

Radio Testing of the
Nextivity Inc
Cellular Signal Booster
Model Name: CEL-FI GO
Model Number: G41-CE

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

Nextivity Inc
16550 W Bernardo Drive
San Diego, CA 92127 USA



America

Add value.
Inspire trust.

COMMERCIAL-IN-CONFIDENCE

Date: November 2023
Document Number: 72189913F Issue 01 | Version Number: 01

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Authorized Signatory	Omar Castillo	November 20, 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

DISCLAIMER AND COPYRIGHT

This report has been prepared by TÜV SÜD America with all reasonable skill and care. The document is confidential to the potential Client and TÜV SÜD America. No part of this document may be reproduced without the prior written approval of TÜV SÜD America.

ACCREDITATION

Our A2LA Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our A2LA Accreditation.

TÜV SÜD America, Inc.
10040 Mesa Rim Road
San Diego, CA 92121-2912

TÜV SÜD America, Inc.
Rancho Bernardo Facility
16936 Via Del Campo
San Diego, CA 92127

Phone: 858 678 1400
www.TÜV-sud-america.com



REPORT ON

Radio Testing of the
Nextivity Inc
Model: CEL-FI GO (Cellular Signal Booster)
Model Number: G41-CE

TEST REPORT NUMBER

72189913F

TEST REPORT DATE

November 2023

PREPARED FOR

Nextivity Inc
16550 W Bernardo Drive
San Diego, CA 92127 USA

CONTACT PERSON

CK Li
Sr. Principal Engineer, Regulatory
CLi@NextivityInc.com
+1 (858) 485-9442

PREPARED BY


Omar Castillo
Name
Authorized Signatory
Title: Senior EMC/Wireless Test Engineer

APPROVED BY


Ferdinand S. Custodio
Name
Authorized Signatory
Title: Senior EMC Test Engineer / Wireless Team Lead

DATED

November 20, 2023



Revision History

72189913F Nextivity Inc Model: CEL-FI GO G41-CE					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
11/20/2023	—	Initial Release			Ferdinand S. Custodio

CONTENTS

Section	Page No
1	REPORT SUMMARY 5
1.2	Brief Summary of Results 7
1.3	Product Information 8
1.4	EUT Test Configuration 8
1.5	Deviations From The Standard 9
1.6	Modification Record 11
1.7	Test Methodology 11
1.8	Test Facility Location 11
1.9	Test Facility Registration 11
2	TEST DETAILS 13
2.1	Peak Output Power 14
2.2	Conducted Emissions 17
2.3	99% Emission Bandwidth 21
2.4	Minimum 6 dB RF Bandwidth 25
2.5	Out-Of-Band Emissions - Conducted 29
2.6	Band-Edge Compliance of RF Conducted Emissions 37
2.7	Radiated Spurious Emissions 43
2.8	Power Spectral Density 52
3	TEST EQUIPMENT USED 59
3.1	Test Equipment Used 60
3.2	Measurement Uncertainty 61
4	DIAGRAM OF TEST SETUP 63
4.1	Test Setup Diagram 64
5	ACCREDITATION, DISCLAIMERS AND COPYRIGHT 67
5.1	Accreditation, Disclaimers and Copyright 68



SECTION 1

REPORT SUMMARY

Radio Testing of the
Nextivity Inc
CEL-FI GO Cellular Signal Booster
G41-CE



1.1 INTRODUCTION

The information contained in this report is intended to show verification of the CEL-FI GO Cellular Signal Booster G41-CE 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	Nextivity Inc
EUT	Cellular Signal Booster
Product Code	G41-CE
Model Name	CEL-FI GO
FCC ID	YETG41-CE
FCC Classification	Low power Communications Device Transmitter (DTS)
Serial Number(s)	560311000040
Number of Samples Tested	1
Test Specification/Issue/Date	• FCC Part 15 Subpart C §15.247 (October 1, 2022). • RSS-247–Digital Transmission Systems (DTS), 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	July 10, 2023
Finish of Test	August 2, 2023
Name of Engineer(s)	Omar Castillo
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. • Product Spec for RFQ_Sapporo G41-BE_US_v1 • G41_BT_Antenna_data_to Lab.pdf • 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	Compliant	
2.6	§15.247(d)	RSS-247 5.5	Band-edge Compliance of RF Conducted Emissions	Compliant	
2.7	§15.247(d)	RSS-247 5.5	Radiated Spurious Emissions	Compliant	
	-	RSS-Gen 7.3 and 7.4	Receiver Spurious Emissions	N/A	
2.8	§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 an CEL-FI GO Cellular Signal Booster for treating sleep apnea. The BLE function of the EUT is verified in this test report.

1.3.2 EUT General Description

EUT Description	Cellular Signal Booster
Model Name	CEL-FI GO
Model Number	G41-CE
Rated Voltage	24VDC
Mode Verified	Bluetooth LE
Capability	Bluetooth LE
Primary Unit (EUT)	☐ Production ☐ Pre-Production ☒ Engineering (same as Production)
Manufacturer Declared Temperature Range	0°C to 40°C
Antenna Type	Custom Design
Manufacturer	Nextivity Inc
Antenna Model	G41 Bluetooth Antenna
Maximum Antenna Gain	-7.1 dBi at 2440MHz

1.3.3 Maximum Conducted Output Power

Bluetooth Low Energy (LE)	Frequency Range (MHz)	Gated RMS (dBm)	Duty Cycle (%)
	2402-2480	-1.8	67.887 %

1.3.4 Equipment under test

Manufacturer	Equipment	Description
Nextivity	EUT Equipment Under Test	Model Number: G41-CE SN:560311000040
Simsukian	EUT's AC/DC Adapter	Model: SK03T1-1200250U SN: 21121001000007

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
Test Mode (Tx modulated)	Bluetooth TX Modulated Mode. The EUT is connected to a support laptop via USB cable and is programmed NCI (Nextivity Chart Interface v1.0.0.78) Software. The manufacturer provided instructions how to set the EUT in test mode, how to change between channels (LOW, MID and High channels).

1.4.2 EUT Exercise Software

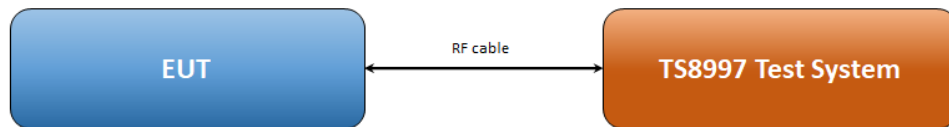
Manufacturer Provided a Nextivity Chart Interface v1.0.0.78

1.4.3 Support Equipment and I/O cables

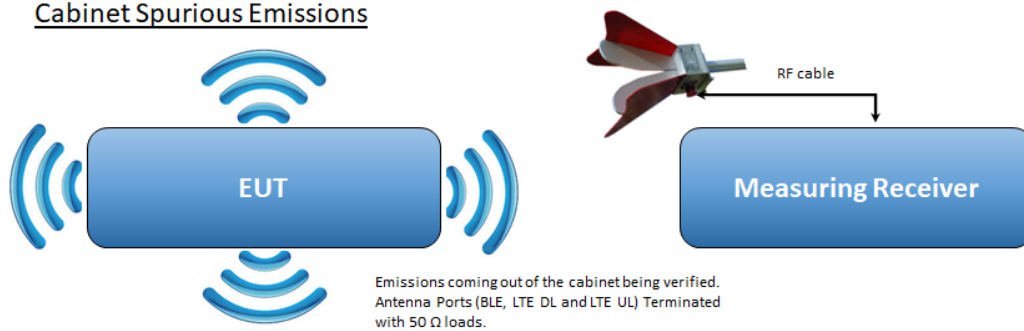
Manufacturer	Equipment/Cable	Description
Lenovo	Support laptop	Model: ThinkPad T440S S/N: PC-03DGHK 15/02
Lenovo	AC Adapter	Part Number ADLX90NLC2A S/n: 36200286
Nextivity	Support USB Cable	Custom 1.0 meter shielded USB Type A to Micro B Cable
MCL	2x 30dB Attenuator	VAT-30W2+ 2W DC-6GHz
Amphenol	2x SMA Terminator	SMA Terminator Plug (50 ohms)

1.4.1 Simplified Test Configuration Diagram

Antenna Port Conducted Test Setup



Cabinet Spurious Emissions





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

TÜV SÜD 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 (ISED) Registration No.: 3067A-1 & 22806-1

The 10m Semi-anechoic chamber of TÜV SÜD 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 TÜV SÜD 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)

TÜV 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)

TÜV SÜD 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 LP0002 for Low-Power RF Device type of testing.

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

TÜV SÜD 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

TÜV SÜD 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

TÜV SÜD 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
Nextivity Inc
CEL-FI GO Cellular Signal Booster



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: 560311000040 / Default Test Configuration

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

July 27, 2023 / OC

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	24.6 °C
Relative Humidity	52.9 %
ATM Pressure	99.8 kPa

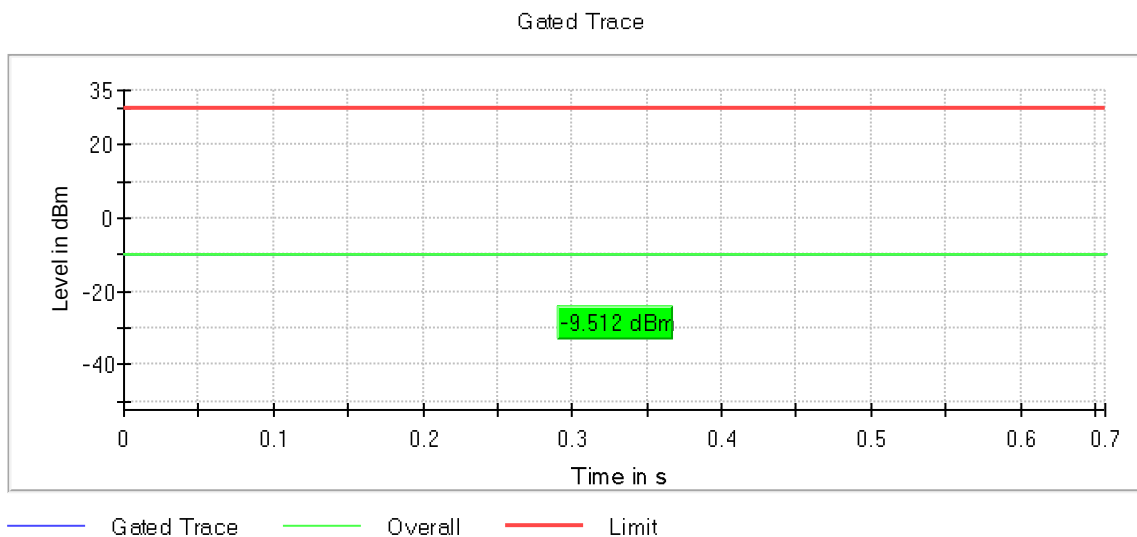
2.1.7 Additional Observations

- 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.

2.1.8 Test Results

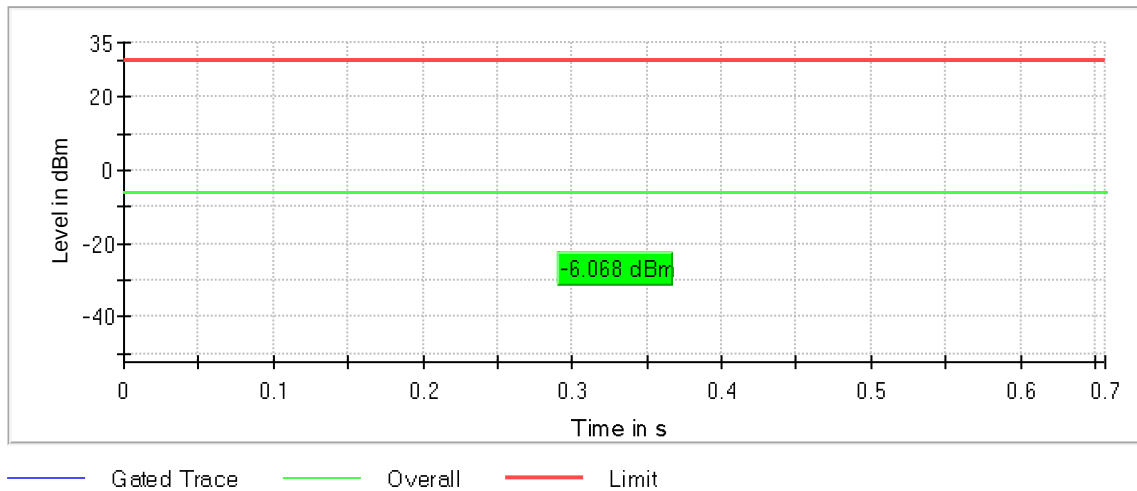
DUT Frequency (MHz)	PHY	Gated RMS* (dBm)	Limit Max (dBm)	DutyCycle (%)	Result
2402.000000	1M	-9.5	30.0	65.887	PASS
2440.000000	1M	-6.1		65.887	PASS
2480.000000	1M	-1.8		65.903	PASS

2.1.9 Sample Test Plots



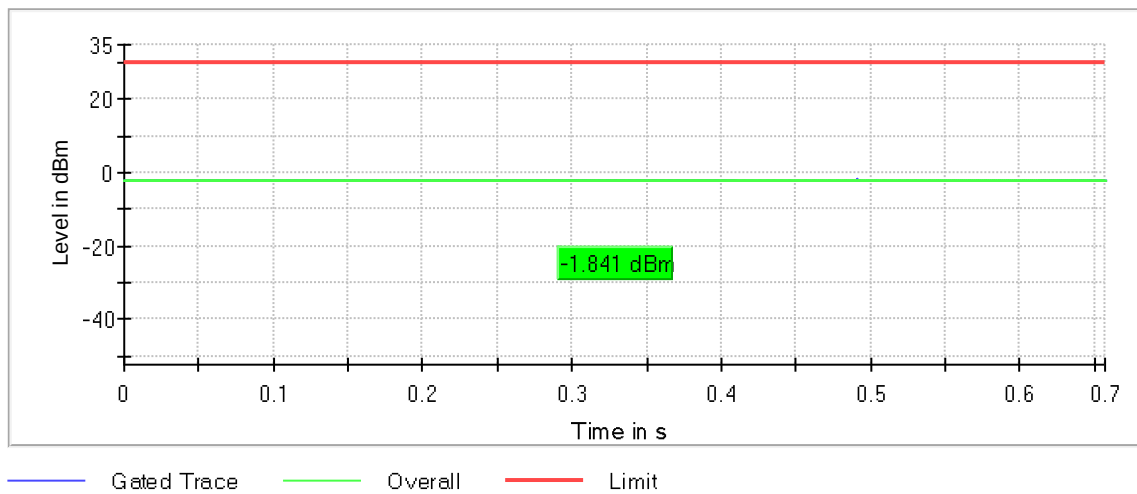
Bluetooth LE. Low Channel 1M PHY

Gated Trace



Bluetooth LE. Mid Channel 1M PHY

Gated Trace



Bluetooth LE. High Channel 1M PHY

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 μ s	1.000 μ s

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 μ H/50 ohms line impedance stabilization network (LISN).

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	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: 560311000040 / Default Test Configuration

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

July 17, 2023 / OC

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	25.3°C
Relative Humidity	42.4%
ATM Pressure	99.5kPa

2.2.7 Additional Observations

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.



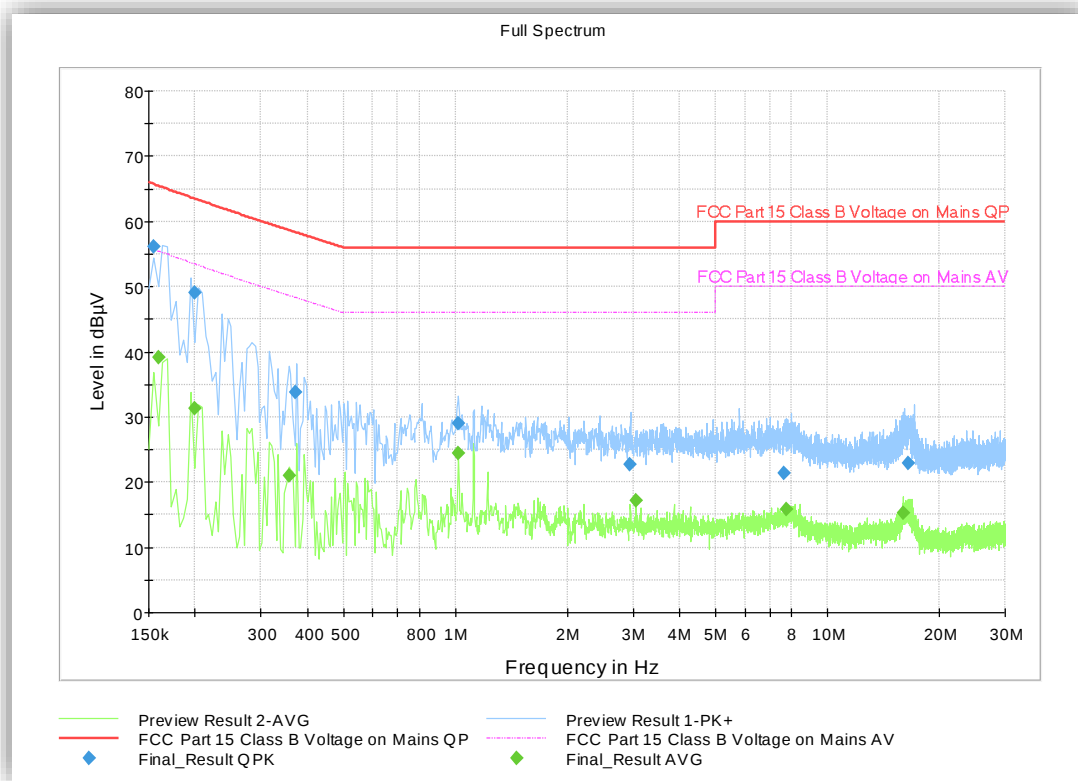
2.2.8 Sample Computation (Conducted Emission – Quasi Peak)

Measuring equipment raw measurement (db μ V) @ 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 (db μ V) @ 150kHz			26.2

2.2.9 Test Results

Compliant. See attached plots and tables.

2.2.10 TX Mode (120V-60Hz) Line 1



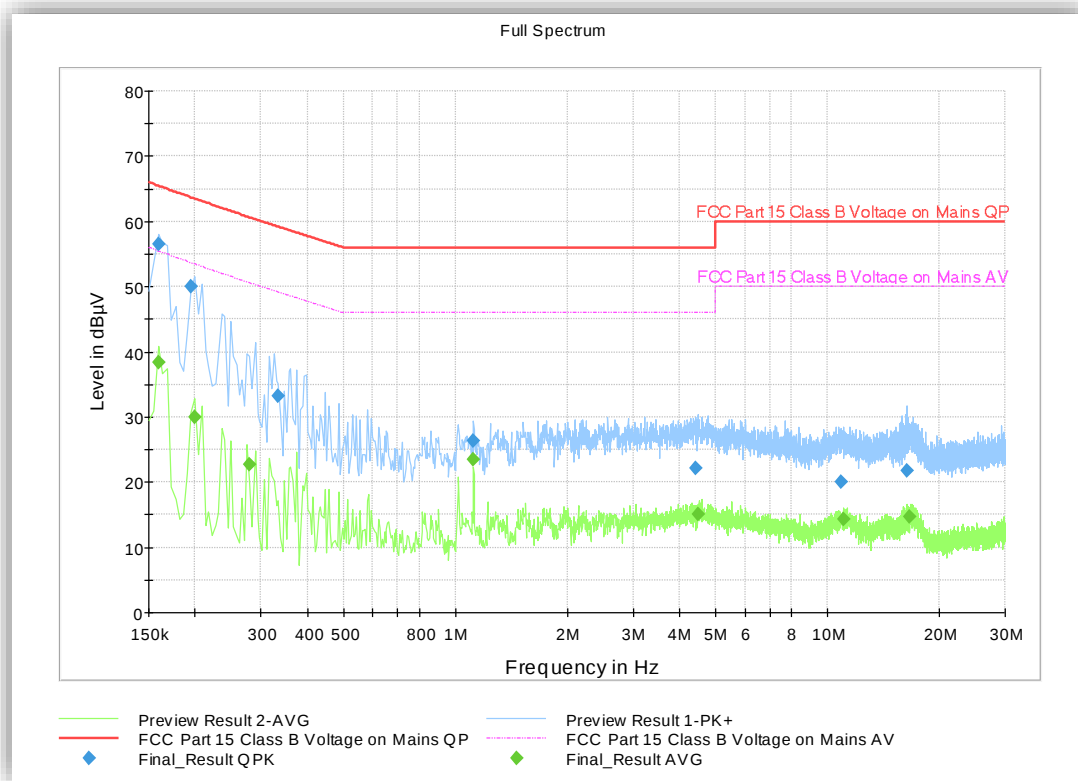
Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.154500	56.09	65.73	9.64	1000.0	9.000	L1	OFF	20.0
0.199500	49.00	63.48	14.48	1000.0	9.000	L1	OFF	20.0
0.370500	33.81	58.34	24.53	1000.0	9.000	L1	OFF	20.1
1.018500	28.95	56.00	27.05	1000.0	9.000	L1	OFF	20.4
2.949000	22.79	56.00	33.21	1000.0	9.000	L1	OFF	20.5
7.660500	21.32	60.00	38.68	1000.0	9.000	L1	OFF	20.2
16.494000	23.00	60.00	37.00	1000.0	9.000	L1	OFF	20.1

Average Data

Frequency (MHz)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.159000	39.23	55.47	16.23	1000.0	9.000	L1	OFF	20.0
0.199500	31.31	53.45	22.14	1000.0	9.000	L1	OFF	20.0
0.357000	21.01	48.60	27.60	1000.0	9.000	L1	OFF	20.1
1.018500	24.35	46.00	21.65	1000.0	9.000	L1	OFF	20.4
3.052500	17.10	46.00	28.90	1000.0	9.000	L1	OFF	20.5
7.759500	15.89	50.00	34.11	1000.0	9.000	L1	OFF	20.2
15.967500	15.36	50.00	34.64	1000.0	9.000	L1	OFF	20.1

2.2.11 TX Mode (120V-60Hz) Neutral



Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.159000	56.55	65.48	8.92	1000.0	9.000	N	OFF	20.0
0.195000	49.93	63.68	13.75	1000.0	9.000	N	OFF	20.0
0.334500	33.21	59.16	25.95	1000.0	9.000	N	OFF	20.1
0.361500	33.61	58.53	24.93	1000.0	9.000	N	OFF	20.1
1.117500	26.34	56.00	29.66	1000.0	9.000	N	OFF	20.4
4.429500	22.17	56.00	33.83	1000.0	9.000	N	OFF	20.5
10.846500	20.08	60.00	39.92	1000.0	9.000	N	OFF	20.2
16.318500	21.69	60.00	38.31	1000.0	9.000	N	OFF	20.1

Average Data

Frequency (MHz)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.159000	38.44	55.47	17.03	1000.0	9.000	N	OFF	20.0
0.199500	29.94	53.45	23.51	1000.0	9.000	N	OFF	20.0
0.280500	22.73	50.56	27.83	1000.0	9.000	N	OFF	20.1
1.117500	23.42	46.00	22.58	1000.0	9.000	N	OFF	20.4
4.479000	15.06	46.00	30.94	1000.0	9.000	N	OFF	20.5
11.017500	14.31	50.00	35.69	1000.0	9.000	N	OFF	20.2
16.570500	14.72	50.00	35.28	1000.0	9.000	N	OFF	20.1



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: 560311000040 / Default Test Configuration

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

July 27, 2023 / OC

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	24.6 °C
Relative Humidity	52.9 %
ATM Pressure	99.8 kPa

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.

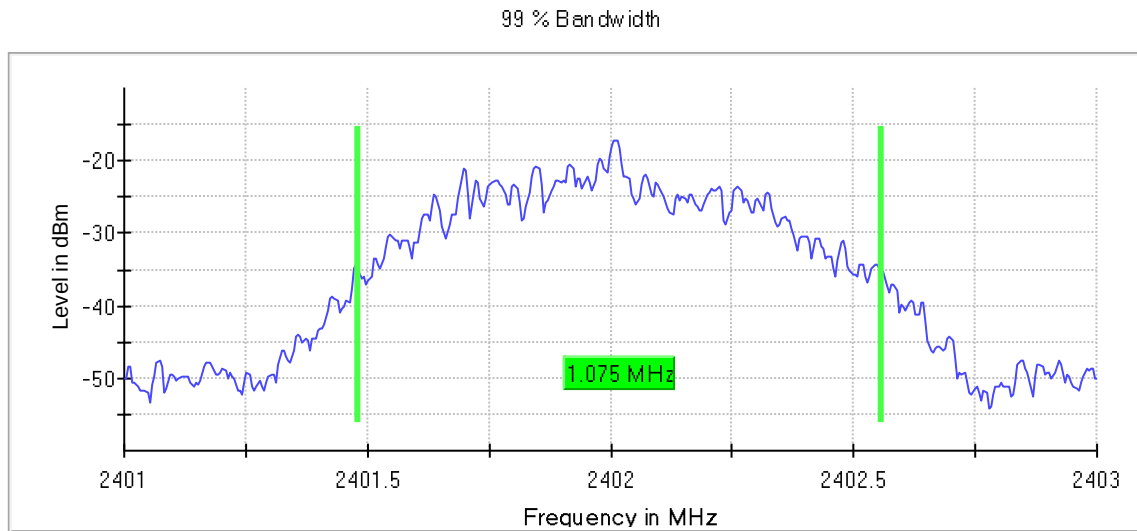
2.3.8 Sample Measurement Settings

Setting	Instrument Value	Target Value
Span	2.000 MHz	2.000 MHz
RBW	10.000 kHz	>= 10.000 kHz
VBW	30.000 kHz	>= 30.000 kHz
SweepPoints	400	~ 400
SweepTime	189.648 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
Preamplifier	off	off
Stablemode	Trace	Trace
Stablevalue	0.30 dB	0.30 dB
Run	5 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.06 dB	0.30 dB

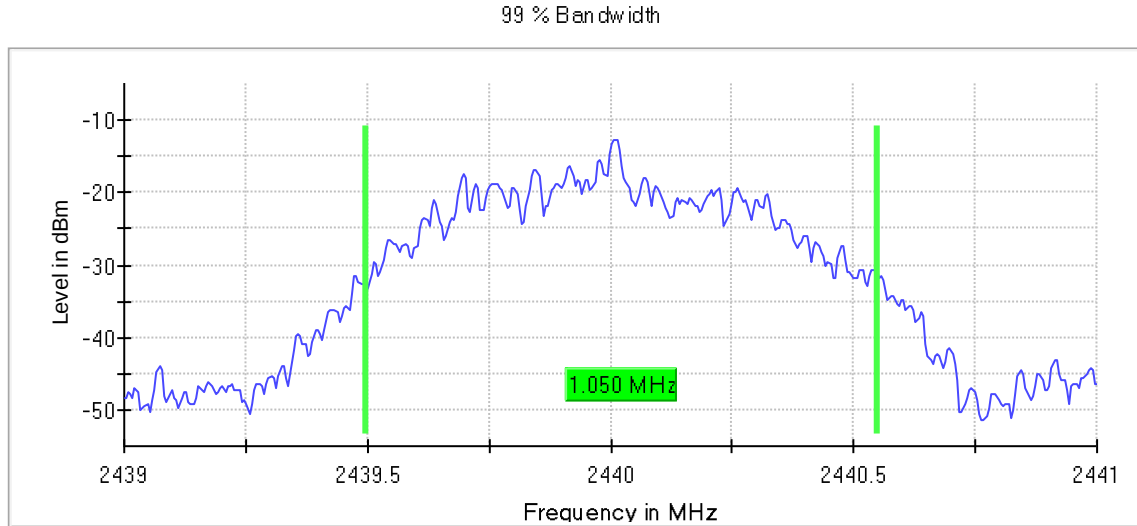
2.3.9 Test Results

DUT Frequency (MHz)	PHY	99% Bandwidth	Band Edge Left (MHz)	Band Edge Right (MHz)	Result
2402.000000	1M	1.075000	2401.482500	2402.557500	PASS
2440.000000	1M	1.050000	2439.497500	2440.547500	PASS
2480.000000	1M	1.100000	2479.472500	2480.572500	PASS

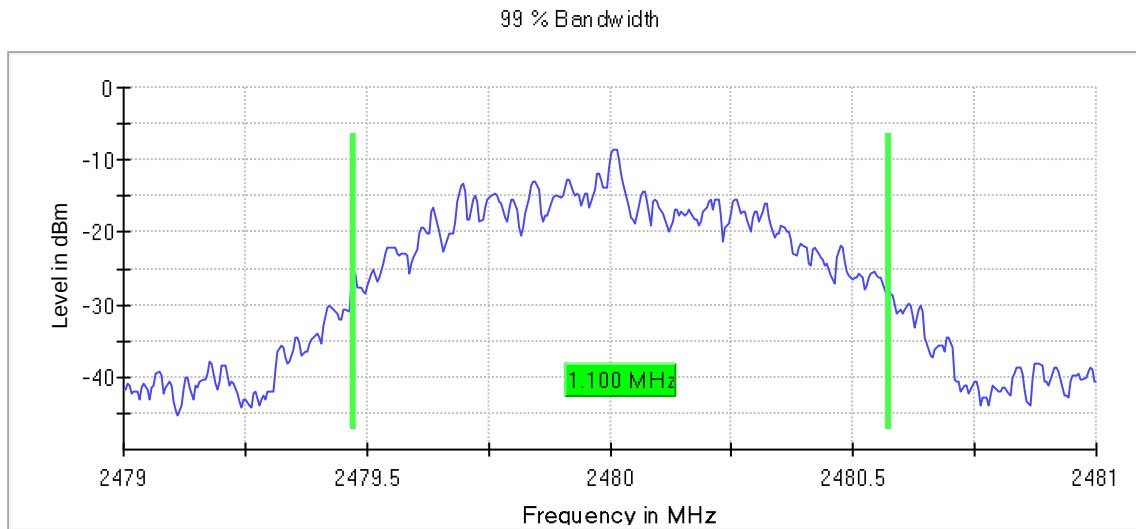
2.3.10 Test Plots



Bluetooth LE Low Channel 1M PHY



Bluetooth LE Middle Channel 1M PHY



Bluetooth LE High Channel 1M PHY



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: 560311000040 / Default Test Configuration

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

July 27, 2023 / OC

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 Facility)

Ambient Temperature	24.6 °C
Relative Humidity	52.9 %
ATM Pressure	99.8 kPa

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.

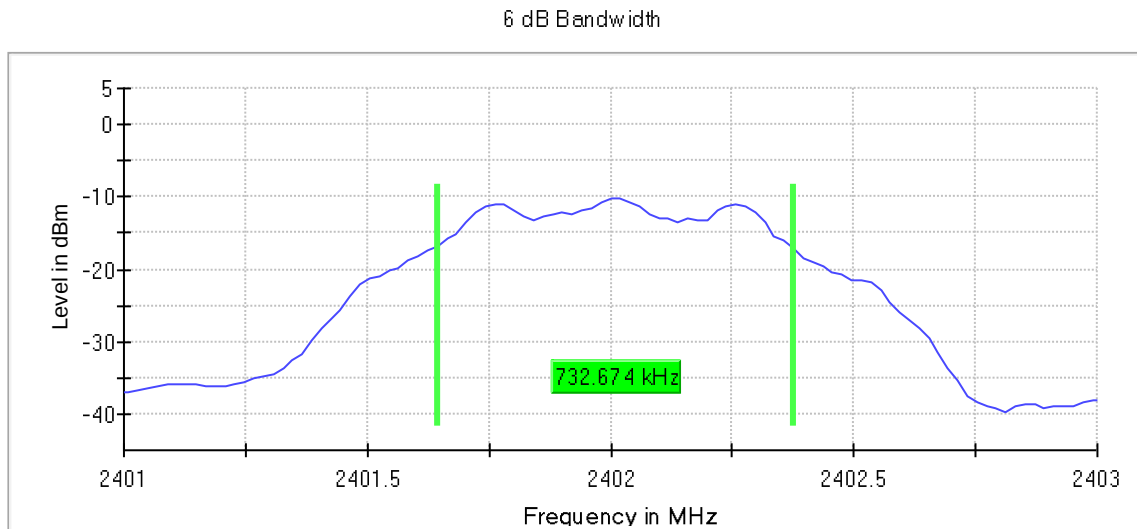
2.4.8 Sample Measurement Settings

Setting	Instrument Value	Target Value
Span	2.000 MHz	2.000 MHz
RBW	100.000 kHz	~ 100.000 kHz
VBW	300.000 kHz	~ 300.000 kHz
SweepPoints	101	~ 40
SweepTime	18.938 μ s	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
Preamplifier	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	7 / max. 150	max. 150
Stable	5 / 5	5
Max Stable Difference	0.13 dB	0.50 dB

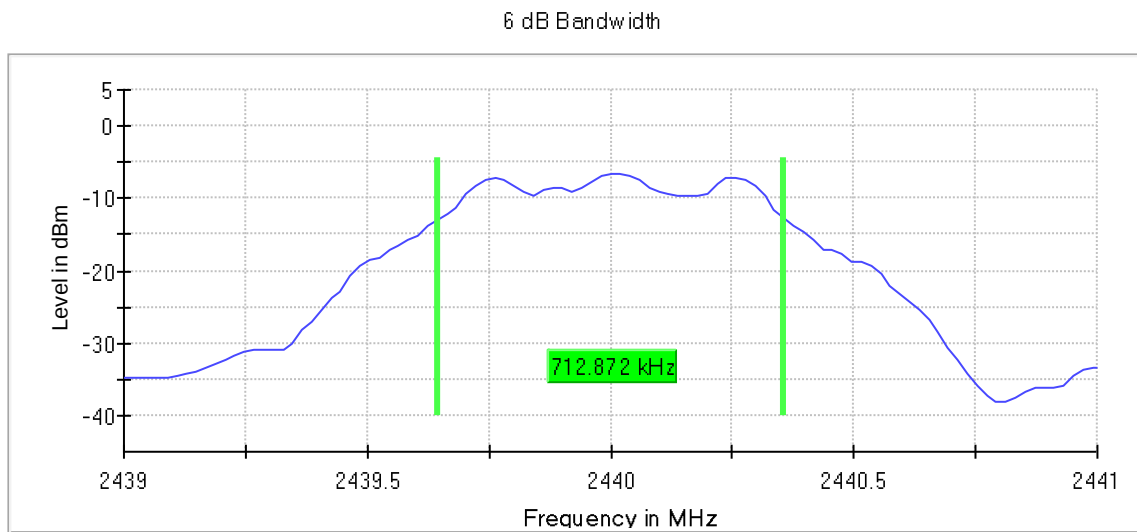
2.4.9 Test Results

DUT Frequency (MHz)	PHY	Limit Min (MHz)	Bandwidth (MHz)	Result
2402.000000	1M	0.500000	0.732674	PASS
2440.000000	1M		0.712872	PASS
2480.000000	1M		0.732674	PASS

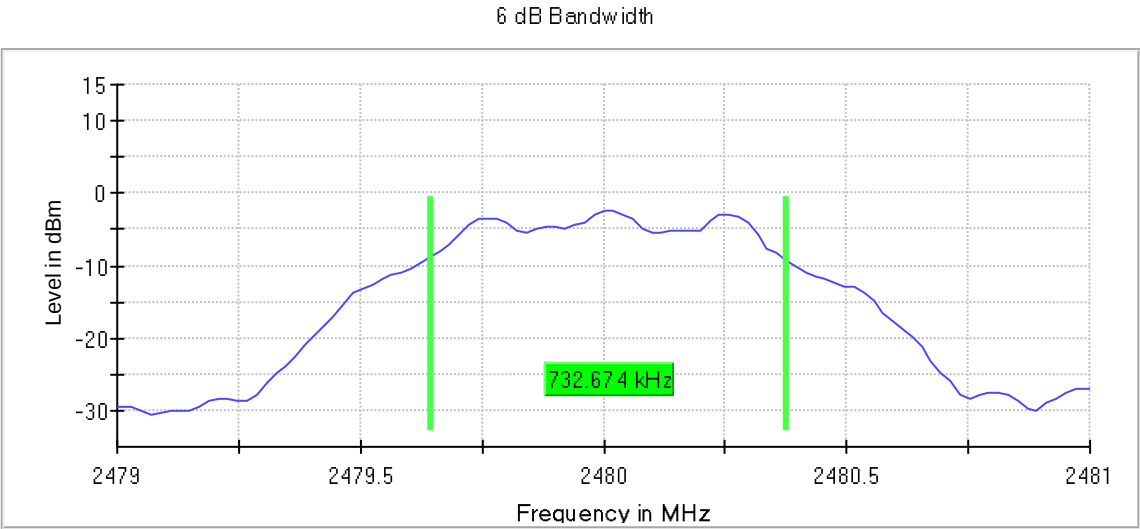
2.4.10 Test Plots



Bluetooth LE Low Channel 1M PHY



Bluetooth LE Middle Channel 1M PHY



Bluetooth LE High Channel 1M PHY



2.5 OUT-OF-BAND EMISSIONS - CONDUCTED

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: 560311000040 / Default Test Configuration

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

July 27 and August 2, 2023 / OC

2.5.5 Test Equipment Used

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

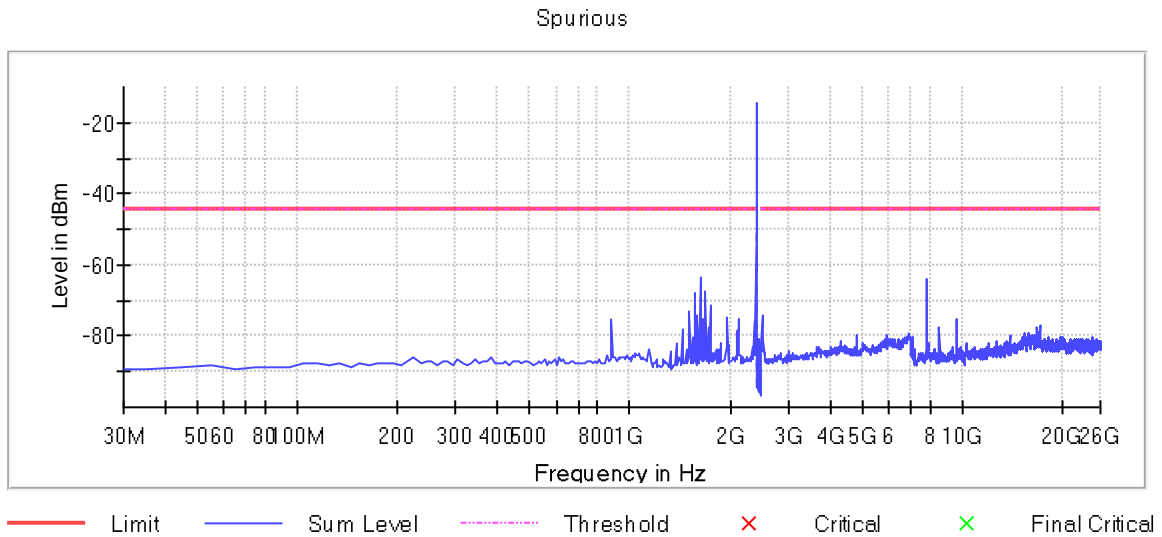
2.5.6 Environmental Conditions (Rancho Bernardo Satellite Facility)

Ambient Temperature	24.6 °C	25.4 °C
Relative Humidity	52.9 %	58.2 %
ATM Pressure	99.8 kPa	99.1 kPa

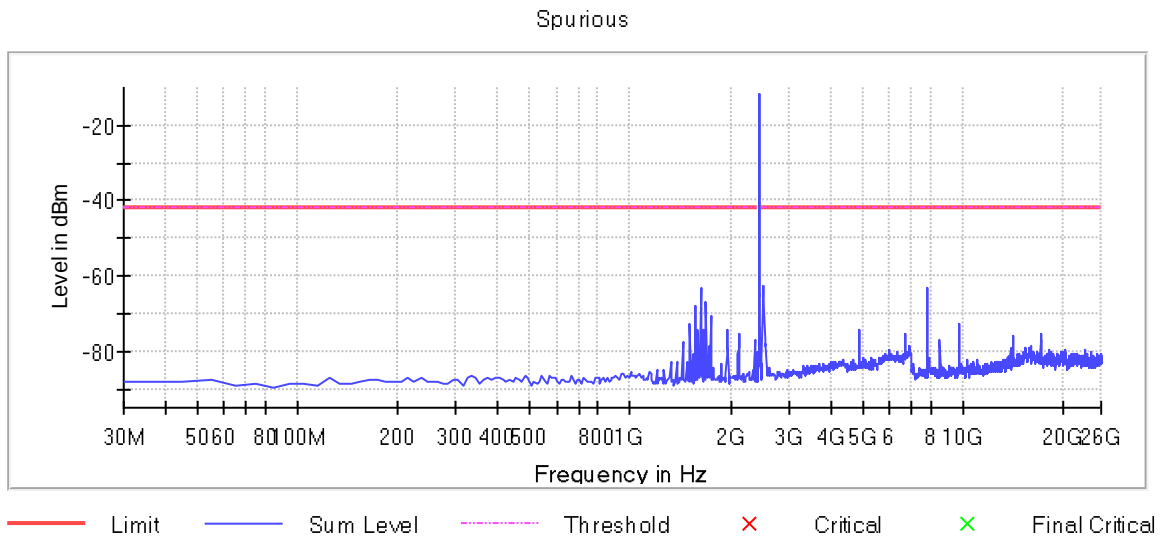
2.5.7 Additional Observations

- This is a conducted test using a spectrum analyser.
- The path loss was all accounted for using a transducer factor (TDF).
- 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. Limit is based on 100kHz RBW, for above 1GHz, requirement is 1MHz RBW. Appropriate Antenna gain and pigtail insertion loss are programmed as Offset for §15.205 verification.
- For §15.247(d) requirement, no emissions observed within the measurement threshold during prescan, further verification is not required.

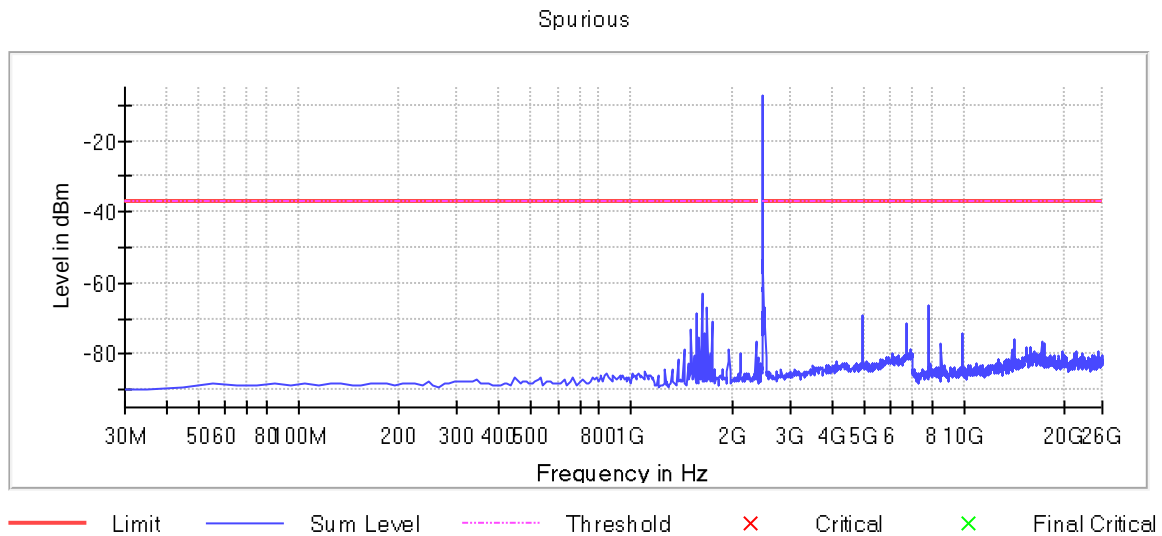
2.5.8 Test Results Plots (§15.247 requirements)



Low Channel 1M PHY



Middle Channel 1M PHY

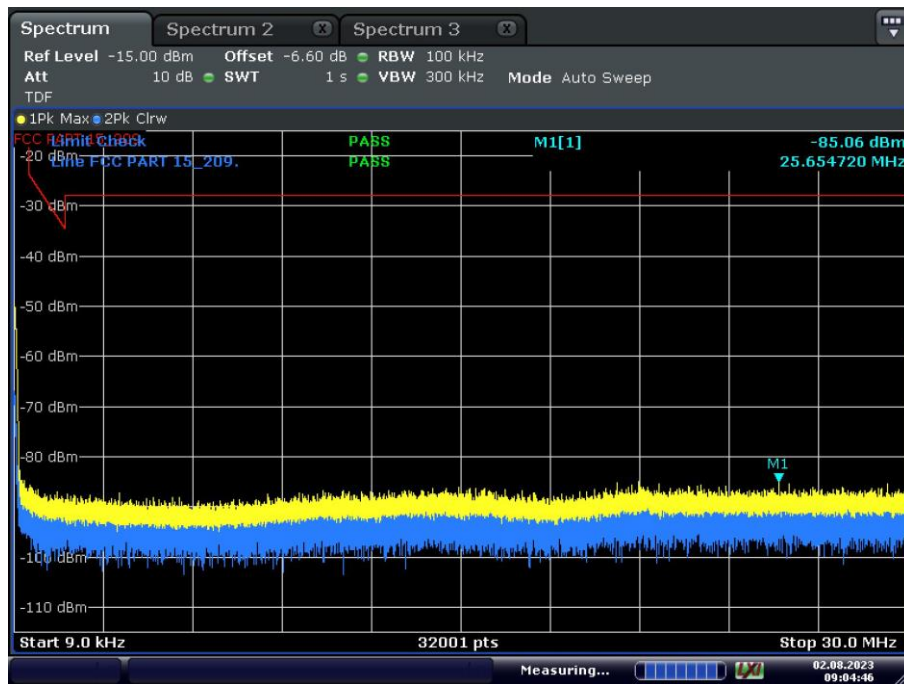


High Channel 1M PHY

2.5.9 Test Results Plots (§15.205 requirements)

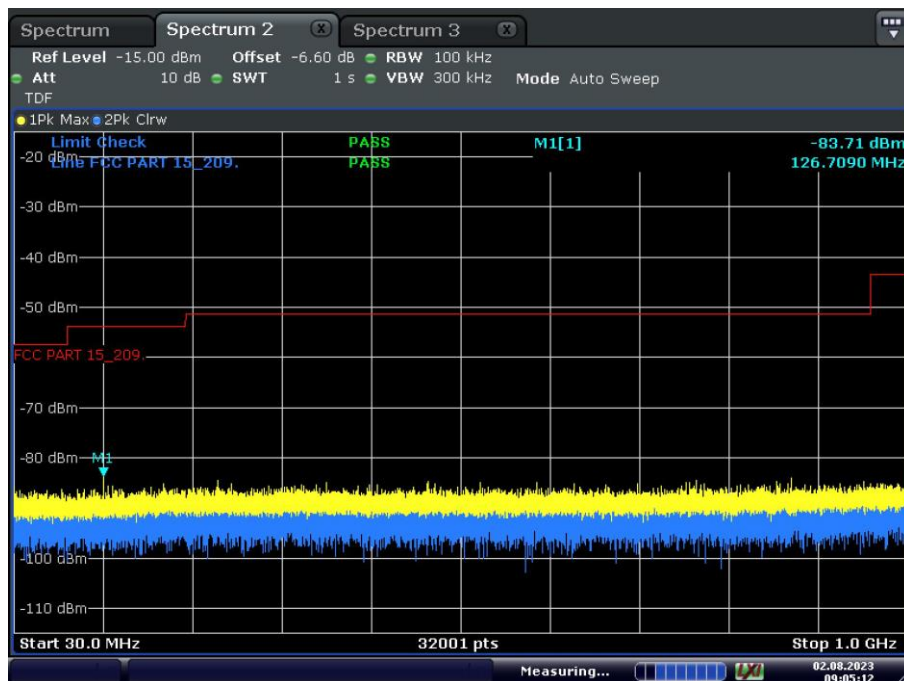
Plots presented under this Section are using Peak Detector (worst-case comparing with quasi peak and average detector) with corresponding antenna gain and pigtail insertion loss as declared by the manufacturer as an Offset. TDF (Transducer Factor) is used for other losses along the measurement path. Limit used is for Average measurement.

Marginal result (Low channel, 1GHz to 26GHz range) was verified with rms detector.



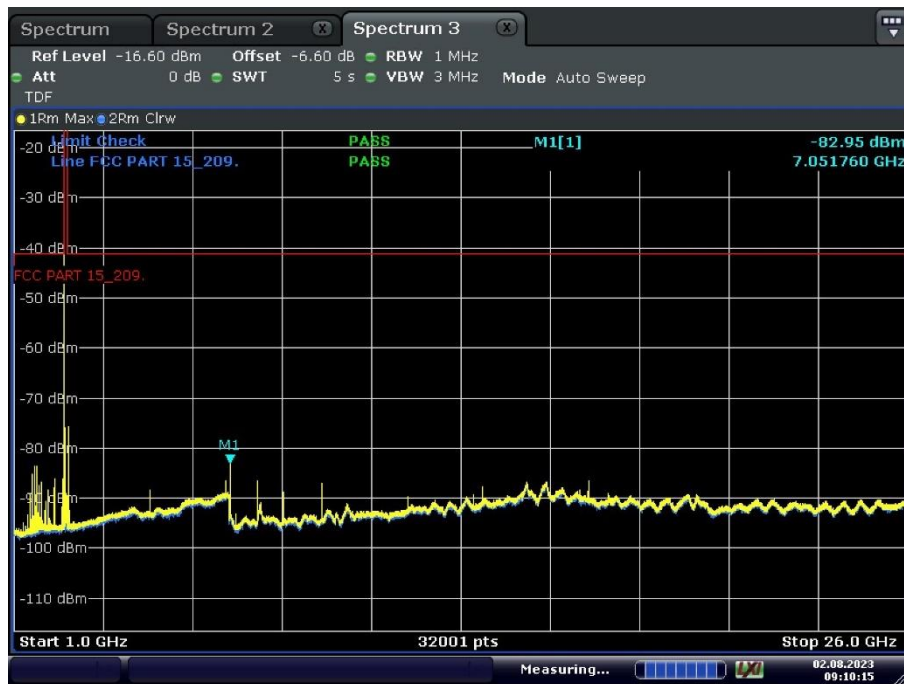
Date: 2.AUG.2023 09:04:46

BLE Low Channel 1M PHY (9kHz to 30MHz)



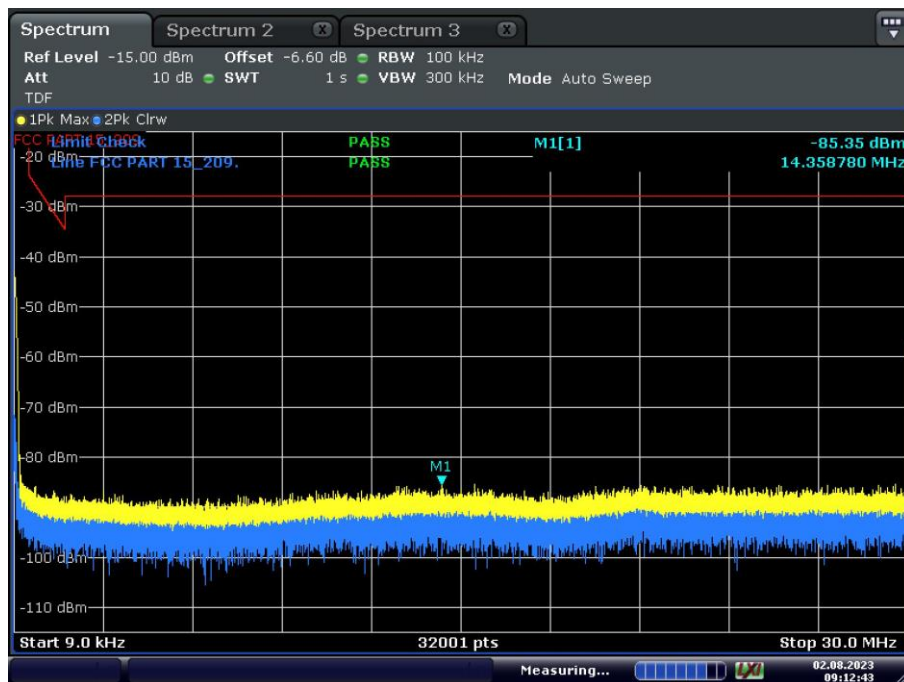
Date: 2.AUG.2023 09:05:12

BLE Low Channel 1M PHY (30MHz to 1GHz)



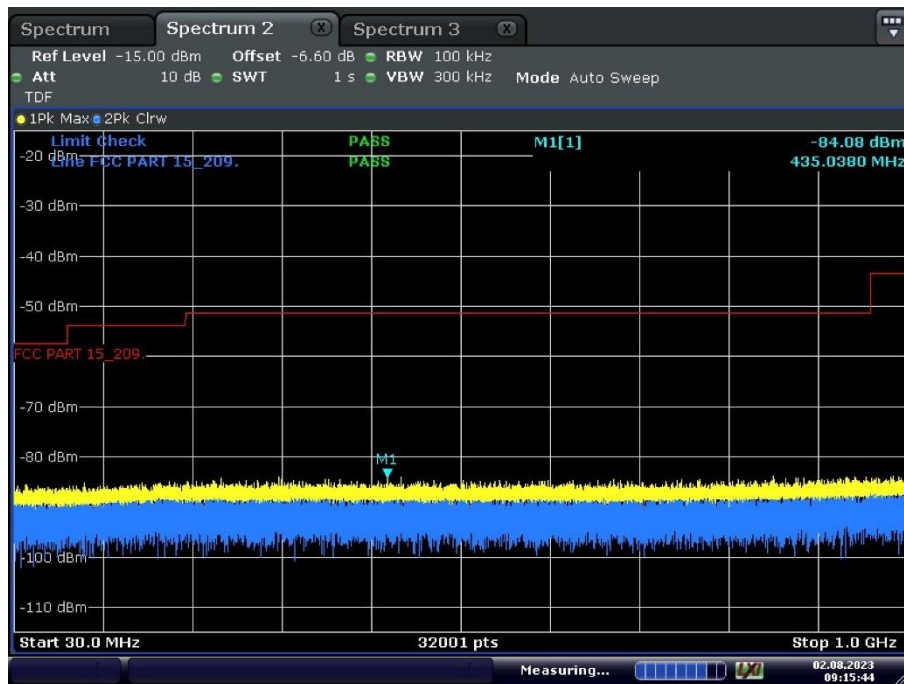
Date: 2.AUG.2023 09:10:15

BLE Low Channel 1M PHY (1GHz to 26GHz)



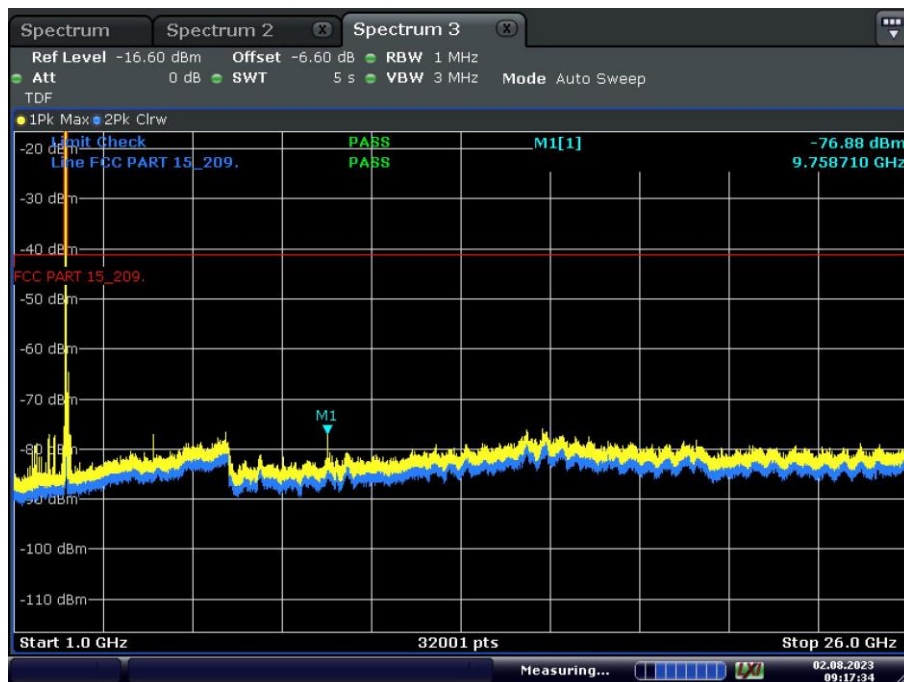
Date: 2.AUG.2023 09:12:43

BLE Mid Channel 1M PHY (9kHz to 30MHz)



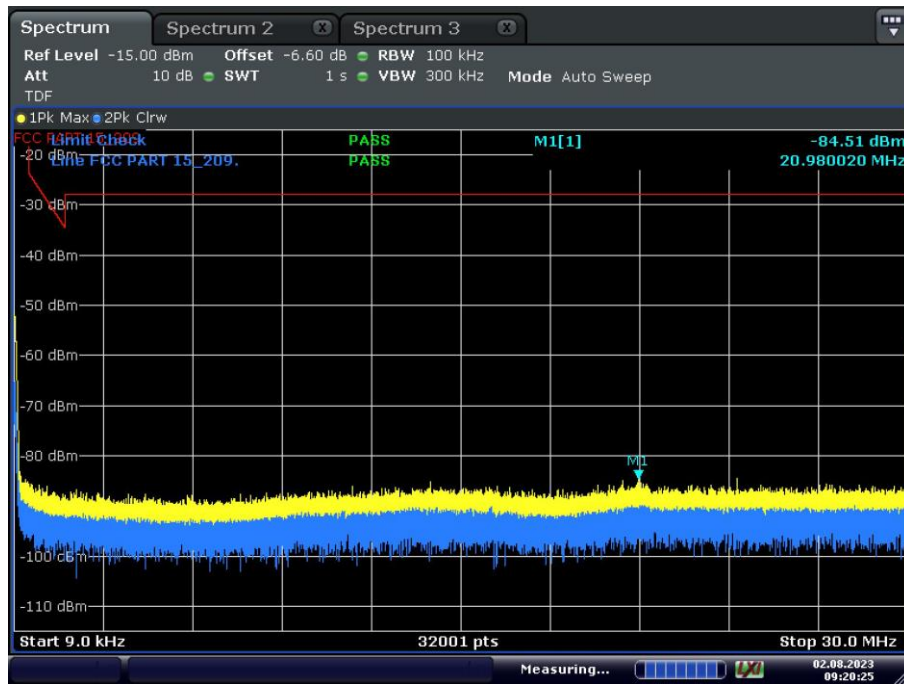
Date: 2.AUG.2023 09:15:45

BLE Mid Channel 1M PHY (30MHz to 1GHz)



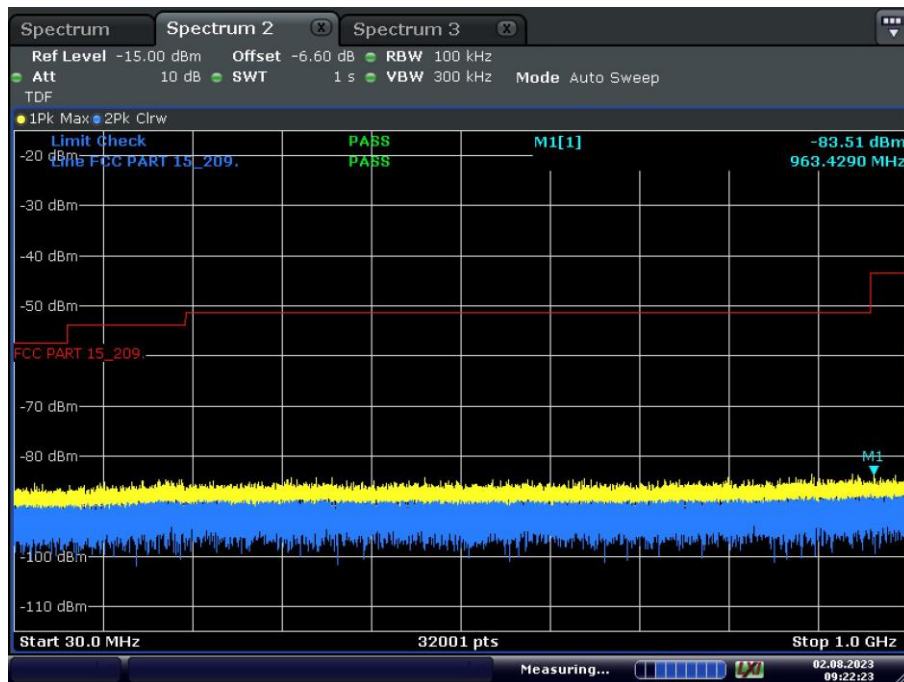
Date: 2.AUG.2023 09:17:34

BLE Mid Channel 1M PHY (1GHz to 26GHz)



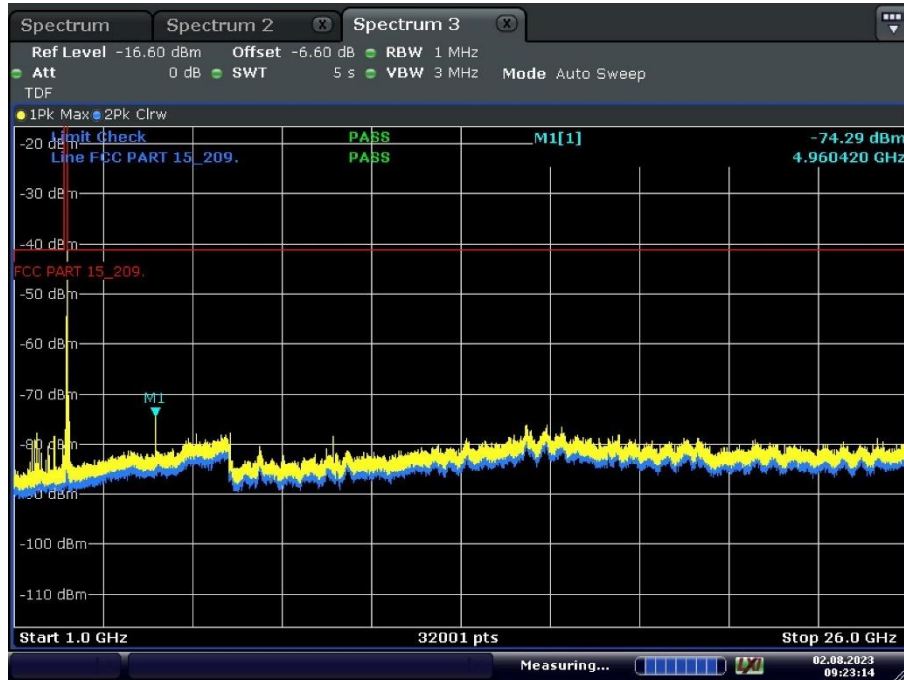
Date: 2.AUG.2023 09:20:25

BLE High Channel 1M PHY (9kHz to 30MHz)



Date: 2.AUG.2023 09:22:23

BLE High Channel 1M PHY (30MHz to 1GHz)



Date: 2.AUG.2023 09:23:15

BLE High Channel 1M PHY (1GHz to 26GHz)



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: 560311000040 / Default Test Configuration

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

July 27, 2023 / OC

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	24.6 °C
Relative Humidity	52.9 %
ATM Pressure	99.8 kPa

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	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 μ s	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	0.50 dB	0.50 dB
Run	6 / 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 μ s	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	0.50 dB	0.50 dB
Run	5 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.00 dB	0.50 dB

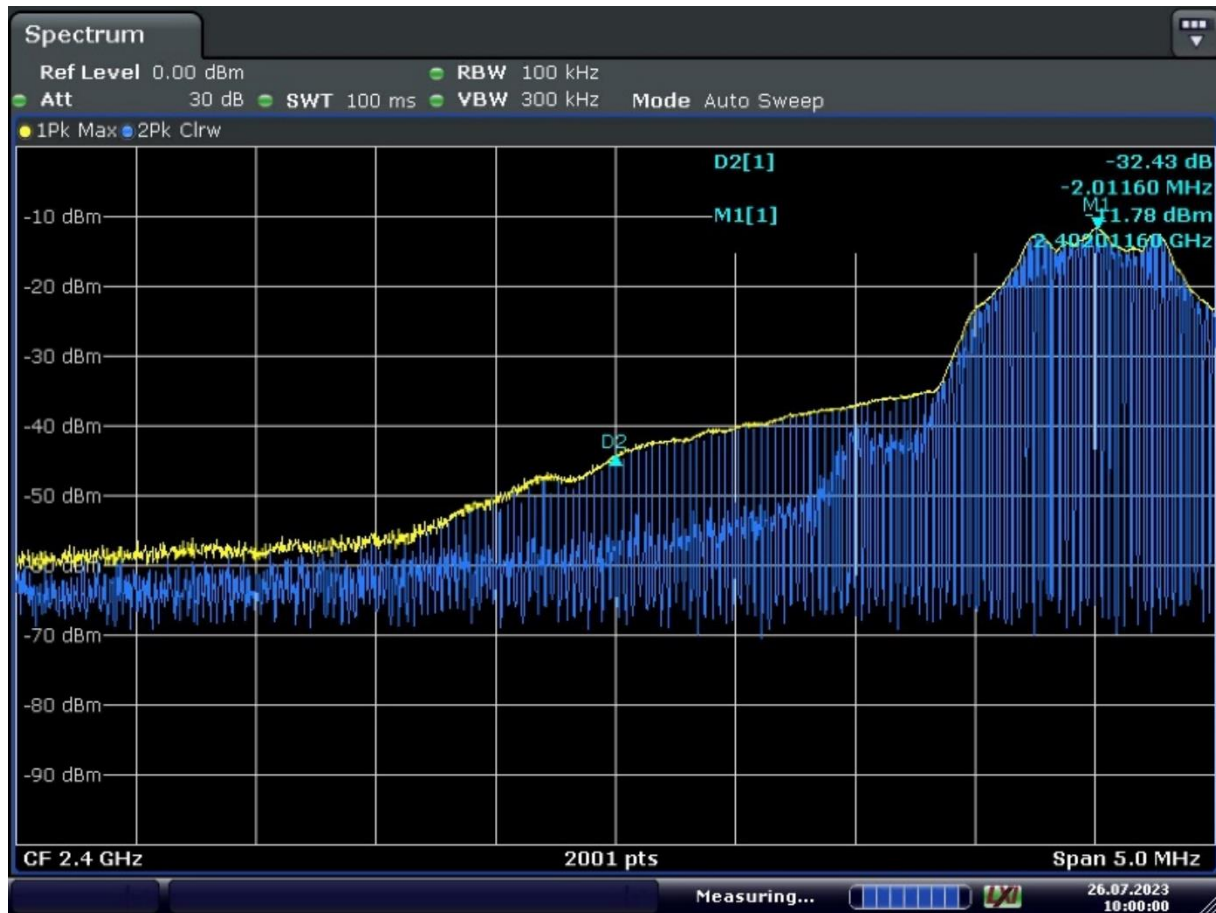
2.6.9 Test Results (Lower Band Edge 1M PHY)

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2400.00	-44.21	12.43	-31.78	PASS

2.6.10 Test Results (Upper Band Edge 1M PHY)

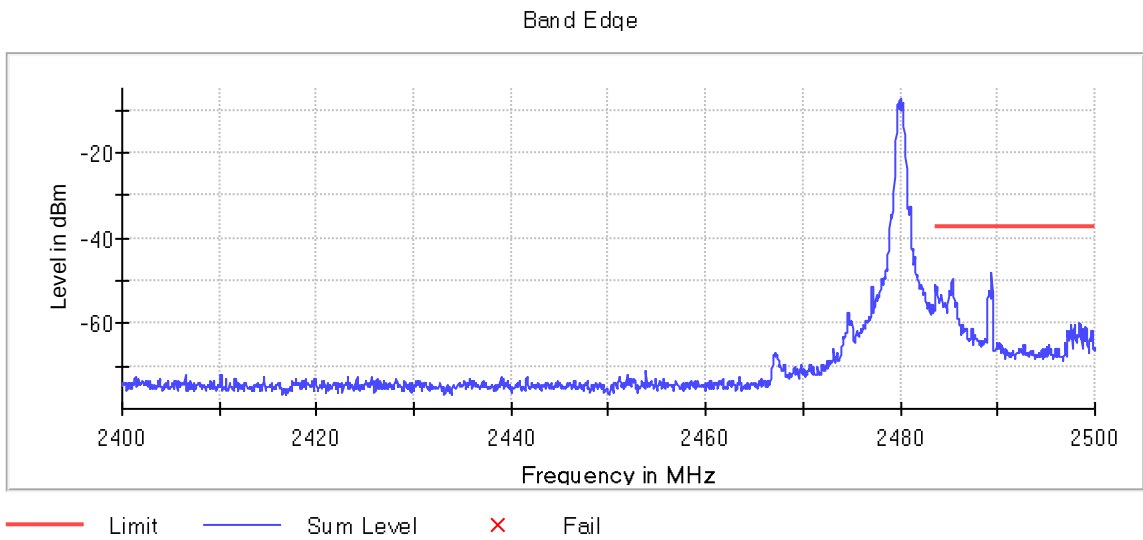
Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2489.375000	-48.1	10.6	-37.5	PASS
2489.425000	-48.6	11.1	-37.5	PASS
2489.325000	-49.2	11.7	-37.5	PASS
2485.325000	-49.6	12.1	-37.5	PASS
2485.375000	-49.7	12.2	-37.5	PASS
2485.275000	-50.3	12.8	-37.5	PASS
2483.525000	-50.8	13.3	-37.5	PASS
2489.275000	-50.9	13.4	-37.5	PASS
2485.425000	-51.1	13.6	-37.5	PASS
2483.825000	-51.3	13.8	-37.5	PASS
2483.775000	-51.5	14.0	-37.5	PASS
2483.575000	-52.1	14.6	-37.5	PASS
2485.225000	-52.1	14.6	-37.5	PASS
2489.125000	-52.1	14.6	-37.5	PASS
2489.075000	-52.2	14.7	-37.5	PASS

2.6.11 Test Plots



Date: 26.JUL.2023 09:59:59

Bluetooth LE Low Band Edge 2400MHz 1M PHY



Bluetooth LE Upper Band Edge 2483.5MHz 1M PHY



2.6.12 Upper band edge calculation (2483.5 MHz) within Restricted Band for 1M PHY:

- 2483.525000 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.

$$\begin{aligned} E(\text{dB}\mu\text{V/m}) &= \text{EIRP (dBm)} + 95.2 \\ &= (-50.0 \text{ dBm} + 2.8 \text{ dBi antenna gain}) + 95.2 \\ &= 48.0 \text{ dB}\mu\text{V/m @ 3 meters (Peak complies with 54 dB}\mu\text{V/m Average limit)} \end{aligned}$$



2.7 RADIATED SPURIOUS EMISSIONS

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: 560311000040 / Default Test Configuration

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

July 10 to 13, 2023 / OC

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 (Mira Mesa Facility)

Ambient Temperature	25.2 – 26.7 °C
Relative Humidity	42.1 – 45.6 %
ATM Pressure	99.8 – 99.9 kPa

2.7.7 Additional Observations

- This is a radiated test. The spectrum was searched from 9kHz 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 Channel presented below 1GHz. There are no significant differences in emissions between channels when verifying cabinet spurious emissions.
- Antenna port terminated with 50 Ω load. Emissions coming out of the cabinet being verified.

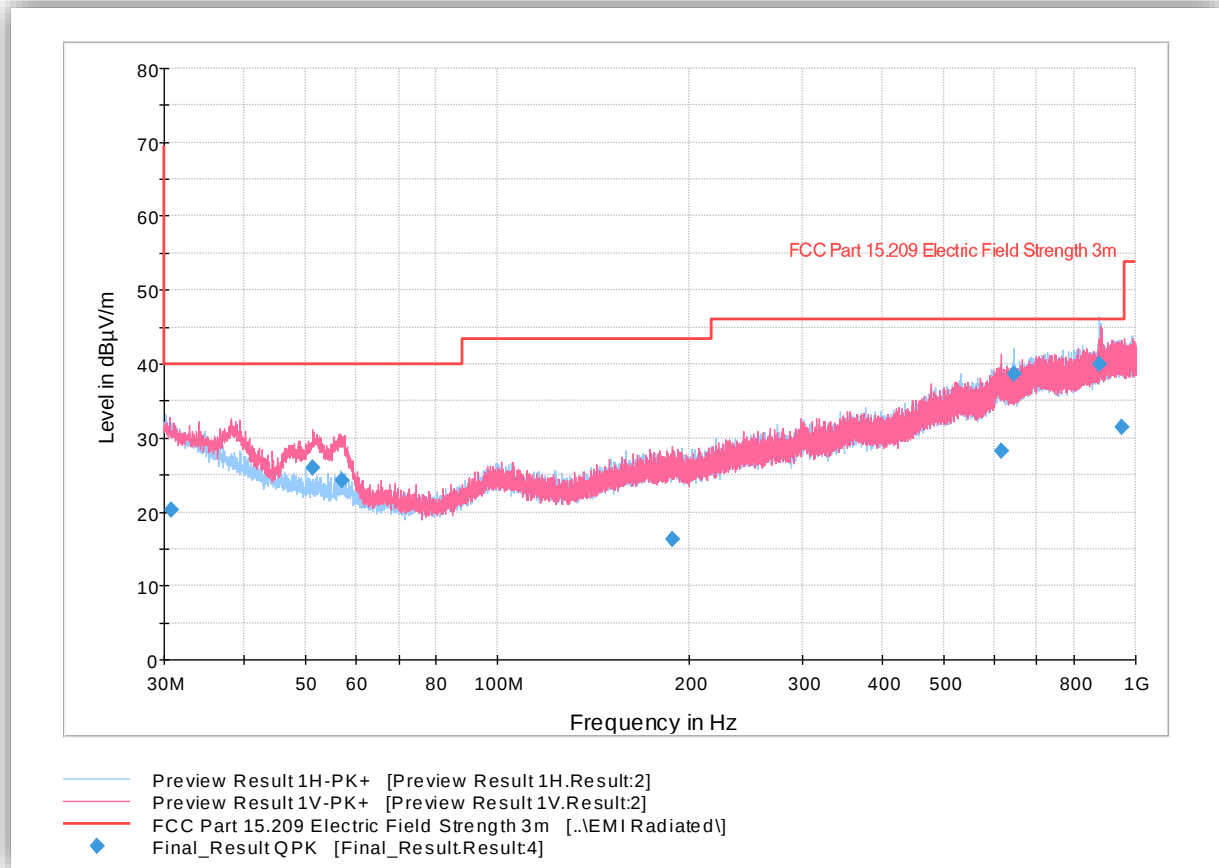


- Measurement was done using EMC32 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only. See Section 2.7.8 for sample computation.

2.7.8 Sample Computation (Radiated Emission)

Measuring equipment raw measurement (db μ V) @ 30 MHz			-0.8
Correction Factor (dB/m)	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 (db μ V/m) @ 30MHz			11.8

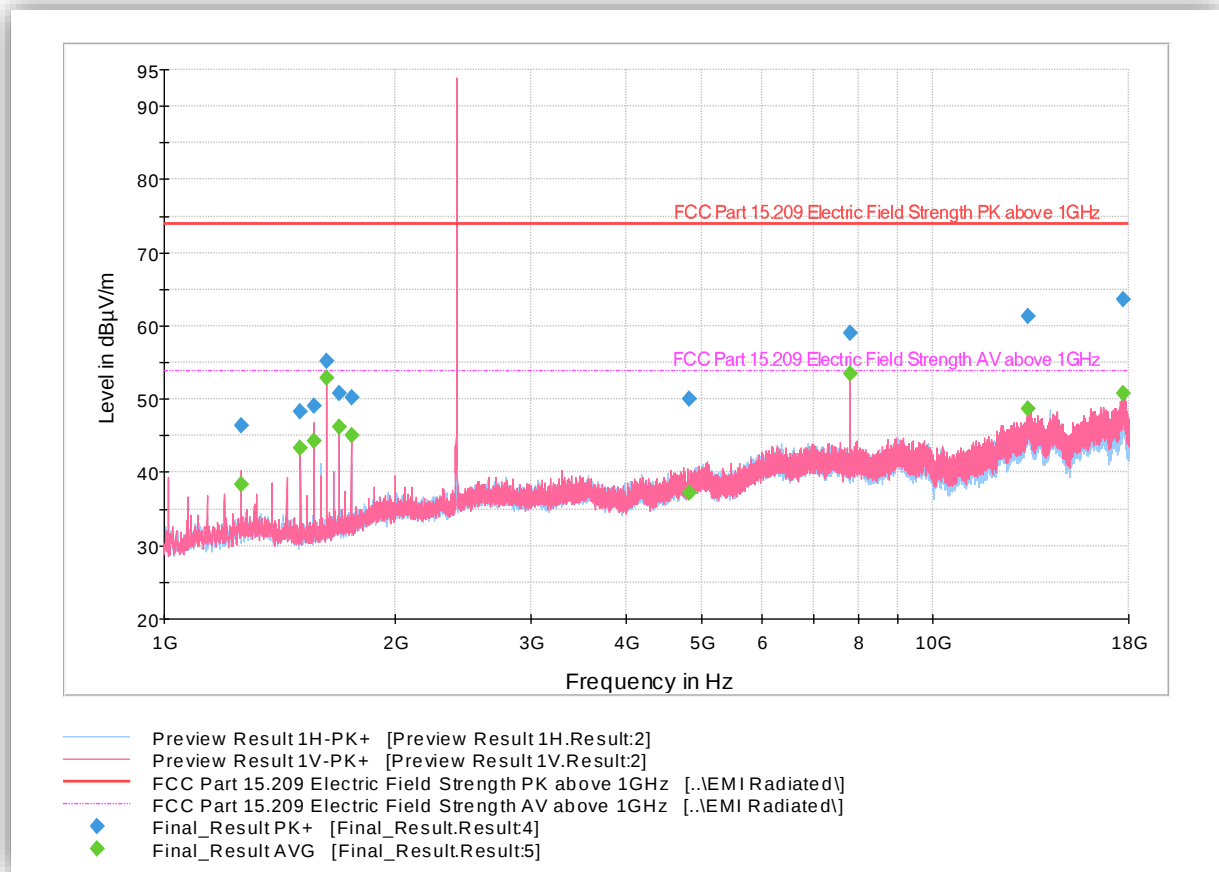
2.7.9 Test Results for 30MHz to 1GHz



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)
30.840000	20.35	40.00	19.65	1000.	120.000	114.0	H	182.0	22
51.227667	26.00	40.00	14.00	1000.	120.000	112.0	V	20.0	14
56.898000	24.32	40.00	15.68	1000.	120.000	205.0	V	139.0	14
187.39600	16.32	43.50	27.18	1000.	120.000	400.0	V	276.0	17
616.84500	28.20	46.00	17.80	1000.	120.000	112.0	V	57.0	27
645.10166	38.59	46.00	7.41	1000.	120.000	115.0	H	37.0	27
878.88800	39.99	46.00	6.01	1000.	120.000	253.0	H	80.0	30
951.38333	31.39	46.00	14.61	1000.	120.000	390.0	V	51.0	31

2.7.10 Test Results for 1GHz to 18GHz Low Channel



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)
1259.33333	46.46	73.90	27.44	1000.0	1000.000	207.0	V	202.0	0
1505.10000	48.28	73.90	25.62	1000.0	1000.000	234.0	H	239.0	0
1566.86666	49.02	73.90	24.88	1000.0	1000.000	330.0	V	211.0	0
1628.06666	55.19	73.90	18.71	1000.0	1000.000	175.0	V	198.0	1
1689.66666	50.89	73.90	23.01	1000.0	1000.000	205.0	H	239.0	1
1751.03333	50.17	73.90	23.73	1000.0	1000.000	140.0	V	198.0	2
4811.83333	49.97	73.90	23.93	1000.0	1000.000	155.0	V	343.0	7
7800.20000	58.95	73.90	14.95	1000.0	1000.000	285.0	V	216.0	12
13300.3000	61.42	73.90	12.48	1000.0	1000.000	171.0	V	45.0	18
17737.4666	63.64	73.90	10.26	1000.0	1000.000	348.0	V	328.0	24

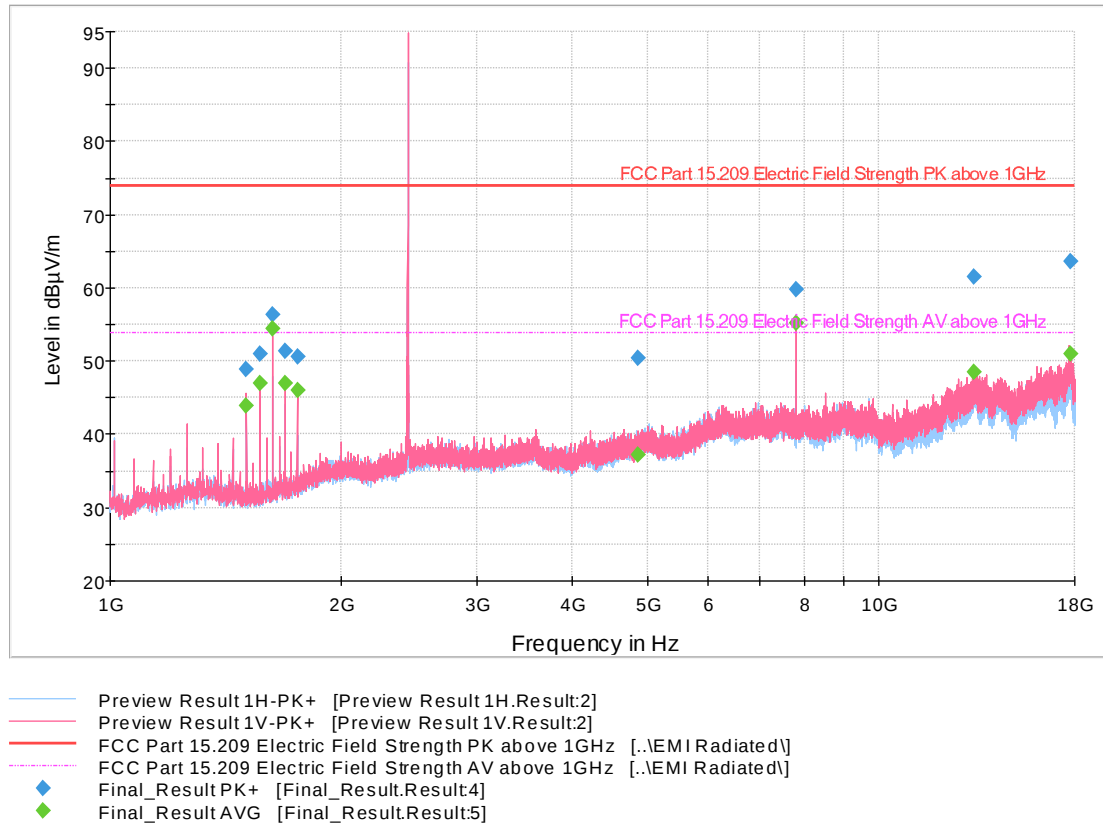


Average Data

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1259.33333	38.36	53.90	15.54	1000.0	1000.000	207.0	V	202.0	0
1505.10000	43.43	53.90	10.47	1000.0	1000.000	234.0	H	239.0	0
1566.86666	44.30	53.90	9.60	1000.0	1000.000	330.0	V	211.0	0
1628.06666	52.94	53.90	0.96	1000.0	1000.000	175.0	V	198.0	1
1689.66666	46.13	53.90	7.77	1000.0	1000.000	205.0	H	239.0	1
1751.03333	45.00	53.90	8.90	1000.0	1000.000	140.0	V	198.0	2
4811.83333	37.13	53.90	16.77	1000.0	1000.000	155.0	V	343.0	7
7800.20000	53.57	53.90	0.33	1000.0	1000.000	285.0	V	216.0	12
13300.3000	48.66	53.90	5.24	1000.0	1000.000	171.0	V	45.0	18
17737.4666	50.75	53.90	3.15	1000.0	1000.000	348.0	V	328.0	24

Test Notes: Fundamental will be ignored for this test (antenna port terminated).

2.7.11 Test Results for 1GHz to 18GHz Mid Channel



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)
1505.10000	48.96	73.90	24.94	1000.0	1000.000	225.0	V	198.0	0
1566.86666	51.06	73.90	22.84	1000.0	1000.000	175.0	V	185.0	0
1628.06666	56.37	73.90	17.53	1000.0	1000.000	175.0	V	194.0	1
1689.83333	51.33	73.90	22.57	1000.0	1000.000	158.0	V	194.0	1
1751.03333	50.58	73.90	23.32	1000.0	1000.000	140.0	V	188.0	2
4870.16666	50.48	73.90	23.42	1000.0	1000.000	155.0	V	28.0	7
7800.20000	59.85	73.90	14.05	1000.0	1000.000	365.0	V	178.0	12
13330.5666	61.55	73.90	12.35	1000.0	1000.000	175.0	V	123.0	18
17744.4666	63.57	73.90	10.33	1000.0	1000.000	206.0	V	326.0	24

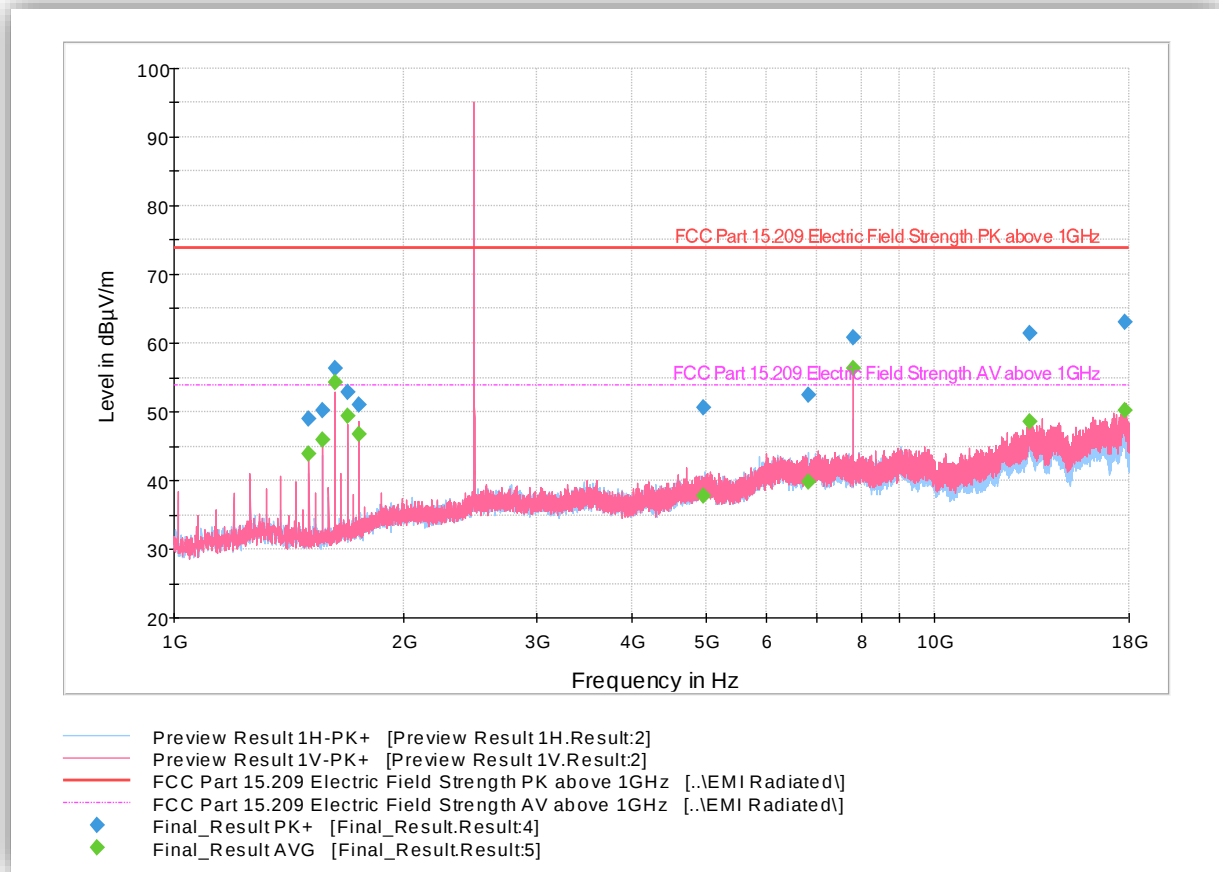
Average Data

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1505.10000	43.82	53.90	10.08	1000.0	1000.000	225.0	V	198.0	0
1566.86666	47.02	53.90	6.88	1000.0	1000.000	175.0	V	185.0	0
1628.06666	54.36	53.90	-0.46	1000.0	1000.000	175.0	V	194.0	1
1689.83333	47.00	53.90	6.90	1000.0	1000.000	158.0	V	194.0	1
1751.03333	45.94	53.90	7.96	1000.0	1000.000	140.0	V	188.0	2
4870.16666	37.31	53.90	16.59	1000.0	1000.000	155.0	V	28.0	7
7800.20000	55.14	53.90	-1.24	1000.0	1000.000	365.0	V	178.0	12
13330.5666	48.45	53.90	5.45	1000.0	1000.000	175.0	V	123.0	18
17744.4666	50.93	53.90	2.97	1000.0	1000.000	206.0	V	326.0	24

Test Notes: Fundamental will be ignored for this test (antenna port terminated).

Failing frequencies (1628.06666MHz and 7800.2 MHz) are not in the restricted bands and are not generated by the BLE radio.

2.7.12 Test Results for 1GHz to 18GHz High Channel



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)
1505.10000	49.02	73.90	24.88	1000.0	1000.000	244.0	V	204.0	0
1566.86666	50.18	73.90	23.73	1000.0	1000.000	161.0	V	192.0	0
1628.06666	56.43	73.90	17.47	1000.0	1000.000	175.0	V	191.0	1
1689.66666	52.89	73.90	21.01	1000.0	1000.000	167.0	V	195.0	1
1751.03333	50.98	73.90	22.92	1000.0	1000.000	175.0	V	202.0	2
4970.63333	50.64	73.90	23.26	1000.0	1000.000	356.0	H	146.0	8
6818.66666	52.43	73.90	21.47	1000.0	1000.000	255.0	H	28.0	10
7800.20000	60.82	73.90	13.08	1000.0	1000.000	335.0	V	175.0	12
13300.6666	61.34	73.90	12.56	1000.0	1000.000	335.0	V	144.0	18
17803.9000	62.96	73.90	10.94	1000.0	1000.000	317.0	V	264.0	23

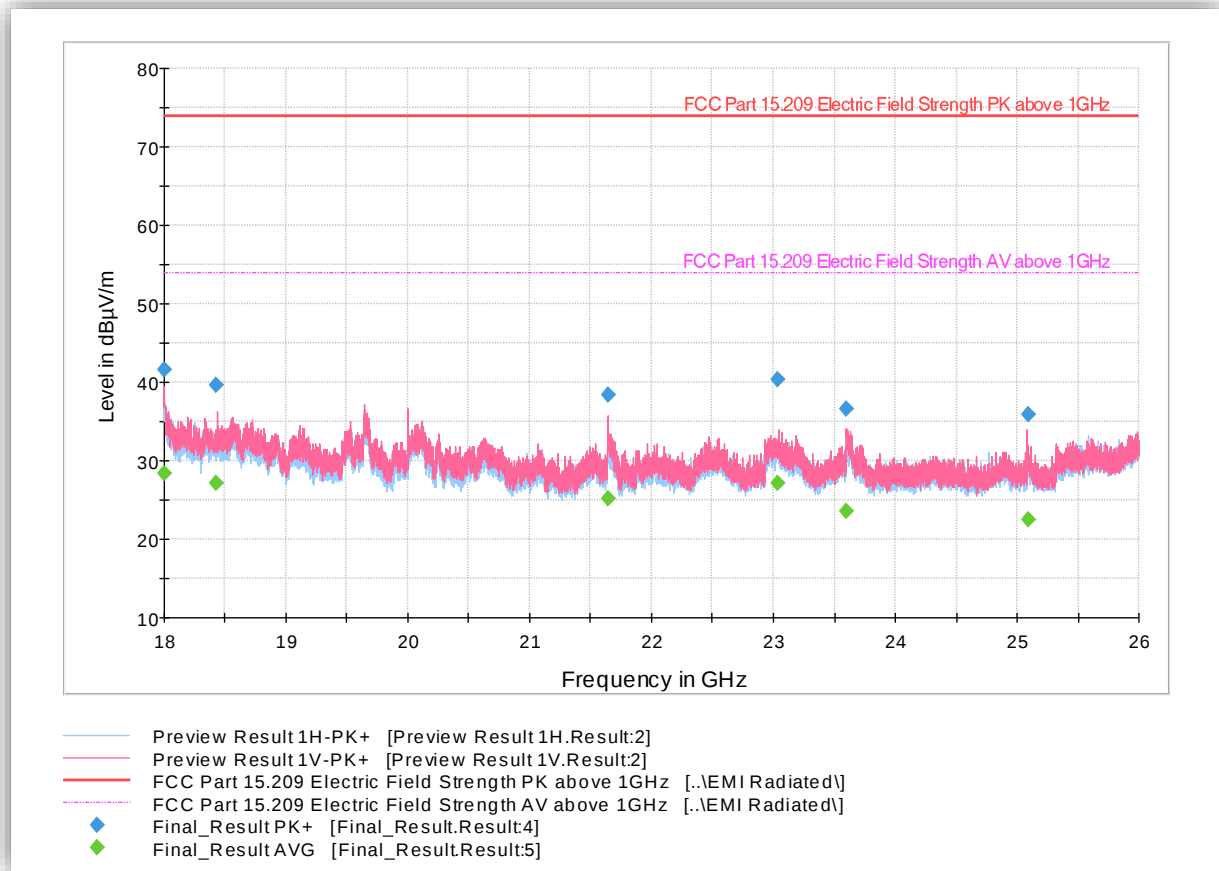
Average Data

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1505.10000	43.95	53.90	9.95	1000.0	1000.000	244.0	V	204.0	0
1566.86666	45.91	53.90	7.99	1000.0	1000.000	161.0	V	192.0	0
1628.06666	54.21	53.90	-0.31	1000.0	1000.000	175.0	V	191.0	1
1689.66666	49.43	53.90	4.47	1000.0	1000.000	167.0	V	195.0	1
1751.03333	46.83	53.90	7.07	1000.0	1000.000	175.0	V	202.0	2
4970.63333	37.75	53.90	16.15	1000.0	1000.000	356.0	H	146.0	8
6818.66666	39.81	53.90	14.09	1000.0	1000.000	255.0	H	28.0	10
7800.20000	56.23	53.90	-2.33	1000.0	1000.000	335.0	V	175.0	12
13300.6666	48.51	53.90	5.39	1000.0	1000.000	335.0	V	144.0	18
17803.9000	50.28	53.90	3.62	1000.0	1000.000	317.0	V	264.0	23

Test Notes: Fundamental will be ignored for this test (antenna port terminated).

Failing frequencies (1628.06666MHz and 7800.2 MHz) are not in the restricted bands and are not generated by the BLE radio.

2.7.13 Test Results for 18GHz to 26GHz Low Channel



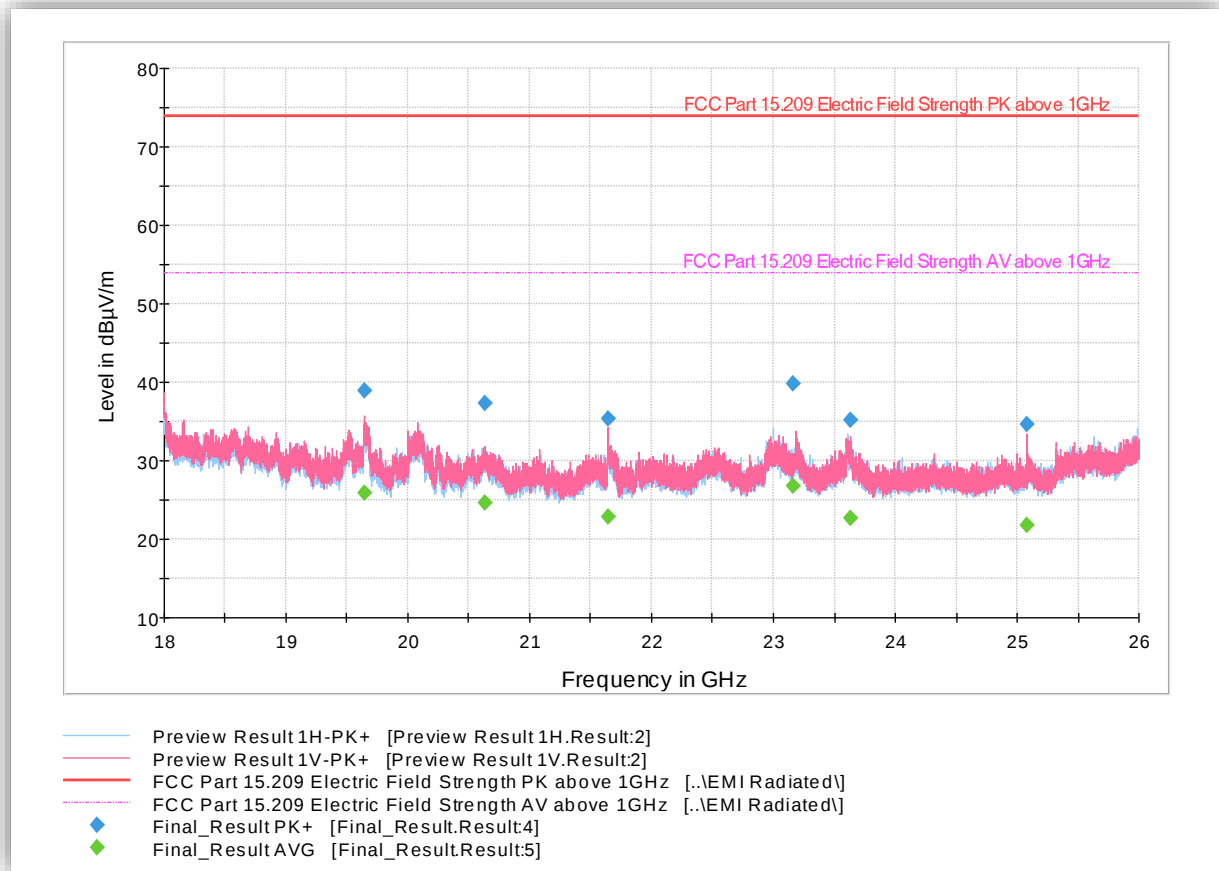
Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
18004.4537	41.53	73.90	32.37	1000.0	1000.000	137.0	V	185.0	-2
18430.0690	39.66	73.90	34.24	1000.0	1000.000	162.0	V	324.0	-3
21647.2820	38.43	73.90	35.47	1000.0	1000.000	139.0	V	293.0	-2
23038.5945	40.45	73.90	33.45	1000.0	1000.000	200.0	V	138.0	0
23593.2675	36.67	73.90	37.23	1000.0	1000.000	139.0	V	302.0	-1
25089.3940	35.94	73.90	37.96	1000.0	1000.000	162.0	V	241.0	-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)
18004.4537	28.35	53.90	25.55	1000.0	1000.000	137.0	V	185.0	-2
18430.0690	27.20	53.90	26.70	1000.0	1000.000	162.0	V	324.0	-3
21647.2820	25.17	53.90	28.73	1000.0	1000.000	139.0	V	293.0	-2
23038.5945	27.19	53.90	26.71	1000.0	1000.000	200.0	V	138.0	0
23593.2675	23.50	53.90	30.40	1000.0	1000.000	139.0	V	302.0	-1
25089.3940	22.49	53.90	31.41	1000.0	1000.000	162.0	V	241.0	-1

2.7.14 Test Results for 18GHz to 26GHz Mid Channel



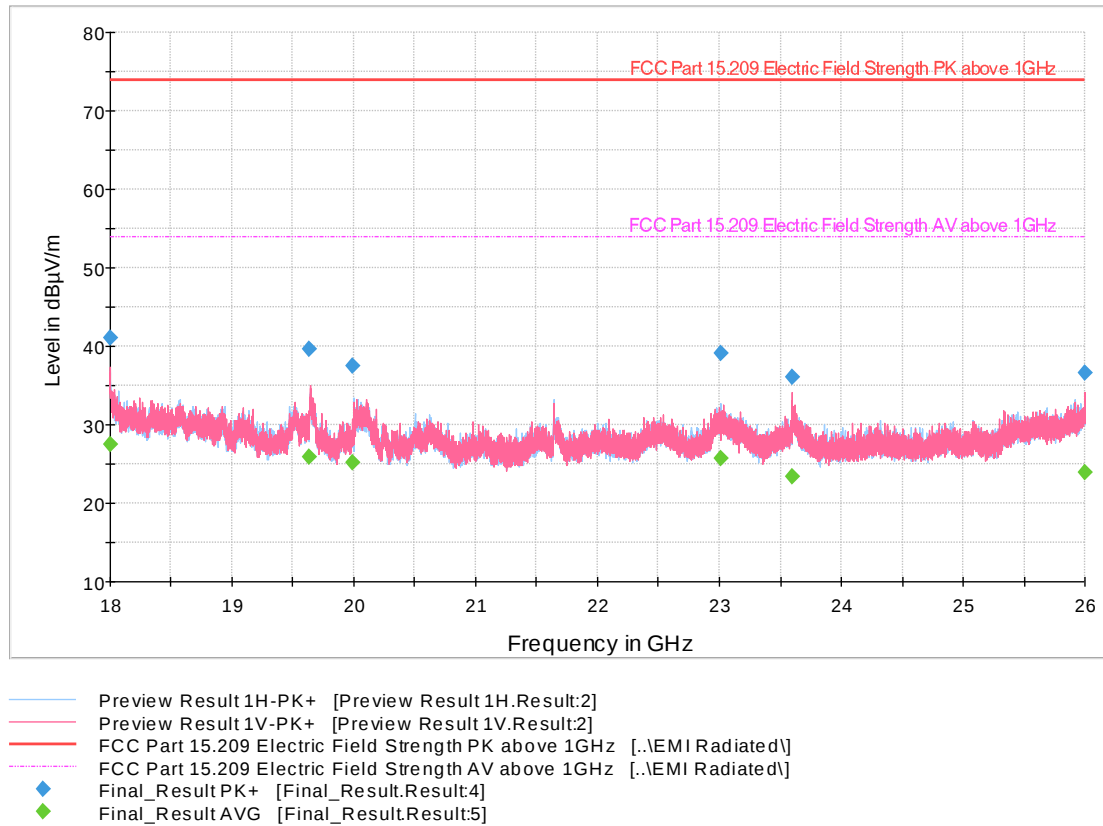
Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
19639.1160	38.87	73.90	35.03	1000.0	1000.000	139.0	V	178.0	-3
20627.1740	37.38	73.90	36.52	1000.0	1000.000	162.0	V	302.0	-3
21648.6560	35.33	73.90	38.57	1000.0	1000.000	162.0	V	284.0	-2
23156.9305	39.87	73.90	34.03	1000.0	1000.000	212.0	H	30.0	0
23636.2900	35.18	73.90	38.72	1000.0	1000.000	162.0	V	308.0	-1
25079.7480	34.63	73.90	39.27	1000.0	1000.000	162.0	V	29.0	-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)
19639.1160	25.96	53.90	27.94	1000.0	1000.000	139.0	V	178.0	-3
20627.1740	24.73	53.90	29.17	1000.0	1000.000	162.0	V	302.0	-3
21648.6560	22.83	53.90	31.07	1000.0	1000.000	162.0	V	284.0	-2
23156.9305	26.86	53.90	27.04	1000.0	1000.000	212.0	H	30.0	0
23636.2900	22.67	53.90	31.23	1000.0	1000.000	162.0	V	308.0	-1
25079.7480	21.86	53.90	32.05	1000.0	1000.000	162.0	V	29.0	-1

2.7.15 Test Results for 18GHz to 26GHz High Channel



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)
18004.8422	41.11	73.90	32.79	1000.0	1000.000	213.0	V	196.0	-2
19635.4095	39.66	73.90	34.24	1000.0	1000.000	156.0	V	41.0	-3
19993.4410	37.54	73.90	36.36	1000.0	1000.000	139.0	H	301.0	-3
23016.7930	39.11	73.90	34.79	1000.0	1000.000	189.0	H	281.0	0
23600.8450	36.08	73.90	37.82	1000.0	1000.000	203.0	V	194.0	-1
25995.3944	36.60	73.90	37.30	1000.0	1000.000	158.0	V	51.0	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)
18004.8422	27.56	53.90	26.34	1000.0	1000.000	213.0	V	196.0	-2
19635.4095	25.81	53.90	28.09	1000.0	1000.000	156.0	V	41.0	-3
19993.4410	25.14	53.90	28.76	1000.0	1000.000	139.0	H	301.0	-3
23016.7930	25.80	53.90	28.10	1000.0	1000.000	189.0	H	281.0	0
23600.8450	23.33	53.90	30.57	1000.0	1000.000	203.0	V	194.0	-1
25995.3944	23.97	53.90	29.93	1000.0	1000.000	158.0	V	51.0	1



2.8 POWER SPECTRAL DENSITY

2.8.1 Specification Reference

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

2.8.2 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.

2.8.3 Equipment Under Test and Modification State

Serial No: 560311000040 / Default Test Configuration

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

July 27, 2023 / OC

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 (Rancho Bernardo Satellite Facility)

Ambient Temperature	24.6 °C
Relative Humidity	52.9 %
ATM Pressure	99.8 kPa

2.8.7 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.

2.8.8 Test Results Summary

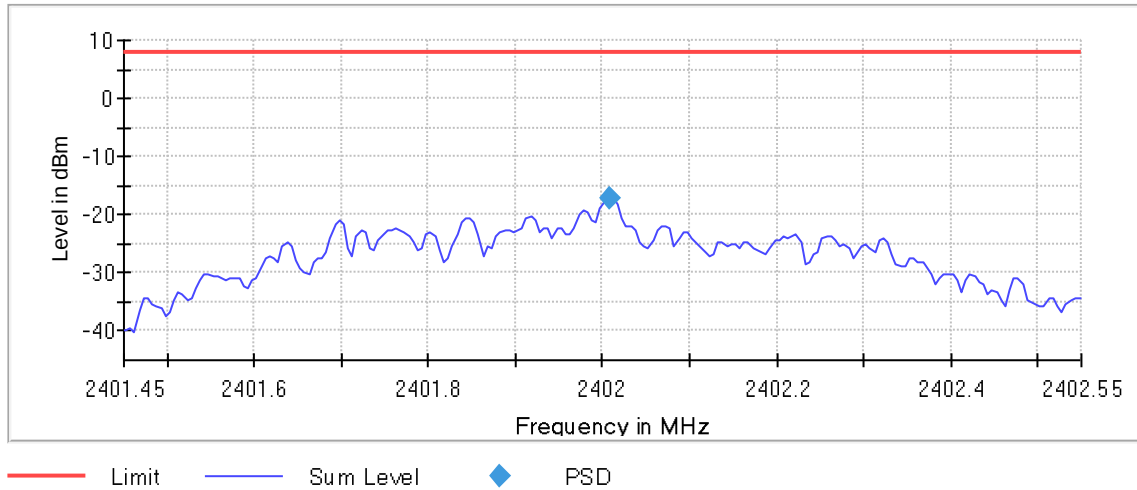
DUT Frequency (MHz)	PHY	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2402.000000	1M	2402.007493	-17.063	8.0	PASS
2440.000000	1M	2440.007495	-12.430	8.0	PASS
2480.000000	1M	2480.007493	-8.410	8.0	PASS

2.8.9 Sample Measurement Settings

Setting	Instrument Value	Target Value
Span	1.099 MHz	1.099 MHz
RBW	10.000 kHz	<= 10.000 kHz
VBW	30.000 kHz	>= 30.000 kHz
SweepPoints	220	~ 220
Sweeptime	1.100 ms	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	Sweep	Sweep
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	3 / max. 150	max. 150
Stable	2 / 2	2
Max Stable Difference	0.30 dB	0.50 dB

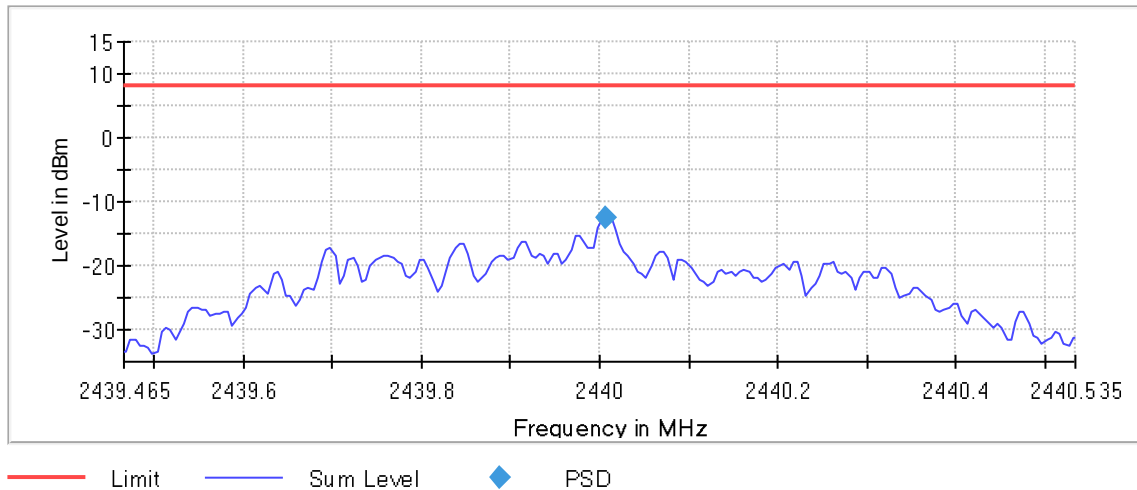
2.8.10 Test Plots

Peak Power Spectral Density



Bluetooth LE Low Channel

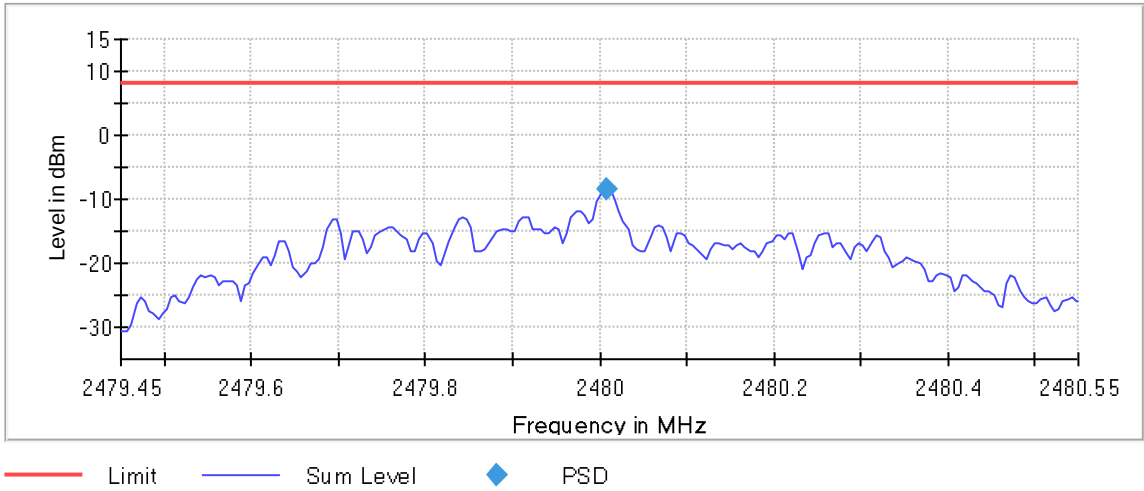
Peak Power Spectral Density



Bluetooth LE Mid Channel



Peak Power Spectral Density



Bluetooth LE High Channel



SECTION 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
Conducted Port Setup						
7643	Signal/Spectrum Analyzer	FSV30	1321.3008K3 0/103166	Rhode & Schwarz	12/21/22	03/20/24
7655	Vector Signal Generator	SMBV100A	260734	Rhode & Schwarz	12/21/22	12/21/23
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	
AC Conducted Emissions						
6836	LISN	FCC-LISN-50-25-2	05024	Fischer Custom Comm.	04/14/23	04/14/24
8824	Bi-Directional Attenuator	34-20-34	BP4150	MCE / Weinschel	05/31/23	05/31/24
8822	Bi-Directional Attenuator	34-20-34	BP4180	MCE / Weinschel	05/31/23	05/31/24
56393	EMI Test Receiver	ESR7	102585	Rhode & Schwarz	04/04/23	04/04/24
Radiated Emission						
7620	EMI Test Receiver	ESU40	100399	Rohde & Schwarz	08/05/22	08/05/23
1002	BiConiLog Antenna	3142C	00058717	ETS Lindgren	10/21/21	10/21/23
7631	1-18GHz DRG Horn	3117	00205418	ETS Lindgren	01/05/23	01/05/25
46797	0.5 to 22GHz Preamplifier	PA-122	181925	Com Power	12/03/22	12/03/23
40815	18GHz to 40GHz Low Noise Amplifier	SLKKa-30-6	19D18	Spacek Labs	08/21/22	08/21/23
9001	18-26 GHz Antenna	HO42S	101	Custom Microwave, Inc	09/23/21	09/23/23
Miscellaneous						
43003	True RMS Multimeter	85 III	69880143	Fluke	01/09/23	01/09/24
7554	Temp, Humidity and Barometric Sensor	iBTHX-W	400706	Omega Engineering	16/15/23	06/15/24
7619	Temp, Humidity and Barometric Sensor	iBTHX-W	15050268	Omega Engineering	16/15/23	06/15/24
	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 AC 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		

3.2.2 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	

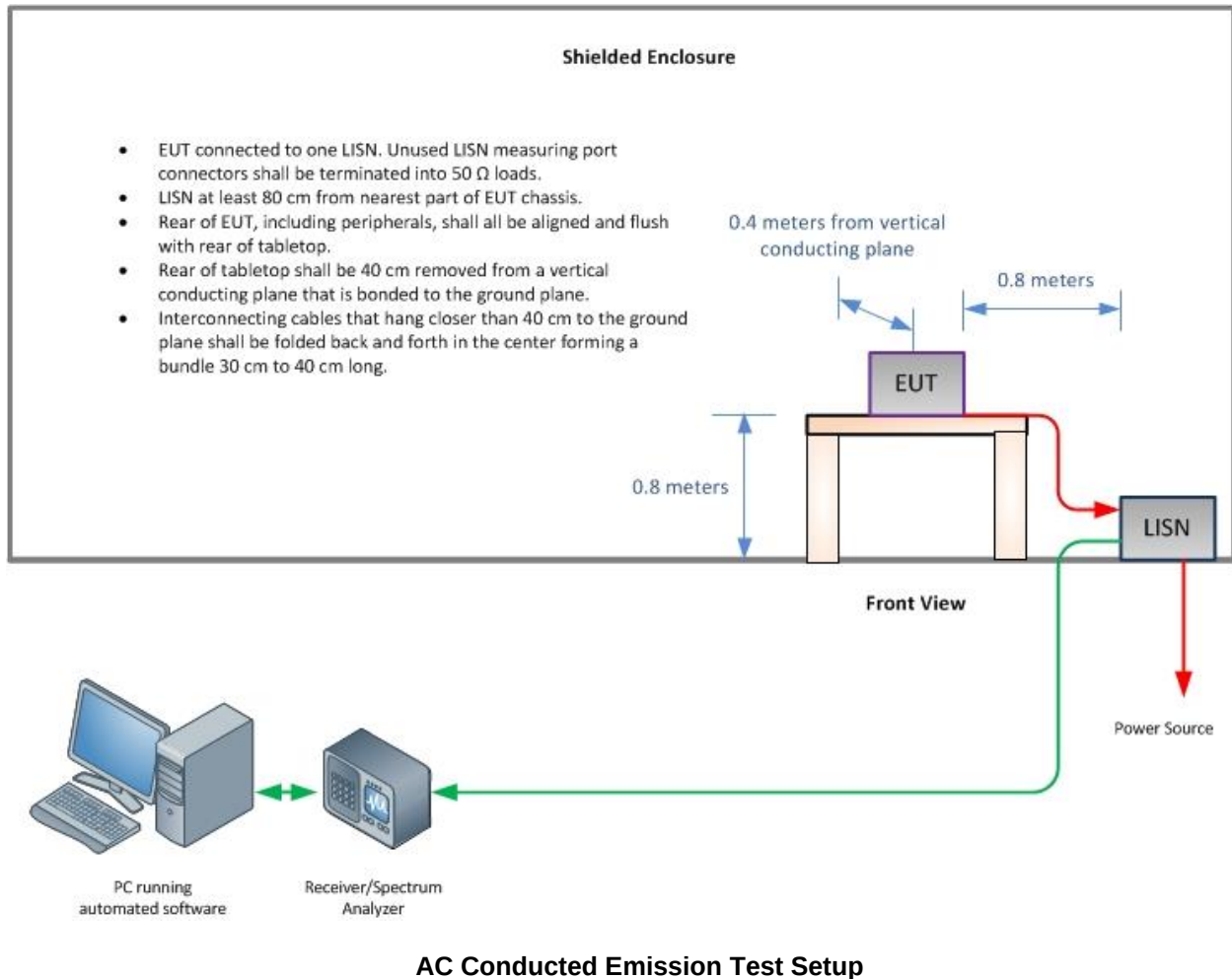
3.2.1 Radiated Emission Measurements (1GHz to 18GHz)

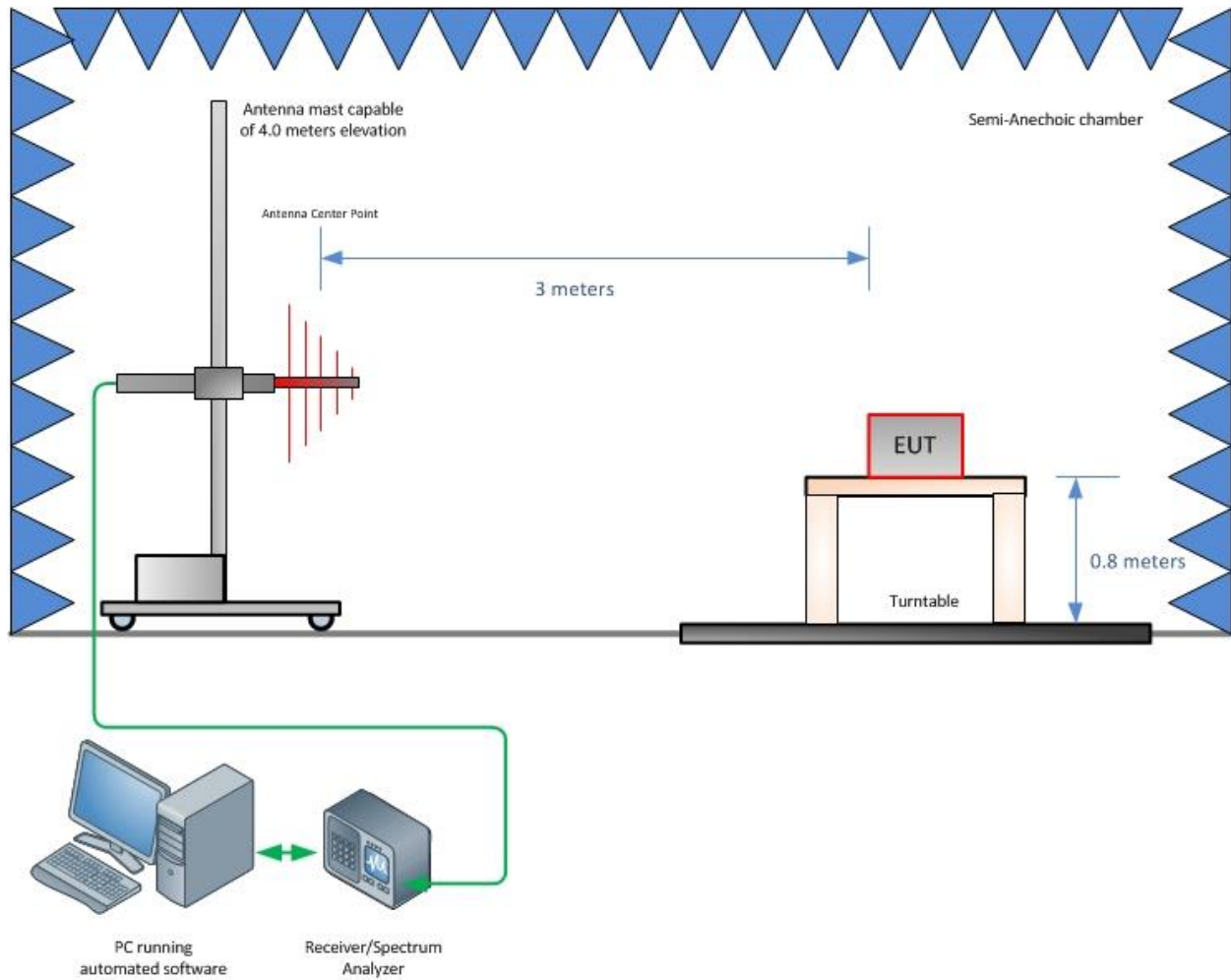
	Input Quantity (Contribution) X_i	Value	Prob. Dist.	Divisor	$u_i(x)$	$u_i(x)^2$
1	Receiver reading	0.10 dB	Normal, k=1	1.000	0.10	0.01
2	Attenuation: antenna-receiver	0.30 dB	Normal, k=2	2.000	0.15	0.02
3	Preamplifier Gain	0.20 dB	Normal, k=2	2.000	0.10	0.01
4	Antenna factor AF	0.47 dB	Normal, k=2	2.000	0.24	0.06
5	Sinewave accuracy	0.15 dB	Normal, k=2	2.000	0.08	0.01
6	Instability of preamp gain	1.21 dB	Rectangular	1.732	0.70	0.49
7	Noise floor proximity	0.70 dB	Rectangular	1.732	0.40	0.16
8	Mismatch: antenna-preamplifier	1.41 dB	U-shaped	1.414	1.00	0.99
9	Mismatch: preamplifier-receiver	1.30 dB	U-shaped	1.414	0.92	0.85
10	AF frequency interpolation	0.30 dB	Rectangular	1.732	0.17	0.03
11	Directivity difference at 3 m	1.50 dB	Rectangular	1.732	0.87	0.75
12	Phase center location at 3 m	0.30 dB	Rectangular	1.732	0.17	0.03
13	Cross-polarization	0.90 dB	Rectangular	1.732	0.52	0.27
14	Site imperfections VSWR (Method 2)	5.53 dB	Triangular	2.000	4.89	1.13
15	Effect of setup table material	1.57 dB	Rectangular	1.732	0.91	0.82
16	Separation distance at 3 m	0.30 dB	Rectangular	1.732	0.17	0.03
17	Table height at 3 m	0.00 dB	Normal, k=2	2.000	0.00	0.00
Combined standard uncertainty				Normal	2.38 dB	
Expanded uncertainty				Normal, k=2	4.76 dB	

SECTION 4

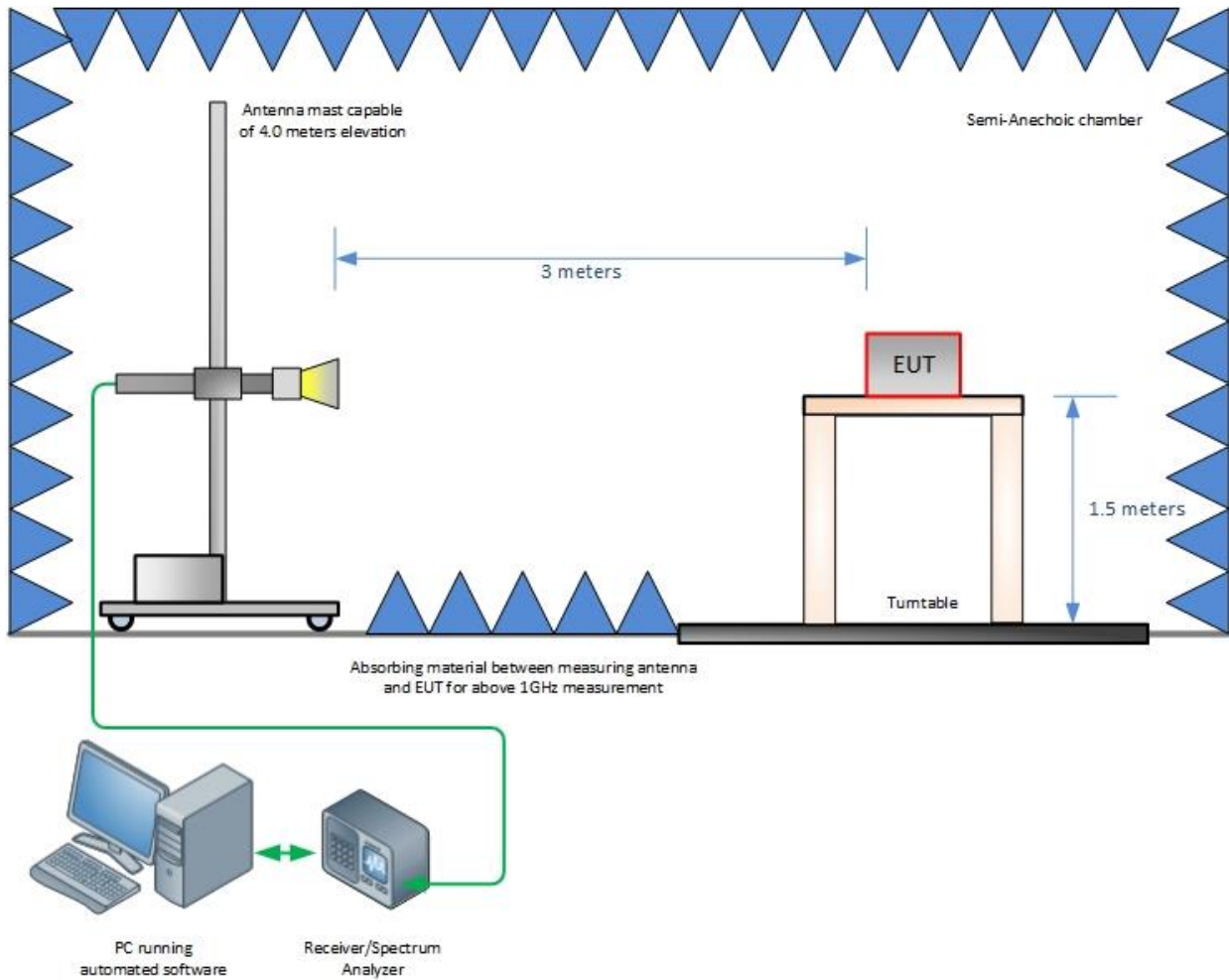
DIAGRAM OF TEST SETUP

4.1 Test Setup Diagram





Radiated Emission Test Setup (Below 1GHz)



Radiated Emission Test Setup (Above 1GHz)



SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT



5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

TÜV SÜD America Inc.'s reports apply only to the specific sample tested under stated test conditions. It is the manufacturer's responsibility to assure the continued compliance of production units of this model. TÜV SÜD America, Inc. shall have no liability for any deductions, inferences or generalizations drawn by the client or others from TÜV SÜD America, Inc.'s issued reports.

This report is the confidential property of the client. As a mutual protection to our clients, the public and TÜV SÜD America, Inc., extracts from the test report shall not be reproduced, except in full without TÜV SÜD America, Inc.'s written approval.

This report must not be used to claim product certification, approval, or endorsement by A2LA, NIST, or any agency of the federal government.

TÜV SÜD America, Inc. and its professional staff hold government and professional organization certifications for AAMI, ACIL, AEA, ANSI, IEEE, A2LA, NIST and VCCI.



A2LA Cert. No. 2955.13

