OUTPUT POWER - LOWERED POWER

XMit 2020.12.30.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFL	2021-03-11	2022-03-11
Block - DC	Fairview Microwave	SD3379	AMM	2020-09-21	2021-09-21
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The fundamental emission output power (maximum average conducted output power) was measured using the channels and modes as called out on the following data sheets. The transmit power was set to its default maximum.

The method in section 5.2.4.4 of ANSI C63.26 was used to make the measurement. This method uses trace averaging across ON and OFF times of the EUT transmissions in the spectrum analyzer channel power function using an RMS detector. Following the measurement a duty cycle correction was applied by adding [10 log (1 / D)], where D is the duty cycle, to the measured power to compute the average power during the actual transmission times.

RF conducted emissions testing was performed on one port. The AAFB antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in this certification report) and port 1 was selected to perform the testing under this effort as allowed by ANSI C63.26-2015 paragraphs 5.2.5.3, 5.7.2i and 6.4. The total average transmit power of all antenna ports was determined per ANSI C63.26-2015 paragraph 6.4.3.1.

As shown in the EIRP calculation table in the "PSD and EIRP Calculations" report section, the highest AAFB antenna port 1 PSD level that will not cause the calculated EIRP to exceed the EIRP limit is 29.1 dBm/MHz. The NR5 and NR10 maximum carrier power levels were reduced by 3.0dB and 0.4 dB respectively by changing the carrier power parameters in the base station configuration file to comply with the EIRP limit (62.15 dBm/MHz).

The AAFB base station configuration file parameters set for maximum carrier output power (37.9dBm) gives a measured maximum NR5 PSD/port result of 32.0dBm/MHz and a worst case calculated EIRP that is 2.85dB over the EIRP limit (62.15dBm/MHz). To show compliance with the EIRP limit (62.15dBm/MHz), the AAFB base station configuration file parameters setting for NR5 carrier output power was set to 34.9dBm (reduced 3.0 dB from maximum) that gives a measured maximum NR5 PSD/port result of 28.9dBm/MHz and a worst case calculated EIRP that is 0.2dB below the EIRP limit (62.15dBm/MHz).

The AAFB base station configuration file parameters set for maximum carrier output power (37.9dBm) gives a measured maximum NR10 PSD/port result of 29.2dBm/MHz and a worst case calculated EIRP that is 0.05dB over the EIRP limit (62.15dBm/MHz). To show compliance with the EIRP limit (62.15dBm/MHz), the AAFB base station configuration file parameters setting for NR10 carrier output power was set to 37.5dBm (reduced 0.4 dB from maximum) that gives a measured maximum NR10 PSD/port result of 28.8dBm/MHz and a worst case calculated EIRP that is 0.3dB below the EIRP limit (62.15dBm/MHz).

OUTPUT POWER - LOWERED POWER

element

TbtTx 2021.03.19.1 XMit 2020.12.30.0

EUT:	AAFB (FCC/ISED C2PC)			Work Order:	NOKI0031
Serial Number:	BL2032H23PI			Date:	31-Jul-21
Customer:	Nokia Solutions and Networks			Temperature:	21.5 °C
Attendees:	David Le, Mitchell Hill			Humidity:	56.5% RH
Project:	None			Barometric Pres.:	1016 mbar
Tested by:	Brandon Hobbs	Power:	54 VDC	Job Site:	TX09

TEST SPECIFICATIONS	Test Method
FCC 24E:2021	ANSI C63.26:2015
RSS-133 Issue 6:2013+A1:2018	RSS-133 Issue 6:2013+A1:2018

COMMENTS

All measurement path losses were accounted for in the reference level offest including any attenuators, filters and DC blocks. The output power was measured for a single carrier over the carrier channel bandwidth on port 1. The NR5 and NR10 carrier power levels were reduced to demonstrate compliance with EIRP limits shown elsewhere in this report.

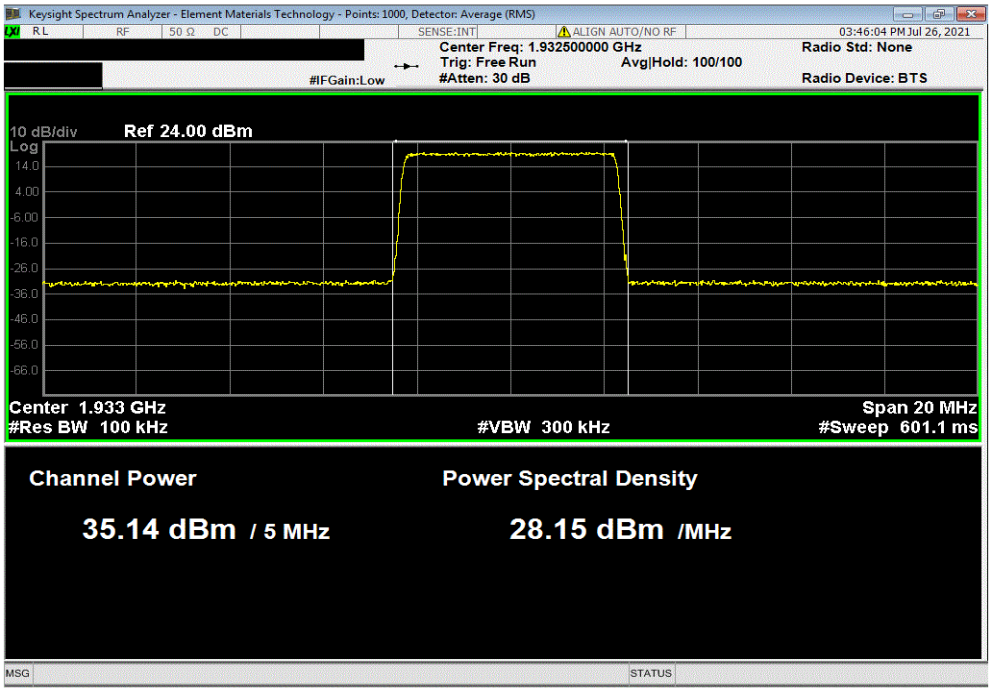
DEVIATIONS FROM TEST STANDARD

None

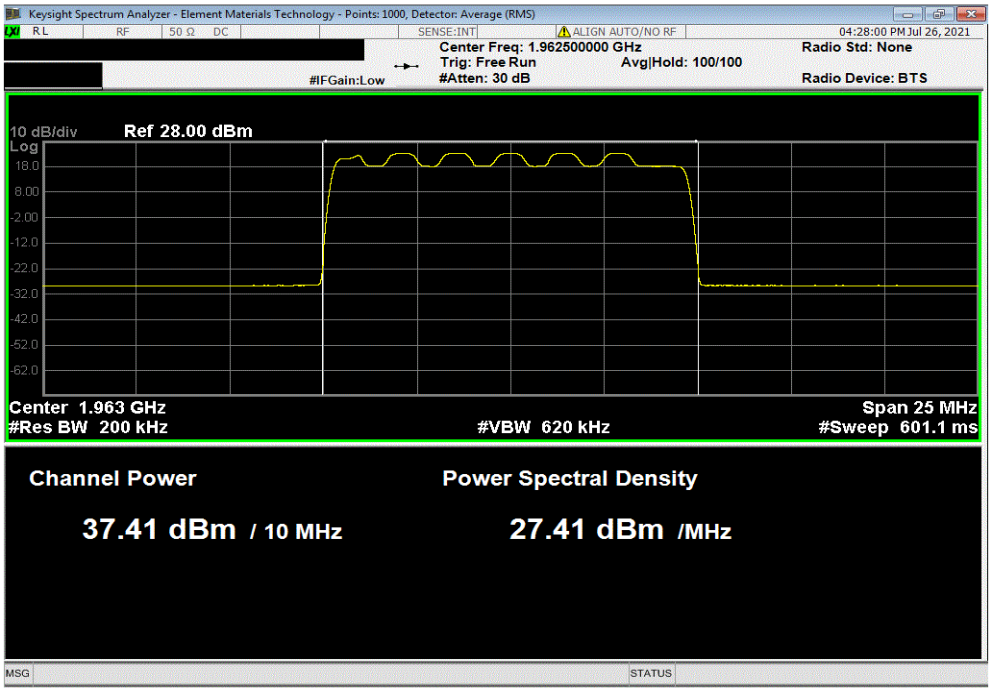
Configuration #	2	Signature

	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW
Band n25, 1930 MHz - 1995 MHz, 5G			
Port 1			
5 MHz Bandwdith			
64-QAM Modulation			
Low Channel, 1932.5 MHz	35.144	0	35.1
10 MHz Bandwdith			
16-QAM Modulation			
Mid Channel, 1962.5 MHz	37.413	0	37.4

Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwdith, 64-QAM Modulation, Low Channel, 1932.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Single Port dBm/Carrier BW		
	35.144	0		35.1		



Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 10 MHz Bandwdith, 16-QAM Modulation, Mid Channel, 1962.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Single Port dBm/Carrier BW		
	37.413	0		37.4		



POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

XMit 2020.12.30.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFL	2021-03-11	2022-03-11
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17
Block - DC	Fairview Microwave	SD3379	AMM	2020-09-21	2021-09-21

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The fundamental emission power spectral density was measured using the channels and modes as called out on the following data sheets.

The method of ANSI C63.26-2015 section 5.2.4.5 was used to make this measurement.

The RF conducted emission testing was performed on one port. The AAFB antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in the “Output Power - All Ports” report section) and antenna port 1 was selected to perform the testing under this effort as allowed by ANSI C63.26-2015 paragraphs 5.2.5.3, 5.7.2i, and 6.4.

The total PSD for all antenna ports (at the radio output) were determined per ANSI C63.26-2015 paragraph 6.4.3.2.4.
The EIRP calculations are based upon ANSI C63.26-2015 paragraphs 6.4 and 6.4.6.3.

EIRP Requirements:

FCC Requirements: Part 24.232 Power and antenna height limits.
(a)(2) Base stations with an emission bandwidth greater than 1 MHz are limited to 1640 watts/MHz equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT, except as described in paragraph (b) below.
(a)(3) Base station antenna heights may exceed 300 meters HAAT with a corresponding reduction in power; *see* Tables 1 and 2 of this section.
(b)(2) Base stations that 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, with an emission bandwidth greater than 1 MHz are limited to 3280 watts/MHz equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT.

ISED Requirements RSS-133 Section 6.4/SRSP-510 section 5.1.1:
SRSP-510 section 5.1 Radiated power and antenna height limits for base stations
For base stations with a channel bandwidth greater than 1 MHz, the maximum e.i.r.p. is limited to 3280 watts/MHz e.i.r.p. (i.e., no more than 3280 watts e.i.r.p. in any 1 MHz band segment) with an antenna height above average terrain (HAAT) up to 300 metres. Fixed or base stations operating in urban areas are limited to a maximum allowable e.i.r.p. of 1640 watts/MHz e.i.r.p. Base station antenna heights above average terrain may exceed 300 metres with a corresponding reduction in e.i.r.p. according to the following table:

POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

element

TbtTx 2021.03.19.1 XMit 2020.12.30.0

EUT:	AAFB (FCC/ISED C2PC)			Work Order:	NOKI0031
Serial Number:	BL2032H23PI			Date:	23-Jul-21
Customer:	Nokia Solutions and Networks			Temperature:	21.4 °C
Attendees:	David Le, Mitchell Hill			Humidity:	55.7% RH
Project:	None			Barometric Pres.:	1017 mbar
Tested by:	Brandon Hobbs	Power:	54 VDC	Job Site:	TX09

TEST SPECIFICATIONS	Test Method
FCC 24E:2021	ANSI C63.26:2015
RSS-133 Issue 6:2013+A1:2018	RSS-133 Issue 6:2013+A1:2018

COMMENTS

All measurement path losses were accounted for in the reference level offest including any attenuators, filters and DC blocks. Band n25 carriers are enabled at maximum power (6.25 watts/carrier). The PSD was measured while transmitting one carrier on Port 1. The total PSD for multiport (2x2 MIMO, 4x4 MIMO, 8x8 MIMO & 16x16 MIMO) operation was determinded based upon ANSI 63.26 clause 6.4.3.2.4 (10 Log Nout). The total PSD for two port operation is single port PSD +3dB [i.e. 10 Log(2)]. The total PSD for four port operation is single port PSD +6dB [i.e. 10 Log(4)]. The total PSD for eight port operation is single port PSD +9dB [i.e. 10 Log(8)]. The total PSD for sixteen port operation is single port PSD +12dB [i.e. 10 Log(16)]. The carrier power was set to maximum for all testing.

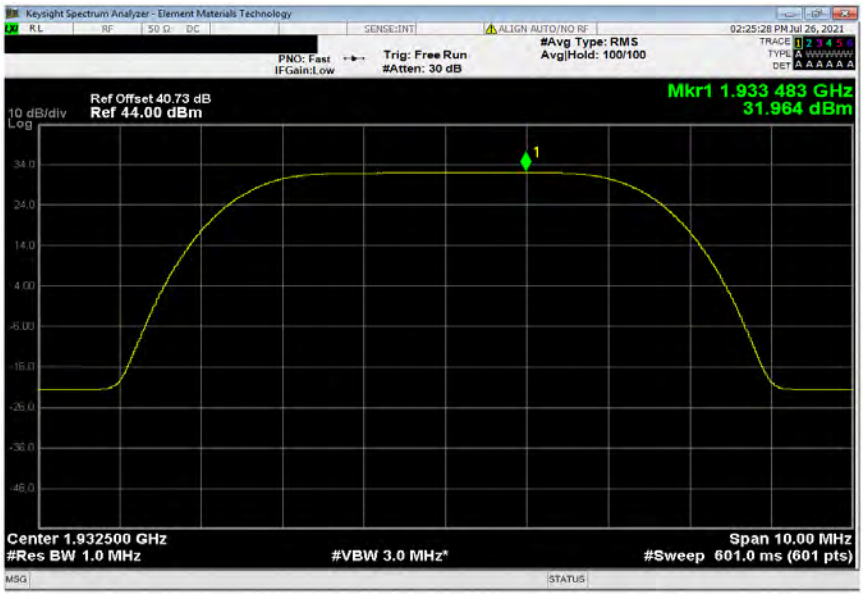
DEVIATIONS FROM TEST STANDARD

None

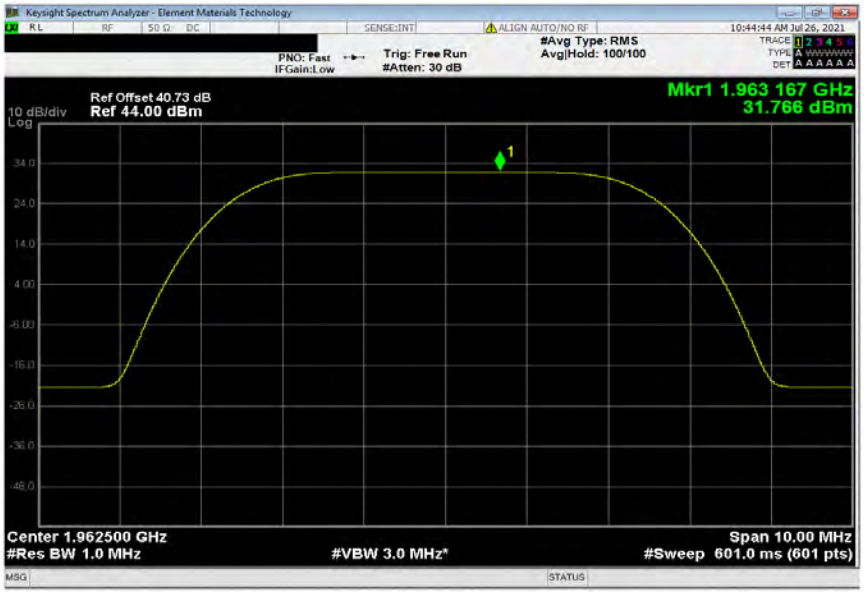
Configuration #	2	Signature

	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	Eight Port (8x8 MIMO) dBm/MHz == PSD	Sixteen Port (16x16 MIMO) dBm/MHz == PSD
Band n25, 1930 MHz - 1995 MHz, 5G							
Port 1							
5 MHz Bandwdith							
QPSK Modulation							
Low Channel, 1932.5 MHz	31.964	0	32.0	35.0	38.0	41.0	44.0
Mid Channel, 1962.5 MHz	31.766	0	31.8	34.8	37.8	40.8	43.8
High Channel, 1992.5 MHz	31.727	0	31.7	34.7	37.7	40.7	43.7
16-QAM Modulation							
Low Channel, 1932.5 MHz	31.881	0	31.9	34.9	37.9	40.9	43.9
Mid Channel, 1962.5 MHz	31.745	0	31.7	34.7	37.7	40.7	43.7
High Channel, 1992.5 MHz	31.719	0	31.7	34.7	37.7	40.7	43.7
64-QAM Modulation							
Low Channel, 1932.5 MHz	31.986	0	32.0	35.0	38.0	41.0	44.0
Mid Channel, 1962.5 MHz	31.697	0	31.7	34.7	37.7	40.7	43.7
High Channel, 1992.5 MHz	31.713	0	31.7	34.7	37.7	40.7	43.7
256-QAM Modulation							
Low Channel, 1932.5 MHz	31.949	0	31.9	34.9	37.9	40.9	43.9
Mid Channel, 1962.5 MHz	31.688	0	31.7	34.7	37.7	40.7	43.7
High Channel, 1992.5 MHz	31.684	0	31.7	34.7	37.7	40.7	43.7
10 MHz Bandwdith							
QPSK Modulation							
Mid Channel, 1962.5 MHz	28.526	0	28.5	31.5	34.5	37.5	40.5
16-QAM Modulation							
Mid Channel, 1962.5 MHz	29.245	0	29.2	32.2	35.2	38.2	41.2
64-QAM Modulation							
Mid Channel, 1962.5 MHz	28.509	0	28.5	31.5	34.5	37.5	40.5
256-QAM Modulation							
Mid Channel, 1962.5 MHz	28.538	0	28.5	31.5	34.5	37.5	40.5
15 MHz Bandwdith							
QPSK Modulation							
Mid Channel, 1962.5 MHz	26.712	0	26.7	29.7	32.7	35.7	38.7
16-QAM Modulation							
Mid Channel, 1962.5 MHz	27.666	0	27.7	30.7	33.7	36.7	39.7
64-QAM Modulation							
Mid Channel, 1962.5 MHz	26.693	0	26.7	29.7	32.7	35.7	38.7
256-QAM Modulation							
Mid Channel, 1962.5 MHz	26.681	0	26.7	29.7	32.7	35.7	38.7
20 MHz Bandwdith							
QPSK Modulation							
Mid Channel, 1962.5 MHz	25.51	0	25.5	28.5	31.5	34.5	37.5
16-QAM Modulation							
Mid Channel, 1962.5 MHz	27.15	0	27.2	30.2	33.2	36.2	39.2
64-QAM Modulation							
Mid Channel, 1962.5 MHz	25.535	0	25.5	28.5	31.5	34.5	37.5
256-QAM Modulation							
Mid Channel, 1962.5 MHz	25.406	0	25.4	28.4	31.4	34.4	37.4

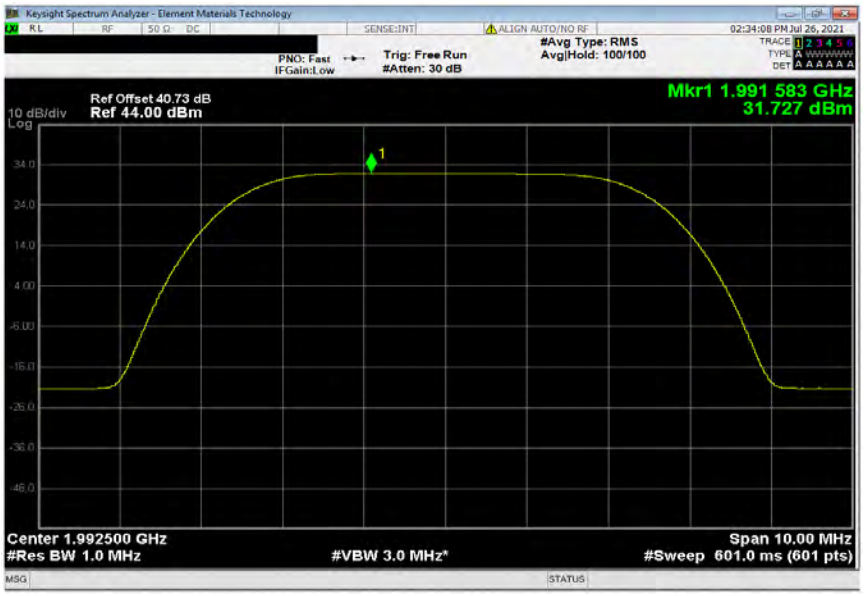
Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwdith, QPSK Modulation , Low Channel, 1932.5 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	Eight Port (8x8 MIMO) dBm/MHz == PSD	Sixteen Port (16x16 MIMO) dBm/MHz == PSD
31.964	0	31.96	34.96	37.96	40.96	43.96



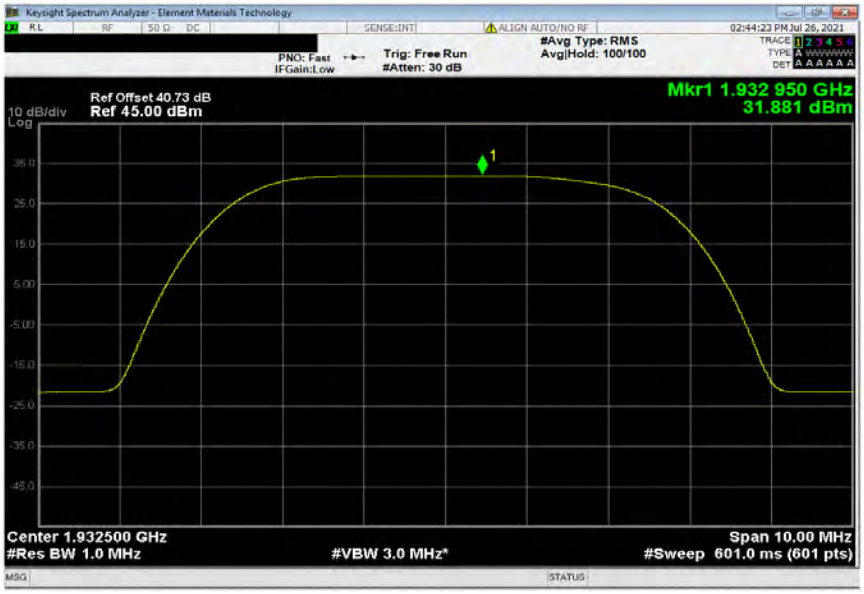
Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwdith, QPSK Modulation , Mid Channel, 1962.5 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	Eight Port (8x8 MIMO) dBm/MHz == PSD	Sixteen Port (16x16 MIMO) dBm/MHz == PSD
31.766	0	31.77	34.77	37.77	40.77	43.77



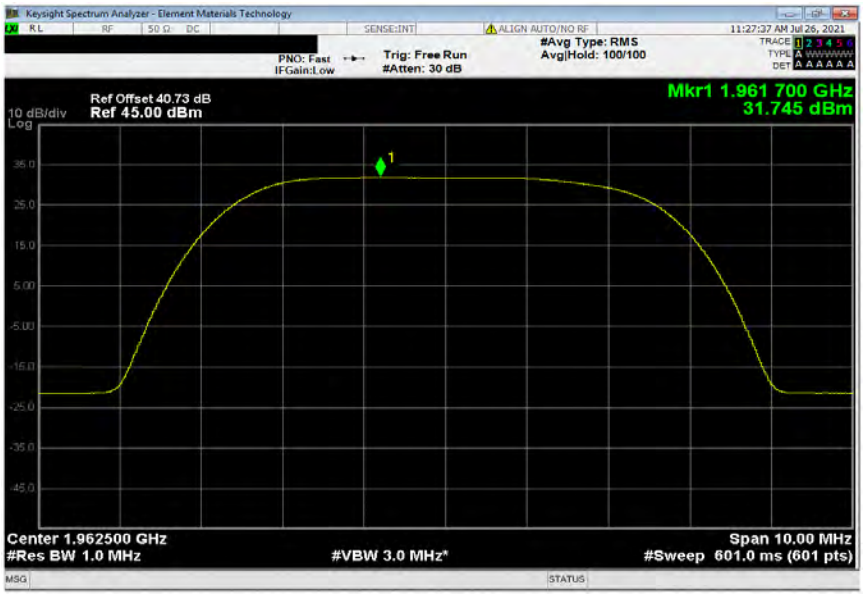
Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwdith, QPSK Modulation , High Channel, 1992.5 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	Eight Port (8x8 MIMO) dBm/MHz == PSD	Sixteen Port (16x16 MIMO) dBm/MHz == PSD
31.727	0	31.73	34.73	37.73	40.73	43.73



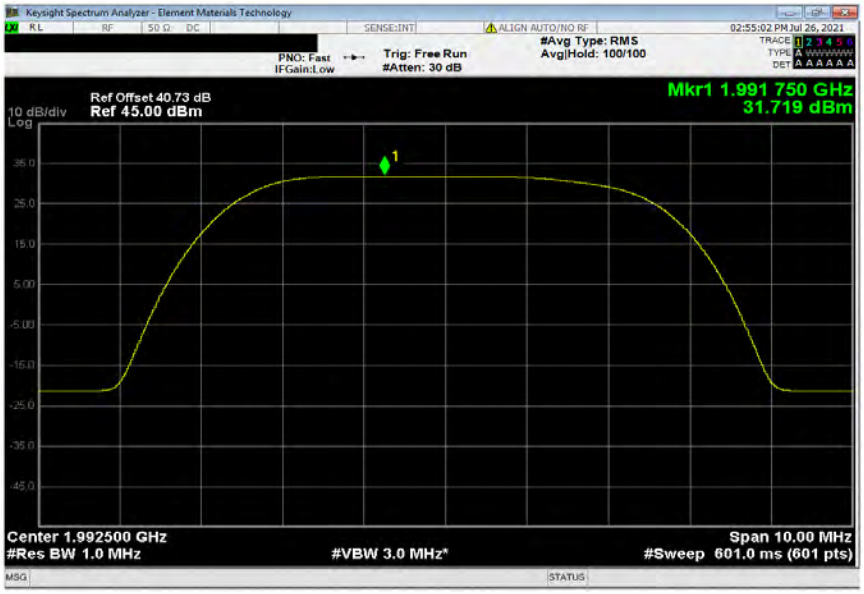
Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwdith, 16-QAM Modulation, Low Channel, 1932.5 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	Eight Port (8x8 MIMO) dBm/MHz == PSD	Sixteen Port (16x16 MIMO) dBm/MHz == PSD
31.881	0	31.88	34.88	37.88	40.88	43.88



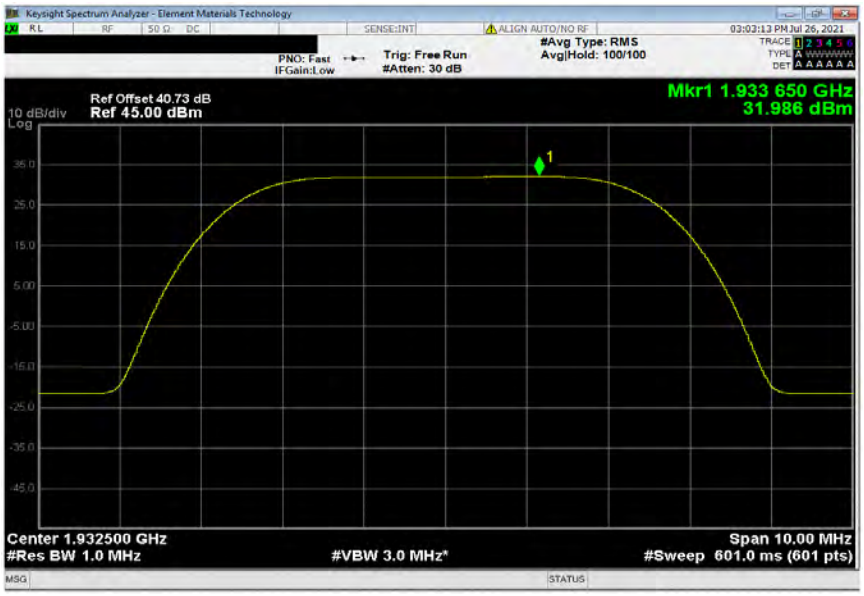
Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwdith, 16-QAM Modulation, Mid Channel, 1962.5 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	Eight Port (8x8 MIMO) dBm/MHz == PSD	Sixteen Port (16x16 MIMO) dBm/MHz == PSD
31.745	0	31.75	34.75	37.75	40.75	43.75



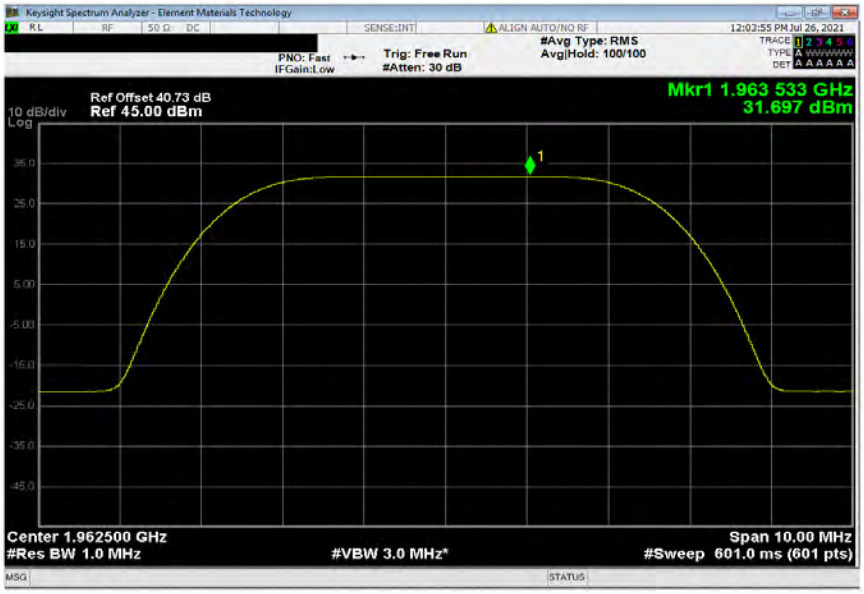
Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwdith, 16-QAM Modulation, High Channel, 1992.5 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	Eight Port (8x8 MIMO) dBm/MHz == PSD	Sixteen Port (16x16 MIMO) dBm/MHz == PSD
31.719	0	31.72	34.72	37.72	40.72	43.72



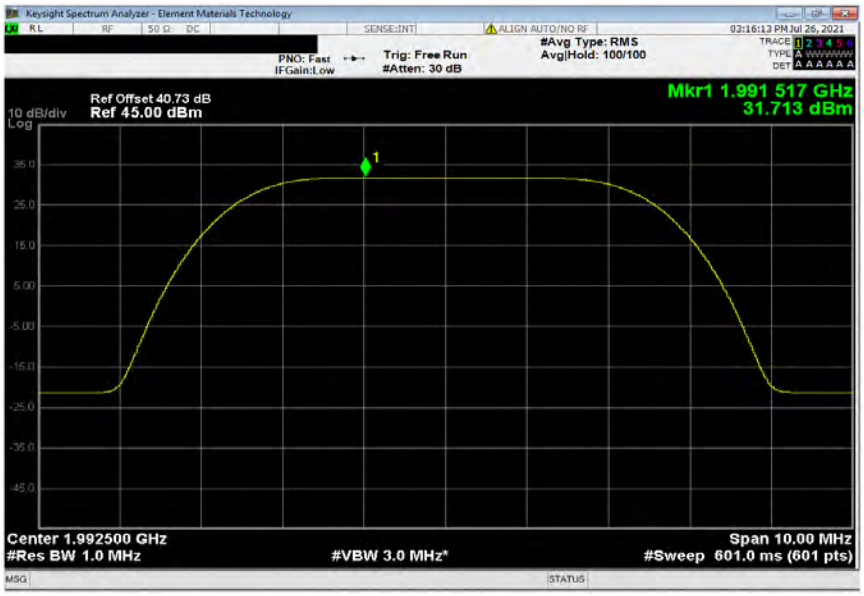
Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwdith, 64-QAM Modulation, Low Channel, 1932.5 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	Eight Port (8x8 MIMO) dBm/MHz == PSD	Sixteen Port (16x16 MIMO) dBm/MHz == PSD
31.986	0	31.99	34.99	37.99	40.99	43.99



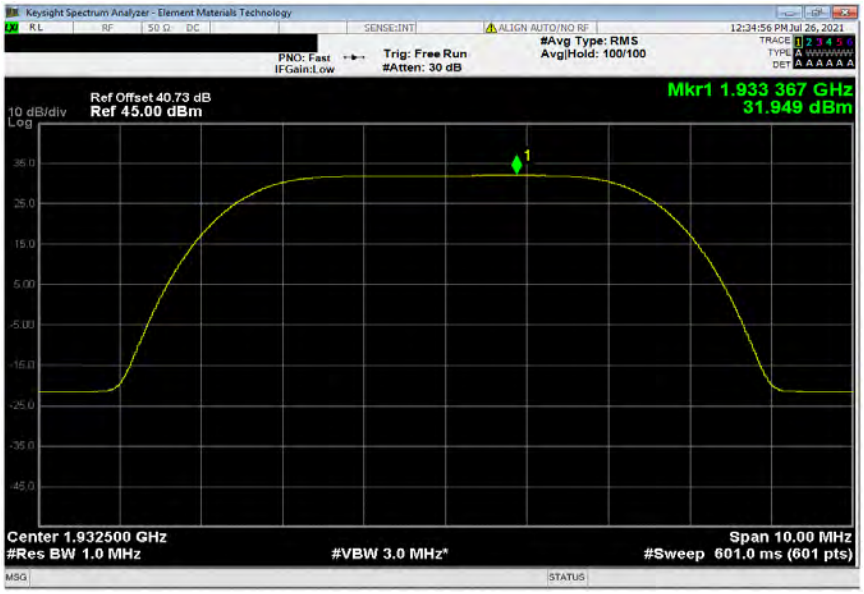
Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwdith, 64-QAM Modulation, Mid Channel, 1962.5 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	Eight Port (8x8 MIMO) dBm/MHz == PSD	Sixteen Port (16x16 MIMO) dBm/MHz == PSD
31.697	0	31.70	34.70	37.70	40.70	43.70



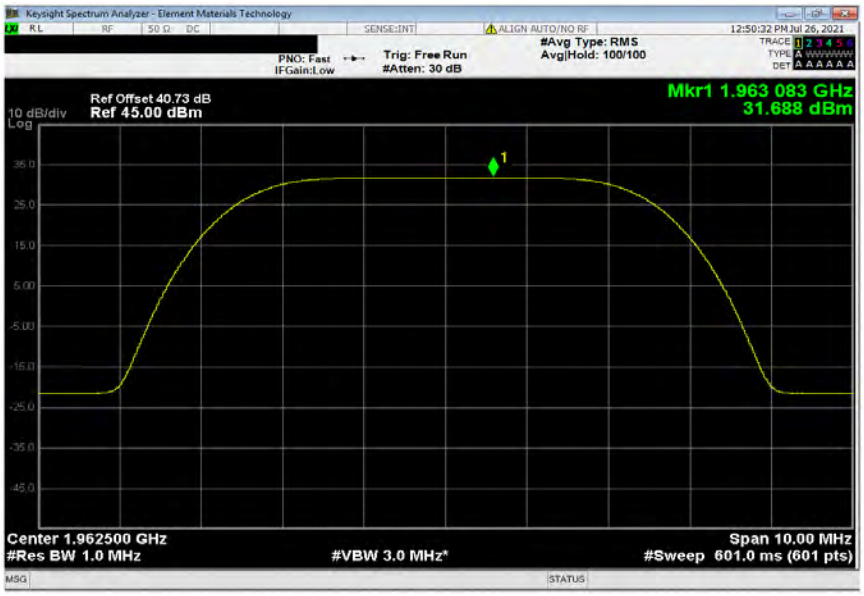
Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwdith, 64-QAM Modulation, High Channel, 1992.5 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	Eight Port (8x8 MIMO) dBm/MHz == PSD	Sixteen Port (16x16 MIMO) dBm/MHz == PSD
31.713	0	31.71	34.71	37.71	40.71	43.71



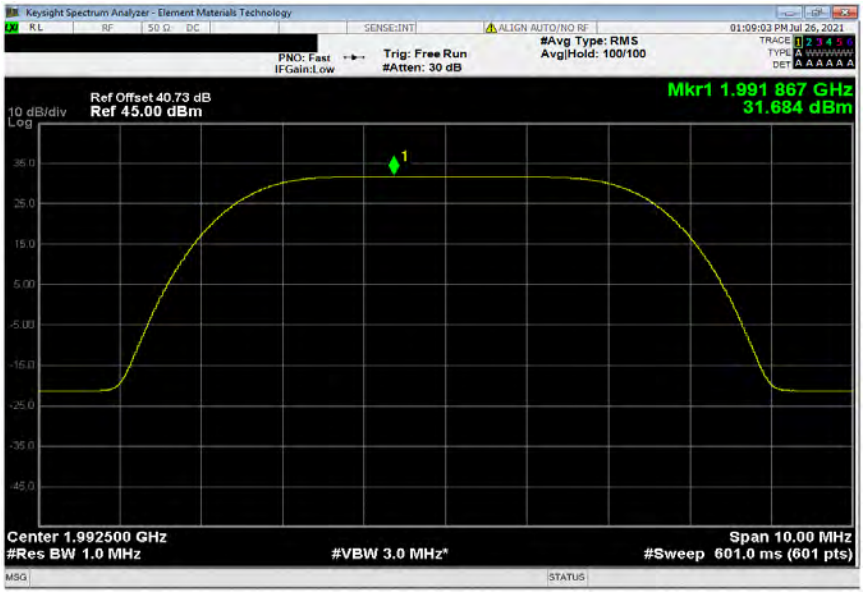
Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwdith, 256-QAM Modulation, Low Channel, 1932.5 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	Eight Port (8x8 MIMO) dBm/MHz == PSD	Sixteen Port (16x16 MIMO) dBm/MHz == PSD
31.949	0	31.95	34.95	37.95	40.95	43.95



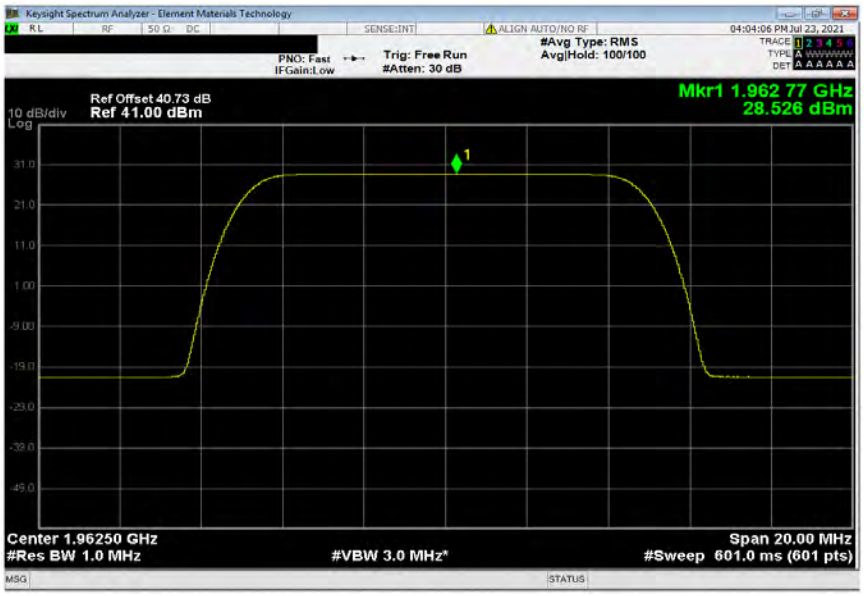
Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwdith, 256-QAM Modulation, Mid Channel, 1962.5 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	Eight Port (8x8 MIMO) dBm/MHz == PSD	Sixteen Port (16x16 MIMO) dBm/MHz == PSD
31.688	0	31.69	34.69	37.69	40.69	43.69



Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwdith, 256-QAM Modulation, High Channel, 1992.5 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	Eight Port (8x8 MIMO) dBm/MHz == PSD	Sixteen Port (16x16 MIMO) dBm/MHz == PSD
31.684	0	31.68	34.68	37.68	40.68	43.68

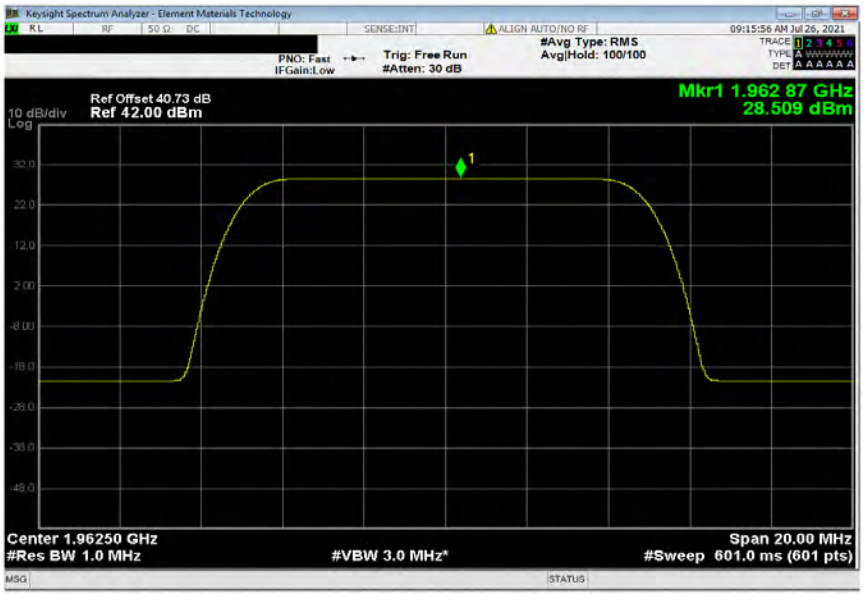


Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 10 MHz Bandwdith, QPSK Modulation , Mid Channel, 1962.5 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	Eight Port (8x8 MIMO) dBm/MHz == PSD	Sixteen Port (16x16 MIMO) dBm/MHz == PSD
28.526	0	28.53	31.53	34.53	37.53	40.53

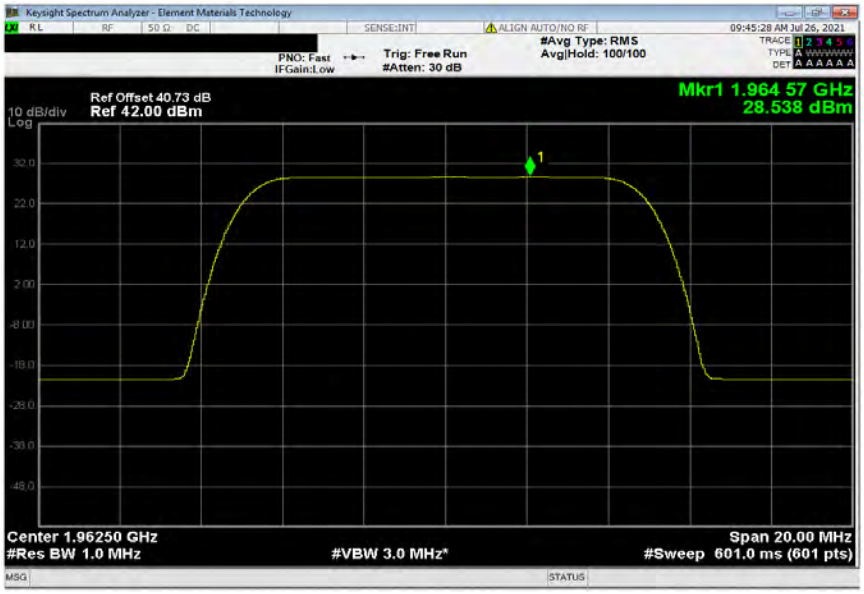


Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 10 MHz Bandwdith, 16-QAM Modulation, Mid Channel, 1962.5 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	Eight Port (8x8 MIMO) dBm/MHz == PSD	Sixteen Port (16x16 MIMO) dBm/MHz == PSD
29.245	0	29.25	32.25	35.25	38.25	41.25

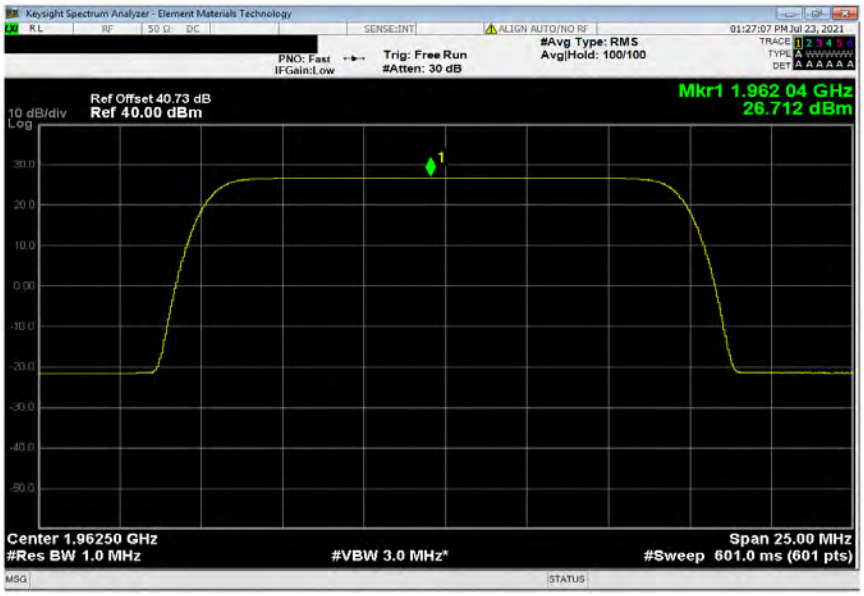
Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 10 MHz Bandwdith, 64-QAM Modulation, Mid Channel, 1962.5 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	Eight Port (8x8 MIMO) dBm/MHz == PSD	Sixteen Port (16x16 MIMO) dBm/MHz == PSD
28.509	0	28.51	31.51	34.51	37.51	40.51



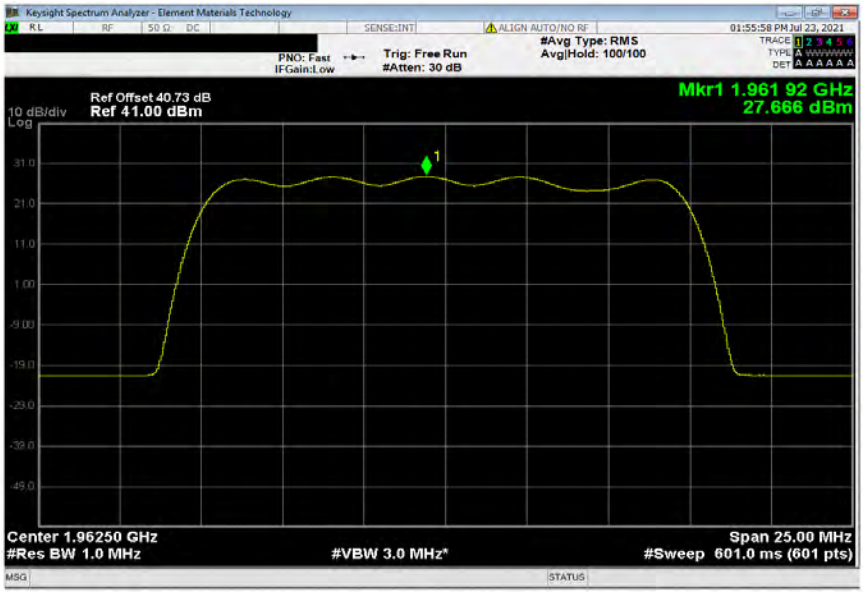
Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 10 MHz Bandwdith, 256-QAM Modulation, Mid Channel, 1962.5 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	Eight Port (8x8 MIMO) dBm/MHz == PSD	Sixteen Port (16x16 MIMO) dBm/MHz == PSD
28.538	0	28.54	31.54	34.54	37.54	40.54



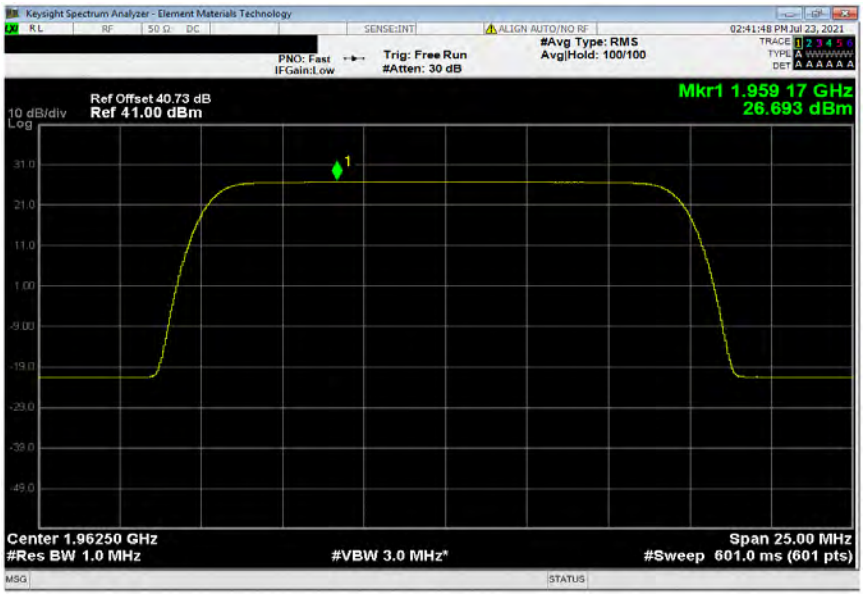
Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 15 MHz Bandwdith, QPSK Modulation , Mid Channel, 1962.5 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	Eight Port (8x8 MIMO) dBm/MHz == PSD	Sixteen Port (16x16 MIMO) dBm/MHz == PSD
26.712	0	26.71	29.71	32.71	35.71	38.71



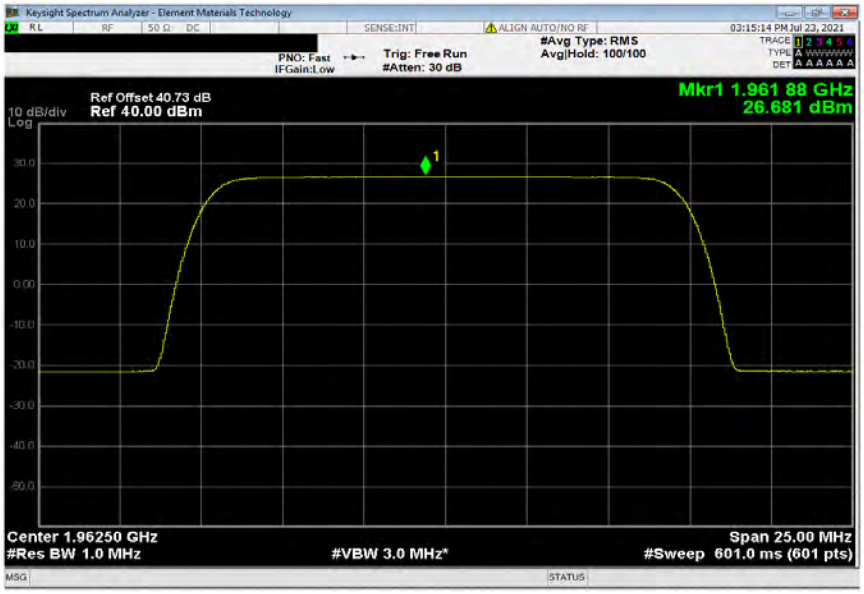
Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 15 MHz Bandwdith, 16-QAM Modulation, Mid Channel, 1962.5 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	Eight Port (8x8 MIMO) dBm/MHz == PSD	Sixteen Port (16x16 MIMO) dBm/MHz == PSD
27.666	0	27.67	30.67	33.67	36.67	39.67



Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 15 MHz Bandwdith, 64-QAM Modulation, Mid Channel, 1962.5 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	Eight Port (8x8 MIMO) dBm/MHz == PSD	Sixteen Port (16x16 MIMO) dBm/MHz == PSD
26.693	0	26.69	29.69	32.69	35.69	38.69

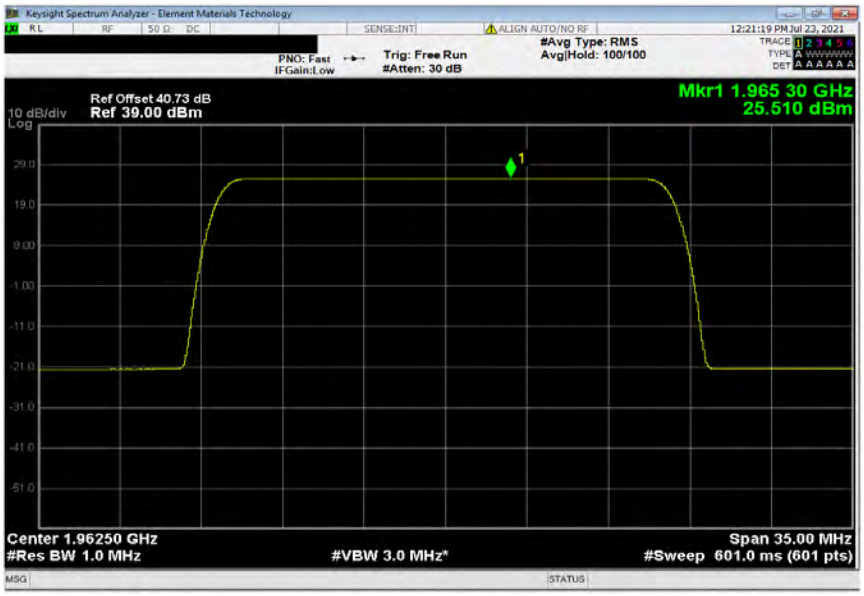


Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 15 MHz Bandwdith, 256-QAM Modulation, Mid Channel, 1962.5 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	Eight Port (8x8 MIMO) dBm/MHz == PSD	Sixteen Port (16x16 MIMO) dBm/MHz == PSD
26.681	0	26.68	29.68	32.68	35.68	38.68



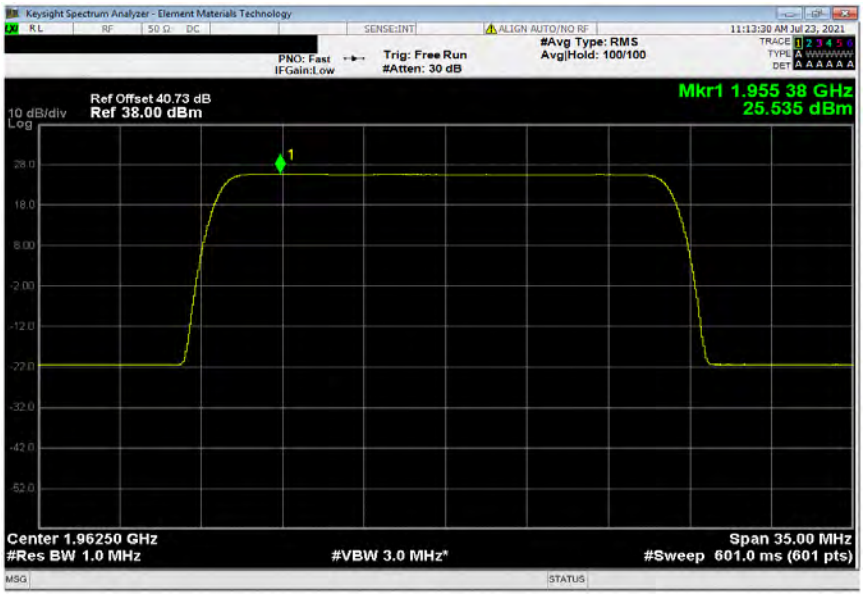
POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 20 MHz Bandwdith, QPSK Modulation , Mid Channel, 1962.5 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	Eight Port (8x8 MIMO) dBm/MHz == PSD	Sixteen Port (16x16 MIMO) dBm/MHz == PSD
25.51	0	25.51	28.51	31.51	34.51	37.51

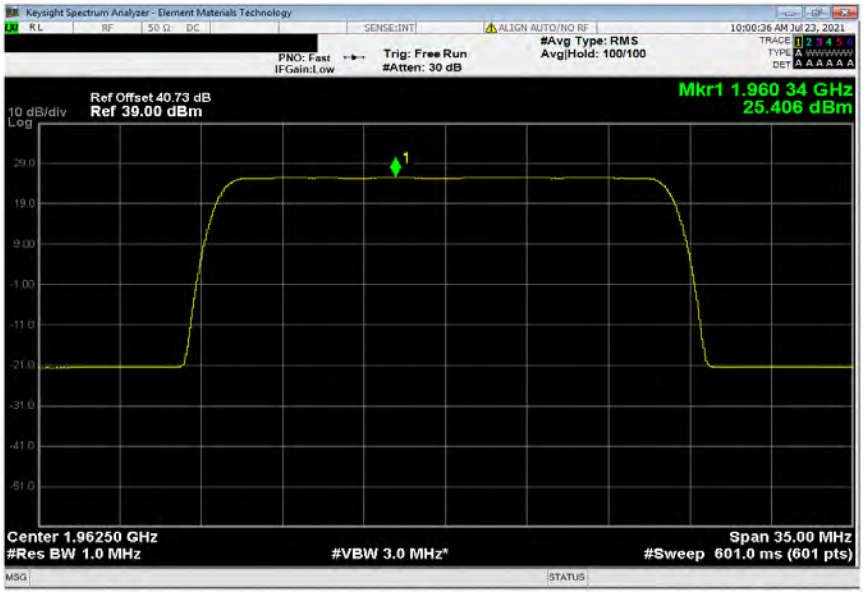


Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 20 MHz Bandwdith, 16-QAM Modulation, Mid Channel, 1962.5 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	Eight Port (8x8 MIMO) dBm/MHz == PSD	Sixteen Port (16x16 MIMO) dBm/MHz == PSD
27.15	0	27.15	30.15	33.15	36.15	39.15

Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 20 MHz Bandwdith, 64-QAM Modulation, Mid Channel, 1962.5 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	Eight Port (8x8 MIMO) dBm/MHz == PSD	Sixteen Port (16x16 MIMO) dBm/MHz == PSD
25.535	0	25.54	28.54	31.54	34.54	37.54



Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 20 MHz Bandwdith, 256-QAM Modulation, Mid Channel, 1962.5 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	Eight Port (8x8 MIMO) dBm/MHz == PSD	Sixteen Port (16x16 MIMO) dBm/MHz == PSD
25.406	0	25.41	28.41	31.41	34.41	37.41



5G NR EIRP Calculations for Sixteen Port MIMO Operations

EIRP calculations are needed at each transmitter location to optimize base station operational performance while meeting regulatory requirements. Each cell site installation needs to consider the power measurements in the radio certification report as well as site specific regulatory requirements (such as antenna height, population density, etc.), site installation parameters (line loss between antenna and radio, antenna parameters, etc.) and base station operational parameters (MIMO operational setup, carrier power level, channel bandwidth, modulation type, etc.) to optimize performance. Transmitter output power may be reduced (from maximum) by base station setup parameters.

The AAFB radio module connects to an 8-column antenna assembly with a maximum beamforming gain of 24 dBi. The columns within the antenna have ±45° cross-polarized (orthogonal) radiators. The sixteen AAFB transmitter outputs are connected to the columns (eight are connected to +45° radiators/antennas and eight are connected to the -45° radiators/antennas). The AAFB radio module provides transmitter outputs for one 8-column antenna assembly.

Equivalent Isotropically Radiated Power (EIRP) is calculated (as specified in ANSI C63.26-2015 section 6.4 for a system of correlated output signals) from the results of the power measurements (highest measured PSD for each channel bandwidth type). The maximum antenna assembly beamforming gain (8-column antenna maximum beamforming gain is 24 dBi) was used for this calculation. The cable loss between the antenna and transmitter is assumed to be 0dB for this worst case EIRP calculation. Calculations of worst-case EIRP for sixteen port MIMO are as follows:

Parameter	5 MHz Ch BW	10 MHz Ch BW	15 MHz Ch BW	20 MHz Ch BW
Worst Case PSD/Antenna Port	1.58 W/MHz or 32.0 dBm/MHz	0.83 W/MHz or 29.2 dBm/MHz	0.59 W/MHz or 27.7 dBm/MHz	0.52 W/MHz or 27.2 dBm/MHz
Cable Loss	0 dB	0 dB	0 dB	0 dB
Number of Ant Ports per Polarization	8	8	8	8
Total PSD per Polarization	12.64 W/MHz or 41.0 dBm/MHz	6.64 W/MHz or 38.2 dBm/MHz	4.72 W/MHz or 36.7 dBm/MHz	4.16 W/MHz or 36.2 dBm/MHz
Maximum Antenna Beamforming Gain per Polarization	24.0 dBi	24.0 dBi	24.0 dBi	24.0 dBi
EIRP per Polarization	65.0 dBm/MHz or 3162 W/MHz	62.2 dBm/MHz or 1660 W/MHz	60.7 dBm/MHz or 1175 W/MHz	60.2 dBm/MHz or 1047 W/MHz
Number of Polarizations	2	2	2	2
EIRP Total (See Note 1)	65.0 dBm/MHz or 3162 W/MHz	62.2 dBm/MHz or 1660 W/MHz	60.7 dBm/MHz or 1175 W/MHz	60.2 dBm/MHz or 1047 W/MHz

Note 1: The EIRP per antenna polarization is required to be below the regulatory limit as described in ANSI C63.26-2015 section 6.4.6.3 b)2) and KDB 662911 D02v01 page 3 example (2) since the two transmitter outputs to each antenna are 90 degree-phase shifted relative to each other (cross-polarized radiators).

Calculation Summary

The worst case AAFB sixteen port MIMO EIRP levels using the 8-column antenna assembly are:
(1) Less than the FCC and ISED (3280 W/MHz or 65.16 dBm/MHz) EIRP Regulatory Limits for all (5, 10, 15 & 20MHz) channel bandwidths.
(2) Less than the FCC and ISED (1640 W/MHz or 62.15 dBm/MHz) EIRP Regulatory Limits for 15 & 20MHz channel bandwidths
(3) Over the FCC and ISED (1640 W/MHz or 62.15 dBm/MHz) EIRP Regulatory Limits by 2.85 dB for the 5MHz channel bandwidth and by 0.05 dB for the 10MHz channel bandwidth. EIRP calculations are needed at each transmitter location to optimize base station operational performance while meeting regulatory requirements as noted above.
(4) The AAFB antenna port NR5 maximum carrier power level was reduced 3.0 dB by changing the BTS configuration file output power parameter definition to show compliance with the 62.15 dBm/MHz EIRP regulatory limit. See "Output Power Lowered Power" and "Power Spectral Density Lowered Power" sections of this report for details.
(5) The AAFB antenna port NR10 maximum carrier power level was reduced 0.4 dB by changing the BTS configuration file output power parameter definition to show compliance with the 62.15 dBm/MHz EIRP regulatory limit. See "Output Power Lowered Power" and "Power Spectral Density Lowered Power" sections of this report for details.

POWER SPECTRAL DENSITY - LOWERED POWER

XMit 2020.12.30.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFL	2021-03-11	2022-03-11
Block - DC	Fairview Microwave	SD3379	AMM	2020-09-21	2021-09-21
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The fundamental emission power spectral density was measured using the channels and modes as called out on the following data sheets. The transmit power was set to levels seen in the datasheet.

The method of section 5.2.4.5 of ANSI C63.26 was used to make the measurement. The method uses trace averaging across ON and OFF times of EUT transmissions using the spectrum analyzer's RMS detector. Following the measurement a duty cycle correction was applied by adding [10log(1/D)], where D is the duty cycle, to the measured power to compute the PSD during the transmit times.

RF conducted emissions testing was performed on one port. The AAFB antenna ports are essentially electrically identical (the RF power variation between antenna ports is small) and port 1 was selected to perform the testing under this effort as allowed by ANSI C63.26-2015 paragraphs 5.2.5.3, 5.7.2i and 6.4.

The total PSD of all antenna ports (at the radio output) was determined per ANSI C63.26-2015 paragraph 6.4.3.2.4.

The EIRP calculations were based upon ANSI C63.26-2015 sections 6.4.3.2.4, section 6.4.6.3, section 6.4.5.3 and section 6.4.5.2

Compliance check for EIRP Limit of 1640W/MHz or 62.15 dBm/MHz:
As shown in the EIRP calculation table of the "PSD and EIRP Calculations" report section, the highest AAFB antenna port 1 PSD level that will not cause the calculated EIRP to exceed the EIRP limit is 29.1 dBm/MHz. The NR5 and NR10 maximum carrier power levels were reduced by 3.0dB and 0.4 dB respectively by changing the carrier power parameters in the base station configuration file to comply with the EIRP limit (62.15 dBm/MHz).

The AAFB base station configuration file parameters set for maximum carrier output power (37.9dBm) gives a measured maximum NR5 PSD/port result of 32.0dBm/MHz and a worst case calculated EIRP that is 2.85dB over the EIRP limit (62.15dBm/MHz). To show compliance with the EIRP limit (62.15dBm/MHz), the AAFB base station configuration file parameters setting for NR5 carrier output power was set to 34.9dBm (reduced 3.0 dB from maximum) that gives a measured maximum NR5 PSD/port result of 28.9dBm/MHz and a worst case calculated EIRP that is 0.2dB below the EIRP limit (62.15dBm/MHz).

The AAFB base station configuration file parameters set for maximum carrier output power (37.9dBm) gives a measured maximum NR10 PSD/port result of 29.2dBm/MHz and a worst case calculated EIRP that is 0.05dB over the EIRP limit (62.15dBm/MHz). To show compliance with the EIRP limit (62.15dBm/MHz), the AAFB base station configuration file parameters setting for NR10 carrier output power was set to 37.5dBm (reduced 0.4 dB from maximum) that gives a measured maximum NR10 PSD/port result of 28.8dBm/MHz and a worst case calculated EIRP that is 0.3dB below the EIRP limit (62.15dBm/MHz).

POWER SPECTRAL DENSITY - LOWERED POWER

TbtTx 2021.03.19.1 XMit 2020.12.30.0

EUT:	AAFB (FCC/ISED C2PC)			Work Order:	NOKI0031
Serial Number:	BL2032H23PI			Date:	31-Jul-21
Customer:	Nokia Solutions and Networks			Temperature:	21.4 °C
Attendees:	David Le, Mitchell Hill			Humidity:	56.7% RH
Project:	None			Barometric Pres.:	1016 mbar
Tested by:	Brandon Hobbs	Power:	54 VDC	Job Site:	TX09

TEST SPECIFICATIONS	Test Method
FCC 24E:2021	ANSI C63.26:2015
RSS-133 Issue 6:2013+A1:2018	RSS-133 Issue 6:2013+A1:2018

COMMENTS

All measurement path losses were accounted for in the reference level offest including any attenuators, filters and DC blocks. The NR5 and NR10 carrier power levels were reduced to demonstrate compliance with EIRP limits. The maximum port 1 PSD level is 29.1 dBm/MHz for the base station calculated EIRP level not to exceed the EIRP limit (62.15 dBm/MHz).

DEVIATIONS FROM TEST STANDARD

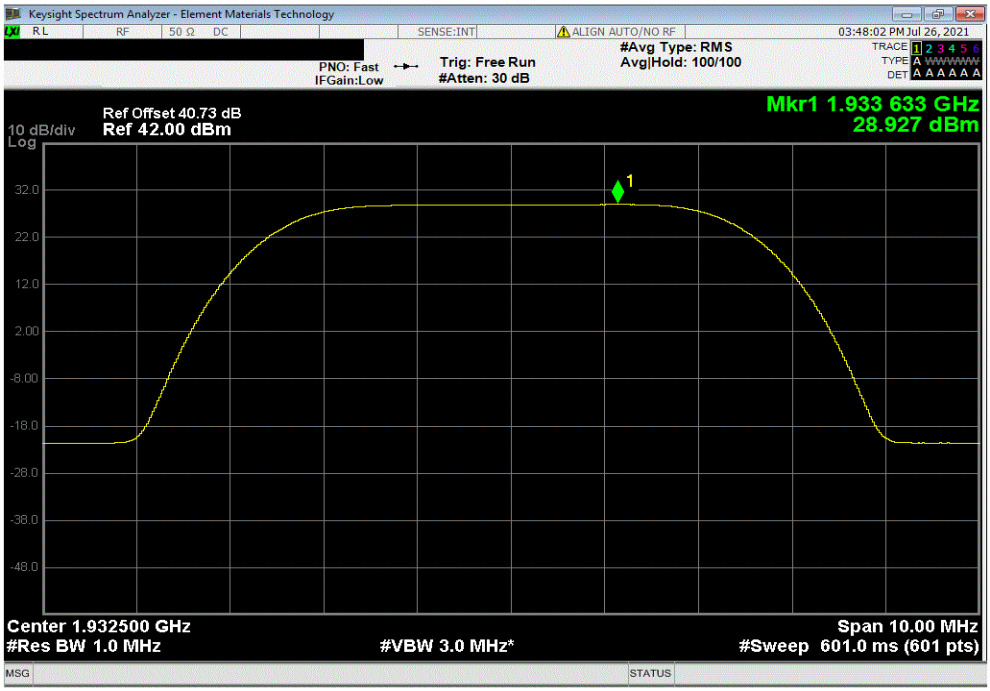
None

Configuration #	2	Signature

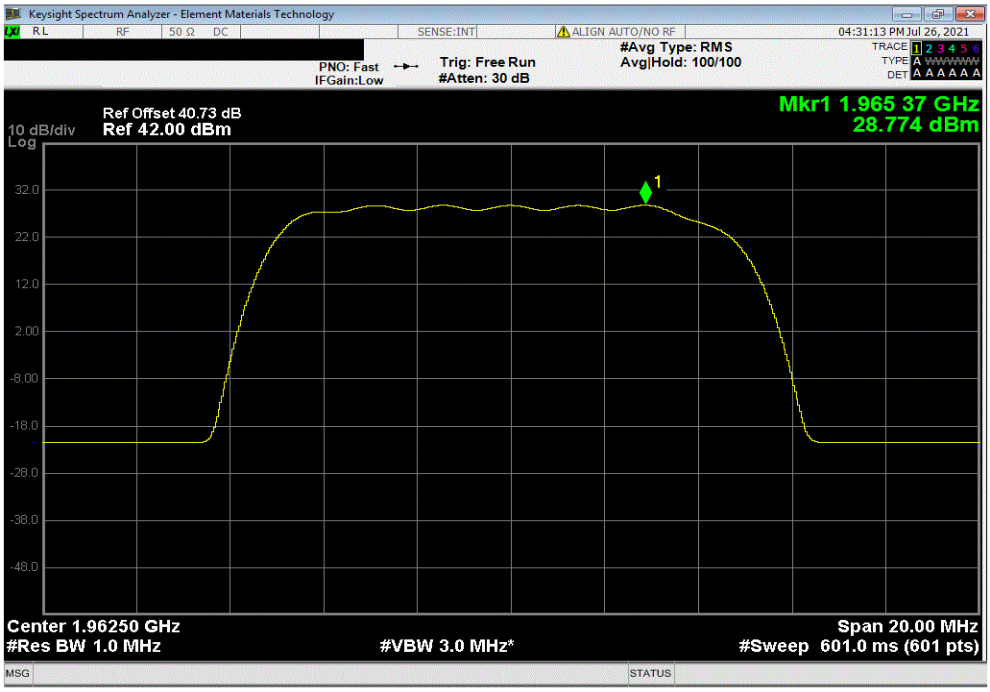
	Initial Value dBm/MHz == PSD	Duty Cycle	Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
Band n25, 1930 MHz - 1995 MHz, 5G					
Port 1					
5 MHz Bandwdith					
64-QAM Modulation					
Low Channel, 1932.5 MHz	28.927	0	28.9	29.1	Pass
10 MHz Bandwdith					
16-QAM Modulation					
Mid Channel, 1962.5 MHz	28.774	0	28.8	29.1	Pass

POWER SPECTRAL DENSITY - LOWERED POWER

Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwdith, 64-QAM Modulation, Low Channel, 1932.5 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	28.927	0		28.93	29.1	Pass



Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 10 MHz Bandwdith, 16-QAM Modulation, Mid Channel, 1962.5 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	28.774	0		28.77	29.1	Pass



PEAK TO AVERAGE POWER (PAPR) CCDF

XMit 2020.12.30.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Block - DC	Fairview Microwave	SD3379	AMM	2020-09-21	2021-09-21
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFL	2021-03-11	2022-03-11
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

Because the conducted Output Power was measured using a RMS Average detector, the Peak to Average Power Ratio (PAPR) was measured to show that the maximum peak-max-hold spectrum to the maximum of the average spectrum does not exceed the rule part defined limit.

The PAPR measurement method is described in ANSI C63.26 section 5.2.3.4.
The PAPR was measured using the CCDF function of the spectrum analyzer.

Per FCC part 24.232(d) and RSS 133 6.4, the PAPR limit shall not exceed 13 dB for more than the ANSI described 0.1% of the time.

RF conducted emissions testing was performed only on one port. The testing was performed on the same version of hardware (AAFB) as the original certification test. The AAFB antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in this certification testing) and antenna port 1 was selected to perform the testing under this effort as allowed by ANSI C63.26-2015 paragraphs 5.2.5.3, 5.7.2i, and 6.4.

PEAK TO AVERAGE POWER (PAPR) CCDF

TbtTx 2021.03.19.1 XMit 2020.12.30.0

EUT:	AAFB (FCC/ISED C2PC)			**Work Order:**	NOKI0031
Serial Number:	BL2032H23PI			**Date:**	23-Jul-21
Customer:	Nokia Solutions and Networks			**Temperature:**	21.5 °C
Attendees:	David Le, Mitchell Hill			**Humidity:**	55.5% RH
Project:	None			**Barometric Pres.:**	1017 mbar
Tested by:	Brandon Hobbs	**Power:**	54 VDC	**Job Site:**	TX09

TEST SPECIFICATIONS	Test Method
FCC 24E:2021	ANSI C63.26:2015
RSS-133 Issue 6:2013+A1:2018	RSS-133 Issue 6:2013+A1:2018

COMMENTS

All measurement path losses were accounted for in the reference level offest including any attenuators, filters and DC blocks.Band n25 carriers are enabled at maximum power (6.25 watts/carrier).

DEVIATIONS FROM TEST STANDARD

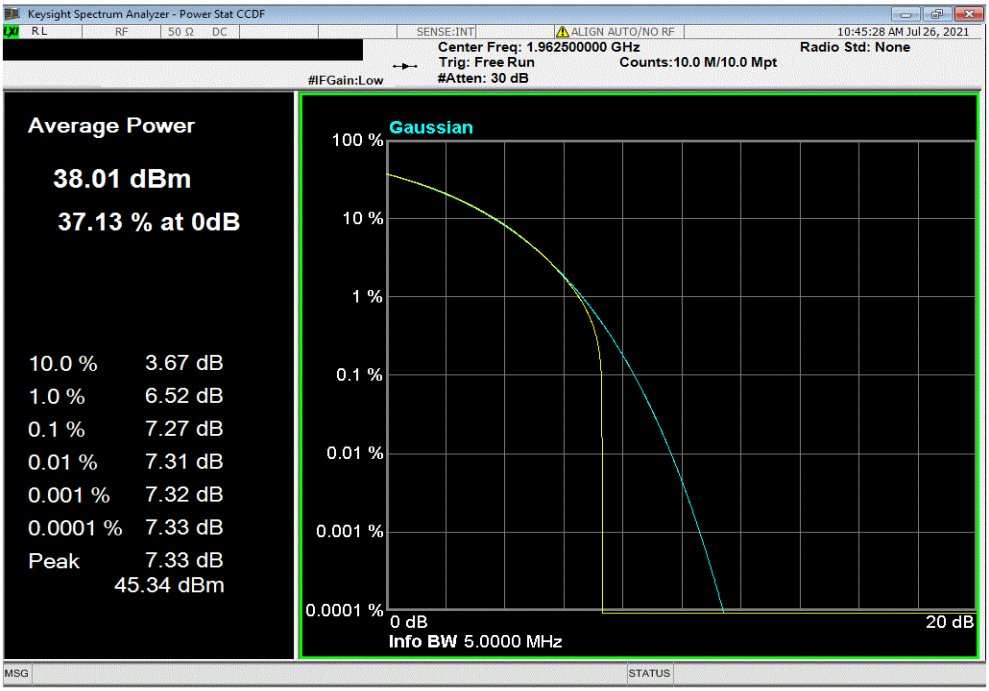
None

Configuration #	2	Signature

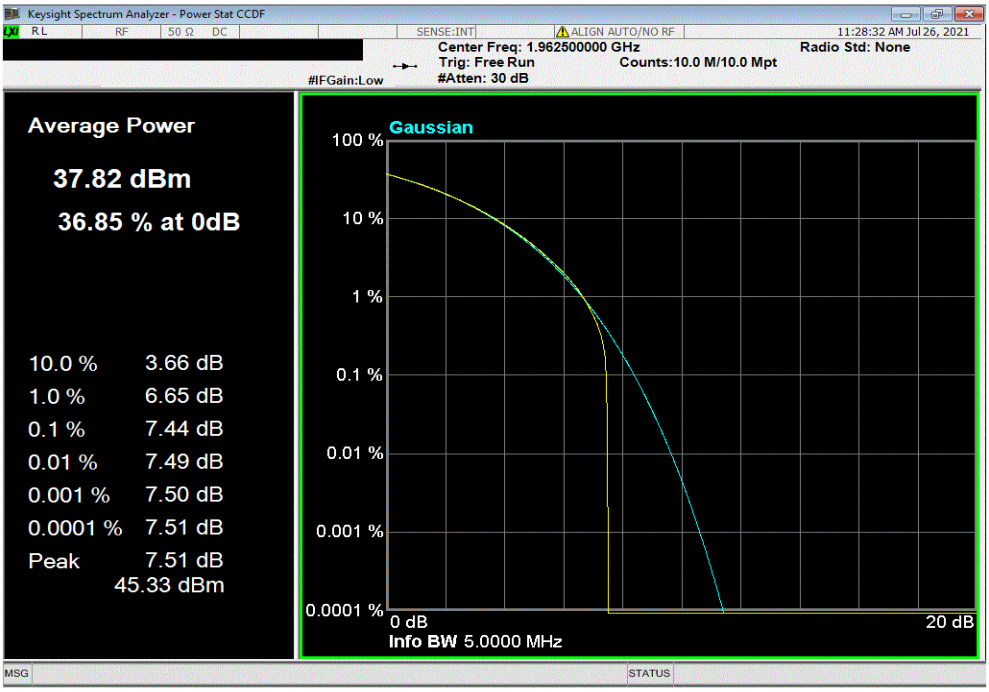
	PAPR Value (dB)	PAPR Limit (dB)	Results
Band n25, 1930 MHz - 1995 MHz, 5G			
Port 1			
5 MHz Bandwdith			
QPSK Modulation			
Mid Channel, 1962.5 MHz	7.27	13	Pass
16-QAM Modulation			
Mid Channel, 1962.5 MHz	7.44	13	Pass
64-QAM Modulation			
Mid Channel, 1962.5 MHz	7.27	13	Pass
256-QAM Modulation			
Low Channel, 1932.5 MHz	7.28	13	Pass
Mid Channel, 1962.5 MHz	7.28	13	Pass
High Channel, 1992.5 MHz	7.29	13	Pass
10 MHz Bandwdith			
256-QAM Modulation			
Low Channel, 1935.0 MHz	7.33	13	Pass
Mid Channel, 1962.5 MHz	7.29	13	Pass
High Channel, 1990 MHz	7.30	13	Pass
15 MHz Bandwdith			
256-QAM Modulation			
Low Channel, 1937.5 MHz	7.50	13	Pass
Mid Channel, 1962.5 MHz	7.45	13	Pass
High Channel, 1987.5 MHz	7.44	13	Pass
20 MHz Bandwdith			
256-QAM Modulation			
Low Channel, 1940 MHz	7.34	13	Pass
Mid Channel, 1962.5 MHz	7.17	13	Pass
High Channel, 1985 MHz	7.20	13	Pass

PEAK TO AVERAGE POWER (PAPR) CCDF

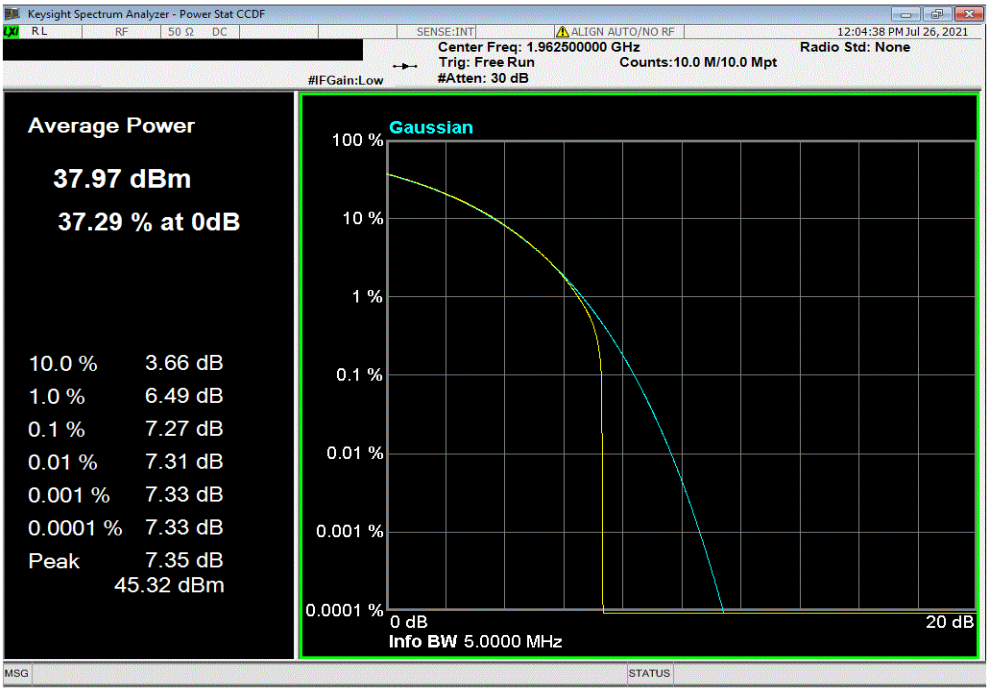
Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwdith, QPSK Modulation , Mid Channel, 1962.5 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.27	13	Pass



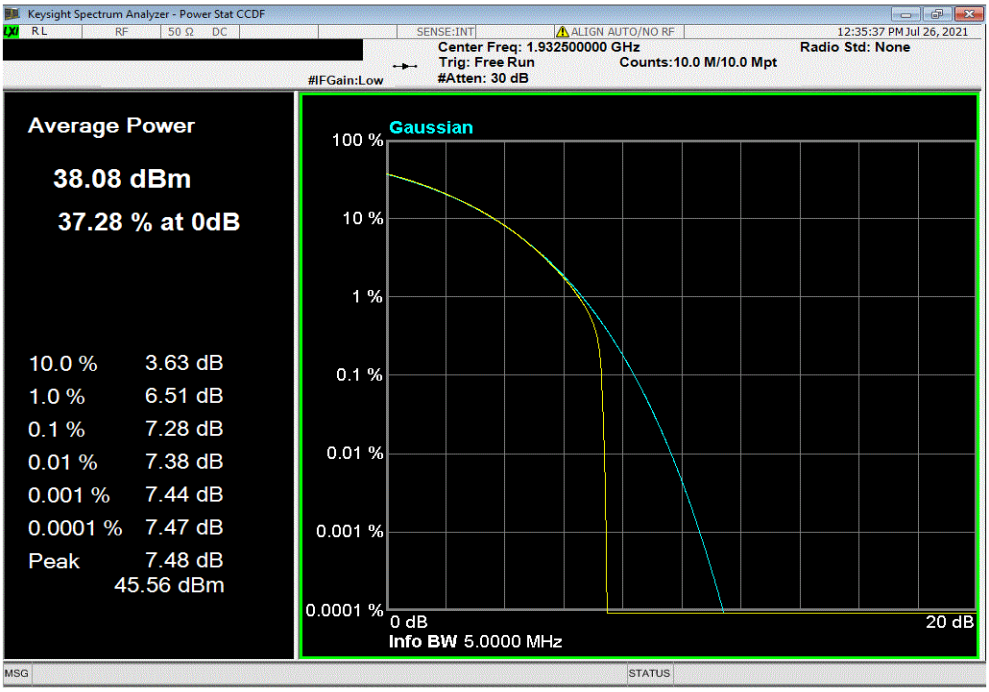
Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwdith, 16-QAM Modulation, Mid Channel, 1962.5 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.44	13	Pass



Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwdith, 64-QAM Modulation, Mid Channel, 1962.5 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.27	13	Pass

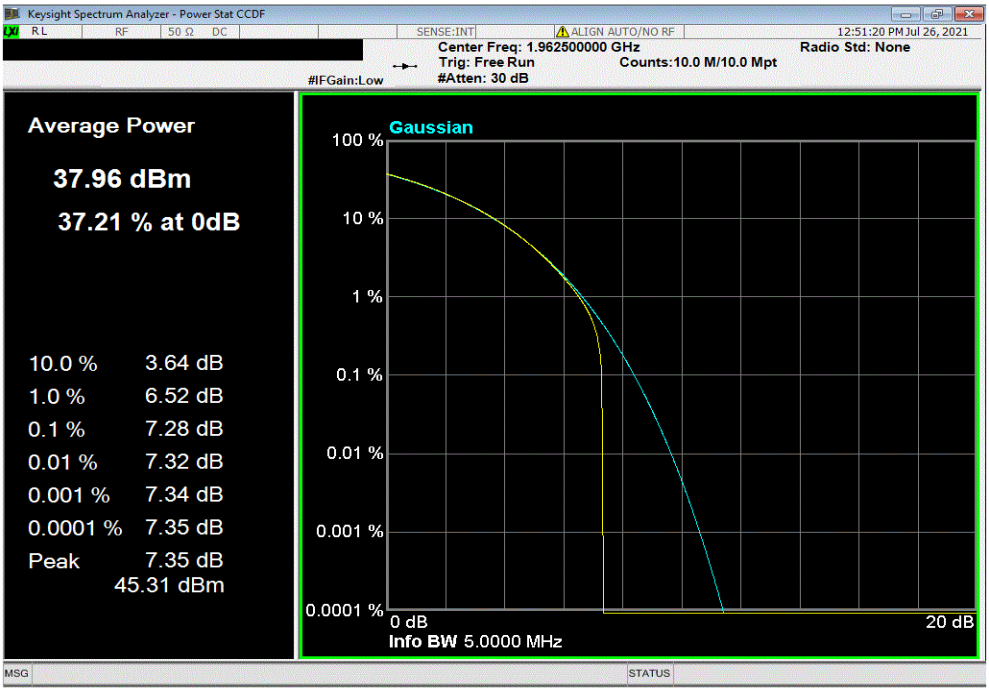


Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwdith, 256-QAM Modulation, Low Channel, 1932.5 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.28	13	Pass

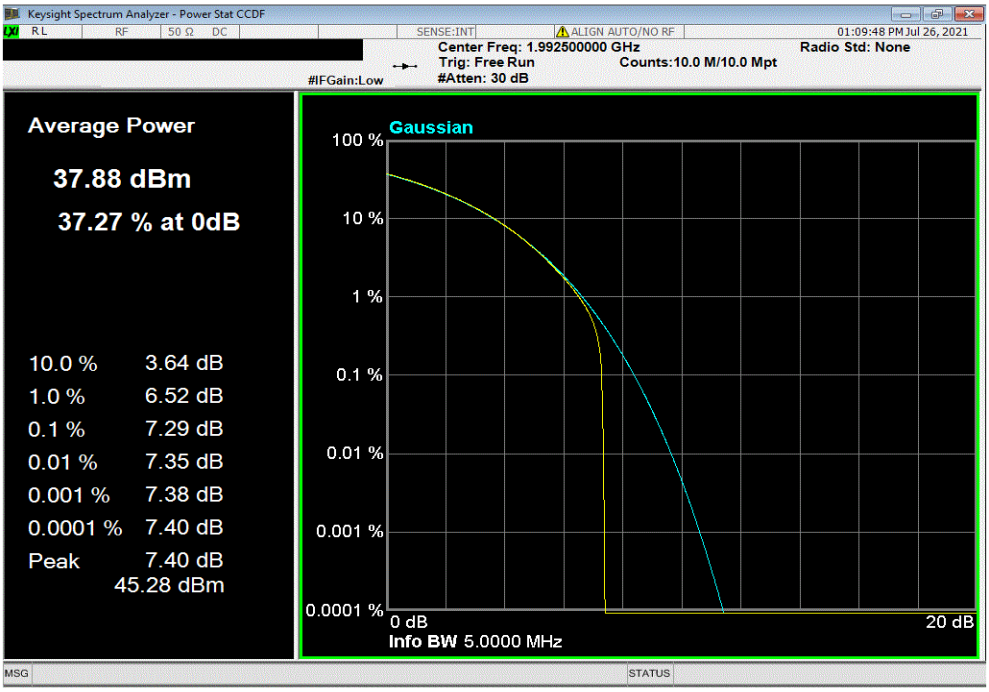


PEAK TO AVERAGE POWER (PAPR) CCDF

Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwdith, 256-QAM Modulation, Mid Channel, 1962.5 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.28	13	Pass

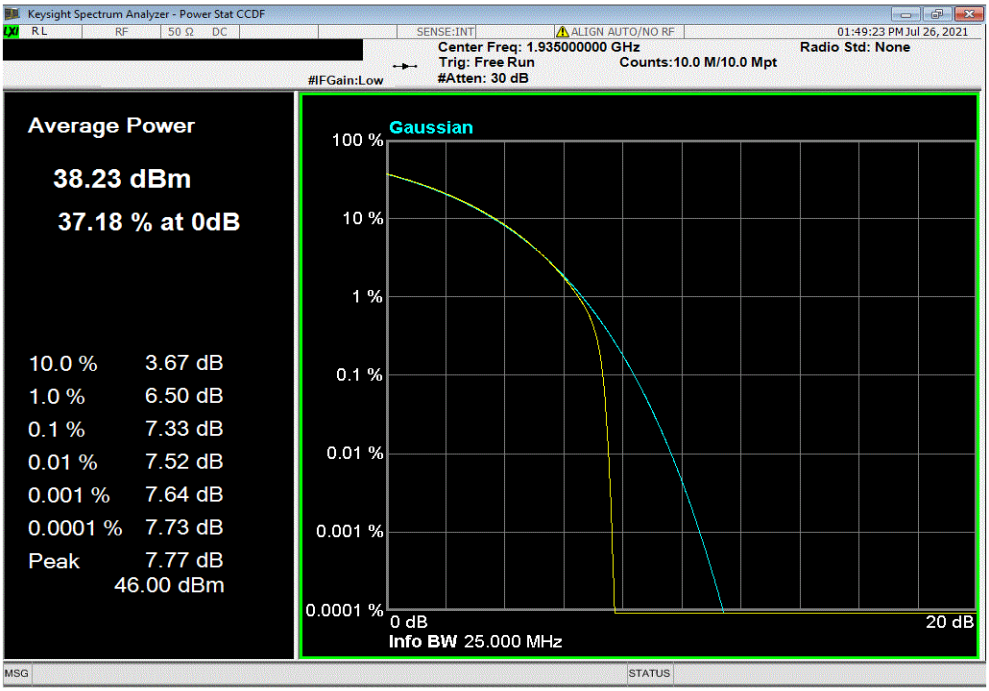


Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwdith, 256-QAM Modulation, High Channel, 1992.5 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.29	13	Pass

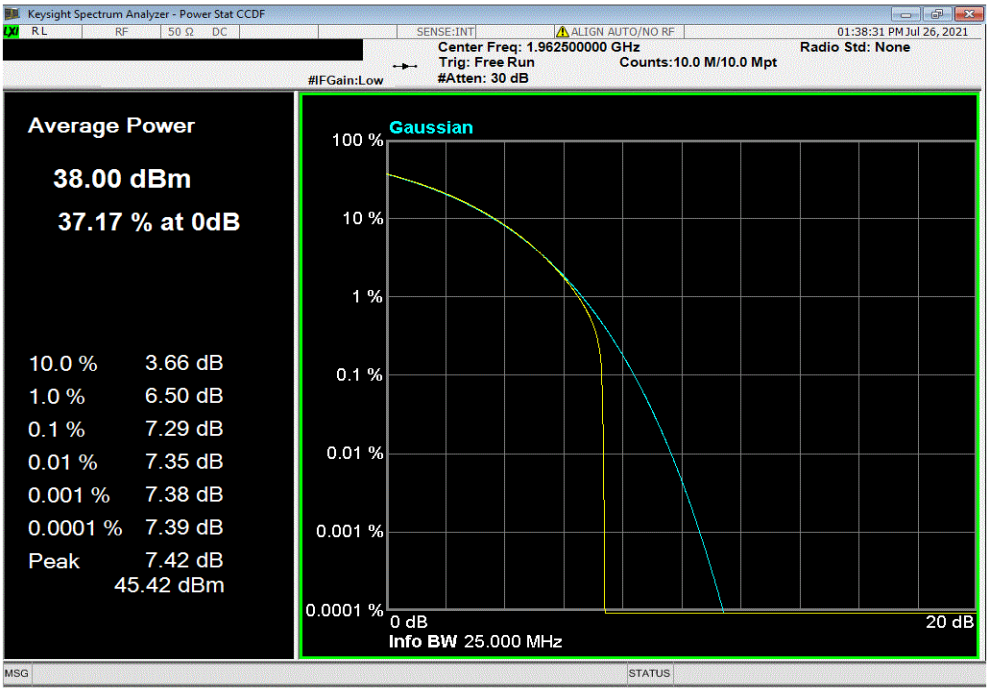


PEAK TO AVERAGE POWER (PAPR) CCDF

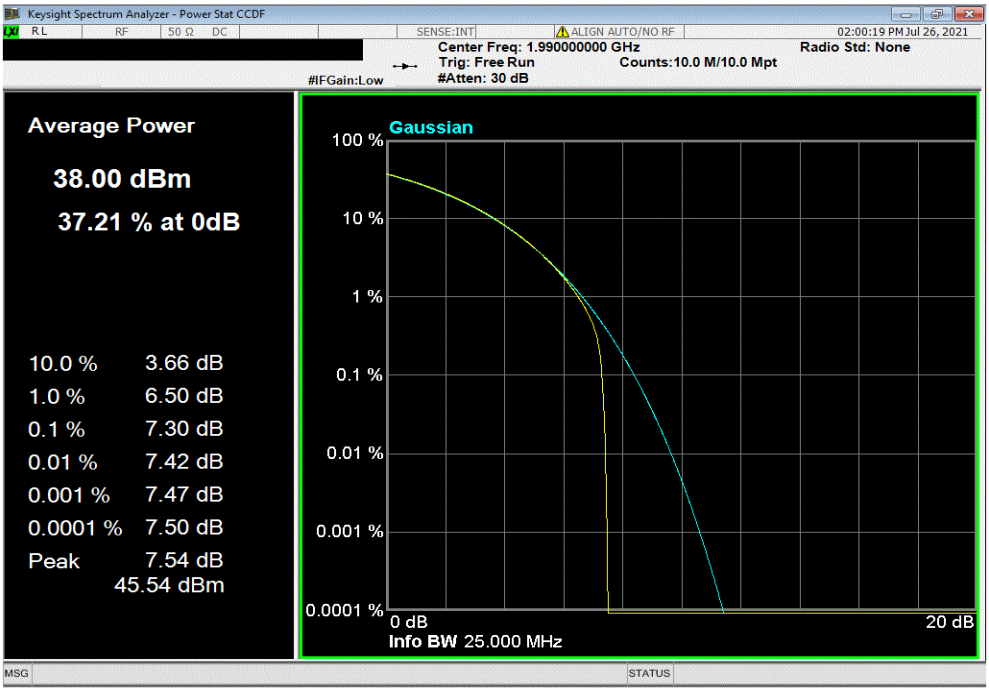
Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 10 MHz Bandwdith, 256-QAM Modulation, Low Channel, 1935.0 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.33	13	Pass



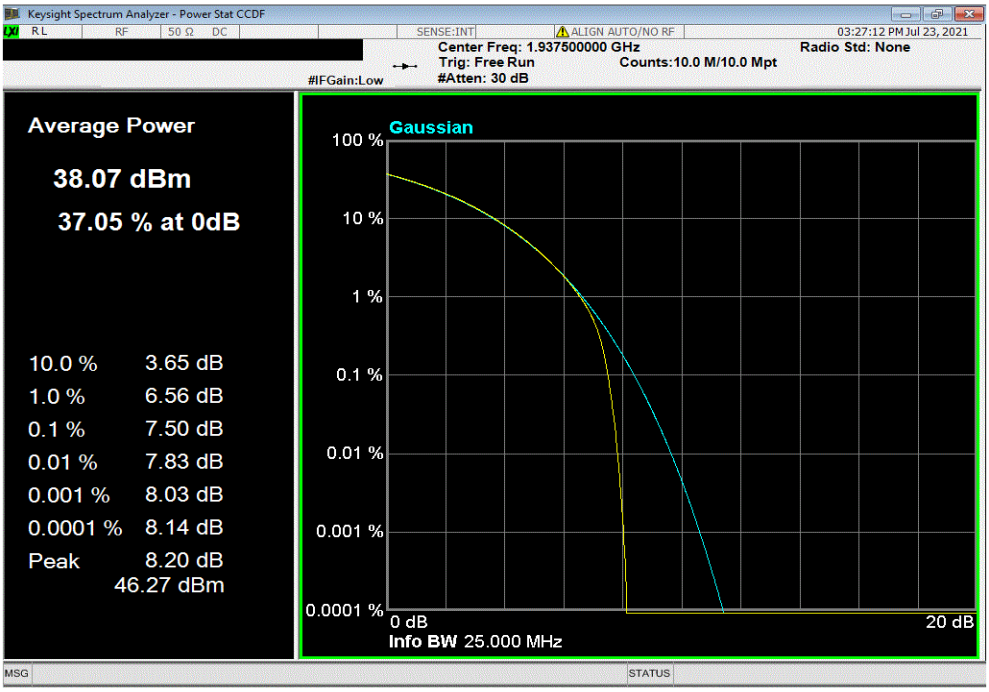
Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 10 MHz Bandwdith, 256-QAM Modulation, Mid Channel, 1962.5 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.29	13	Pass



Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 10 MHz Bandwdith, 256-QAM Modulation, High Channel, 1990 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.3	13	Pass

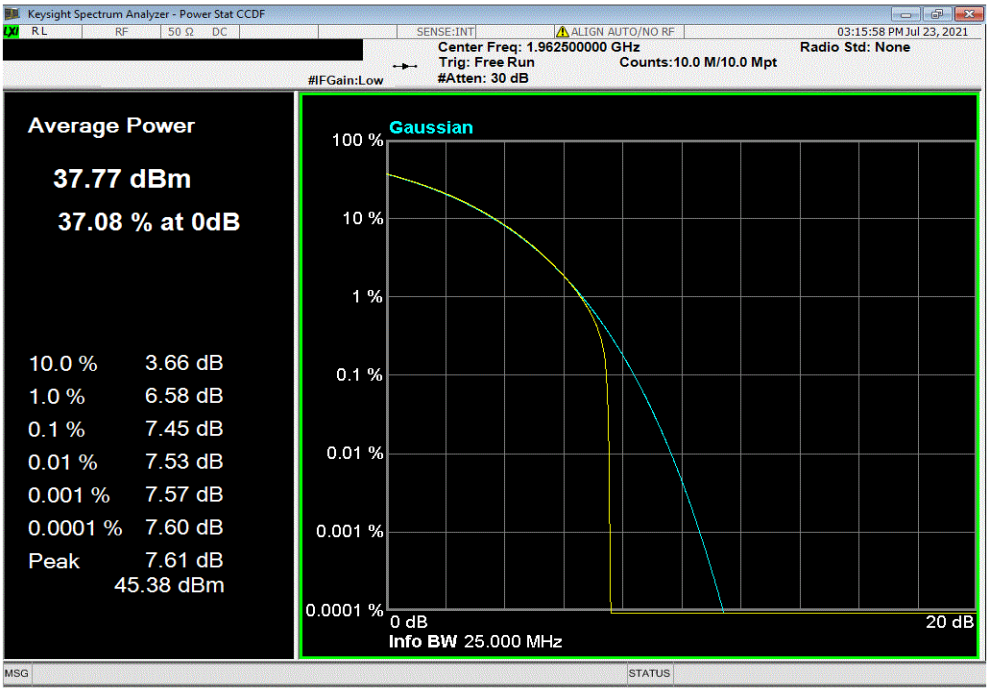


Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 15 MHz Bandwdith, 256-QAM Modulation, Low Channel, 1937.5 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.5	13	Pass

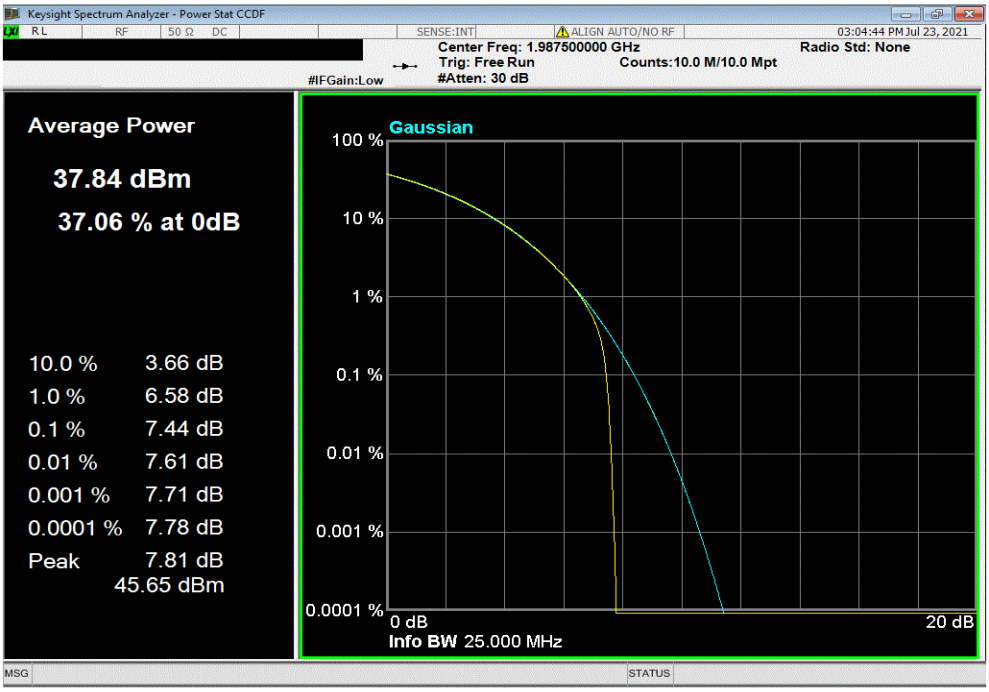


PEAK TO AVERAGE POWER (PAPR) CCDF

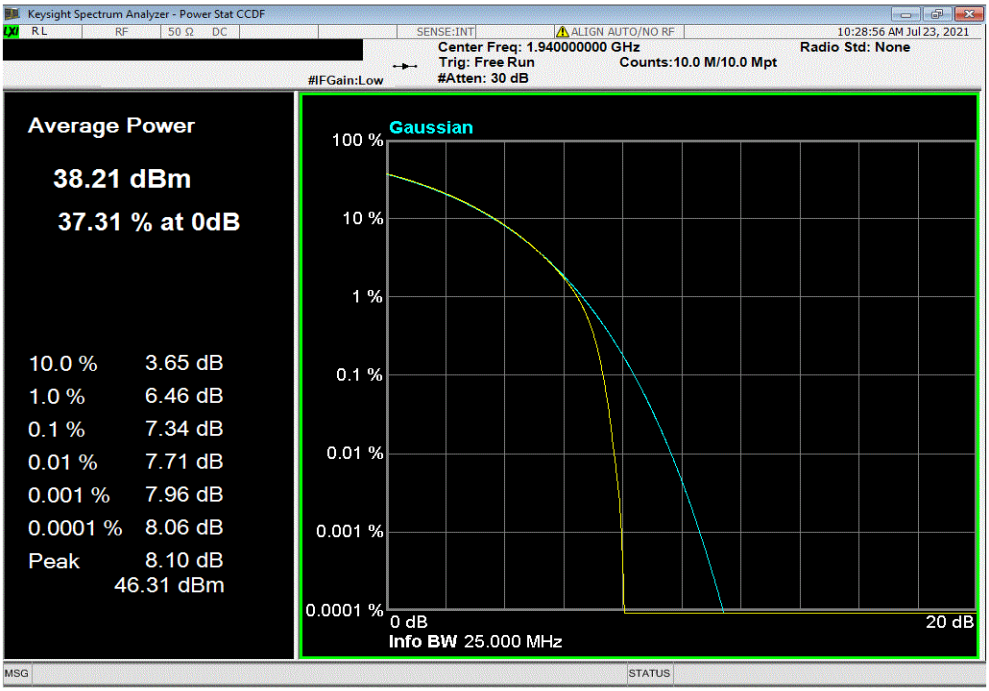
Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 15 MHz Bandwdith, 256-QAM Modulation, Mid Channel, 1962.5 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.45	13	Pass



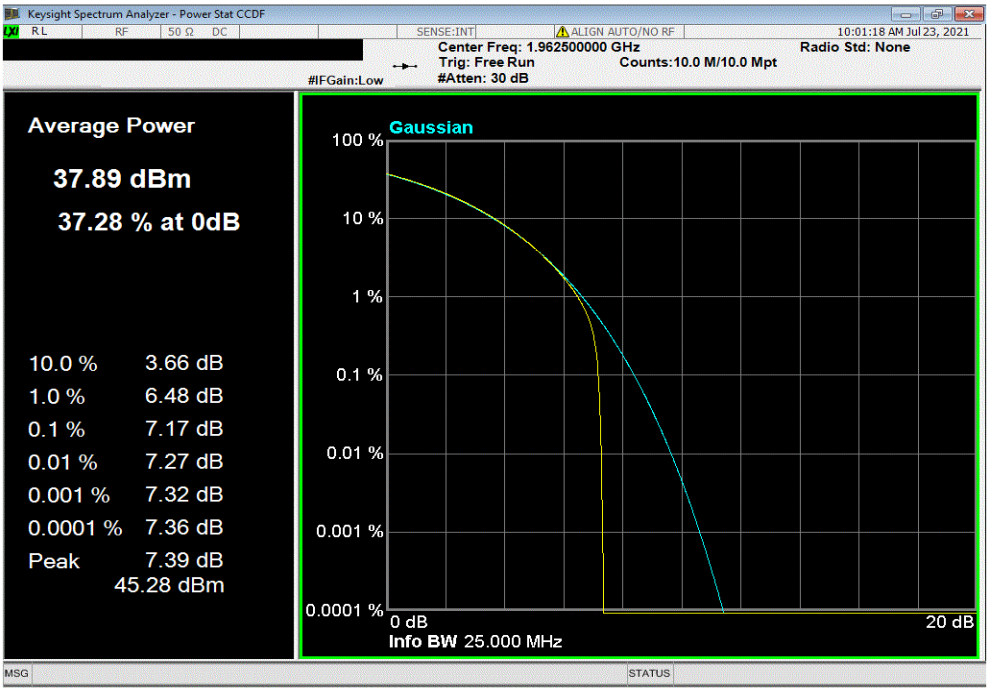
Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 15 MHz Bandwdith, 256-QAM Modulation, High Channel, 1987.5 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.44	13	Pass



Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 20 MHz Bandwdith, 256-QAM Modulation, Low Channel, 1940 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.34	13	Pass



Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 20 MHz Bandwdith, 256-QAM Modulation, Mid Channel, 1962.5 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.17	13	Pass



PEAK TO AVERAGE POWER (PAPR) CCDF

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TbtTx 2021.03.19.1 XMit 2020.12.30.0

Band n25, 1930 MHz - 1995 MHz, 5G, Port 1, 20 MHz Bandwdith, 256-QAM Modulation, High Channel, 1985 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.2	13	Pass