# Radio Testing of the

# DEERE & COMPANY
# Sensor, Cotton Mass Flow Low Power
# Model: PH85246071

## In accordance with
## FCC Part 15 Subpart C §15.245
## ISED RSS-210 Issue 10 December 2019
## And AS/NZS 4268:2017 Amd 1:2021

America

Add value.
Inspire trust.

DEERE & COMPANY
One John Deere Place
Moline, IL 61265 USA

## COMMERCIAL-IN-CONFIDENCE

Date: May 2023
Document Number: 72184151B Issue 03 | Version Number: 01

| RESPONSIBLE FOR | NAME | DATE | SIGNATURE |
|---|---|---|---|
| **Authorized Signatory** | Ferdinand S. Custodio | 05/15/23 | |

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 §15.245 ISED RSS-210 Issue 10 December 2019 and AS/NZS 4268:2017 Amd 1:2021

A2LA Cert. No. 2955.13



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| | |
|---|---|
| **REPORT ON** | Radio Testing of the<br>DEERE & COMPANY<br>PH85246071 Sensor, Cotton Mass Flow Low Power |
| **TEST REPORT NUMBER** | 72184151B |
| **TEST REPORT DATE** | May 2023 |
| **PREPARED FOR** | DEERE & COMPANY<br>One John Deere Place<br>Moline, IL 61265 USA |
| CONTACT PERSON | Jessica Berberich<br>Sr. Standards Engineer<br>BerberichJessicaL@JohnDeere.com<br>(515) 253-6337 |
| **PREPARED BY** | Joe Salvador<br>**Name**<br>Authorized Signatory<br>Title: RF Test Engineer |
| **APPROVED BY** | Ferdinand S. Custodio<br>**Name**<br>Authorized Signatory<br>Title: Senior EMC Test Engineer / Wireless Team Lead |
| **DATED** | 05/15/23 |

## Revision History

| 72184151B<br>DEERE & COMPANY<br>Model PH85246071 Sensor, Cotton Mass Flow Low Power | | | | | |
|---|---|---|---|---|---|
| DATE | OLD REVISION | NEW REVISION | REASON | PAGES AFFECTED | APPROVED BY |
| 2/24/23 | | Initial Release | | | Ferdinand Custodio |
| 03/10/23 | | 02 | Customer provided new FCC ID. FCC ID is now 2AAFX-PH85246071 | 1-45 | Ferdinand Custodio |
| 05/15/23 | Initial Release | 03 | AS/NZS 4268:2017 Amd 1:2021 added to the report. | 1,4,6,7 | Ferdinand Custodio |
| | | | | | |
| | | | | | |

# CONTENTS

# SECTION 1

# REPORT SUMMARY

Radio Testing of the
DEERE & COMPANY
Sensor, Cotton Mass Flow Low Power

## 1.1 INTRODUCTION

The information contained in this report is intended to show verification of the DEERE & COMPANY Sensor, Cotton Mass Flow Low Power PH85246071 to the requirements of FCC Part 15 Subpart C §15.245, ISED RSS-210 Issue 10 December 2019 and AS/NZS 4268:2017 Amd 1:2021.

| | |
|---|---|
| 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 | DEERE & COMPANY |
| EUT | Sensor, Cotton Mass Flow Low Power |
| Trade Name | JOHN DEERE |
| Model # | PH85246071 |
| FCC ID | 2AAFX-PH85246071 |
| Serial Number(s) | PSX00N100051 |
| Number of Samples Tested | 1 |
| Test Specification/Issue/Date | • FCC Part 15 Subpart C §15.245 (October 1, 2021).<br>• ISED RSS-210 Issue 10 December 2019: License-Exempt Radio Apparatus: Category I Equipment.<br>• AS/NZS 4268:2017 Amd1:2021 Radio equipment and systems - Short range devices - Limits and methods of measurement. |
| Start of Test | November 7, 2022 |
| Finish of Test | November 14, 2022 |
| Name of Engineer(s) | Joe Salvador |
| Related Document(s) | • ANSI C63.10-2013. American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices<br>• ENG-012 F10 Rev C – CMFS EMC Emissions.docx<br>• 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 §15.245 and ISED RSS-210 Issue 10 December 2019 and with cross-reference to the corresponding ISED RSS standard are shown below. FCC rule requirements referenced from AS/NZS 4268:2017 Amd 1:2021 section 6.2.2.

| Section | §15.245 Spec Clause | RSS | Test Description | Result | Comments /Base Standard |
|---|---|---|---|---|---|
| 2.1 | §15.245(b) | RSS-210 Annex F | Fundamental Emissions | Compliant | |
| 2.2 | §15.245(b) | RSS-210 Annex F | Spurious Emissions | Compliant | |
| 2.3 | - | RSS-Gen 6.7 | 99% Emission Bandwidth | For Reference Only | |
| - | | RSS-Gen 8.8 | AC Powerline conducted Emissions | N/A | |

N/A Not performed as the EUT does not have provisions to connect to public AC mains.

## 1.3 PRODUCT INFORMATION

### 1.3.1 Technical Description

The Equipment Under Test (EUT) is a DEERE & COMPANY PH85246071. The EUT is a sensor used to measure the mass flow rate of cotton flowing through a non-conductive duct on a cotton picker using a microwave signal. The cotton mass flow rate in duct ranges from 0 to 1.3 kg/s. The cotton velocity ranges from 13m/s to 18m/s (46.8 km/h to 64.8 km/h / 29.1 mph to 40.3 mph).

### 1.3.2 EUT General Description

| | |
|---|---|
| EUT Description | Sensor |
| Model Name | Sensor, Cotton Mass Flow Low Power |
| Model Number | PH85246071 |
| Serial Number | PSX00N100051 |
| Input Voltage | 13.8VDC Nominal (9VDC to 16VDC) |
| Output RF Power | 97.98 mW Peak EIRP |
| Frequency Range (TX) | 24.136 GHz |

## 1.4 EUT TEST CONFIGURATION

### 1.4.1 Test Configuration Description

| Test Configuration | Description |
|---|---|
| Default | The EUT will start transmitting once power is applied (9 to 16VDC) |

### 1.4.2 EUT Exercise Software

None. No special software was utilized to exercise the EUT during verifications.

### 1.4.3 Support Equipment and I/O cables

| Manufacturer | Equipment/Cable | Description |
|---|---|---|
| John Deere | Wiring Harness | Custom cable assy with eight (8) 1.1 meters conductors and banana Jack connectors |

### 1.4.4 Simplified Test Configuration Diagram

Not required. The EUT was verified on a stand-alone configuration.

## 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: PSX00N100051 | | |
| None | — | — |

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 (IC) 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 LP002 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
DEERE & COMPANY
Sensor, Cotton Mass Flow Low Power

## 2.1 RF POWER OUTPUT

### 2.1.1 Specification Reference

FCC 47 Chapter I Subchapter A Part 15 Subpart C §15.245
RSS-210, Annex F

### 2.1.2 Standard Applicable

(b) The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

| Fundamental frequency (MHz) | Field strength of fundamental (mv/m) | Field strength of harmonics (mv/m) |
|---|---|---|
| 902-928 | 500 | 1.6 |
| 2435-2465 | 500 | 1.6 |
| 5785-5815 | 500 | 1.6 |
| 10500-10550 | 2500 | 25.0 |
| 24075-24175 | 2500 | 25.0 |

1) Regardless of the limits shown in the above table, harmonic emissions in the restricted bands below 17.7 GHz, as specified in §15.205, shall not exceed the field strength limits shown in §15.209. Harmonic emissions in the restricted bands at and above 17.7 GHz shall not exceed the following field strength limits:

(i) For the second and third harmonics of field disturbance sensors operating in the 24075-24175 MHz band and for other field disturbance sensors designed for use only within a building or to open building doors, 25.0 mV/m.

(ii) For all other field disturbance sensors, 7.5 mV/m.

(iii) Field disturbance sensors designed to be used in motor vehicles or aircraft must include features to prevent continuous operation unless their emissions in the restricted bands, other than the second and third harmonics from devices operating in the 24075-24175 MHz band, fully comply with the limits given in §15.209. Continuous operation of field disturbance sensors designed to be used in farm equipment, vehicles such as fork lifts that are intended primarily for use indoors or for very specialized operations, or railroad locomotives, railroad cars and other equipment which travels on fixed tracks is permitted. A field disturbance sensor will be considered not to be operating in a continuous mode if its operation is limited to specific activities of limited duration (e.g., putting a vehicle into reverse gear, activating a turn signal, etc.).

### 2.1.3 Equipment Under Test and Modification State

Serial No: PSX00N100051 / Default Test Configuration

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

November 7, 2022 / JS

### 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

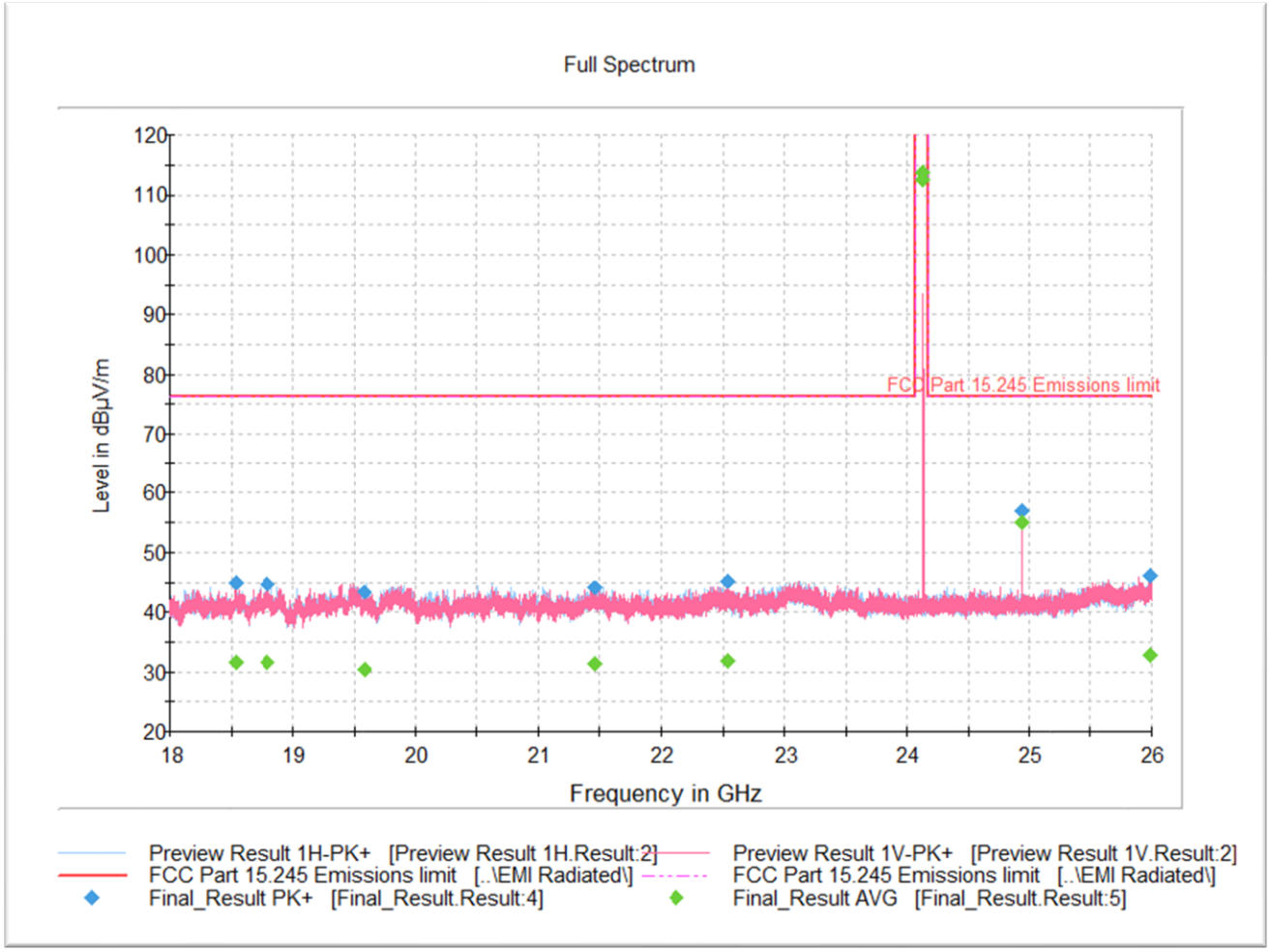
Test performed at TÜV SÜD America Inc. Mira Mesa facility

| | |
|---|---|
| Ambient Temperature | 27.5 °C |
| Relative Humidity | 43.5 % |
| ATM Pressure | 100.1 kPa |

### 2.1.7 Test Results

Compliant. See attached test plot.

### 2.1.8 From 18GHz to 26.5GHz Radiated Emission Test




**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) |
|---|---|---|---|---|---|---|---|---|---|
| 24136.175000 | 115.14 | 129.20 | 15.30 | 1000.0 | 1000.000 | 163.0 | V | 67.0 | -2 |

**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)** |
|---|---|---|---|---|---|---|---|---|---|
| 24136.175000 | 115.08 | 129.20 | 15.36 | 1000.0 | 1000.000 | 163.0 | V | 67.0 | -2 |

## 2.2 SPURIOUS EMISSIONS

### 2.2.1 Specification Reference

FCC 47 Chapter I Subchapter A Part 15 Subpart C §15.245
RSS-210, Annex F

### 2.2.2 Standard Applicable

(2) Field strength limits are specified at a distance of 3 meters.

(3) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

(4) The emission limits shown above are based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply.

### 2.2.3 Equipment Under Test and Modification State

Serial No: PSX00N100051 / Default Test Configuration

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

November 10, 2022 / 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

Test performed at TÜV SÜD America Inc. Mira Mesa facility

| | |
|---|---|
| Ambient Temperature | 27.5 °C |
| Relative Humidity | 43.5 % |
| ATM Pressure | 100.1 kPa |

### 2.2.7 Additional Observations

- This is a radiated test.
- The spectrum was searched from 9kHz to 100GHz.
- Limits used outside the frequency band 24075-24175MHz as required is per §15.209 which is identical to FCC Subpart B limit (§15.109 Class B). There are no significant emissions observed other than the Fundamental and Harmonics. Above 40GHz, only the Harmonics limits presented.
- Measurement was done using EMC32 automated software below 40GHz. 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.

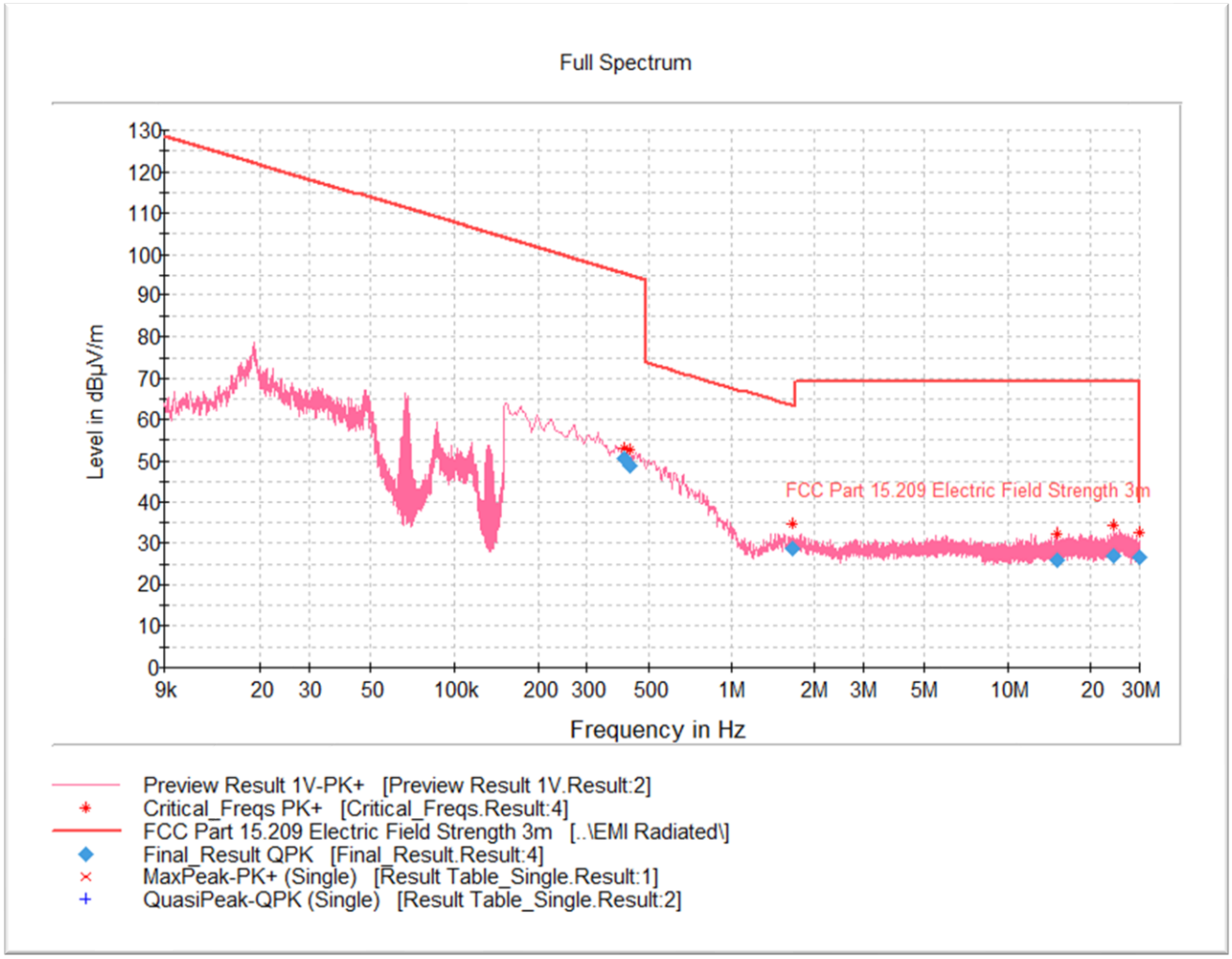
### 2.2.8 Sample Computation (Radiated Emission)

| | | | |
|---|---|---|---|
| Measuring equipment raw measurement (dbµV) @ 30 MHz | | | 24.4 |
| Correction Factor (dB) | Asset# 1066 (cable) | 0.3 | -12.6 |
| | Asset# 1172 (cable) | 0.3 | |
| | Asset# 1016 (preamplifier) | -30.7 | |
| | Asset# 1175(cable) | 0.3 | |
| | Asset# 1002 (antenna) | 17.2 | |
| **Reported QuasiPeak Final Measurement (dbµV/m) @ 30MHz** | | | **11.8** |

### 2.2.9 Test Results

Compliant. See attached plots.

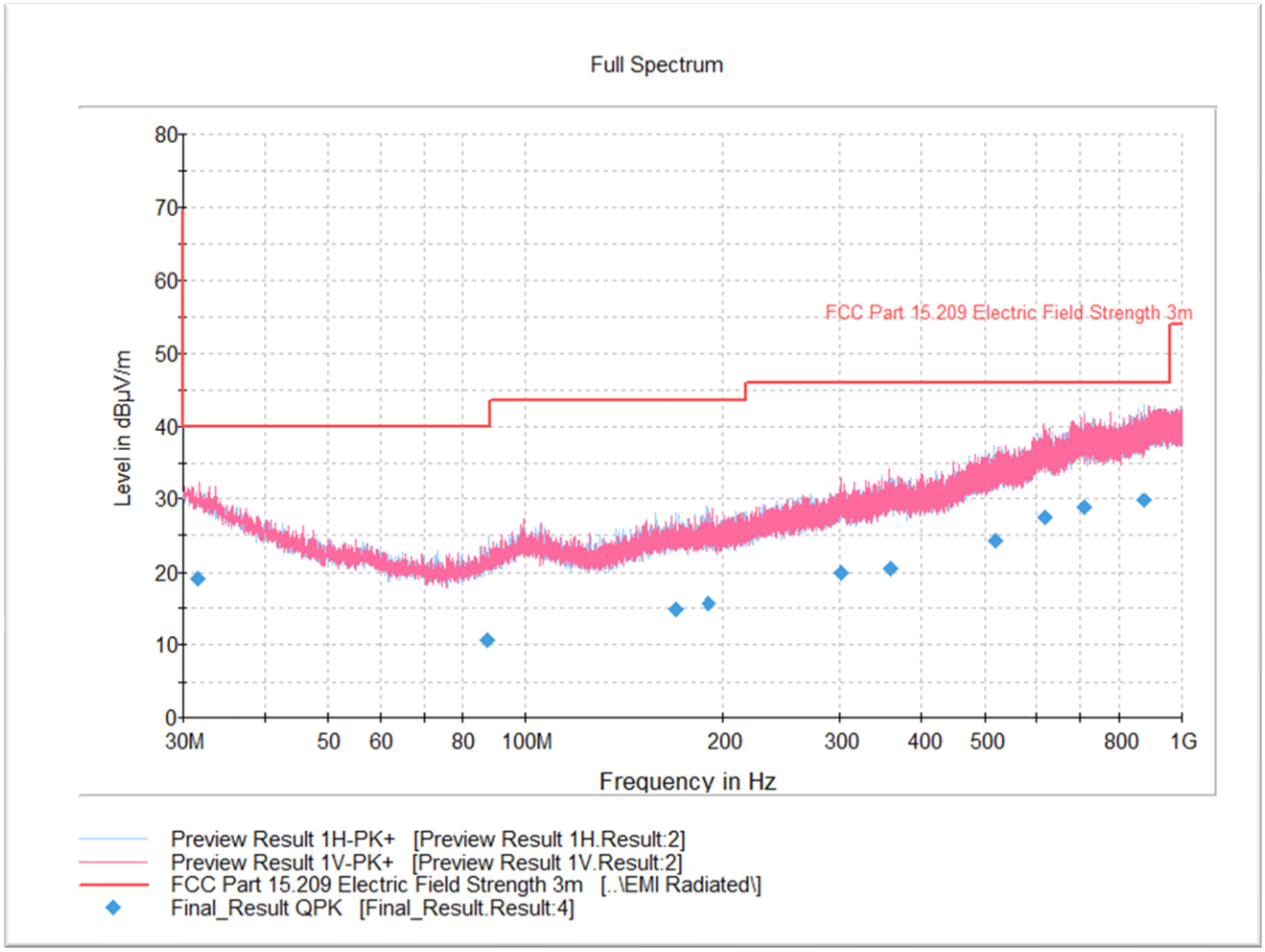
### 2.2.10 Below 30MHz Radiated Emission Test




**Quasi-Peak Data**

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Pol | Height (cm) | Azimuth (degrees) | Corr. (dB/m) |
|---|---|---|---|---|---|---|---|---|---|
| 0.407730 | 50.52 | 95.40 | 44.88 | 1000.0 | 9.000 | 400.0 | H | 229.0 | 19 |
| 0.427640 | 48.96 | 94.98 | 46.02 | 1000.0 | 9.000 | 400.0 | H | 39.0 | 19 |
| 1.660128 | 28.63 | 63.19 | 34.57 | 1000.0 | 9.000 | 400.0 | H | 98.0 | 20 |
| 14.983473 | 26.12 | 69.50 | 43.38 | 1000.0 | 9.000 | 400.0 | H | 111.0 | 22 |
| 24.320943 | 26.95 | 69.50 | 42.55 | 1000.0 | 9.000 | 400.0 | H | 318.0 | 24 |
| 29.837130 | 26.53 | 69.50 | 42.97 | 1000.0 | 9.000 | 400.0 | H | 325.0 | 25 |

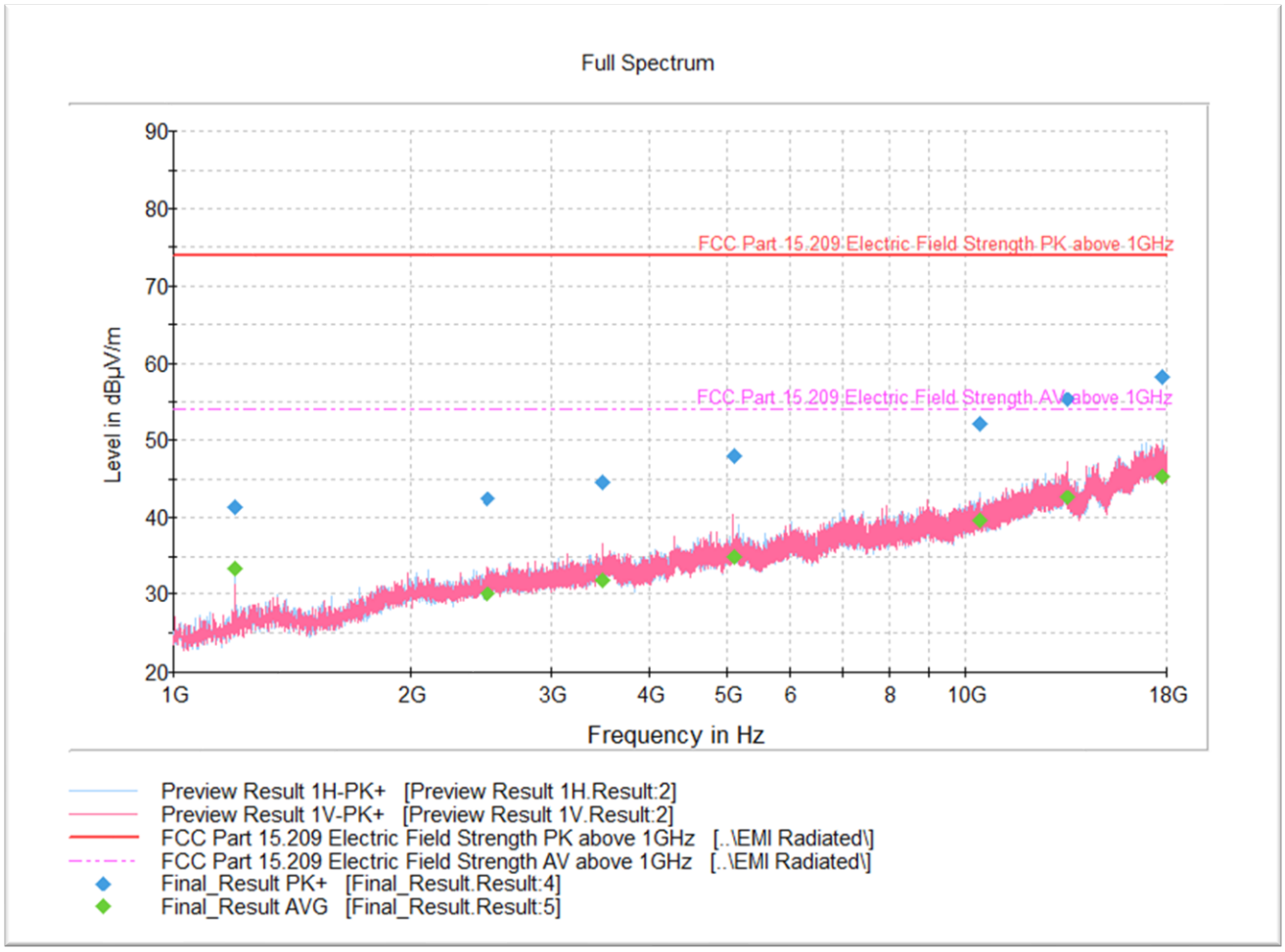
### 2.2.11 30MHz to 1GHz Radiated Emission Test




**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) |
|---|---|---|---|---|---|---|---|---|---|
| 31.707667 | 19.10 | 40.00 | 20.90 | 1000.0 | 120.000 | 367.0 | V | 71.0 | 21 |
| 86.904000 | 10.60 | 40.00 | 29.40 | 1000.0 | 120.000 | 384.0 | H | 288.0 | 13 |
| 168.765333 | 14.83 | 43.50 | 28.67 | 1000.0 | 120.000 | 140.0 | H | 234.0 | 17 |
| 189.864667 | 15.70 | 43.50 | 27.80 | 1000.0 | 120.000 | 383.0 | H | 145.0 | 17 |
| 302.543000 | 19.90 | 46.00 | 26.10 | 1000.0 | 120.000 | 296.0 | V | -6.0 | 22 |
| 358.200667 | 20.61 | 46.00 | 25.39 | 1000.0 | 120.000 | 175.0 | V | 152.0 | 23 |
| 517.869333 | 24.34 | 46.00 | 21.66 | 1000.0 | 120.000 | 325.0 | H | 146.0 | 26 |
| 617.257667 | 27.42 | 46.00 | 18.58 | 1000.0 | 120.000 | 325.0 | V | 191.0 | 27 |
| 709.542667 | 28.75 | 46.00 | 17.25 | 1000.0 | 120.000 | 164.0 | H | 178.0 | 29 |
| 876.696000 | 29.73 | 46.00 | 16.27 | 1000.0 | 120.000 | 306.0 | H | 352.0 | 30 |

### 2.2.12 From 1GHz to 18GHz Radiated Emission Test



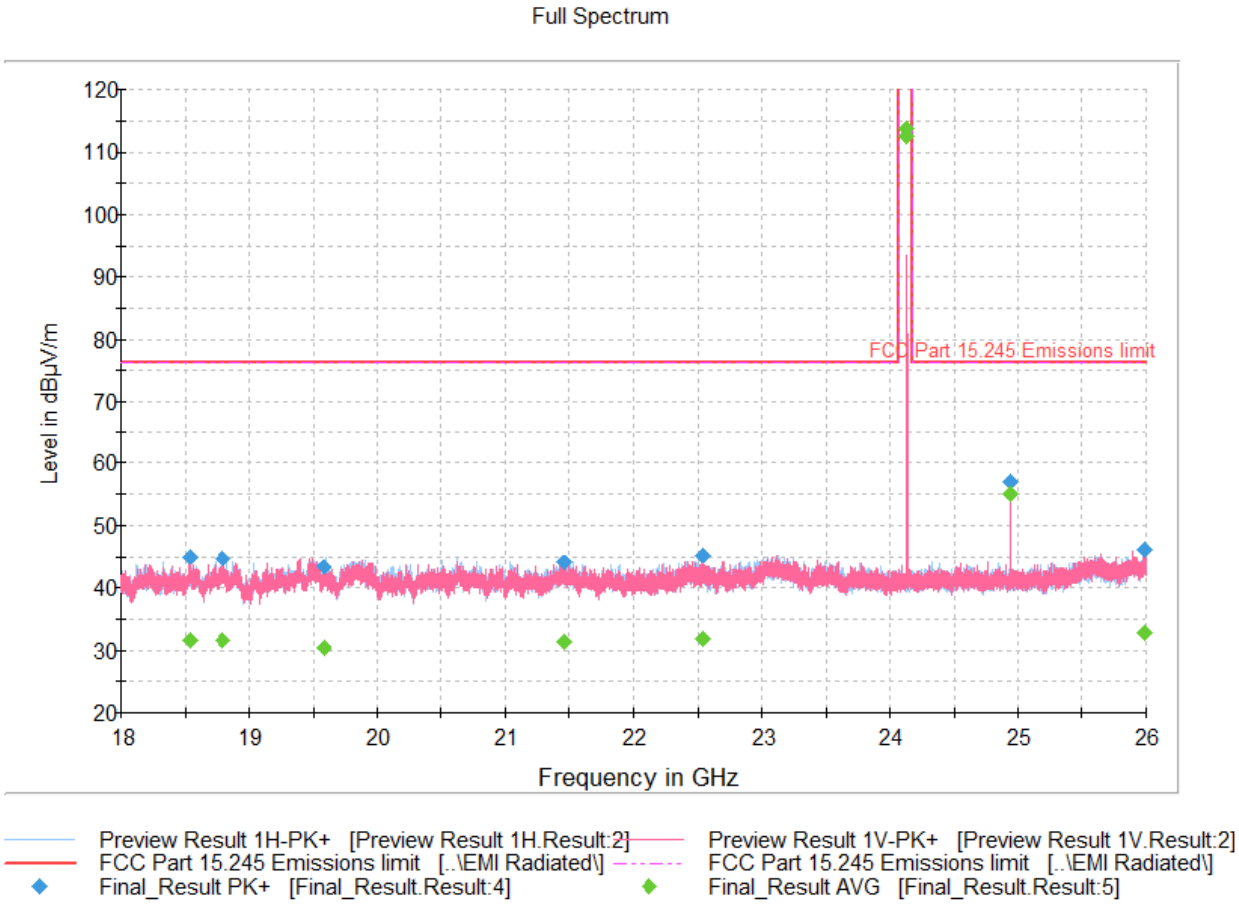

**Peak Data**

| Frequency (MHz) | MaxPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) |
|---|---|---|---|---|---|---|---|---|---|
| 1200.066667 | 41.35 | 73.90 | 32.55 | 1000.0 | 1000.000 | 365.0 | H | 47.0 | -5 |
| 2495.966667 | 42.33 | 73.90 | 31.57 | 1000.0 | 1000.000 | 175.0 | V | 286.0 | 1 |
| 3492.900000 | 44.69 | 73.90 | 29.21 | 1000.0 | 1000.000 | 166.0 | V | 17.0 | 3 |
| 5110.400000 | 48.01 | 73.90 | 25.89 | 1000.0 | 1000.000 | 175.0 | V | 20.0 | 5 |
| 10417.500000 | 52.16 | 73.90 | 21.74 | 1000.0 | 1000.000 | 255.0 | H | 312.0 | 12 |
| 13457.633333 | 55.26 | 73.90 | 18.64 | 1000.0 | 1000.000 | 132.0 | V | 238.0 | 13 |
| 17740.633333 | 58.36 | 73.90 | 15.54 | 1000.0 | 1000.000 | 365.0 | H | 284.0 | 19 |

## 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) |
|---|---|---|---|---|---|---|---|---|---|
| 1200.066667 | 33.38 | 53.90 | 20.52 | 1000.0 | 1000.000 | 365.0 | H | 47.0 | -5 |
| 2495.966667 | 30.04 | 53.90 | 23.86 | 1000.0 | 1000.000 | 175.0 | V | 286.0 | 1 |
| 3492.900000 | 31.91 | 53.90 | 21.99 | 1000.0 | 1000.000 | 166.0 | V | 17.0 | 3 |
| 5110.400000 | 35.02 | 53.90 | 18.88 | 1000.0 | 1000.000 | 175.0 | V | 20.0 | 5 |
| 10417.500000 | 39.63 | 53.90 | 14.27 | 1000.0 | 1000.000 | 255.0 | H | 312.0 | 12 |
| 13457.633333 | 42.61 | 53.90 | 11.29 | 1000.0 | 1000.000 | 132.0 | V | 238.0 | 13 |
| 17740.633333 | 45.33 | 53.90 | 8.57 | 1000.0 | 1000.000 | 365.0 | H | 284.0 | 19 |

### 2.2.13 18GHz to 26GHz Radiated Emission Test



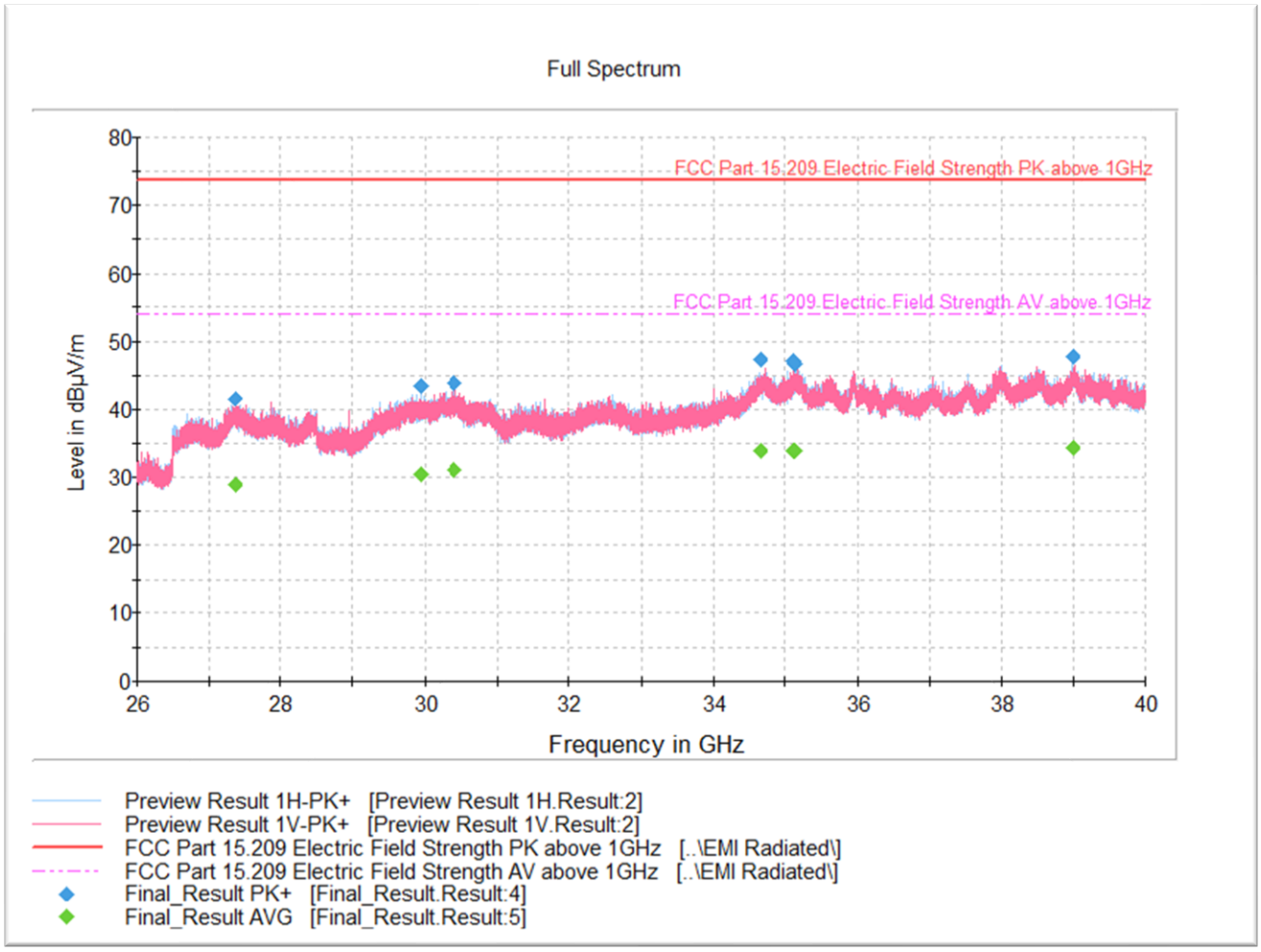

**Peak Data**

| Frequency (MHz) | MaxPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) |
|---|---|---|---|---|---|---|---|---|---|
| 18530.236000 | 45.05 | 76.20 | 31.15 | 1000.0 | 1000.000 | 213.0 | V | 83.0 | -3 |
| 18793.812500 | 44.79 | 76.20 | 31.41 | 1000.0 | 1000.000 | 150.0 | V | 12.0 | -3 |
| 19583.374500 | 43.30 | 76.20 | 32.90 | 1000.0 | 1000.000 | 162.0 | H | 255.0 | -3 |
| 21457.634500 | 44.18 | 76.20 | 32.02 | 1000.0 | 1000.000 | 163.0 | H | 357.0 | -2 |
| 22535.210000 | 45.30 | 76.20 | 30.90 | 1000.0 | 1000.000 | 213.0 | V | 18.0 | -1 |
| 24136.175000 | 115.14 | 129.20 | 15.30 | 1000.0 | 1000.000 | 163.0 | V | 67.0 | -2 |
| 24133.444500 | 112.64 | 129.20 | 16.56 | 1000.0 | 1000.000 | 137.0 | V | 68.0 | -2 |
| 24942.047500 | 57.02 | 76.20 | 19.18 | 1000.0 | 1000.000 | 150.0 | V | 65.0 | -1 |
| 25986.963000 | 46.28 | 76.20 | 29.92 | 1000.0 | 1000.000 | 156.0 | H | 222.0 | 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) |
|---|---|---|---|---|---|---|---|---|---|
| 18530.236000 | 31.65 | 76.20 | 44.55 | 1000.0 | 1000.000 | 213.0 | V | 83.0 | -3 |
| 18793.812500 | 31.75 | 76.20 | 44.45 | 1000.0 | 1000.000 | 150.0 | V | 12.0 | -3 |
| 19583.374500 | 30.52 | 76.20 | 45.68 | 1000.0 | 1000.000 | 162.0 | H | 255.0 | -3 |
| 21457.634500 | 31.52 | 76.20 | 44.68 | 1000.0 | 1000.000 | 163.0 | H | 357.0 | -2 |
| 22535.210000 | 31.88 | 76.20 | 44.32 | 1000.0 | 1000.000 | 213.0 | V | 18.0 | -1 |
| 24136.175000 | 115.08 | 129.20 | 15.36 | 1000.0 | 1000.000 | 163.0 | V | 67.0 | -2 |
| 24133.444500 | 112.51 | 129.20 | 16.69 | 1000.0 | 1000.000 | 137.0 | V | 68.0 | -2 |
| 24942.047500 | 55.16 | 76.20 | 21.04 | 1000.0 | 1000.000 | 150.0 | V | 65.0 | -1 |
| 25986.963000 | 32.87 | 76.20 | 43.33 | 1000.0 | 1000.000 | 156.0 | H | 222.0 | 1 |

### 2.2.14 26GHz to 40GHz Radiated Emission Test



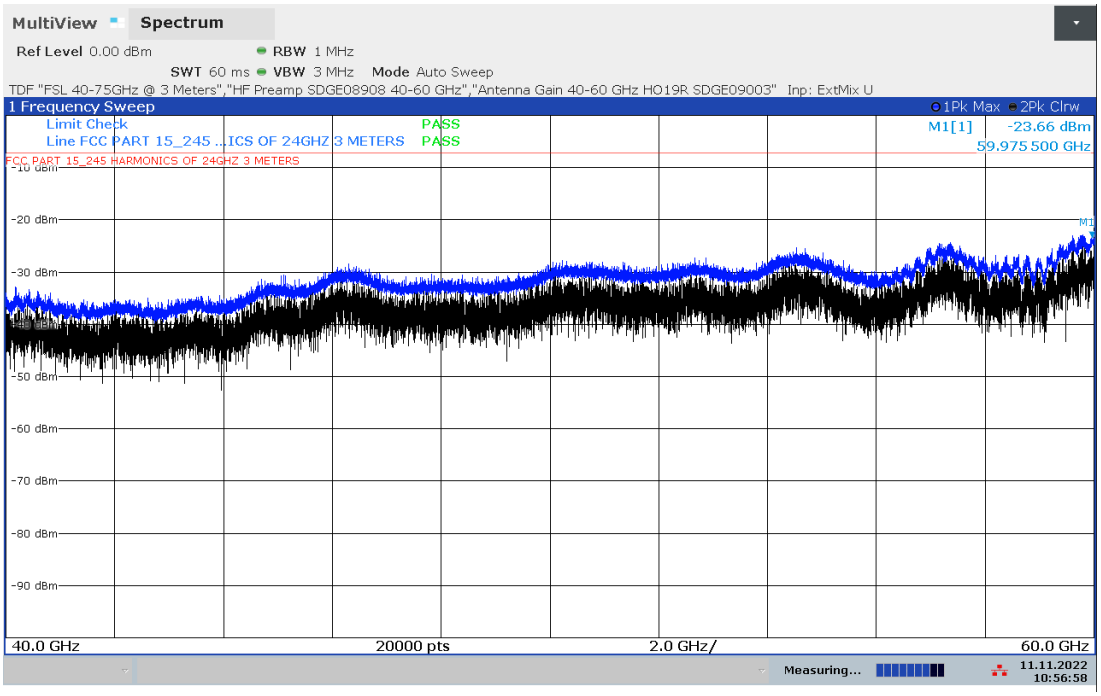

**Peak Data**

| Frequency (MHz) | MaxPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) |
|---|---|---|---|---|---|---|---|---|---|
| 27363.029616 | 41.69 | 73.90 | 32.21 | 1000.0 | 1000.000 | 225.0 | V | 308.0 | 4 |
| 29950.243846 | 43.57 | 73.90 | 30.33 | 1000.0 | 1000.000 | 175.0 | H | 316.0 | 8 |
| 30414.420000 | 43.92 | 73.90 | 29.98 | 1000.0 | 1000.000 | 175.0 | H | 308.0 | 7 |
| 34645.533077 | 47.40 | 73.90 | 26.50 | 1000.0 | 1000.000 | 175.0 | H | 341.0 | 8 |
| 35118.284230 | 47.06 | 73.90 | 26.84 | 1000.0 | 1000.000 | 181.0 | H | 250.0 | 8 |
| 35122.579231 | 46.74 | 73.90 | 27.16 | 1000.0 | 1000.000 | 215.0 | H | 270.0 | 8 |
| 38993.343846 | 47.82 | 73.90 | 26.08 | 1000.0 | 1000.000 | 177.0 | H | 29.0 | 9 |

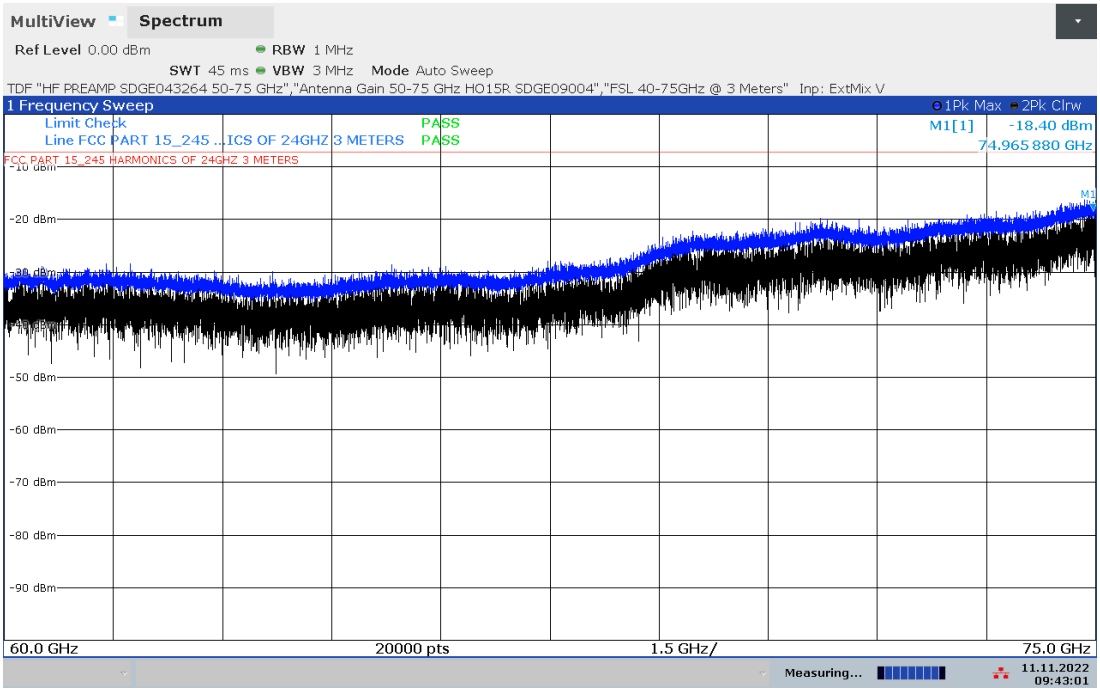
### Average Data

| Frequency (MHz) | Average (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) |
|---|---|---|---|---|---|---|---|---|---|
| 27363.029616 | 29.09 | 53.90 | 24.81 | 1000.0 | 1000.000 | 225.0 | V | 308.0 | 4 |
| 29950.243846 | 30.43 | 53.90 | 23.47 | 1000.0 | 1000.000 | 175.0 | H | 316.0 | 8 |
| 30414.420000 | 31.06 | 53.90 | 22.84 | 1000.0 | 1000.000 | 175.0 | H | 308.0 | 7 |
| 34645.533077 | 33.94 | 53.90 | 19.96 | 1000.0 | 1000.000 | 175.0 | H | 341.0 | 8 |
| 35118.284230 | 33.99 | 53.90 | 19.91 | 1000.0 | 1000.000 | 181.0 | H | 250.0 | 8 |
| 35122.579231 | 34.02 | 53.90 | 19.88 | 1000.0 | 1000.000 | 215.0 | H | 270.0 | 8 |
| 38993.343846 | 34.44 | 53.90 | 19.46 | 1000.0 | 1000.000 | 177.0 | H | 29.0 | 9 |

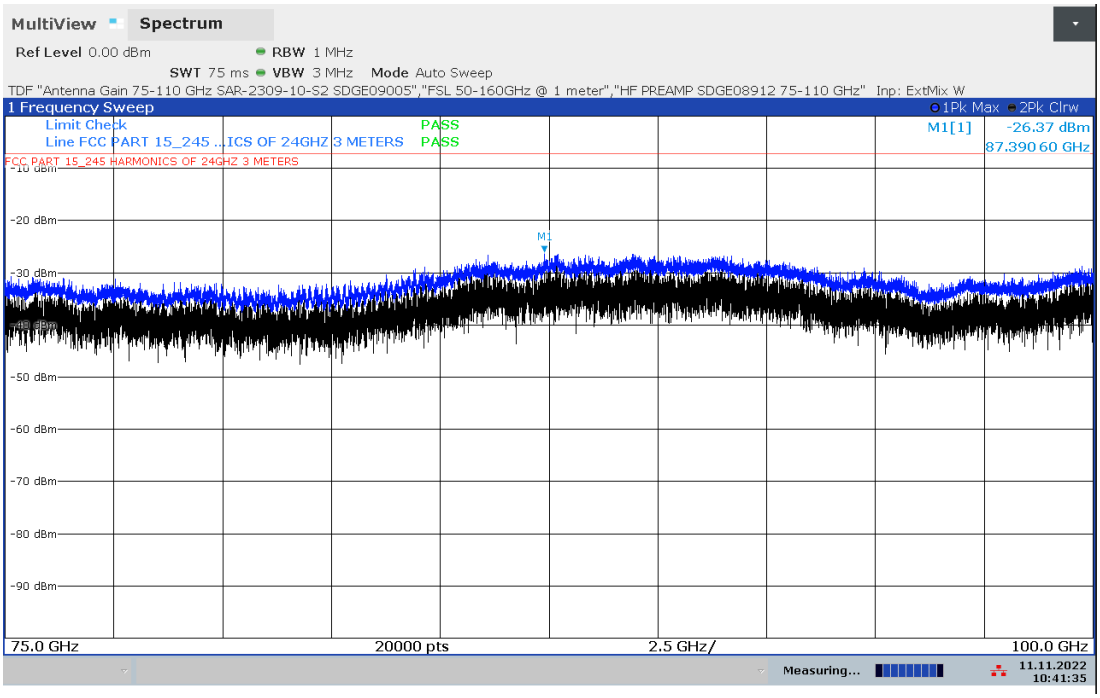
### 2.2.15 Maximized Plot from 40GHz to 100GHz




**40GHz to 60GHz**




**60GHz to 75GHz**




**75GHz to 100GHz Verification**

## 2.3 99% EMISSION BANDWIDTH

### 2.3.1 Specification Reference

RSS-Gen 6.7

### 2.3.2 Standard Applicable

The occupied bandwidth or the “99% emission bandwidth” is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.
In some cases, the “x dB bandwidth” is required, which is defined as the frequency range between two points, one at the lowest frequency below and one at the highest frequency above the carrier frequency, at which the maximum power level of the transmitted emission is attenuated x dB below the maximum inband power level of the modulated signal, where the two points are on the outskirts of the in-band emission.

### 2.3.3 Equipment Under Test and Modification State

Serial No: PSX00N100051 / Default Test Configuration

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

November 10, 2022 / 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

Test performed at TÜV SÜD America Inc. Mira Mesa facility

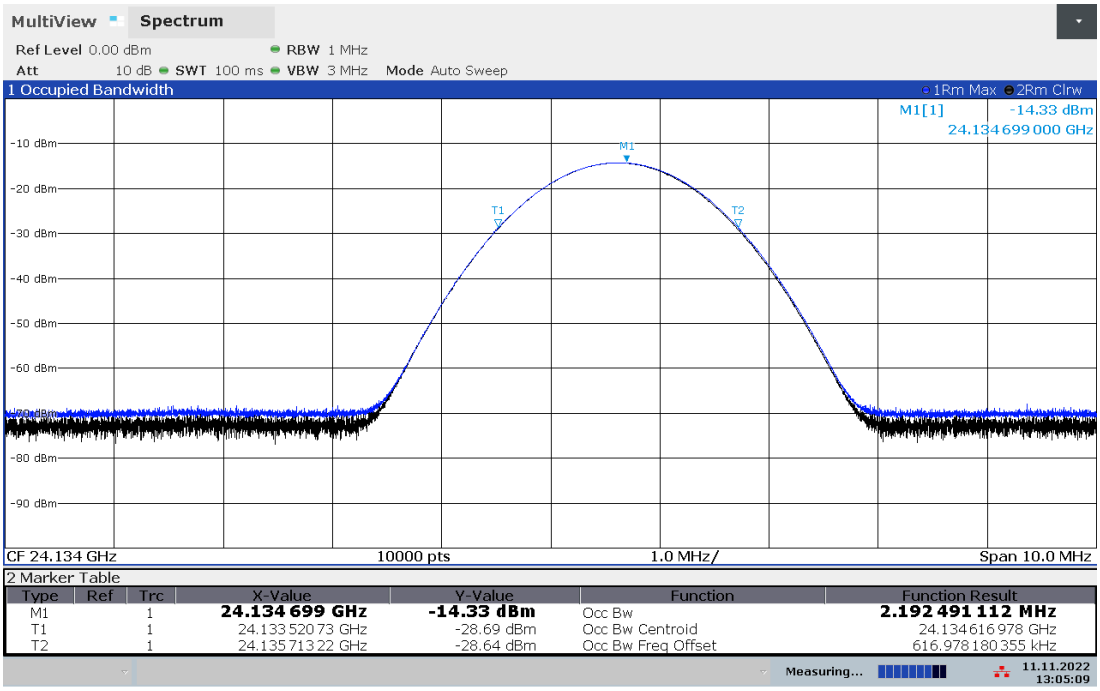
| | |
|---|---|
| Ambient Temperature | 28.6 °C |
| Relative Humidity | 47.2 % |
| ATM Pressure | 100.2 kPa |

### 2.3.7 Additional Observations

The EUT behaves like a CW signal. The verification therefore is performed using worst case RBW of 1MHz.

### 2.3.8 Test Results

See attached test plot. For reference only.


MultiView
Spectrum
Ref Level 0.00 dBm
RBW 1 MHz
Att 10 dB SWT 100 ms VBW 3 MHz Mode Auto Sweep
1 Occupied Bandwidth
1Rm Max 2Rm Clrw
M1[1] -14.33 dBm
24.134 699 000 GHz
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-80 dBm
-90 dBm
M1
T1
T2
CF 24.134 GHz
10000 pts
1.0 MHz/
Span 10.0 MHz
2 Marker Table
Type Ref Trc X-Value Y-Value Function Function Result
M1 1 24.134 699 GHz -14.33 dBm Occ Bw 2.192 491 112 MHz
T1 1 24.133 520 73 GHz -28.69 dBm Occ Bw Centroid 24.134 616 978 GHz
T2 1 24.135 713 22 GHz -28.64 dBm Occ Bw Freq Offset 616.978 180 355 kHz
Measuring...
11.11.2022
13:05:09

**99% OBW**

# 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*** | | | | | | |
| 1049 | EMI Test Receiver | ESU40 | 100133 | Rohde & Schwarz | 09/21/22 | 09/21/23 |
| 7611 | Signal/Spectrum Analyzer | FSW26 | 102017 | Rohde & Schwarz | 02/09/22 | 02/09/23 |
| 1003 | Signal Generator | SMR40 | 100443 | Rohde & Schwarz | 11/17/21 | 11/17/22 |
| 1002 | Bilog Antenna | 3142C | 0058717 | EMCO | 10/21/21 | 10/21/23 |
| 7631 | Double-ridged waveguide horn | 3117 | 00205418 | ETS-Lindgren | 09/16/20 | 11/16/22 |
| 46797 | Preamplifier | PA-122 | 181925 | Com Power | 11/10/21 | 12/10/22 |
| 6628 | Loop Antenna | HFH2-Z2335.4711.52 | FNr.800.458/25 | Rohde & Schwarz | 06/23/22 | 06/23/24 |
| 9001 | Horn antenna (18-26.5GHz) | HO42S | 101 | Custom Microwave | 09/23/23 | 09/23/23 |
| 9003 | Horn antenna (26-40 GHz) | HO28S | 102 | Custom Microwaves | 09/23/23 | 09/23/23 |
| 40815 | Pre-amplifier (18-40 GHz) | 19D18 | 15G27 | Spacek Labs | 08/21/22 | 08/21/23 |
| 7637 | Harmonics mixer (40-60 GHz) | FS-Z60 | 100009 | Rhode & Schwarz | 07/29/20 | 07/29/23 |
| 7636 | Harmonics mixer (60-90 GHz) | FS-Z90 | 100092 | Rhode & Schwarz | 07/29/20 | 07/29/23 |
| 51288 | Harmonics mixer (50-75 GHz) | FS-Z75 | 102099 | Rohde & Schwarz | 03/11/21 | 07/29/23 |
| 7633 | Harmonics mixer (75-110 GHz) | HM-110-7 | 101000 | Radiometer Physics | 02/22/21 | 07/29/23 |
| 8908 | Pre-amplifier (40-60 GHz) | SBL-4036033080-1919-E1 | 12020-01 | Sage Millimeter, Inc. | 07/07/21 | 07/29/23 |
| 8892 | Pre-amplifier (50-75 GHz) | SBL-5037533050-1515-E1 | 12020-01 | Sage Millimeter, Inc. | 07/07/21 | 07/29/23 |
| 8912 | Pre-amplifier (75-110 GHz) | FLNA-10-0005 | FTL17328 | Farran Technology Ltd. | 07/07/21 | 07/29/23 |
| 9003 | Horn antenna (40-60 GHz) | HO19R | 103 | Custom Microwaves | Verified by 7611 and corresponding direct reading attenuator/active multiplier combination | |
| 9004 | Horn antenna (50-75 GHz) | HO15R | 104 | Custom Microwaves | | |
| 7628 | Horn antenna (75-110 GHz) | SAR-2309-10-S2 | 13481-01 | Sage Millimeter, Inc. | | |
| 8872 | Direct Reading Attenuator (40-60 | STA-60-19-D1 | 11875-01 | Sage Millimeter, Inc. | Verified by 7611 and corresponding antenna/mixer combination | |
| 8860 | Direct Reading Attenuator (50-75 | STA-60-15-D1 | 11466-01 | Sage Millimeter, Inc. | | |
| 8861 | Direct Reading Attenuator (75-110 | STA-60-10-D1 | 11466-01 | Sage Millimeter, Inc. | | |
| 8919 | Direct Reading Attenuator (90-140 | STA-60-08-D1 | 12605-01 | Sage Millimeter, Inc. | | |
| 8873 | Active Multiplier (40-60 GHz) | AMC-19-RFH00 | 124 | Millitech, Inc. | | |

| ID Number (SDGE/SDRB) | Test Equipment | Type | Serial Number | Manufacturer | Cal Date | Cal Due Date |
|---|---|---|---|---|---|---|
| 8914 | Active Multiplier (50-75 GHz) | AMC-15-RFH00 | 283 | Millitech, Inc. | Verified by 7611 and corresponding antenna/mixer combination | |
| 8915 | Active Multiplier (75-110 GHz) | AMC-10-RFH00 | 606 | Millitech, Inc. | | |
| 8920 | Active Multiplier (90-140 GHz) | AMC-08-RFH00 | 58 | Millitech, Inc. | | |
| ***Miscellaneous*** | | | | | | |
| 43003 | True RMS Multimeter | 85 III | 69880143 | Fluke | 11/19/21 | 11/19/22 |
| 7619 | Temp/Humidity Sensor | iBTHX-W | 15050268 | Omega | 05/27/22 | 05/27/23 |
| - | 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 Emission Measurements (Below 30MHz)

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

### 3.2.2 Radiated Measurements (30MHz to 1GHz)

| | Input Quantity (Contribution) $X_i$ | Value | | Prob. Dist. | Divisor | $u_i(x)$ | $u_i(x)^2$ |
|---|---|---|---|---|---|---|---|
| 1 | Receiver reading | 0.10 | dB | Normal, k=1 | 1.000 | 0.10 | 0.01 |
| 2 | Attenuation: antenna-receiver | 0.20 | dB | Normal, k=2 | 2.000 | 0.10 | 0.01 |
| 3 | Antenna factor AF | 0.58 | dB | Normal, k=2 | 2.000 | 0.29 | 0.08 |
| 4 | Receiver sinewave accuracy | 0.15 | dB | Normal, k=2 | 2.000 | 0.08 | 0.01 |
| 5 | Receiver pulse amplitude | 1.50 | dB | Rectangular | 1.732 | 0.87 | 0.75 |
| 6 | Receiver pulse repetition rate | 1.50 | dB | Rectangular | 1.732 | 0.87 | 0.75 |
| 7 | Noise floor proximity | 0.50 | dB | Rectangular | 1.732 | 0.29 | 0.08 |
| 8 | Mismatch: antenna-receiver | 0.95 | dB | U-shaped | 1.414 | 0.67 | 0.45 |
| 9 | AF frequency interpolation | 0.30 | dB | Rectangular | 1.732 | 0.17 | 0.03 |
| 10 | AF height deviations | 0.10 | dB | Rectangular | 1.732 | 0.06 | 0.00 |
| 11 | Directivity difference at 3 m | 3.12 | dB | Rectangular | 1.732 | 1.80 | 3.24 |
| 12 | Phase center location at 3 m | 1.00 | dB | Rectangular | 1.732 | 0.58 | 0.33 |
| 13 | Cross-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 | 3.99 | 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 |

### 3.2.3 Radiated Measurements (Below 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 | 0.75 | 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 | 3.76 | dB | Triangular | 2.449 | 1.54 | 2.36 |
| 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 | 2.95 | dB |
| **Expanded uncertainty** | **Normal, k=2** | **5.90** | **dB** |

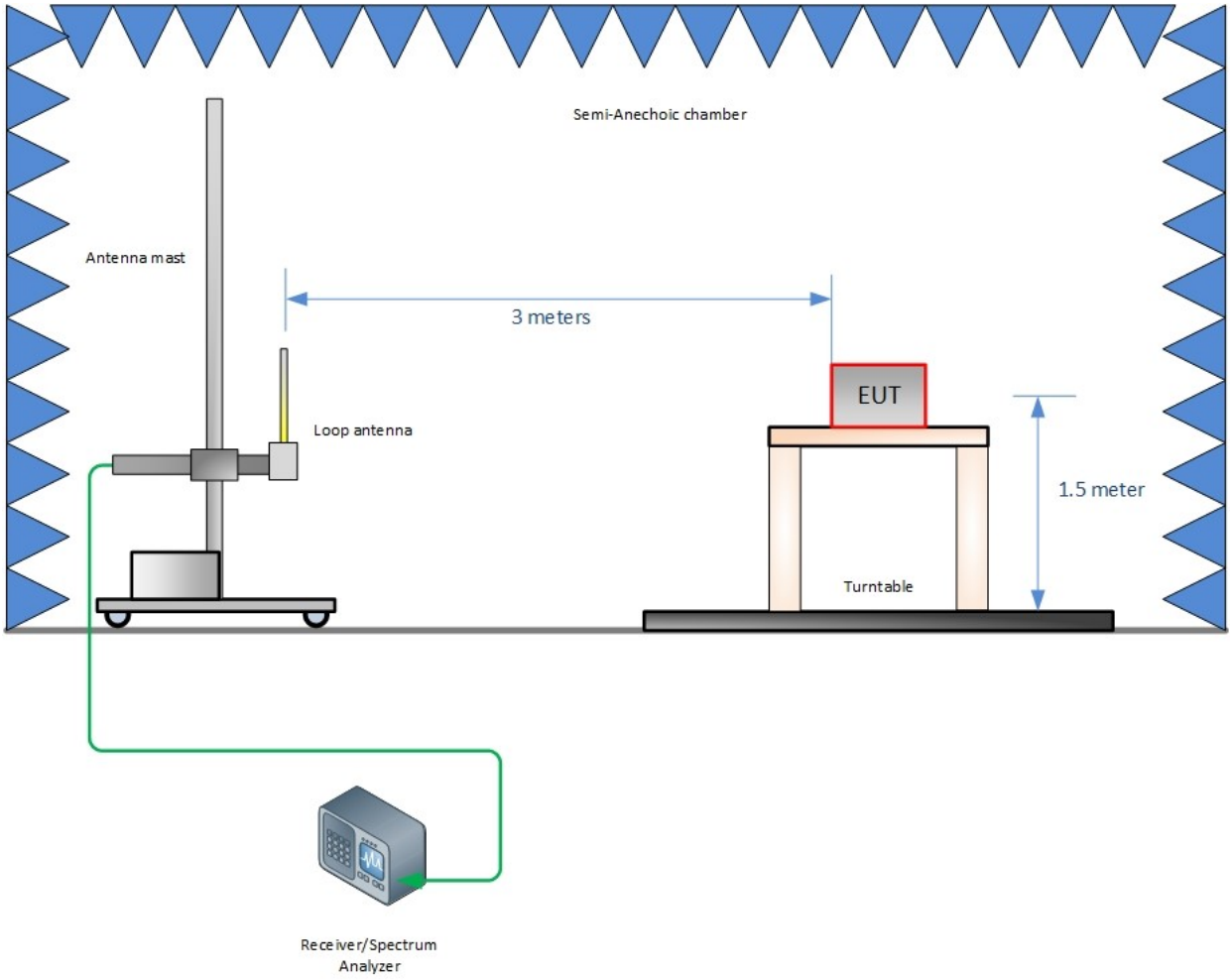
### 3.2.4 Radiated Emission Measurements (Above 1GHz)

| | 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 | 0.75 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

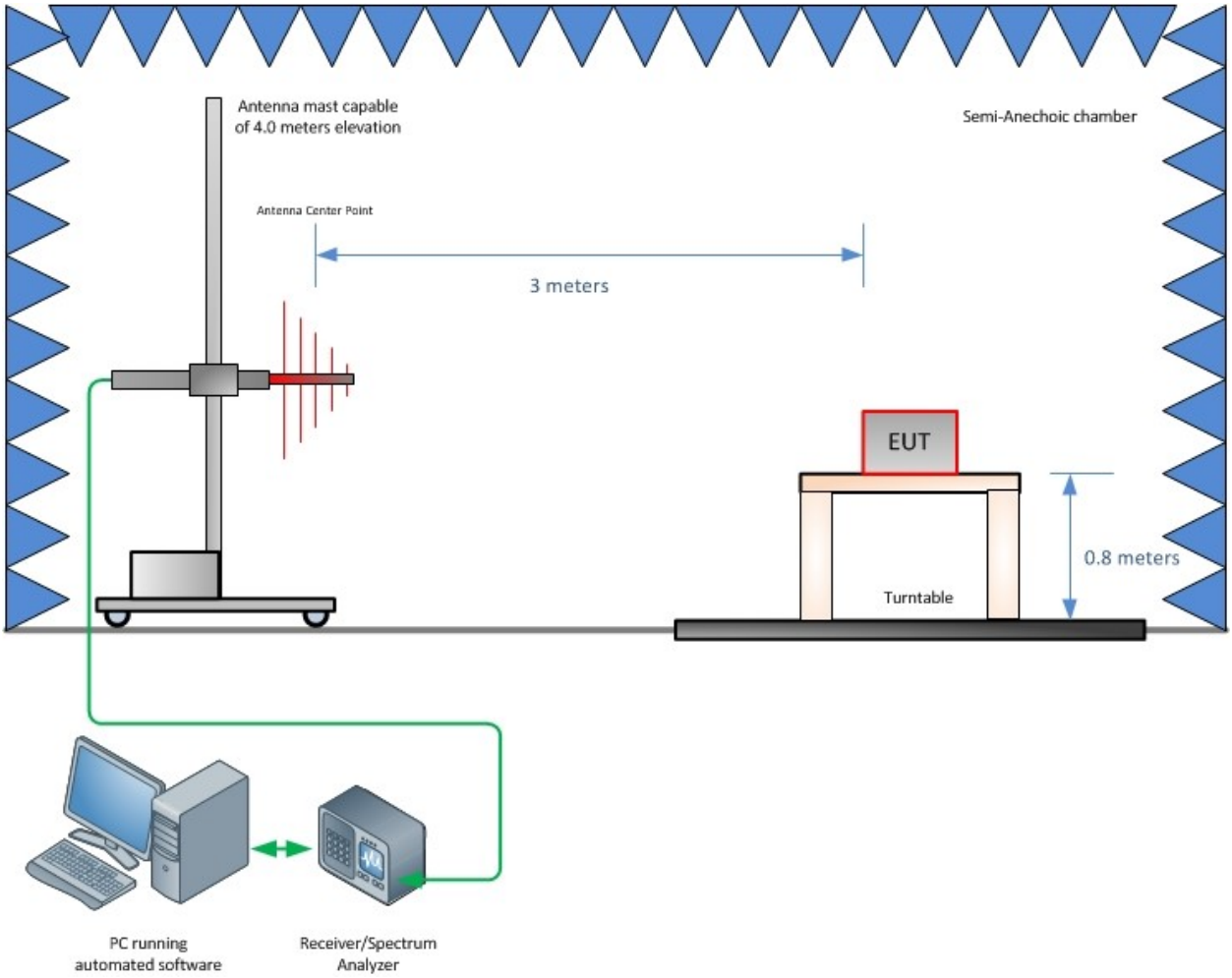
# DIAGRAM OF TEST SETUP

## 4.1 Test Setup Diagram

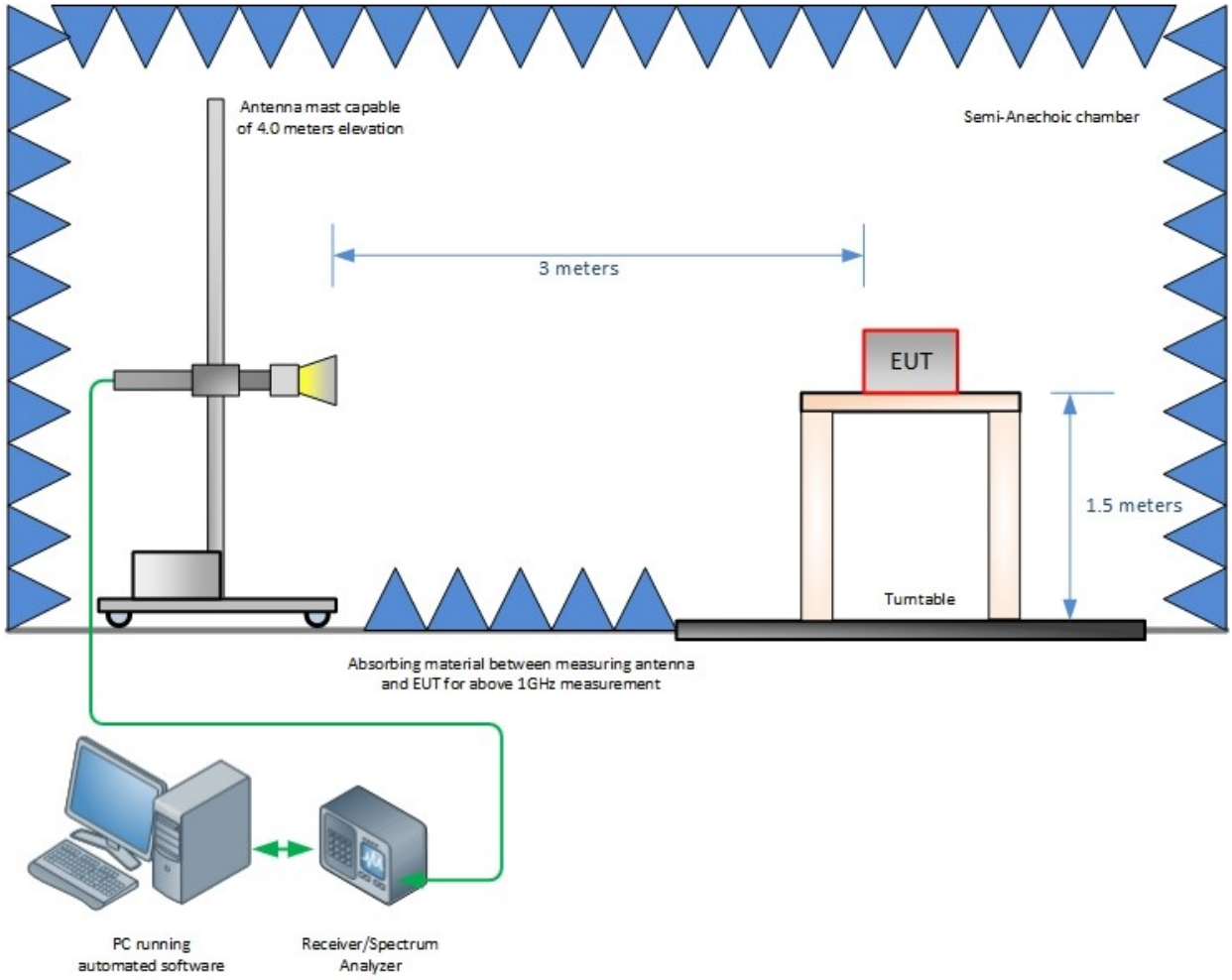



**Radiated Emission Test Setup (Below 30MHz)**

**Observed margin at this range is >20dB, the use of altenate test site (3 meter SAC) is justified.*




**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.

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