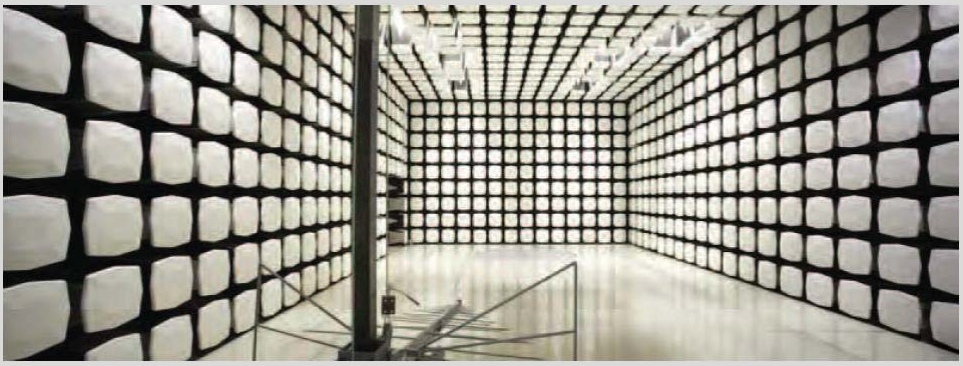
element

Radio Test Report
Application for Grant of Equipment Authorization
FCC Part 27 Subpart C and IC RSS-130
617MHz – 652MHz
And
728MHz – 746MHz

FCC ID: VBNAHLOA-01
IC ID: 661W-AHLOA

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

Report: NOKI0058.0 Rev. 0, Issue Date: May 17, 2023



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A2LA ACCREDITED
CERT #3310.03

CERTIFICATE OF TEST

Last Date of Test: May 4, 2023
Nokia Solutions and Networks
EUT: Airscale Base Transceiver Station Remote Radio Head
Model: AHLOA

Radio Equipment Testing

Standards

Specification	Method
Code of Federal Regulations (CFR) Title 47 Part 2 and (CFR) Title 47 Part 27 Subpart C (Radio Standards Specification) RSS-Gen Issue 5: 2019 and RSS-130 Issue 2: February 2019	ANSI C63.26-2015 FCC KDB 971168 D01 v03r01 FCC KDB 662911D01 v02r01 FCC KDB 662911D02 v01

Results

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

Deviations From Test Standards

None

Approved By:

Adam Bruno, Operations Manager

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

REVISION HISTORY

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

ACCREDITATIONS AND AUTHORIZATIONS

United States

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

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

Canada

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

European Union

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

United Kingdom

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

Australia/New Zealand

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

Korea

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

Japan

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

Taiwan

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

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

Singapore

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

Israel

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

Hong Kong

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

Vietnam

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

SCOPE

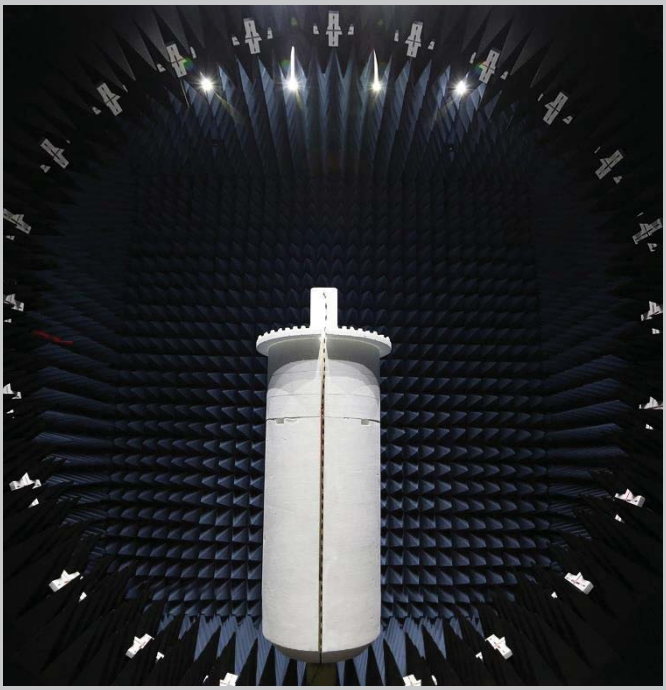
For details on the Scopes of our Accreditations, please visit:

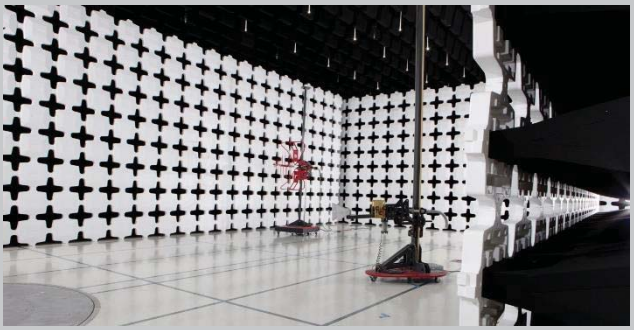
California Minnesota Oregon Texas Washington

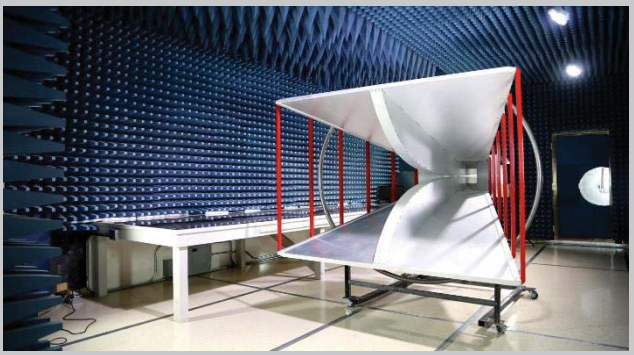
FACILITIES

element
2020.12.15

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







MEASUREMENT UNCERTAINTY

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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

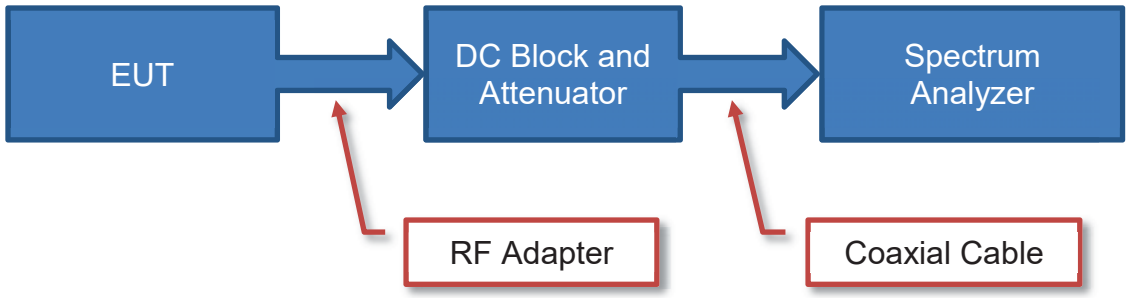
TEST SETUP BLOCK DIAGRAMS

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.

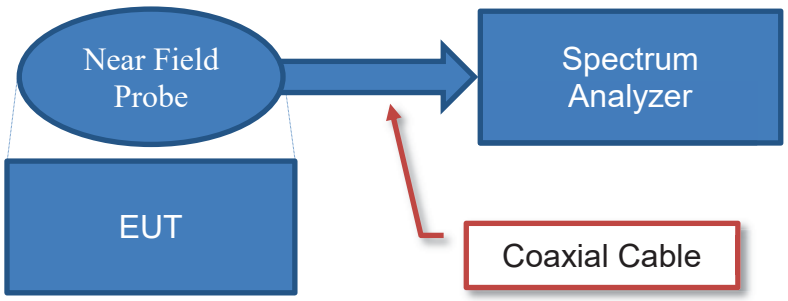
Antenna Port Conducted Measurements



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

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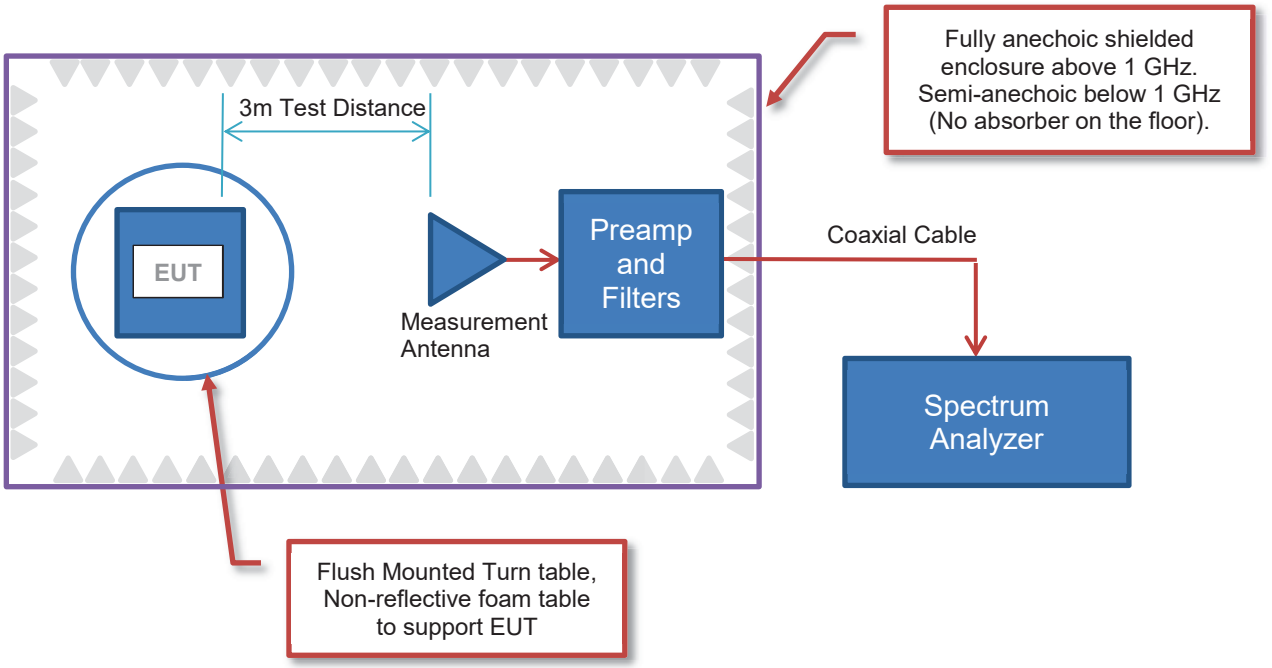
2022.04.22

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**

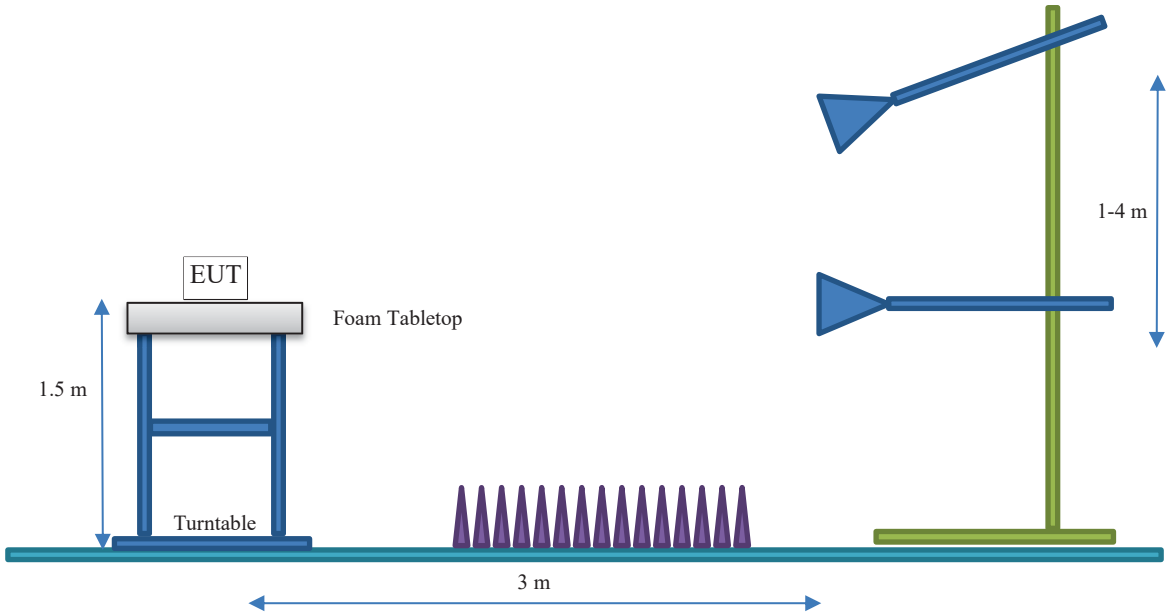
Radiated Power (ERP/EIRP) – Substitution Method:

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 AHLOA
First Date of Test:	May 2, 2023
Last Date of Test:	May 4, 2023
Receipt Date of Samples:	May 2, 2023
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:

A permissive change on the original filing is being pursued to add 5G NR (new radio) 5, 10, and 15MHz channel bandwidth carriers for 3GPP frequency band n85 to the Air Scale Base Transceiver Station Remote Radio Head Model AHLOA ISED radio certifications. The original test effort included testing for 5G NR technologies in band n71 (IC ID:661W-AHLOA). See Element Report: NOKI0023, Issue Date: November 3, 2023. Please refer to the test report on the original certification for details on all required testing.

Additionally, a permissive change on the original filing is being pursued to add 5G NR (new radio) 15MHz channel bandwidth carriers for 3GPP frequency band n85 to the Air Scale Base Transceiver Station Remote Radio Head Model AHLOA FCC radio certifications (FCC ID:VBNAHLOA-01). See NTS Test Report No. PR086613 Rev. 0. Issue Date: April 9, 2019. Please refer to the test report on the original certification for details on all required testing.

All conducted RF testing performed for the original FCC and IC certification testing has been repeated using 5G NR 5, 10, and 15MHz channel bandwidth carriers for this permissive change per correspondence/guidance from Nemko TCB. Additionally, multi carrier operating in both 3GPP frequency band n85 and 3GPP frequency band n71 is tested. Multi carrier operation is supported via the feature software updates. 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 (AHLOA) as the original certification test. The base station and remote radio head software for this testing is an updated release that includes 5G NR 5, 10, 15MHz channel bandwidth carrier support for 3GPP frequency band n85 and multi carrier operation support for both 3GPP frequency band n85 and 3GPP frequency band n71.

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

Nokia Solutions and Networks Air Scale Base Transceiver Station (BTS) Remote Radio Head (RRH) module, model AHLOA is being developed under this effort. The AHLOA remote radio head is a multi-standard multi-carrier radio module designed to support 4G LTE, 5G NR (new radio), narrow band IoT (internet of things) operations (in-band, guard band, standalone) and Dynamic Spectrum Sharing (DSS). The scope of testing in this effort is for the addition of 5, 10, 15MHz channel bandwidth for 3GPP frequency band n85 and multi carrier operating in 3GPP frequency band n85 and band n71 in 5G NR FDD operations.

The AHLOA RRH has four transmit/four receive antenna ports (4TX/4RX for 3GPP frequency band n71 and 4TX/4RX for 3GPP frequency band n85). Each antenna port supports 3GPP frequency band n71 (BTS Rx: 663 to 698 MHz/BTS TX: 617 to 652 MHz) and 3GPP frequency band n85 (BTS Rx: 698 to 716 MHz/BTS TX: 728 to 746 MHz). The maximum RF output power of the RRH is 240 Watts (60 watts per antenna port and 60 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 5G NR bandwidths of 5, 10, 15 and 20MHz for 3GPP frequency band n71 operations. The RRH supports 5G NR bandwidths of 5, 10 and 15MHz for 3GPP frequency band n85 operations. The RRH supports four NR downlink modulation types (QPSK, 16QAM, 64QAM and 256QAM). Multi-carrier operation is also supported.

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

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

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

AHLOA Downlink Band Edge 5G NR Band n71 Frequency Channels

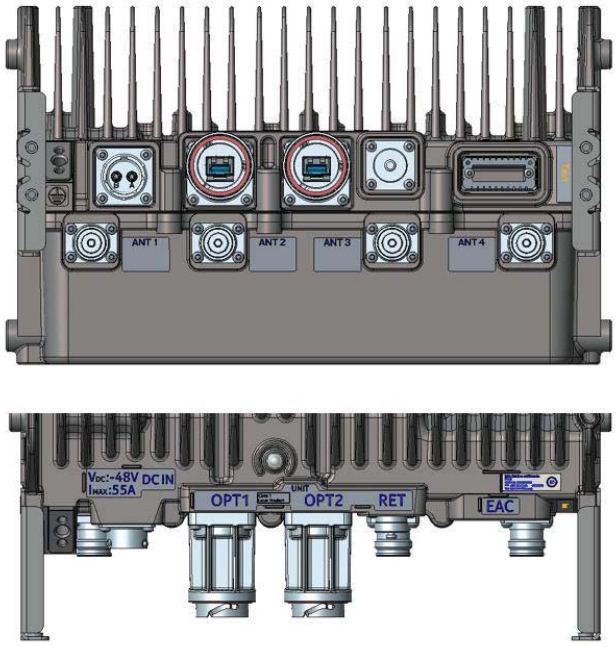
AHLOA 3GPP Frequency Band n85 NR Downlink Band Edge NR-ARFCNs
The 3GPP frequency band n85 (728 - 746 MHz) band edge downlink (BTS Transmit) NR-ARFCNs for NR channel bandwidths (5, 10, and 15 MHz) are provided in below. The NR-ARFCN is defined as Absolute Radio Frequency Channel Number. The channel spacing is 100 kHz between channel numbers.
Notes: The formula for 5G NR ARFCN is described in 3GPP TS 38.104 chapter 5.4.2.1.

	Downlink 5G NR NR-ARFCN	Downlink Frequency (MHz)	5G NR Channel Bandwidth		
			5 MHz	10 MHz	15 MHz
AHLOA Band n85 (Ant 1 through 4)	145600	728.0	Band Edge	Band Edge	Band Edge
	146100	730.5	Bottom Ch		
	146600	733.0		Bottom Ch	
	147100	735.5			Bottom Ch
	147400	737.0	Middle Ch	Middle Ch	Middle Ch
	147700	738.5			Top Ch
	148200	741.0		Top Ch	
	148700	743.5	Top Ch		
	149200	746.0	Band Edge	Band Edge	Band Edge

AHLOA Downlink Band Edge 5G NR Band n85 Frequency Channels

PRODUCT DESCRIPTION

AHLOA Connector Layout:



AHLOA External Interfaces

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

Testing Objective:

Demonstrate FCC and ISED compliance of Airscale Base Transceiver Station (BTS) Remote Radio Head (RRH) module, model AHLOA for 5G NR FDD single carriers operating in 3GPP frequency band n85 (728MHz to 746MHz) and 5G NR FDD multi carriers operating in 3GPP frequency band n85 (728MHz to 746MHz) and 3GPP frequency band n71 (617MHz to 652MHz).

CONFIGURATIONS

Configuration NOKI0058-1

Software/Firmware Running during test	
Description	**Version**
5G BTS Software Version (23R3)	SBTS00_ENB_9999_230330_000005
5G RF_SW	RF.FRM.trunk.20230329.002

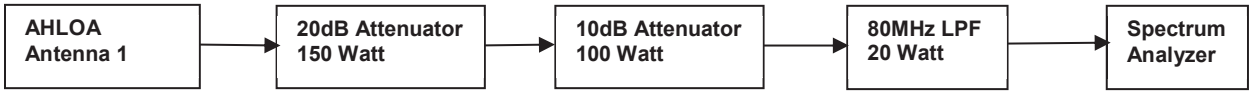
Equipment being tested (include Peripherals)			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
AMIA (BTS System Module)	Nokia Solutions and Networks	473098A.204	UK222201001
ASIB (BTS System Module)	Nokia Solutions and Networks	473764A.102	DH211165881
ABIO (BTS Baseband Module)	Nokia Solutions and Networks	475266A.102	L1205105870
AHLOA (Radio Module Model)	Nokia Solutions and Networks	474331A.101	K9180540675
80MHz Low Pass Filter/20 Watt	Microwave Circuits, Inc.	VLFX-80+	15542
Attenuator 100W/10dB DC - 18GHz	Aeroflex Weinschel	48-10-43-LIM	BJ1771
Attenuator 150W/20dB DC - 18GHz	Aeroflex Weinschel	66-20-33	BZ2075
2 Meters RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297384
1 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_104	SN564428/4
AOMC SFP28 70m MM I-temp RS	Nokia	474900A.101	VF20180015S
AOMC SFP28 70m MM I-temp RS	Nokia	474900A.101	VF20180016Z
Lenovo T470	HP	T470	N-20HEPF17B91U
Keysight- DC System power supply	Keysight	N8757A	US21D4053S
FPAC (DC-pwr supply)	Nokia	472438A.101	G7111007170
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN531431/6
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN531433/6
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297389
250W -50ohm -Terminating Load	API Weinschel inc	1433-3-LIM	TV065
250W -50ohm -Terminating Load	API Weinschel inc	1433-3-LIM	TC870
250W -50ohm -Terminating Load	API Weinschel inc	1433-3-LIM	TC863
GPS cable 100m	FTSH	472577A.103	CA2029
FYGC GPS receiver	Nokia	474074A	1294000684
Cat-5e cable	CSA	LL73189	E151955
Fiber Optic cable 2m	Amphenol Fiber Optic	VZ1701	995741A

CONFIGURATIONS

Cables (Peripheral)					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1 (5G)**	**Connection 2**
Fiber Optic Cable	N	2 meters	N	ABIO	AHLOA
GPS Receiver Cable	Y	100 meters	N	ASIB	FYGB GPS receiver
Cat-5e Cable	Y	7 meters	N	ASIB	WebEM- PC
HS-SUCOFLEX_106 – RF CABLES	Y	2 meters	N	EUT [AHLOA] Ant ports 2-4	250W -50ohm - Loads

Cables, Filters, Attenuators					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
HS-SUCOFLEX_106	Y	2 meters	N	EUT [AHLOA] Ant port #1	Attenuator 150W/20dB
Attenuator 150W/20dB	N	N/A	N	RF cable HS-SUCOFLEX_106	Attenuator 100W/10dB
Attenuator 100W/10dB	N	N/A	N	Attenuator 150W/20dB	Low Pass Filter 80MHz/20W
Low Pass Filter 80MHz/20W	N	N/A	N	Attenuator 100W/10dB	HS-SUCOFLEX_104
HS-SUCOFLEX_104	Y	1 meter	N	Low Pass Filter 80MHz/20W	Analyzer

RF Test Setup Diagram:



CONFIGURATIONS

Configuration NOKI0058-2

Software/Firmware Running during test	
Description	**Version**
5G BTS Software Version (23R3)	SBTS00_ENB_9999_230330_000005
5G RF_SW	RF.FRM.trunk.20230329.002

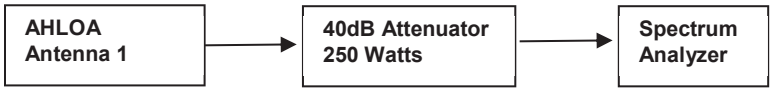
Equipment being tested (include Peripherals)			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
AMIA (BTS System Module)	Nokia Solutions and Networks	473098A.204	UK222201001
ASIB (BTS System Module)	Nokia Solutions and Networks	473764A.102	DH211165881
ABIO (BTS Baseband Module)	Nokia Solutions and Networks	475266A.102	L1205105870
AHLOA (Radio Module Model)	Nokia Solutions and Networks	474331A.101	K9180540675
Attenuator 40dB/250 Watts	API Weinschel	58-40-43-LIM	UN619
2 Meters RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297384
1 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_104	SN564428/4
AOMC SFP28 70m MM I-temp RS	Nokia	474900A.101	VF20180015S
AOMC SFP28 70m MM I-temp RS	Nokia	474900A.101	VF20180016Z
Lenovo T470	HP	T470	N-20HEPF17B91U
Keysight- DC System power supply	Keysight	N8757A	US21D4053S
FPAC (DC-pwr supply)	Nokia	472438A.101	G7111007170
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN531431/6
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN531433/6
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297389
250W -50ohm -Terminating Load	API Weinschel inc	1433-3-LIM	TV065
250W -50ohm -Terminating Load	API Weinschel inc	1433-3-LIM	TC870
250W -50ohm -Terminating Load	API Weinschel inc	1433-3-LIM	TC863
GPS cable 100m	FTSH	472577A.103	CA2029
FYGC GPS receiver	Nokia	474074A	1294000684
Cat-5e cable	CSA	LL73189	E151955
Fiber Optic cable 2m	Amphenol Fiber Optic	VZ1701	995741A

CONFIGURATIONS

Cables (Peripheral)					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1 (5G)**	**Connection 2**
Fiber Optic Cable	N	2 meters	N	ABIO	AHLOA
GPS Receiver Cable	Y	100 meters	N	ASIB	FYGB GPS receiver
Cat-5e Cable	Y	7 meters	N	ASIB	WebEM- PC
HS-SUCOFLEX_106 – RF CABLES	Y	2 meters	N	EUT [AHLOA] Ant ports 2-4	250W -50ohm - Loads

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

RF Test Setup Diagram:



CONFIGURATIONS

Configuration NOKI0058-3

Software/Firmware Running during test	
Description	**Version**
5G BTS Software Version (23R3)	SBTS00_ENB_9999_230330_000005
5G RF_SW	RF.FRM.trunk.20230329.002

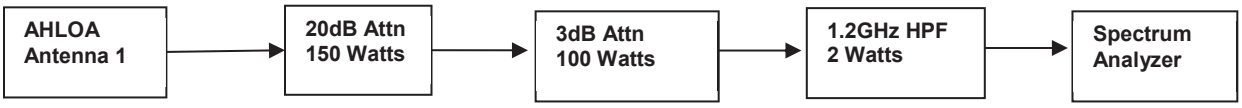
Equipment being tested (include Peripherals)			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
AMIA (BTS System Module)	Nokia Solutions and Networks	473098A.204	UK222201001
ASIB (BTS System Module)	Nokia Solutions and Networks	473764A.102	DH211165881
ABIO (BTS Baseband Module)	Nokia Solutions and Networks	475266A.102	L1205105870
AHLOA (Radio Module Model)	Nokia Solutions and Networks	474331A.101	K9180540675
1.2 GHz HPF 2 Watts	Micro-Tronic	HPM11692	002
Attenuator 150W/20dB	Aeroflex Weinschel	66-20-33	BZ2075
Attenuator 100W/3dB	Aeroflex Weinschel	47-3-33	CG5493
2 Meters RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297384
1 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_104	SN564428/4
AOMC SFP28 70m MM I-temp RS	Nokia	474900A.101	VF20180015S
AOMC SFP28 70m MM I-temp RS	Nokia	474900A.101	VF20180016Z
Lenovo T470	HP	T470	N-20HEPF17B91U
Keysight- DC System power supply	Keysight	N8757A	US21D4053S
FPAC (DC-pwr supply)	Nokia	472438A.101	G7111007170
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN531431/6
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN531433/6
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297389
250W -50ohm -Terminating Load	API Weinschel inc	1433-3-LIM	TV065
250W -50ohm -Terminating Load	API Weinschel inc	1433-3-LIM	TC870
250W -50ohm -Terminating Load	API Weinschel inc	1433-3-LIM	TC863
GPS cable 100m	FTSH	472577A.103	CA2029
FYGC GPS receiver	Nokia	474074A	1294000684
Cat-5e cable	CSA	LL73189	E151955
Fiber Optic cable 2m	Amphenol Fiber Optic	VZ1701	995741A

CONFIGURATIONS

Cables (Peripheral)					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1 (5G)**	**Connection 2**
Fiber Optic Cable	N	2 meters	N	ABIO	AHLOA
GPS Receiver Cable	Y	100 meters	N	ASIB	FYGB GPS receiver
Cat-5e Cable	Y	7 meters	N	ASIB	WebEM- PC
HS-SUCOFLEX_106 – RF CABLES	Y	2 meters	N	EUT [AHLOA] Ant ports 2-4	250W -50ohm - Loads

Cables, Filters, Attenuators					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
HS-SUCOFLEX_106	Y	2 meters	N	EUT [AHLOA] Ant port #1	Attenuator 150W/20dB
Attenuator 150W/20dB	N	NA	N	HS-SUCOFLEX_106	Attenuator 100W/3dB
Attenuator 100W/3dB	N	NA	N	Attenuator 150W/20dB	1.2GHz -13GHz HPF 2Watts
1.2GHz HPF 2Watts	N	NA	N	Attenuator 100W/3dB	HS-SUCOFLEX_104
HS-SUCOFLEX_104	N	1 meter	N	1.2GHz -13GHz HPF 2Watts	Spectrum Analyzer

RF Test Setup Diagram:



MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2023-05-02	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.
2	2023-05-02	Power Spectral Density	Tested as delivered to test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
3	2023-05-03	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.
4	2023-05-03	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.
5	2023-05-03	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.
6	2023-05-04	Occupied Bandwidth	Tested as delivered to test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

POWER SPECTRAL DENSITY AND EIRP CALCULATION - SINGLE CARRIER

XMit 2023.02.14.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Block - DC	Fairview Microwave	SD3379	AMM	2022-09-09	2023-09-09
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2023-02-09	2024-02-09
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17

TEST DESCRIPTION

The method of section 5.2.4.5 of ANSI C63.26 was used to make the measurement. The method uses trace averaging across ON and OFF times of EUT transmissions using the spectrum analyzer's RMS detector. Following the measurement a duty cycle correction was applied by adding [10log(1/D)], where D is the duty cycle, to the measured power to compute the PSD during the transmit times.

RF conducted emissions testing was performed only on one port. The testing was performed on the same version of hardware (AHLOA) as the original certification test. The AHLOA antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in the original certification effort) 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 of all antenna ports (at the radio output) were determined per ANSI C63.26-2015 paragraph 6.4.3.2.4.

The EIRP calculations were based upon ANSI C63.26-2015 paragraph 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 1000watts/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 populations 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 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

The applicable ISED regulatory requirement for EIRP are provided below:

ISED Requirements RSS-130 Section 4.6/SRSP-518 section 5.1:
SRSP-518 section 5.1 Radiated power and antenna height limits for fixed and base stations
21. For fixed and base stations transmitting in accordance with section 4, the maximum permissible equivalent isotropically radiated power (e.i.r.p.) is 1640 watts and 1640 watts/MHz for a channel bandwidth less than or equal to 1 MHz and greater than 1 MHz, respectively. These e.i.r.p. limits apply for stations with an antenna height above average terrain (HAAT) up to 305 metres.
22. Fixed and base stations located in geographical areas at a distance greater than 26 km from large or medium population centres and transmitting in accordance with section 4, may increase their e.i.r.p. up to a maximum of 3280 watts/MHz (i.e. no more than 3280 watts e.i.r.p. in any 1 MHz band segment), with an antenna HAAT up to 305 metres.

POWER SPECTRAL DENSITY AND EIRP CALCULATION - SINGLE CARRIER

TbtTx 2022.05.02.0 XMit 2023.02.14.0

EUT:	AHLOA (FCC/ISED C2PC)			Work Order:	NOKI0058
Serial Number:	K9180540675			Date:	05/02/2023
Customer:	Nokia Solutions and Networks			Temperature:	21.7°C
Attendees:	John Rattanavong, Mitchel Hill			Humidity:	41.2%
Project:	None			Barometric Pres.:	1012 mbar
Tested by:	Brandon Hobbs	Power:	54 VDC	Job Site:	TX07

TEST SPECIFICATIONS	Test Method
FCC 27:2023	ANSI C63.26:2015
RSS-130 Issue 2:2019	ANSI C63.26:2015

COMMENTS

All losses in the measurement path were accounted for: attenuators, cables, DC block and filter when in use. Band n85 carriers are enabled at maximum power (60 watts/carrier). The following is the power spectral density (PSD) measurements at the radio output ports. The PSD was measured for a single 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

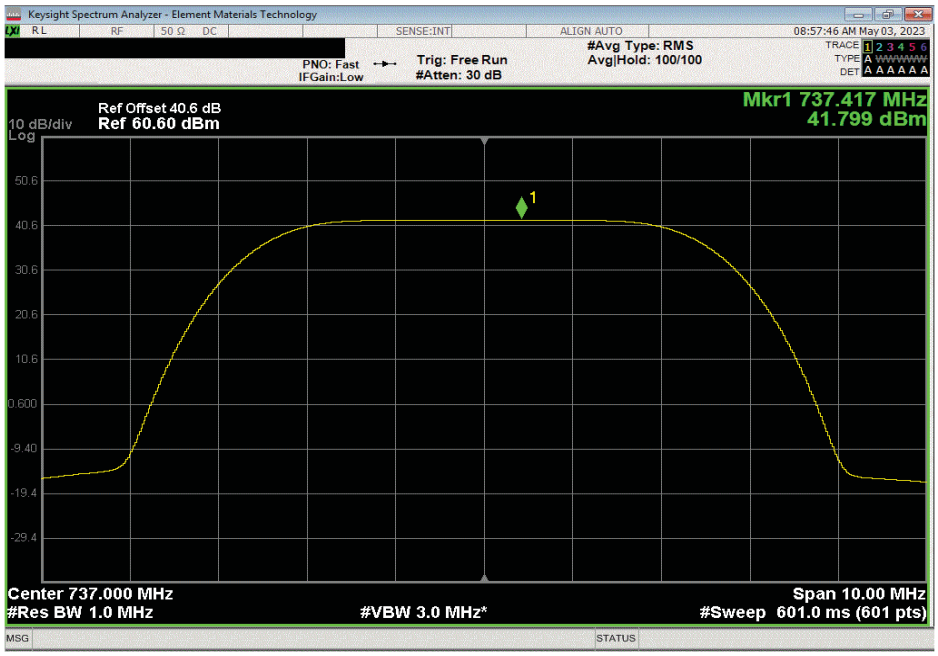
None

Configuration #	NOKI0058-2	Signature

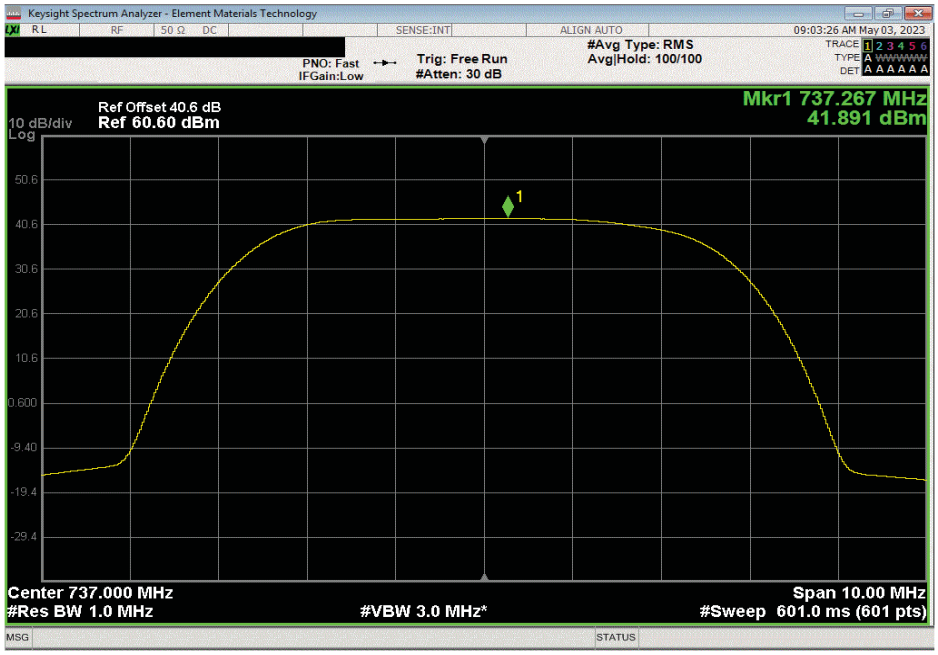
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD
Band n85 728 MHz - 746 MHz, 5G NR					
Port 1					
5 MHz Bandwidth					
QPSK Modulation					
Mid Channel 737 MHz	41.799	0	41.8	44.8	47.8
16-QAM Modulation					
Mid Channel 737 MHz	41.891	0	41.9	44.9	47.9
64-QAM Modulation					
Mid Channel 737 MHz	41.867	0	41.9	44.9	47.9
256-QAM Modulation					
Low Channel 730.5 MHz	41.996	0	42.0	45.0	48.0
Mid Channel 737 MHz	41.925	0	41.9	44.9	47.9
High Channel 743.5 MHz	41.824	0	41.8	44.8	47.8
10 MHz Bandwidth					
QPSK Modulation					
Mid Channel 737 MHz	38.611	0	38.6	41.6	44.6
16-QAM Modulation					
Mid Channel 737 MHz	39.273	0	39.3	42.3	45.3
64-QAM Modulation					
Mid Channel 737 MHz	38.658	0	38.7	41.7	44.7
256-QAM Modulation					
Low Channel 733 MHz	38.771	0	38.8	41.8	44.8
Mid Channel 737 MHz	38.649	0	38.6	41.6	44.6
High Channel 741 MHz	38.662	0	38.7	41.7	44.7
15 MHz Bandwidth					
QPSK Modulation					
Mid Channel 737 MHz	36.822	0	36.8	39.8	42.8
16-QAM Modulation					
Mid Channel 737 MHz	38.244	0	38.2	41.2	44.2
64-QAM Modulation					
Mid Channel 737 MHz	36.845	0	36.8	39.8	42.8
256-QAM Modulation					
Low Channel 735.5 MHz	36.872	0	36.9	39.9	42.9
Mid Channel 737 MHz	36.830	0	36.8	39.8	42.8
High Channel 738.5 MHz	36.852	0	36.9	39.9	42.9

POWER SPECTRAL DENSITY AND EIRP CALCULATION - SINGLE CARRIER

Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 5 MHz Bandwidth, QPSK Modulation, Mid Channel 737 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	
	41.799	0	41.799	44.799	47.799	

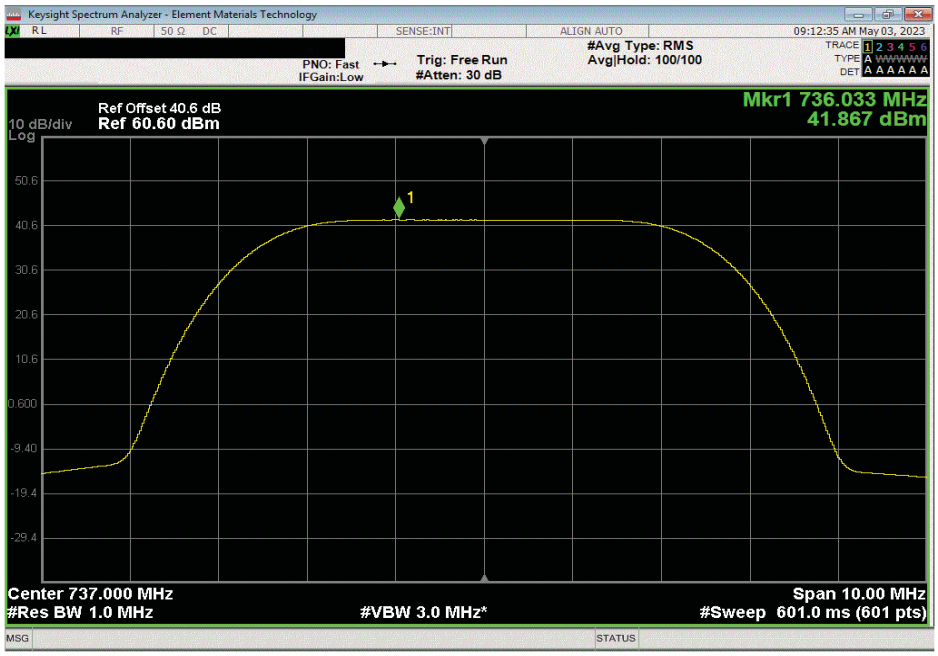


Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 5 MHz Bandwidth, 16-QAM Modulation, Mid Channel 737 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	41.891	0	41.891	44.891	47.891	

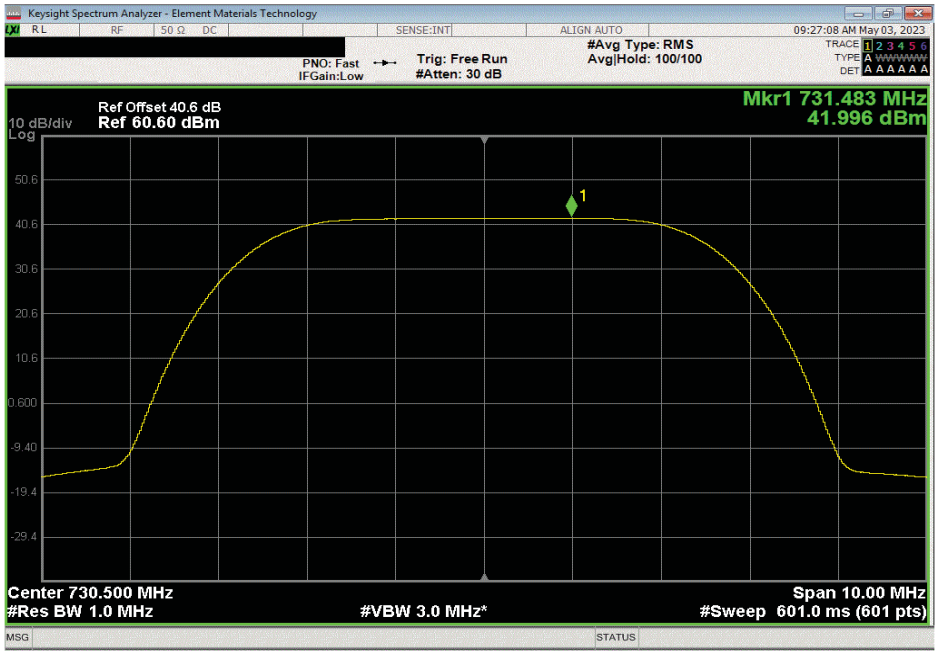


POWER SPECTRAL DENSITY AND EIRP CALCULATION - SINGLE CARRIER

Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 5 MHz Bandwidth, 64-QAM Modulation, Mid Channel 737 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	
	41.867	0	41.867	44.867	47.867	

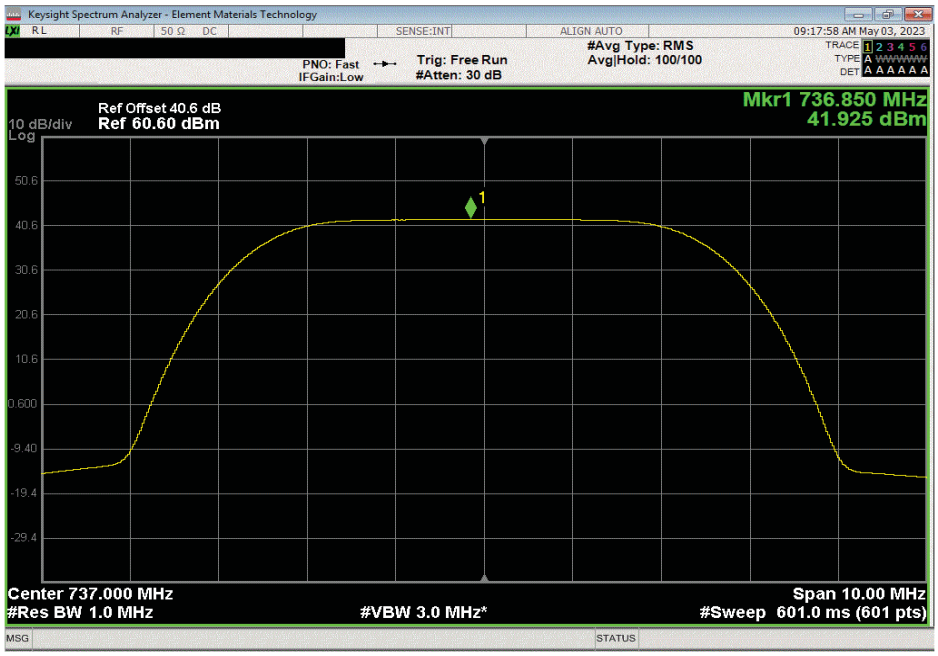


Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 5 MHz Bandwidth, 256-QAM Modulation, Low Channel 730.5 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	41.996	0	41.996	44.996	47.996	

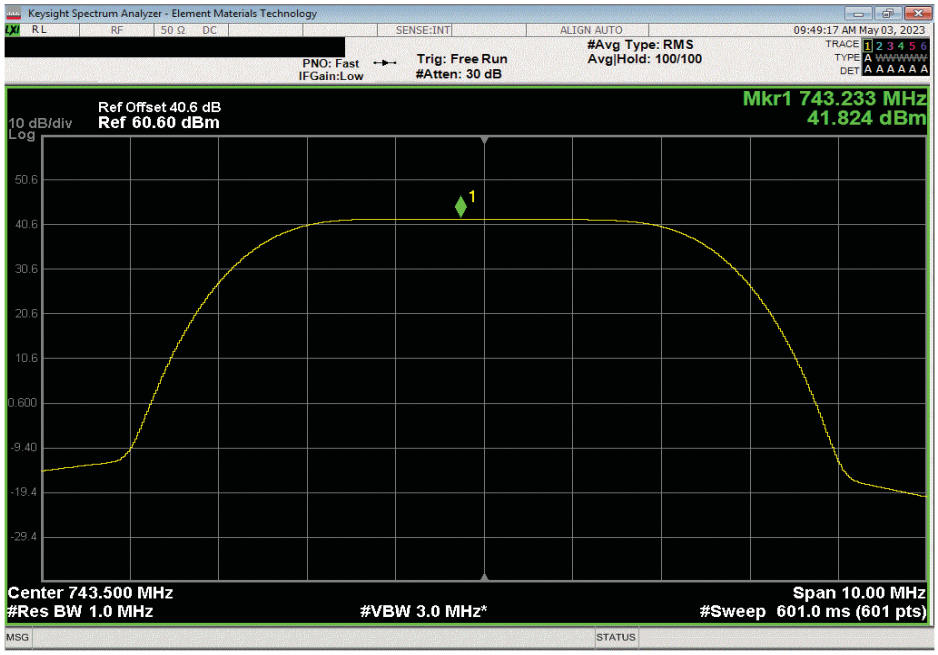


POWER SPECTRAL DENSITY AND EIRP CALCULATION - SINGLE CARRIER

Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 5 MHz Bandwidth, 256-QAM Modulation, Mid Channel 737 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	
	41.925	0	41.925	44.925	47.925	

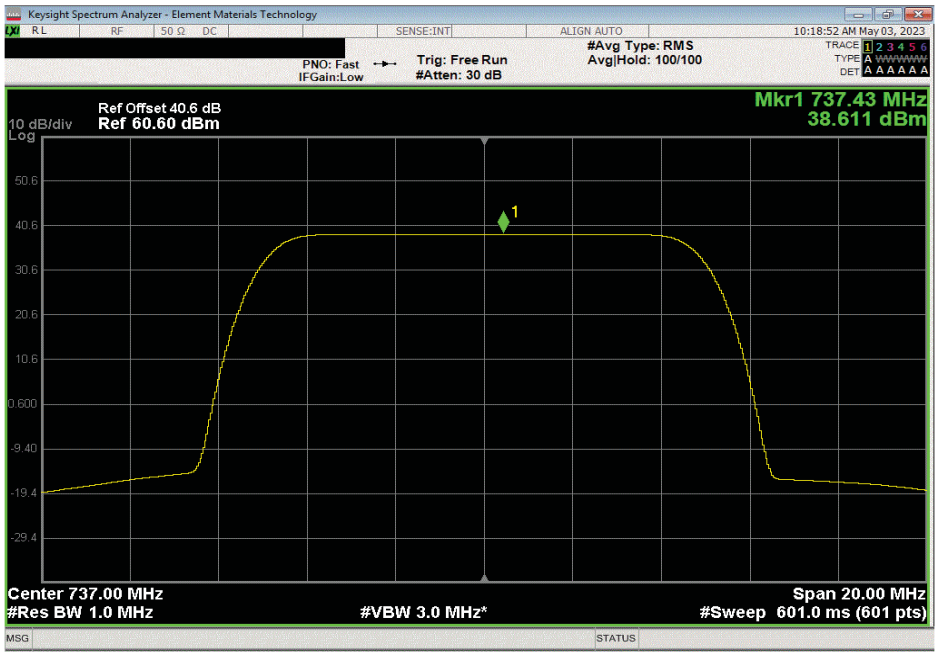


Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 5 MHz Bandwidth, 256-QAM Modulation, High Channel 743.5 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	41.824	0	41.824	44.824	47.824	

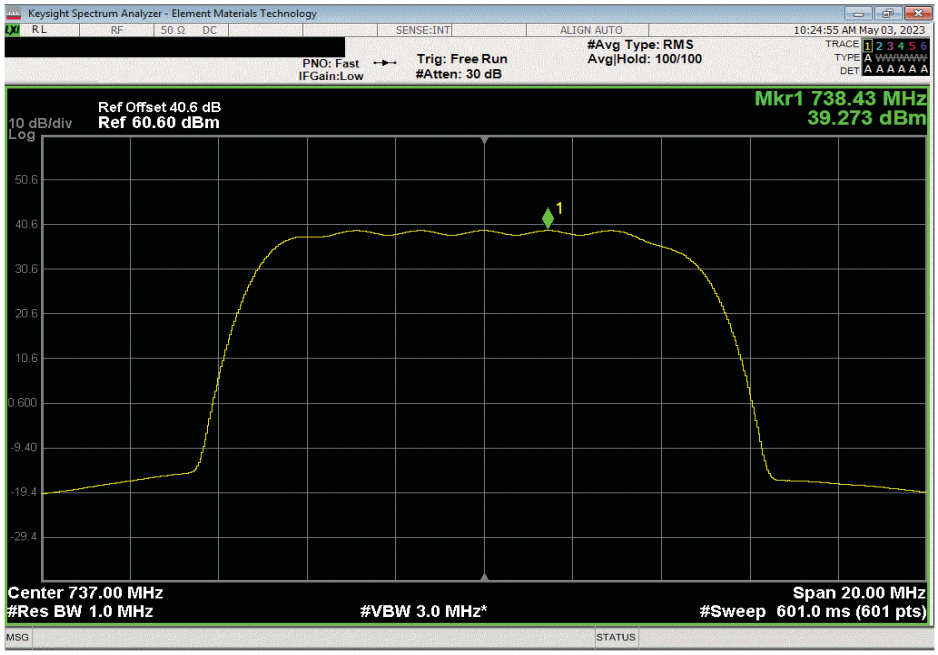


POWER SPECTRAL DENSITY AND EIRP CALCULATION - SINGLE CARRIER

Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 10 MHz Bandwidth, QPSK Modulation, Mid Channel 737 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	
	38.611	0	38.611	41.611	44.611	

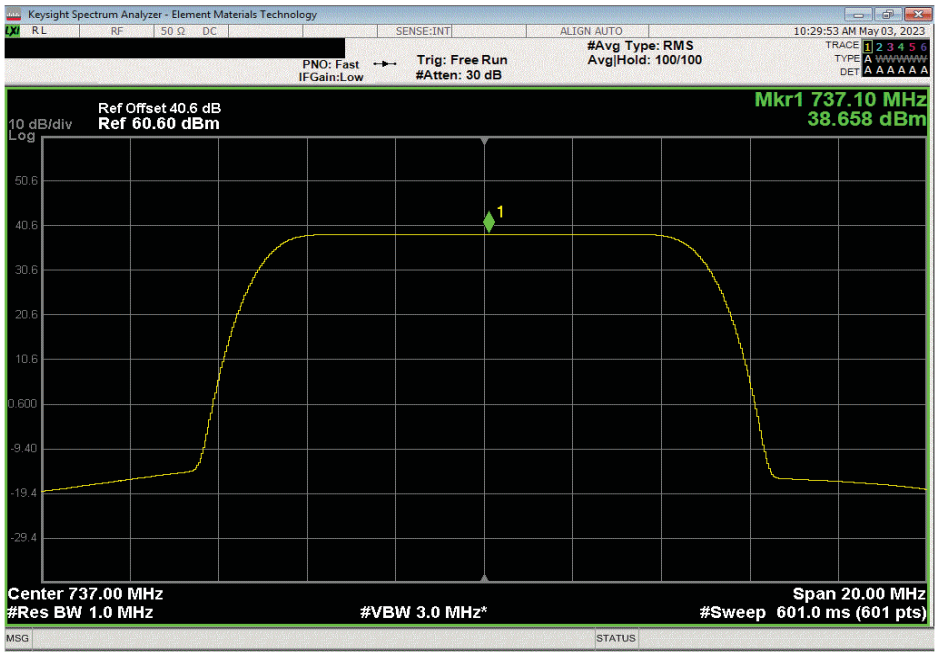


Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 10 MHz Bandwidth, 16-QAM Modulation, Mid Channel 737 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	39.273	0	39.273	42.273	45.273	

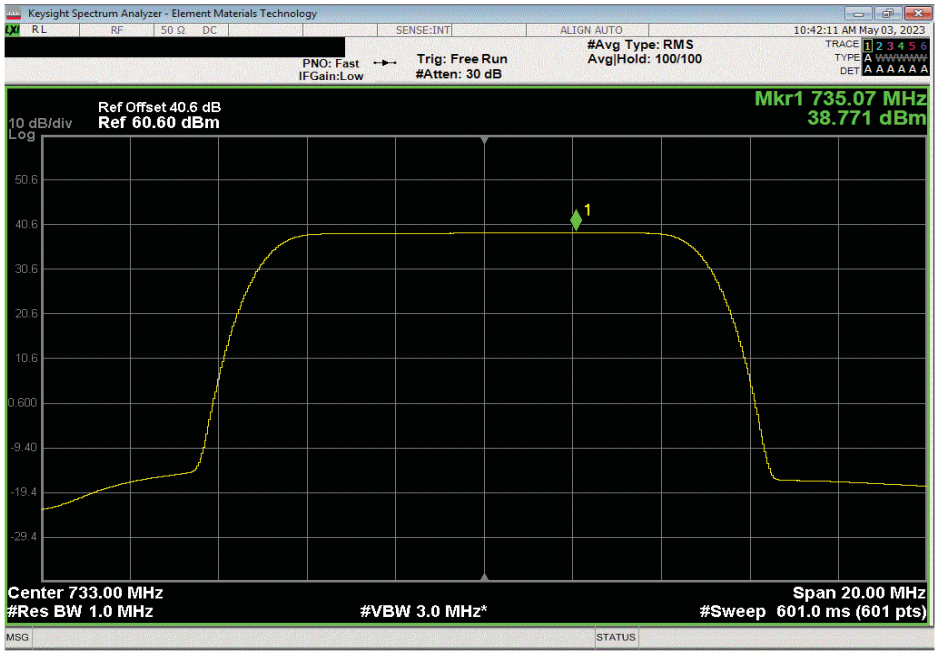


POWER SPECTRAL DENSITY AND EIRP CALCULATION - SINGLE CARRIER

Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 10 MHz Bandwidth, 64-QAM Modulation, Mid Channel 737 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	
	38.658	0	38.658	41.658	44.658	

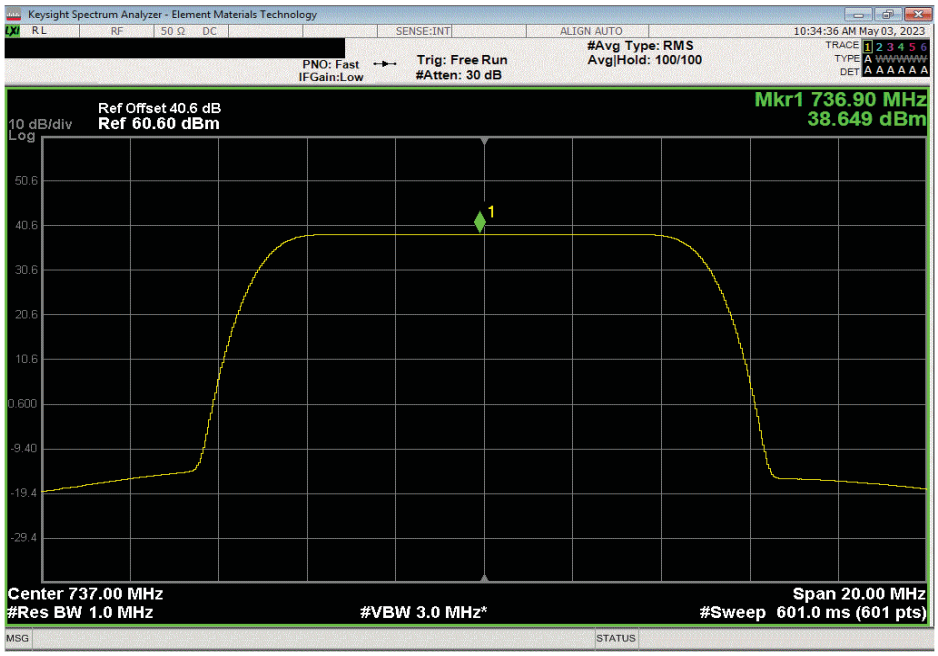


Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 10 MHz Bandwidth, 256-QAM Modulation, Low Channel 733 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	38.771	0	38.771	41.771	44.771	

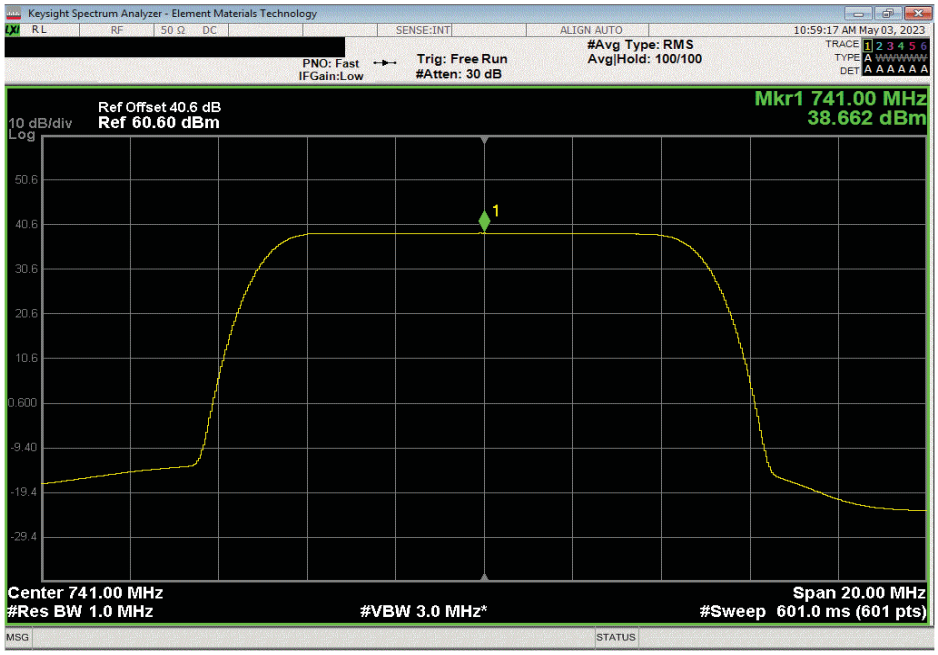


POWER SPECTRAL DENSITY AND EIRP CALCULATION - SINGLE CARRIER

Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 10 MHz Bandwidth, 256-QAM Modulation, Mid Channel 737 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	
	38.649	0	38.649	41.649	44.649	

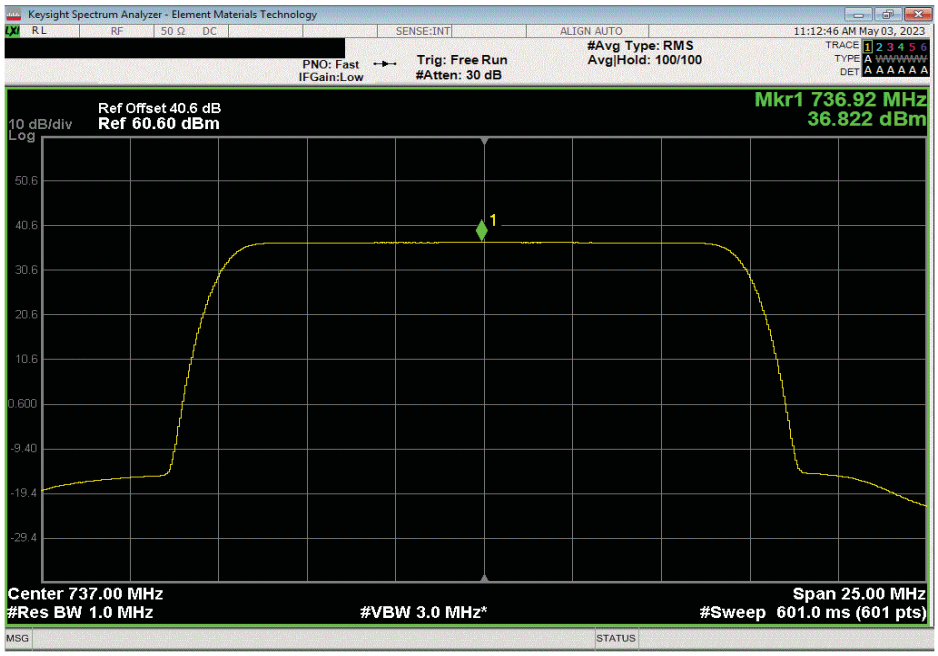


Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 10 MHz Bandwidth, 256-QAM Modulation, High Channel 741 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	38.662	0	38.662	41.662	44.662	

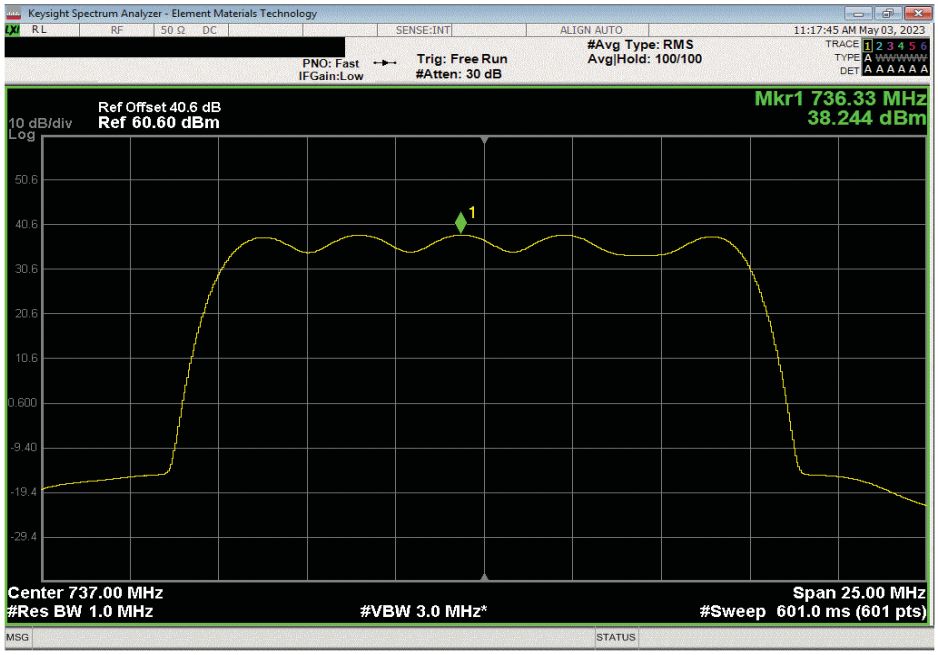


POWER SPECTRAL DENSITY AND EIRP CALCULATION - SINGLE CARRIER

Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 15 MHz Bandwidth, QPSK Modulation, Mid Channel 737 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	
	36.822	0	36.822	39.822	42.822	

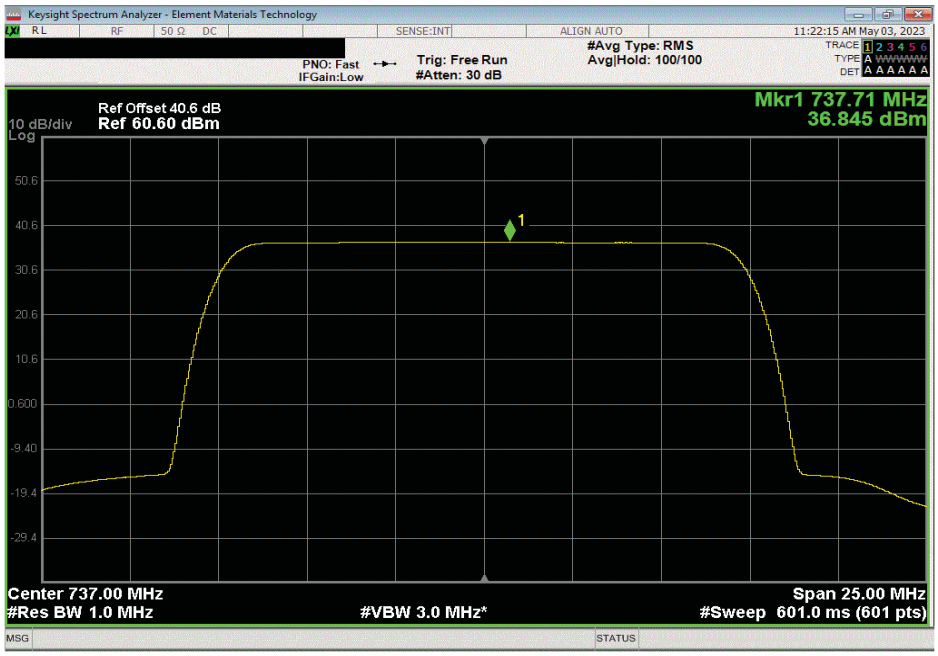


Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 15 MHz Bandwidth, 16-QAM Modulation, Mid Channel 737 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	38.244	0	38.244	41.244	44.244	

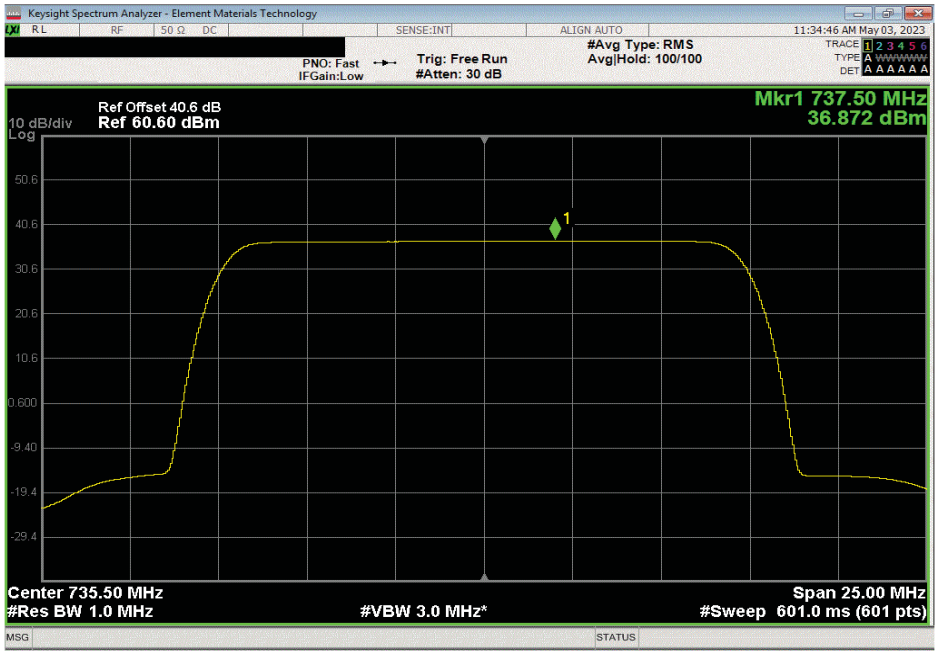


POWER SPECTRAL DENSITY AND EIRP CALCULATION - SINGLE CARRIER

Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 15 MHz Bandwidth, 64-QAM Modulation, Mid Channel 737 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	
	36.845	0	36.845	39.845	42.845	

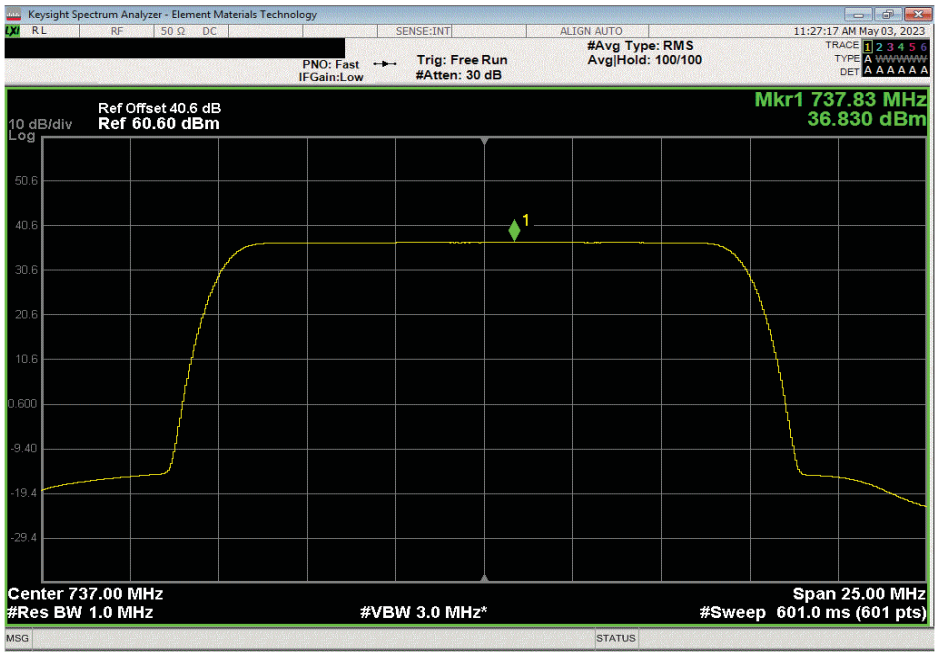


Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 15 MHz Bandwidth, 256-QAM Modulation, Low Channel 735.5 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	36.872	0	36.872	39.872	42.872	

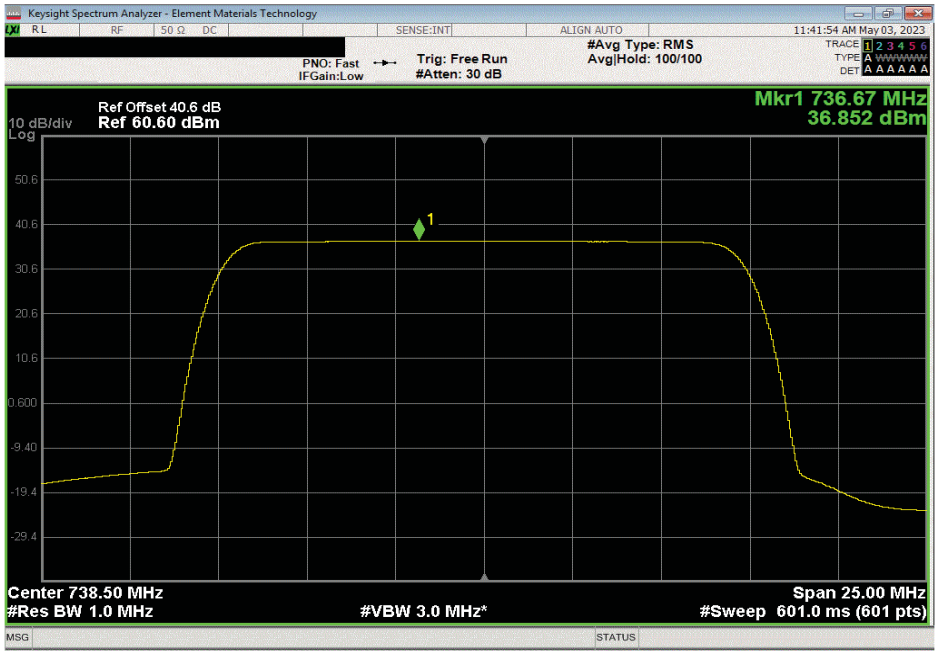


POWER SPECTRAL DENSITY AND EIRP CALCULATION - SINGLE CARRIER

Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 15 MHz Bandwidth, 256-QAM Modulation, Mid Channel 737 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	
	36.83	0	36.83	39.83	42.83	



Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 15 MHz Bandwidth, 256-QAM Modulation, High Channel 738.5 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	
	36.852	0	36.852	39.852	42.852	



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 n85 gain (15.9dBi) 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 AHLOA 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 a system of 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	15 MHz Ch BW
Worst Case PSD/Antenna Port	42.0dBm/MHz	39.3dBm/MHz	38.2dBm/MHz
Number of Ant Ports per Polarization	2	2	2
Total PSD per Polarization 10*Log (2) = +3dB	45.0dBm/MHz	42.3dBm/MHz	41.2dBm/MHz
Cable Loss (site dependent)	0 dB	0 dB	0 dB
Dir Gain = Maximum Antenna Gain (G_{Ant}) See Note 1	15.9 dBi	15.9 dBi	15.9 dBi
EIRP per Polarization	60.9dBm/MHz or 1230.3Watts/MHz	58.2dBm/MHz or 660.7Watts/MHz	57.1dBm/MHz or 512.9Watts/MHz
Number of Polarizations	2	2	2
EIRP Total = R1 ±45°and R2 ±45° See Note 2	60.9dBm/MHz or 1230.3Watts/MHz	58.2dBm/MHz or 660.7Watts/MHz	57.1dBm/MHz or 512.9Watts/MHz
Passing FCC and ISED EIRP Limits	62.15 & 65.16 dBm/MHz	62.15 & 65.16 dBm/MHz	62.15 & 65.16 dBm/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 AHLOA Band n85 four port MIMO EIRP levels using antenna assembly model "FF-65C-R1" are:

(1) Less than the FCC and ISED (3280 W/MHz or 65.16 dBm/MHz) EIRP Regulatory Limits for all (5, 10, and 15MHz) channel bandwidths
(2) Less than the FCC and ISED (1640 W/MHz or 62.15 dBm/MHz) EIRP Regulatory Limits for all (5, 10, and 15MHz) channel bandwidths

OCCUPIED BANDWIDTH - SINGLE CARRIER

XMit 2023.02.14.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2023-02-09	2024-02-09
Block - DC	Fairview Microwave	SD3379	AMM	2022-09-09	2023-09-09

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The Method in section 5.4 of ANSI C63.26 was used to make this measurement. The spectrum analyzer setting were as follows:

- RBW is 1% - 5% of the occupied bandwidth
- VBW is $\geq$ 3x the RBW
- Peak Detector was used
- Trace max was used

The occupied bandwidth was measured with the EUT configured in the modes called out in the datasheets.
FCC 27.53 defines the 26dB emission bandwidth requirement.
RSS-130 4.5 requires an emission bandwidth measurement and RSS Gen 6.7 defines the 99% emission bandwidth requirement.

The RF conducted emission testing was performed on one port. The AHLOA antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in the original certification effort) 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.

Band 85 (728MHz to 746MHz) Emission Designators derived from the measurement results are in the following table.

FCC and ISED Emission Designators for Band n85 (728MHz to 746MHz)									
Ch BW	Radio Channel	5G-NR: QPSK		5G-NR: 16QAM		5G-NR: 64QAM		5G-NR: 256QAM	
		FCC	ISED	FCC	ISED	FCC	ISED	FCC	ISED
5MHz	Low							4M82G7W	4M48G7W
	Mid	4M83G7W	4M45G7W	4M84G7W	4M50G7W	4M84G7W	4M48G7W	4M83G7W	4M48G7W
	High							4M83G7W	4M49G7W
10MHz	Low							9M89G7W	9M32G7W
	Mid	9M88G7W	9M30G7W	9M83G7W	9M25G7W	9M85G7W	9M28G7W	9M88G7W	9M33G7W
	High							9M87G7W	9M33G7W
15MHz	Low							14M8G7W	14M1G7W
	Mid	14M8G7W	14M1G7W	14M8G7W	14M1G7W	14M8G7W	14M1G7W	14M8G7W	14M1G7W
	High							14M8G7W	14M1G7W
Note: FCC emission designators are based on 26dB emission bandwidth. ISED emission designators are based on 99% emission bandwidth.									

OCCUPIED BANDWIDTH - SINGLE CARRIER

element

TbtTx 2022.05.02.0 XMit 2023.02.14.0

EUT:	AHLOA (FCC/ISED C2PC)			**Work Order:**	NOKI0058
Serial Number:	K9180540675			**Date:**	05/04/2023
Customer:	Nokia Solutions and Networks			**Temperature:**	21.7°C
Attendees:	John Rattanavong, Mitchel Hill			**Humidity:**	44.9%
Project:	None			**Barometric Pres.:**	1014 mbar
Tested by:	Brandon Hobbs	**Power:**	54 VDC	**Job Site:**	TX07

TEST SPECIFICATIONS	Test Method
FCC 27:2023	ANSI C63.26:2015
RSS-130 Issue 2:2019	ANSI C63.26:2015

COMMENTS

All losses in the measurement path were accounted for: attenuators, cables, DC block and filter when in use. Band n85 carriers are enabled at maximum power (60 watts/carrier).

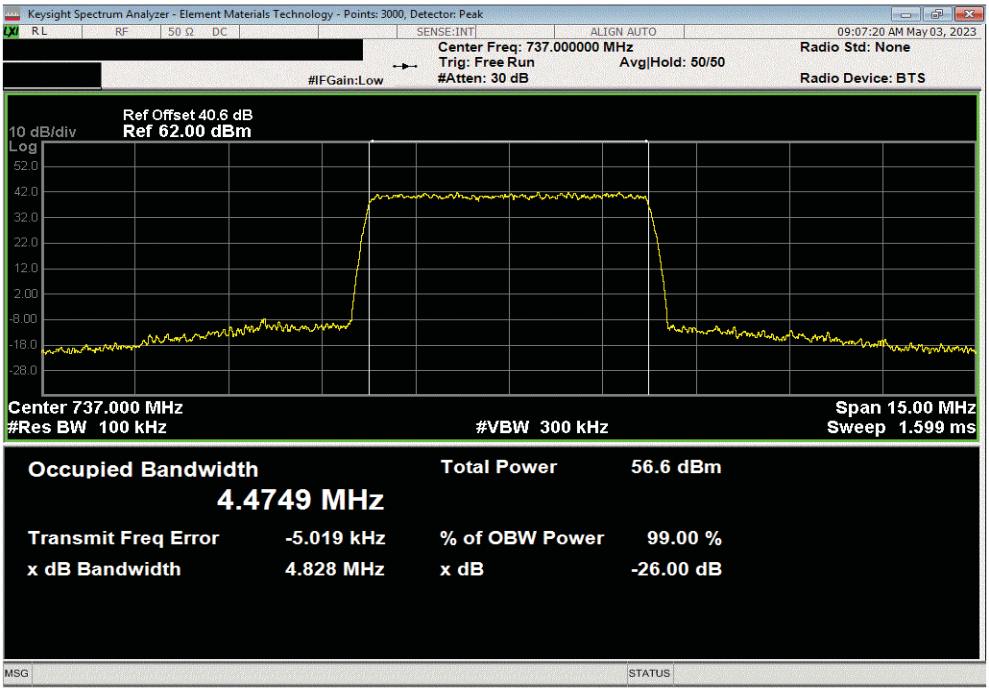
DEVIATIONS FROM TEST STANDARD

None

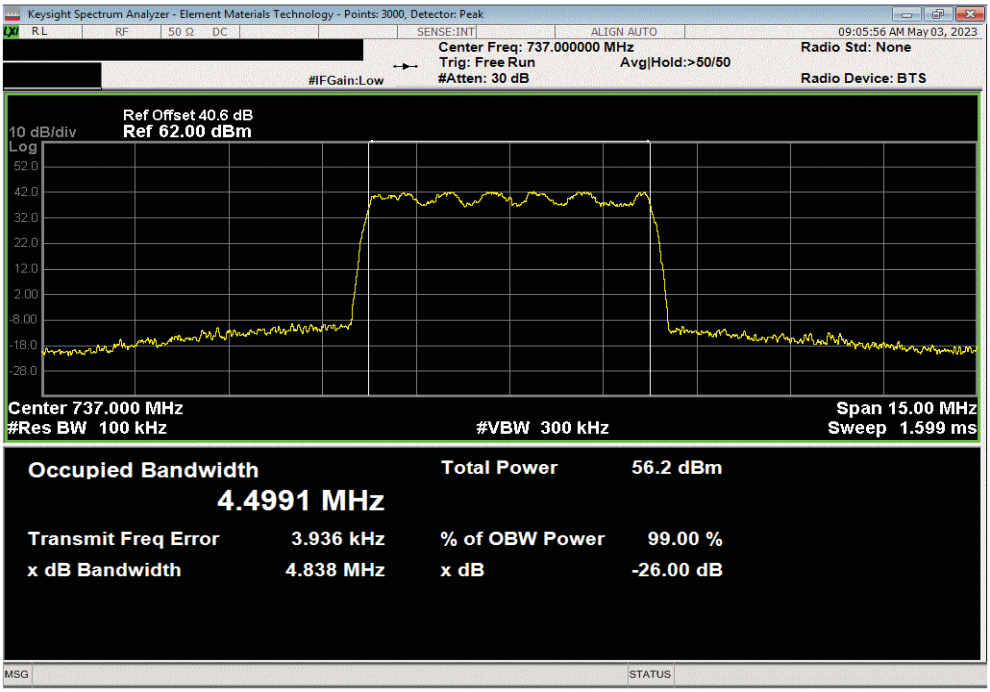
Configuration #	NOKI0058-2	Signature

	Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
Band n85 728 MHz - 746 MHz, 5G NR				
Port 1				
5 MHz Bandwidth				
QPSK Modulation				
Mid Channel 737 MHz	4.48	4.83	Within Band	Pass
16-QAM Modulation				
Mid Channel 737 MHz	4.50	4.84	Within Band	Pass
64-QAM Modulation				
Mid Channel 737 MHz	4.48	4.84	Within Band	Pass
256-QAM Modulation				
Low Channel 730.5 MHz	4.48	4.82	Within Band	Pass
Mid Channel 737 MHz	4.48	4.83	Within Band	Pass
High Channel 743.5 MHz	4.49	4.83	Within Band	Pass
10 MHz Bandwidth				
QPSK Modulation				
Mid Channel 737 MHz	9.30	9.88	Within Band	Pass
16-QAM Modulation				
Mid Channel 737 MHz	9.25	9.83	Within Band	Pass
64-QAM Modulation				
Mid Channel 737 MHz	9.28	9.85	Within Band	Pass
256-QAM Modulation				
Low Channel 733 MHz	9.32	9.89	Within Band	Pass
Mid Channel 737 MHz	9.33	9.88	Within Band	Pass
High Channel 741 MHz	9.33	9.87	Within Band	Pass
15 MHz Bandwidth				
QPSK Modulation				
Mid Channel 737 MHz	14.1	14.8	Within Band	Pass
16-QAM Modulation				
Mid Channel 737 MHz	14.1	14.8	Within Band	Pass
64-QAM Modulation				
Mid Channel 737 MHz	14.1	14.8	Within Band	Pass
256-QAM Modulation				
Low Channel 735.5 MHz	14.1	14.8	Within Band	Pass
Mid Channel 737 MHz	14.1	14.8	Within Band	Pass
High Channel 738.5 MHz	14.1	14.8	Within Band	Pass

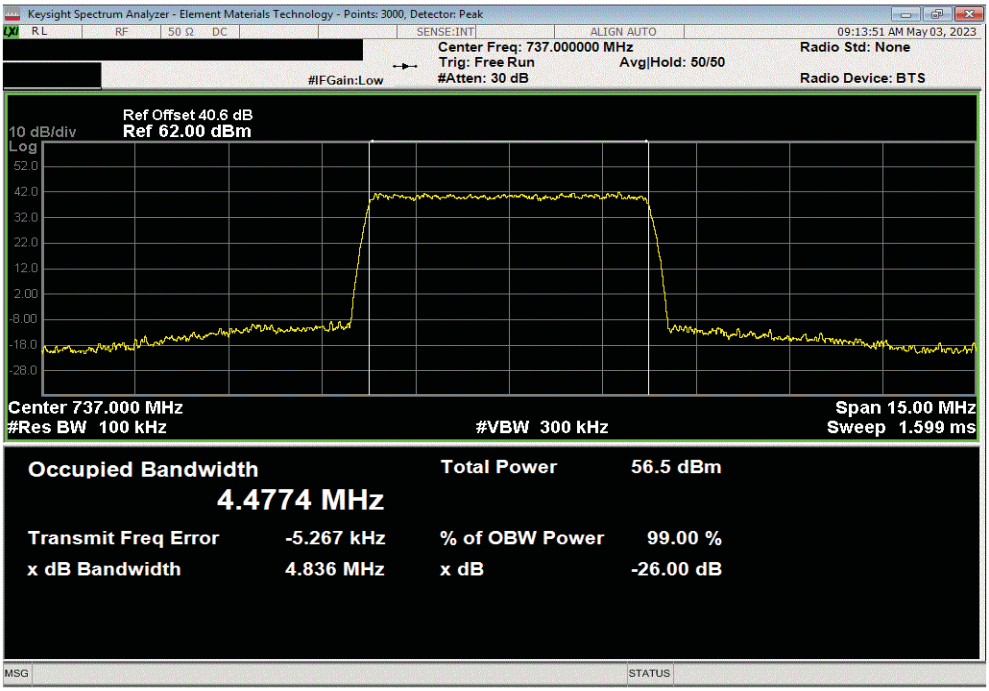
Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 5 MHz Bandwidth, QPSK Modulation, Mid Channel 737 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			4.475	4.828	Within Band	Pass



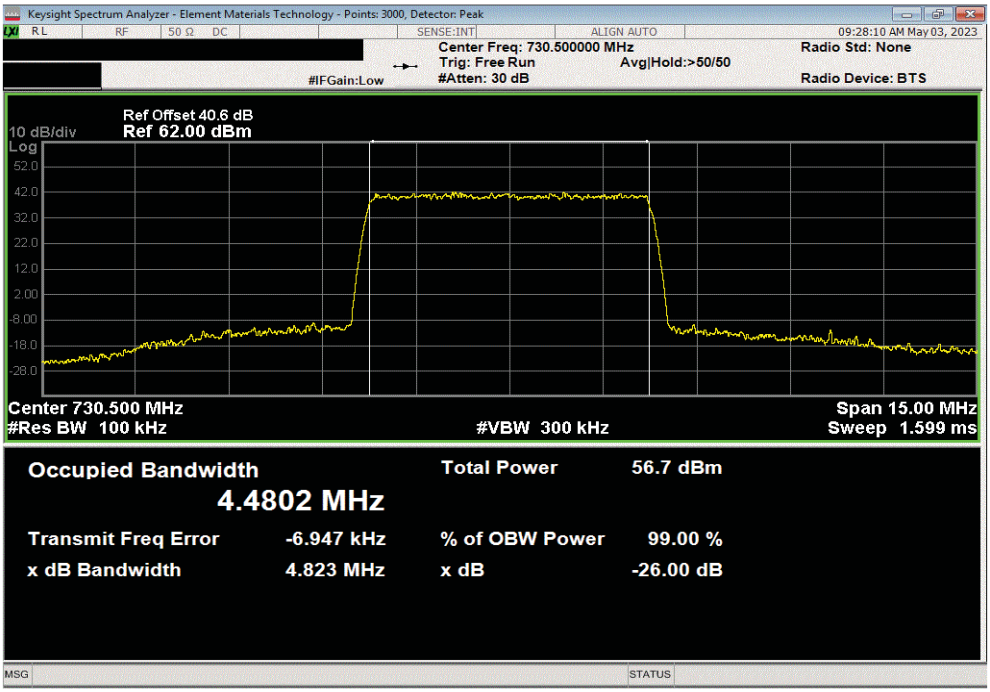
Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 5 MHz Bandwidth, 16-QAM Modulation, Mid Channel 737 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			4.499	4.838	Within Band	Pass



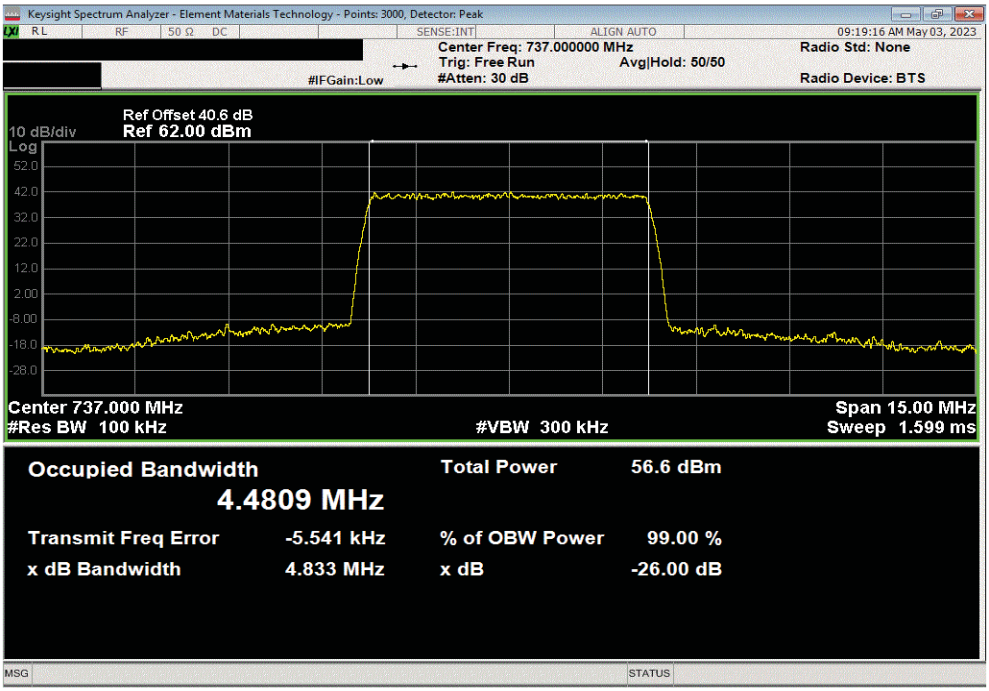
Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 5 MHz Bandwidth, 64-QAM Modulation, Mid Channel 737 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			4.477	4.836	Within Band	Pass



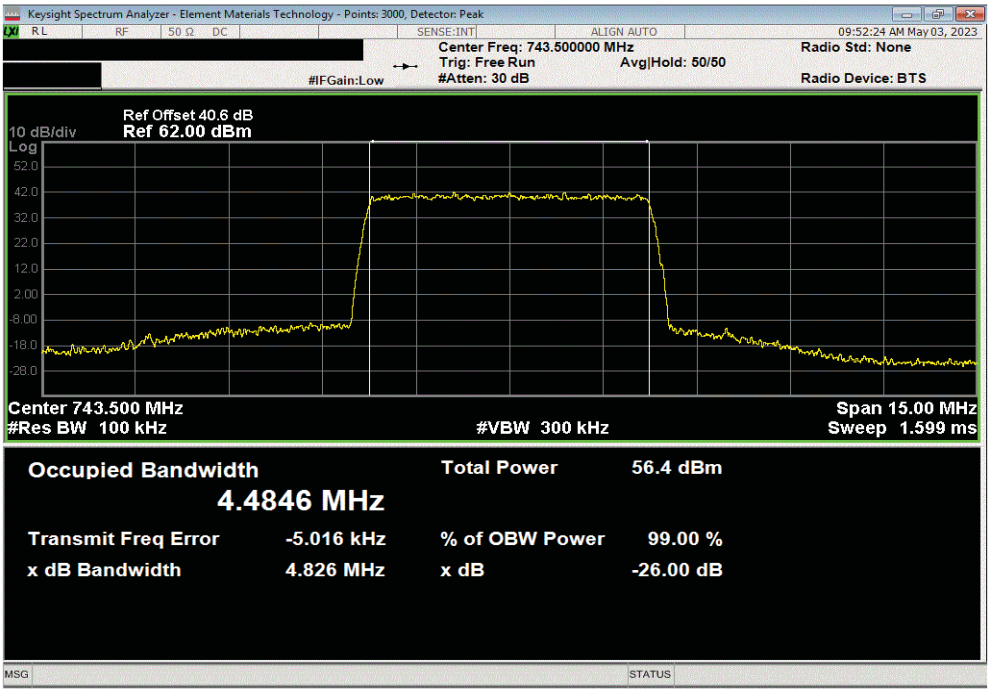
Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 5 MHz Bandwidth, 256-QAM Modulation, Low Channel 730.5 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			4.48	4.823	Within Band	Pass



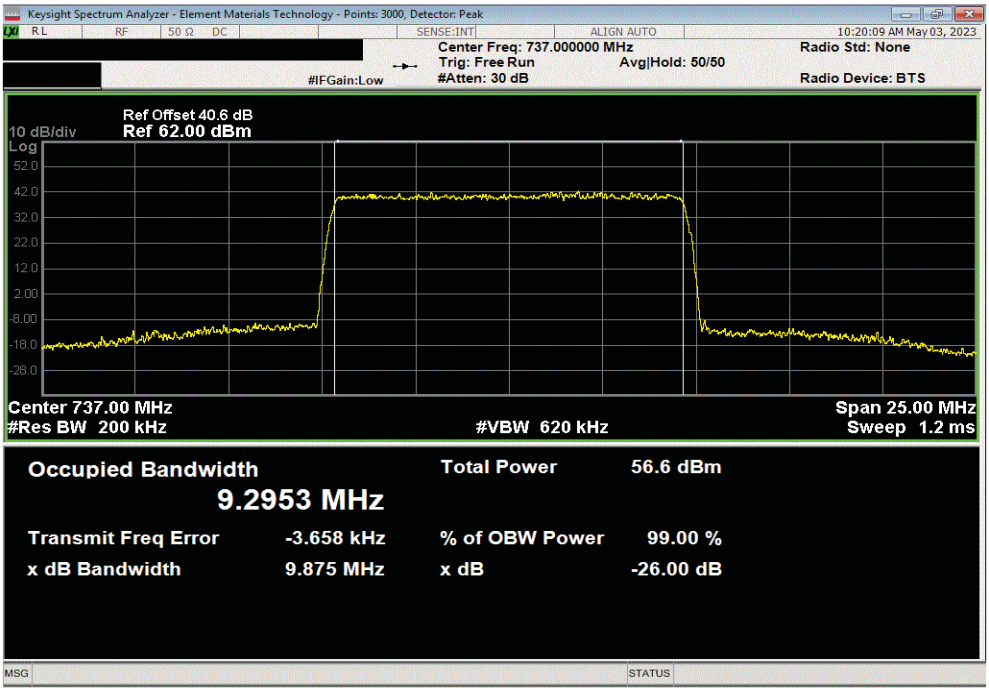
Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 5 MHz Bandwidth, 256-QAM Modulation, Mid Channel 737 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			4.481	4.833	Within Band	Pass



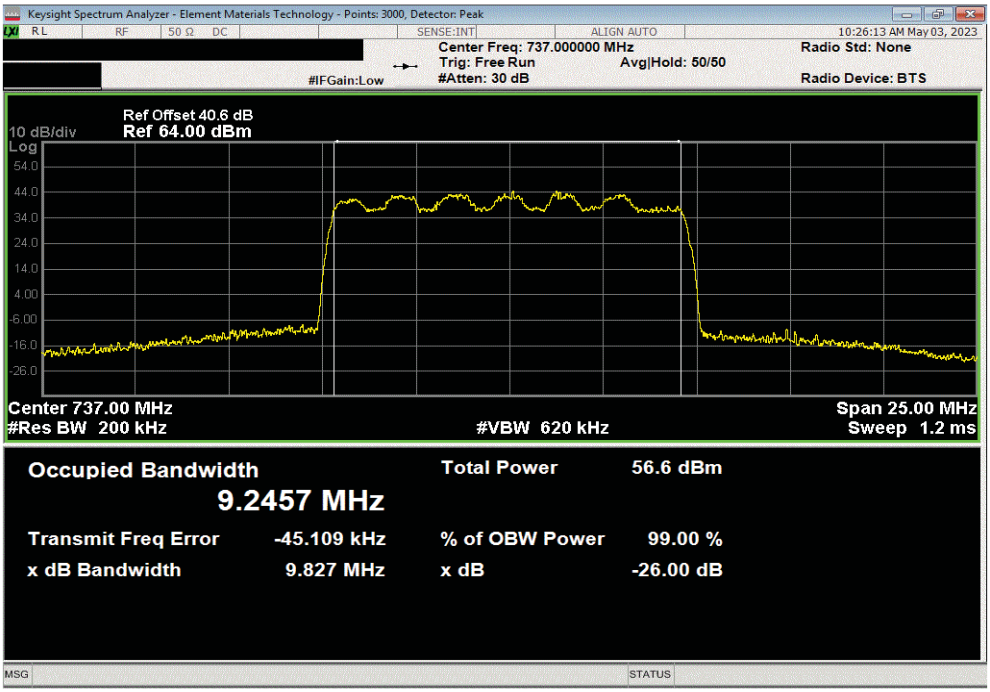
Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 5 MHz Bandwidth, 256-QAM Modulation, High Channel 743.5 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			4.485	4.826	Within Band	Pass



Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 10 MHz Bandwidth, QPSK Modulation, Mid Channel 737 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			9.295	9.875	Within Band	Pass

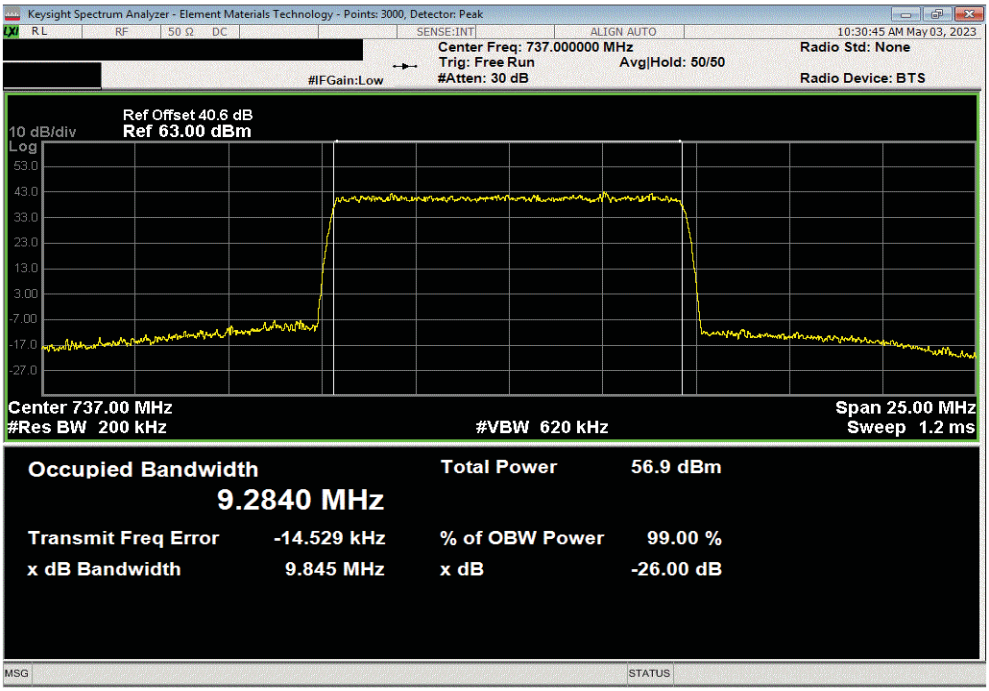


Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 10 MHz Bandwidth, 16-QAM Modulation, Mid Channel 737 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			9.246	9.827	Within Band	Pass



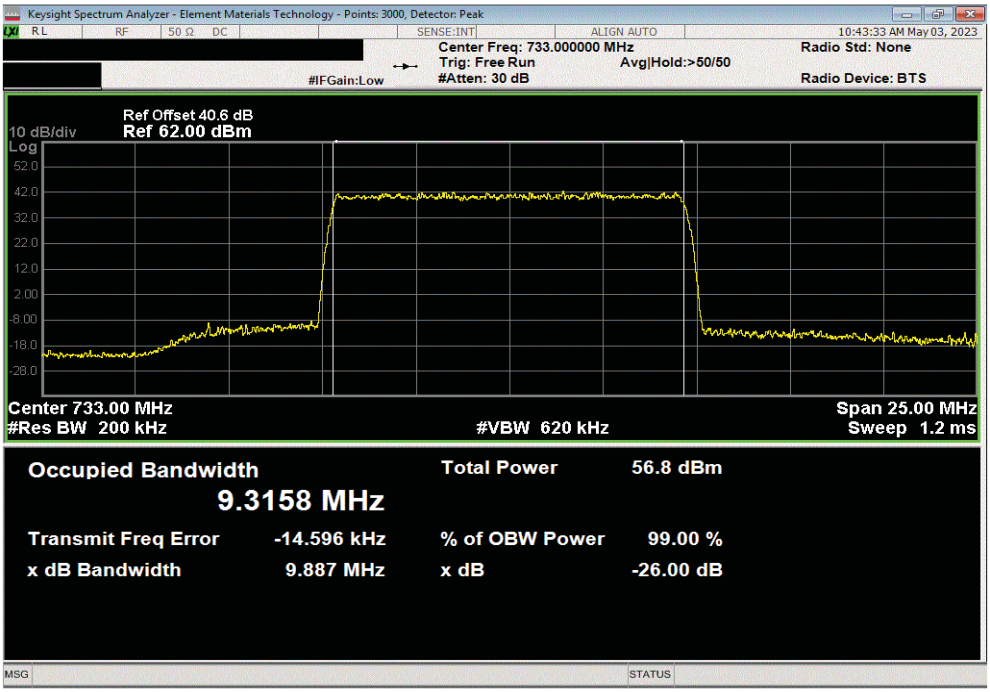
Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 10 MHz Bandwidth, 64-QAM Modulation, Mid Channel 737 MHz

			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			9.284	9.845	Within Band	Pass



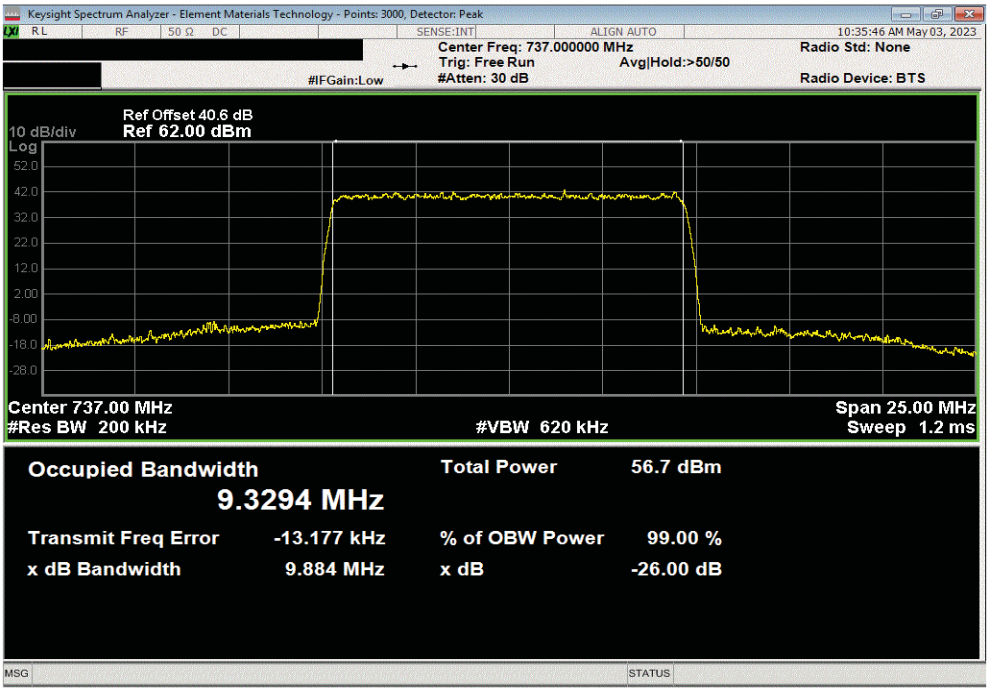
Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 10 MHz Bandwidth, 256-QAM Modulation, Low Channel 733 MHz

			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			9.316	9.887	Within Band	Pass



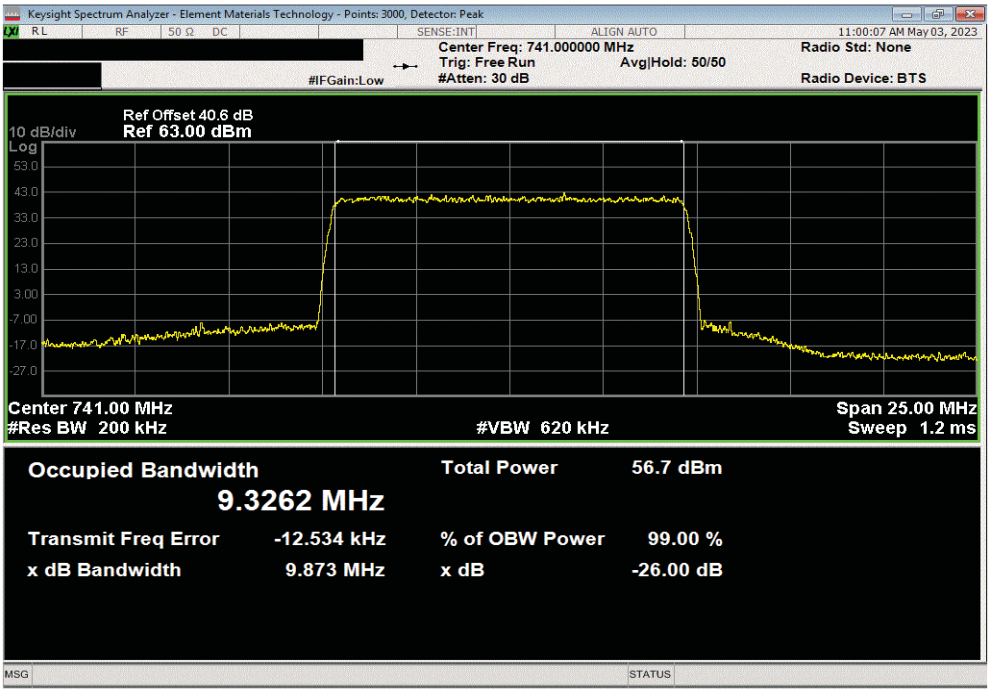
Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 10 MHz Bandwidth, 256-QAM Modulation, Mid Channel 737 MHz

			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			9.329	9.884	Within Band	Pass



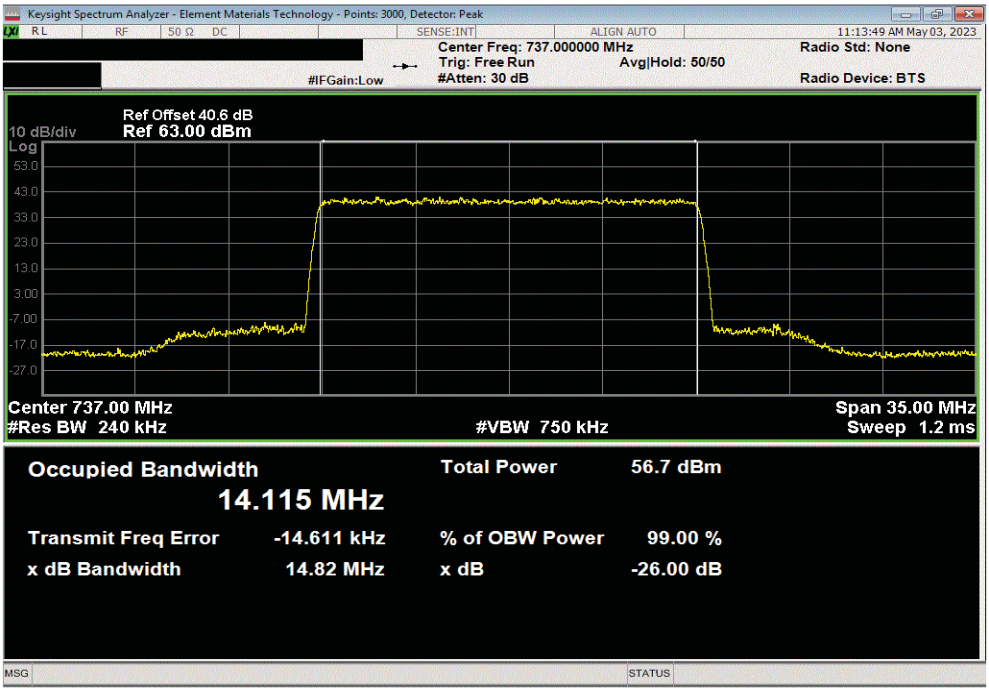
Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 10 MHz Bandwidth, 256-QAM Modulation, High Channel 741 MHz

			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			9.326	9.873	Within Band	Pass

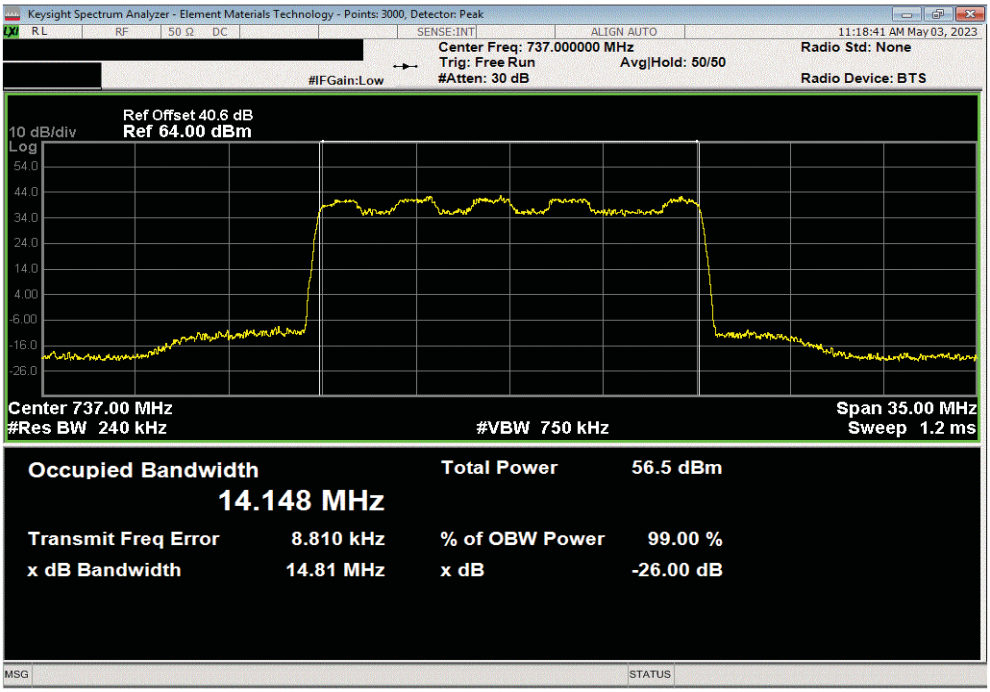


OCCUPIED BANDWIDTH - SINGLE CARRIER

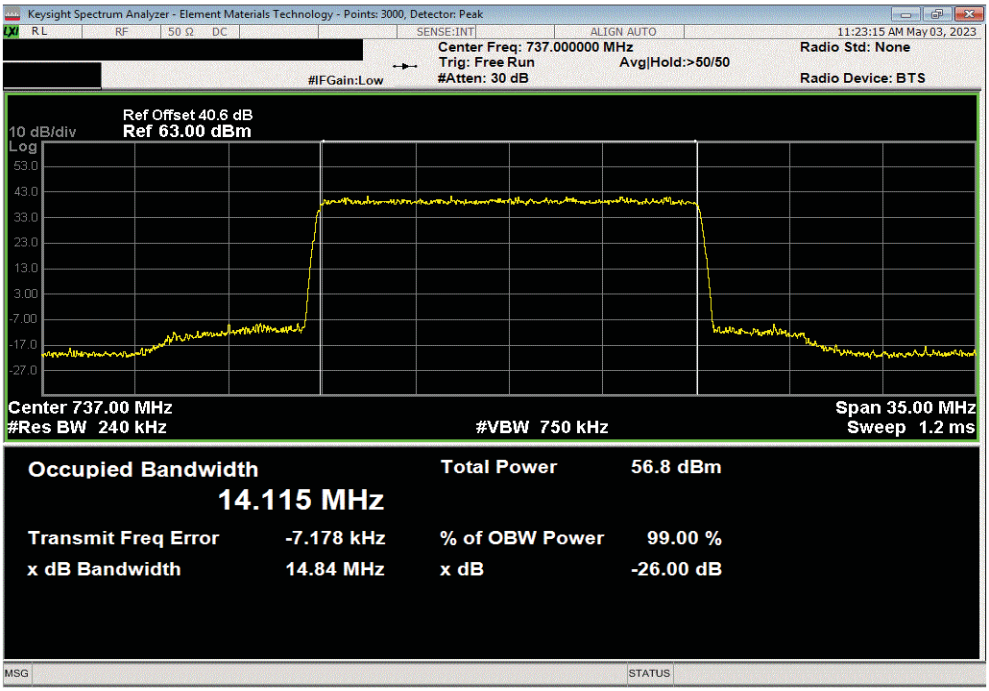
Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 15 MHz Bandwidth, QPSK Modulation, Mid Channel 737 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			14.115	14.82	Within Band	Pass



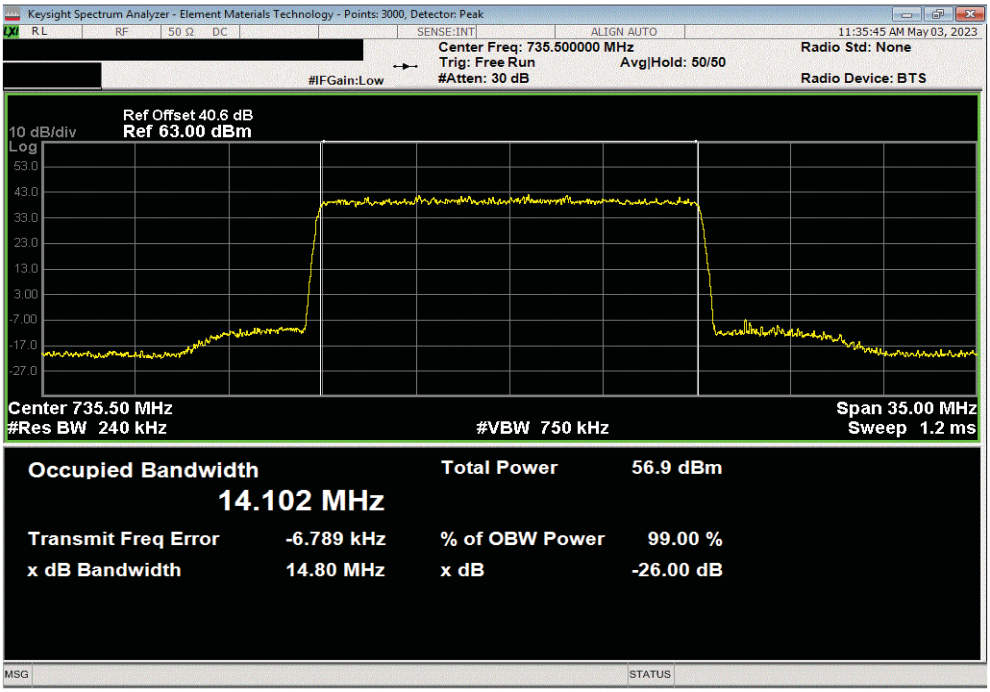
Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 15 MHz Bandwidth, 16-QAM Modulation, Mid Channel 737 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			14.148	14.806	Within Band	Pass



Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 15 MHz Bandwidth, 64-QAM Modulation, Mid Channel 737 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			14.115	14.842	Within Band	Pass

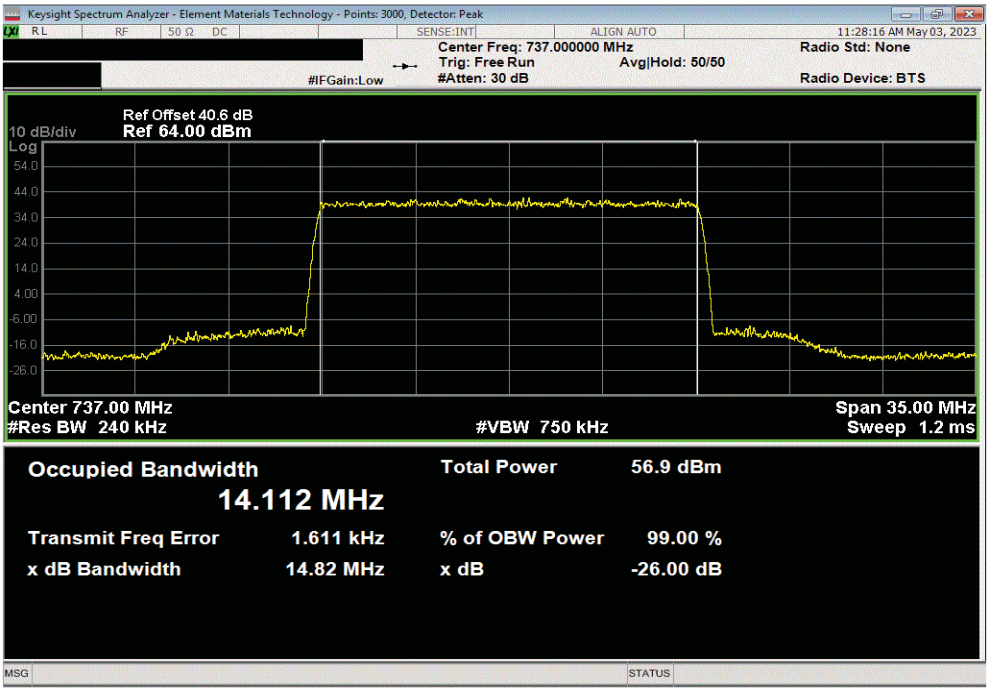


Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 15 MHz Bandwidth, 256-QAM Modulation, Low Channel 735.5 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			14.102	14.795	Within Band	Pass

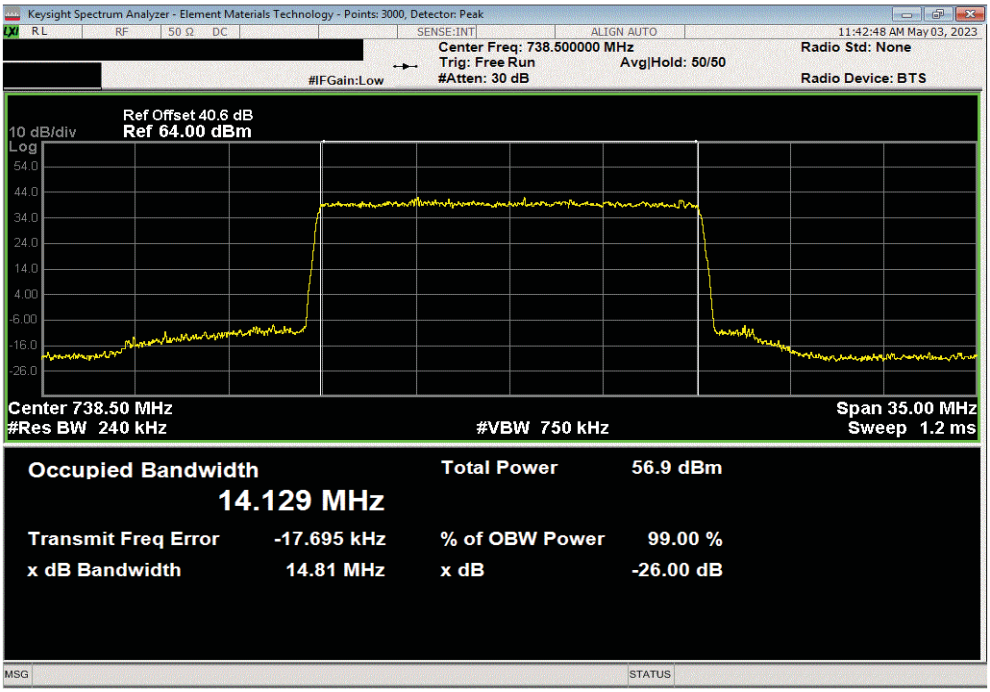


OCCUPIED BANDWIDTH - SINGLE CARRIER

Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 15 MHz Bandwidth, 256-QAM Modulation, Mid Channel 737 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			14.112	14.816	Within Band	Pass



Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 15 MHz Bandwidth, 256-QAM Modulation, High Channel 738.5 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			14.129	14.808	Within Band	Pass



AVERAGE POWER - MULTICARRIER

XMit 2023.02.14.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Block - DC	Fairview Microwave	SD3379	AMM	2022-09-09	2023-09-09
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2023-02-09	2024-02-09
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17

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

Multicarrier test cases have been developed as shown below:
Notes: Max port power (60watts is shared between Bands n71/n85)

Multi-Carrier Test Case 1): 3GPP Band n71 Multicarrier In the Band n71 _Three NR5 carriers using two carriers (with minimum spacing between carrier frequencies) at the lower band edge (619.5 & 624.5MHz) and a third carrier with maximum spacing between the other two carrier frequencies (649.5MHz) 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 60 watts (~20W/Band n71 carriers). 3GPP Band n85 carrier is not enable.

Multi-Carrier Test Case 2): 3GPP Band n71 Multicarrier: In the Band n71 _ One NR 20MHz carriers and one NR 15MHz carriers (with minimum spacing between carrier frequencies) at the lower band edge (627.0 & 644.5MHz). The largest channel bandwidth is selected to maximize carrier OBW. The carriers are operated at maximum power for a total port power of 60 watts (~30W/Band n71 carriers). 3GPP Band n85 carrier is not enable.

Multi-Carrier Test Case 3): 3GPP Band n85 Multicarrier: In the Band n85 _Two NR5 carriers using one carrier at the lower band edge (730.5MHz) and a second carrier at maximum spacing at the upper band edge (743.5MHz). The NR5 channel bandwidth was selected to maximize carrier power spectral density. The carriers are operated at maximum power for a total port power of 60 watts (~30W/Band n85 carrier). 3GPP Band n71 carrier is not enable.

Multi-Carrier Test Case 4): 3GPP Band n71 and Band n85 Multicarrier Multiband: Three NR 5MHz carriers using two carriers (with minimum spacing between carrier frequencies) at the Band n71 lower band edge (619.5 & 624.5MHz) and a third carrier with maximum spacing between the other two carrier frequencies (743.5MHz) at the Band n85 upper band edge. The smallest channel bandwidth was selected to maximize carrier power spectral density. The carriers were operated at maximum power (~20/ Band n71 carrier and ~20W Band n85 carrier) for a total port power of 60 watts.

RF conducted emissions testing was performed only on one port. The testing was performed on the same version of hardware (AHLOA) as the original certification test. The AHLOA antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in the original certification effort) 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 - MULTICARRIER

element

TbtTx 2022.05.02.0 XMit 2023.02.14.0

EUT:	AHLOA (FCC/ISED C2PC)			Work Order:	NOKI0058
Serial Number:	K9180540675			Date:	05/03/2023
Customer:	Nokia Solutions and Networks			Temperature:	21.1°C
Attendees:	John Rattanavong, Mitchel Hill			Humidity:	42.5%
Project:	None			Barometric Pres.:	1014 mbar
Tested by:	Brandon Hobbs	Power:	54 VDC	Job Site:	TX07

TEST SPECIFICATIONS	Test Method
FCC 27:2023	ANSI C63.26:2015
RSS-130 Issue 2:2019	ANSI C63.26:2015

COMMENTS

All losses in the measurement path were accounted for: attenuators, cables, DC block and filter when in use. Bands n85/n71 carriers were operating at meximum power in each applicable test case to achieve a total port power of 60 watts. The following is the output power measurements at the radio's single output port.

DEVIATIONS FROM TEST STANDARD

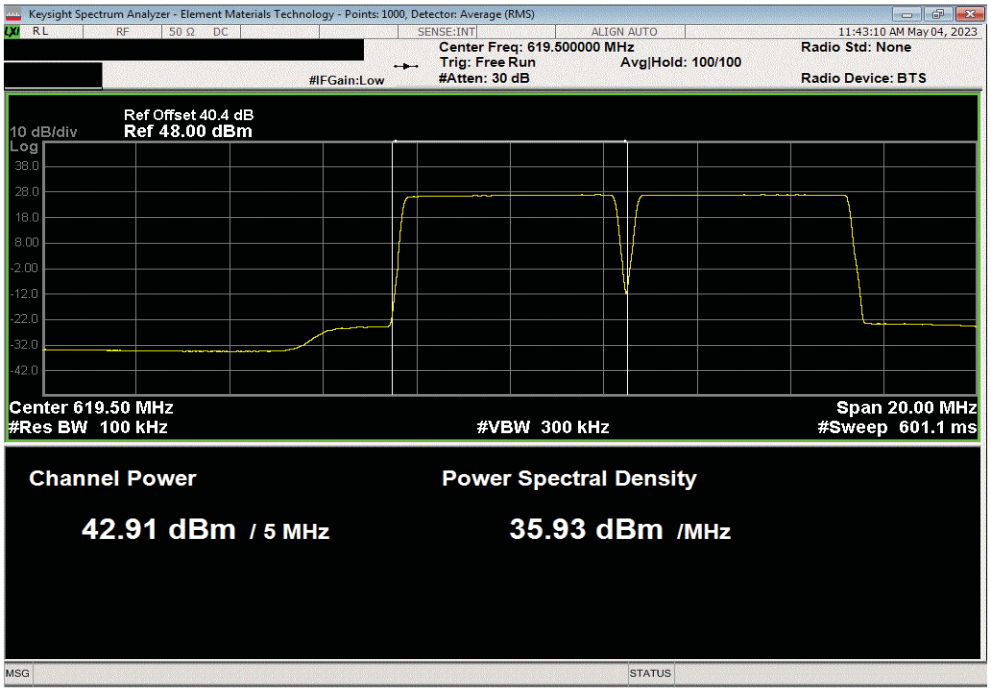
None

Configuration #	NOKI0058-2	Signature

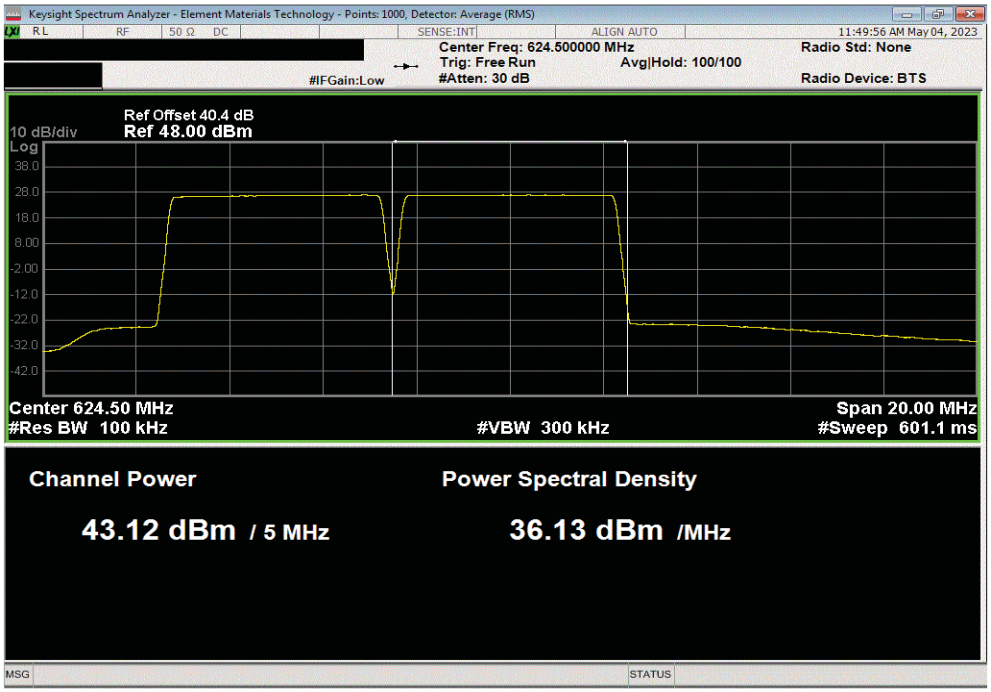
	Avg Cond Initial Pwr (dBm)	Duty Cycle Factor (dBm)	Avg Cond Carrier Pwr (dB)	Avg Cond Band Pwr (dBm)	Avg Cond Port Pwr (dBm)	Limit (dBm)	Results
Port 1, 5G NR Multi-Carrier Operation							
QPSK Modulation							
Test Case 1, n71 NR5							
Low Channel 619.5 MHz	42.915	0	42.9	N/A	N/A	Within Tolerance	Pass
Mid Channel 624.5 MHz	43.120	0	43.1	N/A	N/A	Within Tolerance	Pass
High Channel 649.5 MHz	42.728	0	42.7	N/A	N/A	Within Tolerance	Pass
Test Case 2, n71 NR20							
Low Channel 627 MHz	45.034	0	45.0	N/A	N/A	Within Tolerance	Pass
Test Case 2, n71 NR15							
High Channel 644.5 MHz	44.961	0	45.0	N/A	N/A	Within Tolerance	Pass
Test Case 3, n85 NR5							
Low Channel 730.5 MHz	45.047	0	45.0	N/A	N/A	Within Tolerance	Pass
High Channel 743.5 MHz	45.067	0	45.1	N/A	N/A	Within Tolerance	Pass
Test Case 4, n71 NR5							
Mid Channel 624.5 MHz	42.794	0	42.8	N/A	N/A	Within Tolerance	Pass
Low Channel 619.5 MHz	43.063	0	43.1	N/A	N/A	Within Tolerance	Pass
Test Case 4, n85 NR5							
High Channel 743.5 MHz	42.911	0	42.9	N/A	N/A	Within Tolerance	Pass
Port 1, 5G NR Multi-Carrier Operation							
QPSK Modulation							
Multicarrier Multiband Test Case 1	N/A	0	N/A	View Table	View Table	Within Tolerance	Pass
Multicarrier Multiband Test Case 2	N/A	0	N/A	View Table	View Table	Within Tolerance	Pass
Multicarrier Multiband Test Case 3	N/A	0	N/A	View Table	View Table	Within Tolerance	Pass
Multicarrier Multiband Test Case 4	N/A	0	N/A	View Table	View Table	Within Tolerance	Pass

AVERAGE POWER - MULTICARRIER

Port 1, 5G NR Multi-Carrier Operation, QPSK Modulation, Test Case 1, n71 NR5, Low Channel 619.5 MHz						
Avg Cond Initial Pwr (dBm)	Duty Cycle Factor (dBm)	Avg Cond Carrier Pwr (dB)	Avg Cond Band Pwr (dBm)	Avg Cond Port Pwr (dBm)	Limit (dBm)	Results
42.915	0	42.915	N/A	N/A	Within Tolerance	Pass

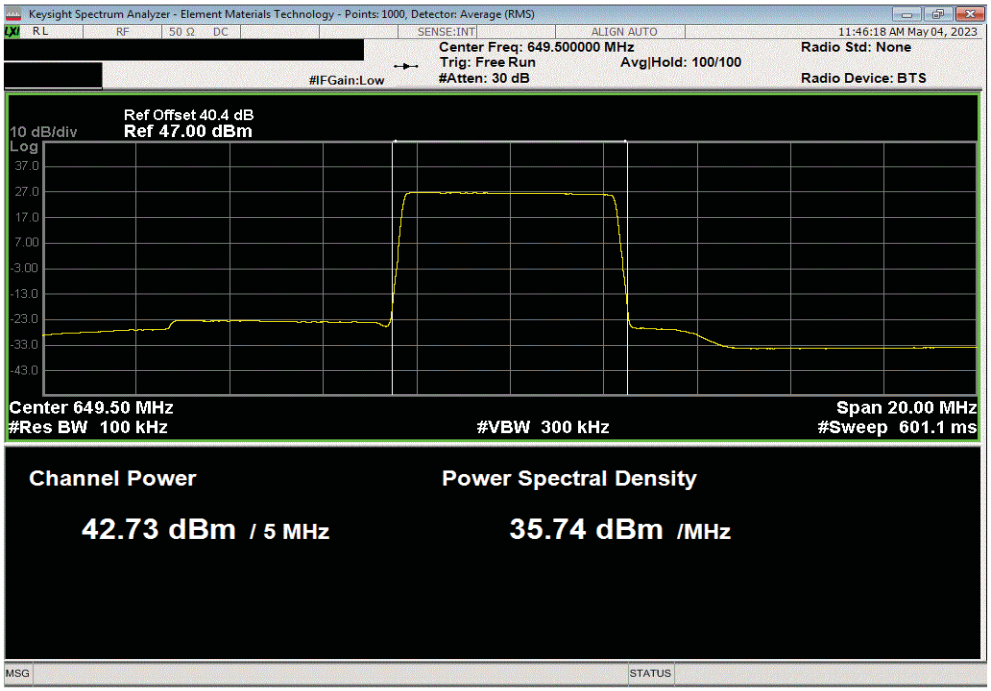


Port 1, 5G NR Multi-Carrier Operation, QPSK Modulation, Test Case 1, n71 NR5, Mid Channel 624.5 MHz						
Avg Cond Initial Pwr (dBm)	Duty Cycle Factor (dBm)	Avg Cond Carrier Pwr (dB)	Avg Cond Band Pwr (dBm)	Avg Cond Port Pwr (dBm)	Limit (dBm)	Results
43.12	0	43.12	N/A	N/A	Within Tolerance	Pass

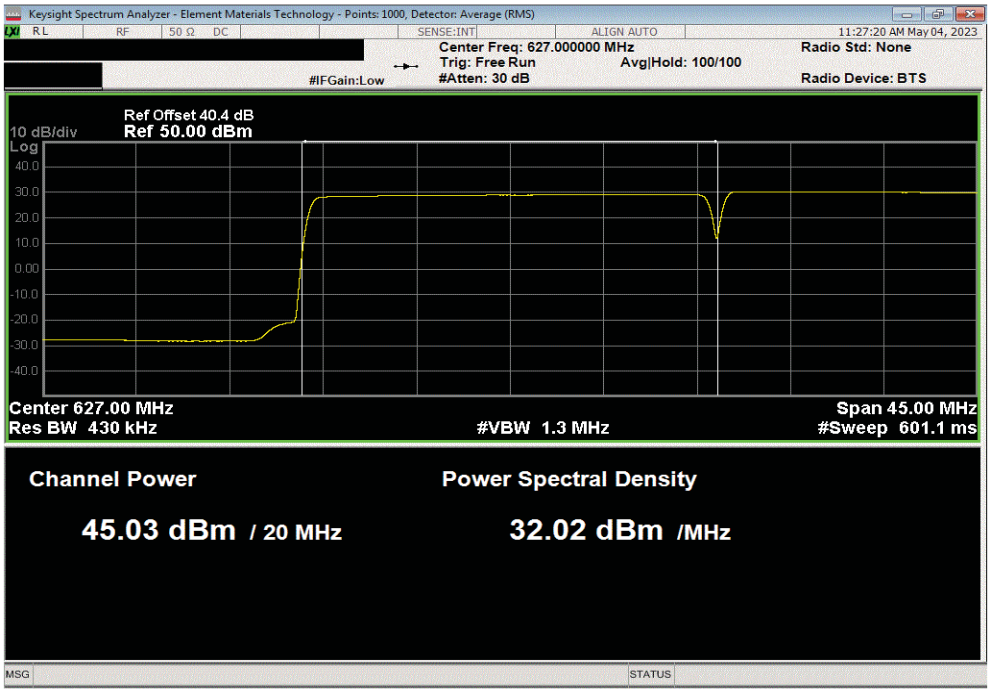


AVERAGE POWER - MULTICARRIER

Port 1, 5G NR Multi-Carrier Operation, QPSK Modulation, Test Case 1, n71 NR5, High Channel 649.5 MHz						
Avg Cond Initial Pwr (dBm)	Duty Cycle Factor (dBm)	Avg Cond Carrier Pwr (dB)	Avg Cond Band Pwr (dBm)	Avg Cond Port Pwr (dBm)	Limit (dBm)	Results
42.728	0	42.728	N/A	N/A	Within Tolerance	Pass

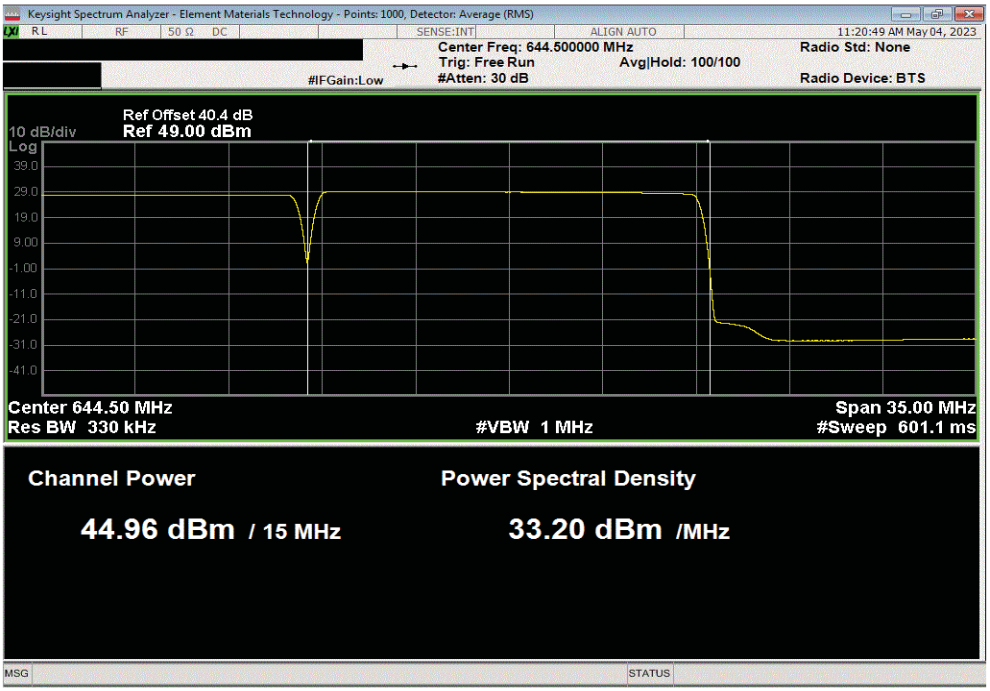


Port 1, 5G NR Multi-Carrier Operation, QPSK Modulation, Test Case 2, n71 NR20, Low Channel 627 MHz						
Avg Cond Initial Pwr (dBm)	Duty Cycle Factor (dBm)	Avg Cond Carrier Pwr (dB)	Avg Cond Band Pwr (dBm)	Avg Cond Port Pwr (dBm)	Limit (dBm)	Results
45.034	0	45.034	N/A	N/A	Within Tolerance	Pass

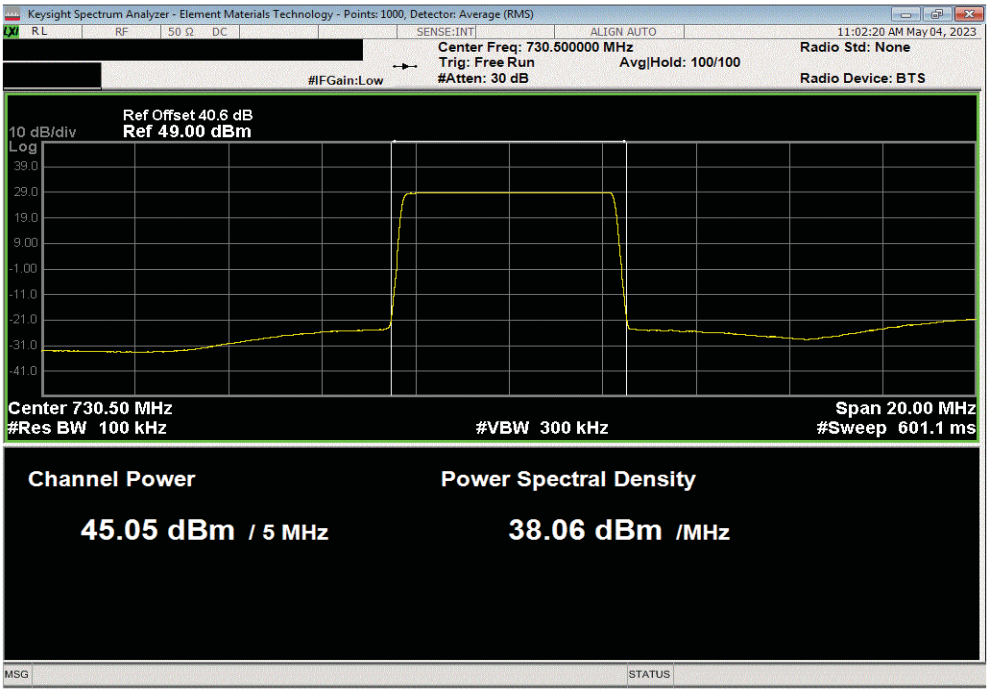


AVERAGE POWER - MULTICARRIER

Port 1, 5G NR Multi-Carrier Operation, QPSK Modulation, Test Case 2, n71 NR15, High Channel 644.5 MHz						
Avg Cond Initial Pwr (dBm)	Duty Cycle Factor (dBm)	Avg Cond Carrier Pwr (dB)	Avg Cond Band Pwr (dBm)	Avg Cond Port Pwr (dBm)	Limit (dBm)	Results
44.961	0	44.961	N/A	N/A	Within Tolerance	Pass



Port 1, 5G NR Multi-Carrier Operation, QPSK Modulation, Test Case 3, n85 NR5, Low Channel 730.5 MHz						
Avg Cond Initial Pwr (dBm)	Duty Cycle Factor (dBm)	Avg Cond Carrier Pwr (dB)	Avg Cond Band Pwr (dBm)	Avg Cond Port Pwr (dBm)	Limit (dBm)	Results
45.047	0	45.047	N/A	N/A	Within Tolerance	Pass

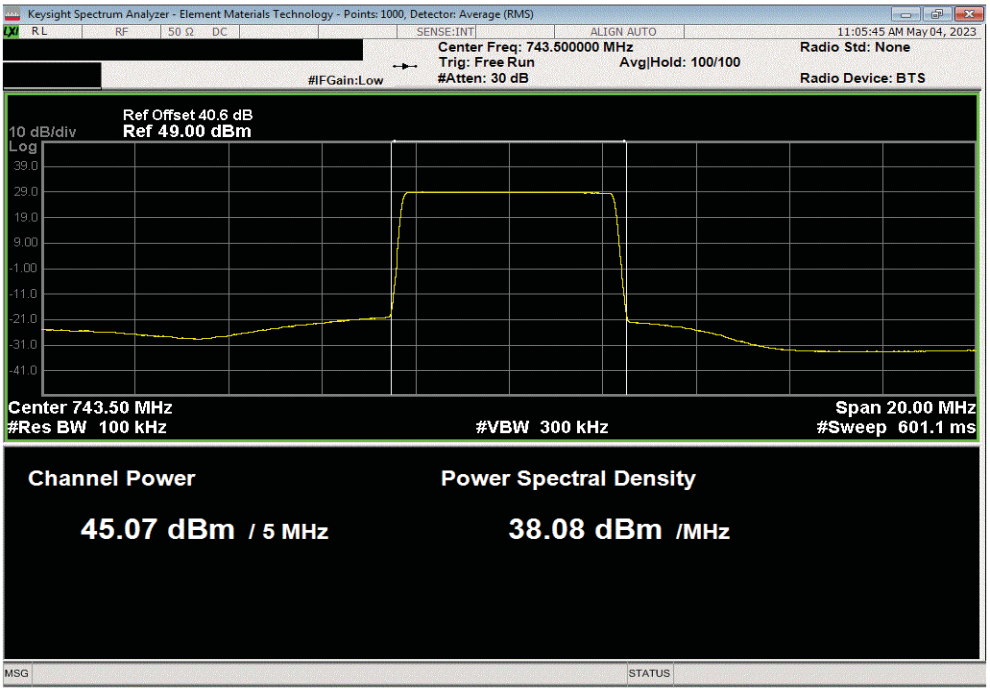


AVERAGE POWER - MULTICARRIER

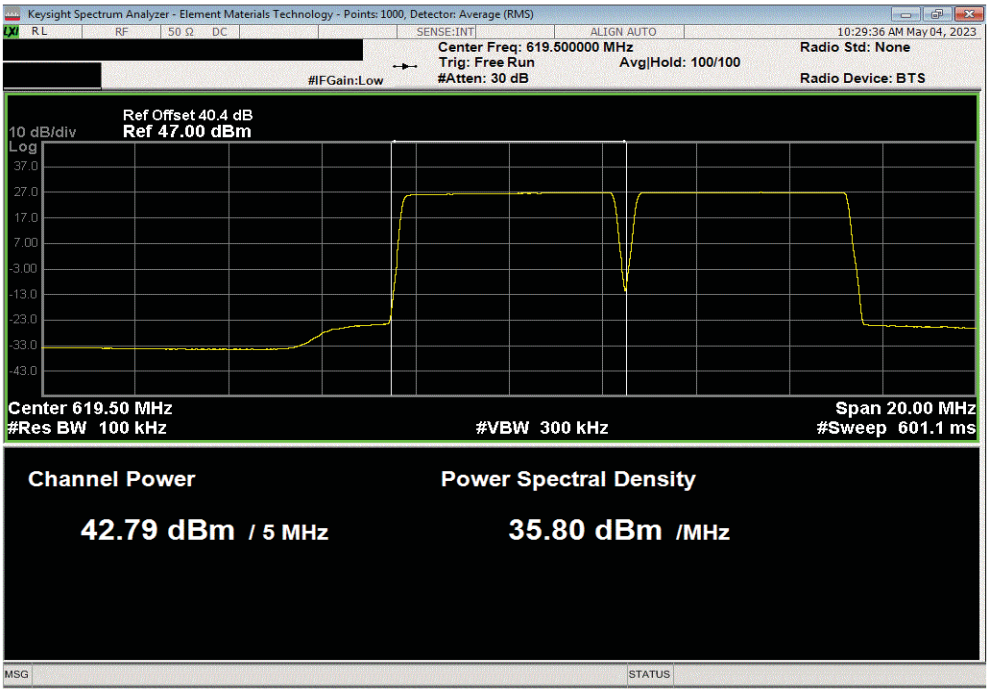
element

TbtTx 2022.05.02.0 XMit 2023.02.14.0

Port 1, 5G NR Multi-Carrier Operation, QPSK Modulation, Test Case 3, n85 NR5, High Channel 743.5 MHz						
Avg Cond Initial Pwr (dBm)	Duty Cycle Factor (dBm)	Avg Cond Carrier Pwr (dB)	Avg Cond Band Pwr (dBm)	Avg Cond Port Pwr (dBm)	Limit (dBm)	Results
45.067	0	45.067	N/A	N/A	Within Tolerance	Pass

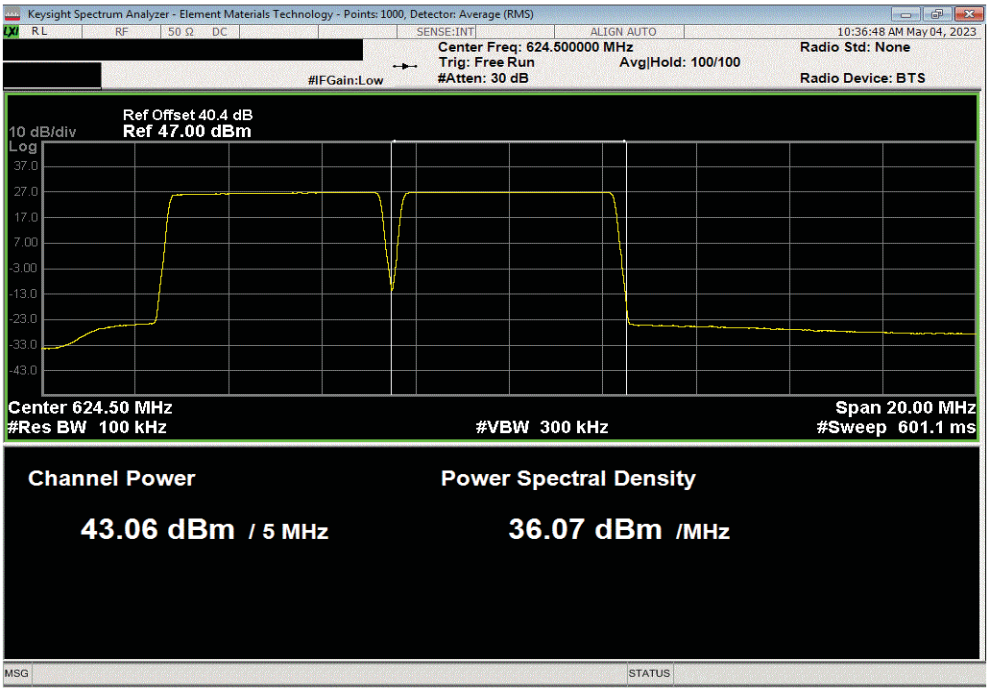


Port 1, 5G NR Multi-Carrier Operation, QPSK Modulation, Test Case 4, n71 NR5, Mid Channel 624.5 MHz						
Avg Cond Initial Pwr (dBm)	Duty Cycle Factor (dBm)	Avg Cond Carrier Pwr (dB)	Avg Cond Band Pwr (dBm)	Avg Cond Port Pwr (dBm)	Limit (dBm)	Results
42.794	0	42.794	N/A	N/A	Within Tolerance	Pass

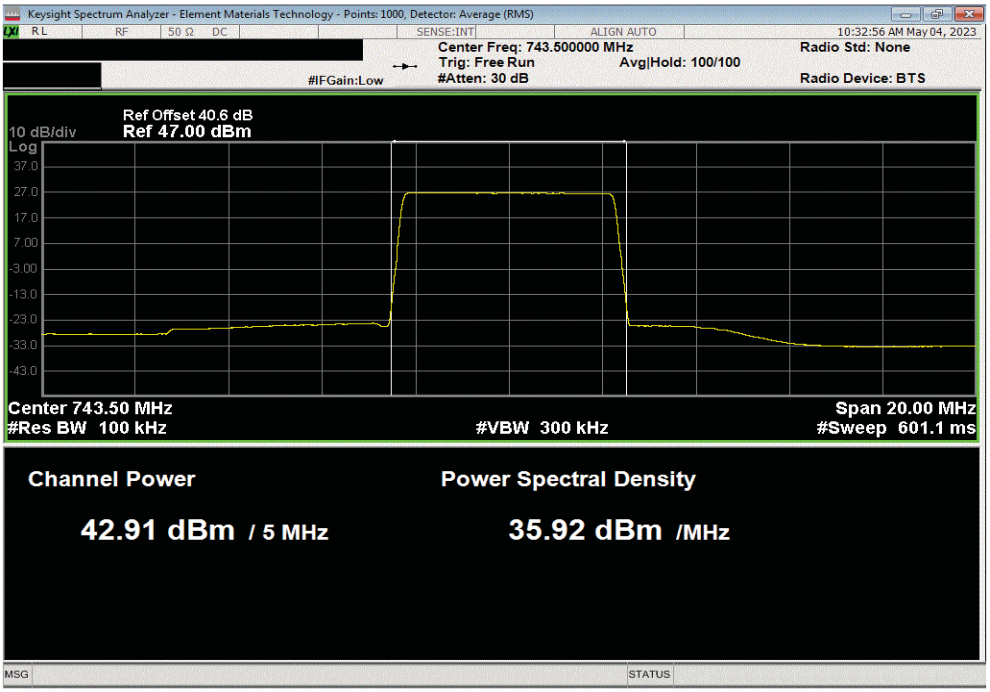


AVERAGE POWER - MULTICARRIER

Port 1, 5G NR Multi-Carrier Operation, QPSK Modulation, Test Case 4, n71 NR5, Low Channel 619.5 MHz						
Avg Cond Initial Pwr (dBm)	Duty Cycle Factor (dBm)	Avg Cond Carrier Pwr (dB)	Avg Cond Band Pwr (dBm)	Avg Cond Port Pwr (dBm)	Limit (dBm)	Results
43.063	0	43.063	N/A	N/A	Within Tolerance	Pass



Port 1, 5G NR Multi-Carrier Operation, QPSK Modulation, Test Case 4, n85 NR5, High Channel 743.5 MHz						
Avg Cond Initial Pwr (dBm)	Duty Cycle Factor (dBm)	Avg Cond Carrier Pwr (dB)	Avg Cond Band Pwr (dBm)	Avg Cond Port Pwr (dBm)	Limit (dBm)	Results
42.911	0	42.911	N/A	N/A	Within Tolerance	Pass



AVERAGE POWER - MULTICARRIER

Port 1, 5G NR Multi-Carrier Operation, QPSK Modulation, Test Case 1

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

Carrier Band	Carrier Frequencies	Carrier Power (dBm)	Carrier Power (Watts)	Band Total Pwr (Watts)	Band Total Pwr (dBm)	Port Total Pwr (Watts)	Port Total Pwr (dBm)
n71, NR5	619.5 MHz	**42.9**	19.6	N/A	N/A	N/A	N/A
n71, NR5	624.5 MHz	**43.1**	20.5	N/A	N/A	N/A	N/A
n71, NR5	649.5 MHz	**42.7**	18.7	N/A	N/A	N/A	N/A
n71, NR5	N/A	N/A	N/A	58.8	**47.7**	**58.8**	**47.7**

Port 1, 5G NR Multi-Carrier Operation, QPSK Modulation, Test Case 2

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

Carrier Band	Carrier Frequencies	Carrier Power (dBm)	Carrier Power (Watts)	Band Total Pwr (Watts)	Band Total Pwr (dBm)	Port Total Pwr (Watts)	Port Total Pwr (dBm)
n71, NR15	627 MHz	**45.0**	31.9	N/A	N/A	N/A	N/A
n71, NR20	644.5 MHz	**45.0**	31.3	N/A	N/A	N/A	N/A
n71, NR15 and NR20	N/A	N/A	N/A	63.2	**48.0**	**63.2**	**48.0**

AVERAGE POWER - MULTICARRIER

Port 1, 5G NR Multi-Carrier Operation, QPSK Modulation, Test Case 3						
Avg Cond Initial Pwr (dBm)	**Duty Cycle Factor (dBm)**	**Avg Cond Carrier Pwr (dB)**	**Avg Cond Band Pwr (dBm)**	**Avg Cond Port Pwr (dBm)**	**Limit (dBm)**	**Results**
N/A	0	N/A	View Table	View Table	Within Tolerance	Pass

Carrier Band	Carrier Frequencies	Carrier Power (dBm)	Carrier Power (Watts)	Band Total Pwr (Watts)	Band Total Pwr (dBm)	Port Total Pwr (Watts)	Port Total Pwr (dBm)
n85, NR5	730.5 MHz	**45.0**	32.0	N/A	N/A	N/A	N/A
n85, NR5	743.5 MHz	**45.1**	32.1	N/A	N/A	N/A	N/A
n85, NR5	N/A	N/A	N/A	64.1	**48.1**	**64.1**	**48.1**

Port 1, 5G NR Multi-Carrier Operation, QPSK Modulation, Test Case 4						
Avg Cond Initial Pwr (dBm)	**Duty Cycle Factor (dBm)**	**Avg Cond Carrier Pwr (dB)**	**Avg Cond Band Pwr (dBm)**	**Avg Cond Port Pwr (dBm)**	**Limit (dBm)**	**Results**
N/A	0	N/A	View Table	View Table	Within Tolerance	Pass

Carrier Band	Carrier Frequencies	Carrier Power (dBm)	Carrier Power (Watts)	Band Total Pwr (Watts)	Band Total Pwr (dBm)	Port Total Pwr (Watts)	Port Total Pwr (dBm)
n71, NR5	619.5 MHz	**42.8**	19.0	N/A	N/A	N/A	N/A
n71, NR5	624.5 MHz	**43.1**	20.2	N/A	N/A	N/A	N/A
n71, NR5	N/A	N/A	N/A	39.3	**45.9**	N/A	N/A
n85, NR5	743.5 MHz	**42.9**	19.5	N/A	N/A	N/A	N/A
n85, NR5	N/A	N/A	N/A	19.5	**42.9**	N/A	N/A
n71 and n85, NR5	N/A	N/A	N/A	N/A	N/A	**58.8**	**47.7**

AVERAGE POWER - SINGLE CARRIER

XMit 2023.02.14.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Block - DC	Fairview Microwave	SD3379	AMM	2022-09-09	2023-09-09
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2023-02-09	2024-02-09
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17

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 testing was performed on the same version of hardware (AHLOA) as the original certification test. The AHLOA antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in the original certification effort) 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 - SINGLE CARRIER

element

TbtTx 2022.05.02.0 XMit 2023.02.14.0

EUT:	AHLOA (FCC/ISED C2PC)			Work Order:	NOKI0058
Serial Number:	K9180540675			Date:	05/02/2023
Customer:	Nokia Solutions and Networks			Temperature:	21.3°C
Attendees:	John Rattanavong, Mitchel Hill			Humidity:	46.2%
Project:	None			Barometric Pres.:	1014 mbar
Tested by:	Brandon Hobbs	Power:	54 VDC	Job Site:	TX07

TEST SPECIFICATIONS	Test Method
FCC 27:2023	ANSI C63.26:2015
RSS-130 Issue 2:2019	ANSI C63.26:2015

COMMENTS

All losses in the measurement path were accounted for: attenuators, cables, DC block and filter when in use. Band n85 carriers were enabled at maximmum power (60watts/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

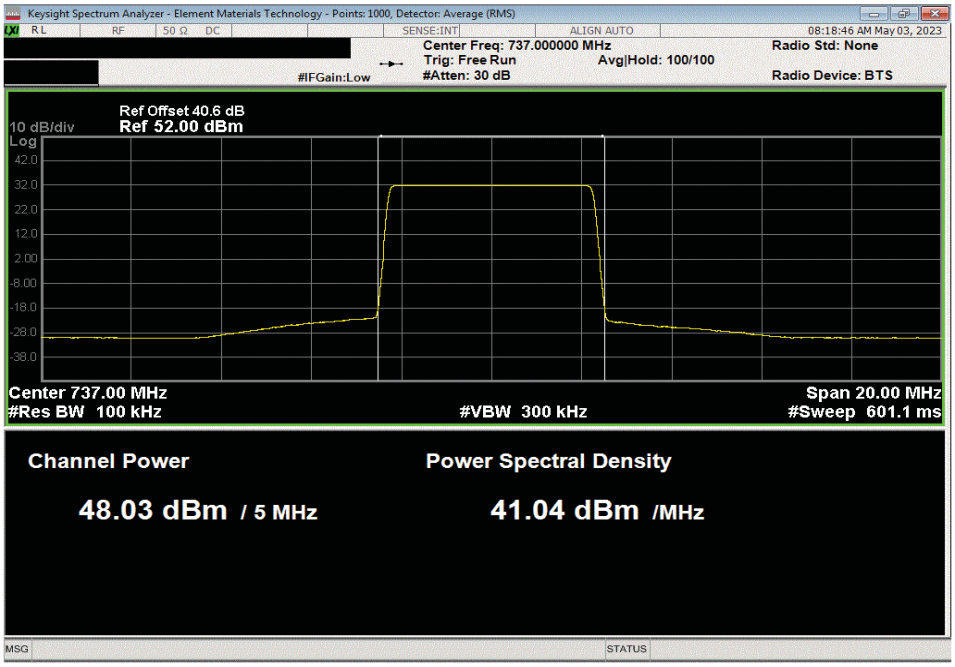
None

Configuration #	NOKI0058-2	Signature

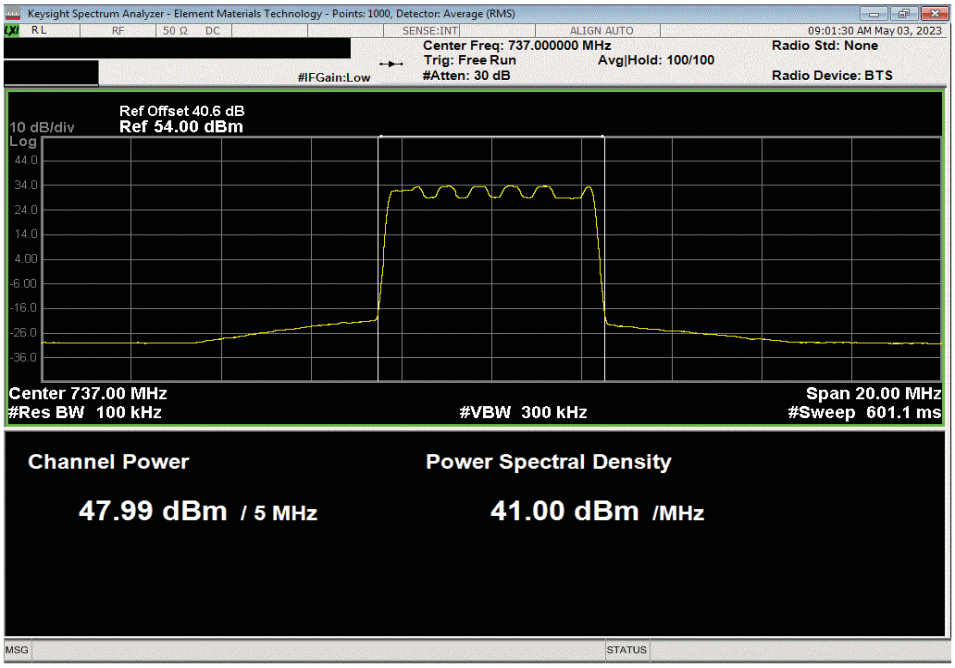
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	Results
Band n85 728 MHz - 746 MHz, 5G NR						
Port 1						
5 MHz Bandwidth						
QPSK Modulation						
Mid Channel 737 MHz	48.034	0	48.0	51.0	54.0	
16-QAM Modulation						
Mid Channel 737 MHz	47.987	0	48.0	51.0	54.0	
64-QAM Modulation						
Mid Channel 737 MHz	48.182	0	48.2	51.2	54.2	
256-QAM Modulation						
Low Channel 730.5 MHz	48.224	0	48.2	51.2	54.2	
Mid Channel 737 MHz	48.168	0	48.2	51.2	54.2	
High Channel 743.5 MHz	48.047	0	48.0	51.0	54.0	
10 MHz Bandwidth						
QPSK Modulation						
Mid Channel 737 MHz	48.039	0	48.0	51.0	54.0	
16-QAM Modulation						
Mid Channel 737 MHz	47.911	0	47.9	50.9	53.9	
64-QAM Modulation						
Mid Channel 737 MHz	48.067	0	48.1	51.1	54.1	
256-QAM Modulation						
Low Channel 733 MHz	48.129	0	48.1	51.1	54.1	
Mid Channel 737 MHz	48.072	0	48.1	51.1	54.1	
High Channel 741 MHz	48.078	0	48.1	51.1	54.1	
15 MHz Bandwidth						
QPSK Modulation						
Mid Channel 737 MHz	48.035	0	48.0	51.0	54.0	
16-QAM Modulation						
Mid Channel 737 MHz	47.862	0	47.9	50.9	53.9	
64-QAM Modulation						
Mid Channel 737 MHz	48.049	0	48.0	51.0	54.0	
256-QAM Modulation						
Low Channel 735.5 MHz	48.070	0	48.1	51.1	54.1	
Mid Channel 737 MHz	48.056	0	48.1	51.1	54.1	
High Channel 738.5 MHz	48.065	0	48.1	51.1	54.1	

AVERAGE POWER - SINGLE CARRIER

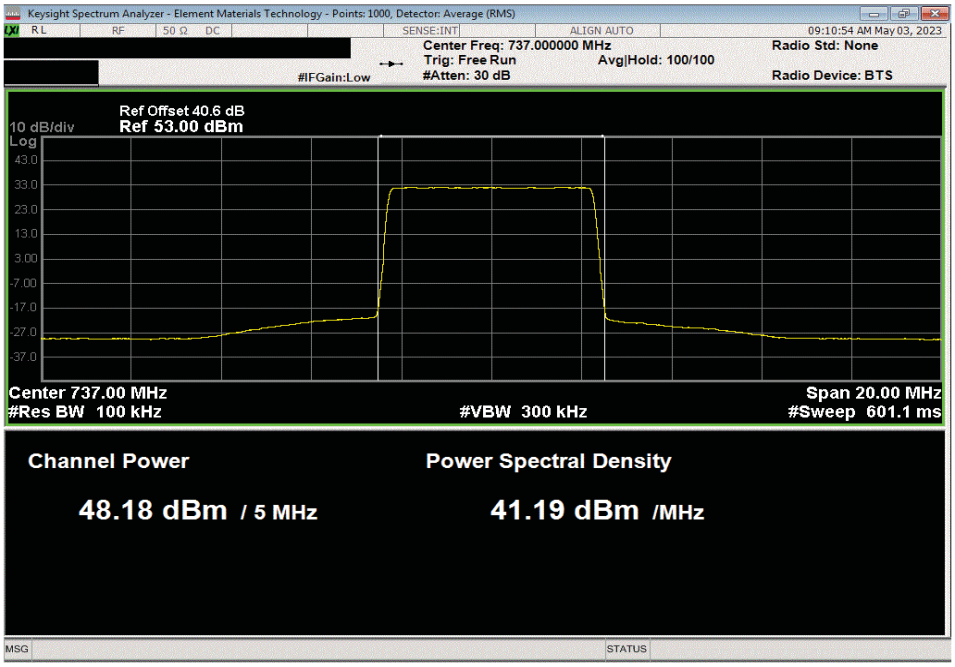
Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 5 MHz Bandwidth, QPSK Modulation, Mid Channel 737 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	Results
	48.034	0	48.034	51.034	54.034	



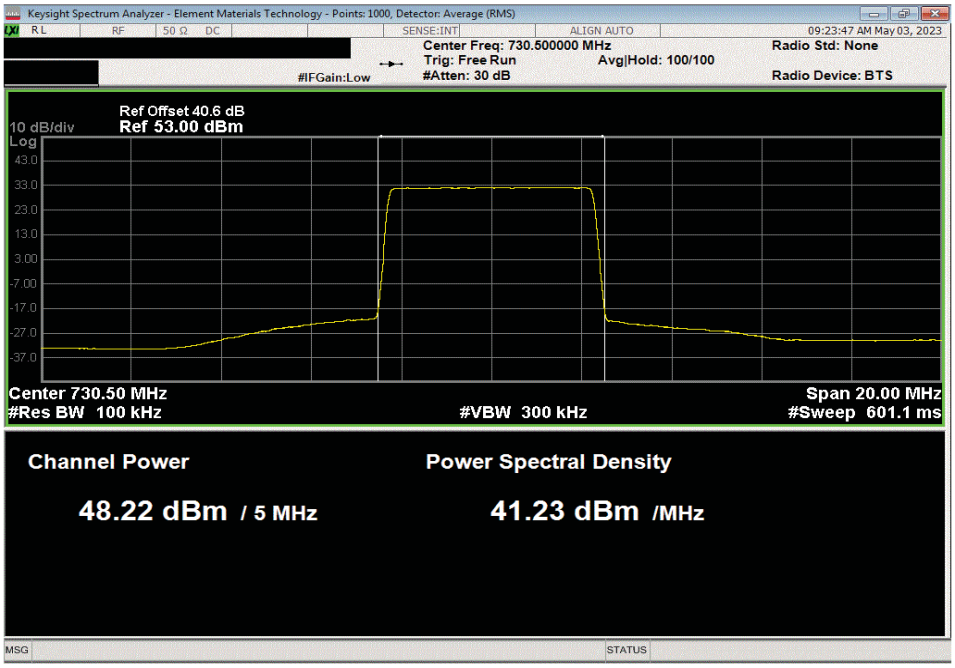
Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 5 MHz Bandwidth, 16-QAM Modulation, Mid Channel 737 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	Results
	47.987	0	47.987	50.987	53.987	



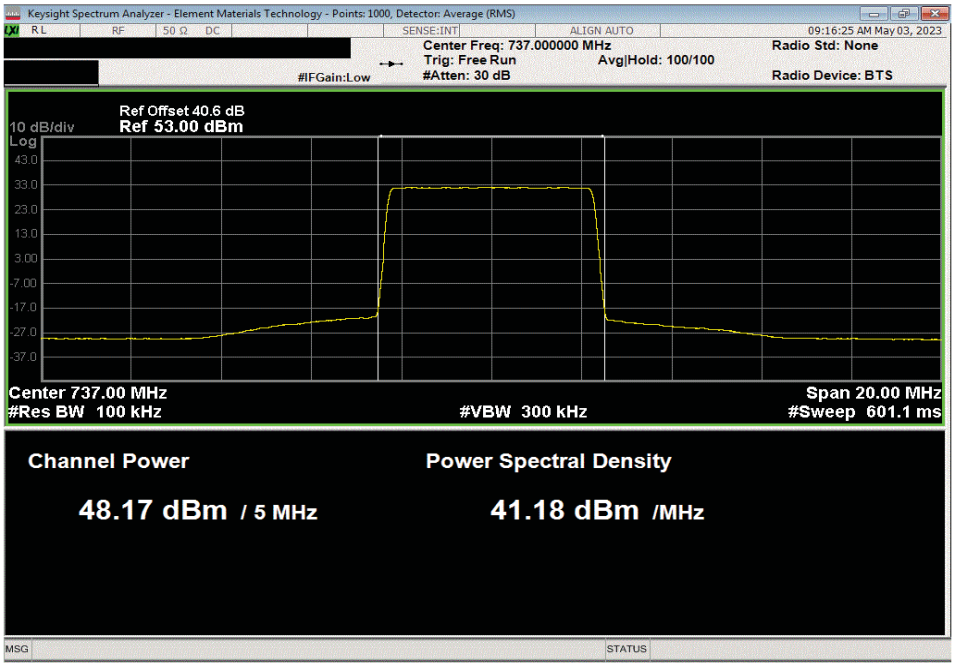
Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 5 MHz Bandwidth, 64-QAM Modulation, Mid Channel 737 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	Results
	48.182	0	48.182	51.182	54.182	



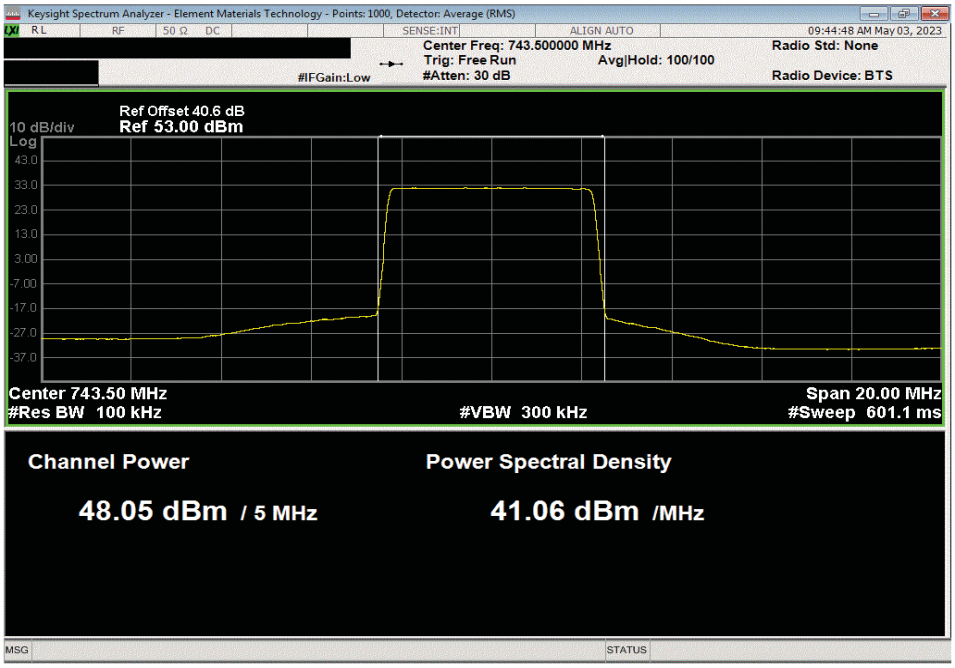
Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 5 MHz Bandwidth, 256-QAM Modulation, Low Channel 730.5 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	Results
	48.224	0	48.224	51.224	54.224	



Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 5 MHz Bandwidth, 256-QAM Modulation, Mid Channel 737 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	Results
	48.168	0	48.168	51.168	54.168	

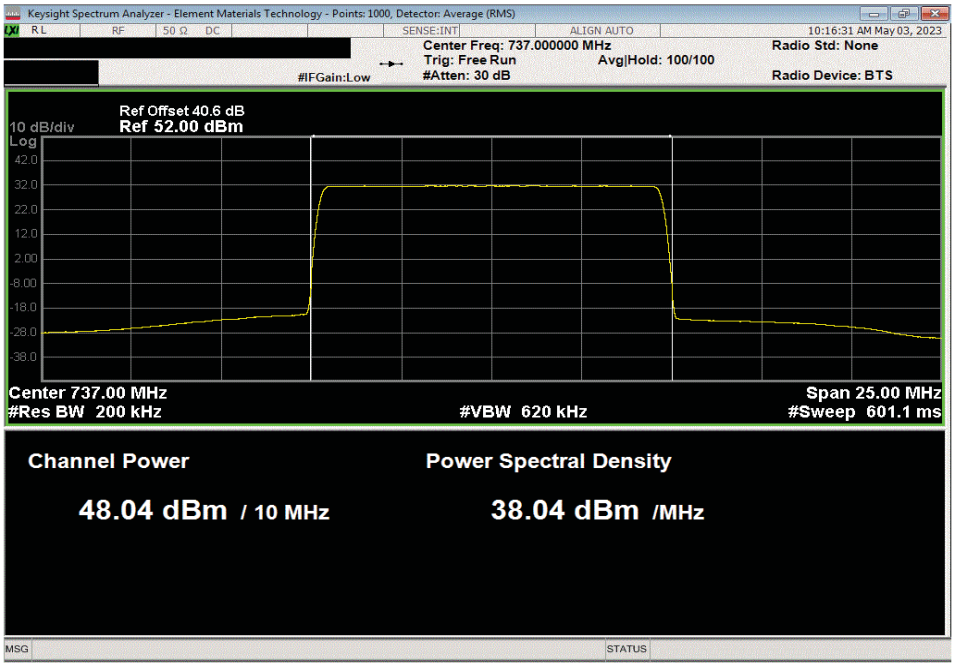


Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 5 MHz Bandwidth, 256-QAM Modulation, High Channel 743.5 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	Results
	48.047	0	48.047	51.047	54.047	

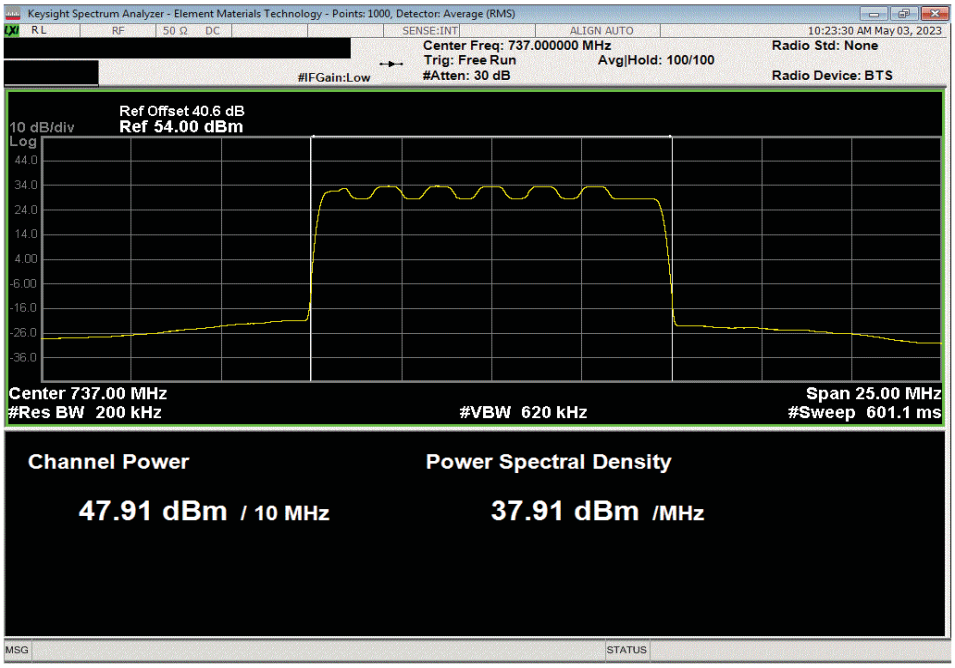


AVERAGE POWER - SINGLE CARRIER

Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 10 MHz Bandwidth, QPSK Modulation, Mid Channel 737 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	Results
	48.039	0	48.039	51.039	54.039	

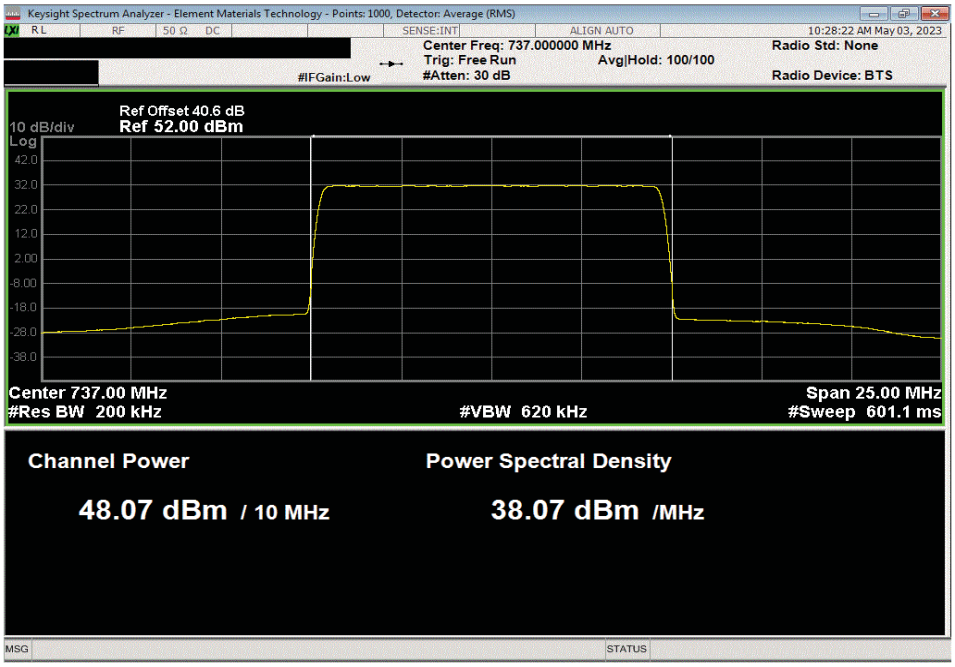


Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 10 MHz Bandwidth, 16-QAM Modulation, Mid Channel 737 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	Results
	47.911	0	47.911	50.911	53.911	

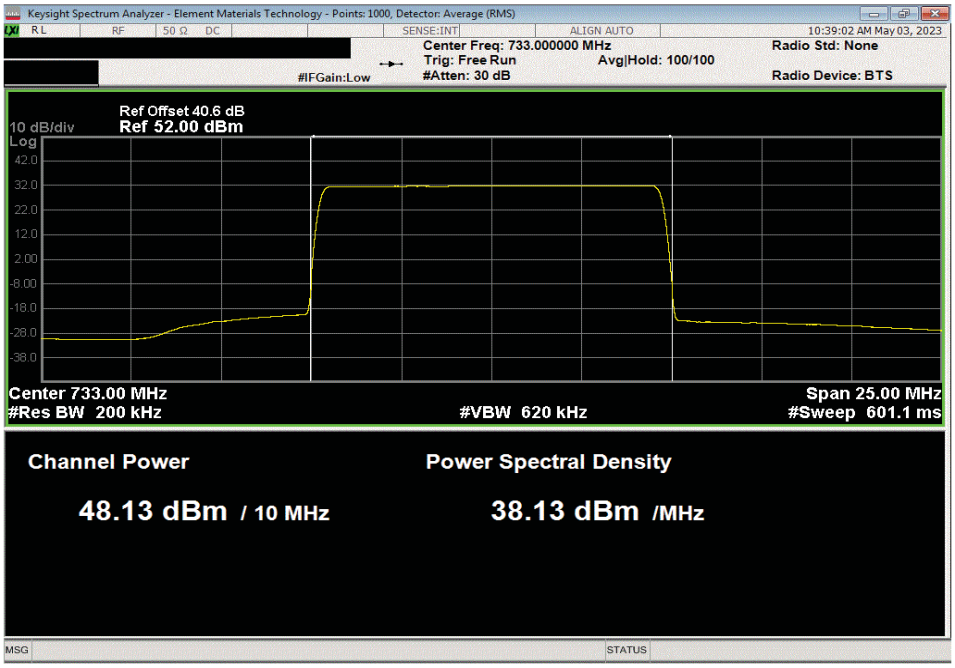


AVERAGE POWER - SINGLE CARRIER

Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 10 MHz Bandwidth, 64-QAM Modulation, Mid Channel 737 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	Results
	48.067	0	48.067	51.067	54.067	

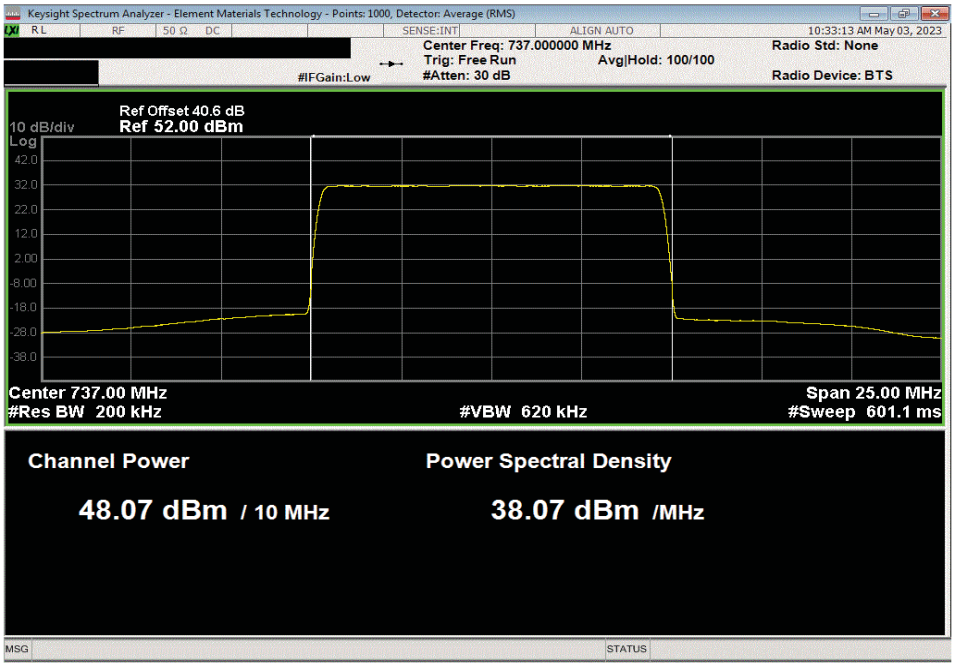


Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 10 MHz Bandwidth, 256-QAM Modulation, Low Channel 733 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	Results
	48.129	0	48.129	51.129	54.129	

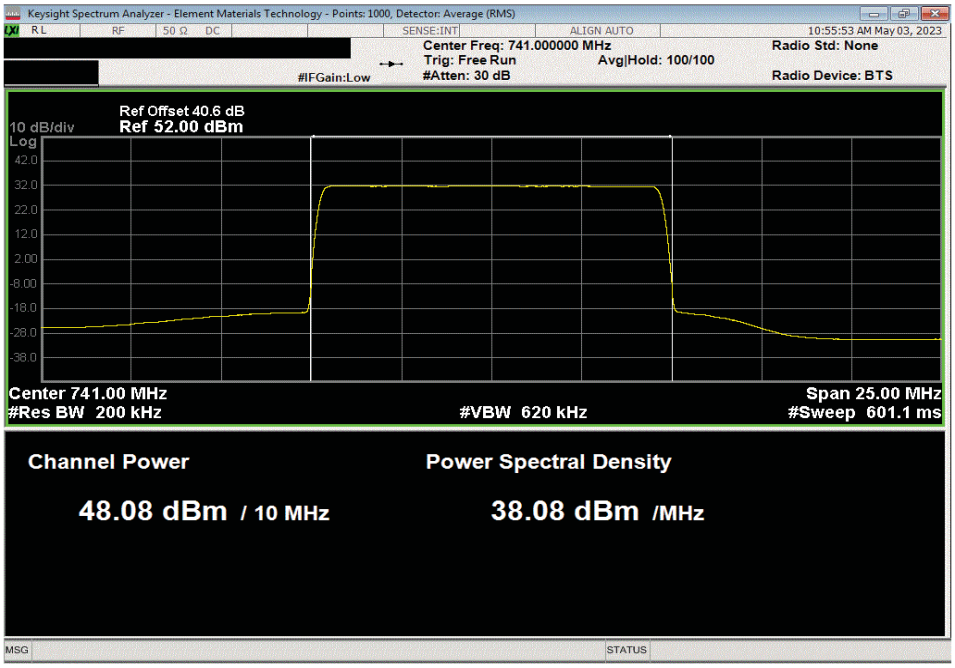


AVERAGE POWER - SINGLE CARRIER

Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 10 MHz Bandwidth, 256-QAM Modulation, Mid Channel 737 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	Results
	48.072	0	48.072	51.072	54.072	

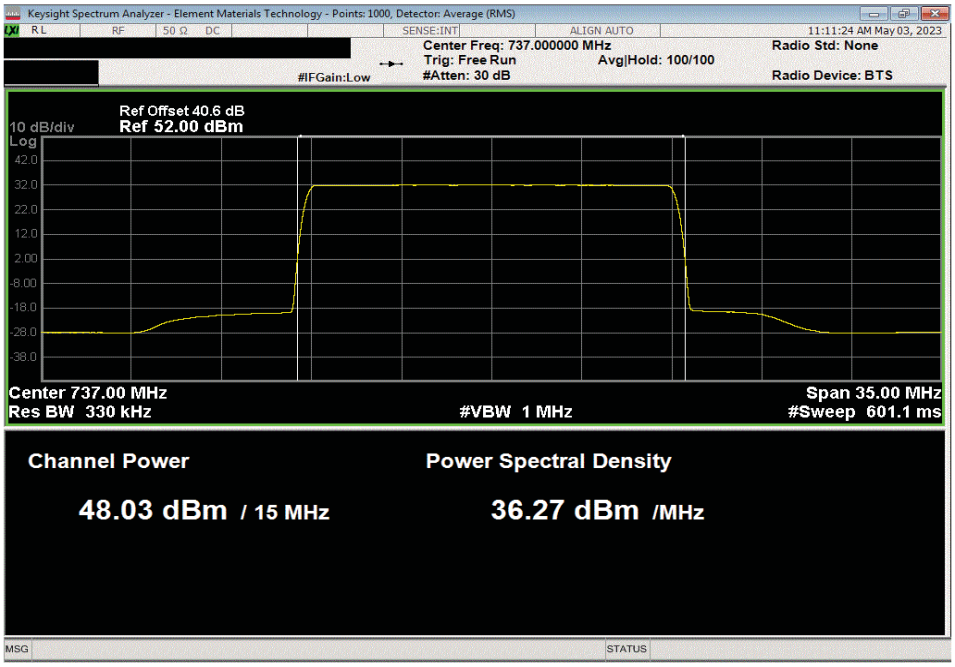


Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 10 MHz Bandwidth, 256-QAM Modulation, High Channel 741 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	Results
	48.078	0	48.078	51.078	54.078	

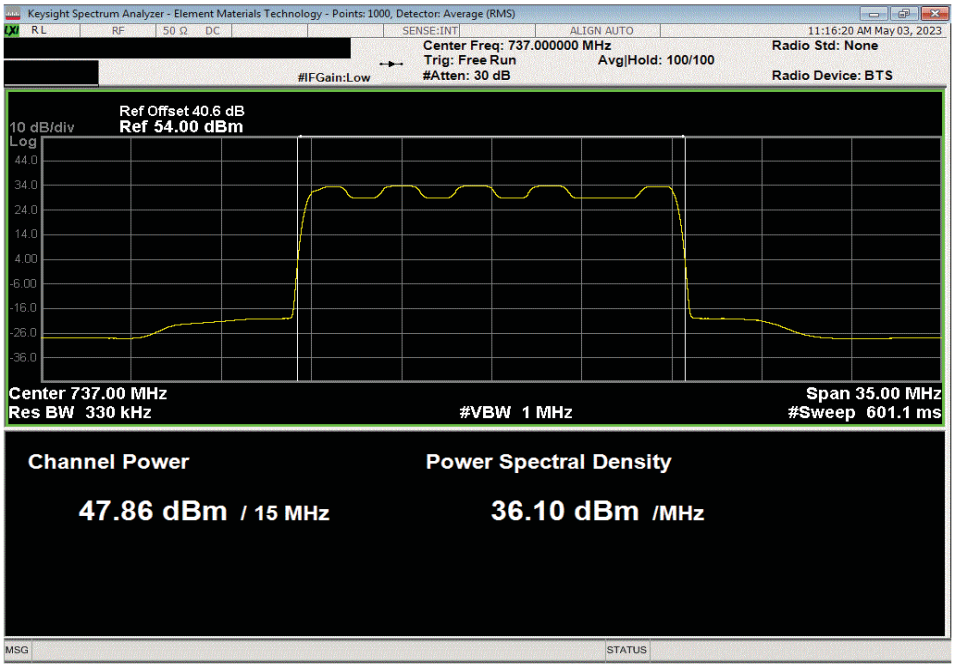


AVERAGE POWER - SINGLE CARRIER

Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 15 MHz Bandwidth, QPSK Modulation, Mid Channel 737 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	Results
	48.035	0	48.035	51.035	54.035	

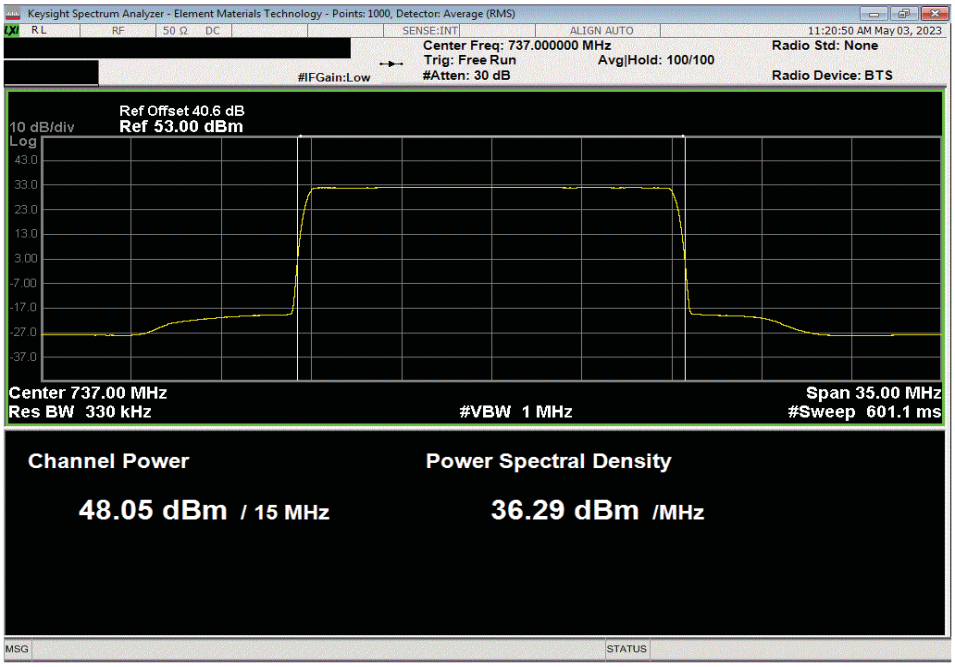


Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 15 MHz Bandwidth, 16-QAM Modulation, Mid Channel 737 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	Results
	47.862	0	47.862	50.862	53.862	

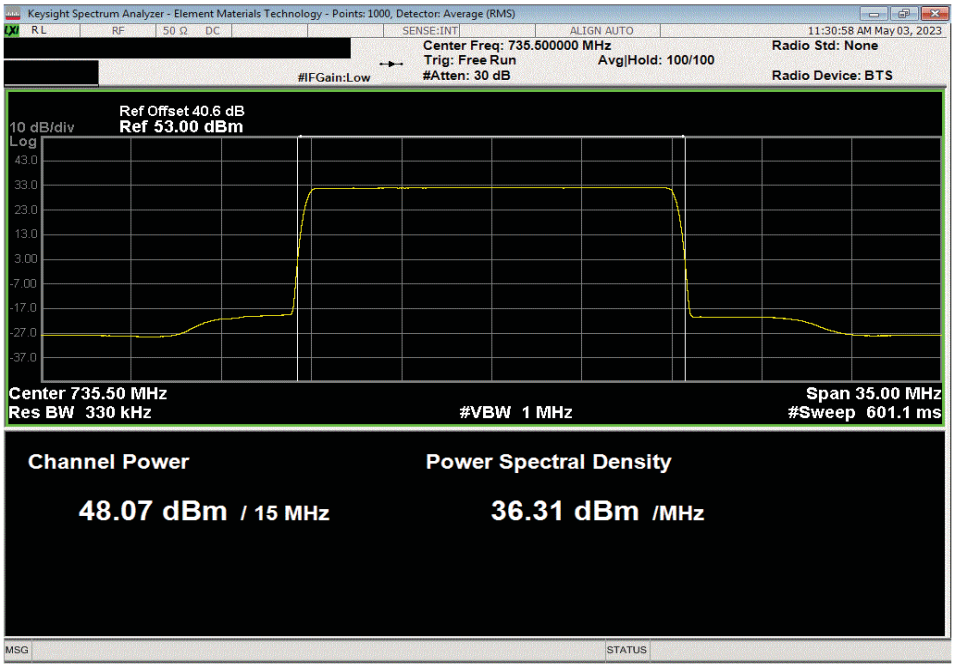


AVERAGE POWER - SINGLE CARRIER

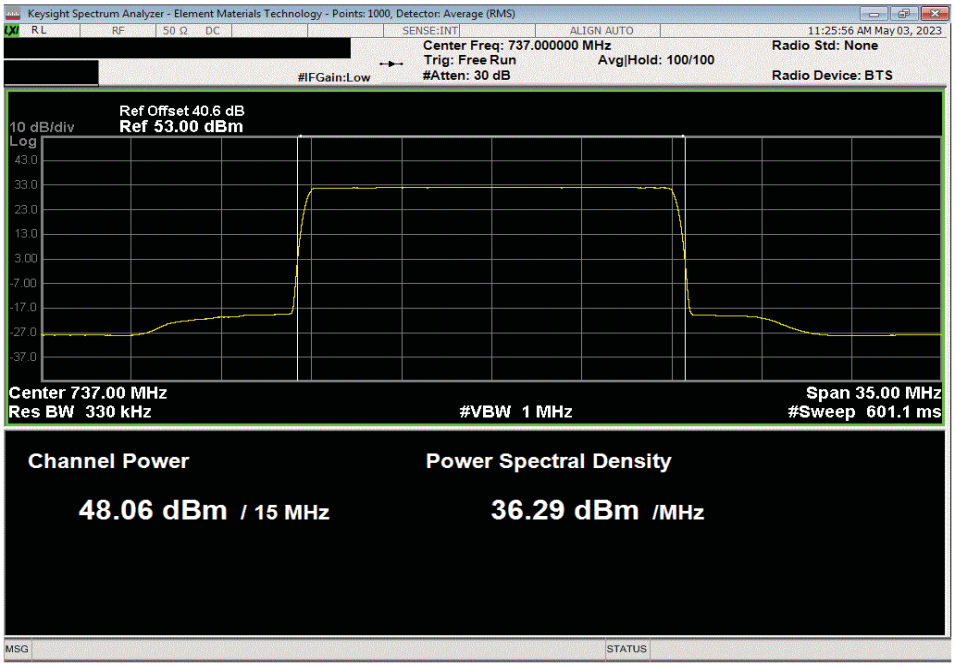
Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 15 MHz Bandwidth, 64-QAM Modulation, Mid Channel 737 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	Results
	48.049	0	48.049	51.049	54.049	



Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 15 MHz Bandwidth, 256-QAM Modulation, Low Channel 735.5 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	Results
	48.07	0	48.07	51.07	54.07	



Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 15 MHz Bandwidth, 256-QAM Modulation, Mid Channel 737 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	Results
	48.056	0	48.056	51.056	54.056	



Band n85 728 MHz - 746 MHz, 5G NR , Port 1, 15 MHz Bandwidth, 256-QAM Modulation, High Channel 738.5 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	Results
	48.065	0	48.065	51.065	54.065