

## 4.2 Edge of band 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 spectrum analyzer was reduced (to an amplitude usable by the spectrum analyzer) by using a calibrated attenuator and test coupler. The path attenuation was offset on the display and the signal for single 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.

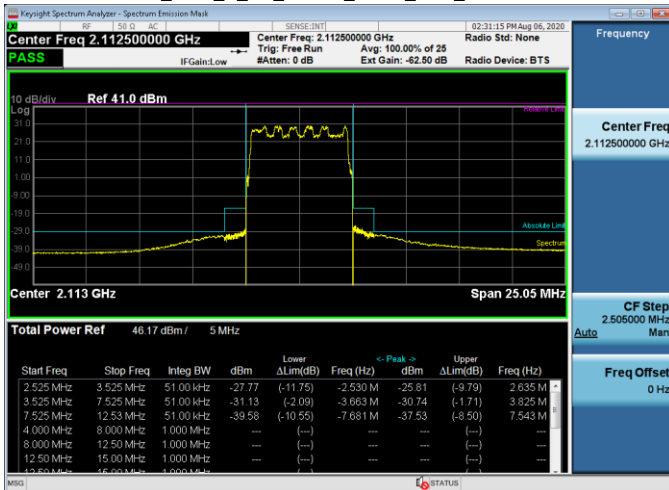
### 4.2.1 Edge of Band Emissions - Plots.

All of the measurements met the requirements of Part 27.53 when measured per Part 2.1049. limit is derived using the 10 Log (n) rule for limits with n=64

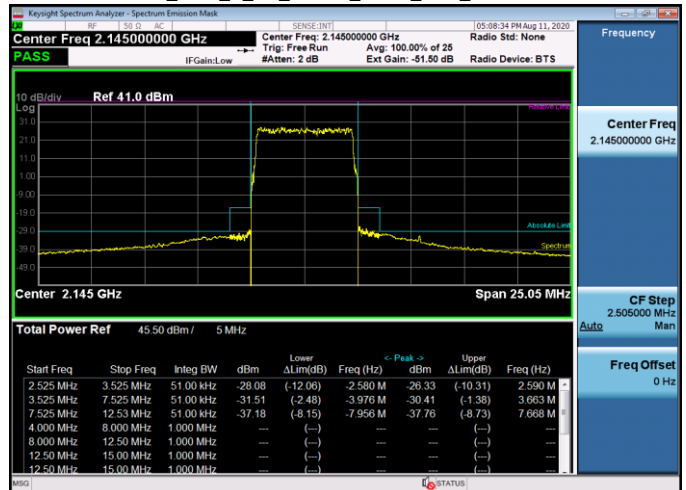
NOTE: Only a sample of the plots are used in this report. The full suite of raw data resides at the MH, New Jersey location.

#### 1C Data – 5MHz BW

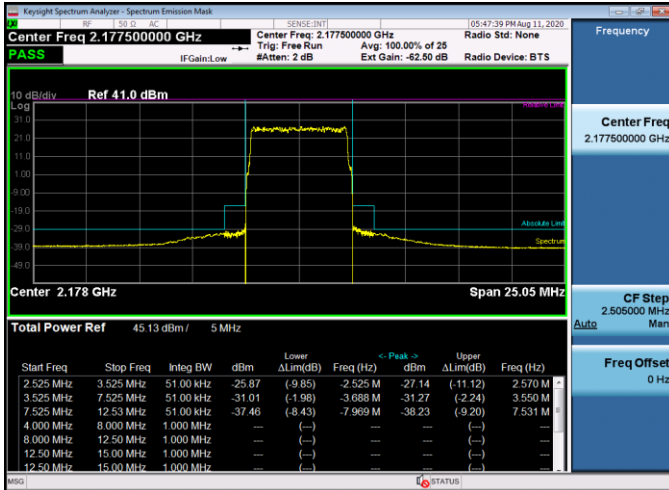
Oobe\_TM3\_2\_1C\_5MBW\_2112\_TX1\_40W 5G-NR



Oobe\_TM3\_1\_1C\_5MBW\_2145\_TX1\_33W 5G-NR

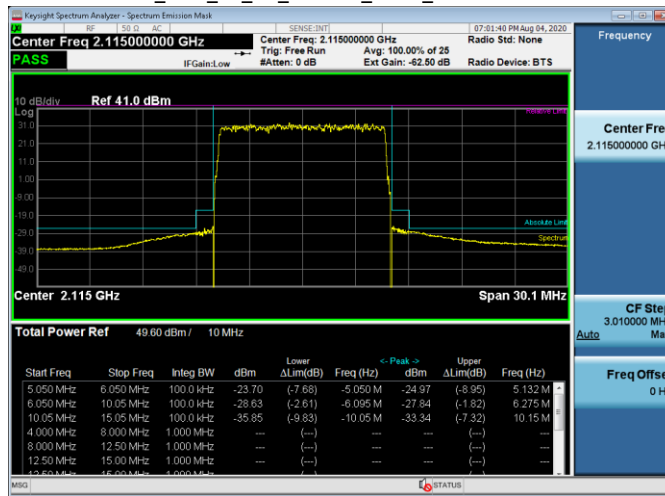


Oobe\_TM3\_1\_1C\_5MBW\_2177\_TX1\_33W 5G-NR

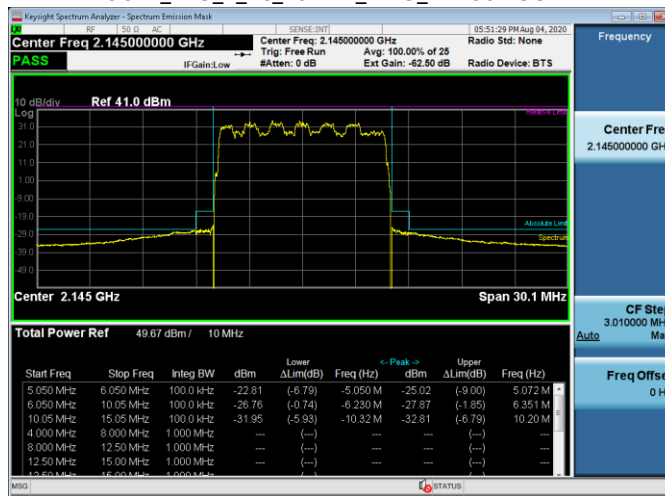


1C Data – 10MHz BW

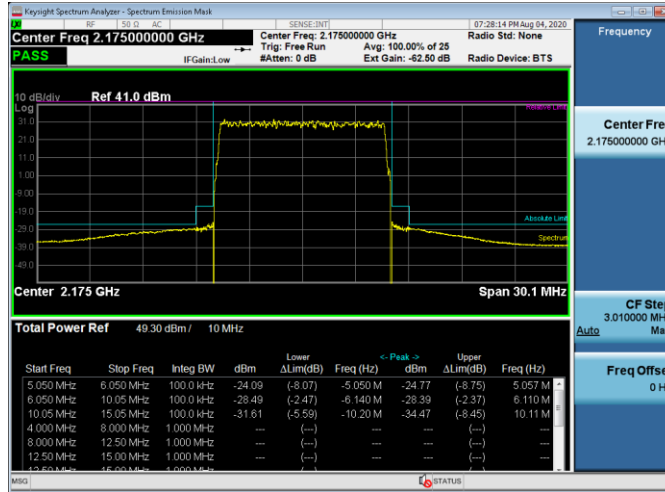
OOBE\_TM3\_1a\_1C\_10MBW\_2115\_TX1 90W 5G-NR



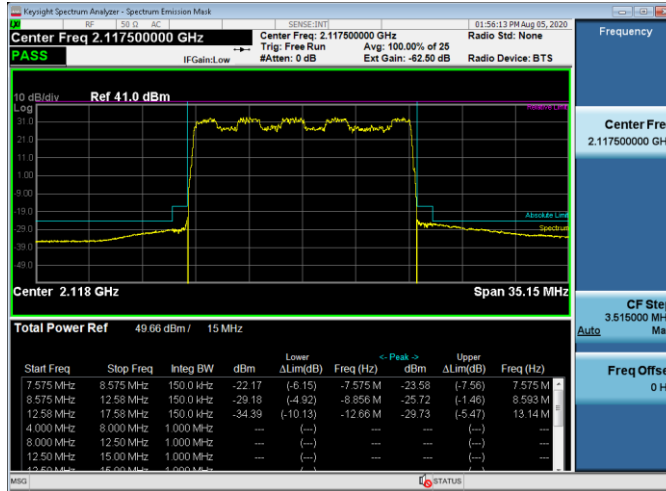
OOBE\_TM3\_2\_1C\_10MBW\_2145\_TX1 90W 5G-NR



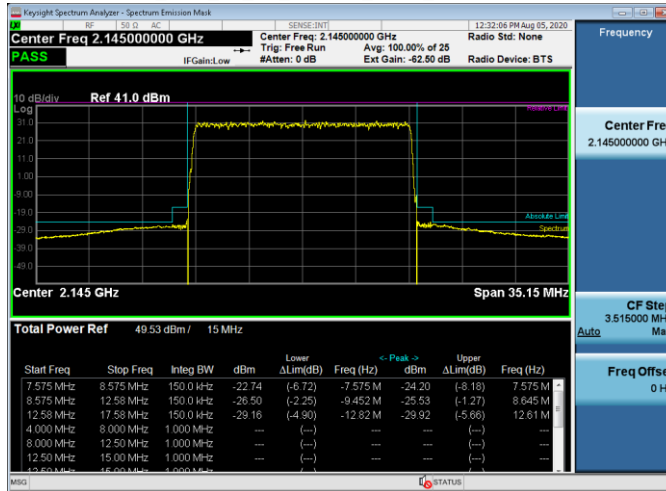
OOBE\_TM3\_1\_1C\_10MBW\_2175\_TX1 90W 5G-NR



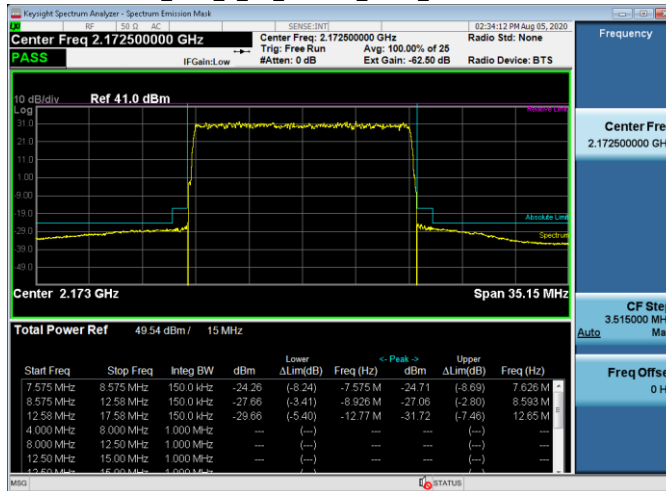
1C Data – 15MHz BW  
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OOB\_T\_M3\_1a\_1C\_15MBW\_2145\_TX1 90W 5G-NR



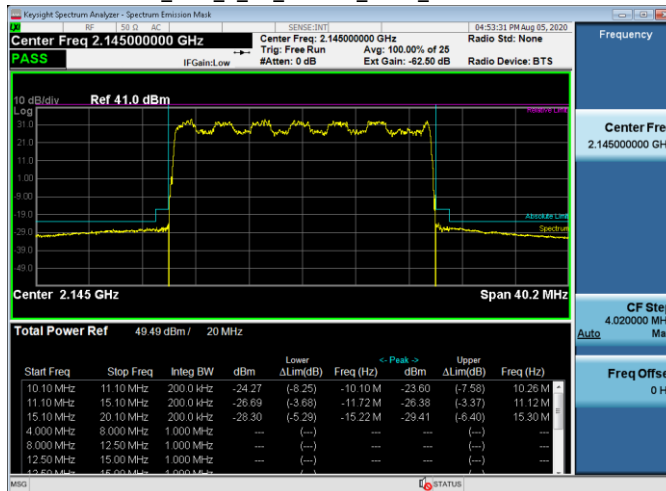
OOB\_T\_M3\_1\_1C\_15MBW\_2172\_TX1 90W 5G-NR



1C Data – 20MHz BW  
 OOB\_T\_M3\_1\_1C\_20MBW\_2120\_TX1 90W 5G-NR



OOB\_T\_M3\_2\_1C\_20MBW\_2145\_TX1 90W 5G-NR

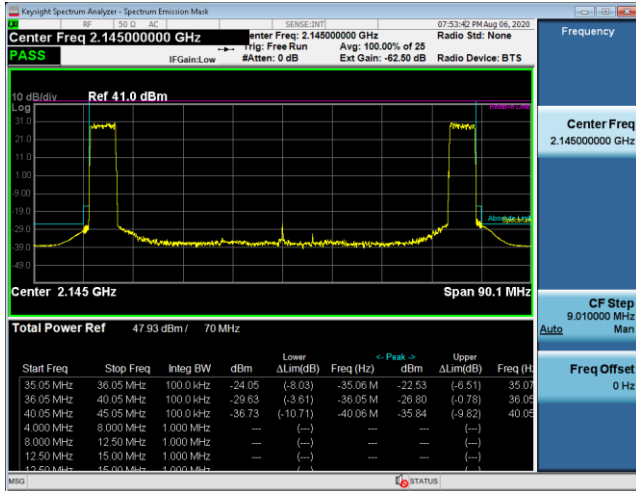


OOB\_T\_M3\_1a\_1C\_20MBW\_2170\_TX1 90W 5G-NR

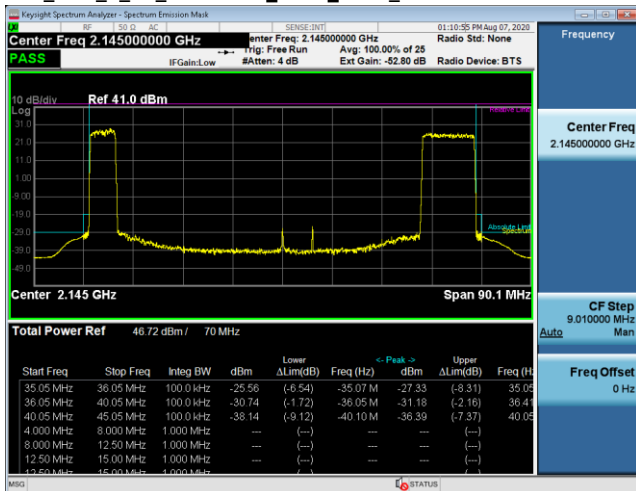


2C Data

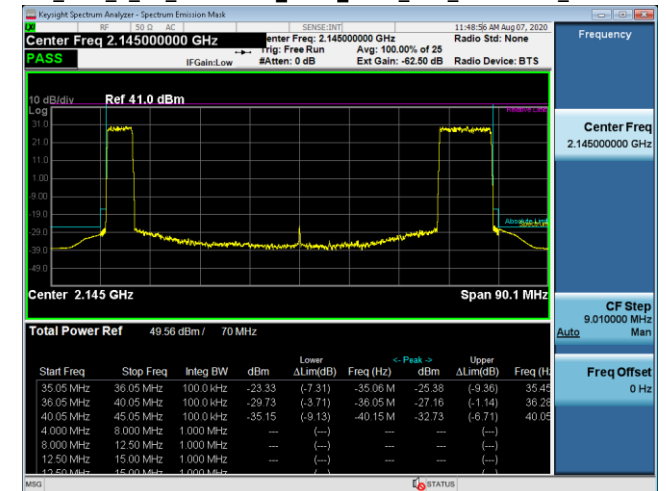
OOBE\_TM3\_1\_2C\_5+5MBW\_2112\_2177\_TX1 33W LTE +5G-NR



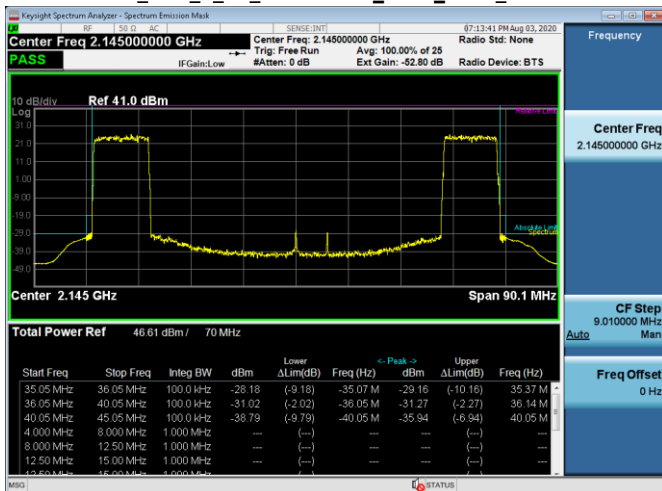
OOBE\_TM3\_1\_2C\_5+10MBW\_2112\_2175\_TX4 20W+25W LTE+5G-NR



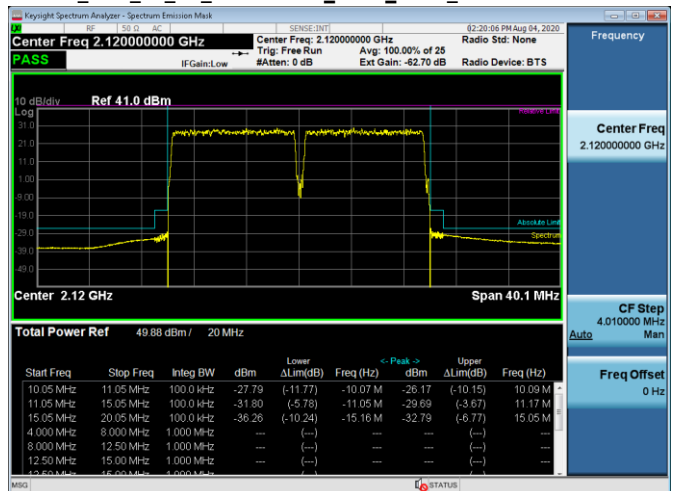
OOBE\_TM3\_1\_2C\_5+10MBW\_2112\_2175\_TX1\_33W+57W\_LTE+5G-NR



OOBE\_TM3\_1\_2C\_10+10MBW\_2115\_2175\_TX2 45W

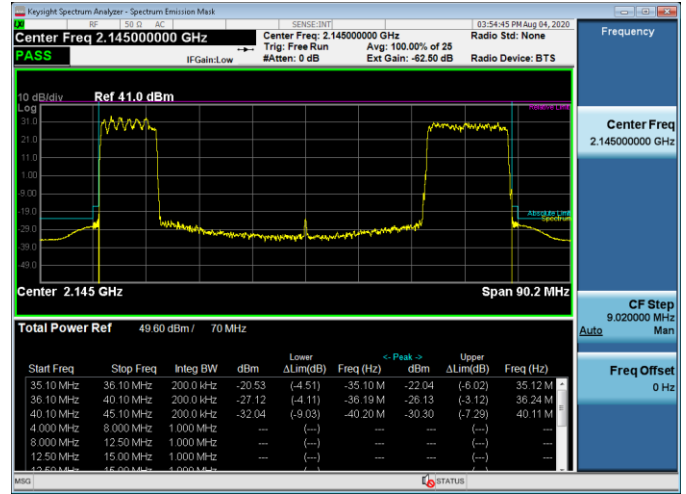
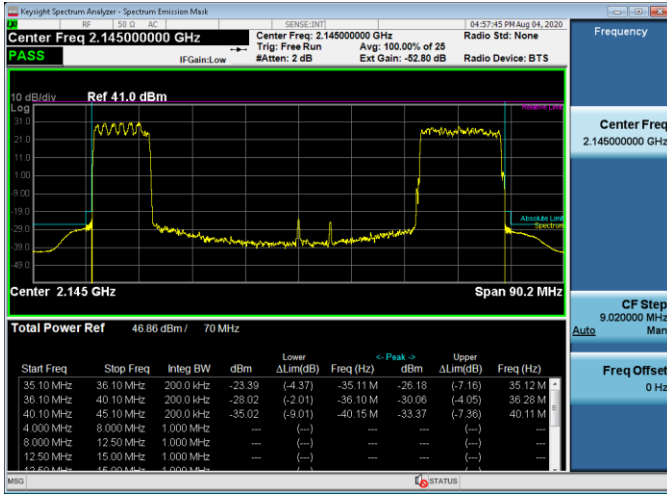


OOBE\_TM3\_1a\_2C\_10+10MBW\_2115\_2125\_TX1 90W 5G-NR+LTE



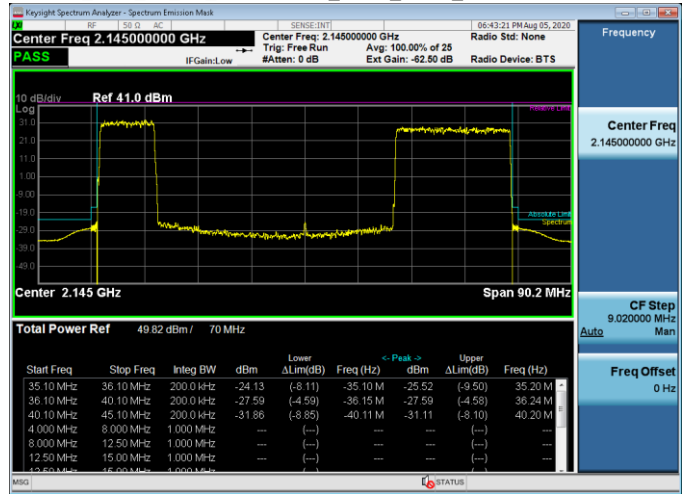
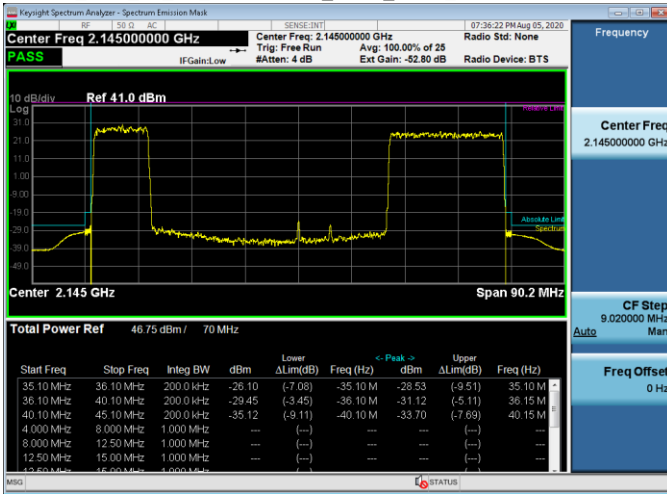
OOBE\_TM3\_2\_2C\_10+15MBW\_2115\_2172\_TX4 45W 5G-NR+LTE

OOBE\_TM3\_2\_2C\_10+15MBW\_2115\_2172\_TX1 90W LTE+5G-NR



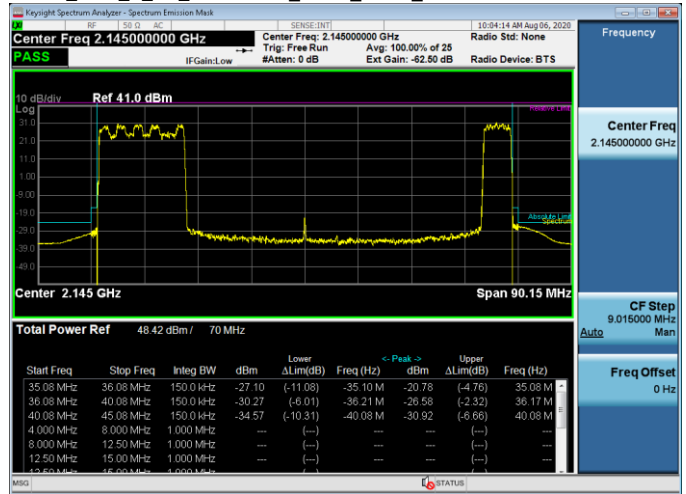
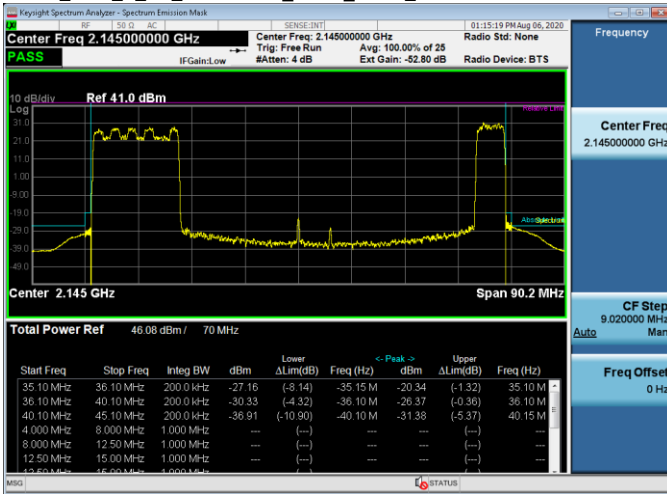
OOBE\_TM3\_1a\_2C\_10+20MBW\_2115\_2170\_TX4 45W LTE+5G-NR

OOBE\_TM3\_1a\_2C\_10+20MBW\_2115\_2170\_TX1 90W LTE+5G-NR

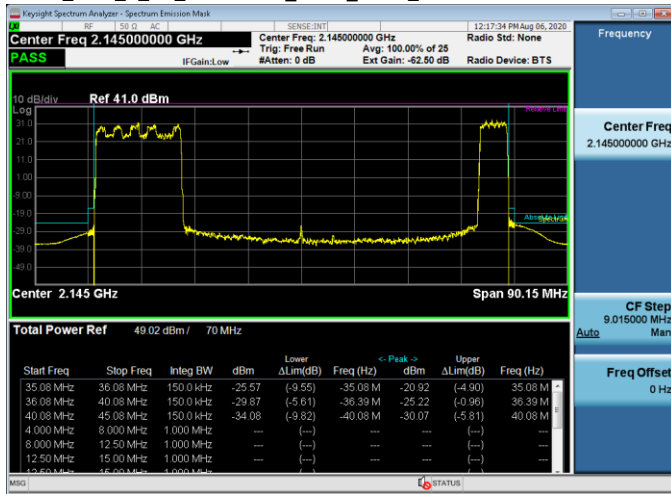


OOBE\_TM3\_2\_2C\_15+5MBW\_2117\_2177\_TX4 25W+20W 5G-NR+LTE

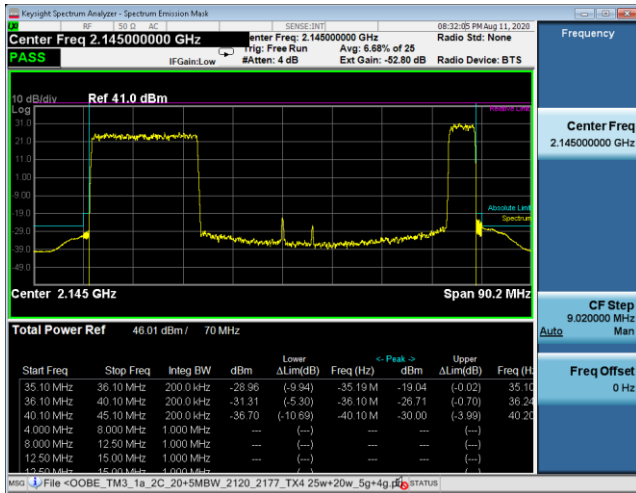
OOBE\_TM3\_2\_2C\_15+5MBW\_2117\_2177\_TX1 45W+20W 5G-NR+LTE



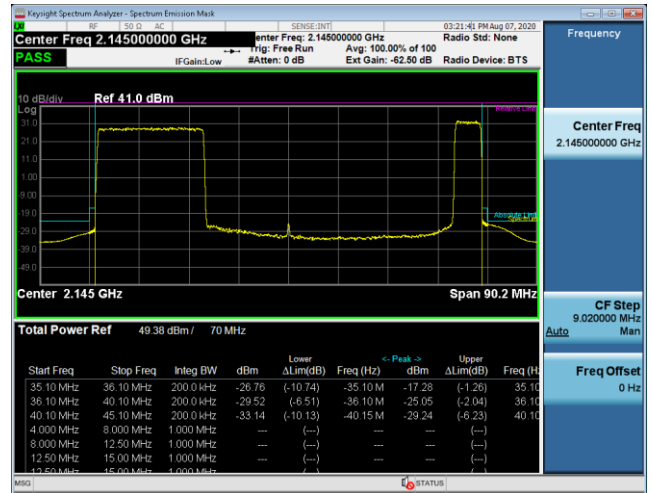
OOBE\_TM3\_2\_2C\_15+5MBW\_2117\_2177\_TX1 45W+33W 5G-NR+LTE



OOBE\_TM3\_1a\_2C\_20+5MBW\_2120\_2177\_TX4 25W+20W\_5G-NR+LTE



OOBE\_TM3\_1a\_2C\_20+5MBW\_2120\_2177\_TX1\_33W+57W\_5G-NR+LTE

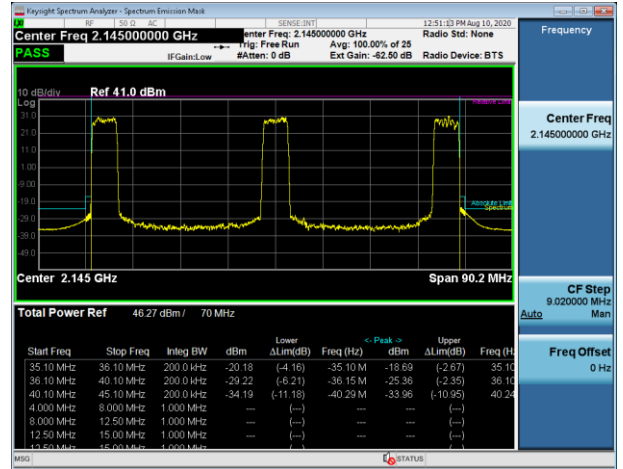
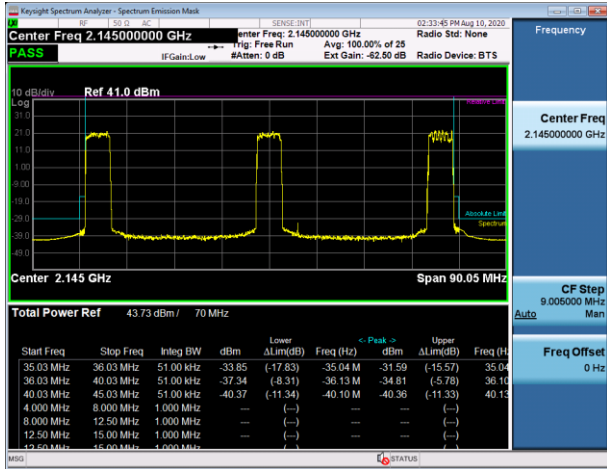




3C Data

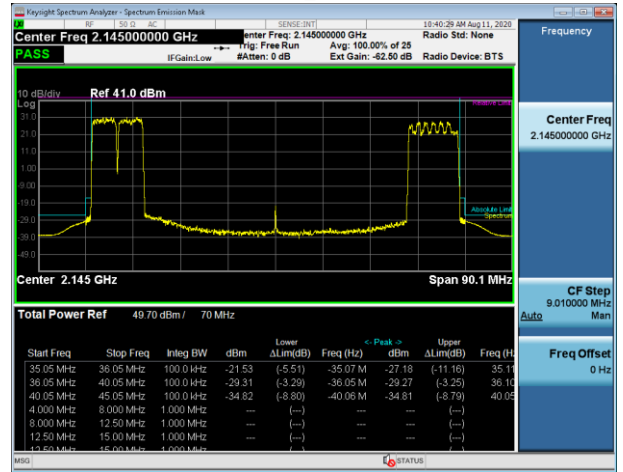
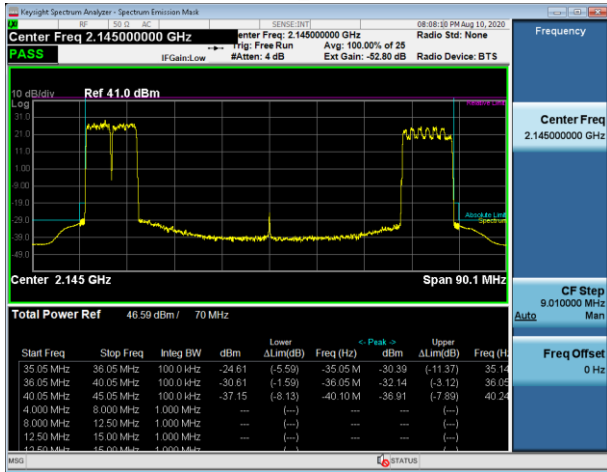
Oobe\_TM3\_2\_3C\_5+5+5MBW\_2112\_2145\_2177\_TX1  
43W\_LTE+LTE+5G-NR

Oobe\_TM3\_2\_3C\_5+5+5MBW\_2112\_2145\_2177\_TX1  
46W\_LTE+LTE+5G-NR



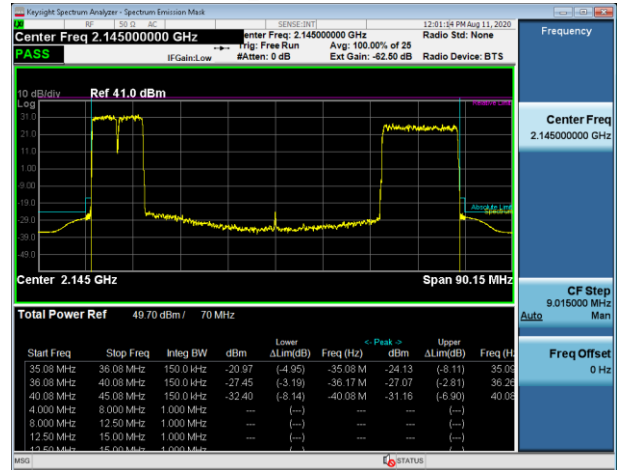
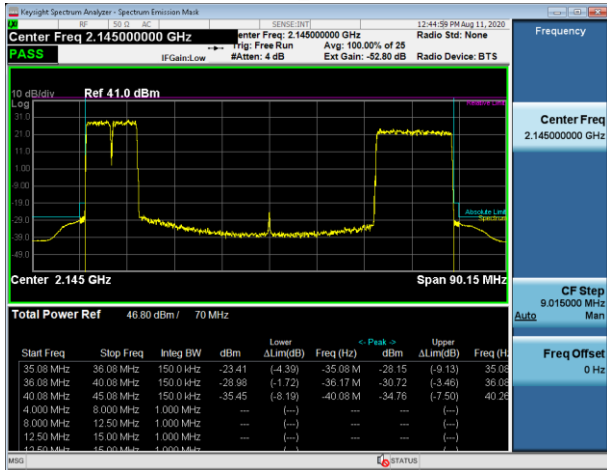
Oobe\_TM3\_2\_3C\_5+5+10MBW\_2112\_2117\_2175\_TX4  
15W+15W+15W\_LTE+LTE+5G-NR

Oobe\_TM3\_2\_3C\_5+5+10MBW\_2112\_2117\_2175\_TX1  
30W+30W+30W\_LTE+LTE+5G-NR



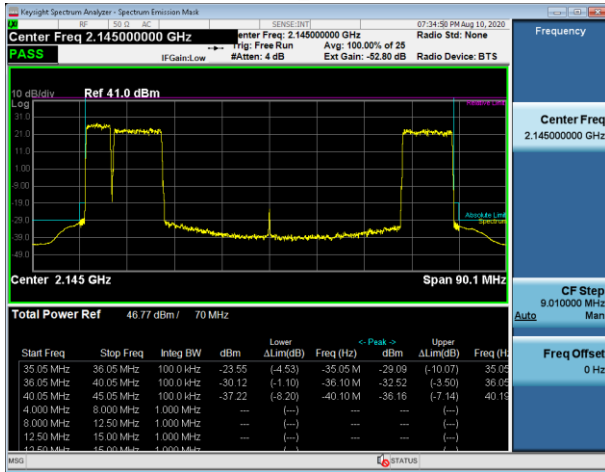
Oobe\_TM3\_1\_3C\_5+5+15MBW\_2112\_2117\_2172\_TX4  
15W+15W+15W\_LTE+LTE+5G-NR

Oobe\_TM3\_1\_3C\_5+5+15MBW\_2112\_2117\_2172\_TX1  
90W\_LTE+LTE+5G-NR

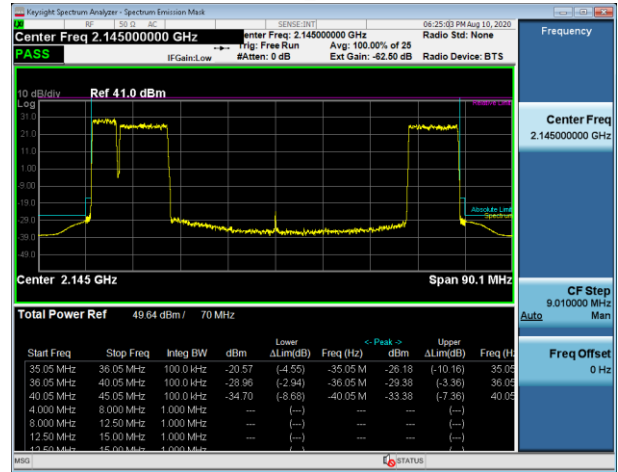




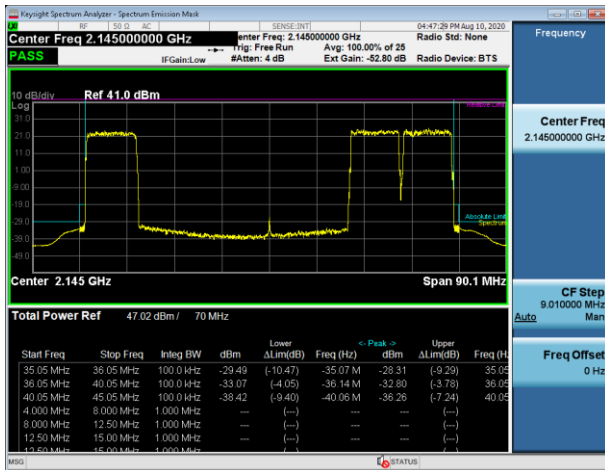
OOBE\_TM3\_1\_3C\_5+10+10MBW\_2112\_2120\_2175\_TX4  
15W+15W+15W\_LTE+LTE+5G-NR



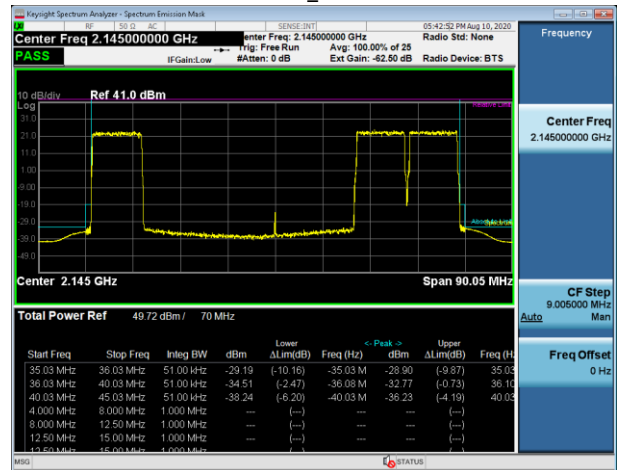
OOBE\_TM3\_1\_3C\_5+10+10MBW\_2112\_2120\_2175\_TX1  
30W+30W+30W\_LTE+LTE+5G-NR



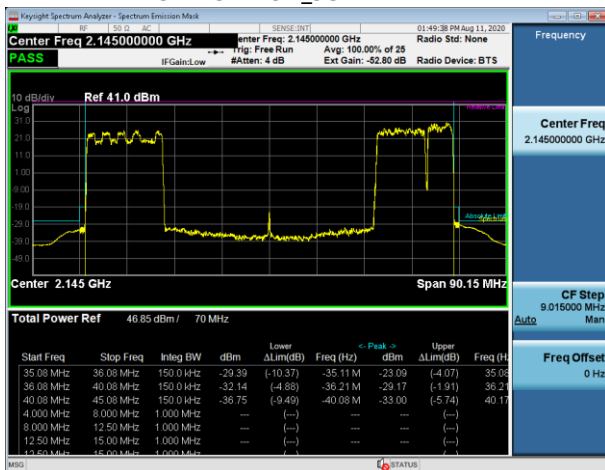
OOBE\_TM3\_1a\_3C\_10+10+10MBW\_2115\_2165\_2175\_TX4  
45W 5G-NR+LTE+LTE



OOBE\_TM3\_2\_3C\_10+10+10MBW\_2115\_2165\_2175\_TX1  
30W+30W+30W\_5G-NR+LTE+LTE



OOBE\_TM3\_2\_3C\_15+10+5MBW\_2117\_2170\_2177\_TX4  
15W+15W+15W\_5G-NR+LTE+LTE



OOBE\_TM3\_1\_3C\_15+10+5MBW\_2117\_2170\_2177\_TX1  
90W\_LTE+LTE+5G-NR



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

### 5.1 Measurement of Spurious Emissions at Transmit Antenna Port

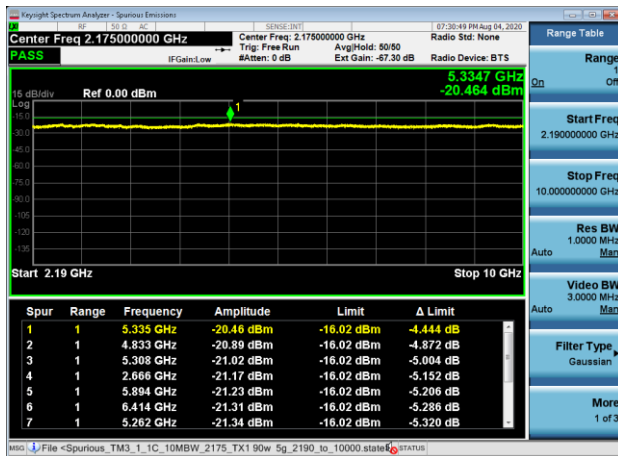
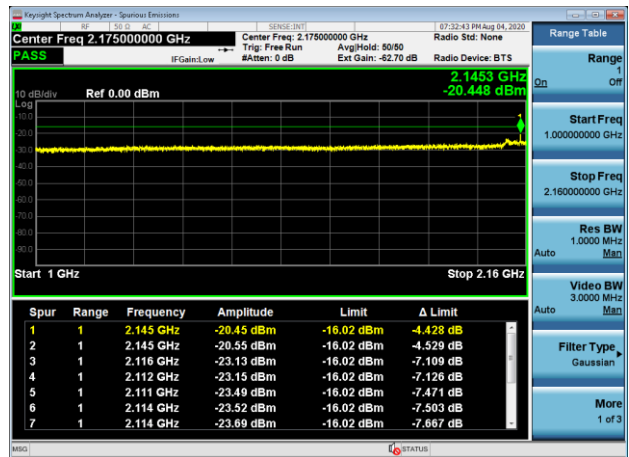
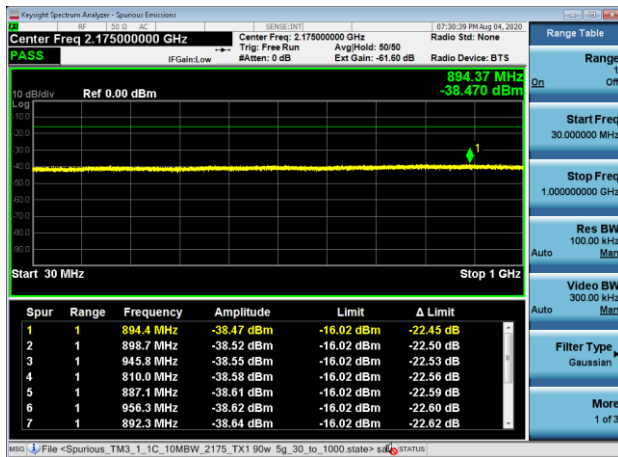
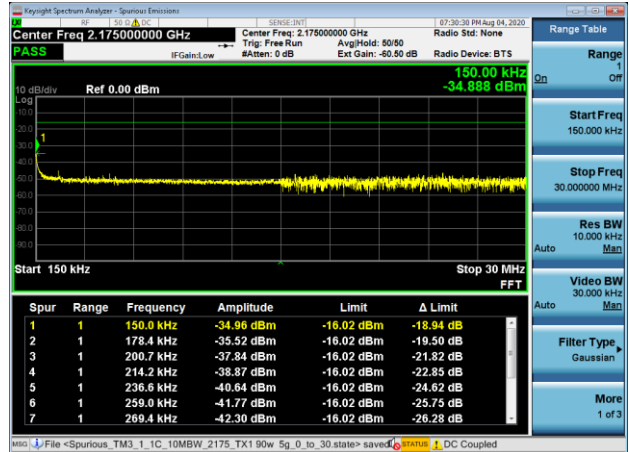
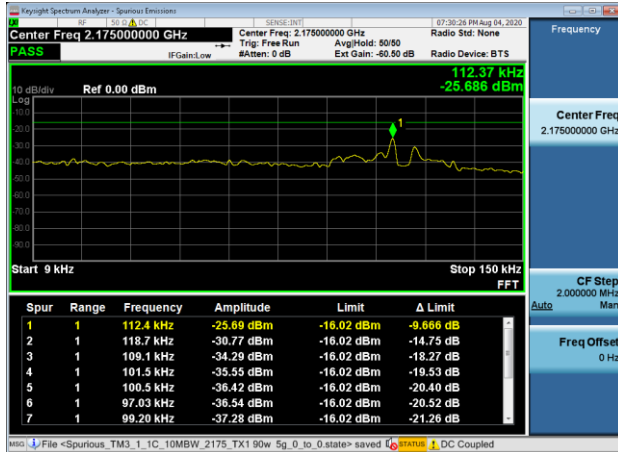
Spurious Emissions at the transmit-antenna terminals were investigated over the frequency range of 10 MHz to beyond the 10th harmonic of the specific transmit band. Carrier Bandwidth is exempt. For this band of operation, the measurements were performed up to 10 GHz. Measurements were made using a Keysight MXA Signal Analyzer. The RF output from the transmitter was reduced (to an amplitude usable by the receivers) using calibrated attenuators. The RF power level was continuously monitored via a coupled RF Power Meter.

The required emission limitation is specified as appropriate in 27.53. The measured spurious emission levels were plotted for the frequency range as specified in 2.1057. There were no reportable emissions. Data below documents performance up to 10 GHz. The limit is derived using the 10 Log (n) rule for limits with  $n=64$

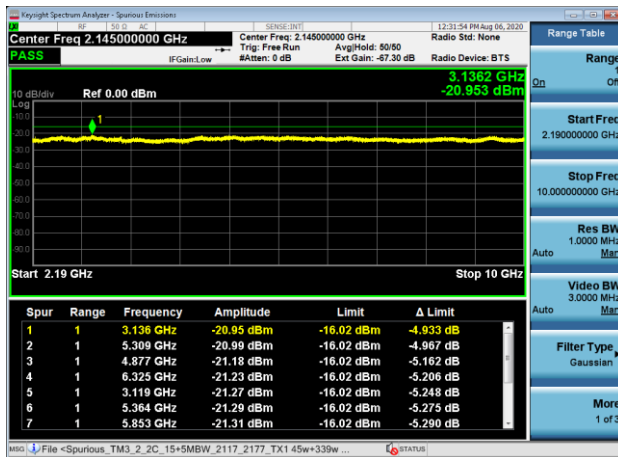
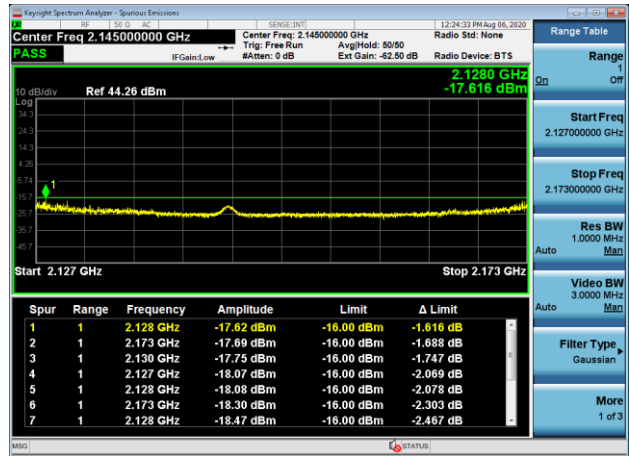
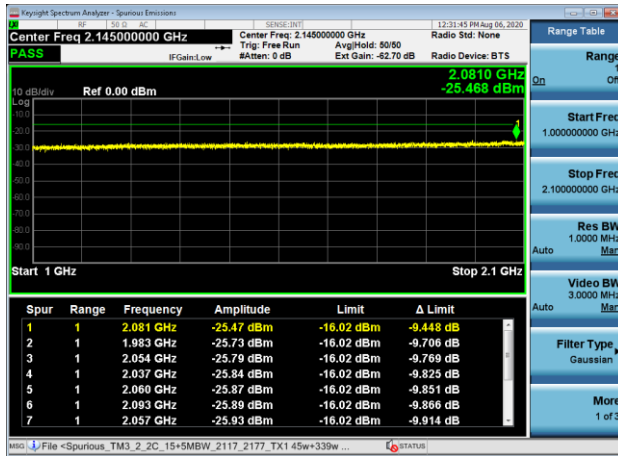
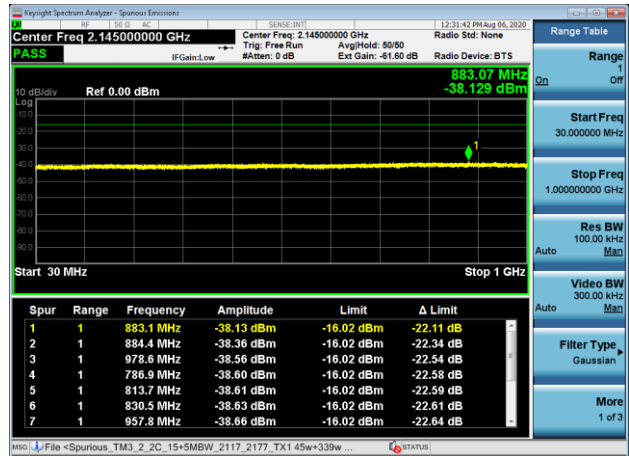
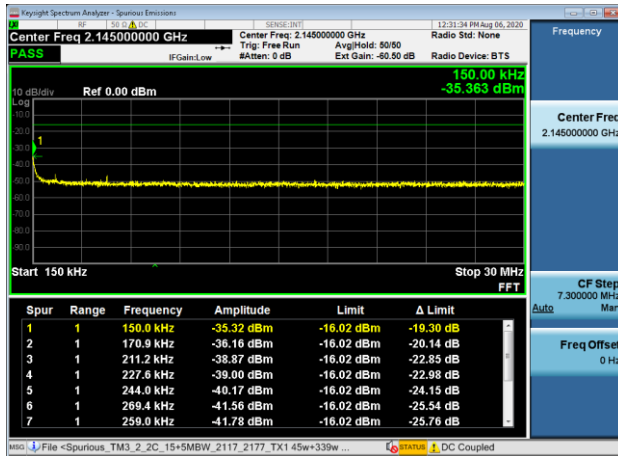
### 5.1.1 Spurious Emissions at Tx Port - Plots

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.

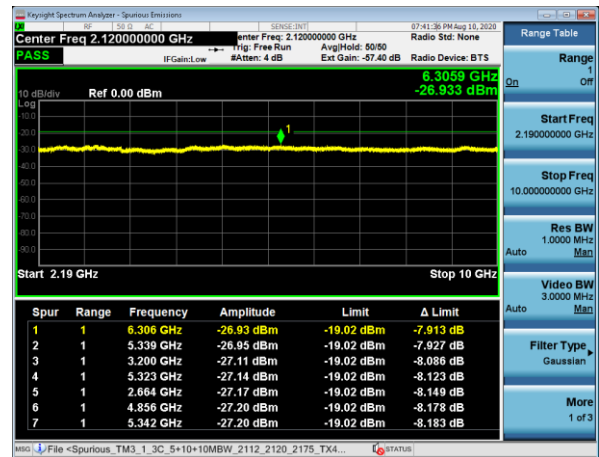
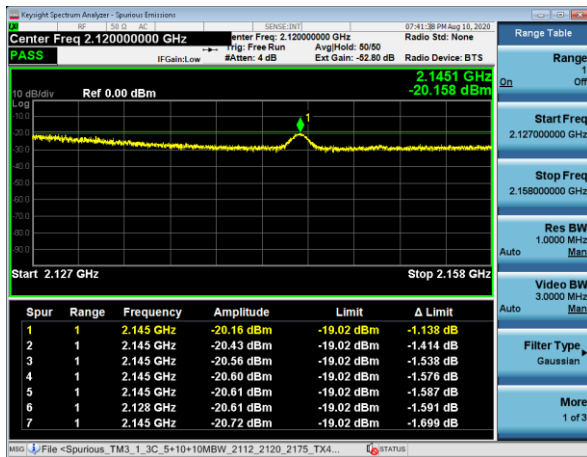
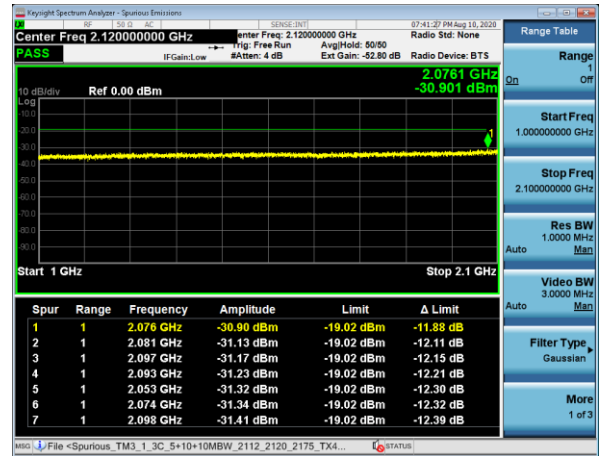
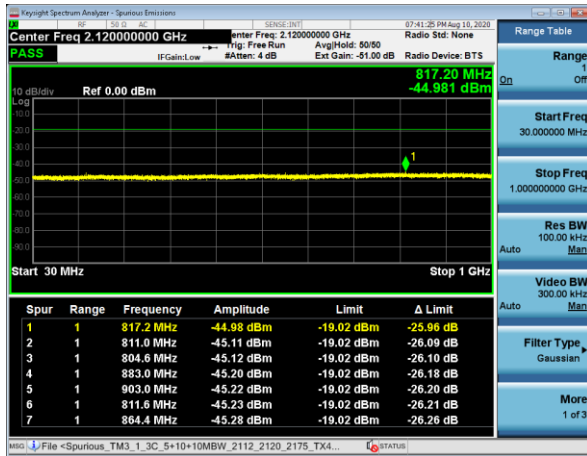
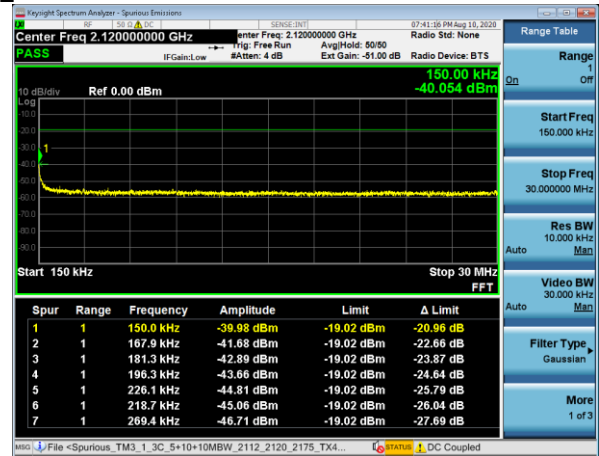
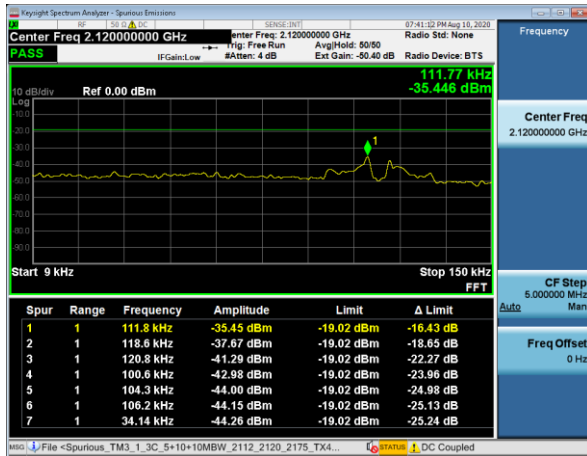
1C Data - TM3.1 / 10MBW / 2175MHz CF/ TX1 90W



2C Data - TM3.2 / 15+5 MHz BW / 2117+2177 / TX1 / 45W+33W / 5G-NR+ LTE



3C Data - TM3.1 / 5+10+10MHz BW / 2112\_2120\_2175 / TX4 / 15W+15W+15W / LTE + LTE +5G-NR





## Photographs





**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	2019-01-31	2021-01-31
E1022	Weinschel	Attenuator	10dB DC-18GHz 25W	46-10-34-LIM	BN3118	CNR-V	CNR-V

**Customer Provided Equipment**

Manufacturer	Type	Description	Model	Serial	Calibration Date	Calibration Due
Weinschel	Attenuator	20dB DC-18GHz 100W	48-20-43	BC5416	CNR-V	CNR-V
Weinschel	Attenuator	30dB DC-18GHz 150W	66-30-34	BJ5923	CNR-V	CNR-V
True Blue	RF Cable		90-095-144	MFR-57500 04-040741	CNR-V	CNR-V
Mini Circuits	Modular Test System (switch)		ZTM-53	11701250030	CNR-V	CNR-V

CNR-V: Calibration Not Required; Must be Verified

## 6. FCC Section 2.1053 - Field strength of spurious radiation.

### 6.1 Section 2.1053 Field Strength of Spurious Emissions

Field strength measurements of radiated spurious emissions were made in an FCC registered 3m Semi-Anechoic Chamber which is maintained by Nokia Bell Labs in Murray Hill, New Jersey. A complete description and full measurement data for the site is on file with the Commission (Site Registration Number: 515091).

The spectrum from 30 MHz to beyond the tenth harmonic of the carrier, 10 GHz, was searched for spurious radiation. Measurements were made using both horizontally and vertically polarized broadband antennas. Per FCC regulations, the comparison of out of band spurious emissions directly to the limit is appropriately made using the substitution method. However, when the emissions are more than 20 dB below the specification limit, the use of field strength measurements for compliance determination is acceptable and those emissions are considered not reportable (Section 2.1053 and the FCC Interpretive database for 2.1053). For this case the evaluation of acceptable radiated field strength is as follows.

### 6.2 Field Strength of Spurious Emissions - Limits

Sections 2.1053 and 27.53 contain the requirements for the levels of spurious radiation as a function of the level of the unmodulated carrier. The reference level for the unmodulated carrier is calculated as the field produced by an ideal dipole excited by the transmitter output power according to the following relation taken from Reference Data for Radio Engineers, page 676, 4<sup>th</sup> edition, IT&T Corp.

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

$$20 \log (E \cdot 10^6) - (43 + 10 \log P) = 82.23 \text{ dB}\mu\text{V}/\text{meter}$$

Where:

E = Field Intensity in Volts/meter

P = Transmitted Power in Watts

R = Measurement distance in meters = 3 m

The Part 27 Limit is 82.23 dBuV/m at 3m and 91.77 dBuV/m at 1m

The Part 27 non-report level is 62.23 dBuV/m at 3m.

The calculated emission levels were found by:

$$\text{Measured level (dB}\mu\text{V)} + \text{Cable Loss(dB)} + \text{Antenna Factor(dB)} = \text{Field Strength (dB}\mu\text{V}/\text{m)}$$

#### RESULTS:

For compliance with 47CFR Parts 2 and 27, the field strength of any spurious radiation, measured at 3m, is required to be less than 82.23 dBuV/meter (82.23 @ 3m). Emissions equal to or less than 62.23 dBuV/meter at 3m are not reportable and may be verified using field strength measurements and broadband antennas. Over the out of band spectrum investigated from 30 MHz to beyond the tenth harmonic of the carrier (up to 10 GHz), no reportable spurious emissions were detected.

## 7. NVLAP Certificate of Accreditation

<p>United States Department of Commerce National Institute of Standards and Technology</p>  <hr/> <p><b>Certificate of Accreditation to ISO/IEC 17025:2005</b></p> <hr/> <p>NVLAP LAB CODE: 100275-0</p> <p><b>Nokia, Global Product Compliance Lab</b> Murray Hill, NJ</p> <p><i>is accredited by the National Voluntary Laboratory Accreditation Program for specific services, 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 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).</i></p> <table border="0" style="width: 100%;"><tr><td style="width: 40%;"><hr/><p>2019-09-20 through 2020-09-30 <i>Effective Dates</i></p></td><td style="width: 20%; text-align: center;"></td><td style="width: 40%;"><hr/><p><i>[Signature]</i> For the National Voluntary Laboratory Accreditation Program</p></td></tr></table>		<hr/> <p>2019-09-20 through 2020-09-30 <i>Effective Dates</i></p>		<hr/> <p><i>[Signature]</i> For the National Voluntary Laboratory Accreditation Program</p>
<hr/> <p>2019-09-20 through 2020-09-30 <i>Effective Dates</i></p>		<hr/> <p><i>[Signature]</i> For the National Voluntary Laboratory Accreditation Program</p>		