# 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

# CERTIFICATE OF TEST

element
2018-09-14

**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<br>CFR Title 47 Part 27 Subpart C | ANSI C63.26-2015 with<br>FCC KDB 971168 D01 v03r01<br>FCC KDB 662911D01 v02r01<br>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.
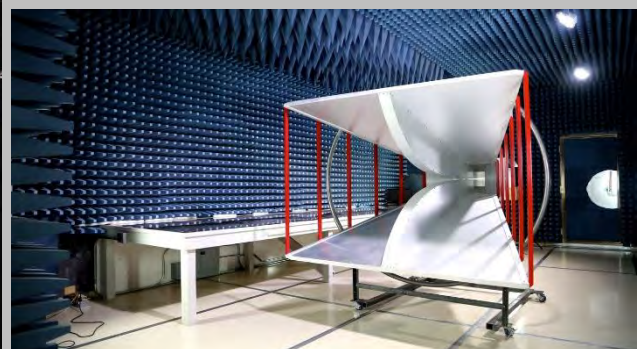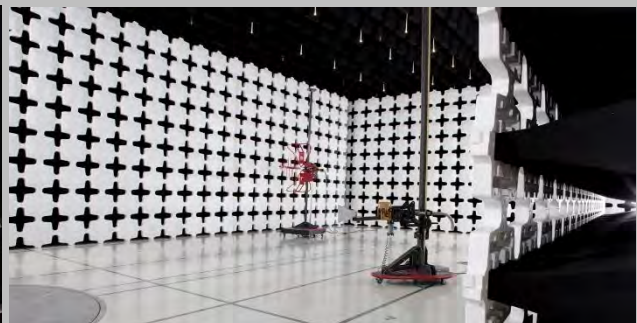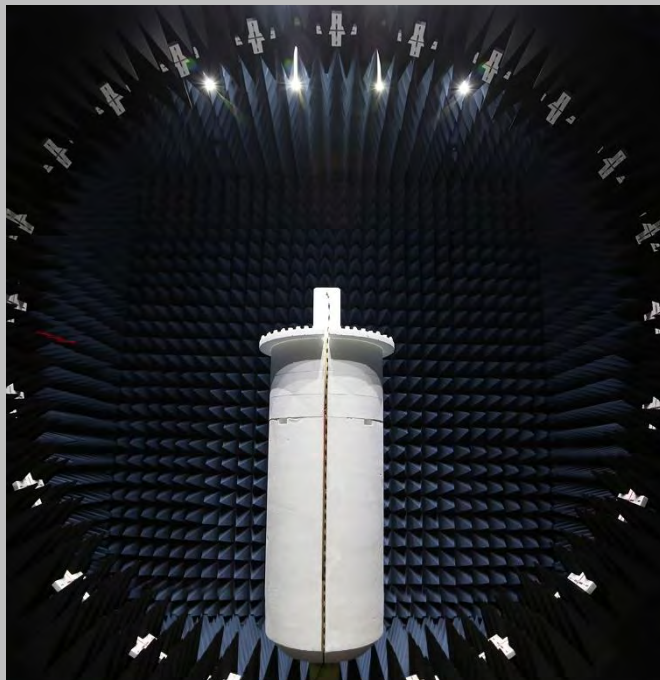
## SCOPE

For details on the Scopes of our Accreditations, please visit:
https://www.nwemc.com/emc-testing-accreditations

# FACILITIES





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


element
TMU.2015.07.10

## Measurement Uncertainty

When a measurement is made, the result will be different from the true or theoretically correct value.  The difference is the result of tolerances in the measurement system that cannot be completely eliminated.  To the extent that technology allows us, it has been our aim to minimize this error.  Measurement uncertainty is a statistical expression of measurement error qualified by a probability distribution.
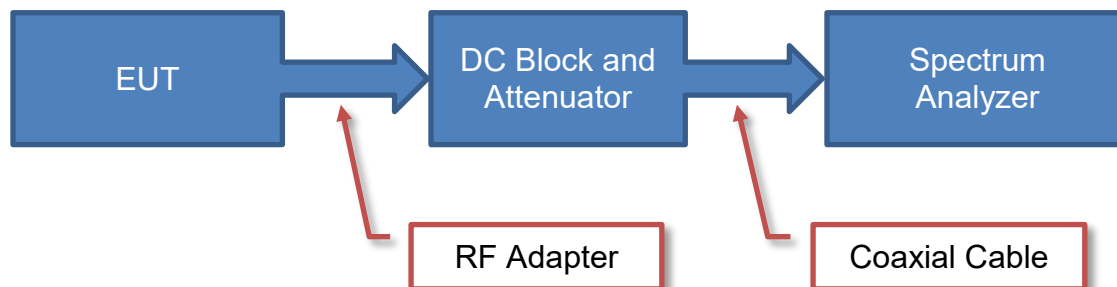
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found in the table below. A lab specific value may also be found in the applicable test description section. Our measurement data meets or exceeds the measurement uncertainty requirements of the applicable specification; therefore, the test data can be compared directly to the specification limit to determine compliance.  The calculations for estimating measurement uncertainty are based upon ETSI TR 100 028 (or CISPR 16-4-2 as applicable), and are available upon request.

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

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

# Test Setup Block Diagrams

## Antenna Port Conducted Measurements

```
EUT  →  DC Block and Attenuator  →  Spectrum Analyzer
```

RF Adapter

Coaxial Cable

## Near Field Test Fixture Measurements

```
Near Field Probe  →  Spectrum Analyzer

EUT
```

Coaxial Cable

## Spurious Radiated Emissions

3m Test Distance

EUT

Measurement Antenna

Preamp and Filters

Coaxial Cable

Spectrum Analyzer

Fully anechoic shielded enclosure above 1 GHz. Semi-anechoic below 1 GHz (No absorber on the floor).

Flush Mounted Turn table, Non-reflective foam table to support EUT
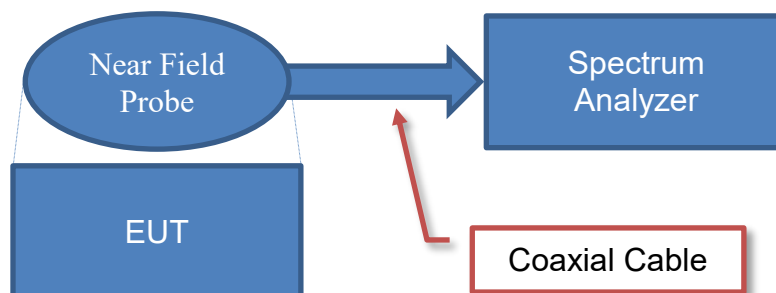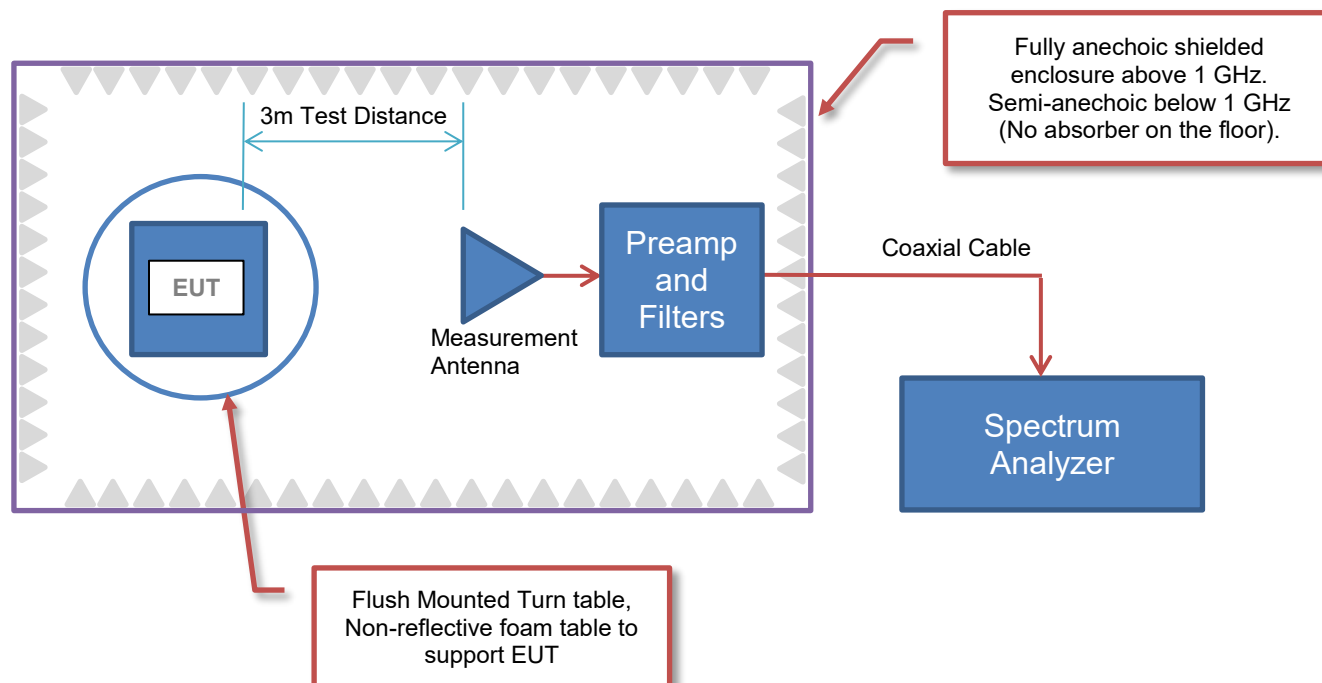
# PRODUCT DESCRIPTION

## 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 +45° cross-polarized (orthogonal) radiators (four ports are connected to +45° 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 ($\pm$ 1MHz), 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

# PRODUCTION 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:**
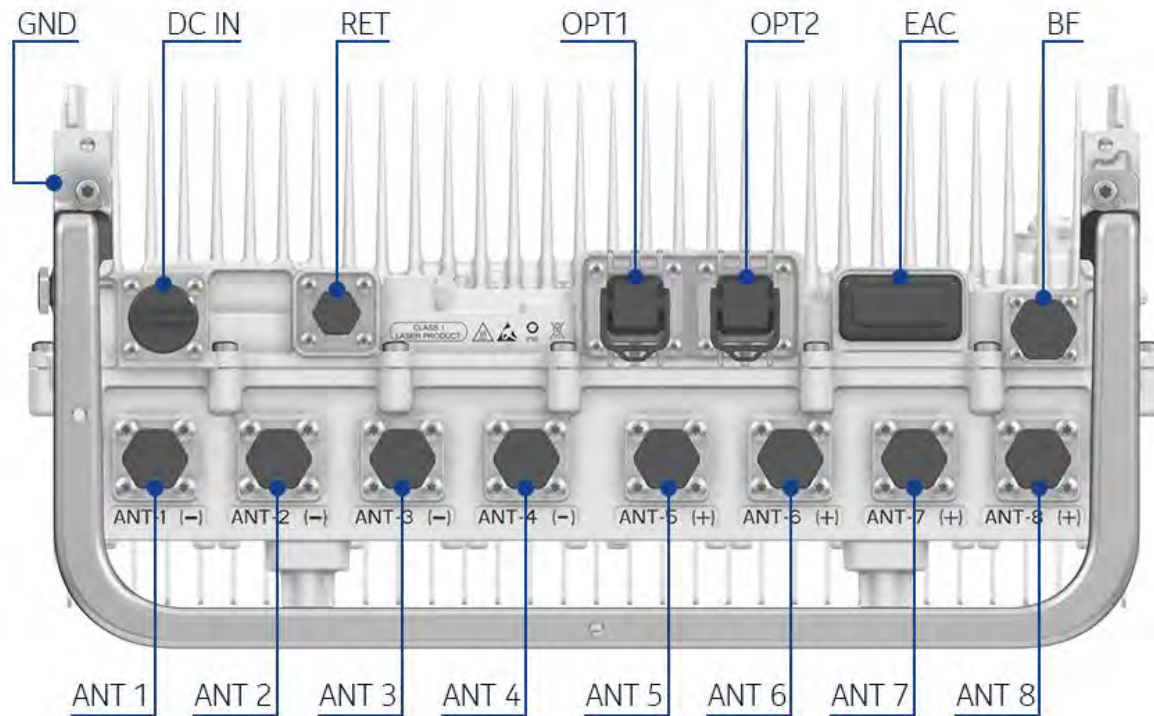


**EUT External Interfaces**

| 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 Airscale 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

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 ≥ 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

element

TbtTx 2019.08.30.0          XMit 2020.12.30.0

| EUT: | AZHL | | Work Order: | NOKI0018 |
|---|---|---|---|---|
| Serial Number: | YK203400016 | | Date: | 19-Feb-21 |
| Customer: | Nokia Solutions and Networks | | Temperature: | 23.6 °C |
| Attendees: | John Rattanavong, 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

| 5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR20 (20MHz), QPSK, Mid Channel 2592.99 MHz | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value | Limit | |
| | | | | (26 dB) | | 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 | Limit | |
| | | | | (26 dB) | | Result |
| | | | | 19.849 MHz | Within Band | Pass |
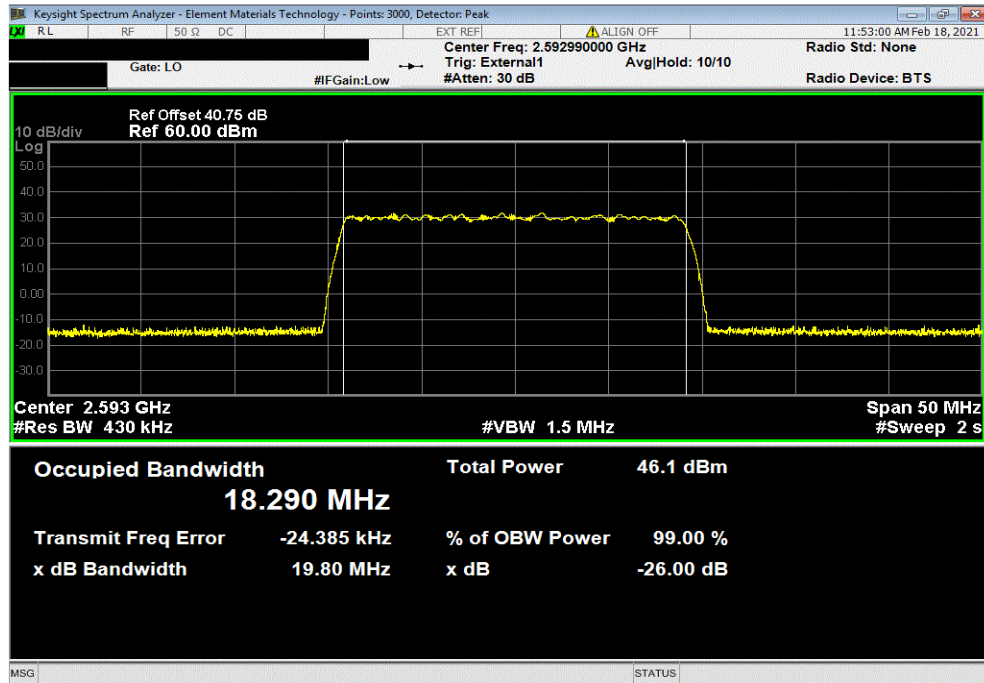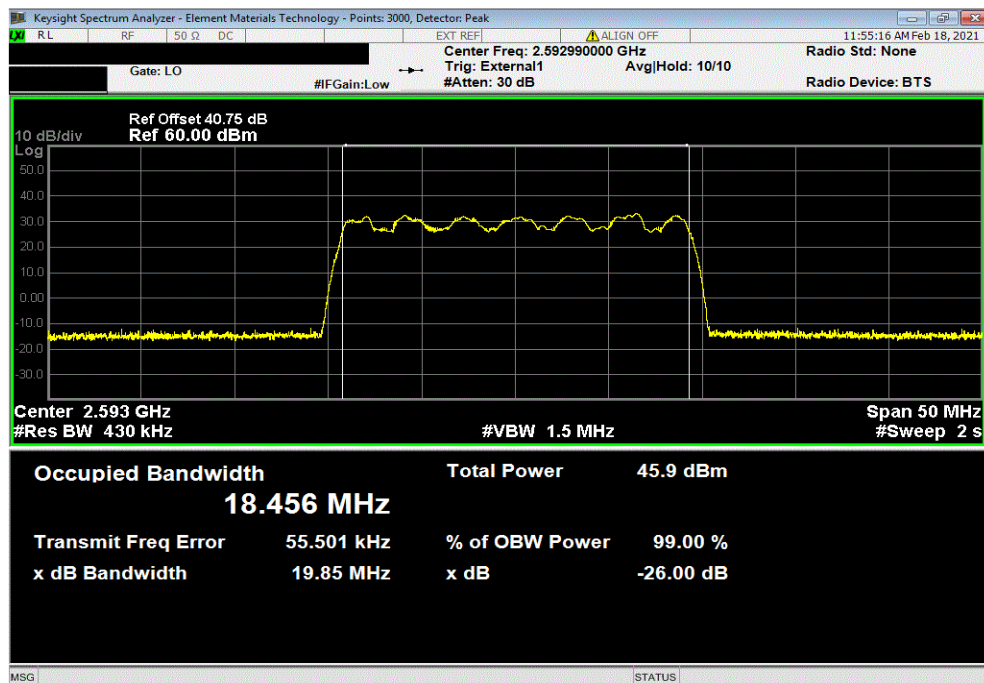
# OCCUPIED BANDWIDTH 5G

| 5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR20 (20MHz), 64QAM, Mid Channel 2592.99 MHz | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value | Limit | |
| | | | | (26 dB) | | Result |
| | | | | 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 | |
| | | | | (26 dB) | | Result |
| | | | | 19.816 MHz | Within Band | Pass |
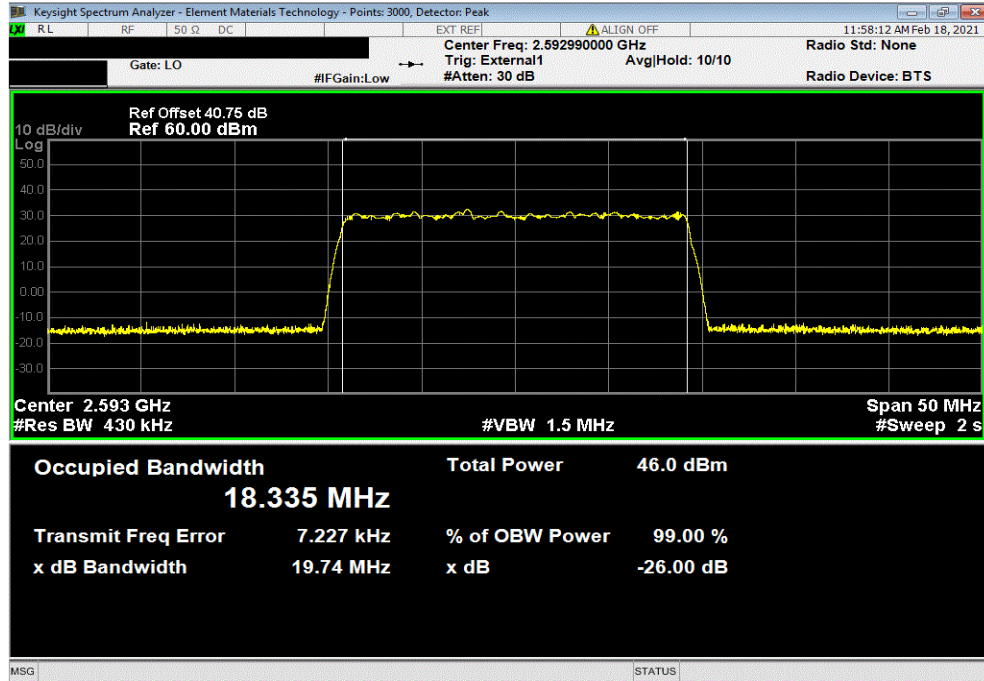
# OCCUPIED BANDWIDTH 5G

| 5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR20 (20MHz), 256QAM, Mid Channel 2592.99 MHz | | | | | |
|---|---|---|---|---|---|
| | | | | Value | Limit |
| | | | | (26 dB) | | 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 | Limit |
| | | | | (26 dB) | | Result |
| | | | | 19.761 MHz | Within Band | Pass |
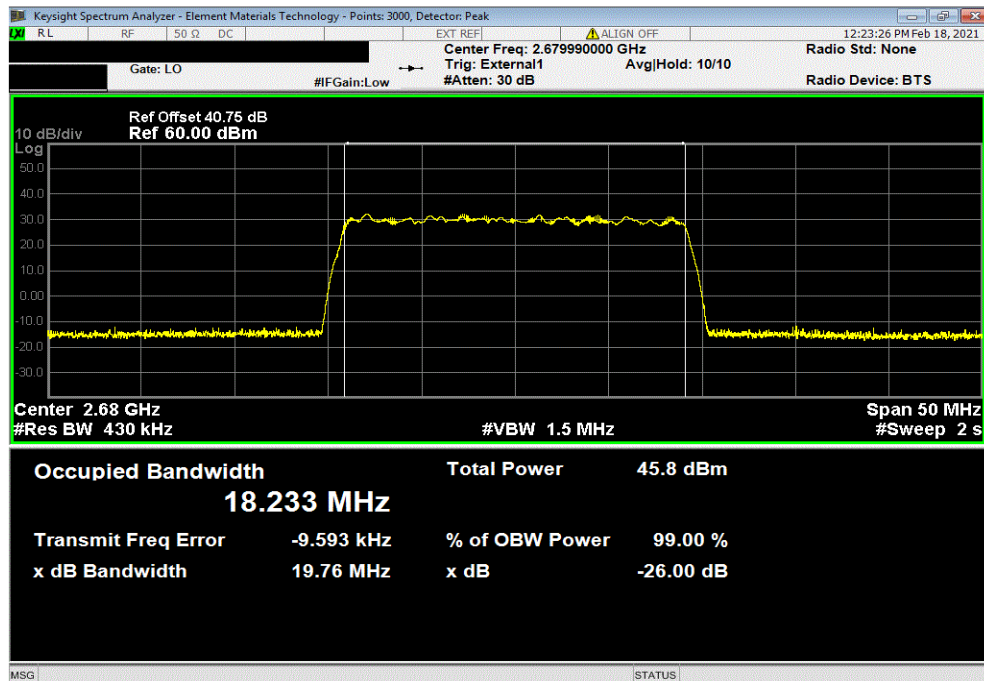
# OCCUPIED BANDWIDTH 5G

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



**Occupied Bandwidth**

**37.875 MHz**
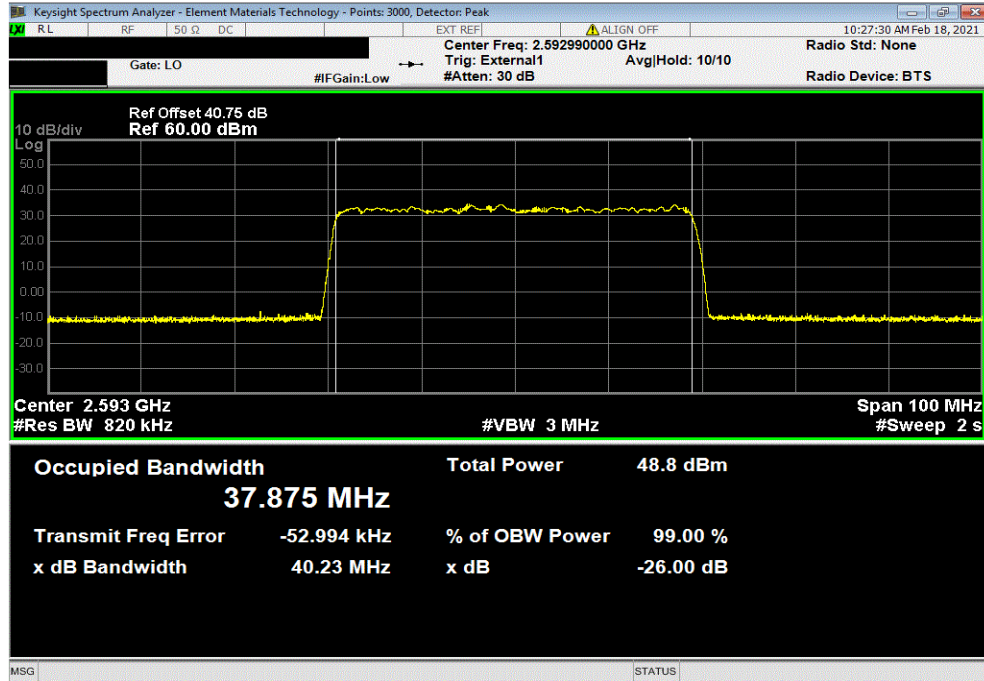
| | | |
|---|---|---|
| Total Power | 48.8 dBm | |
| Transmit Freq Error | -52.994 kHz | % of OBW Power | 99.00 % |
| x dB Bandwidth | 40.23 MHz | x dB | -26.00 dB |

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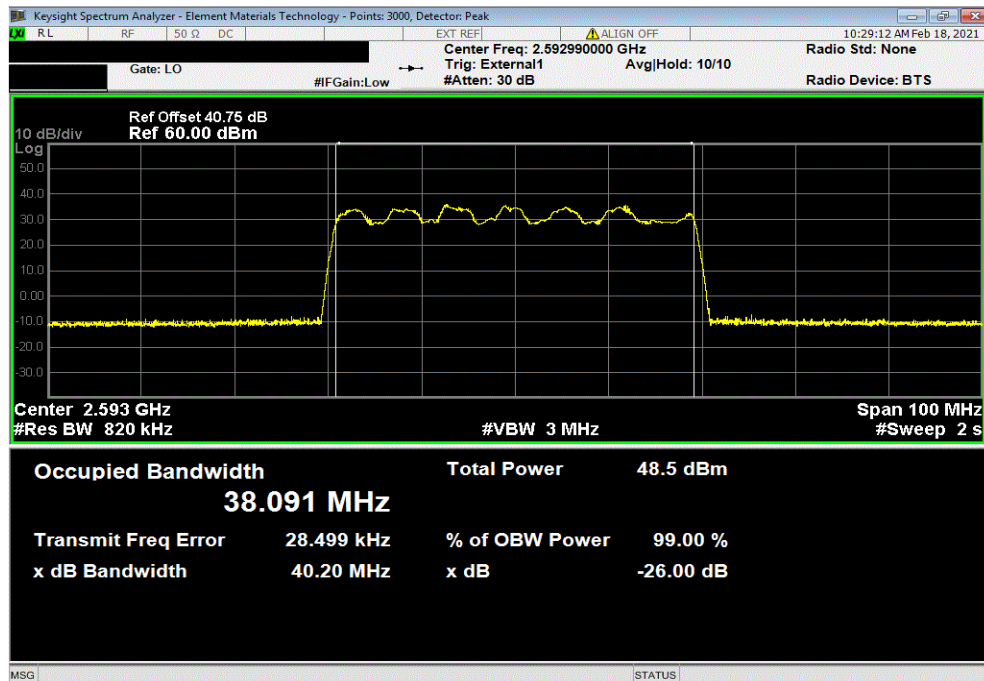


**Occupied Bandwidth**

**38.091 MHz**

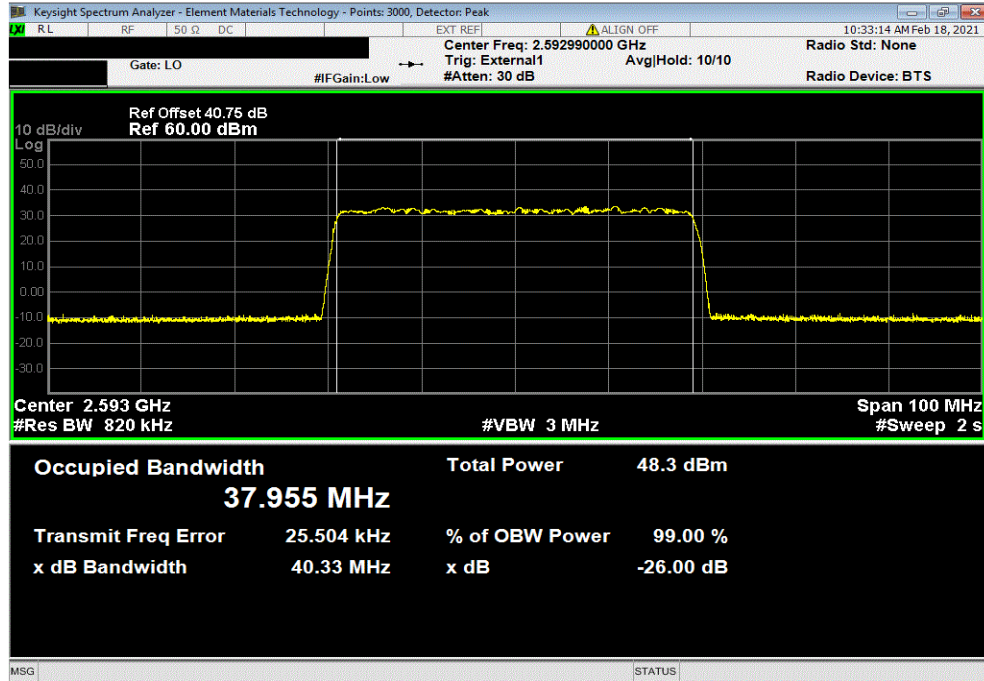| | | |
|---|---|---|
| Total Power | 48.5 dBm | |
| Transmit Freq Error | 28.499 kHz | % of OBW Power | 99.00 % |
| x dB Bandwidth | 40.20 MHz | x dB | -26.00 dB |

# OCCUPIED BANDWIDTH 5G

| 5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR40 (40MHz), 64QAM, Mid Channel 2592.99 MHz | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (26 dB) | Limit | Result |
| | | | | 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 (26 dB) | Limit | Result |
| | | | | 40.375 MHz | Within Band | Pass |
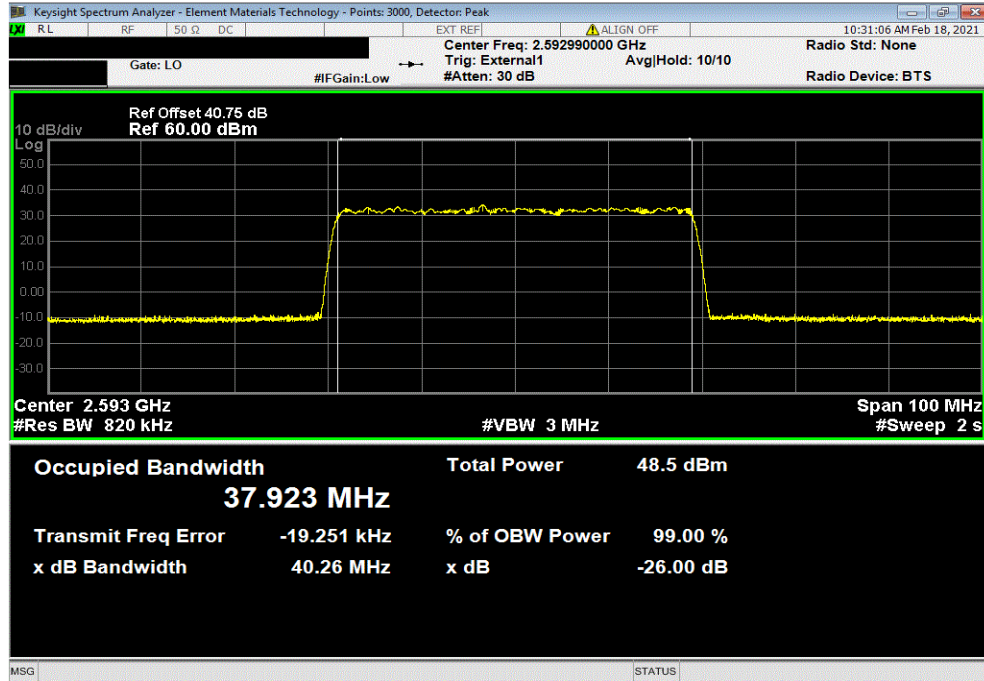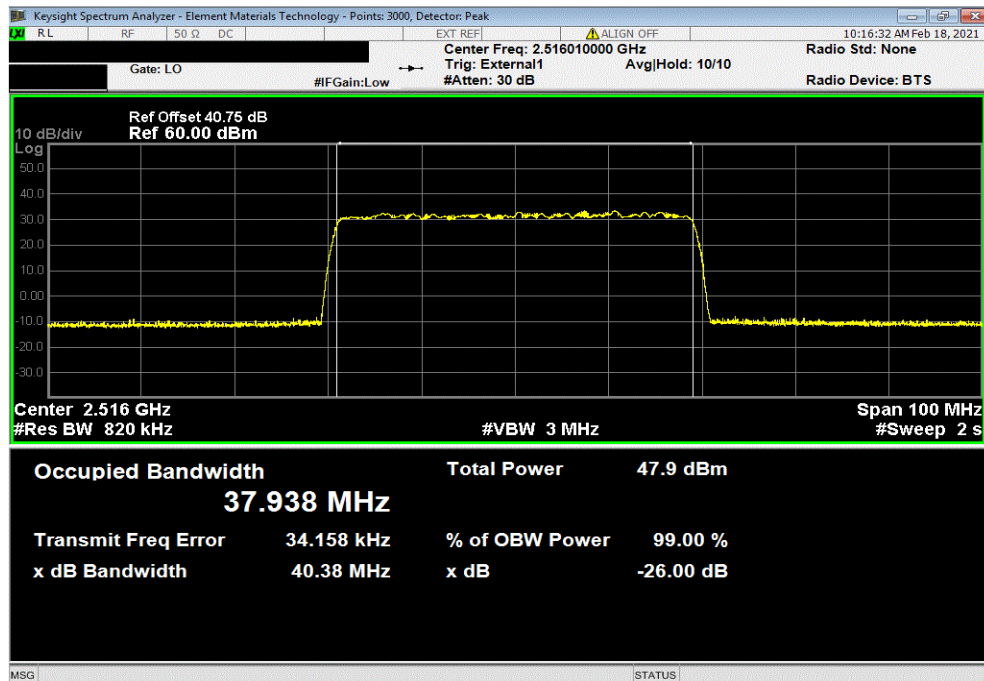
# OCCUPIED BANDWIDTH 5G

| 5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR40 (40MHz), 256QAM, Mid Channel 2592.99 MHz | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | Value | Limit |
| | | | | | (26 dB) | | 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 | Limit |
| | | | | | (26 dB) | | Result |
| | | | | | 40.384 MHz | Within Band | Pass |
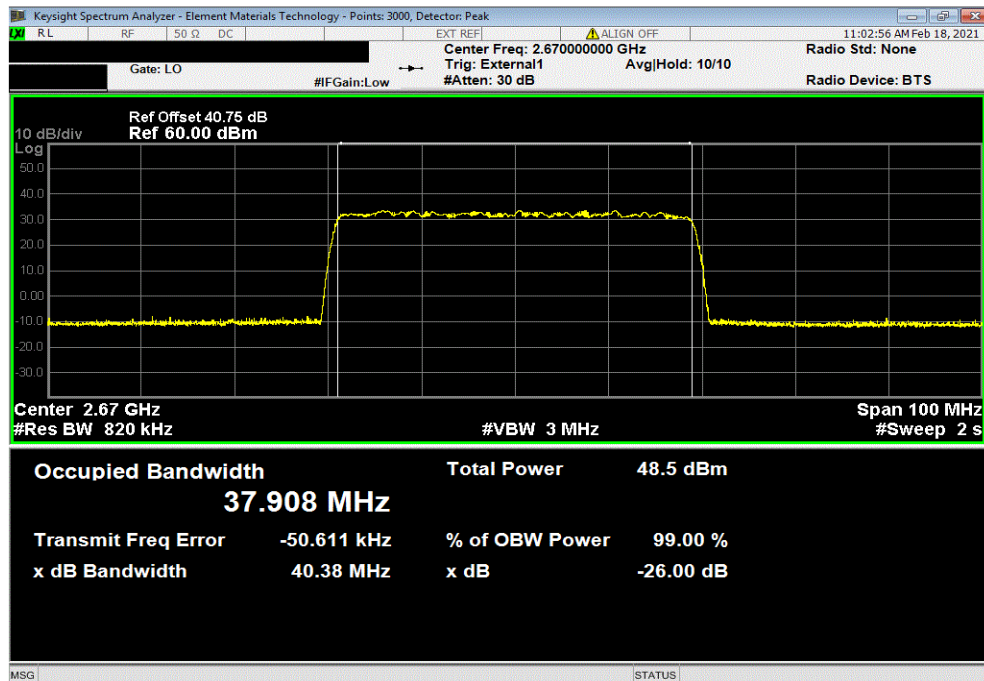
# OCCUPIED BANDWIDTH 5G

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



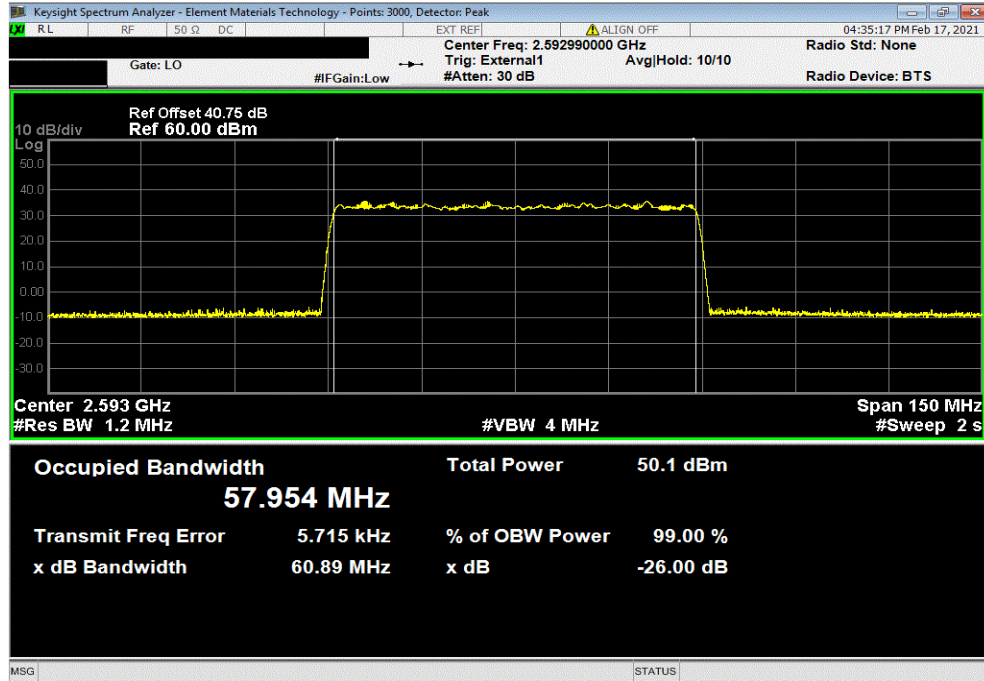| 5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR60 (60MHz), 16QAM, Mid Channel 2592.99 MHz | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value | Limit | |
| | | | | (26 dB) | | Result |
| | | | | 60.96 MHz | Within Band | Pass |
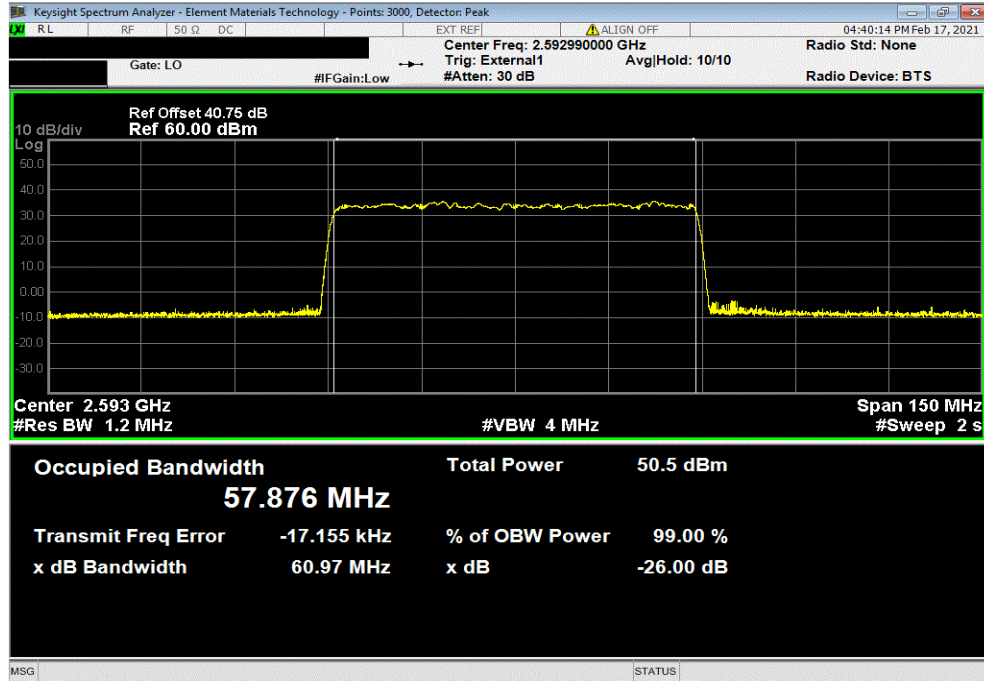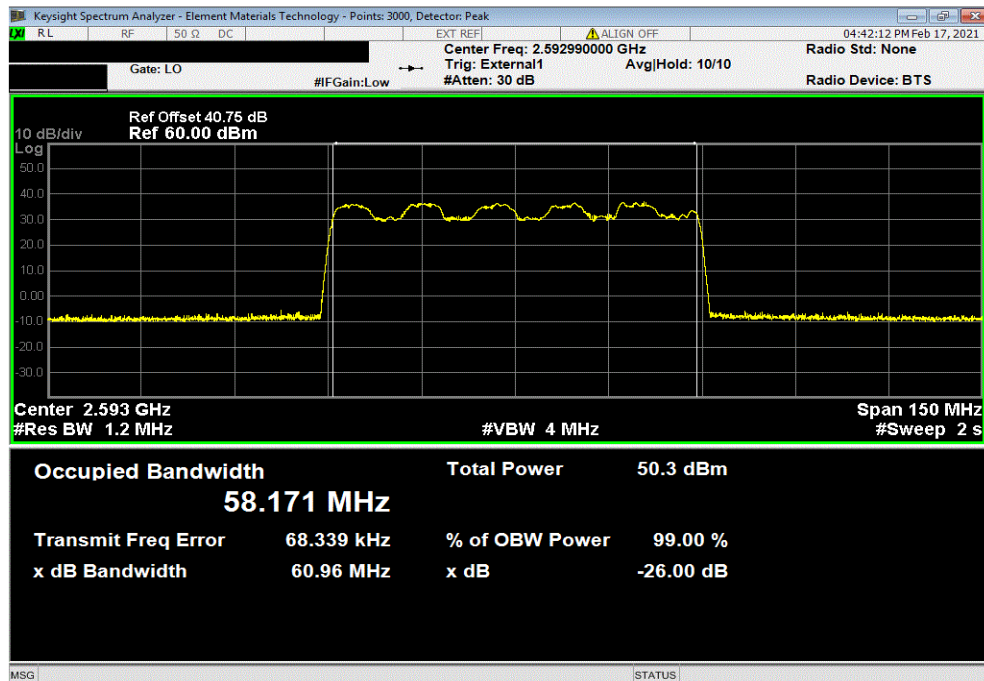
# OCCUPIED BANDWIDTH 5G

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

Keysight Spectrum Analyzer - Element Materials Technology - Points: 3000, Detector: Peak

R L     RF     50 Ω   DC          EXT REF          ⚠ ALIGN OFF          04:43:52 PM Feb 17, 2021

Center Freq: 2.592990000 GHz          Radio Std: None
Gate: LO                     Trig: External1     Avg|Hold: 10/10
#IFGain:Low          #Atten: 30 dB          Radio Device: BTS

Ref Offset 40.75 dB
10 dB/div     Ref 60.00 dBm
Log

Center 2.593 GHz                              Span 150 MHz
#Res BW  1.2 MHz          #VBW  4 MHz          #Sweep  2 s

**Occupied Bandwidth**          Total Power     50.3 dBm
**57.941 MHz**
Transmit Freq Error     37.453 kHz     % of OBW Power     99.00 %
x dB Bandwidth          60.89 MHz     x dB          -26.00 dB

MSG                              STATUS

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

Keysight Spectrum Analyzer - Element Materials Technology - Points: 3000, Detector: Peak

R L     RF     50 Ω   DC          EXT REF          ⚠ ALIGN OFF          04:19:53 PM Feb 17, 2021

Center Freq: 2.526000000 GHz          Radio Std: None
Gate: LO                     Trig: External1     Avg|Hold: 10/10
#IFGain:Low          #Atten: 30 dB          Radio Device: BTS

Ref Offset 40.75 dB
10 dB/div     Ref 60.00 dBm
Log

Center 2.526 GHz                              Span 150 MHz
#Res BW  1.2 MHz          #VBW  4 MHz          #Sweep  2 s

**Occupied Bandwidth**          Total Power     50.0 dBm
**57.894 MHz**
Transmit Freq Error     63.064 kHz     % of OBW Power     99.00 %
x dB Bandwidth          60.87 MHz     x dB          -26.00 dB

MSG                              STATUS

# OCCUPIED BANDWIDTH 5G

| 5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR60 (60MHz), 256QAM, Mid Channel 2592.99 MHz | | | | | |
|---|---|---|---|---|---|
| | | | | **Value** | **Limit** |
| | | | | **(26 dB)** | | **Result** |
| | | | | 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** |
| | | | | **(26 dB)** | | **Result** |
| | | | | 60.833 MHz | Within Band | Pass |

# OCCUPIED BANDWIDTH 5G

| 5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR80 (80MHz), QPSK, Mid Channel 2592.99 MHz | | | | |
|---|---|---|---|---|
| | | | **Value** | **Limit** |
| | | | **(26 dB)** | | **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** | **Limit** |
| | | | **(26 dB)** | | **Result** |
| | | | 81.38 MHz | Within Band | Pass |
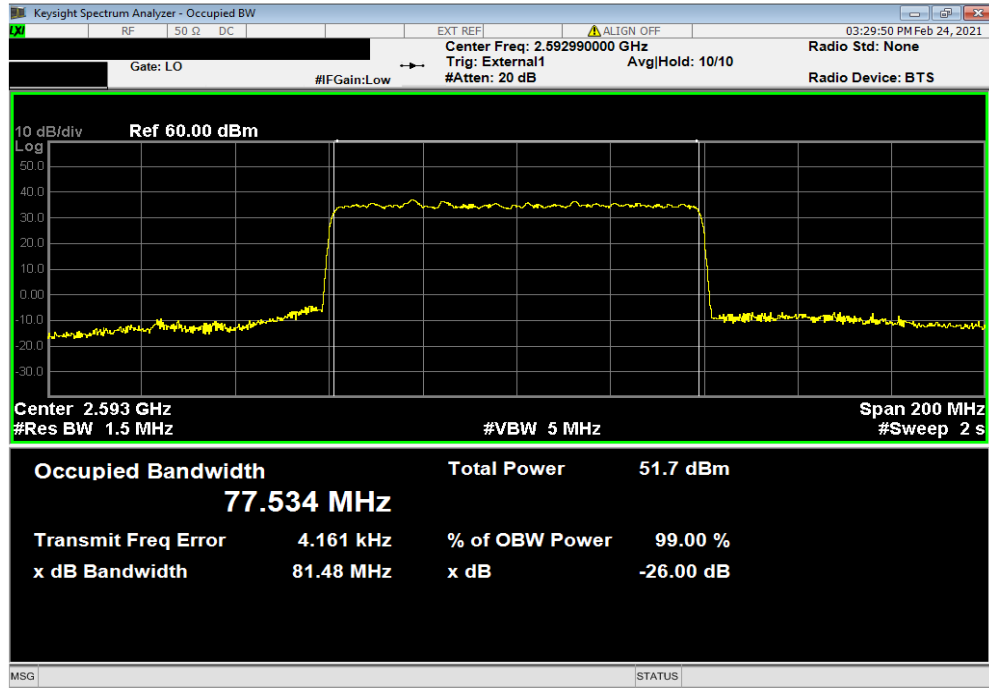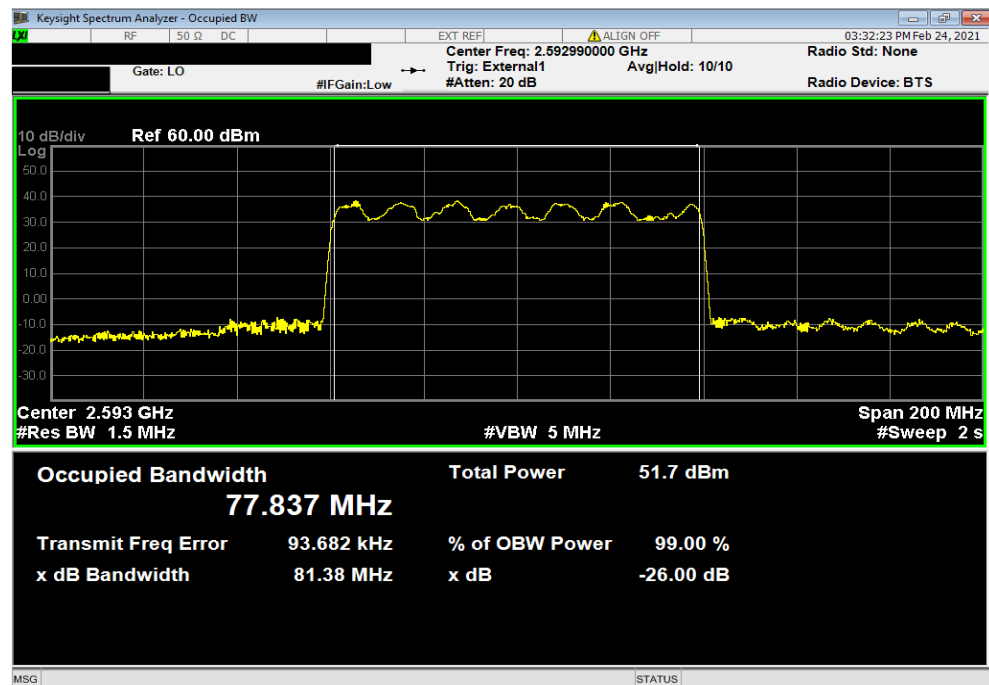
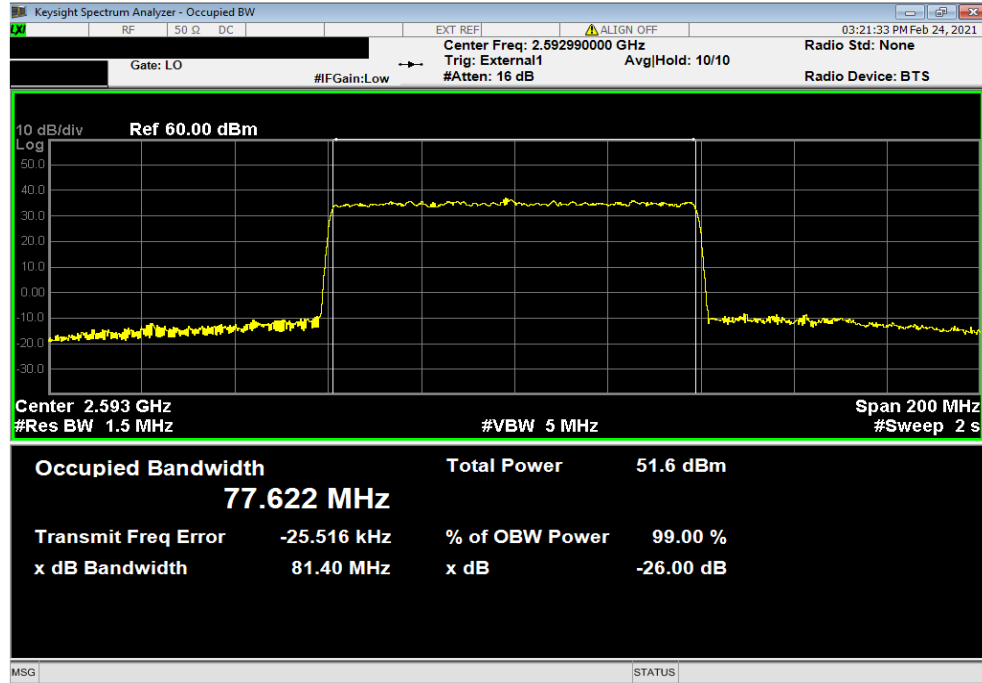# OCCUPIED BANDWIDTH 5G

| 5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR80 (80MHz), 64QAM, Mid Channel 2592.99 MHz | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (26 dB) | Limit | Result |
| | | | | 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 (26 dB) | Limit | Result |
| | | | | 81.37 MHz | Within Band | Pass |
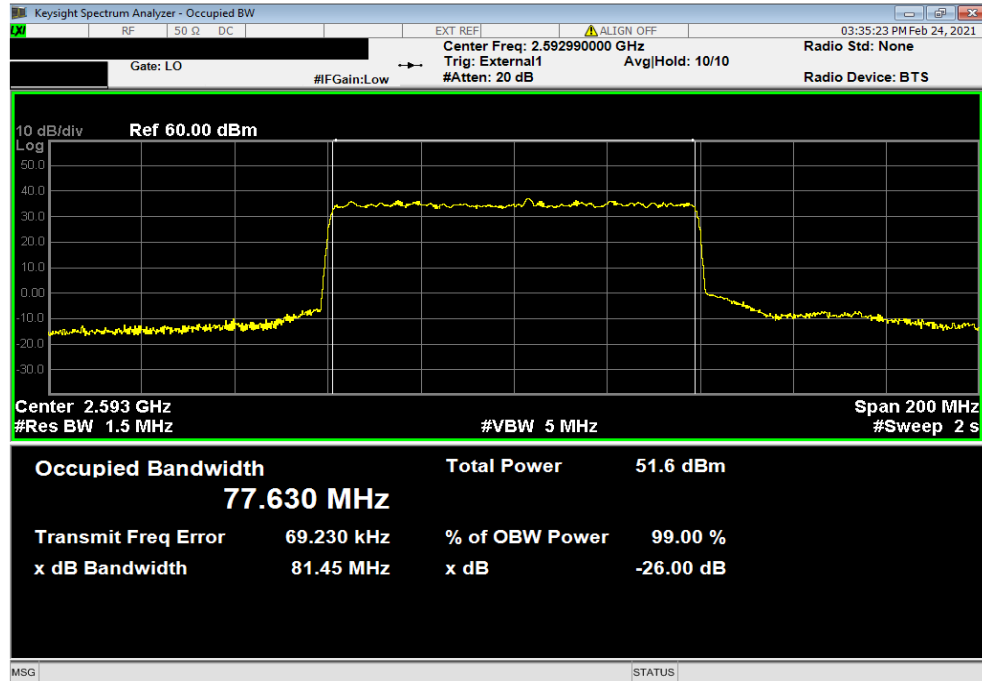
# OCCUPIED BANDWIDTH 5G

| 5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR80 (80MHz), 256QAM, Mid Channel 2592.99 MHz | | | | |
|---|---|---|---|---|
| | | | Value<br>(26 dB) | Limit |
| | | | | | Result |
| | | | 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<br>(26 dB) | Limit |
| | | | | | Result |
| | | | 81.35 MHz | Within Band | Pass |
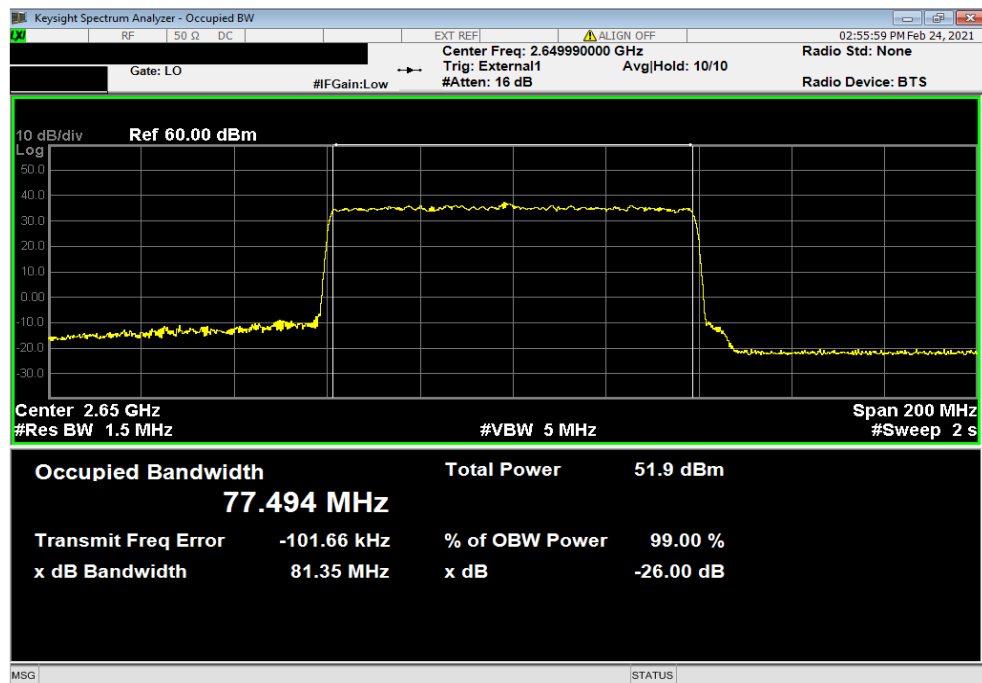
# OCCUPIED BANDWIDTH 5G

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



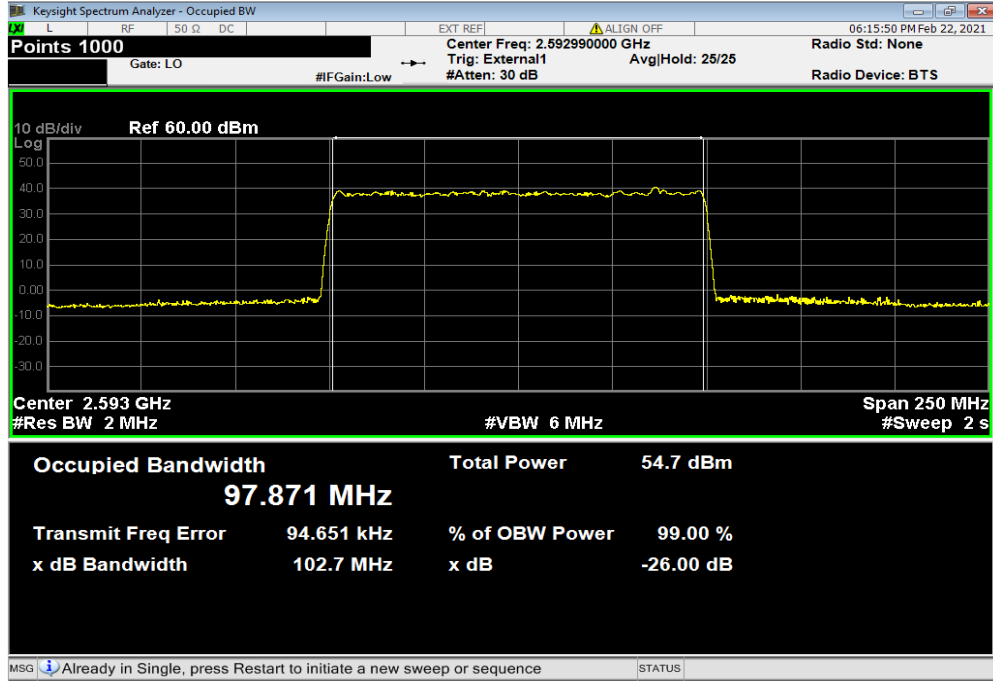| 5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR100 (100MHz), 16QAM, Mid Channel 2592.99 MHz | | | | | |
|---|---|---|---|---|---|
| | | | | Value | Limit | |
| | | | | (26 dB) | | Result |
| | | | | 102.547 MHz | Within Band | Pass |
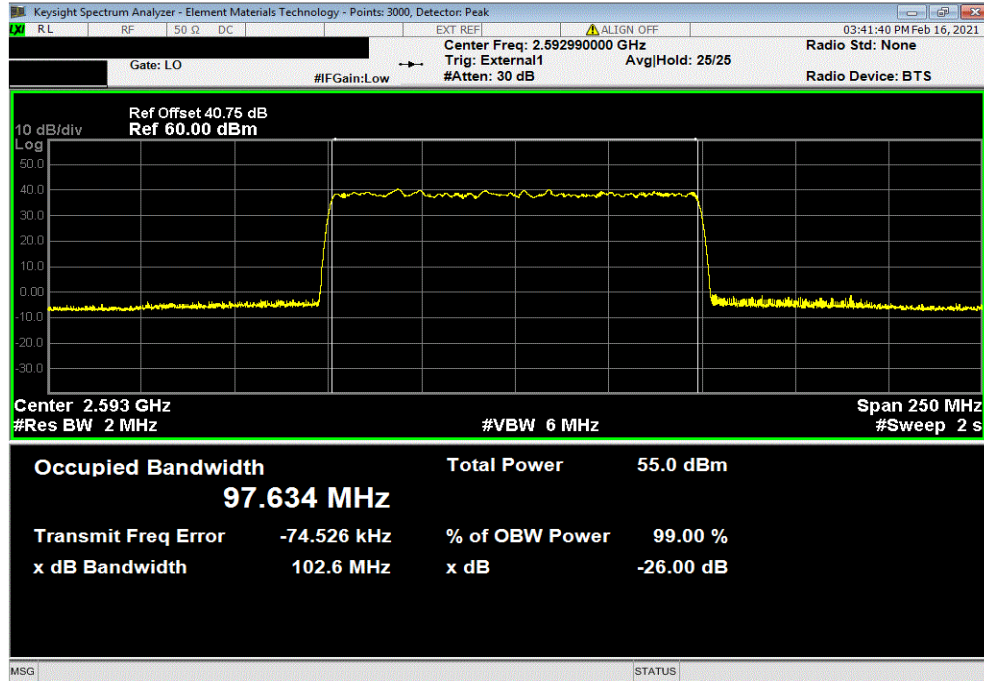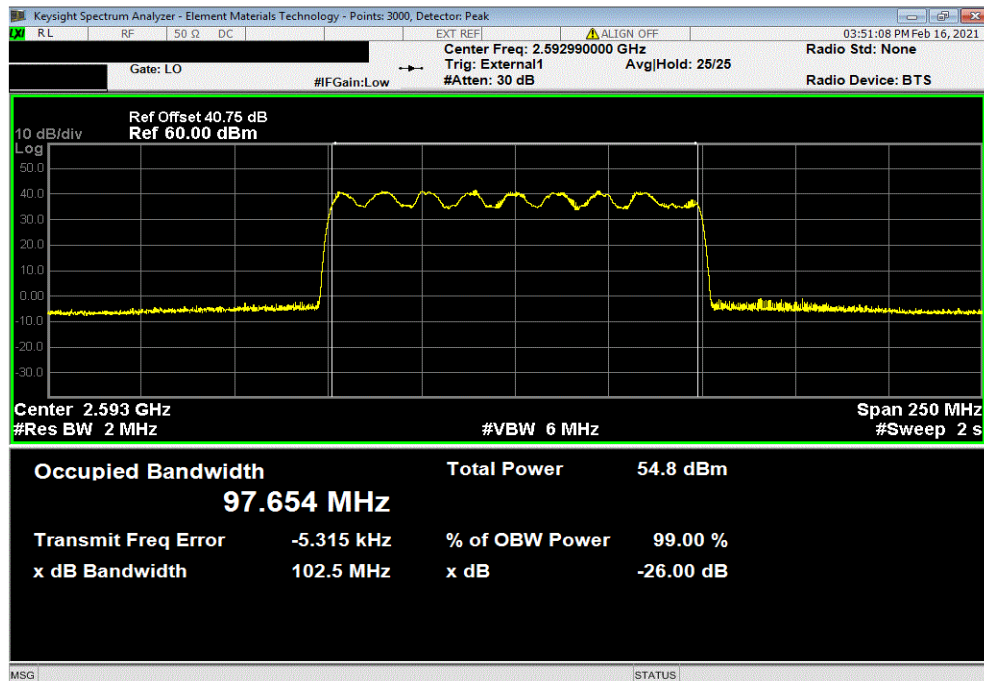
# OCCUPIED BANDWIDTH 5G

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



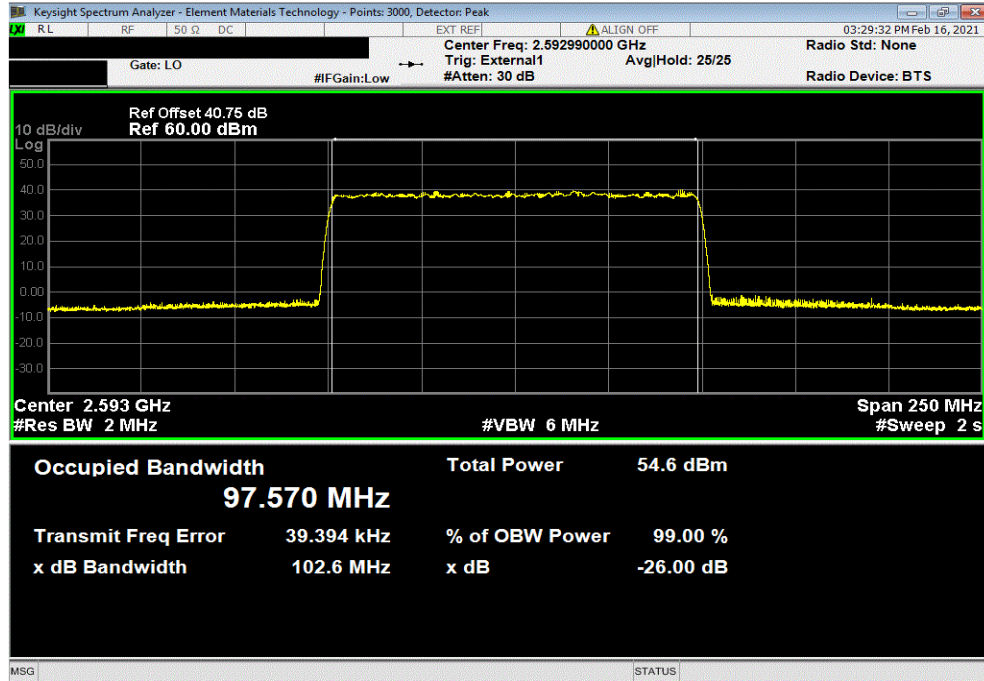| 5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR100 (100MHz), 256QAM, Low Channel 2546.01 MHz | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value | Limit | |
| | | | | (26 dB) | | Result |
| | | | | 102.539 MHz | Within Band | Pass |
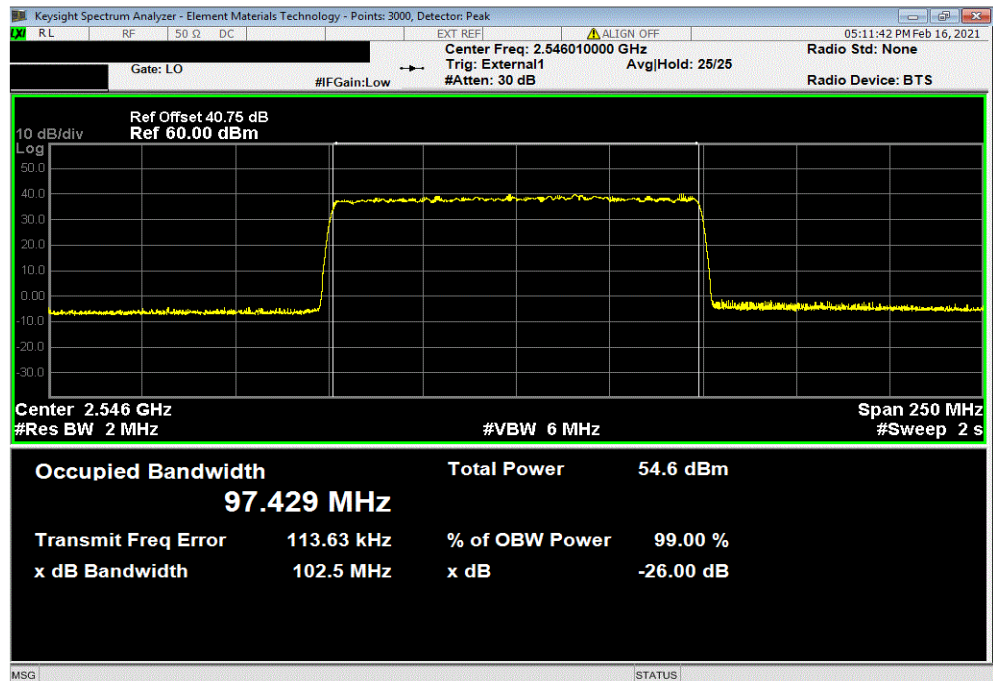
# OCCUPIED BANDWIDTH 5G

| 5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR100 (100MHz), 256QAM, Mid Channel 2592.99 MHz | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value | Limit | |
| | | | | (26 dB) | | 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 | Limit | |
| | | | | (26 dB) | | Result |
| | | | | 102.547 MHz | Within Band | Pass |