Test Report Issued Under the Responsibility of:

ITC ENGINEERING SERVICES, INC.

Test Report **FCC CFR Title 47 Part 15.247, 15.209 , Part 2 Sect. 2.1049 (H)**	
Report Reference No. ..... :	20240515-01R-RF Zerene
Date of Issue ..... :	10/08/2024
Total Number of Pages ..... :	30
Testing Laboratory ..... :	ITC Engineering Services, Inc.
Address ..... :	9959 Calaveras Road, Box 543, Sunol CA 94586
Applicant's Name ..... :	Zerene Inc.
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Phone ..... :	314-707-2039
Test Specification Standard ..... :	FCC CFR Title 47 Part 15 Subpart C 15.205, 15.209, 15.247
Test Procedure ..... :	KDB 558074 D01 DTS Meas Guidance v03r04 ANSI C63.4:2014, ANSI C63.10:2020 (Test Procedures)
Judgment ..... :	Complies as Tested
Test Item Description ..... :	Bluetooth Smart Enabled
Trade Mark ..... :	Zerene
Manufacturer ..... :	Zerene Inc.
Model/Type Reference ..... :	Zerene 100
RF Operating Frequency Bands ..... :	2.402 - 2.48 GHz
FCC ID. ..... :	2BHQJ-ZERENE100

NVLAP TESTING

LAB CODE: 600310-0

ilac-MRA

PJLA Testing

Accreditation#: 93332

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1 DOCUMENTATION

1.1 Testing Location

☒ ITC Testing Laboratory:	:	ITC Engineering Services, Inc.	
Testing Location/Address	:	9959 Calaveras Road, PO Box 543, Sunol, CA 94586, USA	
Prepared By (Name + Signature)	:	Mehdi Bahadorzadeh	M Bahadorzadeh
Tested By (Name + Signature)	:	Mehdi Bahadorzadeh	M Bahadorzadeh
Tested By (Name + Signature)	:	Parvinder Singh	Psingh
Approved By (Name + Signature)	:	Michael Gbadebo, PE	M Gbadebo
☐ Manufacturer Facility	:		
Testing Location/Address	:		
Tested By (Name + Signature)	:		
Approved By (+ Signature)	:		
☐ 3rd Party Test Facility	:		
Testing Location/Address	:		
Tested By (Name + Signature)	:		
Approved By (+ Signature)	:		

1.2 Declaration/Disclaimer

It is the manufacturer's responsibility to assure that additional production units of these models are manufactured with identical electrical and mechanical characteristics. This report is the confidential property of the client. As a mutual protection to our clients, the public, and ourselves, extracts from the test report shall not be reproduced except in full without ITC Engineering Service's written approval. The applicant/manufacturer shall not use this report to claim product endorsement by any US or International Government agency.

1.3 Revision History

Revision Date	Revision No.	Report No. New	Revision
N/A	N/A	20240515-01- RF Zerene	Initial release
10/08/2024	1	20240515-01R- RF Zerene	1. Added FCC ID on Page 1 2. Removed Test setup & EUT Photos (Section 1.11 & 13.2)

1.4 Condition of EUT

Equipment Under Test (EUT) was tested as it was received. The radiated mode tests utilize the EUT internal antenna. The Bluetooth radio uses internal SMD antenna. For the conducted mode tests, the internal antenna was removed. A UFL RF cable was used to connect the antenna port to the spectrum analyzer. The EUT operation was controlled via Bluetooth connection from a cellphone.

1.5 General Description of the EUT

Product	Zerene
Model No.	Zerene 100
Power Supply	Internal rechargeable Lithium Polymer battery, 3.7V 100mAh
I/O Ports	USB charging
Operating Frequency Range	2.402 - 2.48 GHz
Bluetooth 5.2 Smart	
Modulation Type	GFSK (2 Mbps)
Modulation Technology	FHSS
Transfer Rate	2 Mbps
Number of Channels	40
Maximum Output Power	0 dBm, Class 3
Channel Separation	2 MHz
Antenna	
Antenna Type	Chip antenna
Antenna Gain, Peak	-2.0 dBi
Radiation Pattern	Omni-directional

1.6 Operational Description of the EUT

The Zerene is a wearable BLE device that interfaces with a mouthguard to collect telemetry on the jaw as a user sleeps. Furthermore, it provides vibratory stimulation to retrain the user to stop clenching/grinding the jaw; thereby, benefiting the jaw and teeth.

1.7 List of Peripherals/Supporting Equipment's Used During Test

Description	Manufacturer	Model Name	Serial Number
Cellphone	Samsung	Android	N/A

1.8 General Test Remarks

The EUT and peripheral equipment were operated under the following conditions during testing:

☐	Standby	☐	Test Program (H - Pattern)
☐	Test Program (Color Bar)	☐	Test Program (Customer Specific) *
☐	TV/VCR Signal Input	☐	Signal Generator Input
☐	Continuous Audio Tone (1kHz)	☐	Cycled Audio Tone (1kHz)
☐	Printer/Parallel Function	☐	Modem/Serial Function
☐	Serpentine Program with I/O	☐	Serpentine Program without I/O
☐	Practice Operation	☒	Normal Operating Mode
☐	Essential Operation (Functional Safety)	☐	Continuous Unmonitored Operation
☒	Continuous Monitored Operation	☐	Non-Continuous Operation

The requirements according to the technical regulations are:

☒	**Met**	☐	**Not Met**

The Equipment under Test does:

☒ Fulfill the general approval requirements
☐ Not fulfill the general approval requirements

1.9 Summary of Tests

ITC Engineering Services, Inc. as an independent testing laboratory, declares that the equipment specified above was tested to the requirements of:

Table 1: Test Summary

Section of FCC Title 47 CFR	Test Description	Result
15.209	Radiated Emissions, general	Passed
Part 15.247 (1)	Carrier Frequency Separation	Passed
15.247 (A)(2)	Min 6 dB Bandwidth	Passed
15.247 (B)(3)	Peak Conducted Output Power	Passed
15.247 (E)	Power Spectral Density	Passed
15.247 (D)	Lower/Upper - Band-Edge Measurement	Passed
2.1049 (h)	Occupied Bandwidth	Passed
15.209/205	Conducted Spurious & Restricted Band Emissions	Passed
15.247 (b)(4)	Gain of Transmission Antenna	Passed

1.10 Measurement Uncertainty

The measurement of uncertainty levels were estimated based on calculation in accordance with TR 100-028-1. Using the value k = 2 for expanded uncertainty, this provides a 95% level of confidence.

	Measurement Method	Calculated Uncertainty (dB)
1	RF Power, Conducted	1.5
2	Radiated emission of transmitter (30MHz - 13 GHz) @ 3m	3.2

2 Radiated Emission Test Per FCC Part 15.209

2.1 Administrative and Environmental Details

Site Used:	Semi-anechoic Chamber
Test Date:	05/30/24, 05/31/24
Test Engineer:	Mehdi Bahadorzadeh
Temperature:	23 °C
Humidity:	42% RH

2.2 Test Equipment

Equipment Description	Manufacturer	Model Name	Serial Number	Calibration Due
Active Loop Antenna	Com-Power	AL-130R	10160035	08/26/2024
Bi Log Antenna	Com-Power	AC-220	061132	07/18/2025
Horn Antenna	EMCO	3115	8812-3050	07/10/2025
EMC Analyzer	Agilent	E7405A	US40240257	02/11/2026

2.3 Limits/Requirements

Table 2: RE Field Strength FCC Part 15.209

Frequency (MHz)	Field strength Average (µV/m)	Field strength Average (dBµV/m)	Field strength Peak (dBµV/m)	Measurement distance (m)	Average Limit @ 3m (dBµV/m)	Peak Limit @ 3m (dBµV/m)
0.009-0.49	267 – 4.9 **	48.5 - 13.8	68.5 – 33.8	300*	88.5 – 53.8	108.5 – 73.8
0.49-1.705	49 – 15.2 ***	33.8 - 23	53.8 - 43	30*	53.8 - 43	73.8 - 63
1.705-30	30	29.5	49.5	30*	49.5	69.5
30-88	100	40	60	3	-	-
88-216	150	43.5	63.5	3	-	-
216-960	200	46	66	3	-	-
Above 960	500	54	74	3	-	-

*Measurement performed at 3m per 47 CFR 15.31 (f)(2) distance scaling factor.
** 2400/F(kHz)
*** 24000/F(kHz)

2.4 Test Description and Procedure

The EUT was placed on a wooden turntable 80 cm above the ground reference plane in a semi-anechoic chamber. It was powered on and placed in an operational mode. The table was rotated to maximize the signal received by the measurement system. Radiated emissions were monitored from 9KHz to 13 GHz using 3 different Antennas placed three meters from the EUT. The elevation of the Antennas above the ground plane was moved up and down between 1 to 4 m, in order to acquire maximum signal strength for both BiLog and Horn Antenna. The active loop Antenna was located at a fixed height of 1 meter. In all cases measurements were made with Antennas Vertically and Horizontally polarized. Measured signals were oberserved and recorded. Data plots included below are the worst-case data.

9 KHz - 30MHz Radiated Emissions

Transmit	Freq (MHz)	Peak Emission	Average (dBuV/m)	Quasi-Peak (dBuV/m)	Result	Peak Limit (dBuV/m)

Freq (MHz)	H	V	(dBuV/m) H	V	H	V	H	V		
2402	0.082	0.082	9.63	14.99	2.28	12.01	2.28	12.52	Passed	108.5 – 73.8
2446	1.101	0.680	29.46	47.84	6.99	47.84	24.88	45.72	Passed	73.8 - 63
2480	2.531	2.323	40.22	41.11	39.52	40.37	35.55	37.30	Passed	69.5

30 MHz - 216 MHz Radiated Emissions

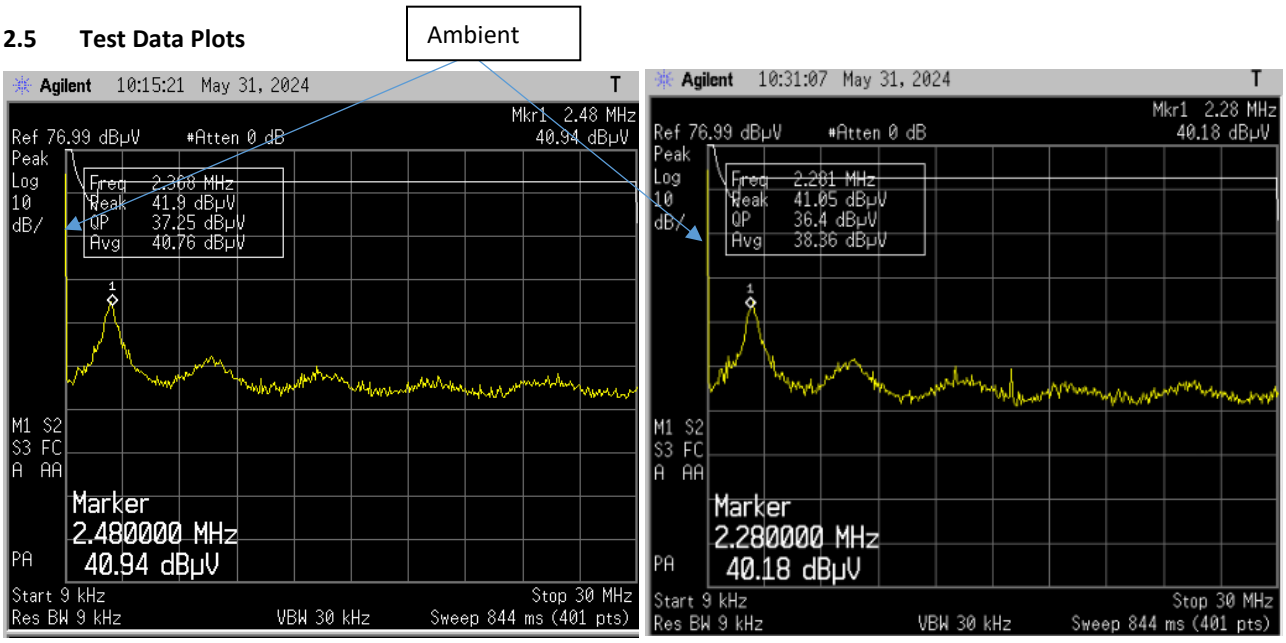
Transmit Freq (MHz)	Freq (MHz) H	V	Peak Emission (dBuV/m) H	V	Average (dBuV/m) H	V	Quasi-Peak (dBuV/m) H	V	Result	Peak Limit Limit (dBuV/m)
2402	40.06	42.49	31.54	23.06	6.81	23.23	22.3	14.74	Passed	60
2446	44.99	40.02	23.46	32.91	12.55	23.14	18.35	24.14	Passed	60
2480	102.5	42.62	19.68	9.253	25.19	6.99	13.40	21.15	Passed	63.5

216 MHz - 1000 MHz Radiated Emissions

Transmit Freq (MHz)	Freq (MHz) H	V	Peak Emission (dBuV/m) H	V	Average (dBuV/m) H	V	Quasi-Peak (dBuV/m) H	V	Result	Peak Limit Limit (dBuV/m)
2402	767.0	759.3	36.45	33.55	18.93	21.55	30.05	25.84	Passed	66
2446	882.0	880.8	35.42	35.74	27.41	21.02	26.94	30.78	Passed	66
2480	750.6	742.7	27.53	27.38	17.90	15.58	20.75	20.79	Passed	66

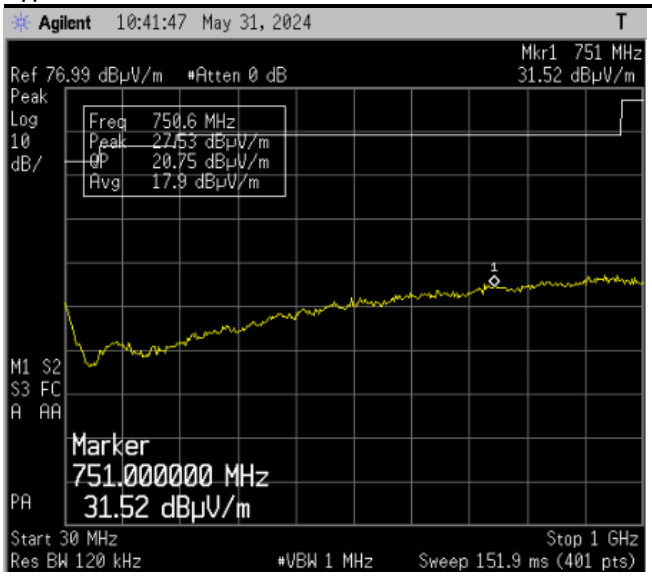
NOTE: H MEANS HORIZONTAL AND V MEANS VERTICAL ANTENNA POLARIZATIONS

2.5 Test Data Plots

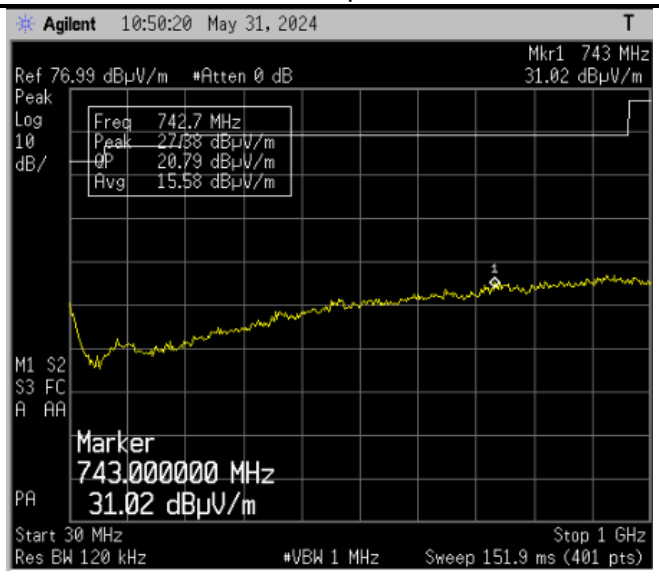


Horizontal polarization Vertical polarization

Figure 1: Radiated Emissions – Active Loop, 9 kHz – 30 MHz, Max Peak Measurement

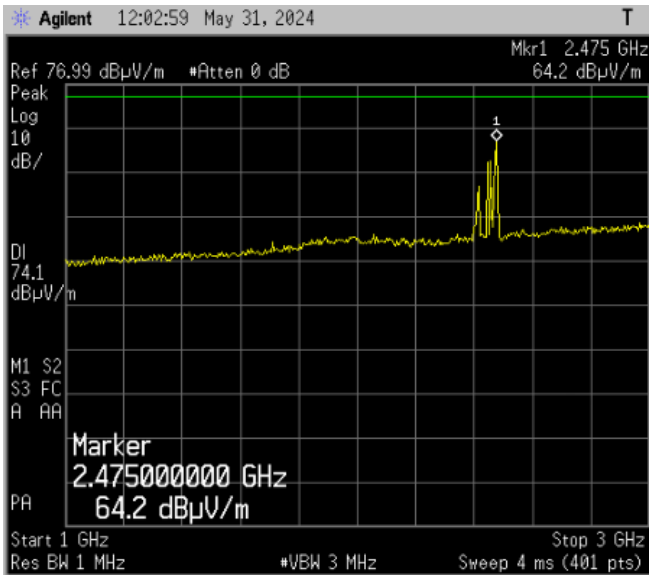


Horizontal polarization

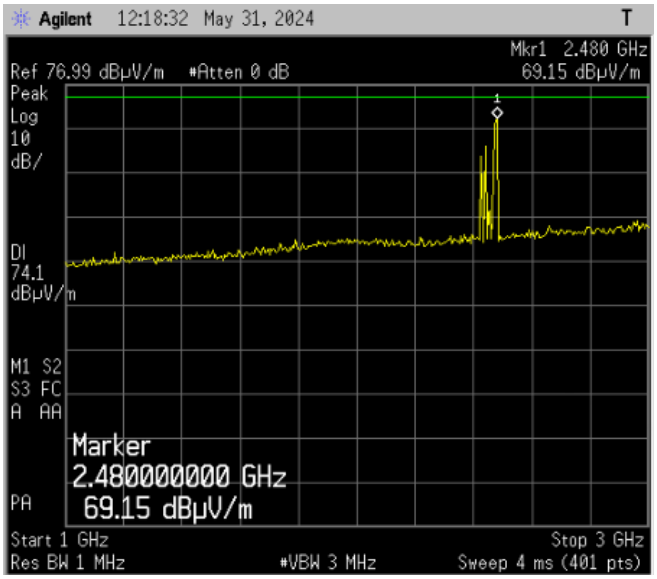


Vertical polarization

Figure 2: Radiated Emissions – BiLog Antenna 30 MHz – 1000 MHz, Max Peak Measurement

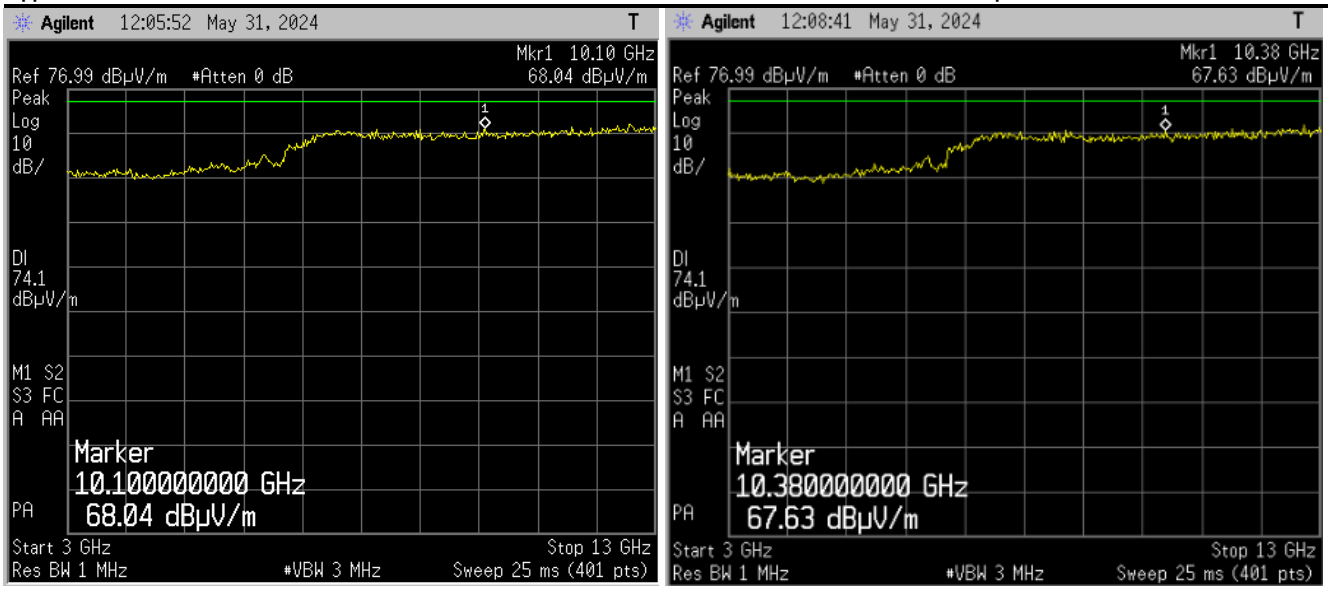


Horizontal polarization



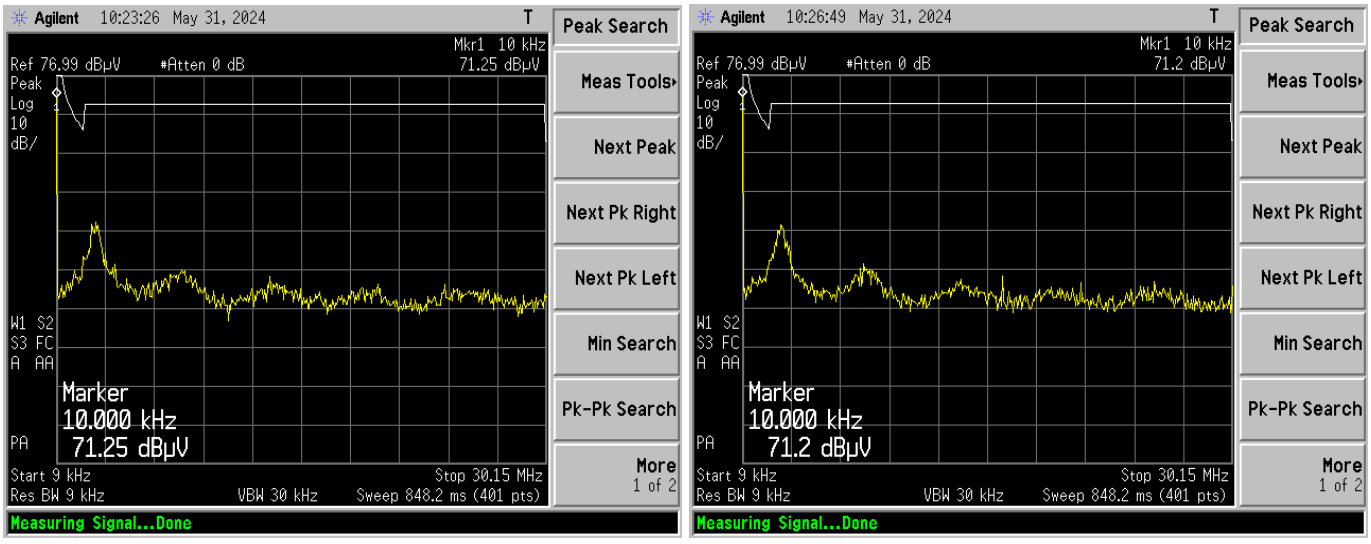
Vertical polarization

Figure 3: Radiated Emissions – Horn Antenna, 1 – 3 GHz, Max Peak Measurement



Horizontal polarization Vertical polarization

Figure 4: Radiated Emissions – Horn Antenna, 3 – 13 GHz, Max Peak Measurement



Horizontal polarization Vertical polarization

Figure 5: Ambient Noise 9KHz to 30 MHz

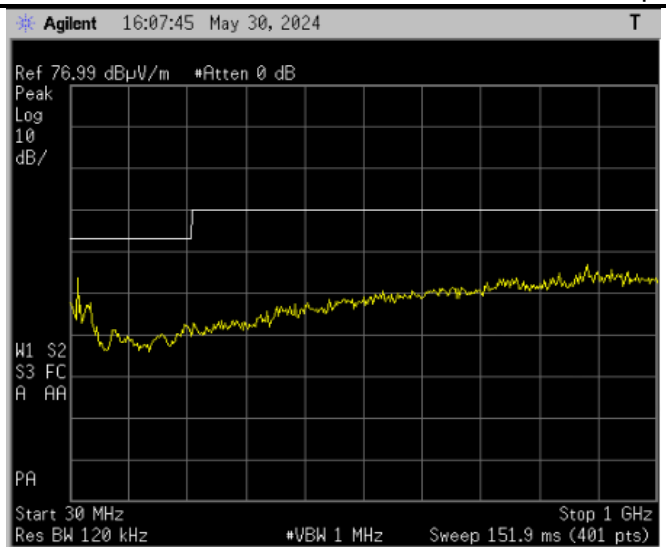


Figure 6: Ambient Noise 30MHz to 1 GHz

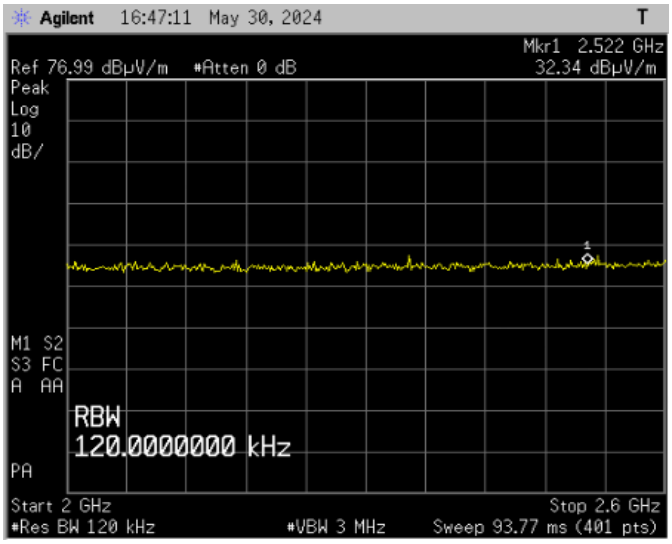


Figure 7: Base Line Only (2 GHz – 2.6 GHz)

3 CONDUCTED POWER LINE EMISSIONS PER FCC PART 15.207-BLUETOOTH SMART

3.1 Administrative and Environmental Details

Site Used:	EMC Lab 2A
Test Date:	06/12/2024
Test Engineer:	Parvinder Singh
Temperature	23°C
Humidity:	33%

3.2 Test Equipment

Equipment Description	Manufacturer	Model Name	Serial Number	Calibration Due Date
EMC Analyzer	Agilent	E7405A	US40240257	02/11/2026
LISN	COM-POWER	LIN-120C	20160042	05/17/2025

3.3 Limits/Requirements

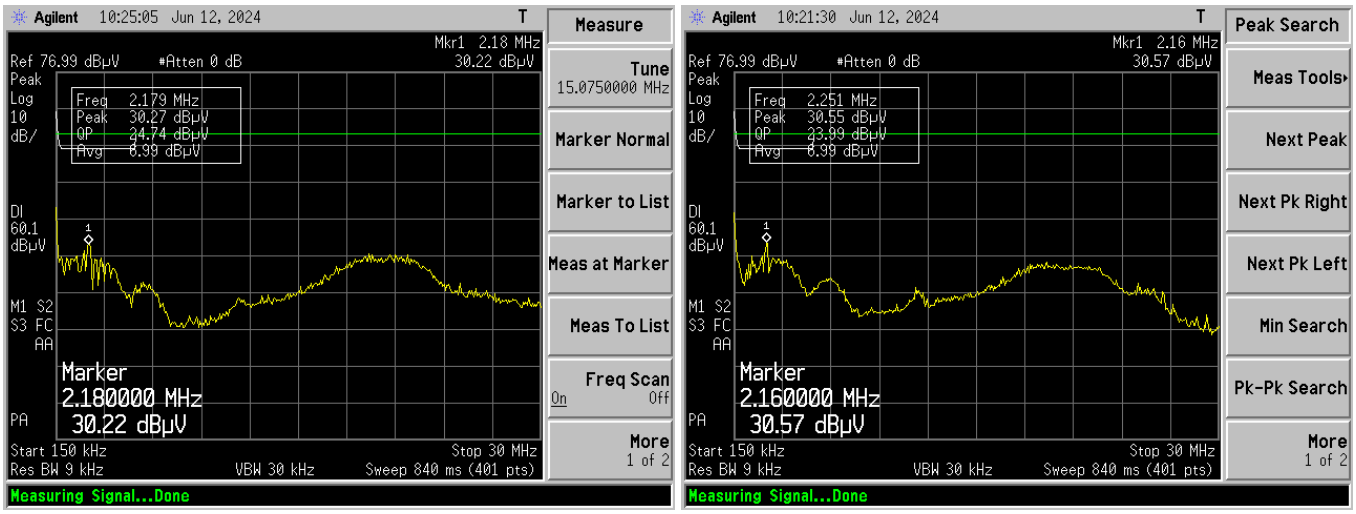
Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

3.4 Test Description and Procedure

The EUT was placed in a shielded room 80 cm above the horizontal ground reference plane and 40 cm away from the vertical ground reference plane. AC mains input to the DC charging adapter was supplied through a LISN (Line Impedance Stabilization Network). The 5Vdc output of the charging adapter was supplied to the EUT. The line conducted tests were performed on the AC mains hot and neutral lines.

3.5 Test Data Plots



(Hot Line) (Neutral Line)

Figure 8: Powerline Conducted Emission Test Plots

4 Carrier Frequency Separation Per FCC Part 15.247 (a)(1) – Bluetooth 5.2 Smart

4.1 Administrative and Environmental Details

Site Used:	EMC Lab 2A
Test Date:	08/30/2024
Test Engineer:	Parvinder Singh
Temperature:	21 °C
Humidity:	48% RH

4.2 Test Equipment

Equipment Description	Manufacturer	Model Name	Serial Number	Calibration Due Date
Signal Analyzer	Agilent	N9020A	MY47271103	10/25/2024

4.3 Limits/Requirements

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on 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. The frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

4.4 Test Description and Procedure

The EUT antenna port was connected to the spectrum analyzer using the PCB MHF connector cable. The transmitted trace was allowed to stabilize using Max Hold. The number of frequency hops were counted. The frequency separation was measured at the peaks of adjacent channels in operating mode, as well as from the 20 dB bandwidth of the peak signal.

Table 3: Minimum 25KHz Separation between the channels at 20 dB bandwidth

Channel	Frequency	Separation (KHz)	Results
Low Channels	2403 - 2407	816	Pass
Mid Channels	2445 - 2449	844	Pass
High Channels	2475 - 2579	808	Pass

4.5 Test Data Plots

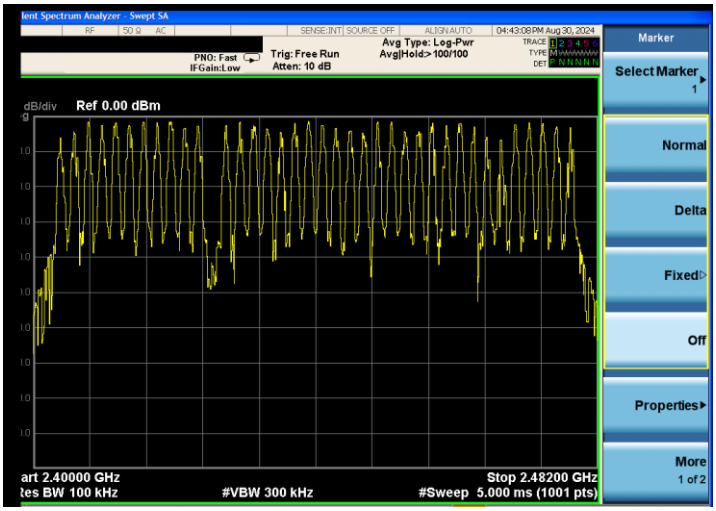


Figure 9: BLE Channel frequency separation 2 MHz

Figure 10: BLE Channel frequency separation for Low Channel and Mid Channel

Figure 11: BLE Channel frequency separation for high Channel

5 Minimum 6 dB Bandwidth Per FCC Part 15.247 (a)(2) – Bluetooth 5.2 Smart

5.1 Administrative and Environmental Details

Site Used:	EMC Lab 2A
Test Date:	08/30/2024
Test Engineer:	Parvinder Singh
Temperature:	21 °C
Humidity:	48% RH

5.2 Test Equipment

Equipment Description	Manufacturer	Model Name	Serial Number	Calibration Due Date
Signal Analyzer	Agilent	N9020A	MY47271103	10/25/2024

5.3 Limits/Requirements

Systems using digital modulation techniques may operate in the 2400-2483.5 MHz band the minimum 6 dB bandwidth shall be at least 500 kHz.

5.4 Test Description and Procedure

The minimum 6dB bandwidth was determined by measuring the width of the carrier signal at point where the level was 6dB below the maximum signal power. The EUT was placed in operational mode. The test was performed at or near the low, mid and high channel of the operating band.

Table 4: 6 dB Bandwidth Measurement Test Data

Channel	Frequency	GFSK 6 dB BW (KHz)	Results
0	2404	516	Pass
18	2444	522	Pass
36	2480	664	Pass

5.5 Test data Plots

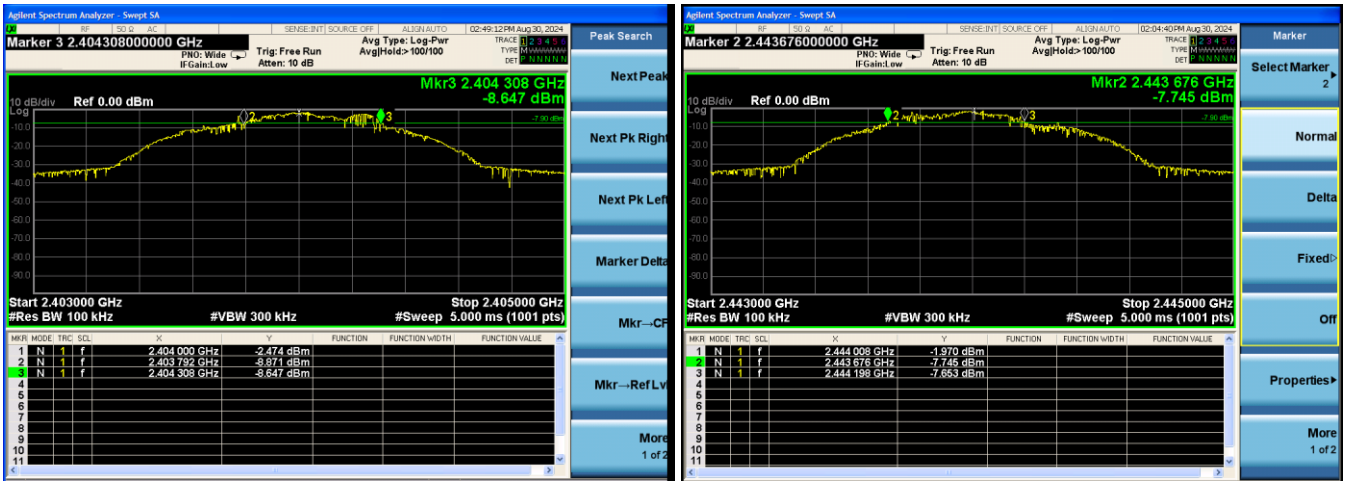


Figure 12: Bluetooth 5.2 Smart Low & Mid Band

Figure 13: Bluetooth 5.2 Smart High Band

6 Peak Conducted Output Power Per FCC Part 15.247 (B)(3) – Bluetooth 5.2 Smart

6.1 Administrative and Environmental Details

Site Used:	EMC Lab 2A
Test Date:	08/29/2024
Test Engineer:	Parvinder Singh
Temperature:	27 °C
Humidity:	44% RH

6.2 Test Equipment

Equipment Description	Manufacturer	Model Name	Serial Number	Calibration Due Date
Signal Analyzer	Agilent	N9020A	MY47271103	10/25/2024

6.3 Limits/Requirements

(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:
(3) Maximum peak power transmitted is 1 Watt or 30 dBm.

6.4 Test Description and Procedure

The maximum peak conducted output power was measured at the center peak of the selected channel. Measurements are performed at each of the low, mid and high frequencies in the band. The cable loss at the Bluetooth frequency range was 0.8 dB. Based on the datasheet of EFR32BG22C112 Wireless Gecko SoC the maximum transmit power through integrated PA is up to 0 dBm (2.4 GHz).

Table 5: Test Data Tables

Channel	Freq (MHz)	MPP (dBm)	CPP (dBm)	Margin = 30 - CPP (dB)	Result
		GFSK	GFSK	GFSK	
0	2404	-2.04	-1.24	31.24	Passed
19	2444	-2.96	-2.16	32.16	Passed
39	2480	-3.44	-2.64	32.64	Passed

MPP = Measured Peak Power CPP = Corrected Peak Power = MPP + Cable Loss 0.8 dB

6.5 Test Data Plot

(Low Ch 0)

(Mid Ch 19)

Figure 14: Peak Conducted Output Power

(High Ch 36)

Figure 15: Peak Conducted Output Power

7 Power Spectral Density Per FCC Part 15.247 (E) – Bluetooth 5.2 Smart

7.1 Administrative and Environmental Details

Site Used:	EMC Lab 2A
Test Date:	08/28/2024
Test Engineer:	Parvinder Singh
Temperature:	27 °C
Humidity:	48% RH

7.2 Test Equipment

Equipment Description	Manufacturer	Model Name	Serial Number	Calibration Due Date
Signal Analyzer	Agilent	N9020A	MY47271103	10/25/2024

7.3 Limits/Requirements

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

7.4 Test Description and Procedure

The EUT antenna port was connected to the spectrum analyzer by using UFL to N-Port cable. The power spectral density was measured at the center peak of the selected channel. Measurements were performed at each of the low, mid and high frequencies in the band.

At the peak of the fundamental frequency, the 8 dB bandwidth is 600 kHz for the low channel, 752 kHz for the mid channel, and 710 kHz for the high channel. Therefore, the 3 kHz bandwidth during any continuous transmission period cannot exceed 8 dBm.

Table 6: Test Data Table

Channel	Freq (MHz)	MPSD (dBm/3 kHz)	CPSD (dBm/3 kHz)	Margin = 8 – CPSD (dB)	Result
		GFSK	GFSK	GFSK	
0	2404	-2.74	-1.94	9.94	Passed
19	2444	-2.96	-2.16	10.16	Passed
36	2478	-3.16	-2.36	10.36	Passed

PSD = Measured Power Spectral Density CPSD = Corrected Power Spectral Density = MPSD + Cable Loss 0.8 dB

7.5 Power Spectral Density Plots

Figure 16: GFSK Power Spectral Density (Low Band & Mid Band)

Figure 17: GFSK Power Spectral Density (High Band)

8 Lower/Upper Band Edge Per FCC Part 15 Section 15.247 (D) – Bluetooth 5.2 Smart

8.1 Administrative and Environmental Details

Site Used:	EMC Lab 2A
Test Date:	08/26/2024
Test Engineer:	Parvinder Singh
Temperature:	27 °C
Humidity:	44% RH

8.2 Test Equipment

Equipment Description	Manufacturer	Model Name	Serial Number	Calibration Due Date
Signal Analyzer	Agilent	N9020A	MY47271103	10/25/2024

8.3 Limits/Requirements

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.

8.4 Test Description and Procedure

Using the conducted test method, the band edge measurement was made at the peak level of the emission. The span was set to be wide enough to capture the highest peak level.

The measurement plots below show the highest signal outside of the 100 KHz bandwidth from the transmit signal is more than 20 dB for low and high channel.

8.5 Test Data Plots

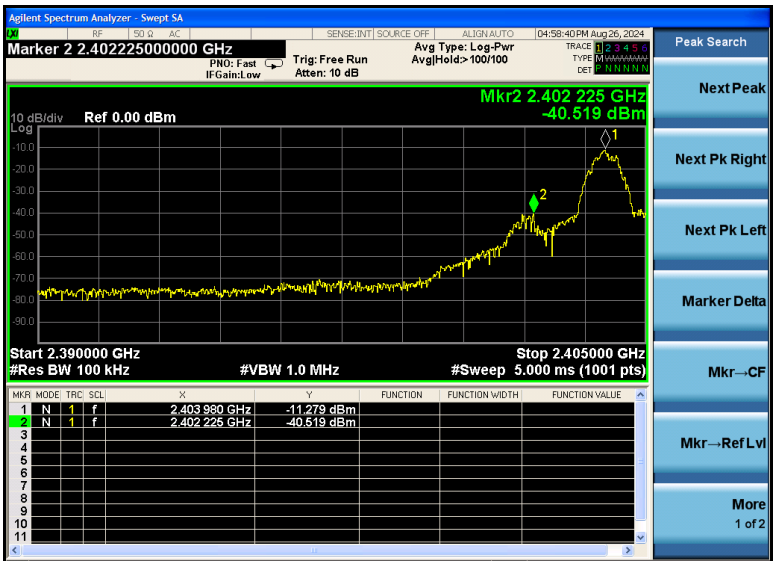


Figure 18: GFSK Lower Band Edge

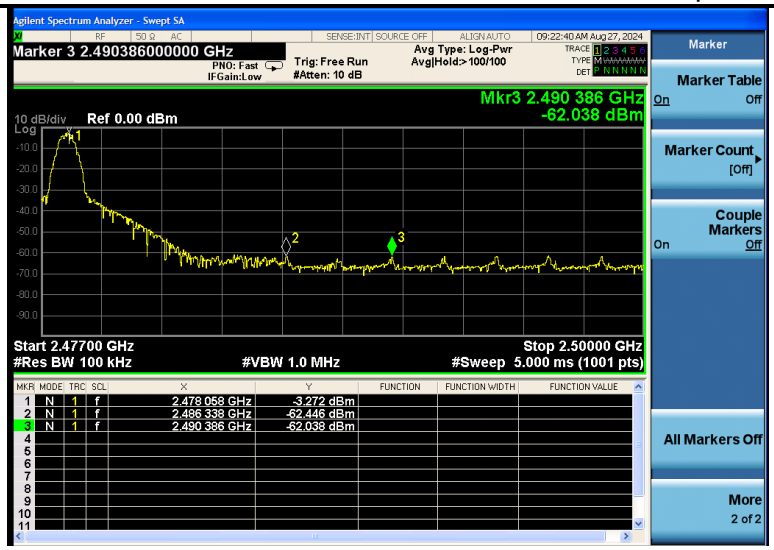


Figure 19: GFSK Upper Band Edge

9 Occupied Bandwidth Per FCC Part 2 Section 2.1049 (H)- Bluetooth Smart

9.1 Administrative and Environmental Details

Site Used:	EMC Lab 2A
Test Date:	08/29/2024
Test Engineer:	Parvinder Singh
Temperature:	27 °C
Humidity:	44% RH

9.2 Test Equipment

Equipment Description	Manufacturer	Model Name	Serial Number	Calibration Due Date
Signal Analyzer	Agilent	N9020A	MY47271103	10/25/2024

9.3 Limits/Requirements

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission. Transmitters employing digital modulation techniques—when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated.

9.4 Test Description and Procedure

Using the conducted test method, the occupied bandwidth measurement was made utilizing the Analyzer's OBW function. The span was set to be wide enough to capture the entire operating channel.

9.5 Test Plots

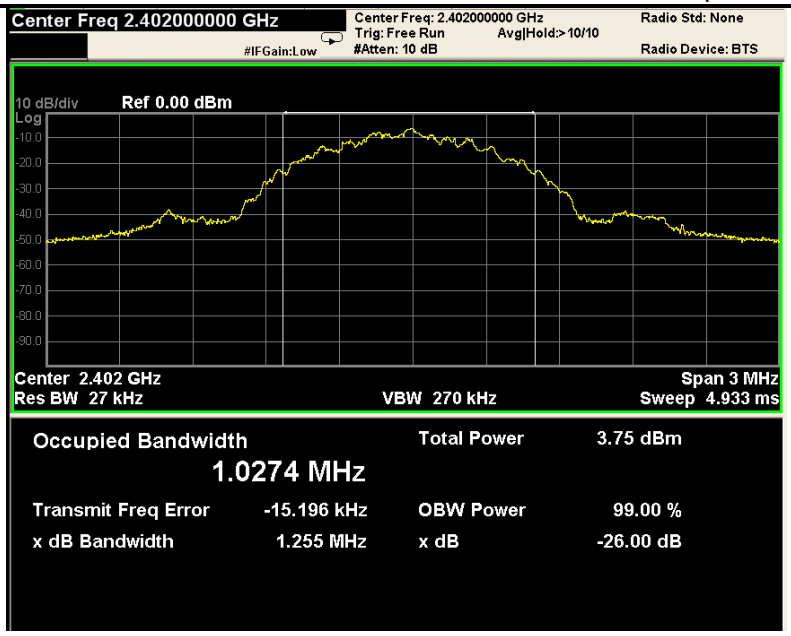


Figure 20: GFSK Occupied Bandwidth (Low Channel)

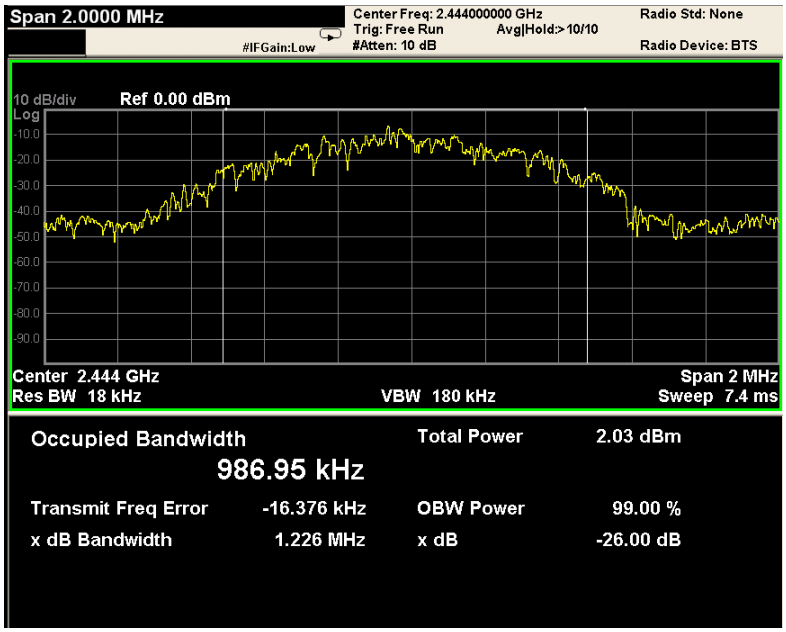


Figure 21: GFSK Occupied Bandwidth (Mid Channel)

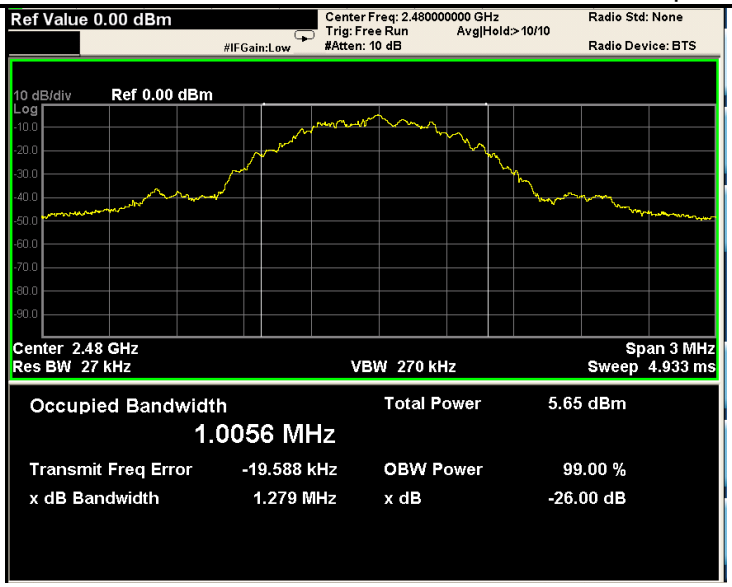


Figure 22: GFSK Occupied Bandwidth (Low Channel)

10 Time of Occupancy (Dwell Time) Per FCC Part 15.247 A(1)(iii) – Bluetooth 5.2 Smart

10.1 Administrative and Environmental Details

Site Used:	EMC Lab 2A
Test Date:	08/29/2024
Test Engineer:	Parvinder Singh
Temperature:	27 °C
Humidity:	44% RH

10.2 Test Equipment

Equipment Description	Manufacturer	Model Name	Serial Number	Calibration Due Date
EMC Analyzer	Agilent	E7405A	US40240257	02/11/2026

10.3 Limits/Requirements

Based on 15.247 A(1(iii) 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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

10.4 Test Description and Procedure

Using the conducted test method, the occupied bandwidth measurement was made on the spectrum analyzer. The span was set to be wide enough to capture the entire operating channel. For all cases the average time of channel occupancy is less than 400 microseconds.

In Figures 23-25, markers 1 and 2 show the signal occupancy, which is less than 400 milliseconds.

10.5 Test Data Plots

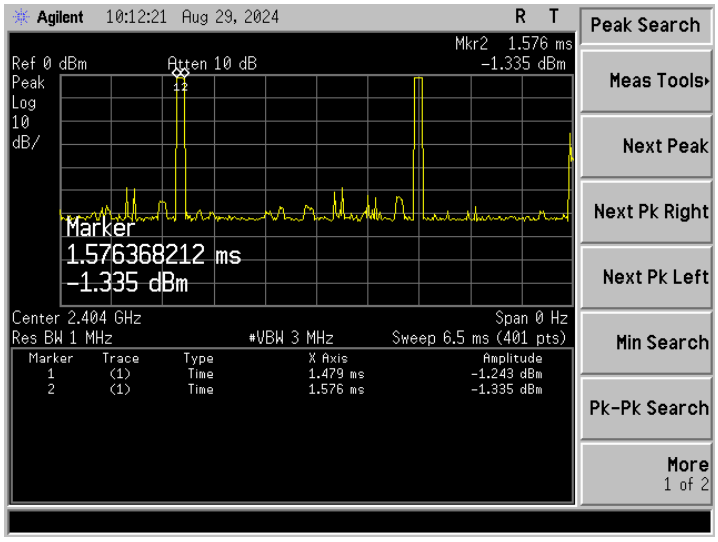


Figure 23: Channel average time of occupancy (Low Band)

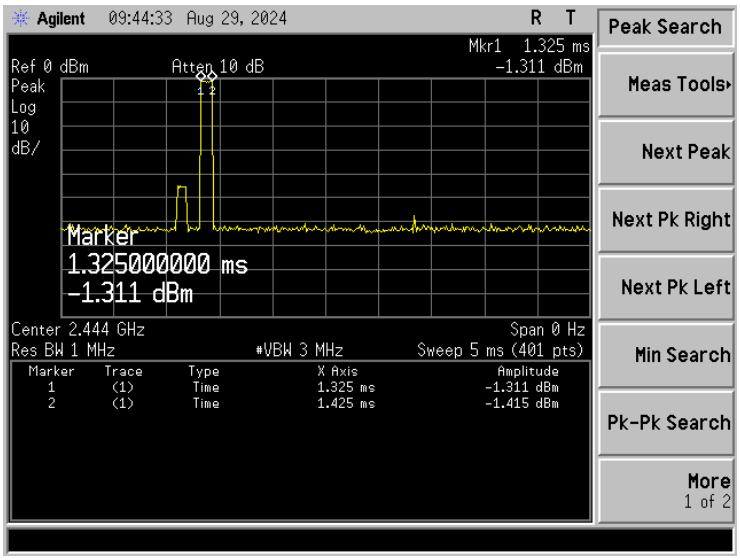


Figure 24: Channel average time of occupancy (Mid Band)

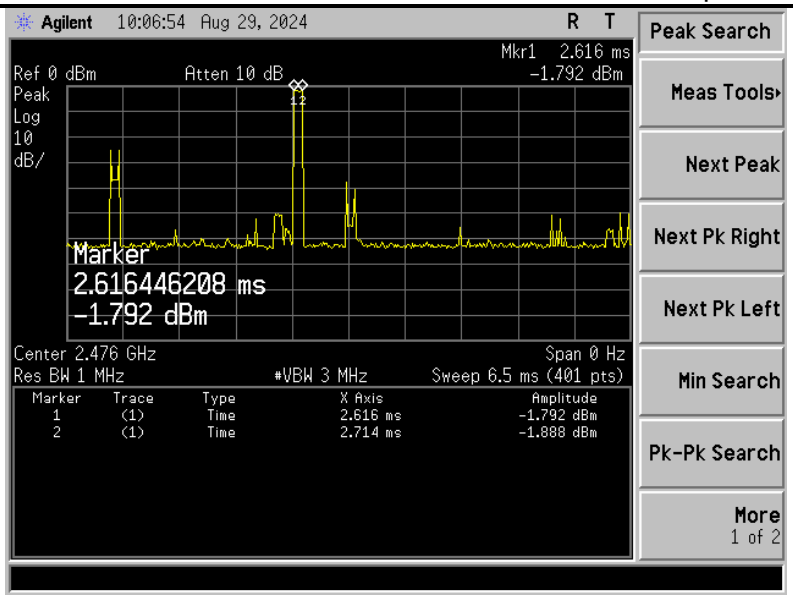


Figure 25: Channel average time of occupancy (High Band)

11 Conducted Spurious & restricted bands emissions Per FCC Part 15 sections 15.205

11.1 Administrative and Environmental Details

Site Used:	EMC Lab 2A
Test Date:	08/28/2024
Test Engineer:	Parvinder Singh
Temperature:	27 °C
Humidity:	44% RH

11.2 Test Equipment

Equipment Description	Manufacturer	Model Name	Serial Number	Calibration Due Date
EMC Analyzer	Agilent	E7405A	US40240257	02/11/2026

11.3 Limits/Requirements

The Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

Table 7: FCC Part 15 section 15.205 Restricted Bands

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
5.225-5.228	25.5-25.67	1300-1427	8.025-8.5
5.27725-5.27775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5

6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	

11.4 Test Description and Procedure

No signal was detected in the restricted bands as shown in the plots below.

11.5 Conducted Spurious Emissions Plots

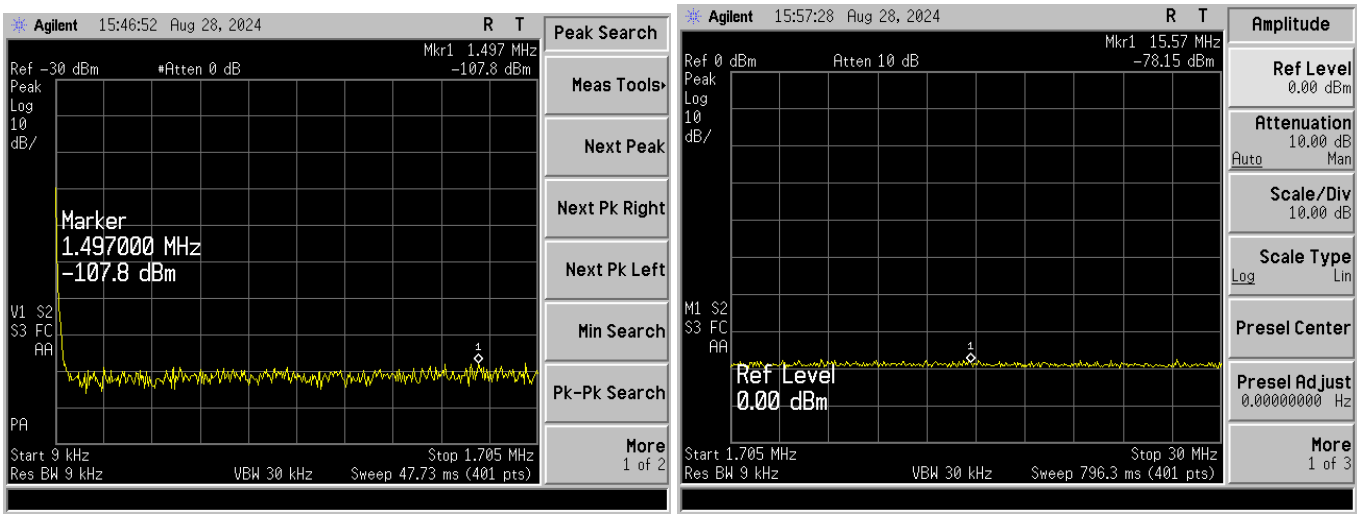


Figure 26: Conducted Spurious Measurement (9 KHz- 30MHz)

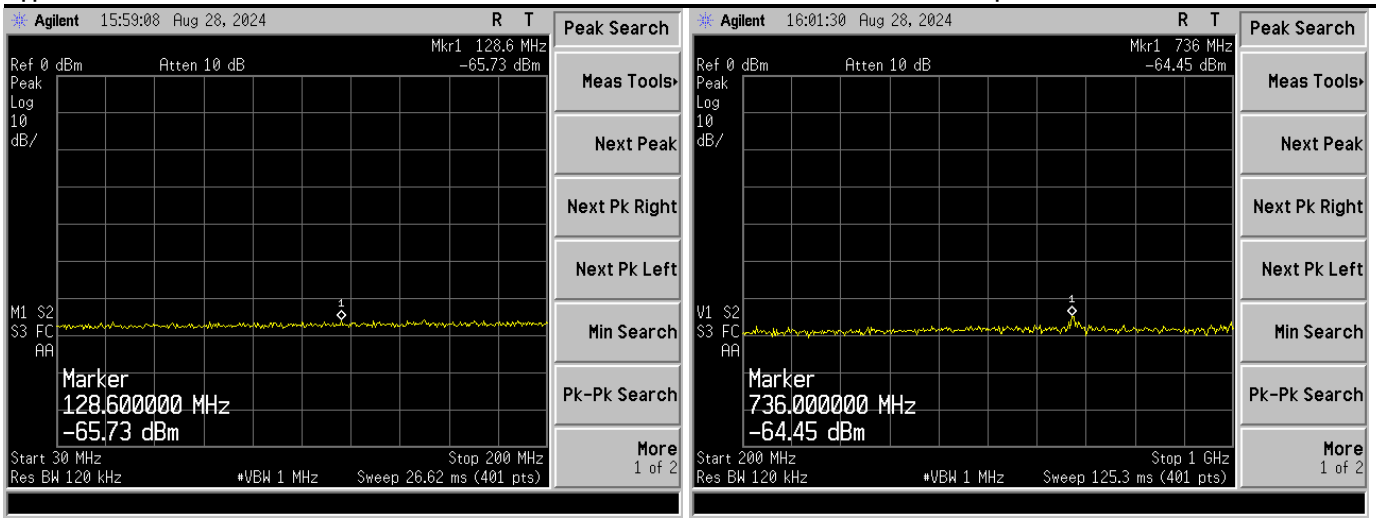


Figure 27: Conducted Spurious Measurement (30MHz- 1GHz)

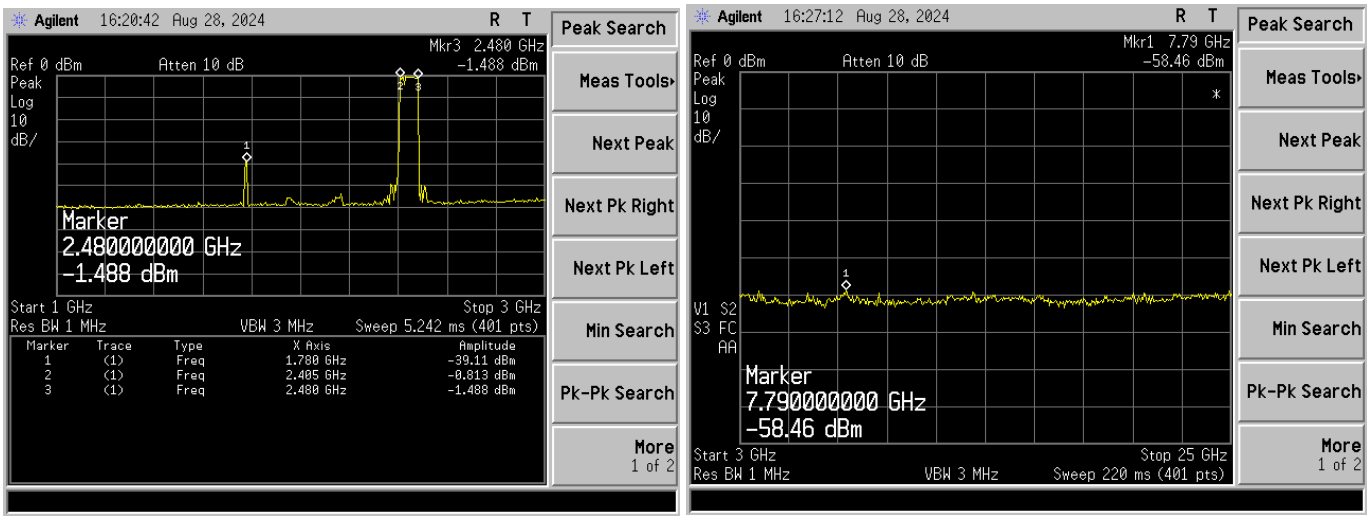


Figure 28: Conducted Spurious Measurement (1GHz- 25GHz)

12 Gain of transmission antenna Per FCC Part 15.247 (B)(4)

12.1 Limits/Requirements

4) 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.

The EUT antenna is 2450AT42E0100. Based on provided data in datasheet it has peak gain -2.0 dBi over entire of 2400 – 2480 MHz bandwidth.

12.2 Antenna Specification

Electrical	
Antenna chip number	P/N 2450AT42E0100
Operation frequency (GHz)	2400 – 2480 MHz
Antenna peak gain (dBi)	-2
Antenna average gain (dBi)	-5
Radiation pattern	Omni
Maximum input power (W)	2 CW
Mechanical	
Antenna element size (mm) L × W × H (±0.008)	0.197 mm x 0.079 mm x 0.059
Operating Temp	-40 to +85°C

12.3 Antenna Pattern

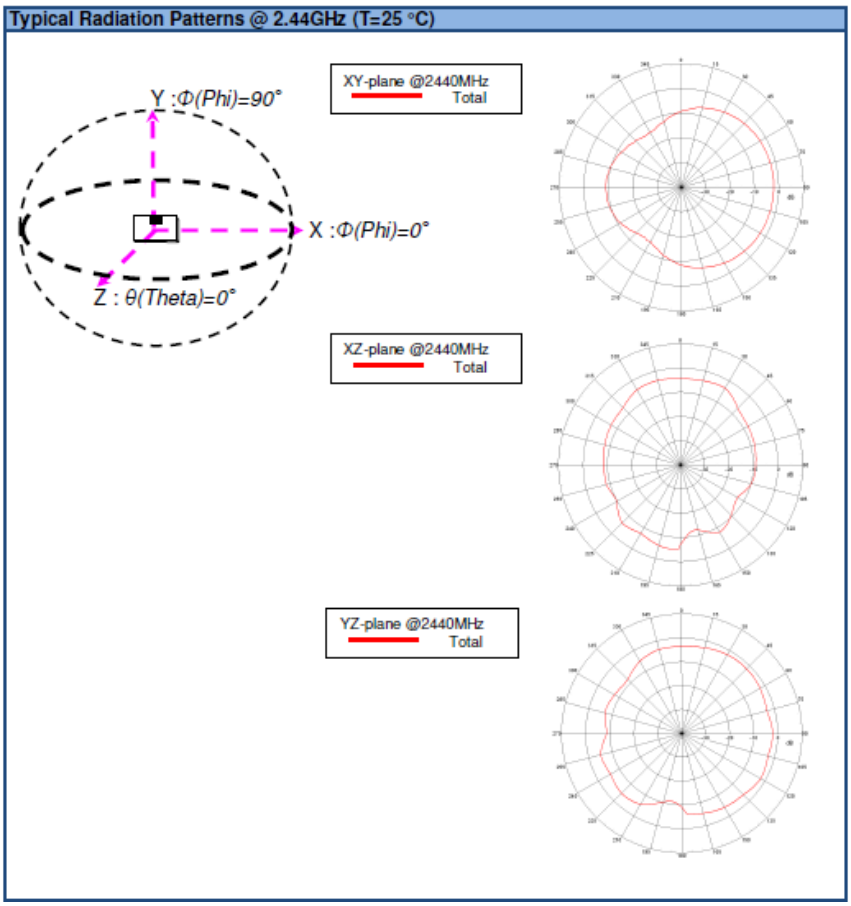


Figure 29: Antenna specification

13 APPENDICES

13.1 EUT Technical Specifications

Manufacturer:	Zerene Inc.		
General Description:	Zerene is a wearable BLE device that interfaces with a mouthguard to collect telemetry on the jaw as a user sleeps. Furthermore, it provides vibratory stimulation to retrain the user to stop clenching/grinding the jaw; thereby, benefiting the jaw and teeth.		
Model:	Zerene 100		
Serial Number of EUT:	80027-002-01-ZR-2420-0002		
EUT Rated Voltage:	3.7V 100mAh		
Cable Type:	N/A	Cable Length:N/A	Shielded ☐ Unshielded ☐

13.2 Modification Letter

No modifications were made to the EUT during testing.

To Whom It May Concern:

The EUT, Zerene 100, described in this report was tested to the requirements of the standard below.

Standards EUT was tested to:

FCC CFR Title 47 Part 15.247, 15.209, 15.205 & 2.1049 (H)

For further information, please contact the manufacturer at:

Zerene Inc.
33 Jerome Court,
Walnut Creek, CA 94596

Mr. Arash Sabet
Email: Arash@zerenelife.com
Phone No. : 314-707-2039