NOKIA Bell Labs

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TESTING
NVLAP LAB CODE: 100275-0

FCC Certification Part 30 Test Report

Regulation:
FCC Part 30

Client:
NOKIA SOLUTIONS AND NETWORKS

Product Evaluated
AWKUA (AC) / AWKUB (DC) 28GHz

Report Number:
TR-2024-0032-FCC30

Date Issued:
September 27, 2024

Revisions

Date	Revision	Section	Change
9/15/2024	0		Initial Release
9/27/2024	1.0	All	Revised report to 69 dBm/Pol 72 dBm Total Power

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Table of Contents

1. ATTESTATION OF TEST RESULTS

Company Name	Nokia Solutions and Networks, OY
FCC ID	2AD8UAWKUAB01
Product Name	AWKUA (AC) / AWKUB (DC) 28GHz
Part No	Refer to Section 3.1
Serial Number(s)	Refer to Section 3.1
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 v01r02–April 2021 • 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) • ETSI TS 138 141-2 V15.17.0 5G; NR; Base Station (BS) conformance testing Part 2: Radiated conformance testing (2023-05)
Test Date	7/11/2024 – 9/13/2024
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)	Jeff Webb
Lead Engineer	W. Steve Majkowski
Test Engineer (s)	W. Steve Majkowski, Mike Soli, Hussain Saifnijat
Test Results: The EUT, as tested met the above listed Test Requirements. The decision rule employed is binary (Pass/Fail) based on the measured values without accounting for Measurement Uncertainty or any Guard Band. The measured values obtained during testing were compared to a value given in the referenced regulation or normative standard. Report copies and other information not contained in this report are held by either the product engineer or in an identified file at the Global Product Compliance Laboratory in New Providence, NJ.	

2. SUMMARY OF THE TEST RESULTS

47 CFR FCC Sections	Description of Tests	Compliance Results
2.1046, 30.202 (a)	RF Power Output	Pass
2.1047	Modulation Characteristics	Pass
2.1049, 30.203	(a) Occupied Bandwidth (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	Pass

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 30 MHz – 200 MHz V 200 MHz – 1000 MHz H 200 MHz – 1000 MHz V 1 GHz- 18 GHz	±5.4 dB ±5.4 dB ±4.7 dB ±4.7 dB ±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	AWKUA (AC) / AWKUB (DC) 28GHz
Radio Type	Intentional Transceiver
Power Type	Both DC & AC
Modulation	QPSK, 16QAM, 64QAM
Operating Frequency Range	26.5-29.5 GHz
Channel Bandwidth	100MHz
Max Radiated Power	69 dBm per unit per polarization 72 dBm Total per unit
Antenna Gain	(2T2R) 31 dBi (72 dBm) (4T4R) 28 dBi (69 dBm) (8T8R) 25 dBi (66 dBm)
Operating Mode	2x / 4x / 8x MIMO (2 duplex Tx/Rx Ports) each unit
Software Version	SBTS22R3
Hardware Version	DC Version: 476238A.X22 AC Version: 476237A.X22
Antenna(s)	Refer to Section 3.2

AC Unit

DC Unit

3.2 EIRP/ PSD Compliance and Antenna Information.

The product incorporates integrated antennas. Externally mounted antennas cannot be attached to the unit or mounted remotely. The units integrated antennas are electronically steerable with a maximum gain that exceeds 30 dBi. There is a single antenna board assembly inside the product. This antenna assembly has polarized antenna Tx/Rx modules. The antennas nominal RF drive level is 39 dBm per polarization. The 39 dBm RF power and 30 dBi gain results in a 69 dBm EIRP per polarization. The sum of the two 69 dBm EIRP beams results in a maximum total EIRP of 72 dBm. Antenna Gain vs frequency is detailed in Exhibit 6 of the filing package.

3.3 Antenna Far Field Determination Distance

The Moongilan Test (1) 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

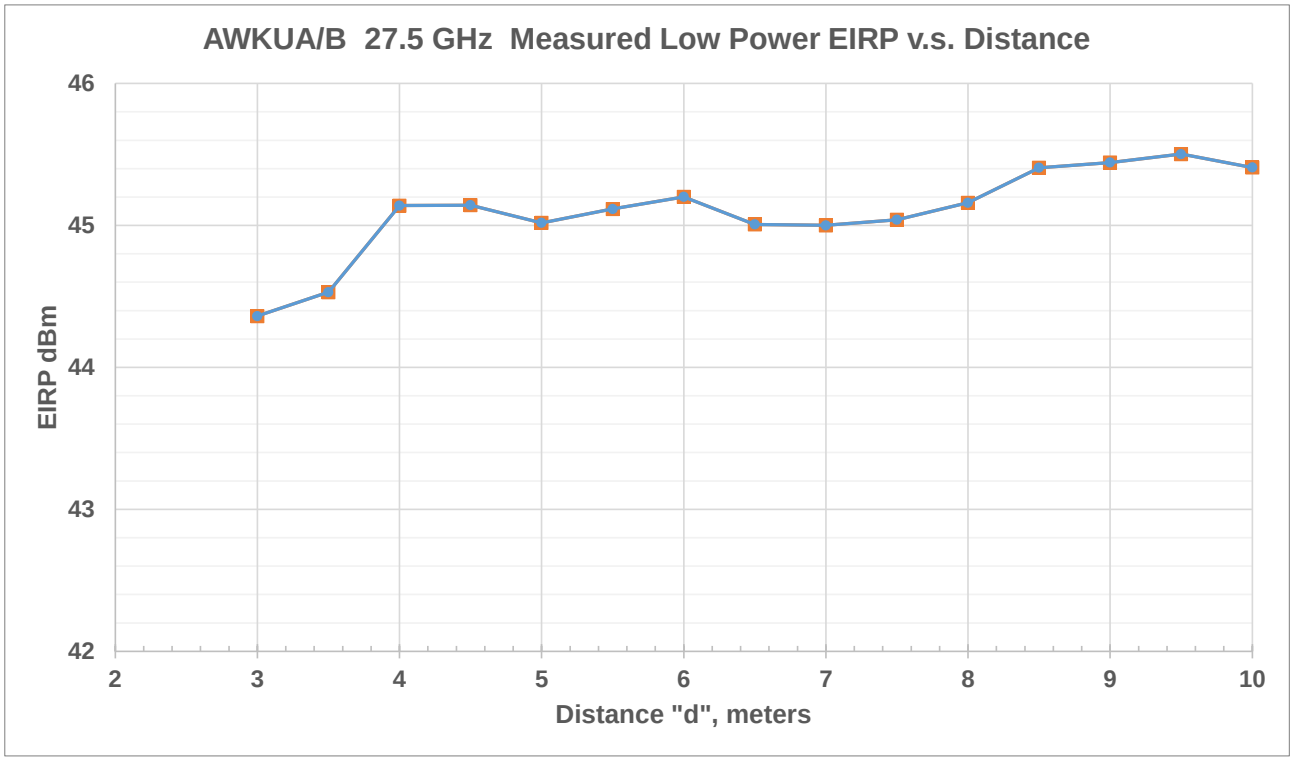
The individual polarization antenna array has a 20 cm diagional. At 27.5 GHz the individual array dimensions results in a minimum Fraunhofer far field distance, $d_{ff,}$ of 7.33 meters.

While the Fraunhofer far field distance is the minimum predictable distance where the far field can occur, it does not predict the actual distance where the far field occurs. The Moongilan Test determines the actual distance where the far field power is constant and where it actually occurs for the specific product under test.

The Moongilan Test was performed at low power using a standard gain horn antenna. In the vertical polarization the reliable far field distance was determined to be at 7.0 m. The results are shown below.

To eliminate any inconsistancy all Power, OBW and OOBE measurements were made at 7.0 m.

(1) The Moongilan Test is named in honor of the late Dheena Moongilan who discovered it and formulated its use into C63.26.



3.4 Product Operational Configuration and RF Test Model

Three 3GPP Test Models for 5G New Radio (NR) in Frequency Range 2 (FR > 6GHz) were used in the performance of these tests. They are:

NR FR2 Test Model 1.1	Typically called NR-FR2-TM1.1 or **QPSK**
NR FR2 Test Model 3.1	Typically called NR-FR2-TM3.1 or **64QAM**
NR FR2 Test Model 3.1N	Typically called NR-FR2-TM3.1N which is **QPSK + 16QAM**

Testing was performed for one through five carriers placed at the left , middle and right side of band. The six, seven and eight carriers configurations were placed at the left and right side of band. All of these configurations were for the same 69 dBm per polarization / 72 dBm total power setting. Their was no discernable worst case configuration for spurious emissions outside the band. The single carrier Max power did show greater spectral regrowth along side the carrier, as would be expected for this max PSD configuration, but it was fully compliant. All the channel configurations of 1 through 8 carriers were tested.

47CFR Part 30 does not specify any Modulation requirements, however 3GPP has identified the appropriate worst case test model to use for specific tests. These are identified in in section 4.9.2 of TS 138 141-2 V15.17.0 (2023-05) Specifically the NR-FR2-TM1.1 or **QPSK**, which is identified within this document as **QPSK**, is the required 3GPP industry standard Test Model for

- Radiated transmit power
- BS output power
- Transmiter off radiated emissions
- Unwanted emissions
- Occupied bandwidth
- ACLR
- Time Alignment Error
- Operating band unwanted emissions
- Transmitter spurious emissions
- Receiver spurious emissions

The major fixed parameters of the transmit signal were:

Table 3.4-1 Transmit Signal Parameters

Number of Resource Blocks	66
Resource Blocks Bandwidth	1.44 MHz
Nominal Signal Bandwidth	100 MHz
Minimum Signal Bandwidth	94.05 MHz
Sub-Carrier Spacing	120 kHz

Specific physical channel parameters for NR-FR2-TM1.1 are defined in the table below.

Table 3.4-1 Specific Physical Channel Parameters for NR-FR2-TM1.1

Parameter	Value
Number of PRBs PDSCH $\eta_{RNTI} = 0$	N_{RB} - 3
Modulation of PDSCH $\eta_{RNTI} = 0$	QPSK
RB starting location of PDSCH $\eta_{RNTI} = 0$	3
Modulation of PDSCH $\eta_{RNTI} = 0$	QPSK
RB starting location of PDSCH $\eta_{RNTI} = 0$	0

There are four additional tables of other commom fixed parameters which are documented in Tables 4.9.2.2-1, 4.9.2.2-2, 4.9.2.2-3, 4.9.2.2-4. of TS 138 141-2 V15.17.0(2023-05). All other parameters, per 3GPP, are varied dynamically. The parameters for the three test models were hard fixed in the test software and were unchanged throughout all tests. Unless otherwise noted radiated spurious emissions measurements were performed with the product configured for a single 28.248GHz QPSK carrier at maximum power.

4. REQUIRED MEASUREMENTS AND RESULTS

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

Table 4.0a Required Certification Measurements

47 CFR FCC Sections	Description of Tests	Test Required for Class I Authorization
2.1046, 30.202 (a)	**RF Power Output** **(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 **30.204, 15.109(a) Class B**	**Field Strength of Spurious Radiation**	**Yes**
2.1055	**Measurement of Frequency Stability**	**Yes**

The measurements were conducted in accordance with the procedures set out in Section 2.1041 and as appropriate per the test Standards listed in Table 4.0b below. The comprehensive list of tests performed included measurements at Left, Center and Right side of the Part 30 Band. These tests are presented to demonstrate compliance with FCC requirements. The Product was configured with the appropriate 3GPP test models per TS 138 141-2 V15.17.0 (2023-05) section 4.2.2 as described in 3.4.

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

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

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

Test Standard(s)	• 47 CFR FCC Parts 2 and Part 30 • 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 v01r02–April 2021 • 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) • ETSI TS 138 141-2 V15.17.0 (2023-05) 5G; NR; Base Station (BS) conformance testing Part 2: Radiated conformance testing

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 a measurement of the total radiated power in terms of the maximum EIRP radiated by the product.

The FCC requirements under Part 30 limits the average power of the sum of all antenna elements to an equivalent isotopically radiated power (EIRP) density of +75dBm/100 MHz.

The **Nokia AWKUA (AC) / AWKUB (DC) 28GHz Radio Unit FCC ID: 2AD8UAWKUAB01** is a 5G-NR Remote radio head that can be configured for one to eight carrier operation. It is specified to provide a maximum power output of 69 dBm /7943 W EIRP per transmit polarization for a sum total of 72 dBm /15886 W EIRP. The product is designed for the 5G global market including operation per 47 CFR Part 30 rules for use in the USA authorized n261 portions of the 5G New Radio Band, 27.5 – 28.35 GHz. In the US market operation will be limited to 8 carriers of operation.

4.1.1 RF Power Output Measurement

The product was configured for test as shown in Figure 4.1.1 below and allowed to warm up and stabilize per KDB 971168 D01 and ANSI C63.26. The Product was configured with the appropriate 3GPP test models per TS 138 141-2 V15.17.0 (2023-05) and as identified on the results tables.

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 7.0 m distance using a nominal 82 dB offset. An additional FSW transducer correction factor is used to ascertain the actual measured EIRP power. The calculation of path loss, cable loss and measurement antenna gain are listed in Table 4.1.1. below. The unit was configured to transmit at its maximum power.

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

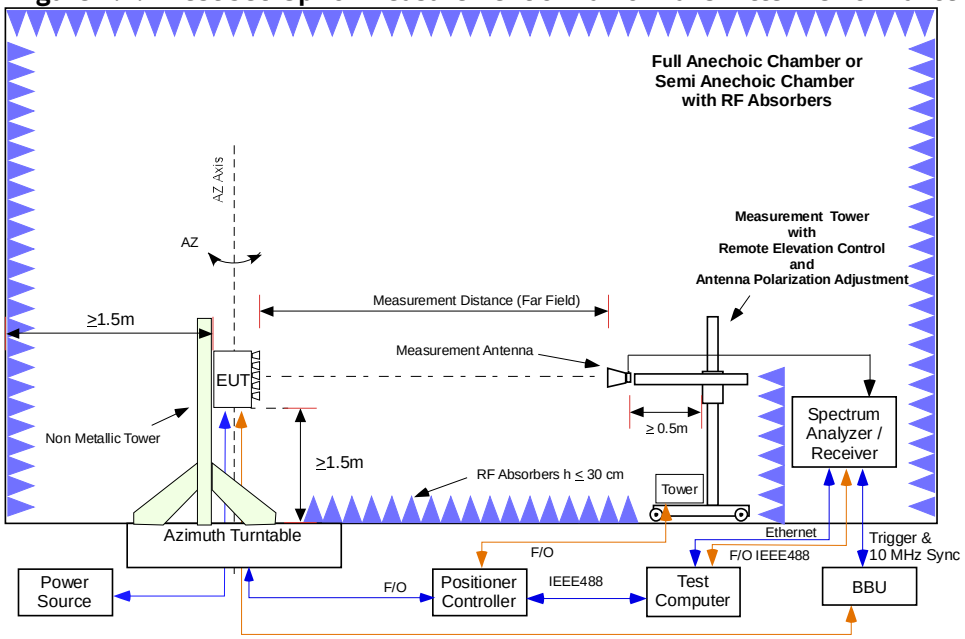


Table 4.1.1 Corrections For Transmitter Power Measurements

Frequency	Free Space Path Loss, "PL"	Measurement Antenna Gain, "G1"	Measurement Cable Loss, "L1"	Total Offset Required PL -G1 + L1	FSW Measurement Offset	Required Final Correction
GHz	dB	dBi	dB	dB	dB	dB
26.50	77.81	22.989	27.887	82.71	82	0.706
27.00	77.97	22.883	27.949	83.04	82	1.037
27.50	78.13	23.078	28.107	83.16	82	1.159
28.00	78.29	23.438	28.200	83.05	82	1.049
28.50	78.44	23.216	28.333	83.56	82	1.557
29.00	78.59	23.581	28.537	83.55	82	1.548
29.50	78.74	23.428	28.642	83.95	82	1.954
30.00	78.89	23.657	28.814	84.04	82	2.043
30.50	79.03	23.766	28.945	84.21	82	2.208
31.00	79.17	23.546	29.118	84.74	82	2.743
31.50	79.31	24.014	29.240	84.54	82	2.536
32.00	79.45	23.411	29.321	85.36	82	3.357
32.50	79.58	24.398	29.419	84.60	82	2.602
33.00	79.71	23.363	29.613	85.96	82	3.964
33.50	79.84	24.240	29.665	85.27	82	3.269
34.00	79.97	23.898	29.643	85.72	82	3.719
34.50	80.10	24.306	29.802	85.60	82	3.596
35.00	80.23	24.098	29.890	86.02	82	4.017
35.50	80.35	23.932	30.104	86.52	82	4.520
36.00	80.47	24.527	30.291	86.23	82	4.233
36.50	80.59	23.453	30.419	87.56	82	5.555
37.00	80.71	24.568	30.628	86.77	82	4.768
37.50	80.82	23.458	30.768	88.13	82	6.134

4.1.1.1 RF Power Output Results

Power output measurements verified the expected performance of 69 dBm EIRP per polarization for a Total Power of 72 dBm. The maximum measured level was 69.86 dBm for a single polarization and 72.46 dBm total. This level is well within the maximum Part 30.202(a) limit of 75 dBm EIRP.

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

Table 4.1.1.1 – Channel Power Measurements

Channel Center Frequencies, GHz	# of carriers	Modulation	Horizontal Polarization	Vertical Polarization	Sum Total Channel Power	Margin to Part 30.202a Limit
			Total Channel Power, EIRP	Total Channel Power, EIRP	EIRP	
			dBm	dBm	dBm	dB
27.54996	1	QPSK	**69.64**	**69.25**	**72.46**	**2.54**
27.79332	1	QPSK	68.51	67.67	71.12	3.88
28.24884	1	QPSK	68.89	**69.86**	72.41	2.59
27.6498	2	QPSK	**68.75**	**69.16**	**71.97**	**3.03**
27.54996						
27.94932	2	QPSK	68.20	67.15	70.72	4.28
27.84948						
28.149	2	QPSK	68.06	69.63	71.93	3.07
28.24884						
27.54996	3	QPSK	**69.11**	**69.32**	**72.23**	**2.54**
27.6498						
27.74964						
27.84948	3	QPSK	67.22	68.16	70.23	3.54
27.94932						
28.04916						
28.04916	3	QPSK	67.44	68.64	71.09	4.54
28.149						
28.24884						
2754996	4	QPSK	67.25	66.07	69.71	5.29
27.6498						
27.74964						
27.84948						
27.74964	4	QPSK	67.12	67.47	70.31	4.69
27.84948						
27.94932						
28.04916						
27.94932	4	QPSK	**67.62**	**68.39**	**71.03**	**3.97**
28.04916						
28.149						
28.24884						
27.54996	5	QPSK	67.51	67.38	70.46	4.54
27.6498						
27.74964						
27.84948						
27.94932						
27.84948	5	QPSK	**67.97**	**67.49**	**70.75**	**4.25**
27.94932						
28.04916						
28.149						
28.24884						

Table 4.1.1.1 – Channel Power Measurements *continued*

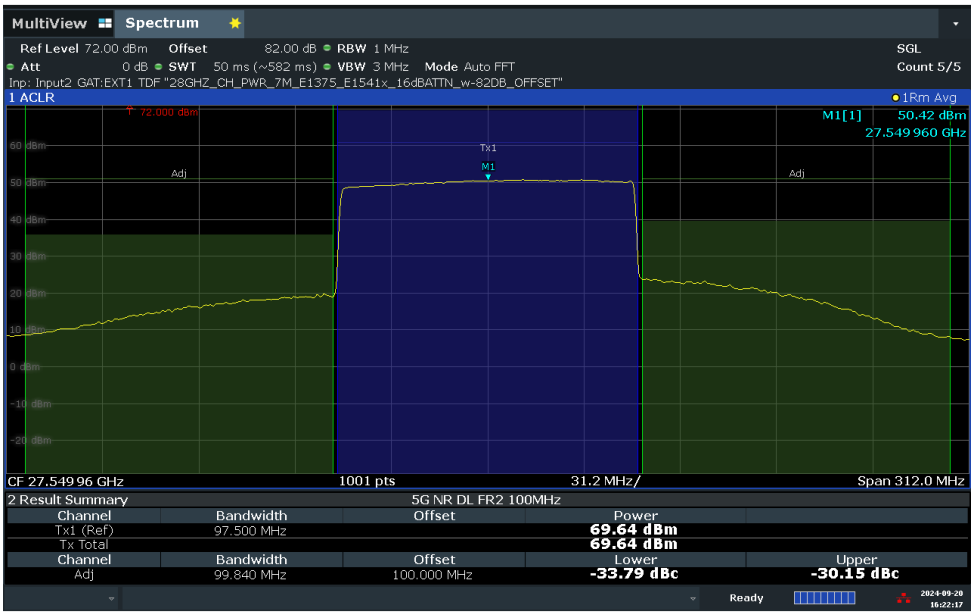
Channel Center Frequencies, GHz	# of carriers	Modulation	Horizontal Polarization	Vertical Polarization	Sum Total Channel Power	Margin to Part 30.202a Limit
			Total Channel Power, EIRP	Total Channel Power, EIRP	EIRP	
27.54996	6	QPSK	**67.68**	**67.21**	**70.46**	**4.54**
27.6498						
27.74964						
27.84948						
27.94932						
28.04916						
27.74968	6	QPSK	67.39	67.37	70.31	4.69
27.84948						
27.94932						
28.04916						
28.149						
28.24884						
27.54996	7	QPSK	66.96	67.47	70.23	4.77
27.6498						
27.74964						
27.84948						
27.94932						
28.04916						
28.149						
27.6498	7	QPSK	**67.17**	**67.31**	**70.25**	**4.75**
27.74968						
27.84948						
27.94932						
28.04916						
28.149						
28.24884						
27.54996	8	QPSK	66.95	66.92	70.14	4.86
27.6498						
27.74964						
27.84948						
27.94932						
28.04916						
28.149						
28.24884						
27.60108	8	QPSK	**67.85**	**67.12**	**70.51**	**4.49**
27.70092						
27.80076						
27.9006						
28.00044						
28.10028						
28.20012						
28.29996						

4.1.1.1.1 Channel Power Measurement Plots

Single Carrier - Bottom

Horizontal

2024-0032 28 GHz AWKUA/B s/n YK240800006



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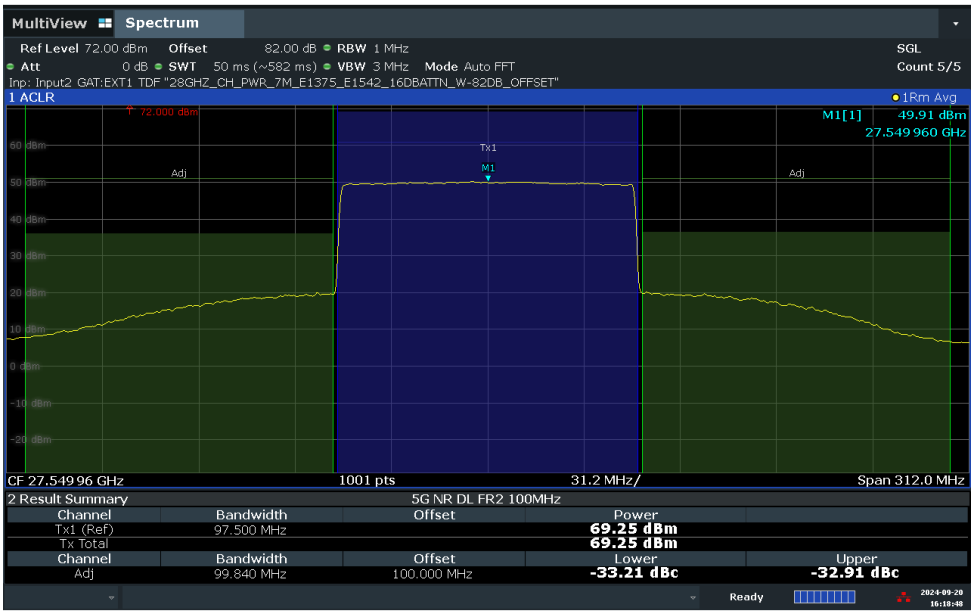
Vertical

2024-0032 28 GHz AWKUA/B s/n YK240800006



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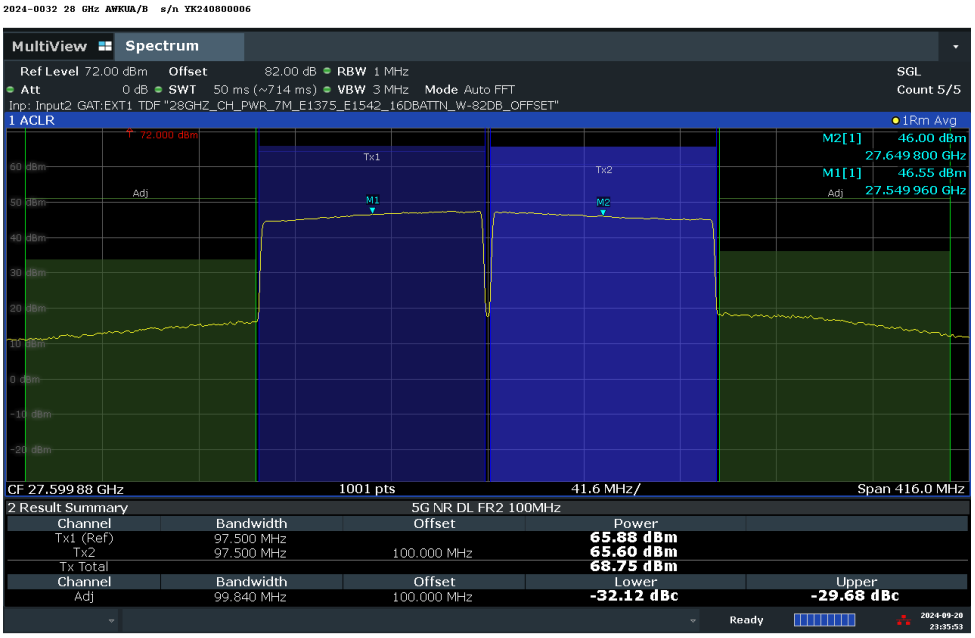
Two Carrier - Bottom

Horizontal



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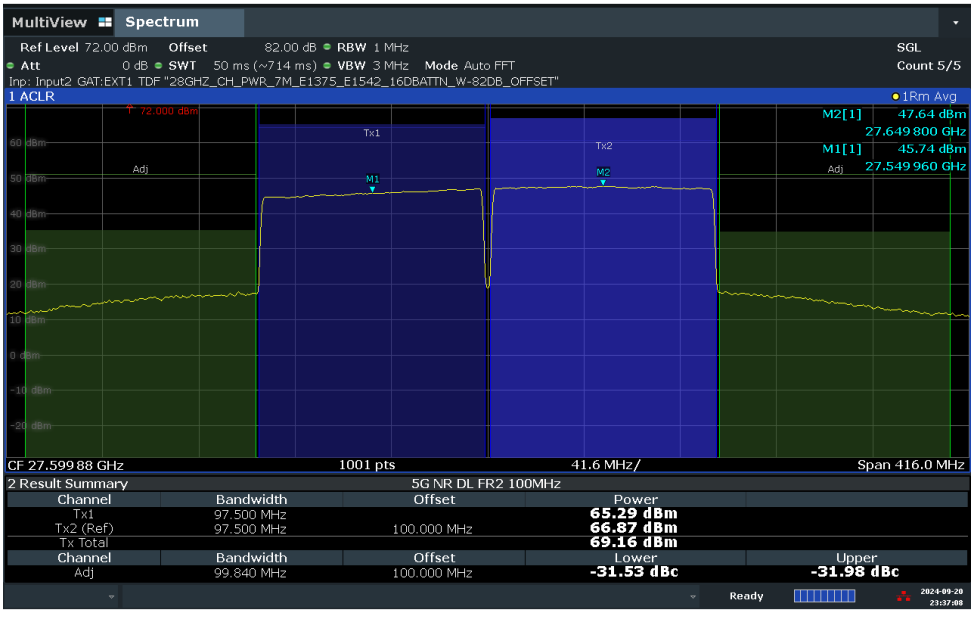
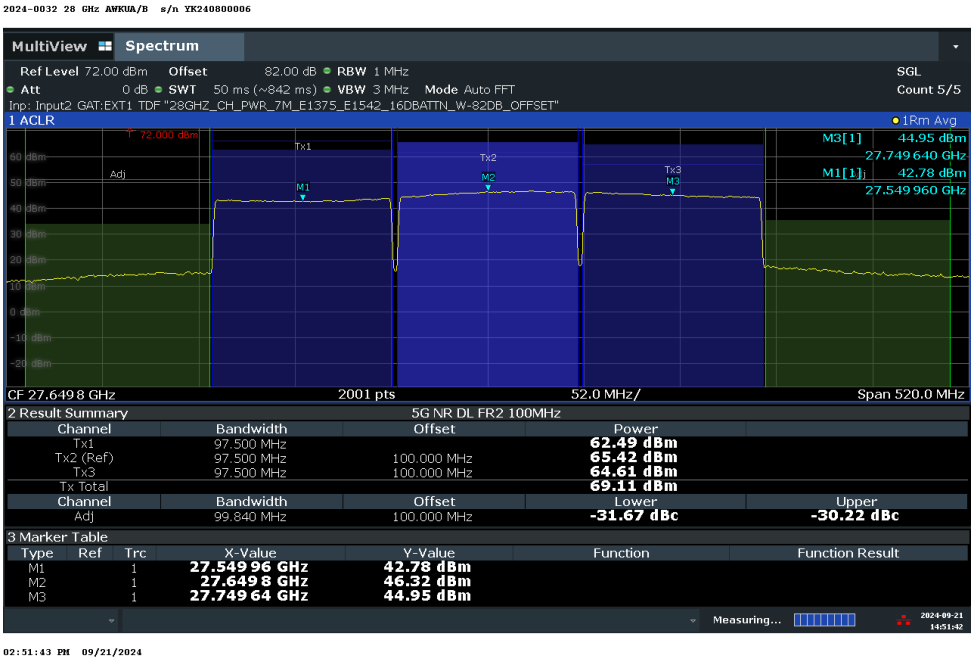


Three Carrier - Bottom

Horizontal



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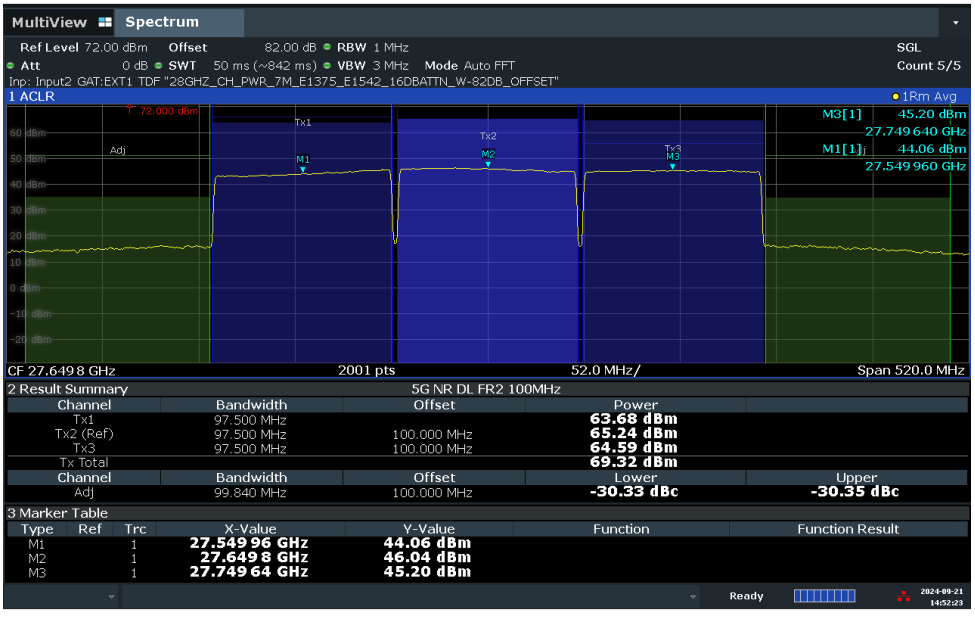
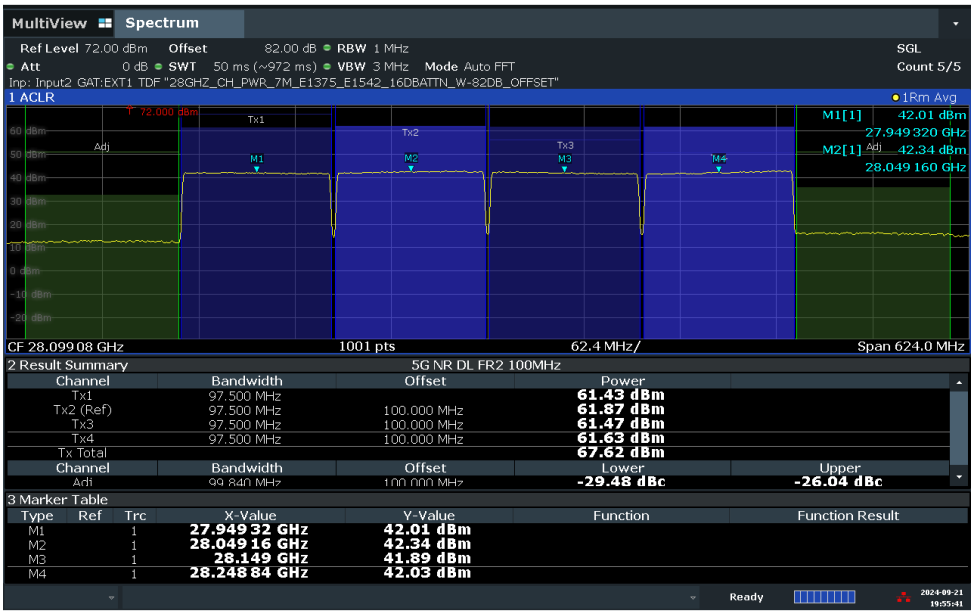


Four Carrier - Top

Horizontal

2024-0032 28 GHz AWKUA/B s/n YK240800006



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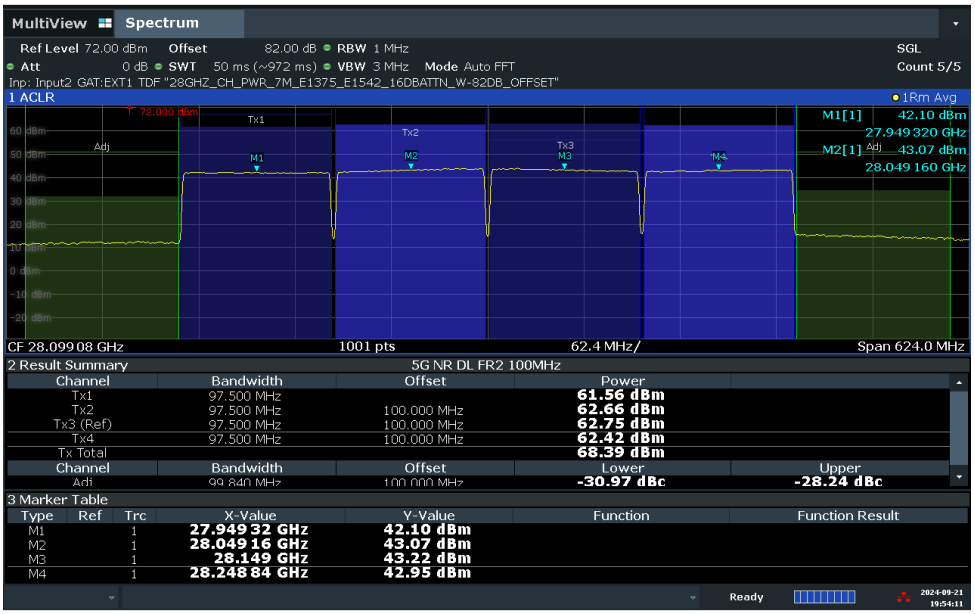
Vertical

2024-0032 28 GHz AWKUA/B s/n YK240800006



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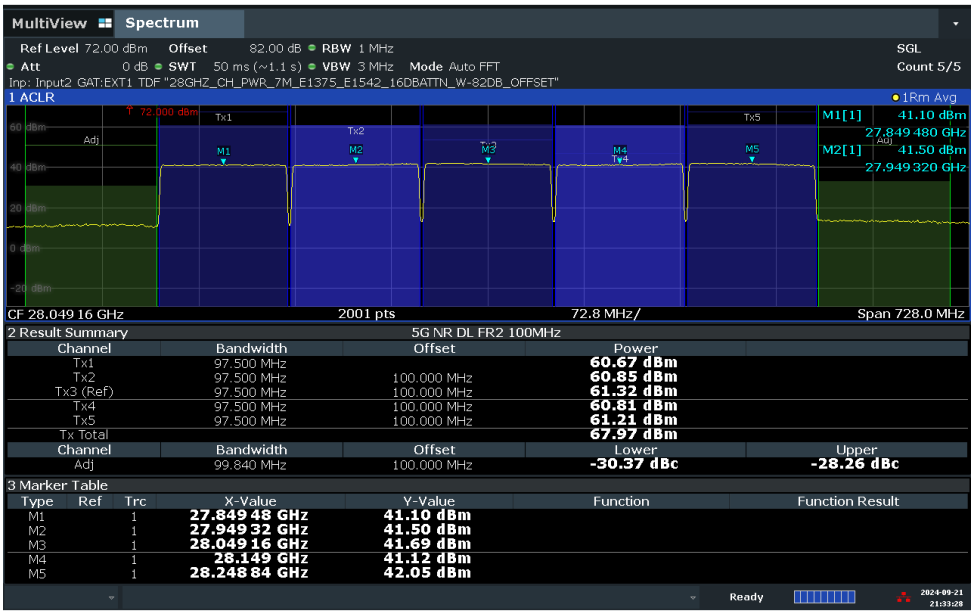
Five Carrier - Top

Horizontal

2024-0032 28 GHz AWKUA/B s/n YK240800006



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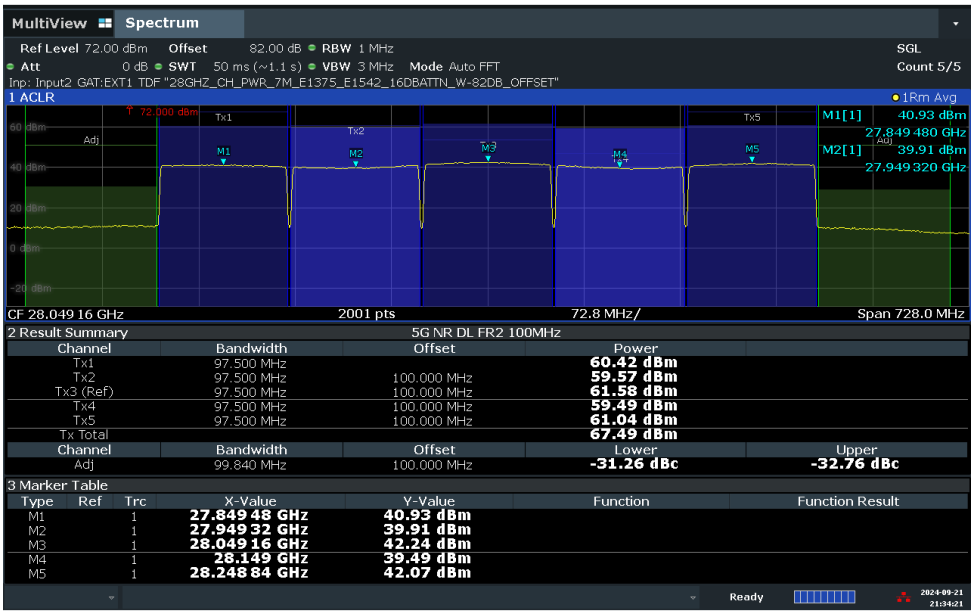
Vertical

2024-0032 28 GHz AWKUA/B s/n YK240800006

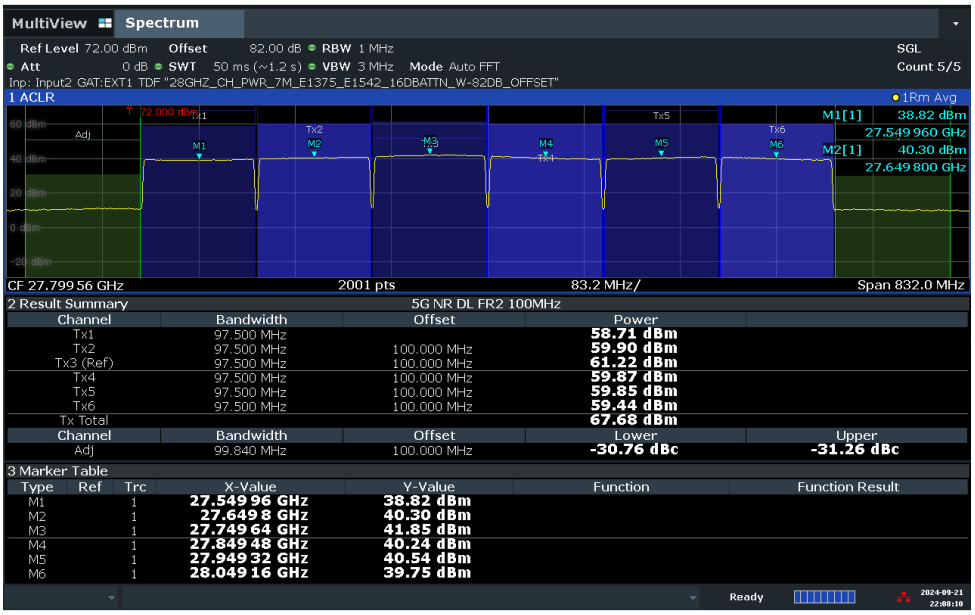


09:34:22 PM 09/21/2024

Six Carrier - Bottom

Horizontal

2024-0032 28 GHz AWKUA/B s/n YK240800006



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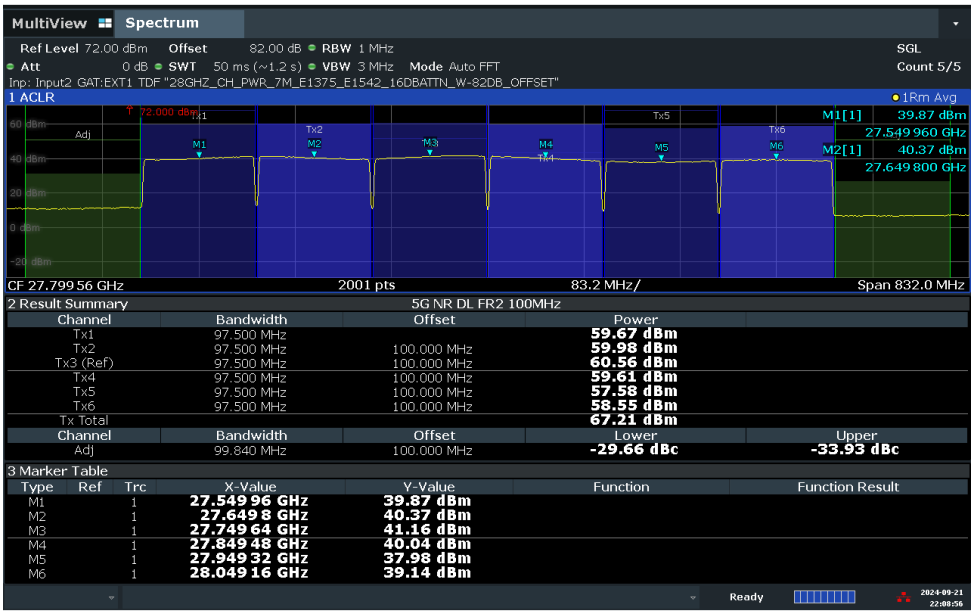
Vertical

2024-0032 28 GHz AWKUA/B s/n YK240800006



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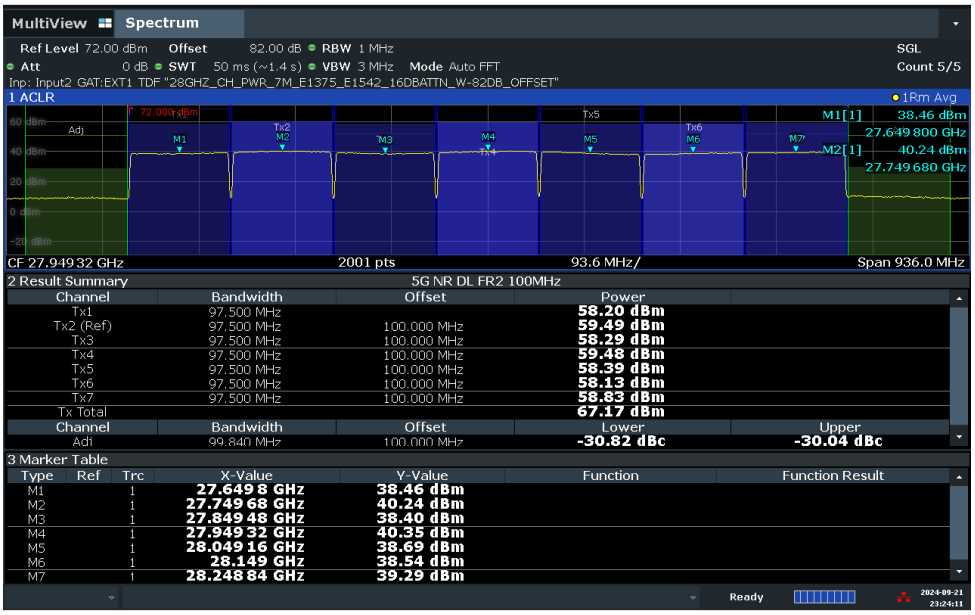
Seven Carrier - Top

Horizontal

2024-0032 28 GHz AWKUA/B s/n YK240800006



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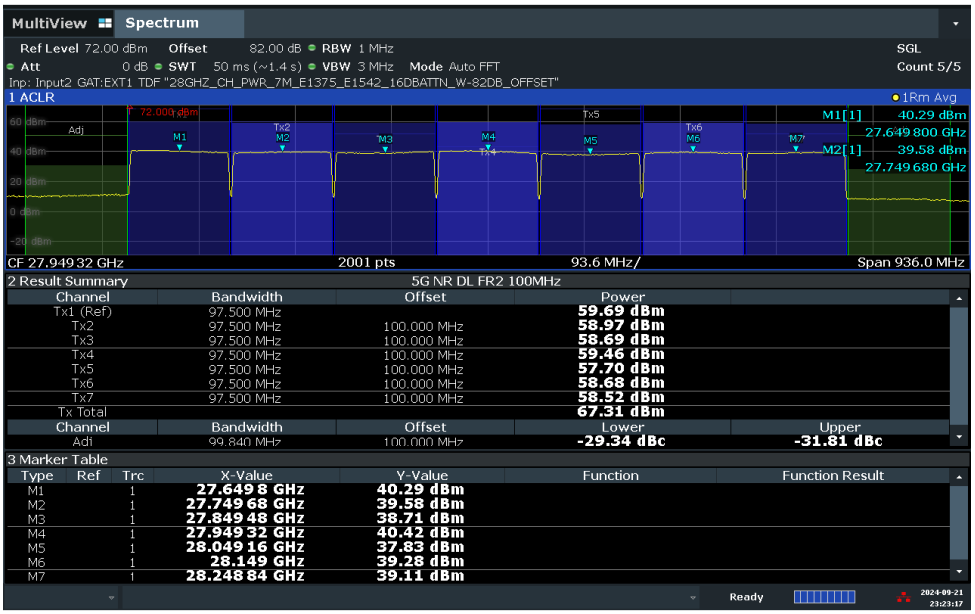
Vertical

2024-0032 28 GHz AWKUA/B s/n YK240800006



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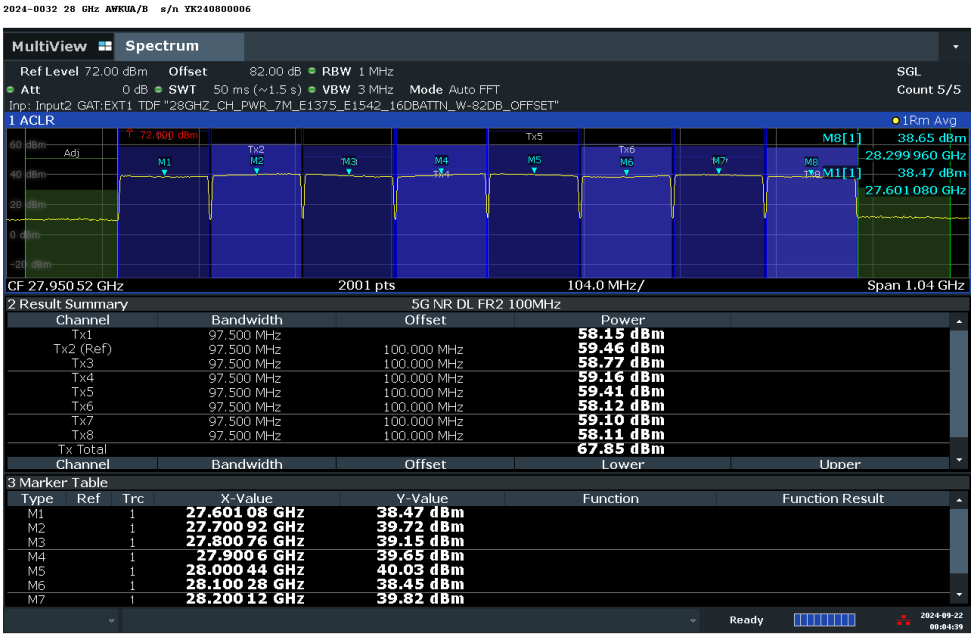
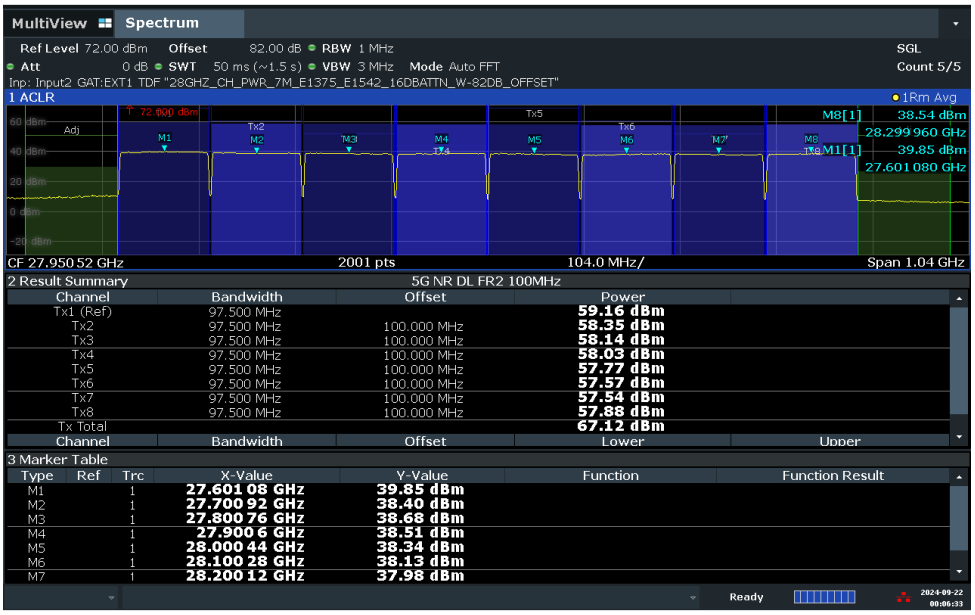
Eight Carrier - Top

Horizontal



Vertical



4.2 Section 2.1047 MEASUREMENT REQUIRED: MODULATION CHARACTERISTICS

AWKUA (AC) / AWKUB (DC) 28GHz supports the 5G New Radio Modulation. 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

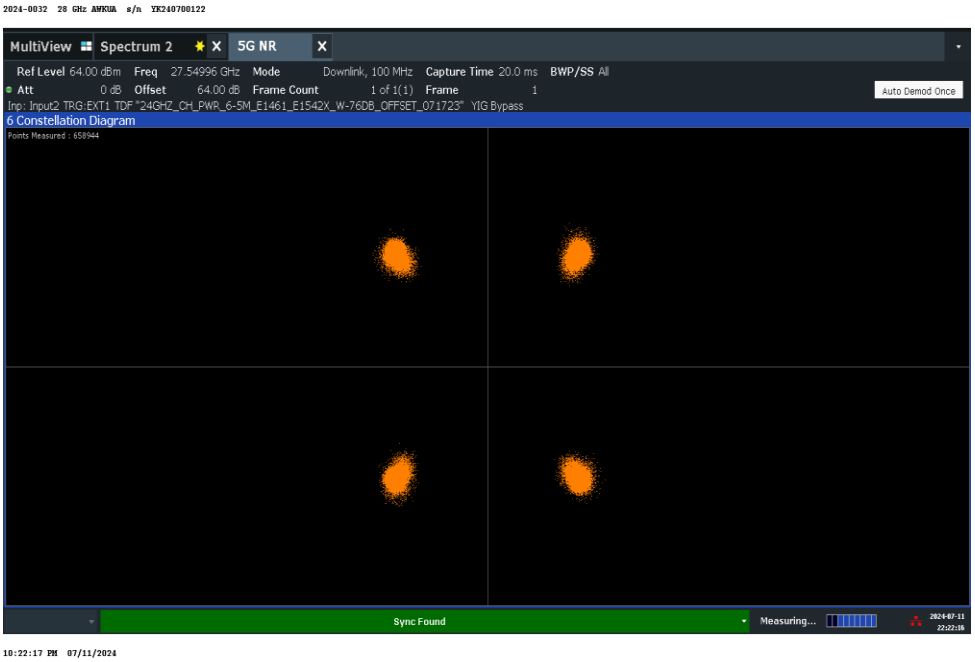
The measurements were performed at a distance of 6.5 m from the unit utilizing the test configuration in Figure 4.4.1 utilizing an Rohde & Schwarz FSW85 Signal analyzer with the 3GPP 5G-NR DL Measurement software option. Representative screen plots of the modulation measurement are attached below for all three of the subcarrier configurations and sample polarizations. Data was collected at left, center and right side of the n261 / NAR 28GHz frequency band.

4.2.2 Modulation Measurements Results:

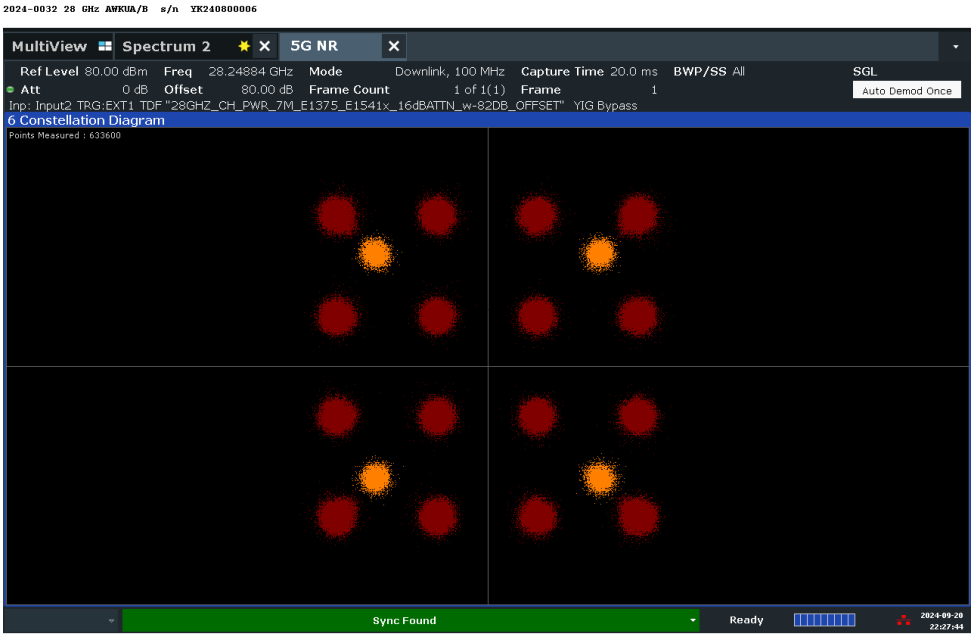
The typical measured modulation characteristics of the EUT are shown below:

Figure 4.2 Sample Modulation Results

QPSK



16QAM


2024-0032 28 GHz AWKUA/B s/n YK240800006
MultiView
Spectrum 2
5G NR
Ref Level 80.00 dBm Freq 28.24884 GHz Mode Downlink, 100 MHz Capture Time 20.0 ms BWP/SS All
Att 0 dB Offset 80.00 dB Frame Count 1 of 1(1) Frame 1
SGL
Auto Demod Once
Inp: Input2 TRG:EXT1 TDF "28GHZ_CH_PWR_7M_E1375_E1541x_16dBATTN_w-82DB_OFFSET" YIG Bypass
6 Constellation Diagram
Points Measured : 633600
Sync Found
Ready
2024-09-20
22:27:44
10:27:45 PM 09/20/2024

64QAM


2024-0032 28 GHz AWKUA/B s/n YK240800006
MultiView
Spectrum 2
5G NR
Ref Level 80.00 dBm Freq 27.54996 GHz Mode Downlink, 100 MHz Capture Time 20.0 ms BWP/SS All
Att 0 dB Offset 80.00 dB Frame Count 1 of 1(1) Frame 1
SGL
Auto Demod Once
Inp: Input2 TRG:EXT1 TDF "28GHZ_CH_PWR_7M_E1375_E1541x_16dBATTN_w-82DB_OFFSET" YIG Bypass
6 Constellation Diagram
Points Measured : 633600
Sync Found
Ready
2024-09-20
16:50:53
04:50:54 PM 09/20/2024

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 that is 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.

Table 4.3.1-1 – Occupied Bandwidth

Freq Range	Carrier Frequencies (GHz)	Number of Carriers	Test Model TM1.1 / QPSK	RBW	Horizontal Polarization Occupied Signal Bandwidth (MHz)	Vertical Polarization Occupied Signal Bandwidth (MHz)
Bottom	27.60996	1	QPSK	1MHz	94.001	94.206
				3MHz	94.893	95.233
Middle	27.94932	1	QPSK	1MHz	94.127	94.060
				3MHz	**95.129**	**95.016**
Top	28.23996	1	QPSK	1MHz	94.120	94.121
				3MHz	95.119	95.104
Bottom	27.54998 27.6498	2	QPSK	1MHz	192.059	192.576
				3MHz	192.298	192.970
Middle	27.84948 27.94932	2	QPSK	1MHz	192.541	192.450
				3MHz	192.917	192.789
				10MHz	**193.932**	**193.763**
Top	28.20012 28.29996	2	QPSK	1MHz	192.418	192.128
				3MHz	192.733	192.390
				10MHz	193.683	193.251
Bottom	27.54996 27.6498 27.74964	3	QPSK	1MHz	291.883	291.735
				3MHz	292.309	292.024
				5MHz	292.809	292.598
Middle	27.74964 27.84948 27.94932	3	QPSK	1MHz	292.436	291.697
				3MHz	292.810	291.921
				5MHz	**293.636**	**292.625**
Top	28.10028 28.20012 28.29996	3	QPSK	1MHz	291.938	291.473
				3MHz	292.241	291.725
				5MHz	292.931	292.324
Bottom	27.54996 27.6498 27.74964 27.84948	4	QPSK	1MHz	391.005	390.723
				3MHz	391.180	390.881
				5MHz	391.647	391.351
Middle	27.74964 27.84948 27.94932 28.04916	4	QPSK	1MHz	390.935	391.163
				3MHz	391.224	391.293
				5MHz	391.750	391.851
Top	28.00044 28.10028 28.20012 28.29996	4	QPSK	1MHz	391.147	390.716
				3MHz	391.338	390.853
				5MHz	**391.894**	**391.332**
Bottom	27.54996 27.6498 27.74964 27.84948 27.94932	5	QPSK	1MHz	489.262	489.440
				3MHz	489.256	489.437
				5MHz	489.529	489.511
Middle	27.74964 27.84948 27.94932 28.04916 28.149	5	QPSK	1MHz	489.429	489.883
				3MHz	489.607	489.947
				5MHz	**489.783**	**490.309**

Table 4.3.1-1 – Occupied Bandwidth- ***continued***

Freq Range	Carrier Frequencies (GHz)	Number of Carriers	Test Model TM1.1 / QPSK	RBW	Horizontal Polarization Occupied Signal Bandwidth (MHz)	Vertical Polarization Occupied Signal Bandwidth (MHz)
Top	27.9006 28.00044 28.10028 28.20012 28.29996	5	QPSK	1MHz	489.302	488.908
				3MHz	489.361	488.954
				5MHz	489.647	489.216
Bottom	27.54996 27.6498 27.74964 27.84948 27.94932 28.04916	6	QPSK	1MHz	587.375	587.258
				3MHz	587.620	587.430
				5MHz	587.726	587.608
				10MHz	588.971	588.942
Middle	27.6498 27.74964 27.84948 27.94932 28.04916 28.149	6	QPSK	1MHz	587.631	588.529
				3MHz	587.672	588.552
				5MHz	587.835	588.773
				10MHz	**589.251**	**590.427**
Top	27.80076 27.9006 28.00044 28.10028 28.20012 28.29996	6	QPSK	1MHz	588.493	587.878
				3MHz	588.651	587.900
				5MHz	588.863	588.042
Bottom	27.54996 27.6498 27.74964 27.84948 27.94932 28.04916 28.149	7	QPSK	1MHz	688.122	687.406
				3MHz	688.107	687.369
				5MHz	688.238	687.499
				10MHz	688.717	688.717
Top	27.70092 27.80076 27.9006 28.00044 28.10028 28.20012 28.29996	7	QPSK	1MHz	687.384	687.987
				3MHz	687.361	688.154
				5MHz	687.468	688.342
				10MHz	**688.673**	**689.803**
Bottom	27.54996 27.6498 27.74964 27.84948 27.94932 28.04916 28.149 28.24884	8	QPSK	1MHz	786.259	786.706
				3MHz	786.220	786.648
				5MHz	786.256	786.724
				10MHz	787.228	787.800
Top	27.60108 27.70092 27.80076 27.9006 28.00044 28.10028 28.20012 28.29996	8	QPSK	1MHz	786.377	786.645
				3MHz	786.354	786.680
				5MHz	786.430	786.613
				10MHz	**787.356**	**787.852**

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 **AWKUA/B** is thus defined as follows. The individual carriers, with a maximum bandwidth of 97.5 MHz, are spaced on centers that are either 99.96 MHz or 99.84 MHz apart. These carriers do not overlap and their spacing is determined by the carriers preference.

The overall signal bandwidth for n adjacent carriers is depicted in Figure 4.3.1.1. This is the maximum number of adjacent 97M5G7W carriers that can fit in the upper FCC authorized 27.5 – 28.35 GHz Band. The calculated assessment was that the 8 carrier aggregated bandwidth is 797.22 MHz which translates to an appropriate aggregated emissions designator of 798MG7W. The measurement of 8 adjacent carriers documented a measured maximum 8 carrier bandwidth of 789 MHz which is within the parameters of the selected Carrier Aggregation Emissions Designator.

During operation, one to eight carriers may be placed anywhere in the FCC authorized 27.5 to 28.35 GHz spectrum. So considered separately, the two carrier configuration produces an aggregated bandwidth of:
99.96 MHz + 97.5 MHz = 197.46 MHz which indicates a 198MG7W Emissions Designator

The calculated assessment for two through eight carriers are identified below.

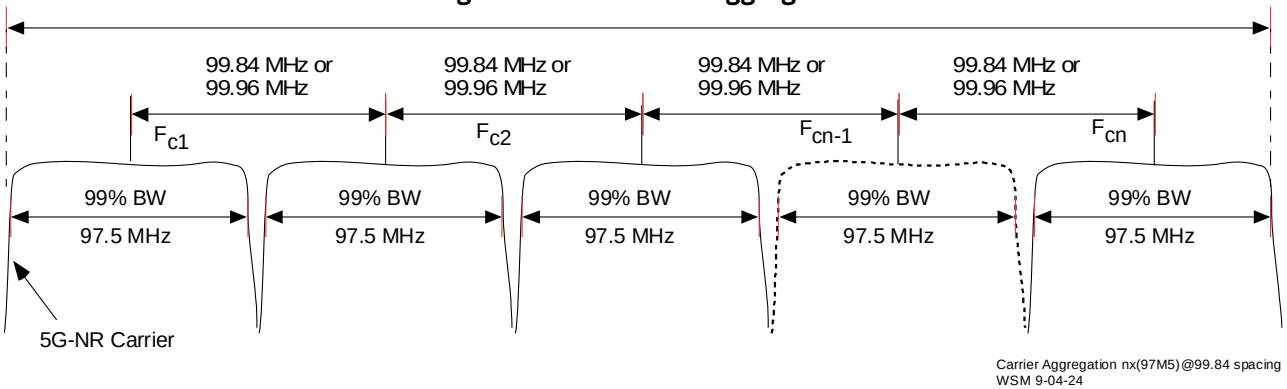
Two Carrier Aggregation Bandwidth = 1(99.96) + 97.5MHz = 197.46 MHz = 198MG7W
Three Carrier Aggregation Bandwidth = 2(99.96) + 97.5MHz = 297.42 MHz = 298MG7W
Four Carrier Aggregation Bandwidth = 3(99.96) + 97.5MHz = 397.38 MHz = 398MG7W
Five Carrier Aggregation Bandwidth = 4(99.96) + 97.5 MHz = 497.34 MHz = 498MG7W
Six Carrier Aggregation Bandwidth = 4(99.96) + 97.5 MHz = 597.30 MHz = 598MG7W
Seven Carrier Aggregation Bandwidth = 4(99.96) + 97.5 MHz = 697.26 MHz = 698MG7W
Eight Carrier Aggregation Bandwidth = 4(99.96) + 97.5 MHz = 797.22 MHz = 798MG7W

A comparison of the maximum difference of the Aggregation Bandwidth for the 99.96 MHz carrier spacing vs the 99.84 MHz carrier spacing is as follows.

Maximum Carrier Aggregation Bandwidth (99.96MHz)= 7(99.96) + 97.5MHz = 797.22 MHz = 798MG7W
Maximum Carrier Aggregation Bandwidth (99.84MHz)= 7(99.84) + 97.5MHz = 796.38 MHz < 798MG7W

Since the values are nearly identical (~0.1%) for two through eight carriers the 99.96 set will be used.

Figure 4.3.1.1 Carrier Aggregation

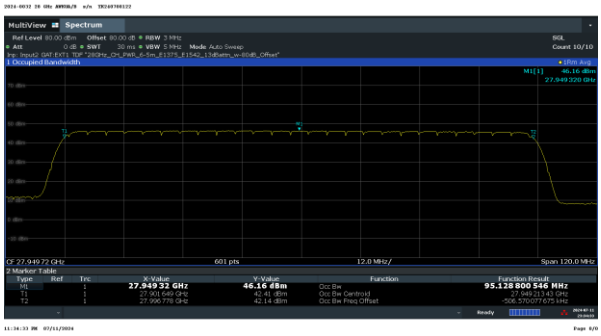


The Maximum 8 Carrier Aggregation Bandwidth = 7(99.96) + 97.5MHz = 797.22 MHz

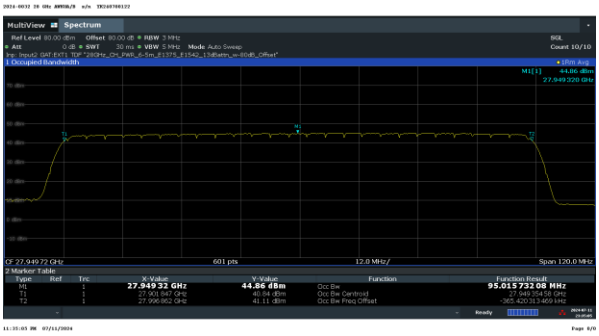
4.3.1.2 99% Signal Bandwidth Sample Plots

One carrier

Horizontal

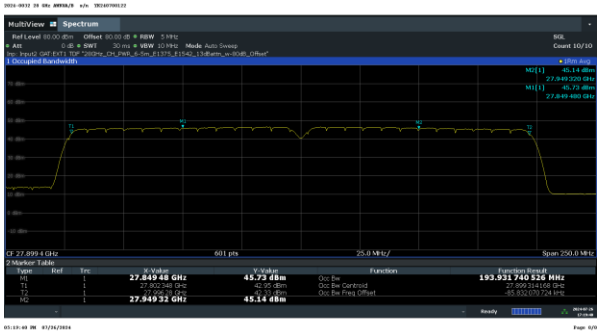


Vertical

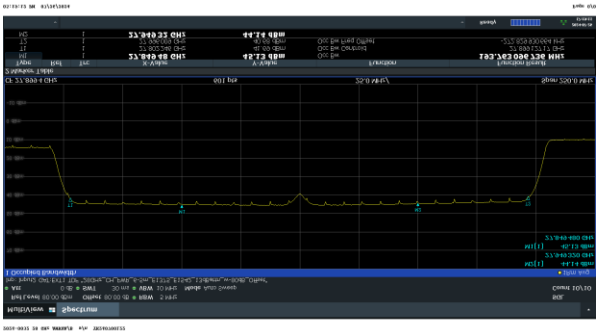


Two Carrier

Horizontal

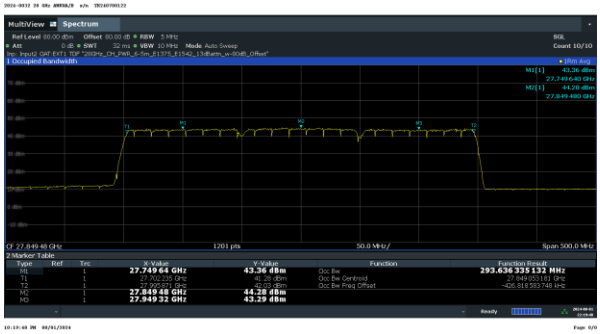


Vertical

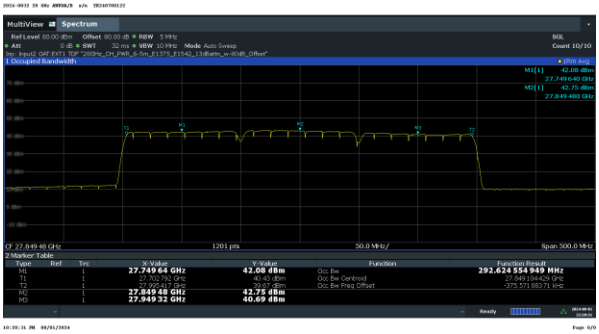


Three Carrier

Horizontal



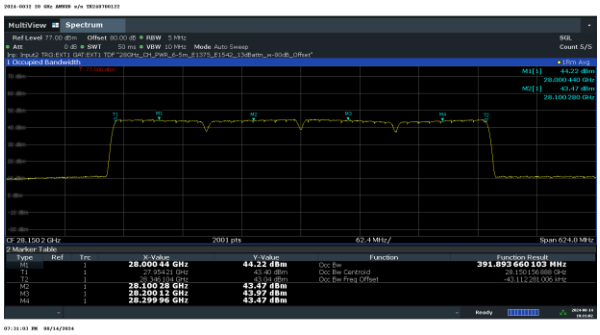
Vertical



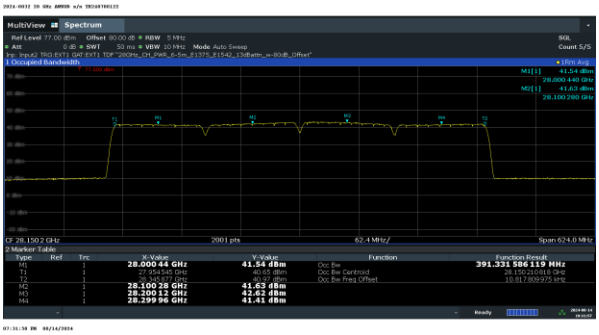
99% Signal Bandwidth Plots *continued*

Four Carrier

Horizontal

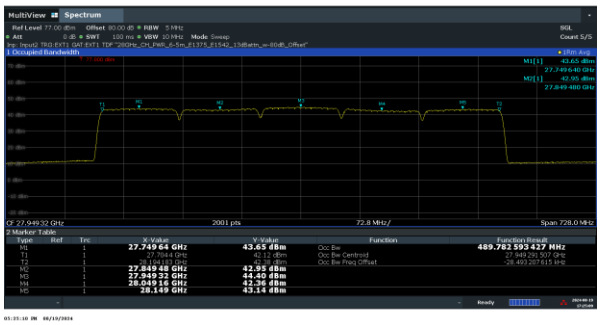


Vertical

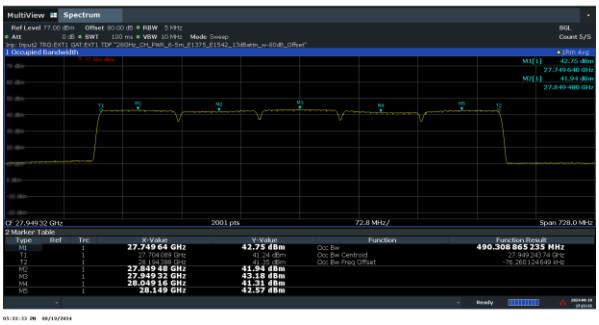


Five Carrier

Horizontal

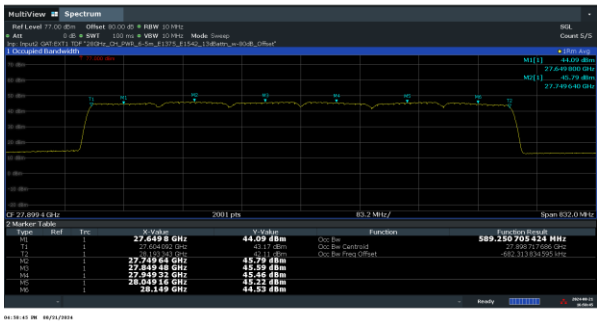


Vertical

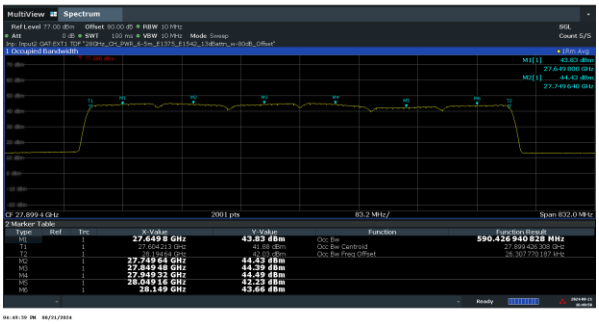


Six Carrier

Horizontal



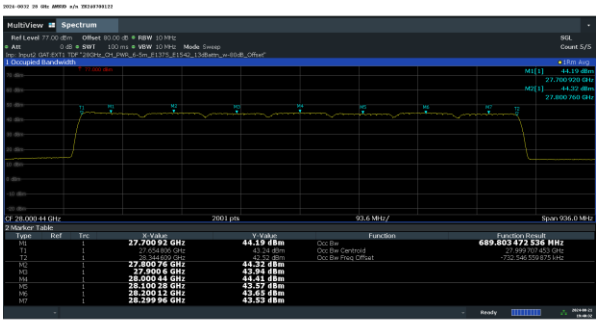
Vertical



Seven Carrier

Horizontal

Vertical



Eight Carrier

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 **2AD8UAWKUAB01 AWKUA/B 5G AirScale 28 GHz mmWave Radio** Unit presently supports nominal 100 MHz bandwidth 5G-New Radio 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 7.0m boundary distance. The measurements were performed for one thru eight nominal 100 MHz bandwidth 5GNR carriers. Channel power plots identify the individual carrier power, modulation and the total power. The measurement process meets the requirements of ANSI C63.26 and ISO17025. The test setup was as shown in Figure 4.1.1. Measurements for both vertical and horizontal polarizations were performed at 7.0m.

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 antenna 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 of Block", and "Right Edge of Block" across the Part 30 Upper Microwave Flexible Use Service spectrum.

4.3.3 Requirements Emissions Limits

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

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

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

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

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

In order to address the limit as imposed for the requirement in 47CFR 96.41 we evaluated emissions per the requirements in ANSI C63.26 and per KDB 940660 D01 Part 30 CBRS Equipment.
The average detector function was used for all MXA measurements and the Peak detector function were used for EMC receiver measurements.

4.3.4 Measurement Offset and MIMO

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

4.3.5 Mask Parameters

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

Table 4.3.5 - Mask Parameters Out Of Band / Edge of Band Emissions

Frequency	Part 30 Limit
GHz	dBm
26.50	-13
27.49	-13
27.49	-5
27.50	-5
27.50	29
28.35	29
28.35	-5
28.36	-5
28.36	-13
29.00	-13
40.00	-13

4.3.6 Measurement Path Adjustments

The measured power 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 filing 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 28 GHz;

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

Total Required Adjustment (@28 GHz) **=** 52.24 dB = 78.29 dB -23.44dBi + 28.20 dB – 30.81 dBi

This adjustment was only used for the OOBE/EoB frequency range. Table 4.3.6 below lists the offset correction factors used for the measurement distance of 7.0 m including the AWKUA/B product gain. The measurements were made using a flat offset of 52 dB with a transducer correction identified below.

This adjustment was only used for the OOBE/EoB frequency range. Table 4.3.6 below lists the offset correction factors used for the measurement distance of 7.0 m. 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+ 13 dB attenuator Loss, "L"	PL-G+L	AWKUA/B Antenna Gain, IEEE	Total Required Adjustment	FSW Offset	Transducer Correction Factor
GHz	dB	dBi	dB	dB	dBi	dB	dB	dB
26.50	77.81	22.989	27.887	82.71	30.04	52.66	52	0.664
27.00	77.97	22.883	27.949	83.04	30.37	52.67	52	0.666
27.50	78.13	23.078	28.107	83.16	30.59	52.57	52	0.569
28.00	78.29	23.438	28.200	83.05	30.81	52.24	52	0.239
28.50	78.44	23.216	28.333	83.56	30.98	52.58	52	0.582
29.00	78.59	23.581	28.537	83.55	31.14	52.41	52	0.408
29.50	78.74	23.428	28.642	83.95	31.06	52.90	52	0.895
30.00	78.89	23.657	28.814	84.04	30.98	53.06	52	1.064
30.50	79.03	23.766	28.945	84.21	31.00	53.21	52	1.208
31.00	79.17	23.546	29.118	84.74	31.00	53.74	52	1.743
31.50	79.31	24.014	29.240	84.54	31.00	53.54	52	1.536
32.00	79.45	23.411	29.321	85.36	31.00	54.36	52	2.357
32.50	79.58	24.398	29.419	84.60	31.00	53.60	52	1.602
33.00	79.71	23.363	29.613	85.96	31.00	54.96	52	2.964
33.50	79.84	24.240	29.665	85.27	31.00	54.27	52	2.269
34.00	79.97	23.898	29.643	85.72	31.00	54.72	52	2.719
34.50	80.10	24.306	29.802	85.60	31.00	54.60	52	2.596
35.00	80.23	24.098	29.890	86.02	31.00	55.02	52	3.017
35.50	80.35	23.932	30.104	86.52	31.00	55.52	52	3.520
36.00	80.47	24.527	30.291	86.23	31.00	55.23	52	3.233
36.50	80.59	23.453	30.419	87.56	31.00	56.56	52	4.555
37.00	80.71	24.568	30.628	86.77	31.00	55.77	52	3.768
37.50	80.82	23.458	30.768	88.13	31.00	57.13	52	5.134

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 7m. The measurements were performed with an FSW spectrum analyzer and in compliance with the procedure and requirements of ANSI C63.26. The test set-up diagram in Figure 4.1.1 was used. All testing was performed with 100 MHz carriers. Testing was performed for the one thru eight carrier configuration at the left side and right side of the n261 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 and 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 n261 bands in vertical and horizontal polarizations.

From the radiated measurement in the 40 GHz to 150 GHz presented in Section 4.5, the worst "in beam" EIRP emission is at 90.006 GHz with an amplitude at -15.96 dBm/MHz. It is 2.96 dB below the TRP limit before averaging. From the field strength measurement in the 27 GHz to 40 GHz range presented in Section 4.5, the worst emission is at 24574 MHz with a margin of 7.81 dB (avg).

Table 4.5.3 Results - Spurious Emissions 40-150GHz

Number of Carriers	Modulation	Frequency of measured OOBE, GHz	Measured Value Vertical Polarization	Margin to Part 30.203 limit of -13 dBm	Measured Value Horizontal Polarization	Margin to Part 30.203 limit of -13 dBm	Occupied Bandwidth Edge of Block / OOBE Compliance
8	QPSK	48.45704	-36.32	23.32	-36.26	23.26	Compliant
8	QPSK	60.17175	-24.16	11.16	-23.94	20.94	Compliant
8	QPSK	90.00575	-16.08	**3.08**	-15.96	**2.96**	Compliant
8	QPSK	140.03475	-24.41	11.41	-24.73	11.73	Compliant

The maximum EIRP emissions from both vertical and horizontal polarizations are below the TRP limits with a minimum margin of 2.96 dB. Therefore, the early exit condition was met and the EUT is compliant.

4.3.7.2 Out Of Band Emissions Results

The worst case 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 7.0m.

The measurement results of the out-of-band emissions are documented in Table 4.3.7.2 below.
For n261 28 GHz band, the worst emission was identified at 27.74964 GHz with a level at -12.64dBm/MHz.

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

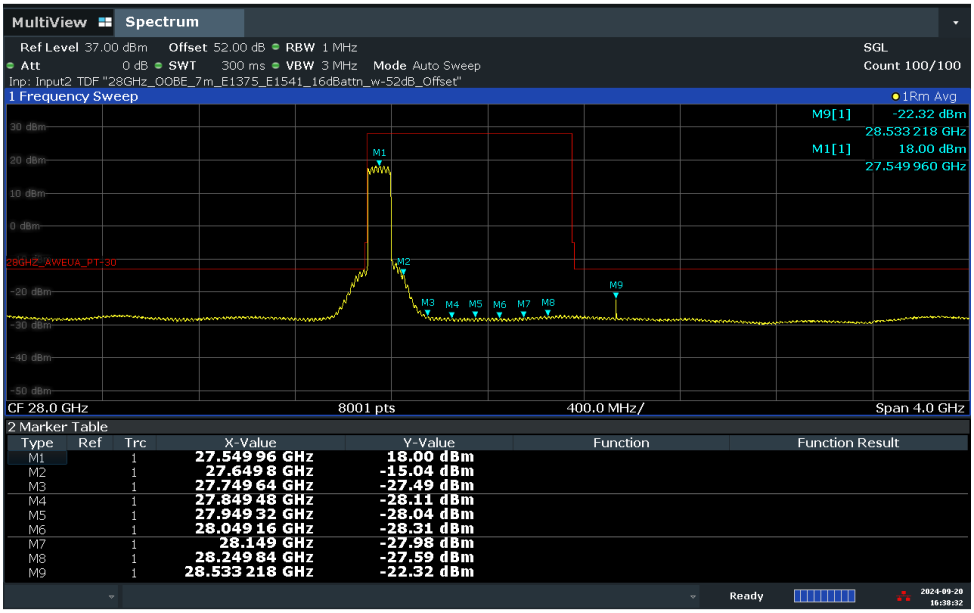
Table 4.3.7.2 Results -Edge of Block Emissions/ Out Of Band Emissions (OOBE)

Number of Carriers	Test Model TM1.1 / QPSK	Frequency of measured OOBE, GHz	Measured Value Horizontal Polarization dBm	Margin to Part 30.203 limit of -13 dBm, dB	Measured Value Vertical Polarization dBm	Margin to Part 30.203 limit of -13 dBm, dB	Occupied Bandwidth Edge of Block / OOBE Compliance
1	QPSK	27.54996	-15.04	2.04	-17.50	4.50	Compliant
2	QPSK	27.74964	-12.64	0.36	-16.79	3.79	Compliant
3	QPSK	27.84948	-15.17	2.17	-16.95	3.95	Compliant
4	QPSK	27.84948	-20.07	7.07	-19.32	6.32	Compliant
5	QPSK	27.74964	-19.24	6.24	-18.80	5.80	Compliant
6	QPSK	27.6498	-18.94	5.94	-20.81	7.81	Compliant
7	QPSK	27.54996	-20.93	7.93	-22.16	9.16	Compliant
8	QPSK	28.933563	-20.17	7.17	-26.17	13.17	Compliant

4.3.7.2.1 Occupied Bandwidth Edge of Band Sample Plots

1 Carrier Configuration QPSK, Bottom, Horizontal

2024-0032 28 GHz AWKUA/B s/n YK240800006



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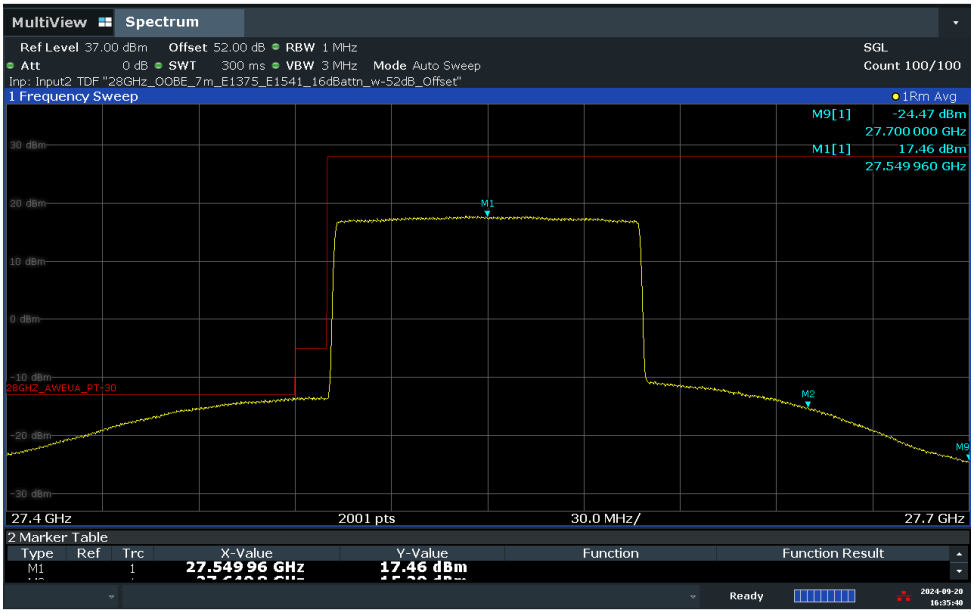
Horizontal Narrow Band

2024-0032 28 GHz AWKUA/B s/n YK240800006



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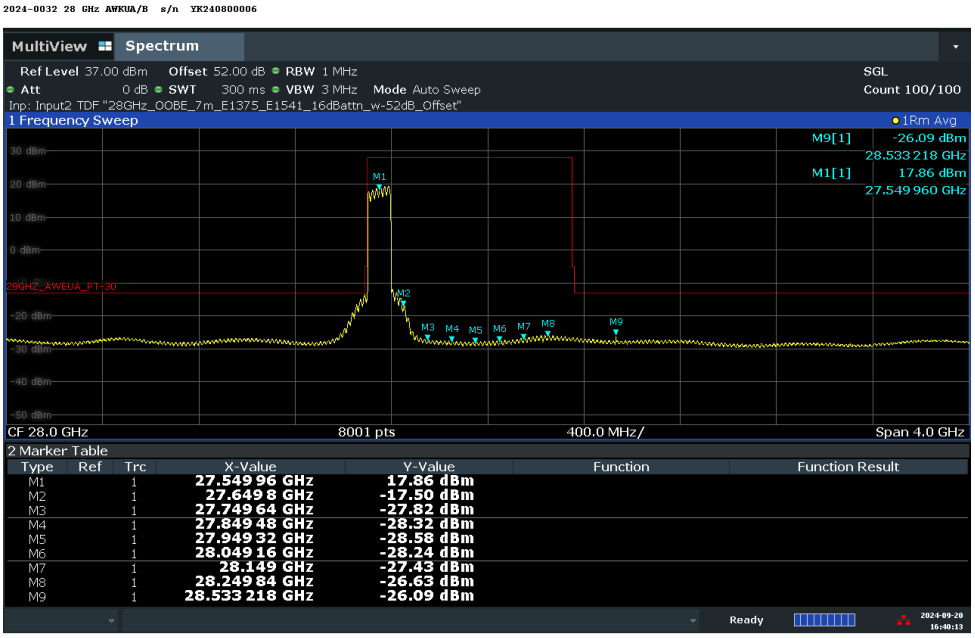
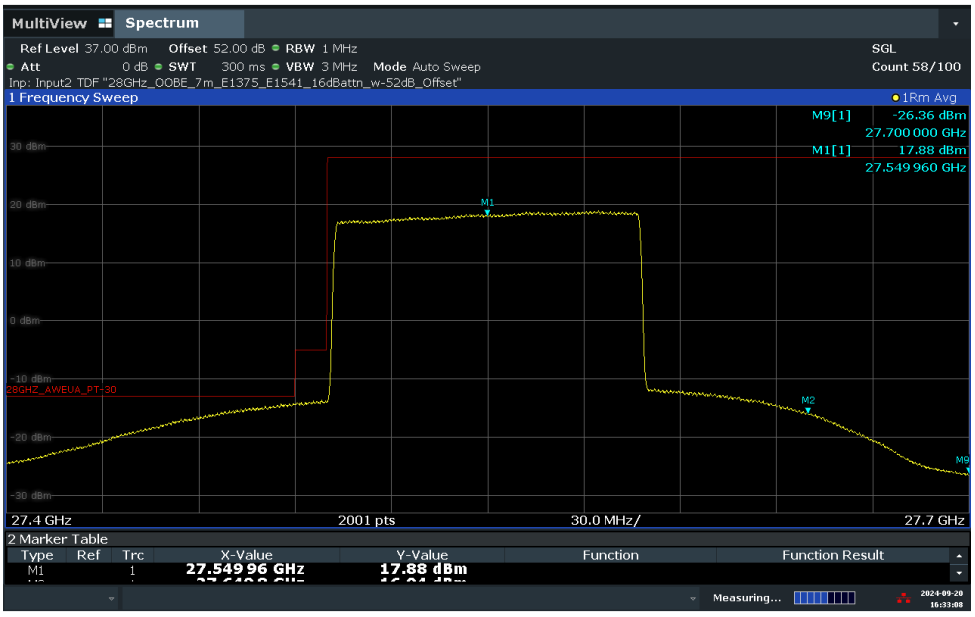
Vertical

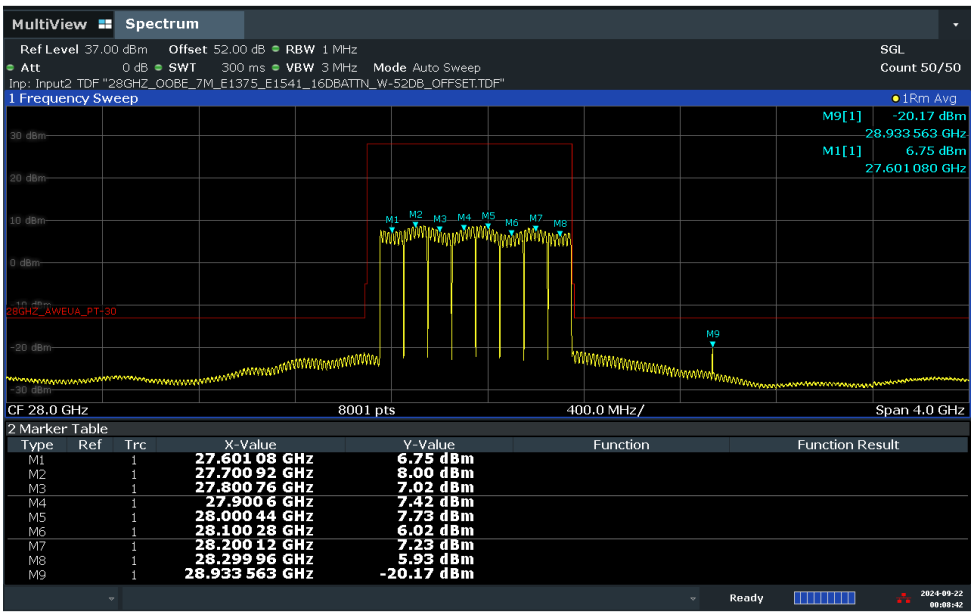


Vertical Narrow Band



8 Carrier Configuration QPSK, Top Horizontal

2024-0032 28 GHz AWKUA/B s/n YK240800006



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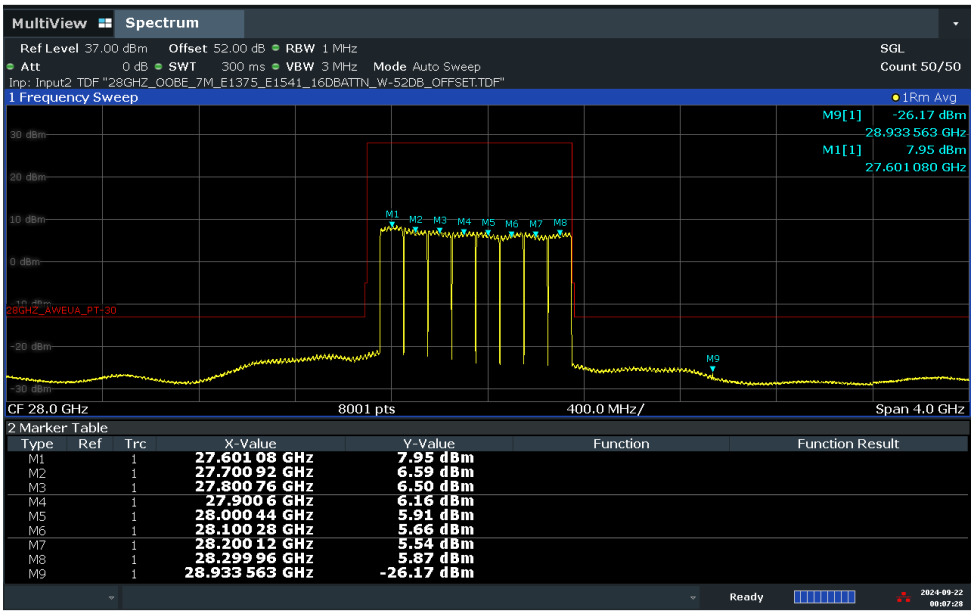
Vertical

2024-0032 28 GHz AWKUA/B s/n YK240800006



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

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

4.4.1 Section 2.1051 Spurious Emissions at Antenna Terminals

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

2.1057(a) In all of the measurements set forth in §§2.1051 and 2.1053, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the frequency shown below:

(3) If the equipment operates at or above 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 200 GHz, whichever is lower.

(c) The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

(d) Unless otherwise specified, measurements above 40 GHz shall be performed using a minimum resolution bandwidth of 1 MHz.

4.4.2 Required Limit

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

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

4.4.3 Results

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

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

The measurements were performed in compliance with ANSI C63.26, KDB 842590 D01, C63.26 mmWave JTG, and our ISO17025 process. The measurement meets the ANSI C63.26 requirements in paragraphs 5.2.4.4.1 and 5.7 which requires that the number of points in the sweep be > 2 × Span/RBW. The ESW-44 spectrum analyzer measurements examine the 30 MHz to 40 GHz range. The FSW based mmWave transmitter test system was used to provide measurement capability from 40 GHz to 150 GHz.

4.5 OTA Transmitter Operating Band Unwanted Emissions (New Section for EESS)

4.5.1 Procedures

The transmitter operating band unwanted emissions were evaluated at the bottom, middle and top channels with 100+100MHz and 100+ 7x100MHz configurations, respectively. The true RMS detector was used.

Directions to be tested: As the requirement is TRP the beam pattern(s) may be set up to optimize the TRP measurement procedure (see annex I 3GPP TS 38.141-2) as long as the required TRP level is achieved.
The directional power measurement procedure was used for measuring TRP as described in in annex I in 3GPP TS 38.141-2. Per 3GPP TS 38.141-2 Annex I.10, beam-based direction can be used in the base station *operating band* only if the directivity of the radiation pattern of the emssions being measured is known. $TRP_{Estimate}$ is defined as

$$TRP_{Estimate} = \frac{EIRP_{peak}}{D_{EUT}},$$

where $EIRP_{peak}$ is the maximum EIRP in the beam peak direction within a particular beam direction pair and D_{EUT} is the directivity of the EUT. EIRP peak can be obtained by reducing antenna gain.

The EIRP can be measured by

$$EIRP_{EUT} = EIRP_{re} – G_{re} + L_p + L_c,$$
$$TRP_{EUT} = EIRP_{EUT} - G_{EUT}$$
$$= EIRP_{re} - G_{EUT} – G_{re} + L_p + L_c$$

where $EIRP_{re}$ is the measured data by the receiver, G_{re} is the receiver antenna gain and Lc includes all cable losses, attenuators and amplifier gain and L_p is free space propagation path loss. In L_p, the D is measurement distance in meter and f is the frequency in MHz:

$$L_p = 20\log f + 20\log D - 27.5 \text{ in dB.}$$

$$L_p = 20\log f - 17.96 \text{ for 3m,}$$

$$L_p = 20\log f - 27.5 \text{ for 1m,}$$

$$L_p = 20\log f - 14.44 \text{ for 4.5m.}$$

The number of $-G_{EUT} - G_{re} + L_p + L_c$ will be set as offset in the measurement equipment.

4.5.2 Procedure for Evaluation of Earth Exploration Satellite Service (EESS) Out Of Band Emissions

The directional power measurement procedure from Annex I in 3GPP TS 38.141-2 was used to measure the TRP in the EESS band. The Orthogonal cut grid procedure in Annex I.5 was followed. The individual measurement sweeps utilized a 1 MHz RBW and was structured as 200 samples across the 23.7 to 23.9 GHz band of interest. This centered the measurement on the band. The measurement sweeps were performed every 2 degrees in azimuth at the elevation of the measured peak of the beam. The first cut was using a horizontal polarized measurement antenna with the product normally oriented. The second cut was performed with the product rotated counterclockwise 90 degrees on its rear mounting fixture. This allowed the vertical polarized beam to be measured exactly as the horizontal beam. Prior to each of the TRP cut measurements the actual channel power and peak beam location and elevation was verified.

4.5.3 Total Radiated Power EESS Results

An evaluation of Out Of Band Emissions to determine compliance with Earth Exploration Satellite Service (EESS) requirements was performed. We used the maximum number of carriers at the maximum Channel Power and maximum instantaneous bandwidth (IBW) in the maximum power 2T/2R configuration. The maximum EESS band TRP value was -18.7 dBm/200 MHz which is – 48dBW/200 MHz and below the required limit.

Maximum TRP Measured EESS Band Results

# of Carriers	Frequencies, GHz	Tx Pwr, dBm/pol	Results dBm/200 MHz	Compliance -3 dBm/200MHz Limit
8	27.54996, 27.6498, 27.74964, 27.84948 , 27.94932, 28.04916, 28.149, 28.24984	63	Cut1=-20.304 Cut 2= -20.033 Cut1&2 Avg = -18.659 (-18.7 dBm = -48.7 dBW)	Pass

Table 1: WRC-19 Resolution 750 Unwanted emissions permitted within any 200 megahertz in the 23.6-24 GHz passive band		
Type of Station	Current TRP Limits	TRP Limits After Sept. 1, 2027
IMT Base Stations	–33 dBW	–39 dBW
IMT Mobile Stations	–29 dBW	–35 dBW

4.6 Section 2.1053 MEASUREMENT REQUIRED: FIELD STRENGTH OF SPURIOUS RADIATION

The field strength measurements of radiated spurious emissions were made in FCC registered five-meter semi-anechoic chamber AR-8 (FCC Registration Number: 395778) **NVLAP** Lab Code: 100275-0 and IC (Filing Number: 6933F- 8) which is maintained by Nokia Bell Labs in Murray Hill, New Jersey.

4.6.1 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

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

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:

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

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

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

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

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

The field strength of radiated spurious emissions measured was determined by

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

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

4.6.2 Radiated Spurious Emissions Measurements: 40 GHz - 150 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 125 GHz. The procedure and methodology followed the recommendations of ANSI C63.4–2014, C63.26-2015 and C63.26 mmWave JTG.

A Rohde & Schwarz FSW 85 was employed with external three port Harmonic Down Converters (HDC). The waveguide RF input converters provided coverage for 40-60 GHz (U), 60-90 GHz (E) and 90-140 GHz (F) and 140-150 GHz (G) bands. The HDC's were paired with 25 dB Standard Gain Horns.

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	140-150	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 horizontal cut radiated power is down 14 dB at just $\pm$ 15 degrees off center. All of the peak emissions and harmonics were found to be centered within 30 degrees of the beam,

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 266 degrees azimuth, and nominal elevations 175 cm for both 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 stepped in rotation from 360 degrees back to 0 degrees. This method locates any emission and provides the maximum emissions but requires operation with 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 40-150 GHz were performed this way.

4.6.2.1 Bandwidth Limits and Corrections: Radiated Measurements 40 GHz - 150 GHz

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

4.6.2.2 Resolution Bandwidth and # of Points:

For measurements above 40 GHz we performed final measurement scans with the required 1 MHz resolution bandwidth and preliminary scans with either a 10 MHz or 3 MHz resolution bandwidth. Final measurements were performed so that the resolution bandwidth and span limitations of ANSI C63.26 were followed so that the number of measurement points > 2(Span/RBW).

Our FSW's 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.

4.6.2.3 Part 30 Limit:

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

4.6.2.4 Emissions Correction Factors

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.

$$\text{Emissions Correction} = \text{Path Loss} - \text{Antenna Gain} + \text{IF Cable loss (1dB)}$$
$$\text{Where Free Space Path Loss} = ((4\pi d)/\lambda))^2$$

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

Table 4.5.2.4c Radiated Emissions Corrections for 90-140 GHz at 3m

Frequency	λ	Measurement Distance, d	Path Loss	Measurement Antenna Gain	IF Cable Loss	Emissions Correction Total
GHz	m	m	dB	dB	dB	dB
90.0	0.0033	3	81.07	21.90	1.03	60.199
95.0	0.0032	3	81.54	22.30	1.03	60.269
100.0	0.0030	3	81.98	22.60	1.03	60.414
105.0	0.0029	3	82.41	22.95	1.03	60.488
110.0	0.0027	3	82.81	23.30	1.03	60.542
115.0	0.0026	3	83.20	23.60	1.03	60.628
120.0	0.0025	3	83.57	23.85	1.03	60.748
125.0	0.0024	3	83.92	24.05	1.03	60.902
130.0	0.002308	3	84.26	24.18	1.03	61.113
135.0	0.0022222	3	84.59	24.35	1.03	61.271
140.0	0.0021429	3	84.91	24.50	1.03	61.437

Table 4.5.2.4c Radiated Emissions Corrections for 140-150 GHz at 3m

Frequency	λ	Measurement Distance, d	Path Loss	Measurement Antenna Gain	IF Cable Loss	Emissions Correction Total
GHz	m	m	dB	dB	dB	dB
140.0	0.0021429	3	84.91	21.80	1.03	64.137
145.0	0.002069	3	85.21	22.30	1.03	63.942
150.0	0.002	3	85.51	22.70	1.03	63.836

4.6.3 Field Strength of Spurious Radiation Results:

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

Presented results include the standard measurements from 30 MHz to 40 GHz followed by the 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 product was configured for both single and eight QPSK carriers at maximum power. The limit in the measurement is the conducted -13 dBm limit as specified in Part 30.203. Corrections to the emissions levels consisted of only the HDC conversion loss, the Free Space Path Loss and the gain of the measurement antenna as detailed in Table 4.5.2.4.

Over the out of band spectrum investigated from 30 MHz to 150 GHz, reportable spurious emissions were detected and determined to be compliant with the Part 30 limit. From the field strength measurement in the 27 GHz to 40 GHz range presented in Section 4.5, the worst emission is at 29.715 GHz with a margin of -1.31 dB (avg).

From the radiated measurement in the 40 GHz to 150 GHz presented in Section 4.5, the worst "in beam" EIRP emission is at 90.43175 GHz with an amplitude at -13.44 dBm/MHz. It is 0.44 dB below the TRP limit before averaging. There was no signal found as this was just the noise floor measurement.

Table 4.5.3 Results - Spurious Emissions 40-150GHz

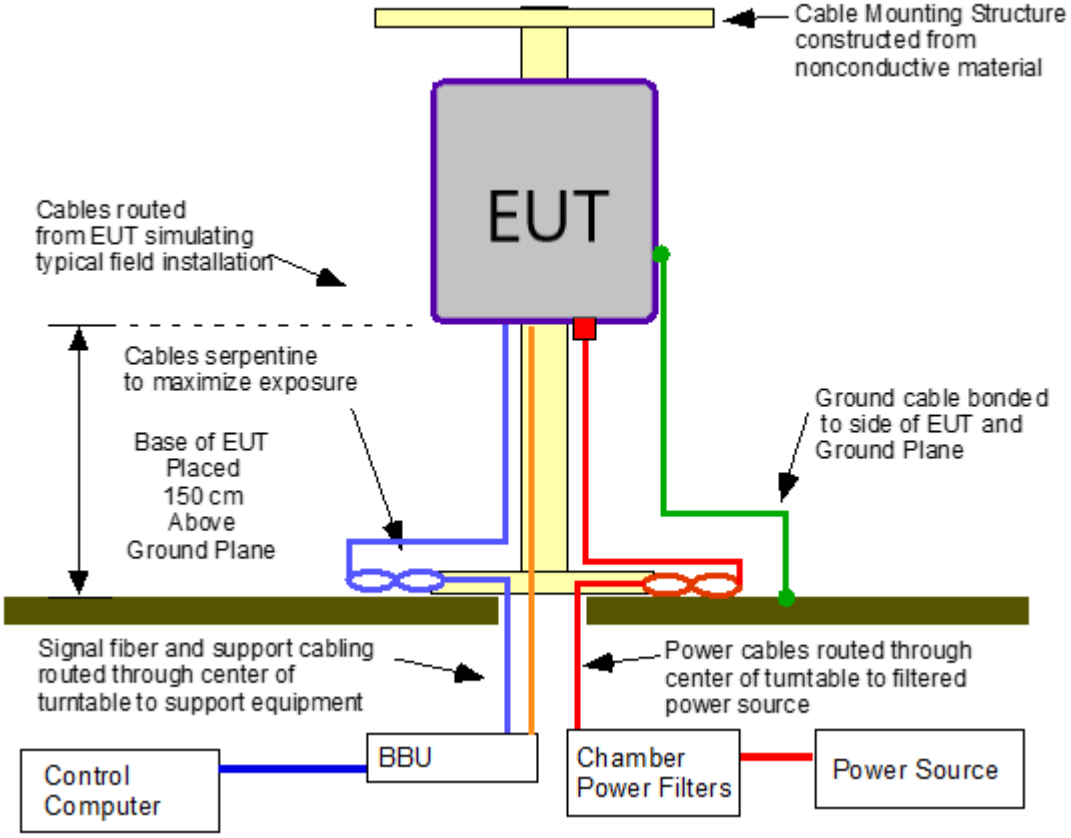
Number of Carriers	Test Model TM1.1 / QPSK	Frequency of measured OOBE, GHz	Measured Value Vertical Polarization	Margin to Part 30.203 limit of -13 dBm	Measured Value Horizontal Polarization	Margin to Part 30.203 limit of -13 dBm	Occupied Bandwidth Edge of Block / OOBE Compliance
8	QPSK	58.445	-36.24	23.24	-35.40	22.40	Compliant
8	QPSK	88.924	-24.20	11.20	-23.44	10.44	Compliant
8	QPSK	90.43175	-13.44	**0.44**	-14.59	**1.59**	Compliant
8	QPSK	149.981	-25.60	11.41	-25.06	11.73	Compliant

The maximum OOBE emissions from both vertical and horizontal polarizations was -20.17 dBm at 28.933 GHz. This is well below the TRP limits with a minimum margin of 7.17 dB. Therefore, the early exit condition was met and the EUT is compliant.
The minimum margin, measured in horizontal polarization, was 3.08 dB (Avg) at 25.108 GHz. Additionally, from 30 MHz to 40 GHz all non-transmitter emissions were a minimum of 0.35 dB below the Part 15 Class B limit.

This demonstrates that **AWKUA (AC) / AWKUB (DC) 28GHz Radio FCC ID: 2AD8UAWKUAB01,** 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.

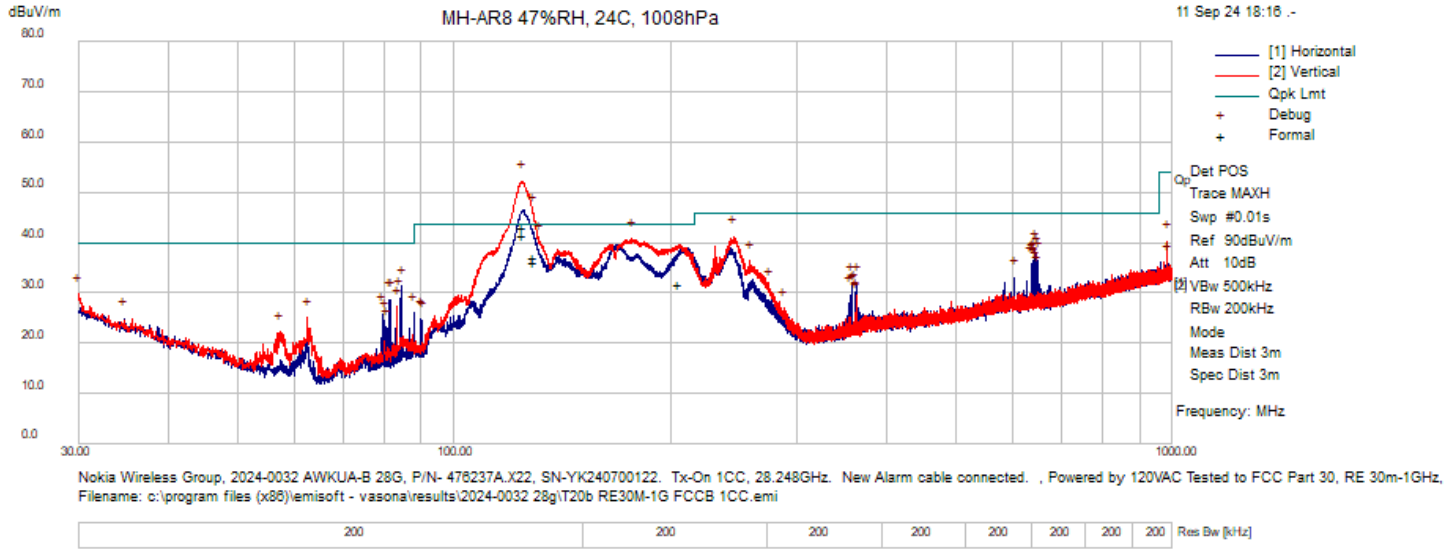
Photographs of the measurement setup are in the filing exhibits.

Figure 4.5 Radiated Emissions Product Setup



4.6.4 Transmitter Measurements of Radiated Spurious Emissions

30MHz -1GHz AC 1CC



Test Information

Results Title	RE30M-1G Bilog 3M
File Name	T20b RE30M-1G FCCB 1CC.emi
Test Laboratory	MH-AR8 47%RH, 24C, 1008hPa
Test Engineer	MJS/HS
Test Software	Vasona by EMISoft, version 6.061
Equipment	Nokia Wireless Group
EUT Details	2024-0032 AWKUA-B 28G, P/N- 476237A.X22, SN-YK240700122. Tx-On 1CC, 28.248GHz. New Alarm cable connected.
Configuration	Powered by 120VAC Tested to FCC Part 30, RE 30m-1GHz, @ 3-Meters, Preview RBW 120k; Formal RBW Default. Int. Att. 10dB, PA-E813, LPF-E1268, ESU-E954, Bilog Antenna E602.
Date	2024-09-11 18:16:17

Formal Data

Frequency MHz	Raw dBuV	Cable Loss	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
124.124	51.73	1.34	-9.92	43.15	QuasiMax	V	104	291	43.50	-0.35	Pass	
124.2325	50.13	1.34	-9.90	41.57	Quasi Peak	V	104	291	43.50	-1.93	Pass	
128.879375	45.57	1.35	-9.61	37.31	QuasiMax	V	116	300	43.50	-6.19	Pass	
128.6375	44.63	1.35	-9.62	36.36	Quasi Peak	V	103	291	43.50	-7.14	Pass	
205.413	46.20	1.44	-15.66	31.97	QuasiMax	V	111	11	43.50	-11.53	Pass	

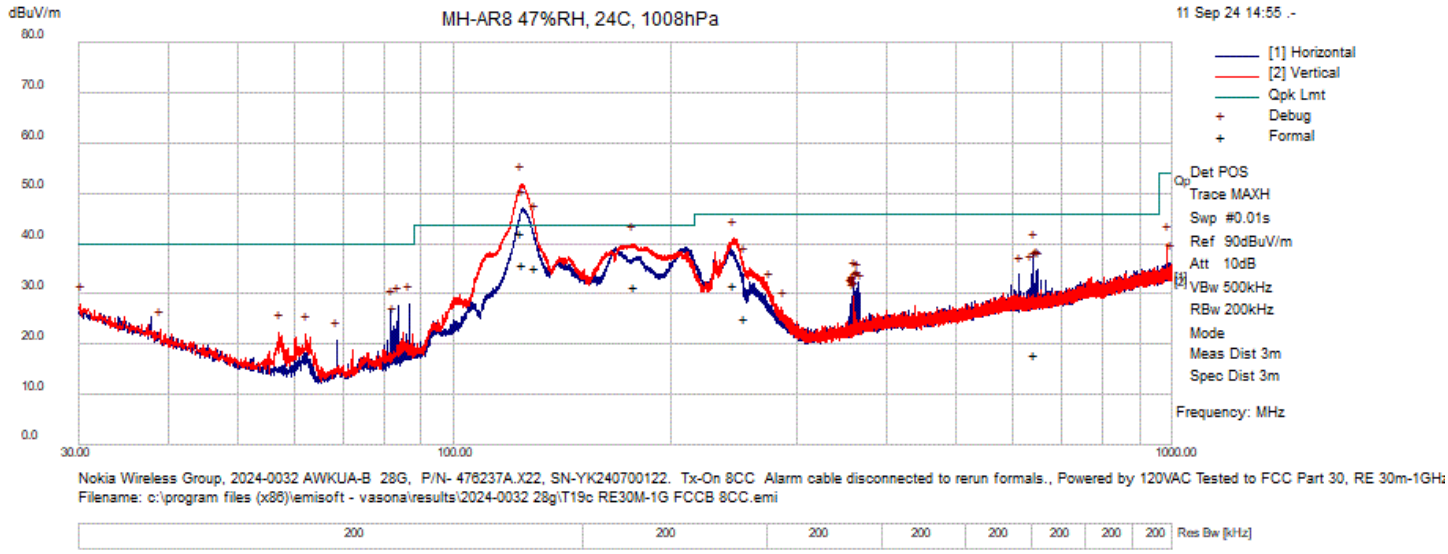
Preview Data

Frequency MHz	Raw dBuV	Cable Loss	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
124.514375	60.69	1.34	-9.86	52.17	Debug	V	103	270	43.50	8.67	Fail	
128.879375	54.01	1.35	-9.61	45.75	Debug	V	103	315	43.50	2.25	Fail	
176.773125	52.29	1.39	-13.01	40.67	Debug	V	103	0	43.50	-2.83	Pass	
131.72875	48.02	1.35	-9.48	39.89	Debug	V	175	90	43.50	-3.61	Pass	
244.97625	51.88	1.55	-12.27	41.16	Debug	V	103	0	46.00	-4.84	Pass	

Frequency MHz	Raw dBuV	Cable Loss	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
643.343125	43.46	2.60	-7.56	38.50	Debug	H	253	0	46.00	-7.50	Pass	
646.859375	42.44	2.61	-7.49	37.56	Debug	H	178	0	46.00	-8.44	Pass	
84.501875	47.45	1.32	-17.51	31.26	Debug	H	103	315	40.00	-8.74	Pass	
640.73625	41.44	2.60	-7.61	36.43	Debug	H	253	180	46.00	-9.57	Pass	
651.40625	41.14	2.62	-7.41	36.34	Debug	H	253	315	46.00	-9.66	Pass	
258.131875	47.03	1.58	-12.29	36.32	Debug	V	103	0	46.00	-9.68	Pass	
638.9175	41.13	2.59	-7.65	36.08	Debug	H	178	315	46.00	-9.92	Pass	
30.000	36.30	1.82	-8.42	29.70	Debug	V	103	135	40.00	-10.30	Pass	
636.12875	40.76	2.59	-7.70	35.64	Debug	H	178	135	46.00	-10.36	Pass	
643.100625	40.48	2.60	-7.56	35.52	Debug	H	178	90	46.00	-10.48	Pass	
641.585	40.16	2.60	-7.59	35.17	Debug	H	325	45	46.00	-10.83	Pass	
84.016875	45.12	1.31	-17.61	28.82	Debug	H	103	45	40.00	-11.18	Pass	
81.228125	45.58	1.31	-18.23	28.66	Debug	H	178	0	40.00	-11.34	Pass	
644.191875	39.56	2.60	-7.54	34.62	Debug	H	253	45	46.00	-11.38	Pass	
81.591875	45.41	1.31	-18.15	28.57	Debug	H	178	315	40.00	-11.43	Pass	
648.314375	38.40	2.61	-7.46	33.55	Debug	H	253	135	46.00	-12.45	Pass	
83.22875	43.64	1.31	-17.78	27.17	Debug	V	325	225	40.00	-12.83	Pass	
603.0275	38.00	2.53	-7.67	32.87	Debug	H	178	135	46.00	-13.13	Pass	
983.14625	39.42	3.35	-2.57	40.20	Debug	V	175	135	54.00	-13.80	Pass	
363.55875	42.33	1.88	-12.31	31.91	Debug	H	253	90	46.00	-14.09	Pass	
87.9575	41.26	1.32	-16.68	25.90	Debug	H	103	315	40.00	-14.10	Pass	
79.34875	43.19	1.30	-18.67	25.83	Debug	H	178	45	40.00	-14.17	Pass	
357.49625	42.48	1.86	-12.60	31.74	Debug	H	178	0	46.00	-14.26	Pass	
62.555625	44.74	1.29	-21.07	24.96	Debug	V	103	315	40.00	-15.04	Pass	
274.6825	43.11	1.63	-13.85	30.89	Debug	V	103	0	46.00	-15.11	Pass	
34.668125	33.94	1.66	-10.86	24.75	Debug	H	103	45	40.00	-15.25	Pass	
80.136875	41.59	1.30	-18.47	24.42	Debug	H	178	270	40.00	-15.58	Pass	
361.315625	40.68	1.87	-12.41	30.14	Debug	H	325	270	46.00	-15.86	Pass	
358.648125	40.62	1.87	-12.54	29.94	Debug	H	253	270	46.00	-16.06	Pass	
356.04125	40.31	1.86	-12.67	29.50	Debug	H	253	45	46.00	-16.50	Pass	
80.56125	40.12	1.30	-18.38	23.05	Debug	H	103	225	40.00	-16.95	Pass	
362.34625	39.10	1.88	-12.36	28.62	Debug	H	253	225	46.00	-17.38	Pass	
362.9525	38.87	1.88	-12.33	28.41	Debug	H	178	90	46.00	-17.59	Pass	
57.160	40.97	1.29	-20.14	22.12	Debug	V	103	135	40.00	-17.88	Pass	
985.025625	34.99	3.35	-2.55	35.79	Debug	H	103	270	54.00	-18.21	Pass	
89.77625	39.63	1.33	-16.25	24.70	Debug	H	103	90	43.50	-18.80	Pass	
90.3825	39.29	1.33	-16.10	24.52	Debug	H	178	45	43.50	-18.98	Pass	
287.716875	39.01	1.65	-13.78	26.88	Debug	V	103	315	46.00	-19.12	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.

30MHz -1GHz AC 8CC



Test Information

Results Title	RE30M-1G Bilog 3M
File Name	T19c RE30M-1G FCCB 8CC.emi
Test Laboratory	MH-AR8 47%RH, 24C, 1008hPa
Test Engineer	MJS/HS
Test Software	Vasona by EMISoft, version 6.061
Equipment	Nokia Wireless Group
EUT Details	2024-0032 AWKUA-B 28G, P/N- 476237A.X22, SN-YK240700122. Tx-On 8CC, New Alarm cable connected.
Configuration	Powered by 120VAC Tested to FCC Part 30, RE 30m-1GHz, @ 3-Meters, Preview RBW 120k; Formal RBW Default. Int. Att. 10dB, PA-E813, LPF-E1268, ESU-E954, Bilog Antenna E602.
Date	2024-09-11 14:58:50

Formal Data

Frequency MHz	Raw dBuV	Cable Loss	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
123.969	50.98	1.34	-9.94	42.39	QuasiMax	V	105	278	43.50	-1.11	Pass	
124.577	44.31	1.34	-9.85	35.80	QuasiMax	H	191	8	43.50	-7.70	Pass	
129.425	43.57	1.35	-9.58	35.33	QuasiMax	V	103	298	43.50	-8.17	Pass	
177.536	43.28	1.39	-13.10	31.57	QuasiMax	V	104	6	43.50	-11.93	Pass	
245.090	42.70	1.55	-12.26	32.00	QuasiMax	V	109	4	46.00	-14.00	Pass	
253.340	35.64	1.56	-11.82	25.39	QuasiMax	V	106	16	46.00	-20.61	Pass	
640.244	22.91	2.60	-7.62	17.88	QuasiMax	H	164	40	46.00	-28.12	Pass	

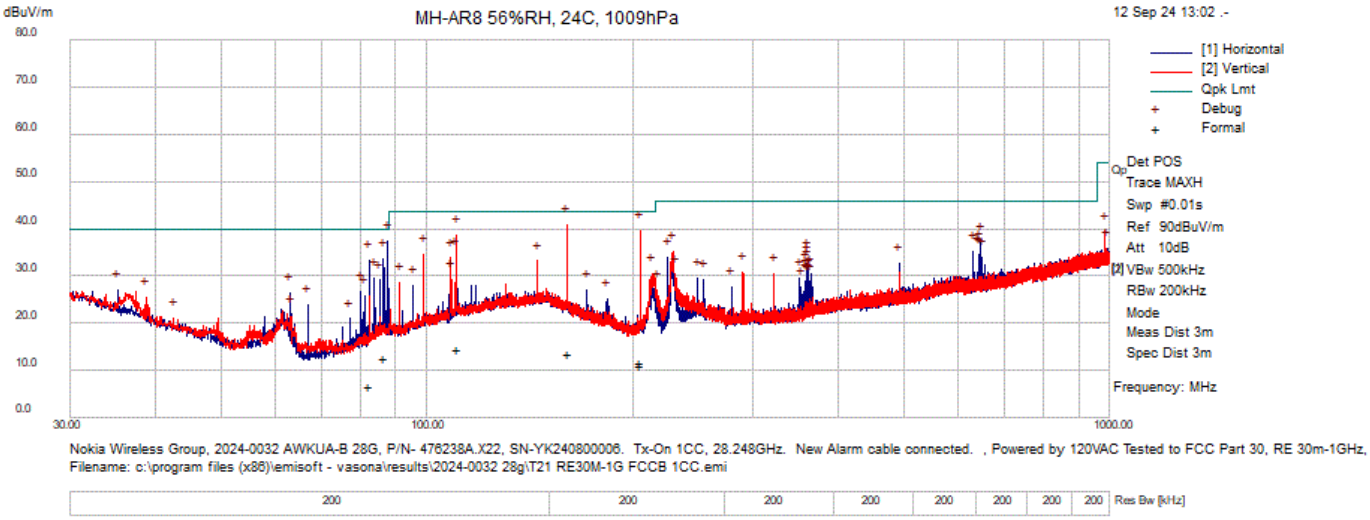
Preview Data

Frequency MHz	Raw dBuV	Cable Loss	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
123.96875	60.34	1.34	-9.94	51.74	Debug	V	103	270	43.50	8.24	Fail	
124.577	55.23	1.34	-9.85	46.72	Debug	H	104	2	43.50	3.22	Fail	
129.425	52.31	1.35	-9.58	44.07	Debug	V	103	315	43.50	0.57	Fail	
177.31875	51.49	1.39	-13.08	39.80	Debug	V	103	0	43.50	-3.70	Pass	
245.0975	51.73	1.55	-12.25	41.02	Debug	V	103	0	46.00	-4.98	Pass	

Frequency MHz	Raw dBuV	Cable Loss	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
640.25125	43.25	2.60	-7.62	38.23	Debug	H	325	45	46.00	-7.77	Pass	
253.403125	45.91	1.56	-11.82	35.65	Debug	V	103	0	46.00	-10.35	Pass	
649.163125	39.80	2.61	-7.44	34.97	Debug	H	253	90	46.00	-11.03	Pass	
646.435	39.50	2.61	-7.50	34.61	Debug	H	325	315	46.00	-11.39	Pass	
649.890625	39.33	2.61	-7.43	34.51	Debug	H	253	0	46.00	-11.49	Pass	
86.563125	43.75	1.32	-17.02	28.05	Debug	H	178	225	40.00	-11.95	Pass	
30.181875	34.58	1.81	-8.52	27.86	Debug	V	103	180	40.00	-12.14	Pass	
636.0075	38.93	2.59	-7.70	33.81	Debug	H	325	270	46.00	-12.19	Pass	
612.000	39.00	2.55	-7.77	33.77	Debug	H	178	180	46.00	-12.23	Pass	
83.47125	44.06	1.31	-17.73	27.64	Debug	H	178	180	40.00	-12.36	Pass	
81.6525	43.76	1.31	-18.13	26.94	Debug	H	178	315	40.00	-13.06	Pass	
360.40625	43.43	1.87	-12.46	32.85	Debug	H	325	180	46.00	-13.15	Pass	
365.135	42.63	1.89	-12.23	32.29	Debug	H	253	90	46.00	-13.71	Pass	
983.085625	39.04	3.35	-2.57	39.82	Debug	V	103	225	54.00	-14.18	Pass	
364.165	41.36	1.88	-12.28	30.97	Debug	H	178	270	46.00	-15.03	Pass	
274.743125	42.83	1.63	-13.86	30.60	Debug	V	103	0	46.00	-15.40	Pass	
362.043125	40.95	1.88	-12.38	30.45	Debug	H	178	0	46.00	-15.55	Pass	
367.43875	40.41	1.89	-12.12	30.18	Debug	H	253	90	46.00	-15.82	Pass	
359.0725	40.59	1.87	-12.52	29.93	Debug	H	325	225	46.00	-16.07	Pass	
358.830	40.19	1.87	-12.53	29.52	Debug	H	178	270	46.00	-16.48	Pass	
82.198125	40.18	1.31	-18.01	23.48	Debug	H	178	45	40.00	-16.52	Pass	
357.375	39.91	1.86	-12.60	29.16	Debug	H	325	180	46.00	-16.84	Pass	
359.67875	39.65	1.87	-12.49	29.03	Debug	H	253	315	46.00	-16.97	Pass	
38.9725	34.46	1.54	-13.11	22.89	Debug	V	175	180	40.00	-17.11	Pass	
360.770	39.32	1.87	-12.44	28.75	Debug	H	103	225	46.00	-17.25	Pass	
57.099375	41.23	1.29	-20.13	22.40	Debug	V	103	45	40.00	-17.60	Pass	
358.1025	38.96	1.86	-12.57	28.26	Debug	H	253	0	46.00	-17.74	Pass	
994.240625	35.23	3.33	-2.42	36.14	Debug	H	325	0	54.00	-17.86	Pass	
62.191875	41.79	1.29	-21.03	22.05	Debug	V	103	315	40.00	-17.95	Pass	
287.050	38.86	1.65	-13.78	26.73	Debug	V	103	45	46.00	-19.27	Pass	
68.67875	40.27	1.31	-20.93	20.64	Debug	H	178	225	40.00	-19.36	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.

30MHz -1GHz DC 1CC



Test Information

Results Title	RE30M-1G Bilog 3M
File Name	T21 RE30M-1G FCCB 1CC.emi
Test Laboratory	MH-AR8 56%RH, 24C, 1009hPa
Test Engineer	MJS/HS
Test Software	Vasona by EMISoft, version 6.061
Equipment	Nokia Wireless Group
EUT Details	2024-0032 AWKUA-B 28G, P/N- 476238A.X22, SN-YK240800006. Tx-On 1CC, 28.248GHz. New Alarm cable connected.
Configuration	Powered by -48Vdc Tested to FCC Part 30, RE 30m-1GHz, @ 3-Meters, Preview RBW 120k; Formal RBW Default. Int. Att. 10dB, PA-E813, LPF-E1268, ESU-E954, Bilog Antenna E602.
Date	2024-09-12 13:08:19

Formal Data

Frequency MHz	Raw dBuV	Cable Loss	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
86.415	28.32	1.32	-17.06	12.58	QuasiMax	H	164	103	40.00	-27.42	Pass	
110.577	25.04	1.34	-11.94	14.44	QuasiMax	V	104	6	43.50	-29.06	Pass	
160.628	22.65	1.38	-10.51	13.52	QuasiMax	V	175	198	43.50	-29.98	Pass	
205.080	25.81	1.44	-15.67	11.59	QuasiMax	V	152	229	43.50	-31.91	Pass	
205.098	25.38	1.44	-15.67	11.15	QuasiMax	H	123	357	43.50	-32.35	Pass	
82.347	23.51	1.31	-17.98	6.84	QuasiMax	H	209	281	40.00	-33.16	Pass	

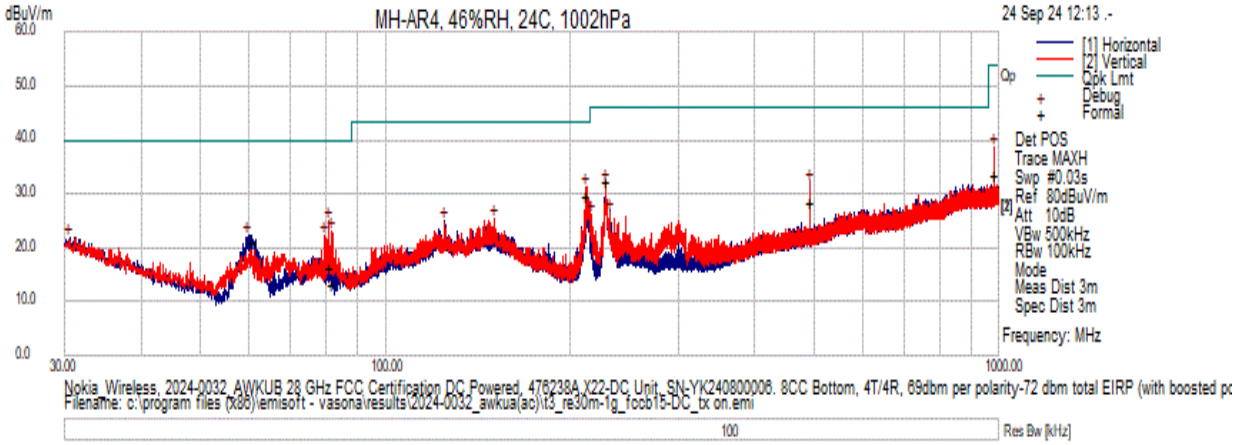
Preview Data

Frequency MHz	Raw dBuV	Cable Loss	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
87.715	52.90	1.32	-16.74	37.48	Debug	H	175	45	40.00	-2.52	Pass	
160.404375	50.05	1.38	-10.47	40.96	Debug	V	253	315	43.50	-2.54	Pass	
205.085	53.72	1.44	-15.67	39.49	Debug	V	103	90	43.50	-4.01	Pass	
110.449375	49.26	1.34	-11.96	38.64	Debug	V	103	0	43.50	-4.86	Pass	
86.441875	49.44	1.32	-17.05	33.71	Debug	H	103	0	40.00	-6.29	Pass	
82.319375	49.95	1.31	-17.98	33.27	Debug	H	325	45	40.00	-6.73	Pass	
647.405	42.13	2.61	-7.48	37.26	Debug	H	250	90	46.00	-8.74	Pass	

Frequency MHz	Raw dBuV	Cable Loss	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
98.870	47.23	1.33	-13.97	34.59	Debug	V	253	315	43.50	-8.91	Pass	
110.206875	44.65	1.34	-12.00	33.99	Debug	V	103	0	43.50	-9.51	Pass	
108.266875	44.72	1.34	-12.31	33.75	Debug	V	103	0	43.50	-9.75	Pass	
145.126875	40.68	1.36	-8.89	33.14	Debug	V	253	315	43.50	-10.36	Pass	
83.774375	45.99	1.31	-17.67	29.63	Debug	H	103	225	40.00	-10.37	Pass	
645.7075	40.41	2.61	-7.51	35.50	Debug	H	175	180	46.00	-10.50	Pass	
631.945625	40.45	2.58	-7.79	35.25	Debug	H	175	225	46.00	-10.75	Pass	
229.395625	48.48	1.51	-14.83	35.16	Debug	V	178	315	46.00	-10.84	Pass	
85.290	45.07	1.32	-17.33	29.06	Debug	H	103	0	40.00	-10.94	Pass	
642.736875	39.45	2.60	-7.57	34.48	Debug	H	175	135	46.00	-11.52	Pass	
643.64625	39.25	2.60	-7.55	34.30	Debug	H	250	0	46.00	-11.70	Pass	
225.09125	48.06	1.50	-15.57	33.98	Debug	H	103	315	46.00	-12.02	Pass	
650.92125	38.68	2.62	-7.42	33.88	Debug	H	250	315	46.00	-12.12	Pass	
361.0125	44.30	1.87	-12.43	33.74	Debug	H	103	135	46.00	-12.26	Pass	
213.511875	44.70	1.46	-15.63	30.53	Debug	V	253	225	43.50	-12.97	Pass	
35.274375	36.46	1.64	-11.17	26.94	Debug	H	175	45	40.00	-13.06	Pass	
80.015625	43.86	1.30	-18.50	26.66	Debug	H	175	180	40.00	-13.34	Pass	
360.40625	43.24	1.87	-12.46	32.66	Debug	H	103	180	46.00	-13.34	Pass	
491.538125	40.29	2.11	-9.74	32.65	Debug	H	175	90	46.00	-13.35	Pass	
63.040625	46.32	1.29	-21.12	26.49	Debug	H	103	45	40.00	-13.51	Pass	
361.194375	42.24	1.87	-12.42	31.70	Debug	H	250	315	46.00	-14.30	Pass	
81.04625	42.65	1.31	-18.27	25.69	Debug	H	325	45	40.00	-14.31	Pass	
108.509375	40.04	1.34	-12.27	29.11	Debug	V	103	0	43.50	-14.39	Pass	
983.14625	38.66	3.35	-2.57	39.45	Debug	V	253	90	54.00	-14.55	Pass	
38.790625	36.81	1.55	-13.02	25.34	Debug	V	103	0	40.00	-14.66	Pass	
359.315	41.91	1.87	-12.51	31.27	Debug	H	175	225	46.00	-14.73	Pass	
91.23125	43.25	1.33	-15.87	28.70	Debug	V	253	315	43.50	-14.80	Pass	
290.384375	42.91	1.65	-13.76	30.81	Debug	V	103	90	46.00	-15.19	Pass	
95.414375	41.52	1.33	-14.80	28.05	Debug	H	103	0	43.50	-15.45	Pass	
322.394375	41.99	1.76	-13.23	30.53	Debug	V	103	90	46.00	-15.47	Pass	
364.650	40.67	1.88	-12.25	30.30	Debug	H	250	90	46.00	-15.70	Pass	
231.275	43.19	1.52	-14.51	30.20	Debug	V	178	270	46.00	-15.80	Pass	
66.920625	43.71	1.31	-21.11	23.90	Debug	H	175	45	40.00	-16.10	Pass	
361.86125	40.39	1.88	-12.39	29.88	Debug	H	325	180	46.00	-16.12	Pass	
359.860625	40.48	1.87	-12.48	29.86	Debug	H	325	315	46.00	-16.14	Pass	
171.559375	37.92	1.38	-12.26	27.04	Debug	H	103	45	43.50	-16.46	Pass	
351.555	40.57	1.84	-12.89	29.53	Debug	H	175	315	46.00	-16.47	Pass	
249.401875	39.53	1.55	-11.58	29.51	Debug	H	325	45	46.00	-16.49	Pass	
254.67625	39.62	1.57	-11.95	29.24	Debug	H	103	315	46.00	-16.76	Pass	
358.70875	39.63	1.87	-12.54	28.96	Debug	H	103	0	46.00	-17.04	Pass	
363.498125	39.27	1.88	-12.31	28.84	Debug	H	103	270	46.00	-17.16	Pass	
361.61875	39.19	1.88	-12.40	28.67	Debug	H	103	315	46.00	-17.33	Pass	
365.074375	38.94	1.89	-12.23	28.60	Debug	H	325	0	46.00	-17.40	Pass	
363.013125	38.96	1.88	-12.33	28.51	Debug	H	103	180	46.00	-17.49	Pass	
989.20875	35.09	3.34	-2.49	35.94	Debug	V	178	225	54.00	-18.06	Pass	
63.34375	41.69	1.29	-21.15	21.84	Debug	H	325	45	40.00	-18.16	Pass	
279.16875	39.93	1.64	-13.85	27.72	Debug	H	175	45	46.00	-18.28	Pass	
353.495	38.65	1.85	-12.80	27.70	Debug	H	175	0	46.00	-18.30	Pass	
183.86625	37.64	1.40	-13.86	25.18	Debug	H	103	90	43.50	-18.32	Pass	
42.549375	34.44	1.46	-14.82	21.08	Debug	V	103	225	40.00	-18.92	Pass	
217.391875	41.12	1.47	-15.61	26.98	Debug	V	253	270	46.00	-19.02	Pass	
77.105625	38.82	1.30	-19.25	20.88	Debug	H	325	45	40.00	-19.12	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.

30MHz -1GHz DC 8CC



Test Information

Results Title	Radiated Emissions 3m 30MHz-1GHz
File Name	t3_re30m-1g_fccb15-DC_tx on.emi
Test Laboratory	MH-AR4, 46%RH, 24C, 1002hPa
Test Engineer	HS
Test Software	Vasona by EMISoft, version 6.061
Equipment	Nokia_Wireless
EUT Details	2024-0032_AWKUB 28 GHz FCC Certification DC Powered 476238A.X22-DC Unit, SN-YK240800006. 8CC Bottom, 4T/4R, 69dbm per polarity-72 dBm total EIRP (with boosted power), TM1.1. TX. On.
Configuration	FCC Class B Part 15, RE30M-1GHz, @3-Meters, BiLog Antenna E602, Sonoma Preamp-E813, LPF-E792, ESW67-E1511.Internal Attenuation 10dB.
Date	2024-09-24 12:18:52

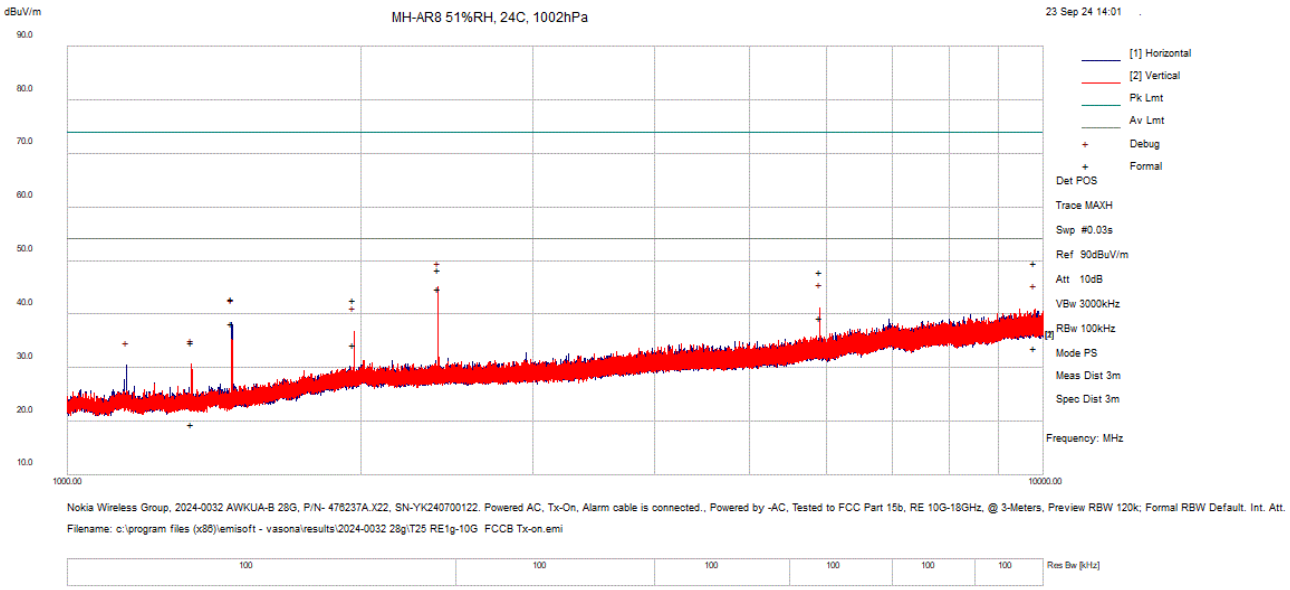
Formal Data

Frequency MHz	Raw dBuV	Cable Loss	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
228.634	45.98	1.42	-14.96	32.43	QuasiMax	V	118	290	46.00	-13.57	Pass	
212.628	43.86	1.36	-15.63	29.59	QuasiMax	V	257	317	43.50	-13.91	Pass	
491.533	36.19	2.09	-9.74	28.53	QuasiMax	V	182	43	46.00	-17.47	Pass	
60.864	41.14	0.77	-20.90	21.01	QuasiMax	H	280	168	40.00	-18.99	Pass	
983.039	32.84	3.25	-2.57	33.52	QuasiMax	V	104	348	54.00	-20.48	Pass	
80.747	33.64	0.89	-18.33	16.20	QuasiMax	V	105	342	40.00	-23.80	Pass	
81.867	30.44	0.90	-18.08	13.25	QuasiMax	V	121	330	40.00	-26.75	Pass	

Preview Data

Frequency MHz	Raw dBuV	Cable Loss	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
212.489333	45.56	1.36	-15.63	31.29	Debug	V	252	315	43.50	-12.21	Pass	
491.526	39.96	2.09	-9.74	32.30	Debug	V	177	270	46.00	-13.70	Pass	
228.365	45.83	1.42	-15.01	32.24	Debug	V	102	270	46.00	-13.76	Pass	
80.763333	42.50	0.89	-18.33	25.06	Debug	V	102	0	40.00	-14.94	Pass	
983.057333	38.16	3.25	-2.57	38.84	Debug	V	102	135	54.00	-15.16	Pass	
81.862667	40.27	0.90	-18.09	23.08	Debug	V	102	0	40.00	-16.92	Pass	
59.714333	42.19	0.76	-20.74	22.21	Debug	H	250	180	40.00	-17.79	Pass	
79.664	39.88	0.88	-18.59	22.18	Debug	V	102	0	40.00	-17.82	Pass	
30.549667	30.20	0.52	-8.73	21.99	Debug	H	102	0	40.00	-18.01	Pass	
150.571	33.08	1.20	-8.79	25.49	Debug	V	102	90	43.50	-18.01	Pass	
124.963	33.81	1.13	-9.80	25.13	Debug	H	102	135	43.50	-18.37	Pass	
232.665333	39.63	1.43	-14.28	26.78	Debug	H	102	45	46.00	-19.22	Pass	
216.498667	40.44	1.38	-15.62	26.20	Debug	V	252	270	46.00	-19.80	Pass	

1GHz-10GHz AC 8CC



Test Information

Results Title	Radiated Emissions 3m 1GHz-18GHz
File Name	T25 RE1g-10G FCCB Tx-on.emi
Test Laboratory	MH-AR8 51%RH, 24C, 1002hPa
Test Engineer	HS
Test Software	Vasona by EMISoft, version 6.061
Equipment	Nokia Wireless Group
EUT Details	2024-0032 AWKUA-B 28G, P/N- 476237A.X22, SN-YK240700122. Powered AC, 8CC Bottom, 69dBm per polarity-72dBm total EIRP (With boosted power).Tx-On, Alarm cable is connected.
Configuration	Powered by 120AC, Tested to FCC Part 15b, RE 1G-10GHz, @ 3-Meters, Preview RBW 120k; Formal RBW Default. Int. Att. 10dB, PA-E1603, LPF-E1475, FSW85, 3117 DR Horn Antenna E1073. Tx-on.
Date	2024-09-23 14:09:55

Formal Data

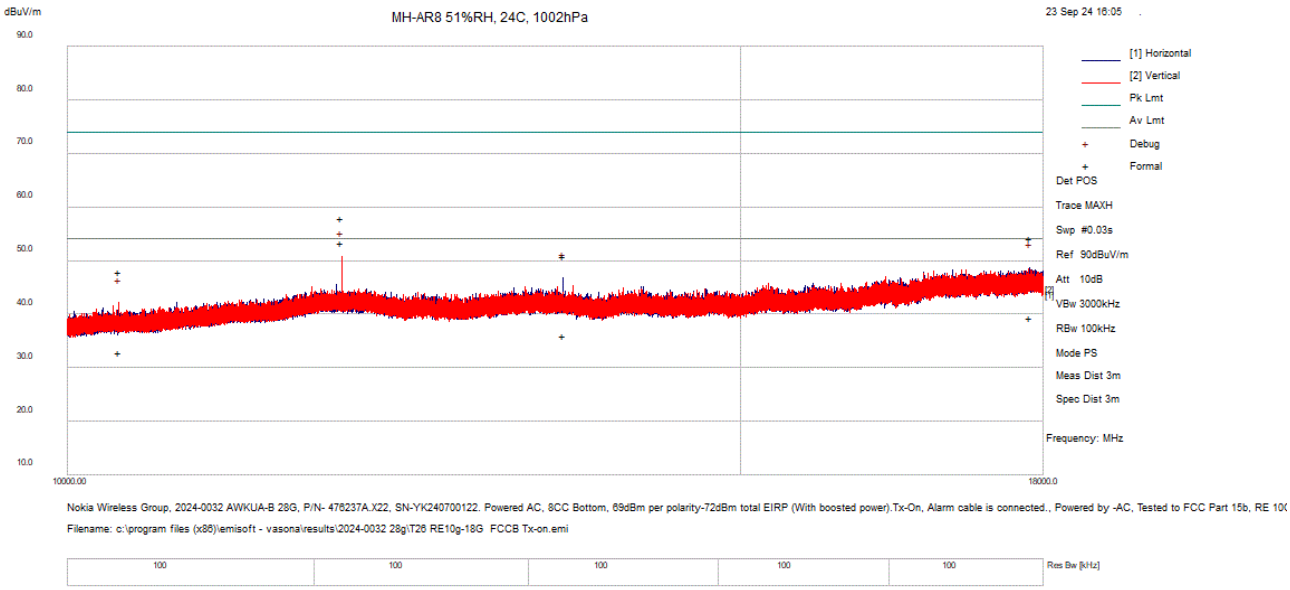
Frequency MHz	Raw dBuV	Cable Loss	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
2399.993	53.62	2.49	-11.30	44.82	AvgMax	V	179	199	54.00	-9.18	Pass	
5898.246	42.51	3.97	-7.15	39.32	AvgMax	V	202	230	54.00	-14.68	Pass	
1474.564	51.57	2.15	-15.28	38.45	AvgMax	H	317	81	54.00	-15.55	Pass	
1966.069	43.51	2.34	-11.49	34.35	AvgMax	H	250	122	54.00	-19.65	Pass	
9794.228	30.66	5.37	-2.35	33.68	AvgMax	V	156	302	54.00	-20.32	Pass	
9794.228	46.65	5.37	-2.35	49.67	PeakMax	V	156	302	74.00	-24.33	Pass	
2399.993	57.16	2.49	-11.30	48.36	PeakMax	V	179	199	74.00	-25.64	Pass	
5898.246	51.11	3.97	-7.15	47.93	PeakMax	V	202	230	74.00	-26.07	Pass	
1474.564	56.06	2.15	-15.28	42.94	PeakMax	H	317	81	74.00	-31.06	Pass	
1966.069	51.89	2.34	-11.49	42.74	PeakMax	H	250	122	74.00	-31.26	Pass	
1341.172	33.10	2.10	-15.56	19.64	AvgMax	V	108	73	54.00	-34.36	Pass	
1341.172	48.27	2.10	-15.56	34.81	PeakMax	V	108	73	74.00	-39.19	Pass	

Preview Data

Frequency MHz	Raw dBuV	Cable Loss	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
1341.150	44.23	2.10	-15.56	30.77	Debug	V	178	0	54.00	-23.23	Pass	
9794.950	37.88	5.37	-2.35	40.90	Debug	V	178	0	54.00	-13.10	Pass	
1474.550	51.44	2.15	-15.28	38.32	Debug	H	325	90	54.00	-15.68	Pass	
1150.650	44.37	2.01	-16.02	30.37	Debug	H	325	90	54.00	-23.63	Pass	
1966.100	45.99	2.34	-11.49	36.84	Debug	H	253	135	54.00	-17.16	Pass	
5898.250	44.26	3.97	-7.15	41.08	Debug	V	250	225	54.00	-12.92	Pass	
2400.000	53.87	2.49	-11.30	45.06	Debug	V	178	315	54.00	-8.94	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 AC 8CC



Test Information

Results Title	Radiated Emissions 3m 1GHz-18GHz
File Name	T26a RE10g-18G FCCB Tx-on.emi
Test Laboratory	MH-AR8 51%RH, 24C, 1002hPa
Test Engineer	HS
Test Software	Vasona by EMISoft, version 6.061
Equipment	Nokia Wireless Group
EUT Details	2024-0032 AWKUA-B 28G, P/N- 476237A.X22, SN-YK240700122. Powered AC, 8CC Bottom, 69dBm per polarity-72dBm total EIRP (With boosted power).Tx-On, Alarm cable is connected.
Configuration	Powered by 120VAC, Tested to FCC Part 15b, RE 10G-18GHz, @ 3-Meters, Preview RBW 120k; Formal RBW Default. Int. Att. 10dB, PA-E1603, LPF-E1475, FSW85, 3117 DR Horn Antenna E1073. Tx-on.
Date	2024-09-23 16:28:33

Formal Data

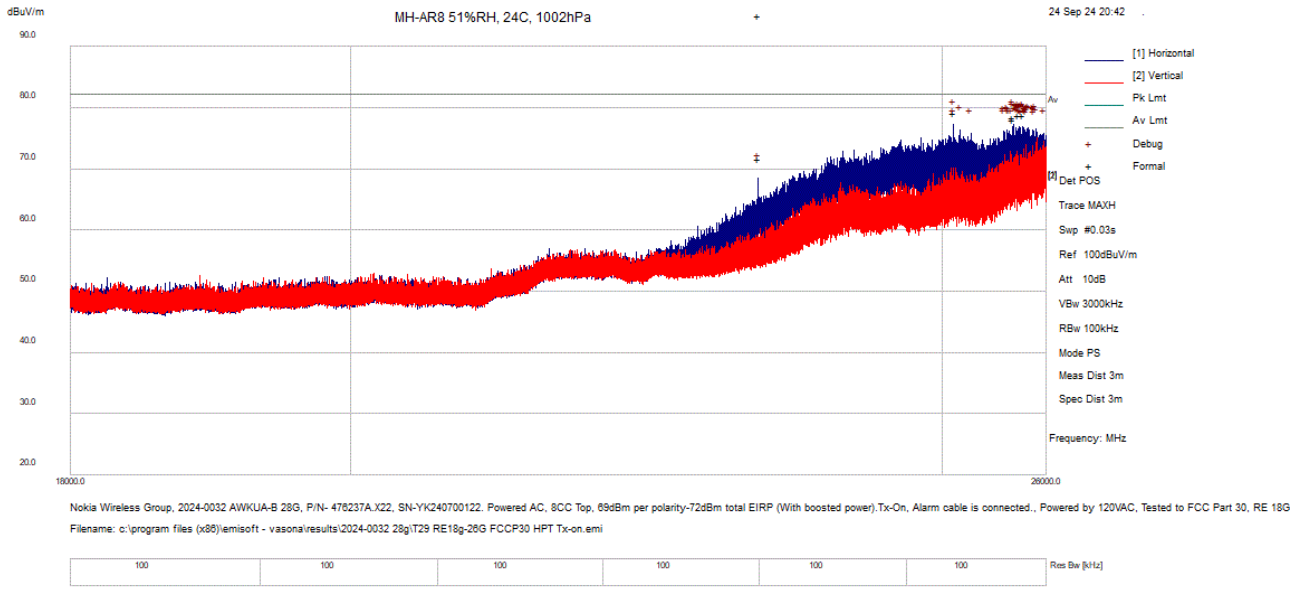
Frequency MHz	Raw dBuV	Cable Loss	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
11796.469	46.11	6.21	1.04	53.36	AvgMax	V	184	249	54.00	-0.64	Pass	
17849.387	28.74	7.72	2.87	39.32	AvgMax	H	314	75	54.00	-14.68	Pass	
11796.469	50.81	6.21	1.04	58.06	PeakMax	V	184	249	74.00	-15.94	Pass	
13482.417	28.99	6.64	0.44	36.07	AvgMax	H	262	125	54.00	-17.93	Pass	
17849.387	43.60	7.72	2.87	54.18	PeakMax	H	314	75	74.00	-19.82	Pass	
10315.065	29.04	5.57	-1.72	32.89	AvgMax	V	114	68	54.00	-21.11	Pass	
13482.417	43.85	6.64	0.44	50.94	PeakMax	H	262	125	74.00	-23.06	Pass	
10315.065	44.08	5.57	-1.72	47.93	PeakMax	V	114	68	74.00	-26.07	Pass	

Preview Data

Frequency MHz	Raw dBuV	Cable Loss	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
11796.480	43.50	6.21	1.04	50.75	Debug	V	178	270	54.00	-3.25	Pass	
17849.387	38.10	7.72	2.87	48.68	Debug	H	178	45	54.00	-5.32	Pass	
13481.973	39.67	6.64	0.44	46.75	Debug	H	178	225	54.00	-7.25	Pass	
10315.065	38.14	5.57	-1.72	41.99	Debug	V	179	44	54.00	-12.01	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 -26GHz AC 8CC



Test Information

Results Title	Radiated Emissions 3M 18GHz-26.5GHz
File Name	T29a RE18g-26G FCCP30 HP-Top Tx-on.emi
Test Laboratory	MH-AR8 51%RH, 24C, 1002hPa
Test Engineer	MJS/HS
Test Software	Vasona by EMISoft, version 6.061
Equipment	Nokia Wireless Group
EUT Details	2024-0032 AWKUA-B 28G, P/N- 476237A.X22, SN-YK240700122. Powered AC, 8CC Top, 69dBm per polarity-72dBm total EIRP (With boosted power).Tx-On, Alarm cable is connected.
Configuration	Powered by 120VAC, Tested to FCC Part 30, RE 18G-26GHz, @ 3-Meters, Preview RBW 120k; Formal RBW Default. Int. Att. 10dB, PA-E1525, LPF-E1507, FSW67, 3116 Horn Antenna E1527. Tx-on.
Date	2024-09-24 20:49:52

Formal Data

Frequency MHz	Raw dBuV	Cable Loss	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
25108.356	55.50	13.81	9.85	79.15	AvgMax	H	162	262	82.23	-3.08	Pass	
25766.889	54.33	14.45	10.15	78.93	AvgMax	H	163	263	82.23	-3.30	Pass	
25729.422	54.33	14.33	10.10	78.76	AvgMax	H	169	263	82.23	-3.47	Pass	
25676.356	54.26	14.25	10.04	78.55	AvgMax	H	164	259	82.23	-3.68	Pass	
25672.978	53.76	14.24	10.03	78.03	AvgMax	H	192	261	82.23	-4.20	Pass	
23326.075	50.80	13.04	7.84	71.68	AvgMax	H	152	263	82.23	-10.55	Pass	

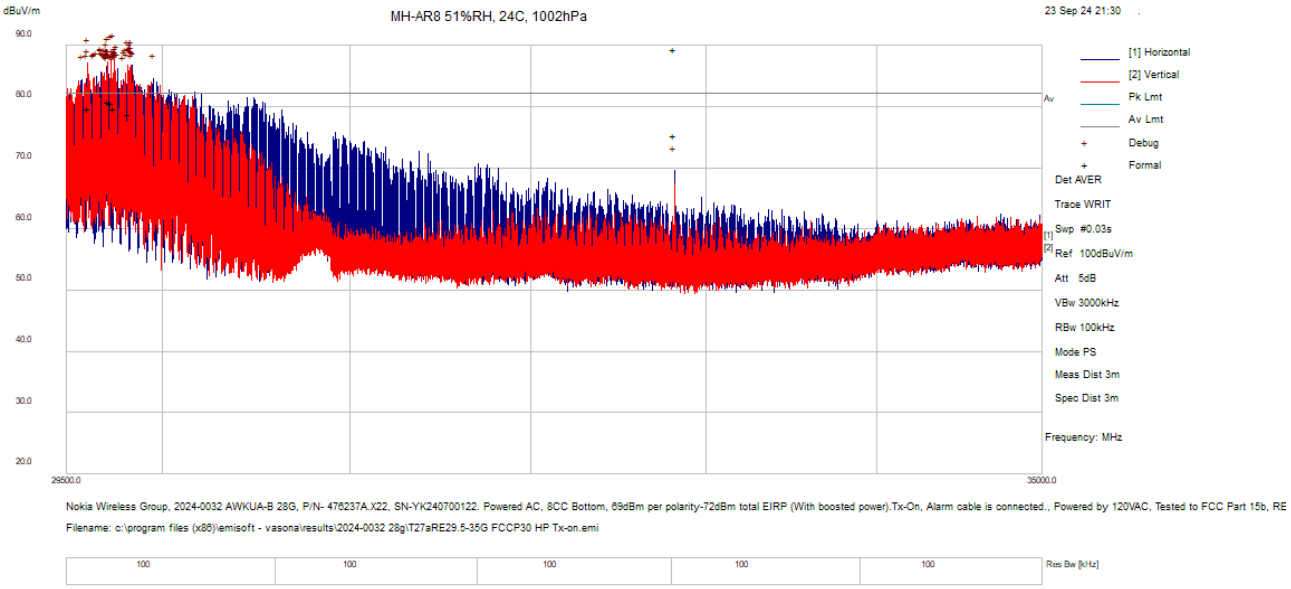
Preview Data

Frequency MHz	Raw dBuV	Cable Loss	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
25676.356	53.00	14.25	10.04	77.29	Debug	H	178	270	82.23	-4.94	Pass	

Frequency MHz	Raw dBuV	Cable Loss	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
25108.356	53.58	13.81	9.85	77.24	Debug	H	178	270	82.23	-4.99	Pass	
25729.422	52.48	14.33	10.10	76.91	Debug	H	178	270	82.23	-5.32	Pass	
25672.978	52.59	14.24	10.03	76.86	Debug	H	178	270	82.23	-5.37	Pass	
25766.889	52.25	14.45	10.15	76.85	Debug	H	178	270	82.23	-5.38	Pass	
25746.133	52.30	14.35	10.12	76.78	Debug	H	178	270	82.23	-5.45	Pass	
25702.400	52.42	14.29	10.07	76.77	Debug	H	178	270	82.23	-5.46	Pass	
25775.422	52.01	14.50	10.16	76.67	Debug	H	178	270	82.23	-5.56	Pass	
25823.600	51.66	14.76	10.22	76.63	Debug	H	178	270	82.23	-5.60	Pass	
25895.911	51.11	15.15	10.30	76.56	Debug	H	178	270	82.23	-5.67	Pass	
25776.222	51.86	14.50	10.16	76.52	Debug	H	178	270	82.23	-5.71	Pass	
25724.311	52.09	14.32	10.10	76.50	Debug	H	178	270	82.23	-5.73	Pass	
25819.778	51.50	14.74	10.21	76.45	Debug	H	178	270	82.23	-5.78	Pass	
25812.444	51.54	14.70	10.20	76.44	Debug	H	178	270	82.23	-5.79	Pass	
25868.089	51.11	15.00	10.27	76.37	Debug	H	178	270	82.23	-5.86	Pass	
25620.222	52.21	14.16	9.97	76.34	Debug	H	178	270	82.23	-5.89	Pass	
25836.089	51.28	14.83	10.23	76.33	Debug	H	178	270	82.23	-5.90	Pass	
25166.800	52.67	13.81	9.85	76.32	Debug	H	178	270	82.23	-5.91	Pass	
25722.445	51.87	14.32	10.09	76.28	Debug	H	178	270	82.23	-5.95	Pass	
25793.644	51.46	14.60	10.18	76.24	Debug	H	178	270	82.23	-5.99	Pass	
25635.645	52.04	14.19	9.99	76.21	Debug	H	178	270	82.23	-6.02	Pass	
25587.956	52.11	14.11	9.93	76.15	Debug	H	178	270	82.23	-6.08	Pass	
25878.444	50.78	15.05	10.28	76.12	Debug	H	178	270	82.23	-6.11	Pass	
25699.956	51.75	14.28	10.07	76.10	Debug	H	178	270	82.23	-6.13	Pass	
25713.867	51.68	14.31	10.08	76.07	Debug	H	178	270	82.23	-6.16	Pass	
25803.156	51.11	14.65	10.19	75.95	Debug	H	178	270	82.23	-6.28	Pass	
25903.733	50.41	15.19	10.31	75.92	Debug	H	178	270	82.23	-6.31	Pass	
25591.200	51.84	14.12	9.93	75.90	Debug	H	178	270	82.23	-6.33	Pass	
25102.622	52.23	13.80	9.85	75.89	Debug	H	178	270	82.23	-6.34	Pass	
25269.822	52.20	13.83	9.84	75.86	Debug	H	178	270	82.23	-6.37	Pass	
25628.667	51.68	14.18	9.98	75.83	Debug	H	178	270	82.23	-6.40	Pass	
25641.733	51.62	14.20	9.99	75.81	Debug	H	178	270	82.23	-6.42	Pass	
25740.222	51.34	14.35	10.11	75.80	Debug	H	178	270	82.23	-6.43	Pass	
25791.022	51.03	14.58	10.18	75.79	Debug	H	178	270	82.23	-6.44	Pass	
25745.867	51.31	14.35	10.12	75.78	Debug	H	178	270	82.23	-6.45	Pass	
25976.533	49.75	15.58	10.40	75.73	Debug	H	178	270	82.23	-6.50	Pass	
25664.356	51.48	14.23	10.02	75.73	Debug	H	178	270	82.23	-6.50	Pass	
25756.089	51.08	14.39	10.13	75.60	Debug	H	178	270	82.23	-6.63	Pass	
25875.244	50.27	15.04	10.28	75.58	Debug	H	178	270	82.23	-6.65	Pass	
25803.600	50.74	14.65	10.19	75.58	Debug	H	178	270	82.23	-6.65	Pass	
23327.333	47.61	13.04	7.84	68.49	Debug	H	102	353	82.23	-13.74	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.

29.5GHz -35GHz AC 8CC



Test Information

Results Title	Radiated Emissions 3m 26.5GHz-40GHz
File Name	T27a RE29.5-35G FCC-P30 HP Tx-on.emi
Test Laboratory	MH-AR8 51%RH, 24C, 1002hPa
Test Engineer	MJS/HS
Test Software	Vasona by EMISoft, version 6.061
Equipment	Nokia Wireless Group
EUT Details	2024-0032 AWKUA-B 28G, P/N- 476237A.X22, SN-YK240700122. Powered AC, 8CC Bottom, 69dBm per polarity-72dBm total EIRP (With boosted power).Tx-On, Alarm cable is connected.
Configuration	Powered by 120VAC, Tested to FCC Part 30, RE 29.5G-35GHz, @ 3-Meters, Preview RBW 120k; Formal RBW Default. Int. Att. 5dB, PA-E1525, LPF-E1515, FSW67, 3116 Horn Antenna E1527. Tx-on.
Date	2024-09-23 21:30:26

Formal Data

Frequency MHz	Raw dBuV	Cable Loss	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
29715.747	49.63	20.32	10.97	80.92	AvgMax	V	174	262	82.23	-1.31	Pass	
29732.137	49.67	20.06	10.95	80.68	AvgMax	V	172	263	82.23	-1.55	Pass	
29611.540	46.61	22.10	11.09	79.80	AvgMax	V	172	263	82.23	-2.43	Pass	
29746.327	48.93	19.84	10.93	79.69	AvgMax	V	175	264	82.23	-2.54	Pass	
29820.320	49.34	18.70	10.85	78.89	AvgMax	V	169	263	82.23	-3.34	Pass	
32814.713	49.82	14.62	10.97	75.42	AvgMax	H	138	262	82.23	-6.81	Pass	

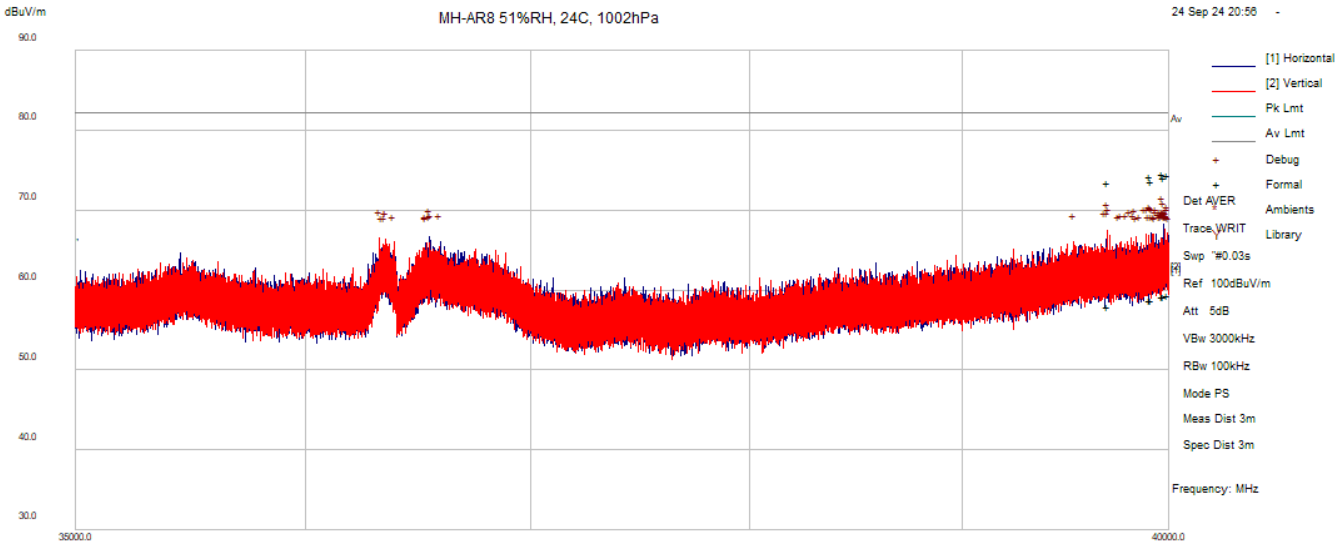
Preview Data

Frequency MHz	Raw dBuV	Cable Loss	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
29746.327	57.09	19.84	10.93	87.86	Debug	V	178	264	82.23	5.63	Fail	
29732.137	56.61	20.06	10.95	87.62	Debug	V	178	264	82.23	5.39	Fail	
29715.747	56.03	20.32	10.97	87.32	Debug	V	178	264	82.23	5.09	Fail	

Frequency MHz	Raw dBuV	Cable Loss	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
29611.540	53.96	22.10	11.09	87.15	Debug	V	178	264	82.23	4.92	Fail	
29820.320	57.24	18.70	10.85	86.79	Debug	V	178	264	82.23	4.56	Fail	
29840.780	57.52	18.42	10.82	86.76	Debug	H	178	264	82.23	4.53	Fail	
29835.757	57.43	18.49	10.83	86.75	Debug	V	178	264	82.23	4.52	Fail	
29710.100	55.10	20.41	10.97	86.49	Debug	H	178	264	82.23	4.26	Fail	
29829.780	56.95	18.57	10.84	86.35	Debug	V	178	264	82.23	4.12	Fail	
29764.037	55.67	19.56	10.91	86.14	Debug	H	178	264	82.23	3.91	Fail	
29836.050	56.63	18.48	10.83	85.94	Debug	V	178	264	82.23	3.71	Fail	
29838.727	56.62	18.44	10.83	85.89	Debug	V	178	264	82.23	3.66	Fail	
29754.613	55.16	19.71	10.92	85.79	Debug	V	178	264	82.23	3.56	Fail	
29827.177	56.33	18.61	10.84	85.77	Debug	V	178	264	82.23	3.54	Fail	
29681.610	53.72	20.89	11.01	85.62	Debug	H	178	264	82.23	3.39	Fail	
29828.790	56.09	18.58	10.84	85.51	Debug	V	178	264	82.23	3.28	Fail	
29682.673	53.63	20.87	11.00	85.51	Debug	V	178	264	82.23	3.28	Fail	
29708.157	54.07	20.44	10.98	85.49	Debug	V	178	264	82.23	3.26	Fail	
29698.917	53.87	20.59	10.99	85.45	Debug	V	178	264	82.23	3.22	Fail	
29806.863	55.67	18.89	10.86	85.42	Debug	V	178	264	82.23	3.19	Fail	
29748.600	54.69	19.80	10.93	85.42	Debug	V	178	264	82.23	3.19	Fail	
29741.670	54.55	19.91	10.94	85.40	Debug	V	178	264	82.23	3.17	Fail	
29713.950	54.05	20.35	10.97	85.37	Debug	V	178	264	82.23	3.14	Fail	
29836.380	56.06	18.48	10.83	85.37	Debug	V	178	264	82.23	3.14	Fail	
29717.727	54.11	20.29	10.96	85.37	Debug	H	178	264	82.23	3.14	Fail	
29720.220	54.13	20.25	10.96	85.35	Debug	H	178	264	82.23	3.12	Fail	
29614.327	52.14	22.06	11.08	85.28	Debug	V	178	264	82.23	3.05	Fail	
29805.800	55.45	18.91	10.86	85.21	Debug	V	178	264	82.23	2.98	Fail	
29757.180	54.55	19.67	10.92	85.14	Debug	V	178	264	82.23	2.91	Fail	
29845.290	55.93	18.35	10.82	85.10	Debug	V	178	264	82.23	2.87	Fail	
29715.490	53.73	20.33	10.97	85.03	Debug	H	178	264	82.23	2.80	Fail	
29847.417	55.86	18.32	10.82	85.00	Debug	H	178	264	82.23	2.77	Fail	
29686.377	53.17	20.81	11.00	84.98	Debug	V	178	264	82.23	2.75	Fail	
29656.237	52.53	21.33	11.04	84.90	Debug	H	178	264	82.23	2.67	Fail	
29752.670	54.23	19.74	10.92	84.90	Debug	V	178	264	82.23	2.67	Fail	
29690.447	53.13	20.74	11.00	84.86	Debug	V	178	264	82.23	2.63	Fail	
29715.013	53.54	20.33	10.97	84.84	Debug	V	178	264	82.23	2.61	Fail	
29698.623	53.24	20.60	10.99	84.83	Debug	V	178	264	82.23	2.60	Fail	
29768.730	54.43	19.48	10.91	84.82	Debug	H	178	264	82.23	2.59	Fail	
29708.560	53.30	20.44	10.97	84.72	Debug	V	178	264	82.23	2.49	Fail	
29645.310	52.15	21.52	11.05	84.71	Debug	V	178	264	82.23	2.48	Fail	
29756.190	54.11	19.68	10.92	84.71	Debug	V	178	264	82.23	2.48	Fail	
29816.763	55.10	18.75	10.85	84.70	Debug	H	178	264	82.23	2.47	Fail	
29709.330	53.28	20.42	10.97	84.68	Debug	V	178	264	82.23	2.45	Fail	
29605.967	51.35	22.20	11.09	84.65	Debug	H	178	264	82.23	2.42	Fail	
29753.550	53.97	19.72	10.92	84.61	Debug	V	178	264	82.23	2.38	Fail	
29955.803	56.94	16.97	10.69	84.61	Debug	H	178	264	82.23	2.38	Fail	
29638.417	51.90	21.64	11.06	84.60	Debug	V	178	264	82.23	2.37	Fail	
29728.543	53.52	20.12	10.95	84.59	Debug	V	178	264	82.23	2.36	Fail	
29749.370	53.81	19.79	10.93	84.53	Debug	H	178	264	82.23	2.30	Fail	
29840.927	55.28	18.41	10.82	84.52	Debug	H	178	264	82.23	2.29	Fail	
29737.673	53.56	19.97	10.94	84.47	Debug	V	178	264	82.23	2.24	Fail	
29734.850	53.48	20.02	10.94	84.44	Debug	V	178	264	82.23	2.21	Fail	
29583.453	50.68	22.61	11.12	84.41	Debug	H	178	264	82.23	2.18	Fail	
29736.133	53.46	20.00	10.94	84.41	Debug	V	178	264	82.23	2.18	Fail	
29746.693	53.62	19.83	10.93	84.38	Debug	V	178	264	82.23	2.15	Fail	
29753.073	53.71	19.73	10.92	84.36	Debug	V	178	264	82.23	2.13	Fail	
29705.627	52.88	20.48	10.98	84.34	Debug	V	178	264	82.23	2.11	Fail	
29797.073	54.41	19.03	10.87	84.31	Debug	H	178	264	82.23	2.08	Fail	
29710.430	52.91	20.41	10.97	84.29	Debug	V	178	264	82.23	2.06	Fail	
32814.673	43.82	14.62	10.97	69.41	Debug	H	102	316	82.23	-12.82	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.

35GHz -40GHz AC 8CC



Test Information

Results Title	Radiated E 3m 26.5GHz-40GHz
File Name	T28b RE35-40g fccp30 hp tx-on.emi
Test Laboratory	MH-AR8 51%RH, 24C, 1002hPa
Test Engineer	MJS/HS
Test Software	Vasona by EMISoft, version 6.061
Equipment	Nokia Wireless Group
EUT Details	2024-0032 AWKUA-B 28G, P/N- 476237A.X22, SN-YK240700122. Powered AC, 8CC Bottom, 69dBm per polarity-72dBm total EIRP (With boosted power).Tx-On, Alarm cable is connected.
Configuration	Powered by 120VAC, Tested to FCC Part 30, RE 35G-40GHz, @ 3-Meters, Preview RBW 120k; Formal RBW Default. Int. Att. 10dB, PA-E1525, LPF-E1515, FSW67, 3116 Horn Antenna E1527. Tx-on.
Date	2024-09-24 20:56:22

Formal Data

Frequency MHz	Raw dBuV	Cable Loss	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
39993.207	28.98	19.32	11.05	59.35	AvgMax	V	112	191	82.23	-22.88	Pass	
39977.475	28.97	19.31	11.01	59.29	AvgMax	V	203	100	82.23	-22.94	Pass	
39971.070	28.91	19.31	10.99	59.20	AvgMax	H	130	174	82.23	-23.03	Pass	
39916.636	28.62	19.29	10.84	58.74	AvgMax	V	194	222	82.23	-23.49	Pass	
39909.441	28.63	19.28	10.82	58.73	AvgMax	H	226	256	82.23	-23.50	Pass	
39698.804	28.65	19.19	10.23	58.07	AvgMax	V	226	19	82.23	-24.16	Pass	

Preview Data

Frequency MHz	Raw dBuV	Cable Loss	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
39971.000	38.00	19.31	10.99	68.29	Debug	H	103	44	82.23	-13.94	Pass	
39977.700	37.32	19.31	11.01	67.64	Debug	V	253	315	82.23	-14.59	Pass	

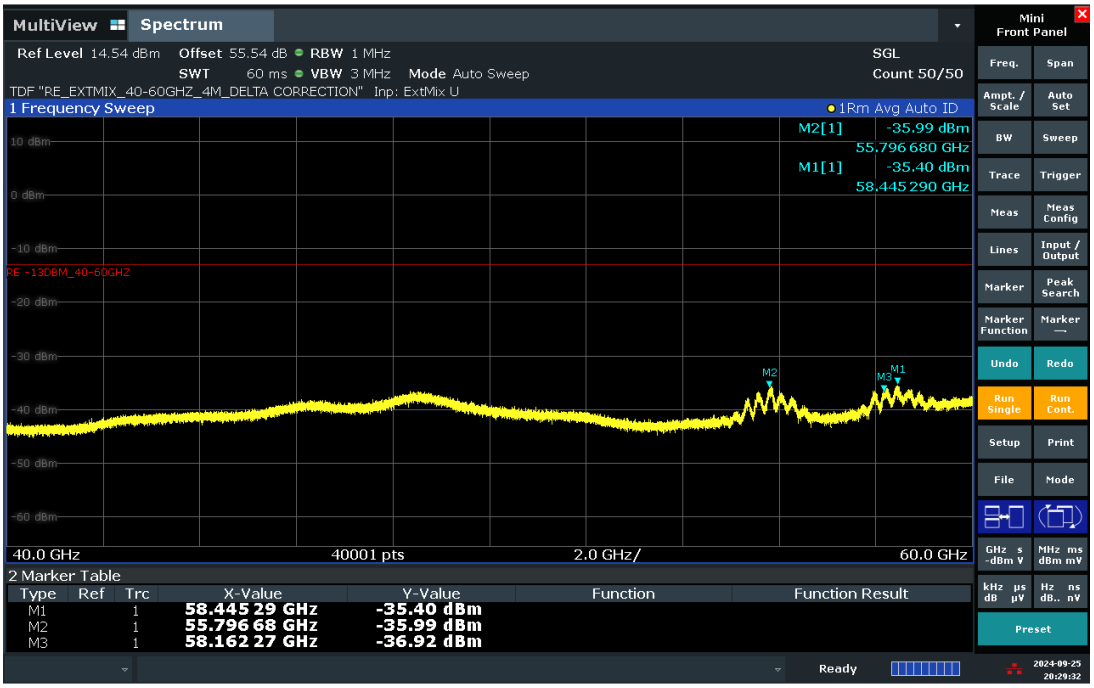
Frequency MHz	Raw dBuV	Cable Loss	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
39698.800	38.02	19.19	10.23	67.44	Debug	V	178	286	82.23	-14.79	Pass	
39909.500	37.08	19.28	10.82	67.18	Debug	H	103	198	82.23	-15.05	Pass	
39993.267	36.80	19.32	11.05	67.17	Debug	V	178	198	82.23	-15.06	Pass	
39915.900	36.91	19.29	10.84	67.03	Debug	V	253	286	82.23	-15.20	Pass	
39922.667	36.80	19.29	10.85	66.94	Debug	V	178	0	82.23	-15.29	Pass	
39886.667	36.90	19.27	10.75	66.93	Debug	V	103	132	82.23	-15.30	Pass	
39937.433	36.72	19.30	10.90	66.91	Debug	H	103	44	82.23	-15.32	Pass	
39995.433	36.47	19.32	11.06	66.85	Debug	H	103	154	82.23	-15.38	Pass	
39897.400	36.77	19.28	10.78	66.83	Debug	V	178	66	82.23	-15.40	Pass	
39708.633	37.33	19.20	10.26	66.79	Debug	V	253	220	82.23	-15.44	Pass	
36547.367	40.67	17.00	9.01	66.68	Debug	H	178	88	82.23	-15.55	Pass	
39837.400	36.79	19.25	10.62	66.66	Debug	V	253	132	82.23	-15.57	Pass	
36325.767	40.61	16.80	9.18	66.59	Debug	V	253	198	82.23	-15.64	Pass	
39969.067	36.30	19.31	10.98	66.59	Debug	H	253	176	82.23	-15.64	Pass	
39978.833	36.26	19.31	11.01	66.58	Debug	H	253	242	82.23	-15.65	Pass	
39812.667	36.79	19.24	10.55	66.58	Debug	V	253	66	82.23	-15.65	Pass	
39938.067	36.34	19.30	10.90	66.53	Debug	H	178	264	82.23	-15.70	Pass	
39958.767	36.26	19.30	10.95	66.52	Debug	V	103	0	82.23	-15.71	Pass	
39989.433	36.10	19.32	11.04	66.45	Debug	V	103	44	82.23	-15.78	Pass	
39691.367	37.01	19.19	10.21	66.41	Debug	H	103	44	82.23	-15.82	Pass	
36353.600	40.38	16.82	9.18	66.38	Debug	V	178	198	82.23	-15.85	Pass	
36353.233	40.38	16.82	9.18	66.38	Debug	V	178	44	82.23	-15.85	Pass	
39977.033	36.06	19.31	11.01	66.37	Debug	H	103	88	82.23	-15.86	Pass	
39700.267	36.91	19.19	10.23	66.34	Debug	V	178	308	82.23	-15.89	Pass	
39976.767	36.02	19.31	11.00	66.33	Debug	V	253	132	82.23	-15.90	Pass	
39969.500	36.00	19.31	10.98	66.30	Debug	V	178	286	82.23	-15.93	Pass	
39948.600	35.97	19.30	10.93	66.19	Debug	H	253	286	82.23	-16.04	Pass	
36553.733	40.15	17.01	8.99	66.15	Debug	H	103	0	82.23	-16.08	Pass	
39987.167	35.78	19.32	11.03	66.13	Debug	V	253	132	82.23	-16.10	Pass	
39982.533	35.75	19.31	11.02	66.09	Debug	H	178	220	82.23	-16.14	Pass	
39986.733	35.74	19.32	11.03	66.08	Debug	H	103	198	82.23	-16.15	Pass	
39988.700	35.73	19.32	11.04	66.08	Debug	V	178	198	82.23	-16.15	Pass	
39537.467	37.18	19.12	9.78	66.08	Debug	V	103	66	82.23	-16.15	Pass	
39829.667	36.23	19.25	10.59	66.08	Debug	V	253	308	82.23	-16.15	Pass	
39973.433	35.76	19.31	11.00	66.07	Debug	H	103	286	82.23	-16.16	Pass	
36593.467	40.13	17.04	8.87	66.05	Debug	H	253	88	82.23	-16.18	Pass	
39795.167	36.29	19.23	10.50	66.02	Debug	V	178	315	82.23	-16.21	Pass	
39767.233	36.38	19.22	10.42	66.02	Debug	V	178	66	82.23	-16.21	Pass	
39967.167	35.73	19.31	10.98	66.02	Debug	V	103	0	82.23	-16.21	Pass	
36387.033	39.97	16.85	9.17	65.99	Debug	V	103	286	82.23	-16.24	Pass	
39992.200	35.61	19.32	11.05	65.97	Debug	H	103	242	82.23	-16.26	Pass	
39964.033	35.69	19.31	10.97	65.96	Debug	H	103	0	82.23	-16.27	Pass	
39983.700	35.60	19.32	11.02	65.94	Debug	H	253	110	82.23	-16.29	Pass	
36531.600	39.89	16.99	9.05	65.93	Debug	H	178	110	82.23	-16.30	Pass	
39860.900	35.96	19.26	10.68	65.90	Debug	V	103	88	82.23	-16.33	Pass	
39927.667	35.74	19.29	10.87	65.90	Debug	H	253	66	82.23	-16.33	Pass	
36545.267	39.88	17.00	9.01	65.89	Debug	V	103	315	82.23	-16.34	Pass	
39956.733	35.64	19.30	10.95	65.89	Debug	V	103	132	82.23	-16.34	Pass	
39757.733	36.27	19.22	10.39	65.89	Debug	V	178	0	82.23	-16.34	Pass	
39989.700	35.53	19.32	11.04	65.88	Debug	H	103	0	82.23	-16.35	Pass	
39913.033	35.77	19.28	10.83	65.88	Debug	V	103	132	82.23	-16.35	Pass	
39900.233	35.78	19.28	10.79	65.85	Debug	H	103	176	82.23	-16.38	Pass	
36531.967	39.79	16.99	9.05	65.83	Debug	V	103	198	82.23	-16.40	Pass	
39844.033	35.94	19.25	10.63	65.83	Debug	H	253	22	82.23	-16.40	Pass	
36349.367	39.81	16.82	9.18	65.81	Debug	H	103	315	82.23	-16.42	Pass	
39999.367	35.42	19.32	11.07	65.81	Debug	H	253	132	82.23	-16.42	Pass	
39934.233	35.61	19.29	10.89	65.79	Debug	V	178	44	82.23	-16.44	Pass	
36338.133	39.79	16.81	9.18	65.78	Debug	V	178	264	82.23	-16.45	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**

Horizontal

2024-0032 AWKUA/B 28GHz



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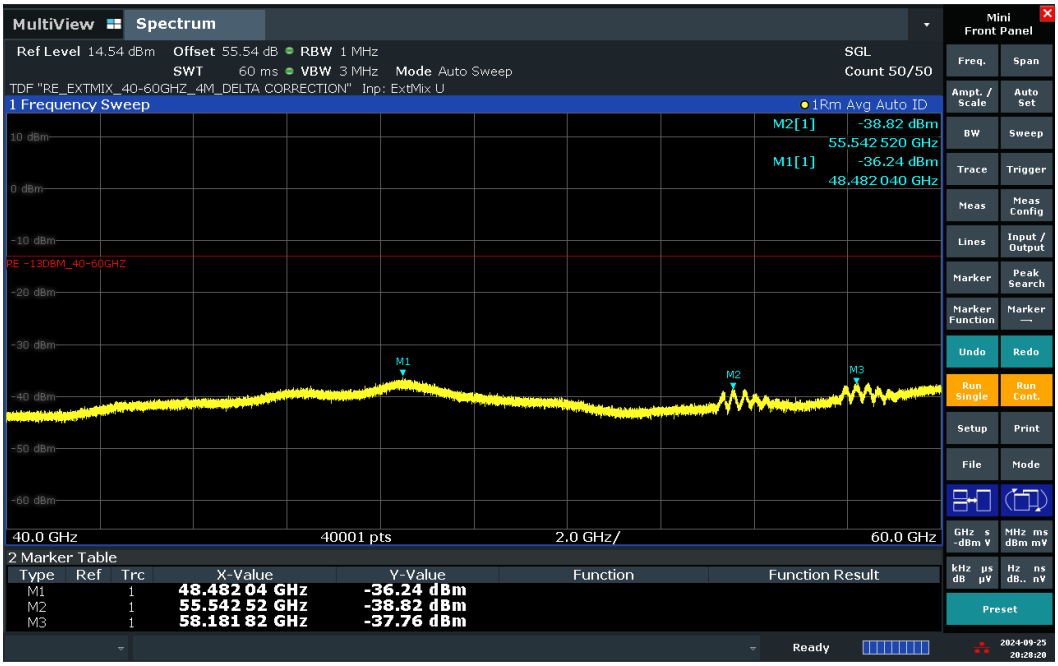
Vertical

2024-0032 AWKUA/B 28GHz



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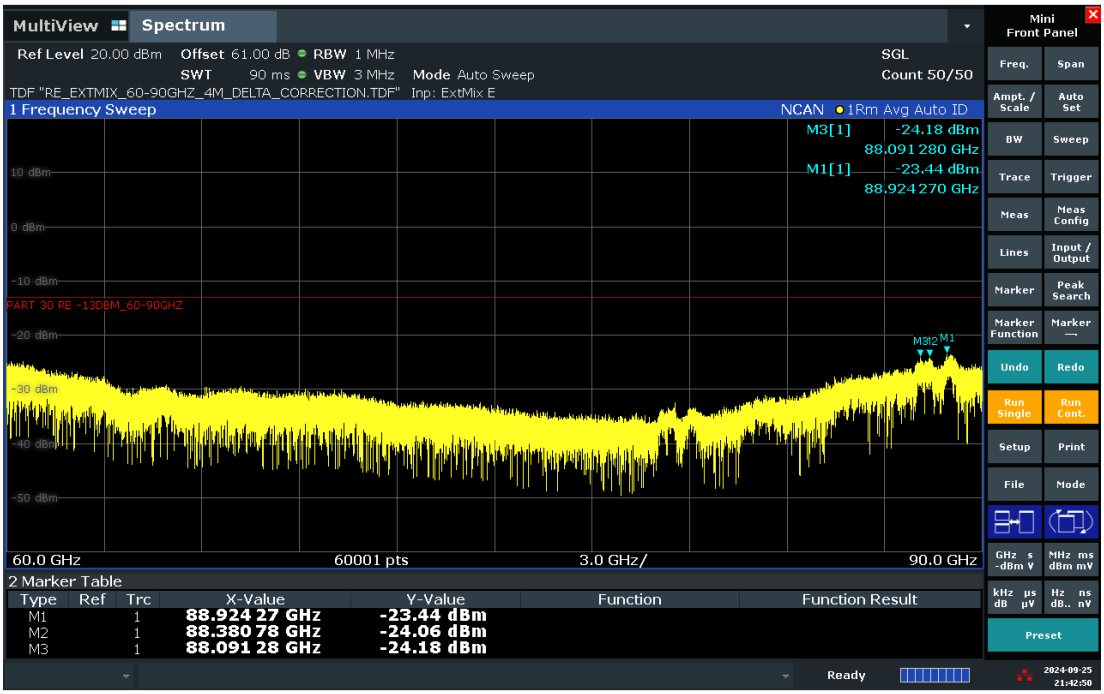
Maximum Measured Radiated Emissions -U Band 60GHz-90GHz FCC Part 30

Horizontal

2024-0032 AWKUA/B 28GHz



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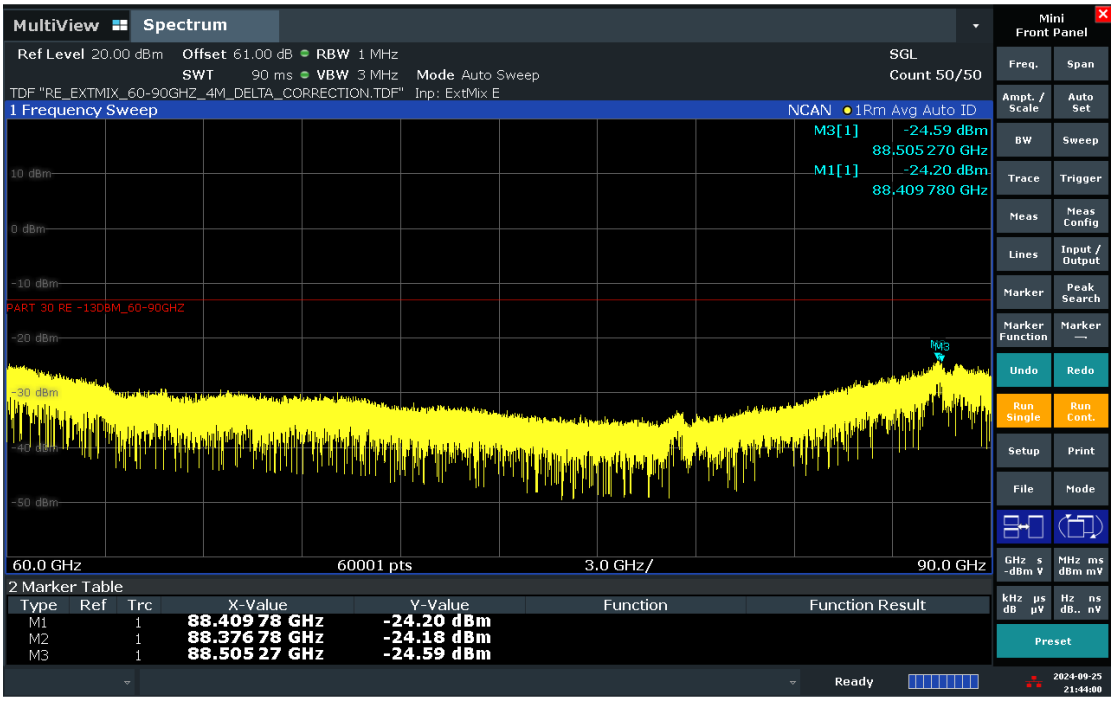
Vertical

2024-0032 AWKUA/B 28GHz



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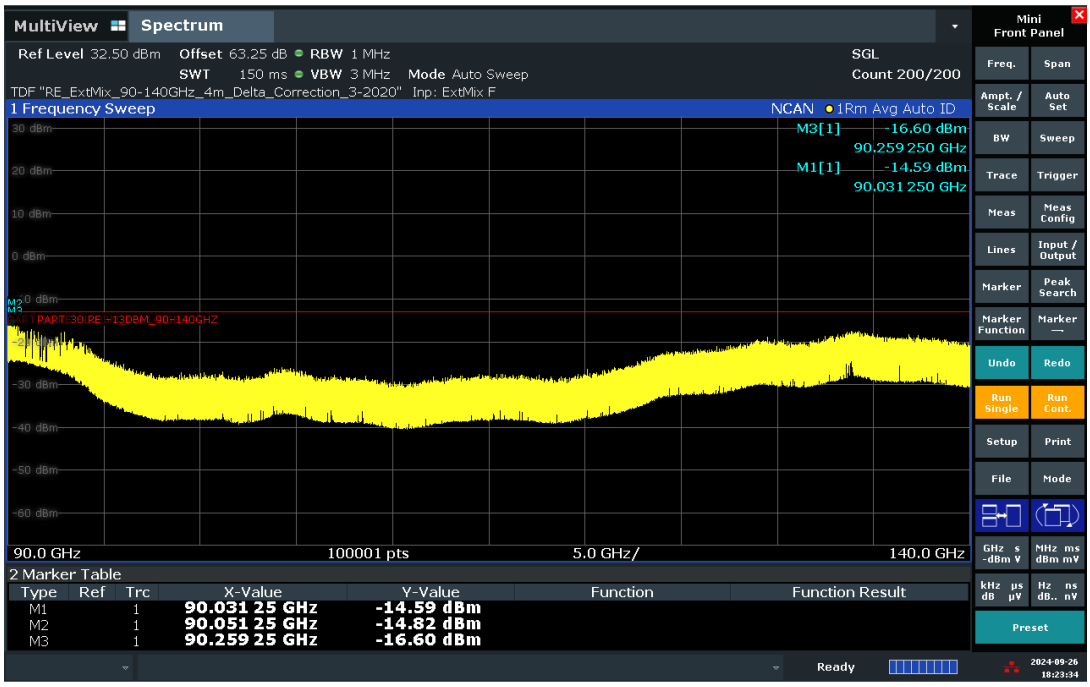
Maximum Measured Radiated Emissions -U Band 90GHz-140GHz **FCC Part 30**

Horizontal

2024-0032 AWKUA/B



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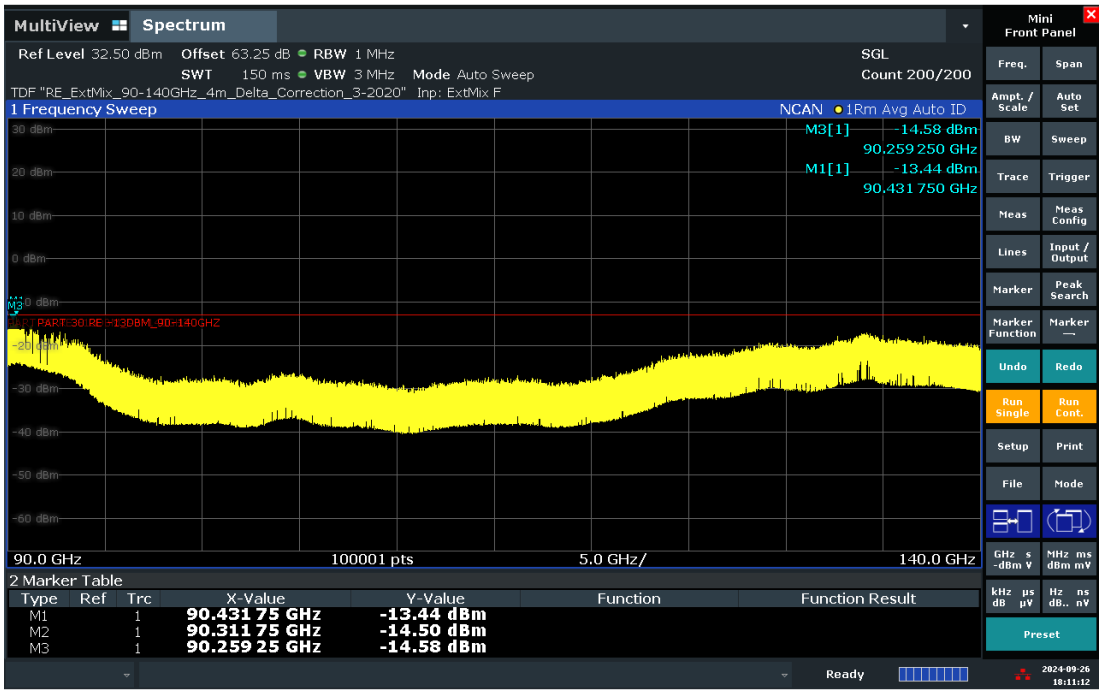
Vertical

2024-0032 AWKUA/B



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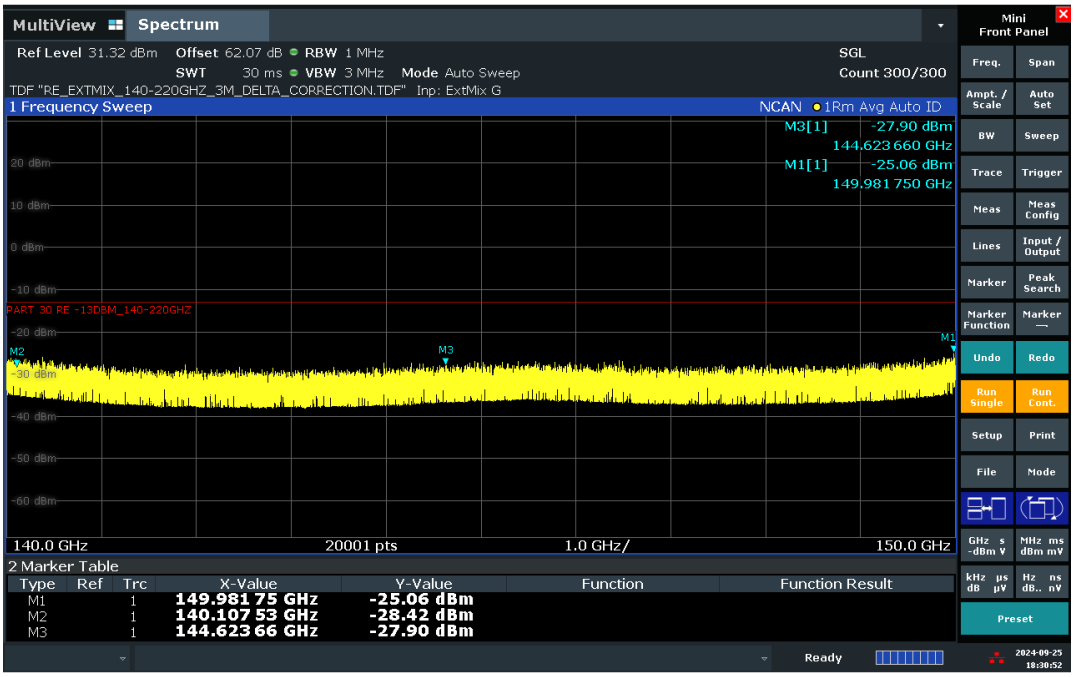
Maximum Measured Radiated Emissions -U Band 140GHz-150GHz FCC Part 30

Horizontal

2024-0032 AWKUA/B 28 GHz



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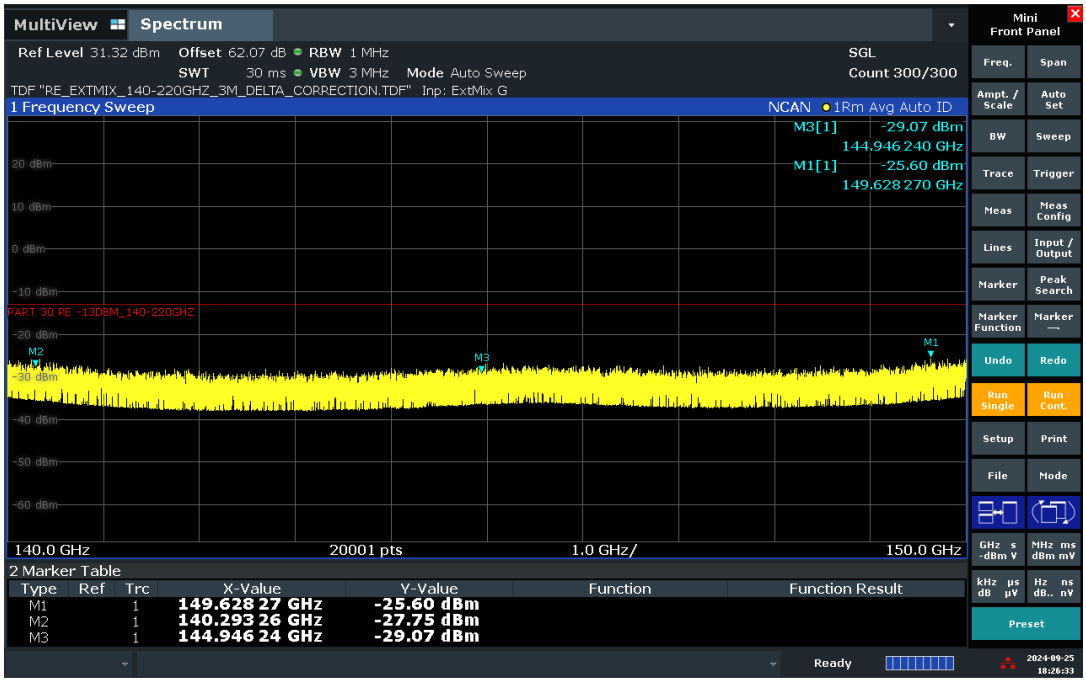
Vertical

2024-0032 AWKUA/B 28 GHz



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4.7 Section 2.1055 MEASUREMENT OF FREQUENCY STABILITY

This measurement evaluates the frequency difference between the actual transmit carrier frequency and the specified transmit frequency assignment. Only the portion of the transmitter system containing the frequency determining and stabilizing circuitry need be put in an environmental chamber and subjected to the temperature variation test per FCC Section 2.1055 and RSS-133. The unit which provides baseband signals, such as BBU (baseband unit), can be located outside the chamber if it is a separated unit.

4.7.1 Frequency Stability Results AC Model:

Frequency Stability testing was completed on: AWKUA, 28GHz Radio (CF = 27849.48 MHz). Testing was performed from 08/12/2024 through 08/13/2024 on the radio, which was located in the T-16 Thermal chamber of the Global Product Compliance Laboratory (GPCL) test facility located in Building 4, Room 4-280, Murray Hill, NJ, by Joe Bordonaro from GPCL

Table 1: Unit Under Test

Series	Vendor	Serial Number	Comcode
AWKUA	Nokia	YK240700124	476237A.X22

The temperatures to which the UUT were subjected ranged from a high temperature of +50ºC system ambient to a low temperature of -30ºC system ambient with measurements recorded at 10C increments. Transmit frequency error measures the deviation between the actual transmit frequency and the assigned frequency. The transmit frequency error in this case was measured by capturing the transmitted signal using a receiving antenna and a MXA signal analyzer. The system level frequency stability testing resulted in a worst case deviation of **108.85 Hz** which is within the compliance with established design criteria of 1215 Hz.

4.7.2 Frequency Stability Results DC Model:

Frequency Stability testing was completed on: AWKUB, 28GHz Radio (CF = 27849.48 MHz). Testing was performed from 08/14/2024 through 08/15/2024 on the radio, which was located in the T-14 Thermal chamber of the Global Product Compliance Laboratory (GPCL) test facility located in Building 4, Room 4-280, Murray Hill, NJ, by Joe Bordonaro from GPCL.

Table 2: Unit Under Test

Series	Vendor	Serial Number	Model #
AWKUB	Nokia	YK240800006	476238A.X22

The temperatures to which the UUT were subjected ranged from a high temperature of +50ºC system ambient to a low temperature of -30ºC system ambient with measurements recorded at 10C increments. Transmit frequency error measures the deviation between the actual transmit frequency and the assigned frequency. The transmit frequency error in this case was measured by capturing the transmitted signal using a receiving antenna and a MXA signal analyzer. The system level frequency stability testing resulted in a worst case deviation of **94.73 Hz** which is within the compliance with established design criteria of 1215 Hz.

AC Model

Baseline Measurement at +25°C

Transmit Frequency Deviation at +25°C at 100% of Nominal Voltage, 120VAC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**5.24**
0.5	**6.11**
1.0	**-20.11**
1.5	**-4.68**
2.0	**-24.14**
2.5	**2.20**
3.0	**-12.87**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm) ±0.05ppm = ±Hz**
FCC RESULT	**Pass**

Transmit Frequency Deviation at +50°C at 100% of Nominal Voltage, 120VAC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**11.02**
0.5	**7.18**
1.0	**-19.98**
1.5	**-12.83**
2.0	**-2.11**
2.5	**25.06**
3.0	**-21.66**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm) ±0.05ppm = ±Hz**
FCC RESULT	**Pass**

Transmit Frequency Deviation at +40°C at 100% of Nominal Voltage, 120VAC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**-6.47**
0.5	**3.46**
1.0	**9.54**
1.5	**-15.38**
2.0	**-12.18**
2.5	**1.73**
3.0	**-11.41**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm) ±0.05ppm = ±Hz**
FCC RESULT	**Pass**

Transmit Frequency Deviation at +30°C at 100% of Nominal Voltage, 120VAC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**6.70**
0.5	**11.20**
1.0	**30.99**
1.5	**9.58**
2.0	**-14.66**
2.5	**-6.92**
3.0	**-19.99**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm)** **±0.05ppm = ±Hz**
FCC RESULT	**Pass**

Transmit Frequency Deviation at +20°C at 100% of Nominal Voltage, 120VAC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**-17.07**
0.5	**-12.23**
1.0	**-41.73**
1.5	**-26.06**
2.0	**-7.27**
2.5	**-14.21**
3.0	**-11.25**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm)** **±0.05ppm = ±Hz**
FCC RESULT	**Pass**

Transmit Frequency Deviation at +10°C at 100% of Nominal Voltage, 120VAC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	**7.81**
0.5	**-2.08**
1.0	**8.63**
1.5	**-5.63**
2.0	**-20.17**
2.5	**12.55**
3.0	**-36.40**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm)** **±0.05ppm = ±Hz**
FCC RESULT	**Pass**

Transmit Frequency Deviation at 0°C at 100% of Nominal Voltage, 120VAC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**18.85**
0.5	**26.44**
1.0	**16.73**
1.5	**-1.97**
2.0	**12.02**
2.5	**22.16**
3.0	**19.37**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm) ±0.05ppm = ±Hz**
FCC RESULT	**Pass**

Transmit Frequency Deviation at -10°C at 100% of Nominal Voltage, 120VAC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**3.00**
0.5	**27.24**
1.0	**2.35**
1.5	**11.44**
2.0	**17.02**
2.5	**5.41**
3.0	**-18.21**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm) ±0.05ppm = ±Hz**
FCC RESULT	**Pass**

Transmit Frequency Deviation at -20°C at 100% of Nominal Voltage, 120VAC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**-4.91**
0.5	**-21.61**
1.0	**2.56**
1.5	**5.65**
2.0	**-13.35**
2.5	**-23.21**
3.0	**-36.60**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm) ±0.05ppm = ±Hz**
FCC RESULT	**Pass**

Transmit Frequency Deviation at -30°C at 100% of Nominal Voltage, 120VAC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**9.83**
0.5	**37.19**
1.0	**12.17**
1.5	**5.63**
2.0	**-5.05**
2.5	**10.54**
3.0	**-2.53**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm) ±0.05ppm = ±Hz**
FCC RESULT	**Pass**

Upon return to +25°C.

Transmit Frequency Deviation at +25°C at 100% of Nominal Voltage, 120VAC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**25.67**
0.5	**11.59**
1.0	**1.39**
1.5	**-4.22**
2.0	**-16.55**
2.5	**4.15**
3.0	**15.34**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm) ±0.05ppm = ±Hz**
FCC RESULT	**Pass**

Transmit Frequency Deviation at +25°C at +15% of Nominal Voltage, 138.0VAC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**11.52**
0.5	**2.51**
1.0	**6.29**
1.5	**22.39**
2.0	**-8.25**
2.5	**-14.65**
3.0	**-5.38**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm) ±0.05ppm = ±Hz**
FCC RESULT	**Pass**

Transmit Frequency Deviation at +25°C at +12% of Nominal Voltage, 134.40VAC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**-15.58**
0.5	**-6.52**
1.0	**2.46**
1.5	**-27.14**
2.0	**1.34**
2.5	**-5.23**
3.0	**10.30**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm) ±0.05ppm = ±Hz**
FCC RESULT	**Pass**

Transmit Frequency Deviation at +25°C at +9% of Nominal Voltage, 130.80VAC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**17.17**
0.5	**2.39**
1.0	**-14.11**
1.5	**19.50**
2.0	**13.60**
2.5	**12.11**
3.0	**-12.15**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm) ±0.05ppm = ±Hz**
FCC RESULT	**Pass**

Transmit Frequency Deviation at +25°C at +6% of Nominal Voltage, 127.20VAC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**-9.96**
0.5	**12.12**
1.0	**-5.16**
1.5	**-12.07**
2.0	**108.85**
2.5	**40.62**
3.0	**-2.35**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm) ±0.05ppm = ±Hz**
FCC RESULT	**Pass**

Transmit Frequency Deviation at +25°C at +3% of Nominal Voltage, 123.60VAC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**-31.87**
0.5	**-12.78**
1.0	**6.21**
1.5	**39.13**
2.0	**9.23**
2.5	**-57.46**
3.0	**-6.31**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm) ±0.05ppm = ±Hz**
FCC RESULT	**Pass**

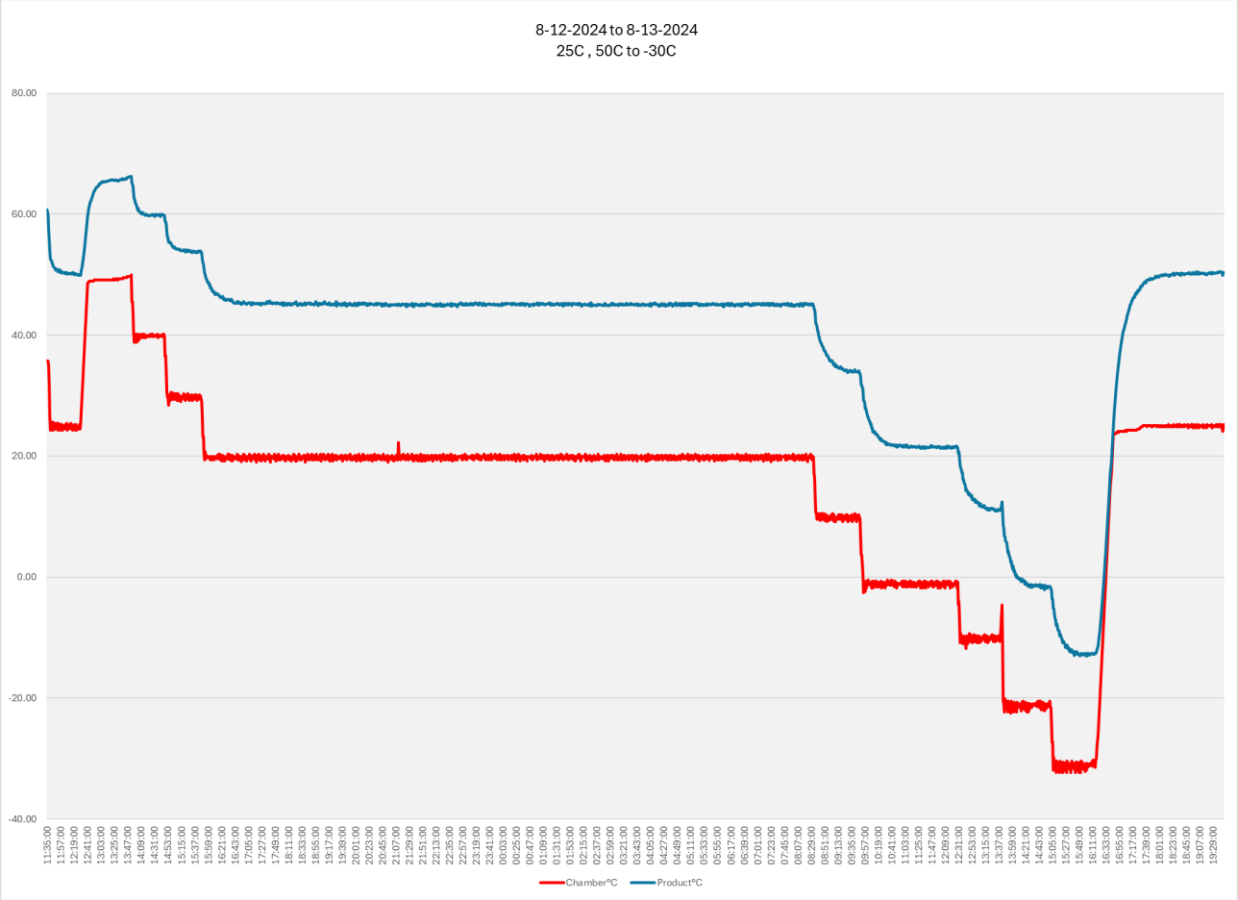
Transmit Frequency Deviation at +25°C at -3% of Nominal Voltage, 116.40VAC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**-1.32**
0.5	**2.16**
1.0	**9.16**
1.5	**-6.59**
2.0	**-21.26**
2.5	**-12.04**
3.0	**20.05**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm) ±0.05ppm = ±Hz**
FCC RESULT	**Pass**

Transmit Frequency Deviation at +25°C at -6% of Nominal Voltage, 112.80VAC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**-5.21**
0.5	**4.80**
1.0	**-2.12**
1.5	**-12.90**
2.0	**-3.30**
2.5	**-13.19**
3.0	**-23.22**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm) ±0.05ppm = ±Hz**
FCC RESULT	**Pass**

Transmit Frequency Deviation at +25°C at -9% of Nominal Voltage, 109.20VAC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**4.41**
0.5	**9.22**
1.0	**-8.18**
1.5	**-5.06**
2.0	**-6.93**
2.5	**-3.92**
3.0	**4.51**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm) ±0.05ppm = ±Hz**
FCC RESULT	**Pass**

Transmit Frequency Deviation at +25°C at -12% of Nominal Voltage, 105.60VAC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**12.83**
0.5	**-5.29**
1.0	**20.95**
1.5	**1.47**
2.0	**7.50**
2.5	**5.88**
3.0	**-9.45**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm) ±0.05ppm = ±Hz**
FCC RESULT	**Pass**

Transmit Frequency Deviation at +25°C at -15% of Nominal Voltage, 102.0VAC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**-1.73**
0.5	**27.66**
1.0	**-7.23**
1.5	**11.87**
2.0	**10.31**
2.5	**-9.99**
3.0	**13.40**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm) ±0.05ppm = ±Hz**
FCC RESULT	**Pass**


8-12-2024 to 8-13-2024
25C , 50C to -30C
80.00
60.00
40.00
20.00
0.00
-20.00
-40.00
Chamber°C
Product°C

DC Model

Baseline Measurement at +25°C

Transmit Frequency Deviation at +25°C at 100% of Nominal Voltage, -48VDC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**-5.61**
0.5	**8.76**
1.0	**2.10**
1.5	**12.39**
2.0	**31.81**
2.5	**-5.28**
3.0	**-7.14**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm) ±0.05ppm = ±Hz**
FCC RESULT	**PASS**

Transmit Frequency Deviation at +50°C at 100% of Nominal Voltage, -48VDC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**26.64**
0.5	**1.87**
1.0	**10.02**
1.5	**-14.27**
2.0	**21.09**
2.5	**-2.46**
3.0	**-5.31**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm) ±0.05ppm = ±Hz**
FCC RESULT	**PASS**

Transmit Frequency Deviation at +40°C at 100% of Nominal Voltage, -48VDC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**-14.02**
0.5	**-2.04**
1.0	**6.07**
1.5	**3.47**
2.0	**-21.89**
2.5	**5.42**
3.0	**-12.16**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm) ±0.05ppm = ±Hz**
FCC RESULT	**PASS**

Transmit Frequency Deviation at +30°C at 100% of Nominal Voltage, -48VDC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**11.77**
0.5	**-5.09**
1.0	**25.33**
1.5	**40.02**
2.0	**20.47**
2.5	**-20.27**
3.0	**9.97**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm)** **±0.05ppm = ±Hz**
FCC RESULT	**PASS**

Transmit Frequency Deviation at +20°C at 100% of Nominal Voltage, -48VDC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**20.86**
0.5	**11.84**
1.0	**-22.17**
1.5	**18.57**
2.0	**13.76**
2.5	**18.64**
3.0	**30.55**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm)** **±0.05ppm = ±Hz**
FCC RESULT	**PASS**

Transmit Frequency Deviation at +10°C at 100% of Nominal Voltage, -48VDC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**22.67**
0.5	**10.45**
1.0	**22.72**
1.5	**4.91**
2.0	**14.40**
2.5	**22.89**
3.0	**7.60**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm)** **±0.05ppm = ±Hz**
FCC RESULT	**PASS**

Transmit Frequency Deviation at 0°C at 100% of Nominal Voltage, -48VDC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**6.48**
0.5	**-13.58**
1.0	**-48.23**
1.5	**-11.49**
2.0	**-13.13**
2.5	**47.36**
3.0	**-6.17**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm)** **±0.05ppm = ±Hz**
FCC RESULT	**PASS**

Transmit Frequency Deviation at -10°C at 100% of Nominal Voltage, -48VDC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**-9.66**
0.5	**5.23**
1.0	**-3.01**
1.5	**28.59**
2.0	**-3.98**
2.5	**10.88**
3.0	**-4.53**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm)** **±0.05ppm = ±Hz**
FCC RESULT	**PASS**

Transmit Frequency Deviation at -20°C at 100% of Nominal Voltage, -48VDC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**35.55**
0.5	**21.11**
1.0	**15.89**
1.5	**77.51**
2.0	**-15.68**
2.5	**4.90**
3.0	**15.36**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm)** **±0.05ppm = ±Hz**
FCC RESULT	**PASS**

Transmit Frequency Deviation at -30°C at 100% of Nominal Voltage, -48VDC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**-9.61**
0.5	**2.54**
1.0	**37.61**
1.5	**24.85**
2.0	**18.17**
2.5	**12.19**
3.0	**36.02**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm) ±0.05ppm = ±Hz**
FCC RESULT	**PASS**

Upon return to +25°C.

Transmit Frequency Deviation at +25°C at 100% of Nominal Voltage, -48VDC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**7.20**
0.5	**10.31**
1.0	**-1.05**
1.5	**-8.65**
2.0	**-1.87**
2.5	**21.35**
3.0	**-10.41**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm) ±0.05ppm = ±Hz**
FCC RESULT	**PASS**

Transmit Frequency Deviation at +25°C at 103% of Nominal Voltage, -49.44VDC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**-2.99**
0.5	**-10.41**
1.0	**28.14**
1.5	**4.99**
2.0	**2.97**
2.5	**-3.35**
3.0	**-17.50**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm) ±0.05ppm = ±Hz**
FCC RESULT	**PASS**

Transmit Frequency Deviation at +25°C at 106% of Nominal Voltage, -50.88VDC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**19.12**
0.5	**13.33**
1.0	**-2.24**
1.5	**18.29**
2.0	**-14.82**
2.5	**-13.33**
3.0	**-5.13**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm)** **±0.05ppm = ±Hz**
FCC RESULT	**PASS**

Transmit Frequency Deviation at +25°C at 109% of Nominal Voltage, -52.32VDC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**94.73**
0.5	**-36.54**
1.0	**1.65**
1.5	**-24.91**
2.0	**8.21**
2.5	**11.23**
3.0	**-8.79**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm)** **±0.05ppm = ±Hz**
FCC RESULT	**PASS**

Transmit Frequency Deviation at +25°C at 112% of Nominal Voltage, -53.76VDC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**-1.99**
0.5	**10.52**
1.0	**15.59**
1.5	**7.22**
2.0	**-12.01**
2.5	**15.41**
3.0	**-6.13**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm)** **±0.05ppm = ±Hz**
FCC RESULT	**PASS**

Transmit Frequency Deviation at +25°C at 115% of Nominal Voltage, -55.20VDC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**10.34**
0.5	**21.42**
1.0	**-12.31**
1.5	**15.50**
2.0	**8.82**
2.5	**-14.95**
3.0	**-1.43**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm)** **±0.05ppm = ±Hz**
FCC RESULT	**PASS**

Transmit Frequency Deviation at +25°C at 100% of Nominal Voltage, -48.0VDC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**5.49**
0.5	**11.62**
1.0	**-6.68**
1.5	**-17.61**
2.0	**19.77**
2.5	**22.86**
3.0	**21.57**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm)** **±0.05ppm = ±Hz**
FCC RESULT	**PASS**

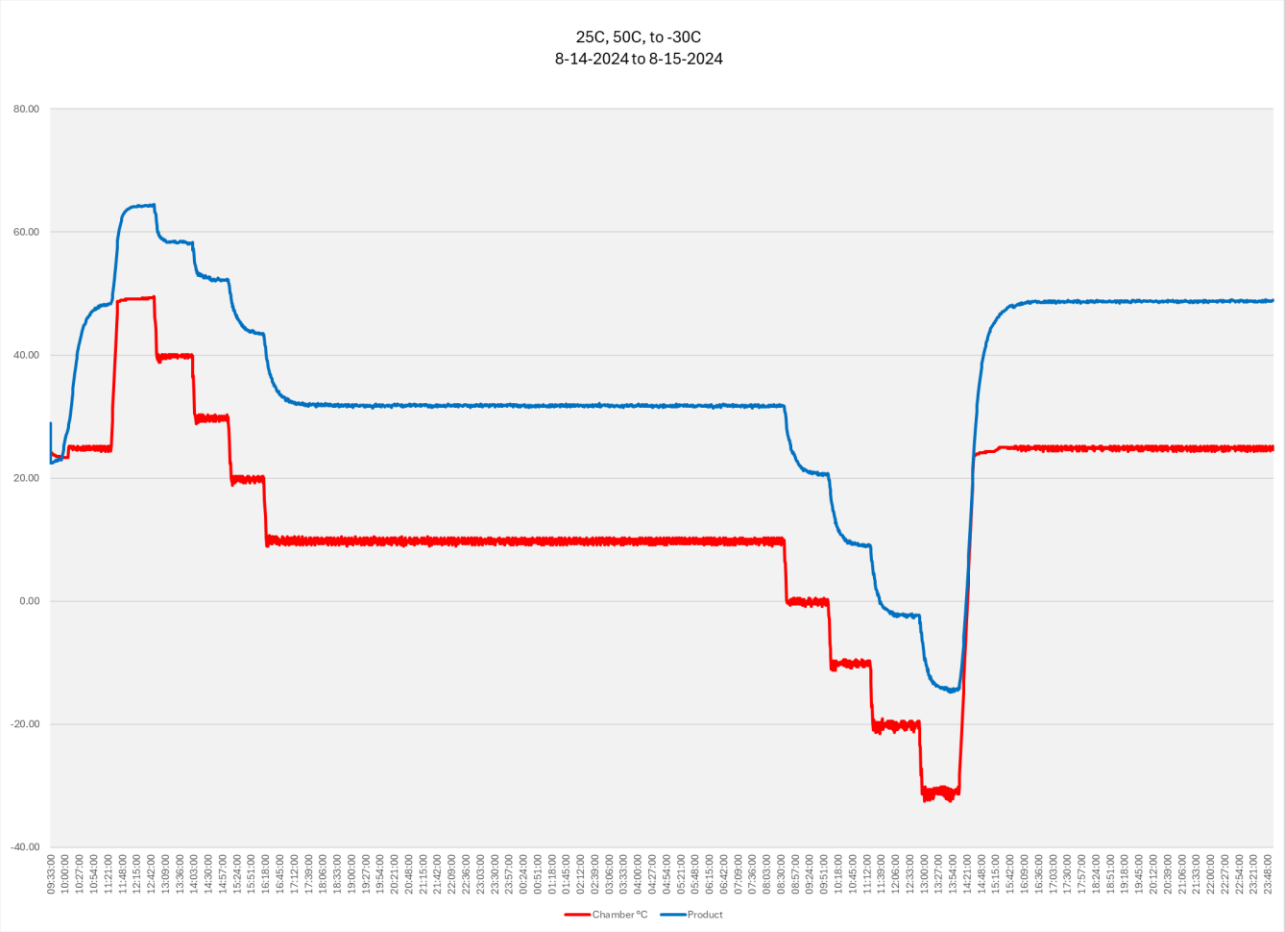
Transmit Frequency Deviation at +25°C at -3% of Nominal Voltage, -46.56VDC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**15.87**
0.5	**13.00**
1.0	**-9.57**
1.5	**3.21**
2.0	**-5.54**
2.5	**-14.26**
3.0	**1.39**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm)** **±0.05ppm = ±Hz**
FCC RESULT	**PASS**

Transmit Frequency Deviation at +25°C at -6% of Nominal Voltage, -45.12VDC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**-18.95**
0.5	**5.88**
1.0	**12.63**
1.5	**16.39**
2.0	**3.53**
2.5	**7.20**
3.0	**11.49**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm) ±0.05ppm = ±Hz**
FCC RESULT	**PASS**

Transmit Frequency Deviation at +25°C at -9% of Nominal Voltage, -43.68VDC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**-2.93**
0.5	**-4.70**
1.0	**13.87**
1.5	**-4.80**
2.0	**5.46**
2.5	**-9.19**
3.0	**10.66**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm) ±0.05ppm = ±Hz**
FCC RESULT	**PASS**

Transmit Frequency Deviation at +25°C at -12% of Nominal Voltage, -42.24VDC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**7.68**
0.5	**-4.17**
1.0	**30.27**
1.5	**12.97**
2.0	**24.15**
2.5	**20.87**
3.0	**-14.29**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm) ±0.05ppm = ±Hz**
FCC RESULT	**PASS**

Transmit Frequency Deviation at +25°C at -15% of Nominal Voltage, -40.80VDC	
Time (minutes)	**Transmit Carrier Deviation (Hz)**
0	**13.38**
0.5	**-4.54**
1.0	**1.76**
1.5	**-16.47**
2.0	**-6.98**
2.5	**11.79**
3.0	**19.30**
FCC SPECIFICATION	**1392.474 Hz (±0.05ppm)** **±0.05ppm = ±Hz**
FCC RESULT	**PASS**



4.8 List of Test Equipment

4.8.1 List of Radio Measurements and Radiated Emissions Test Equipment

Asset ID	Manufacturer	Type	Description	Model	Serial	Calibration Date	Calibration Due
E1260	Rohde & Schwarz	Spectrum Analyzer		FSW67	104007	2023-01-13	2025-01-13
E1384	Rohde & Schwarz	Spectrum Analyzer	2 Hz to 85 GHz (with R&S®FSW-B90G option: 2 Hz to 90 GHz)	FSW85	101537	2023-01-26	2025-01-26
E1527	ETS Lindgren	Horn Antenna	Double Ridged Horn 18-40 GHz	3116C	00227823	2023-01-10	2025-01-10
E1073	ETS Lindgren	Horn Antenna	Double-Ridged Waveguide Horn 1-18 GHz	3117	00135198	2023-06-06	2025-06-06
E1603	A.H. Systems Inc.	Pre-Amplifier	20 MHz - 18 GHz, 1 Watt Input limiter	PAM-0118P	621	2023-01-10	2025-01-10
E1475		Filter, Low Pass Filter	DC - 20 GHz	11LS-X20GS11	SN20-02	CNR-V	CNR-V
E1507		Filter, Low Pass Filter	DC - 25 GHz, 2.0 dB	11LS-X25GK11	20-01	CNR-V	CNR-V
E1525	A.H. Systems Inc.	Pre-Amplifier	18 GHz-40 GHz, 37 dB	PAM-1840VH	186	2023-03-06	2025-03-06
E1527	ETS Lindgren	Horn Antenna	Double Ridged Horn 18-40 GHz	3116C	0227823	2023-01-10	2025-01-10
E1514		Filter, High Pass Filter	30.5 - 40 GHz, 2 dB	11HS-X30.5GK11	SN20-01	CNR-V	CNR-V
E602	A.H. Systems Inc.	Bilogical Antenn a	25 - 2000 MHz	SAS-521-2	410	2023-12-07	2025-12-07
E954	Rohde & Schwarz	Test Receiver	EMI 20Hz - 40GHz -155 dBm +30 dBm	ESU40	100246	2022-12-08	2024-12-08
E813	Sonoma Instrument Co.	Amplifier	9kHz-1GHz	310N	186750	2022-11-28	2024-11-28
E1268	Trilithic	Filter, Low Pass Filter	DC - 1620 MHz	23042	200802040	CNR-V	CNR-V
E1255	ETS Lindgren	Multi-Device Controller		2090	00078509	CNR	CNR
E772	Sunol Sciences Corp	Modular Controller		SC104V	0	CNR	CNR
E1524	Traceable	Data Logger	Barometric Humidity Temp Data Logger	6453	200665968	2023-06-23	2025-06-23
E1638		RF EMF Strength Meter	80.0 MHz (0.08 GHz) to 40 GHz	EME Guard XS 40 GHz	XL_051_1423	CNR-V	CNR-V
E485	Kikusui	Power Supply	DC 55 Volts 120 Amps	PAD 55-120L	DL000416	CNR	CNR

Asset ID	Manufacturer	Type	Description	Model	Serial	Calibration Date	Calibration Due
E1323	Mi-Wave	Antenna, Horn Antenna	G-band pyramidal horn antenna -140.0-220.0 GHz	261G-25/387	N/A	Factory, - in Service 2018-07-01	CNR-V
E1313	Rohde & Schwarz	Harmonic Mixer	140 GHz to 220 GHz	FS-Z220	100960	2021-09-28	2024-09-28
E1330	Sage Millimeter, Inc.	Antenna, Horn Antenna	U-band pyramidal horn antenna - 40 to 60 GHz	SAR-2309-19-S2	14853-01	Factory, - in Service 2018-07-01	CNR-V
E1311	Rohde & Schwarz	Harmonic Mixer	40 GHz to 60 GHz	FS-Z60	100977	2021-10-06	2024-10-06
E1332	Sage Millimeter, Inc.	Antenna, Horn Antenna	E-band pyramidal horn antenna - 60 to 90 GHz.	SAR-2309-12-S2	14853-01	Factory, - in Service 2018-07-01	CNR-V
E1312	Rohde & Schwarz	Harmonic Mixer	60 GHz to 90 GHz	FS-Z90	101719	2021-09-28	2024-09-28
E1335	Sage Millimeter, Inc.	Antenna, Horn Antenna	F-band pyramidal horn antenna - 90 to 140 GHz	SAR-2309-08-S2	14853-02	Factory, - in Service 2018-07-01	CNR-V
E1308	Rohde & Schwarz	Harmonic Mixer	90-140 GHz	FS-Z140	101008	2021-10-07	2024-10-07

CNR: Calibration Not Required
CNR-V: Calibration Not Required, Must Be Verified
Test Date: 7/11/2024 – 9/24/2024

4.8.2 List of Frequency Stability Test Equipment

Asset ID	Manufacturer	Type	Description	Model	Serial	Calibration Date	Calibration Due
TH069	Extech	Data Logger	Barometric Pressure/ Humidity/ Temperature	SD700	Q690305	2023-07-24	2025-07-24
TH054	Yokogawa	Recorder	10 Channel Paperless Recorder	MV2048	S5JC04076	2023-03-03	2025-03-03
TH-T16	Envirotronics	Chamber, Thermal Chamber	Thermal Chamber	N/A	3015243	Calibration Not Required	
Customer provided Equipment	KeySight Technologies	MXA EMI Receiver	MXA EMI Receiver	N9020B	MY59050106	2022-08-30	2024-08-30
TH514-T16	Envirotronics	Controller	Controller	SPPCM	SP000637	2023-06-13	2025-06-13
TH303	Yokogawa	Analyzer, Power Analyzer	10 Channel Paperless Recorder	WT500	91L222240	2024-05-08	2026-05-08

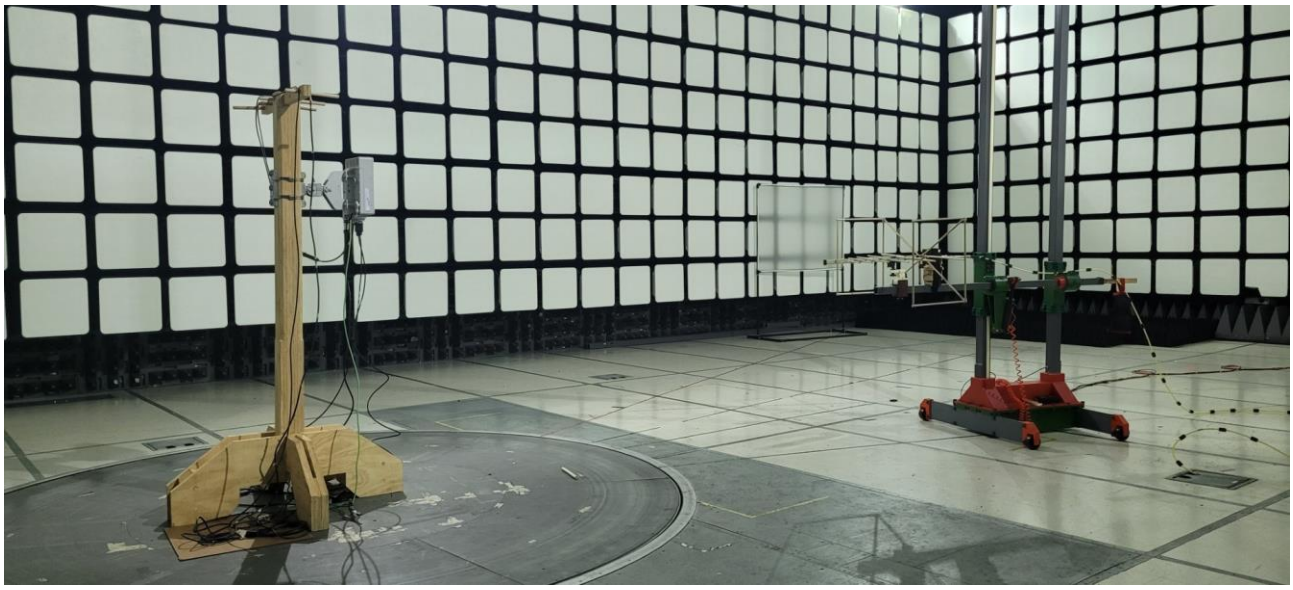
Test Date: 8/12/2024 – 8/15/2024

4.9 PHOTOGRAPHS OF THE TEST SETUPS

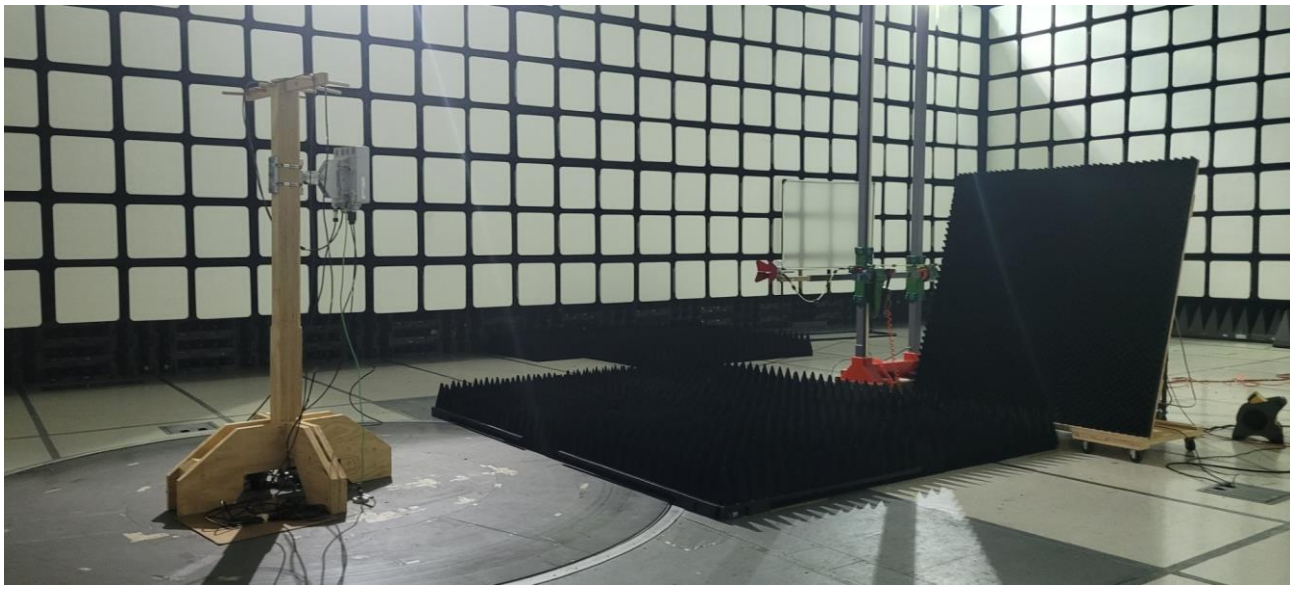
Radiated Emissions and Radio Measurements Test

Radiated Emissions

30 MHz-1 GHz

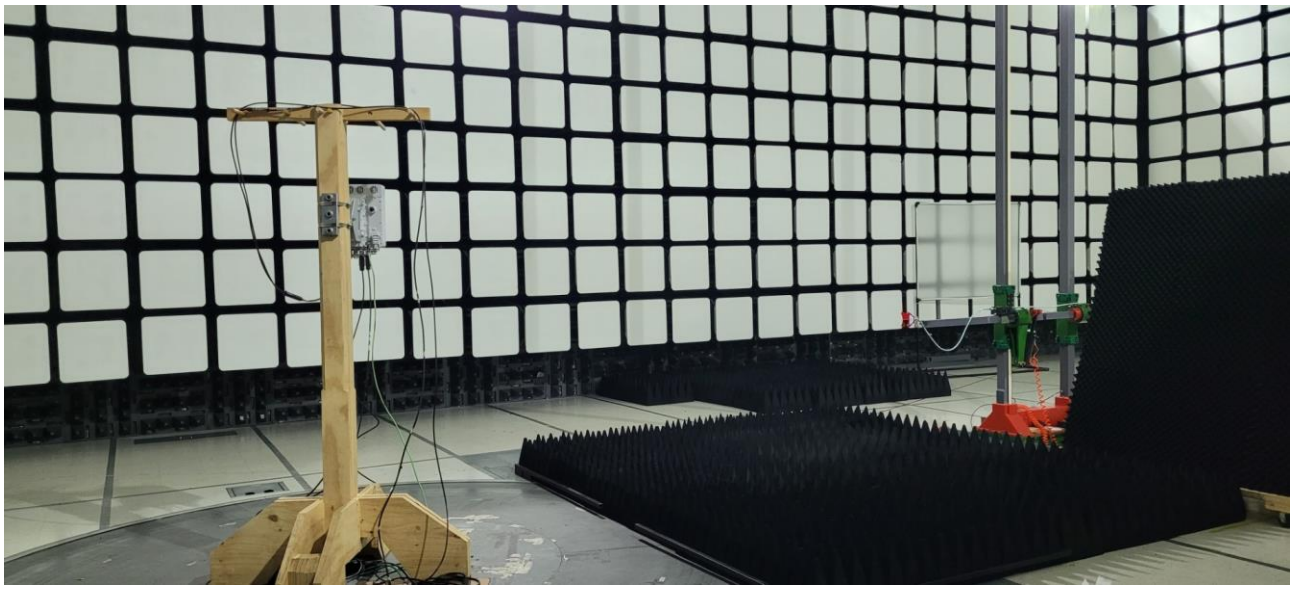


1 GHz – 18 GHz



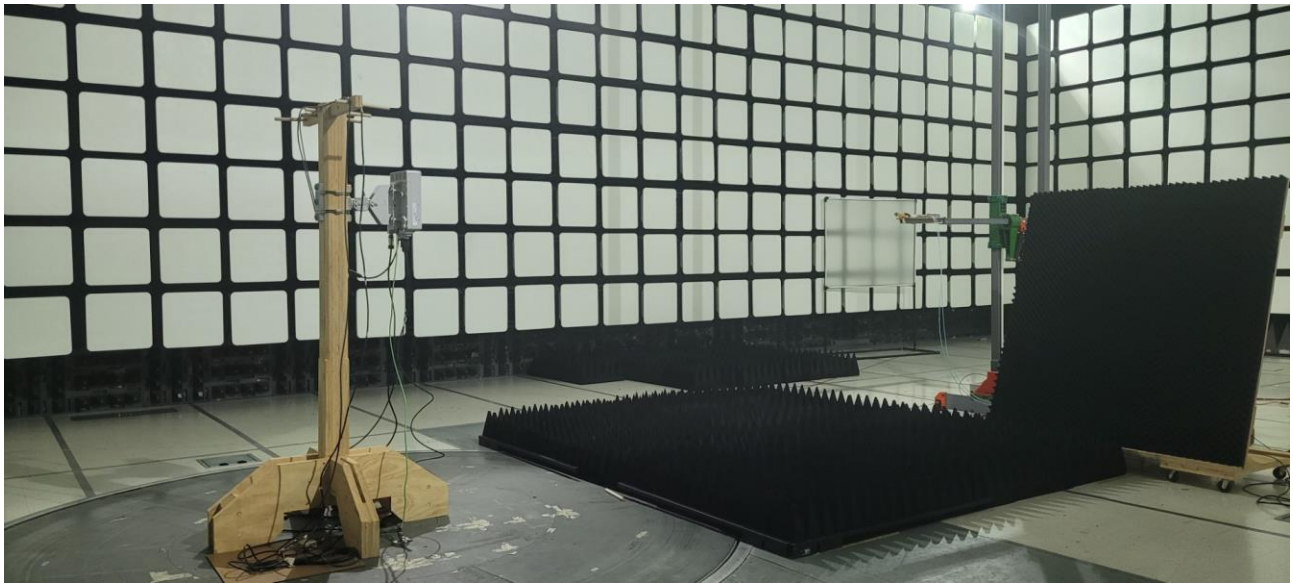
Radiated Emissions Test Photos *continued*

18GHz-40 GHz



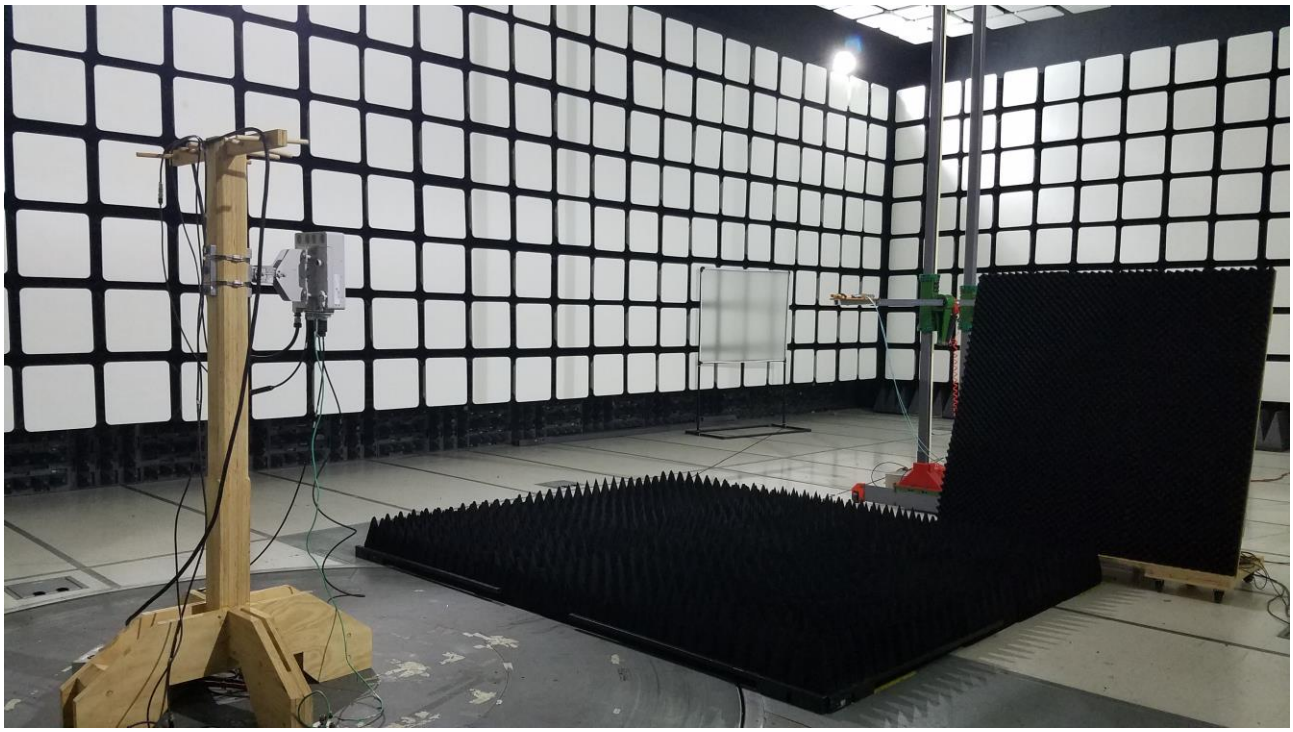
Radiated Emissions mmWave bands Test

40GHz-60 GHz

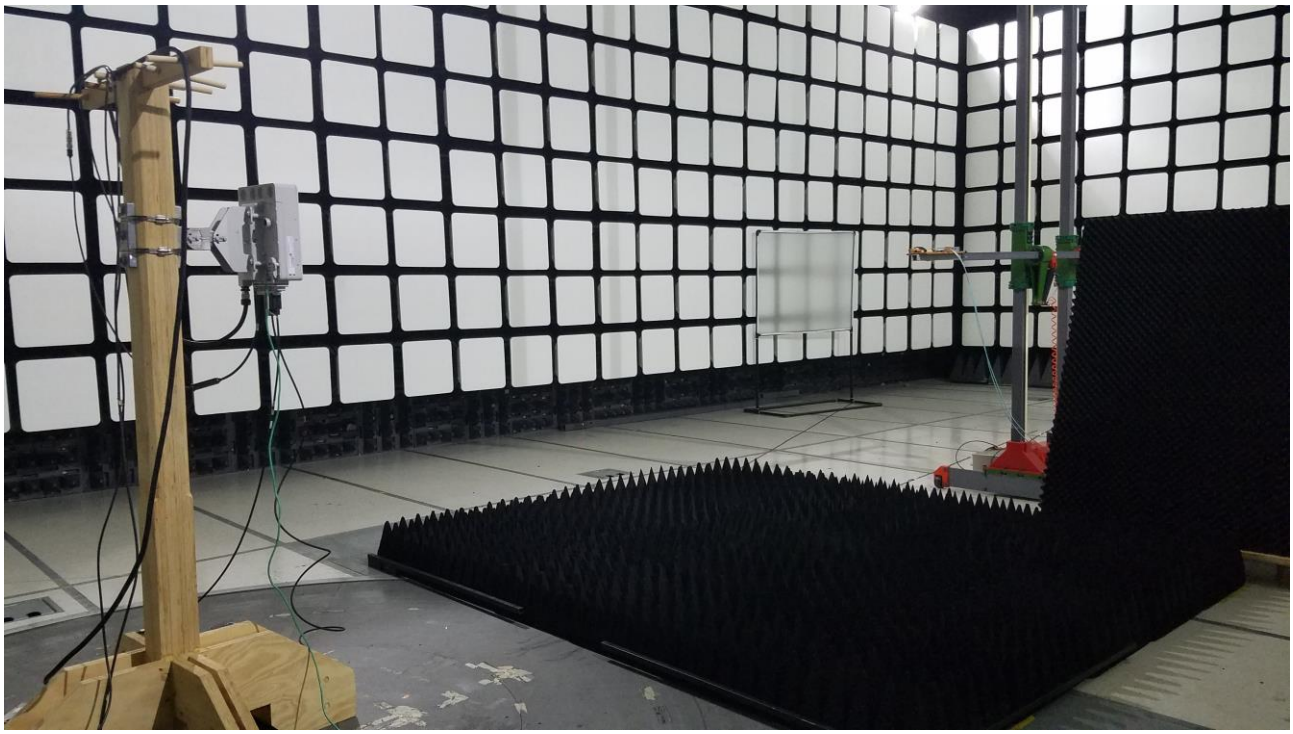


Radiated Emissions mmWave bands Test ***continued***

60GHz-90 GHz

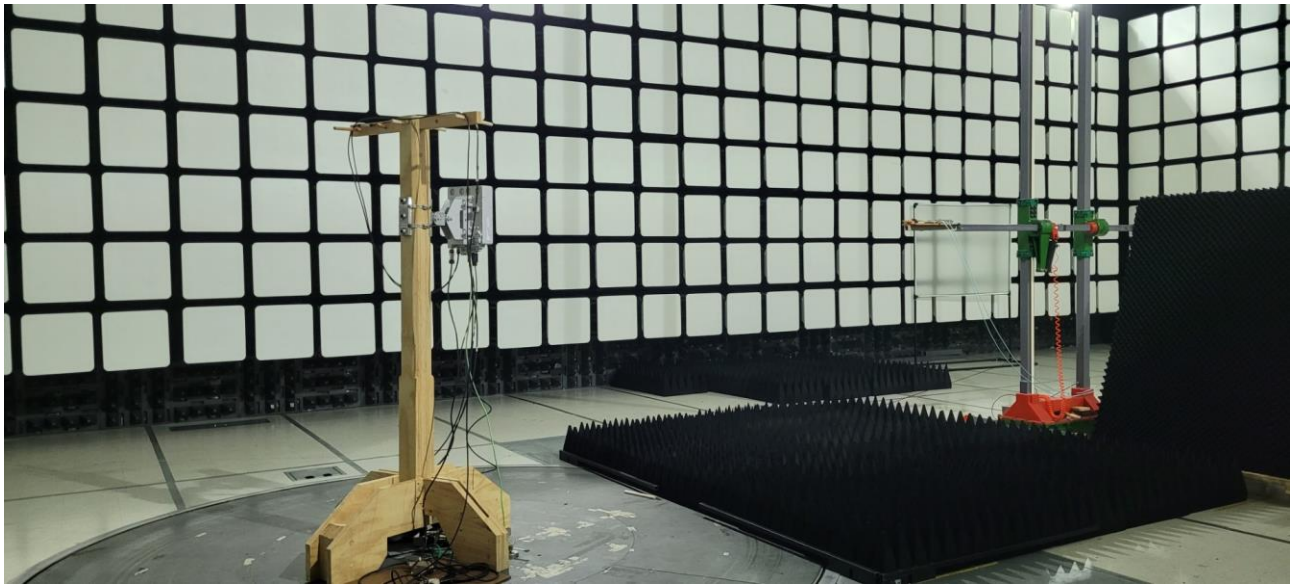


90GHz – 140GHz



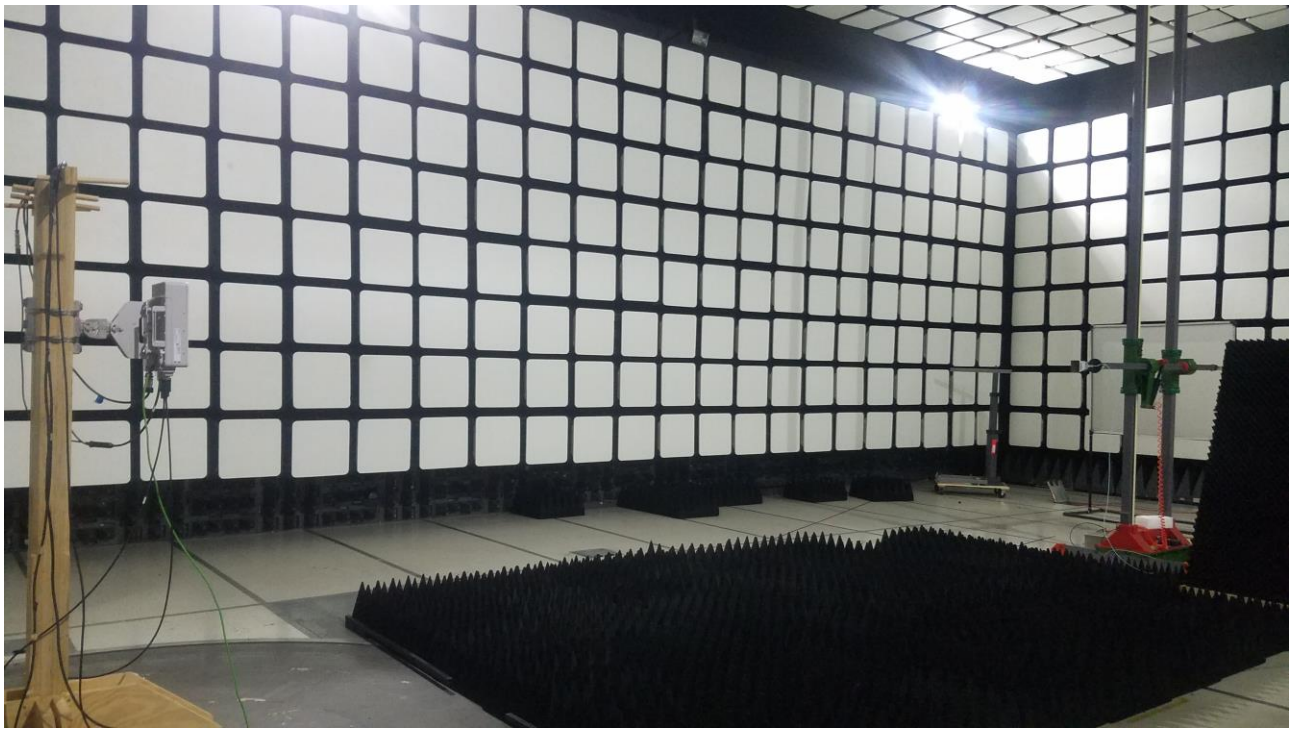
Radiated Emissions mmWave bands Test ***continued***

140GHz – 150GHz

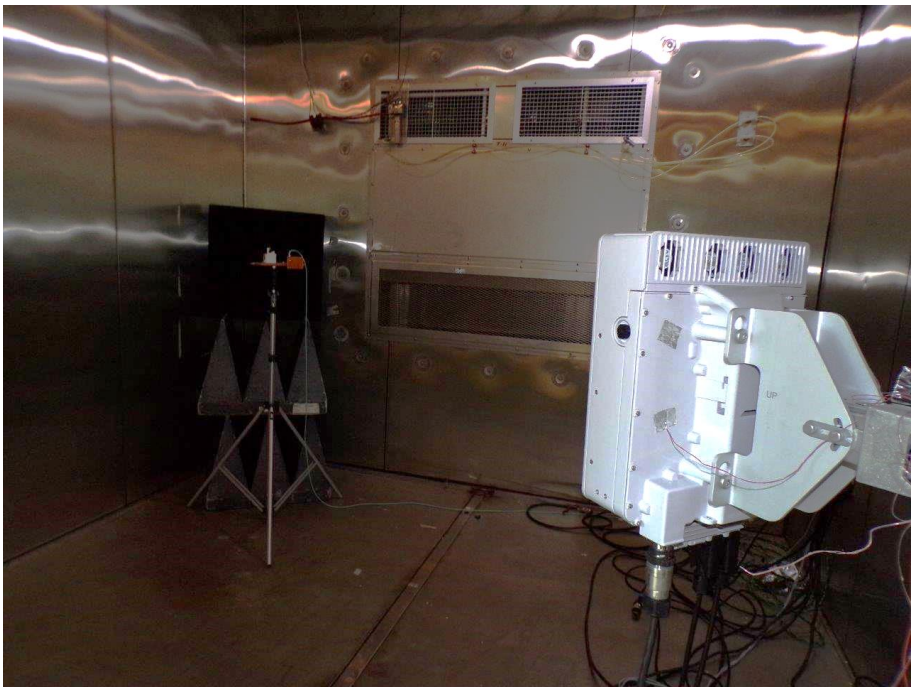


Radio Performance Measurement Test

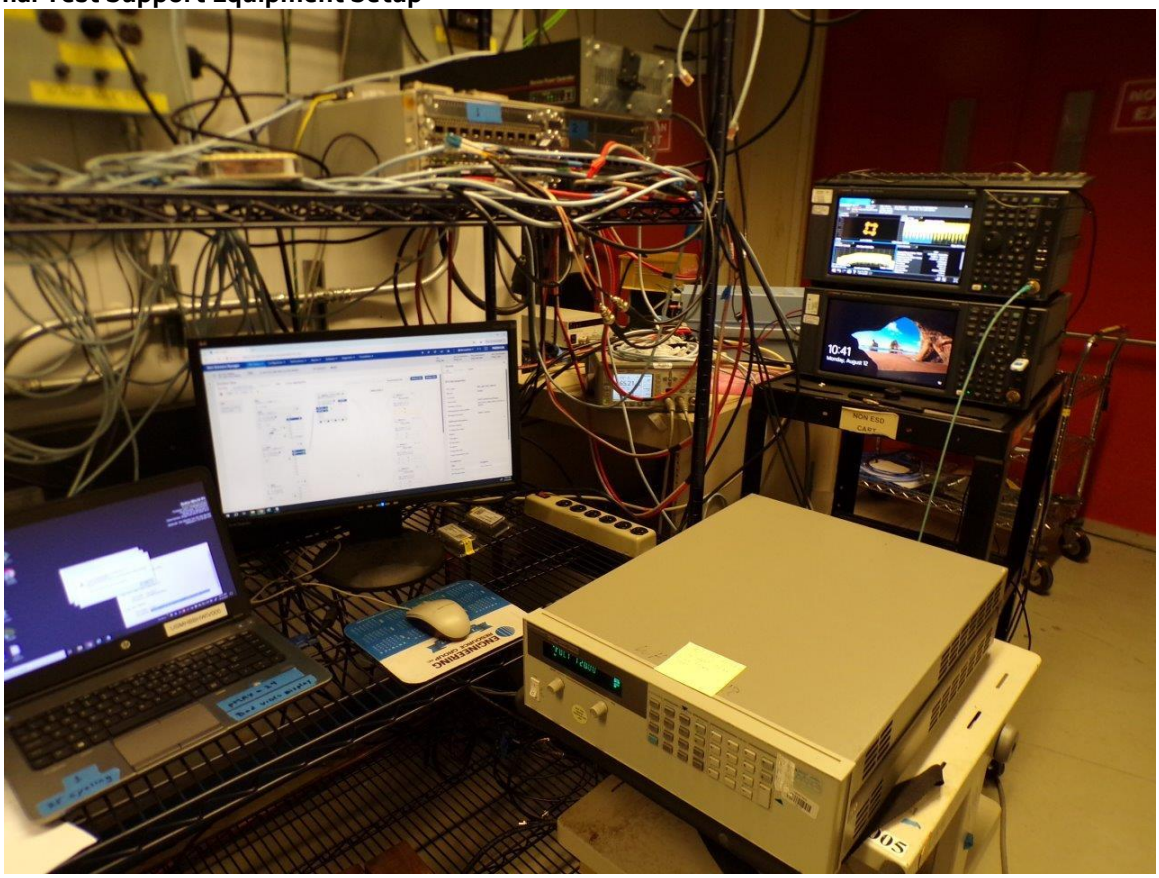
Radio Test at 6.5 meters Setup Photo



Frequency Stability Tests



Thermal Test Support Equipment Setup



4.10 FACILITIES AND ACCREDITATION

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

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

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

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

and is as listed in the Table below.

OET Accredited Test Firm Scope List

Test Firm: Nokia, Global Product Compliance Lab

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

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

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

ilac-MRA

Certificate of Accreditation to ISO/IEC 17025:2017

NVLAP LAB CODE: 100275-0

Nokia, Global Product Compliance Lab
Murray Hill, NJ

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

Electromagnetic Compatibility & Telecommunications

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

2023-09-07 through 2024-09-30
Effective Dates

DEPARTMENT OF COMMERCE · UNITED STATES OF AMERICA

For the National Voluntary Laboratory Accreditation Program

5. APPENDIX A - CALIBRATION CERTIFICATES.

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