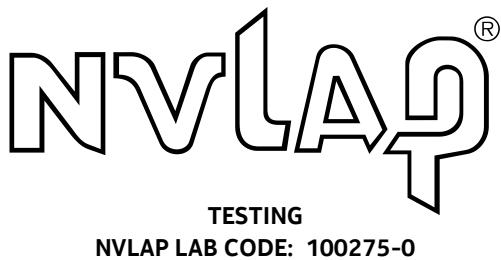


Global Product Compliance Laboratory
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Title 47 Code of Federal Regulations Test Report

Regulation:
Title 47 CFR FCC Part 96

Client:
NOKIA SOLUTIONS AND NETWORKS, OY

Product Evaluated:
AirScale Micro RRH 3.5GHz 4T/4R 20W (AZQC)

Report Number:
TR-2021-0133-FCC96

Date Issued:
November 3, 2021

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Revisions

Date	Revision	Section	Change
11/03/2021	0		Initial Release

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1. System Information and Requirements

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 Murray-Hill, NJ.

Equipment Under Test (EUT):	AirScale Micro RRH 3.5GHz 4T/4R 20W (AZQC)
Serial Number:	1M181624804
FCC ID:	2AD8UAZQCRH1
Hardware Version:	474156A.101
Software Version:	FLF17SP
Frequency Range:	3550 - 3700 MHz
GPCL Project Number:	2021-0133
Manufacturer:	NOKIA SOLUTIONS AND NETWORKS OY KARAKAARI 7, FI-02610 ESPOO FINLAND
Applicant:	Nokia Solutions and Networks, OY 200 Lucent Lane Naperville, Illinois 60563 Terry P. Schwenk
Test Requirement(s):	Title 47 CFR Part96
Test Standards:	<ul style="list-style-type: none"> • Title 47 CFR Parts 2 and 96 • KDB 940660 D01 Certification And Test Procedures For Citizens Broadband Radio Service Devices Authorized Under Part 96, v03, Oct 29, 2020 • KDB 971168 D01 Power Measurement License Digital Systems v03r01 April 9, 2018. • KDB 662911 D01 Multiple Transmitter Output v02r01 Oct 2013 • ANSI C63.26 (2015) • ANSI C63.4 (2014)
Measurement Procedure(s):	<ul style="list-style-type: none"> • FCC-IC-OB - GPCL Power Measurement, Occupied Bandwidth & Modulation Test Procedure 6-20-2019 • FCC-IC-SE - GPCL Spurious Emissions Test Procedure 6-20-2019
Test Date(s):	9/30/2021 – 10/4/2021 (Radio) 10/12/2021 – 10/14/2021 (Radiated Emission)
Test Performed By:	Nokia Global Product Compliance Laboratory 600-700 Mountain Ave. P.O. Box 636 Murray Hill, NJ 07974-0636 Test Site Number: US5302
Product Engineer(s):	Ron Remy
Lead Engineer:	Steve Gordon
Test Engineer (s):	Mike Soli, Jaideep Yadav
Test Results:	The EUT, <i>as tested</i> met the above listed Test Requirements. The decision rule employed is binary (Pass/Fail) based on the measured values without accounting for Measurement Uncertainty or any Guard Band. The measured values obtained during testing were compared to a value given in the referenced regulation or normative standard. Report copies and other information not contained in this report are held by either the product engineer or in an identified file at the Global Product Compliance Laboratory in New Providence, NJ.

1.1 Introduction

This Conformity test report applies to the AirScale Micro RRH 3.5GHz 4T/4R 20W (AZQC), hereinafter referred to as the Equipment Under Test (EUT).

1.2 Purpose and Scope

This document is to provide the testing data required for qualifying the EUT in compliance with FCC Part 96 measured in accordance with the procedures set out in Section 2.1033 (c) (14) of the Rules.

This Class II permissive change is to demonstrate compliance for the **AirScale Micro RRH 3.5GHz 4T/4R 20W (AZQC)** product for new 5G-NR 20 MHz BW operation. The AZQC was previously certified for 4G operation with 10 and 20 MHz bandwidths. No software changes have been made to the product that would necessitate a repeat of the Spectrum Allocation Server (SAS) testing.

1.3 EUT Details

1.3.1 Specifications

Specification Items	Description
Product Type	AirScale Micro RRH 3.5GHz 4T/4R 20W (AZQC)
Radio Type	Intentional Transceiver
CBSD Category	Category B CBSD Device
Power Type	DC: -40.5V to -57V AC: 80V to 276V (via external AC/DC converter)
Modulation	5G-NR and LTE-TDD with QPSK, 16QAM, 64QAM and 256QAM
Operating Frequency Range	CBRS (Tx/Rx: 3550-3700 MHz),
Channel Bandwidth	20 MHz
Max Conducted Power (Rated)	Up to 4x5W per TX path (0.1 dB steps down to 50mW)
Operating Mode	4T4R
Software Version	FLF17SP
Hardware Version	474156A.101
Antenna(s)	Refer to Section 1.3.2

1.3.2 EIRP/ PSD Compliance and Antenna Information.

The product does not incorporate integrated antennas. Externally mounted antennas can be attached to the unit or mounted remotely. The unit is supplied with unit mounted Omni antennas for use on the B48 transmit ports. This antenna has a nominal gain of 6 dBi.

1.3.3 Photographs

Serial Number



Radio Unit



1.4 Test Requirements

Each required measurement is listed below:

47 CFR FCC Sections	Description of Tests	Test Required
2.1046, 96.41 (b) 96.41(g)	RF Power Output (b) Power Limits, EIRP, PSD (g) Peak-to-Average Power Ratio	Yes
2.1047, 96.41(a)	Modulation Characteristics	Yes
2.1049, 96.41(e)(2)(3)	(a) Occupied Bandwidth (b) Out-of-Band Emissions	Yes
2.1051, 96.41(e)	Spurious Emissions at Antenna Terminals	Yes
2.1053, 96.41(e)(2)(3)	Field Strength of Spurious Radiation	Yes
2.1055, 96.41(e)(2)(3)	Measurement of Frequency Stability	No ¹

¹ Testing was performed in GPCL project 2018-0097.

1.5 Test Standards & Measurement Procedures

1.5.1 Test Standards

- Title 47 Code of Federal Regulations, Federal Communications Commission Part 2.
- Title 47 Code of Federal Regulations, Federal Communications Commission Part 96.
- KDB 940660 D01 Certification And Test Procedures For Citizens Broadband Radio Service Devices Authorized Under Part 96, v03, Oct 29, 2020
- KDB 971168 D01 Power Measurement License Digital Systems v03r01 April 9, 2018.
- KDB 662911 D01 Multiple Transmitter Output v02r01 Oct 2013
- ANSI C63.26-2015, American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
- ANSI C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

1.5.2 Measurement Procedures

- FCC-IC-OB - GPCL Power Measurement, Occupied Bandwidth & Modulation Test Procedure 6-20-2019
- FCC-IC-SE - GPCL Spurious Emissions Test Procedure 6-20-2019

1.6 MEASUREMENT UNCERTAINTY

The results of the calculations to estimate uncertainties for the several test methods and standards are shown in the Table 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-6 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	±5.1 dB ±5.1 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, Conducted Spurious Emissions	10 Hz 100 Hz 10 kHz to 1 MHz 1MHz	9 kHz to 20 MHz 20 MHz to 1 GHz 1 GHz to 10 GHz 10 GHz to 40 GHz:	1.78 dB
RF Power	10 Hz to 20 MHz	50 MHz to 18 GHz	0.5 dB

1.7 Executive Summary

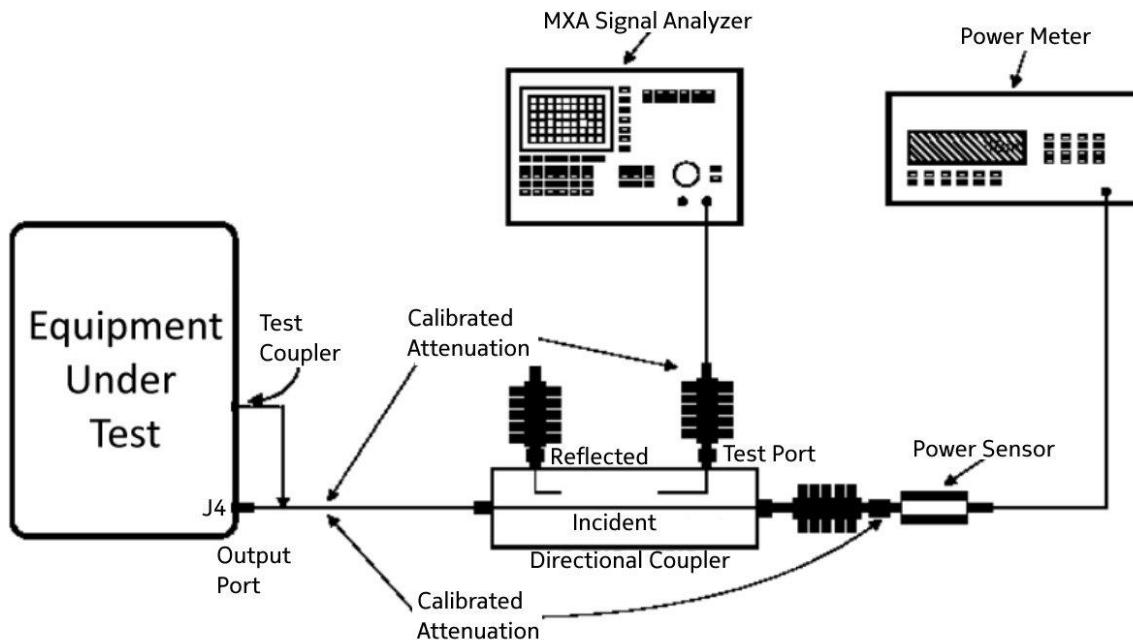
Requirement 47 CFR FCC Parts 2 and 96	Description of Tests	Result
2.1046, 96.41 (b) 96.41(g)	RF Power Output (b) Power Limits, EIRP, PSD (g) Peak-to-Average Power Ratio	COMPLIES
2.1047, 96.41(a)	Modulation Characteristics	COMPLIES
2.1049, 96.41(e)(2)(3)	(a) Occupied Bandwidth (b) Out-of-Band Emissions	COMPLIES
2.1051, 96.41(e)	Spurious Emissions at Antenna Terminals	COMPLIES
2.1053, 96.41(e)	Field Strength of Spurious Radiation	COMPLIES
2.1055	Measurement of Frequency Stability	NT

1. **COMPLIES** - Passed all applicable tests.

2. **N/A** – Not Applicable.
3. **NT** – Not Tested.

1.8 Test Configurations

Test Setup for all Antenna Port Measurements



2. FCC Section 2.1046 - RF Power Output and Power Spectral Density

2.1 RF Power Output

This test is a measurement of the total RF power level transmitted at the antenna-transmitting terminal. The product was allowed to warm up and stabilize per KDB 971168 D01 and ANSI C63.26.

For 5G-NR transmit carrier operation, the AirScale Micro RRH 3.5GHz 4T/4R 20W (AZQC), is specified to provide a maximum power output of 5W/37 dBm per transmit port for a sum total of 20 Watts /43 dBm per transmit module.

The power is under digital control. The product is designed to operate under Part 96 rules for Band 48.

Under Part 96 the product is limited to the Category B CBSD maximum EIRP of 47 dBm/10 MHz with a PSD of 37 dBm/MHz.

The unit is supplied with externally mounted Omni antennas for use on the B48 transmit ports. This antenna has a nominal gain of 6 dBi.

In the event the customer wants to use a different antenna, the maximum gain + cable loss cannot exceed 10.98 dBi when operating at full power in order to stay within the EIRP limits for the band.

If the product is installed with other antenna(s), then per FCC Rules the RF exposure compliance shall be addressed at the time of licensing, as required by the responsible FCC Bureau(s), including antenna co-location requirements of Part 1.1307(b)(3).

2.1.1 RF Power Output Measurements

Power measurements of the TDD transmit signal were conducted with an MXA Signal analyzer per KDB 971168 D01 and a gated broadband RF Power Meter.

The applied signal from the AirScale Micro RRH 3.5GHz 4T/4R 20W (AZQC), met the recommended characteristics as defined in 3GPP TS 36.141 V14.1.0 (2016-09) Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) conformance testing (Release 14).

The maximum rated mean power at the antenna transmitting terminal was measured at the Left, Center and Right side of the 3550-3700 CBRS frequency range for three different modulation modes. These were 3GPP standard base station test models for QPSK+16QAM, 64QAM and 256QAM modulation. This power level was documented on each data sheet for Occupied bandwidth.

2.1.2 RF Power Output Results

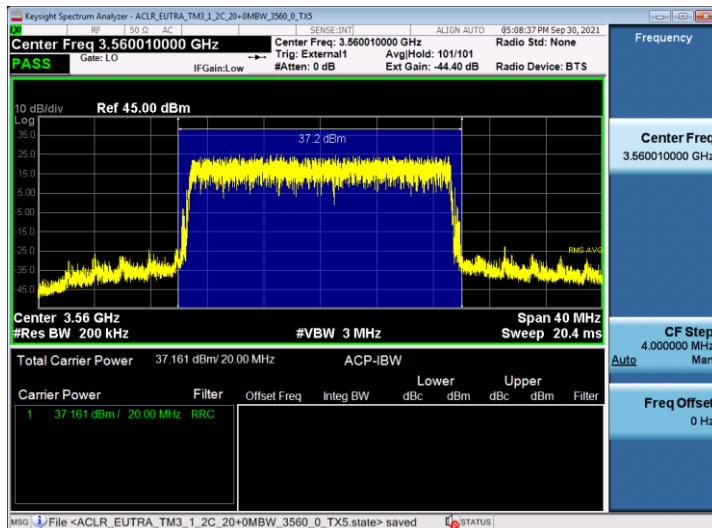
Table 2.1 RF Power Output Results

Test Model	Modulation	TX Port	Channel Frequency MHz	Signal BW MHz	Channel Power dBm/BW
3.1	64QAM	1	3560	20	37.161
3.1	64QAM	2	3560	20	36.932
3.1	64QAM	3	3560	20	37.850
3.1	64QAM	4	3560	20	37.200
3.2	QPSK/16QAM	1	3625	20	36.471
3.2	QPSK/16QAM	2	3625	20	36.272
3.2	QPSK/16QAM	3	3625	20	37.150
3.2	QPSK/16QAM	4	3625	20	36.506
3.1a	256QAM	1	3690	20	36.368
3.1a	256QAM	2	3690	20	36.219
3.1a	256QAM	3	3690	20	36.694
3.1a	256QAM	4	3690	20	36.456

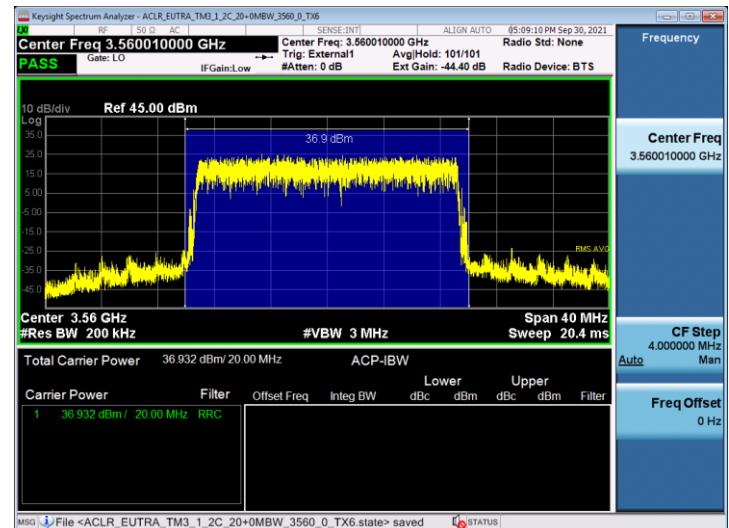
2.1.3 Maximum RF Conducted Output Power Plots

Test Model 3.1
Modulation 64QAM
20MHz BW
Channel Frequency 3560MHz

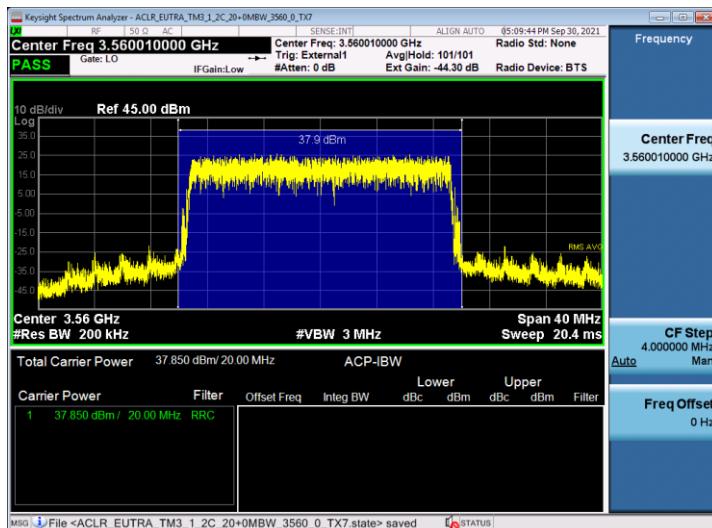
TX Port 1



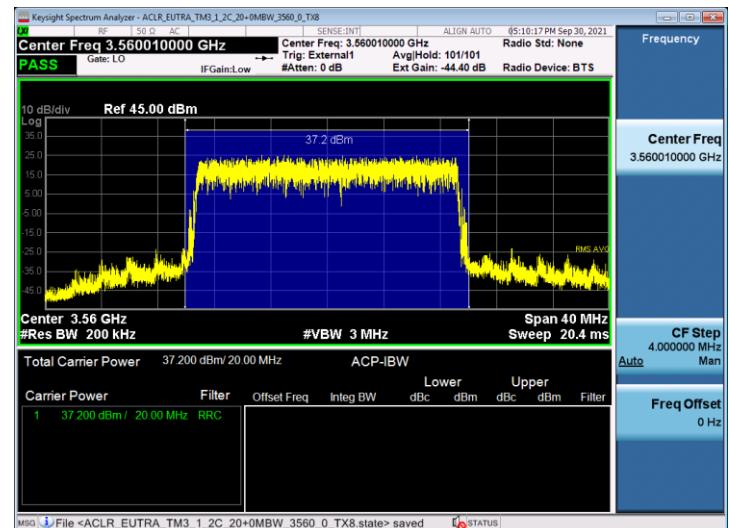
TX Port 2



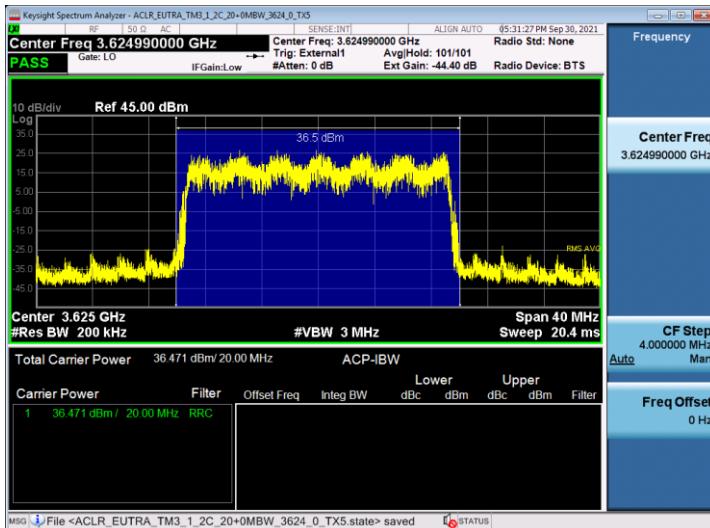
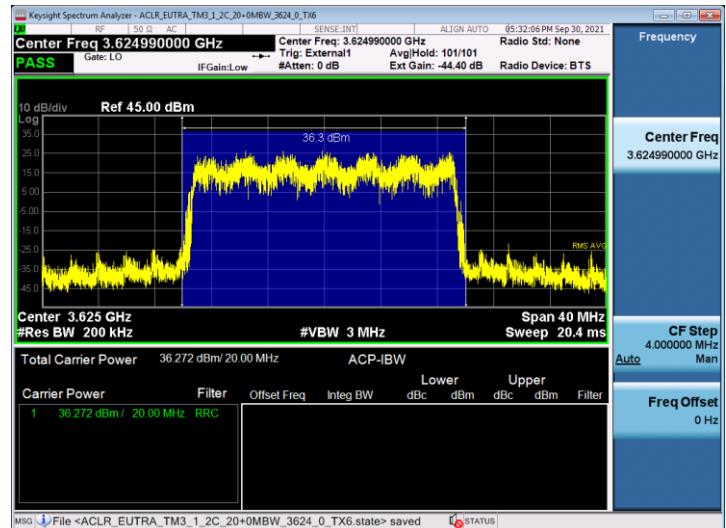
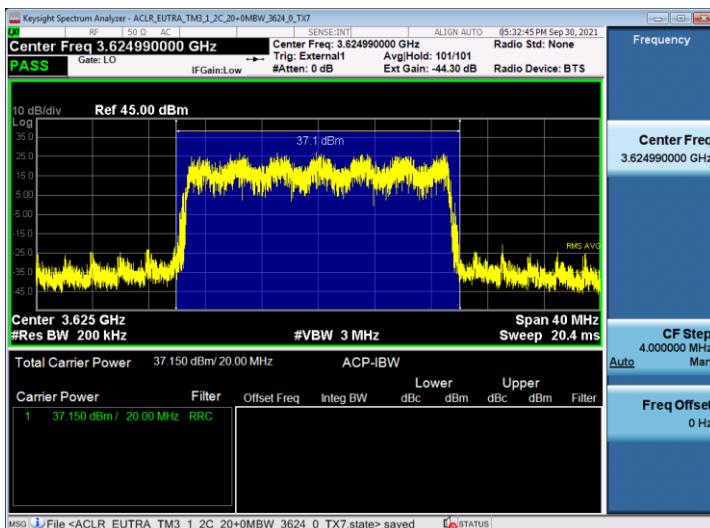
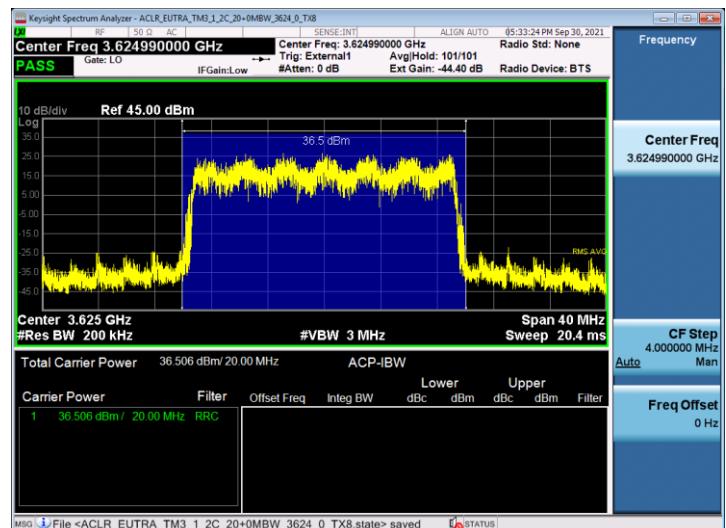
TX Port 3



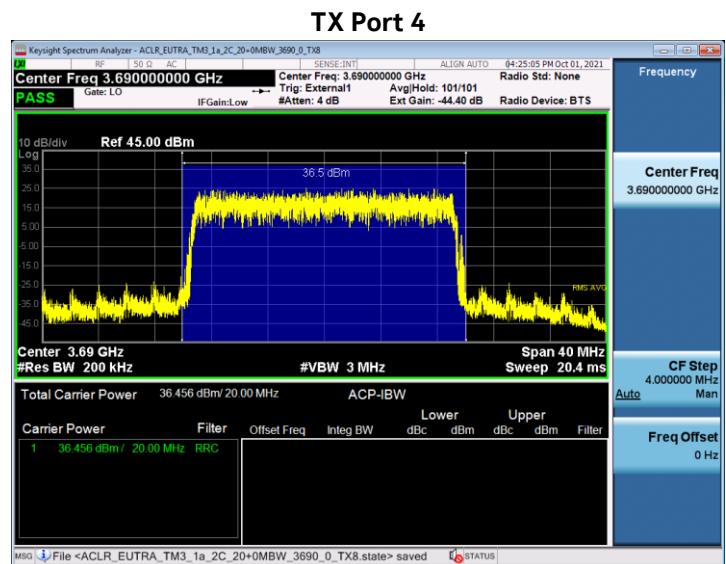
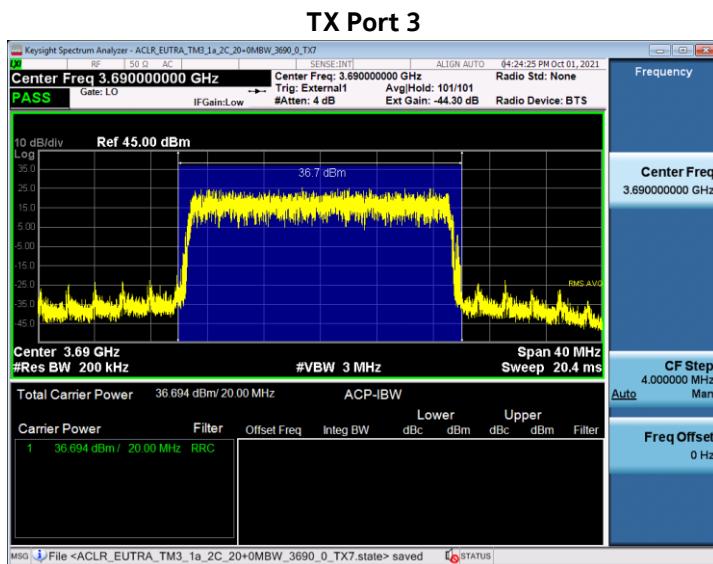
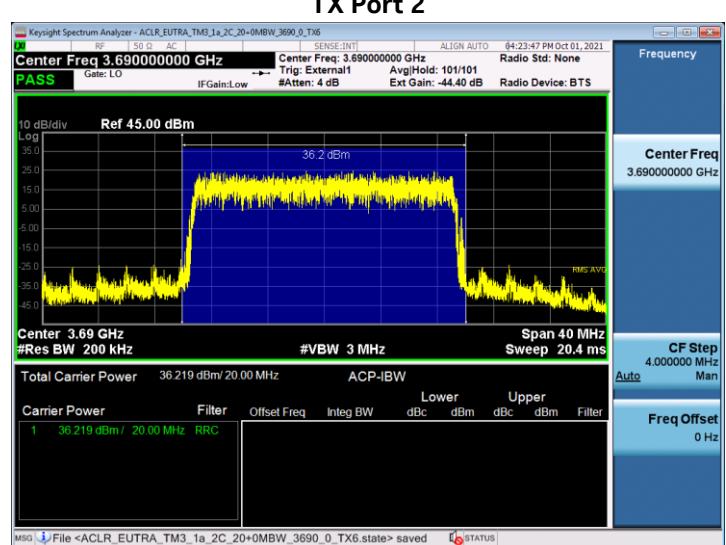
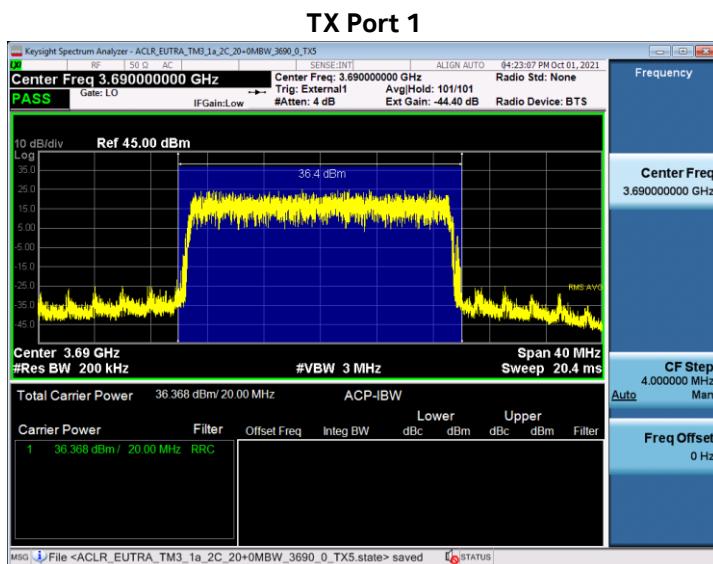
TX Port 4



Test Model 3.2
Modulation QPSK/16QAM
20MHz BW
Channel Frequency 3625MHz

TX Port 1**TX Port 2****TX Port 3****TX Port 4**

Test Model 3.1a
Modulation 256QAM
20MHz BW
Channel Frequency 3690MHz



2.2 EIRP Compliance

The product does not incorporate integrated antennas. Externally mounted antennas can be attached to the unit or mounted remotely. The unit is supplied with unit mounted Omni antennas for use on the B48 transmit ports. This antenna has a nominal gain of 6 dBi. Compliance with the supplied antennas is documented in Table 2.2 for EIRP.

Under Part 96.41 the product is limited to a maximum Effective Isotropically Radiated Power (EIRP) of 47 dBm/10 MHz. Compliance with the EIRP requirements of Part 96.41 is tabulated in Table 2.2 below.

When set to the maximum total output power of 37 dBm the maximum allowable antenna gain is 10.98 dBi.

In the event the customer wants to use a different antenna, the maximum gain + cable loss cannot exceed 10.98 dBi when operating at full power in order to stay within the EIRP limits for the band.

If the product is installed with other antenna(s), then per FCC Rules the RF exposure compliance shall be addressed at the time of licensing, as required by the responsible FCC Bureau(s), including antenna co-location requirements of Part 1.1307(b)(3).

Table 2.2 Effective Isotropically Radiated Power (EIRP) Compliance

Transmit Signal Bandwidth	Total 4x MIMO Transmit Power	Antenna Gain	EIRP Bandwidth Correction for /10 MHz	Total Product EIRP	Part 96.41 EIRP Limit	Margin to Part 96 EIRP Limit.	EIRP Compliance
MHz	dBm	dBi	dB	dBm/10 MHz	dBm/ 10 MHz	dB	Pass/Fail
20	43.87	6	-3.01	46.86	47.00	0.14	Pass

2.3 Power Spectral Density

The Power Spectral Density (PSD) of the EUT was measured per KDB 971168 D01 the Channel Power Measurement feature of the MXA Analyzer. The signal bandwidths, modulations and transmit channels identified in Table 2.3 were evaluated.

The FCC Part 96 requirement for PSD is that the Power Spectral Density (PSD) of the EUT shall not exceed 37 dBm/MHz.

2.3.1 Results

The maximum Power Spectral Density (PSD) of the EUT measured at its antenna transmitting terminals were measured to be 23.64 dBm/MHz plus 6.02 dBm adjustment for 4 ports. This results in a margin of 7.34 dBm below the 37 dBm/MHz limit. Therefore, the EUT is in full compliance with the requirement. The measured values are in Table 2.3 below.

Table 2.3 Power Spectral Density Results

Test Model	Modulation	TX Port	Channel Frequency MHz	Signal BW MHz	PSD dBm/MHz (1 Port)	Total PSD dBm/MHz (4 Ports)	PSD Limit dBm/MHz	PSD Results Margin dBm/MHz
3.2	QPSK/16QAM	3	3625	20	23.64	29.66	37	7.34
3.1a	256QAM	3	3690	20	23.51	29.53	37	7.47

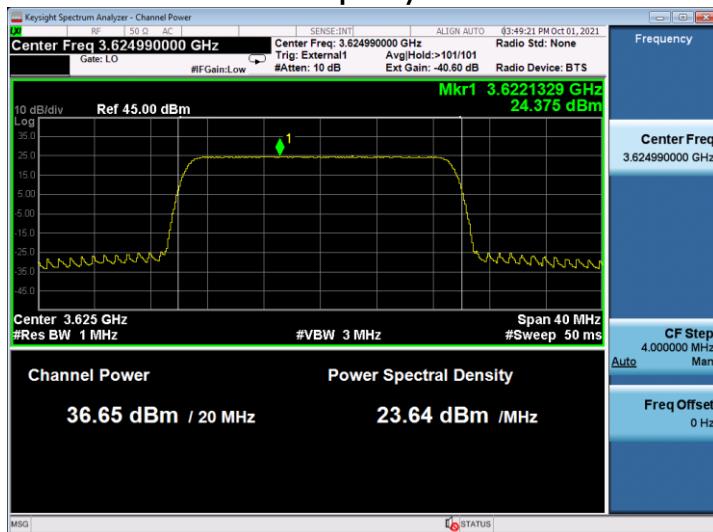
2.3.2 PSD Plots

Test Model 3.2

Modulation QPSK/16QAM

20MHz BW

Channel Frequency 3625MHz

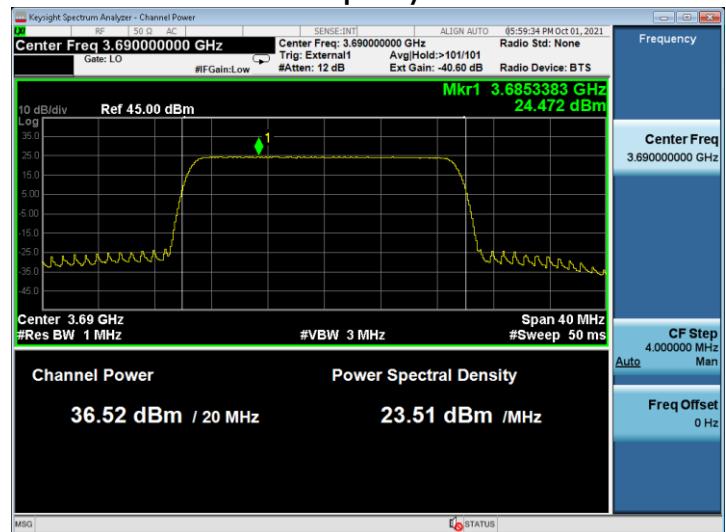


Test Model 3.1a

Modulation 256QAM

20MHz BW

Channel Frequency 3690MHz



2.4 Peak-to-Average Power Ratio (PAPR)

The Peak-to-Average Power Ratio (PAPR) of the EUT was measured per KDB 971168 D01 using the Power Complementary Cumulative Distribution Function (CCDF) feature of the MXA Analyzer. The PAPR measurements are tabulated in Table 2.4.

The FCC requirement for PAPR is that the transmitter's peak-to-average power ratio (PAPR) shall not exceed 13 dB for more than 0.1% of the time using a signal corresponding to the highest PAPR during periods of continuous transmission. The maximum PAPR value for each measured configuration is given in Table 2.4.

2.4.1 Peak-to-Average Power Ratio Results:

The maximum Peak-to-Average Power Ratio (PAPR) of the EUT measured at its antenna transmitting terminals was measured to be 8.93dB maximum, which is in full compliance with the requirement to not exceed 13 dB as specified by the FCC. The representative data sets exact values are listed in Table 2.4 below.

Table 2.4 Peak to Average Power Ratio

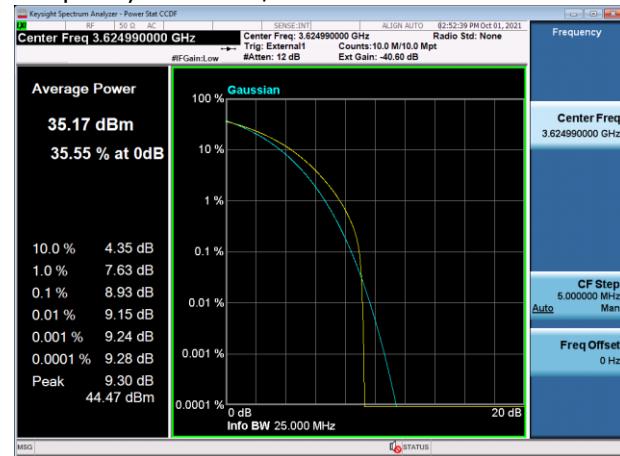
Test Model	Modulation	TX Port	Center Frequency MHz	Signal BW MHz	PAR at 0.1% Limit - 13 dB
3.1	64QAM	3	3560	20	8.70
3.2	QPSK/16QAM	3	3625	20	8.93

2.4.2 Peak-to-Average Power Ratio Plots

Test Model 3.1, Modulation 64QAM, Center Frequency 3560MHz, TX3



Test Model 3.2, Modulation QPSK/16QAM, Center Frequency 3625MHz, TX3

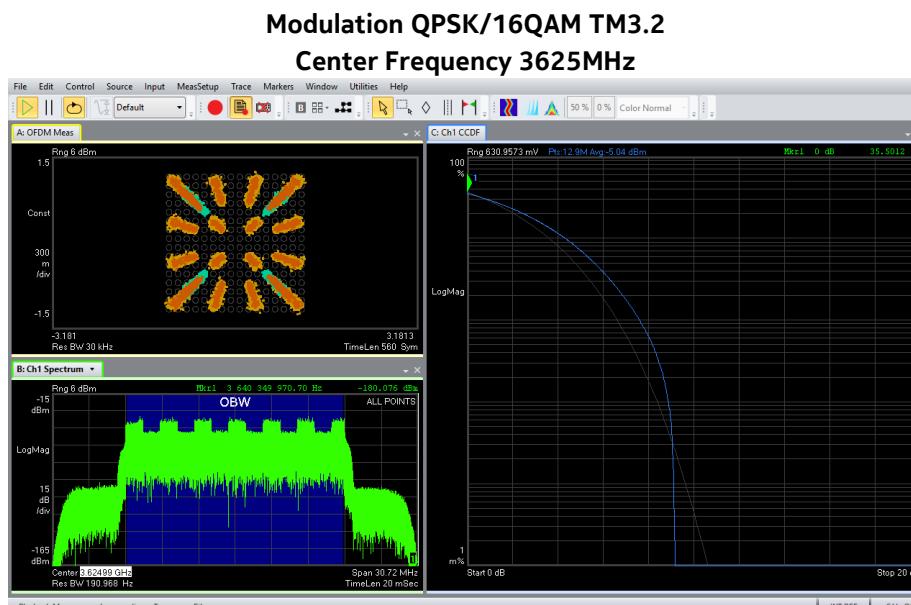
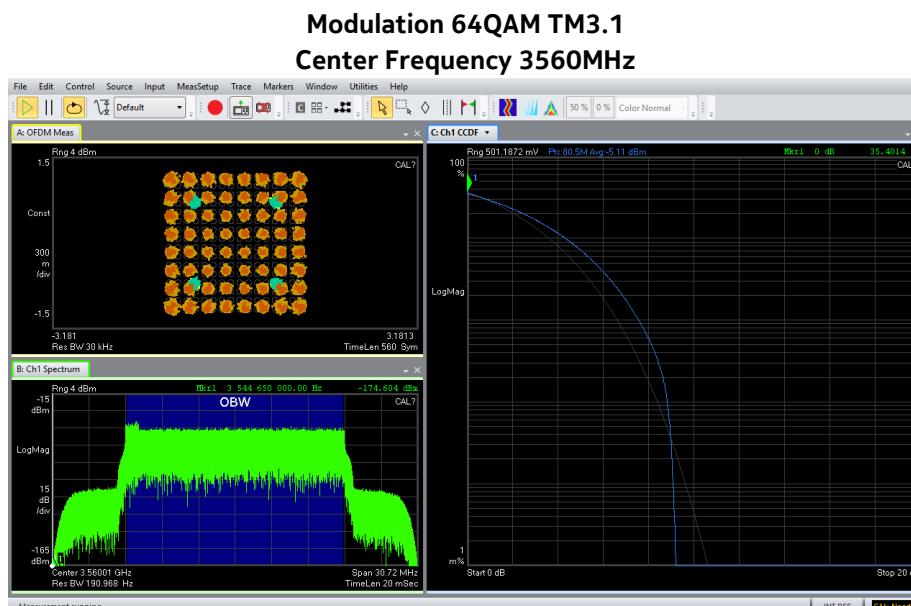


3. FCC Section 2.1047 - Modulation Characteristics

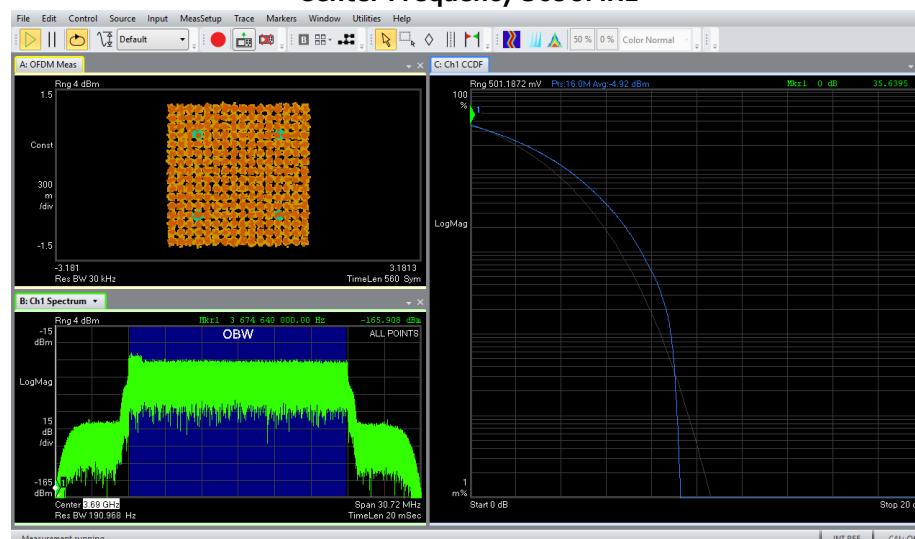
3.1 Modulation Characteristics

The RF signal at the antenna port was demodulated and verified for correctness of the modulation signal used before each test was performed.

3.1.1 Modulation Characteristics – Plots



Modulation 256QAM TM3.1a
Center Frequency 3690MHz



4. FCC Section 2.1049 – Occupied Bandwidth/Edge of Band Emissions

4.1 Occupied Bandwidth

In 47CFR 2.1049 the FCC requires:

“The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable.”

This required measurement is the 99% Occupied Bandwidth, also called the designated signal bandwidth and needs to be within the parameters of the products specified emissions designator. During these measurements it is customary to evaluate the Edge of Band emissions at block/band edges.

Part 96.41e(3) specified that the fundamental emission bandwidth 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 at least 26 dB below the transmitter power.

The transmitted signal occupied bandwidth was measured using a Keysight MXA Signal Analyzer. All emissions were within the parameters as required.

4.1.1 Occupied Bandwidth (Signal Bandwidth) Results

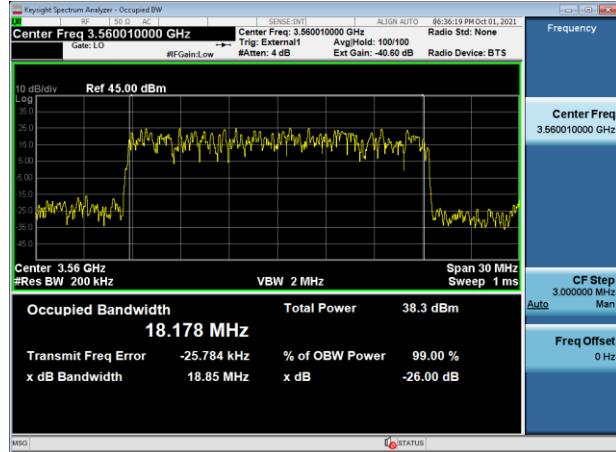
The 99% occupied bandwidth and -26 dB relative bandwidth was measured with an Agilent/Keysight MXA signal analyzer for the emission designators. The results are tabulated in Table 4.1 and example plots are in section 4.1.2 and shows that the measured signals are within the parameters of the emissions designator for the FCC.

Table 4.1: 99% Occupied Bandwidth

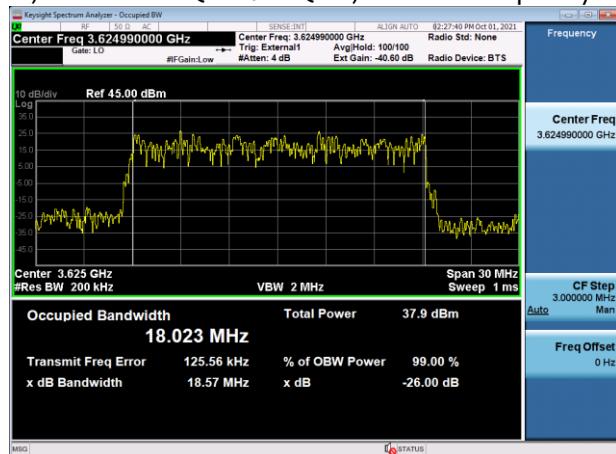
Test Model	Modulation	TX Port	Center Frequency MHz	Signal BW MHz	Occupied BW MHz
3.1	64QAM	3	3560	20	18.178
3.2	QPSK/16QAM	3	3625	20	18.023
3.1a	256QAM	3	3690	20	17.995

4.1.2 Occupied Bandwidth – Plots

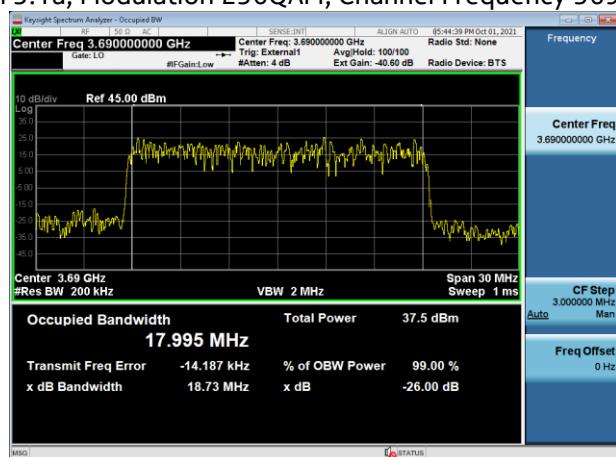
Test Model 3.1, Modulation 64QAM, Channel Frequency 3560MHz, TX3



Test Model 3.2, Modulation QPSK/16QAM, Channel Frequency 3625MHz, TX3



Test Model 3.1a, Modulation 256QAM, Channel Frequency 3690 MHz, TX3



4.2 Edge of band Emissions

47CFR 96.41 (e)(1) (i) and KDB 940660 D01 Section 3.2 (b)(6) specified that the limits for the emissions outside the fundamental are as follows.

- within 0 MHz to 10 MHz above and below the assigned channel ≤ -13 dBm/MHz,
- greater than 10 MHz above and below the assigned channel ≤ -25 dBm/MHz,
- any emission below 3530 MHz and above 3720 MHz ≤ -40 dBm/MHz.

47CFR 96.41 (e)(3) and KDB 940660 D01 Section 3.2 (b)(6) specified stated that (i) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's authorized frequency channel, a resolution bandwidth of no less than one percent of the fundamental emission bandwidth may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full reference bandwidth (*i.e.*, 1 MHz or 1 percent of emission bandwidth, as specified). The fundamental emission bandwidth 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 at least 26 dB below the transmitter power. (ii) When measuring unwanted emissions to demonstrate compliance with the limits, the CBSD and End User Device nominal carrier frequency/channel shall be adjusted as close to the licensee's authorized frequency block edges, both upper and lower, as the design permits. (iii) Compliance with emission limits shall be demonstrated using either average (RMS)-detected or peak-detected power measurement techniques.

KDB 940660 D01 Section 3.2 (b)(6) specified that measurements must be performed for low, mid, and high channels. It is acceptable to apply the procedures in Section 5.7 of ANSI C63.26-2015. When antenna-port conducted measurements are performed to demonstrate compliance to the applicable unwanted emission limits (Section 2.1051), a separate radiated measurement is required to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation (Section 2.1053). The Section 96.41(e) limits generally also apply to radiated unwanted emissions.

The Edge of Band emissions of the EUT at the external antenna connector (EAC) were measured using a Keysight MXA Signal Analyzer. The RF power level was continuously measured using a RF broadband power meter. The RF output from the EAC port to signal analyzer was reduced (to an amplitude usable by the signal analyzer) by using a calibrated attenuator and test coupler. The path attenuation was offset on the display and the signal for the carrier was adjusted to the corrected RF power level for the resolution bandwidth used for the transmit signal. All mask values were adjusted based upon the designated signal bandwidth and measurement bandwidths. The Top of Mask corresponds to the set rated power level as confirmed by the RF power meter.

4.2.1 Edge of Band Emissions - Plots.

All of the measurements met the requirements of Part 96.41(e)(1) and KDB 940660 D01 Section 3.2 (b)(6) when measured per Part 2.1049.

Test Model 3.1, Modulation 64QAM, Channel Frequency 3560 MHz, TX3



Test Model 3.2, Modulation QPSK/16QAM, Channel Frequency 3625 MHz, TX3



Test Model 3.1a, Modulation 256QAM, Channel Frequency 3690 MHz, TX12



5. FCC Section 2.1051 - Spurious Emissions at Transmit Antenna Port

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.

5.1 Section 2.1051 Spurious Emissions at Antenna Terminals

Spurious Emissions at the antenna terminals were investigated per 47CFR Section 2.1057(a)(1) over the frequency range of 10 MHz to 37 GHz which is beyond the 10th harmonic of the carrier frequency. A test coupler which incorporates a low intermod broadband RF attenuator was used to reduce the transceiver's amplitude to a level usable by the spectrum analyzer. The test configuration is shown in Figure 4.4.1 which documents the test set up used for the measurements. In this set up the complete RF test path was calibrated over the 10 MHz-37 GHz range.

The spurious measurements were made using an automated test system and an MXA Signal Analyzer. The automated test system consists of a Rohde & Schwarz ESIB-40 Test Receiver/ Spectrum Analyzer and a PC based computer test controller. These measurements are performed in compliance with ANSI C63.26 and our ISO17025 process. The measurement meets the ANSI C63.26 requirements in paragraphs 5.2.4.4.1 and 5.7 which requires that the number of points in the sweep be $> 2 \times \text{Span}/\text{RBW}$. The MXA signal analyzer measurements examine the 10 MHz to 26.5 GHz range while the automated test system overlaps and extends the frequency range to examine the 10 MHz to 40 GHz range.

Measurements were performed for all of the test configurations in Table 5.1 and these matches the test configurations used for Occupied Bandwidth / Edge of Band Emissions, RF Power and modulation.

5.2 Required Limit

The required emission limitation specified in **47CFR 96.41 (e)** was applied to these tests. Based upon the criterion given in Section 96 of the Code and as developed in 4.3.3, the required emission limit for emissions outside a licensee's frequency block is:

47CFR 96.41 (e)(2) *Additional protection levels.* Notwithstanding paragraph (e)(1) of this section, the conducted power of any emissions below 3540 MHz or above 3710 MHz shall not exceed -25 dBm/MHz, and the conducted power of emissions below 3530 MHz or above 3720 MHz shall not exceed -40dBm/MHz.

In order to account for the spectral adding of identical signals from the primary and diversity ports, per KDB 662911 D01 Multiple Transmitter Output v01r01, the level needs be adjusted by $10\text{LOG}(n)$ where n = number of outputs.

The adjustment for $n=4$ is: $6.02 \text{ dB} = 10\text{LOG}(4)$

Therefore, the limit for emissions below 3540 MHz or above 3710 MHz frequency block when measured with a RBW of 1 MHz is:

$$-25 \text{ dBm} - 6.02 \text{ dB} = -31.02 \text{ dBm} \text{ for 4x MIMO}$$

Therefore, the limit for emissions below 3530 MHz or above 3720 MHz frequency block when measured with a RBW of 1 MHz is:

$$-40 \text{ dBm} - 6.02 \text{ dB} = -46.02 \text{ dBm} \text{ for 4x MIMO}$$

5.3 Spurious Emissions at Antenna Terminals Results

Over the required frequency spectrum investigated for the EUT, no reportable out-of-block spurious emissions were detected. The out-of-block spurious emissions in the entire spectrum investigated are under the required reportable emission limit and are tabulated in Table 5.1 below. The measurement results demonstrate that the subject of the application is in full compliance with the Rules of the Commission and Industry Canada.

Table 5.1: Spurious Emissions at Antenna Terminals

Test Model	Modulation	TX Port	Channel Frequency MHz	Signal BW MHz	Conducted Spurious Emissions Results Pass/ Fail
3.1	64QAM	3	3560	20	Pass
3.2	QPSK/16QAM	3	3625	20	Pass
3.1a	256QAM	3	3690	20	Pass

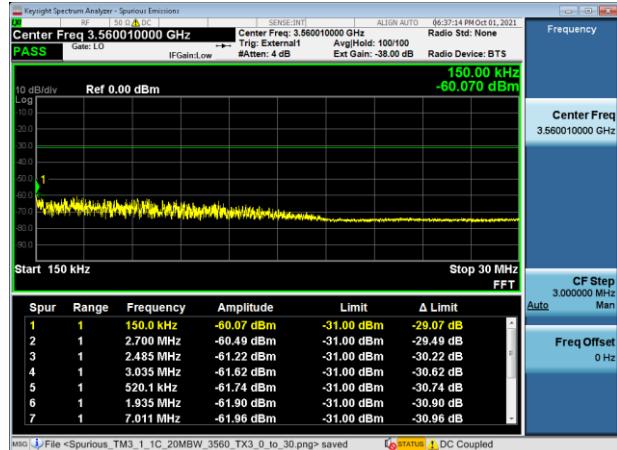
5.4 Spurious Emissions Plots

Test Model	Modulation	TX Port	Channel Frequency (MHz)	Signal BW (MHz)
3.1	64QAM	3	3560	20

9KHz – 150kHz

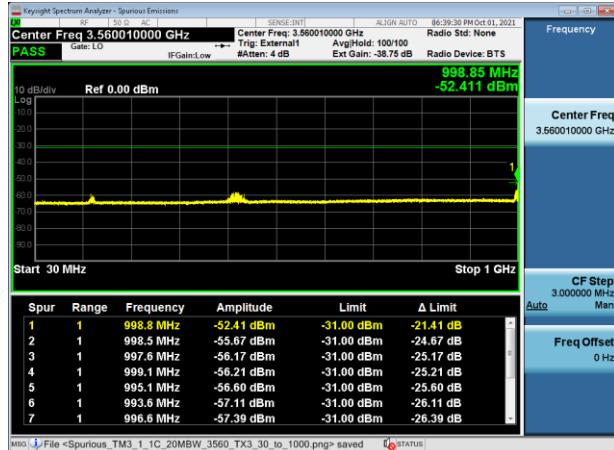


150kHz – 30MHz



Note: The correct limit for frequency ranges above is -46dBm

30MHz – 1GHz



1GHz – 3.53GHz



Note: The correct limit for frequency ranges above is -46dBm

Title 47 Code of Federal Regulations Test Report

Global Product Compliance Laboratory

Report No.: TR-2021-0133-FCC96

Product: AirScale Micro RRH 3.5GHz 4T/4R 20W (AZQC)

3.53GHz – 3.54GHz



3.58GHz – 3.72GHz



3.72GHz – 5GHz



5GHz – 10GHz



10GHz – 37GHz

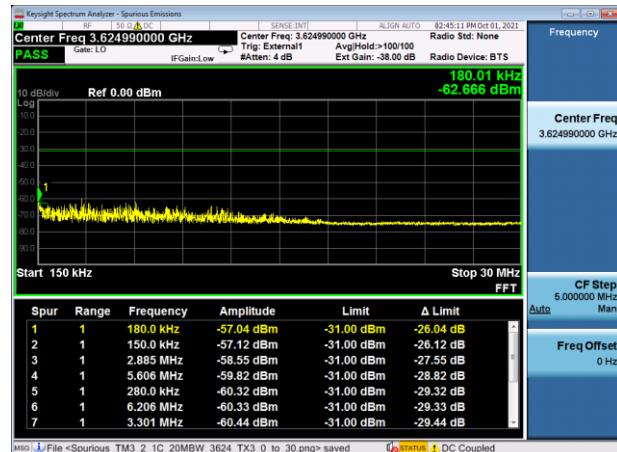


Test Model	Modulation	TX Port	Channel Frequency (MHz)	Signal BW (MHz)
3.2	QPSK/16QAM	3	3625	20

9kHz – 150kHz

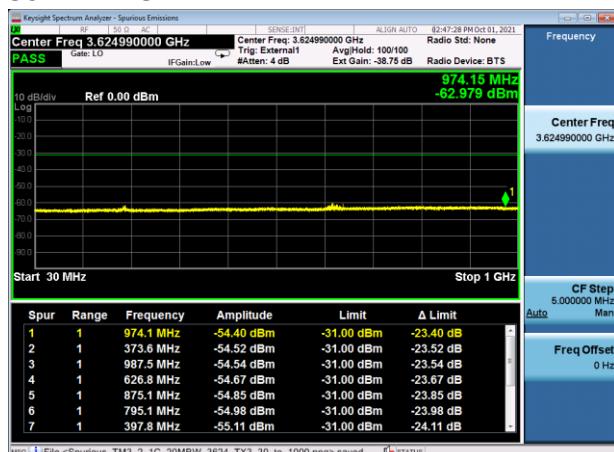


150kHz – 30MHz



Note: The correct limit for frequency ranges above is -46dBm

30MHz – 1GHz



1GHz – 3.53GHz



Note: The correct limit for frequency ranges above is -46dBm

3.72GHz – 5GHz



5GHz – 10GHz



10GHz – 37GHz

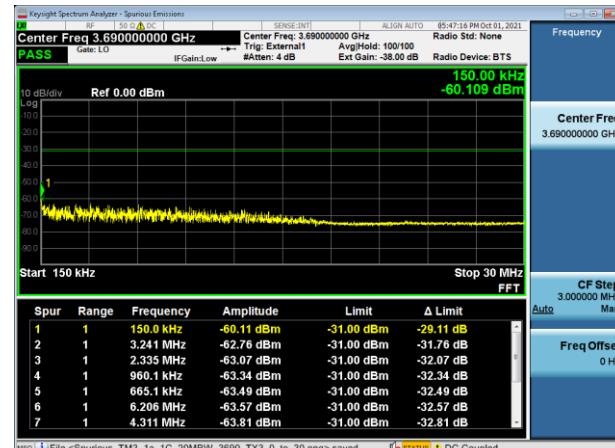


Test Model	Modulation	TX Port	Channel Frequency (MHz)	Signal BW (MHz)
3.1a	256QAM	3	3690	20

9KHz – 150kHz

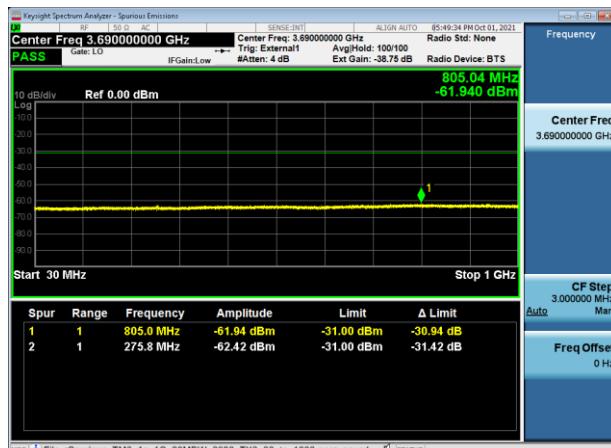


150kHz – 30MHz



Note: The correct limit for frequency ranges above is -46dBm

30MHz – 1GHz



1GHz – 3.53GHz



Note: The correct limit for frequency ranges above is -46dBm

10GHz – 37GHz



PUBLIC

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6. Section 2.1053 - Measurement Required: Field Strength of Spurious Radiation

The field strength measurements of radiated spurious emissions were made in a FCC registered 3-meter semi-anechoic chamber AR-6, (FCC Registration Number: 395774) **NVLAP** Lab Code: 100275-0 and IC (Filing Number: 6933F-5) which is maintained by Nokia Bell Labs in Murray Hill, New Jersey.

6.1 Spurious Radiation and Radiated Emissions Requirements.

This product meets Parts 2,15 and 96 requirements. FCC Part 15 Class B require emissions to be below 54.5 dB μ V/m at 3m.

47CFR 96.41 (e)(1) (i) and KDB 940660 D01 Section 3.2 (b)(6) specified that the limits for the emissions outside the fundamental are as follows.

- within 0 MHz to 10 MHz above and below the assigned channel ≤ -13 dBm/MHz,
- greater than 10 MHz above and below the assigned channel ≤ -25 dBm/MHz,
- any emission below 3530 MHz and above 3720 MHz ≤ -40 dBm/MHz.

Title 47CFR section 2.1053 contains the requirements for the levels of spurious radiation as a function of the EIRP of the unmodulated carrier. The reference level for the unmodulated 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.

$$E = [(30 * EIRP)^{1/2}] / R$$

Where: E = Field Intensity in Volts/ meter R = Distance in meters = 3 m
 P = Emission Power in Watts

Hence,

$$E (\text{dB}\mu\text{V}/\text{m}) = \text{EIRP} (\text{dBm}) - 20 \log d (\text{m}) + 104.77.$$

For EIRP = -13dBm/MHz, $E = 82.2$ dB μ V/m,
 For EIRP = -25dBm/MHz, $E = 70.2$ dB μ V/m,
 For EIRP = -40dBm/MHz, $E = 55.2$ dB μ V/m.

The field strength of radiated spurious emissions measured was determined by

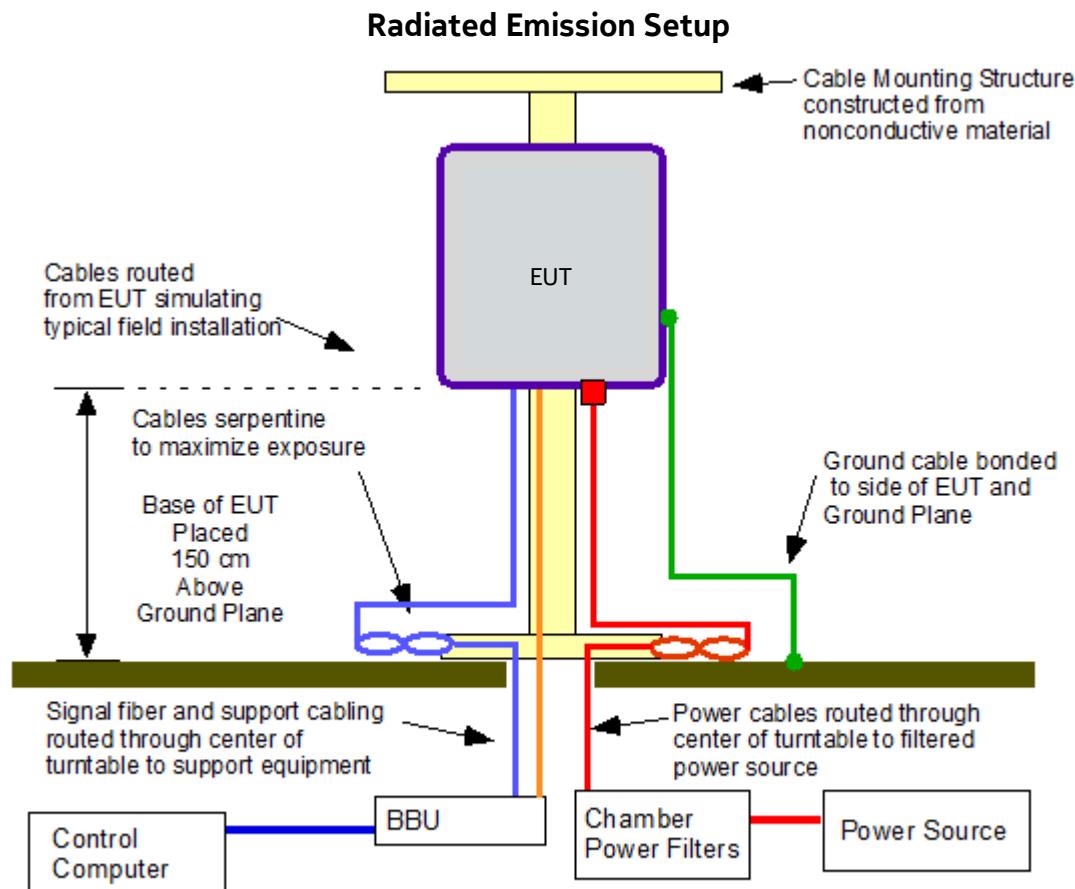
$$E(\text{dB}\mu\text{V}/\text{m}) = V_{\text{meas}} (\text{dB}\mu\text{V}) + \text{Cable Loss (dB)} + \text{Antenna Factor (dBi/m)}.$$

Field strength measurements of radiated spurious emissions were made in the 3m semi-anechoic chamber, AR-9 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 section 6.2. The minimum margin to the Part 90.1323 limit as measured in accordance with 2.1053 is more than 20dB.

6.2 Field Strength of Spurious Radiation Results:

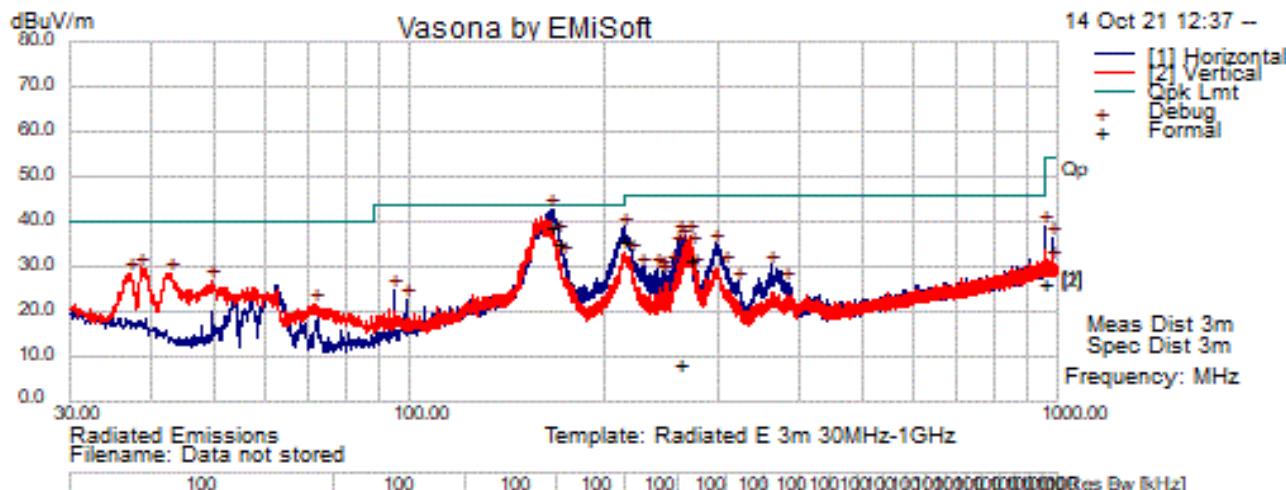
This product meets Part 96 Requirements. For the Title 47CFR section 90.1323 and 2.1053 test, the field strength of any spurious radiation, measured at 3m, is required to be less than 102.23dB μ V/meter. Emissions equal to or less than 82.23 dB μ V/meter are not reportable and may be verified using field strength measurements with broadband antennas.

Over the out of band spectrum investigated from 10 MHz to beyond the tenth harmonic of the carrier (37GHz), no reportable spurious emissions were detected. Additionally, from 10 MHz to beyond the tenth harmonic of the carrier (37GHz), all non-transmit carrier emissions were below 54.5 dB μ V/m. This demonstrates that the AirScale Micro RRH 3.5GHz 4T/4R 20W (AZQC), complies with FCC Part 15 Class B, and FCC Sections 2.1053, 90.1323 and 2.1057 of the Rules.



6.3 Transmitter Measurements of Radiated Spurious Emissions Plots

RE 30MHz – 1GHz



Test Information

Results Title	Radiated E 3m 30MHz-1GHz
File Name	t5a re30m-1g fccb.emi
Test Laboratory	MH-AR9, 40%RH, 21C, 995hPa.
Test Engineer	JY
Test Software	Vasona by EMISoft, version 6.061
Equipment	Nokia Wireless Group
EUT Details	AZQC 5G FCC, SN-1M181624804, PN-474156A.101
Configuration	AR9- Powered by 120VAC, 1CC, 3624.99MHz, ETM3.2, 37dBm. RE 30MHz-1GHz, FCC Class B limits, ESI-E908, PA-E812, Ant-E602, Preliminary Scan- RBW/VBW - 100k/300k, Int. Att. 0dB
Date	2021-10-14 12:49:14

Formal Data

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
165.839	49.94	0.80	-11.96	38.78	QuasiMax	H	209	1	43.50	-4.72	Pass	
214.453	50.92	0.92	-16.27	35.57	QuasiMax	H	114	236	43.50	-7.93	Pass	
170.669	47.39	0.82	-12.80	35.41	QuasiMax	H	195	340	43.50	-8.09	Pass	
270.987	44.69	1.04	-14.19	31.55	QuasiMax	V	100	292	46.00	-14.45	Pass	
958.568	27.69	2.63	-3.93	26.39	QuasiMax	H	111	95	46.00	-19.61	Pass	
261.642	20.58	1.02	-13.30	8.30	QuasiMax	H	108	90	46.00	-37.70	Pass	

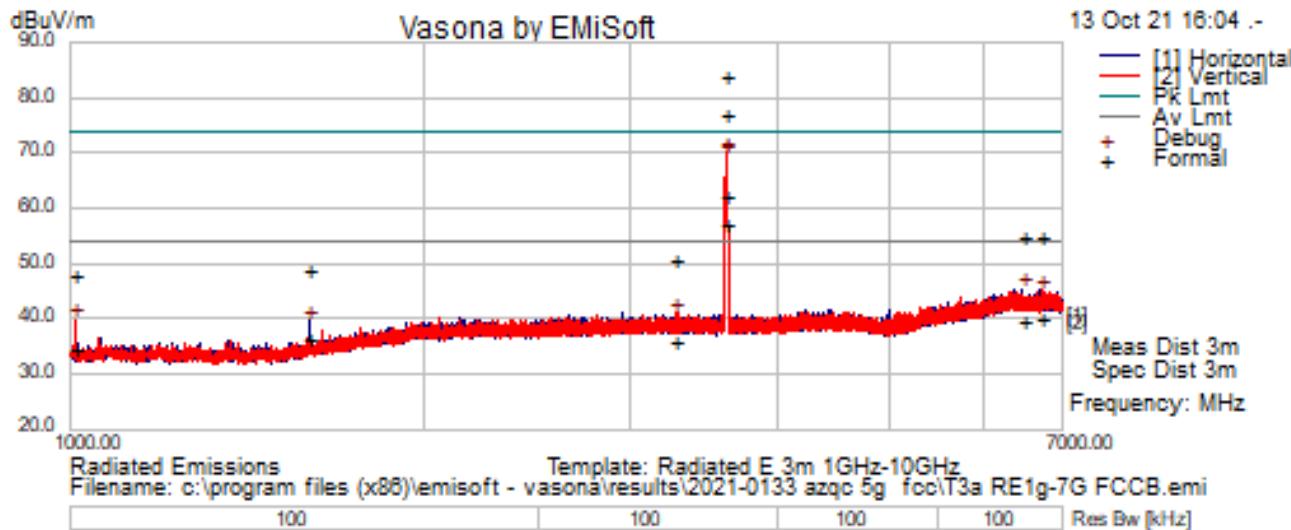
Preview Data

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
165.794046	53.99	0.80	-11.96	42.84	Debug	H	200	180	43.50	-0.66	Pass	

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
214.854565	53.99	0.92	-16.26	38.65	Debug	H	100	225	43.50	-4.85	Pass	
170.700044	49.02	0.82	-12.81	37.03	Debug	H	200	180	43.50	-6.47	Pass	
958.160561	40.27	2.63	-3.94	38.96	Debug	H	100	90	46.00	-7.04	Pass	
261.322269	49.06	1.02	-13.27	36.81	Debug	H	100	90	46.00	-9.19	Pass	
271.226952	49.88	1.04	-14.21	36.71	Debug	V	100	315	46.00	-9.29	Pass	
263.451313	48.28	1.02	-13.47	35.83	Debug	H	100	90	46.00	-10.17	Pass	
38.608557	42.48	0.42	-13.23	29.67	Debug	V	100	135	40.00	-10.33	Pass	
296.868048	48.14	1.10	-14.30	34.94	Debug	H	100	315	46.00	-11.06	Pass	
173.939894	44.92	0.82	-13.36	32.39	Debug	H	200	315	43.50	-11.11	Pass	
259.100697	46.63	1.01	-13.05	34.59	Debug	H	100	90	46.00	-11.41	Pass	
42.866553	43.26	0.43	-15.23	28.46	Debug	V	100	180	40.00	-11.54	Pass	
37.03495	40.35	0.41	-12.48	28.28	Debug	V	100	225	40.00	-11.72	Pass	
272.985727	47.42	1.04	-14.37	34.10	Debug	V	100	315	46.00	-11.90	Pass	
49.623808	44.39	0.44	-18.04	26.80	Debug	V	100	45	40.00	-13.20	Pass	
221.61182	48.02	0.93	-16.19	32.77	Debug	H	100	135	46.00	-13.23	Pass	
361.849176	42.10	1.22	-13.06	30.27	Debug	H	100	315	46.00	-15.73	Pass	
307.235565	43.04	1.12	-14.11	30.04	Debug	H	100	135	46.00	-15.96	Pass	
254.472441	41.46	1.00	-12.60	29.86	Debug	H	100	135	46.00	-16.14	Pass	
229.664986	44.13	0.95	-15.37	29.71	Debug	H	100	315	46.00	-16.29	Pass	
241.605888	42.05	0.97	-13.45	29.58	Debug	H	100	90	46.00	-16.42	Pass	
277.799218	43.02	1.05	-14.52	29.56	Debug	H	100	0	46.00	-16.44	Pass	
245.308493	40.76	0.98	-12.87	28.87	Debug	H	100	135	46.00	-17.13	Pass	
982.782886	37.24	2.60	-3.47	36.37	Debug	H	100	90	54.00	-17.63	Pass	
246.049014	40.03	0.98	-12.76	28.26	Debug	H	100	90	46.00	-17.74	Pass	
248.918533	39.53	0.99	-12.32	28.20	Debug	H	100	135	46.00	-17.80	Pass	
71.839439	41.66	0.50	-20.65	21.51	Debug	V	100	0	40.00	-18.49	Pass	
94.795994	39.37	0.57	-15.36	24.58	Debug	H	100	0	43.50	-18.92	Pass	
322.138551	39.18	1.15	-13.83	26.50	Debug	H	100	135	46.00	-19.50	Pass	
383.69502	37.12	1.27	-12.25	26.14	Debug	H	100	270	46.00	-19.86	Pass	
99.146649	36.41	0.58	-14.39	22.59	Debug	H	100	0	43.50	-20.91	Pass	
988.151663	31.89	2.59	-3.44	31.04	Debug	H	300	90	54.00	-22.96	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.

RE 1GHz – 7GHz



Test Information

Results Title	Radiated E 3m 1GHz-10GHz
File Name	T3a RE1g-7G FCCB.emi
Test Laboratory	MH-AR9, 40%RH, 21C, 995hPa.
Test Engineer	JY
Test Software	Vasona by EMISoft, version 6.061
Equipment	Nokia Wireless Group
EUT Details	AZQC 5G FCC, SN-1M181624804, PN-474156A.101
Configuration	AR9- Powered by 120VAC, 1CC, 3624.99MHz, ETM3.2, 37dBm. RE1GHz-7GHz, FCC Class B limits, FSW67-E1260, PA-E447, Ant-E1074, 6dB pad E1130, Preliminary Scan- RBW/VBW - 1M/1M, Final Scan-RBW/VBW - 1M/3M Int. Att. 0dB
Date	2021-10-13 16:04:22

Formal Data

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
3630.625	78.18	10.96	-5.23	83.90	PeakMax	V	134	22	74.00	9.90	Fail	TX Exempt
3630.625	56.67	10.96	-5.23	62.39	AvgMax	V	134	22	54.00	8.39	Fail	TX Exempt
3619.000	51.68	10.95	-5.24	57.38	AvgMax	V	138	254	54.00	3.38	Fail	TX Exempt
3619.000	71.35	10.95	-5.24	77.05	PeakMax	V	138	254	74.00	3.05	Fail	TX Exempt
6736.788	28.08	14.36	-2.33	40.11	AvgMax	V	112	101	54.00	-13.89	Pass	
6488.875	27.73	14.29	-2.16	39.86	AvgMax	H	154	125	54.00	-14.14	Pass	
1600.000	37.90	8.98	-10.45	36.43	AvgMax	H	107	84	54.00	-17.57	Pass	
3287.183	31.12	10.64	-5.63	36.14	AvgMax	V	161	230	54.00	-17.86	Pass	
6736.788	42.99	14.36	-2.33	55.02	PeakMax	V	112	101	74.00	-18.98	Pass	
6488.875	42.59	14.29	-2.16	54.72	PeakMax	H	154	125	74.00	-19.28	Pass	
1007.500	38.80	8.45	-12.72	34.53	AvgMax	V	173	126	54.00	-19.47	Pass	

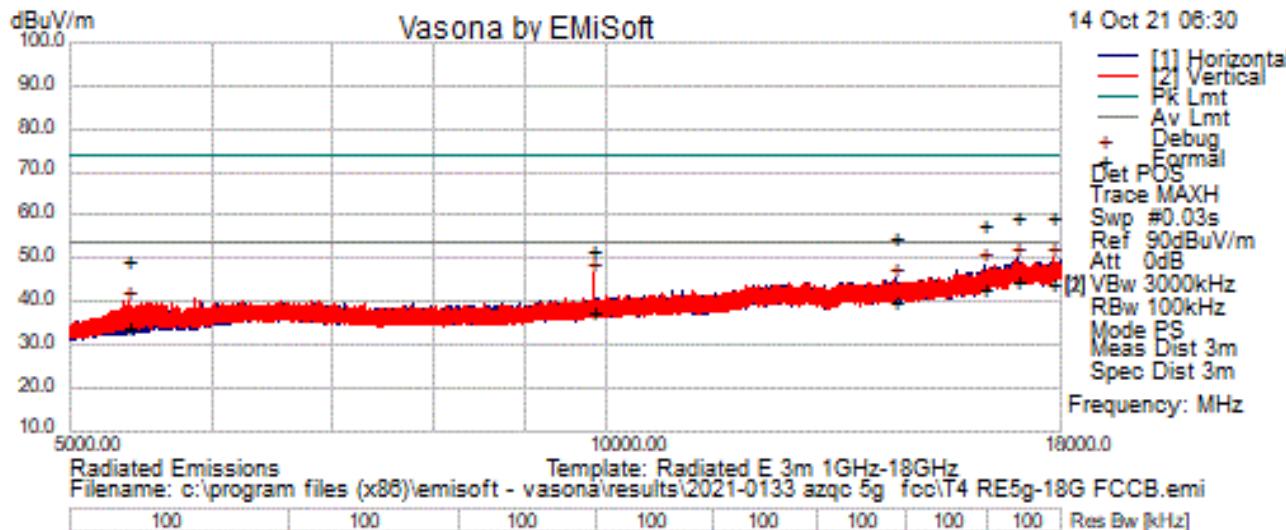
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
3287.183	45.91	10.64	-5.63	50.93	PeakMax	V	161	230	74.00	-23.07	Pass	
1600.000	50.25	8.98	-10.45	48.78	PeakMax	H	107	84	74.00	-25.22	Pass	
1007.500	52.24	8.45	-12.72	47.97	PeakMax	V	173	126	74.00	-26.03	Pass	

Preview Data

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
3630.625	64.32	10.96	-5.23	70.04	Debug	V	150	45	54.00	16.04	Fail	
3619.000	63.62	10.95	-5.24	69.32	Debug	V	150	45	54.00	15.32	Fail	
6488.875	33.17	14.29	-2.16	45.30	Debug	H	201	350	54.00	-8.70	Pass	
1007.500	44.13	8.45	-12.72	39.86	Debug	V	150	180	54.00	-14.14	Pass	
1600.000	41.11	8.98	-10.45	39.64	Debug	H	101	90	54.00	-14.36	Pass	
6736.788	32.93	14.36	-2.33	44.96	Debug	V	100	349	54.00	-9.04	Pass	
3287.183	35.64	10.64	-5.63	40.66	Debug	V	100	349	54.00	-13.34	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.

RE 5GHz – 18GHz



Test Information

Results Title	Radiated E 3m 1GHz-18GHz
File Name	T4a RE5g-18G FCCB.emi
Test Laboratory	MH-AR9, 40%RH, 21C, 995hPa.
Test Engineer	MJS / JY
Test Software	Vasona by EMiSoft, version 6.061
Equipment	Nokia Wireless Group
EUT Details	AZQC 5G FCC, SN-1M181624804, PN-474156A.101
Configuration	AR9- Powered by 120VAC, 1CC, 3624.99MHz, ETM3.2, 37dBm. RE5GHz-18GHz, FCC Class B limits, FSW67-E1260, PA-E447, Ant-E1074, HPF-E1479, Preliminary Scan- RBW/VBW - 100k/1M, Final Scan-RBW/VBW - 1M/3M Int. Att. 0dB
Date	2021-10-14 09:29:10

Formal Data

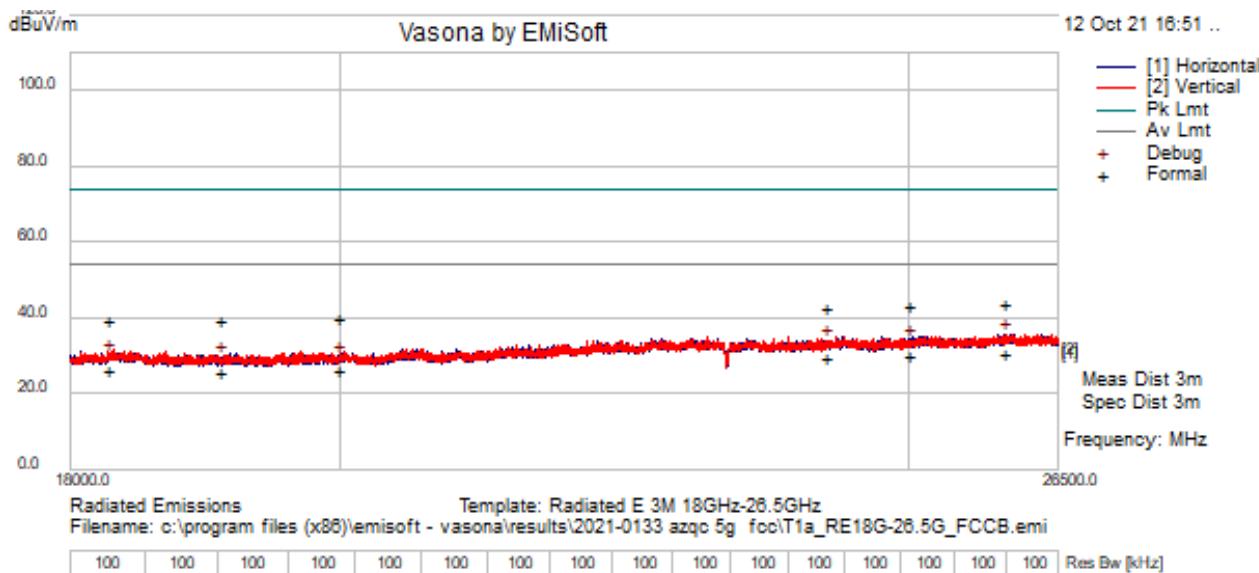
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
17013.990	26.98	11.53	6.17	44.68	AvgMax	H	296	8	54.00	-9.32	Pass	
17862.907	26.99	12.14	5.32	44.45	AvgMax	V	180	120	54.00	-9.55	Pass	
16342.338	27.63	11.35	3.73	42.71	AvgMax	H	187	68	54.00	-11.29	Pass	
14542.226	27.25	10.58	2.19	40.03	AvgMax	H	311	253	54.00	-13.97	Pass	
17862.907	42.45	12.14	5.32	59.90	PeakMax	V	180	120	74.00	-14.10	Pass	
17013.990	41.97	11.53	6.17	59.67	PeakMax	H	296	8	74.00	-14.33	Pass	
16342.338	42.84	11.35	3.73	57.92	PeakMax	H	187	68	74.00	-16.08	Pass	
9830.419	30.88	9.00	-2.15	37.73	AvgMax	V	135	10	54.00	-16.27	Pass	
14542.226	42.24	10.58	2.19	55.01	PeakMax	H	311	253	74.00	-18.99	Pass	
5381.132	30.45	7.12	-3.48	34.08	AvgMax	V	145	195	54.00	-19.92	Pass	
9830.419	44.90	9.00	-2.15	51.75	PeakMax	V	135	10	74.00	-22.25	Pass	
5381.132	45.88	7.12	-3.48	49.51	PeakMax	V	145	195	74.00	-24.49	Pass	

Preview Data

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
17862.907	32.48	12.14	5.32	49.94	Debug	V	100	349	54.00	-4.06	Pass	
17013.990	32.11	11.53	6.17	49.81	Debug	H	100	349	54.00	-4.19	Pass	
16342.338	33.40	11.35	3.73	48.48	Debug	H	100	349	54.00	-5.52	Pass	
9830.419	39.54	9.00	-2.15	46.39	Debug	V	100	349	54.00	-7.61	Pass	
14542.226	32.53	10.58	2.19	45.30	Debug	H	100	349	54.00	-8.70	Pass	
5381.132	36.07	7.12	-3.48	39.70	Debug	V	100	349	54.00	-14.30	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.

RE 18GHz – 26.5GHz



Test Information

Results Title	Radiated E 3M 18GHz-26.5GHz
File Name	T1a_RE18G-26.5G_FCCB.emi
Test Laboratory	MH-AR9, 40%RH, 21C, 995hPa.
Test Engineer	JY / MJS
Test Software	Vasona by EMiSoft, version 6.061
Equipment	AR9-Nokia Wireless Group
EUT Details	AZQC 5G FCC, SN-1M181624804, PN-474156A.101
Configuration	AR9- Powered by 120VAC, 1CC, 3624.99MHz, ETM3.2, 37dBm. RE18G-226.5GHz, ESI-E908, PA-E1525, Ant-E1453, HPF-E1213, Preliminary Scan- RBW/VBW - 100k/1M, Final Scan-RBW/VBW - 1M/3M Int. Att. 0dB
Date	2021-10-12 16:51:42

Formal Data

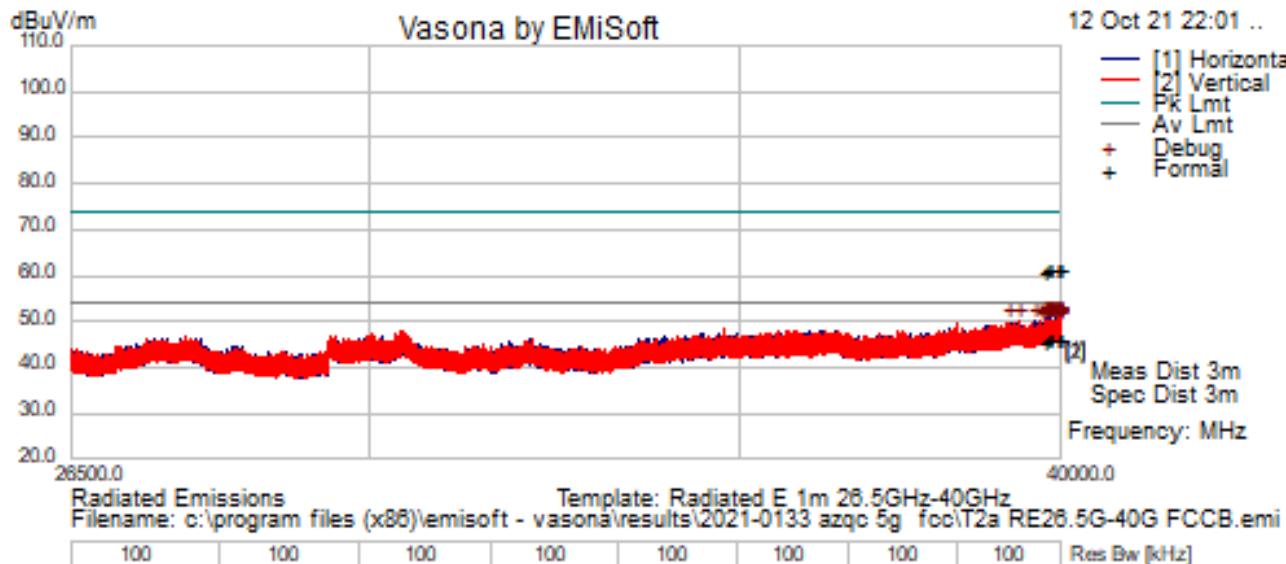
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
25957.286	19.08	14.47	-3.08	30.48	AvgMax	H	134	186	54.00	-23.52	Pass	
24996.654	19.24	14.29	-3.39	30.14	AvgMax	V	100	105	54.00	-23.86	Pass	
24192.911	19.24	14.11	-3.93	29.41	AvgMax	H	117	23	54.00	-24.59	Pass	
18266.506	22.16	12.68	-8.40	26.44	AvgMax	V	109	5	54.00	-27.56	Pass	
19992.968	22.82	12.79	-9.17	26.43	AvgMax	V	173	301	54.00	-27.57	Pass	
19089.935	22.60	12.48	-9.06	26.03	AvgMax	H	241	17	54.00	-27.97	Pass	
25957.286	32.56	14.47	-3.08	43.95	PeakMax	H	134	186	74.00	-30.05	Pass	
24996.654	32.69	14.29	-3.39	43.59	PeakMax	V	100	105	74.00	-30.41	Pass	
24192.911	32.56	14.11	-3.93	42.73	PeakMax	H	117	23	74.00	-31.27	Pass	
19992.968	36.63	12.79	-9.17	40.25	PeakMax	V	173	301	74.00	-33.75	Pass	
19089.935	36.14	12.48	-9.06	39.56	PeakMax	H	241	17	74.00	-34.44	Pass	
18266.506	35.23	12.68	-8.40	39.51	PeakMax	V	109	5	74.00	-34.49	Pass	

Preview Data

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
25957.286	22.92	14.47	-3.08	34.31	Debug	H	100	344	54.00	-19.69	Pass	
24996.654	21.93	14.29	-3.39	32.83	Debug	V	100	344	54.00	-21.17	Pass	
24192.911	22.57	14.11	-3.93	32.74	Debug	H	100	344	54.00	-21.26	Pass	
18266.506	24.74	12.68	-8.40	29.02	Debug	V	100	344	54.00	-24.98	Pass	
19089.935	25.07	12.48	-9.06	28.49	Debug	H	100	344	54.00	-25.51	Pass	
19992.968	24.70	12.79	-9.17	28.32	Debug	V	100	344	54.00	-25.68	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.

RE 26.5 GHz – 40 GHz



Test Information

Results Title	Radiated E 3m 26.5GHz-40GHz
File Name	T2a RE26.5G-40G FCCB.emi
Test Laboratory	MH-AR9, 40%RH, 21C, 995hPa.
Test Engineer	MJS
Test Software	Vasona by EMiSoft, version 6.061
Equipment	Nokia Wireless Group
EUT Details	AZQC 5G FCC, SN-1M181624804, PN-474156A.101
Configuration	AR9- Powered by 120VAC 1CC, 3624.99MHz, ETM3.2, 37dBm. RE26.5G-40GHz, FCC Class B limits, FSW67-E1260, PA-E1525, Ant-E1374, Preliminary Scan- RBW/VBW - 1M/1M, Final Scan-RBW/VBW - 1M/3M Int. Att. 0dB
Date	2021-10-12 22:01:53

Formal Data

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
39778.375	45.44	17.17	-1.22	61.39	PeakMax	H	221	324	74.00	-12.61	Pass	
39924.963	45.43	17.17	-1.13	61.47	PeakMax	H	214	227	74.00	-12.53	Pass	
39972.381	45.22	17.17	-1.14	61.26	PeakMax	V	209	269	74.00	-12.74	Pass	
39735.681	44.84	17.17	-1.24	60.77	PeakMax	H	252	219	74.00	-13.23	Pass	
39939.363	45.38	17.17	-1.13	61.41	PeakMax	V	102	36	74.00	-12.59	Pass	
39817.638	45.64	17.17	-1.19	61.62	PeakMax	H	207	308	74.00	-12.38	Pass	
39778.375	30.23	17.17	-1.22	46.18	AvgMax	H	221	324	54.00	-7.82	Pass	
39924.963	30.32	17.17	-1.13	46.36	AvgMax	H	214	227	54.00	-7.64	Pass	
39972.381	30.13	17.17	-1.14	46.16	AvgMax	V	209	269	54.00	-7.84	Pass	
39735.681	29.97	17.17	-1.24	45.89	AvgMax	H	252	219	54.00	-8.11	Pass	
39939.363	30.24	17.17	-1.13	46.28	AvgMax	V	102	36	54.00	-7.72	Pass	
39817.638	30.42	17.17	-1.19	46.39	AvgMax	H	207	308	54.00	-7.61	Pass	

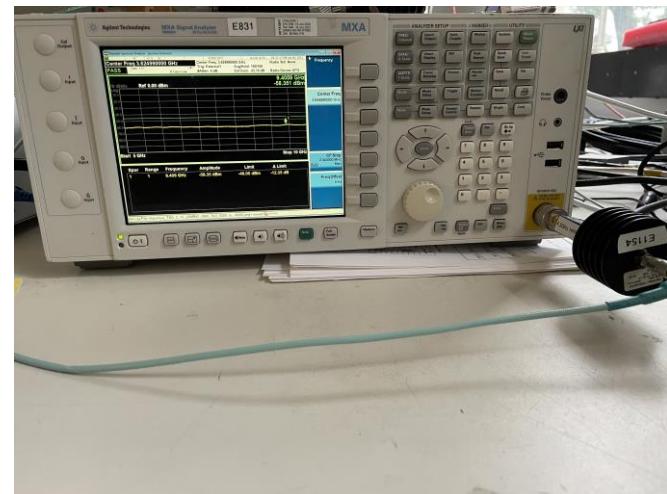
Preview Data

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass/Fail	Comments
39778.375	34.90	17.17	-1.22	50.85	Debug	H	250	240	54.00	-3.15	Pass	
39924.963	34.73	17.17	-1.13	50.77	Debug	H	250	210	54.00	-3.23	Pass	
39972.381	34.69	17.17	-1.14	50.73	Debug	V	175	180	54.00	-3.27	Pass	
39735.681	34.74	17.17	-1.24	50.67	Debug	H	250	270	54.00	-3.33	Pass	
39939.363	34.55	17.17	-1.13	50.59	Debug	V	100	120	54.00	-3.41	Pass	
39817.638	34.53	17.17	-1.19	50.51	Debug	H	250	60	54.00	-3.49	Pass	
39981.831	34.46	17.17	-1.14	50.49	Debug	V	175	120	54.00	-3.51	Pass	
39793.450	34.48	17.17	-1.21	50.44	Debug	H	250	150	54.00	-3.56	Pass	
39903.025	34.38	17.17	-1.13	50.42	Debug	H	175	330	54.00	-3.58	Pass	
39839.125	34.38	17.17	-1.17	50.37	Debug	H	175	90	54.00	-3.63	Pass	
39773.538	34.41	17.17	-1.22	50.36	Debug	V	250	330	54.00	-3.64	Pass	
39997.244	34.29	17.17	-1.14	50.31	Debug	H	250	150	54.00	-3.69	Pass	
39773.875	34.36	17.17	-1.22	50.30	Debug	V	100	210	54.00	-3.70	Pass	
39875.688	34.28	17.17	-1.14	50.30	Debug	H	100	180	54.00	-3.70	Pass	
39923.613	34.26	17.17	-1.13	50.30	Debug	V	250	210	54.00	-3.70	Pass	
39804.250	34.28	17.17	-1.20	50.25	Debug	V	175	120	54.00	-3.75	Pass	
39788.669	34.29	17.17	-1.21	50.25	Debug	H	175	300	54.00	-3.75	Pass	
39780.513	34.28	17.17	-1.22	50.24	Debug	H	100	30	54.00	-3.76	Pass	
39309.813	34.60	17.16	-1.57	50.19	Debug	V	175	240	54.00	-3.81	Pass	
39824.950	34.20	17.17	-1.19	50.19	Debug	H	175	30	54.00	-3.81	Pass	
39884.463	34.15	17.17	-1.14	50.18	Debug	H	100	300	54.00	-3.82	Pass	
39866.688	34.13	17.17	-1.15	50.15	Debug	V	250	270	54.00	-3.85	Pass	
39959.219	34.11	17.17	-1.14	50.15	Debug	H	175	210	54.00	-3.85	Pass	
39930.813	34.11	17.17	-1.13	50.15	Debug	V	100	270	54.00	-3.85	Pass	
39794.519	34.18	17.17	-1.21	50.14	Debug	V	250	0	54.00	-3.86	Pass	
39864.494	34.10	17.17	-1.15	50.12	Debug	H	250	90	54.00	-3.88	Pass	
39860.106	34.10	17.17	-1.16	50.11	Debug	H	175	210	54.00	-3.89	Pass	
39746.763	34.08	17.17	-1.23	50.01	Debug	H	175	240	54.00	-3.99	Pass	
39950.388	33.95	17.17	-1.13	49.99	Debug	H	175	120	54.00	-4.01	Pass	
39712.169	34.05	17.17	-1.25	49.96	Debug	H	175	210	54.00	-4.04	Pass	
39732.025	34.01	17.17	-1.24	49.94	Debug	V	250	180	54.00	-4.06	Pass	
39545.725	34.18	17.16	-1.45	49.89	Debug	H	250	210	54.00	-4.11	Pass	
39994.206	33.83	17.17	-1.14	49.86	Debug	H	250	270	54.00	-4.14	Pass	
39621.944	34.06	17.16	-1.37	49.86	Debug	V	100	30	54.00	-4.14	Pass	
39782.313	33.90	17.17	-1.21	49.85	Debug	V	250	120	54.00	-4.15	Pass	
39997.975	33.82	17.17	-1.14	49.85	Debug	V	250	30	54.00	-4.15	Pass	
39120.644	34.13	17.15	-1.44	49.84	Debug	V	100	90	54.00	-4.16	Pass	
39762.906	33.88	17.17	-1.22	49.82	Debug	V	250	60	54.00	-4.18	Pass	
39980.088	33.65	17.17	-1.14	49.68	Debug	V	175	240	54.00	-4.32	Pass	
39698.050	33.76	17.17	-1.26	49.67	Debug	H	250	210	54.00	-4.33	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.

Photographs

Radio Test



Radiated Emission Test

30MHz- 1GHz

1GHz-18GHz

18GHz – 26.5GHz

26.5GHz – 40GHz

Test Equipment**Radio Test Equipment**

Asset ID	Manufacturer	Type	Description	Model	Serial	Calibration Date	Calibration Due
E831	Agilent Technologies	MXA Signal Analyzer	20Hz-26.5GHz	N9020A	MY48011791	2020-06-16	2022-06-16
E896	Agilent Technologies	Network Analyzer	10 MHz - 40 GHz	N5230C	MY49000897	2021-03-03	2023-03-03
E1347	Fairview Microwave	Attenuator	10 dB, DC - 40 GHz, 20 watt	SA4023-10	N/A	CNR-V	CNR-V
E1338	KeySight Technologies	MXA Signal Analyzer		N9020B	MY57430927	2019-11-14	2021-11-14
E1212	RLC Electronics Inc	Filter, High Pass	10 - 30 GHz, 2W, 5dB	F-19414	1444002	CNR-V	CNR-V
E1479	Reactel, Inc.	Filter, High Pass	DC - 4.3 GHz	11HS-X4.3 GS11	SN20-01	CNR-V	CNR-V
E1156	Weinschel	Attenuator	10dB 0.05GHz- 26GHz 25W	74-10-12	1069	CNR-V	CNR-V
E1155	Weinschel	Attenuator	10dB 25Watt 0.05GHz - 26GHz	74-10-12	1068	CNR-V	CNR-V
E1154	Weinschel	Attenuator	30dB 25W 0.05GHz- 26GHz	74-30-12	1065	CNR-V	CNR-V

CNR-V: Calibration Not Required, Must Be Verified

Test Dates: 9/30/2021 – 10/4/2021

Radiated Emission Test Equipment

Asset ID	Manufacturer	Type	Description	Model	Serial	Calibration Date	Calibration Due
E1453	A-Info	Horn Antenna	18 to 26.5 GHz WR42 25 dB	LB-42-25-C2-KFSP0	J202066362	2020-07-24	2023-07-24
E1374	A-Info	Horn Antenna	26.5-40GHz WR28 25 dB	LB-28-25-C2-KF	J202062736	2018-12-05	2021-12-05
E1525	A.H. Systems Inc.	Pre-Amplifier	18 GHz-40 GHz, 37 dB	PAM-1840VH	186	2020-11-30	2022-11-30
E1213	RLC Electronics Inc	Filter, High Pass	10 - 30 GHz, 2W, 5dB	F-19414	1444001	CNR-V	CNR-V
E1260	Rohde & Schwarz	Spectrum Analyzer		FSW67	104007	2020-08-21	2022-08-21

Asset ID	Manufacturer	Type	Description	Model	Serial	Calibration Date	Calibration Due
E908	Rohde & Schwarz	Test Receiver	EMI (20Hz to 40 GHz)-150 +30dBm	ESIB40	100100	2020-04-17	2022-04-17
E602	A.H. Systems Inc.	Biological Antenna	25 - 2000 MHz	SAS-521-2	410	2021-09-21	2023-09-21
E812	Sonoma Instrument Co.	Amplifier	9kHz-1GHz	310N	186744	2020-10-20	2022-10-20

CNR-V: Calibration Not Required, Must Be Verified

Test Dates: 10/12/2021 – 10/14/2021

7. NVLAP Certificate of Accreditation

United States Department of Commerce
National Institute of Standards and Technology



Certificate of Accreditation to ISO/IEC 17025:2017

NVLAP LAB CODE: 100275-0

Nokia, Global Product Compliance Lab
Murray Hill, NJ

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

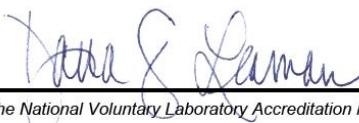
Electromagnetic Compatibility & Telecommunications

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

2021-09-24 through 2022-09-30

Effective Dates




For the National Voluntary Laboratory Accreditation Program