

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:

FCC Part 2 and 24

Client:

Nokia of America Corporation

Product Evaluated:

B25 RRH 4x30

Report Number:

TR-2020-0104-FCC2-24

Date Issued:

September 10, 2020

This report shall not be reproduced, in whole or in part without the approval of Nokia Global Product Compliance Laboratory. This report must not be used by the recipient to claim product endorsement by NVLAP or any other agency of the U.S. Government.

Table of Contents

1. SYSTEM INFORMATION AND REQUIREMENTS	4
1.1 INTRODUCTION	5
1.2 PURPOSE AND SCOPE	5
1.3 EUT DETAILS	5
1.4 TEST REQUIREMENTS.....	7
1.5 STANDARDS & PROCEDURES	7
1.6 EXECUTIVE SUMMARY	9
1.7 TEST CONFIGURATION FOR ALL ANTENNA PORT MEASUREMENTS.	9
2. FCC SECTION 2.1046 - RF POWER OUTPUT	10
2.1 RF POWER OUTPUT.....	10
3. FCC SECTION 2.1047 - MODULATION CHARACTERISTICS	17
3.1 MODULATION CHARACTERISTICS.....	17
4. FCC SECTION 2.1049 – OCCUPIED BANDWIDTH/EDGE OF BAND EMISSIONS.....	19
4.1 OCCUPIED BANDWIDTH.....	19
4.2 EDGE OF BAND EMISSIONS.....	26
5. FCC SECTION 2.1051 - SPURIOUS EMISSIONS AT TRANSMIT ANTENNA PORT.....	34
5.1 MEASUREMENT OF SPURIOUS EMISSIONS AT TRANSMIT ANTENNA PORT.....	34
6. FCC SECTION 2.1053 - FIELD STRENGTH OF SPURIOUS RADIATION.	41
6.1 SECTION 2.1053 FIELD STRENGTH OF SPURIOUS EMISSIONS	41
6.2 FIELD STRENGTH OF SPURIOUS EMISSIONS - LIMITS	41
7. NVLAP CERTIFICATE OF ACCREDITATION	42

Revisions

Date	Revision	Section	Change
9/10/2020	0		Initial Release

Nokia Global Product Compliance Laboratories is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP®) for specific services, listed on the Scope of Accreditation, for: Electromagnetic Compatibility and 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 Communiqué dated January 2009). NVLAP LAB CODE: 100275-0.

Nokia Global Product Compliance Laboratory represents to the client that the laboratory's accreditation or any of its calibration or test reports in no way constitutes or implies product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. government.

Prepared By:

Signed:



9/10/2020

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

Approved By:

Signed:



9/10/2020

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

Reviewed By:

Signed:



9/10/2020

Steve Gordon
Compliance 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.

Equipment Under Test (EUT):	B25 RRH 4x30
FCC ID:	AS5BBTRX-22
Serial Number:	See Section 1.3.2
Hardware Version:	See Section 1.3.2
Software Version:	5G: 5G20C 4G: SBTS20C
Frequency Range:	1930-1995 MHz
GPCL Project Number:	2020-0104
Manufacturer:	NOKIA SOLUTIONS AND NETWORKS OY KARAKAARI 7, FI-02610 ESPOO FINLAND
Applicant Information	Nokia of America Corporation 600-700 Mountain Avenue Murray Hill, NJ 07974
Test Requirement(s):	Title 47 CFR Parts 2 and 24
Test Standards:	• Title 47 CFR Parts 2 and 24 • 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) • ANSI C63.4 (2014)
Measurement Procedure(s):	• FCC-IC-OB - GPCL Occupied Bandwidth and Power Measurement Test Procedure 12-4-2017 • FCC-IC-SE - GPCL Spurious Emissions Test Procedure 12-4-2017
Test Date(s):	8/17/ 2020 – 8/26/2020
Test Performed By:	Nokia Global Product Compliance Laboratory 600-700 Mountain Ave. P.O. Box 636 Murray Hill, NJ 07974-0636
Product Engineer(s):	Ron Remy
Lead Engineer:	Steve Gordon
Test Engineer (s):	Jaideep Yadav
Test Results: The EUT, <i>as tested</i> met the above listed 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 New Providence, NJ.	

1.1 Introduction

This Conformity test report applies to the **R25 RRH 4x30**, hereinafter referred to as the Equipment Under Test (EUT).

1.2 Purpose and Scope

The purpose of this document is to provide the testing data required for qualifying the EUT in compliance with FCC Parts 2 and 24 measured in accordance with the procedures set out in Section 2.1033 (c) (14) of the Rules.

The **R25 RRH 4x30** supports 5G-NR with LTE. All LTE BW have been tested previously and are documented in the FCC filings for AS5BBTRX-22. This testing demonstrates compliance for a FCC Class II permissive change for 5G-NR modes of operation for 5 MHz, 10 MHz, 15 MHz and 20 MHz Bandwidths. Also, Concurrent 5G-NR and LTE operation with 2-Carrier Configuration (1x LTE + 1x 5G NR) and 3-Carrier Configuration (2x LTE + 1x 5G-NR). The unit supports 60W operation over two ports, and 30W operation over all 4 ports. Configurations supported are listed below:

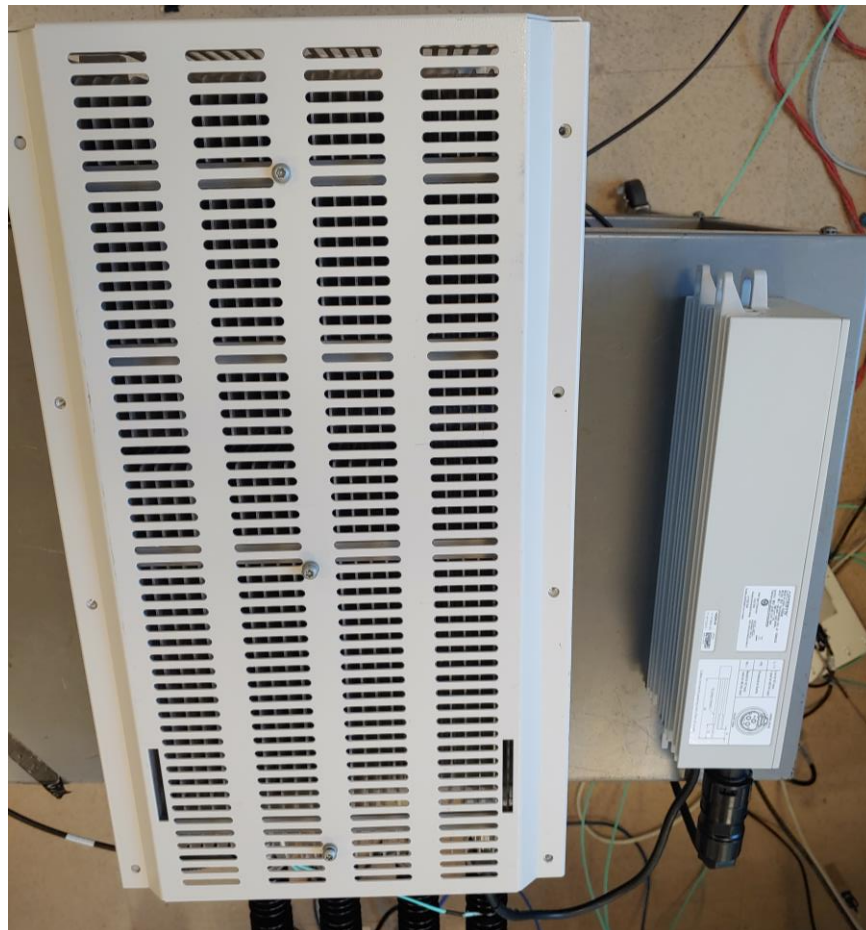
Radio	Dual Carrier (1 LTE+1 5G-NR)	Tri Carrier (2 LTE+ 1 5G-NR)
R25 RRH 4x30	5+5	5+5+5
	5+10	5+5+10
	5+15	5+5+15
	5+20	5+10+10
	10+10	5+10+15
	10+15	10+10+10

1.3 EUT Details

1.3.1 Specifications

Specification Items	Description
Radio Access Technology	LTE -TDD/ 5G-NR
Modulation Type(s)	QPSK, 16QAM, 64QAM, 256QAM
Operation Frequency Range	1930-1995 MHz
Channel Bandwidth	5, 10, 15, 20 MHz
Number of Tx Ports per Unit	4
Number of Rx Ports Per Unit	4
MIMO	2x60W MIMO (Ports 1 and 2) and 4x30W MIMO (Ports 1-4)
Max Conducted Power	44.8 dBm per port for 4T4R and 47.8 dBm per port for 2T2R
Deployment Environment	Outdoor
Power Source	-48VDC

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, 24.238	RF Power Output	Yes
2.1047, 24.238	Modulation Characteristics	Yes
2.1049, 24.238	(a) Occupied Bandwidth (b) Out-of-Band Emissions	Yes
2.1051, 24.238	Spurious Emissions at Antenna Terminals	Yes
2.1053, 24.238	Field Strength of Spurious Radiation	Yes
2.1055, 24.238	Frequency Stability	No*

*Note-The measurement of frequency stability was performed during the original filing tests. There has been no change to the frequency generating and stabilizing circuitry. Additional frequency stability testing is therefore not required.

1.5 Standards & Procedures

1.5.1 Standards

- Title 47 Code of Federal Regulations, Federal Communications Commission Part 2.
- Title 47 Code of Federal Regulations, Federal Communications Commission Part 24.
- ANSI C63.26, American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services

1.5.2 Procedures

1. FCC-IC-OB and FCC-IC-SE
2. ANSI C63.4 (2014) entitled: "American National Standard for Methods of Measurement of Radio-Noise Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40 GHz", American National Standards Institute, Institute of Electrical and Electronic Engineers, Inc., New York, NY 10017-2394, USA.
3. FCC KDB 971168 D01 Power Measurement License Digital Systems v03r01 April 9, 2018.
FCC KDB 662911 D01 Multiple Transmitter Output v02r01 Oct 2013

1.5.3 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, (<i>e.g.</i> , ANSI C63.4, CISPR 11, 14, 22, <i>etc.</i> , using ESHS 30,	Conducted Emissions	0.009 - 30	±3.5 dB
	Radiated Emissions (AR-6 Semi-Anechoic Chamber)	30 MHz – 200MHz H	±5.1 dB
		30 MHz – 200 MHz V	±5.1 dB
		200 MHz – 1000 MHz H	±4.7 dB
		200 MHz – 1000 MHz V	±4.7 dB
		1 GHz - 18 GHz	±3.3 dB

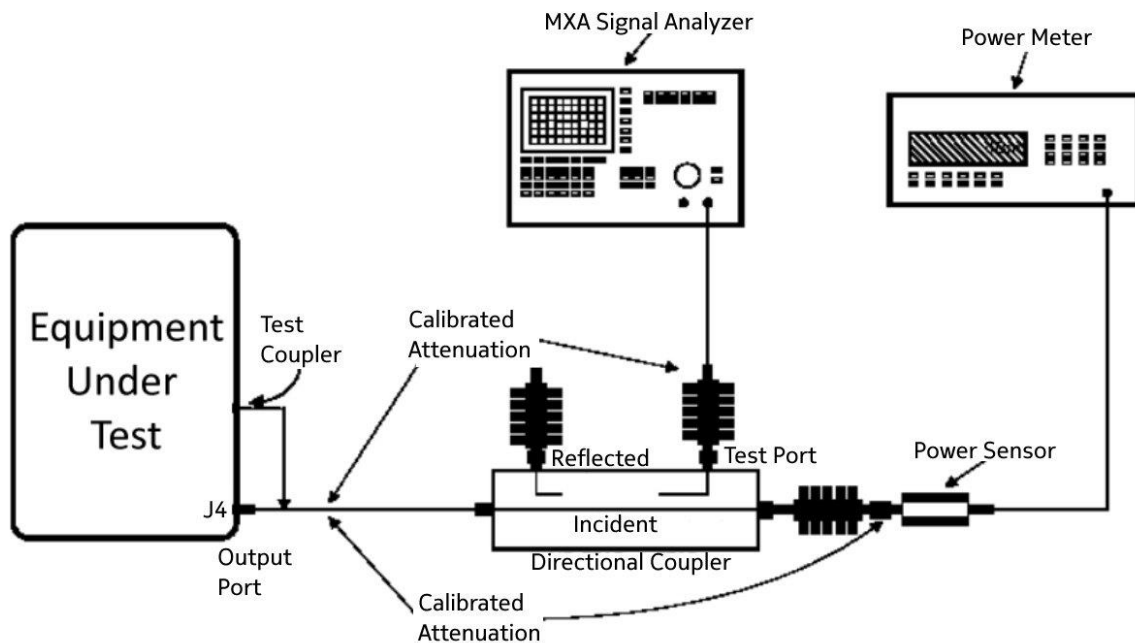
Antenna Port Test	Signal Bandwidth	Frequency Range	Expanded Uncertainty (k=2), Amplitude
Occupied Bandwidth, Edge of Band, Conducted Spurious Emissions	10 Hz	9 kHz to 20 MHz	1.78 dB
	100 Hz	20 MHz to 1 GHz	
	10 kHz to 1 MHz	1 GHz to 10 GHz	
	1MHz	10 GHz to 40 GHz:	
RF Power	10 Hz to 20 MHz	50 MHz to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

1.6 Executive Summary

Requirement	Description	Result
47 CFR FCC Parts 2 and 24		
2.1046, 24.238	RF Power Output Peak to Average Power Ratio	COMPLIES
2.1047, 24.238	Modulation Characteristics	COMPLIES
2.1049, 24.238	(a) Occupied Bandwidth (b) Edge of Band Emissions	COMPLIES
2.1051, 24.238	Spurious Emissions at Antenna Terminals	COMPLIES
2.1053, 24.238	Field Strength of Spurious Radiation	COMPLIES
2.1055, 24.238	Frequency Stability	NT

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

1.7 Test Configuration for all Antenna Port Measurements.



2. FCC Section 2.1046 - RF Power Output

2.1 RF Power Output

This test is a measurement of the total RF power level transmitted at the antenna-transmitting terminal. The product was configured for test as shown in section above and allowed to warm up and stabilize per KDB 971168 D01 and ANSI C63.26.

Power measurements were made with an MXA Signal Analyzer

Tabular Raw Data – Channel RF Power

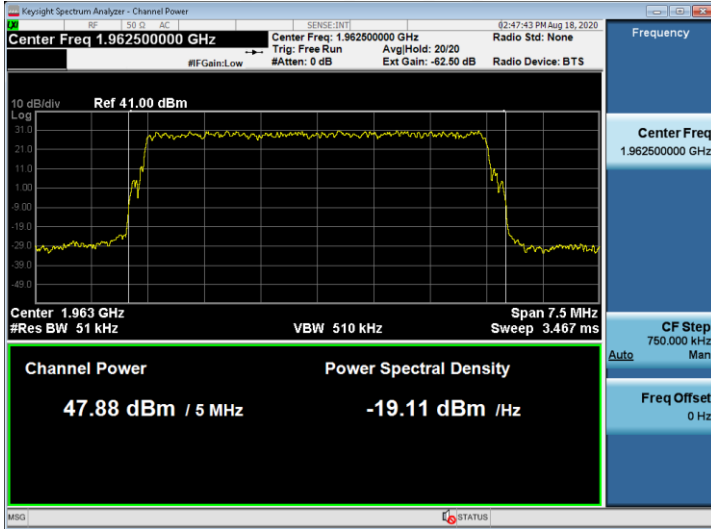
# of Carriers	Test Model	Modulation	TX Port	Channel Frequency MHz	Signal BW MHz	Radio Access Technology	Channel Power dBm
1	3.1	64QAM	1	1932.5	5	5G-NR	47.58
1	3.1	64QAM	1	1962.5	5	5G-NR	47.88
1	3.2	QPSK/16QAM	1	1992.5	5	5G-NR	47.38
1	3.2	QPSK/16QAM	1	1935	10	5G-NR	47.48
1	3.1a	256QAM	1	1962.5	10	5G-NR	48.16
1	3.1	64QAM	1	1990	10	5G-NR	47.79
1	3.1a	256QAM	1	1937.5	15	5G-NR	47.87
1	3.1	64QAM	1	1962.5	15	5G-NR	48.18
1	3.2	QPSK/16QAM	1	1987.5	15	5G-NR	47.63
1	3.1a	256QAM	1	1940	20	5G-NR	47.78
1	3.1	64QAM	1	1962.5	20	5G-NR	48.16
1	3.1	64QAM	1	1985	20	5G-NR	47.72
2	3.1a	256QAM	4	1932+1992	5+5	5G-NR+LTE	44.63
2	3.1a	256QAM	1	1932+1992	5+5	5G-NR+LTE	47.42
2	3.1	64QAM	4	1932+1990	5+10	LTE+5G-NR	44.73
2	3.1	64QAM	1	1932+1990	5+10	LTE+5G-NR	47.52
2	3.1	64QAM	4	1935+1990	10+10	LTE+5G-NR	45.05
2	3.1	64QAM	1	1935+1990	10+10	LTE+5G-NR	47.89
2	3.1	64QAM	4	1935+1987	10+15	LTE+5G-NR	45.12
2	3.1	64QAM	1	1935+1987	10+15	LTE+5G-NR	47.89
2	3.2	QPSK/16QAM	4	1937+1992	15+5	5G-NR+LTE	44.57
2	3.2	QPSK/16QAM	1	1937+1992	15+5	5G-NR+LTE	47.67
2	3.2	QPSK/16QAM	4	1940+1992	20+5	5G-NR+LTE	44.53
2	3.2	QPSK/16QAM	1	1940+1992	20+5	5G-NR+LTE	47.57
3	3.1a	256QAM	4	1932+1937+1992	5+5+5	LTE+LTE+5G-NR	45.24
3	3.1a	256QAM	1	1932+1937+1992	5+5+5	LTE+LTE+5G-NR	47.65
3	3.2	QPSK/16QAM	4	1932+1962+1990	5+5+10	LTE+LTE+5G-NR	45.21
3	3.2	QPSK/16QAM	1	1932+1962+1990	5+5+10	LTE+LTE+5G-NR	48.12
3	3.2	QPSK/16QAM	1	1932+1937+1990	5+5+10	LTE+LTE+5G-NR	47.73
3	3.1	64QAM	4	1932+1937+1987	5+5+15	LTE+LTE+5G-NR	45.19
3	3.1	64QAM	1	1932+1937+1987	5+5+15	LTE+LTE+5G-NR	48.03
3	3.2	QPSK/16QAM	4	1932+1940+1990	5+10+10	LTE+LTE+5G-NR	45.17
3	3.2	QPSK/16QAM	1	1932+1940+1990	5+10+10	LTE+LTE+5G-NR	47.99
3	3.1	64QAM	4	1940+1977+1987	10+5+15	5G-NR+LTE+LTE	45.17
3	3.1	64QAM	1	1940+1977+1985	10+5+15	5G-NR+LTE+LTE	47.97
3	3.1a	256QAM	4	1935+1962+1990	10+10+10	LTE+LTE+5G-NR	44.99
3	3.1a	256QAM	1	1935+1962+1990	10+10+10	LTE+LTE+5G-NR	48.09

2.1.1 Channel RF Power - Plots.

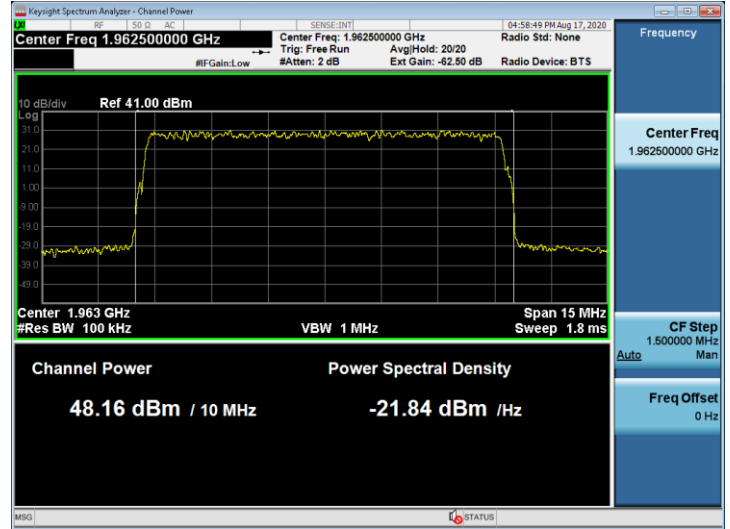
NOTE: Only the worst-case plots in each scenario are used in this report. The full suite of raw data resides at the MH, New Jersey location.

1 Carrier Data

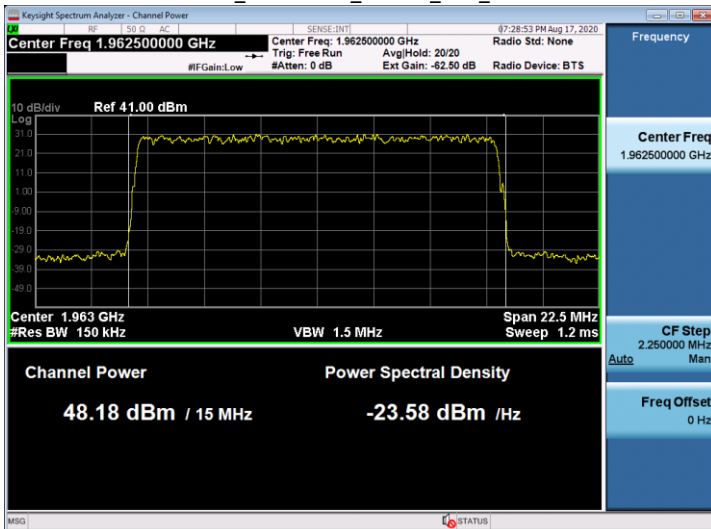
TM 3.1_5MHz BW_1962.5_TX1_5G-NR



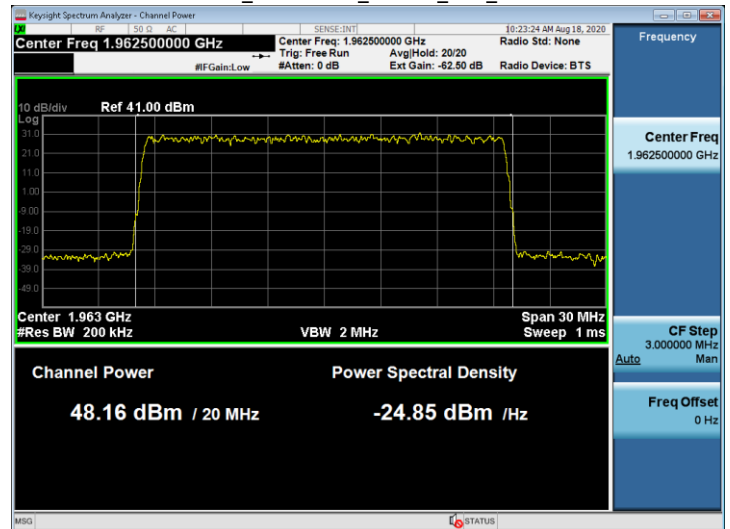
TM 3.1a_10MHz BW_1962.5_TX1_5G-NR



TM 3.1_15MHz BW_1962.5_TX1_5G-NR

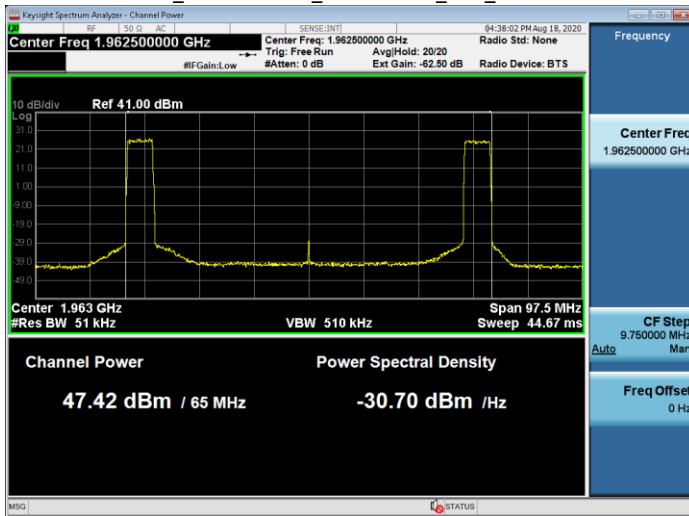


TM 3.1_20MHz BW_1962.5_TX1_5G-NR

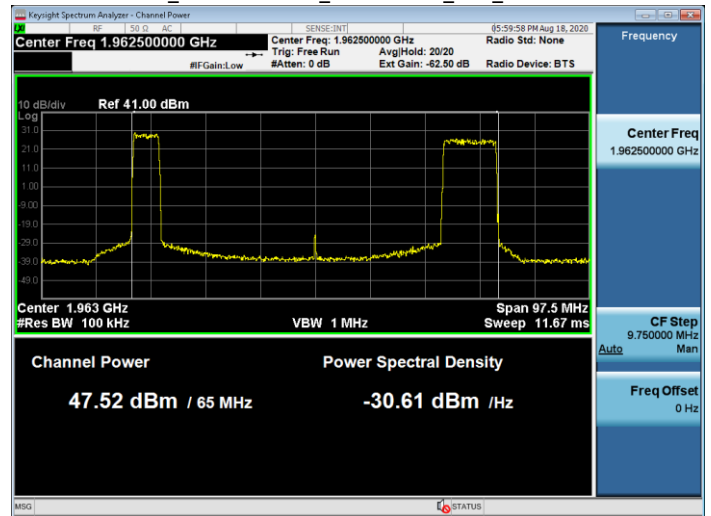


2 Carrier Data

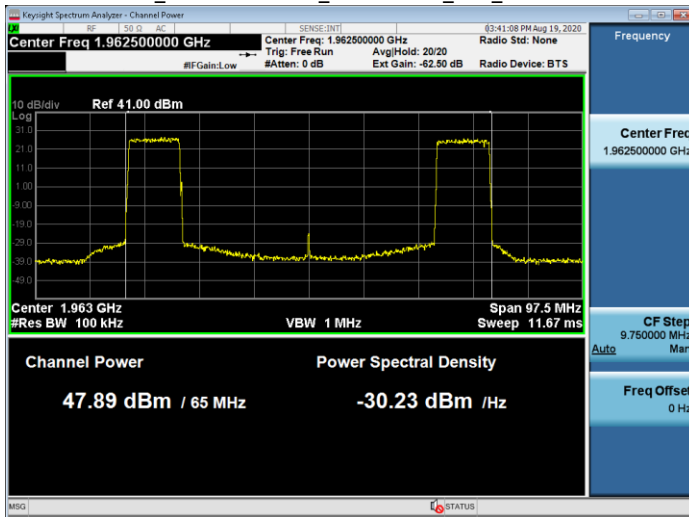
TM 3.1a_5+5 MHz BW_1932+1992_TX1_5G-NR+LTE



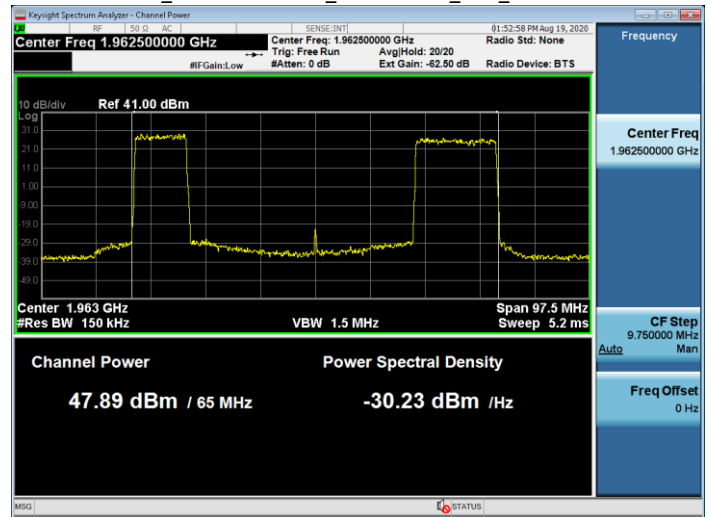
TM 3.1_5+10 MHz BW_1932+1990_TX1_LTE+5G-NR



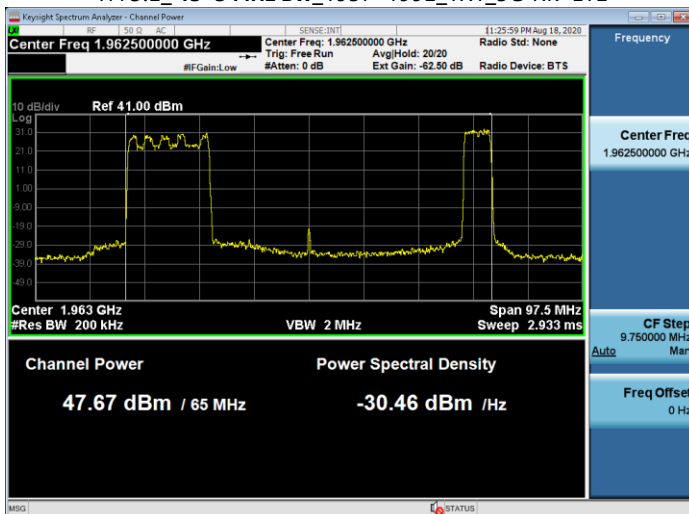
TM 3.1_10+10 MHz BW_1935+1990_TX1_LTE+5G-NR



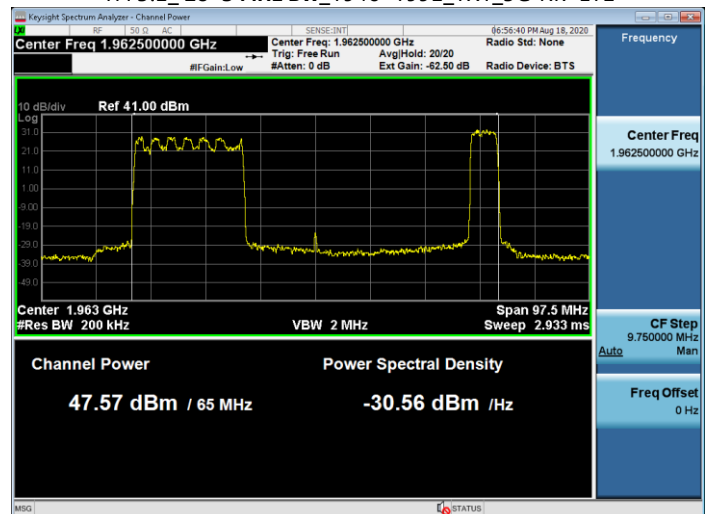
TM 3.1_10+15 MHz BW_1935+1987_TX1_LTE+5G-NR



TM 3.2_15+5 MHz BW_1937+1992_TX1_5G-NR+LTE

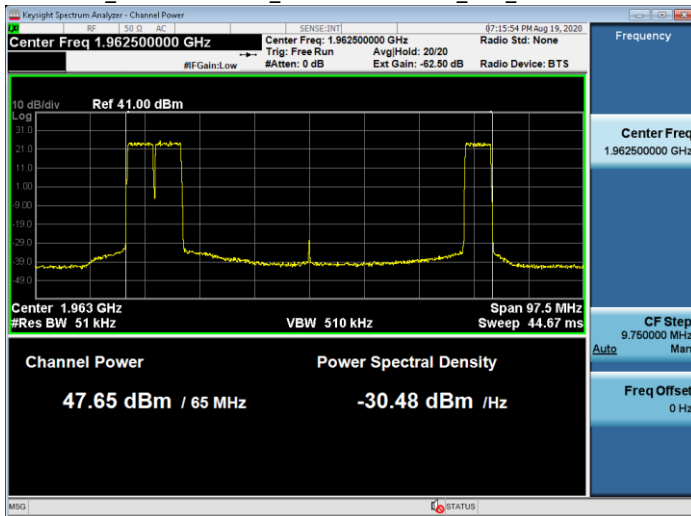


TM 3.2_20+5 MHz BW_1940+1992_TX1_5G-NR+LTE

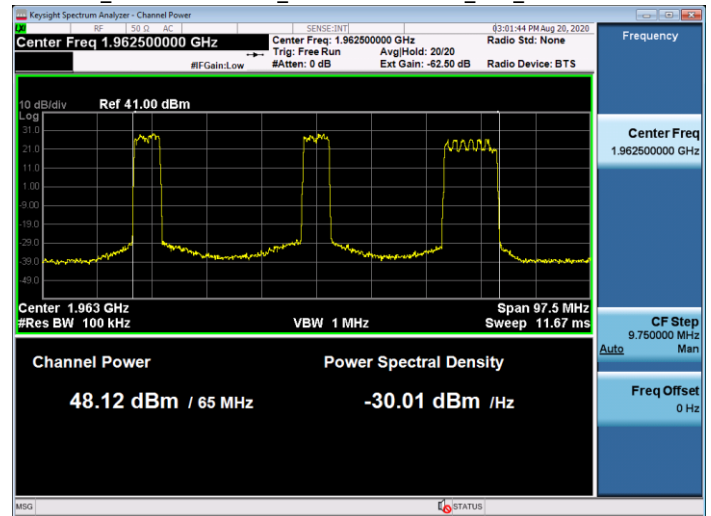


3 Carrier Data

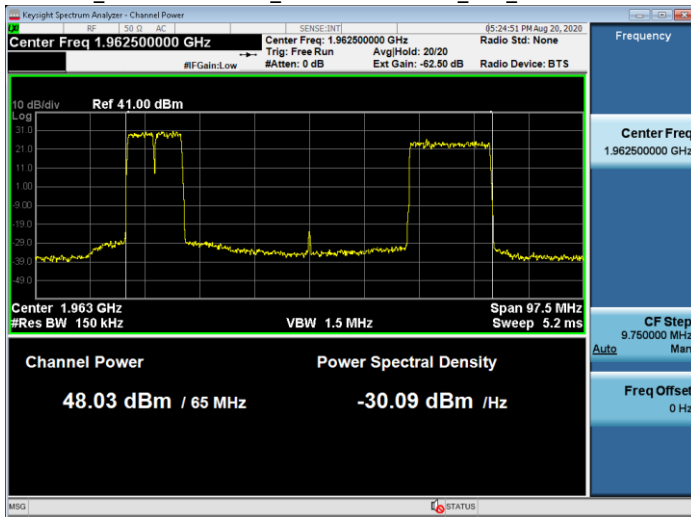
TM 3.1a_5+5+5 MHz BW_1932+1937+1992_TX1_LTE+LTE+5G-NR



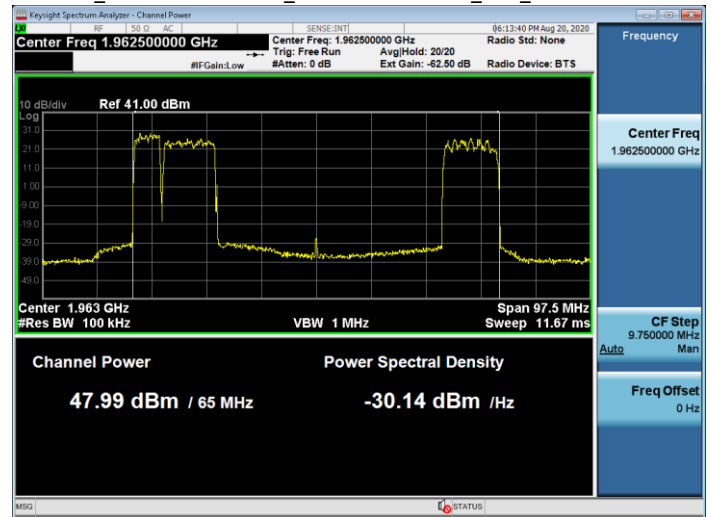
TM 3.2_5+5+10 MHz BW_1932+1962+1990_TX1_LTE+LTE+5G-NR



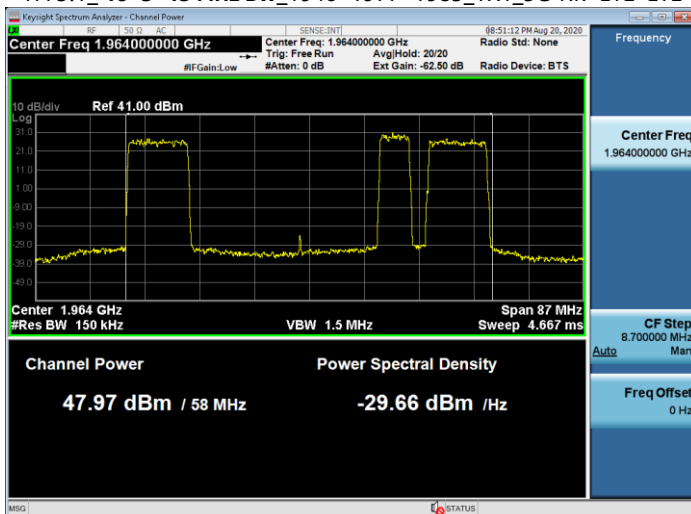
TM 3.1_5+5+15 MHz BW_1932+1937+1987_TX1_LTE+LTE+5G-NR



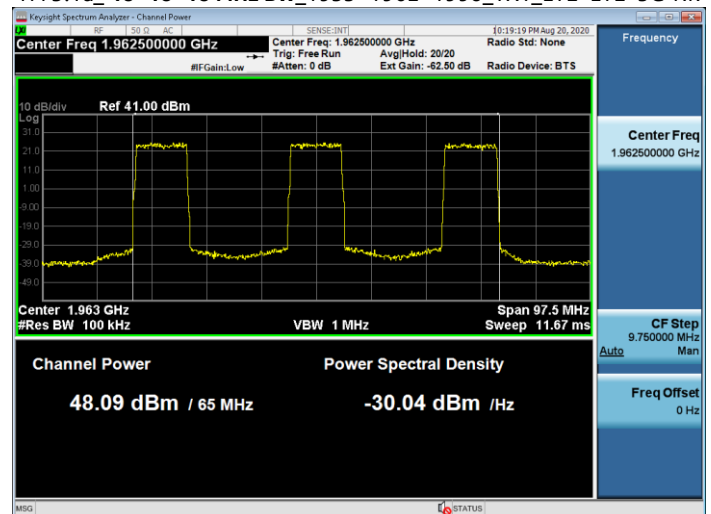
TM 3.2_5+10+10 MHz BW_1932+1940+1990_TX1_LTE+LTE+5G-NR



TM 3.1_10+5+15 MHz BW_1940+1977+1985_TX1_5G-NR+LTE+LTE



TM 3.1a_10+10+10 MHz BW_1935+1962+1990_TX1_LTE+LTE+5G-NR

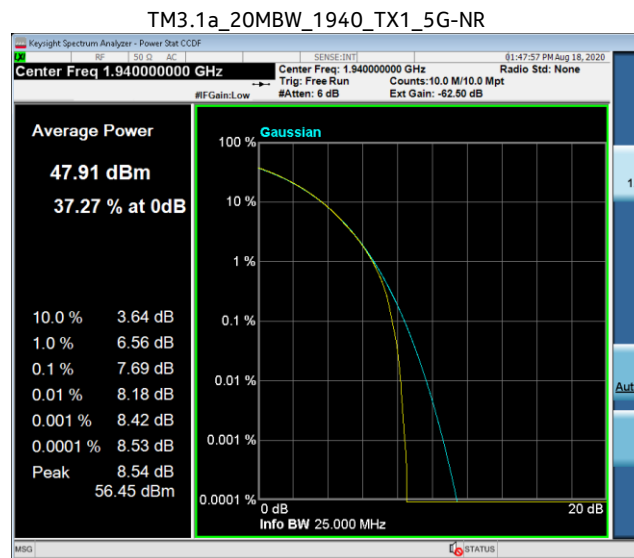
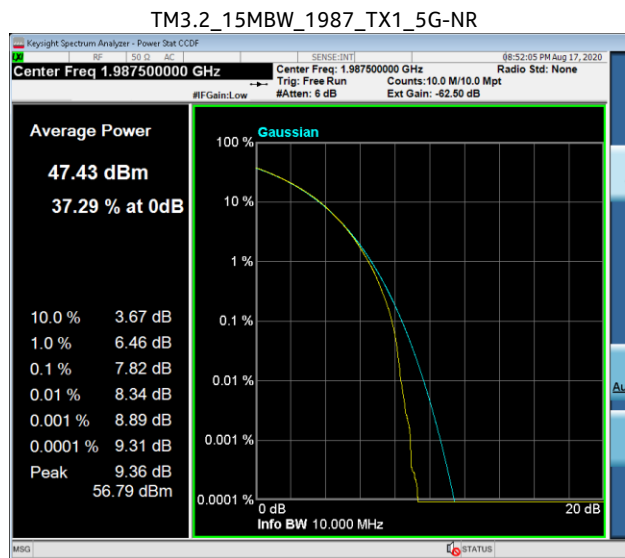
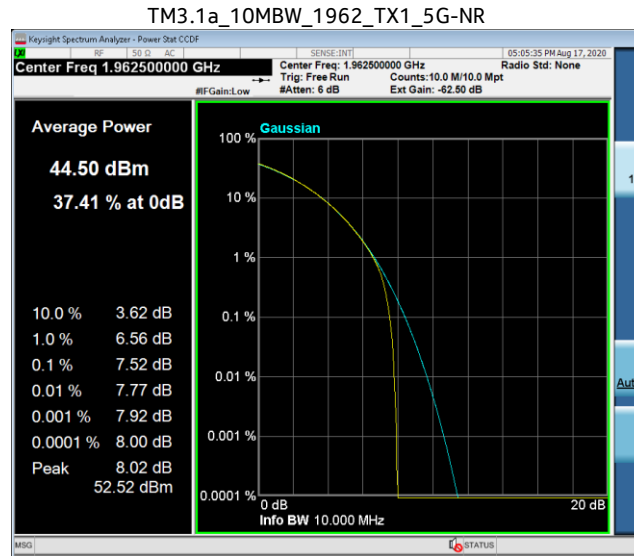
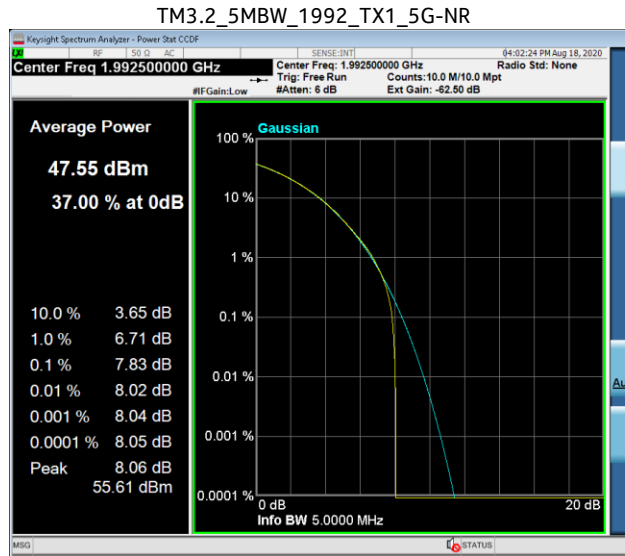


2.1.2 Peak-to-Average Power Ratio (PAPR) - Plots

The Peak-to-Average Power Ratio (PAPR) was evaluated per KDB 971168. The PAPR values of all carriers measured are below 13dB.

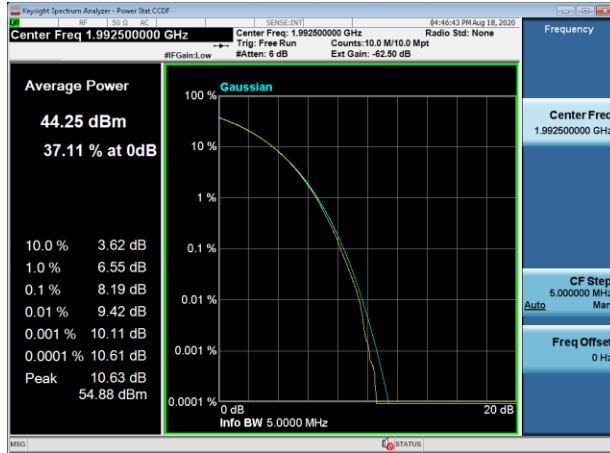
NOTE: Only the worst-case plots in each scenario are used in this report. The full suite of raw data resides at the MH, New Jersey location.

1 Carrier Data

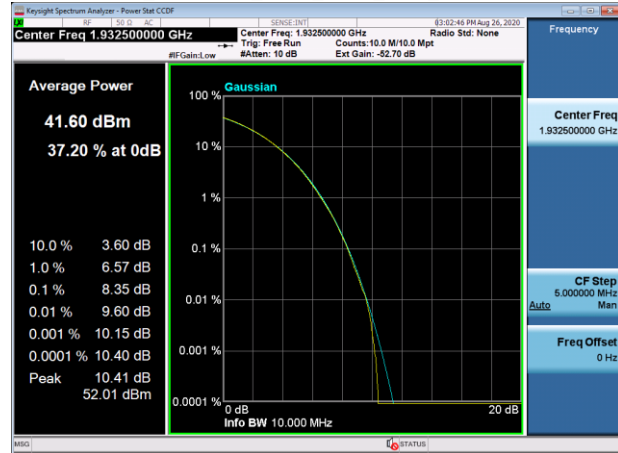


2 Carrier Data

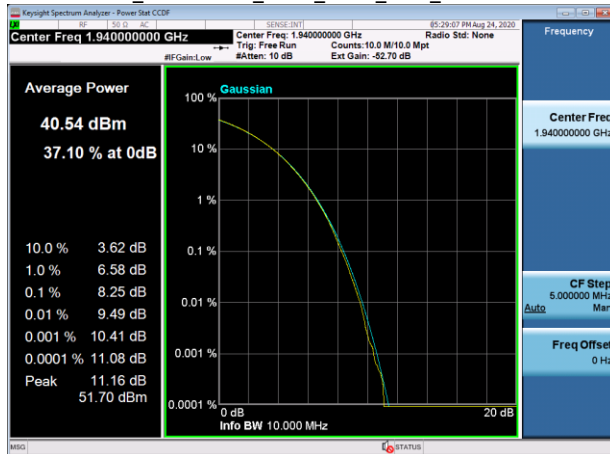
TM3.1a_5+5MBW_1932_1992_TX1_5G-NR+LTE



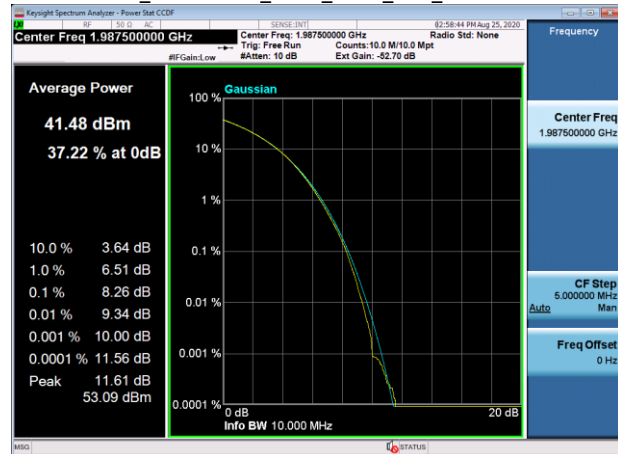
TM3.1_5+10MBW_1932_1990_TX4_LTE+5G-NR



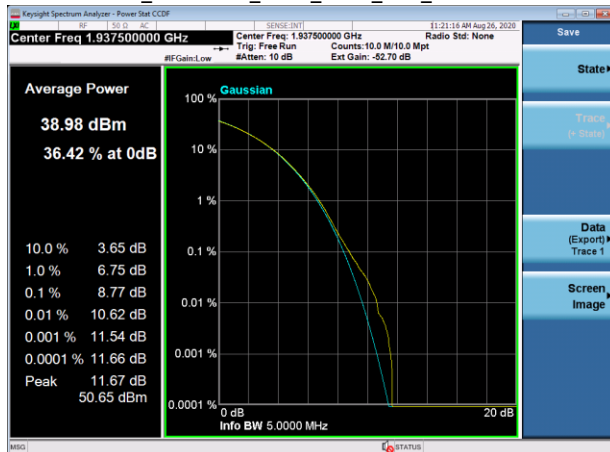
TM3.1_10+10MBW_1935_1990_TX4_LTE+5G-NR



TM3.1_10+15MBW_1935_1987_TX4_LTE+5G-NR



TM3.2_15+5MBW_1937_1992_TX4_5G-NR+LTE



TM3.2_20+5MBW_1940_1992_TX1_5G-NR+LTE

