element

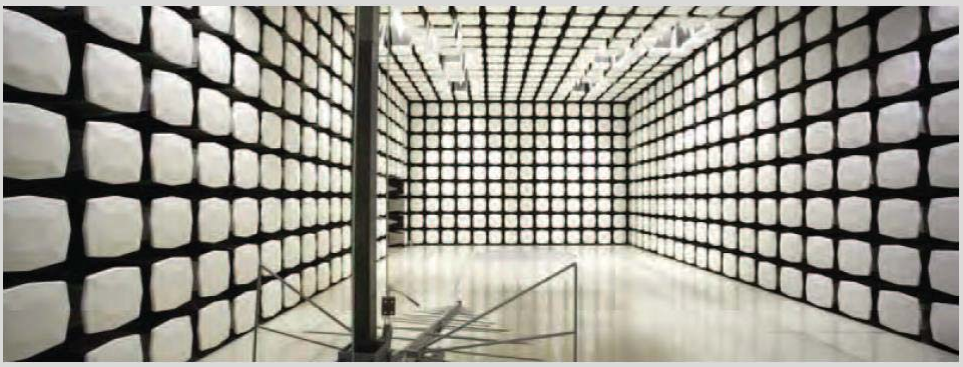
Radio Test Report Application for Grant of Equipment Authorization
FCC Part 27 Subpart C and IC RSS-130
617MHz – 652MHz

FCC ID: VBNAHLOB-01
IC: 661W-AHLOB

Nokia Solutions and Networks
Airscale Base Transceiver Station Remote Radio Head

Model: AHLOB

Report: NOKI0073.0 Rev. 0, Issue Date: February 20, 2024



ilac-MRA

A2LA ACCREDITED
CERT #3310.03

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element
2023.04.17

Section	Page Number

CERTIFICATE OF TEST

Last Date of Test: January 17, 2024
Nokia Solutions and Networks
EUT: Airscale Base Transceiver Station Remote Radio Head Model AHLOB

Radio Equipment Testing

Standards

Specification	Method
Code of Federal Regulations (CFR) Title 47 Part 2 and (CFR) Title 47 Part 27 Subpart C (Radio Standards Specification) RSS-Gen Issue 5: April 2018 and RSS-130 Issue 2: February 2019	ANSI C63.26-2015 ANSI C63.4-2014 with FCC KDB 971168 D01 v03r01 FCC KDB 662911D01 v02r01

Results

Test Description	Result	Comments
Average Power	Pass	
Band Edge Compliance	Pass	
Spurious Conducted Emissions	Pass	
Occupied Bandwidth	Pass	
Peak and Average (PAPR) CCDF	Pass	
Power Spectral Density	Pass	

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

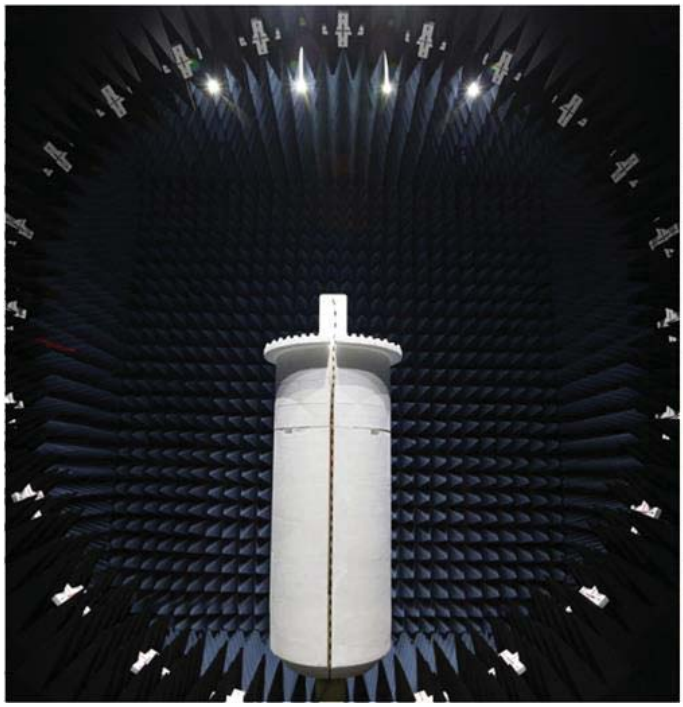
element
2023.09.21

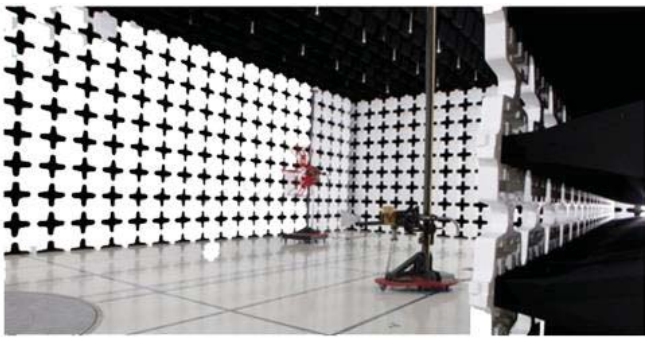
Testing was performed at the following location(s)

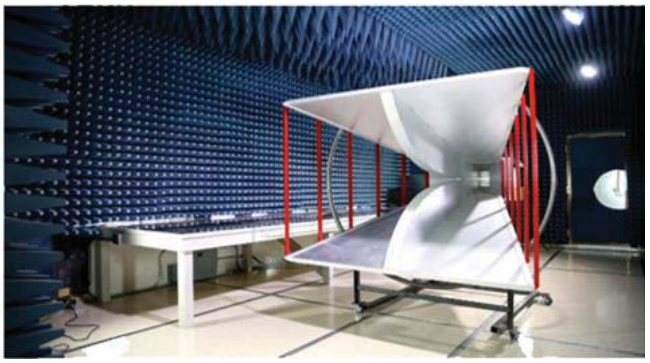
	Location	Labs (1)	Address	A2LA (2)	ISED (3)	BSMI (4)	VCCI (5)	CAB (6)	FDA (7)
☐	California	OC01-17	41 Tesla Irvine, CA 92618 (949) 861-8918	3310.04	2834B	SL2-IN-E-1154R	A-0029	US0158	TL-55
☐	Minnesota	MN01-11	9349 W Broadway Ave. Brooklyn Park, MN 55445 (612) 638-5136	3310.05	2834E	SL2-IN-E-1152R	A-0109	US0175	TL-57
☐	Oregon	EV01-12	6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	3310.02	2834D	SL2-IN-E-1017	A-0108	US0017	TL-56
☒	Texas	TX01-09	3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	3310.03	2834G	SL2-IN-E-1158R	A-0201	US0191	TL-54
☐	Washington	NC01-05	19201 120th Ave NE Bothell, WA 98011 (425) 984-6600	3310.06	2834F	SL2-IN-E-1153R	A-0110	US0157	TL-67
☐	Offsite	N/A	See Product Description	N/A	N/A	N/A	N/A	N/A	N/A

See data sheets for specific labs

(1) The lab designations denote individual rooms within each location. (OC01, OC02, OC03, etc.)
(2) A2LA Certificate No.
(3) ISED Company No.
(4) BSMI No.
(5) VCCI Site Filing No.
(6) CAB Identifier. Recognized Phase I CAB for ISED, ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA
(7) FDA ASCA No.







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

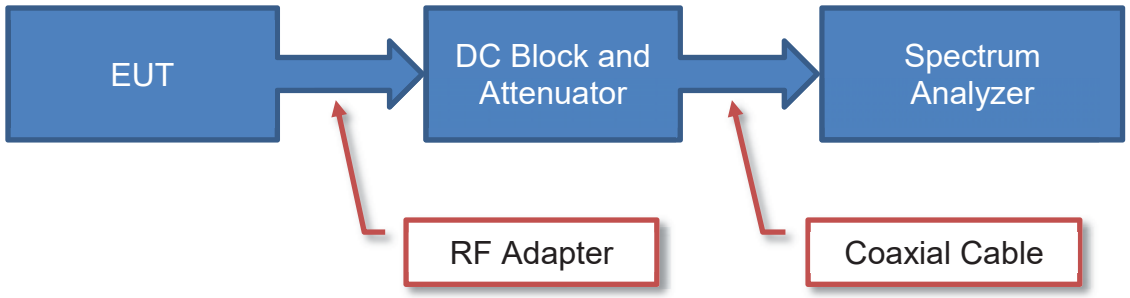
TEST SETUP BLOCK DIAGRAMS

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.

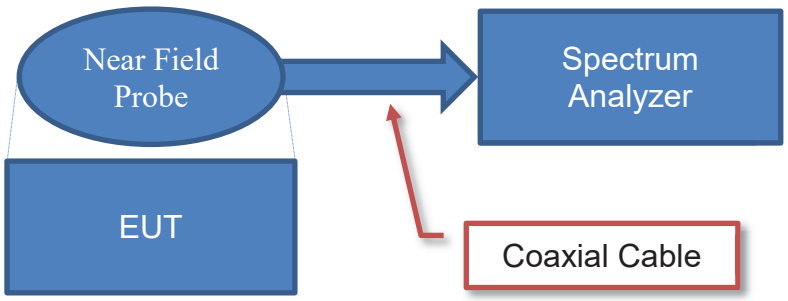
Antenna Port Conducted Measurements



Sample Calculation (logarithmic units)

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

Near Field Test Fixture Measurements

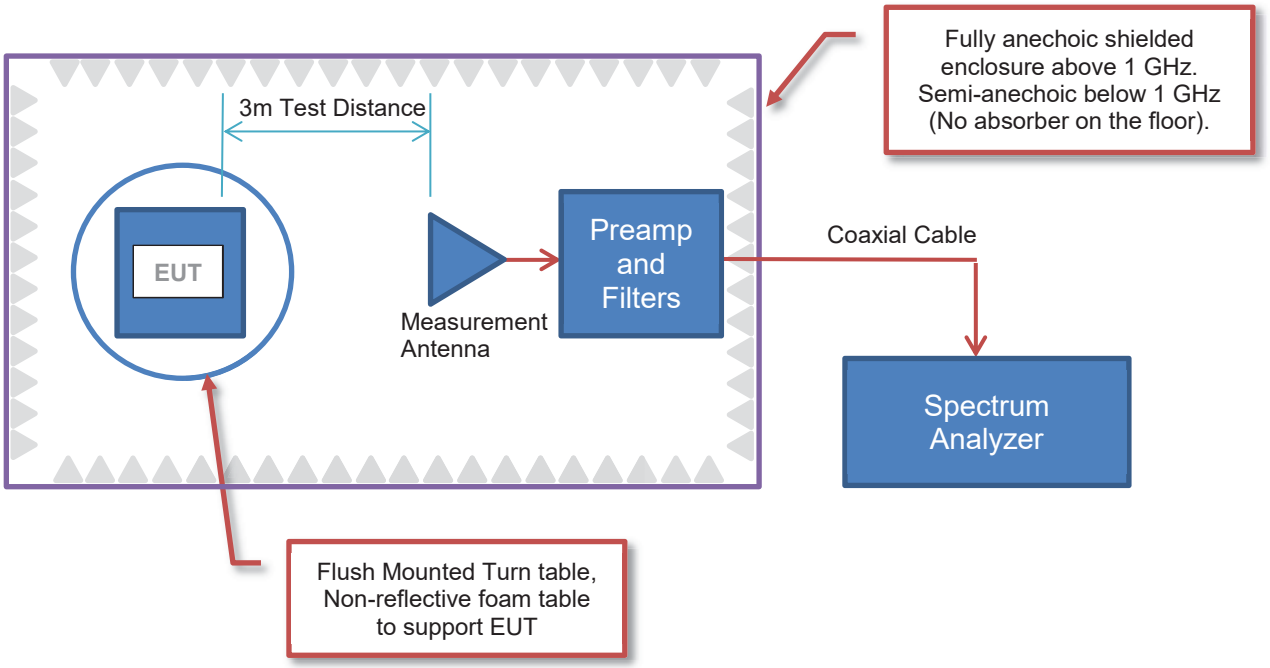


Sample Calculation (logarithmic units)

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**

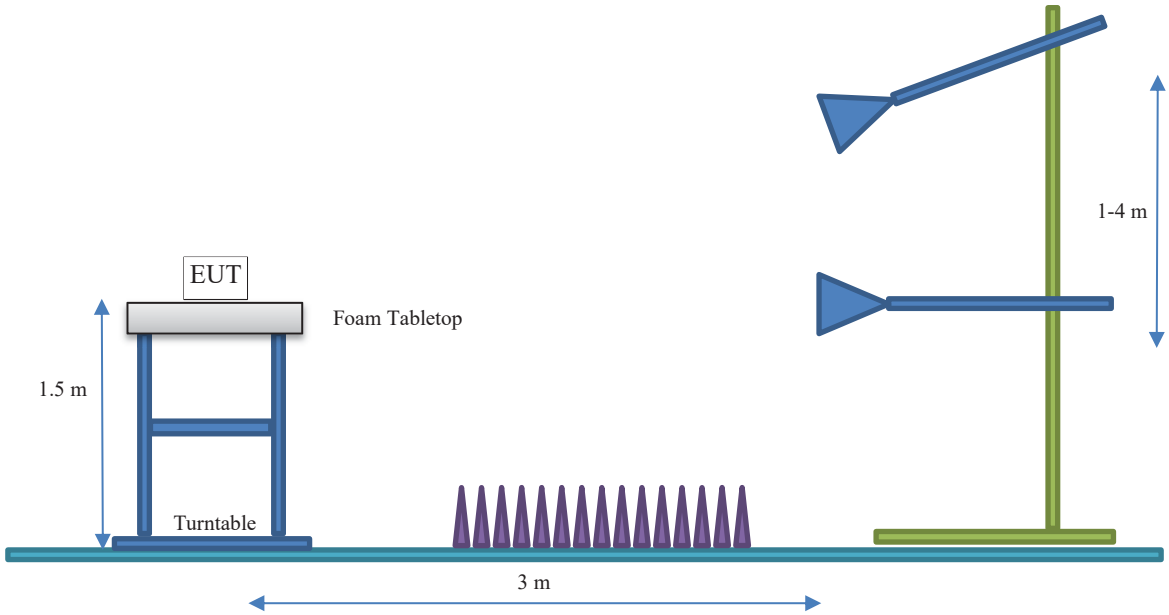
Radiated Power (ERP/EIRP) – Substitution Method:

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 Solutions and Networks
Address:	3201 Olympus Blvd
City, State, Zip:	Dallas, TX 75019
Test Requested By:	Steve Mitchell
EUT:	Airscale Base Transceiver Station Remote Radio Head Model AHLOB
First Date of Test:	January 17, 2024
Last Date of Test:	January 17, 2024
Receipt Date of Samples:	January 17, 2024
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) 30MHz channel bandwidth carriers for 3GPP frequency band n71 to the Air Scale Base Transceiver Station Remote Radio Head Model AHLOB FCC and ISED radio certifications. The original and class II permissive change test efforts included testing for 5G NR technologies with smaller channel bandwidths. 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 30MHz 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 (AHLOB) as the original certification test. The base station and remote radio head software for this testing is an updated release that includes 5G NR 30MHz 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 Air Scale Base Transceiver Station (BTS) Remote Radio Head (RRH) module, model AHLOB is being developed under this effort. The AHLOB remote radio head is a multi-standard multi-carrier radio module designed to support 4G LTE, 5G NR (new radio), narrow band IoT (internet of things) operations (in-band, guard band, standalone) and Dynamic Spectrum Sharing (DSS). The scope of testing in this effort is for the addition of 30MHz carrier bandwidth for 3GPP frequency band n71 in 5G NR FDD operations.

The AHLOB RRH has four transmit/four receive antenna ports (4TX/4RX for Band n71 and 4TX/4RX for Band n85). Each antenna port supports 3GPP frequency band n71 (BTS Rx: 663 to 698 MHz/BTS TX: 617 to 652 MHz) and 3GPP frequency band n85 (BTS Rx: 698 to 716 MHz/BTS TX: 728 to 746 MHz). The maximum RF output power of the RRH is 320 Watts (80 watts per antenna port shared between Band n71 and Band n85). The TX and RX instantaneous bandwidth cover the full operational bandwidth. Multi-carrier operation is supported. The maximum RF output power for single carriers are as follows.

Single Carrier Maximum RF Output Power per Port for each Channel Bandwidth				
NB IoT SA	**LTE5 or NR5**	**LTE10 or NR10**	**LTE15 or NR15**	**LTE20, NR20, NR25 or NR30**
20.0 Watts or 43.0 dBm	40.0 Watts or 46.0 dBm	60.0 Watts or 47.8 dBm	80.0 Watts or 49.0 dBm	80.0 Watts or 49.0 dBm

The RRH can be operated as a 4x4 MIMO, 2x2 MIMO or as non-MIMO. The RRH supports 5G NR bandwidths of 5, 10, 15, 20, 25MHz and 30MHz for 3GPP frequency band n71 operations. The RRH supports 5G NR bandwidths of 5, 10, and 15MHz for 3GPP frequency band n85. 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).

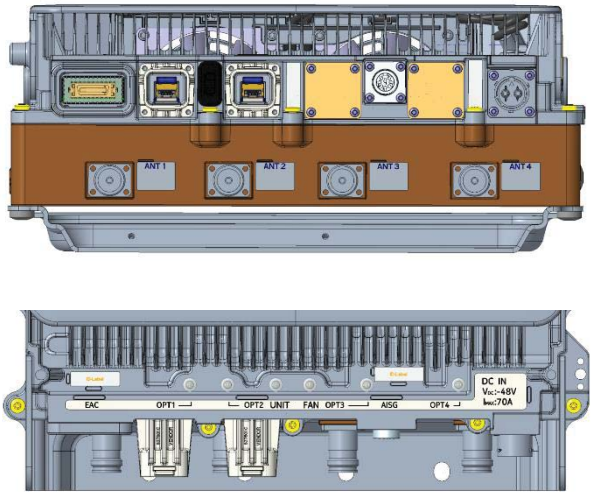
The RRH has external interfaces including DC power (DC In), ground, transmit/receive (ANT), external alarm (EAC), optical (OPT) and remote electrical tilt (RET). The RRH with applicable installation kit may be pole or wall mounted.

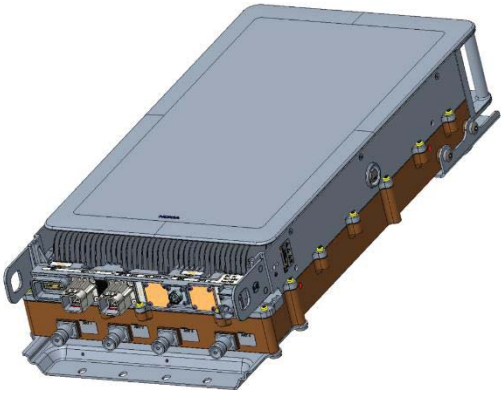
AHLOB 3GPP frequency band n71 Downlink Band Edge NR-ARFCNs
The 3GPP frequency band n71 (617 to 652 MHz) band edge downlink (BTS Transmit) NR-ARFCNs for NR channel bandwidths (5, 10, 15, 20, 25 and 30 MHz) are provided below. The NR-ARFCN is defined as Absolute Radio Frequency Channel Number. The channel spacing is 100 kHz between channel numbers. The formula for 5G NR ARFCN is described in 3GPP TS 38.104 chapter 5.4.2.1.

	Downlink NR-ARFCN	Downlink Frequency (MHz)	NR Channel Bandwidth					
			5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz
Band n71 (Ant 1, 2, 3, 4)	123400	617.0	Band Edge	Band Edge	Band Edge	Band Edge	Band Edge	Band Edge
	123900	619.5	Bottom Ch					
	124400	622.0		Bottom Ch				
	124900	624.5			Bottom Ch			
	125400	627.0				Bottom Ch		
	125900	629.5					Bottom Ch	
	126400	632.0						Bottom Ch
	126900	634.5	Middle Ch	Middle Ch	Middle Ch	Middle Ch	Middle Ch	Middle Ch
	127400	637.0						Top Channel
	127900	639.5					Top Channel	
	128400	642.0				Top Channel		
	128900	644.5			Top Channel			
	129400	647.0		Top Channel				
	129900	649.5	Top Channel					
	130400	652.0	Band Edge	Band Edge	Band Edge	Band Edge	Band Edge	Band Edge

PRODUCT DESCRIPTION

AHLOB Connector Layout:





AHLOB External Interfaces

Name	Qty	Connector Type	Purpose (and Description)
DC In	1	Quick Disconnect	2-pole Power Input Terminal
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:

Demonstrate FCC and ISED compliance of Airscale Base Transceiver Station (BTS) Remote Radio Head (RRH) module, AHLOB for 5G NR FDD single carriers operating in 3GPP Band n71 (617MHz to 652MHz).

CONFIGURATIONS

element
2018-07-17

Test Configuration 1 RF Conducted Emissions

Software/Firmware Running during test	
Description	**Version**
BTS Software Version (24R2)	SBTS24R2_ENB_9999_231201_000013
RF_SW	RF.FRM6.trunk.20231122.010

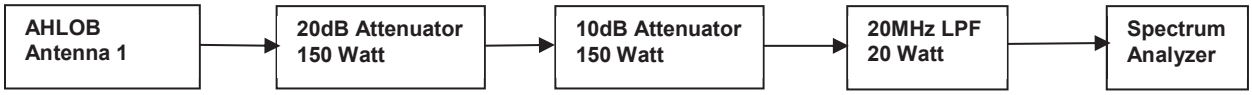
Equipment being tested (include Peripherals)			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
AMIA (BTS System Module)	Nokia Solutions and Networks	473098A.101	J8164063259
ASIB (BTS System Module)	Nokia Solutions and Networks	473764A.102	L1224904438
ABIO (BTS Baseband Module)	Nokia Solutions and Networks	475266A.104	L1214403575
AHLOB (Radio Module Model)	Nokia Solutions and Networks	475910A.101	YK220900029
20MHz Low Pass Filter/20 Watt	Microwave Circuits, Inc.	VLFX-80+	15542
Attenuator 150W/10dB	Aeroflex Weinschel	6375	B22688
Attenuator 150W/20dB	Aeroflex Weinschel	66-20-33	BZ1165
SFP+ 9.8G,300M,850NM (BS)	Nokia	474900A.101	FR214719830
SFP+ 9.8G,300M,850NM (Radio)	Nokia	474900A.101	FR214719846
Lenovo	HP	Thinkpad	PF26RRVZ0
Keysight- DC System power supply	HP	N8757A	US21D5054S
FPAD (DC-pwr supply)	Nokia	472805A.101	A9124600282
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN531429/6
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN531432/6
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297388
500W -50ohm -Terminating Load	API Weinschel inc	1434-3-LIM	US882
500W -50ohm -Terminating Load	API Weinschel inc	1434-3-LIM	US880
500W -50ohm -Terminating Load	API Weinschel inc	1434-3-LIM	US882
GPS cable 100m	CSA	LL73189	E151955
FYGB GPS receiver	Nokia	472748A	71231431
CAT5e data cable	LEONI L	64867m	146180
Fiber Optic cable 50m	AMPHENOL Fiber	995109C	E201648
6 Meter RF cable	Huber+suhner	SUCOFLEX 106	SN 297372
1 Meter RF cable	Huber+suhner	SUCOFLEX 104	SN 551432/4

CONFIGURATIONS

Cables (Peripheral)					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
Fiber Optic Cable	N	15 meters	N	ABIO	AHLOB
GPS Receiver Cable	Y	100 meters	N	ASIB	FYGB GPS receiver
Cat-5e Cable	Y	25 meters	N	ASIB	WebEM- PC
HS-SUCOFLEX_106 – RF CABLES	Y	2 meters	N	EUT [AHLOB] Ant ports 2-4	500W -50ohm -Loads (3)

Cables, Filters, Attenuators					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
HS-SUCOFLEX_106	Y	6 meters	N	EUT [AHLOB] Ant port #1	Attenuator 150W/20dB
Attenuator 150W/20dB	N	N/A	N	RF cable HS-SUCOFLEX_106	Attenuator 150W/10dB
Attenuator 150W/10dB	N	N/A	N	Attenuator 150W/20dB	Low Pass Filter 20MHz/20W
Low Pass Filter 20MHz/20W	N	N/A	N	Attenuator 150W/10dB	HS-SUCOFLEX_104
HS-SUCOFLEX_104	Y	1 meter	N	Low Pass Filter 20MHz/20W	Analyzer

RF Test Setup Diagram:



CONFIGURATIONS

Test Configuration 2 RF Conducted Emissions

Software/Firmware Running during test	
Description	**Version**
BTS Software Version (24R2)	SBTS24R2_ENB_9999_231201_000013
RF_SW	RF.FRM6.trunk.20231122.010

Equipment being tested (include Peripherals)			
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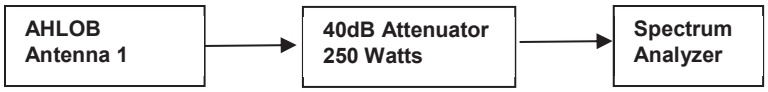
ABIO (BTS Baseband Module)	Nokia Solutions and Networks	475266A.104	L1214403575
AHLOB (Radio Module Model)	Nokia Solutions and Networks	475910A.101	YK220900029
Attenuator 40dB/250 Watts	API Weinschel	58-40-43-LMI	TC909
SFP+ 9.8G,300M,850NM (BS)	Nokia	474900A.101	FR214719830
SFP+ 9.8G,300M,850NM (Radio)	Nokia	474900A.101	FR214719846
Lenovo	HP	Thinkpad	PF26RRVZ0
Keysight- DC System power supply	HP	N8757A	US21D5054S
FPAD (DC-pwr supply)	Nokia	472805A.101	A9124600282
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN531429/6
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN531432/6
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297388
500W -50ohm -Terminating Load	API Weinschel inc	1434-3-LIM	US882
500W -50ohm -Terminating Load	API Weinschel inc	1434-3-LIM	US880
500W -50ohm -Terminating Load	API Weinschel inc	1434-3-LIM	US882
GPS cable 100m	CSA	LL73189	E151955
FYGB GPS receiver	Nokia	472748A	71231431
CAT5e data cable	LEONI L	64867m	146180
Fiber Optic cable 50m	AMPHENOL Fiber	995109C	E201648
6 Meter RF cable	Huber+suhner	SUCOFLEX 106	SN 297372
1 Meter RF cable	Huber+suhner	SUCOFLEX 104	SN 551432/4

CONFIGURATIONS

Cables (Peripheral)					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
Fiber Optic Cable	N	15 meters	N	ABIO	AHLOB
GPS Receiver Cable	Y	100 meters	N	ASIB	FYGB GPS receiver
Cat-5e Cable	Y	25 meters	N	ASIB	WebEM- PC
HS-SUCOFLEX_106 – RF CABLES (3)	Y	2 meters	N	EUT [AHLOB] Ant ports 2-4	500W -50ohm -Loads (3)

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

RF Test Setup Diagram:



CONFIGURATIONS

Test Configuration 3 RF Conducted Emissions

Software/Firmware Running during test	
Description	**Version**
BTS Software Version (24R2)	SBTS24R2_ENB_9999_231201_000013
RF_SW	RF.FRM6.trunk.20231122.010

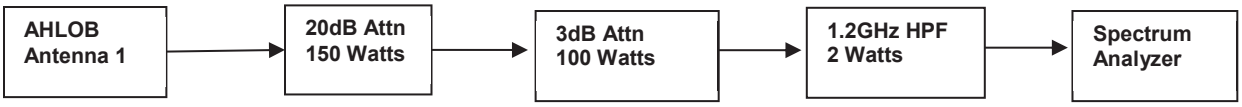
Equipment being tested (include Peripherals)			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
AMIA (BTS System Module)	Nokia Solutions and Networks	473098A.101	J8164063259
ASIB (BTS System Module)	Nokia Solutions and Networks	473764A.102	L1224904438
ABIO (BTS Baseband Module)	Nokia Solutions and Networks	475266A.104	L1214403575
AHLOB (Radio Module Model)	Nokia Solutions and Networks	475910A.101	YK220900029
1.2 GHz HPF 2 Watts	RLC Electronics	F-14699	4050
Attenuator 150W/20dB	Aeroflex Weinschel	66-20-33	BZ1165
Attenuator 100W/3dB	Aeroflex Weinschel	47-3-33	CC7387
SFP+ 9.8G,300M,850NM (BS)	Nokia	474900A.101	FR214719830
SFP+ 9.8G,300M,850NM (Radio)	Nokia	474900A.101	FR214719846
Lenovo	HP	Thinkpad	PF26RRVZ0
Keysight- DC System power supply	HP	N8757A	US21D5054S
FPAD (DC-pwr supply)	Nokia	472805A.101	A9124600282
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN531429/6
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN531432/6
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297388
500W -50ohm -Terminating Load	API Weinschel inc	1434-3-LIM	US882
500W -50ohm -Terminating Load	API Weinschel inc	1434-3-LIM	US880
500W -50ohm -Terminating Load	API Weinschel inc	1434-3-LIM	US882
GPS cable 100m	CSA	LL73189	E151955
FYGB GPS receiver	Nokia	472748A	71231431
CAT5e data cable	LEONI L	64867m	146180
Fiber Optic cable 50m	AMPHENOL Fiber	995109C	E201648
6 Meter RF cable	Huber+suhner	SUCOFLEX 106	SN 297372
1 Meter RF cable	Huber+suhner	SUCOFLEX 104	SN 551432/4

CONFIGURATIONS

Cables (Peripheral)					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1 (5G)**	**Connection 2**
Fiber Optic Cable	N	15 meters	N	ABIO	AHLOB
GPS Receiver Cable	Y	100 meters	N	ASIB	FYGB GPS receiver
Cat-5e Cable	Y	25 meters	N	ASIB	WebEM- PC
HS-SUCOFLEX_106 – RF CABLES (3)	Y	2 meters	N	EUT [AHLOB] Ant ports 2-4	500W -50ohm -Loads (3)

Cables, Filters, Attenuators					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
HS-SUCOFLEX_106	Y	6 meters	N	EUT [AHLOB] Ant port #1	Attenuator 150W/20dB
Attenuator 150W/20dB	N	NA	N	HS-SUCOFLEX_106	Attenuator 100W/3dB
Attenuator 100W/3dB	N	NA	N	Attenuator 150W/20dB	1.2GHz HPF 2Watts
1.2GHz HPF 2Watts	N	NA	N	Attenuator 100W/3dB	HS-SUCOFLEX_104
HS-SUCOFLEX_104	N	1 meter	N	1.2GHz HPF 2Watts	Spectrum Analyzer

RF Test Setup Diagram:



MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2024-01-17	Average 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.
2	2024-01-17	Band Edge	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	2024-01-17	Spurious Conducted Emissions	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	2024-01-17	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.
5	2024-01-17	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.
6	2024-01-17	Power Spectral Density	Tested as delivered to test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

AVERAGE POWER

element
TbtTx 2023.12.05.0
WTD.2023.11.13.0

TEST DESCRIPTION

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.

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 only on one port. The testing was performed on the same version of hardware (AHLOB) as the original certification test. The AHLOB 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 1 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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFL	2023-03-17	2024-03-17
Block - DC	Fairview Microwave	SD3235-2148	ANF	2023-05-24	2024-05-24
Generator - Signal	Agilent	N5173B	TIW	2023-08-07	2026-08-07

AVERAGE POWER

element
TbtTx 2023.12.05.0
WTD.2023.11.13.0

EUT:	Airscale Base Transceiver Station Remote Radio Head Model AHLOB	Work Order:	NOKI0073
Serial Number:	YK220900029	Date:	2024-01-26
Customer:	Nokia Solutions and Networks	Temperature:	21.7°C
Attendees:	David Le, John Rattanavong	Relative Humidity:	42.1%
Customer Project:	None	Bar. Pressure (PMSL):	1024 mbar
Tested By:	Jarrod Brenden	Job Site:	TX07
Power:	54 VDC	Configuration:	NOKI0073-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 27:2024	ANSI C63.26:2015
RSS-130 Issue 2:2019	ANSI C63.26:2015

COMMENTS

All measurement path losses were accounted for in the reference level offset including any attenuators, filters and DC blocks. 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 bandwidth on port 1. The total output power for multiport (2x2, 4x4 MIMO) operation was determined based upon ANSI 63.26 clauses 6.4.3.1 and 6.4.3.2.4 (10 log Nout). The total output power for two port operation is single port power + 3dB [i.e. 10log(2)] and the total output power for a four port operation is single port power + 6dB [i.e. 10log(4)]. The carriers were enabled at maximum power.

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

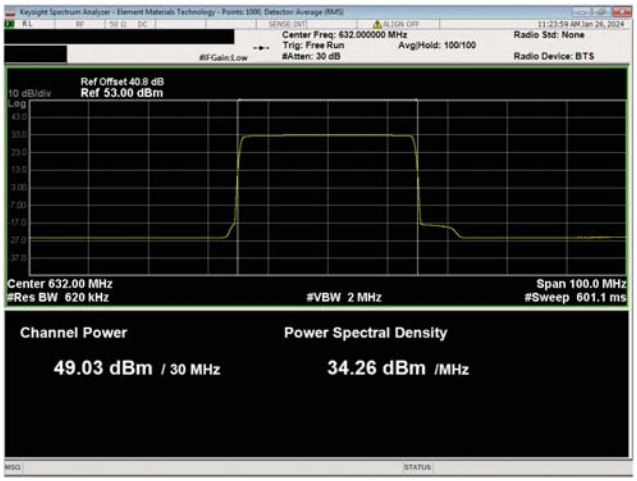
Pass

Tested By

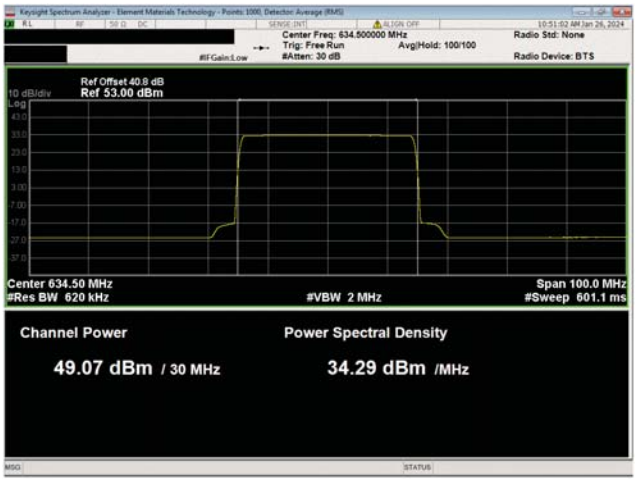
TEST RESULTS

	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 n71 617 MHz - 652 MHz, 5G NR					
NR 30 MHz Channel Bandwidth					
QPSK					
Low Ch, 632.0 MHz	49.032	0	49	52	55
Mid Ch, 634.5 MHz	49.066	0	49.1	52.1	55.1
High Ch, 637.0 MHz	49.001	0	49	52	55
16QAM					
Low Ch, 632.0 MHz	49.011	0	49	52	55
Mid Ch, 634.5 MHz	48.949	0	48.9	51.9	54.9
High Ch, 637.0 MHz	49.022	0	49	52	55
64QAM					
Low Ch, 632.0 MHz	49.025	0	49	52	55
Mid Ch, 634.5 MHz	48.968	0	49	52	55
High Ch, 637.0 MHz	49.009	0	49	52	55
256QAM					
Low Ch, 632.0 MHz	49.004	0	49	52	55
Mid Ch, 634.5 MHz	48.935	0	48.9	51.9	54.9
High Ch, 637.0 MHz	48.946	0	48.9	51.9	54.9

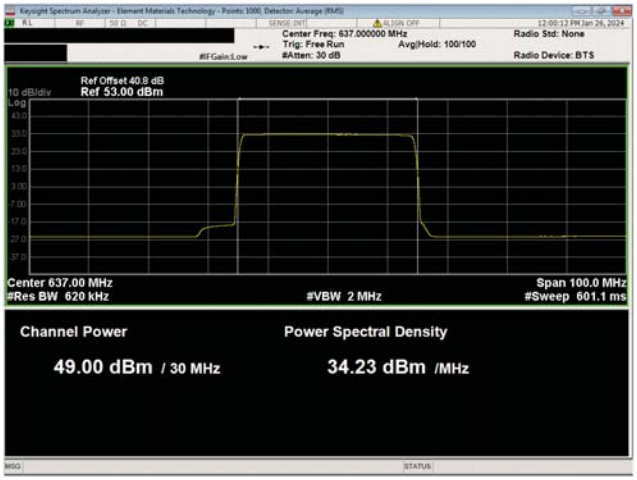
AVERAGE POWER



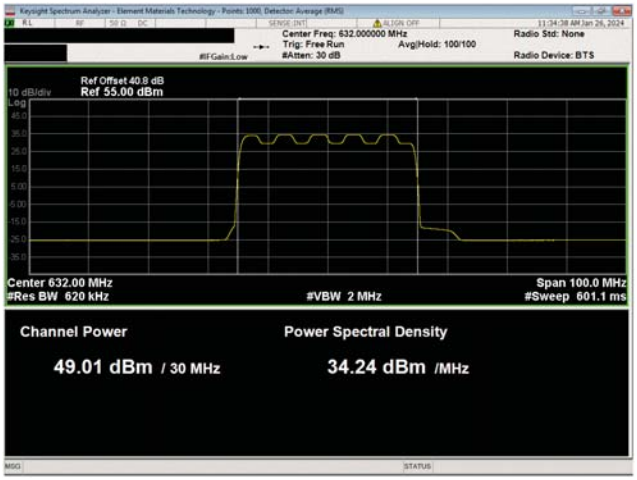
Port 1
NR 30 MHz Channel Bandwidth
QPSK
Low Ch, 632.0 MHz



Port 1
NR 30 MHz Channel Bandwidth
QPSK
Mid Ch, 634.5 MHz

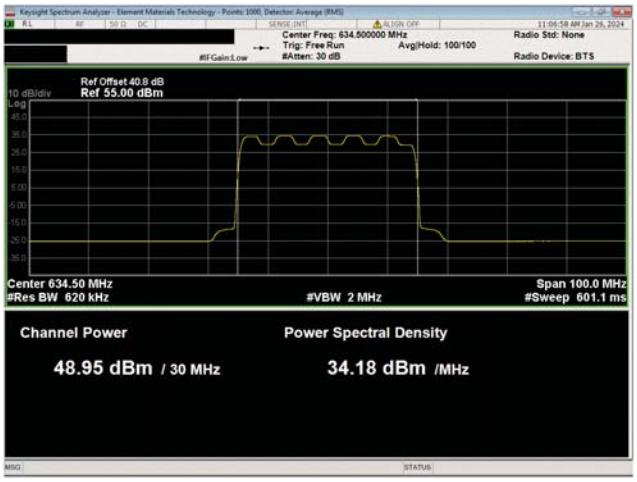


Port 1
NR 30 MHz Channel Bandwidth
QPSK
High Ch, 637.0 MHz

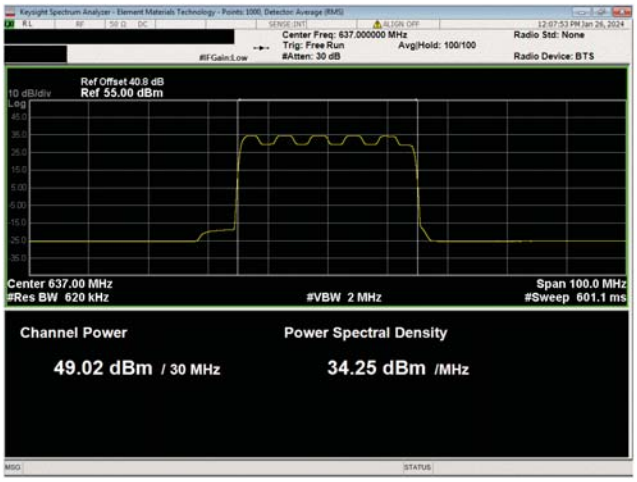


Port 1
NR 30 MHz Channel Bandwidth
16QAM
Low Ch, 632.0 MHz

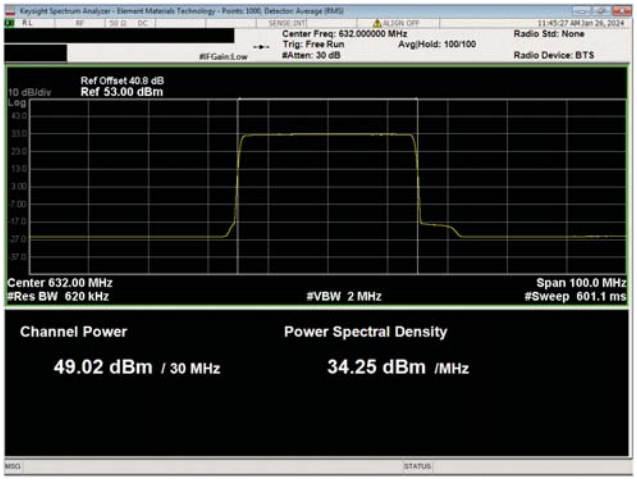
AVERAGE POWER



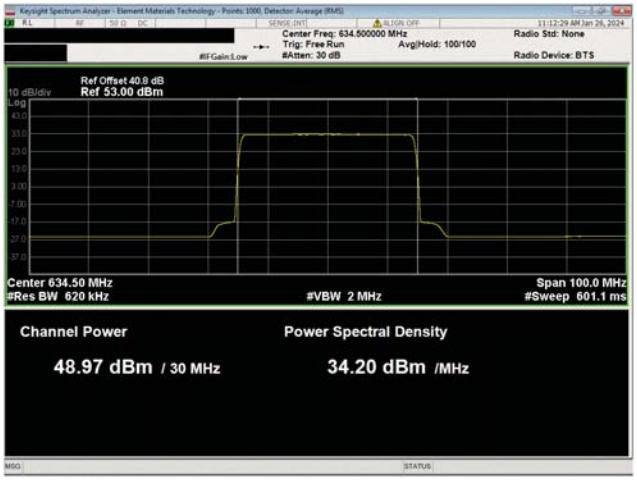
Port 1
NR 30 MHz Channel Bandwidth
16QAM
Mid Ch, 634.5 MHz



Port 1
NR 30 MHz Channel Bandwidth
16QAM
High Ch, 637.0 MHz

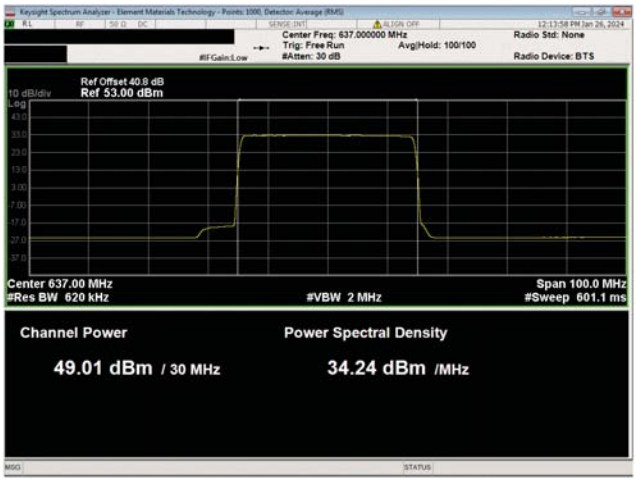


Port 1
NR 30 MHz Channel Bandwidth
64QAM
Low Ch, 632.0 MHz

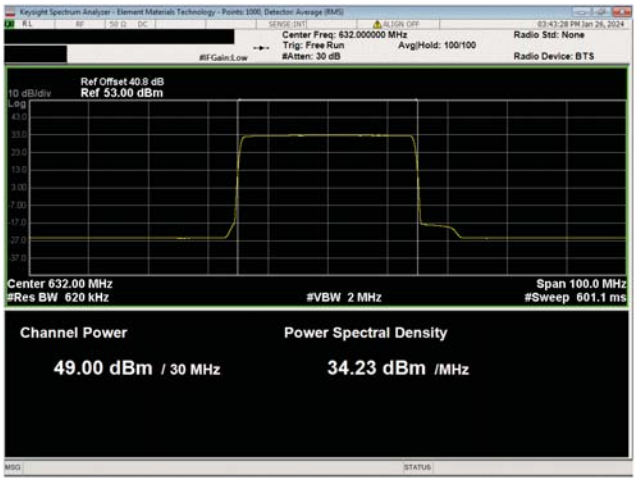


Port 1
NR 30 MHz Channel Bandwidth
64QAM
Mid Ch, 634.5 MHz

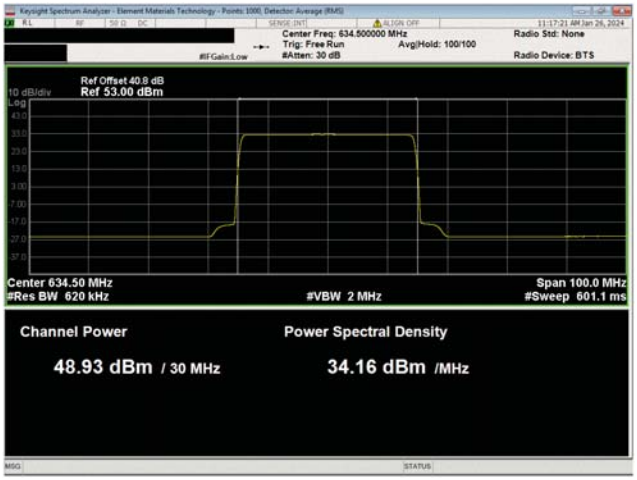
AVERAGE POWER



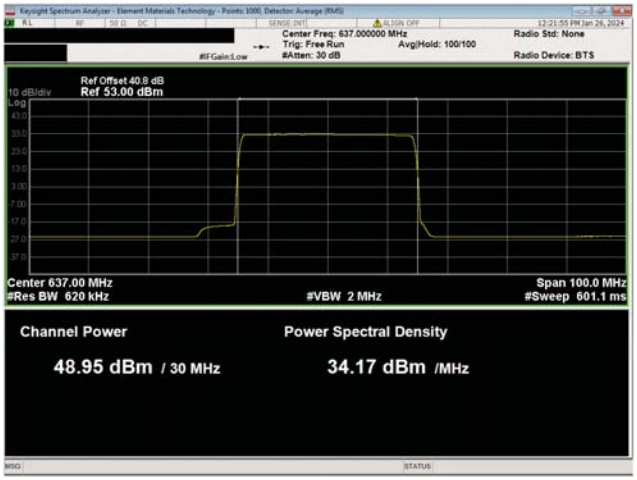
Port 1
NR 30 MHz Channel Bandwidth
64QAM
High Ch, 637.0 MHz



Port 1
NR 30 MHz Channel Bandwidth
256QAM
Low Ch, 632.0 MHz



Port 1
NR 30 MHz Channel Bandwidth
256QAM
Mid Ch, 634.5 MHz



Port 1
NR 30 MHz Channel Bandwidth
256QAM
High Ch, 637.0 MHz

BAND EDGE COMPLIANCE

element
TbtTx 2023.12.05.0
WTD.2023.11.13.0

TEST DESCRIPTION

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.

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

The spurious RF conducted emissions at the edges of the authorized bands were measured with the EUT set to low and high transmit frequencies of the available band. The channels closest to the band edges were selected. The EUT was transmitting at the data rate(s) listed in the datasheet.

The spectrum was scanned below the lower band edge and above the higher band edge.

RF conducted emissions testing was performed only on one port. The testing was performed on the same version of hardware (AHLOB) as the original certification test. The AHLOB 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 1 was selected to perform the testing under this effort as allowed by ANSI C63.26-2015 paragraph 5.7.2i.

All limits were adjusted by a factor of [-10*log(4)] dB to account for the device operation as a 4 port MIMO transmitter, as per FCC KDB 622911.

Per RSS 130 4.7 and FCC section 27.53(g) the power of any emission outside of the authorized operating frequency range cannot exceed -13 dBm. The limit is adjusted to -19 dBm [-13 dBm -10 log (4)] per FCC KDB 662911D01 v02r01 because the BTS may operate as a 4 port MIMO transmitter.

RSS 130 4.7 and FCC section 27.53(g) requires a >100 kHz measurement bandwidth for emissions 100 kHz outside of the RRH operating frequency range. RSS 130 4.7 and FCC section 27.53(g) requires a >30 kHz measurement bandwidth for emissions between 100 kHz outside of the RRH operating frequency range and band edge of the operating frequency range.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFL	2023-03-17	2024-03-17
Block - DC	Fairview Microwave	SD3235-2148	ANF	2023-05-24	2024-05-24
Generator - Signal	Agilent	N5173B	TIW	2023-08-07	2026-08-07

BAND EDGE COMPLIANCE

element
TbtTx 2023.12.05.0
WTD.2023.11.13.0

EUT:	Airscale Base Transceiver Station Remote Radio Head Model AHLOB	Work Order:	NOKI0073
Serial Number:	YK220900029	Date:	2024-01-26
Customer:	Nokia Solutions and Networks	Temperature:	21.8°C
Attendees:	David Le, John Rattanavong	Relative Humidity:	40.6%
Customer Project:	None	Bar. Pressure (PMSL):	1024 mbar
Tested By:	Jarrod Brenden	Job Site:	TX07
Power:	54 VDC	Configuration:	NOKI0073-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 27:2024	ANSI C63.26:2015
RSS-130 Issue 2:2019	ANSI C63.26:2015

COMMENTS

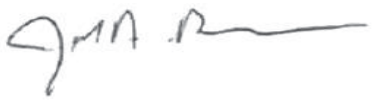
All losses in the measurement path were accounted for: attenuators, cables, DC block, and filters where used. The carriers were enables at maximum power.

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

Pass



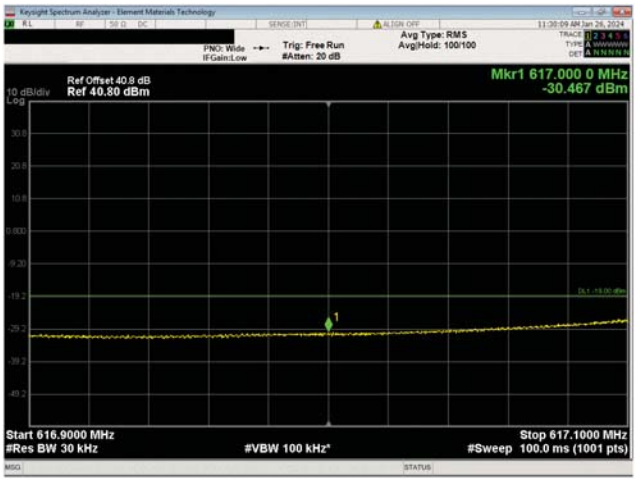
Tested By

TEST RESULTS

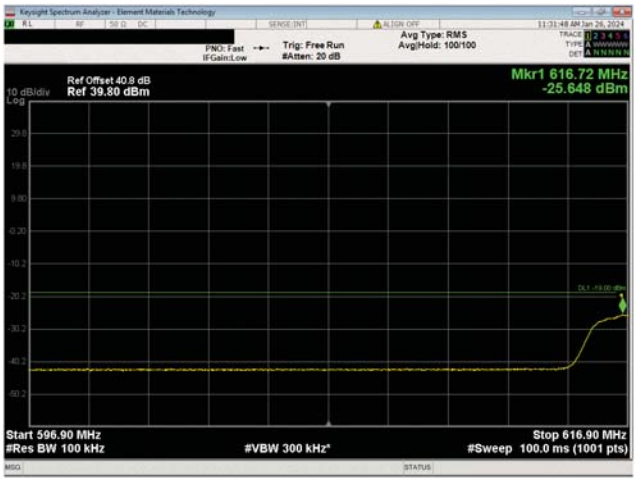
		Frequency Range	Measured Freq (MHz)	Max Value (dBm)	Limit (dBm)	Result
Band n71, 617 MHz - 652 MHz						
NR 30 MHz Channel Bandwidth						
QPSK						
	Low Ch, 632.0 MHz	616.9 MHz - 617.1 MHz	617.00	-30.47	-19	Pass
		596.9 MHz - 616.9 MHz	616.72	-25.65	-19	Pass
	High Ch, 637.0 MHz	616.9 MHz - 617.1 MHz	652.00	-30.51	-19	Pass
		596.9 MHz - 616.9 MHz	652.26	-25.32	-19	Pass
16QAM						
	Low Ch, 632.0 MHz	616.9 MHz - 617.1 MHz	617.00	-30.09	-19	Pass
		596.9 MHz - 616.9 MHz	616.90	-25.38	-19	Pass
	High Ch, 637.0 MHz	616.9 MHz - 617.1 MHz	652.00	-30.91	-19	Pass
		596.9 MHz - 616.9 MHz	652.18	-25.6	-19	Pass
64QAM						
	Low Ch, 632.0 MHz	616.9 MHz - 617.1 MHz	617.00	-30.78	-19	Pass
		596.9 MHz - 616.9 MHz	616.84	-25.38	-19	Pass
	High Ch, 637.0 MHz	616.9 MHz - 617.1 MHz	652.00	-30.66	-19	Pass
		596.9 MHz - 616.9 MHz	652.10	-25.69	-19	Pass
256QAM						
	Low Ch, 632.0 MHz	616.9 MHz - 617.1 MHz	617.00	-30.01	-19	Pass
		596.9 MHz - 616.9 MHz	616.86	-25.87	-19	Pass
	High Ch, 637.0 MHz	616.9 MHz - 617.1 MHz	652.00	-30.94	-19	Pass
		596.9 MHz - 616.9 MHz	652.18	-25.54	-19	Pass

BAND EDGE COMPLIANCE

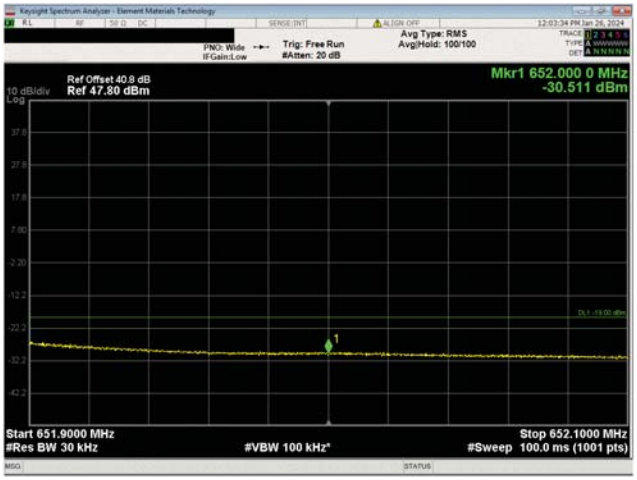
element
TbtTx 2023.12.05.0
WTD.2023.11.13.0



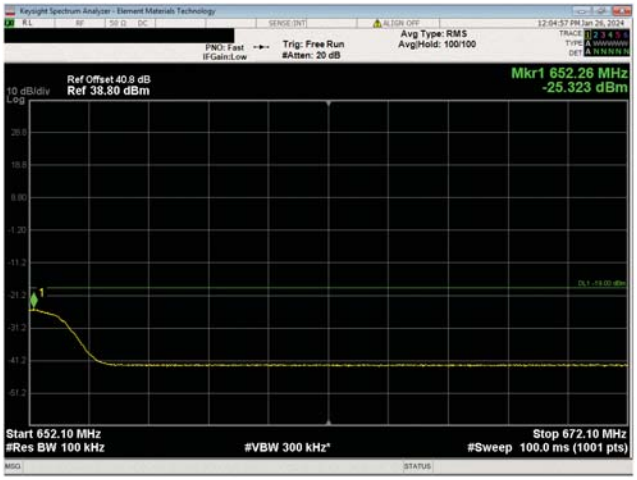
Port 1
NR 30 MHz Channel Bandwidth
QPSK
Low Ch, 632.0 MHz



Port 1
NR 30 MHz Channel Bandwidth
QPSK
Low Ch, 632.0 MHz



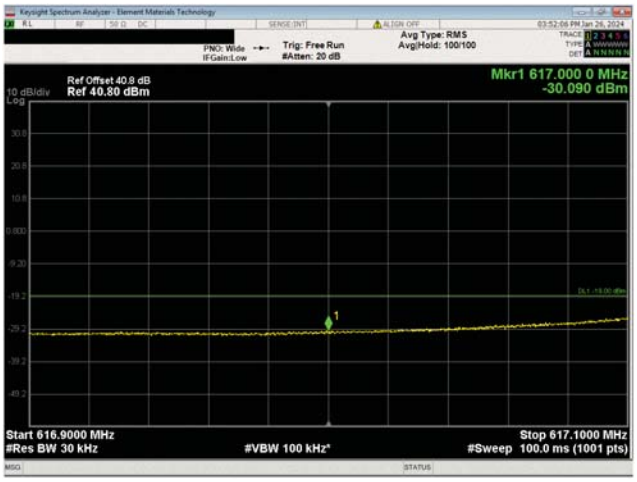
Port 1
NR 30 MHz Channel Bandwidth
QPSK
High Ch, 637.0 MHz



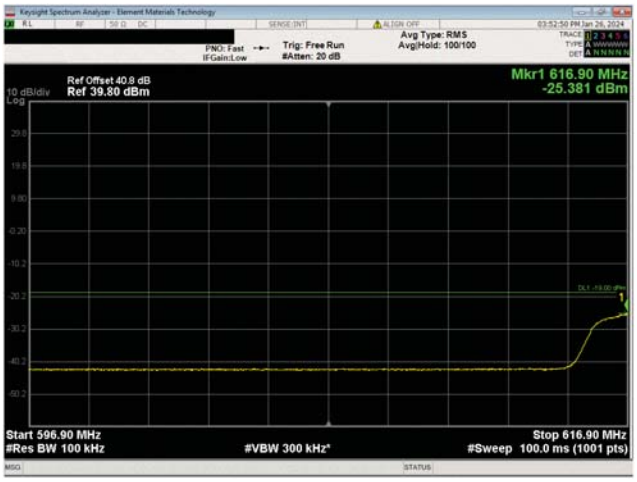
Port 1
NR 30 MHz Channel Bandwidth
QPSK
High Ch, 637.0 MHz

BAND EDGE COMPLIANCE

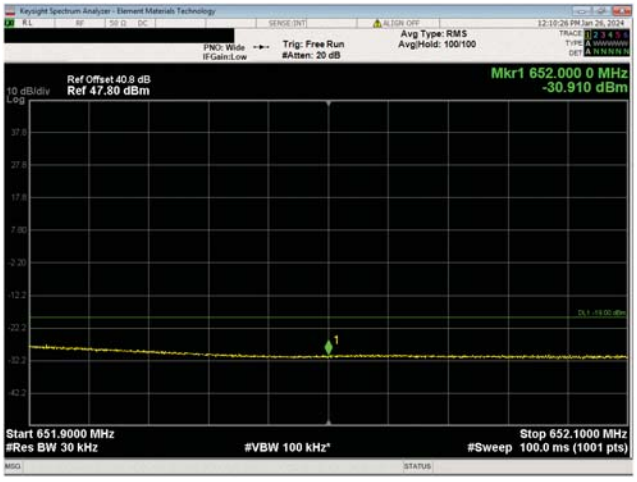
element
TbtTx 2023.12.05.0
WTD.2023.11.13.0



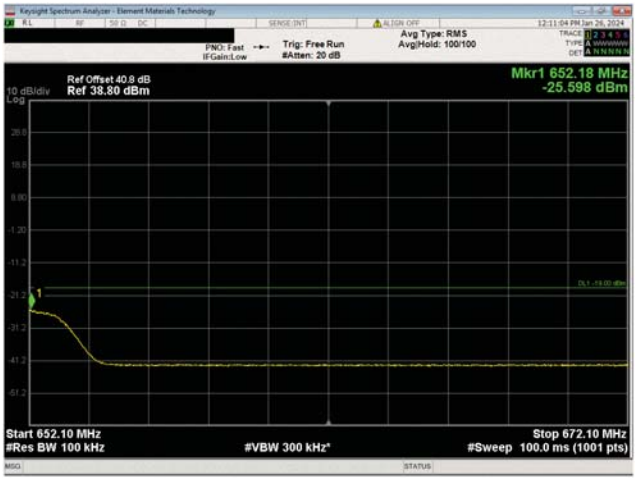
Port 1
NR 30 MHz Channel Bandwidth
16QAM
Low Ch, 632.0 MHz



Port 1
NR 30 MHz Channel Bandwidth
16QAM
Low Ch, 632.0 MHz



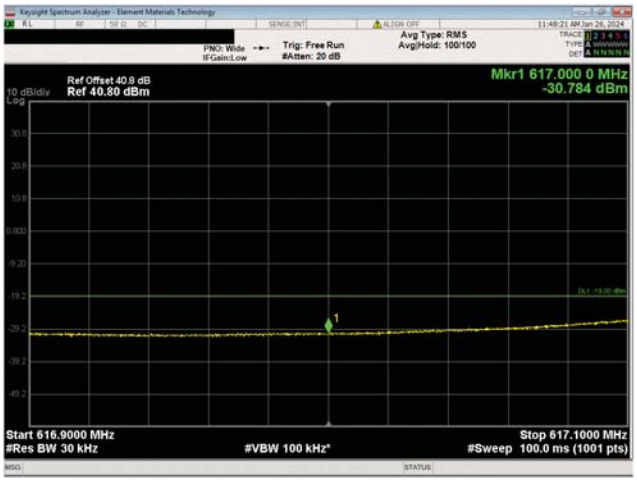
Port 1
NR 30 MHz Channel Bandwidth
16QAM
High Ch, 637.0 MHz



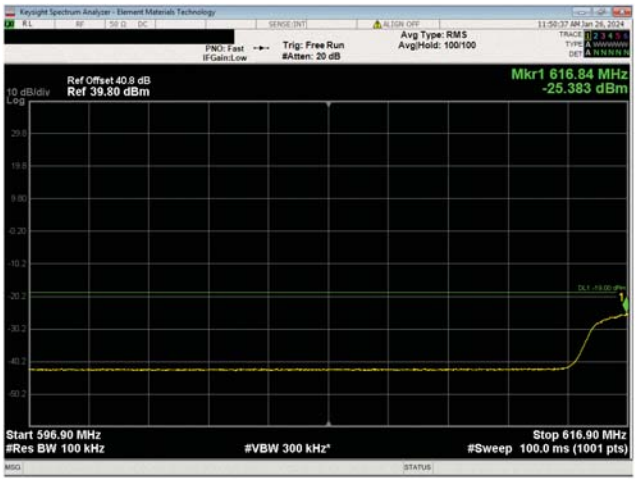
Port 1
NR 30 MHz Channel Bandwidth
16QAM
High Ch, 637.0 MHz

BAND EDGE COMPLIANCE

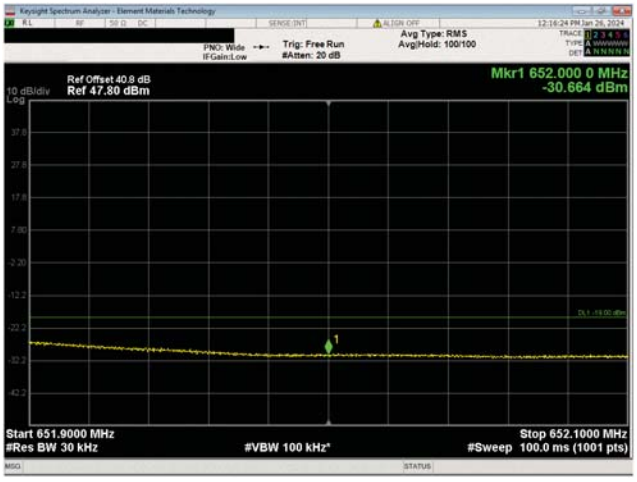
element
TbtTx 2023.12.05.0
WTD.2023.11.13.0



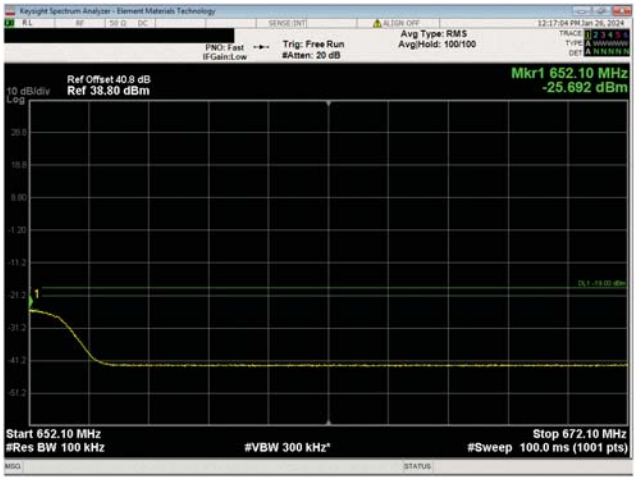
Port 1
NR 30 MHz Channel Bandwidth
64QAM
Low Ch, 632.0 MHz



Port 1
NR 30 MHz Channel Bandwidth
64QAM
Low Ch, 632.0 MHz



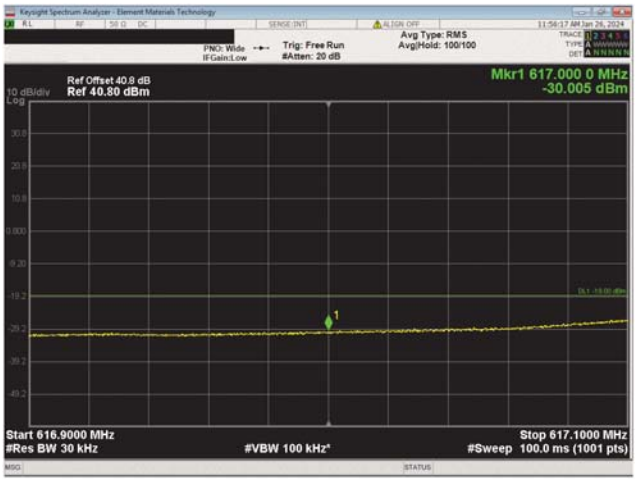
Port 1
NR 30 MHz Channel Bandwidth
64QAM
High Ch, 637.0 MHz



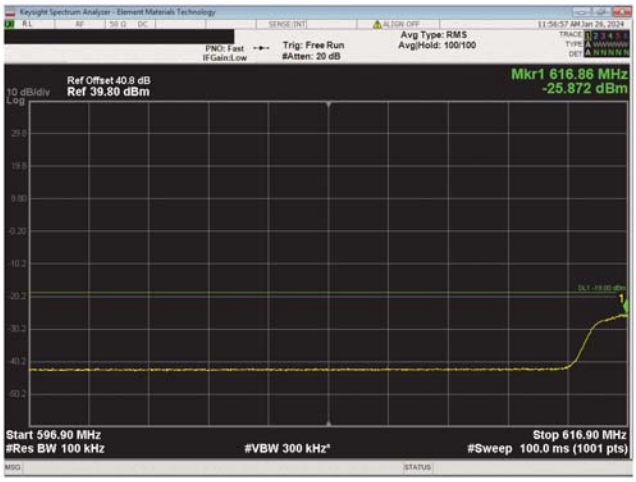
Port 1
NR 30 MHz Channel Bandwidth
64QAM
High Ch, 637.0 MHz

BAND EDGE COMPLIANCE

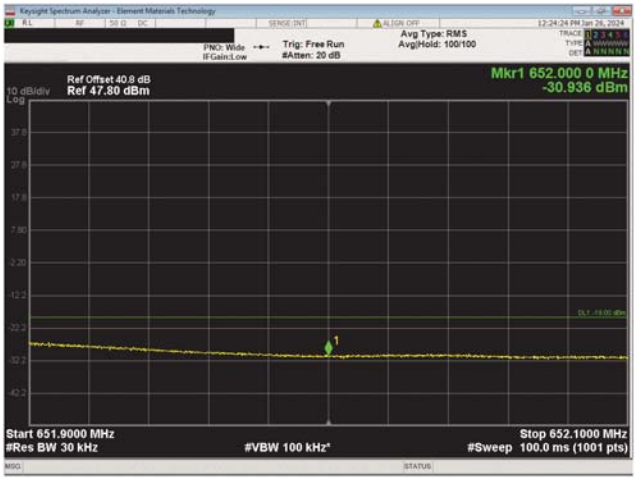
element
TbtTx 2023.12.05.0
WTD.2023.11.13.0



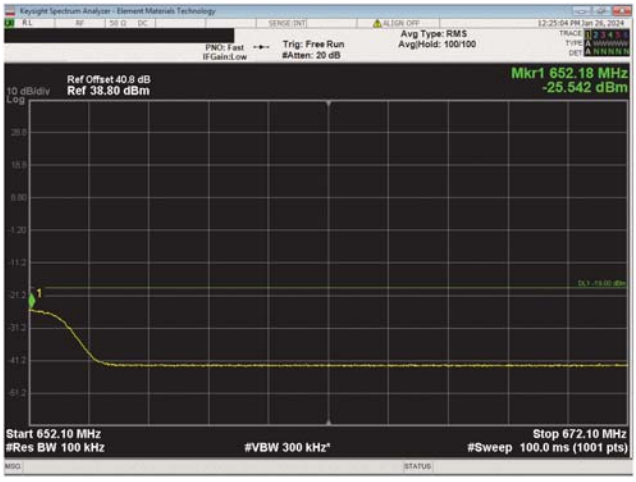
Port 1
NR 30 MHz Channel Bandwidth
256QAM
Low Ch, 632.0 MHz



Port 1
NR 30 MHz Channel Bandwidth
256QAM
Low Ch, 632.0 MHz



Port 1
NR 30 MHz Channel Bandwidth
256QAM
High Ch, 637.0 MHz



Port 1
NR 30 MHz Channel Bandwidth
256QAM
High Ch, 637.0 MHz