



**Radio Test Report
Application for Grant 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: NOKI0018.1, Issue Date: March 19, 2021



NVLAP LAB CODE: 201049-0



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CERTIFICATE OF TEST



Last Date of Test: February 26, 2021

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	Applied	Results	Comments
Duty Cycle	No	N/A	Not requested.
Occupied Bandwidth	Yes	Pass	
Frequency Stability	Yes	Pass	
Output Power	Yes	Pass	
Peak to Average Power (PAPR)CCDF	Yes	Pass	
Band Edge Compliance	Yes	Pass	
Spurious Conducted Emissions	Yes	Pass	
Spurious Radiated Emissions	Yes	Pass	

Deviations From Test Standards

None

Approved By:

Adam Bruno, Operations Manager

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

REVISION HISTORY



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

ACCREDITATIONS AND AUTHORIZATIONS



United States

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

A2LA - Accredited by A2LA to ISO / IEC 17065 as a product certifier. This allows Element to certify transmitters to FCC and IC specifications.

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

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

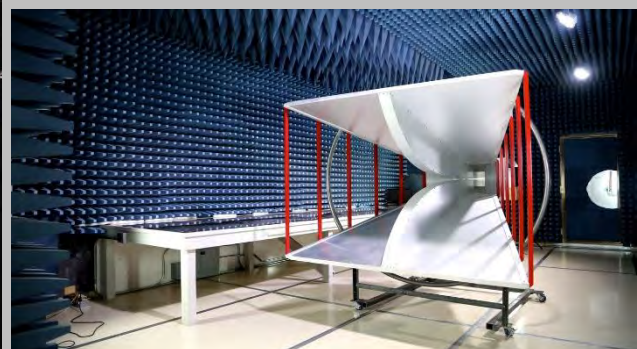
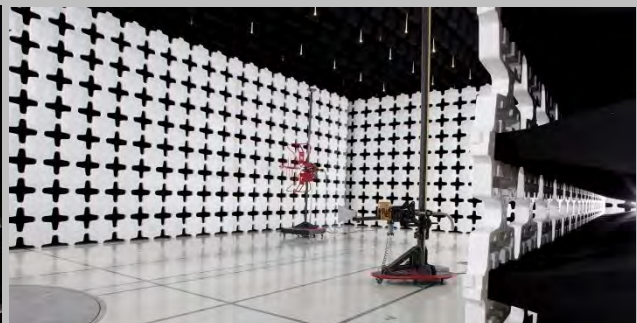
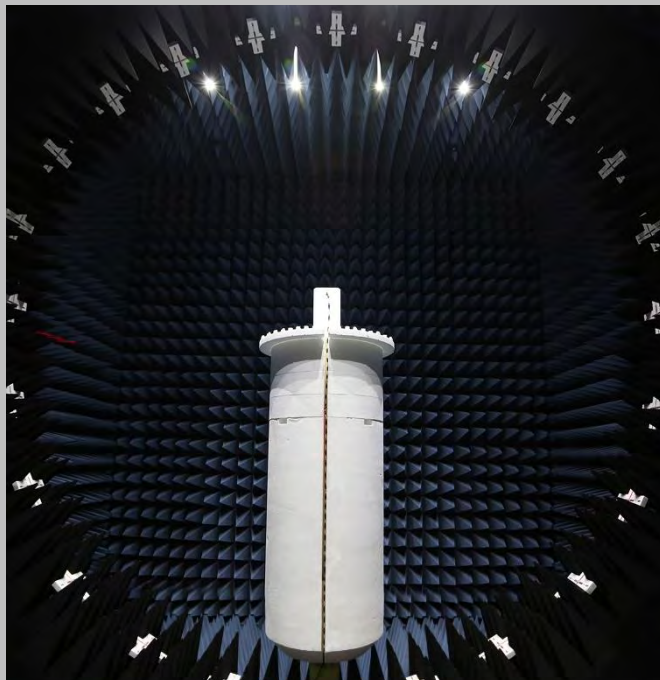
For details on the Scopes of our Accreditations, please visit:

<https://www.nwemc.com/emc-testing-accreditations>

FACILITIES



California Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Minnesota Labs MN01-11 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Oregon Labs EV01-12 6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	Texas Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Washington Labs NC01-05 19201 120 th Ave NE Bothell, WA 98011 (425)984-6600
NVLAP				
NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200630-0	NVLAP Lab Code:201049-0	NVLAP Lab Code: 200629-0
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



Measurement Uncertainty

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

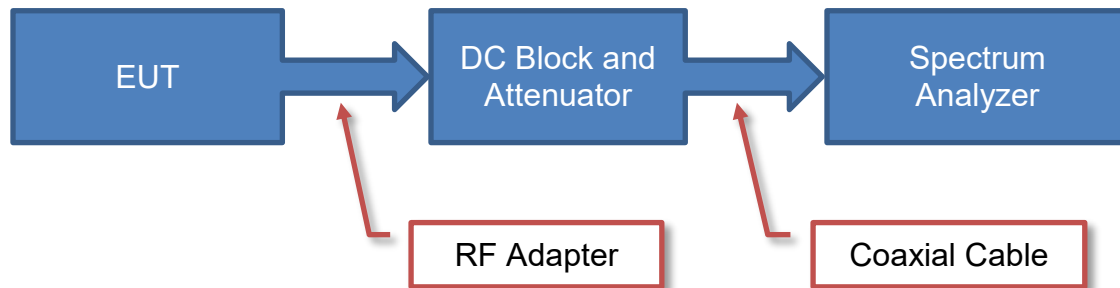
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found in the table below. A lab specific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

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

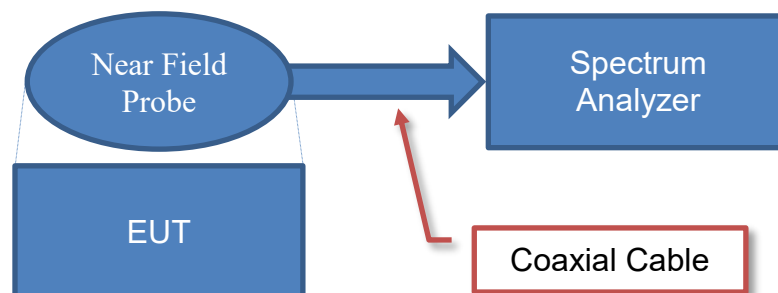
Test	+ MU	- MU
Frequency Accuracy	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	1.2 dB	-1.2 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.1 dB	-5.1 dB
AC Powerline Conducted Emissions (dB)	2.6 dB	-2.6 dB

Test Setup Block Diagrams

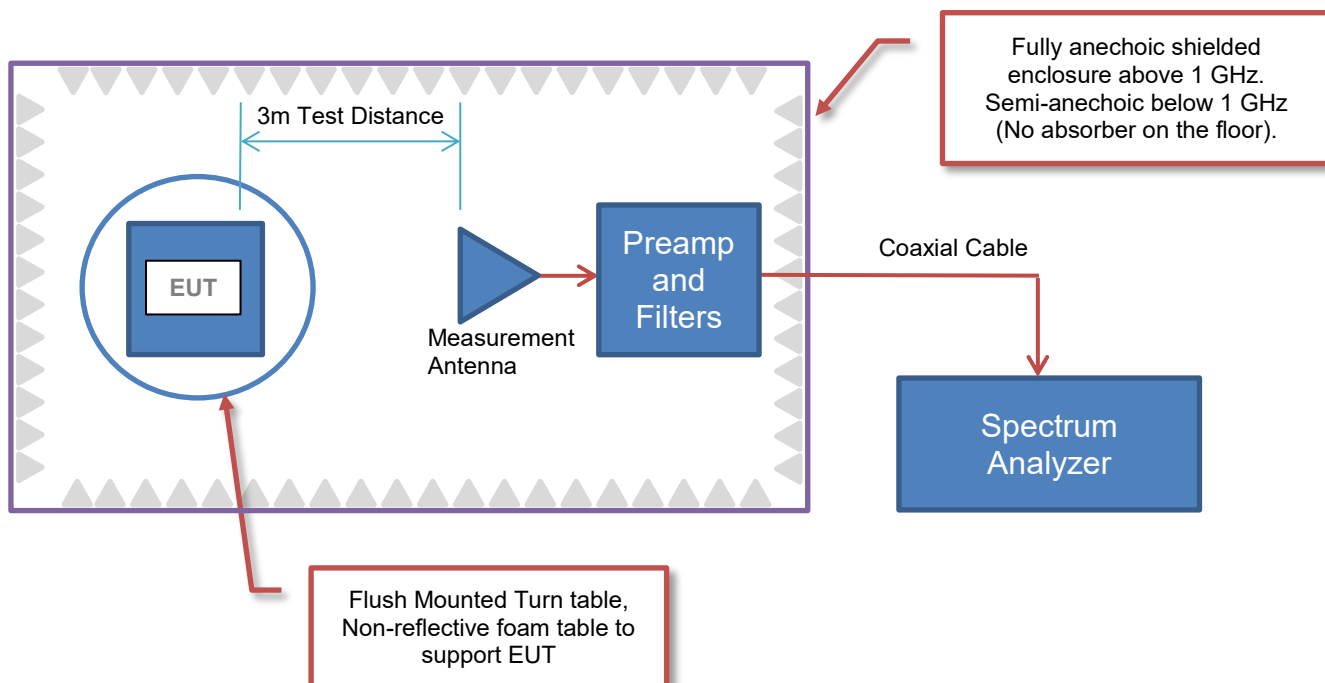
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	Nokia Solutions and Networks
Address:	3201 Olympus Blvd
City, State, Zip:	Dallas, TX 75019
Test Requested By:	Steve Mitchell
EUT:	Airscale Base Transceiver Station Remote Radio Head Model AZHL
First Date of Test:	February 19, 2021
Last Date of Test:	February 26, 2021
Receipt Date of Samples:	February 19, 2021
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:

The equipment under test (EUT) is a Nokia Solutions and Networks AirScale Base Transceiver Station (BTS) Remote Radio Head (RRH) module, model AZHL. The AZHL remote radio head is a multi-standard multi-carrier remote radio head designed to support 4G LTE TDD and 5G NR TDD. **The scope of testing in this effort is FCC radio certification of the AZHL for 4G LTE TDD and 5G NR TDD single carrier operations.**

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 20, 40, 60, 80 and 100MHz 5G NR TDD bandwidths. The maximum RF output power for single carrier operations are provided below.

Single Carrier Maximum RF Output Power per Port in Watts for each Radio Access Technology Channel Bandwidth							
LTE10	LTE15	LTE20	NR20	NR40	NR60	NR80	NR100
5.0 W	5.0 W	5.0 W	5.0 W	10.0 W	15.0 W	20.0 W	40.0 W

The AZHL software supports four downlink modulation types (QPSK, 16QAM, 64QAM, and 256QAM) for both 4G and 5G technologies. Single carrier operations will be certified/verified under this effort. Multicarrier operations will be verified/certified under separate effort. The instantaneous bandwidth covers the full operational bandwidth.

The AZHL MIMO operating modes include 8T8R, 2x 4T4R and 4x 2T2R. The AZHL is designed to operate with cross-polarized (orthogonal radiators) antennas only. The eight transmit/receive ports connected to $\pm 45^\circ$ cross-polarized (orthogonal) radiators (four ports are connected to $+45^\circ$ radiators/antennas and four ports are connected to the -45° radiators/antennas).

PRODUCT DESCRIPTION

The remote radio head has external interfaces including DC power (DC In), ground, RF transmit/receive (ANT), beamforming calibration (BF Cal), optical (OPT) and remote electrical tilt (RET). The RRH with applicable installation kit may be pole or wall mounted. The remote radio head may be configured with an optional cooling fan.

Tests to be performed include RF channel power, CCDF -peak to average power ratio, emission bandwidth (99% and 26 dB down), band edge spurious emissions (± 1 MHz), spurious emissions (conducted and radiated), and frequency stability (over required voltage/temperature ranges). The 4G LTE modulation types are setup according to 3GPP TS 36.141 E-UTRA Test Models (E-TM) as follows E-TM 1.1: QPSK, E-TM 3.1: 64QAM, E-TM3.1a: 256QAM and E-TM 3.2: 16QAM. 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).

The AZHL downlink channel numbers and frequencies for 4G LTE operations are as follows:

3GPP Frequency Band 41 LTE Band Edge EARFCNs

The 3GPP frequency band 41 (2496-2690 MHz) band edge EARFCNs for 4G LTE channel bandwidths (10, 15 and 20 MHz) are provided below. The EARFCN is defined as E-UTRA Absolute Radio Frequency Channel Number. The spacing is 100 kHz between channel numbers.

	4G LTE EARFCN	Frequency (MHz)	4G LTE Channel Bandwidth		
			10 MHz	15 MHz	20 MHz
AZHL Band 41 (Antennas 1 through 8)	39650	2496.0	Lower Band Edge		
					
	39700	2501.0	Bottom Ch		
					
	39725	2503.5		Bottom Ch	
					
	39750	2506.0			Bottom Ch
					
	40620	2593.0	Middle Channel		
					
	41490	2680.0			Top Channel
					
	41515	2682.5		Top Channel	
					
	41540	2685.0	Top Channel		
					
	41590	2690.0	Upper Band Edge		

AZHL Downlink Band Edge 4G LTE Band 41 Frequency Channels

PRODUCT DESCRIPTION

The AZHL downlink channel numbers and frequencies for 5G NR operations are as follows:

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

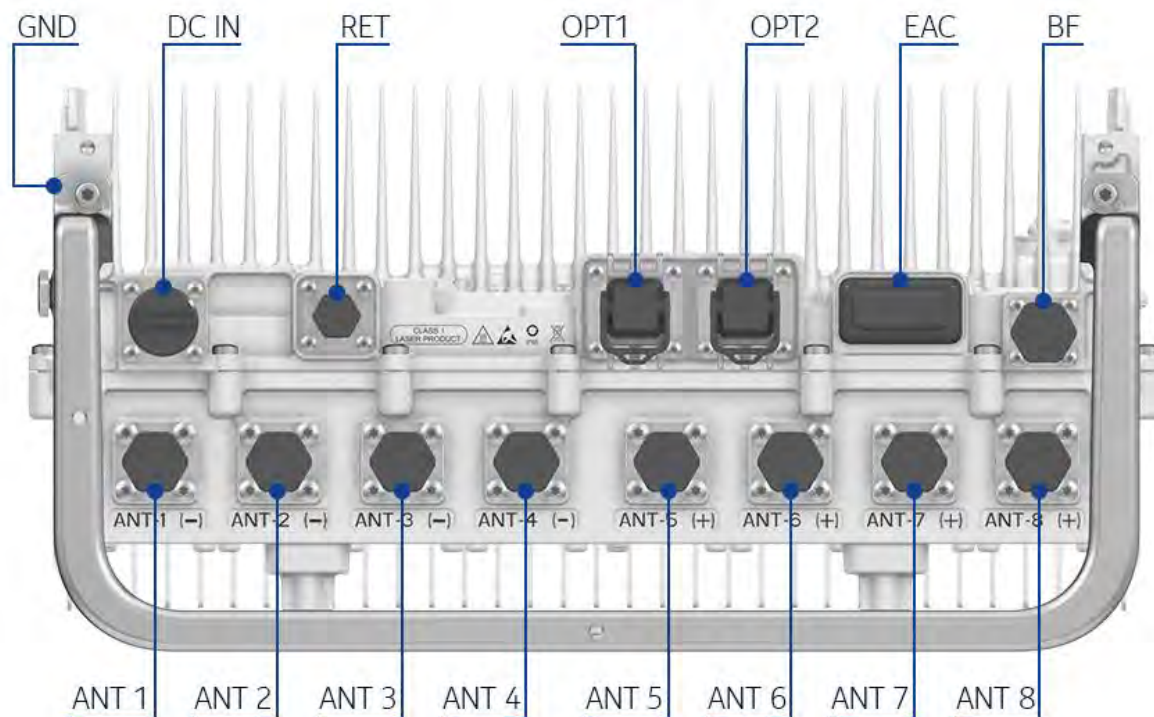
The 3GPP frequency band n41 (2496-2690 MHz) band edge NR-ARFCNs for 5G NR channel bandwidths (20, 40, 60, 80 and 100 MHz) are provided in following table. The NR-ARFCN is defined as New Radio - Absolute Radio Frequency Channel Number.

	5G NR NR- ARFCN	Frequency (MHz)	5G NR Channel Bandwidth				
			20 MHz	40 MHz	60 MHz	80 MHz	100 MHz
AZHL Band n41 (Antennas 1 through 8)	Band Edge	2496.00	Lower Band Edge				
							
	501204	2506.02	Bot Ch				
							
	503202	2516.01		Bot Ch			
							
	505200	2526.00			Bot Ch		
							
	507204	2536.02				Bot Ch	
							
	509202	2546.01					Bot Ch
							
	518598	2592.99	Middle Channel				
							
	528000	2640.00					Top Ch
							
	529998	2649.99				Top Ch	
							
	531996	2659.98			Top Ch		
							
	534000	2670.00		Top Ch			
							
	535998	2679.99	Top Ch				
							
	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:

Demonstration of Aircscale BTS RRH model AZHL (4G LTE and 5G NR operations over the 2496MHz to 2690MHz frequency band) radio compliance for FCC certification.

CONFIGURATIONS

Configuration NOKI0018- 1

Software/Firmware Running during test	
Description	Version
4G BTS Software Version	SBTS20C_ENB_0000_001590_00000
4G RF_SW	URM60.09.R29P
5G BTS Software Version	5G20A_GNB_0009_001800_001498
5G RF_SW	URM60.09.R30P

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
AZHL (Radio Module Module)	Nokia Solutions and Networks	475432A.101	YK203400016

CONFIGURATIONS

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
ASIK (5G BTS System Module)	Nokia Solutions and Networks	474021A.101	L1183529610
ABIL (5G BTS Baseband Module)	Nokia Solutions and Networks	474020A.102	L1183602625
AMIA (BTS System Module)	Nokia Solutions and Networks	473098A.203	RK182307104
AOMC SFP28+ 9.8G,70M,850NM (Radio)	Nokia	P462265	VF2023002SU
AOMC SFP28+ 9.8G,70M,850NM (Radio)	Nokia	P462265	VF2023003TA
AOMC SFP28 + 9.8G,70M,850NM (BS)	Nokia	474900A.101	VF2023008Y
AOMC SFP28 + 9.8G,70M,850NM (BS)	Nokia	474900A.101	VF2023003TA
ThinkPad T490 (WebEM- PC)	Lenovo	20N3S88012	PF26RVZ0
HP- DC System power supply (Radio)	HP	6032A	3440A-10308
FPAC (DC-PWR supply)	Nokia	472805A.X21	A9124600282
Fiber Optic cable 10m	Amphenol Fiber Optic	E201648	995109C-180512
GPS Receiver Cable	Nokia	995426C	CA2029
Cat-5e cable	CSA	E151955	LL79189
2 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297374
1 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_104	SN551432/4
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SR299
Reference cable (Frame Clock & Trigger)	Pomona	2249	C-72
Reference cable (Frame Clock & Trigger)	Pomona	2249	C-48
ASIA (4G BTS System Module)	Nokia Solutions and Networks	473095A.101	L1164105428
ABIA (4G BTS Baseband Module)	Nokia Solutions and Networks	473096A.103	AH173006372
ABIA (4G BTS Baseband Module)	Nokia Solutions and Networks	473096A.103	AH173006385
Low Pass Filter 1.4GHz/100W	Microwave Circuits,Inc.	L13502G1	SN2454-01
Attenuator 100W/10dB	Weinschel Corp	48-10-43-LIM	BJ1771
2 Meter RF cable	RD Microwave Systems	CBL-6FT-NMNM-402J-N	18-0204-01
2 Meter RF cable	RD Microwave Systems	CBL-6FT-NMNM-402J-N	18-0204-04
2 Meter RF cable	RD Microwave Systems	CBL-6FT-NMNM-402J-N	18-0204-08
2 Meter RF cable	RD Microwave Systems	CBL-6FT-NMNM-402J-N	18-0204-11
2 Meter RF cable	RD Microwave Systems	CBL-6FT-NMNM-402J-N	18-0204-17
2 Meter RF cable	RD Microwave Systems	CBL-6FT-NMNM-402J-N	18-0204-24

CONFIGURATIONS

2 Meter RF cable	RD Microwave Systems	CBL-6FT-NMNM-402J-N	18-0204-29
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SR299
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SR300
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SR301
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SR302
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	PZ465
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	LY351
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SK301

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
Fiber Optic Cable (2)	N	10 meters	N	ABIL/ABIA	AZHL
GPS Receiver Cable	Y	100 meters	N	ASIA/ASIK	FYGB GPS receiver
Cat-5e Cable	Y	7 meters	N	ASIA/ASIK	WebEM- PC
Reference cables (Frame Clock & Trigger)	Y	1 meter	N	ASIA/ASIK	Analyzer (PXA)
RD Microwave Systems – RF CABLE	Y	2 meters	N	EUT [RRH] Ant ports 2-8	150W -50ohm - Load
Reference cables (Frame Clock & Trigger)	Y	1 meter	N	ASIK/ASIA	Analyzer
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

CONFIGURATIONS



Configuration NOKI0018- 2

Software/Firmware Running during test	
Description	Version
4G BTS Software Version	SBTS20C_ENB_0000_001590_00000
4G RF_SW	URM60.09.R29P
5G BTS Software Version	5G20A_GNB_0009_001800_001498
5G RF_SW	URM60.09.R30P

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
AZHL (Radio Module Module)	Nokia Solutions and Networks	475432A.101	YK203400016

CONFIGURATIONS

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
ASIK (5G BTS System Module)	Nokia Solutions and Networks	474021A.101	L1183529610
ABIL (5G BTS Baseband Module)	Nokia Solutions and Networks	474020A.102	L1183602625
AMIA (BTS System Module)	Nokia Solutions and Networks	473098A.203	RK182307104
Attenuator 250W/40dB	API Weinschel	58-40-43-LIM	TC909
AOMC SFP28+ 9.8G,70M,850NM (Radio)	Nokia	P462265	VF2023002SU
AOMC SFP28+ 9.8G,70M,850NM (Radio)	Nokia	P462265	VF2023003TA
AOMC SFP28 + 9.8G,70M,850NM (BS)	Nokia	474900A.101	VF2023008Y
AOMC SFP28 + 9.8G,70M,850NM (BS)	Nokia	474900A.101	VF2023003TA
ThinkPad T490 (WebEM- PC)	Lenovo	20N3S88012	PF26RVZ0
HP- DC System power supply (Radio)	HP	6032A	3440A-10308
FPAC (DC-PWR supply)	Nokia	472805A.X21	A9124600282
Fiber Optic cable 10m	Amphenol Fiber Optic	E201648	995109C-180512
GPS Receiver Cable	Nokia	995426C	CA2029
Cat-5e cable	CSA	E151955	LL79189
2 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297374
1 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_104	SN551432/4
Reference cable (Frame Clock & Trigger)	Pomona	2249	C-72
Reference cable (Frame Clock & Trigger)	Pomona	2249	C-48
ASIA (4G BTS System Module)	Nokia Solutions and Networks	473095A.101	L1164105428
ABIA (4G BTS Baseband Module)	Nokia Solutions and Networks	473096A.103	AH173006372
ABIA (4G BTS Baseband Module)	Nokia Solutions and Networks	473096A.103	AH173006385
2 Meter RF cable	RD Microwave Systems	CBL-6FT-NMNM-402J-N	18-0204-01
2 Meter RF cable	RD Microwave Systems	CBL-6FT-NMNM-402J-N	18-0204-04
2 Meter RF cable	RD Microwave Systems	CBL-6FT-NMNM-402J-N	18-0204-08
2 Meter RF cable	RD Microwave Systems	CBL-6FT-NMNM-402J-N	18-0204-11
2 Meter RF cable	RD Microwave Systems	CBL-6FT-NMNM-402J-N	18-0204-17
2 Meter RF cable	RD Microwave Systems	CBL-6FT-NMNM-402J-N	18-0204-24
2 Meter RF cable	RD Microwave Systems	CBL-6FT-NMNM-402J-N	18-0204-29
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SR299

CONFIGURATIONS

150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SR300
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SR301
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SR302
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	PZ465
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	LY351
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SK301

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
Fiber Optic Cable (2)	N	10 meters	N	ABIL/ABIA	AZHL
GPS Receiver Cable	Y	100 meters	N	ASIA/ASIK	FYGB GPS receiver
Cat-5e Cable	Y	7 meters	N	ASIA/ASIK	WebEM- PC
HS-SUCOFLEX_104 1 Meter RF cable	Y	1 meter	N	Attenuator 250W/40dB	Analyzer(PXA)
HS-SUCOFLEX_106 2 Meter RF cable	Y	2 meter	N	EUT [AZHL] Ant port #1	Analyzer(PXA)
Attenuator 250W/40dB	N	NA	N	RF cable HS-SUCOFLEX_106	RF cable HS-SUCOFLEX_104
RD Microwave Systems – RF CABLE	Y	2 meters	N	EUT [RRH] Ant ports 2-8	150W -50ohm - Load
Reference cables (Frame Clock & Trigger)	Y	1 meter	N	ASIK/ASIA	Analyzer

CONFIGURATIONS

Configuration NOKI0018- 3

Software/Firmware Running during test	
Description	Version
4G BTS Software Version	SBTS20C_ENB_0000_001590_00000
4G RF_SW	URM60.09.R29P
5G BTS Software Version	5G20A_GNB_0009_001800_001498
5G RF_SW	URM60.09.R30P

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
AZHL (Radio Module Module)	Nokia Solutions and Networks	475432A.101	YK203400016

CONFIGURATIONS

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
ASIK (5G BTS System Module)	Nokia Solutions and Networks	474021A.101	L1183529610
ABIL (5G BTS Baseband Module)	Nokia Solutions and Networks	474020A.102	L1183602625
AMIA (BTS System Module)	Nokia Solutions and Networks	473098A.203	RK182307104
AOMC SFP28+ 9.8G,70M,850NM (Radio)	Nokia	P462265	VF2023002SU
AOMC SFP28+ 9.8G,70M,850NM (Radio)	Nokia	P462265	VF2023003TA
AOMC SFP28 + 9.8G,70M,850NM (BS)	Nokia	474900A.101	VF2023008Y
AOMC SFP28 + 9.8G,70M,850NM (BS)	Nokia	474900A.101	VF2023003TA
ThinkPad T490 (WebEM- PC)	Lenovo	20N3S88012	PF26RVZ0
HP- DC System power supply (Radio)	HP	6032A	3440A-10308
FPAC (DC-PWR supply)	Nokia	472805A.X21	A9124600282
Fiber Optic cable 10m	Amphenol Fiber Optic	E201648	995109C-180512
GPS Receiver Cable	Nokia	995426C	CA2029
Cat-5e cable	CSA	E151955	LL79189
2 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297374
1 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_104	SN551432/4
Reference cable (Frame Clock & Trigger)	Pomona	2249	C-72
Reference cable (Frame Clock & Trigger)	Pomona	2249	C-48
ASIA (4G BTS System Module)	Nokia Solutions and Networks	473095A.101	L1164105428
ABIA (4G BTS Baseband Module)	Nokia Solutions and Networks	473096A.103	AH173006372
ABIA (4G BTS Baseband Module)	Nokia Solutions and Networks	473096A.103	AH173006385
2 Meter RF cable	RD Microwave Systems	CBL-6FT-NMNM-402J-N	18-0204-01
2 Meter RF cable	RD Microwave Systems	CBL-6FT-NMNM-402J-N	18-0204-04
2 Meter RF cable	RD Microwave Systems	CBL-6FT-NMNM-402J-N	18-0204-08
2 Meter RF cable	RD Microwave Systems	CBL-6FT-NMNM-402J-N	18-0204-11
2 Meter RF cable	RD Microwave Systems	CBL-6FT-NMNM-402J-N	18-0204-17
2 Meter RF cable	RD Microwave Systems	CBL-6FT-NMNM-402J-N	18-0204-24
2 Meter RF cable	RD Microwave Systems	CBL-6FT-NMNM-402J-N	18-0204-29
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SR299
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SR300

CONFIGURATIONS

150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SR301
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SR302
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	PZ465
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	LY351
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SK301
High Pass Filter 3.2GHz/2W	RLC Electronics	F-100-3000-5-R	0011
Attenuator 150W/20dB	Aeroflex Weinschel	66-20-33	BZ2075
Attenuator 100W/3dB	Aeroflex Weinschel	47-3-33	CG5493

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
Fiber Optic Cable (2)	N	10 meters	N	ABIL/ABIA	AZHL
GPS Receiver Cable	Y	100 meters	N	ASIA/ASIK	FYGB GPS receiver
Cat-5e Cable	Y	7 meters	N	ASIA/ASIK	WebEM- PC
HS-SUCOFLEX_106 2 Meter RF cable	Y	2 meter	N	EUT [AZHL] Ant port #1	Attenuator 150W/20dB
RD Microwave Systems – RF CABLE	Y	2 meters	N	EUT [RRH] Ant ports 2-8	150W -50ohm - Load
Reference cables (Frame Clock & Trigger)	Y	1 meter	N	ASIK/ASIA	Analyzer
Attenuator 150W/20dB	N	N	N	RF cable HS-SUCOFLEX_106	Attenuator 100W/3dB
Attenuator 100W/3dB	N	N	N	Attenuator 150W/20dB	High Pass Filter 3.2GHz
High Pass Filter 3.2GHz/2W	N	N	N	Attenuator 100W/3dB	RF cable HS-SUCOFLEX_104
HS-SUCOFLEX_104	Y	1 meter	N	High Pass Filter 3.2GHz/2W	Analyzer

CONFIGURATIONS

Configuration NOKI0018- 4

Software/Firmware Running during test	
Description	Version
4G BTS Software Version	SBTS20C_ENB_0000_001590_00000
4G RF_SW	URM60.09.R29P
5G BTS Software Version	5G20A_GNB_0009_001800_001498
5G RF_SW	URM60.09.R30P

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
AZHL (Radio Module Module)	Nokia Solutions and Networks	475432A.101	YK203400016

CONFIGURATIONS

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
ASIK (5G BTS System Module)	Nokia Solutions and Networks	474021A.101	L1183529610
ABIL (5G BTS Baseband Module)	Nokia Solutions and Networks	474020A.102	L1183602625
AMIA (BTS System Module)	Nokia Solutions and Networks	473098A.203	RK182307104
AOMC SFP28+ 9.8G,70M,850NM (Radio)	Nokia	P462265	VF2023002SU
AOMC SFP28+ 9.8G,70M,850NM (Radio)	Nokia	P462265	VF2023003TA
AOMC SFP28 + 9.8G,70M,850NM (BS)	Nokia	474900A.101	VF2023008Y
AOMC SFP28 + 9.8G,70M,850NM (BS)	Nokia	474900A.101	VF2023003TA
ThinkPad T490 (WebEM- PC)	Lenovo	20N3S88012	PF26RVZ0
HP- DC System power supply (Radio)	HP	6032A	3440A-10308
FPAC (DC-PWR supply)	Nokia	472805A.X21	A9124600282
Fiber Optic cable 10m	Amphenol Fiber Optic	E201648	995109C-180512
GPS Receiver Cable	Nokia	995426C	CA2029
Cat-5e cable	CSA	E151955	LL79189
2 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_104	SN184424/4
1 Meter RF cable	RF-Lambda	RFC6767A-B7RU1219	AC20040003
Reference cable (Frame Clock & Trigger)	Pomona	2249	C-72
Reference cable (Frame Clock & Trigger)	Pomona	2249	C-48
ASIA (4G BTS System Module)	Nokia Solutions and Networks	473095A.101	L1164105428
ABIA (4G BTS Baseband Module)	Nokia Solutions and Networks	473096A.103	AH173006372
ABIA (4G BTS Baseband Module)	Nokia Solutions and Networks	473096A.103	AH173006385
2 Meter RF cable	RD Microwave Systems	CBL-6FT-NMNM-402J-N	18-0204-01
2 Meter RF cable	RD Microwave Systems	CBL-6FT-NMNM-402J-N	18-0204-04
2 Meter RF cable	RD Microwave Systems	CBL-6FT-NMNM-402J-N	18-0204-08
2 Meter RF cable	RD Microwave Systems	CBL-6FT-NMNM-402J-N	18-0204-11
2 Meter RF cable	RD Microwave Systems	CBL-6FT-NMNM-402J-N	18-0204-17
2 Meter RF cable	RD Microwave Systems	CBL-6FT-NMNM-402J-N	18-0204-24
2 Meter RF cable	RD Microwave Systems	CBL-6FT-NMNM-402J-N	18-0204-29
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SR299
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SR300

CONFIGURATIONS

150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SR301
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SR302
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	PZ465
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	LY351
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SK301
Attenuator 50W/10dB	RF-Lambda	RFS50G26S10FF	20031702
High Pass Filter 8-40GHz/15W	RF-Lambda	RHPF23G08G40	17102700014

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
Fiber Optic Cable (2)	N	10 meters	N	ABIL/ABIA	AZHL
GPS Receiver Cable	Y	100 meters	N	ASIA/ASIK	FYGB GPS receiver
Cat-5e Cable	Y	7 meters	N	ASIA/ASIK	WebEM- PC
HS-SUCOFLEX_104 RF cable	Y	2 meter	N	EUT [AZHL] Ant port 1	Attenuator 50W/10dB
RD Microwave Systems – RF CABLE	Y	2 meters	N	EUT [RRH] Ant ports 2-8	150W -50ohm - Load
Reference cables (Frame Clock & Trigger)	Y	1 meter	N	ASIK/ASIA	Analyzer
Attenuator 50W/10dB	N	NA	N	RF cable HS-SUCOFLEX_104	High Pass Filter 8-40GHz
High Pass Filter 8-40GHz/15W	N	NA	N	Attenuator 50W/10dB	RF-Lambda - AC20040003
RF-Lambda - AC20040003	Y	1 meter	N	High Pass Filter 8-40GHz/15W	Analyzer

CONFIGURATIONS

Configuration NOKI0018- 5

Software/Firmware Running during test	
Description	Version
5G BTS Software Version	5G20A_GNB_0009_001800_001498
5G RF_SW	URM60.09.R30P

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Remote Radio Head	Nokia Solutions and Networks	AZHL / 475432A.101	YK203400016

Peripherals in the test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
AOMC SFP28+ 9.8G,70M,850NM (Multi-Mode - Radio)	Nokia	474900A.101	VF2023002SU
AOMC SFP28+ 9.8G,70M,850NM (Multi-Mode - Radio)	Nokia	474900A.101	VF2023003TA
AOSD SFP28+ 9.8G,10KM,1310NM (Single-Mode - Radio)	Nokia	474902A.101	VF1922001EI
AOSC SFP28+ 9.8G,2KM,1310NM (Single-Mode - Radio)	Nokia	474901A.101	FR202400972

CONFIGURATIONS

Equipment outside of test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
AMIA (BTS System Module)	Nokia Solutions and Networks	473098A.203	RK182307104
ASIK (5G BTS System Module)	Nokia Solutions and Networks	474021A.101	L1183529610
ABIL (5G BTS Baseband Module)	Nokia Solutions and Networks	474020A.102	L1183602625
ThinkPad T490 (WebEM- PC)	Lenovo	20N3S88012	PF26RVZ0
HP- DC System power supply (Radio)	HP	6032A	3440A-10308
Cat-5e cable	CSA	E151955	LL79189
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SR299
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SR300
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SR301
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SR302
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	PZ465
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	LY351
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SK301
AOMC SFP28+ 9.8G,70M,850NM (Multi-Mode - BS)	Nokia	474900A.101	VF2023008Y
AOMC SFP28+ 9.8G,70M,850NM (Multi-Mode - BS)	Nokia	474900A.101	VF2023003TA
AOSD SFP28+ 9.8G,10KM,1310NM (Single-Mode - BS)	Nokia	474902A.101	FR202427765
AOSD SFP28+ 9.8G,10KM,1310NM (Single-Mode - BS)	Nokia	474902A.101	VF19220012F
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SK764
Electric Fan (AC pwr)	Electric	L908	None
GPS cable 100m	CA2029	FTSH	995426C

CONFIGURATIONS

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
TMS Load 1	Y	2m	N	EUT [AZHL] Ant port #1	Antenna Load 1
TMS Load 2	Y	2m	N	EUT [AZHL] Ant port #2	Antenna Load 2
TMS Load 3	Y	2m	N	EUT [AZHL] Ant port #3	Antenna Load 3
TMS Load 4	Y	2m	N	EUT [AZHL] Ant port #4	Antenna Load 4
TMS Load 5	Y	2m	N	EUT [AZHL] Ant port #5	Antenna Load 5
TMS Load 6	Y	2m	N	EUT [AZHL] Ant port #6	Antenna Load 6
TMS Load 7	Y	2m	N	EUT [AZHL] Ant port #7	Antenna Load 7
TMS Load 8	Y	2m	N	EUT [AZHL] Ant port #8	Antenna Load 8
TMS Load 9	Y	2m	N	EUT [AZHL] BF Cal Port	Load 9
AC Power (PS Base Station)	N	2m	N	AC mains	Power Supply (Base Station)
AC Power (Laptop)	N	1.65m	N	AC mains	(Laptop)
DC Power Leads	N	7.5m	Y	DC Power Supply (HP)	Remote Radio Head Module
AC Power (HP)	N	4m	N	AC mains	DC Power Supply (Radiated)
Optical Fiber (SM)	N	30m	N	Airscale Base Station (ABIA)	Remote Radio Head Module
Optical Fiber (MM)	N	30m	N	Airscale Base Station (ABIA)	Remote Radio Head Module
RET	N	2.4m	N	Remote Radio Head Module	Unterminated
EAC	N	5.4m	N	Remote Radio Head Module	Unterminated
Grounding	N	2.3m	N	Remote Radio Head Module	Turntable Ground
Amphenol Fiber Optic cable	N	2m	N	ASIA	AZHL
Cat-5e Data cable	Y	7 meters	N	ASIA	WebEM- PC

CONFIGURATIONS



Configuration NOKI0018- 6

Software/Firmware Running during test	
Description	Version
4G RF_SW	URM60.09.R29P
5G BTS Software Version	5G20A_GNB_0009_001800_001498

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
AZHL (Radio Module Model)	Nokia Solutions and Networks	475432A.101	YK203400016

CONFIGURATIONS

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
AMIA (BTS System Module)	Nokia Solutions and Networks	473098A.203	RK182307104
ASIK (5G BTS System Module)	Nokia Solutions and Networks	474021A.101	L1183529610
ABIL (5G BTS Baseband Module)	Nokia Solutions and Networks	474020A.102	L1183602625
Attenuator 250W/40dB	API Weinschel	58-40-43-LIM	TC909
AOMC SFP28+ 9.8G,70M,850NM (Radio)	Nokia	P462265	VF2023002SU
AOMC SFP28+ 9.8G,70M,850NM (Radio)	Nokia	P462265	VF2023003TA
AOMC SFP28 + 9.8G,70M,850NM (BS)	Nokia	474900A.101	VF2023008Y
AOMC SFP28 + 9.8G,70M,850NM (BS)	Nokia	474900A.101	VF2023003TA
ThinkPad T490 (WebEM- PC)	Lenovo	20N3S88012	PF26RVZ0
HP- DC System power supply (Radio)	HP	6032A	3440A-10308
FPAC (DC-PWR supply)	Nokia	472805A.X21	A9124600282
Fiber Optic cable 10m	Amphenol Fiber Optic	E201648	995109C-180512
GPS Receiver Cable	Nokia	995426C	CA2029
Cat-5e cable	CSA	E151955	LL79189
2 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297374
1 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_104	SN551432/4
2 Meter RF cable (Load cable)	RD Microwave Systems	CBL-6FT-NMNM-402J-N	18-0204-01
150W -50ohm -Terminating Load	API Weinschel inc	1435-3-LIM	SR299
Thermal Chamber	Cincinnati Sub-zero Product Inc	ZPH-8-2-SCT/AC	ZP1424214
Digital Multimeter	Fluke	77IV	CAL: 27210148
Thermometer	Omega Engineering Inc	HH31	1130101855
Reference cable (Frame Clock & Trigger)	Pomona	2249	C-72
Reference cable (Frame Clock & Trigger)	Pomona	2249	C-48

CONFIGURATIONS

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
Fiber Optic Cable (2)	N	10 meters	N	ABIL/ABIA	AZHL
GPS Receiver Cable	Y	100 meters	N	ASIA/ASIK	FYGB GPS receiver
Cat-5e Cable	Y	7 meters	N	ASIA/ASIK	WebEM- PC
CBL-6FT-NMNM-402J-N 2 Meter RF cable	Y	2 meter	N	EUT [AZHL] Ant port #5	150W -50ohm - Terminating Load
Reference cables (Frame Clock & Trigger)	Y	1 meter	N	ASIA/ASIK	Analyzer (PXA)
Grounding	Y	2.3m	N	Remote Radio Head Module	Interior Temp Chamber wall
HS-SUCOFLEX_106	Y	2 meters	N	EUT [AZHL] Ant port #1	Attenuator 250W/40dB
Attenuator 250W/40dB	N	NA	N	RF cable HS-SUCOFLEX_106	RF cable HS-SUCOFLEX_104
HS-SUCOFLEX_104	Y	1 meter	N	Attenuator 250W/40dB	Analyzer (PXA)

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2021-02-22	Occupied Bandwidth	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
2	2021-02-22	Output Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
3	2021-02-22	Peak to Average Power (PAPR)CCDF	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
4	2021-02-23	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.
5	2021-02-22	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
6	2021-02-24	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
7	2021-02-26	Frequency Stability	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

OCCUPIED BANDWIDTH 5G



XMIT 2020.03.25.0

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	Agilent	N9010A	AFL	27-Feb-20	27-Feb-21
Generator - Signal	Keysight	N5171B-506	TEW	2-May-18	2-May-21

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 $\geq 3x$ 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 Band n41 (2496MHz to 2690MHz)					
Channel Bandwidth	Radio Channel	5G-NR: QPSK	5G-NR: 16QAM	5G-NR: 64QAM	5G-NR: 256QAM
20M	Low				19M8G7W
	Mid	19M8G7W	19M8G7W	19M7G7W	19M7G7W
	High				19M8G7W
40M	Low				40M4G7W
	Mid	40M2G7W	40M2G7W	40M3G7W	40M3G7W
	High				40M4G7W
60M	Low				60M9G7W
	Mid	61M0G7W	61M0G7W	60M9G7W	60M9G7W
	High				60M8G7W
80M	Low				81M4G7W
	Mid	81M5G7W	81M4G7W	81M5G7W	81M4G7W
	High				81M4G7W
100M	Low				103MG7W
	Mid	103MG7W	103MG7W	103MG7W	103MG7W
	High				103MG7W
Note: FCC Emission Designators are based on 26dB emission bandwidth					

OCCUPIED BANDWIDTH 5G



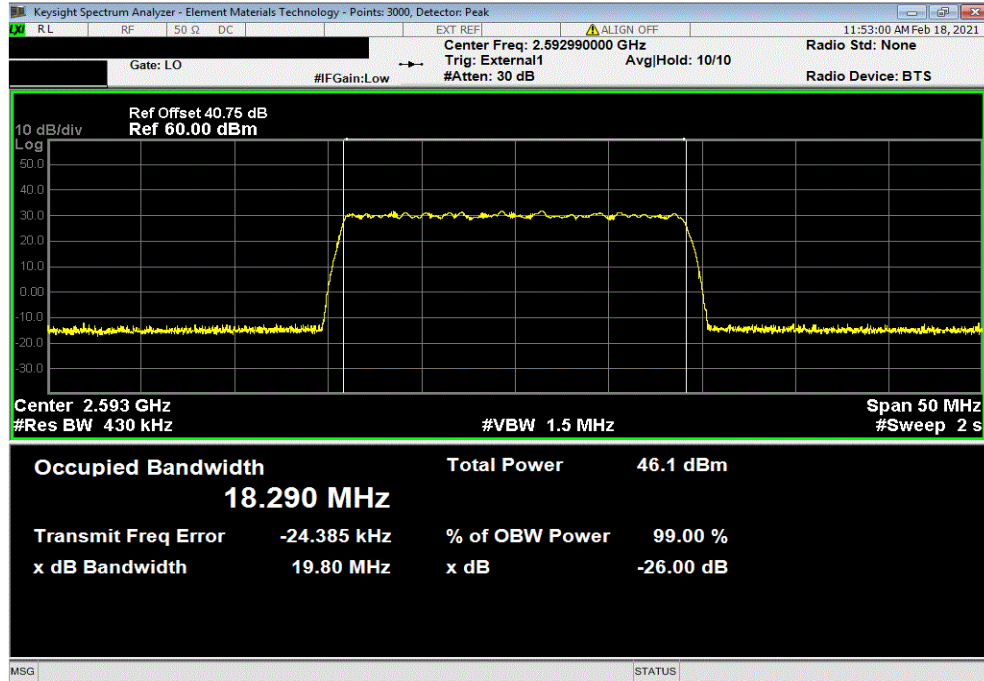
EUT:	AZHL		Work Order:		NOKI0018	
Serial Number:	YK203400016		Date:		19-Feb-21	
Customer:	Nokia Solutions and Networks		Temperature:		23.6 °C	
Attendees:	John Rattanaovong, Mitchell Hill, David Le		Humidity:		14.9% RH	
Project:	None		Barometric Pres.:		1037 mbar	
Tested by:	Mark Baytan		Power:		54 VDC	
			Job Site:		TX05	
TEST SPECIFICATIONS			Test Method			
FCC 27:2021			ANSI C63.26:2015			
COMMENTS						
External 1 gating was set using a trig delay = 86.2us and a gate length = 3.714ms. Reference level offset adjusted to include (2) coax cables, DC block, and attenuator. The carrier power was set to maximum for all testing.						
DEVIATIONS FROM TEST STANDARD						
None						
Configuration #	2		Signature 			
			Value (26 dB)	Limit	Result	
5G NR, Band n41, 2496 MHz - 2690 MHz						
Port 1						
NR20 (20MHz)						
QPSK						
Mid Channel 2592.99 MHz			19.804 MHz	Within Band	Pass	
16QAM						
Mid Channel 2592.99 MHz			19.849 MHz	Within Band	Pass	
64QAM						
Mid Channel 2592.99 MHz			19.737 MHz	Within Band	Pass	
256QAM						
Low Channel 2506.02 MHz			19.816 MHz	Within Band	Pass	
Mid Channel 2592.99 MHz			19.749 MHz	Within Band	Pass	
High Channel 2679.99 MHz			19.761 MHz	Within Band	Pass	
NR40 (40MHz)						
QPSK						
Mid Channel 2592.99 MHz			40.228 MHz	Within Band	Pass	
16QAM						
Mid Channel 2592.99 MHz			40.199 MHz	Within Band	Pass	
64QAM						
Mid Channel 2592.99 MHz			40.259 MHz	Within Band	Pass	
256QAM						
Low Channel 2516.01 MHz			40.375 MHz	Within Band	Pass	
Mid Channel 2592.99 MHz			40.326 MHz	Within Band	Pass	
High Channel 2670 MHz			40.384 MHz	Within Band	Pass	
NR60 (60MHz)						
QPSK						
Mid Channel 2592.99 MHz			60.968 MHz	Within Band	Pass	
16QAM						
Mid Channel 2592.99 MHz			60.96 MHz	Within Band	Pass	
64QAM						
Mid Channel 2592.99 MHz			60.894 MHz	Within Band	Pass	
256QAM						
Low Channel 2526 MHz			60.872 MHz	Within Band	Pass	
Mid Channel 2592.99 MHz			60.892 MHz	Within Band	Pass	
High Channel 2659.98 MHz			60.833 MHz	Within Band	Pass	
NR80 (80MHz)						
QPSK						
Mid Channel 2592.99 MHz			81.48 MHz	Within Band	Pass	
16QAM						
Mid Channel 2592.99 MHz			81.38 MHz	Within Band	Pass	
64QAM						
Mid Channel 2592.99 MHz			81.45 MHz	Within Band	Pass	
256QAM						
Low Channel 2536.02 MHz			81.37 MHz	Within Band	Pass	
Mid Channel 2592.99 MHz			81.40 MHz	Within Band	Pass	
High Channel 2649.99 MHz			81.35 MHz	Within Band	Pass	
NR100 (100MHz)						
QPSK						
Mid Channel 2592.99 MHz			102.572 MHz	Within Band	Pass	
16QAM						
Mid Channel 2592.99 MHz			102.547 MHz	Within Band	Pass	
64QAM						
Mid Channel 2592.99 MHz			102.719 MHz	Within Band	Pass	
256QAM						
Low Channel 2546.01 MHz			102.539 MHz	Within Band	Pass	
Mid Channel 2592.99 MHz			102.581 MHz	Within Band	Pass	
High Channel 2640 MHz			102.547 MHz	Within Band	Pass	

OCCUPIED BANDWIDTH 5G

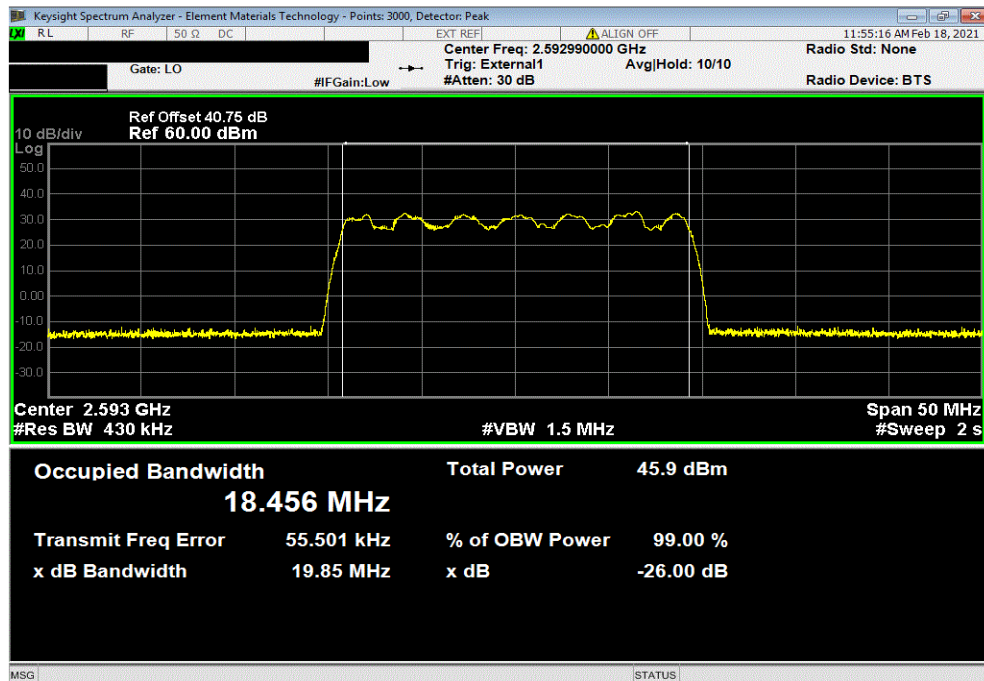


TbTx 2019.08.30.0 XMit 2020.12.30.0

5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR20 (20MHz), QPSK, Mid Channel 2592.99 MHz						
				Value (26 dB)	Limit	Result
				19.804 MHz	Within Band	Pass



5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR20 (20MHz), 16QAM, Mid Channel 2592.99 MHz						
				Value (26 dB)	Limit	Result
				19.849 MHz	Within Band	Pass

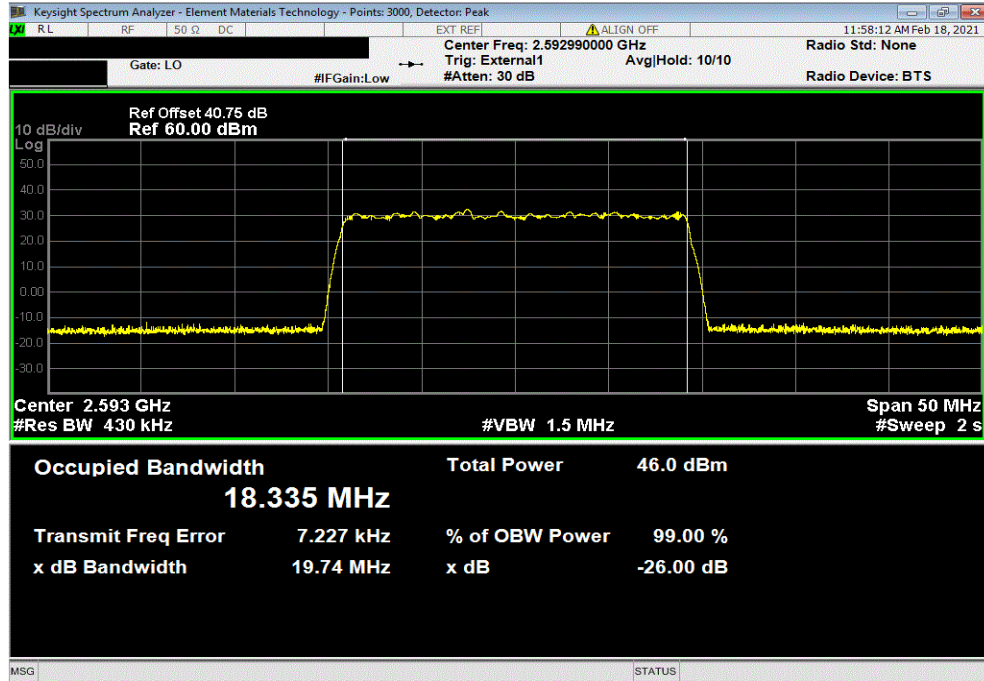


OCCUPIED BANDWIDTH 5G

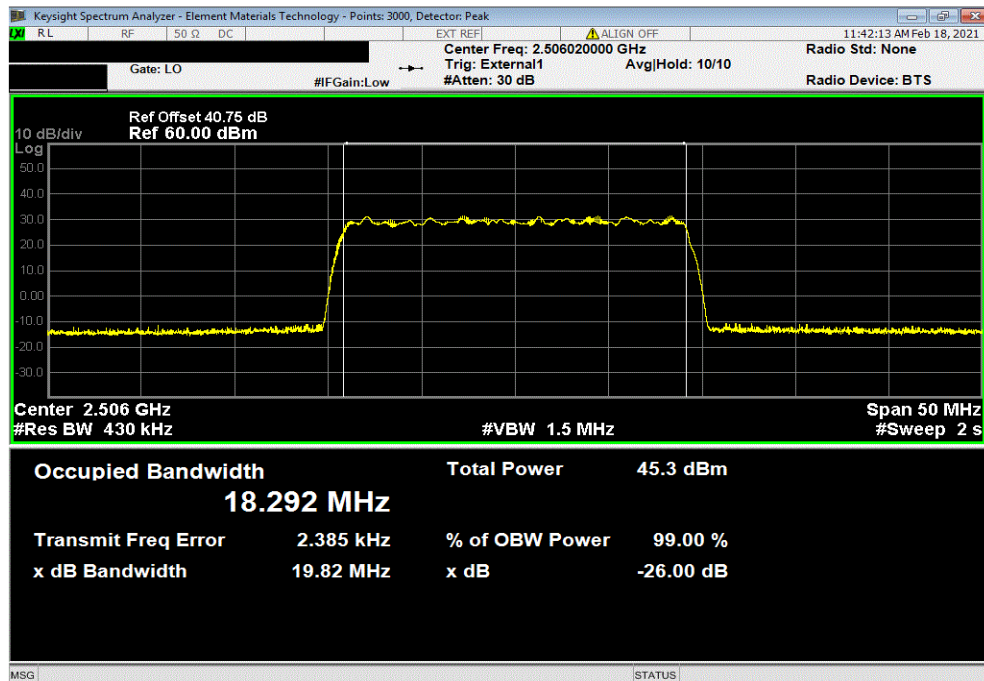


TbTx 2019.08.30.0 XMI 2020.12.30.0

5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR20 (20MHz), 64QAM, Mid Channel 2592.99 MHz						
	Value	Limit	Result			
	(26 dB)					
	19.737 MHz	Within Band	Pass			



5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR20 (20MHz), 256QAM, Low Channel 2506.02 MHz						
	Value	Limit	Result			
	(26 dB)					
	19.816 MHz	Within Band	Pass			

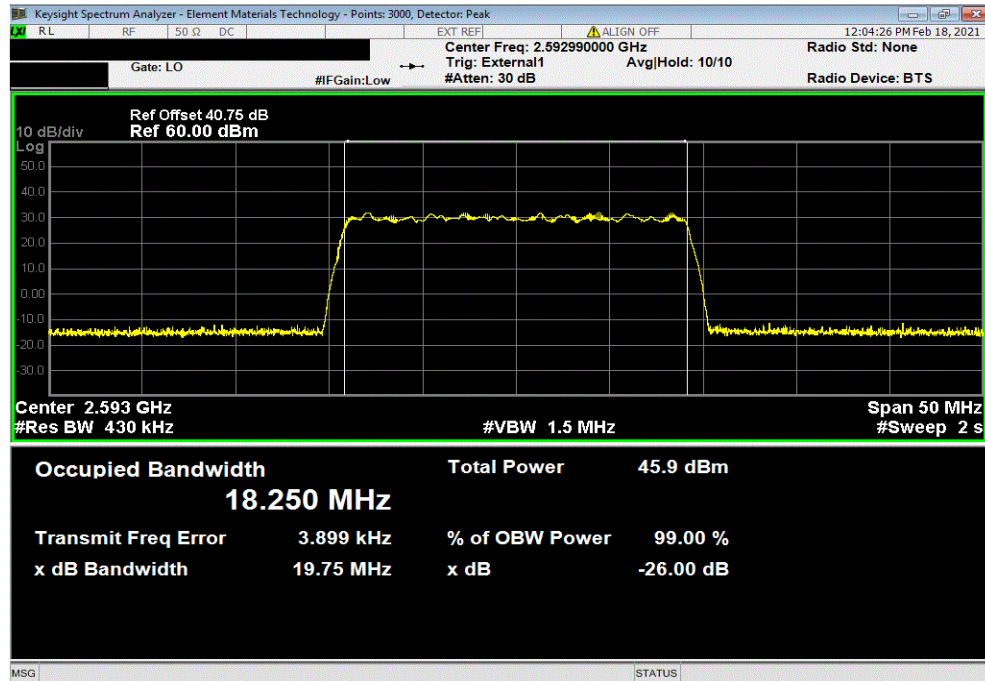


OCCUPIED BANDWIDTH 5G

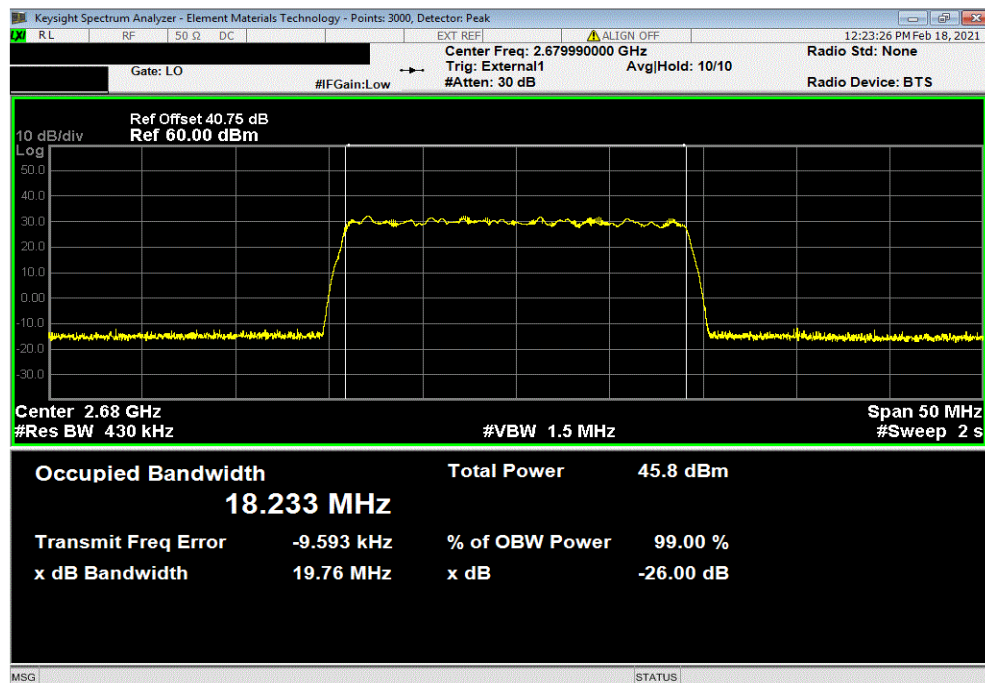


TbTx 2019.08.30.0 XMI 2020.12.30.0

5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR20 (20MHz), 256QAM, Mid Channel 2592.99 MHz						
				Value (26 dB)	Limit	Result
				19.749 MHz	Within Band	Pass



5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR20 (20MHz), 256QAM, High Channel 2679.99 MHz						
				Value (26 dB)	Limit	Result
				19.761 MHz	Within Band	Pass

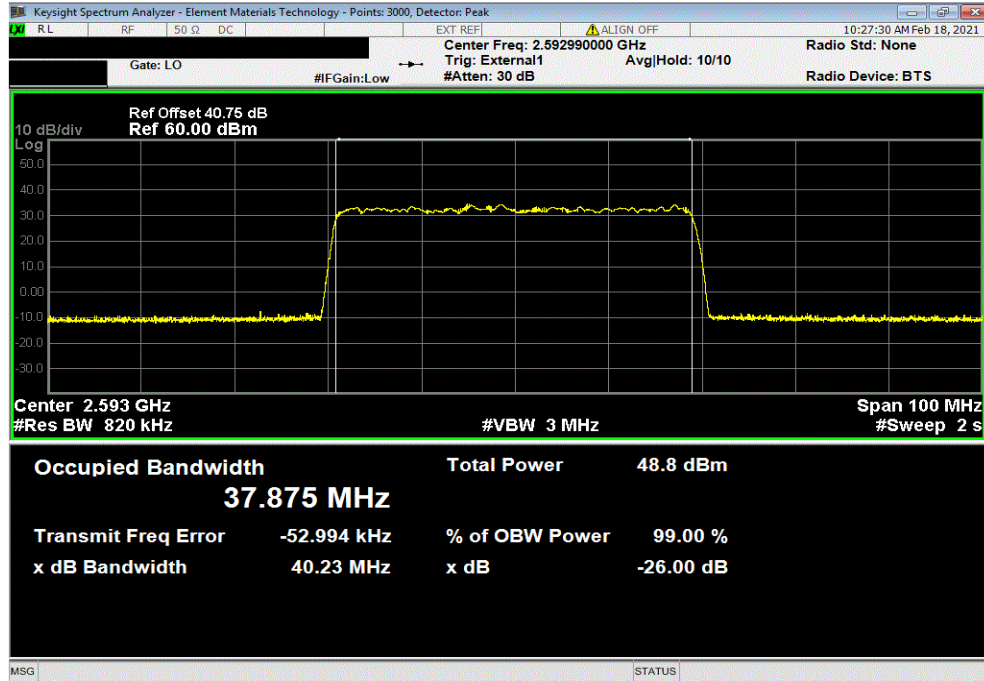


OCCUPIED BANDWIDTH 5G

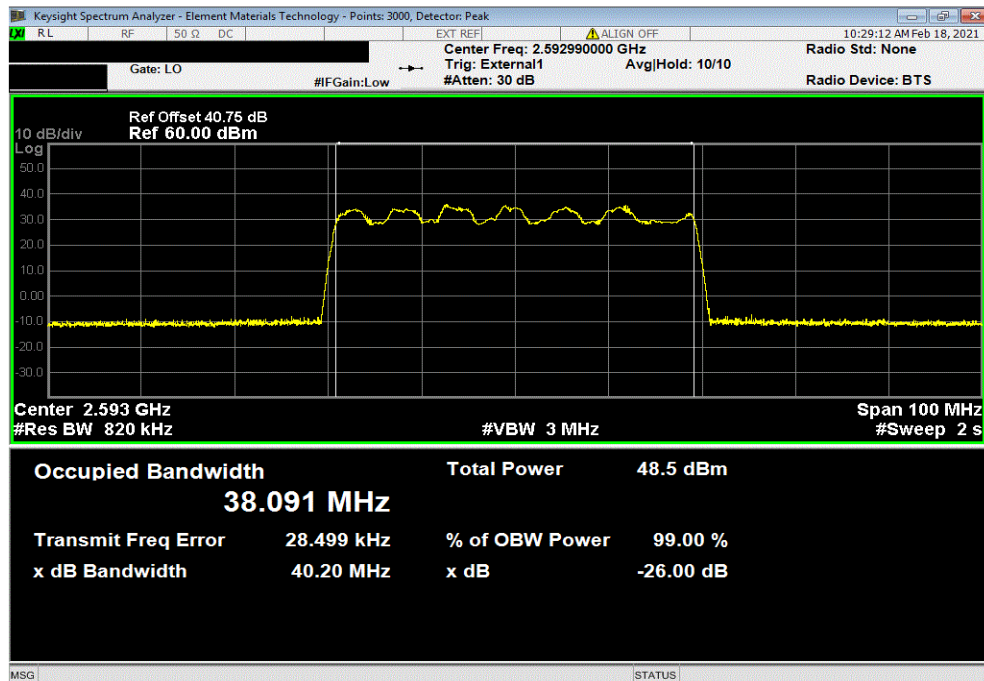


TbTx 2019.08.30.0 XMit 2020.12.30.0

5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR40 (40MHz), QPSK, Mid Channel 2592.99 MHz						
				Value (26 dB)	Limit	Result
				40.228 MHz	Within Band	Pass



5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR40 (40MHz), 16QAM, Mid Channel 2592.99 MHz						
				Value (26 dB)	Limit	Result
				40.199 MHz	Within Band	Pass

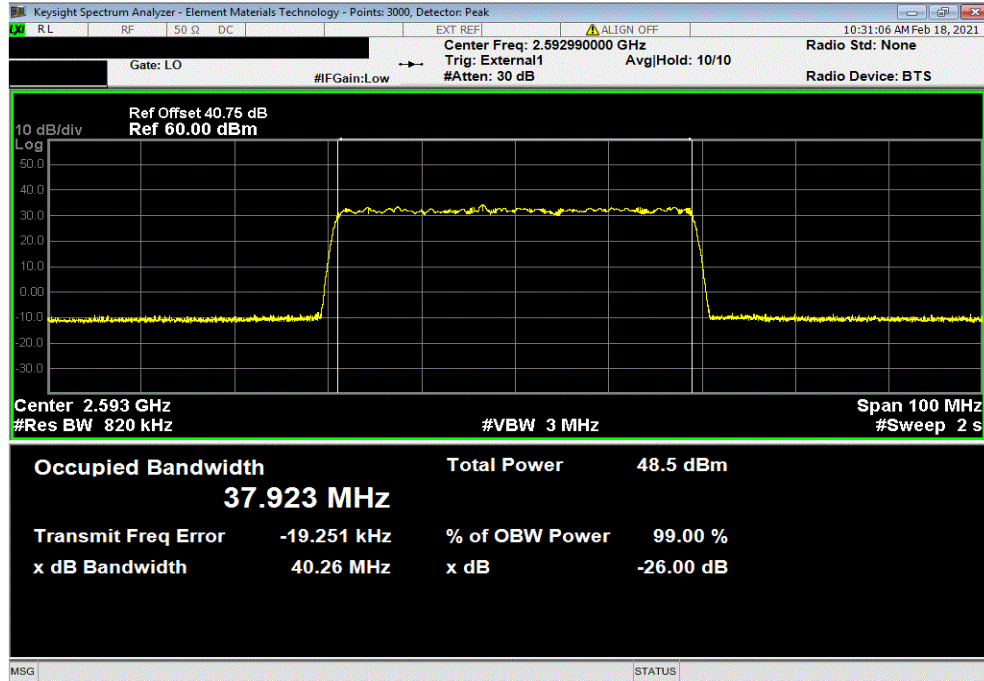


OCCUPIED BANDWIDTH 5G

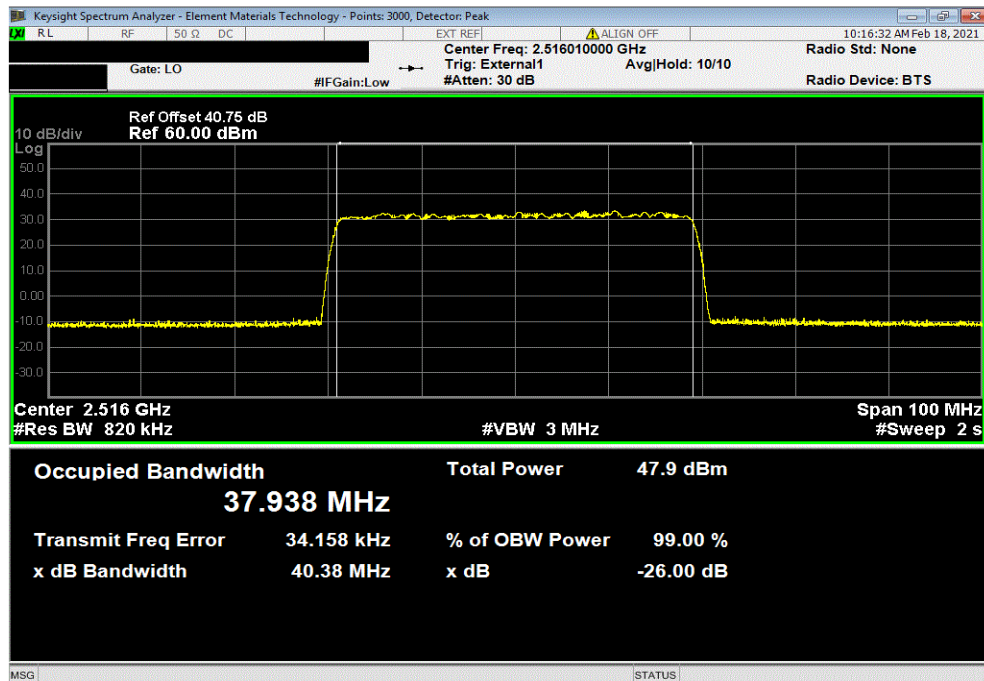


TbTx 2019.08.30.0 XMit 2020.12.30.0

5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR40 (40MHz), 64QAM, Mid Channel 2592.99 MHz						
	Value	Limit	Result			
	(26 dB)					
	40.259 MHz	Within Band	Pass			



5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR40 (40MHz), 256QAM, Low Channel 2516.01 MHz						
	Value	Limit	Result			
	(26 dB)					
	40.375 MHz	Within Band	Pass			

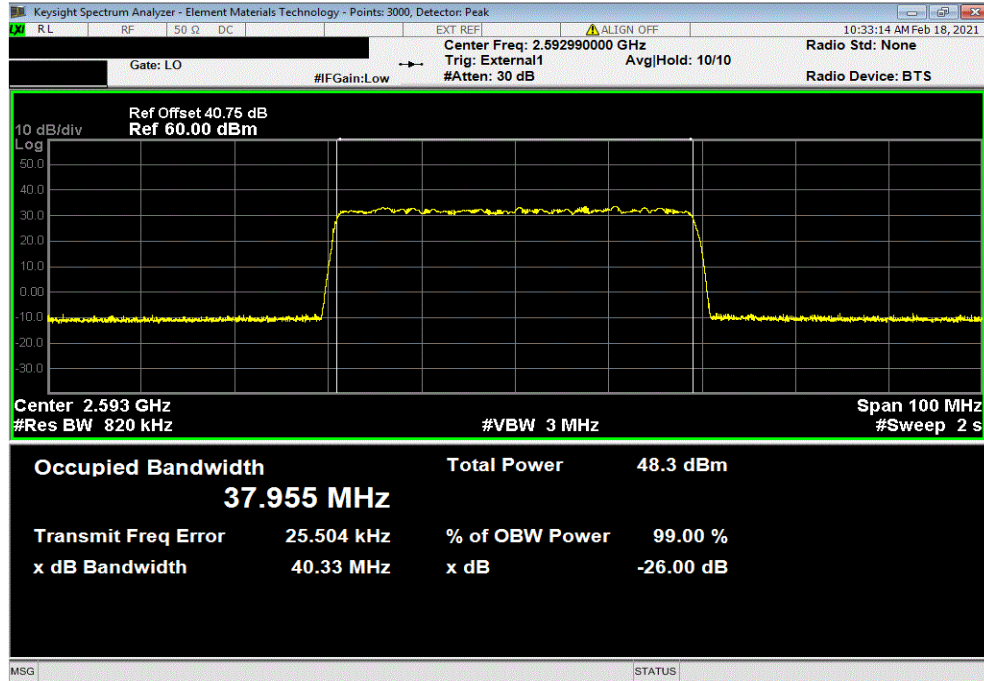


OCCUPIED BANDWIDTH 5G

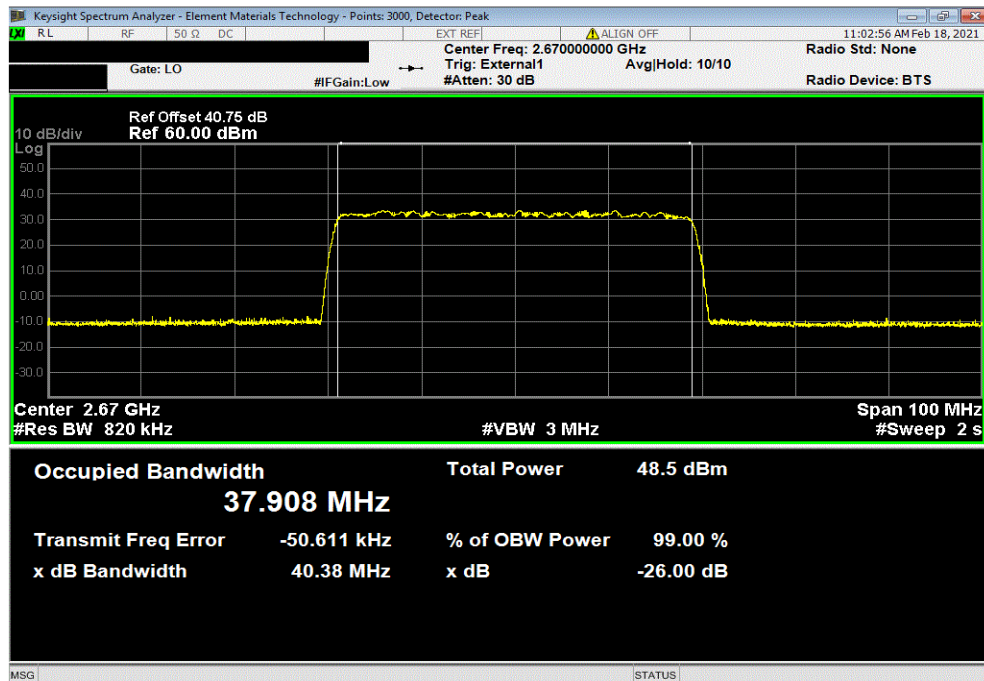


TbTx 2019.08.30.0 XMit 2020.12.30.0

5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR40 (40MHz), 256QAM, Mid Channel 2592.99 MHz						
				Value (26 dB)	Limit	Result
				40.326 MHz	Within Band	Pass



5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR40 (40MHz), 256QAM, High Channel 2670 MHz						
				Value (26 dB)	Limit	Result
				40.384 MHz	Within Band	Pass

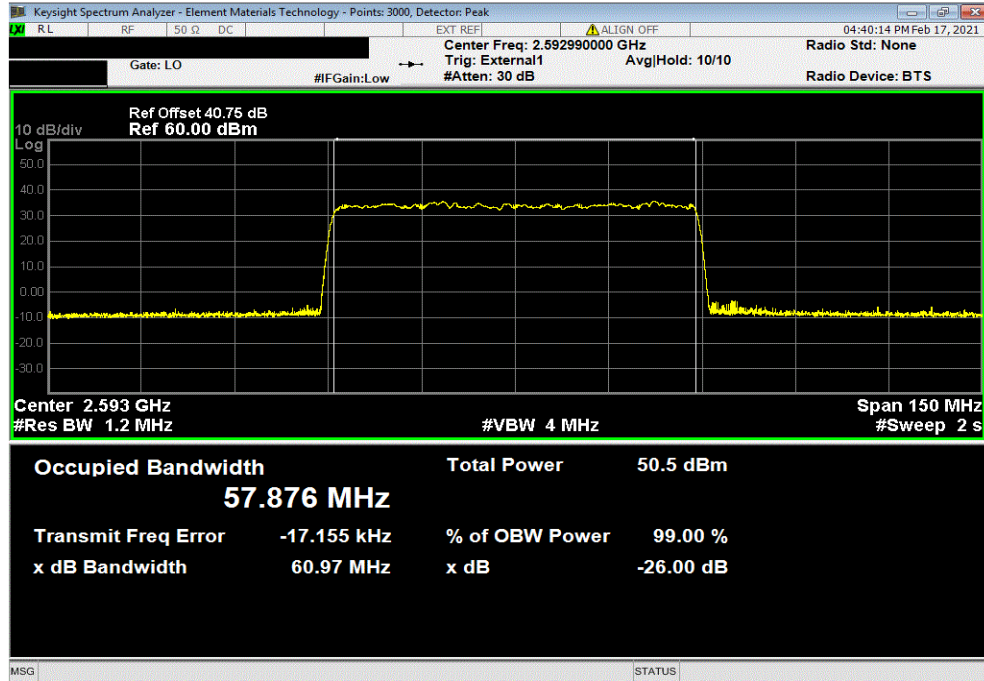


OCCUPIED BANDWIDTH 5G

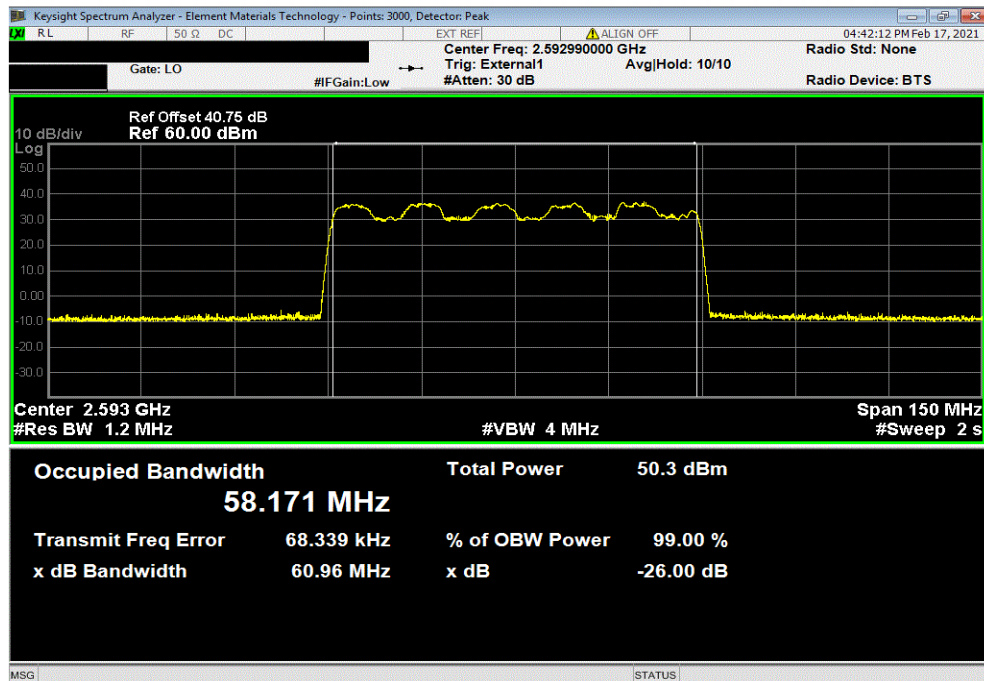


TbTx 2019.08.30.0 XbTx 2020.12.30.0

5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR60 (60MHz), QPSK, Mid Channel 2592.99 MHz						
				Value (26 dB)	Limit	Result
				60.968 MHz	Within Band	Pass



5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR60 (60MHz), 16QAM, Mid Channel 2592.99 MHz						
				Value (26 dB)	Limit	Result
				60.96 MHz	Within Band	Pass

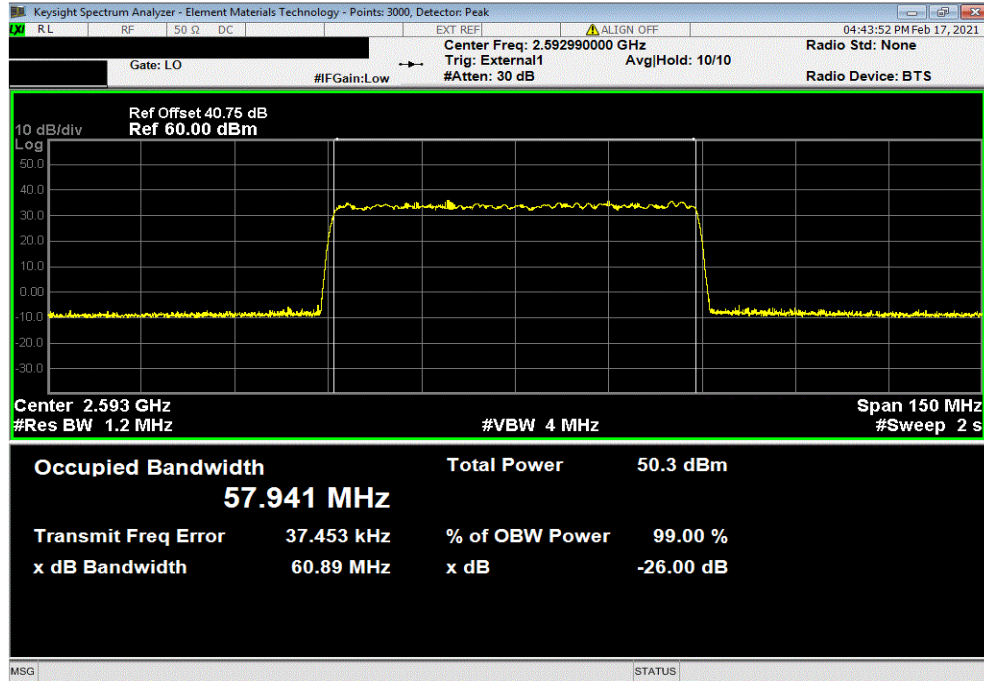


OCCUPIED BANDWIDTH 5G

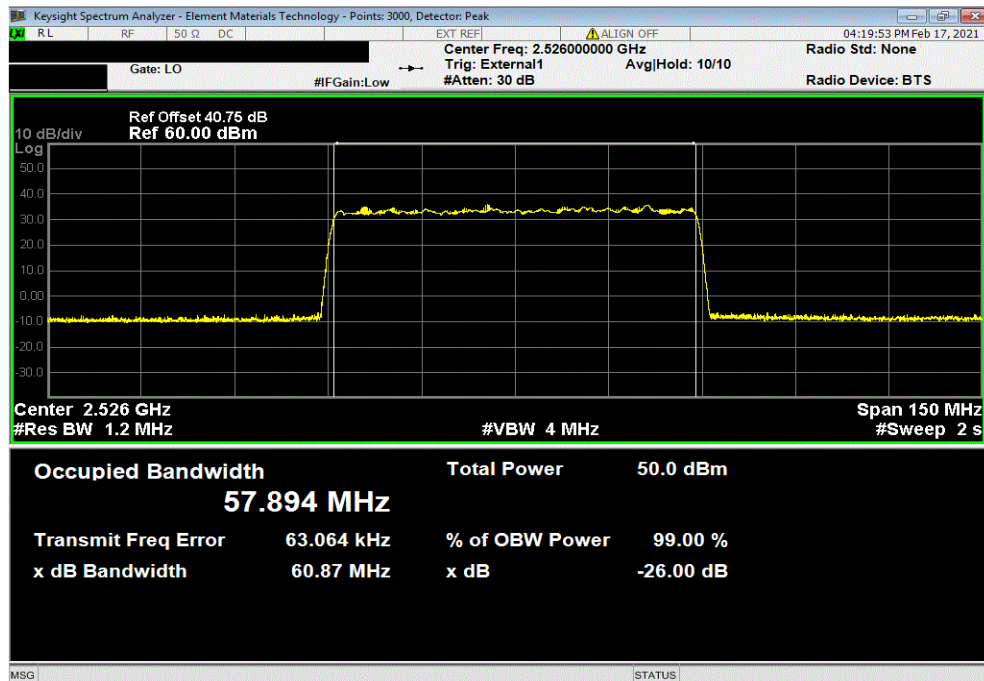


TbTx 2019.08.30.0 XMit 2020.12.30.0

5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR60 (60MHz), 64QAM, Mid Channel 2592.99 MHz						
	Value	Limit	Result			
	(26 dB)					
	60.894 MHz	Within Band	Pass			



5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR60 (60MHz), 256QAM, Low Channel 2526 MHz						
	Value	Limit	Result			
	(26 dB)					
	60.872 MHz	Within Band	Pass			

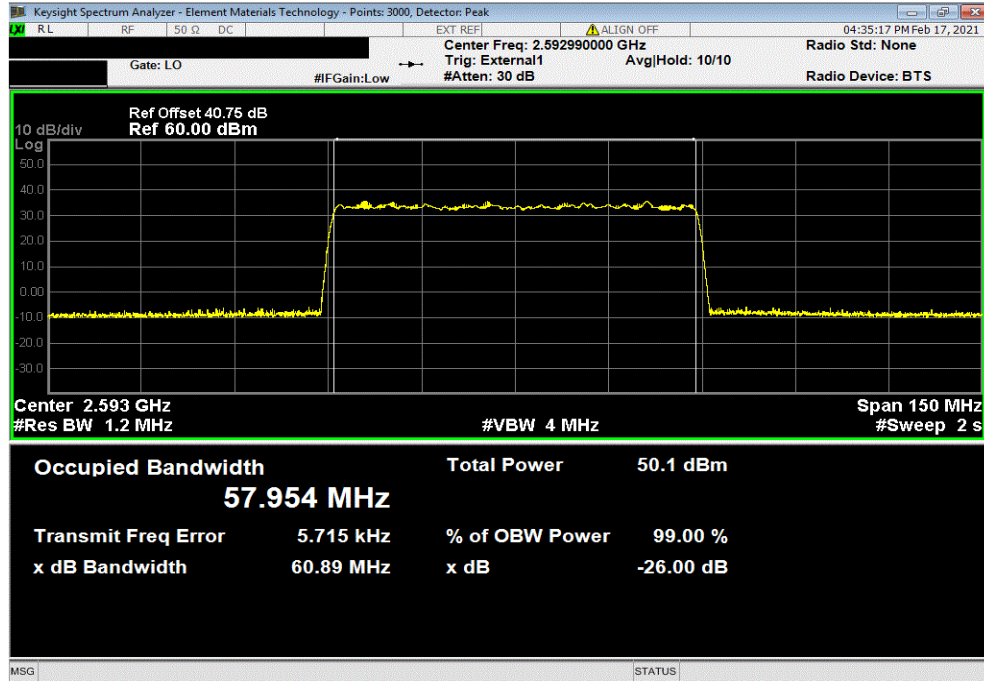


OCCUPIED BANDWIDTH 5G

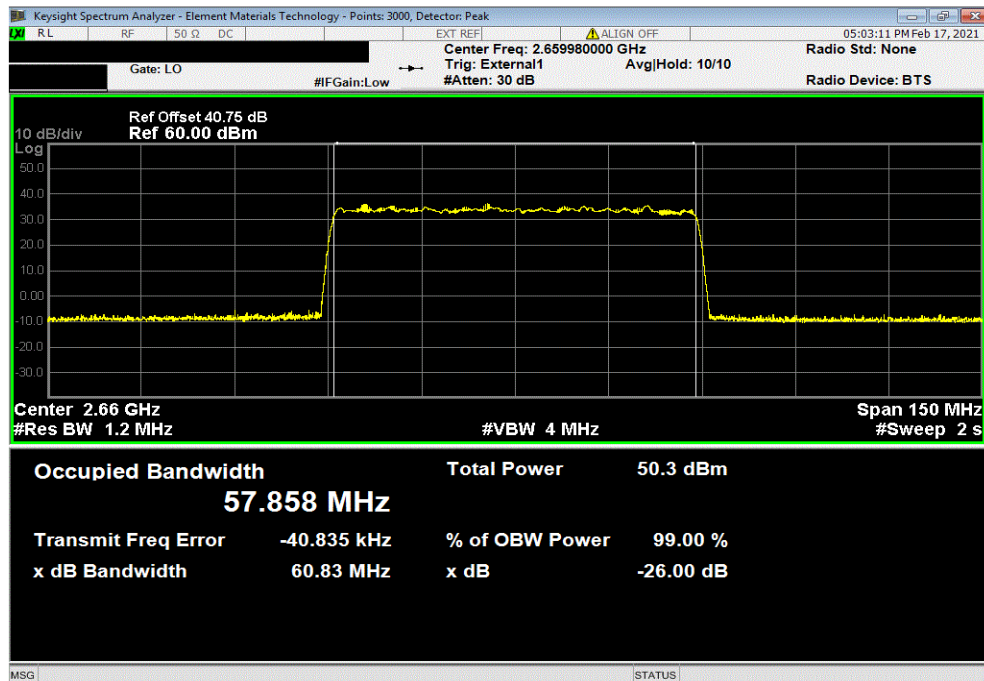


TbTx 2019.08.30.0 XMit 2020.12.30.0

5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR60 (60MHz), 256QAM, Mid Channel 2592.99 MHz						
	Value	Limit	Result			
	(26 dB)					
	60.892 MHz	Within Band	Pass			



5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR60 (60MHz), 256QAM, High Channel 2659.98 MHz						
	Value	Limit	Result			
	(26 dB)					
	60.833 MHz	Within Band	Pass			

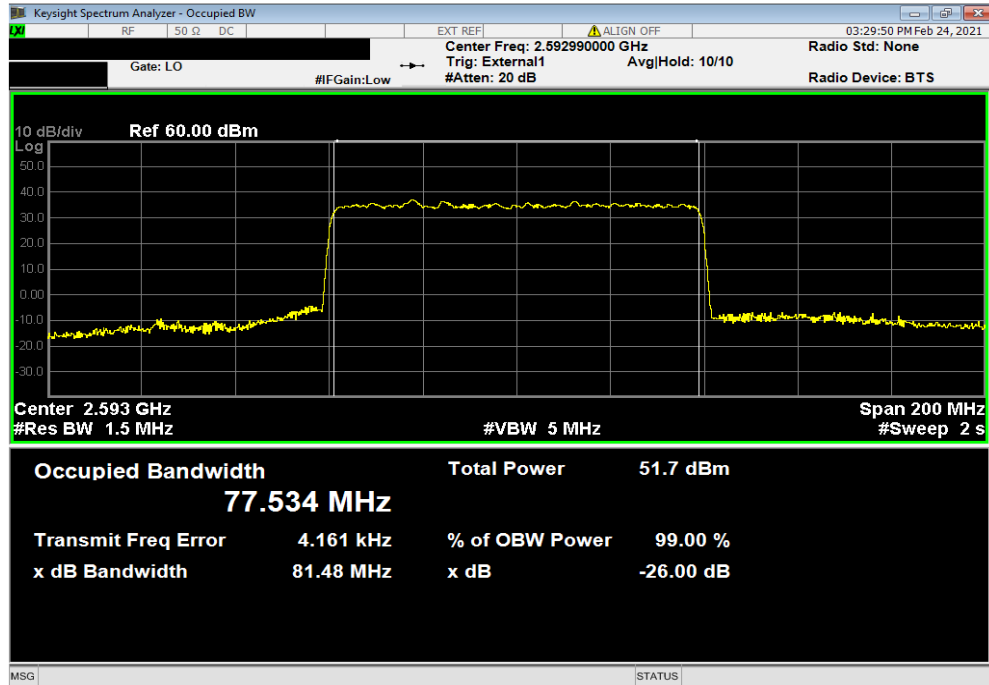


OCCUPIED BANDWIDTH 5G

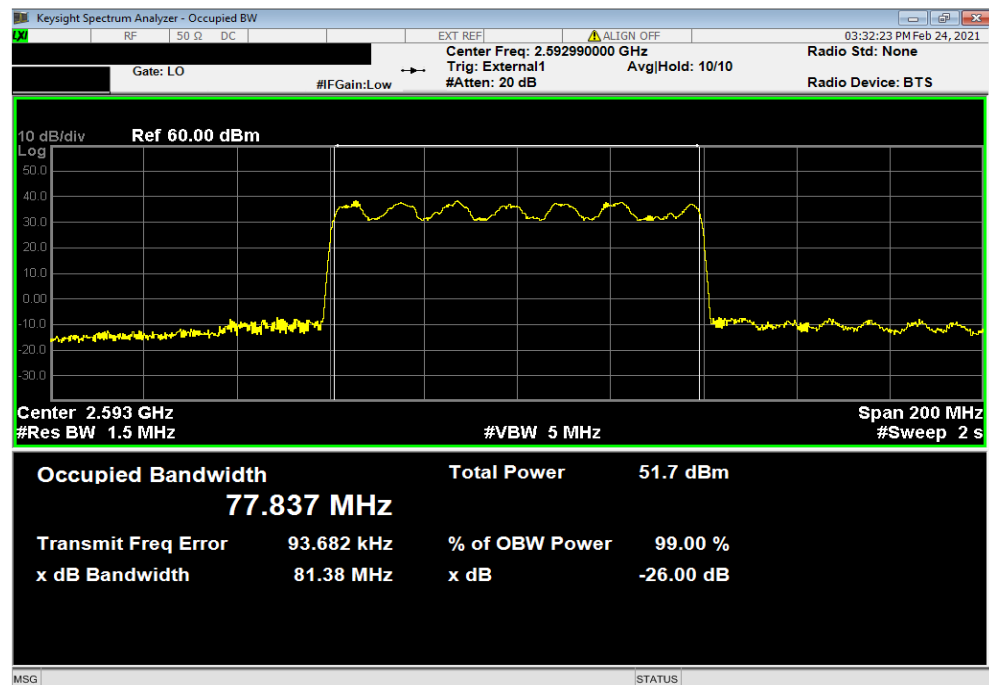


TbTx 2019.08.30.0 XMit 2020.12.30.0

5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR80 (80MHz), QPSK, Mid Channel 2592.99 MHz						
				Value (26 dB)	Limit	Result
				81.48 MHz	Within Band	Pass



5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR80 (80MHz), 16QAM, Mid Channel 2592.99 MHz						
				Value (26 dB)	Limit	Result
				81.38 MHz	Within Band	Pass

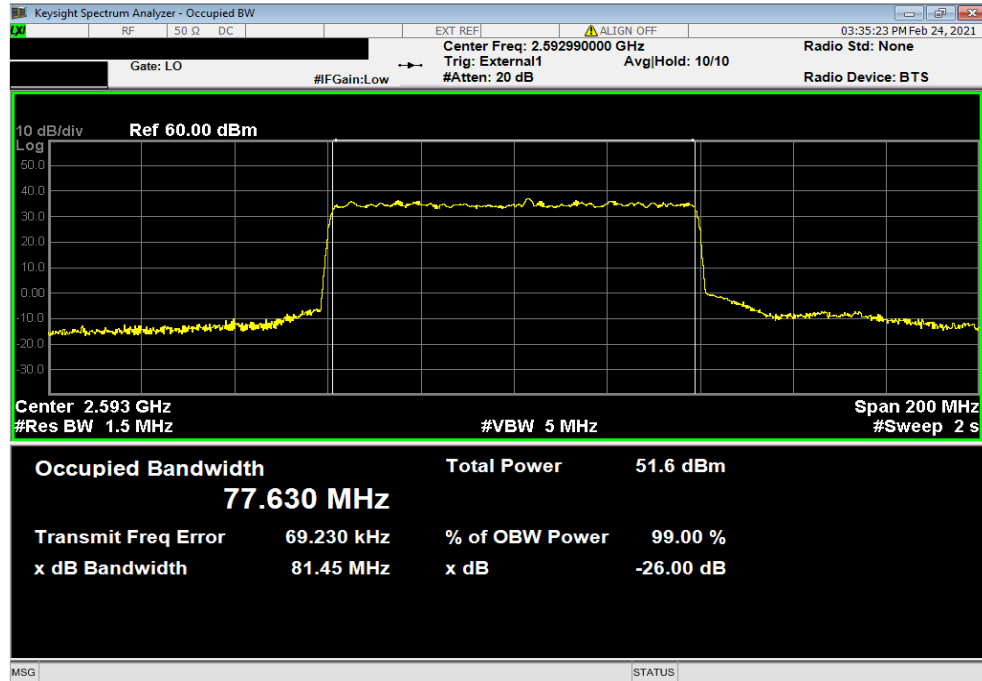


OCCUPIED BANDWIDTH 5G

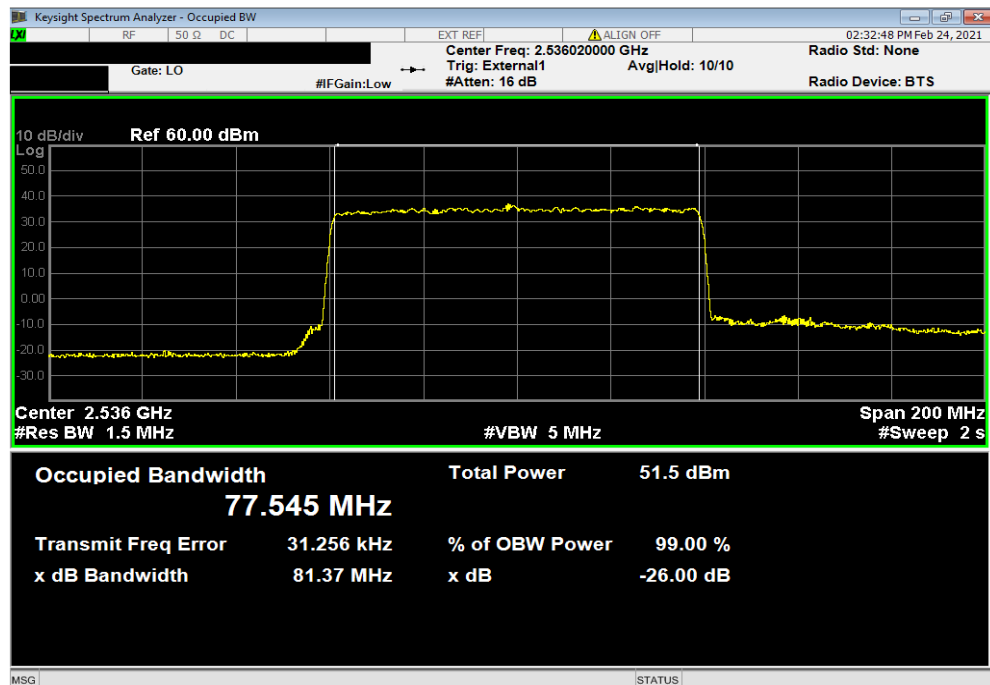


TbTx 2019.08.30.0 XMit 2020.12.30.0

5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR80 (80MHz), 64QAM, Mid Channel 2592.99 MHz						
	Value	Limit	Result			
	(26 dB)					
	81.45 MHz	Within Band	Pass			



5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR80 (80MHz), 256QAM, Low Channel 2536.02 MHz						
	Value	Limit	Result			
	(26 dB)					
	81.37 MHz	Within Band	Pass			

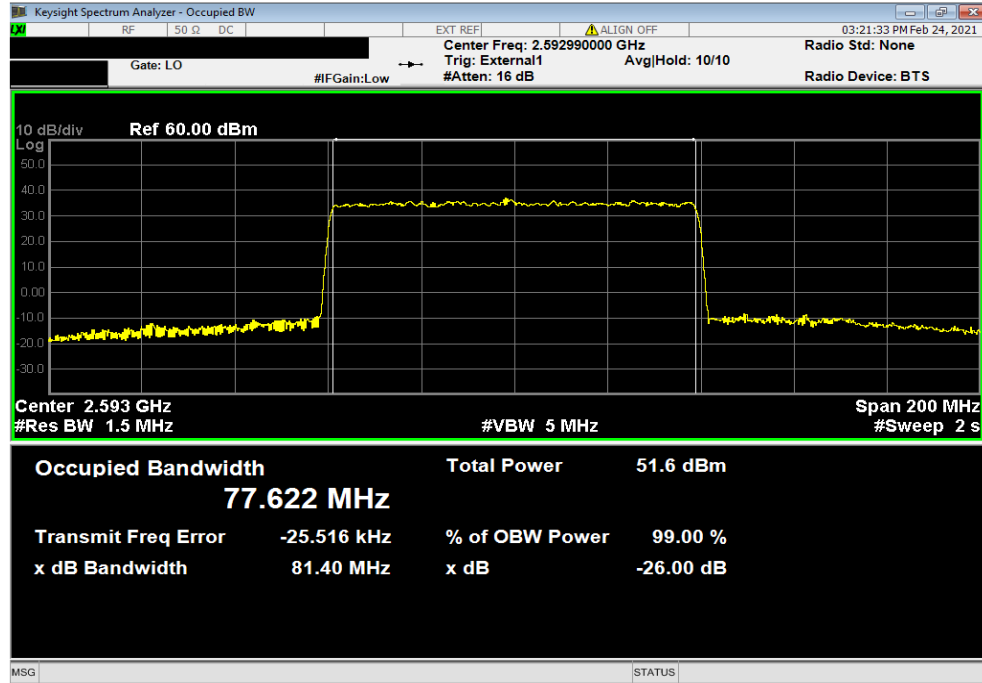


OCCUPIED BANDWIDTH 5G

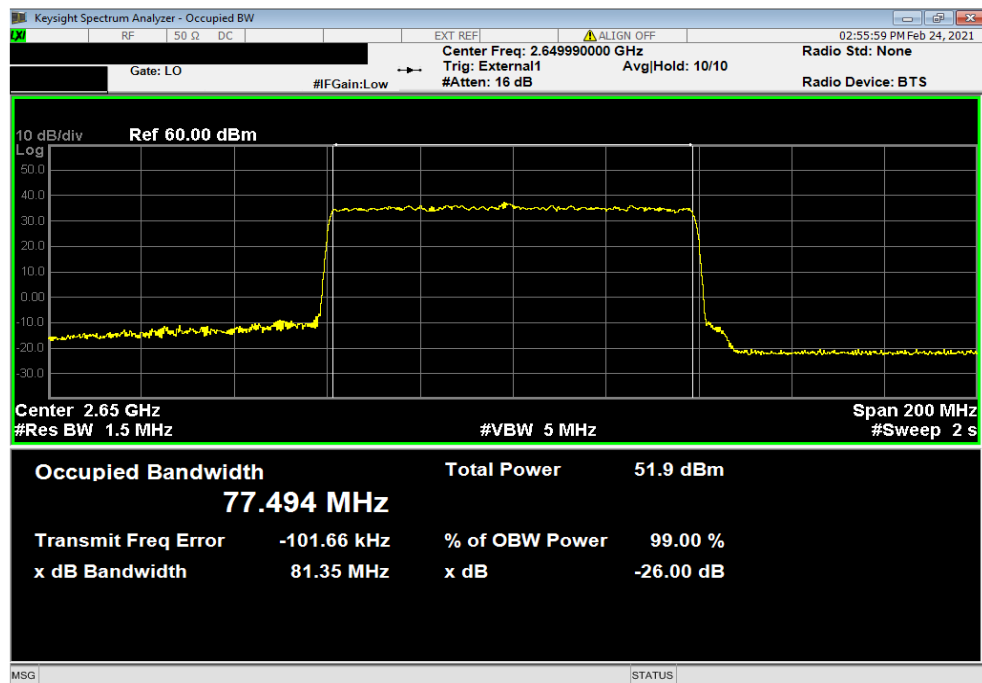


TbTx 2019.08.30.0 XMI 2020.12.30.0

5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR80 (80MHz), 256QAM, Mid Channel 2592.99 MHz						
Value				Limit	Result	
(26 dB)						
			81.40 MHz	Within Band	Pass	



5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR80 (80MHz), 256QAM, High Channel 2649.99 MHz						
Value				Limit	Result	
(26 dB)						
			81.35 MHz	Within Band	Pass	

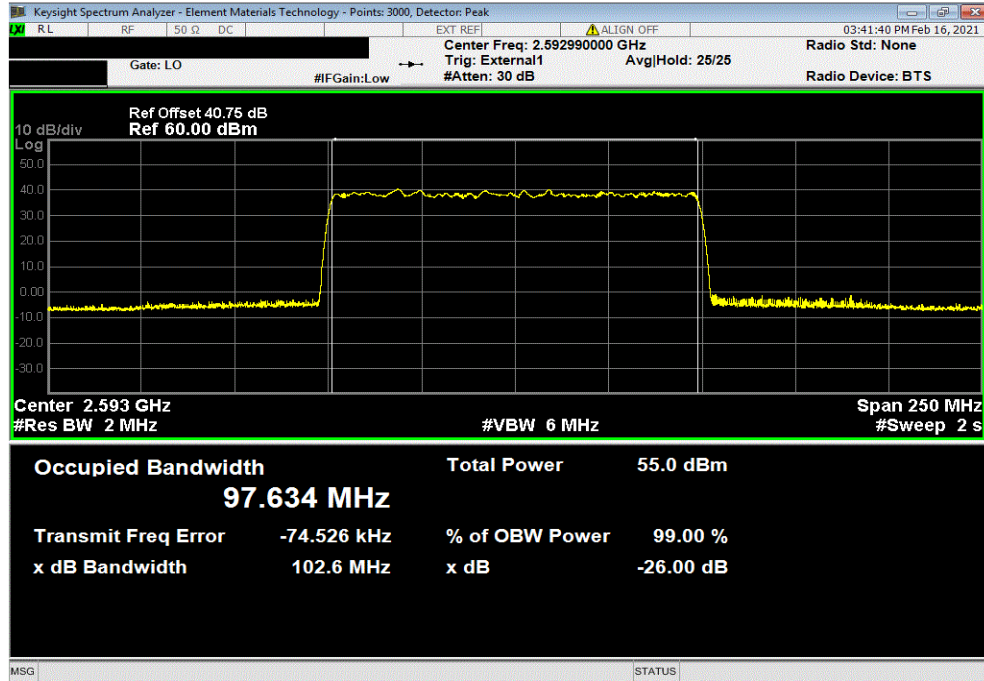


OCCUPIED BANDWIDTH 5G

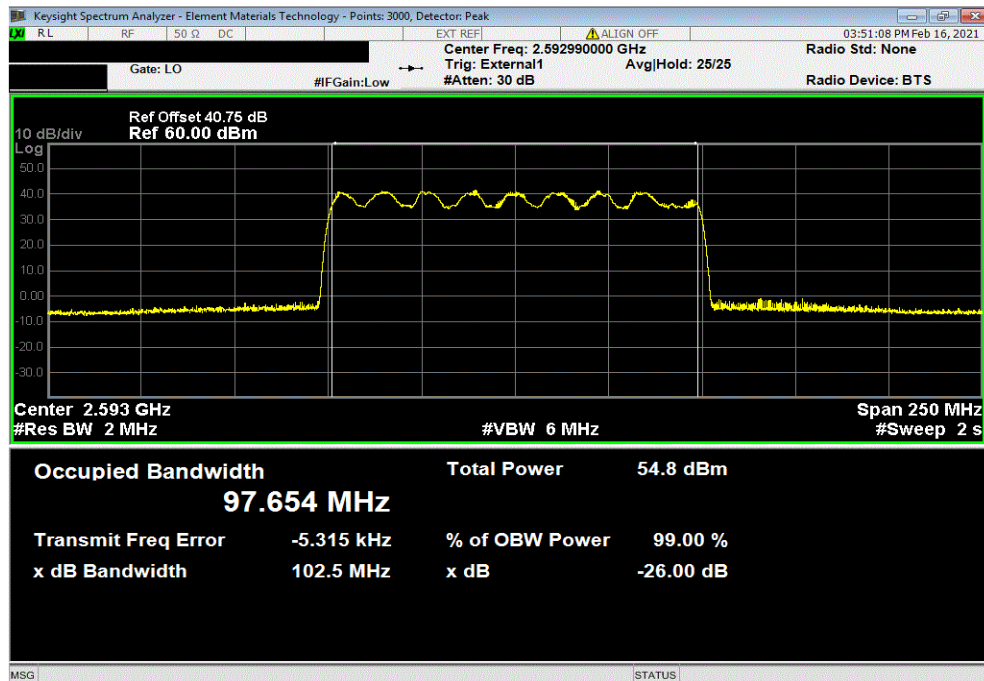


TbTx 2019.08.30.0 XMit 2020.12.30.0

5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR100 (100MHz), QPSK, Mid Channel 2592.99 MHz						
				Value (26 dB)	Limit	Result
				102.572 MHz	Within Band	Pass



5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR100 (100MHz), 16QAM, Mid Channel 2592.99 MHz						
				Value (26 dB)	Limit	Result
				102.547 MHz	Within Band	Pass

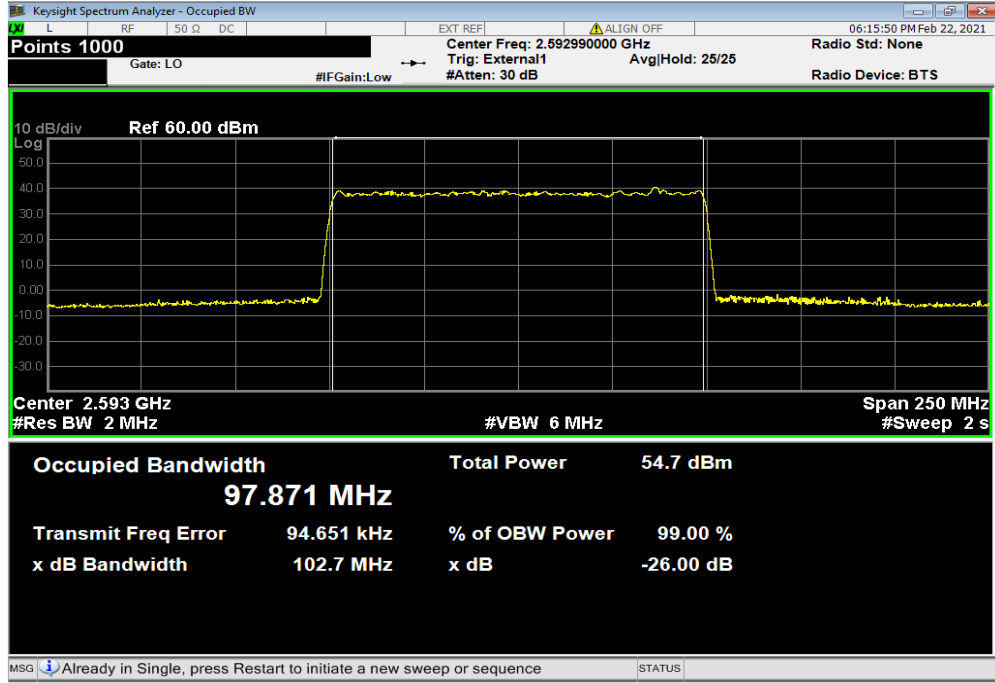


OCCUPIED BANDWIDTH 5G

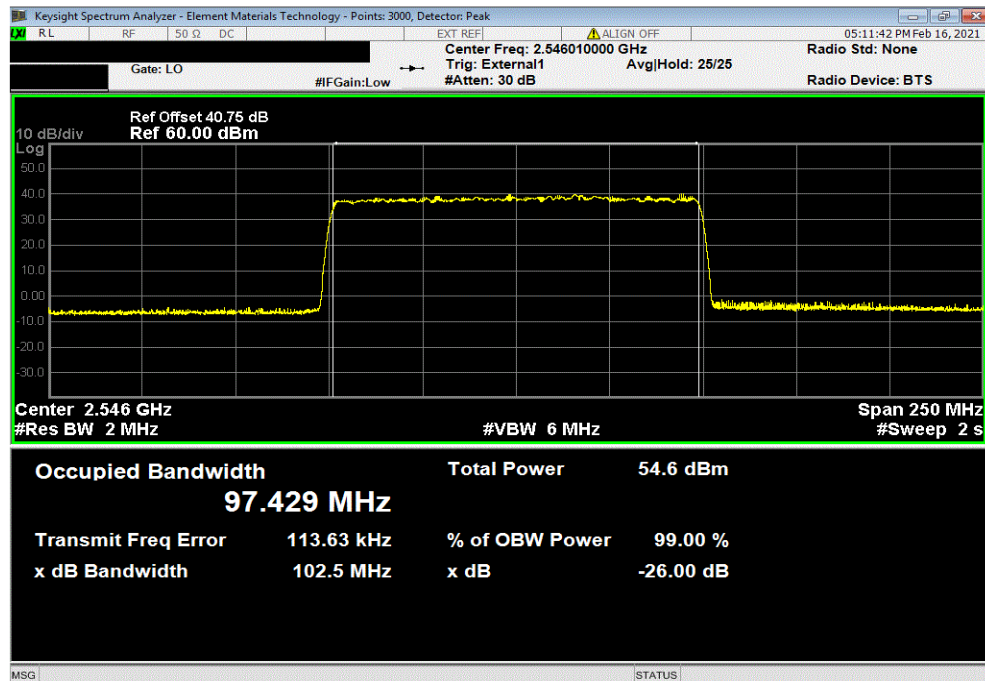


TbTx 2019.08.30.0 XMI 2020.12.30.0

5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR100 (100MHz), 64QAM, Mid Channel 2592.99 MHz						
	Value	Limit	Result			
	(26 dB)					
	102.719 MHz	Within Band	Pass			



5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR100 (100MHz), 256QAM, Low Channel 2546.01 MHz						
	Value	Limit	Result			
	(26 dB)					
	102.539 MHz	Within Band	Pass			

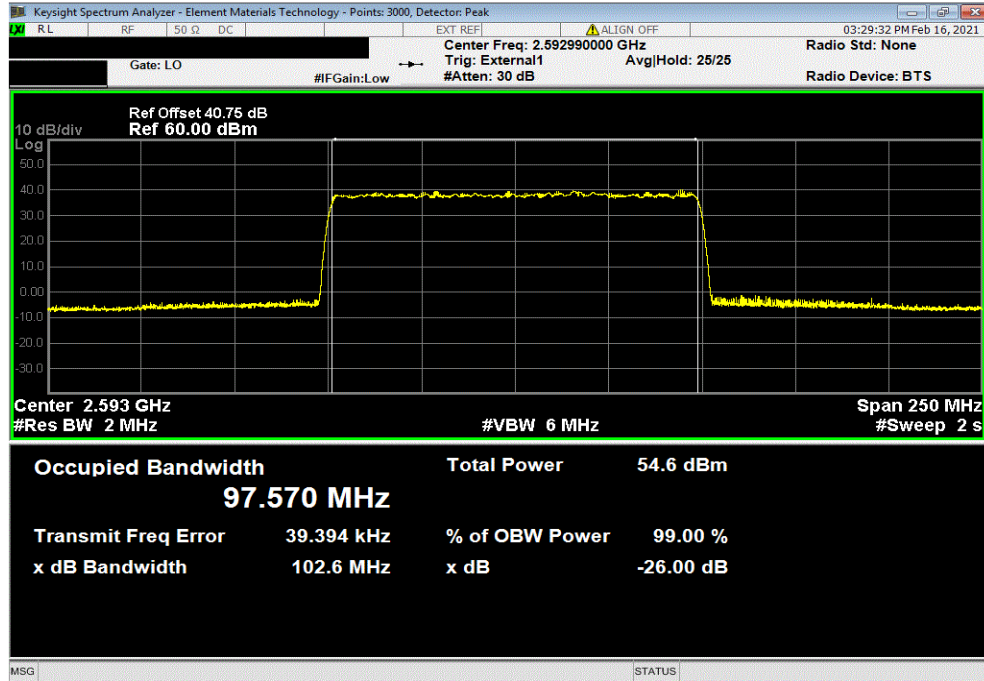


OCCUPIED BANDWIDTH 5G



TbTx 2019.08.30.0 XMI 2020.12.30.0

5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR100 (100MHz), 256QAM, Mid Channel 2592.99 MHz						
				Value (26 dB)	Limit	Result
				102.581 MHz	Within Band	Pass



5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR100 (100MHz), 256QAM, High Channel 2640 MHz						
				Value (26 dB)	Limit	Result
				102.547 MHz	Within Band	Pass

