



# element

**Radio Test Report**  
**Application for a Class II Permissive Change of Equipment Authorization**  
**FCC Part 24 and IC RSS-133**  
**[1930MHz – 1995MHz]**

**FCC ID: VBNFHFB-01**  
**IC ID: 661W-FHFB**

**Nokia Solutions and Networks**  
**Flexi MultiRadio Base Station Remote Radio Head**  
**Model: FHFB**

**Report: NOKI0021, Issue Date: October 15, 2020**



NVLAP LAB CODE: 201049-0

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# CERTIFICATE OF TEST

Last Date of Test: September 10, 2020

Nokia Solutions and Networks

EUT: Flexi MultiRadio Base Station Remote Radio Head Model FHFB

## Radio Equipment Testing

### Standards

Specification	Method
Code of Federal Regulations (CFR) Title 47 Part 2 (Radio Standards Specification) RSS-Gen Issue 5: 2019 CFR Title 47 Part 24 Subpart E – Broadband PCS RSS-133 Issue 6 - January 18, 2018 – 2GHz Personal Communications Services	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	No	N/A	Not requested.
Output Power	Yes	Pass	
Peak to Average Power (PAPR)/CCDF	Yes	Pass	
Power Spectral Density	Yes	Pass	
Band Edge Compliance	Yes	Pass	
Spurious Conducted Emissions	Yes	Pass	
Spurious Radiated Emissions	No	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



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## 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

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## 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.

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## European Union

**European Commission** – Within Element, we have a EU Notified Body validated for the EMCD and RED Directives.

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## Australia/New Zealand

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

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## Korea

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

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## Japan

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

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## 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.

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## Singapore

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

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## Israel

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

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## Hong Kong

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

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## Vietnam

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

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## SCOPE

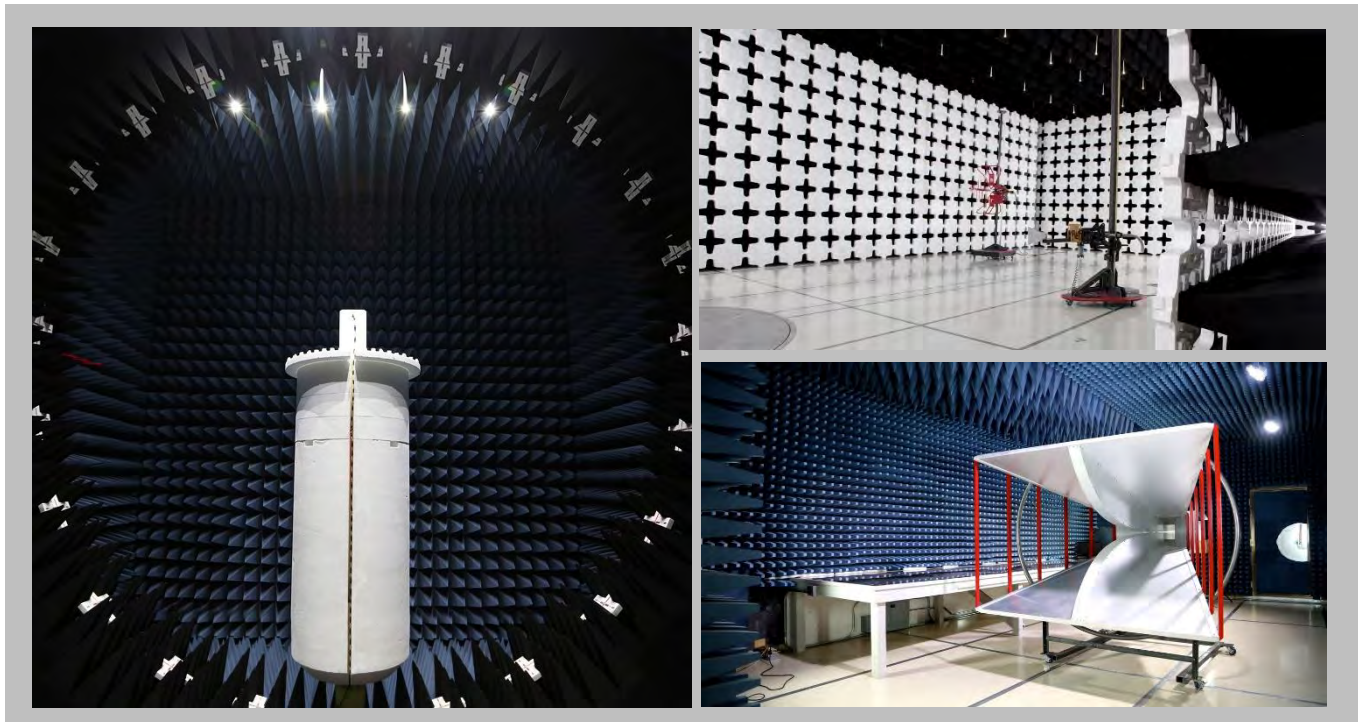
For details on the Scopes of our Accreditations, please visit:

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

# FACILITIES



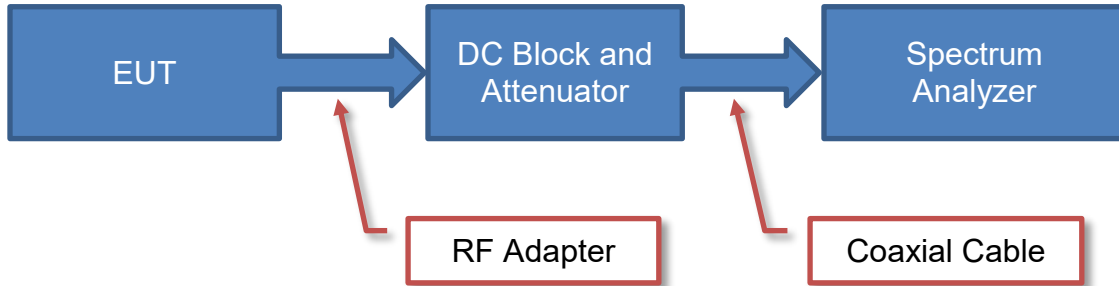
<b>California</b> Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	<b>Minnesota</b> Labs MN01-10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	<b>Oregon</b> Labs EV01-12 6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	<b>Texas</b> Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	<b>Washington</b> Labs NC01-05 19201 120 <sup>th</sup> Ave NE Bothell, WA 98011 (425)984-6600
<b>NVLAP</b>				
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
<b>Innovation, Science and Economic Development Canada</b>				
2834B-1, 2834B-3	2834E-1, 2834E-3	2834D-1	2834G-1	2834F-1
<b>BSMI</b>				
SL2-IN-E-1154R	SL2-IN-E-1152R	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
<b>VCCI</b>				
A-0029	A-0109	A-0108	A-0201	A-0110
<b>Recognized Phase I CAB for ISED, ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA</b>				
US0158	US0175	US0017	US0191	US0157



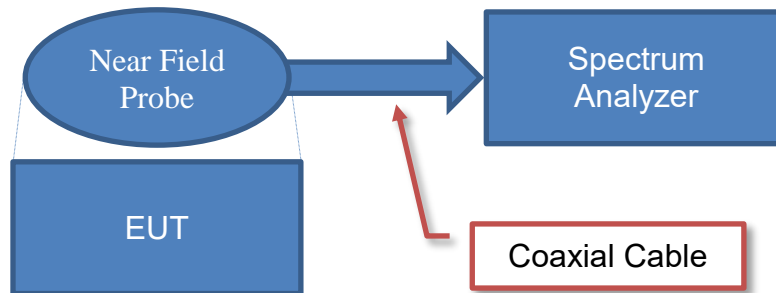


# Test Setup Block Diagrams

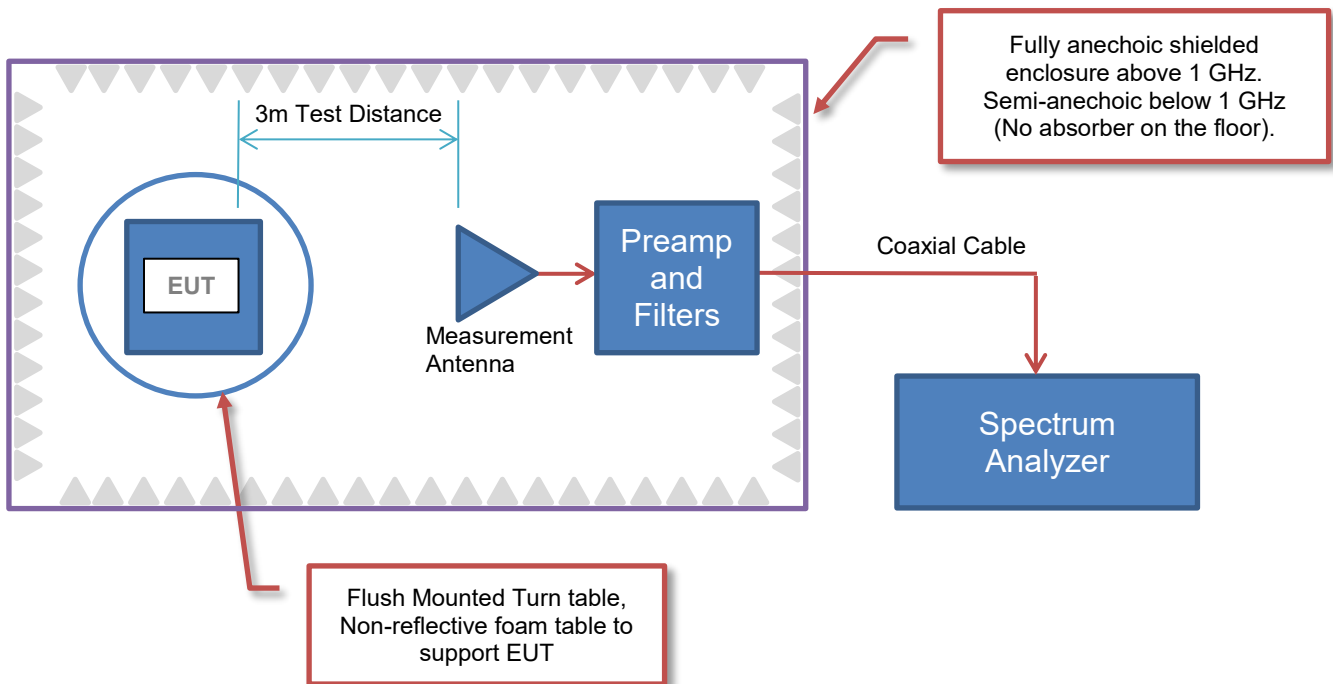
## Antenna Port Conducted Measurements



## Near Field Test Fixture Measurements



## Spurious Radiated Emissions



# 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 included as part of the applicable test description page. 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.

<b>Test</b>	<b>+ MU</b>	<b>- MU</b>
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

# PRODUCT DESCRIPTION

## Client and Equipment Under Test (EUT) Information

<b>Company Name:</b>	Nokia Solutions and Networks
<b>Address:</b>	3201 Olympus Blvd
<b>City, State, Zip:</b>	Dallas, TX 75019
<b>Test Requested By:</b>	Steve Mitchell
<b>EUT:</b>	Flexi MultiRadio Base Station Remote Radio Head Model FHFB
<b>First Date of Test:</b>	September 8, 2020
<b>Last Date of Test:</b>	September 10, 2020
<b>Receipt Date of Samples:</b>	September 8, 2020
<b>Equipment Design Stage:</b>	Production
<b>Equipment Condition:</b>	No Damage
<b>Purchase Authorization:</b>	Verified

## Information Provided by the Party Requesting the Test

### Functional Description of the EUT:

A class II permissive change on the original filing is being pursued to add 5G NR (new radio) carriers to the Flexi MultiRadio Base Station Remote Radio Head Model FHFB FCC and ISSED radio certifications.

The original FCC and ISSED radio certification (FCC ID: VBNFHFB-01 and IC ID: 661W-FHFB) submittal is NTS Test Report Number PR033297 Revision 1 dated February 10, 2016. The original test effort includes testing for LTE and WCDMA technologies. Please refer to the test report on the original certification for details on all required testing.

All conducted RF testing performed for the original certification testing has been repeated using 5G NR carriers for this class II permissive change per correspondence/guidance from Nemko TCB. The same test methodology used in the original certification testing was used in this class II permissive change test effort. 5G NR carrier bandwidths of 5MHz, 10MHz, 15MHz and 20MHz with QPSK, 16QAM, 64QAM and 256QAM modulation types were verified under this effort. Tests performed under the class II change effort include RF power, PSD, CCDF, emission bandwidth (99% and 26 dB down), band edge spurious emissions, and conducted spurious emissions. The 5G NR carriers/modulation types for this testing are setup according to 3GPP TS 38.141-1 Test Models and are NR-FR1-TM 1.1 (QPSK modulation type), NR-FR1-TM 3.2 (16QAM modulation type), NR-FR1-TM 3.1 (64QAM modulation type), and NR-FR1-TM 3.1a (256QAM modulation type).

The testing was performed on the same hardware version (FHFB) as the original certification test. The base station and remote radio head software for this testing is an updated release that includes 5G NR carrier support.

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

The equipment under test (EUT) is a Nokia Solutions and Networks Flexi MultiRadio Base Station Remote Radio Head Model FHFB. The FHFB remote radio head is a multi-standard multi-carrier radio module designed to support GSM/EDGE, WCDMA, LTE and 5G NR operations. The scope of testing in this effort is for 5G NR Single Carrier operations.

The FHFB RRH has four transmit/four receive antenna ports (4TX/4RX). Each antenna port supports 3GPP frequency band n25 (BTS Rx: 1850 to 1915 MHz/BTS TX: 1930 to 1995 MHz). The maximum RF output power of the RRH is 160 Watts (40 watts per carrier and 40 per port) for band n25 operations. The TX and RX instantaneous bandwidth cover the full operational RRH bandwidth. The RRH can be operated as a 4x4 MIMO, 2x2 MIMO or as non-MIMO for 5G NR. The RRH supports 5, 10, 15 and 20MHz 5G NR bandwidths. The RRH supports four 5G NR downlink modulation types (QPSK, 16QAM, 64QAM and 256QAM).

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



# PRODUCT DESCRIPTION



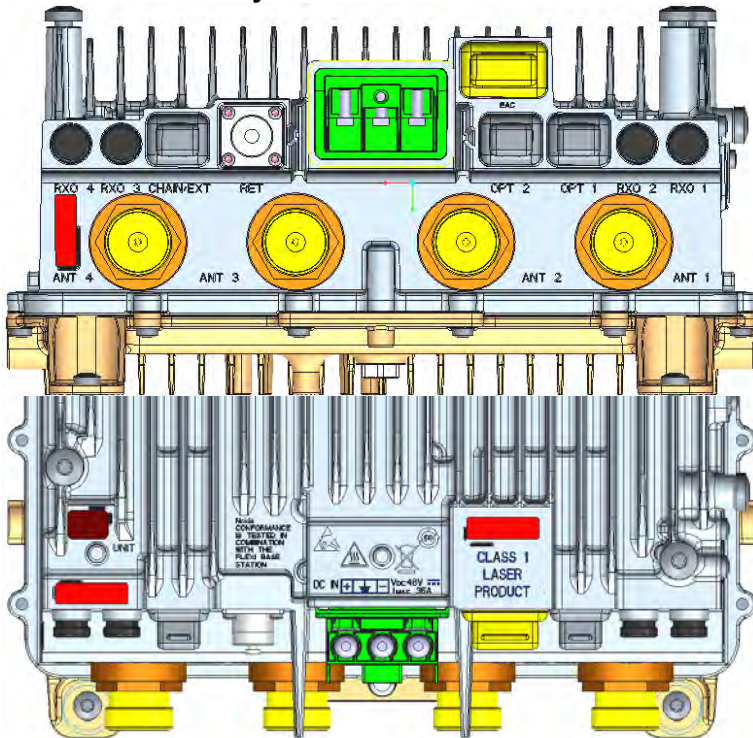
The FHFB PCS Band 5G NR channel bandwidths are 5, 10, 15 and 20MHz. The downlink channel numbers and frequencies are provided below.

	Downlink 5G NR NR-ARFCN	Downlink Frequency (MHz)	5G NR Channel Bandwidth			
			5 MHz	10 MHz	15 MHz	20 MHz
<b>FHFB Band n25 (Ant 1, 2, 3, 4)</b>	386000	1930.0	Band Edge	Band Edge	Band Edge	Band Edge
	386500	1932.5	Bottom Ch			
	387000	1935.0		Bottom Ch		
	387500	1937.5			Bottom Ch	
	388000	1940.0				Bottom Ch
	392500	1962.5	Middle Ch	Middle Ch	Middle Ch	Middle Ch
	397000	1985.0				Top Channel
	397500	1987.5			Top Channel	
	398000	1990.0		Top Channel		
398500	1992.5	Top Channel				
399000	1995.0	Band Edge	Band Edge	Band Edge	Band Edge	

FHFB Downlink Band Edge 5G NR Band n25 Frequency Channels

# PRODUCT DESCRIPTION

## FHFB Connector Layout



## EUT External Interfaces

Name	Qty	Connector Type	Purpose (and Description)
DC In	1	Screw Terminal	3-pole Power Input Terminal
GND	1	Screw lug (2xM5/1xM8)	Ground
ANT	4	7/16	RF signal for Transmitter/Receiver (50 Ohm)
Unit	1	LED	Unit Status LED
EAC	1	MDR14	External Alarm Interface (4 alarms)
OPT	2	SFP+ cage	Optical Interface
RET	1	8-pin circular connector conforming to IEC 60130-9 – Ed.3.0	AISG 2.0 to external devices

### Testing Objective:

A class II permissive change on the original filing is being pursued to add 5G NR (new radio) carriers to the Flexi MultiRadio Base Station Remote Radio Head Model FHFB FCC and ISED radio certifications.

# CONFIGURATIONS



## Configuration NOKI0021-1

Software/Firmware Running during test	
Description	Version
5G BTS Software Version	5G20A_GNB_0009_001800_000863

Equipment being tested (include Peripherals)			
Description	Manufacturer	Model/Part Number	Serial Number
AMIA (BTS System Module)	Nokia Solutions and Networks	473098A.203	RK182307104
MDEA (Mobile Fronthaul Switch)	Nokia Solutions and Networks	473922A.102	6Q202306254
ASIK (5G BTS System Module)	Nokia Solutions and Networks	474021A.102	EA194259377
ABIL (5G BTS Baseband Module)	Nokia Solutions and Networks	474020A.102	L1183300437
FHFB (Radio Module Model)	Nokia Solutions and Networks	473042A.101	L9144200604
Low Pass Filter 1.4GHz/100W	Microwave Circuits, Inc.	L13502G1	SN2454-01
Attenuator 100W/10dB	Aeroflex Weinschel	58-10-43-LIM	TD446
SFP+ 9.8G,300M,850NM	Nokia	473842.A101	KR16090020071
SFP+ 9.8G,300M,850NM	Nokia	473842.A101	KR16180010036
SFP+ 9.8G,300M,850NM	Nokia	473842.A101	KR16180010011
SFP+ 9.8G,300M,850NM	Nokia	473842.A101	MA17331610209
SFP+ 9.8G,300M,850NM	Nokia	473842.A101	KR17030010035
SFP+ 9.8G,300M,850NM	Nokia	473842.A101	MA17331610207
Lenovo T490	HP	T490	PF26RVZ0
HP- DC System power supply	HP	6032A	3440A-10308
FPAC (DC-pwr supply)	Nokia	474676.X21	A9183050057
FPAE	Nokia	472953A.X31	A9142603109
2 Meter RF cable	Times Microwave Systems	SPP250NM43MR2.0M	463559-00005TMC
2 Meter RF cable	Times Microwave Systems	SPP250NM43MR2.0M	463559-00006TMC
2 Meter RF cable	Times Microwave Systems	SPP250NM43MR2.0M	463559-00002TMC
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC867
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TV066
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC870
Fiber Optic cable 25m	Occfiber.com	BX002DAIS	334280
Fiber Optic cable 2m	Amphenol	995109C 180512	0213M
Fiber Optic cable 2m	Amphenol	995109C 180512	0128M
CAT5e data cable	BELKIN	#R7J304	E178882
CAT5e data cable	LEONI L	64867m	146180
FYGB GPS receiver	Nokia	472748A	71231431
Cat-5e cable	CSA	LL73189	E151955
6 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX 106	SN297370...
1 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX 104	SN551123/4

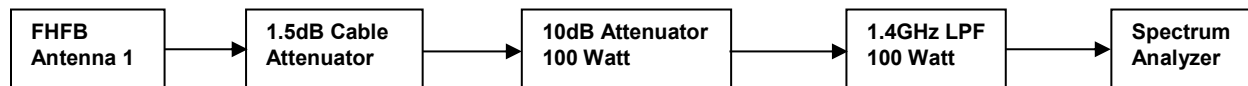
# CONFIGURATIONS



Cables (Peripheral)					
Description	Shield (Y/N)	Length (m)	Ferrite (Y/N)	Connection 1	Connection 2
Fiber Optic cable	N	2 meters	N	ASIK	MDEA
Fiber Optic cable	N	2 meters	N	ASIK	MDEA
Fiber Optic cable	N	25 meters	N	MDEA	FHFB
Cat-5e cable (CSA)	Y	25 meters	N	ASIK	FYGB GPS receiver
Cat-5e cable	Y	25 meters	N	ASIK	WebEM- PC
Times Microwave Systems	Y	2 meters	N	EUT [RRH] Ant ports 2, 3, 4	250W -50ohm - Load

Cables					
Description	Shield (Y/N)	Length (m)	Ferrite (Y/N)	Connection 1	Connection 2
HS-SUCOFLEX_106 1.5dB cable attenuator	Y	6 meters	N	EUT [FHFB] Ant port #1	Attenuator 100W/10dB
Attenuator 100W/10dB	N	NA	N	RF cable HS- SUCOFLEX_106	Low Pass filter 1.4G/100W
Low Pass Filter 1.4G/100W	N	NA	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



## Configuration NOKI0021-2

Software/Firmware Running during test	
Description	Version
5G BTS Software Version	5G20A_GNB_0009_001800_000863

Equipment being tested (include Peripherals)			
Description	Manufacturer	Model/Part Number	Serial Number
AMIA (BTS System Module)	Nokia Solutions and Networks	473098A.203	RK182307104
MDEA (Mobile Fronthaul Switch)	Nokia Solutions and Networks	473922A.102	6Q202306254
ASIK (5G BTS System Module)	Nokia Solutions and Networks	474021A.102	EA194259377
ABIL (5G BTS Baseband Module)	Nokia Solutions and Networks	474020A.102	L1183300437
FHFB (Radio Module Model)	Nokia Solutions and Networks	473042A.101	L9144200604
Attenuator 250W/40dB	Aeroflex Weinschel	58-40-43-LIM	TC909
SFP+ 9.8G,300M,850NM	Nokia	473842.A101	KR16090020071
SFP+ 9.8G,300M,850NM	Nokia	473842.A101	KR16180010036
SFP+ 9.8G,300M,850NM	Nokia	473842.A101	KR16180010011
SFP+ 9.8G,300M,850NM	Nokia	473842.A101	MA17331610209
SFP+ 9.8G,300M,850NM	Nokia	473842.A101	KR17030010035
SFP+ 9.8G,300M,850NM	Nokia	473842.A101	MA17331610207
Lenovo T490	HP	T490	PF26RVZ0
HP- DC System power supply	HP	6032A	3440A-10308
FPAC (DC-pwr supply)	Nokia	474676.X21	A9183050057
FPAE	Nokia	472953A.X31	A9142603109
2 Meter RF cable	Times Microwave Systems	SPP250NM43MR2.0M	463559-00005TMC
2 Meter RF cable	Times Microwave Systems	SPP250NM43MR2.0M	463559-00006TMC
2 Meter RF cable	Times Microwave Systems	SPP250NM43MR2.0M	463559-00002TMC
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC867
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TV066
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC870
Fiber Optic cable 25m	Ocxfiber.com	BX002DAIS	334280
Fiber Optic cable 2m	Amphenol	995109C 180512	0213M
Fiber Optic cable 2m	Amphenol	995109C 180512	0128M
CAT5e data cable	BELKIN	#R7J304	E178882
CAT5e data cable	LEONI L	64867m	146180
FYGB GPS receiver	Nokia	472748A	71231431
Cat-5e cable	CSA	LL73189	E151955
6 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297370...
1 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_104	SN551123/4

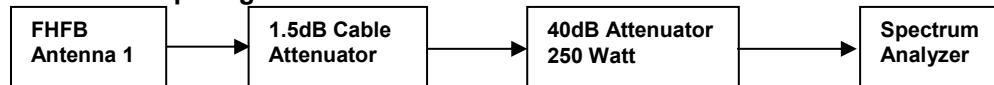
# CONFIGURATIONS



Cables (Peripheral)					
Description	Shield (Y/N)	Length (m)	Ferrite (Y/N)	Connection 1	Connection 2
Fiber Optic cable	N	2 meters	N	ASIK	MDEA
Fiber Optic cable	N	2 meters	N	ASIK	MDEA
Fiber Optic cable	N	25 meters	N	MDEA	FHFB
Cat-5e cable (CSA)	Y	25 meters	N	ASIK	FYGB GPS receiver
Cat-5e cable	Y	25 meters	N	ASIK	WebEM- PC
Times Microwave Systems	Y	2 meters	N	EUT [RRH] Ant ports 2, 3, 4	250W -50ohm - Load

Cables					
Description	Shield (Y/N)	Length (m)	Ferrite (Y/N)	Connection 1	Connection 2
HS-SUCOFLEX_106 1.5dB cable attenuator	Y	6 meters	N	EUT [FHFB] 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

## RF Test Setup Diagram:





# CONFIGURATIONS



## Configuration NOKI0021-3

Software/Firmware Running during test	
Description	Version
5G BTS Software Version	5G20A_GNB_0009_001800_000863

Equipment being tested (include Peripherals)			
Description	Manufacturer	Model/Part Number	Serial Number
AMIA (BTS System Module)	Nokia Solutions and Networks	473098A.203	RK182307104
MDEA (Mobile Fronthaul Switch)	Nokia Solutions and Networks	473922A.102	6Q202306254
ASIK (5G BTS System Module)	Nokia Solutions and Networks	474021A.102	EA194259377
ABIL (5G BTS Baseband Module)	Nokia Solutions and Networks	474020A.102	L1183300437
FHFB (Radio Module Model)	Nokia Solutions and Networks	473042A.101	L9144200604
High Pass Filter 2.5GHz/2W	RLC Electronics	F-100-3000-5-R	0028
Attenuator 150W/20dB	Aeroflex Weinschel	66-20-33	BZ2075
Attenuator 100W/3dB	Aeroflex Weinschel	47-3-33	CG5493
SFP+ 9.8G,300M,850NM	Nokia	473842.A101	KR16090020071
SFP+ 9.8G,300M,850NM	Nokia	473842.A101	KR16180010036
SFP+ 9.8G,300M,850NM	Nokia	473842.A101	KR16180010011
SFP+ 9.8G,300M,850NM	Nokia	473842.A101	MA17331610209
SFP+ 9.8G,300M,850NM	Nokia	473842.A101	KR17030010035
SFP+ 9.8G,300M,850NM	Nokia	473842.A101	MA17331610207
Lenovo T490	HP	T490	PF26RVZ0
HP- DC System power supply	HP	6032A	3440A-10308
FPAC (DC-pwr supply)	Nokia	474676.X21	A9183050057
FPAE	Nokia	472953A.X31	A9142603109
2 Meter RF cable	Times Microwave Systems	SPP250NM43MR2.0M	463559-00005TMC
2 Meter RF cable	Times Microwave Systems	SPP250NM43MR2.0M	463559-00006TMC
2 Meter RF cable	Times Microwave Systems	SPP250NM43MR2.0M	463559-00002TMC
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC867
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TV066
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC870
Fiber Optic cable 25m	Occfiber.com	BX002DAIS	334280
Fiber Optic cable 2m	Amphenol	995109C 180512	0213M
Fiber Optic cable 2m	Amphenol	995109C 180512	0128M
CAT5e data cable	BELKIN	#R7J304	E178882
CAT5e data cable	LEONI L	64867m	146180
FYGB GPS receiver	Nokia	472748A	71231431
Cat-5e cable	CSA	LL73189	E151955
6 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297370...
1 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_104	SN551123/4

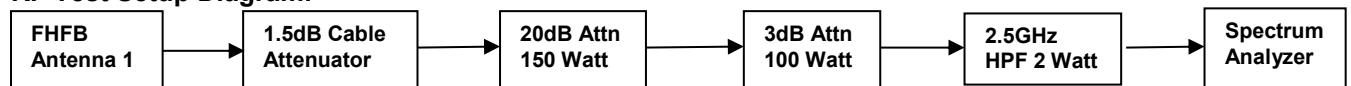
# CONFIGURATIONS



Cables (Peripheral)					
Description	Shield (Y/N)	Length (m)	Ferrite (Y/N)	Connection 1	Connection 2
Fiber Optic cable	N	2 meters	N	ASIK	MDEA
Fiber Optic cable	N	2 meters	N	ASIK	MDEA
Fiber Optic cable	N	25 meters	N	MDEA	FHFB
Cat-5e cable (CSA)	Y	25 meters	N	ASIK	FYGB GPS receiver
Cat-5e cable	Y	25 meters	N	ASIK	WebEM- PC
Times Microwave Systems	Y	2 meters	N	EUT [RRH] Ant ports 2, 3, 4	250W -50ohm - Load

Cables					
Description	Shield (Y/N)	Length (m)	Ferrite (Y/N)	Connection 1	Connection 2
HS-SUCOFLEX_106 1.5dB cable attenuator	Y	6 meters	N	EUT [FHFB] RF 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 2.5GHz
High Pass Filter 2.5GHz/2W	N	NA	N	Attenuator 100W/3dB	RF cable HS-SUCOFLEX_104
HS-SUCOFLEX_104	Y	1 meter	N	High Pass Filter 2.5GHz/2W	Analyzer

## RF Test Setup Diagram:



# MODIFICATIONS



## Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2020-09-10	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	2020-09-10	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	2020-09-10	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	2020-09-10	Power Spectral Density	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
5	2020-09-10	Band Edge Compliance	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
6	2020-09-10	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

# OCCUPIED BANDWIDTH



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 testing was performed on the same version of hardware (FHFB) as the original certification test. The FHFB antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in the original certification testing) and antenna port 4 was selected to perform the testing under this effort as allowed by ANSI C63.26-2015 paragraph 5.7.2i.

The occupied bandwidth was measured with the EUT configured in the modes called out in the data sheets. FCC 24.238(b) defines the 26dB emission bandwidth requirement. RSS GEN Section 6.7 defines the 99% emission bandwidth requirement.

### Band 25 Emissions Designators:


Band 25 (1930MHz to 1995MHz) Emission Designators									
Channel Bandwidth	Radio Channel	5G-NR: QPSK		5G-NR: 16-QAM		5G-NR: 64-QAM		5G-NR: 256-QAM	
		FCC	IC	FCC	IC	FCC	IC	FCC	IC
5 MHz	Mi d	4M89G7W	4M51G7W	4M87G7W	4M52G7W	4M87G7W	4M50G7W	4M86G7W	4M48G7W
10 MHz	Mi d	9M89G7W	9M31G7W	9M79G7W	9M22G7W	9M89G7W	9M31G7W	9M88G7W	9M27G7W
15 MHz	Mi d	15M02G7W	14M11G7W	14M94G7W	14M17G7W	14M93G7W	14M12G7W	14M91G7W	14M11G7W
20 MHz	Mi d	19M99G7W	18M92G7W	19M93G7W	19M01G7W	20M02G7W	18M93G7W	20M07G7W	18M95G7W

Note: FCC based on 26db emission bandwidth; IC based on 99% emission bandwidth

# OCCUPIED BANDWIDTH



TbTfx 2020.09.08.0 BETA XMI 2020.03.25.0

EUT: FHFB (FCC C2PC)		Work Order: NOKI0021	
Serial Number: L9144200604		Date: 10-Sep-20	
Customer: Nokia Solutions and Networks		Temperature: 22.6 °C	
Attendees: Mitchell Hill, John Rattanavong		Humidity: 50.1% RH	
Project: None		Barometric Pres.: 1024 mbar	
Tested by: Brandon Hobbs	Power: 54 VDC	Job Site: TX05	
TEST SPECIFICATIONS		Test Method	
FCC 24E:2020	ANSI C63.26:2015		
RSS-Gen:2019	RSS-Gen:2019		
COMMENTS			
All measurement path losses were accounted for in the reference level offset including any attenuators, filters and DC blocks. The carrier power was set to maximum for all testing.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	2	Signature 	
		Value	Value
		99% (MHz)	26dB (MHz)
		Limit	Result

Band 25, 1930 MHz - 1995 MHz, 5G  
Port 1

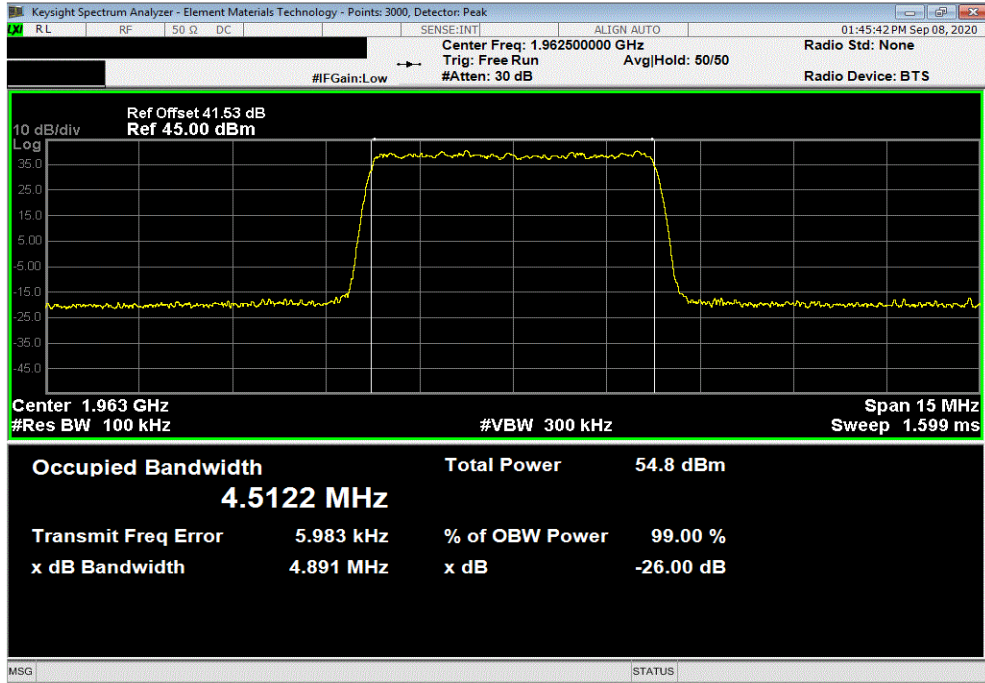
Bandwidth	Modulation	Channel	Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
<b>5 MHz Bandwidth</b>						
	QPSK Modulation	Mid Channel, 1962.5 MHz	4.51	4.89	Within Band	Pass
	16-QAM Modulation	Mid Channel, 1962.5 MHz	4.52	4.87	Within Band	Pass
	64-QAM Modulation	Mid Channel, 1962.5 MHz	4.50	4.87	Within Band	Pass
	256-QAM Modulation	Mid Channel, 1962.5 MHz	4.48	4.86	Within Band	Pass
<b>10 MHz Bandwidth</b>						
	QPSK Modulation	Mid Channel, 1962.5 MHz	9.31	9.89	Within Band	Pass
	16-QAM Modulation	Mid Channel, 1962.5 MHz	9.22	9.79	Within Band	Pass
	64-QAM Modulation	Mid Channel, 1962.5 MHz	9.31	9.89	Within Band	Pass
	256-QAM Modulation	Mid Channel, 1962.5 MHz	9.27	9.88	Within Band	Pass
<b>15 MHz Bandwidth</b>						
	QPSK Modulation	Mid Channel, 1962.5 MHz	14.11	15.02	Within Band	Pass
	16-QAM Modulation	Mid Channel, 1962.5 MHz	14.17	14.94	Within Band	Pass
	64-QAM Modulation	Mid Channel, 1962.5 MHz	14.12	14.93	Within Band	Pass
	256-QAM Modulation	Mid Channel, 1962.5 MHz	14.11	14.91	Within Band	Pass
<b>20 MHz Bandwidth</b>						
	QPSK Modulation	Mid Channel, 1962.5 MHz	18.92	19.99	Within Band	Pass
	16-QAM Modulation	Mid Channel, 1962.5 MHz	19.01	19.93	Within Band	Pass
	64-QAM Modulation	Mid Channel, 1962.5 MHz	18.93	20.02	Within Band	Pass
	256-QAM Modulation	Mid Channel, 1962.5 MHz	18.95	20.07	Within Band	Pass

# OCCUPIED BANDWIDTH

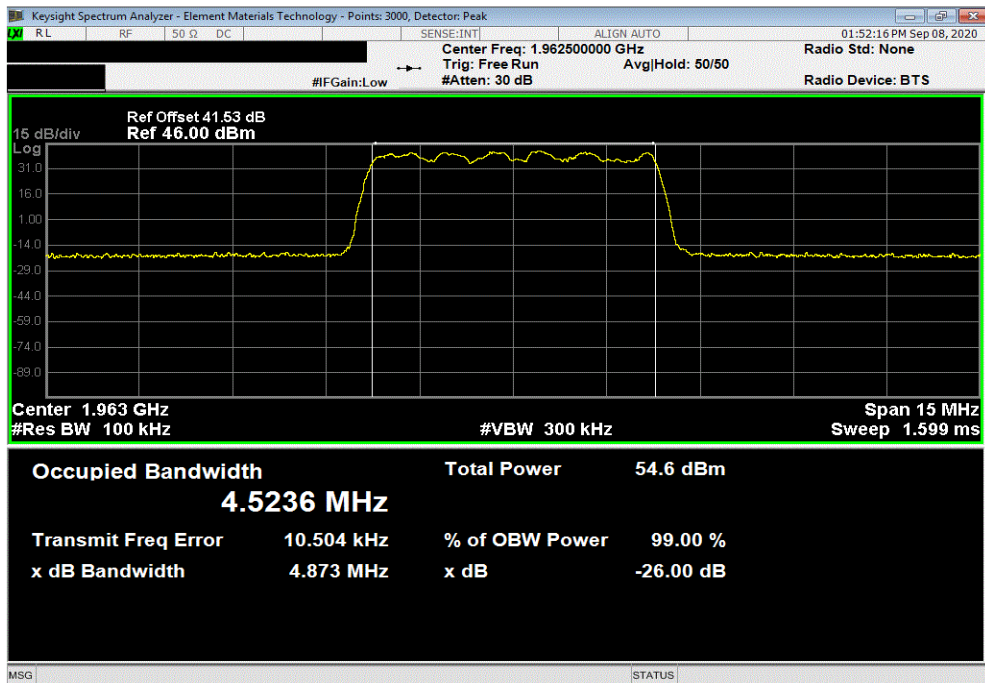


TMTX 2020.09.08.0 BETA XMI 2020.03.25.0

Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwidth, QPSK Modulation, Mid Channel, 1962.5 MHz							
		Value	Value			Limit	Result
		99% (MHz)	26dB (MHz)				
		4.512	4.891			Within Band	Pass



Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwidth, 16-QAM Modulation, Mid Channel, 1962.5 MHz							
		Value	Value			Limit	Result
		99% (MHz)	26dB (MHz)				
		4.524	4.873			Within Band	Pass



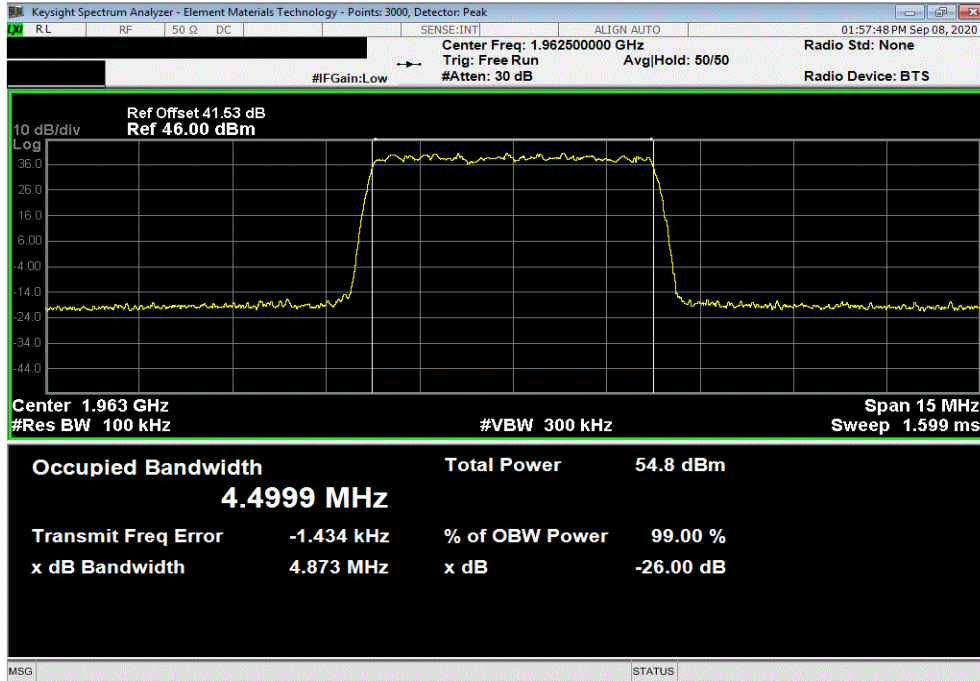


# OCCUPIED BANDWIDTH

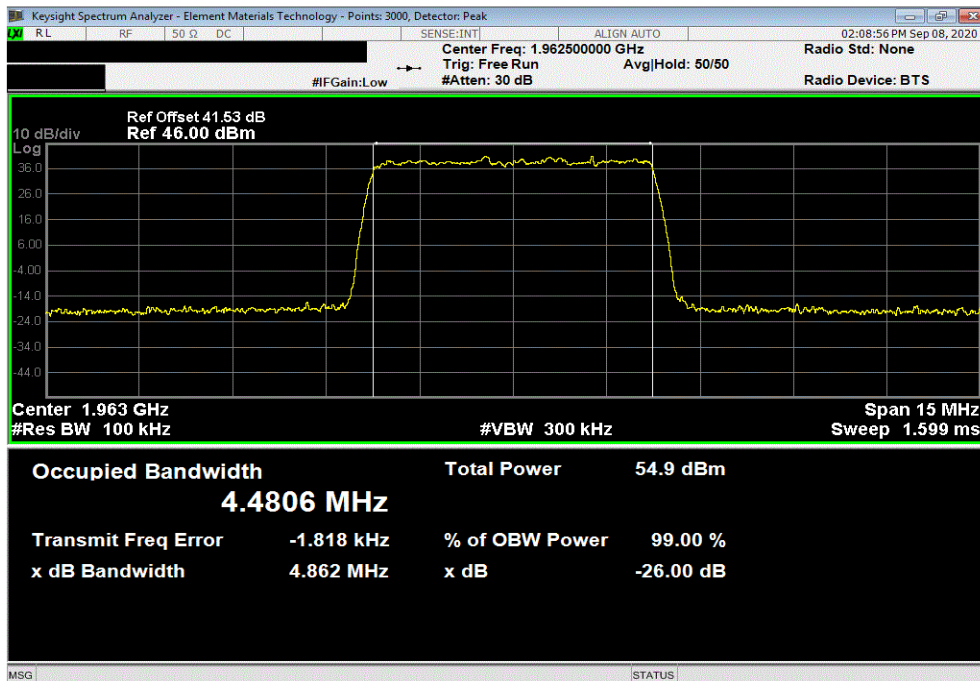


TMTX 2020.09.08.0 BETA XMI 2020.03.25.0

Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwidth, 64-QAM Modulation, Mid Channel, 1962.5 MHz							
			Value	Value	Limit	Result	
			99% (MHz)	26dB (MHz)			
			4.5	4.873	Within Band	Pass	



Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwidth, 256-QAM Modulation, Mid Channel, 1962.5 MHz							
			Value	Value	Limit	Result	
			99% (MHz)	26dB (MHz)			
			4.481	4.862	Within Band	Pass	

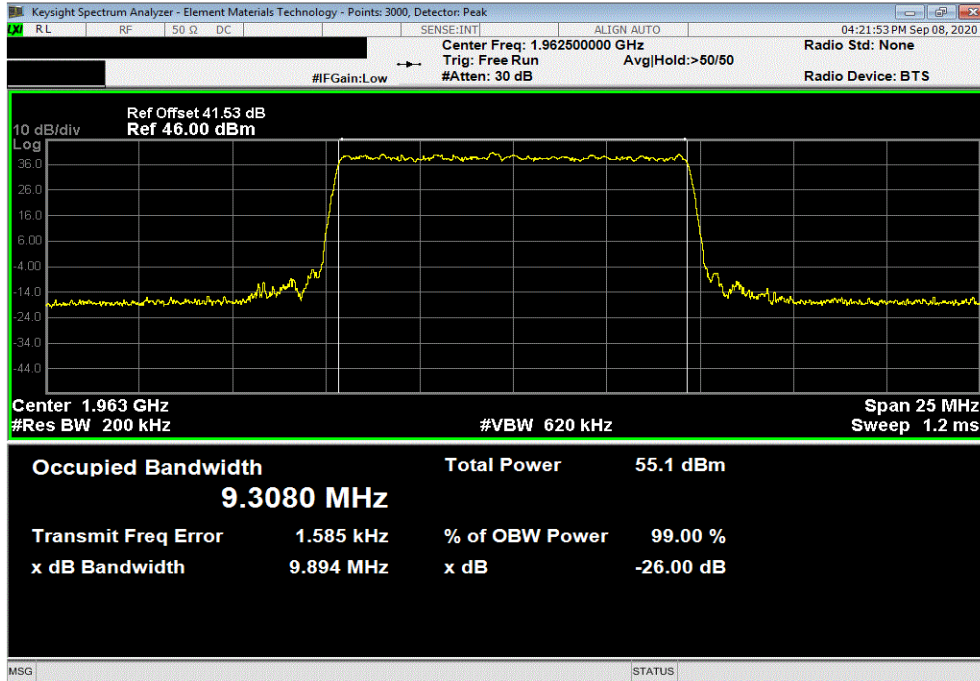


# OCCUPIED BANDWIDTH

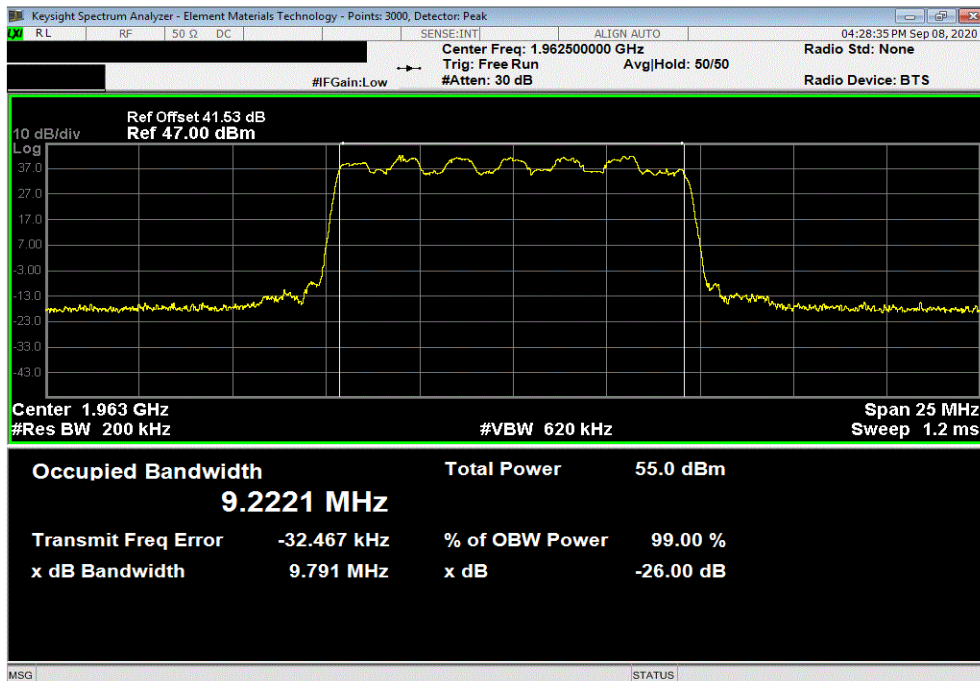


TMTX 2020.09.08.0 BETA XMI 2020.03.25.0

Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 10 MHz Bandwidth, QPSK Modulation , Mid Channel, 1962.5 MHz						
	Value	Value	Limit	Result		
	99% (MHz)	26dB (MHz)				
	9.308	9.894	Within Band	Pass		



Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 10 MHz Bandwidth, 16-QAM Modulation, Mid Channel, 1962.5 MHz						
	Value	Value	Limit	Result		
	99% (MHz)	26dB (MHz)				
	9.222	9.791	Within Band	Pass		

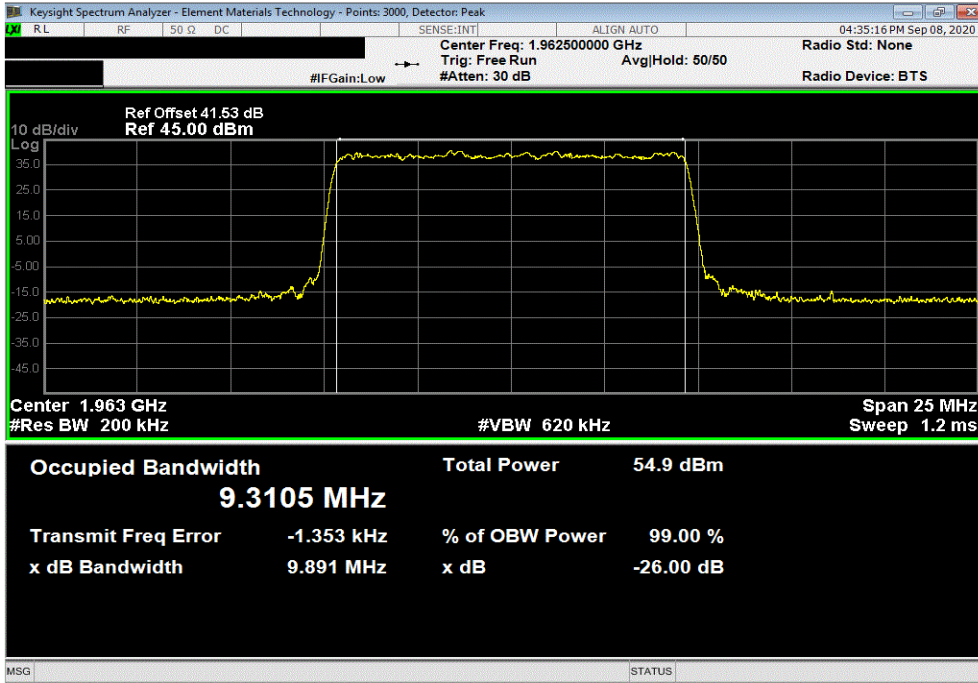


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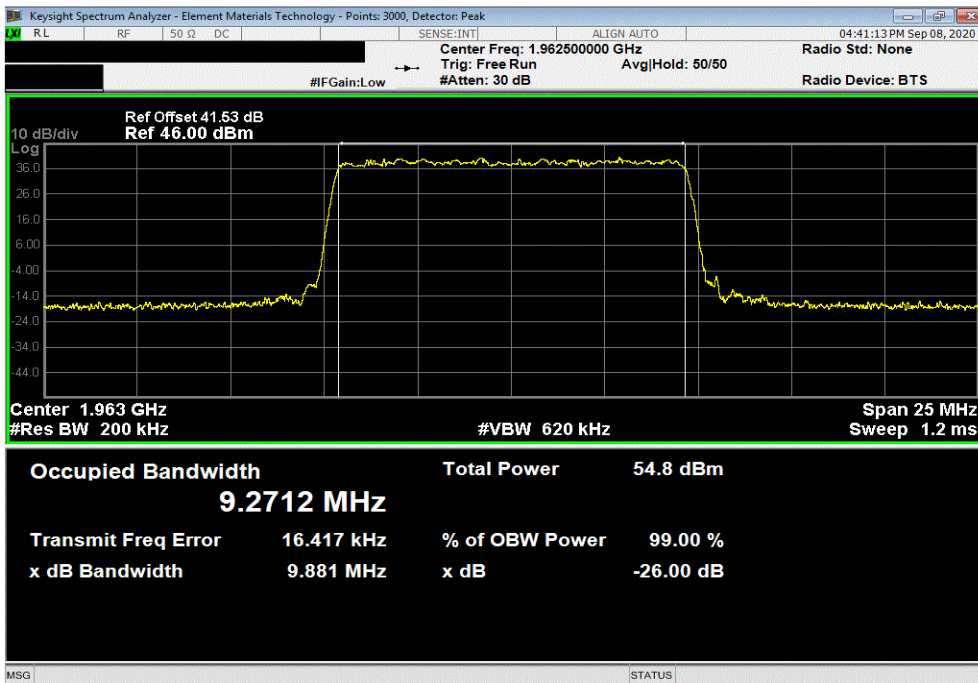


TMTX 2020.09.08.0 BETA XMI 2020.03.25.0

Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 10 MHz Bandwidth, 64-QAM Modulation, Mid Channel, 1962.5 MHz							
			Value	Value	Limit	Result	
			99% (MHz)	26dB (MHz)			
			9.311	9.891	Within Band	Pass	



Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 10 MHz Bandwidth, 256-QAM Modulation, Mid Channel, 1962.5 MHz							
			Value	Value	Limit	Result	
			99% (MHz)	26dB (MHz)			
			9.271	9.881	Within Band	Pass	

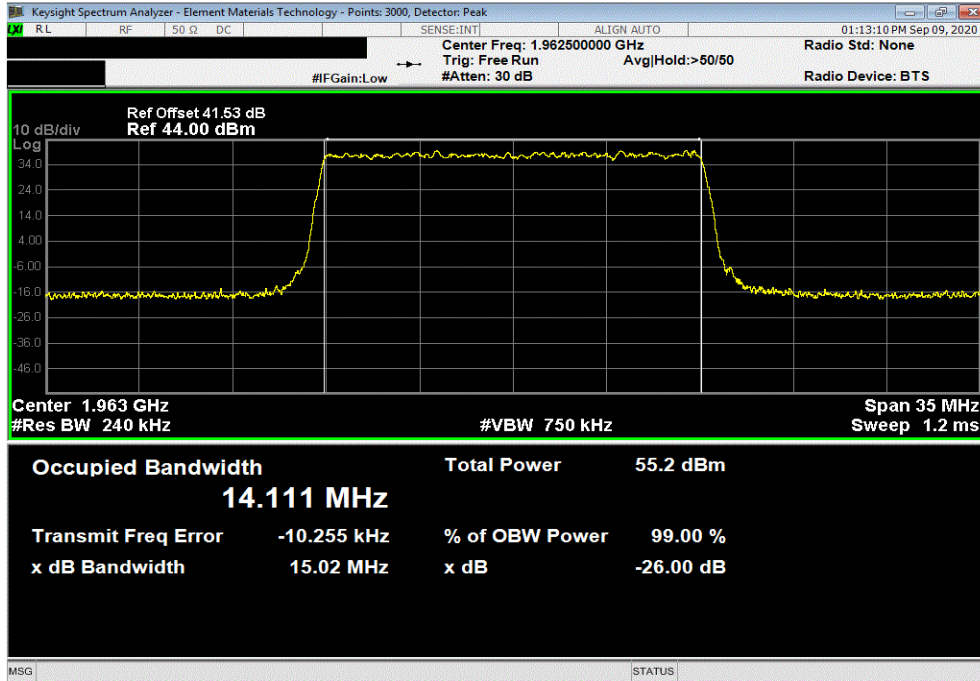


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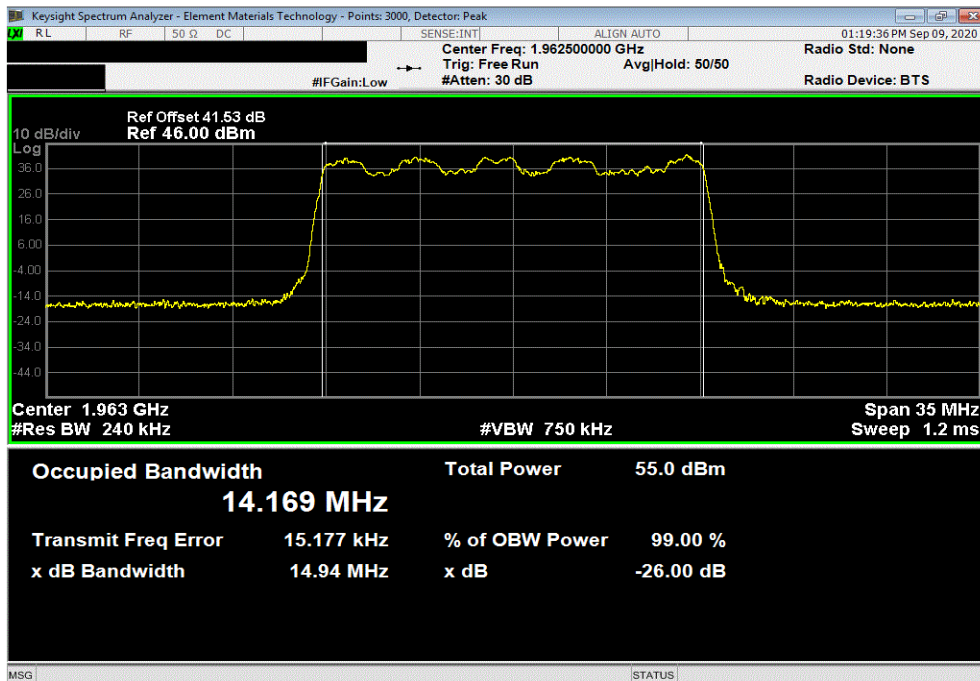


TMTX 2020.09.08.0 BETA XMI 2020.03.25.0

Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 15 MHz Bandwidth, QPSK Modulation, Mid Channel, 1962.5 MHz							
		Value	Value			Limit	Result
		99% (MHz)	26dB (MHz)				
		14.111	15.02			Within Band	Pass



Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 15 MHz Bandwidth, 16-QAM Modulation, Mid Channel, 1962.5 MHz							
		Value	Value			Limit	Result
		99% (MHz)	26dB (MHz)				
		14.169	14.935			Within Band	Pass

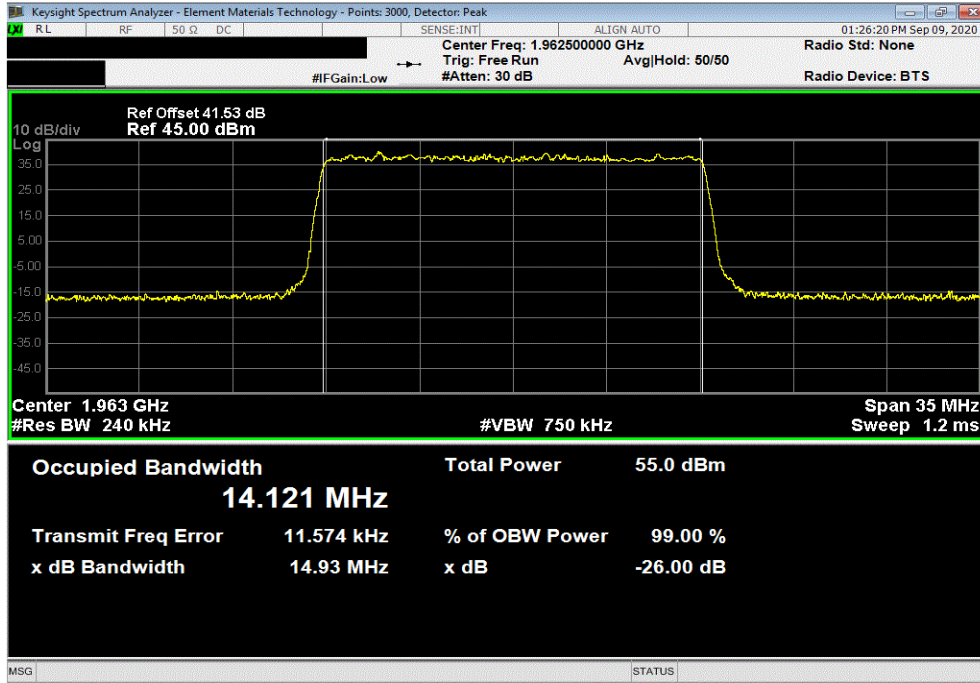


# OCCUPIED BANDWIDTH

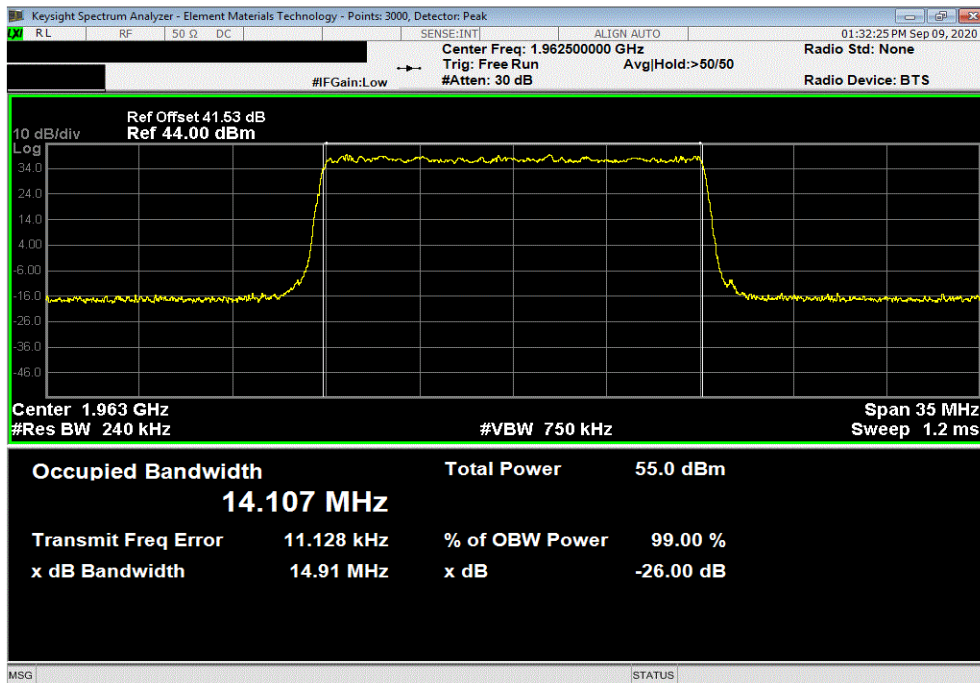


TMTX 2020.09.08.0 BETA XMI 2020.03.25.0

Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 15 MHz Bandwidth, 64-QAM Modulation, Mid Channel, 1962.5 MHz						
	Value	Value	Limit	Result		
	99% (MHz)	26dB (MHz)				
	14.121	14.933	Within Band	Pass		



Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 15 MHz Bandwidth, 256-QAM Modulation, Mid Channel, 1962.5 MHz						
	Value	Value	Limit	Result		
	99% (MHz)	26dB (MHz)				
	14.107	14.91	Within Band	Pass		



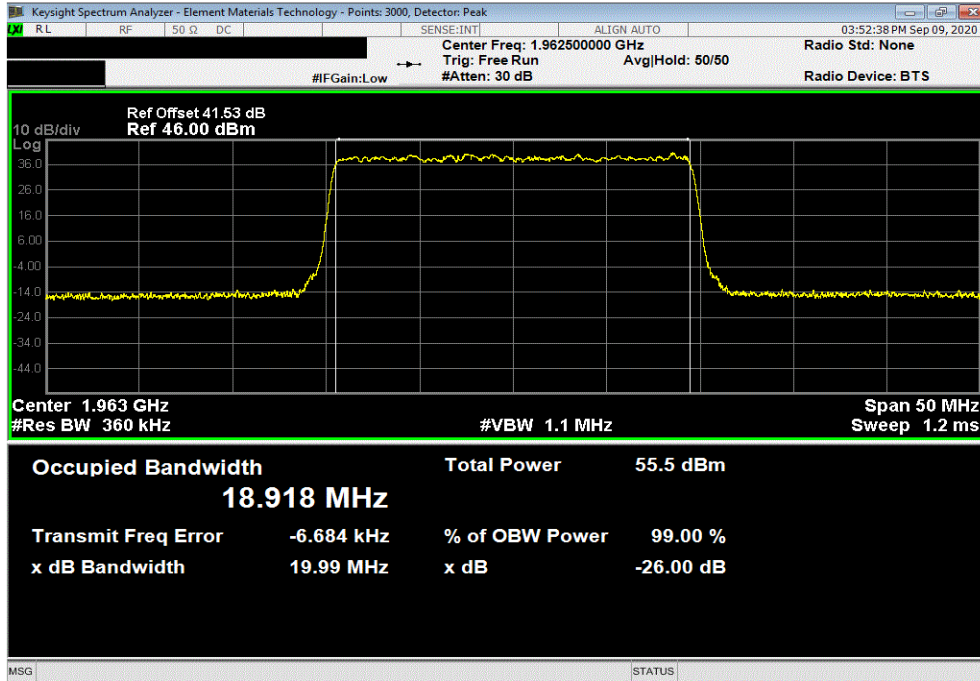


# OCCUPIED BANDWIDTH

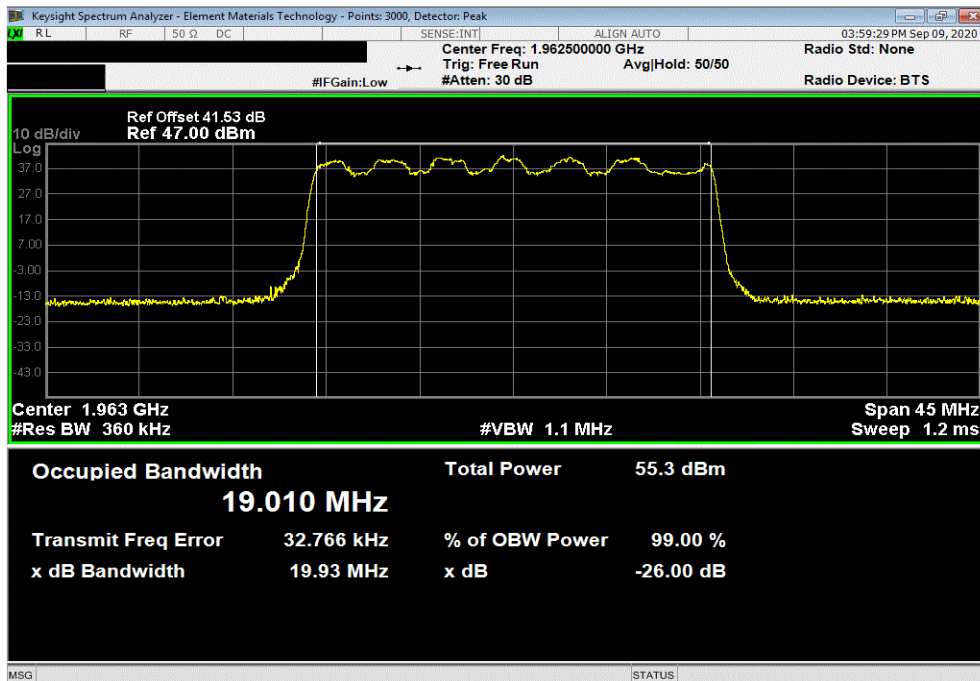


TMTX 2020.09.08.0 BETA XMI 2020.03.25.0

Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 20 MHz Bandwidth, QPSK Modulation, Mid Channel, 1962.5 MHz							
			Value	Value			
			99% (MHz)	26dB (MHz)	Limit	Result	
			18.918	19.99	Within Band	Pass	



Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 20 MHz Bandwidth, 16-QAM Modulation, Mid Channel, 1962.5 MHz							
			Value	Value			
			99% (MHz)	26dB (MHz)	Limit	Result	
			19.01	19.932	Within Band	Pass	



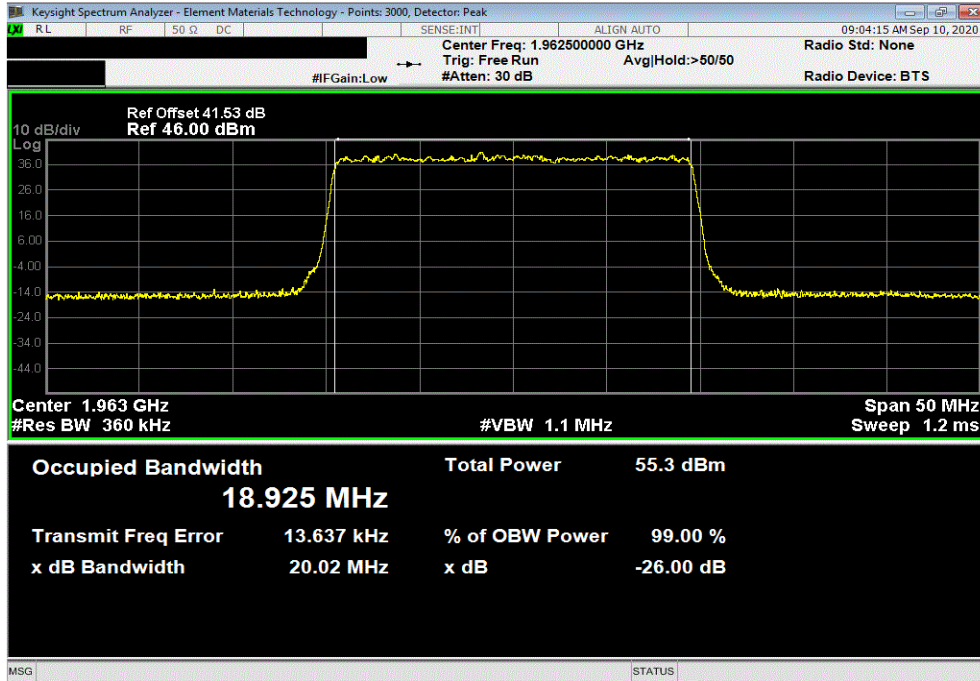


# OCCUPIED BANDWIDTH



TMTX 2020.09.08.0 BETA XMI 2020.03.25.0

Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 20 MHz Bandwidth, 64-QAM Modulation, Mid Channel, 1962.5 MHz							
		Value	Value	Limit	Result		
		99% (MHz)	26dB (MHz)				
		18.925	20.018	Within Band	Pass		



Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 20 MHz Bandwidth, 256-QAM Modulation, Mid Channel, 1962.5 MHz							
		Value	Value	Limit	Result		
		99% (MHz)	26dB (MHz)				
		18.947	20.069	Within Band	Pass		

