CERTIFICATION TEST REPORT

CLASS II PERMISSIVE CHANGE

Report Number. : 4790941133-FR1V1

Applicant	:	SAMSUNG ELECTRONICS CO., LTD. 129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI, GYEONGGI-DO, 16677, KOREA
Model	:	RF4461d-13A
FCC ID	:	A3LRF4461D-13A
EUT Description	:	RRU (RF4461d)
Test Standard(s)	:	FCC 47 CFR PART 22

Date Of Issue:
2023-08-28

Prepared by:
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Suwon Test Site: UL KOREA, LTD. Suwon Laboratory
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IAS ACCREDITED Testing Laboratory TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	2023-08-28	Initial issue	Jaejin Lee

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SAMSUNG ELECTRONICS CO., LTD.

EUT DESCRIPTION: RRU (RF4461d)

MODEL NUMBER: RF4461d-13A

SERIAL NUMBER: DKN2303015

DATE TESTED: 2023-08-21 ~ 2023-08-25

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
47 CFR Part 22	Complies

UL KOREA, LTD. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL KOREA, LTD. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL KOREA, LTD. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL KOREA, LTD. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by IAS, any agency of the Federal Government, or any agency of any government.

Approved & Released For
UL KOREA, LTD. By:

Seokhwan Hong
Suwon Lab Engineer
UL KOREA, LTD.

Tested By:

Jaejin Lee
Suwon Lab Engineer
UL KOREA, LTD.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with following methods.

1. FCC CFR 47 Part 2.
2. FCC CFR 47 Part 22.
3. ANSI C63.26, 2015
4. KDB 971168 D01 Power Meas License Digital Systems v03r01
5. KDB 662911 D01 Multiple Transmitter Output v02r01

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do,16675, Korea. Line conducted emissions are measured only at the 218 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

218 Maeyeong-ro
☐ Chamber 1
☐ Chamber 2
☐ Chamber 3
☒ 10m Chamber

UL KOREA, LTD. is accredited by IAS, Laboratory Code TL-637. The full scope of accreditation can be viewed at https://www.iasonline.org/wp-content/uploads/2017/05/TL-637-cert-New.pdf.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

EIRP = PSA reading with EUT worst orientation (dBm) + Path loss (dB) – cable loss(between the SG and substitution antenna) + Substitution Antenna Factor (dBi)

ERP = PSA reading with EUT worst orientation (dBm) + Path loss (dB) – cable loss(between the SG and substitution antenna)

(Path loss = Signal generator output – PSA reading with substitution antenna)

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Output Power	1.3 dB
Occupied Bandwidth	36 kHz
Conducted Spurious Emissions	1.3 dB
Radiated Disturbance, 30 MHz to 1 GHz	4.1 dB
Radiated Disturbance, >1 GHz	4.6 dB

Uncertainty figures are valid to a confidence level of 95%.

4.4. DECISION RULE

Decision rule for statement(s) of conformity is based on Procedure 2, Clause 4.4.3 in IEC Guide 115:2021.

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a RRU (RF4461d) Base Station.

5.2. EUT INFORMATION

<table>
<tr><td>Power Supply</td><td colspan="5">-48 Vdc</td></tr>
<tr><td>Frequency Range</td><td colspan="5">Band (n5) TX (Downlink): 869 MHz ~ 894 MHz
RX (Uplink) : 824 MHz ~ 849 MHz</td></tr>
<tr><td>Antenna port</td><td colspan="5">2TX/RX (Port 1, 2)
4TX/RX (Port 1, 2, 3, 4)</td></tr>
<tr><td>Power Configuration</td><td colspan="5">2TX : MAX 120 W / RU, 60 W / path
4TX : MAX 160 W / RU, 40 W / path</td></tr>
<tr><td>Supporting Channel BW</td><td colspan="5">LTE: 5/10 MHz
NR: 5/10/15/20 MHz
DSS: 10 MHz</td></tr>
<tr><td>Number of CCs</td><td colspan="5">Max 3CC</td></tr>
<tr><td>Operating mode</td><td colspan="5">LTE only : Max 3CC
NR only : Max 2CC
DSS only : Max 2CC
LTE +NR : Max 3CC with up to NR 2CC
LTE +DSS : Max 3CC with up to DSS 2CC
LTE +DSS+ NR : 3CC (LTE 1CC+ DSS 1CC + NR 1CC)</td></tr>
<tr><td rowspan="8">TX Output Power</td><td rowspan="2">Band</td><td rowspan="2">Carrier</td><td rowspan="2">Bandwidth</td><td colspan="2">Max. Conducted Output Power (W)</td></tr>
<tr><td>QPSK</td><td>QAM</td></tr>
<tr><td>5G NR n5 (2TX)</td><td>1</td><td>20 MHz</td><td>120.50</td><td>121.41</td></tr>
<tr><td>5G NR n5 (4TX)</td><td>1</td><td>20 MHz</td><td>165.03</td><td>165.14</td></tr>
<tr><td>5G NR n5 + 5G NR n5 (2TX)</td><td>2</td><td>20 MHz + 5 MHz</td><td>110.56</td><td>113.62</td></tr>
<tr><td>5G NR n5 + 5G NR n5 (4TX)</td><td>2</td><td>20 MHz + 5 MHz</td><td>149.33</td><td>155.00</td></tr>
<tr><td>5G NR n5 + LTE B5 (2TX)</td><td>2</td><td>20 MHz + 5 MHz</td><td>111.65</td><td>115.14</td></tr>
<tr><td>5G NR n5 + LTE B5 (4TX)</td><td>2</td><td>20 MHz + 5 MHz</td><td>150.56</td><td>152.55</td></tr>
</table>

	Band	Carrier	Bandwidth	Emission Designator	
				QPSK	QAM
Emission Designator	5G NR n5 (2TX)	1	20 MHz	19M0G7D	19M0W7D
	5G NR n5 (4TX)	1	20 MHz	19M0G7D	19M0W7D
	5G NR n5 + 5G NR n5 (2TX)	2	20 MHz + 5 MHz	24M1G7D	24M2W7D
	5G NR n5 + 5G NR n5 (4TX)	2	20 MHz + 5 MHz	24M2G7D	24M2W7D
	5G NR n5 + LTE B5 (2TX)	2	20 MHz + 5 MHz	24M1G7D	24M2W7D
	5G NR n5 + LTE B5 (4TX)	2	20 MHz + 5 MHz	24M1G7D	24M2W7D
Modulation Type	QPSK, 16QAM, 64QAM, 256QAM				
Division Duplex	FDD				
Antenna Specification	Antenna is not provided by manufacturer				

5.3. DESCRIPTION OF TEST

- The EUT was operated in a manner representative of the typical usage of the equipment.
- During all testing, system components were manipulated within the confines of typical usage to maximize each emission.
- All modulation types (QPSK, 16QAM, 64QAM, 256QAM) supported by the EUT have been tested.
- All mode of operation, supporting bandwidth and frequencies were investigated. The test plots shown in the following sections represent the worst case emissions.
- The dummy loads were connected to the RF output ports for radiated spurious emission testing.
- This test is for adding 5G NR single bandwidth 20MHz and accordingly multi carrier combinations.
- Single-carrier (Bandwith 20MHz) mode was all tested.
- Among the multi-carrier combinations, only worst case combinations have been tested in this test report to cover all multi-carrier combinations addressed in technical documents.
- Multi-carriers use a similar approach to check output power and the total power is equal to all multi-carrier bandwidth combinations.
- This device was tested at 100 % duty cycle.

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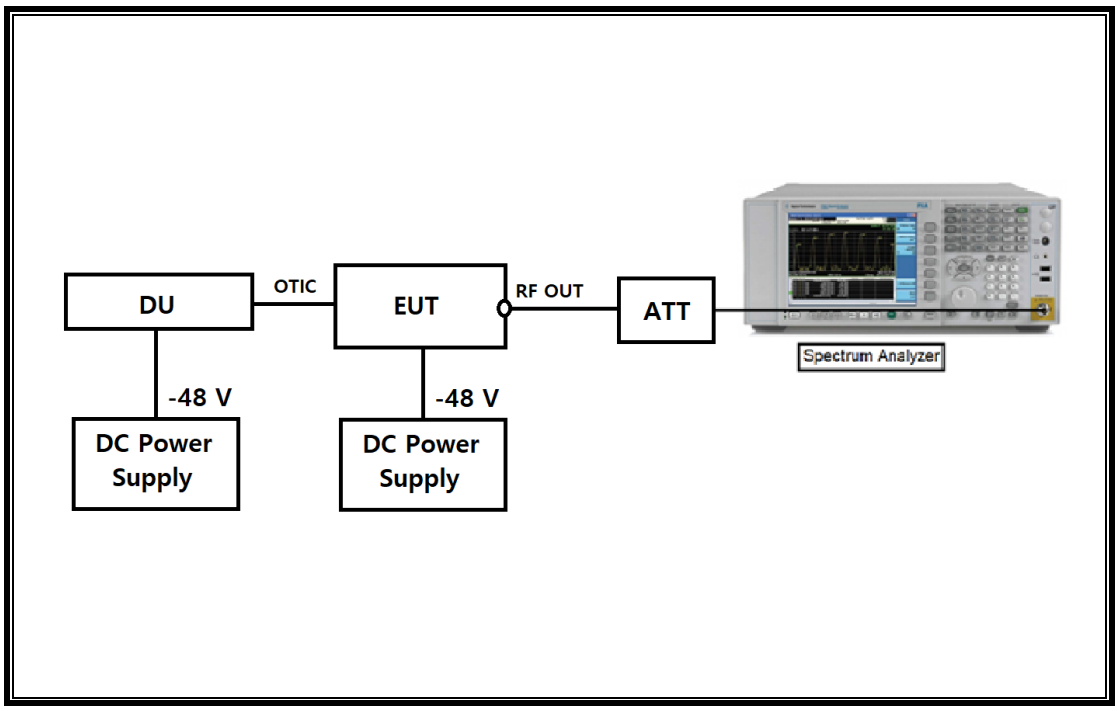
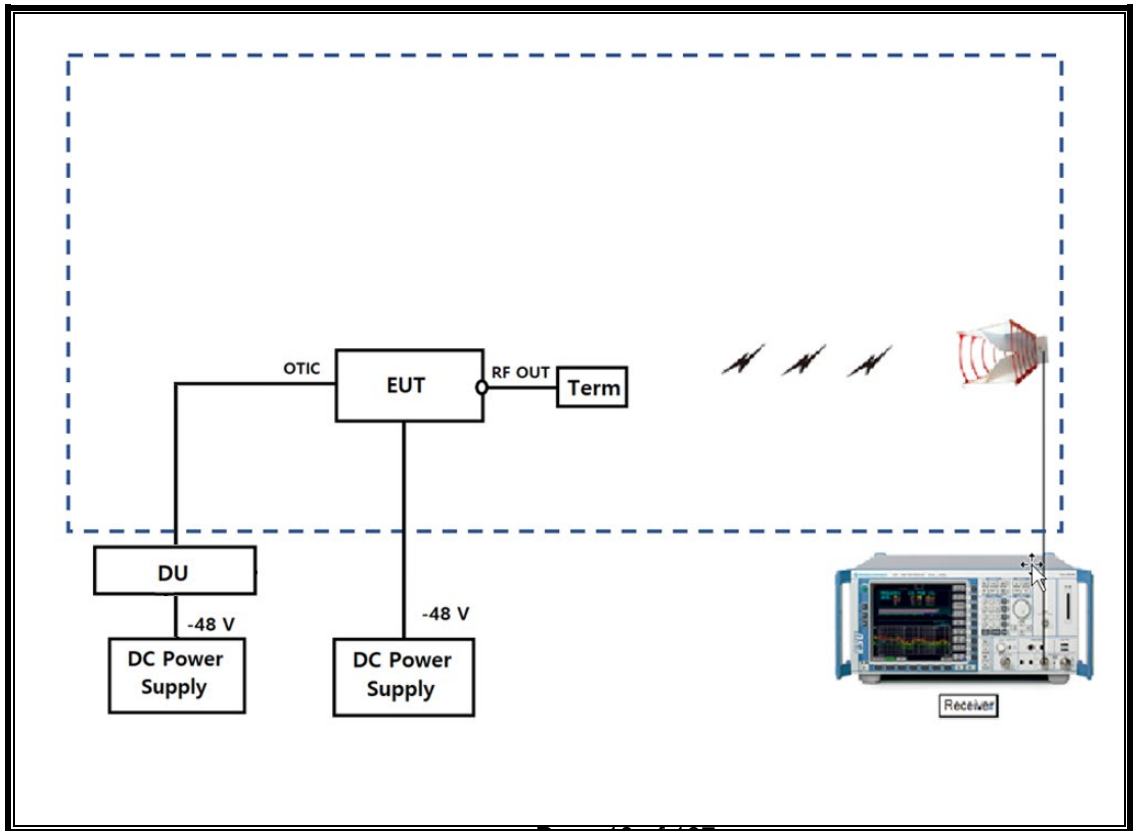
SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)



SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment List				
Description	**Manufacturer**	**Model**	**S/N**	**Cal Due**
Spectrum Analyzer	KEYSIGHT	N9030B	MY57143717	2024-07-24
DC Power Supply	KIKUSUI	PWR2001ML	AQ000860	2024-07-24
DC Power Supply	KIKUSUI	PWR2001ML	AX000660	2024-07-24
Walk in chamber	ENEX SCIENCE	EN-RC-2004-1K	EN20200711	2024-07-26
RF Switching Unit	TA Engineering	TA-018S-16	SW-1	N/A
ATTENUATOR	WEINSCHEL	WA96-30-0303	1	2024-07-26
ATTENUATOR	WEINSCHEL	WA96-30-0303	2	2024-07-26
ATTENUATOR	WEINSCHEL	WA96-30-0303	3	2024-07-26
ATTENUATOR	WEINSCHEL	WA96-30-0303	4	2024-07-26
ATTENUATOR	WEINSCHEL	56-10	61105	2024-07-24
EMI Test Receiver	R&S	ESW44	101848	2024-07-26
Open Switch and Control Platform	R&S	OSP220	101456	N/A
TRILOG Broadband Antenna	SCHWARZBECK	VULB9163	1242	2024-11-16
Double-Ridged Guide Antenna	ETS Lindgren	3117	227048	2025-07-25
Pre-Amplifier	R&S	SCU08F2	100725	2024-07-26
Pre-Amplifier	R&S	SCU18F	100726	2024-07-25
Filter	MICRO-TRONICS	HPM50115-02	G003	2024-07-24
Temp and Humidity recorder	LUTRON	MHB-382SD	AJ.84563	2024-07-26

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7. SUMMARY TABLE

FCC Part Section	Test Description	Test Condition	Test Result
§2.1046 §22.913	RF Output Power	Conducted	Complies
§22.913	Peak-to-Average Ratio (PAR)		Complies
§2.1049	Occupied Bandwidth		Complies
§2.1051 §22.917	Out of band emissions (Band Edge)		Complies
	Out of band emissions (Spurious)		Complies
§2.1055	Frequency Stability		Complies
§2.1053 §22.917	Radiated Emissions	Radiated	Complies

8. LIMITS AND CONDUCTED RESULTS

8.1. RF OUTPUT POWER

RULE PART(S)

FCC : §2.1046, §22.913

LIMITS

§22.913

Licensees in the Cellular Radiotelephone Service are subject to the effective radiated power (ERP) limits and other requirements in this Section. See also § 22.169.

(a) Maximum ERP. The ERP of transmitters in the Cellular Radiotelephone Service must not exceed the limits in this section.

(1) Except as described in paragraphs (a)(2), (3), and (4) of this section, the ERP of base stations and repeaters must not exceed—

(i) 500 watts per emission; or

(ii) 400 watts/MHz (PSD) per sector.

(2) Except as described in paragraphs (a)(3) and (4) of this section, for systems operating in areas more than 72 kilometers (45 miles) from international borders that:

(i) Are located in counties with population densities of 100 persons or fewer per square mile, based upon the most recently available population statistics from the Bureau of the Census; or

(ii) Extend coverage into Unserved Area on a secondary basis (see § 22.949), the ERP of base transmitters and repeaters must not exceed—

(A) 1000 watts per emission; or

(B) 800 watts/MHz (PSD) per sector.

(3) Provided that they also comply with paragraphs (b) and (c) of this section, licensees are permitted to operate their base transmitters and repeaters with an ERP greater than 400 watts/MHz (PSD) per sector, up to a maximum ERP of 1000 watts/MHz (PSD) per sector unless they meet the conditions in paragraph (a)(4) of this section.

(4) Provided that they also comply with paragraphs (b) and (c) of this section, licensees of systems operating in areas more than 72 kilometers (45 miles) from international borders that:

(i) Are located in counties with population densities of 100 persons or fewer per square mile, based upon the most recently available population statistics from the Bureau of the Census; or

(ii) Extend coverage into Unserved Area on a secondary basis (see § 22.949), are permitted to operate base transmitters and repeaters with an ERP greater than 800 watts/MHz (PSD) per sector, up to a maximum of 2000 watts/MHz (PSD) per sector.

(5) The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts.

TEST PROCEDURE

Section 5.2.4.4.1 of ANSI C63.26:

a) Set span to 2 × to 3 × the OBW.

b) Set RBW = 1 % to 5 % of the OBW.

c) Set VBW ≥ 3 × RBW.

d) Set number of measurement points in sweep ≥ 2 × span / RBW.

e) Sweep time:
1) Set = auto-couple, or
2) Set ≥ [10 × (number of points in sweep) × (transmission symbol period)] for single sweep (automation-compatible) measurement.

f) Detector = power averaging (rms).

g) If the EUT can be configured to transmit continuously, then set the trigger to free run.

h) If the EUT cannot be configured to transmit continuously, then use a sweep trigger with the level set to enable triggering only on full power bursts and configure the EUT to transmit at full power for the entire duration of each sweep. Verify that the sweep time is less than or equal to the transmission burst duration. Time gating can also be used under similar constraints (i.e., configured such that measurement data is collected only during active full-power transmissions).

i) Trace average at least 100 traces in power averaging (rms) mode if sweep is set to auto-couple. To accurately determine the average power over multiple symbols, it can be necessary to increase the number of traces to be averaged above 100 or, if using a manually configured sweep time, increase the sweep time.

j) Compute the power by integrating the spectrum across the OBW of the signal using the instrument's band or channel power measurement function, with the band/channel limits set equal to the OBW band edges. If the instrument does not have a band or channel power function, then sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

- Sum of results (dBm) = $10 \log\{10^{(ANT1\ (dBm)/10)} + 10^{(ANT2\ (dBm)/10)} + \cdots + 10^{(ANT\_N\ (dBm)/10)}\}$

RESULTS

See the following pages.

8.1.1. RF OUTPUT POWER RESULTS

5G NR n5 20 MHz (1 Carrier) – 2TX

ANT	Modulation	CH	Frequency (MHz)	Output Power @ ANT	
				Measured value (dBm)	Result (W)
1	QPSK	L	879	47.85	60.92
		M	881.5	***47.87***	***61.22***
		H	884	47.80	60.22
	16QAM	L	879	47.88	61.36
		M	881.5	47.88	61.31
		H	884	47.84	60.81
	64QAM	L	879	47.81	60.36
		M	881.5	47.84	60.84
		H	884	47.79	60.09
	256QAM	L	879	47.88	61.31
		M	881.5	***47.89***	***61.51***
		H	884	47.82	60.59
2	QPSK	L	879	47.67	58.51
		M	881.5	47.73	59.28
		H	884	47.64	58.14
	16QAM	L	879	47.70	58.92
		M	881.5	47.77	59.90
		H	884	47.70	58.83
	64QAM	L	879	47.70	58.85
		M	881.5	47.75	59.59
		H	884	47.69	58.71
	256QAM	L	879	47.69	58.72
		M	881.5	47.77	59.90
		H	884	47.66	58.41

CH	Frequency (MHz)	Sum of Output Power (W) @ ANT ALL			
		QPSK	16QAM	64QAM	256QAM
L	879	119.43	120.28	119.21	120.04
M	881.5	120.50	121.21	120.42	***121.41***
H	884	118.35	119.64	118.81	119.00

Modulation	Maximum Sum of Output Power @ ANT ALL	
	W	dBm
G7D	120.50	50.81
W7D	121.41	50.84

5G NR n5 20 MHz (1 Carrier) – 4TX

ANT	Modulation	CH	Frequency (MHz)	Output Power @ ANT	
				Measured value (dBm)	Result (W)
1	QPSK	L	879	46.18	41.53
		M	881.5	***46.26***	***42.29***
		H	884	46.15	41.20
	16QAM	L	879	46.19	41.62
		M	881.5	***46.30***	***42.61***
		H	884	46.20	41.66
	64QAM	L	879	46.19	41.56
		M	881.5	46.22	41.87
		H	884	46.15	41.24
	256QAM	L	879	46.20	41.70
		M	881.5	46.19	41.61
		H	884	46.16	41.35
2	QPSK	L	879	46.09	40.62
		M	881.5	46.14	41.12
		H	884	46.03	40.12
	16QAM	L	879	46.04	40.18
		M	881.5	46.14	41.11
		H	884	46.08	40.58
	64QAM	L	879	46.07	40.50
		M	881.5	46.13	40.99
		H	884	46.08	40.52
	256QAM	L	879	46.05	40.28
		M	881.5	46.10	40.76
		H	884	46.06	40.32
3	QPSK	L	879	46.07	40.50
		M	881.5	46.13	40.98
		H	884	46.12	40.95
	16QAM	L	879	46.12	40.92
		M	881.5	46.15	41.23
		H	884	46.13	41.06
	64QAM	L	879	46.06	40.36
		M	881.5	46.14	41.09
		H	884	46.12	40.96
	256QAM	L	879	46.09	40.68
		M	881.5	46.13	41.03
		H	884	46.12	40.89

ANT	Modulation	CH	Frequency (MHz)	Output Power @ ANT	
				Measured value (dBm)	Result (W)
4	QPSK	L	879	46.02	40.03
		M	881.5	46.09	40.64
		H	884	46.08	40.59
	16QAM	L	879	46.03	40.09
		M	881.5	46.04	40.19
		H	884	46.09	40.60
	64QAM	L	879	46.08	40.59
		M	881.5	46.11	40.82
		H	884	46.08	40.53
	256QAM	L	879	46.04	40.20
		M	881.5	46.09	40.62
		H	884	46.01	39.92

CH	Frequency (MHz)	Sum of Output Power (W) @ ANT ALL			
		QPSK	16QAM	64QAM	256QAM
L	879	162.68	162.81	163.01	162.85
M	881.5	165.03	***165.14***	164.77	164.02
H	884	162.87	163.90	163.26	162.48

Modulation	Maximum Sum of Output Power @ ANT ALL	
	W	dBm
G7D	165.03	52.18
W7D	165.14	52.18

5G NR n5 20 MHz 1C + 5G NR n5 5 MHz 1C (2 Carrier) – 2TX – Contiguous

ANT	Modulation	CH	Frequency (MHz)	Output Power @ ANT	
				Measured value (dBm)	Result (W)
1	QPSK	M	879 + 891.5	***47.49***	***56.05***
	16QAM	M	879 + 891.5	47.60	57.49
	64QAM	M	879 + 891.5	47.61	57.62
	256QAM	M	879 + 891.5	***47.61***	***57.63***
2	QPSK	M	879 + 891.5	47.36	54.51
	16QAM	M	879 + 891.5	47.44	55.41
	64QAM	M	879 + 891.5	47.43	55.33
	256QAM	M	879 + 891.5	47.48	55.99

CH	Frequency (MHz)	Sum of Output Power (W) @ ANT ALL			
		QPSK	16QAM	64QAM	256QAM
M	879 + 891.5	110.56	112.90	112.95	***113.62***

Modulation	Maximum Sum of Output Power @ ANT ALL	
	W	dBm
G7D	110.56	50.44
W7D	113.62	50.55

5G NR n5 20 MHz 1C + 5G NR n5 5 MHz 1C (2 Carrier) – 4TX – Contiguous

ANT	Modulation	CH	Frequency (MHz)	Output Power @ ANT	
				Measured value (dBm)	Result (W)
1	QPSK	M	879 + 891.5	45.75	37.61
	16QAM	M	879 + 891.5	45.93	39.21
	64QAM	M	879 + 891.5	***46.03***	***40.10***
	256QAM	M	879 + 891.5	45.95	39.38
2	QPSK	M	879 + 891.5	45.63	36.52
	16QAM	M	879 + 891.5	45.81	38.10
	64QAM	M	879 + 891.5	45.86	38.51
	256QAM	M	879 + 891.5	45.82	38.22
3	QPSK	M	879 + 891.5	***45.78***	***37.82***
	16QAM	M	879 + 891.5	45.83	38.28
	64QAM	M	879 + 891.5	45.87	38.62
	256QAM	M	879 + 891.5	45.84	38.40
4	QPSK	M	879 + 891.5	45.73	37.38
	16QAM	M	879 + 891.5	45.77	37.76
	64QAM	M	879 + 891.5	45.77	37.77
	256QAM	M	879 + 891.5	45.80	38.01

CH	Frequency (MHz)	Sum of Output Power (W) @ ANT ALL			
		QPSK	16QAM	64QAM	256QAM
M	879 + 891.5	149.33	***153.33***	155.00	154.01

Modulation	Maximum Sum of Output Power @ ANT ALL	
	W	dBm
G7D	149.33	51.74
W7D	155.00	51.9

5G NR n5 20 MHz 1C + LTE B5 5 MHz 1C (2 Carrier) – 2TX - Contiguous

ANT	Modulation	CH	Frequency (MHz)	Output Power @ ANT	
				Measured value (dBm)	Result (W)
1	QPSK	M	879 + 891.5	***47.54***	***56.69***
	16QAM	M	879 + 891.5	47.59	57.37
	64QAM	M	879 + 891.5	47.60	57.56
	256QAM	M	879 + 891.5	***47.69***	***58.77***
2	QPSK	M	879 + 891.5	47.40	54.96
	16QAM	M	879 + 891.5	47.47	55.81
	64QAM	M	879 + 891.5	47.50	56.20
	256QAM	M	879 + 891.5	47.51	56.37

CH	Frequency (MHz)	Sum of Output Power (W) @ ANT ALL			
		QPSK	16QAM	64QAM	256QAM
M	879 + 891.5	111.65	113.18	113.76	***115.14***

Modulation	Maximum Sum of Output Power @ ANT ALL	
	W	dBm
G7D	111.65	50.48
W7D	115.14	50.61

5G NR n5 20 MHz 1C + LTE B5 5 MHz 1C (2 Carrier) – 4TX - Contiguous

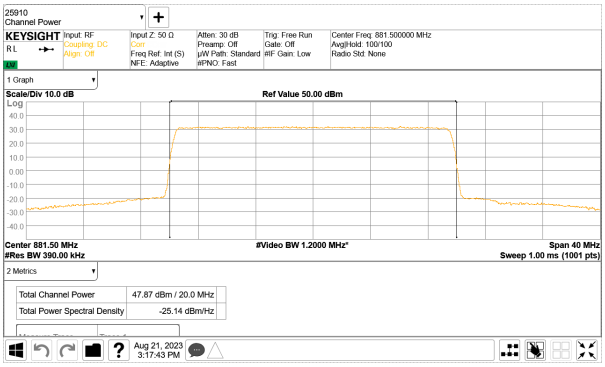
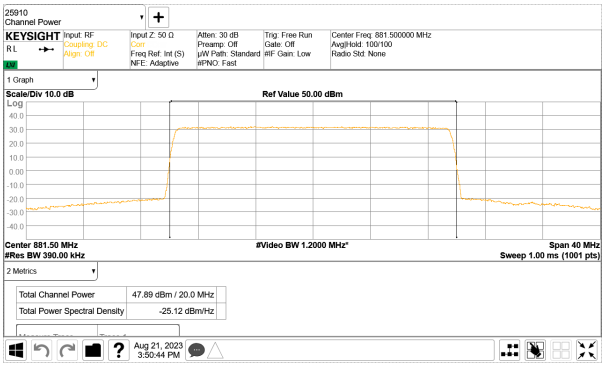
ANT	Modulation	CH	Frequency (MHz)	Output Power @ ANT	
				Measured value (dBm)	Result (W)
1	QPSK	M	879 + 891.5	***45.79***	***37.96***
	16QAM	M	879 + 891.5	***45.88***	***38.70***
	64QAM	M	879 + 891.5	45.81	38.13
	256QAM	M	879 + 891.5	45.87	38.66
2	QPSK	M	879 + 891.5	45.71	37.23
	16QAM	M	879 + 891.5	45.79	37.94
	64QAM	M	879 + 891.5	45.70	37.18
	256QAM	M	879 + 891.5	45.73	37.44
3	QPSK	M	879 + 891.5	45.78	37.81
	16QAM	M	879 + 891.5	45.83	38.25
	64QAM	M	879 + 891.5	45.82	38.18
	256QAM	M	879 + 891.5	45.80	38.01
4	QPSK	M	879 + 891.5	45.75	37.56
	16QAM	M	879 + 891.5	45.76	37.65
	64QAM	M	879 + 891.5	45.72	37.29
	256QAM	M	879 + 891.5	45.77	37.80

CH	Frequency (MHz)	Sum of Output Power (W) @ ANT ALL			
		QPSK	16QAM	64QAM	256QAM
M	879 + 891.5	150.56	***152.55***	150.78	151.91

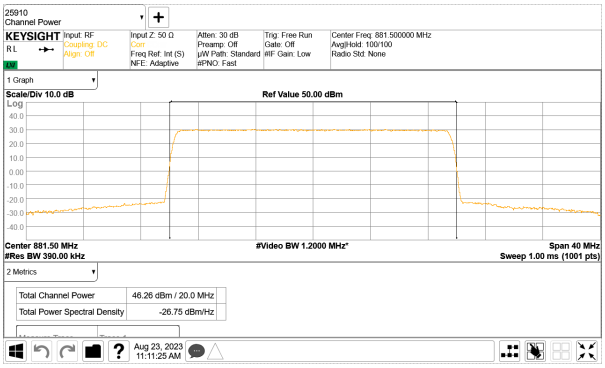
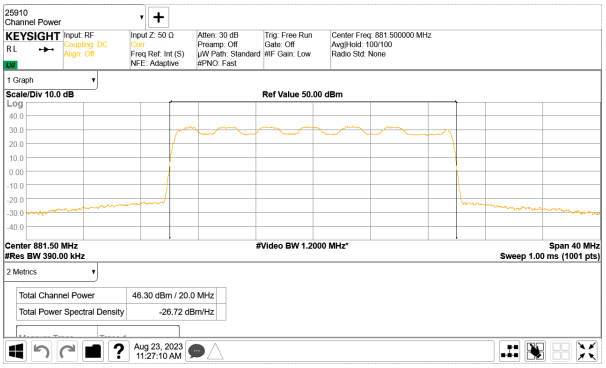
Modulation	Maximum Sum of Output Power @ ANT ALL	
	W	dBm
G7D	150.56	51.78
W7D	152.55	51.83

8.1.2. WORST PLOT OF RF OUTPUT POWER

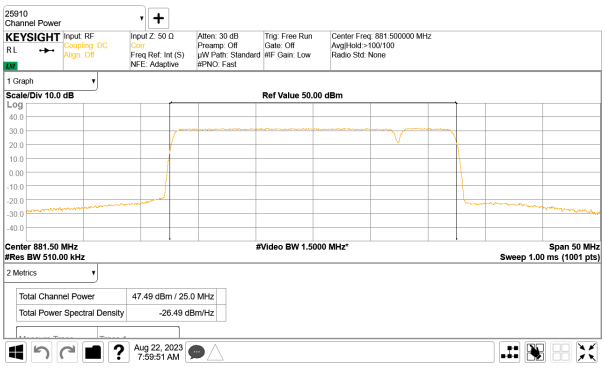
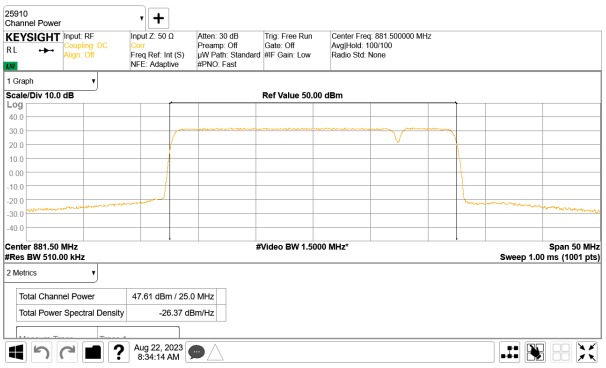
5G NR n5 20 MHz (1 Carrier) – 2TX

QPSK	256QAM
	
ANT 1 / Mid channel	ANT 1 / Mid channel

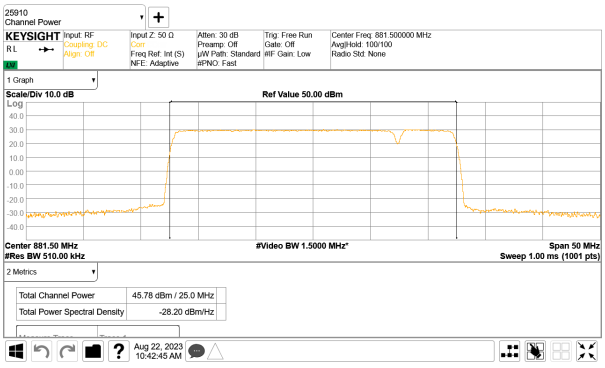
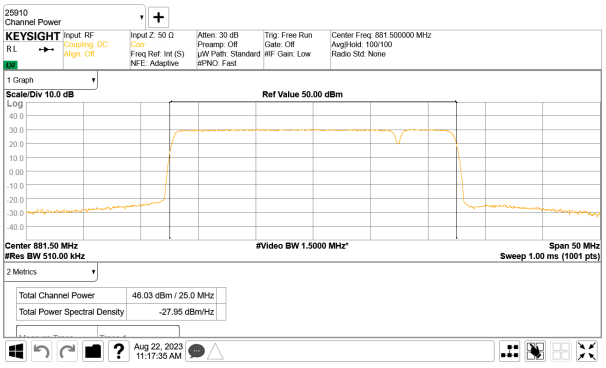
5G NR n5 20 MHz (1 Carrier) – 4TX

QPSK	16QAM
	
ANT 1 / Mid channel	ANT 1 / Mid channel

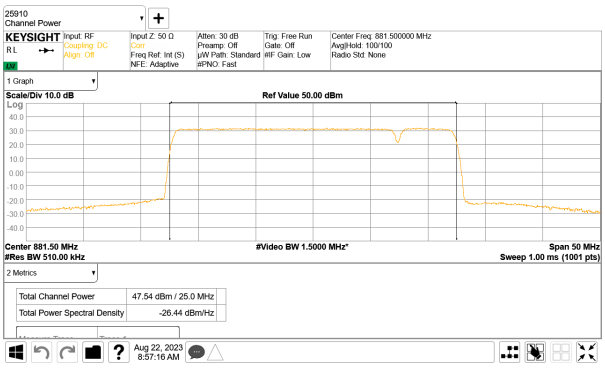
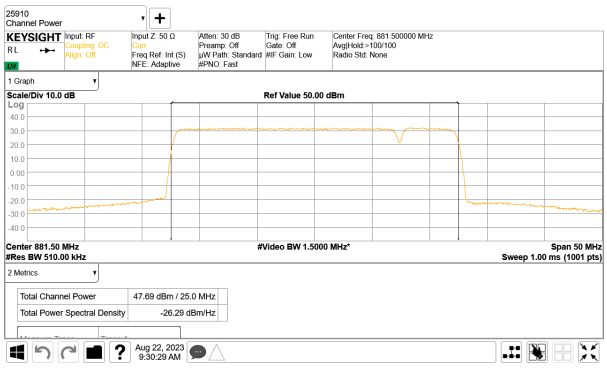
5G NR n5 20 MHz 1C + 5G NR n5 5 MHz 1C (2 Carrier) – 2TX – Contiguous

QPSK	256QAM
	
ANT 1 / Mid channel	ANT 1 / Mid channel

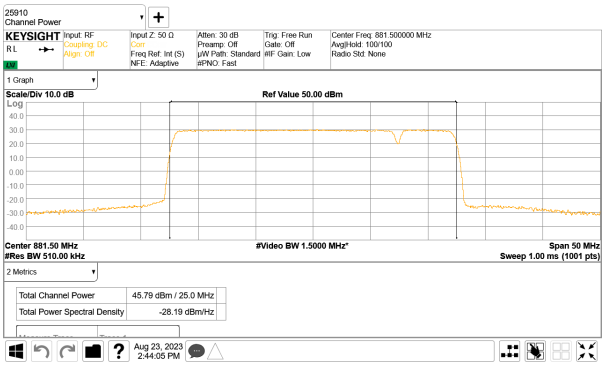
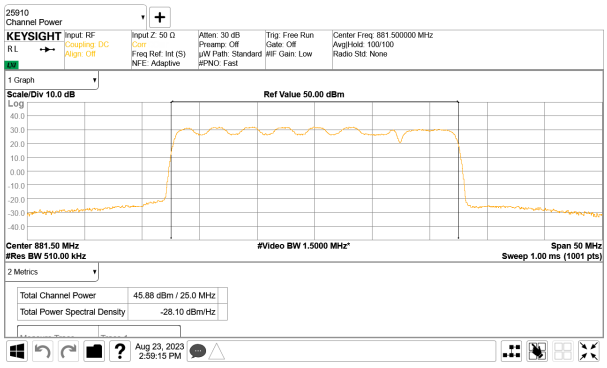
5G NR n5 20 MHz 1C + 5G NR n5 5 MHz 1C (2 Carrier) – 4TX – Contiguous

QPSK	64QAM
	
ANT 3 / Mid channel	ANT 1 / Mid channel

5G NR n5 20 MHz 1C + LTE B5 5 MHz 1C (2 Carrier) – 2TX - Contiguous

QPSK	256QAM
	
ANT 1 / Mid channel	ANT 1 / Mid channel

5G NR n5 20 MHz 1C + LTE B5 5 MHz 1C (2 Carrier) – 4TX - Contiguous

QPSK	16QAM
	
ANT 1 / Mid channel	ANT 1 / Mid channel

8.1.3. PSD RESULTS

5G NR n5 20 MHz (1 Carrier) – 2TX

ANT	Modulation	CH	Frequency (MHz)	PSD @ ANT	
				Measured value (dBm/MHz)	Result (W/MHz)
1	QPSK	L	879	35.71	3.73
		M	881.5	35.74	3.75
		H	884	35.75	3.75
	16QAM	L	879	***37.47***	***5.58***
		M	881.5	37.38	5.46
		H	884	37.45	5.56
	64QAM	L	879	35.68	3.70
		M	881.5	35.81	3.81
		H	884	35.83	3.83
	256QAM	L	879	35.72	3.74
		M	881.5	35.78	3.78
		H	884	35.86	3.86
2	QPSK	L	879	35.63	3.65
		M	881.5	35.65	3.68
		H	884	***35.75***	***3.76***
	16QAM	L	879	37.35	5.43
		M	881.5	37.30	5.37
		H	884	37.40	5.50
	64QAM	L	879	35.56	3.60
		M	881.5	35.63	3.66
		H	884	35.67	3.69
	256QAM	L	879	35.62	3.64
		M	881.5	35.65	3.67
		H	884	35.66	3.68

CH	Frequency (MHz)	Sum of PSD (W/MHz) @ ANT ALL			
		QPSK	16QAM	64QAM	256QAM
L	879	7.38	11.01	7.30	7.38
M	881.5	7.42	10.83	7.46	7.45
H	884	7.51	***11.05***	7.52	7.54

5G NR n5 20 MHz (1 Carrier) – 4TX

ANT	Modulation	CH	Frequency (MHz)	PSD @ ANT	
				Measured value (dBm/MHz)	Result (W/MHz)
1	QPSK	L	879	34.01	2.52
		M	881.5	34.08	2.56
		H	884	33.99	2.51
	16QAM	L	879	35.62	3.65
		M	881.5	35.80	3.80
		H	884	***35.81***	***3.81***
	64QAM	L	879	33.91	2.46
		M	881.5	34.05	2.54
		H	884	34.05	2.54
	256QAM	L	879	34.11	2.57
		M	881.5	34.00	2.51
		H	884	33.97	2.50
2	QPSK	L	879	33.95	2.48
		M	881.5	33.89	2.45
		H	884	33.92	2.47
	16QAM	L	879	35.65	3.67
		M	881.5	35.68	3.70
		H	884	35.72	3.73
	64QAM	L	879	33.99	2.50
		M	881.5	33.96	2.49
		H	884	33.92	2.46
	256QAM	L	879	33.97	2.50
		M	881.5	33.98	2.50
		H	884	33.92	2.46
3	QPSK	L	879	33.92	2.46
		M	881.5	34.00	2.51
		H	884	***34.12***	***2.58***
	16QAM	L	879	35.59	3.63
		M	881.5	35.71	3.72
		H	884	35.73	3.74
	64QAM	L	879	33.90	2.45
		M	881.5	33.91	2.46
		H	884	34.04	2.53
	256QAM	L	879	33.90	2.45
		M	881.5	33.90	2.45
		H	884	34.03	2.53

ANT	Modulation	CH	Frequency (MHz)	PSD @ ANT	
				Measured value (dBm/MHz)	Result (W/MHz)
4	QPSK	L	879	33.93	2.47
		M	881.5	34.07	2.56
		H	884	33.99	2.50
	16QAM	L	879	35.53	3.57
		M	881.5	35.61	3.64
		H	884	35.63	3.65
	64QAM	L	879	33.91	2.46
		M	881.5	33.94	2.48
		H	884	33.99	2.51
	256QAM	L	879	33.90	2.45
		M	881.5	33.92	2.46
		H	884	34.01	2.51

CH	Frequency (MHz)	Sum of PSD (W/MHz) @ ANT ALL			
		QPSK	16QAM	64QAM	256QAM
L	879	9.94	14.52	9.88	9.98
M	881.5	10.07	14.86	9.97	9.93
H	884	10.06	***14.93***	10.04	10.00

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5G NR n5 20 MHz 1C + 5G NR n5 5 MHz 1C (2 Carrier) – 2TX – Contiguous

ANT	Modulation	CH	Frequency (MHz)	PSD @ ANT	
				Measured value (dBm/MHz)	Result (W/MHz)
1	QPSK	M	879 + 891.5	34.55	2.85
	16QAM	M	879 + 891.5	36.15	4.12
	64QAM	M	879 + 891.5	34.76	2.99
	256QAM	M	879 + 891.5	34.70	2.95
2	QPSK	M	879 + 891.5	***34.57***	***2.86***
	16QAM	M	879 + 891.5	***36.17***	***4.14***
	64QAM	M	879 + 891.5	34.64	2.91
	256QAM	M	879 + 891.5	34.63	2.90

CH	Frequency (MHz)	Sum of PSD (W/MHz) @ ANT ALL			
		QPSK	16QAM	64QAM	256QAM
M	879 + 891.5	5.71	***8.26***	5.91	5.85

5G NR n5 20 MHz 1C + 5G NR n5 5 MHz 1C (2 Carrier) – 4TX – Contiguous

ANT	Modulation	CH	Frequency (MHz)	PSD @ ANT	
				Measured value (dBm/MHz)	Result (W/MHz)
1	QPSK	M	879 + 891.5	32.77	1.89
	16QAM	M	879 + 891.5	***34.60***	***2.88***
	64QAM	M	879 + 891.5	33.21	2.10
	256QAM	M	879 + 891.5	33.03	2.01
2	QPSK	M	879 + 891.5	32.66	1.84
	16QAM	M	879 + 891.5	34.49	2.81
	64QAM	M	879 + 891.5	33.02	2.00
	256QAM	M	879 + 891.5	32.96	1.98
3	QPSK	M	879 + 891.5	***32.90***	***1.95***
	16QAM	M	879 + 891.5	34.48	2.81
	64QAM	M	879 + 891.5	32.92	1.96
	256QAM	M	879 + 891.5	32.86	1.93
4	QPSK	M	879 + 891.5	32.81	1.91
	16QAM	M	879 + 891.5	34.37	2.74
	64QAM	M	879 + 891.5	32.95	1.97
	256QAM	M	879 + 891.5	32.86	1.93

CH	Frequency (MHz)	Sum of PSD (W/MHz) @ ANT ALL			
		QPSK	16QAM	64QAM	256QAM
M	879 + 891.5	7.60	***11.24***	8.03	7.85

5G NR n5 20 MHz 1C + LTE B5 5 MHz 1C (2 Carrier) – 2TX - Contiguous

ANT	Modulation	CH	Frequency (MHz)	PSD @ ANT	
				Measured value (dBm/MHz)	Result (W/MHz)
1	QPSK	M	879 + 891.5	***34.76***	***2.99***
	16QAM	M	879 + 891.5	***36.17***	***4.14***
	64QAM	M	879 + 891.5	34.70	2.95
	256QAM	M	879 + 891.5	34.78	3.00
2	QPSK	M	879 + 891.5	34.66	2.92
	16QAM	M	879 + 891.5	36.03	4.01
	64QAM	M	879 + 891.5	34.55	2.85
	256QAM	M	879 + 891.5	34.77	3.00

CH	Frequency (MHz)	Sum of PSD (W/MHz) @ ANT ALL			
		QPSK	16QAM	64QAM	256QAM
M	879 + 891.5	5.91	***8.15***	5.80	6.00

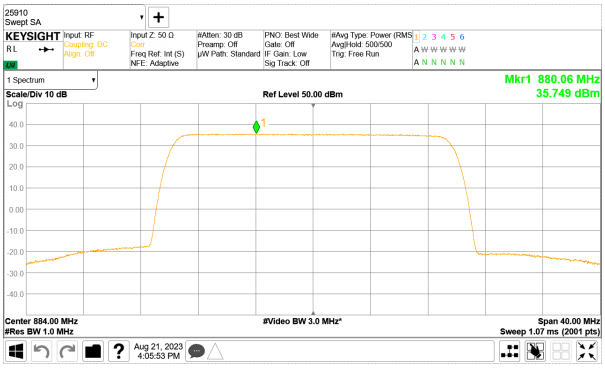
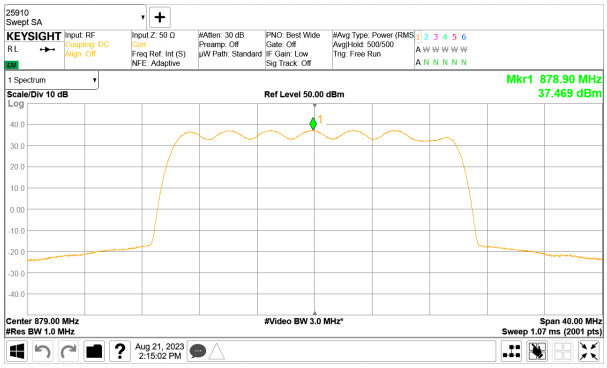
5G NR n5 20 MHz 1C + LTE B5 5 MHz 1C (2 Carrier) – 4TX - Contiguous

ANT	Modulation	CH	Frequency (MHz)	PSD @ ANT	
				Measured value (dBm/MHz)	Result (W/MHz)
1	QPSK	M	879 + 891.5	32.76	1.89
	16QAM	M	879 + 891.5	34.40	2.75
	64QAM	M	879 + 891.5	32.82	1.92
	256QAM	M	879 + 891.5	32.94	1.97
2	QPSK	M	879 + 891.5	32.84	1.92
	16QAM	M	879 + 891.5	***34.44***	***2.78***
	64QAM	M	879 + 891.5	32.76	1.89
	256QAM	M	879 + 891.5	32.82	1.91
3	QPSK	M	879 + 891.5	***32.97***	***1.98***
	16QAM	M	879 + 891.5	34.37	2.74
	64QAM	M	879 + 891.5	32.87	1.94
	256QAM	M	879 + 891.5	33.16	2.07
4	QPSK	M	879 + 891.5	32.83	1.92
	16QAM	M	879 + 891.5	34.30	2.69
	64QAM	M	879 + 891.5	32.77	1.89
	256QAM	M	879 + 891.5	32.90	1.95

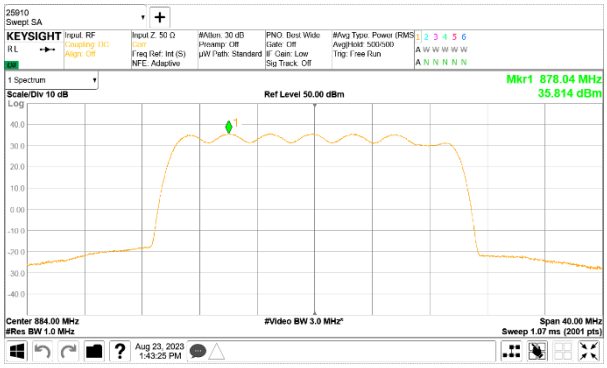
CH	Frequency (MHz)	Sum of PSD (W/MHz) @ ANT ALL			
		QPSK	16QAM	64QAM	256QAM
M	879 + 891.5	7.71	***10.96***	7.63	7.90

8.1.4. WORST PLOT OF PSD

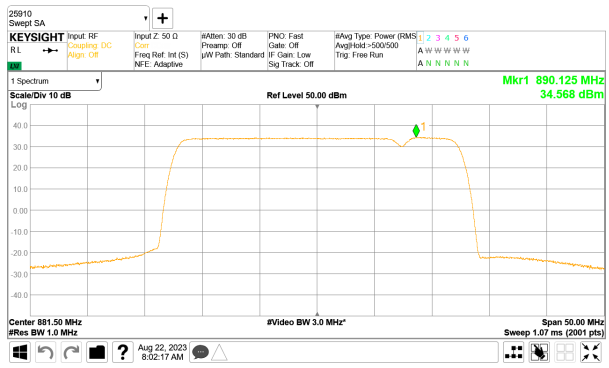
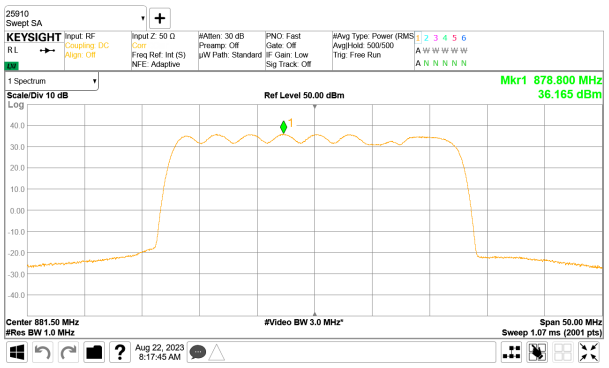
5G NR n5 20 MHz (1 Carrier) – 2TX

QPSK	16QAM
	
ANT 2 / High channel	ANT 1 / Low channel

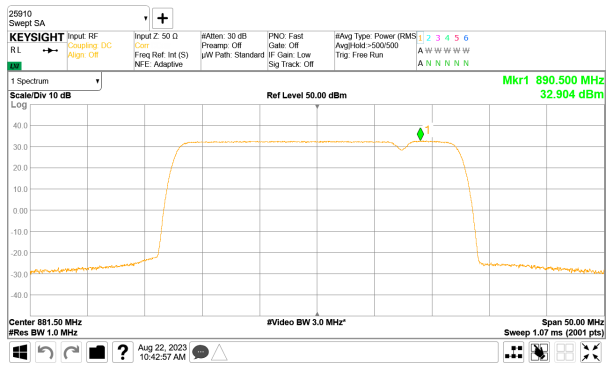
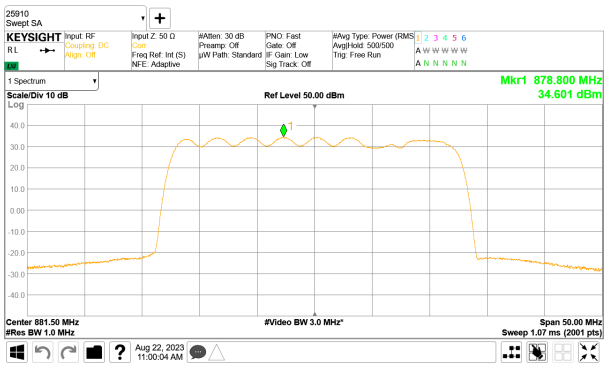
5G NR n5 20 MHz (1 Carrier) – 4TX

QPSK	16QAM
	
ANT 3 / High channel	ANT 1 / High channel

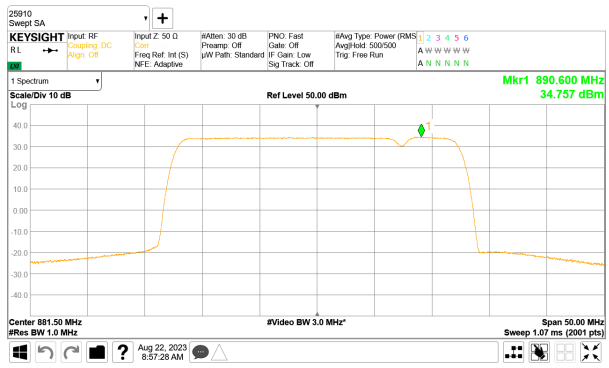
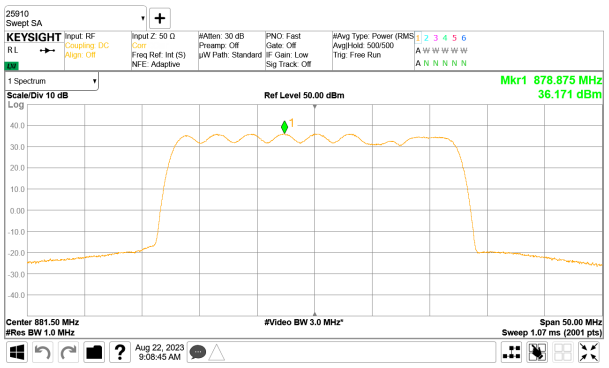
5G NR n5 20 MHz 1C + 5G NR n5 5 MHz 1C (2 Carrier) – 2TX – Contiguous

QPSK	16QAM
	
ANT 2 / Mid channel	ANT 2 / Mid channel

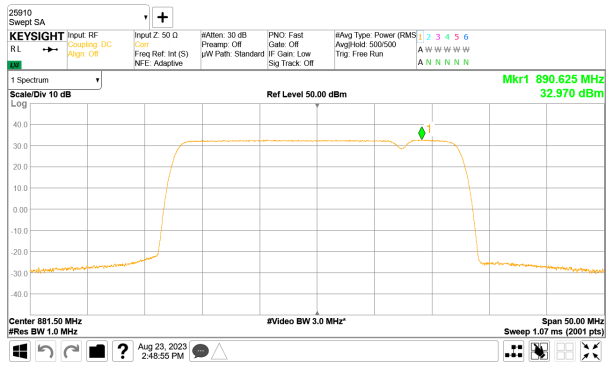
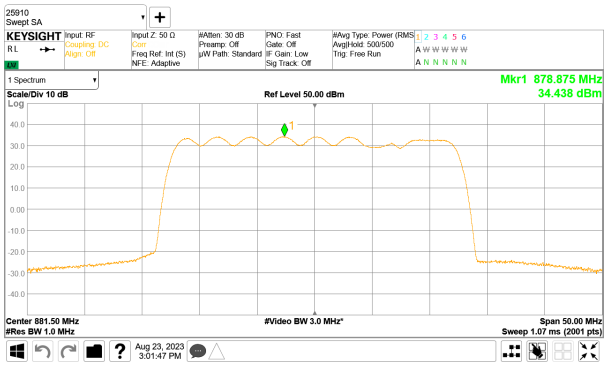
5G NR n5 20 MHz 1C + 5G NR n5 5 MHz 1C (2 Carrier) – 4TX – Contiguous

QPSK	16QAM
	
ANT 3 / Mid channel	ANT 1 / Mid channel

5G NR n5 20 MHz 1C + LTE B5 5 MHz 1C (2 Carrier) – 2TX - Contiguous

QPSK	16QAM
	
ANT 1 / Mid channel	ANT 1 / Mid channel

5G NR n5 20 MHz 1C + LTE B5 5 MHz 1C (2 Carrier) – 4TX - Contiguous

QPSK	16QAM
	
ANT 3 / Mid channel	ANT 2 / Mid channel

8.2. PEAK TO AVERAGE RATIO (PAR)

RULE PART(S)

FCC : §22.913

LIMITS

§22.913

(d) Measurement of the ERP of Cellular base transmitters and repeaters must be made using an average power measurement technique. The peak-to-average ratio (PAR) of the transmission must not exceed 13 dB.

TEST PROCEDURE

The measurement is performed in accordance with Section 5.2.3.4 of ANSI C63.26.

The following guidelines are offered for performing a CCDF measurement.

a) Set resolution/measurement bandwidth ≥ OBW or specified reference bandwidth.

b) Set the number of counts to a value that stabilizes the measured CCDF curve.

c) Set the measurement interval as follows:

1) For continuous transmissions, set to the greater of [10 × (number of points in sweep) × (transmission symbol period)] or 1 ms.

2) For burst transmissions, employ an external trigger that is synchronized with the EUT burst timing sequence, or use the internal burst trigger with a trigger level that allows the burst to stabilize. Set the measurement interval to a time that is less than or equal to the burst duration.

3) If there are several carriers in a single antenna port, the peak power shall be determined for each individual carrier (by disabling the other carriers while measuring the required carrier) and the total peak power calculated from the sum of the individual carrier peak powers.

d) Record the maximum PAPR level associated with a probability of 0.1 %.

e) The peak power level is calculated form the sum of the PAPR value from step d) to the measured average power.

RESULTS

See the following pages.

8.2.1. PEAK TO AVERAGE RATIO (PAR) RESULTS

5G NR n5 20 MHz (1 Carrier) – 2TX

ANT	Modulation	CH	Frequency (MHz)	PAR (dB)
1	QPSK	M	881.5	***7.68***
	16QAM	M	881.5	***7.72***
	64QAM	M	881.5	7.67
	256QAM	M	881.5	7.69
2	QPSK	M	881.5	7.68
	16QAM	M	881.5	7.71
	64QAM	M	881.5	7.66
	256QAM	M	881.5	7.68

5G NR n5 20 MHz (1 Carrier) – 4TX

ANT	Modulation	CH	Frequency (MHz)	PAR (dB)
1	QPSK	M	881.5	8.40
	16QAM	M	881.5	8.38
	64QAM	M	881.5	8.41
	256QAM	M	881.5	8.33
2	QPSK	M	881.5	***8.41***
	16QAM	M	881.5	***8.45***
	64QAM	M	881.5	8.38
	256QAM	M	881.5	8.36
3	QPSK	M	881.5	7.69
	16QAM	M	881.5	7.71
	64QAM	M	881.5	7.68
	256QAM	M	881.5	7.70
4	QPSK	M	881.5	7.68
	16QAM	M	881.5	7.71
	64QAM	M	881.5	7.69
	256QAM	M	881.5	7.70

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5G NR n5 20 MHz 1C + 5G NR n5 5 MHz 1C (2 Carrier) – 2TX – Contiguous

ANT	Modulation	CH	Frequency (MHz)	PAR (dB)
1	QPSK	M	879 + 891.5	8.17
	16QAM	M	879 + 891.5	8.23
	64QAM	M	879 + 891.5	8.24
	256QAM	M	879 + 891.5	8.23
2	QPSK	M	879 + 891.5	***8.23***
	16QAM	M	879 + 891.5	8.20
	64QAM	M	879 + 891.5	8.21
	256QAM	M	879 + 891.5	***8.27***

5G NR n5 20 MHz 1C + 5G NR n5 5 MHz 1C (2 Carrier) – 4TX – Contiguous

ANT	Modulation	CH	Frequency (MHz)	PAR (dB)
1	QPSK	M	879 + 891.5	8.43
	16QAM	M	879 + 891.5	8.48
	64QAM	M	879 + 891.5	8.45
	256QAM	M	879 + 891.5	8.43
2	QPSK	M	879 + 891.5	***8.46***
	16QAM	M	879 + 891.5	8.46
	64QAM	M	879 + 891.5	***8.50***
	256QAM	M	879 + 891.5	8.46
3	QPSK	M	879 + 891.5	8.21
	16QAM	M	879 + 891.5	8.21
	64QAM	M	879 + 891.5	8.21
	256QAM	M	879 + 891.5	8.22
4	QPSK	M	879 + 891.5	8.21
	16QAM	M	879 + 891.5	8.21
	64QAM	M	879 + 891.5	8.20
	256QAM	M	879 + 891.5	8.21

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5G NR n5 20 MHz 1C + LTE B5 5 MHz 1C (2 Carrier) – 2TX - Contiguous

ANT	Modulation	CH	Frequency (MHz)	PAR (dB)
1	QPSK	M	879 + 891.5	***8.22***
	16QAM	M	879 + 891.5	8.21
	64QAM	M	879 + 891.5	8.24
	256QAM	M	879 + 891.5	8.25
2	QPSK	M	879 + 891.5	8.21
	16QAM	M	879 + 891.5	***8.26***
	64QAM	M	879 + 891.5	8.23
	256QAM	M	879 + 891.5	8.26

5G NR n5 20 MHz 1C + LTE B5 5 MHz 1C (2 Carrier) – 4TX - Contiguous

ANT	Modulation	CH	Frequency (MHz)	PAR (dB)
1	QPSK	M	879 + 891.5	***8.42***
	16QAM	M	879 + 891.5	8.43
	64QAM	M	879 + 891.5	8.44
	256QAM	M	879 + 891.5	8.43
2	QPSK	M	879 + 891.5	8.39
	16QAM	M	879 + 891.5	8.42
	64QAM	M	879 + 891.5	8.43
	256QAM	M	879 + 891.5	***8.48***
3	QPSK	M	879 + 891.5	8.20
	16QAM	M	879 + 891.5	8.23
	64QAM	M	879 + 891.5	8.19
	256QAM	M	879 + 891.5	8.18
4	QPSK	M	879 + 891.5	8.25
	16QAM	M	879 + 891.5	8.19
	64QAM	M	879 + 891.5	8.01
	256QAM	M	879 + 891.5	8.19

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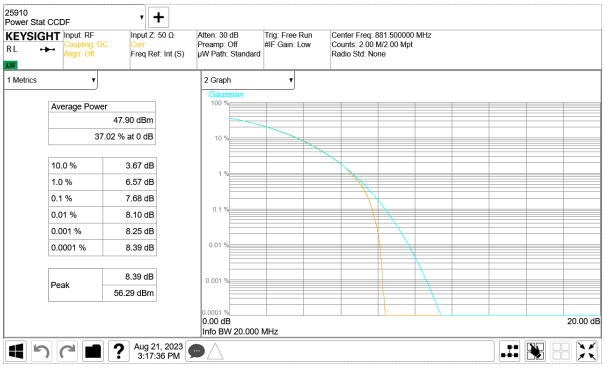
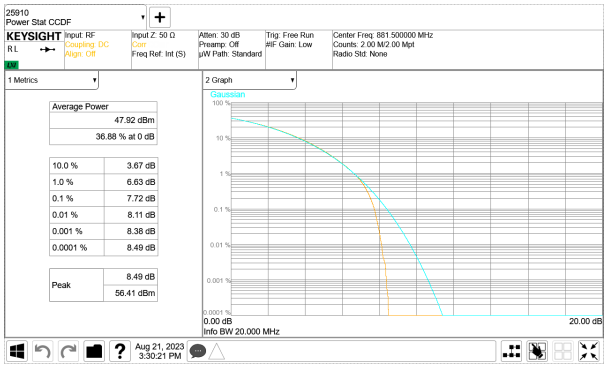
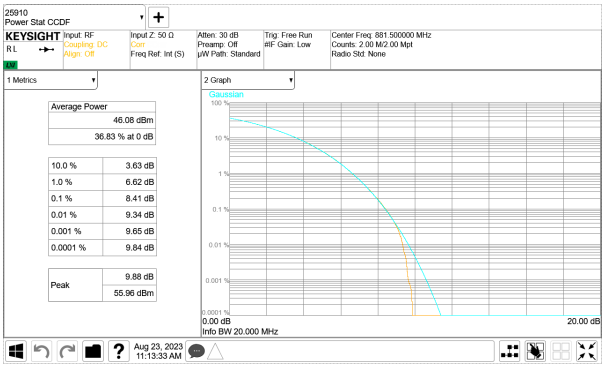
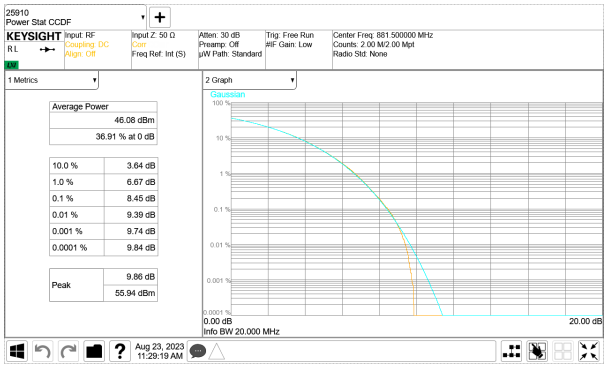
8.2.2. WORST PLOT OF PEAK TO AVERAGE RATIO (PAR)

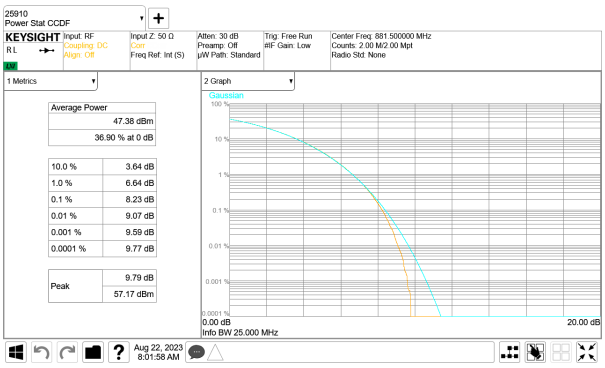
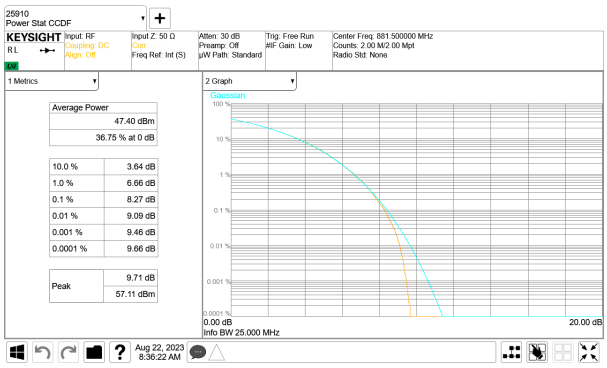
5G NR n5 20 MHz (1 Carrier) – 2TX

QPSK	16QAM
	
ANT 1 / Mid channel	ANT 1 / Mid channel

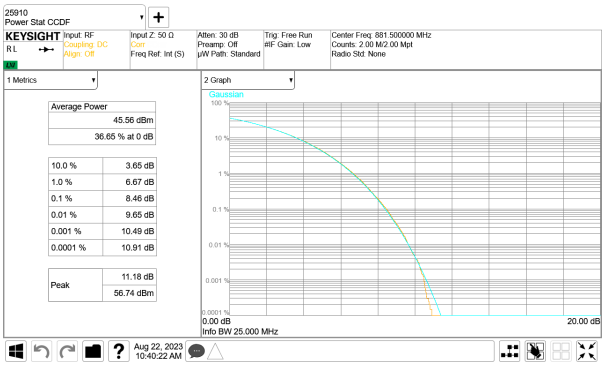
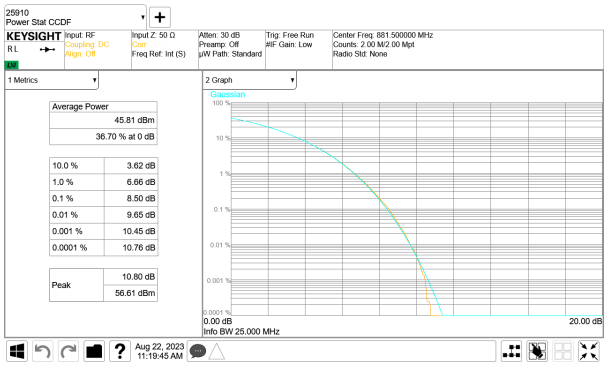
5G NR n5 20 MHz (1 Carrier) – 4TX

QPSK	16QAM
	
ANT 2 / Mid channel	ANT 2 / Mid channel

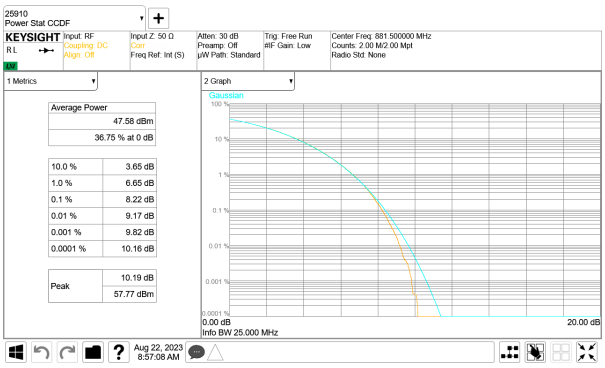
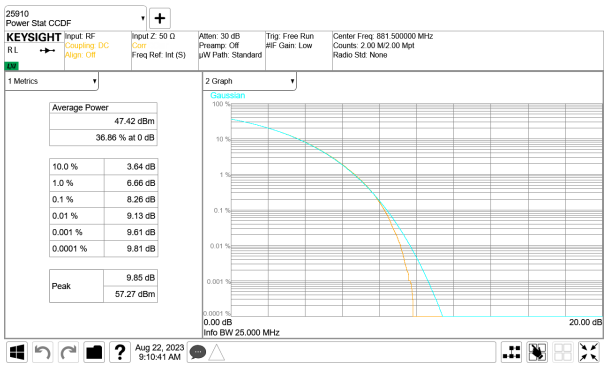
5G NR n5 20 MHz 1C + 5G NR n5 5 MHz 1C (2 Carrier) – 2TX – Contiguous

QPSK	256QAM
	
ANT 2 / Mid channel	ANT 2 / Mid channel

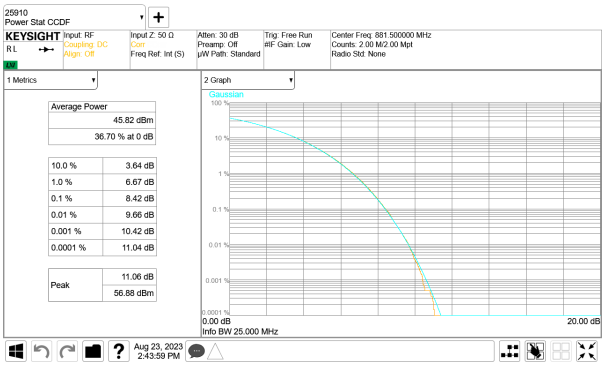
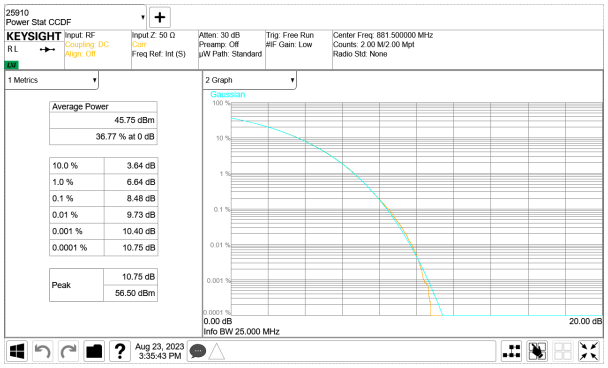
5G NR n5 20 MHz 1C + 5G NR n5 5 MHz 1C (2 Carrier) – 4TX – Contiguous

QPSK	64QAM
	
ANT 2 / Mid channel	ANT 2 / Mid channel

5G NR n5 20 MHz 1C + LTE B5 5 MHz 1C (2 Carrier) – 2TX - Contiguous

QPSK	16QAM
	
ANT 1 / Mid channel	ANT 2 / Mid channel

5G NR n5 20 MHz 1C + LTE B5 5 MHz 1C (2 Carrier) – 4TX - Contiguous

QPSK	256QAM
	
ANT 1 / Mid channel	ANT 2 / Mid channel

8.3. OCCUPIED BANDWIDTH

RULE PART(S)

FCC : §2.1049

LIMITS

For reporting purposes only

TEST PROCEDURE

The transmitter output was connected to a calibrated coaxial cable and attenuator, the other end of which was connected to a spectrum analyzer. The occupied bandwidth was measured with the spectrum analyzer at the low, middle and high channel in each band. The occupied bandwidth was also measured and recorded.

(Section 5.4.3 and 5.4.4 of ANSI C63.26)

RESULTS

See the following pages.

8.3.1. OCCUPIED BANDWIDTH RESULTS

5G NR n5 20 MHz (1 Carrier) – 2TX

ANT	Modulation	CH	Frequency (MHz)	Occupied Bandwidth (MHz)
1	QPSK	L	879	18.952
		M	881.5	***18.952***
		H	884	18.924
	16QAM	L	879	19.018
		M	881.5	19.002
		H	884	18.995
	64QAM	L	879	18.988
		M	881.5	18.970
		H	884	18.952
	256QAM	L	879	18.981
		M	881.5	18.979
		H	884	18.963
2	QPSK	L	879	18.941
		M	881.5	18.945
		H	884	18.918
	16QAM	L	879	***19.039***
		M	881.5	18.996
		H	884	18.995
	64QAM	L	879	18.973
		M	881.5	18.962
		H	884	18.942
	256QAM	L	879	18.955
		M	881.5	18.976
		H	884	18.952

5G NR n5 20 MHz (1 Carrier) – 4TX

ANT	Modulation	CH	Frequency (MHz)	Occupied Bandwidth (MHz)
1	QPSK	L	879	18.954
		M	881.5	***18.959***
		H	884	18.937
	16QAM	L	879	***19.029***
		M	881.5	19.006
		H	884	19.002
	64QAM	L	879	18.979
		M	881.5	18.971
		H	884	18.963
	256QAM	L	879	18.983
		M	881.5	18.977
		H	884	18.959
2	QPSK	L	879	18.950
		M	881.5	18.947
		H	884	18.930
	16QAM	L	879	19.028
		M	881.5	19.016
		H	884	18.997
	64QAM	L	879	18.984
		M	881.5	18.974
		H	884	18.987
	256QAM	L	879	18.965
		M	881.5	18.953
		H	884	18.941
3	QPSK	L	879	18.954
		M	881.5	18.941
		H	884	18.929
	16QAM	L	879	19.019
		M	881.5	19.010
		H	884	19.009
	64QAM	L	879	18.980
		M	881.5	18.962
		H	884	18.953
	256QAM	L	879	18.981
		M	881.5	18.989
		H	884	18.970

ANT	Modulation	CH	Frequency (MHz)	Occupied Bandwidth (MHz)
4	QPSK	L	879	18.945
		M	881.5	18.957
		H	884	18.937
	16QAM	L	879	19.025
		M	881.5	19.022
		H	884	18.993
	64QAM	L	879	18.960
		M	881.5	18.961
		H	884	18.958
	256QAM	L	879	18.967
		M	881.5	18.971
		H	884	18.950

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5G NR n5 20 MHz 1C + 5G NR n5 5 MHz 1C (2 Carrier) – 2TX – Contiguous

ANT	Modulation	CH	Frequency (MHz)	Occupied Bandwidth (MHz)
1	QPSK	M	879 + 891.5	24.112
	16QAM	M	879 + 891.5	24.141
	64QAM	M	879 + 891.5	24.095
	256QAM	M	879 + 891.5	24.083
2	QPSK	M	879 + 891.5	***24.132***
	16QAM	M	879 + 891.5	***24.163***
	64QAM	M	879 + 891.5	24.101
	256QAM	M	879 + 891.5	24.111

5G NR n5 20 MHz 1C + 5G NR n5 5 MHz 1C (2 Carrier) – 4TX – Contiguous

ANT	Modulation	CH	Frequency (MHz)	Occupied Bandwidth (MHz)
1	QPSK	M	879 + 891.5	***24.177***
	16QAM	M	879 + 891.5	***24.158***
	64QAM	M	879 + 891.5	24.111
	256QAM	M	879 + 891.5	24.111
2	QPSK	M	879 + 891.5	24.122
	16QAM	M	879 + 891.5	24.136
	64QAM	M	879 + 891.5	24.093
	256QAM	M	879 + 891.5	24.106
3	QPSK	M	879 + 891.5	24.151
	16QAM	M	879 + 891.5	24.130
	64QAM	M	879 + 891.5	24.113
	256QAM	M	879 + 891.5	24.110
4	QPSK	M	879 + 891.5	24.086
	16QAM	M	879 + 891.5	24.142
	64QAM	M	879 + 891.5	24.110
	256QAM	M	879 + 891.5	24.095

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5G NR n5 20 MHz 1C + LTE B5 5 MHz 1C (2 Carrier) – 2TX - Contiguous

ANT	Modulation	CH	Frequency (MHz)	Occupied Bandwidth (MHz)
1	QPSK	M	879 + 891.5	24.120
	16QAM	M	879 + 891.5	24.131
	64QAM	M	879 + 891.5	24.153
	256QAM	M	879 + 891.5	24.119
2	QPSK	M	879 + 891.5	***24.134***
	16QAM	M	879 + 891.5	***24.175***
	64QAM	M	879 + 891.5	24.127
	256QAM	M	879 + 891.5	24.166

5G NR n5 20 MHz 1C + LTE B5 5 MHz 1C (2 Carrier) – 4TX - Contiguous

ANT	Modulation	CH	Frequency (MHz)	Occupied Bandwidth (MHz)
1	QPSK	M	879 + 891.5	24.107
	16QAM	M	879 + 891.5	24.101
	64QAM	M	879 + 891.5	24.145
	256QAM	M	879 + 891.5	24.140
2	QPSK	M	879 + 891.5	***24.136***
	16QAM	M	879 + 891.5	24.120
	64QAM	M	879 + 891.5	24.162
	256QAM	M	879 + 891.5	24.116
3	QPSK	M	879 + 891.5	24.134
	16QAM	M	879 + 891.5	24.150
	64QAM	M	879 + 891.5	***24.173***
	256QAM	M	879 + 891.5	24.139
4	QPSK	M	879 + 891.5	24.116
	16QAM	M	879 + 891.5	24.118
	64QAM	M	879 + 891.5	24.161
	256QAM	M	879 + 891.5	24.151

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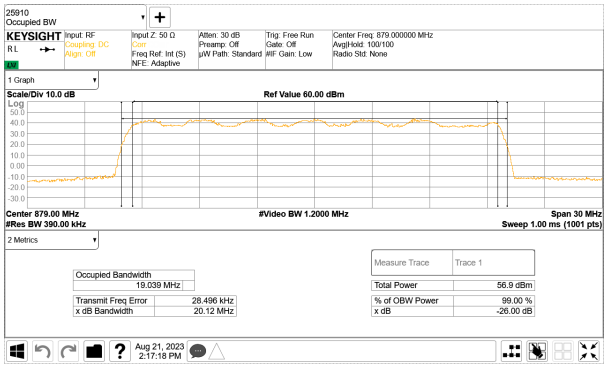
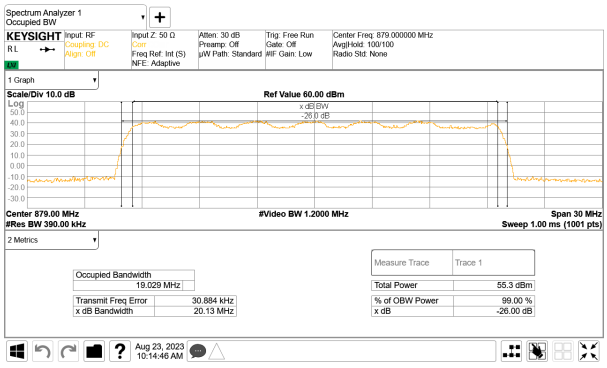
8.3.2. WORST PLOT OF OCCUPIED BANDWIDTH

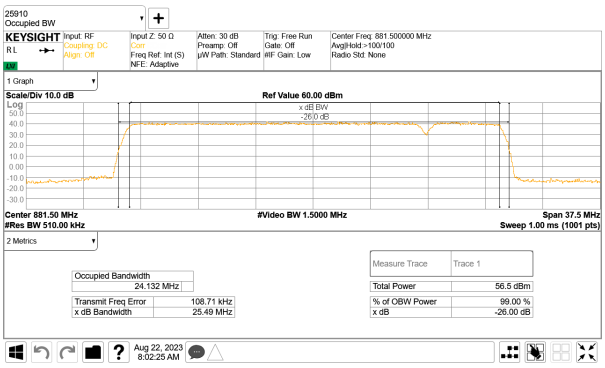
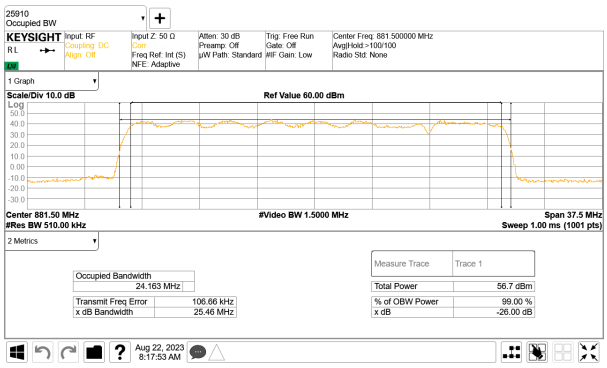
5G NR n5 20 MHz (1 Carrier) – 2TX

QPSK	16QAM
	
ANT 1 / Mid channel	ANT 2 / Low channel

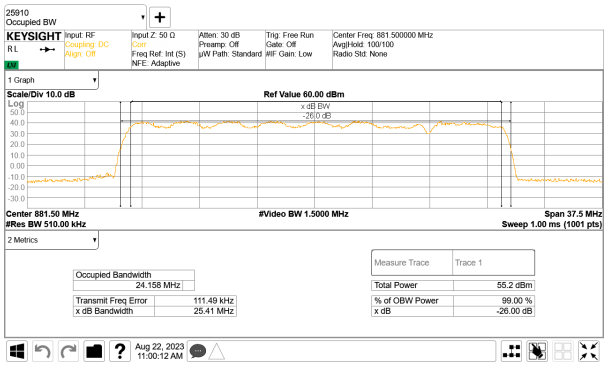
5G NR n5 20 MHz (1 Carrier) – 4TX

QPSK	16QAM
	
ANT 1 / Mid channel	ANT 1 / Low channel

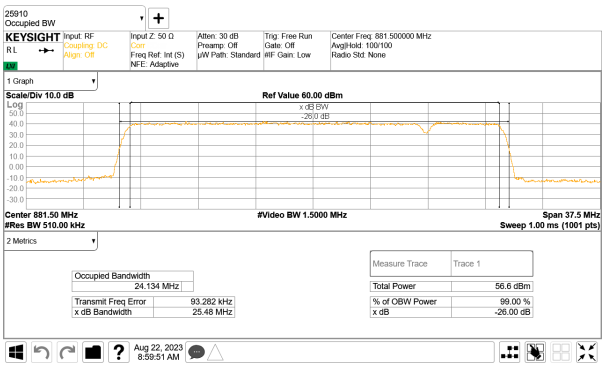
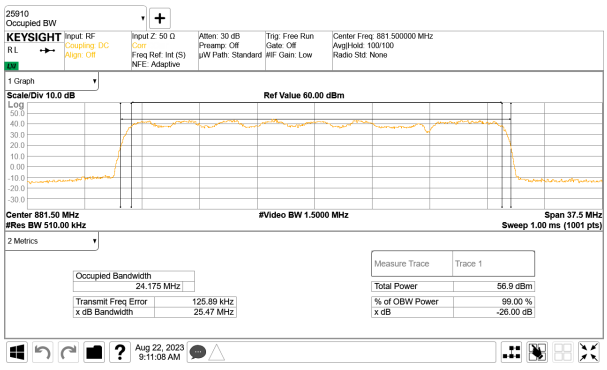
5G NR n5 20 MHz 1C + 5G NR n5 5 MHz 1C (2 Carrier) – 2TX – Contiguous

QPSK	16QAM
	
ANT 2 / Mid channel	ANT 2 / Mid channel

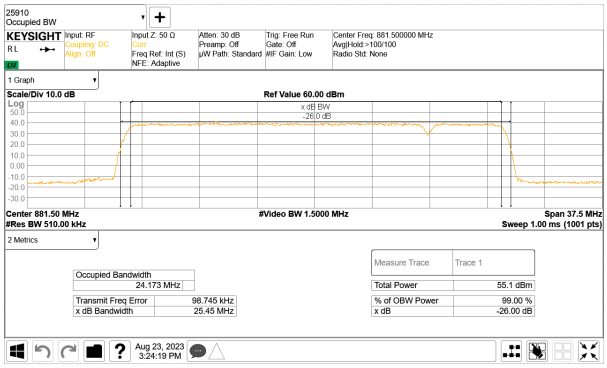
5G NR n5 20 MHz 1C + 5G NR n5 5 MHz 1C (2 Carrier) – 4TX – Contiguous

QPSK	16QAM
	
ANT 1 / Mid channel	ANT 1 / Mid channel

5G NR n5 20 MHz 1C + LTE B5 5 MHz 1C (2 Carrier) – 2TX - Contiguous

QPSK	16QAM
	
ANT 2 / Mid channel	ANT 2 / Mid channel

5G NR n5 20 MHz 1C + LTE B5 5 MHz 1C (2 Carrier) – 4TX - Contiguous

QPSK	64QAM
	
ANT 2 / Mid channel	ANT 3 / Mid channel

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8.4. OUT OF BAND EMISSIONS (BAND EDGE)

RULE PART(S)

FCC : §2.1051 §22.917

LIMITS

§22.917

The rules in this section govern the spectral characteristics of emissions in the Cellular Radiotelephone Service.

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

(b) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a reference bandwidth as follows:

(1) In the spectrum below 1 GHz, instrumentation should employ a reference bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy, provided that the measured power is integrated over the full required reference bandwidth (i.e., 100 kHz or 1 percent of emission bandwidth, as specified). The 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.

(2) In the spectrum above 1 GHz, instrumentation should employ a reference bandwidth of 1 MHz.

(c) Alternative out of band emission limit. Licensees in this service may establish an alternative out of band emission limit to be used at specified band edge(s) in specified geographical areas, in lieu of that set forth in this section, pursuant to a private contractual arrangement of all affected licensees and applicants. In this event, each party to such contract shall maintain a copy of the contract in their station files and disclose it to prospective assignees or transferees and, upon request, to the FCC.

(d) Interference caused by out of band emissions. If any emission from a transmitter operating in this service results in interference to users of another radio service, the FCC may require a greater attenuation of that emission than specified in this section.

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TEST PROCEDURE

Section 5.7.3 of ANSI C63.26:

Out-of-band unwanted emissions measurements

a) Set the spectrum analyzer center frequency to the block, band, or channel edge frequency.

b) Set the span wide enough to capture the fundamental emission closest to the authorized block or band edge, and to include all modulation products that spill into the immediately adjacent frequency band. In some cases, it may be possible to set the center frequency and span so as to encompass the fundamental emission and the unwanted out-of-band (band-edge) emissions on either side of the authorized block, band, or channel. This can be accomplished with a single (slow) sweep, if adequate overload protection and sufficient dynamic range can be maintained.

c) Set the number of points in sweep ≥ 2 × span / RBW.

d) Sweep time should be auto for peak detection. For rms detection the sweep time should be set as follows:

1) If the device can be configured to transmit continuously (duty cycle ≥ 98%), set the (sweep time) > (number of points in sweep) × (symbol period) (e.g., by a factor of 10 × symbol period × number of points). Increasing the sweep time (i.e., slowing the sweep speed) will allow for averaging over multiple symbols

2) If the device cannot transmit continuously (duty cycle < 98%), a gated sweep shall be used when possible (i.e., gate triggered such that the analyzer only sweeps when the device is transmitting at full power), set the sweep time > (number of points in sweep) × (symbol period) but the sweep time shall always be maintained at a value that is less than or equal to the minimum transmission time.

3) If the device cannot be configured to transmit continuously (duty cycle < 98%) and a freerunning sweep must be used, set the sweep time so that the averaging is performed over multiple on/off cycles by setting the sweep time > (number of points in sweep) × (transmitter period) (i.e., the transmit on-time + the off-time). The spectrum analyzer readings shall subsequently be corrected by [10 log (1/duty cycle)]. This assumes that the transmission period and duty cycle is relatively constant (duty cycle variation ≤ ±2%).

4) If the device cannot be configured to transmit continuously and a free-running sweep must be used, and if the transmissions exhibit a non-constant duty cycle (duty cycle variations > ±2%), set the sweep time so that the averaging is performed over the on-period by setting the sweep time > (symbol period) × (number of points), while also maintaining the sweep time < (transmitter on-time). The trace mode shall be set to max hold, since not every display point will be averaged only over just the on-time. Thus, multiple sweeps (e.g., 100) in maximum hold are necessary to ensure that the maximum power is measured.

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NOTE:

1) For all frequencies below 869 MHz and above 894 MHz, correction has been added to the limit for each port according to KDB 662911 D01 v02r01.

- 2TX MIMO correction: 10 log(N_{ANT}) = 10 log(2) =3.01 dB
- 2TX MIMO Limit : -13 dBm – 3.01 dB = -16.01 dBm
- 4TX MIMO correction: 10 log(N_{ANT}) = 10 log(4) =6.02 dB
- 4TX MIMO Limit : -13 dBm – 6.02 dB = -19.02 dBm

RESULTS

See the following pages.

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8.4.1. OUT OF BAND EMISSIONS (BAND EDGE)

5G NR n5 20 MHz (1 Carrier) – 2TX

ANT	Modulation	CH	Frequency (MHz)	BE	dBm
1	QPSK	L	879	L	-26.82
				H	-29.80
	16QAM	L	879	L	-25.75
				H	-30.19
	64QAM	L	879	L	***-25.25***
				H	-29.18
	256QAM	L	879	L	-26.38
				H	-29.47
2	QPSK	L	879	L	-27.63
				H	-29.62
	16QAM	L	879	L	-27.44
				H	-30.39
	64QAM	L	879	L	-26.53
				H	-29.43
	256QAM	L	879	L	-27.04
				H	-29.25
1	QPSK	H	884	L	-28.24
				H	-26.52
	16QAM	H	884	L	-29.16
				H	-27.32
	64QAM	H	884	L	-28.48
				H	-26.40
	256QAM	H	884	L	-29.63
				H	***-26.25***
2	QPSK	H	884	L	-29.81
				H	-26.97
	16QAM	H	884	L	-29.54
				H	-27.95
	64QAM	H	884	L	-29.69
				H	-26.98
	256QAM	H	884	L	-30.13
				H	-26.73

5G NR n5 20 MHz (1 Carrier) – 4TX

ANT	Modulation	CH	Frequency (MHz)	BE	dBm
1	QPSK	L	879	L	-29.41
				H	-31.98
	16QAM	L	879	L	-28.67
				H	-32.46
	64QAM	L	879	L	***-27.13***
				H	-32.05
	256QAM	L	879	L	-27.55
				H	-32.07
2	QPSK	L	879	L	-29.45
				H	-31.59
	16QAM	L	879	L	-29.33
				H	-31.99
	64QAM	L	879	L	-28.27
				H	-31.79
	256QAM	L	879	L	-29.48
				H	-31.34
3	QPSK	L	879	L	-30.27
				H	-32.11
	16QAM	L	879	L	-29.46
				H	-32.65
	64QAM	L	879	L	-29.26
				H	-31.90
	256QAM	L	879	L	-30.03
				H	-31.51
4	QPSK	L	879	L	-29.89
				H	-32.38
	16QAM	L	879	L	-30.22
				H	-32.84
	64QAM	L	879	L	-29.99
				H	-32.74
	256QAM	L	879	L	-30.48
				H	-31.50

ANT	Modulation	CH	Frequency (MHz)	BE	dBm
1	QPSK	H	884	L	-31.01
				H	-29.11
	16QAM	H	884	L	-31.34
				H	-29.85
	64QAM	H	884	L	-31.37
				H	-28.82
	256QAM	H	884	L	-31.55
				H	***-28.50***
2	QPSK	H	884	L	-30.94
				H	-29.57
	16QAM	H	884	L	-31.84
				H	-30.44
	64QAM	H	884	L	-31.78
				H	-29.54
	256QAM	H	884	L	-31.96
				H	-29.15
3	QPSK	H	884	L	-31.49
				H	-30.55
	16QAM	H	884	L	-31.31
				H	-30.52
	64QAM	H	884	L	-31.22
				H	-30.18
	256QAM	H	884	L	-32.79
				H	-30.84
4	QPSK	H	884	L	-30.94
				H	-30.34
	16QAM	H	884	L	-31.55
				H	-30.56
	64QAM	H	884	L	-31.41
				H	-30.47
	256QAM	H	884	L	-31.48
				H	-29.92

5G NR n5 20 MHz 1C + 5G NR n5 5 MHz 1C (2 Carrier) – 2TX – Contiguous

ANT	Modulation	CH	Frequency (MHz)	BE	dBm
1	QPSK	M	879 + 891.5	L	-27.60
				H	***-26.22***
	16QAM	M	879 + 891.5	L	-26.78
				H	-26.83
	64QAM	M	879 + 891.5	L	-26.98
				H	-27.13
	256QAM	M	879 + 891.5	L	***-26.43***
				H	-26.49
2	QPSK	M	879 + 891.5	L	-27.76
				H	-26.31
	16QAM	M	879 + 891.5	L	-27.17
				H	-26.67
	64QAM	M	879 + 891.5	L	-27.76
				H	-27.00
	256QAM	M	879 + 891.5	L	-27.28
				H	-26.43

5G NR n5 20 MHz 1C + 5G NR n5 5 MHz 1C (2 Carrier) – 4TX – Contiguous

ANT	Modulation	CH	Frequency (MHz)	BE	dBm
1	QPSK	M	879 + 891.5	L	-28.72
				H	-28.00
	16QAM	M	879 + 891.5	L	-29.43
				H	-29.01
	64QAM	M	879 + 891.5	L	-29.51
				H	-29.05
	256QAM	M	879 + 891.5	L	-28.44
				H	-28.65
2	QPSK	M	879 + 891.5	L	***-27.05***
				H	***-27.39***
	16QAM	M	879 + 891.5	L	-28.03
				H	-28.44
	64QAM	M	879 + 891.5	L	-29.09
				H	-29.13
	256QAM	M	879 + 891.5	L	-29.57
				H	-28.59
3	QPSK	M	879 + 891.5	L	-30.78
				H	-29.62
	16QAM	M	879 + 891.5	L	-30.97
				H	-29.58
	64QAM	M	879 + 891.5	L	-30.75
				H	-29.49
	256QAM	M	879 + 891.5	L	-31.11
				H	-29.57
4	QPSK	M	879 + 891.5	L	-30.32
				H	-28.97
	16QAM	M	879 + 891.5	L	-30.94
				H	-29.43
	64QAM	M	879 + 891.5	L	-30.80
				H	-29.41
	256QAM	M	879 + 891.5	L	-30.62
				H	-29.53

5G NR n5 20 MHz 1C + LTE B5 5 MHz 1C (2 Carrier) – 2TX - Contiguous

ANT	Modulation	CH	Frequency (MHz)	BE	dBm
1	QPSK	M	879 + 891.5	L	-25.90
				H	-26.24
	16QAM	M	879 + 891.5	L	***-25.43***
				H	-26.61
	64QAM	M	879 + 891.5	L	-27.41
				H	-26.35
	256QAM	M	879 + 891.5	L	-26.20
				H	-26.36
2	QPSK	M	879 + 891.5	L	-27.06
				H	-26.51
	16QAM	M	879 + 891.5	L	-27.75
				H	-26.74
	64QAM	M	879 + 891.5	L	-27.92
				H	-26.53
	256QAM	M	879 + 891.5	L	-27.42
				H	***-26.00***

5G NR n5 20 MHz 1C + LTE B5 5 MHz 1C (2 Carrier) – 4TX - Contiguous

ANT	Modulation	CH	Frequency (MHz)	BE	dBm
1	QPSK	M	879 + 891.5	L	-28.02
				H	-28.36
	16QAM	M	879 + 891.5	L	***-27.57***
				H	-28.58
	64QAM	M	879 + 891.5	L	-28.02
				H	***-28.14***
	256QAM	M	879 + 891.5	L	-28.13
				H	-28.60
2	QPSK	M	879 + 891.5	L	-29.53
				H	-28.43
	16QAM	M	879 + 891.5	L	-29.36
				H	-29.22
	64QAM	M	879 + 891.5	L	-29.80
				H	-29.08
	256QAM	M	879 + 891.5	L	-30.28
				H	-28.94
3	QPSK	M	879 + 891.5	L	-31.14
				H	-29.48
	16QAM	M	879 + 891.5	L	-30.68
				H	-30.04
	64QAM	M	879 + 891.5	L	-30.76
				H	-29.53
	256QAM	M	879 + 891.5	L	-30.83
				H	-29.71
4	QPSK	M	879 + 891.5	L	-31.05
				H	-29.78
	16QAM	M	879 + 891.5	L	-31.00
				H	-29.96
	64QAM	M	879 + 891.5	L	-31.00
				H	-29.57
	256QAM	M	879 + 891.5	L	-31.27
				H	-29.77