Radio Testing of the
Dexcom, Inc.
Bluetooth Transmitter
Model: Dexcom G7 Transmitter

In accordance with FCC Part 15 Subpart C §15.247 and IC RSS-247 Issue 2 February 2017

America

Add value.
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Dexcom, Inc.
6340 Sequence Dr
San Diego, CA 92121

COMMERCIAL-IN-CONFIDENCE

Date: January 2023
Document Number: 72185725A Issue 01 | Version Number: 01

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Authorized Signatory	Omar Castillo	January 31, 2023	

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD document control rules.

EXECUTIVE SUMMARY
A sample of this product was tested and found to be in compliance with FCC Part 15 Subpart C §15.247 and IC RSS-247 Issue 2 February 2017.

A2LA Cert. No. 2955.13

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REPORT ON	Radio Testing of the Dexcom, Inc. Model/HVIN: MT-26423 (Bluetooth Transmitter)
TEST REPORT NUMBER	72185725A
TEST REPORT DATE	January 2023
PREPARED FOR	Dexcom, Inc. 6340 Sequence Dr San Diego, CA 92121
CONTACT PERSON	Vivian Wu Senior Staff Engineer vivian.wu@dexcom.com (858) 200-0200
PREPARED BY	Ferdinand S. Custodio **Name** Authorized Signatory Title: Senior EMC Test Engineer/Wireless Team Lead
APPROVED BY	Omar Castillo **Name** Authorized Signatory Title: Senior EMC / Wireless Test Engineer
DATED	January 31, 2023

Revision History

72185725A Dexcom, Inc. Model: Dexcom G7 Transmitter					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
01/31/2023	Initial Release				Ferdinand S. Custodio

CONTENTS

SECTION 1

REPORT SUMMARY

Radio Testing of the
Dexcom, Inc.
Dexcom G7 Transmitter

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Dexcom, Inc. Dexcom G7 Transmitter to the requirements of FCC Part 15 Subpart C §15.247 and IC RSS-247 Issue 2 February 2017.

Objective	To perform verification testing to support Class II Permissive Change covering the following changes over the original filing: ***Transmitter PCBA:*** a. Changes to the RF matching network b. Change to location of parts related to the RF Matching network and power supply decoupling c. Changes to PCBA ground planes to improve noise floor ***Transmitter FW*** a. Changes to improve the BLE communication performance, no change to other FW functionality.
Manufacturer	Dexcom, Inc.
EUT	Bluetooth Transmitter
Trade Name	Dexcom G7 Transmitter
Model/HVIN	MT-26423
FCC ID	PH29788
IC Number	9290A-900618
FCC Classification	Low power Communications Device Transmitter (DTS)
Serial Number(s)	300963026241 and 297827838279
Number of Samples Tested	2
Test Specification/Issue/Date	• FCC Part 15 Subpart C §15.247 (October 1, 2022). • RSS-247–Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices (Issue 2, February 2017). • RSS-Gen - General Requirements for Compliance of Radio Apparatus (Issue 5, Amendment 2 February 2021).
Start of Test	January 11, 2023
Finish of Test	January 11, 2023

Name of Engineer(s)	Ferdinand Custodio Ivan Retana
Related Document(s)	• ANSI C63.10-2013. American National Standard of Procedures for Compliance testing of Unlicensed Wireless Devices. • KDB 558074 D01 15.247 v05r02 Guidance for compliance measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices operating under Section 15.247 of the FCC rules. • Supporting documents for EUT certification are separate exhibits.

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC Part 15 Subpart C §15.247 and IC RSS-247 Issue 2 February 2017 with cross-reference to the corresponding IC RSS standard are shown below.

Section	§15.247 Spec Clause	RSS	Test Description	Result	Comments /Base Standard
2.1	§15.247(b)(3)	RSS-247 5.4(d)	Peak Output Power	Compliant	
-	§15.207(a)	RSS-Gen 8.8	Conducted Emissions	N/A	
-	-	RSS-Gen 6.7	99% Emission Bandwidth	N/A**	
-	§15.247(a)(2)	RSS-247 5.2(a)	Minimum 6 dB RF Bandwidth	N/A**	
2.2	§15.247(d)	RSS-247 5.5	Out-of-Band Emissions - Conducted	Compliant	
2.3	§15.247(d)	RSS-247 5.5	Band-edge Compliance of RF Conducted Emissions	Compliant	
2.4	§15.247(d)	RSS-247 5.5	Radiated Spurious Emissions	Compliant	
	-	RSS-Gen 7.3 and 7.4	Receiver Spurious Emissions	N/A*	
-	§15.247(e)	RSS-247 5.2(b)	Power Spectral Density for Digitally Modulated Device	N/A**	

N/A EUT does not have provisions to connect directly to public AC mains. AC Conducted Emissions not performed. However, it is recommended to perform this test on the final host configuration.
N/A* Not required as per RSS-Gen 5.3 The EUT does not fall into any category defined as Receiver under RSS-Gen.
N/A** Not performed per test plan (Class II Permissive Change).

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) is a Dexcom, Inc. MT-26423 Dexcom G7 Transmitter. The EUT is part of the G7 continuous Glucose Monitoring System. The Dexcom G7 System is an ambulatory glucose monitoring system communicating at 2.4 GHz BLE in conjunction with a Dexcom glucose sensor assembly. The receiver and optional smart device with app receive EGV data wirelessly from a wearable transmitter (EUT) and displays the data to the user. The receiver and optional smart device will also provide rate of change and trend information of the user to facilitate management of their diabetes. The receiver or smart device app can be configured to alarm for various conditions, (i.e., low glucose values, rapid glucose rise, etc.). The Bluetooth LE function of the EUT was verified in this test report.

1.3.2 EUT General Description

EUT Description	Dexcom G7 Transmitter
Model/HVIN	MT-26423
Model Number	MT-26423-31 Rev 001
Software Revision	32.192.105.59
Rated Voltage	Internal battery
Mode Verified	Bluetooth LE (1MHz BW only)
Capability	Bluetooth Low Energy (BLE 5.0)
Primary Unit (EUT)	☐ Production
	☒ Pre-Production
	☐ Engineering
Manufacturer Declared Temperature Range	10°C to 42°C
Antenna Type	PCB Trace Antenna (Monopole)
Manufacturer	Dexcom
Antenna Model	N/A - custom printed PCB trace
Maximum Antenna Gain	-1.57 dBi

1.3.3 Maximum Conducted Output Power

Bluetooth Low Energy (LE)	Frequency Range (MHz)	Gated RMS (dBm)	Duty Cycle (%)
	2402-2480	-0.3	91.9

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
Default	EUT is configured to operate in test mode in which it can transmit continuously. A laptop with Dexcom software was used to manually set EUT to transmit at Low, Mid, and High frequency channels for evaluations.

1.4.2 EUT Exercise Software

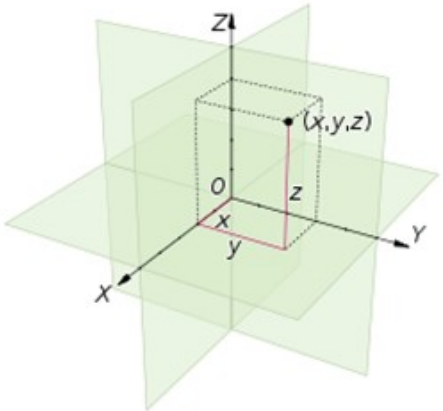
EUT test mode for radio testing is configured via NFC command tool (nfccmd command line tool, SW11835 version 1.0.6.0).

1.4.3 Support Equipment and I/O cables

Manufacturer	Equipment/Cable	Description
Dell	Support Laptop	Model Precision 5500
Adafruit Industries	Breakout Board	Model PN532 (Dexcom Fixture FX92215)
Protek	DC Power supply	3006B DC Power Supply S/N: H010295
Hewlett Packard	DC Power Supply	Model 6632B S/N US37472178

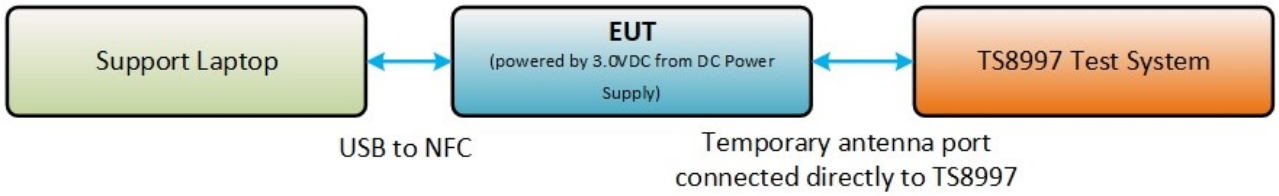
1.4.4 Worst Case Configuration

For radiated measurements X, Y, and Z orientations were verified. The verification was determined “X” as worst case configuration.



1.4.5 Simplified Test Configuration Diagram

Antenna Port Conducted Test Setup



Cabinet Spurious Emissions Test Setup

1.4.6 Worst Case Configuration (Cabinet Spurious Emissions)

Low channel was chosen as the representative channel given that there are no significant differences between each channel in terms of emissions:

Mode	Channel	Data Rate
Bluetooth LE	37 (Low Channel)	1Mbps

1.5 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standards or test plan were made during testing.

1.6 MODIFICATION RECORD

Description of Modification	Modification Fitted By	Date Modification Fitted
Serial Number: No modifications		
N/A		

The table above details modifications made to the EUT during the test programme. The modifications incorporated during each test (if relevant) are recorded on the appropriate test pages.

1.7 TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

For conducted and radiated emissions, the equipment under test (EUT) was configured to measure its highest possible emission level. This level was based on the maximized cable configuration from exploratory testing per ANSI C63.10-2013. The test modes were adapted according to the Operating Instructions provided by the manufacturer/client.

1.8 TEST FACILITY LOCATION

1.8.1 TÜV SÜD America Inc. (Mira Mesa)

10040 Mesa Rim Road, San Diego, CA 92121-2912 (32.901268,-117.177681). Phone: 858 678 1400 FAX: 858-546 0364

1.8.2 TÜV SÜD America Inc. (Rancho Bernardo)

16936 Via Del Campo, San Diego, CA 92127-1708 (33.018644,-117.092409). Phone: 858 678-1400 Fax: 858 546 0364.

1.9 TEST FACILITY REGISTRATION

1.9.1 FCC – Designation No.: US1146

TUV SUD America Inc. (San Diego), is an accredited test facility with the site description report on file and has met all the requirements specified in §2.948 of the FCC rules. The acceptance letter from the FCC is maintained in our files and the Designation is US1146.

1.9.2 Innovation, Science and Economic Development Canada (IC) Registration No.: 3067A-1 & 22806-1

The 10m Semi-anechoic chamber of TUV SUD America Inc. (San Diego Rancho Bernardo) has been registered by Certification and Engineering Bureau of Innovation, Science and Economic Development Canada for radio equipment testing with Registration No. 3067A-1.

The 3m Semi-anechoic chamber of TUV SUD America Inc. (San Diego Mira Mesa) has been registered by Certification and Engineering Bureau of Innovation, Science and Economic Development Canada for radio equipment testing with Registration No. 22806-1.

1.9.3 BSMI – Laboratory Code: SL2-IN-E-028R (US0102)

TUV Product Service Inc. (San Diego) is a recognized EMC testing laboratory by the BSMI under the MRA (Mutual Recognition Arrangement) with the United States. Accreditation includes CNS 13438 up to 6GHz.

1.9.4 NCC (National Communications Commission - US0102)

TUV SUD America Inc. (San Diego) is listed as a Foreign Recognized Telecommunication Equipment Testing Laboratory and is accredited to ISO/IEC 17025 (A2LA Certificate No.2955.13) which under APEC TEL MRA Phase 1 was designated as a Conformity Assessment Body competent to perform testing of equipment subject to the Technical Regulations covered under its scope of accreditation including RTTE01, PLMN01 and PLMN08 for TTE type of testing and LP002 for Low-Power RF Device type of testing.

1.9.5 VCCI – Registration No. A-0280 and A-0281

TUV SUD America Inc. (San Diego) is a VCCI registered measurement facility which includes radiated field strength measurement, radiated field strength measurement above 1GHz, mains port interference measurement and telecommunication port interference measurement.

1.9.6 RRA – Identification No. US0102

TUV SUD America Inc. (San Diego) is National Radio Research Agency (RRA) recognized laboratory under Phase I of the APEC Tel MRA.

1.9.7 OFCA – U.S. Identification No. US0102

TUV SUD America Inc. (San Diego) is recognized by Office of the Communications Authority (OFCA) under Appendix B, Phase I of the APEC Tel MRA.

SECTION 2

TEST DETAILS

Radio Testing of the
Dexcom, Inc.
Dexcom G7 Transmitter

2.1 PEAK OUTPUT POWER

2.1.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.247(b)(3)
RSS-247, Clause 5.4 (d)

2.1.2 Standard Applicable

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands, the maximum peak conducted output shall not exceed 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

2.1.3 Equipment Under Test and Modification State

Serial No: 300963026241 / Default Test Configuration

2.1.4 Date of Test/Initial of test personnel who performed the test

January 11, 2023 / FSC

2.1.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.6 Environmental Conditions (Rancho Bernardo Satellite Facility)

Ambient Temperature	22.5°C
Relative Humidity	46.0%
ATM Pressure	99.8kPa

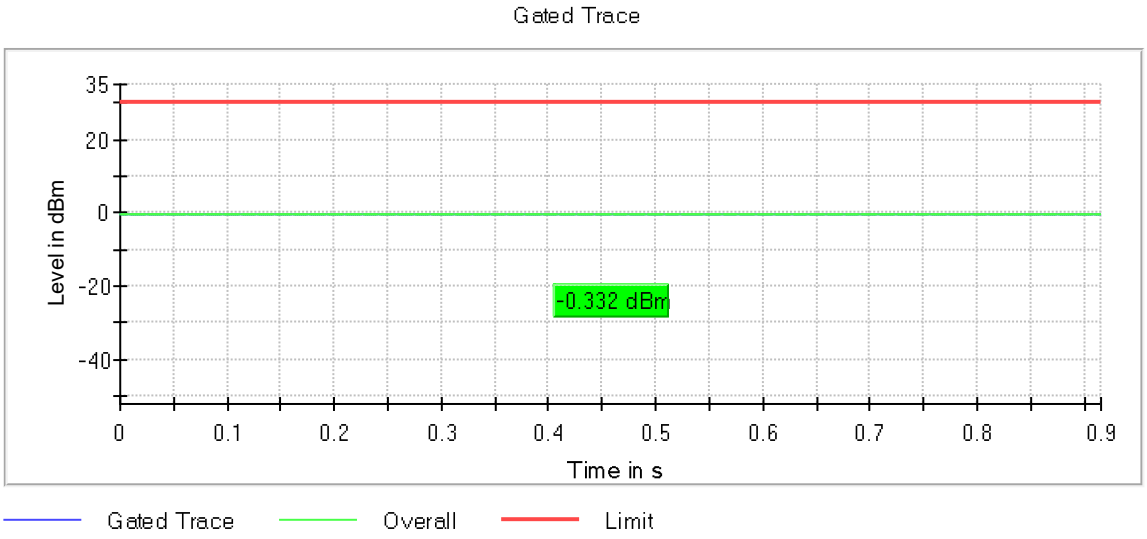
2.1.7 Additional Observations

- This is a conducted test using direct connection to the TS8997 Test System.
- The path loss was all accounted for with the test system calibration.
- Test methodology is per FCC title 47 part 15 §15.247(b), KDB 558074 D01 DTS Meas Guidance v05 and ANSI C63.10-2013 11.9.2.3.2.
- The requirement is the total transmit power delivered to the antenna. Therefore, Gated EIRP data are for reference only. The actual antenna gain of the EUT is not considered.

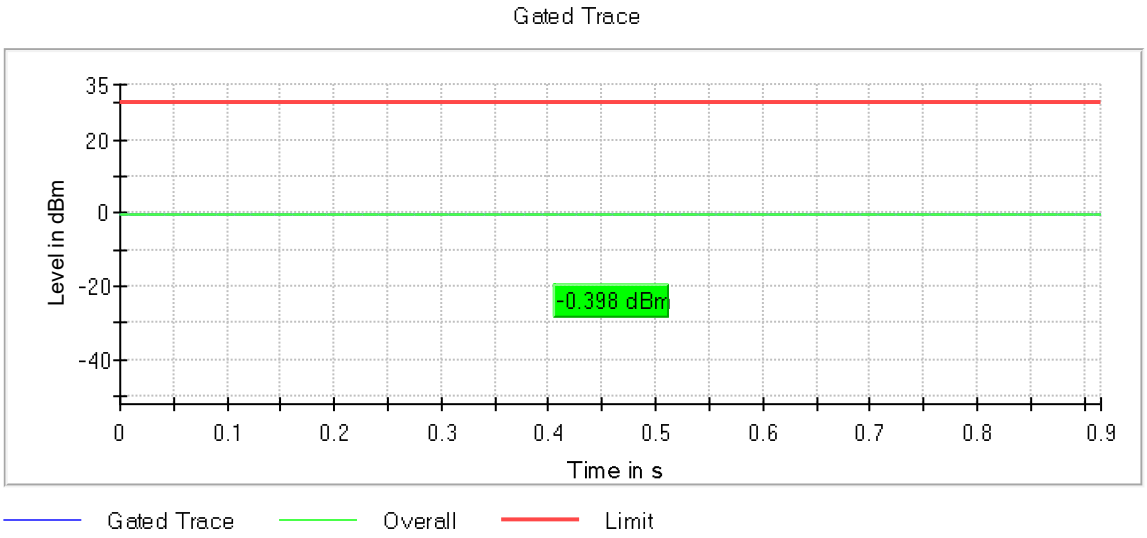
2.1.8 Test Results

DUT Frequency (MHz)	Gated RMS (dBm)	Limit Max (dBm)	Gated EIRP (dBm)	DutyCycle (%)	Result
2402.000000	**-0.3**	30.0	-0.3	91.861	PASS
2440.000000	**-0.4**	30.0	-0.4	91.867	PASS
2480.000000	**-0.3**	30.0	-0.3	91.869	PASS

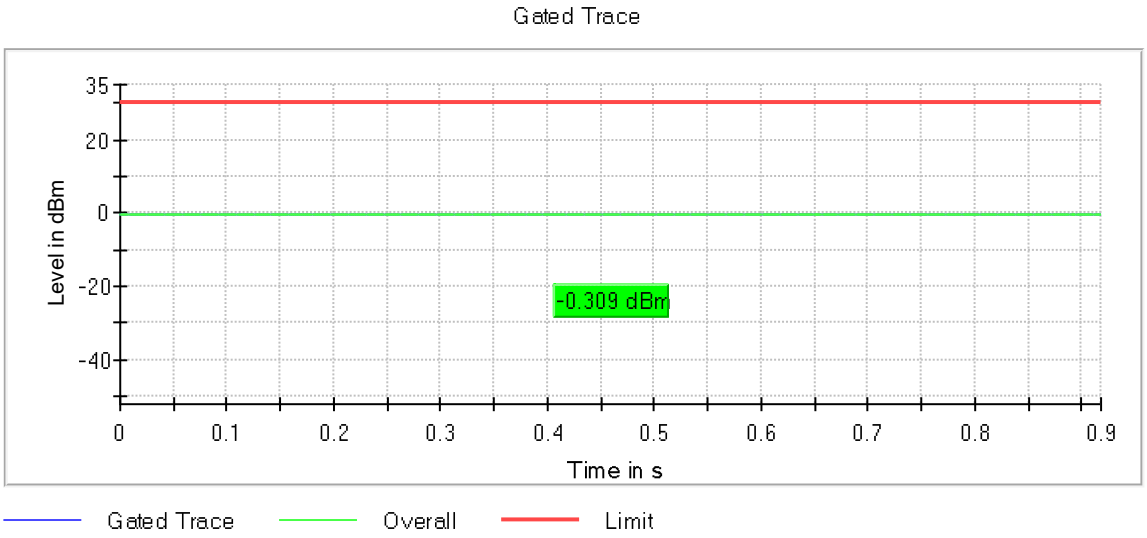
2.1.9 Sample Test Plots



Bluetooth LE. Low Channel



Bluetooth LE. Mid Channel



Bluetooth LE. High Channel

2.1.10 Power Meter Settings

Setting	Instrument Value	Target Value
Measurement Time	1.000 s	1.000 s
Points	1000000	1000000
Time resolution	1.000 µs	1.000 µs

2.2 OUT-OF-BAND EMISSIONS - CONDUCTED

2.2.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.247(d)
RSS-247, Clause 5.5

2.2.2 Standard Applicable

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)).

2.2.3 Equipment Under Test and Modification State

Serial No: 300963026241 / Default Test Configuration

2.2.4 Date of Test/Initial of test personnel who performed the test

January 11, 2023 / FSC

2.2.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.6 Environmental Conditions (Rancho Bernardo Satellite Facility)

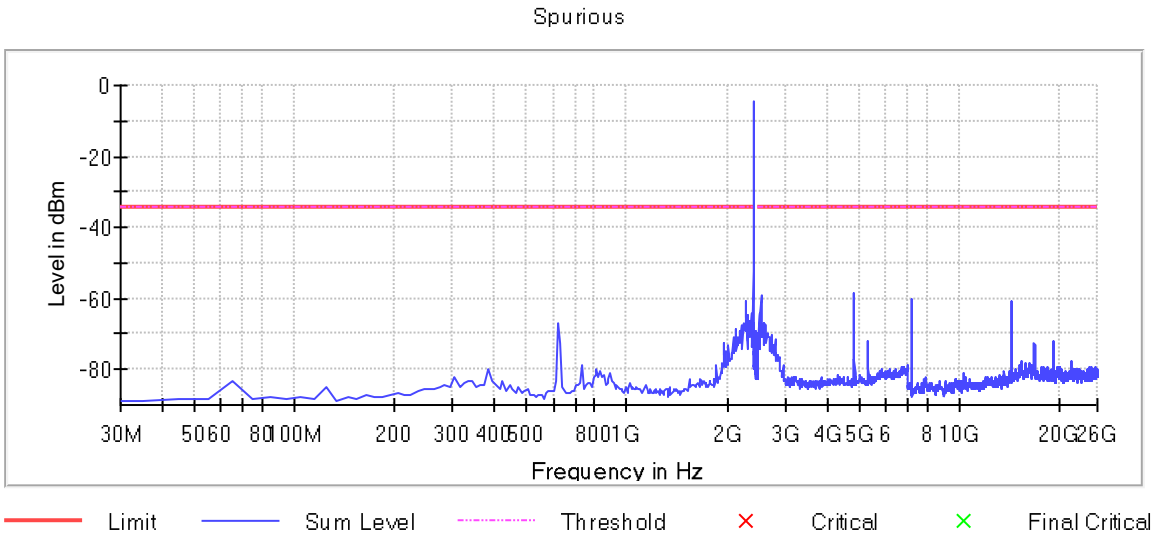
Ambient Temperature	22.5°C
Relative Humidity	46.0%
ATM Pressure	99.8kPa

2.2.7 Additional Observations

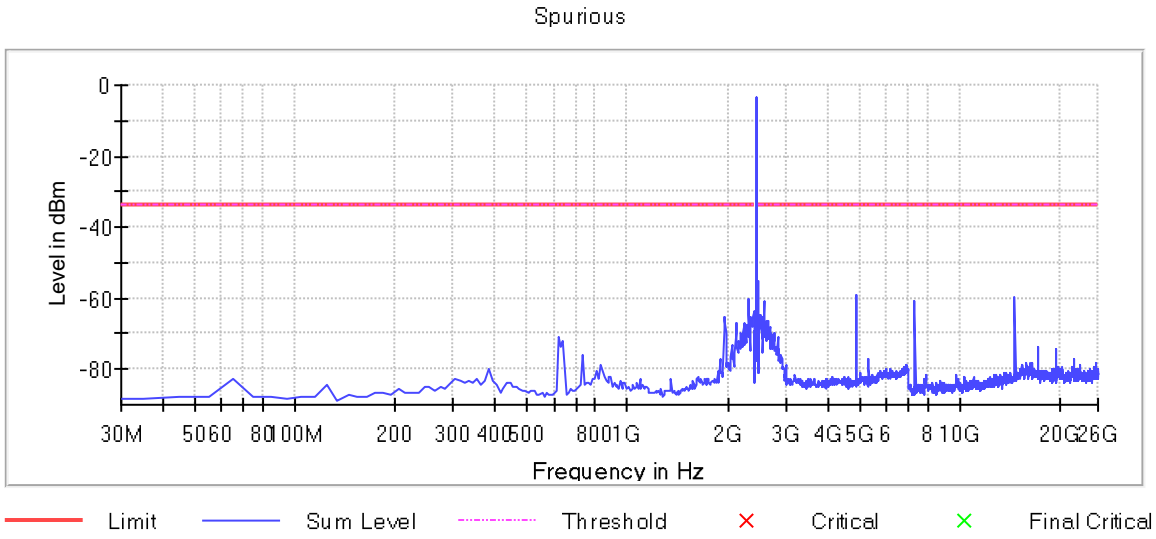
- This is a conducted test using a spectrum analyser.
- The path loss was all accounted for using a transducer factor (TDF) including the maximum antenna gain of -1.57 dBi.
- Test methodology is per FCC title 47 part 15 §15.247(d), KDB 558074 D01 DTS Meas Guidance v05 and ANSI C63.10-2013 11.11.2 & 11.11.3.
- Both §15.205 and §15.247(d) requirements verified.
- Limits of §15.209 is converted to EIRP using formula from Clause 12.7.2(d) of ANSI C63.10-2013.
- For §15.247(d) requirement, no emissions observed within the measurement threshold during prescan, further verification is not required.

- For §15.209 requirement, prescan will be performed using Peak detector with corresponding RBW setting verified against the Average limit. Any Peak emissions failing the Average limit will be re-evaluated using DCCF to calculate the true Average level. For 30MHz to 1GHz, worst case RBW of 1MHz is used, limit at this range is for 100kHz RBW.

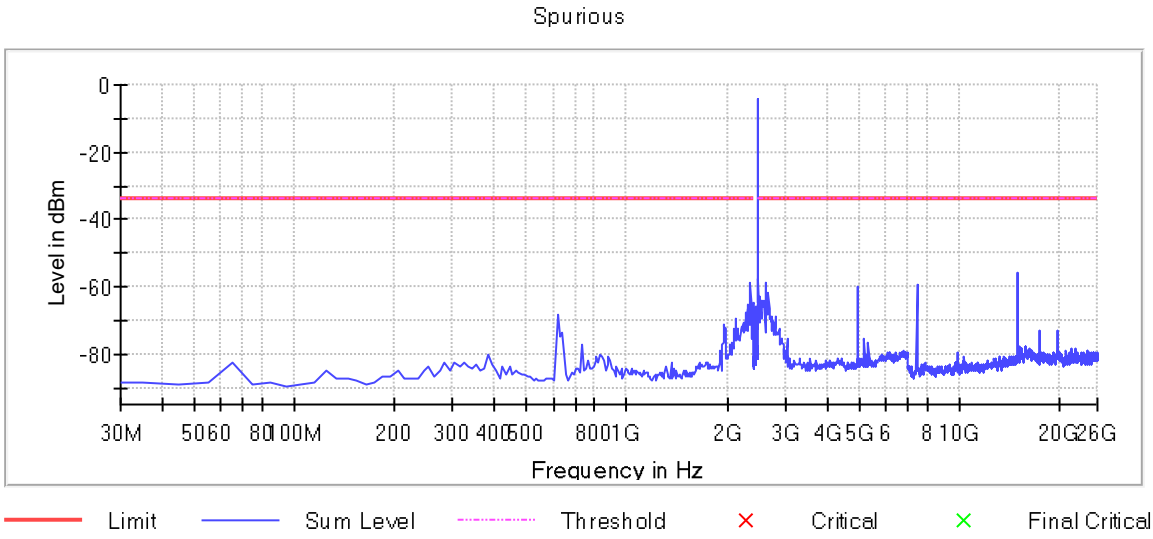
2.2.8 Test Results Plots (§15.247 requirements)



Low Channel

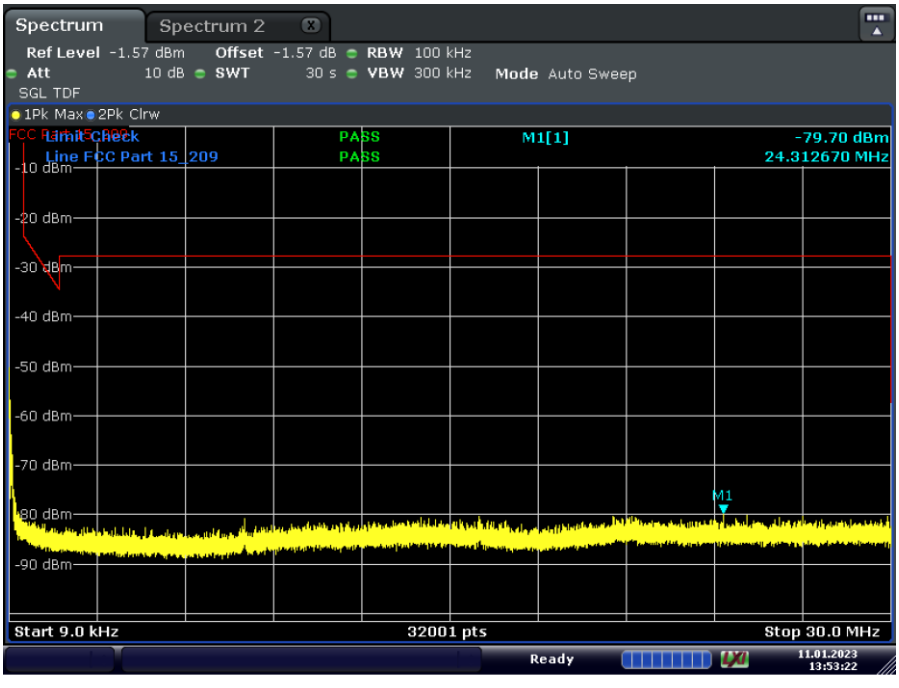


Middle Channel



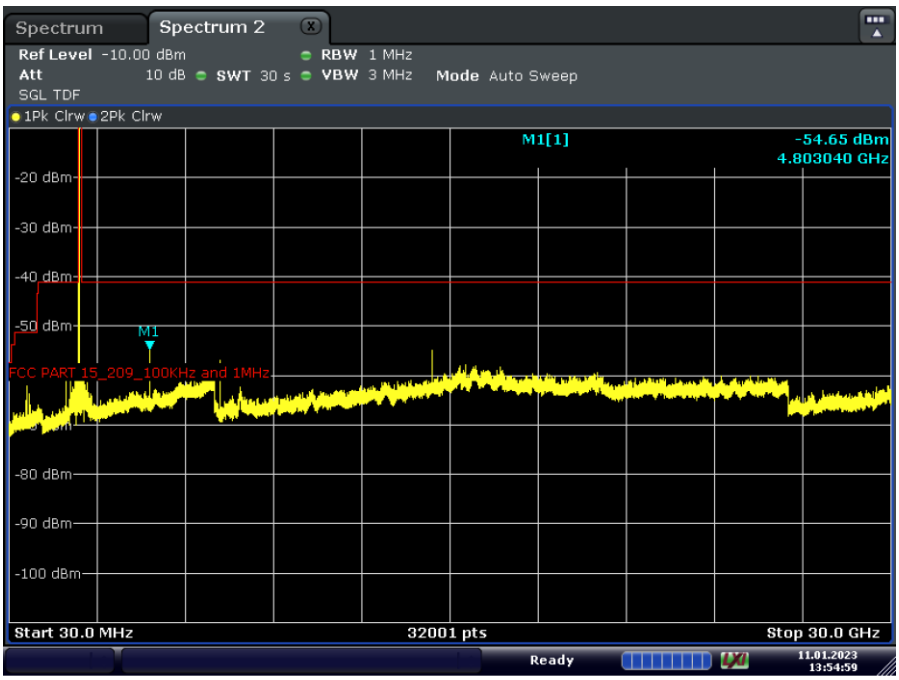
High Channel

2.2.9 Test Results Plots (§15.205 requirements)



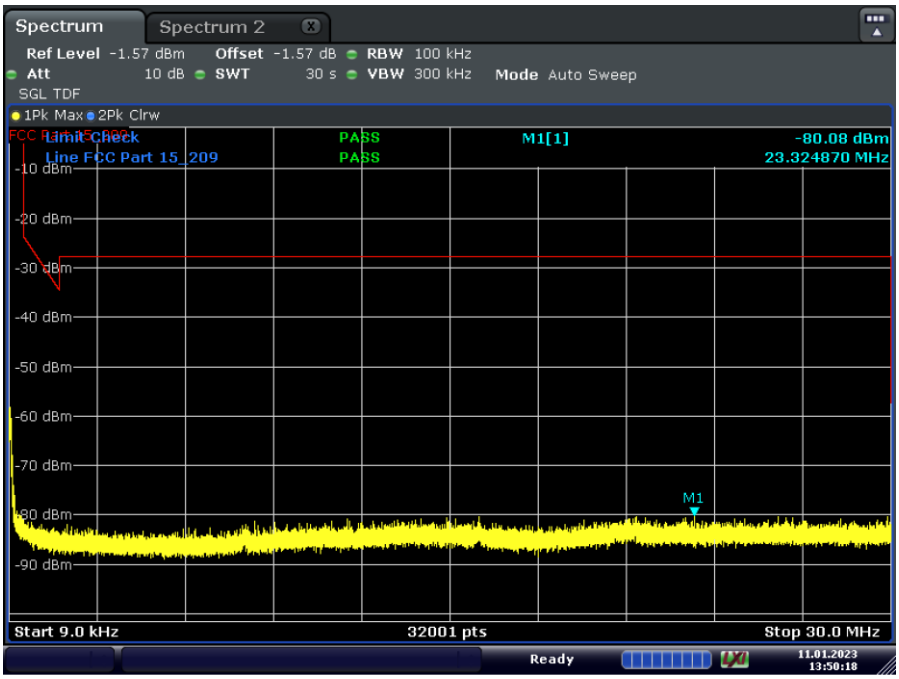
Date: 11.JAN.2023 13:53:22

BLE Low Channel (9kHz to 30MHz)



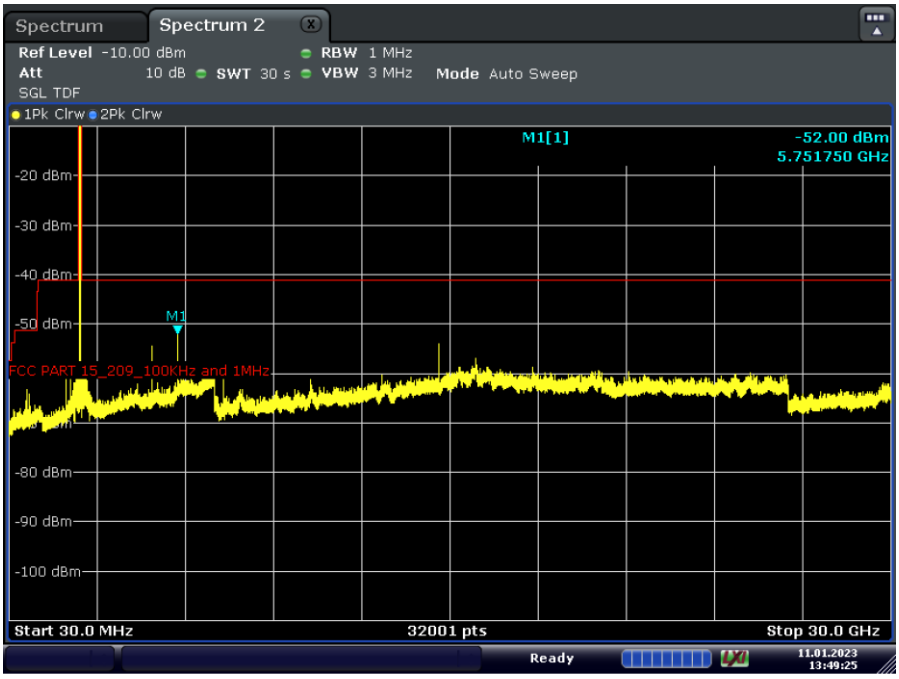
Date: 11.JAN.2023 13:55:00

BLE Low Channel (30MHz to 30GHz)



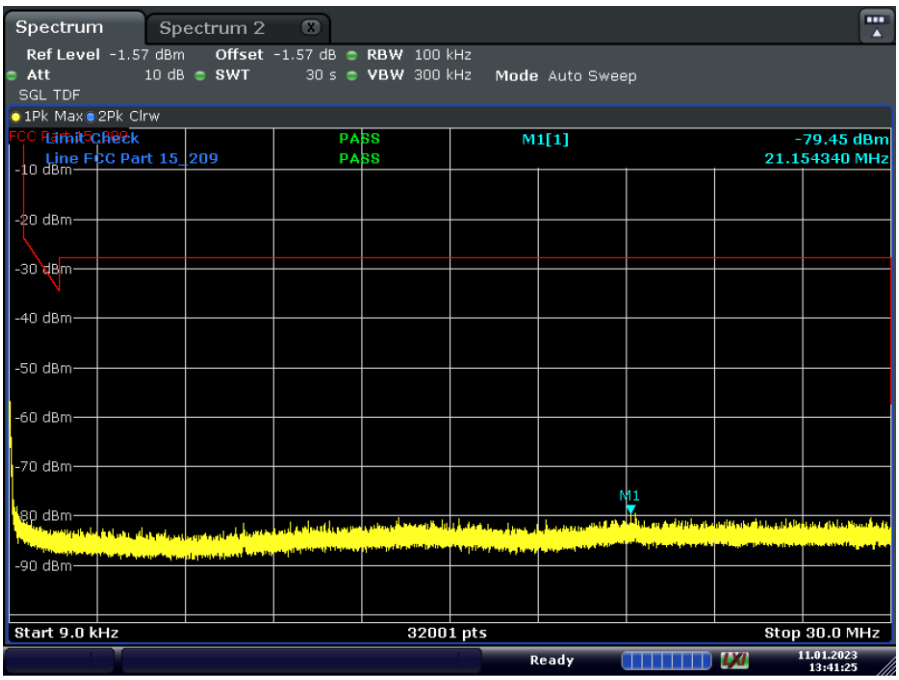
Date: 11.JAN.2023 13:50:19

BLE Mid Channel (9kHz to 30MHz)



Date: 11.JAN.2023 13:49:26

BLE Mid Channel (30MHz to 30GHz)



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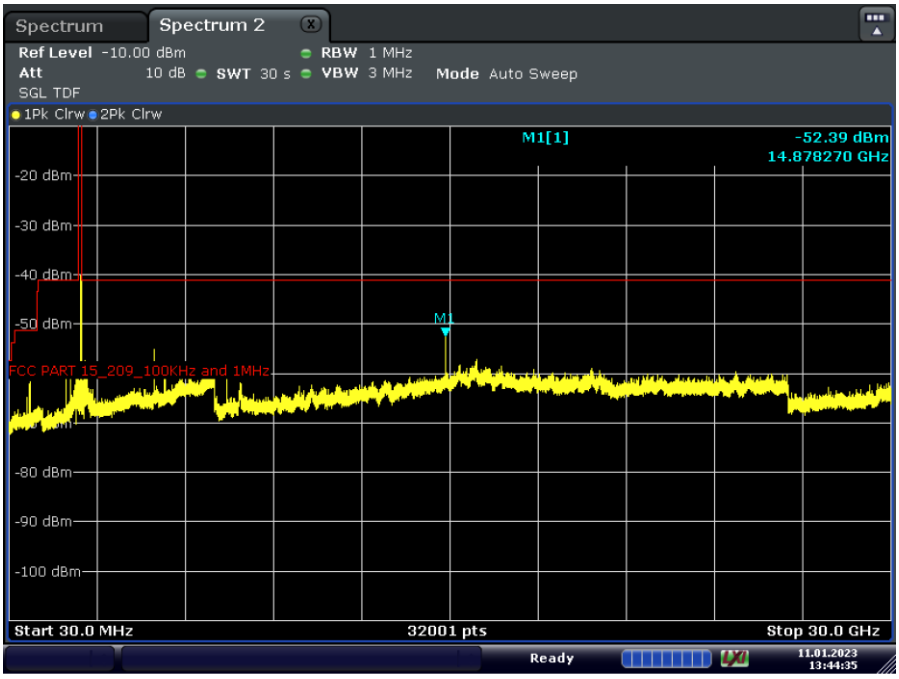
BLE High Channel (9kHz to 30MHz)



Date: 11.JAN.2023 13:44:36

BLE High Channel (30MHz to 30GHz)

2.3 BAND-EDGE COMPLIANCE OF RF CONDUCTED EMISSIONS

2.3.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.247(d)
FCC 47 CFR Part 15, Clause 15.205
RSS-247, Clause 5.5

2.3.2 Standard Applicable

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)).

2.3.3 Equipment Under Test and Modification State

Serial No: 300963026241 / Default Test Configuration

2.3.4 Date of Test/Initial of test personnel who performed the test

January 11, 2023 / FSC

2.3.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.3.6 Environmental Conditions (Rancho Bernardo Satellite Facility)

Ambient Temperature	22.5°C
Relative Humidity	46.0%
ATM Pressure	99.8kPa

2.3.7 Additional Observations

- This is a conducted test using direct connection to the Spectrum Analyzer being controlled by the TS8997 Test System.
- The path loss was all accounted for with the test system calibration.
- Test methodology is per FCC title 47 part 15 §15.247(d), KDB 558074 D01 DTS Meas Guidance v05 8.7 and ANSI C63.10-2013.

2.3.8 Sample Measurement Settings

Measurement 1		
Setting	**Instrument Value**	**Target Value**
Span	90.000 MHz	90.000 MHz
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	1800	~ 1800
Sweeptime	113.672 µs	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	4 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.00 dB	0.50 dB

Measurement 2		
Setting	**Instrument Value**	**Target Value**
Span	83.500 MHz	83.500 MHz
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	1670	~ 1670
Sweeptime	94.727 µs	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	10 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.03 dB	0.50 dB

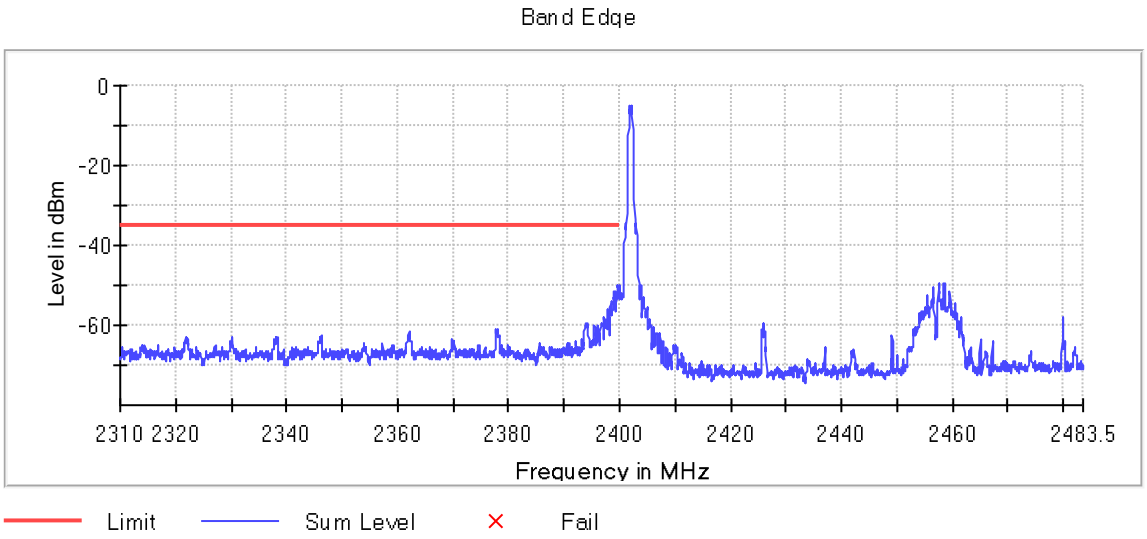
2.3.9 Test Results (Lower Band Edge)

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.725000	-49.9	15.1	-34.8	PASS
2399.775000	-49.9	15.2	-34.8	PASS
2399.575000	-50.2	15.4	-34.8	PASS
2399.975000	-50.2	15.4	-34.8	PASS
2399.625000	-50.3	15.5	-34.8	PASS
2399.675000	-50.4	15.6	-34.8	PASS
2399.525000	-51.1	16.3	-34.8	PASS
2399.825000	-51.3	16.5	-34.8	PASS
2399.925000	-51.3	16.5	-34.8	PASS
2399.125000	-51.5	16.8	-34.8	PASS
2399.075000	-51.7	16.9	-34.8	PASS
2399.175000	-52.6	17.8	-34.8	PASS
2399.875000	-52.6	17.8	-34.8	PASS
2398.925000	-52.8	18.0	-34.8	PASS
2398.975000	-52.9	18.2	-34.8	PASS

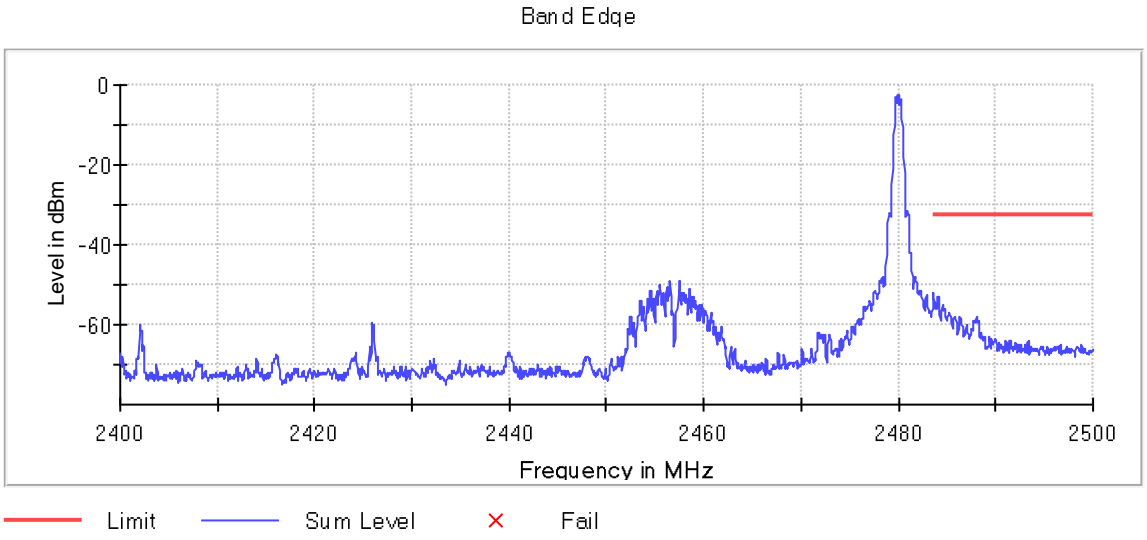
2.3.10 Test Results (Upper Band Edge)

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2483.525000	-52.0	19.5	-32.5	PASS
2483.575000	-52.1	19.6	-32.5	PASS
2483.625000	-52.7	20.3	-32.5	PASS
2484.125000	-52.9	20.4	-32.5	PASS
2484.075000	-52.9	20.4	-32.5	PASS
2483.675000	-53.5	21.0	-32.5	PASS
2484.175000	-53.5	21.0	-32.5	PASS
2484.025000	-53.9	21.4	-32.5	PASS
2483.725000	-54.6	22.1	-32.5	PASS
2483.975000	-55.0	22.5	-32.5	PASS
2484.575000	-55.2	22.7	-32.5	PASS
2484.525000	-55.2	22.8	-32.5	PASS
2484.225000	-55.4	22.9	-32.5	PASS
2484.625000	-55.6	23.1	-32.5	PASS
2483.925000	-55.8	23.3	-32.5	PASS

2.3.11 Test Plots



Bluetooth LE Low Band Edge 2400MHz



Bluetooth LE Upper Band Edge 2483.5MHz

2.3.12 Upper band edge calculation (2483.5 MHz) within Restricted Band:

- 2483.5 MHz (in the restricted bands)
- Procedure is per Clause 12.7.2 of ANSI C63.10-2013.
- Use the following formula as per Clause 12.7.2(d) of ANSI C63.10-2013.

E(dBµV/m) = EIRP (dBm) + 95.2
= (-52.0 dBm + (-1.57 dBi antenna gain)) + 95.2
= 41.63dBµV/m @ 3 meters (Peak complies with 54 dBµV/m Average limit)

2.4 RADIATED SPURIOUS EMISSIONS

2.4.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.247(d)
RSS-247, Clause 5.5

2.4.2 Standard Applicable

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)).

2.4.3 E **Equipment Under Test and Modification State**

Serial No: 297827838279 / Default Test Configuration

2.4.4 Date of Test/Initial of test personnel who performed the test

January 11, 2023 / IR

2.4.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.4.6 Environmental Conditions (Rancho Bernardo Satellite Facility)

Ambient Temperature	22.5°C
Relative Humidity	46.0%
ATM Pressure	99.8kPa

2.4.7 Additional Observations

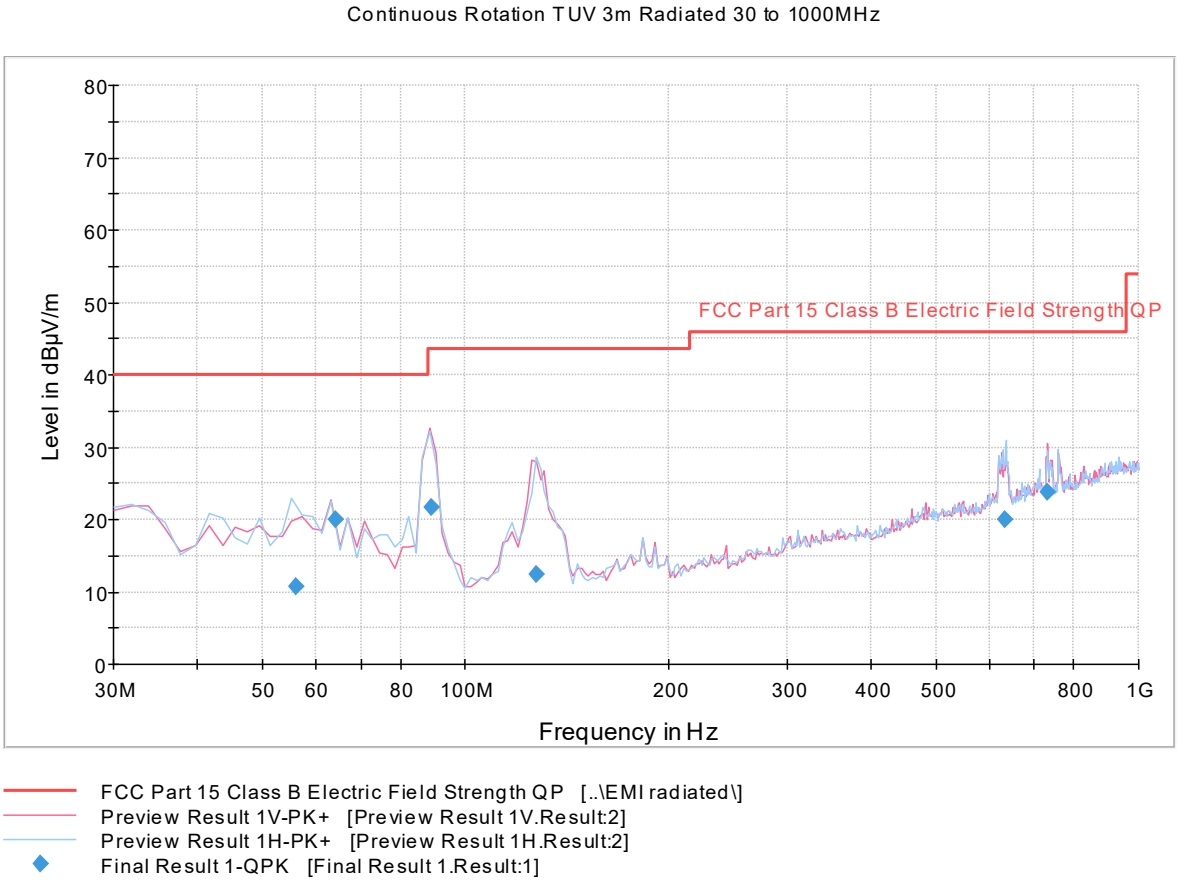
- This is a radiated test using a radiated sample with integral antenna.
- There are no emissions found that do not comply to the restricted bands defined in FCC Part 15 Subpart C, 15.205 or Part 15.247(d).
- Only the worst case BLE (Low Channel) presented. There are no significant differences in emissions between all channels.
- Initial prescan indicates >30db margin in 9kHz to 30MHz range (see Section 2.2.9 for details). Radiated verification at this range is not required as there are no emissions observed that falls under the restricted bands per § 15.205(a).

- Measurement was done using EMC32 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only. See Section 2.4.8 for sample computation.

2.4.8 Sample Computation (Radiated Emission)

Measuring equipment raw measurement (dbµV) @ 30 MHz			-0.8
Correction Factor (dB)	Asset# 1066 (cable)	18.1	12.6
	Asset# 1172 (cable)	0.3	
	Asset# 1175(cable)	0.3	
	Asset# 1002 (antenna)	17.2	
Reported QuasiPeak Final Measurement (dbµV/m) @ 30MHz			**11.8**

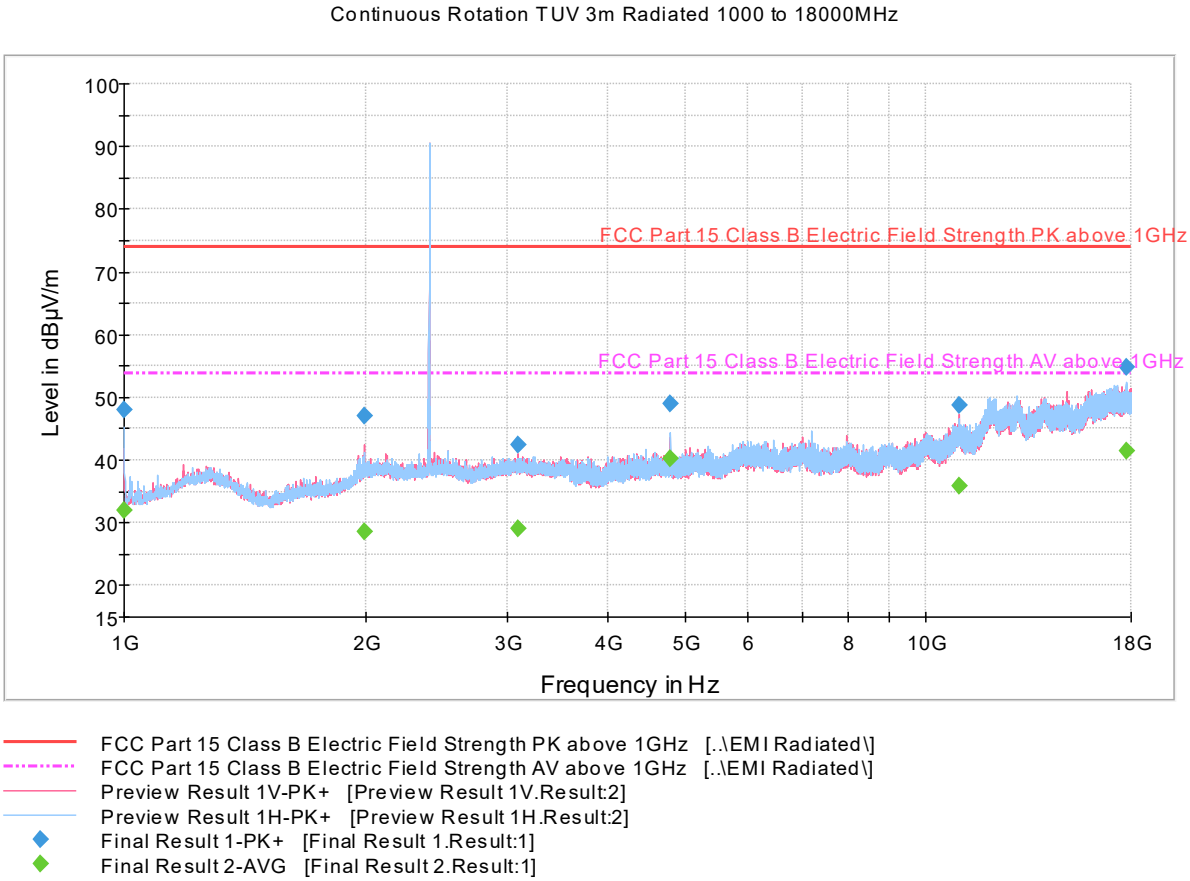
2.4.9 Test Results for 30MHz to 1GHz



Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
55.990541	10.7	1000.0	120.000	100.0	H	9.0	-16.4	29.3	40.0
64.006092	20.0	1000.0	120.000	100.0	V	293.0	-18.0	20.0	40.0
89.036633	21.8	1000.0	120.000	100.0	V	17.0	-16.8	21.7	43.5
127.39438	12.4	1000.0	120.000	100.0	H	354.0	-16.3	31.1	43.5
633.74909	20.0	1000.0	120.000	206.0	H	306.0	-1.6	26.0	46.0
731.16737	23.8	1000.0	120.000	333.0	V	300.0	0.4	22.2	46.0

2.4.10 Test Results for 1GHz to 18GHz



Peak Data

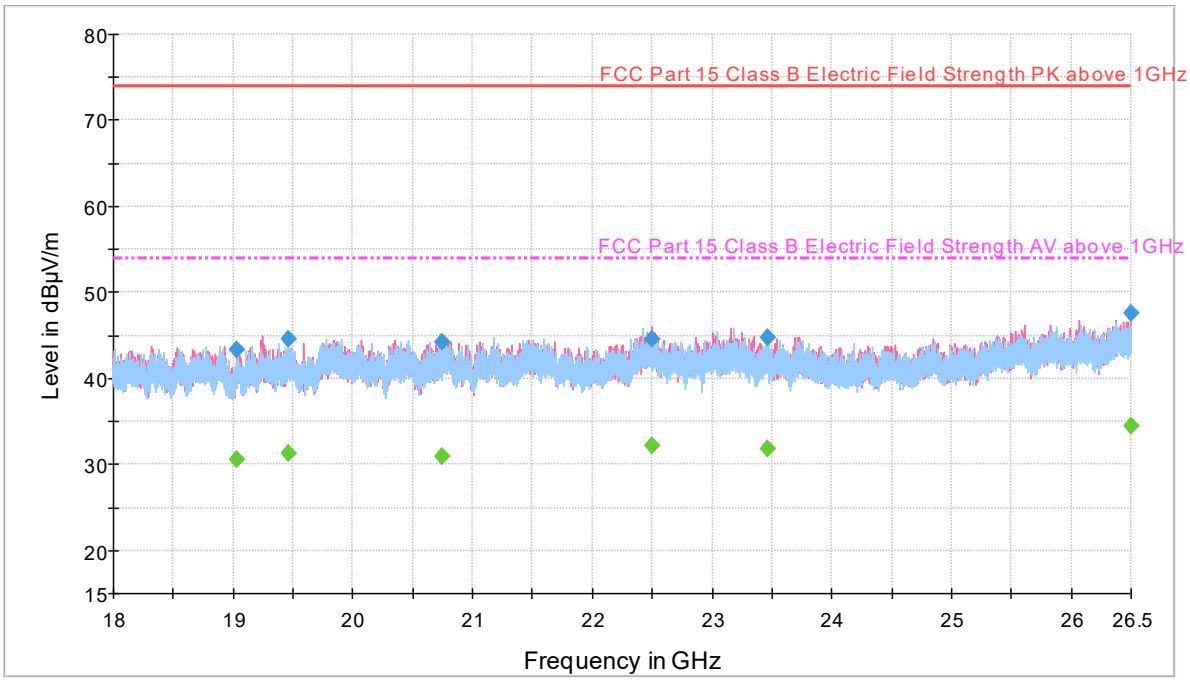
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.80000	48.0	1000.	1000.000	119.7	H	4.0	-7.9	25.9	73.9
1991.23333	47.1	1000.	1000.000	406.7	V	208.0	-2.4	26.8	73.9
3101.00000	42.5	1000.	1000.000	289.2	V	358.0	0.4	31.4	73.9
4804.40000	49.1	1000.	1000.000	103.7	H	232.0	3.6	24.8	73.9
10986.9333	48.8	1000.	1000.000	301.2	V	285.0	13.3	25.1	73.9
17795.4666	54.8	1000.	1000.000	410.7	H	162.0	22.1	19.1	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.80000	32.0	1000.	1000.000	119.7	H	4.0	-7.9	21.9	53.9
1991.23333	28.7	1000.	1000.000	406.7	V	208.0	-2.4	25.2	53.9
3101.00000	29.2	1000.	1000.000	289.2	V	358.0	0.4	24.7	53.9
4804.40000	40.2	1000.	1000.000	103.7	H	232.0	3.6	13.7	53.9
10986.9333	35.8	1000.	1000.000	301.2	V	285.0	13.3	18.1	53.9
17795.4666	41.4	1000.	1000.000	410.7	H	162.0	22.1	12.5	53.9

Test Notes: Fundamental will be ignored for this test.

2.4.11 Test Results for 18GHz to 26GHz



FCC Part 15 Class B Electric Field Strength PK above 1GHz [..\EMI radiated\]
FCC Part 15 Class B Electric Field Strength AV above 1GHz [..\EMI radiated\]
Preview Result 1V-PK+ [Preview Result 1V.Result:2]
Preview Result 1H-PK+ [Preview Result 1H.Result:2]
Final Result 1-PK+ [Final Result 1.Result:1]
Final Result 2-AVG [Final Result 2.Result:1]

Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
19033.2333	43.3	1000.	1000.000	150.2	V	161.0	-2.8	30.6	73.9
19464.6333	44.5	1000.	1000.000	150.2	H	150.0	-2.4	29.4	73.9
20748.0000	44.2	1000.	1000.000	150.2	V	5.0	-1.5	29.7	73.9
22502.7666	44.6	1000.	1000.000	150.2	V	110.0	0.1	29.3	73.9
23461.2833	44.7	1000.	1000.000	150.2	H	310.0	-0.2	29.2	73.9
26499.8000	47.5	1000.	1000.000	150.2	V	320.0	3.3	26.4	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
19033.2333	30.6	1000.	1000.000	150.2	V	161.0	-2.8	23.3	53.9
19464.6333	31.3	1000.	1000.000	150.2	H	150.0	-2.4	22.6	53.9
20748.0000	31.0	1000.	1000.000	150.2	V	5.0	-1.5	22.9	53.9
22502.7666	32.2	1000.	1000.000	150.2	V	110.0	0.1	21.7	53.9
23461.2833	31.7	1000.	1000.000	150.2	H	310.0	-0.2	22.2	53.9
26499.8000	34.5	1000.	1000.000	150.2	V	320.0	3.3	19.4	53.9

SECTION 3

TEST EQUIPMENT USED

TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

ID Number (SDGE/SDRB)	Test Equipment	Type	Serial Number	Manufacturer	Cal Date	Cal Due Date
Conducted Port Setup						
7643	Signal/Spectrum Analyzer	FSV30	1321.3008K30/103166	Rhode & Schwarz	12/20/22	12/20/23
7655	Vector Signal Generator	SMBV100A	260734	Rhode & Schwarz	12/20/22	12/20/23
7654	Signal Generator	SMB 100A	175750	Rhode & Schwarz	12/21/22	12/21/23
7656	OSP with B157	OSP120	101310	Rhode & Schwarz	12/21/22	12/21/23
8825	20dB Attenuator	46-20-34	BK5773	Weinschel Corp.	Verified by 7643 and 7654	
Radiated Emission						
SDRB1033	Bilog Antenna	3142C	00044556	EMCO	10/05/21	10/05/23
SDRB1040	EMI Test Receiver	ESIB40	100292	Rohde & Schwarz	10/26/23	10/26/23
SDGE51235	RF Pre-Amp (9Khz to 1GHz)	310	412802	SONOMA	09/30/23	09/30/23
SDRB1049	EMI Test Receiver	ESU40	100133	Rohde & Schwarz	09/21/23	09/21/23
SDGE08628	RF Pre-Amp	QJL-01182835-JO	8986002	Quinstar	03/29/23	03/29/23
SDGE07575	1-18GHz Horn Antenna	3117	155511	ETS Lindgren	08/08/22	08/08/24
SDGE09001	18-26GHz Horn Antenna	HO42S	101	Custom Microwave	09/23/21	09/23/23
Miscellaneous						
SDGE07554	Barometer/ Temperature/Humidity	iBTHX-W	400706	Omega	05/27/22	05/27/23
47045	True RMS Mustimeter	87 V	18290478	Fluke	03/29/22	03/29/23
40923	D.C. Power Supply	6632B	US37472178	Hewlett Packard	Verified by 47045	
EQ-E900309-002	DC Power Supply	3006B	H010295	Protek	Verified by 47045	
	Test Software	EMC32	V8.53	Rhode & Schwarz	N/A	

Measurement Uncertainty

Calculation of Measurement Uncertainty per CISPR 16-4-2:2011 with Corr. 1

2.4.1 Radiated Measurements (9kHz to 30MHz)

	Input Quantity (Contribution) X_i	Value		Prob. Dist.	Divisor	$u_i(x)$	$u_i(x)^2$
1	Receiver reading	0.10	dB	Normal, k=1	1.000	0.10	0.01
2	Attenuation: antenna-receiver	0.20	dB	Normal, k=2	2.000	0.10	0.01
3	Antenna factor AF	0.44	dB	Normal, k=2	2.000	0.22	0.05
4	Receiver sinewave accuracy	0.15	dB	Normal, k=2	2.000	0.08	0.01
5	Receiver pulse amplitude	1.50	dB	Rectangular	1.732	0.87	0.75
6	Receiver pulse repetition rate	1.50	dB	Rectangular	1.732	0.87	0.75
7	Noise floor proximity	0.50	dB	Rectangular	1.732	0.29	0.08
8	Mismatch: antenna-receiver	0.95	dB	U-shaped	1.414	0.67	0.45
9	AF frequency interpolation	0.30	dB	Rectangular	1.732	0.17	0.03
10	AF height deviations	0.10	dB	Rectangular	1.732	0.06	0.00
11	Directivity difference at 10 m	3.12	dB	Rectangular	1.732	1.80	3.24
12	Phase center location at 10 m	1.00	dB	Rectangular	1.732	0.58	0.33
13	Cross-polarization	0.90	dB	Rectangular	1.732	0.52	0.27
14	Balance	0.00	dB	Rectangular	1.732	0.00	0.00
15	Site imperfections	0.00	dB	Triangular	2.449	0.00	0.00
16	Separation distance at 10 m	0.30	dB	Rectangular	1.732	0.17	0.03
17	Effect of setup table material	0.00	dB	Rectangular	1.732	0.00	0.00
18	Table height at 10 m	0.10	dB	Normal, k=2	2.000	0.05	0.00
19	Near-field effects	0.00	dB	Triangular	2.449	0.00	0.00
20	Effect of ambient noise on OATS	0.00	dB				0.00
	Combined standard uncertainty			Normal	2.45	dB	
	Expanded uncertainty			Normal, k=2	**4.91**	**dB**	

2.4.2 Radiated Measurements (30MHz to 1GHz)

	Input Quantity (Contribution) X_i	Value		Prob. Dist.	Divisor	$u_i(x)$	$u_i(x)^2$
1	Receiver reading	0.10	dB	Normal, k=1	1.000	0.10	0.01
2	Attenuation: antenna-receiver	0.20	dB	Normal, k=2	2.000	0.10	0.01
3	Antenna factor AF	0.58	dB	Normal, k=2	2.000	0.29	0.08
4	Receiver sinewave accuracy	0.15	dB	Normal, k=2	2.000	0.08	0.01
5	Receiver pulse amplitude	1.50	dB	Rectangular	1.732	0.87	0.75
6	Receiver pulse repetition rate	1.50	dB	Rectangular	1.732	0.87	0.75
7	Noise floor proximity	0.50	dB	Rectangular	1.732	0.29	0.08
8	Mismatch: antenna-receiver	0.95	dB	U-shaped	1.414	0.67	0.45
9	AF frequency interpolation	0.30	dB	Rectangular	1.732	0.17	0.03
10	AF height deviations	0.10	dB	Rectangular	1.732	0.06	0.00
11	Directivity difference at 3 m	3.12	dB	Rectangular	1.732	1.80	3.24
12	Phase center location at 3 m	1.00	dB	Rectangular	1.732	0.58	0.33
13	Cross-polarization	0.90	dB	Rectangular	1.732	0.52	0.27
14	Balance	0.00	dB	Rectangular	1.732	0.00	0.00
15	Site imperfections	3.99	dB	Triangular	2.449	1.63	2.65
16	Separation distance at 3 m	0.30	dB	Rectangular	1.732	0.17	0.03
17	Effect of setup table material	0.57	dB	Rectangular	1.732	0.33	0.11
18	Table height at 3 m	0.10	dB	Normal, k=2	2.000	0.05	0.00
19	Near-field effects	0.00	dB	Triangular	2.449	0.00	0.00
20	Effect of ambient noise on OATS	0.00	dB				0.00
	Combined standard uncertainty			Normal	2.97	dB	
	Expanded uncertainty			Normal, k=2	**5.94**	**dB**	

2.4.1 Radiated Emission Measurements (1GHz to 18GHz)

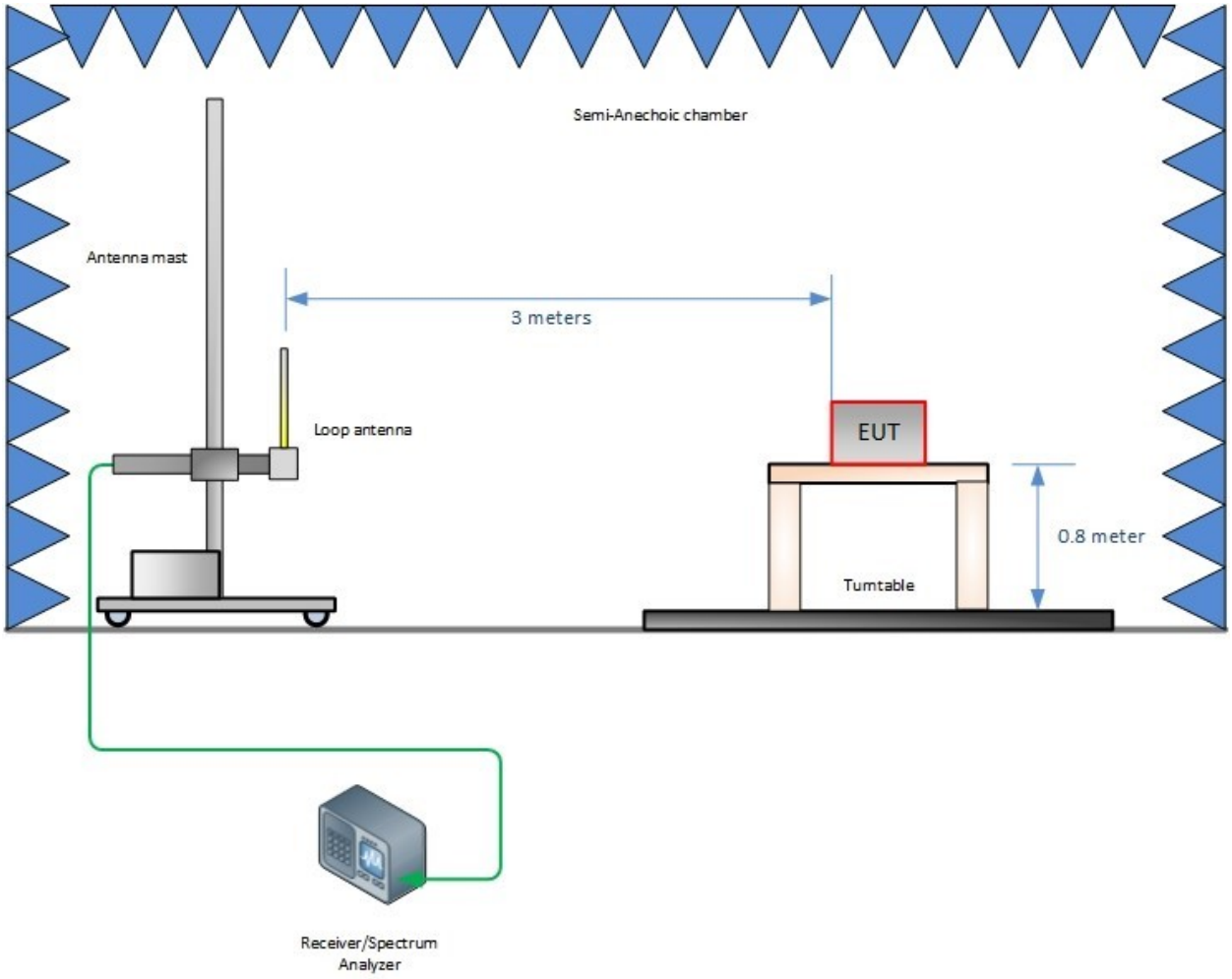
	Input Quantity (Contribution) X_i	Value		Prob. Dist.	Divisor	$u_i(x)$	$u_i(x)^2$
1	Receiver reading	0.10	dB	Normal, k=1	1.000	0.10	0.01
2	Attenuation: antenna-receiver	0.20	dB	Normal, k=2	2.000	0.10	0.01
3	Antenna factor AF	0.75	dB	Normal, k=2	2.000	0.38	0.14
4	Receiver sinewave accuracy	0.45	dB	Normal, k=2	2.000	0.23	0.05
5	Receiver pulse amplitude	1.50	dB	Rectangular	1.732	0.87	0.75
6	Receiver pulse repetition rate	1.50	dB	Rectangular	1.732	0.87	0.75
7	Noise floor proximity	0.50	dB	Rectangular	1.732	0.29	0.08
8	Mismatch: antenna-receiver	0.95	dB	U-shaped	1.414	0.67	0.45
9	AF frequency interpolation	0.30	dB	Rectangular	1.732	0.17	0.03
10	AF height deviations	0.10	dB	Rectangular	1.732	0.06	0.00
11	Directivity difference at 3 m	3.12	dB	Rectangular	1.732	1.80	3.24
12	Phase center location at 3 m	1.00	dB	Rectangular	1.732	0.58	0.33
13	Cross-polarisation	0.90	dB	Rectangular	1.732	0.52	0.27
14	Balance	0.00	dB	Rectangular	1.732	0.00	0.00
15	Site imperfections	3.25	dB	Triangular	2.449	1.33	1.76
16	Separation distance at 3 m	0.30	dB	Rectangular	1.732	0.17	0.03
17	Effect of setup table material	0.77	dB	Rectangular	1.732	0.44	0.20
18	Table height at 3 m	0.10	dB	Normal, k=2	2.000	0.05	0.00
19	Near-field effects	0.00	dB	Triangular	2.449	0.00	0.00
20	Effect of ambient noise on OATS	0.00	dB				0.00
	Combined standard uncertainty			Normal	2.85	dB	
	Expanded uncertainty			Normal, k=2	**5.70**	**dB**	

SECTION 4

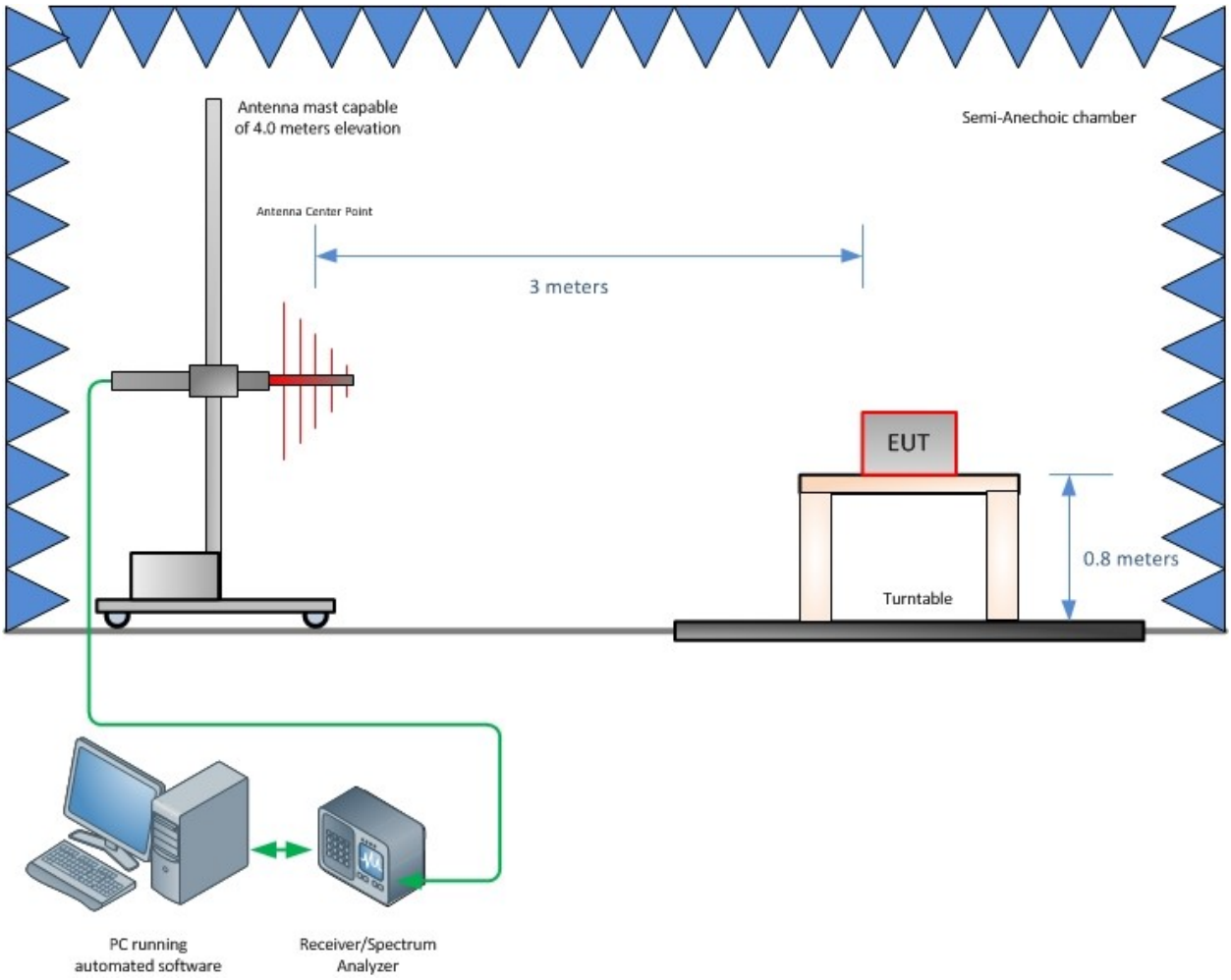
Diagram of Test Setup

America

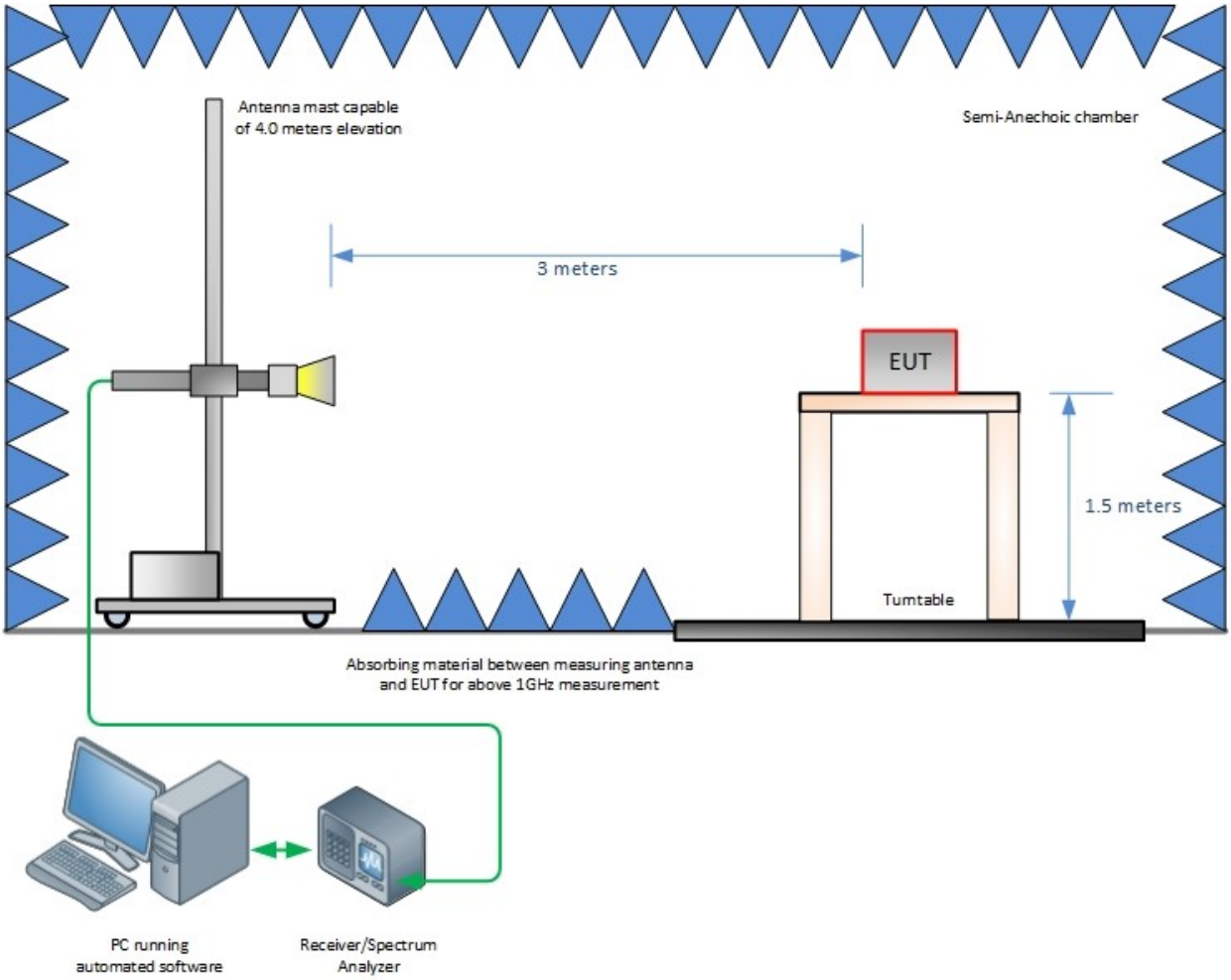
Test Setup Diagram



Radiated Emission Test Setup (Below 30MHz)



Radiated Emission Test Setup (Below 1GHz)



Radiated Emission Test Setup (Above 1GHz)

SECTION 5

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ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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