

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



NVLAP LAB CODE: 100275-0

# Title 47 Code of Federal Regulations Test Report

Regulation: FCC Part 2 and 27

Client: NOKIA SOLUTIONS AND NETWORKS

Product Evaluated: AHBCD AirScale Dual RRH 4T4R 240W

> Report Number: TR-2023-0100-FCC2-27

> > Date Issued: August 8, 2023

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#### Revisions

Date	Revision	Section	Change
8/8/2023	0		Initial Release

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# 1. System Information and Requirements

Equipment Under Test (EUT):	AHBCD AirScale Dual RRH 4T4R 240W					
Serial Number:	RW2201000010					
FCC ID:	VBNAHBCD-01					
Hardware Version:	476021A.X21					
Software Version:	SBTS23R4					
Frequency Range:	746 – 756 MHz					
GPCL Project Number:	2023-0100					
Applicant	NOKIA SOLUTIONS AND NETWORKS					
	Steve Mitchell					
	3201 Olympus Blvd,					
	Dallas, Texas 75019					
	United States					
Test Requirement(s):	Title 47 CFR Parts 2 and 27					
Test Standards:	Title 47 CFR Parts 2 and 27					
	• 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):	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):	7/12/2023 – 7/20/2023					
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:	Steve Gordon					
Test Engineer (s):	Nilesh Patel, Norman Albrecht					
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 normat	ive 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 **AHBCD AirScale Dual RRH 4T4R 240W**, hereinafter referred to as the Equipment Under Test (EUT).

The Nokia AHBCD AirScale Dual RRH 4T4R 240W is a low power Remote Radio Head (RRH), operating in the Frequency Band 746-756 MHz.

The AHBCD consists of four transceiver chains (main and diversity) that are capable of transmitting up to a maximum RF Conducted power of 80 W and EIRP power of 1640 W/MHz (62.15dBm).

The AHBCD is typically installed on poles or walls in fixed locations. Therefore, AHBCD is neither a portable nor a mobile wireless device.

#### 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 27 measured in accordance with the procedures set out in Section 2.1033 (c) (14) of the Rules.

The purpose of this current test program is to demonstrate 5G-NR operation at 80W power for the following bandwidths in the frequency band 746 – 758 MHz:

- 5 MHz
- 10MHz

No Frequency Stability testing was considered necessary for this test program since there were no changes to the basic frequency determining and stabilizing circuitry (including clock and data rates).

#### 1.3 EUT Details

#### **1.3.1 Specifications**

Specification Items	Description
Radio Access Technology	5G-NR
Modulation Type(s)	QPSK, 16QAM, 64QAM, 256QAM
<b>Operation Frequency Range</b>	746 – 756 MHz
Channel Bandwidth	5 and 10 MHz
Number of Tx Ports per Unit	4
ΜΙΜΟ	Yes
Deployment Environment	Outdoor
Supply Voltage	-48.0 VDC
Max RF Output Power	4X20 W (43.01 dBm ± 2.0dBm)

### 1.3.2 Photographs





### 1.4 Test Requirements

47 CFR FCC Sections	Description of Tests	Test Required
2.1046, 27.53	RF Power Output	Yes
2.1047, 27.53	Modulation Characteristics	Yes
2.1049, 27.53	(a) Occupied Bandwidth (b) Out-of-Band Emissions	Yes
2.1051, 27.53	Spurious Emissions at Antenna Terminals	Yes
2.1053, 27.53	Field Strength of Spurious Radiation	Yes
2.1055, 27.53	Frequency Stability	No*

Each required measurement is listed below:

\*Previously evaluated; no changes to the basic frequency determining and stabilizing circuitry (including clock and data rates). Refer to GPCL Project 2022-0010 for Results.

#### 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 27.
- 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.

Standard, Method or Procedure		Condition	Frequency MHz	Expanded Uncertainty (k=2)
a.	Classical Emissions, ( <i>e.g.</i> , ANSI C63.4, CISPR 11, 14, 32, <i>etc.</i> , using ESHS 30,	Conducted Emissions	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 70 dp
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

#### 1.7 Executive Summary

Requirement	Description	Result
47 CFR FCC Parts 2 and 27		
2.1046, 27.50	RF Power Output	
	Peak to Average Power Ratio	COMPLIES
2.1047	Modulation Characteristics	COMPLIES
2.1049, 27.53	(a) Occupied Bandwidth	COMPLIES
	(b) Edge of Band Emissions	
2.1051, 27.53	Spurious Emissions at Antenna	COMPLIES
	Terminals	
2.1053, 27.53	Field Strength of Spurious Radiation	COMPLIES
2.1055, 27.54	Frequency Stability	NT*

\*Previously evaluated; no changes to the basic frequency determining and stabilizing circuitry (including clock and data rates).

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

### 1.8 Test Configurations



#### Test Setup for Radiated Measurement



#### FCC Section 2.1046 - RF Power Output 2.

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. Power measurements were made with an MXA Signal Analyzer.

### 2.1 Channel RF Power

Tabular Data – RF Power (5G-NR)							
Test Model 1	3.1	Test Model 3	3.1	Test Model 3.1a			
Modulation 64	QAM	Modulation 64	QAM	Modulation 256QAM			
Channel Frequency	748.5MHz	Channel Frequency	751MHz	Channel Frequency 753.5MHz			
Signal BW 5N	1Hz	Signal BW 10	MHz	Signal BW 5MHz			
TX Port	(dBm)	TX Port (dBm)		TX Port	(dBm)		
0 43.10		0	42.98	0	43.11		
1 43.24		1	43.00	1	43.22		
2 43.14		2	43.00	2	43.08		
3 43.10		3	42.93	3	43.11		
Total Power (dBm) 49.17		Total Power (dBm)	49.00	Total Power (dBm)	49.15		
Total Power (W)	82.53	Total Power (W)	79.40	Total Power (W)	82.24		

#### ---. . . . . . .

### 2.1.1 Channel RF Power – Plots

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



#### 5G-NR, 5MHz BW, 748.5MHz TM3.1, 64QAM, TX1



#### 5G-NR, 10MHz BW, 751MHz TM3.1, 64QAM, TX1

#### 5G-NR, 5MHz BW, 753.5MHz TM3.1a, 256QAM, TX1



#### 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.

Signal	Test	Modulation	ТΧ	Channel Frequency	PAR at 0.1%			
BW MHz	Model	Modulation	Port	MHz	Limit - 13 dB			
5	3.1	64QAM	1	748.5	6.71			
10	3.1	64QAM	1	751	6.75			
5	3.1a	256QAM	1	753.5	6.71			

#### Tabular Data – PAPR Data

### 2.2.1 Peak-to-Average Power Ratio Plot(s)

NOTE: Only worst-case plot is used in this report. The full suite of raw data resides at the MH, New Jersey location.



5G-NR, 10MHz BW, 751MHz, TM3.1, 64QAM, TX1

# 3. FCC Section 2.1047 - Modulation Characteristics

### 3.1 Modulation Characteristics

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

### 3.1.1 Modulation Characteristics Plot(s)

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

			11	193.1/04	QAM				
Spectrum Anal Spurious Emis	yzer 1 sions	5G NR 2 Modulation Analysis	• +				*	Frequency	- ※
	Input: RF Coupling: DC Ext Gain: -58 Align: Auto	Input Z: 50 Ω Corr CCorr 3.25 dB Freq Ref: Int (S)	Atten: 16 dB Preamp: Off µW Path: Standard #PNO: Best Close	Trig: Free Run IF Gain: -5 dB d	Carrier Ref Freq: 751.0 CC Info: DL, 1 CC, SIS	000000 MHz SO	Carrier Refe Frequency 751.00000	erence 0 MHz	Settings
1 CC0-BWP1 IQ Meas Time	v								
962 m 722 m			*****						
481 m 241 m			****	***					
0 -241 m									
-722 m -962 m									
-5.037			μ = 1: 30 kHz			5.037			
3 CC0 Spectrum Scale/Div 10.0	▼ 00 dB		Ref Value 25.00 d	iBm					
15.0 5.00		I I I I I I I I I I I I I I I I I I I							
-15.0			an talaya ya kata daga ta	adigraphic and the state of the					
-45.0 -55.0 -65.0									
Ctr: 751.00000 Res BW: 100 I	)0 MHz Hz	n carr an r An c An driffield i sin ce halfer li fail ann	Info BW: 24.58 N	ЛНz	With Mathematical Institution of the second s	ith: 27.65 MHz			
15	2	<b>?</b> Jul 05, 2023							

M2 1	1	640AM
I*I3.I	1	04QAM

-

#### TM3.1a / 256QAM

Spectrum Analyze Spurious Emissio	er 1 ons	5G NR 3 Modulation Analysis	• +						Frequency	迷
	nput: RF Coupling: DC Ext Gain: -58.1	Input Ζ: 50 Ω Corr CCorr 10 dB Freq Ref: Int (S)	Atten: 10 dB Preamp: Off µW Path: Standard	Trig: Free Run #IF Gain: Low I	Carrier Ref F CC Info: DL,	req: 748.5000 1 CC, SISO	000 MHz	Carrier Ref		Settings
LXI A	lign: Auto		#PNO: Best Close					748.50000	U MHZ	
1 CC0-BWP1 IQ Meas Time	•									
1.60			in gh							
1.20 800 m										
400 m			Contraction of the							
-400 m			出了一							
-800 m				1 H H						
-1.20										
-1.60				1944 - Sec. 19						
-8.376			μ = 0: 15 kHz				8.376			
3 CC0 Spectrum	•									
Scale/Div 10.00	dB		Ref Value 25.00 d	Bm						
15.0				3/4///						
-5.00				. as a de						
-25.0			and the state	100						
-35.0		a substantia de la companya de la compan		and the second sec						
-55.0 -65.0	รถเวลาเออโรง (	alematic here all a dere dar inde	แม่ที่	ali definitation per che	in an institution of	rin da la suato e da su				
Ctr: 748.500000	MHz					Width:	27.65 MHz			
Res BW: 100 Hz			Info BW: 24.58 M	Hz						
<b>4</b> 50		<b>?</b> Jul 12, 2023 11:35:34 AM								

# 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.

Signal BW MHz	Test Model	Modulation	TX Port	Channel Frequency MHz	99% Occupied BW MHz	
5	3.1	64QAM	1	748.5	4.4527	
10	3.1	64QAM	1	751.0	9.2641	
5	3.1a	256QAM	1	753.5	4.4737	

#### Tabular Data – 99% Occupied Bandwidth

	-					
Signal BW MHz	Test Model	Modulation	TX Port	Channel Frequency MHz	26dB Emission Bandwidth MHz	
5	3.1	64QAM	1	748.5	4.765	
10	3.1	64QAM	1	751.0	9.722	
5	312	2560AM	1	753 5	4 700	

#### Tabular Data – 26 dB Occupied Bandwidth

### 4.2 Occupied Bandwidth – Plots



TM 3.1 / 5MHz BW / 64QAM / 748.5MHz / TX1

#### TM 3.1 / 10MHz BW / 64QAM / 751MHz / TX1



			11.1	J.1a/ J.		2JUQA	1.1.7	/ ) )	/////Z / //	<b>N</b> 1			
Spectrum Analy Occupied BW	/zer 1	Spectrum A Occupied E	Analyzer 3 3W	• +								Frequency	· · 😤
RL ++-	Input: RF Coupling: DC Ext Gain: -50.4 Align: Auto	Input Z Corr C 40 dB Freq R	:: 50 Ω Corr tef: Int (S)	Atten: 0 dB Preamp: Off µW Path: Stan	Trig: Gate: idard #IF G	Free Run Off ain: Low	Cei Avç Ra	nter Frec g Hold: 1 dio Std: I	; 753.500000 00/100 None	MHz	Center Fr 753.5000	equency 000 MHz	Settings
1 Graph	▼										Span 10.000 M	1Hz	
Scale/Div 10.0	dB	m	-and lanese answer of	Ref Value 46.(	00 dBm	announger.M	~~~				CF Step 1.000000	) MHz	
16.0 6.00								4			Auto Man	-4	
-4.00 -14.0 -24.0											0 Hz	et	
-34.0 10,000 -44.0	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~								าางใรรถางใ <sub>กสโ</sub> ลไม่	M. My Charleson			
Center 753.500 #Res BW 51.00	0 MHz 00 kHz		#	Video BW 150	0.00 kHz			s	S weep 3.72 n	pan 10 MHz ns (980 pts)			
2 Metrics	•												
Occup	pied Bandwidt	'n			Mea	isure Trace		Trace	1				
	4.4	737 MHz			Tota	l Power			50.1 di	Зm			
Trans x dB f	mit Freq Erroi Bandwidth	r	-5.964 kH 4.799 MH	Z Z	% o x dE	f OBW Pow 3	er		99.00 -26.00	dB			Local
<b>1</b> 5		<b>?</b> Jul 1 10:45	2, 2023 5:07 AM										

TM 3.1a / 5MHz BW / 256QAM / 753.5MHz / TX1

### 4.3 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. 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. 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 base station was configured to transmit a single carrier continuously ( $\geq$  98% duty cycle) between 746 – 756 MHz. At each of the carrier frequencies, the carrier power level at each antenna terminal was adjusted to the maximum rated mean power +43 dBm (20W). In accordance with KDB 662911 D01 Multiple Transmitter Output, the limit has been adjusted to -19 dBm to reflect 10 log(n) where n=4 for the 4x4 MIMO operation.

### 4.3.1 Edge of Band Emissions – Plots

All of the measurements met the requirements of Part 27.53 when measured per Part 2.1049.



#### 5G-NR, 10MHz BW, 751MHz TM3.1, 64QAM, TX1



#### 5G-NR, 5MHz BW, 753.5MHz TM3.1a, 256QAM, TX1



# 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 10 MHz to beyond the 10th harmonic of the specific transmit band. Carrier Bandwidth is exempt. For this band of operation, the measurements were performed up to 27 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 27.53. The measured spurious emission levels were plotted for the frequency range as specified in 2.1057. The limit of -13 dBm was adjusted to -19 dBm based on 10 log (4) for 4X MIMO as required in KDB 662911 D01.

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.

#### 5.1.1 Transmitter Spurious Emissions – Plots

The spurious emissions measured were all below the required limits and are in full compliance with the Rules of the Department.

NOTES: Only plots with minimum margin plots are used in this report. The full suite of raw data resides at the MH, New Jersey location.

			753.	5MHz, 5H	lz BW, TM3.′	1a, 256Q/	AM, TX1			
Spectrum Analyz Occupied BW	zer 1	Spectrum A Spurious E	nalyzer 3 missions	• +					Frequency	- ※
	Input: RF Coupling: DC Ext Gain: -44 Alian: Auto	Input Z Corr Co 60 dB Freq R	: 50 Ω Atte Corr Pre ef: Int (S) μW	en: 0 dB eamp: Off / Path: Standard	Trig: Free Run Gate: Off IF Gain: Low	Center Freq: 7 Avg Hold: 99/1 Radio Std: Nor	53.500000 MHz 00 ne	Center Fr 753.500	equency 000 MHz	Settings
1 Graph	Aligh: Auto					M	kr1 9 1199 kHz	CF Step 4.399000	0000 GHz	
Range 1 Scale/Div 10.0 c	βB		Ref	Value 0.00 dE	3m		-54.59 dBm	Auto Man		
-10.0								Freq Offs 0 Hz	et	
-40.0										
-60.0										
-90.0										
Start 9.000 kHz Res BW 1.0000	kHz		Video	o BW 3.0000 k	(Hz*		Stop 150.000 kHz Sweep 1.33 ms			
2 Table	•									
					Measure Trace Trace Type	: Tr	Trace 1 ace Average (Active)			
	Spu	ır Range	Frequency	Amplitude	Limit	∆Limit				
		1 1	9.120 kHz	-54.59 dBm	-19.00 dBm	-35.59 dB				
		2 1	9.000 kHz	-54.62 dBm	-19.00 dBm	-35.62 dB				
		3 1	64.60 kHz	-55.73 dBm	-19.00 dBm	-36.73 dB				Local
		4 1	59.53 kHz	-56.95 dBm	-19.00 dBm	-37.95 dB				
		5 1	66.83 kHz	-57.02 dBm	-19.00 dBm	-38.02 dB				
<b>4</b> 50		<b>?</b> Jul 12 10:46	2, 2023 5:07 AM	$\wedge$						

9kHz – 150kHz 5MHz, 5Hz BW, TM3.1a, 256QAM, TX1

150kHz – 30MHz 753.5MHz, 5Hz BW, TM3.1a, 256QAM, TX1



30MHz – 736MHz 748.5MHz, 5MHz BW, TM3.1, 640AM, TX1

Spectrum Analyzer	1	5G NR 3 Modulation Ar	nalysis	+	···· · · · ,	, , , , , , , , , , , , , , , , , , , ,	,	\$	Frequency	· · · 🔆
KEYSIGHT Inpu   R L Inpu   Ext 0   Data PASS	it: RF pling: DC Gain: -49.2i n: Auto	Input Z: 5 Corr CCo 0 dB Freq Ref:	0 Ω Atte rr Pre Int (S) μW	en: 10 dB eamp: Off ' Path: Standard	Trig: Free Run Gate: Off IF Gain: Low	Center Freq: 74 Avg Hold: 100/1 Radio Std: None	8.500000 MHz 00 9	Center Fre 748.5000	quency 00 MHz	Settings
1 Graph	•					Mkr	1 713 /8 MHz	4.399000	000 GHz	
Range 1 Scale/Div 10.0 dB			Ref	Value 0.00 dE	ßm	WIKI	-45.31 dBm	Auto Man		
-10.0								Freq Offse 0 Hz	t	
-30.0 -40.0 -50.0							<b>1</b>			
-60.0 -70.0 -80.0										
-90.0 Start 30.000000 MH Res BW 100.00 kHz	iz z		Video	o BW 300.00 k	Hz*	Si	top 736.000000 MHz Sweep 4.00 ms			
2 Table	v									
					Measure Trace Trace Type	Tra	Trace 1 ce Average (Active)			
	Spur	Range I	Frequency	Amplitude	Limit	∆Limit				
	1	1	713.5 MHz	-45.31 dBm	-19.00 dBm	-26.31 dB				
	2	1	734.4 MHz	-45.40 dBm	-19.00 dBm	-26.40 dB				
	3	1	732.0 MHz	-45.56 dBm	-19.00 dBm	-26.56 dB				Local
	4	1	722.5 MHz	-45.58 dBm	-19.00 dBm	-26.58 dB				
	5		049.7 MHZ	-45.60 dBm	- 19.00 dBm	-20.00 dB				
<b>1</b> 7 7		<b>?</b> Jul 12, 2 11:26:2	2023 💬 /							

782MHz – 1GHz 752MHz, 10MHz BW, TM3.1, 64QAM, TX1



1GHz – 2GHz 748.5MHz, 5MHz BW, TM3.1, 64QAM, TX1



2GHz – 10GHz 748.5MHz, 5MHz BW, TM3.1, 64QAM, TX1



# 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, 30 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 27.53 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 27 Limit is 82.23 dBµV/m at 3m and 91.77 dBuV/m at 1m The Part 27 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 27, 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 30 GHz), no reportable spurious emissions were detected.

# 7. FCC Section 2.1053 – Frequency Stability

Frequency Stability testing not required. Refer to GPCL project 2022-0010 for results.

# Photographs



#### **Radiated Emission Test Setup**





## **Test Equipment List**

Asset ID	Manufacturer	Туре	Description	Model	Serial	Calibration Date	Calibration Due
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
1609	Traceable	Data Logger	Barometric Humidity Temp Data Logger	6453,98767-15	221743404	2022-08-25	2024-08-25
	Weinschel	Attenuator	20dB/50W DC-8.5GHz	24-20-12-LIM	CE5786	CNR-V	CNR-V
	Weinschel	Attenuator	10dB 25W DC - 18GHz	46-10-34	BH8105	CNR-V	CNR-V
	Fairview Microwave	Attenuator	30dB/150W, DC – 18GHz	66-30-34	BJ5920	CNR-V	CNR-V
	Weinschel	Attenuator	30dB/150W DC-18GHz	6528-30-34-LIM	BN4177	CNR-V	CNR-V
	Weinschel	Attenuator	30dB/150W DC-18GHz	6528-30-34-LIM	BN4181	CNR-V	CNR-V
	Fairview Microwave	Attenuator	10 dB, DC - 40 GHz, 20 watt	SA4023-10	N/A	CNR-V	CNR-V
	Weinschel	Attenuator	30 dB / 150 W	66-30-33	BV2473	CNR-V	CNR-V

**Radio Test Equipment** 

CNR-V: Calibration Not Required. Must Be Verified. Test Date: 7/12/2023

#### **Radiated Emission Test Equipment**

Asset ID	Manufacturer	Туре	Description	Model	Serial	Calibration Date	Calibration Due
EIH43	A.H. Systems Inc.	Bilogical Antenna	25 - 2000 MHz	SAS-521-2	511	2021-09-09	2023-09-09
E1073	ETS Lindgren	Horn Antenna	Double-Ridged Waveguide Horn 1- 18 GHz	3117	00135198	2023-06-06	2025-06-06
E1119	Extech	Data Logger	Pressure Humidity Temp data logger	SD700	Q668960	2022-12-13	2024-12-13
E1608	KeySight Technologies	EMI Receiver	MXE EMI Receiver, 3 Hz - 44 GHz	N9038B	MY61380146	2022-11-29	2024-11-29
E1604	KeySight Technologies	Pre-Amplifier	0.1 - 18.0GHz, 15dbM	87405C	MY61410017	2023-05-18	2025-05-18
E814	Sonoma Instrument Co.	Amplifier	9kHz-1GHz	310N	186747	2022-11-30	2024-11-30

Test Date: 7/18/2023 – 7/20/2023

# 8. NVLAP Certificate of Accreditation

