode(Left earbuds)_Keep the EUT in continuously transmitting mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.
Final test	06	TX_non-Hop mode(Right earbuds)_Keep the EUT in continuously transmitting mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.



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7.9.3 Test Setup Diagram



7.9.4 Measurement Procedure and Data

a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

g. Test the EUT in the lowest channel, the middle channel, the Highest channel.

h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

i. Repeat above procedures until all frequencies measured was complete.

Remark:

1) Through pre-scan found the worst case is the lowest channel. Only the worst case is recorded in the report.

2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level = Receiver Reading + Antenna Factor + Cable Factor - Preamplifier Factor

3) Scan from 9kHz to 1 GHz, the disturbance below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.



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The test was performed at a 10m test site. According to below formulate and the test data at 10m test distance.

 $L_3 / L_{10} = D_{10} / D_3$

Note:

L₃: Level @ 3m distance. Unit: uV/m;

L10: Level @ 10m distance. Unit: uV/m;

D₃: 3m distance. Unit: m

D10: 10m distance. Unit: m

The level at 3m test distance is below:

Frequency (MHz)	Level @ 10m (dBuV/m)	Level @ 10m (uV/m)	Level @ 3m (uV/m)	Level @ 3m (dBuV/m)	Limit @ 3m (dBuV/m)	Margin (dB)	Ant. Polarization
42.154	9.30	2.92	9.72	19.76	40.00	-20.24	Н
56.792	10.59	3.38	11.28	21.05	40.00	-18.95	Н
156.458	11.63	3.82	12.72	22.09	43.50	-21.41	Н
332.519	14.09	5.06	16.88	24.55	46.00	-21.45	Н
668.142	23.12	14.32	47.74	33.58	46.00	-12.42	Н
922.516	27.99	25.09	83.63	38.45	46.00	-7.55	Н
39.994	10.19	3.23	10.77	20.65	40.00	-19.35	V
53.318	9.81	3.09	10.31	20.27	40.00	-19.73	V
148.963	12.15	4.05	13.50	22.61	43.50	-20.89	V
338.400	13.94	4.98	16.59	24.40	46.00	-21.60	V
614.214	22.32	13.06	43.54	32.78	46.00	-13.22	V
935.546	27.77	24.46	81.54	38.23	46.00	-7.77	V



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Test Mode: 04; Polarity: Horizontal



:	SGS
:	
:	
:	
:	04
	: : : : :

	Freq	Read Level	Anterna Factor	Cable Loss	Preamp Factor	Measured Level	Limit Line	Over Limit	Pol/ Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		<u> </u>
1	42.154	22.09	13.27	1.11	27.17	9.30	29.50	-20.20	HORIZONTAL	QP
2	56.792	23.32	13.22	1.21	27.16	10.59	29.50	-18.91	HORIZONTAL	QP
3	156.458	22.79	13.35	2.30	26.81	11.63	33.10	-21.47	HORIZONTAL	QP
4	332.519	23.31	14.13	3.42	26.77	14.09	35.60	-21.51	HORIZONTAL	QP
5	668.142	25.16	20.52	5.61	28.17	23.12	35.60	-12.48	HORIZONTAL	QP
6	922.516	25.02	23.78	7.01	27.82	27.99	35.60	-7.61	HORIZONTAL	QP



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Test Mode: 04; Polarity: Vertical



Trace: (Discrete)

Site	:	SGS
Job	:	
Model	:	
Power	:	
Test Mode	:	04

	Freq	Read Level	Anterna Factor	Cable Loss	Preamp Factor	Measured Level	Limit Line	Over Limit	Pol/ Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	39.994	23.27	13.00	1.10	27.18	10.19	29.50	-19.31	VERTICAL	QP
2	53.318	22.31	13.50	1.17	27.17	9.81	29.50	-19.69	VERTICAL	QP
3	148.963	23.45	13.32	2.22	26.84	12.15	33.10	-20.95	VERTICAL	QP
4	338.400	23.04	14.22	3.50	26.82	13.94	35.60	-21.66	VERTICAL	QP
5	614.214	25.19	20.10	5.23	28.20	22.32	35.60	-13.28	VERTICAL	QP
6	935.546	24.87	23.62	7.06	27.78	27.77	35.60	-7.83	VERTICAL	QP



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The test was performed at a 10m test site. According to below formulate and the test data at 10m test distance.

 $L_3 / L_{10} = D_{10} / D_3$

Note:

L₃: Level @ 3m distance. Unit: uV/m;

L10: Level @ 10m distance. Unit: uV/m;

D₃: 3m distance. Unit: m

D10: 10m distance. Unit: m

The level at 3m test distance is below:

Frequency (MHz)	Level @ 10m (dBuV/m)	Level @ 10m (uV/m)	Level @ 3m (uV/m)	Level @ 3m (dBuV/m)	Limit @ 3m (dBuV/m)	Margin (dB)	Ant. Polarization
34.396	9.25	2.90	9.67	19.71	40.00	-20.29	Н
50.232	9.94	3.14	10.47	20.40	40.00	-19.60	Н
145.861	10.76	3.45	11.50	21.22	43.50	-22.28	Н
329.039	13.67	4.83	16.08	24.13	46.00	-21.87	Н
627.274	22.86	13.90	46.33	33.32	46.00	-12.68	Н
766.057	26.34	20.75	69.16	36.80	46.00	-9.20	Н
44.431	9.90	3.13	10.42	20.36	40.00	-19.64	V
63.759	10.57	3.38	11.26	21.03	40.00	-18.97	V
151.597	11.89	3.93	13.10	22.35	43.50	-21.15	V
280.024	12.85	4.39	14.63	23.31	46.00	-22.69	V
605.659	22.93	14.01	46.71	33.39	46.00	-12.61	V
893.857	27.65	24.13	80.42	38.11	46.00	-7.89	V



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Test Mode: 06; Polarity: Horizontal



Trace: (Discrete)

:	SGS
:	
:	
:	
:	06

	Freq	Read Level	Anterna Factor	Cable Loss	Preamp Factor	Measured Level	Limit Line	Over Limit	Pol/ Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	34.396	22.96	12.41	1.06	27.18	9.25	29.50	-20.25	HORIZONTAL	QP
2	50.232	22.34	13.62	1.15	27.17	9.94	29.50	-19.56	HORIZONTAL	QP
3	145.861	22.21	13.23	2.18	26.86	10.76	33.10	-22.34	HORIZONTAL	QP
4	329.039	22.96	14.06	3.38	26.73	13.67	35.60	-21.93	HORIZONTAL	QP
5	627.274	25.79	19.94	5.33	28.20	22.86	35.60	-12.74	HORIZONTAL	QP
6	766.057	26.31	22.04	6.05	28.06	26.34	35.60	-9.26	HORIZONTAL	QP



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Test Mode: 06; Polarity: Vertical



Trace: (Discrete)

Site	:	SGS
Job	:	
Model	:	
Power	:	
Test Mode	:	06

	Freq	Read Level	Anterna Factor	Cable Loss	Preamp Factor	Measured Level	Limit Line	Over Limit	Pol/ Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB); <u></u> ()
1	44.431	22.54	13.41	1.12	27.17	9.90	29.50	-19.60	VERTICAL	QP
2	63.759	24.07	12.33	1.32	27.15	10.57	29.50	-18.93	VERTICAL	QP
3	151.597	23.10	13.36	2.26	26.83	11.89	33.10	-21.21	VERTICAL	QP
4	280.024	23.61	12.72	3.09	26.57	12.85	35.60	-22.75	VERTICAL	QP
5	605.659	26.10	19.86	5.18	28.21	22.93	35.60	-12.67	VERTICAL	QP
6	893.857	25.41	23.24	6.86	27.86	27.65	35.60	-7.95	VERTICAL	QP



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7.10 Radiated Spurious Emissions (Above 1GHz)

Test Requirement	47 CFR Part 15, Subpart C 15.205 & 15.209
Test Method:	ANSI C63.10 (2013) Section 6.4,6.5,6.6
Measurement Distance:	3m
Limit:	

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
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

Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

7.10.1 E.U.T. Operation

Operating Environment:										
Temperature:	25	°C	Humidity:	52	% RH	Atmospheric Pressure:	1003	mbar		

7.10.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	04	TX_non-Hop mode(Left earbuds)_Keep the EUT in continuously transmitting mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.
Final test	06	TX_non-Hop mode(Right earbuds)_Keep the EUT in continuously transmitting mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.



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7.10.3 Test Setup Diagram





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7.10.4 Measurement Procedure and Data

a. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, guasi-peak or average method as specified and then reported in a data sheet.

g. Test the EUT in the lowest channel, the middle channel, the Highest channel.

h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

i. Repeat above procedures until all frequencies measured was complete.

Remark:

1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level =Receiver Reading + Antenna Factor + Cable Factor - Preamplifier Factor

2) Scan from 1GHz to 25GHz, the disturbance above 18GHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

3) The field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.



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Test Mode: 06; Polarity: Horizontal; Modulation:GFSK; ; Channel:High





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8 Test Setup Photo

Refer to Appendix – SetupPhoto for GZCR2204000427AT

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9 EUT Constructional Details (EUT Photos)

Refer to Appendix – External and Internal Photos for GZCR2204000427AT

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10 Appendix

For right earbud:

- 1. Bandwidth
- 1.1 OBW
- 1.1.1 Test Result

Mada	ΤХ	Frequency	Packet		99% Occupied Bandwidth (MHz)	Vardiat	
Mode	Туре	(MHz) Type ANT		ANT	Result	VEICICI	
		2402	DH5	1	0.942	Pass	
GFSK	SISO	2441	DH5	1	0.928	Pass	
		2480	DH5	1	0.939	Pass	
	SISO	2402	2DH5	1	1.133	Pass	
Pi/4DQPSK		2441	2DH5	1	1.132	Pass	
		2480	2DH5	1	1.132	Pass	
		2402	3DH5	1	1.139	Pass	
8DPSK	SISO	2441	3DH5	1	1.142	Pass	
		2480	3DH5	1	1.144	Pass	



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1.1.2 Test Graph



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1.2 20dB BW

1.2.1 Test Result

Mada	ТΧ	Frequency	Packet		20dB Bandwidth (MHz)	Vordict	
Mode	Туре	(MHz) Type		ANT	Result	verdict	
		2402	DH5	1	1.048	Pass	
GFSK	SISO	2441	DH5	1	1.044	Pass	
		2480	DH5	1	1.045	Pass	
	SISO	2402	2DH5	1	1.214	Pass	
Pi/4DQPSK		2441	2DH5	1	1.206	Pass	
		2480	2DH5	1	1.209	Pass	
		2402	3DH5	1	1.247	Pass	
8DPSK	SISO	2441	3DH5	1	1.246	Pass	
		2480	3DH5	1	1.251	Pass	



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1.2.2 Test Graph



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2. Maximum Conducted Output Power

2.1 Power

2.1.1 Test Result

Mode	TX Type	Frequency (MHz)	Packet Type	Maximum Peak Conduc	Vardiat	
				ANT1	Limit	verdict
GFSK	SISO	2402	DH5	13.34	<=20.97	Pass
		2441	DH5	13.83	<=20.97	Pass
		2480	DH5	14.07	<=20.97	Pass
Pi/4DQPSK	SISO	2402	2DH5	13.27	<=20.97	Pass
		2441	2DH5	13.76	<=20.97	Pass
		2480	2DH5	14.00	<=20.97	Pass
8DPSK	SISO	2402	3DH5	13.25	<=20.97	Pass
		2441	3DH5	13.73	<=20.97	Pass
		2480	3DH5	13.96	<=20.97	Pass



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3. Carrier Frequency Separation

3.1 Ant1

3.1.1 Test Result

Ant1									
Mode	ТХ Туре	Frequency (MHz)	Packet Type	Channel Separation (MHz)	20dB Bandwidth (MHz)	Limit (MHz)	Verdict		
GFSK	SISO	HOPP	DH5	0.990	1.048	>=0.699	Pass		
Pi/4DQPSK	SISO	HOPP	2DH5	1.001	1.214	>=0.809	Pass		
8DPSK	SISO	HOPP	3DH5	0.996	1.251	>=0.834	Pass		



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3.1.2 Test Graph





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4. Number of Hopping Frequencies

4.1 HoppNum

4.1.1 Test Result

Mada	ΤХ	Frequency	Packet Type	Num of Hoppir	Vordiat	
Mode	Туре	(MHz)		ANT1	Limit	verdict
GFSK	SISO	HOPP	DH5	79	>=15	Pass
Pi/4DQPSK	SISO	HOPP	2DH5	79	>=15	Pass
8DPSK	SISO	HOPP	3DH5	79	>=15	Pass



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4.1.2 Test Graph





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5. Time of Occupancy (Dwell Time)

5.1 Ant1

5.1.1 Test Result

Ant1										
Mode	ТХ Туре	Frequency (MHz)	Packet Type	Duration of Single Pulse (ms)	Observation Period (s)	Num of Pulse in Observation Period	Dwell Time (ms)	Limit (ms)	Verdict	
GFSK	SISO	HOPP	DH1	0.398	31.600	168	66.864	<=400	Pass	
			DH3	1.670	31.600	93	155.310	<=400	Pass	
			DH5	2.916	31.600	84	244.944	<=400	Pass	
Pi/4DQPSK	SISO	HOPP	2DH1	0.404	31.600	170	68.680	<=400	Pass	
			2DH3	1.674	31.600	117	195.858	<=400	Pass	
			2DH5	2.902	31.600	79	229.258	<=400	Pass	
8DPSK	SISO	SO HOPP	3DH1	0.402	31.600	170	68.340	<=400	Pass	
			3DH3	1.674	31.600	111	185.814	<=400	Pass	
			3DH5	2.924	31.600	80	233.920	<=400	Pass	



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5.1.2 Test Graph



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