Electromagnetic Compatibility Test Report

Tests Performed on a Quip NYC, Inc.

Toothbrush with Bluetooth, Model S

Radiometrics Document RP-9993

ACCREDITED
TESTING CERT #1495.01

Product Detail:
FCC ID: 2AT6D-S Equipment type: Toothbrush with Transceiver
Test Standards:
US CFR Title 47, Chapter I, FCC Part 15 Subpart C FCC Part 15 CFR Title 47: 2023 Canada ISED; RSS-210, Issue 10: 2019 as required for Category I Equipment IC RSS-GEN Issue 5: 2018 This report concerns: Original Grant for Certification FCC Part 15.249

Tests Performed For:	*Test Facility:*
Quip NYC, Inc. 45 Main St., Suite 630 Brooklyn, NY 11201	**Radiometrics Midwest Corporation** 12 Devonwood Avenue Romeoville, IL 60446-1349 (815) 293-0772

Test Date(s):
June 4 to 13 and August 19, 2024

Document RP-9993 Revisions:

Rev.	Issue Date	Revised By
0	August 13, 2024	
1	August 20, 2024	Joseph Strzelecki

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1.0 ADMINISTRATIVE DATA

Equipment Under Test:	
A Quip NYC, Inc., Toothbrush with Bluetooth Model: S; Serial Numbers 003: This will be referred to as the EUT in this Report	
Date EUT Received at Radiometrics:	*Test Date(s):*
June 1, 2024	June 4 to 13 and August 19, 2024
Test Report Written and Authorized By:	*Test Witnessed By:*
Joseph Strzelecki Senior EMC Engineer	The tests were not witnessed by personnel from Quip NYC, Inc..
Radiometrics' Personnel Responsible for Test:	*EUT Checked By:*
Joseph Strzelecki 08/20/2024 Date Joseph Strzelecki Senior EMC Engineer NARTE EMC-000877-NE Chris D'Alessio EMC Technician	Joseph Strzelecki Chris D'Alessio Radiometrics

2.0 TEST SUMMARY AND RESULTS

The EUT (Equipment Under Test) is a Toothbrush with Bluetooth, Model S, manufactured by Quip NYC, Inc. The detailed test results are presented in a separate section. The following is a summary of the test results.

Emissions Tests Results

Environmental Phenomena	Frequency Range	Basic Standard	Test Result
RF Radiated Emissions	30-25,000 MHz	RSS-210 & FCC Part 15.249	Pass
Conducted Emissions, AC Mains	0.15 - 30 MHz	RSS-210 & FCC Part 15.207	Pass
Occupied Bandwidth Test	Fundamental Freq.	RSS-GEN & FCC Part 15	Pass

IEC 17025 Decision Rule:
The declaration of pass or fail is based on the specifications listed above. The declaration of pass or fail did not consider measurement uncertainty.

2.1 RF Exposure Compliance Requirements

Since the average power output is less than 10 mW, the EUT meets the FCC requirement for RF exposure, and it is exempt from RSS-102 SAR and RF exposure evaluations. There are no power level adjustments available to the end user. The antenna is permanently attached. The detailed calculations for RF Exposure are presented in a separate document.

3.0 EQUIPMENT UNDER TEST (EUT) DETAILS

3.1 EUT Description

The EUT is a Toothbrush with Bluetooth, Model S, manufactured by Quip NYC, Inc. The EUT was in good working condition during the tests, with no known defects.

3.1.1 FCC Section 15.203 & RSS-GEN Antenna Requirements

The antenna is permanently attached to the printed circuit board. The antenna is internal to the EUT, and it is not readily available to be modified by the end user. Therefore, it meets the 15.203 Requirements.

Since the measurements at the antenna port are used to determine the RF output power, RSS-GEN section 6.8 requires that the effective gain of the products antenna be stated, based on a measurement or on data from the antenna's manufacturer.

4.0 TESTED SYSTEM DETAILS

4.1 Tested System Configuration

The system was configured for testing in a typical fashion. The EUT was placed on an 80-cm or 150 cm high, nonconductive test stand. The testing was performed in conditions as close as possible to installed conditions. The EUT was tested as a stand-alone device.

Power was supplied with a new battery. There are no external cables

The identification for all equipment, are:

Tested System Configuration List

Item	Description	Type*	Manufacturer	Model Number	Serial Number
1	Toothbrush with Bluetooth	E	Quip NYC, Inc.	S	003

* Type: E = EUT, P = Peripheral,

Type of modulation including the bit rate and symbol rate	GFSK / 2Mbit/s
Name and version of the test software used to exercise the device	superfine-ALPHA-fcc_test_code_11-2-2023.s37
Power settings used for the purpose of exercising the device	0 dBm
Firmware number of the transmitter	application-superfine-DVT.s37

4.2 EUT Operating Modes

The transmit mode for all tests was continuous. The continuous mode produces a Duty Cycle of at least 99%.

The EUT was in its normal GFSK modulation during the tests. It was tested as a stand-alone battery powered device since that is the configuration in the final installation.

4.3 Special Accessories

No special accessories were used during the tests in order to achieve compliance.

4.4 Equipment Modifications

No modifications were made to the EUT at Radiometrics' test facility in order to comply with the standards listed in this report.

5.0 TEST SPECIFICATIONS

Document	Date	Title
FCC CFR Title 47	2023	Code of Federal Regulations Title 47, Chapter 1, Federal Communications Commission, Part 15 - Radio Frequency Devices
IC RSS-210 Issue 10	2019	Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands) Category I Equipment
IC RSS-Gen Issue 5	2019	General Requirements and Information for the Certification of Radiocommunication Equipment (RSS-Gen)

6.0 TEST PROCEDURE DOCUMENTS

The tests were performed using the procedures from the following specifications:

Document	Date	Title
ANSI C63.4-2014	2014	Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10-2013	2013	American National Standard for Testing Unlicensed Wireless Devices

7.0 RADIOMETRICS' TEST FACILITIES

The results of these tests were obtained at Radiometrics Midwest Corp. in Romeoville, Illinois, USA. Radiometrics is accredited by A2LA (American Association for Laboratory Accreditation) to conform to ISO/IEC 17025: 2017 "General Requirements for the Competence of Calibration and Testing Laboratories". Radiometrics' Lab Code is 121191 and Certification Number is 1495.01. Radiometrics' scope of accreditation includes all of the test methods listed herein. A copy of the accreditation can be accessed on our web site (www.radiomet.com). Radiometrics accreditation status can be verified at A2LA's web site (www.a2la2.org).

The following is a list of shielded enclosures located in Romeoville, Illinois used during the tests:

Chamber E: Is a custom-made anechoic chamber that measures 52' L X 30' W X 18' H. The walls and ceiling are fully lined with RF absorbers. Pro-shield of Collinsville, Oklahoma manufactured the chamber. The floor has a 9' x 9' section of microwave absorber for testing above 1 GHz.

Test Station F: Is an area that measures 10' D X 12' W X 10' H. The floor and back wall are metal shielded. This area is used for conducted emissions measurements.

A separate ten-foot long, brass plated, steel ground rod attached via a 6-inch copper braid grounds each of the above chambers. Each enclosure is also equipped with low-pass power line filters.

The FCC has accepted these sites as test site number US1065. The FCC test site Registration Number is 732175. Details of the site characteristics are on file with the Industry Canada as site number IC 3124A with a CAB ID of US0224.

A complete list of the test equipment is provided herein. The calibration due dates are indicated on the equipment list. The equipment is calibrated in accordance with ANSI/NCSL Z540-1 with traceability to the National Institute of Standards and Technology (NIST).

8.0 DEVIATIONS AND EXCLUSIONS FROM THE TEST SPECIFICATIONS

There were no deviations or exclusions from the test specifications.

9.0 CERTIFICATION

Radiometrics Midwest Corporation certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specification and the data contained herein was taken with calibrated test equipment. The results relate only to the EUT listed herein.

10.0 TEST EQUIPMENT TABLE

RMC ID	Manufacturer	Description	Model No.	Serial No.	Frequency Range	Cal Period	Cal Date
AMP-05	RMC/Celeritek	Pre-amplifier	MW110G	1001	1.0-12GHz	12 Mo.	01/31/24
AMP-20	Avantek	Pre-amplifier	SF8-0652	15221	8-18GHz	12 Mo	06/06/24
AMP-59	Amplitech	Pre-amplifier	APTMP44	AMP-59	18-26 GHz	12 Mo.	01/31/25
ANT-48	RMC	Std. Gain Horn	HW2020	1001	18-26.5 GHz	36 Mo.	11/23/22
ANT-66	ETS-Lindgren	Horn Antenna	3115	62580	1.0-18GHz	24 Mo.	03/16/23
ANT-68	EMCO	Log-Periodic Ant.	93146	9604-4456	200-1000MHz	24 Mo.	01/30/24
ANT-80	AH Systems	Bicon Antenna	SAS-540	294	20-330MHz	24 Mo.	01/26/23
HPF-06	Mini-Circuits	High Pass Filter	VHF-3800+	31035	3-11 GHz	24 Mo.	05/22/24
REC-21	Agilent	Spectrum Analyzer	E7405A	MY45118341	9Hz-26.5 GHz	24 Mo.	04/24/24
REC-44	Agilent	Spectrum Analyzer	E4440A	US40420673	3Hz-26.5GHz	24 Mo.	07/18/24
THM-02	Fluke	Temp/Humid Meter	971	93490471	N/A	24 Mo.	11/22/22

Note: All calibrated equipment is subject to periodic checks.
REC-44 was only used on the August 19, 2024, test.

Software Company	Test Software Name	Version	Applicable Tests
Radiometrics	REREC11D	07.21.22	RF Radiated Emissions (FCC Part 15 & EN 55032)
Agilent	PSA/ESA-E/L/EMC	2.4.0.42	Bandwidth and screen shots

11.0 TEST SECTIONS

11.1 Radiated RF Emissions

Radiated emission measurements were performed with linearly polarized broadband antennas. The results obtained with these antennas can be correlated with results obtained with a tuned dipole antenna. The radiated emission measurements were performed with a spectrum analyzer. The bandwidth used from 150 kHz to 30 MHz is 9 or 10 kHz and the bandwidth from 30 MHz to 1000 MHz is 100 or 120 kHz. Above 1 GHz, a 1 MHz bandwidth is used. A 10 dB linearity check is performed prior to start of testing in order to determine if an overload condition exists. Figure 4 herein lists the details of the test equipment used during radiated emissions tests.

In addition, a high pass filter was used to reduce the fundamental emission. High pass filters were not needed above 10 GHz, since the preamplifiers attenuated the fundamental emission.

The EUT was rotated through three orthogonal axis as per 5.10.1 of ANSI C63.10 during the radiated tests.

Final radiated emissions measurements were performed inside of an anechoic chamber at a test distance of 3 meters. The anechoic chamber is designated as Chamber E. This Chamber meets the Site Attenuation requirements of ANSI C63.4. Chamber E is located at 12 Devonwood Ave. Romeoville, Illinois EMI test lab.

The entire frequency range from 30 to 25000 MHz was slowly scanned. Measurements were performed using two antenna polarizations, (vertical and horizontal). The worst case emissions were recorded. All measurements may be performed using either the peak, average or quasi-peak detector functions. If the peak detector data exceeds or is marginally close to the limits, the measurements are repeated using a quasi-peak detector or average function as required by the specification for final determination of compliance. The QP and average detectors have a linear response.

The detected emission levels were maximized by rotating the EUT, adjusting the positions of all cables, and by scanning the measurement antenna from 1 to 4 meters above the ground.

Radiated Emissions Field Strength Limits

Frequency Range (MHz)	Test Distance (meters)	Non-Fundamental Limits	
		uV/m	dB(uV/m)
30 - 88	3	100	40.0
88 - 216	3	150	43.5
216 - 960	3	200	46.0
Above 960	3	500	54.0

The emission limits shown in the above table are based on measurements using a CISPR quasi-peak detector below 1 GHz. Above 1 GHz, the radiated emission limits are based on measurements employing an average detector. Above 1 GHz peak emissions shall not be more than 20 dB above the average limits.

The fundamental limit is 94 dBuV/m for Average and 114 dBuV/m for peak detection.

11.1.1 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and by subtracting the Amplifier Gain from the measured reading. The basic equation is as follows:

FS = RA + AF + CF - AG + HPF + PKA

Where: FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor
CF = Cable Attenuation Factor
AG = Amplifier Gain
HPF = High pass Filter Loss
PKA = Peak to Average Factor (This is only used for average measurements above 1 GHz)

The Peak to average factor is used when average measurements are required. It is calculated by the highest duty cycle in percent over any 100mS transmission.

11.1.2 Duty Cycle

In accordance to 7.5 of ANSI C63.10 the following procedures were used.

a) The EUT was set to the "worst-case" pulse ON time.
b) The RF output was Coupled to the input of a spectrum analyzer by a "near-field" coupling method. The signal received shall be of sufficient level to trigger adequately the spectrum analyzer sweep display.
c) The center frequency of the spectrum analyzer was set to the center of the RF signal.
d) The spectrum analyzer was set for ZERO SPAN.
e) The sweep time was of the analyzer was set to 100 ms and other times to show the duty cycle.
f) Since the pulse train has a period that exceeds 100 ms, then:
1) The trigger on the spectrum analyzer was set to capture the greatest amount of pulse "ON time" over 100 ms.
2) The 100 ms period that contains the maximum "on time" was found.
3) The duty cycle was determined by dividing the total maximum "ON time" by 100 ms (tON/100 ms).
h) The duty cycle correction factor was used applying Equation (10) of ANSI C63.10 to the duty cycle determined in the preceding steps.

The width of each pulse is 0.07 mSeconds. There are, at most, 170 pulses per 100mS. This yields an effective duty cycle of 11.6%. The Peak to average factor is calculated by the highest duty cycle in percent over any 100mS transmission. The transmitter operates for a maximum duration of 11.9 ms in any 100 ms interval. 20 Log*(11.6mSec/100mSec) = -18.5 dB Peak to Average correction factor.

11.1.3 Radiated Emissions Test Results

Test Date	06/04 & 06/05/2024
EUT	Model: S
Test Distance	3 Meters
Specification	FCC Part 15 Subpart C & RSS-210 Section B.10
Notes	Corr. Factors = cable loss - preamp gain
Abbreviations	Pol = Antenna Polarization; V = Vertical; H = Horizontal; P = peak; Q = QP
Configuration	The EUT is in the transmit mode with the receiver on

This table includes all emissions except Fundamental, Band edge and harmonics emissions.

EUT	Serial # 003

Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Ant Factor dB/m	Corr. Factors	Dist Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB	Note
32.2	18.2	P	H	12.5	0.6	0.0	31.3	40.0	8.7	
45.3	9.7	P	H	9.9	0.7	0.0	20.3	40.0	19.7	
59.9	10.1	P	H	8.8	0.8	0.0	19.7	40.0	20.3	
66.1	9.8	P	H	9.1	0.8	0.0	19.7	40.0	20.3	
80.9	10.3	P	H	9.0	1.0	0.0	20.3	40.0	19.7	
92.2	10.2	P	H	9.6	1.0	0.0	20.8	43.5	22.7	
102.3	10.6	P	H	10.3	1.1	0.0	22.0	43.5	21.5	
113.0	10.6	P	H	11.0	1.1	0.0	22.7	43.5	20.8	
124.2	11.0	P	H	11.8	1.2	0.0	24.0	43.5	19.5	
150.6	11.2	P	H	12.6	1.3	0.0	25.1	43.5	18.4	
170.9	11.0	P	H	13.0	1.4	0.0	25.4	43.5	18.1	
195.3	10.5	P	H	14.1	1.5	0.0	26.1	43.5	17.4	
216.7	11.7	P	H	14.7	1.6	0.0	28.0	46.0	18.0	
242.6	11.4	P	H	15.1	1.7	0.0	28.2	46.0	17.8	
269.7	9.0	P	H	12.8	1.8	0.0	23.6	46.0	22.4	
351.7	8.8	P	H	14.4	2.1	0.0	25.3	46.0	20.7	
426.6	10.1	P	H	15.9	2.3	0.0	28.3	46.0	17.7	
481.1	9.6	P	H	17.2	2.5	0.0	29.3	46.0	16.7	
526.5	7.7	P	H	17.5	2.6	0.0	27.8	46.0	18.2	
631.1	8.8	P	H	19.5	2.8	0.0	31.1	46.0	14.9	
797.3	8.7	P	H	21.3	3.2	0.0	33.2	46.0	12.8	
943.9	8.6	P	H	23.2	3.5	0.0	35.3	46.0	10.7	
1166.9	42.4	P	H	24.8	-34.3	0.0	32.9	74.0	41.1	1
1416.2	43.3	P	H	25.0	-34.4	0.0	33.9	74.0	40.1	1
1667.4	42.7	P	H	26.0	-34.2	0.0	34.5	74.0	39.5	1
1941.7	44.0	P	H	27.2	-34.2	0.0	37.0	74.0	37.0	1
2210.2	41.8	P	H	27.8	-34.0	0.0	35.6	74.0	38.4	1
2414.4	52.3	P	H	28.3	-33.7	0.0	46.9	74.0	27.1	1
2895.9	44.9	P	H	29.5	-33.3	0.0	41.1	74.0	32.9	1
2962.0	42.9	P	H	29.8	-33.3	0.0	39.4	74.0	34.6	1
3141.1	43.6	P	H	30.7	-32.8	0.0	41.5	74.0	32.5	1
3252.3	43.4	P	H	31.1	-32.7	0.0	41.8	74.0	32.2	1
3669.7	42.7	P	H	31.9	-32.4	0.0	42.2	74.0	31.8	1
3819.8	42.4	P	H	32.7	-32.3	0.0	42.8	74.0	31.2	1
38.2	16.1	P	V	11.3	0.6	0.0	28.0	40.0	12.0	
40.6	18.2	P	V	10.5	0.7	0.0	29.4	40.0	10.6	
58.8	10.3	P	V	9.0	0.8	0.0	20.1	40.0	19.9	
67.2	12.6	P	V	9.1	0.9	0.0	22.6	40.0	17.4	
80.4	10.9	P	V	9.0	1.0	0.0	20.9	40.0	19.1	

Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Ant Factor dB/m	Corr. Factors	Dist Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB	Note
92.2	17.7	P	V	9.6	1.0	0.0	28.3	43.5	15.2	
105.4	10.7	P	V	10.5	1.1	0.0	22.3	43.5	21.2	
128.2	10.8	P	V	12.0	1.2	0.0	24.0	43.5	19.5	
150.8	10.9	P	V	12.6	1.3	0.0	24.8	43.5	18.7	
171.4	10.8	P	V	13.0	1.4	0.0	25.2	43.5	18.3	
197.7	11.8	P	V	14.2	1.5	0.0	27.5	43.5	16.0	
220.7	11.4	P	V	14.8	1.6	0.0	27.8	46.0	18.2	
241.0	11.6	P	V	15.1	1.7	0.0	28.4	46.0	17.6	
269.4	14.1	P	V	12.8	1.8	0.0	28.7	46.0	17.3	
340.6	9.6	P	V	14.3	2.0	0.0	25.9	46.0	20.1	
420.5	14.2	P	V	15.7	2.3	0.0	32.2	46.0	13.8	
491.9	9.9	P	V	17.4	2.5	0.0	29.8	46.0	16.2	
601.6	7.9	P	V	18.8	2.7	0.0	29.4	46.0	16.6	
714.7	7.7	P	V	21.0	3.0	0.0	31.7	46.0	14.3	
825.3	8.8	P	V	21.8	3.3	0.0	33.9	46.0	12.1	
938.4	8.4	P	V	23.0	3.5	0.0	34.9	46.0	11.1	
1037.0	55.0	P	V	24.2	-34.1	0.0	45.1	74.0	28.9	1
1357.4	42.7	P	V	25.0	-34.3	0.0	33.4	74.0	40.6	1
1665.7	43.1	P	V	26.0	-34.2	0.0	34.9	74.0	39.1	1
1886.9	48.9	P	V	27.1	-34.1	0.0	41.9	74.0	32.1	1
2111.1	44.1	P	V	27.6	-34.2	0.0	37.5	74.0	36.5	1
2632.6	42.2	P	V	28.8	-33.4	0.0	37.6	74.0	36.4	1
2876.9	45.1	P	V	29.5	-33.4	0.0	41.2	74.0	32.8	1
3047.0	43.0	P	V	30.2	-33.0	0.0	40.2	74.0	33.8	1
3373.4	42.8	P	V	31.2	-32.5	0.0	41.5	74.0	32.5	1
3696.7	42.4	P	V	32.0	-32.4	0.0	42.0	74.0	32.0	1
3964.0	42.9	P	V	32.8	-31.9	0.0	43.8	74.0	30.2	1

Note 1: The Peak data is under the Average limit, therefore Average measurement not performed

Judgment: Passed by **8.7** dB

Fundammental and Harmonic Emissions FCC 15.249; Three axis

	Tx	Spectrum Analyzer Readings dBuV									EUT	Peak	Ave	Peak	Ave	Margin
hrm	Freq	Peak			Ave	Peak			Ave	Corr.	Emission	Tot. FS		Limit		Under
		Vertical Polarization				Horizontal Polarization				Fact	Freq					Limit
#	MHz	X	Y	Z	Max	X	Y	Z	Max	dB/m	MHz	dBuV/m		dBuV/m		dB
1	2402	89.3	90.0	92.5	74.0	95.5	97.0	86.9	78.5	-5.5	2402.0	91.5	73.0	114	94	21.0
BE	2402	55.6	56.3	58.8	40.3	61.8	63.3	53.2	44.8	3.5	2400.0	66.8	48.3	74	54	5.7
2	2402	42.3	40.5	42.0	23.8	42.4	45.1	41.7	26.6	2.3	4804.0	47.4	28.9	74	54	25.1
3	2402	39.5	41.6	40.8	23.1	41.2	41.6	41.3	23.1	7.1	7206.0	48.7	30.2	74	54	23.8
4	2402	44.9	44.5	44.5	26.2	44.7	44.8	44.5	26.4	10.5	9608.0	55.4	36.9	74	54	17.1
1	2440	89.8	89.1	90.8	72.3	94.0	98.5	86.8	80.0	-5.5	2440.0	93.0	74.5	114	94	19.5
2	2440	42.0	41.2	41.1	23.5	41.8	41.9	41.3	23.4	2.6	4880.0	44.6	26.1	74	54	27.9
3	2440	40.2	39.9	40.3	21.8	40.2	40.2	40.1	21.7	7.4	7320.0	47.7	29.2	74	54	24.8
4	2440	44.5	44.7	44.7	26.2	44.9	44.8	44.1	26.4	10.9	9760.0	55.8	37.3	74	54	16.7
1	2480	85.0	83.8	85.9	67.4	88.8	91.5	81.7	73.0	-5.3	2480.0	86.2	67.7	114	94	26.3
BE	2480	42.4	41.2	43.3	24.8	46.2	48.9	39.1	30.4	4.4	2483.5	53.3	34.8	74	54	19.2
2	2480	41.3	40.6	40.8	22.8	40.0	40.9	40.4	22.4	2.7	4960.0	44.0	25.5	74	54	28.5
3	2480	40.2	40.0	40.4	21.9	40.5	40.0	40.2	22.0	8.0	7440.0	48.5	30.0	74	54	24.0
4	2480	43.8	44.3	44.2	25.8	44.0	43.8	44.0	25.5	11.2	9920.0	55.5	37.0	74	54	17.0
Column numbers (see below for explanations)																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

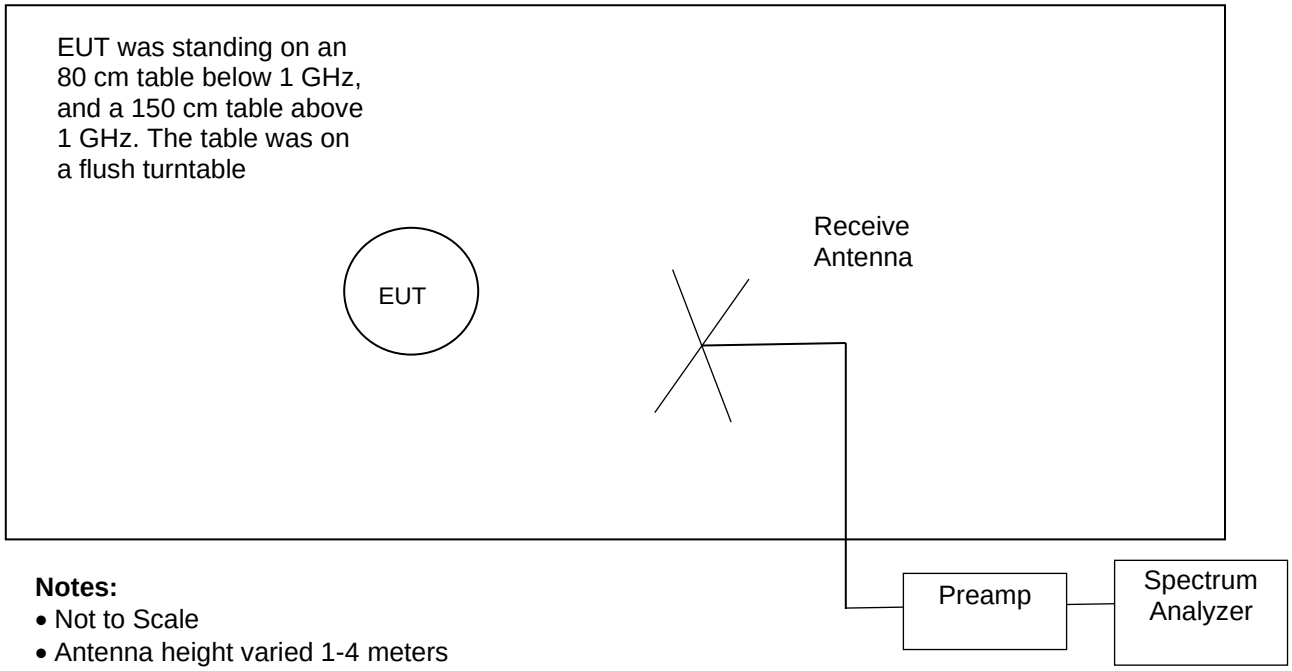
Column #1. hrm = Harmonic; BE = Band Edge emissions
Column #2. Frequency of Transmitter.
Column #3. Uncorrected readings from the spectrum analyzer with First Axis Rotation.
Column #4. Uncorrected readings from the spectrum analyzer with Second Axis Rotation.
Column #5. Uncorrected readings from the spectrum analyzer with Third Axis Rotation.
Column #6. Average Reading based on peak reading reduced by the Duty cycle correction
Column #7. Uncorrected readings from the spectrum analyzer with First Axis Rotation.
Column #8. Uncorrected readings from the spectrum analyzer with Second Axis Rotation.
Column #9. Uncorrected readings from the spectrum analyzer with Third Axis Rotation.
Column #10. Average Reading based on peak reading reduced by the Duty cycle correction
Column #11. Corr. Factors = Cable Loss – Preamp Gain + Antenna Factor
Column #12. Frequency of Tested Emission
Column #13. Highest peak field strength at listed frequency.
Column #14. Highest Average field strength at listed frequency.
Column #15. Peak Limit.
Column #16. Average Limit.
Column #17. The margin (last column) is the worst-case margin under the peak or average limits for that row.

Overall Judgment: Passed by 5.7 dB

No other Emissions were detected from 30 to 25,000 MHz within 10 dB of the limits.

Figure 1. Drawings of Radiated Emissions Setup

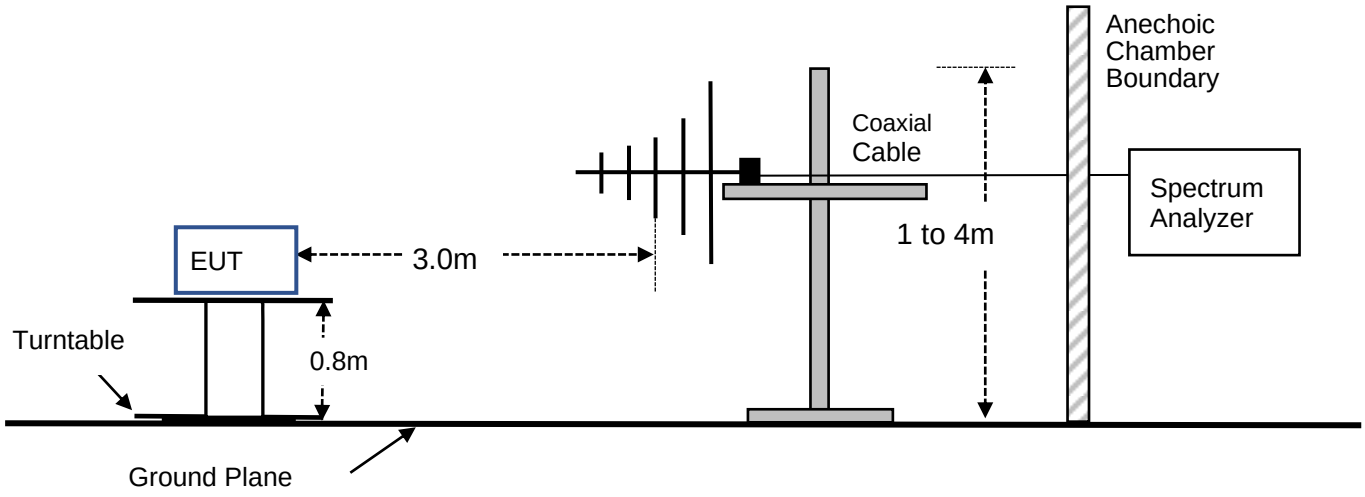
Chamber E, anechoic



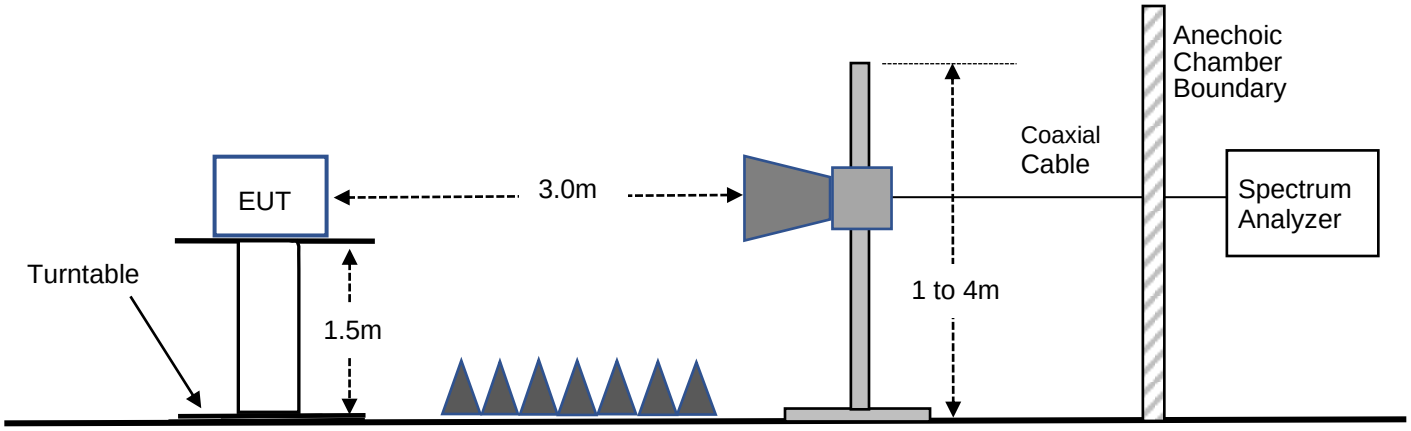
Notes:
- Not to Scale
- Antenna height varied 1-4 meters
- Distance from antenna to tested system is 3 meters
- AC cords not shown. They are connected to AC outlet with low-pass filter on turntable

Frequency Range	Receive Antenna	Pre-Amplifier	Spectrum Analyzer
30 to 200 MHz	ANT-80	None	REC-21
200 to 1000 MHz	ANT-68	None	REC-21
1 to 10 GHz	ANT-66	AMP-05	REC-21
10 to 18 GHz	ANT-66	AMP-20	REC-21
18 to 25 GHz	ANT-48	AMP-59	REC-21

Radiated Emissions Test Setup for Frequencies from 30MHz to 1000MHz (Side View)



Radiated Emissions Test Setup for Frequencies over 1000MHz (Side View)



11.2 Occupied Bandwidth Data

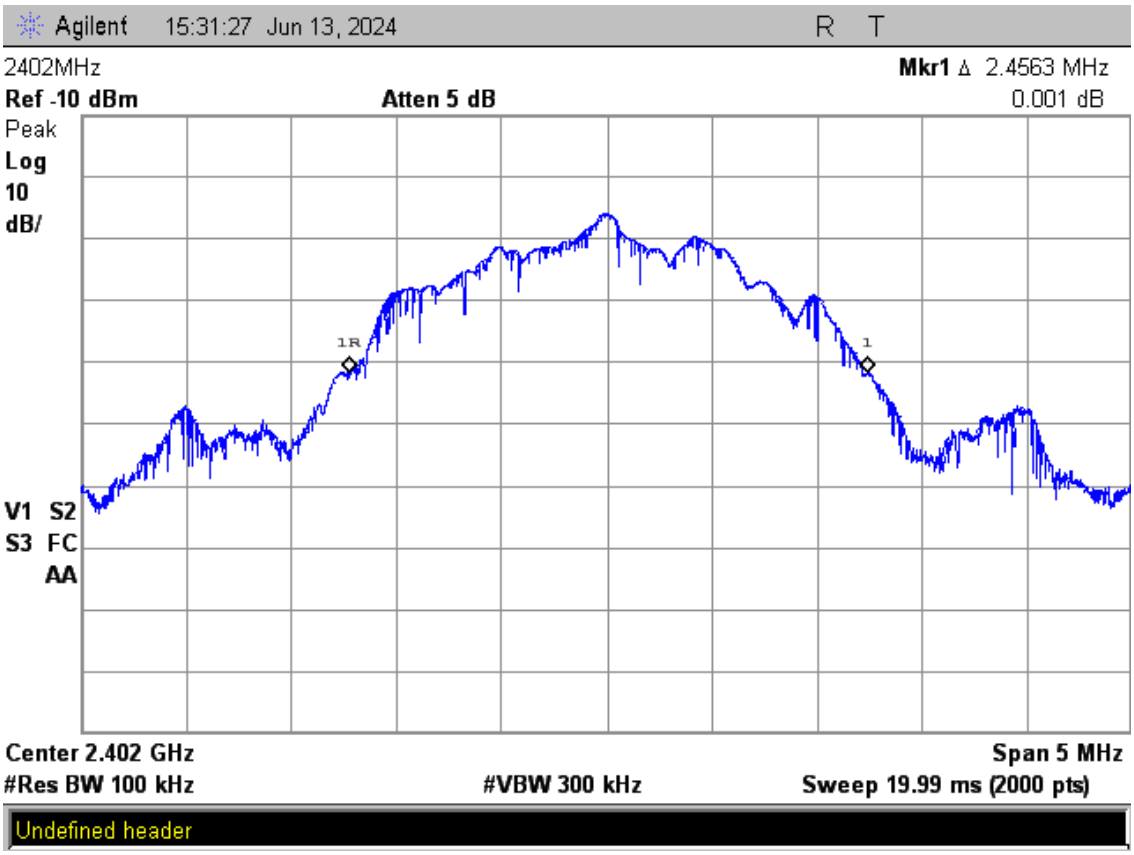
The occupied bandwidth of the RF output was measured using a spectrum analyzer. The bandwidth was measured using the peak detector function. The spectrum analyzer was set to the MAX HOLD mode to record the worst case of the modulation. The marker-to-peak function was set to the peak of the emission. Then the marker-delta function was used to measure 26 dB down one side of the emission. The marker-delta function was reset and then moved to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the bandwidth of the emission. The plots of the occupied bandwidth for the EUT are supplied on the following pages.

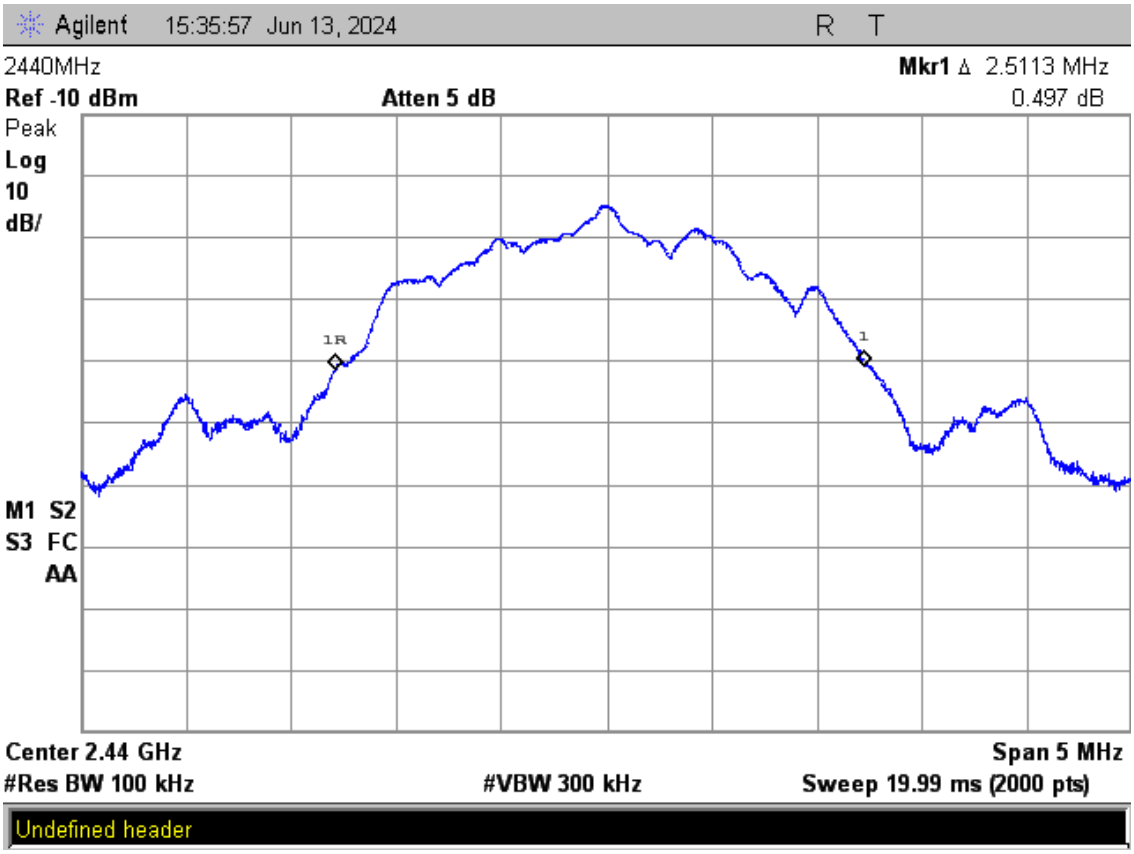
Test Date	06/13/2024 & 08/19/2024
EUT	Model: S
Equipment	REC-21 for 26 dB OBW and REC-44 for 99% OBW
Specification	FCC Part 15 Subpart C & RSS-210 Section B.10

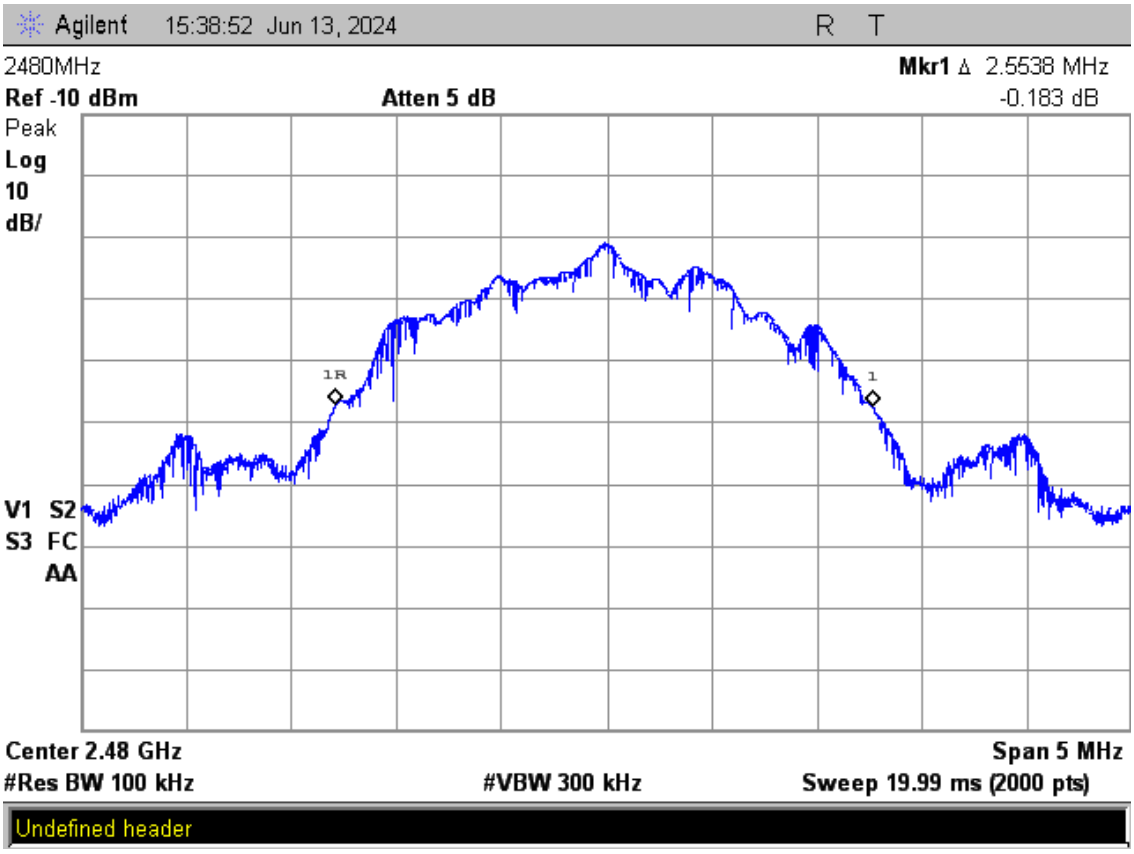
The 26 dB OBW is within the allowed 2400 to 2483.5 MHz authourized band.

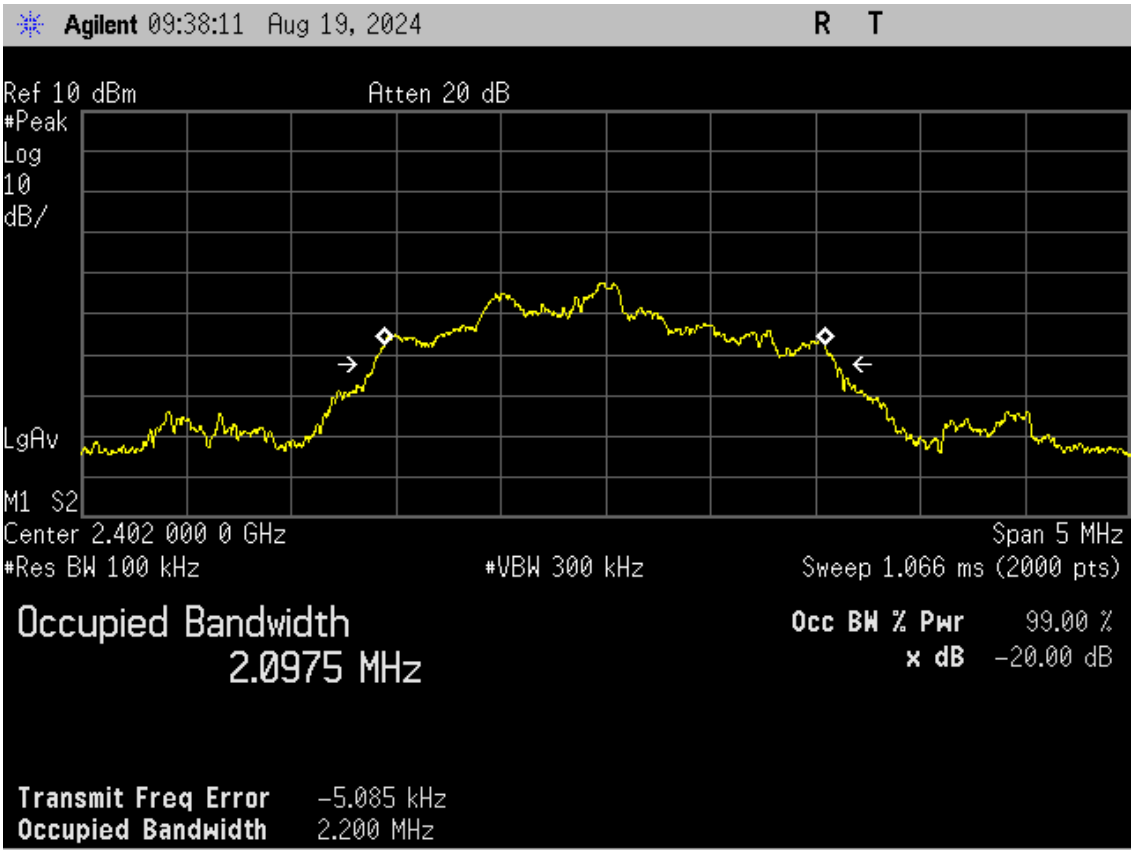
Channel	26 dB OBW MHz	99% OBW MHz
2402	2.4563	2.0975
2440	2.5113	2.1150
2480	2.5538	2.1259

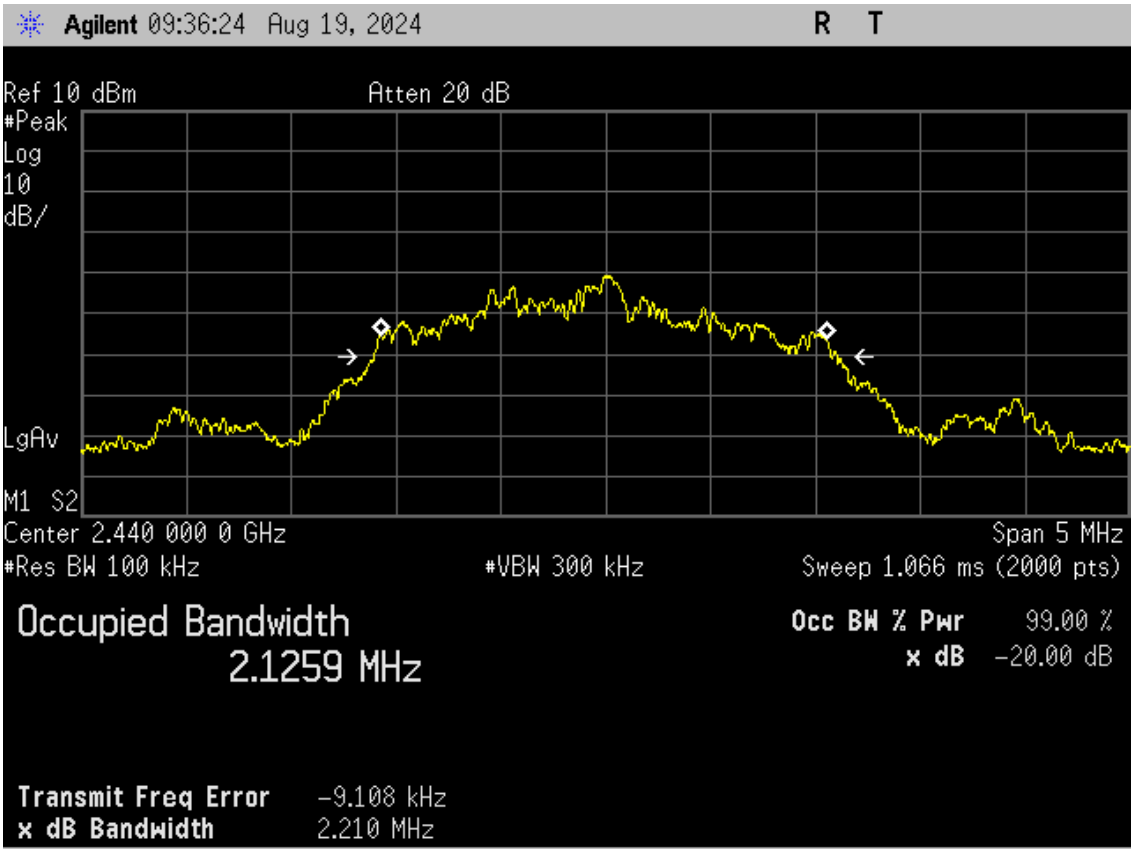
Figure 2. Occupied Bandwidth Plots

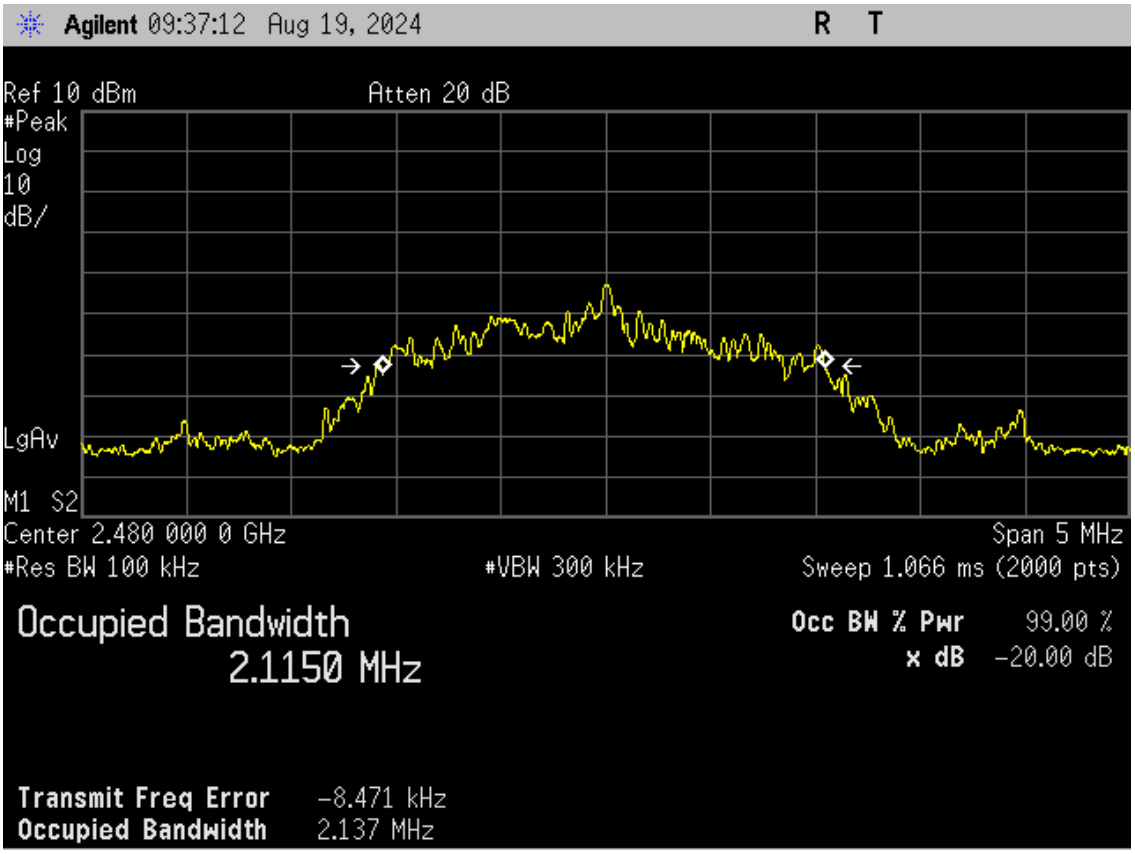



Agilent 15:35:57 Jun 13, 2024
R T
2440MHz
Mkr1 Δ 2.5113 MHz
Ref -10 dBm
Atten 5 dB
0.497 dB
Peak
Log
10
dB/
1R
1
M1 S2
S3 FC
AA
Center 2.44 GHz
Span 5 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 19.99 ms (2000 pts)
Undefined header


Agilent 15:38:52 Jun 13, 2024
R T
2480MHz
Mkr1 Δ 2.5538 MHz
Ref -10 dBm
Atten 5 dB
-0.183 dB
Peak
Log
10
dB/
1R
1
V1 S2
S3 FC
AA
Center 2.48 GHz
Span 5 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 19.99 ms (2000 pts)
Undefined header


Agilent 09:38:11 Aug 19, 2024
R T
Ref 10 dBm
Atten 20 dB
#Peak
Log
10
dB/
LgAv
M1 S2
Center 2.402 000 0 GHz
Span 5 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 1.066 ms (2000 pts)
Occupied Bandwidth
2.0975 MHz
Occ BW % Pwr 99.00 %
x dB -20.00 dB
Transmit Freq Error -5.085 kHz
Occupied Bandwidth 2.200 MHz


Agilent 09:36:24 Aug 19, 2024
R T
Ref 10 dBm
Atten 20 dB
#Peak
Log
10
dB/
LgAv
M1 S2
Center 2.440 000 0 GHz
Span 5 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 1.066 ms (2000 pts)
Occupied Bandwidth
2.1259 MHz
Occ BW % Pwr 99.00 %
x dB -20.00 dB
Transmit Freq Error -9.108 kHz
x dB Bandwidth 2.210 MHz


Agilent 09:37:12 Aug 19, 2024
R T
Ref 10 dBm
Atten 20 dB
#Peak
Log
10
dB/
LgAv
M1 S2
Center 2.480 000 0 GHz
Span 5 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 1.066 ms (2000 pts)
Occupied Bandwidth
2.1150 MHz
Occ BW % Pwr 99.00 %
x dB -20.00 dB
Transmit Freq Error -8.471 kHz
Occupied Bandwidth 2.137 MHz

11.2.1 Measurement Instrumentation Uncertainty

Measurement	Uncertainty
Radiated Emissions, E-field, 3 meters, 30 to 200 MHz	4.8 dB
Radiated Emissions, E-field, 3 meters, 200 to 1000 MHz	4.6 dB
Radiated Emissions, E-field, 3 meters, 1 to 6 GHz	5.0 dB
Radiated Emissions, E-field, 3 meters, 6 to 18 GHz	5.5 dB
Radiated Emissions, E-field, 3 meters, 18 to 26 GHz	5.9 dB
Bandwidth using marker delta method at a span of 10 MHz	4 kHz
Occupied Bandwidth	1% of frequency span
Temperature	0.6 Deg C

The uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k=2 in accordance with CISPR 16-4-2.

12.0 REVISION HISTORY

Document RP-9993 Revisions:			
Rev.	Affected Sections	Description	Rationale
1	11.1.3	Added note on Average vs Peak limit	Clarification
1	11.2	Added 99% OBW	Additional data requested