

Global Product Compliance Laboratory 600-700 Mountain Avenue Room 5B-108 Murray Hill, New Jersey 07974-0636 USA



# Title 47 Code of Federal Regulations Test Report

Regulation: FCC Part 2 and 22

Client: NOKIA SOLUTIONS AND NETWORKS

Product Evaluated: AHCF AirScale RRH 4T4R B26 200W

> Report Number: TR-2023-0112-FCC2-22

Date Issued: September 20, 2023

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# Revisions

Date	Revision	Section	Change
9/20/2023	0		Initial Release

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Laboratory in New Providence, NJ.

# 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):	AHCF AirScale RRH 4T4R B5 200W						
FCC ID:	VBNAHCF-01						
Serial Number:	6Q201003935						
Hardware Version:	475313A.101						
	ftware Version:     SBTS21B       equency Range:     869-894MHz						
Frequency Range:         869-894MHz           GPCL Project Number:         2023-0054							
Applicant							
	3201 Olympus Blvd						
	Dallas, Texas 75019 Store Mitchell						
	Steve Mitchell						
Manufacturer:	NOKIA SOLUTIONS AND NETWORKS OY						
	KARAKAARI 7, FI-02610 ESPOO						
	FINLAND						
Test Requirement(s):	Title 47 CFR Parts 2 and 22						
Test Standards:	Refer to Section 1.5.1						
Measurement Procedure(s): Refer to Section 1.5.2							
Test Date(s):	6/29/2023						
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:	Nilesh Patel						
Test Engineer (s):	Nilesh Patel						
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 v	values obtained during testing were compared to a value given in the						
referenced regulation or normation	ive standard. Report copies and other information not contained in this						
report are held by either the pro	oduct engineer or in an identified file at the Global Product Compliance						

# 1.1 Introduction

This Conformity test report applies to the **AHCF AirScale RRH 4T4R B26 200W**, hereinafter referred to as the Equipment Under Test (EUT).

The Nokia AHCF AirScale RRH 4T4R B5 200W (RRH) (hereinafter referred to as "AHCF") is a higher power RRH operating under the regulations of FCC Part 22 - Cellular Telephone Systems Operating in Band 26, 869-894 MHz. The AHCF supports 5G-NR and Long Term Evolution - Frequency Division Duplex (LTE FDD) technology, 4 MIMO ports configured for 2x60W + 2x45W or 4x45W MIMO. The AHCF also supports single and multiple carriers (contiguous or noncontiguous), with combinations of LTE + NBIoT (Guardband and Inband), and NBIOT Standalone as well as single and multiple carrier operations.

# 1.2 Purpose and Scope

The purpose of this document is to provide the testing data required for qualifying the EUT in compliance with FCC Parts 2 and 22, per requirements for Class II permissive changes certification, measured in accordance with the procedures set out in Section 2.1033 (c) (14) of the Rules.

5G-NR carrier tested configurations are as follows:

- 15 MHz Single 5G-NR carrier
- 20 MHz Single 5G-NR carrier

This report adds 15 and 20 MHz 5G-NR emissions designators to the existing grant.

The grant already states that the EUT supports 15 and 20 MHz bandwidths, however, this was done in error. The addition of the 15 and 20 MHz in this project would allow for the Grant to stay as is but with Emission Designators added to support the statement.

# 1.3 EUT Details

# 1.3.1 Specifications

	5G-NR				
Specification Items	Description				
Radio Access Technology		5G-NR			
Duplex Mode		FDD			
Modulation Type(s)	QP	SK, 16QAM, 64QAM,	256QAM		
Channel Bandwidth		20 MHz, 15			
Number of Tx Ports per Unit	4				
МІМО	Yes				
Max Conducted Power	2 x 47.8 dBm (60 W	) + 2 x 46.5 dBm (45 v	W) or 4 x 46.5 dBm (45 W)		
Max Number of Carriers per Port		4			
Deployment Environment		Outdoor			
Environment Temperature Range		-40 °C to 55 °C			
Power Source		Voltage Ranges (V	DC)		
	Minimum	Nominal	Maximum		
	-40.0	-48.0	-57.0		
Antenna	C	Detachable Directiona	al Panel		

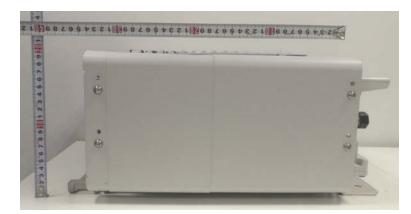
# 1.3.2 Photographs











# 1.4 Test Requirements

47 CFR FCC Sections	Description of Tests	Test Required
2.1046	RF Power Output	Yes
2.1047	Modulation Characteristics	Yes
2.1049	(a) Occupied Bandwidth (b) Out-of-Band Emissions	Yes
2.1051	Conducted Out-of-Band Emissions Spurious Emissions at Antenna Terminals	Yes
2.1053, 22.917	Field Strength of Spurious Radiation	Yes

Each required measurement is listed below:

# 1.5 Standards & Procedures

### 1.5.1 Standards

- Title 47 Code of Federal Regulations, Federal Communications Commission Part 2.
- Title 47 Code of Federal Regulations, Federal Communications Commission Part 22.
- FCC KDB 971168 D01 Power Measurement License Digital Systems v03r01 April 9, 2018.
- FCC 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) entitled: "American National Standard for Methods of Measurement of Radio-Noise Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40 GHz.

### 1.5.2 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

# **1.5.3 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.

Standard, Method or Procedure		Condition	Frequency MHz	Expanded Uncertainty (k=2)					
a.	Classical Emissions, ( <i>e.g.</i> , ANSI C63.4, CISPR 11, 14, 22, <i>etc.</i> , using ESHS 30,		0.009 - 30	±3.5 dB					
		Radiated Emissions	30 MHz – 200MHz H	±5.1 dB					
		(AR-6 Semi-Anechoic	30 MHz – 200 MHz V	±5.1 dB					
		Chamber)	200 MHz  – 1000 MHz H	±4.7 dB					
			200 MHz – 1000 MHz V	±4.7 dB					
			1 GHz - 18 GHz	±3.3 dB					

#### **Worst-Case Estimated Measurement Uncertainties**

Antenna Port Test	Signal Bandwidth	Frequency Range	Expanded Uncertainty (k=2), Amplitude
	10 Hz	9 kHz to 20 MHz	
Occupied Bandwidth, Edge of Band,	100 Hz	20 MHz to 1 GHz	1.78 dB
Conducted Spurious Emissions	10 kHz to 1 MHz	1 GHz to 10 GHz	1.70 UD
	1MHz	10 GHz to 40 GHz:	
RF Power	10 Hz to 20 MHz	50 MHz to 18 GHz	0.5 dB

# **1.6 Executive Summary**

Requirement	Description	Result
47 CFR FCC Parts 2 and 22		
2.1046	RF Power Output	COMPLIES
	Peak to Average Power Ratio	COMPLIES
2.1047	Modulation Characteristics	COMPLIES
2.1049	(a) Occupied Bandwidth	COMPLIES
	(b) Edge of Band Emissions	
2.1051	Spurious Emissions at Antenna	COMPLIES
	Terminals	
2.1053, 22.917	Field Strength of Spurious Radiation	COMPLIES

- 1. **COMPLIES -** Passed all applicable tests.
- 2. N/A Not Applicable.
- 3. **NT –** Not Tested.

# **1.7** Test Configuration for all Antenna Port Measurements.



# 2. FCC Section 2.1046 - RF Power Output

# 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 configured for test as shown in section above and allowed to warm up and stabilize per KDB 971168 D01 and ANSI C63.26. The product is rated for 45 W (46.5 dBm +/- 2.0 dBm) or 60W (47.8 dBm +/- 2.0 dBm) per port for each of the four transmit ports.

Power measurements were made with an MXA Signal Analyzer.

			Signal BV	V - 15 MHz			
	45\	N			60	W	
Test Mo Modulatio		Test Model 3.1a Modulation 256QAM		Test Model 3.1 Modulation 64QAM		Test Model 3.1a Modulation 256QAM	
Channel F 876.5	• •	Channel Fr 886.5	• •	Channel Fre 876.5N	. ,	Channel Frequency 886.5MHz	
TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)
2	46.14	2	45.89	0	47.99	0	47.81
3	46.17	3	45.96	1	47.89	1	47.76
Total Power (dBm)	49.17	Total Power (dBm)	48.94	Total Power (dBm)	50.95	Total Power (dBm)	50.80
Total Power (W)	82.51	Total Power (W)	78.26	Total Power (W)	124.47	Total Power (W)	120.10

# 2.1.1 5G-NR Results

Signal BW - 20 MHz									
	45\	N			60	W			
	odel 1.1 ion QPSK	Test Model 3.2 Modulation QPSK/16QAM		Test Model 1.1 Modulation QPSK		Test Model 3.2 Modulation QPSK/16QAM			
	Channel Frequency 879MHz		Channel Frequency 884MHz		Channel Frequency 879MHz		Channel Frequency 884MHz		
TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)	TX Port	(dBm)		
2	45.90	2	45.95	0	47.89	0	47.97		
3	46.05	3	46.06	1	47.82	1	47.80		
Total Power (dBm)	48.99	Total Power (dBm)	49.02	Total Power (dBm)	50.87	Total Power (dBm)	50.90		
Total Power (W)	79.18	Total Power (W)	79.72	Total Power (W)	122.05	Total Power (W)	122.92		

# 2.1.2 Channel RF Power – 45W Plots

NOTE: Only a sample of the plots are used in this report. The full suite of raw data resides at the MH, New Jersey location.

#### Channel Frequency 876.5MHz, 64QAM 15MHz BW, TX3

Channe	im Analy el Power		• +	-							Frequency	· • 🛞
RL	₽	Input: RF Coupling: [ Ext Gain: - Align: Auto	57.62 dE	Input Z: 50 Ω Corr CCorr Freq Ref: Int (S)	Atten: 0 dB Preamp: Off µW Path: St #PNO: Fast	Gate andard #IF G		Center Freq: 8 Avg Hold:>10 Radio Std: No		200000000000000000000000000000000000000	Frequency 00000 MHz	Settings
1 Graph	ı	•								Span 22.500	) MHz	
Scale/I	Div 10.0	dB			Ref Value 4	6.00 dBm	_		<b></b>	CF Ste	p	
36.0										2.250	000 MHz	
26.0			/	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~				~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		AL Ma		
6.00			$\square$							Freq O	ffset	
-4.00									-}	0 Hz		
-14.0												
-24.0												
-34.0	مسموديس								m	****		
-44.0												
	876.50				/ideo BW 1.	5000 MHz*			Span 22.5			
1000000000	W 150.0	and the second sec						Swe	ep 1.20 ms (1001	pts)		
2 Metric	s	•										
Tota	al Chann	el Power		46.17 dBm / 15	0 MHz							
Tota	al Power	Spectral [	Density	-25.59 d	Bm/Hz							
	_											
				Jun 29, 2023								
	า (	G	?	6:50:29 AM								

#### Channel Frequency 884MHz, QPSK/16QAM 20MHz BW, TX3

Spectrum Anal Channel Powe	yzer 1 🔹 🕇							<b>*</b>	Frequency	- * 景
	Input: RF Coupling: DC Ext Gain: -57.62 dB Align: Auto	Corr CCorr Pr Freq Ref: Int (S) µV	iten: 0 dB reamp: Off W Path: Standard PNO: Fast	Trig: Free Run Gate: Off #IF Gain: Low	Center Freq: 88 Avg Hold: 100/1 Radio Std: Non	100		884.00	Frequency 0000 MHz	Settings
1 Graph	•			I				Span 30.000	MHz	
Scale/Div 10.0	O dB	Ret	f Value 46.00 df	Bm				CF Step 3.0000 Aut Ma	00 MHz	
16.0 6.00 -4.00 -14.0								Freq Of 0 Hz	lset	
-24.0 -34.0 -44.0						hy				
Center 884.00 #Res BW 200.		Vide	eo BW 2.0000 N	IHz*	Swee	Span 30 p 1.00 ms (100				
2 Metrics	¥									
Total Chan Total Powe	nel Power er Spectral Density	46.06 dBm / 20.0 M -26.95 dBm/								
15	C 7 ?	Jun 29, 2023					X			

# 2.1.3 Channel RF Power – 60W Plots

			15MHz BW	, TXO		
Spectrum Anal Channel Powe	yzer 1 🕇 🕇 🕇				Frequence	w • 🛞
KEYSIGHT		nput Z: 50 Ω Atten: 0 df Corr CCorr Preamp: C Freq Ref: Int (S) μW Path: : #PNO: Fa:	off Gate: Off Standard #IF Gain: Low	Center Freq: 876.500000 MHz Avg Hold:>100/100 Radio Std: None	Center Frequency 876.500000 MHz	Settings
1 Graph	•				Span 22.500 MHz	
Scale/Div 10.1           Log         38.0           26.0         16.0           6.00		Ref Value	46.00 dBm		CF Step 2.250000 MHz Auto Man Freq Offset 0 Hz	
Center 876.50 #Res BW 150		Video BW 1	.5000 MHz*	Span 22.5 M Sweep 1.20 ms (1001 p		
2 Metrics	•					
Total Chan	nel Power	47.99 dBm / 15.0 MHz				
Total Powe	er Spectral Density	-23.77 dBm/Hz				
د 1	C <sup>*</sup> ■ ?	Jun 29, 2023 6:49:18 AM			1	

#### Channel Frequency 876.5MHz, 64QAM 15MHz BW TX0

#### Channel Frequency 884MHz, QPSK/16QAM 20MHz BW, TX0



# 2.2 Peak-to-Average Power Ratio (PAPR)

The Peak-to-Average Power Ratio (PAPR) was evaluated per KDB 971168. The PAPR values of all carriers measured are below 13dB.

BW MHz	Modulation	TX Port	Channel Frequency MHz	PAR at 0.1% Limit - 13 dB						
15	64QAM	0	876.5	7.24						
15	256QAM	0	886.5	7.85						
20	QPSK	0	879	7.16						
20	QPSK/16QAM	0	884	7.51						

### PAPR Tabular Data (5G-NR)

### 2.2.1 Peak-to-Average Power Ratio (PAPR) – Plots

The Peak-to-Average Power Ratio (PAPR) was evaluated per KDB 971168. The PAPR values of all carriers measured are below 13dB.

### 2.2.1.1 PAPR Plots



# Channel Frequency 876.5MHz, 64QAM,

#### Channel Frequency 886.5MHz, 256QAM, 15MHz BW, TX0





#### Channel Frequency 879MHz, QPSK, 20MHz BW, TX0

#### Channel Frequency 884MHz, QPSK/16WAM, 20MHz BW, TX0



# 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

				QPSK				
5G NR 1 SEM		5G NR 2 Modulation Analysis	• +			*	Frequency	· • 😹
KEYSIGHT	Coupling: DC	Input Z: 50 Ω Corr CCorr 10 dB Freq Ref: Int (S)	Atten: 14 dB Preamp: Off µW Path: Standard #PNO: Best Close	Trig: Free Run #IF Gain: Low	Carrier Ref Freq: 879.00000 MHz CC Info: DL, 1 CC, SISO	Frequen	teference cy 000 MHz	Settings
1 CC0-BWP1 IQ Meas Time	•							
1.60 1.20								
800 m 400 m			•	•				
0 -400 m				_				
-800 m -1.20			•	•				
-1.60 -8.376			μ = 0: 15 kHz		8.37	6		
3 CC0 Spectrum	1			20-01				
Scale/Div 10.0	0 dB		Ref Value 25.00 d	Bm				
5.00 -5.00 -15.0								
-15.0 -25.0 -35.0 -45.0	(lev)	and the second second	aller to see quickly	, Colonya Mangalana	un Persident aparteria			
-55.0								
Ctr: 879.00000 Res BW: 100 H			Info BW: 24.58 M	Hz	Width: 27.65 Mi	Hz		
15	2	<b>?</b> Jun 29, 2023 8:59:00 AM	ÐA					

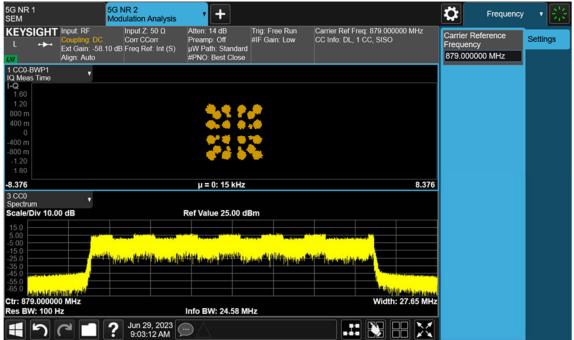
64QAM

5G NR 1 SEM		5G NR 2 Modulation Analysis	• +				Frequency	- ' 法
	Coupling: DC	Input Ζ: 50 Ω Corr CCorr 10 dB Freq Ref: Int (S)	Atten: 14 dB Preamp: Off µW Path: Standard #PNO: Best Close	Trig: Free Run #IF Gain: Low	Carrier Ref Freq: 879.00 CC Info: DL, 1 CC, SIS0	C	Carrier Reference Frequency 879.000000 MHz	Settings
1 CC0-BWP1 IQ Meas Time I-Q 1.60								
1.20 800 m 400 m 0								
-400 m -800 m -1.20 -1.60								
-8.376			μ = 0: 15 kHz			8.376		
3 CC0 Spectrum Scale/Div 10.0	• 0 dB		Ref Value 25.00 d	Bm				
15.0 5.00 -5.00 -15.0				ubort moderne attendes				
-25.0 -35.0 -45.0 -55.0	and a second second	ai na latenna si site h a d	i na	and the first of the second	older sich bergestigen.			
-65.0 Ctr: 879.00000 Res BW: 100 F	0 MHz		Info BW: 24.58 M	Hz	Widt	th: 27.65 MHz		
15	2	? Jun 29, 2023 9:04:27 AM	ÐA					

256QAM

5G NR 1 SEM	5G N Mode	NR 2 ulation Analysis	• +			\$	Meas Setup	。 <b>-  </b> <del>影</del>
		Input Ζ: 50 Ω Corr CCorr Freq Ref: Int (S)	Atten: 16 dB Preamp: Off µW Path: Standard #PNO: Best Close	Trig: Free Run IF Gain: -5 dB	Carrier Ref Freq: 879 000000 MHz CC Info: DL, 1 CC, SISO	CC0	onent Carrier	
LOV           1 CC0-BWP1           IC0 Meas Time           I-Q           962 m           722 m           481 m           0           -241 m           -381 m	γ γ		#PNU: Best Close			PDCC	Carrier: DL     Auto Detect     On     Off     CH Auto Detect     On     Off     CH Auto Detect     Ch Auto Detect     On     Off     CH Auto Detect     On     Off	Settings Radio Meas Standard Component Carriers
-722 m -962 m -5.037 3 CC0 Spectrum Scale/Div 10.0	v 0 dB		μ = 1: 30 kHz Ref Value 25.00 df		5.0	)37	on Manual Introl and User Channels	Meas Time Channel Profile Advanced
13.0 5.00 -5.00 -25.0 -25.0 -35.0 -55.0 -55.0 -55.0 -55.0 -55.0 -55.0 -55.0 -55.0 -55.0 -55.0 -25.0 -55.0 -25.0 -55.0 -25.0 -55.0 -2	0 MHz	<mark>ist for liter of the set of the set</mark>		<mark>Arabaléna restano pa</mark>	de del mpl H (η Unit Width: 27.65 M			Decode Power Meas
	<pre> 2 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7</pre>	lup 20, 2022	Info BW: 24.58 M	12		<		

#### QPSK/16QAM



# 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.

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

BW MHz	Modulation	TX Port	Channel Frequency MHz	Occupied BW (MHz)
15	64QAM	0	876.5	14.10
15	256QAM	0	886.5	14.075
20	QPSK	0	879	18.916
20	QPSK/16QAM	0	884	18.928

#### Tabular Data – Occupied Bandwidth

# 4.1.1 Occupied Bandwidth – Plots

NOTE: Only a sample of the plots are used in this report. The full suite of raw data resides at the MH, New Jersey location.

#### Channel Frequency 876.5MHz, 64QAM 15MHz BW, TX0



#### Channel Frequency 884MHz, QPSK/16QAM 20MHz BW, TX0

			.,		
Spectrum Analyzer 1	+			Frequency v	$\mathbb{R}^{2}_{0}$
KEYSIGHT Input: RF L ++ Coupling: DC Ext Gain: -58.10 Align: Auto	Corr CCorr Prea	n: 0 dB Trig: Free Run amp: Off Gate: Off Path: Standard #IF Gain: Low	Center Freq: 884.000000 MHz Avg Hold: 100/100 Radio Std: None	Center Frequency 884.000000 MHz	igs
Graph v				Span 40.000 MHz	
cale/Div 10.0 dB .og 36.0 16.0		/alue 46.00 dBm		CF Step 4.000000 MHz Auto Man	
6.00 1.00 1.00 24.0 14.0 14.0 14.0	~			Freq Offset 0 Hz	
enter 884.00 MHz Res BW 200.00 kHz	#Vide	o BW 620.00 kHz	Span 40 M Sweep 1.07 ms (1000 p		
Metrics v		Measure Trac	e Trace 1		
Occupied Bandwidth 18.92	28 MHz	Total Power	55.2 dBm		
Transmit Freq Error x dB Bandwidth	-15.189 kHz 19.63 MHz	% of OBW Po x dB	wer 99.00 % -26.00 dB		
560	Jun 29, 2023	$\Delta$			

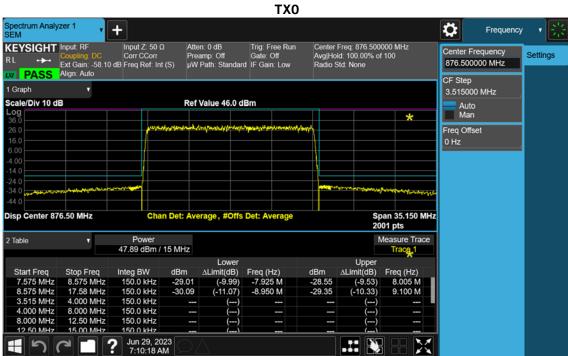
# 4.2 Edge of band Emissions

The Edge of Band emissions of the EUT at the external antenna connector (EAC) were measured using a Keysight MXA Signal Analyzer. Before measuring the Edge of Band emissions, the RF power level was confirmed with the Keysight MXA Signal Analyzer. 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 RF Switch. 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.

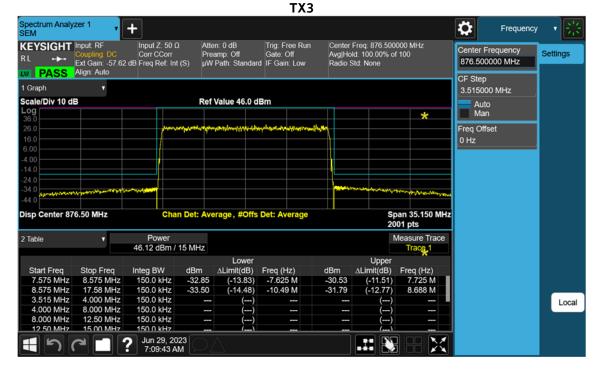
## 4.2.1 Edge of Band Emissions – Plots

All of the measurements met the requirements of Part 2.1049. The limit line was set to -19 dBm to reflect the -13 dBm limit corrected for MIMO operation using 10 log (4).

# 4.2.1.1.1 OOBE Plots (15MHz BW)



### Channel Frequency 876.5MHz, 64QAM



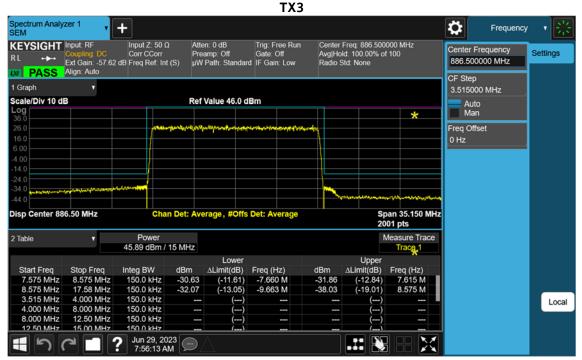
### Channel Frequency 876.5MHz, 64QAM

#### Channel Frequency 886.5MHz, 256QAM

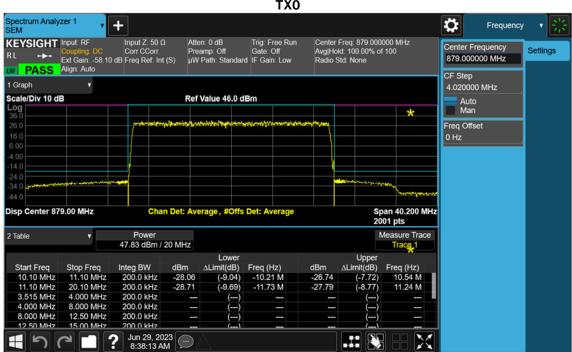
XU	

					17							
Spectrum Analy SEM	zer 1	+									Frequency	- 张
	Coupling: DC	Input Z: 50 Ω Corr CCorr ) dB Freq Ref: Int (S	Pre	en: 0 dB amp: Off Path: Standard	Trig: Free R Gate: Off I IF Gain: Low		Avg Ho	Freq: 886.500 ld: 100.00% of std: None			requency 0000 MHz	Settings
PASS     Graph     Scale/Div 10 d	•		Ref	Value 46.0 dl	Bm					CF Step 3.51500	00 MHz	
Log 36.0	<u>.</u>		Kei	Value 40.0 ul					*	Aut Ma		
36.0 26.0 16.0		mushin		4.1879.26.0789 <sup>1</sup> 79.056	****	40.Marth				Freq Off 0 Hz		
6.00												
-14.0												
-24.0 -34.0 -44.0	างการการการการการการการการการการการการการก	Martin and					<b>~</b> ~	ener son and	degradgetergeter			
Disp Center 88	6.50 MHz	Chan	Det: Ave	erage, #Offs	Det: Averag	e			oan 35.150 MHz 01 pts			
2 Table	v	Power						Ν	Measure Trace			
		46.47 dBm / 15	MHz						Trace 1			
Start Freq	Ctop Frog	Integ BW/	dBm	Lower ∆Limit(dB)	Free (Hz)	4	Bm	Upper ∆Limit(dB)				
7.575 MHz	Stop Freq 8.575 MHz	Integ BW 150.0 kHz	-30.53	(-11.51)	Freq (Hz) -8.305 M		31.20	(-12.18)	Freq (Hz) 7.840 M			
8.575 MHz	17.58 MHz	150.0 kHz	-31.47	(-12.45)	-8.838 M		38.03	(-19.01)	8.575 M			
3.515 MHz	4.000 MHz	150.0 kHz		()				()				
4.000 MHz	8.000 MHz	150.0 kHz		()				()				
8.000 MHz	12.50 MHz	150.0 kHz		()				()				
12 50 MHz	15 00 MHz	150 0 kHz		()				()				
) ( <b>ا</b>		Jun 29, 2023 7:52:46 AM							i 🔀			

# Channel Frequency 886.5MHz, 256QAM



# 4.2.1.1.2 OOBE Plots (20MHz BW)

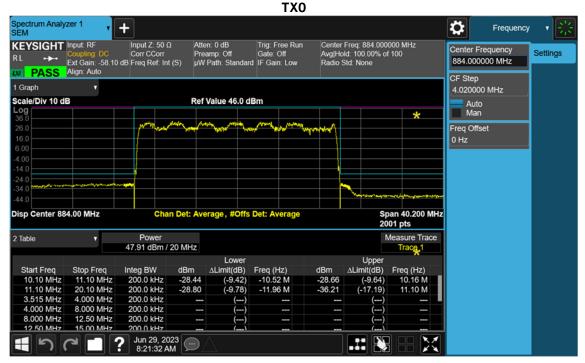


### Channel Frequency 879MHz, QPSK

TX0

#### **Channel Frequency 879MHz, QPSK** ТХ3

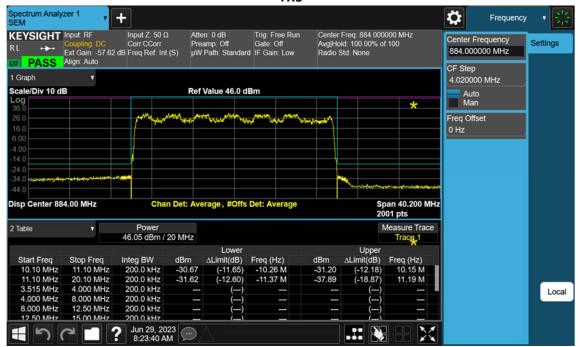
					173						
Spectrum Analy. SEM	zer 1 🔻	+							\$	Frequency	- <b>1</b>
KL 🗭	Coupling: DC	Input Z: 50 Ω Corr CCorr 2 dB Freq Ref: Int (S	Pre	n: 0 dB amp: Off Path: Standard	Trig: Free Run Gate: Off IF Gain: Low	Avg H	r Freq: 879.000 old: 100.00% ol Std: None		200000000000000000000000000000000000000	requency 000 MHz	Settings
1 Graph Scale/Div 10 dl	•		Pof	Value 46.0 dE	łm				CF Step 4.02000		
og	-		Rei	value 40.0 de				*	Auto Mar		
36.0 26.0 16.0		guirrau by Cale Alarge Al	nan nahq	ntationen titten konse	warryiqadye argori	wanter			Freq Offs 0 Hz		
6.00 4.00											
24.0											
34.0 44.0	al arm provide the first	~~ <b>~</b>					hall the second s	and the second second			
isp Center 87	9.00 MHz	Chan I	Det: Ave	erage, #Offs	Det: Average			oan 40.200 MHz 01 pts			
Table		Power					Ν	Measure Trace			
		47.39 dBm / 20	MHz					Trace 1			
				Lower			Upper				
Start Freq	Stop Freq		dBm		Freq (Hz)	dBm	∆Limit(dB)	Freq (Hz)			
10.10 MHz	11.10 MHz		-28.47	(-9.45)	-10.65 M	-27.69		10.16 M			
11.10 MHz	20.10 MHz	200.0 kHz	-28.89	(-9.87)	-12.00 M	-28.75	(-9.73)	11.51 M			
3.515 MHz 4.000 MHz	4.000 MHz 8.000 MHz	200.0 kHz 200.0 kHz		()			( )	1			
4.000 MHz	12.50 MHz	200.0 kHz		() ()							
12 50 MHz	15.00 MHz	200.0 kHz 200.0 kHz		()			· ()				
150		Jun 29, 2023 8:38:46 AM	• •	$\wedge$							



### Channel Frequency 884MHz, QPSK/16QAM

#### Channel Frequency 884MHz, QPSK/16QAM

ТХЗ



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

### 5.1 Measurement of Spurious Emissions at Transmit Antenna Port

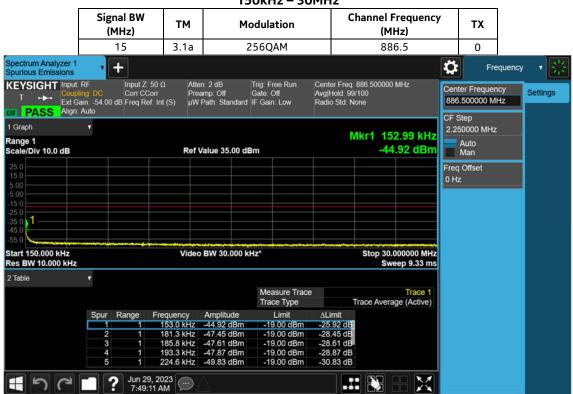
Spurious Emissions at the transmit-antenna terminals were investigated over the frequency range of 9kHz to beyond the 10th harmonic of the specific transmit band. For this band of operation, the measurements were performed up to 9 GHz. Measurements were made using a Keysight MXA Signal Analyzer. The RF output from the transmitter was reduced (to an amplitude usable by the receivers) using calibrated attenuators.

The required emission limitation is specified as appropriate in 22.917. The limit line was set to -19 dBm to reflect the -13 dBm limit corrected for MIMO operation using 10 log (4). The measured spurious emission levels were plotted for the frequency range as specified in 2.1057. There were no reportable emissions. Data below documents performance up to 10 GHz.

# 5.1.1 Spurious Emissions at Tx Port – Plots

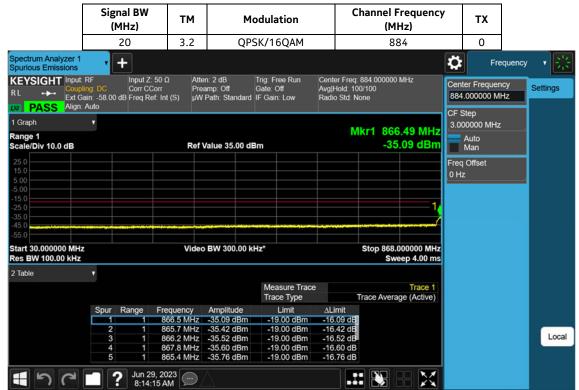
NOTE: Only plots with lowest margin in each frequency range are used in this report. The full suite of raw data resides at the MH, New Jersey location.

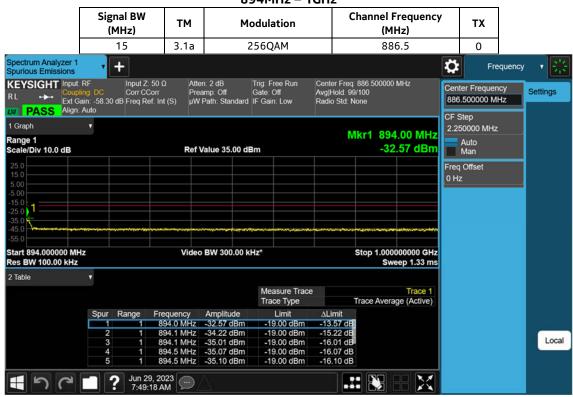
				9	KHz – 150	kHz					
	•	nal BW MHz)	тм	м	odulation	Cł	nannel Frequei (MHz)	ıcy	тх		
		15	3.1a	Ĩ	256QAM		886.5		0		
Spectrum Analyzer 1 Spurious Emissions	•	+						Ċ,	Fre	quency	- 影
Ext G	ling: DC	Input Z: Corr CC dB Freq Re	orr Prea	en: 2 dB amp: Off Path: Standard	Trig: Free Run Gate: Off IF Gain: Low	Center Freq: 8 Avg Hold: 99/ Radio Std: No		88	nter Frequen 6.500000 MI Step		Settings
1 Graph Range 1 Scale/Div 10.0 dB	T		Ref	Value 35.00 dl	Bm	М	kr1 52.407 kl -49.69 dB	3.t	515000 MHz Auto Man		
25.0 15.0 5.00 -5.00 -15.0 -25.0 -35.0								Fre 0 H	q Offset		
45.0 -55.0 Start 9.000 kHz Res BW 1.0000 kHz	~~~~~		Video	9 BW 3.0000 k	Hz*		Stop 150.000 k Sweep 1.33				
2 Table	•				Measure Trace Trace Type		Trace race Average (Active				
	Spur 1 2 3 4 5	Range 1 1 1 1 1	18.05 kHz 35.75 kHz 48.94 kHz	Amplitude -49.69 dBm -50.74 dBm -50.75 dBm -50.79 dBm -50.89 dBm	Limit -19.00 dBm -19.00 dBm -19.00 dBm -19.00 dBm -19.00 dBm	∆Limit -30.69 dB -31.74 dB -31.75 dB -31.79 dB -31.89 dB	0				Local
- - - - - - - - - - - - - -			9, 2023 💬	Δ							



150kHz – 30MHz

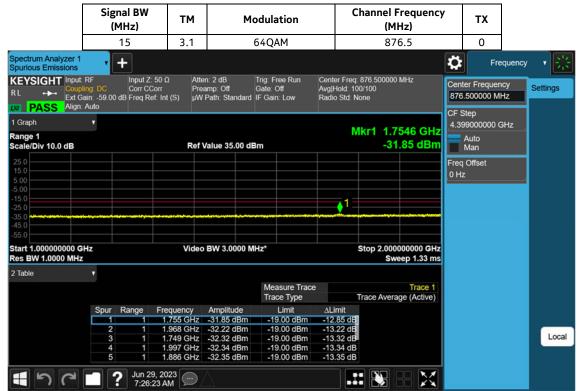
#### 30MHz - 868MHz

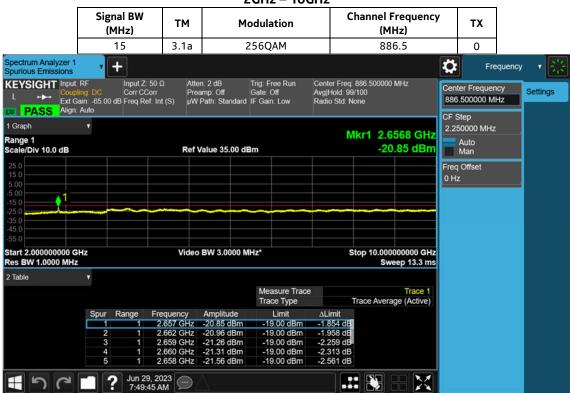




894MHz – 1GHz

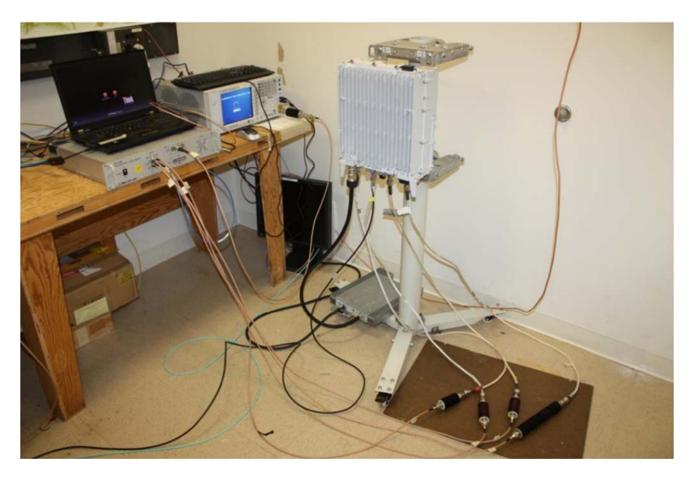
1GHz – 2GHz



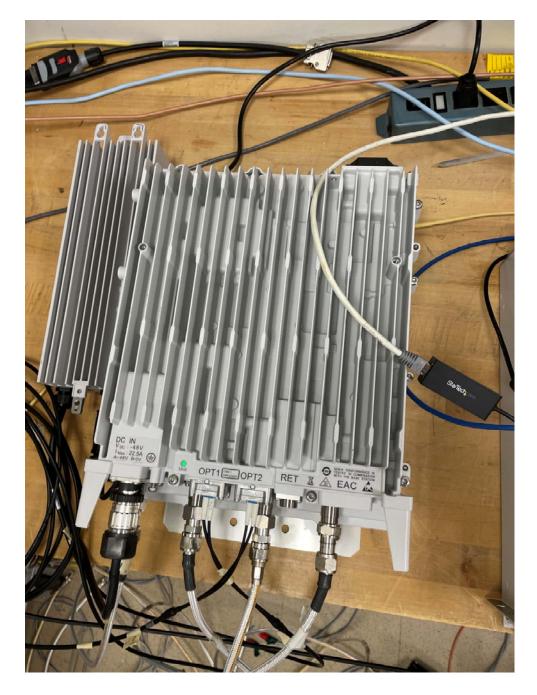


2GHz – 10GHz

# Photographs



#### **Global Product Compliance Laboratory** Report No.: TR-2023-0112-FCC2-22 Product: AHCF AirScale RRH 4T4R B26 200W



# **Test Equipment**

_			Radio Test Equi	pment			
Asset ID	Manufacturer	Туре	Description Model		Serial	Calibration Date	Calibration Due
E1218	KeySight Technologies	EMI Receiver	MXE EMI Receiver 44 GHz	N9038A	MY54130037	2021-12-29	2023-12-29
E1338	KeySight Technologies	MXA Signal Analyzer	20 Hz-44 GHz (Analysis Bandwidth 125 MHz)	N9020B	MY57430927	2023-05-06	2025-05-06
E896	Agilent Technologies	Network Analyzer	10 MHz - 40 GHz	N5230C	MY49000897	2023-02-08	2025-02-08
E1534	Traceable	Data Logger	Barometric Humidity Temp Data Logger	6529	200648430	2023-01-16	2025-01-16
E1212	<b>RLC Electronics</b>	Filter, High Pass	10 - 30 GHz, 2W, 5dB	F-19414	1444002	CNR-V	CNR-V
E1022	Weinschel	Attenuator	10dB DC-18GHz 25W	46-10-34-LIM	BN3118	CNR-V	CNR-V
E1023	Weinschel	Attenuator	20 dB DC-18 GHz 25W	46-20-34	BJ4772	CNR-V	CNR-V
E1344	Macom	Attenuator	3 dB, DC - 4 GHz, 2W	2082-6171-03	N/A	CNR-V	CNR-V
E1155	Weinschel	Attenuator	10dB 25W 0.05- 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
E1250	Weinschel	Attenuator	3dB Attenuator 100W	24-3-43	BB9072	CNR-V	CNR-V
E1251	Aeroflex	Attenuator	30dB 150W DC-18GHz Attenuator	66-30-33	BV1667	CNR-V	CNR-V

CNR-V: Calibration Not Required. Must Be Verified. Test Date: 6/29/2023

# 6. FCC Section 2.1053 - Field strength of spurious radiation

# 6.1 Section 2.1053 Field Strength of Spurious Emissions

Field strength measurements of radiated spurious emissions were made in an FCC registered 3m Semi-Anechoic Chamber which is maintained by Nokia Bell Labs in Murray Hill, New Jersey. A complete description and full measurement data for the site is on file with the Commission (Site Registration Number: 515091).

The spectrum from 30 MHz to beyond the tenth harmonic of the carrier, 10 GHz, was searched for spurious radiation. Measurements were made using both horizontally and vertically polarized broadband antennas. Per FCC regulations, the comparison of out of band spurious emissions directly to the limit is appropriately made using the substitution method. However, when the emissions are more than 20 dB below the specification limit, the use of field strength measurements for compliance determination is acceptable and those emissions are considered not reportable (Section 2.1053 and the FCC Interpretive database for 2.1053). For this case the evaluation of acceptable radiated field strength is as follows.

# 6.2 Field Strength of Spurious Emissions - Limits

Sections 2.1053 and 22.917 contain the requirements for the levels of spurious radiation as a function of the level of the unmodulated carrier. The reference level for the unmodulated carrier is calculated as the field produced by an ideal dipole excited by the transmitter output power according to the following relation taken from Reference Data for Radio Engineers, page 676, 4<sup>th</sup> edition, IT&T Corp.

E= [(30\*P)<sup>1/2</sup>]/R

20 log (E\*10<sup>6</sup>) – (43 + 10 log P) = 82.23 dBµV/meter

Where:

E = Field Intensity in Volts/meter P = Transmitted Power in Watts R = Measurement distance in meters = 3 m

The Part 22 Limit is 82.23 dBµV/m at 3m and 91.77 dBµV/m at 1m The Part 22 non-report level is 62.23 dBµV/m at 3m.

The calculated emission levels were found by:

Measured level (dB $\mu$ V) + Cable Loss(dB)+Antenna Factor(dB) = Field Strength (dB $\mu$ V/m)

#### RESULTS:

For compliance with 47CFR Parts 2 and 22, the field strength of any spurious radiation, measured at 3m, is required to be less than 82.23 dB $\mu$ V/meter (82.23 @ 3m). Emissions equal to or less than 62.23 dB $\mu$ V/meter at 3m are not reportable and may be verified using field strength measurements and broadband antennas. Over the out of band spectrum investigated from 30 MHz to beyond the tenth harmonic of the carrier (up to 10 GHz). No reportable spurious emissions were detected.

# 7. NVLAP Certificate of Accreditation

