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TESTING
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Regulation:
FCC Part 2 and 30

Product Evaluated
ASMR 39 GHz Main AWEWA/B + 24 GHz Extension FA3UB

Client
Nokia Solutions and Networks, OY

Report Number:
TR-2022-0052-FCC30

Date
July 5, 2022

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Revisions

Date	Revision	Section	Change
7/5/2022	0		Initial Release

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1. ATTESTATION OF TEST RESULTS

Equipment Under Test (EUT)	ASMR 39 Main (AWEWA/B) + 24 Extension (FA3UB)
Serial Number(s)	AWEWB - YK212500119 24 Extension (FA3UB) - AH212200116
FCC ID	FCC ID: 2AD8UAWEWAB01 FCC ID: 2AD8UAFA3UB01
Model Name	AWEWB, FA3UB
Hardware Version	AWEWB – 475170A.101 24 Extension (FA3UB) – 475046A.104
GPCL Project Number	2022-0052
Manufacturer	NOKIA SOLUTIONS AND NETWORKS OY KARAKAARI 7, FI-02610 ESPOO FINLAND
Test Requirement	• 47 CFR FCC Part 2 and Part 30
Test Standard(s)	• 47 CFR FCC Parts 2 and Part 30 • KDB 971168 D01 Power Meas License Digital Systems v03r01 April 9, 2018 • KDB 662911 D01 Multiple Transmitter Output v02r01 Oct 2013 • KDB 842590 D01 Upper Microwave Flexible Use Service v01r01–April 2020 • 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) • ANSI C63.4 (2014) • TR 14-1001, MMW Measurements with Harmonic Mixers (April-4-2014)
Test Date	5/12/2022 – 6/20/2022
Test Performed By	Nokia Global Product Compliance Laboratory 600-700 Mountain Avenue P.O. Box 636 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, <i>as tested</i> 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 (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	±5.4 dB
		30 MHz – 200 MHz V	±5.4 dB
		200 MHz – 1000 MHz H	±4.7 dB
		200 MHz – 1000 MHz V	±4.7 dB
		1 GHz- 18 GHz	±3.3 dB

Antenna Port Test	Signal Bandwidth	Frequency Range	Expanded Uncertainty (k=2), Amplitude
Occupied Bandwidth, Edge of Band,	10 Hz 100 Hz 10 kHz to 1 MHz 1MHz to 100 MHz	9 kHz to 20 MHz 20 MHz to 1 GHz 1 GHz to 10 GHz 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 FA3UB Extension Module
Radio Type	Intentional Transceiver
Power Type	Both DC & AC
Modulation	QPSK, 16QAM, 64QAM, 256QAM
Operating Frequency Range	24.25 – 25.25 GHz 37 – 40 GHz
Channel Bandwidth	100, 200, 300, 400, 500, 600, 700, 800 MHz
Max Radiated Power (EIRP)	AWEWA/B: 52 dBm (158.5W) EIRP per unit per polarization; 55 dBm (316.2W) EIRP Total per unit. FA3UB: 52 dBm (158.5W) EIRP per unit per polarization; 55 dBm (316.2W) EIRP Total per unit
Antenna Gain	23 dBi
Operating Mode	2x2 MIMO (2 duplex Tx/Rx Ports)
Software Version	SBTS22R3
Antenna(s)	Refer to Section 3.2

3.2 EIRP/ PSD Compliance and Antenna Information.

Both AWEUA/B and FA3UB incorporate integrated antennas which are electronically steerable. Each antenna assembly has two cross-polarized modules where each antenna Tx/Rx module of AWEWA/B has an 8x12 matrix (96 elements) and each antenna Tx/Rx module of FA3UB has an 8x12 matrix (96 elements). The information about Antenna Gain vs frequency is detailed in the original filing package of AWEWA/B under 2AD8UAWEWAB01 and FA3UB under 2AD8UAFA3UB01, respectively.

3.3 Antenna Far Field Determination Distance

A test was performed to determine the far field boundary location using calculations and low power measurements. 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 λ = 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.

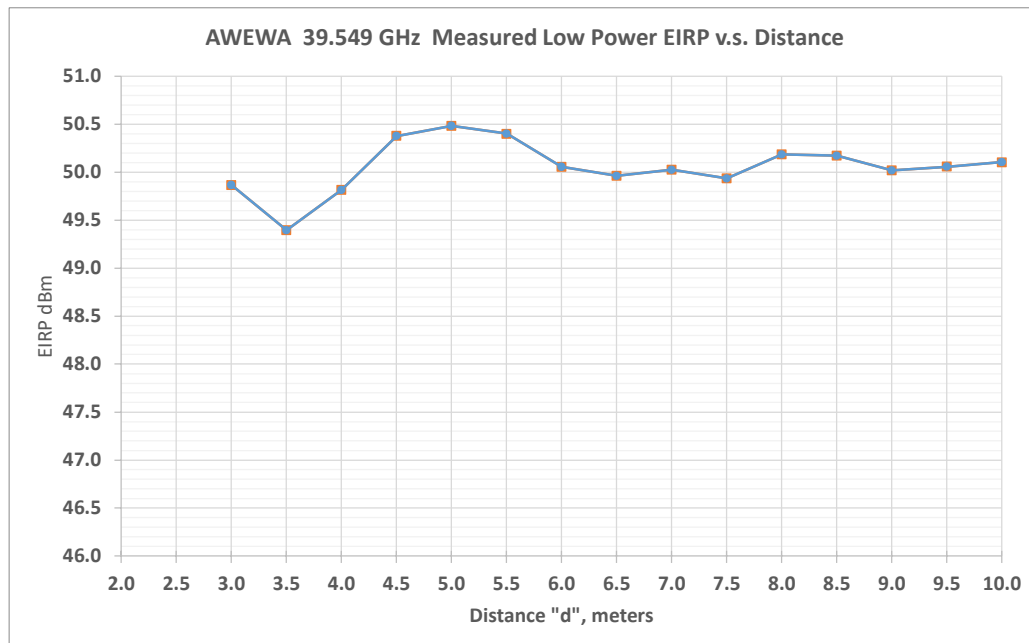
At 40 GHz the individual array dimensions results in a minimum Fraunhofer far field distance, d_{ff} , of 6.4 meters.

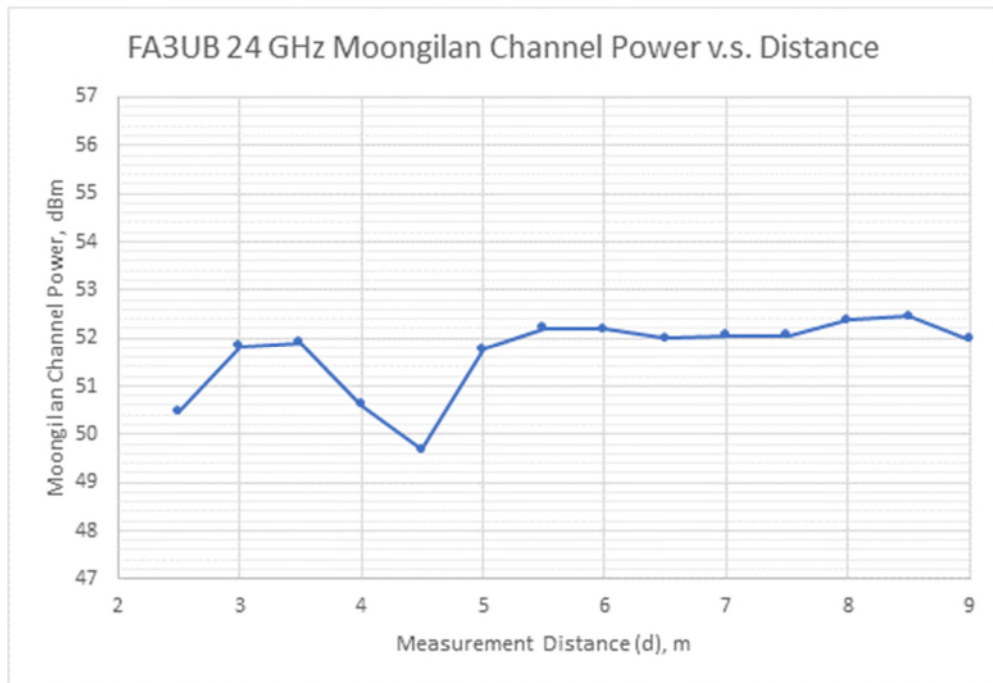
At 40 GHz the overall array dimensions results in a minimum Fraunhofer far field distance, d_{ff} , of 24 meters.

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 inconsistency all Power, OBW and OOB measurements were made at 6.5 m for 39GHz and 6.0m for 24GHz.





4. REQUIRED MEASUREMENTS AND RESULTS

Both AWEWA/B and FA3UB have been FCC certified individually. This test is to evaluate the configuration that AWEWA/B is paired with FA3UB for co-current operation. Therefore, only out-of-band emissions and spurious emissions need to be evaluated. Other tests, such as RF power output, modulation characteristics and occupied bandwidth, are for verification purpose.

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 II Authorization
2.1046, 30.202 (a)	RF Power Output (a) Power Limits, EIRP, PSD	Yes
2.1047	Modulation Characteristics	Yes
2.1049, 30.203	(a) Occupied Bandwidth (b) Out-of-Band Emissions	Yes
2.1051, 30.203	Spurious Emissions at Antenna Terminals	Yes
2.1053, 30.203, 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 EUT was configured to transmit a single beam for each band at the rated maximum EIRP. 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 at a distance of 6.5 m for 39GHz and 6.0 m for 24GHz. 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 • KDB 971168 D01 Power Meas License Digital Systems v03r01 April 9, 2018 • KDB 662911 D01 Multiple Transmitter Output v02r01 Oct 2013 • KDB 842590 D01 Upper Microwave Flexible Use Service v01r01–April 2020 • 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 • ANSI C63.26 (2015) • ANSI C63.4 (2014) • 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 24 GHz Extension Unit (FA3UB) FCC ID: 2AD8UAFA3UB01 is a 5G-NR Remote radio head 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, n258 in 24.25-25.75 and n260 in 37 – 40 GHz.

4.1.1 RF Power Output Measurement

The product was 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 for 39 GHz and 6.0 m for 24 GHz using a constant 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 units were configured to transmit at their maximum power.

The Channel Power function of the FSW spectrum analyzer was used to measure the maximum average Horizontal and Vertical EIRP. For all measurements a nominal 100 MHz bandwidth carrier with 5G-NR modulations was used. Channel power plots identify the individual carrier power, modulation and the total power.

Table 4.1.1a 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

Table 4.1.1b 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
22.00	74.85	23.46	11.02	62.41	62	0.407
22.50	75.05	23.49	11.17	62.73	62	0.730
23.00	75.24	23.69	11.43	62.98	62	0.981
23.50	75.43	23.80	11.51	63.13	62	1.134
24.00	75.61	23.80	11.41	63.23	62	1.227
24.23	75.69	23.92	11.50	63.27	62	1.270
24.23	75.69	23.92	11.50	63.27	62	1.270
24.50	75.79	24.06	11.60	63.33	62	1.328
25.00	75.96	24.14	11.72	63.55	62	1.549
25.30	76.07	24.10	11.76	63.73	62	1.731
25.30	76.07	24.10	11.76	63.73	62	1.731
25.50	76.14	24.07	11.79	63.86	62	1.859
26.00	76.30	24.28	11.95	63.97	62	1.972
26.50	76.47	24.38	12.16	64.25	62	2.252
27.00	76.63	24.39	12.26	64.50	62	2.504
27.50	76.79	24.39	12.29	64.69	62	2.694
28.00	76.95	24.57	12.40	64.78	62	2.778
28.50	77.10	24.63	12.57	65.05	62	3.045
29.00	77.25	24.53	12.61	65.33	62	3.332
29.50	77.40	24.60	12.82	65.62	62	3.616
30.00	77.55	24.71	12.90	65.73	62	3.733
30.50	77.69	24.63	13.04	66.10	62	4.099
31.00	77.83	24.71	13.13	66.25	62	4.248
31.50	77.97	24.74	13.17	66.40	62	4.399

32.00	78.11	24.75	13.31	66.67	62	4.674
32.50	78.24	24.85	13.37	66.76	62	4.761
33.00	78.38	24.83	13.50	67.05	62	5.047

4.1.1.1 RF Power Output Results

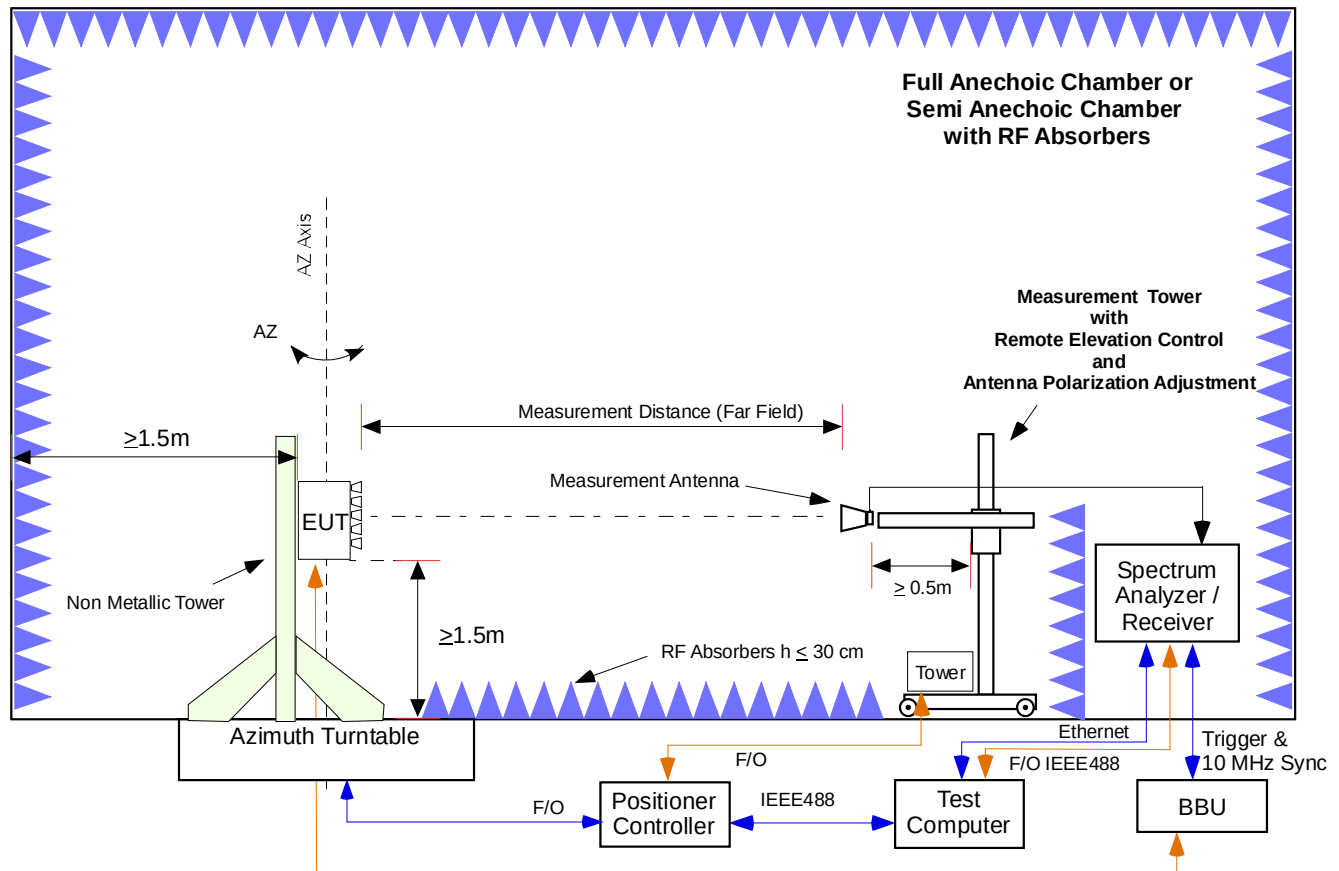
Power output measurements verified the expected performance of 52 dBm EIRP per polarization for a Total Power of 55 dBm. The maximum measured level was 51.30 dBm for a single polarization and 54.06 dBm total for three to five 100MHz carriers. This level is well within the maximum Part 30.202a limit of 75 dBm/100MHz 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

Channel Center Frequencies, GHz	# of 100MHz carriers	Modulation	Horizontal Polarization Total Channel Power, EIRP	Vertical Polarization Total Channel Power, EIRP	Sum Total Channel Power EIRP
			dBm	dBm	dBm
37.05 37.14984 37.25389	3	QPSK	50.38	50.67	53.54
24.7992 24.89904 24.99888 25.09872 25.19856	5	QPSK	50.79	51.30	54.06

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

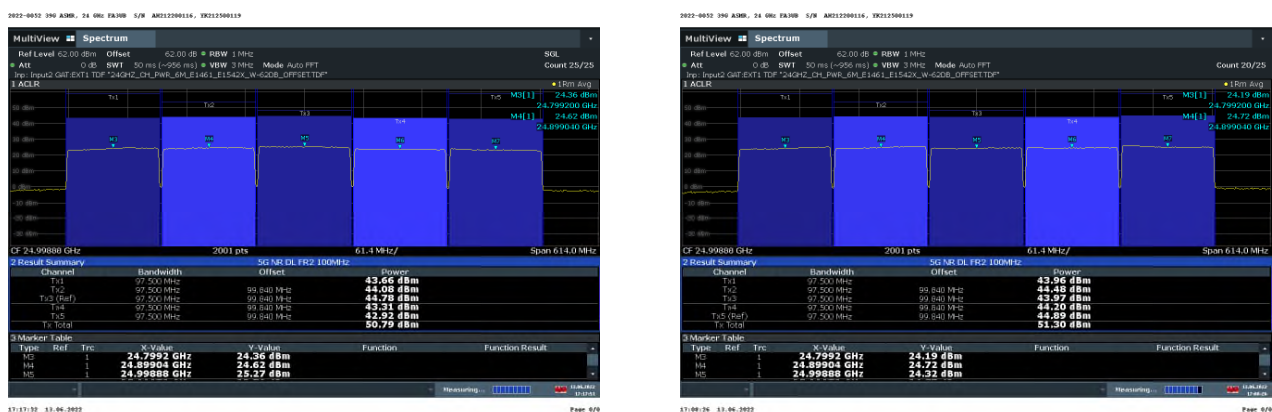


4.1.1.1.1 Channel Power Measurement Plots

Channel Power Measurements, 39 GHz Main, 3 Carrier – QPSK



Channel Power Measurements, 24 GHz Extension, 5 Carrier – QPSK



4.2 Section 2.1047 MEASUREMENT REQUIRED: MODULATION CHARACTERISTICS

The AirScale 39 GHz Radio Unit (AWEWA-B) FCC ID: 2AD8UAWEWAB01 and 24 GHz Extension Unit (FA3UB) FCC ID: 2AD8UAFA3UB01 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 6.5 m for 39GHz and 6.0 m for 24GHz from the unit utilizing the test configuration in Figure 4.4.1 utilizing a 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.

4.2.2 Modulation Measurements Results:

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

Figure 4.2 Sample Modulation Results

QPSK (37GHz)



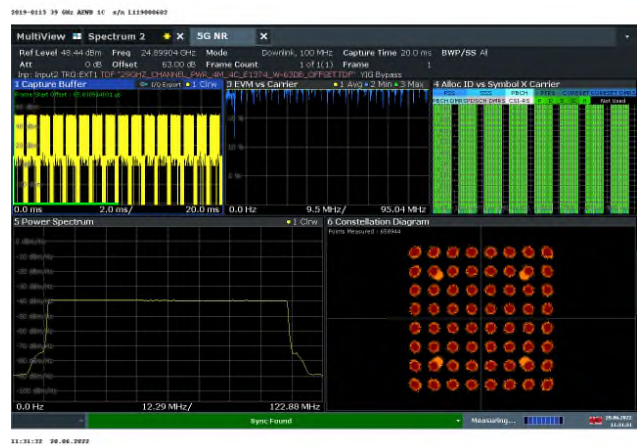
16QAM (37GHz)



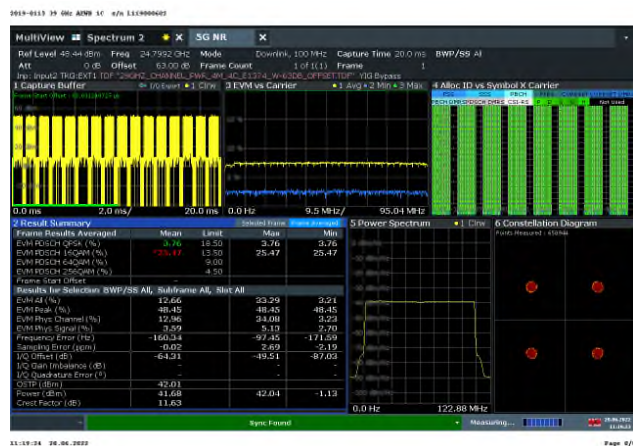
64QAM (37GHz)



64QAM (24GHz)



QPSK (24GHz)



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 97MHz for AWEWA/B in n260 band and 97.5MHz for 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

Carrier Frequencies (GHz)	Number of Carriers	Modulation	Horizontal Polarization Occupied Signal Bandwidth (MHz)	Vertical Polarization Occupied Signal Bandwidth (MHz)
37.05 37.14984 37.25389	3	QPSK	292.210	292.002
24.7992 24.89904 24.99888 25.09872 25.19856	5	QPSK	489.233	490.343

4.3.1.1 Results - Occupied Bandwidth Carrier Aggregation

The April 12, 2016 TCBC viewgraph package identified that Carrier Aggregation data should be supplied during filing. This requirement is not yet formalized in a KDB for LTE, 5G-NR or UMFUS but we used the same rules as used for Part 15. The multi-carrier bandwidth of the AWEWA/B is thus defined as follows.

For AWEWA/B, the N260 39 GHz Band can be assigned a total of 30 side by side carriers over the 37-40 GHz frequency range. The AWEWA/B can be operated anywhere within this 3 GHz wide band.

The AWEWA/B product can support up to eight carriers operating within its maximum instantaneous 1.4 GHz bandwidth. Additionally, we have evaluated carrier spacing configuration of 99.96 MHz and 99.84 MHz respectively. There was no difference identified for Power, radiated spurious or OOB measurements with either spacing.

The maximum calculated assessment for two through eight carriers using 99.96 and 99.84 channel spacings are identified below.

Two Carrier Aggregation Bandwidth	= 1(99.96) + 97 MHz = 196.96 MHz = 197MG7W
Three Carrier Aggregation Bandwidth	= 2(99.96) + 97 MHz = 296.92 MHz = 297MG7W
Four Carrier Aggregation Bandwidth	= 3(99.96) + 97 MHz = 396.88 MHz = 397MG7W
Five Carrier Aggregation Bandwidth	= 4(99.96) + 97 MHz = 496.84 MHz = 497MG7W
Six Carrier Aggregation Bandwidth	= 5(99.96) + 97 MHz = 596.80 MHz = 597MG7W
Seven Carrier Aggregation Bandwidth	= 6(99.96) + 97 MHz = 696.76 MHz = 697MG7W
Eight Carrier Aggregation Bandwidth	= 7(99.96) + 97 MHz = 796.72 MHz = 797MG7W

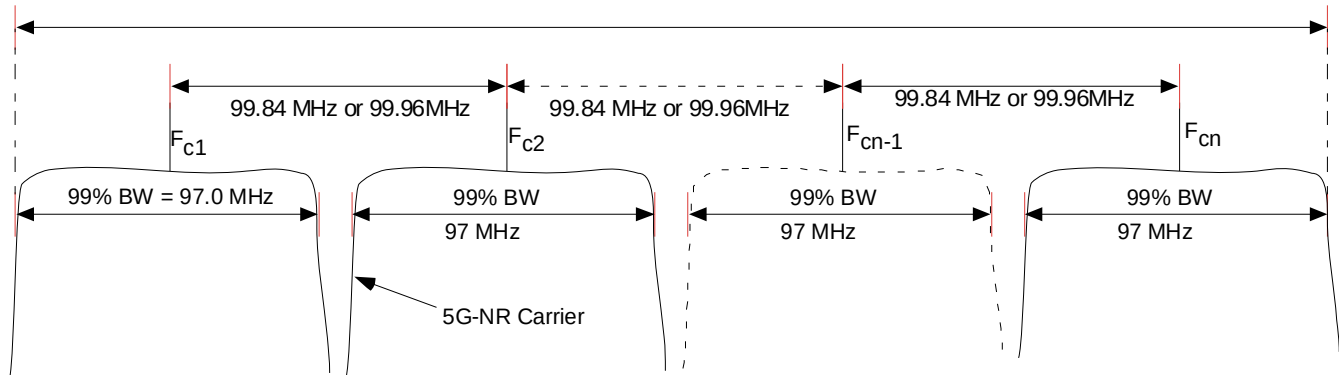
The maximum calculated assessment for two through eight carriers using 99.84 channel spacing are identified below.

Two Carrier Aggregation Bandwidth	= 1(99.84) + 97 MHz = 196.84 MHz = 197MG7W
Three Carrier Aggregation Bandwidth	= 2(99.84) + 97 MHz = 296.68 MHz = 297MG7W
Four Carrier Aggregation Bandwidth	= 3(99.84) + 97 MHz = 396.52 MHz = 397MG7W
Five Carrier Aggregation Bandwidth	= 4(99.84) + 97 MHz = 496.36 MHz = 497MG7W
Six Carrier Aggregation Bandwidth	= 5(99.84) + 97 MHz = 596.20 MHz = 597MG7W
Seven Carrier Aggregation Bandwidth	= 6(99.84) + 97 MHz = 696.04 MHz = 697MG7W
Eight Carrier Aggregation Bandwidth	= 7(99.84) + 97 MHz = 795.88 MHz ≤ 797MG7W

The bandwidth of 3 adjacent carriers measured for n260 is 292 MHz, less than 297MHz calculated above.

Since the values are identical for two through seven and nearly so for eight carriers the 99.96 set will be used.

Figure 4.3.1.1a Carrier Aggregation



Carrier Aggregation nx(97M0)
WSM 7-12-21

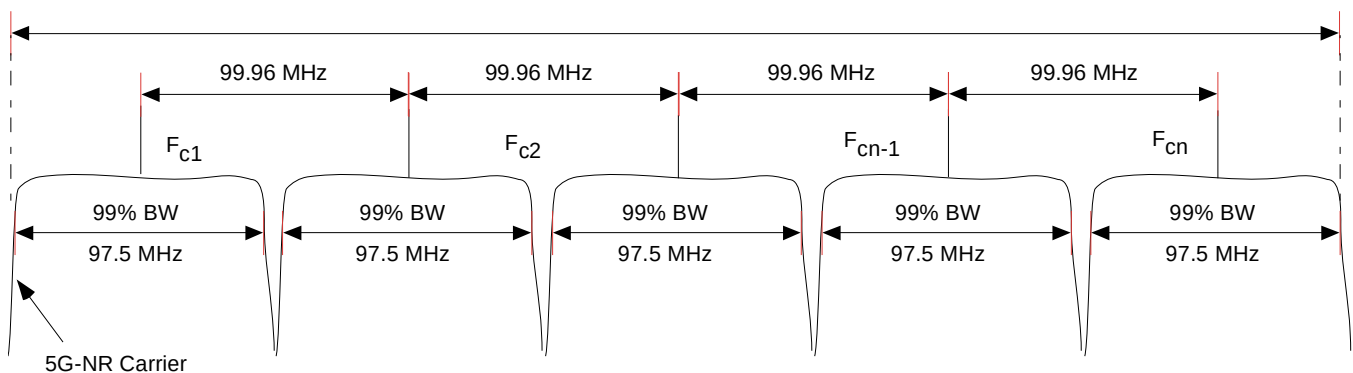
For FA3UB, the multi-carrier bandwidth is defined as follows. We have a two carrier configuration in the lower band and one to five carrier configurations in the USA upper n258 band. In both cases the individual carriers, with a bandwidth of 97.5 MHz maximum, are spaced on center 99.96 MHz apart and they do not overlap.

The overall signal bandwidth for 5 adjacent carriers is depicted in Figure 4.3.1.1b. This is the maximum number of adjacent 97M5G7W carriers that can fit in the upper FCC authorized 24.75-25.25 GHz Band. The calculated assessment was that the 5 carrier aggregated bandwidth is 497.34 MHz.

The bandwidth of 5 adjacent carriers measured for n258 is 490 MHz within the authorized band and are less than 498MHz calculated or used in the emission designator.

Figure 4.3.1.1b Carrier Aggregation

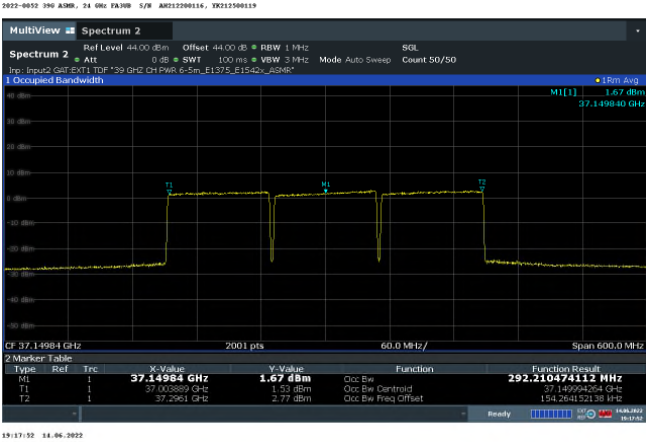
Maximum Carrier Aggregation Bandwidth = $4(99.96) + 97.5\text{MHz} = 497.34\text{ MHz}$



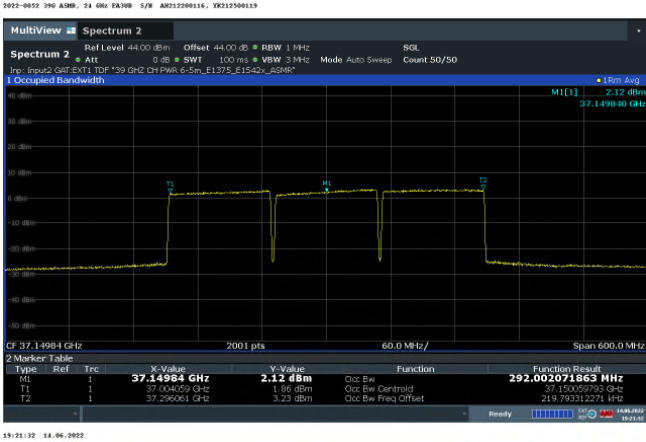
Carrier Aggregation 5x(97M5)
WSM 10-28-20

4.3.1.2 99% Signal Bandwidth Plots

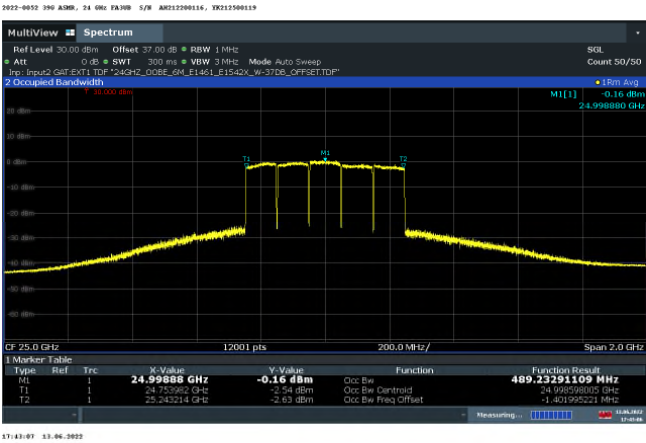
3 Carrier, 37GHz, QPSK
Horizontal



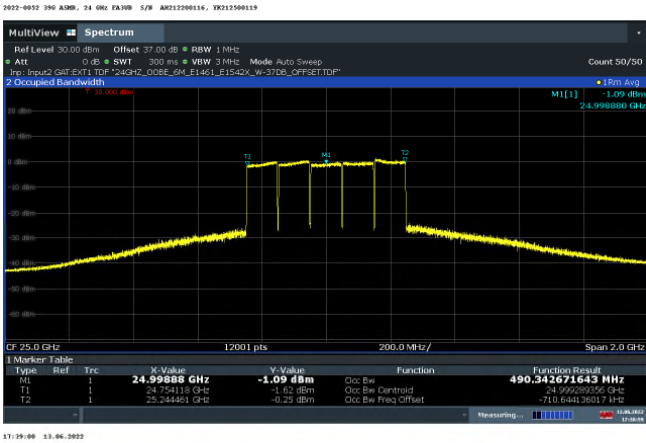
Vertical



5 Carrier, 24GHz, QPSK
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 24 GHz Extension Unit (FA3UB) FCC ID: 2AD8UAFA3UB01** presently supports nominal 100 MHz bandwidth 5G-New Radio and LTE TDD technologies. The Out Of Band evaluation addresses operation with one through eight carriers.

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 one carrier which is the maximum spectral density carrier at the left, center and right side of band, two thru eight carriers at the left side of band and eight carriers at the left, center and right side of band. Additionally, the eight carrier non adjacent configurations spaced across the maximum instantaneous bandwidth of 1.4 GHz were evaluated at left side and right side of the band.

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 multiple mixed carrier configurations for Left Edge, Center and Right Edge of the 39 GHz and 24 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 = $\frac{1}{2}$ the measurement Resolution Bandwidth were not used.

**Table 4.3.5 - Mask Parameters Out Of Band / Edge of Band Emissions
(37-40GHz 3C, 24.25-24.45GHz 1C and 24.75-25.25GHz 5C)**

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

Frequency	Part 30 Limit
GHz	dBm
22.00	-13.0
24.24	-13.0
24.24	-5.0
24.25	-5.0
24.25	28.0
24.45	28.0
24.45	-5.0
24.46	-5.0
24.46	-13.0
24.70	-13.0
24.70	-5.0

24.75	-5.0
24.75	28.0
24.75	28.0
25.25	28.0
25.25	-5.0
25.30	-5.0
25.30	-13.0
33.00	-13.0

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 FA3UB 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 (@35 GHz) = 50.32 dB = 79.58 dB - 23.96dBi + 12.84dB – 18.14 dBi

This adjustment was only used for the OOB/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 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	AEWF 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	12.84	68.46	18.14	50.32	44	6.324
35.50	79.70	23.52	13.03	69.21	20.05	49.16	44	5.162
36.00	79.83	24.27	13.20	68.75	21.97	46.78	44	2.784
36.50	79.95	23.28	13.35	70.01	22.81	47.20	44	3.203
37.00	80.06	24.42	13.39	69.04	23.65	45.39	44	1.387
37.50	80.18	23.27	13.39	70.29	23.82	46.47	44	2.469
38.00	80.30	24.29	13.45	69.45	23.99	45.46	44	1.461
38.50	80.41	23.18	13.54	70.76	24.11	46.65	44	2.653
39.00	80.52	23.65	13.73	70.60	24.22	46.38	44	2.382
39.50	80.63	23.03	13.76	71.36	24.10	47.26	44	3.256
40.00	80.74	23.00	13.79	71.53	23.98	47.55	44	3.547
40.50	80.85	23.35	13.84	71.34	23.91	47.43	44	3.433
41.00	80.96	23.22	13.98	71.72	23.84	47.88	44	3.880
41.50	81.06	23.28	14.14	71.93	23.20	48.73	44	4.731
42.00	81.17	23.39	14.23	72.01	22.56	49.46	44	5.459
42.50	81.27	23.81	14.36	71.81	21.52	50.29	44	6.290
43.00	81.37	23.55	15.30	73.11	20.49	52.62	44	8.620
43.50	81.47	23.60	16.14	74.01	18.55	55.46	44	11.462

Frequency	Free Space Path Loss, PL	Measurement Antenna Gain, "G"	Measurement Cable Loss, "L"	PL-G1+L1	AEWF Antenna Gain, IEEE	Total Required Adjustment	FSW Offset	Transducer Correction Factor
GHz	dB	dBi	dB	dB	dBi	dB	dB	dB
22.00	74.85	23.46	11.02	62.41	24.77	37.64	37	0.637
22.50	75.05	23.49	11.17	62.73	24.90	37.83	37	0.833
23.00	75.24	23.69	11.43	62.98	25.02	37.96	37	0.957
23.50	75.43	23.80	11.51	63.13	25.15	37.98	37	0.982
24.00	75.61	23.80	11.41	63.23	25.28	37.95	37	0.947
24.50	75.79	24.06	11.60	63.33	25.41	37.92	37	0.921
25.00	75.96	24.14	11.72	63.55	25.53	38.01	37	1.014
25.50	76.14	24.07	11.79	63.86	25.72	38.14	37	1.141
26.00	76.30	24.28	11.95	63.97	25.90	38.07	37	1.071
26.50	76.47	24.38	12.16	64.25	26.16	38.09	37	1.087
27.00	76.63	24.39	12.26	64.50	26.43	38.08	37	1.077
27.50	76.79	24.39	12.29	64.69	26.72	37.97	37	0.972
28.00	76.95	24.57	12.40	64.78	27.02	37.76	37	0.760
28.50	77.10	24.63	12.57	65.05	27.41	37.64	37	0.637
29.00	77.25	24.53	12.61	65.33	27.80	37.53	37	0.532
29.50	77.40	24.60	12.82	65.62	27.41	38.21	37	1.208
30.00	77.55	24.71	12.90	65.73	27.02	38.72	37	1.717
30.50	77.69	24.63	13.04	66.10	25.06	41.04	37	4.041
31.00	77.83	24.71	13.13	66.25	23.10	43.15	37	6.149
31.50	77.97	24.74	13.17	66.40	23.87	42.53	37	5.526
32.00	78.11	24.75	13.31	66.67	24.65	42.02	37	5.025
32.50	78.24	24.85	13.37	66.76	24.75	42.02	37	5.015
33.00	78.38	24.83	13.50	67.05	24.84	42.21	37	5.205

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 three 100 MHz carrier configuration at the left side of the n260 Band and the five 100 MHz carrier configuration at the upper band of the n258 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 both n258 and n260 bands in vertical and horizontal polarizations.

For n260 39GHz band, the worst emission was identified at 41.2 GHz with a level at -23.71dBm/MHz. From the radiated measurement in the 40 GHz to 60 GHz presented in Section 4.5, the worst EIRP emission is at 41.2 GHz with an amplitude at -26.68 dBm/MHz. It is 13.68 dB below the TRP limit. From the field strength measurement in the 26.5 GHz to 37.5 GHz presented in Section 4.5, the worst emission is at 26.5 GHz with a margin of 7.04 dB.

For n258 24GHz band, the out-of-band emissions were evaluated in the frequency range of 24 GHz to 26 GHz. worst emission was identified around 25.3 GHz with a level around -26.05dBm/MHz. From the field strength measurement in the 18 GHz – 24.5 GHz and 26.5 GHz - 37.5 GHz presented in Section 4.5, the worst emissions below and above the transmitting band is at 23.986 GHz with a margin of 4.18 dB and at 26.5 GHz with a margin of 7.04 dB, respectively.

The maximum EIRP emissions from both vertical and horizontal polarizations are below the TRP limits with a minimum margin of 4.18 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/ OOB

Center Frequencies of Edge Channels, GHz	Number of Carriers	Modulation	Polarization	Occupied Bandwidth Edge of Block / OOB Compliance
37.05 37.14984 37.25389	3	QPSK	Horizontal	Compliant
			Vertical	Compliant
24.7992 24.89904 24.99888 25.09872 25.19856	5	QPSK	Horizontal	Compliant
			Vertical	Compliant

4.3.7.2.1 Occupied Bandwidth Edge of Band Plots

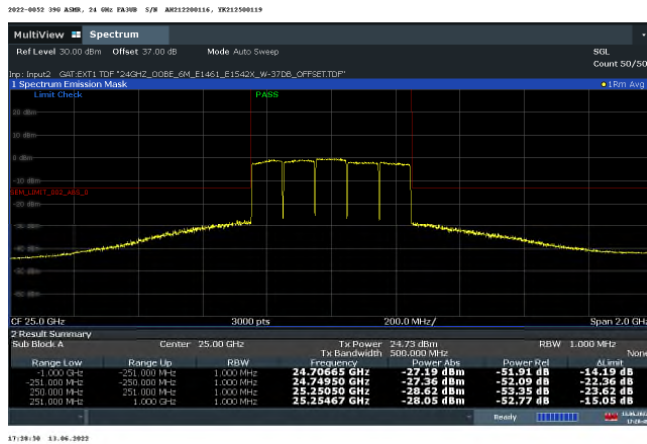
3 Carrier, 37GHz, QPSK OOBE/EoB – Horizontal Polarization



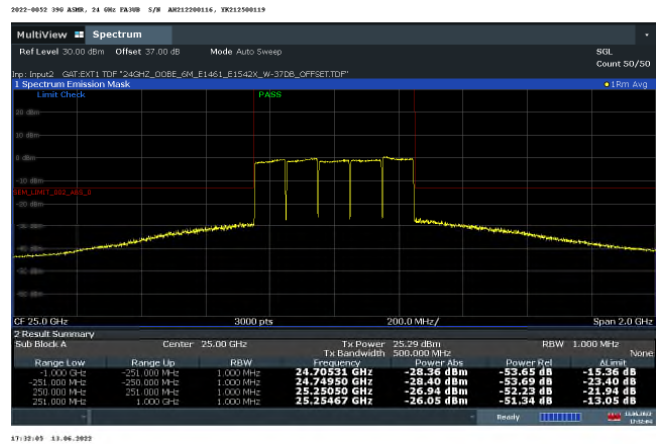
OOBE/EoB – Vertical Polarization



5 Carrier, 24GHz, QPSK OOBE/EoB – Horizontal Polarization



OOBE/EoB – Vertical Polarization



Note: the emission limit at 25.25467GHz, 24.70665 and 24.70531 should be -5dBm/MHz instead of -13dBm/MHz

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)

(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 $> 2 \times \text{Span/RBW}$. 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 chambers AR-4 (FCC Registration Number: 395774) NVLAP Lab Code: 100275-0 and IC (Filing Number: 6933F-4 & 8) which are maintained by Nokia Bell Labs in Murray Hill, New Jersey.

The **AirScale 39 GHz Radio Unit (AWEWA-B) FCC ID: 2AD8UAWEWAB01** and **24 GHz Extension Unit (FA3UB) FCC ID: 2AD8UAFA3UB01** (EUT) was configured in semi-anechoic chamber in a manner simulating a normal field installation. The recommendations of ANSI C63.4-2014, C63.26-2015, KDB 842590 D01 and C63.26 mmWave JTG were followed for EUT testing setup and cabling. The EUT was configured to operate in a 5G-NR test model per the constraints identified in section 4.2.

Both AWEWA/B main and FA3UB extension units were configured into the full power forward beam transmit configuration as defined in Table 4.5.1. The unit was configured with the maximum transmit bandwidth of eight carriers for each polarization. The Vertical and Horizontal polarizations each transmitted 52 dBm EIRP, with the total transmit power of 55 dBm EIRP. The product in the below configurations was evaluated over the 30 MHz to 200 GHz frequency range as required.

Table 4.5.1 EUT Transmit Configuration

AWEWA/B Tx Frequencies GHz	Transmit Active Polarization	Signal Bandwidth, MHz	Modulation	Total Power, dBm EIRP	Radiated Emissions Pass / Fail
37.05 37.14984 37.25389	H & V	100	QPSK	55	Pass
24.7992 24.89904 24.99888 25.09872 25.19856	H & V	100	QPSK	55	Pass

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

$$-43+10\log P=-13 \text{ dBm.}$$

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:

$$\begin{aligned} P_{\text{meas}} (\text{dBm}) + \text{Cable Loss}(\text{dB}) + \text{Antenna Factor}(\text{dB}) + 107 (\text{dB}\mu\text{V}/\text{dBm}) - \text{Amplifier Gain} (\text{dB}) \\ = \text{Field Strength} (\text{dB}\mu\text{V}/\text{m}) \end{aligned}$$

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.

$$\begin{aligned} E &= (120\pi P)^{1/2} = [(30 \cdot P)^{1/2}] / R \\ 20 \log (E \cdot 10^6) - (43 + 10 \log P) &= 82.23 \text{ dB } \mu\text{V}/\text{meter} \end{aligned}$$

Where: E = Field Intensity in Volts/ meter R = Distance in meters = 3 m
 P = Transmitted Power, Watts = 316.23 W

The field strength of radiated spurious emissions measured was determined by

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

Per KDB 842590 D01 Section 4.4.3.3.1, perform maximum EIRP measurement as described in 5.5.3 of ANSI C63.26 (substitution method) or 5.5.4 of ANSI C63.26 (field strength method). Note: EIRP measurements are performed using linearly polarized antenna. Both horizontal and vertical polarizations are measured separately and not summed. The highest amplitude signal from horizontal or vertical polarization is used for compliance to the unwanted emissions limit. Compare the measured maximum EIRP at each frequency with the applicable TRP limit. If the maximum EIRP is less than TRP limit then early exit condition is met, and no further measurements are required for that frequency.

Field strength measurements of radiated spurious emissions were made in the semi-anechoic chamber, AR-4 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 200 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 67 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 narrow and radiated power is down 23 dB at just ± 12 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 location of 21 degrees azimuth, and a nominal elevations 172 cm for Vertical and 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 21 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 40-200 GHz were performed this way for the 1 carrier and the 8 carrier transmit configurations.

4.5.2.1 Bandwidth Limits and Corrections: Radiated Measurements 40 GHz - 200 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 $> 2(\text{Span}/\text{RBW})$. 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	λ	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

4.5.3 Field Strength of Spurious Radiation Results:

This product meets Part 15B limits 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 four 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.

In the frequency range of 30 MHz to 18 GHz, the field strength of the EUT measured has a minimum margin of 27.87 dB to 82.23 dBμV/m field strength limit derived from -13dBm TRP limit with an isotropic radiator assumed. Therefore, the maximum EIRP emissions measured is below -13dBm/MHz TRP limit with a 27.87dB margin.

In the frequency range of 18 MHz to 40 GHz, the field strength of the EUT measured has a minimum margin of 4.18 dB. Therefore, the maximum EIRP emissions measured is below -13 dBm/MHz TRP limit with a 4.18 dB margin.

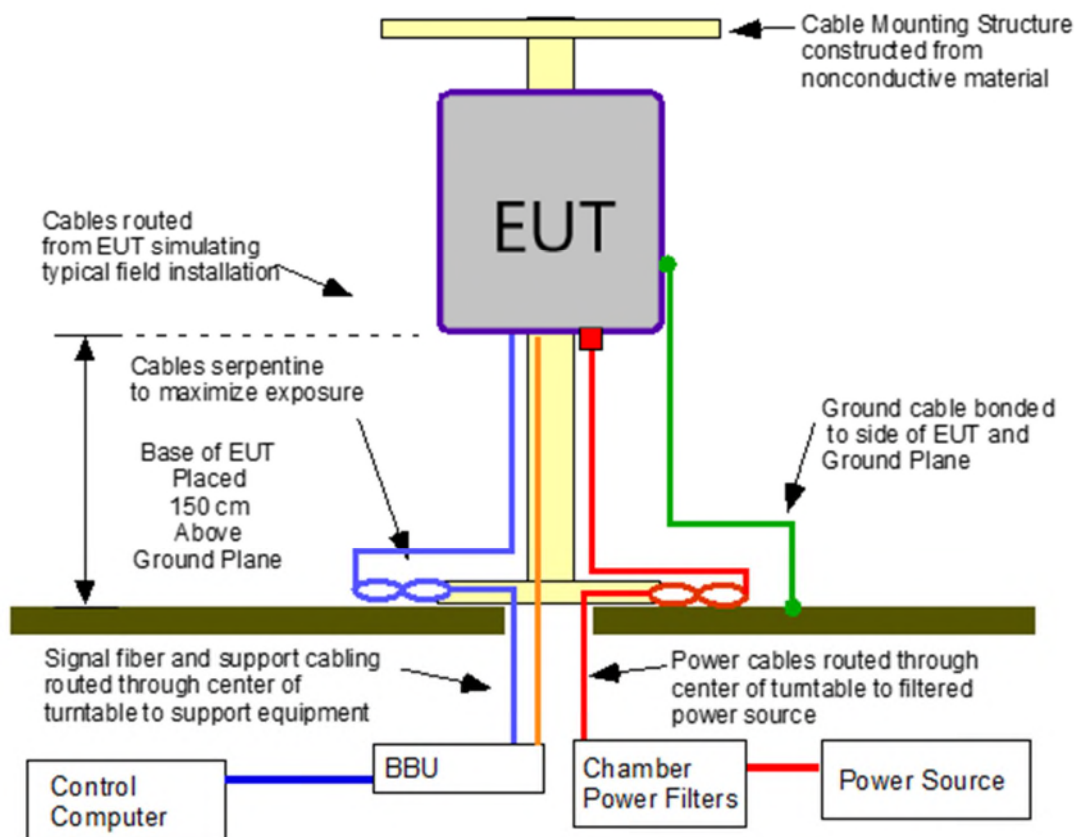
In the frequency range of 40 GHz to 200 GHz, the EIRP of the EUT measured has a minimum margin of 3.17 dB to the -13 dBm TRP limit.

The maximum EIRP in the frequency range of 30 MHz to 200 GHz measured is less than the TRP limit, then early exit condition is met and no further measurements are required. Therefore, the spurious emissions of the EUT are in compliance with FCC Part 30 requirements.

The emissions below 40 GHz were below the Part 15 Class B limit.

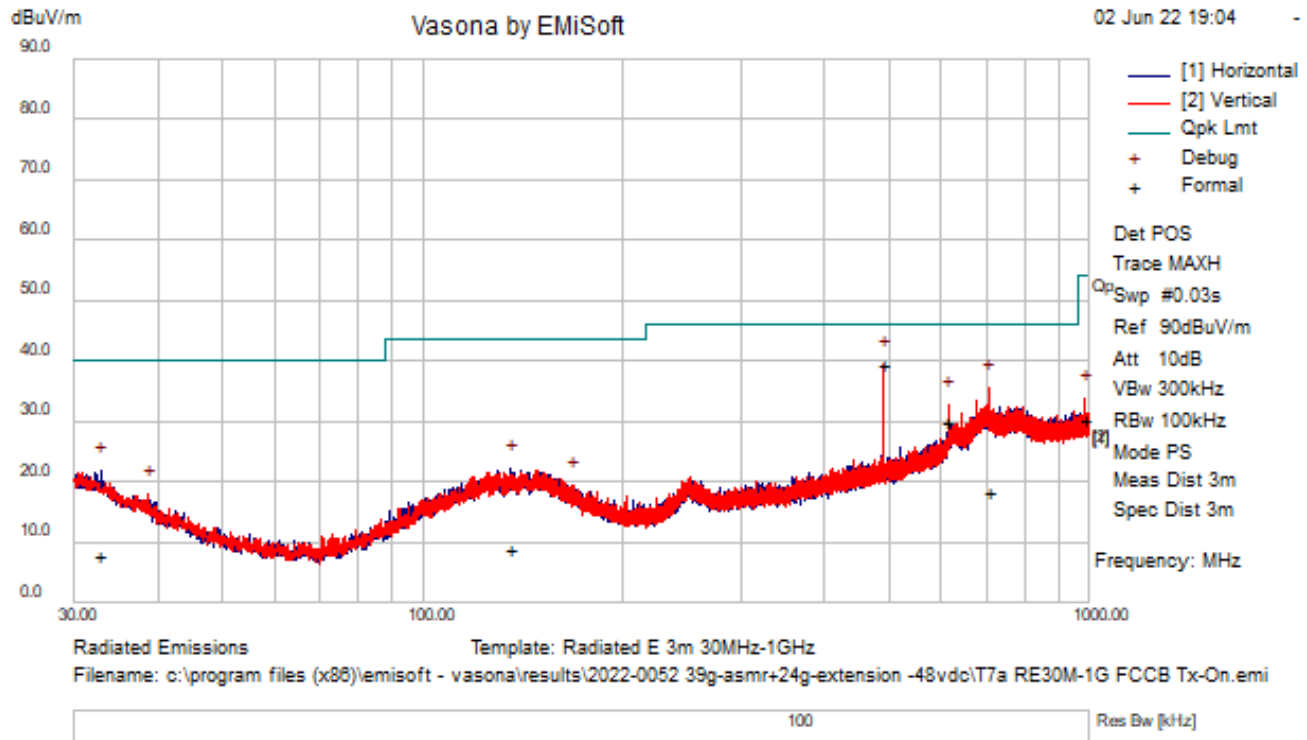
This demonstrates that the AirScale 39 GHz Radio Unit (AWEWA-B) FCC ID: 2AD8UAWEWAB01 and 24 GHz Extension Unit (FA3UB) FCC ID: 2AD8UAFA3UB01, the subject of this application, complies with FCC Part 15 Class B, and FCC Sections 2.1053, 30.203 and 2.1057 of the Rules.

Figure 4.5 Radiated Emissions Product Setup



4.5.4 Transmitter Measurements of Radiated Spurious Emissions

30MHz-1GHz



Test Information

Results Title	Radiated E 3m 30MHz-1GHz
File Name	T7a RE30M-1G FCCB Tx-On.emi
Test Laboratory	MH-AR4, 36.6%RH, 22.8C, 994hPa
Test Engineer	MJS
Test Software	Vasona by EMISoft, version 6.061
Equipment	Nokia Wireless Group
EUT Details	ASMR 39G Main + 24G Extension (FA3UB) - New FCC Filing for Ext. Tx-On.
Configuration	AR4, Powered by -48Vdc, 39G ASMR - YK212500119 24G Extension - AH212200116. RE 30M-1GHz, FCC Part 15b Class B limits. Bilog Antenna E766, FSW67-E1260, PA-E812, LPF-E1268. AR4 cables.
Date	2022-06-02 19:04:23

Formal Data

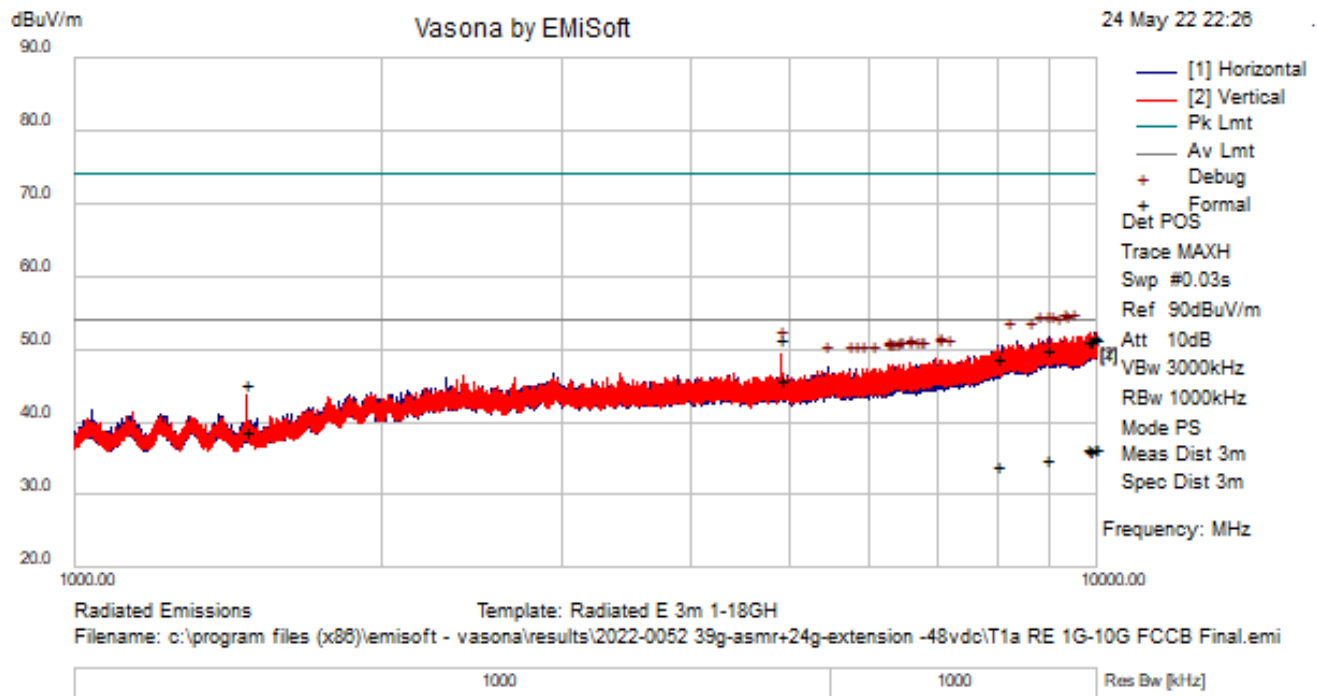
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
491.516	47.36	2.49	-10.44	39.41	QuasiMax	V	182	311	46.00	-6.59	Pass	
614.392667	33.21	2.75	-5.80	30.17	QuasiMax	H	136	6	46.00	-15.83	Pass	
983.041	30.02	3.58	-3.13	30.46	QuasiMax	V	104	234	54.00	-23.54	Pass	
708.411	17.89	2.92	-2.33	18.48	QuasiMax	V	171	208	46.00	-27.52	Pass	
32.877667	17.87	1.91	-11.73	8.05	QuasiMax	H	137	333	40.00	-31.95	Pass	
135.665333	17.68	1.67	-10.20	9.15	QuasiMax	H	287	120	43.50	-34.35	Pass	

Preview Data

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
491.493667	47.46	2.49	-10.44	39.51	Debug	V	100	315	46.00	-6.49	Pass	
706.542667	34.72	2.91	-2.24	35.40	Debug	V	100	90	46.00	-10.60	Pass	
614.392667	35.69	2.75	-5.80	32.65	Debug	H	125	0	46.00	-13.35	Pass	
32.877667	31.53	1.91	-11.73	21.71	Debug	H	100	90	40.00	-18.29	Pass	
983.025	33.25	3.58	-3.13	33.69	Debug	V	100	225	54.00	-20.31	Pass	
135.665333	30.74	1.67	-10.20	22.21	Debug	H	125	0	43.50	-21.29	Pass	
38.730	30.98	1.74	-14.77	17.96	Debug	V	300	225	40.00	-22.04	Pass	
167.287333	30.21	1.72	-12.62	19.30	Debug	V	200	45	43.50	-24.20	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.

1GHz – 10GHz



Test Information

Results Title	Radiated E 3m 1-18GH
File Name	T1a RE 1G-10G FCCB Final.emi
Test Laboratory	MH-AR4, 36.6%RH, 22.8C, 994hPa
Test Engineer	MJS
Test Software	Vasona by EMISoft, version 6.061
Equipment	Nokia Wireless Group
EUT Details	ASMR 39G Main + 24G Extension (FA3UB) - New FCC Filing for Ext.
Configuration	AR4, Powered by -48Vdc, 39G ASMR - YK212500119 24G Extension - AH212200116. RE 1G-10GHz, FCC Part 15b Class B limits, With Tx-On. DR Horn Antenna E1073, FSW67-E1260, PA-E447, LPF-E1475. AR4 Direct cables. 1M BW
Date	2022-05-24 22:26:35

Formal Data

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
4915.150	45.63	4.45	-4.08	46.01	AvgMax	V	104	98	54.00	-7.99	Pass	
1474.345	47.49	2.60	-11.35	38.74	AvgMax	V	140	187	54.00	-15.26	Pass	
9999.700	30.50	7.93	-1.91	36.51	AvgMax	V	141	0	54.00	-17.49	Pass	
9956.800	30.47	7.89	-1.95	36.40	AvgMax	H	281	0	54.00	-17.60	Pass	
9826.300	30.64	7.76	-2.06	36.33	AvgMax	V	174	303	54.00	-17.67	Pass	
9855.550	30.38	7.78	-2.04	36.12	AvgMax	V	228	318	54.00	-17.88	Pass	
9873.700	30.27	7.80	-2.02	36.05	AvgMax	H	283	355	54.00	-17.95	Pass	
8971.600	29.88	7.59	-2.53	34.93	AvgMax	H	99	355	54.00	-19.07	Pass	
8017.150	29.68	7.19	-2.75	34.12	AvgMax	H	245	355	54.00	-19.88	Pass	

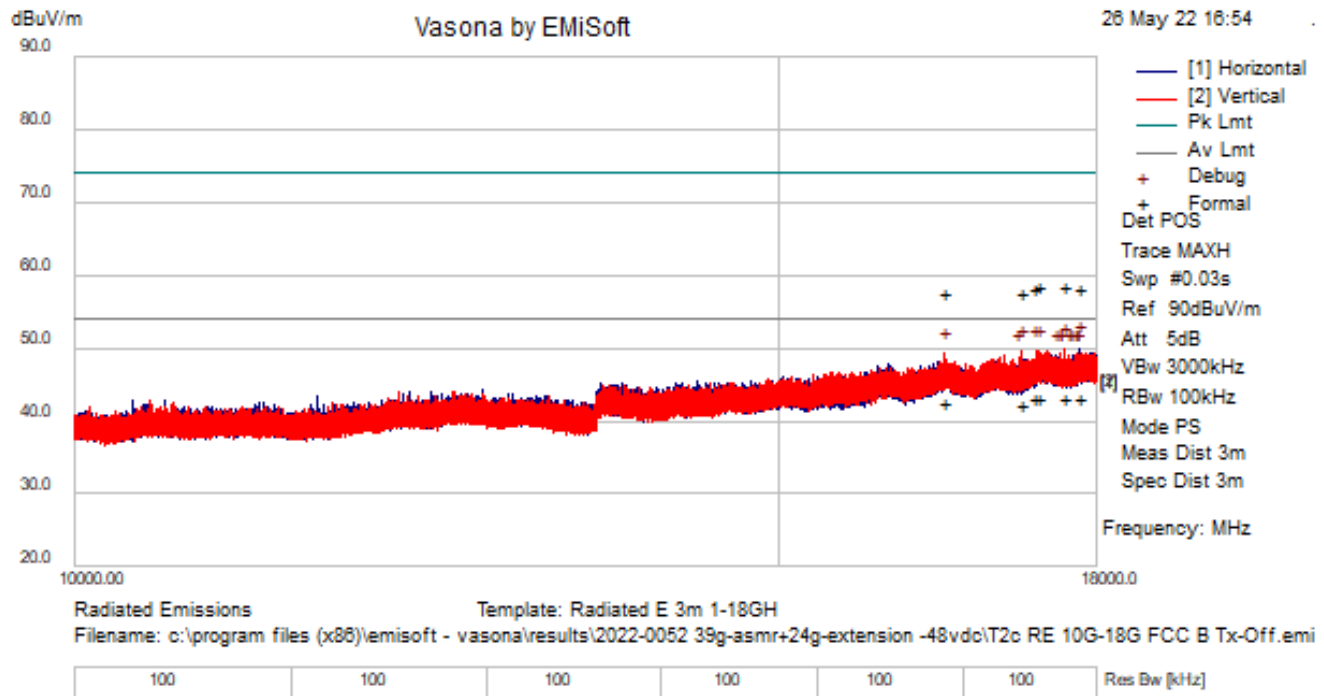
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
9956.800	45.81	7.89	-1.95	51.75	PeakMax	H	281	0	74.00	-22.25	Pass	
9999.700	45.52	7.93	-1.91	51.54	PeakMax	V	141	0	74.00	-22.46	Pass	
4915.150	51.16	4.45	-4.08	51.53	PeakMax	V	104	98	74.00	-22.47	Pass	
9873.700	45.39	7.80	-2.02	51.18	PeakMax	H	283	355	74.00	-22.82	Pass	
9826.300	45.41	7.76	-2.06	51.10	PeakMax	V	174	303	74.00	-22.90	Pass	
9855.550	45.36	7.78	-2.04	51.10	PeakMax	V	228	318	74.00	-22.90	Pass	
8971.600	45.01	7.59	-2.53	50.07	PeakMax	H	99	355	74.00	-23.93	Pass	
8017.150	44.46	7.19	-2.75	48.89	PeakMax	H	245	355	74.00	-25.11	Pass	
1474.345	54.00	2.60	-11.35	45.25	PeakMax	V	140	187	74.00	-28.75	Pass	

Preview Data

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
9501.700	46.69	7.43	-2.36	51.76	Debug	V	100	352	54.00	-2.24	Pass	
9296.950	46.54	7.49	-2.42	51.61	Debug	V	175	330	54.00	-2.39	Pass	
9032.500	46.42	7.58	-2.50	51.49	Debug	V	250	154	54.00	-2.51	Pass	
8792.350	46.51	7.58	-2.63	51.46	Debug	V	175	110	54.00	-2.54	Pass	
8944.150	46.38	7.59	-2.55	51.41	Debug	H	325	242	54.00	-2.59	Pass	
9338.650	46.26	7.48	-2.41	51.32	Debug	V	175	0	54.00	-2.68	Pass	
9200.350	46.23	7.52	-2.45	51.30	Debug	V	100	308	54.00	-2.70	Pass	
8214.700	45.96	7.34	-2.76	50.55	Debug	V	100	308	54.00	-3.45	Pass	
8615.200	45.67	7.57	-2.72	50.52	Debug	V	175	110	54.00	-3.48	Pass	
4915.150	48.88	4.45	-4.08	49.25	Debug	V	100	88	54.00	-4.75	Pass	
7042.450	45.14	5.92	-2.61	48.45	Debug	V	175	132	54.00	-5.55	Pass	
7034.050	45.06	5.91	-2.61	48.36	Debug	V	325	308	54.00	-5.64	Pass	
7171.000	44.94	6.05	-2.65	48.34	Debug	V	100	330	54.00	-5.66	Pass	
6570.550	45.34	5.46	-2.68	48.11	Debug	V	250	154	54.00	-5.89	Pass	
6460.600	45.30	5.38	-2.72	47.96	Debug	V	175	286	54.00	-6.04	Pass	
6562.900	45.15	5.45	-2.69	47.91	Debug	V	250	22	54.00	-6.09	Pass	
6723.850	44.93	5.61	-2.65	47.88	Debug	V	250	286	54.00	-6.12	Pass	
6658.000	44.98	5.55	-2.67	47.86	Debug	H	175	352	54.00	-6.14	Pass	
6263.650	45.35	5.33	-2.84	47.83	Debug	V	250	66	54.00	-6.17	Pass	
6764.650	44.80	5.65	-2.65	47.81	Debug	V	250	110	54.00	-6.19	Pass	
6420.700	45.17	5.37	-2.75	47.79	Debug	V	100	22	54.00	-6.21	Pass	
6399.850	45.13	5.36	-2.76	47.73	Debug	H	175	220	54.00	-6.27	Pass	
6329.500	45.13	5.35	-2.80	47.67	Debug	V	175	198	54.00	-6.33	Pass	
6271.450	45.17	5.33	-2.84	47.67	Debug	V	325	0	54.00	-6.33	Pass	
6283.150	45.02	5.34	-2.83	47.52	Debug	V	100	352	54.00	-6.48	Pass	
5455.600	45.91	5.02	-3.50	47.42	Debug	H	325	198	54.00	-6.58	Pass	
6058.450	45.01	5.28	-2.98	47.31	Debug	V	100	88	54.00	-6.69	Pass	
5903.650	45.10	5.23	-3.10	47.23	Debug	V	100	44	54.00	-6.77	Pass	
5829.400	45.17	5.20	-3.16	47.20	Debug	H	100	176	54.00	-6.80	Pass	
5728.600	45.29	5.16	-3.25	47.20	Debug	H	325	66	54.00	-6.80	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.

10GHz – 18GHz



Test Information

Results Title	Radiated E 3m 1-18GH
File Name	T2c RE 10G-18G FCC B Tx-Off.emi
Test Laboratory	MH-AR4, 36.6%RH, 22.8C, 994hPa
Test Engineer	MJS
Test Software	Vasona by EMISoft, version 6.061
Equipment	Nokia Wireless Group
EUT Details	ASMR 39G Main + 24G Extension (FA3UB) - New FCC Filing for Ext.
Configuration	AR4, Powered by -48Vdc, 39G ASMR - YK212500119 24G Extension - AH212200116. RE 10G-18GHz, FCC Part 15b Class B limits. DR Horn Antenna E1073, FSW67-E1260, PA-E447, LPF-E1475. AR4 Direct cables. 1M BW
Date	2022-05-26 16:54:42

Formal Data

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
17825.289	28.28	10.21	4.88	43.37	AvgMax	H	201	355	54.00	-10.63	Pass	
17410.889	28.41	10.08	4.87	43.36	AvgMax	V	215	268	54.00	-10.64	Pass	
17673.911	28.16	10.16	4.92	43.23	AvgMax	V	104	164	54.00	-10.77	Pass	
17381.867	28.27	10.08	4.85	43.20	AvgMax	V	221	0	54.00	-10.80	Pass	
16500.306	28.74	10.25	3.51	42.50	AvgMax	V	263	52	54.00	-11.50	Pass	
17242.934	27.69	10.05	4.72	42.46	AvgMax	V	201	64	54.00	-11.54	Pass	
17673.911	43.40	10.16	4.92	58.47	PeakMax	V	104	164	74.00	-15.53	Pass	
17410.889	43.45	10.08	4.87	58.40	PeakMax	V	215	268	74.00	-15.60	Pass	

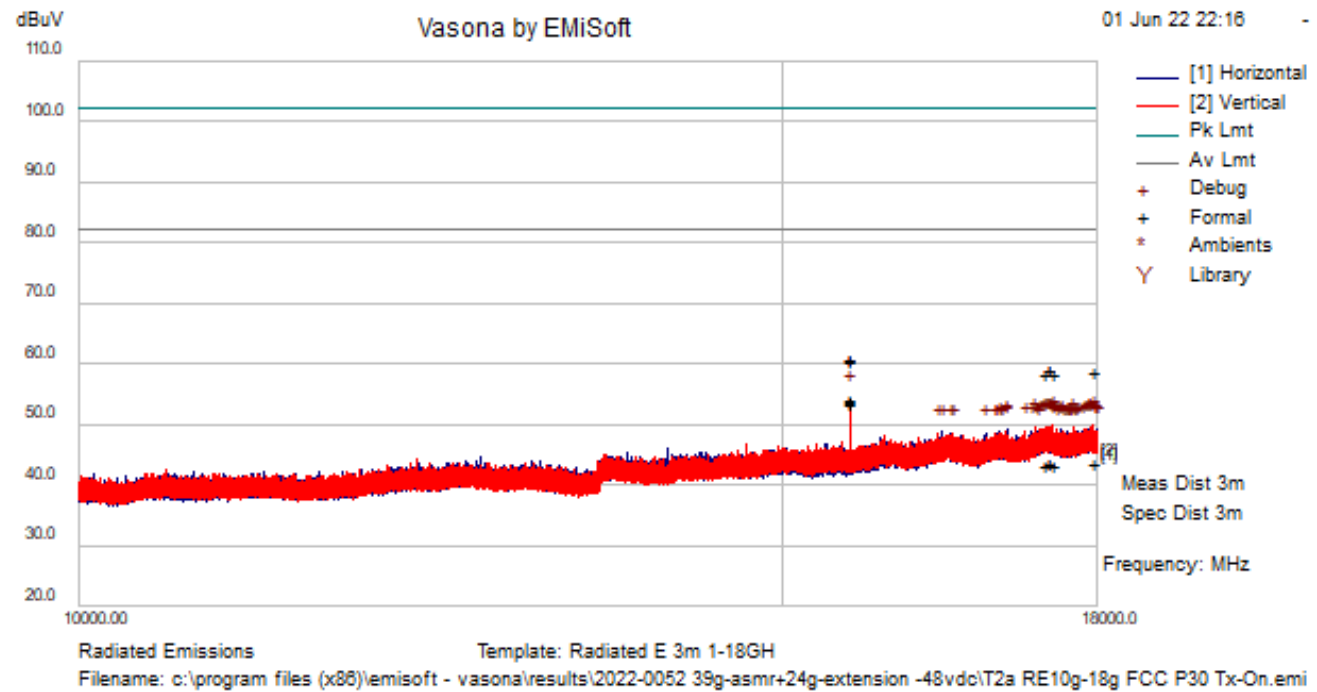
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
17825.289	43.18	10.21	4.88	58.27	PeakMax	H	201	355	74.00	-15.73	Pass	
17381.867	43.29	10.08	4.85	58.21	PeakMax	V	221	0	74.00	-15.79	Pass	
17242.934	42.89	10.05	4.72	57.66	PeakMax	V	201	64	74.00	-16.34	Pass	
16500.306	43.78	10.25	3.51	57.55	PeakMax	V	263	52	74.00	-16.45	Pass	

Preview Data

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
17825.289	34.77	10.21	4.88	49.87	Debug	H	175	352	54.00	-4.13	Pass	
17673.911	34.66	10.16	4.92	49.74	Debug	V	175	330	54.00	-4.26	Pass	
17242.934	34.72	10.05	4.72	49.49	Debug	V	325	352	54.00	-4.51	Pass	
17381.867	34.56	10.08	4.85	49.48	Debug	V	325	308	54.00	-4.52	Pass	
17410.889	34.52	10.08	4.87	49.48	Debug	V	250	22	54.00	-4.52	Pass	
16497.600	35.43	10.25	3.50	49.18	Debug	V	250	330	54.00	-4.82	Pass	
17794.578	33.83	10.20	4.89	48.92	Debug	V	175	22	54.00	-5.08	Pass	
17632.578	33.81	10.14	4.93	48.88	Debug	H	325	176	54.00	-5.12	Pass	
17583.111	33.82	10.12	4.94	48.88	Debug	H	250	220	54.00	-5.12	Pass	
17633.822	33.80	10.14	4.93	48.86	Debug	H	100	132	54.00	-5.14	Pass	
17752.489	33.77	10.19	4.90	48.85	Debug	H	325	286	54.00	-5.15	Pass	
17717.511	33.77	10.17	4.91	48.85	Debug	V	325	242	54.00	-5.15	Pass	
17813.067	33.75	10.21	4.89	48.85	Debug	V	250	264	54.00	-5.15	Pass	
17802.889	33.69	10.20	4.89	48.78	Debug	V	325	242	54.00	-5.22	Pass	
17212.934	34.04	10.05	4.69	48.78	Debug	V	175	220	54.00	-5.22	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.

10GHz – 18GHz TX-ON



Test Information

Results Title	Radiated E 3m 1-18GH
File Name	T2a RE10g-18g FCC P30 Tx-On.emi
Test Laboratory	MH-AR4, 36.6%RH, 22.8C, 994hPa
Test Engineer	MJS
Test Software	Vasona by EMIsoft, version 6.061
Equipment	Nokia Wireless Group
EUT Details	ASMR 39G Main + 24G Extension (FA3UB) - New FCC Filing for Ext.
Configuration	AR4, Powered by -48Vdc, 39G ASMR - YK212500119 24G Extension - AH212200116. RE 10G-18GHz, FCC Part 15b Class B limits. DR Horn Antenna E1073, FSW67-E1260, PA-E447, LPF-E1475. AR4 Direct cables. 1M BW
Date	2022-06-01 22:16:01

Formal Data

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
15602.875	42.18	9.92	2.26	54.36	AvgMax	V	170	6	82.23	-27.87	Pass	
15602.875	41.74	9.92	2.26	53.92	AvgMax	V	168	8	82.23	-28.31	Pass	
15602.875	41.35	9.92	2.26	53.53	AvgMax	V	170	4	82.23	-28.70	Pass	
17495.511	28.79	10.09	4.95	43.84	AvgMax	V	243	119	82.23	-38.39	Pass	
17510.933	28.64	10.10	4.95	43.69	AvgMax	H	241	0	82.23	-38.54	Pass	
17948.311	28.57	10.25	4.86	43.68	AvgMax	V	114	0	82.23	-38.55	Pass	
17539.689	28.38	10.11	4.95	43.44	AvgMax	V	299	57	82.23	-38.79	Pass	
17463.911	28.27	10.09	4.92	43.28	AvgMax	H	286	0	82.23	-38.95	Pass	

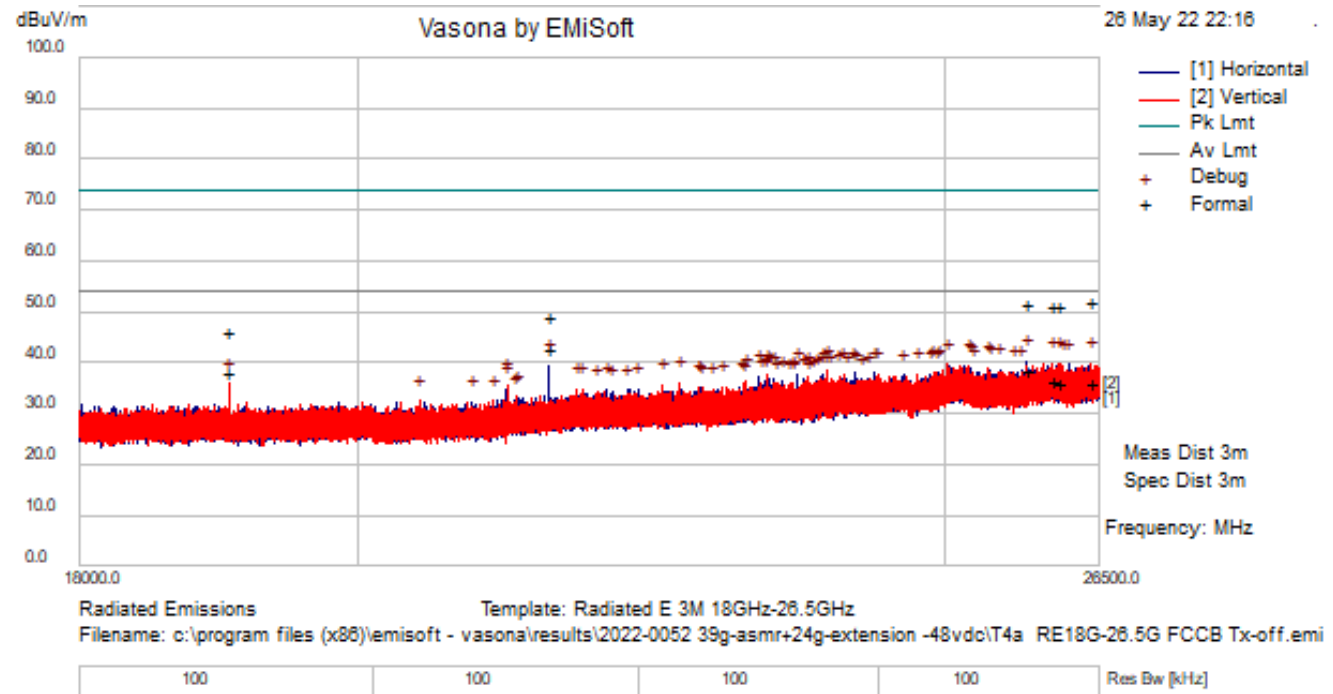
Preview Data

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
15602.844	41.89	9.92	2.26	54.07	Debug	V	100	22	82.23	-28.16	Pass	
17539.689	34.88	10.11	4.95	49.94	Debug	V	175	132	82.23	-32.29	Pass	
17948.311	34.67	10.25	4.86	49.78	Debug	V	100	0	82.23	-32.45	Pass	
17495.511	34.65	10.09	4.95	49.70	Debug	V	175	220	82.23	-32.53	Pass	
17510.933	34.61	10.10	4.95	49.66	Debug	H	325	22	82.23	-32.57	Pass	
17463.911	34.60	10.09	4.92	49.61	Debug	H	175	264	82.23	-32.62	Pass	
17743.822	34.52	10.18	4.90	49.60	Debug	V	100	286	82.23	-32.63	Pass	
17529.511	34.50	10.11	4.95	49.56	Debug	H	100	352	82.23	-32.67	Pass	
17917.867	34.44	10.24	4.86	49.55	Debug	V	175	352	82.23	-32.68	Pass	
17355.022	34.55	10.07	4.82	49.44	Debug	V	325	66	82.23	-32.79	Pass	
17470.889	34.40	10.09	4.93	49.42	Debug	V	100	242	82.23	-32.81	Pass	
17920.311	34.27	10.24	4.86	49.38	Debug	V	250	132	82.23	-32.85	Pass	
17872.756	34.18	10.23	4.87	49.29	Debug	V	100	264	82.23	-32.94	Pass	
17457.200	34.27	10.09	4.92	49.27	Debug	H	100	66	82.23	-32.96	Pass	
17577.511	34.21	10.12	4.94	49.27	Debug	V	100	0	82.23	-32.96	Pass	
17984.756	34.13	10.27	4.85	49.25	Debug	H	175	88	82.23	-32.98	Pass	
17622.178	34.17	10.14	4.93	49.23	Debug	H	175	0	82.23	-33.00	Pass	
17904.133	34.04	10.24	4.87	49.14	Debug	H	250	220	82.23	-33.09	Pass	
17523.022	34.08	10.10	4.95	49.14	Debug	H	100	22	82.23	-33.09	Pass	
17894.356	34.01	10.24	4.87	49.11	Debug	V	175	110	82.23	-33.12	Pass	
17084.134	34.51	10.03	4.57	49.10	Debug	H	325	286	82.23	-33.13	Pass	
17432.489	34.10	10.08	4.89	49.08	Debug	V	100	22	82.23	-33.15	Pass	
17411.289	34.12	10.08	4.87	49.08	Debug	V	325	264	82.23	-33.15	Pass	
17935.156	33.96	10.25	4.86	49.07	Debug	V	175	176	82.23	-33.16	Pass	
17749.867	33.93	10.18	4.90	49.01	Debug	H	325	132	82.23	-33.22	Pass	
17620.222	33.95	10.14	4.93	49.01	Debug	H	175	22	82.23	-33.22	Pass	
17988.800	33.89	10.27	4.85	49.01	Debug	H	175	22	82.23	-33.22	Pass	
17997.067	33.87	10.27	4.85	48.99	Debug	H	175	176	82.23	-33.24	Pass	
17988.044	33.86	10.27	4.85	48.98	Debug	H	250	176	82.23	-33.25	Pass	
17691.911	33.90	10.16	4.91	48.98	Debug	H	100	220	82.23	-33.25	Pass	
17009.600	34.46	10.01	4.50	48.97	Debug	H	325	110	82.23	-33.26	Pass	
17259.378	34.17	10.05	4.73	48.96	Debug	V	100	330	82.23	-33.27	Pass	
17325.422	34.09	10.07	4.79	48.95	Debug	H	175	308	82.23	-33.28	Pass	
17844.533	33.83	10.22	4.88	48.93	Debug	H	250	242	82.23	-33.30	Pass	
17378.889	33.99	10.07	4.84	48.91	Debug	H	175	22	82.23	-33.32	Pass	
17765.556	33.82	10.19	4.90	48.91	Debug	V	250	44	82.23	-33.32	Pass	
17541.778	33.74	10.11	4.95	48.80	Debug	H	325	198	82.23	-33.43	Pass	
17804.978	33.65	10.20	4.89	48.75	Debug	H	100	154	82.23	-33.48	Pass	
17073.822	34.14	10.02	4.56	48.72	Debug	V	175	352	82.23	-33.51	Pass	
17779.956	33.62	10.20	4.89	48.71	Debug	H	325	198	82.23	-33.52	Pass	
17636.400	33.62	10.14	4.93	48.69	Debug	V	250	154	82.23	-33.54	Pass	
16455.956	34.98	10.26	3.41	48.66	Debug	H	100	330	82.23	-33.57	Pass	
16875.645	34.34	10.07	4.25	48.65	Debug	H	325	132	82.23	-33.58	Pass	
17677.378	33.51	10.16	4.92	48.59	Debug	H	175	132	82.23	-33.64	Pass	
17787.778	33.48	10.20	4.89	48.57	Debug	H	250	330	82.23	-33.66	Pass	
16418.667	34.96	10.27	3.33	48.56	Debug	V	175	308	82.23	-33.67	Pass	
17726.800	33.47	10.18	4.91	48.55	Debug	V	250	154	82.23	-33.68	Pass	
17719.022	33.42	10.17	4.91	48.50	Debug	V	100	66	82.23	-33.73	Pass	

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
17010.667	34.00	10.01	4.50	48.50	Debug	H	325	154	82.23	-33.73	Pass	
17027.911	33.97	10.02	4.51	48.50	Debug	V	100	352	82.23	-33.73	Pass	
17395.245	33.54	10.08	4.86	48.48	Debug	V	250	308	82.23	-33.75	Pass	
17700.045	33.40	10.17	4.91	48.48	Debug	V	100	198	82.23	-33.75	Pass	
17645.422	33.40	10.15	4.92	48.47	Debug	V	100	198	82.23	-33.76	Pass	
17728.667	33.36	10.18	4.91	48.44	Debug	H	325	198	82.23	-33.79	Pass	
16983.067	33.95	10.02	4.45	48.43	Debug	H	100	308	82.23	-33.80	Pass	
17591.778	33.36	10.13	4.94	48.43	Debug	V	175	110	82.23	-33.80	Pass	
17751.911	33.32	10.19	4.90	48.41	Debug	V	100	0	82.23	-33.82	Pass	
16966.756	33.95	10.03	4.42	48.40	Debug	V	175	264	82.23	-33.83	Pass	
16537.645	34.58	10.24	3.58	48.40	Debug	H	250	198	82.23	-33.83	Pass	
16556.267	34.54	10.23	3.62	48.39	Debug	V	250	132	82.23	-33.84	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.

18GHz – 26.5GHz



Test Information

Results Title	Radiated E 3M 18GHz-26.5GHz
File Name	T4a RE18G-26.5G FCCB Tx-off.emi
Test Laboratory	MH-AR4, 36.6%RH, 22.8C, 994hPa
Test Engineer	MJS
Test Software	Vasona by EMISoft, version 6.061
Equipment	Nokia Wireless Group
EUT Details	ASMR 39G Main + 24G Extension (FA3UB) - New FCC Filing for Ext.
Configuration	AR4, Powered by -48Vdc, 39G ASMR - YK212500119 24G Extension - AH212200116. RE 18G-26.5GHz, Tx -Off, FCC Part 15b Class B limits. DR Horn Antenna E1452, FSW67-E1260, PA-E1525, No filters. E1501 and E502 cables. 100k BW Pre / 1M BW Formals
Date	2022-05-26 22:16:50

Formal Data

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
21504.000	38.26	12.30	-7.87	42.69	AvgMax	H	147	197	54.00	-11.31	Pass	
25781.253	28.30	13.43	-3.20	38.52	AvgMax	H	171	121	54.00	-15.48	Pass	
19046.395	35.56	11.47	-8.98	38.05	AvgMax	V	159	166	54.00	-15.95	Pass	
26032.003	25.99	13.49	-3.10	36.37	AvgMax	V	130	36	54.00	-17.63	Pass	
26416.982	25.92	13.60	-3.21	36.30	AvgMax	V	136	209	54.00	-17.70	Pass	
26100.145	25.70	13.51	-3.18	36.03	AvgMax	V	249	112	54.00	-17.97	Pass	
26416.982	41.59	13.60	-3.21	51.97	PeakMax	V	136	209	74.00	-22.03	Pass	
25781.253	41.66	13.43	-3.20	51.89	PeakMax	H	171	121	74.00	-22.11	Pass	
26032.003	40.98	13.49	-3.10	51.37	PeakMax	V	130	36	74.00	-22.63	Pass	
26100.145	40.78	13.51	-3.18	51.11	PeakMax	V	249	112	74.00	-22.89	Pass	
21504.000	44.86	12.30	-7.87	49.29	PeakMax	H	147	197	74.00	-24.71	Pass	

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
19046.395	43.89	11.47	-8.98	46.38	PeakMax	V	159	166	74.00	-27.62	Pass	

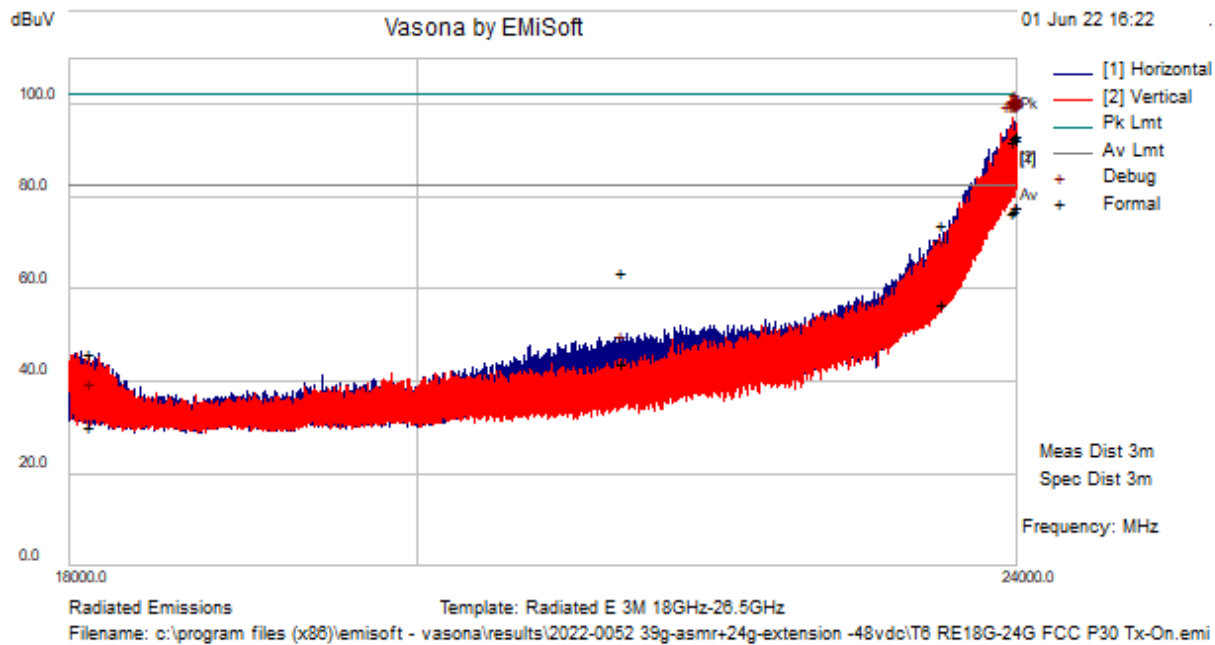
Preview Data

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
25781.253	29.90	13.43	-3.20	40.12	Debug	H	100	135	54.00	-13.88	Pass	
26416.982	29.45	13.60	-3.21	39.83	Debug	V	250	180	54.00	-14.17	Pass	
26100.145	29.48	13.51	-3.18	39.81	Debug	V	100	315	54.00	-14.19	Pass	
26032.003	29.38	13.49	-3.10	39.77	Debug	V	175	135	54.00	-14.23	Pass	
26192.582	29.29	13.53	-3.16	39.66	Debug	H	100	315	54.00	-14.34	Pass	
25018.378	29.59	13.29	-3.35	39.53	Debug	V	100	135	54.00	-14.47	Pass	
25216.924	29.35	13.32	-3.22	39.45	Debug	V	100	315	54.00	-14.55	Pass	
21503.983	34.94	12.30	-7.87	39.37	Debug	H	175	180	54.00	-14.63	Pass	
26141.157	28.99	13.52	-3.17	39.34	Debug	V	250	135	54.00	-14.66	Pass	
25243.062	28.96	13.32	-3.27	39.01	Debug	H	250	225	54.00	-14.99	Pass	
25410.299	29.04	13.35	-3.54	38.84	Debug	V	100	352	54.00	-15.16	Pass	
25426.378	28.86	13.35	-3.54	38.67	Debug	H	175	180	54.00	-15.33	Pass	
25517.399	28.64	13.36	-3.52	38.48	Debug	H	250	270	54.00	-15.52	Pass	
25730.820	28.27	13.42	-3.29	38.40	Debug	H	175	180	54.00	-15.60	Pass	
23906.649	29.89	13.03	-4.58	38.33	Debug	V	175	270	54.00	-15.67	Pass	
24887.691	28.58	13.26	-3.69	38.15	Debug	V	100	270	54.00	-15.85	Pass	
25651.132	28.17	13.40	-3.44	38.13	Debug	V	175	90	54.00	-15.87	Pass	
25265.516	28.10	13.33	-3.32	38.11	Debug	H	175	90	54.00	-15.89	Pass	
24935.857	28.39	13.28	-3.56	38.10	Debug	H	175	315	54.00	-15.90	Pass	
24152.087	28.89	13.10	-4.00	37.99	Debug	H	175	270	54.00	-16.01	Pass	
24920.557	28.23	13.27	-3.61	37.89	Debug	V	100	270	54.00	-16.11	Pass	
24333.207	28.42	13.14	-3.70	37.86	Debug	H	175	90	54.00	-16.14	Pass	
23628.983	29.55	12.93	-4.70	37.79	Debug	H	175	315	54.00	-16.21	Pass	
24052.707	28.79	13.07	-4.21	37.65	Debug	V	250	315	54.00	-16.35	Pass	
24362.391	28.20	13.14	-3.70	37.64	Debug	V	250	135	54.00	-16.36	Pass	
23866.062	29.24	13.01	-4.61	37.64	Debug	H	250	225	54.00	-16.36	Pass	
24733.416	28.42	13.23	-4.02	37.64	Debug	V	175	315	54.00	-16.36	Pass	
24851.070	28.13	13.26	-3.78	37.61	Debug	H	100	315	54.00	-16.39	Pass	
24154.778	28.35	13.10	-3.99	37.45	Debug	H	100	0	54.00	-16.55	Pass	
24607.191	28.22	13.20	-3.97	37.45	Debug	H	250	270	54.00	-16.55	Pass	
23368.741	29.38	12.85	-4.78	37.45	Debug	V	175	270	54.00	-16.55	Pass	
24008.508	28.63	13.06	-4.34	37.36	Debug	V	250	0	54.00	-16.64	Pass	
23291.037	29.26	12.82	-4.87	37.22	Debug	H	175	0	54.00	-16.78	Pass	
23730.487	28.82	12.97	-4.68	37.10	Debug	V	250	135	54.00	-16.90	Pass	
23845.591	28.68	13.01	-4.63	37.07	Debug	H	250	315	54.00	-16.93	Pass	
24289.503	27.57	13.13	-3.71	36.98	Debug	V	175	180	54.00	-17.02	Pass	
23380.995	28.90	12.85	-4.77	36.98	Debug	H	100	180	54.00	-17.02	Pass	
23932.149	28.40	13.04	-4.52	36.91	Debug	V	250	180	54.00	-17.09	Pass	
23429.304	28.75	12.87	-4.74	36.88	Debug	H	175	352	54.00	-17.12	Pass	
24076.507	27.81	13.08	-4.14	36.75	Debug	H	100	135	54.00	-17.25	Pass	
23890.358	28.33	13.02	-4.60	36.75	Debug	V	250	45	54.00	-17.25	Pass	
24217.112	27.47	13.11	-3.88	36.70	Debug	H	175	352	54.00	-17.30	Pass	
23695.070	28.36	12.96	-4.70	36.61	Debug	H	175	315	54.00	-17.39	Pass	
23344.516	28.51	12.84	-4.80	36.55	Debug	H	175	315	54.00	-17.45	Pass	

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
23697.691	28.19	12.96	-4.70	36.45	Debug	V	175	180	54.00	-17.55	Pass	
23182.875	28.70	12.79	-5.08	36.41	Debug	V	175	180	54.00	-17.59	Pass	
23803.587	28.01	12.99	-4.65	36.35	Debug	H	250	135	54.00	-17.65	Pass	
23502.474	28.06	12.89	-4.72	36.23	Debug	H	175	270	54.00	-17.77	Pass	
23775.537	27.82	12.98	-4.66	36.14	Debug	V	250	45	54.00	-17.86	Pass	
23356.416	28.08	12.84	-4.79	36.13	Debug	H	175	352	54.00	-17.87	Pass	
22602.962	29.42	12.63	-6.08	35.96	Debug	V	250	135	54.00	-18.04	Pass	
23591.158	27.73	12.92	-4.70	35.95	Debug	V	175	225	54.00	-18.05	Pass	
23312.783	27.92	12.83	-4.84	35.91	Debug	V	100	0	54.00	-18.09	Pass	
23739.483	27.60	12.97	-4.68	35.89	Debug	V	250	45	54.00	-18.11	Pass	
23444.462	27.67	12.87	-4.73	35.81	Debug	V	250	135	54.00	-18.19	Pass	
23563.391	27.57	12.91	-4.70	35.78	Debug	V	100	315	54.00	-18.22	Pass	
19046.350	33.29	11.47	-8.98	35.78	Debug	V	175	180	54.00	-18.22	Pass	
23149.441	28.16	12.78	-5.16	35.77	Debug	V	250	0	54.00	-18.23	Pass	
23599.587	27.53	12.92	-4.69	35.76	Debug	H	175	315	54.00	-18.24	Pass	
21171.350	31.92	12.19	-8.40	35.71	Debug	V	175	180	54.00	-18.29	Pass	
22458.321	29.22	12.59	-6.22	35.58	Debug	V	250	225	54.00	-18.42	Pass	
22771.475	28.52	12.67	-5.98	35.21	Debug	V	175	270	54.00	-18.79	Pass	
22779.266	28.48	12.67	-5.98	35.18	Debug	H	100	225	54.00	-18.82	Pass	
23166.937	27.50	12.78	-5.12	35.17	Debug	V	100	315	54.00	-18.83	Pass	
22970.020	28.03	12.72	-5.68	35.07	Debug	V	250	135	54.00	-18.93	Pass	
22795.558	28.23	12.68	-5.98	34.93	Debug	V	100	270	54.00	-19.07	Pass	
22248.654	29.05	12.53	-6.71	34.87	Debug	H	250	180	54.00	-19.13	Pass	
22887.641	27.99	12.70	-5.83	34.86	Debug	V	100	0	54.00	-19.14	Pass	
21782.713	30.01	12.39	-7.55	34.85	Debug	H	100	45	54.00	-19.15	Pass	
21986.288	29.60	12.46	-7.21	34.85	Debug	H	175	180	54.00	-19.15	Pass	
21166.038	31.06	12.19	-8.41	34.83	Debug	H	175	0	54.00	-19.17	Pass	
21740.213	29.88	12.38	-7.59	34.67	Debug	V	100	90	54.00	-19.33	Pass	
22154.021	29.00	12.50	-6.88	34.63	Debug	H	175	180	54.00	-19.37	Pass	
21901.854	29.31	12.43	-7.33	34.40	Debug	V	250	352	54.00	-19.60	Pass	
22027.088	28.89	12.47	-7.13	34.22	Debug	H	175	270	54.00	-19.78	Pass	
21243.742	29.38	12.21	-8.23	33.36	Debug	V	175	270	54.00	-20.64	Pass	
21236.517	28.91	12.21	-8.24	32.88	Debug	V	100	180	54.00	-21.12	Pass	
20477.963	29.42	11.95	-8.85	32.53	Debug	V	250	135	54.00	-21.47	Pass	
21061.063	28.93	12.15	-8.69	32.39	Debug	V	100	135	54.00	-21.61	Pass	
20887.379	28.96	12.09	-8.82	32.24	Debug	H	250	270	54.00	-21.76	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.

18GHz – 24GHz TX-ON



Test Information

Results Title	Radiated Emissions 3M 18GHz-24GHz
File Name	T6a RE18G-24G FCC P30 Tx-On.emi
Test Laboratory	MH-AR4, 36.6%RH, 22.8C, 994hPa
Test Engineer	MJS
Test Software	Vasona by EMIsoft, version 6.061
Equipment	Nokia Wireless Group
EUT Details	ASMR 39G Main + 24G Extension (FA3UB) - New FCC Filing for Ext.
Configuration	AR4, Powered by -48Vdc, 39G ASMR - YK212500119 24G Extension - AH212200116. RE 18G-24GHz, Tx -On, FCC Part 30 limits. DR Horn Antenna E1452, FSW67-E1260, PA-E1525, LPF'S Filters-E1498 and E1499. E1501 and E502 cables. 100k BW Pre / 1M BW Formals.
Date	2022-06-01 16:26:02

Formal Data

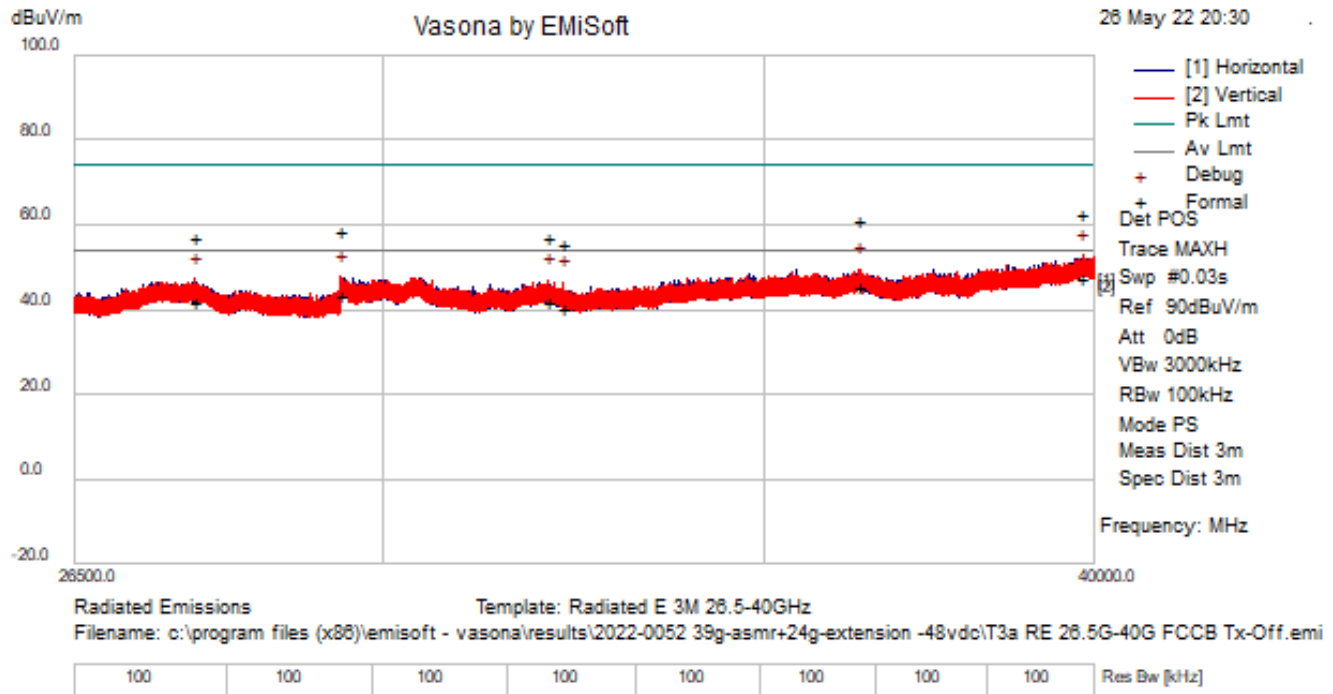
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
23985.667	22.60	59.84	-4.39	78.05	AvgMax	H	227	0	82.23	-4.18	Pass	
23985.033	22.57	59.81	-4.40	77.98	AvgMax	H	284	0	82.23	-4.25	Pass	
23980.400	22.57	59.57	-4.41	77.74	AvgMax	H	104	110	82.23	-4.49	Pass	
23972.033	22.49	59.14	-4.43	77.21	AvgMax	V	114	352	82.23	-5.02	Pass	
23964.033	22.45	58.74	-4.44	76.74	AvgMax	V	282	0	82.23	-5.49	Pass	
23440.467	28.54	33.14	-4.74	56.95	AvgMax	H	170	0	82.23	-25.28	Pass	
21268.505	38.00	14.07	-8.19	43.89	AvgMax	H	161	6	82.23	-38.34	Pass	
18093.451	25.98	12.59	-8.26	30.30	AvgMax	H	156	0	82.23	-51.93	Pass	

Preview Data

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
23972.033	42.21	59.14	-4.43	96.93	Debug	V	175	352	82.23	14.70	Fail	
23980.400	41.08	59.57	-4.41	96.25	Debug	H	175	0	82.23	14.02	Fail	
23985.667	40.59	59.84	-4.39	96.04	Debug	H	175	0	82.23	13.81	Fail	
23985.033	40.55	59.81	-4.40	95.96	Debug	H	175	352	82.23	13.73	Fail	
23964.033	41.59	58.74	-4.44	95.88	Debug	V	175	352	82.23	13.65	Fail	
23995.033	39.61	60.32	-4.37	95.55	Debug	V	175	352	82.23	13.32	Fail	
23983.200	40.20	59.71	-4.40	95.52	Debug	H	175	352	82.23	13.29	Fail	
23962.867	41.28	58.68	-4.45	95.51	Debug	V	175	352	82.23	13.28	Fail	
23991.700	39.64	60.15	-4.38	95.40	Debug	H	175	0	82.23	13.17	Fail	
23959.433	41.31	58.50	-4.46	95.36	Debug	H	175	0	82.23	13.13	Fail	
23964.800	40.89	58.78	-4.44	95.22	Debug	H	175	0	82.23	12.99	Fail	
23993.133	39.21	60.22	-4.38	95.05	Debug	H	175	0	82.23	12.82	Fail	
23995.533	39.06	60.34	-4.37	95.04	Debug	H	175	0	82.23	12.81	Fail	
23999.733	38.70	60.56	-4.36	94.90	Debug	H	175	0	82.23	12.67	Fail	
23967.600	40.41	58.92	-4.44	94.90	Debug	H	175	0	82.23	12.67	Fail	
23969.367	40.24	59.01	-4.43	94.82	Debug	V	175	352	82.23	12.59	Fail	
23974.467	39.97	59.27	-4.42	94.82	Debug	V	175	352	82.23	12.59	Fail	
23983.867	39.42	59.75	-4.40	94.77	Debug	H	175	0	82.23	12.54	Fail	
23991.067	38.94	60.11	-4.38	94.67	Debug	H	175	0	82.23	12.44	Fail	
23971.200	39.90	59.10	-4.43	94.58	Debug	H	175	352	82.23	12.35	Fail	
23981.300	39.28	59.62	-4.40	94.49	Debug	H	175	0	82.23	12.26	Fail	
23982.500	39.12	59.68	-4.40	94.39	Debug	H	175	22	82.23	12.16	Fail	
23957.833	40.39	58.42	-4.46	94.36	Debug	V	175	352	82.23	12.13	Fail	
23938.367	41.39	57.43	-4.51	94.32	Debug	V	175	352	82.23	12.09	Fail	
23918.833	42.39	56.43	-4.55	94.27	Debug	H	175	0	82.23	12.04	Fail	
18093.451	30.11	12.59	-8.26	34.44	Debug	H	100	352	82.23	-47.79	Pass	
21268.505	39.00	14.07	-8.19	44.88	Debug	H	100	352	82.23	-37.35	Pass	
23440.467	36.85	33.14	-4.74	65.26	Debug	H	100	352	82.23	-16.97	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.

26.5GHz – 40GHz



Test Information

Results Title	Radiated E 3M 26.5-40GHz
File Name	T3a RE 26.5G-40G FCCB Tx-Off.emi
Test Laboratory	MH-AR4, 36.6%RH, 22.8C, 994hPa
Test Engineer	MJS
Test Software	Vasona by EMISoft, version 6.061
Equipment	Nokia Wireless Group
EUT Details	ASMR 39G Main + 24G Extension (FA3UB) - New FCC Filing for Ext.
Configuration	AR4, Powered by -48Vdc, 39G ASMR - YK212500119 24G Extension - AH212200116. RE 26.5G-40GHz, Tx -Off, FCC Part 15b Class B limits. DR Horn Antenna E1375, FSW67-E1260, PA-E1525, No filters. E1501 and E502 cables. 100k BW Pre / 1M BW Formals
Date	2022-05-26 20:30:22

Formal Data

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
39812.575	30.51	17.17	0.12	47.80	AvgMax	V	115	352	54.00	-6.20	Pass	
36387.569	30.60	16.28	-1.09	45.79	AvgMax	V	109	352	54.00	-8.21	Pass	
29501.331	28.29	14.38	0.65	43.32	AvgMax	V	143	210	54.00	-10.68	Pass	
39812.575	45.40	17.17	0.12	62.68	PeakMax	V	115	352	74.00	-11.32	Pass	
27823.394	28.02	13.97	0.02	42.02	AvgMax	V	156	83	54.00	-11.98	Pass	
32079.944	26.00	15.35	0.47	41.83	AvgMax	V	167	124	54.00	-12.17	Pass	
36387.569	45.80	16.28	-1.09	60.99	PeakMax	V	109	352	74.00	-13.01	Pass	
32279.181	25.36	15.39	-0.38	40.37	AvgMax	V	160	0	54.00	-13.63	Pass	
29501.331	43.44	14.38	0.65	58.47	PeakMax	V	143	210	74.00	-15.53	Pass	
32079.944	41.27	15.35	0.47	57.10	PeakMax	V	167	124	74.00	-16.90	Pass	

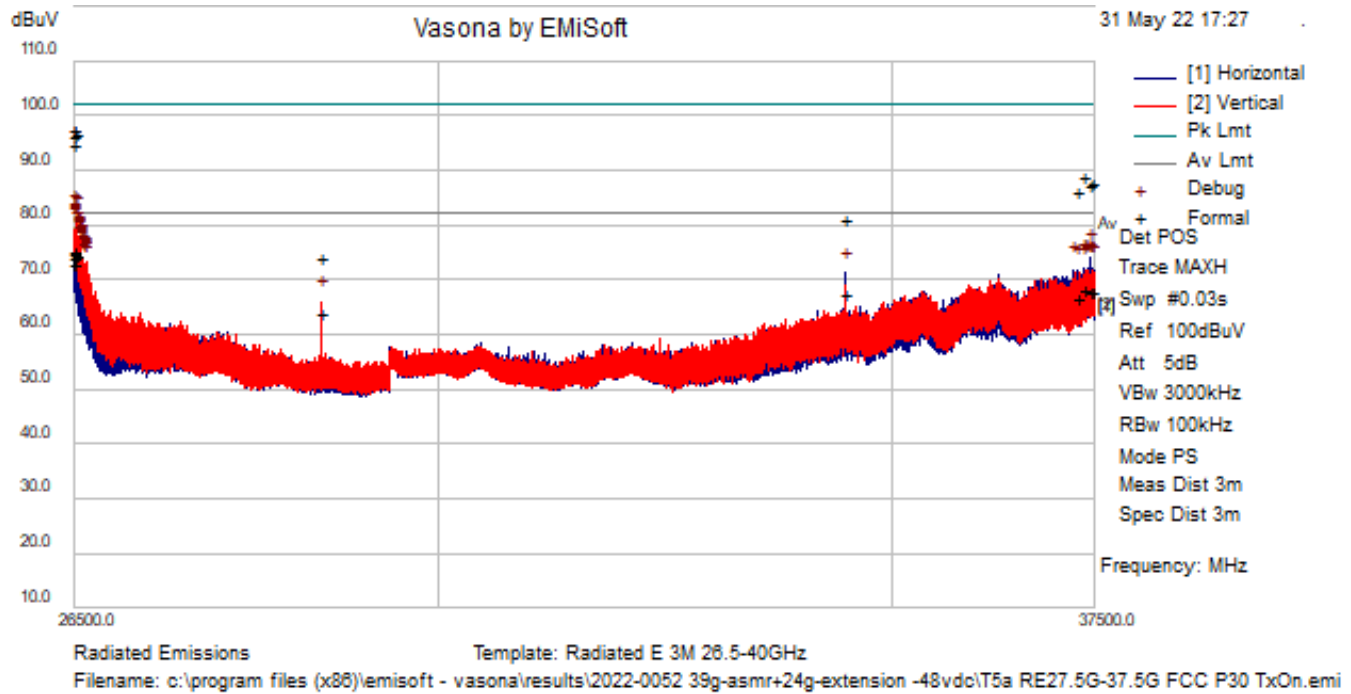
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
27823.394	43.01	13.97	0.02	57.01	PeakMax	V	156	83	74.00	-16.99	Pass	
32279.181	40.77	15.39	-0.38	55.77	PeakMax	V	160	0	74.00	-18.23	Pass	

Preview Data

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
39812.575	35.44	17.17	0.12	52.73	Debug	V	100	88	54.00	-1.27	Pass	
36387.569	34.37	16.28	-1.09	49.56	Debug	V	150	44	54.00	-4.44	Pass	
29501.331	32.74	14.38	0.65	47.77	Debug	V	225	220	54.00	-6.23	Pass	
27823.394	33.25	13.97	0.02	47.24	Debug	V	150	88	54.00	-6.76	Pass	
32079.944	31.22	15.35	0.47	47.05	Debug	V	225	22	54.00	-6.95	Pass	
32279.181	31.33	15.39	-0.38	46.33	Debug	V	150	154	54.00	-7.67	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.

27.5GHz – 37.5GHz TX-ON



Test Information

Results Title	Radiated E 3M 26.5-40GHz
File Name	T5a RE27.5G-37.5G FCC P30 Tx-On.emi
Test Laboratory	MH-AR4, 36.6%RH, 22.8C, 994hPa
Test Engineer	MJS
Test Software	Vasona by EMIsoft, version 6.061
Equipment	Nokia Wireless Group
EUT Details	ASMR 39G Main + 24G Extension (FA3UB) - New FCC Filing for Ext.
Configuration	AR4, Powered by -48Vdc, 39G ASMR - YK212500119 24G Extension - AH212200116. RE 26.5G-37.5GHz, Tx -On, FCC Part 30 limits. DR Horn Antenna E1475, FSW67-E1260, PA-E1525, HPF+ LPF'S Filters-E1361, E1362, E1472, E1473. E1501 and E502 cables. 100k BW Pre / 1M BW Formals
Date	2022-05-31 17:27:03

Formal Data

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
26502.154	46.72	28.61	-0.14	75.19	AvgMax	V	160	350	82.23	-7.04	Pass	
26509.442	46.60	28.42	-0.13	74.89	AvgMax	V	167	345	82.23	-7.34	Pass	
26504.721	66.38	28.54	-0.14	94.79	PeakMax	V	163	352	102.23	-7.44	Pass	
26517.096	46.50	28.21	-0.12	74.60	AvgMax	V	159	345	82.23	-7.63	Pass	
26510.863	45.82	28.38	-0.13	74.07	AvgMax	V	153	350	82.23	-8.16	Pass	
26504.721	44.81	28.54	-0.14	73.22	AvgMax	V	163	352	82.23	-9.01	Pass	
37380.421	64.36	26.12	-1.49	88.99	PeakMax	V	163	169	102.23	-13.24	Pass	
37380.421	43.54	26.12	-1.49	68.17	AvgMax	V	163	169	82.23	-14.06	Pass	
37489.183	42.72	26.73	-1.35	68.10	AvgMax	H	174	170	82.23	-14.13	Pass	
37489.183	62.65	26.73	-1.35	88.03	PeakMax	H	174	170	102.23	-14.20	Pass	

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
37445.825	42.76	26.49	-1.40	67.85	AvgMax	H	168	165	82.23	-14.38	Pass	
34447.382	46.59	21.87	-0.85	67.61	AvgMax	H	168	168	82.23	-14.62	Pass	
37445.825	62.33	26.49	-1.40	87.43	PeakMax	H	168	165	102.23	-14.80	Pass	
37286.600	42.87	25.60	-1.73	66.74	AvgMax	H	172	168	82.23	-15.49	Pass	
37286.600	62.40	25.60	-1.73	86.27	PeakMax	H	172	168	102.23	-15.96	Pass	
28824.167	44.03	19.89	-0.01	63.90	AvgMax	V	156	342	82.23	-18.33	Pass	
34447.382	60.13	21.87	-0.85	81.15	PeakMax	H	168	168	102.23	-21.08	Pass	
28824.167	54.35	19.89	-0.01	74.22	PeakMax	V	156	342	102.23	-28.01	Pass	

Preview Data

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
26504.721	52.56	28.54	-0.14	80.97	Debug	V	175	352	82.23	-1.26	Pass	
26517.096	52.44	28.21	-0.12	80.54	Debug	V	175	352	82.23	-1.69	Pass	
26509.442	51.18	28.42	-0.13	79.47	Debug	V	175	352	82.23	-2.76	Pass	
26502.154	50.60	28.61	-0.14	79.06	Debug	V	175	352	82.23	-3.17	Pass	
26510.863	50.54	28.38	-0.13	78.79	Debug	V	175	352	82.23	-3.44	Pass	
26522.367	50.13	28.08	-0.11	78.09	Debug	V	175	352	82.23	-4.14	Pass	
26523.375	49.96	28.05	-0.11	77.90	Debug	V	175	352	82.23	-4.33	Pass	
26548.171	49.80	27.40	-0.07	77.13	Debug	V	175	352	82.23	-5.10	Pass	
26531.763	48.91	27.83	-0.10	76.64	Debug	V	175	352	82.23	-5.59	Pass	
26540.425	49.09	27.60	-0.08	76.61	Debug	V	175	352	82.23	-5.62	Pass	
26534.833	48.59	27.75	-0.09	76.24	Debug	V	175	352	82.23	-5.99	Pass	
26550.188	48.48	27.35	-0.07	75.75	Debug	V	175	352	82.23	-6.48	Pass	
26553.533	48.25	27.26	-0.06	75.44	Debug	V	175	352	82.23	-6.79	Pass	
26551.150	48.03	27.32	-0.07	75.28	Debug	V	175	352	82.23	-6.95	Pass	
26546.429	47.73	27.44	-0.07	75.10	Debug	V	175	352	82.23	-7.13	Pass	
26556.054	47.75	27.19	-0.06	74.89	Debug	V	175	352	82.23	-7.34	Pass	
26560.821	47.51	27.07	-0.05	74.53	Debug	V	175	352	82.23	-7.70	Pass	
37438.400	49.14	26.45	-1.41	74.19	Debug	H	175	176	82.23	-8.04	Pass	
26573.608	47.02	26.73	-0.03	73.72	Debug	V	175	352	82.23	-8.51	Pass	
26599.779	47.18	26.05	0.00	73.23	Debug	V	175	352	82.23	-9.00	Pass	
26577.779	46.56	26.62	-0.03	73.16	Debug	V	175	352	82.23	-9.07	Pass	
26589.971	46.44	26.30	-0.01	72.74	Debug	V	175	352	82.23	-9.49	Pass	
26592.629	46.12	26.23	-0.01	72.35	Debug	V	175	352	82.23	-9.88	Pass	
26593.775	46.08	26.20	0.00	72.28	Debug	V	175	352	82.23	-9.95	Pass	
26584.288	45.83	26.45	-0.02	72.26	Debug	V	175	352	82.23	-9.97	Pass	
37454.854	47.00	26.54	-1.39	72.15	Debug	H	175	176	82.23	-10.08	Pass	
37407.692	47.23	26.28	-1.44	72.06	Debug	H	175	176	82.23	-10.17	Pass	
37365.479	47.36	26.04	-1.53	71.88	Debug	H	175	176	82.23	-10.35	Pass	
37402.788	47.04	26.25	-1.45	71.84	Debug	H	175	176	82.23	-10.39	Pass	
26594.233	45.57	26.19	0.00	71.76	Debug	V	175	352	82.23	-10.47	Pass	
37467.321	46.48	26.61	-1.37	71.72	Debug	V	175	176	82.23	-10.51	Pass	
37447.750	46.61	26.50	-1.40	71.71	Debug	H	175	176	82.23	-10.52	Pass	
37235.450	48.26	25.37	-1.95	71.67	Debug	H	175	176	82.23	-10.56	Pass	
37489.183	46.27	26.73	-1.35	71.65	Debug	H	175	176	82.23	-10.58	Pass	
26598.313	45.48	26.08	0.00	71.56	Debug	V	175	352	82.23	-10.67	Pass	
37445.825	46.44	26.49	-1.40	71.54	Debug	H	175	176	82.23	-10.69	Pass	
37286.600	47.60	25.60	-1.73	71.47	Debug	H	175	176	82.23	-10.76	Pass	

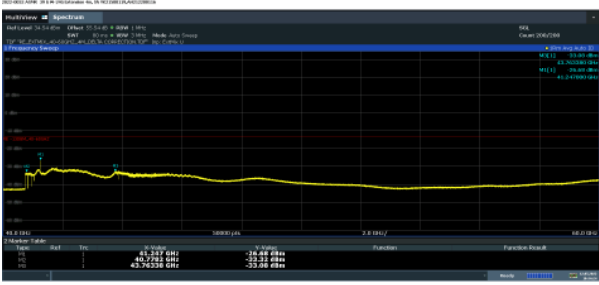
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
37380.421	46.84	26.12	-1.49	71.47	Debug	V	175	176	82.23	-10.76	Pass	
34447.382	49.55	21.87	-0.85	70.57	Debug	H	100	352	82.23	-11.66	Pass	
28824.167	45.62	19.89	-0.01	65.49	Debug	V	100	352	82.23	-16.74	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

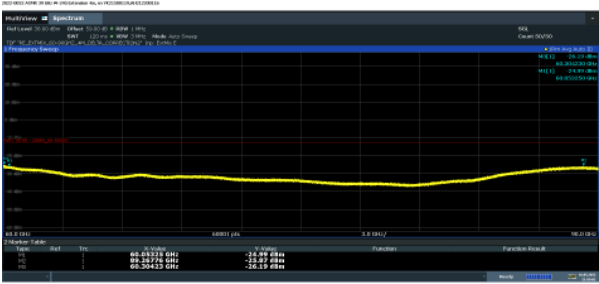
Vertical Polarization – ASMR (170 deg)



Maximum Measured Radiated Emissions -U Band 60GHz-90GHz

FCC Part 30

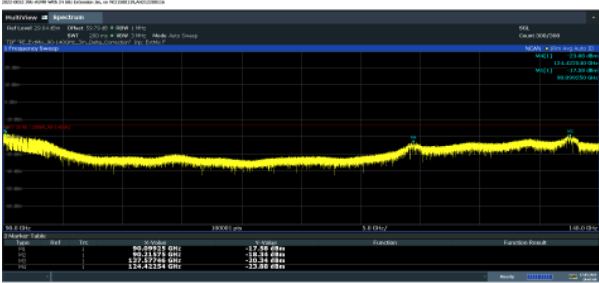
Vertical Polarization – ASMR (160 deg)



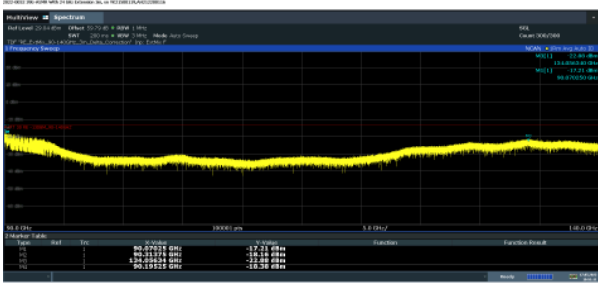
Maximum Measured Radiated Emissions -U Band 90GHz-140GHz

FCC Part 30

Horizontal Polarization – FA3UB (346 deg)

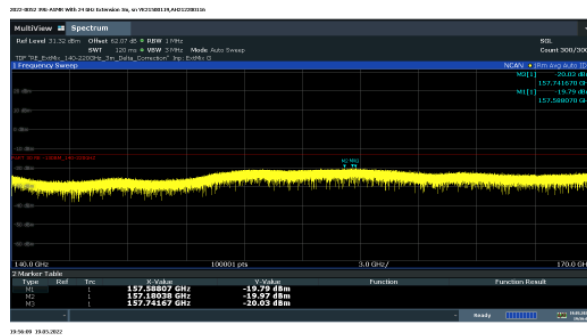


Vertical Polarization – FA3UB (320 deg)

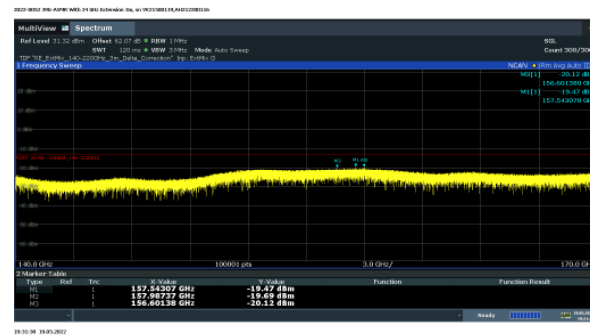


Maximum Measured Radiated Emissions -U Band 140GHz-170GHz FCC Part 30

Horizontal Polarization – FA3UB (350 deg)

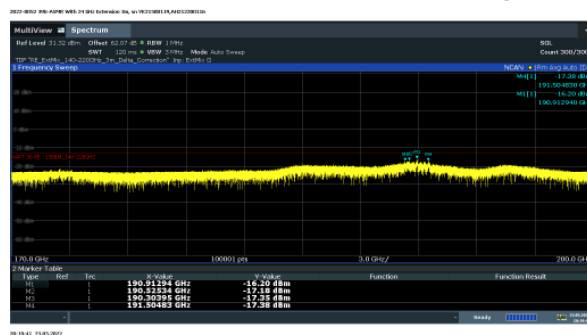


Vertical Polarization – FA3UB (320 deg)

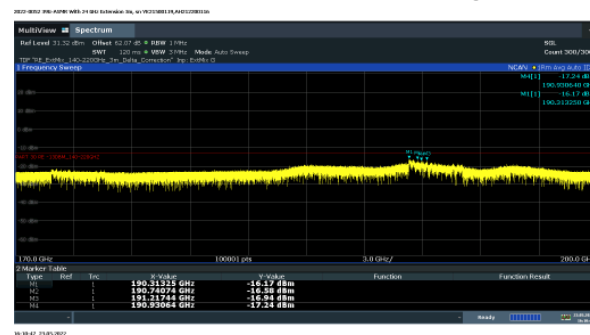


Maximum Measured Radiated Emissions -U Band 170GHz-200GHz FCC Part 30

Horizontal Polarization – FA3UB (343 deg)



Vertical Polarization – FA3UB (341 deg)



4.6 Section 2.1055 MEASUREMENT OF FREQUENCY STABILITY

Frequency Stability not required.

4.7 List of Test Equipment

4.7.1 List of Radio Measurements Test Equipment

Asset ID	Manufacturer	Type	Description	Model	Serial	Calibration Date	Calibration Due
E1461	A-Info	Horn Antenna	22 - 33 GHz WR34 25dB	LB-34-25-C2-KF	J202026030	2022-01-25	2024-01-25
E1375	A-Info	Horn Antenna	26.5-40GHz WR28 25 dB	LB-28-25-C2-KF	J202023249	2020-07-27	2023-07-27
E1119	Extech	Data Logger	Pressure Humidity Temp data logger	SD700	Q668960	2021-01-11	2023-01-11
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	2022-08-25

Test Dates: 6/13/2022 – 6/20/2022

4.7.2 List of Radiated Emissions Test Equipment

Asset ID	Manufacturer	Type	Description	Model	Serial	Calibration Date	Calibration Due
E766	A.H. Systems Inc.	Biological Antenna	25 - 2000 MHz	SAS-521-2	457	2021-05-18	2023-05-18
E1150	Extech	Data Logger	Pressure Humidity Temp Data Logger	SD700	Q752767	2021-01-11	2023-01-11
E483	Kikusui	Power Supply	DC 55 Volts 120 Amps	PAD 55- 120L	DM000112	CNR	CNR
E812	Sonoma Instrument Co.	Amplifier	9kHz-1GHz	310N	186744	2020-10-20	2022-10-20
E1268	Trilithic	Filter, Low Pass	DC - 1620 MHz	23042	200802040	CNR-V	CNR-V

Asset ID	Manufacturer	Type	Description	Model	Serial	Calibration Date	Calibration Due
E1452	A-Info	Horn Antenna	18 to 26.5 GHz WR42 25 dB	LB-42-25- C2-KF	J202066361	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	3117	00135198	2022-01-04	2024-01-04

Asset ID	Manufacturer	Type	Description	Model	Serial	Calibration Date	Calibration Due
			Horn 1-18 GHz				
E447	Hewlett Packard	Pre-Amplifier	Preamplifier 1-26.5 GHz	8449B	3008A01384	2020-08-31	2022-08-31
E1361	Marki Microwave	Filter, Low Pass	DC - 36.6 GHz, 1W, 1.8 dB	FLP-3660	N/A	CNR-V	CNR-V
E1362	Marki Microwave	Filter, Low Pass	DC - 36.6 GHz, 1W, 1.8 dB	FLP-3660	N/A	CNR-V	CNR-V
E1472	Reactel, Inc.	Filter, High Pass	1 - 27 GHz, 2dB	11HS-X27G-K11	SN20-02	CNR-V	CNR-V
E1473	Reactel, Inc.	Filter, High Pass	DC - 27 GHz	11HS-X27G-K11	SN20-02	CNR-V	CNR-V
E1475	Reactel, Inc.	Filter, Low Pass	DC - 20 GHz	11LS-X20GS11	SN20-02	CNR-V	CNR-V
E1498	Reactel, Inc.	Filter, Low Pass	DC - 22 GHz, 1 dB	11LS-X22-6GK11	20-01	N/A	N/A
E1499	Reactel, Inc.	Filter, Low Pass	DC - 22 GHz, 1 dB	11LS-X22-6GK11	20-02	N/A	N/A
E1260	Rohde & Schwarz	Spectrum Analyzer		FSW67	104007	2020-08-21	2022-08-21

CNR: Calibration Not Required

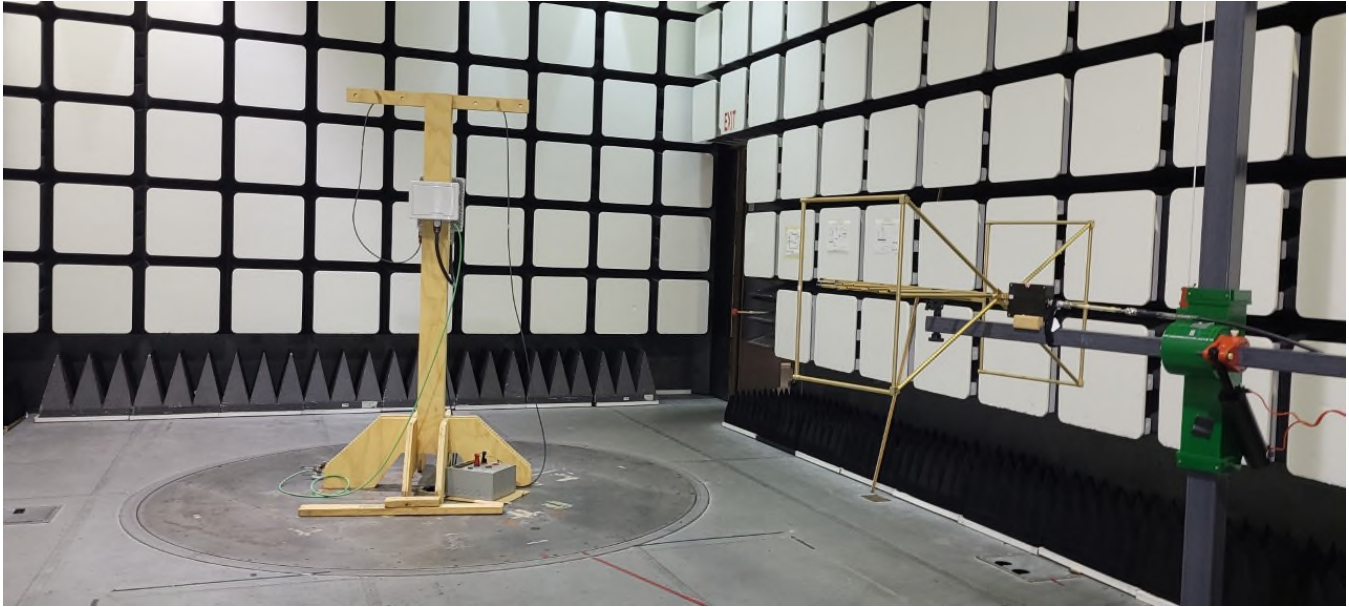
CNR-V: Calibration Not Required, Must Be Verified

Test Dates: 5/12/2022 – 6/2/2022

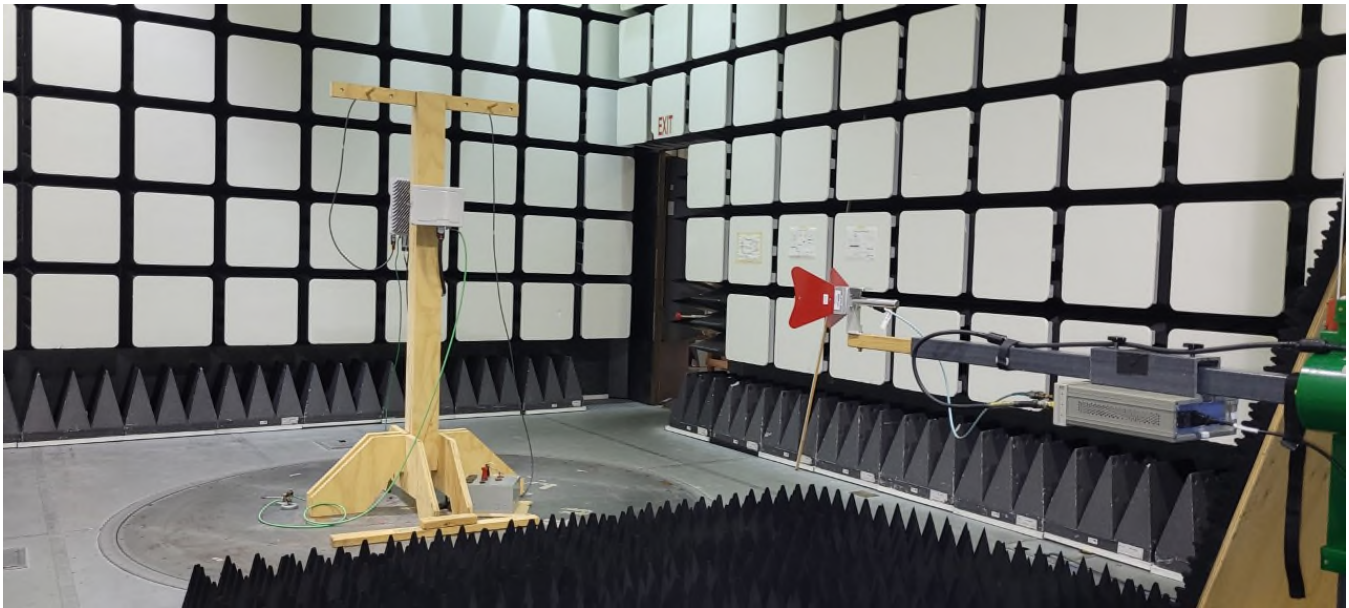
4.8 PHOTOGRAPHS OF THE TEST SETUPS

Radiated Emissions Test

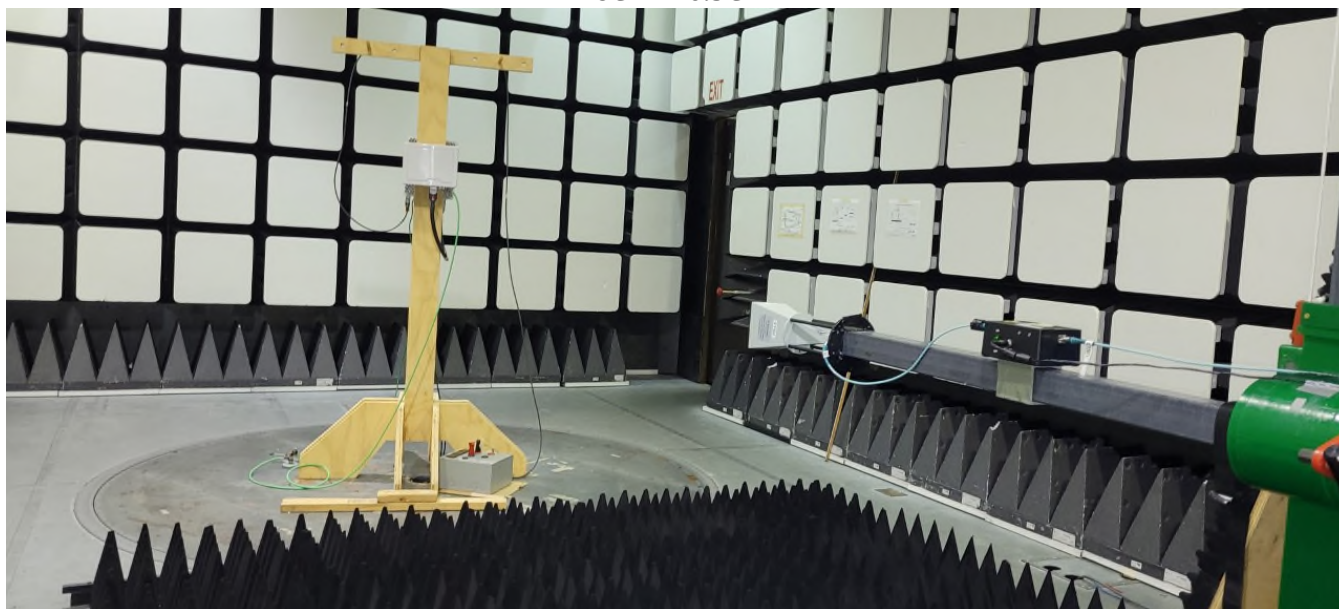
30 MHz-1 GHz



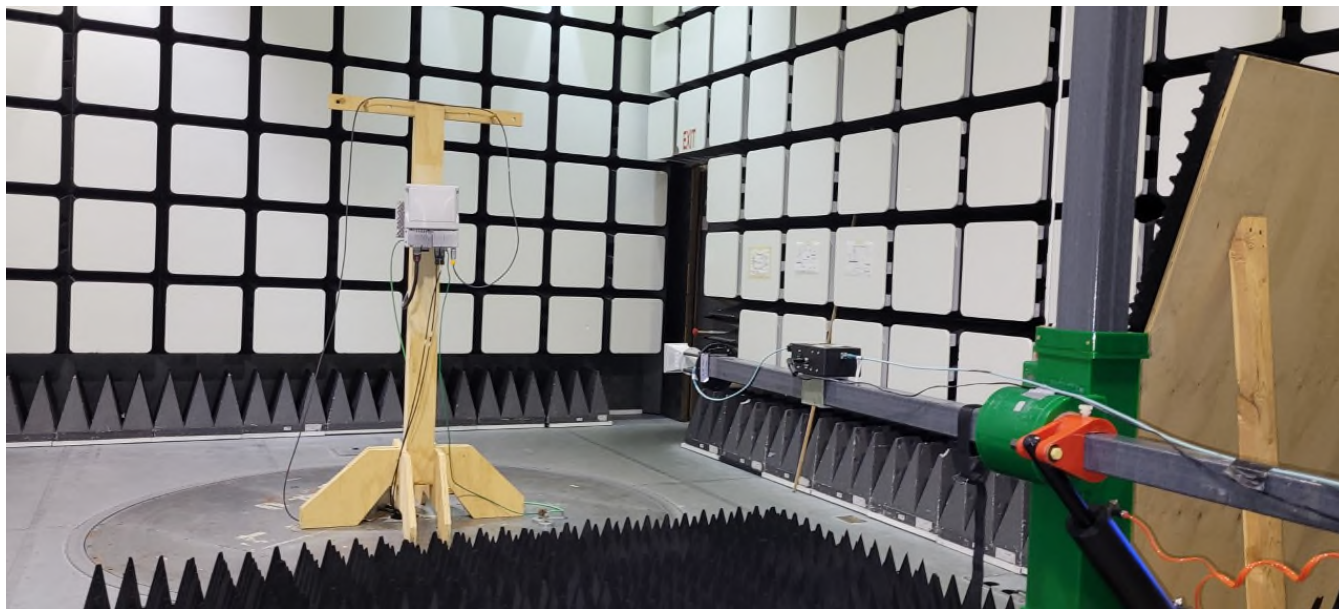
1 GHz – 18 GHz



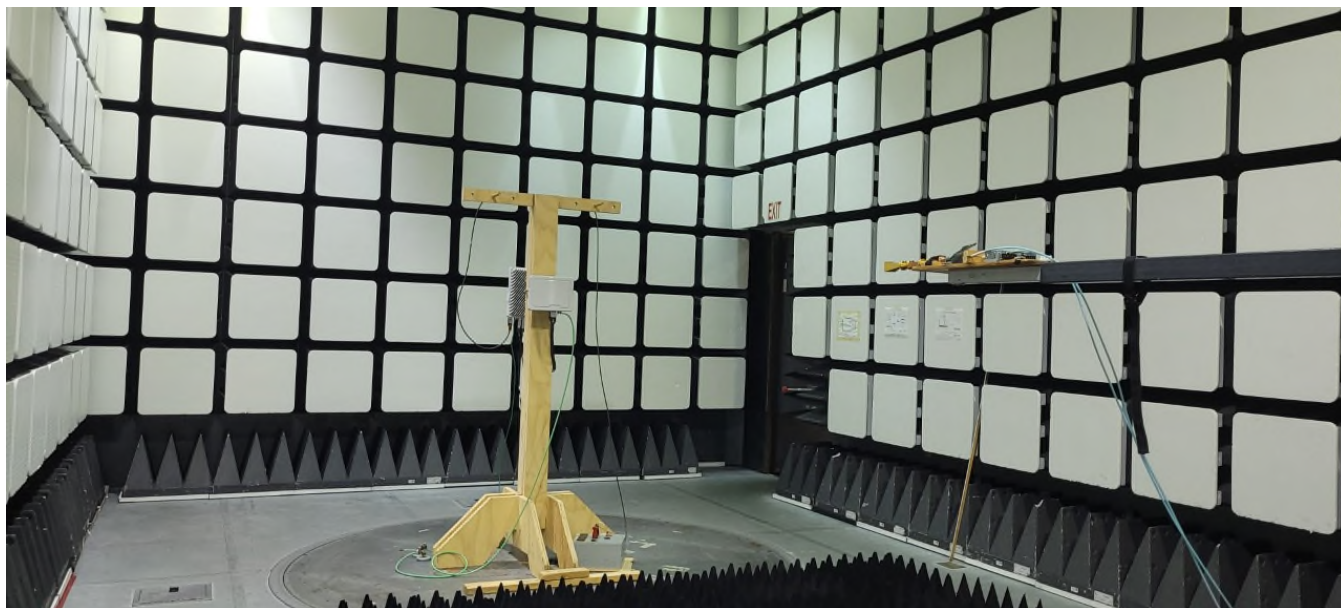
18GHz-26.5GHz



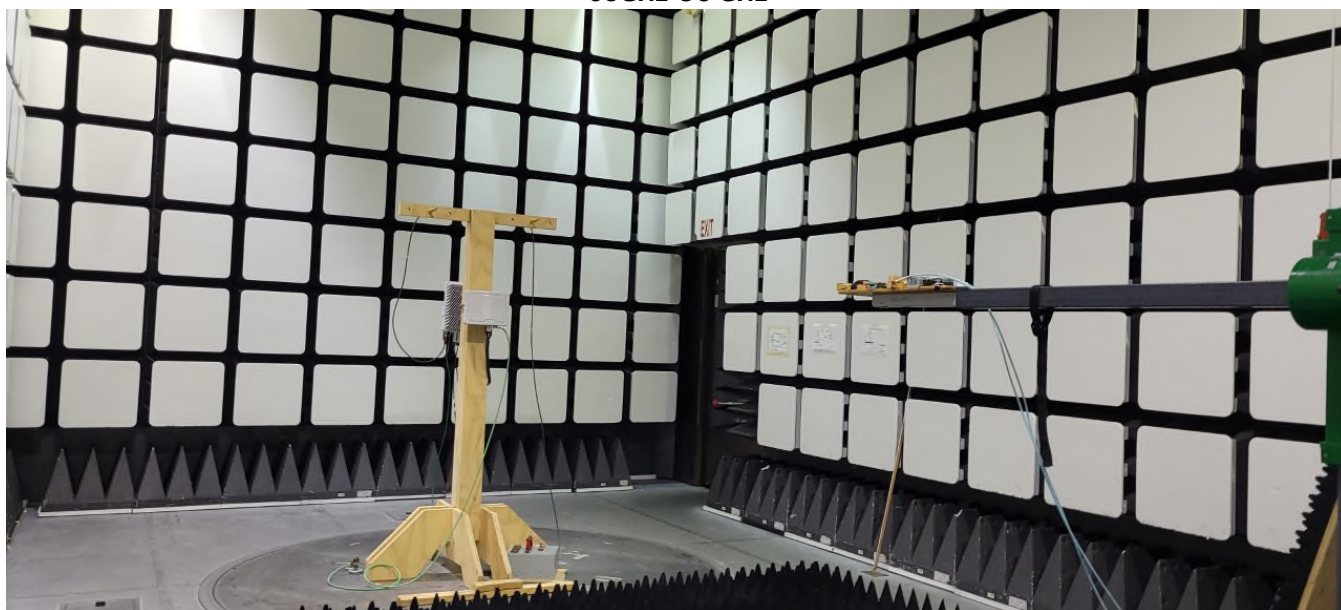
26.5GHz-40 GHz



40GHz-60 GHz



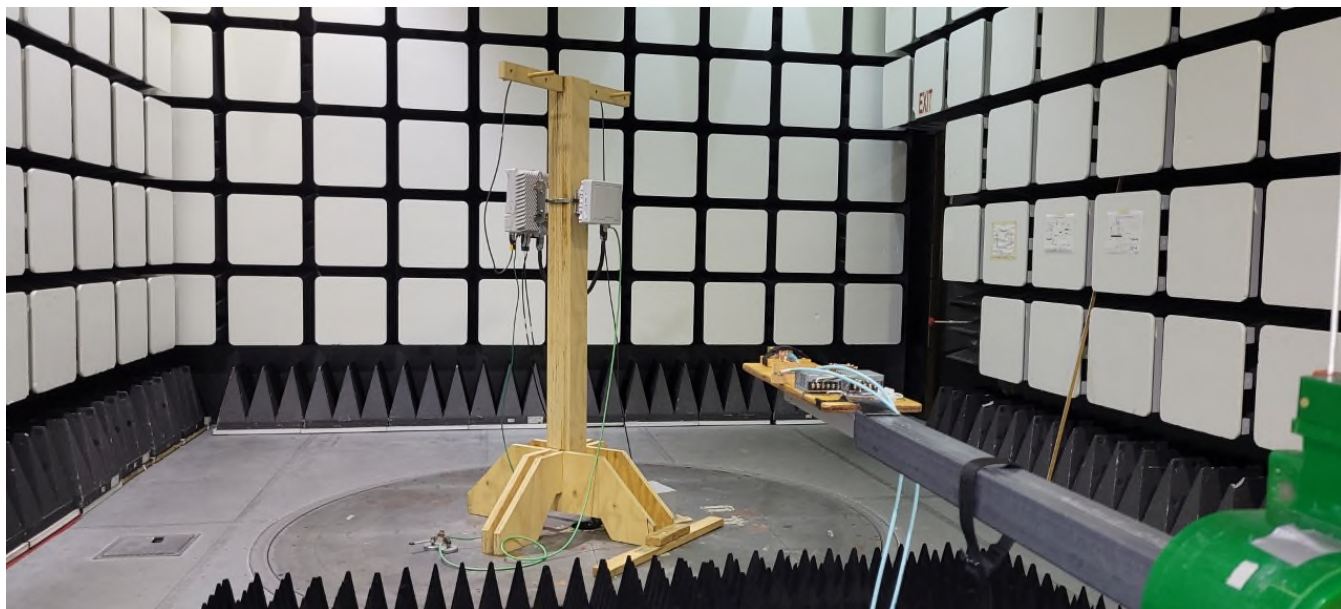
60GHz-90 GHz



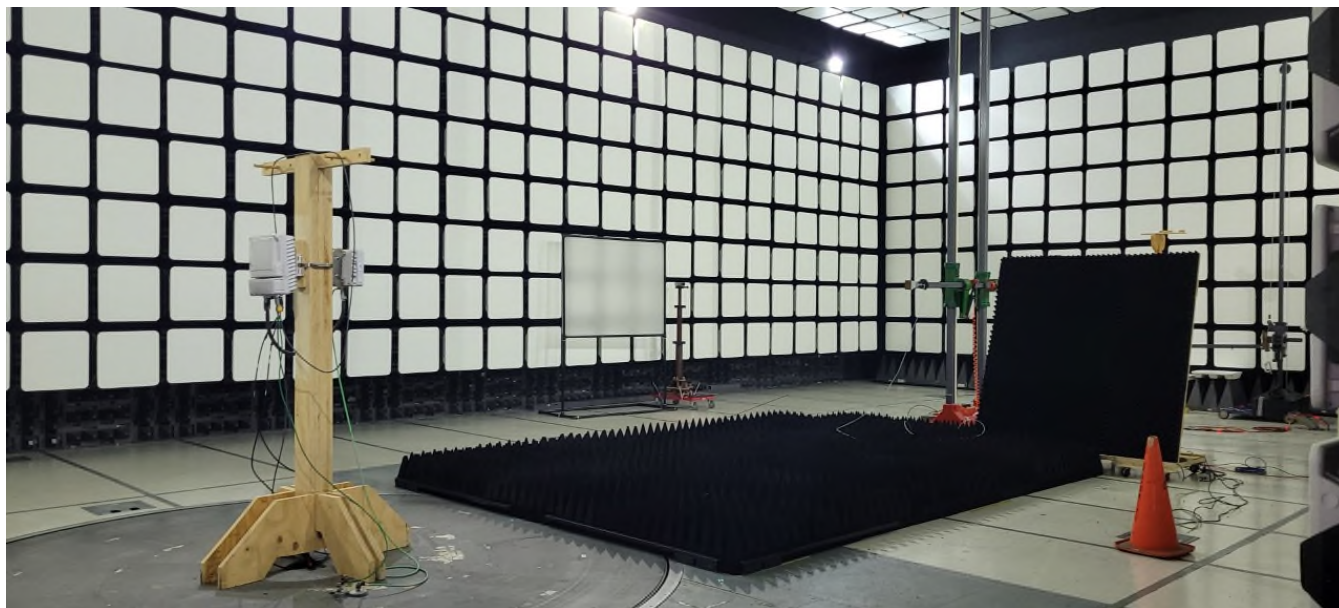
90GHz-140 GHz



140GHz-200GHz



Radio Testing



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-4, (FCC Registration Number: 395774) **NVLAP** Lab Code: 100275-0 and IC (Filing Number: 6933F-5) 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®num_specified=N&test_firm_id=7007

United States Department of Commerce
National Institute of Standards and Technology



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

A handwritten signature in blue ink, reading "Dana S. Laman".

For the National Voluntary Laboratory Accreditation Program

5. APPENDIX A - CALIBRATION CERTIFICATES.

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