element

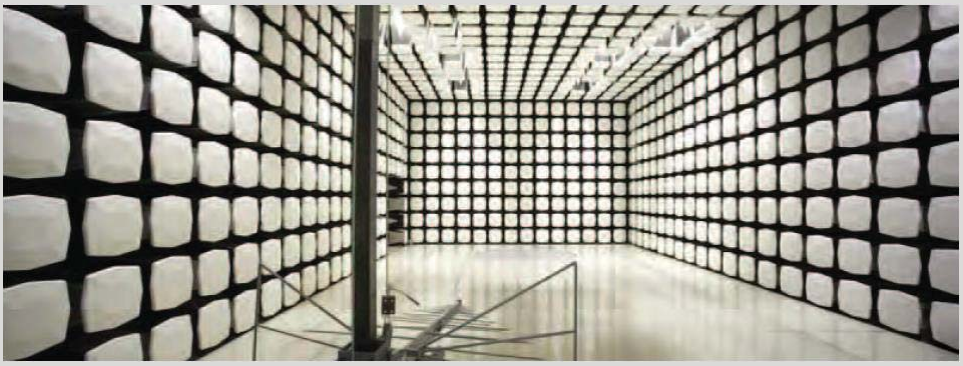
Radio Test Report
Application for a Permissive Change of Equipment Authorization
FCC Part 24 and IC RSS-133
[1930MHz – 1995MHz]

FCC Part 27 and IC RSS-139
[2110MHz – 2200MHz]

FCC ID: VBNAHFIB-01
IC ID: 661W-AHFIB

Nokia Solutions and Networks
Airscale Base Transceiver Station Remote Radio Head
Model: AHFIB

Report: NOKI0056.0 Rev. 0, Issue Date: April 11, 2023



ilac-MRA

A2LA ACCREDITED
CERT #3310.03

CERTIFICATE OF TEST

Last Date of Test: March 18, 2023
Nokia of America Corporation
EUT: AirScale Base Transceiver Station Remote Radio Head Model AHFIB

Radio Equipment Testing

Standards

Specification	Method
Code of Federal Regulations (CFR) Title 47 Part 2 (Radio Standards Specification) RSS-Gen Issue 5 CFR Title 47 Part 24 Subpart E – Broadband PCS RSS-133 Issue 6 - January 18, 2018 – 2GHz Personal Communications Services CFR Title 47 Part 27 RSS-139 Issue 4 - September 29, 2022– Advanced Wireless Services (AWS) SRSP 513 Issue 4 - September 29, 2022 SRSP 519 Issue 2 - September 29, 2022	ANSI C63.26-2015 with FCC KDB 971168 D01 v03r01 FCC KDB 971168 D03 v01 FCC KDB 662911D01 v02r01 FCC KDB 662911D02 v01

Results

Test Description	Result	Comments
Duty Cycle	N/A	Not requested.
Occupied Bandwidth	Pass	
Output Power	Pass	
Peak to Average Power (PAPR)CCDF	Pass	
Band Edge Compliance	Pass	
Spurious Conducted Emissions	Pass	
Power Spectral Density	Pass	
Spurious Radiated Emissions	N/A	Not requested.

Deviations From Test Standards

None

Approved By:

Adam Bruno, Operations Manager

Product compliance is the responsibility of the client; therefore, the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information. As indicated in the Statement of Work sent with the quotation, Element's standard process is to always use the latest published version of the test methods even when earlier versions are cited in the test specification. Issuance of a purchase order was de facto acceptance of this approach. Otherwise, the client would have advised Element in writing of the specific version of the test methods they wanted applied to the subject testing.

REVISION HISTORY

Revision Number	Description	Date (yyyy-mm-dd)	Page Number
00	None		

ACCREDITATIONS AND AUTHORIZATIONS

United States

FCC - Designated by the FCC as a Telecommunications Certification Body (TCB). Certification chambers, Open Area Test Sites, and conducted measurement facilities are listed with the FCC.

A2LA - Each laboratory is accredited by A2LA to ISO / IEC 17025, and as a product certifier to ISO / IEC 17065 which allows Element to certify transmitters to FCC and IC specifications.

Canada

ISED - Recognized by Innovation, Science and Economic Development Canada as a Certification Body (CB) and as a CAB for the acceptance of test data.

European Union

European Commission – Recognized as an EU Notified Body validated for the EMCD and RED Directives.

United Kingdom

BEIS – Recognized by the UK as an Approved Body under the UK Radio Equipment and UK EMC Regulations.

Australia/New Zealand

ACMA - Recognized by ACMA as a CAB for the acceptance of test data.

Korea

MSIT / RRA - Recognized by KCC's RRA as a CAB for the acceptance of test data.

Japan

VCCI - Associate Member of the VCCI. Conducted and radiated measurement facilities are registered.

Taiwan

BSMI – Recognized by BSMI as a CAB for the acceptance of test data.

NCC - Recognized by NCC as a CAB for the acceptance of test data.

Singapore

IDA – Recognized by IDA as a CAB for the acceptance of test data.

Israel

MOC – Recognized by MOC as a CAB for the acceptance of test data.

Hong Kong

OFCA – Recognized by OFCA as a CAB for the acceptance of test data.

Vietnam

MIC – Recognized by MIC as a CAB for the acceptance of test data.

SCOPE

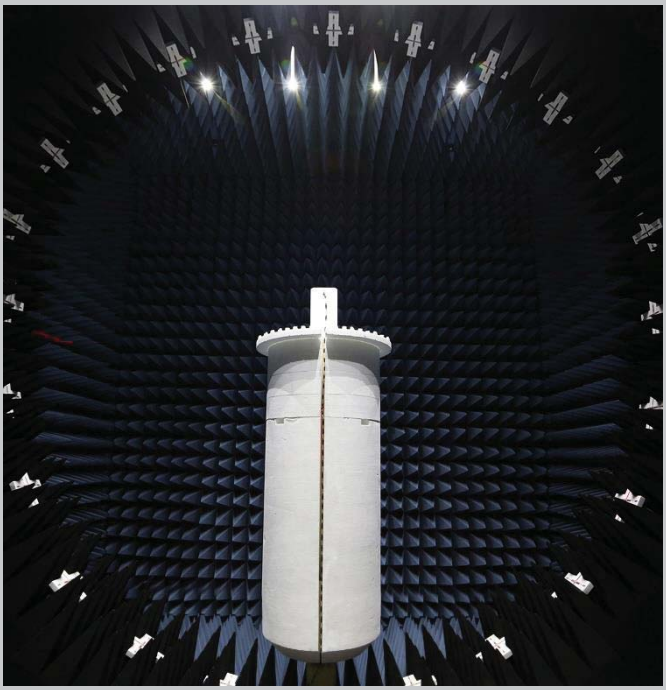
For details on the Scopes of our Accreditations, please visit:

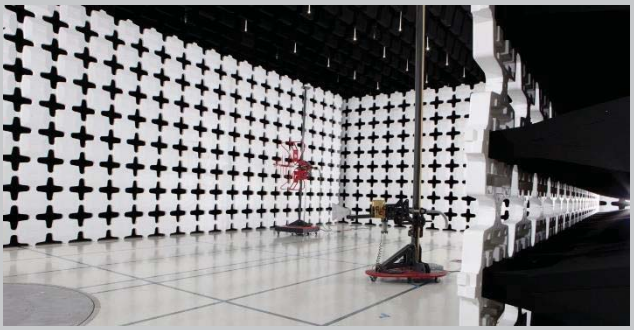
California Minnesota Oregon Texas Washington

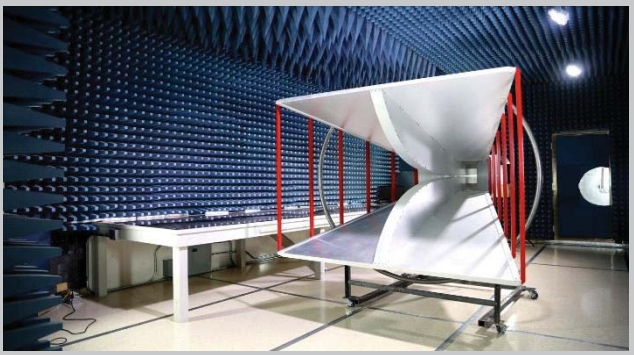
FACILITIES

element
2020.12.15

California	Minnesota	Oregon	Texas	Washington
Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs MN01-11 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Labs EV01-12 6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Labs NC01-05 19201 120th Ave NE Bothell, WA 98011 (425)984-6600
A2LA				
Lab Code: 3310.04	Lab Code: 3310.05	Lab Code: 3310.02	Lab Code: 3310.03	Lab Code: 3310.06
Innovation, Science and Economic Development Canada				
2834B-1, 2834B-3	2834E-1, 2834E-3	2834D-1	2834G-1	2834F-1
BSMI				
SL2-IN-E-1154R	SL2-IN-E-1152R	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI				
A-0029	A-0109	A-0108	A-0201	A-0110
Recognized Phase I CAB for ISED, ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA				
US0158	US0175	US0017	US0191	US0157







MEASUREMENT UNCERTAINTY

element
TMU.2015.07.10

Measurement Uncertainty

When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. Measurement uncertainty is a statistical expression of measurement error qualified by a probability distribution.

A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found in the table below. A lab specific value may also be found in the applicable test description section. Our measurement data meets or exceeds the measurement uncertainty requirements of the applicable specification; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for estimating measurement uncertainty are based upon ETSI TR 100 028 (or CISPR 16-4-2 as applicable), and are available upon request.

The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

Test	+ MU	- MU
Frequency Accuracy	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	1.2 dB	-1.2 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.1 dB	-5.1 dB
AC Powerline Conducted Emissions (dB)	3.1 dB	-3.1 dB

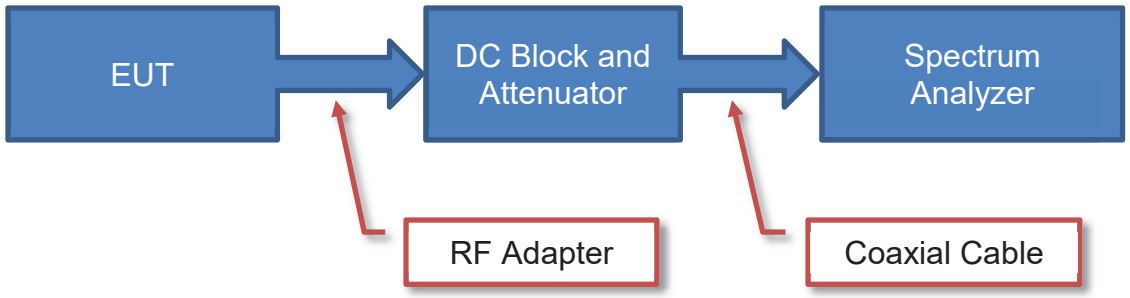
TEST SETUP BLOCK DIAGRAMS

Measurement Bandwidths

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

Unless otherwise stated, measurements were made using the bandwidths and detectors specified. No video filter was used.

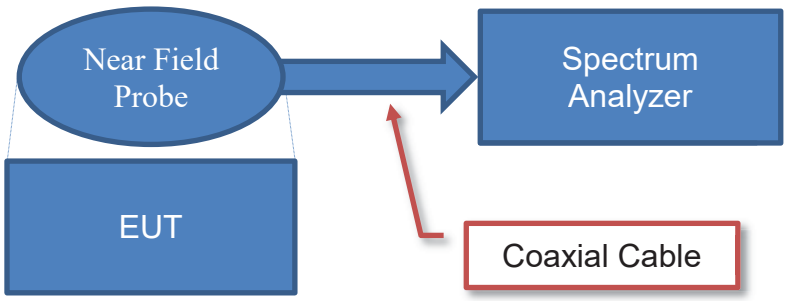
Antenna Port Conducted Measurements



Sample Calculation (logarithmic units)

Measured Value		Measured Level		Reference Level Offset
71.2	=	42.6	+	28.6

Near Field Test Fixture Measurements

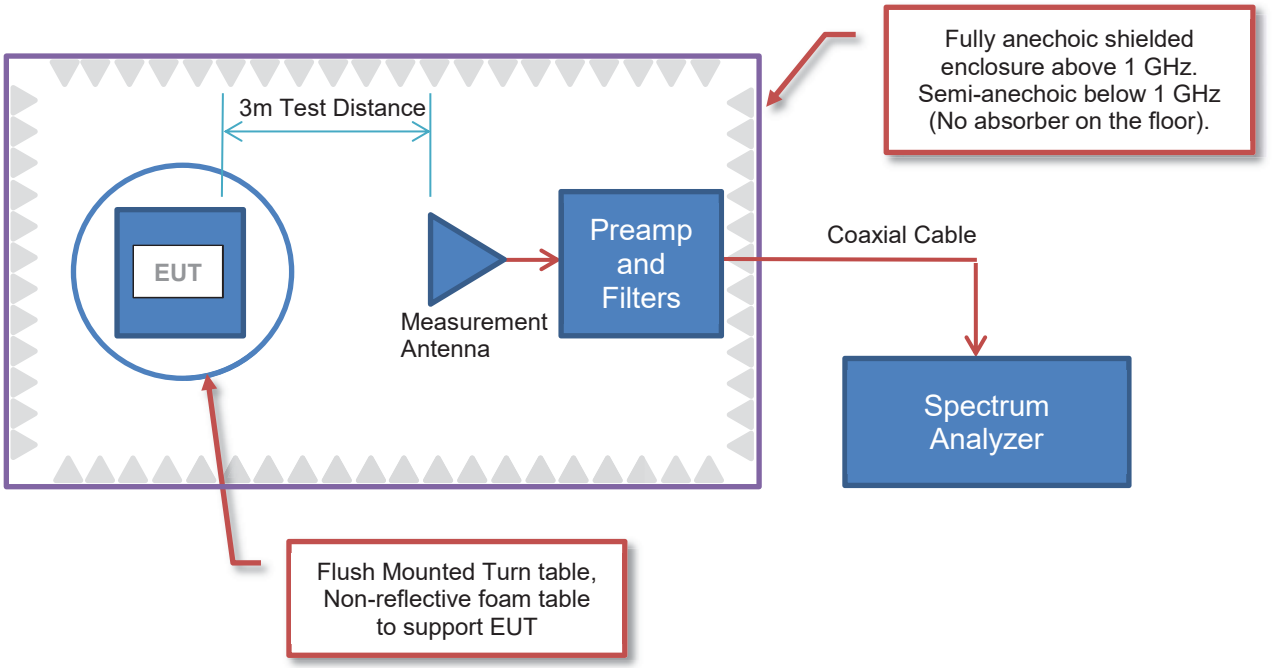


Sample Calculation (logarithmic units)

Measured Value		Measured Level		Reference Level Offset
71.2	=	42.6	+	28.6

TEST SETUP BLOCK DIAGRAMS

Emissions Measurements



Sample Calculation (logarithmic units)

Radiated Emissions:

Measured Level (Amplitude)		Factor: Antenna Factor		Factor: Cable Factor		Factor: Amplifier Gain		Distance Adjustment Factor		External Attenuation		Field Strength
42.6	+	28.6	+	3.1	-	40.8	+	0.0	+	0.0	=	**33.5**

Conducted Emissions:

Measured Level (Amplitude)		Factor: Transducer Factor		Factor: Cable Factor		External Attenuation		Adjusted Level
26.7	+	0.3	+	0.1	+	20.0	=	**47.1**

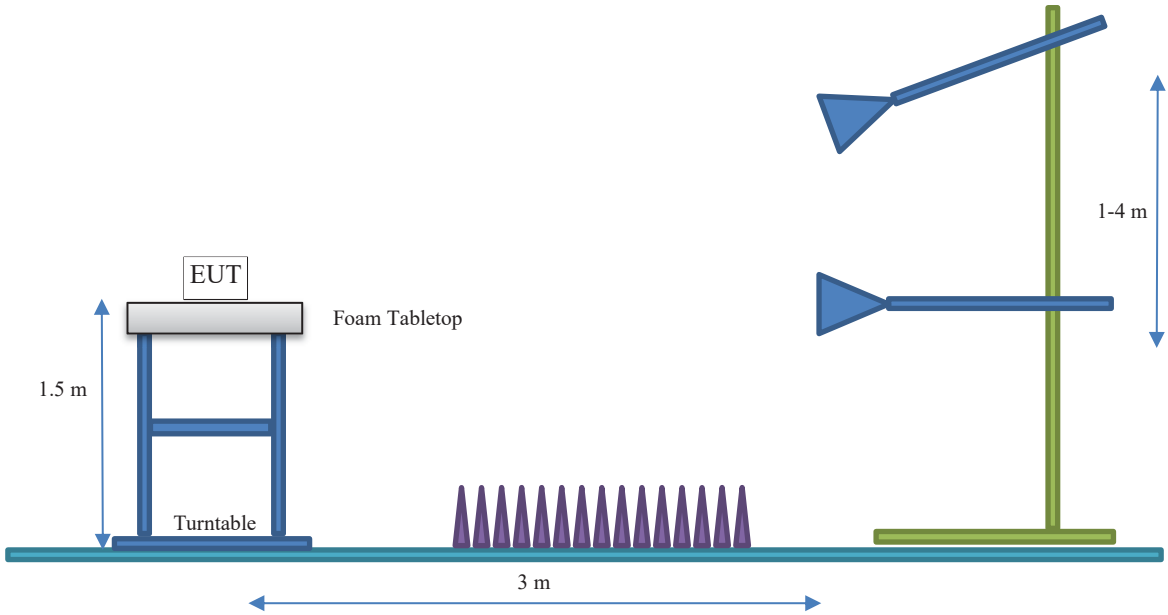
Radiated Power (ERP/EIRP) – Substitution Method:

Measured Level into Substitution Antenna (Amplitude dBm)		Substitution Antenna Factor (dBi)		EIRP to ERP (if applicable)		Measured power (dBm ERP/EIRP)
10.0	+	6.0	-	2.15	=	**13.9/16.0**

TEST SETUP BLOCK DIAGRAMS

Bore Sighting (>1GHz)

The diameter of the illumination area is the dimension of the line tangent to the EUT formed by 3 dB beamwidth of the measurement antenna at the measurement distance. At a 3 meter test distance, the diameter of the illumination area was 3.8 meters at 1 GHz and greater than 2.1 meters up to 6 GHz. Above 1 GHz, when required by the measurement standard, the antenna is pointed for both azimuth and elevation to maintain the receive antenna within the cone of radiation from the EUT. The specified measurement detectors were used for comparison of the emissions to the peak and average specification limits.



PRODUCT DESCRIPTION

Client and Equipment under Test (EUT) Information

Company Name:	Nokia of America Corporation
Address:	3201 Olympus Blvd
City, State, Zip:	Dallas, TX 75019
Test Requested By:	Steve Mitchell
EUT:	Airscale Base Transceiver Station Remote Radio Head Model AHFIB
First Date of Test:	March 17, 2023
Last Date of Test:	March 18, 2023
Receipt Date of Samples:	March 17, 2023
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:

A permissive change on the original filing is being pursued to add 5G NR (new radio) 25MHz channel bandwidth carriers to the AirScale Base Transceiver Station Remote Radio Head Model AHFIB FCC and ISED radio certifications. The original test effort includes testing for 4G LTE technologies. Please refer to the test report on the original certification for details on all required testing.

All conducted RF testing performed for the original certification testing has been repeated using 5G NR 25MHz channel bandwidth carriers for this permissive change per correspondence/guidance from Nemko TCB. The same test methodology used in the original certification testing was used in this permissive change test effort. Tests performed under the change effort include RF power, PSD, CCDF, emission bandwidth (99% and 26 dB down), band edge spurious emissions, and conducted spurious emissions.

The testing was performed on the same hardware version (AHFIB) as the original certification test. The base station and remote radio head software for this testing is an updated release that includes 5G NR 25MHz channel bandwidth carrier support.

The radiated emissions and frequency stability measurements performed in the original certification were not repeated under this effort per TCB guidance. The radiated emission and frequency stability/accuracy results from the original certification had enough margin to preclude requiring additional testing. The same frequency stability/accuracy radio design is the same for all radio technologies/modulation types.

Nokia Solutions and Networks AirScale Base Transceiver Station (BTS) Remote Radio Head (RRH) module, model AHFIB is being developed under this effort. The AHFIB remote radio head is a multi-standard multi-carrier radio module designed to support GSM/EDGE, WCDMA, LTE, LTE Narrow Band Internet of Things (NB IoT) operations (in-band, guard band, standalone) and 5G NR. **The scope of testing in this effort is for the addition of 25MHz bandwidth in 5G NR FDD operations.**

The AHFIB RRH has four transmit/four receive antenna ports (4TX/4RX for Band n25 and 4TX/4RX for Band n66). Each antenna port supports 3GPP frequency band n25 (BTS Rx: 1850 to 1915 MHz/BTS TX: 1930 to 1995 MHz) and 3GPP frequency band n66 (BTS Rx: 1710 to 1780 MHz/BTS TX: 2110 to 2200 MHz). The maximum RF output power of the RRH is 320 Watts (40 watts per carrier, 80 watts per antenna port x 4 port). The maximum power per band (Band n25 or Band n66) is 40 watts. The maximum single carrier power level is 40 watts. The TX and RX instantaneous bandwidth cover the full operational RRH bandwidth. Multi-carrier operation is supported.

The RRH can be operated as a 4x4 MIMO, 2x2 MIMO or as non-MIMO for 5G NR FDD. The RRH supports 5, 10, 15, 20, 25 and 30MHz 5G NR bandwidths. The RRH supports four 5G NR downlink modulation types (QPSK, 16QAM, 64QAM and 256QAM). The 5G NR carriers/modulation types for this testing are setup according to 3GPP TS 38.141-1 Test Models

and are NR-FR1-TM 1.1 (QPSK modulation type), NR-FR1-TM 3.2 (16QAM modulation type), NR-FR1-TM 3.1 (64QAM modulation type), and NR-FR1-TM 3.1a (256QAM modulation type).

The RRH has external interfaces including DC power (DC In), ground, transmit/receive (ANT), external alarm (EAC), optical (OPT) and remote electrical tilt (RET). The RRH with applicable installation kit may be pole or wall mounted. The PCS Band 5G NR channel bandwidths are 5, 10, 15, 20, 25 and 30MHz. The downlink channel numbers are provided below. The 25MHz carrier bandwidth is tested under this effort; the other carrier bandwidths were verified under previous efforts and are provided for thoroughness.

	Downlink 5G NR NR-ARFCN	Downlink Frequency (MHz)	5G NR Channel Bandwidth					
			5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz
AHFIB Band n25 (Ant 1 through 4)	386000	1930.0	Band Edge	Band Edge	Band Edge	Band Edge	Band Edge	Band Edge
	386500	1932.5	Bottom Ch					
	387000	1935.0		Bottom Ch				
	387500	1937.5			Bottom Ch			
	388000	1940.0				Bottom Ch		
	388500	1942.5					Bottom Ch	
	389000	1945.0						Bottom Ch
	392500	1962.5	Middle Ch	Middle Ch	Middle Ch	Middle Ch	Middle Ch	Middle Ch
	396000	1980.0						Top Channel
	396500	1982.5					Top Channel	
	397000	1985.0				Top Channel		
	397500	1987.5			Top Channel			
	398000	1990.0		Top Channel				
	398500	1992.5	Top Channel					
	399000	1995.0	Band Edge	Band Edge	Band Edge	Band Edge	Band Edge	Band Edge

AHFIB Downlink Band Edge 5G NR Band n25 Frequency Channels

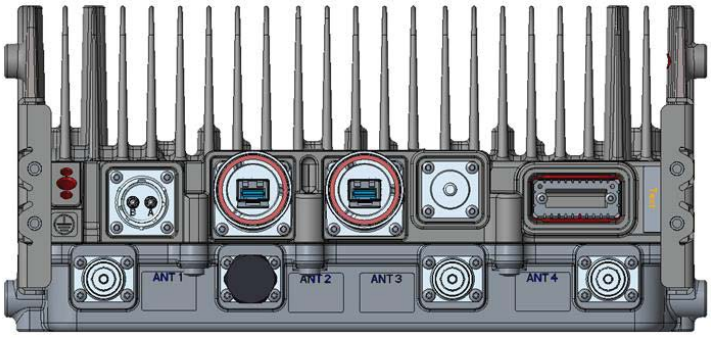
The AWS Band 5G NR channel bandwidths are 5, 10, 15, 20, 25 and 30MHz. The downlink channel numbers are provided below. The 25MHz carrier bandwidth is tested under this effort; the other carrier bandwidths were verified under previous efforts and are provided for thoroughness.

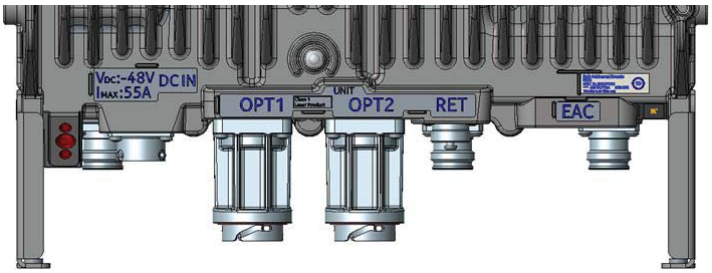
	Downlink 5G NR NR-ARFCN	Downlink Frequency (MHz)	5G NR Channel Bandwidth					
			5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz
AHFIB 5G NR Band n66 (Ant 1 through 4)	422000	2110.0	Band Edge	Band Edge	Band Edge	Band Edge	Band Edge	Band Edge
	422500	2112.5	Bottom Ch					
	423000	2115.0		Bottom Ch				
	423500	2117.5			Bottom Ch			
	424000	2120.0				Bottom Ch		
	424500	2122.5					Bottom Ch	
	425000	2125.0						Bottom Ch
	431000	2155.0	Middle Ch	Middle Ch	Middle Ch	Middle Ch	Middle Ch	Middle Ch
	437000	2185.0						Top Channel
	437500	2187.5					Top Channel	
	438000	2190.0				Top Channel		
	438500	2192.5			Top Channel			
	439000	2195.0		Top Channel				
	439500	2197.5	Top Channel					
	440000	2200.0	Band Edge	Band Edge	Band Edge	Band Edge	Band Edge	Band Edge

AHFIB Downlink Band Edge 5G NR Band n66 Frequency Channels

PRODUCT DESCRIPTION

AHFIB Connector Layout





EUT External Interfaces

Name	Qty	Connector Type	Purpose (and Description)
DC In	1	Quick Disconnect	2-pole Power Circular Connector
GND	1	Screw lug (2xM5/1xM8)	Ground
ANT	4	4.3-10	RF signal for Transmitter/Receiver (50 Ohm)
Unit	1	LED	Unit Status LED
EAC	1	MDR26	External Alarm Interface (4 alarms)
OPT	2	SFP+ cage	Optical CPRI Interface up to 10 Gps.
RET	1	8-pin circular connector conforming to IEC 60130-9 – Ed.3.0	AISG 2.0 to external devices
Fan	1	Molex Microfit	Power for RRH Fan. Located on the side of RRH.

Testing Objective:

A permissive change on the original filing is being pursued to add 5G NR (new radio) 25MHz channel bandwidth carrier operations to the Nokia Solutions and Networks AirScale Base Transceiver Station (BTS) Remote Radio Head (RRH) model AHFIB FCC and ISED radio certifications.

CONFIGURATIONS

Configuration NOKI0056-1

Software/Firmware Running during test	
Description	**Version**
5G BTS Software Version (23R2)	SBTS00_ENB_9999_230209_000006
5G RF_SW	RF. FRM5.trunk.20230208.005

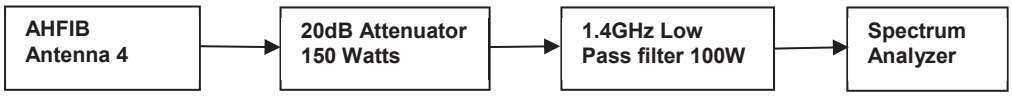
Equipment being tested (include Peripherals)			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
AMIA (BTS System Module)	Nokia Solutions and Networks	473098A.102	J8173107703
ASIB (5G BTS System Module)	Nokia Solutions and Networks	473764A.102	DH211165881
ABIO (5G BTS Baseband Module)	Nokia Solutions and Networks	475266A.104	L1214403575
AHFIB (Radio Remote Head)	Nokia Solutions and Networks	474216A.101	K9181401111
Low Pass Filter 1.4GHz/100W	Microwave Circuits,Inc.	L13502G1	SN2454-01
Attenuator 150W/20dB	Weinschel Corp	66-20-33	BZ1165
SFP+ 9.8G,300M,850NM	Nokia	474900A.101	VF20470022K
SFP+ 9.8G,300M,850NM	Nokia	474900A.101	VF20230058S
Lenovo T490	HP	T490	PF26RVZ0
Keysight N8757- DC System power supply	Keysight	N8757A	US21D4054S
FPAC (DC-pwr supply)	Nokia	472805A.X21	A9124600282
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297387
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297388
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN531432/6
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC869
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC864
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC865
Cat-5e cable	CSA	LL73189	E151955
6 Meters RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN528837/6
1 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_104	SN551432/4
Fiber Optic cable 2m	Amphenol Fiber Optic	VZ1701	995741A

CONFIGURATIONS

Cables (Peripheral)					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
Fiber Optic Cable	N	2 meters	N	ASIB	AHFIB
Cat-5e Cable	Y	7 meters	N	ABIO	WebEM- PC
HS-SUCOFLEX_106 – RF CABLE	Y	2 meters	N	EUT [AHFIB] Ant 1-3	250W -50ohm - Load

Cables					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
HS-SUCOFLEX_106 1.5dB cable attenuator	Y	6 meters	N	EUT [AHFIB] Ant port #4	Attenuator 150W/20dB
Attenuator 150W/20dB	N	N/A	N	RF cable HS-SUCOFLEX_106	1.4GHz Low Pass filter 100W
1.4GHz Low Pass filter 100W	N	N/A	N	Attenuator 150W/20dB	RF cable HS-SUCOFLEX_104
HS-SUCOFLEX_104	Y	1 meter	N	1.4GHz Low Pass filter 100W	Analyzer

RF Test Setup Diagram:



CONFIGURATIONS

Configuration NOKI0056-2

Software/Firmware Running during test	
Description	**Version**
5G BTS Software Version (23R2)	SBTS00_ENB_9999_230209_000006
5G RF_SW	RF. FRM5.trunk.20230208.005

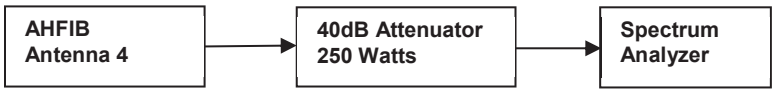
Equipment being tested (include Peripherals)			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
AMIA (BTS System Module)	Nokia Solutions and Networks	473098A.102	J8173107703
ASIB (5G BTS System Module)	Nokia Solutions and Networks	473764A.102	DH211165881
ABIO (5G BTS Baseband Module)	Nokia Solutions and Networks	475266A.104	L1214403575
AHFIB (Radio Remote Head)	Nokia Solutions and Networks	474216A.101	K9181401111
Attenuator 40dB/250W	API Weinschel	58-40-43-LIM	TC909
SFP+ 9.8G,300M,850NM	Nokia	474900A.101	VF20470022K
SFP+ 9.8G,300M,850NM	Nokia	474900A.101	VF20230058S
Lenovo T490	HP	T490	PF26RVZ0
Keysight N8757- DC System power supply	Keysight	N8757A	US21D4054S
FPAC (DC-pwr supply)	Nokia	472805A.X21	A9124600282
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297387
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297388
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN531432/6
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC869
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC864
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC865
Cat-5e cable	CSA	LL73189	E151955
6 Meters RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN528837/6
1 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_104	SN551432/4
Fiber Optic cable 2m	Amphenol Fiber Optic	VZ1701	995741A

CONFIGURATIONS

Cables (Peripheral)					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
Fiber Optic Cable	N	2 meters	N	ASIB	AHFIB
Cat-5e Cable	Y	7 meters	N	ABIO	WebEM- PC
HS-SUCOFLEX_106 – RF CABLE	Y	2 meters	N	EUT [AHFIB] Ant 1-3	250W -50ohm - Load

Cables					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
HS-SUCOFLEX_106	Y	6 meters	N	EUT [AHFIB] Ant port #4	Attenuator 250W/40dB
Attenuator 250W/40dB	N	NA	N	RF cable HS-SUCOFLEX_106	RF cable HS-SUCOFLEX_104
HS-SUCOFLEX_104	Y	1 meter	N	Attenuator 250W/40dB	Analyzer

RF Test Setup Diagram:



CONFIGURATIONS

Configuration NOKI0056-3

Software/Firmware Running during test	
Description	**Version**
5G BTS Software Version (23R2)	SBTS00_ENB_9999_230209_000006
5G RF_SW	RF. FRM5.trunk.20230208.005

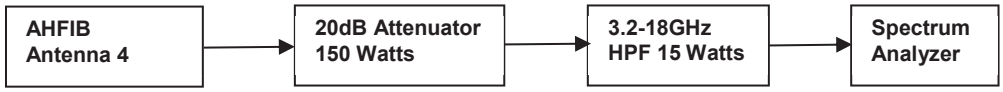
Equipment being tested (include Peripherals)			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
AMIA (BTS System Module)	Nokia Solutions and Networks	473098A.102	J8173107703
ASIB (5G BTS System Module)	Nokia Solutions and Networks	473764A.102	DH211165881
ABIO (5G BTS Baseband Module)	Nokia Solutions and Networks	475266A.104	L1214403575
AHFIB (Radio Remote Head)	Nokia Solutions and Networks	474216A.101	K9181401111
High Pass Filter 3.2-18GHz/15W	RL-Lambda	RHPF23G03G18	20121400045
Attenuator 150W/20dB	Aeroflex Weinschel	66-20-33	BZ2075
SFP+ 9.8G,300M,850NM	Nokia	474900A.101	VF20470022K
SFP+ 9.8G,300M,850NM	Nokia	474900A.101	VF20230058S
Lenovo T490	HP	T490	PF26RVZ0
Keysight N8757- DC System power supply	Keysight	N8757A	US21D4054S
FPAC (DC-pwr supply)	Nokia	472805A.X21	A9124600282
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297387
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297388
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN531432/6
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC869
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC864
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC865
Cat-5e cable	CSA	LL73189	E151955
6 Meters RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN528837/6
1 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_104	SN551432/4
Fiber Optic cable 2m	Amphenol Fiber Optic	VZ1701	995741A

CONFIGURATIONS

Cables (Peripheral)					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
Fiber Optic Cable	N	2 meters	N	ASIB	AHFIB
Cat-5e Cable	Y	7 meters	N	ABIO	WebEM- PC
HS-SUCOFLEX_106 – RF CABLE	Y	2 meters	N	EUT [AHFIB] Ant 1-3	250W -50ohm - Load

Cables					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
HS-SUCOFLEX_106	Y	6 meters	N	EUT [AHFIB] Ant port #4	Attenuator 150W/20dB
Attenuator 150W/20dB	N	NA	N	RF cable HS-SUCOFLEX_106	High Pass Filter 3.2-18GHz/15W
High Pass Filter 3.2-18GHz/15W	N	NA	N	Attenuator 150W/20dB	RF cable HS-SUCOFLEX_104
HS-SUCOFLEX_104	Y	1 meter	N	High Pass Filter 3.2-18GHz/15W	Analyzer

RF Test Setup Diagram:



CONFIGURATIONS

Configuration NOKI0056-4

Software/Firmware Running during test	
Description	**Version**
5G BTS Software Version (23R2)	SBTS00_ENB_9999_230209_000006
5G RF_SW	RF. FRM5.trunk.20230208.005

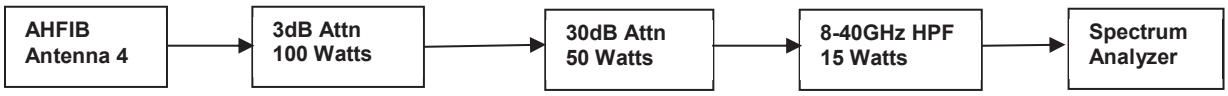
Equipment being tested (include Peripherals)			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
AMIA (BTS System Module)	Nokia Solutions and Networks	473098A.102	J8173107703
ASIB (5G BTS System Module)	Nokia Solutions and Networks	473764A.102	DH211165881
ABIO (5G BTS Baseband Module)	Nokia Solutions and Networks	475266A.104	L1214403575
AHFIB (Radio Remote Head)	Nokia Solutions and Networks	474216A.101	K9181401111
Attenuator 100W/3dB	API Weinschel	47-3-33	CC7387
Attenuator 50W/30dB	Narda	776B	30
High Pass Filter 8-40GHz/15W	RF-Lambda	RHPF23G08G40	17102700016
SFP+ 9.8G,300M,850NM	Nokia	474900A.101	VF20470022K
SFP+ 9.8G,300M,850NM	Nokia	474900A.101	VF20230058S
Lenovo T490	HP	T490	PF26RVZ0
Keysight N8757- DC System power supply	Keysight	N8757A	US21D4054S
FPAC (DC-pwr supply)	Nokia	472805A.X21	A9124600282
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297387
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297388
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN531432/6
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC869
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC864
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC865
Cat-5e cable	CSA	LL73189	E151955
6 Meters RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN528837/6
1 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_104	SN551432/4
Fiber Optic cable 2m	Amphenol Fiber Optic	VZ1701	995741A

CONFIGURATIONS

Cables (Peripheral)					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
Fiber Optic Cable	N	2 meters	N	ASIB	AHFIB
Cat-5e Cable	Y	7 meters	N	ABIO	WebEM- PC
HS-SUCOFLEX_106 – RF CABLE	Y	2 meters	N	EUT [AHFIB] Ant 1-3	250W -50ohm - Load

Cables					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
HS-SUCOFLEX_106	Y	6 meters	N	EUT [AHFIB] Ant port #4	Attenuator 100W/3dB
Attenuator 100W/3dB	N	NA	N	RF cable HS-SUCOFLEX_106	Attenuator 50W/30dB
Attenuator 50W/30dB	N	NA	N	Attenuator 100W/3dB	High Pass Filter 8-40GHz/15W
HS-SUCOFLEX_104	Y	1 meter	N	Attenuator 250W/40dB	Analyzer

RF Test Setup Diagram:



MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2023-03-17	Occupied Bandwidth	Tested as delivered to test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
2	2023-03-17	Output Power	Tested as delivered to test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
3	2023-03-17	Peak to Average Power (PAPR)CCDF	Tested as delivered to test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
4	2023-03-17	Power Spectral Density	Tested as delivered to test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
5	2023-03-17	Band Edge Compliance	Tested as delivered to test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
6	2023-03-18	Spurious Conducted Emissions	Tested as delivered to test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

OCCUPIED BANDWIDTH - BAND n25 5G

element

XMit 2023.02.14.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2023-02-09	2024-02-09
Block - DC	Fairview Microwave	SD3239	ANE	2023-02-16	2024-02-16
Attenuator	Fairview Microwave	SA18E 1648	TZW	2022-09-13	2023-09-13

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

The method in section 5.4 of ANSI C63.26 was used to make this measurement. The spectrum analyzer settings were as follows:
- RBW is 1% - 5% of the occupied bandwidth
- VBW is ≥ 3x the RBW
- Peak Detector was used
- Trace max hold was used

The occupied bandwidth was measured with the EUT configured in the modes called out in the data sheets.
FCC 24.238(b) defines the 26dB emission bandwidth requirement.
RSS GEN Section 6.7 defines the 99% emission bandwidth requirement.

FCC and ISED Emission Designators for Band n25 (1930MHz to 1995MHz)

Ch BW	Radio Channel	5G-NR: QPSK		5G-NR: 16QAM		5G-NR: 64QAM		5G-NR: 256QAM	
		FCC	ISED	FCC	ISED	FCC	ISED	FCC	ISED
25MHz	Low							24M9G7W	23M8G7W
	Mid	24M9G7W	23M7G7W	24M9G7W	23M9G7W	24M9G7W	23M8G7W	24M9G7W	23M8G7W
	High							24M9G7W	23M8G7W

Note: FCC emission designators are based on 26dB emission bandwidth. ISED emission designators are based on 99% emission bandwidth.

RF conducted emissions testing was performed on one port. The testing was performed on the same version of hardware (AHFIB) as the original certification test. The AHFIB antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in the original certification testing) and antenna port 4 was selected to perform the testing under this effort as allowed by ANSI C63.26-2015 paragraphs 5.2.5.3, 5.7.2i and 6.4.

OCCUPIED BANDWIDTH - BAND n25 5G

TbtTx 2022.05.02.0 XMit 2023.02.14.0

EUT:	Airscale Base Transceiver Station Remote Radio Head Model AHFIB			Work Order:	NOKI0056
Serial Number:	K9181401111			Date:	03/17/23
Customer:	Nokia of America Corporation			Temperature:	24°C
Attendees:	David Le, Mitchel Hill			Humidity:	26.2%
Project:	None			Barometric Pres.:	990.7 mbar
Tested by:	Brandon Hobbs	Power:	54 VDC	Job Site:	TX07

TEST SPECIFICATIONS	Test Method
FCC 24E:2023	ANSI C63.26:2015
RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.26-2015

COMMENTS

All measurement path losses were accounted for in the reference level offest including any attenuators, filters and DC blocks. Band n25 carriers are enabled at maximum power (40 watts/carrier).

DEVIATIONS FROM TEST STANDARD

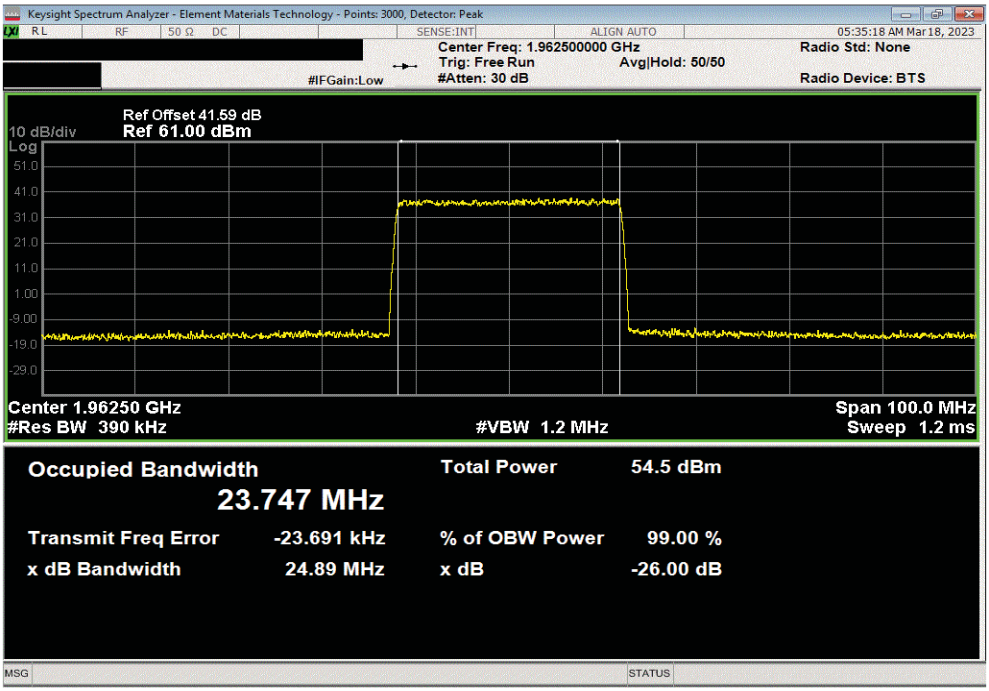
None

Configuration #	NOKI0056-2	Signature

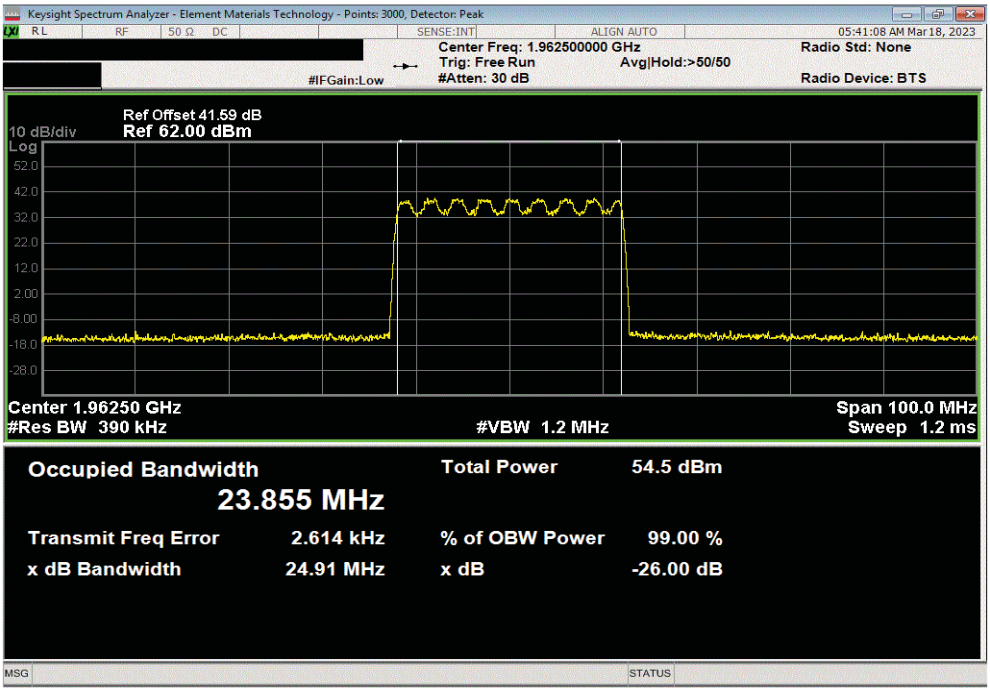
	Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
Band n25 1930 MHz - 1995 MHz, 5G NR				
Port 4				
25 MHz Bandwidth				
QPSK Modulation				
Mid Channel 1962.5 MHz	23.747	24.894	Within Band	Pass
16-QAM Modulation				
Mid Channel 1962.5 MHz	23.855	24.914	Within Band	Pass
64-QAM Modulation				
Mid Channel 1962.5 MHz	23.781	24.945	Within Band	Pass
256-QAM Modulation				
Low Channel 1942.5 MHz	23.807	24.898	Within Band	Pass
Mid Channel 1962.5 MHz	23.783	24.940	Within Band	Pass
High Channel 1982.5 MHz	23.761	24.934	Within Band	Pass

OCCUPIED BANDWIDTH - BAND n25 5G

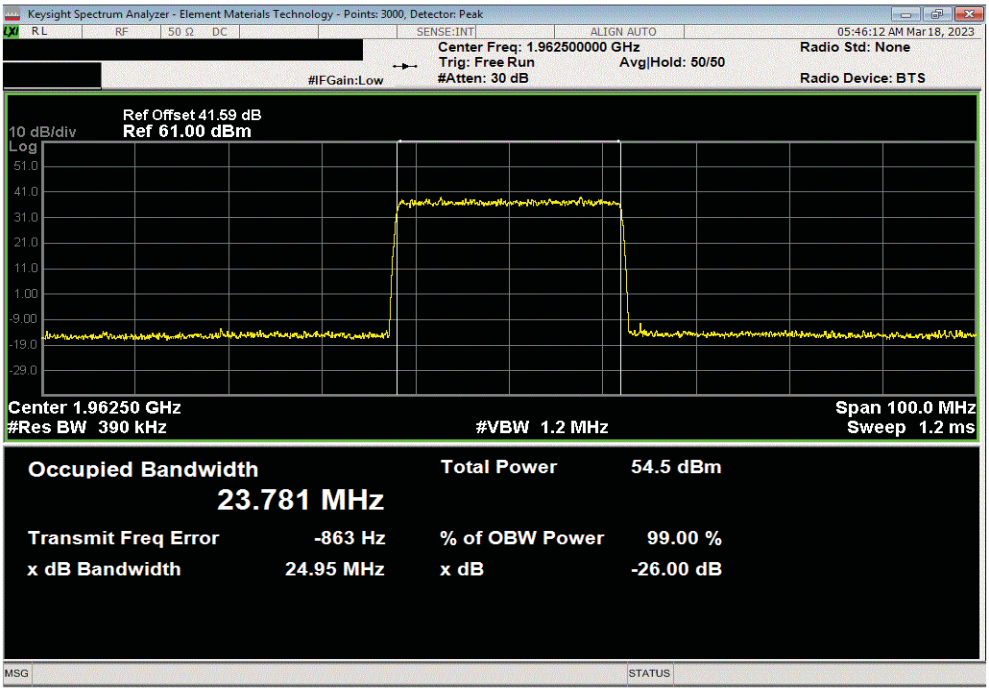
Band n25 1930 MHz - 1995 MHz, 5G NR , Port 4, 25 MHz Bandwidth, QPSK Modulation, Mid Channel 1962.5 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			23.747	24.894	Within Band	Pass



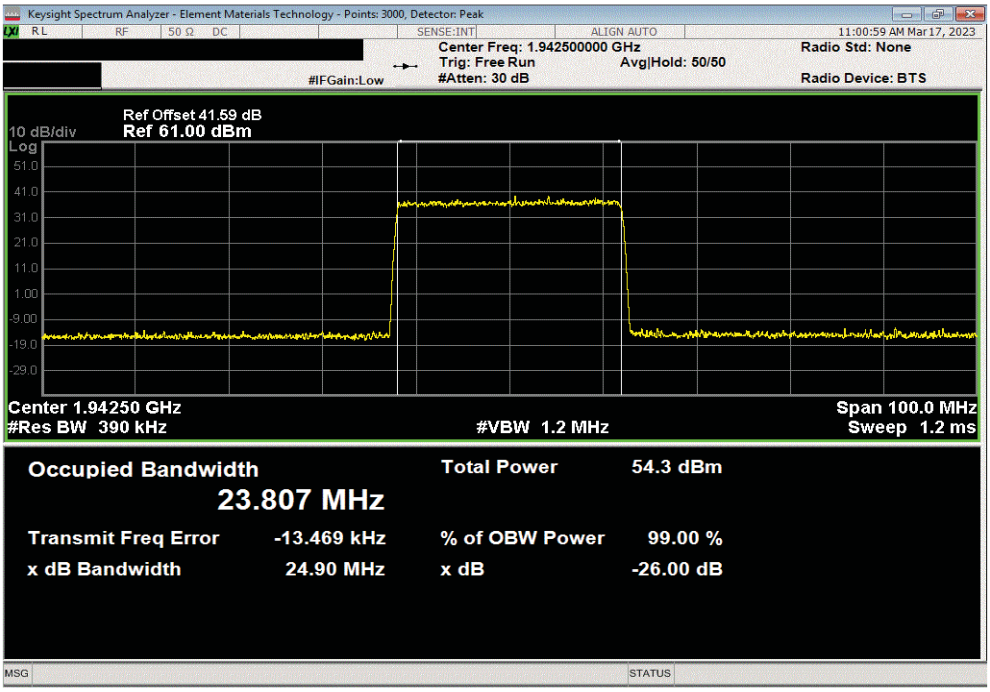
Band n25 1930 MHz - 1995 MHz, 5G NR , Port 4, 25 MHz Bandwidth, 16-QAM Modulation, Mid Channel 1962.5 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			23.855	24.914	Within Band	Pass



Band n25 1930 MHz - 1995 MHz, 5G NR , Port 4, 25 MHz Bandwidth, 64-QAM Modulation, Mid Channel 1962.5 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			23.781	24.945	Within Band	Pass

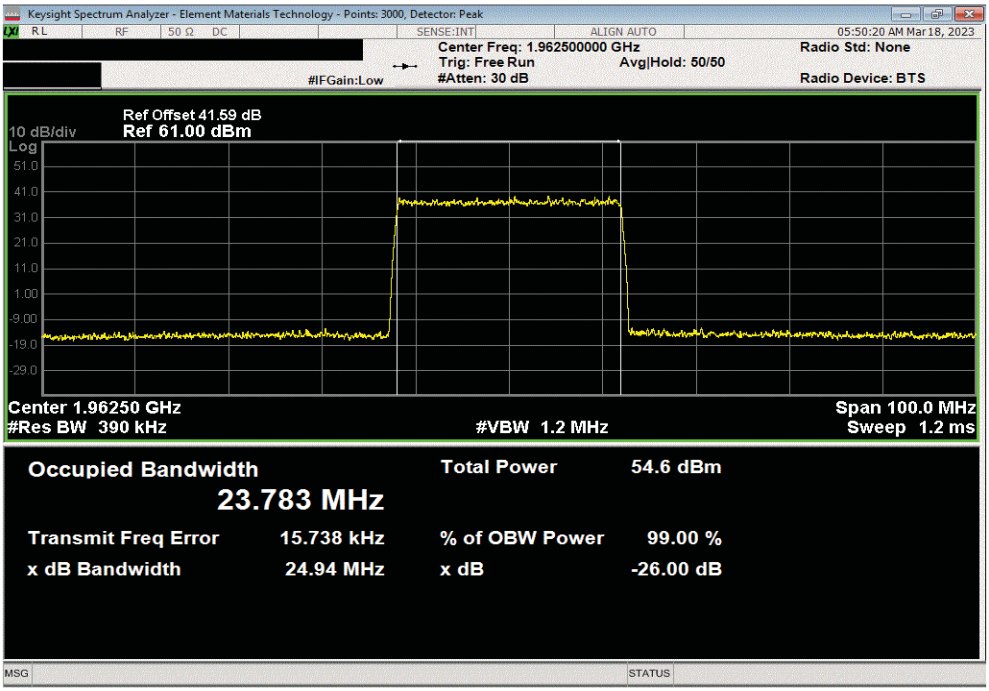


Band n25 1930 MHz - 1995 MHz, 5G NR , Port 4, 25 MHz Bandwidth, 256-QAM Modulation, Low Channel 1942.5 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			23.807	24.898	Within Band	Pass

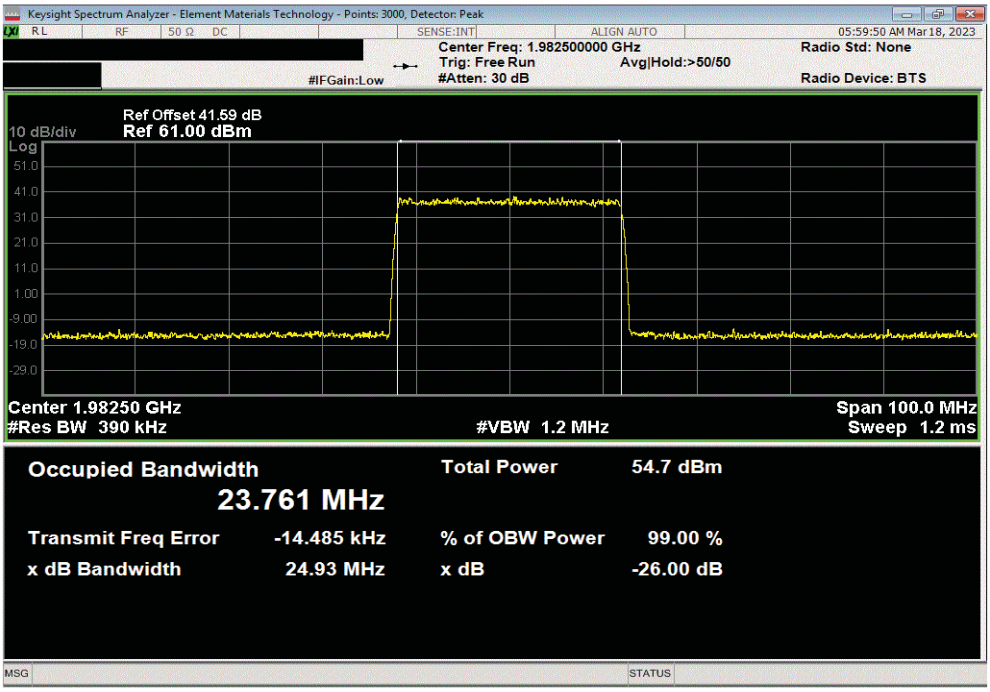


OCCUPIED BANDWIDTH - BAND n25 5G

Band n25 1930 MHz - 1995 MHz, 5G NR , Port 4, 25 MHz Bandwidth, 256-QAM Modulation, Mid Channel 1962.5 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			23.783	24.94	Within Band	Pass



Band n25 1930 MHz - 1995 MHz, 5G NR , Port 4, 25 MHz Bandwidth, 256-QAM Modulation, High Channel 1982.5 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			23.761	24.934	Within Band	Pass



OCCUPIED BANDWIDTH - BAND n66 5G

XMit 2023.02.14.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2023-02-09	2024-02-09
Block - DC	Fairview Microwave	SD3239	ANE	2023-02-16	2024-02-16
Attenuator	Fairview Microwave	SA18E 1648	TZW	2022-09-13	2023-09-13

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

The method in section 5.4 of ANSI C63.26 was used to make this measurement. The spectrum analyzer settings were as follows:

- RBW is 1% - 5% of the occupied bandwidth
- VBW is ≥ 3x the RBW
- Peak Detector was used
- Trace max hold was used

The occupied bandwidth was measured with the EUT configured in the modes called out in the data sheets.
FCC 27.53(h)(3) defines he 26dB emission bandwidth requirement.
RSS GEN Section 6.7 defines the 99% emission bandwidth requirement.

FCC and ISED Emission Designators for Band n66 (2110MHz to 2200MHz)

Ch BW	Radio Channel	5G-NR: QPSK		5G-NR: 16QAM		5G-NR: 64QAM		5G-NR: 256QAM	
		FCC	ISED	FCC	ISED	FCC	ISED	FCC	ISED
25MHz	Low							24M9G7W	23M7G7W
	Mid	24M9G7W	23M8G7W	25M0G7W	23M8G7W	24M8G7W	23M7G7W	24M9G7W	23M8G7W
	High							24M9G7W	23M8G7W

Note: FCC emission designators are based on 26dB emission bandwidth. ISED emission designators are based on 99% emission bandwidth.

RF conducted emissions testing was performed on one port. The testing was performed on the same version of hardware (AHFIB) as the original certification test. The AHFIB antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in the original certification testing) and antenna port 4 was selected to perform the testing under this effort as allowed by ANSI C63.26-2015 paragraphs 5.2.5.3, 5.7.2i and 6.4.

OCCUPIED BANDWIDTH - BAND n66 5G

TbtTx 2022.05.02.0 XMit 2023.02.14.0

EUT:	Airscale Base Transceiver Station Remote Radio Head Model AHFIB			Work Order:	NOKI0056
Serial Number:	K9181401111			Date:	03/17/23
Customer:	Nokia of America Corporation			Temperature:	24°C
Attendees:	David Le, Mitchel Hill			Humidity:	26.8%
Project:	None			Barometric Pres.:	990.8 mbar
Tested by:	Brandon Hobbs	Power:	54 VDC	Job Site:	TX07

TEST SPECIFICATIONS	Test Method
FCC 27:2023	ANSI C63.26:2015
RSS-139 Issue 4:2022	ANSI C63.26:2015

COMMENTS

All measurement path losses were accounted for in the reference level offest including any attenuators, filters and DC blocks. Band n66 carriers are enabled at maximum power (40 watts/carrier).

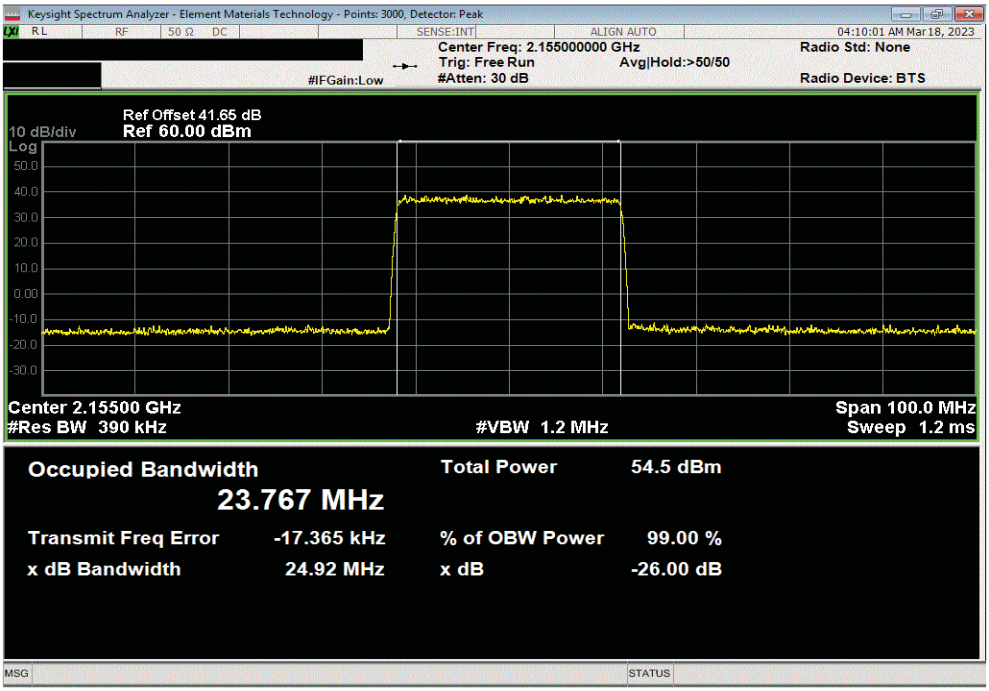
DEVIATIONS FROM TEST STANDARD

None

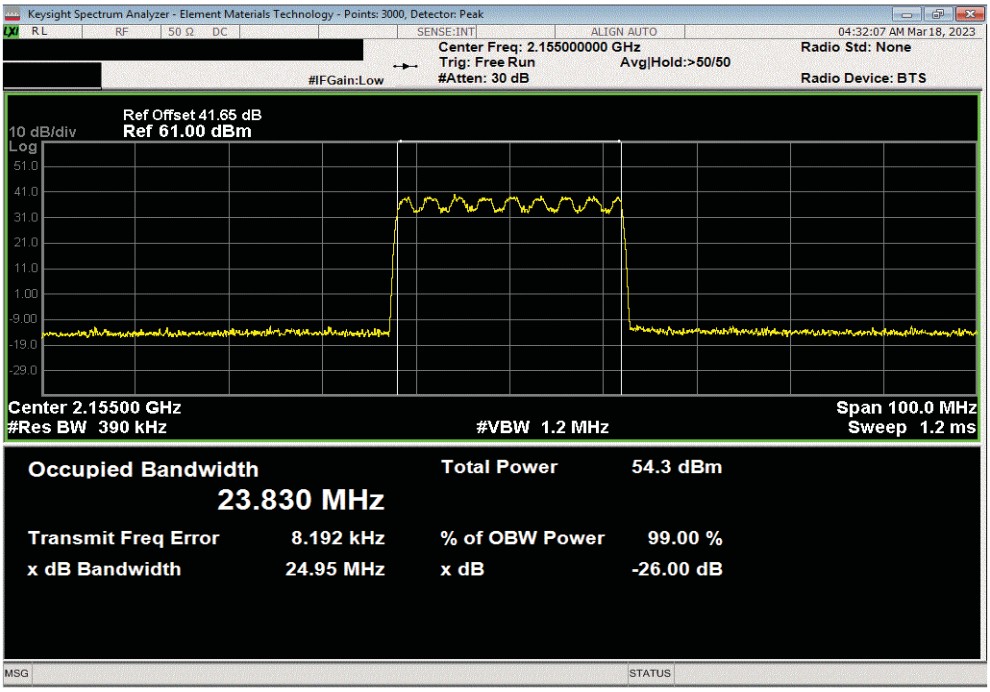
Configuration #	NOKI0056-2	Signature

	Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
Band n66 2110 MHz - 2200 MHz, 5G NR				
Port 4				
25 MHz Bandwidth				
QPSK Modulation				
Mid Channel 2155 MHz	23.767	24.918	Within Band	Pass
16-QAM Modulation				
Mid Channel 2155 MHz	23.830	24.953	Within Band	Pass
64-QAM Modulation				
Mid Channel 2155 MHz	23.723	24.803	Within Band	Pass
256-QAM Modulation				
Low Channel 2122.5 MHz	23.737	24.927	Within Band	Pass
Mid Channel 2155 MHz	23.753	24.880	Within Band	Pass
High Channel 2187.5 MHz	23.800	24.926	Within Band	Pass

Band n66 2110 MHz - 2200 MHz, 5G NR , Port 4, 25 MHz Bandwidth, QPSK Modulation, Mid Channel 2155 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			23.767	24.918	Within Band	Pass

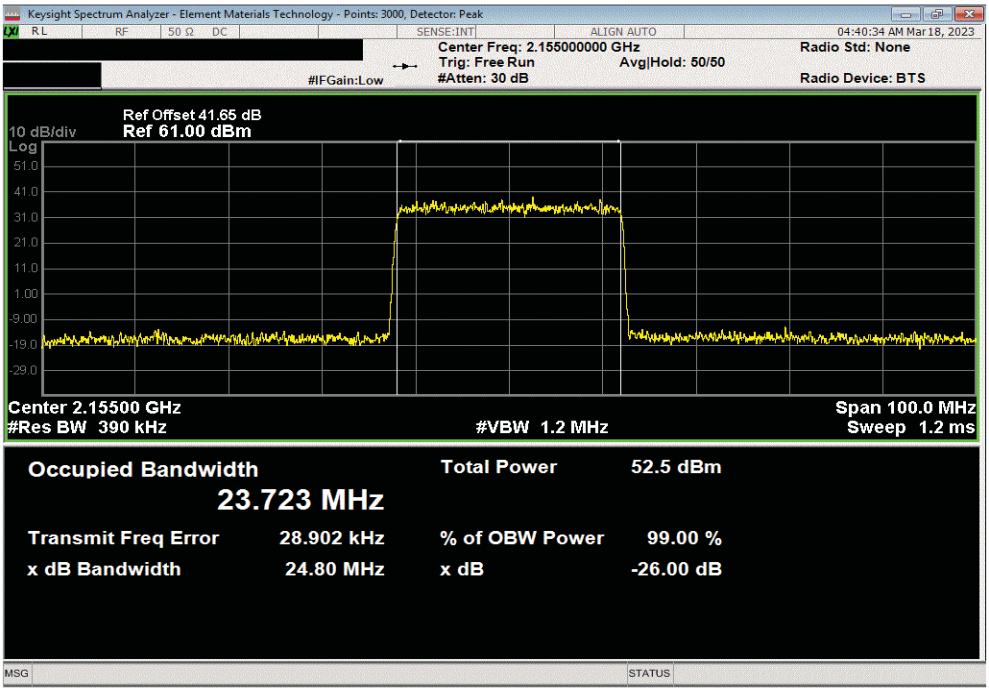


Band n66 2110 MHz - 2200 MHz, 5G NR , Port 4, 25 MHz Bandwidth, 16-QAM Modulation, Mid Channel 2155 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			23.83	24.953	Within Band	Pass



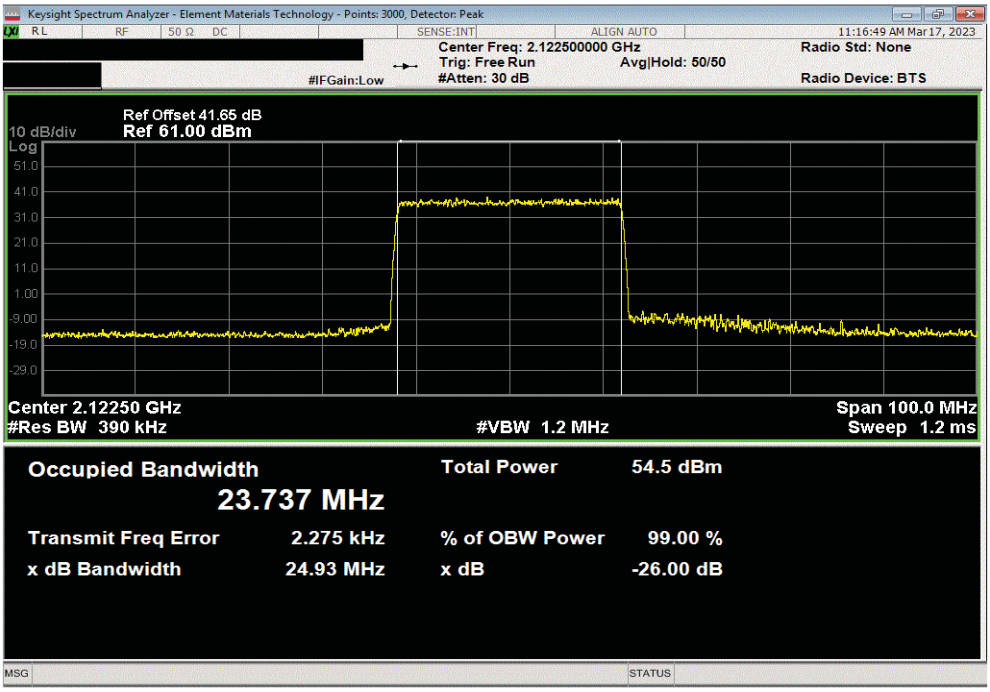
Band n66 2110 MHz - 2200 MHz, 5G NR , Port 4, 25 MHz Bandwidth, 64-QAM Modulation, Mid Channel 2155 MHz

			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			23.723	24.803	Within Band	Pass



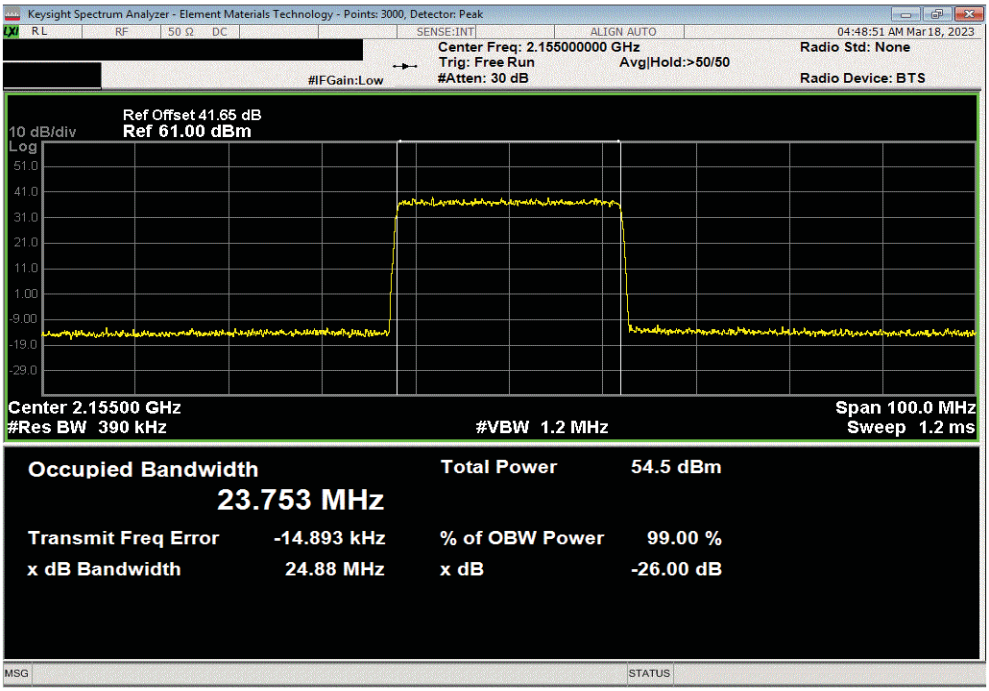
Band n66 2110 MHz - 2200 MHz, 5G NR , Port 4, 25 MHz Bandwidth, 256-QAM Modulation, Low Channel 2122.5 MHz

			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			23.737	24.927	Within Band	Pass

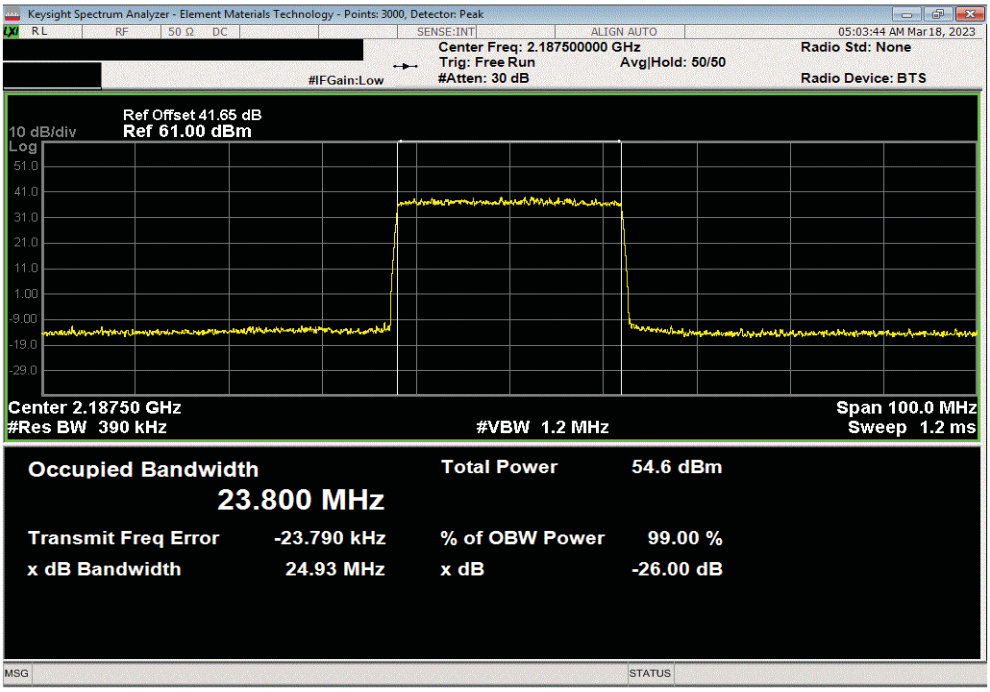


OCCUPIED BANDWIDTH - BAND n66 5G

Band n66 2110 MHz - 2200 MHz, 5G NR , Port 4, 25 MHz Bandwidth, 256-QAM Modulation, Mid Channel 2155 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			23.753	24.88	Within Band	Pass



Band n66 2110 MHz - 2200 MHz, 5G NR , Port 4, 25 MHz Bandwidth, 256-QAM Modulation, High Channel 2187.5 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			23.8	24.926	Within Band	Pass



OUTPUT POWER - BAND n25 5G

XMit 2023.02.14.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2023-02-09	2024-02-09
Block - DC	Fairview Microwave	SD3239	ANE	2023-02-16	2024-02-16
Attenuator	Fairview Microwave	SA18E 1648	TZW	2022-09-13	2023-09-13

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The fundamental emission output power (maximum average conducted output power) was measured using the channels and modes as called out on the following data sheets. The transmit power was set to its default maximum.

The method in section 5.2.4.4 of ANSI C63.26 was used to make the measurement. This method uses trace averaging across ON and OFF times of the EUT transmissions in the spectrum analyzer channel power function using an RMS detector. Following the measurement a duty cycle correction was applied by adding [10 log (1 / D)], where D is the duty cycle, to the measured power to compute the average power during the actual transmission times.

RF conducted emissions testing was performed on one port. The testing was performed on the same version of hardware (AHFIB) as the original certification test. The AHFIB antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in the original certification testing) and antenna port 4 was selected to perform the testing under this effort as allowed by ANSI C63.26-2015 paragraphs 5.2.5.3, 5.7.2i and 6.4.

OUTPUT POWER - BAND n25 5G

element

TbtTx 2022.05.02.0 XMit 2023.02.14.0

EUT:	Airscale Base Transceiver Station Remote Radio Head Model AHFIB			Work Order:	NOKI0056
Serial Number:	K9181401111			Date:	03/17/23
Customer:	Nokia of America Corporation			Temperature:	24°C
Attendees:	David Le, Mitchel Hill			Humidity:	26.8%
Project:	None			Barometric Pres.:	990.8 mbar
Tested by:	Brandon Hobbs	Power:	54 VDC	Job Site:	TX07

TEST SPECIFICATIONS	Test Method
FCC 24E:2023	ANSI C63.26:2015
RSS-133 Issue 6:2013+A1:2018	ANSI C63.26:2015

COMMENTS

All measurement path losses were accounted for in the reference level offest including any attenuators, filters and DC blocks. Band n25 carriers are enabled at maximum power (40 watts/carrier). The following is the output power measurements at the radio output ports. The output power was measured for a single carrier over the carrier channel bandwidthon port 4. The total output power for multiport (2x2 MIMO, 4x4 MIMO) operation was determined based upon ANSI C63.26 clauses 6.4.3.1 and 6.4.3.2.4 (10 log Nout) The total output power for two port operation is the single port power +3 [i.e. 10*log(2)]. The total power for four port operations is single port power +6 dB [i.e. 10*log(4)].

DEVIATIONS FROM TEST STANDARD

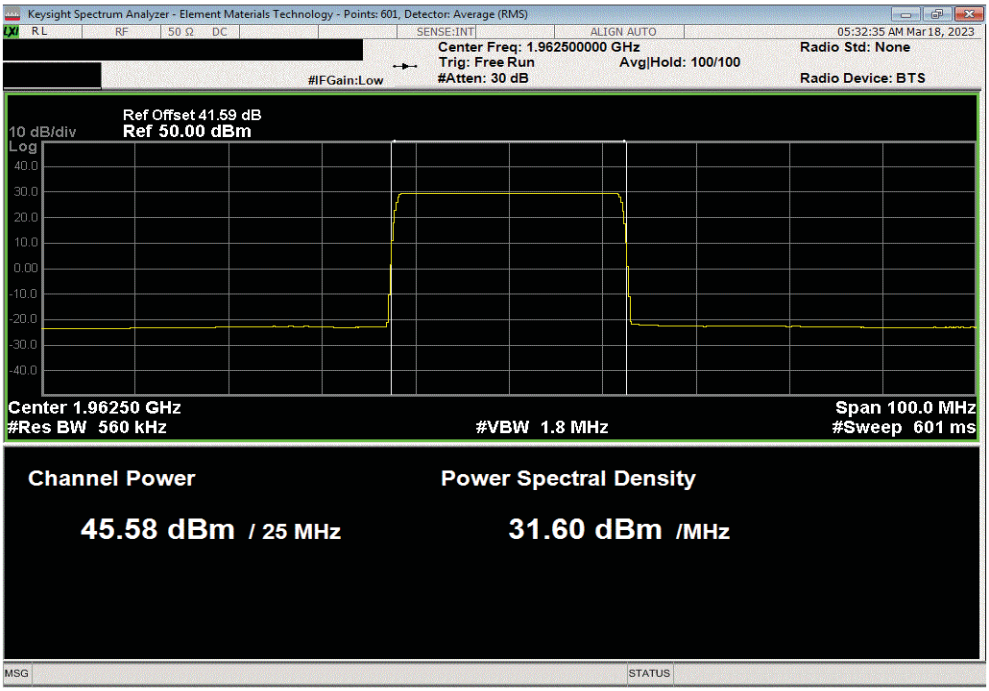
None

Configuration #	NOKI0056-2	Signature

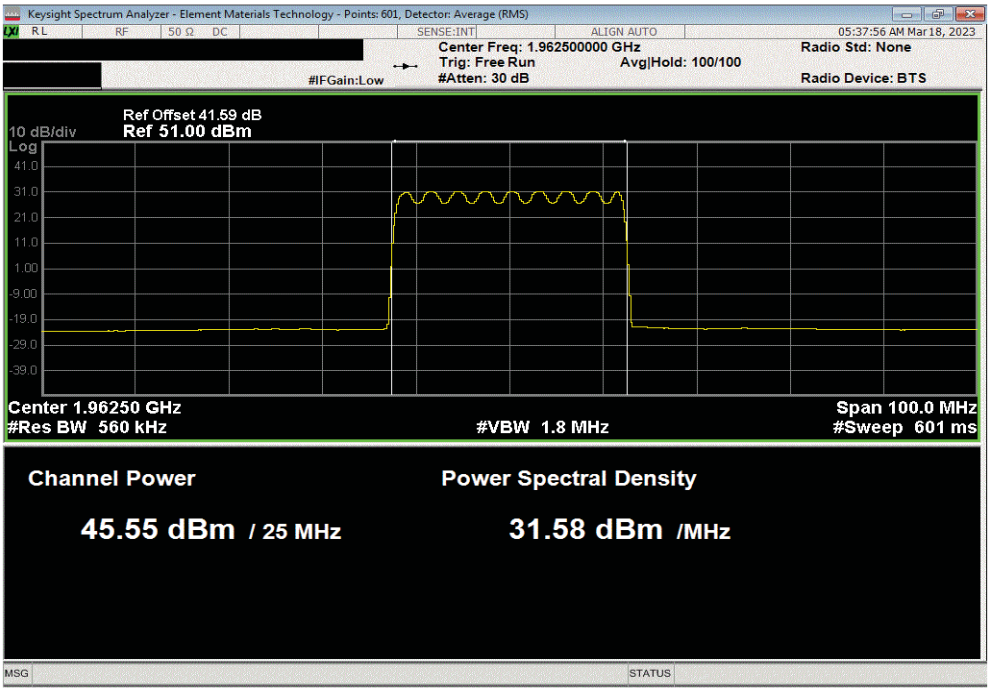
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW
Band n25 1930 MHz - 1995 MHz, 5G NR					
Port 4					
25 MHz Bandwidth					
QPSK Modulation					
Mid Channel 1962.5 MHz	45.576	0	45.576	48.576	51.576
16-QAM Modulation					
Mid Channel 1962.5 MHz	45.554	0	45.554	48.554	51.554
64-QAM Modulation					
Mid Channel 1962.5 MHz	45.561	0	45.561	48.561	51.561
256-QAM Modulation					
Low Channel 1942.5 MHz	45.271	0	45.271	48.271	51.271
Mid Channel 1962.5 MHz	45.582	0	45.582	48.582	51.582
High Channel 1982.5 MHz	45.607	0	45.607	48.607	51.607

OUTPUT POWER - BAND n25 5G

Band n25 1930 MHz - 1995 MHz, 5G NR , Port 4, 25 MHz Bandwidth, QPSK Modulation, Mid Channel 1962.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	
	45.576	0	45.576	48.576	51.576	

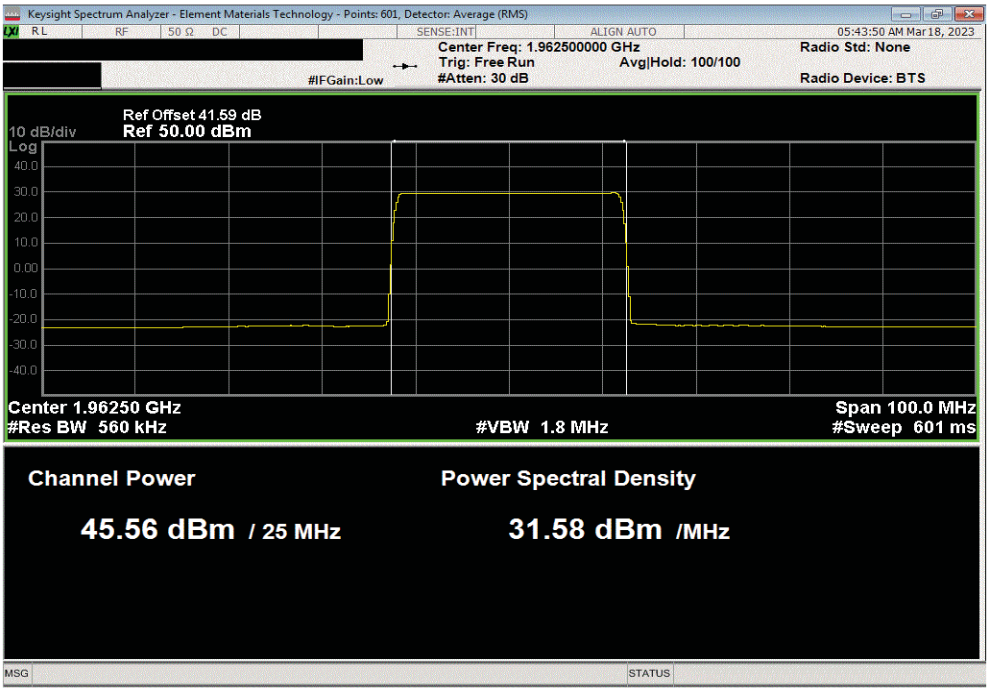


Band n25 1930 MHz - 1995 MHz, 5G NR , Port 4, 25 MHz Bandwidth, 16-QAM Modulation, Mid Channel 1962.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	ro Port (2x2 MIMur Port (4x4 MIM dBm/Carrier BW dBm/Carrier BW		
	45.554	0	45.554	48.554	51.554	

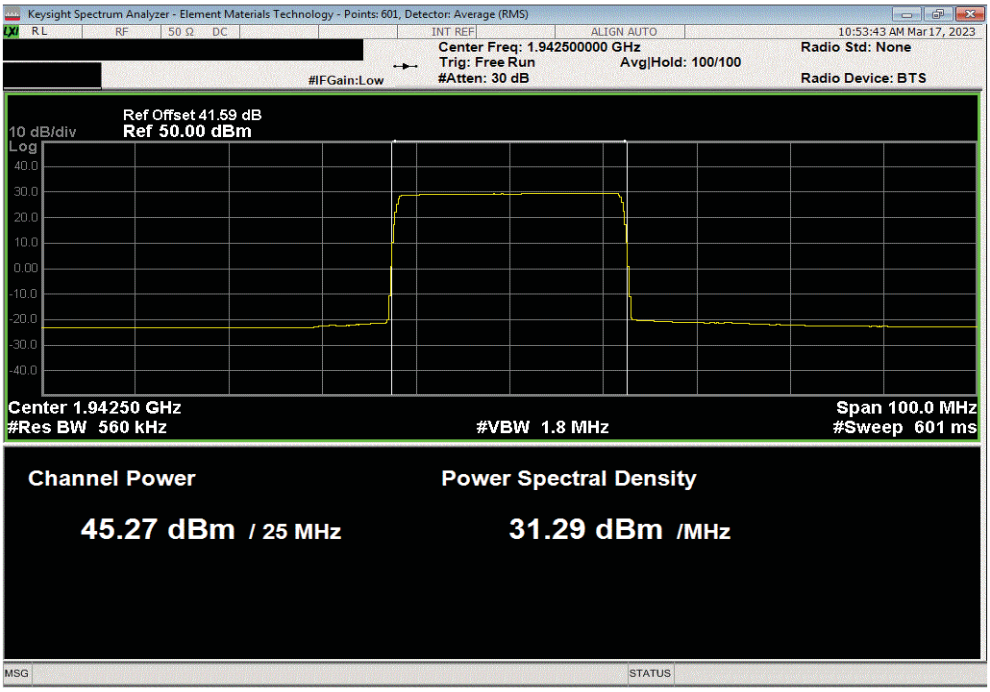


OUTPUT POWER - BAND n25 5G

Band n25 1930 MHz - 1995 MHz, 5G NR , Port 4, 25 MHz Bandwidth, 64-QAM Modulation, Mid Channel 1962.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	
	45.561	0	45.561	48.561	51.561	

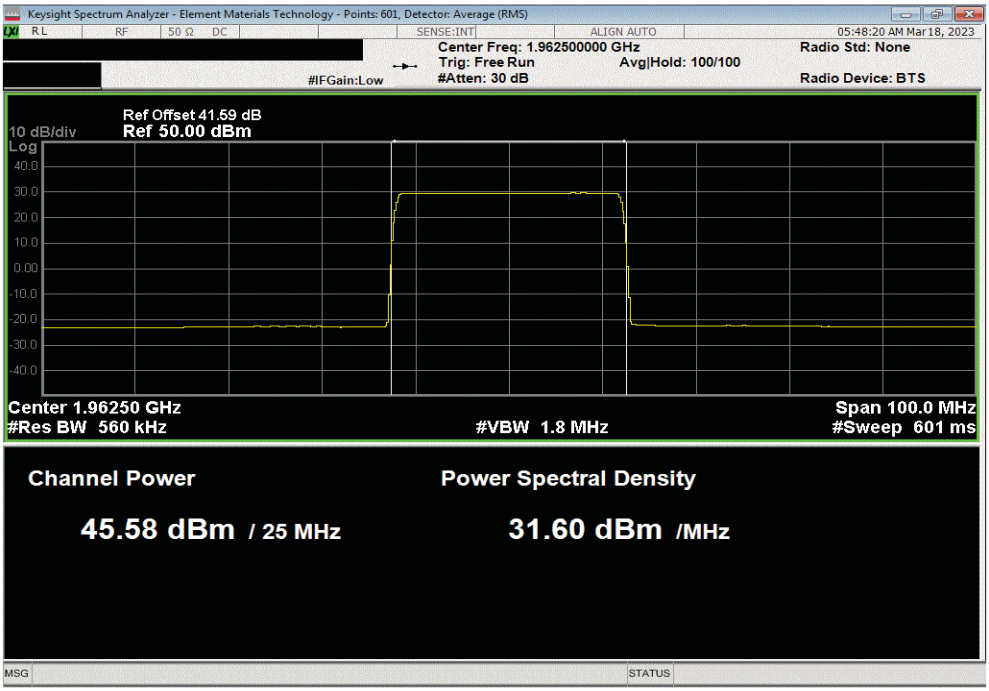


Band n25 1930 MHz - 1995 MHz, 5G NR , Port 4, 25 MHz Bandwidth, 256-QAM Modulation, Low Channel 1942.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	ro Port (2x2 MIMur Port (4x4 MIN dBm/Carrier BW	dBm/Carrier BW	
	45.271	0	45.271	48.271	51.271	

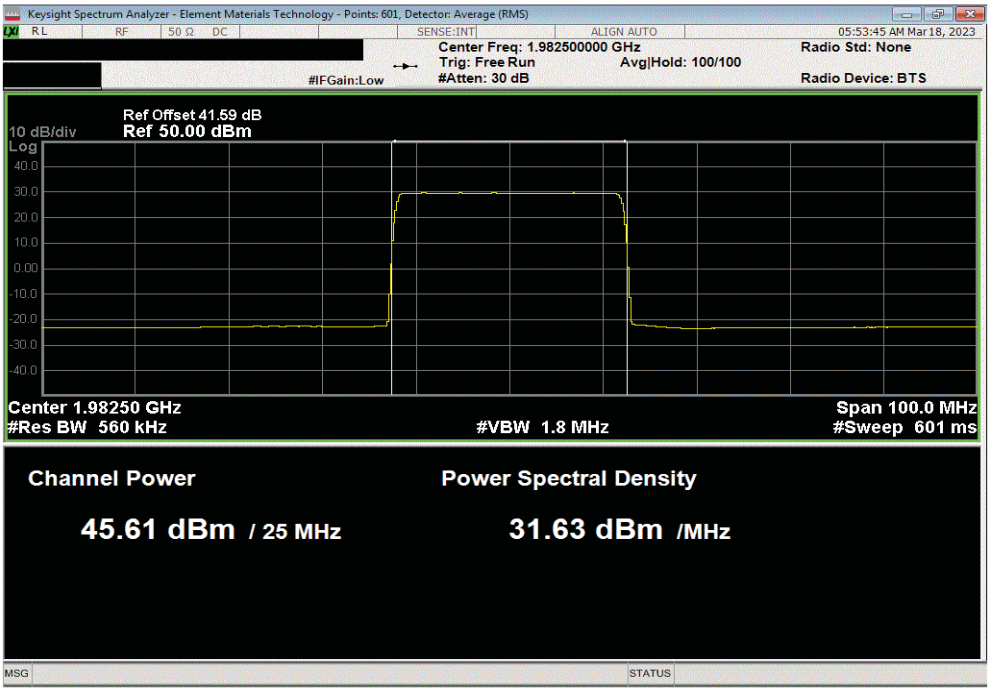


OUTPUT POWER - BAND n25 5G

Band n25 1930 MHz - 1995 MHz, 5G NR , Port 4, 25 MHz Bandwidth, 256-QAM Modulation, Mid Channel 1962.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	
	45.582	0	45.582	48.582	51.582	



Band n25 1930 MHz - 1995 MHz, 5G NR , Port 4, 25 MHz Bandwidth, 256-QAM Modulation, High Channel 1982.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	ro Port (2x2 MIMur Port (4x4 MIN dBm/Carrier BW	dBm/Carrier BW	
	45.607	0	45.607	48.607	51.607	



OUTPUT POWER - BAND n66 5G

XMit 2023.02.14.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2023-02-09	2024-02-09
Block - DC	Fairview Microwave	SD3239	ANE	2023-02-16	2024-02-16
Attenuator	Fairview Microwave	SA18E 1648	TZW	2022-09-13	2023-09-13

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

The fundamental emission output power (maximum average conducted output power) was measured using the channels and modes as called out on the following data sheets. The transmit power was set to its default maximum.

The method in section 5.2.4.4 of ANSI C63.26 was used to make the measurements. This method uses trace averaging across the ON and OFF times of the EUT transmissions in the spectrum analyzer channel power function using an RMS detector. Following the measurement a duty cycle correction was applied by adding [10 log (1/D)], where D is the duty cycle in decimal, to the measured power to compute the average power during the actual transmission times

RF conducted emissions testing was performed on one port. The testing was performed on the same version of hardware (AHFIB) as the original certification test. The AHFIB antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in the original certification testing) and antenna port 4 was selected to perform the testing under this effort as allowed by ANSI C63.26-2015 paragraphs 5.2.5.3, 5.7.2i and 6.4.

The total average transmit power of all antenna ports was determined per ANSI C63.26-2105 paragraph 6.4.3.1.

OUTPUT POWER - BAND n66 5G

element

TbtTx 2022.05.02.0 XMit 2023.02.14.0

EUT:	Airscale Base Transceiver Station Remote Radio Head Model AHFIB			Work Order:	NOKI0056
Serial Number:	K9181401111			Date:	03/17/23
Customer:	Nokia of America Corporation			Temperature:	24.2°C
Attendees:	David Le, Mitchel Hill			Humidity:	27.4%
Project:	None			Barometric Pres.:	991 mbar
Tested by:	Brandon Hobbs	Power:	54 VDC	Job Site:	TX07

TEST SPECIFICATIONS	Test Method
FCC 27:2023	ANSI C63.26:2015
RSS-139 Issue 4:2022	ANSI C63.26:2015

COMMENTS

All measurement path losses were accounted for in the reference level offest including any attenuators, filters and DC blocks. Band n66 carriers are enabled at maximum power (40 watts/carrier). The following is the output power measurements at the radio output ports. The output power was measured for a single carrier over the carrier channel bandwidthon port 4. The total output power for multiport (2x2 MIMO, 4x4 MIMO) operation was determined based upon ANSI C63.26 clauses 6.4.3.1 and 6.4.3.2.4 (10 log Nout) The total output power for two port operation is the single port power +3 [i.e. 10*log(2)]. The total power for four port operations is single port power +6 dB [i.e. 10*log(4)].

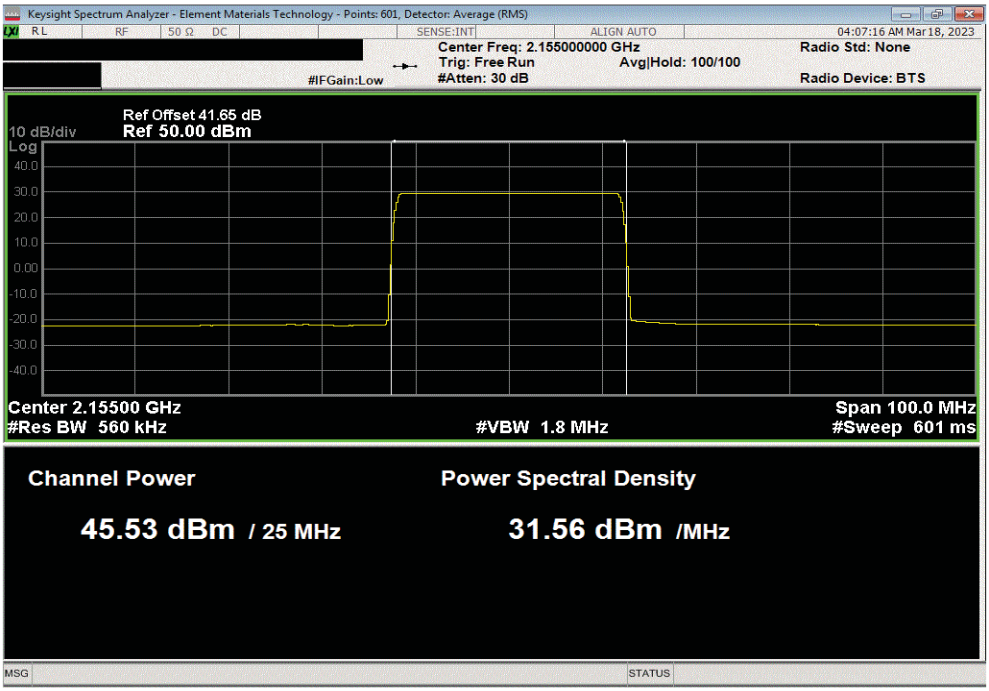
DEVIATIONS FROM TEST STANDARD

None

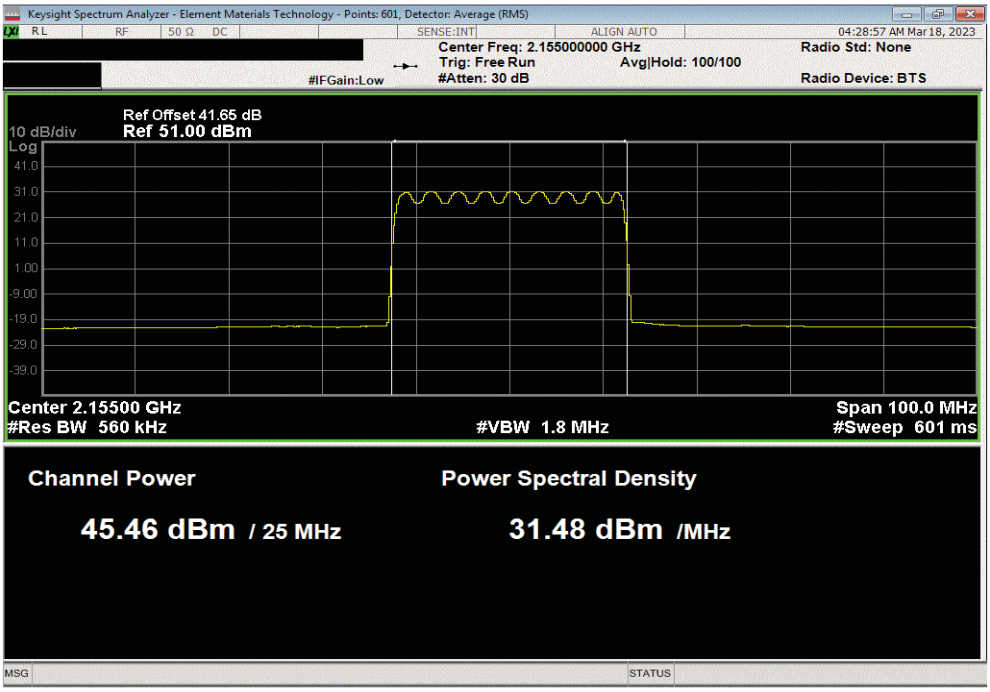
Configuration #	NOKI0056-2	Signature

	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW
Band n66 2110 MHz - 2200 MHz, 5G NR					
Port 4					
25 MHz Bandwidth					
QPSK Modulation					
Mid Channel 2155 MHz	45.535	0	45.535	48.535	51.535
16-QAM Modulation					
Mid Channel 2155 MHz	45.463	0	45.463	48.463	51.463
64-QAM Modulation					
Mid Channel 2155 MHz	45.552	0	45.552	48.552	51.552
256-QAM Modulation					
Low Channel 2122.5 MHz	45.523	0	45.523	48.523	51.523
Mid Channel 2155 MHz	45.580	0	45.580	48.580	51.580
High Channel 2187.5 MHz	45.599	0	45.599	48.599	51.599

Band n66 2110 MHz - 2200 MHz, 5G NR , Port 4, 25 MHz Bandwidth, QPSK Modulation, Mid Channel 2155 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	
	45.535	0	45.535	48.535	51.535	

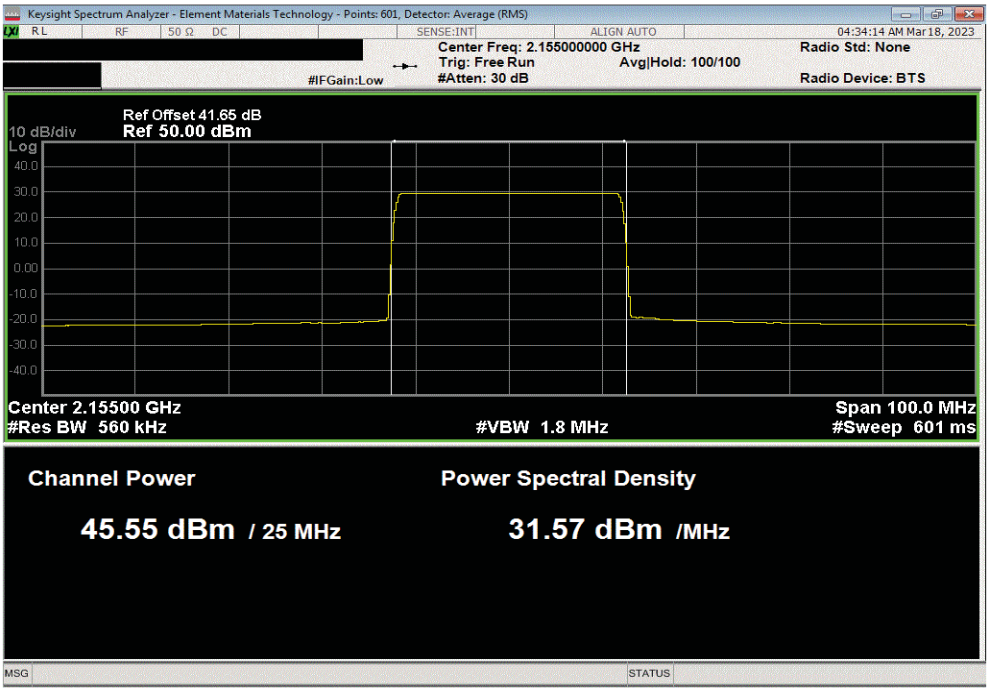


Band n66 2110 MHz - 2200 MHz, 5G NR , Port 4, 25 MHz Bandwidth, 16-QAM Modulation, Mid Channel 2155 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	ro Port (2x2 MIMur Port (4x4 MIN dBm/Carrier BW	dBm/Carrier BW	
	45.463	0	45.463	48.463	51.463	

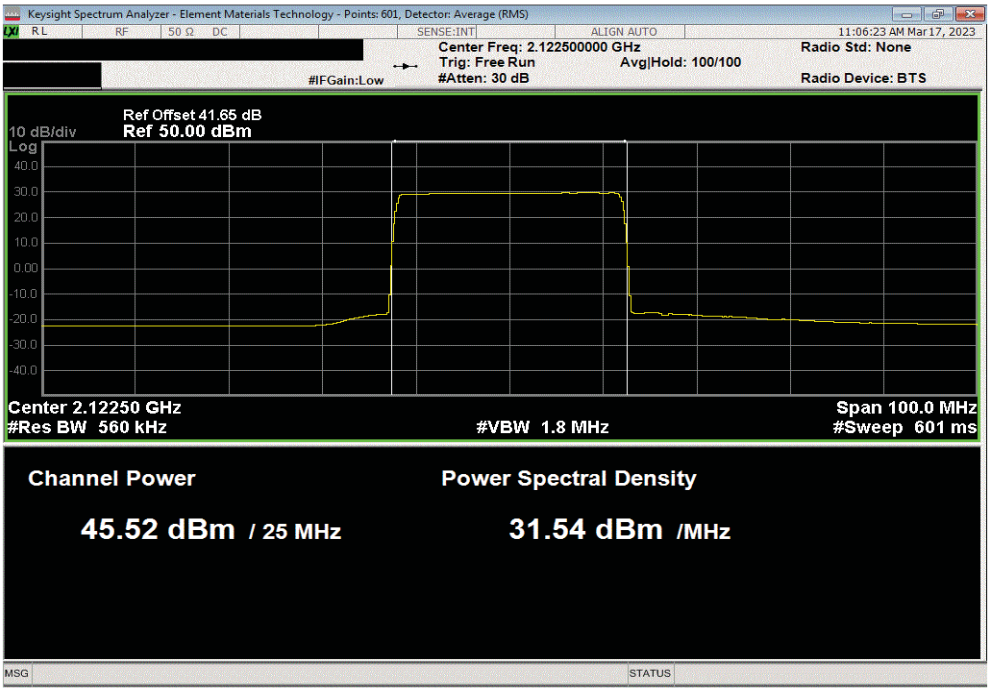


OUTPUT POWER - BAND n66 5G

Band n66 2110 MHz - 2200 MHz, 5G NR , Port 4, 25 MHz Bandwidth, 64-QAM Modulation, Mid Channel 2155 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	
	45.552	0	45.552	48.552	51.552	

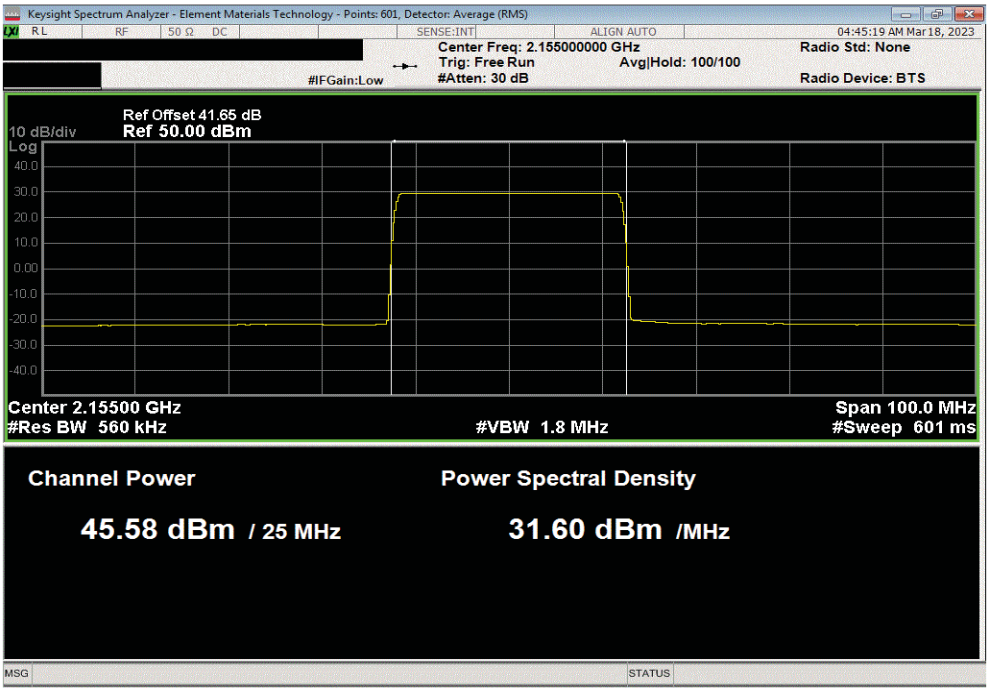


Band n66 2110 MHz - 2200 MHz, 5G NR , Port 4, 25 MHz Bandwidth, 256-QAM Modulation, Low Channel 2122.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	ro Port (2x2 MIMur Port (4x4 MIN dBm/Carrier BW	dBm/Carrier BW	
	45.523	0	45.523	48.523	51.523	

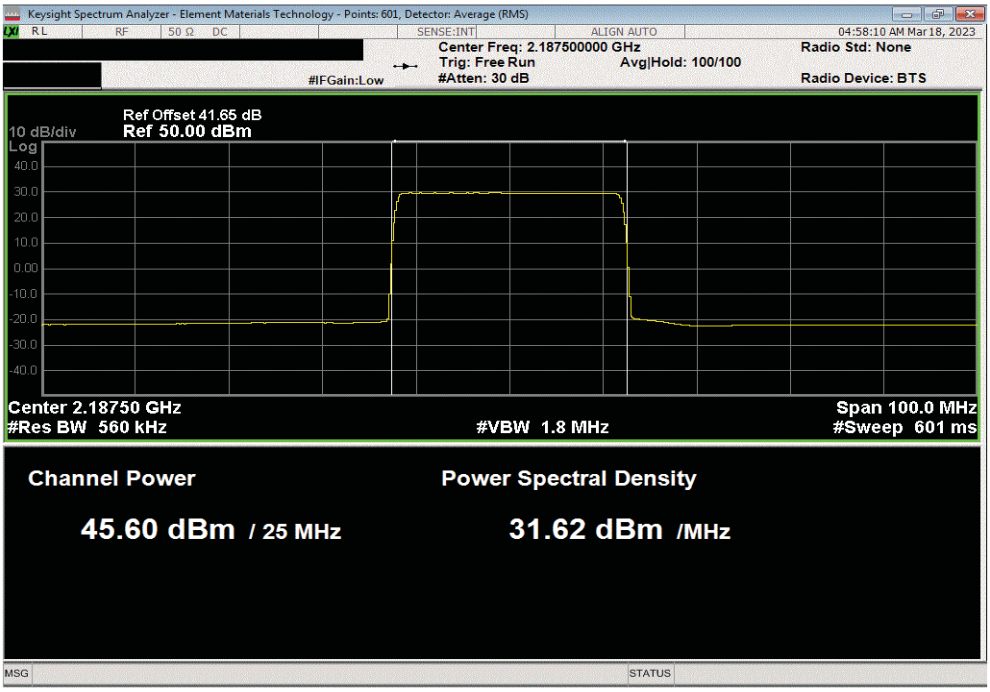


OUTPUT POWER - BAND n66 5G

Band n66 2110 MHz - 2200 MHz, 5G NR , Port 4, 25 MHz Bandwidth, 256-QAM Modulation, Mid Channel 2155 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	
	45.58	0	45.58	48.58	51.58	



Band n66 2110 MHz - 2200 MHz, 5G NR , Port 4, 25 MHz Bandwidth, 256-QAM Modulation, High Channel 2187.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	ro Port (2x2 MIMur Port (4x4 MIN dBm/Carrier BW	dBm/Carrier BW	
	45.599	0	45.599	48.599	51.599	



PEAK TO AVERAGE RATIO (PAPR) CCDF - BAND n25 5G

XMit 2023.02.14.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2023-02-09	2024-02-09
Block - DC	Fairview Microwave	SD3239	ANE	2023-02-16	2024-02-16
Attenuator	Fairview Microwave	SA18E 1648	TZW	2022-09-13	2023-09-13

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

Because the conducted Output Power was measured using a RMS Average detector, the Peak to Average Power Ratio (PAPR) was measured to show that the maximum peak-max-hold spectrum to the maximum of the average spectrum does not exceed the rule part defined limit.

The PAPR measurement method is described in ANSI C63.26 section 5.2.3.4.
The PAPR was measured using the CCDF function of the spectrum analyzer.

Per FCC part 24.232(d) and RSS 133 6.4, the PAPR limit shall not exceed 13 dB for more than the ANSI described 0.1% of the time.

RF conducted emissions testing was performed on one port. The testing was performed on the same version of hardware (AHFIB) as the original certification test. The AHFIB antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in the original certification testing) and antenna port 4 was selected to perform the testing under this effort as allowed by ANSI C63.26-2015 paragraphs 5.2.5.3, 5.7.2i and 6.4.

PEAK TO AVERAGE RATIO (PAPR) CCDF - BAND n25 5G

element

TbtTx 2022.05.02.0 XMit 2023.02.14.0

EUT:	Airscale Base Transceiver Station Remote Radio Head Model AHFIB			Work Order:	NOKI0056
Serial Number:	K9181401111			Date:	03/17/2023
Customer:	Nokia of America Corporation			Temperature:	22.9°C
Attendees:	David Le, Mitchel Hill			Humidity:	48.3%
Project:	None			Barometric Pres.:	990.3 mbar
Tested by:	Brandon Hobbs	Power:	54 VDC	Job Site:	TX07

TEST SPECIFICATIONS	Test Method
FCC 24E:2023	ANSI C63.26:2015
RSS-133 Issue 6:2013+A1:2018	ANSI C63.26:2015

COMMENTS

All measurement path losses were accounted for in the reference level offest including any attenuators, filters and DC blocks. Band n25 carriers are enabled at maximum power (40 watts/carrier).

DEVIATIONS FROM TEST STANDARD

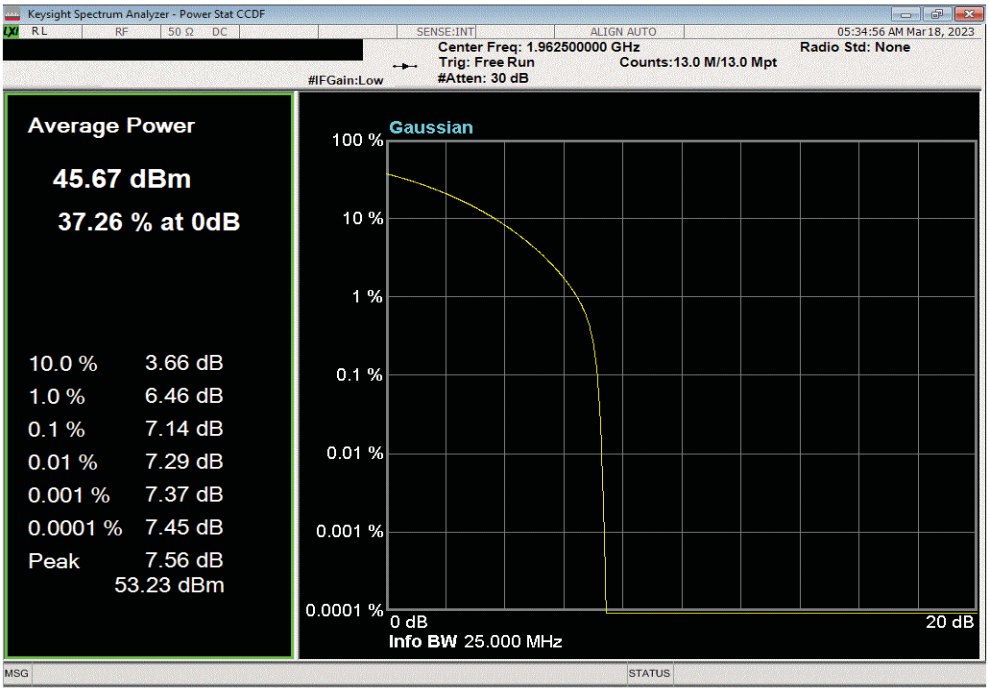
None

Configuration #	NOKI0056-2	Signature

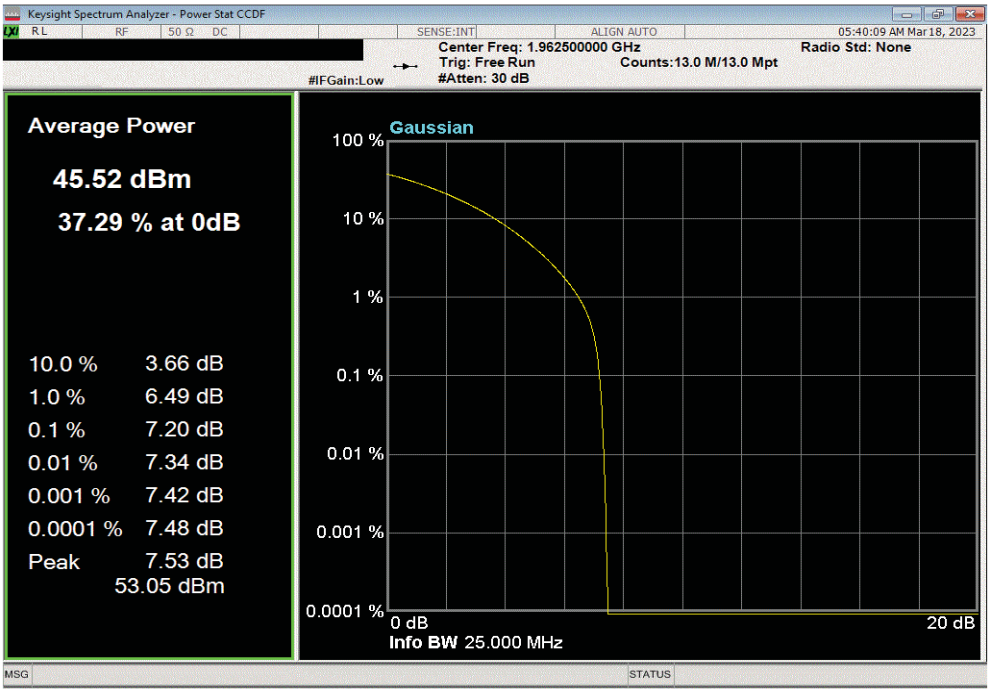
	0.1% PAPR Value (dB)	PAPR Limit (dB)	Results
Band n25 1930 MHz - 1995 MHz, 5G NR			
Port 4			
25 MHz Bandwidth			
QPSK Modulation			
Mid Channel 1962.5 MHz	7.14	13	Pass
16-QAM Modulation			
Mid Channel 1962.5 MHz	7.2	13	Pass
64-QAM Modulation			
Mid Channel 1962.5 MHz	7.14	13	Pass
256-QAM Modulation			
Low Channel 1942.5 MHz	7.42	13	Pass
Mid Channel 1962.5 MHz	7.13	13	Pass
High Channel 1982.5 MHz	7.20	13	Pass

PEAK TO AVERAGE RATIO (PAPR) CCDF - BAND n25 5G

Band n25 1930 MHz - 1995 MHz, 5G NR , Port 4, 25 MHz Bandwidth, QPSK Modulation, Mid Channel 1962.5 MHz						
				0.1% PAPR Value (dB)	PAPR Limit (dB)	Results
				7.14	13	Pass

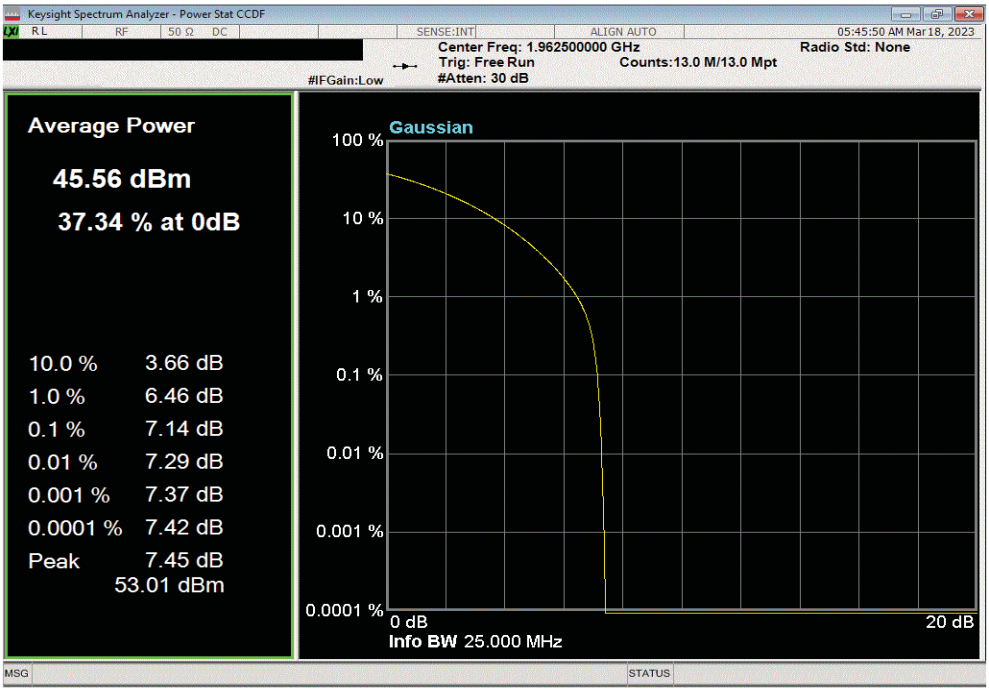


Band n25 1930 MHz - 1995 MHz, 5G NR , Port 4, 25 MHz Bandwidth, 16-QAM Modulation, Mid Channel 1962.5 MHz						
				0.1% PAPR Value (dB)	PAPR Limit (dB)	Results
				7.2	13	Pass

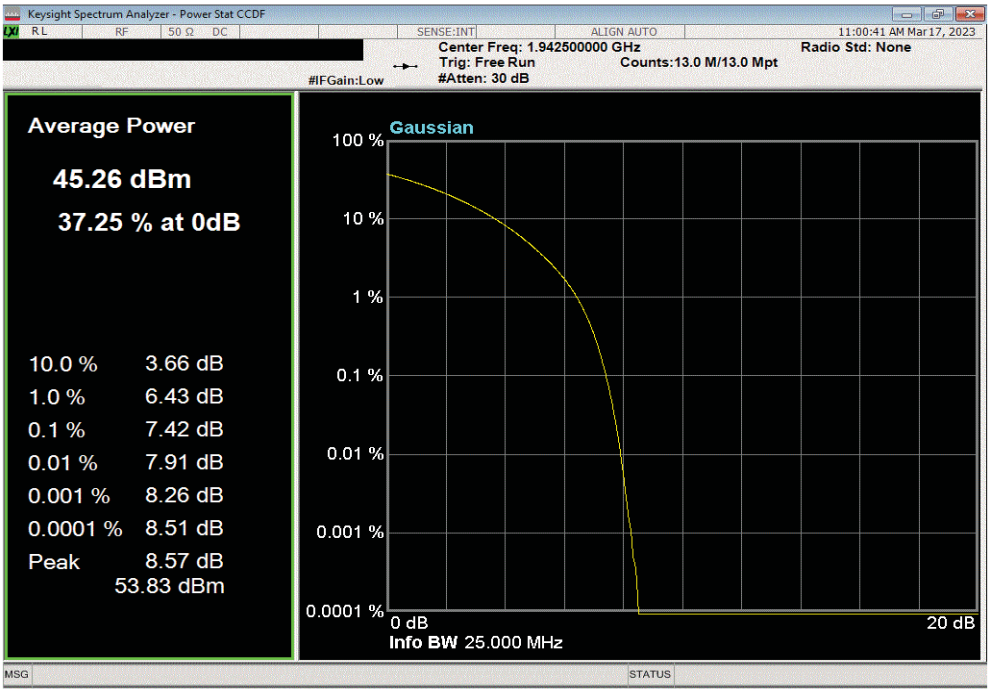


PEAK TO AVERAGE RATIO (PAPR) CCDF - BAND n25 5G

Band n25 1930 MHz - 1995 MHz, 5G NR , Port 4, 25 MHz Bandwidth, 64-QAM Modulation, Mid Channel 1962.5 MHz						
				0.1% PAPR Value (dB)	PAPR Limit (dB)	Results
				7.14	13	Pass

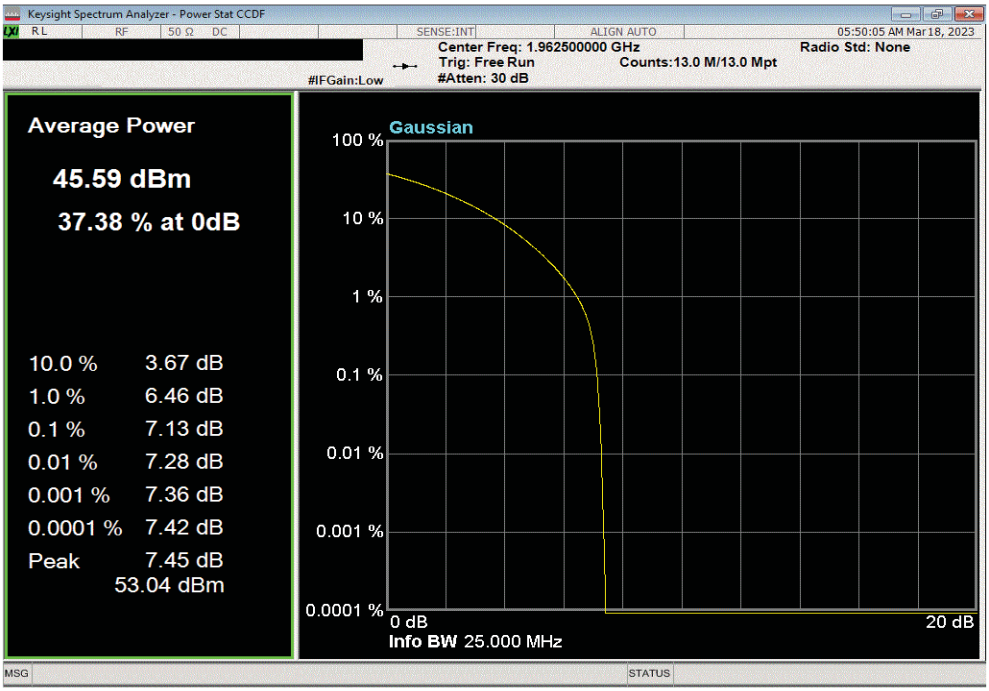


Band n25 1930 MHz - 1995 MHz, 5G NR , Port 4, 25 MHz Bandwidth, 256-QAM Modulation, Low Channel 1942.5 MHz						
				0.1% PAPR Value (dB)	PAPR Limit (dB)	Results
				7.42	13	Pass

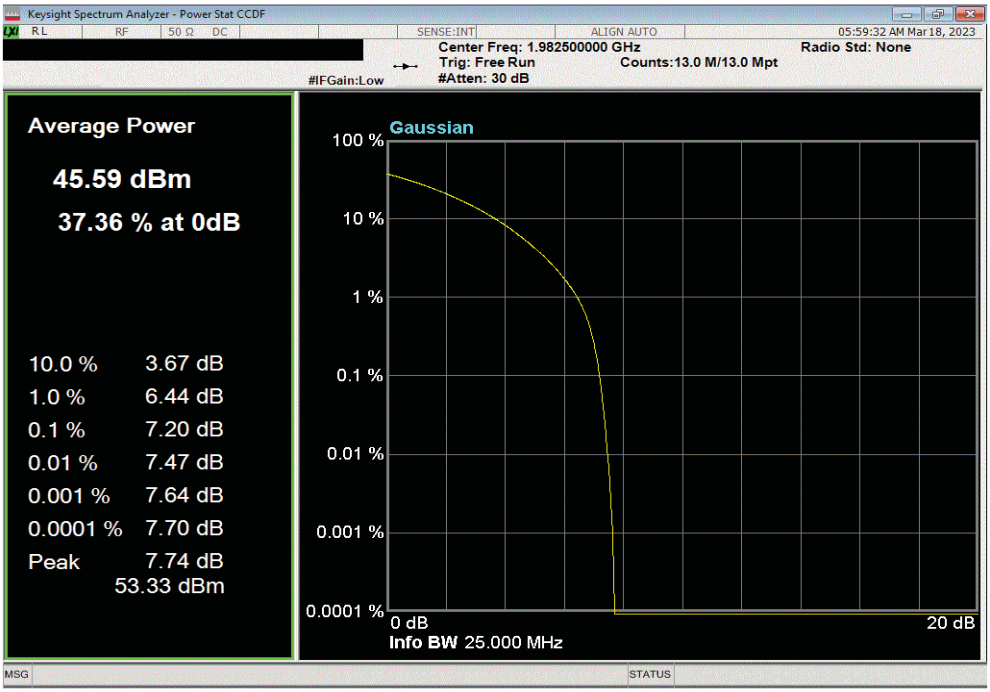


PEAK TO AVERAGE RATIO (PAPR) CCDF - BAND n25 5G

Band n25 1930 MHz - 1995 MHz, 5G NR , Port 4, 25 MHz Bandwidth, 256-QAM Modulation, Mid Channel 1962.5 MHz						
				0.1% PAPR Value (dB)	PAPR Limit (dB)	Results
				7.13	13	Pass



Band n25 1930 MHz - 1995 MHz, 5G NR , Port 4, 25 MHz Bandwidth, 256-QAM Modulation, High Channel 1982.5 MHz						
				0.1% PAPR Value (dB)	PAPR Limit (dB)	Results
				7.2	13	Pass



PEAK TO AVERAGE RATIO (PAPR) CCDF - BAND n66 5G

XMit 2023.02.14.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2023-02-09	2024-02-09
Block - DC	Fairview Microwave	SD3239	ANE	2023-02-16	2024-02-16
Attenuator	Fairview Microwave	SA18E 1648	TZW	2022-09-13	2023-09-13

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

Because the conducted Output Power was measured using a RMS Average detector, the Peak to Average Power Ratio (PAPR) was measured to show that the maximum peak-max-hold spectrum to the maximum of the average spectrum does not exceed the rule part defined limit.

The PAPR measurement method is described in ANSI C63.26 section 5.2.3.4.

The PAPR was measured using the CCDF function of the spectrum analyzer.

Per FCC part 24.232(d) and RSS 133 6.4, the PAPR limit shall not exceed 13 dB for more than the ANSI described 0.1% of the time.

Per FCC part 27.50(d)(5) and RSS-139 6.5, the peak-to-average power ratio (PAPR) shall not exceed 13dB.

RF conducted emissions testing was performed on one port. The testing was performed on the same version of hardware (AHFIB) as the original certification test. The AHFIB antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in the original certification testing) and antenna port 4 was selected to perform the testing under this effort as allowed by ANSI C63.26-2015 paragraphs 5.2.5.3, 5.7.2i and 6.4.

PEAK TO AVERAGE RATIO (PAPR) CCDF - BAND n66 5G

element

TbtTx 2022.05.02.0 XMit 2023.02.14.0

EUT:	Airscale Base Transceiver Station Remote Radio Head Model AHFIB			Work Order:	NOKI0056
Serial Number:	K9181401111			Date:	03/17/23
Customer:	Nokia of America Corporation			Temperature:	22.8°C
Attendees:	David Le, Mitchel Hill			Humidity:	47.3%
Project:	None			Barometric Pres.:	990.4 mbar
Tested by:	Brandon Hobbs	Power:	54 VDC	Job Site:	TX07

TEST SPECIFICATIONS	Test Method
FCC 27:2023	ANSI C63.26:2015
RSS-139 Issue 4:2022	ANSI C63.26:2015

COMMENTS

All measurement path losses were accounted for in the reference level offest including any attenuators, filters and DC blocks. Band n66 carriers are enabled at maximum power (40 watts/carrier).

DEVIATIONS FROM TEST STANDARD

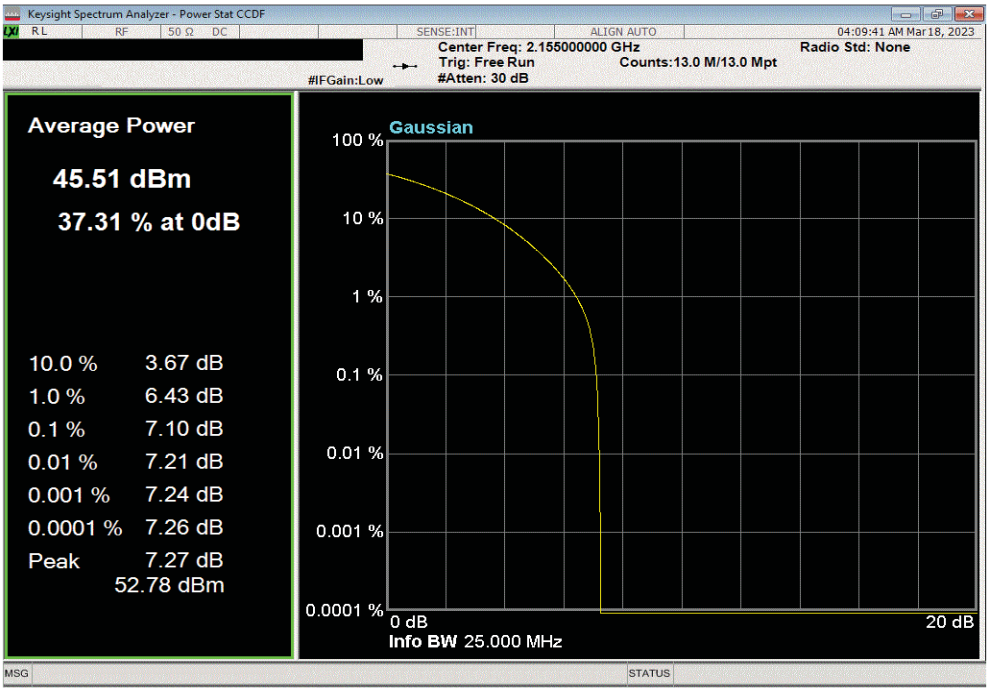
None

Configuration #	NOKI0056-2	Signature

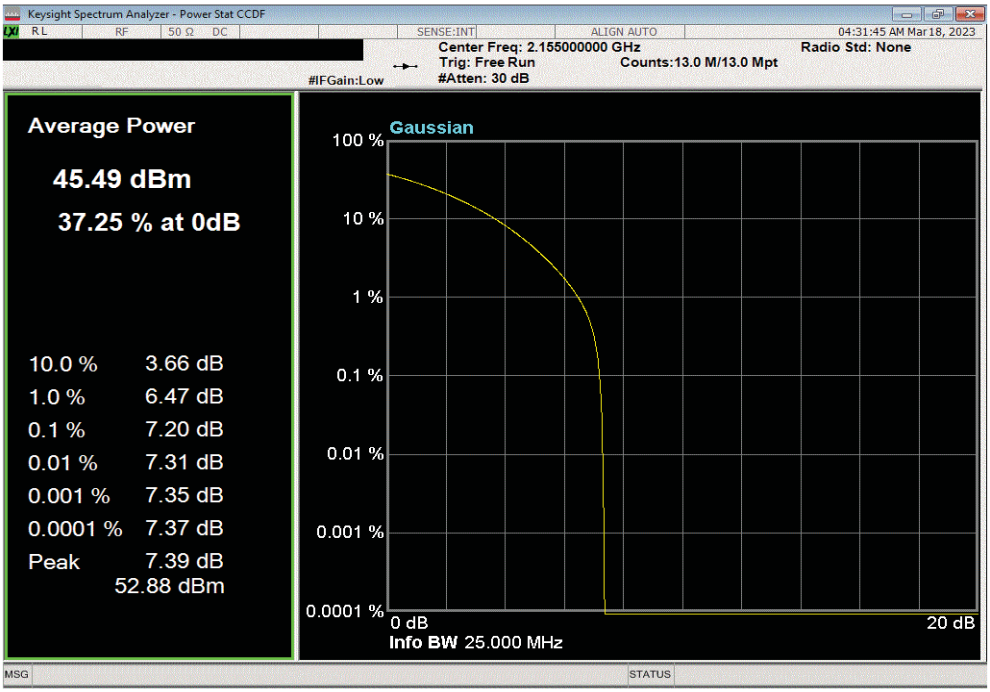
	Value (dB)	Limit < (dB)	Results
Band n66 2110 MHz - 2200 MHz, 5G NR			
Port 4			
25 MHz Bandwidth			
QPSK Modulation			
Mid Channel 2155 MHz	7.10	13	Pass
16-QAM Modulation			
Mid Channel 2155 MHz	7.20	13	Pass
64-QAM Modulation			
Mid Channel 2155 MHz	7.10	13	Pass
256-QAM Modulation			
Low Channel 2122.5 MHz	7.19	13	Pass
Mid Channel 2155 MHz	7.14	13	Pass
High Channel 2187.5 MHz	7.20	13	Pass

PEAK TO AVERAGE RATIO (PAPR) CCDF - BAND n66 5G

Band n66 2110 MHz - 2200 MHz, 5G NR , Port 4, 25 MHz Bandwidth, QPSK Modulation, Mid Channel 2155 MHz						
				Value (dB)	Limit < (dB)	Results
				7.1	13	Pass

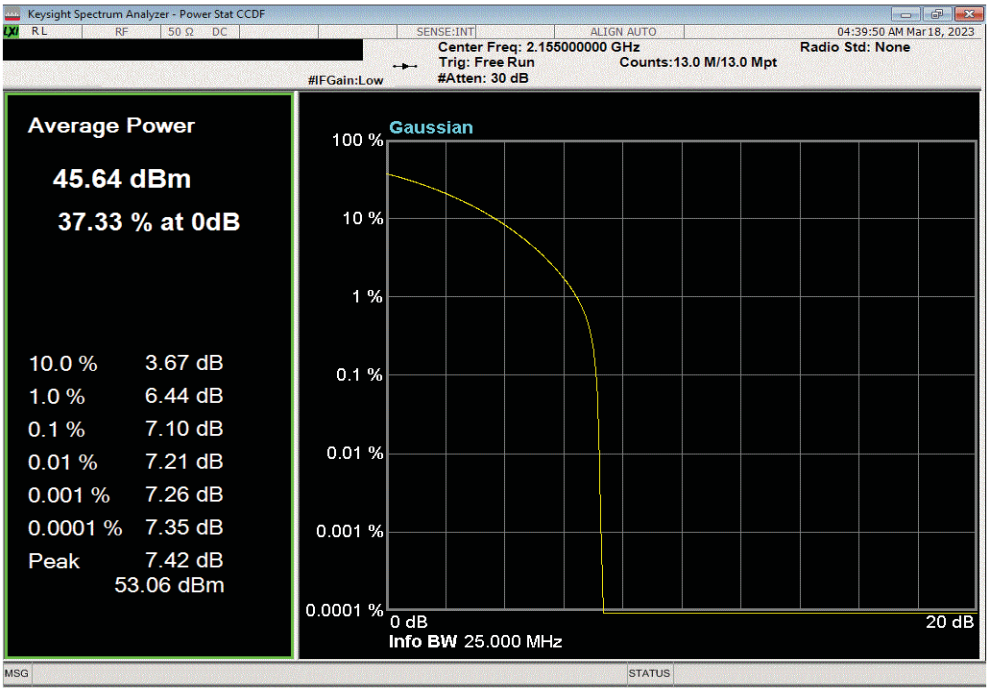


Band n66 2110 MHz - 2200 MHz, 5G NR , Port 4, 25 MHz Bandwidth, 16-QAM Modulation, Mid Channel 2155 MHz						
				Value (dB)	Limit < (dB)	Results
				7.2	13	Pass

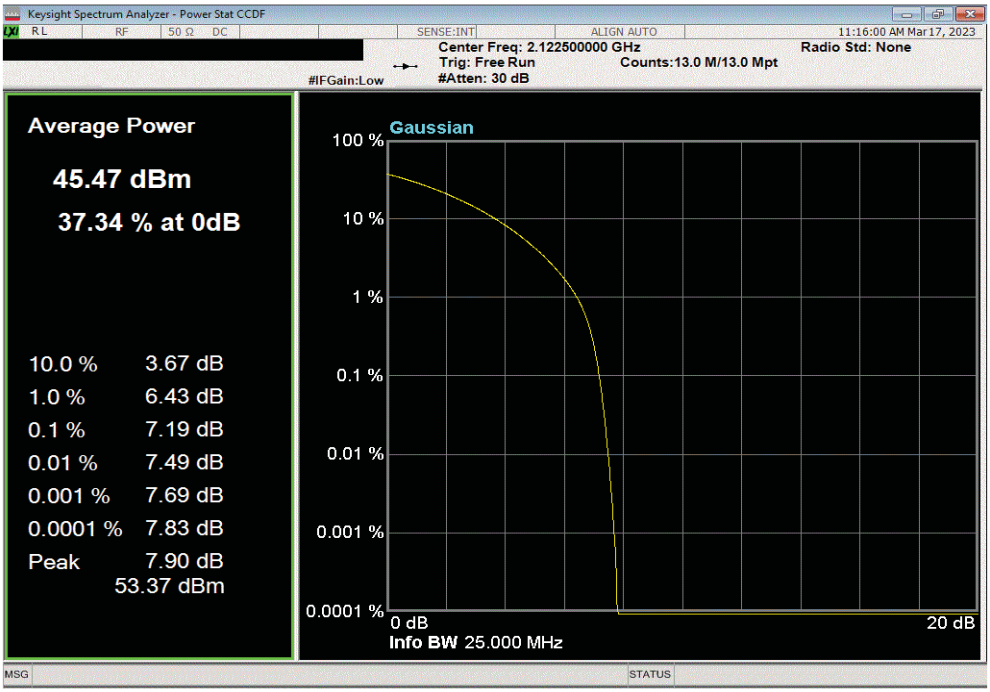


PEAK TO AVERAGE RATIO (PAPR) CCDF - BAND n66 5G

Band n66 2110 MHz - 2200 MHz, 5G NR , Port 4, 25 MHz Bandwidth, 64-QAM Modulation, Mid Channel 2155 MHz						
				Value (dB)	Limit < (dB)	Results
				7.1	13	Pass

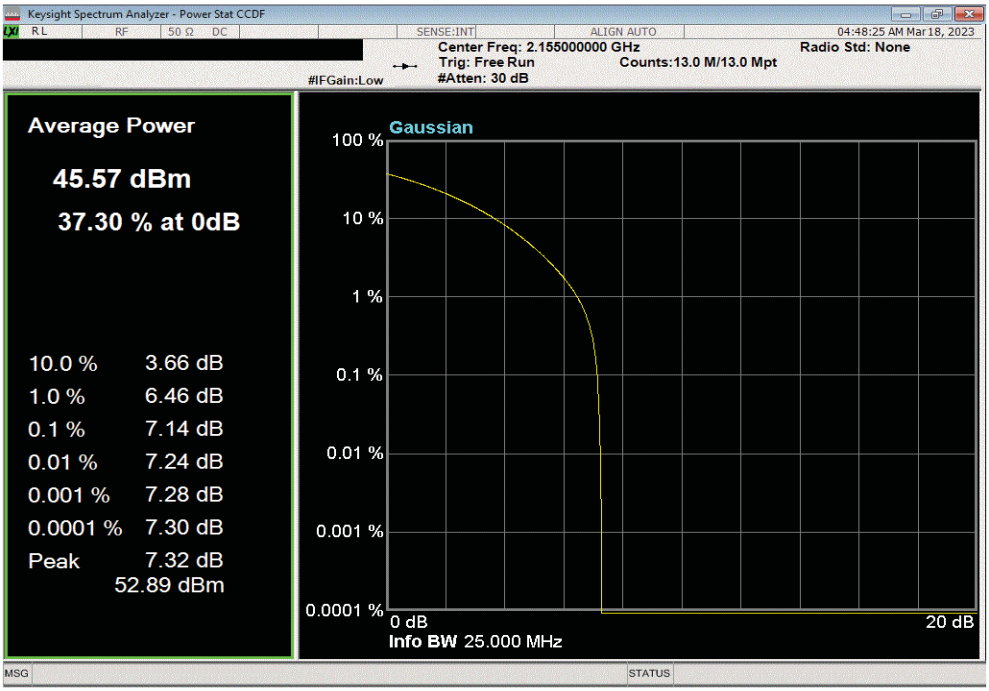


Band n66 2110 MHz - 2200 MHz, 5G NR , Port 4, 25 MHz Bandwidth, 256-QAM Modulation, Low Channel 2122.5 MHz						
				Value (dB)	Limit < (dB)	Results
				7.19	13	Pass



PEAK TO AVERAGE RATIO (PAPR) CCDF - BAND n66 5G

Band n66 2110 MHz - 2200 MHz, 5G NR , Port 4, 25 MHz Bandwidth, 256-QAM Modulation, Mid Channel 2155 MHz						
				Value (dB)	Limit < (dB)	Results
				7.14	13	Pass



Band n66 2110 MHz - 2200 MHz, 5G NR , Port 4, 25 MHz Bandwidth, 256-QAM Modulation, High Channel 2187.5 MHz						
				Value (dB)	Limit < (dB)	Results
				7.2	13	Pass