Radio Testing of the St. Jude Medical Implantable Cardioverter Defibrillator Device Model: Avant™, Neutrino™ NxT, Gallant™ and Entrant™

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

America

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St. Jude Medical
15900 Valley View Court
Sylmar, CA 91342 USA

COMMERCIAL-IN-CONFIDENCE

Date: July 2023
Document Number: 72189670A Issue 02 | Version Number: 01

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Authorized Signatory	Omar Castillo	July 05, 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 Radiated Spurious Emissions requirements.

A2LA Cert. No. 2955.13

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 St. Jude Medical Model: Avant™, Neutrino™ NxT, Gallant™ and Entrant™ (Implantable Cardioverter Defibrillator Device)
TEST REPORT NUMBER	72189670A Issue 02
TEST REPORT DATE	July 2023
PREPARED FOR	St. Jude Medical 15900 Valley View Court Sylmar, CA 91342 USA
CONTACT PERSON	Houman Naeli Senior Design Engineer houman.naeli@abbott.com +1 (818) 493-2789
PREPARED BY	Ferdinand S. Custodio **Name** Authorized Signatory Title: Senior EMC Test Engineer / Wireless Team Lead
APPROVED BY	Omar Castillo **Name** Authorized Signatory Title: Senior EMC/Wireless Test Engineer
DATED	July 05, 2023

Revision History

72189670A Issue 02 St. Jude Medical Model: Avant™, Neutrino™ NxT, Gallant™ and Entrant™ Implantable Cardioverter Defibrillator Device					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
05/19/2023	—	Initial Release			Omar Castillo
07/05/2023	Initial Release	Issue 2	Updated Section 2.1 with conducted power measurements		Omar Castillo

CONTENTS

SECTION 1

REPORT SUMMARY

Radio Testing of the
St. Jude Medical
Avant™, Neutrino™ NxT, Gallant™ and Entrant™ Implantable Cardioverter Defibrillator Device

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Avant™, Neutrino™ NxT, Gallant™ and Entrant™ Implantable Cardioverter Defibrillator 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. The EUT is already certified. The Grantee is seeking Class II Permissive Change due to updated antenna used. All other RF functionalities remained the same.
Manufacturer	St. Jude Medical
EUT	Implantable Cardioverter Defibrillator Device
Model Number	CDVRA700T, CDDRA700T and CDHFA700T (representative sample verified)
Model Name	Avant™, Neutrino™ NxT, Gallant™ and Entrant™
FCC ID	RIAICDRFNGQ
IC Number	7067A-ICDRF
FCC Classification	Low power Communications Device Transmitter (DTS)
Serial Number(s)	210006578 (VR), 210006575 (DR), 210006571 (HF) and BBZ273.1 (Conducted Sample)
Number of Samples Tested	4
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	May 03, 2023
Finish of Test	July 13, 2023
Name of Engineer(s)	Joe Salvador Ferdinand 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.
- OTA_DTM_Hex_Command.xlsx
- 72146326B St. Jude FCC IC Part 15.247 RSS247 BT LE Test Report.pdf (Issued by TÜV SÜD America, Inc. 10040 Mesa Rim Road, San Diego, CA 92121-2912 on July 2019)
- Instructions for Conducted RF Testing of NGQ Wire Access Devices.docx (HN 06-29-2023)
- Supporting documents for Class II Permissive Change application are separate exhibits.

1.2 BRIEF SUMMARY OF RESULTS

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

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

N/A Not performed per test plan. The Grantee is seeking Class II Permissive Change for updated antenna used. RF characteristics up to the antenna port as declared by the Grantee remained identical justifying not repeating all original RF conducted measurements.

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) are Avant™, Neutrino™ NxT, Gallant™ and Entrant™ Implantable Cardioverter Defibrillator Device. The EUT are battery-powered device placed under the skin that monitors the heart rate. Special wires connect the EUT to the heart. If an abnormal heart rhythm is detected, the EUT will deliver either pacing therapy if the heart rate is too slow or an electric shock if the heart rate is chaotic or beating too fast. The BLE function of the EUT is verified in this test report.

The Gallant and Entrant series have the same hardware as Avant. The only difference is the firmware for therapy. So, RF functionality is identical. The Neutrino series are the Japanese name and models for Avant and Gallant. Therefore, same exact hardware and firmware as Avant and Gallant. Avant series models were provided as worst case of all other models for evaluation. These determinations were made in accordance with the methodology used as the original filing.

Variant models are listed below:

Product Name	NGQ Device Models		
	VR	DR	CRT-D (HF)
Avant™	CDVRA700T	CDDRA700T	CDHFA700T
Neutrino™ NxT	CDVRA800T	CDDRA800T	CDHFA800T
Gallant™	CDVRA500T	CDDRA500T	CDHFA500T
Neutrino™ NxT	CDVRA600T	CDDRA600T	CDHFA600T
Entrant™	CDVRA300T	CDDRA300T	CDHFA300T

1.3.2 EUT General Description

EUT Description	Implantable Cardioverter Defibrillator Device
Model Name	Avant™, Neutrino™ NxT, Gallant™ and Entrant™
Model Numbers	CDVRA700T, CDDRA700T and CDHFA700T
Rated Voltage	Internal battery (3.0VDC)
Mode Verified	Bluetooth LE
Capability	Bluetooth LE
Primary Unit (EUT)	☐ Production
	☒ Pre-Production
	☐ Engineering (same as Production)

Manufacturer Declared Temperature Range	20°C to 37°C
Antenna Type	Wire Monopole Antenna
Manufacturer	St. Jude Medical
Antenna Model	N/A
Peak Antenna Gain	

Device	Peak Antenna Gain(dBi)
DF1 VR	-14.6
DF1 DR	-15.4
DF1 HF	-14.8

1.3.3 Maximum Conducted Output Power

Bluetooth Low Energy (LE)	Frequency Range (MHz)	Gated RMS (dBm)
	2402-2480	3.7

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
Default	The EUT is configured with test software loaded instead of the standard product software. The test software allows for the EUT's Bluetooth radio to be controlled by an external device (eg. Apple iPod Touch). The iPod Touch can configure the EUT for transmit modes covering Low, Mid, and High channels. The manufacturer provided guidance how to program the EUT (OTA_DTM_Hex_Command.xlsx) with power setting set to 6dBm CW. During radiated testing, the EUT must reside in a phantom cylinder filled with tissue simulating liquid to simulate the human body. Due to the physical dimensions of the cylinder including size and weight, some test requirements cannot be practically performed such as the actual height requirement of the EUT in reference to the floor.
Alternative	The manufacturer requested additional conducted power measurement to align with original filing. Test configuration and all supporting equipment are detailed under the instructions provided (Instructions for Conducted RF Testing of NGQ Wire Access Devices.docx (HN 06-29-2023))

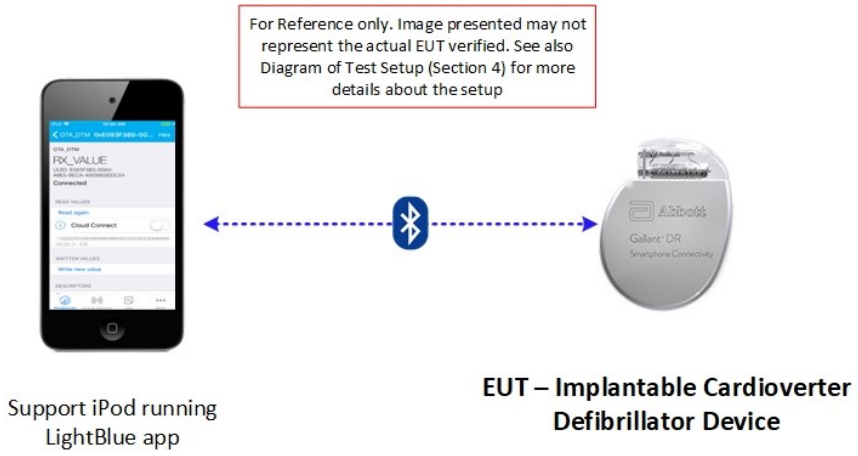
1.4.2 EUT Exercise Software

For the RF testing, test firmware is used to control the RF parameters (CW, channels, power, duration, etc.). The support iPod Touch is running LightBlue app V4.1.1.

1.4.3 Support Equipment and I/O cables

Manufacturer	Equipment/Cable	Description
Apple	iPod Touch	Model MKH62LL/A S/N CCQS91TCGGK6

1.4.1 Simplified Test Configuration Diagram



1.5 DEVIATIONS FROM THE STANDARD

EUT is a mobile device requiring verification on all three axes. However, since the EUT will be inside a torso simulator simulating placement inside a human body, only two configurations are possible to verify: Front (worse case – the front side/logo of the EUT is facing and is 2cm from the cylinder/simulator wall) and Flipped (the back side of the EUT is facing and is 2cm from the cylinder/simulator wall). These are the only positions possible while maintaining the required separation distance between the EUT and the simulator wall.

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
St. Jude Medical
Avant™, Neutrino™ NxT, Gallant™ and Entrant™ Implantable Cardioverter Defibrillator Device

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: BBZ273.1 / Alternative Test Configuration

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

July 13, 2023 / FSC

2.1.5 Test Equipment Used

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

2.1.6 Environmental Conditions (Rancho Bernardo Facility)

Ambient Temperature	24.6 °C
Relative Humidity	52.9 %
ATM Pressure	100.1 kPa

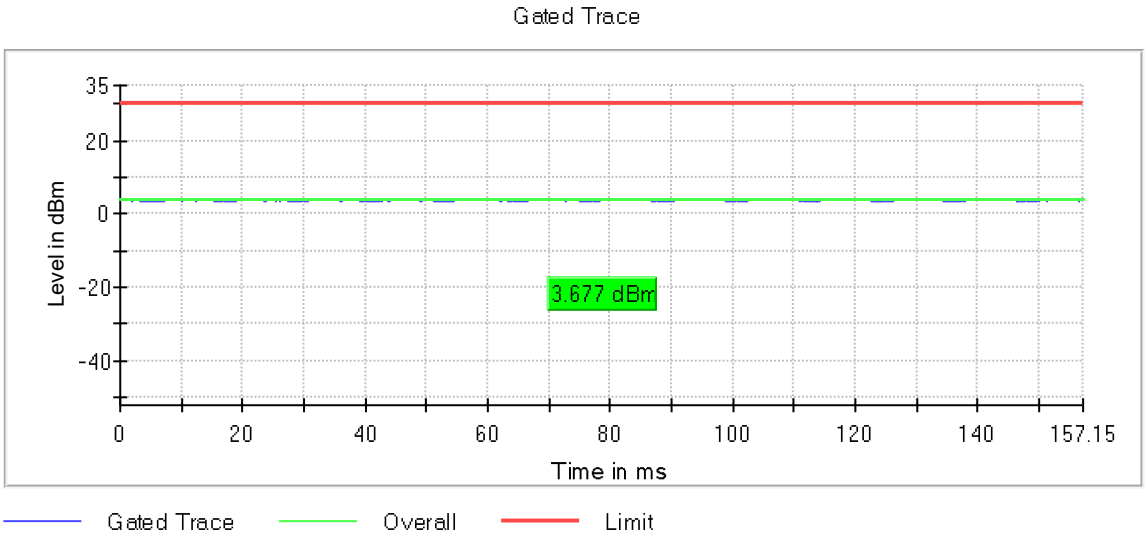
2.1.7 Additional Observations

- 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.
- 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.
- The conducted power rating of the EUT is identical as the original filing as declared by the manufacturer. The changes implemented are in the antenna used.

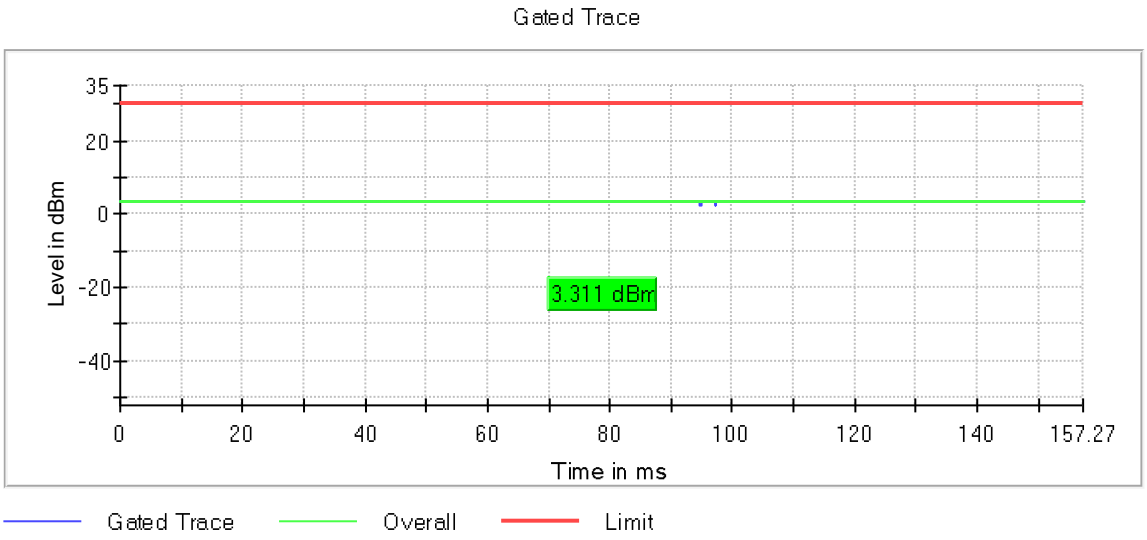
2.1.8 Test Results

DUT Frequency (MHz)	Gated RMS (dBm)	Limit Max (dBm)	Gated EIRP (dBm)	DutyCycle (%)	Result
2402.000000	3.7	30.0	3.7	15.885	PASS
2440.000000	3.3	30.0	3.3	15.897	PASS
2480.000000	3.2	30.0	3.2	15.914	PASS

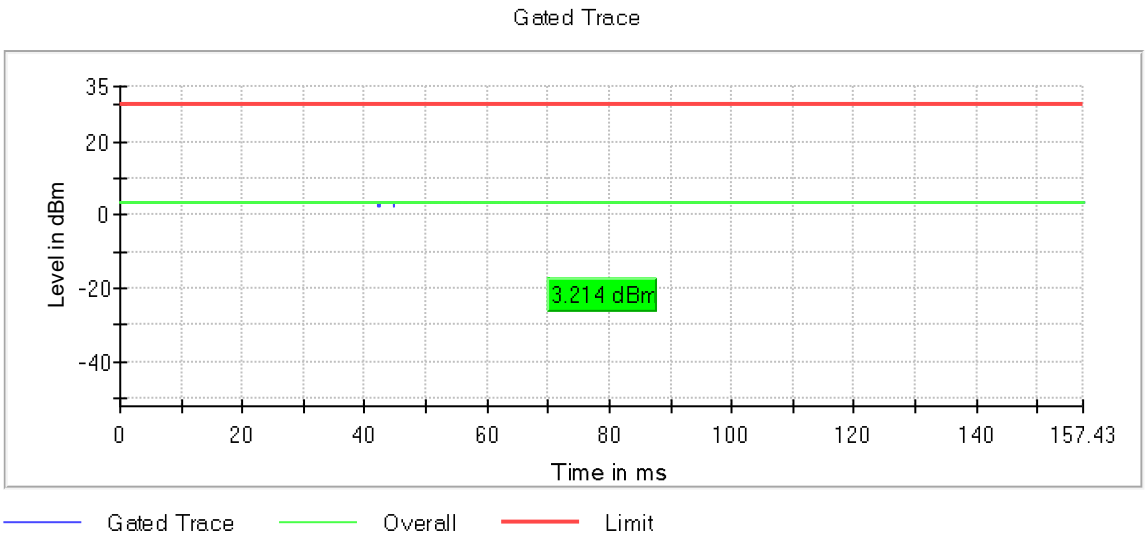
2.1.9 Sample Test Plots



Bluetooth LE. Low Channel



Bluetooth LE. Mid Channel



Bluetooth LE. High Channel

2.1.10 Power Meter Settings

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

2.2 BAND-EDGE COMPLIANCE

2.2.1 Specification Reference

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

2.2.2 Standard Applicable

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

2.2.3 Equipment Under Test and Modification State

Serial No: 210006578, 210006575 and 210006571 / Default Test Configuration

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

May 03 to 09, 2023 / JS

2.2.5 Test Equipment Used

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

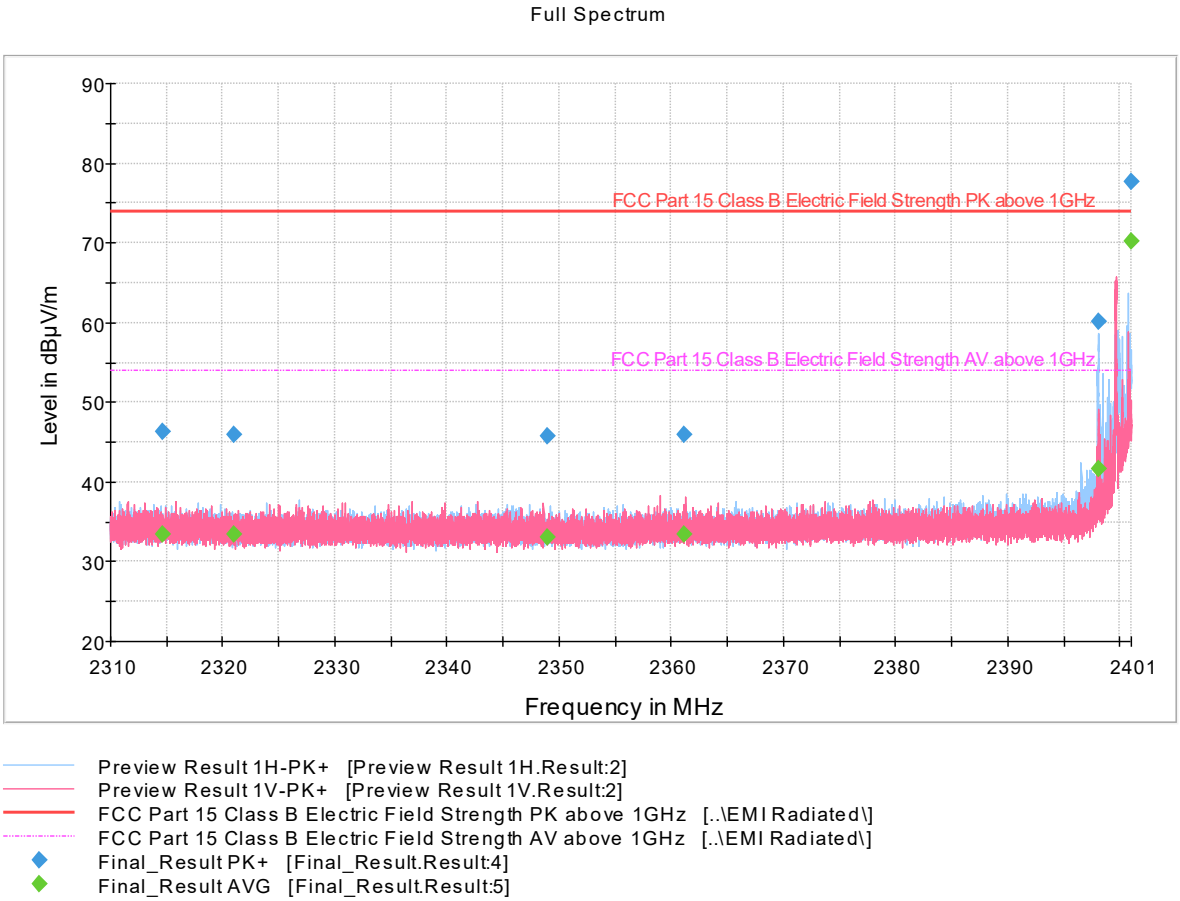
2.2.6 Environmental Conditions (Mira Mesa Facility)

Ambient Temperature	28.6 °C
Relative Humidity	42.1 %
ATM Pressure	99.5 kPa

2.2.7 Additional Observations

- This is a radiated test. The spectrum was searched from 2310MHz to 2400MHz for Lower Band Edge and 2483.5MHz to 2500MHz for Upper Band Edge verifications. This ensures coverage of immediate restricted bands.
- 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 Low and High Channels presented as required.
- 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 Test Results for Lower Band Edge (VR)



Peak Data

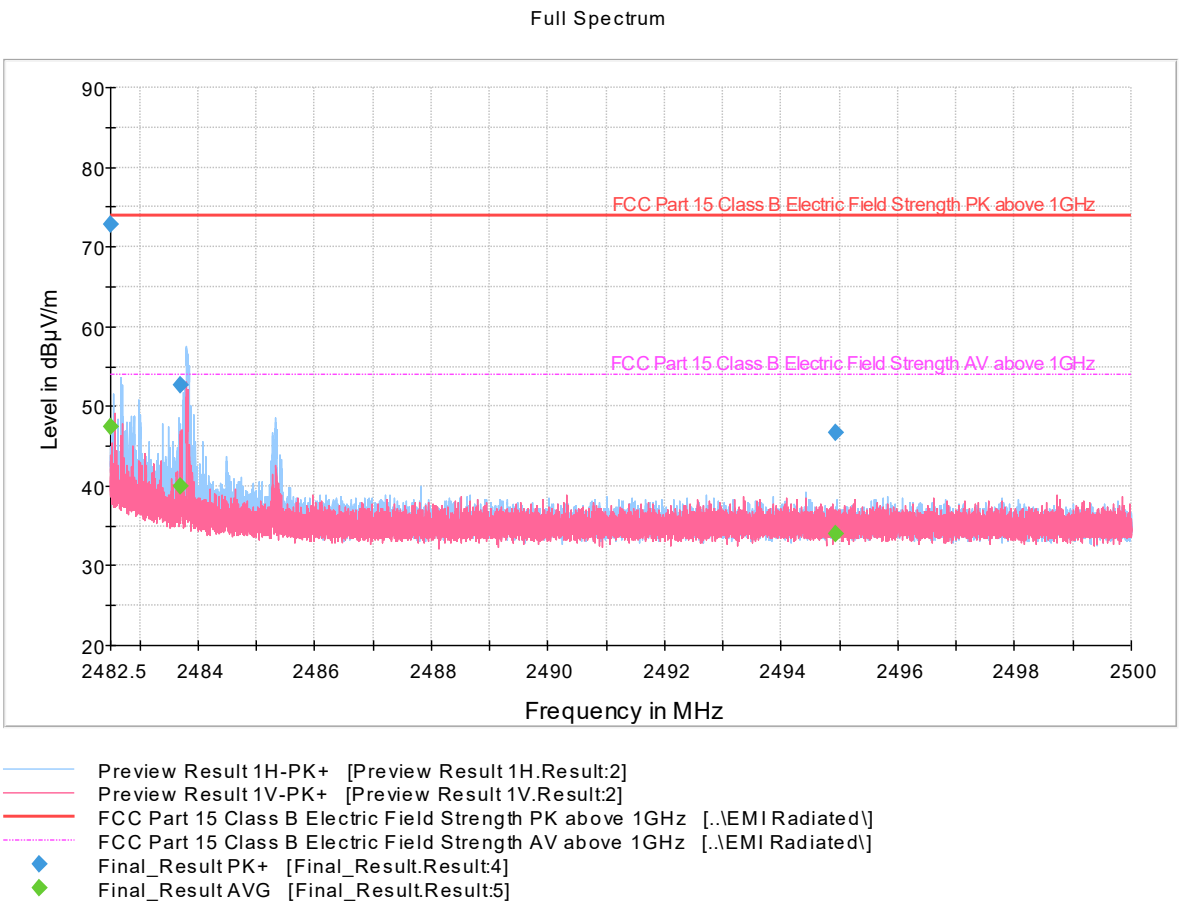
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2314.60000	46.39	73.90	27.51	1000.0	1000.000	175.0	H	325.0	4
2321.05926	46.03	73.90	27.87	1000.0	1000.000	365.0	H	304.0	4
2348.93573	45.82	73.90	28.08	1000.0	1000.000	224.0	V	274.0	4
2361.15193	45.91	73.90	27.99	1000.0	1000.000	323.0	V	220.0	4
2398.09240	60.11	73.90	13.79	1000.0	1000.000	122.0	H	44.0	4
2400.00000	71.60	74.59	2.99	1000.0	1000.000	281.5	H	40.1	4
2401.00000	77.67	In-Band		1000.0	1000.000	365.0	H	38.0	4

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)
2314.60000	33.50	53.90	20.40	1000.0	1000.000	175.0	H	325.0	4
2321.05926	33.35	53.90	20.55	1000.0	1000.000	365.0	H	304.0	4
2348.93573	33.04	53.90	20.86	1000.0	1000.000	224.0	V	274.0	4
2361.15193	33.35	53.90	20.55	1000.0	1000.000	323.0	V	220.0	4
2398.09240	41.73	53.90	12.17	1000.0	1000.000	122.0	H	44.0	4
2400.00000	60.40	64.35	3.950	1000.0	1000.000	281.5	H	40.1	4
2401.00000	70.12	In-Band		1000.0	1000.000	315.0	H	50.0	4

Test Notes: Limits used for band edge verifications (not in restricted bands) are based on fundamental measurement of Section 2.2.11 of this test report.

2.2.9 Test Results for Upper Band Edge (VR)



Peak Data

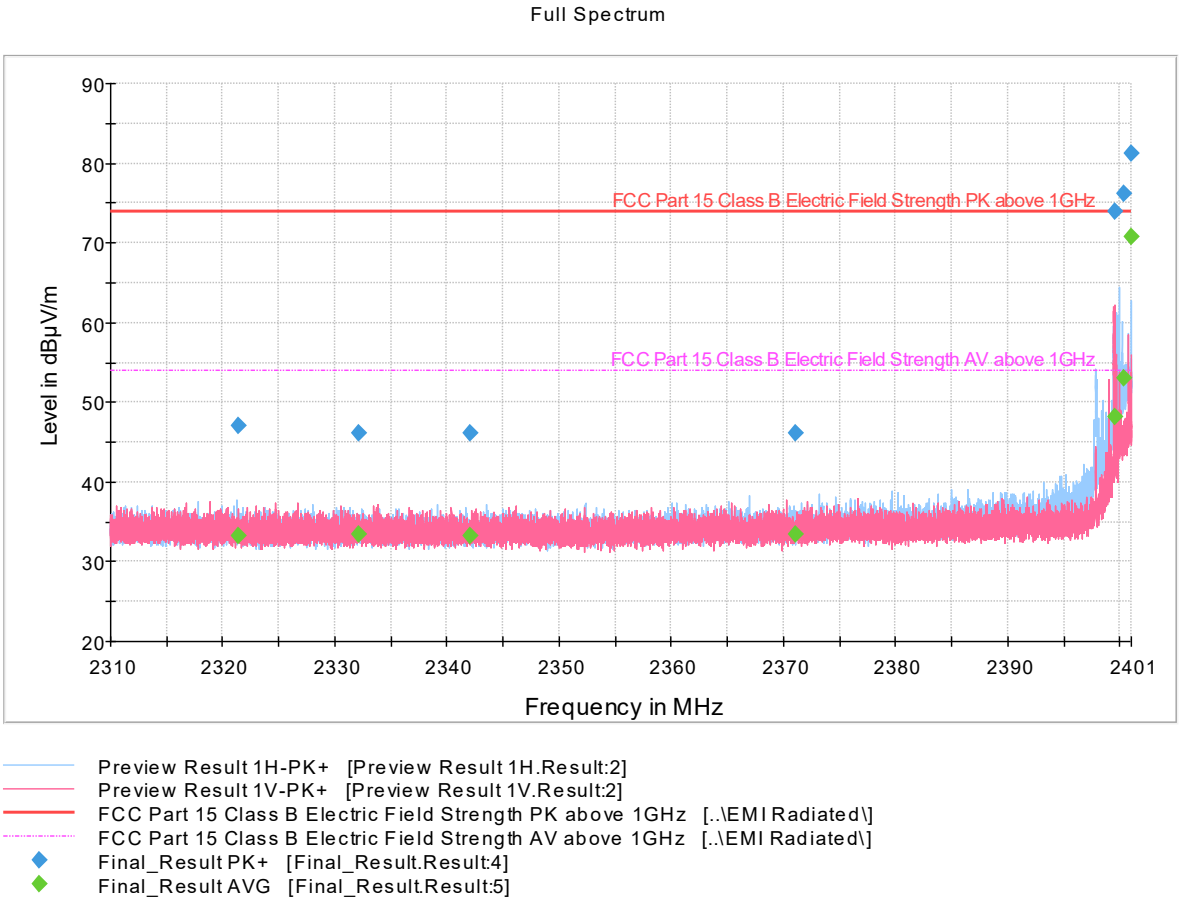
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2482.50000	72.92	73.90	0.98	1000.0	1000.000	123.0	H	46.0	4
2483.70000	52.61	73.90	21.29	1000.0	1000.000	175.0	H	32.0	4
2494.93591	46.74	73.90	27.16	1000.0	1000.000	210.0	V	176.0	4

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)
2482.50000	47.37	53.90	6.53	1000.0	1000.000	123.0	H	46.0	4
2483.70000	39.95	53.90	13.95	1000.0	1000.000	175.0	H	32.0	4
2494.93591	34.05	53.90	19.85	1000.0	1000.000	210.0	V	176.0	4

Test Notes: All emissions observed complies with §15.205(c) limits (upper band edge is within a restricted band).

2.2.10 Test Results for Lower Band Edge (DR)



Peak Data

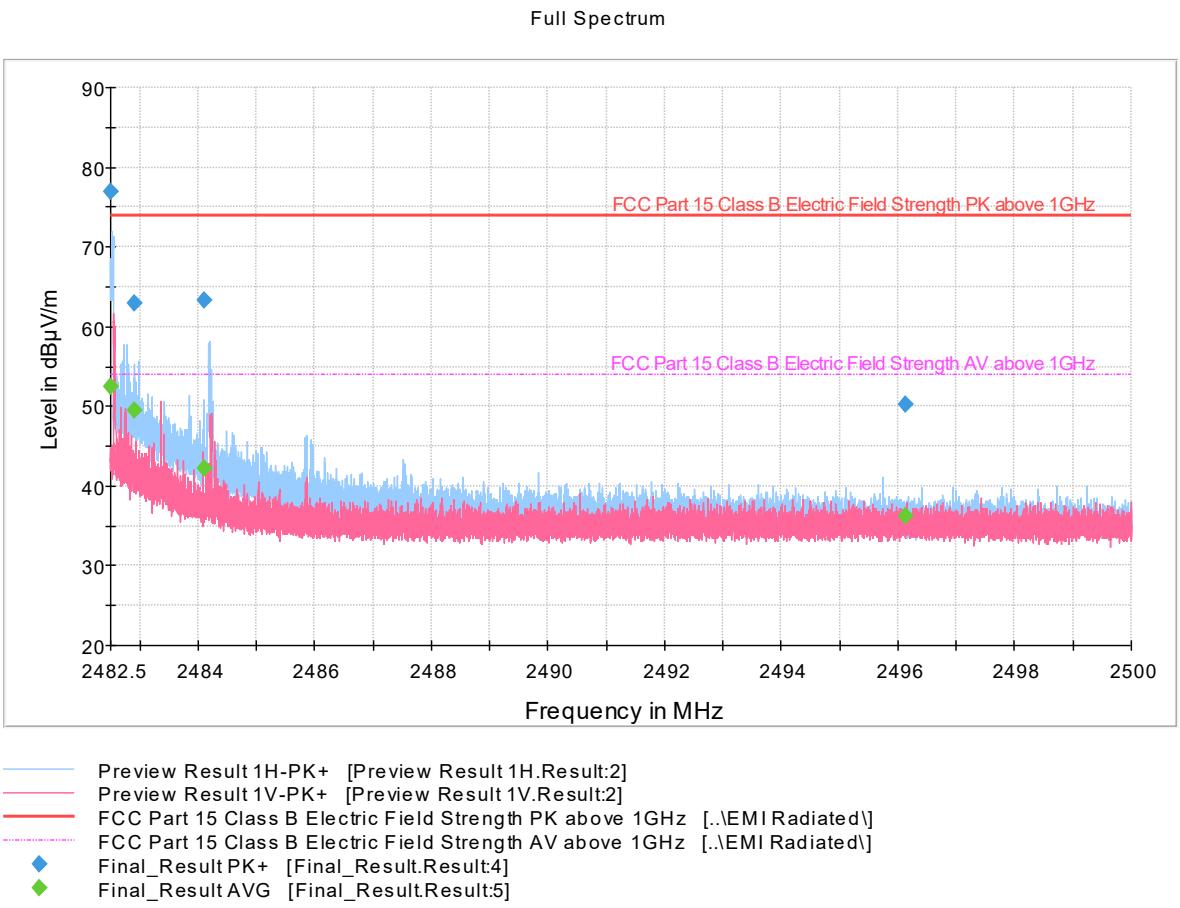
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2321.39603	47.09	73.90	26.81	1000.0	1000.000	286.0	H	159.0	4
2332.14096	46.19	73.90	27.71	1000.0	1000.000	365.0	V	306.0	4
2342.12106	46.09	73.90	27.82	1000.0	1000.000	210.0	H	159.0	4
2371.12353	46.20	73.90	27.70	1000.0	1000.000	304.0	H	278.0	4
2399.57490	73.85	73.90	0.05	1000.0	1000.000	314.0	H	45.0	4
2400.00000	76.24	76.49	0.25	1000.0	1000.000	334.0	H	50.0	4
2401.00000	81.15	In-band		1000.0	1000.000	255.0	H	54.0	4

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)
2321.39603	33.30	53.90	20.60	1000.0	1000.000	286.0	H	159.0	4
2332.14096	33.37	53.90	20.53	1000.0	1000.000	365.0	V	306.0	4
2342.12106	33.29	53.90	20.61	1000.0	1000.000	210.0	H	159.0	4
2371.12353	33.42	53.90	20.48	1000.0	1000.000	304.0	H	278.0	4
2399.57490	48.12	53.90	5.78	1000.0	1000.000	314.0	H	45.0	4
2400.00000	53.08	64.20	11.12	1000.0	1000.000	334.0	H	50.0	4
2401.00000	70.73	In-Band		1000.0	1000.000	255.0	H	54.0	4

Test Notes: Limits used for band edge verifications (not in restricted bands) are based on fundamental measurement of Section 2.2.15 of this test report.

2.2.11 Test Results for Upper Band Edge (DR)



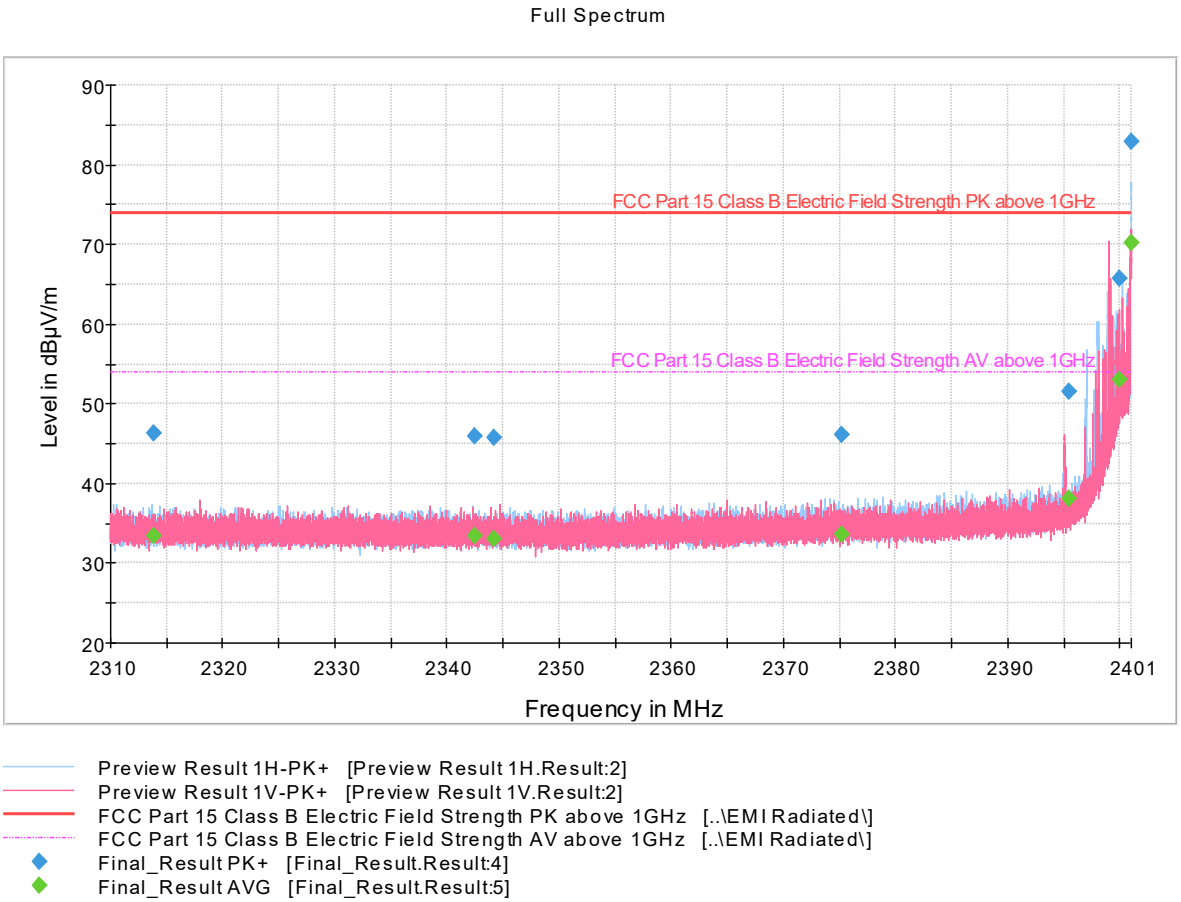
Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2482.50000	77.01	In-Band		1000.0	1000.000	205.0	H	50.0	4
2482.90000	62.92	73.90	10.98	1000.0	1000.000	209.0	H	70.0	4
2484.10000	63.33	73.90	10.57	1000.0	1000.000	286.0	H	38.0	4
2496.13650	50.23	73.90	23.67	1000.0	1000.000	315.0	H	67.0	4

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)
2482.50000	52.54	In-Band		1000.0	1000.000	121.0	H	46.0	4
2482.90000	49.52	53.90	4.38	1000.0	1000.000	209.0	H	70.0	4
2484.10000	42.29	53.90	11.61	1000.0	1000.000	286.0	H	38.0	4
2496.13650	36.26	53.90	17.64	1000.0	1000.000	315.0	H	67.0	4

2.2.12 Test Results for Lower Band Edge (HF)



Peak Data

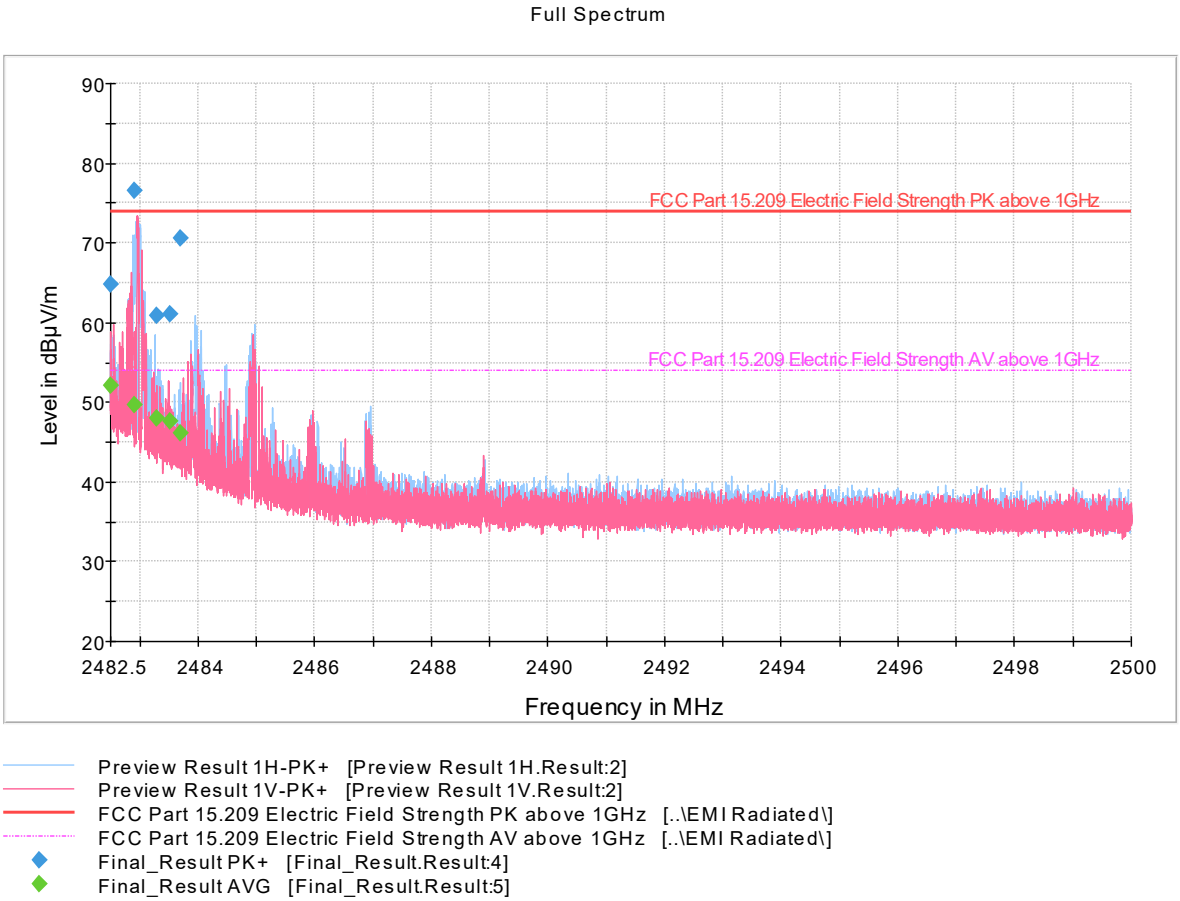
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2313.80000	46.31	73.90	27.59	1000.0	1000.000	175.0	V	87.0	4
2342.51043	46.00	73.90	27.90	1000.0	1000.000	240.0	V	28.0	4
2344.23143	45.84	73.90	28.06	1000.0	1000.000	365.0	V	172.0	4
2375.18523	46.13	73.90	27.77	1000.0	1000.000	320.0	V	157.0	4
2395.37430	51.54	73.90	22.36	1000.0	1000.000	255.0	H	49.0	4
2400.00000	65.32	65.56	0.24	1000.0	1000.000	255.0	H	75.0	4
2401.00000	82.96	In-Band		1000.0	1000.000	207.0	V	24.0	4

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)
2313.80000	33.46	53.90	20.44	1000.0	1000.000	175.0	V	87.0	4
2342.51043	33.35	53.90	20.55	1000.0	1000.000	240.0	V	28.0	4
2344.23143	33.16	53.90	20.74	1000.0	1000.000	365.0	V	172.0	4
2375.18523	33.54	53.90	20.36	1000.0	1000.000	320.0	V	157.0	4
2395.37430	38.16	53.90	15.74	1000.0	1000.000	255.0	H	49.0	4
2400.00000	53.08	64.31	11.23	1000.0	1000.000	255.0	H	75.0	4
2401.00000	70.18	In-Band		1000.0	1000.000	207.0	V	24.0	4

Test Notes: Limits used for band edge verifications (not in restricted bands) are based on fundamental measurement of Section 2.2.19 of this test report.

2.2.13 Test Results for Upper Band Edge (HF)



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)
2482.50000	64.77	In-Band		1000.0	1000.000	175.0	H	19.0	4
2482.90000	76.54	In-Band		1000.0	1000.000	205.0	H	14.0	4
2483.30000	60.87	In-Band		1000.0	1000.000	175.0	H	37.0	4
2483.51408	61.02	73.90	12.88	1000.0	1000.000	151.0	H	40.0	4
2483.70000	70.60	73.90	3.30	1000.0	1000.000	140.0	H	30.0	4

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)
2482.50000	52.15	In-Band		1000.0	1000.000	175.0	H	19.0	4
2482.90000	49.66	In-Band		1000.0	1000.000	205.0	H	14.0	4
2483.30000	48.02	In-Band		1000.0	1000.000	175.0	H	37.0	4
2483.51408	47.70	53.90	6.20	1000.0	1000.000	151.0	H	40.0	4
2483.70000	46.12	53.90	7.78	1000.0	1000.000	140.0	H	30.0	4

2.3 RADIATED SPURIOUS EMISSIONS

2.3.1 Specification Reference

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

2.3.2 Standard Applicable

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

2.3.3 Equipment Under Test and Modification State

Serial No: 210006578, 210006575 and 210006571 / Default Test Configuration

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

May 03 to 09, 2023 / JS

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 (Mira Mesa Facility)

Ambient Temperature	28.6 °C
Relative Humidity	42.1 %
ATM Pressure	99.5 kPa

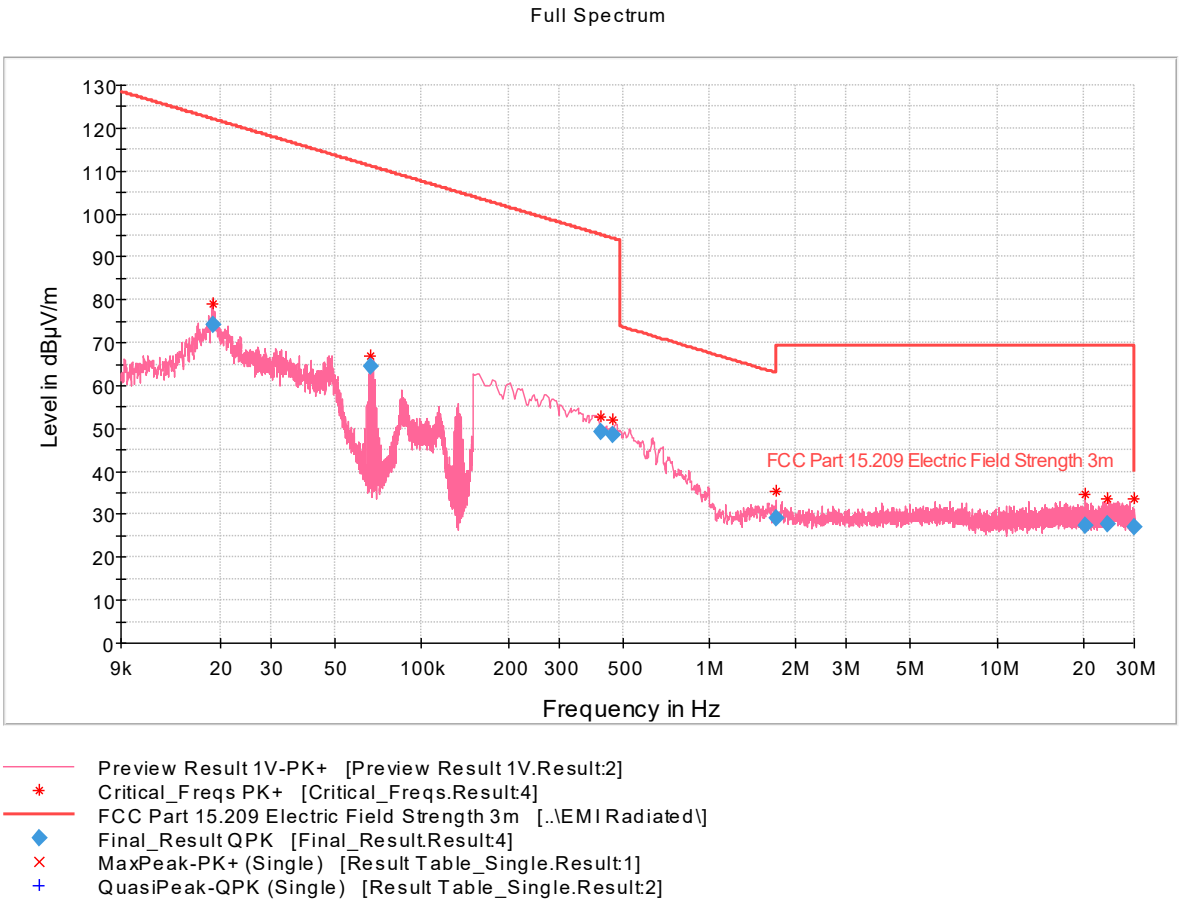
2.3.7 Additional Observations

- 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 and axis presented per model.
- 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.

2.3.8 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**

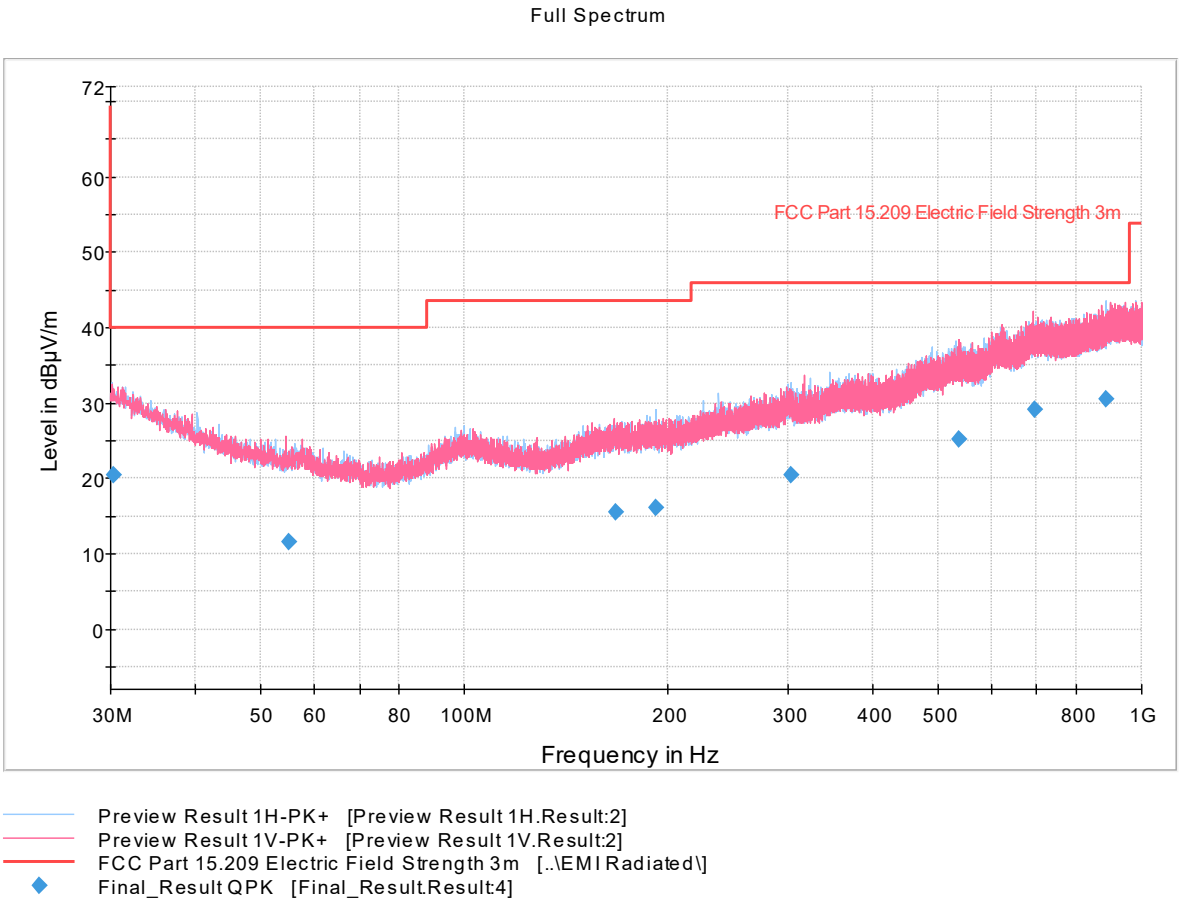
2.3.9 Test Results for 9kHz to 30MHz (VR)



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)
0.018923	74.11	122.06	47.95	1000.	0.200	400.0	H	351.0	22
0.066610	64.43	111.13	46.70	1000.	0.200	400.0	H	66.0	20
0.417700	49.11	95.19	46.08	1000.	9.000	400.0	H	171.0	19
0.463610	48.53	94.28	45.75	1000.	9.000	400.0	H	298.0	20
1.703689	28.97	62.97	34.00	1000.	9.000	400.0	H	60.0	20
20.198578	27.46	69.50	42.04	1000.	9.000	400.0	H	204.0	24
24.328626	27.60	69.50	41.90	1000.	9.000	400.0	H	318.0	24
29.982100	27.21	69.50	42.29	1000.	9.000	400.0	H	264.0	25

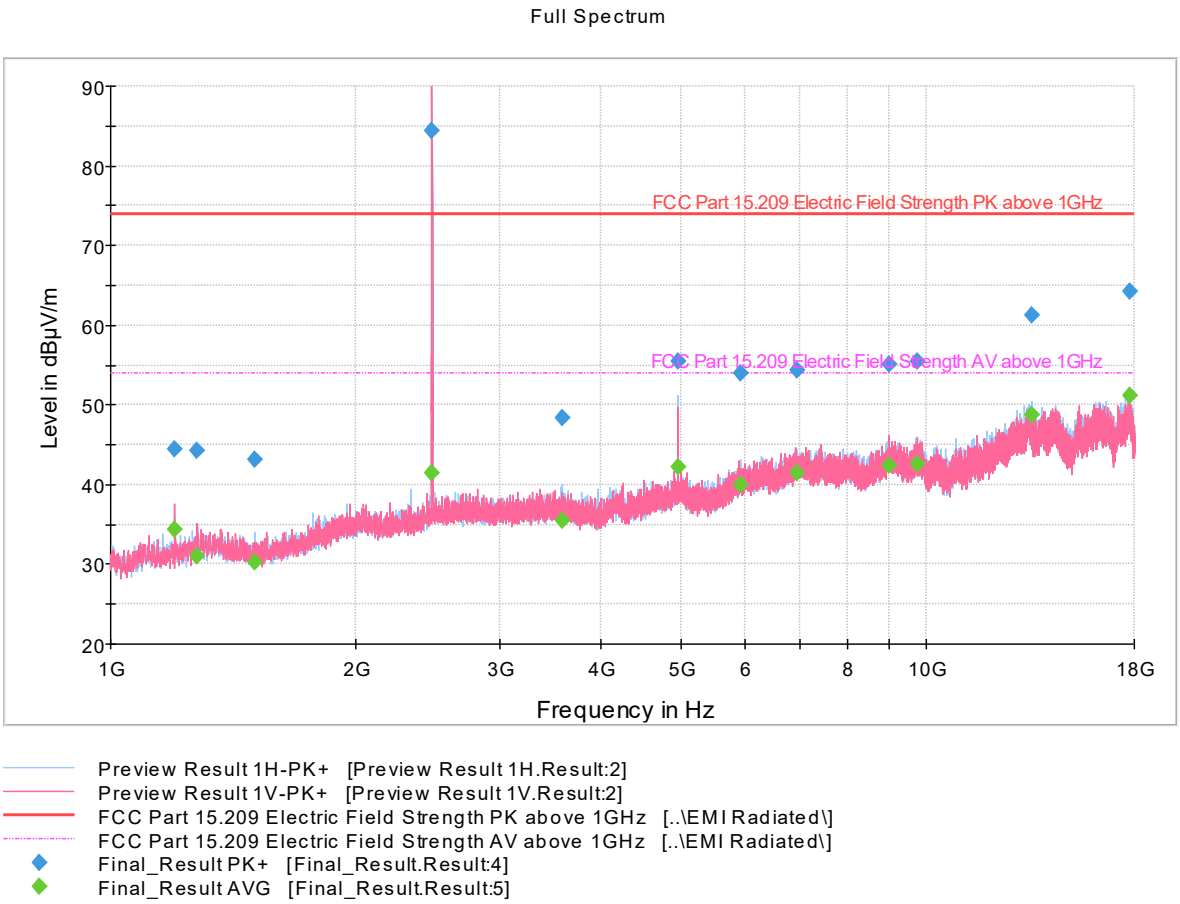
2.3.10 Test Results for 30MHz to 1GHz (VR)



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)
30.360000	20.35	40.00	19.65	1000.	120.000	265.0	H	249.0	22
54.971667	11.50	40.00	28.50	1000.	120.000	246.0	V	12.0	14
166.92933	15.46	43.50	28.04	1000.	120.000	367.0	V	223.0	17
191.70233	16.17	43.50	27.33	1000.	120.000	125.0	H	245.0	17
303.59633	20.51	46.00	25.49	1000.	120.000	324.0	H	62.0	22
537.05566	25.20	46.00	20.80	1000.	120.000	354.0	V	83.0	26
693.61966	29.22	46.00	16.78	1000.	120.000	343.0	V	220.0	29
887.44933	30.53	46.00	15.47	1000.	120.000	184.0	H	249.0	30

2.3.11 Test Results for 1GHz to 18GHz (VR)



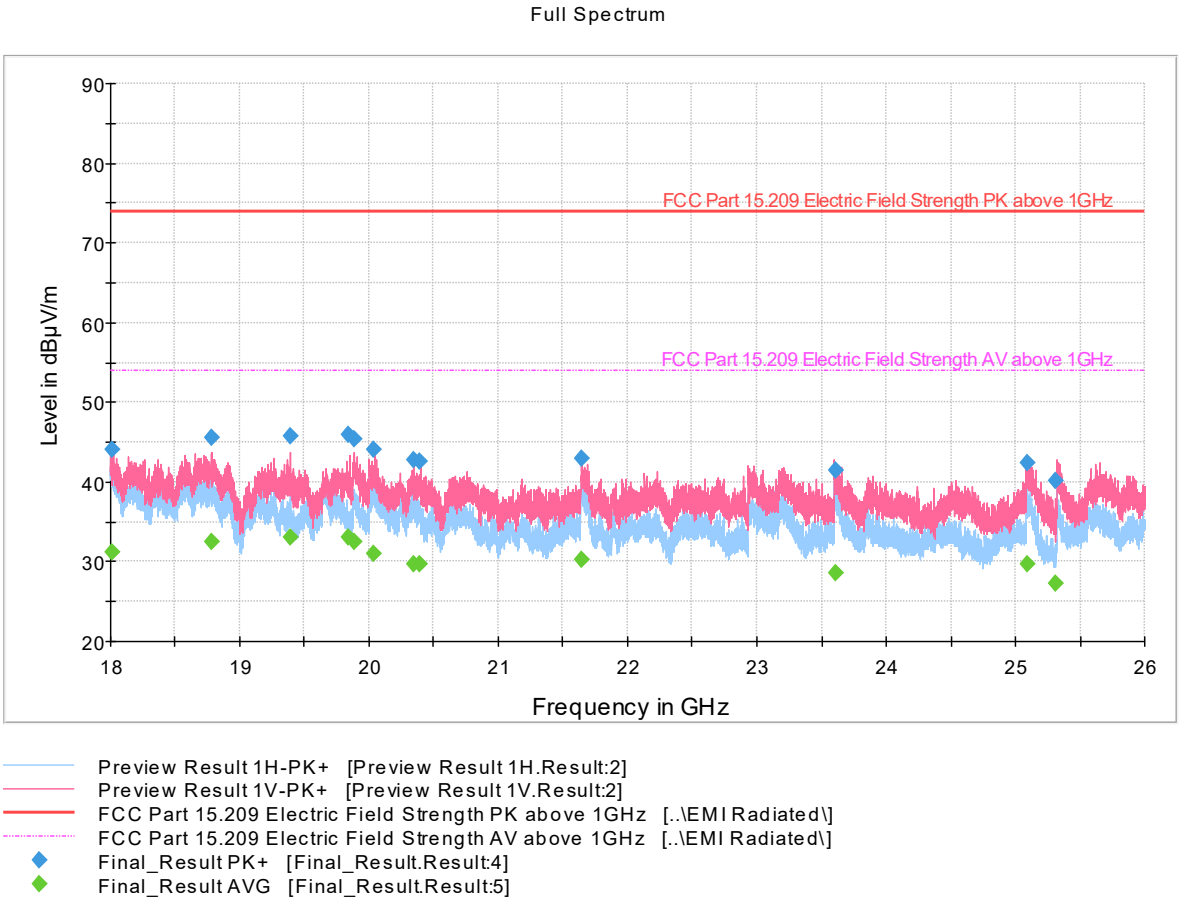
Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1200.06666	44.49	73.90	29.41	1000.0	1000.000	255.0	V	292.0	-1
1277.53333	44.20	73.90	29.70	1000.0	1000.000	255.0	V	314.0	0
1500.00000	43.20	73.90	30.70	1000.0	1000.000	335.0	H	108.0	0
2479.63333	84.32	73.90	-10.42	1000.0	1000.000	235.0	H	350.0	4
2479.76666	94.59	73.90	-20.69	1000.0	1000.000	119.0	H	53.0	4
2479.90000	92.31	73.90	-18.41	1000.0	1000.000	320.0	H	84.0	4
3579.10000	48.36	73.90	25.54	1000.0	1000.000	348.0	H	156.0	6
4959.26666	55.40	73.90	18.50	1000.0	1000.000	317.0	H	74.0	8
5929.06666	54.06	73.90	19.84	1000.0	1000.000	207.0	H	274.0	9
6955.46666	54.35	73.90	19.55	1000.0	1000.000	144.0	H	301.0	10
9014.20000	55.05	73.90	18.85	1000.0	1000.000	140.0	V	309.0	13
9762.43333	55.43	73.90	18.47	1000.0	1000.000	335.0	V	95.0	13
13467.2333	61.31	73.90	12.59	1000.0	1000.000	365.0	H	264.0	18
17767.8000	64.21	73.90	9.69	1000.0	1000.000	128.0	H	43.0	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)
1200.06666	34.42	53.90	19.48	1000.0	1000.000	255.0	V	292.0	-1
1277.53333	31.09	53.90	22.81	1000.0	1000.000	255.0	V	314.0	0
1500.00000	30.25	53.90	23.65	1000.0	1000.000	335.0	H	108.0	0
2479.63333	41.53	53.90	12.37	1000.0	1000.000	235.0	H	350.0	4
2479.76666	94.35	53.90	-40.45	1000.0	1000.000	119.0	H	53.0	4
2479.90000	92.20	53.90	-38.30	1000.0	1000.000	320.0	H	84.0	4
3579.10000	35.51	53.90	18.39	1000.0	1000.000	348.0	H	156.0	6
4959.26666	42.30	53.90	11.60	1000.0	1000.000	317.0	H	74.0	8
5929.06666	39.99	53.90	13.91	1000.0	1000.000	207.0	H	274.0	9
6955.46666	41.51	53.90	12.39	1000.0	1000.000	144.0	H	301.0	10
9014.20000	42.34	53.90	11.56	1000.0	1000.000	140.0	V	309.0	13
9762.43333	42.59	53.90	11.31	1000.0	1000.000	335.0	V	95.0	13
13467.2333	48.78	53.90	5.12	1000.0	1000.000	365.0	H	264.0	18
17767.8000	51.24	53.90	2.66	1000.0	1000.000	128.0	H	43.0	24

2.3.12 Test Results for 18GHz to 26GHz (VR)



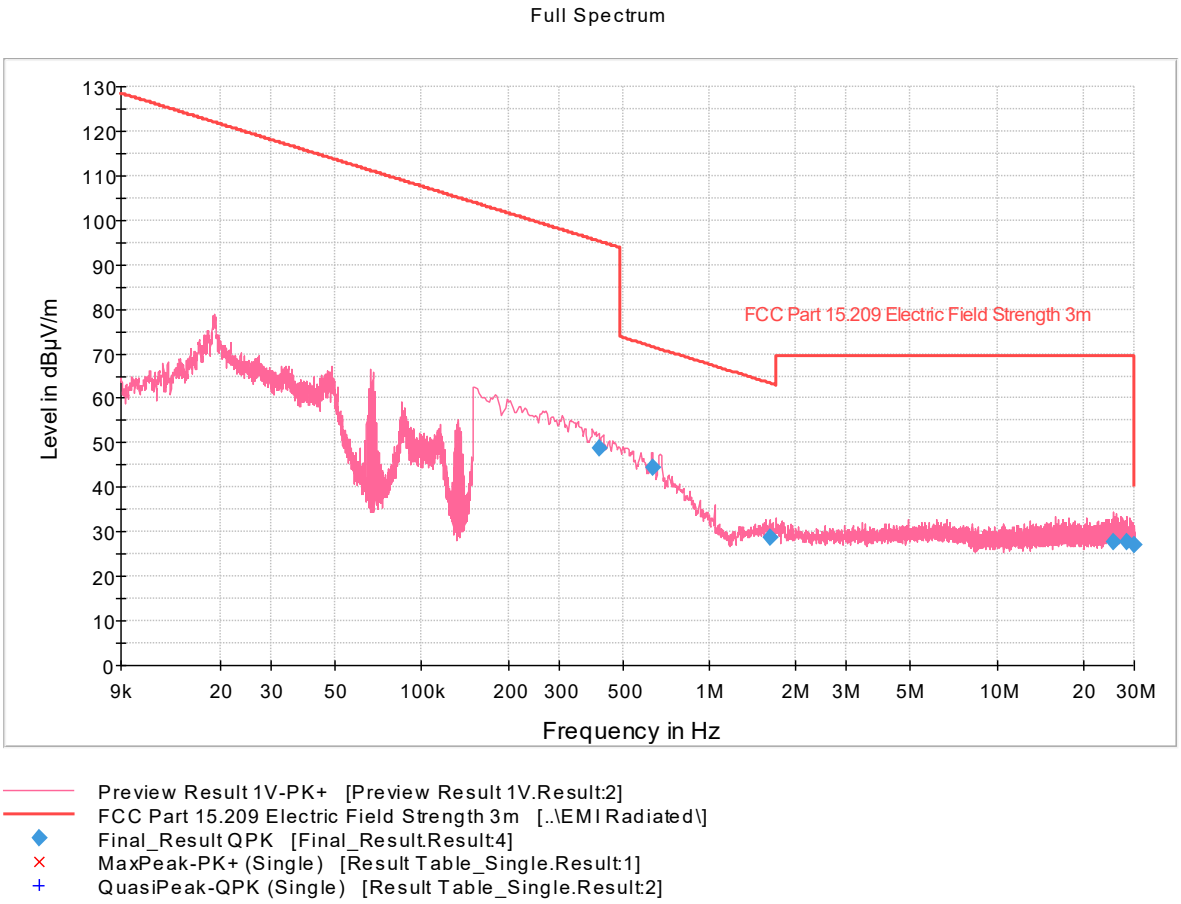
Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
18015.2465	44.08	73.90	29.82	1000.0	1000.000	212.0	V	230.0	-2
18779.1560	45.61	73.90	28.29	1000.0	1000.000	162.0	V	129.0	-3
19389.8215	45.72	73.90	28.18	1000.0	1000.000	139.0	V	41.0	-3
19843.0575	46.02	73.90	27.88	1000.0	1000.000	162.0	V	68.0	-3
19889.3625	45.45	73.90	28.45	1000.0	1000.000	149.0	V	72.0	-3
20039.9545	44.09	73.90	29.81	1000.0	1000.000	139.0	V	107.0	-3
20349.3460	42.70	73.90	31.20	1000.0	1000.000	154.0	V	108.0	-4
20395.5380	42.63	73.90	31.27	1000.0	1000.000	162.0	V	129.0	-3
21648.0235	42.97	73.90	30.93	1000.0	1000.000	139.0	V	68.0	-2
23607.5555	41.41	73.90	32.49	1000.0	1000.000	162.0	V	44.0	-1
25088.3190	42.31	73.90	31.59	1000.0	1000.000	162.0	V	183.0	-1
25315.8470	40.08	73.90	33.82	1000.0	1000.000	139.0	V	181.0	0

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)
18015.2465	31.20	53.90	22.70	1000.0	1000.000	212.0	V	230.0	-2
18779.1560	32.53	53.90	21.37	1000.0	1000.000	162.0	V	129.0	-3
19389.8215	33.02	53.90	20.88	1000.0	1000.000	139.0	V	41.0	-3
19843.0575	33.05	53.90	20.85	1000.0	1000.000	162.0	V	68.0	-3
19889.3625	32.55	53.90	21.35	1000.0	1000.000	149.0	V	72.0	-3
20039.9545	31.02	53.90	22.88	1000.0	1000.000	139.0	V	107.0	-3
20349.3460	29.72	53.90	24.18	1000.0	1000.000	154.0	V	108.0	-4
20395.5380	29.77	53.90	24.13	1000.0	1000.000	162.0	V	129.0	-3
21648.0235	30.18	53.90	23.72	1000.0	1000.000	139.0	V	68.0	-2
23607.5555	28.57	53.90	25.33	1000.0	1000.000	162.0	V	44.0	-1
25088.3190	29.68	53.90	24.22	1000.0	1000.000	162.0	V	183.0	-1
25315.8470	27.30	53.90	26.60	1000.0	1000.000	139.0	V	181.0	0

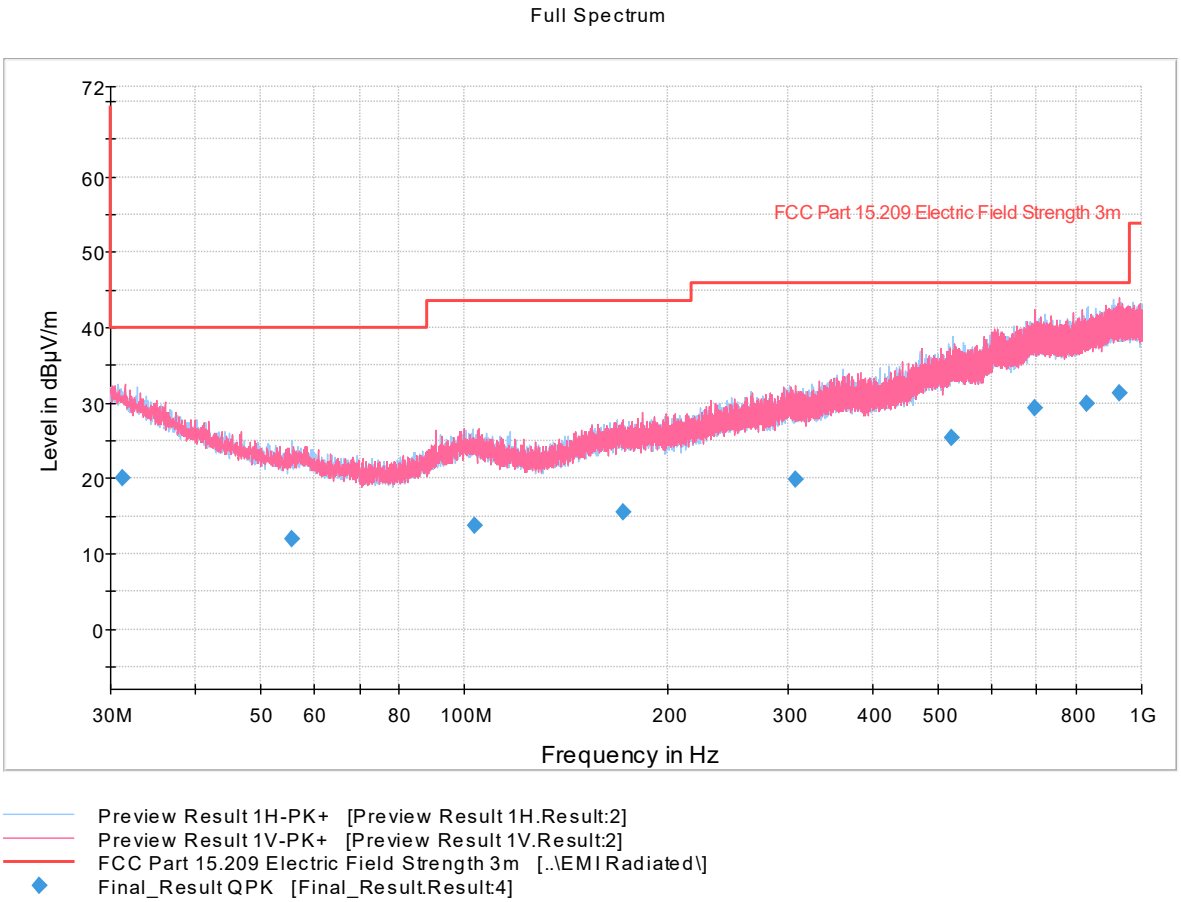
2.3.13 Test Results for 9kHz to 30MHz (DR)



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)
0.416745	48.79	95.21	46.41	1000.	9.000	400.0	H	277.0	19
0.636845	44.60	71.52	26.92	1000.	9.000	400.0	H	329.0	20
1.636387	28.76	63.32	34.55	1000.	9.000	400.0	H	271.0	20
25.498503	27.85	69.50	41.65	1000.	9.000	400.0	H	329.0	24
28.303194	27.74	69.50	41.76	1000.	9.000	400.0	H	66.0	25
29.876220	27.16	69.50	42.34	1000.	9.000	400.0	H	237.0	25

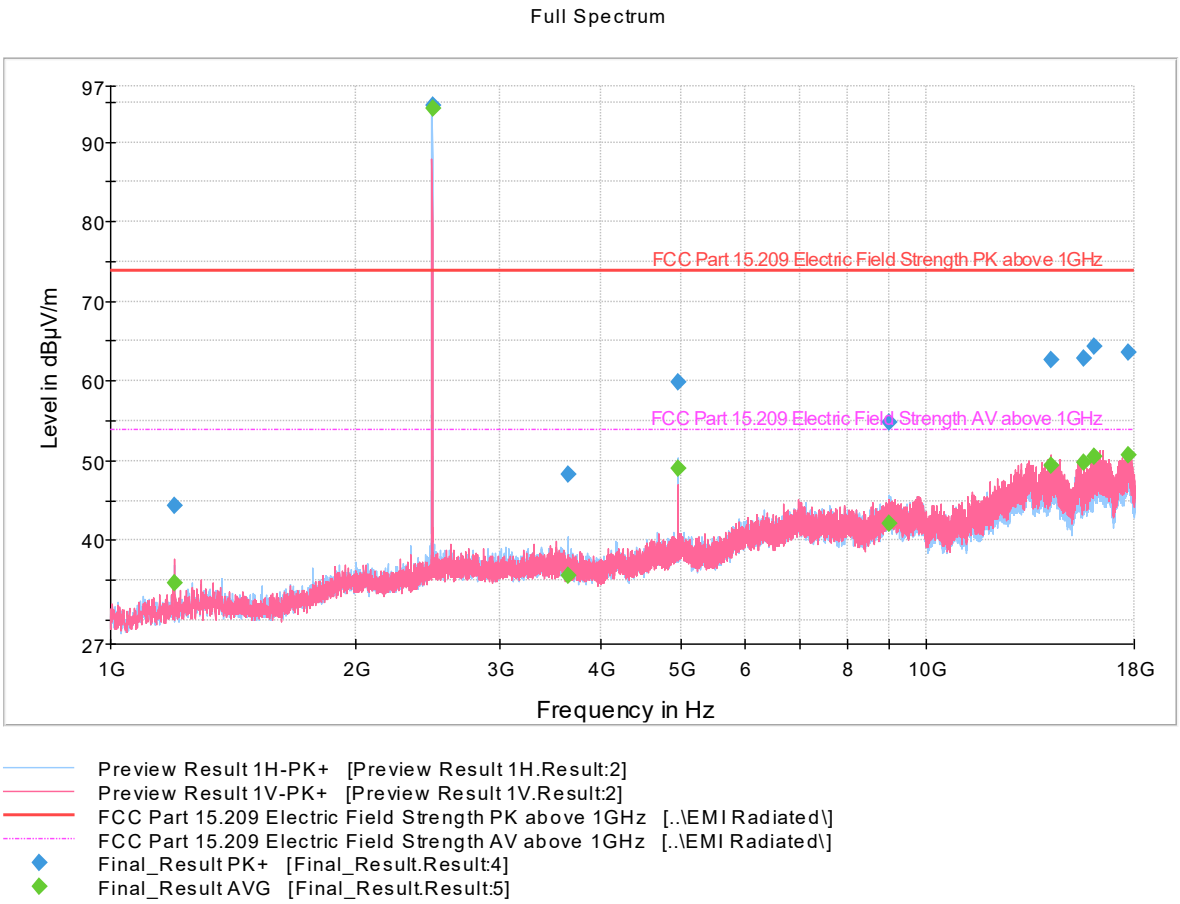
2.3.14 Test Results for 30MHz to 1GHz (DR)



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)
31.160000	20.03	40.00	19.97	1000.	120.000	205.0	H	164.0	22
55.472667	11.91	40.00	28.09	1000.	120.000	166.0	H	15.0	14
103.32500	13.68	43.50	29.82	1000.	120.000	338.0	H	-2.0	16
171.48733	15.43	43.50	28.07	1000.	120.000	164.0	V	336.0	17
308.06166	19.79	46.00	26.21	1000.	120.000	365.0	V	17.0	21
524.85300	25.32	46.00	20.68	1000.	120.000	178.0	H	279.0	26
694.70600	29.32	46.00	16.68	1000.	120.000	191.0	V	194.0	29
830.83866	30.00	46.00	16.00	1000.	120.000	173.0	H	291.0	29
927.32400	31.23	46.00	14.77	1000.	120.000	374.0	V	237.0	31

2.3.15 Test Results for 1GHz to 18GHz (DR)



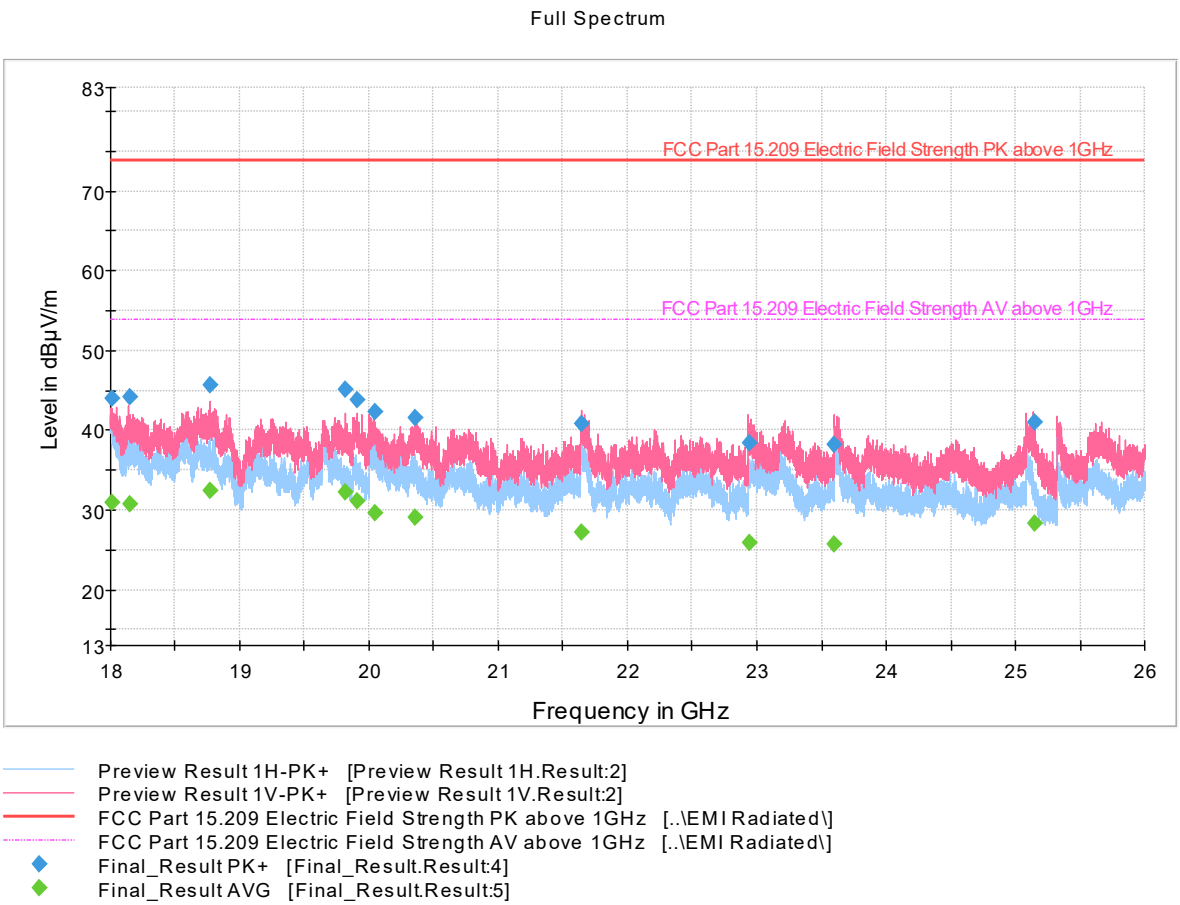
Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1200.06666	44.41	73.90	29.49	1000.0	1000.000	301.0	V	206.0	-1
2480.16666	96.49	73.90	-22.59	1000.0	1000.000	122.0	H	50.0	4
3636.50000	48.24	73.90	25.66	1000.0	1000.000	365.0	H	11.0	6
4960.06666	59.78	73.90	14.12	1000.0	1000.000	335.0	H	91.0	8
9006.86666	54.88	73.90	19.02	1000.0	1000.000	287.0	H	280.0	13
14231.3000	62.58	73.90	11.32	1000.0	1000.000	175.0	V	230.0	18
15623.4333	62.84	73.90	11.06	1000.0	1000.000	137.0	V	273.0	19
16087.5333	64.35	73.90	9.55	1000.0	1000.000	129.0	V	283.0	20
17716.6666	63.66	73.90	10.24	1000.0	1000.000	119.0	V	47.0	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)
1200.06666	34.58	53.90	19.32	1000.0	1000.000	301.0	V	206.0	-1
2480.16666	94.20	53.90	-40.30	1000.0	1000.000	122.0	H	50.0	4
3636.50000	35.62	53.90	18.28	1000.0	1000.000	365.0	H	11.0	6
4960.06666	49.02	53.90	4.88	1000.0	1000.000	335.0	H	91.0	8
9006.86666	42.03	53.90	11.87	1000.0	1000.000	287.0	H	280.0	13
14231.3000	49.32	53.90	4.58	1000.0	1000.000	175.0	V	230.0	18
15623.4333	49.74	53.90	4.16	1000.0	1000.000	137.0	V	273.0	19
16087.5333	50.45	53.90	3.45	1000.0	1000.000	129.0	V	283.0	20
17716.6666	50.76	53.90	3.14	1000.0	1000.000	119.0	V	47.0	24

2.3.16 Test Results for 18GHz to 26GHz (DR)



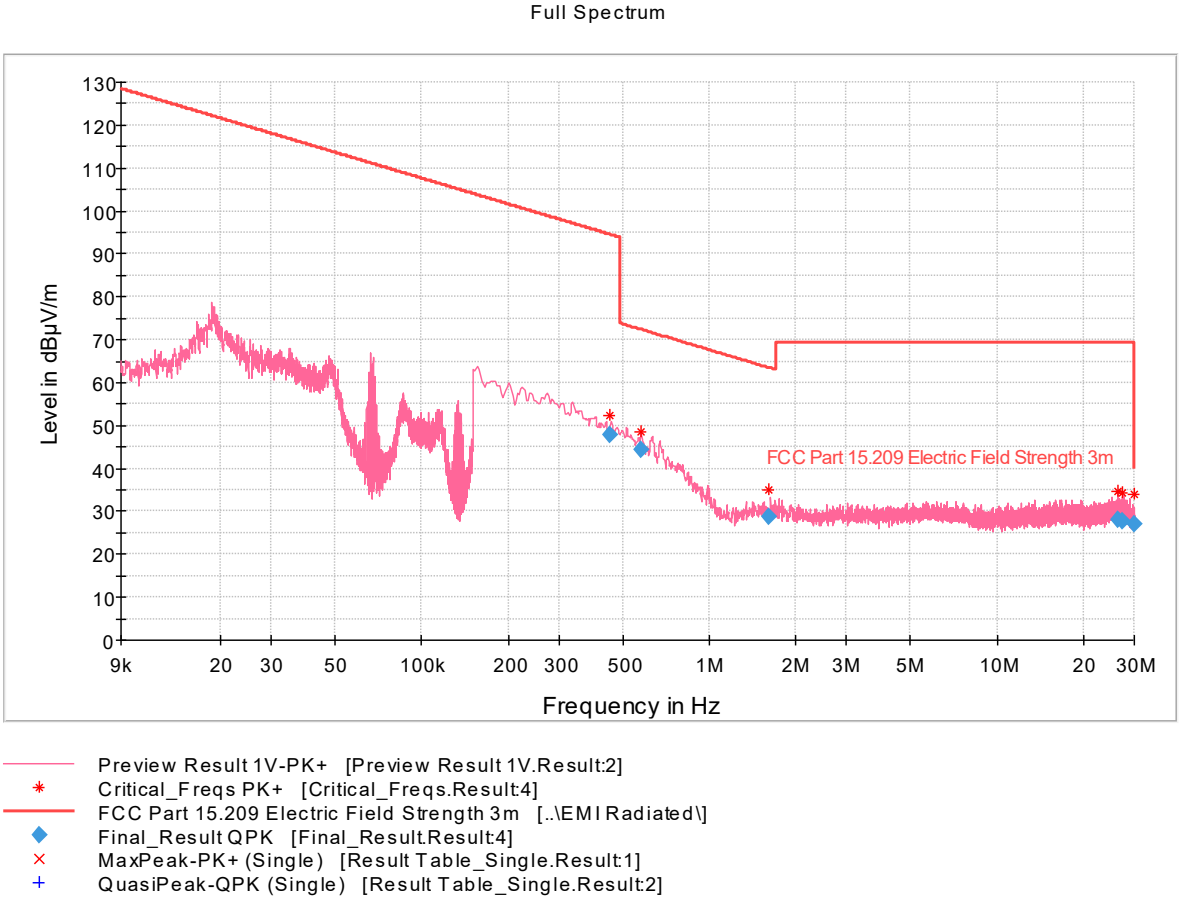
Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
18007.4045	44.06	73.90	29.84	1000.0	1000.000	189.0	V	304.0	-2
18147.6105	44.15	73.90	29.75	1000.0	1000.000	162.0	V	55.0	-2
18770.6725	45.61	73.90	28.29	1000.0	1000.000	162.0	V	43.0	-3
19818.0890	45.06	73.90	28.84	1000.0	1000.000	162.0	V	46.0	-3
19912.6830	43.86	73.90	30.04	1000.0	1000.000	139.0	V	61.0	-3
20047.7970	42.40	73.90	31.50	1000.0	1000.000	162.0	V	217.0	-3
20355.0930	41.57	73.90	32.33	1000.0	1000.000	139.0	V	68.0	-4
21648.2130	40.76	73.90	33.14	1000.0	1000.000	162.0	V	138.0	-2
22937.7690	38.36	73.90	35.54	1000.0	1000.000	139.0	V	265.0	-1
23593.2755	38.29	73.90	35.61	1000.0	1000.000	137.0	V	134.0	-1
25147.1860	41.08	73.90	32.82	1000.0	1000.000	162.0	V	49.0	-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)
18007.4045	30.92	53.90	22.98	1000.0	1000.000	189.0	V	304.0	-2
18147.6105	30.74	53.90	23.16	1000.0	1000.000	162.0	V	55.0	-2
18770.6725	32.44	53.90	21.46	1000.0	1000.000	162.0	V	43.0	-3
19818.0890	32.23	53.90	21.67	1000.0	1000.000	162.0	V	46.0	-3
19912.6830	31.17	53.90	22.73	1000.0	1000.000	139.0	V	61.0	-3
20047.7970	29.55	53.90	24.35	1000.0	1000.000	162.0	V	217.0	-3
20355.0930	29.05	53.90	24.85	1000.0	1000.000	139.0	V	68.0	-4
21648.2130	27.28	53.90	26.62	1000.0	1000.000	162.0	V	138.0	-2
22937.7690	25.81	53.90	28.09	1000.0	1000.000	139.0	V	265.0	-1
23593.2755	25.74	53.90	28.16	1000.0	1000.000	137.0	V	134.0	-1
25147.1860	28.25	53.90	25.65	1000.0	1000.000	162.0	V	49.0	-1

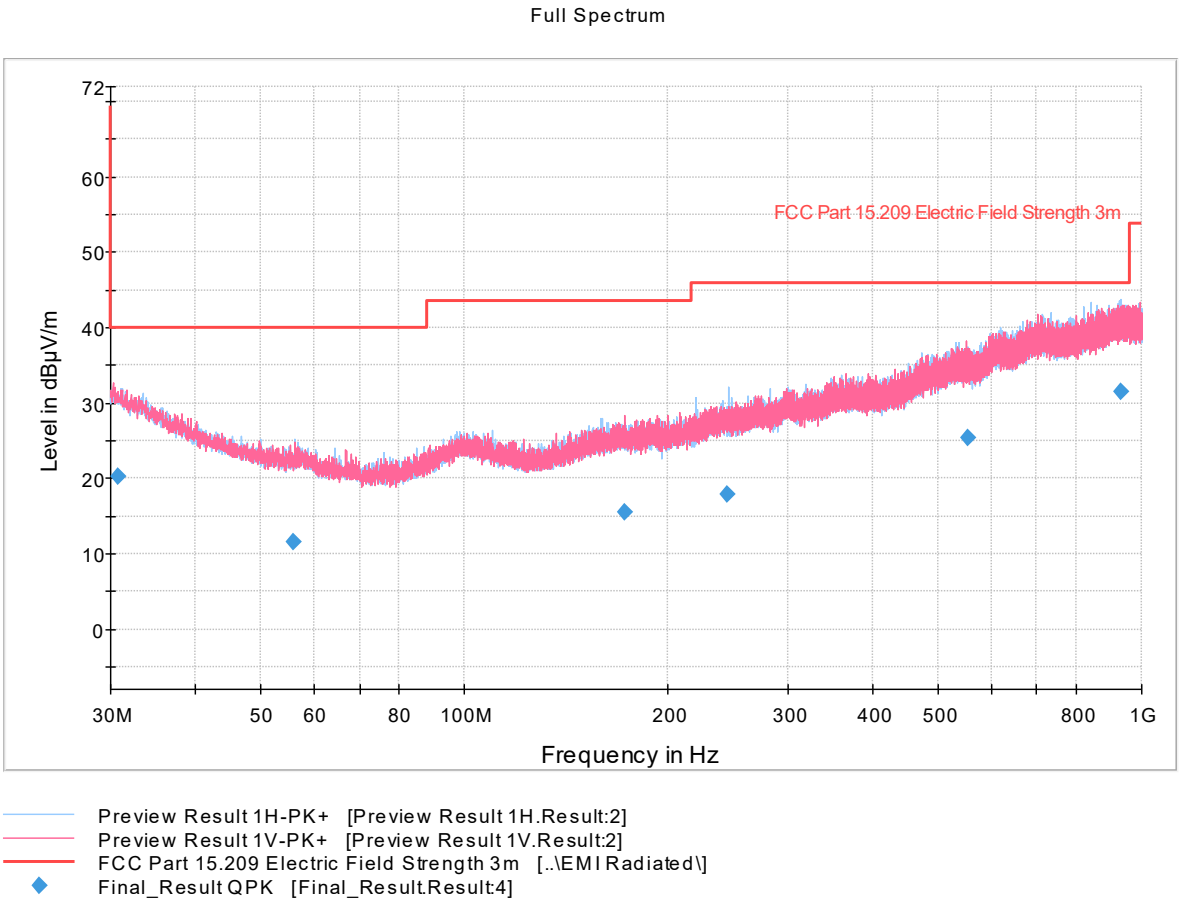
2.3.17 Test Results for 9kHz to 30MHz (HF)



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)
0.450670	47.87	94.53	46.66	1000.	9.000	400.0	H	137.0	20
0.576070	44.35	72.39	28.04	1000.	9.000	400.0	H	163.0	20
1.604518	28.84	63.49	34.65	1000.	9.000	400.0	H	215.0	20
26.322956	28.00	69.50	41.50	1000.	9.000	400.0	H	39.0	25
27.412081	27.81	69.50	41.69	1000.	9.000	400.0	H	262.0	25
29.990030	27.00	69.50	42.50	1000.	9.000	400.0	H	14.0	25

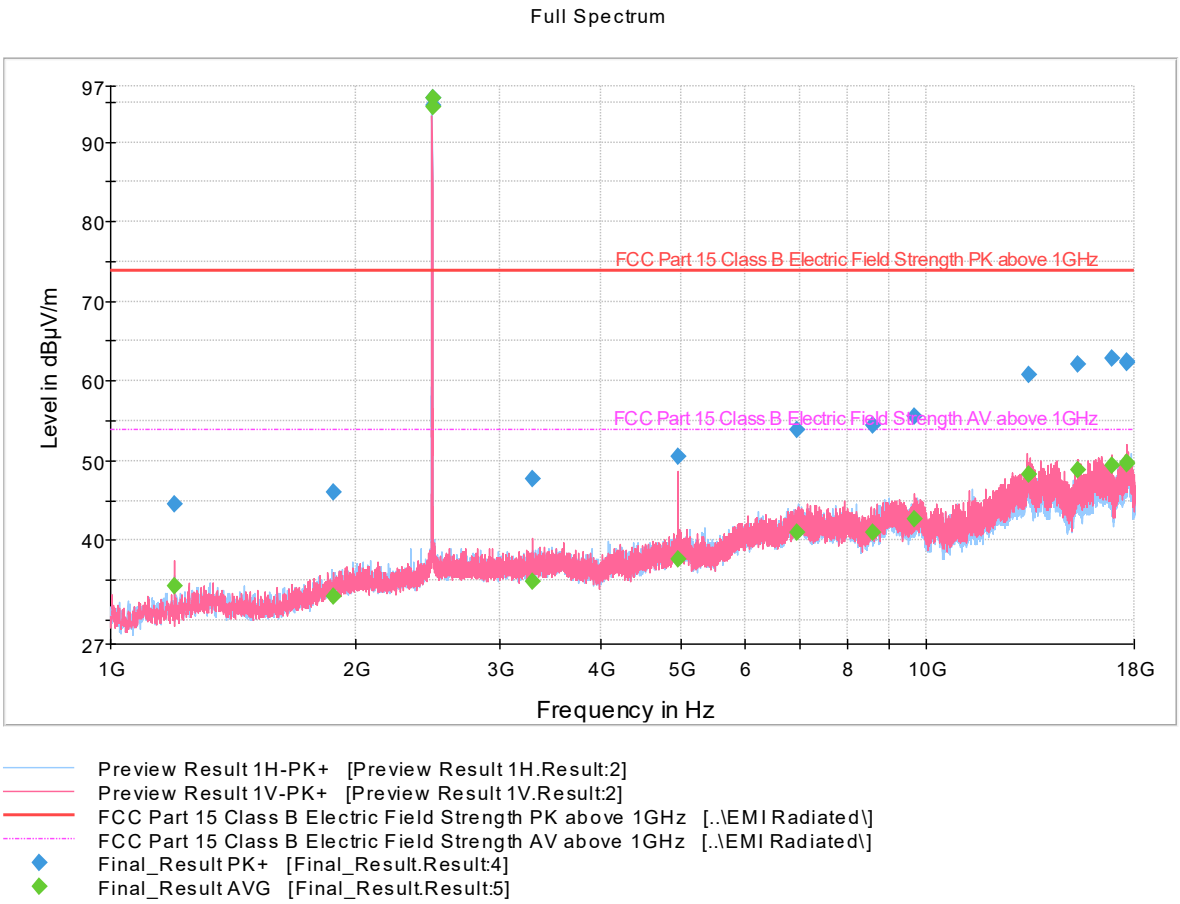
2.3.18 Test Results for 30MHz to 1GHz (HF)



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	20.20	40.00	19.80	1000.	120.000	388.0	V	240.0	22
55.828333	11.65	40.00	28.35	1000.	120.000	205.0	H	135.0	14
172.69900	15.41	43.50	28.09	1000.	120.000	205.0	V	75.0	17
244.39200	17.88	46.00	28.12	1000.	120.000	322.0	H	128.0	19
553.33566	25.34	46.00	20.66	1000.	120.000	125.0	V	18.0	26
932.41333	31.44	46.00	14.56	1000.	120.000	365.0	H	12.0	31

2.3.19 Test Results for 1GHz to 18GHz (HF)



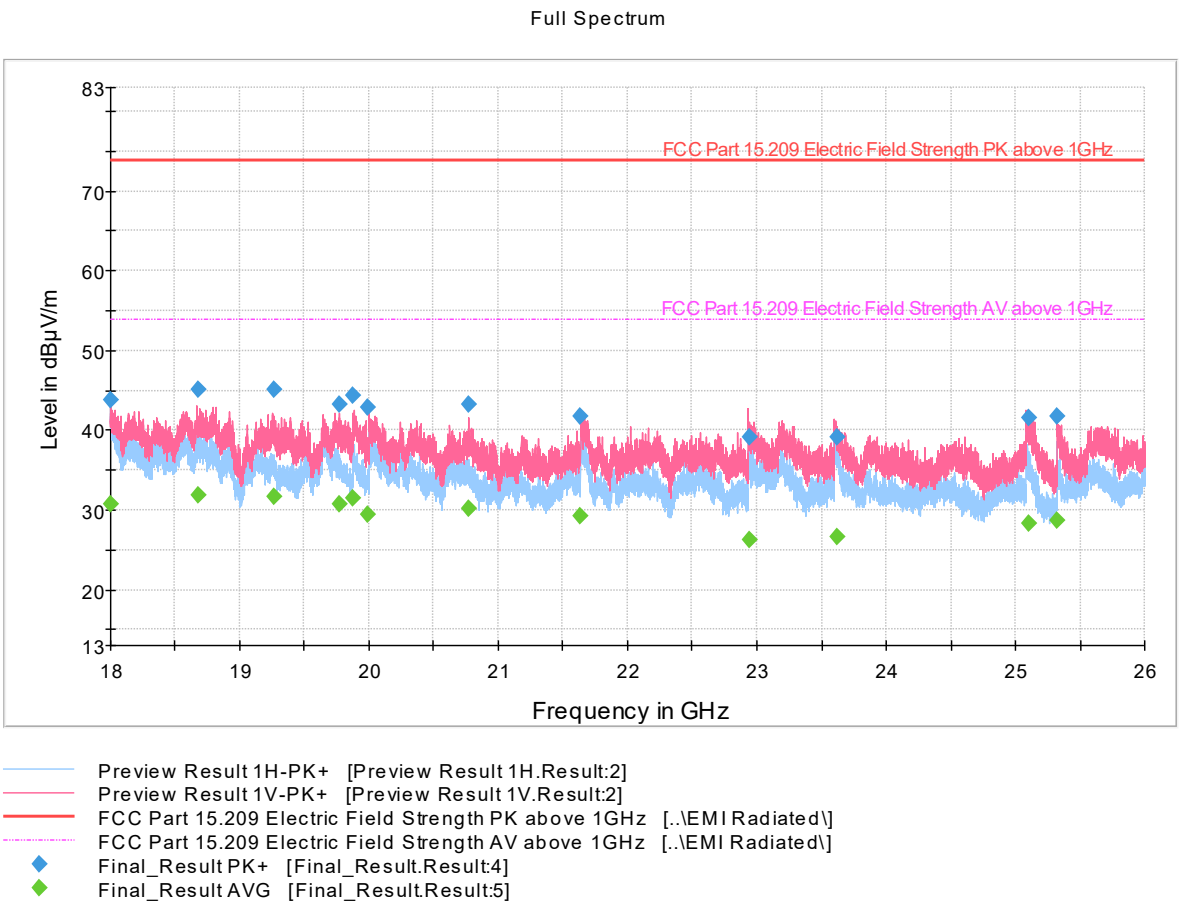
Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1200.06666	44.57	73.90	29.33	1000.0	1000.000	304.0	V	292.0	-1
1876.33333	45.95	73.90	27.95	1000.0	1000.000	335.0	H	42.0	3
2480.03333	95.56	73.90	-21.66	1000.0	1000.000	122.0	H	43.0	4
2480.16666	94.59	73.90	-20.69	1000.0	1000.000	119.0	H	51.0	4
3293.03333	47.72	73.90	26.18	1000.0	1000.000	126.0	V	110.0	5
4959.26666	50.57	73.90	23.33	1000.0	1000.000	205.0	V	354.0	8
6958.40000	53.79	73.90	20.11	1000.0	1000.000	255.0	V	41.0	10
8594.70000	54.48	73.90	19.42	1000.0	1000.000	329.0	H	139.0	14
9690.00000	55.63	73.90	18.27	1000.0	1000.000	365.0	V	110.0	12
13338.0000	60.76	73.90	13.14	1000.0	1000.000	175.0	V	211.0	18
15351.3666	62.09	73.90	11.81	1000.0	1000.000	140.0	V	45.0	19
16895.9333	62.84	73.90	11.06	1000.0	1000.000	139.0	V	77.0	21
17592.5666	62.53	73.90	11.37	1000.0	1000.000	162.0	V	50.0	23
17598.5666	62.36	73.90	11.54	1000.0	1000.000	175.0	V	7.0	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)
1200.06666	34.27	53.90	19.63	1000.0	1000.000	304.0	V	292.0	-1
1876.33333	32.88	53.90	21.02	1000.0	1000.000	335.0	H	42.0	3
2480.03333	95.48	53.90	-41.58	1000.0	1000.000	122.0	H	43.0	4
2480.16666	94.31	53.90	-40.41	1000.0	1000.000	119.0	H	51.0	4
3293.03333	34.93	53.90	18.97	1000.0	1000.000	126.0	V	110.0	5
4959.26666	37.57	53.90	16.33	1000.0	1000.000	205.0	V	354.0	8
6958.40000	41.04	53.90	12.86	1000.0	1000.000	255.0	V	41.0	10
8594.70000	40.92	53.90	12.98	1000.0	1000.000	329.0	H	139.0	14
9690.00000	42.60	53.90	11.30	1000.0	1000.000	365.0	V	110.0	12
13338.0000	48.32	53.90	5.58	1000.0	1000.000	175.0	V	211.0	18
15351.3666	48.93	53.90	4.97	1000.0	1000.000	140.0	V	45.0	19
16895.9333	49.45	53.90	4.45	1000.0	1000.000	139.0	V	77.0	21
17592.5666	49.73	53.90	4.17	1000.0	1000.000	162.0	V	50.0	23
17598.5666	49.67	53.90	4.23	1000.0	1000.000	175.0	V	7.0	23

2.3.20 Test Results for 18GHz to 26GHz (HF)



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)
18004.4221	43.79	73.90	30.11	1000.0	1000.000	162.0	V	70.0	-2
18676.0885	45.14	73.90	28.76	1000.0	1000.000	152.0	V	200.0	-3
19261.5465	45.11	73.90	28.79	1000.0	1000.000	139.0	V	45.0	-3
19772.9215	43.30	73.90	30.60	1000.0	1000.000	162.0	V	48.0	-3
19877.4040	44.43	73.90	29.47	1000.0	1000.000	137.0	V	123.0	-3
19994.2170	42.79	73.90	31.11	1000.0	1000.000	139.0	V	43.0	-3
20764.4900	43.28	73.90	30.62	1000.0	1000.000	162.0	V	90.0	-3
21636.8690	41.79	73.90	32.11	1000.0	1000.000	156.0	V	244.0	-2
22939.1505	39.20	73.90	34.70	1000.0	1000.000	137.0	V	235.0	-1
23616.4010	39.20	73.90	34.70	1000.0	1000.000	162.0	V	66.0	-1
25102.2985	41.51	73.90	32.39	1000.0	1000.000	159.0	V	75.0	-1
25325.9935	41.69	73.90	32.21	1000.0	1000.000	152.0	V	47.0	0

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)
18004.4221	30.67	53.90	23.23	1000.0	1000.000	162.0	V	70.0	-2
18676.0885	31.87	53.90	22.03	1000.0	1000.000	152.0	V	200.0	-3
19261.5465	31.73	53.90	22.18	1000.0	1000.000	139.0	V	45.0	-3
19772.9215	30.79	53.90	23.11	1000.0	1000.000	162.0	V	48.0	-3
19877.4040	31.57	53.90	22.33	1000.0	1000.000	137.0	V	123.0	-3
19994.2170	29.47	53.90	24.43	1000.0	1000.000	139.0	V	43.0	-3
20764.4900	30.15	53.90	23.75	1000.0	1000.000	162.0	V	90.0	-3
21636.8690	29.30	53.90	24.60	1000.0	1000.000	156.0	V	244.0	-2
22939.1505	26.18	53.90	27.72	1000.0	1000.000	137.0	V	235.0	-1
23616.4010	26.58	53.90	27.32	1000.0	1000.000	162.0	V	66.0	-1
25102.2985	28.33	53.90	25.57	1000.0	1000.000	159.0	V	75.0	-1
25325.9935	28.71	53.90	25.19	1000.0	1000.000	152.0	V	47.0	0

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
Radiated Emission						
6628	Loop Antenna	HFH2-Z2335.4711.52	FNr.800.458/25	Schwarbeck	06/23/22	06/23/24
1033	BiConiLog Antenna	3142C	00044556	ETS Lindgren	10/05/21	10/05/23
51235	RF Pre-Amp (9kHz to 1GHz)	310	412802	Sonoma	08/26/21	08/26/23
7575	1-18GHz DRG Horn	3117	155511	ETS Lindgren	08/08/21	08/08/24
8628	Pre Amplifier	QLJ-01182835-JO	8986002	Quinstar	05/29/22	05/29/23
1049	EMI Test Receiver	ESU40	100133	Rhone & Schwarz	09/21/22	09/21/23
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						
7619	Barometer/ Temperature/Humidity	iBTHX-W	15250268	Omega	05/27/22	05/27/23
43003	True RMS Multimeter	85 III	69880143	Fluke	01/09/23	01/09/24
	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 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 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	0.00 dB	Triangular	2.449	0.00	0.00
16	Separation distance at 3 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 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	2.45 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

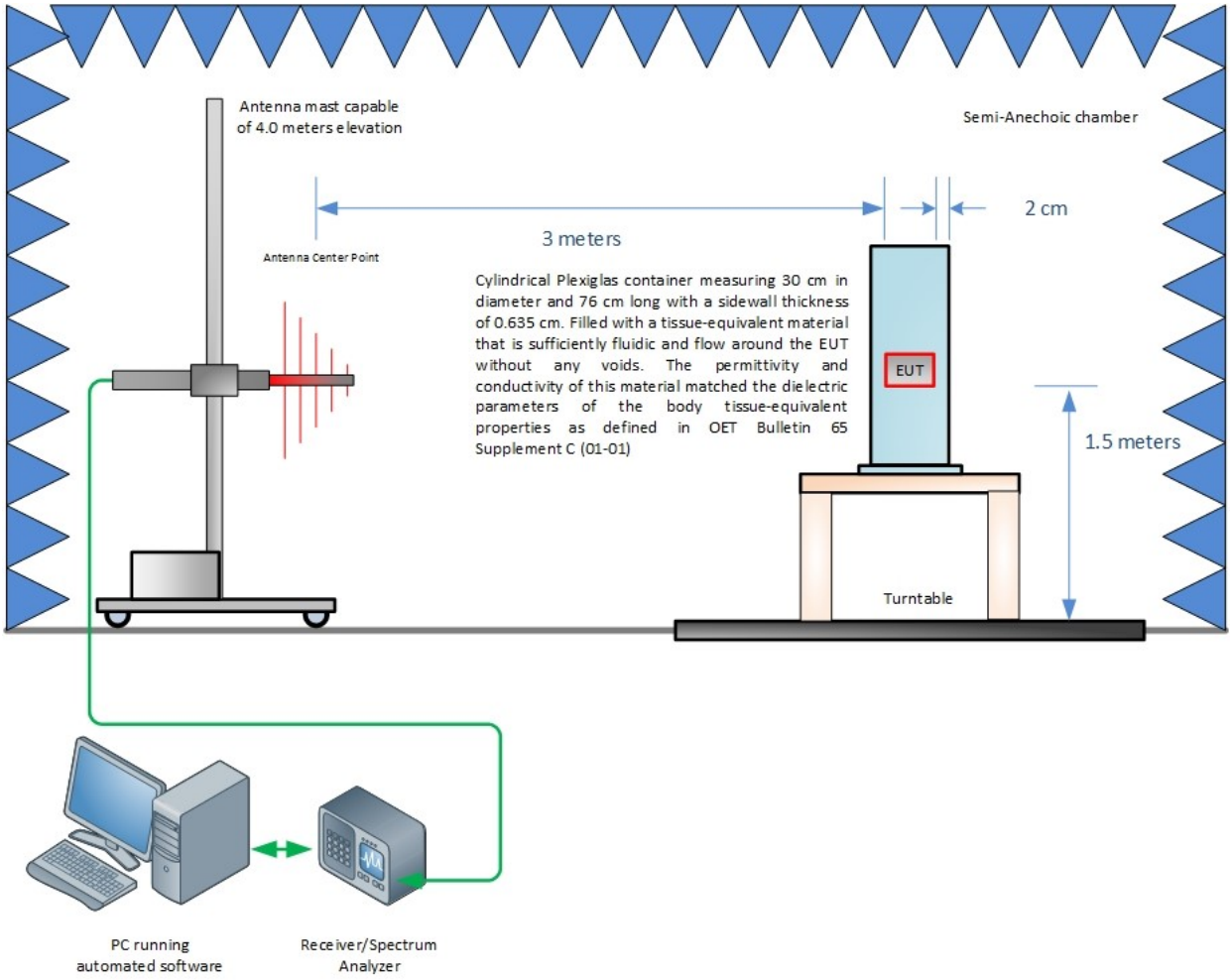
13	Cross-polarisation	0.90	dB	Rectangular	1.732	0.52	0.27
14	Balance	0.00	dB	Rectangular	1.732	0.00	0.00
15	Site imperfections	3.25	dB	Triangular	2.449	1.33	1.76
16	Separation distance at 3 m	0.30	dB	Rectangular	1.732	0.17	0.03
17	Effect of setup table material	0.77	dB	Rectangular	1.732	0.44	0.20
18	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**

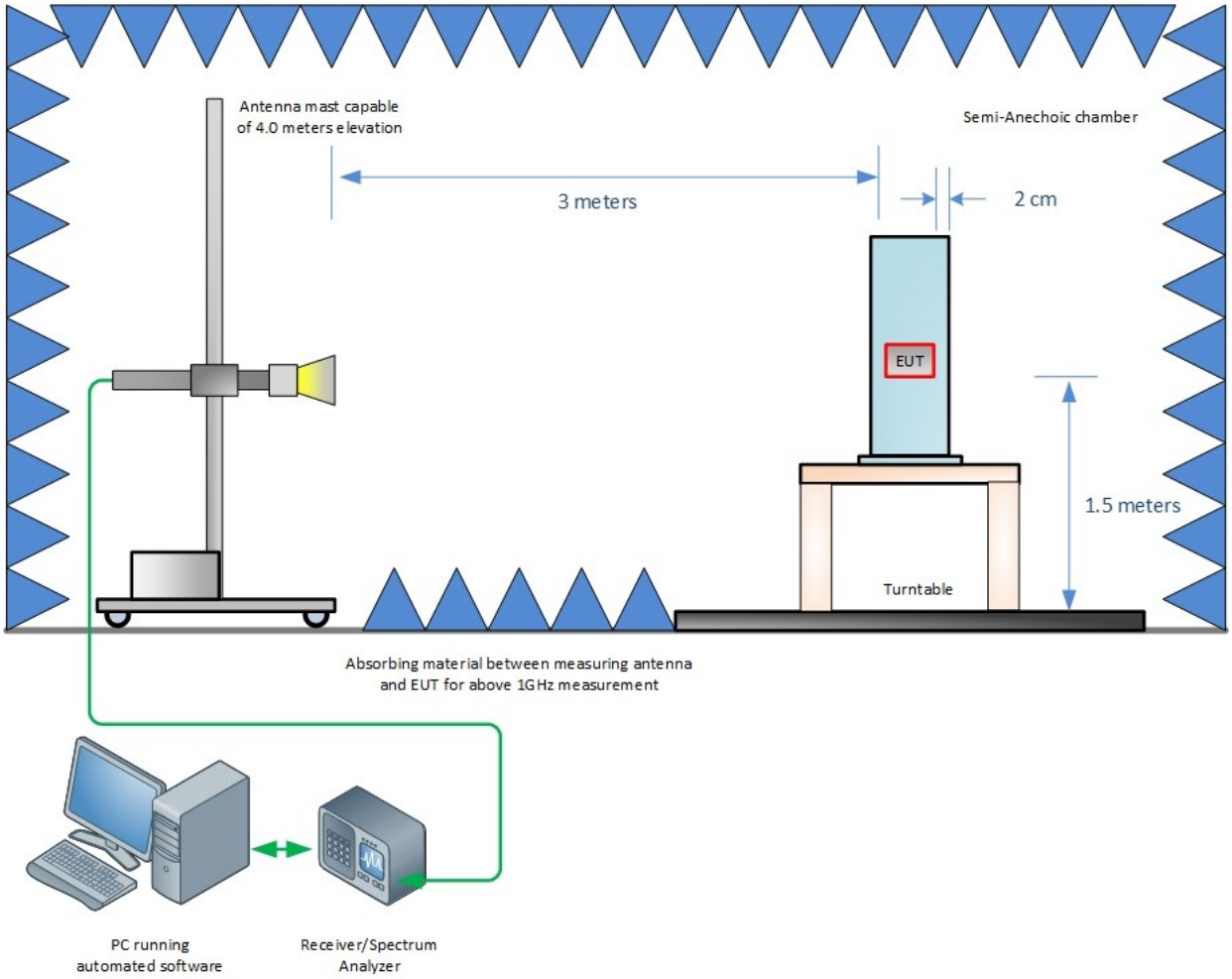
SECTION 4

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

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