PEAK AND AVERAGE (PAPR) CCDF - 5G NR

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
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17
Spectrum Analyzer	Keysight	N9030B	R296	2021-07-15	2022-07-15

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 13 dB.

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 27.50, 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 AZHL antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown during output power 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 AND AVERAGE (PAPR) CCDF - 5G NR

element

TbtTx 2019.08.30.0 XMit 2020.12.30.0

EUT:	AZHL (C2PC LTE/5G NR B41)			**Work Order:**	NOKI0035
Serial Number:	YK203400025			**Date:**	8-Oct-21
Customer:	Nokia Solutions and Networks			**Temperature:**	21.3 °C
Attendees:	David Le, John Rattanavong			**Humidity:**	50.9% RH
Project:	None			**Barometric Pres.:**	1021 mbar
Tested by:	Brandon Hobbs	**Power:**	54 VDC	**Job Site:**	TX09

TEST SPECIFICATIONS	Test Method
FCC 27:2021	ANSI C63.26:2015

COMMENTS

All losses in the measurement path were accounted for: attenuators, cables, DC block and filter when in use. Band n41 carriers and enabled at maximum power. External 1 gating was set using a trig delay = 86.2us and a gate length = 3.714ms.

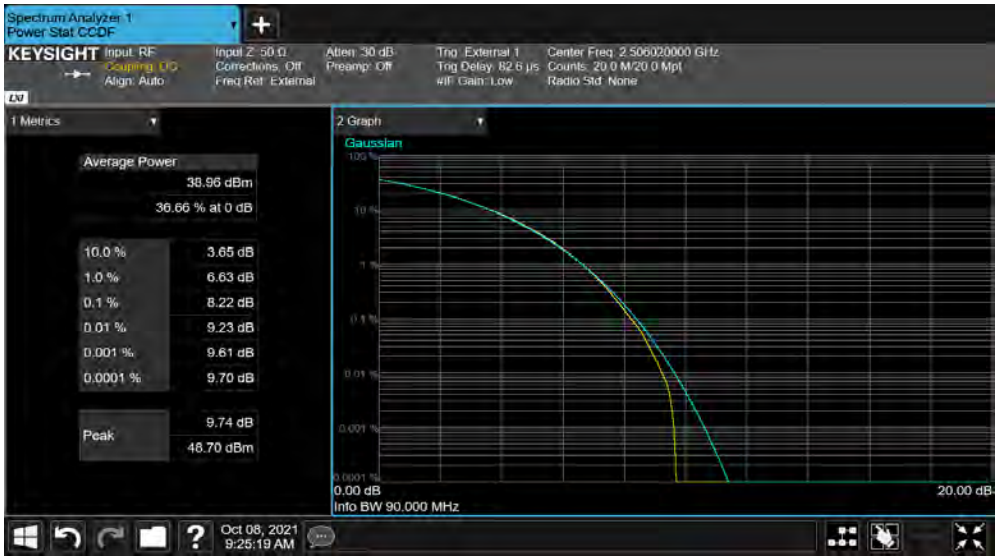
DEVIATIONS FROM TEST STANDARD

None

Configuration #	2	Signature

	0.1% Value (dB)	Limit (dB)	Result
Port 1, 5G NR, Band n41, 2496 MHz - 2690 MHz			
(NR20) 20 MHz Bandwidth			
256QAM Modulation			
Low Channel 2506.02 MHz	8.22	13	Pass
Mid Channel 2592.99 MHz	8.13	13	Pass
High Channel 2679.99 MHz	8.18	13	Pass
(NR30) 30 MHz Bandwidth			
256QAM Modulation			
Low Channel 2511.00 MHz	8.07	13	Pass
Mid Channel 2592.99 MHz	7.99	13	Pass
High Channel 2674.98 MHz	8.09	13	Pass
(NR40) 40 MHz Bandwidth			
256QAM Modulation			
Low Channel 2516.01 MHz	8.29	13	Pass
Mid Channel 2592.99 MHz	8.21	13	Pass
High Channel 2670.00 MHz	8.17	13	Pass
(NR50) 50 MHz Bandwidth			
256QAM Modulation			
Low Channel 2521.02 MHz	8.27	13	Pass
Mid Channel 2592.99 MHz	8.11	13	Pass
High Channel 2664.99 MHz	8.22	13	Pass
(NR60) 60 MHz Bandwidth			
256QAM Modulation			
Low Channel 2526.00 MHz	8.16	13	Pass
Mid Channel 2592.99 MHz	8.09	13	Pass
High Channel 2659.98 MHz	8.17	13	Pass
(NR70) 70 MHz Bandwidth			
256QAM Modulation			
Low Channel 2531.01 MHz	8.21	13	Pass
Mid Channel 2592.99 MHz	8.19	13	Pass
High Channel 2655.00 MHz	8.25	13	Pass
(NR80) 80 MHz Bandwidth			
256QAM Modulation			
Low Channel 2536.02 MHz	8.21	13	Pass
Mid Channel 2592.99 MHz	8.15	13	Pass
High Channel 2649.99 MHz	8.29	13	Pass
(NR90) 90 MHz Bandwidth			
QPSK Modulation			
Mid Channel 2592.99 MHz	8.03	13	Pass
16QAM Modulation			
Mid Channel 2592.99 MHz	8.02	13	Pass
64QAM Modulation			
Mid Channel 2592.99 MHz	8.05	13	Pass
256QAM Modulation			
Low Channel 2541.00 MHz	8.18	13	Pass
Mid Channel 2592.99 MHz	8.05	13	Pass
High Channel 2644.98 MHz	8.22	13	Pass

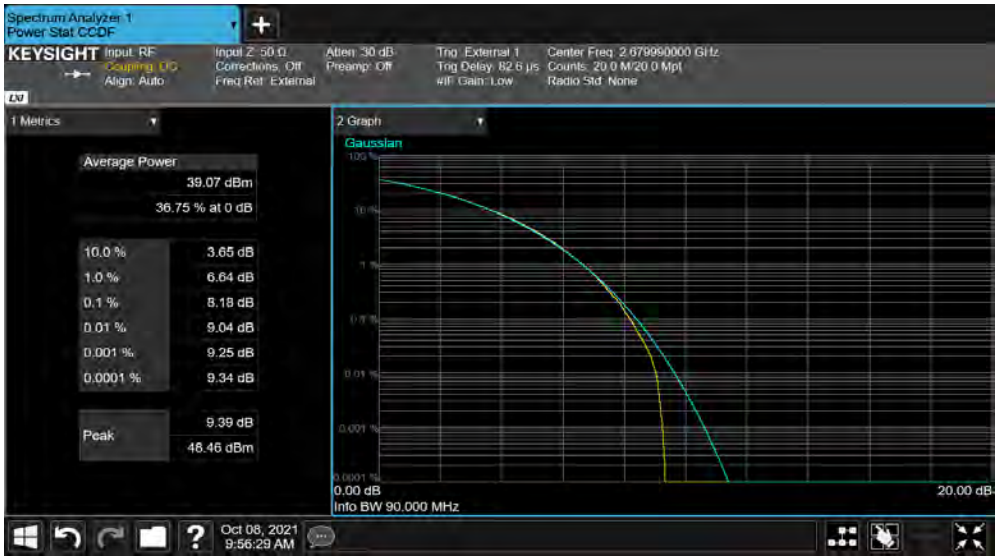
Port 1, 5G NR, Band n41, 2496 MHz - 2690 MHz, (NR20) 20 MHz Bandwidth, 256QAM Modulation, Low Channel 2506.02 MHz						
				0.1% Value (dB)	Limit (dB)	Result
				8.22	13	Pass



Port 1, 5G NR, Band n41, 2496 MHz - 2690 MHz, (NR20) 20 MHz Bandwidth, 256QAM Modulation, Mid Channel 2592.99 MHz						
				0.1% Value (dB)	Limit (dB)	Result
				8.13	13	Pass

PEAK AND AVERAGE (PAPR) CCDF - 5G NR

Port 1, 5G NR, Band n41, 2496 MHz - 2690 MHz, (NR20) 20 MHz Bandwidth, 256QAM Modulation, High Channel 2679.99 MHz						
				0.1% Value (dB)	Limit (dB)	Result
				8.18	13	Pass

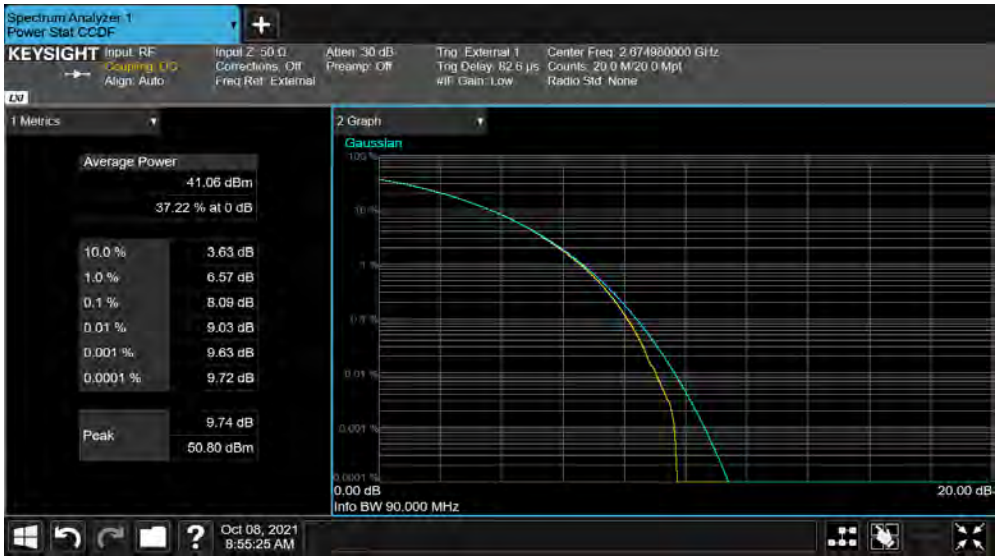


Port 1, 5G NR, Band n41, 2496 MHz - 2690 MHz, (NR30) 30 MHz Bandwidth, 256QAM Modulation, Low Channel 2511.00 MHz						
				0.1% Value (dB)	Limit (dB)	Result
				8.07	13	Pass

PEAK AND AVERAGE (PAPR) CCDF - 5G NR

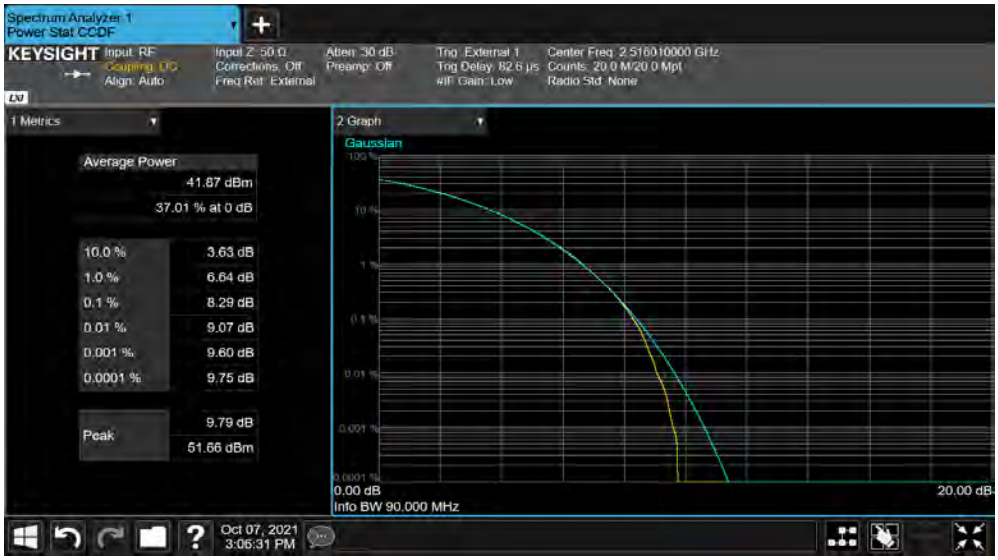
Port 1, 5G NR, Band n41, 2496 MHz - 2690 MHz, (NR30) 30 MHz Bandwidth, 256QAM Modulation, Mid Channel 2592.99 MHz						
				0.1% Value (dB)	Limit (dB)	Result
				7.99	13	Pass

Port 1, 5G NR, Band n41, 2496 MHz - 2690 MHz, (NR30) 30 MHz Bandwidth, 256QAM Modulation, High Channel 2674.98 MHz						
				0.1% Value (dB)	Limit (dB)	Result
				8.09	13	Pass

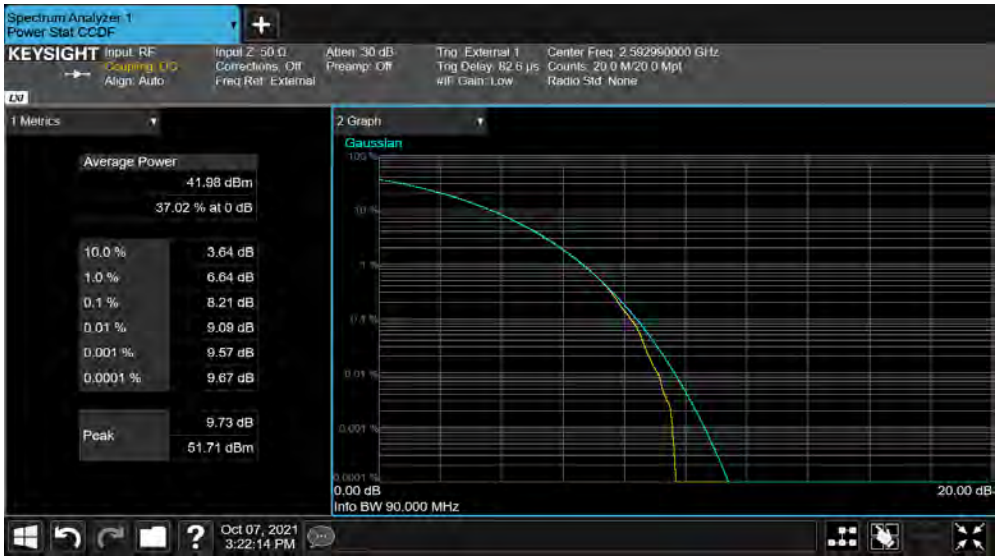


PEAK AND AVERAGE (PAPR) CCDF - 5G NR

Port 1, 5G NR, Band n41, 2496 MHz - 2690 MHz, (NR40) 40 MHz Bandwidth, 256QAM Modulation, Low Channel 2516.01 MHz						
				0.1% Value (dB)	Limit (dB)	Result
				8.29	13	Pass

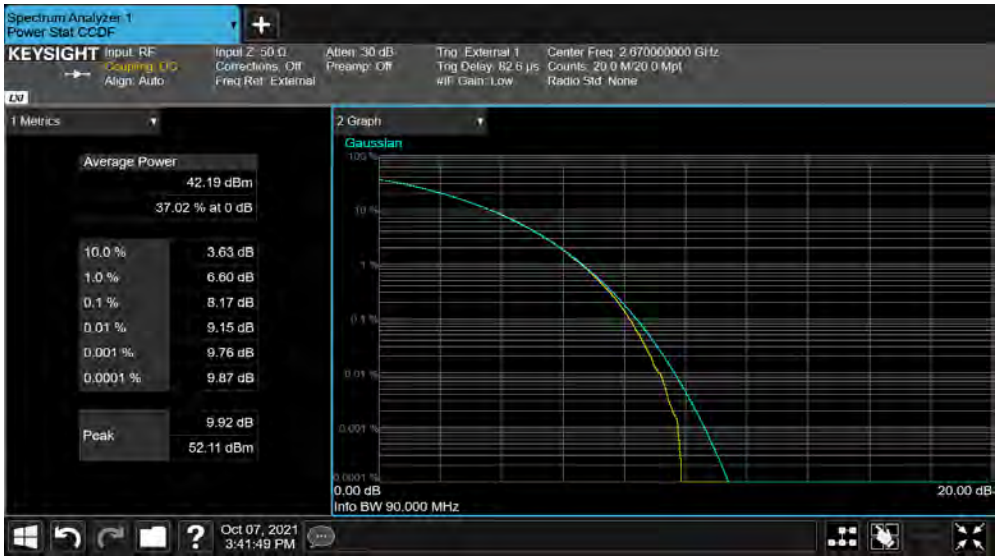


Port 1, 5G NR, Band n41, 2496 MHz - 2690 MHz, (NR40) 40 MHz Bandwidth, 256QAM Modulation, Mid Channel 2592.99 MHz						
				0.1% Value (dB)	Limit (dB)	Result
				8.21	13	Pass



PEAK AND AVERAGE (PAPR) CCDF - 5G NR

Port 1, 5G NR, Band n41, 2496 MHz - 2690 MHz, (NR40) 40 MHz Bandwidth, 256QAM Modulation, High Channel 2670.00 MHz						
				0.1% Value (dB)	Limit (dB)	Result
				8.17	13	Pass

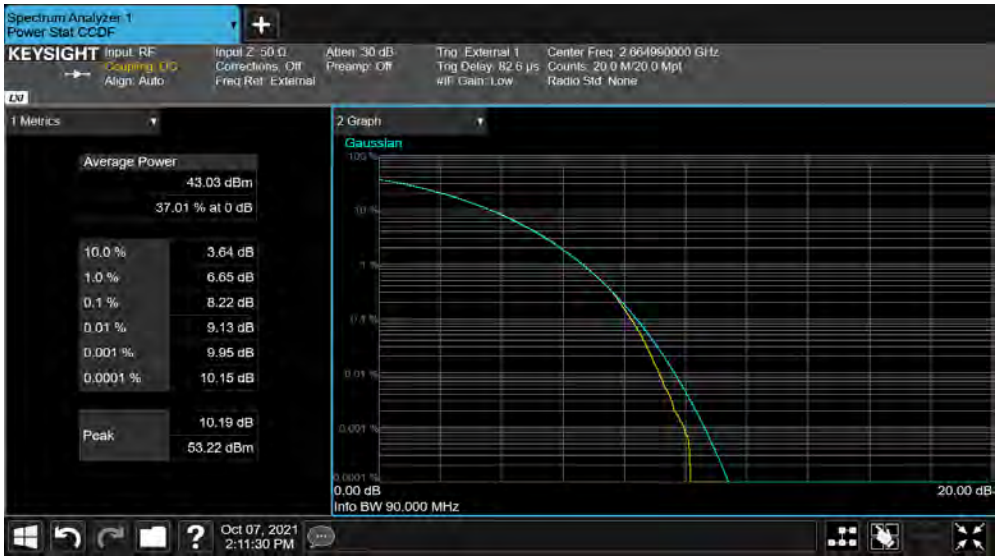


Port 1, 5G NR, Band n41, 2496 MHz - 2690 MHz, (NR50) 50 MHz Bandwidth, 256QAM Modulation, Low Channel 2521.02 MHz						
				0.1% Value (dB)	Limit (dB)	Result
				8.27	13	Pass

PEAK AND AVERAGE (PAPR) CCDF - 5G NR

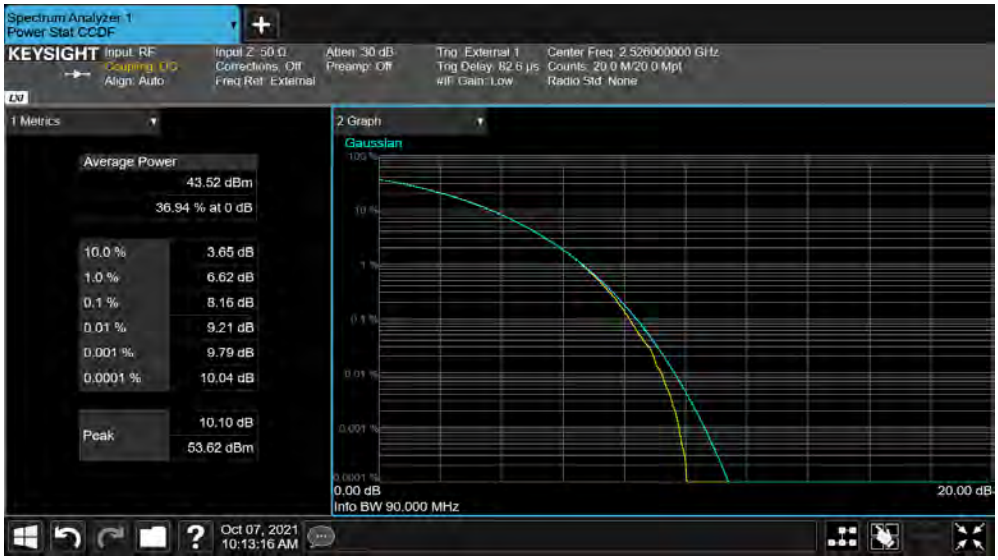
Port 1, 5G NR, Band n41, 2496 MHz - 2690 MHz, (NR50) 50 MHz Bandwidth, 256QAM Modulation, Mid Channel 2592.99 MHz						
				0.1% Value (dB)	Limit (dB)	Result
				8.11	13	Pass

Port 1, 5G NR, Band n41, 2496 MHz - 2690 MHz, (NR50) 50 MHz Bandwidth, 256QAM Modulation, High Channel 2664.99 MHz						
				0.1% Value (dB)	Limit (dB)	Result
				8.22	13	Pass

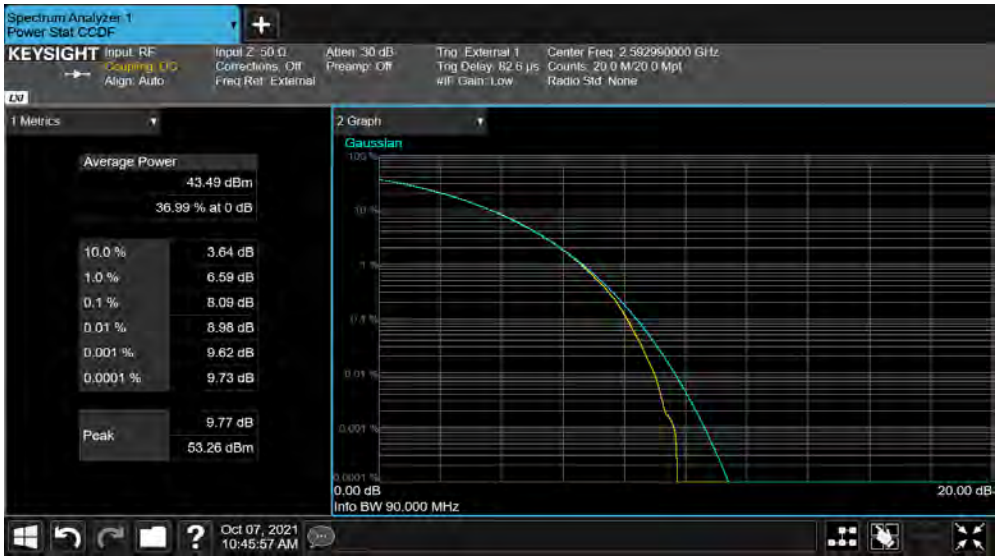


PEAK AND AVERAGE (PAPR) CCDF - 5G NR

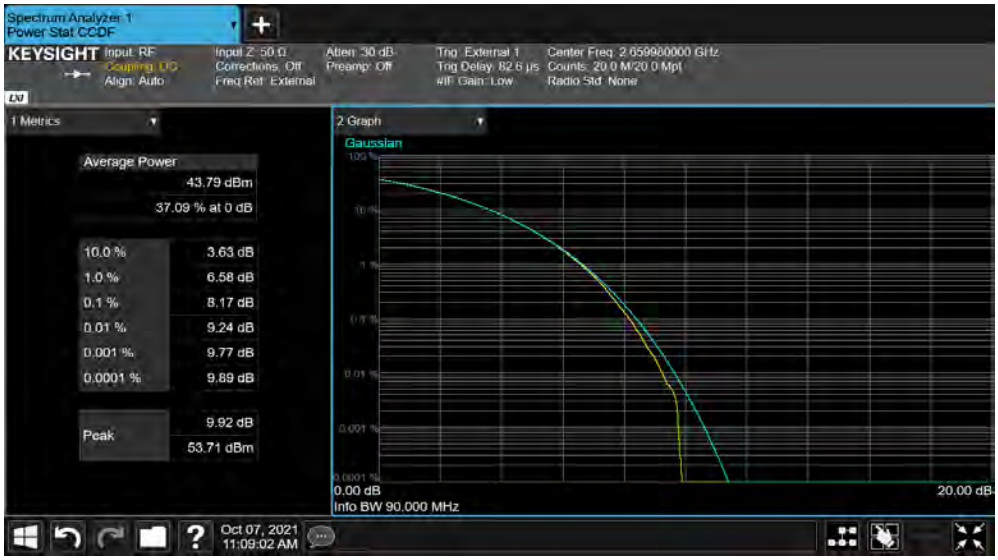
Port 1, 5G NR, Band n41, 2496 MHz - 2690 MHz, (NR60) 60 MHz Bandwidth, 256QAM Modulation, Low Channel 2526.00 MHz						
				0.1% Value (dB)	Limit (dB)	Result
				8.16	13	Pass



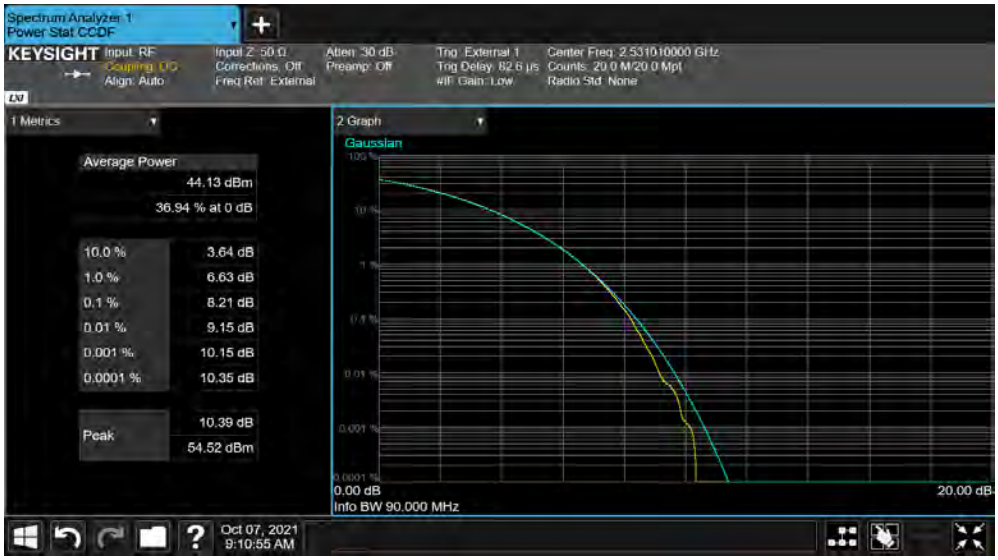
Port 1, 5G NR, Band n41, 2496 MHz - 2690 MHz, (NR60) 60 MHz Bandwidth, 256QAM Modulation, Mid Channel 2592.99 MHz						
				0.1% Value (dB)	Limit (dB)	Result
				8.09	13	Pass



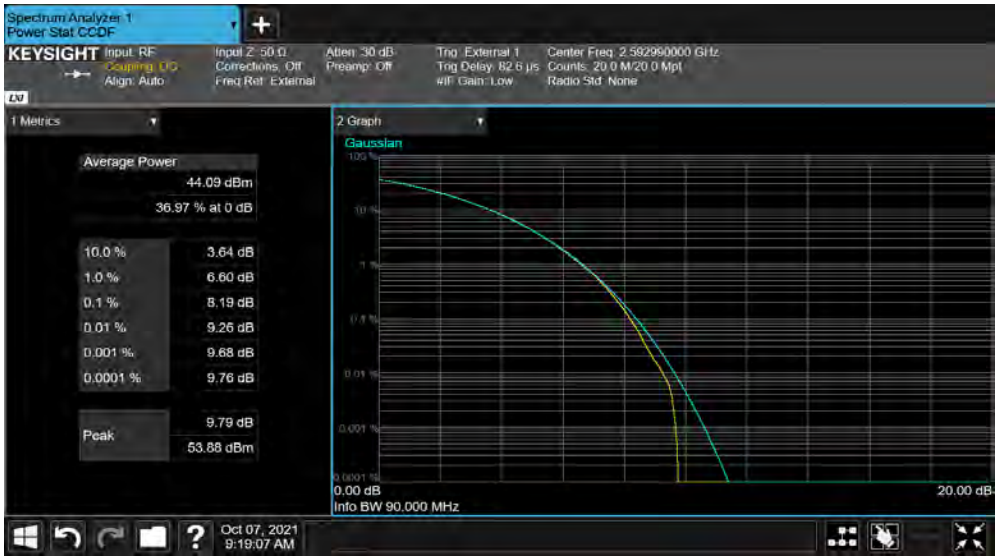
Port 1, 5G NR, Band n41, 2496 MHz - 2690 MHz, (NR60) 60 MHz Bandwidth, 256QAM Modulation, High Channel 2659.98 MHz						
				0.1% Value (dB)	Limit (dB)	Result
				8.17	13	Pass



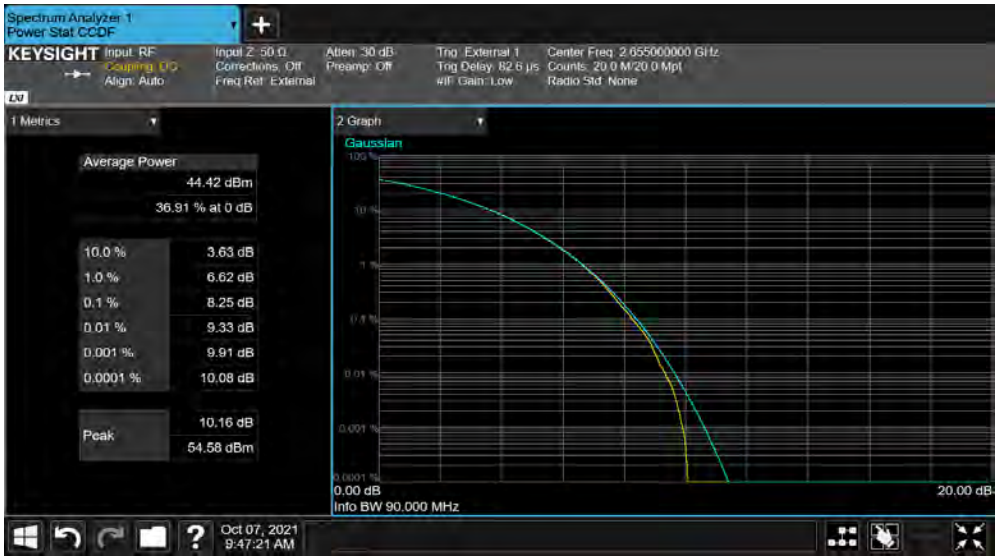
Port 1, 5G NR, Band n41, 2496 MHz - 2690 MHz, (NR70) 70 MHz Bandwidth, 256QAM Modulation, Low Channel 2531.01 MHz						
				0.1% Value (dB)	Limit (dB)	Result
				8.21	13	Pass



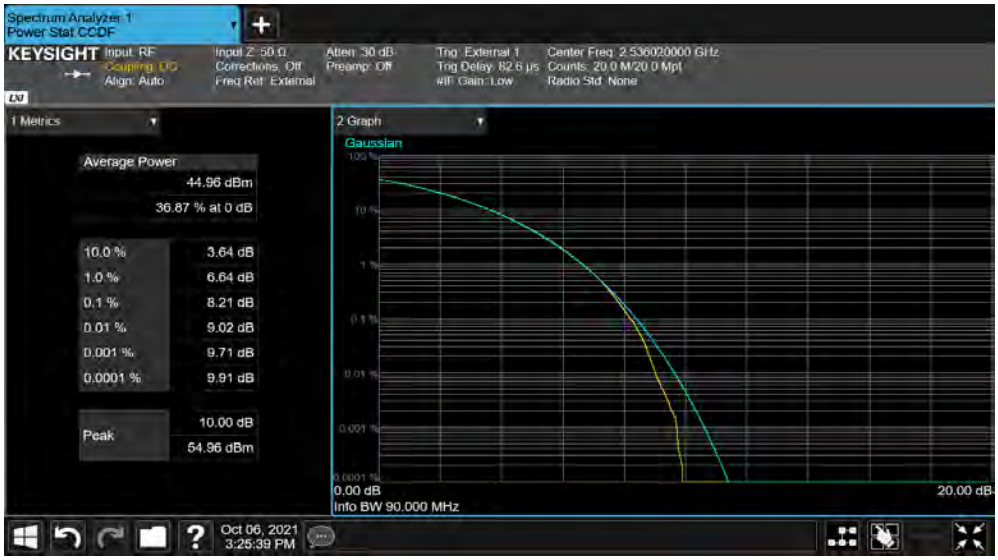
Port 1, 5G NR, Band n41, 2496 MHz - 2690 MHz, (NR70) 70 MHz Bandwidth, 256QAM Modulation, Mid Channel 2592.99 MHz						
				0.1% Value (dB)	Limit (dB)	Result
				8.19	13	Pass



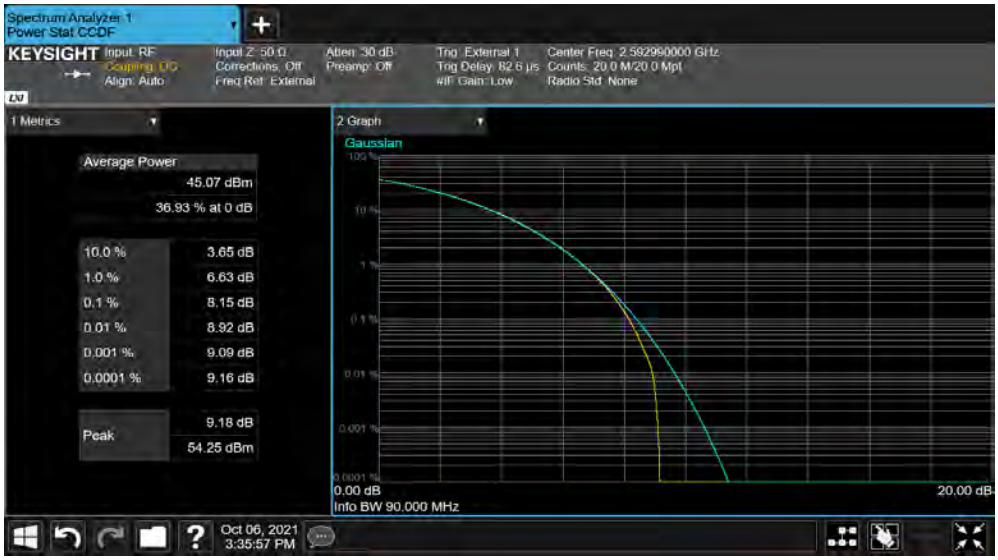
Port 1, 5G NR, Band n41, 2496 MHz - 2690 MHz, (NR70) 70 MHz Bandwidth, 256QAM Modulation, High Channel 2655.00 MHz						
				0.1% Value (dB)	Limit (dB)	Result
				8.25	13	Pass



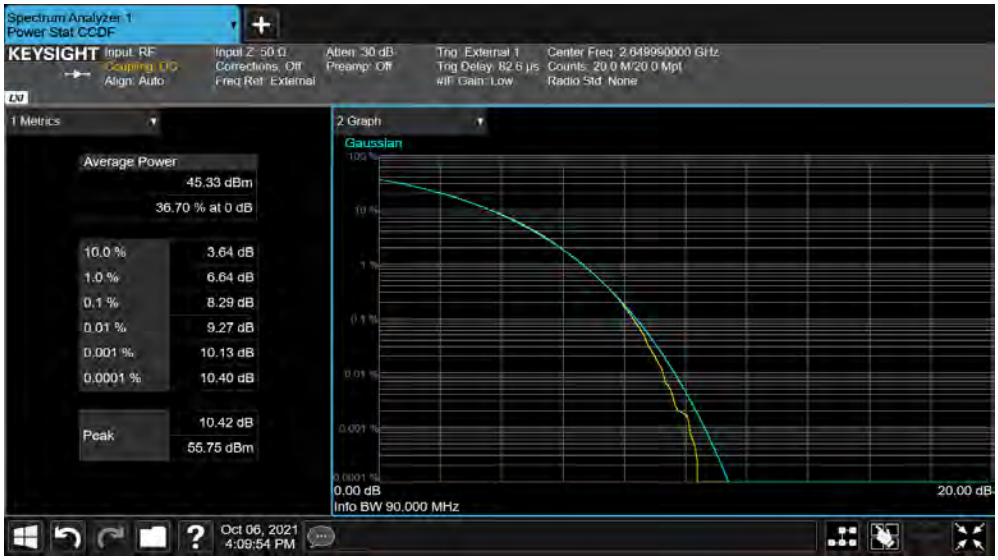
Port 1, 5G NR, Band n41, 2496 MHz - 2690 MHz, (NR80) 80 MHz Bandwidth, 256QAM Modulation, Low Channel 2536.02 MHz						
				0.1% Value (dB)	Limit (dB)	Result
				8.21	13	Pass



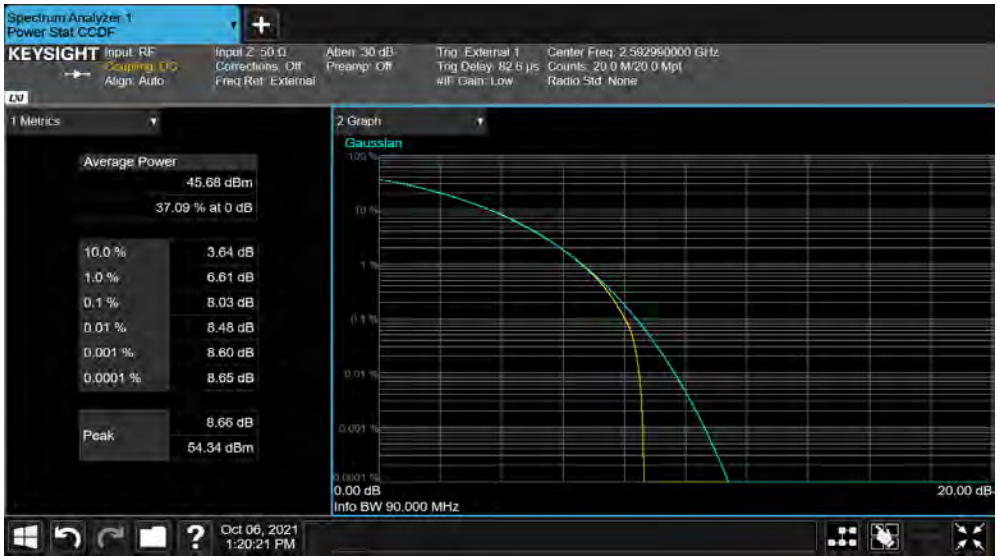
Port 1, 5G NR, Band n41, 2496 MHz - 2690 MHz, (NR80) 80 MHz Bandwidth, 256QAM Modulation, Mid Channel 2592.99 MHz						
				0.1% Value (dB)	Limit (dB)	Result
				8.15	13	Pass



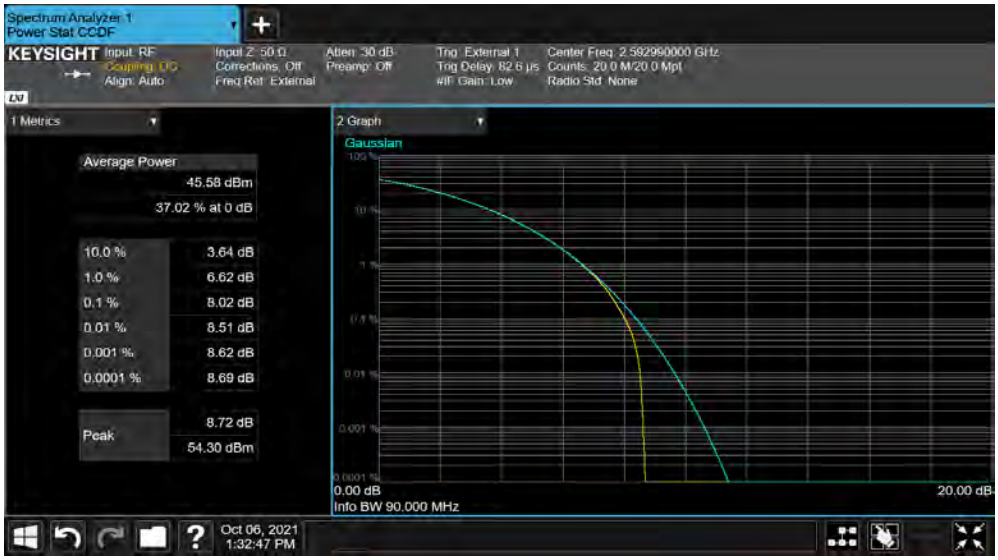
Port 1, 5G NR, Band n41, 2496 MHz - 2690 MHz, (NR80) 80 MHz Bandwidth, 256QAM Modulation, High Channel 2649.99 MHz						
				0.1% Value (dB)	Limit (dB)	Result
				8.29	13	Pass



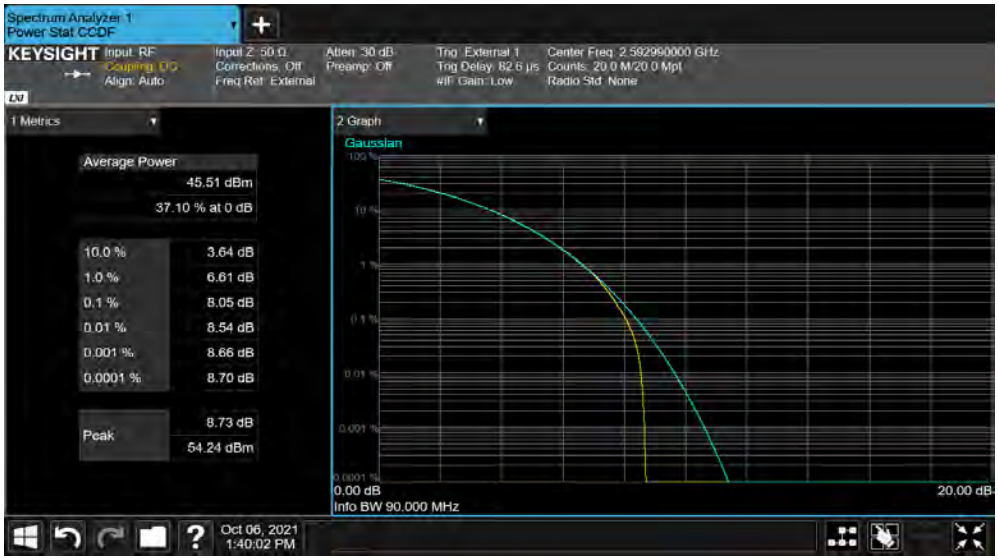
Port 1, 5G NR, Band n41, 2496 MHz - 2690 MHz, (NR90) 90 MHz Bandwidth, QPSK Modulation, Mid Channel 2592.99 MHz						
				0.1% Value (dB)	Limit (dB)	Result
				8.03	13	Pass



Port 1, 5G NR, Band n41, 2496 MHz - 2690 MHz, (NR90) 90 MHz Bandwidth, 16QAM Modulation, Mid Channel 2592.99 MHz						
				0.1% Value (dB)	Limit (dB)	Result
				8.02	13	Pass

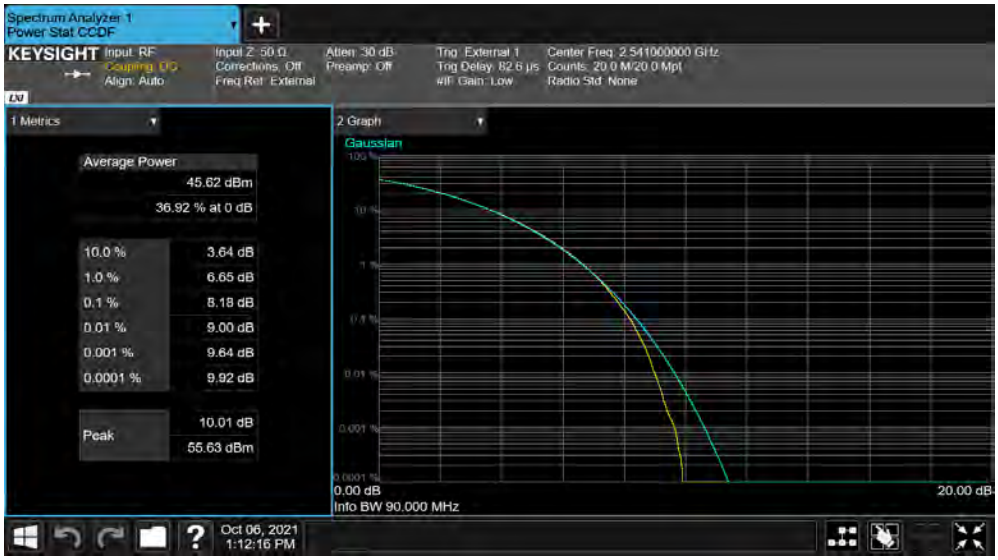


Port 1, 5G NR, Band n41, 2496 MHz - 2690 MHz, (NR90) 90 MHz Bandwidth, 64QAM Modulation, Mid Channel 2592.99 MHz						
				0.1% Value (dB)	Limit (dB)	Result
				8.05	13	Pass



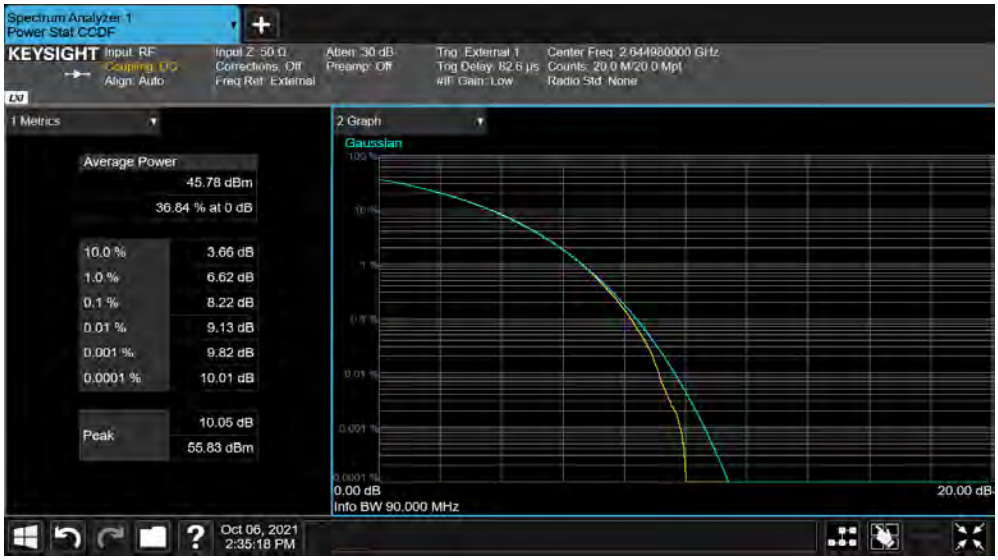
PEAK AND AVERAGE (PAPR) CCDF - 5G NR

Port 1, 5G NR, Band n41, 2496 MHz - 2690 MHz, (NR90) 90 MHz Bandwidth, 256QAM Modulation, Low Channel 2541.00 MHz						
				0.1% Value (dB)	Limit (dB)	Result
				8.18	13	Pass



Port 1, 5G NR, Band n41, 2496 MHz - 2690 MHz, (NR90) 90 MHz Bandwidth, 256QAM Modulation, Mid Channel 2592.99 MHz						
				0.1% Value (dB)	Limit (dB)	Result
				8.05	13	Pass

Port 1, 5G NR, Band n41, 2496 MHz - 2690 MHz, (NR90) 90 MHz Bandwidth, 256QAM Modulation, High Channel 2644.98 MHz							
					0.1% Value (dB)	**Limit (dB)**	**Result**
					8.22	13	Pass



PEAK AND AVERAGE (PAPR) CCDF - 4G LTE

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
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17
Spectrum Analyzer	Keysight	N9030B	R296	2021-07-15	2022-07-15

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 13 dB.

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 27.50, 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 AZHL antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown during output power 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 AND AVERAGE (PAPR) CCDF - 4G LTE

TbtTx 2021.03.19.1 XMit 2020.12.30.0

EUT:	AZHL (C2PC LTE/5G NR B41)			**Work Order:**	NOKI0035
Serial Number:	YK203400025			**Date:**	13-Oct-21
Customer:	Nokia Solutions and Networks			**Temperature:**	22.9 °C
Attendees:	David Le, John Rattanavong			**Humidity:**	52% RH
Project:	None			**Barometric Pres.:**	1011 mbar
Tested by:	Brandon Hobbs	**Power:**	54 VDC	**Job Site:**	TX09

TEST SPECIFICATIONS	Test Method
FCC 27:2021	ANSI C63.26:2015

COMMENTS

All losses in the measurement path were accounted for: attenuators, cables, DC block and filter when in use. Band n41 carriers and enabled at maximum power. External 1 gating was set using a trig delay = 5.044ms and a gate length = 6.8061ms.

DEVIATIONS FROM TEST STANDARD

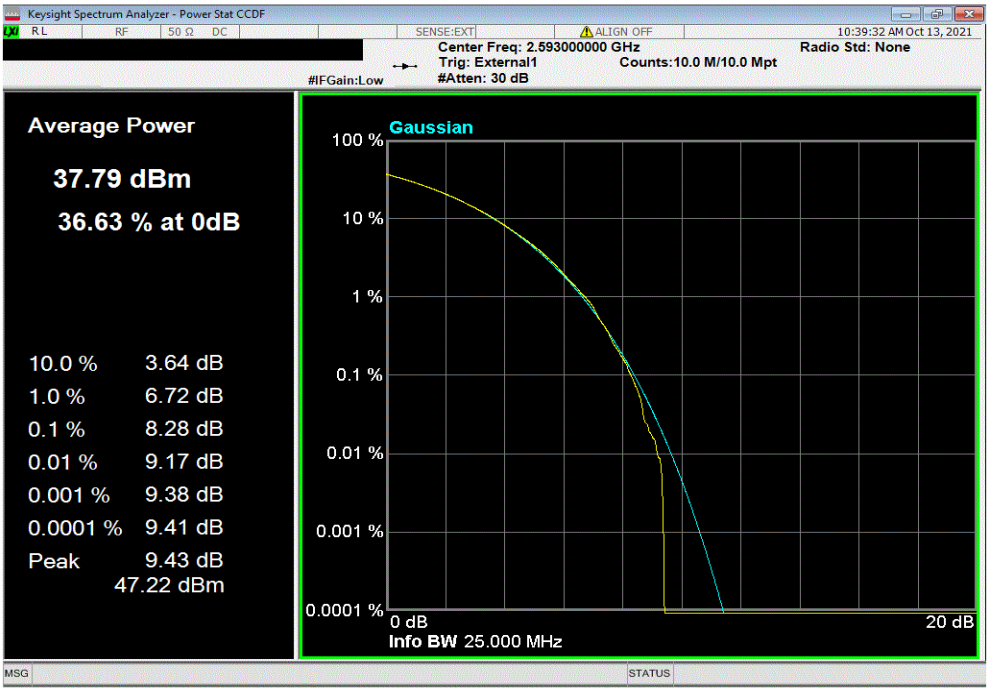
None

Configuration #	2	Signature

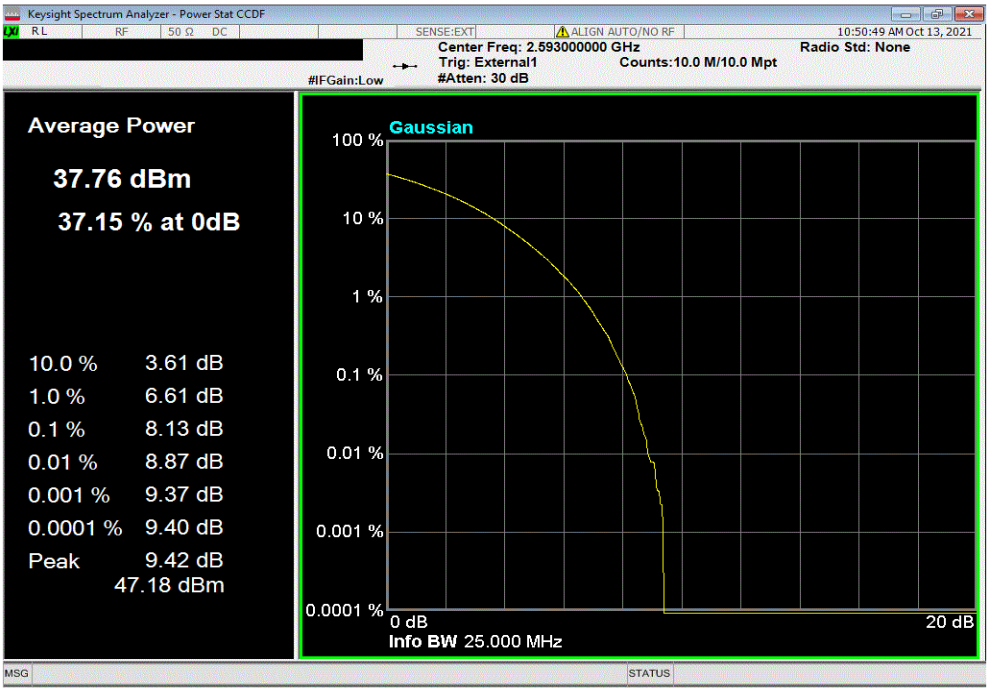
		0.1% Value (dB)	Limit (dB)	Results
4G LTE, Band 41, 2496 MHz - 2690 MHz				
Port 1				
LTE15 (15MHz)				
QPSK				
	Mid Channel 2593 MHz	8.28	13	Pass
16QAM				
	Mid Channel 2593 MHz	8.13	13	Pass
64QAM				
	Mid Channel 2593 MHz	8.10	13	Pass
256QAM				
	Low Channel 2503.5 MHz	7.98	13	Pass
	Mid Channel 2593 MHz	8.09	13	Pass
	High Channel 2682.5 MHz	8.06	13	Pass
LTE20 (20MHz)				
256QAM				
	Low Channel 2506 MHz	8.13	13	Pass
	Mid Channel 2593 MHz	7.98	13	Pass
	High Channel 2680 MHz	8.28	13	Pass

PEAK AND AVERAGE (PAPR) CCDF - 4G LTE

4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE15 (15MHz), QPSK, Mid Channel 2593 MHz						
				0.1% Value (dB)	Limit (dB)	Results
				8.28	13	Pass

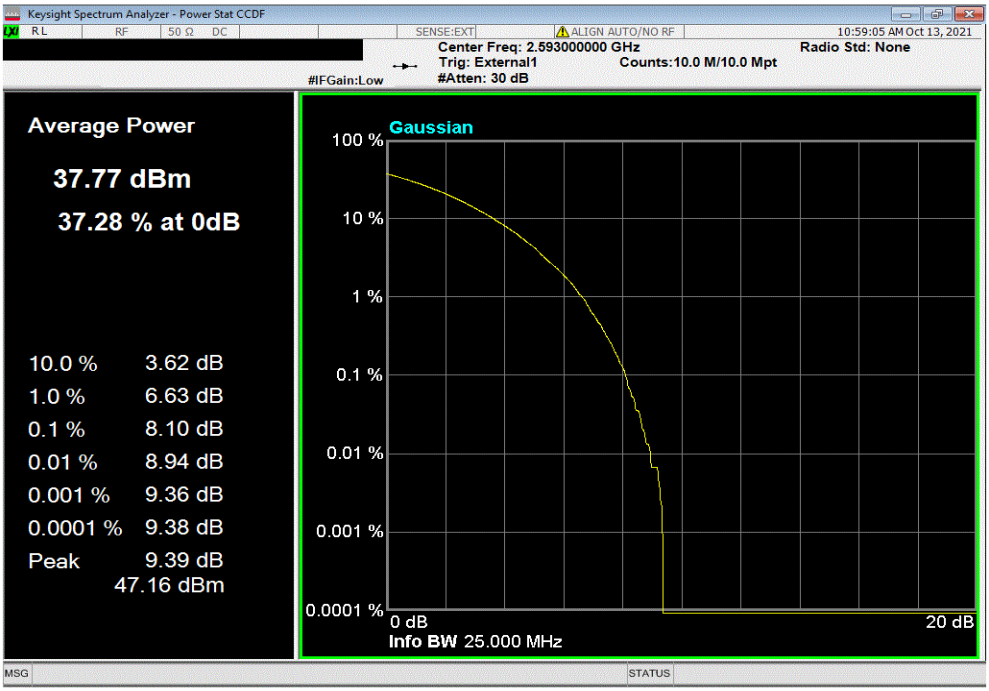


4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE15 (15MHz), 16QAM, Mid Channel 2593 MHz						
				0.1% Value (dB)	Limit (dB)	Results
				8.13	13	Pass

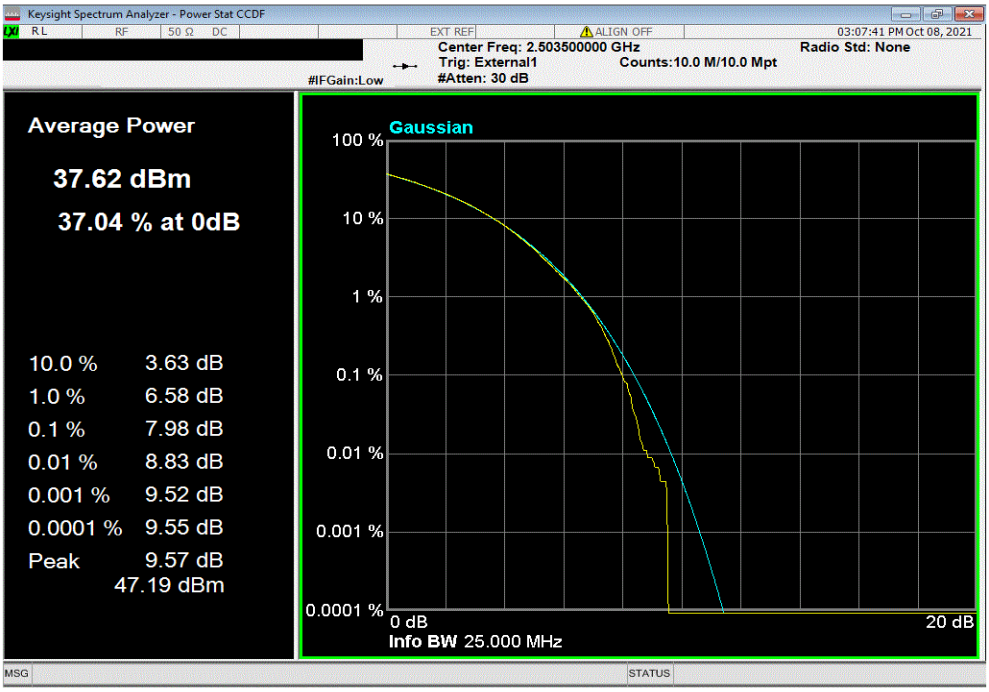


PEAK AND AVERAGE (PAPR) CCDF - 4G LTE

4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE15 (15MHz), 64QAM, Mid Channel 2593 MHz						
				0.1% Value (dB)	Limit (dB)	Results
				8.1	13	Pass

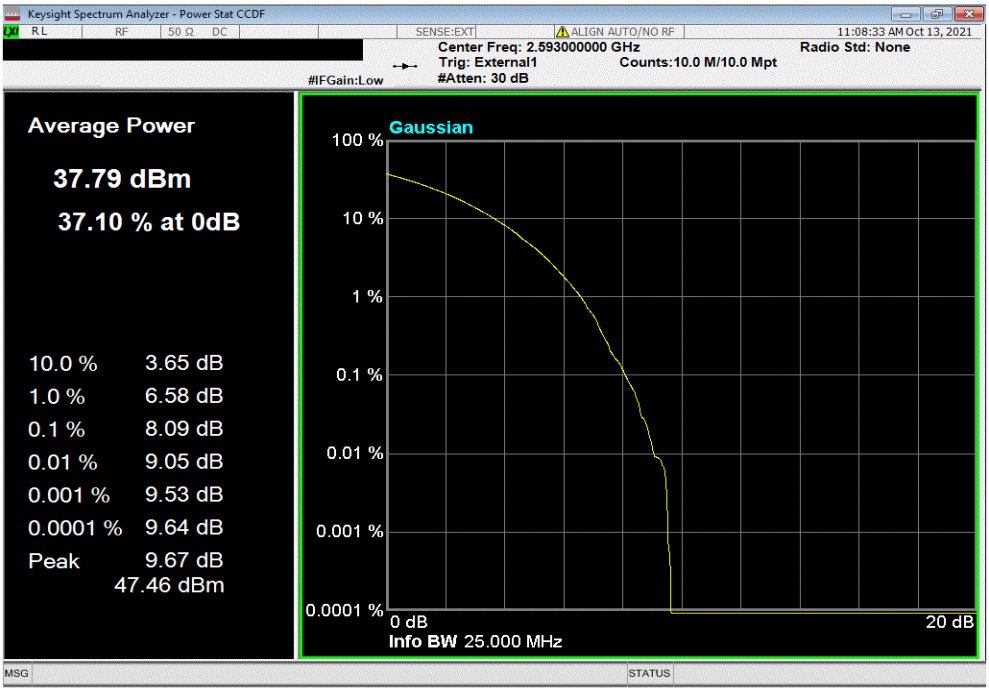


4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE15 (15MHz), 256QAM, Low Channel 2503.5 MHz						
				0.1% Value (dB)	Limit (dB)	Results
				7.98	13	Pass

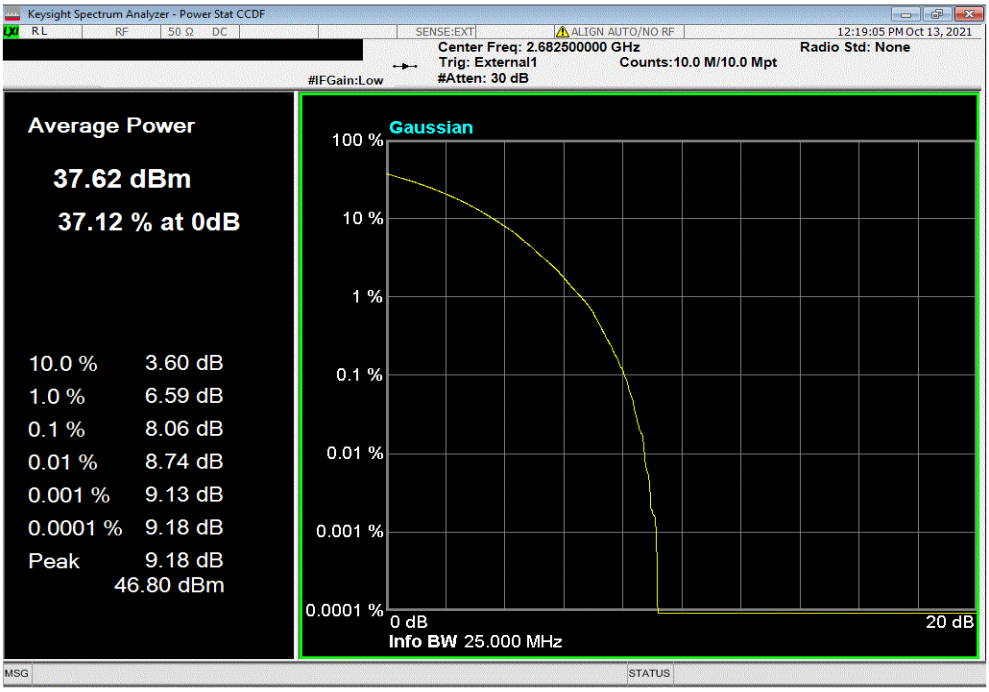


PEAK AND AVERAGE (PAPR) CCDF - 4G LTE

4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE15 (15MHz), 256QAM, Mid Channel 2593 MHz						
				0.1% Value (dB)	Limit (dB)	Results
				8.09	13	Pass

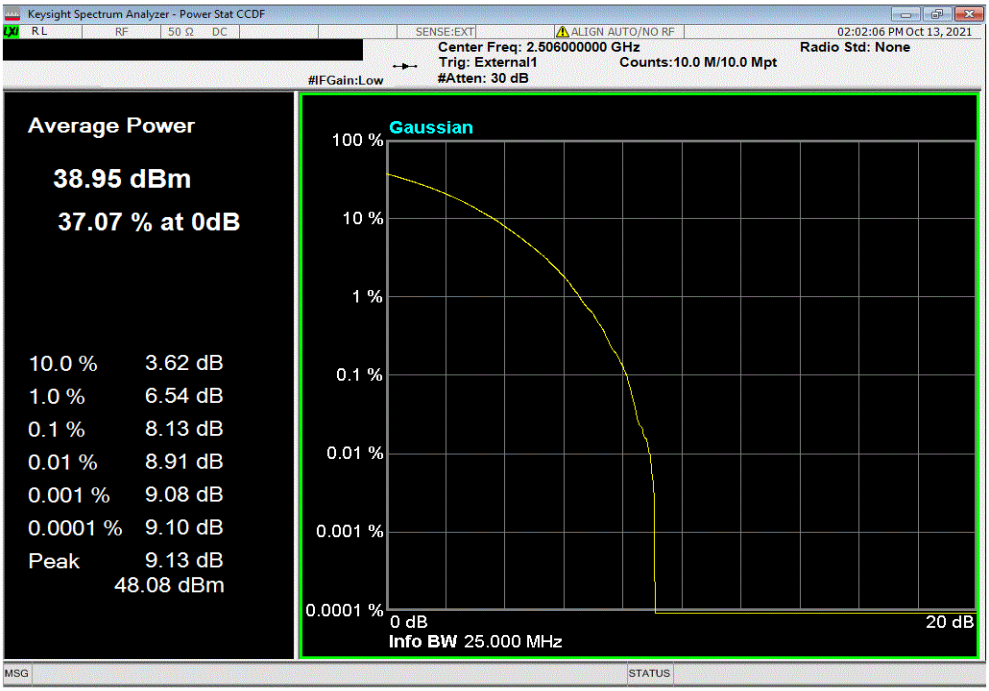


4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE15 (15MHz), 256QAM, High Channel 2682.5 MHz						
				0.1% Value (dB)	Limit (dB)	Results
				8.06	13	Pass

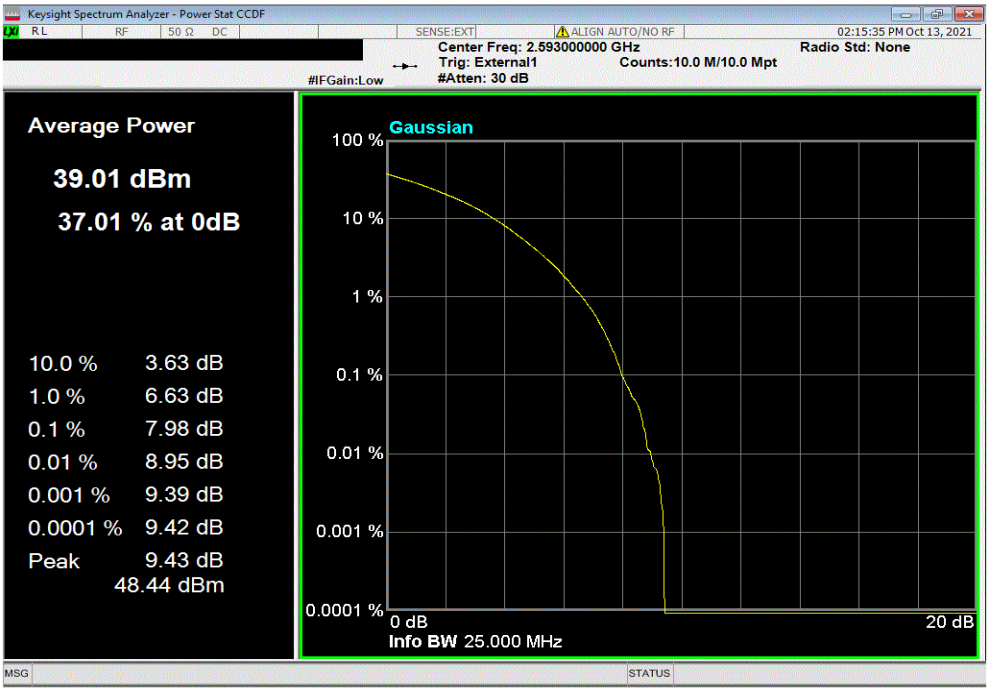


PEAK AND AVERAGE (PAPR) CCDF - 4G LTE

4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE20 (20MHz), 256QAM, Low Channel 2506 MHz						
				0.1% Value (dB)	Limit (dB)	Results
				8.13	13	Pass



4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE20 (20MHz), 256QAM, Mid Channel 2593 MHz						
				0.1% Value (dB)	Limit (dB)	Results
				7.98	13	Pass



PEAK AND AVERAGE (PAPR) CCDF - 4G LTE

4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE20 (20MHz), 256QAM, High Channel 2680 MHz						
				0.1% Value (dB)	Limit (dB)	Results
				8.28	13	Pass