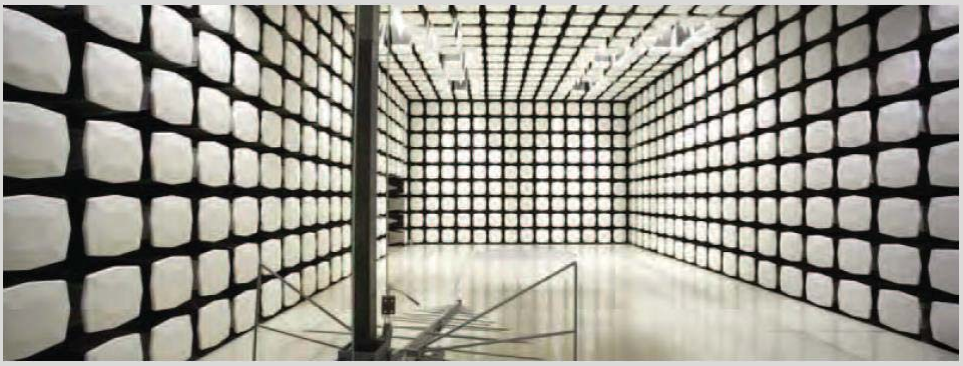
Radio Test Report
Application for a Permissive Change of Equipment Authorization
FCC Part 27 Subpart C
729MHz – 745MHz

FCC Part 90 Subpart R
758MHz – 768MHz

FCC ID: VBNAHLBA-01

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

Report: NOKI0046, Issue Date: September 23, 2022



CERT #3310.03

CERTIFICATE OF TEST

Last Date of Test: August 19, 2022
Nokia Solutions and Networks
EUT: Airscale Base Transceiver Station Remote Radio Head Model AHLBA

Radio Equipment Testing

Standards

Specification	Method
Code of Federal Regulations (CFR) Title 47 Part 2	ANSI C63.26-2015
CFR Title 47 Part 27 Subpart C Miscellaneous Wireless Communication Services	FCC KDB 971168 D01 v03r01
CFR Title 47 Part 90 Subpart R – Private Land Mobile Radio	FCC KDB 662911D01 v02r01

Results

Test Description	Applied	Results	Comments
Occupied Bandwidth	Yes	Pass	
Frequency Stability	No	N/A	Not requested.
Power Spectral Density and EIRP Calcualation	Yes	Pass	
Average Power	Yes	Pass	
Peak to Average Power (PAPR)CCDF	Yes	Pass	
Band Edge Compliance	Yes	Pass	
Spurious Conducted Emissions	Yes	Pass	
Spurious Emissions at the Antenna Terminals	Yes	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.

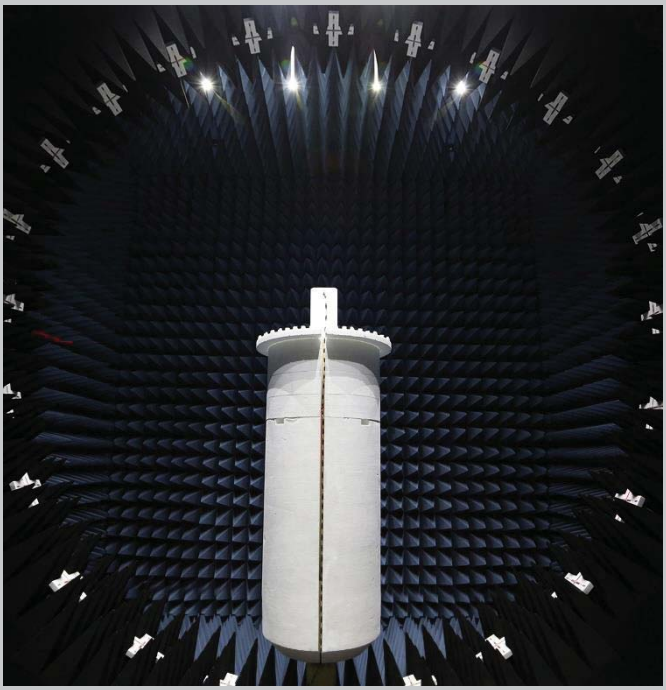
SCOPE

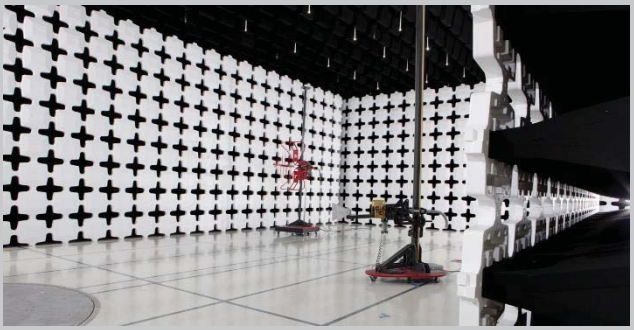
For details on the Scopes of our Accreditations, please visit:

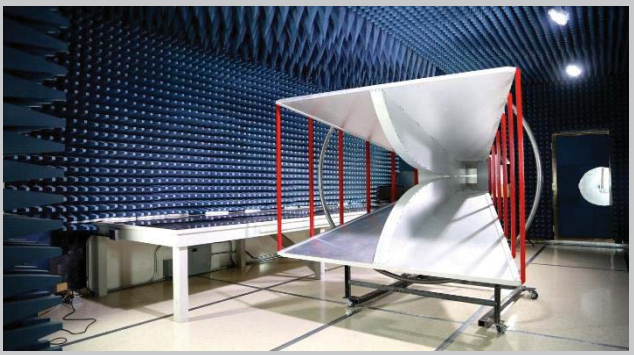
California Minnesota Oregon Texas Washington

FACILITIES

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

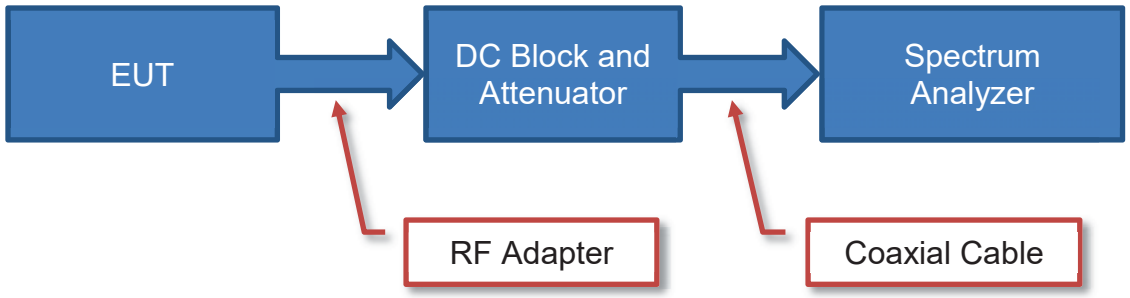
TEST SETUP BLOCK DIAGRAMS

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.

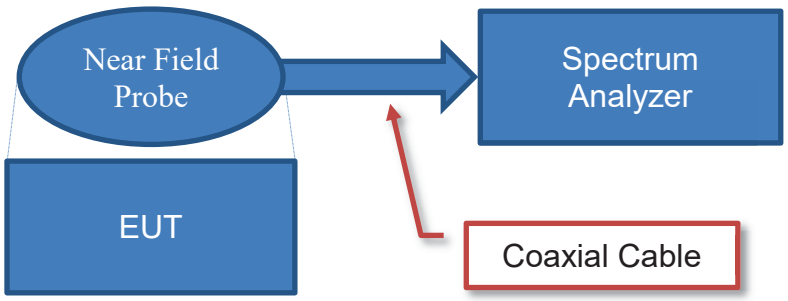
Antenna Port Conducted Measurements



Sample Calculation (logarithmic units)

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

Near Field Test Fixture Measurements

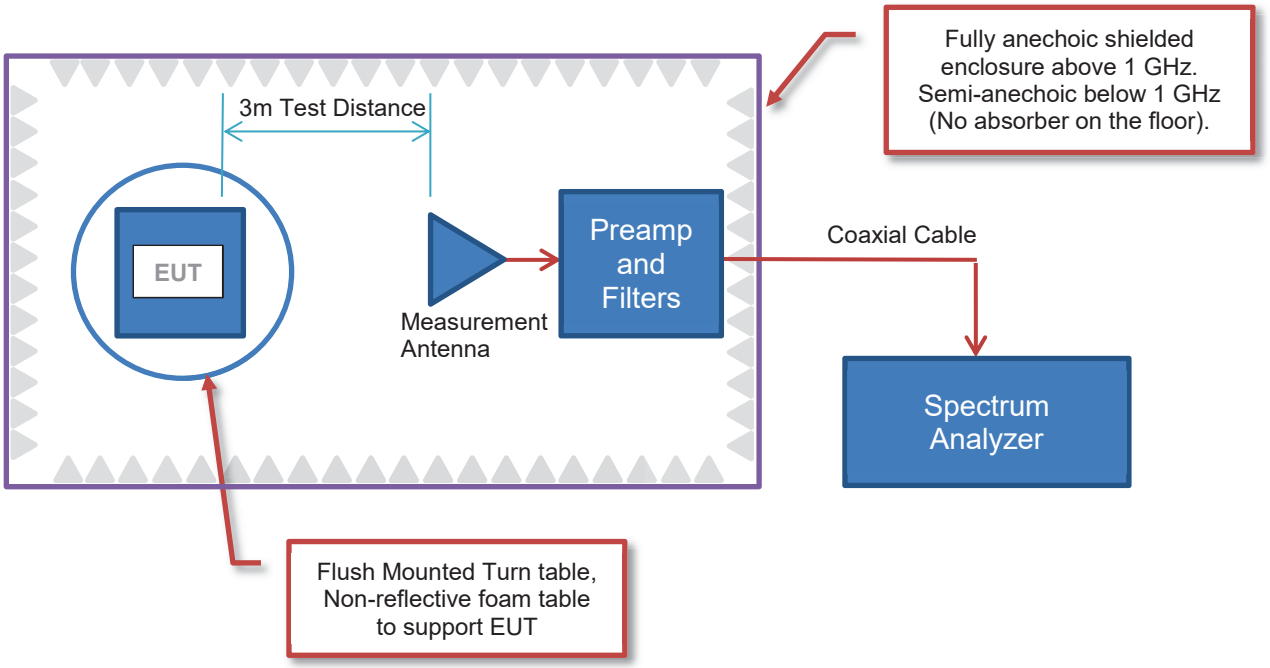


Sample Calculation (logarithmic units)

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**

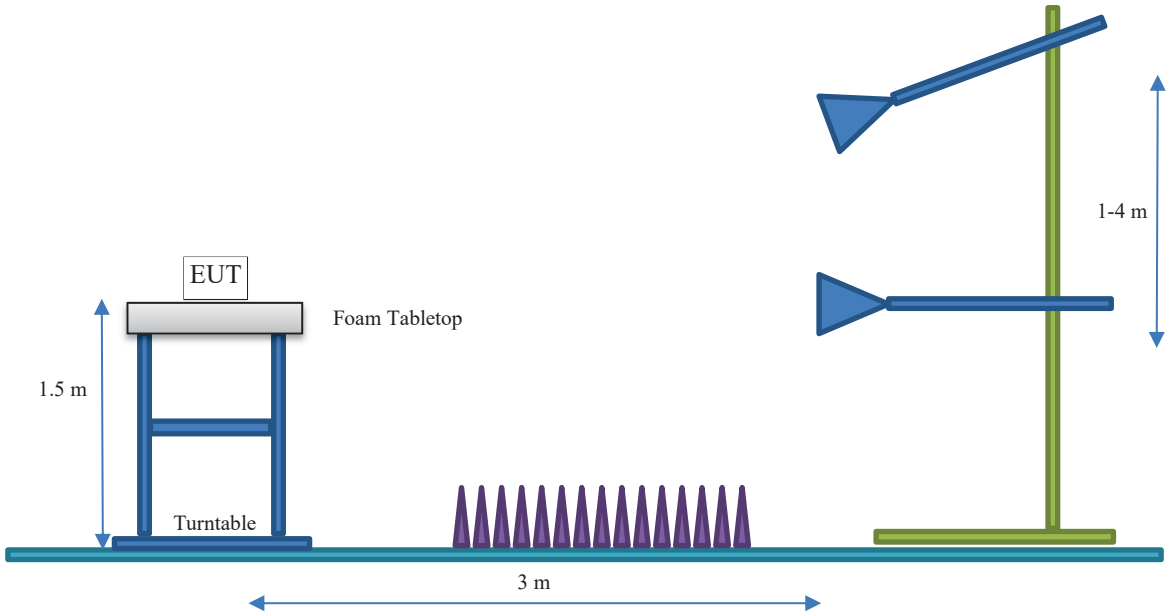
Radiated Power (ERP/EIRP) – Substitution Method:

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 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 AHLBA
First Date of Test:	August 17, 2022
Last Date of Test:	August 19, 2022
Receipt Date of Samples:	August 17, 2022
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 technologies to the AirScale Base Transceiver Station Remote Radio Head Model AHLBA FCC radio certifications. The original test effort includes testing for 4G LTE technologies. Please refer to the test report on the original certification (FCC ID: VBNAHLBA-01).

All conducted RF testing performed for the original certification testing has been repeated using 5G NR 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 (AHLBA) as the original certification test. The base station and remote radio head software for this testing is an updated release that includes 5G NR 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 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) variant AHLBA is being developed under this effort. The AHLBA remote radio head is a multi-standard multi-carrier radio module designed to support 4G LTE, 5G NR, 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 5G NR-FDD operations.**

The AHLBA RRH has four transmit/four receive antenna ports (4TX/4RX for Band n12 and 4TX/4RX for Band n14). Each antenna port supports 3GPP 5G NR frequency band n12 (BTS Rx: 699 to 715 MHz/BTS TX: 729 to 745 MHz) and 3GPP 5G NR frequency band n14 (BTS Rx: 788 to 798 MHz/BTS TX: 758 to 768 MHz). The maximum RF output power of the RRH is 320 Watts (80 watts per antenna port and 80 watts per carrier). The RRH can be operated as a 4x4 MIMO, 2x2 MIMO or as

non-MIMO. The TX and RX instantaneous bandwidth cover the full operational bandwidth. The RRH supports 5GNR bandwidths of 5, 10 and 15 MHz for band n12 and bandwidths of 5 and 10MHz for band n14. The RRH supports four 5GNR downlink modulation types (QPSK, 16QAM, 64QAM and 256QAM). Multi-carrier operation is supported.
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).
Single carriers are tested at the bottom, middle and top channels provided in Band n12 and Band n14 frequency channel tables. Multicarrier testing is performed at maximum port/carrier power per KDB 971168 D03v01 guidance.
The RRH has external interfaces including DC power (DC In), ground, transmit/receive (ANT), external alarm (EAC), optical CPRI/eCPRI (OPT) and remote electrical tilt (RET). The RRH with applicable installation kit may be pole or wall mounted.

Multicarrier/Multiband test cases have been developed as shown below:
Multi-Carrier Test Case 1 (3GPP Band n12 Multicarrier): Three NR5 carriers using two carriers (with minimum spacing between carrier frequencies) at the lower band (731.5MHz & 736.5MHz) and a third carrier with maximum spacing between the other two carrier frequencies (742.5MHz) at the upper band edge. The NR 5MHz channel bandwidth was selected to maximize carrier power spectral density. The carriers are operated at maximum power for a total port power of 80 watts (~26.6W/Band n12 carriers).
Multi-Carrier Test Case 2 (3GPP Band n12 and Band n14 Multicarrier/Multiband): In the Band n12 _ Two NR5 carriers at the lower band edge (731.5 & 736.5MHz). In Band n14 one NR5 carrier at the upper band edge (765.5MHz). The NR 5MHz channel bandwidth was selected to maximize carrier power spectral density. The carriers are operated at maximum power for a total port power of 80 watts (~26.6W/Band n12/n14 carriers).

AHLBA 3GPP Frequency Band n12 5GNR Downlink Band Edge NR-ARFCNs

The 3GPP frequency band n12 (729 - 745 MHz) band edge downlink (BTS Transmit) NR-ARFCNs for 5GNR channel bandwidths (5,10, and 15 MHz) are provided below. The NR-ARFCN is defined as New Radio - Absolute Radio Frequency Channel Number.

	Downlink NR-ARFCN	Downlink Frequency (MHz)	5GNR Channel Bandwidth		
			5 MHz	10 MHz	15 MHz
Band n12 (Ant 1, 2, 3, 4)	145800	729.0	Band Edge	Band Edge	Band Edge
	……				
	146300	731.5	Bottom Ch		
	……				
	146800	734.0		Bottom Ch	
	……				
	147300	736.5			Bottom Ch
	……				
	147400	737	Middle Ch	Middle Ch	Middle Ch
	……				
	147500	737.5			Top Channel
	……				
	148000	740		Top Channel	
	……				
	148500	742.5	Top Channel		
	……				
	149000	745.0	Band Edge	Band Edge	Band Edge

AHLBA Downlink Band Edge 5GNR Band n12 Frequency Channels

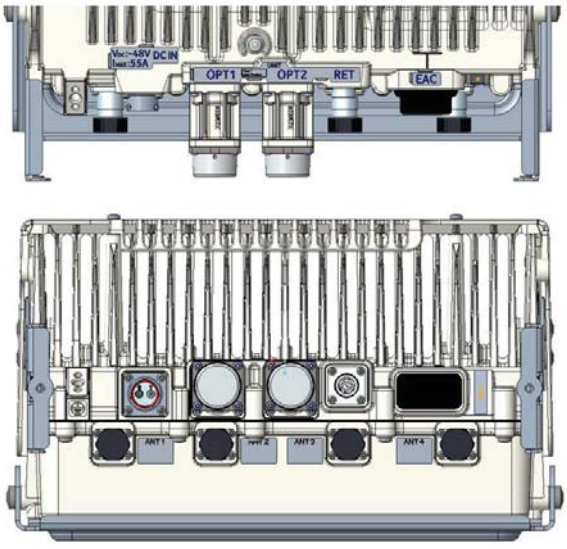
AHLBA 3GPP Frequency Band n14 5GNR Downlink Band Edge NR-ARFCNs

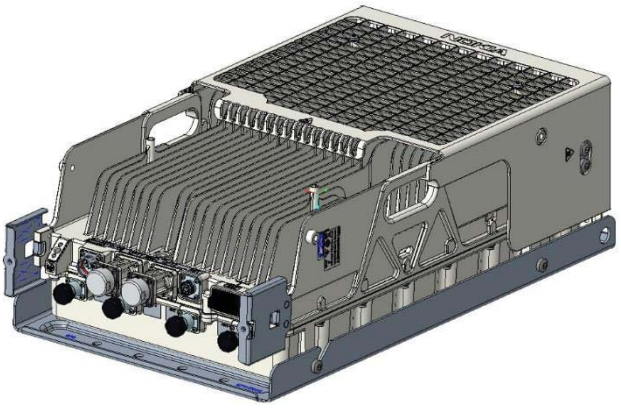
The 3GPP frequency band n14 (758-768 MHz) band edge downlink (BTS Transmit) NR-ARFCNs for 5GNR channel bandwidths (5 and 10MHz) are provided below. The NR-ARFCN is defined as New Radio -Absolute Radio Frequency Channel Number.

	Downlink NR-ARFCN	Downlink Frequency (MHz)	5GNR Channel Bandwidth	
			5 MHz	10 MHz
Band n14 (Ant 1, 2, 3, 4)	151600	758.0	Band Edge	Band Edge
	……			
	152100	760.5	Bottom Ch	
	……			
	152600	763.0	Middle Ch	Bottom Ch Middle Ch Top Channel
	……			
	153100	765.5	Top Channel	
	……			
	153600	768.0	Band Edge	Band Edge

AHLBA Downlink Band edge 5GNR Band n14 Frequency Channels

AHLBA Connector Layout





PRODUCT DESCRIPTION

AHLBA 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

Testing Objective:

A permissive change on the original filing is being pursued to add 5G NR operations to the Nokia Solutions and Networks AirScale Base Transceiver Station (BTS) Remote Radio Head (RRH) model AHLBA FCC certifications.

CONFIGURATIONS

Configuration NOKI0046- 1

Software/Firmware Running during test	
Description	**Version**
Radio Module Software	RF. FRM5.trunk.20220621.022
BTS Software Version (22R4)	SBTS22R4_ENB_9999_22063_000003

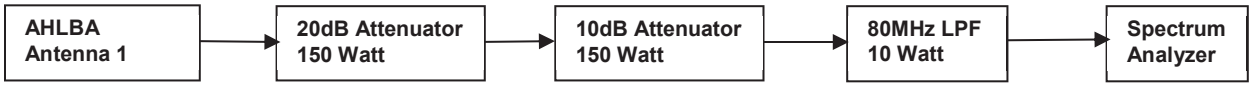
Equipment being tested (include Peripherals)			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
AMIA (BTS System Module)	Nokia Solutions and Networks	473098A.101	J8164063259
ASIB (BTS System Module)	Nokia Solutions and Networks	473764A.102	K9214331950
ABIO (BTS System Module)	Nokia Solutions and Networks	475266A.102	L1205105845
AHLBA (Remote Radio Head)	Nokia Solutions and Networks	474240A.101	K9180844519
Low Pass Filter	Mini-Circuits	VLFX-80+	RUU95701952
Attenuator 150W/20dB	AeroflexWeinschel	66-20-33	BZ2075
Attenuator 150W/10dB	AeroflexWeinschel	6375	BJ2483
SFP+ 9.8G,300M,850NM	Nokia	474900A.101	VF2023004CK
SFP+ 9.8G,300M,850NM	Nokia	474900A.101	VF2023000RM
Lenovo T490	HP	T490	PF26RVZ0
Keysight N8757- DC System power supply	Keysight	N8757A	US21D4054S
FPAC (DC – Radio power supply)	Nokia	472438A.101	G7111007170
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC865
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC863
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC866
Fiber Optic cable	Amphenol	E201648	2701M
CAT5e data cable	LEONI L	64867M	146180
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297384
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297374
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297373
1 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_104	SN551123/4
6 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN528836/6
GPS Receiver	Trimble	92626-60	71231431
GPS cable	Nokia	FTSH 472577A.103	CA2029

CONFIGURATIONS

Cables (Peripheral)					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
Fiber Optic Cable	N	7 meters	N	ABIO	AHLBA
Cat-5e Cable	Y	7 meters	N	ASIB	WebEM- PC
HS-SUCOFLEX_106 – RF CABLE	Y	6 meters	N	EUT [AHLBA] Ant 2-4	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 [AHLBA] Ant 1	Attenuator 150W/20dB
Attenuator 150W/20dB	Y	NA	N	RF cable HS-SUCOFLEX_106	Attenuator 150W/10dB
Attenuator 150W/10dB	Y	NA	N	Attenuator 150W/20dB	Low Pass Filter 80MHz/10W
Low Pass Filter 80MHz/10W	Y	NA	N	Attenuator 100W/10dB	RF cable HS-SUCOFLEX_104
HS-SUCOFLEX_104	Y	1 meter	N	Low Pass Filter 80MHz/10W	Spectrum Analyzer

RF Test Setup Diagram:



CONFIGURATIONS

Configuration NOKI0046- 2

Software/Firmware Running during test	
Description	**Version**
Radio Module Software	RF. FRM5.trunk.20220621.022
BTS Software Version (22R4)	SBTS22R4_ENB_9999_22063_000003

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	K9214331950
ABIO (BTS System Module)	Nokia Solutions and Networks	475266A.102	L1205105845
AHLBA (Remote Radio Head)	Nokia Solutions and Networks	474240A.101	K9180844519
Attenuator 40dB/250W	API Weinschel	58-40-43-LIM	TC909
SFP+ 9.8G,300M,850NM	Nokia	474900A.101	VF2023004CK
SFP+ 9.8G,300M,850NM	Nokia	474900A.101	VF2023000RM
Lenovo T490	HP	T490	PF26RVZ0
Keysight N8757- DC System power supply	Keysight	N8757A	US21D4054S
FPAC (DC – Radio power supply)	Nokia	472438A.101	G7111007170
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC865
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC863
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC866
Fiber Optic cable	Amphenol	E201648	2701M
CAT5e data cable	LEONI L	64867M	146180
2 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297384
2 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297374
2 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297373
1 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_104	SN551123/4
6 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN528836/6
GPS Receiver	Trimble	92626-60	71231431
GPS cable	Nokia	FTSH 472577A.103	CA2029

CONFIGURATIONS

Cables (Peripheral)					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
Fiber Optic Cable	N	7 meters	N	ABIO	AHLBA
Cat-5e Cable	Y	7 meters	N	ASIB	WebEM- PC
HS-SUCOFLEX_106 – RF CABLE	Y	6 meters	N	EUT [AHLBA] Ant 2-4	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 [AHLBA] Ant 1	Attenuator 250W/40dB
Attenuator 250W/40dB	Y	NA	N	RF cable HS-SUCOFLEX_106	RF cable HS-SUCOFLEX_104
HS-SUCOFLEX_104	Y	1 meter	N	Attenuator 250W/40dB	Spectrum Analyzer

RF Test Setup Diagram:

CONFIGURATIONS

Configuration NOKI0046- 3

Software/Firmware Running during test	
Description	**Version**
Radio Module Software	RF. FRM5.trunk.20220621.022
BTS Software Version (22R4)	SBTS22R4_ENB_9999_22063_000003

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	K9214331950
ABIO (BTS System Module)	Nokia Solutions and Networks	475266A.102	L1205105845
AHLBA (Remote Radio Head)	Nokia Solutions and Networks	474240A.101	K9180844519
1.2 GHz High Pass Filter 2W	RLC Electronics	F-14699	0050
Attenuator 150W/20dB	AeroflexWeinschel	66-20-33	BZ2075
Attenuator 100W/3dB	AeroflexWeinschel	47-3-33	CG5493
SFP+ 9.8G,300M,850NM	Nokia	474900A.101	VF2023004CK
SFP+ 9.8G,300M,850NM	Nokia	474900A.101	VF2023000RM
Lenovo T490	HP	T490	PF26RVZ0
Keysight N8757- DC System power supply	Keysight	N8757A	US21D4054S
FPAC (DC – Radio power supply)	Nokia	472438A.101	G7111007170
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC865
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC863
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC866
Fiber Optic cable	Amphenol	E201648	2701M
CAT5e data cable	LEONI L	64867M	146180
2 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297384
2 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297374
2 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297373
1 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_104	SN551123/4
6 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN528836/6
GPS Receiver	Trimble	92626-60	71231431
GPS cable	Nokia	FTSH 472577A.103	CA2029

CONFIGURATIONS

Cables (Peripheral)					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
Fiber Optic Cable	N	7 meters	N	ABIO	AHLBA
Cat-5e Cable	Y	7 meters	N	ASIB	WebEM- PC
HS-SUCOFLEX_106 – RF CABLE	Y	6 meters	N	EUT [AHLBA] Ant 2-4	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 [AHLBA] Ant 1	Attenuator 150W/20dB
Attenuator 150W/20dB	Y	NA	N	RF cable HS-SUCOFLEX_106	Attenuator 100W/3dB
Attenuator 100W/3dB	Y	NA	N	Attenuator 150W/20dB	1.2 GHz High Pass Filter 2W
1.2 GHz High Pass Filter 2W	Y	NA	N	Attenuator 100W/3dB	RF cable HS-SUCOFLEX_104
HS-SUCOFLEX_104	Y	1 meter	N	High Pass Filter 2W	Spectrum Analyzer

RF Test Setup Diagram:

CONFIGURATIONS

Configuration NOKI0046- 4

Software/Firmware Running during test	
Description	**Version**
Radio Module Software	RF. FRM5.trunk.20220621.022
BTS Software Version (22R4)	SBTS22R4_ENB_9999_22063_000003

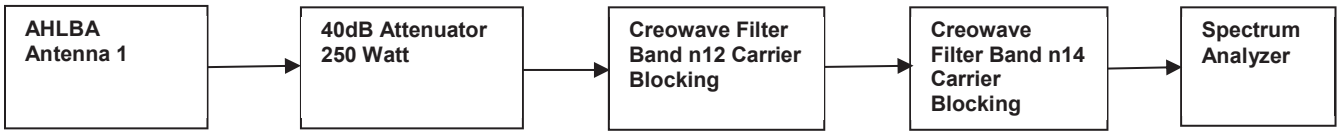
Equipment being tested (include Peripherals)			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
AMIA (BTS System Module)	Nokia Solutions and Networks	473098A.101	J8164063259
ASIB (BTS System Module)	Nokia Solutions and Networks	473764A.102	K9214331950
ABIO (BTS System Module)	Nokia Solutions and Networks	475266A.102	L1205105845
AHLBA (Remote Radio Head)	Nokia Solutions and Networks	474240A.101	K9180844519
Band n12 Carrier Blocking Filter	Creowave Filters OY	CW-DPF-729-745-E1-M2	901003
Band n14 Carrier Blocking Filter	Creowave Filters OY	CW-DPF-758-768-E5-M2	1001001
Attenuator 250W/40dB	API Weinschel	253-40-33-LIM	UP093
SFP+ 9.8G,300M,850NM	Nokia	474900A.101	VF2023004CK
SFP+ 9.8G,300M,850NM	Nokia	474900A.101	VF2023000RM
Lenovo T490	HP	T490	PF26RVZ0
Keysight N8757- DC System power supply	Keysight	N8757A	US21D4054S
FPAC (DC – Radio power supply)	Nokia	472438A.101	G7111007170
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC865
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC863
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC866
Fiber Optic cable	Amphenol	E201648	2701M
CAT5e data cable	LEONI L	64867M	146180
2 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297384
2 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297374
2 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297373
1 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_104	SN551123/4
6 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN528836/6
GPS Receiver	Trimble	92626-60	71231431
GPS cable	Nokia	FTSH 472577A.103	CA2029

CONFIGURATIONS

Cables (Peripheral)					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
Fiber Optic Cable	N	7 meters	N	ABIO	AHLBA
Cat-5e Cable	Y	7 meters	N	ASIB	WebEM- PC
HS-SUCOFLEX_106 – RF CABLE	Y	6 meters	N	EUT [AHLBA] Ant 2-4	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 [AHLBA] Ant port 1	Attenuator 250W/40dB
Attenuator 250W/40dB	Y	NA	N	RF cable HS-SUCOFLEX_106	Band n12 Carrier Blocking Filter
Band n12 Carrier Blocking Filter	Y	NA	N	Attenuator 250W/40dB	Band n14 Carrier Blocking Filter
Band n14 Carrier Blocking Filter	Y	NA	N	Band n12 Carrier Blocking Filter	HS-SUCOFLEX_104
HS-SUCOFLEX_104	Y	1 meter	N	Band n14 Carrier Blocking Filter	Spectrum Analyzer

RF Test Setup Diagram:



MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2022-08-17	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	2022-08-19	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.
3	2022-08-19	Power Spectral Density and EIRP Calculation	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	2022-08-19	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.
5	2022-08-19	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	2022-08-19	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.
7	2022-08-19	Spurious Emissions at the Antenna Terminals	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

OCCUPIED BANDWIDTH - Band n12

XMit 2022.02.07.0

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
Block - DC	Fairview Microwave	SD3239	ANE	2022-03-02	2023-03-02
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2022-01-17	2023-01-17

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.
The emissions bandwidth 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 5.4 of ANSI C63.26 was used to make the measurement.

FCC Emission Designators for Band n12 (729MHz to 745MHz)					
Chan BW	Radio Channel	5G-NR: QPSK	5G-NR: 16QAM	5G-NR: 64QAM	5G-NR: 256QAM
5MHz	Low				4M82G7W
	Mid	4M83G7W	4M82G7W	4M82G7W	4M82G7W
	High				4M83G7W
10MHz	Low				9M86G7W
	Mid	9M89G7W	9M82G7W	9M90G7W	9M86G7W
	High				9M87G7W
15MHz	Low				14M9G7W
	Mid	14M9G7W	14M9G7W	14M9G7W	14M9G7W
	High				14M9G7W
Note: FCC emission designators are based on 26dB emission bandwidth.					

The spectrum analyzer settings were as follows: RBW is 1% - 5% of the occupied bandwidth VBW is ≥ 3x the RBW Peak Detector and Trace max hold was used.

RRH conducted emissions testing was performed only on one port. The AHLBA antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in this 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.

FCC 27.53 defines the 26dB emission bandwidth requirement.

OCCUPIED BANDWIDTH - Band n12

element

TbtTx 2022.05.02.0 XMit 2022.02.07.0

EUT:	AHLBA			Work Order:	NOKI0046
Serial Number:	K9180844519			Date:	17-Aug-22
Customer:	Nokia Solutions and Networks			Temperature:	21.3 °C
Attendees:	David Le			Humidity:	52.9% RH
Project:	None			Barometric Pres.:	1017 mbar
Tested by:	Marty Martin	Power:	54 VDC	Job Site:	TX07

TEST SPECIFICATIONS	Test Method
FCC 27:2022	ANSI C63.26:2015
FCC 90R:2022	ANSI C63.26:2015

COMMENTS

All measurement path loses accounted for in the reference level offest including any attenuators, filters, and DC blocks. Carriers enabled at maximum power.

DEVIATIONS FROM TEST STANDARD

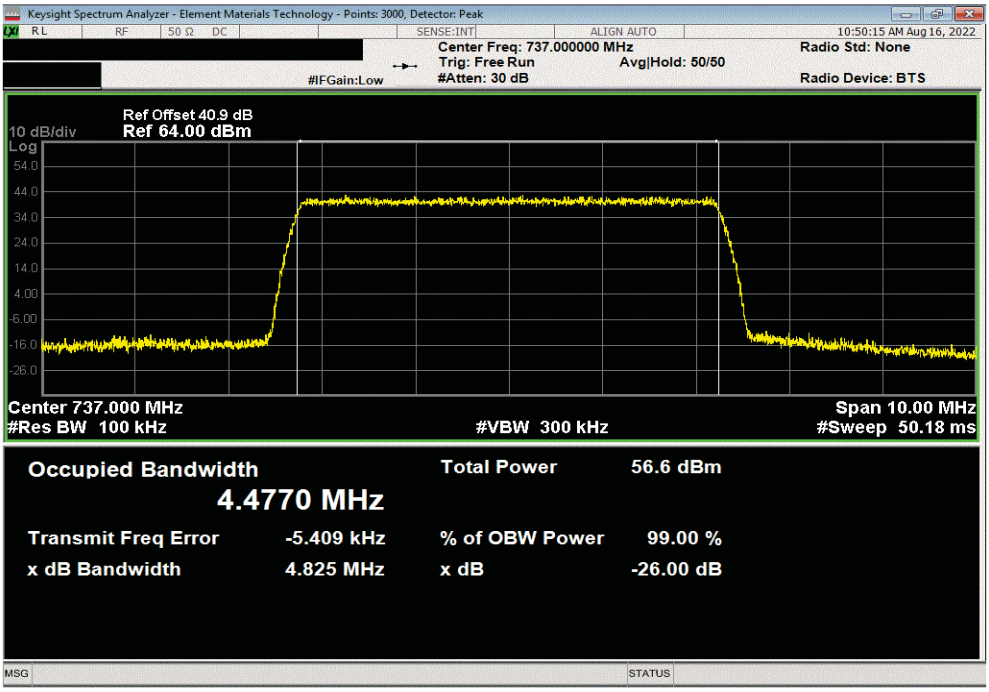
None

Configuration #	2	Signature

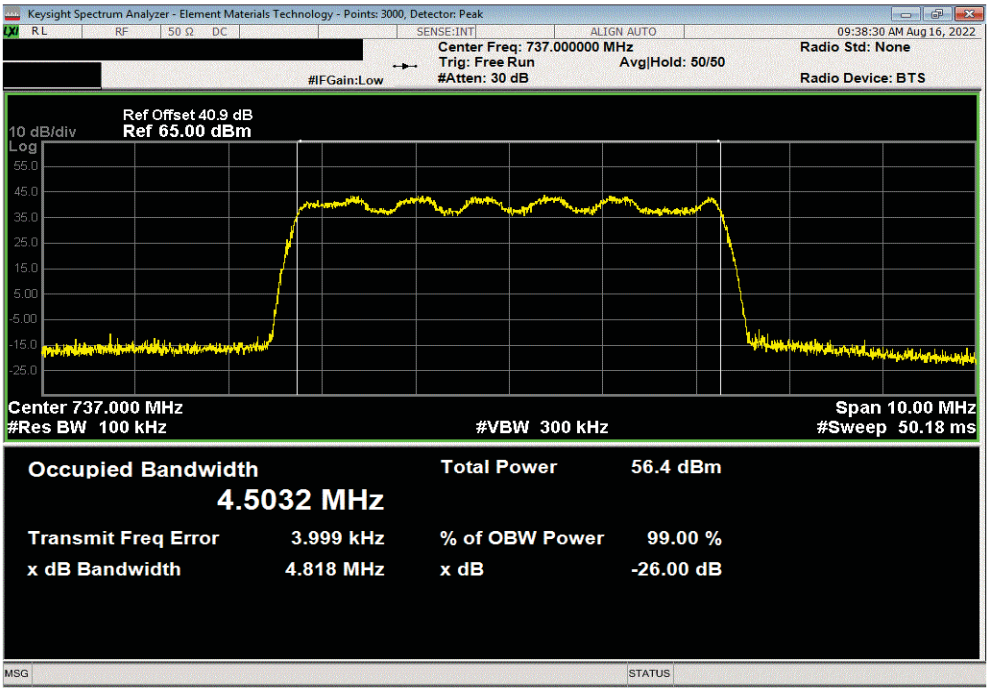
	Value 99 % (MHz)	Value 26 dB (MHz)	Limit	Result
Port 1				
5G NR Band n12, 729 - 745 Mhz				
5 MHz Bandwidth				
QPSK Modulation				
Mid Channel, 737.0 MHz	4.48	4.83	Within Band	Pass
16QAM Modulation				
Mid Channel, 737.0 MHz	4.5	4.82	Within Band	Pass
64QAM Modulation				
Mid Channel, 737.0 MHz	4.47	4.82	Within Band	Pass
256QAM Modulation				
Low Channel, 731.5 MHz	4.48	4.82	Within Band	Pass
Mid Channel, 737.0 MHz	4.48	4.82	Within Band	Pass
High Channel, 742.5 MHz	4.48	4.83	Within Band	Pass
10 MHz Bandwidth				
QPSK Modulation				
Mid Channel, 737.0 MHz	9.3	9.89	Within Band	Pass
16QAM Modulation				
Mid Channel, 737.0 MHz	9.24	9.82	Within Band	Pass
64QAM Modulation				
Mid Channel, 737.0 MHz	9.3	9.9	Within Band	Pass
256QAM Modulation				
Low Channel, 734 MHz	9.29	9.86	Within Band	Pass
Mid Channel, 737.0 MHz	9.29	9.86	Within Band	Pass
High Channel, 740 MHz	9.29	9.87	Within Band	Pass
15 MHz Bandwidth				
QPSK Modulation				
Mid Channel, 737.0 MHz	14.1	14.9	Within Band	Pass
16QAM Modulation				
Mid Channel, 737.0 MHz	14.2	14.9	Within Band	Pass
64QAM Modulation				
Mid Channel, 737.0 MHz	14.1	14.9	Within Band	Pass
256QAM Modulation				
Low Channel, 736.5 MHz	14.1	14.9	Within Band	Pass
Mid Channel, 737.0 MHz	14.1	14.9	Within Band	Pass
High Channel, 737.5 MHz	14.1	14.9	Within Band	Pass

OCCUPIED BANDWIDTH - Band n12

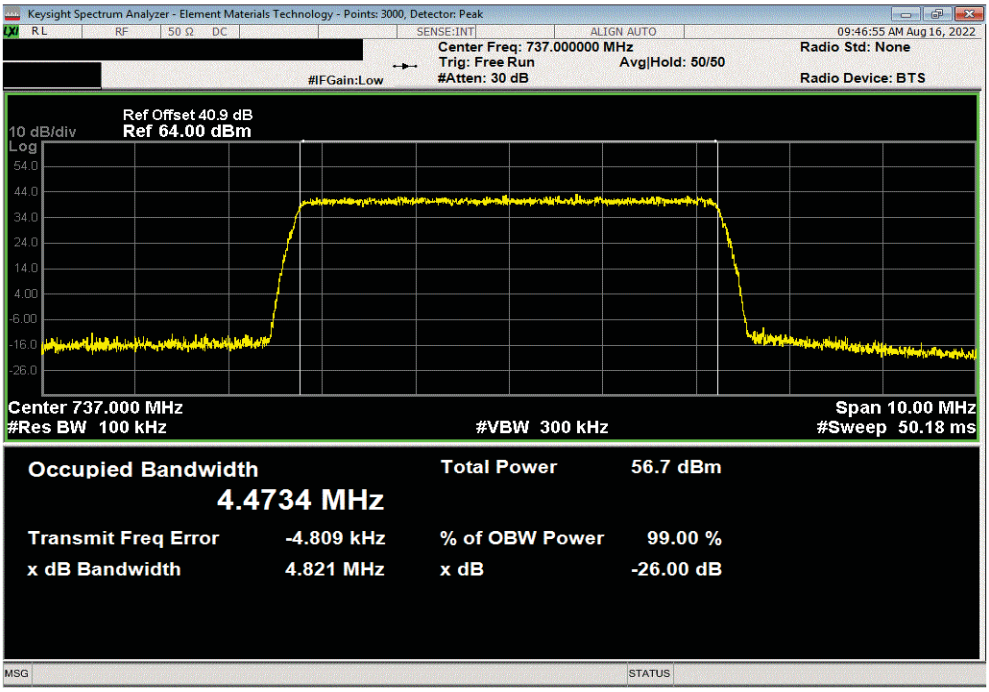
Port 1, 5G NR, Band n12, 729 - 745 Mhz, 5 MHz Bandwidth, QPSK Modulation, Mid Channel, 737.0 MHz						
			Value 99 % (MHz)	Value 26 dB (MHz)	Limit	Result
			4.48	4.83	Within Band	Pass



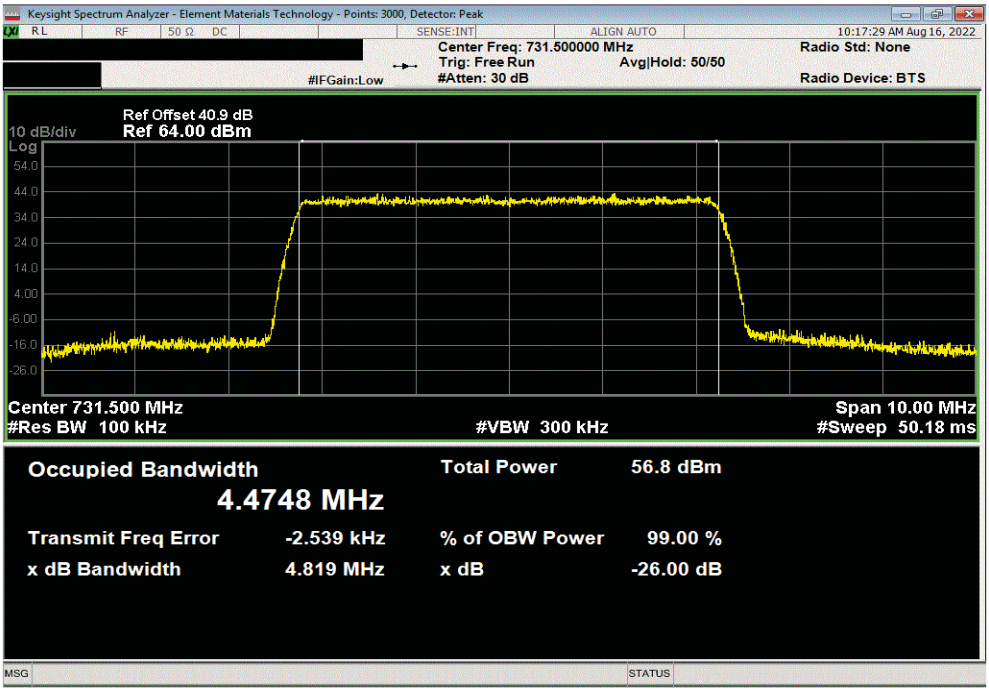
Port 1, 5G NR, Band n12, 729 - 745 Mhz, 5 MHz Bandwidth, 16QAM Modulation, Mid Channel, 737.0 MHz						
			Value 99 % (MHz)	Value 26 dB (MHz)	Limit	Result
			4.5	4.82	Within Band	Pass



Port 1, 5G NR, Band n12, 729 - 745 Mhz, 5 MHz Bandwidth, 64QAM Modulation, Mid Channel, 737.0 MHz						
			Value 99 % (MHz)	Value 26 dB (MHz)	Limit	Result
			4.47	4.82	Within Band	Pass

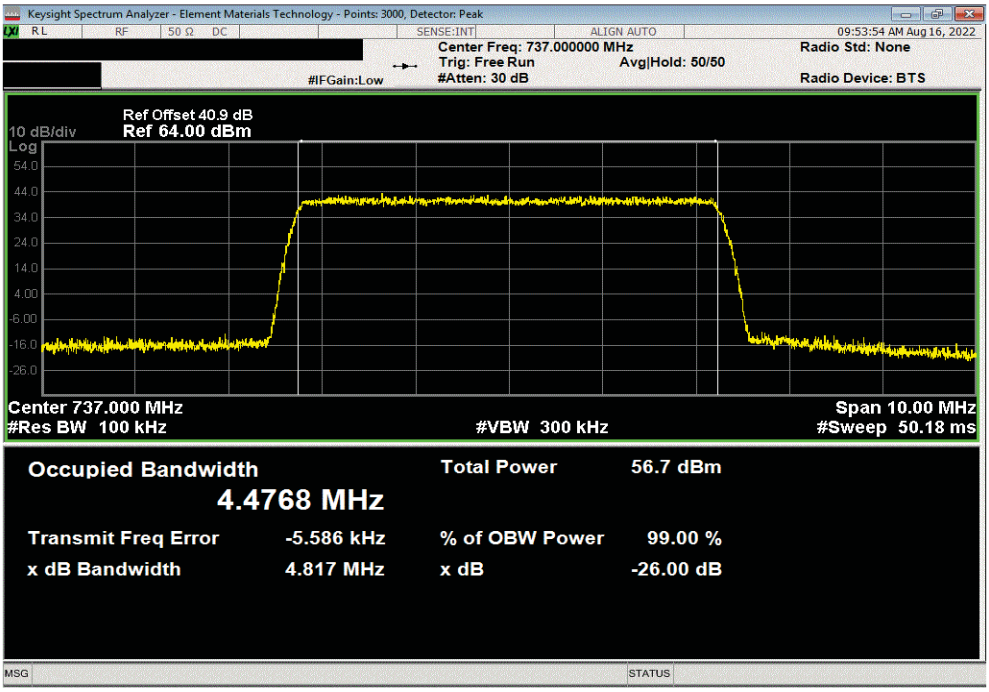


Port 1, 5G NR, Band n12, 729 - 745 Mhz, 5 MHz Bandwidth, 256QAM Modulation, Low Channel, 731.5 MHz						
			Value 99 % (MHz)	Value 26 dB (MHz)	Limit	Result
			4.48	4.82	Within Band	Pass



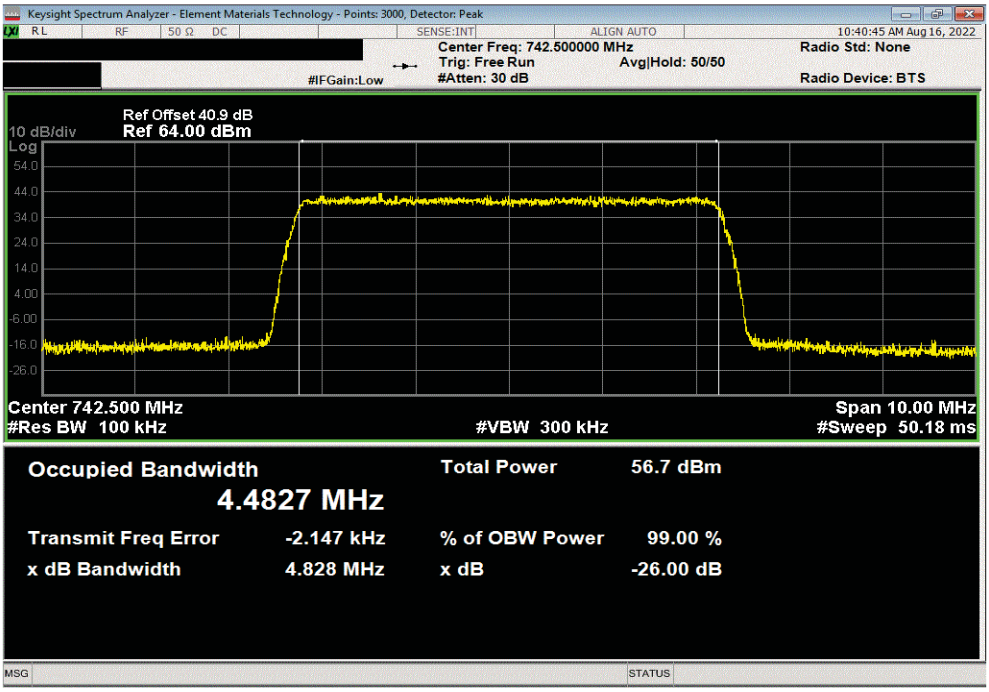
Port 1, 5G NR, Band n12, 729 - 745 Mhz, 5 MHz Bandwidth, 256QAM Modulation, Mid Channel, 737.0 MHz

			Value 99 % (MHz)	Value 26 dB (MHz)	Limit	Result
			4.48	4.82	Within Band	Pass



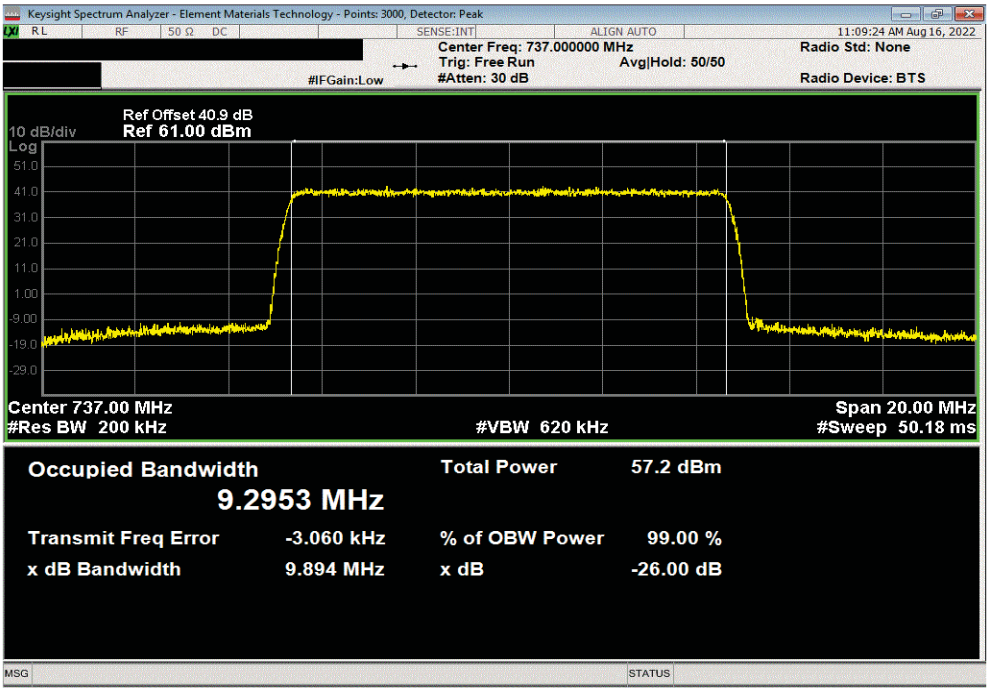
Port 1, 5G NR, Band n12, 729 - 745 Mhz, 5 MHz Bandwidth, 256QAM Modulation, High Channel, 742.5 MHz

			Value 99 % (MHz)	Value 26 dB (MHz)	Limit	Result
			4.48	4.83	Within Band	Pass

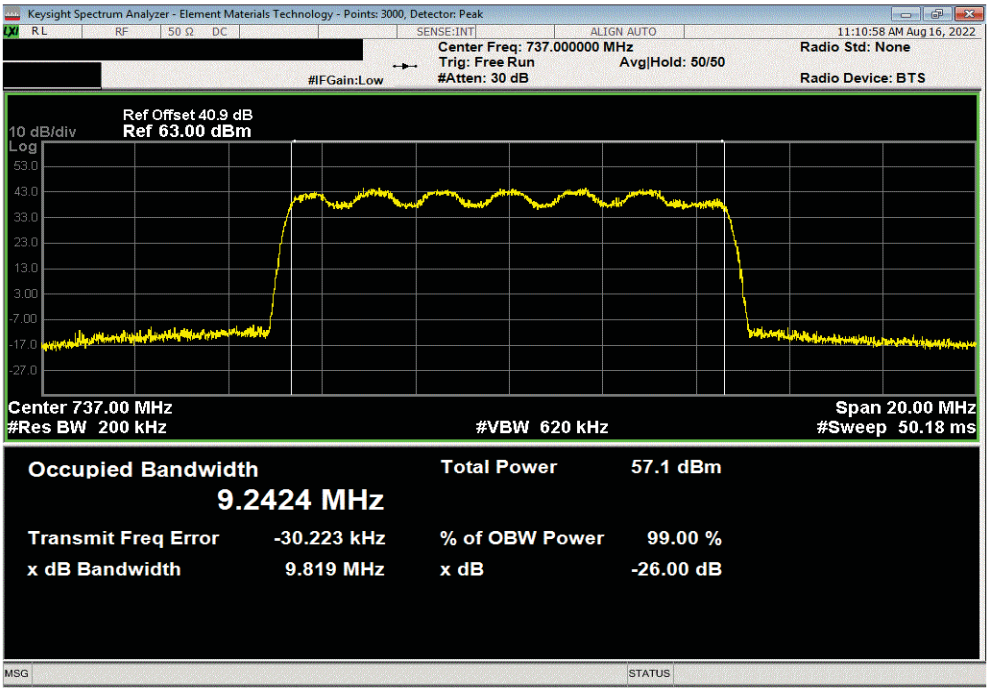


OCCUPIED BANDWIDTH - Band n12

Port 1, 5G NR, Band n12, 729 - 745 Mhz, 10 MHz Bandwidth, QPSK Modulation, Mid Channel, 737.0 MHz						
			Value 99 % (MHz)	Value 26 dB (MHz)	Limit	Result
			9.3	9.89	Within Band	Pass

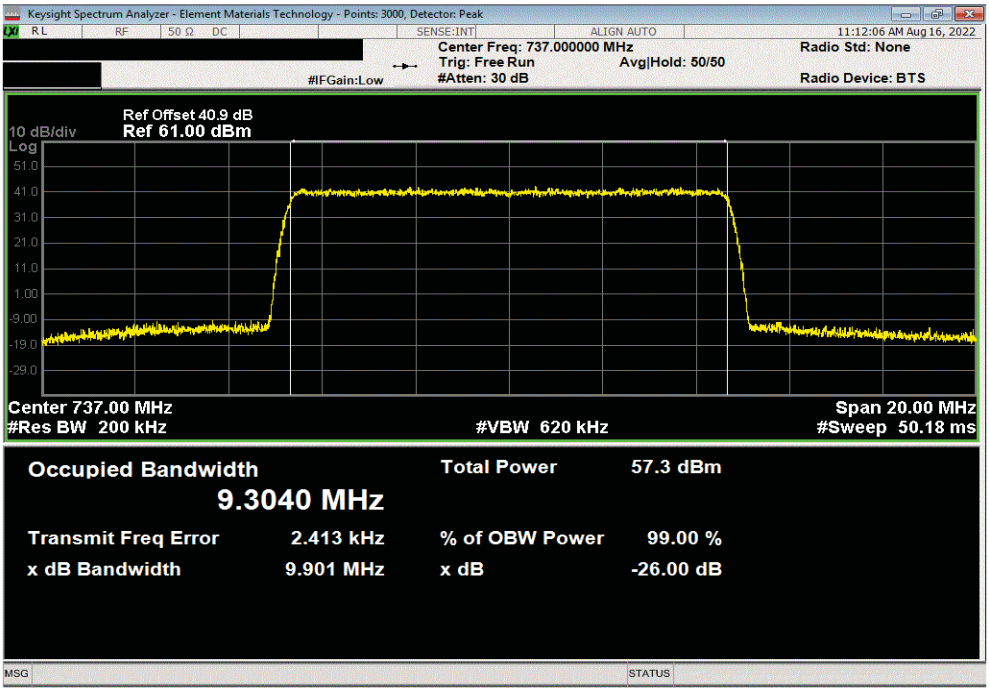


Port 1, 5G NR, Band n12, 729 - 745 Mhz, 10 MHz Bandwidth, 16QAM Modulation, Mid Channel, 737.0 MHz						
			Value 99 % (MHz)	Value 26 dB (MHz)	Limit	Result
			9.24	9.82	Within Band	Pass

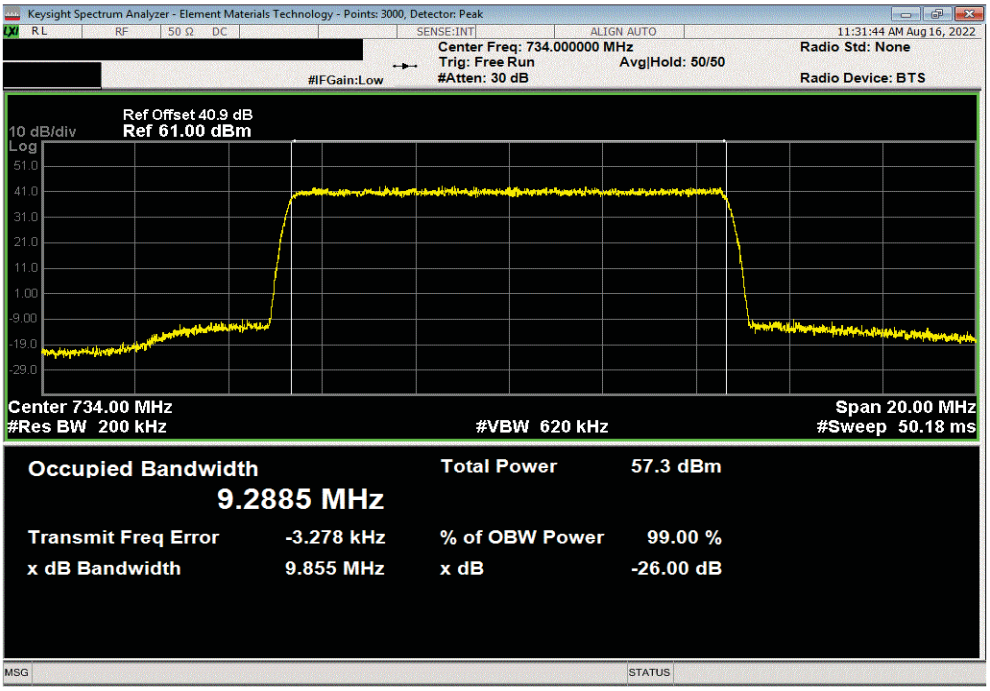


OCCUPIED BANDWIDTH - Band n12

Port 1, 5G NR, Band n12, 729 - 745 Mhz, 10 MHz Bandwidth, 64QAM Modulation, Mid Channel, 737.0 MHz						
			Value 99 % (MHz)	Value 26 dB (MHz)	Limit	Result
			9.3	9.9	Within Band	Pass

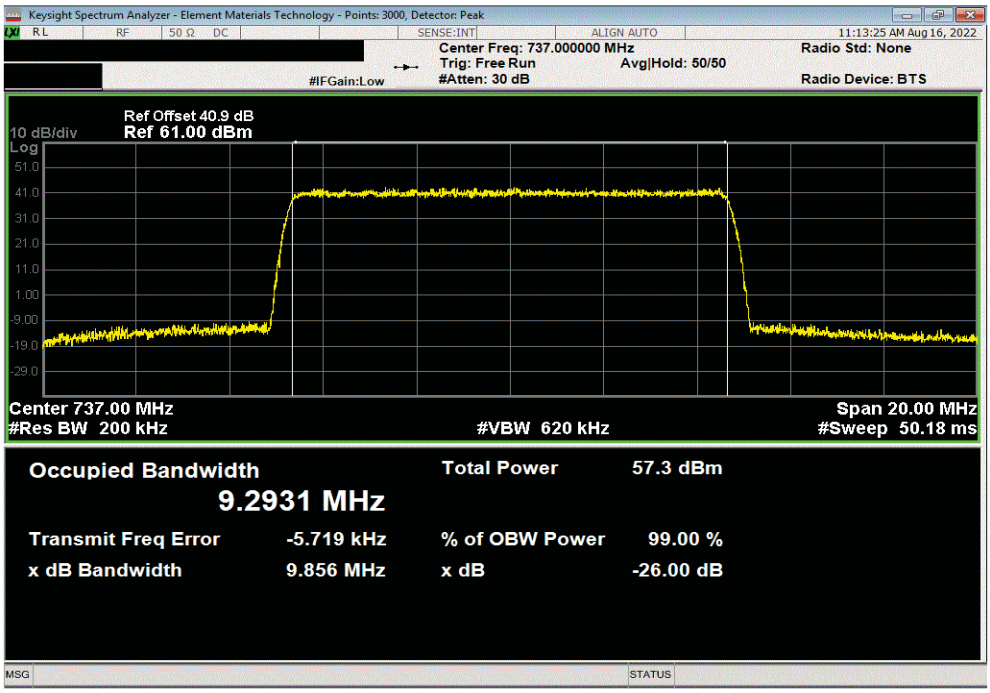


Port 1, Band n12, 729 - 745 Mhz, 10 MHz Bandwidth, 256QAM Modulation, Low Channel, 734 MHz						
			Value 99 % (MHz)	Value 26 dB (MHz)	Limit	Result
			9.29	9.86	Within Band	Pass

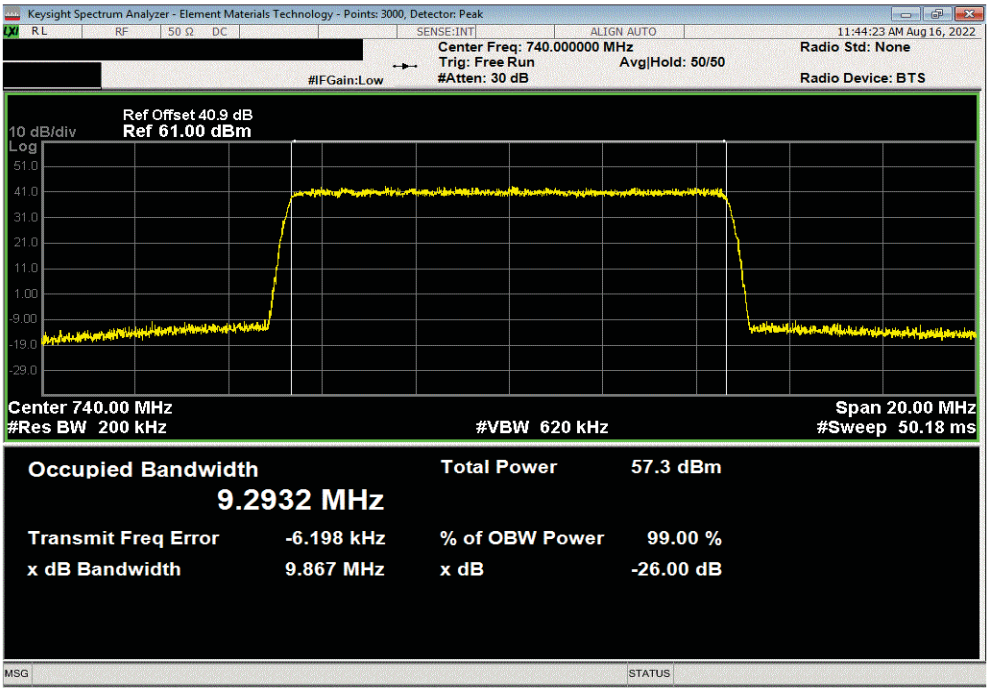


OCCUPIED BANDWIDTH - Band n12

Port 1, Band n12, 729 - 745 Mhz, 10 MHz Bandwidth, 256QAM Modulation, Mid Channel, 737.0 MHz						
			Value 99 % (MHz)	Value 26 dB (MHz)	Limit	Result
			9.29	9.86	Within Band	Pass

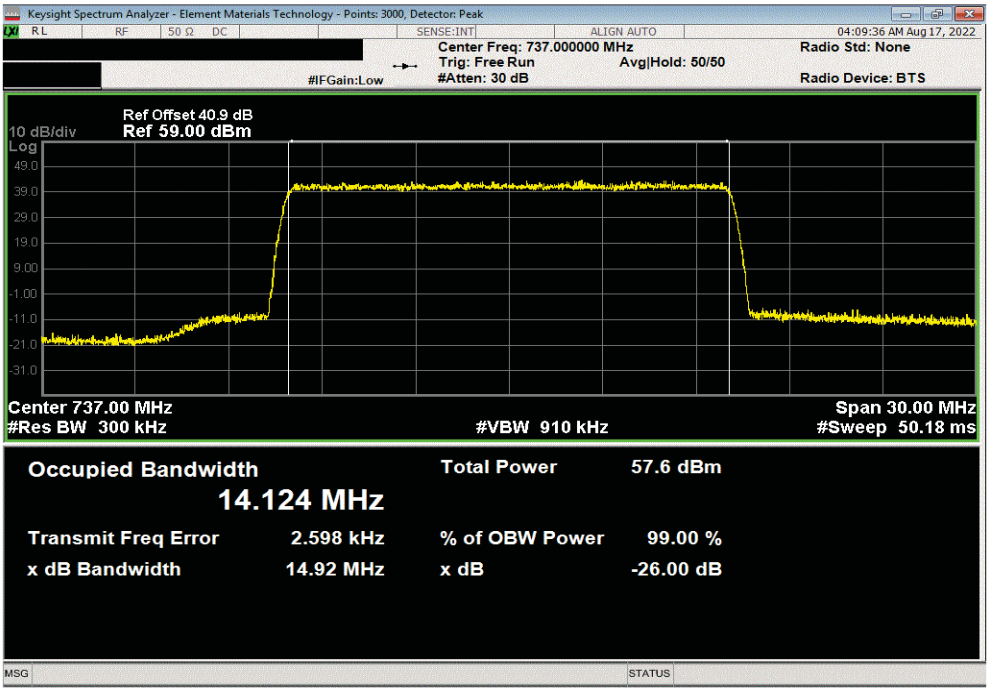


Port 1, 5G NR, Band n12, 729 - 745 Mhz, 10 MHz Bandwidth, 256QAM Modulation, High Channel, 740 MHz						
			Value 99 % (MHz)	Value 26 dB (MHz)	Limit	Result
			9.29	9.87	Within Band	Pass

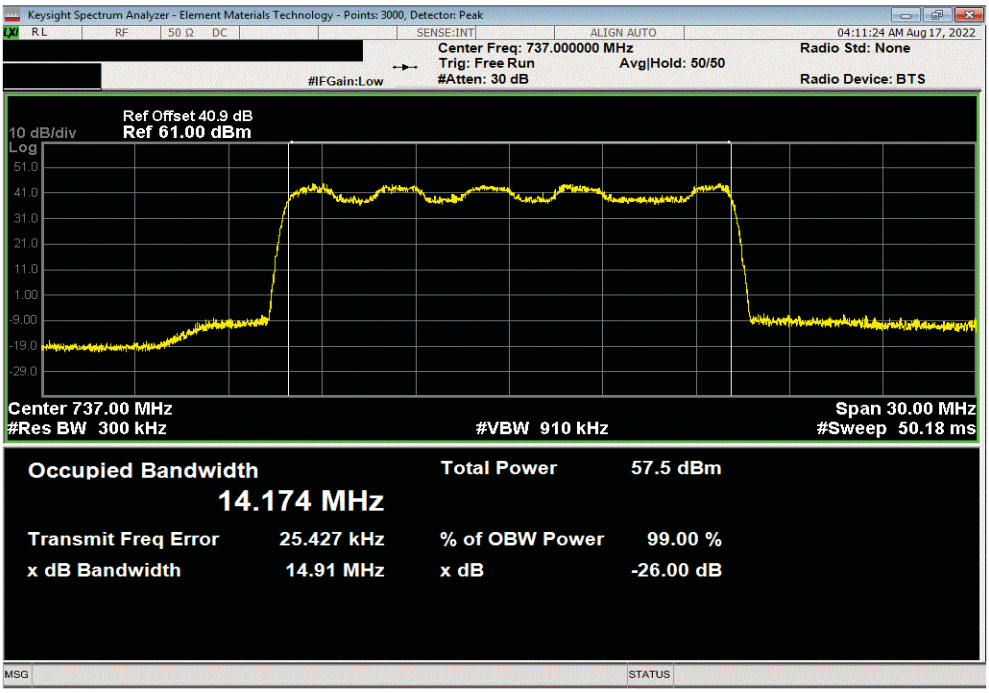


OCCUPIED BANDWIDTH - Band n12

Port 1, 5G NR, Band n12, 729 - 745 Mhz, 15 MHz Bandwidth, QPSK Modulation, Mid Channel, 737.0 MHz						
			Value 99 % (MHz)	Value 26 dB (MHz)	Limit	Result
			14.1	14.9	Within Band	Pass

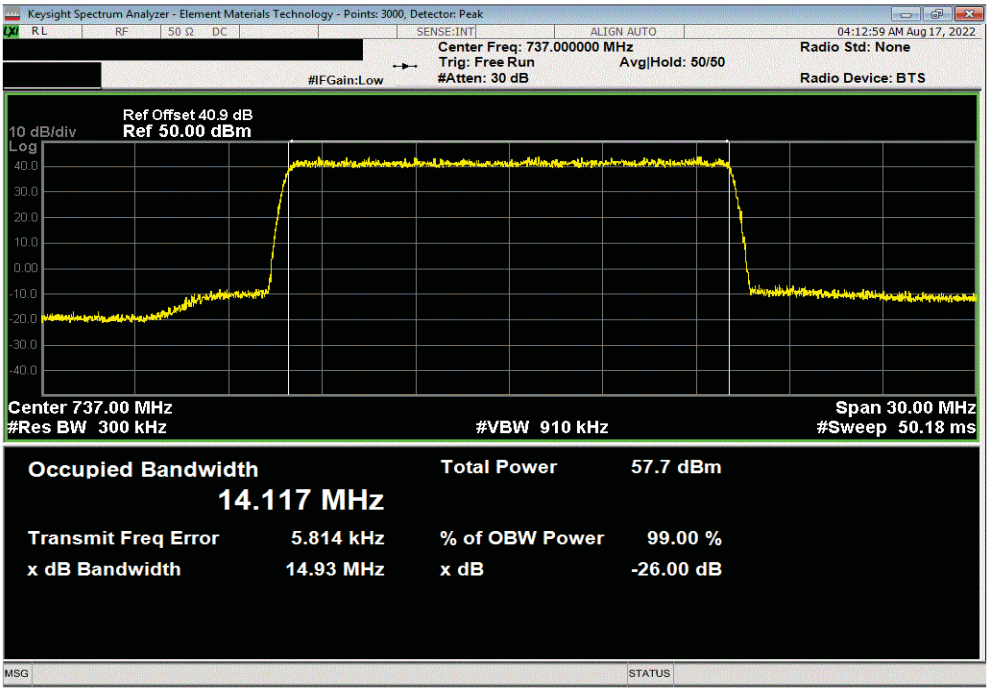


Port 1, 5G NR, Band n12, 729 - 745 Mhz, 15 MHz Bandwidth, 16QAM Modulation, Mid Channel, 737.0 MHz						
			Value 99 % (MHz)	Value 26 dB (MHz)	Limit	Result
			14.2	14.9	Within Band	Pass

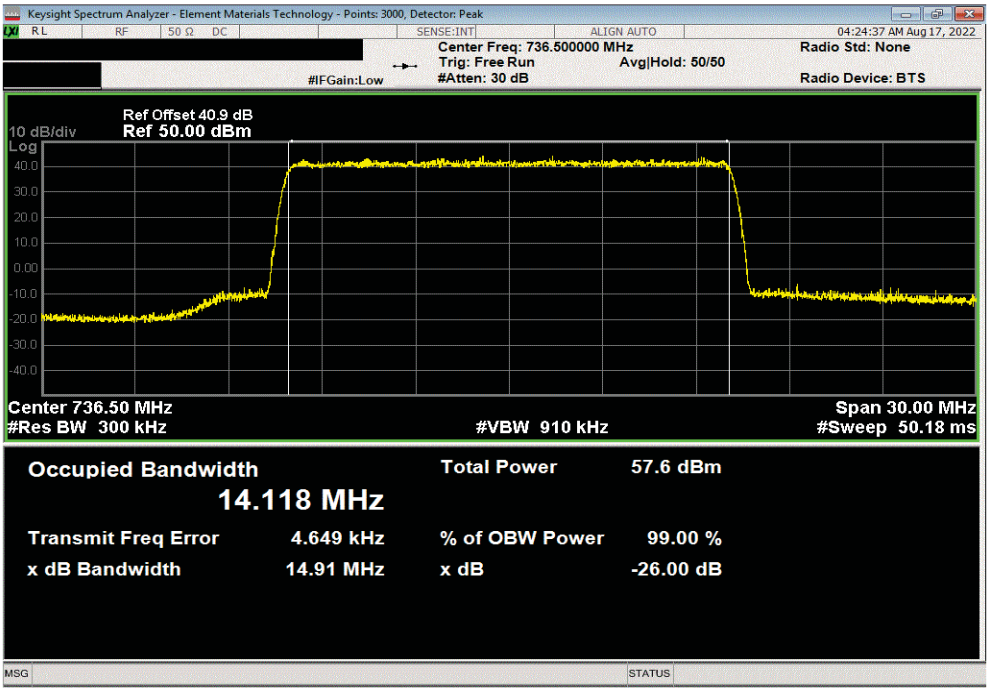


OCCUPIED BANDWIDTH - Band n12

Port 1, 5G NR, Band n12, 729 - 745 Mhz, 15 MHz Bandwidth, 64QAM Modulation, Mid Channel, 737.0 MHz						
			Value 99 % (MHz)	Value 26 dB (MHz)	Limit	Result
			14.1	14.9	Within Band	Pass

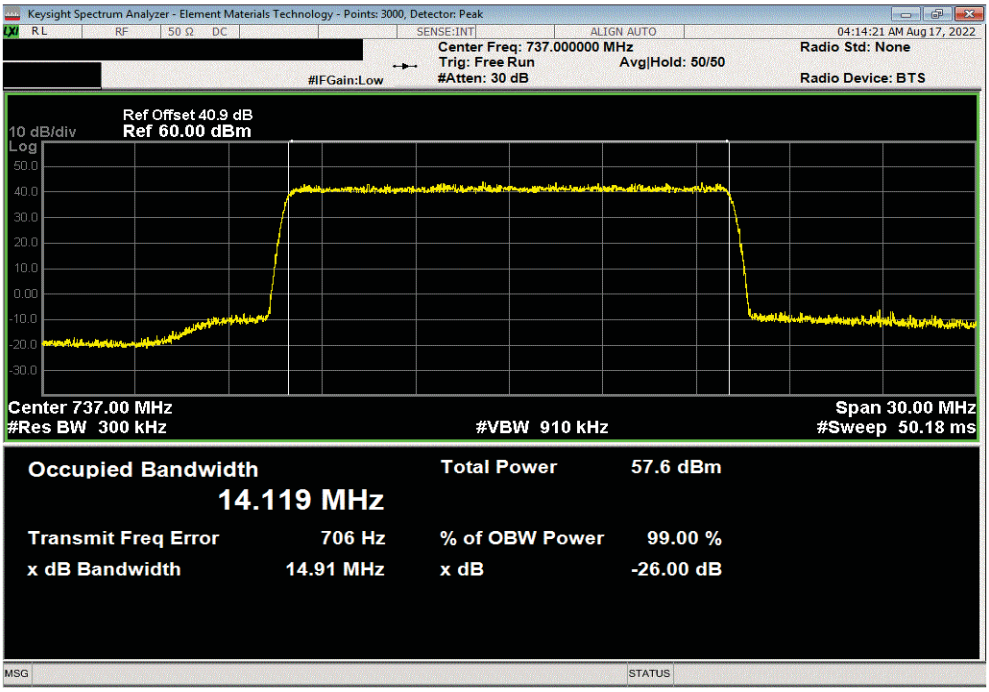


Port 1, 5G NR, Band n12, 729 - 745 Mhz, 15 MHz Bandwidth, 256QAM Modulation, Low Channel, 736.5 MHz						
			Value 99 % (MHz)	Value 26 dB (MHz)	Limit	Result
			14.1	14.9	Within Band	Pass

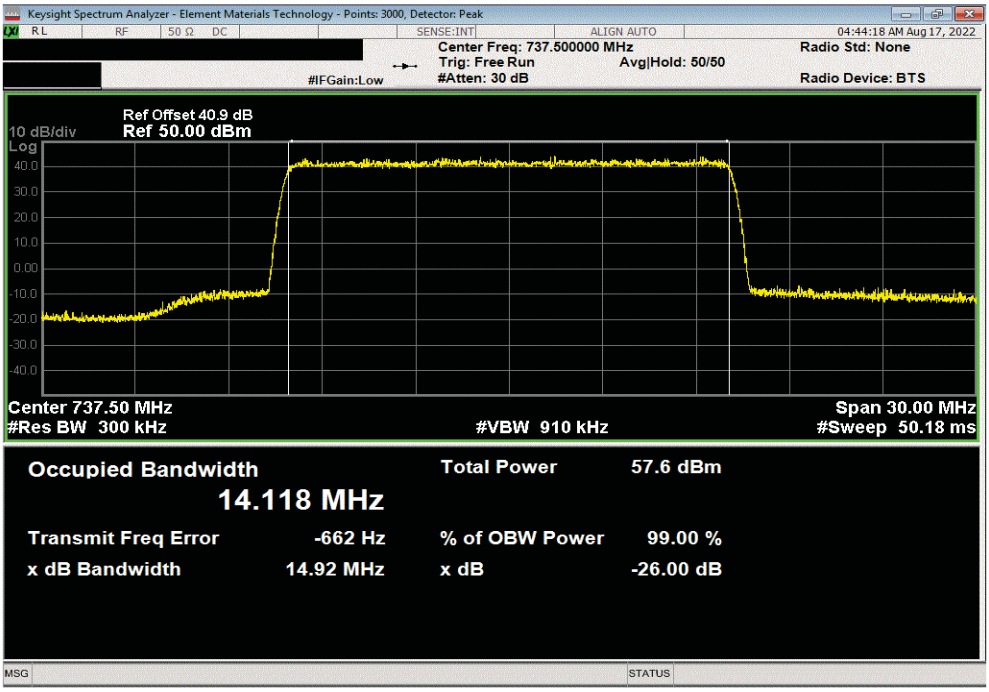


OCCUPIED BANDWIDTH - Band n12

Port 1, 5G NR, Band n12, 729 - 745 Mhz, 15 MHz Bandwidth, 256QAM Modulation, Mid Channel, 737.0 MHz						
			Value 99 % (MHz)	Value 26 dB (MHz)	Limit	Result
			14.1	14.9	Within Band	Pass



Port 1, 5G NR, Band n12, 729 - 745 Mhz, 15 MHz Bandwidth, 256QAM Modulation, High Channel, 737.5 MHz						
			Value 99 % (MHz)	Value 26 dB (MHz)	Limit	Result
			14.1	14.9		Pass



OCCUPIED BANDWIDTH - BAND n14

XMit 2022.02.07.0

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
Block - DC	Fairview Microwave	SD3239	ANE	2022-03-02	2023-03-02
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2022-01-17	2023-01-17

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The emissions bandwidth
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 5.4 of ANSI C63.26 was used to make the 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

RRH conducted emissions testing was performed only on one port. The AHLBA antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in this 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.
FCC 2.1049 requires an emission bandwidth measurement.

FCC Emission Designators for Band n14 (758MHz to 768MHz)					
Chan BW	Radio Channel	5G-NR: QPSK	5G-NR: 16QAM	5G-NR: 64QAM	5G-NR: 256QAM
5MHz	Low				4M83G7W
	Mid	4M83G7W	4M82G7W	4M82G7W	4M82G7W
	High				4M82G7W
10MHz	Low				
	Mid	9M88G7W	9M80G7W	9M87G7W	9M86G7W
	High				
Note: FCC emission designators are based on 26dB emission bandwidth.					

OCCUPIED BANDWIDTH - BAND n14

TbtTx 2022.05.02.0 XMit 2022.02.07.0

EUT:	AHLBA			Work Order:	NOKI0046
Serial Number:	K9180844519			Date:	19-Aug-22
Customer:	Nokia Solutions and Networks			Temperature:	22.2 °C
Attendees:	David Le			Humidity:	54.7% RH
Project:	None			Barometric Pres.:	1018 mbar
Tested by:	Marty Martin	Power:	54 VDC	Job Site:	TX07

TEST SPECIFICATIONS	Test Method
FCC 27:2022	ANSI C63.26:2015
FCC 90R:2022	ANSI C63.26:2015

COMMENTS

All measurement path loses accounted for in the reference level offest including any attenuators, filters, and DC blocks. Carriers enabled at maximum power.

DEVIATIONS FROM TEST STANDARD

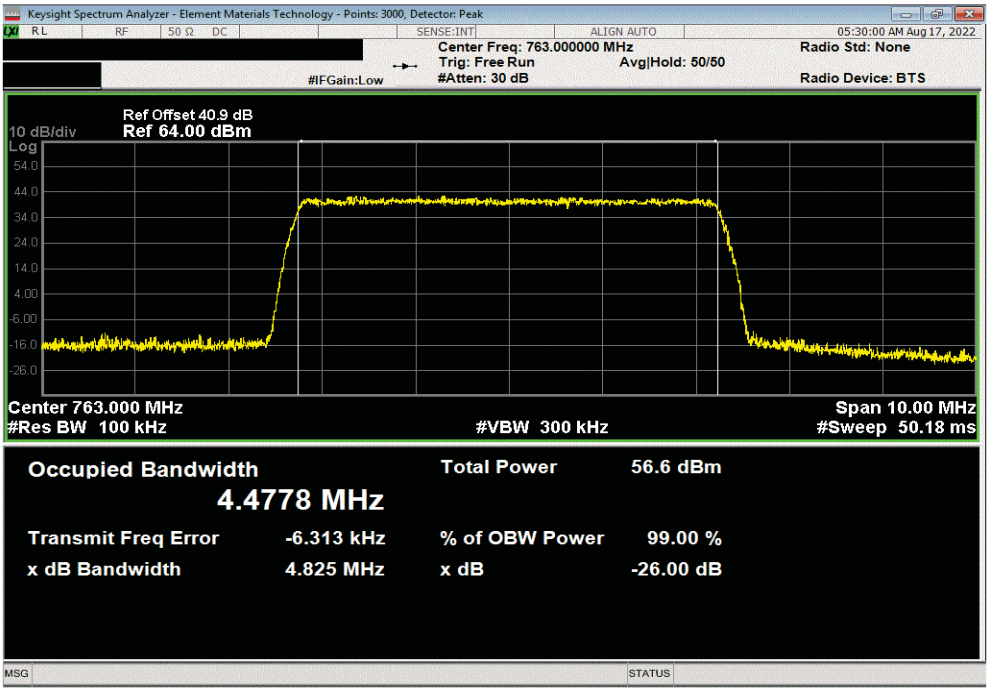
None

Configuration #	2	Signature

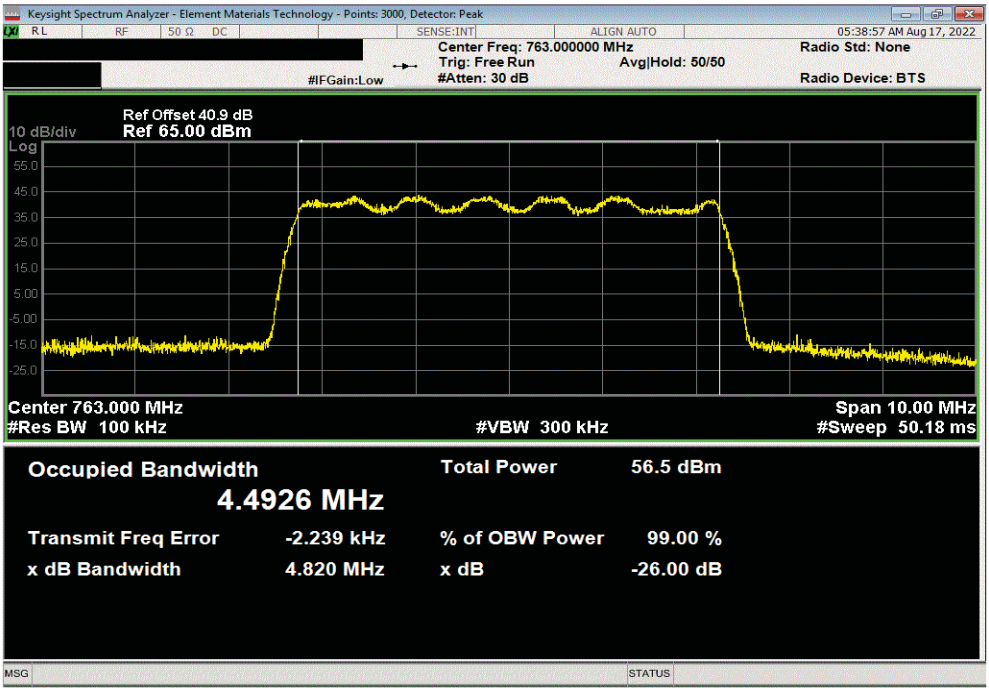
	Value 99 (%)	Value 26 dB (MHz)	Limit	Result
Port 1				
5G NR, Band n14, 758 - 768 Mhz				
5 MHz Bandwidth				
QPSK Modulation				
Mid Channel, 763 MHz	4.48	4.83	Within Band	Pass
16QAM Modulation				
Mid Channel, 763 MHz	4.49	4.82	Within Band	Pass
64QAM Modulation				
Mid Channel, 763 MHz	4.48	4.82	Within Band	Pass
256QAM Modulation				
Low Channel, 760.5 MHz	4.48	4.83	Within Band	Pass
Mid Channel, 763 MHz	4.48	4.82	Within Band	Pass
High Channel, 765.5 MHz	4.47	4.82	Within Band	Pass
10 MHz Bandwidth				
QPSK Modulation				
Mid Channel, 763 MHz	9.29	9.88	Within Band	Pass
16QAM Modulation				
Mid Channel, 763 MHz	9.24	9.8	Within Band	Pass
64QAM Modulation				
Mid Channel, 763 MHz	9.3	9.87	Within Band	Pass
256QAM Modulation				
Mid Channel, 763 MHz	9.27	9.86	Within Band	Pass

OCCUPIED BANDWIDTH - BAND n14

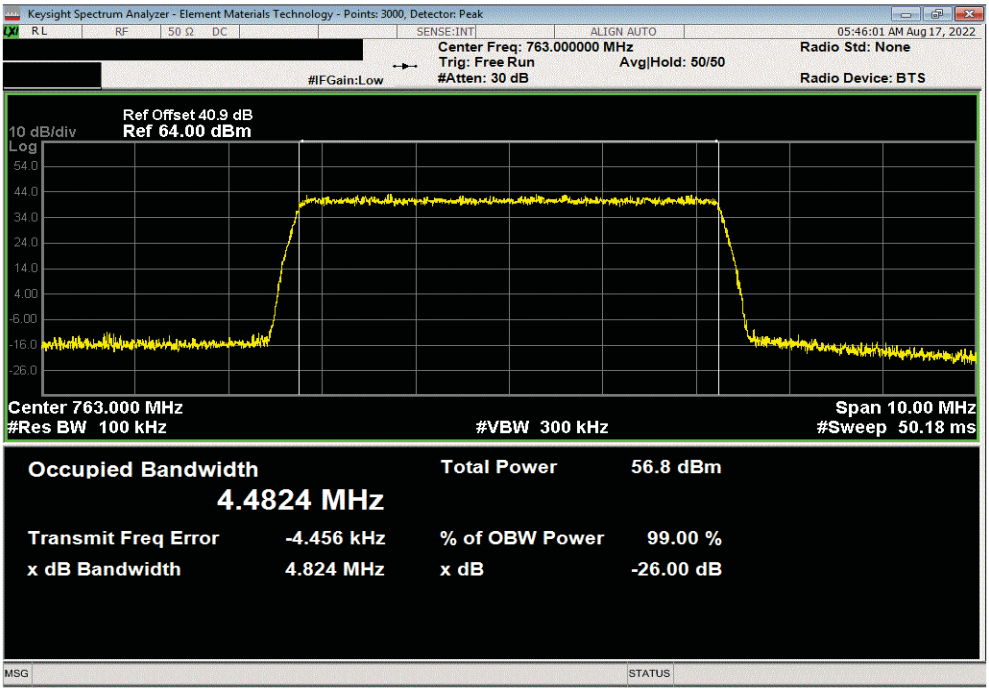
Port 1, 5G NR, Band n14, 758 - 768 Mhz, 5 MHz Bandwidth, QPSK Modulation, Mid Channel, 763 MHz						
			Value 99 (%)	Value 26 dB (MHz)	Limit	Result
			4.48	4.83	Within Band	Pass



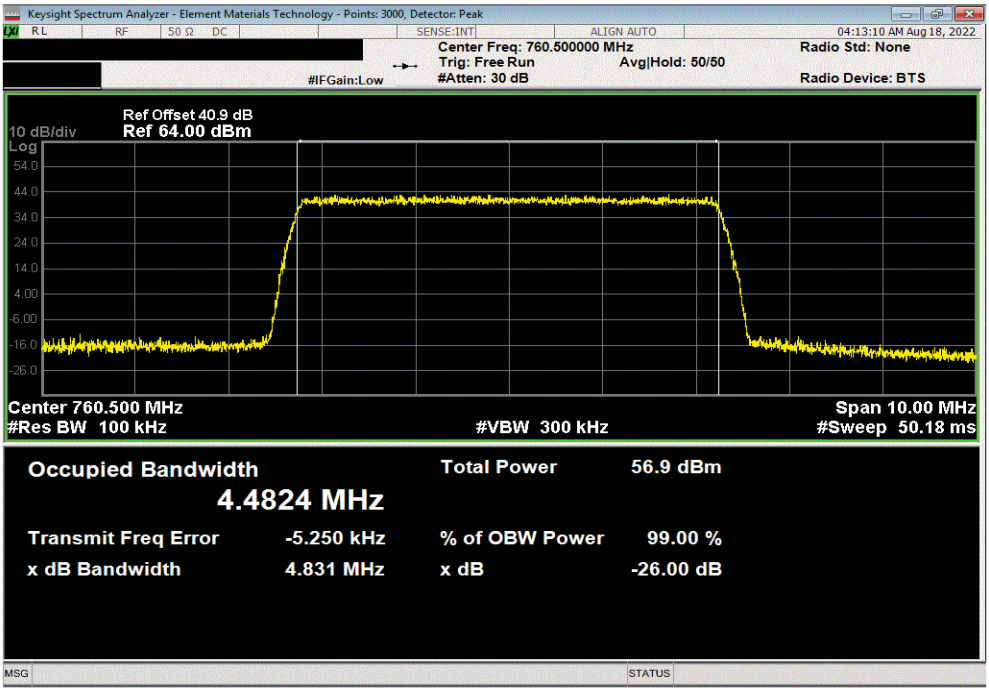
Port 1, 5G NR, Band n14, 758 - 768 Mhz, 5 MHz Bandwidth, 16QAM Modulation, Mid Channel, 763 MHz						
			Value 99 (%)	Value 26 dB (MHz)	Limit	Result
			4.49	4.82	Within Band	Pass



Port 1, 5G NR, Band n14, 758 - 768 Mhz, 5 MHz Bandwidth, 64QAM Modulation, Mid Channel, 763 MHz						
			Value 99 (%)	Value 26 dB (MHz)	Limit	Result
			4.48	4.82	Within Band	Pass

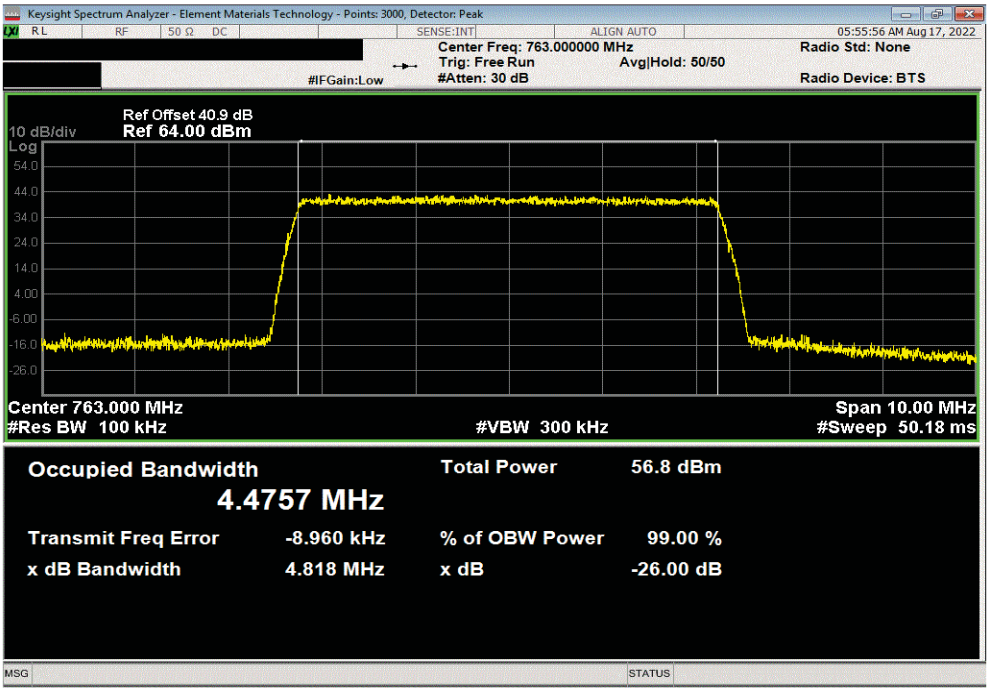


Port 1, 5G NR, Band n14, 758 - 768 Mhz, 5 MHz Bandwidth, 256QAM Modulation, Low Channel, 760.5 MHz						
			Value 99 (%)	Value 26 dB (MHz)	Limit	Result
			4.48	4.83	Within Band	Pass

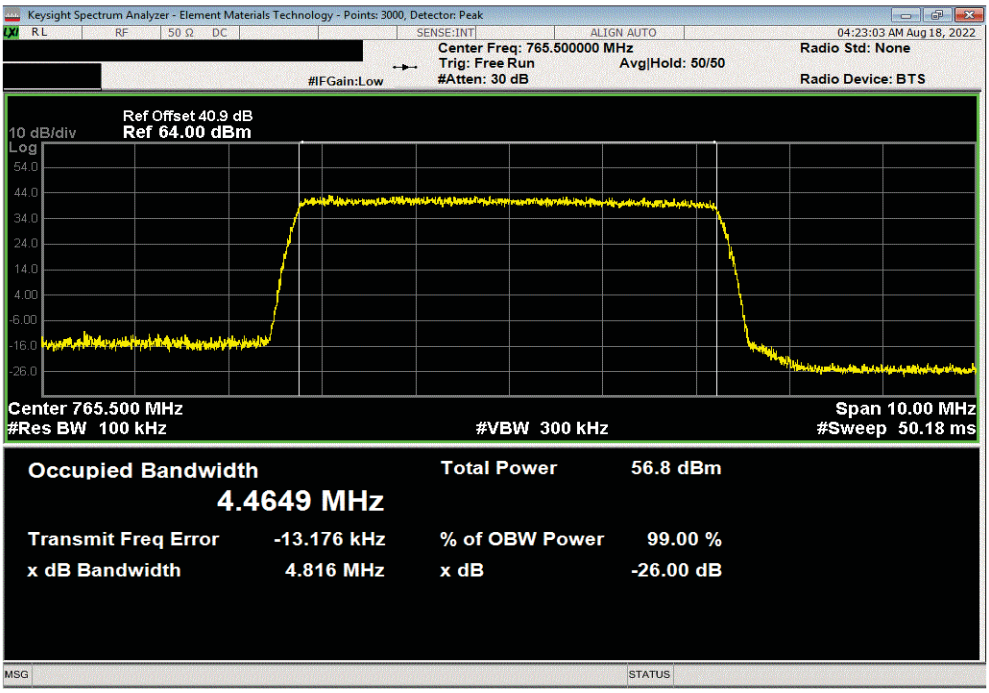


OCCUPIED BANDWIDTH - BAND n14

Port 1, 5G NR, Band n14, 758 - 768 Mhz, 5 MHz Bandwidth, 256QAM Modulation, Mid Channel, 763 MHz						
			Value 99 (%)	Value 26 dB (MHz)	Limit	Result
			4.48	4.82	Within Band	Pass

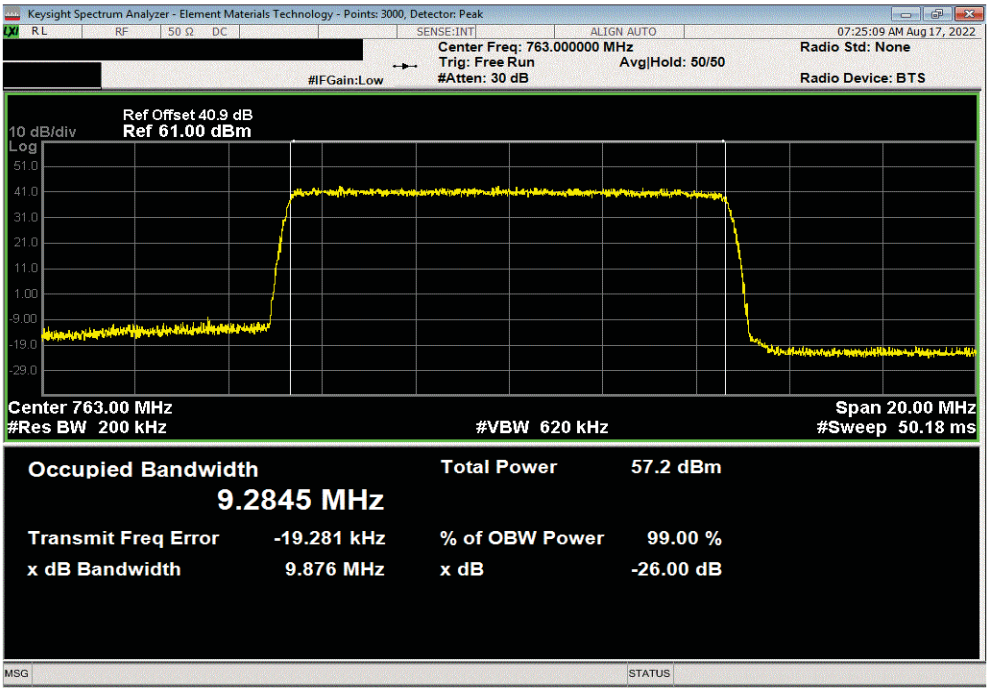


Port 1, 5G NR, Band n14, 758 - 768 Mhz, 5 MHz Bandwidth, 256QAM Modulation, High Channel, 765.5 MHz						
			Value 99 (%)	Value 26 dB (MHz)	Limit	Result
			4.47	4.82	Within Band	Pass

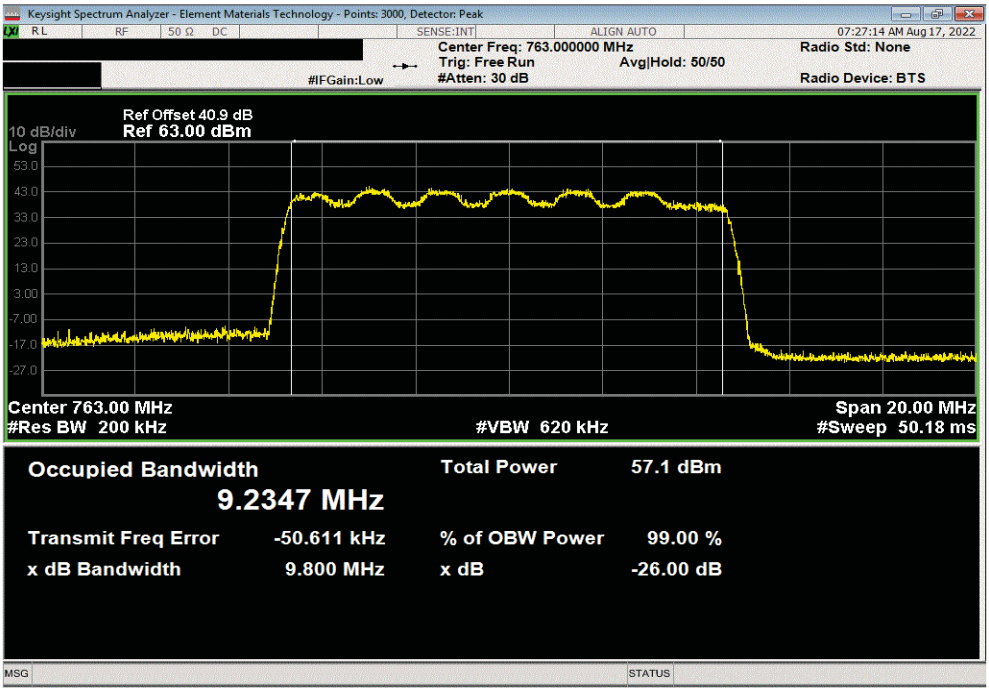


OCCUPIED BANDWIDTH - BAND n14

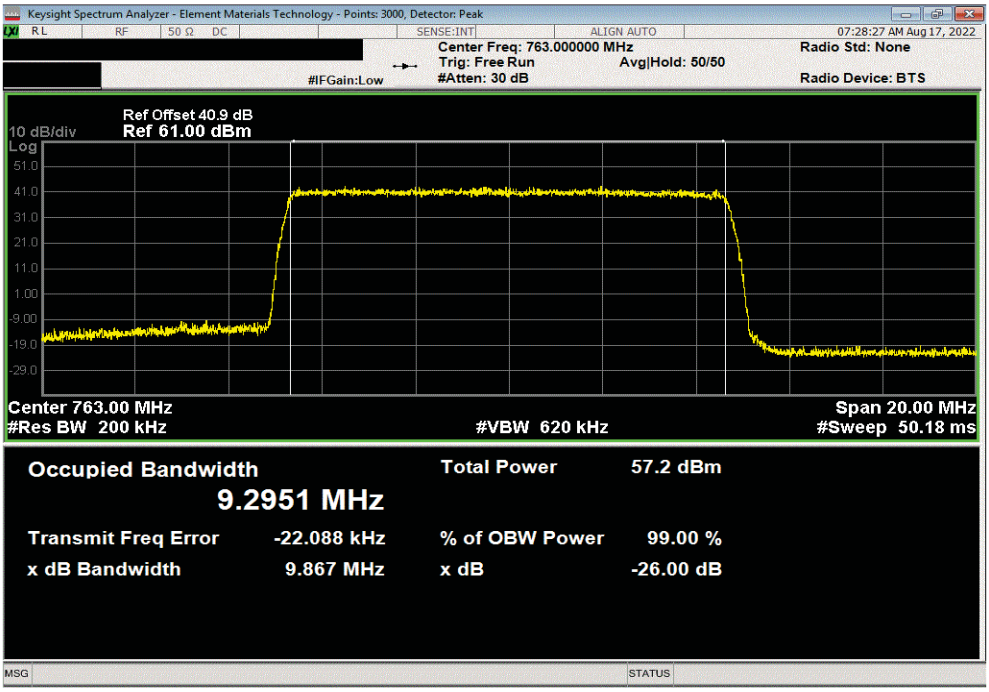
Port 1, 5G NR, Band n14, 758 - 768 Mhz, 10 MHz Bandwidth, QPSK Modulation, Mid Channel, 763 MHz						
			Value 99 (%)	Value 26 dB (MHz)	Limit	Result
			9.29	9.88	Within Band	Pass



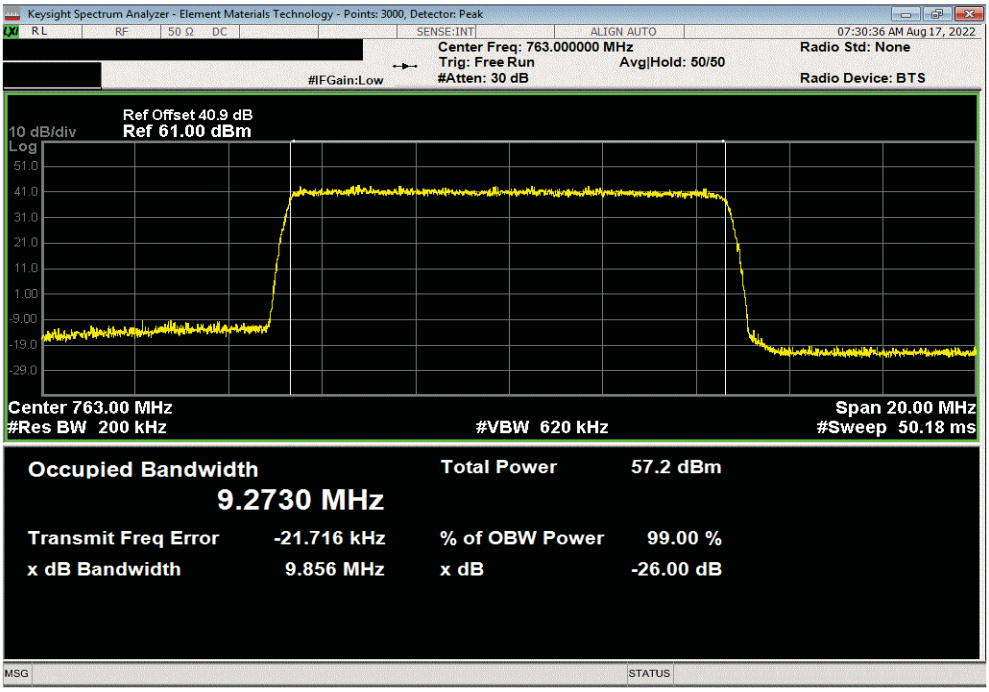
Port 1, 5G NR, Band n14, 758 - 768 Mhz, 10 MHz Bandwidth, 16QAM Modulation, Mid Channel, 763 MHz						
			Value 99 (%)	Value 26 dB (MHz)	Limit	Result
			9.24	9.8	Within Band	Pass



Port 1, 5G NR, Band n14, 758 - 768 Mhz, 10 MHz Bandwidth, 64QAM Modulation, Mid Channel, 763 MHz						
			Value 99 (%)	Value 26 dB (MHz)	Limit	Result
			9.3	9.87	Within Band	Pass



Port 1, 5G NR, Band n14, 758 - 768 Mhz, 10 MHz Bandwidth, 256QAM Modulation, Mid Channel, 763 MHz						
			Value 99 (%)	Value 26 dB (MHz)	Limit	Result
			9.27	9.86	Within Band	Pass



POWER SPECTRAL DENSITY AND EIRP CALCULATION - BAND n12

XMit 2022.02.07.0

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
Block - DC	Fairview Microwave	SD3239	ANE	2022-03-02	2023-03-02
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2022-01-17	2023-01-17

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The fundamental emission power spectral density 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 of ANSI C63.26-2015 section 5.2.4.5 was used to make this measurement.

The RF conducted emission testing was performed on one port. The AHLBA antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in the “Output Power - All Ports” report section) 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 PSD for all antenna ports (at the radio output) were determined per ANSI C63.26-2015 paragraph 6.4.3.2.4. The EIRP calculations are based upon ANSI C63.26-2015 paragraphs 6.4 for a four port MIMO base station.

FCC Requirements:
FCC 27.50(c) (3) Fixed and base stations transmitting a signal with an emission bandwidth greater than 1 MHz must not exceed an ERP of 1000 watts/MHz and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 1000 watts/MHz ERP in accordance with Table 3 of this section;
FCC 27.50(c) (4) Fixed and base stations located in a county with population density of 100 or fewer persons per square mile, based upon the most recently available population statistics from the Bureau of the Census, and transmitting a signal with an emission bandwidth greater than 1 MHz must not exceed an ERP of 2000 watts/MHz and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 2000 watts/MHz ERP in accordance with Table 4 of this section;

Note: EIRP = ERP + 2.15dB
1000 watts = 60.00 dBm, EIRP = (60 dBm + 2.15dB) /MHz = 62.15dBm/MHz or 1640W/MHz
2000 watts = 63.01 dBm, EIRP = (63 dBm + 2.15dB) /MHz = 65.16dBm/MHz or 3280W/MHz

POWER SPECTRAL DENSITY AND EIRP CALCULATION - BAND n12

TbtTx 2022.05.02.0 XMit 2022.02.07.0

EUT:	AHLBA			Work Order:	NOKI0046
Serial Number:	K9180844519			Date:	18-Aug-22
Customer:	Nokia Solutions and Networks			Temperature:	20.3 °C
Attendees:	David Le			Humidity:	58% RH
Project:	None			Barometric Pres.:	1018 mbar
Tested by:	Marty Martin	Power:	54 VDC	Job Site:	TX07

TEST SPECIFICATIONS	Test Method
FCC 27:2022	ANSI C63.26:2015
FCC 90R: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. The carriers were enabled at maximum power. The PSD was measured while transmitting one carrier on Port 1. The total PSD for multiport (2x2 MIMO, 4x4 MIMO) operation was determinded based upon ANSI 63.26 clause 6.4.3.2.4 (10 Log Nout). The total PSD for two port operation is single port PSD +3dB [i.e. 10 Log(2)]. The total PSD for four port operation is single port PSD +6dB [i.e. 10 Log(4)].

DEVIATIONS FROM TEST STANDARD

None

Configuration #	2	Signature

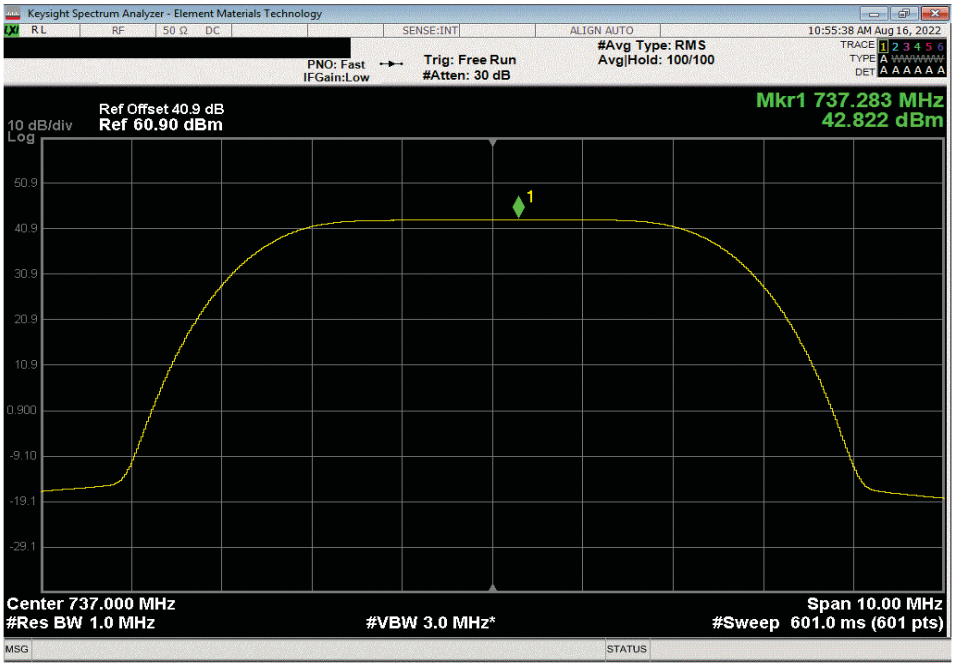
	Initial dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD
Port 1					
5G NR Band n12, 729 - 745 Mhz					
5 MHz Bandwidth					
QPSK Modulation					
Mid Channel, 737.0 MHz	42.822	0	42.8	45.8	48.8
16QAM Modulation					
Mid Channel, 737.0 MHz	42.71	0	42.7	45.7	48.7
64QAM Modulation					
Mid Channel, 737.0 MHz	42.777	0	42.8	45.8	48.8
256QAM Modulation					
Low Channel, 731.5 MHz	42.815	0	42.8	45.8	48.8
Mid Channel, 737.0 MHz	42.729	0	42.7	45.7	48.7
High Channel, 742.5 MHz	42.697	0	42.7	45.7	48.7
10 MHz Bandwidth					
256QAM Modulation					
Low Channel, 734 MHz	39.713	0	39.7	42.7	45.7
Mid Channel, 737.0 MHz	39.607	0	39.6	42.6	45.6
High Channel, 740 MHz	39.56	0	39.6	42.6	45.6
15 MHz Bandwidth					
256QAM Modulation					
Low Channel, 736.5 MHz	37.948	0	38	41	44
Mid Channel, 737.0 MHz	37.952	0	38	41	44
High Channel, 737.5 MHz	37.984	0	38	41	44

POWER SPECTRAL DENSITY AND EIRP CALCULATION - BAND n12

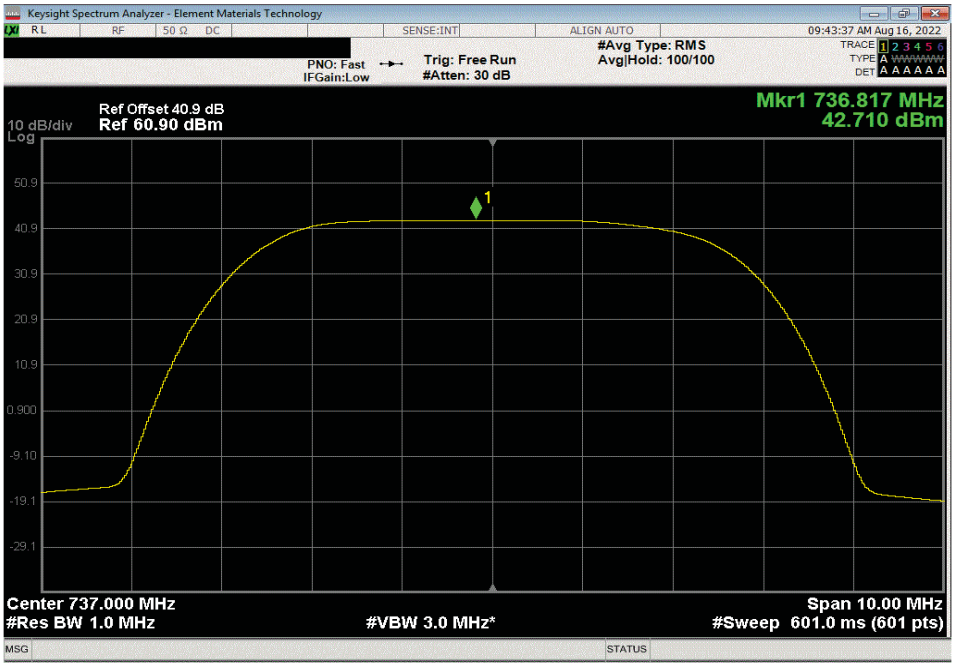
element

TbiTx 2022.05.02.0 XMit 2022.02.07.0

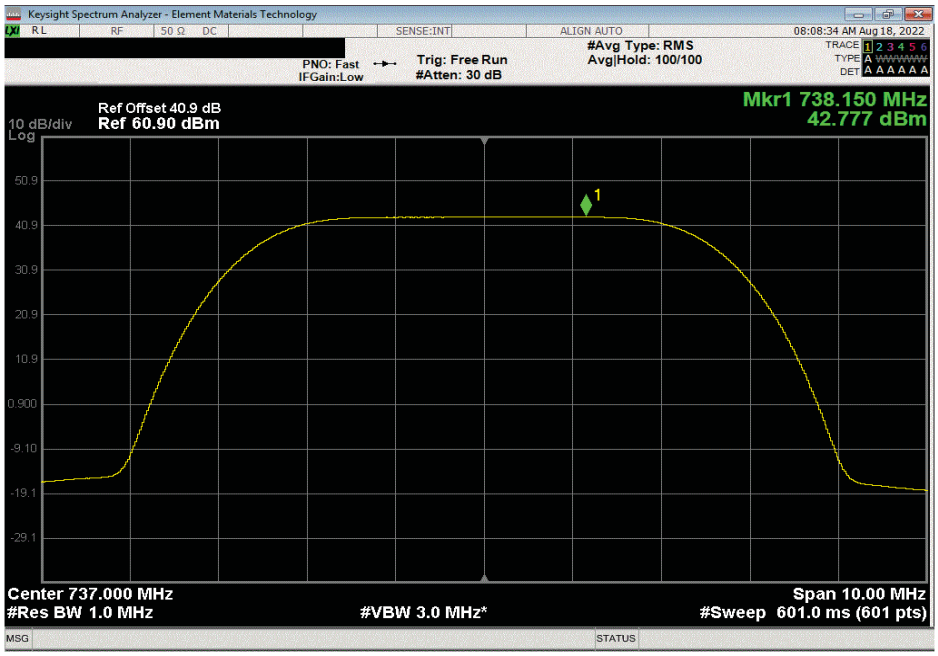
Port 1, 5G NR, Band n12, 729 - 745 Mhz, 5 MHz Bandwidth, QPSK Modulation, Mid Channel, 737.0 MHz							
			Initial dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD
			42.822	0	42.8	45.8	48.8



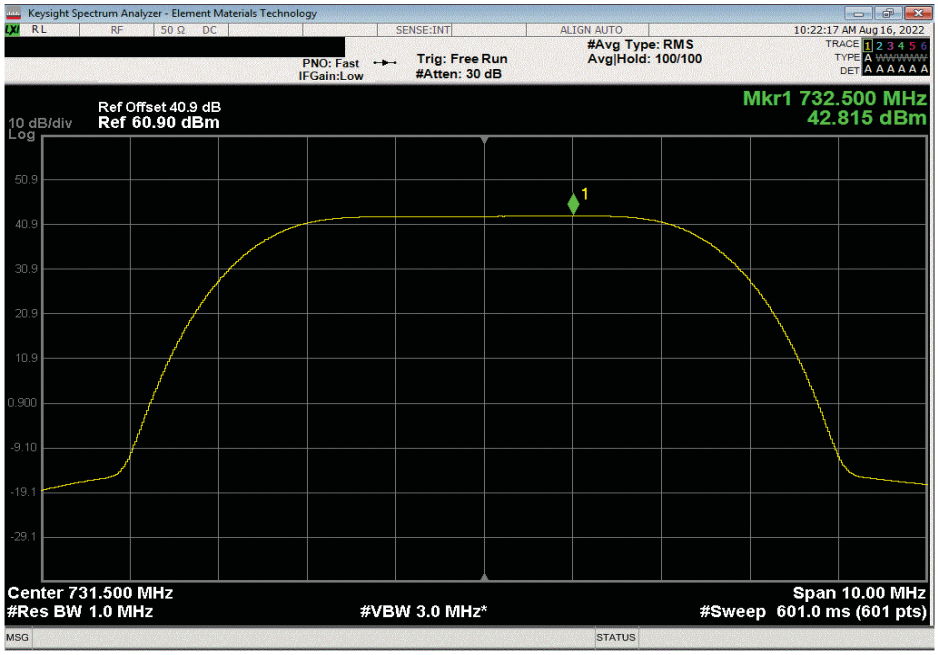
Port 1, 5G NR, Band n12, 729 - 745 Mhz, 5 MHz Bandwidth, 16QAM Modulation, Mid Channel, 737.0 MHz							
			Initial dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD
			42.71	0	42.7	45.7	48.7



Port 1, 5G NR, Band n12, 729 - 745 Mhz, 5 MHz Bandwidth, 64QAM Modulation, Mid Channel, 737.0 MHz						
		Initial dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD
		42.777	0	42.8	45.8	48.8

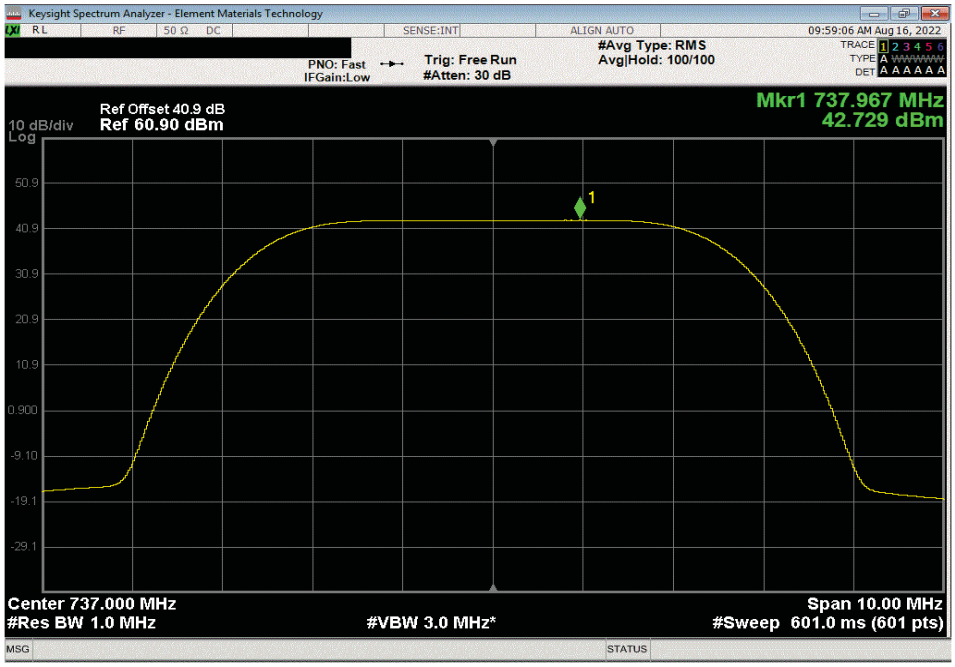


Port 1, 5G NR, Band n12, 729 - 745 Mhz, 5 MHz Bandwidth, 256QAM Modulation, Low Channel, 731.5 MHz						
		Initial dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD
		42.815	0	42.8	45.8	48.8

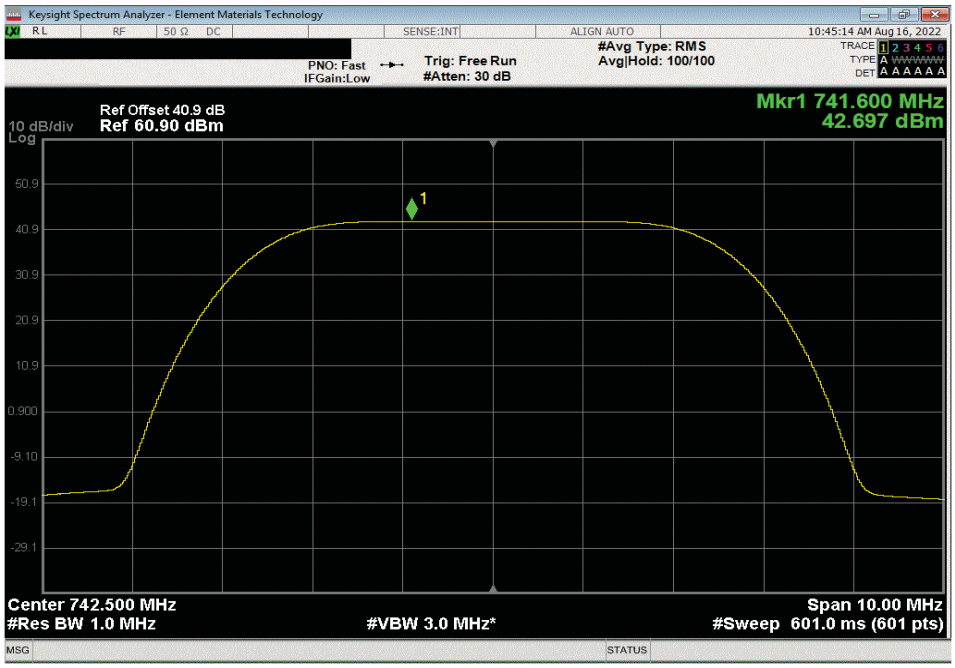


POWER SPECTRAL DENSITY AND EIRP CALCULATION - BAND n12

Port 1, 5G NR, Band n12, 729 - 745 Mhz, 5 MHz Bandwidth, 256QAM Modulation, Mid Channel, 737.0 MHz						
		Initial dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD
		42.729	0	42.8	45.8	48.8



Port 1, 5G NR, Band n12, 729 - 745 Mhz, 5 MHz Bandwidth, 256QAM Modulation, High Channel, 742.5 MHz						
		Initial dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD
		42.697	0	42.7	45.7	48.7

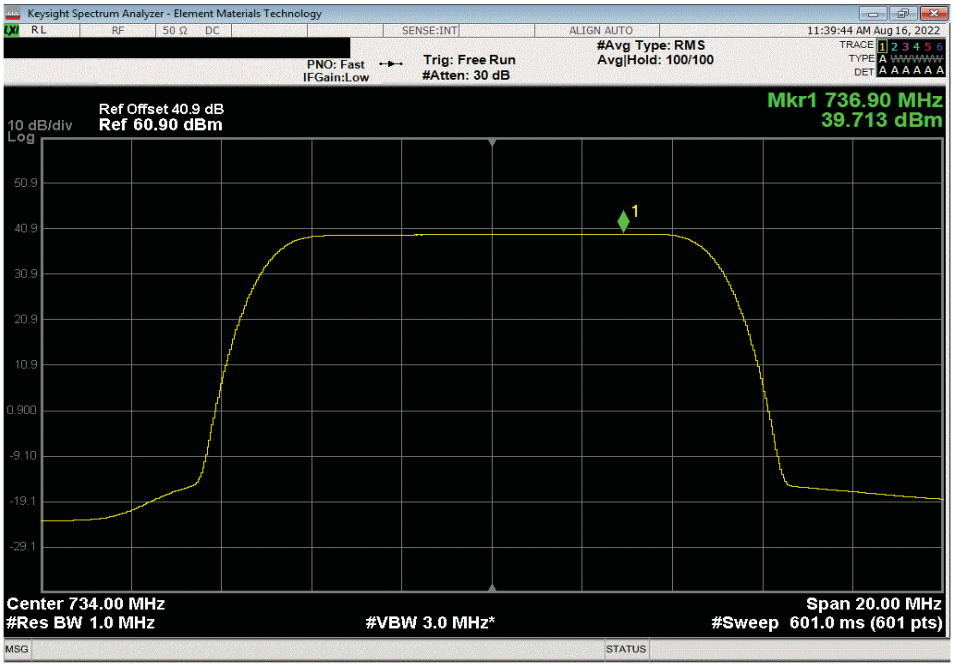


POWER SPECTRAL DENSITY AND EIRP CALCULATION - BAND n12

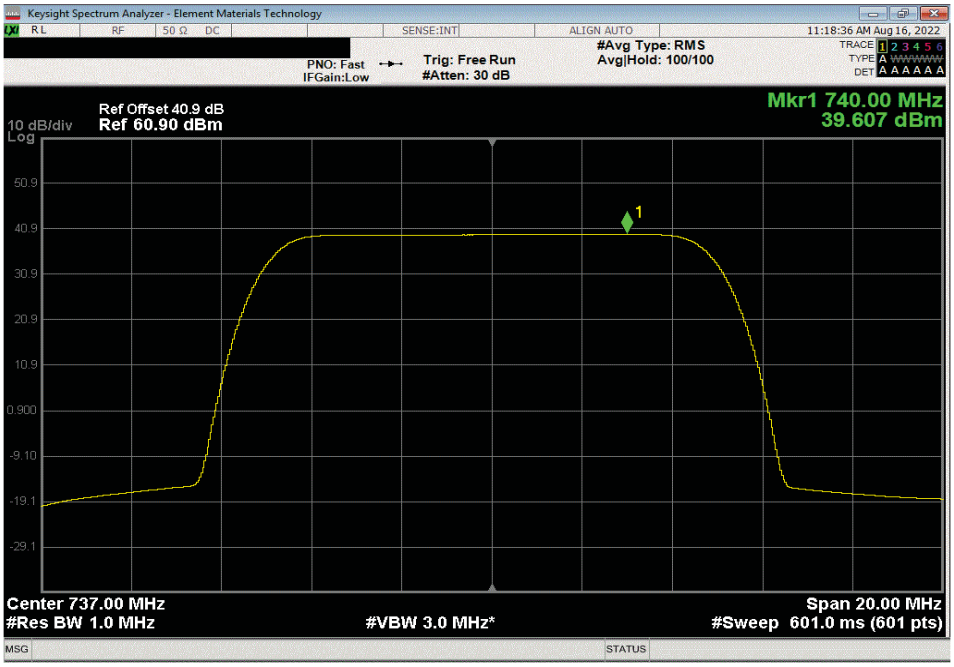
element

TbiTx 2022.05.02.0 XMit 2022.02.07.0

Port 1, Band n12, 729 - 745 Mhz, 10 MHz Bandwidth, 256QAM Modulation, Low Channel, 734 MHz						
		Initial dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD
		39.713	0	39.7	42.7	45.7

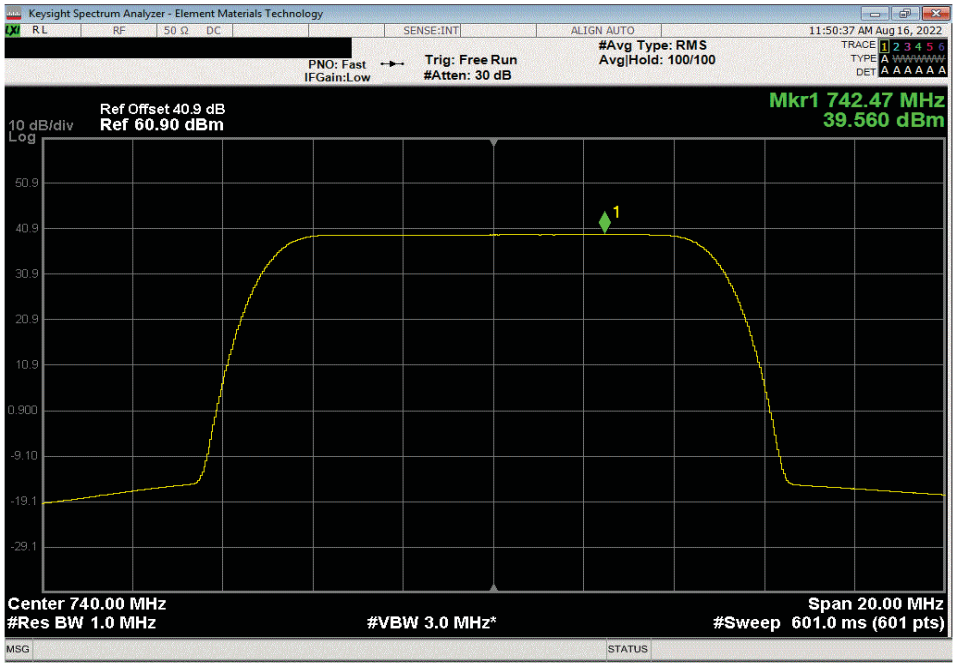


Port 1, Band n12, 729 - 745 Mhz, 10 MHz Bandwidth, 256QAM Modulation, Mid Channel, 737.0 MHz						
		Initial dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD
		39.607	0	39.7	42.7	45.7

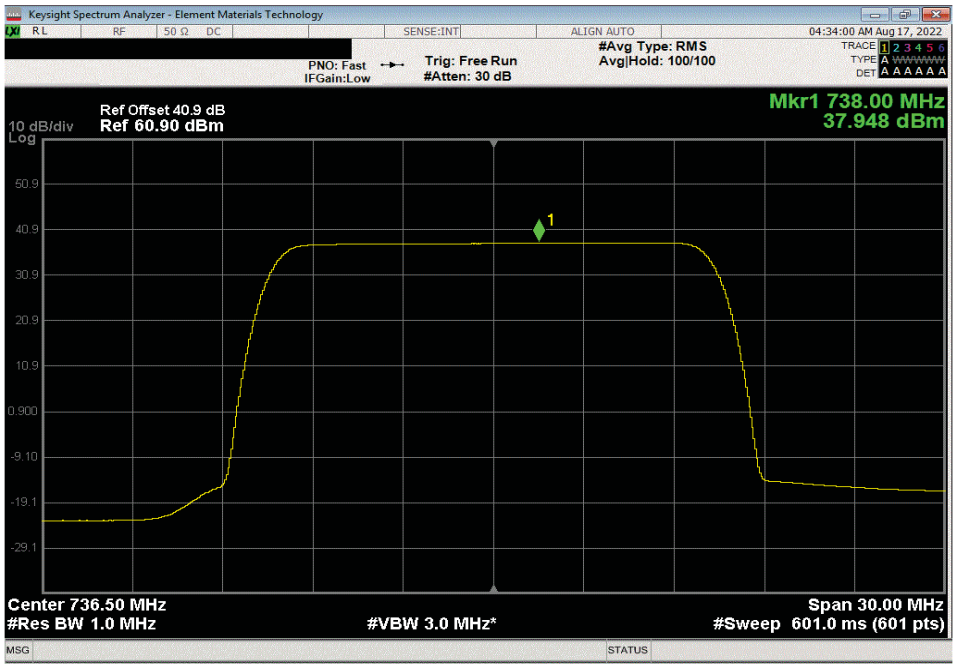


POWER SPECTRAL DENSITY AND EIRP CALCULATION - BAND n12

Port 1, 5G NR, Band n12, 729 - 745 Mhz, 10 MHz Bandwidth, 256QAM Modulation, High Channel, 740 MHz							
			Initial dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD
			39.56	0	39.6	42.6	45.6

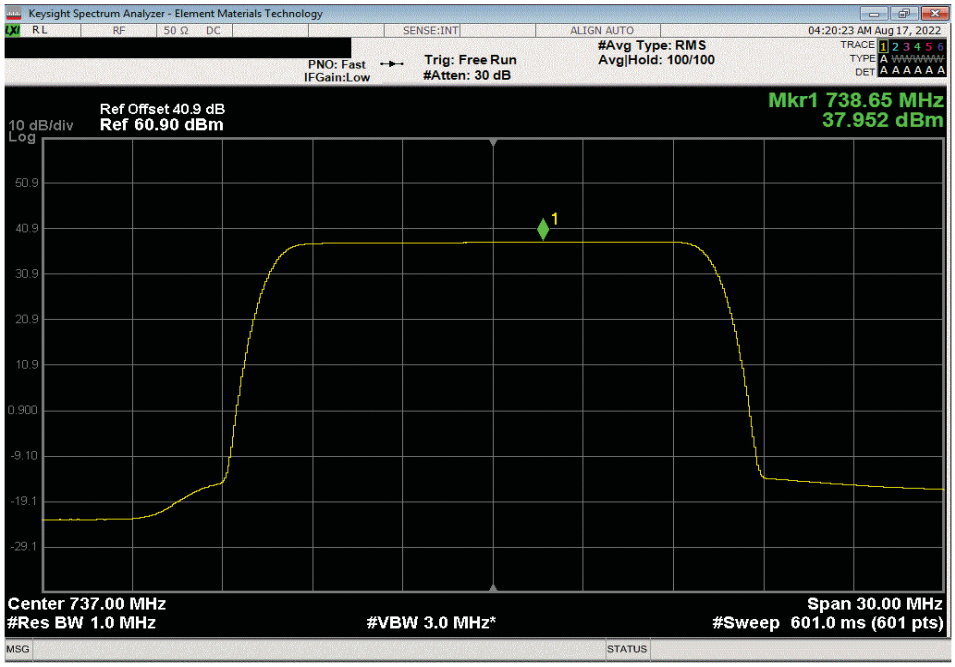


Port 1, 5G NR, Band n12, 729 - 745 Mhz, 15 MHz Bandwidth, 256QAM Modulation, Low Channel, 736.5 MHz							
			Initial dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD
			37.948	0	38	41	44

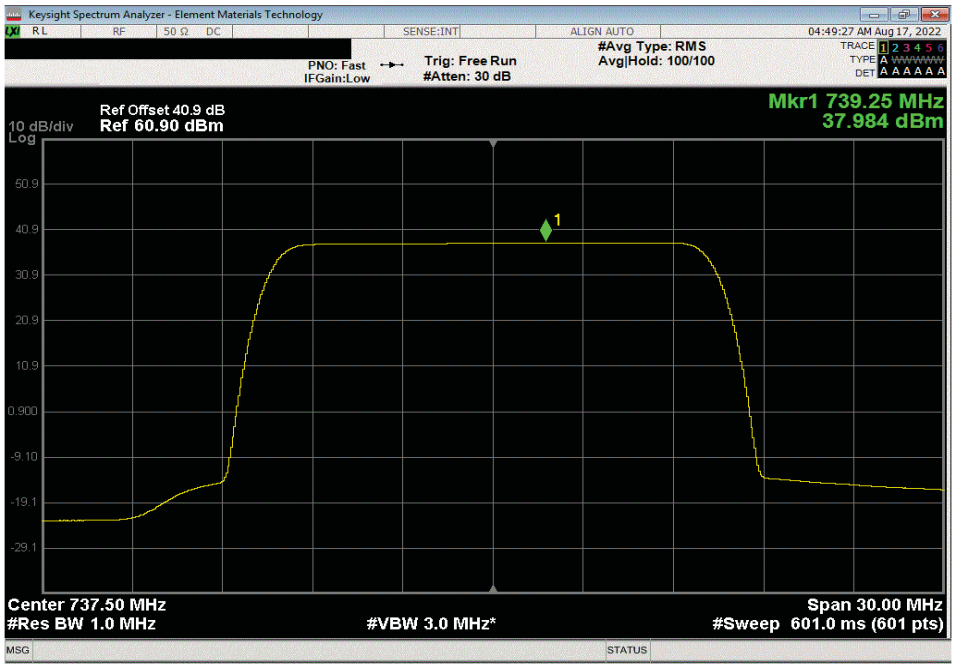


POWER SPECTRAL DENSITY AND EIRP CALCULATION - BAND n12

Port 1, 5G NR, Band n12, 729 - 745 Mhz, 15 MHz Bandwidth, 256QAM Modulation, Mid Channel, 737.0 MHz						
		Initial dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD
		37.952	0	38	41	44



Port 1, 5G NR, Band n12, 729 - 745 Mhz, 15 MHz Bandwidth, 256QAM Modulation, High Channel, 737.5 MHz						
		Initial dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD
		37.984	0	38	41	44



POWER SPECTRAL DENSITY AND EIRP CALCULATION - BAND n12

EIRP Calculations
EIRP calculations are needed at each transmitter location to optimize base station operational performance while meeting regulatory requirements. Each cell site installation needs to consider the power measurements in the radio certification report as well as site specific regulatory requirements (such as antenna height, population density, etc.), site installation parameters (line loss between antenna and radio, antenna parameters, etc.) and base station operational parameters (whether to operate two port or four port MIMO, carrier power level, channel bandwidth, modulation type, etc.) to optimize performance. Transmitter output power may be reduced in 0.1dB increments (from maximum) by base station setup parameters. Base station antennas are selected by the customer.

The base station antenna is selected by the customer and this EIRP calculation is based upon a sample worst case antenna. The EIRP calculation is based upon Commscope antenna assembly model "FF-65C-R1". The maximum Band n12 gain (15.8dBi) for this antenna was used for the EIRP calculation. This antenna assembly has a pair of +45° cross-polarized radiators. The four antenna RF inputs on the antenna assembly are labeled as R1 +45 °, R1 -45°, R2 +45° and R2 -45°. The four AHLBA transmitter outputs are connected to the antenna assembly RF inputs.

Equivalent Isotropically Radiated Power (EIRP) is calculated (as specified in ANSI C63.26-2015 section 6.4 for four port MIMO) from the results of power measurements (highest measured PSD for each channel bandwidth type). The maximum antenna gain was used for this calculation. The cable loss between the antenna and transmitter is site dependent (will not be 0 dB) but for this worst case EIRP calculation 0 dB was used. Calculations of worst-case EIRP for four port MIMO are as follows:

Parameter	5 MHz Ch BW	10 MHz Ch BW	15 MHz Ch BW
Worst Case PSD/Antenna Port	42.8 dBm/MHz	39.7 dBm/MHz	38.0 dBm/MHz
Number of Ant Ports per Polarization	2	2	2
Total PSD per Polarization 10Log(2) = +3dB	45.8 dBm/MHz	42.7 dBm/MHz	41.0 dBm/MHz
Cable Loss (site dependent)	0 dB	0 dB	0 dB
Dir Gain = Maximum Antenna Gain (G_{Ant}) See Note 1	15.8 dBi	15.8 dBi	15.8 dBi
EIRP per Polarization = Total PSD/Pol + Dir Gain	61.6 dBm/MHz or 1445 Watts/MHz	58.5 dBm/MHz or 707.9 Watts/MHz	56.8 dBm/MHz or 478.6 Watts/MHz
Number of Polarizations	2	2	2
EIRP Total = R1 ±45°and R2 ±45° See Note 2	61.6 dBm/MHz or 1445 Watts/MHz	58.5 dBm/MHz or 707.9 Watts/MHz	56.8 dBm/MHz or 478.6 Watts/MHz

Note 1: The directional gain is equal to antenna gain since the transmin signals are completely uncorrelated. See ANSI C63.26 sections 6.4.5.2.3b) and 6.4.5.3.1b) for guidance.

Note 2: The EIRP per antenna polarity is required to be below the regulatory limit as described in ANSI C63.26-2015 section 6.4.6.3.b)2) and KDB 662911 D02v01 page 3 example (2) since the two transmitter outputs to each antenna are 90 degree-phase shifted relative to each other (cross-polarized radiators).

EIRP Calculation Summary
The worst case AHLBA Band n12 four port MIMO EIRP levels using antenna assembly model "FF-65C-R1" are less than the FCC and ISED (65.16 dBm/MHz and 62.15 dBm/MHz) EIRP Regulatory Limits for all (5, 10, & 15MHz) channel bandwidths.

POWER SPECTRAL DENSITY AND EIRP CALCULATION - BAND n14

XMit 2022.02.07.0

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
Block - DC	Fairview Microwave	SD3239	ANE	2022-03-02	2023-03-02
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2022-01-17	2023-01-17

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The fundamental emission power spectral density 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 of ANSI C63.26-2015 section 5.2.4.5 was used to make this measurement.

The RF conducted emission testing was performed on one port. The antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in the “Output Power - All Ports” report section) 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 PSD for all antenna ports (at the radio output) were determined per ANSI C63.26-2015 paragraph 6.4.3.2.4.
The EIRP calculations are based upon ANSI C63.26-2015 paragraphs 6.4 for a four port MIMO base station.

FCC EIRP Requirements:
FCC 90.542(a)(3) Fixed and base stations transmitting a signal in the 758-768 MHz band with an emission bandwidth greater than 1 MHz must not exceed an ERP of 1000
watts/MHz and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 1000 watts/MHz
ERP accordance with Table 3 of this section.

FCC 90.542(a)(4) Fixed and base stations located in a county with population density of 100 or fewer persons per square mile, based upon the most recently available
population statistics from the Bureau of the Census, and transmitting a signal in the 758-768 MHz band with an emission bandwidth greater than 1 MHz must not exceed
an ERP of 2000 watts/MHz and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below
2000 watts/MHz ERP in accordance with Table 4 of this section.

Note: EIRP = ERP + 2.15dB
1000 watts = 60.00 dBm, EIRP = (60 dBm + 2.15dB) /MHz = 62.15dBm/MHz or 1640W/MHz
2000 watts = 63.01 dBm, EIRP = (63 dBm + 2.15dB) /MHz = 65.16dBm/MHz or 3280W/MHz

POWER SPECTRAL DENSITY AND EIRP CALCULATION - BAND n14

TbtTx 2022.05.02.0 XMit 2022.02.07.0

EUT:	AHLBA			Work Order:	NOKI0046
Serial Number:	K9180844519			Date:	19-Aug-22
Customer:	Nokia Solutions and Networks			Temperature:	21.6 °C
Attendees:	David Le			Humidity:	55.5% RH
Project:	None			Barometric Pres.:	1018 mbar
Tested by:	Marty Martin	Power:	54 VDC	Job Site:	TX07

TEST SPECIFICATIONS	Test Method
FCC 27:2022	ANSI C63.26:2015
FCC 90R: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. Carriers are enabled at maximum power (80 watts/carrier). The PSD was measured while transmitting one carrier on Port 1. The total PSD for multiport (2x2 MIMO, 4x4 MIMO) operation was determinded based upon ANSI 63.26 clause 6.4.3.2.4 (10 Log Nout). The total PSD for two port operation is single port PSD +3dB [i.e. 10 Log(2)]. The total PSD for four port operation is single port PSD +6dB [i.e. 10 Log(4)].

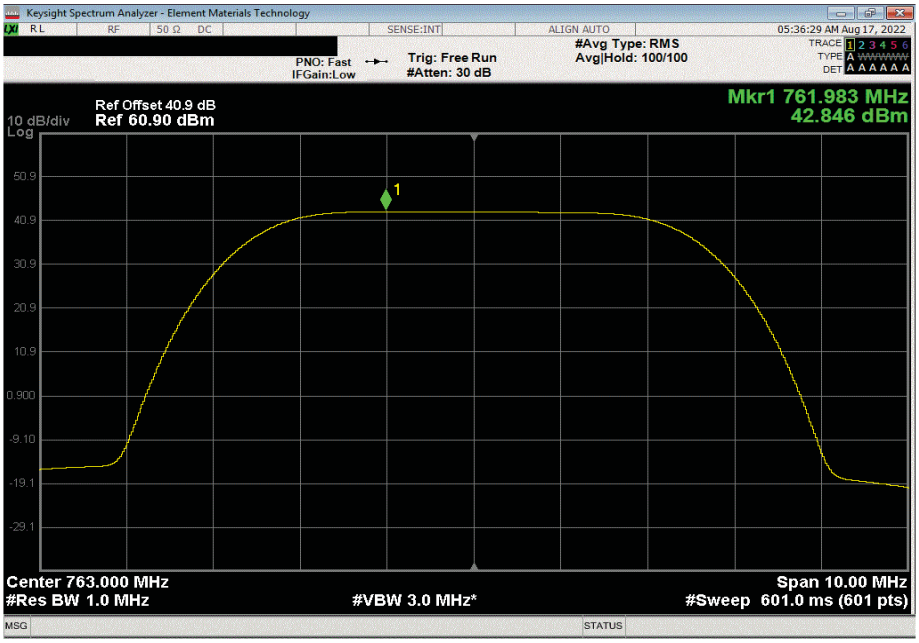
DEVIATIONS FROM TEST STANDARD

None

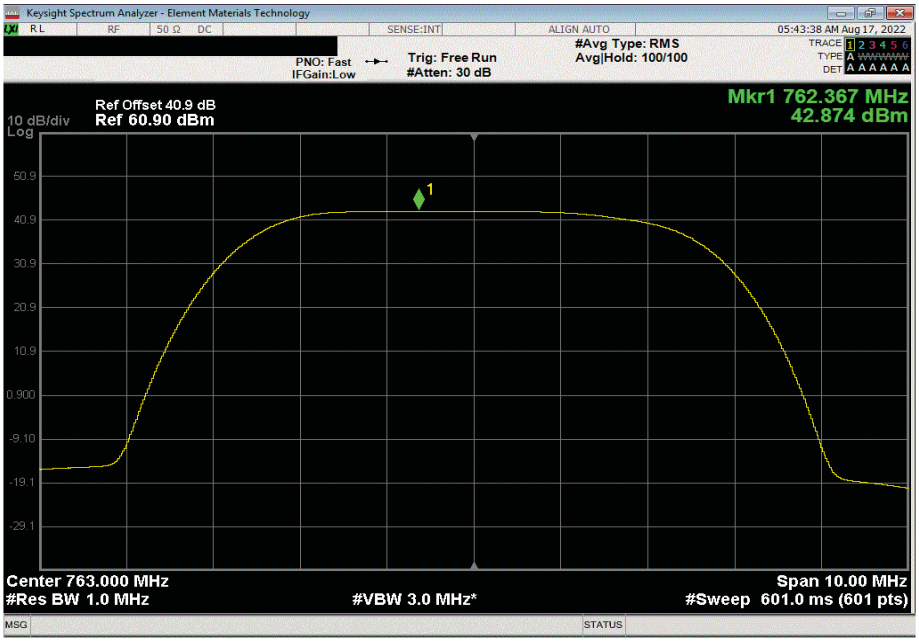
Configuration #	2	Signature	Marty Martin

	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD
Port 1					
5G NR, Band n14, 758 - 768 Mhz					
5 MHz Bandwidth					
QPSK Modulation					
Mid Channel, 763 MHz	42.846	0	42.8	45.8	48.8
16QAM Modulation					
Mid Channel, 763 MHz	42.874	0	42.9	45.9	48.9
64QAM Modulation					
Mid Channel, 763 MHz	42.935	0	42.9	45.9	48.9
256QAM Modulation					
Low Channel, 760.5 MHz	42.969	0	43	46	49
Mid Channel, 763 MHz	42.885	0	42.9	45.9	48.9
High Channel, 765.5 MHz	43.034	0	43	46	49
10 MHz Bandwidth					
256QAM Modulation					
Mid Channel, 763 MHz	39.842	0	39.8	42.8	45.8

Port 1, 5G NR, Band n14, 758 - 768 Mhz, 5 MHz Bandwidth, QPSK Modulation, Mid Channel, 763 MHz						
		Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD
		42.846	0	42.8	45.8	48.8

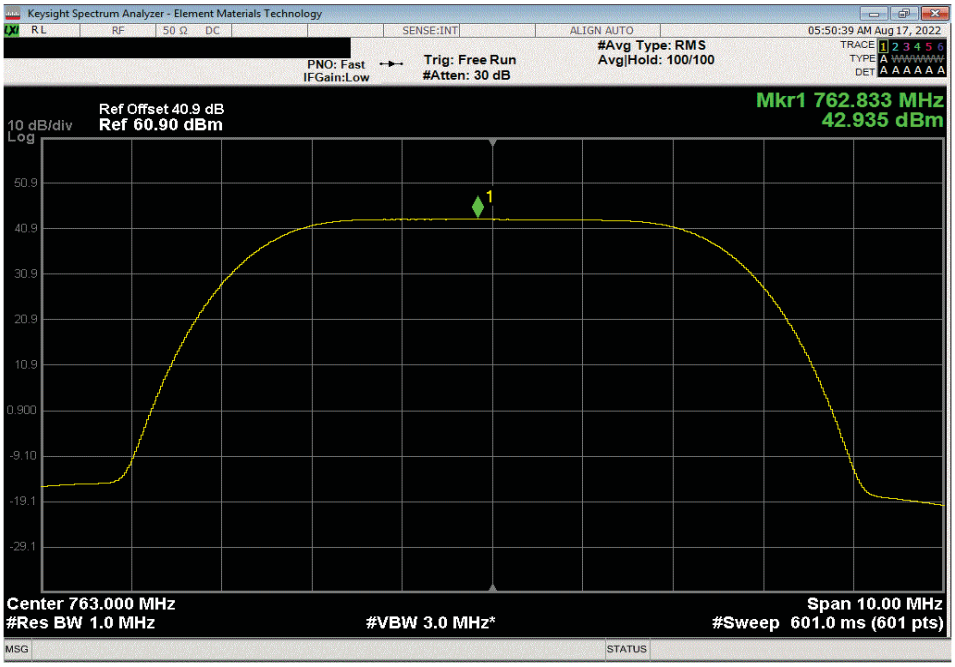


Port 1, 5G NR, Band n14, 758 - 768 Mhz, 5 MHz Bandwidth, 16QAM Modulation, Mid Channel, 763 MHz						
		Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD
		42.874	0	42.9	45.9	48.9

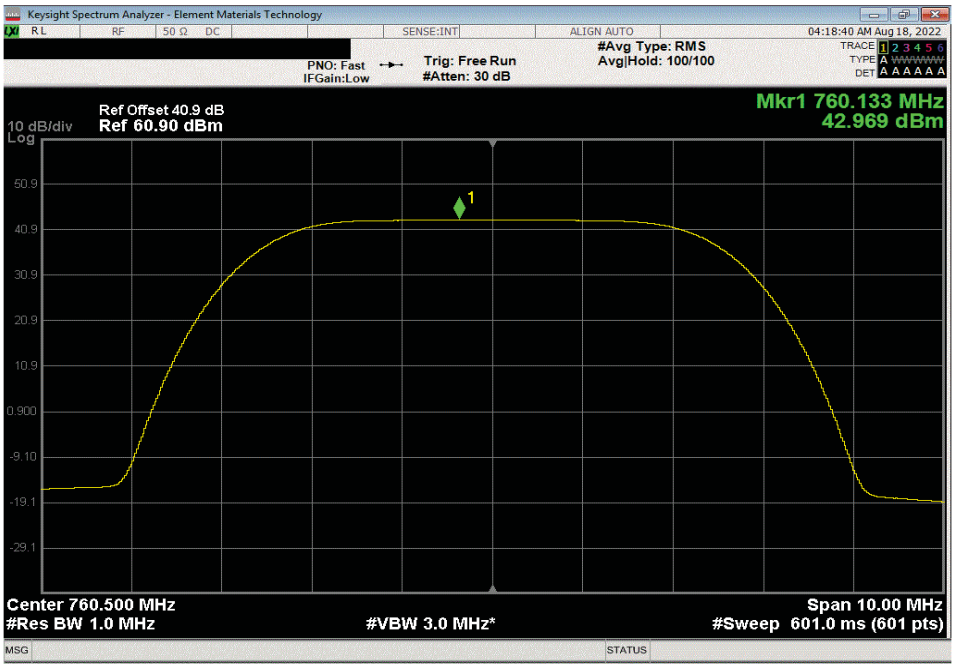


POWER SPECTRAL DENSITY AND EIRP CALCULATION - BAND n14

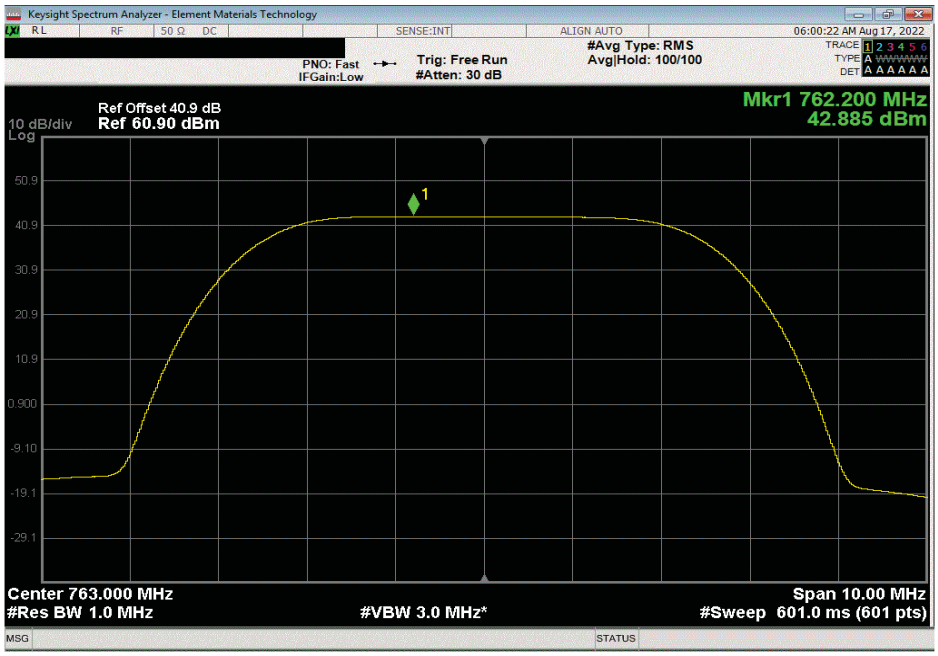
Port 1, 5G NR, Band n14, 758 - 768 Mhz, 5 MHz Bandwidth, 64QAM Modulation, Mid Channel, 763 MHz						
		Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD
		42.935	0	43	46	49



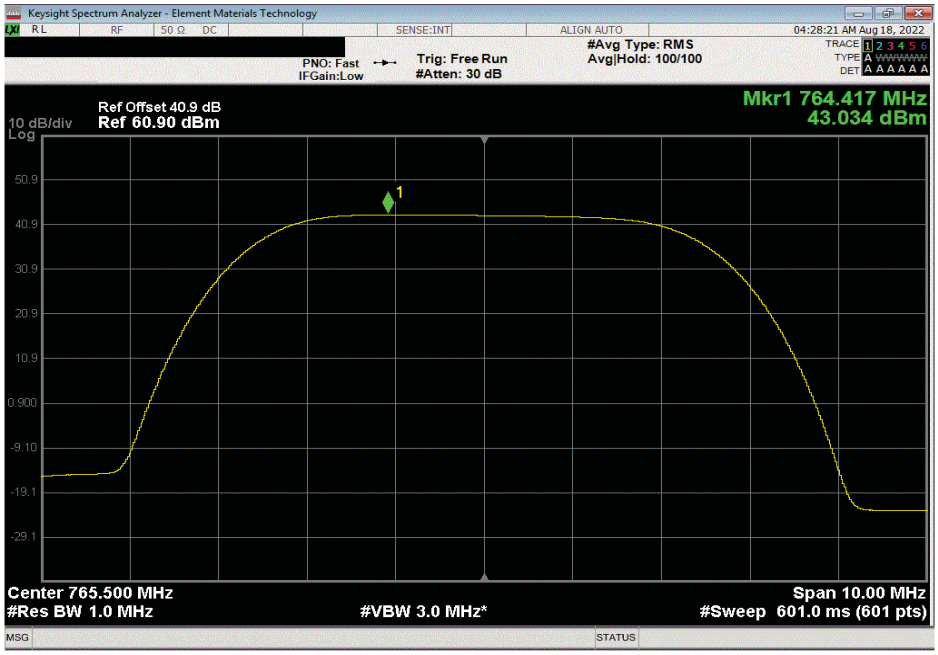
Port 1, 5G NR, Band n14, 758 - 768 Mhz, 5 MHz Bandwidth, 256QAM Modulation, Low Channel, 760.5 MHz						
		Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD
		42.969	0	43	46	49



Port 1, 5G NR, Band n14, 758 - 768 Mhz, 5 MHz Bandwidth, 256QAM Modulation, Mid Channel, 763 MHz						
		Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD
		42.885	0	42.9	45.9	48.9



Port 1, 5G NR, Band n14, 758 - 768 Mhz, 5 MHz Bandwidth, 256QAM Modulation, High Channel, 765.5 MHz						
		Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD
		43.034	0	43	46	49

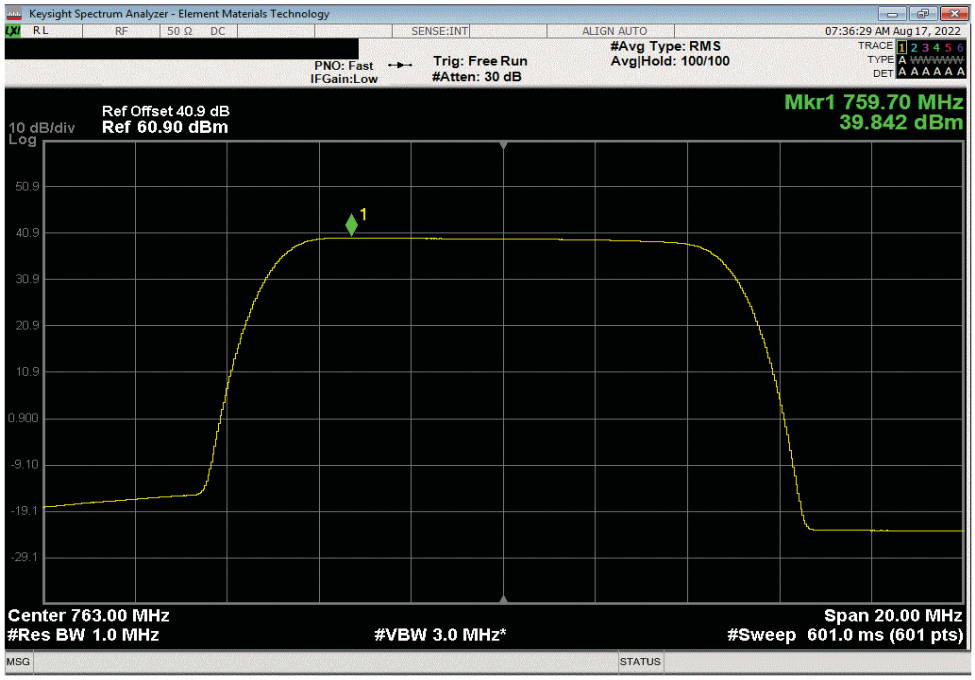


POWER SPECTRAL DENSITY AND EIRP CALCULATION - BAND n14

element

TbtTx 2022.05.02.0 XMit 2022.02.07.0

Port 1, 5G NR, Band n14, 758 - 768 Mhz, 10 MHz Bandwidth, 256QAM Modulation, Mid Channel, 763 MHz							
			Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD
			39.842	0	39.8	42.8	45.8



POWER SPECTRAL DENSITY AND EIRP CALCULATION - BAND n14

EIRP Calculations

EIRP calculations are needed at each transmitter location to optimize base station operational performance while meeting regulatory requirements. Each cell site installation needs to consider the power measurements in the radio certification report as well as site specific regulatory requirements (such as antenna height, population density, etc.), site installation parameters (line loss between antenna and radio, antenna parameters, etc.) and base station operational parameters (MIMO operational setup, carrier power level, channel bandwidth, modulation type, etc.) to optimize performance. Transmitter output power may be reduced (from maximum) by base station setup parameters. Base station antennas are selected by the customer.

The base station antenna is selected by the customer and this EIRP calculation is based upon a sample worst case antenna. The EIRP calculation is based upon Commscope antenna assembly model "FF-65C-R1". The maximum Band n14 gain (15.8dBi) for this antenna was used for the EIRP calculation. This antenna assembly has a pair of +45° cross-polarized radiators. The four antenna RF inputs on the antenna assembly are labeled as R1 +45°, R1 -45°, R2 +45° and R2 -45°. The four AHLBA transmitter outputs are connected to the antenna assembly RF inputs.

Equivalent Isotropically Radiated Power (EIRP) is calculated for four port MIMO (as specified in ANSI C63.26-2015 section 6.4 for uncorrelated output signals) from the results of power measurements (highest measured PSD for each channel bandwidth type). The maximum antenna gain was used for this calculation. The cable loss between the antenna and transmitter is site dependent (will not be 0 dB) but for this worst case EIRP calculation 0 dB was used. Calculations of worst-case EIRP for four port MIMO are as follows:

Parameter	5 MHz Ch BW	10 MHz Ch BW
Worst Case PSD/Antenna Port	43.0 dBm/MHz	39.8 dBm/MHz
Number of Ant Ports per Polarization	2	2
Total PSD per Polarization 10Log(2) = +3dB	46.0 dBm/MHz	42.8 dBm/MHz
Cable Loss (site dependent)	0 dB	0 dB
Dir Gain = Maximum Antenna Gain (G_{Ant}) See Note 1	15.8 dBi	15.8 dBi
EIRP per Polarization = Total PSD/Pol + Dir Gain	61.8 dBm/MHz or 1514 Watts/MHz	58.6 dBm/MHz or 724.4 Watts/MHz
Number of Polarizations	2	2
EIRP Total = R1 ±45°and R2 ±45° See Note 2	61.8 dBm/MHz or 1514 Watts/MHz	58.6 dBm/MHz or 724.4 Watts/MHz

Note 1: The directional gain is equal to antenna gain since the transmit signals are completely uncorrelated. See ANSI C63.26 sections 6.4.5.2.3b) and 6.4.5.3.1b) for guidance.
Note 2: The EIRP per antenna polarity is required to be below the regulatory limit as described in ANSI C63.26-2015 section 6.4.6.3 b)2) and KDB 662911 D02v01 page 3 example (2) since the two transmitter outputs to each antenna are 90 degree-phase shifted relative to each other (cross-polarized radiators).

EIRP Calculation Summary

The worst case AHLBA Band n14 four port MIMO EIRP levels using antenna assembly model "FF-65C-R1" are less than the FCC and ISED (65.16 dBm/MHz and 62.15 dBm/MHz) EIRP Regulatory Limits for all (5 & 10MHz) channel bandwidths.

AVERAGE POWER - ALL PORTS - BAND n12

XMit 2022.02.07.0

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
Block - DC	Fairview Microwave	SD3239	ANE	2022-03-02	2023-03-02
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2022-01-17	2023-01-17

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 all ports (for 5G NR carrier at the middle channel using 256 QAM modulation.) in order to prove the AHLBA antenna ports are essentially electrically identical. 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.

AVERAGE POWER - ALL PORTS - BAND n12

element

TbtTx 2022.05.02.0 XMit 2022.02.07.0

EUT:	AHLBA			Work Order:	NOKI0046
Serial Number:	K9180844519			Date:	19-Aug-22
Customer:	Nokia Solutions and Networks			Temperature:	21.7 °C
Attendees:	David Le			Humidity:	55.1% RH
Project:	None			Barometric Pres.:	1017 mbar
Tested by:	Marty Martin	Power:	54 VDC	Job Site:	TX07

TEST SPECIFICATIONS	Test Method
FCC 27:2022	ANSI C63.26:2015
FCC 90R:2022	ANSI C63.26:2015

COMMENTS

All measurement path loses accounted for in the reference level offest including any attenuators, filters, and DC blocks. The carriers are operated at maximum power.

DEVIATIONS FROM TEST STANDARD

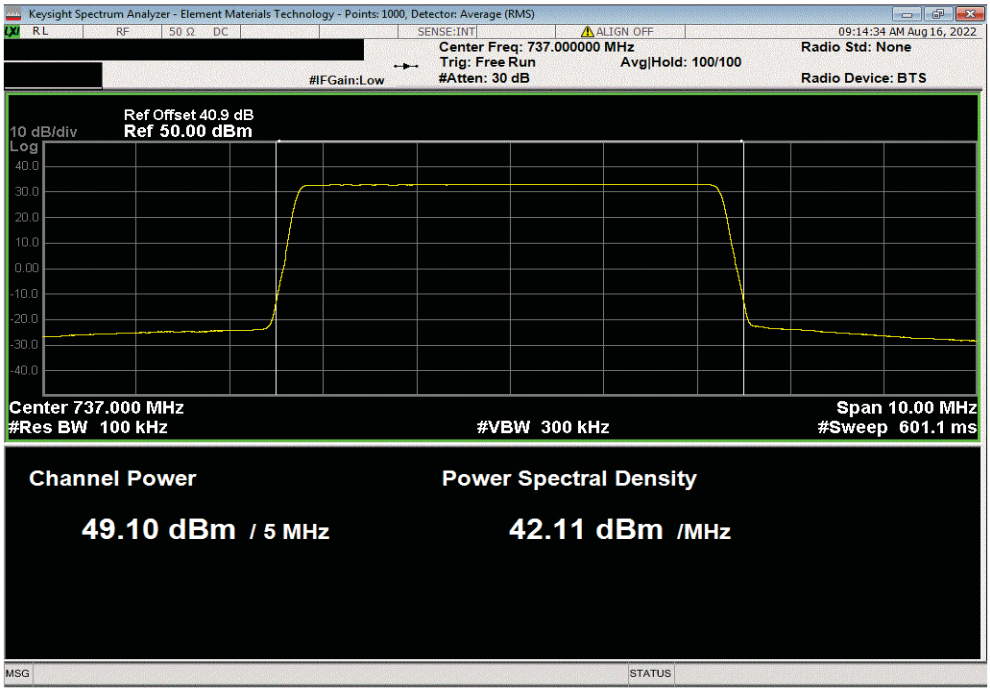
None

Configuration #	2	Signature

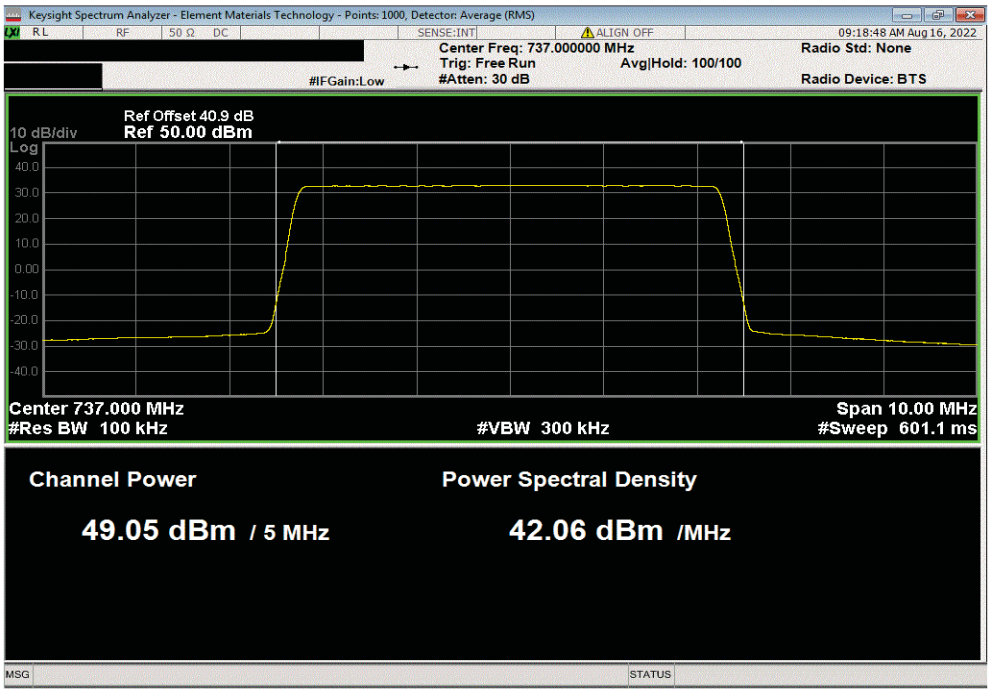
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	All Ports Value (dBm)	Limit (dBm)	Results
Port 1						
5G NR Band n12, 729 - 745 Mhz						
5 MHz Bandwidth						
256QAM Modulation						
Mid Channel, 737.0 MHz	49.096	0	49.1	N/A	Within Tolerance	N/A
Port 2						
5G NR Band n12, 729 - 745 Mhz						
5 MHz Bandwidth						
256QAM Modulation						
Mid Channel, 737.0 MHz	49.046	0	49	N/A	Within Tolerance	N/A
Port 3						
5G NR Band n12, 729 - 745 Mhz						
5 MHz Bandwidth						
256QAM Modulation						
Mid Channel, 737.0 MHz	49.035	0	49	N/A	Within Tolerance	N/A
Port 4						
5G NR Band n12, 729 - 745 Mhz						
5 MHz Bandwidth						
256QAM Modulation						
Mid Channel, 737.0 MHz	49.042	0	49	N/A	Within Tolerance	N/A
All Ports						
5G NR Band n12, 729 - 745 MHz						
5 MHz Bandwidth						
256QAM Modulation						
Mid Channel, 737.0 MHz	N/A	0	N/A	55	N/A	N/A

AVERAGE POWER - ALL PORTS - BAND n12

Port 1, 5GNR, Band n12, 729 - 745 Mhz, 5 MHz Bandwidth, 256QAM Modulation, Mid Channel, 737.0 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	All Ports Value (dBm)	Limit (dBm)	Results
	49.096	0	49.1	N/A	Within Tolerance	Pass

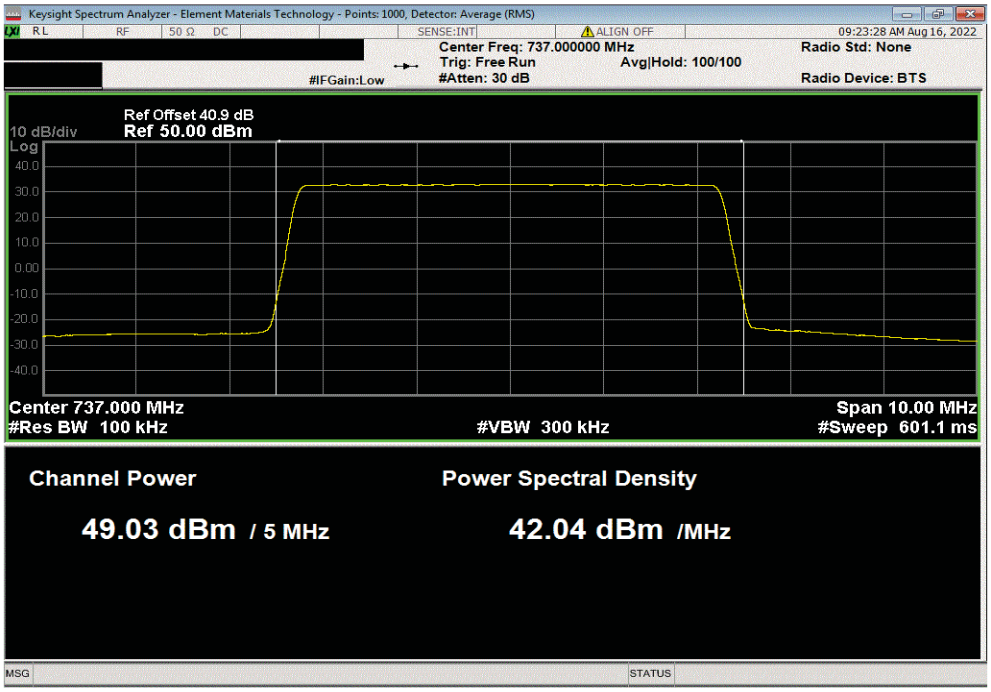


Port 2, 5G NR, Band n12, 729 - 745 Mhz, 5 MHz Bandwidth, 256QAM Modulation, Mid Channel, 737.0 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	All Ports Value (dBm)	Limit (dBm)	Results
	49.046	0	49	N/A	Within Tolerance	Pass

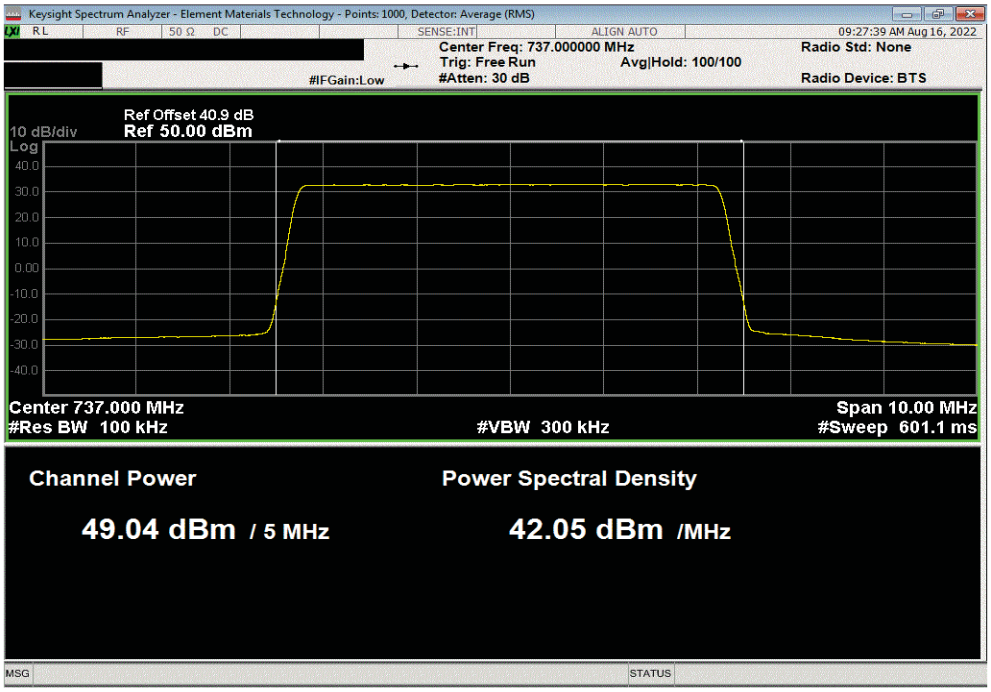


AVERAGE POWER - ALL PORTS - BAND n12

Port 3, 5G NR, Band n12, 729 - 745 Mhz, 5 MHz Bandwidth, 256QAM Modulation, Mid Channel, 737.0 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	All Ports Value (dBm)	Limit (dBm)	Results
	49.035	0	49	N/A	Within Tolerance	Pass



Port 4, 5G NR, Band n12, 729 - 745 Mhz, 5 MHz Bandwidth, 256QAM Modulation, Mid Channel, 737.0 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	All Ports Value (dBm)	Limit (dBm)	Results
	49.042	0	49	N/A	Within Tolerance	Pass



AVERAGE POWER - ALL PORTS - BAND n12

5G NR, Band n12, 729 - 745 Mhz, 5 MHz Bandwidth, 256QAM Modulation, Mid Channel, 737.0 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	All Ports Value (dBm)	Limit (dBm)	Results
	N/A	0	N/A	55	N/A	N/A

AVERAGE POWER PORT SUMMING					
	PORT 1	PORT 2	PORT 3	PORT 4	SUM TOTAL
INITIAL VALUE (dBm)	49.1	49.0	49.0	49.0	N/A
INITIAL VALUE (Watts)	81.3	79.4	79.4	79.4	319.6
TOTAL VALUE (dBm)	N/A	N/A	N/A	N/A	55.0

AVERAGE POWER - ALL PORTS - BAND n14

XMit 2022.02.07.0

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
Block - DC	Fairview Microwave	SD3239	ANE	2022-03-02	2023-03-02
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2022-01-17	2023-01-17

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 all ports (for 5G NR5 carrier at the middle channel using 256 QAM modulation) in order to prove the antenna ports are essentially electrically identical. 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.

AVERAGE POWER - ALL PORTS - BAND n14

TbtTx 2022.05.02.0 XMit 2022.02.07.0

EUT:	AHLBA			Work Order:	NOKI0046
Serial Number:	K9180844519			Date:	19-Aug-22
Customer:	Nokia Solutions and Networks			Temperature:	21.2 °C
Attendees:	David Le			Humidity:	56.9% RH
Project:	None			Barometric Pres.:	1018 mbar
Tested by:	Marty Martin	Power:	54 VDC	Job Site:	TX07

TEST SPECIFICATIONS	Test Method
FCC 27:2022	ANSI C63.26:2015
FCC 90R:2022	ANSI C63.26:2015

COMMENTS

All measurement path loses accounted for in the reference level offest including any attenuators, filters, and DC blocks. The carriers are operated at maximum power.

DEVIATIONS FROM TEST STANDARD

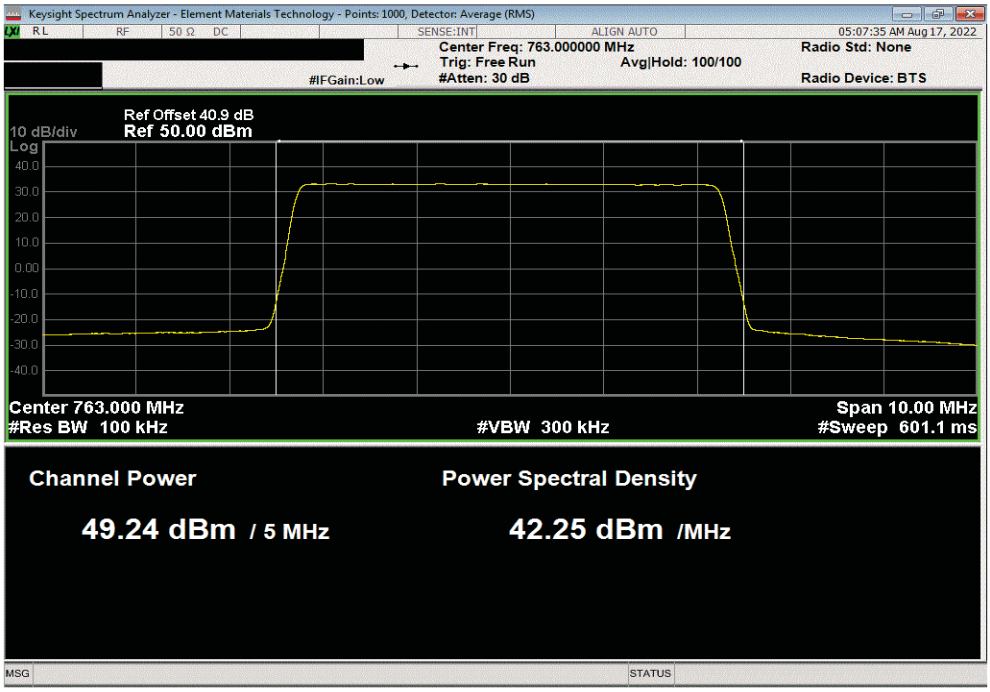
None

Configuration #	2	Signature

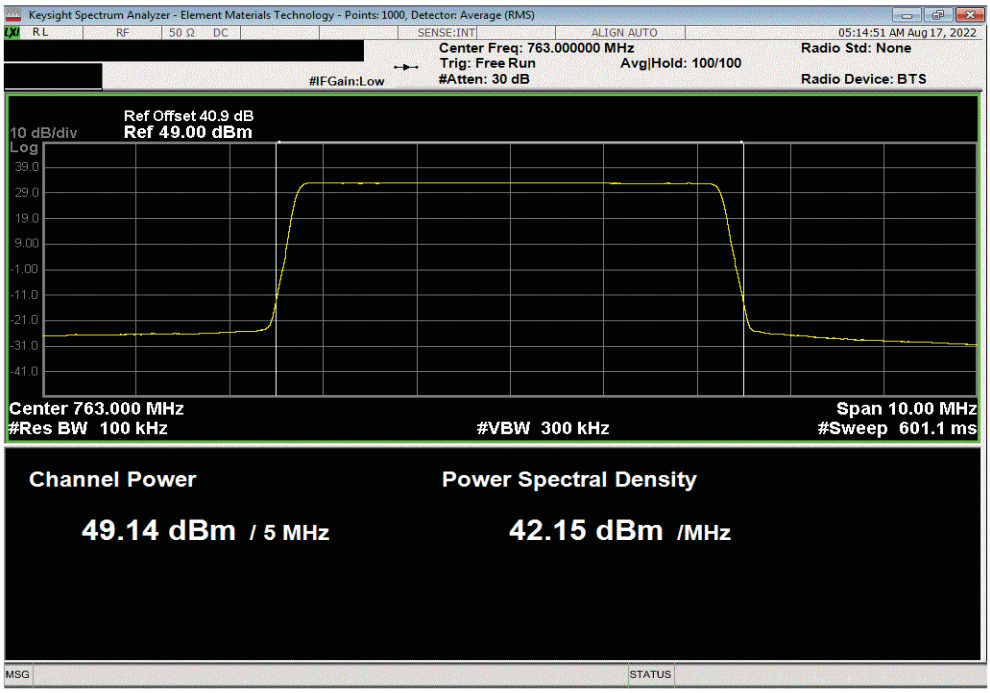
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	All Ports Value (dBm)	Value (dBm)	Limit (dBm)	Results
Port 1						
5G NR, Band n14, 758 - 768 Mhz						
5 MHz Bandwidth						
256QAM Modulation						
Mid Channel, 763.0 MHz	49.244	0	N/A	49.2	Within Tolerance	N/A
Port 2						
5G NR, Band n14, 758 - 768 Mhz						
5 MHz Bandwidth						
256QAM Modulation						
Mid Channel, 763.0 MHz	49.139	0	N/A	49.1	Within Tolerance	N/A
Port 3						
5G NR, Band n14, 758 - 768 Mhz						
5 MHz Bandwidth						
256QAM Modulation						
Mid Channel, 763.0 MHz	49.239	0	N/A	49.2	Within Tolerance	N/A
Port 4						
5G NR, Band n14, 758 - 768 Mhz						
5 MHz Bandwidth						
256QAM Modulation						
Mid Channel, 763.0 MHz	49.24	0	N/A	49.2	Within Tolerance	N/A
All Ports						
5G NR, Band n14, 758 - 768 Mhz						
5 MHz Bandwidth						
256QAM Modulation						
Mid Channel, 763.0 MHz	N/A	0	55.2	N/A	N/A	N/A

AVERAGE POWER - ALL PORTS - BAND n14

Port 1, 5G NR, Band n14, 758 - 768 Mhz, 5 MHz Bandwidth, 256QAM Modulation, Mid Channel, 763.0 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	All Ports Value (dBm)	Value (dBm)	Limit (dBm)	Results
	49.244	0	N/A	49.2	Within Tolerance	N/A

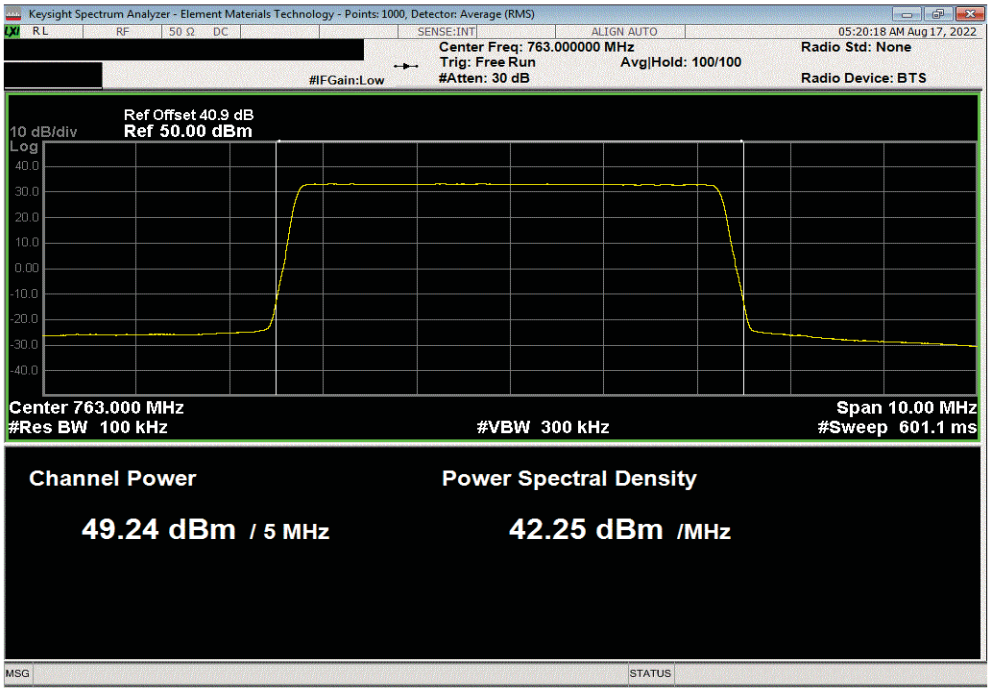


Port 2, 5G NR, Band n14, 758 - 768 Mhz, 5 MHz Bandwidth, 256QAM Modulation, Mid Channel, 763.0 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	All Ports Value (dBm)	Value (dBm)	Limit (dBm)	Results
	49.139	0	N/A	49.1	Within Tolerance	N/A

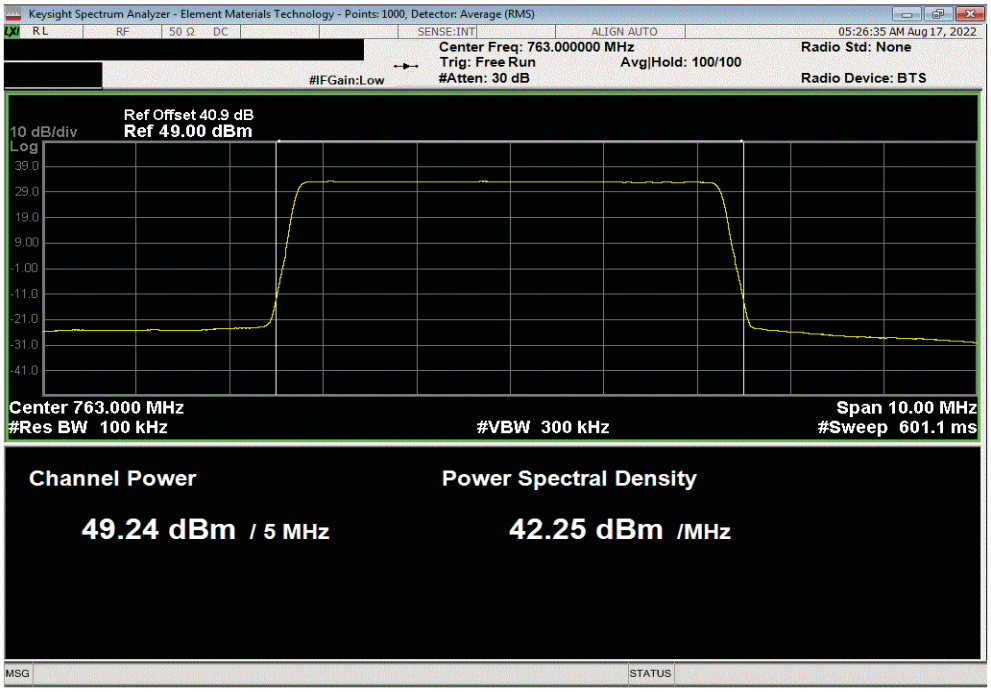


AVERAGE POWER - ALL PORTS - BAND n14

Port 3, 5G NR, Band n14, 758 - 768 Mhz, 5 MHz Bandwidth, 256QAM Modulation, Mid Channel, 763.0 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	All Ports Value (dBm)	Value (dBm)	Limit (dBm)	Results
	49.239	0	N/A	49.2	Within Tolerance	N/A



Port 4, 5G NR, Band n14, 758 - 768 Mhz, 5 MHz Bandwidth, 256QAM Modulation, Mid Channel, 763.0 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	All Ports Value (dBm)	Value (dBm)	Limit (dBm)	Results
	49.24	0	N/A	49.2	Within Tolerance	N/A



AVERAGE POWER - ALL PORTS - BAND n14

5G NR, Band n14, 758 - 768 Mhz, 5 MHz Bandwidth, 256QAM Modulation, Mid Channel, 763.0 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	All Ports Value (dBm)	Limit (dBm)	Results
	N/A	0	N/A	55.2	N/A	N/A

AVERAGE POWER PORT SUMMING					
	PORT 1	PORT 2	PORT 3	PORT 4	SUM TOTAL
INITIAL VALUE (dBm)	49.2	49.1	49.2	49.2	N/A
INITIAL VALUE (Watts)	83.2	81.3	83.2	83.2	330.9
TOTAL VALUE (dBm)	N/A	N/A	N/A	N/A	55.2

AVERAGE POWER - MULTIBAND MULTICARRIER

XMit 2022.02.07.0

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
Block - DC	Fairview Microwave	SD3239	ANE	2022-03-02	2023-03-02
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2022-01-17	2023-01-17

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 only on one port. The AHLBA antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in this 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.

Multicarrier Test Cases

Multi-Carrier Test Case 1 (3GPP Band n12 Multicarrier): Three NR5 carriers using two carriers (with minimum spacing between carrier frequencies) at the lower band (731.5MHz & 736.5MHz) and a third carrier with maximum spacing between the other two carrier frequencies (742.5MHz) at the upper band edge. The NR 5MHz channel bandwidth was selected to maximize carrier power spectral density. The carriers are operated at maximum power for a total port power of 80 watts (~26.6W/Band n12 carriers).

Multi-Carrier Test Case 2 (3GPP Band n12 and Band n14 Multicarrier/Multiband): In the Band n12 _ Two NR5 carriers at the lower band edge (731.5 & 736.5MHz). In Band n14 one NR5 carrier at the upper band edge (765.5MHz). The NR 5MHz channel bandwidth was selected to maximize carrier power spectral density. The carriers are operated at maximum power for a total port power of 80 watts (~26.6W/Band n12/n14 carriers).

AVERAGE POWER - MULTIBAND MULTICARRIER

TbtTx 2022.05.02.0 XMit 2022.02.07.0

EUT:	AHLBA			Work Order:	NOKI0046
Serial Number:	K9180844519			Date:	19-Aug-22
Customer:	Nokia Solutions and Networks			Temperature:	22.1 °C
Attendees:	David Le			Humidity:	53.1% RH
Project:	None			Barometric Pres.:	1017 mbar
Tested by:	Marty Martin	Power:	54 VDC	Job Site:	TX07

TEST SPECIFICATIONS	Test Method
FCC 27:2022	ANSI C63.26:2015
FCC 90R:2022	ANSI C63.26:2015

COMMENTS

All measurement path losses were accounted for in the reference level offset including attenuators, cables, DC block and filter when in use. Band n12 and Band n14 carriers were operating at maximum power in each applicable test case to achieve a total port power of 80 watts.

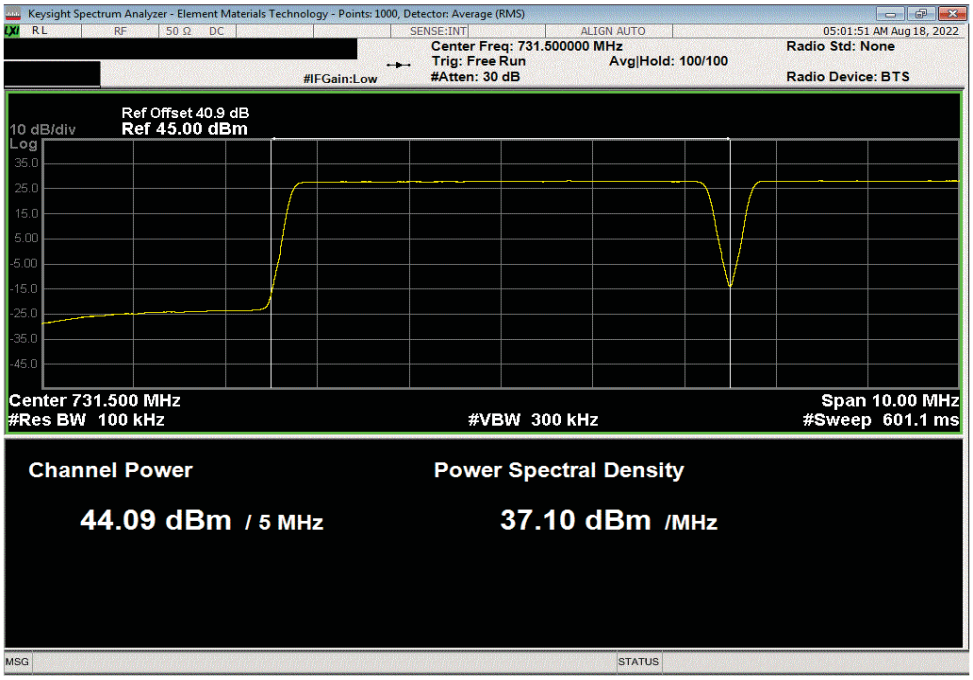
DEVIATIONS FROM TEST STANDARD

None

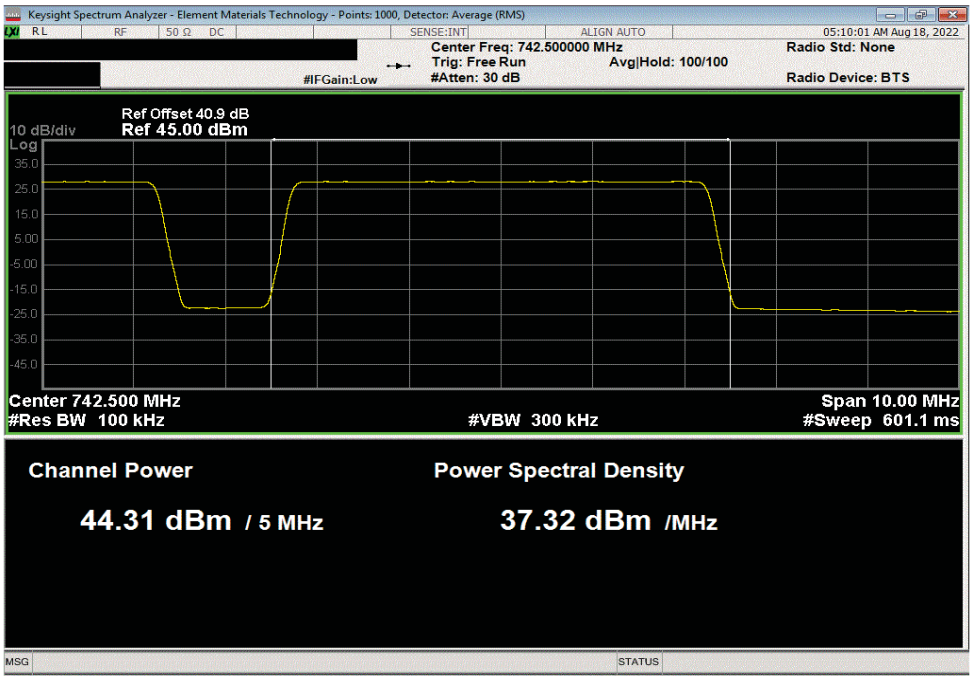
Configuration #	2	Signature

		Avg Cond Initial Pwr (dBm)	Duty Cycle Factor (dB)	Avg Cond Carrier Pwr (dBm)	Avg Cond Band Pwr (dBm)	Avg Cond Port Pwr (dBm)	Limit (dBm)	Results
Port 1, Multi-Carrier Test Case 1								
	5G NR, Band n12, 729 - 745 MHz							
	5 MHz Bandwidth							
	QPSK Modulation							
	Low Channel, 731.5 MHz	44.091	0	44.1	N/A	N/A	Within Tolerance	Pass
	High Channel, 742.5 MHz	44.309	0	44.3	N/A	N/A	Within Tolerance	Pass
	Low Channel, 736.5 MHz	44.282	0	44.3	N/A	N/A	Within Tolerance	Pass
Port 1, Multi-Carrier Test Case 2								
	5G NR, Band n12, 729 - 745 MHz, Band n14 758 - 768 MHz							
	5 MHz Bandwidth							
	QPSK Modulation							
	Low Channel, 731.5 MHz	44.104	0	44.1	N/A	N/A	Within Tolerance	Pass
	Low Channel, 736.5 MHz	44.306	0	44.3	N/A	N/A	Within Tolerance	Pass
	High Channel, 765.5 MHz	43.679	0	43.7	N/A	N/A	Within Tolerance	Pass

Port 1, 5G NR, Multi-Carrier Test Case 1, Band n12, 729 - 745 MHz, 5 MHz Bandwidth, QPSK Modulation, Low Channel, 731.5 MHz						
Avg Cond Initial Pwr (dBm	Duty Cycle Factor (dB)	Avg Cond Carrier Pwr (dBm)	Avg Cond Band Pwr (dBm)	Avg Cond Port Pwr (dBm)	Limit (dBm)	Results
44.091	0	44.1	N/A	N/A	Within Tolerance	Pass



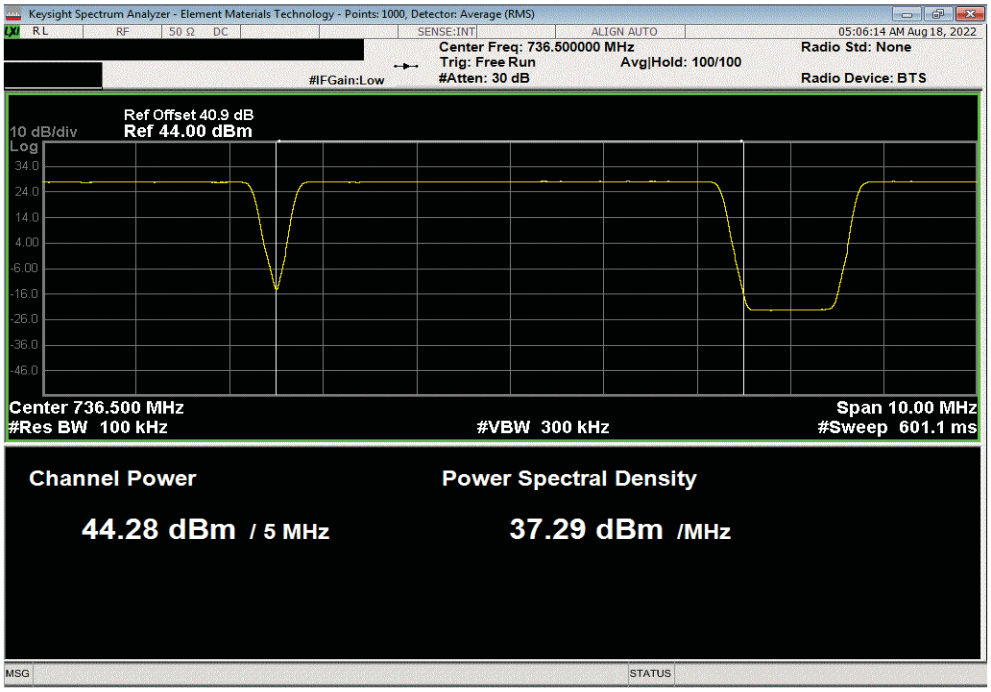
Port 1, 5G NR, Multi-Carrier Test Case 1, Band n12, 729 - 745 MHz, 5 MHz Bandwidth, QPSK Modulation, High Channel, 742.5 MHz						
Avg Cond Initial Pwr (dBm	Duty Cycle Factor (dB)	Avg Cond Carrier Pwr (dBm)	Avg Cond Band Pwr (dBm)	Avg Cond Port Pwr (dBm)	Limit (dBm)	Results
44.309	0	44.3	N/A	N/A	Within Tolerance	Pass



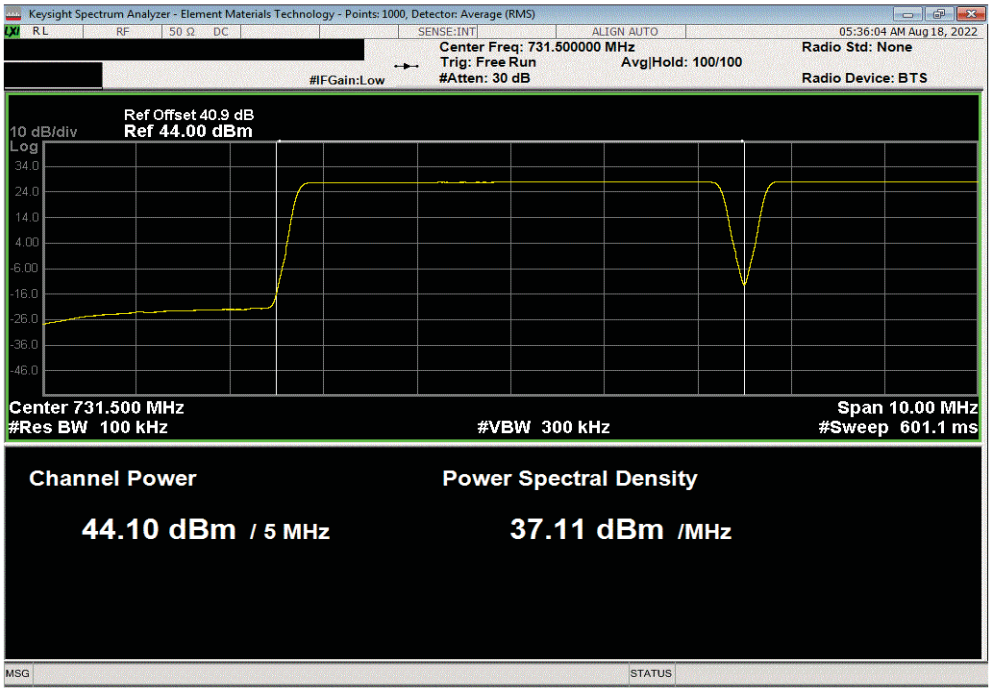
AVERAGE POWER - MULTIBAND MULTICARRIER

Port 1, 5G NR, Multi-Carrier Test Case 1, Band n12, 729 - 745 MHz, 5 MHz Bandwidth, QPSK Modulation, Low Channel, 736.5 MHz

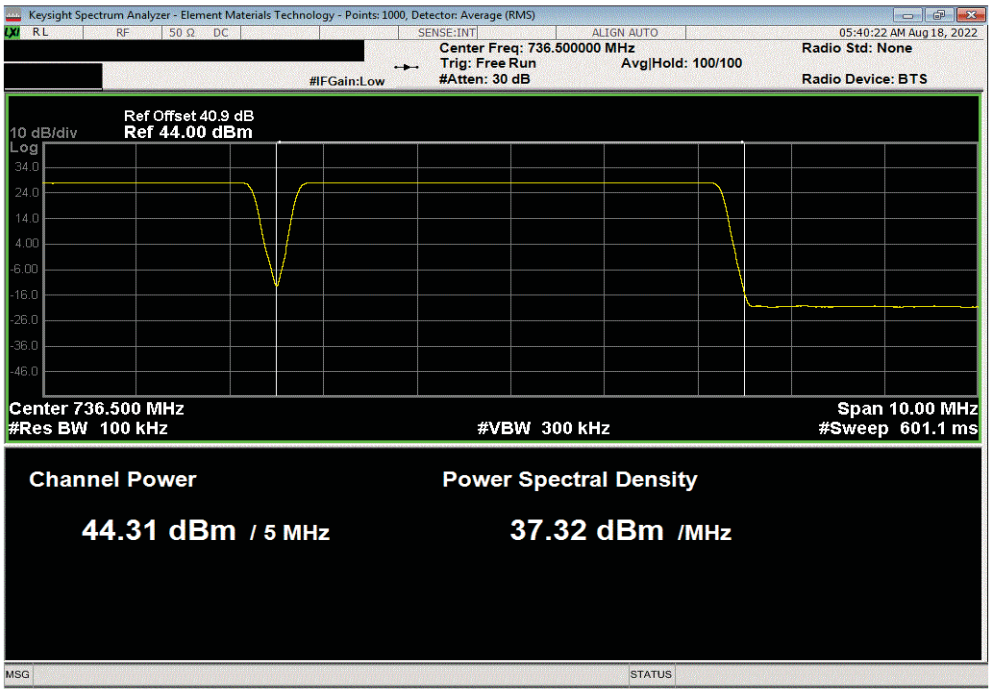
Avg Cond Initial Pwr (dBm	Duty Cycle Factor (dB)	Avg Cond Carrier Pwr (dBm)	Avg Cond Band Pwr (dBm)	Avg Cond Port Pwr (dBm)	Limit (dBm)	Results
44.282	0	44.3	N/A	N/A	Within Tolerance	Pass



Port 1, 5G NR, Multi-Carrier Test Case 2, Band n12, 729 - 745 MHz, Band n14 758 - 768 MHz, 5 MHz Bandwidth, QPSK Modulation, Low Channel, 731.5 MHz						
Avg Cond Initial Pwr (dBm	Duty Cycle Factor (dB)	Avg Cond Carrier Pwr (dBm)	Avg Cond Band Pwr (dBm)	Avg Cond Port Pwr (dBm)	Limit (dBm)	Results
44.104	0	44.1	N/A	N/A	Within Tolerance	Pass

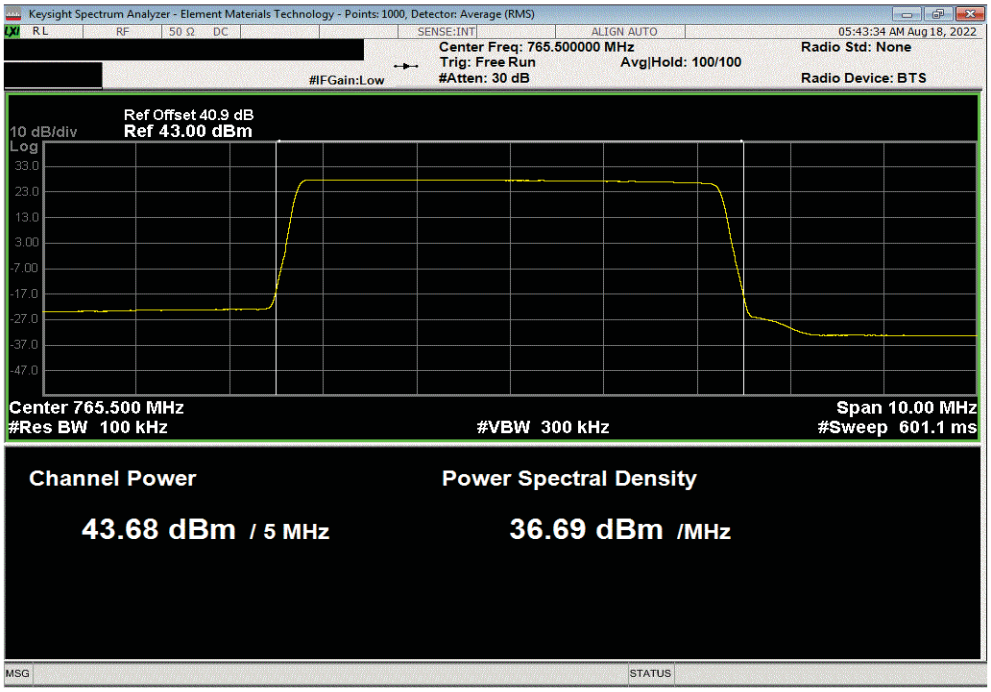


Port 1, 5G NR, Multi-Carrier Test Case 2, Band n12, 729 - 745 MHz, Band n14 758 - 768 MHz, 5 MHz Bandwidth, QPSK Modulation, Low Channel, 736.5 MHz						
Avg Cond Initial Pwr (dBm	Duty Cycle Factor (dB)	Avg Cond Carrier Pwr (dBm)	Avg Cond Band Pwr (dBm)	Avg Cond Port Pwr (dBm)	Limit (dBm)	Results
44.306	0	44.3	N/A	N/A	Within Tolerance	Pass



AVERAGE POWER

Port 1, 5G NR, Multi-Carrier Test Case 2, Band n12, 729 - 745 MHz, Band n14 758 - 768 MHz, 5 MHz Bandwidth, QPSK Modulation, High Channel, 765.5 MHz						
Avg Cond Initial Pwr (dBm	Duty Cycle Factor (dB)	Avg Cond Carrier Pwr (dBm)	Avg Cond Band Pwr (dBm)	Avg Cond Port Pwr (dBm)	Limit (dBm)	Results
43.679	0	43.7	N/A	N/A	Within Tolerance	Pass



AVERAGE POWER - BAND n12

XMit 2022.02.07.0

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
Block - DC	Fairview Microwave	SD3239	ANE	2022-03-02	2023-03-02
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2022-01-17	2023-01-17

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 only on one port. The AHLBA antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in this 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

AVERAGE POWER - BAND n12

TbtTx 2022.05.02.0 XMit 2022.02.07.0

EUT:	AHLBA			Work Order:	NOKI0046
Serial Number:	K9180844519			Date:	17-Aug-22
Customer:	Nokia Solutions and Networks			Temperature:	21.5 °C
Attendees:	David Le			Humidity:	52.9% RH
Project:	None			Barometric Pres.:	1016 mbar
Tested by:	Marty Martin	Power:	54 VDC	Job Site:	TX07

TEST SPECIFICATIONS	Test Method
FCC 27:2022	ANSI C63.26:2015
FCC 90R: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. The carriers are enabled at maximum power (80 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 bandwidth on port 1. The total output power for multiport (2x2 MIMO, 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)]. The total output power for four port operation is single port power + 6dB [i.e. 10log(4)].

DEVIATIONS FROM TEST STANDARD

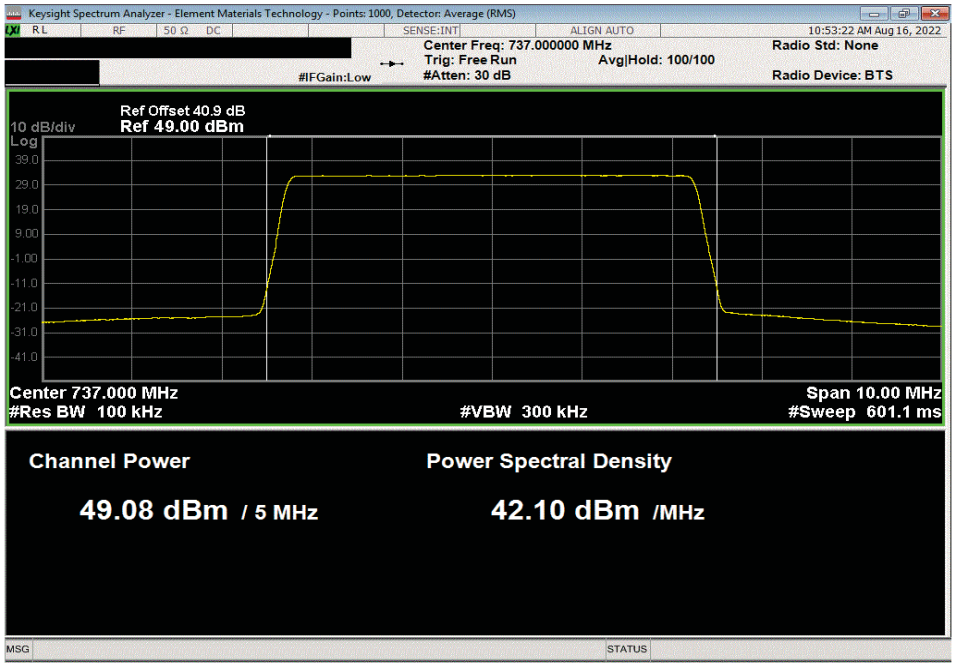
None

Configuration #	2	Signature

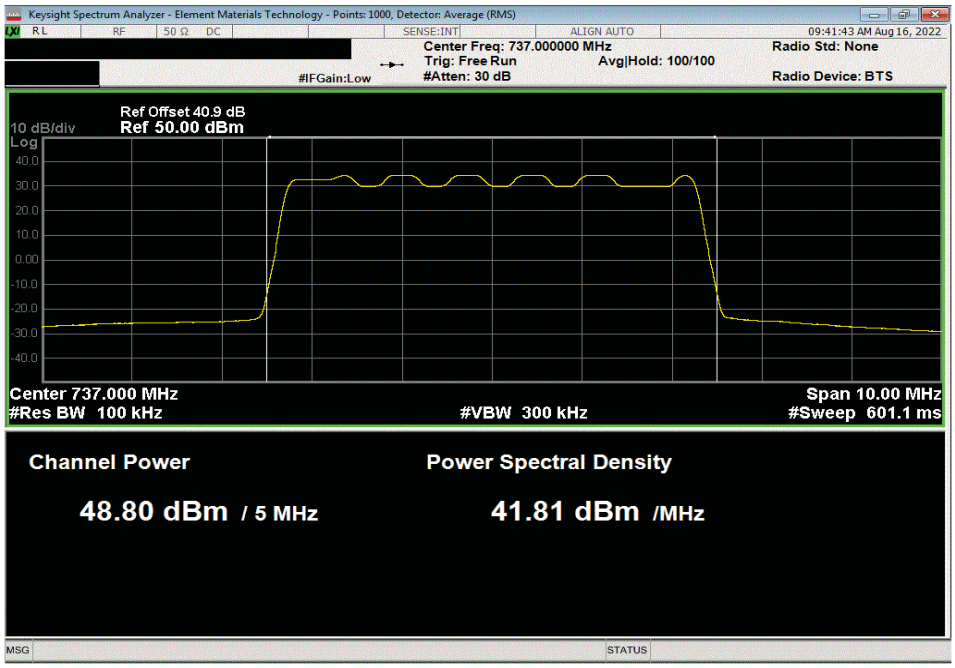
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO dBm/Carrier BW
Port 1					
5G NR Band n12, 729 - 745 Mhz					
5 MHz Bandwidth					
QPSK Modulation					
Mid Channel, 737.0 MHz	49.085	0	49.1	52.1	55.1
16QAM Modulation					
Mid Channel, 737.0 MHz	48.798	0	48.8	51.8	54.8
64QAM Modulation					
Mid Channel, 737.0 MHz	49.023	0	49	52	55
256QAM Modulation					
Low Channel, 731.5 MHz	49.023	0	49	52	55
Mid Channel, 737.0 MHz	49.007	0	49	52	55
High Channel, 742.5 MHz	48.998	0	49	52	55
10 MHz Bandwidth					
256QAM Modulation					
Low Channel, 734 MHz	49.019	0	49	52	55
Mid Channel, 737.0 MHz	49.003	0	49	52	55
High Channel, 740 MHz	48.969	0	49	52	55
15 MHz Bandwidth					
256QAM Modulation					
Low Channel, 736.5 MHz	49.091	0	49.1	52.1	55.1
Mid Channel, 737.0 MHz	49.121	0	49.1	52.1	55.1
High Channel, 737.5 MHz	49.154	0	49.2	52.2	55.2

AVERAGE POWER - BAND n12

Port 1, 5G NR, Band n12, 729 - 745 Mhz, 5 MHz Bandwidth, QPSK Modulation, Mid Channel, 737.0 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO dBm/Carrier BW	
	49.085	0	49.1	52.1	55.1	

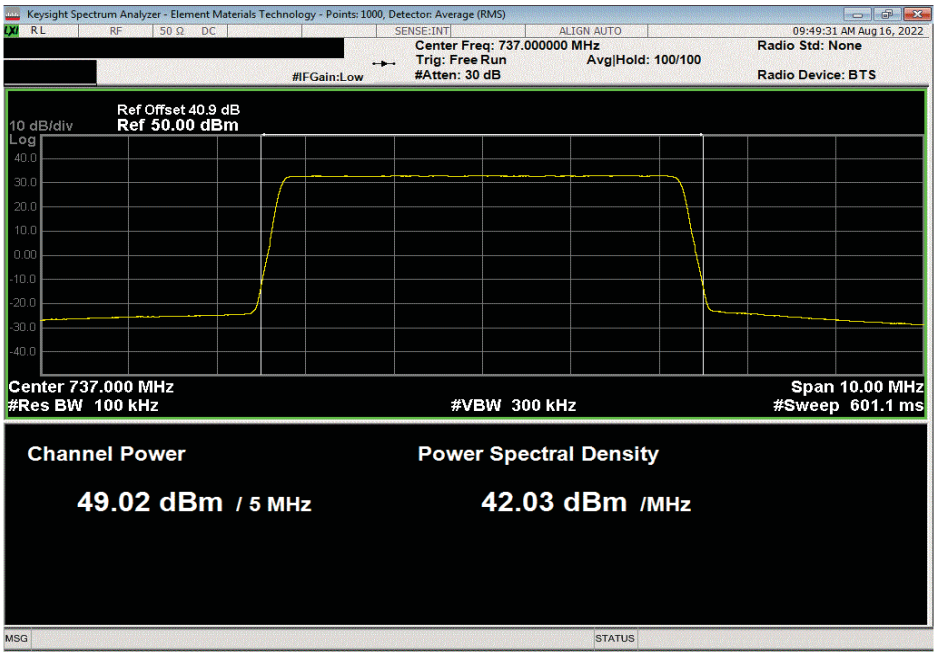


Port 1, 5G NR, Band n12, 729 - 745 Mhz, 5 MHz Bandwidth, 16QAM Modulation, Mid Channel, 737.0 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO dBm/Carrier BW	
	48.798	0	48.8	51.8	54.8	

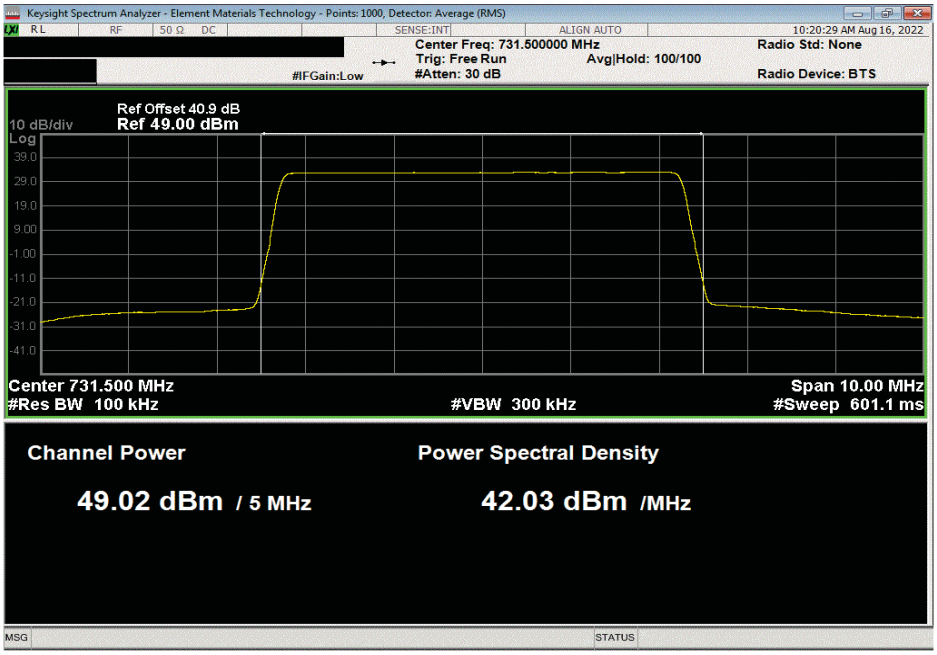


AVERAGE POWER - BAND n12

Port 1, 5G NR, Band n12, 729 - 745 Mhz, 5 MHz Bandwidth, 64QAM Modulation, Mid Channel, 737.0 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO dBm/Carrier BW	
	49.023	0	49	52	55	

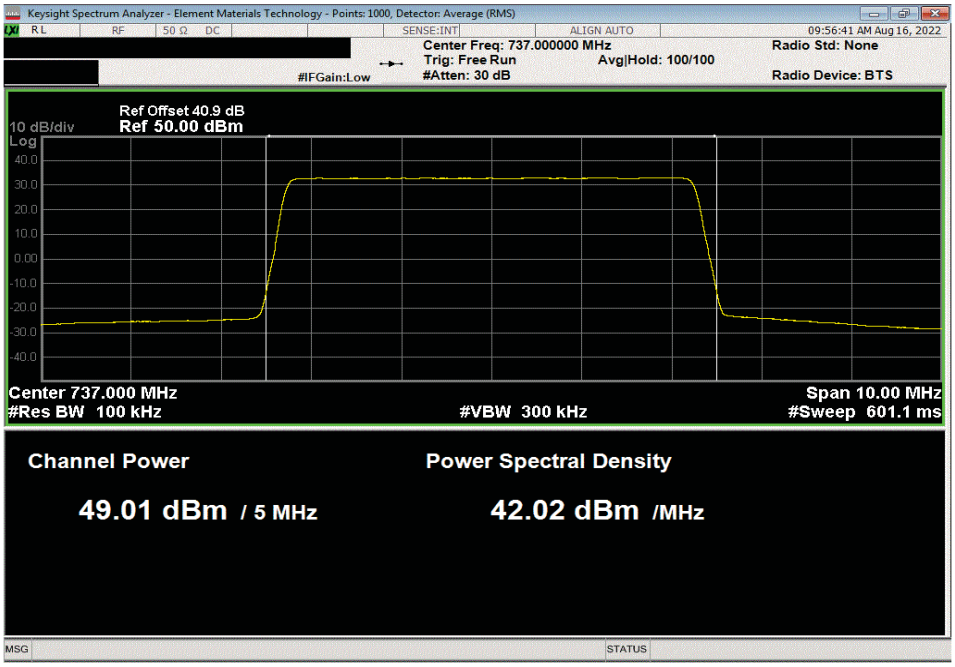


Port 1, 5G NR, Band n12, 729 - 745 Mhz, 5 MHz Bandwidth, 256QAM Modulation, Low Channel, 731.5 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO dBm/Carrier BW	
	49.023	0	49	52	55	

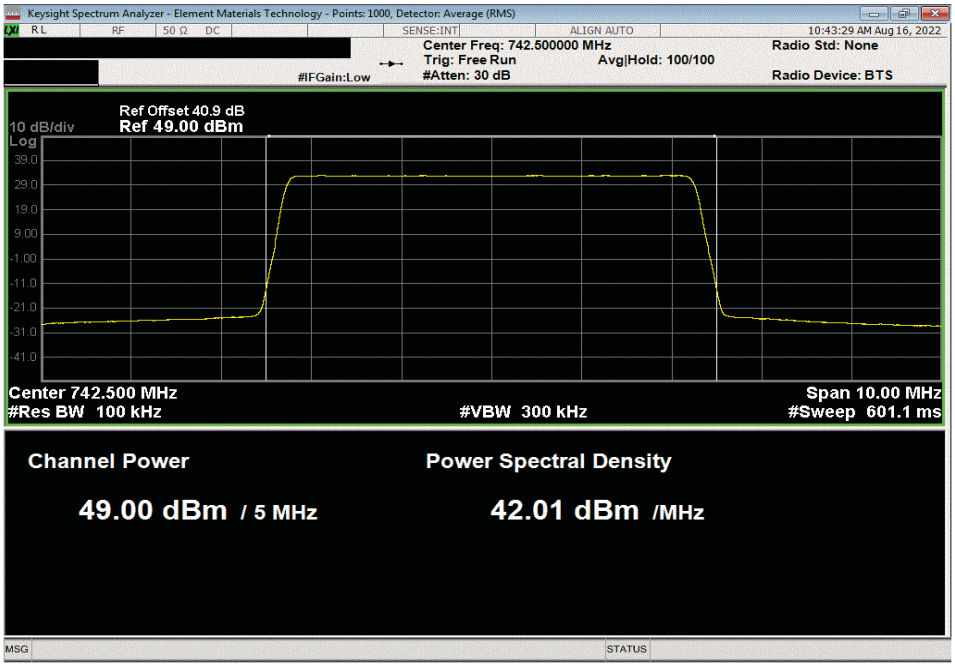


AVERAGE POWER - BAND n12

Port 1, 5G NR, Band n12, 729 - 745 Mhz, 5 MHz Bandwidth, 256QAM Modulation, Mid Channel, 737.0 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO dBm/Carrier BW	
	49.007	0	49	52	55	

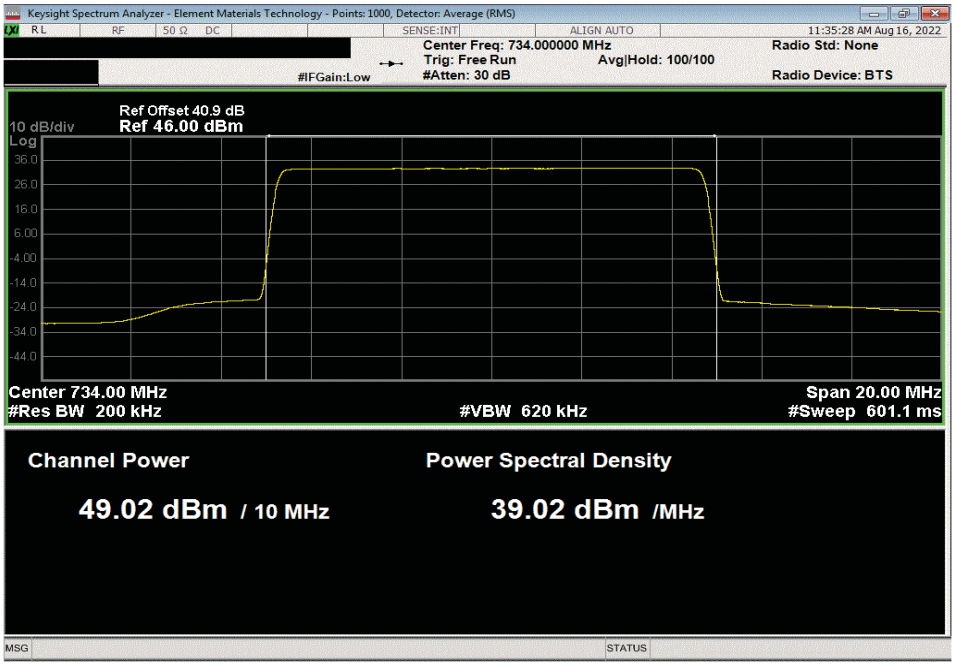


Port 1, 5G NR, Band n12, 729 - 745 Mhz, 5 MHz Bandwidth, 256QAM Modulation, High Channel, 742.5 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO dBm/Carrier BW	
	48.998	0	49	52	55	

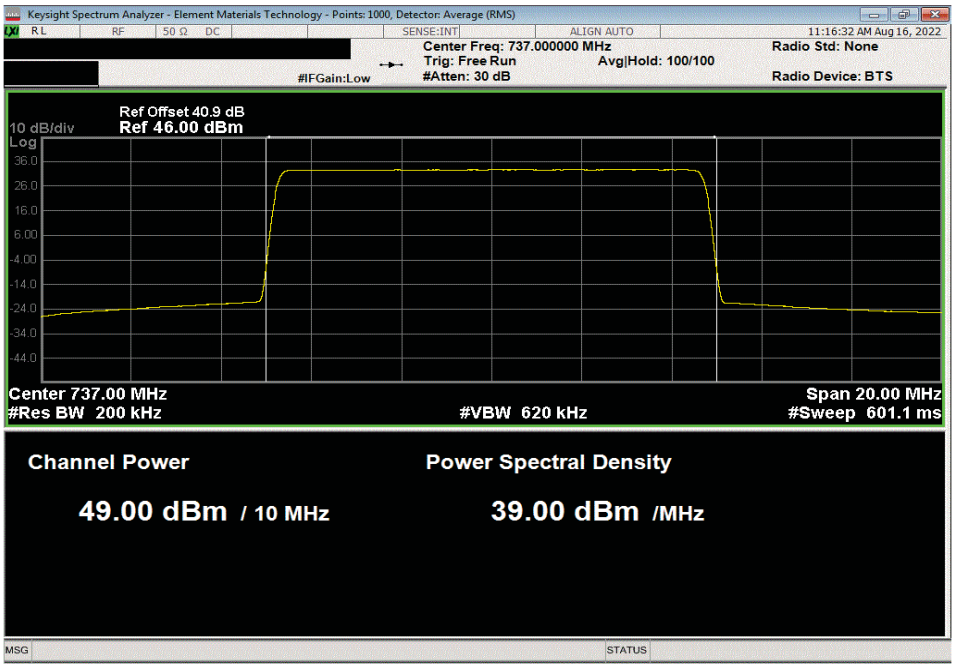


AVERAGE POWER - BAND n12

Port 1, Band n12, 729 - 745 Mhz, 10 MHz Bandwidth, 256QAM Modulation, Low Channel, 734 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO dBm/Carrier BW	
	49.019	0	49	52	55	

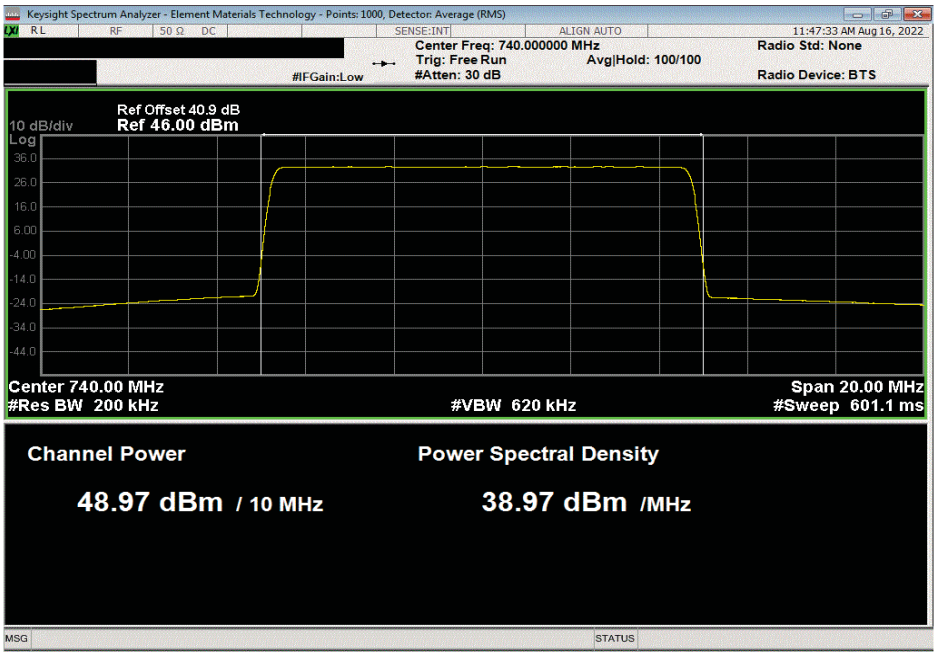


Port 1, Band n12, 729 - 745 Mhz, 10 MHz Bandwidth, 256QAM Modulation, Mid Channel, 737.0 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO dBm/Carrier BW	
	49.003	0	49	52	55	

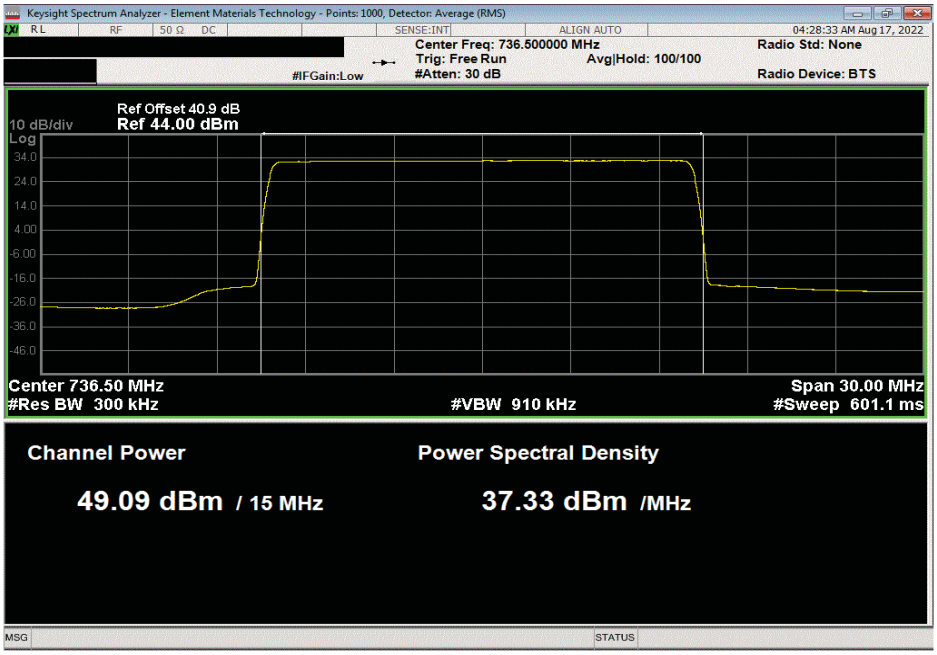


AVERAGE POWER - BAND n12

Port 1, 5G NR, Band n12, 729 - 745 Mhz, 10 MHz Bandwidth, 256QAM Modulation, High Channel, 740 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO dBm/Carrier BW	
	48.969	0	49	52	55	

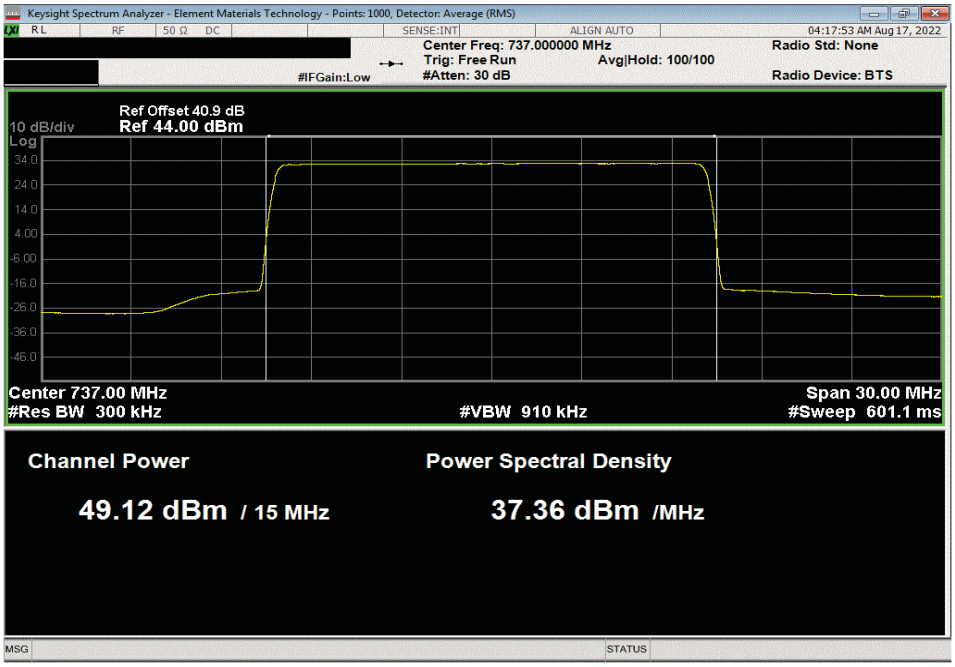


Port 1, 5G NR, Band n12, 729 - 745 Mhz, 15 MHz Bandwidth, 256QAM Modulation, Low Channel, 736.5 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO dBm/Carrier BW	
	49.091	0	49.1	52.1	55.1	

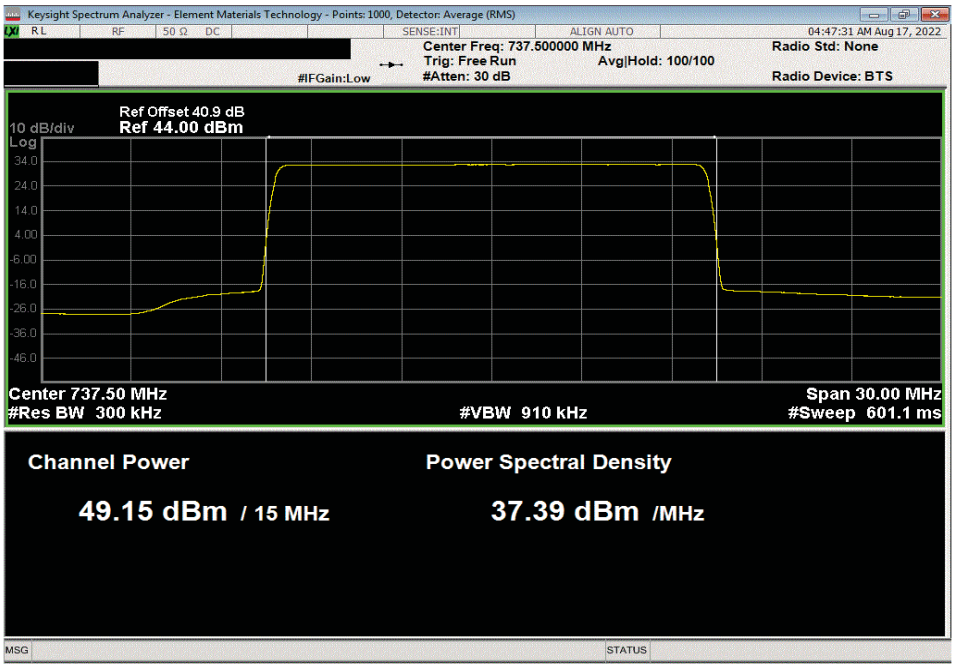


AVERAGE POWER - BAND n12

Port 1, 5G NR, Band n12, 729 - 745 Mhz, 15 MHz Bandwidth, 256QAM Modulation, Mid Channel, 737.0 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO dBm/Carrier BW	
	49.121	0	49.1	52.1	55.1	



Port 1, 5G NR, Band n12, 729 - 745 Mhz, 15 MHz Bandwidth, 256QAM Modulation, High Channel, 737.5 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO dBm/Carrier BW	
	49.154	0		49.2		Fail



AVERAGE POWER - BAND n14

XMit 2022.02.07.0

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
Block - DC	Fairview Microwave	SD3239	ANE	2022-03-02	2023-03-02
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2022-01-17	2023-01-17

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 only on one port. The AHLBA antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in this 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

AVERAGE POWER - BAND n14

element

TbtTx 2022.05.02.0 XMit 2022.02.07.0

EUT:	AHLBA			Work Order:	NOKI0046
Serial Number:	K9180844519			Date:	19-Aug-22
Customer:	Nokia Solutions and Networks			Temperature:	21.6 °C
Attendees:	David Le			Humidity:	56.6% RH
Project:	None			Barometric Pres.:	1018 mbar
Tested by:	Marty Martin	Power:	54 VDC	Job Site:	TX07

TEST SPECIFICATIONS	Test Method
FCC 27:2022	ANSI C63.26:2015
FCC 90R: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. The carriers are enabled at maximum power (80 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 bandwidth on port 1. The total output power for multiport (2x2 MIMO, 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)]. The total output power for four port operation is single port power + 6dB [i.e. 10log(4)].

DEVIATIONS FROM TEST STANDARD

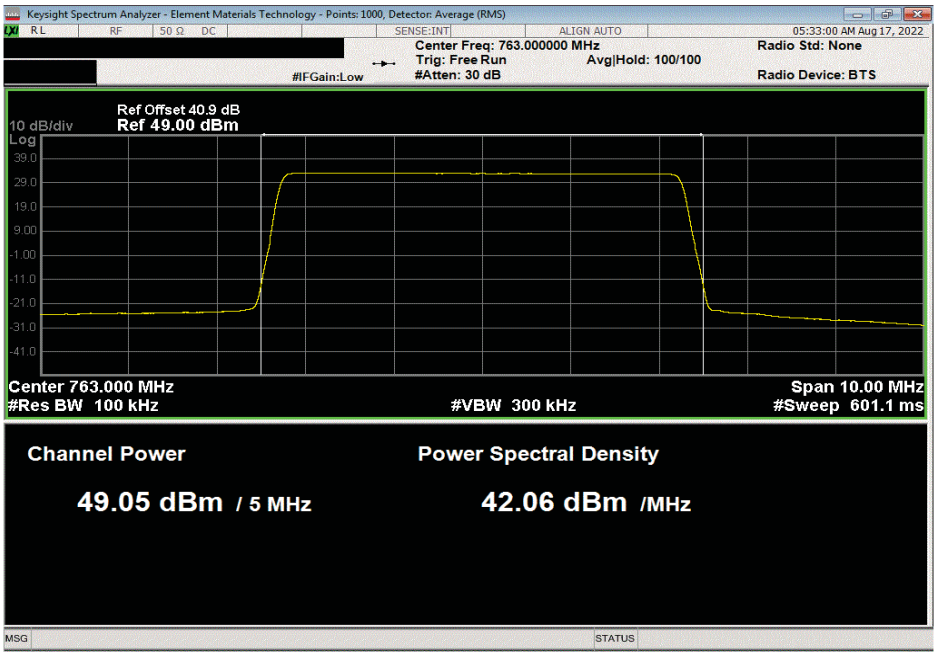
None

Configuration #	2	Signature	Marty Martin

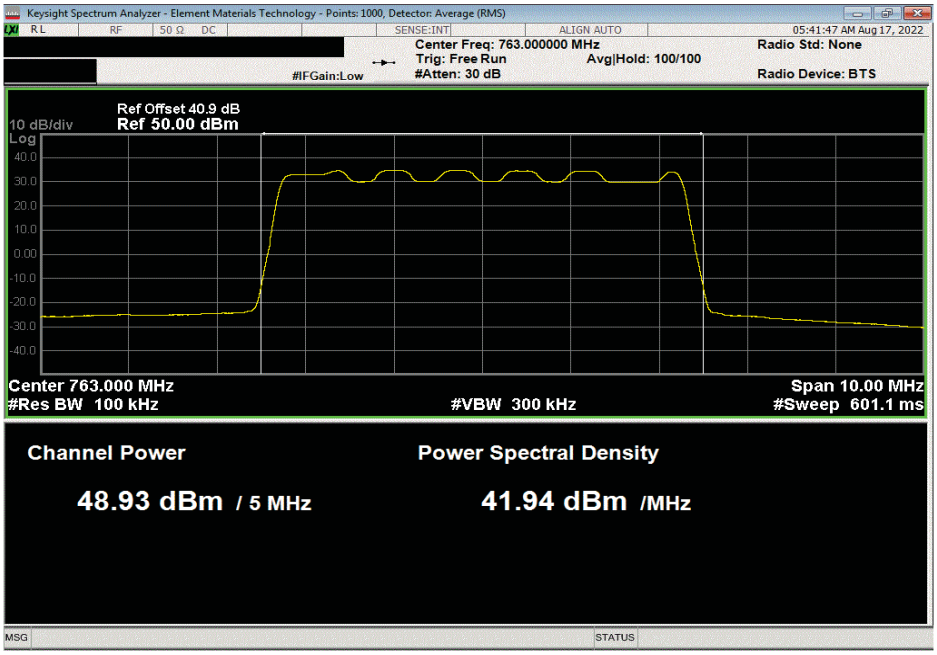
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Signle Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW
Port 1					
5G NR, Band n14, 758 - 768 Mhz					
5 MHz Bandwidth					
QPSK Modulation					
Mid Channel, 763 MHz	49.049	0	49	52	55
16QAM Modulation					
Mid Channel, 763 MHz	48.93	0	48.9	51.9	54.9
64QAM Modulation					
Mid Channel, 763 MHz	49.166	0	49.2	52.2	55.2
256QAM Modulation					
Low Channel, 760.5 MHz	49.249	0	49.2	52.2	55.2
Mid Channel, 763 MHz	49.109	0	49.1	52.1	55.1
High Channel, 765.5 MHz	49.061	0	49.1	52.1	55.1
10 MHz Bandwidth					
256QAM Modulation					
Mid Channel, 763 MHz	48.987	0	49	52	55

AVERAGE POWER - BAND n14

Port 1, 5G NR, Band n14, 758 - 768 Mhz, 5 MHz Bandwidth, QPSK Modulation, Mid Channel, 763 MHz						
		Initial Value dBm/MHz	Duty Cycle Factor (dB)	Signle Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW
		49.049	0	49	52	55

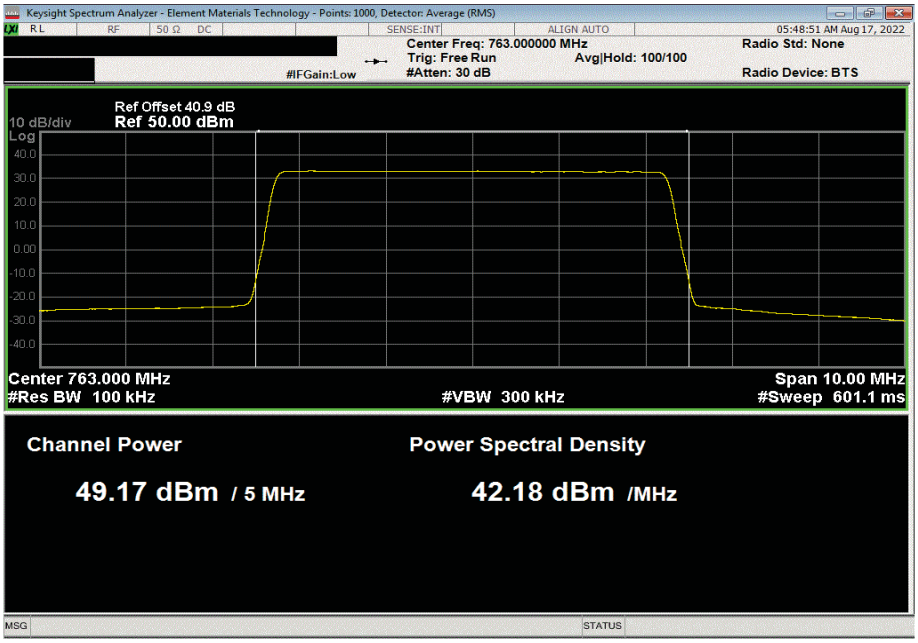


Port 1, 5G NR, Band n14, 758 - 768 Mhz, 5 MHz Bandwidth, 16QAM Modulation, Mid Channel, 763 MHz						
		Initial Value dBm/MHz	Duty Cycle Factor (dB)	Signle Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW
		48.93	0	48.9	51.9	54.9

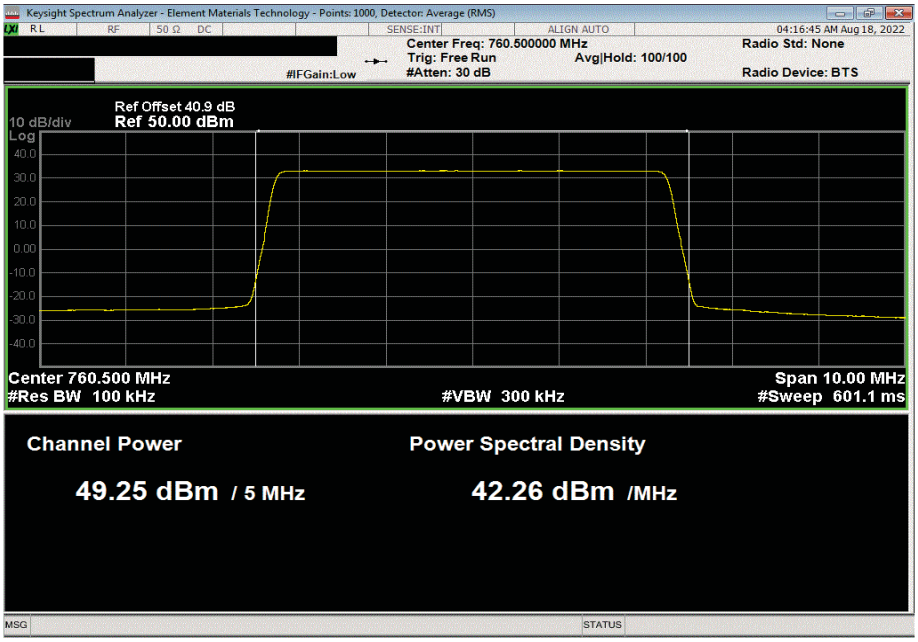


AVERAGE POWER - BAND n14

Port 1, 5G NR, Band n14, 758 - 768 Mhz, 5 MHz Bandwidth, 64QAM Modulation, Mid Channel, 763 MHz						
		Initial Value dBm/MHz	Duty Cycle Factor (dB)	Signle Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW
		49.166	0	49.2	52.2	55.2

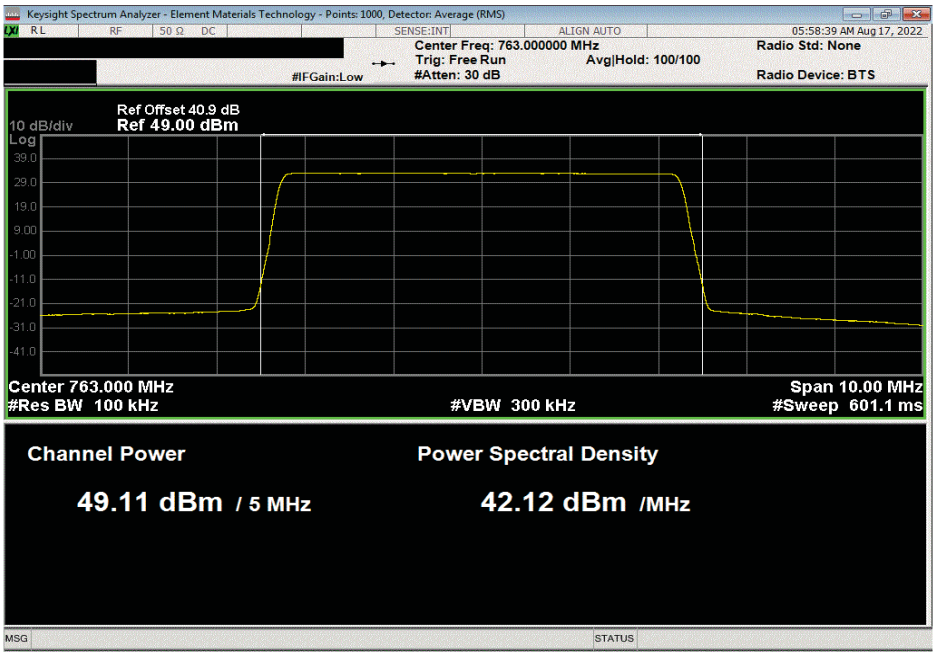


Port 1, 5G NR, Band n14, 758 - 768 Mhz, 5 MHz Bandwidth, 256QAM Modulation, Low Channel, 760.5 MHz						
		Initial Value dBm/MHz	Duty Cycle Factor (dB)	Signle Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW
		49.249	0	49.2	52.2	55.2

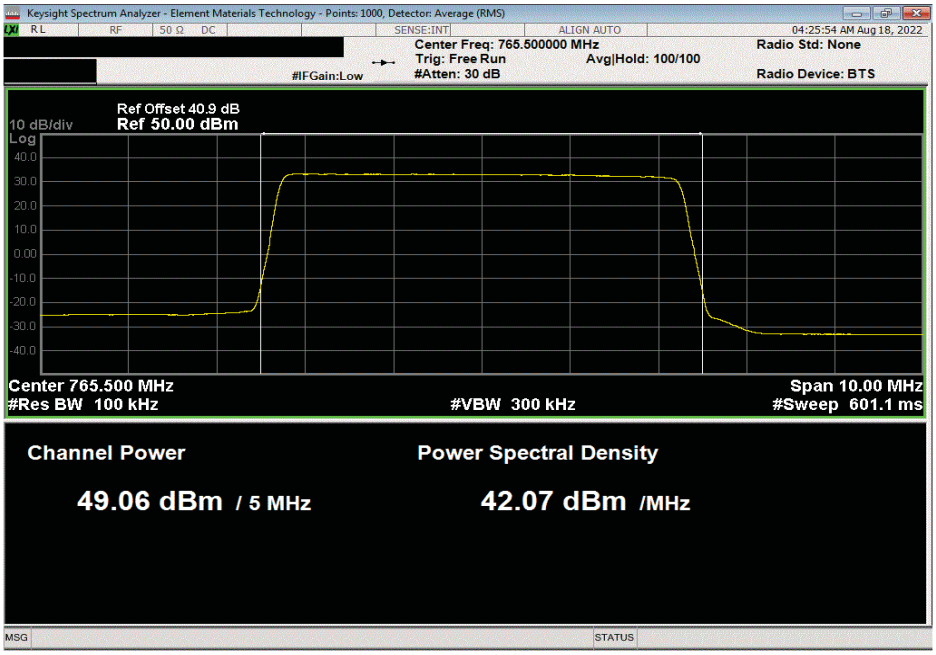


AVERAGE POWER - BAND n14

Port 1, 5G NR, Band n14, 758 - 768 Mhz, 5 MHz Bandwidth, 256QAM Modulation, Mid Channel, 763 MHz						
		Initial Value dBm/MHz	Duty Cycle Factor (dB)	Signle Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW
		49.109	0	49.1	52.1	55.1



Port 1, 5G NR, Band n14, 758 - 768 Mhz, 5 MHz Bandwidth, 256QAM Modulation, High Channel, 765.5 MHz						
		Initial Value dBm/MHz	Duty Cycle Factor (dB)	Signle Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW
		49.061	0	49.1	52.1	55.1



AVERAGE POWER - BAND n14

Port 1, 5G NR, Band n14, 758 - 768 Mhz, 10 MHz Bandwidth, 256QAM Modulation, Mid Channel, 763 MHz						
		Initial Value dBm/MHz	Duty Cycle Factor (dB)	Signle Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW
		48.987	0	49	52	55