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NVLAP®

TESTING
NVLAP LAB CODE: 100275-0

# FCC Certification Part 30 Test Report

Regulation:
FCC Part 30

Client:
NOKIA SOLUTIONS AND NETWORKS

Product Evaluated
ASMR 39 GHz Main AWEWA/B + 39 GHz Extension FA3WA

Report Number:
TR-2022-0117-FCC30

Date Issued:
October 14, 2022

**Revisions**

| Date | Revision | Section | Change |
|---|---|---|---|
| 9/30/2022 | 0 | | Initial Release |
| 10/12/2022 | 1 | | Header and 4.10 |
| 10/14/2022 | 2 | 4.3.2 | Remove highlight |
| | | | |

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# Table of Contents

# 1. ATTESTATION OF TEST RESULTS

| | |
|---|---|
| **Company Name** | Nokia Solutions and Networks, OY |
| **FCC ID** | 2AD8UAWEWAB01, 2AD8UFA3WA01 |
| **Product Name** | ASMR 39 GHz Main AWEWA/B + 39 GHz Extension FA3WA |
| **Model Name(s)** | AWEWA/B, FA3WA |
| **Part No** | 475170A.101AWEWA/B / 475002A.101 FA3WA |
| **Serial Number(s)** | AWEWA/B - YK212500116<br>FA3WA - YK212500175 |
| **Test Standard(s)** | • 47 CFR FCC Parts 2 and Part 30<br>• KDB 971168 D01 Power Meas License Digital Systems v03r01 April 9, 2018<br>• KDB 662911 D01 Multiple Transmitter Output v02r01 Oct 2013<br>• KDB 842590 D01 Upper Microwave Flexible Use Service v01r02–April 2021<br>• Procedures on TRP Compliance for Out of Band and Spurious Emissions C63.26 mmWave JTG - Version # 1 July 14th 2018 |
| **Reference(s)** | • ANSI C63.26 (2015)<br>• ANSI C63.4 (2014)<br>• TR 14-1001, MMW Measurements with Harmonic Mixers (April-4-2014) |
| **Test Date** | September 6, 2022 – September 29, 2022 |
| **Test Performed By** | Nokia<br>Global Product Compliance Laboratory<br>600-700 Mountain Avenue<br>P.O. Box 636<br>Murray Hill, NJ 07974-0636 |
| **FCC Registered Test Site Number** | Designation Number: **US5302**, Test Firm Registration Number: **395774** |
| **Product Engineer(s)** | Ron Remy |
| **Lead Engineer** | W. Steve Majkowski |
| **Test Engineer (s)** | W. Steve Majkowski, Mike Soli |
| Test Results: The EUT, as tested met the above listed Test Requirements. The decision rule employed is binary (Pass/Fail) based on the measured values without accounting for Measurement Uncertainty or any Guard Band. The measured values obtained during testing were compared to a value given in the referenced regulation or normative standard. Report copies and other information not contained in this report are held by either the product engineer or in an identified file at the Global Product Compliance Laboratory in New Providence, NJ. | |

# 2. SUMMARY OF THE TEST RESULTS

| 47 CFR FCC Sections | Description of Tests | Compliance Results |
|---|---|---|
| 2.1046, 30.202 (a) | RF Power Output | Pass |
| 2.1047 | Modulation Characteristics | Pass |
| 2.1049, 30.203 | (a) Occupied Bandwidth<br>(b) Edge-of-Band Emissions | Pass |
| 2.1051, 30.203 | Spurious Emissions at Antenna Terminals - Radiated | Pass |
| 2.1053, 30.203 | Field Strength of Spurious Radiation | Pass |
| 2.1055 | Measurement of Frequency Stability | Not Required |

## 2.1 Measurement Uncertainty

The results of the calculations to estimate uncertainties for the several test methods and standards are shown in the Tables below. These are the worst-case values.

**Worst-Case Estimated Measurement Uncertainties**

| Standard, Method or Procedure | Condition | Frequency MHz | Expanded Uncertainty (k=2) |
|---|---|---|---|
| a. Classical Emissions, (*e.g.*, ANSI C63.4, CISPR 11, 14, 22, *etc.*, using ESHS 30, | Conducted Emissions | 0.009 - 30 | ±3.5 dB |
| | Radiated Emissions (AR-8 Semi-Anechoic Chamber) | 30 MHz – 200MHz H<br>30 MHz – 200 MHz V<br>200 MHz – 1000 MHz H<br>200 MHz – 1000 MHz V<br>1 GHz- 18 GHz | ±5.4 dB<br>±5.4 dB<br>±4.7 dB<br>±4.7 dB<br>±3.3 dB |

| Antenna Port Test | Signal Bandwidth | Frequency Range | Expanded Uncertainty (k=2), Amplitude |
|---|---|---|---|
| Occupied Bandwidth, Edge of Band, | 10 Hz<br>100 Hz<br>10 kHz to 1 MHz<br>1MHz to 100 MHz | 9 kHz to 20 MHz<br>20 MHz to 1 GHz<br>1 GHz to 10 GHz<br>10 GHz to 40 GHz: | ±2.2 dB |
| Conducted Spurious Emissions | 30 kHz to 100 MHz | 10 MHz to 40 GHz: | ±2.8 dB |
| RF Power, Channel Power | 10 Hz to 100 MHz | 10 MHz to 40 GHz | ±1.4 dB |

# 3. GENERAL INFORMATION

## 3.1 Product Descriptions

The equipment under test (EUT) has the following specifications.

**Table 3.1.1 Product Specifications**

| Specification Items | Description |
|---|---|
| Product Type | AWEWA/B and FA3WA Extension Module |
| Radio Type | Intentional Transceiver |
| Power Type | Both DC & AC |
| Modulation | QPSK, 16QAM, 64QAM, 256QAM |
| Operating Frequency Range | 37-40 GHz |
| Channel Bandwidth | 100/200/300/400/500/600/700/800 MHz<br>1400MHz contiguous |
| Max Radiated Power (EIRP) | AWEWA/B & FA3WA:<br>52 dBm (158.5W) EIRP per unit per polarization;<br>55 dBm (316.2W) EIRP Total per unit. |
| Antenna Gain | 23 dBi |
| Operating Mode | 2x2 MIMO (2 duplex Tx/Rx Ports) each unit |
| Software Version | SBTS22R3 |
| Hardware Version | 475170A.101AWEWA/B<br>475002A.101 FA3WA |
| Antenna(s) | Refer to Section 3.2 |

## 3.2 EIRP/ PSD Compliance and Antenna Information.

Both AWEUA/B and FA3WA incorporate the same integrated antenna module which are electronically steerable. Each antenna assembly has two cross-polarized modules. Each of these Tx/Rx modules are an 8x12 antenna matrix with 96 elements. The information about Antenna Gain vs frequency is detailed in the original filing package of AWEWA/B under 2AD8UAWEWAB01 and FA3WA under 2AD8UAFA3WA01, respectively.

## 3.3 Antenna

A test was previously performed to determine the far field boundary location of the AWEWA and the FA3WA using low power measurements and calculations. For the antenna array we can calculate the Fraunhofer distance from

$$d_{ff} \geq 2D^2/\lambda$$

where $d_{ff}$ = Far Field distance in meters,
D is the maximum size of the radiating array    $\lambda$ = wavelength of the operating signal in meters

The individual polarization antenna array height is 135 mm and is 77 mm wide with a 155mm diagonal. The diagonal for both arrays is 301 mm.

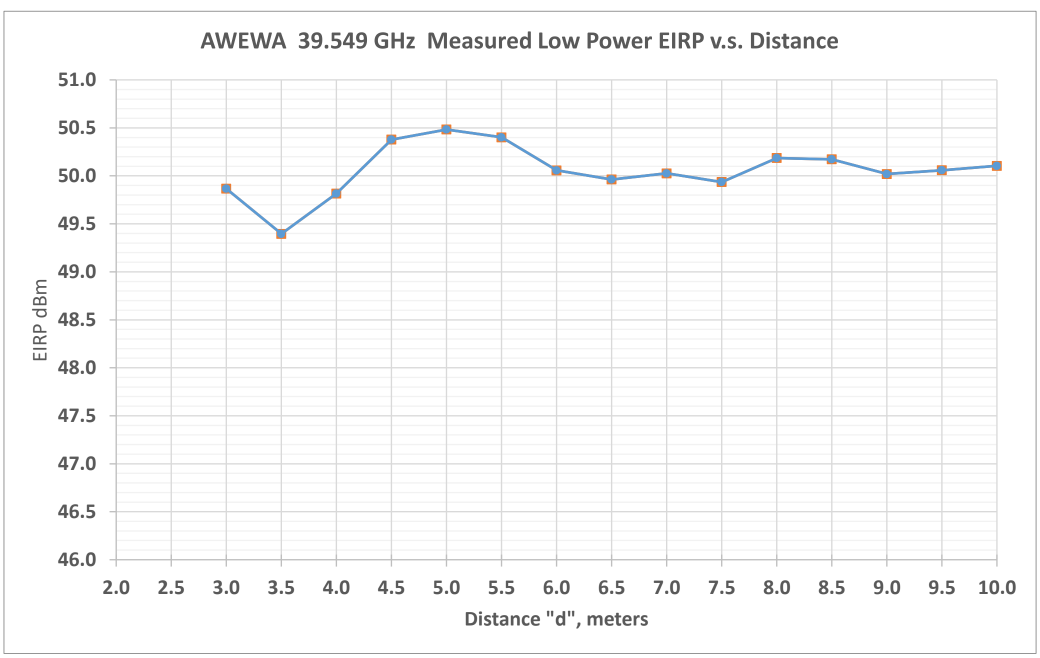
At 40 GHz the individual array dimensions results in a minimum Fraunhofer far field distance, $d_{ff,}$ of 6.4 meters.

At 40 GHz the overall array dimensions results in a minimum Fraunhofer far field distance, $d_{ff,}$ of 24 meters.

While the Fraunhofer far field distance is the minimum distance where the far field can occur, it does not predict the actual distance where the far field occurs. The far field boundary test determines the actual distance where the far field occurs for the specific configuration under test.

Measurements for the far field boundary were performed at low power using a standard gain horn antenna In the horizontal polarization the determined boundary was 6.0 m.

To eliminate any inconsistancy all Power, OBW and OOBE measurements were made at 6.5 m for 39GHz.



# 4. REQUIRED MEASUREMENTS AND RESULTS

Both AWEUC/D Main Unit and FA3UB extension Unit have been FCC certified individually. This test is to evaluate the configuration that AWEUC/D is paired with FA3UB for concurrent operation. Therefore, only one configuration needs to be evaluated for out-of-band emissions and spurious emissions. Other tests, such as RF power output, modulation characteristics and occupied bandwidth, are for verification purpose. This evaluation does not support installation where the Main and Extension Units are operated in the same sector or with any portion of the transmit beams overlapping.

Per 47CFR FCC Section 2.1033(c)(14), the following certification tests are required by Section 2.1046 through Section 2.1057. These tests are identified in Table 4.0a below.

**Table 4.0a Required Certification Measurements**

| 47 CFR FCC Sections | Description of Tests | Test Required for Class I Authorization |
|---|---|---|
| **2.1046, 30.202 (a)** | **RF Power Output**<br>**(a) Power Limits, EIRP, PSD** | **Yes** |
| **2.1047** | **Modulation Characteristics** | **Yes** |
| **2.1049, 30.203** | **(a) Occupied Bandwidth**<br>**(b) Out-of-Band Emissions** | **Yes** |
| **2.1051, 30.203** | **Spurious Emissions at Antenna Terminals** | **Yes** |
| **2.1053, 30.203**<br>**30.204, 15.109(a) Class B** | **Field Strength of Spurious Radiation** | **Yes** |
| **2.1055** | **Measurement of Frequency Stability** | **No** |

The measurements were conducted in accordance with the procedures set out in Section 2.1041 and as appropriate per the test Standards listed in Table 4.0b below. The comprehensive list of tests performed included measurements at Left, Center and Right side of the Part 30 Band. These tests are presented to demonstrate compliance with FCC requirements.

The procedures defined in ANSI C63.26-2015 and KDB 971168 D01 were developed for conducted measurements. The mmWave Joint Technical Group with FCC oversight has been working diligently on revisions to add mmWave measurements for Upper Microwave Flexible Use Service (UMFUS). The new KDB, 842590, is closely aligned with those efforts.

All of the measurements performed herein were performed as radiated measurements. In order to perform these measurements, the equipment settings required to enable the FSW internal noise reduction capability were used. This typically required the use of average detector, and multiple sweep averages. The individual test sections identify any changes in measurement process.

**Table 4.0b Test Standards Used for Radiated Measurements of Radio Performance**

| | |
|---|---|
| **Test Standard(s)** | • 47 CFR FCC Parts 2 and Part 30<br>• KDB 971168 D01 Power Meas License Digital Systems v03r01 April 9, 2018<br>• KDB 662911 D01 Multiple Transmitter Output v02r01 Oct 2013<br>• KDB 842590 D01 Upper Microwave Flexible Use Service v01r02–April 2021<br>• Procedures on TRP Compliance for Out of Band and Spurious Emissions C63.26 mmWave JTG - Version # 1 July 14th 2018 |
| **Reference(s)** | • 47 CFR FCC Part 2 and Part 30<br>• ANSI C63.26 (2015)<br>• ANSI C63.4 (2014)<br>• TR 14-1001, MMW Measurements with Harmonic Mixers (April-4-2014) |

## 4.1 Section 2.1046 MEASUREMENT REQUIRED: RF POWER OUTPUT

The product incorporates internal antennas that are part of the signal source. There is no antenna terminal connection on the product. Therefore, this test as implemented is not a measurement of the total conducted power at the antenna terminal but rather the total radiated power in terms of the maximum EIRP radiated by the product.

The FCC recognized that these products would use integrated antennas and likewise structured the requirements under Part 30. Under Part 30 the average power of the sum of all antenna elements is limited to an equivalent isotopically radiated power (EIRP) density of +75dBm/100 MHz.

The **Nokia AirScale 39 GHz Radio Unit (AWEWA-B) FCC ID: 2AD8UAWEWAB01** and **39 GHz Extension Unit (FA3WA) FCC ID: 2AD8UAFA3WA01** is a 5G-NR Remote radio head and is configured for one to eight carrier operation. It is specified to provide a maximum power output of 52 dBm /158.5 W EIRP per transmit polarization for a sum total of 55 dBm /317W EIRP per unit. The product is designed for the 5G global market including operation per 47 CFR Part 30 rules for use in the USA authorized portions of 5G New Radio Band, n260 in 37 – 40 GHz.

### 4.1.1 RF Power Output Measurement

The product was configured for test as shown in Figure 4.1.1 below and allowed to warm up and stabilize per KDB 971168 D01 and ANSI C63.26.

Radiated Power measurements of the 5G New Radio transmit signal were conducted with an FSW Spectrum Analyzer per KDB 971168 D01 and KDB 842590 D01. Measurements were performed at a 6.5 m distance using a nominal 68 dB offset. An additional FSW transducer correction factor is used to ascertain the actual measured EIRP power. The calculation of path loss, cable loss and measurement antenna gain are listed in Table 4.1.1. below. The unit was configured to transmit at its maximum power.

**Table 4.1.1 Corrections For Transmitter Power Measurements**

| Frequency | Free Space Path Loss, "PL" | Measurement Antenna Gain, "G1" | Measurement Cable Loss, "L1" | Total Offset Required PL -G1 + L1 | FSW Measurement Offset | Required Final Correction |
|---|---|---|---|---|---|---|
| GHz | dB | dBi | dB | dB | dB | dB |
| 35.00 | 79.58 | 23.96 | 12.84 | 68.46 | 68 | 0.460 |
| 35.50 | 79.70 | 23.52 | 13.03 | 69.21 | 68 | 1.214 |
| 36.00 | 79.83 | 24.27 | 13.20 | 68.75 | 68 | 0.754 |
| 36.50 | 79.95 | 23.28 | 13.35 | 70.01 | 68 | 2.015 |
| 37.00 | 80.06 | 24.42 | 13.39 | 69.04 | 68 | 1.040 |
| 37.50 | 80.18 | 23.27 | 13.39 | 70.29 | 68 | 2.293 |
| 38.00 | 80.30 | 24.29 | 13.45 | 69.45 | 68 | 1.455 |
| 38.50 | 80.41 | 23.18 | 13.54 | 70.76 | 68 | 2.762 |
| 39.00 | 80.52 | 23.65 | 13.73 | 70.60 | 68 | 2.604 |
| 39.50 | 80.63 | 23.03 | 13.76 | 71.36 | 68 | 3.358 |
| 40.00 | 80.74 | 23.00 | 13.79 | 71.53 | 68 | 3.530 |
| 40.50 | 80.85 | 23.35 | 13.84 | 71.34 | 68 | 3.343 |
| 41.00 | 80.96 | 23.22 | 13.98 | 71.72 | 68 | 3.717 |
| 41.50 | 81.06 | 23.28 | 14.14 | 71.93 | 68 | 3.927 |
| 42.00 | 81.17 | 23.39 | 14.23 | 72.01 | 68 | 4.014 |
| 42.50 | 81.27 | 23.81 | 14.36 | 71.81 | 68 | 3.815 |
| 43.00 | 81.37 | 23.55 | 15.30 | 73.11 | 68 | 5.114 |
| 43.50 | 81.47 | 23.60 | 16.14 | 74.01 | 68 | 6.008 |

### 4.1.1.1 RF Power Output Results

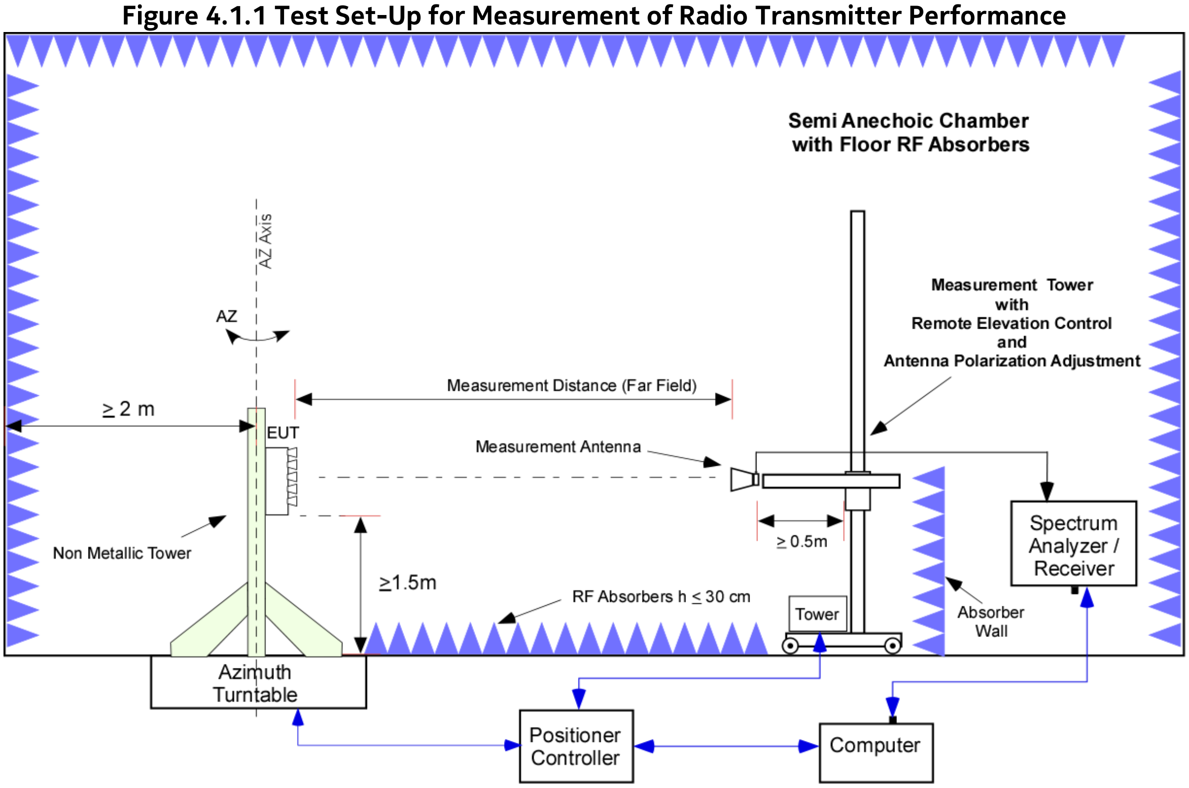
Power output measurements verified the expected performance of 52 dBm EIRP per polarization for a Total Power of 55 dBm. The maximum measured level was 52.37 dBm for a single polarization and 55.26 dBm total. This level is well within the maximum Part 30.202a limit of 75 dBm EIRP. Measurements were performed for each modulation.

The measured performance was in full compliance with the Rules of the Commission. The data plots are detailed below.

**Table 4.1.1.1 – Channel Power Measurements**

| Unit | Channel Center Frequencies, GHz | # of carriers | Modulation | Horizontal Polarization Total Channel Power, EIRP | Vertical Polarization Total Channel Power, EIRP | Sum Total Channel Power EIRP |
|---|---|---|---|---|---|---|
| | | | | dBm | dBm | dBm |
| **AWEWA/B** | 37.05<br>37.14984<br>37.24968<br>37.34952 | **4** | **QPSK** | **52.13** | **51** | **54.61** |
| **FA3WA** | 37.05<br>37.14984<br>37.24968<br>37.34952 | **4** | **QPSK** | **53.14** | **52.21** | **55.71** |

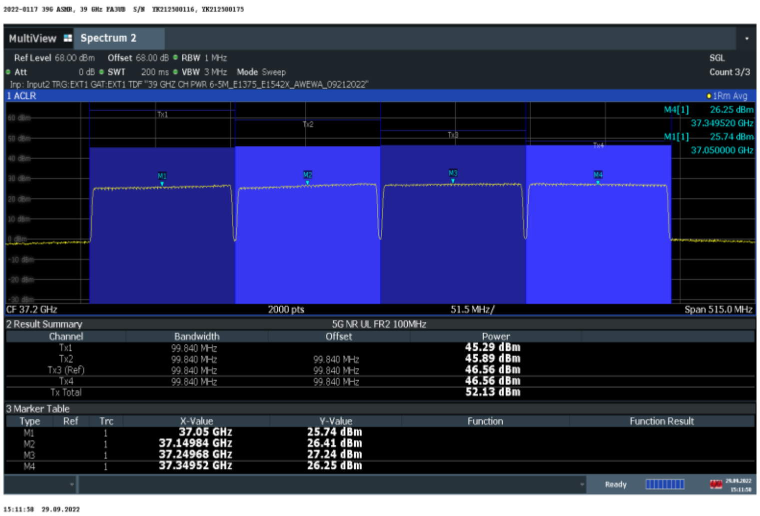
**Figure 4.1.1 Test Set-Up for Measurement of Radio Transmitter Performance**



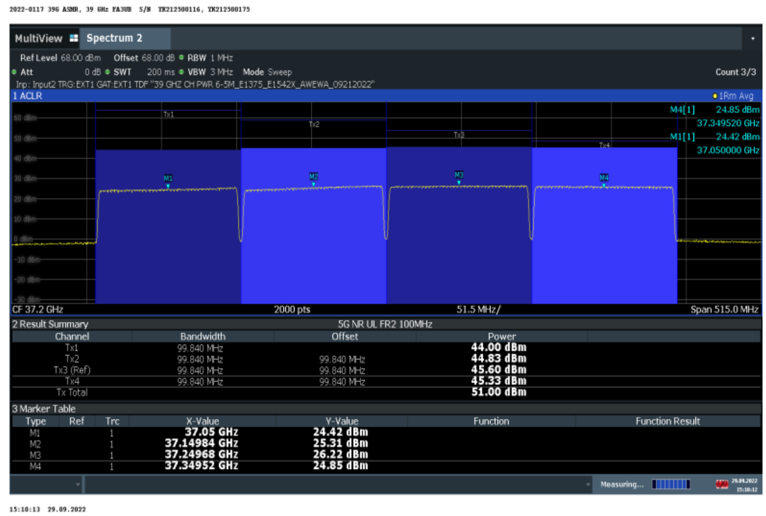
### 4.1.1.1.1 Channel Power Measurement Plots

## AWEWA/B

**Horizontal**

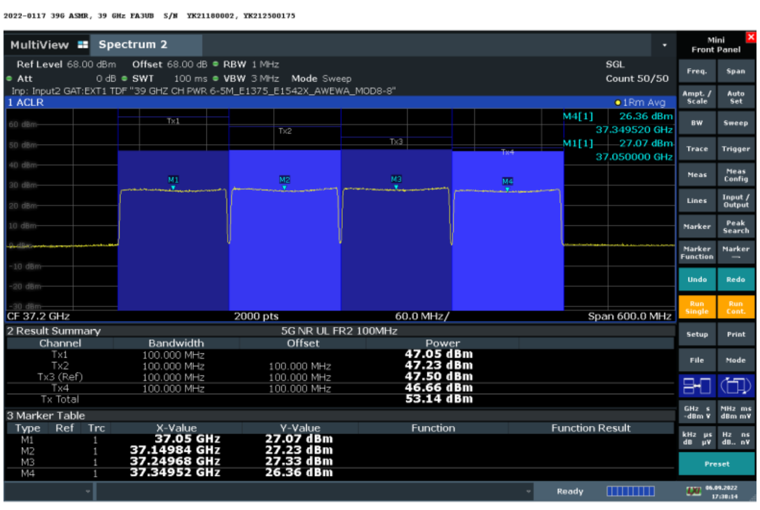



**Vertical**

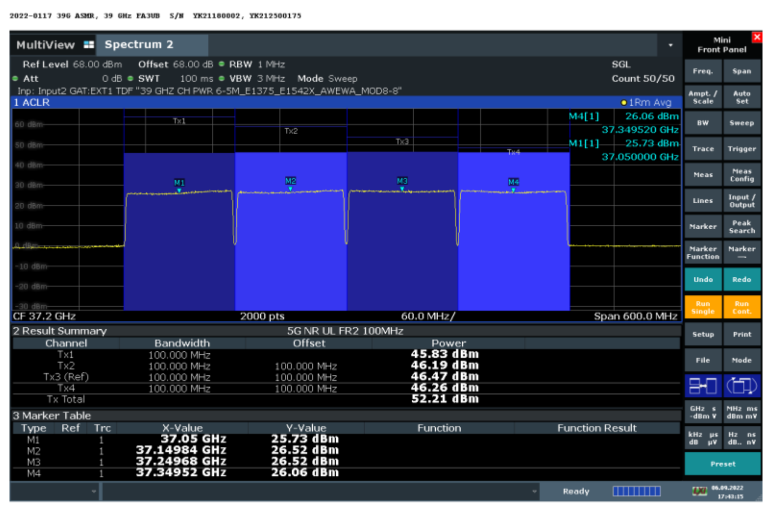



## FA3WA

**Horizontal**




**Vertical**



## 4.2 Section 2.1047 MEASUREMENT REQUIRED: MODULATION CHARACTERISTICS

The AirScale 39 GHz Radio Unit (AWEWA-B) FCC ID: 2AD8UAWEWAB01 and 39 GHz Extension Unit (FA3WA) FCC ID: 2AD8UAFA3WA01 supports the 5G New Radio Modulation Format based upon LTE TDD technologies. LTE utilizes Orthogonal Frequency Division Multiplexing (OFDM) which splits the carrier frequency bandwidth into many small subcarriers. Each individual subcarrier can be modulated with QPSK, 16QAM and 64QAM digital modulation formats.

There are no FCC Limits for Modulation and all of the formats presented look spectrally the same from a channel edge and regrowth standpoint and we are pleased with the fidelity that available with test equipment as configured.

### 4.2.1 Modulation Characteristics Measurement

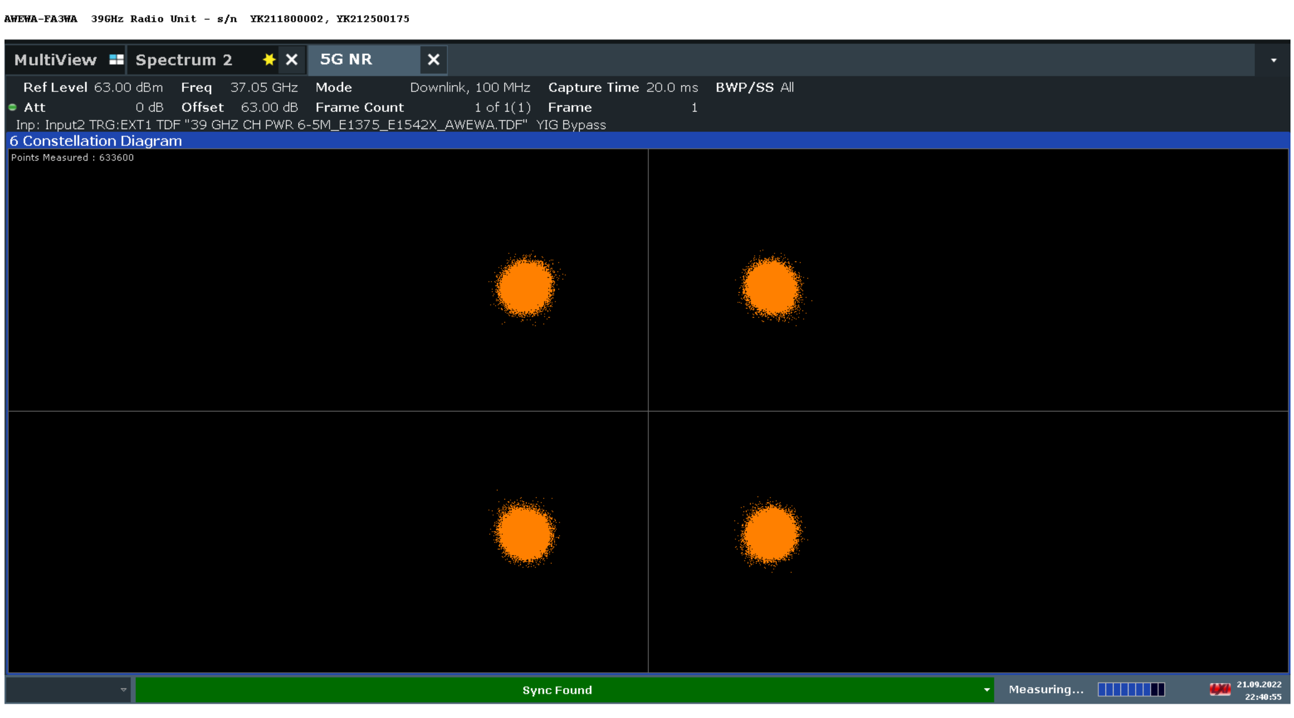
The measurements were performed at a distance of 6 m from the unit utilizing the test configuration in Figure 4.4.1 utilizing an Rohde & Schwarz FSW85 Signal analyzer with the 3GPP 5G-NR DL Measurement software option. Representative screen plots of the modulation measurement are attached below for all three of the subcarrier configurations and sample polarizations. Data was collected at left, center and right side of the n258 24 GHz frequency band.

### 4.2.2 Modulation Measurements Results:

The typical measured modulation characteristics of the EUT are shown below:

**Figure 4.2 Sample Modulation Results**

QPSK



16QAM

AWEWA-FA3WA 39GHz Radio Unit - s/n YK211800002, YK212500175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64QAM

AWEWA-FA3WA 39GHz Radio Unit - s/n YK211800002, YK212500175


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## 4.3 Section 2.1049 MEASUREMENT REQUIRED: OCCUPIED BANDWIDTH and EDGE of BAND EMISSIONS

This test measures the Occupied Bandwidth of the transmitting carrier and the Edge of-Block Emissions in the frequency spectrum immediately outside and adjacent to the transmitting carrier(s).

The occupied bandwidth (OBW) is usually defined either as the 99% power OBW or a relative OBW. The 99% OBW is the signal bandwidth such that, below its lower and above its upper frequency limits, the mean power radiated or conducted are each equal to 0.5 percent of the total mean power radiated or conducted by a given emission. The relative OBW is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated by at least X dB below the transmitter power, where the value of X is typically specified as 26.

Per KDB 971168 D01 v02, the relative OBW must be measured and reported when it is specified in the applicable rule part; otherwise, the 99% OBW shall be measured and reported. The OBW shall be measured when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment is operated.

### 4.3.1 Results Occupied Bandwidth (Signal Bandwidth)

The measurements of 99% occupied bandwidth were performed with a Rohde & Schwartz FSW85 GHz spectrum analyzer. The bandwidth of the 100 MHz 5G-NR carrier measured is less than 97.5MHz for both AWEUC/D and FA3UB in n258 band. Both are within the authorized band and are less than the bandwidth used in the emission designator.

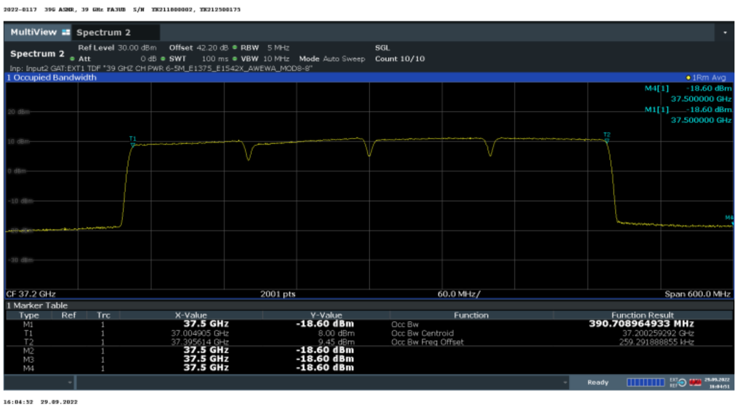
Tabular Data – Occupied Bandwidth **1MHz** RBW

| Unit | Carrier Frequencies (GHz) | Number of Carriers | Modulation | Horizontal Polarization Occupied Signal Bandwidth (MHz) | Vertical Polarization Occupied Signal Bandwidth (MHz) |
|---|---|---|---|---|---|
| **AWEWA/B** | 37050.00<br>37149.84<br>37249.68<br>37349.52 | 4 | QPSK | 390.71 | 391.27 |
| **FA3WA** | 37050.00<br>37149.84<br>37249.68<br>37349.52 | 4 | QPSK | 391.36 | 390.92 |

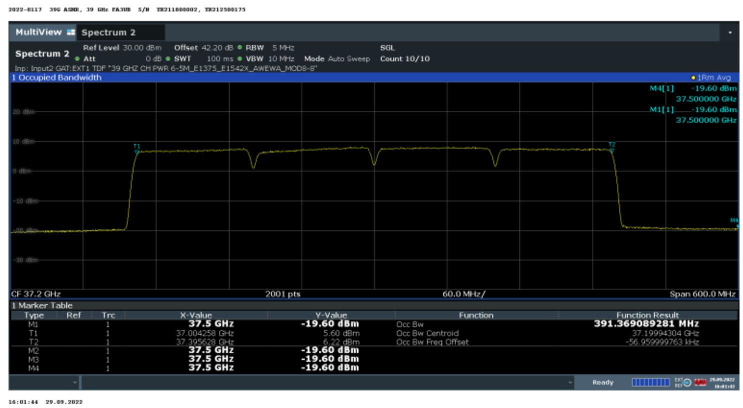
### 4.3.1.1 99% Signal Bandwidth Plots

## AWEWA/B

**Horizontal**



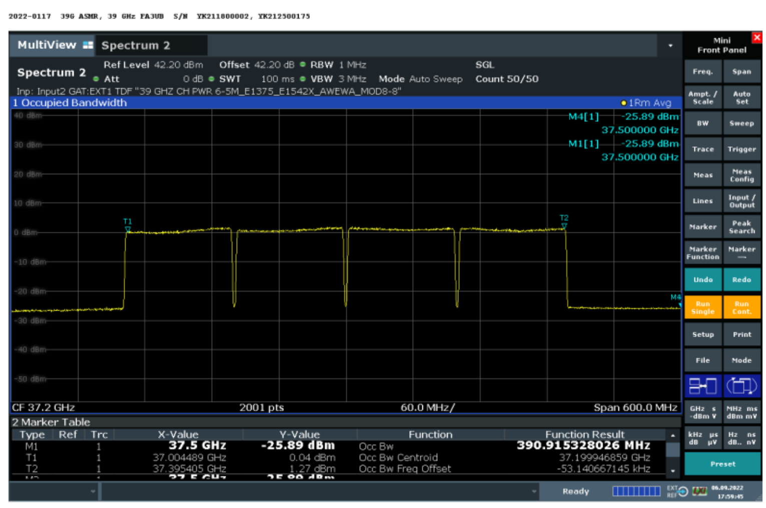

**Vertical**




## FA3WA

**Horizontal**


**Vertical**



## 4.3.2 Occupied Bandwidth-Edge of Block Emissions

The classical Occupied Bandwidth measurement of Edge of Block Emissions or conveniently Out Of Band Emissions (OOBE) is an evaluation of the transmit carrier compliance with edge of block/edge of band requirements. This measurement documents the product's ability to maintain compliance with FCC Parts 2 and Part 30.203 limitations on emissions outside the block/ band of operation.

The **AirScale 39 GHz Radio Unit (AWEWA-B) FCC ID: 2AD8UAWEWAB01 and 39 GHz Extension Unit (FA3WA) FCC ID: 2AD8UAFA3WA01** presently supports nominal 100 MHz bandwidth 5G-New Radio and LTE TDD technologies. The Out Of Band evaluation addresses eight carrier operation with one through four carriers operating simultaneously from both the **AWEWA** and the **FA3WA**.

The OOBE evaluation is used to measure the maximum average spurious levels outside the transmit band as measured at the 6.5m boundary distance. The measurements were performed for four carriers at the left, side of band. The original filing tests had indicated that this was the worst case configuration for generation of out of band spurious.

For each configuration channel power and modulation were verified prior to other measurements. The measurement process meets the requirements of ANSI C63.26 and ISO17025. The test setup was as shown in Figure 4.1.1. Measurements were performed in the far field at 6.5m for both vertical and horizontal polarizations.

The Out Of Band Emissions of each of the signals identified in Table 4.3.6 was measured using a Rohde & Schwarz FSW85 Spectrum analyzer, a remote PC based instrumentation controller and the same calibrated RF attenuation path used for channel power. The correction included the products antenna gain to correct the emissions to the relative "antenna connection" port. All spurious emissions > 10% Signal BW outside the band was evaluated for compliance without the product gain as is required.
Plots are provided using the triggered functionality of the test analyzer and demonstrate compliance with edge of band limits.

These sheets contain data for the multiple carrier configurations operating simultaneously from the **AWEWA** and the **FA3WA** in the 39 GHz Part 30 Upper Microwave Flexible Use Service spectrum.

## 4.3.3 Requirements Emissions Limits

The Limit in 47 CFR 30.203 for Emissions Limits is as follows:

(a) The conductive power or the total radiated power of any emission outside a licensee's frequency block shall be −13 dBm/MHz or lower. However, in the bands immediately outside and adjacent to the licensee's frequency block, having a bandwidth equal to 10 percent of the channel bandwidth, the conductive power or the total radiated power of any emission shall be −5 dBm/MHz or lower.

(b)(1) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater.

(2) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges as the design permits.

(3) The measurements of emission power can be expressed in peak or average values.

In order to address the limit as imposed for the requirement in 47CFR 96.41 we evaluated emissions per the requirements in ANSI C63.26 and per KDB 940660 D01 Part 30 CBRS Equipment.

The average detector function was used for all MXA measurements and the Peak detector function were used for EMC receiver measurements.

### 4.3.4 Measurement Offset and MIMO

As this was a radiated EIRP measurement no MIMO adjustment was used.

### 4.3.5 Mask Parameters

The mask parameters are in units as stated in Part 30 and are listed in Table 4.3.5. Mask parameters are as stated in Table 4.3.5. The Guard band was adjusted for 10% of the maximum signal bandwidth (100 MHz). Mask Edge Offsets = ½ the measurement Resolution Bandwidth were not used.

**Table 4.3.5 - Mask Parameters Out Of Band / Edge of Band Emissions (37-40GHz)**

| Frequency | Part 30 Limit |
|---|---|
| GHz | dBm |
| 35.00 | -13 |
| 36.00 | -13 |
| 36.97 | -13 |
| 36.97 | -5 |
| 37.00 | -5 |
| 37.00 | 57 |
| 40.00 | 57 |
| 40.00 | -5 |
| 40.03 | -5 |
| 40.03 | -13 |
| 43.00 | -13 |

### 4.3.6 Measurement Path Adjustments

The power value measured at the spectrum analyzer input was adjusted for calculated free space loss, cable loss, measurement antenna gain and the product antenna gain over its applicable frequency range as documented in Exhibit 6 of the AWEWA/B and FA3WA original filings and in the table below. This is appropriate for Out Of Band Emissions / Edge of Band emissions only for the frequency range that the transmit antenna has documentable and consistent gain. Since different products have different gain responses vs frequency, the products documentable antenna gain only applies for the operational frequency range for which the product is designed.

Sample calculation: The sample calculation below is the formula and the correction for 35 GHz;

Adjustment = Free Space Path Loss - Measurement Antenna Gain + Cable Loss - Product Antenna Gain.

Total Required Adjustment (@37 GHz) = 46.66 dB = 80.06 dB -24.42dBi + 14.67dB – 23.65 dBi

This adjustment was only used for the OOBE/EoB frequency range. Table 4.3.6 below lists the offset correction factors used for the measurement distance of 6.5m. The measurements were made using a flat offset of 46dB with a transducer correction identified below.

**Table 4.3.6 Measurement Correction for Edge of Band / Out of Band Emissions**

| Frequency | Free Space Path Loss, PL | Measurement Antenna Gain, "G" | Measurement Cable Loss, "L" | PL-G+L | AEWA/B FA3WA Antenna Gain, IEEE | Total Required Adjustment | FSW Offset | Transducer Correction Factor |
|---|---|---|---|---|---|---|---|---|
| GHz | dB | dBi | dB | dB | dBi | dB | dB | dB |
| 35.00 | 79.58 | 23.96 | 14.11 | 69.74 | 18.14 | 51.60 | 46 | 5.599 |
| 35.50 | 79.70 | 23.52 | 14.32 | 70.50 | 20.05 | 50.45 | 46 | 4.448 |
| 36.00 | 79.83 | 24.27 | 14.56 | 70.12 | 21.97 | 48.15 | 46 | 2.151 |
| 36.50 | 79.95 | 23.28 | 14.67 | 71.33 | 22.81 | 48.52 | 46 | 2.521 |
| 37.00 | 80.06 | 24.42 | 14.67 | 70.31 | 23.65 | 46.66 | 46 | 0.661 |
| 37.50 | 80.18 | 23.27 | 14.53 | 71.43 | 23.82 | 47.61 | 46 | 1.608 |
| 38.00 | 80.30 | 24.29 | 14.66 | 70.67 | 23.99 | 46.68 | 46 | 0.675 |
| 38.50 | 80.41 | 23.18 | 14.83 | 72.05 | 24.11 | 47.94 | 46 | 1.944 |
| 39.00 | 80.52 | 23.65 | 15.16 | 72.03 | 24.22 | 47.81 | 46 | 1.809 |
| 39.50 | 80.63 | 23.03 | 15.47 | 73.07 | 24.10 | 48.97 | 46 | 2.966 |
| 40.00 | 80.74 | 23.00 | 15.54 | 73.28 | 23.98 | 49.30 | 46 | 3.297 |
| 40.50 | 80.85 | 23.35 | 15.76 | 73.26 | 23.91 | 49.35 | 46 | 3.352 |
| 41.00 | 80.96 | 23.22 | 15.69 | 73.42 | 23.84 | 49.59 | 46 | 3.587 |
| 41.50 | 81.06 | 23.28 | 15.89 | 73.68 | 23.20 | 50.48 | 46 | 4.482 |
| 42.00 | 81.17 | 23.39 | 16.08 | 73.86 | 22.56 | 51.30 | 46 | 5.304 |
| 42.50 | 81.27 | 23.81 | 16.44 | 73.90 | 21.52 | 52.37 | 46 | 6.375 |
| 43.00 | 81.37 | 23.55 | 16.88 | 74.69 | 20.49 | 54.20 | 46 | 8.199 |
| 43.50 | 81.47 | 23.60 | 19.02 | 76.89 | 18.55 | 58.34 | 46 | 12.342 |

### 4.3.7 Edge of Band Measurements

The Occupied Bandwidth and Edge-of-Band emissions measurements were made as a radiated measurement at a distance of 6.5m. The measurements were performed with an FSW spectrum analyzer in compliance with the procedure and requirements of ANSI C63.26. The test set-up diagram in Figure 4.1.1 was used. Testing was performed for the four 100 MHz carrier configuration at the left side of the n260 Band. All of the Edge of Band measurements were performed at the specified 1 MHz resolution bandwidths. Adjustment factors were as described in Section 4.3.6 above.

#### 4.3.7.1 EIRP Results - Edge of Band Measurements

KDB 842590 D01 Section 4.4.2.1 allows an "early exit", an alternative approach to TRP (or conducted power) measurement. In other words, it is acceptable to perform maximum EIRP measurements, over the required frequency range, and compare the measurements to the limit to verify compliance. If the measured EIRP levels are below the TRP limit the early exit condition is met and the device is compliant. If the device does not meet the emission limit at one or some frequencies, then TRP measurements need be performed only at those frequencies.

EIRP measurements need to be performed using linearly polarized antenna. Both horizontal and vertical polarizations are measured separately and not summed. The highest amplitude signal measured from horizontal or vertical polarization is used for determining compliance to the unwanted emission limit.

The out-of-band emissions were measured for n260 bands in vertical and horizontal polarizations.

For n260 39GHz band, the worst and only out of band emission was identified at 41.2 GHz with a level at -23.71dBm/MHz. From multiple tests of these product operating in the n260 39GHz band the worst case and only out of band radiated emission occurs at the LO frequency of 40.65875 GHz. The measurement at this frequency identified a maximum value of 21.84 dBm/MHz which is 8.84 dB below the -13 dBm limit. All other emissions are below the noise floor of the measurement system.

The maximum EIRP emissions from both vertical and horizontal polarizations are below the TRP limits with a minimum margin of 8.84 dB. Therefore, the early exit condition was met and the EUT is compliant.

### 4.3.7.2 Out Of Band Emissions Results

The Out Of Band Emissions plots for the tested configurations are shown below. These Occupied Bandwidth and Edge-of-Band emissions measurements were made as a radiated measurement at the verified far field measurement distance of 6.5m for 39 GHz and 6.0m for 24 GHz, respectively.

The measurement results of the occupied bandwidth and the out-of-band emissions as documented in the plots demonstrate the full compliance with the Rules of the Commission for the operating bands.

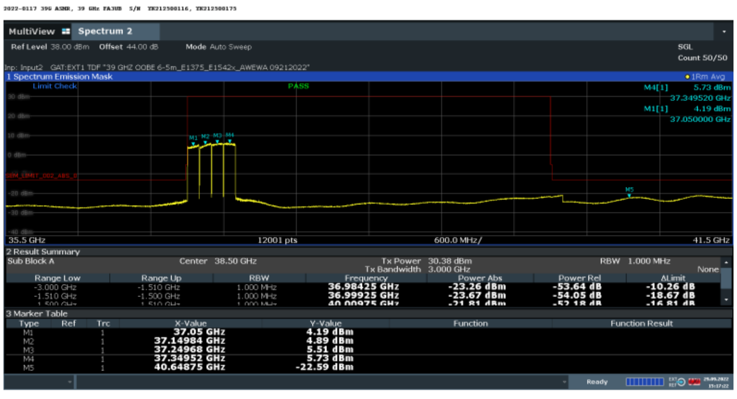
**Table 4.3.7.1 Results - Occupied Bandwidth-Edge of Block Emissions/ OOBE**

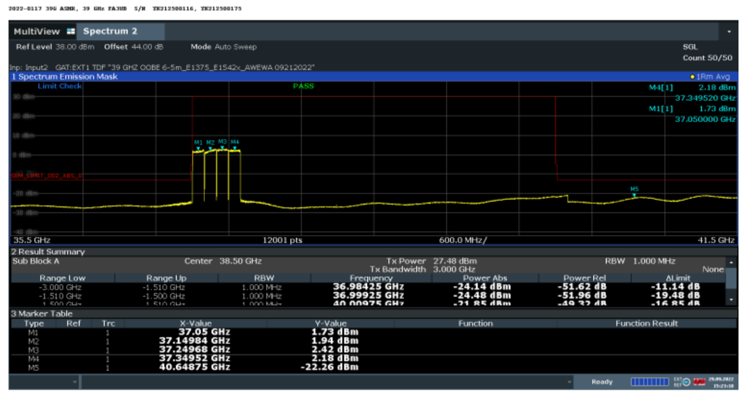
| Center Frequencies of Edge Channels, GHz | Number of Carriers | Modulation | Polarization | Occupied Bandwidth Edge of Block / OOBE Compliance |
|---|---|---|---|---|
| 37050.00<br>37149.84<br>37249.68<br>37349.52 | 4 | QPSK | Horizontal | Compliant |
| | | | Vertical | Compliant |
| 37050.00<br>37149.84<br>37249.68<br>37349.52 | 4 | QPSK | Horizontal | Compliant |
| | | | Vertical | Compliant |

### 4.3.7.2.1 Occupied Bandwidth Edge of Band Plots

**AWEWA/B**

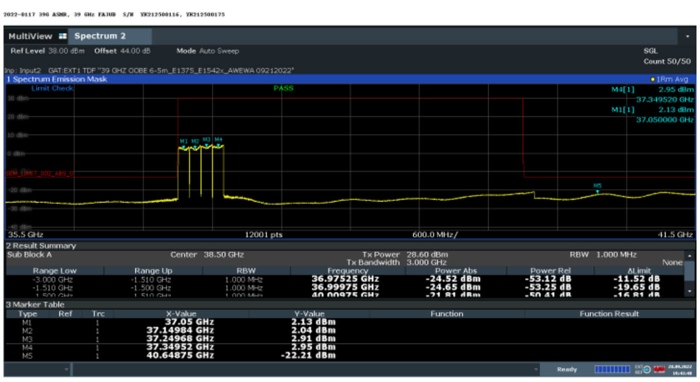
**Horizontal** **Vertical**

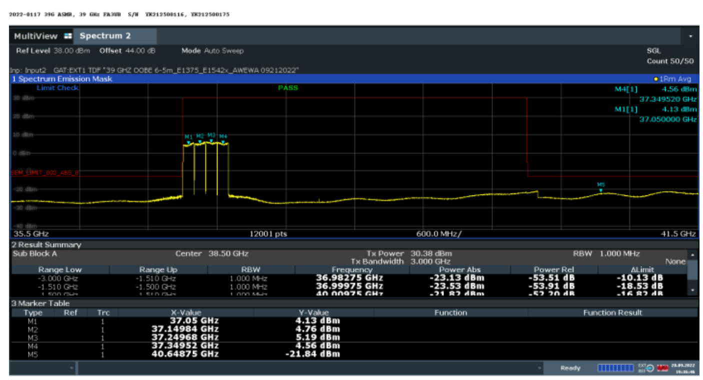



**FA3WA**

**Horizontal** **Vertical**



## 4.4 Section 2.1051 MEASUREMENT REQUIRED: SPURIOUS EMISSIONS AT THE ANTENNA TERMINALS

This test measures the emissions of spurious signals which may come from harmonic, parasitic, intermodulation and frequency conversion products and are outside the necessary bandwidth but excludes Edge-of-Band emissions.

### 4.4.1 Section 2.1051 Spurious Emissions at Antenna Terminals

Spurious Emissions were investigated per 47CFR Section 2.1057(a)(1) over the frequency range of 30 MHz to 200 GHz as specified in 2.1057(a)(2).

> 2.1057(a) In all of the measurements set forth in §§2.1051 and 2.1053, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the frequency shown below:
>
> (3) If the equipment operates at or above 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 200 GHz, whichever is lower.
>
> (c) The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.
>
> (d) Unless otherwise specified, measurements above 40 GHz shall be performed using a minimum resolution bandwidth of 1 MHz.

### 4.4.2 Required Limit

The required emission limitation specified in 47CFR 30.203 (a) was applied to these tests. Based upon the criterion given in Section 30 of the Code and as developed in 4.3.3, the required emission limit for emissions outside a licensee's frequency block is:

47CFR 30.203 (a) The conductive power or the total radiated power of any emission outside a licensee's frequency block shall be -13 dBm/MHz or lower. However, in the bands immediately outside and adjacent to the licensee's frequency block, having a bandwidth equal to 10 percent of the channel bandwidth, the conductive power or the total radiated power of any emission shall be -5 dBm/MHz or lower.

### 4.4.3 Results

Since there is no antenna terminal, all measurements were performed as radiated measurements and standard radiated emissions. The emissions near the band edges are presented in 4.3.7 and are in compliance with the requirements.

The standard radiated emissions are documented in Section 4.5 "Section 2.1053 Measurement Required: Field Strength of Spurious Radiation".

The measurements were performed in compliance with ANSI C63.26, KDB 842590 D01, C63.26 mmWave JTG, and our ISO17025 process. The measurement meets the ANSI C63.26 requirements in paragraphs 5.2.4.4.1 and 5.7 which requires that the number of points in the sweep be > 2 × Span/RBW. The ESW-44 spectrum analyzer measurements examine the 30 MHz to 40 GHz range. The FSW based mmWave transmitter test system were used to provide measurement capability from 40 GHz to 220 GHz range.

## 4.5 Section 2.1053 MEASUREMENT REQUIRED: FIELD STRENGTH OF SPURIOUS RADIATION

The field strength measurements of radiated spurious emissions were made in FCC registered five meter semi-anechoic chamber AR-4 (FCC Registration Number: 395774) **NVLAP** Lab Code: 100275-0 and IC (Filing Number: 6933F-4 & 8) which is maintained by Nokia Bell Labs in Murray Hill, New Jersey.

### 4.5.1 Spurious Radiation and Radiated Emissions Requirements.

This product meets Part 15B, and Part 30.203 requirements. FCC Part 15 Class B require emissions to be below 54.5 dBuV/m at 3m. Part 30.203 requires emissions to be below the value generated by a conducted emission of -13 dBm. This is a standard value for wireless products typically defined as

-43+10LogP=-13 dBm.

The evaluation of emissions at the Edge of Band was detailed in Sections 4.3.7 and 4.3.8. Emissions removed from the transmit band were evaluated identically to other wireless products.

Measurements were performed in compliance with Section 2.1053, FCC publication 442401, the requirements detailed above and clause 5.5 of ANSI C63.26. For this case the evaluation of acceptable radiated field strength is as follows.

The calculated emission levels were found by:

Pmeas (dBm) + Cable Loss(dB) + Antenna Factor(dB) + 107 (dBμV/dBm) -Amplifier Gain (dB) = Field Strength (dBμV/m)

Title 47CFR section 30.203 and 2.1053 contains the requirements for the levels of spurious radiation as a function of the EIRP of the modulated carrier with 100 MHz of bandwidth. The reference level for the modulated carrier is calculated as the field produced by an isotropic radiator excited by the transmitter output power according to the following relation taken from Reference Data for Radio Engineers, page 27-7, 6th edition, IT&T Corp.

$$\mathbf{E = (120\pi P)^{1/2} = [(30*P)^{1/2}] / R}$$

$$\mathbf{20 \log (E*10^6) - (43 + 10 \log P) = 82.23\ dB\ \mu V/meter}$$

Where: E = Field Intensity in Volts/ meter R = Distance in meters = 3 m
P = Transmitted Power, Watts = 53300 W

The field strength of radiated spurious emissions measured was determined by

$$E\,(\text{dB}\mu\text{V/m}) = V_{\text{meas}}\,(\text{dB}\mu\text{V}) + \text{Cable Loss (dB)} + \text{Antenna Factor (dBi/m)}.$$

Field strength measurements of radiated spurious emissions were made in the 10m semi-anechoic chamber, AR-8 as detailed above. The recommendations of ANSI C63.4 and ANSI C63.26 were followed for EUT testing setup, cabling, and measurement approach and procedures. All the measurement equipment used, including antennas, was calibrated in accordance with ISO 9001 process. The EUT setup diagram is given in the Figure 4.5. The minimum margins to the Part 30.203 limit is as measured in accordance with 2.1053. The test data follows.

### 4.5.2 Radiated Spurious Emissions Measurements: 40 GHz - 100 GHz

The radiated spurious emissions spectrum was investigated per 47CFR Section 2.1057(a)(1) for spurious emissions over the frequency range of 40 GHz to 100 GHz. The procedure and methodology followed the recommendations of ANSI C63.4–2014, C63.26-2015 and C63.26 mmWave JTG.

A Rohde & Schwarz FSW 85 was employed with external three port Harmonic Down Converters (HDC). The waveguide RF input converters provided coverage for 40-60 GHz (U), 60-90 GHz (E), 90-140 GHz (F) and 140-220 GHz (G) bands. The HDC's were paired with 25 dB Standard Gain Horns. A 40 GHz waveguide high pass filter was utilized to limit the transmit carrier emissions from overloading the 40-60 GHz HDC.

Operation of the harmonic down converters utilizes a swept LO with a fixed IF frequency of 1.325 GHz. The IF cable loss for the 4m of cable was 1.03 dB and was corrected internally to the FSW along with the Conversion loss for the harmonic down converters. Additional external shielding of the HDC's was necessary to limit carrier energy from creating immunity issues with the measurements.

Cable loss compensation for the LO cable loss was necessary to enable scan heights from 1-3 meters. The experience of this test indicated that a 3m maximum test height with this product is adequate (0.5 m above the top of product). This allowed for a reduction of the test cables length and reduce IF images which occurred at multiples of the 1.325 GHz IF frequency.

Measurements were performed at the following distances:

| mmWave Band | Frequency Range, GHz | Measurement distance meters |
|---|---|---|
| U | 40-60 | 4 |
| E | 60-90 | 4 |
| F | 90-140 | 3 |
| G | 140-220 | 3 |

Operation was verified prior to testing by bore-sighting a mmWave signal generator or mmWave source module with an antenna identical to the measurement antenna at the test distance. The location of the maximum beams had previously been ascertained for both vertical and horizontal polarizations. The beam is extremely narrow and radiated power is down 19 dB at just $\pm$ 7 degrees off center. All of the emissions and harmonics were found to be centered on the beam as well.

Based upon previous experience a continuous max hold (average detector) sweep of the product in elevation and azimuth was employed for full coverage scanning of the product. For these measurements in each band the scan was started at the beam peak locations of 202 and 76 degrees azimuth, and nominal elevations 169-170 cm for Vertical and 168-169 cm for Horizontal. The peak was first located for the most prominent emissions in the span. The elevation was then swept down to 1m and back up back to 3m and returned to the beam peak. The product was then rotated continuously to 360 degrees back to 0 degrees and back to 350 degrees. This method locates any emission and provides the maximum emissions but required operation without the analyzer internal noise reduction function. Peaks were noted using the marker function which were later formally measured with the required 1 MHz resolution bandwidth. Measurements for 40-100 GHz were performed this way.

### 4.5.2.1 Bandwidth Limits and Corrections: Radiated Measurements 40 GHz - 100 GHz

All corrections were made to the signal level as detailed below.

### 4.5.2.2 Resolution Bandwidth and # of Points:

For measurements above 40 GHz we performed final measurement scans with the required 1 MHz resolution bandwidth and preliminary scans with either a 10 MHz or 3 MHz resolution bandwidth.

Final measurements were performed so that the resolution bandwidth and span limitations of ANSI C63.26 were followed so that the number of measurement points > 2(Span/RBW).
Our FSW was upgraded from the original filing and now processes 100,000 data points across the screen which allows for 50 GHz spans with a 1 MHz RBW. Multiple spans were therefore used when necessary to evaluate the peak spurious emissions detected.

### 4.5.2.3 Part 30 Limit:

The -13 dBm emissions limit was not adjusted in any way.

### 4.5.2.4 Emissions Corrections

The measured signal was corrected by the FSW for the harmonic downconverter (HDC) conversion loss. In addition, a correction consisting of the radiated path loss, the gain of the measurement antenna and a 1 dB IF cable loss (at 1.3 GHz) was applied. There was no correction applied for the product antenna gain as these measurements are outside the transmit frequency range.

Emissions Correction = Path Loss - Antenna Gain + IF Cable loss (1dB)

Where Free Space Path Loss = $((4\pi d)/\lambda))^2$

Table 4.5.2.4 details the correction for the three bands.

**Table 4.5.2.4a Radiated Emissions Corrections for 40-60 GHz at 4m**

| Frequency | $\lambda$ | Measurement Distance, d | Path Loss | Measurement Antenna Gain | IF Cable Loss | Emissions Correction Total |
|---|---|---|---|---|---|---|
| GHz | m | m | dB | dB | dB | dB |
| 40.0 | 0.0075 | 4 | 76.52 | 21.80 | 1.03 | 55.75 |
| 42.5 | 0.0071 | 4 | 77.05 | 22.20 | 1.03 | 55.87 |
| 45.0 | 0.0067 | 4 | 77.55 | 22.50 | 1.03 | 56.07 |
| 47.5 | 0.0063 | 4 | 78.02 | 22.70 | 1.03 | 56.34 |
| 50.0 | 0.0060 | 4 | 78.46 | 23.00 | 1.03 | 56.49 |
| 52.5 | 0.0057 | 4 | 78.89 | 23.30 | 1.03 | 56.61 |
| 55.0 | 0.0055 | 4 | 79.29 | 23.40 | 1.03 | 56.91 |
| 57.5 | 0.0052 | 4 | 79.68 | 23.60 | 1.03 | 57.10 |
| 60.0 | 0.0050 | 4 | 80.05 | 23.70 | 1.03 | 57.37 |

**Table 4.5.2.4b Radiated Emissions Corrections for 60-90 GHz at 4m**

| Frequency | λ | Measurement Distance, d | Path Loss | Measurement Antenna Gain | IF Cable Loss | Emissions Correction Total |
|---|---|---|---|---|---|---|
| GHz | m | m | dB | dB | dB | dB |
| 60.0 | 0.0050 | 4 | 80.05 | 21.80 | 1.03 | 59.276 |
| 65.0 | 0.0046 | 4 | 80.74 | 22.30 | 1.03 | 59.471 |
| 70.0 | 0.0043 | 4 | 81.38 | 22.70 | 1.03 | 59.715 |
| 75.0 | 0.0040 | 4 | 81.98 | 23.00 | 1.03 | 60.014 |
| 80.0 | 0.0038 | 4 | 82.54 | 23.40 | 1.03 | 60.175 |
| 85.0 | 0.0035 | 4 | 83.07 | 23.60 | 1.03 | 60.501 |
| 90.0 | 0.0033 | 4 | 83.57 | 23.80 | 1.03 | 60.798 |

**Table 4.5.2.4c Radiated Emissions Corrections for 90-100GHz at 3m**

| Frequency | λ | Measurement Distance, d | Path Loss | Measurement Antenna Gain | IF Cable Loss | Emissions Correction Total |
|---|---|---|---|---|---|---|
| GHz | m | m | dB | dB | dB | dB |
| 90.0 | 0.0033 | 3 | 81.07 | 21.90 | 1.03 | 60.199 |
| 95.0 | 0.0032 | 3 | 81.54 | 22.30 | 1.03 | 60.269 |
| 100.0 | 0.0030 | 3 | 81.98 | 22.60 | 1.03 | 60.414 |
| 105.0 | 0.0029 | 3 | 82.41 | 22.95 | 1.03 | 60.488 |
| 110.0 | 0.0027 | 3 | 82.81 | 23.30 | 1.03 | 60.542 |
| 115.0 | 0.0026 | 3 | 83.20 | 23.60 | 1.03 | 60.628 |
| 120.0 | 0.0025 | 3 | 83.57 | 23.85 | 1.03 | 60.748 |
| 125.0 | 0.0024 | 3 | 83.92 | 24.05 | 1.03 | 60.902 |
| 130.0 | 0.0023 | 3 | 84.26 | 24.18 | 1.03 | 61.113 |
| 135.0 | 0.0022 | 3 | 84.59 | 24.35 | 1.03 | 61.271 |
| 140.0 | 0.0021 | 3 | 84.91 | 24.50 | 1.03 | 61.437 |

**Table 4.5.2.4d Radiated Emissions Corrections for 140-200GHz at 3m.**

| Frequency | λ | Measurement Distance, d | Path Loss | Rx Antenna Gain | Total | Offset | Transducer Factor |
|---|---|---|---|---|---|---|---|
| GHz | m | m | dB | dB | dB | dB | dB |
| 140.0 | 0.002143 | 3 | 84.91 | 23.40 | 61.51 | 62.07 | -0.56 |
| 145.0 | 0.002069 | 3 | 85.21 | 23.65 | 61.56 | 62.07 | -0.51 |
| 150.0 | 0.002000 | 3 | 85.51 | 23.90 | 61.61 | 62.07 | -0.46 |
| 155.0 | 0.001935 | 3 | 85.79 | 24.15 | 61.64 | 62.07 | -0.43 |
| 160.0 | 0.001875 | 3 | 86.07 | 24.30 | 61.77 | 62.07 | -0.30 |
| 165.0 | 0.001818 | 3 | 86.33 | 24.55 | 61.78 | 62.07 | -0.29 |
| 170.0 | 0.001765 | 3 | 86.59 | 24.70 | 61.89 | 62.07 | -0.18 |
| 175.0 | 0.001714 | 3 | 86.84 | 24.95 | 61.89 | 62.07 | -0.18 |
| 180.0 | 0.001667 | 3 | 87.09 | 25.10 | 61.99 | 62.07 | -0.08 |
| 185.0 | 0.001622 | 3 | 87.33 | 25.25 | 62.08 | 62.07 | 0.01 |
| 190.0 | 0.001579 | 3 | 87.56 | 25.40 | 62.16 | 62.07 | 0.09 |
| 195.0 | 0.001538 | 3 | 87.78 | 25.55 | 62.23 | 62.07 | 0.16 |
| 200.0 | 0.001500 | 3 | 88.00 | 25.70 | 62.30 | 62.07 | 0.23 |

### 4.5.3 Field Strength of Spurious Radiation Results:

This product meets Part 15B limits below 10 GHz and Part 30 Requirements. For the Title 47CFR section 30.203 and 2.1053 test, the field strength of any spurious radiation, measured at 3m, is required to be less than 82.23 dBμV/meter. Emissions equal to or less than 62.23 dBμV/meter are not reportable.

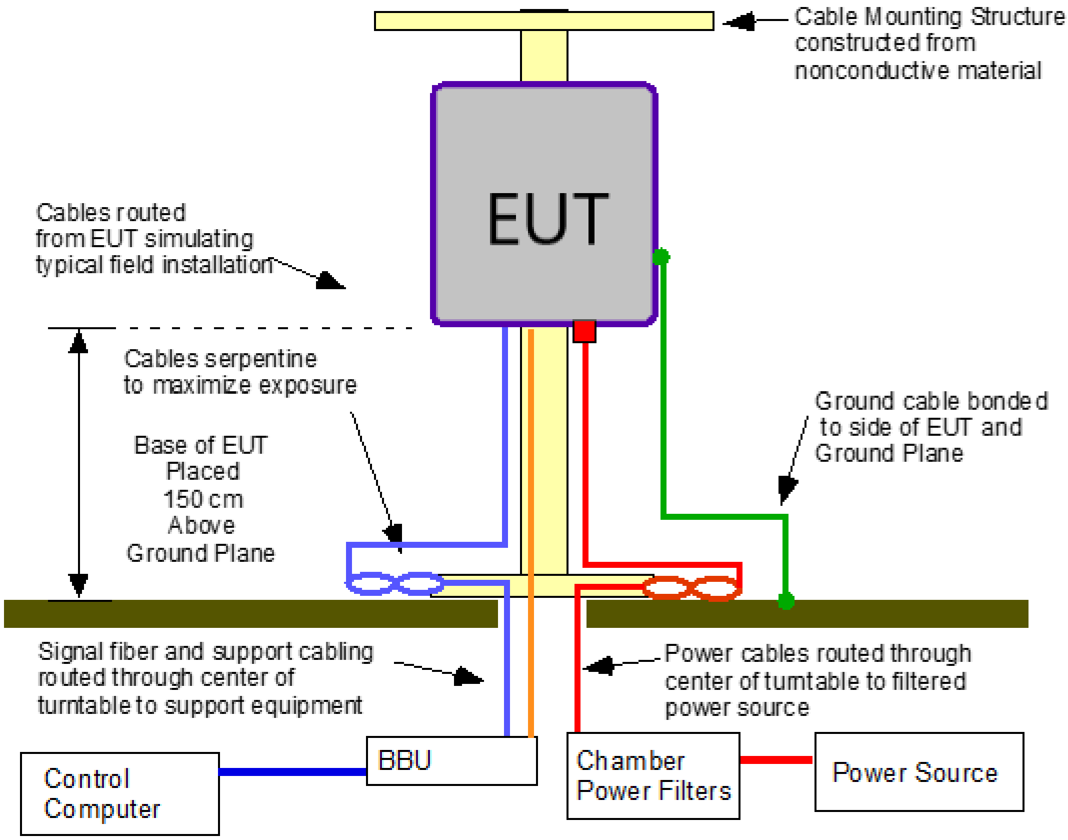
Presented results include the standard measurements from 30 MHz to 40 GHz followed by the three mmWave bands. The worst-case emissions are presented. The scans are performed with the required 1 MHz resolution bandwidth and sufficient number of points per ANSI C63.26 with markers at the frequencies of interest. The limit in the measurement is the conducted -13 dBm limit as specified in Part 30.203. Corrections to the emissions levels consisted of only the HDC conversion loss, the Free Space Path Loss and the gain of the measurement antenna as detailed in Table 4.5.2.4.

Over the out of band spectrum investigated from 30 MHz to 100 GHz, reportable spurious emissions were detected and determined to be compliant with the Part 30 limit. The minimum margin, measured in the vertical polarization, was 9.07 dB at 40.0622GHz. Additionally, from 30 MHz to 40 GHz all non-transmitter emissions were a minimum of 4.46 dB below the Part 15 Class B limit.

This demonstrates that the co-current operation of **AWEWA/B 5G AirScale 39 GHz mmWave Radio FCC ID: 2AD8UAWEWAB01,** the subject of this application, **and FA3WA 39 GHz mmWave Radio Extension FCC ID: 2AD8UFA3WA01**, complies with FCC Part 15 Class B, and FCC Sections 2.1053, 30.203 and 2.1057 of the Rules.

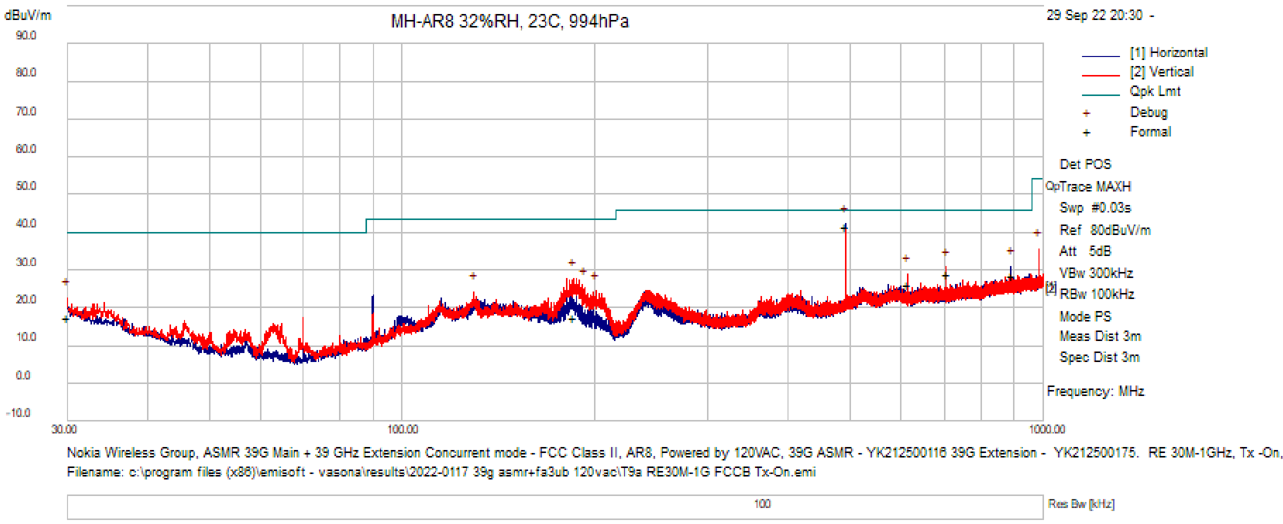
Photographs of the measurement setup are in the filing exhibits.

## Figure 4.5 Radiated Emissions Product Setup



### 4.5.4 Transmitter Measurements of Radiated Spurious Emissions

**Radiated Emissions 30MHz - 1GHz**




**Test Information**

| | |
|---|---|
| **Results Title** | Radiated Emissions 30M-1G Bilog 3M |
| **File Name** | T9a RE30M-1G FCCB Tx-On.emi |
| **Test Laboratory** | MH-AR8 32%RH, 23C, 994hPa |
| **Test Engineer** | MJS |
| **Test Software** | Vasona by EMISoft, version 6.061 |
| **Equipment** | Nokia Wireless Group |
| **EUT Details** | AWEWA/B 5G n260 39GHz FCC 4+4 CC - Ext FA3WA Module Concurrent Mode |
| **Configuration** | AR8, Powered by 120VAC, 39G ASMR - YK212500116 39G Extension - YK212500175. RE 30M-1GHz, Tx -On, FCC Part 15b limits. Bilog Antenna E1073, FSW67-E1260, PA-E813, LPF Filter-E1268, Cable Set- AR8. 100k BW Pre / 1M BW Formals |
| **Date** | 2022-09-29 20:30:49 |

**Formal Data**

| Frequency MHz | Raw dBuV | Cable Loss | AF dB/m | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 491.522 | 48.42 | 2.49 | -9.37 | 41.54 | QuasiMax | H | 102 | 116 | 46.00 | -4.46 | Pass | |
| 706.568 | 33.51 | 2.91 | -7.36 | 29.06 | QuasiMax | V | 108 | 301 | 46.00 | -16.94 | Pass | |
| 890.867 | 30.18 | 3.41 | -5.09 | 28.50 | QuasiMax | H | 123 | 40 | 46.00 | -17.50 | Pass | |
| 614.406 | 31.30 | 2.75 | -7.81 | 26.24 | QuasiMax | V | 132 | 279 | 46.00 | -19.76 | Pass | |
| 30.000 | 25.30 | 2.00 | -9.86 | 17.44 | QuasiMax | V | 103 | 285 | 40.00 | -22.56 | Pass | |
| 184.655 | 30.77 | 1.74 | -14.84 | 17.66 | QuasiMax | V | 106 | 57 | 43.50 | -25.84 | Pass | |

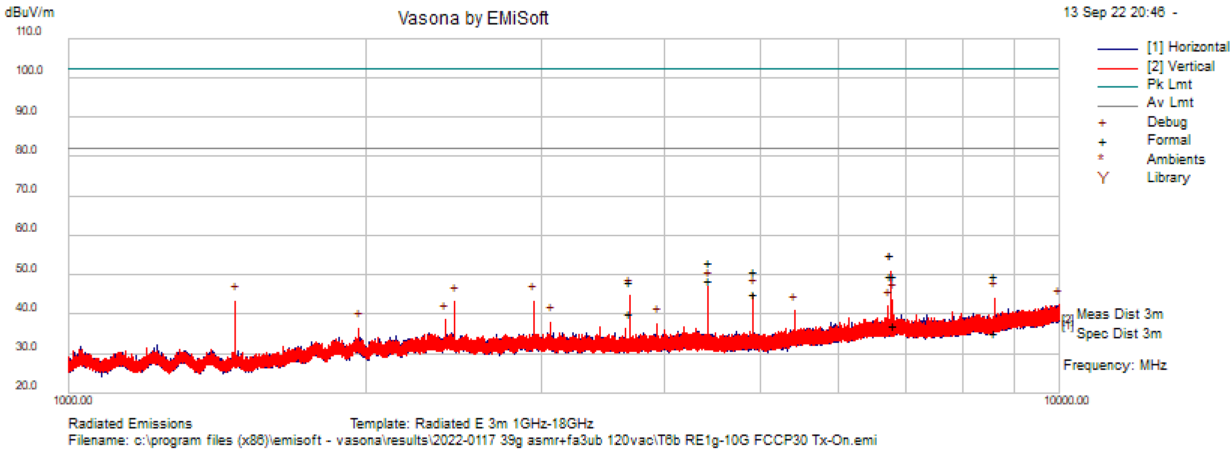
**Preview Data**

| Frequency MHz | Raw dBuV | Cable Loss | AF dB/m | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 491.493667 | 49.05 | 2.49 | -9.37 | 42.17 | Debug | H | 100 | 135 | 46.00 | -3.83 | Pass | |
| 890.875 | 32.56 | 3.41 | -5.09 | 30.88 | Debug | H | 175 | 45 | 46.00 | -15.12 | Pass | |

| Frequency MHz | Raw dBuV | Cable Loss | AF dB/m | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 706.542667 | 35.11 | 2.91 | -7.36 | 30.66 | Debug | V | 100 | 315 | 46.00 | -15.34 | Pass | |
| 184.715 | 40.90 | 1.74 | -14.85 | 27.79 | Debug | V | 100 | 0 | 43.50 | -15.71 | Pass | |
| 614.392667 | 33.87 | 2.75 | -7.81 | 28.81 | Debug | V | 200 | 270 | 46.00 | -17.19 | Pass | |
| 30.000 | 30.37 | 2.00 | -9.86 | 22.51 | Debug | V | 100 | 180 | 40.00 | -17.49 | Pass | |
| 192.636667 | 39.18 | 1.75 | -15.64 | 25.29 | Debug | V | 100 | 0 | 43.50 | -18.21 | Pass | |
| 983.057333 | 35.83 | 3.58 | -3.67 | 35.74 | Debug | V | 200 | 135 | 54.00 | -18.26 | Pass | |
| 200.526 | 38.92 | 1.75 | -16.34 | 24.33 | Debug | V | 100 | 352 | 43.50 | -19.17 | Pass | |
| 129.489667 | 32.66 | 1.66 | -10.25 | 24.07 | Debug | V | 200 | 90 | 43.50 | -19.43 | Pass | |

Note: Preview data was measured using a peak detector to identify frequencies of interest for formal measurement. Formal data consist of all frequencies in the preview list within 6 dB of specification limit or the top six frequencies. Failure in preview data does not necessarily constitute failure in formal data.

## Radiated Emissions 1GHz - 10GHz




### Test Information

| | |
|---|---|
| **Results Title** | Radiated Emissions 3m 1GHz-18GHz |
| **File Name** | T6b RE1g-10G FCCP30 Tx-On.emi |
| **Test Laboratory** | MH-AR8 60%RH, 23C, 994hPa |
| **Test Engineer** | MJS |
| **Test Software** | Vasona by EMISoft, version 6.061 |
| **Equipment** | NOKIA WIRELESS GROUP |
| **EUT Details** | ASMR 39G Main + 39G Extension (FA3UB) - New FCC Filing for Ext. |
| **Configuration** | AR8, Powered by 120VAC, 39G ASMR - YK211800002 39G Extension - YK212500175. RE 1G-10GHz, Tx -On, FCC Part 30 limits. Horn Antenna E1073, FSW67-E1260, PA-E447, LPF Filter-E1475, Cable Set- AR8. 100k BW Pre / 1M BW Formals |
| **Date** | 2022-09-13 20:46:51 |

### Formal Data

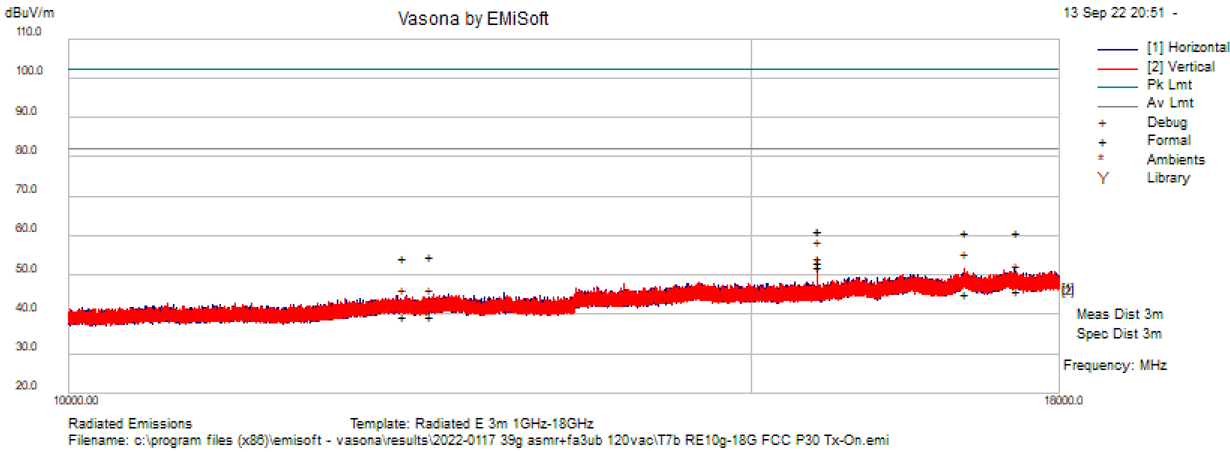
| Frequency MHz | Raw dBuV | Cable Loss | AF dB/m | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6758.397 | 44.66 | 7.99 | -2.65 | 50.01 | AvgMax | V | 119 | 209 | 82.23 | -32.22 | Pass | |
| 4423.689 | 47.27 | 5.95 | -4.39 | 48.83 | AvgMax | V | 109 | 190 | 82.23 | -33.40 | Pass | |
| 4915.200 | 43.13 | 6.24 | -4.08 | 45.29 | AvgMax | V | 110 | 203 | 82.23 | -36.94 | Pass | |
| 3686.408 | 39.99 | 5.33 | -5.15 | 40.17 | AvgMax | V | 241 | 214 | 82.23 | -42.06 | Pass | |
| 6789.128 | 31.71 | 8.03 | -2.64 | 37.10 | AvgMax | V | 202 | 212 | 82.23 | -45.13 | Pass | |
| 8601.606 | 29.08 | 9.18 | -2.73 | 35.54 | AvgMax | V | 255 | 192 | 82.23 | -46.69 | Pass | |
| 6758.397 | 49.75 | 7.99 | -2.65 | 55.09 | PeakMax | V | 119 | 209 | 102.23 | -47.14 | Pass | |
| 4423.689 | 51.67 | 5.95 | -4.39 | 53.23 | PeakMax | V | 109 | 190 | 102.23 | -49.00 | Pass | |
| 4915.200 | 48.78 | 6.24 | -4.08 | 50.94 | PeakMax | V | 110 | 203 | 102.23 | -51.29 | Pass | |
| 8601.606 | 43.44 | 9.18 | -2.73 | 49.89 | PeakMax | V | 255 | 192 | 102.23 | -52.34 | Pass | |
| 6789.128 | 44.35 | 8.03 | -2.64 | 49.74 | PeakMax | V | 202 | 212 | 102.23 | -52.49 | Pass | |
| 3686.408 | 48.03 | 5.33 | -5.15 | 48.21 | PeakMax | V | 241 | 214 | 102.23 | -54.02 | Pass | |

**Preview Data**

| Frequency MHz | Raw dBuV | Cable Loss | AF dB/m | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6758.400 | 45.63 | 7.99 | -2.65 | 50.97 | Debug | V | 100 | 210 | 82.23 | -31.26 | Pass | |
| 4423.650 | 45.26 | 5.95 | -4.39 | 46.82 | Debug | V | 100 | 210 | 82.23 | -35.41 | Pass | |
| 4915.200 | 42.86 | 6.24 | -4.08 | 45.02 | Debug | V | 100 | 180 | 82.23 | -37.21 | Pass | |
| 3686.400 | 44.66 | 5.33 | -5.15 | 44.84 | Debug | V | 100 | 210 | 82.23 | -37.39 | Pass | |
| 8601.550 | 37.53 | 9.18 | -2.73 | 43.98 | Debug | V | 100 | 180 | 82.23 | -38.25 | Pass | |
| 6789.100 | 38.26 | 8.03 | -2.64 | 43.64 | Debug | V | 100 | 210 | 82.23 | -38.59 | Pass | |
| 2949.100 | 44.41 | 4.84 | -5.98 | 43.27 | Debug | V | 100 | 330 | 82.23 | -38.96 | Pass | |
| 1474.550 | 51.10 | 3.50 | -11.35 | 43.25 | Debug | V | 100 | 120 | 82.23 | -38.98 | Pass | |
| 2457.600 | 44.73 | 4.55 | -6.12 | 43.16 | Debug | V | 100 | 330 | 82.23 | -39.07 | Pass | |
| 9995.350 | 33.50 | 10.78 | -1.91 | 42.37 | Debug | V | 300 | 180 | 82.23 | -39.86 | Pass | |
| 6727.700 | 36.57 | 7.95 | -2.65 | 41.87 | Debug | V | 100 | 210 | 82.23 | -40.36 | Pass | |
| 5406.700 | 37.56 | 6.78 | -3.56 | 40.78 | Debug | V | 100 | 180 | 82.23 | -41.45 | Pass | |
| 2400.000 | 40.22 | 4.49 | -6.23 | 38.48 | Debug | V | 100 | 330 | 82.23 | -43.75 | Pass | |
| 3071.950 | 39.01 | 4.89 | -5.89 | 38.01 | Debug | V | 100 | 180 | 82.23 | -44.22 | Pass | |
| 3932.150 | 36.73 | 5.53 | -4.76 | 37.51 | Debug | V | 100 | 240 | 82.23 | -44.72 | Pass | |
| 1966.050 | 39.69 | 3.97 | -7.35 | 36.32 | Debug | V | 100 | 180 | 82.23 | -45.91 | Pass | |

Note: Preview data was measured using a peak detector to identify frequencies of interest for formal measurement. Formal data consist of all frequencies in the preview list within 6 dB of specification limit or the top six frequencies. Failure in preview data does not necessarily constitute failure in formal data.

**Radiated Emissions 10GHz - 18GHz**




## Test Information

| | |
|---|---|
| **Results Title** | Radiated Emissions 3m 1GHz-18GHz |
| **File Name** | T7b RE10g-18G FCC P30 Tx-On.emi |
| **Test Laboratory** | MH-AR8 60%RH, 23C, 994hPa |
| **Test Engineer** | MJS |
| **Test Software** | Vasona by EMISoft, version 6.061 |
| **Equipment** | NOKIA WIRELESS GROUP |
| **EUT Details** | ASMR 39G Main + 39G Extension (FA3UB) - New FCC Filing for Ext. |
| **Configuration** | AR8, Powered by 120VAC, 39G ASMR - YK211800002 39G Extension - YK212500175. RE 10G-18GHz, Tx -On, FCC Part 30 limits. Horn Antenna E1073, FSW67-E1260, PA-E447, LPF Filter-E1475, Cable Set- AR8. 100k BW Pre / 1M BW Formals |
| **Date** | 2022-09-13 20:51:45 |

## Formal Data

| Frequency MHz | Raw dBuV | Cable Loss | AF dB/m | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15598.074 | 37.58 | 13.36 | 2.26 | 53.20 | AvgMax | V | 167 | 82 | 82.23 | -29.03 | Pass | |
| 15598.064 | 36.59 | 13.36 | 2.26 | 52.21 | AvgMax | H | 113 | 347 | 82.23 | -30.02 | Pass | |
| 17550.754 | 26.50 | 14.49 | 4.94 | 45.94 | AvgMax | H | 242 | 233 | 82.23 | -36.29 | Pass | |
| 17018.045 | 26.36 | 14.49 | 4.50 | 45.36 | AvgMax | V | 125 | 119 | 82.23 | -36.87 | Pass | |
| 15598.074 | 45.78 | 13.36 | 2.26 | 61.40 | PeakMax | V | 167 | 82 | 102.23 | -40.83 | Pass | |
| 15598.064 | 45.51 | 13.36 | 2.26 | 61.13 | PeakMax | H | 113 | 347 | 102.23 | -41.10 | Pass | |
| 17018.045 | 41.78 | 14.49 | 4.50 | 60.77 | PeakMax | V | 125 | 119 | 102.23 | -41.46 | Pass | |
| 17550.754 | 41.30 | 14.49 | 4.94 | 60.73 | PeakMax | H | 242 | 233 | 102.23 | -41.50 | Pass | |
| 12389.302 | 27.28 | 11.40 | 0.92 | 39.61 | AvgMax | V | 261 | 101 | 82.23 | -42.62 | Pass | |
| 12197.817 | 27.66 | 11.21 | 0.53 | 39.40 | AvgMax | H | 150 | 22 | 82.23 | -42.83 | Pass | |
| 12389.302 | 42.35 | 11.40 | 0.92 | 54.67 | PeakMax | V | 261 | 101 | 102.23 | -47.56 | Pass | |
| 12197.817 | 42.65 | 11.21 | 0.53 | 54.39 | PeakMax | H | 150 | 22 | 102.23 | -47.84 | Pass | |

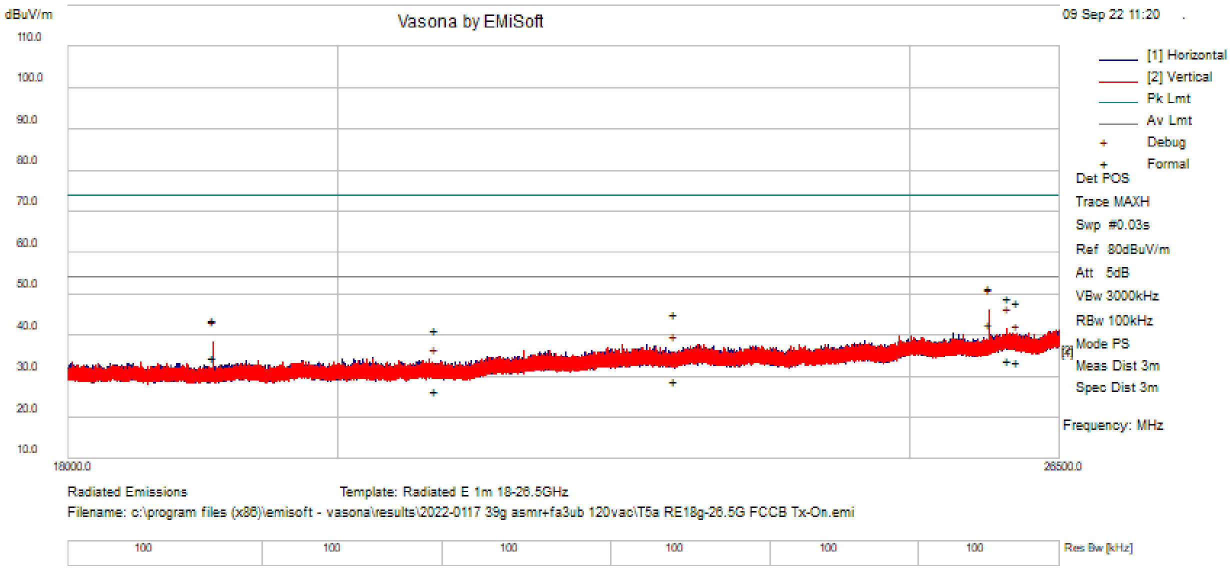
**Preview Data**

| Frequency MHz | Raw dBuV | Cable Loss | AF dB/m | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15598.044 | 38.69 | 13.36 | 2.26 | 54.31 | Debug | V | 200 | 90 | 82.23 | -27.92 | Pass | |
| 17018.045 | 32.44 | 14.49 | 4.50 | 51.43 | Debug | V | 100 | 60 | 82.23 | -30.80 | Pass | |
| 12389.302 | 29.74 | 11.40 | 0.92 | 42.07 | Debug | V | 102 | 331 | 82.23 | -40.16 | Pass | |
| 15598.064 | 34.49 | 13.36 | 2.26 | 50.11 | Debug | H | 102 | 331 | 82.23 | -32.12 | Pass | |
| 17550.754 | 29.02 | 14.49 | 4.94 | 48.46 | Debug | H | 102 | 331 | 82.23 | -33.77 | Pass | |
| 12197.817 | 30.56 | 11.21 | 0.53 | 42.30 | Debug | H | 102 | 331 | 82.23 | -39.93 | Pass | |

Note: Preview data was measured using a peak detector to identify frequencies of interest for formal measurement. Formal data consist of all frequencies in the preview list within 6 dB of specification limit or the top six frequencies. Failure in preview data does not necessarily constitute failure in formal data.

**Radiated Emissions 18GHz-26.5GHz**

Template: Vasona RE Data Template – v6.8




## Test Information

| | |
|---|---|
| **Results Title** | Radiated Emissions 3m 18-26.5GHz |
| **File Name** | T5a RE18g-26.5G FCCB Tx-On.emi |
| **Test Laboratory** | MH-AR8 52%RH, 23C, 994hPa |
| **Test Engineer** | MJS |
| **Test Software** | Vasona by EMISoft, version 6.061 |
| **Equipment** | NOKIA WIRELESS GROUP |
| **EUT Details** | ASMR 39G Main + 39G Extension (FA3UB) - New FCC Filing for Ext. |
| **Configuration** | AR8, Powered by 120VAC, 39G ASMR - YK211800002 39G Extension - YK212500175. RE 18G-26.5GHz, Tx -On, FCC Part 15b limits. Horn Antenna E1453, FSW85-E1384, PA-E1525, LPF Filter-E1516, Cable Set- E1501 and E502. 100k BW Pre / 1M BW Formals |
| **Date** | 2022-09-09 11:20:40 |

## Formal Data

| Frequency MHz | Raw dBuV | Cable Loss | AF dB/m | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25781.260 | 31.66 | 14.40 | -3.20 | 42.85 | AvgMax | V | 167 | 93 | 54.00 | -11.15 | Pass | |
| 19046.366 | 31.60 | 11.93 | -8.98 | 34.56 | AvgMax | V | 140 | 167 | 54.00 | -19.44 | Pass | |
| 25964.121 | 22.46 | 14.43 | -3.07 | 33.81 | AvgMax | V | 141 | 48 | 54.00 | -20.19 | Pass | |
| 26052.837 | 22.16 | 14.45 | -3.13 | 33.48 | AvgMax | H | 151 | 177 | 54.00 | -20.52 | Pass | |
| 25781.260 | 40.22 | 14.40 | -3.20 | 51.42 | PeakMax | V | 167 | 93 | 74.00 | -22.58 | Pass | |
| 25964.121 | 37.81 | 14.43 | -3.07 | 49.17 | PeakMax | V | 141 | 48 | 74.00 | -24.83 | Pass | |
| 22802.802 | 21.28 | 13.61 | -5.97 | 28.92 | AvgMax | H | 200 | 112 | 54.00 | -25.08 | Pass | |
| 26052.837 | 36.79 | 14.45 | -3.13 | 48.11 | PeakMax | H | 151 | 177 | 74.00 | -25.89 | Pass | |
| 20769.338 | 22.70 | 12.50 | -8.80 | 26.40 | AvgMax | H | 118 | 152 | 54.00 | -27.60 | Pass | |
| 22802.802 | 37.46 | 13.61 | -5.97 | 45.10 | PeakMax | H | 200 | 112 | 74.00 | -28.90 | Pass | |
| 19046.366 | 40.70 | 11.93 | -8.98 | 43.65 | PeakMax | V | 140 | 167 | 74.00 | -30.35 | Pass | |
| 20769.338 | 37.72 | 12.50 | -8.80 | 41.42 | PeakMax | H | 118 | 152 | 74.00 | -32.58 | Pass | |

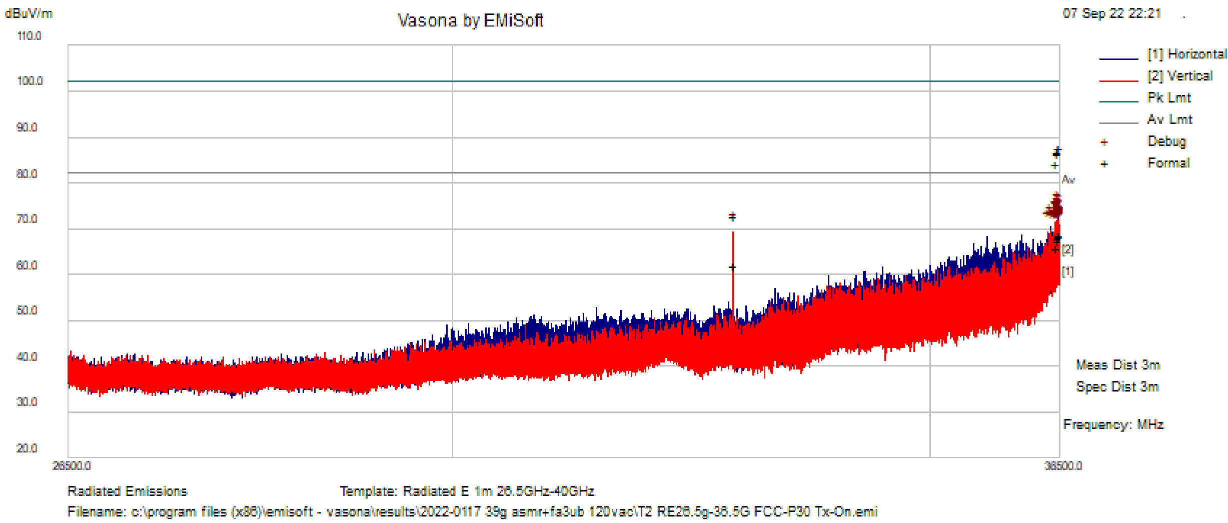
**Preview Data**

| Frequency MHz | Raw dBuV | Cable Loss | AF dB/m | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25781.277 | 35.03 | 14.40 | -3.20 | 46.23 | Debug | V | 150 | 88 | 54.00 | -7.77 | Pass | |
| 25964.121 | 30.06 | 14.43 | -3.07 | 41.41 | Debug | V | 225 | 88 | 54.00 | -12.59 | Pass | |
| 19046.397 | 35.40 | 11.93 | -8.98 | 38.35 | Debug | V | 150 | 88 | 54.00 | -15.65 | Pass | |
| 20769.338 | 28.05 | 12.50 | -8.80 | 31.75 | Debug | H | 102 | 349 | 54.00 | -22.25 | Pass | |
| 26052.837 | 25.83 | 14.45 | -3.13 | 37.15 | Debug | H | 102 | 349 | 54.00 | -16.85 | Pass | |
| 22802.802 | 27.12 | 13.61 | -5.97 | 34.76 | Debug | H | 102 | 349 | 54.00 | -19.24 | Pass | |

Note: Preview data was measured using a peak detector to identify frequencies of interest for formal measurement. Formal data consist of all frequencies in the preview list within 6 dB of specification limit or the top six frequencies. Failure in preview data does not necessarily constitute failure in formal data.

**Radiated Emissions 26.5-36.5 GHz**

Template: Vasona RE Data Template – v6.8




## Test Information

| | |
|---|---|
| **Results Title** | Radiated Emissions 3m 26.5GHz-40GHz |
| **File Name** | T2 RE26.5g-36.5G FCC-P30 Tx-On.emi |
| **Test Laboratory** | MH-AR8 52%RH, 23C, 994hPa |
| **Test Engineer** | MJS |
| **Test Software** | Vasona by EMISoft, version 6.061 |
| **Equipment** | NOKIA WIRELESS GROUP |
| **EUT Details** | ASMR 39G Main + 39G Extension (FA3UB) - New FCC Filing for Ext. |
| **Configuration** | AR8, Powered by 120VAC, 39G ASMR - YK211800002 39G Extension - YK212500175. RE 26.5G-37.5GHz, Tx -On, FCC Part 30 limits. Horn Antenna E1375, FSW85-E1384, PA-E1525, LPF Filter-E1516, Cable Set- E1501 and E502. 100k BW Pre / 1M BW Formals |
| **Date** | 2022-09-07 22:21:32 |

## Formal Data

| Frequency MHz | Raw dBuV | Cable Loss | AF dB/m | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 36486.944 | 37.53 | 32.30 | -0.98 | 68.85 | AvgMax | H | 174 | 73 | 82.23 | -13.38 | Pass | |
| 36478.333 | 37.54 | 32.05 | -0.99 | 68.61 | AvgMax | H | 184 | 201 | 82.23 | -13.62 | Pass | |
| 36474.778 | 37.12 | 31.95 | -0.99 | 68.09 | AvgMax | H | 168 | 73 | 82.23 | -14.14 | Pass | |
| 36486.944 | 56.63 | 32.30 | -0.98 | 87.95 | PeakMax | H | 174 | 73 | 102.23 | -14.28 | Pass | |
| 36478.333 | 56.69 | 32.05 | -0.99 | 87.75 | PeakMax | H | 184 | 201 | 102.23 | -14.48 | Pass | |
| 36476.833 | 36.55 | 32.01 | -0.99 | 67.57 | AvgMax | H | 178 | 197 | 82.23 | -14.66 | Pass | |
| 36474.778 | 55.96 | 31.95 | -0.99 | 86.92 | PeakMax | H | 168 | 73 | 102.23 | -15.31 | Pass | |
| 36476.833 | 55.45 | 32.01 | -0.99 | 86.48 | PeakMax | H | 178 | 197 | 102.23 | -15.75 | Pass | |
| 36455.667 | 35.62 | 31.40 | -1.01 | 66.01 | AvgMax | H | 187 | 208 | 82.23 | -16.22 | Pass | |
| 36455.667 | 53.93 | 31.40 | -1.01 | 84.32 | PeakMax | H | 187 | 208 | 102.23 | -17.91 | Pass | |
| 32849.922 | 46.20 | 15.79 | 0.17 | 62.16 | AvgMax | V | 182 | 199 | 82.23 | -20.07 | Pass | |
| 32849.922 | 57.01 | 15.79 | 0.17 | 72.97 | PeakMax | V | 182 | 199 | 102.23 | -29.26 | Pass | |

### Preview Data

| Frequency MHz | Raw dBuV | Cable Loss | AF dB/m | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 36474.778 | 42.38 | 31.95 | -0.99 | 73.34 | Debug | H | 175 | 198 | 82.23 | -8.89 | Pass | |
| 36486.944 | 41.74 | 32.30 | -0.98 | 73.07 | Debug | H | 175 | 198 | 82.23 | -9.16 | Pass | |
| 36476.833 | 41.37 | 32.01 | -0.99 | 72.40 | Debug | H | 175 | 198 | 82.23 | -9.83 | Pass | |
| 36478.333 | 41.11 | 32.05 | -0.99 | 72.18 | Debug | H | 175 | 198 | 82.23 | -10.05 | Pass | |
| 36455.667 | 41.46 | 31.40 | -1.01 | 71.86 | Debug | H | 175 | 198 | 82.23 | -10.37 | Pass | |
| 36469.722 | 40.99 | 31.81 | -1.00 | 71.81 | Debug | V | 175 | 198 | 82.23 | -10.42 | Pass | |
| 36478.667 | 40.70 | 32.06 | -0.99 | 71.78 | Debug | V | 175 | 198 | 82.23 | -10.45 | Pass | |
| 36458.444 | 41.28 | 31.48 | -1.01 | 71.76 | Debug | H | 175 | 198 | 82.23 | -10.47 | Pass | |
| 36464.611 | 40.99 | 31.66 | -1.00 | 71.65 | Debug | H | 175 | 198 | 82.23 | -10.58 | Pass | |
| 36452.389 | 41.32 | 31.31 | -1.01 | 71.61 | Debug | V | 175 | 198 | 82.23 | -10.62 | Pass | |
| 36475.333 | 40.59 | 31.97 | -0.99 | 71.56 | Debug | H | 175 | 66 | 82.23 | -10.67 | Pass | |
| 36475.722 | 40.46 | 31.98 | -0.99 | 71.45 | Debug | H | 175 | 66 | 82.23 | -10.78 | Pass | |
| 36473.333 | 40.21 | 31.91 | -0.99 | 71.13 | Debug | H | 175 | 198 | 82.23 | -11.10 | Pass | |
| 36482.667 | 39.71 | 32.18 | -0.98 | 70.90 | Debug | H | 175 | 66 | 82.23 | -11.33 | Pass | |
| 36471.944 | 39.92 | 31.87 | -0.99 | 70.80 | Debug | H | 175 | 198 | 82.23 | -11.43 | Pass | |
| 36491.056 | 39.32 | 32.42 | -0.97 | 70.76 | Debug | H | 175 | 66 | 82.23 | -11.47 | Pass | |
| 36468.000 | 39.87 | 31.76 | -1.00 | 70.64 | Debug | V | 175 | 198 | 82.23 | -11.59 | Pass | |
| 36388.444 | 42.20 | 29.49 | -1.09 | 70.59 | Debug | H | 175 | 198 | 82.23 | -11.64 | Pass | |
| 36498.278 | 38.91 | 32.63 | -0.97 | 70.57 | Debug | V | 200 | 198 | 82.23 | -11.66 | Pass | |
| 36487.667 | 39.17 | 32.32 | -0.98 | 70.52 | Debug | H | 175 | 198 | 82.23 | -11.71 | Pass | |
| 36468.667 | 39.72 | 31.78 | -1.00 | 70.50 | Debug | V | 175 | 198 | 82.23 | -11.73 | Pass | |
| 36499.944 | 38.78 | 32.67 | -0.97 | 70.48 | Debug | V | 175 | 198 | 82.23 | -11.75 | Pass | |
| 36488.778 | 39.08 | 32.35 | -0.98 | 70.45 | Debug | H | 175 | 66 | 82.23 | -11.78 | Pass | |
| 36467.278 | 39.51 | 31.74 | -1.00 | 70.25 | Debug | V | 175 | 198 | 82.23 | -11.98 | Pass | |
| 36477.722 | 39.13 | 32.04 | -0.99 | 70.18 | Debug | H | 175 | 198 | 82.23 | -12.05 | Pass | |
| 36497.389 | 38.48 | 32.60 | -0.97 | 70.11 | Debug | H | 200 | 198 | 82.23 | -12.12 | Pass | |
| 36498.833 | 38.43 | 32.64 | -0.97 | 70.10 | Debug | H | 175 | 66 | 82.23 | -12.13 | Pass | |
| 36483.500 | 38.87 | 32.20 | -0.98 | 70.09 | Debug | H | 175 | 66 | 82.23 | -12.14 | Pass | |
| 36436.500 | 40.24 | 30.86 | -1.03 | 70.07 | Debug | H | 200 | 198 | 82.23 | -12.16 | Pass | |
| 36471.000 | 39.19 | 31.84 | -0.99 | 70.04 | Debug | H | 175 | 198 | 82.23 | -12.19 | Pass | |
| 36480.556 | 38.81 | 32.12 | -0.99 | 69.94 | Debug | H | 175 | 198 | 82.23 | -12.29 | Pass | |
| 36457.000 | 39.49 | 31.44 | -1.01 | 69.93 | Debug | H | 175 | 198 | 82.23 | -12.30 | Pass | |
| 36493.167 | 38.40 | 32.48 | -0.97 | 69.90 | Debug | H | 175 | 66 | 82.23 | -12.33 | Pass | |
| 36445.278 | 39.73 | 31.11 | -1.02 | 69.82 | Debug | H | 175 | 198 | 82.23 | -12.41 | Pass | |
| 36496.500 | 38.21 | 32.57 | -0.97 | 69.81 | Debug | H | 150 | 66 | 82.23 | -12.42 | Pass | |
| 36386.444 | 41.38 | 29.44 | -1.10 | 69.72 | Debug | V | 175 | 198 | 82.23 | -12.51 | Pass | |
| 36395.111 | 41.11 | 29.67 | -1.08 | 69.71 | Debug | H | 175 | 198 | 82.23 | -12.52 | Pass | |
| 36448.111 | 39.48 | 31.19 | -1.02 | 69.65 | Debug | H | 200 | 198 | 82.23 | -12.58 | Pass | |
| 36495.667 | 38.06 | 32.55 | -0.97 | 69.64 | Debug | H | 200 | 198 | 82.23 | -12.59 | Pass | |
| 36489.500 | 38.17 | 32.37 | -0.98 | 69.57 | Debug | H | 175 | 66 | 82.23 | -12.66 | Pass | |
| 36479.111 | 38.40 | 32.08 | -0.99 | 69.49 | Debug | V | 175 | 198 | 82.23 | -12.74 | Pass | |
| 36474.333 | 38.47 | 31.94 | -0.99 | 69.42 | Debug | V | 175 | 198 | 82.23 | -12.81 | Pass | |
| 36454.222 | 39.03 | 31.36 | -1.01 | 69.38 | Debug | H | 175 | 198 | 82.23 | -12.85 | Pass | |
| 36469.111 | 38.58 | 31.79 | -1.00 | 69.38 | Debug | H | 175 | 198 | 82.23 | -12.85 | Pass | |
| 36481.278 | 38.20 | 32.14 | -0.98 | 69.35 | Debug | H | 175 | 66 | 82.23 | -12.88 | Pass | |
| 36443.167 | 39.32 | 31.05 | -1.02 | 69.35 | Debug | H | 175 | 198 | 82.23 | -12.88 | Pass | |
| 36499.278 | 37.64 | 32.65 | -0.97 | 69.33 | Debug | V | 200 | 198 | 82.23 | -12.90 | Pass | |
| 36356.222 | 41.86 | 28.61 | -1.17 | 69.29 | Debug | H | 175 | 198 | 82.23 | -12.94 | Pass | |
| 36453.333 | 38.96 | 31.34 | -1.01 | 69.29 | Debug | H | 175 | 198 | 82.23 | -12.94 | Pass | |
| 36444.944 | 39.16 | 31.10 | -1.02 | 69.24 | Debug | V | 175 | 198 | 82.23 | -12.99 | Pass | |
| 36416.722 | 39.96 | 30.29 | -1.05 | 69.20 | Debug | H | 175 | 198 | 82.23 | -13.03 | Pass | |
| 36431.278 | 39.52 | 30.71 | -1.03 | 69.19 | Debug | V | 175 | 198 | 82.23 | -13.04 | Pass | |
| 36489.889 | 37.76 | 32.38 | -0.98 | 69.17 | Debug | H | 175 | 66 | 82.23 | -13.06 | Pass | |
| 36472.500 | 38.24 | 31.89 | -0.99 | 69.13 | Debug | V | 175 | 198 | 82.23 | -13.10 | Pass | |

| Frequency MHz | Raw dBuV | Cable Loss | AF dB/m | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 32849.945 | 53.16 | 15.79 | 0.17 | 69.12 | Debug | V | 175 | 198 | 82.23 | -13.11 | Pass | |
| 36457.667 | 38.61 | 31.46 | -1.01 | 69.06 | Debug | H | 175 | 198 | 82.23 | -13.17 | Pass | |
| 36441.500 | 39.08 | 31.00 | -1.02 | 69.06 | Debug | V | 175 | 198 | 82.23 | -13.17 | Pass | |
| 36464.833 | 38.37 | 31.67 | -1.00 | 69.04 | Debug | V | 175 | 198 | 82.23 | -13.19 | Pass | |
| 36394.667 | 40.45 | 29.66 | -1.08 | 69.03 | Debug | H | 175 | 198 | 82.23 | -13.20 | Pass | |
| 36487.944 | 37.68 | 32.33 | -0.98 | 69.03 | Debug | H | 175 | 198 | 82.23 | -13.20 | Pass | |

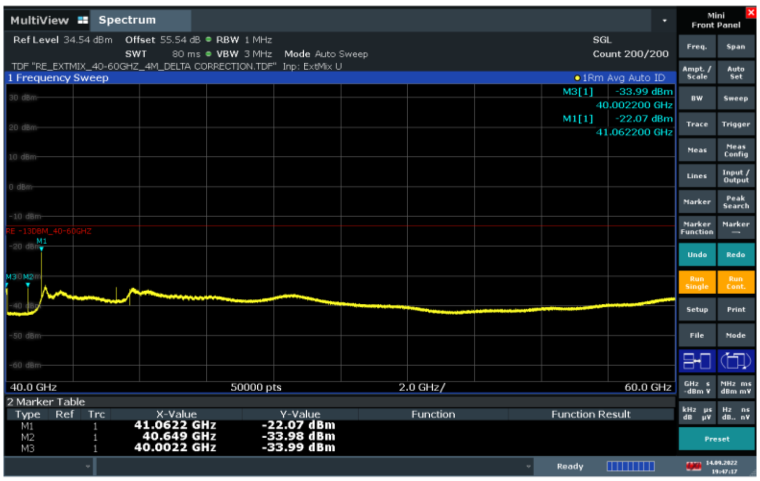
Note: Preview data was measured using a peak detector to identify frequencies of interest for formal measurement. Formal data consist of all frequencies in the preview list within 6 dB of specification limit or the top six frequencies. Failure in preview data does not necessarily constitute failure in formal data.

## Maximum Measured Radiated Emissions -U Band 40GHz-60GHz FCC Part 30

## AWEWA/B

### Horizontal

2022-0117 ASMR 39 G W-39G Extension 4m, SN YK211800002,YK212500175




19:47:18 14.09.2022

### Vertical

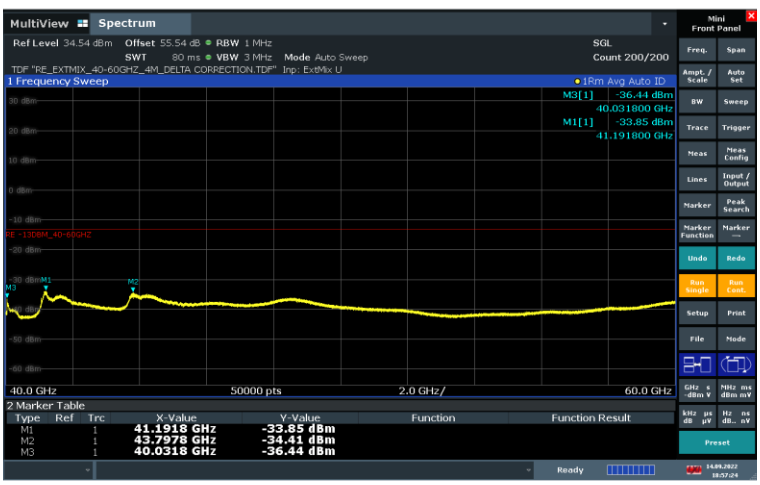
2022-0117 ASMR 39 G W-39G Extension 4m, SN YK211800002,YK212500175


19:42:43 14.09.2022

## FA3WA

### Horizontal

2022-0117 ASMR 39 G W-39G Extension 4m, SN YK211800002,YK212500175




18:57:25 14.09.2022

### Vertical

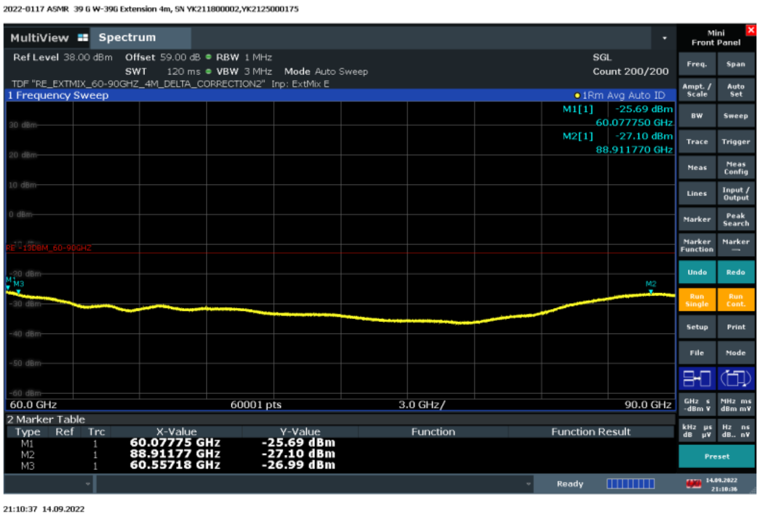
2022-0117 ASMR 39 G W-39G Extension 4m, SN YK211800002,YK212500175


18:07:03 14.09.2022

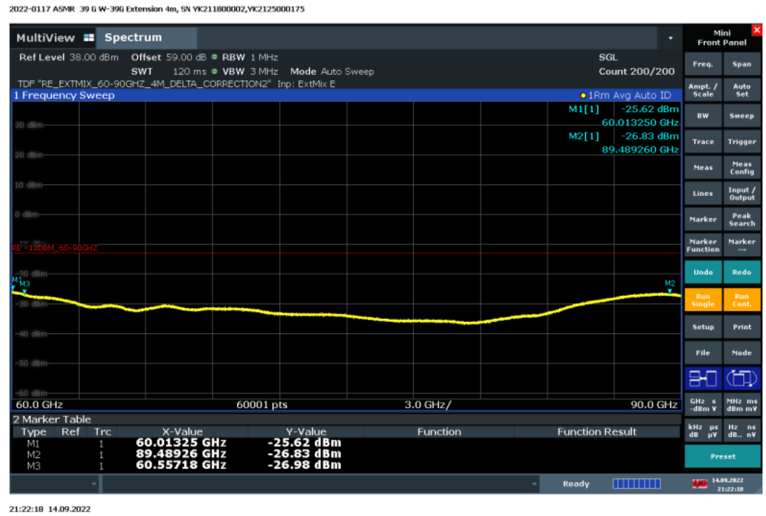
## Maximum Measured Radiated Emissions -U Band 60GHz-90GHz FCC Part 30

## AWEWA/B

### Horizontal

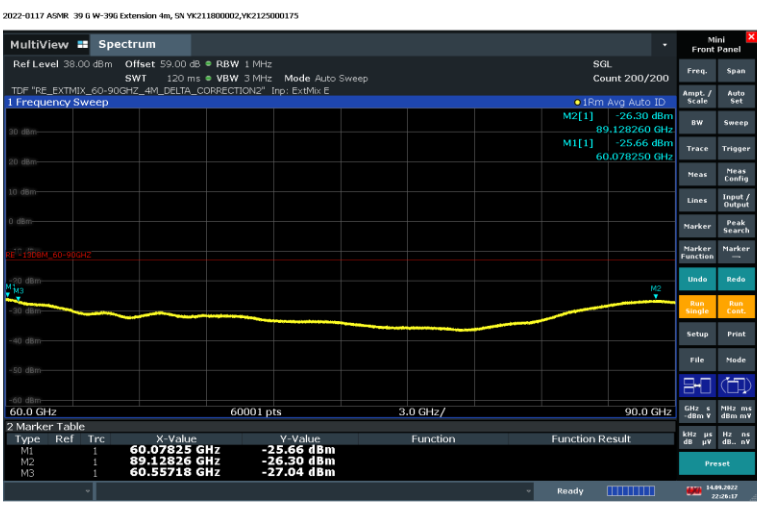



### Vertical

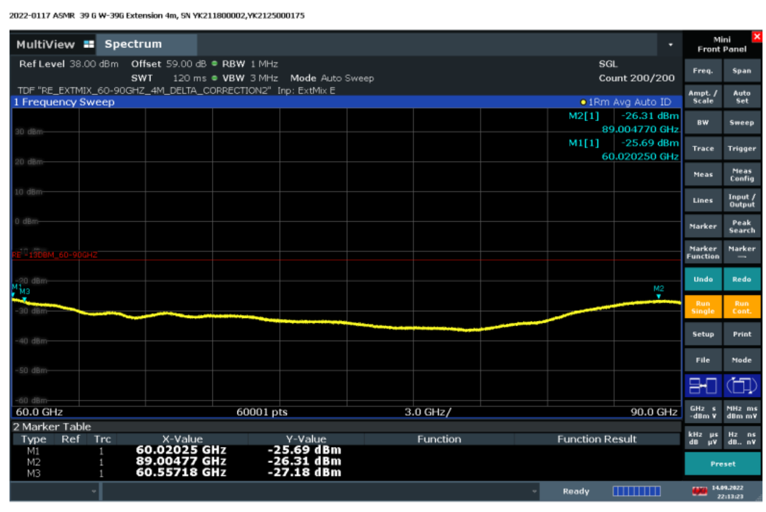



## FA3WA

### Horizontal



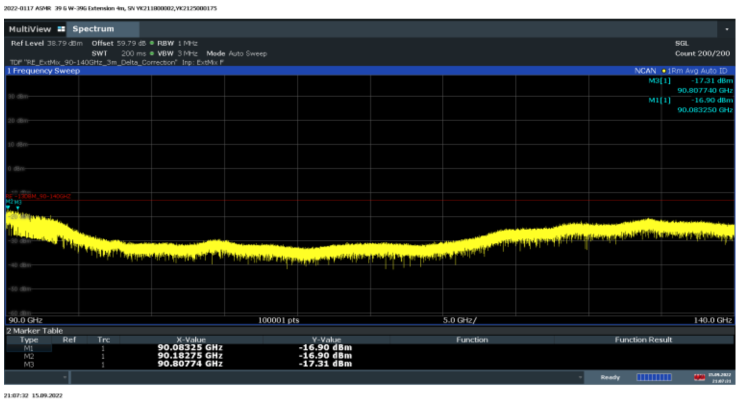

### Vertical



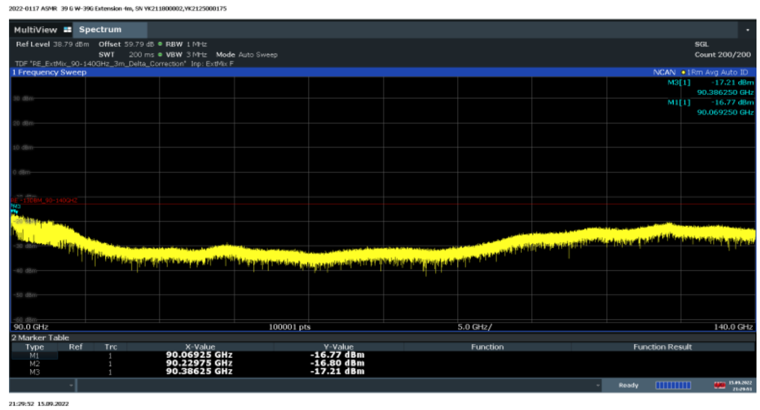
## Maximum Measured Radiated Emissions -U Band 90GHz-140GHz FCC Part 30

## AWEWA/B

### Horizontal

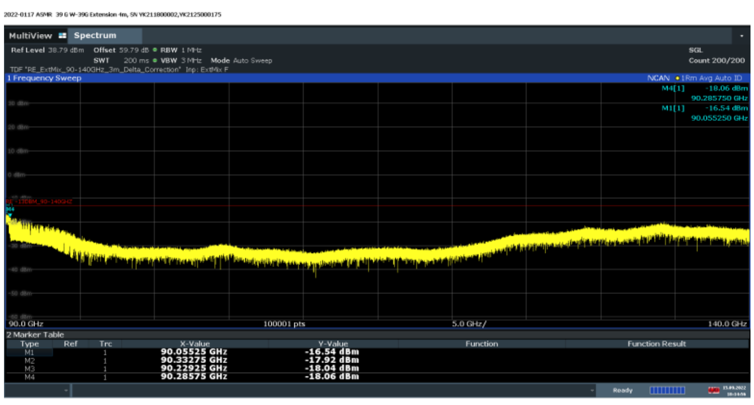



### Vertical

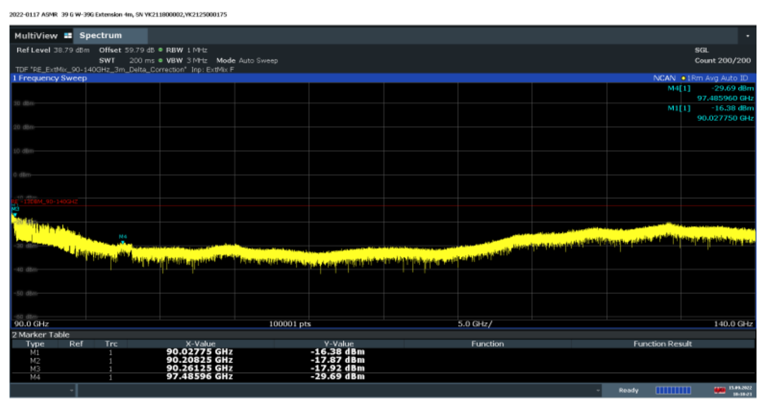



## FA3WA

### Horizontal



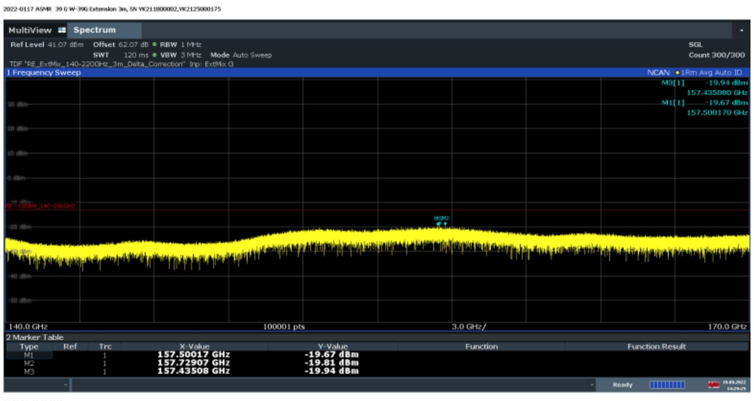

### Vertical



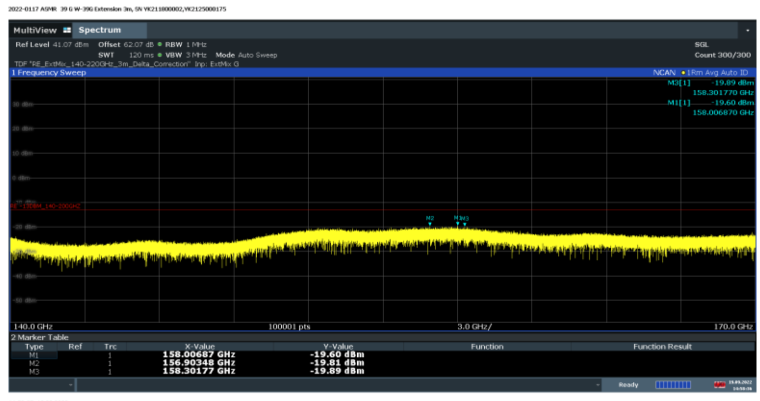
## Maximum Measured Radiated Emissions -U Band 140GHz-170GHz FCC Part 30

### AWEWA/B

**Horizontal**

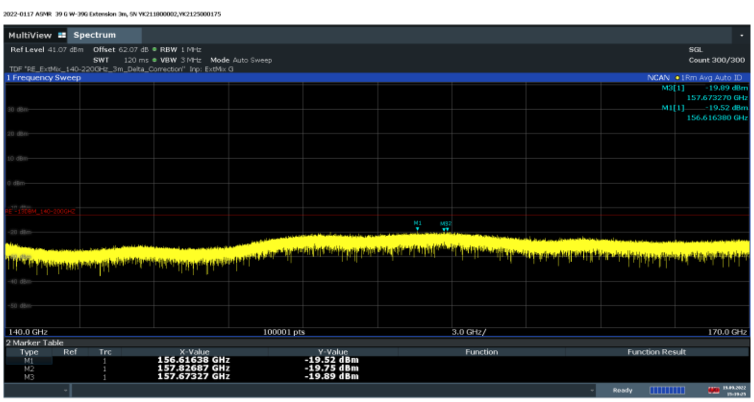



**Vertical**

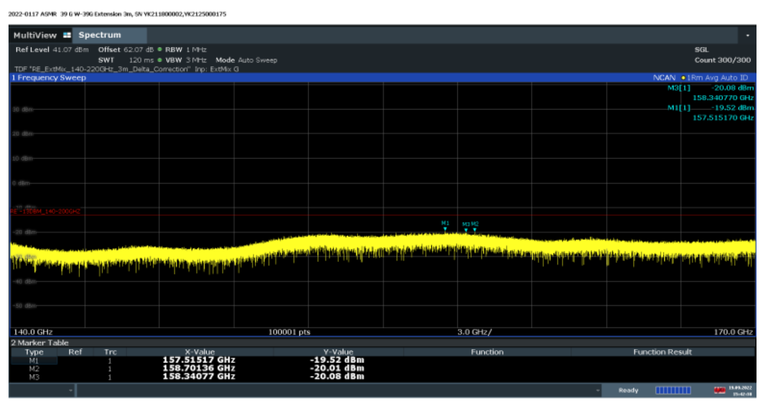



### FA3WA

**Horizontal**



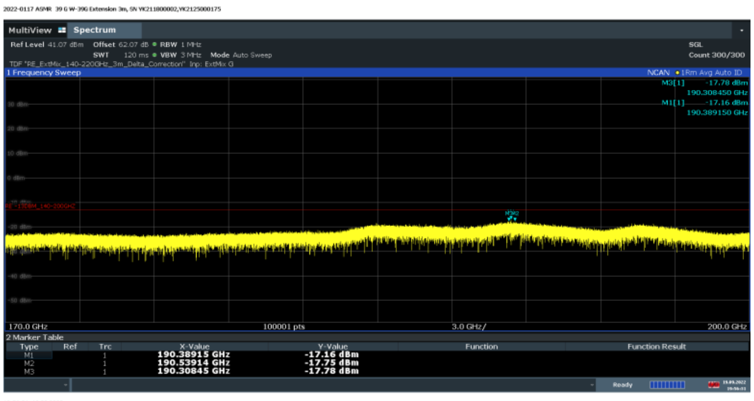

**Vertical**



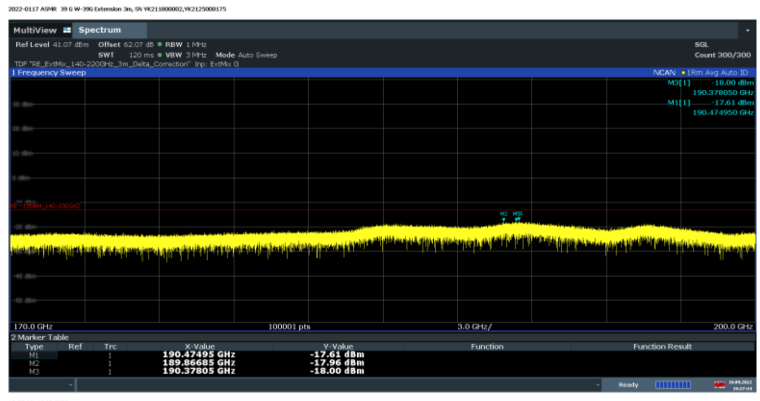
**Maximum Measured Radiated Emissions -U Band 170GHz-200GHz FCC Part 30**

## AWEWA/B

### Horizontal

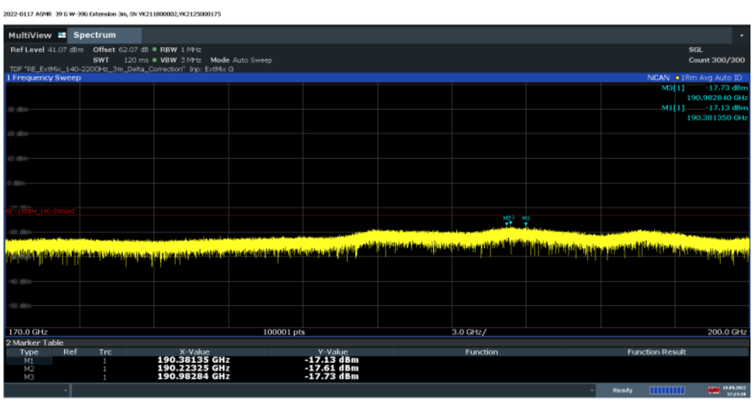



### Vertical

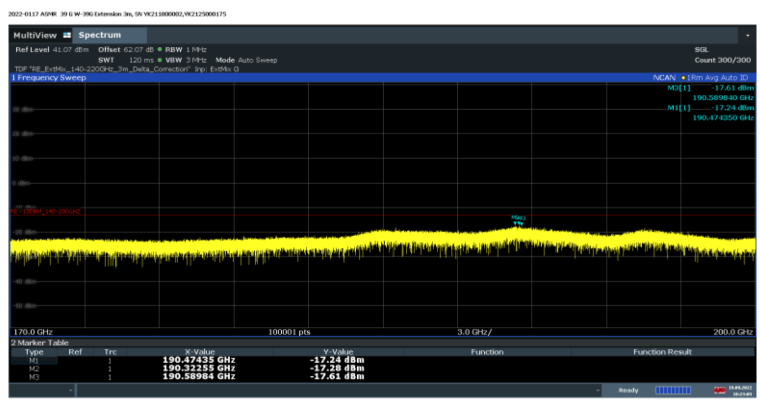



## FA3WA

### Horizontal




### Vertical



## 4.6 Section 2.1055 MEASUREMENT OF FREQUENCY STABILITY

Frequency Stability measurements are not required

## 4.7 List of Test Equipment

### 4.7.1 List of Radio Measurements and Radiated Emissions Test Equipment

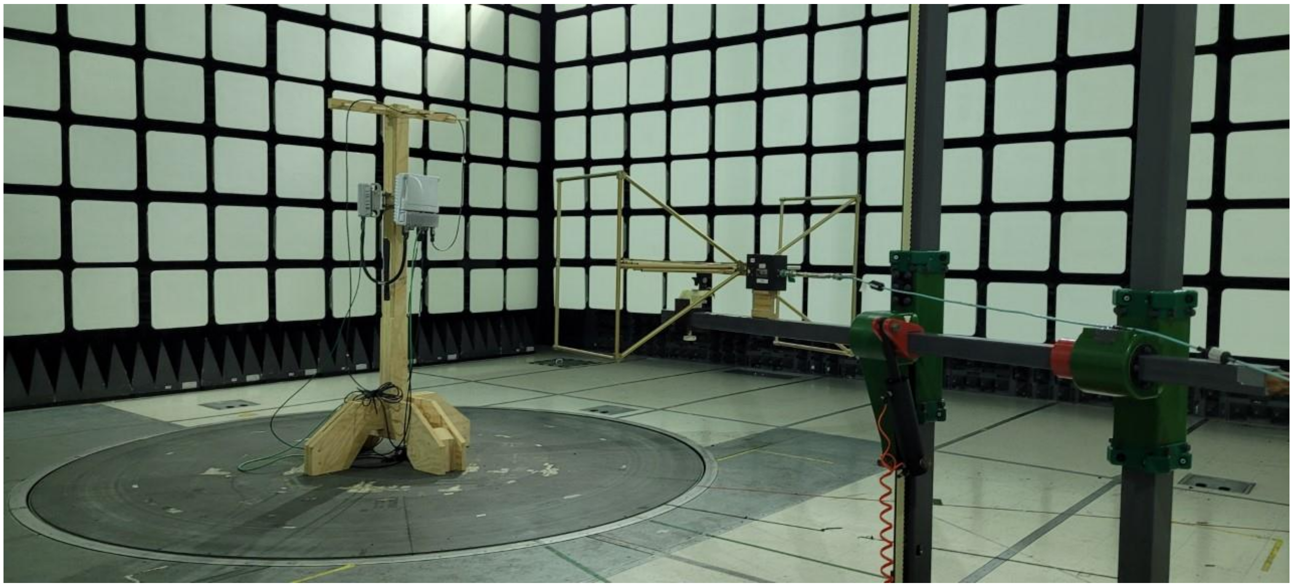
| Asset ID | Manufacturer | Type | Description | Model | Serial | Calibration Date | Calibration Due |
|---|---|---|---|---|---|---|---|
| E1453 | A-Info | Horn Antenna | 18 to 26.5 GHz WR42 25 dB | LB-42-25-C2-KFSP0 | J202066362 | 2020-07-24 | 2023-07-24 |
| E1375 | A-Info | Horn Antenna | 26.5-40GHz WR28 25 dB | LB-28-25-C2-KF | J202023249 | 2020-07-27 | 2023-07-27 |
| E1525 | A.H. Systems Inc. | Pre-Amplifier | 18 GHz-40 GHz, 37 dB | PAM-1840VH | 186 | 2020-11-30 | 2022-11-30 |
| E1073 | ETS Lindgren | Horn Antenna | Double-Ridged Waveguide Horn 1-18 GHz | 3117 | 00135198 | 2022-01-04 | 2024-01-04 |
| E1255 | ETS Lindgren | Controller | Multi-Device Controller | 2090 | 00078509 | CNR | CNR |
| E1119 | Extech | Data Logger | Pressure Humidity Temp data logger | SD700 | Q668960 | 2021-01-11 | 2023-01-11 |
| E447 | Hewlett Packard | Pre-Amplifier | Preamplifier 1-26.5 GHz | 8449B | 3008A01384 | 2020-08-31 | 2022-09-30 |
| E1516 | Reactel, Inc. | Filter, Low Pass | 1 - 34 GHz, 2.0 dB | 11LS-X34GK11 | SN20-01 | CNR-V | CNR-V |
| E1475 | Reactel, Inc. | Filter, Low Pass | DC - 20 GHz | 11LS-X20GS11 | SN20-02 | CNR-V | CNR-V |
| E1260 | Rohde & Schwarz | Spectrum Analyzer | | FSW67 | 104007 | 2020-08-21 | 2022-11-21 |
| E1384 | Rohde & Schwarz | Spectrum Analyzer | 2 Hz to 85 GHz (with R&S®FSW-B90G option: 2 Hz to 90 GHz) | FSW85 | 101537 | 2020-08-25 | 2022-11-25 |
| E772 | Sunol Sciences Corp | Modular Controller | Multi-Device Controller | SC104V | 0 | CNR | CNR |
| E758 | A.H. Systems Inc. | Bilogical Antenna | 25 - 2000 MHz | SAS-521-2 | 458 | 2022-03-01 | 2024-03-01 |
| E813 | Sonoma Instrument Co. | Amplifier | 9kHz-1GHz | 310N | 186750 | 2020-10-20 | 2022-10-20 |
| E1268 | Trilithic | Filter, Low Pass | DC - 1620 MHz | 23042 | 200802040 | CNR-V | CNR-V |

CNR: Calibration Not Required
CNR-V: Calibration Not Required, Must Be Verified
Test Date: 9/6/2022 – 9/29/2022

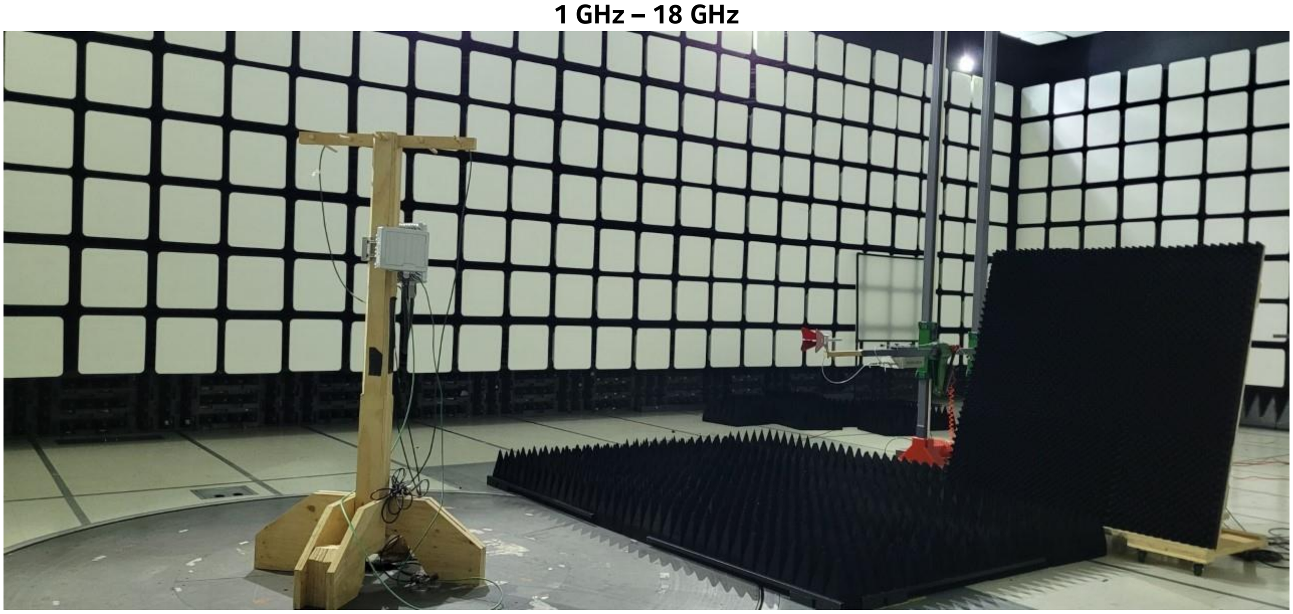
## 4.8 PHOTOGRAPHS OF THE TEST SETUPS

### Radio Measurements and Radiated Emissions Test

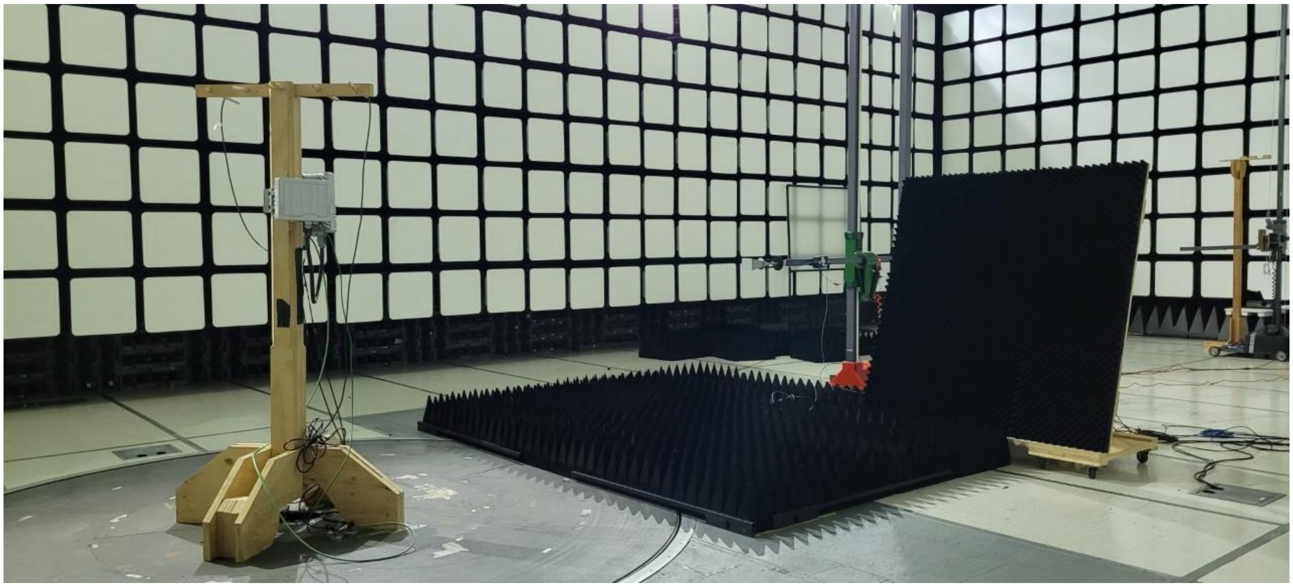
**30 MHz-1 GHz**



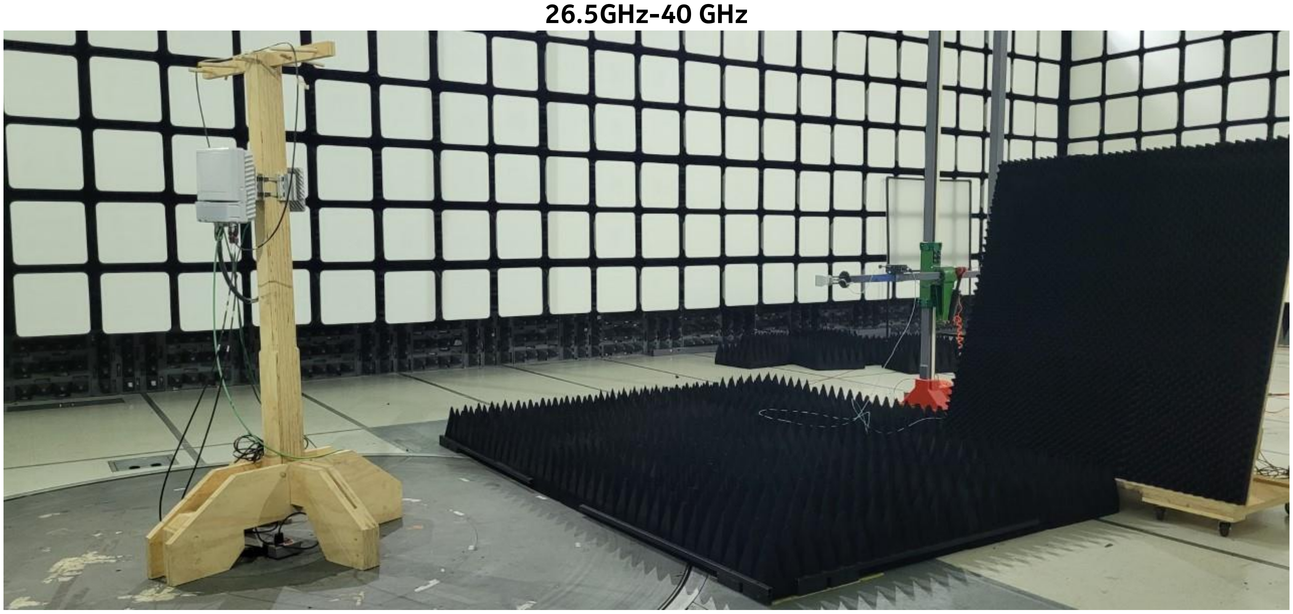
**1 GHz – 18 GHz**



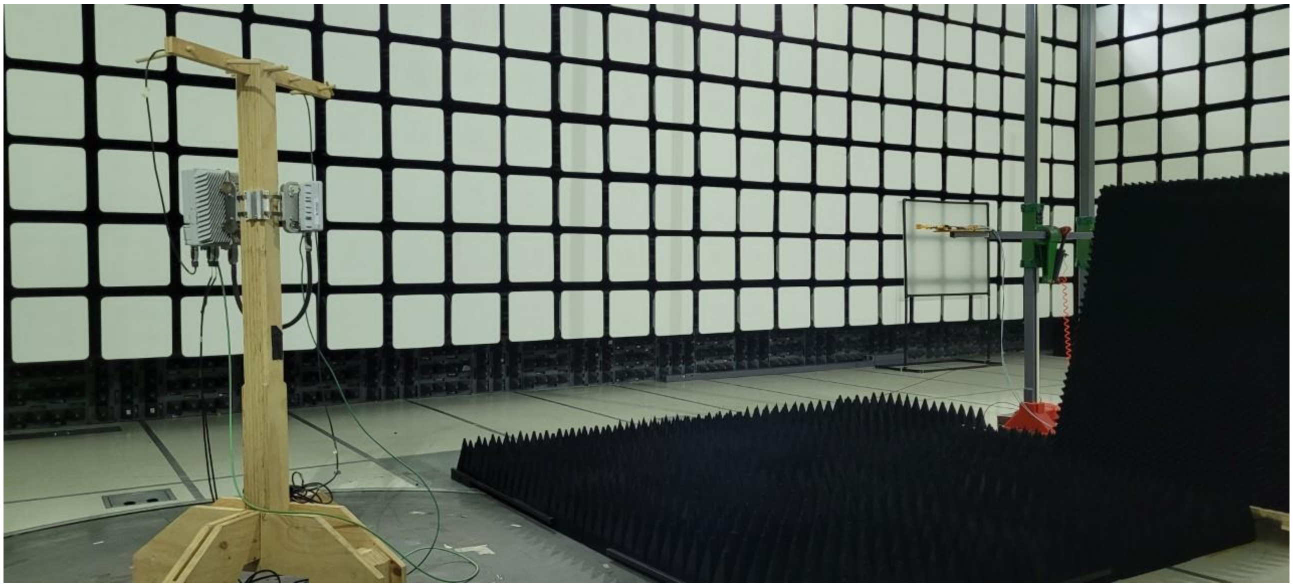
**18GHz-26.5GHz**



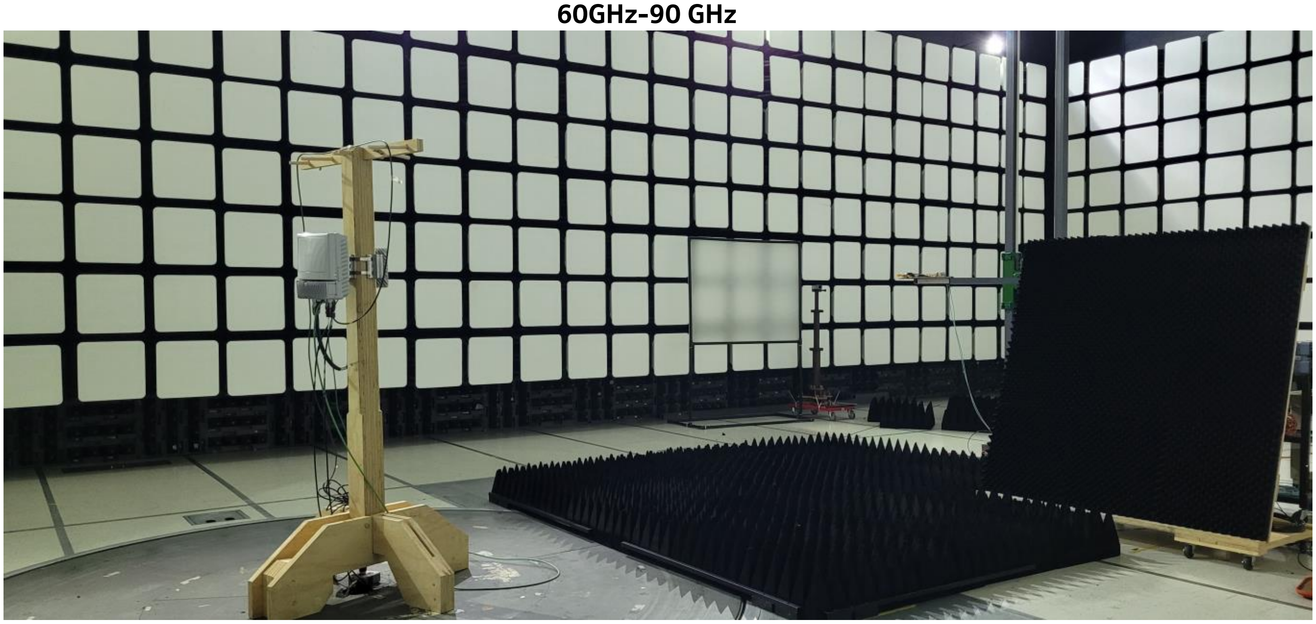
**26.5GHz-40 GHz**



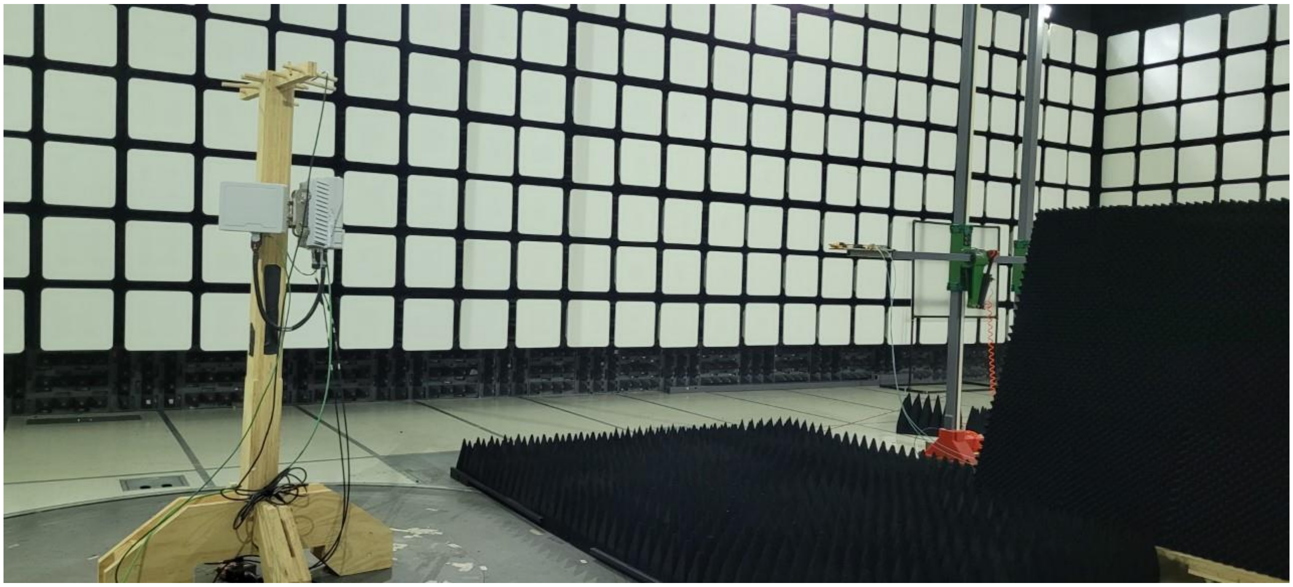
**40GHz-60 GHz**



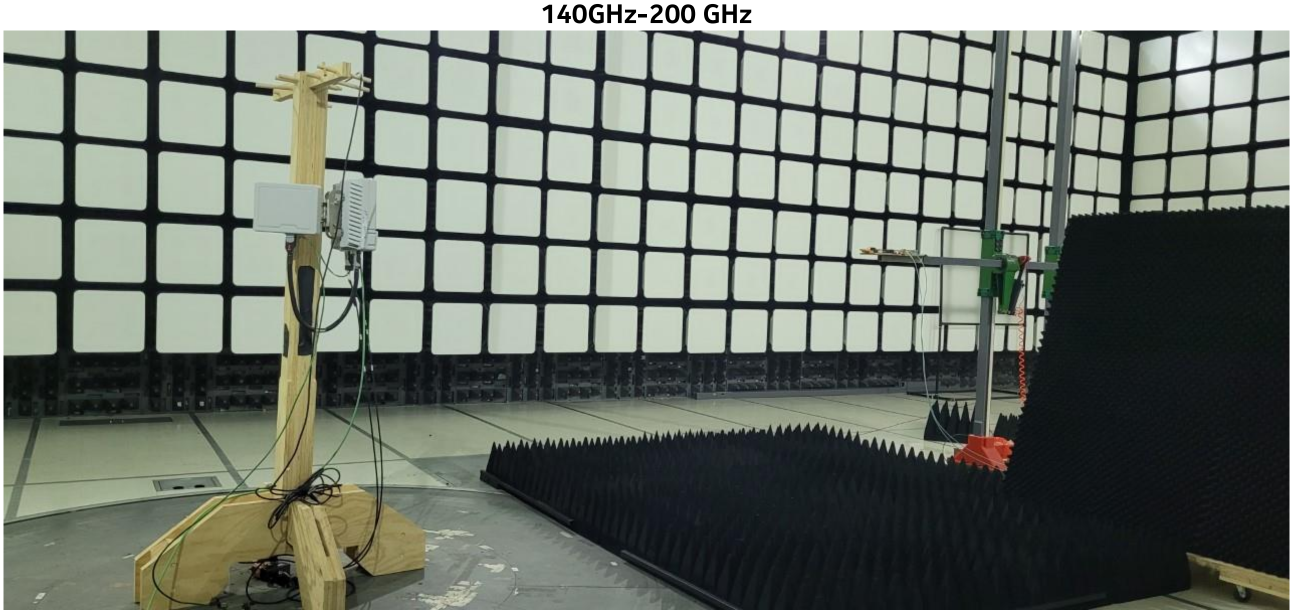
**60GHz-90 GHz**



**90GHz-140 GHz**

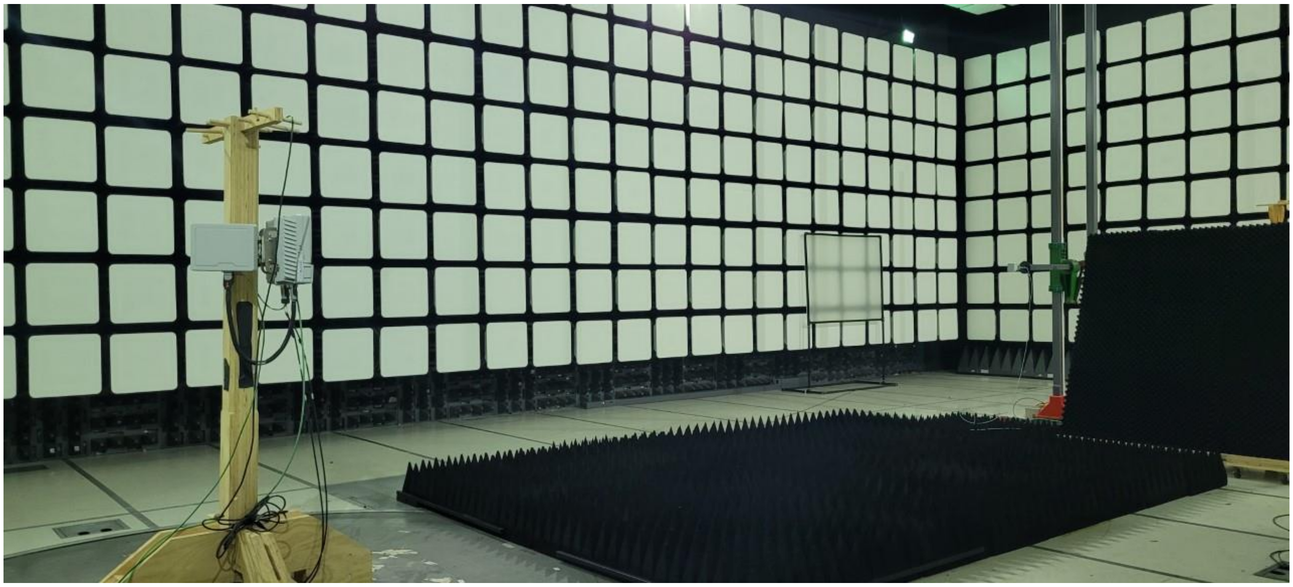


**140GHz-200 GHz**

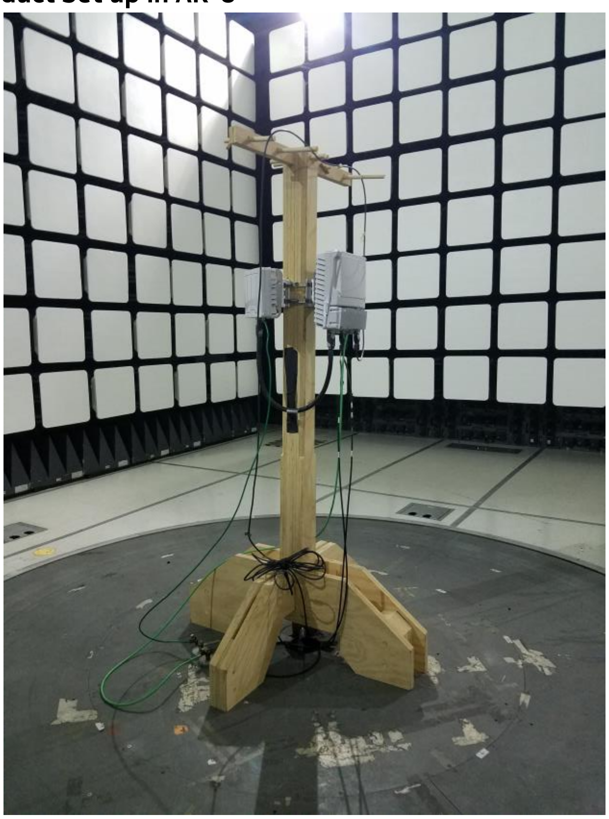


## Radio Testing at 6.5m

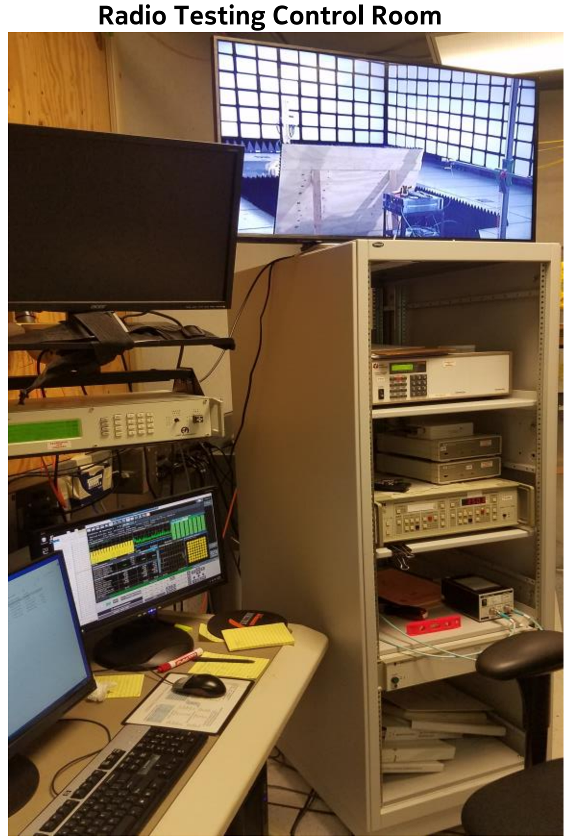
**26.5 GHz - 43.5 GHz**



**Product Set up in AR-8**



**Radio Testing Control Room**



## 4.9 FACILITIES AND ACCREDITATION

Measurement facilities at Nokia, Global Product Compliance Laboratory (GPCL) a member of the Nokia family of companies, was used to collect the measurement data in the test report. The laboratory, which is part of Nokia Bell Labs, is located at 600-700 Mountain Avenue, Murray Hill, New Jersey 07974-0636 USA.

The field strength measurements of radiated spurious emissions were made in a FCC registered five meter semi-anechoic chamber AR-8, (FCC Registration Number: 395774) **NVLAP** Lab Code: 100275-0 and IC (Filing Number:6933F-8) which is maintained by Nokia Bell Labs in Murray Hill, New Jersey. The sites were constructed and are continuously in conformance with the requirements of ANSI C63.4 and CISPR Publication 22.

Nokia Global Product Compliance Laboratory FCC OET Accredited Test Firm Scope List is accessible at:

https://apps.fcc.gov/oetcf/eas/reports/ViewTestFirmAccredScopes.cfm?calledFromFrame=N&RequestTimeout=500&regnum_specified=N&test_firm_id=7007

and is as listed in the Table below.

**OET Accredited Test Firm Scope List**

**Test Firm:** Nokia, Global Product Compliance Lab

| Scope | FCC Rule Parts | Maximum Assessed Frequency, MHz | Status | Expiration Date | Recognition Date |
|---|---|---|---|---|---|
| Unintentional Radiators | FCC Part15, Subpart B | 40000 | Approved | 9/30/2020 | 7/6/2017 |
| Intentional Radiators | FCC Part 15 Subpart C | 40000 | Approved | 9/30/2020 | 6/5/2018 |
| U-NII without DFS Intentional Radiators | FCC Part 15, Subpart E | 40000 | Approved | 9/30/2020 | 6/5/2018 |
| U-NII with DFS Intentional Radiators | FCC Part 15, Subpart E | 40000 | Approved | 9/30/2020 | 6/5/2018 |
| Commercial Mobile Services | Part 22 (cellular), Part 24, Part 25 (below 3 GHz), Part 27 | 40000 | Approved | 9/30/2020 | 6/5/2018 |
| General Mobile Radio Services | Part 22 (non-cellular), Part 90 (below 3 GHz), Part 95 (below 3 GHz), Part 97 (below 3 GHz), Part 101 (below 3 GHz) | 40000 | Approved | 9/30/2020 | 6/5/2018 |
| Citizens Broadband Radio Services | Part 30 | 40000 | Approved | 9/30/2020 | 7/6/2017 |
| Microwave and Millimeter Bands Radio Services | Part 25, Part30, Part 74, Part 90 (90M DSRC, Y, Z), Part 95 (M & L), Part 101 | 200000 | Approved | 9/30/2020 | 7/6/2017 |

## 4.10 NVLAP Certificates

Nokia Global Product Compliance Laboratory is accredited with the US Department of Commerce National Institute of Standards and Technology's National Voluntary Laboratory Accreditation Program (NVLAP) for satisfactory compliance with criteria established in Title 15, Part 7 Code of Federal Regulations for offering test services for selected test methods in Electromagnetic Compatibility; Voluntary Control Council for Interference (VCCI), Japan; Australian Communications and Media Authority (ACMA). The laboratory is ISO 9001:2008 Certified.

**United States Department of Commerce**
**National Institute of Standards and Technology**

NVLAP ® ilac-MRA

**Certificate of Accreditation to ISO/IEC 17025:2017**

**NVLAP LAB CODE: 100275-0**

**Nokia, Global Product Compliance Lab**
Murray Hill, NJ

*is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:*

**Electromagnetic Compatibility & Telecommunications**

*This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).*

2021-09-24 through 2022-09-30
*Effective Dates*

DEPARTMENT OF COMMERCE • UNITED STATES OF AMERICA

*For the National Voluntary Laboratory Accreditation Program*

**United States Department of Commerce**
**National Institute of Standards and Technology**

NVLAP®

ilac-MRA

# Certificate of Accreditation to ISO/IEC 17025:2017

**NVLAP LAB CODE: 100275-0**

**Nokia, Global Product Compliance Lab**
Murray Hill, NJ

*is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:*

**Electromagnetic Compatibility & Telecommunications**

*This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).*

DEPARTMENT OF COMMERCE · UNITED STATES OF AMERICA

2022-09-28 through 2023-09-30
*Effective Dates*

*For the National Voluntary Laboratory Accreditation Program*

# 5. APPENDIX A - CALIBRATION CERTIFICATES.

The attached Calibration certificates represent the Harmonic Downconverters used in this testing.