Radio Testing of the
Quidel Corporation
Sofia Q Compact Reader Device

America

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

Quidel Corporation
10165 McKeller Court
San Diego, CA 92121
USA

COMMERCIAL-IN-CONFIDENCE

Date: January 2021
Document Number: 72164876C Issue 01 | Version Number: 01

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Authorized Signatory	James Morris	30 March 2021	

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 Quidel Corporation Model: Sofia Q (Compact Reader Device)
TEST REPORT NUMBER	72164876C
TEST REPORT DATE	January 2021
PREPARED FOR	Quidel Corporation 10165 McKeller Court San Diego, CA 92121 USA
CONTACT PERSON	Houman Yaghoubi Senior Bioengineer houman.yaghoubi@quidel.com (858) 302-0368
PREPARED BY	Ferdinand S. Custodio **Name** Authorized Signatory Title: Senior EMC Test Engineer/Wireless Team Lead
APPROVED BY	James Morris **Name** Authorized Signatory Title: Service Line Manager, EMC Central
DATED	30 March 2021

Revision History

72164876C Quidel Corporation Model: Sofia Q					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
30 March 2021	Initial Release				James Morris

CONTENTS

SECTION 1

1 REPORT SUMMARY

Radio Testing of the
Quidel Corporation
Sofia Q

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Quidel Corporation Sofia Q Compact Reader Device to the requirements of FCC Part 15 Subpart C §15.247 and IC RSS-247 Issue 2 February 2017.

Objective	To perform Radio Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Quidel Corporation
EUT	Compact Reader Device
Trade Name	Sofia Q
Model Name	Sofia Q
FCC ID	2AX9R-SNFSOFIAQ
FCC Classification	Low power Communications Device Transmitter (DTS)
Serial Number(s)	501700006
Number of Samples Tested	1
Test Specification/Issue/Date	• FCC Part 15 Subpart C §15.247 (October 1, 2020). • 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 1 March 2019).
Start of Test	January 06, 2020
Finish of Test	January 07, 2020
Name of Engineer(s)	Ferdinand S. Custodio
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	
2.2	§15.207(a)	RSS-Gen 8.8	Conducted Emissions	Compliant	
2.3	-	RSS-Gen 6.7	99% Emission Bandwidth	Compliant	
2.4	§15.247(a)(2)	RSS-247 5.2(a)	Minimum 6 dB RF Bandwidth	Compliant	
2.5	§15.247(d)	RSS-247 5.5	Out-of-Band Emissions – Conducted (Restricted Bands)	Compliant	§15.205
2.6	§15.247(d)	RSS-247 5.5	Out-of-Band Emissions - Conducted	Compliant	
2.7	§15.247(d)	RSS-247 5.5	Band-edge Compliance of RF Conducted Emissions	Compliant	§15.205 and §15.247(d)
2.8	§15.247(d)	RSS-247 5.5	Radiated Spurious Emissions	Compliant	
	-	RSS-Gen 7.3 and 7.4	Receiver Spurious Emissions	N/A	
2.9	§15.247(e)	RSS-247 5.2(b)	Power Spectral Density for Digitally Modulated Device	Compliant	

N/A Not required as per RSS-Gen 5.3 The EUT does not fall into any category defined as Receiver under RSS-Gen.

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) is a Quidel Corporation Sofia Q compact reader device, part of an immunodiagnostic analysis system. The EUT works with the Quidel Fluorescence Immunodiagnostic Assay (FIA) cassettes comprising small disposable devices (FIA Cassettes) for running individual tests. The EUT and the software residing in a smart phone (Sofia Q App) provides test interpretation autonomously. In addition, the data and results are uploaded to a dedicated database.
The EUT is designed to work with all Sofia-compatible FIA cassettes produced by Quidel and can in principle be used with any assay developed on them. The EUT is cylindrical in shape, 2.3 inch (58.4 mm) in diameter and 3.2 inch (81.3 mm) in height. It features a cassette receiving slot on the front that allows for Quidel FIA cassettes to be inserted, leaving the cassette barcode exposed. A mini-USB connector on the back provides power. The BLE function the EUT was verified in this test report.

1.3.2 EUT General Description

EUT Description	Compact Reader Device
Trade Name	Sofia Q
Model Name	Sofia Q
Rated Voltage	5.0 VDC via USB
Mode Verified	BT LE 5.0 2Mbps
Capability	BT LE 5.0
SW (App) Version	1.0.49
FW Version	1.1.4
HW Version	1.1.4
Primary Unit (EUT)	☐ Production
	☒ Pre-Production
	☐ Engineering
Manufacturer Declared Temperature Range	15°C to 30°C
Antenna Type	SMT mini antenna
Manufacturer	Johanson Technology
Antenna Model	P/N 2450AT18B100
Maximum Antenna Gain	-0.5 dBi

1.3.3 Maximum Conducted Output Power

Bluetooth Low Energy (LE)	Frequency Range (MHz)	Gated RMS (dBm)	Duty Cycle (%)
	2402-2480	-9.8	100%

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
Default	Antenna Conducted Port Configuration. A temporary antenna connector was provided for the evaluation. The EUT is connected to a support laptop via a UART Serial USB cable. The support laptop is running PuTTY version 0.74 which enables configuration of the BLE 5.0 RF module. The manufacturer was present during evaluation and was responsible for programming the EUT as per requirement for each test.

1.4.2 EUT Exercise Software

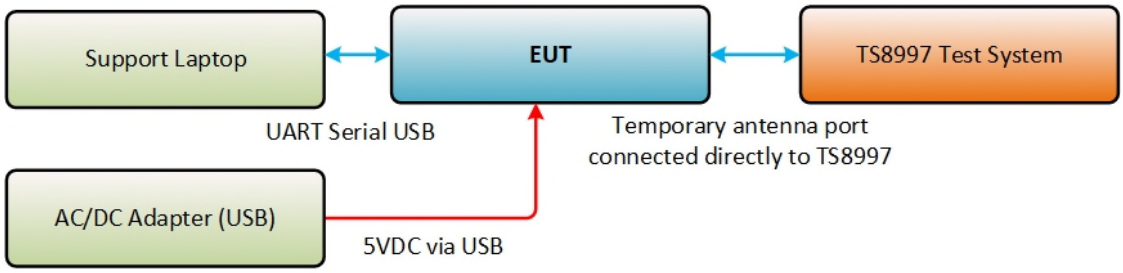
"PuTTY version 0.74" on the support laptop to program the BLE function of the EUT having Software Version 1.4.

1.4.3 Support Equipment and I/O cables

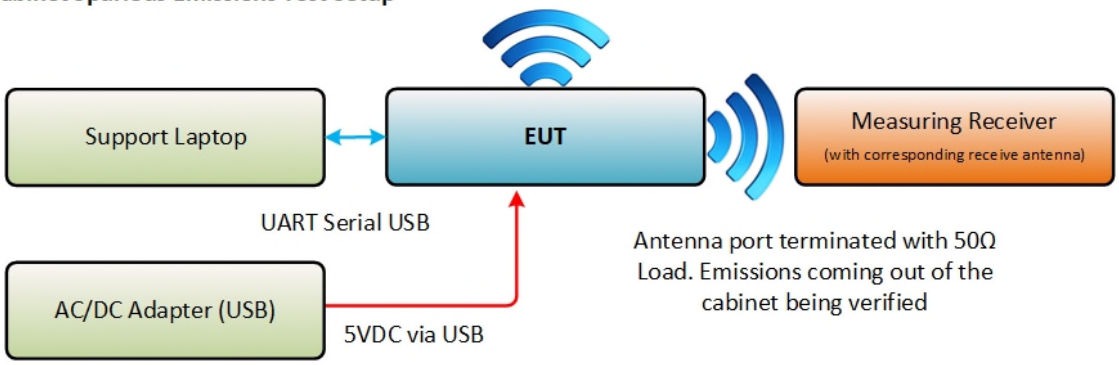
Manufacturer	Equipment/Cable	Description
Lenovo	Support Laptop	Model: Thinkpad T530 Type 2392-45U S/N R9-RM96L
CUI Inc	Support Medical AC Adapter for EUT	Model: SWM6-5-NH-U S/N 196201096 P/N SWM6-5-NH-138
-	USB Cable Leader	P/N 336-45003 (336-USB A Male to Micro B Male
FTDI	TTL to USB Serial Converter Generic Cable	180cm P/N TTL-232RG-VREG1V8-WE

1.4.4 Simplified Test Configuration Diagram

Antenna Port Conducted Test Setup



Cabinet Spurious Emissions Test Setup



1.4.5 Worst Case Configuration (Cabinet Spurious Emissions)

Mid 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 5.0	39 (High Channel)	2Mbps (declared worst case by the manufacturer. 1Mbps not available at the time of testing)

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

2 TEST DETAILS

Radio Testing of the
Quidel Corporation
Sofia Q

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: 501700006 / Default Test Configuration

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

January 06, 2021 / 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	23.3°C
Relative Humidity	38.7%
ATM Pressure	99.9kPa

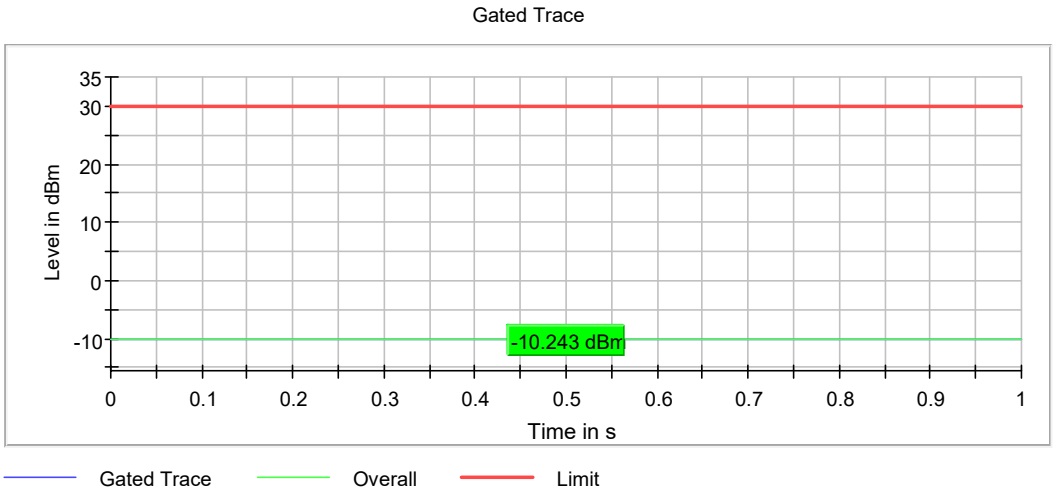
2.1.7 Additional Observations

- 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 was not considered.

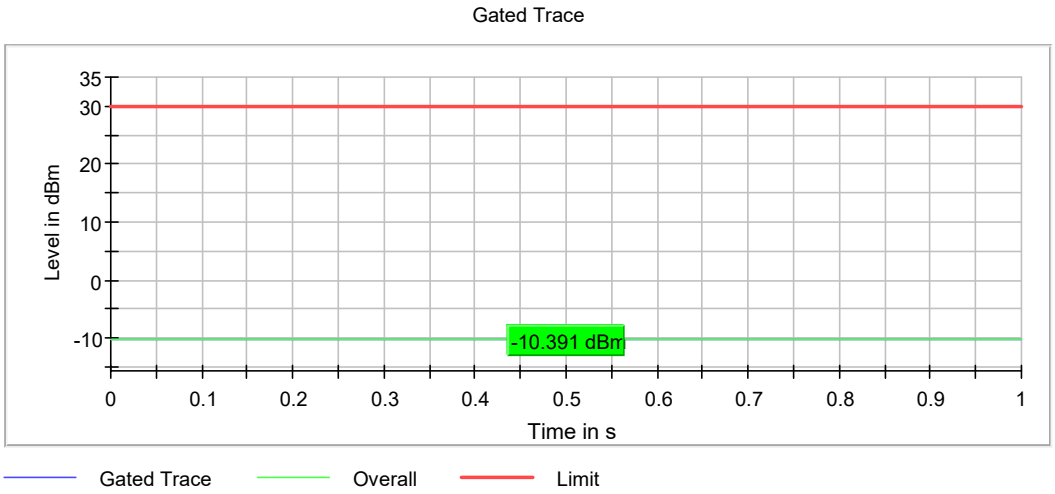
2.1.8 Test Results

DUT Frequency (MHz)	PHY setting	Gated RMS (dBm)	Limit Max (dBm)	Gated EIRP (dBm)	DutyCycle (%)	Result
2402.000000	1M					
	2M	-10.1	30.0	-10.15	100.00	PASS
2440.000000	1M					
	2M	-10.4	30.0	-10.45	100.00	PASS
2480.000000	1M					
	2M	-9.8	30.0	-10.3	100.00	PASS

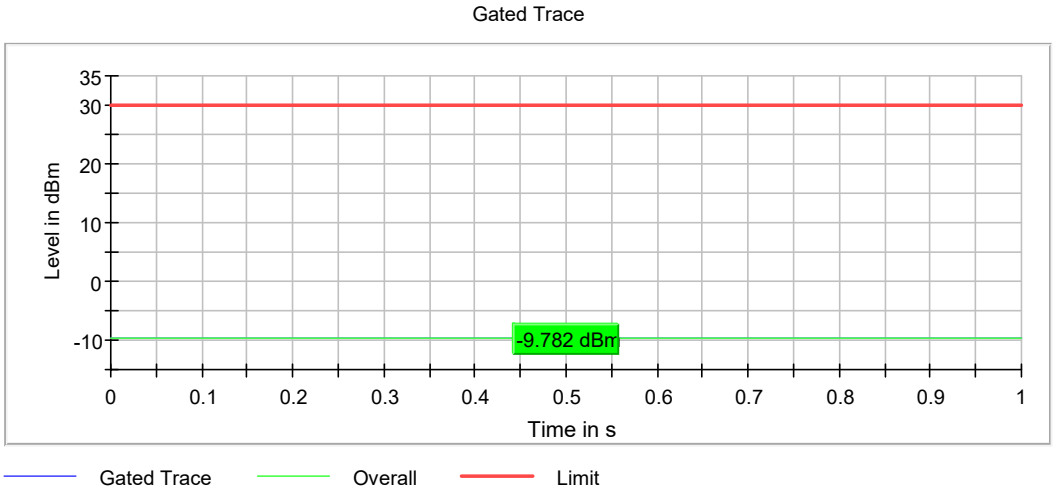
2.1.9 Test Plots



Bluetooth LE. Low Channel 2Mbps



Bluetooth LE. Mid Channel 2Mbps



Bluetooth LE. High Channel 2Mbps

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 CONDUCTED EMISSIONS

2.2.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.207(a)
RSS-GEN, Clause 8.8

2.2.2 Standard Applicable

An intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN).

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.*

2.2.3 Equipment Under Test and Modification State

Serial No: 501700006 / Default Test Configuration

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

January 07, 2021 / 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/ Test Location

Test performed at TÜV SÜD America Inc. Mira Mesa facility

Ambient Temperature	25.8 °C
Relative Humidity	44.8 %
ATM Pressure	100.5 kPa

2.2.7 Additional Observations

- FCC 47 CFR Part 15.207 and Part 15.107 Class B limits are identical.
- EUT configured per section 1.4.5 of this test report.

- 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 2.2.8 for sample computation.

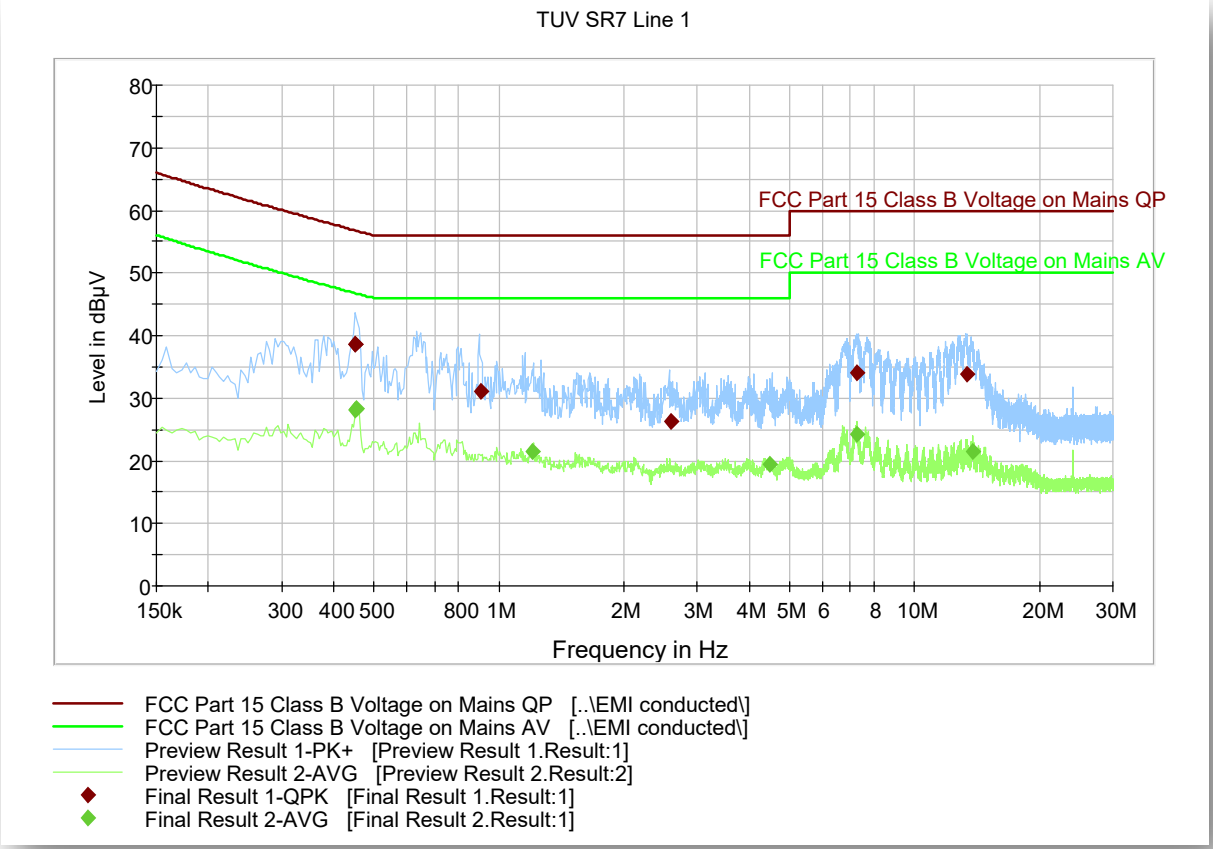
2.2.8 Sample Computation (Conducted Emission – Quasi Peak)

Measuring equipment raw measurement (dbµV) @ 150kHz			5.5
Correction Factor (dB)	Asset# 8607 (20 dB attenuator)	19.9	20.7
	Asset# 1177 (cable)	0.15	
	Asset# 1176 (cable)	0.35	
	Asset# 7568 (LISN)	0.30	
Reported QuasiPeak Final Measurement (dbµV) @ 150kHz			**26.2**

2.2.9 Test Results

Compliant. See attached plots and tables.

2.2.10 FCC Part 15.207 (120V-60Hz) Line 1



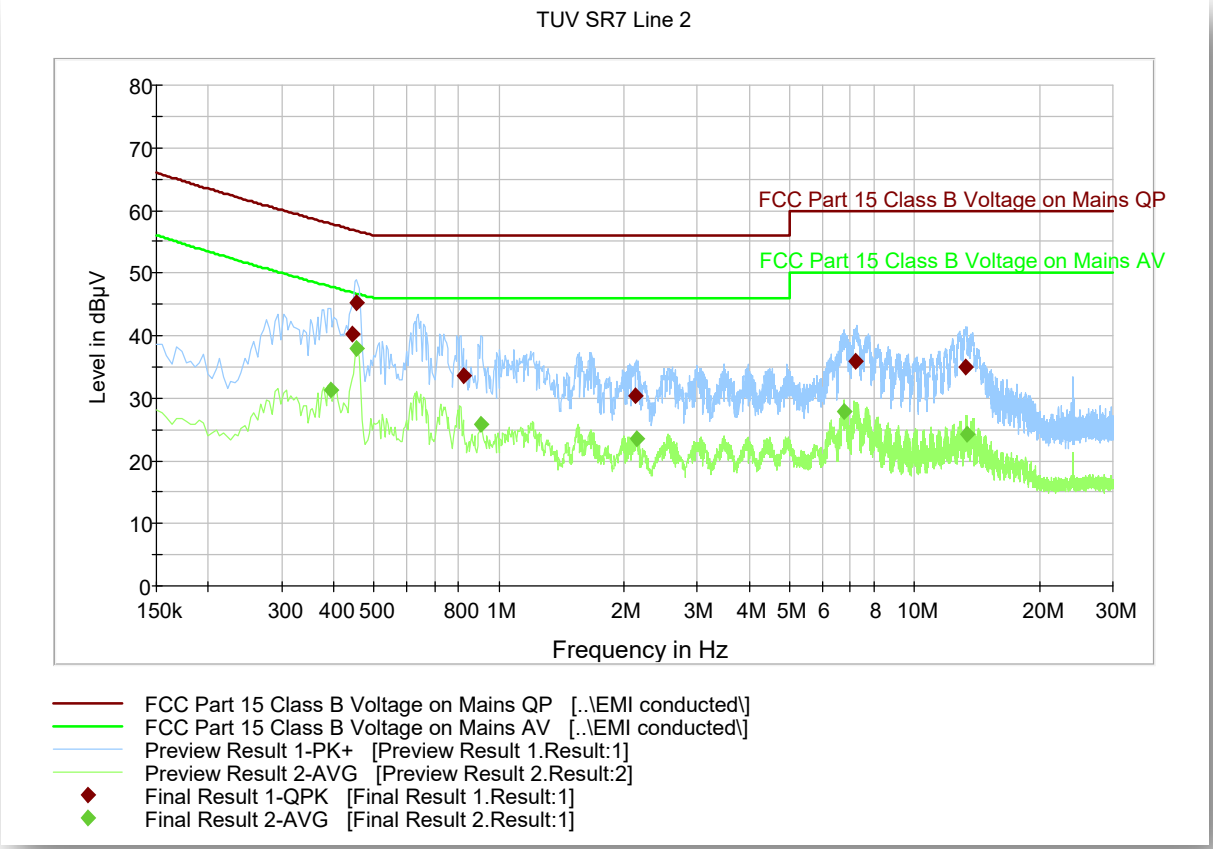
Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.451500	38.6	1000.0	9.000	Off	L1	19.7	18.2	56.8
0.451500	38.7	1000.0	9.000	Off	L1	19.7	18.1	56.8
0.906000	31.0	1000.0	9.000	Off	L1	19.8	25.0	56.0
2.593500	26.2	1000.0	9.000	Off	L1	20.0	29.8	56.0
7.242000	34.2	1000.0	9.000	Off	L1	20.1	25.8	60.0
13.366500	33.8	1000.0	9.000	Off	L1	20.2	26.2	60.0

Average Data

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.451500	28.0	1000.0	9.000	Off	L1	19.7	18.7	46.8
0.456000	28.4	1000.0	9.000	Off	L1	19.7	18.3	46.7
1.207500	21.5	1000.0	9.000	Off	L1	19.9	24.5	46.0
4.470000	19.5	1000.0	9.000	Off	L1	20.1	26.5	46.0
7.255500	24.3	1000.0	9.000	Off	L1	20.1	25.7	50.0
13.830000	21.6	1000.0	9.000	Off	L1	20.2	28.4	50.0

2.2.11 FCC Part 15.207 (120V-60Hz) Line 2



Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.442500	40.2	1000.0	9.000	Off	N	19.7	16.7	56.9
0.456000	45.3	1000.0	9.000	Off	N	19.7	11.4	56.7
0.820500	33.6	1000.0	9.000	Off	N	19.8	22.4	56.0
2.134500	30.5	1000.0	9.000	Off	N	19.9	25.5	56.0
7.210500	35.8	1000.0	9.000	Off	N	20.1	24.2	60.0
13.276500	35.0	1000.0	9.000	Off	N	20.2	25.0	60.0

Average Data

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.393000	31.3	1000.0	9.000	Off	N	19.8	16.5	47.8
0.456000	37.9	1000.0	9.000	Off	N	19.7	8.8	46.7
0.906000	25.9	1000.0	9.000	Off	N	19.8	20.1	46.0
2.148000	23.5	1000.0	9.000	Off	N	19.9	22.5	46.0
6.756000	27.9	1000.0	9.000	Off	N	20.1	22.1	50.0
13.380000	24.3	1000.0	9.000	Off	N	20.2	25.7	50.0

2.3 99% EMISSION BANDWIDTH

2.3.1 Specification Reference

RSS-Gen Clause 6.7

2.3.2 Standard Applicable

The emission bandwidth (x dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated x dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth.
When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.
- The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3x RBW.

Note: Video averaging is not permitted.
A peak, or peak hold, may be used in place of the sampling detector as this may produce a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold may be necessary to determine the occupied bandwidth if the device is not transmitting continuously.
The trace data points are recovered and are directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded.
The difference between the two recorded frequencies is the 99% occupied bandwidth.

2.3.3 Equipment Under Test and Modification State

Serial No: 501700006 / Default Test Configuration

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

January 06, 2021 / 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	23.3°C
Relative Humidity	38.7%
ATM Pressure	99.9kPa

2.3.7 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 Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v05 and ANSI C63.10-2013 11.8.1.

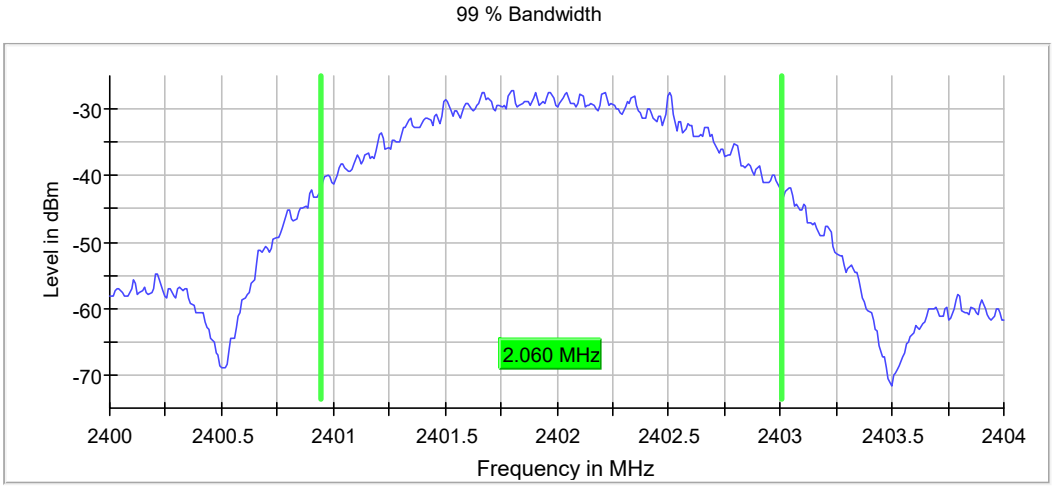
2.3.8 Sample Measurement Settings

Setting	Instrument Value	Target Value
Span	4.000 MHz	4.000 MHz
RBW	20.000 kHz	>= 20.000 kHz
VBW	100.000 kHz	>= 60.000 kHz
SweepPoints	400	~ 400
Sweeptime	94.824 µs	AUTO
Reference Level	-20.000 dBm	-20.000 dBm
Attenuation	0.000 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	0.30 dB	0.30 dB
Run	11 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.15 dB	0.30 dB

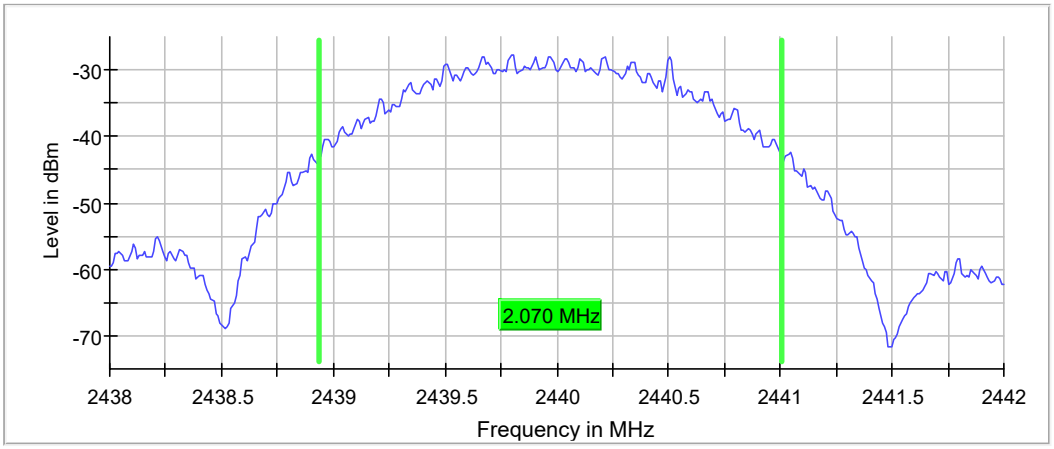
2.3.9 Test Results

DUT Frequency (MHz)	PHY setting	Bandwidth (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Result
2402.000000	1M				
	2M	2.060000	2400.945000	2403.005000	PASS
2440.000000	1M				
	2M	2.070000	2438.935000	2441.005000	PASS
2480.000000	1M				
	2M	2.070000	2478.935000	2481.005000	PASS

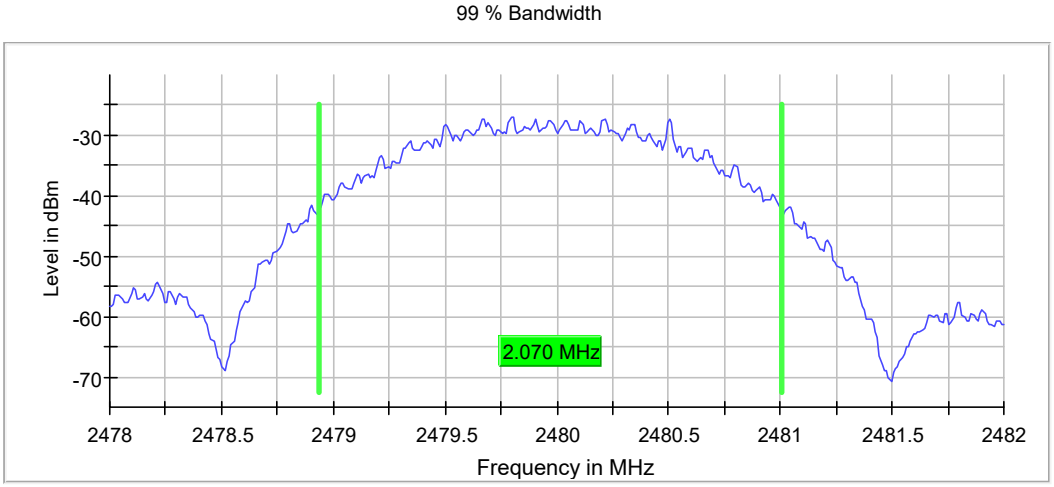
2.3.10 Test Plots



Bluetooth LE Low Channel



Bluetooth LE Mid Channel



Bluetooth LE High Channel

2.4 MINIMUM 6 dB RF BANDWIDTH

2.4.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.247(a)(2)
RSS-247, Clause 5.2 (a)

2.4.2 Standard Applicable

(2) Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

2.4.3 Equipment Under Test and Modification State

Serial No: 501700006 / Default Test Configuration

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

January 06, 2021 / FSC

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	23.3°C
Relative Humidity	38.7%
ATM Pressure	99.9kPa

2.4.7 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(a), KDB 558074 D01 DTS Meas Guidance v05 and ANSI C63.10-2013 11.8.1.

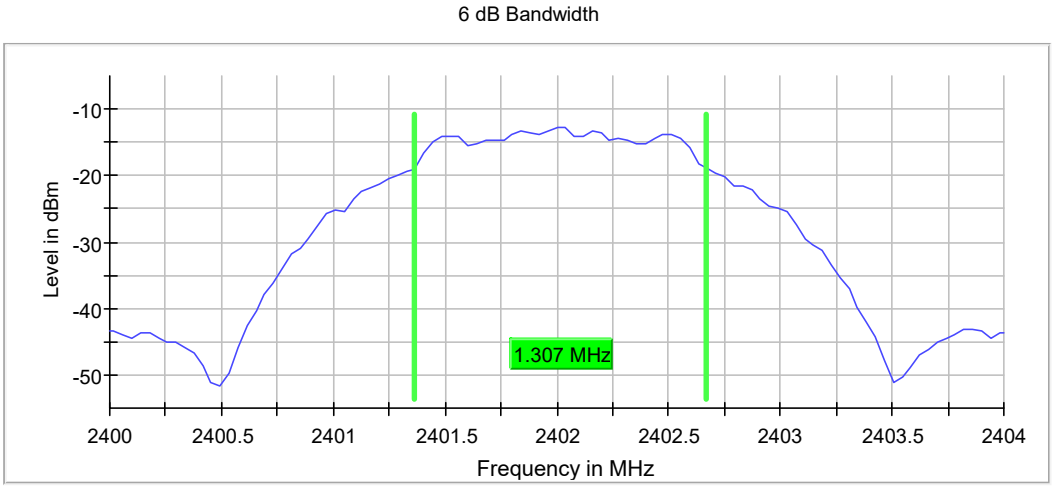
2.4.8 Sample Measurement Settings (1M PHY)

Setting	Instrument Value	Target Value
Span	4.000 MHz	4.000 MHz
RBW	100.000 kHz	~ 100.000 kHz
VBW	300.000 kHz	~ 300.000 kHz
SweepPoints	101	~ 80
Sweeptime	18.938 µs	AUTO
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	10.000 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	8 / max. 150	max. 150
Stable	5 / 5	5
Max Stable Difference	0.00 dB	0.50 dB

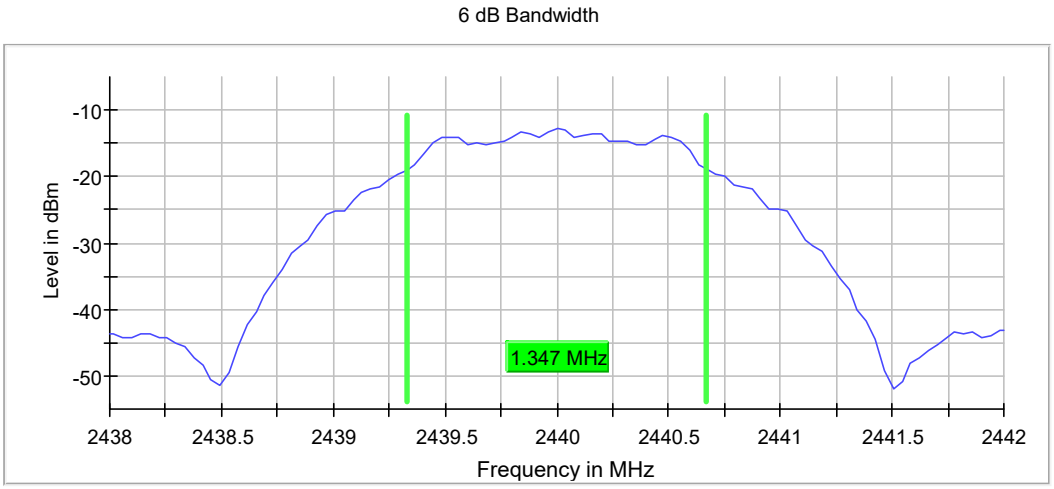
2.4.9 Test Results

DUT Frequency (MHz)	PHY setting	Bandwidth (MHz)	Limit Min (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Result
2402.000000	1M					
	2M	1.306930	0.500000	2401.366337	2402.673267	PASS
2440.000000	1M					
	2M	1.346534	0.500000	2439.326733	2440.673267	PASS
2480.000000	1M					
	2M	1.346534	0.500000	2479.326733	2480.673267	PASS

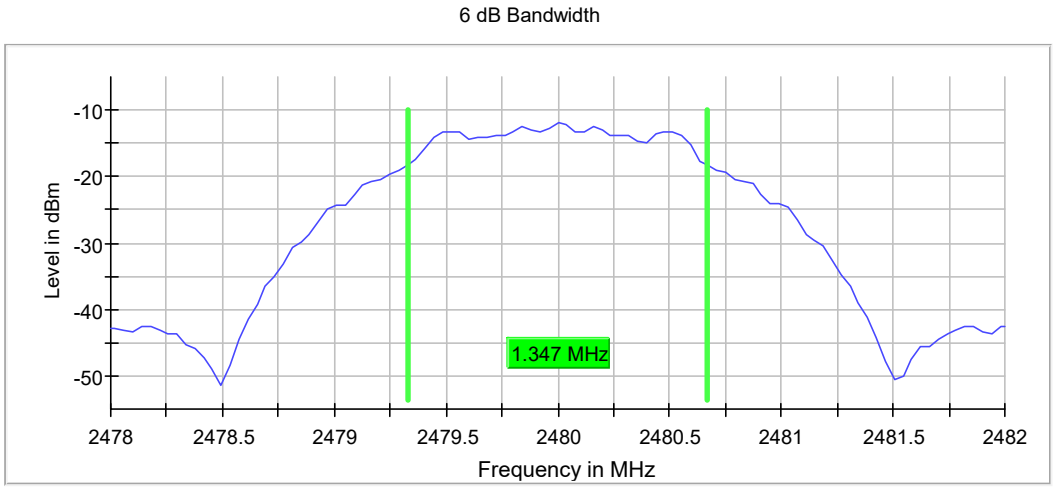
2.4.10 Test Plots



Bluetooth LE Low Channel



Bluetooth LE Mid Channel



Bluetooth LE High Channel

2.5 OUT-OF-BAND EMISSIONS – CONDUCTED (RESTRICTED BANDS)

2.5.1 Specification Reference

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

2.5.2 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)).

2.5.3 Equipment Under Test and Modification State

Serial No: 501700006 / Default Test Configuration

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

January 06, 2021 / FSC

2.5.5 Test Equipment Used

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

2.5.6 Environmental Conditions (Rancho Bernardo Satellite Facility)

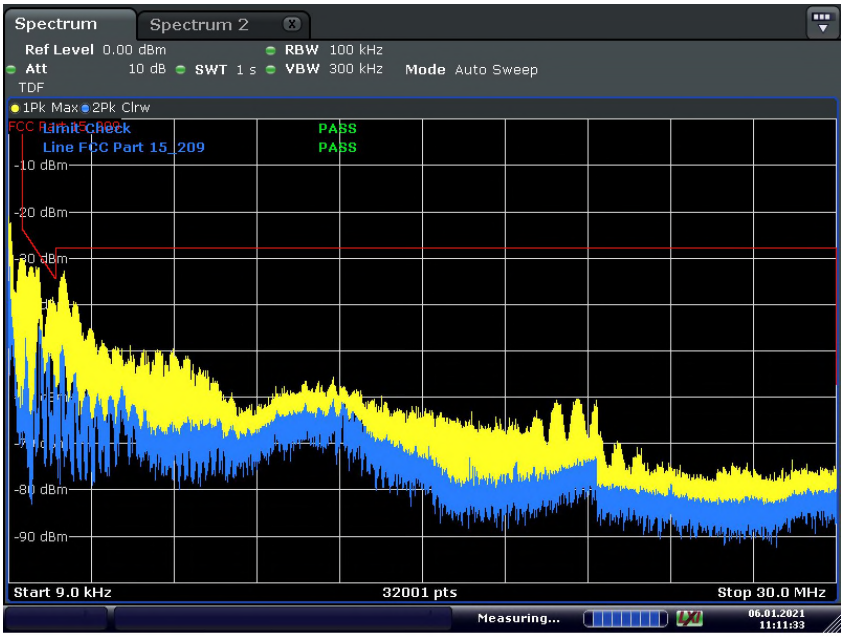
Ambient Temperature	23.3°C
Relative Humidity	38.7%
ATM Pressure	99.9kPa

2.5.7 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 5.05 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.
- Limit used is from §15.209 limits converted to power (dBm).
- Sample calculation of the limit:

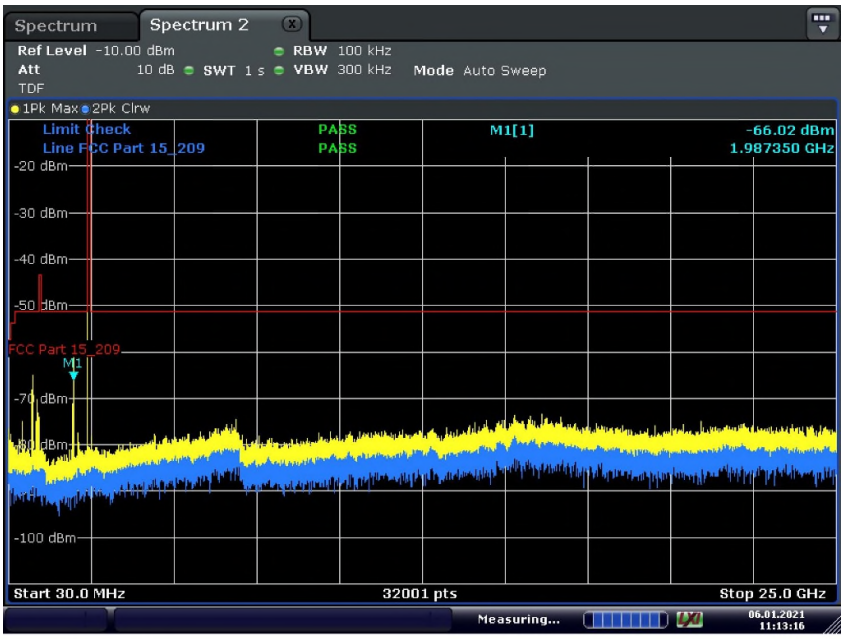
§15.209 limit at 2GHz = 500µV @ 3 meters
= 53.97dBµV @ 3 meters
= -41.26 dBm (solving for EIRP using formula from Clause 12.7.2(d) of ANSI C63.10-2013
= **-51.26 dBm** (with RBW correction factor from 1MHz to 100kHz)

2.5.8 Test Results Plots



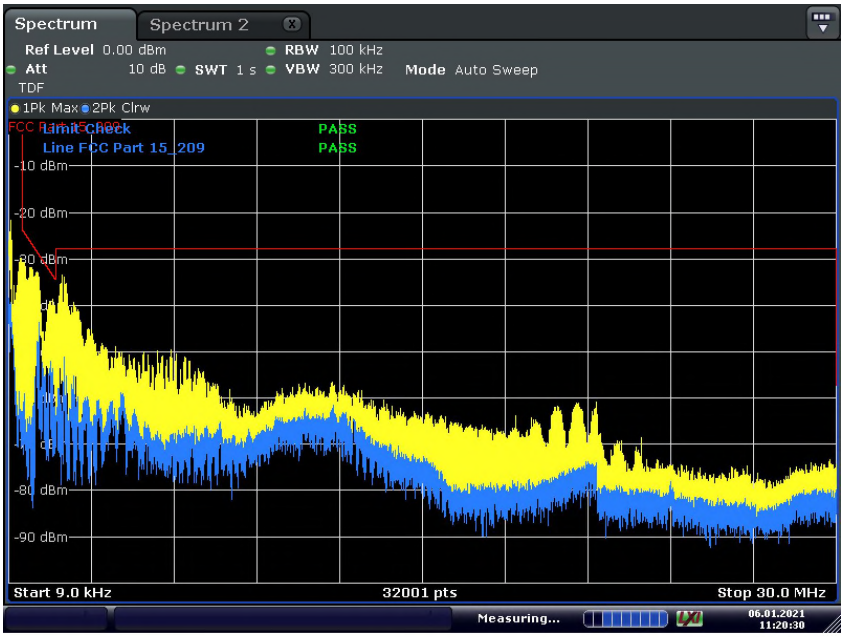
Date: 6.JAN.2021 11:11:33

BLE Low Channel (9kHz to 30MHz)



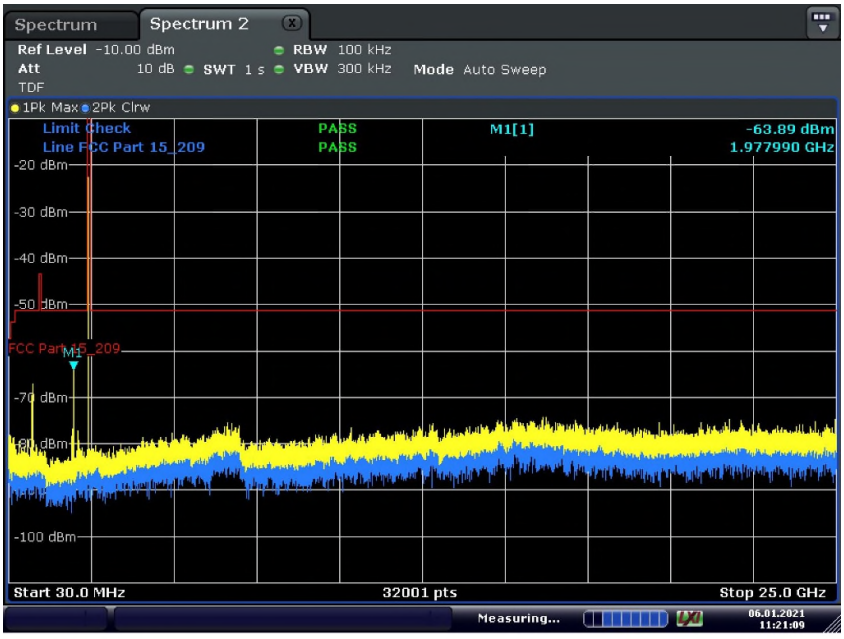
Date: 6.JAN.2021 11:13:16

BLE Low Channel (30MHz to 25GHz)



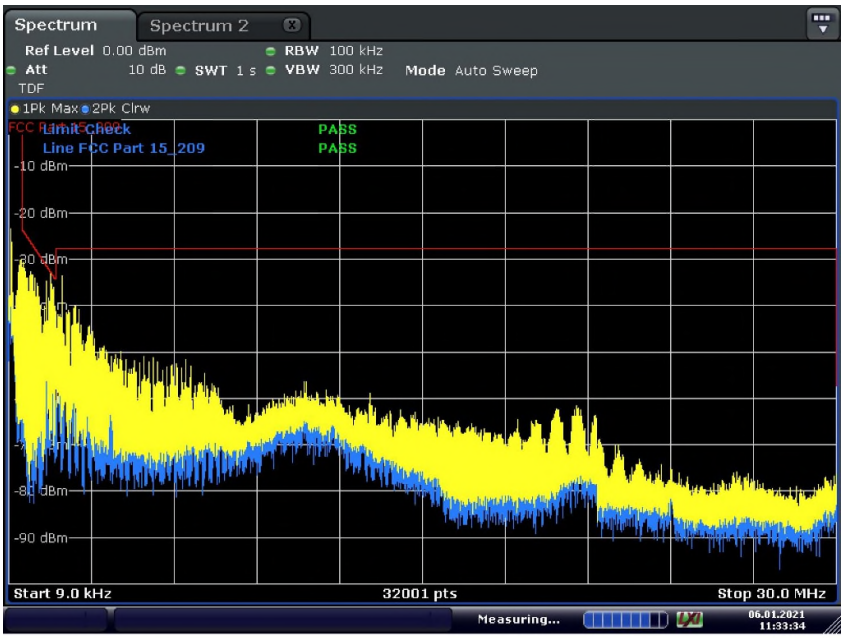
Date: 6.JAN.2021 11:20:30

BLE Mid Channel (9kHz to 30MHz)



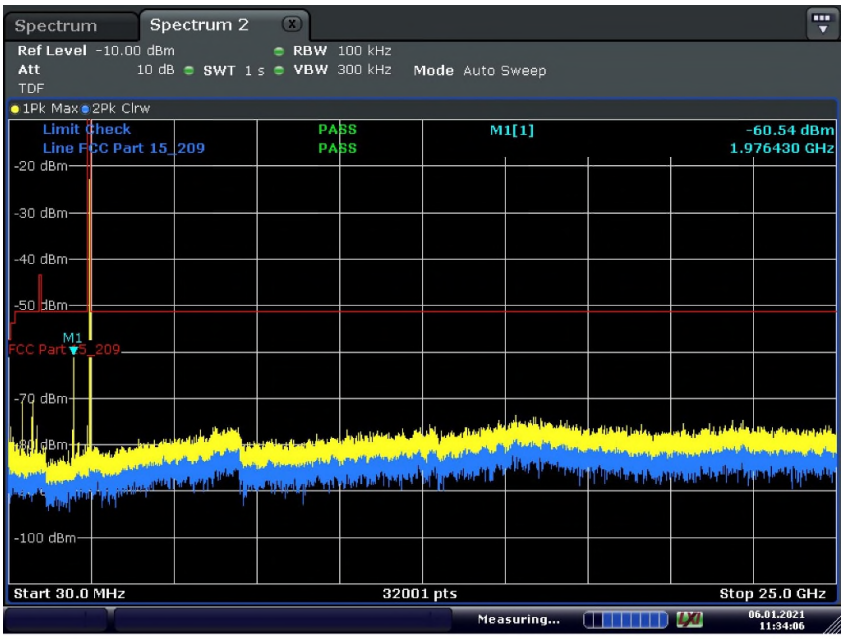
Date: 6.JAN.2021 11:21:10

BLE Mid Channel (30MHz to 25GHz)



Date: 6.JAN.2021 11:33:34

BLE High Channel (9kHz to 30MHz)



Date: 6.JAN.2021 11:34:06

BLE High Channel (30MHz to 25GHz)

2.6 BAND-EDGE COMPLIANCE OF RF CONDUCTED EMISSIONS

2.6.1 Specification Reference

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

2.6.2 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)).

2.6.3 Equipment Under Test and Modification State

Serial No: 501700006 / Default Test Configuration

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

January 06, 2021 / FSC

2.6.5 Test Equipment Used

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

2.6.6 Environmental Conditions (Rancho Bernardo Satellite Facility)

Ambient Temperature	23.3°C
Relative Humidity	38.7%
ATM Pressure	99.9kPa

2.6.7 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.

2.6.8 Sample Measurement Settings

Measurement 1		
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	-10.000 dBm	-10.000 dBm
Attenuation	10.000 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	9 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.03 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	-10.000 dBm	-10.000 dBm
Attenuation	10.000 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	0.18 dB	0.50 dB

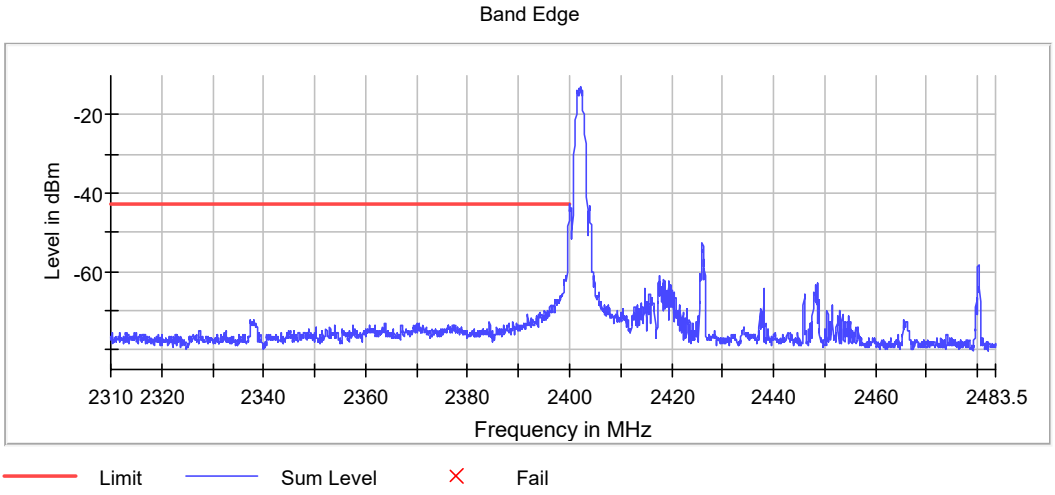
2.6.9 Test Results (Lower Band Edge)

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.975000	-42.7	0.1	-42.6	PASS
2399.925000	-45.4	2.8	-42.6	PASS
2399.875000	-46.4	3.8	-42.6	PASS
2399.825000	-47.1	4.5	-42.6	PASS
2399.775000	-48.5	5.9	-42.6	PASS
2399.725000	-50.9	8.3	-42.6	PASS
2399.675000	-53.3	10.7	-42.6	PASS
2399.625000	-55.8	13.2	-42.6	PASS
2399.575000	-56.1	13.4	-42.6	PASS
2399.525000	-58.9	16.3	-42.6	PASS
2399.475000	-60.4	17.8	-42.6	PASS
2399.225000	-61.1	18.5	-42.6	PASS
2399.175000	-61.3	18.6	-42.6	PASS
2399.275000	-61.6	19.0	-42.6	PASS
2399.325000	-61.7	19.0	-42.6	PASS

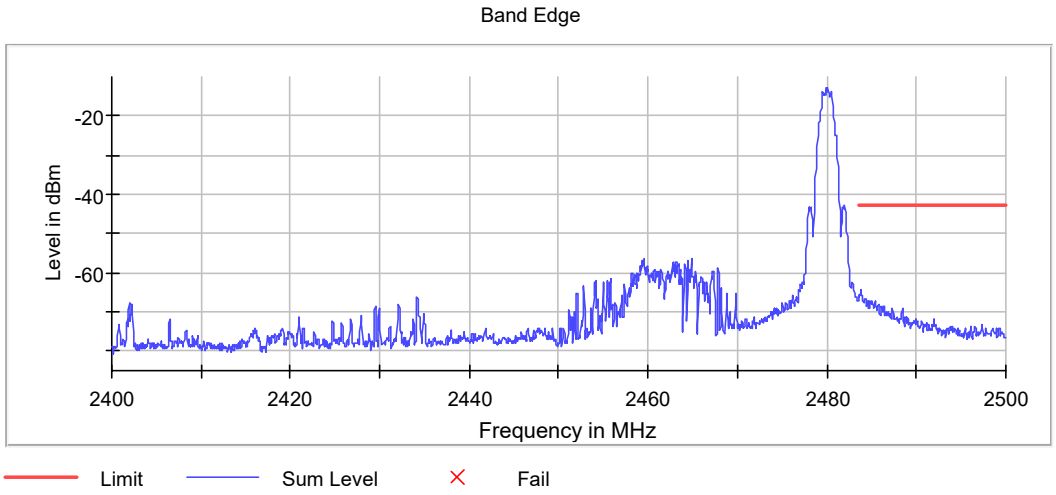
2.6.10 Test Results (Upper Band Edge)

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2483.775000	-64.6	21.9	-42.7	PASS
2483.825000	-65.1	22.4	-42.7	PASS
2483.725000	-65.4	22.7	-42.7	PASS
2483.875000	-65.8	23.1	-42.7	PASS
2483.925000	-65.8	23.1	-42.7	PASS
2483.675000	-65.9	23.2	-42.7	PASS
2483.525000	-66.0	23.3	-42.7	PASS
2483.625000	-66.2	23.5	-42.7	PASS
2483.575000	-66.5	23.8	-42.7	PASS
2484.225000	-66.7	24.0	-42.7	PASS
2484.325000	-66.7	24.1	-42.7	PASS
2484.275000	-66.8	24.1	-42.7	PASS
2484.075000	-67.1	24.4	-42.7	PASS
2485.025000	-67.1	24.4	-42.7	PASS
2484.025000	-67.2	24.6	-42.7	PASS

2.6.11 Test Plots



Bluetooth LE Low Band Edge 2400MHz



Bluetooth LE Upper Band Edge 2400MHz

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

- 2483.525 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
= (-66.0 dBm + (-0.5 dBi antenna gain) + 95.2
= 28.7dBµV/m @ 3 meters (Peak complies with 54 dBµV/m Average limit)

2.7 OUT-OF-BAND EMISSIONS - CONDUCTED

2.7.1 Specification Reference

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

2.7.2 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)).

2.7.3 Equipment Under Test and Modification State

Serial No: 501700006 / Default Test Configuration

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

January 06, 2021 / FSC

2.7.5 Test Equipment Used

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

2.7.6 Environmental Conditions (Rancho Bernardo Satellite Facility)

Ambient Temperature	23.3°C
Relative Humidity	38.7%
ATM Pressure	99.9kPa

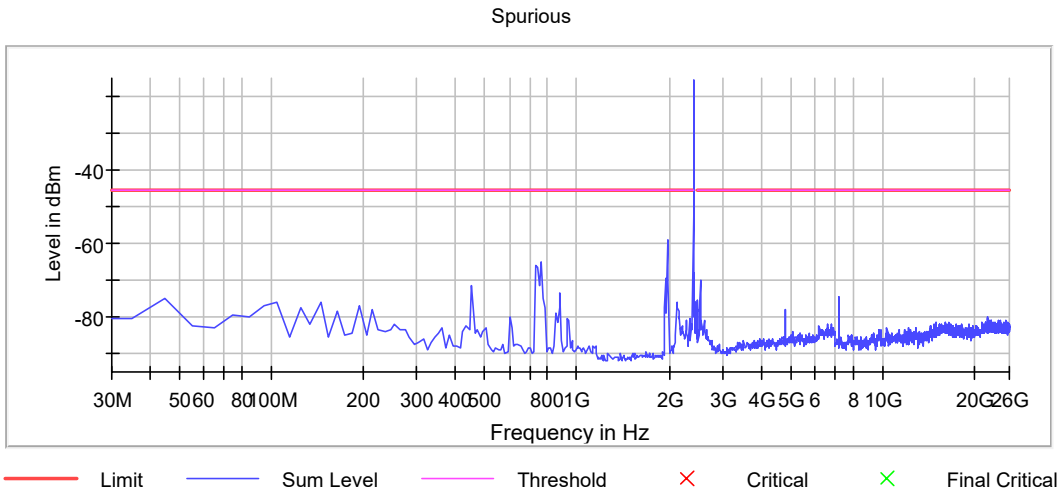
2.7.7 Additional Observations

- 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 Test according to 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.
- EUT complies on all three channels verified. Observed margin from the limit is >20dB.

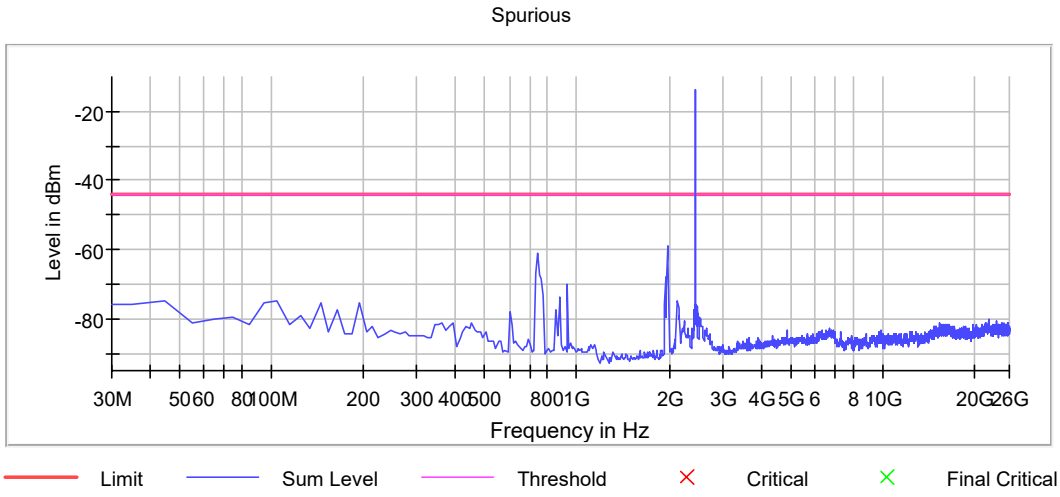
2.7.8 Pre Measurement Settings

Setting	Instrument Value	Target Value
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	238	~ 238
Sweeptime	23.700 ms	AUTO
Reference Level	-20.000 dBm	-30.000 dBm
Attenuation	10.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	3	3
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	7 / max. 40	max. 40
Stable	3 / 3	3
Max Stable Difference	0.00 dB	0.50 dB

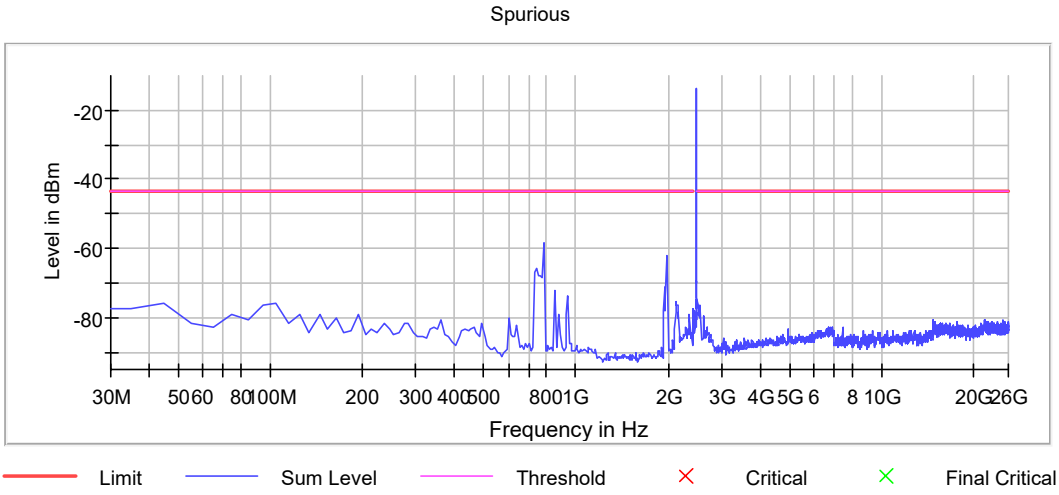
2.7.9 Test Results Plots



Bluetooth LE Low Channel



Bluetooth LE Mid Channel



Bluetooth LE High Channel

2.8 RADIATED SPURIOUS EMISSIONS

2.8.1 Specification Reference

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

2.8.2 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)).

2.8.3 Equipment Under Test and Modification State

Serial No: 501700006 / Default Test Configuration

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

January 07, 2021 / FSC

2.8.5 Test Equipment Used

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

2.8.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Mira Mesa facility

Ambient Temperature	25.8 °C
Relative Humidity	44.8 %
ATM Pressure	100.5 kPa

2.8.7 Additional Observations

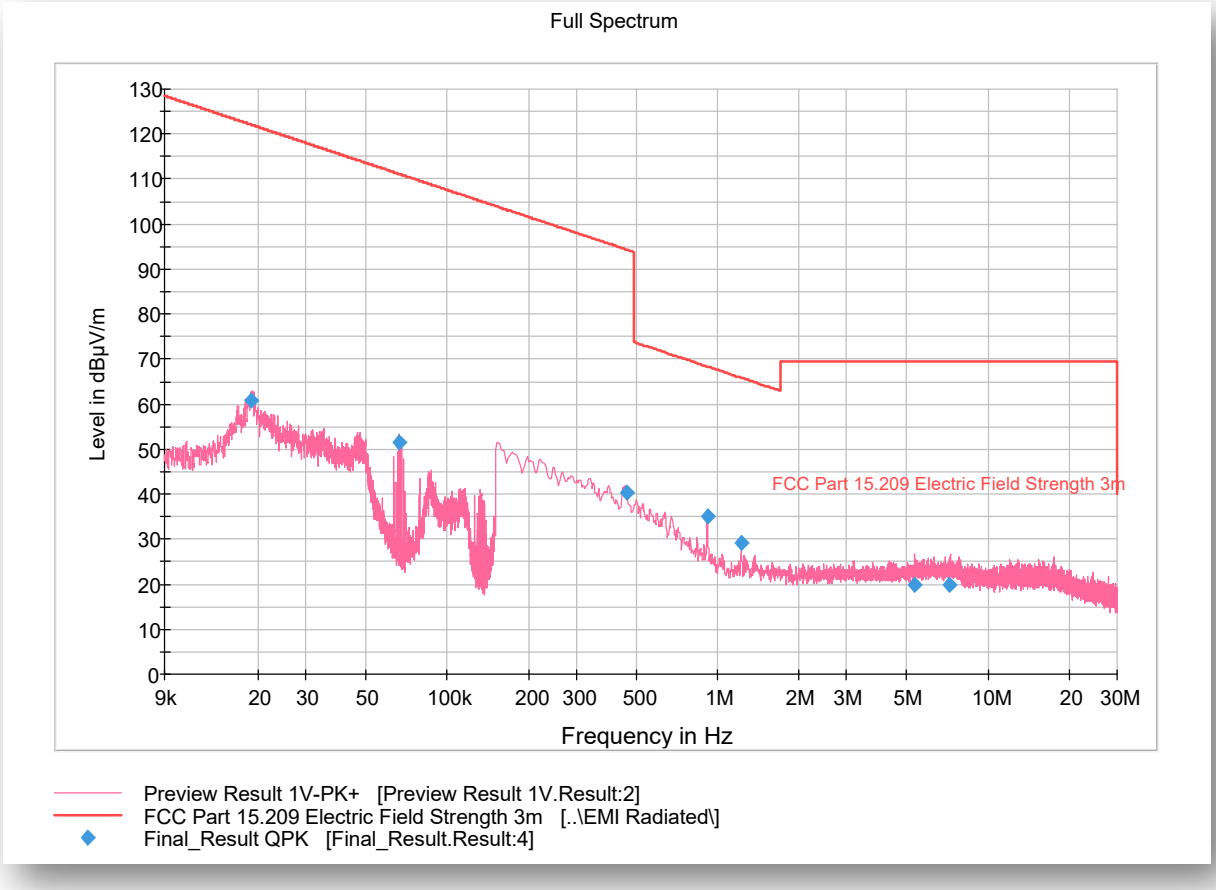
- This is a radiated test. The spectrum was searched from 30MHz to the 10th harmonic.
- There are no emissions found that do not comply to the restricted bands defined in FCC Part 15 Subpart C, 15.205 or Part 15.247(d).
- Only the worst case BLE (High Channel) presented. There are no significant differences in emissions between all channels.
- Antenna port terminated with 50 Ω load. Emissions coming out of the cabinet being verified

- 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 2.8.8 for sample computation.

2.8.8 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**

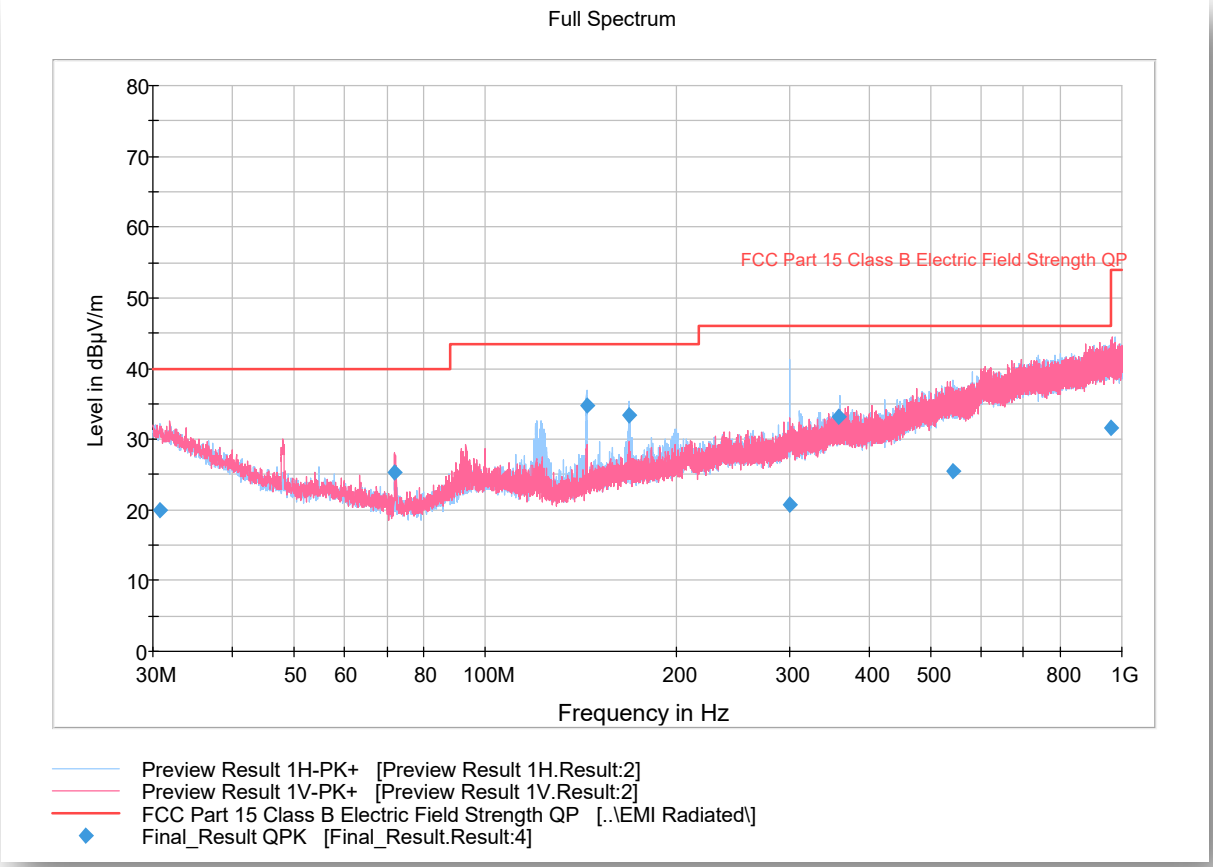
2.8.9 Test Results for 9kHz to 30MHz



Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)
0.018873	60.88	122.08	61.20	1000.0	0.200	H	138.0	15
0.066516	51.58	111.14	59.56	1000.0	0.200	H	16.0	14
0.459745	40.46	94.35	53.89	1000.0	9.000	H	80.0	14
0.916584	34.94	68.36	33.42	1000.0	9.000	H	73.0	14
1.225477	29.27	65.83	36.56	1000.0	9.000	H	154.0	14
5.315455	19.88	69.50	49.62	1000.0	9.000	H	38.0	14
7.193303	19.99	69.50	49.51	1000.0	9.000	H	168.0	15

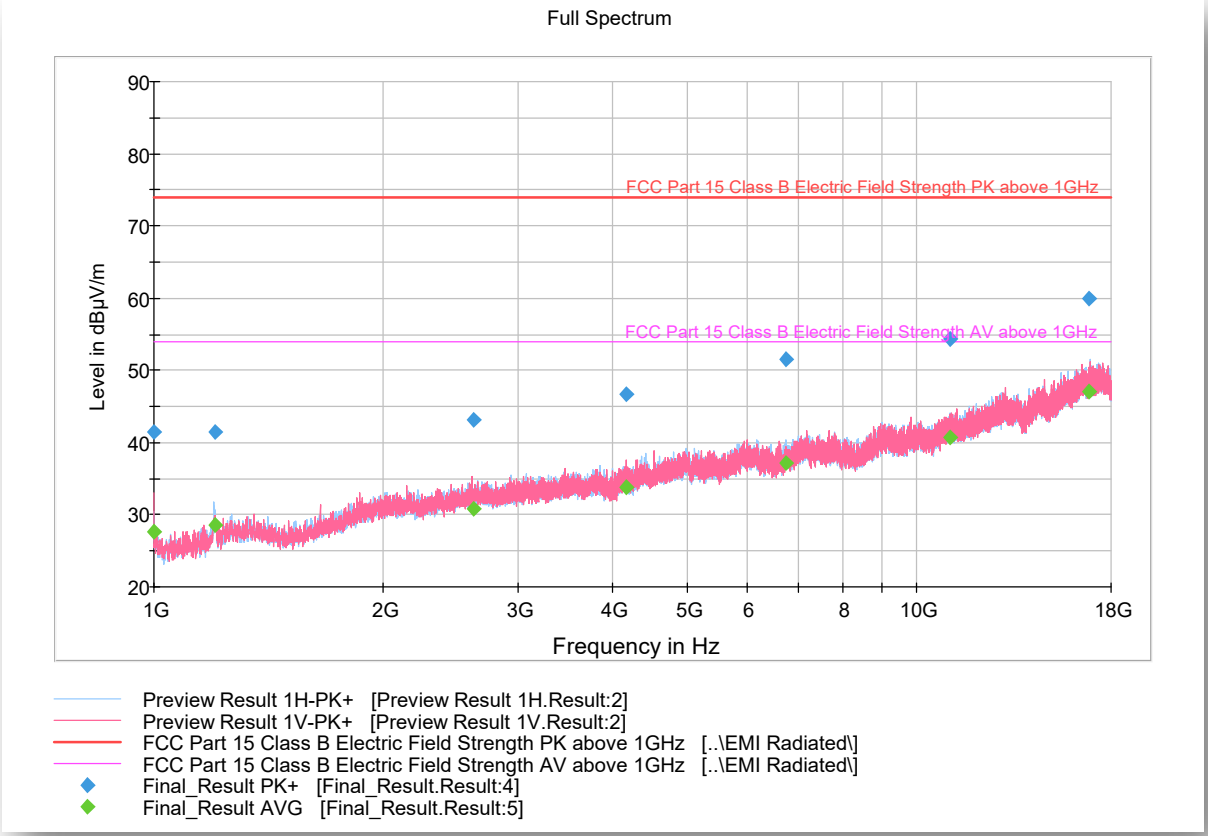
2.8.10 Test Results for 30MHz to 1GHz



Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
30.820000	19.93	40.00	20.07	1000.	120.000	398.0	V	249.0	22
71.993333	25.34	40.00	14.66	1000.	120.000	225.0	V	326.0	12
144.11966	34.79	43.50	8.71	1000.	120.000	191.0	H	165.0	15
168.03266	33.30	43.50	10.20	1000.	120.000	203.0	H	161.0	17
300.38333	20.69	46.00	25.31	1000.	120.000	125.0	H	268.0	21
359.37266	33.17	46.00	12.83	1000.	120.000	100.0	H	355.0	23
543.32733	25.50	46.00	20.50	1000.	120.000	397.0	H	357.0	26
959.24400	31.60	46.00	14.40	1000.	120.000	112.0	V	116.0	31

2.8.11 Test Results for 1GHz to 18GHz



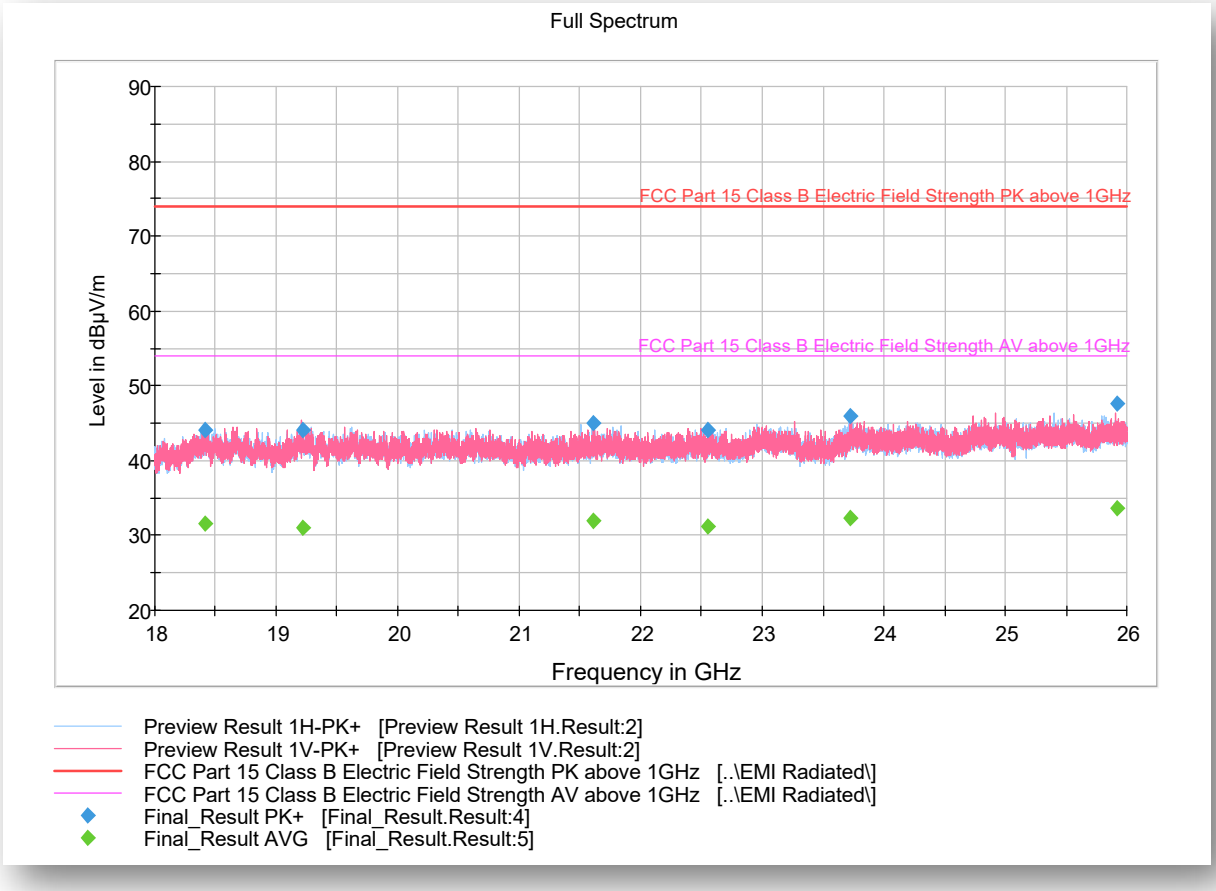
Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1000.00000	41.52	73.90	32.38	1000.0	1000.000	234.0	V	37.0	-6
1201.66666	41.46	73.90	32.44	1000.0	1000.000	226.0	H	250.0	-2
2622.23333	43.15	73.90	30.75	1000.0	1000.000	317.0	V	264.0	2
4156.40000	46.69	73.90	27.21	1000.0	1000.000	125.0	V	6.0	5
6738.13333	51.48	73.90	22.42	1000.0	1000.000	321.0	H	80.0	6
11058.1000	54.31	73.90	19.59	1000.0	1000.000	135.0	H	33.0	14
16856.3333	60.00	73.90	13.90	1000.0	1000.000	175.0	H	14.0	18

Average Data

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1000.00000	27.72	53.90	26.18	1000.0	1000.000	234.0	V	37.0	-6
1201.66666	28.57	53.90	25.33	1000.0	1000.000	226.0	H	250.0	-2
2622.23333	30.79	53.90	23.11	1000.0	1000.000	317.0	V	264.0	2
4156.40000	33.88	53.90	20.02	1000.0	1000.000	125.0	V	6.0	5
6738.13333	37.22	53.90	16.68	1000.0	1000.000	321.0	H	80.0	6
11058.1000	40.73	53.90	13.17	1000.0	1000.000	135.0	H	33.0	14
16856.3333	47.11	53.90	6.79	1000.0	1000.000	175.0	H	14.0	18

2.8.12 Test Results for 18GHz to 26GHz



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
18416.3415	44.08	73.90	29.82	1000.0	1000.000	140.0	H	350.0	-3
19218.4820	44.09	73.90	29.81	1000.0	1000.000	203.0	V	218.0	-3
21612.5595	45.07	73.90	28.83	1000.0	1000.000	200.0	V	294.0	-2
22547.4750	44.02	73.90	29.88	1000.0	1000.000	156.0	V	165.0	-1
23723.7365	45.90	73.90	28.00	1000.0	1000.000	150.0	V	236.0	0
25914.3260	47.62	73.90	26.28	1000.0	1000.000	139.0	V	22.0	1

Average Data

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
18416.3415	31.51	53.90	22.39	1000.0	1000.000	140.0	H	350.0	-3
19218.4820	30.99	53.90	22.91	1000.0	1000.000	203.0	V	218.0	-3
21612.5595	32.00	53.90	21.90	1000.0	1000.000	200.0	V	294.0	-2
22547.4750	31.16	53.90	22.74	1000.0	1000.000	156.0	V	165.0	-1
23723.7365	32.29	53.90	21.61	1000.0	1000.000	150.0	V	236.0	0
25914.3260	33.58	53.90	20.32	1000.0	1000.000	139.0	V	22.0	1

2.9 POWER SPECTRAL DENSITY

2.9.1 Specification Reference

FCC 47 CFR Part 15, Clause 15.247(e)
RSS-247, Clause 5.2(2)

2.9.2 Standard Applicable

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.

2.9.3 Equipment Under Test and Modification State

Serial No: 501700006 / Default Test Configuration

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

January 06, 2021 / FSC

2.9.5 Test Equipment Used

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

2.9.6 Environmental Conditions (Rancho Bernardo Satellite Facility)

Ambient Temperature	23.3°C
Relative Humidity	38.7%
ATM Pressure	99.9kPa

2.9.7 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(a),(e), KDB 558074 D01 DTS Meas Guidance v05 F and ANSI C63.10-2013.

2.9.8 Test Results Summary

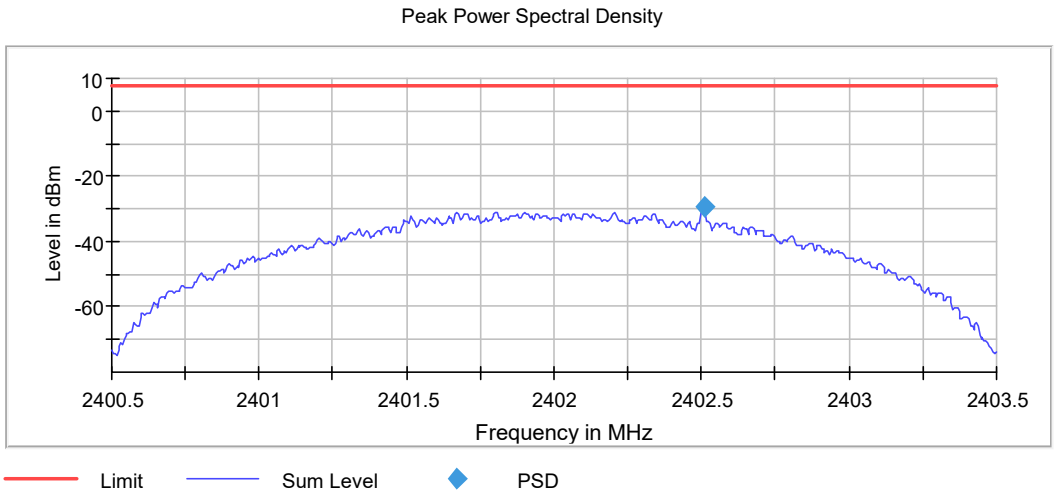
DUT Frequency (MHz)	PHY setting	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2402.000000	1M				
	2M	2402.087500	-29.109	8.0	PASS
2440.000000	1M				
	2M	2440.502500	-29.698	8.0	PASS

2480.000000	1M				
	2M	2480.507500	-28.936	8.0	PASS

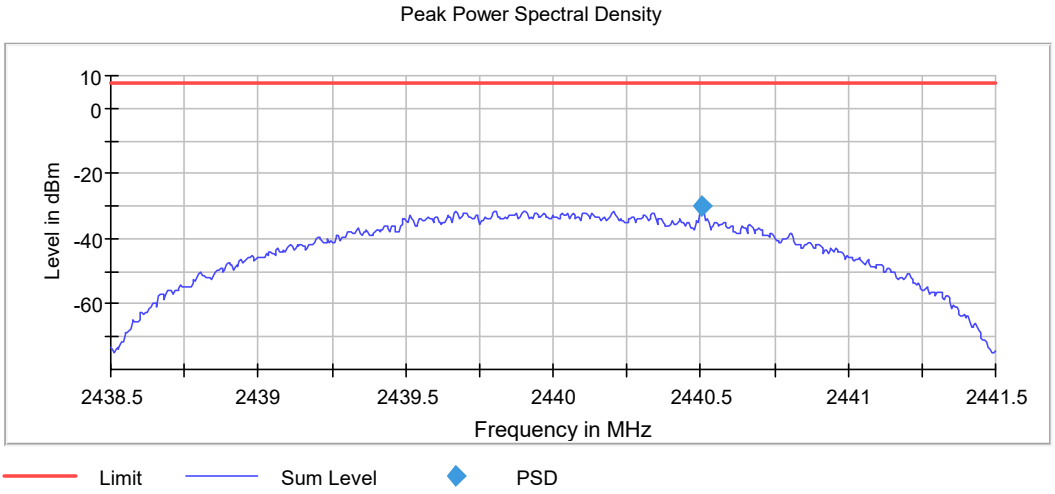
2.9.9 Sample Measurement Settings (2M PHY)

Setting	Instrument Value	Target Value
Span	3.000 MHz	3.000 MHz
RBW	10.000 kHz	<= 10.000 kHz
VBW	30.000 kHz	>= 30.000 kHz
SweepPoints	600	~ 600
Sweeptime	3.000 ms	AUTO
Reference Level	-20.000 dBm	-20.000 dBm
Attenuation	0.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	Sweep
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	4 / max. 150	max. 150
Stable	2 / 2	2
Max Stable Difference	0.36 dB	0.50 dB

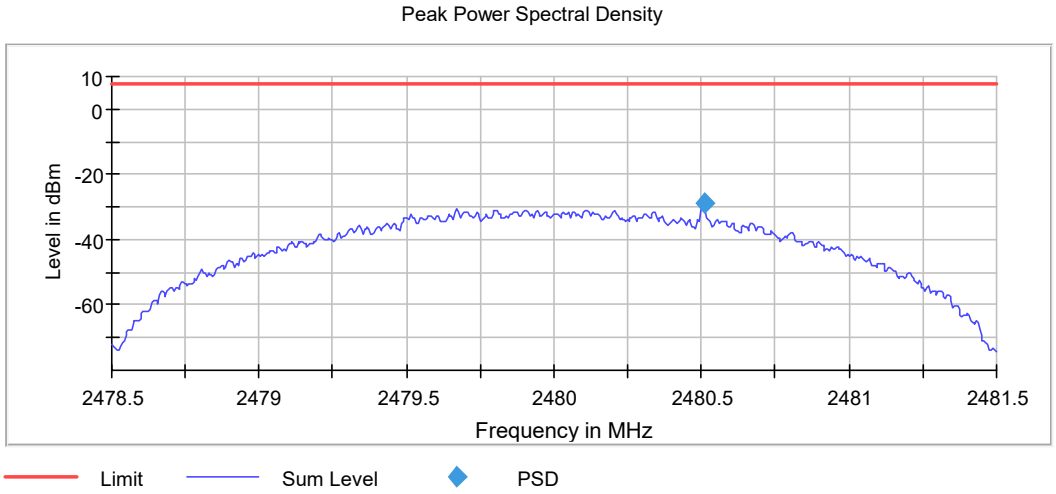
2.9.10 Test Plots



Bluetooth Low Channel



Bluetooth LE Mid Channel



Bluetooth LE High Channel

SECTION 3

3 TEST EQUIPMENT USED

3.1 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
AC Conducted Enissions						
1049	EMI Test Receiver	ESU 40	100133	Rohde & Schwarz	09/25/20	09/25/21
7567	LISN	FCC-LISN-50-25-2-10	120304	Fischer Custom Comm.	01/27/20	01/27/21
8870	20dB Attenuator	34-20-34	BP8030	MCE / Weinschel	02/07/20	02/07/21
Conducted Port Setup						
7643	Signal/Spectrum Analyzer	FSV30	1321.3008K30/103166	Rhode & Schwarz	04/15/20	04/04/21
7655	Vector Signal Generator	SMBV100A	260734	Rhode & Schwarz	12/16/20	12/16/21
7654	Signal Generator	SMB 100A	175750	Rhode & Schwarz	12/29/20	12/29/21
7656	OSP with B157	OSP120	101310	Rhode & Schwarz	07/23/20	07/23/21
8825	20dB Attenuator	46-20-34	BK5773	Weinschel Corp.	Verified by 7643 and 7654	
Radiated Emission						
1002	Bilog Antenna	3142C	0058717	EMCO	10/09/19	10/09/21
7631	Double-ridged waveguide horn	3117	00205418	ETS-Lindgren	09/16/20	09/16/22
46797	Preamplifier	PA-122	181925	Com Power	10/28/20	10/28/21
09001	Horn Antenna	HO42S	101	Custom Microwave Inc	09/09/19	09/09/21
40815	Low Noise Amplifier	SLKKa-30-6	19D18	Spacek Labs	10/18/20	10/18/21
6628	Loop Antenna	HFH2-Z2335.4711.52	FNr.800.458/25	Schwarbeck	05/22/20	05/20/22
1049	EMI Test Receiver	ESU40	100133	Rhode & Schwarz	09/25/20	09/25/21
Miscellaneous						
11312	Mini Environmental Quality Meter	850027	CF099-56010-340	11312	05/22/20	05/22/21
43003	True RMS Multimeter	85 III	69880143	Fluke	10/23/20	10/23/21
40923	System DC Power Supply	6632B	US37472178	Hewlett Packard	Verified by 43003	
6672	D.C. Power Supply	E3611A	KR73012637	Hewlett Packard	Verified by 43003	
	Test Software	EMC32	V10.50.40	Rhode & Schwarz	N/A	

3.2 Measurement Uncertainty

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

3.2.1 Conducted Measurements

	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	LISN-receiver attenuation	0.10	dB	Normal, k=2	2.000	0.05	0.00
3	LISN voltage division factor	0.30	dB	Normal, k=2	2.000	0.15	0.02
4	Receiver sinewave accuracy	0.36	dB	Normal, k=2	2.000	0.18	0.03
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	0.00	dB	Rectangular	1.732	0.00	0.00
8	AMN VDF frequency interpolation	0.10	dB	Rectangular	1.732	0.06	0.00
9	Mismatch	0.07	dB	U-shaped	1.414	0.05	0.00
10	LISN impedance	2.65	dB	Triangular	2.449	1.08	1.17
11	Effect of mains disturbance	0.00	dB			0.00	0.00
12	Effect of the environment						
	Combined standard uncertainty			Normal		1.66	dB
	Expanded uncertainty			**Normal, k=2**		**3.31**	**dB**

3.2.1 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**

3.2.2 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**	

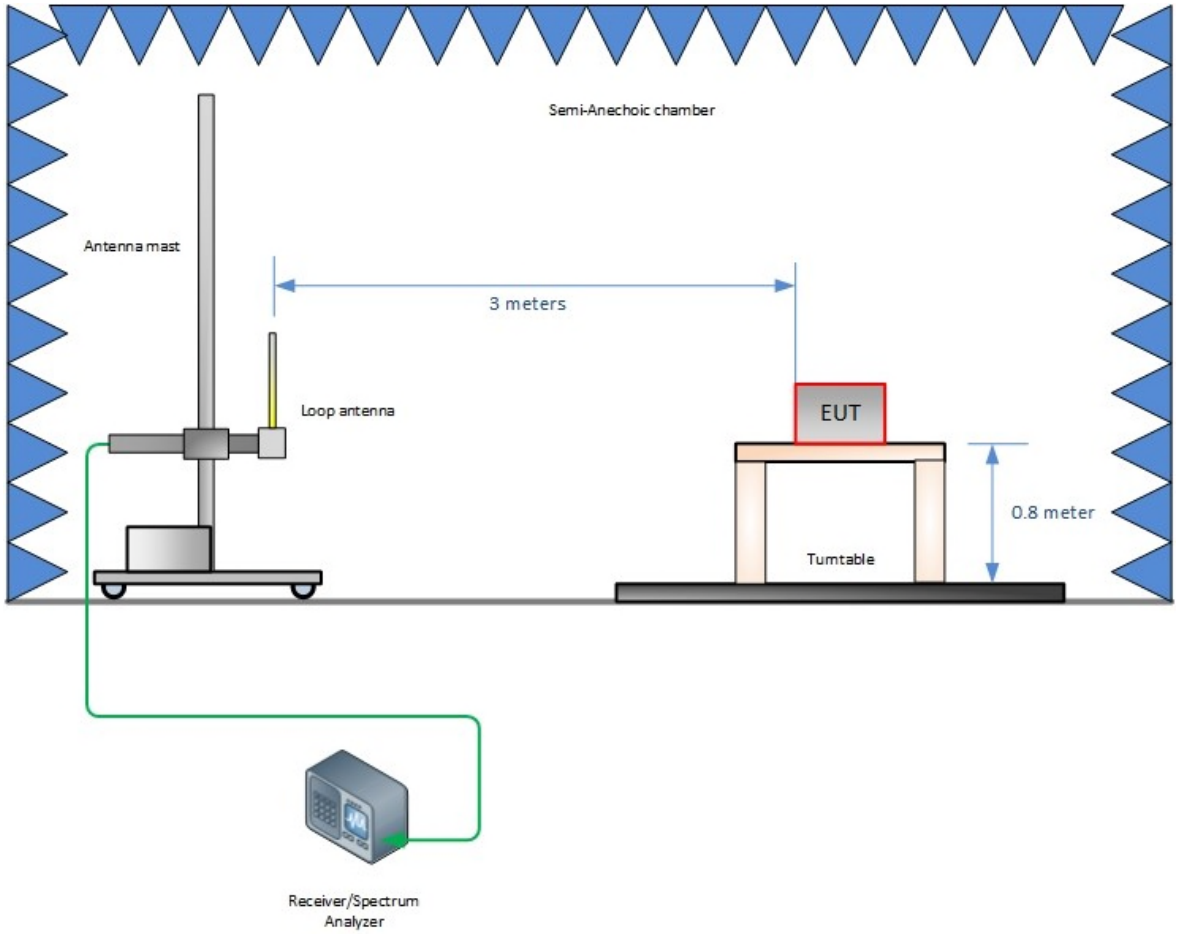
3.2.1 Radiated Emission Measurements (1GHz to 18GHz)

	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**	

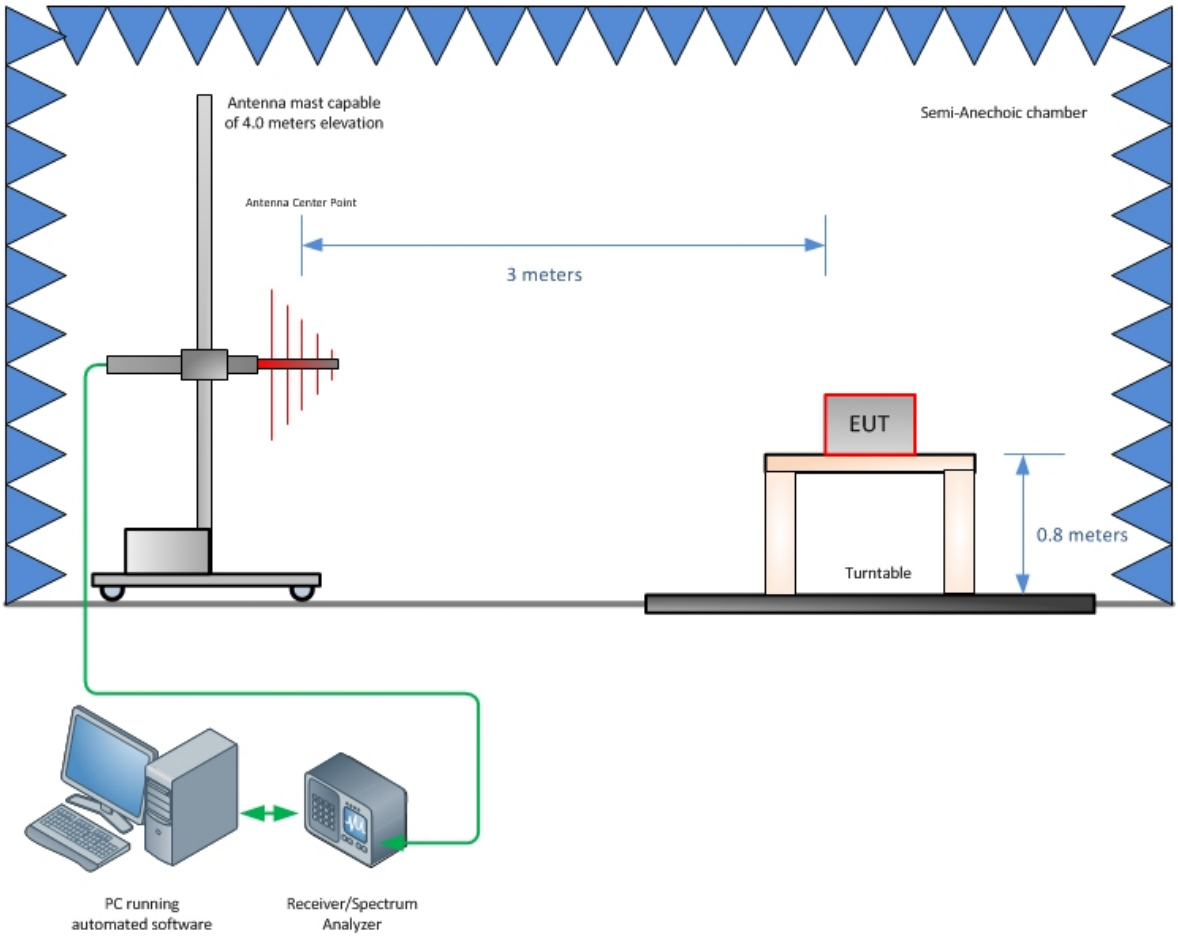
SECTION 4

4 Diagram of Test Setup

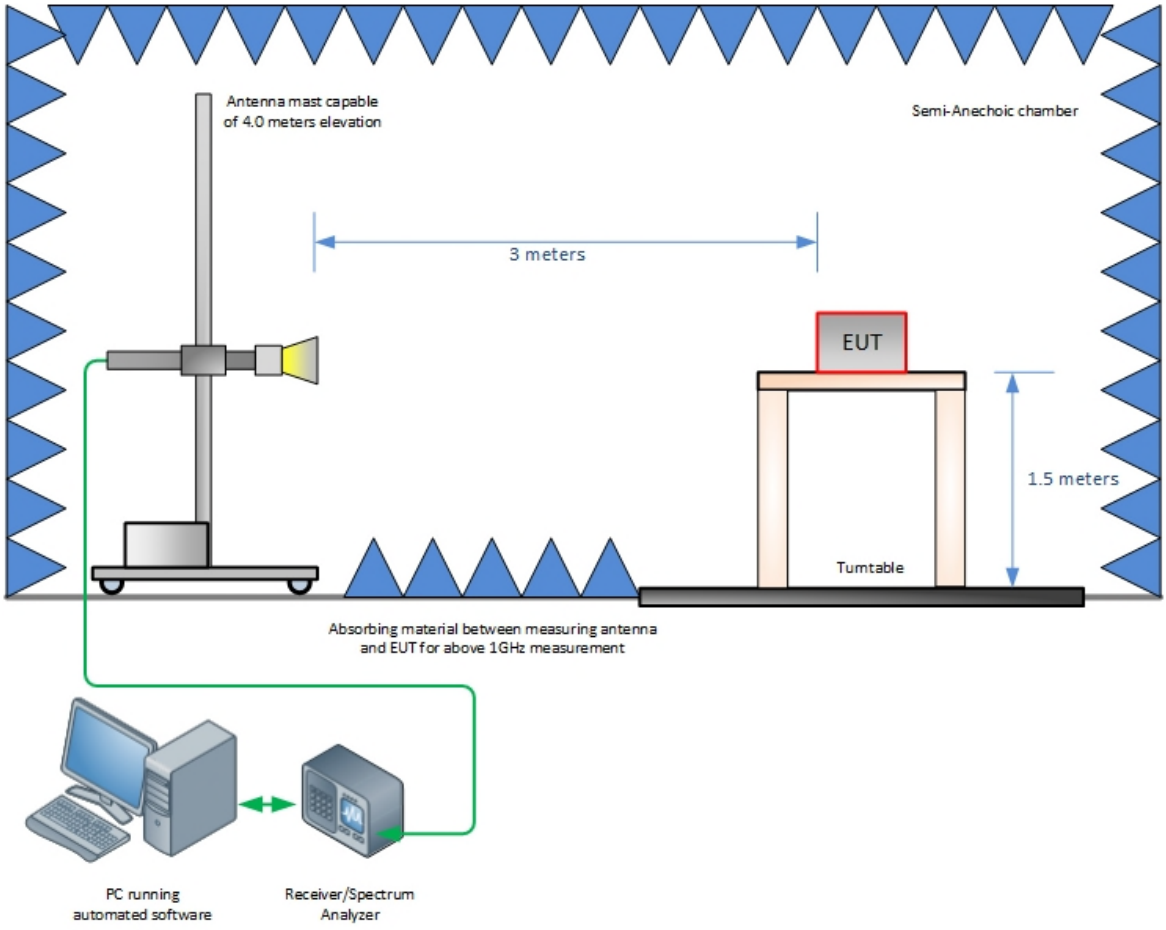
4.1 Test Setup Diagram



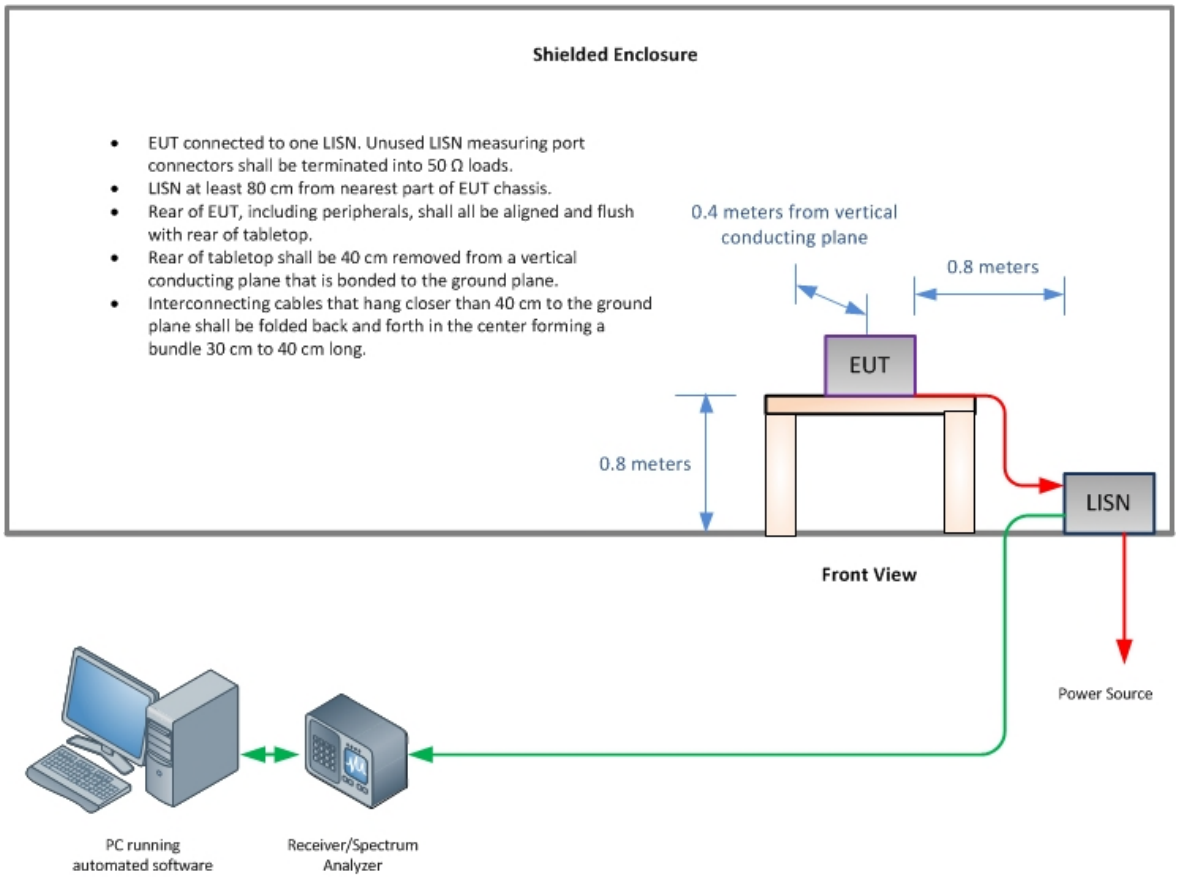
Radiated Emission Test Setup (Below 30MHz)



Radiated Emission Test Setup (Below 1GHz)



Radiated Emission Test Setup (Above 1GHz)



Conducted Emission Test Setup

SECTION 5

5 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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