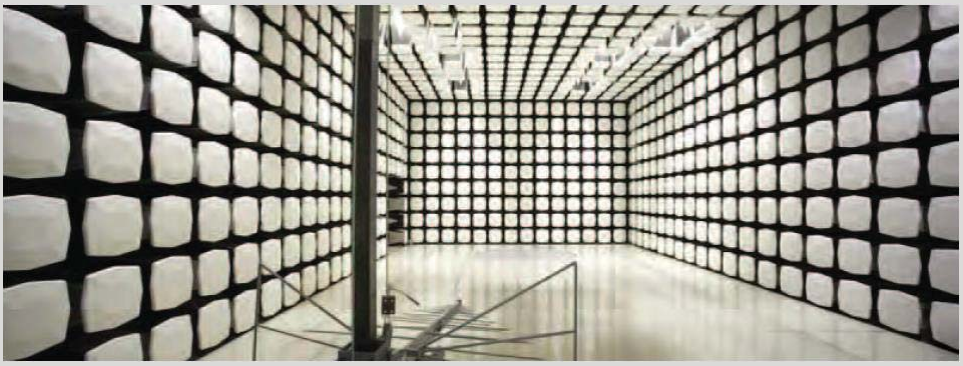
Radio Test Report
Application for Class II Permissive Change of Equipment Authorization

FCC Part 27
[2496MHz – 2690MHz]

FCC ID: VBNAZHL-01

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

Report: NOKI0067.0 Rev. 0, Issue Date: July 28, 2023



ACCREDITED
CERT #3310.03

TABLE OF CONTENTS

element
2023.04.17

Section	Page Number

CERTIFICATE OF TEST

Last Date of Test: July 14, 2023
Nokia Solutions and Networks
EUT: Airscale Base Transceiver Station Remote Radio Head Model AZHL

Radio Equipment Testing

Standards

Specification	Method
Code of Federal Regulations (CFR) Title 47 Part 2 CFR Title 47 Part 27 Subpart C	ANSI C63.26-2015 with FCC KDB 971168 D01 v03r01 FCC KDB 662911D01 v02r01 FCC KDB 662911D02 v01

Results

Test Description	Result	Comments
Duty Cycle	N/A	Not requested.
Occupied Bandwidth	Pass	
Frequency Stability	N/A	Not requested.
Output Power and EIRP Calculations	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

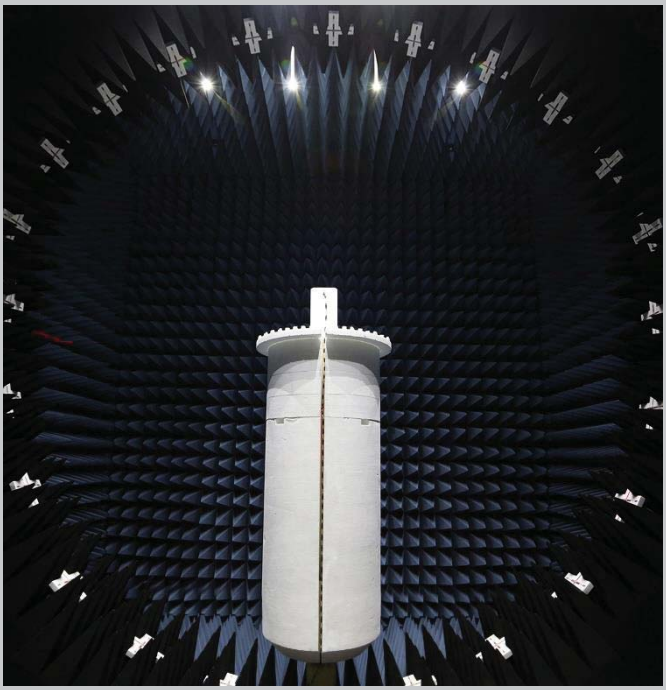
For details on the Scopes of our Accreditations, please visit:

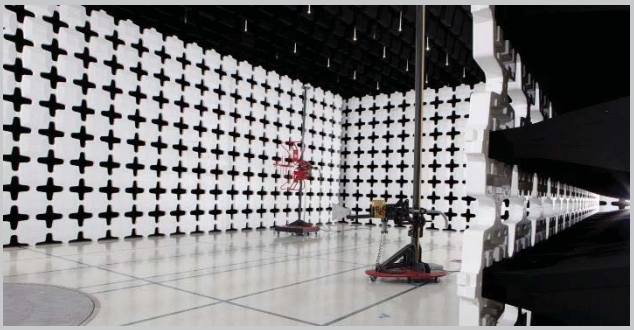
California Minnesota Oregon Texas Washington

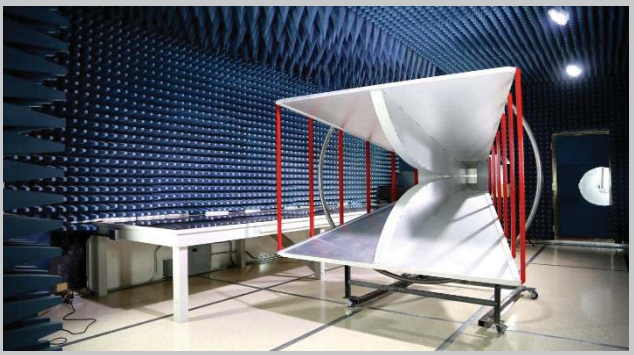
FACILITIES

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

element
RP.2023.05.08.0

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 Location: Texas

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

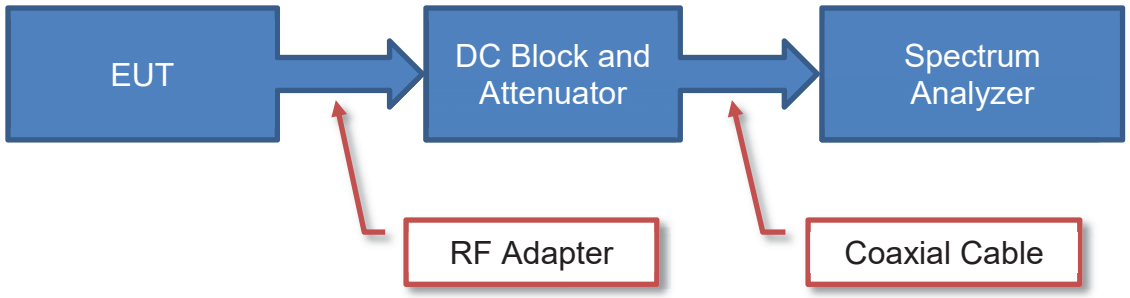
TEST SETUP BLOCK DIAGRAMS

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.

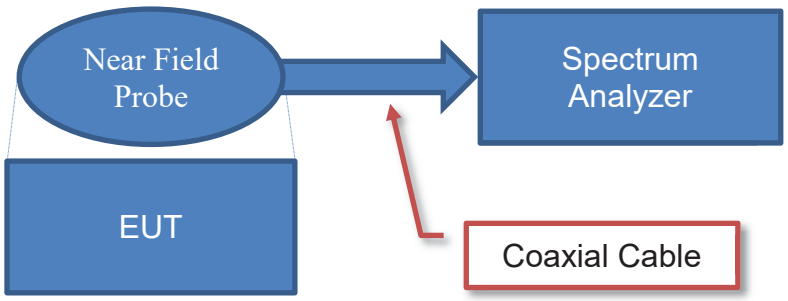
Antenna Port Conducted Measurements



Sample Calculation (logarithmic units)

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

Near Field Test Fixture Measurements

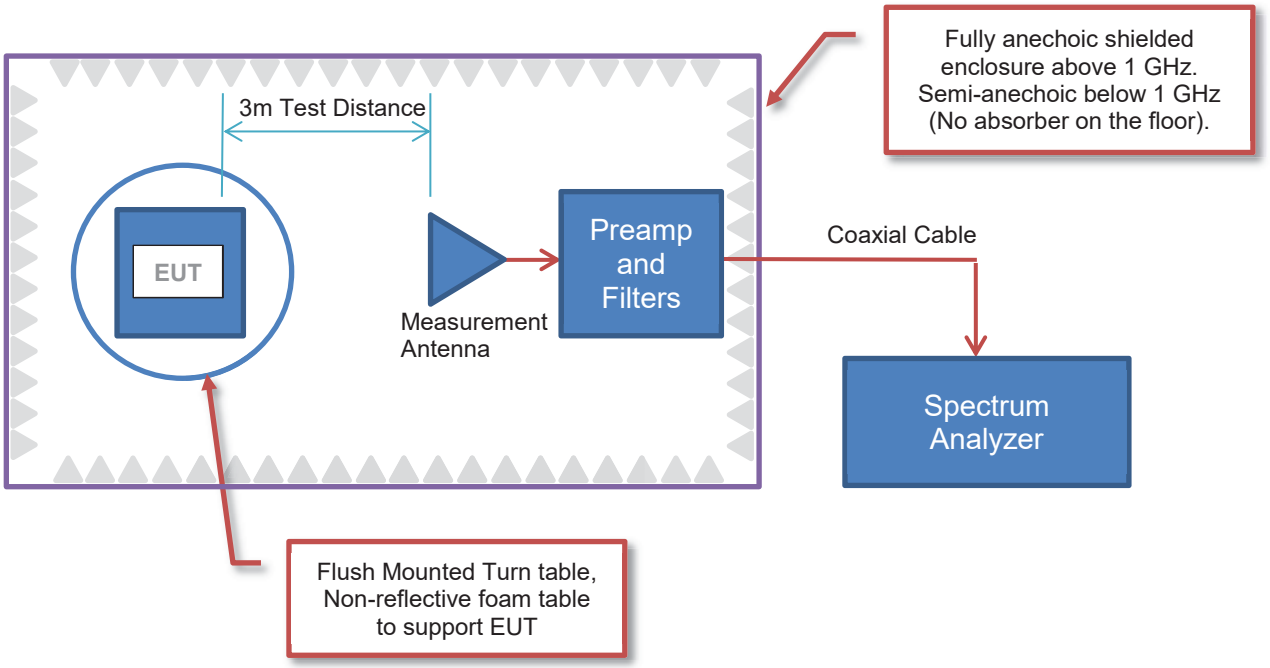


Sample Calculation (logarithmic units)

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**

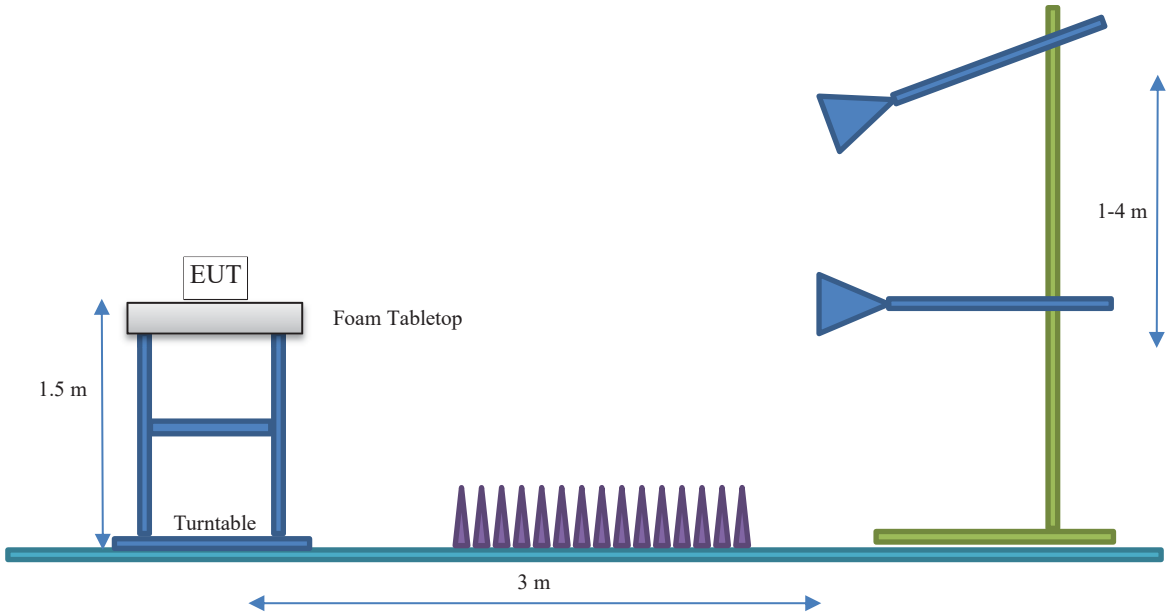
Radiated Power (ERP/EIRP) – Substitution Method:

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

element
2018-07-17

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 AZHL
First Date of Test:	July 13, 2023
Last Date of Test:	July 14, 2023
Receipt Date of Samples:	July 13, 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:

Remote Radio Head (RRH) variant AZHL is being developed under this effort. The AZHL is a multi-standard multi-carrier radio head designed to support 4G LTE TDD and 5G NR TDD. Previous FCC certification efforts demonstrated compliance for 4G LTE TDD single carrier LTE10, LTE15 and LTE20 channel bandwidths and for 5G NR TDD single carrier NR20, NR30, NR40, NR50, NR60, NR70, NR80, NR90 and NR100 channel bandwidths. This FCC permissive class 2 change effort is for add 5G NR TDD 10MHz channel bandwidth.
The AZHL RRH has 8 transmit/receive antenna ports that supports 3GPP frequency band 41/band n41 operations (BTS RX: 2496 to 2690 MHz/BTS TX: 2496 to 2690 MHz). The maximum RF output power of each antenna port is 40 watts. The total RF output power for the AZHL remote radio head is 320 watts (8 x 40 watts). The remote radio head software supports 10, 15, and 20MHz 4G LTE TDD bandwidths. The remote radio head software supports 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100MHz 5G NR TDD bandwidths. The maximum RF output power levels for single carrier operations are provided below.

Single Carrier Maximum RF Output Power per Port
for each
Radio Access Technology Channel Bandwidth

LTE10 & NR10	LTE15	LTE20 & NR20	NR30	NR40	NR50	NR60	NR70	NR80	NR90	NR100
4.0 W or 36.0dBm	5.6 W or 37.5dBm	7.5 W or 38.8dBm	11.3 W or 40.5dBm	15.0 W or 41.8dBm	18.8 W or 42.7dBm	22.5 W or 43.5dBm	26.3 W or 44.2dBm	30.0 W or 44.8dBm	33.8 W or 45.3dBm	40.0 W or 46.0dBm

The AZHL software supports four downlink modulation types (QPSK, 16QAM, 64QAM, and 256QAM) for 5G technologies. The 5G NR 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). Multicarrier operations will be verified/certified in a separate effort. The instantaneous bandwidth covers the full operational bandwidth.

The AZHL MIMO operating modes include 8T8R, 2x4T4R and 4x2T2R. The AZHL is designed to operate with cross-polarized (orthogonal radiators) antennas only. The eight transmit/receive ports connected to +45° cross-polarized (orthogonal) radiators (four ports are connected to +45° radiators/antennas and four ports are connected to the -45° radiators/antennas).
Tests to be performed include RF channel power, peak to average power ratio, emission bandwidth (99% and 26 dB down), band edge spurious emissions (+ 1MHz), and conducted spurious emissions.
The radiated emissions and frequency stability measurements performed in the original certification does not need to be 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.

3GPP Frequency Band n41 5G-NR Band Edge NR-ARFCNs

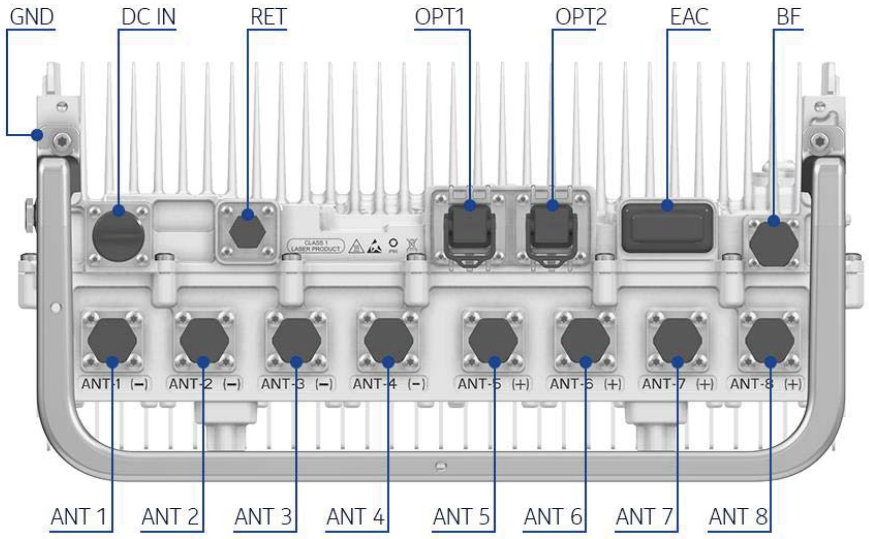
The 3GPP frequency band n41 (2496-2690 MHz) band edge NR-ARFCNs for 5G NR channel bandwidths (10, 20, 30, 40, 50, 60, 80, 90 and 100 MHz) are provided in Table below. The NR-ARFCN is defined as New Radio - Absolute Radio Frequency Channel Number.

	5G NR NR-ARFCN	Frequency (MHz)	5G NR Channel Bandwidth in MHz									
			10	20	30	40	50	60	70	80	90	100
AZHL Band n41 (Antennas 1 through 8)	Band Edge	2496.00	Lower Band Edge									
	.....											
	500202	2501.01	BC									
	.....											
	501204	2506.02		BC								
	.....											
	502200	2511.00			BC							
	.....											
	503202	2516.01				BC						
	.....											
	504204	2521.02					BC					
	.....											
	505200	2526.00						BC				
	.....											
	506202	2531.01							BC			
	.....											
	507204	2536.02								BC		
	.....											
	508200	2541.00									BC	
	.....											
	509202	2546.01										BC
	.....											
	518598	2592.99	Middle Channel									
	.....											
	528000	2640.00										TC
	.....											
	528996	2644.98									TC	
	.....											
	529998	2649.99								TC		
	.....											
	531000	2655.00							TC			
	.....											
	531996	2659.98						TC				
	.....											
	532998	2664.99					TC					
	.....											
	534000	2670.00				TC						
	.....											
	534996	2674.98			TC							
	.....											
	535998	2679.99		TC								
	.....											
	537000	2685.00	TC									
	.....											
	Band Edge	2690.00	Upper Band Edge									

AZHL Downlink Band Edge 5G NR Band n41 Frequency Channels

PRODUCT DESCRIPTION

AZHL Connector Layout:



EUT External Interfaces

Name	Qty	Connector Type	Purpose (and Description)
DC In	1	Screw Terminal	2-pole Power Input Terminal
GND	1	Screw lug (2xM5)	Ground
ANT	8	4.3-10	RF signal for Transmitter/Receiver (50 Ohm)
BF	1	4.3-10	Beamforming Calibration
EAC	1	MDR26	External Alarm Interface
OPT	2	SFP28	Optical CPRI Interface
RET	1	8-pin circular connector	AISG 2.0 to external devices
Fan	1	Nokia	Power for RRH Fan. Located on the side of RRH.

Testing Objective:

A class II permissive change on the original filing is being pursued to add additional 5G-NR 10MHz channel to the Airscale Base Transceiver Station Remote Radio Head Model AZHL FCC radio certification.

CONFIGURATIONS

Test Configuration 1 RF Conducted Emissions

Software/Firmware Running during test	
Description	**Version**
BTS Software Version (23R3)	SBTS23R3_ENB_9999_230510_000006
RF_SW	RF. ERM6.trunk.20230508.011

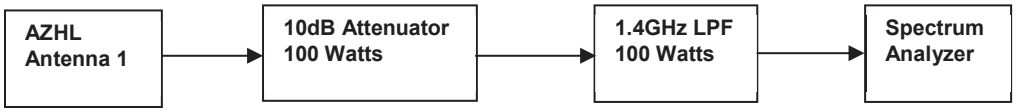
Equipment being tested (include Peripherals)			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
AMIA (AirScale Indoor Subrack)	Nokia Solutions and Networks	473098A.204	UK222201001
ASIB (BTS System Module)	Nokia Solutions and Networks	473764A.102	K9214331950
ABIO (BTS Baseband Module)	Nokia Solutions and Networks	475266A.104	DH223246455
AZHL (Radio Module Model)	Nokia Solutions and Networks	475432A.101	YK203400004
Low Pass Filter 1.4GHz/100W	Microwave Circuits,Inc.	L13502G1	SN2454-01
Attenuator 100W/10dB	Weinschel Corp	48-10-43-LIM	BJ1771
AOMC SFP28 + 9.8G,70M,850NM (BB)	Nokia	474900A.101	FR214716966
AOMC SFP28 + 9.8G,70M,850NM (RRH)	Nokia	474900A.101	FR214719852
ThinkPad T490 (WebEM- PC)	Lenovo	20N3S88012	PF26RVZ0
Keysight- DC System power supply	Keysight	N8757A	US21D4053S
FPAC (DC-PWR supply-BS)	Nokia	472805A.X21	A9124600282
(7) 2 Meter RF Load cables	RD Microwave Systems	CBL-6FT-NMNM-401J-N	19-1570-1941
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SR301
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SR297
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	PZ468
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SR303
250W -50ohm -Terminating Load	API Weinschel inc	1433-3-LIM	TC869
250W -50ohm -Terminating Load	API Weinschel inc	1433-3-LIM	MG870
250W -50ohm -Terminating Load	API Weinschel inc	1433-3-LIM	TC865
Fiber Optic cable 2m	Amphenol Fiber Optic	VZ1701	995741A
GPS cable 100m	FTSH	472577A.103	CA2029
FYGC GPS receiver	Nokia	474074A	1294000684
Cat-5e cable	CSA	LL73189	E151955
2 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297372
1 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_104	SN551431/4
Reference cable (Frame Clock & Trigger)	Pomona	2249	C-72
Reference cable (Frame Clock & Trigger)	Pomona	2249	C-48

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	AZHL
GPS Receiver Cable	Y	20 meters	N	ASIB	FYGB GPS receiver
Cat-5e Cable	Y	5 meters	N	ASIB	WebEM- PC
RD Microwave Systems – RF Load Cables (7)	Y	2 meters	N	EUT [AZHL] Ant ports 2-8	150W -50ohm/250W -50ohm -Load
Reference cables (Frame Clock & Trigger)	Y	1 meter	N	ASIB	Analyzer

Cables					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
HS-SUCOFLEX_106 0.5dB cable attenuator	Y	2 meters	N	EUT [AZHL] Ant port #1	Attenuator 100W/10dB
Attenuator 100W/10dB	N	N/A	N	RF cable HS-SUCOFLEX_106	Low Pass filter 1.4G/100W
Low Pass Filter 1.4G/100W	N	N/A	N	Attenuator 100W/10dB	RF cable HS-SUCOFLEX_104
HS-SUCOFLEX_104	Y	1 meter	N	Low Pass Filter 1.4G/100W	Analyzer

RF Test Setup Diagram:



CONFIGURATIONS

element
2018-07-17

Test Configuration 2 RF Conducted Emissions

Software/Firmware Running during test	
Description	**Version**
BTS Software Version (23R3)	SBTS23R3_ENB_9999_230510_000006
RF_SW	RF. ERM6.trunk.20230508.011

Equipment being tested (include Peripherals)			
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AZHL (Radio Module Model)	Nokia Solutions and Networks	475432A.101	YK203400004
Attenuator 250W/30dB	API Weinschel	58-30-34	LL627
AOMC SFP28 + 9.8G,70M,850NM (BB)	Nokia	474900A.101	FR214716966
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150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SR297
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	PZ468
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SR303
250W -50ohm -Terminating Load	API Weinschel inc	1433-3-LIM	TC869
250W -50ohm -Terminating Load	API Weinschel inc	1433-3-LIM	MG870
250W -50ohm -Terminating Load	API Weinschel inc	1433-3-LIM	TC865
Fiber Optic cable 2m	Amphenol Fiber Optic	VZ1701	995741A
GPS cable 100m	FTSH	472577A.103	CA2029
FYGC GPS receiver	Nokia	474074A	1294000684
Cat-5e cable	CSA	LL73189	E151955
2 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297372
1 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_104	SN551431/4
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CONFIGURATIONS

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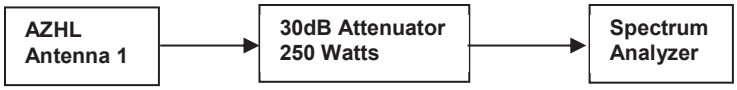
Reference cables (Frame Clock & Trigger)	Y	1 meter	N	ASIB	Analyzer

Cables					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
HS-SUCOFLEX_106	Y	2 meters	N	EUT [AZHL] Ant port #1	Attenuator 250W/30dB
Attenuator 250W/30dB	N	NA	N	HS-SUCOFLEX_106	RF cable HS-SUCOFLEX_104
HS-SUCOFLEX_104	Y	1 meter	N	Attenuator 250W/30dB	Analyzer

RF Test Setup Diagram:



CONFIGURATIONS

Test Configuration 3 RF Conducted Emissions

Software/Firmware Running during test	
Description	**Version**
BTS Software Version (23R3)	SBTS23R3_ENB_9999_230510_000006
RF_SW	RF. ERM6.trunk.20230508.011

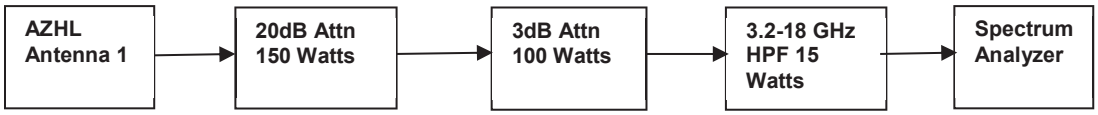
Equipment being tested (include Peripherals)			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
AMIA (AirScale Indoor Subrack)	Nokia Solutions and Networks	473098A.204	UK222201001
ASIB (BTS System Module)	Nokia Solutions and Networks	473764A.102	K9214331950
ABIO (BTS Baseband Module)	Nokia Solutions and Networks	475266A.104	DH223246455
AZHL (Radio Module Model)	Nokia Solutions and Networks	475432A.101	YK203400004
High Pass Filter 3.2-18GHz/15W	RF-Lambda	RHPF23G03G18	20121400045
Attenuator 150W/20dB	Aeroflex Weinschel	66-20-33	BZ1163
Attenuator 100W/3dB	Aeroflex Weinschel	47-3-33	CC7387
AOMC SFP28 + 9.8G,70M,850NM (BB)	Nokia	474900A.101	FR214716966
AOMC SFP28 + 9.8G,70M,850NM (RRH)	Nokia	474900A.101	FR214719852
ThinkPad T490 (WebEM- PC)	Lenovo	20N3S88012	PF26RVZ0
Keysight- DC System power supply	Keysight	N8757A	US21D4053S
FPAC (DC-PWR supply-BS)	Nokia	472805A.X21	A9124600282
(7) 2 Meter RF Load cables	RD Microwave Systems	CBL-6FT-NMNM-401J-N	19-1570-1941
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SR301
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SR297
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	PZ468
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SR303
250W -50ohm -Terminating Load	API Weinschel inc	1433-3-LIM	TC869
250W -50ohm -Terminating Load	API Weinschel inc	1433-3-LIM	MG870
250W -50ohm -Terminating Load	API Weinschel inc	1433-3-LIM	TC865
Fiber Optic cable 2m	Amphenol Fiber Optic	VZ1701	995741A
GPS cable 100m	FTSH	472577A.103	CA2029
FYGC GPS receiver	Nokia	474074A	1294000684
Cat-5e cable	CSA	LL73189	E151955
2 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297372
1 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_104	SN551431/4
Reference cable (Frame Clock & Trigger)	Pomona	2249	C-72
Reference cable (Frame Clock & Trigger)	Pomona	2249	C-48

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	AZHL
GPS Receiver Cable	Y	20 meters	N	ASIB	FYGB GPS receiver
Cat-5e Cable	Y	5 meters	N	ASIB	WebEM- PC
RD Microwave Systems – RF Load Cables (7)	Y	2 meters	N	EUT [AZHL] Ant ports 2-8	150W - 50ohm/250W - 50ohm -Load
Reference cables (Frame Clock & Trigger)	Y	1 meter	N	ASIB	Analyzer

Cables					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
HS-SUCOFLEX_106	Y	2 meters	N	EUT [AZHL] Ant Port #1	Attenuator 150W/20dB
Attenuator 150W/20dB	N	NA	N	RF cable HS-SUCOFLEX_106	Attenuator 100W/3dB
Attenuator 100W/3dB	N	NA	N	Attenuator 150W/20dB	High Pass Filter 3.2-18GHz/15W
High Pass Filter 3.2-18GHz/15W	N	NA	N	Attenuator 100W/3dB	RF cable HS-SUCOFLEX_104
HS-SUCOFLEX_104	Y	1 meter	N	High Pass Filter 3.2-18GHz/15W	Analyzer

RF Test Setup Diagram:



CONFIGURATIONS

Test Configuration 4 RF Conducted Emissions

Software/Firmware Running during test	
Description	**Version**
BTS Software Version (23R3)	SBTS23R3_ENB_9999_230510_000006
RF_SW	RF. ERM6.trunk.20230508.011

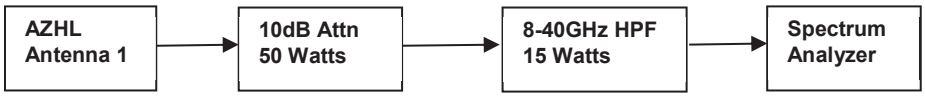
Equipment being tested (include Peripherals)			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
AMIA (AirScale Indoor Subrack)	Nokia Solutions and Networks	473098A.204	UK222201001
ASIB (BTS System Module)	Nokia Solutions and Networks	473764A.102	K9214331950
ABIO (BTS Baseband Module)	Nokia Solutions and Networks	475266A.104	DH223246455
AZHL (Radio Module Model)	Nokia Solutions and Networks	475432A.101	YK203400004
Attenuator 50W/10dB	RF-Lambda	RFS50G26S10FF	20031702
High Pass Filter 8-40GHz/15W	RF-Lambda	RHPF23G08G40	17102700014
AOMC SFP28 + 9.8G,70M,850NM (BB)	Nokia	474900A.101	FR214716966
AOMC SFP28 + 9.8G,70M,850NM (RRH)	Nokia	474900A.101	FR214719852
ThinkPad T490 (WebEM- PC)	Lenovo	20N3S88012	PF26RVZ0
Keysight- DC System power supply	Keysight	N8757A	US21D4053S
FPAC (DC-PWR supply-BS)	Nokia	472805A.X21	A9124600282
(7) 2 Meter RF Load cables	RD Microwave Systems	CBL-6FT-NMNM-401J-N	19-1570-1941
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SR301
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SR297
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	PZ468
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SR303
250W -50ohm -Terminating Load	API Weinschel inc	1433-3-LIM	TC869
250W -50ohm -Terminating Load	API Weinschel inc	1433-3-LIM	MG870
250W -50ohm -Terminating Load	API Weinschel inc	1433-3-LIM	TC865
Fiber Optic cable 2m	Amphenol Fiber Optic	VZ1701	995741A
GPS cable 100m	FTSH	472577A.103	CA2029
FYGC GPS receiver	Nokia	474074A	1294000684
Cat-5e cable	CSA	LL73189	E151955
2 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_104	SN185855/4
1 Meter RF cable	RF-Lambda	RFC6767A-B7RU1219	AC20040004
Reference cable (Frame Clock & Trigger)	Pomona	2249	C-72
Reference cable (Frame Clock & Trigger)	Pomona	2249	C-48

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	AZHL
GPS Receiver Cable	Y	20 meters	N	ASIB	FYGB GPS receiver
Cat-5e Cable	Y	5 meters	N	ASIB	WebEM- PC
RD Microwave Systems – RF Cables (7)	Y	2 meters	N	EUT [AZHL] Ant ports 2-8	150W -50ohm/250W -50ohm -Load
Reference cables (Frame Clock & Trigger)	Y	1 meter	N	ASIB	Analyzer

Cables					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
HS-SUCOFLEX_104	Y	2 meters	N	EUT [AZHL] Ant port #1	Attenuator 50W/10dB
Attenuator 50W/10dB	N	NA	N	RF cable HS-SUCOFLEX_104	High Pass Filter 8-40GHz/15W
High Pass Filter 8-40GHz/15W	N	NA	N	Attenuator 50W/10dB	RF-Lambda - AC20040004
RF-Lambda - AC20040004	Y	1 meter	N	High Pass Filter 8-40GHz/15W	Analyzer

RF Test Setup Diagram:



MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2023-07-14	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.
2	2023-07-14	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.
3	2023-07-14	Output Power	Tested as delivered to test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
4	2023-07-14	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	2023-07-14	Spurious Conducted Emissions	Tested as delivered to test Station.	No EMI suppression devices were added or modified during this test.	Schedule testing was completed.

OCCUPIED BANDWIDTH

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	SD3235-2148	ANF	2023-05-24	2024-05-24
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2023-02-09	2024-02-09
Generator - Signal	Agilent	N5183A	TID	2023-05-12	2025-05-12

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 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

RF conducted emissions testing was performed only on one port. The AZHL antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown during output power testing on 8 ports) 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, 6.4.

The 99% bandwidth was measured utilizing the analyzer's peak detector and measuring the carrier's 26 dB occupied bandwidth based on the peak output power level measured. A plot was taken to show the occupied bandwidth is contained within the allowable transmit band. FCC 27.53(m)(6) defines the emission bandwidth to be used as 26dB down.

The occupied bandwidth was measured with the EUT configured in the modes called out in the data sheets.

Band n41 (2496 MHz to 2690 MHz) Emission Designators derived from the measurement results

FCC Emission Designators for 5G-NR Band n41 (2496MHz to 2690MHz)					
Ch BW	Radio Channel	QPSK	16QAM	64QAM	256QAM
10MHz	Low	9M78G7W	9M77G7W	9M75G7W	9M77G7W
	Mid	9M79G7W	9M67G7W	9M74G7W	9M76G7W
	High	9M79G7W	9M69G7W	9M79G7W	9M74G7W
Note: FCC emission designators are based on 26dB emission bandwidth.					

OCCUPIED BANDWIDTH

TbtTx 2022.05.02.0 XMit 2023.02.14.0

EUT:	**AZHL**			**Work Order:**	**NOKI0067**
Serial Number:	**YK203400004**			**Date:**	**07/14/2023**
Customer:	**Nokia Solutions and Networks**			**Temperature:**	**22°C**
Attendees:	**David Le, Mitchell Hill**			**Humidity:**	**52.2%**
Project:	**None**			**Barometric Pres.:**	**1016 mbar**
Tested by:	**Brandon Hobbs**	**Power:**	**54VDC**	**Job Site:**	**TX07**

TEST SPECIFICATIONS	**Test Method**
FCC 27:2023	ANSI C63.26:2015

COMMENTS

All measurement path losses were accounted for in the reference level offest including any attenuators, filters and DC blocks. Band n41 carriers are enabled at maximum power (4 Watts/carrier).

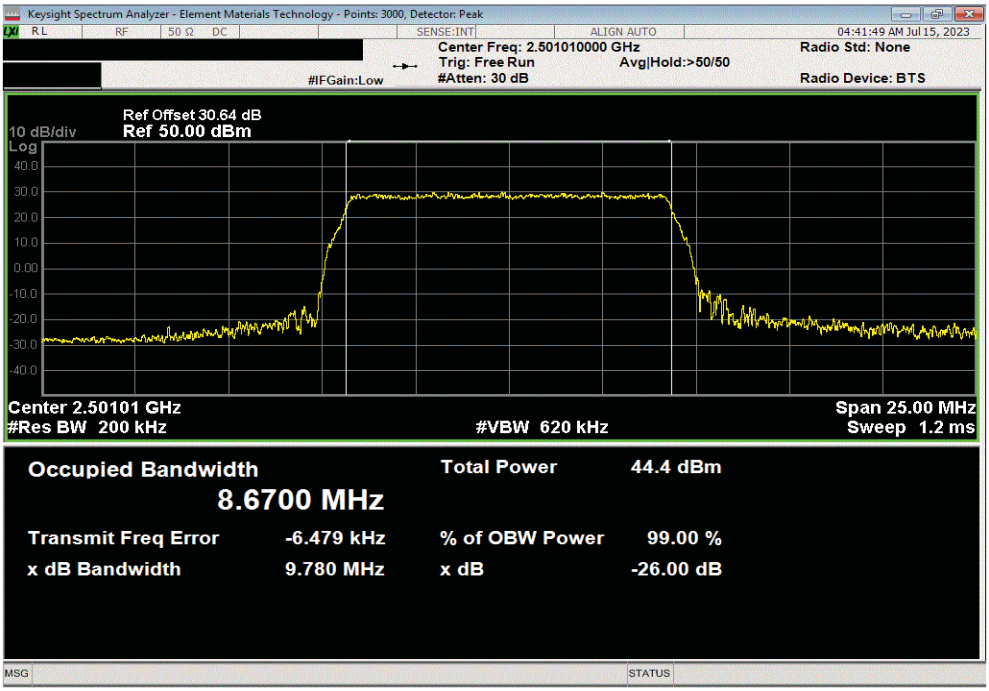
DEVIATIONS FROM TEST STANDARD

None

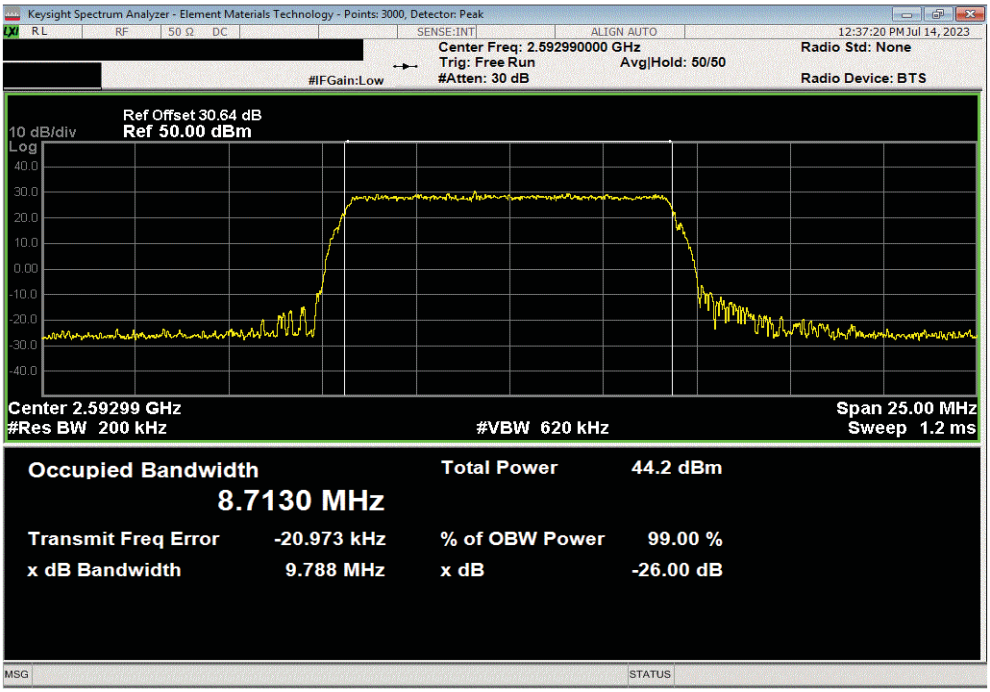
Configuration #	**NOKI0067-2**	*Signature*

	Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
Port 1				
Band n41, 2496 - 2690 MHz				
10 MHz Bandwidth				
QPSK Modulation				
Low Channel, 2501.01 MHz	8.67	9.78	Within Band	Pass
Mid Channel, 2592.99 MHz	8.71	9.79	Within Band	Pass
High Channel, 2685.00 MHz	8.68	9.79	Within Band	Pass
16QAM Modulation				
Low Channel, 2501.01 MHz	8.64	9.77	Within Band	Pass
Mid Channel, 2592.99 MHz	8.65	9.67	Within Band	Pass
High Channel, 2685.00 MHz	8.65	9.69	Within Band	Pass
64QAM Modulation				
Low Channel, 2501.01 MHz	8.69	9.75	Within Band	Pass
Mid Channel, 2592.99 MHz	8.69	9.74	Within Band	Pass
High Channel, 2685.00 MHz	8.68	9.79	Within Band	Pass
256QAM Modulation				
Low Channel, 2501.01 MHz	8.67	9.77	Within Band	Pass
Mid Channel, 2592.99 MHz	8.67	9.76	Within Band	Pass
High Channel, 2685.00 MHz	8.66	9.74	Within Band	Pass

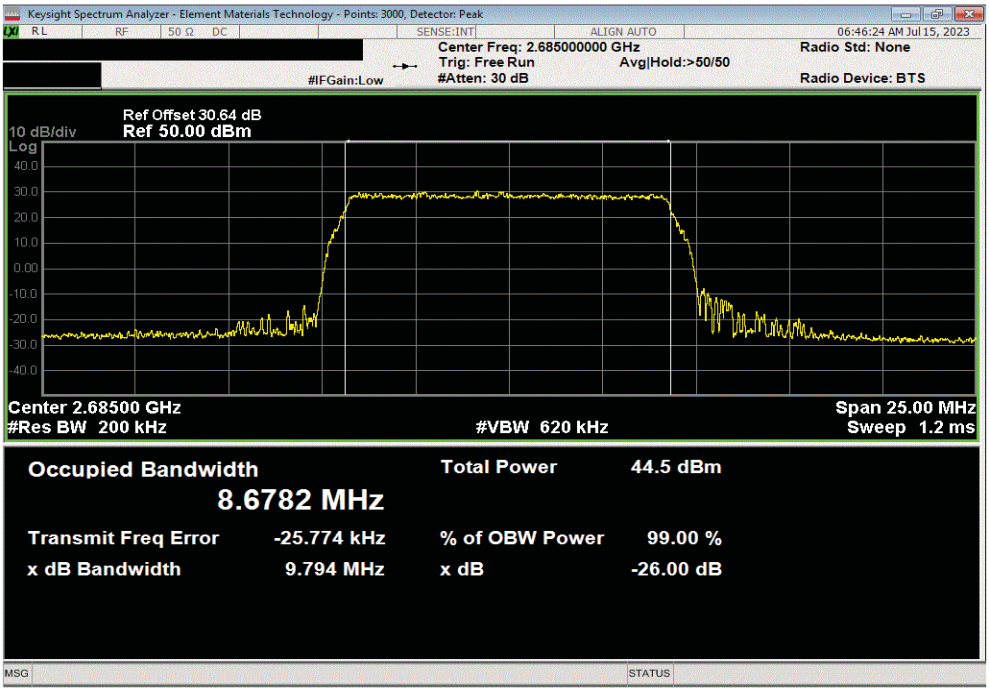
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, QPSK Modulation, Low Channel, 2501.01 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			8.67	9.78	Within Band	Pass



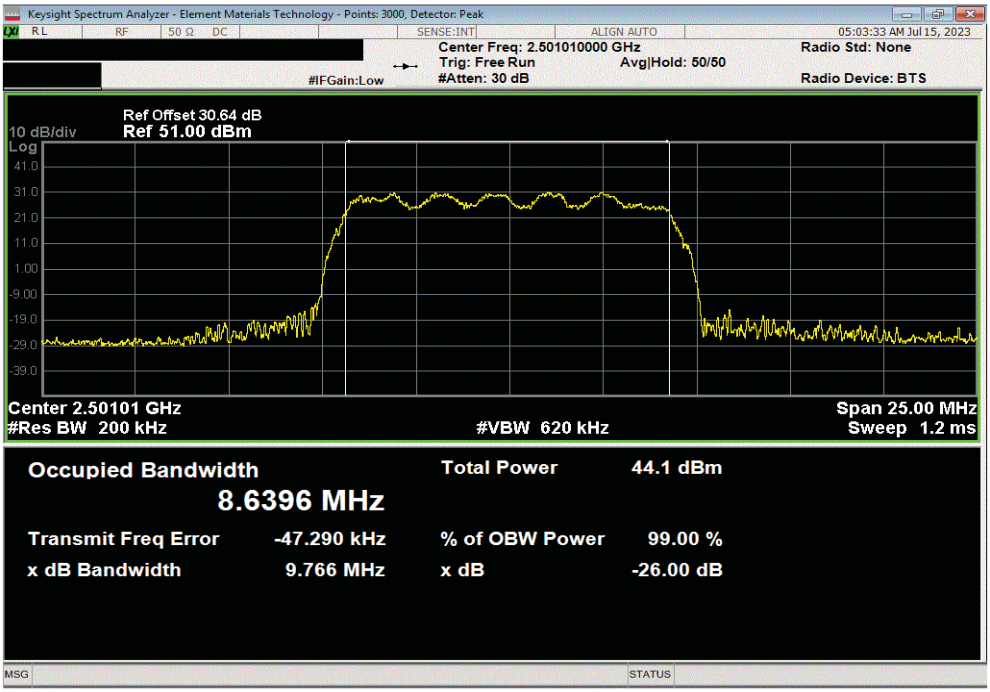
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, QPSK Modulation, Mid Channel, 2592.99 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			8.713	9.788	Within Band	Pass



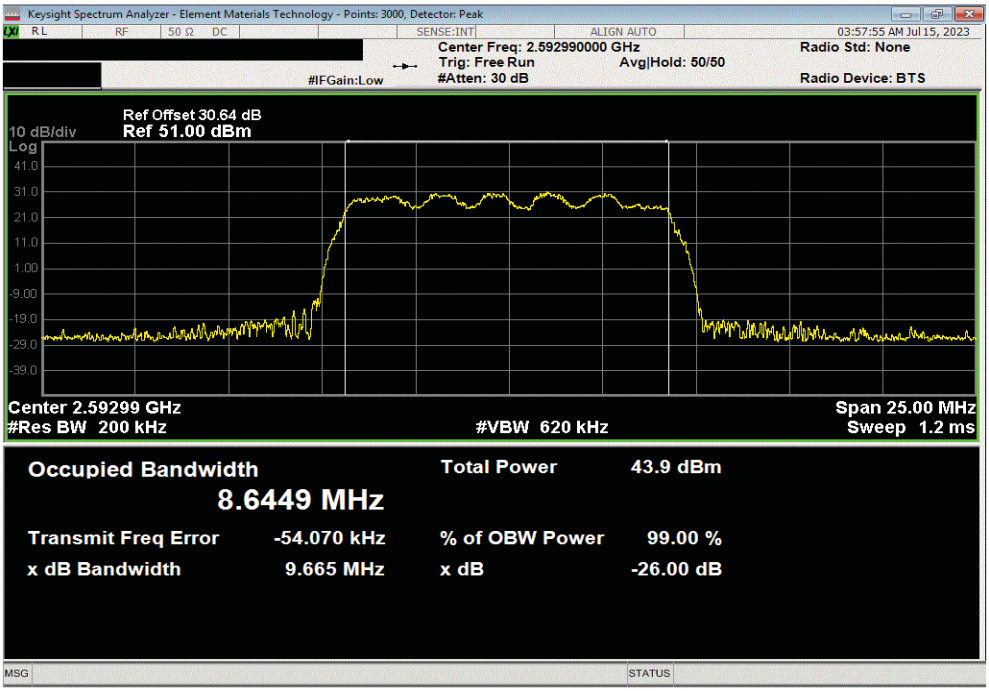
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, QPSK Modulation, High Channel, 2685.00 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			8.678	9.794	Within Band	Pass



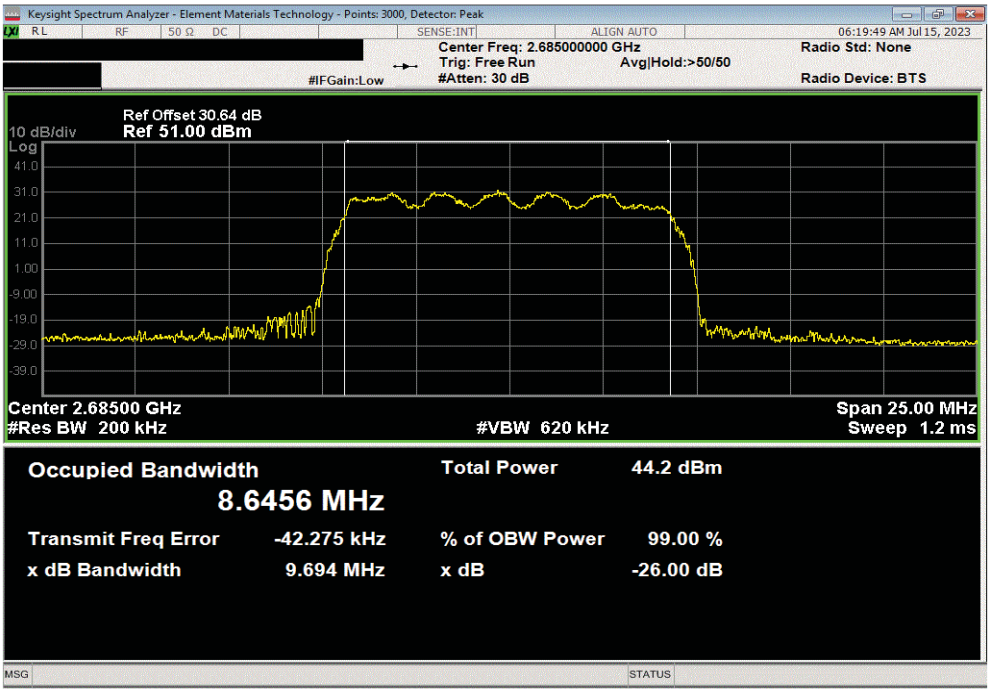
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 16QAM Modulation, Low Channel, 2501.01 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			8.64	9.766	Within Band	Pass



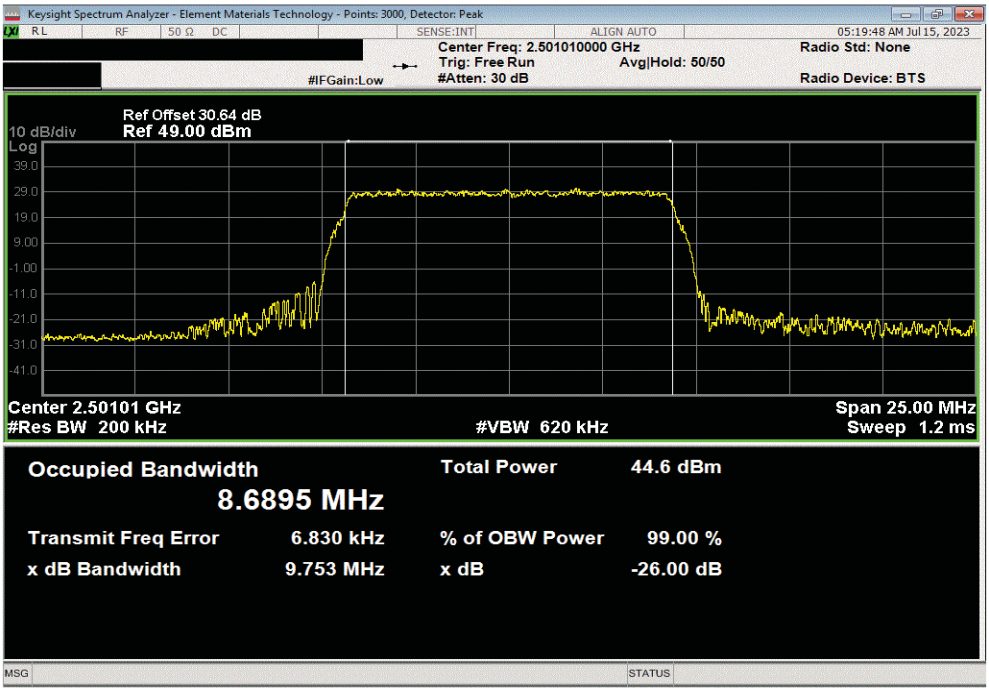
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 16QAM Modulation, Mid Channel, 2592.99 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			8.645	9.665	Within Band	Pass



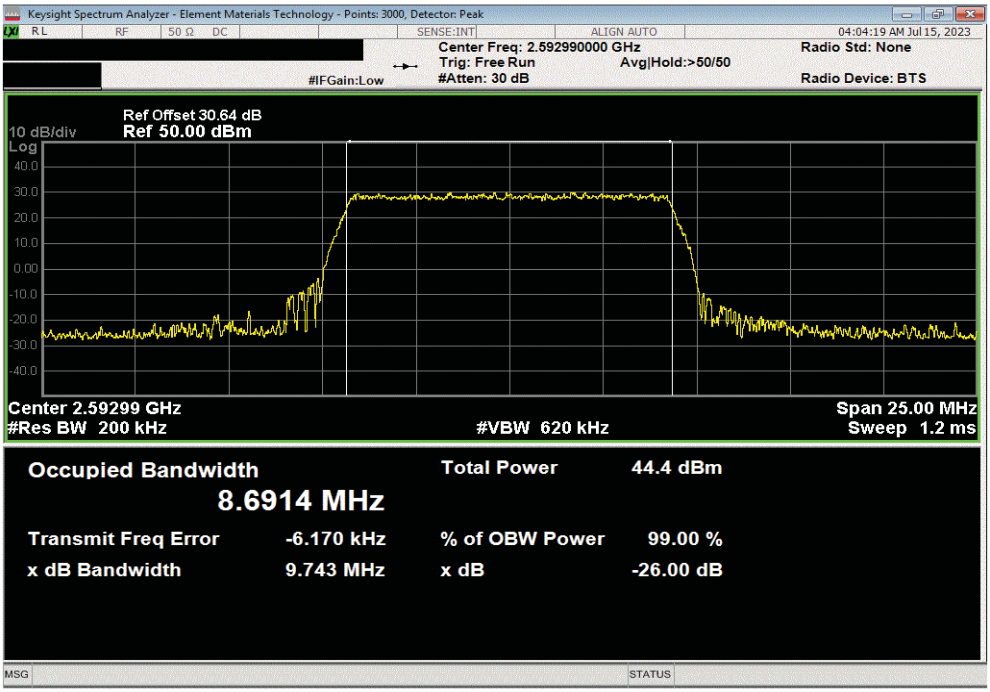
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 16QAM Modulation, High Channel, 2685.00 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			8.646	9.694	Within Band	Pass



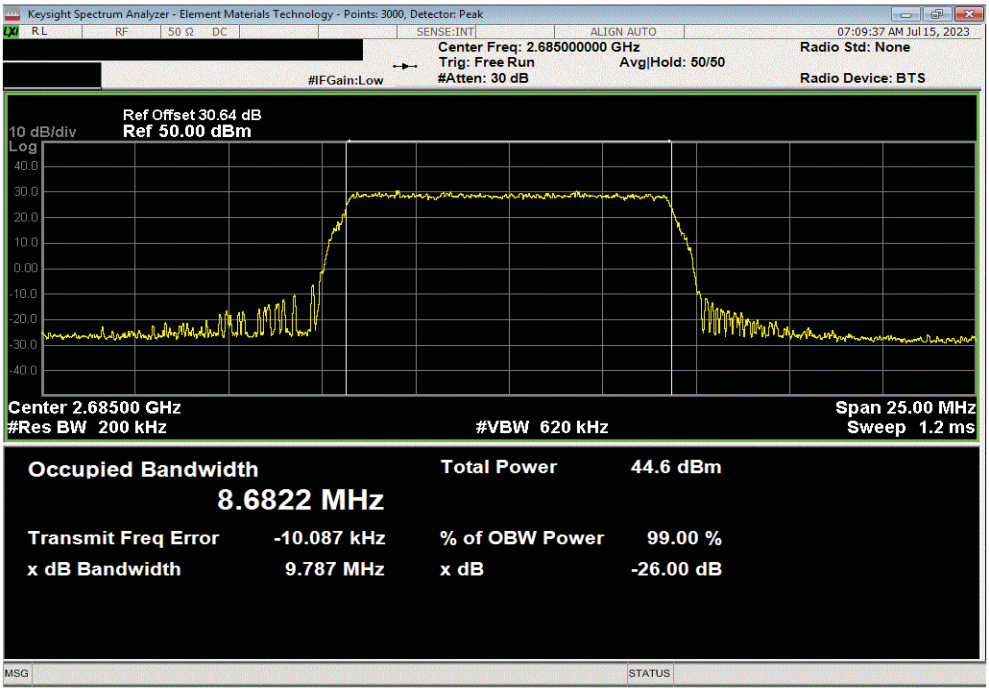
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 64QAM Modulation, Low Channel, 2501.01 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			8.689	9.753	Within Band	Pass



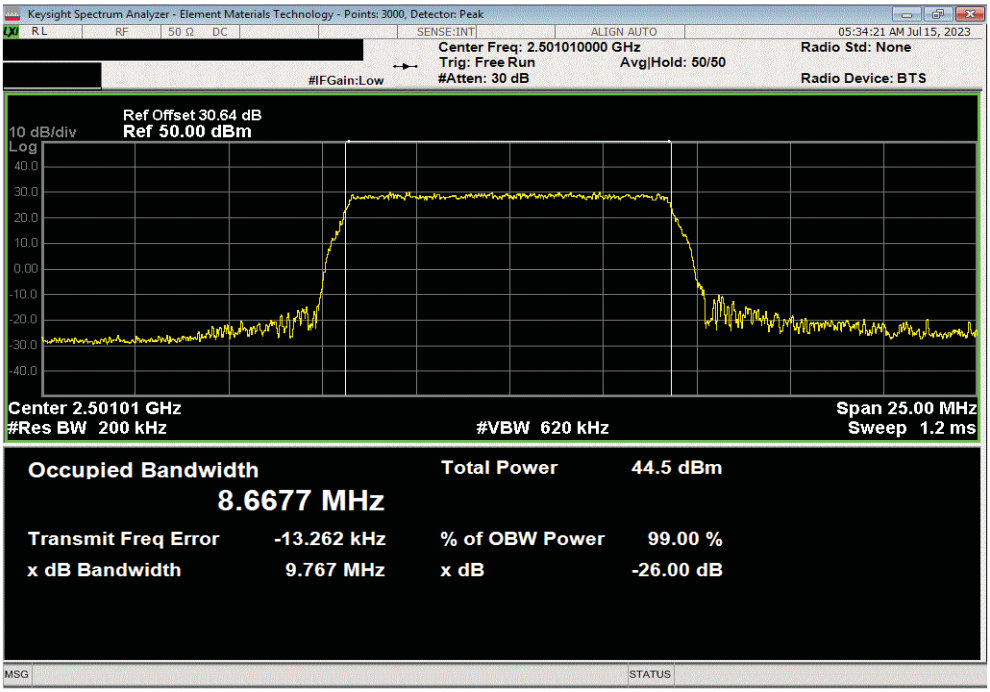
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 64QAM Modulation, Mid Channel, 2592.99 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			8.691	9.743	Within Band	Pass



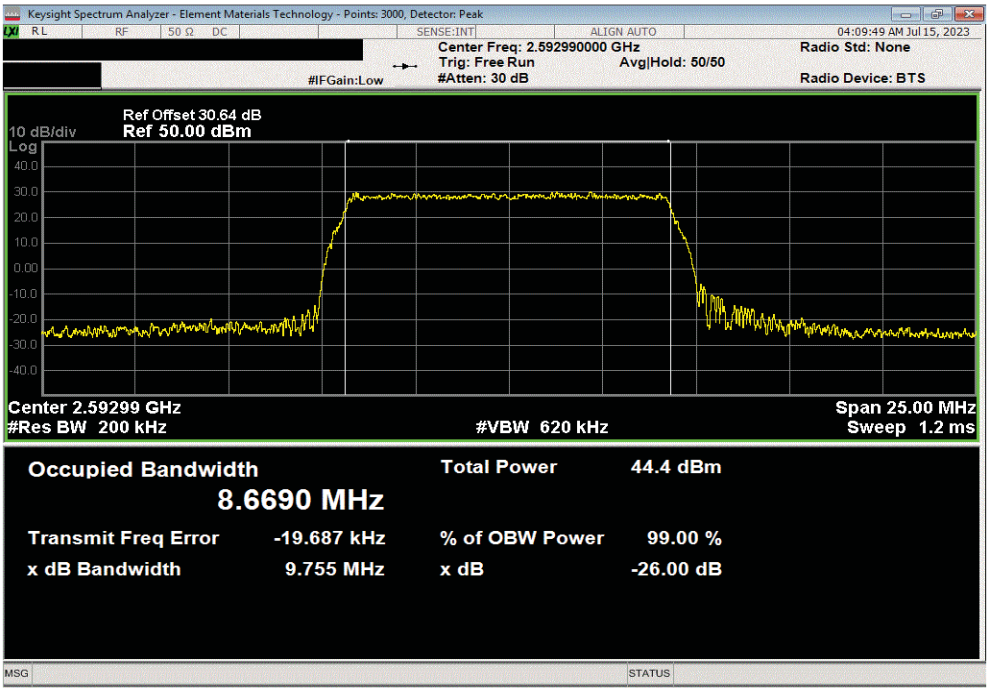
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 64QAM Modulation, High Channel, 2685.00 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			8.682	9.787	Within Band	Pass



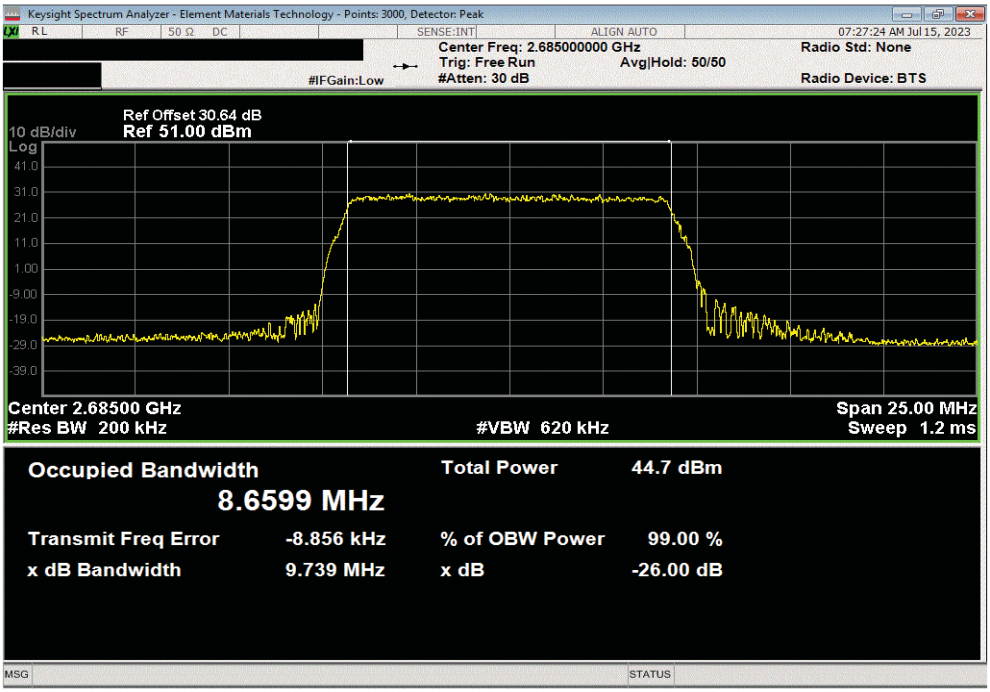
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 256QAM Modulation, Low Channel, 2501.01 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			8.668	9.767	Within Band	Pass



Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 256QAM Modulation, Mid Channel, 2592.99 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			8.669	9.755	Within Band	Pass



Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 256QAM Modulation, High Channel, 2685.00 MHz						
			Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
			8.66	9.739	Within Band	Pass



OUTPUT POWER AND EIRP CALCULATIONS

XMit 2023.02.14.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2023-02-09	2024-02-09
Block - DC	Fairview Microwave	SD3235-2148	ANF	2023-05-24	2024-05-24
Generator - Signal	Agilent	N5183A	TID	2023-05-12	2025-05-12

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 follwoing 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 AZHL antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown during 8 port output power 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.

The EIRP limit is defined by FCC Part27.50(h)(ii) as 33dBW+ 10Log(X/Y) dBW + 10 log(360/beamwidth) dBW where X is the channel width in MHz and Y is 5.5 or 6MHz. PSD (power/1MHz) measurements are not required for this radio since the FCC limits for EIRP are defined in watts.

OUTPUT POWER AND EIRP CALCULATIONS

element

TbiTx 2022.05.02.0 XMit 2023.02.14.0

EUT:	AZHL			**Work Order:**	NOKI0067
Serial Number:	YK203400004			**Date:**	07/14/2023
Customer:	Nokia Solutions and Networks			**Temperature:**	21.1°C
Attendees:	David Le, Mitchell Hill			**Humidity:**	53.8%
Project:	None			**Barometric Pres.:**	1016 mbar
Tested by:	Brandon Hobbs	**Power:**	54VDC	**Job Site:**	TX07

TEST SPECIFICATIONS	Test Method
FCC 27:2023	ANSI C63.26:2015

COMMENTS

The output power was measured for a single carrier channel bandwidth on port 1. The total output power for multiport (2x2 MIMO, 4x4 MIMO, 8x8 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 + 6db [i.e. 10log(4)]. The total output power for eight port operation is single port + 9db [i.e. 10log(8)] All measurement path losses were accounted for in the reference level offset including any attenuators, filters and DC blocks. Band n41

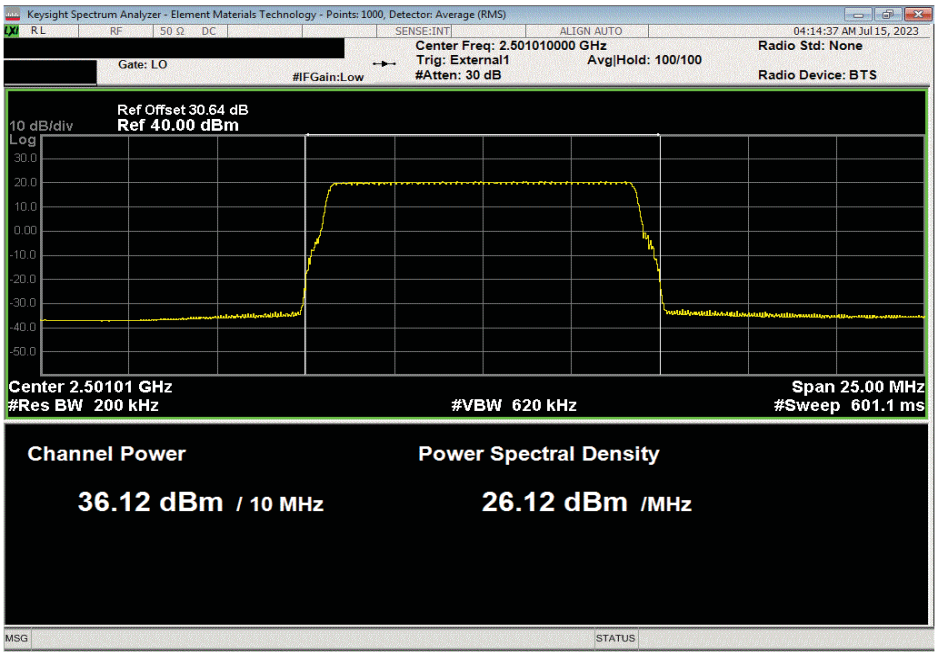
DEVIATIONS FROM TEST STANDARD

None

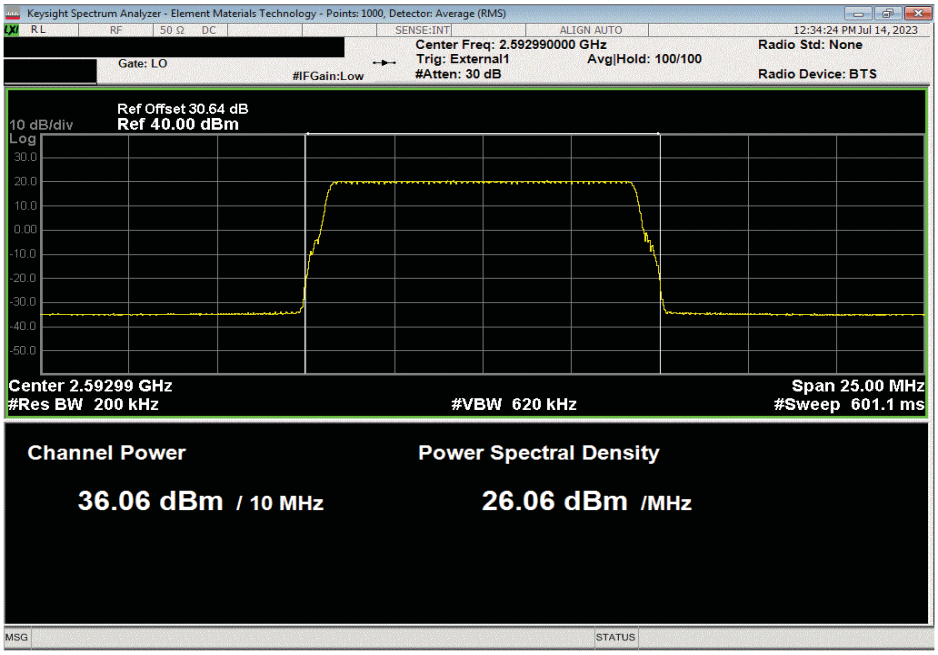
Configuration #	NOKI0067-2	Signature

	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	Eight Port (8x8 MIMO) dBm/Carrier BW	Results
Port 1							
Band n41, 2496 - 2690 MHz							
10 MHz Bandwidth							
QPSK Modulation							
Low Channel, 2501.01 MHz	36.12	0.000	36.120	39.1	42.1	45.1	Pass
Mid Channel, 2592.99 MHz	36.059	0.000	36.059	39.1	42.1	45.1	Pass
High Channel, 2685.00 MHz	36.134	0.000	36.134	39.1	42.1	45.1	Pass
16QAM Modulation							
Low Channel, 2501.01 MHz	35.78	0.000	35.780	38.8	41.8	44.8	Pass
Mid Channel, 2592.99 MHz	35.753	0.000	35.753	38.8	41.8	44.8	Pass
High Channel, 2685.00 MHz	35.924	0.000	35.924	38.9	41.9	44.9	Pass
64QAM Modulation							
Low Channel, 2501.01 MHz	36.014	0.000	36.014	39.0	42.0	45.0	Pass
Mid Channel, 2592.99 MHz	35.8	0.000	35.800	38.8	41.8	44.8	Pass
High Channel, 2685.00 MHz	36.158	0.000	36.158	39.2	42.2	45.2	Pass
256QAM Modulation							
Low Channel, 2501.01 MHz	36.059	0.000	36.059	39.1	42.1	45.1	Pass
Mid Channel, 2592.99 MHz	35.806	0.000	35.806	38.8	41.8	44.8	Pass
High Channel, 2685.00 MHz	36.153	0.000	36.153	39.2	42.2	45.2	Pass

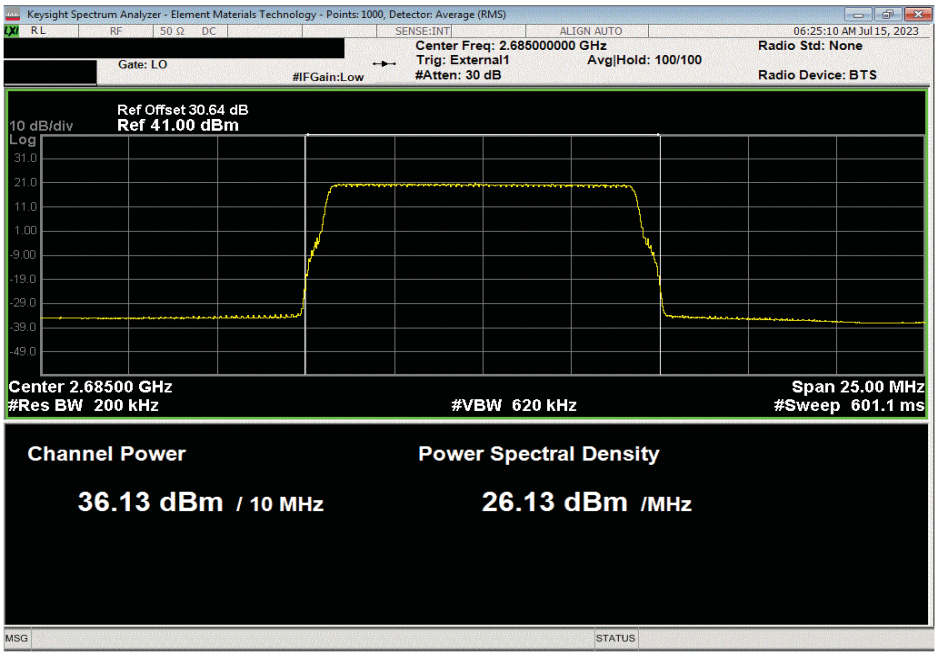
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, QPSK Modulation, Low Channel, 2501.01 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	Eight Port (8x8 MIMO) dBm/Carrier BW	Results
36.12	0	36.12	39.12	42.12	45.12	Pass



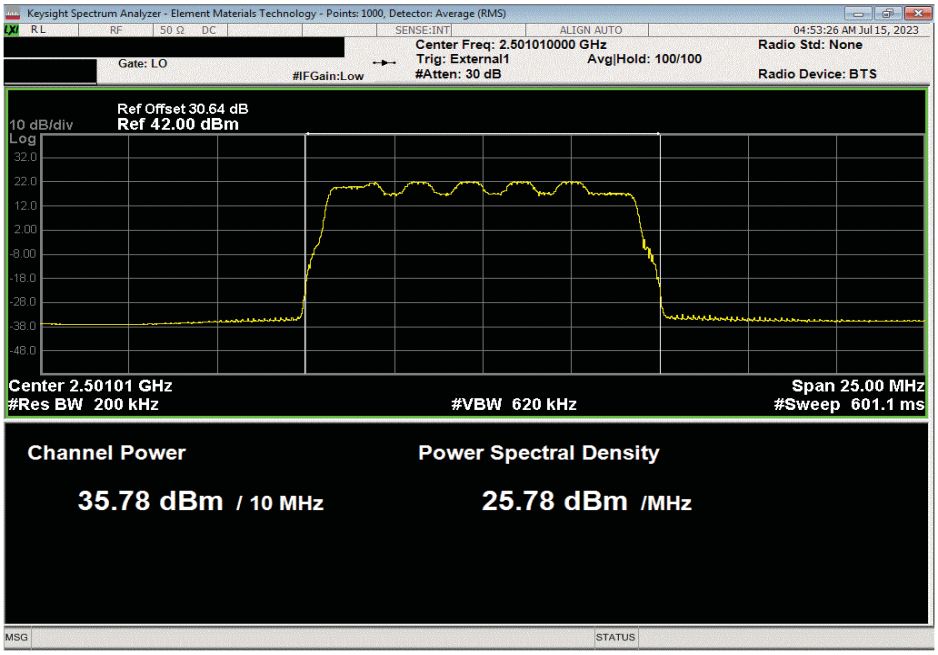
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, QPSK Modulation, Mid Channel, 2592.99 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	Eight Port (8x8 MIMO) dBm/Carrier BW	Results
36.059	0	36.059	39.059	42.059	45.059	Pass



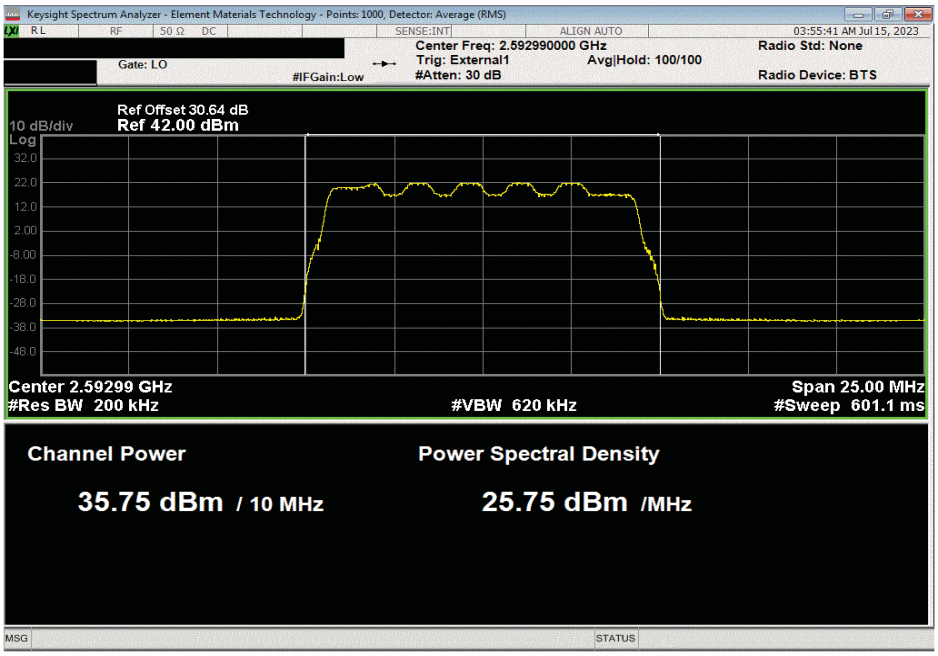
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, QPSK Modulation, High Channel, 2685.00 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	Eight Port (8x8 MIMO) dBm/Carrier BW	Results
36.134	0	36.134	39.134	42.134	45.134	Pass



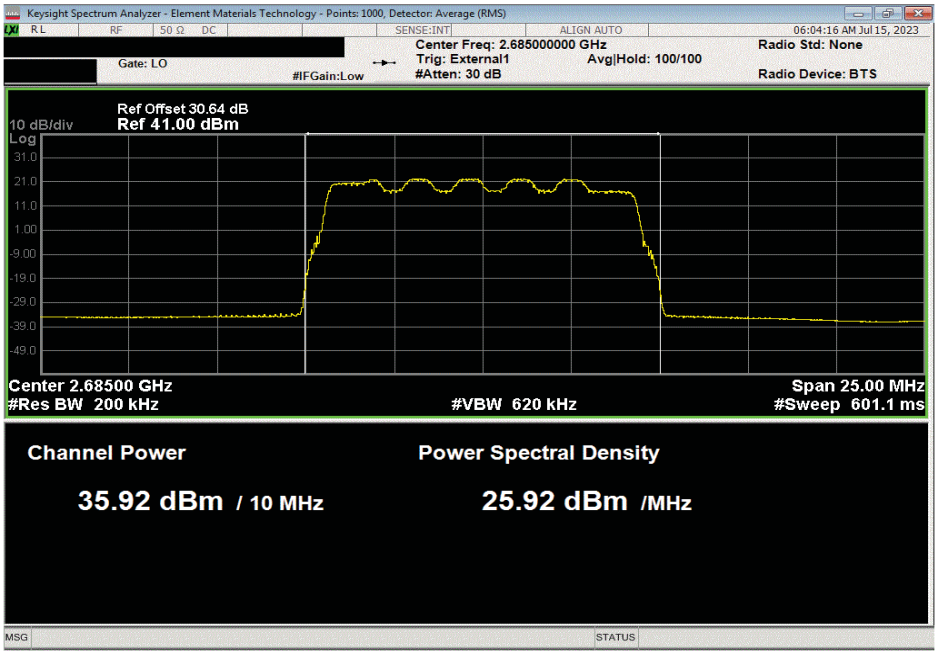
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 16QAM Modulation, Low Channel, 2501.01 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	Eight Port (8x8 MIMO) dBm/Carrier BW	Results
35.78	0	35.78	38.78	41.78	44.78	Pass



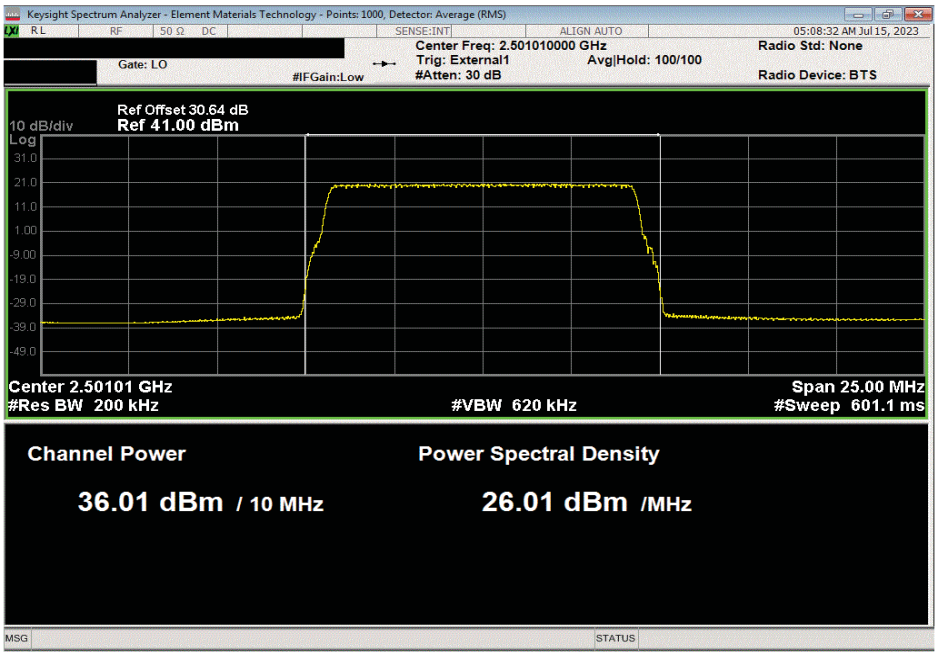
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 16QAM Modulation, Mid Channel, 2592.99 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	Eight Port (8x8 MIMO) dBm/Carrier BW	Results
35.753	0	35.753	38.753	41.753	44.753	Pass



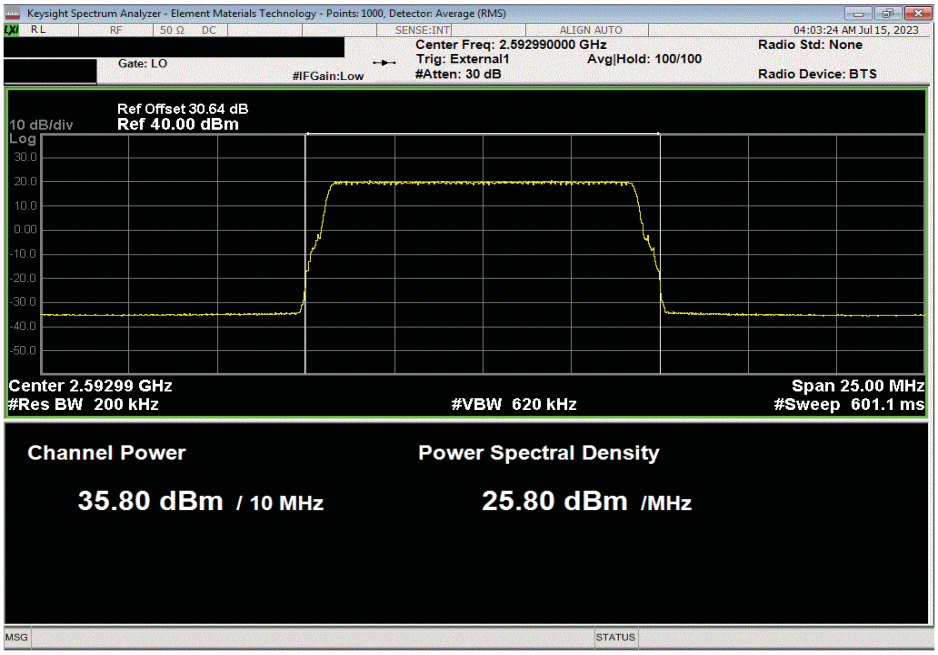
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 16QAM Modulation, High Channel, 2685.00 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	Eight Port (8x8 MIMO) dBm/Carrier BW	Results
35.924	0	35.924	38.924	41.924	44.924	Pass



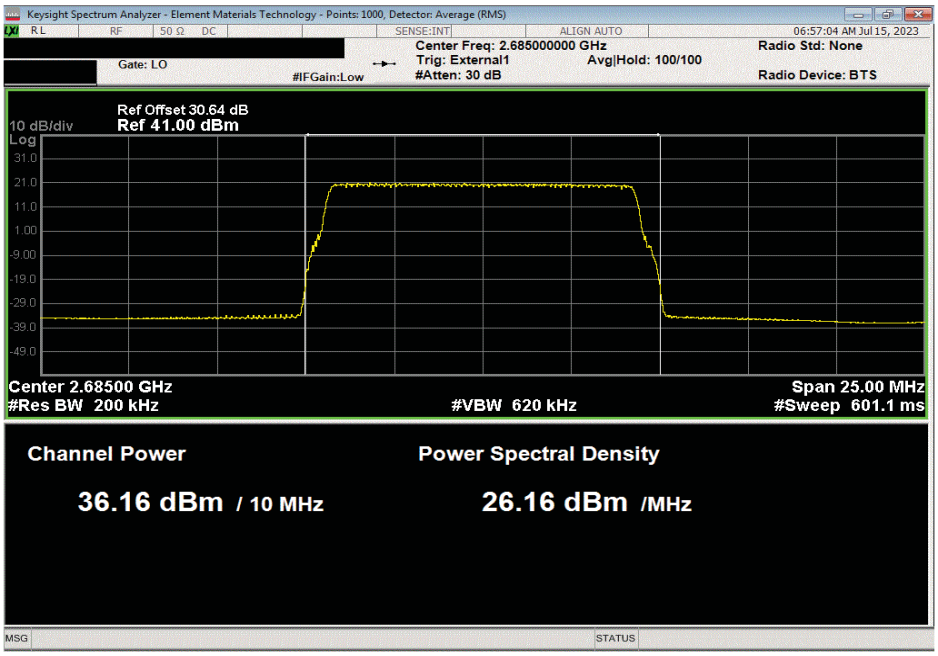
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 64QAM Modulation, Low Channel, 2501.01 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	Eight Port (8x8 MIMO) dBm/Carrier BW	Results
36.014	0	36.014	39.014	42.014	45.014	Pass



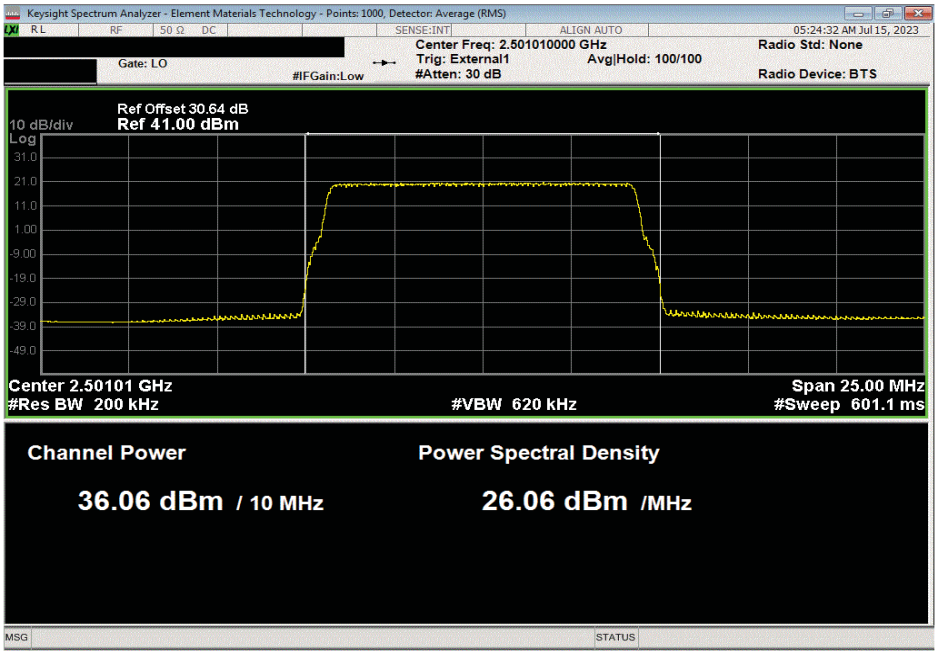
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 64QAM Modulation, Mid Channel, 2592.99 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	Eight Port (8x8 MIMO) dBm/Carrier BW	Results
35.8	0	35.8	38.8	41.8	44.8	Pass



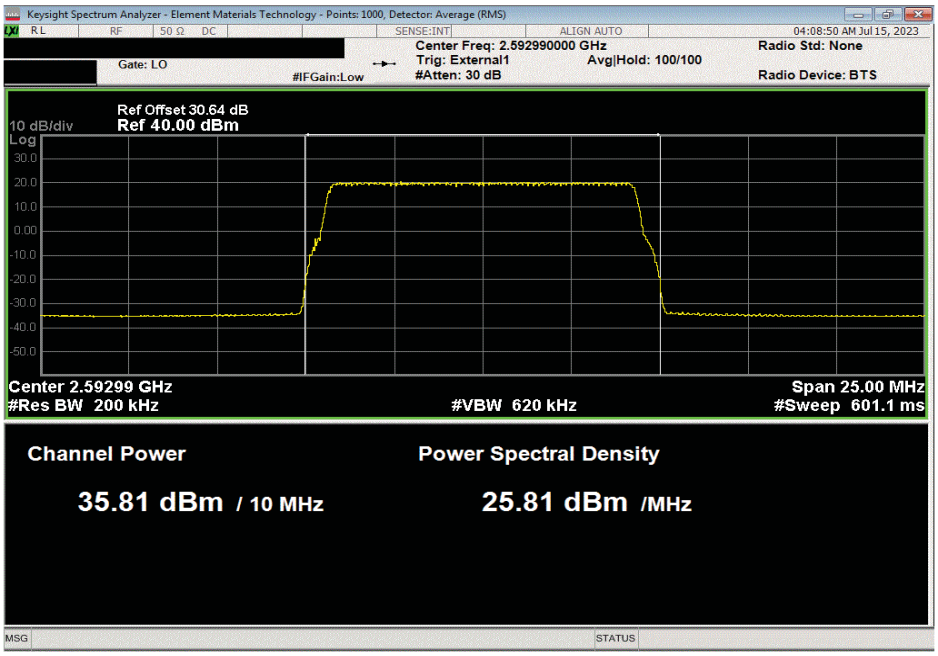
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 64QAM Modulation, High Channel, 2685.00 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	Eight Port (8x8 MIMO) dBm/Carrier BW	Results
36.158	0	36.158	39.158	42.158	45.158	Pass



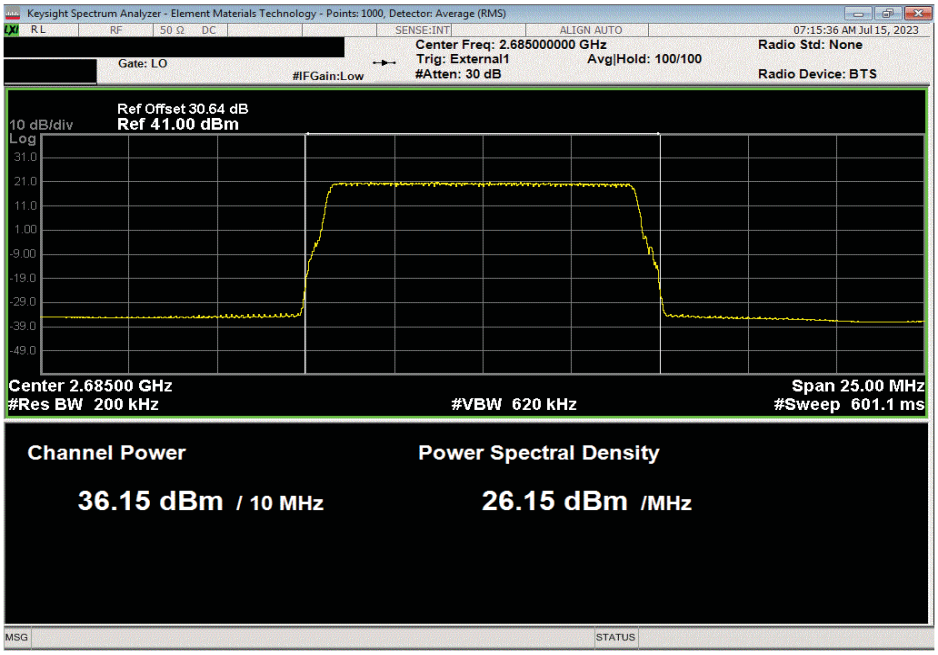
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 256QAM Modulation, Low Channel, 2501.01 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	Four Port (4x4 MIMO) dBm/Carrier BW	Eight Port (8x8 MIMO) dBm/Carrier BW	Results
36.059	0	36.059	39.059	42.059	45.059	Pass



Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 256QAM Modulation, Mid Channel, 2592.99 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	Eight Port (8x8 MIMO) dBm/Carrier BW	Results
35.806	0	35.806	38.806	41.806	44.806	Pass



Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 256QAM Modulation, High Channel, 2685.00 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	Eight Port (8x8 MIMO) dBm/Carrier BW	Results
36.153	0	36.153	39.153	42.153	45.153	Pass



5G NR EIRP Calculations for Eight Port MIMO Operations

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 the Commscope Planar Array Antenna model T4-90A-R1-V2. This antenna assembly has four columns with a maximum beamforming gain of 22.3 ± 0.8dBi. The columns within the antenna have ±45° cross-polarized (orthogonal) radiators. The eight AZHL transmitter outputs are connected to the columns (four are connected to +45° radiators/antennas and four are connected to the -45° radiators/antennas). The AZHL provides transmitter outputs for one 4-column antenna.

Equivalent Isotropically Radiated Power (EIRP) is calculated (as specified in ANSI C63.26-2015 section 6.4 for a system of correlated output signals) from the results of power measurements (highest measured average power for each channel bandwidth type). The maximum antenna assembly beamforming 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 eight port MIMO are as follows:

Parameter	10 MHz Ch BW
Power Out /Radio Antenna Port	36.2 dBm or 4.17 W
Cable Loss	0 dB
Number of Ant Ports per Polarization	4
Total Power per Polarization	16.6 Watts or 42.2 dBm
Maximum Antenna Beamforming Gain per Polarization	23.1 dBi
EIRP per Polarization	65.3 dBm or 3.39 kW
Number of Polarizations	2
EIRP Total (See Note 1)	65.3 dBm or 3.39 kW
EIRP Limit Calculation (See Note 2)	76.6 dBm

Note 1: 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).
Note 2: The EIRP limit is defined by FCC part 27.50(h)(ii) as 33dBW+ 10Log(X/Y) dBW + 10 log(360/beamwidth) dBW where X is the channel width in MHz and Y is 5.5 or 6MHz. The Commscope model T4-90A-R1-V2 antenna has a horizontal beamwidth of 26 degrees. Y was selected to be 6MHz for this calculation.

Calculation Summary

The worst case AZHL eight port MIMO EIRP levels for all 5G NR channel bandwidths using the Commscope antenna assembly model “T4-90A-R1-V2” are less than the FCC regulatory limits.

PEAK TO AVERAGE POWER (PAPR) CCDF

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	SD3235-2148	ANF	2023-05-24	2024-05-24
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2023-02-09	2024-02-09
Generator - Signal	Agilent	N5183A	TID	2023-05-12	2025-05-12

TEST DESCRIPTION

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

Because the conducted Output Power was measured using a RMS Average detector, the Peak to Average Power Ratio (PAPR) was measured to show that the maximum peak-max-hold spectrum to the maximum of the average spectrum does not exceed 13 dB.

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

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

Per FCC Part 27.50, the PAPR limit shall not exceed 13 dB for more than the ANSI described 0.1% of the time.

RF conducted emissions testing was performed only on one port. The AZHL antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown during output power 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.

PEAK TO AVERAGE POWER (PAPR) CCDF

TbtTx 2022.05.02.0 XMit 2023.02.14.0

EUT:	AZHL			Work Order:	NOKI0067
Serial Number:	YK203400004			Date:	07/14/2023
Customer:	Nokia Solutions and Networks			Temperature:	22°C
Attendees:	David Le, Mitchell Hill			Humidity:	51.2%
Project:	None			Barometric Pres.:	1016 mbar
Tested by:	Brandon Hobbs	Power:	54VDC	Job Site:	TX07

TEST SPECIFICATIONS	Test Method
FCC 27:2023	ANSI C63.26:2015

COMMENTS

All measurement path losses were accounted for in the reference level offest including any attenuators, filters and DC blocks. Band n41 carriers are enabled at maximum power (4 Watts/carrier).

DEVIATIONS FROM TEST STANDARD

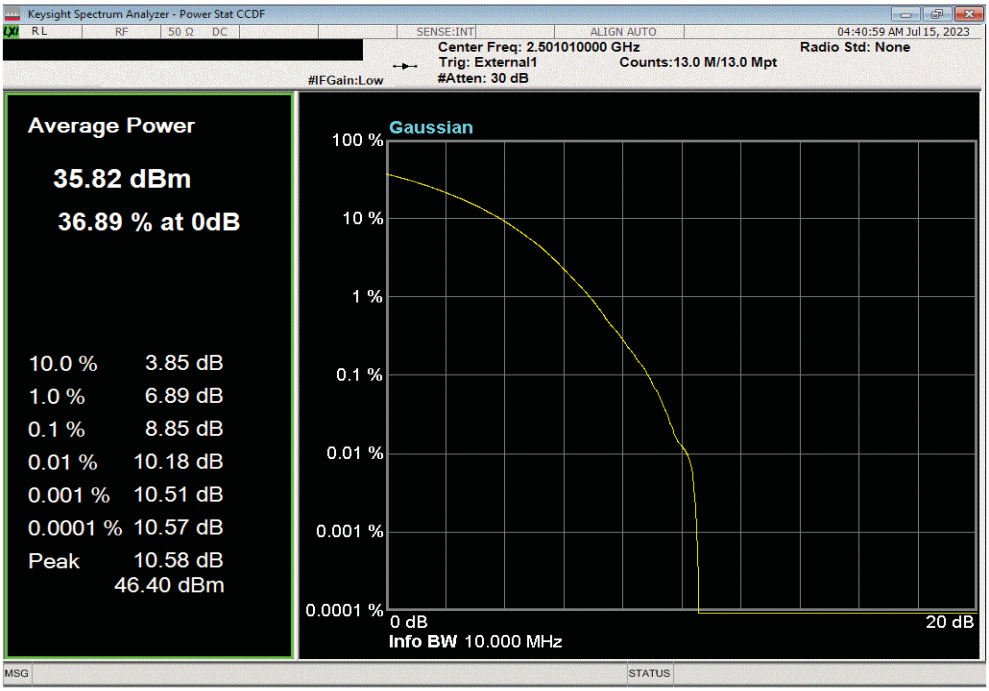
None

Configuration #	NOKI0067-2	Signature

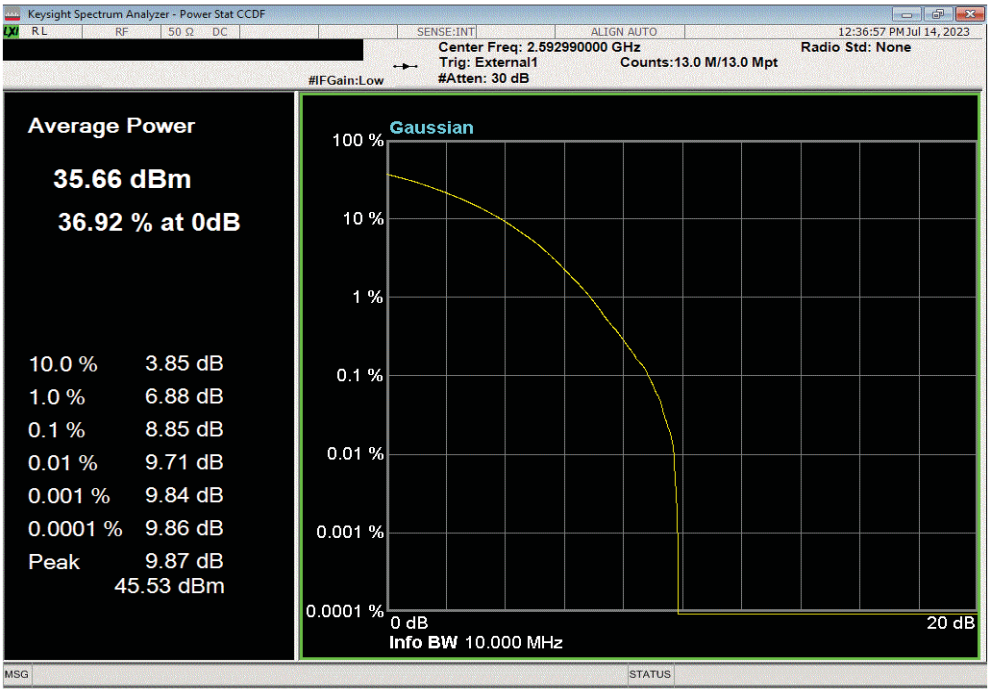
	0.1% PAPR Value (dB)	0.1% PAPR Limit (dB)	Results
Port 1			
Band n41, 2496 - 2690 MHz			
10 MHz Bandwidth			
QPSK Modulation			
Low Channel, 2501.01 MHz	8.85	13	Pass
Mid Channel, 2592.99 MHz	8.85	13	Pass
High Channel, 2685.00 MHz	8.71	13	Pass
16QAM Modulation			
Low Channel, 2501.01 MHz	8.56	13	Pass
Mid Channel, 2592.99 MHz	8.62	13	Pass
High Channel, 2685.00 MHz	8.46	13	Pass
64QAM Modulation			
Low Channel, 2501.01 MHz	8.58	13	Pass
Mid Channel, 2592.99 MHz	8.56	13	Pass
High Channel, 2685.00 MHz	8.42	13	Pass
256QAM Modulation			
Low Channel, 2501.01 MHz	8.68	13	Pass
Mid Channel, 2592.99 MHz	8.70	13	Pass
High Channel, 2685.00 MHz	8.50	13	Pass

PEAK TO AVERAGE POWER (PAPR) CCDF

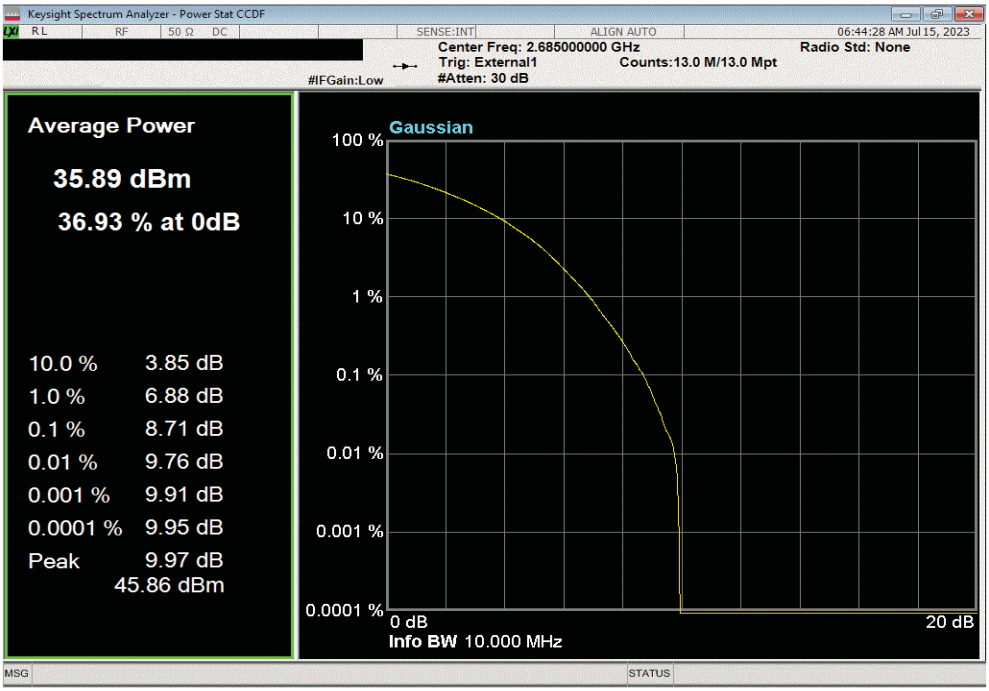
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, QPSK Modulation, Low Channel, 2501.01 MHz						
				0.1% PAPR Value (dB)	0.1% PAPR Limit (dB)	Results
				8.85	13	Pass



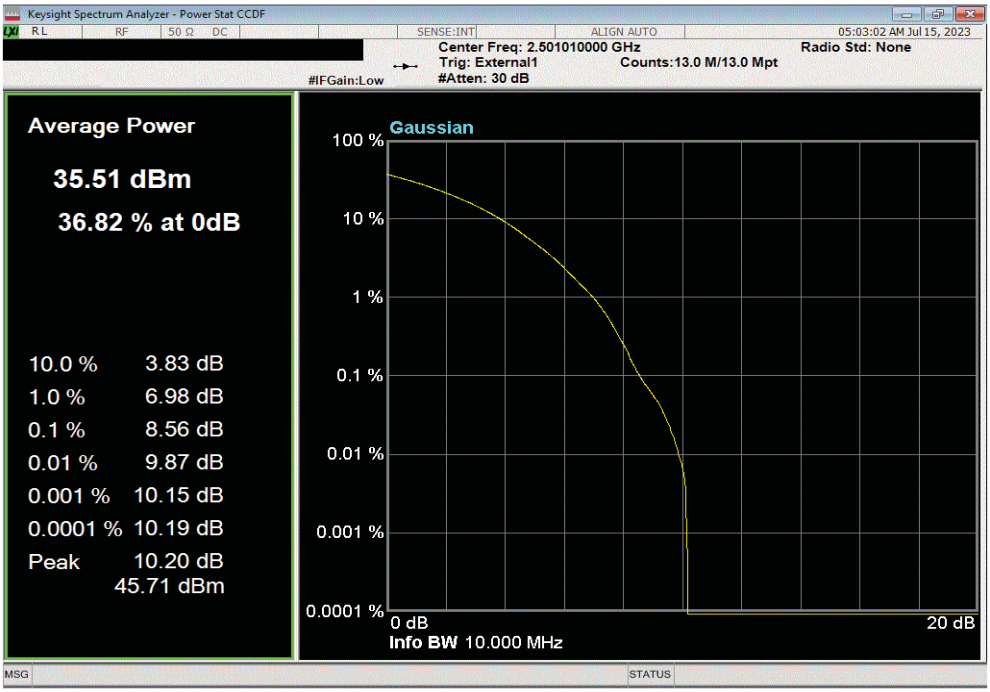
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, QPSK Modulation, Mid Channel, 2592.99 MHz						
				0.1% PAPR Value (dB)	0.1% PAPR Limit (dB)	Results
				8.85	13	Pass



Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, QPSK Modulation, High Channel, 2685.00 MHz						
				0.1% PAPR Value (dB)	0.1% PAPR Limit (dB)	Results
				8.71	13	Pass

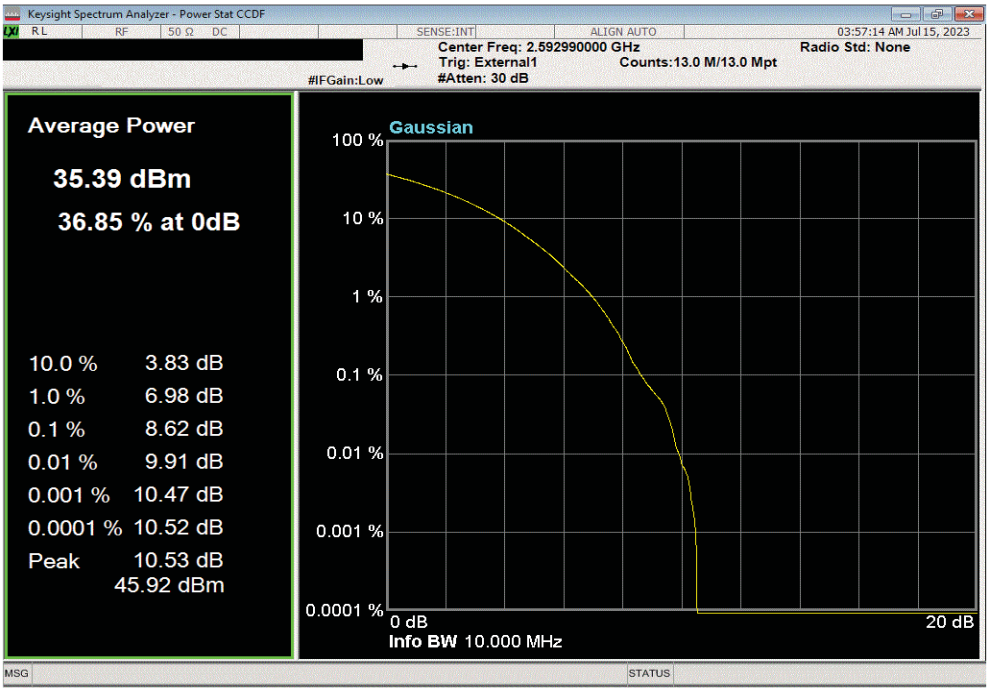


Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 16QAM Modulation, Low Channel, 2501.01 MHz						
				0.1% PAPR Value (dB)	0.1% PAPR Limit (dB)	Results
				8.56	13	Pass

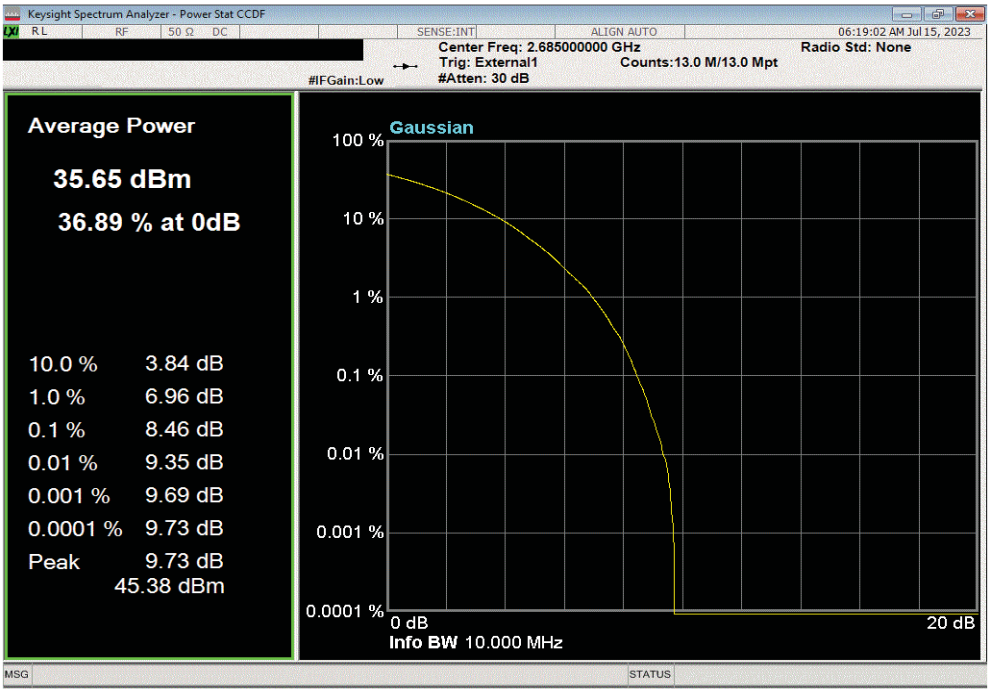


PEAK TO AVERAGE POWER (PAPR) CCDF

Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 16QAM Modulation, Mid Channel, 2592.99 MHz						
				0.1% PAPR Value (dB)	0.1% PAPR Limit (dB)	Results
				8.62	13	Pass

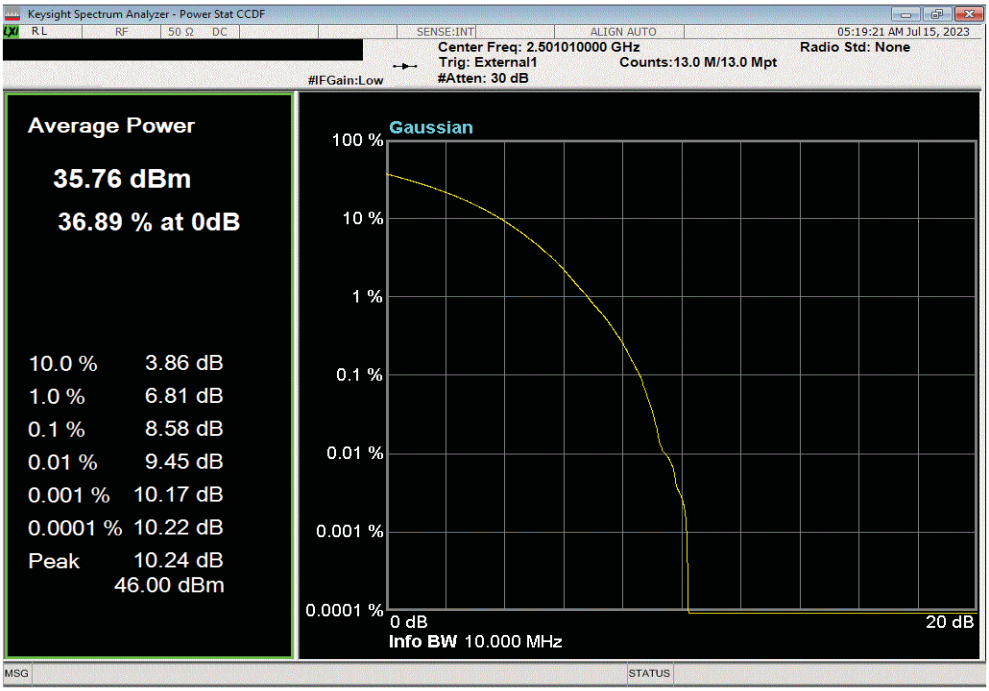


Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 16QAM Modulation, High Channel, 2685.00 MHz						
				0.1% PAPR Value (dB)	0.1% PAPR Limit (dB)	Results
				8.46	13	Pass

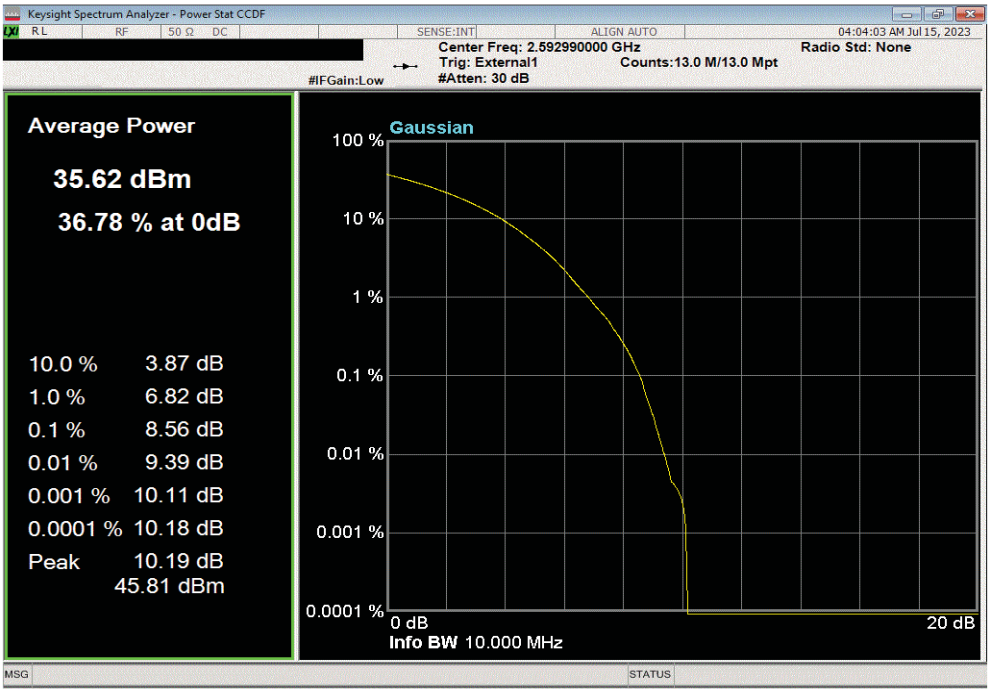


PEAK TO AVERAGE POWER (PAPR) CCDF

Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 64QAM Modulation, Low Channel, 2501.01 MHz						
				0.1% PAPR Value (dB)	0.1% PAPR Limit (dB)	Results
				8.58	13	Pass

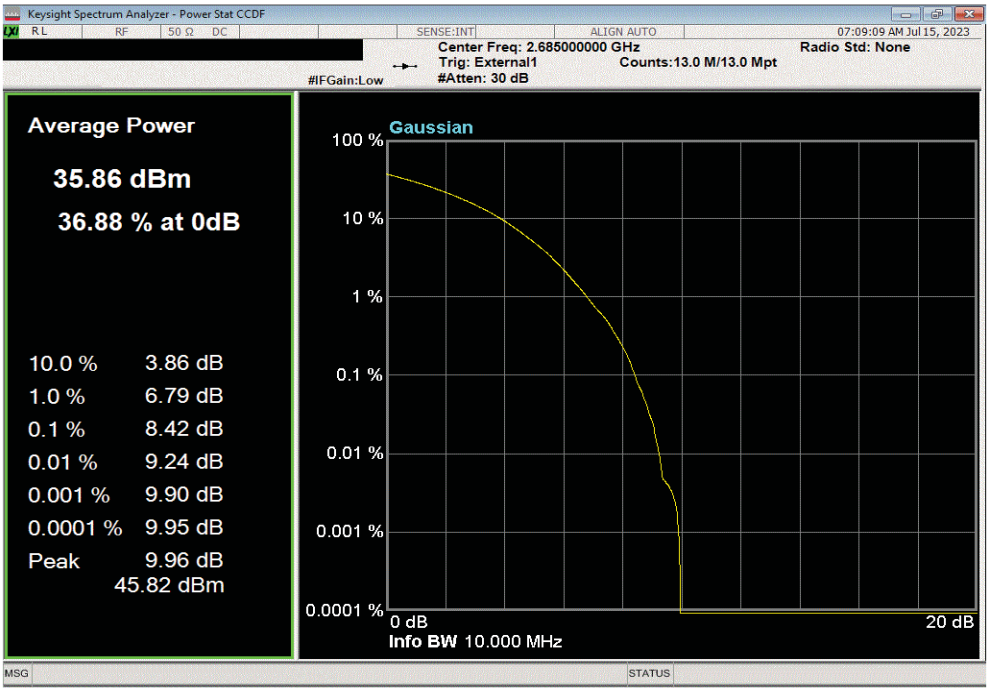


Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 64QAM Modulation, Mid Channel, 2592.99 MHz						
				0.1% PAPR Value (dB)	0.1% PAPR Limit (dB)	Results
				8.56	13	Pass

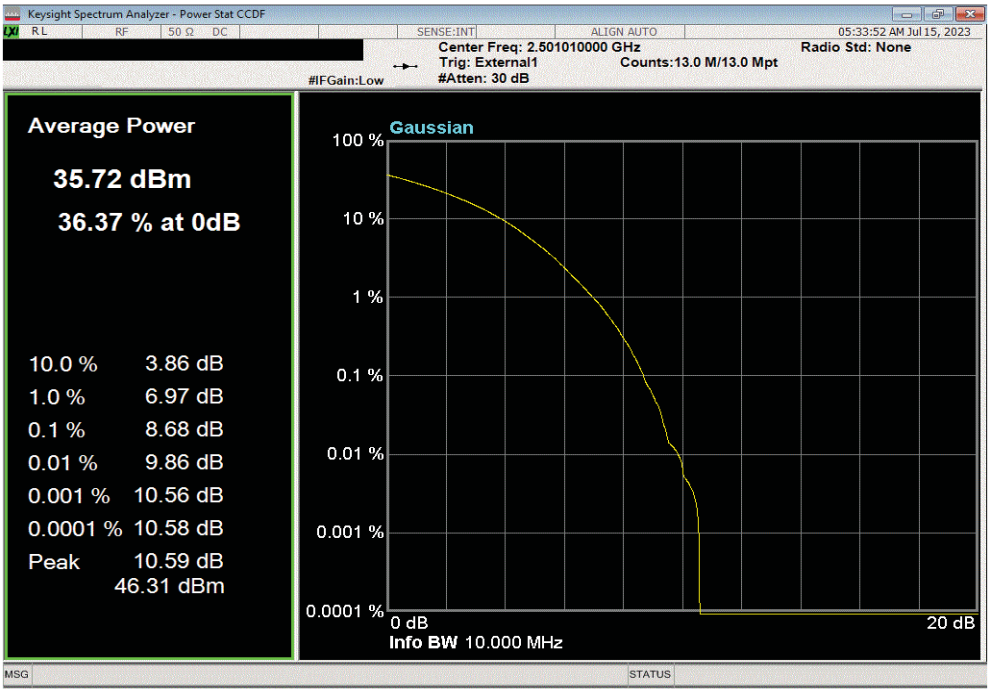


PEAK TO AVERAGE POWER (PAPR) CCDF

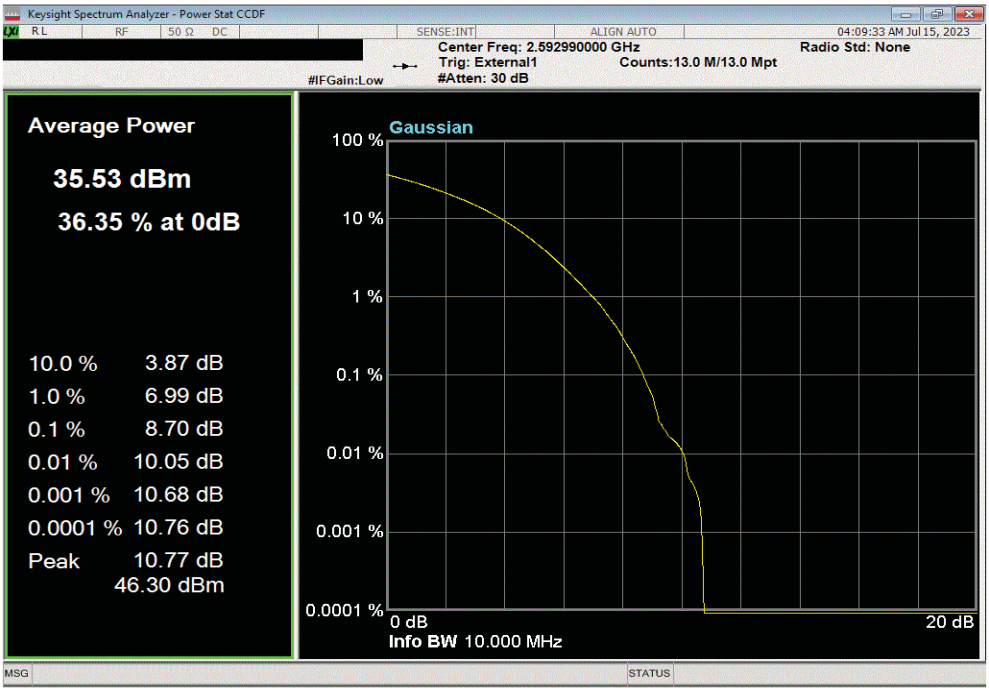
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 64QAM Modulation, High Channel, 2685.00 MHz						
				0.1% PAPR Value (dB)	0.1% PAPR Limit (dB)	Results
				8.42	13	Pass



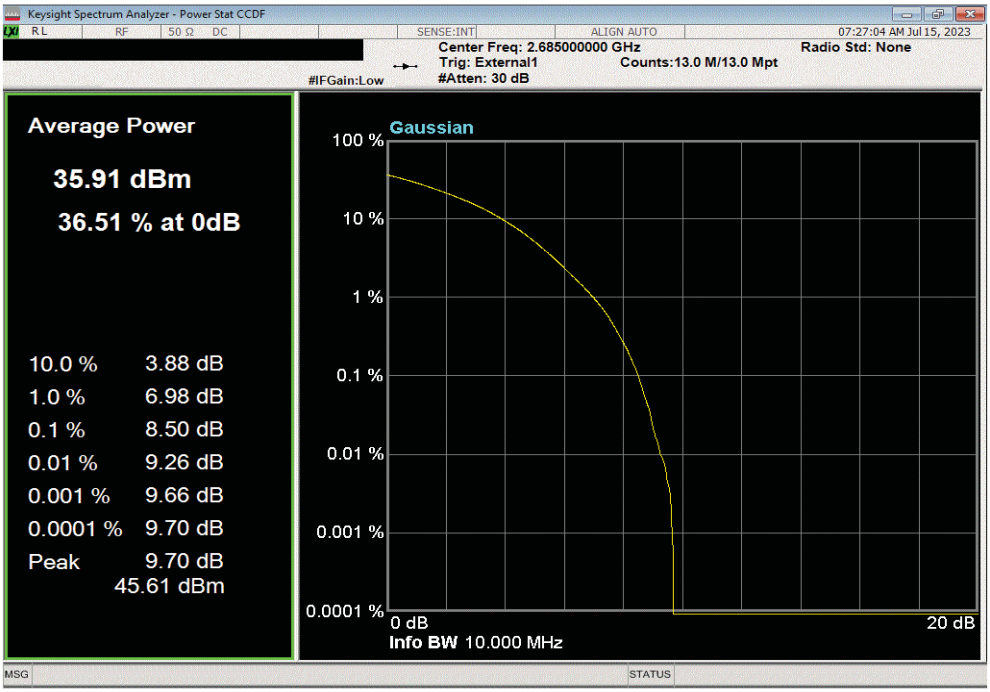
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 256QAM Modulation, Low Channel, 2501.01 MHz						
				0.1% PAPR Value (dB)	0.1% PAPR Limit (dB)	Results
				8.68	13	Pass



Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 256QAM Modulation, Mid Channel, 2592.99 MHz						
				0.1% PAPR Value (dB)	0.1% PAPR Limit (dB)	Results
				8.7	13	Pass



Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 256QAM Modulation, High Channel, 2685.00 MHz						
				0.1% PAPR Value (dB)	0.1% PAPR Limit (dB)	Results
				8.5	13	Pass



BAND EDGE COMPLIANCE

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	SD3235-2148	ANF	2023-05-24	2024-05-24
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2023-02-09	2024-02-09
Generator - Signal	Agilent	N5183A	TID	2023-05-12	2025-05-12

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The spurious RF conducted emissions at the edges of the authorized bands were measured with the EUT set to low and high transmit frequencies in the available band. The channels closest to the band edges were selected. The EUT was transmitting at the data rate(s) listed in the datasheet.

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

Per FCC Part 27.53(m)(2), the power of any emission outside of the authorized operating frequency range cannot exceed -13 dBm. The BTS may operate as a 8 port MIMO transmitter with transmitter outputs connected to four cross-polarized antennas [four transmitter outputs are connected to (+) radiators and four transmitter outputs are connected to (-) radiators]. The limit is adjusted to -19 dBm [-13 dBm -10 log (4)] per FCC KDB 662911D01 v02r01, ANSI C63.26-2015 section 6.4.6.3 b)2) and KDB 662911 D02v01 page 3 example (2) since the transmitter outputs to each antenna are 90 degree-phase shifted relative to each other (cross-polarized radiators).

Per FCC 27.53(m)(6), "Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.....A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 megahertz or 1 percent of emission bandwidth, as specified)".

RF conducted emissions testing was performed only on one port. The AZHL antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown during output power 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.

BAND EDGE COMPLIANCE

element

TbtTx 2022.05.02.0 XMit 2023.02.14.0

EUT:	AZHL			Work Order:	NOKI0067
Serial Number:	YK203400004			Date:	07/14/2023
Customer:	Nokia Solutions and Networks			Temperature:	21.6°C
Attendees:	David Le, Mitchell Hill			Humidity:	52.9%
Project:	None			Barometric Pres.:	1015 mbar
Tested by:	Brandon Hobbs	Power:	54VDC	Job Site:	TX07

TEST SPECIFICATIONS	Test Method
FCC 27:2023	ANSI C63.26:2015

COMMENTS

All measurement path losses were accounted for in the reference level offest including any attenuators, filters and DC blocks. Band n41 carriers are enabled at maximum power (4.0 Watts/carrier).

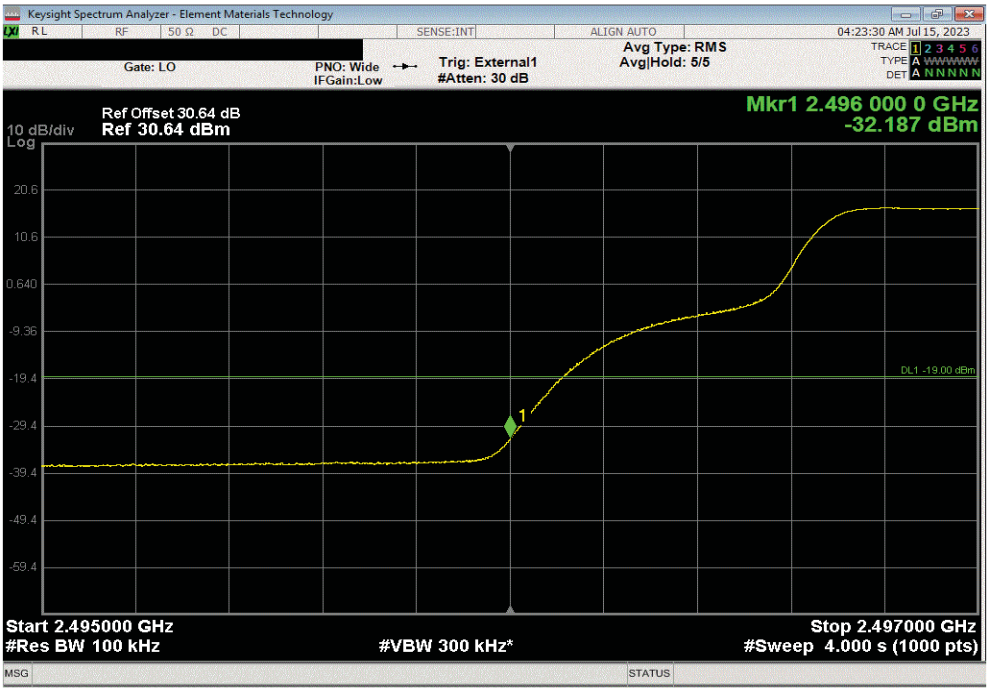
DEVIATIONS FROM TEST STANDARD

None

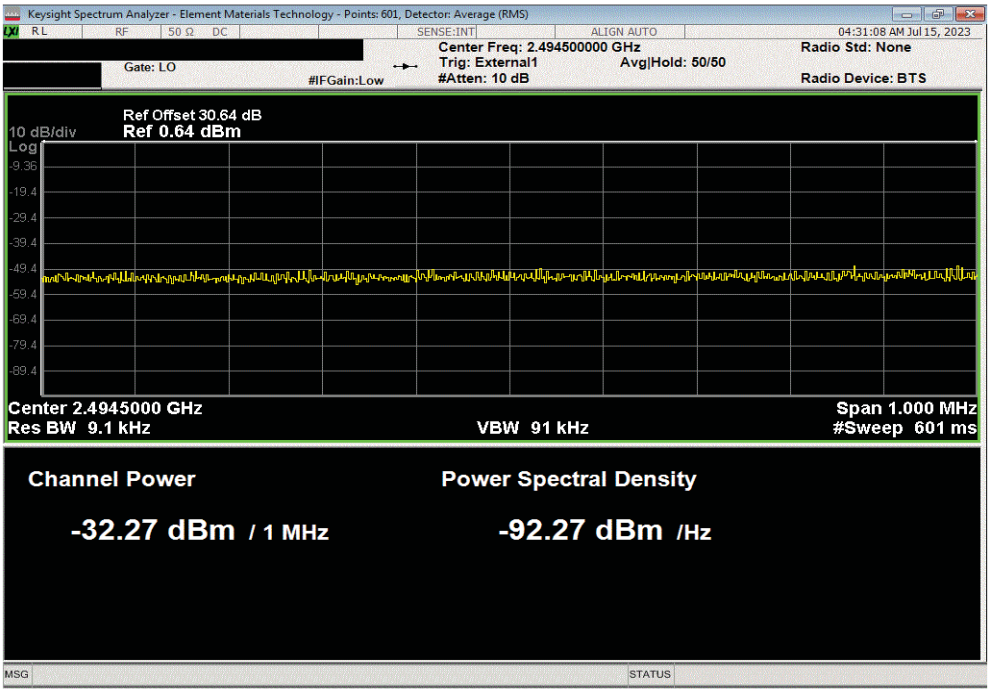
Configuration #	NOKI0067-2	Signature

		Frequency Range	Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
Port 1						
Band n41, 2496 - 2690 MHz						
10 MHz Bandwidth						
QPSK Modulation						
	Low Channel, 2501.01 MHz	1	2496.0	-32.2	-19	Pass
	Low Channel, 2501.01 MHz	2	2494.5	-32.3	-19	Pass
	Low Channel, 2501.01 MHz	3	2494.0	-32.1	-19	Pass
	High Channel, 2685.00 MHz	1	2690.0	-31.1	-19	Pass
	High Channel, 2685.00 MHz	2	2691.5	-31.6	-19	Pass
	High Channel, 2685.00 MHz	3	2692.0	-32.1	-19	Pass
16QAM Modulation						
	Low Channel, 2501.01 MHz	1	2496.0	-32.5	-19	Pass
	Low Channel, 2501.01 MHz	2	2494.5	-32.5	-19	Pass
	Low Channel, 2501.01 MHz	3	2494.0	-32.6	-19	Pass
	High Channel, 2685.00 MHz	1	2690.0	-32.5	-19	Pass
	High Channel, 2685.00 MHz	2	2691.5	-31.5	-19	Pass
	High Channel, 2685.00 MHz	3	2692.0	-32.0	-19	Pass
64QAM Modulation						
	Low Channel, 2501.01 MHz	1	2496.0	-32.3	-19	Pass
	Low Channel, 2501.01 MHz	2	2494.5	-32.6	-19	Pass
	Low Channel, 2501.01 MHz	3	2494.0	-32.8	-19	Pass
	High Channel, 2685.00 MHz	1	2690.0	-31.5	-19	Pass
	High Channel, 2685.00 MHz	2	2691.5	-31.2	-19	Pass
	High Channel, 2685.00 MHz	3	2692.0	-32.1	-19	Pass
256QAM Modulation						
	Low Channel, 2501.01 MHz	1	2496.0	-32.5	-19	Pass
	Low Channel, 2501.01 MHz	2	2494.5	-32.6	-19	Pass
	Low Channel, 2501.01 MHz	3	2493.9	-32.0	-19	Pass
	High Channel, 2685.00 MHz	1	2690.0	-31.8	-19	Pass
	High Channel, 2685.00 MHz	2	2691.5	-31.5	-19	Pass
	High Channel, 2685.00 MHz	3	2692.0	-31.7	-19	Pass

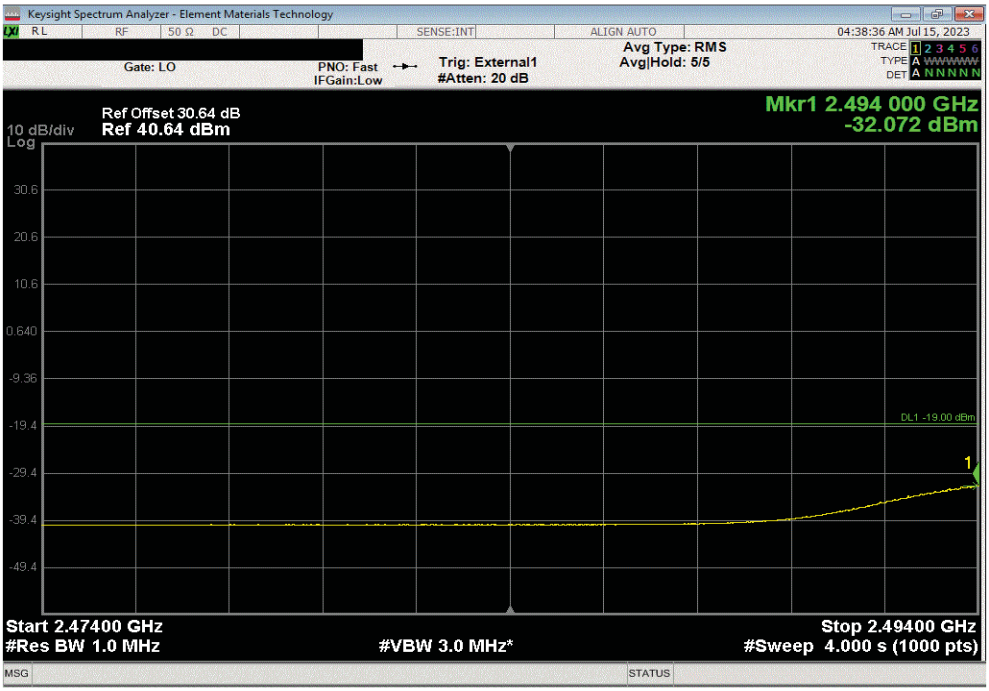
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, QPSK Modulation, Low Channel, 2501.01 MHz						
	Frequency Range		Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
	1		2496.0	-32.2	-19	Pass



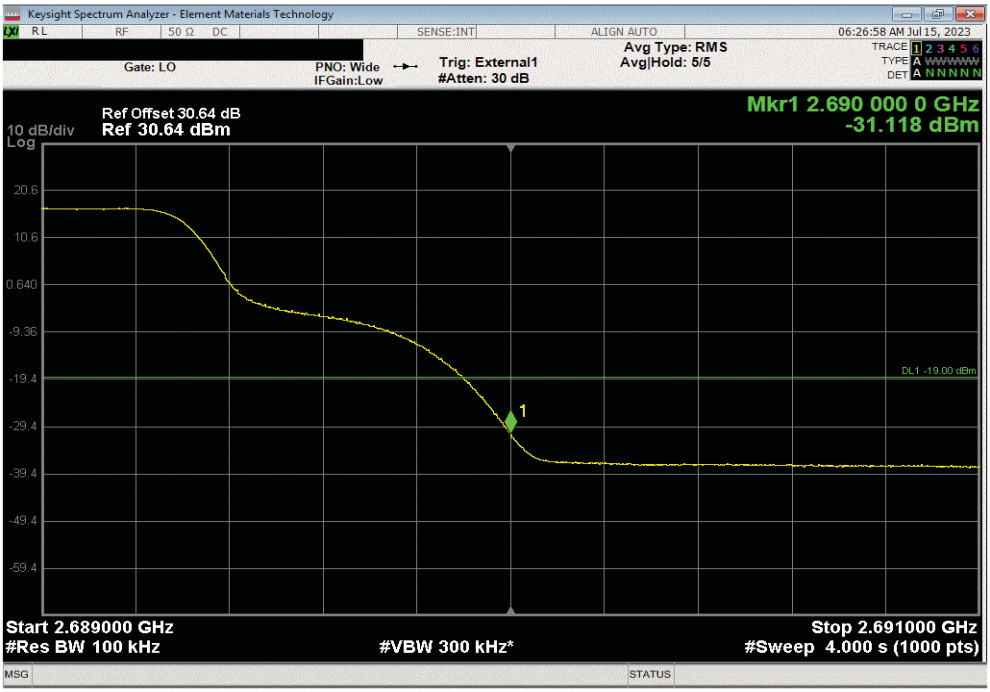
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, QPSK Modulation, Low Channel, 2501.01 MHz						
	Frequency Range		Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
	2		2494.5	-32.3	-19	Pass



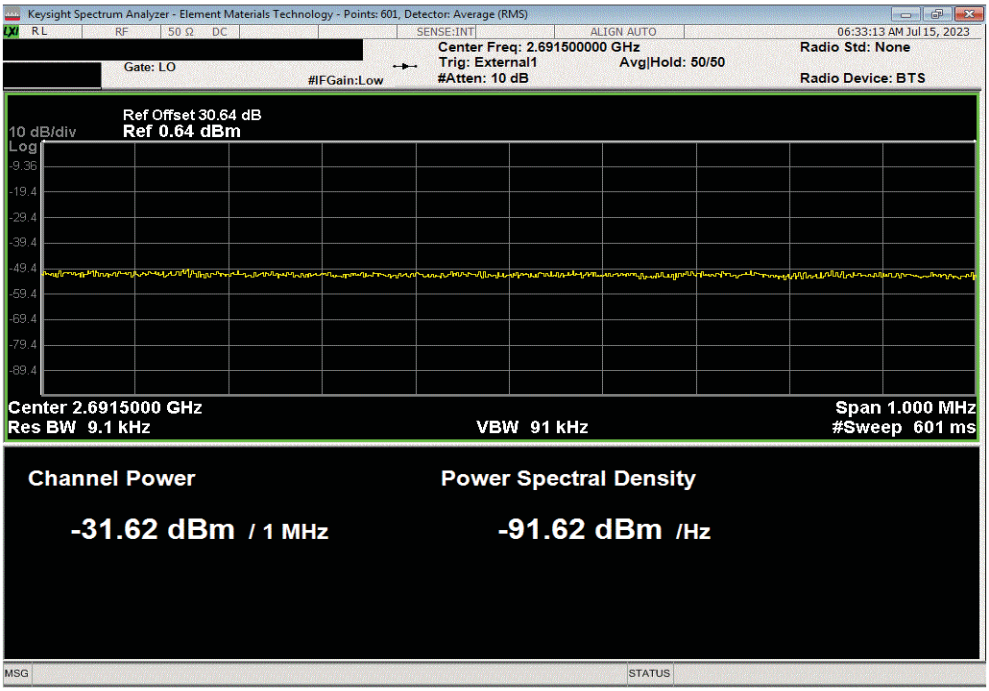
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, QPSK Modulation, Low Channel, 2501.01 MHz						
	Frequency Range		Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
	3		2494.0	-32.1	-19	Pass



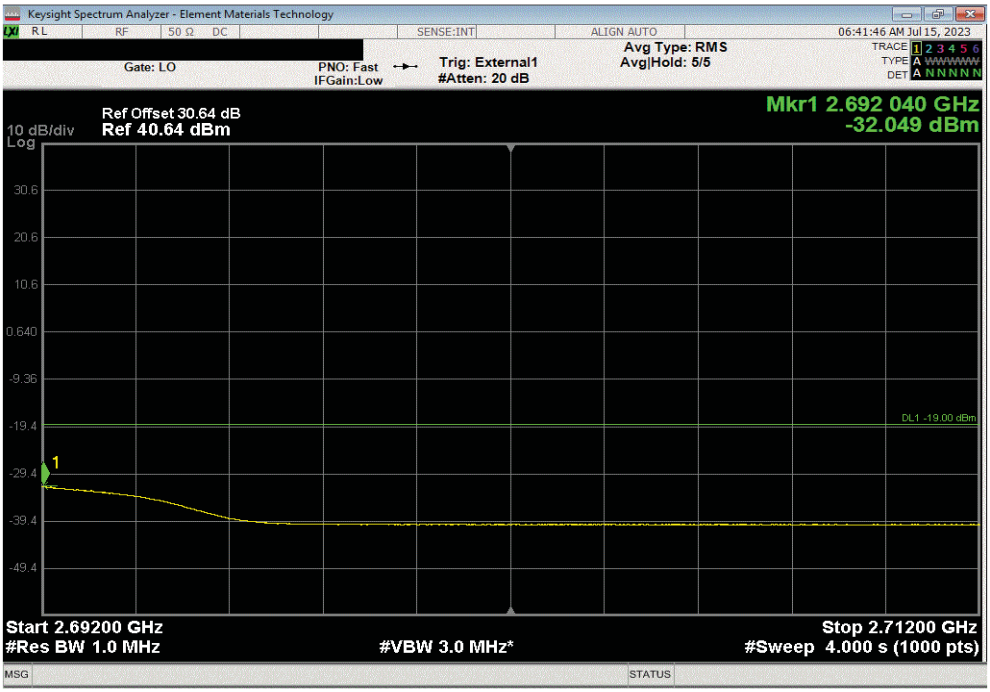
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, QPSK Modulation, High Channel, 2685.00 MHz						
	Frequency Range		Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
	1		2690.0	-31.1	-19	Pass



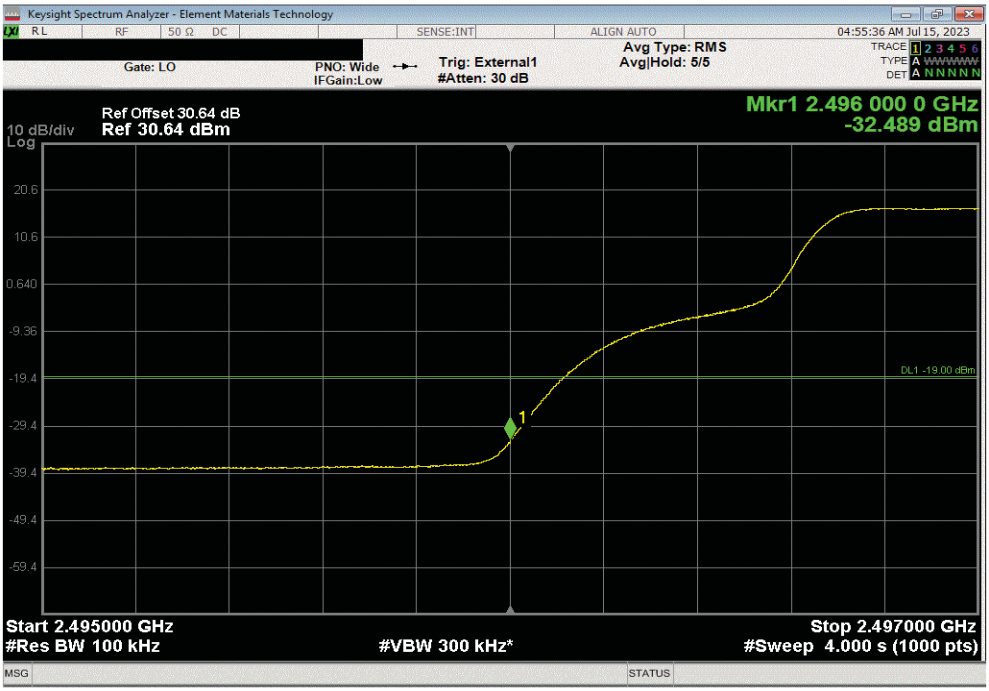
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, QPSK Modulation, High Channel, 2685.00 MHz						
	Frequency Range		Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
	2		2691.5	-31.6	-19	Pass



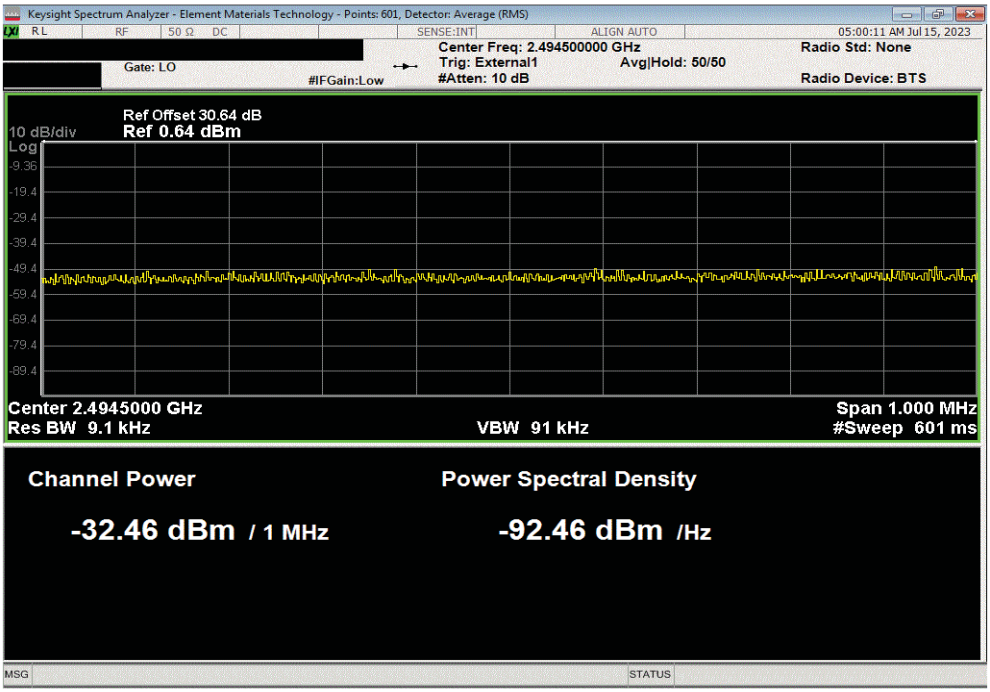
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, QPSK Modulation, High Channel, 2685.00 MHz						
	Frequency Range		Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
	3		2692.0	-32.1	-19	Pass



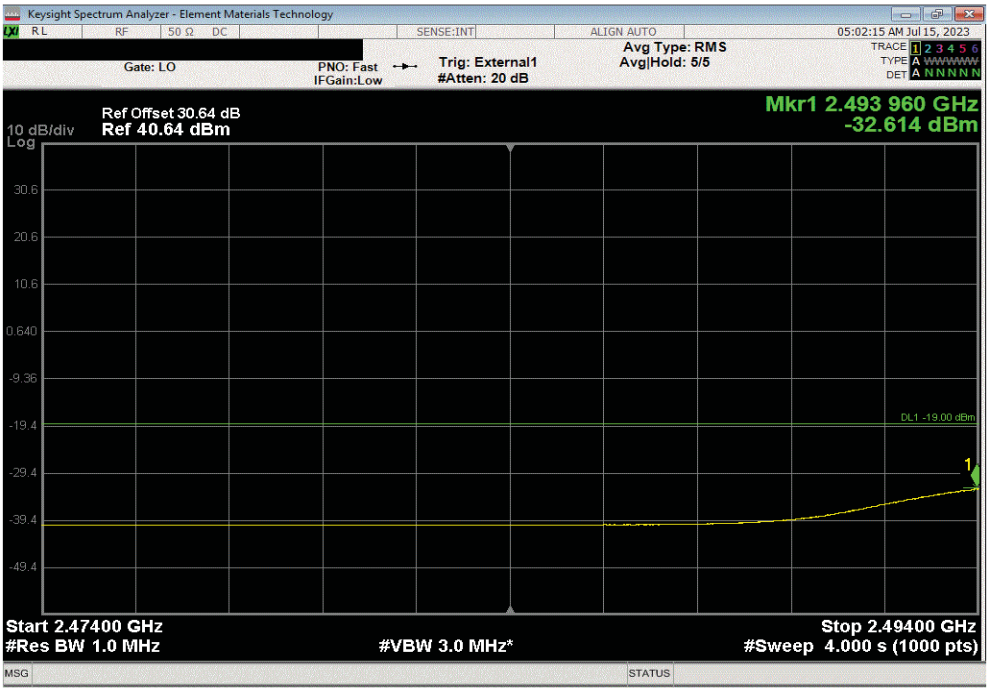
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 16QAM Modulation, Low Channel, 2501.01 MHz						
	Frequency Range		Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
	1		2496.0	-32.5	-19	Pass



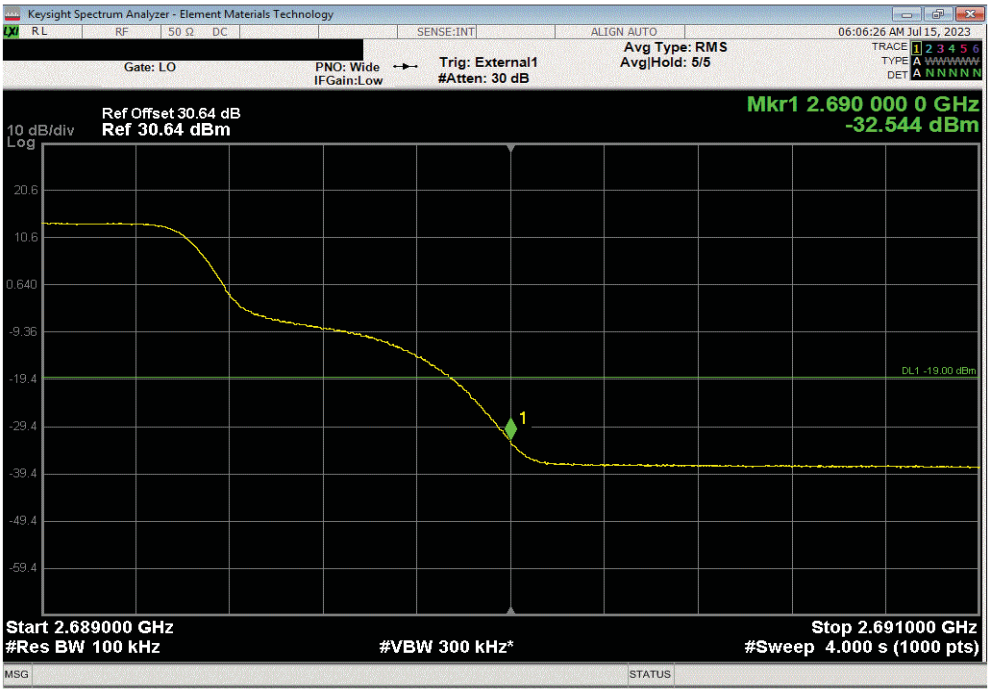
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 16QAM Modulation, Low Channel, 2501.01 MHz						
	Frequency Range		Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
	2		2494.5	-32.5	-19	Pass



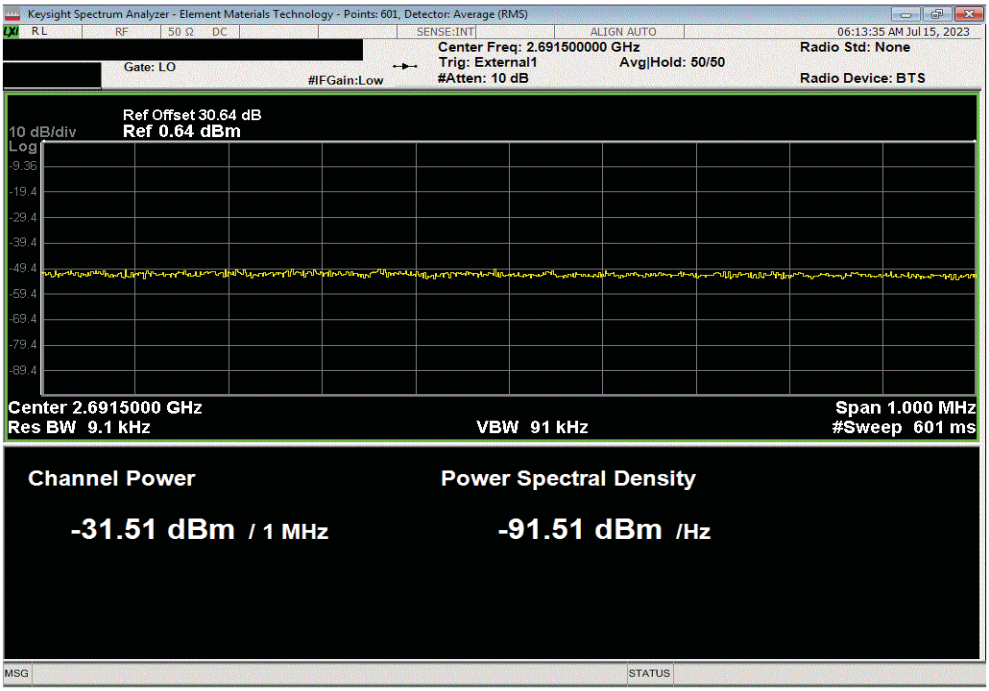
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 16QAM Modulation, Low Channel, 2501.01 MHz						
	Frequency Range		Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
	3		2494.0	-32.6	-19	Pass



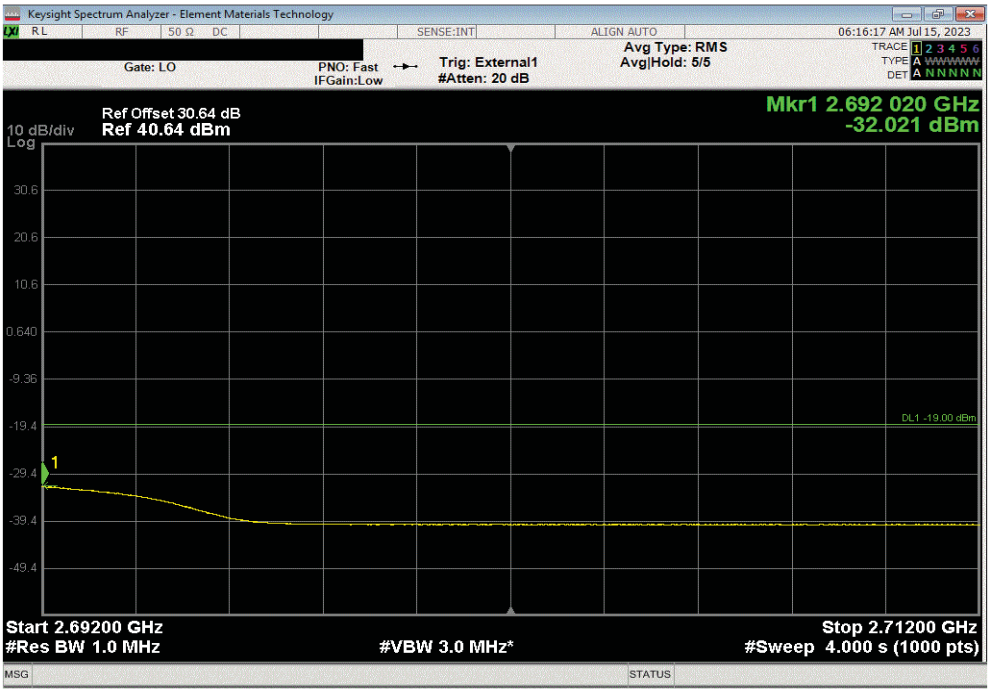
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 16QAM Modulation, High Channel, 2685.00 MHz						
	Frequency Range		Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
	1		2690.0	-32.5	-19	Pass



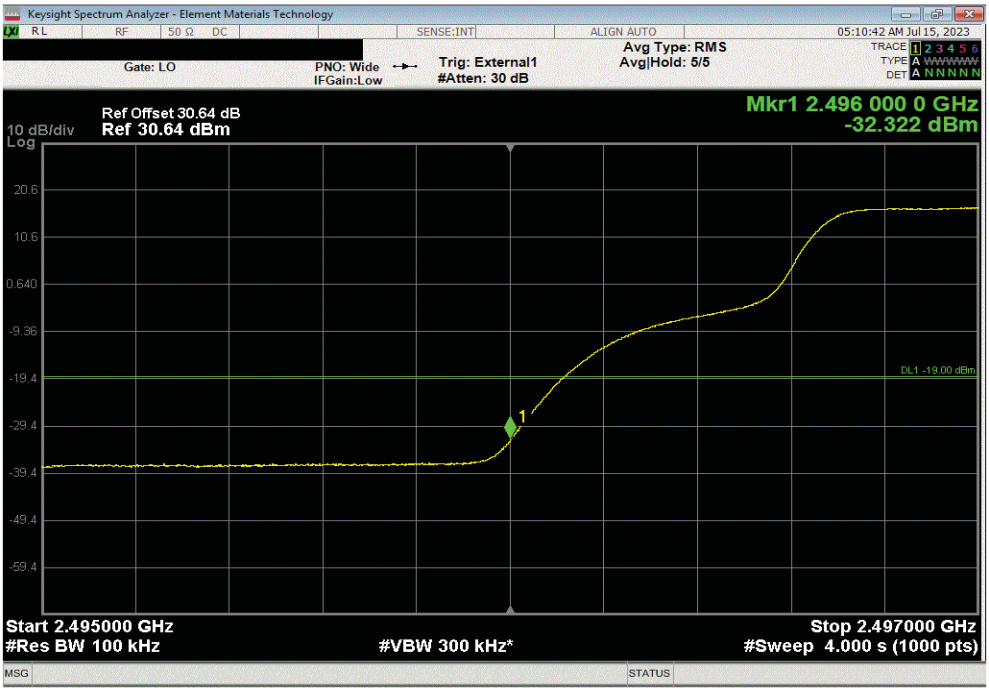
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 16QAM Modulation, High Channel, 2685.00 MHz						
	Frequency Range		Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
	2		2691.5	-31.5	-19	Pass



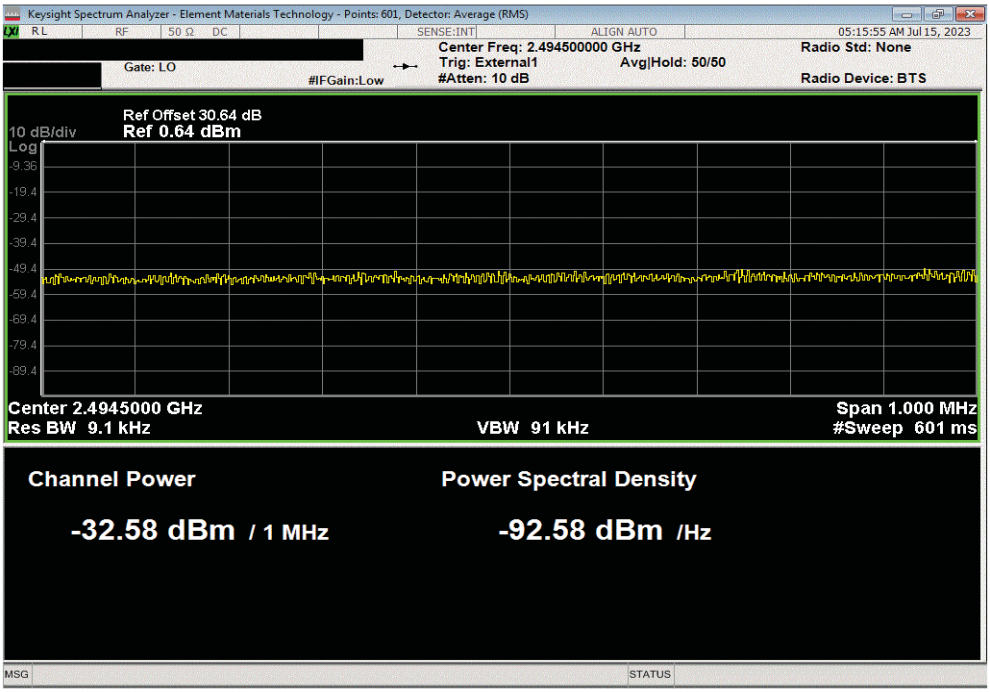
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 16QAM Modulation, High Channel, 2685.00 MHz						
	Frequency Range		Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
	3		2692.0	-32.0	-19	Pass



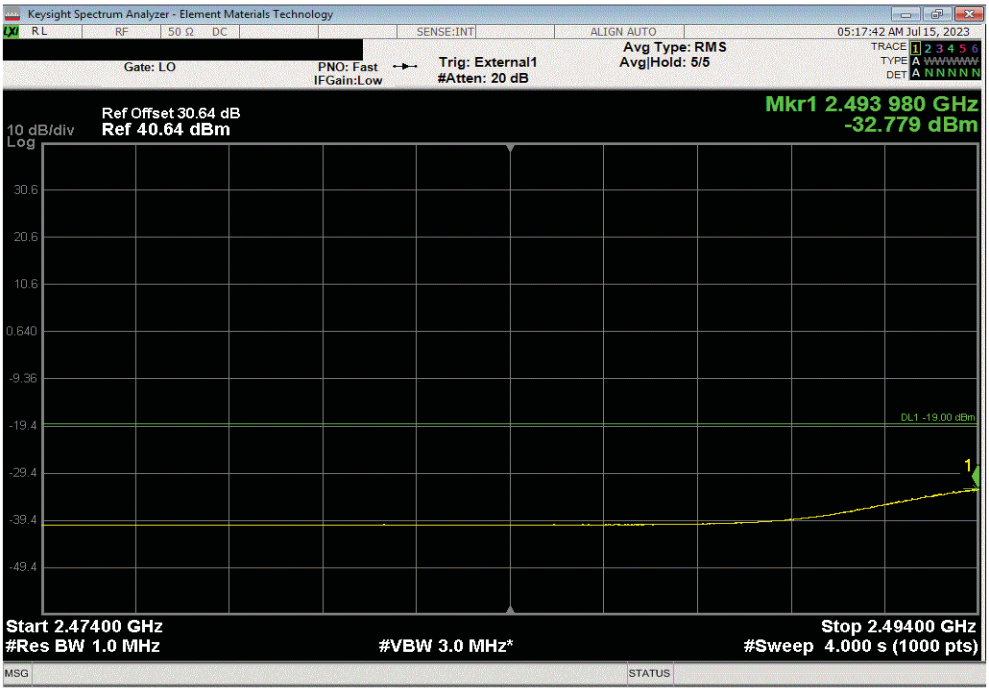
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 64QAM Modulation, Low Channel, 2501.01 MHz						
	Frequency Range		Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
	1		2496.0	-32.3	-19	Pass



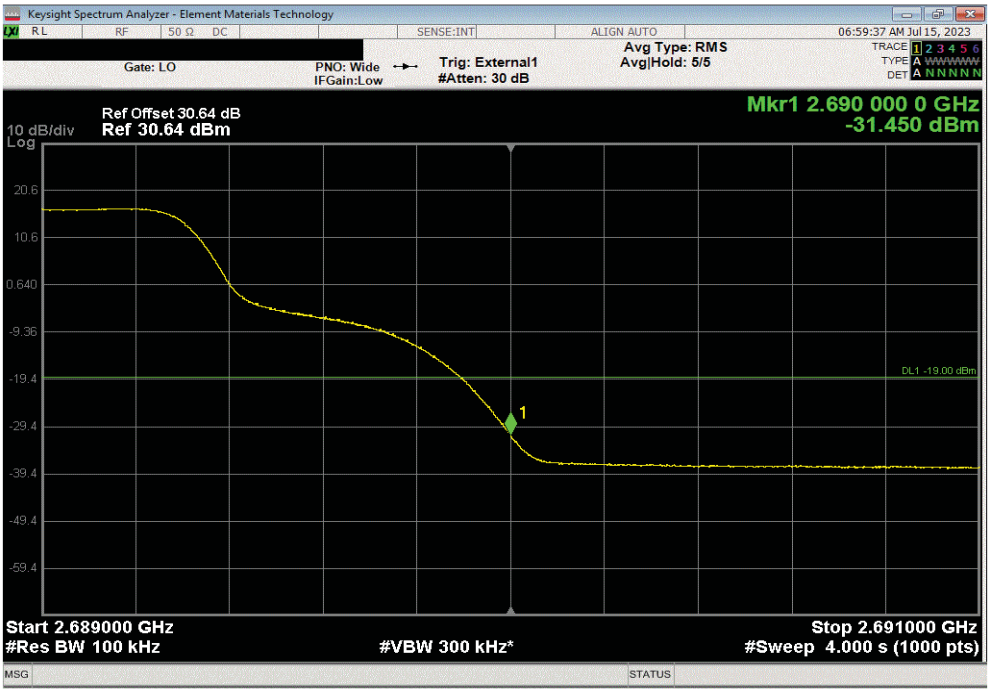
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 64QAM Modulation, Low Channel, 2501.01 MHz						
	Frequency Range		Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
	2		2494.5	-32.6	-19	Pass



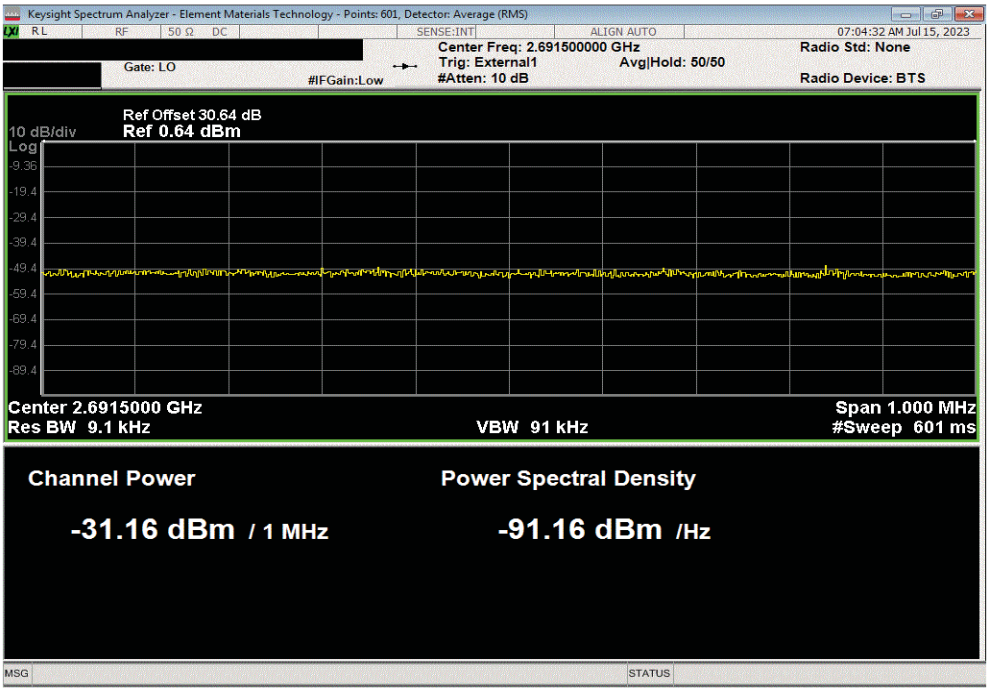
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 64QAM Modulation, Low Channel, 2501.01 MHz						
	Frequency Range		Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
	3		2494.0	-32.8	-19	Pass



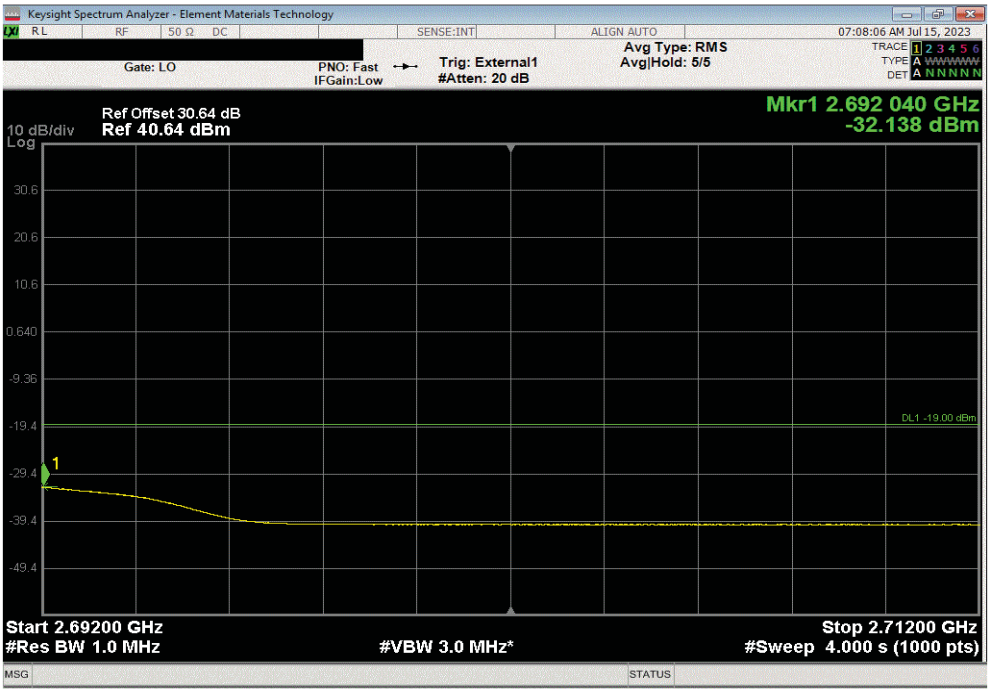
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 64QAM Modulation, High Channel, 2685.00 MHz						
	Frequency Range		Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
	1		2690.0	-31.5	-19	Pass



Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 64QAM Modulation, High Channel, 2685.00 MHz						
	Frequency Range		Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
	2		2691.5	-31.2	-19	Pass

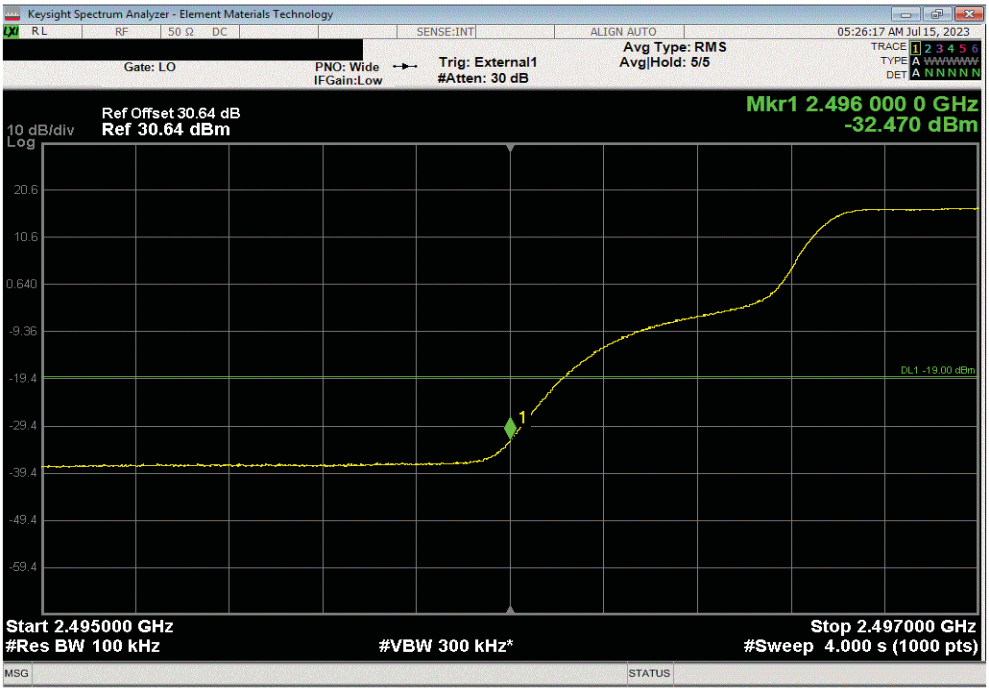


Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 64QAM Modulation, High Channel, 2685.00 MHz						
	Frequency Range		Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
	3		2692.0	-32.1	-19	Pass



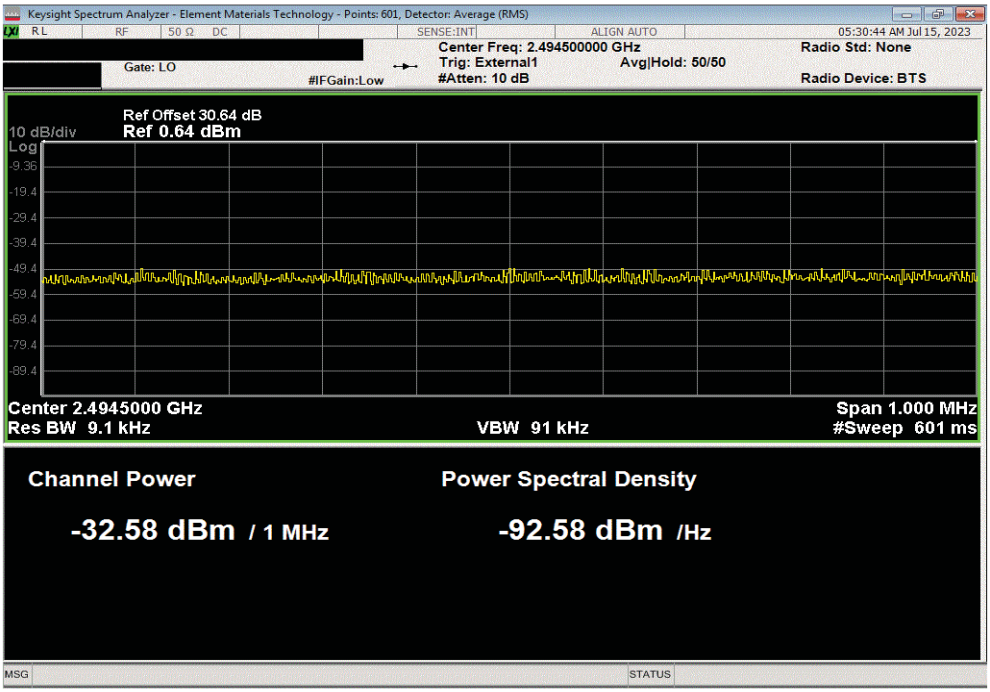
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 256QAM Modulation, Low Channel, 2501.01 MHz

Frequency Range			Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
	1		2496.0	-32.5	-19	Pass

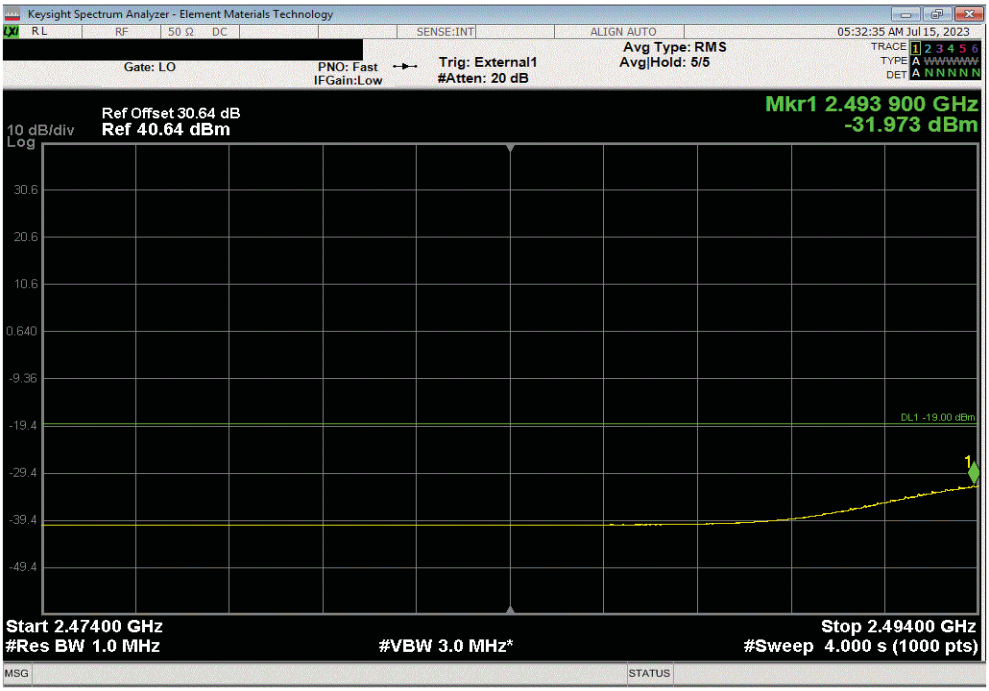


Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 256QAM Modulation, Low Channel, 2501.01 MHz

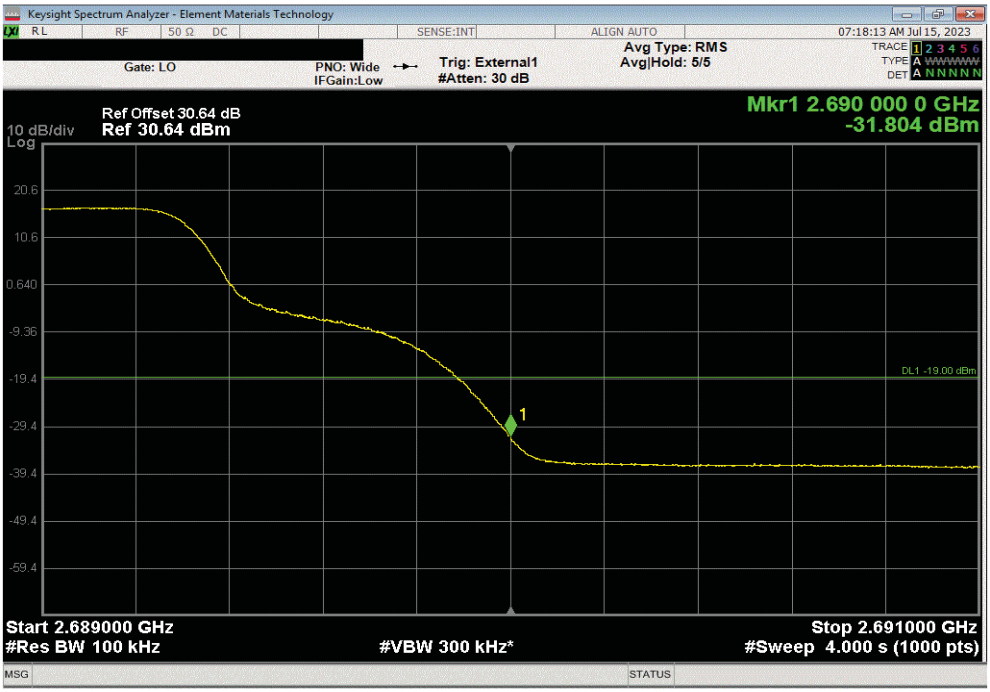
Frequency Range			Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
	2		2494.5	-32.6	-19	Pass



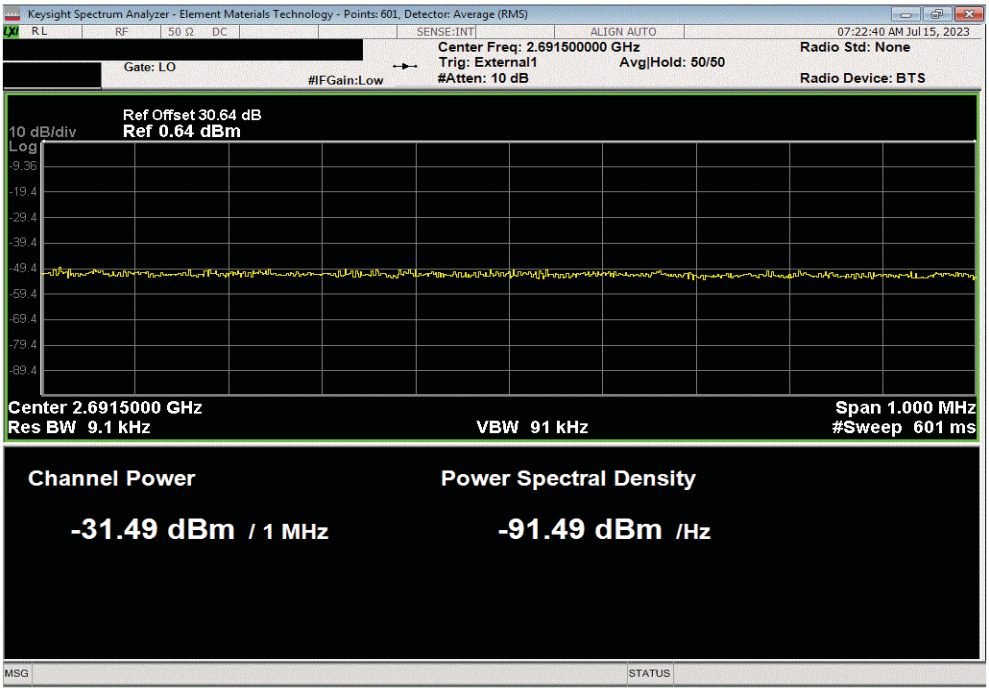
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 256QAM Modulation, Low Channel, 2501.01 MHz						
	Frequency Range		Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
	3		2493.9	-32.0	-19	Pass



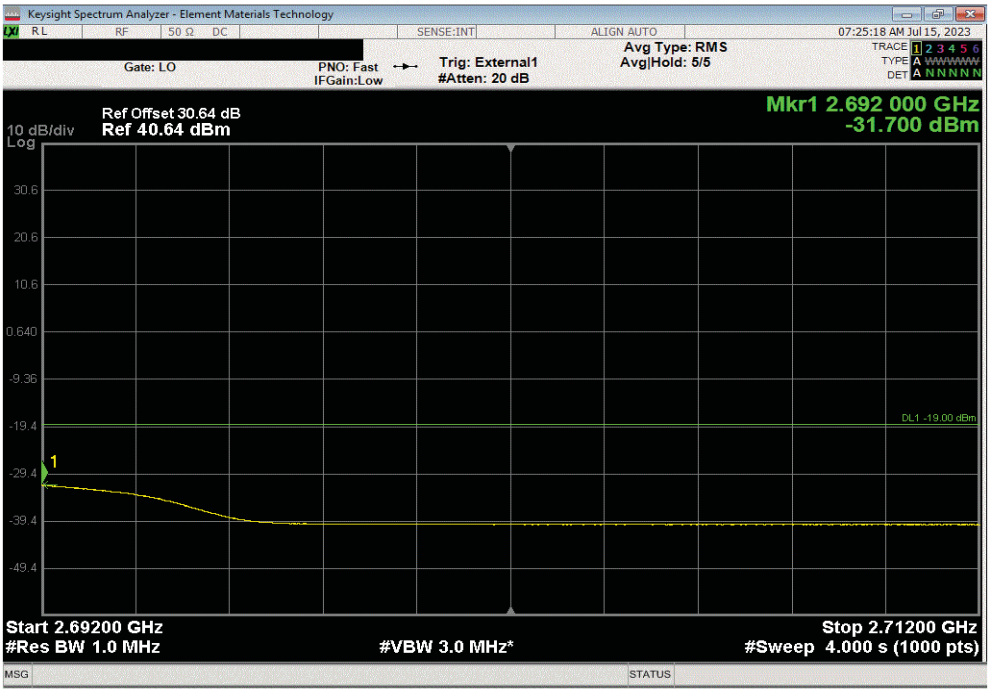
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 256QAM Modulation, High Channel, 2685.00 MHz						
	Frequency Range		Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
	1		2690.0	-31.8	-19	Pass



Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 256QAM Modulation, High Channel, 2685.00 MHz						
	Frequency Range		Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
	2		2691.5	-31.5	-19	Pass



Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 256QAM Modulation, High Channel, 2685.00 MHz						
	Frequency Range		Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
	3		2692.0	-31.7	-19	Pass



SPURIOUS CONDUCTED EMISSIONS

XMit 2023.02.14.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2023-02-09	2024-02-09
Generator - Signal	Agilent	N5183A	TID	2023-05-12	2025-05-12
Block - DC	Fairview Microwave	SD3235-2148	ANF	2023-05-24	2024-05-24
Block - DC	Fairview Microwave	SD3379	AMM	2022-09-09	2023-09-09

TEST DESCRIPTION

The antenna port spurious emissions were measured at the RF output terminal of the EUT through 4 different attenuation configurations which continues through to the RF input of the spectrum analyzer. Analyzer plots utilizing a resolution bandwidth called out by the client's test plan were made for each modulation type from 9 KHz to 27 GHz. The conducted power of spurious emissions, up to the 10th harmonic of the transmit frequency, were investigated to ensure they were less than the limits also called out by the client's test plan shown below.

The measurement methods are detailed in KDB 971168 D01v03 section 6 and ANSI C63.26-2015.

Per FCC 2.1057(a)(1) and RSS Gen 6.13, the upper level of measurement is the 10th harmonic of the highest fundamental frequency.

These measurements are for the frequency band after the first 1.0 MHz bands immediately outside and adjacent to the frequency block.

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

Per FCC Part 27.53(m)(2), the power of any emission outside of the authorized operating frequency range cannot exceed -13 dBm. The BTS may operate as a 8 port MIMO transmitter with transmitter outputs connected to four cross-polarized antennas [four transmitter outputs are connected to (+) radiators and four transmitter outputs are connected to (-) radiators]. The limit is adjusted to -19 dBm [-13 dBm -10 log (4)] per FCC KDB 662911D01 v02r01, ANSI C63.26-2015 section 6.4.6.3 b)2) and KDB 662911 D02v01 page 3 example (2) since the transmitter outputs to each antenna are 90 degree-phase shifted relative to each other (cross-polarized radiators).

Per FCC 27.53(m)(6), "Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.....A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 megahertz or 1 percent of emission bandwidth, as specified)".

The limit for the 9kHz to 150kHz frequency range was adjusted to -49dBm to correct for a spectrum analyzer RBW of 1kHz versus required RBW of 1MHz [i.e.: -49dBm = -19dBm -10log(1MHz/1kHz)]. The limit for the 150kHz to 20MHz frequency range was adjusted to -39dBm to correct for a spectrum analyzer RBW of 10kHz versus required RBW of 1MHz [i.e.: -39dBm = -19dBm -10log(1MHz/10kHz)]. The required limit of -19dBm with a RBW of > 1MHz was used for all other frequency ranges. (See ANSI C63.26-2015 paragraph 5.7.2a for details on the Limit/RBW scaling method)

SPURIOUS CONDUCTED EMISSIONS

element

TbtTx 2022.05.02.0 XMit 2023.02.14.0

EUT:	AZHL			Work Order:	NOKI0067
Serial Number:	YK203400004			Date:	07/14/2023
Customer:	Nokia Solutions and Networks			Temperature:	21.4°C
Attendees:	David Le, Mitchell Hill			Humidity:	52.4%
Project:	None			Barometric Pres.:	1016 mbar
Tested by:	Brandon Hobbs	Power:	54VDC	Job Site:	TX07

TEST SPECIFICATIONS	Test Method
FCC 27:2023	ANSI C63.26:2015

COMMENTS

All measurement path losses were accounted for in the reference level offest including any attenuators, filters and DC blocks. Band n41 carriers are enabled at maximum power (4 Watts/carrier).

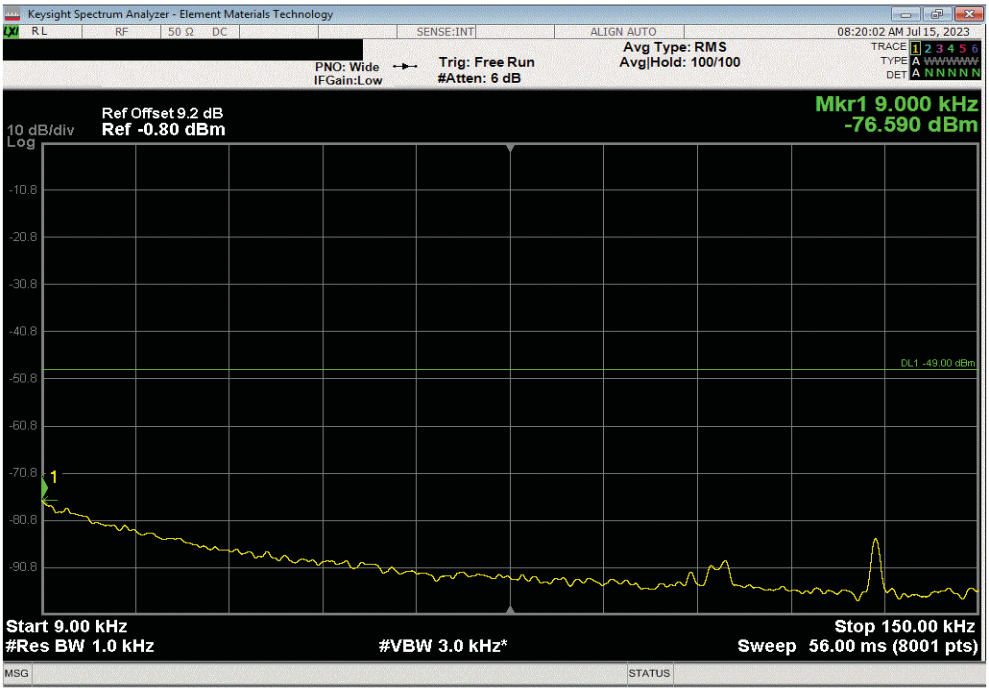
DEVIATIONS FROM TEST STANDARD

None

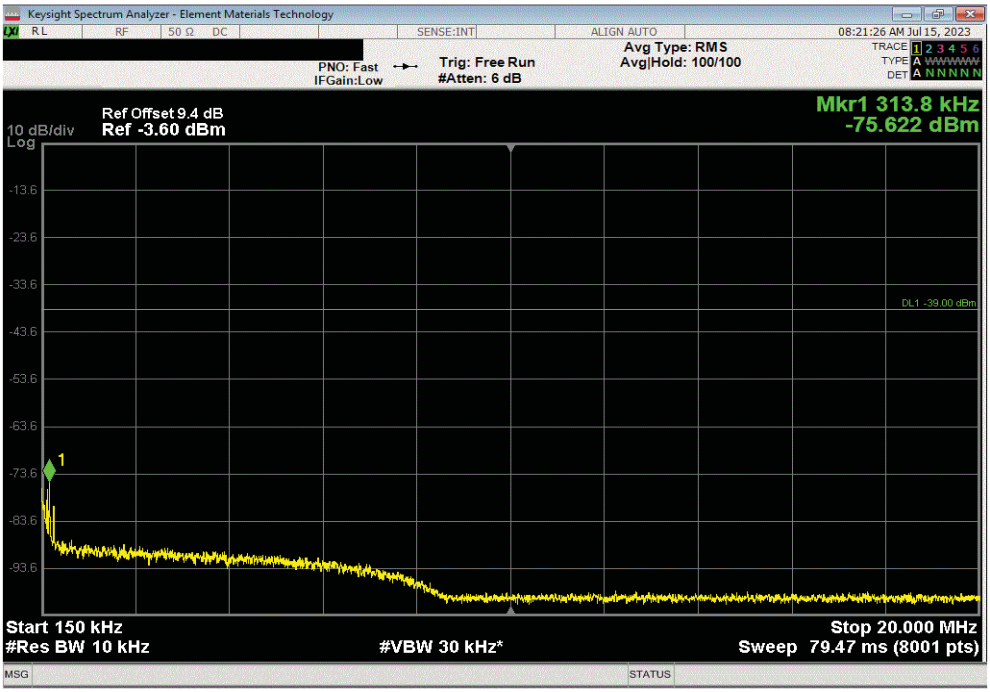
Configuration #	NOKI0067-1 NOKI0067-2 NOKI0067-3 NOKI0067-4	Signature

		Frequency Range	Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
Port 1						
	Band n41, 2496 - 2690 MHz					
	10 MHz Bandwidth					
	QPSK Modulation					
	Mid Channel, 2592.99 MHz	9 kHz - 150 kHz	0.01	-76.6	-49	Pass
	Mid Channel, 2592.99 MHz	150 kHz - 20 MHz	0.31	-75.6	-39	Pass
	Mid Channel, 2592.99 MHz	20 MHz - 4 GHz	3603	-33.1	-19	Pass
	Mid Channel, 2592.99 MHz	2.45 GHz - 2.75 GHz	2730	-34.1	-19	Pass
	Mid Channel, 2592.99 MHz	4 GHz - 11 GHz	4010	-48.3	-19	Pass
	Mid Channel, 2592.99 MHz	11 GHz - 18 GHz	14341	-50.5	-19	Pass
	Mid Channel, 2592.99 MHz	18 GHz - 27 GHz	26116	-54.1	-19	Pass
	16QAM Modulation					
	Mid Channel, 2592.99 MHz	9 kHz - 150 kHz	0.01	-77.6	-49	Pass
	Mid Channel, 2592.99 MHz	150 kHz - 20 MHz	0.31	-75.2	-39	Pass
	Mid Channel, 2592.99 MHz	20 MHz - 4 GHz	3603	-34.1	-19	Pass
	Mid Channel, 2592.99 MHz	2.45 GHz - 2.75 GHz	2725	-34.1	-19	Pass
	Mid Channel, 2592.99 MHz	4 GHz - 11 GHz	4018	-48.4	-19	Pass
	Mid Channel, 2592.99 MHz	11 GHz - 18 GHz	13643	-50.6	-19	Pass
	Mid Channel, 2592.99 MHz	18 GHz - 27 GHz	26117	-54.1	-19	Pass
	64QAM Modulation					
	Mid Channel, 2592.99 MHz	9 kHz - 150 kHz	0.01	-77.5	-49	Pass
	Mid Channel, 2592.99 MHz	150 kHz - 20 MHz	0.31	-75.7	-39	Pass
	Mid Channel, 2592.99 MHz	20 MHz - 4 GHz	3618	-34.4	-19	Pass
	Mid Channel, 2592.99 MHz	2.45 GHz - 2.75 GHz	2727	-34.0	-19	Pass
	Mid Channel, 2592.99 MHz	4 GHz - 11 GHz	4009	-48.2	-19	Pass
	Mid Channel, 2592.99 MHz	11 GHz - 18 GHz	17716	-50.5	-19	Pass
	Mid Channel, 2592.99 MHz	18 GHz - 27 GHz	26166	-54.3	-19	Pass
	256QAM Modulation					
	Mid Channel, 2592.99 MHz	9 kHz - 150 kHz	0.01	-76.7	-49	Pass
	Mid Channel, 2592.99 MHz	150 kHz - 20 MHz	0.31	-75.4	-39	Pass
	Mid Channel, 2592.99 MHz	20 MHz - 4 GHz	3614	-33.5	-19	Pass
	Mid Channel, 2592.99 MHz	2.45 GHz - 2.75 GHz	2716	-34.0	-19	Pass
	Mid Channel, 2592.99 MHz	4 GHz - 11 GHz	4025	-48.2	-19	Pass
	Mid Channel, 2592.99 MHz	11 GHz - 18 GHz	17981	-50.5	-19	Pass
	Mid Channel, 2592.99 MHz	18 GHz - 27 GHz	26112	-53.9	-19	Pass

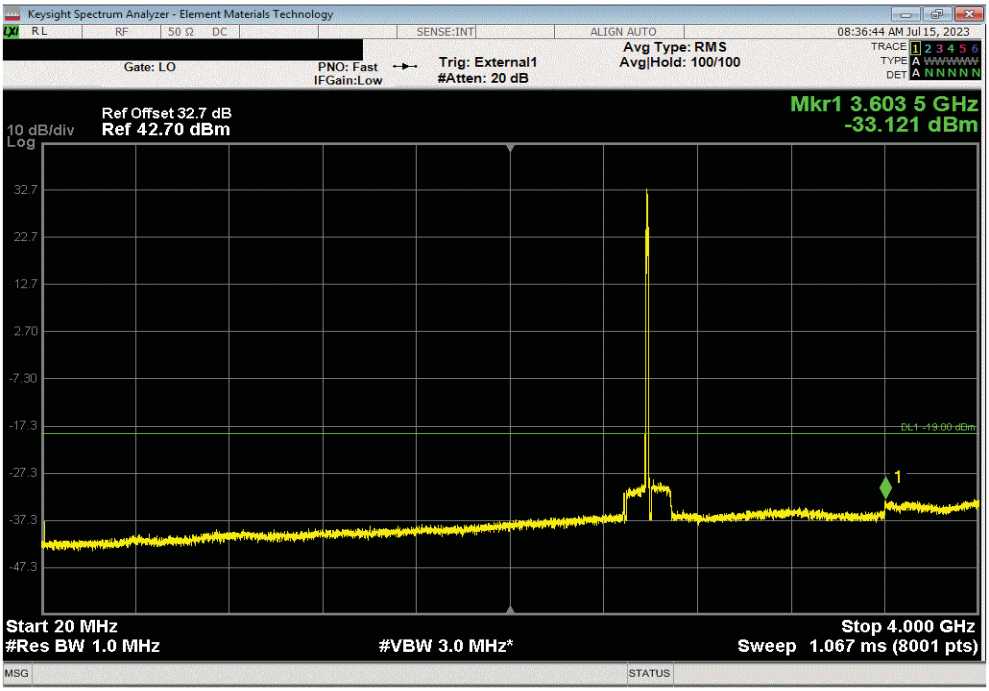
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, QPSK Modulation, Mid Channel, 2592.99 MHz					
	Frequency Range	Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
	9 kHz - 150 kHz	0.01	-76.59	-49	Pass



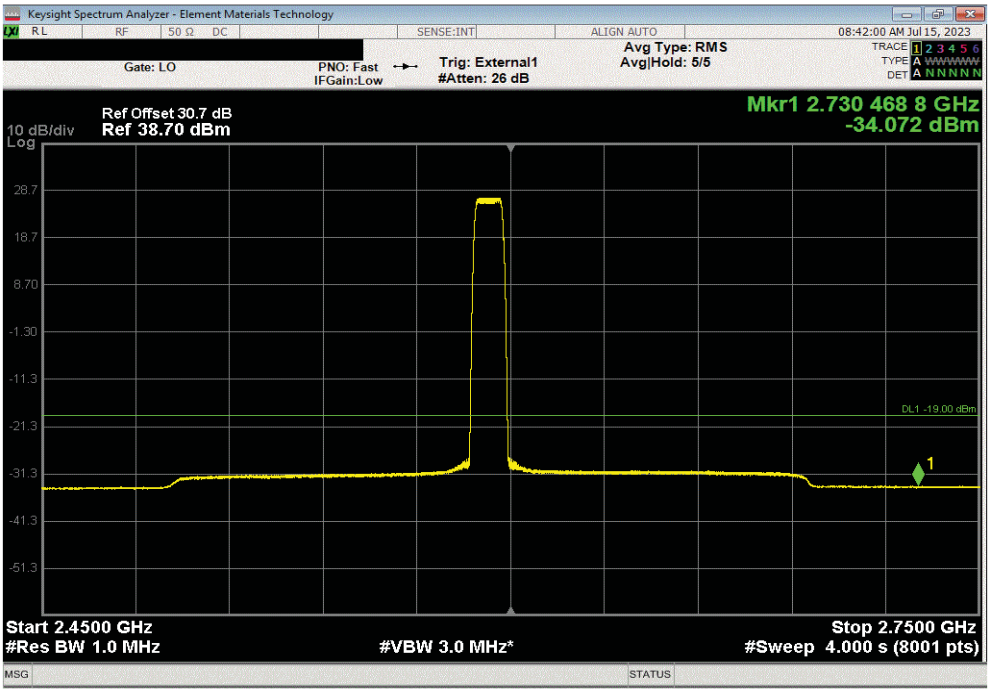
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, QPSK Modulation, Mid Channel, 2592.99 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
150 kHz - 20 MHz	0.31	-75.62	-39	Pass



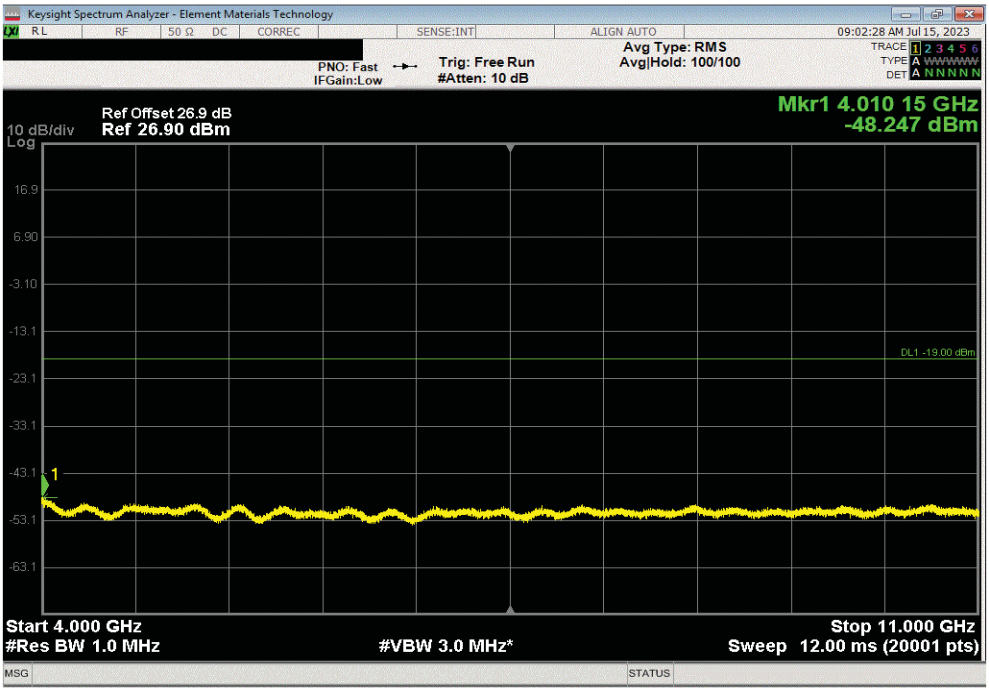
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, QPSK Modulation, Mid Channel, 2592.99 MHz					
	Frequency Range	Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
	20 MHz - 4 GHz	3603.49	-33.12	-19	Pass



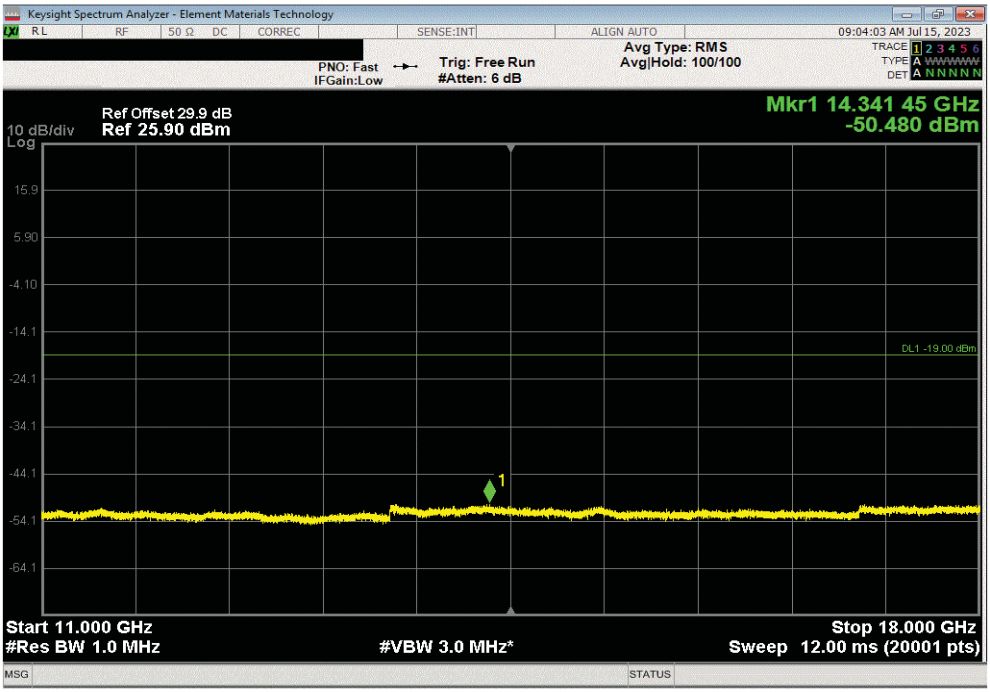
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, QPSK Modulation, Mid Channel, 2592.99 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
2.45 GHz - 2.75 GHz	2730.47	-34.07	-19	Pass



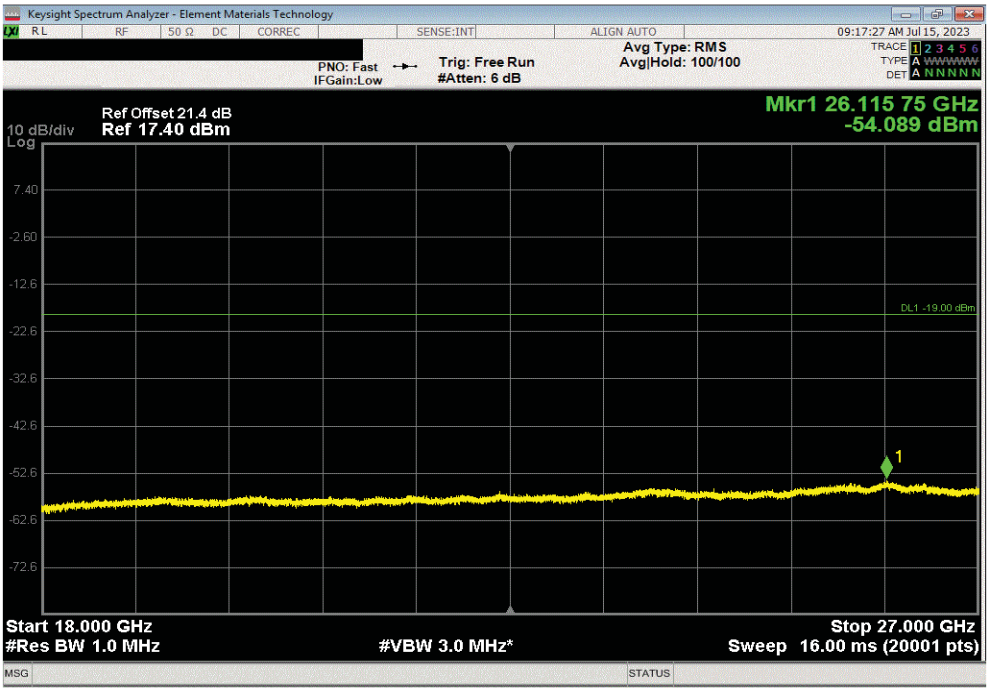
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, QPSK Modulation, Mid Channel, 2592.99 MHz					
	Frequency Range	Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
	4 GHz - 11 GHz	4010.15	-48.25	-19	Pass



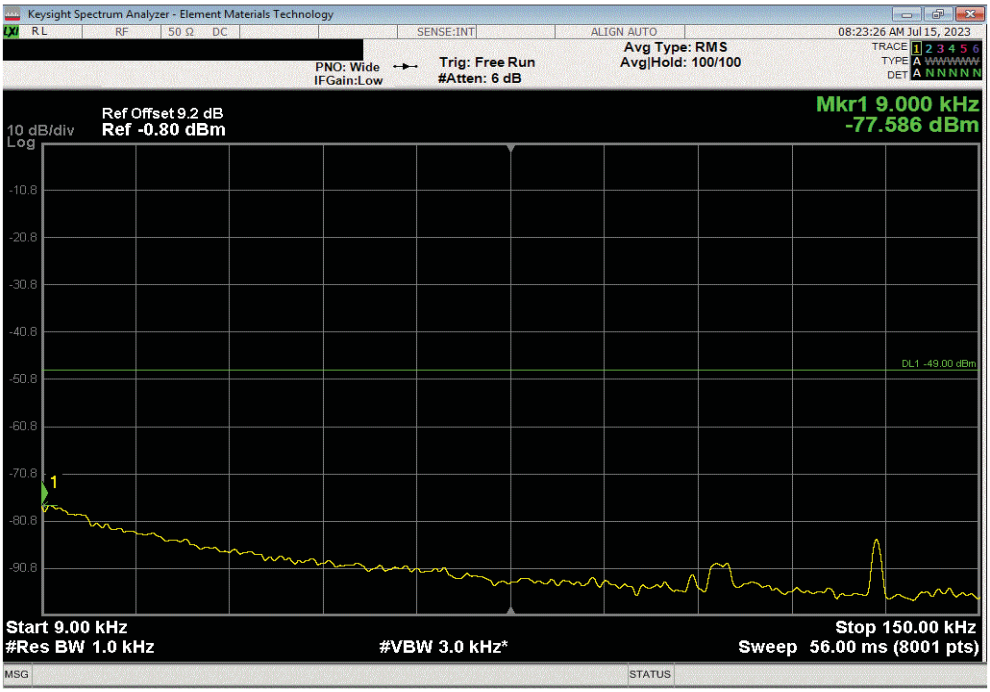
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, QPSK Modulation, Mid Channel, 2592.99 MHz					
	Frequency Range	Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
	11 GHz - 18 GHz	14341.45	-50.48	-19	Pass



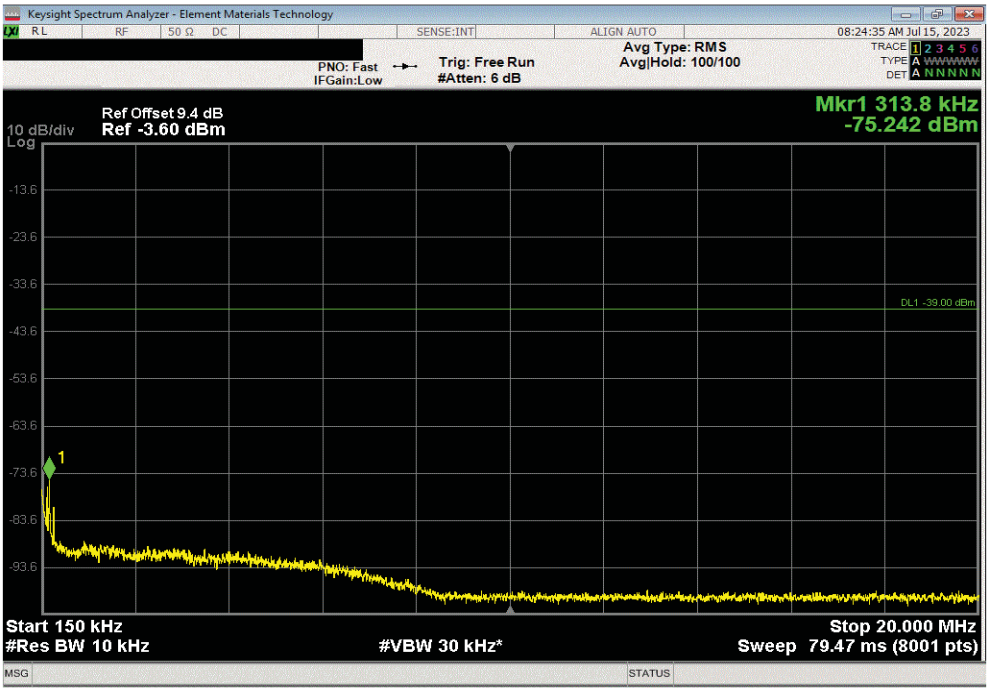
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, QPSK Modulation, Mid Channel, 2592.99 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
18 GHz - 27 GHz	26115.75	-54.09	-19	Pass



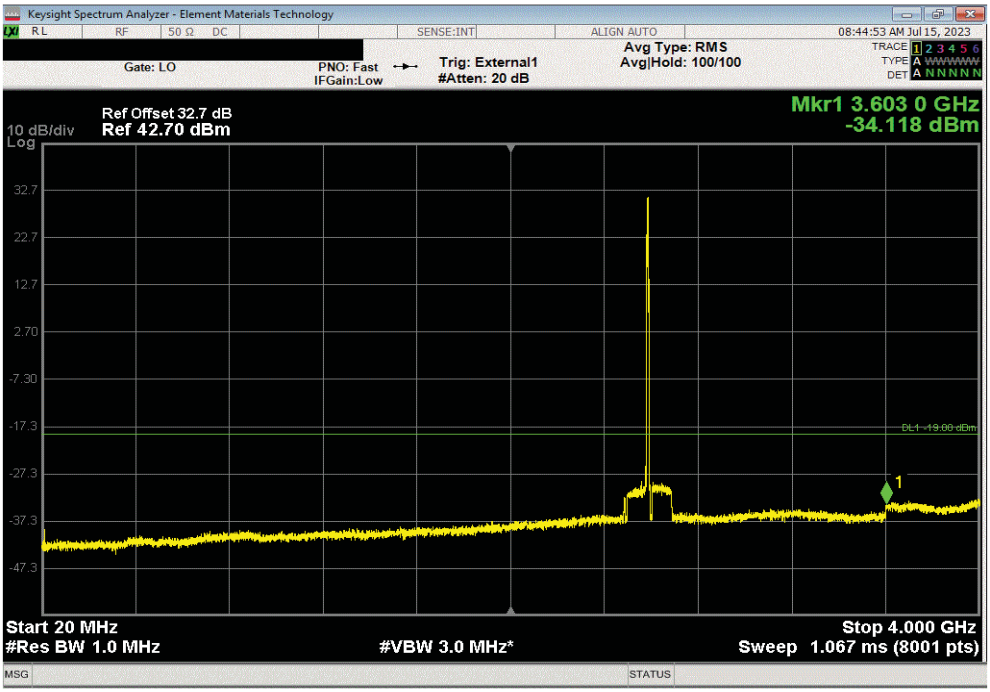
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 16QAM Modulation, Mid Channel, 2592.99 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
9 kHz - 150 kHz	0.01	-77.59	-49	Pass



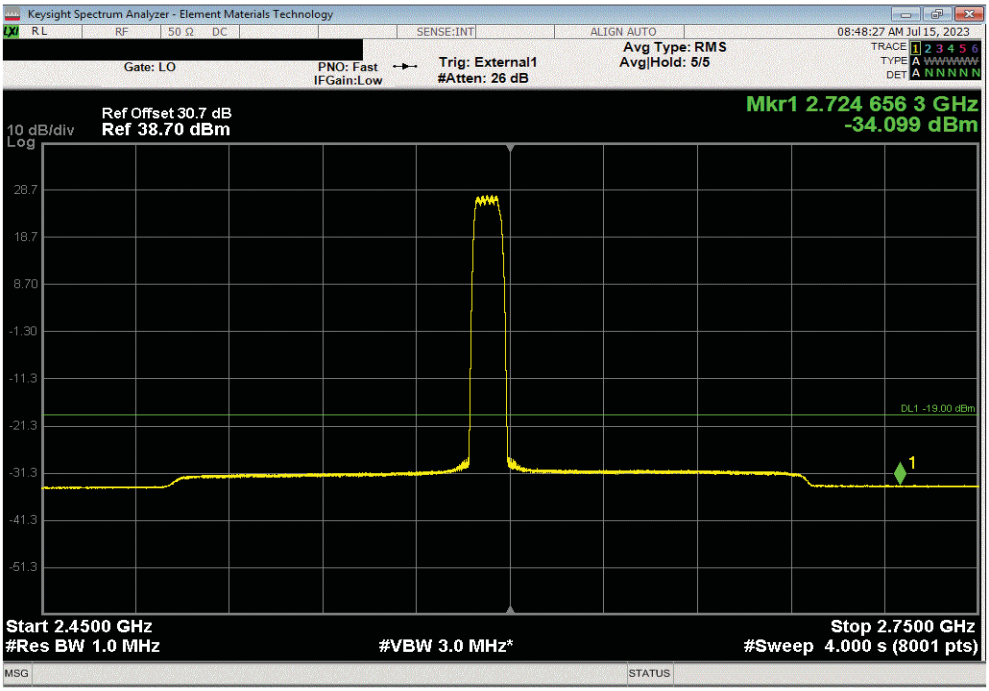
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 16QAM Modulation, Mid Channel, 2592.99 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
150 kHz - 20 MHz	0.31	-75.24	-39	Pass



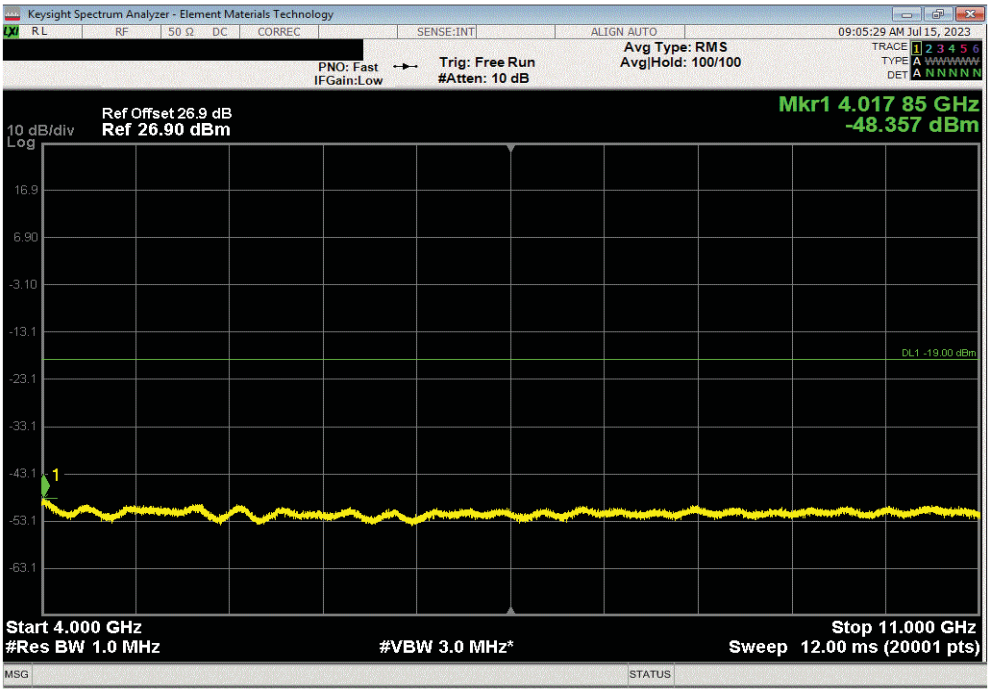
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 16QAM Modulation, Mid Channel, 2592.99 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
20 MHz - 4 GHz	3603	-34.12	-19	Pass



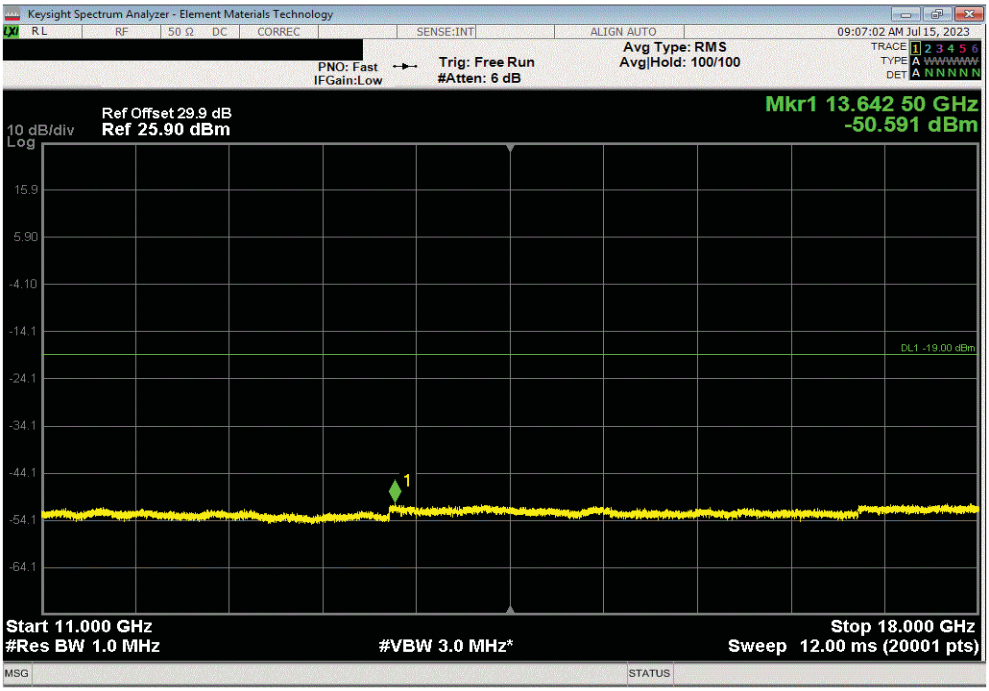
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 16QAM Modulation, Mid Channel, 2592.99 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
2.45 GHz - 2.75 GHz	2724.66	-34.1	-19	Pass



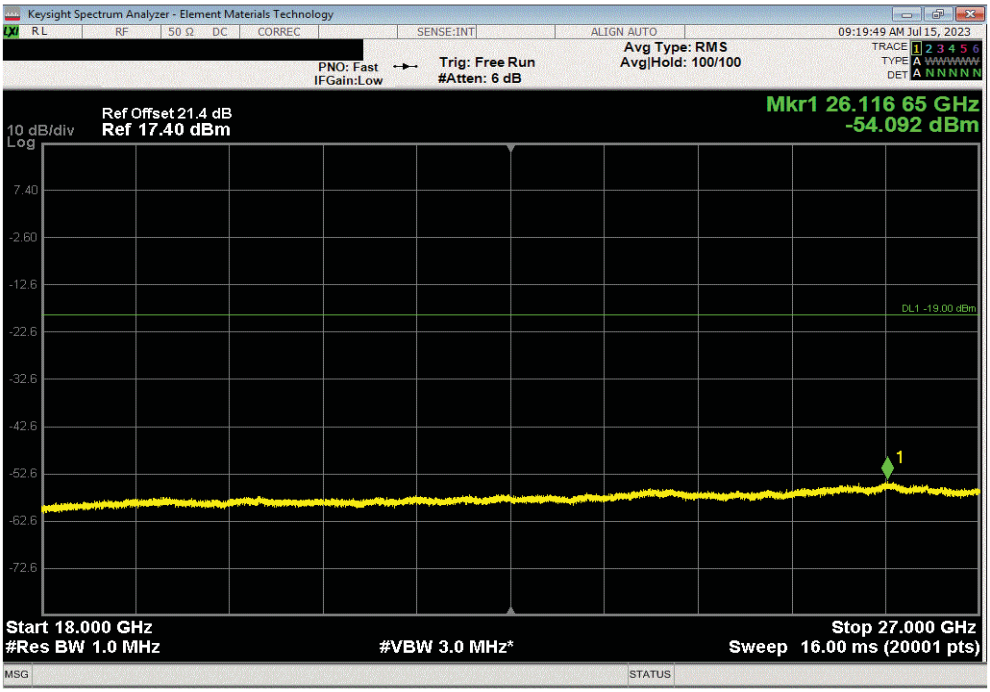
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 16QAM Modulation, Mid Channel, 2592.99 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
4 GHz - 11 GHz	4017.85	-48.36	-19	Pass



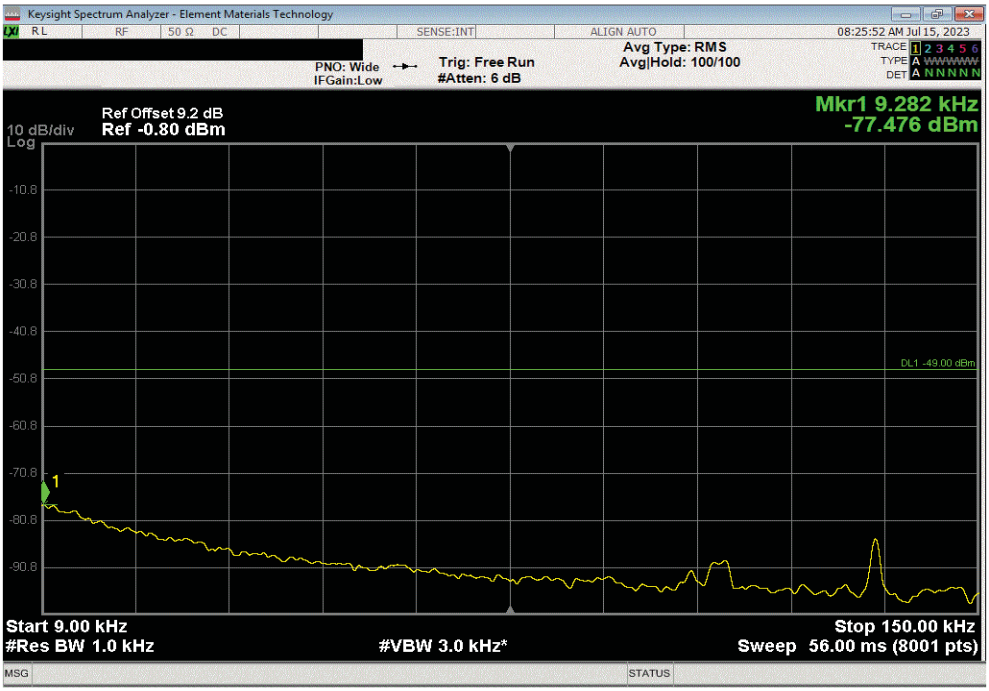
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 16QAM Modulation, Mid Channel, 2592.99 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
11 GHz - 18 GHz	13642.5	-50.59	-19	Pass



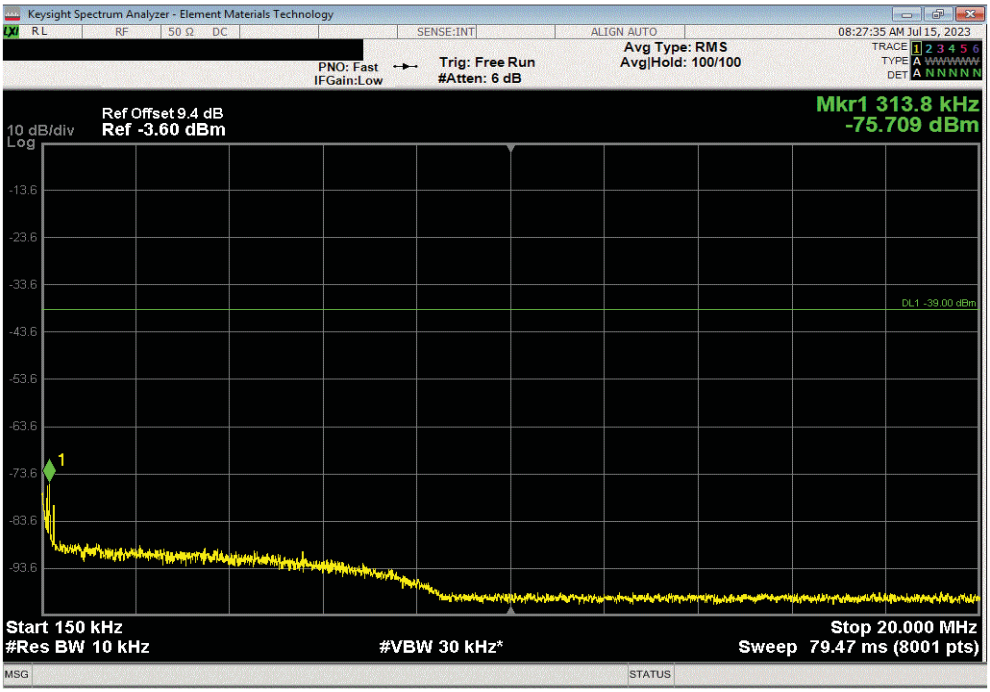
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 16QAM Modulation, Mid Channel, 2592.99 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
18 GHz - 27 GHz	26116.65	-54.09	-19	Pass



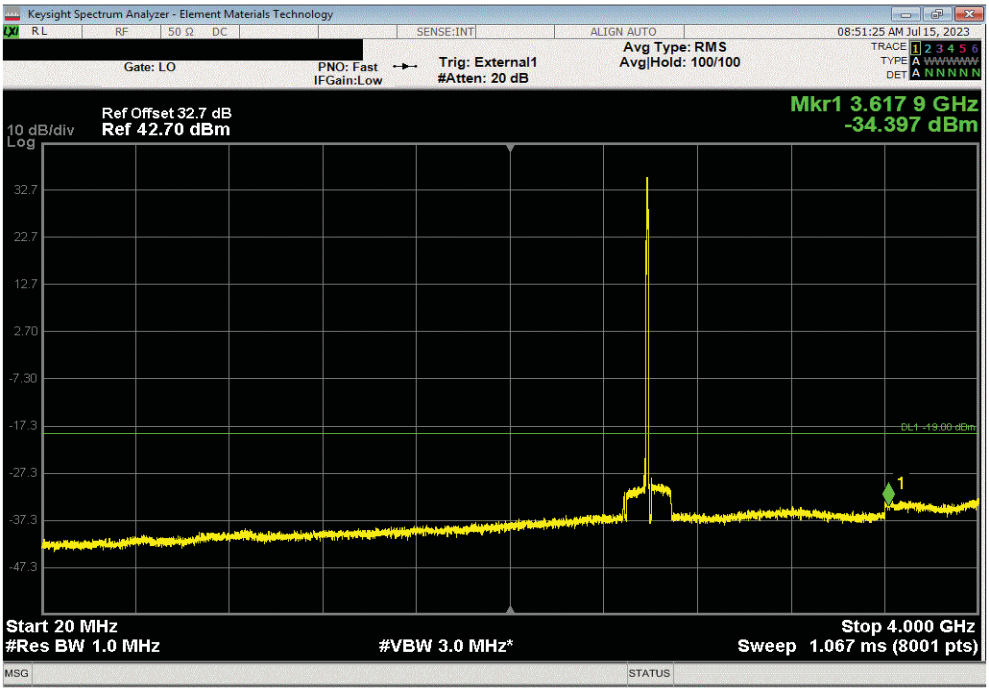
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 64QAM Modulation, Mid Channel, 2592.99 MHz					
	Frequency Range	Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
	9 kHz - 150 kHz	0.01	-77.48	-49	Pass



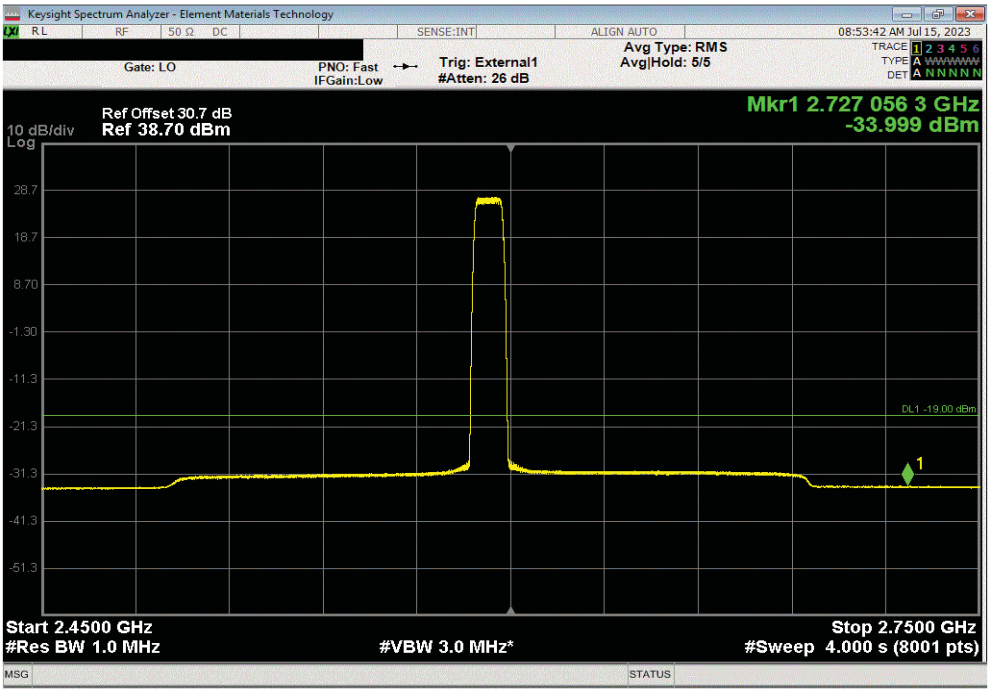
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 64QAM Modulation, Mid Channel, 2592.99 MHz					
	Frequency Range	Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
	150 kHz - 20 MHz	0.31	-75.71	-39	Pass



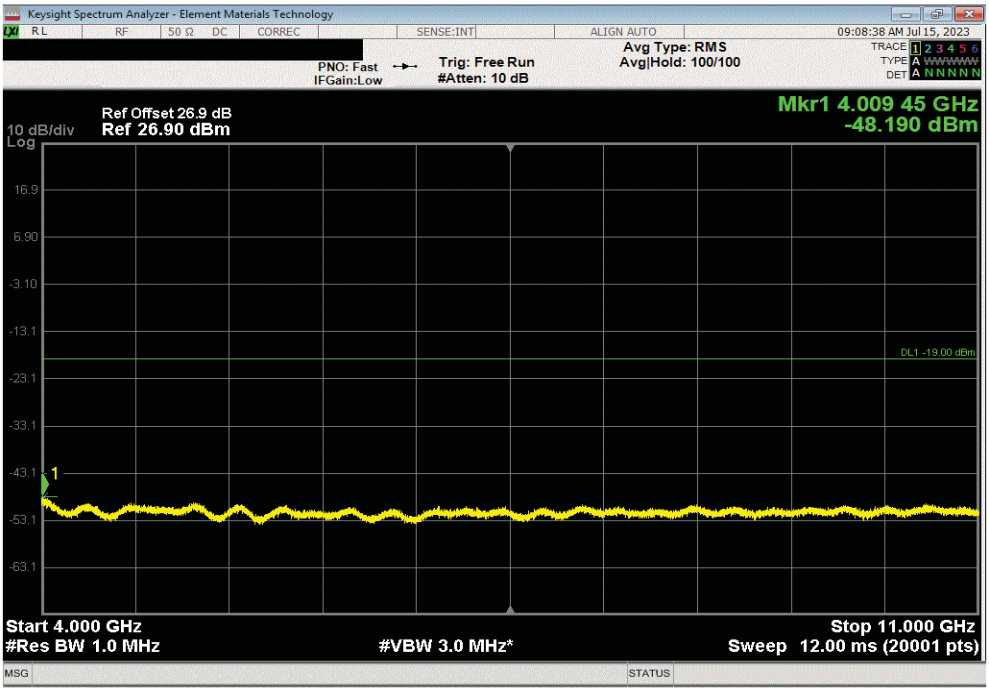
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 64QAM Modulation, Mid Channel, 2592.99 MHz					
	Frequency Range	Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
	20 MHz - 4 GHz	3617.92	-34.4	-19	Pass



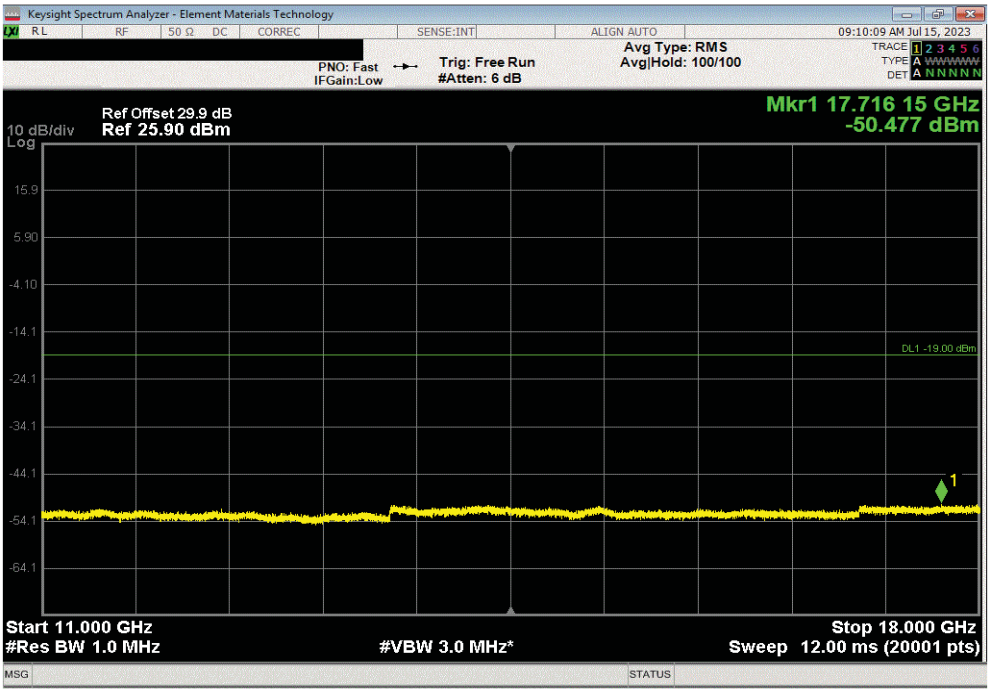
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 64QAM Modulation, Mid Channel, 2592.99 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
2.45 GHz - 2.75 GHz	2727.06	-34	-19	Pass



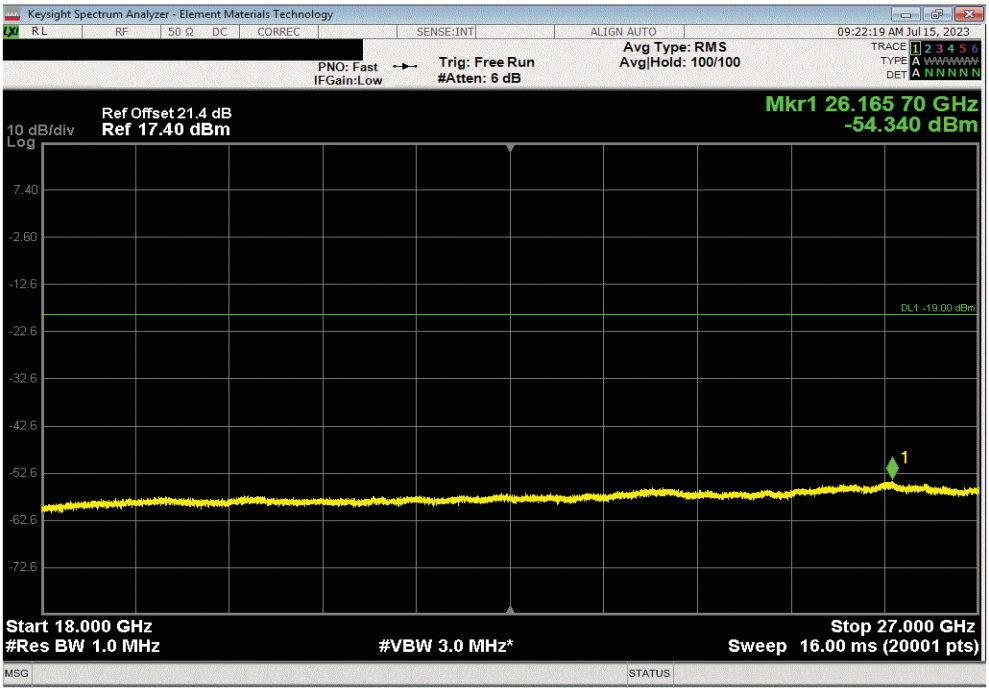
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 64QAM Modulation, Mid Channel, 2592.99 MHz					
	Frequency Range	Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
	4 GHz - 11 GHz	4009.45	-48.19	-19	Pass



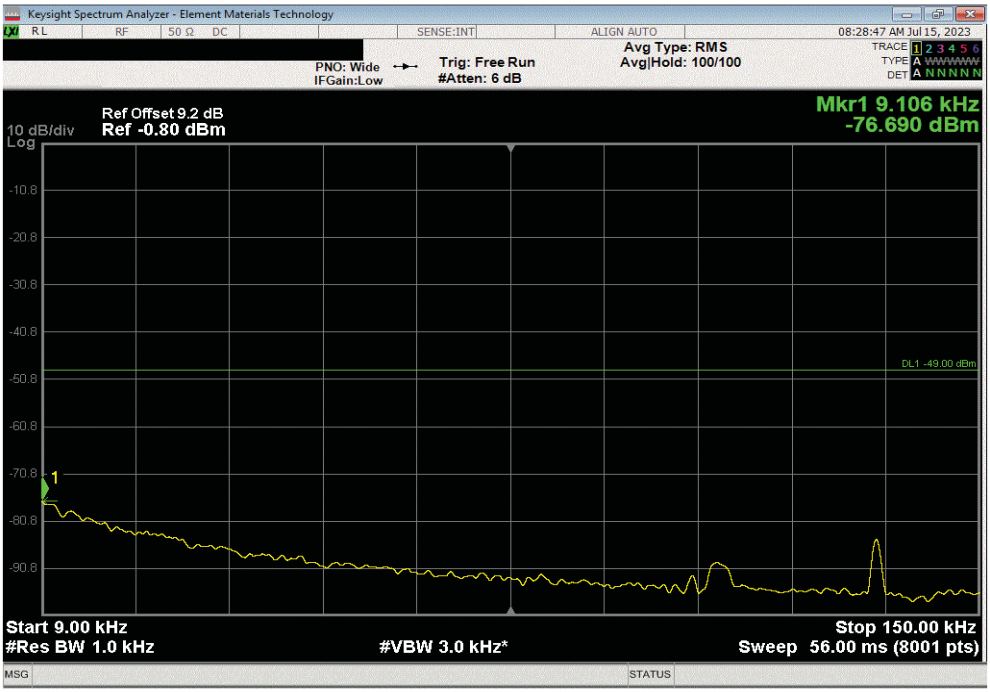
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 64QAM Modulation, Mid Channel, 2592.99 MHz					
	Frequency Range	Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
	11 GHz - 18 GHz	17716.15	-50.48	-19	Pass



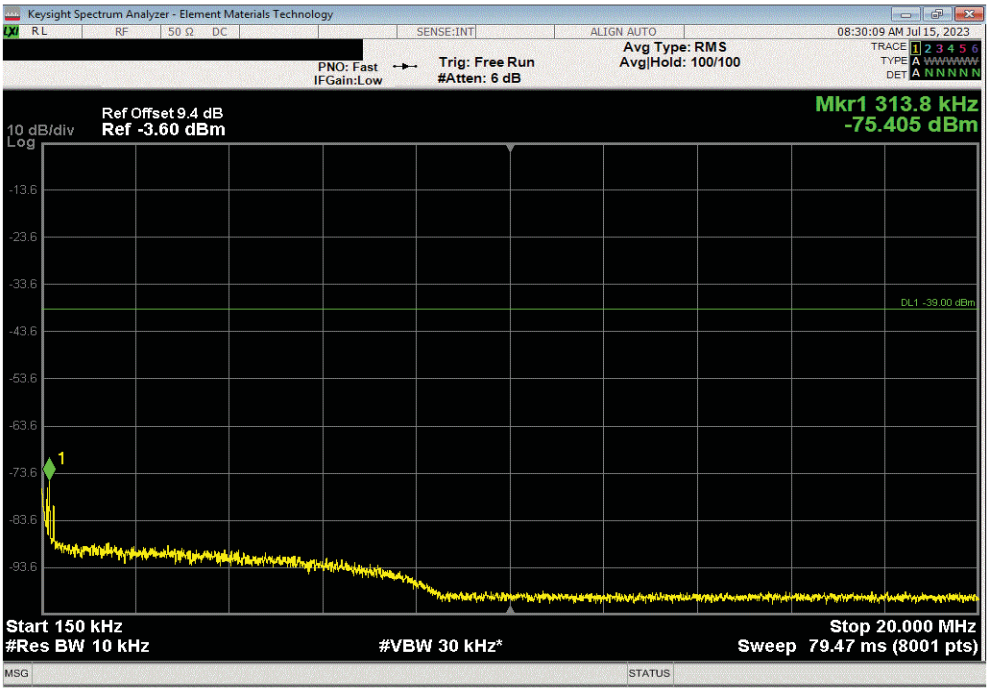
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 64QAM Modulation, Mid Channel, 2592.99 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
18 GHz - 27 GHz	26165.7	-54.34	-19	Pass



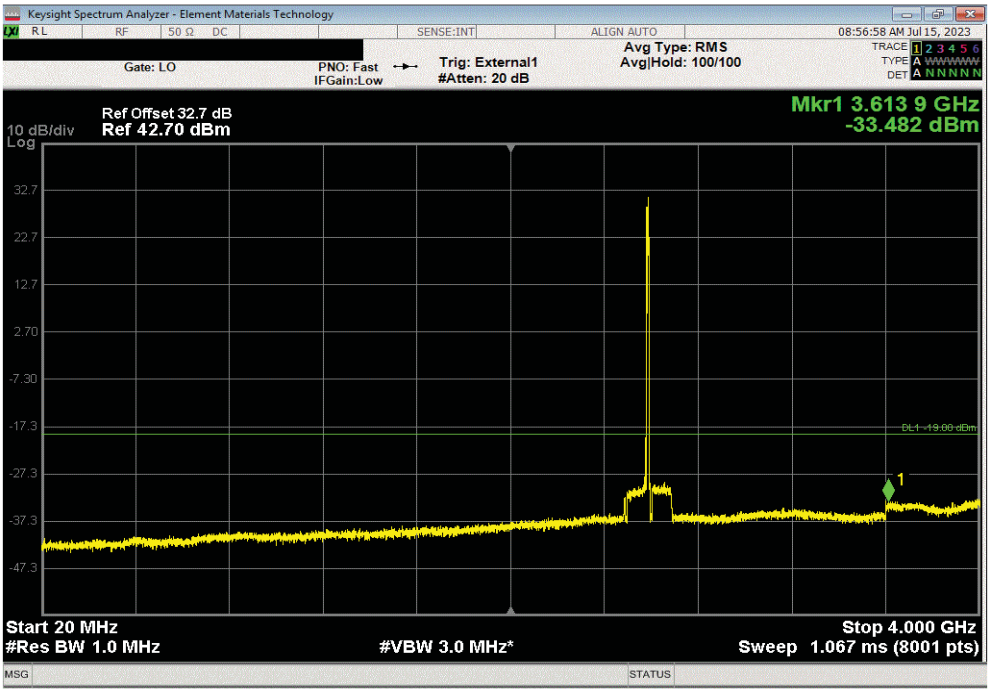
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 256QAM Modulation, Mid Channel, 2592.99 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
9 kHz - 150 kHz	0.01	-76.69	-49	Pass



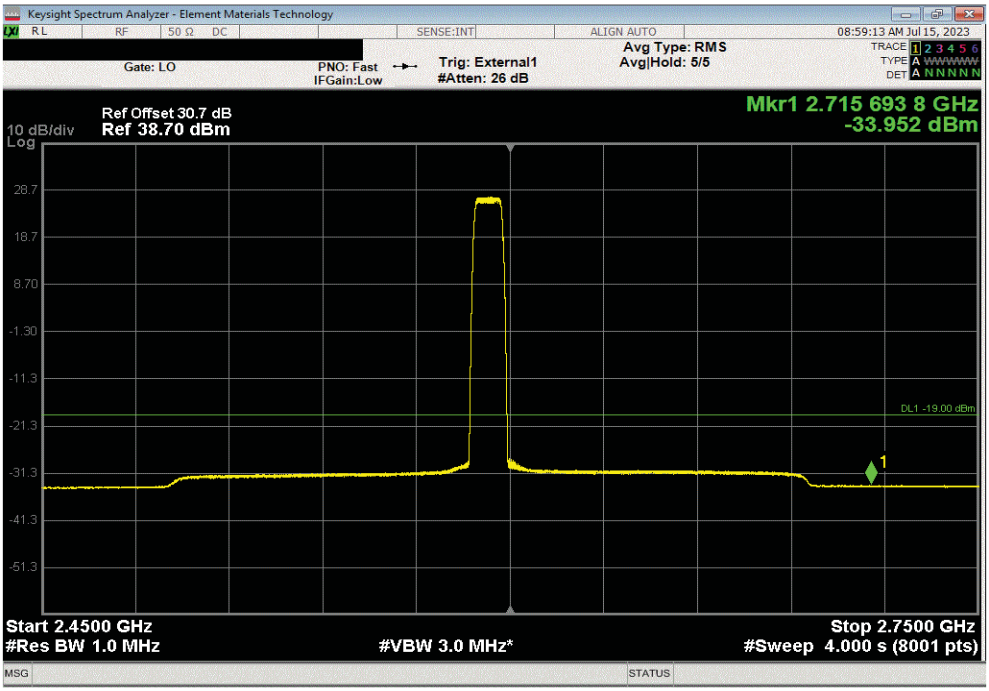
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 256QAM Modulation, Mid Channel, 2592.99 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
150 kHz - 20 MHz	0.31	-75.41	-39	Pass



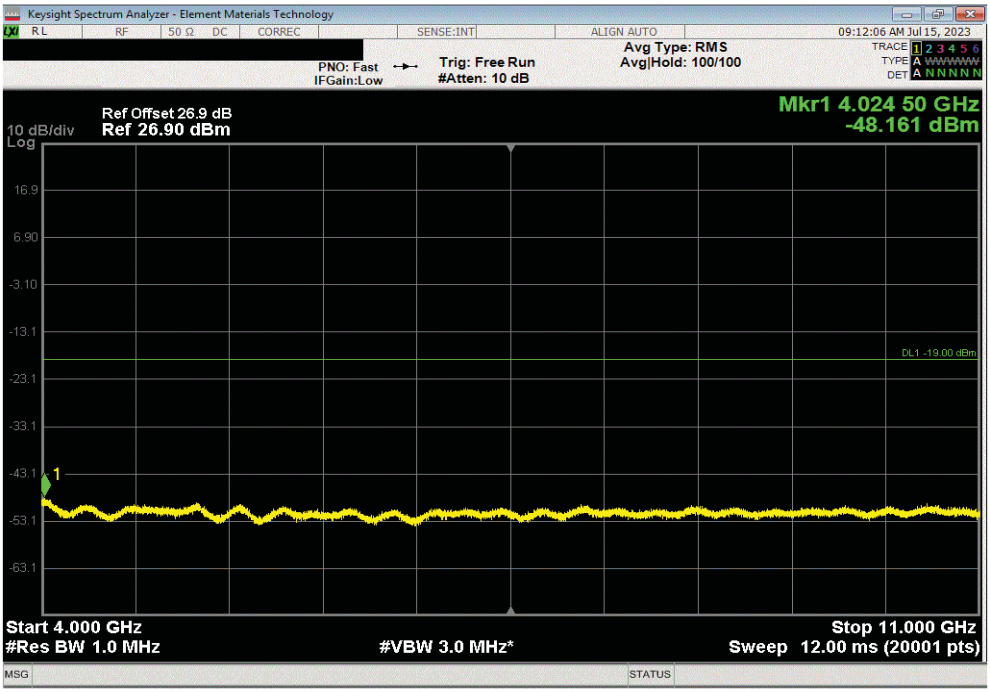
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 256QAM Modulation, Mid Channel, 2592.99 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
20 MHz - 4 GHz	3613.94	-33.48	-19	Pass



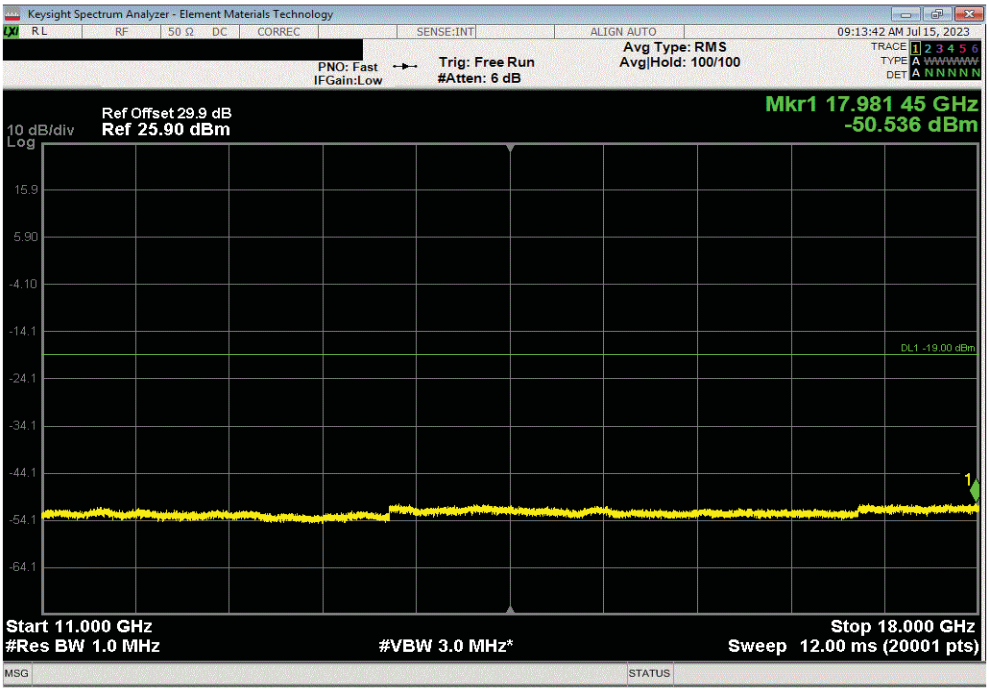
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 256QAM Modulation, Mid Channel, 2592.99 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
2.45 GHz - 2.75 GHz	2715.69	-33.95	-19	Pass



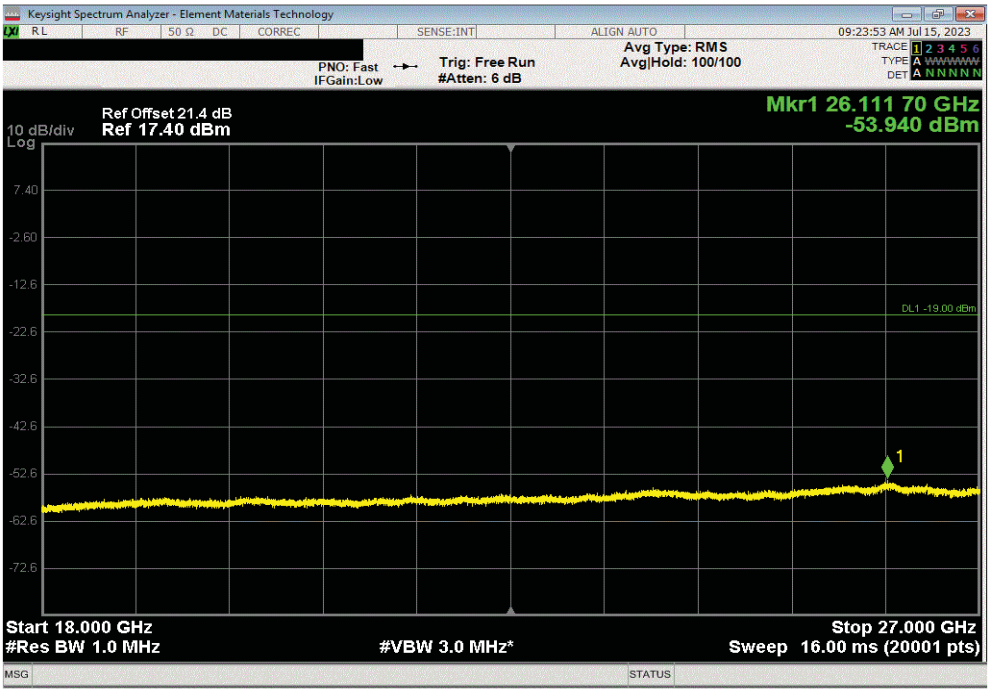
Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 256QAM Modulation, Mid Channel, 2592.99 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
4 GHz - 11 GHz	4024.5	-48.16	-19	Pass



Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 256QAM Modulation, Mid Channel, 2592.99 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
11 GHz - 18 GHz	17981.45	-50.54	-19	Pass



Port 1, Band n41, 2496 - 2690 MHz, 10 MHz Bandwidth, 256QAM Modulation, Mid Channel, 2592.99 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBm)	Limit < (dBm)	Result
18 GHz - 27 GHz	26111.7	-53.94	-19	Pass



End of Test Report