

Global Product Compliance Laboratory  
600-700 Mountain Avenue  
Room 5B-108  
Murray Hill, New Jersey 07974-0636 USA



# **Title 47 Code of Federal Regulations Test Report**

Regulation:

Title 47 CFR FCC Part 96

Client:

NOKIA SOLUTIONS AND NETWORKS

Product Evaluated:

AirScale MAA 64T64R 192AE B48 AEQM

Report Number:

TR-2022-0078-FCC96

Date Issued:

July 29, 2022

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**Revisions**

| Date      | Revision | Section                 | Change                                                                                                                                                                                     |
|-----------|----------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7/21/2021 | 0        |                         | Initial Release                                                                                                                                                                            |
| 2/28/2023 | 1        | 1.3.1,<br>2.1.1,<br>2.3 | Added more details on antenna gain calculation, maximum antenna gain and the worst case to be evaluated. Revised Section 2.3 by adding EIRP compliance tables for various operation modes. |
|           |          |                         |                                                                                                                                                                                            |
|           |          |                         |                                                                                                                                                                                            |

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Prepared By:

Signed:



7/29/2022

Ann Chang  
Compliance Engineer  
NVLAP Signatory  
ann.chang@nokia-bell-labs.com

Approved By:

Signed:



7/29/2022

Raymond Johnson  
Technical Manager  
NVLAP Signatory  
ray.johnson@nokia-bell-labs.com

Reviewed By:

Signed:



7/29/2022

Steve Gordon  
EMC Engineer  
NVLAP Signatory  
steve.gordon@nokia-bell-labs.com

## 1. System Information and Requirements

Report copies and other information not contained in this report are held by either the product engineer or in an identified file at the Global Product Compliance Laboratory in Murray-Hill, NJ.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Equipment Under Test (EUT):</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | AEQM AirScale MAA 64T64R 192AE B48                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Serial Number:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1M211503040, 1M211503041                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>FCC ID:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | VBNAEQM-02                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Hardware Version:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 092851A.101                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Software Version:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | STBS21B                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Frequency Range:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 3550 - 3700 MHz                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>GPCL Project Number:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 2021-0067                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Manufacturer:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | NOKIA SOLUTIONS AND NETWORKS OY<br>KARAKAARI 7, FI-02610 ESPOO<br>FINLAND                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Applicant:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Nokia Solutions and Networks<br>3201 Olympus Blvd<br>Dallas, Texas 75019<br>Steve Mitchell                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Test Requirement(s):</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Title 47 CFR Part96                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Test Standards:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <ul style="list-style-type: none"> <li>• Title 47 CFR Parts 2 and 96</li> <li>• KDB 940660 D01 Certification And Test Procedures For Citizens Broadband Radio Service Devices Authorized Under Part 96, v03, Oct 29, 2020</li> <li>• KDB 971168 D01 Power Measurement License Digital Systems v03r01 April 9, 2018.</li> <li>• KDB 662911 D01 Multiple Transmitter Output v02r01 Oct 2013</li> <li>• ANSI C63.26 (2015)</li> <li>• ANSI C63.4 (2014)</li> </ul> |
| <b>Measurement Procedure(s):</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <ul style="list-style-type: none"> <li>• FCC-IC-OB - GPCL Power Measurement, Occupied Bandwidth &amp; Modulation Test Procedure 6-20-2019</li> <li>• FCC-IC-SE - GPCL Spurious Emissions Test Procedure 6-20-2019</li> </ul>                                                                                                                                                                                                                                    |
| <b>Test Date(s):</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 5/19/2021 – 6/28/2021 (Radio)<br>7/1/2021 – 7/9/2021 (Radiated Emission)<br>6/4/2021 – 6/7/2021 (Frequency Stability)                                                                                                                                                                                                                                                                                                                                           |
| <b>Test Performed By:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Nokia<br>Global Product Compliance Laboratory<br>600-700 Mountain Ave.<br>P.O. Box 636<br>Murray Hill, NJ 07974-0636                                                                                                                                                                                                                                                                                                                                            |
| <b>Product Engineer(s):</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Ron Remy                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Lead Engineer:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Steve Gordon                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Test Engineer (s):</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Jaideep Yadav, Joe Bordonaro, Greg Manuel, Norman Albrecht                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Test Results:</b> The EUT, <i>as tested</i> met the above listed Test Requirements. The decision rule employed is binary (Pass/Fail) based on the measured values without accounting for Measurement Uncertainty or any Guard Band. The measured values obtained during testing were compared to a value given in the referenced regulation or normative standard. Report copies and other information not contained in this report are held by either the product engineer or in an identified file at the Global Product Compliance Laboratory in New Providence, NJ. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

## 1.1 Introduction

This Conformity test report applies to the AirScale MAA 64T64R 192AE B48 AEQM, hereinafter referred to as the Equipment Under Test (EUT).

## 1.2 Purpose and Scope

This document is to provide the testing data required for qualifying the EUT in compliance with FCC Part 96 measured in accordance with the procedures set out in Section 2.1033 (c) (14) of the Rules.

The purpose of this testing is to demonstrate compliance for **AirScale MAA 64T64R 192AE B48 - AEQM** product for a new FCC Product Certification under FCC ID: VBNAEQM-02. The AEQM is a LTE-TDD transceiver and operates in Band 48 Citizens Broadband Radio Service (CBRS) spectrum (3550-3700 MHz).

The AEQM supports 10MHz and 20 MHz single LTE carriers, plus 10+20 and 20+20 MHz multiple carriers and a maximum total output RF power capacity of 32W at its 64T/64R transmit ports. The AEQM also supports cross-polarized 32T/32R 4 streams per polarization and 64T/64R 8 streams per polarization MIMO operations.

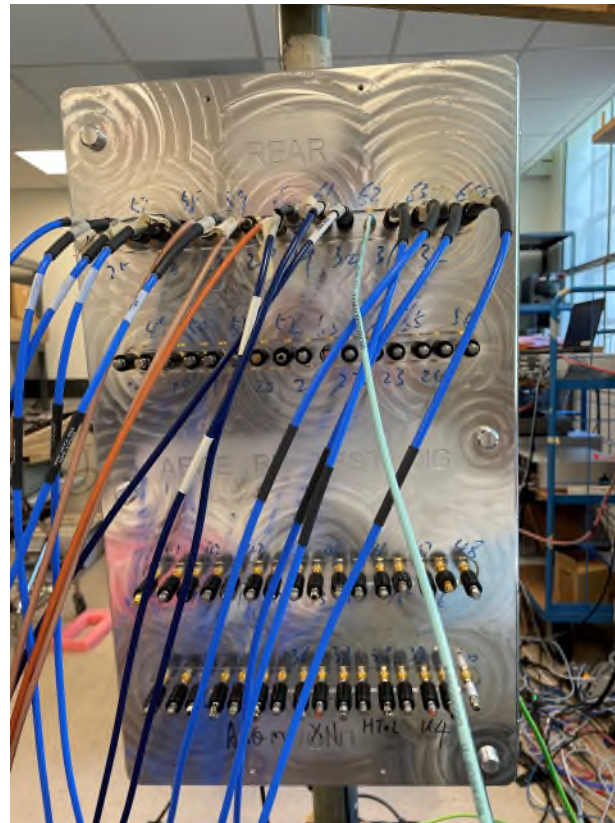
## 1.3 EUT Details

### 1.3.1 Specifications

|                                 |                                              |
|---------------------------------|----------------------------------------------|
| Specification                   | 3GPP/FCC LTE compliant, TDD                  |
| Frequency range                 | 3550 - 3700 MHz                              |
| Max. supported modulation       | QPSK, 16QAM, 64QAM and 256 QAM               |
| Number of TX/RX paths           | 64T/64R and 32T32R                           |
| Polarization                    | Cross Polarization                           |
| Mode of operation               | 16-Beam 64T64R and 8-Beam 32T32R MIMO        |
| Occupied bandwidth OBW          | 10/20/30/40 MHz                              |
| Maximum number of carriers      | 2                                            |
| Support non-contiguous carriers | yes                                          |
| Total average EIRP              | 54.81 dBm                                    |
| Max. output power               | 0.27 w per TRX and 8.6 W total               |
| Antenna configuration           | 12, 8, 2 ( $\pm 45^\circ$ X-polarized)       |
| Max. Antenna gain               | 24.5dBi                                      |
| Horizontal beamwidth            | 15° (boresight)                              |
| Vertical beamwidth              | 6° (boresight)                               |
| Horizontal coverage angle       | $\pm 45^\circ$ (3 dB), $\pm 60^\circ$ (5 dB) |
| Vertical steering angle         | $\pm 6^\circ$                                |
| Dimensions                      | 750 mm (H) x 450 mm (W) x 240 mm (D)         |

|                                 |                                                                                               |
|---------------------------------|-----------------------------------------------------------------------------------------------|
| Volume                          | 81 l                                                                                          |
| Weight                          | 42.2 kg (without mounting brackets)                                                           |
| Supply voltage / Connector type | DC -40.5 V ... -57 V / 2 pole connector                                                       |
| Power Consumption               | 716 W typical (75% DL duty cycle, 30% RF load)<br>752 W max (75% DL duty cycle, 100% RF load) |

### 1.3.2 Photographs



## 1.4 Test Requirements

Each required measurement is listed below:

| 47 CFR FCC Sections           | Description of Tests                                                              | Test Required |
|-------------------------------|-----------------------------------------------------------------------------------|---------------|
| 2.1046, 96.41 (b)<br>96.41(g) | RF Power Output<br>(b) Power Limits, EIRP, PSD<br>(g) Peak-to-Average Power Ratio | Yes           |
| 2.1047, 96.41(a)              | Modulation Characteristics                                                        | Yes           |
| 2.1049, 96.41(e)(2)(3)        | (a) Occupied Bandwidth<br>(b) Out-of-Band Emissions                               | Yes           |
| 2.1051, 96.41(e)              | Spurious Emissions at Antenna Terminals                                           | Yes           |
| 2.1053, 96.41(e)(2)(3)        | Field Strength of Spurious Radiation                                              | Yes           |
| 2.1055, 96.41(e)(2)(3)        | Measurement of Frequency Stability                                                | Yes           |

## 1.5 Test Standards & Measurement Procedures

### 1.5.1 Test Standards

- Title 47 Code of Federal Regulations, Federal Communications Commission Part 2.
- Title 47 Code of Federal Regulations, Federal Communications Commission Part 96.
- KDB 940660 D01 Certification And Test Procedures For Citizens Broadband Radio Service Devices Authorized Under Part 96, v03, Oct 29, 2020
- KDB 971168 D01 Power Measurement License Digital Systems v03r01 April 9, 2018.
- KDB 662911 D01 Multiple Transmitter Output v02r01 Oct 2013
- ANSI C63.26-2015, American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
- ANSI C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

### 1.5.2 Measurement Procedures

- FCC-IC-OB - GPCL Power Measurement, Occupied Bandwidth & Modulation Test Procedure 6-20-2019
- FCC-IC-SE - GPCL Spurious Emissions Test Procedure 6-20-2019

## 1.6 MEASUREMENT UNCERTAINTY

The results of the calculations to estimate uncertainties for the several test methods and standards are shown in the Table below. These are the worst-case values.

**Worst-Case Estimated Measurement Uncertainties**

| Standard, Method or Procedure                                                     | Condition                                       | Frequency MHz                                                                                             | Expanded Uncertainty (k=2)                          |
|-----------------------------------------------------------------------------------|-------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------|
| a. Classical Emissions, (e.g., ANSI C63.4, CISPR 11, 14, 22, etc., using ESHS 30, | Conducted Emissions                             | 0.009 - 30                                                                                                | ±3.5 dB                                             |
|                                                                                   | Radiated Emissions (AR-6 Semi-Anechoic Chamber) | 30 MHz – 200MHz H<br>30 MHz – 200 MHz V<br>200 MHz – 1000 MHz H<br>200 MHz – 1000 MHz V<br>1 GHz - 18 GHz | ±5.1 dB<br>±5.1 dB<br>±4.7 dB<br>±4.7 dB<br>±3.3 dB |

| Antenna Port Test                                              | Signal Bandwidth                           | Frequency Range                                                            | Expanded Uncertainty (k=2), Amplitude |
|----------------------------------------------------------------|--------------------------------------------|----------------------------------------------------------------------------|---------------------------------------|
| Occupied Bandwidth, Edge of Band, Conducted Spurious Emissions | 10 Hz<br>100 Hz<br>10 kHz to 1 MHz<br>1MHz | 9 kHz to 20 MHz<br>20 MHz to 1 GHz<br>1 GHz to 10 GHz<br>10 GHz to 40 GHz: | 1.78 dB                               |
| RF Power                                                       | 10 Hz to 20 MHz                            | 50 MHz to 18 GHz                                                           | 0.5 dB                                |

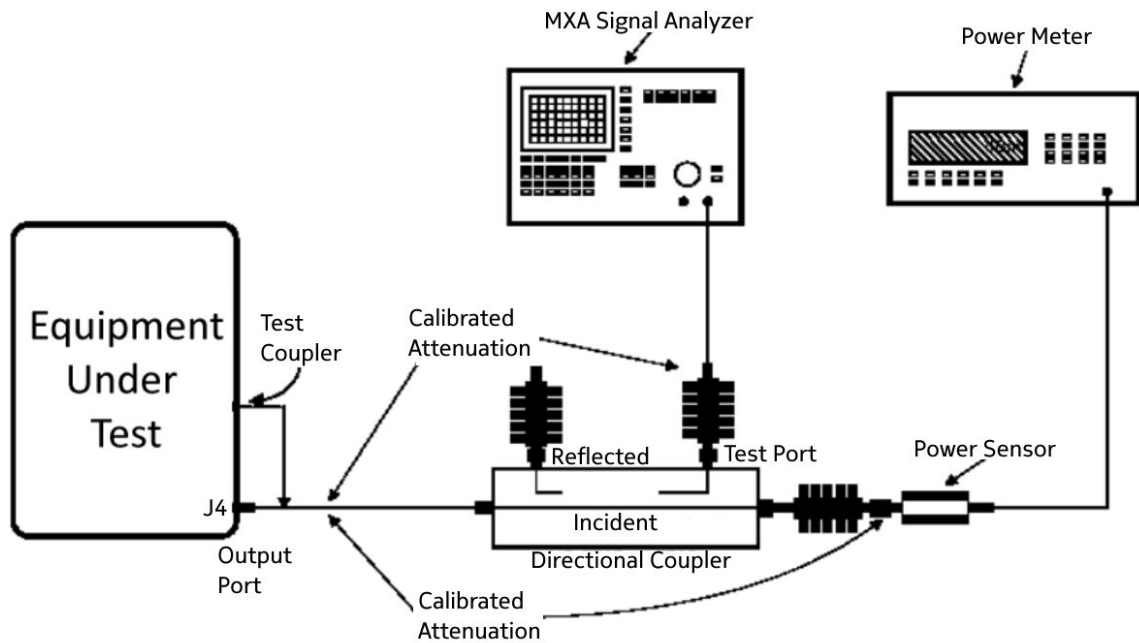
## 1.7 Executive Summary

| Requirement<br>47 CFR FCC Parts 2 and 96 | Description of Tests                                                              | Result   |
|------------------------------------------|-----------------------------------------------------------------------------------|----------|
| 2.1046, 96.41 (b)<br>96.41(g)            | RF Power Output<br>(b) Power Limits, EIRP, PSD<br>(g) Peak-to-Average Power Ratio | COMPLIES |
| 2.1047, 96.41(a)                         | Modulation Characteristics                                                        | COMPLIES |
| 2.1049, 96.41(e)(2)(3)                   | (a) Occupied Bandwidth<br>(b) Out-of-Band Emissions                               | COMPLIES |
| 2.1051, 96.41(e)                         | Spurious Emissions at Antenna Terminals                                           | COMPLIES |
| 2.1053, 96.41(e)                         | Field Strength of Spurious Radiation                                              | COMPLIES |
| 2.1055                                   | Measurement of Frequency Stability                                                | COMPLIES |

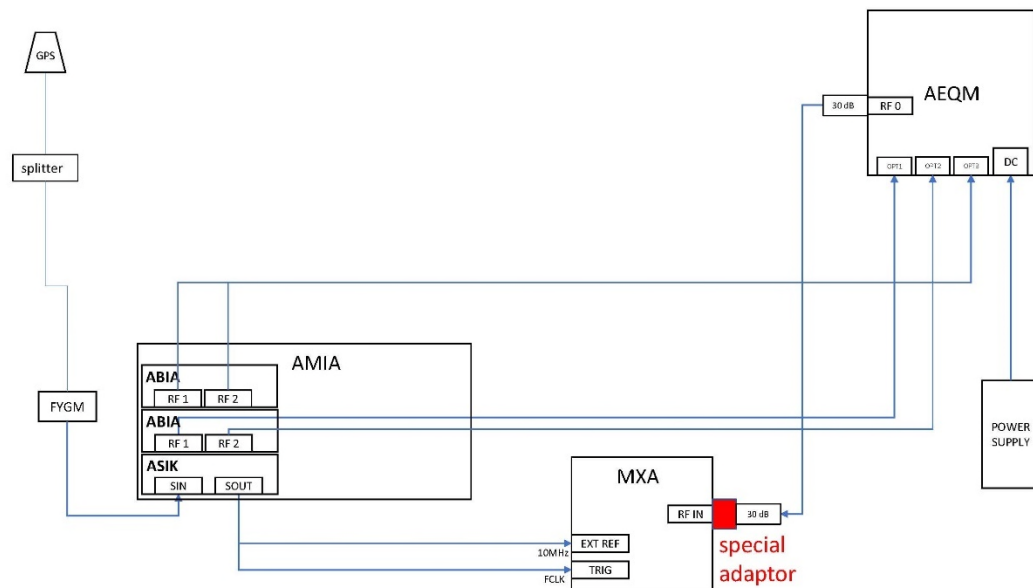
1. **COMPLIES** - Passed all applicable tests.
2. **N/A** – Not Applicable.
3. **NT** – Not Tested.

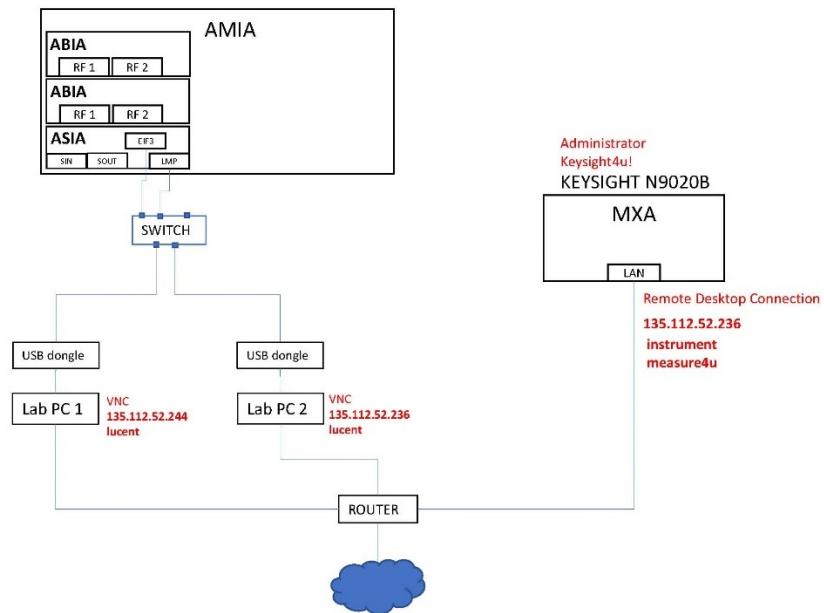
## 1.8 Test Configurations

Test Setup for all Antenna Port Measurements



Test Setup for Frequency Stability





## 2. FCC Section 2.1046 - RF Power Output and Power Spectral Density

### 2.1 RF Power Output

#### 2.1.1 Limits

The FCC Part 96.41 requirement for Category B CBSD is that the Output Power of the EUT shall not exceed 47 dBm/10MHz EIRP.

Directional Antenna Gain Calculation:

The EUT has 192 AE (antenna elements) for 64 ports operation and 96 AE for 32 ports operation where each antenna port has 3 AEs. The gain of each antenna is around 9.45 dBi.

- a. Antenna Gain
  - i. Antenna Gain for 1-Beam 64T64R = 27.5 dBi,
  - ii. Antenna Gain for 1-Beam 32T32R = 24.5 dBi;
- b. Antenna Gain for cross-polarization
  - i. Antenna Gain for 2-Beam 64T64R = 24.5 dBi,
  - ii. Antenna Gain for 2-Beam 32T32R = 21.5 dBi;
- c. Multi-Beam Antenna Gain Reduction
  - i. 16-Beam Reduction =  $10 \cdot \log(1/16)$  dB = -12.04
  - ii. 8-Beam Reduction =  $10 \cdot \log(1/8)$  dB = -9.03
- d. Effective Antenna Gain
  - i. Effective Antenna Gain for 16-Beam 64T64R =  $27.5 - 12.04 = 15.46$  dBi
  - ii. Effective Antenna Gain for 8-Beam 32T32R =  $24.5 - 9.03 = 15.47$  dBi

With cross-polarized antennas and 1 stream per polarization, the maximum effective antenna gain is 24.5 dBi for 64T64R.

KDB 662911 D02 MIMO with Cross-Polarized Antenna specified that for Rules That Specify Radiated Limits, 1) if the transmitter output signals are completely uncorrelated, then each of the two EIRPs must individually be below the limit; 2) if one of the transmitter outputs is a 90-degree phase-shifted replica of the other and the phase centers of the two antennas are co-located (as would be the case when creating a circularly polarized transmission using linearly polarized antennas), then the each of the two EIRPs must individually be below the limit; 3) other than the above cases 1) and 2), the sum of the two EIRPs from two polarizations must be below the limit.

The EUT is capable of supporting MIMO Rank 2+ transmission schemes where the output signals on two polarizations could be uncorrelated or have a 90-degree phase-shift, depending on the deployment scenario and channel conditions, and each of the two EIRPs must individually be below the 47dBm/10MHz EIRP limit. For compliance testing, the case that each of the two EIRPs is individually below the 47dBm/10MHz EIRP limit is worse than the case where the correlated signals are sent to two polarization chains and the sum of two EIRPs must be below the 47dBm/10MHz EIRP limit. The former allows for 3dB higher per port conducted output power and thus was evaluated to ensure the compliance. Some RF characteristics for the case that the sum of the EIRPs from two polarizations must be below the 47dBm/10MHz limit were evaluated as well and the data were saved in the project folder.

Table 2.1 RF Conducted Output Power Limits

| Operation Modes         | Effective Antenna Gain (dBi) | FCC 96.41 EIRP Limit (dBm/BW) | Total Conducted Output Power Limit (dBm/BW) | Conducted Output Power Limit per Port (dBm/BW) |
|-------------------------|------------------------------|-------------------------------|---------------------------------------------|------------------------------------------------|
| 16-Beam 64T64R 10MHz    | 15.46                        | 47                            | 34.55                                       | 16.49                                          |
| 8-Beam 32T32R 10MHz     | 15.47                        | 47                            | 34.54                                       | <b>19.49</b>                                   |
| 16-Beam 64T64R 20MHz    | 15.46                        | 50.01                         | 37.56                                       | 19.50                                          |
| 8-Beam 32T32R 20MHz     | 15.47                        | 50.01                         | 37.55                                       | <b>22.50</b>                                   |
| 16-Beam 64T64R 10+20MHz | 15.46                        | 51.77                         | 39.32                                       | 21.26                                          |
| 8-Beam 32T32R 10+20MHz  | 15.47                        | 51.77                         | 39.31                                       | <b>24.26</b>                                   |
| 16-Beam 64T64R 20+20MHz | 15.46                        | 53.02                         | 40.57                                       | 22.51                                          |
| 8-Beam 32T32R 20+20MHz  | 15.47                        | 53.02                         | 40.56                                       | <b>25.51</b>                                   |

The limits for 8-Beam 32T32R modes are higher than that for 16-Beam 64T64R modes. Therefore, the output power at the antenna ports for 8-Beam 32T32R modes was evaluated.

## 2.1.2 Results

Power measurements of the TDD transmit signal were conducted with an MXA Signal analyzer per KDB 971168 D01 and ANSI C63.26. The applied signal from the AEQM, met the recommended characteristics as defined in 3GPP TS 36.141 V16.9.0 (2021-04) Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) conformance testing (Release 14). The Channel power was measured when the product was set to provide the maximum rated power at the antenna transmitting terminals. The output power of the EUT was measured per ANSI C63.26 methods and procedures and the Channel Power Measurement feature of the MXA Analyzer.

The measured output power at antenna ports was documented in the table below. The Maximum Average RF Power Values are bolded in each configuration.

Table 2.2 RF Power Output Results (8-Beam 32T32R Modes)

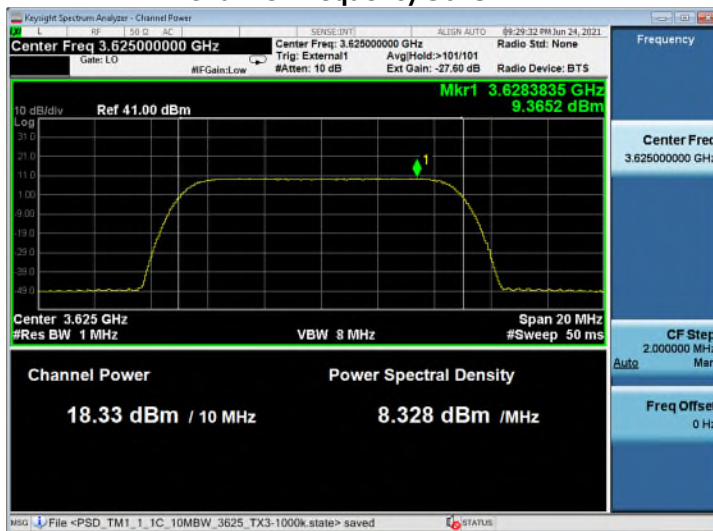
| # of Carriers     | Test Model | Modulation | TX Port | Channel Frequency MHz | Signal BW MHz | Channel Power dBm/BW | Channel Power Limit dBm/BW | Results |
|-------------------|------------|------------|---------|-----------------------|---------------|----------------------|----------------------------|---------|
| 1                 | 1.1        | QPSK       | 3       | 3555                  | 10            | 18.32                | 19.49                      | Pass    |
| 1                 | 1.1        | QPSK       | 3       | 3625                  | 10            | <b>18.33</b>         | 19.49                      | Pass    |
| 1                 | 1.1        | QPSK       | 3       | 3695                  | 10            | 18.30                | 19.49                      | Pass    |
| 1                 | 1.1        | QPSK       | 3       | 3560                  | 20            | 21.16                | 22.50                      | Pass    |
| 1                 | 1.1        | QPSK       | 3       | 3625                  | 20            | 21.26                | 22.50                      | Pass    |
| 1                 | 1.1        | QPSK       | 3       | 3690                  | 20            | <b>21.27</b>         | 22.50                      | Pass    |
| 2<br>(Contiguous) | 1.1        | QPSK       | 3       | 3555+3570             | 10+20         | 22.55                | 24.26                      | Pass    |
| 2<br>(Contiguous) | 1.1        | QPSK       | 3       | 3625+3640             | 10+20         | 22.62                | 24.26                      | Pass    |
| 2<br>(Contiguous) | 1.1        | QPSK       | 3       | 3675+3690             | 10+20         | <b>23.27</b>         | 24.26                      | Pass    |
| 2<br>(Contiguous) | 1.1        | QPSK       | 3       | 3560+3580             | 20+20         | <b>24.29</b>         | 25.51                      | Pass    |
| 2<br>(Contiguous) | 1.1        | QPSK       | 3       | 3625+3645             | 20+20         | 24.23                | 25.51                      | Pass    |
| 2<br>(Contiguous) | 1.1        | QPSK       | 3       | 3670+3690             | 20+20         | 24.24                | 25.51                      | Pass    |

## 2.1.3 Maximum RF Conducted Output Power Plots

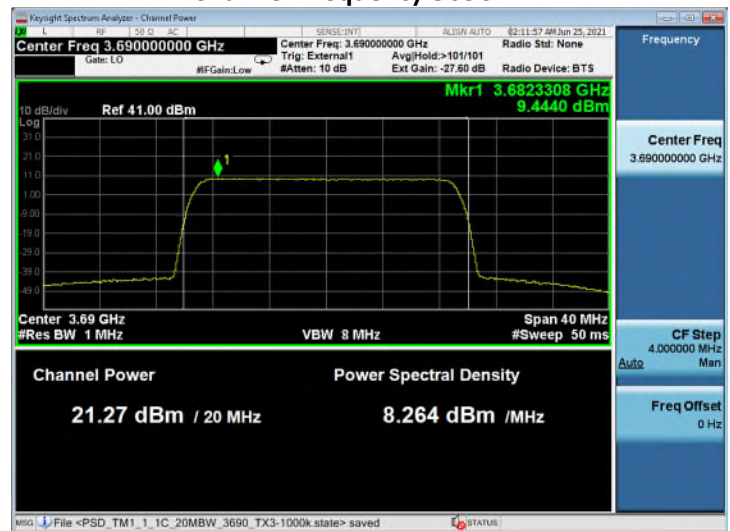
NOTE: Only a sample of the plots are used in this report. The full suite of raw data resides at the MH, New Jersey location.

### Test Model 1.1 Modulation QPSK Mode 8-Beam 32T32R

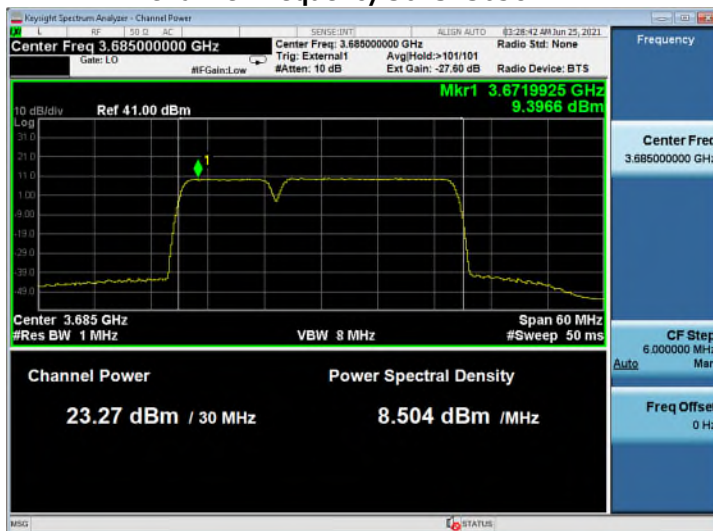
1CC, 10MHz BW  
Channel Frequency 3625MHz



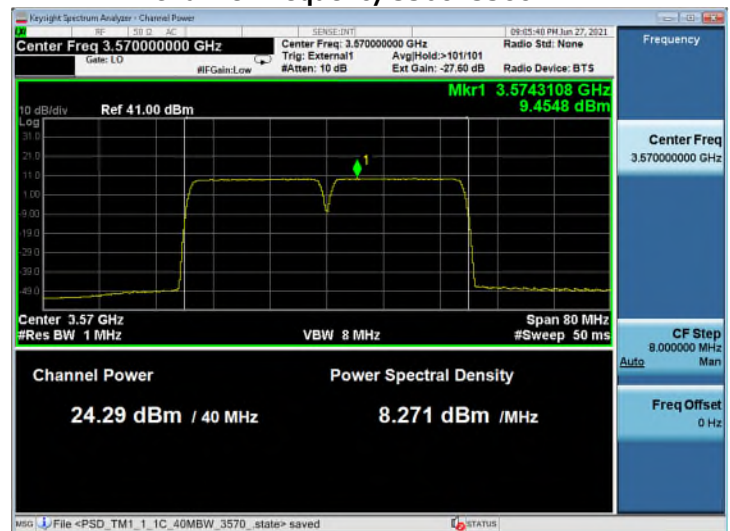
1CC, 20MHz BW  
Channel Frequency 3690MHz



2CC, 10+20 MHz BW  
Channel Frequency 3675+3690MHz



2CC, 20+20 MHz BW  
Channel Frequency 3560+3580MHz



## 2.2 Power Spectral Density

### 2.2.1 Limits

The FCC Part 96.41 requirement for Category B CBSD is that the Power Spectral Density (PSD) of the EUT shall not exceed 37 dBm/MHz. The PSD per port limit was derived below.

**Table 2.3 RF Conducted Power Spectrum Density Limits**

| Operation Modes | Effective Antenna Gain (dBi) | FCC 96.41 PSD Limit (dBm/MHz) | Total Conducted PSD Limit (dBm/MHz) | Conducted PSD Limit per Port (dBm/MHz) |
|-----------------|------------------------------|-------------------------------|-------------------------------------|----------------------------------------|
| 16-Beam 64T64R  | 15.46                        | 37                            | 24.55                               | 6.49                                   |
| 8-Beam 32T32R   | 15.47                        | 37                            | 24.54                               | <b>9.49</b>                            |

Both the power and PSD limits for 8-Beam 32T32R modes are 3dB higher than that for 16-Beam 64T64R modes, Therefore, the output power at the antenna ports for 8-Beam 32T32R modes was evaluated only.

### 2.2.2 Results

The PSD of the EUT was measured per ANSI C63.26 methods and procedures and the PSD Measurement feature of the MXA Analyzer. The PSD was measured when the product was set to provide the maximum rated power at the antenna transmitting terminals. The signal bandwidths, modulations and transmit channels identified in Table below were evaluated. The measured power spectral density level was documented in the table below.

The Maximum Average PSD Values are bolded in each configuration.

**Table 2.4 Power Spectral Density Results (8-Beam 32T32R Modes)**

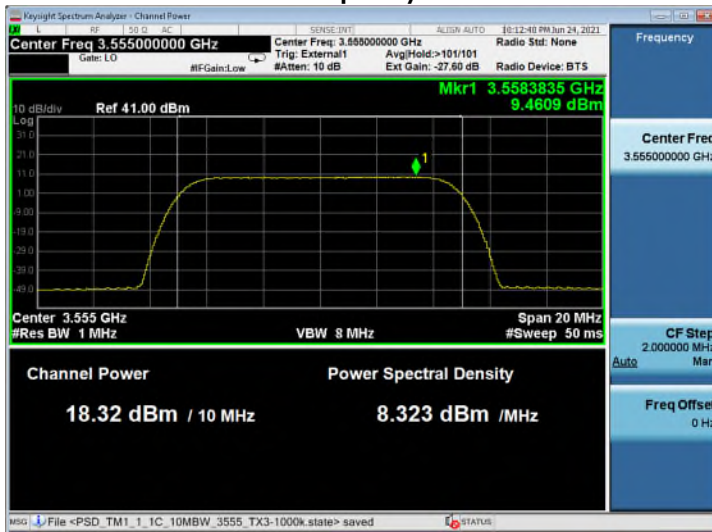
| # of Carriers  | Test Model | Modulation | TX Port | Channel Frequency MHz | Signal BW MHz | PSD Limit dBm/MHz | PSD dBm/MHz   | PSD Results Pass/Fail |
|----------------|------------|------------|---------|-----------------------|---------------|-------------------|---------------|-----------------------|
| 1              | 1.1        | QPSK       | 3       | 3555                  | 10            | 9.49              | <b>9.4609</b> | Pass                  |
| 1              | 1.1        | QPSK       | 3       | 3625                  | 10            | 9.49              | 9.3652        | Pass                  |
| 1              | 1.1        | QPSK       | 3       | 3695                  | 10            | 9.49              | 9.3762        | Pass                  |
| 1              | 1.1        | QPSK       | 3       | 3560                  | 20            | 9.49              | 9.3077        | Pass                  |
| 1              | 1.1        | QPSK       | 3       | 3625                  | 20            | 9.49              | 9.2891        | Pass                  |
| 1              | 1.1        | QPSK       | 3       | 3690                  | 20            | 9.49              | <b>9.4440</b> | Pass                  |
| 2 (Contiguous) | 1.1        | QPSK       | 3       | 3555+3570             | 10+20         | 9.49              | 9.1979        | Pass                  |
| 2 (Contiguous) | 1.1        | QPSK       | 3       | 3625+3640             | 10+20         | 9.49              | 9.1902        | Pass                  |
| 2 (Contiguous) | 1.1        | QPSK       | 3       | 3675+3690             | 10+20         | 9.49              | <b>9.3966</b> | Pass                  |
| 2 (Contiguous) | 1.1        | QPSK       | 3       | 3560+3580             | 20+20         | 9.49              | <b>9.4548</b> | Pass                  |
| 2 (Contiguous) | 1.1        | QPSK       | 3       | 3625+3645             | 20+20         | 9.49              | 9.3219        | Pass                  |
| 2 (Contiguous) | 1.1        | QPSK       | 3       | 3670+3690             | 20+20         | 9.49              | 9.3855        | Pass                  |

## 2.2.3 Maximum Conducted PSD Plots

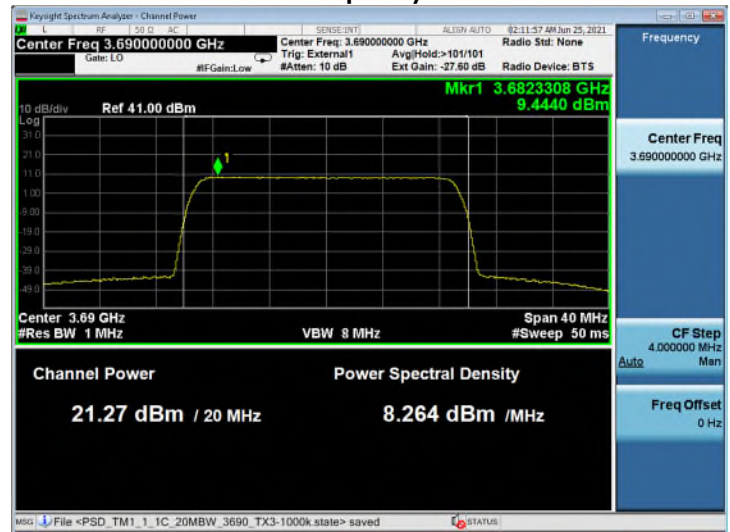
NOTE: Only a sample of the plots are used in this report. The full suite of raw data resides at the MH, New Jersey location.

### Test Model 1.1 Modulation QPSK Mode 8-Beam 32T32R

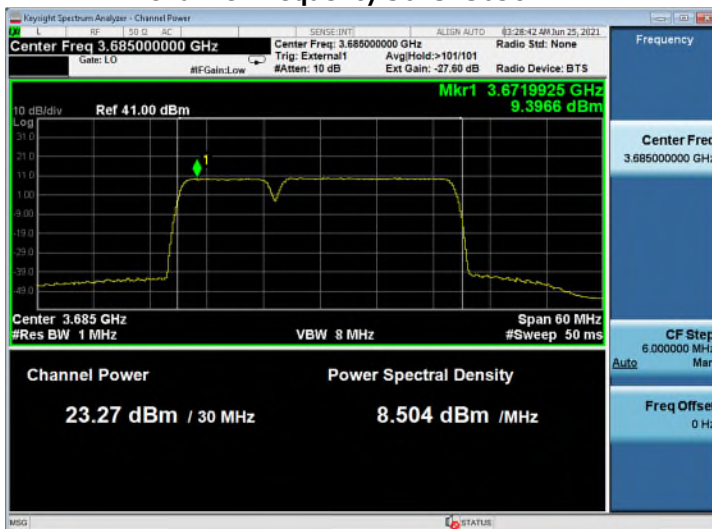
#### 1CC, 10MHz BW Channel Frequency 3555MHz



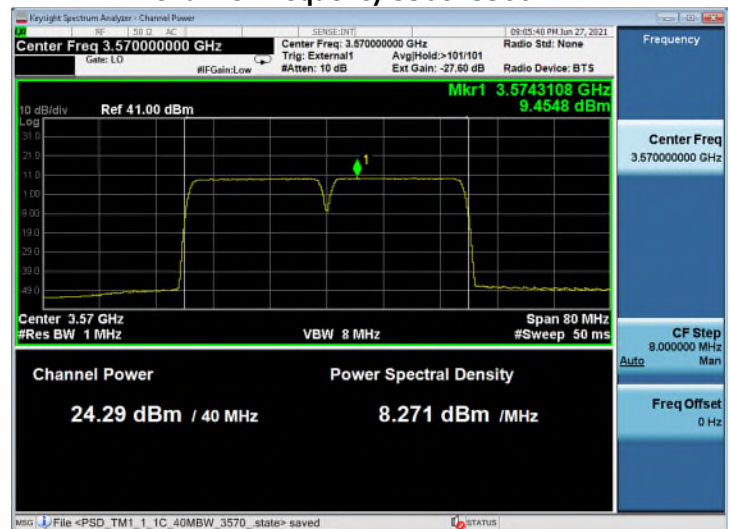
#### 1CC, 20MHz BW Channel Frequency 3690MHz



#### 2CC, 10+20 MHz BW Channel Frequency 3675+3690MHz



#### 2CC, 20+20 MHz BW Channel Frequency 3560+3580MHz



## 2.3 EIRP Compliance

As stated above, the EUT supports two operation modes:

- 1) 16-Beam 64T64R with cross polarization (32 ports and 8 streams each polarization) and
- 2) 8-Beam 32T32R with cross polarization (16 ports and 4 streams each polarization),

where MIMO Rank 2+ transmission schemes are supported for each operation mode. As a result, it results in two scenarios for EIRP compliance for each operation mode: A) when the output signals on two polarizations are uncorrelated or have a 90-degree phase-shift, depending on the deployment scenario and channel conditions, then each of the two EIRPs must individually be below the 47dBm/10MHz EIRP limit, B) when the correlated signals are sent to two polarization chains, then the sum of two EIRPs must be below the 47dBm/10MHz EIRP limit. The case 2A (the case A with 8-Beam 32T32R mode) allows for highest per port conducted output power and was thus evaluated at the antenna port in Section 2.1 to ensure the compliance.

Table 2.5 presented the maximum EIRP values for the following four cases or configurations:

- 1A: 16-Beam 64T64R CP, each EIRP below 47dBm/10MHz EIRP limit,
- 1B: 16-Beam 64T64R CP, sum of both EIRPs below 47dBm/10MHz EIRP limit,
- 2A: 8-Beam 32T32R CP, each EIRP below 47dBm/10MHz EIRP limit,
- 2B: 8-Beam 32T32R CP, sum of both EIRPs below 47dBm/10MHz EIRP limit.

**Table 2.5(a) Maximum EIRP for 32T32R 8 Beam CP Configuration 2A**

| Bandwidth (MHz) | Maxi Cond Power per Port dBm** | Maxi Cond Power per Port Allowed dBm* | Maxi EIRP dBm | Maxi EIRP W | FCC Limit 96.41 dBm EIRP | FCC Limit 96.41 W EIRP |
|-----------------|--------------------------------|---------------------------------------|---------------|-------------|--------------------------|------------------------|
| 10              | 18.33                          | 19.49                                 | 45.84         | 38.38       | 47.0                     | 50.12                  |
| 20              | 21.27                          | 22.50                                 | 48.83         | 76.4        | 50.01                    | 100.24                 |
| 30              | 23.27                          | 24.26                                 | 50.85         | 121.7       | 51.77                    | 150.36                 |
| 40              | 24.29                          | 25.51                                 | 51.80         | 151.40      | 53.02                    | 200.47                 |

\*per FCC limit. \*\* From Table 2.2

**Table 2.5(b) Maximum EIRP for 32T32R 8 Beam CP Configuration 2B**

| Bandwidth (MHz) | Maxi Cond Power per Port dBm** | Maxi Cond Power per Port Allowed dBm* | Maxi EIRP dBm | Maxi EIRP W | FCC Limit 96.41 dBm EIRP | FCC Limit 96.41 W EIRP |
|-----------------|--------------------------------|---------------------------------------|---------------|-------------|--------------------------|------------------------|
| 10              | 16.4                           | 16.48                                 | 46.92         | 49.22       | 47.0                     | 50.12                  |
| 20              | 19.4                           | 19.49                                 | 49.92         | 98.21       | 50.01                    | 100.24                 |
| 30              | 21.2                           | 21.25                                 | 51.72         | 148.64      | 51.77                    | 150.36                 |
| 40              | 22.4                           | 22.5                                  | 52.92         | 195.95      | 53.02                    | 200.47                 |

\*per FCC limit. \*\* The power per port was reduced from 2A.

**Table 2.5(c) Maximum EIRP for 64T64R 16 Beam CP Configurations 1A**

| Bandwidth (MHz) | Maxi Cond Power per Port dBm** | Maxi Cond Power per Port Allowed dBm* | Maxi EIRP dBm | Maxi EIRP W | FCC Limit 96.41 dBm EIRP | FCC Limit 96.41 W EIRP |
|-----------------|--------------------------------|---------------------------------------|---------------|-------------|--------------------------|------------------------|
| 10              | 16.4                           | 16.48                                 | 46.91         | 49.11       | 47.0                     | 50.12                  |
| 20              | 19.4                           | 19.49                                 | 49.90         | 97.98       | 50.01                    | 100.24                 |
| 30              | 21.2                           | 21.25                                 | 51.71         | 148.30      | 51.77                    | 150.36                 |
| 40              | 22.4                           | 22.5                                  | 52.91         | 195.50      | 53.02                    | 200.47                 |

\* per FCC limit. \*\* The power per port was reduced from 2A.

**Table 2.5(d) Maximum EIRP for 64T64R 16 Beam CP Configurations 1B**

| Bandwidth (MHz) | Maxi Cond Power per Port dBm** | Maxi Cond Power per Port Allowed dBm* | Maxi EIRP dBm | Maxi EIRP W | FCC Limit 96.41 dBm EIRP | FCC Limit 96.41 W EIRP |
|-----------------|--------------------------------|---------------------------------------|---------------|-------------|--------------------------|------------------------|
| 10              | 13.4                           | 13.47                                 | 46.92         | 49.2        | 47.0                     | 50.12                  |
| 20              | 16.4                           | 16.48                                 | 49.92         | 98.2        | 50.01                    | 100.24                 |
| 30              | 18.2                           | 18.24                                 | 51.72         | 148.7       | 51.77                    | 150.36                 |
| 40              | 19.4                           | 19.49                                 | 52.92         | 196.0       | 53.02                    | 200.47                 |

\* per FCC limit. \*\* The power per port was reduced from 2A.

The sample calculation for the maximum EIRP for 2A as follows,

The maximum Conducted Output Power per port = 24.29 dBm

The maximum Conducted Output Power per polarization =  $24.29 + 10 \times \log(16) = 36.33$  dBm

The maximum EIRP per polarization =  $36.33 + 15.47 = 51.80$  dBm.

The sample calculation for the maximum EIRP for 2B as follows,

The maximum Conducted Output Power per port = 22.4dBm

The maximum Conducted Output Power per polarization =  $22.4 + 10 \times \log(32) = 37.45$  dBm

The maximum EIRP per polarization =  $37.45 + 15.47 = 52.92$  dBm.

The sample calculation for the maximum EIRP for 1A as follows,

The maximum Conducted Output Power per port = 22.4dBm

The maximum Conducted Output Power per polarization =  $22.4 + 10 \times \log(32) = 37.45$  dBm

The maximum EIRP per polarization =  $37.45 + 15.46 = 52.91$  dBm.

The sample calculation for the maximum EIRP for 1B as follows,

The maximum Conducted Output Power per port = 19.4dBm

The maximum Conducted Output Power per polarization =  $19.4 + 10 \times \log(64) = 37.46$  dBm

The maximum EIRP per polarization =  $37.46 + 15.46 = 52.92$  dBm.

**Table 2.5(e) Maximum EIRP for Configurations 64T64R 16 Beam CP 1A/1B and 32T32R 8 Beam CP 2A/2B**

| Bandwidth (MHz) | Configurations | Maxi EIRP dBm | Maxi EIRP W | FCC Limit 96.41 dBm EIRP | FCC Limit 96.41 W EIRP | Results |
|-----------------|----------------|---------------|-------------|--------------------------|------------------------|---------|
| 10              | 1B, 2B         | 46.92         | 49.22       | 47.0                     | 50.12                  | Pass    |
| 20              | 1B, 2B         | 49.92         | 98.2        | 50.01                    | 100.24                 | Pass    |
| 30              | 1B, 2B         | 51.72         | 148.6       | 51.77                    | 150.36                 | Pass    |
| 40              | 1B, 2B         | 52.92         | 196.0       | 53.02                    | 200.47                 | Pass    |

## 2.4 Peak-to-Average Power Ratio (PAPR)

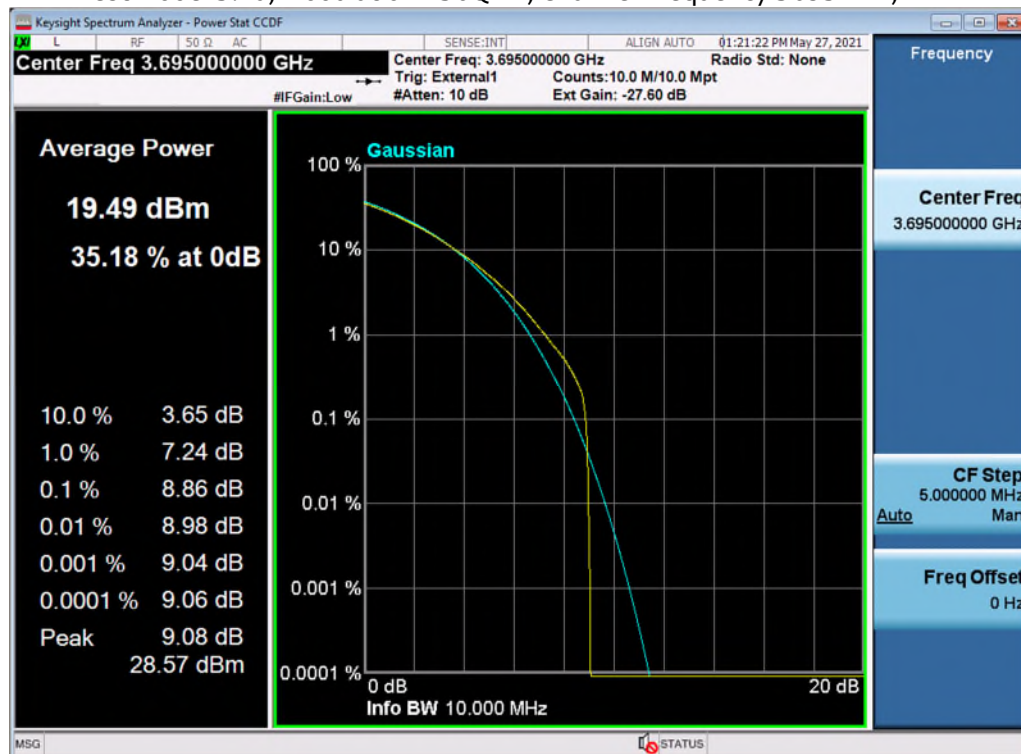
The Peak-to-Average Power Ratio (PAPR) was evaluated per ANSI C63.26 for 8-Beam 32T32R with 5, 10, 10+20, and 20+20 MHz bandwidth. The PAPR values of all carriers measured are below 13dB.

**Table 2.6 Peak to Average Power Ratio (8-Beam 32T32R)**

| # of Carriers      | Test Model | Modulation | TX Port | Channel Frequency MHz | Center Frequency MHz | Signal BW MHz | PAR at 0.1% Limit - 13 dB |
|--------------------|------------|------------|---------|-----------------------|----------------------|---------------|---------------------------|
| 1                  | 3.2        | QPSK/16QAM | 15      | 3555                  | 3555                 | 10            | 8.62                      |
| 1                  | 3.1        | 64QAM      | 3       | 3625                  | 3625                 | 10            | 8.63                      |
| 1                  | 3.1a       | 256QAM     | 12      | 3695                  | 3695                 | 10            | 8.86                      |
| 1                  | 3.1        | 64QAM      | 3       | 3560                  | 3560                 | 20            | 8.57                      |
| 1                  | 3.1a       | 256QAM     | 3       | 3625                  | 3625                 | 20            | 8.44                      |
| 1                  | 3.1a       | 256QAM     | 2       | 3690                  | 3690                 | 20            | 8.46                      |
| 2 (Contiguous)     | 3.2        | QPSK/16QAM | 4       | 3555+3570             | 3565                 | 10+20         | 8.56                      |
| 2 (Contiguous)     | 3.2        | QPSK/16QAM | 4       | 3625+3640             | 3635                 | 10+20         | 8.37                      |
| 2 (Contiguous)     | 3.2        | QPSK/16QAM | 4       | 3675+3690             | 3585                 | 10+20         | 8.66                      |
| 2 (Non-Contiguous) | 3.1a       | 256QAM     | 12      | 3555+3690             | 3555                 | 10+20         | 9.26                      |
| 2 (Non-Contiguous) | 3.1a       | 256QAM     | 12      | 3555+3690             | 3690                 | 10+20         | 8.46                      |
| 2 (Contiguous)     | 3.1        | 64QAM      | 6       | 3560+3580             | 3570                 | 20+20         | 8.60                      |
| 2 (Contiguous)     | 3.2        | QPSK/16QAM | 4       | 3560+3580             | 3570                 | 20+20         | 8.35                      |
| 2 (Contiguous)     | 3.2        | QPSK/16QAM | 3       | 3625+3645             | 3635                 | 20+20         | 9.08                      |
| 2 (Contiguous)     | 3.2        | QPSK/16QAM | 4       | 3670+3690             | 3680                 | 20+20         | 9.08                      |
| 2 (Non-Contiguous) | 3.1a       | 256QAM     | 9       | 3560+3690             | 3560                 | 20+20         | 6.12                      |
| 2 (Non-Contiguous) | 3.1a       | 256QAM     | 9       | 3560+3690             | 3690                 | 20+20         | 6.20                      |

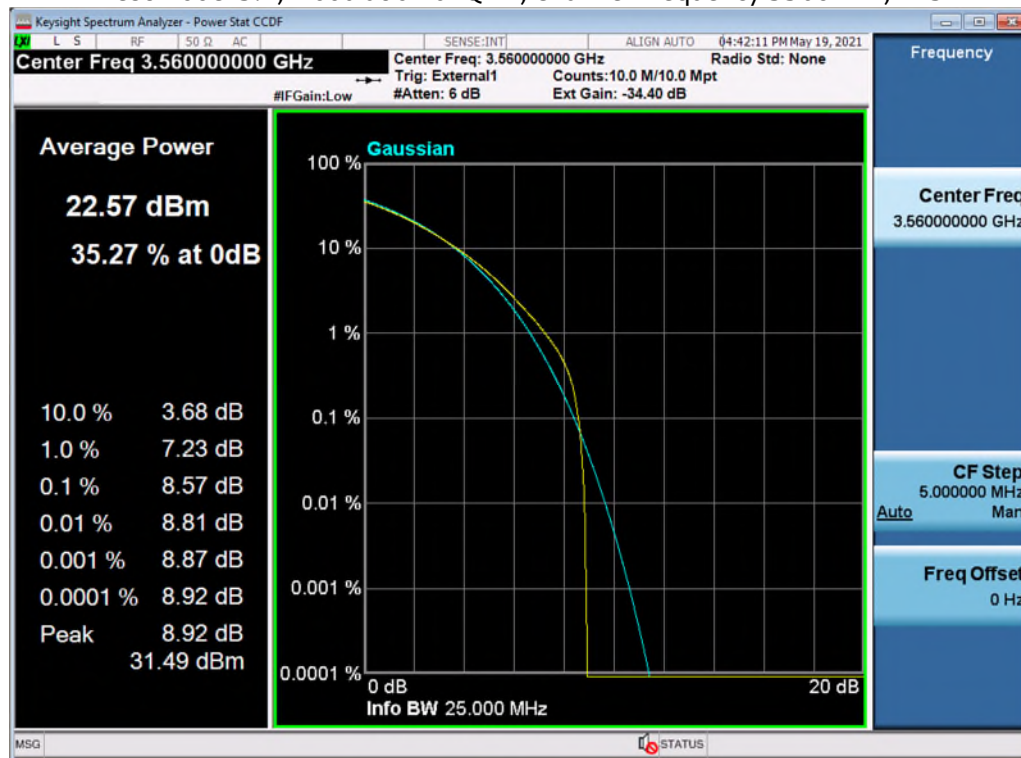
### Single Carrier - 8-Beam 32T32R 10 MHz

Test Model 3.1a, Modulation 256QAM, Channel Frequency 3695MHz, TX12

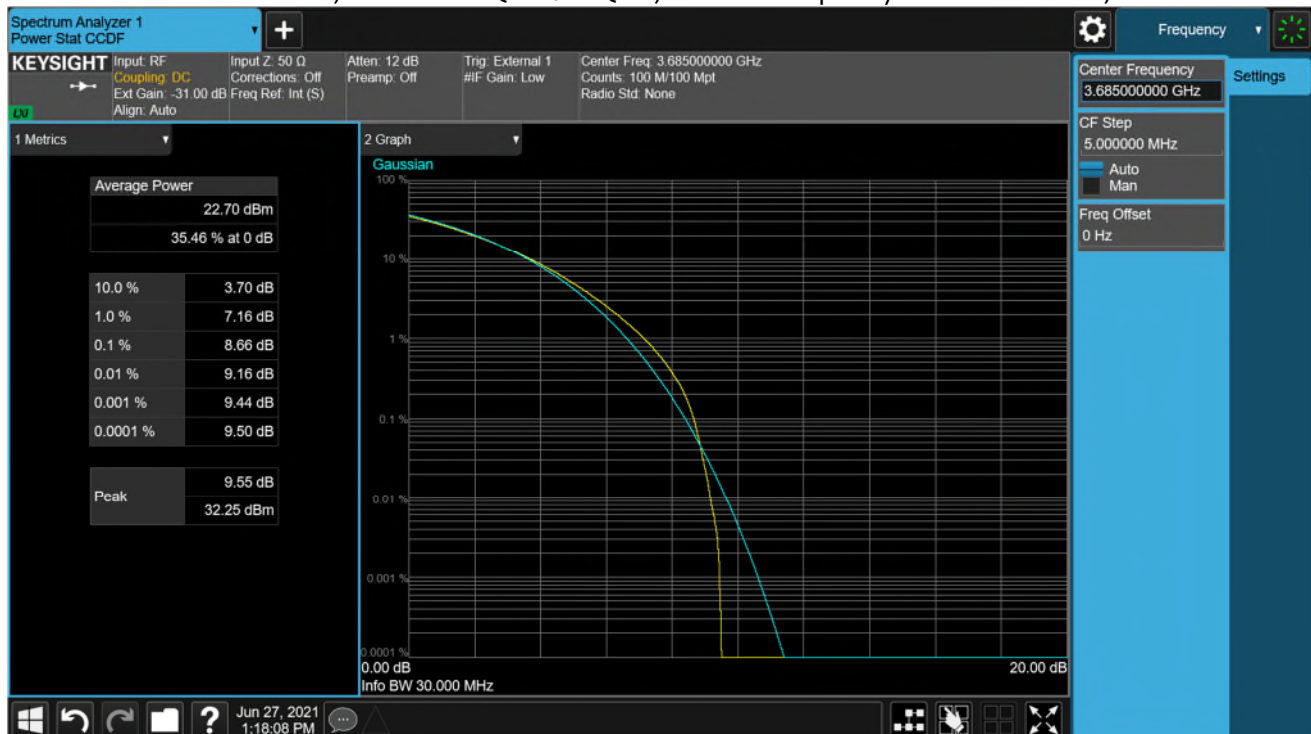


**Single Carrier - 8-Beam 32T32R 20 MHz**

Test Model 3.1, Modulation 64QAM, Channel Frequency 3560MHz, TX3

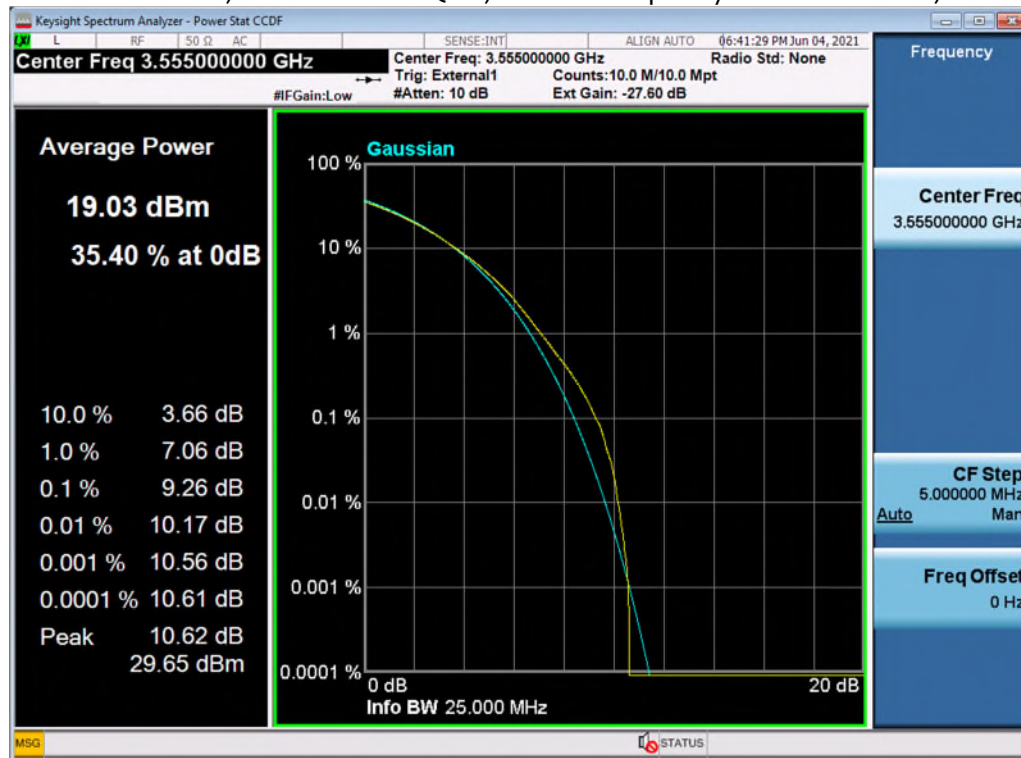
**Dual Carrier Contiguous - 8-Beam 32T32R 10+20 MHz**

Test Model 3.2, Modulation QPSK/16QAM, Channel Frequency 3675+3690 MHz, TX4



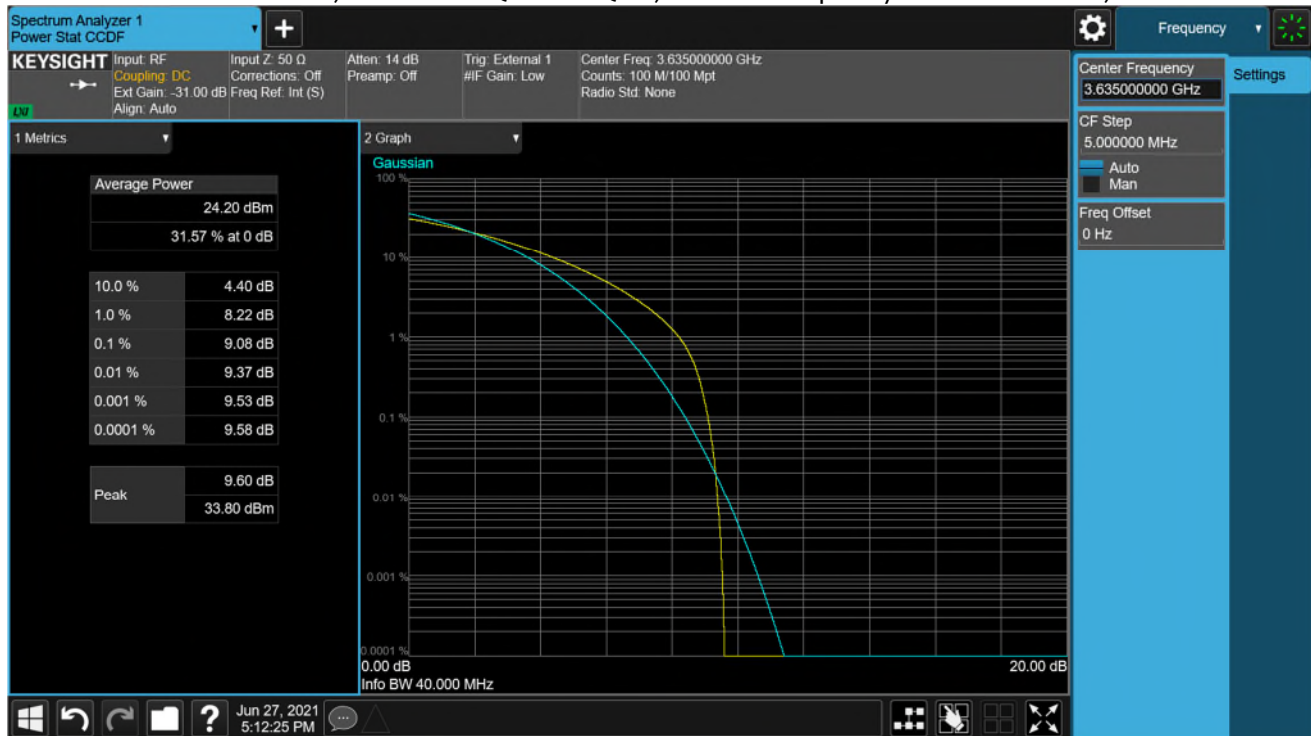
**Dual Carrier Non-Contiguous – 8-Beam 32T32R 10+20 MHz**

Test Model 3.1a, Modulation 256QAM, Channel Frequency 3555+3690 MHz, TX12

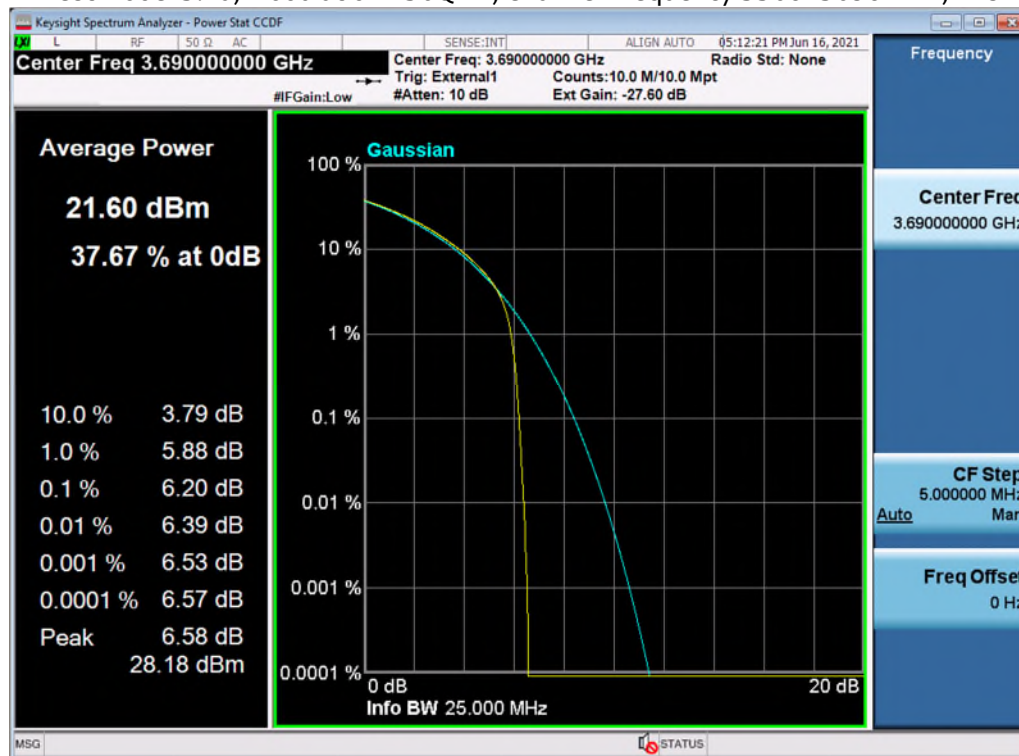


**Dual Carrier Contiguous – 8-Beam 32T32R 20+20 MHz**

Test Model 3.2, Modulation QPSK/16QAM, Channel Frequency 3625+3645 MHz, TX3

**Dual Carrier Non-Contiguous – 20+20 MHz BW**

Test Model 3.1a, Modulation 256QAM, Channel Frequency 3560+3690 MHz, TX9

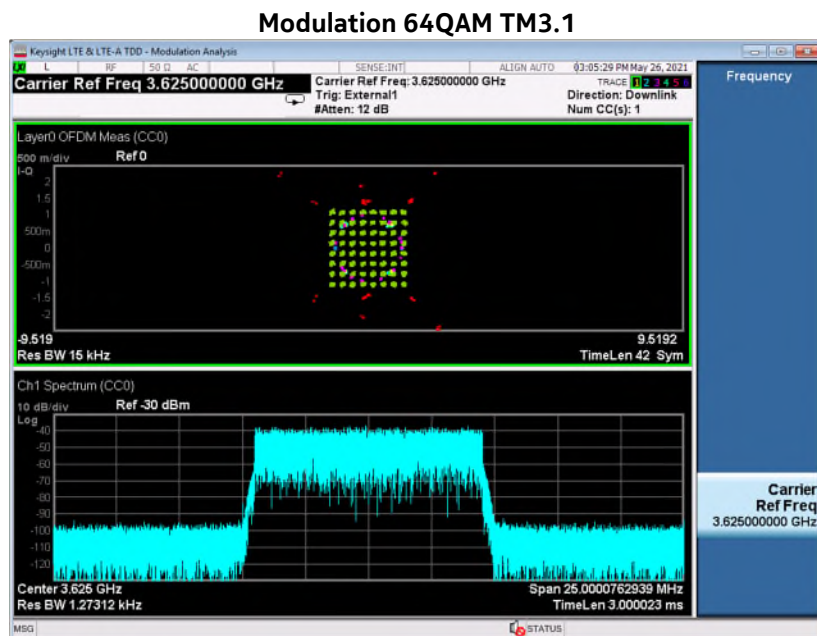
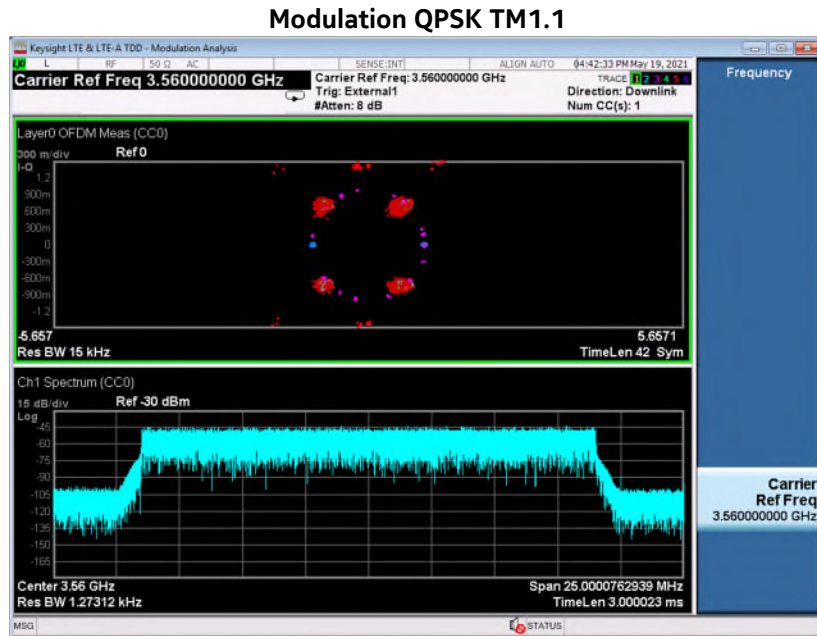


### 3. FCC Section 2.1047 - Modulation Characteristics

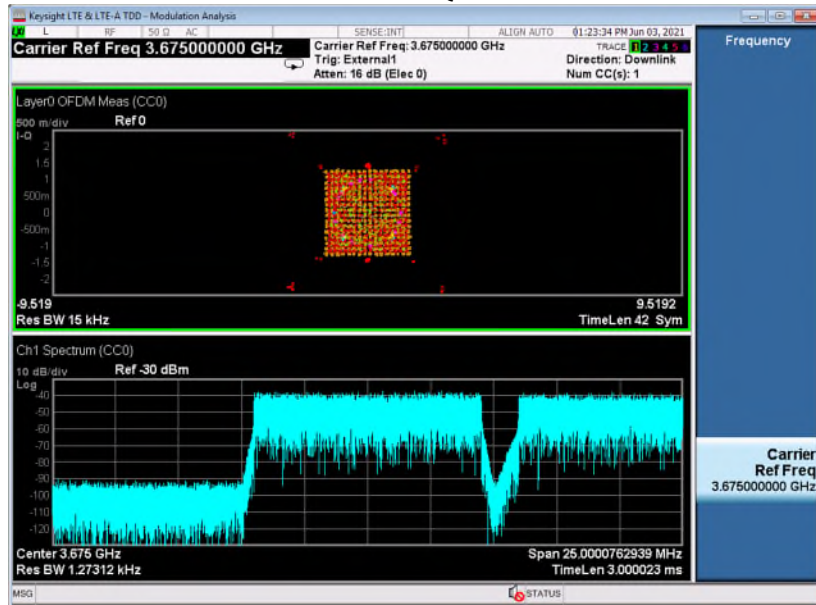
#### 3.1 Modulation Characteristics

The RF signal at the antenna port was demodulated and verified for correctness of the modulation signal used before each test was performed.

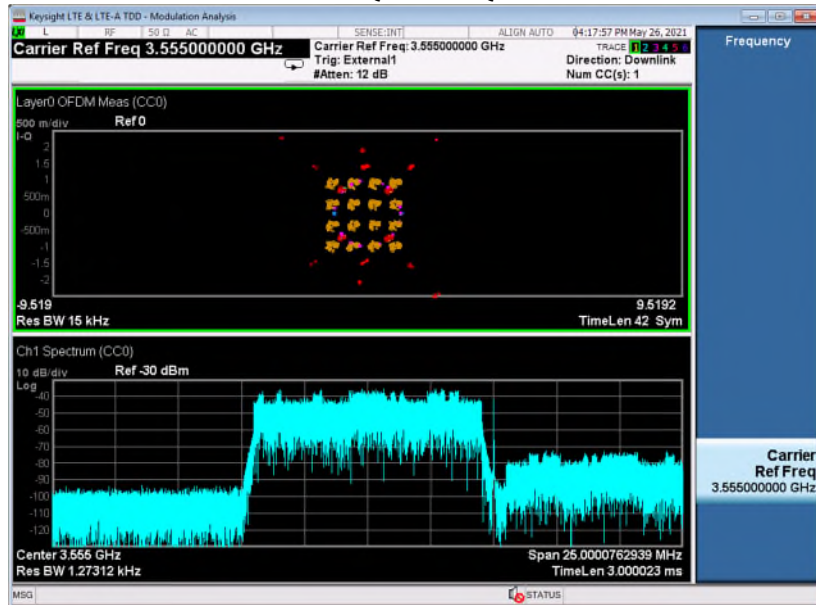
##### 3.1.1 Modulation Characteristics – Plots



## Modulation 256QAM TM3.1a



## Modulation QPSK/16QAM TM3.2



## 4. FCC Section 2.1049 – Occupied Bandwidth/Edge of Band Emissions

### 4.1 Occupied Bandwidth

In 47CFR 2.1049 the FCC requires:

“The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable.”

This required measurement is the 99% Occupied Bandwidth, also called the designated signal bandwidth and needs to be within the parameters of the products specified emissions designator. During these measurements it is customary to evaluate the Edge of Band emissions at block/band edges.

Part 96.41e(3) specified that The fundamental emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

The transmitted signal occupied bandwidth was measured using a Keysight MXA Signal Analyzer. All emissions were within the parameters as required. The 8-Beam 32T32R modes have higher conducted RF output power per port, therefore, 8-Beam 32T32R modes were used for occupied bandwidth and band edge emissions evaluations.

**AEQM 99% Occupied Bandwidth (8-Beam 32T32R)**

| # of Carriers      | Test Model | Modulation | TX Port | Channel Frequency MHz | Center Frequency MHz | Signal BW MHz | Occupied BW MHz |
|--------------------|------------|------------|---------|-----------------------|----------------------|---------------|-----------------|
| 1                  | 1.1        | QPSK       | 3       | 3555                  | 3555                 | 10            | 8.8551          |
| 1                  | 1.1        | QPSK       | 3       | 3625                  | 3625                 | 10            | 8.8579          |
| 1                  | 1.1        | QPSK       | 3       | 3695                  | 3695                 | 10            | 8.8555          |
| 1                  | 3.1        | 64QAM      | 3       | 3560                  | 3560                 | 20            | 17.728          |
| 1                  | 1.1        | QPSK       | 3       | 3625                  | 3625                 | 20            | 17.733          |
| 1                  | 1.1        | QPSK       | 3       | 3690                  | 3690                 | 20            | 17.732          |
| 2 (Contiguous)     | 1.1        | QPSK       | 3       | 3555+3570             | 3565                 | 10+20         | 28.15           |
| 2 (Contiguous)     | 1.1        | QPSK       | 3       | 3625+3640             | 3635                 | 10+20         | 28.144          |
| 2 (Contiguous)     | 3.1a       | 256QAM     | 14      | 3675+3690             | 3685                 | 10+20         | 28.162          |
| 2 (Non-Contiguous) | 3.1a       | 256QAM     | 12      | 3555+3690             | 3555+3690            | 10+20         | 9.1767+18.258   |
| 2 (Contiguous)     | 1.1        | QPSK       | 6       | 3560+3580             | 3570                 | 20+20         | 37.655          |
| 2 (Contiguous)     | 1.1        | QPSK       | 8       | 3625+3645             | 3635                 | 20+20         | 37.530          |
| 2 (Contiguous)     | 1.1        | QPSK       | 10      | 3670+3690             | 3680                 | 20+20         | 37.672          |
| 2 (Non-Contiguous) | 3.1a       | 256QAM     | 9       | 3560+3690             | 3560+3690            | 20+20         | 18.232+18.259   |

**AEQM 26dB Emission Bandwidth**

| # of Carriers      | Test Model | Modulation | TX Port | Channel Frequency MHz | Center Frequency MHz | Signal BW MHz | Occupied BW MHz |
|--------------------|------------|------------|---------|-----------------------|----------------------|---------------|-----------------|
| 1                  | 1.1        | QPSK       | 3       | 3555                  | 3555                 | 10            | 9.265           |
| 1                  | 1.1        | QPSK       | 3       | 3625                  | 3625                 | 10            | 9.268           |
| 1                  | 1.1        | QPSK       | 3       | 3695                  | 3695                 | 10            | 9.265           |
| 1                  | 3.1        | 64QAM      | 3       | 3560                  | 3560                 | 20            | 18.32           |
| 1                  | 1.1        | QPSK       | 3       | 3625                  | 3625                 | 20            | 18.33           |
| 1                  | 1.1        | QPSK       | 3       | 3690                  | 3690                 | 20            | 18.31           |
| 2 (Contiguous)     | 1.1        | QPSK       | 3       | 3555+3570             | 3565                 | 10+20         | 29.18           |
| 2 (Contiguous)     | 1.1        | QPSK       | 3       | 3625+3640             | 3635                 | 10+20         | 29.07           |
| 2 (Contiguous)     | 3.1a       | 256QAM     | 14      | 3675+3690             | 3685                 | 10+20         | 29.18           |
| 2 (Non-Contiguous) | 3.1a       | 256QAM     | 12      | 3555+3690             | 3555+3690            | 10+20         | 9.747+20.0      |
| 2 (Contiguous)     | 1.1        | QPSK       | 6       | 3560+3580             | 3570                 | 20+20         | 39.60           |
| 2 (Contiguous)     | 1.1        | QPSK       | 8       | 3625+3645             | 3635                 | 20+20         | 39.94           |
| 2 (Contiguous)     | 1.1        | QPSK       | 10      | 3670+3690             | 3680                 | 20+20         | 39.58           |
| 2 (Non-Contiguous) | 3.1a       | 256QAM     | 9       | 3560+3690             | 3560+3690            | 20+20         | 20.0+20.0       |

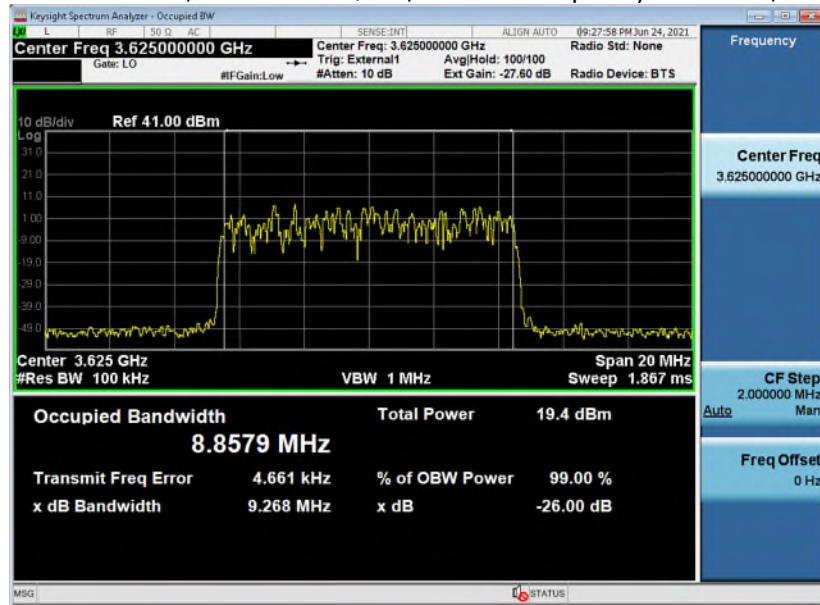
## 4.1.1 Occupied Bandwidth – Plots

NOTE: Only the plots which give the widest bandwidth for each configuration evaluated are used in this report. The full suite of raw data resides at the MH, New Jersey location.

### 4.1.1.1 99% Occupied Bandwidth Plots

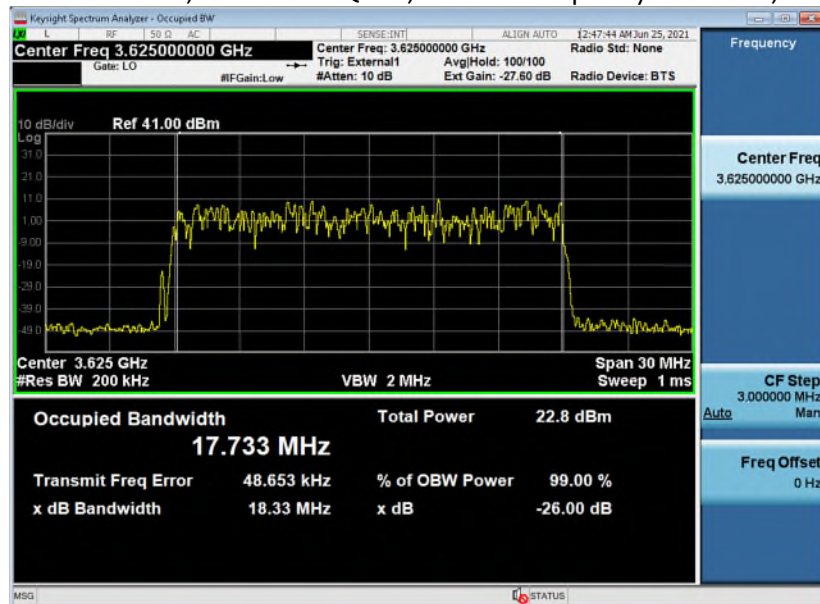
#### Single Carrier - 8-Beam 32T32R 10 MHz

Test Model 1.1, Modulation QPSK, Channel Frequency 3625MHz, TX3



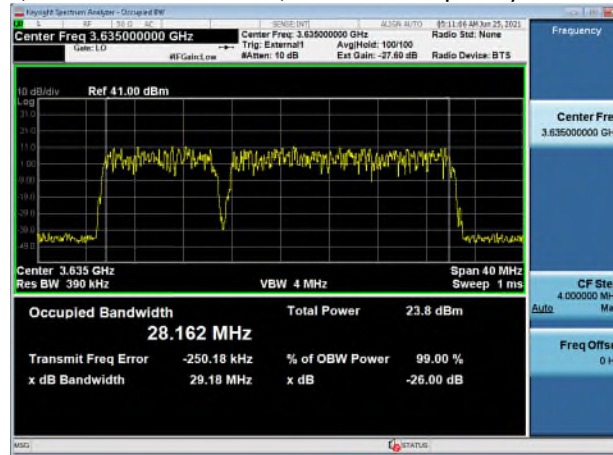
#### Single Carrier - 8-Beam 32T32R 20 MHz

Test Model 1.1, Modulation QPSK, Channel Frequency 3625MHz, TX3

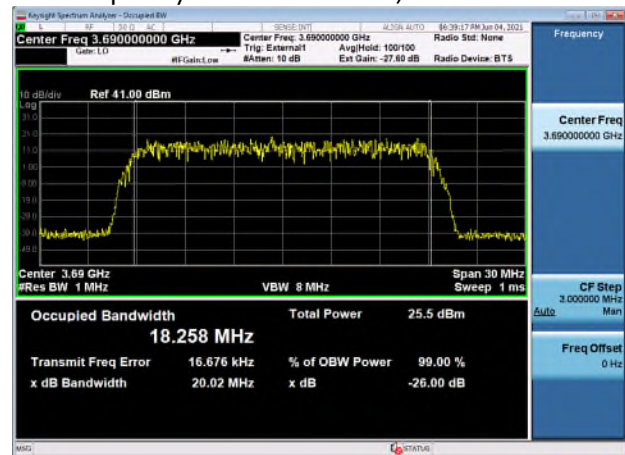
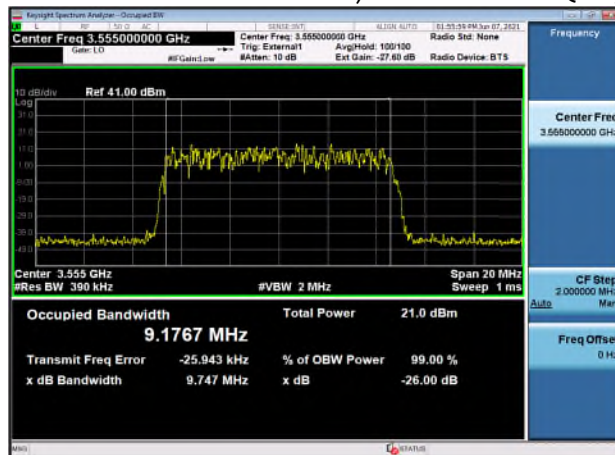


**Dual Carrier Contiguous – 8-Beam 32T32R 10+20 MHz**

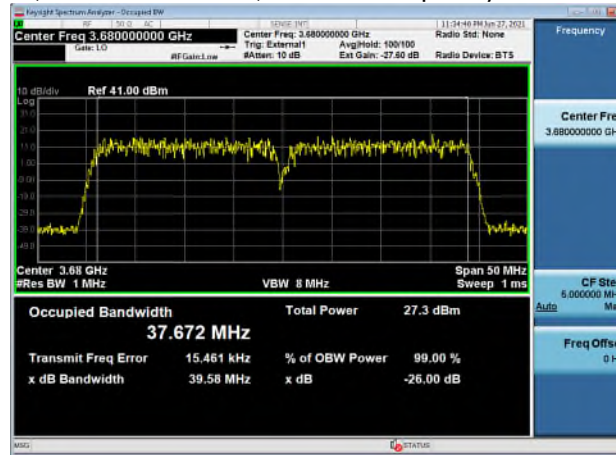
Test Model 3.1a, Modulation 256QAM, Channel Frequency 3675+3690 MHz, TX14

**Dual Carrier Non-Contiguous – 8-Beam 32T32R 10+20 MHz**

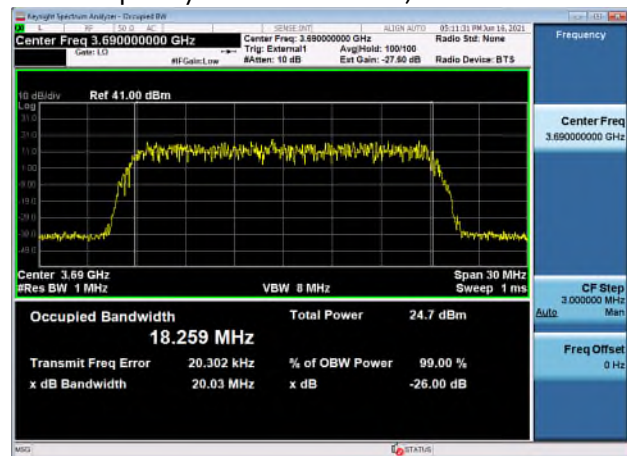
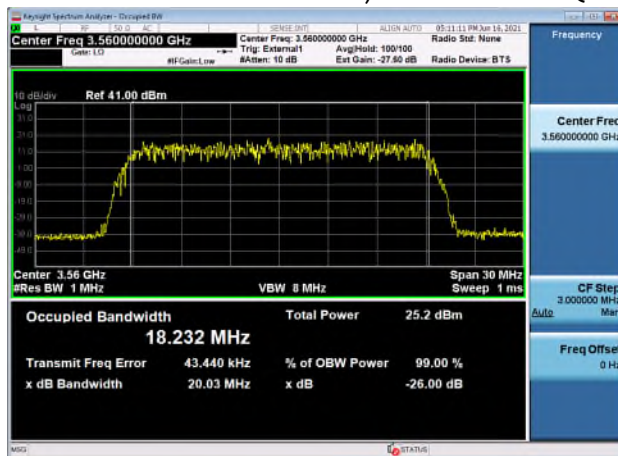
Test Model 3.1a, Modulation 256QAM, Channel Frequency 3555+3690 MHz, TX12



**Dual Carrier Contiguous – 8-Beam 32T32R 20+20 MHz**  
Test Model 1.1, Modulation QPSK, Channel Frequency 3670+3690 MHz, TX10



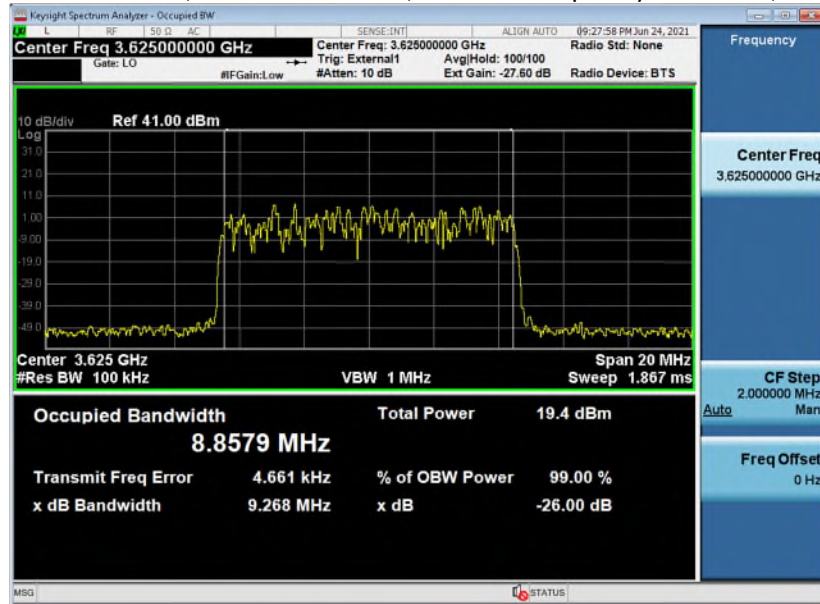
**Dual Carrier Non-Contiguous – 8-Beam 32T32R 20+20 MHz**  
Test Model 3.1a, Modulation 256QAM, Channel Frequency 3560+3690 MHz, TX9



#### 4.1.1.2 26 dB Emission Bandwidth Plots

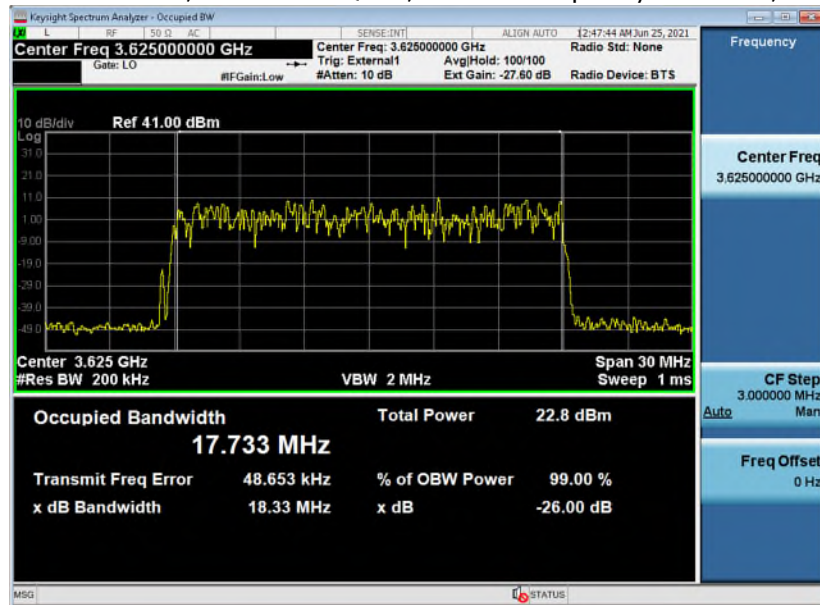
##### Single Carrier - 8-Beam 32T32R 10 MHz

Test Model 1.1, Modulation QPSK, Channel Frequency 3625MHz, TX3



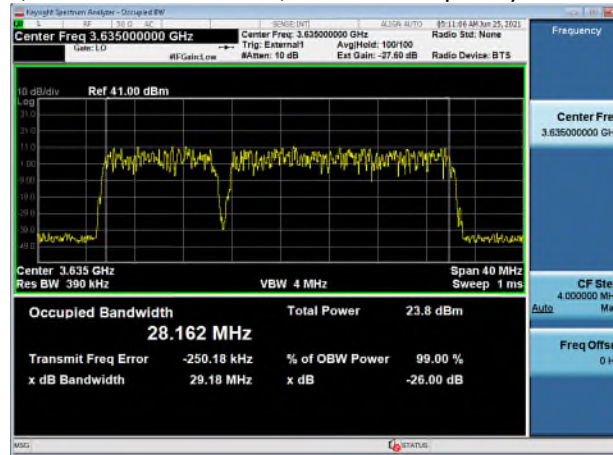
##### Single Carrier - 8-Beam 32T32R 20 MHz

Test Model 1.1, Modulation QPSK, Channel Frequency 3625MHz, TX3

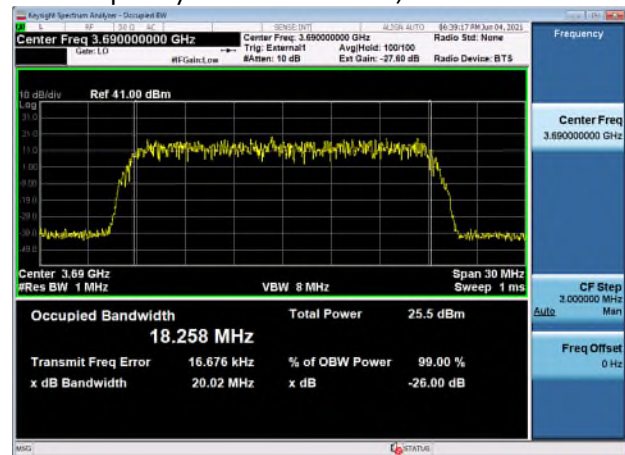
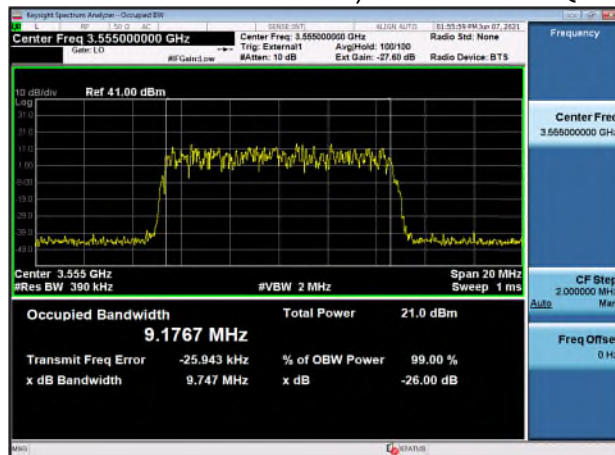


**Dual Carrier Contiguous – 8-Beam 32T32R 10+20 MHz**

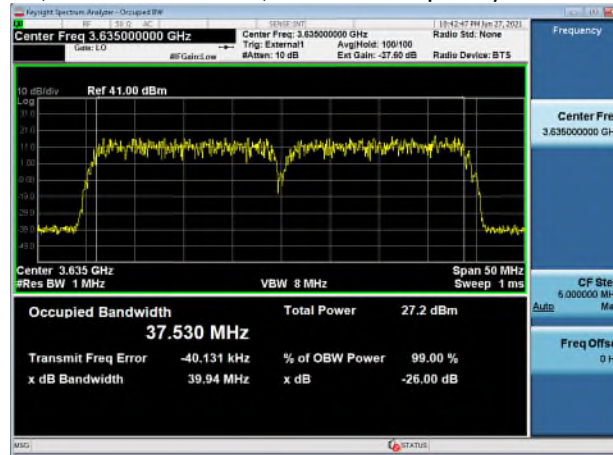
Test Model 3.1a, Modulation 256QAM, Channel Frequency 3675+3690 MHz, TX14

**Dual Carrier Non-Contiguous – 8-Beam 32T32R 10+20 MHz**

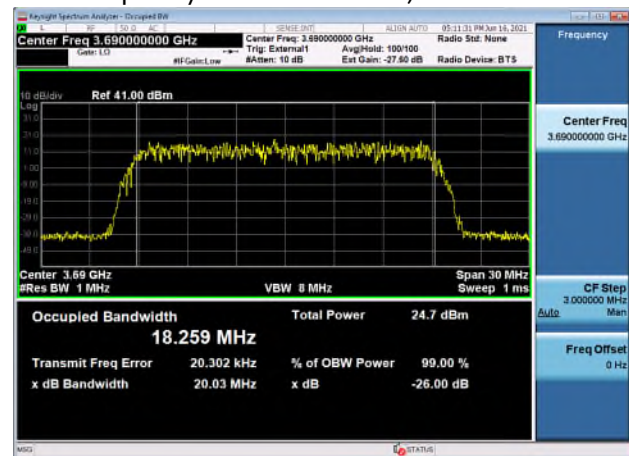
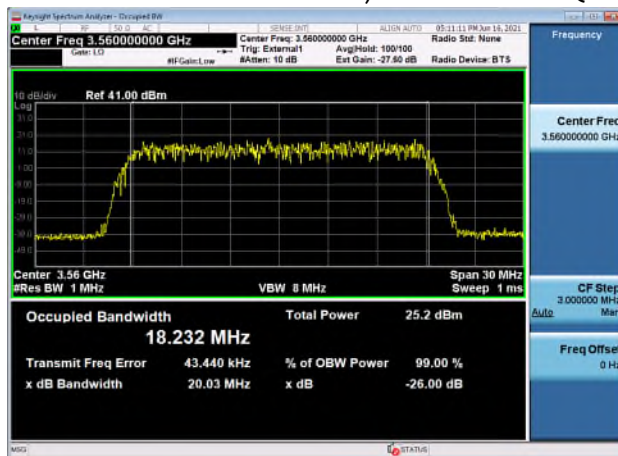
Test Model 3.1a, Modulation 256QAM, Channel Frequency 3555+3690 MHz, TX12



**Dual Carrier Contiguous – 8-Beam 32T32R 20+20 MHz**  
Test Model 1.1, Modulation QPSK, Channel Frequency 3625+3645 MHz, TX8



**Dual Carrier Non-Contiguous – 8-Beam 32T32R 20+20 MHz**  
Test Model 3.1a, Modulation 256QAM, Channel Frequency 3560+3690 MHz, TX9



## 4.2 Edge of band Emissions

47CFR 96.41 (e)(1) (i) and KDB 940660 D01 Section 3.2 (b)(6) specified that the limits for the emissions outside the fundamental are as follows.

- within 0 MHz to 10 MHz above and below the assigned channel  $\leq -13$  dBm/MHz,
- greater than 10 MHz above and below the assigned channel  $\leq -25$  dBm/MHz,
- any emission below 3530 MHz and above 3720 MHz  $\leq -40$  dBm/MHz.

47CFR 96.41 (e)(3) and KDB 940660 D01 Section 3.2 (b)(6) specified stated that (i) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 Megahertz band immediately outside and adjacent to the licensee's authorized frequency channel, a resolution bandwidth of no less than one percent of the fundamental emission bandwidth may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full reference bandwidth (*i.e.*, 1 MHz or 1 percent of emission bandwidth, as specified). The fundamental emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power. (ii) When measuring unwanted emissions to demonstrate compliance with the limits, the CBSD and End User Device nominal carrier frequency/channel shall be adjusted as close to the licensee's authorized frequency block edges, both upper and lower, as the design permits. (iii) Compliance with emission limits shall be demonstrated using either average (RMS)-detected or peak-detected power measurement techniques.

KDB 940660 D01 Section 3.2 (b)(6) specified that measurements must be performed for low, mid, and high channels. It is acceptable to apply the procedures in Section 5.7 of ANSI C63.26-2015. When antenna-port conducted measurements are performed to demonstrate compliance to the applicable unwanted emission limits (Section 2.1051), a separate radiated measurement is required to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation (Section 2.1053). The Section 96.41(e) limits generally also apply to radiated unwanted emissions.

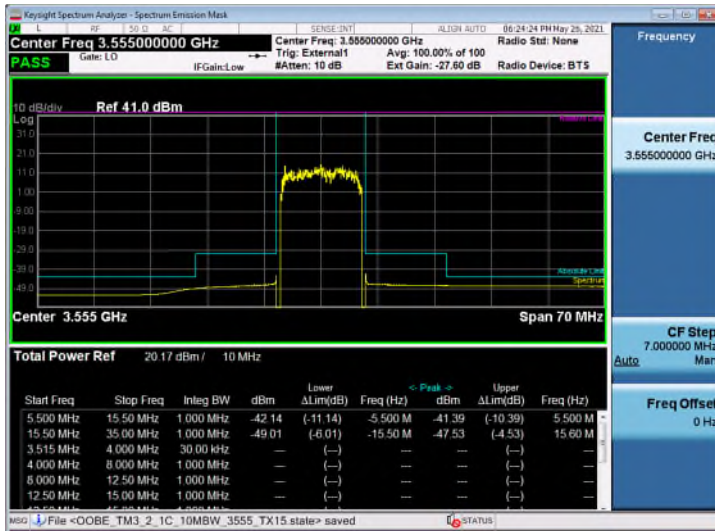
The Edge of Band emissions of the EUT at the external antenna connector (EAC) were measured using a Keysight MXA Signal Analyzer. The RF power level was continuously measured using a RF broadband power meter. The RF output from the EAC port to signal analyzer was reduced (to an amplitude usable by the signal analyzer) by using a calibrated attenuator and test coupler. The path attenuation was offset on the display and the signal for the carrier was adjusted to the corrected RF power level for the resolution bandwidth used for the transmit signal. All mask values were adjusted based upon the designated signal bandwidth and measurement bandwidths. The Top of Mask corresponds to the set rated power level as confirmed by the RF power meter.

### 4.2.1 Edge of Band Emissions - Plots.

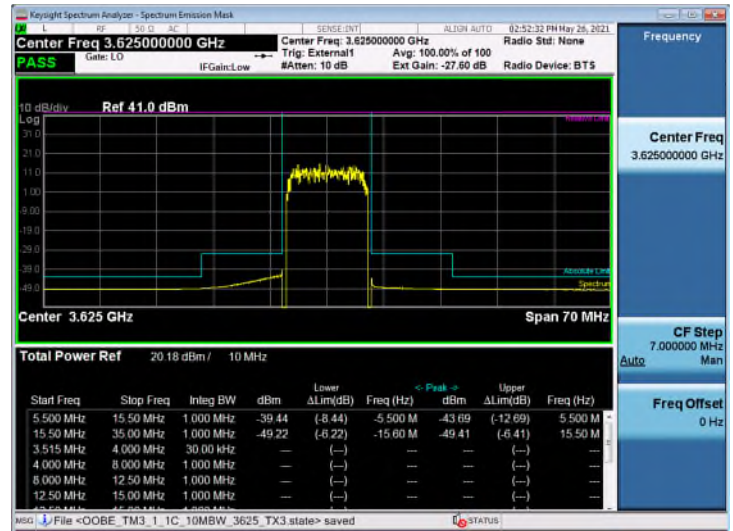
All of the measurements met the requirements of Part 96.41(e)(1) and KDB 940660 D01 Section 3.2 (b)(6) when measured per Part 2.1049.

#### Single Carrier - 8-Beam 32T32R 10 MHz

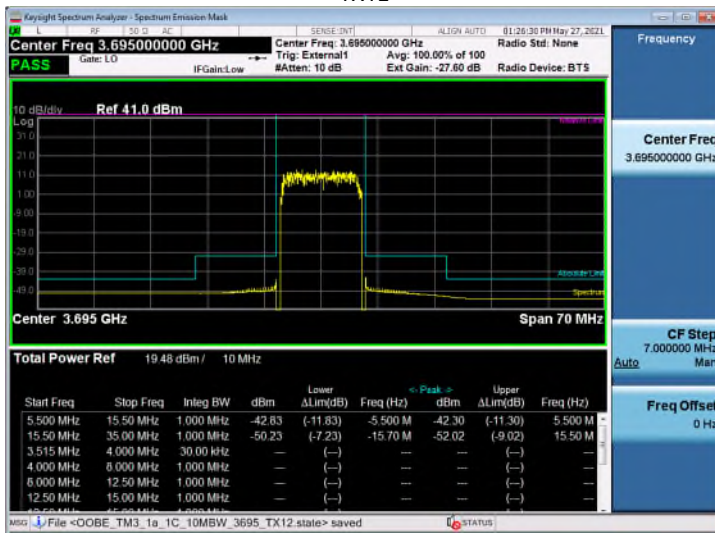
Test Model 3.2, Modulation QPSK/16QAM, Channel Frequency 3555 MHz, TX15



Test Model 3.1, Modulation 64QAM, Channel Frequency 3625 MHz, TX3



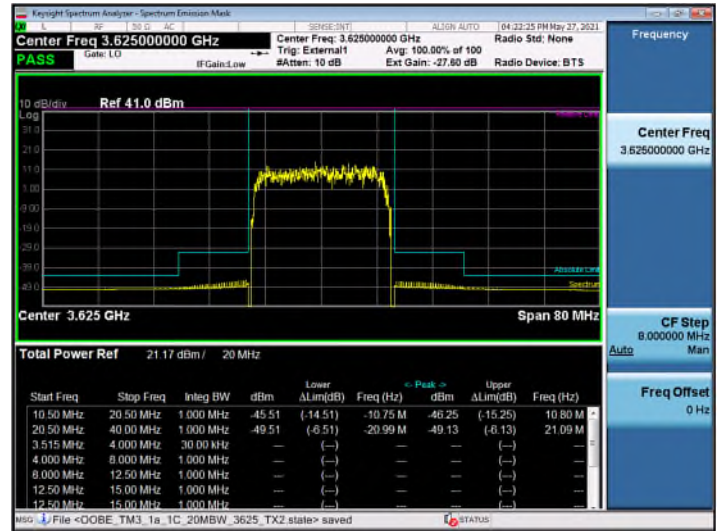
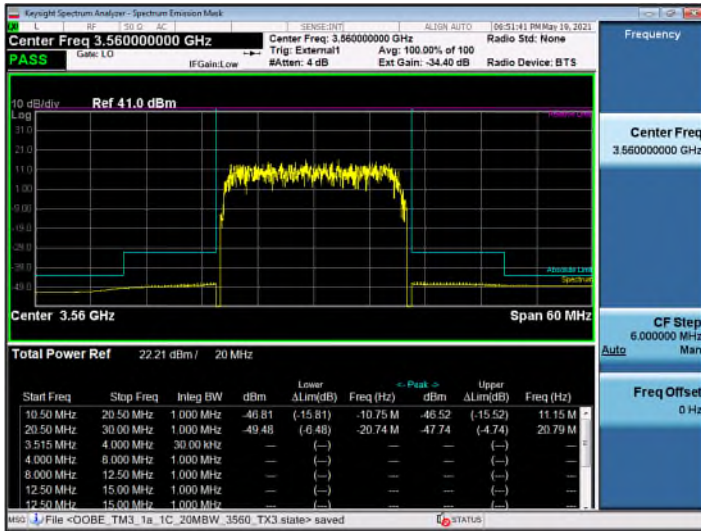
Test Model 3.1a, Modulation 256QAM, Channel Frequency 3695 MHz, TX12



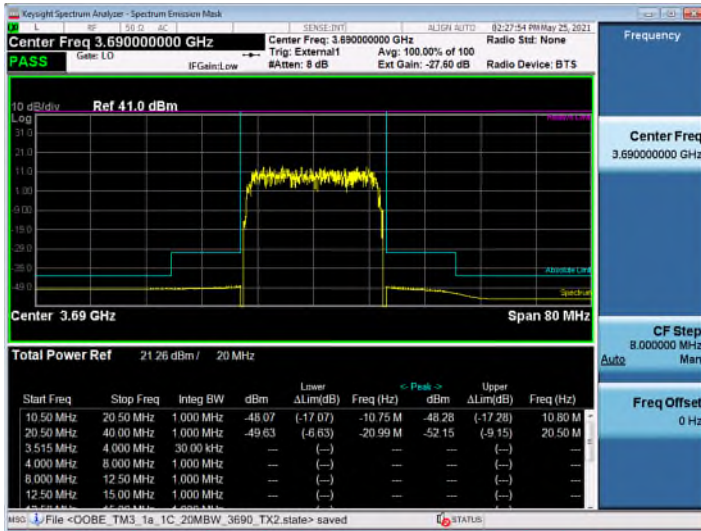
## Single Carrier - 8-Beam 32T32R 20 MHz

Test Model 3.1, Modulation 64QAM, Channel Frequency 3560 MHz, TX3

Test Model 3.1a, Modulation 256QAM, Channel Frequency 3625 MHz, TX3

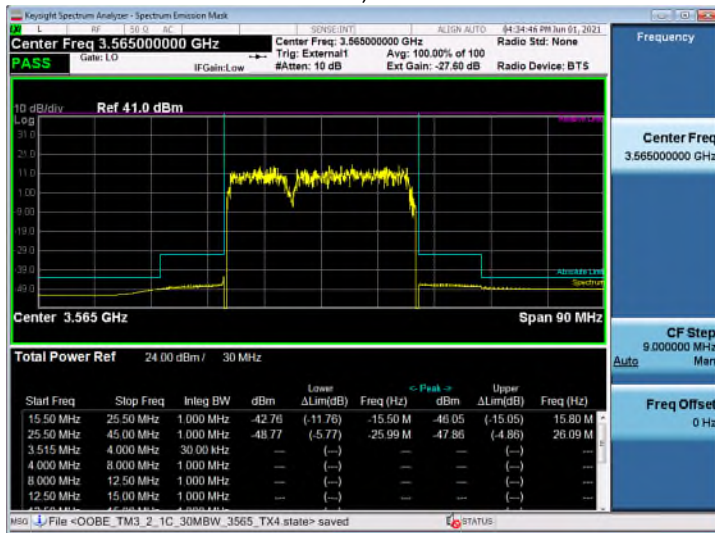


Test Model 3.1a, Modulation 256QAM, Channel Frequency 3690 MHz, TX2

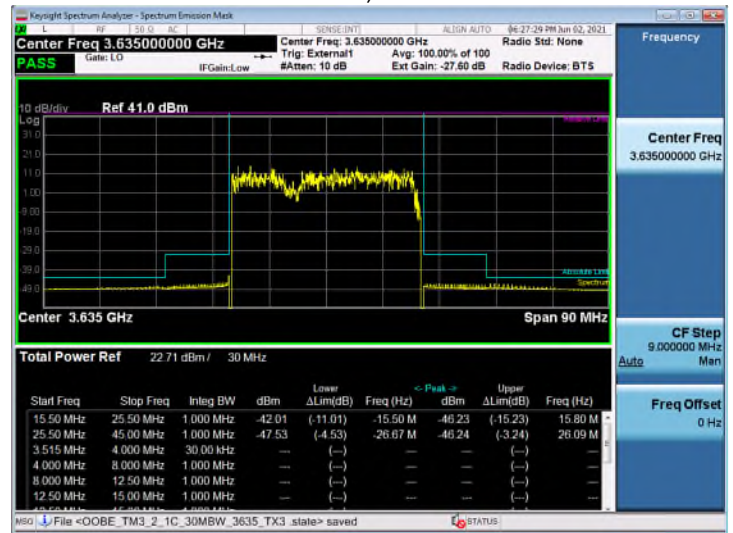


**Dual Carrier Contiguous – 8-Beam 32T32R 10+20 MHz**

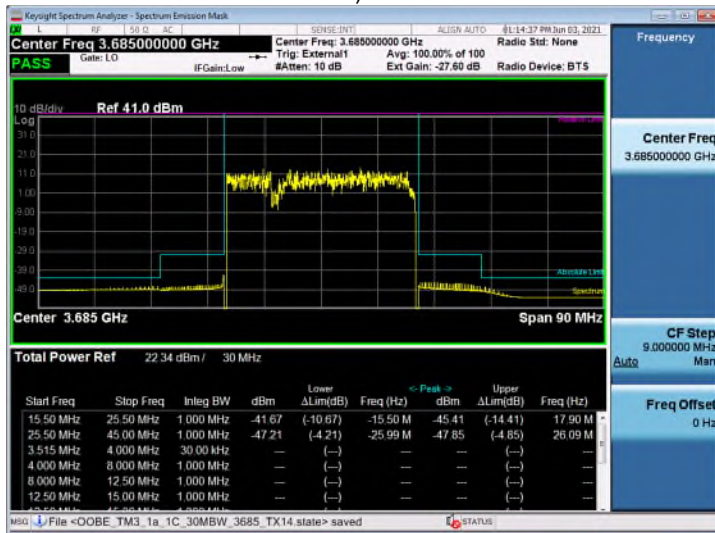
Test Model 3.2, Modulation QPSK/16QAM, Channel Frequency 3555+3570 MHz, TX4



Test Model 3.2, Modulation QPSK/16QAM, Channel Frequency 3625+3640 MHz, TX3

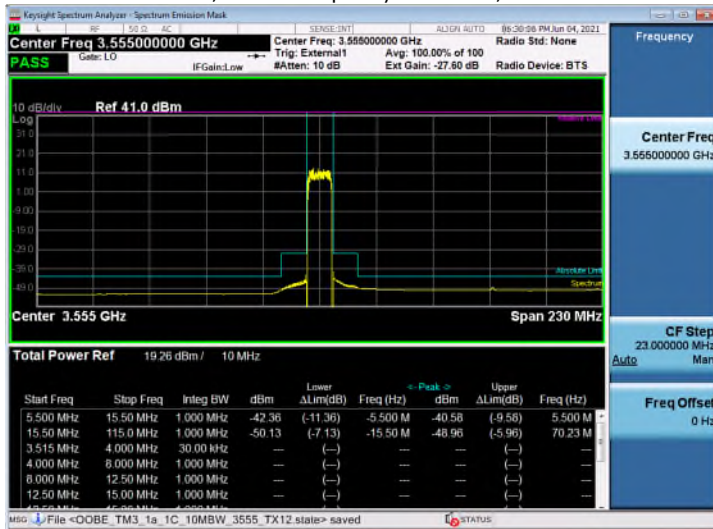


Test Model 3.1a, Modulation 256QAM, Channel Frequency 3675+3690 MHz, TX14

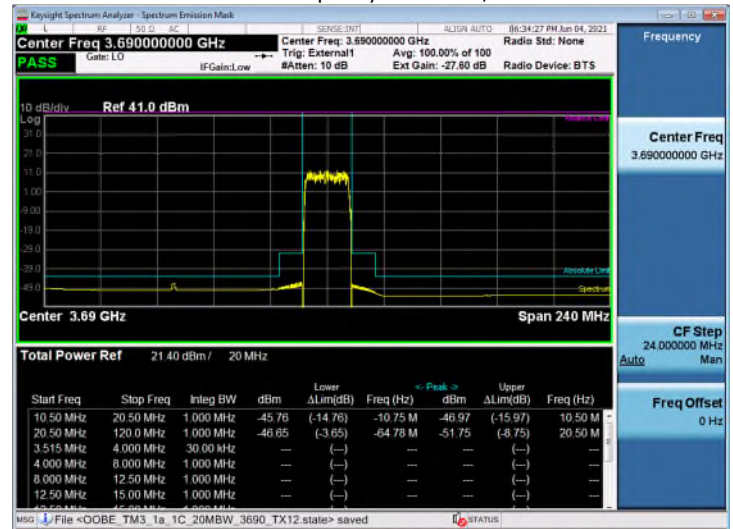


**Dual Carrier Non-Contiguous  
8-Beam 32T32R 10+20 MHz**

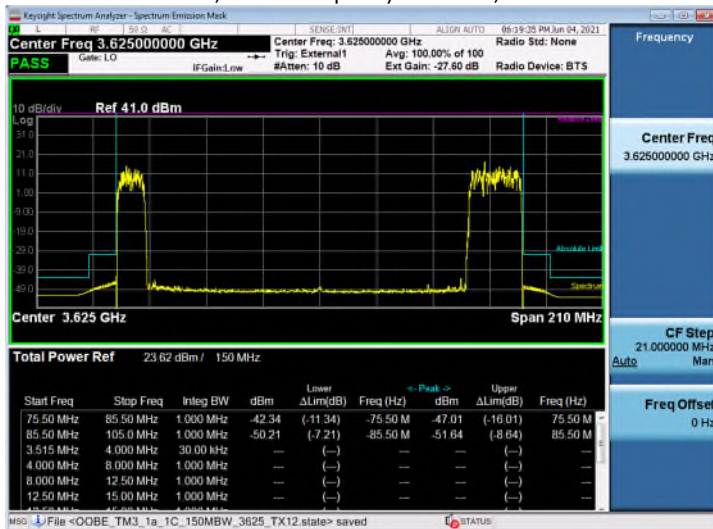
Test Model 3.1a, Modulation 256QAM, Channel Frequency 3555+3690 MHz, Center Frequency 3555 MHz, TX12

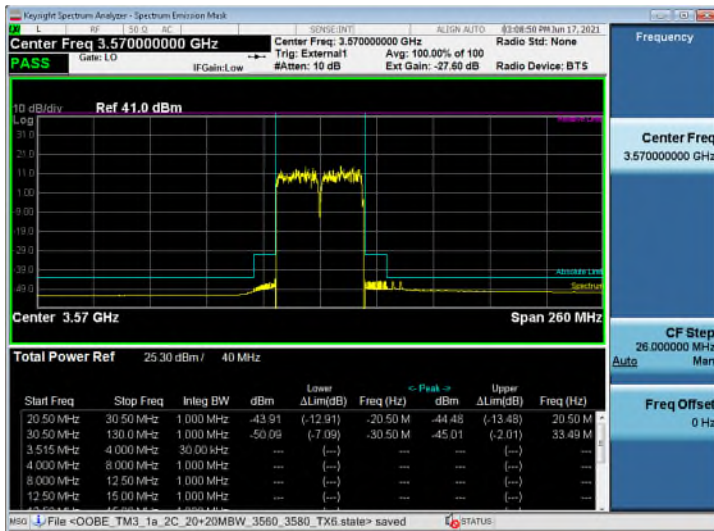
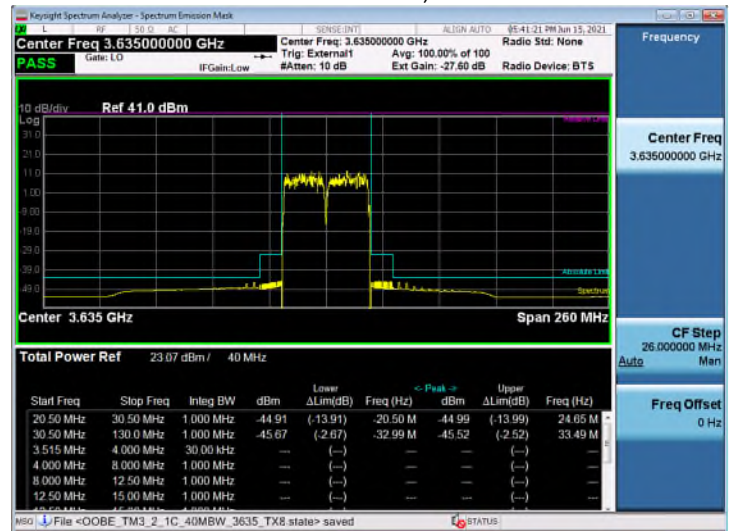
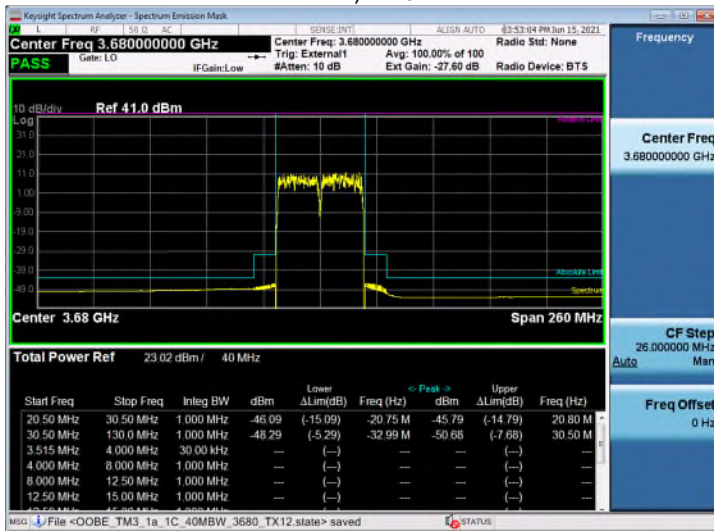


Test Model 3.1a, Modulation 256QAM, Channel Frequency 3555+3690 MHz, Center Frequency 3690 MHz, TX12



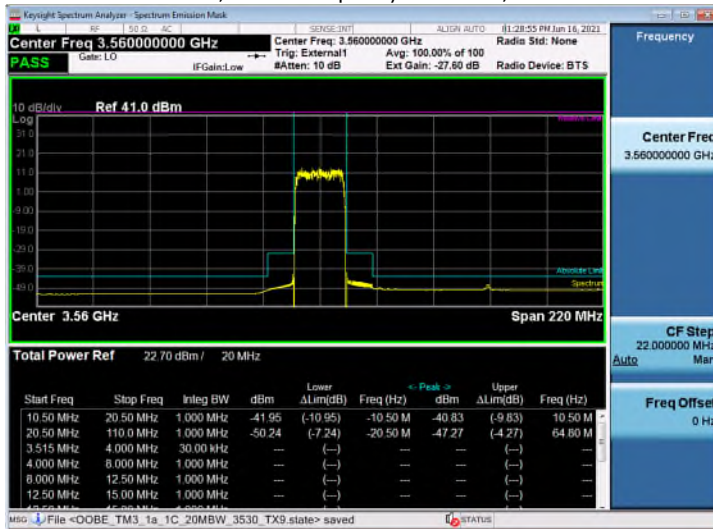
Test Model 3.1a, Modulation 256QAM, Channel Frequency 3555+3690 MHz, Center Frequency 3625 MHz, TX12



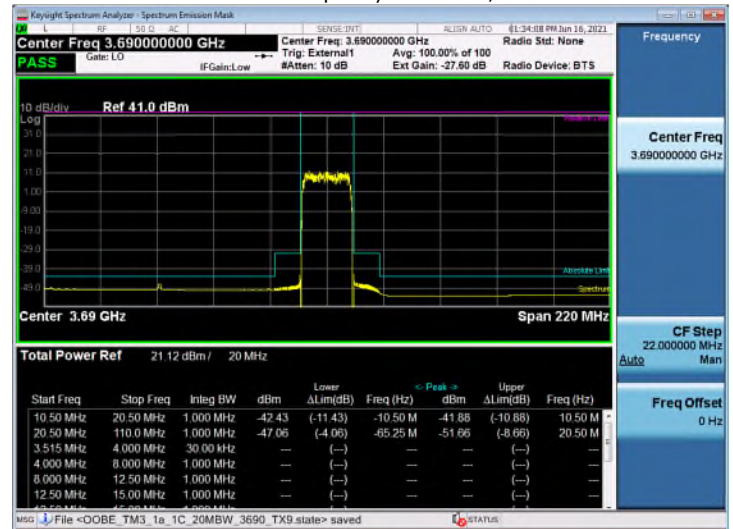
**Dual Carrier Contiguous – 8-Beam 32T32R 20+20 MHz**Test Model 3.1, Modulation 64QAM, Channel Frequency 3560+3580 MHz,  
TX6Test Model 3.2, Modulation QPSK/16QAM, Channel Frequency  
3625+3645MHz, TX8Test Model 3.1a, Modulation 256QAM, Channel Frequency 3670+3690  
MHz, TX10

**Dual Carrier Non-Contiguous  
8-Beam 32T32R 20+20 MHz**

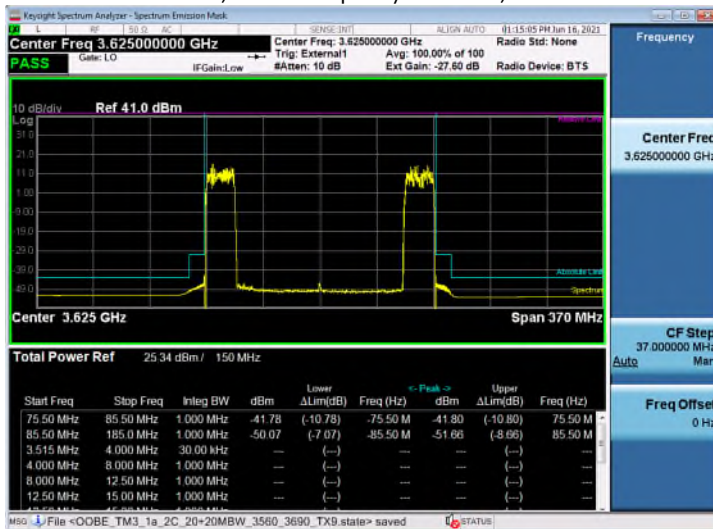
Test Model 3.1a, Modulation 256QAM, Channel Frequency 3560+3690 MHz, Center Frequency 3560 MHz, TX9



Test Model 3.1a, Modulation 256QAM, Channel Frequency 3560+3690 MHz, Center Frequency 3690 MHz, TX9



Test Model 3.1a, Modulation 256QAM, Channel Frequency 3560+3690 MHz, Center Frequency 3625MHz, TX9



## 5. FCC Section 2.1051 - Spurious Emissions at Transmit Antenna Port

This test measures the emissions of spurious signals which may come from harmonic, parasitic, intermodulation and frequency conversion products and are outside the necessary bandwidth but excludes Edge-of-Band emissions.

### 5.1 Section 2.1051 Spurious Emissions at Antenna Terminals

Spurious Emissions at the antenna terminals were investigated per 47CFR Section 2.1057(a)(1) over the frequency range of 9 KHz to 38 GHz which is beyond the 10th harmonic of the carrier frequency. A test coupler and/or attenuator which incorporates a low intermod broadband RF attenuator was used to reduce the transceiver's amplitude to a level usable by the spectrum analyzer.

The spurious measurements were made using a PC based automated test system which controls either a MXA Signal Analyzer or a Rohde & Schwarz ESU-40 Test Receiver/ Spectrum Analyzer. These measurements are performed in compliance with ANSI C63.26 and our ISO17025 process. The measurement meets the ANSI C63.26 requirements in paragraphs 5.2.4.4.1 and 5.7 which requires that the number of points in the sweep be  $> 2 \times \text{Span/RBW}$ .

The required emission limitation specified in **47CFR 96.41 (e)** was applied to these tests. Based upon the criterion given in Section 96 of the Code, the required emission limit for emissions outside a licensee's frequency block is:

47CFR 96.41 (e)(2) Additional protection levels. Notwithstanding paragraph (d)(1) of this section, the conducted power of any emissions below 3530 MHz or above 3720 MHz shall not exceed  $-40\text{dBm/MHz}$ . In order to account for the spectral adding of identical signals from the primary and diversity ports, per KDB 662911 D01 Multiple Transmitter Output v01r01, the level needs be adjusted by  $10\text{LOG}(n)$  where  $n$  = number of outputs.

The adjustment for  $n=64 \rightarrow 10\text{LOG}(64) = 18.06\text{ dB}$

Therefore, the limit for emissions  $>1\text{ MHz}$  outside a licensee's frequency block when measured with a RBW of 1 MHz is:

$-40\text{ dBm} - 18.06\text{ dB} = -58.06\text{ dBm}$  for 64x MIMO

## 5.2 Spurious Emissions at Antenna Terminals Results

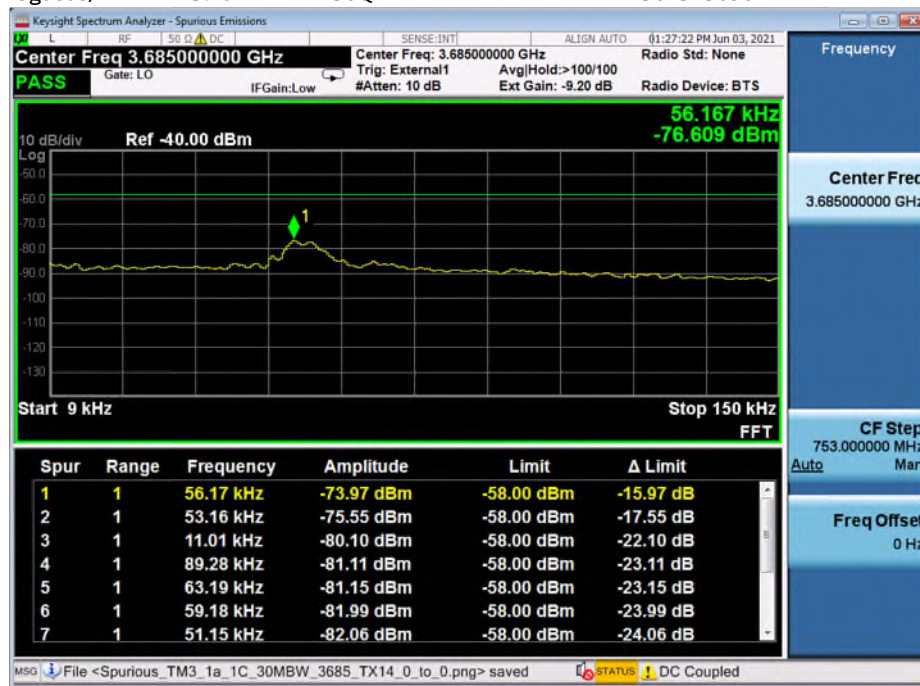
NOTE: Only plots with lowest margin in each frequency range are used in this report. The full suite of raw data resides at the MH, New Jersey location.

**Tabular Data – Spurious Emissions at Antenna Terminals**

| # of Carriers      | Test Model | Modulation | TX Port | Channel Frequency MHz | Signal BW MHz | Conducted Spurious Emissions Results Pass/ Fail |
|--------------------|------------|------------|---------|-----------------------|---------------|-------------------------------------------------|
| 1                  | 3.2        | QPSK/16QAM | 15      | 3555                  | 10            | Pass                                            |
| 1                  | 3.1        | 64QAM      | 3       | 3625                  | 10            | Pass                                            |
| 1                  | 3.1a       | 256QAM     | 12      | 3695                  | 10            | Pass                                            |
| 1                  | 3.1        | 64QAM      | 3       | 3560                  | 20            | Pass                                            |
| 1                  | 3.1a       | 256QAM     | 3       | 3625                  | 20            | Pass                                            |
| 1                  | 3.1a       | 256QAM     | 2       | 3690                  | 20            | Pass                                            |
| 2 (Contiguous)     | 3.2        | QPSK/16QAM | 4       | 3555+3570             | 10+20         | Pass                                            |
| 2 (Contiguous)     | 3.2        | QPSK/16QAM | 3       | 3625+3640             | 10+20         | Pass                                            |
| 2 (Contiguous)     | 3.1a       | 256QAM     | 14      | 3675+3690             | 10+20         | Pass                                            |
| 2 (Non-Contiguous) | 3.1a       | 256QAM     | 12      | 3555+3690             | 10+20         | Pass                                            |
| 2 (Contiguous)     | 3.1        | 256QAM     | 6       | 3560+3580             | 20+20         | Pass                                            |
| 2 (Contiguous)     | 3.2        | QPSK/16QAM | 8       | 3625+3645             | 20+20         | Pass                                            |
| 2 (Contiguous)     | 3.1a       | 256QAM     | 10      | 3670+3690             | 20+20         | Pass                                            |
| 2 (Non-Contiguous) | 3.1a       | 256QAM     | 9       | 3560+3690             | 20+20         | Pass                                            |

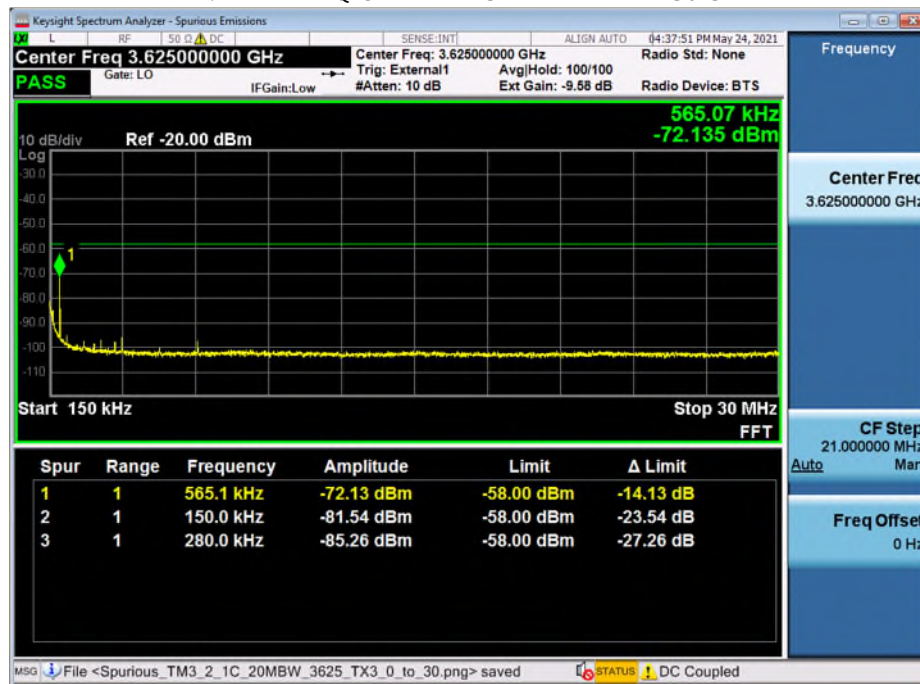
## 9KHz – 150kHz

# of Carriers      Test Model      Modulation      TX Port      Channel Frequency (MHz)      Signal BW (MHz)  
2 (Contiguous)      3.1a      256QAM      14      3675+3690      10+20



## 150kHz – 30MHz

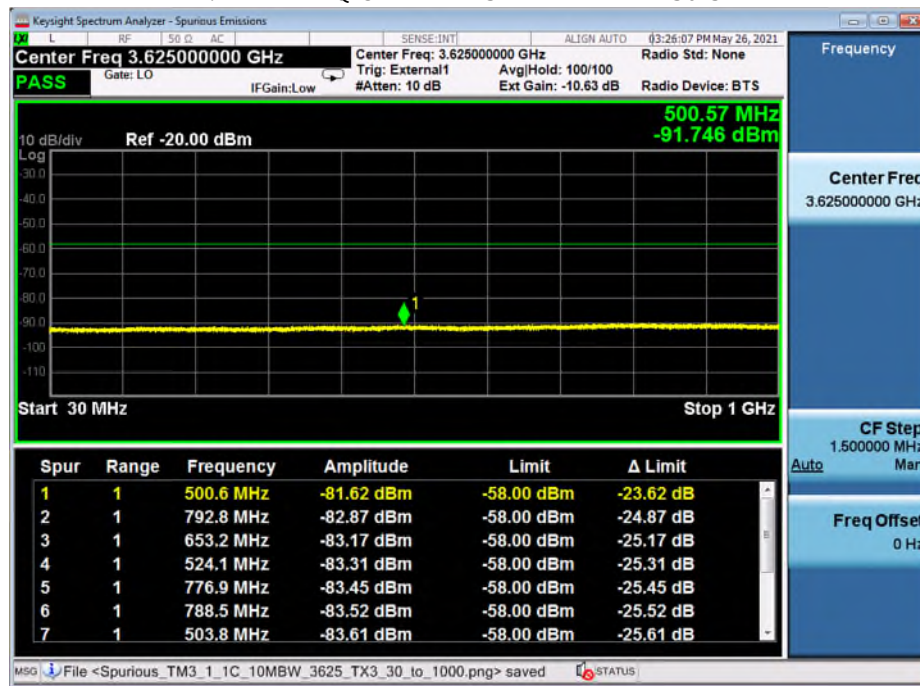
# of Carriers      Test Model      Modulation      TX Port      Channel Frequency (MHz)      Signal BW (MHz)  
1      1.1      QPSK      3      3625      20



## 30MHz – 1GHz

# of Carriers      Test Model      Modulation      TX Port      Channel Frequency (MHz)      Signal BW (MHz)

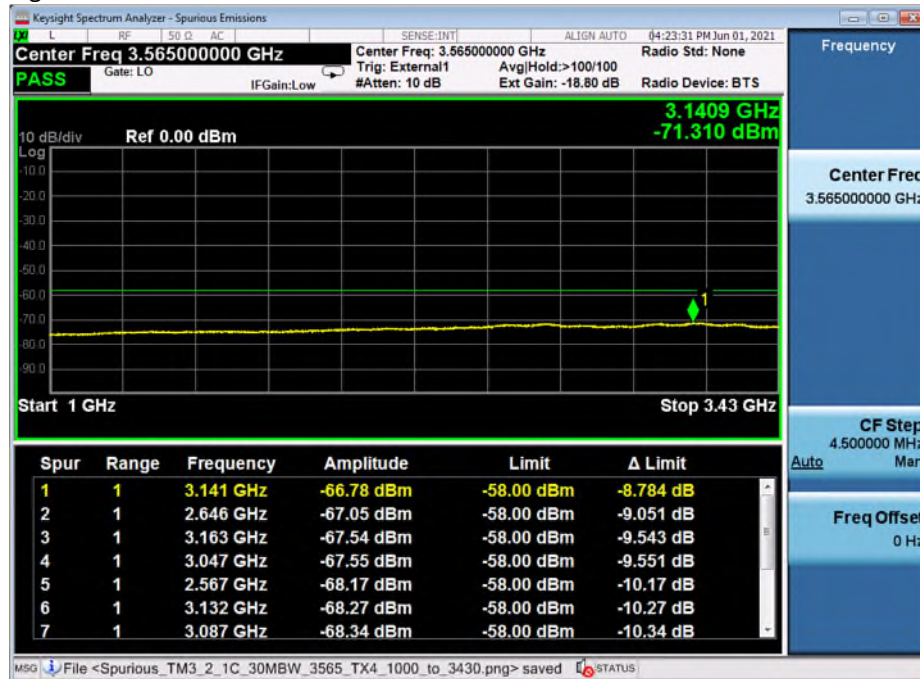
1                      1.1                      QPSK                      3                      3625                      10



## 1GHz – 3.43GHz

# of Carriers      Test Model      Modulation      TX Port      Channel Frequency (MHz)      Signal BW (MHz)

2 (Contiguous)                      1.1                      QPSK                      3                      3555+3570                      10+20



**3.43GHz – 3.53GHz**

# of Carriers      Test Model      Modulation      TX Port      Channel Frequency (MHz)      Signal BW (MHz)  
1                      3.1                      64QAM                      3                      3560                      20

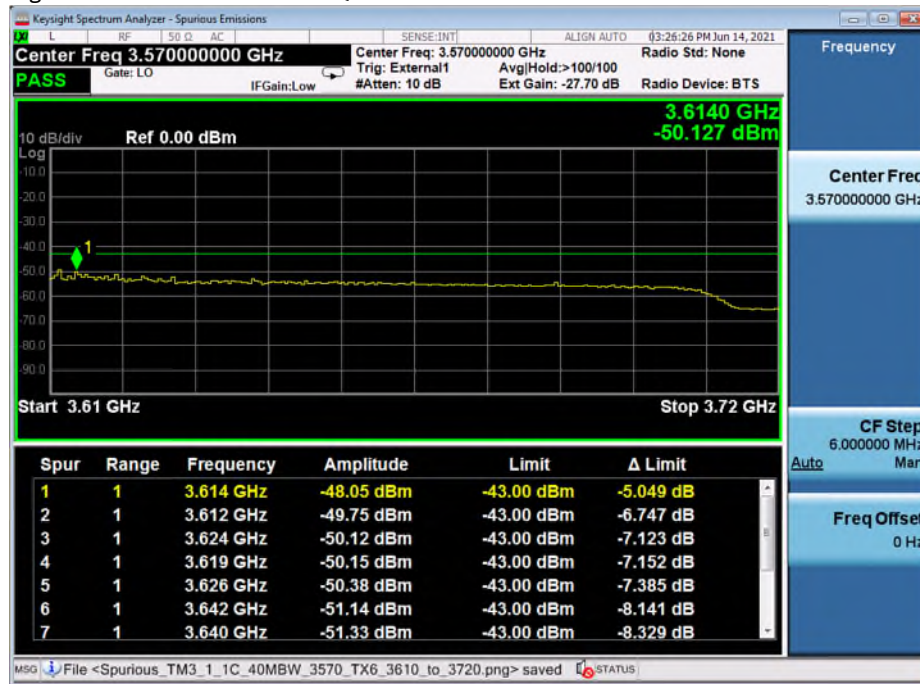
**3.53GHz – 3.595GHz**

# of Carriers      Test Model      Modulation      TX Port      Channel Frequency (MHz)      Signal BW (MHz)  
2 (Contiguous)      1.1                      QPSK                      3                      3555+3570                      10+20



**3.61GHz – 3.72GHz**

# of Carriers      Test Model      Modulation      TX Port      Channel Frequency (MHz)      Signal BW (MHz)  
2 (Contiguous)      1.1      QPSK      6      3560+3580      20+20

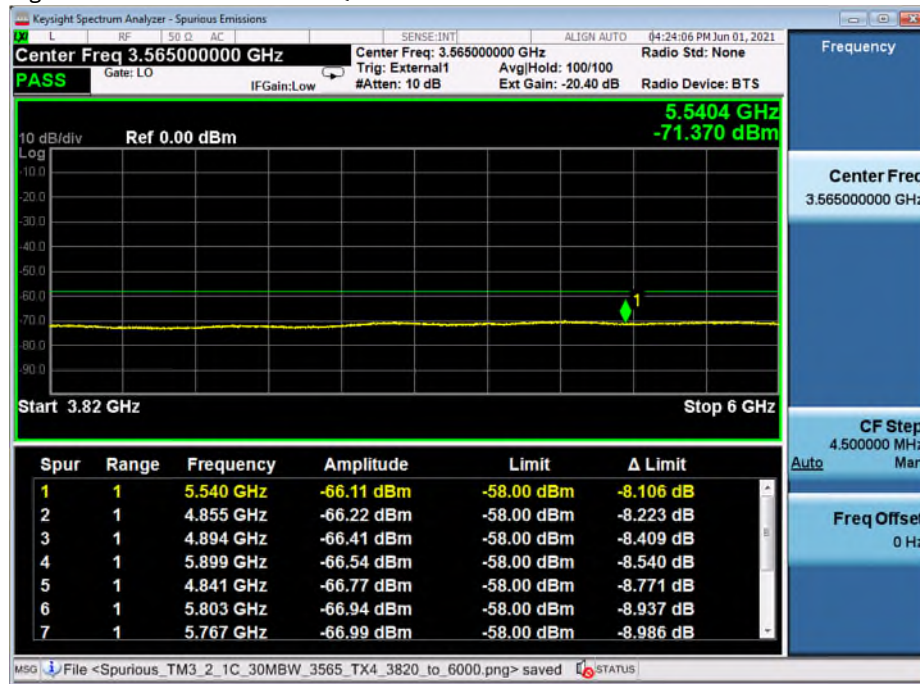
**3.72GHz – 3.82GHz**

# of Carriers      Test Model      Modulation      TX Port      Channel Frequency (MHz)      Signal BW (MHz)  
1      3.1      64QAM      3      3560      20



## 3.82GHz – 6GHz

# of Carriers      Test Model      Modulation      TX Port      Channel Frequency (MHz)      Signal BW (MHz)  
2 (Contiguous)      1.1      QPSK      3      3555+3570      10+20



## 6GHz – 9GHz

# of Carriers      Test Model      Modulation      TX Port      Channel Frequency (MHz)      Signal BW (MHz)  
1      1.1      QPSK      3      3625      10



## 9GHz – 38.2GHz

| # of Carriers  | Test Model | Modulation | TX Port | Channel Frequency (MHz) | Signal BW (MHz) |
|----------------|------------|------------|---------|-------------------------|-----------------|
| 2 (Contiguous) | 3.1a       | 256QAM     | 14      | 3675+3690               | 10+20           |



## 6. Section 2.1053 - Measurement Required: Field Strength of Spurious Radiation

The field strength measurements of radiated spurious emissions were made in a FCC registered 3-meter semi-anechoic chamber AR-6, (FCC Registration Number: 395774) NVLAP Lab Code: 100275-0 and IC (Filing Number: 6933F-5) which is maintained by Nokia Bell Labs in Murray Hill, New Jersey.

### 6.1 Spurious Radiation and Radiated Emissions Requirements.

This product meets Parts 2,15 and 96 requirements. FCC Part 15 Class B require emissions to be below 54.5 dBuV/m at 3m.

47CFR 96.41 (e)(1) (i) and KDB 940660 D01 Section 3.2 (b)(6) specified that the limits for the emissions outside the fundamental are as follows.

- within 0 MHz to 10 MHz above and below the assigned channel  $\leq -13$  dBm/MHz,
- greater than 10 MHz above and below the assigned channel  $\leq -25$  dBm/MHz,
- any emission below 3530 MHz and above 3720 MHz  $\leq -40$  dBm/MHz.

Title 47CFR section 2.1053 contains the requirements for the levels of spurious radiation as a function of the EIRP of the unmodulated carrier. The reference level for the unmodulated carrier is calculated as the field produced by an isotropic radiator excited by the transmitter output power according to the following relation taken from Reference Data for Radio Engineers, page 27-7, 6th edition, IT&T Corp.

$$E = [(30 \cdot \text{EIRP})^{1/2}] / R$$

Where: E = Field Intensity in Volts/ meter  
P = Emission Power in Watts

R = Distance in meters = 3 m

Hence,

$$E (\text{dB}\mu\text{V/m}) = \text{EIRP (dBm)} - 20 \log d (\text{m}) + 104.77.$$

For EIRP = -13dBm/MHz, E = 82.2 dB $\mu$ V/m,

For EIRP = -25dBm/MHz, E = 70.2 dB $\mu$ V/m,

For EIRP = -40dBm/MHz, E = 55.2 dB $\mu$ V/m.

The field strength of radiated spurious emissions measured was determined by

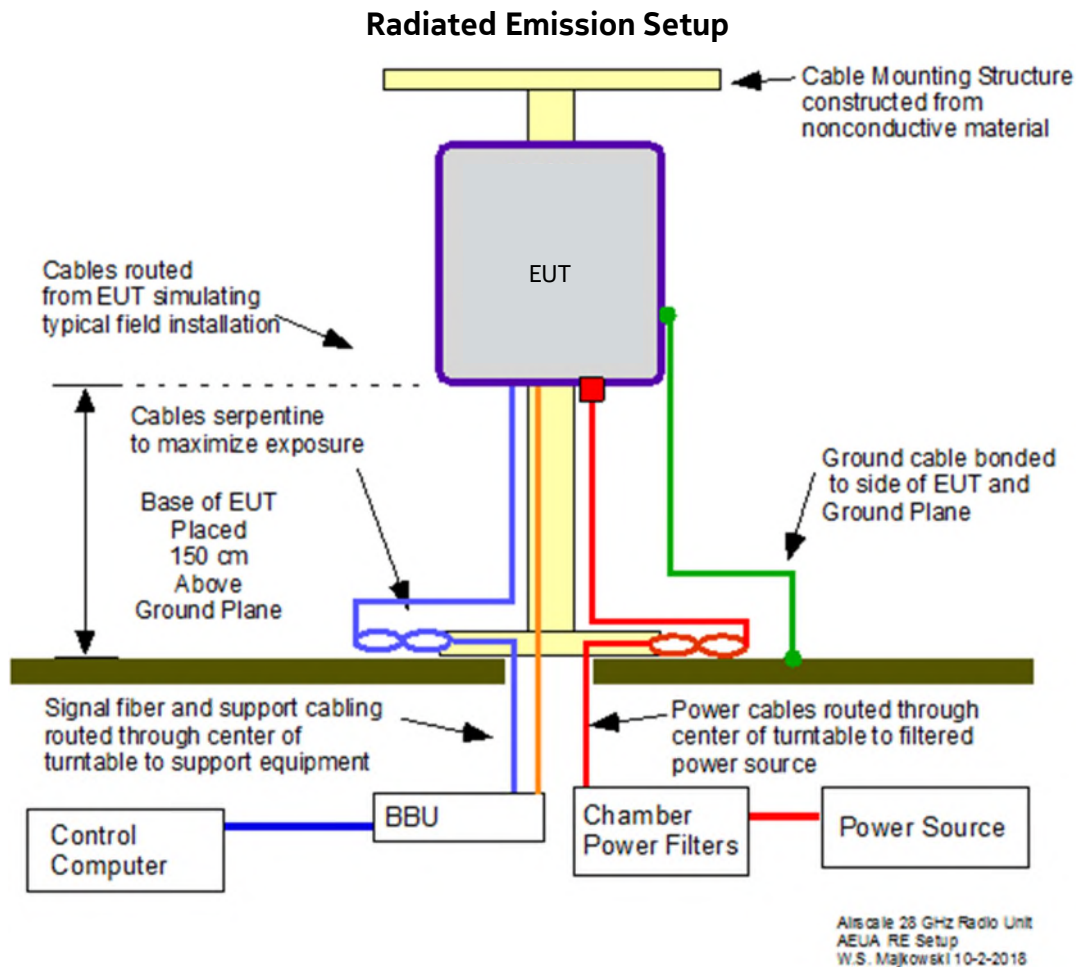
$$E (\text{dB}\mu\text{V/m}) = V_{\text{meas}} (\text{dB}\mu\text{V}) + \text{Cable Loss (dB)} + \text{Antenna Factor (dBi/m)}.$$

Field strength measurements of radiated spurious emissions were made in the 3m semi-anechoic chamber, AR-6 as detailed above. The recommendations of ANSI C63.4 and ANSI C63.26 were followed for EUT testing setup, cabling, and measurement approach and procedures. All the measurement equipment used, including antennas, was calibrated in accordance with ISO 9001 process. The EUT setup diagram is given in the Figure 4.5.

Below 18GHz, FCC Part 15 Class B limit 54.5 dBuV/m was used which is worse than FCC Part 96 limit. Above 18GHz, the limit 55.2 dBuV/m was used.

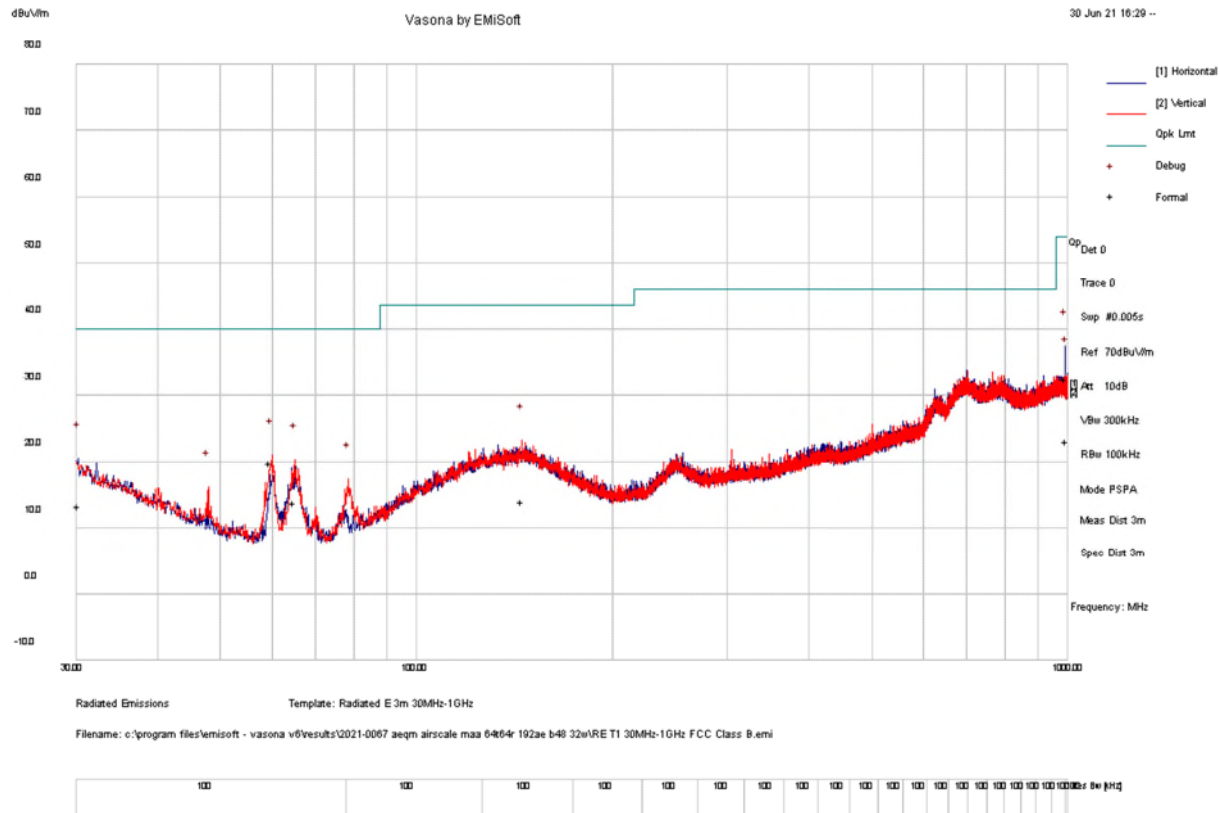
## 6.2 Field Strength of Spurious Radiation Results:

This product meets Part 96 Requirements. For the Title 47CFR section 96.41(e) and 2.1053 test, the field strength of any spurious radiation, measured at 3m, is required to be less than 55.2dB $\mu$ V/meter. Emissions equal to or less than 35.2 dB $\mu$ V/meter are not reportable and may be verified using field strength measurements with broadband antennas.



## 6.3 Transmitter Measurements of Radiated Spurious Emissions Plots

### RE 30MHz – 1GHz



### Test Information

|                 |                                                                                                                                   |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Results Title   | Radiated E 3m 30MHz-1GHz                                                                                                          |
| File Name       | RE T1 30MHz-1GHz FCC Class B.emi                                                                                                  |
| Test Laboratory | MH-AR6, 24.7C, 52%RH, 996mB.                                                                                                      |
| Test Engineer   | GM                                                                                                                                |
| Test Software   | Vasona by EMISoft, version 6.061                                                                                                  |
| Equipment       | Nokia                                                                                                                             |
| EUT Details     | 2021-0067 AEQM AirScale MAA 64T64R 192AE B48 32W, F1 3560MHz, TM3.1, 20MHz BW; F2 3580MHz, TM3.1, 20MHz BW Upper only. -48Vdc,    |
| Configuration   | FCC Pt.15 Class B. RE 30MHz- 1GHz, ESI E936, PA E507, Ant E766, RBW: Previews 100kHz / Formals 100KHz, VBW: 300KHz, Int. Att 10dB |
| Date            | 2021-07-01 09:42:25                                                                                                               |

### Formal Data

| Freq. (MHz) | Raw (dBuV) | Cable (dB) | Factor (dB) | Level (dBuV/m) | Emission Type | Pol (H/V) | Ht (cm) | Az (deg) | Limit (dBuV/m) | Margin (dB) | Pass/Fail | Comments |
|-------------|------------|------------|-------------|----------------|---------------|-----------|---------|----------|----------------|-------------|-----------|----------|
| 59.740      | 40.58      | 0.44       | -21.06      | 19.96          | QuasiMax      | V         | 143     | 244      | 40.00          | -20.04      | Pass      |          |
| 990.736     | 32.03      | 2.84       | -2.32       | 32.54          | QuasiMax      | H         | 156     | 97       | 54.00          | -21.46      | Pass      |          |
| 64.775      | 34.70      | 0.48       | -21.25      | 13.92          | QuasiMax      | V         | 162     | 247      | 40.00          | -26.08      | Pass      |          |
| 30.289      | 23.22      | 0.41       | -10.09      | 13.54          | QuasiMax      | H         | 346     | 324      | 40.00          | -26.46      | Pass      |          |
| 145.142     | 23.19      | 0.77       | -9.78       | 14.19          | QuasiMax      | V         | 227     | 229      | 43.50          | -29.31      | Pass      |          |

| Freq. (MHz) | Raw (dBuV) | Cable (dB) | Factor (dB) | Level (dBuV/m) | Emission Type | Pol (H/V) | Ht (cm) | Az (deg) | Limit (dBuV/m) | Margin (dB) | Pass/Fail | Comments |
|-------------|------------|------------|-------------|----------------|---------------|-----------|---------|----------|----------------|-------------|-----------|----------|
| 997.675     | 22.67      | 2.85       | -2.25       | 23.26          | QuasiMax      | H         | 162     | 62       | 54.00          | -30.74      | Pass      |          |

**Preview Data**

| Freq. (MHz) | Raw (dBuV) | Cable (dB) | Factor (dB) | Level (dBuV/m) | Emission Type | Pol (H/V) | Ht (cm) | Az (deg) | Limit (dBuV/m) | Margin (dB) | Pass/Fail | Comments |
|-------------|------------|------------|-------------|----------------|---------------|-----------|---------|----------|----------------|-------------|-----------|----------|
| 990.741483  | 36.86      | 2.84       | -2.32       | 37.37          | Debug         | H         | 184     | 90       | 54.00          | -16.63      | Pass      |          |
| 59.915832   | 41.72      | 0.44       | -21.09      | 21.07          | Debug         | V         | 200     | 270      | 40.00          | -18.93      | Pass      |          |
| 30.288577   | 30.20      | 0.41       | -10.09      | 20.52          | Debug         | H         | 384     | 45       | 40.00          | -19.48      | Pass      |          |
| 65.11022    | 41.11      | 0.48       | -21.26      | 20.33          | Debug         | V         | 200     | 90       | 40.00          | -19.67      | Pass      |          |
| 145.142285  | 32.21      | 0.77       | -9.78       | 23.21          | Debug         | V         | 200     | 135      | 43.50          | -20.29      | Pass      |          |
| 997.675351  | 32.68      | 2.85       | -2.25       | 33.27          | Debug         | H         | 284     | 270      | 54.00          | -20.73      | Pass      |          |
| 78.577154   | 36.86      | 0.51       | -20.01      | 17.36          | Debug         | V         | 100     | 45       | 40.00          | -22.64      | Pass      |          |
| 47.891784   | 34.48      | 0.36       | -18.57      | 16.28          | Debug         | V         | 200     | 225      | 40.00          | -23.72      | Pass      |          |

Note: Preview data was measured using a peak detector to identify frequencies of interest for formal measurement. Formal data consist of all frequencies in the preview list within 6 dB of specification limit or the top six frequencies. Failure in preview data does not necessarily constitute failure in formal data.

Vasona by EMIsoft

02 Jul 21 10:12

dBuV/m

80.0

70.0

60.0

50.0

40.0

30.0

20.0

1000.00

10000.00

Radiated Emissions

Filename: Data not stored

Template: Radiated E3m 1-18GHz

Frequency: MHz

Legend:

- [1] Horizontal
- [2] Vertical
- Pk Lmt
- Avg Lmt
- Debug
- Formal
- Dist
- POI
- Trace MAXH
- Swp #0.02s
- Ref 70dBuV/m
- Att 0dB
- VBw 3000kHz
- RBw 100kHz
- Mode
- Meas Dist 3m
- Spec Dist 3m

|                        |                                                                                                                                                         |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Results Title</b>   | Radiated E 3m 1-18GHz                                                                                                                                   |
| <b>File Name</b>       | re02_1g_10g_formal.emi                                                                                                                                  |
| <b>Test Laboratory</b> | MH-AR6, 24.6C, 53%RH, 993mB.                                                                                                                            |
| <b>Test Engineer</b>   | GM                                                                                                                                                      |
| <b>Test Software</b>   | Vasona by EMISoft, version 6.061                                                                                                                        |
| <b>Equipment</b>       | Nokia                                                                                                                                                   |
| <b>EUT Details</b>     | 2021-0067 AEQM AirScale MAA 64T64R 192AE B48 32W, F1 3560MHz, TM3.1, 20MHz BW; F2 3580MHz, TM3.1, 20MHz BW Upper only. -48Vdc,                          |
| <b>Configuration</b>   | Radiated Emissions 1GHz - 10GHz, GR-1089 / FCC Pt.15 Class B limit, Rcvr ESU EIH69, PA E376, Ant E1074, RBW: Previews 100KHz / Formals 1MHz, VBW: 3MHz, |
| <b>Date</b>            | 2021-07-02 10:13:35                                                                                                                                     |

| Freq.<br>(MHz) | Raw<br>(dBuV) | Cable<br>(dB) | Factor<br>(dB) | Level<br>(dBuV/m) | Emission<br>Type | Pol<br>(H/V) | Ht<br>(cm) | Az<br>(deg) | Limit<br>(dBuV/m) | Margin<br>(dB) | Pass/Fail | Comments |
|----------------|---------------|---------------|----------------|-------------------|------------------|--------------|------------|-------------|-------------------|----------------|-----------|----------|
| 3588.506       | 48.78         | 5.00          | 0.18           | 53.96             | AvgMax           | V            | 275        | 6           | 54.00             | -0.04          | Pass      | Carrier  |
| 3571.861       | 48.27         | 4.99          | 0.16           | 53.42             | AvgMax           | H            | 307        | 257         | 54.00             | -0.58          | Pass      | Carrier  |
| 3567.650       | 46.15         | 4.98          | 0.15           | 51.28             | AvgMax           | H            | 305        | 261         | 54.00             | -2.72          | Pass      | Carrier  |
| 3555.217       | 45.52         | 4.97          | 0.13           | 50.63             | AvgMax           | H            | 297        | 312         | 54.00             | -3.37          | Pass      | Carrier  |
| 3588.506       | 63.06         | 5.00          | 0.18           | 68.23             | PeakMax          | V            | 275        | 6           | 74.00             | -5.77          | Pass      | Carrier  |
| 3571.861       | 62.96         | 4.99          | 0.16           | 68.10             | PeakMax          | H            | 307        | 257         | 74.00             | -5.90          | Pass      | Carrier  |
| 3567.650       | 60.60         | 4.98          | 0.15           | 65.74             | PeakMax          | H            | 305        | 261         | 74.00             | -8.26          | Pass      | Carrier  |
| 5890.549       | 36.40         | 6.29          | 2.48           | 45.17             | AvgMax           | V            | 152        | 63          | 54.00             | -8.83          | Pass      |          |
| 4415.985       | 38.25         | 5.57          | 1.11           | 44.93             | AvgMax           | H            | 176        | 74          | 54.00             | -9.07          | Pass      |          |
| 3555.217       | 59.82         | 4.97          | 0.13           | 64.93             | PeakMax          | H            | 297        | 312         | 74.00             | -9.07          | Pass      |          |
| 9945.739       | 28.52         | 11.51         | 4.79           | 44.82             | AvgMax           | V            | 353        | 228         | 54.00             | -9.18          | Pass      |          |
| 3924.468       | 38.89         | 5.25          | 0.63           | 44.77             | AvgMax           | H            | 246        | 43          | 54.00             | -9.23          | Pass      |          |

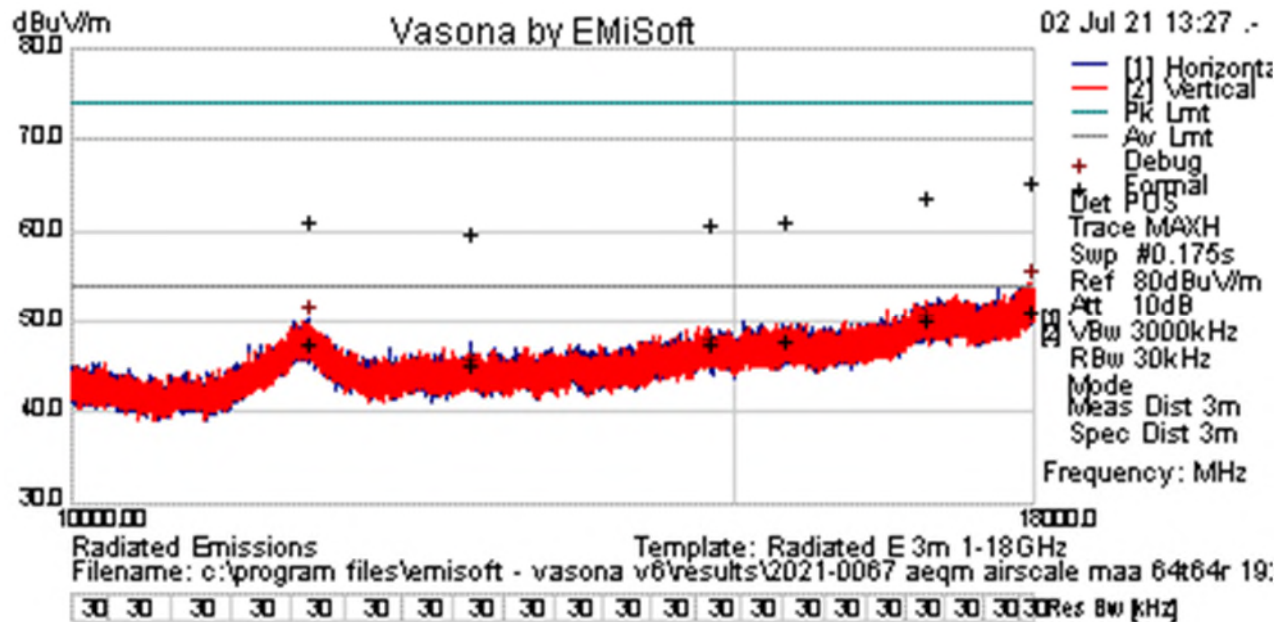
| Freq. (MHz) | Raw (dBuV) | Cable (dB) | Factor (dB) | Level (dBuV/m) | Emission Type | Pol (H/V) | Ht (cm) | Az (deg) | Limit (dBuV/m) | Margin (dB) | Pass/Fail | Comments |
|-------------|------------|------------|-------------|----------------|---------------|-----------|---------|----------|----------------|-------------|-----------|----------|
| 4431.354    | 37.22      | 5.58       | 1.12        | 43.93          | AvgMax        | H         | 191     | 90       | 54.00          | -10.07      | Pass      |          |
| 5905.918    | 34.89      | 6.30       | 2.50        | 43.69          | AvgMax        | V         | 160     | 61       | 54.00          | -10.31      | Pass      |          |
| 5660.152    | 32.91      | 6.20       | 2.14        | 41.25          | AvgMax        | H         | 106     | 23       | 54.00          | -12.75      | Pass      |          |
| 9945.739    | 41.67      | 11.51      | 4.79        | 57.97          | PeakMax       | V         | 353     | 228      | 74.00          | -16.03      | Pass      |          |
| 3924.468    | 49.99      | 5.25       | 0.63        | 55.87          | PeakMax       | H         | 246     | 43       | 74.00          | -18.13      | Pass      |          |
| 4431.354    | 49.10      | 5.58       | 1.12        | 55.80          | PeakMax       | H         | 191     | 90       | 74.00          | -18.20      | Pass      |          |
| 4415.985    | 48.66      | 5.57       | 1.11        | 55.35          | PeakMax       | H         | 176     | 74       | 74.00          | -18.65      | Pass      |          |
| 5660.152    | 46.76      | 6.20       | 2.14        | 55.10          | PeakMax       | H         | 106     | 23       | 74.00          | -18.90      | Pass      |          |
| 5890.549    | 46.10      | 6.29       | 2.48        | 54.88          | PeakMax       | V         | 152     | 63       | 74.00          | -19.12      | Pass      |          |
| 5905.918    | 45.45      | 6.30       | 2.50        | 54.25          | PeakMax       | V         | 160     | 61       | 74.00          | -19.75      | Pass      |          |

## Preview Data

| Freq. (MHz) | Raw (dBuV) | Cable (dB) | Factor (dB) | Level (dBuV/m) | Emission Type | Pol (H/V) | Ht (cm) | Az (deg) | Limit (dBuV/m) | Margin (dB) | Pass/Fail | Comments |
|-------------|------------|------------|-------------|----------------|---------------|-----------|---------|----------|----------------|-------------|-----------|----------|
| 3588.50578  | 50.67      | 5.00       | 0.18        | 55.85          | Debug         | V         | 284     | 0        | 54.00          | 1.85        | Fail      |          |
| 3571.861375 | 50.07      | 4.99       | 0.16        | 55.21          | Debug         | H         | 300     | 270      | 54.00          | 1.21        | Fail      |          |
| 3555.21697  | 49.26      | 4.97       | 0.13        | 54.37          | Debug         | H         | 300     | 315      | 54.00          | 0.37        | Fail      |          |
| 3567.65014  | 46.53      | 4.98       | 0.15        | 51.67          | Debug         | H         | 300     | 270      | 54.00          | -2.33       | Pass      |          |
| 4431.354385 | 44.19      | 5.58       | 1.12        | 50.89          | Debug         | H         | 200     | 90       | 54.00          | -3.11       | Pass      |          |
| 5890.447045 | 40.77      | 6.29       | 2.48        | 49.54          | Debug         | V         | 184     | 315      | 54.00          | -4.46       | Pass      |          |
| 3924.401905 | 43.66      | 5.25       | 0.63        | 49.54          | Debug         | H         | 200     | 0        | 54.00          | -4.46       | Pass      |          |
| 4415.91319  | 42.78      | 5.57       | 1.11        | 49.47          | Debug         | H         | 200     | 90       | 54.00          | -4.53       | Pass      |          |
| 9945.73855  | 33.08      | 11.51      | 4.79        | 49.38          | Debug         | V         | 384     | 90       | 54.00          | -4.62       | Pass      |          |
| 5660.232865 | 39.45      | 6.20       | 2.14        | 47.79          | Debug         | H         | 100     | 0        | 54.00          | -6.21       | Pass      |          |
| 5905.88824  | 38.60      | 6.30       | 2.50        | 47.40          | Debug         | V         | 184     | 315      | 54.00          | -6.60       | Pass      |          |
| 3939.8431   | 41.38      | 5.26       | 0.65        | 47.29          | Debug         | H         | 300     | 45       | 54.00          | -6.71       | Pass      |          |
| 5399.136295 | 39.04      | 6.09       | 1.76        | 46.89          | Debug         | H         | 100     | 270      | 54.00          | -7.11       | Pass      |          |
| 2695.523425 | 42.57      | 4.27       | -0.79       | 46.06          | Debug         | H         | 300     | 45       | 54.00          | -7.94       | Pass      |          |
| 4170.257815 | 38.87      | 5.42       | 0.89        | 45.17          | Debug         | H         | 100     | 270      | 54.00          | -8.83       | Pass      |          |
| 4907.62501  | 37.73      | 5.87       | 1.20        | 44.80          | Debug         | H         | 200     | 0        | 54.00          | -9.20       | Pass      |          |
| 4661.568565 | 37.88      | 5.73       | 1.19        | 44.80          | Debug         | H         | 300     | 45       | 54.00          | -9.20       | Pass      |          |
| 2465.309245 | 41.64      | 4.08       | -0.96       | 44.76          | Debug         | H         | 200     | 315      | 54.00          | -9.24       | Pass      |          |
| 5644.79167  | 36.14      | 6.19       | 2.11        | 44.44          | Debug         | H         | 100     | 0        | 54.00          | -9.56       | Pass      |          |
| 5414.376955 | 36.36      | 6.10       | 1.78        | 44.24          | Debug         | V         | 184     | 45       | 54.00          | -9.76       | Pass      |          |
| 4677.00976  | 37.13      | 5.73       | 1.19        | 44.05          | Debug         | H         | 300     | 45       | 54.00          | -9.95       | Pass      |          |
| 2710.96462  | 40.12      | 4.28       | -0.78       | 43.62          | Debug         | H         | 100     | 45       | 54.00          | -10.38      | Pass      |          |
| 4922.86567  | 36.36      | 5.88       | 1.21        | 43.44          | Debug         | H         | 200     | 45       | 54.00          | -10.56      | Pass      |          |
| 2449.86805  | 39.96      | 4.07       | -1.01       | 43.03          | Debug         | H         | 200     | 315      | 54.00          | -10.97      | Pass      |          |
| 2457.688915 | 39.08      | 4.08       | -0.98       | 42.17          | Debug         | H         | 100     | 315      | 54.00          | -11.83      | Pass      |          |
| 4185.69901  | 35.67      | 5.43       | 0.90        | 41.99          | Debug         | V         | 100     | 45       | 54.00          | -12.01      | Pass      |          |
| 1499.73322  | 41.71      | 3.02       | -6.71       | 38.02          | Debug         | H         | 200     | 0        | 54.00          | -15.98      | Pass      |          |

Note: Preview data was measured using a peak detector to identify frequencies of interest for formal measurement. Formal data consist of all frequencies in the preview list within 6 dB of specification limit or the top six frequencies. Failure in preview data does not necessarily constitute failure in formal data.

## RE 10GHz – 18GHz



## Test Information

|                 |                                                                                                                                                        |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Results Title   | Radiated E 3m 1-18GHz                                                                                                                                  |
| File Name       | re03_10g_18g_formal.emi                                                                                                                                |
| Test Laboratory | MH-AR6, 24.6C, 53%RH, 993mB.                                                                                                                           |
| Test Engineer   | NPA                                                                                                                                                    |
| Test Software   | Vasona by EMISoft, version 6.061                                                                                                                       |
| Equipment       | Nokia                                                                                                                                                  |
| EUT Details     | 2021-0067 AEQM AirScale MAA 64T64R 192AE B48 32W, F1 3560MHz, TM3.1, 20MHz BW; F2 3580MHz, TM3.1, 20MHz BW Upper only. -48Vdc,                         |
| Configuration   | Radiated Emissions 10GHz - 18GHz, GR-1089 / FCC Pt.15 Class B limit, Rcvr ESU EI69, PA E376, Ant E1074, RBW: Previews 30KHz / Formals 1MHz, VBW: 3MHz, |
| Date            | 2021-07-02 13:36:40                                                                                                                                    |

## Formal Data

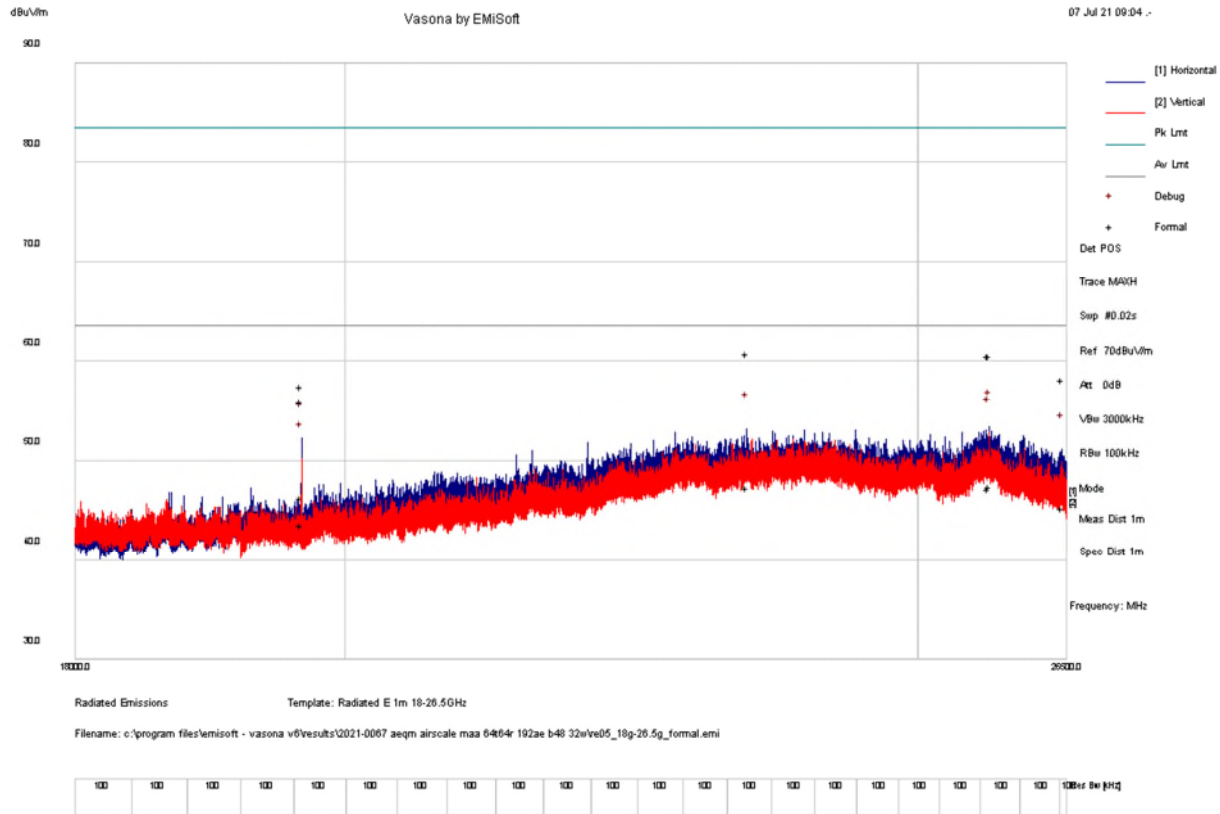
| Freq. (MHz) | Raw (dBuV) | Cable (dB) | Factor (dB) | Level (dBuV/m) | Emission Type | Pol (H/V) | Ht (cm) | Az (deg) | Limit (dBuV/m) | Margin (dB) | Pass/Fail | Comments |
|-------------|------------|------------|-------------|----------------|---------------|-----------|---------|----------|----------------|-------------|-----------|----------|
| 17960.847   | 25.72      | 12.29      | 13.27       | 51.28          | AvgMax        | V         | 381     | 87       | 54.00          | -2.72       | Pass      |          |
| 16858.139   | 26.57      | 11.36      | 12.44       | 50.38          | AvgMax        | V         | 185     | 350      | 54.00          | -3.62       | Pass      |          |
| 15471.764   | 26.60      | 11.92      | 9.56        | 48.08          | AvgMax        | V         | 231     | 223      | 54.00          | -5.92       | Pass      |          |
| 11555.360   | 26.42      | 14.69      | 6.55        | 47.66          | AvgMax        | H         | 346     | 281      | 54.00          | -6.34       | Pass      |          |
| 14778.440   | 26.67      | 11.51      | 9.40        | 47.58          | AvgMax        | V         | 145     | 79       | 54.00          | -6.42       | Pass      |          |
| 17960.847   | 39.89      | 12.29      | 13.27       | 65.45          | PeakMax       | V         | 381     | 87       | 74.00          | -8.55       | Pass      |          |
| 12766.320   | 26.64      | 10.39      | 8.28        | 45.30          | AvgMax        | V         | 100     | 196      | 54.00          | -8.70       | Pass      |          |
| 16858.139   | 39.98      | 11.36      | 12.44       | 63.78          | PeakMax       | V         | 185     | 350      | 74.00          | -10.22      | Pass      |          |
| 15471.764   | 39.86      | 11.92      | 9.56        | 61.34          | PeakMax       | V         | 231     | 223      | 74.00          | -12.66      | Pass      |          |
| 11555.360   | 39.86      | 14.69      | 6.55        | 61.11          | PeakMax       | H         | 346     | 281      | 74.00          | -12.89      | Pass      |          |
| 14778.440   | 39.91      | 11.51      | 9.40        | 60.82          | PeakMax       | V         | 145     | 79       | 74.00          | -13.18      | Pass      |          |
| 12766.320   | 41.13      | 10.39      | 8.28        | 59.79          | PeakMax       | V         | 100     | 196      | 74.00          | -14.21      | Pass      |          |

**Preview Data**

| Freq.<br>(MHz) | Raw<br>(dBuV) | Cable<br>(dB) | Factor<br>(dB) | Level<br>(dBuV/m) | Emission<br>Type | Pol<br>(H/V) | Ht<br>(cm) | Az<br>(deg) | Limit<br>(dBuV/m) | Margin<br>(dB) | Pass/Fail | Comments |
|----------------|---------------|---------------|----------------|-------------------|------------------|--------------|------------|-------------|-------------------|----------------|-----------|----------|
| 17960.847      | 28.86         | 12.29         | 13.27          | 54.42             | Debug            | V            | 184        | 315         | 54.00             | 0.42           | Fail      |          |
| 11555.360      | 29.07         | 14.69         | 6.55           | 50.31             | Debug            | H            | 200        | 90          | 54.00             | -3.69          | Pass      |          |
| 16858.139      | 25.80         | 11.36         | 12.44          | 49.61             | Debug            | V            | 100        | 314         | 54.00             | -4.39          | Pass      |          |
| 15471.764      | 25.14         | 11.92         | 9.56           | 46.62             | Debug            | V            | 100        | 314         | 54.00             | -7.38          | Pass      |          |
| 14778.440      | 25.89         | 11.51         | 9.40           | 46.80             | Debug            | V            | 100        | 314         | 54.00             | -7.20          | Pass      |          |
| 12766.320      | 25.93         | 10.39         | 8.28           | 44.60             | Debug            | V            | 100        | 314         | 54.00             | -9.40          | Pass      |          |

Note: Preview data was measured using a peak detector to identify frequencies of interest for formal measurement. Formal data consist of all frequencies in the preview list within 6 dB of specification limit or the top six frequencies. Failure in preview data does not necessarily constitute failure in formal data.

## RE 18GHz – 26.5GHz



## Test Information

|                        |                                                                                                                                                           |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Results Title</b>   | Radiated E 1m 18-26.5GHz                                                                                                                                  |
| <b>File Name</b>       | re05_18g-26.5g_formal.emi                                                                                                                                 |
| <b>Test Laboratory</b> | MH-AR6, 24.5C, 53%RH, 997mB.                                                                                                                              |
| <b>Test Engineer</b>   | GM                                                                                                                                                        |
| <b>Test Software</b>   | Vasona by EMISoft, version 6.061                                                                                                                          |
| <b>Equipment</b>       | Nokia                                                                                                                                                     |
| <b>EUT Details</b>     | 2021-0067 AEQM AirScale MAA 64T64R 192AE B48 32W, F1 3560MHz, TM3.1, 20MHz BW; F2 3580MHz, TM3.1, 20MHz BW Upper only. -48Vdc, AISG Cable                 |
| <b>Configuration</b>   | Radiated Emissions 18GHz-26.5GHz, GR-1089 / FCC Pt.15 Class B limit, Rcvr ESU EIH69, PA E1387, Ant E1527, RBW: Previews 100KHz / Formals 1MHz, VBW: 3MHz, |
| <b>Date</b>            | 2021-07-07 10:09:22                                                                                                                                       |

## Formal Data

| Freq.<br>(MHz) | Raw<br>(dBuV) | Cable<br>(dB) | Factor<br>(dB) | Level<br>(dBuV/m) | Emission<br>Type | Pol<br>(H/V) | Ht<br>(cm) | Az<br>(deg) | Limit<br>(dBuV/m) | Margin<br>(dB) | Pass/Fail | Comments |
|----------------|---------------|---------------|----------------|-------------------|------------------|--------------|------------|-------------|-------------------|----------------|-----------|----------|
| 25712.977      | 36.31         | 16.61         | -5.49          | 47.43             | AvgMax           | H            | 134        | 263         | 63.50             | -16.07         | Pass      |          |
| 23389.779      | 36.95         | 17.01         | -6.60          | 47.36             | AvgMax           | H            | 157        | 157         | 63.50             | -16.14         | Pass      |          |
| 25707.624      | 36.09         | 16.61         | -5.49          | 47.20             | AvgMax           | V            | 130        | 82          | 63.50             | -16.30         | Pass      |          |
| 19660.755      | 42.50         | 12.14         | -8.33          | 46.30             | AvgMax           | H            | 118        | 221         | 63.50             | -17.20         | Pass      |          |
| 26449.450      | 35.44         | 15.02         | -5.11          | 45.35             | AvgMax           | H            | 105        | 57          | 63.50             | -18.15         | Pass      |          |
| 19660.776      | 39.79         | 12.14         | -8.33          | 43.59             | AvgMax           | V            | 196        | 155         | 63.50             | -19.91         | Pass      |          |

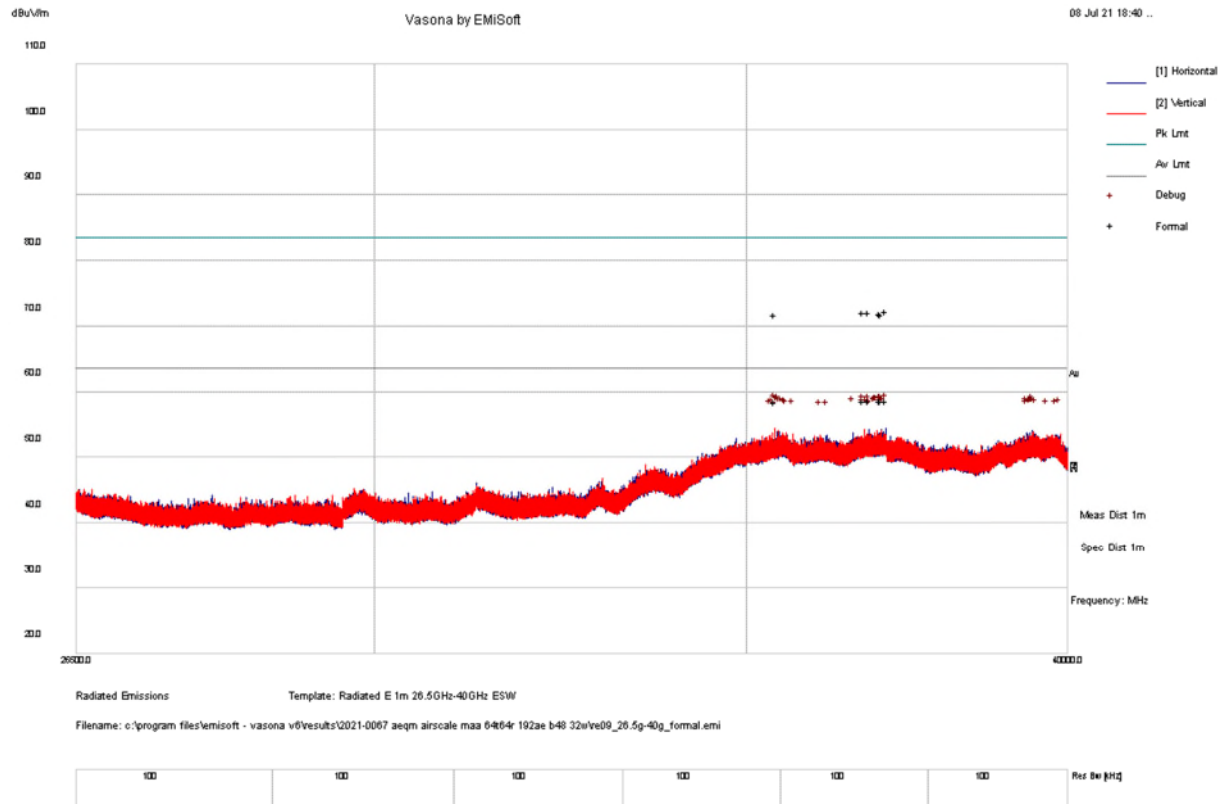
| Freq. (MHz) | Raw (dBuV) | Cable (dB) | Factor (dB) | Level (dBuV/m) | Emission Type | Pol (H/V) | Ht (cm) | Az (deg) | Limit (dBuV/m) | Margin (dB) | Pass/Fail | Comments |
|-------------|------------|------------|-------------|----------------|---------------|-----------|---------|----------|----------------|-------------|-----------|----------|
| 23389.779   | 50.34      | 17.01      | -6.60       | 60.75          | PeakMax       | H         | 157     | 157      | 83.50          | -22.75      | Pass      |          |
| 25707.624   | 49.49      | 16.61      | -5.49       | 60.60          | PeakMax       | V         | 130     | 82       | 83.50          | -22.90      | Pass      |          |
| 25712.977   | 49.48      | 16.61      | -5.49       | 60.60          | PeakMax       | H         | 134     | 263      | 83.50          | -22.90      | Pass      |          |
| 26449.450   | 48.30      | 15.02      | -5.11       | 58.21          | PeakMax       | H         | 105     | 57       | 83.50          | -25.29      | Pass      |          |
| 19660.755   | 53.65      | 12.14      | -8.33       | 57.45          | PeakMax       | H         | 118     | 221      | 83.50          | -26.05      | Pass      |          |
| 19660.776   | 52.16      | 12.14      | -8.33       | 55.96          | PeakMax       | V         | 196     | 155      | 83.50          | -27.54      | Pass      |          |

**Preview Data**

| Freq. (MHz) | Raw (dBuV) | Cable (dB) | Factor (dB) | Level (dBuV/m) | Emission Type | Pol (H/V) | Ht (cm) | Az (deg) | Limit (dBuV/m) | Margin (dB) | Pass/Fail | Comments |
|-------------|------------|------------|-------------|----------------|---------------|-----------|---------|----------|----------------|-------------|-----------|----------|
| 25712.977   | 42.25      | 16.61      | -5.49       | 53.37          | NoTune        | H         | 100     | 154      | 63.50          | -10.13      | Pass      |          |
| 23389.779   | 42.80      | 17.01      | -6.60       | 53.21          | NoTune        | H         | 150     | 220      | 63.50          | -10.29      | Pass      |          |
| 25707.624   | 41.63      | 16.61      | -5.49       | 52.75          | Debug         | V         | 100     | 352      | 63.50          | -10.75      | Pass      |          |
| 19660.755   | 48.44      | 12.14      | -8.33       | 52.24          | NoTune        | H         | 100     | 220      | 63.50          | -11.26      | Pass      |          |
| 26449.450   | 41.22      | 15.02      | -5.11       | 51.13          | NoTune        | H         | 150     | 242      | 63.50          | -12.37      | Pass      |          |
| 19660.776   | 46.39      | 12.14      | -8.33       | 50.19          | NoTune        | V         | 100     | 352      | 63.50          | -13.31      | Pass      |          |

Note: Preview data was measured using a peak detector to identify frequencies of interest for formal measurement. Formal data consist of all frequencies in the preview list within 6 dB of specification limit or the top six frequencies. Failure in preview data does not necessarily constitute failure in formal data.

## RE 26.5 GHz – 40 GHz



## Test Information

|                 |                                                                                                                                                 |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| Results Title   | Radiated E 1m 26.5GHz-40GHz ESW                                                                                                                 |
| File Name       | re09_26.5g-40g_formal.emi                                                                                                                       |
| Test Laboratory | MH-AR6, 23.8C, 62%RH, 990mB.                                                                                                                    |
| Test Engineer   | GM                                                                                                                                              |
| Test Software   | Vasona by EMISoft, version 6.093                                                                                                                |
| Equipment       | Nokia                                                                                                                                           |
| EUT Details     | 2021-0067 AEQM AirScale MAA 64T64R 192AE B48 32W, F1 3560MHz, TM3.1, 20MHz BW; F2 3580MHz, TM3.1, 20MHz BW Upper only. -48Vdc, AISG Cable       |
| Configuration   | Radiated Emissions: 26.5GHz-40GHz, GR-1089 / FCC Pt.15 Class B limit, Rcvr ESW E1511, Ant E526, RBW: Previews 100KHz / Formals 1MHz, VBW: 3MHz, |
| Date            | 2021-07-09 11:12:47                                                                                                                             |

## Formal Data

| Freq. (MHz) | Raw (dBuV) | Cable (dB) | Factor (dB) | Level (dBuV/m) | Emission Type | Pol (H/V) | Ht (cm) | Az (deg) | Limit (dBuV/m) | Margin (dB) | Pass/Fail | Comments |
|-------------|------------|------------|-------------|----------------|---------------|-----------|---------|----------|----------------|-------------|-----------|----------|
| 37028.350   | 34.81      | 10.87      | 13.10       | 58.77          | AvgMax        | V         | 100     | 191      | 63.50          | -4.73       | Pass      |          |
| 37015.375   | 34.80      | 10.87      | 13.11       | 58.77          | AvgMax        | H         | 127     | 257      | 63.50          | -4.73       | Pass      |          |
| 37096.300   | 34.79      | 10.88      | 13.09       | 58.75          | AvgMax        | H         | 148     | 209      | 63.50          | -4.75       | Pass      |          |
| 36836.500   | 34.76      | 10.83      | 13.15       | 58.74          | AvgMax        | H         | 122     | 30       | 63.50          | -4.76       | Pass      |          |
| 36752.425   | 34.64      | 10.81      | 13.17       | 58.62          | AvgMax        | V         | 113     | 236      | 63.50          | -4.88       | Pass      |          |
| 35420.350   | 35.06      | 10.49      | 12.95       | 58.51          | AvgMax        | V         | 175     | 293      | 63.50          | -4.99       | Pass      |          |
| 37096.300   | 48.45      | 10.88      | 13.09       | 72.41          | PeakMax       | H         | 148     | 209      | 83.50          | -11.09      | Pass      |          |
| 36836.500   | 48.27      | 10.83      | 13.15       | 72.25          | PeakMax       | H         | 122     | 30       | 83.50          | -11.25      | Pass      |          |

| Freq. (MHz) | Raw (dBuV) | Cable (dB) | Factor (dB) | Level (dBuV/m) | Emission Type | Pol (H/V) | Ht (cm) | Az (deg) | Limit (dBuV/m) | Margin (dB) | Pass/Fail | Comments |
|-------------|------------|------------|-------------|----------------|---------------|-----------|---------|----------|----------------|-------------|-----------|----------|
| 36752.425   | 48.19      | 10.81      | 13.17       | 72.17          | PeakMax       | V         | 113     | 236      | 83.50          | -11.33      | Pass      |          |
| 37015.375   | 48.10      | 10.87      | 13.11       | 72.07          | PeakMax       | H         | 127     | 257      | 83.50          | -11.43      | Pass      |          |
| 37028.350   | 47.95      | 10.87      | 13.10       | 71.92          | PeakMax       | V         | 100     | 191      | 83.50          | -11.58      | Pass      |          |
| 35420.350   | 48.35      | 10.49      | 12.95       | 71.79          | PeakMax       | V         | 175     | 293      | 83.50          | -11.71      | Pass      |          |

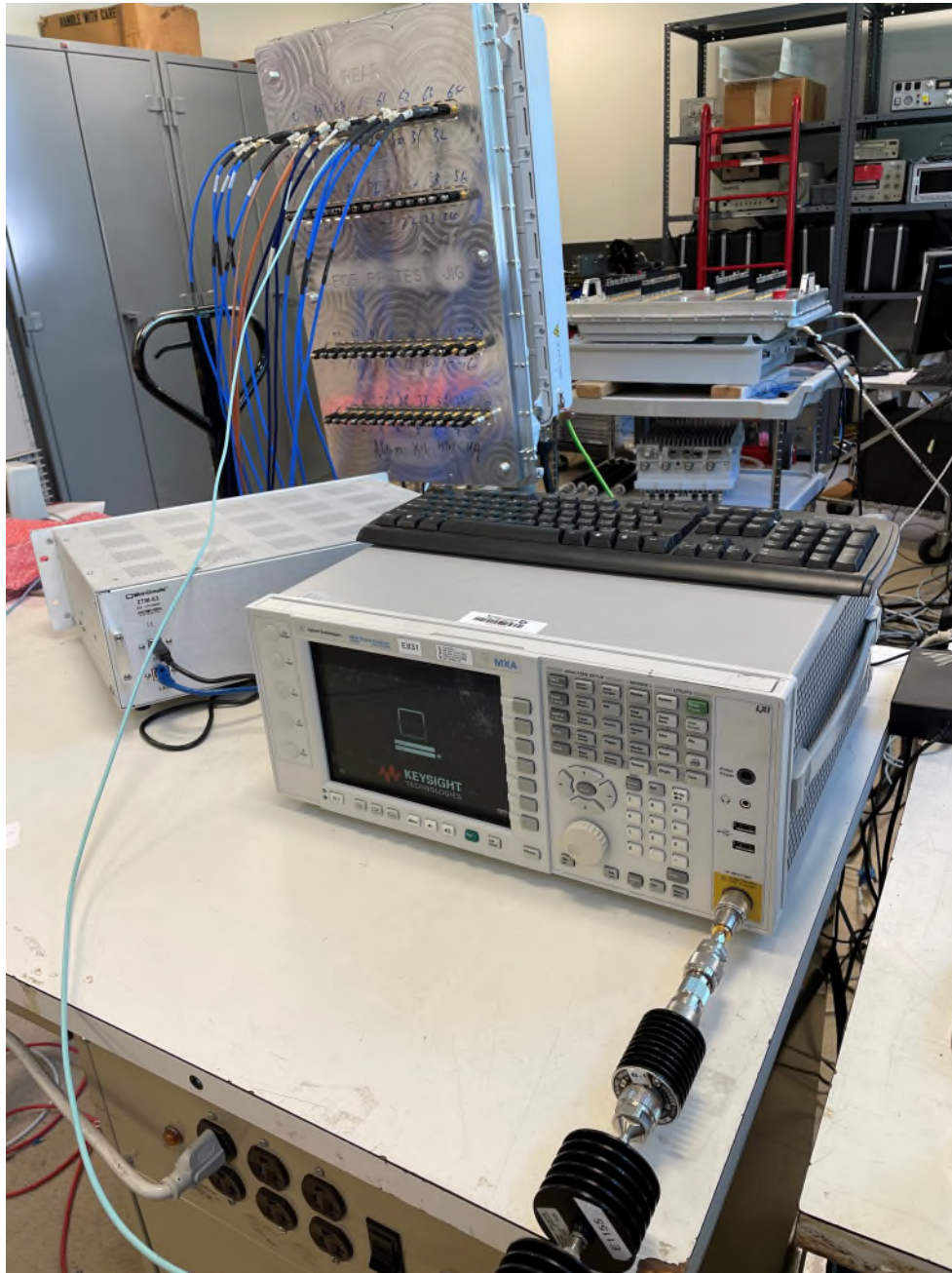
## Preview Data

| Freq. (MHz) | Raw (dBuV) | Cable (dB) | Factor (dB) | Level (dBuV/m) | Emission Type | Pol (H/V) | Ht (cm) | Az (deg) | Limit (dBuV/m) | Margin (dB) | Pass/Fail | Comments |
|-------------|------------|------------|-------------|----------------|---------------|-----------|---------|----------|----------------|-------------|-----------|----------|
| 37096.300   | 30.45      | 10.88      | 13.09       | 54.41          | Debug         | H         | 200     | 253      | 63.50          | -9.09       | Pass      |          |
| 35420.350   | 30.88      | 10.49      | 12.95       | 54.32          | Debug         | V         | 100     | 319      | 63.50          | -9.18       | Pass      |          |
| 37015.375   | 30.21      | 10.87      | 13.11       | 54.18          | Debug         | H         | 120     | 297      | 63.50          | -9.32       | Pass      |          |
| 36836.500   | 30.17      | 10.83      | 13.15       | 54.14          | Debug         | H         | 200     | 264      | 63.50          | -9.36       | Pass      |          |
| 36752.425   | 30.16      | 10.81      | 13.17       | 54.14          | Debug         | V         | 200     | 264      | 63.50          | -9.36       | Pass      |          |
| 37028.350   | 30.13      | 10.87      | 13.10       | 54.10          | Debug         | V         | 140     | 264      | 63.50          | -9.40       | Pass      |          |
| 35467.450   | 30.58      | 10.50      | 13.00       | 54.08          | Debug         | V         | 200     | 143      | 63.50          | -9.42       | Pass      |          |
| 39417.625   | 28.13      | 11.38      | 14.55       | 54.07          | Debug         | H         | 160     | 330      | 63.50          | -9.43       | Pass      |          |
| 36951.475   | 30.00      | 10.85      | 13.13       | 53.98          | Debug         | V         | 200     | 308      | 63.50          | -9.52       | Pass      |          |
| 37023.325   | 29.98      | 10.87      | 13.10       | 53.95          | Debug         | H         | 160     | 99       | 63.50          | -9.55       | Pass      |          |
| 35454.700   | 30.47      | 10.50      | 12.99       | 53.95          | Debug         | H         | 180     | 143      | 63.50          | -9.55       | Pass      |          |
| 36946.300   | 29.94      | 10.85      | 13.13       | 53.92          | Debug         | H         | 200     | 341      | 63.50          | -9.58       | Pass      |          |
| 37053.400   | 29.89      | 10.87      | 13.10       | 53.85          | Debug         | H         | 100     | 99       | 63.50          | -9.65       | Pass      |          |
| 35484.925   | 30.32      | 10.50      | 13.02       | 53.84          | Debug         | H         | 200     | 231      | 63.50          | -9.66       | Pass      |          |
| 39440.350   | 27.86      | 11.39      | 14.55       | 53.81          | Debug         | V         | 160     | 297      | 63.50          | -9.69       | Pass      |          |
| 39407.725   | 27.86      | 11.38      | 14.56       | 53.79          | Debug         | H         | 140     | 77       | 63.50          | -9.71       | Pass      |          |
| 39419.500   | 27.84      | 11.38      | 14.55       | 53.78          | Debug         | V         | 120     | 275      | 63.50          | -9.72       | Pass      |          |
| 36591.400   | 29.71      | 10.77      | 13.29       | 53.78          | Debug         | H         | 200     | 132      | 63.50          | -9.72       | Pass      |          |
| 36921.775   | 29.77      | 10.85      | 13.14       | 53.75          | Debug         | V         | 200     | 132      | 63.50          | -9.75       | Pass      |          |
| 35532.025   | 30.19      | 10.51      | 13.03       | 53.73          | Debug         | V         | 160     | 99       | 63.50          | -9.77       | Pass      |          |
| 39318.925   | 28.07      | 11.35      | 14.31       | 53.73          | Debug         | H         | 120     | 286      | 63.50          | -9.77       | Pass      |          |
| 39384.400   | 27.83      | 11.37      | 14.51       | 53.71          | Debug         | H         | 180     | 264      | 63.50          | -9.79       | Pass      |          |
| 35579.500   | 30.14      | 10.53      | 13.03       | 53.70          | Debug         | V         | 160     | 264      | 63.50          | -9.80       | Pass      |          |
| 37003.975   | 29.67      | 10.86      | 13.11       | 53.65          | Debug         | V         | 160     | 198      | 63.50          | -9.85       | Pass      |          |
| 36753.775   | 29.65      | 10.81      | 13.17       | 53.63          | Debug         | V         | 100     | 176      | 63.50          | -9.87       | Pass      |          |
| 35387.050   | 30.20      | 10.48      | 12.93       | 53.62          | Debug         | V         | 120     | 308      | 63.50          | -9.88       | Pass      |          |
| 39468.550   | 27.66      | 11.40      | 14.55       | 53.61          | Debug         | H         | 160     | 319      | 63.50          | -9.89       | Pass      |          |
| 36807.400   | 29.60      | 10.82      | 13.15       | 53.57          | Debug         | V         | 120     | 352      | 63.50          | -9.93       | Pass      |          |
| 39874.675   | 27.27      | 11.39      | 14.91       | 53.57          | Debug         | V         | 100     | 132      | 63.50          | -9.93       | Pass      |          |
| 36856.525   | 29.49      | 10.83      | 13.15       | 53.47          | Debug         | V         | 200     | 209      | 63.50          | -10.03      | Pass      |          |
| 35687.350   | 29.88      | 10.56      | 13.03       | 53.47          | Debug         | V         | 140     | 220      | 63.50          | -10.03      | Pass      |          |
| 39334.375   | 27.74      | 11.35      | 14.36       | 53.45          | Debug         | H         | 180     | 286      | 63.50          | -10.05      | Pass      |          |
| 39655.300   | 27.28      | 11.40      | 14.75       | 53.44          | Debug         | V         | 100     | 209      | 63.50          | -10.06      | Pass      |          |
| 39818.275   | 27.03      | 11.39      | 15.01       | 53.43          | Debug         | H         | 180     | 198      | 63.50          | -10.07      | Pass      |          |
| 35594.950   | 29.85      | 10.53      | 13.03       | 53.41          | Debug         | H         | 100     | 198      | 63.50          | -10.09      | Pass      |          |
| 39807.475   | 26.97      | 11.39      | 15.03       | 53.39          | Debug         | H         | 160     | 143      | 63.50          | -10.11      | Pass      |          |
| 35350.525   | 29.98      | 10.48      | 12.93       | 53.38          | Debug         | V         | 160     | 330      | 63.50          | -10.12      | Pass      |          |
| 36094.000   | 29.38      | 10.67      | 13.26       | 53.31          | Debug         | V         | 120     | 110      | 63.50          | -10.19      | Pass      |          |
| 35425.150   | 29.85      | 10.49      | 12.96       | 53.30          | Debug         | H         | 160     | 297      | 63.50          | -10.20      | Pass      |          |
| 36198.700   | 29.36      | 10.69      | 13.23       | 53.27          | Debug         | H         | 120     | 44       | 63.50          | -10.23      | Pass      |          |

Note: Preview data was measured using a peak detector to identify frequencies of interest for formal measurement. Formal data consist of all frequencies in the preview list within 6 dB of specification limit or the top six frequencies. Failure in preview data does not necessarily constitute failure in formal data.

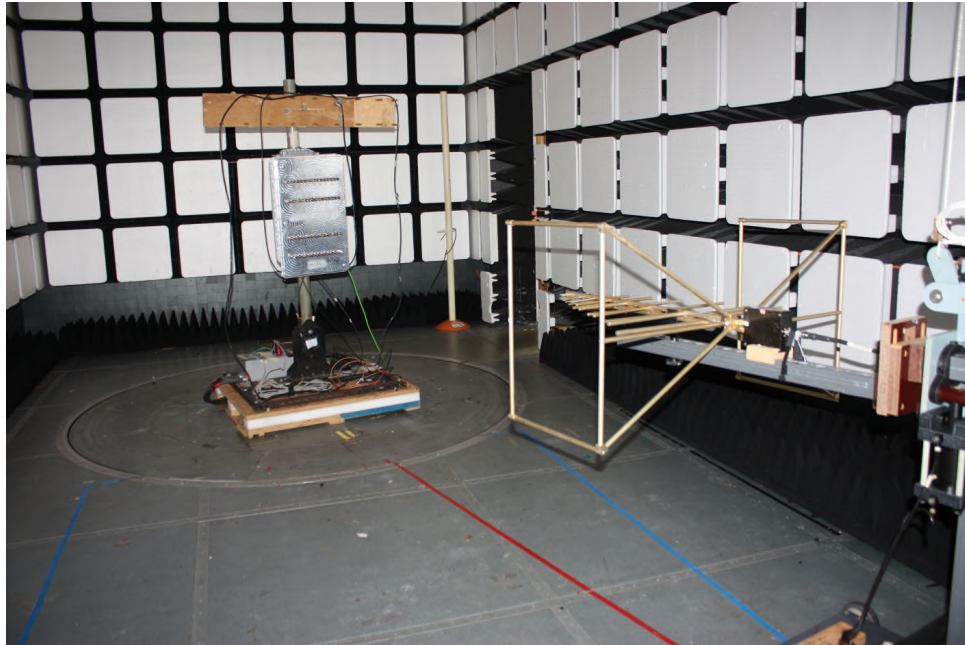
## Photographs

### Radio Test

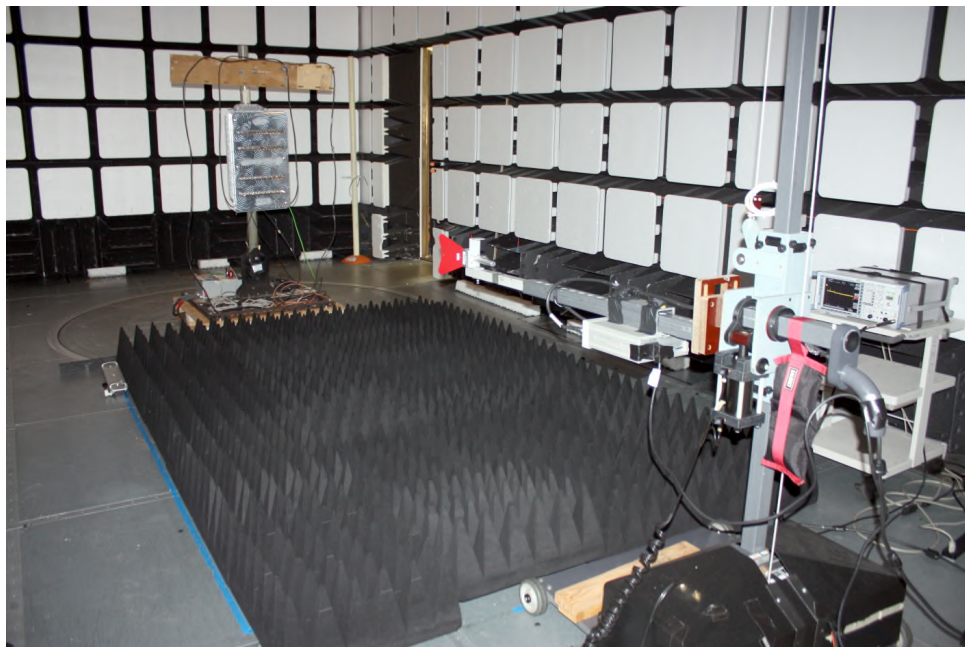


## Radiated Emission Test

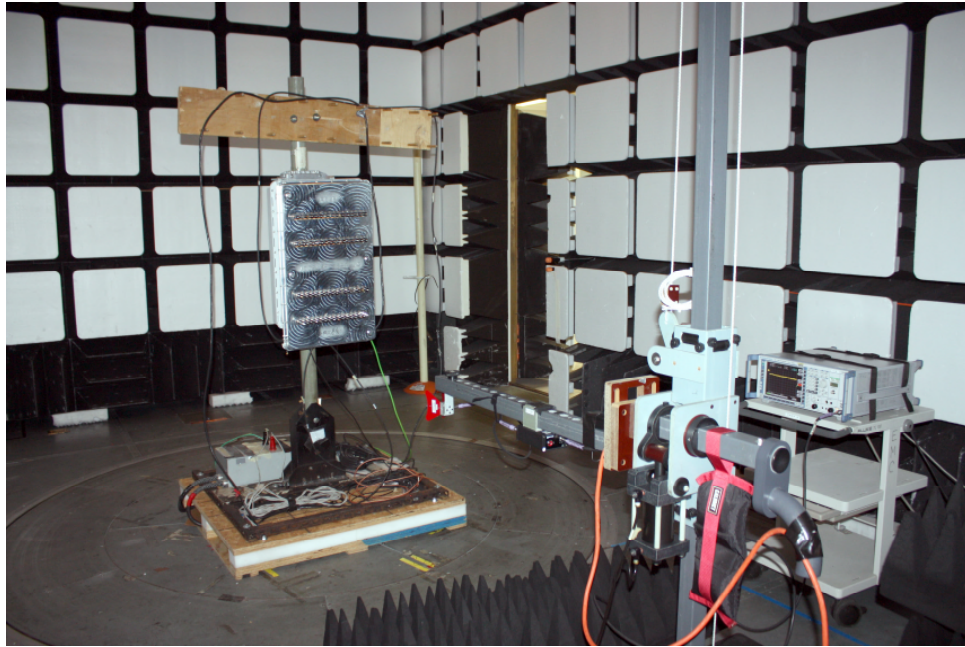
### 30MHz- 1GHz



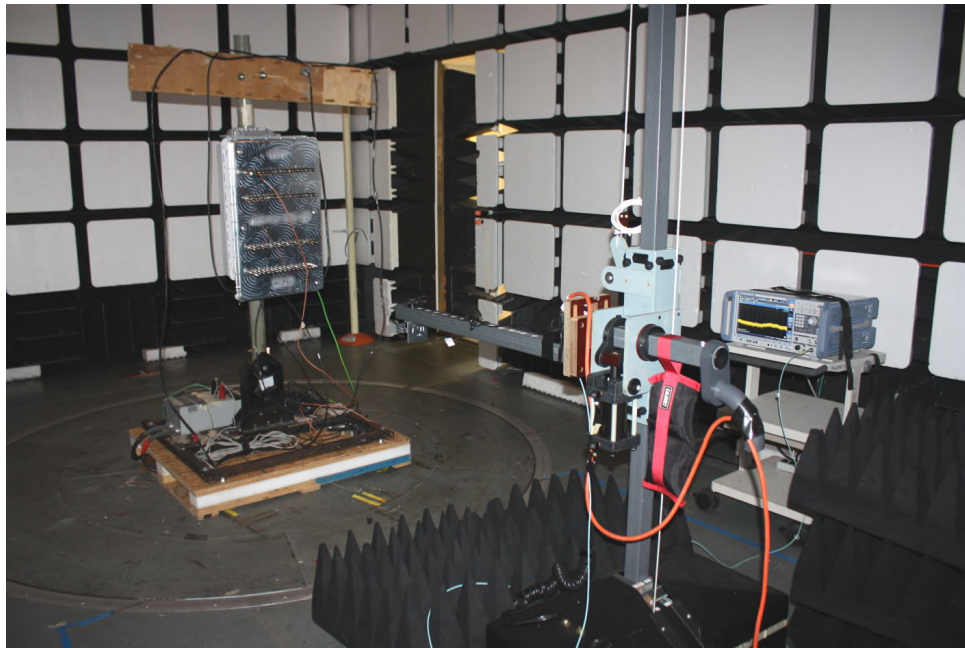
### 1GHz-18GHz



**18GHz – 26.5GHz**



**26.5GHz – 40GHz**



**Test Equipment****Radio Test Equipment**

| Asset ID | Manufacturer          | Type                | Description                 | Model          | Serial     | Calibration Date | Calibration Due |
|----------|-----------------------|---------------------|-----------------------------|----------------|------------|------------------|-----------------|
| E831     | Agilent Technologies  | MXA Signal Analyzer | 20Hz-26.5GHz                | N9020A         | MY48011791 | 2020-06-16       | 2022-06-16      |
| E896     | Agilent Technologies  | Network Analyzer    | 10 MHz - 40 GHz             | N5230C         | MY49000897 | 2021-03-03       | 2023-03-03      |
| E1338    | KeySight Technologies | MXA Signal Analyzer |                             | N9020B         | MY57430927 | 2019-11-14       | 2021-11-14      |
| E1212    | RLC Electronics Inc   | Filter, High Pass   | 10 - 30 GHz, 2W, 5dB        | F-19414        | 1444002    | CNR-V            | CNR-V           |
| E1479    | Reactel, Inc.         | Filter, High Pass   | DC - 4.3 GHz                | 11HS-X4.3 GS11 | SN20-01    | CNR-V            | CNR-V           |
| E1156    | Weinschel             | Attenuator          | 10dB 0.05GHz-26GHz 25W      | 74-10-12       | 1069       | CNR-V            | CNR-V           |
| E1155    | Weinschel             | Attenuator          | 10dB 25Watt 0.05GHz - 26GHz | 74-10-12       | 1068       | CNR-V            | CNR-V           |

**Customer Provided Equipment**

| Manufacturer | Type       | Description | Model | Serial | Calibration Date | Calibration Due |
|--------------|------------|-------------|-------|--------|------------------|-----------------|
| Weinschel    | Attenuator | 6dB 25Watt  | 35-6  | AC8553 | CNR-V            | CNR-V           |

CNR-V: Calibration Not Required, Must Be Verified

**Radiated Emission Test Equipment**

| Asset ID | Manufacturer          | Type              | Description                           | Model         | Serial     | Calibration Date | Calibration Due |
|----------|-----------------------|-------------------|---------------------------------------|---------------|------------|------------------|-----------------|
| E766     | A.H. Systems Inc.     | Bilogical Antenna | 25 - 2000 MHz                         | SAS-521-2     | 457        | 2021-05-18       | 2023-05-18      |
| E1074    | ETS Lindgren          | Horn Antenna      | Double-Ridged Waveguide Horn 1-18 GHz | 3117          | 00135194   | 2019-05-01       | 2021-08-01      |
| E1120    | Extech                | Data Logger       | Pressure Humidity Temp Data Logger    | SD700         | Q673552    | 2021-01-11       | 2023-01-11      |
| E376     | Hewlett Packard       | Pre-Amplifier     | Preamplifier 1-26.5 GHz               | 8449B         | 3008A01270 | 2020-10-21       | 2022-10-21      |
| E1387    | Miteq                 | Pre-Amplifier     | 18 GHz-40 GHz, 45dBm                  | TTA1840-35-HG | 2034       | 2020-08-28       | 2022-08-28      |
| EIH69    | Rohde & Schwarz       | Test Receiver     | EMI 20Hz - 40GHz -155 dBm +30 dBm     | ESU40         | 100247     | 2020-10-29       | 2022-10-29      |
| E1511    | Rohde & Schwarz       | Test Receiver     | EMI Test Receiver 2 Hz - 44 GHz       | ESW44         | 101965     | 2021-04-07       | 2023-04-07      |
| E507     | Sonoma Instrument Co. | Amplifier         | 9KHz-1GHz                             | 310           | 185794     | 2020-10-20       | 2022-10-20      |

## 7. FCC Section 2.1055 - Measurement of Frequency Stability

Frequency Stability testing was completed on AEQM Unit with Center Frequency 3560 MHz. Testing was performed from 6/4/2021 – 6/7/2021, which was located in the T-6 Thermal chamber of the Global Product Compliance Laboratory (GPCL) test facility located in Building 4, Room 4-280, Murray Hill, NJ, by Joe Bordonaro from GPCL.

The temperatures to which the UUT were subjected ranged from a high temperature of +50°C system ambient to a low temperature of -30°C system ambient with measurements recorded at +20°C, +50°C, and -30°C.

Frequency Stability performance was verified by measuring Frequency Tolerance using an MXA Signal Analyzer. Frequency Tolerance is a measurement of the difference between the actual transmit frequency and the assigned frequency (3560 MHz).

Frequency Block Tested: **AEQM (CF = 3560MHz)**

### Baseline Measurement at +25°C

| Transmit Frequency Deviation at +25°C at 100% of Nominal Voltage, -48VDC |                                                                              |
|--------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Time (minutes)                                                           | Transmit Carrier Deviation (Hz)                                              |
| 0                                                                        | +3.8750                                                                      |
| 0.5                                                                      | -13.902                                                                      |
| 1.0                                                                      | +1.8302                                                                      |
| 1.5                                                                      | -3.8023                                                                      |
| 2.0                                                                      | +3.4776                                                                      |
| 2.5                                                                      | -6.7544                                                                      |
| 3.0                                                                      | -1.9865                                                                      |
| FCC SPECIFICATION                                                        | 3560 MHz ( $\pm 0.05\text{ppm}$ )<br>$\pm 0.05\text{ppm} = \pm 178\text{Hz}$ |
| FCC RESULT                                                               | PASS                                                                         |

| Transmit Frequency Deviation at +50°C at 100% of Nominal Voltage, -48VDC |                                                                              |
|--------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Time (minutes)                                                           | Transmit Carrier Deviation (Hz)                                              |
| 0                                                                        | -10.750                                                                      |
| 0.5                                                                      | +14.759                                                                      |
| 1.0                                                                      | -0.69670                                                                     |
| 1.5                                                                      | -4.5439                                                                      |
| 2.0                                                                      | +6.7892                                                                      |
| 2.5                                                                      | +2.4771                                                                      |
| 3.0                                                                      | +4.4456                                                                      |
| FCC SPECIFICATION                                                        | 3560 MHz ( $\pm 0.05\text{ppm}$ )<br>$\pm 0.05\text{ppm} = \pm 178\text{Hz}$ |
| FCC RESULT                                                               | PASS                                                                         |

| Transmit Frequency Deviation at +40°C at 100% of Nominal Voltage, -48VDC |                                                                              |
|--------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Time (minutes)                                                           | Transmit Carrier Deviation (Hz)                                              |
| 0                                                                        | +0.24684                                                                     |
| 0.5                                                                      | -1.6141                                                                      |
| 1.0                                                                      | +0.59917                                                                     |
| 1.5                                                                      | -12.505                                                                      |
| 2.0                                                                      | +4.8579                                                                      |
| 2.5                                                                      | -8.3321                                                                      |
| 3.0                                                                      | -1.2769                                                                      |
| FCC SPECIFICATION                                                        | 3560 MHz ( $\pm 0.05\text{ppm}$ )<br>$\pm 0.05\text{ppm} = \pm 178\text{Hz}$ |
| FCC RESULT                                                               | PASS                                                                         |

| Transmit Frequency Deviation at +30°C at 100% of Nominal Voltage, -48VDC |                                                                              |
|--------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Time (minutes)                                                           | Transmit Carrier Deviation (Hz)                                              |
| 0                                                                        | +4.1848                                                                      |
| 0.5                                                                      | +16.636                                                                      |
| 1.0                                                                      | -6.1450                                                                      |
| 1.5                                                                      | +6.6178                                                                      |
| 2.0                                                                      | +4.6371                                                                      |
| 2.5                                                                      | -10.283                                                                      |
| 3.0                                                                      | +4.9190                                                                      |
| FCC SPECIFICATION                                                        | 3560 MHz ( $\pm 0.05\text{ppm}$ )<br>$\pm 0.05\text{ppm} = \pm 178\text{Hz}$ |
| FCC RESULT                                                               | PASS                                                                         |

| Transmit Frequency Deviation at +20°C at 100% of Nominal Voltage, -48VDC |                                                                              |
|--------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Time (minutes)                                                           | Transmit Carrier Deviation (Hz)                                              |
| 0                                                                        | +3.4777                                                                      |
| 0.5                                                                      | -3.0568                                                                      |
| 1.0                                                                      | +4.3705                                                                      |
| 1.5                                                                      | -0.16530                                                                     |
| 2.0                                                                      | -10.218                                                                      |
| 2.5                                                                      | -0.82249                                                                     |
| 3.0                                                                      | -4.7172                                                                      |
| FCC SPECIFICATION                                                        | 3560 MHz ( $\pm 0.05\text{ppm}$ )<br>$\pm 0.05\text{ppm} = \pm 178\text{Hz}$ |
| FCC RESULT                                                               | PASS                                                                         |

| Transmit Frequency Deviation at +10°C at 100% of Nominal Voltage, -48VDC |                                                                              |
|--------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Time<br>(minutes)                                                        | Transmit Carrier Deviation<br>(Hz)                                           |
| 0                                                                        | +12.347                                                                      |
| 0.5                                                                      | +1.4347                                                                      |
| 1.0                                                                      | -17.583                                                                      |
| 1.5                                                                      | +3.5924                                                                      |
| 2.0                                                                      | 10.104                                                                       |
| 2.5                                                                      | +2.0754                                                                      |
| 3.0                                                                      | -6.3512                                                                      |
| FCC SPECIFICATION                                                        | 3560 MHz ( $\pm 0.05\text{ppm}$ )<br>$\pm 0.05\text{ppm} = \pm 178\text{Hz}$ |
| FCC RESULT                                                               | PASS                                                                         |

| Transmit Frequency Deviation at 0°C at 100% of Nominal Voltage, -48VDC |                                                                              |
|------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Time<br>(minutes)                                                      | Transmit Carrier Deviation<br>(Hz)                                           |
| 0                                                                      | +6.1104                                                                      |
| 0.5                                                                    | -1.7525                                                                      |
| 1.0                                                                    | -7.8115                                                                      |
| 1.5                                                                    | +13.826                                                                      |
| 2.0                                                                    | -14.378                                                                      |
| 2.5                                                                    | +6.6687                                                                      |
| 3.0                                                                    | -2.0080                                                                      |
| FCC SPECIFICATION                                                      | 3560 MHz ( $\pm 0.05\text{ppm}$ )<br>$\pm 0.05\text{ppm} = \pm 178\text{Hz}$ |
| FCC RESULT                                                             | PASS                                                                         |

| Transmit Frequency Deviation at -10°C at 100% of Nominal Voltage, -48VDC |                                                                              |
|--------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Time<br>(minutes)                                                        | Transmit Carrier Deviation<br>(Hz)                                           |
| 0                                                                        | -5.2349                                                                      |
| 0.5                                                                      | +9.9507                                                                      |
| 1.0                                                                      | +3.7016                                                                      |
| 1.5                                                                      | +1.2450                                                                      |
| 2.0                                                                      | +4.8887                                                                      |
| 2.5                                                                      | -3.3121                                                                      |
| 3.0                                                                      | +13.657                                                                      |
| FCC SPECIFICATION                                                        | 3560 MHz ( $\pm 0.05\text{ppm}$ )<br>$\pm 0.05\text{ppm} = \pm 178\text{Hz}$ |
| FCC RESULT                                                               | PASS                                                                         |

| Transmit Frequency Deviation at -20°C at 100% of Nominal Voltage, -48VDC |                                                                              |
|--------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Time (minutes)                                                           | Transmit Carrier Deviation (Hz)                                              |
| 0                                                                        | +7.5858                                                                      |
| 0.5                                                                      | +2.5196                                                                      |
| 1.0                                                                      | -1.6503                                                                      |
| 1.5                                                                      | -19.487                                                                      |
| 2.0                                                                      | +4.7748                                                                      |
| 2.5                                                                      | -8.2757                                                                      |
| 3.0                                                                      | +3.2537                                                                      |
| FCC SPECIFICATION                                                        | 3560 MHz ( $\pm 0.05\text{ppm}$ )<br>$\pm 0.05\text{ppm} = \pm 178\text{Hz}$ |
| FCC RESULT                                                               | PASS                                                                         |

| Transmit Frequency Deviation at -30°C at 100% of Nominal Voltage, -48VDC |                                                                              |
|--------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Time (minutes)                                                           | Transmit Carrier Deviation (Hz)                                              |
| 0                                                                        | +0.26955                                                                     |
| 0.5                                                                      | +2.8445                                                                      |
| 1.0                                                                      | -1.3958                                                                      |
| 1.5                                                                      | -7.6142                                                                      |
| 2.0                                                                      | +6.4045                                                                      |
| 2.5                                                                      | +4.5395                                                                      |
| 3.0                                                                      | -4.8253                                                                      |
| FCC SPECIFICATION                                                        | 3560 MHz ( $\pm 0.05\text{ppm}$ )<br>$\pm 0.05\text{ppm} = \pm 178\text{Hz}$ |
| FCC RESULT                                                               | PASS                                                                         |

Upon return to +25°C.

| Transmit Frequency Deviation at +25°C at 100% of Nominal Voltage, -48VDC |                                                                              |
|--------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Time (minutes)                                                           | Transmit Carrier Deviation (Hz)                                              |
| 0                                                                        | -4.4163                                                                      |
| 0.5                                                                      | +6.9856                                                                      |
| 1.0                                                                      | +3.5827                                                                      |
| 1.5                                                                      | +6.7737                                                                      |
| 2.0                                                                      | -1.5648                                                                      |
| 2.5                                                                      | + 6.0202                                                                     |
| 3.0                                                                      | -4.4824                                                                      |
| FCC SPECIFICATION                                                        | 3560 MHz ( $\pm 0.05\text{ppm}$ )<br>$\pm 0.05\text{ppm} = \pm 178\text{Hz}$ |
| FCC RESULT                                                               | PASS                                                                         |

| Transmit Frequency Deviation at +25°C at 103% of Nominal Voltage, -49.44VDC |                                                                              |
|-----------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Time (minutes)                                                              | Transmit Carrier Deviation (Hz)                                              |
| 0                                                                           | -1.1464                                                                      |
| 0.5                                                                         | +9.8085                                                                      |
| 1.0                                                                         | +19.991                                                                      |
| 1.5                                                                         | +5.3323                                                                      |
| 2.0                                                                         | +0.48917                                                                     |
| 2.5                                                                         | +13.545                                                                      |
| 3.0                                                                         | -9.5809                                                                      |
| FCC SPECIFICATION                                                           | 3560 MHz ( $\pm 0.05\text{ppm}$ )<br>$\pm 0.05\text{ppm} = \pm 178\text{Hz}$ |
| FCC RESULT                                                                  | PASS                                                                         |

| Transmit Frequency Deviation at +25°C at 106% of Nominal Voltage, -50.88VDC |                                                                              |
|-----------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Time (minutes)                                                              | Transmit Carrier Deviation (Hz)                                              |
| 0                                                                           | -2.4299                                                                      |
| 0.5                                                                         | +1.5974                                                                      |
| 1.0                                                                         | -0.79784                                                                     |
| 1.5                                                                         | -5.1383                                                                      |
| 2.0                                                                         | +3.4425                                                                      |
| 2.5                                                                         | -3.4280                                                                      |
| 3.0                                                                         | +5.5968                                                                      |
| FCC SPECIFICATION                                                           | 3560 MHz ( $\pm 0.05\text{ppm}$ )<br>$\pm 0.05\text{ppm} = \pm 178\text{Hz}$ |
| FCC RESULT                                                                  | PASS                                                                         |

| Transmit Frequency Deviation at +25°C at 109% of Nominal Voltage, -52.32VDC |                                                                              |
|-----------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Time (minutes)                                                              | Transmit Carrier Deviation (Hz)                                              |
| 0                                                                           | +9.7076                                                                      |
| 0.5                                                                         | +3.6390                                                                      |
| 1.0                                                                         | -3.7666                                                                      |
| 1.5                                                                         | +10.642                                                                      |
| 2.0                                                                         | -2.5427                                                                      |
| 2.5                                                                         | -0.48523                                                                     |
| 3.0                                                                         | -10.696                                                                      |
| FCC SPECIFICATION                                                           | 3560 MHz ( $\pm 0.05\text{ppm}$ )<br>$\pm 0.05\text{ppm} = \pm 178\text{Hz}$ |
| FCC RESULT                                                                  | PASS                                                                         |

| Transmit Frequency Deviation at +25°C at 112% of Nominal Voltage, -53.76VDC |                                                                              |
|-----------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Time (minutes)                                                              | Transmit Carrier Deviation (Hz)                                              |
| 0                                                                           | +4.2895                                                                      |
| 0.5                                                                         | -1.8626                                                                      |
| 1.0                                                                         | +13.894                                                                      |
| 1.5                                                                         | -2.8591                                                                      |
| 2.0                                                                         | +5.8917                                                                      |
| 2.5                                                                         | +10.770                                                                      |
| 3.0                                                                         | -6.5248                                                                      |
| FCC SPECIFICATION                                                           | 3560 MHz ( $\pm 0.05\text{ppm}$ )<br>$\pm 0.05\text{ppm} = \pm 178\text{Hz}$ |
| FCC RESULT                                                                  | PASS                                                                         |

| Transmit Frequency Deviation at +25°C at 115% of Nominal Voltage, -55.20VDC |                                                                              |
|-----------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Time (minutes)                                                              | Transmit Carrier Deviation (Hz)                                              |
| 0                                                                           | +2.6357                                                                      |
| 0.5                                                                         | -5.4152                                                                      |
| 1.0                                                                         | -0.59246                                                                     |
| 1.5                                                                         | +3.2770                                                                      |
| 2.0                                                                         | -9.0774                                                                      |
| 2.5                                                                         | +2.6013                                                                      |
| 3.0                                                                         | +15.475                                                                      |
| FCC SPECIFICATION                                                           | 3560 MHz ( $\pm 0.05\text{ppm}$ )<br>$\pm 0.05\text{ppm} = \pm 178\text{Hz}$ |
| FCC RESULT                                                                  | PASS                                                                         |

| Transmit Frequency Deviation at +25°C at 100% of Nominal Voltage, -48.0VDC |                                                                              |
|----------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Time (minutes)                                                             | Transmit Carrier Deviation (Hz)                                              |
| 0                                                                          | +3.3582                                                                      |
| 0.5                                                                        | -2.2634                                                                      |
| 1.0                                                                        | +6.6301                                                                      |
| 1.5                                                                        | -0.55364                                                                     |
| 2.0                                                                        | -6.9080                                                                      |
| 2.5                                                                        | -11.393                                                                      |
| 3.0                                                                        | +5.8138                                                                      |
| FCC SPECIFICATION                                                          | 3560 MHz ( $\pm 0.05\text{ppm}$ )<br>$\pm 0.05\text{ppm} = \pm 178\text{Hz}$ |
| FCC RESULT                                                                 |                                                                              |

| Transmit Frequency Deviation at +25°C at -3% of Nominal Voltage, -46.56VDC |                                                                              |
|----------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Time (minutes)                                                             | Transmit Carrier Deviation (Hz)                                              |
| 0                                                                          | +9.5083                                                                      |
| 0.5                                                                        | +13.494                                                                      |
| 1.0                                                                        | -0.41294                                                                     |
| 1.5                                                                        | -6.7902                                                                      |
| 2.0                                                                        | +4.6328                                                                      |
| 2.5                                                                        | +2.0616                                                                      |
| 3.0                                                                        | +4.9448                                                                      |
| FCC SPECIFICATION                                                          | 3560 MHz ( $\pm 0.05\text{ppm}$ )<br>$\pm 0.05\text{ppm} = \pm 178\text{Hz}$ |
| FCC RESULT                                                                 | PASS                                                                         |

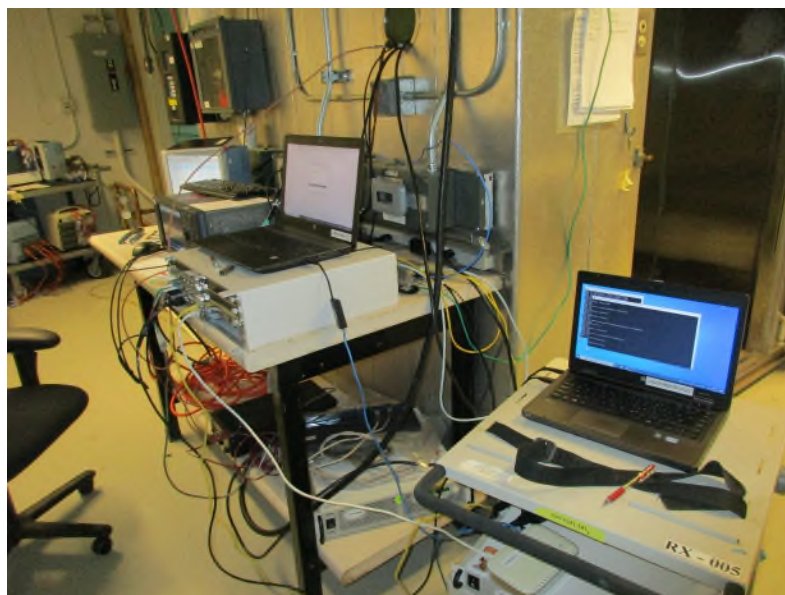
| Transmit Frequency Deviation at +25°C at -6% of Nominal Voltage, -45.12VDC |                                                                              |
|----------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Time (minutes)                                                             | Transmit Carrier Deviation (Hz)                                              |
| 0                                                                          | -17.856                                                                      |
| 0.5                                                                        | +2.7755                                                                      |
| 1.0                                                                        | -6.8828                                                                      |
| 1.5                                                                        | +7.2832                                                                      |
| 2.0                                                                        | +4.2438                                                                      |
| 2.5                                                                        | +4.7231                                                                      |
| 3.0                                                                        | +5.3656                                                                      |
| FCC SPECIFICATION                                                          | 3560 MHz ( $\pm 0.05\text{ppm}$ )<br>$\pm 0.05\text{ppm} = \pm 178\text{Hz}$ |
| FCC RESULT                                                                 | PASS                                                                         |

| Transmit Frequency Deviation at +25°C at -9% of Nominal Voltage, -43.68VDC |                                                                              |
|----------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Time (minutes)                                                             | Transmit Carrier Deviation (Hz)                                              |
| 0                                                                          | +0.86277                                                                     |
| 0.5                                                                        | -3.9744                                                                      |
| 1.0                                                                        | +6.7785                                                                      |
| 1.5                                                                        | +3.6722                                                                      |
| 2.0                                                                        | -2.6485                                                                      |
| 2.5                                                                        | +6.2182                                                                      |
| 3.0                                                                        | +12.340                                                                      |
| FCC SPECIFICATION                                                          | 3560 MHz ( $\pm 0.05\text{ppm}$ )<br>$\pm 0.05\text{ppm} = \pm 178\text{Hz}$ |
| FCC RESULT                                                                 | PASS                                                                         |

| <b>Transmit Frequency Deviation at +25°C at -12% of Nominal Voltage, -42.24VDC</b> |                                                                                                          |
|------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| <b>Time<br/>(minutes)</b>                                                          | <b>Transmit Carrier Deviation<br/>(Hz)</b>                                                               |
| 0                                                                                  | -6.4749                                                                                                  |
| 0.5                                                                                | -2.9890                                                                                                  |
| 1.0                                                                                | +8.6116                                                                                                  |
| 1.5                                                                                | +3.8308                                                                                                  |
| 2.0                                                                                | -4.4166                                                                                                  |
| 2.5                                                                                | -3.7443                                                                                                  |
| 3.0                                                                                | -18.172                                                                                                  |
| <b>FCC SPECIFICATION</b>                                                           | <b>3560 MHz (<math>\pm 0.05\text{ppm}</math>)<br/><math>\pm 0.05\text{ppm} = \pm 178\text{Hz}</math></b> |
| <b>FCC RESULT</b>                                                                  | <b>PASS</b>                                                                                              |

| <b>Transmit Frequency Deviation at +25°C at -15% of Nominal Voltage, -40.80VDC</b> |                                                                                                          |
|------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| <b>Time<br/>(minutes)</b>                                                          | <b>Transmit Carrier Deviation<br/>(Hz)</b>                                                               |
| 0                                                                                  | -0.89076                                                                                                 |
| 0.5                                                                                | -3.5690                                                                                                  |
| 1.0                                                                                | +6.9530                                                                                                  |
| 1.5                                                                                | +3.8680                                                                                                  |
| 2.0                                                                                | -7.8853                                                                                                  |
| 2.5                                                                                | +2.3236                                                                                                  |
| 3.0                                                                                | +9.0061                                                                                                  |
| <b>FCC SPECIFICATION</b>                                                           | <b>3560 MHz (<math>\pm 0.05\text{ppm}</math>)<br/><math>\pm 0.05\text{ppm} = \pm 178\text{Hz}</math></b> |
| <b>FCC RESULT</b>                                                                  | <b>PASS</b>                                                                                              |

## Photographs

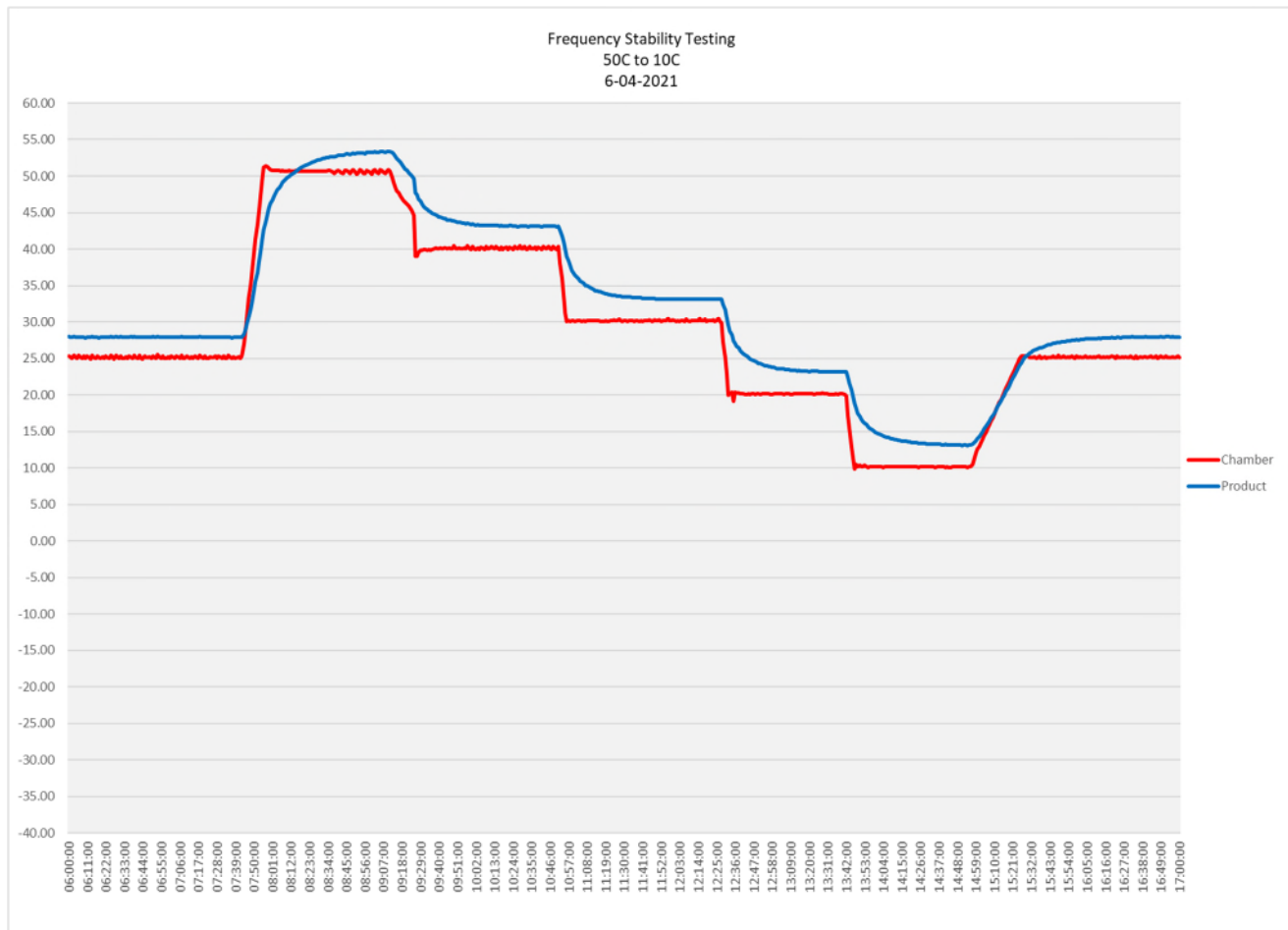


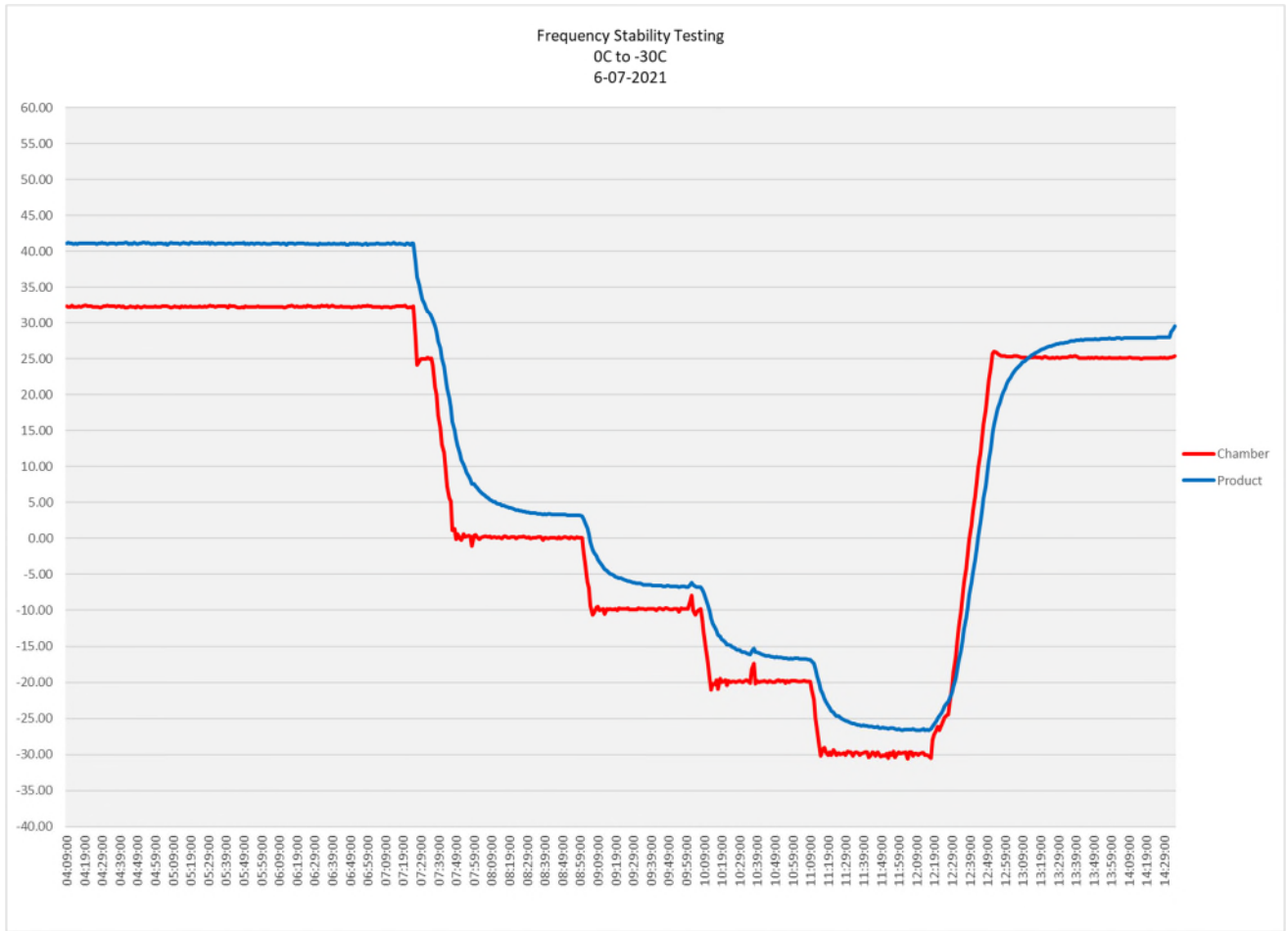
## Test Equipment

| Asset ID  | Manufacturer          | Type                | Description              | Model           | Serial     | Calibration Date | Calibration Due |
|-----------|-----------------------|---------------------|--------------------------|-----------------|------------|------------------|-----------------|
| E1338     | KeySight Technologies | MXA Signal Analyzer |                          | N9020B          | MY57120303 | 2020-12-21       | 2022-12-21      |
| TH530-T06 | Thermotron            | Controller          |                          | Thermotron 7800 | 8E62408    | 2019-09-18       | 2021-09-18      |
| TH-T06    | Thermotron            | Thermal Chamber     |                          | N/A             | 28972      | 2019-09-13       | 2021-09-13      |
| TH070     | Vaisala               | Transmitter         | Humidity and Temperature | HMT330          | J3330109   | 2019-12-04       | 2021-12-04      |
| TH085     | Yokogawa              | Recorder            |                          | GP20            | S5PB04190  | 2020-02-25       | 2022-02-25      |
| TH149     | Fluke                 | Multimeter          | Digital Multimeter       | 87III           | 7519030337 | 2019-07-22       | 2021-07-22      |
| N/A       | TDK Lambda            | Power Supply        | DC Source                | GEN 60-85-3P208 | 13N5110J   | CNR              | CNR             |

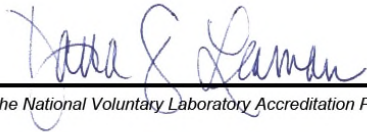
CNR – Calibration Not Required

## Chamber Plots





## 8. NVLAP Certificate of Accreditation

|                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>United States Department of Commerce<br/>National Institute of Standards and Technology</p> <p><b>NVLAP</b>® </p> <hr/> <p><b>Certificate of Accreditation to ISO/IEC 17025:2017</b></p> <hr/>                                                |                                                                                                                                                                                                                                                      |
| <p><b>NVLAP LAB CODE: 100275-0</b></p>                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                      |
| <p><b>Nokia, Global Product Compliance Lab</b><br/>Murray Hill, NJ</p>                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                      |
| <p><i>is accredited by the National Voluntary Laboratory Accreditation Program for specific services,<br/>listed on the Scope of Accreditation, for:</i></p>                                                                                                                                                                       |                                                                                                                                                                                                                                                      |
| <p><b>Electromagnetic Compatibility &amp; Telecommunications</b></p>                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                      |
| <p><i>This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017.<br/>This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality<br/>management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).</i></p> |                                                                                                                                                                                                                                                      |
| <p>2021-09-24 through 2022-09-30<br/>Effective Dates</p>                                                                                                                                                                                                                                                                           | <div><p>For the National Voluntary Laboratory Accreditation Program</p></div> |