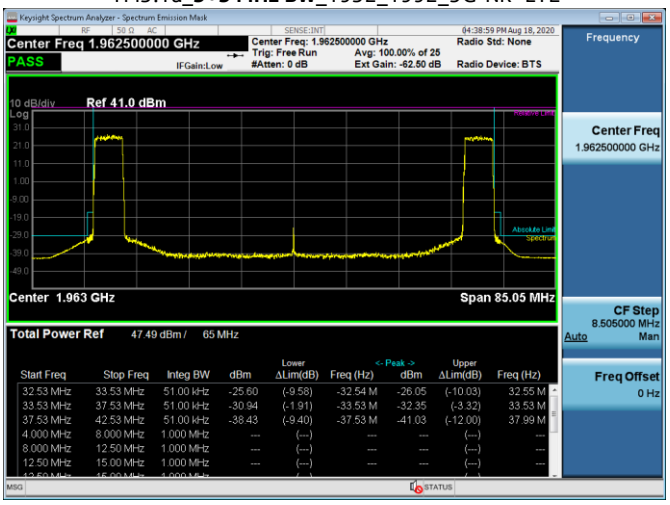
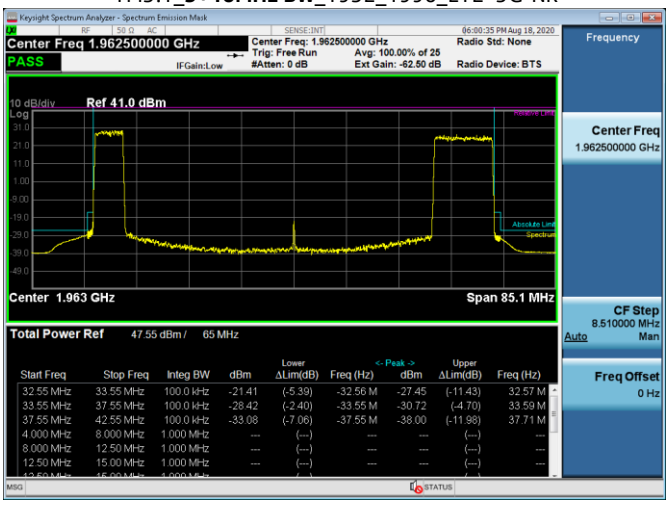
2 Carrier Data – TX1

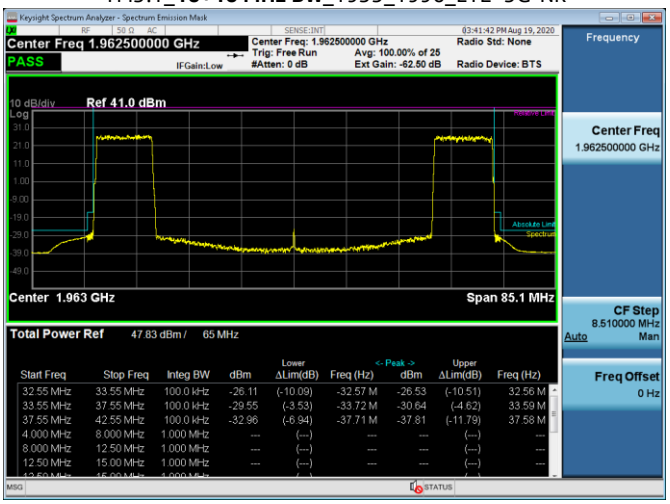
TM3.1a_**5+5 MHz BW**_1932_1992_5G-NR+LTE



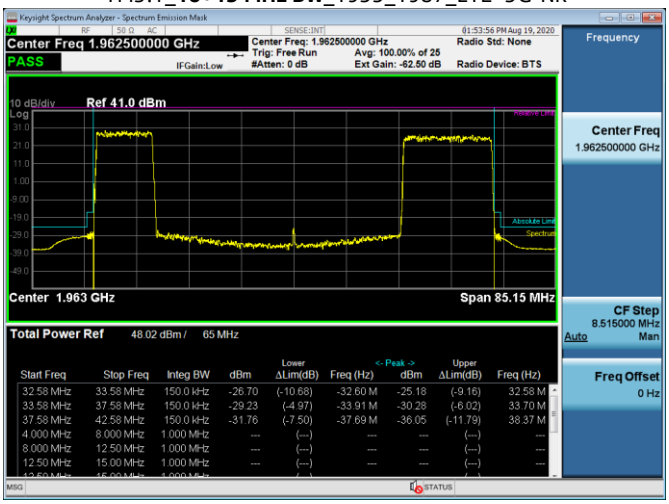
TM3.1_**5+10MHz BW**_1932_1990_LTE+5G-NR



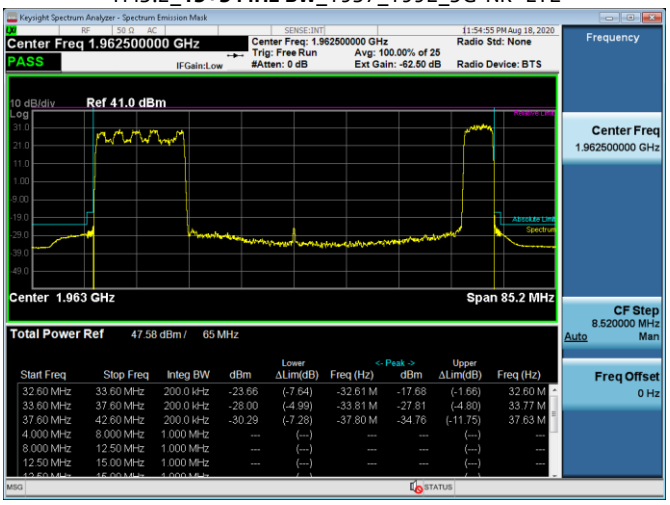
TM3.1_**10+10 MHz BW**_1935_1990_LTE+5G-NR



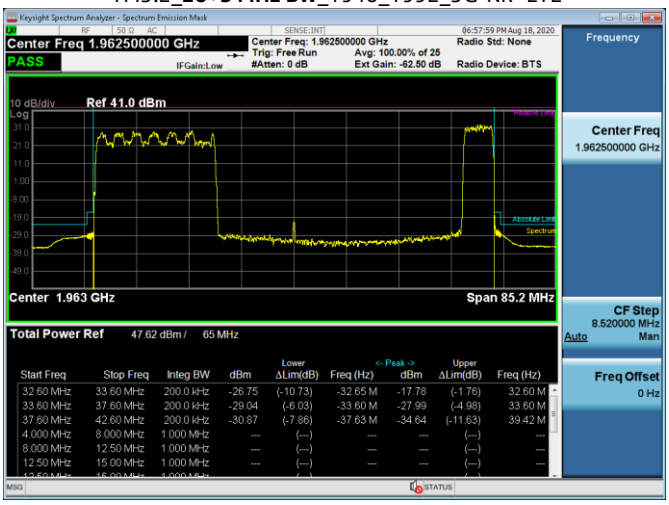
TM3.1_**10+15 MHz BW**_1935_1987_LTE+5G-NR



TM3.2_**15+5 MHz BW**_1937_1992_5G-NR+LTE

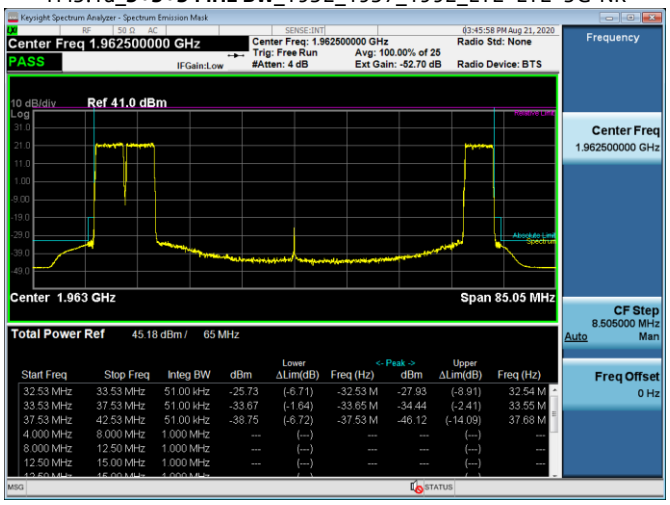


TM3.2_**20+5 MHz BW**_1940_1992_5G-NR+LTE

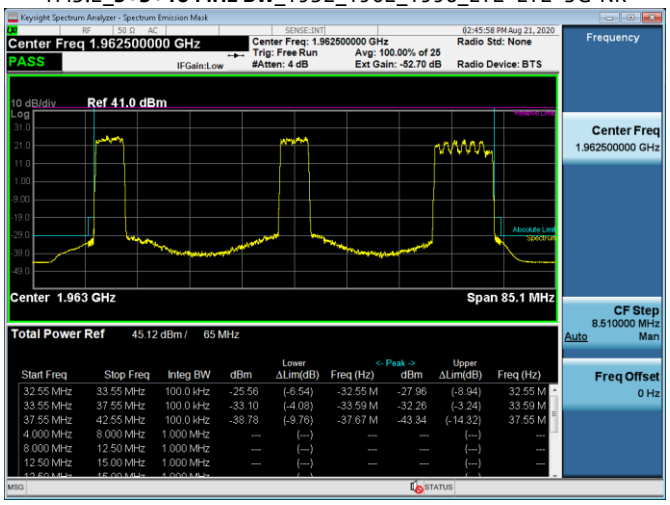


3 Carrier Data - TX 4

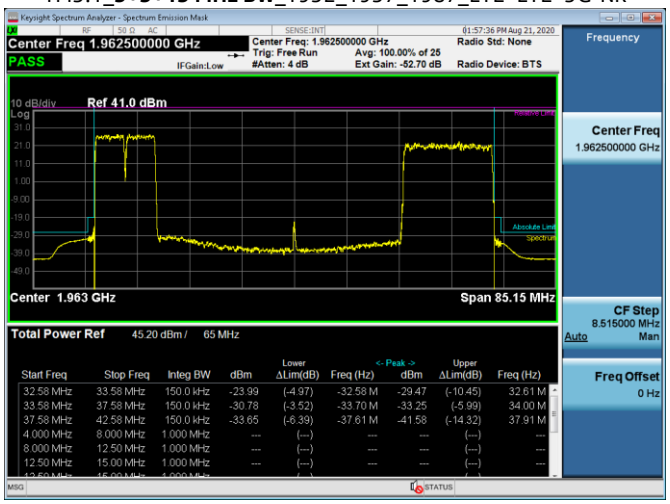
TM3.1a_**5+5+5 MHz BW**_1932_1937_1992_LTE+LTE+5G-NR



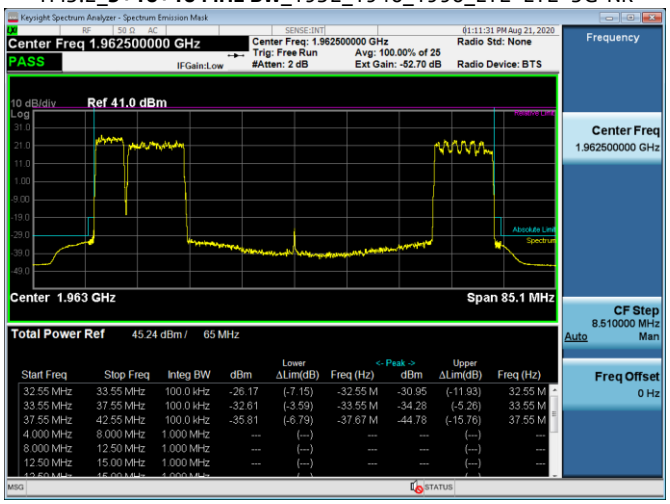
TM3.2_**5+5+10 MHz BW**_1932_1962_1990_LTE+LTE+5G-NR



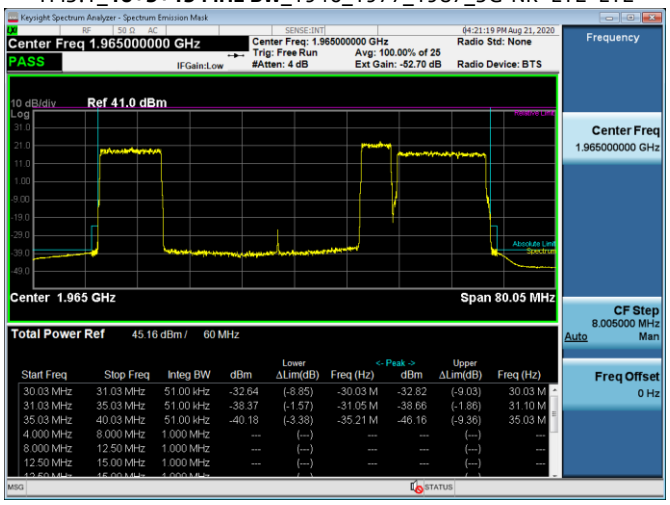
TM3.1_**5+5+15 MHz BW**_1932_1937_1987_LTE+LTE+5G-NR



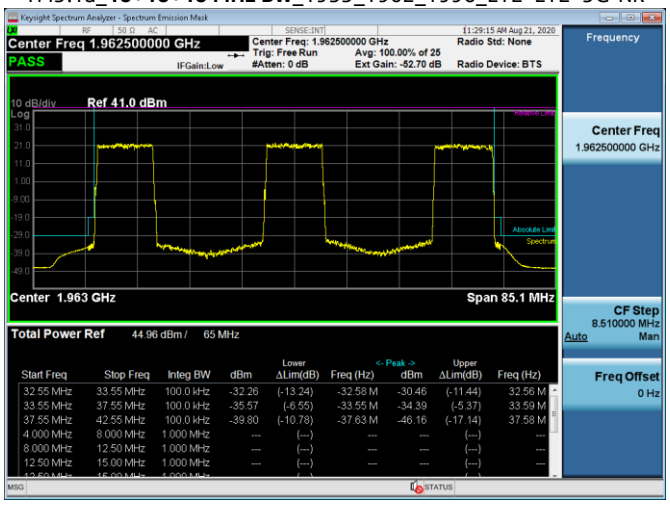
TM3.2_**5+10+10 MHz BW**_1932_1940_1990_LTE+LTE+5G-NR



TM3.1_**10+5+15 MHz BW**_1940_1977_1987_5G-NR+LTE+LTE

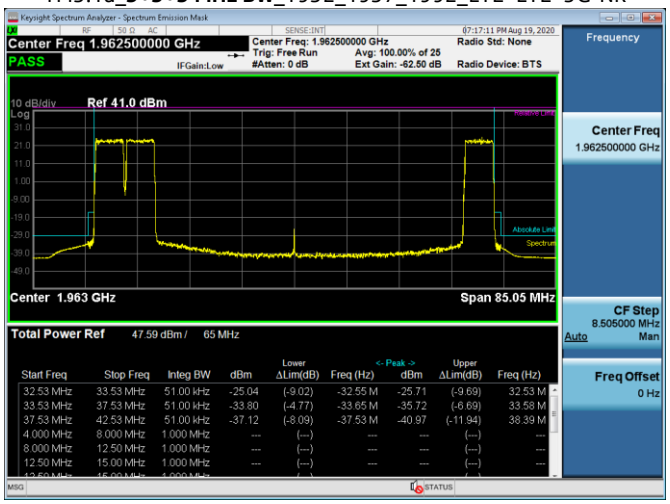


TM3.1a_**10+10+10 MHz BW**_1935_1962_1990_LTE+LTE+5G-NR

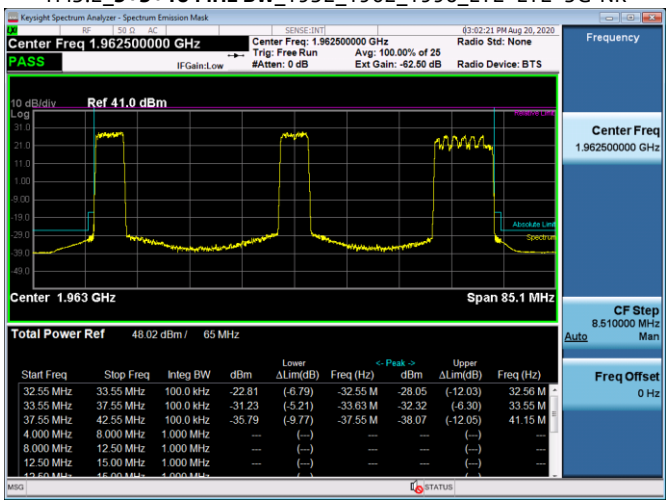


3 Carrier Data - TX 1

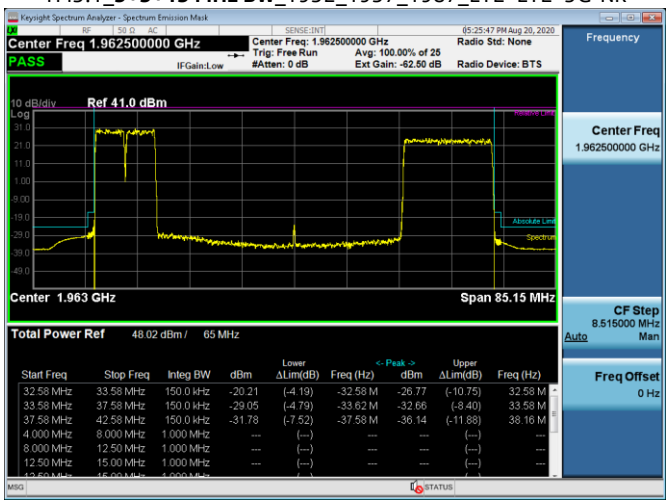
TM3.1a_**5+5+5 MHz BW**_1932_1937_1992_LTE+LTE+5G-NR



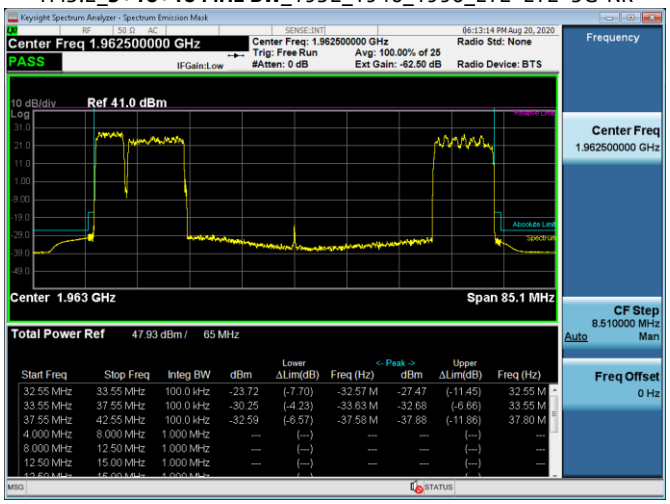
TM3.2_**5+5+10 MHz BW**_1932_1962_1990_LTE+LTE+5G-NR



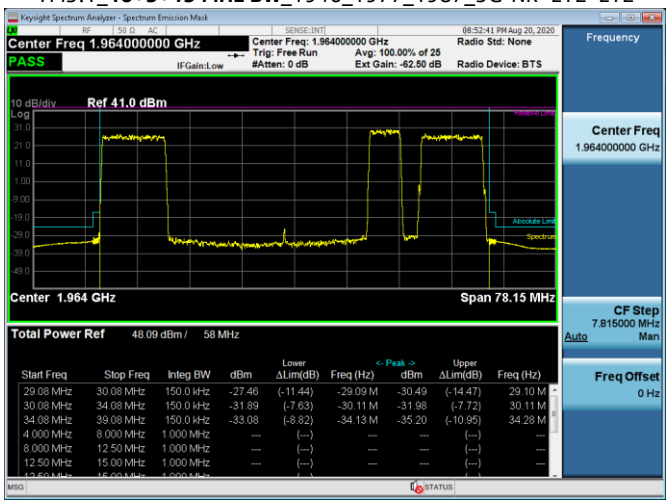
TM3.1_**5+5+15 MHz BW**_1932_1937_1987_LTE+LTE+5G-NR



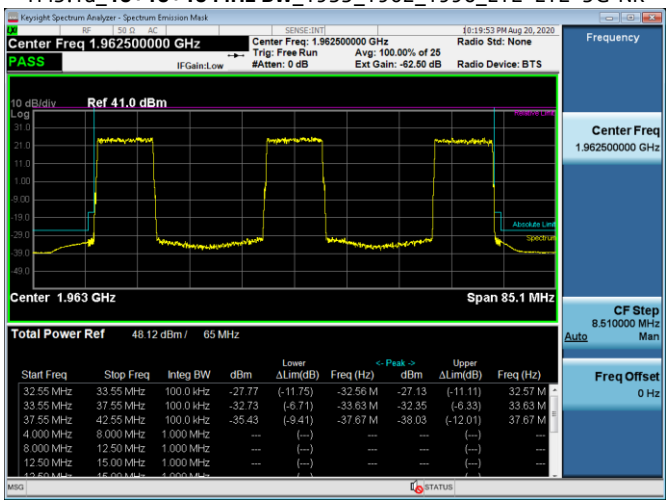
TM3.2_**5+10+10 MHz BW**_1932_1940_1990_LTE+LTE+5G-NR



TM3.1_**10+5+15 MHz BW**_1940_1977_1987_5G-NR+LTE+LTE



TM3.1a_**10+10+10 MHz BW**_1935_1962_1990_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

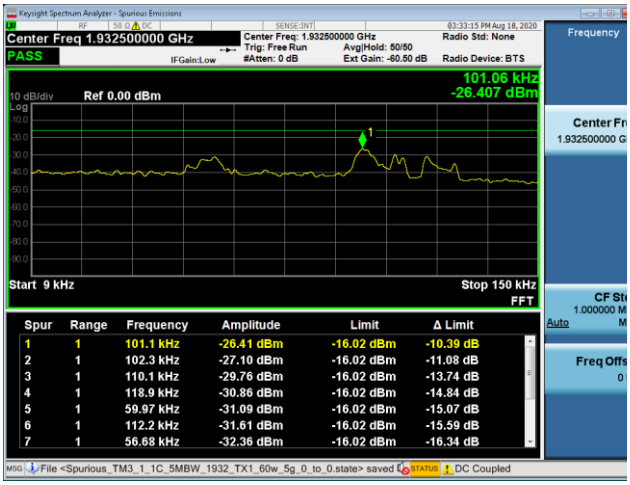
Spurious Emissions at the transmit-antenna terminals were investigated over the frequency range of 10 MHz to beyond the 10th harmonic of the specific transmit band. For this band of operation, the measurements were performed up to 10GHz. Measurements were made using a Keysight MXA Signal Analyzer. The 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.

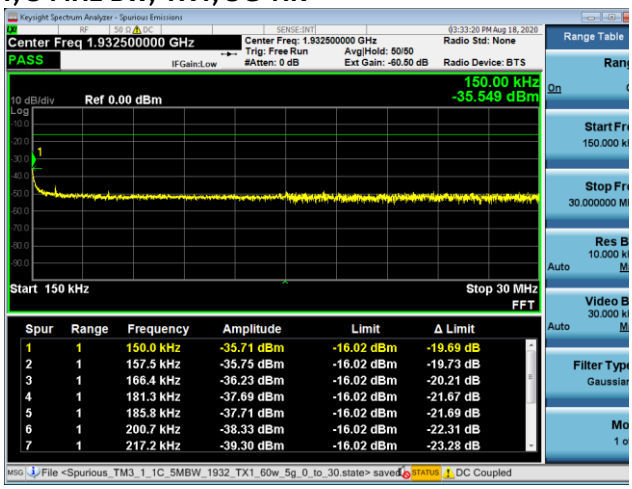
The required emission limitation is specified as appropriate in 24.238. The measured spurious emission levels were plotted for the frequency range as specified in 2.1057. There were no reportable emissions. Data below documents performance up to 20 GHz.

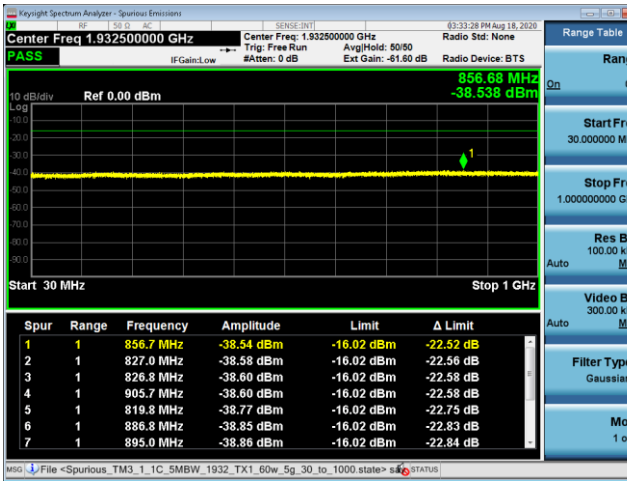
5.1.1 Spurious Emissions at Tx Port - Plots

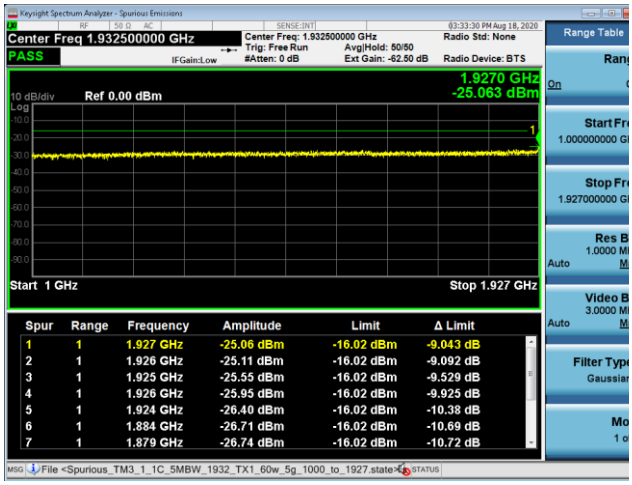
NOTE: Only a sample of the plots are used in this report. The full suite of raw data resides at the MH, New Jersey location.

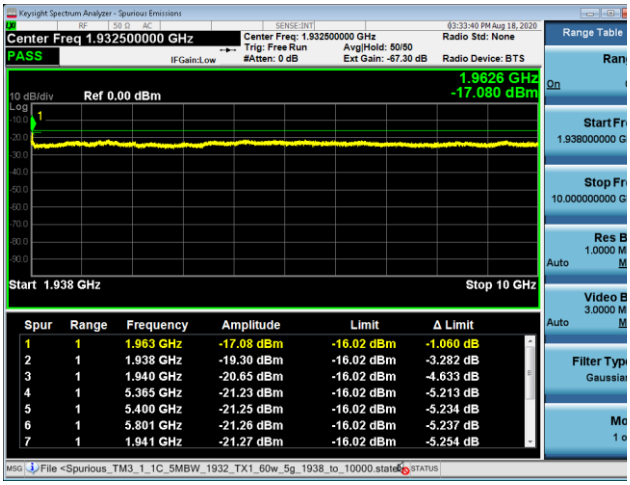
1 Carrier Data - TM3.1, 5 MHz BW, TX1, 5G-NR



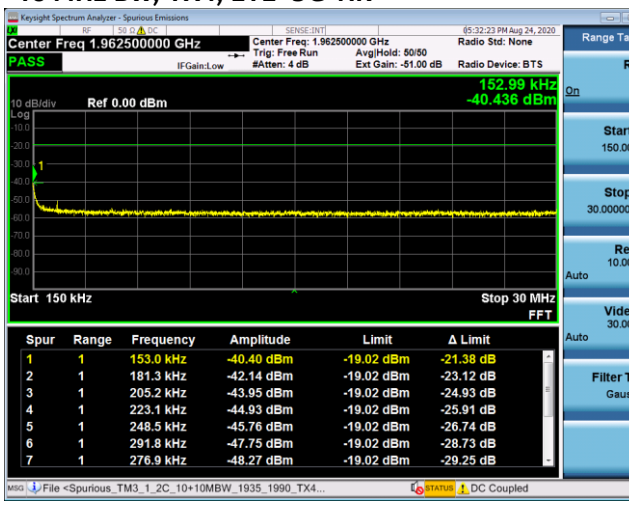


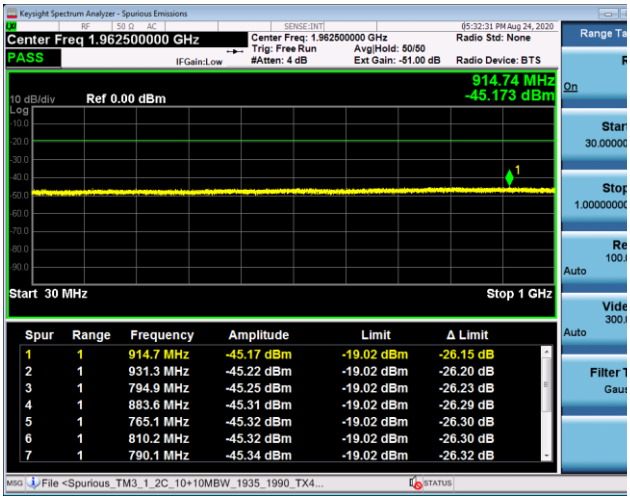


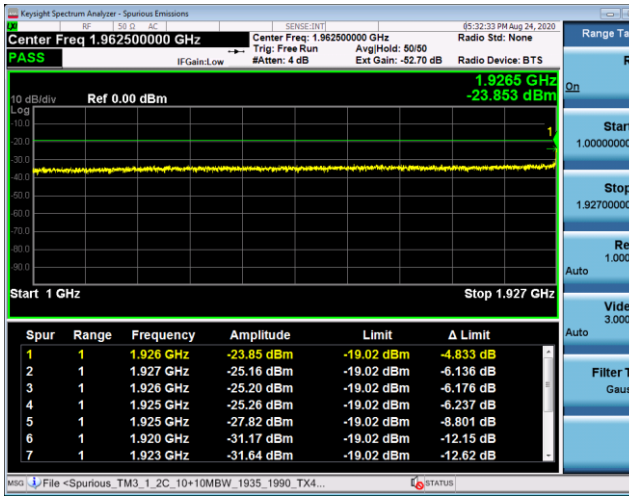


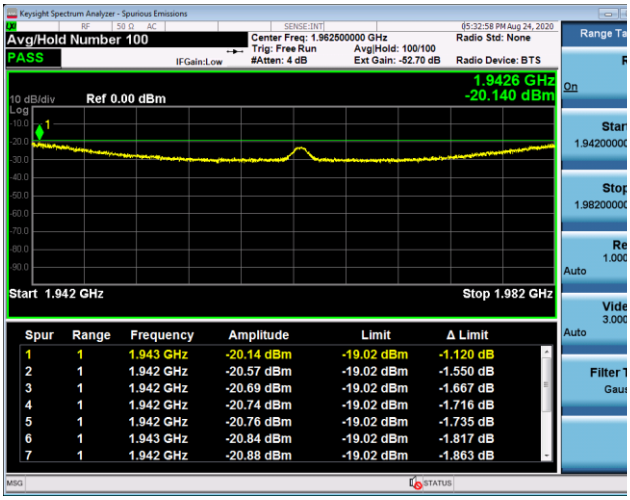


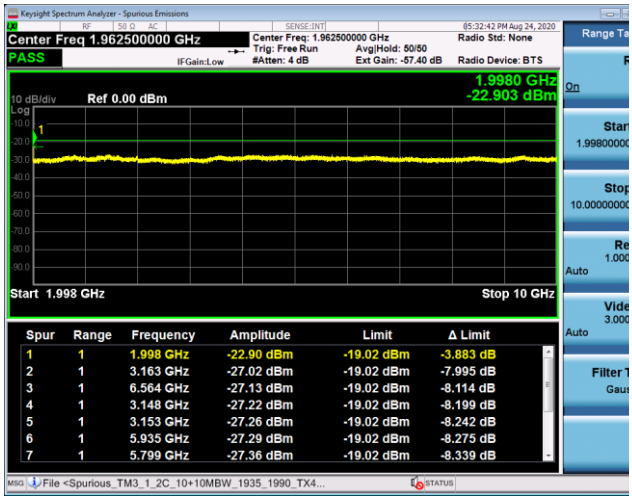
2 Carrier Data - TM3_1, 10+10 MHz BW, TX4, LTE+5G-NR



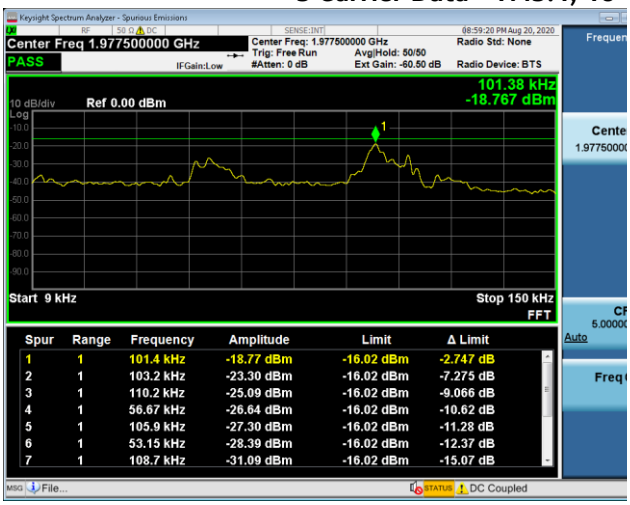


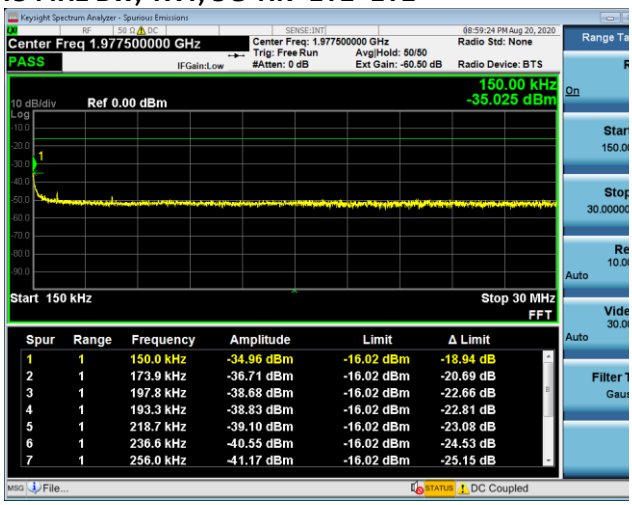


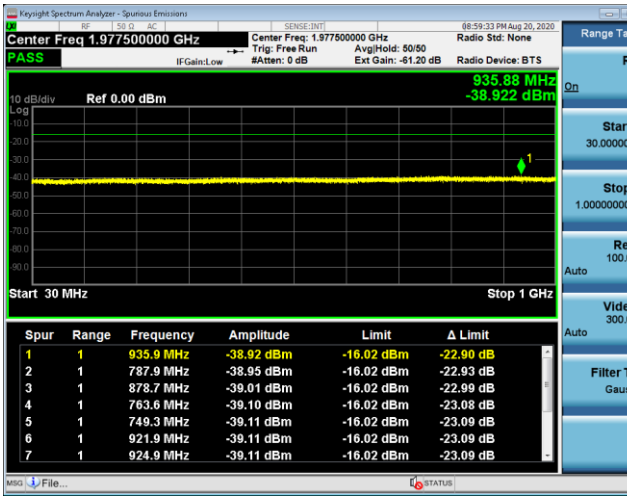


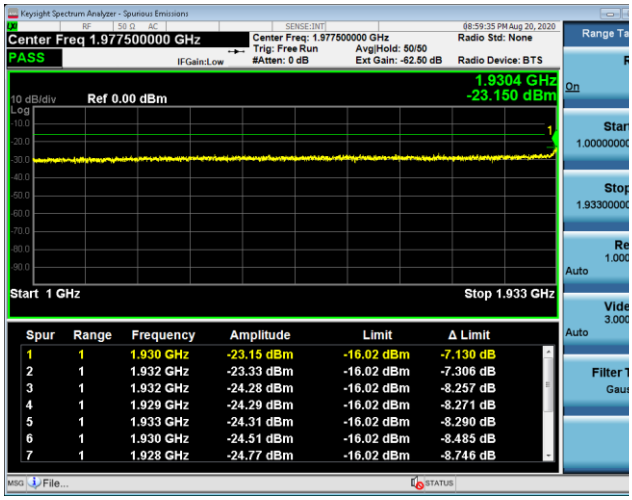


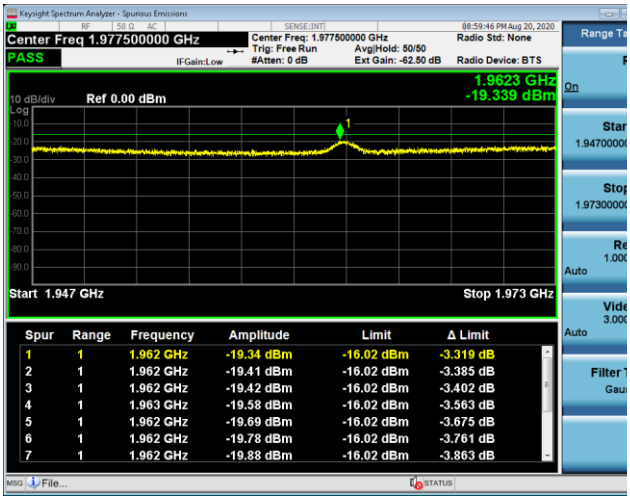
3 Carrier Data - TM3.1, 10+5+15 MHz BW, TX1, 5G-NR+LTE+LTE

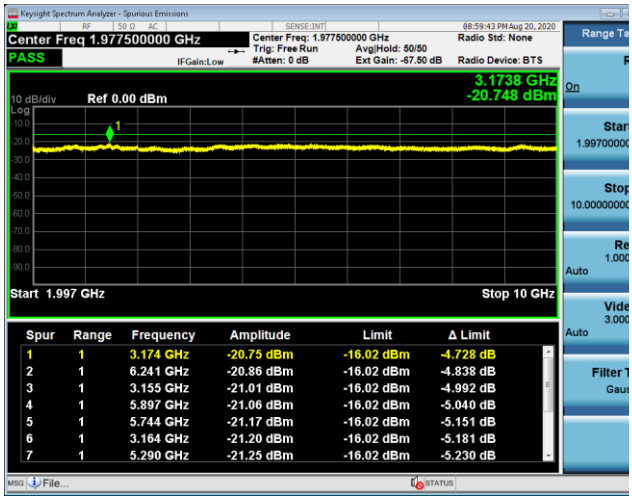






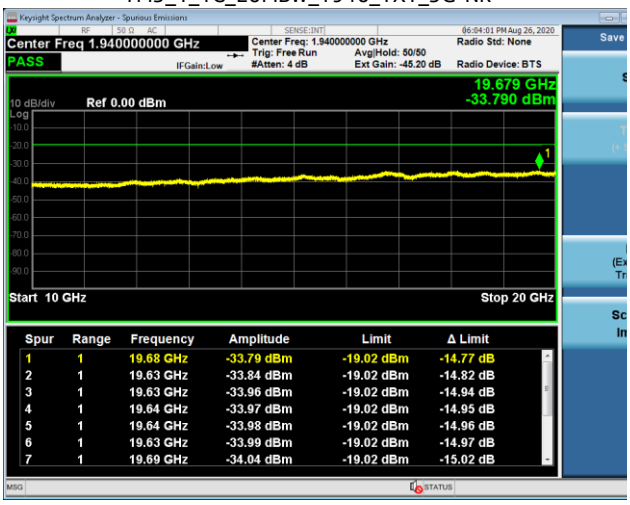




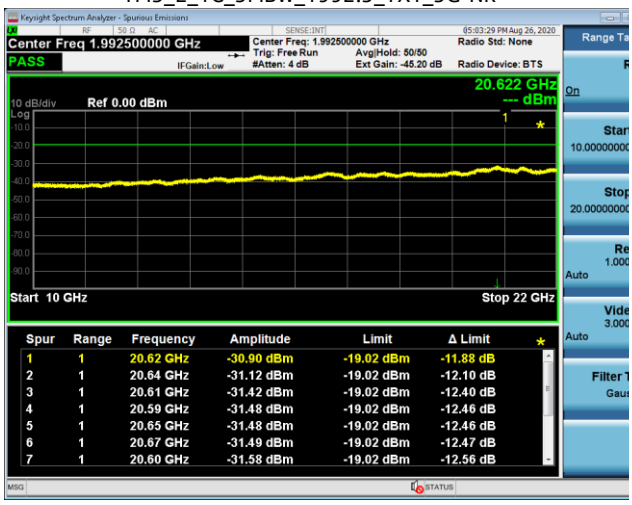


10GHz – 20GHz Data

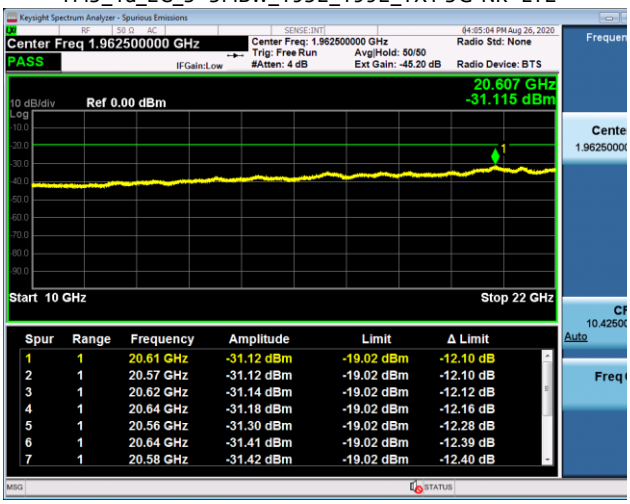
TM3_1_1C_20MBW_1940_TX1_5G-NR



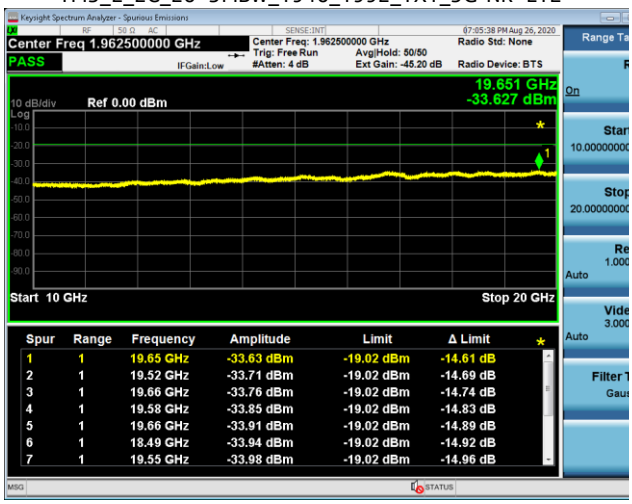
TM3_2_1C_5MBW_1992.5_TX1_5G-NR



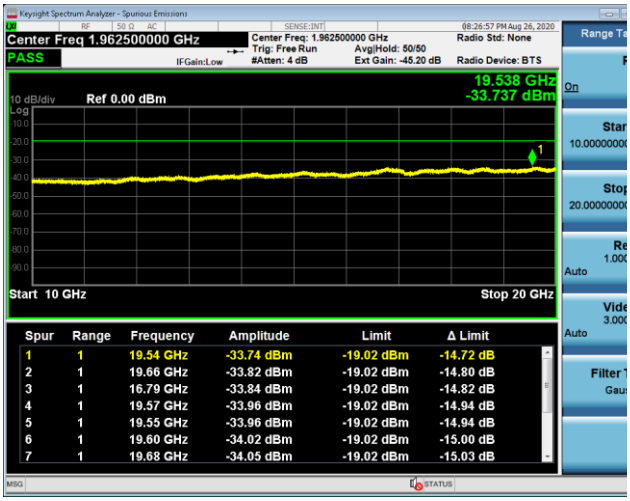
TM3_1a_2C_5+5MBW_1932_1992_TX1 5G-NR+LTE



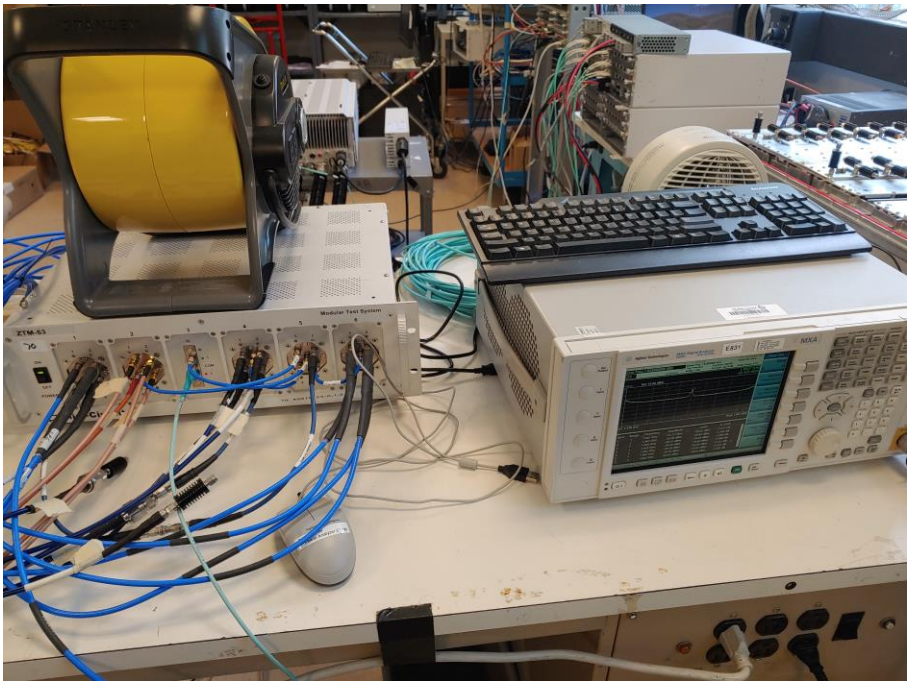
TM3_2_2C_20+5MBW_1940_1992_TX1_5G-NR+LTE

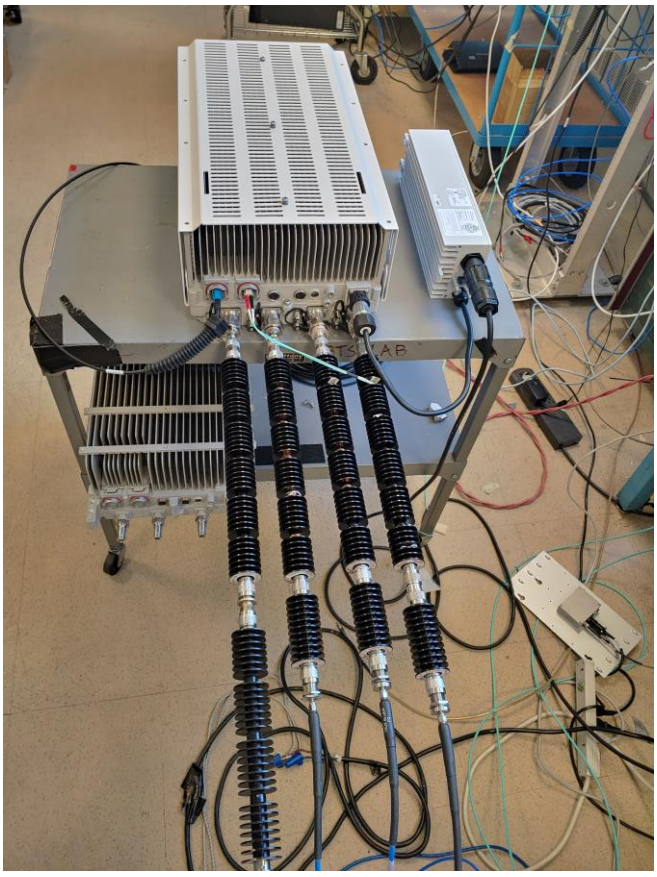


TM3_1a_3C_10+10+10MBW_1935_1962_1992_TX1_LTE+LTE +5G-NR



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 24.238 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, 4th edition, IT&T Corp.

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

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

Where:
E = Field Intensity in Volts/meter P = Transmitted Power in Watts
R = Measurement distance in meters = 3 m

The Part 24 Limit is 82.23 dBuV/m at 3m and 91.77 dBuV/m at 1m
The Part 24 non-report level is 62.23 dBuV/m at 3m.

The calculated emission levels were found by:

Measured level (dBμV) + Cable Loss(dB)+Antenna Factor(dB) = Field Strength (dBμV/m)

RESULTS:

For compliance with 47CFR Parts 2 and 24, the field strength of any spurious radiation, measured at 3m, is required to be less than 82.23 dBμV/meter (82.23 @ 3m). Emissions equal to or less than 62.23 dBμV/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 20 GHz), no reportable spurious emissions were detected.

7. NVLAP Certificate of Accreditation

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 100275-0

Nokia, Global Product Compliance Lab
Murray Hill, NJ

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

Electromagnetic Compatibility & Telecommunications

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).

2019-09-20 through 2020-09-30
Effective Dates

DEPARTMENT OF COMMERCE * UNITED STATES OF AMERICA *

For the National Voluntary Laboratory Accreditation Program