OCCUPIED BANDWIDTH LTE

XMit 2020.03.25.0

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	27-Feb-20	27-Feb-21
Generator - Signal	Keysight	N5171B-506	TEW	2-May-18	2-May-21

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The method in section 5.4 of ANSI C63.26 was used to make this measurement. The spectrum analyzer settings were as follows:

- RBW is 1% - 5% of the occupied bandwidth
- VBW is ≥ 3x the RBW
- Peak Detector was used
- Trace max hold was used

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 on 8 ports) 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 99% bandwidth was measured utilizing the analyzer's peak detector and measuring the carrier's 26 dB occupied bandwidth based on the peak output power level measured. A plot was taken to show the occupied bandwidth is contained within the allowable transmit band. FCC 27.53(m)(6) defines the emission bandwidth to be used as 26dB down.

The occupied bandwidth was measured with the EUT configured in the modes called out in the data sheets.

Band 41 (2496 MHz to 2690 MHz) Emission Designators derived from the measurement results:

FCC Emission Designators for Band 41 (2496MHz to 2690MHz)					
Channel Bandwidth	Radio Channel	4G-LTE: QPSK	4G-LTE: 16QAM	4G-LTE: 64QAM	4G-LTE: 256QAM
10M	Low				9M68F9W
	Mid	9M77F9W	9M68F9W	9M70F9W	9M74F9W
	High				9M68F9W
15M	Low				14M6F9W
	Mid	14M5F9W	14M5F9W	14M6F9W	14M6F9W
	High				14M6F9W
20M	Low				19M4F9W
	Mid	19M4F9W	19M2F9W	19M4F9W	19M4F9W
	High				19M4F9W
Note: FCC Emission Designators are based on 26dB emission bandwidth					

OCCUPIED BANDWIDTH LTE

element

TbtTx 2019.08.30.0 XMit 2020.12.30.0

EUT:	**AZHL**			**Work Order:**	**NOKI0018**
Serial Number:	**YK203400016**			**Date:**	**22-Feb-21**
Customer:	**Nokia Solutions and Networks**			**Temperature:**	**23.6 °C**
Attendees:	**John Rattanavong, Mitchell Hill, David Le**			**Humidity:**	**14.9% RH**
Project:	**None**			**Barometric Pres.:**	**1037 mbar**
Tested by:	**Mark Baytan**	**Power:**	**54 VDC**	**Job Site:**	**TX05**

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

COMMENTS

External 1 gating was set using a trig delay = 5.0us and a gate length = 6.786ms. Reference level offset adjusted to include (2) coax cables, DC block, and attenuator. The carrier power was set to maximum for all testing.

DEVIATIONS FROM TEST STANDARD

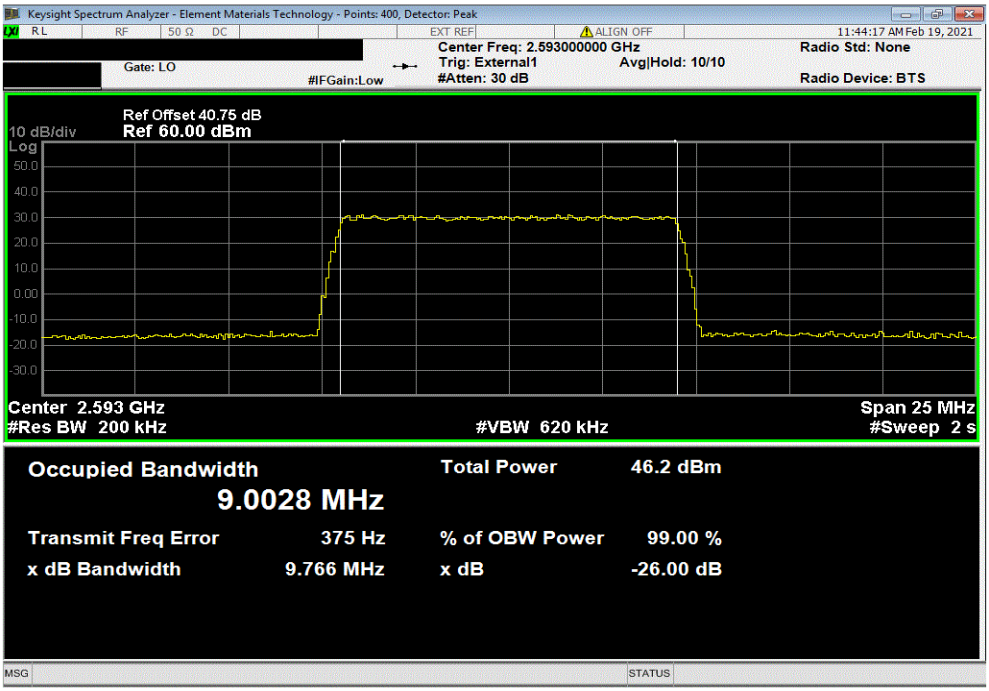
None

Configuration #	**2**	*Signature*

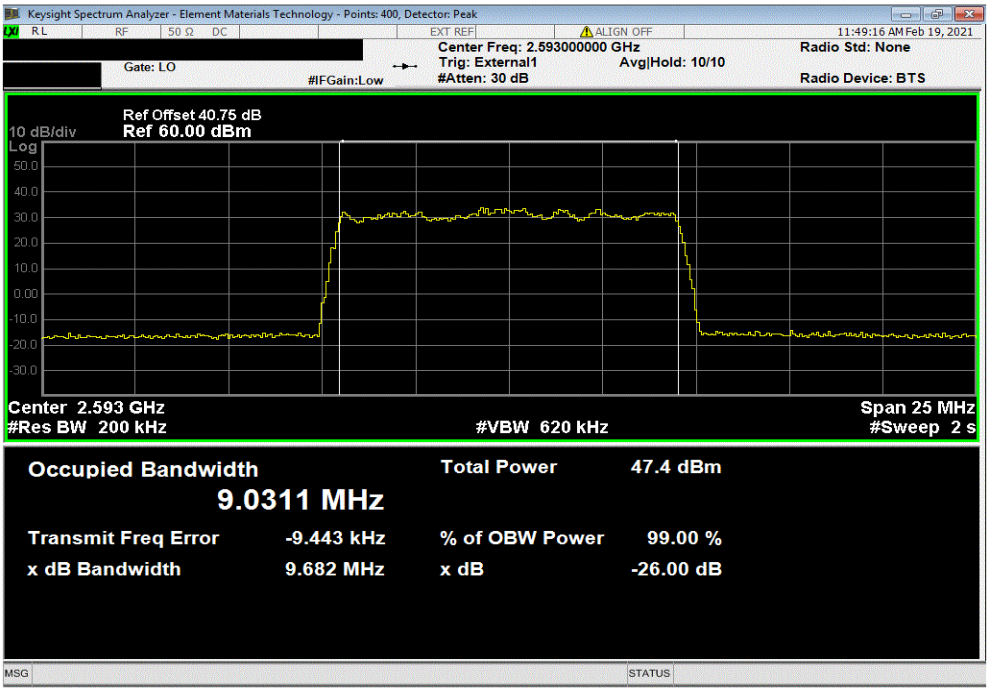
		Value (26 dB)	**Limit**	**Result**
4G LTE, Band 41, 2496 MHz - 2690 MHz				
Port 1				
LTE10 (10MHz)				
QPSK				
	Mid Channel 2593 MHz	9.766 MHz	Within Band	Pass
16QAM				
	Mid Channel 2593 MHz	9.682 MHz	Within Band	Pass
64QAM				
	Mid Channel 2593 MHz	9.7 MHz	Within Band	Pass
256QAM				
	Low Channel 2501 MHz	9.68 MHz	Within Band	Pass
	Mid Channel 2593 MHz	9.736 MHz	Within Band	Pass
	High Channel 2685 MHz	9.684 MHz	Within Band	Pass
LTE15 (15MHz)				
QPSK				
	Mid Channel 2593 MHz	14.549 MHz	Within Band	Pass
16QAM				
	Mid Channel 2593 MHz	14.498 MHz	Within Band	Pass
64QAM				
	Mid Channel 2593 MHz	14.608 MHz	Within Band	Pass
256QAM				
	Low Channel 2503.5 MHz	14.586 MHz	Within Band	Pass
	Mid Channel 2593 MHz	14.585 MHz	Within Band	Pass
	High Channel 2682.5 MHz	14.573 MHz	Within Band	Pass
LTE20 (20MHz)				
QPSK				
	Mid Channel 2593 MHz	19.361 MHz	Within Band	Pass
16QAM				
	Mid Channel 2593 MHz	19.177 MHz	Within Band	Pass
64QAM				
	Mid Channel 2593 MHz	19.393 MHz	Within Band	Pass
256QAM				
	Low Channel 2506 MHz	19.403 MHz	Within Band	Pass
	Mid Channel 2593 MHz	19.404 MHz	Within Band	Pass
	High Channel 2680 MHz	19.422 MHz	Within Band	Pass

OCCUPIED BANDWIDTH LTE

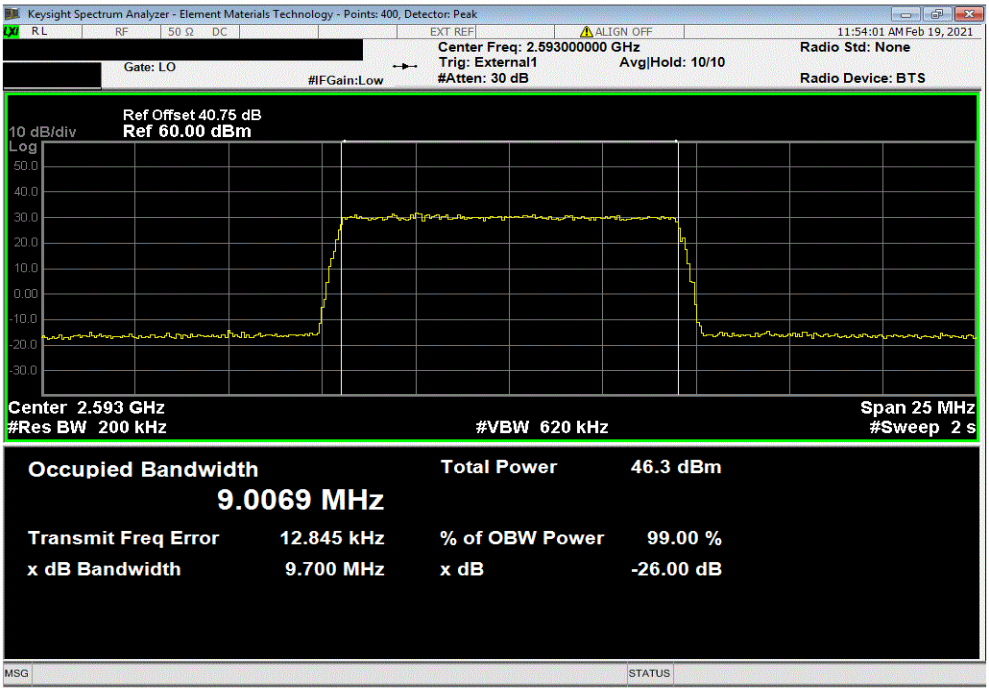
4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE10 (10MHz), QPSK, Mid Channel 2593 MHz						
				Value (26 dB)	Limit	Result
				9.766 MHz	Within Band	Pass



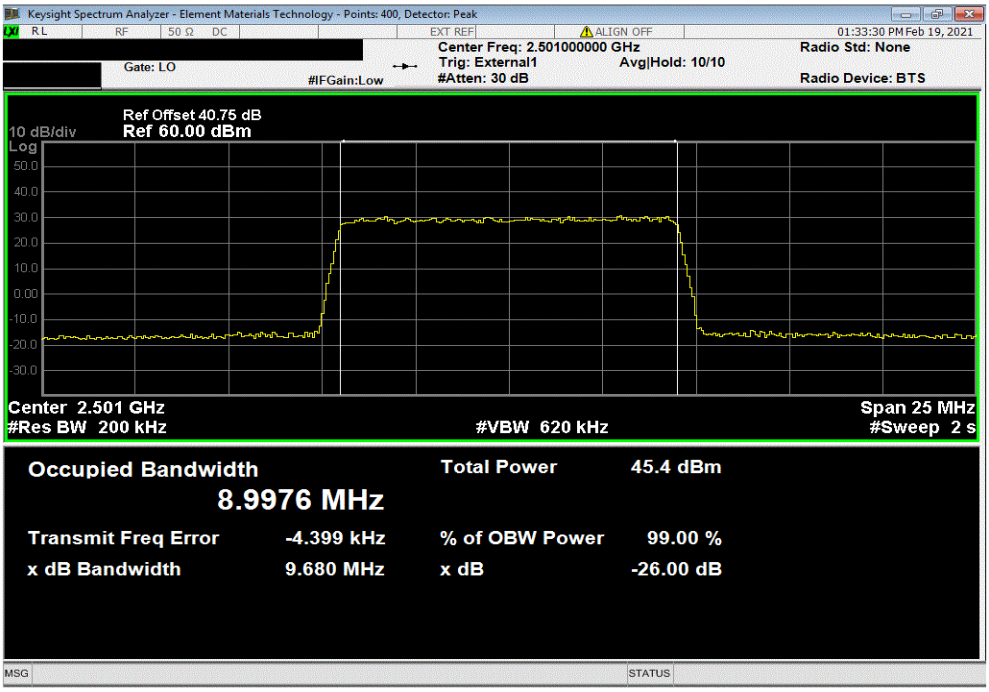
4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE10 (10MHz), 16QAM, Mid Channel 2593 MHz						
				Value (26 dB)	Limit	Result
				9.682 MHz	Within Band	Pass



4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE10 (10MHz), 64QAM, Mid Channel 2593 MHz						
				Value (26 dB)	Limit	Result
				9.7 MHz	Within Band	Pass

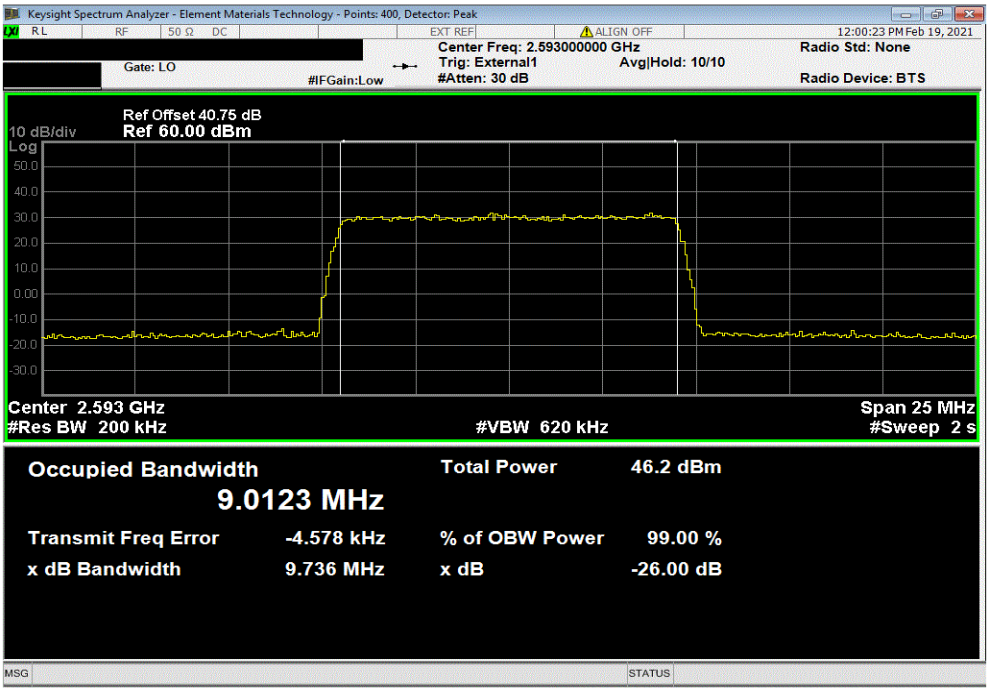


4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE10 (10MHz), 256QAM, Low Channel 2501 MHz						
				Value (26 dB)	Limit	Result
				9.68 MHz	Within Band	Pass

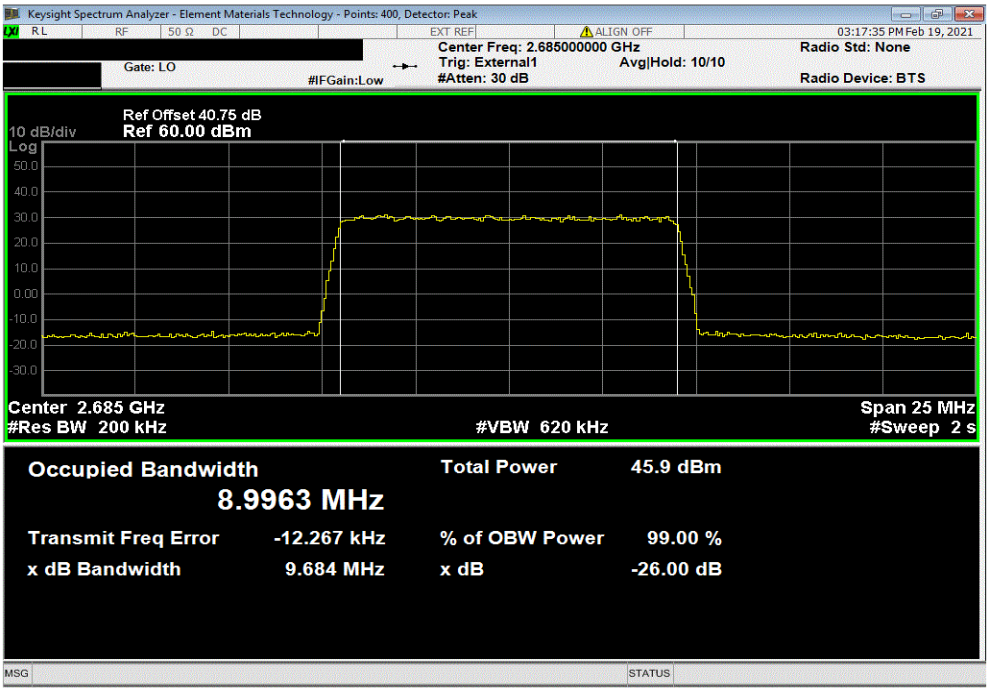


OCCUPIED BANDWIDTH LTE

4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE10 (10MHz), 256QAM, Mid Channel 2593 MHz						
				Value (26 dB)	Limit	Result
				9.736 MHz	Within Band	Pass

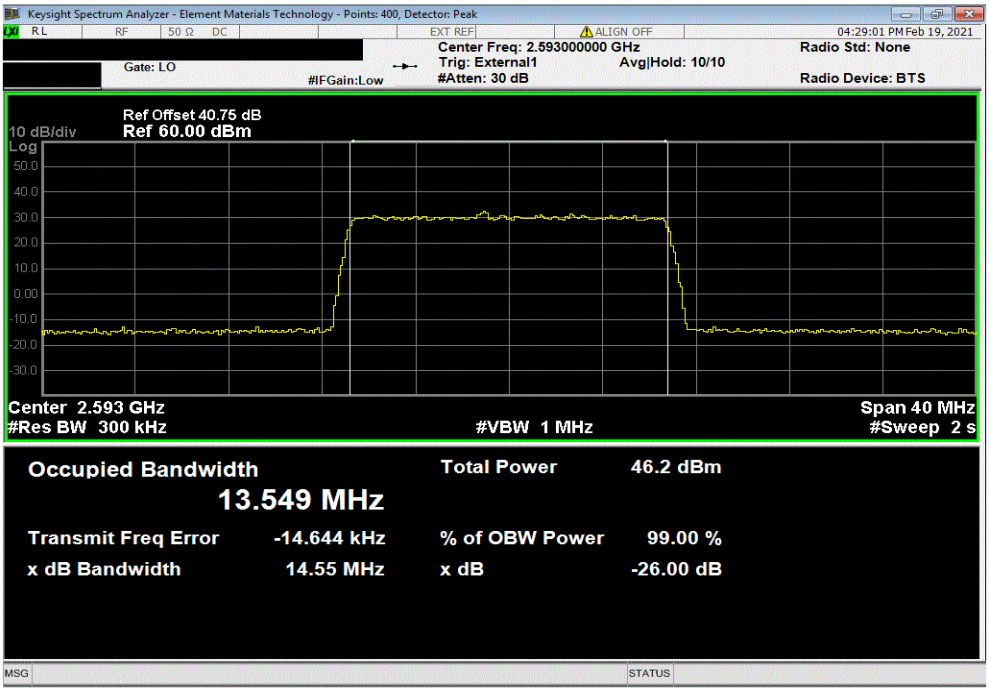


4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE10 (10MHz), 256QAM, High Channel 2685 MHz						
				Value (26 dB)	Limit	Result
				9.684 MHz	Within Band	Pass

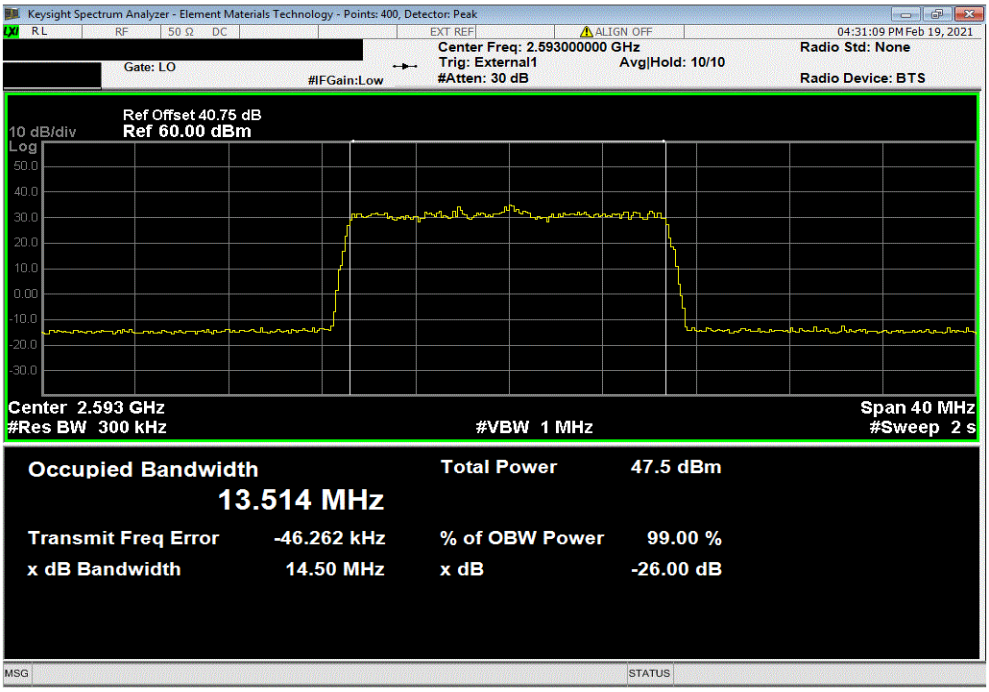


OCCUPIED BANDWIDTH LTE

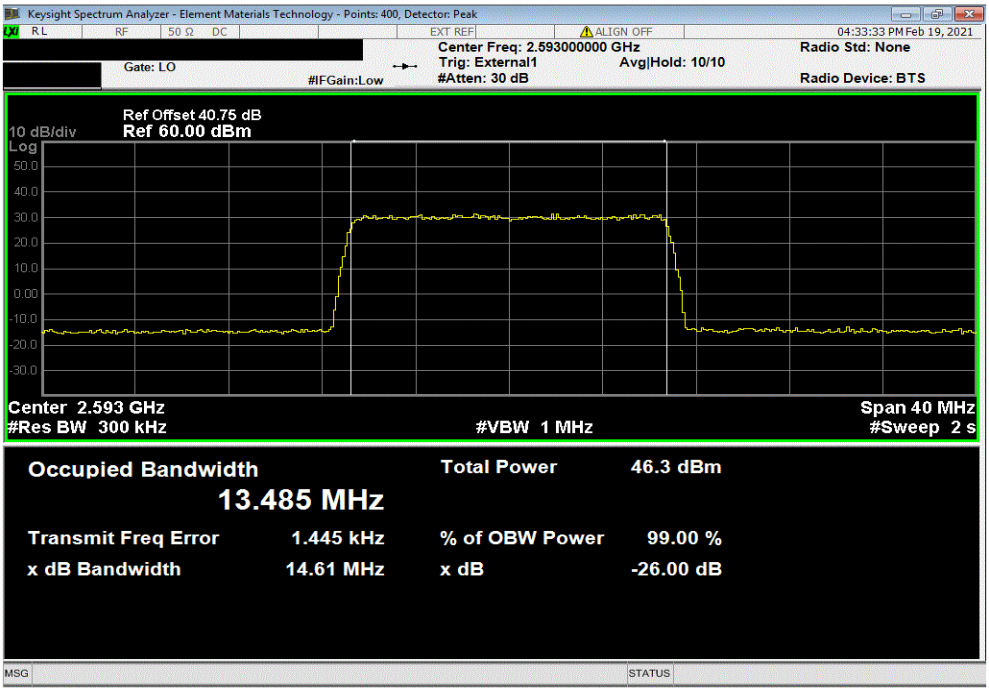
4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE15 (15MHz), QPSK, Mid Channel 2593 MHz						
				Value (26 dB)	Limit	Result
				14.549 MHz	Within Band	Pass



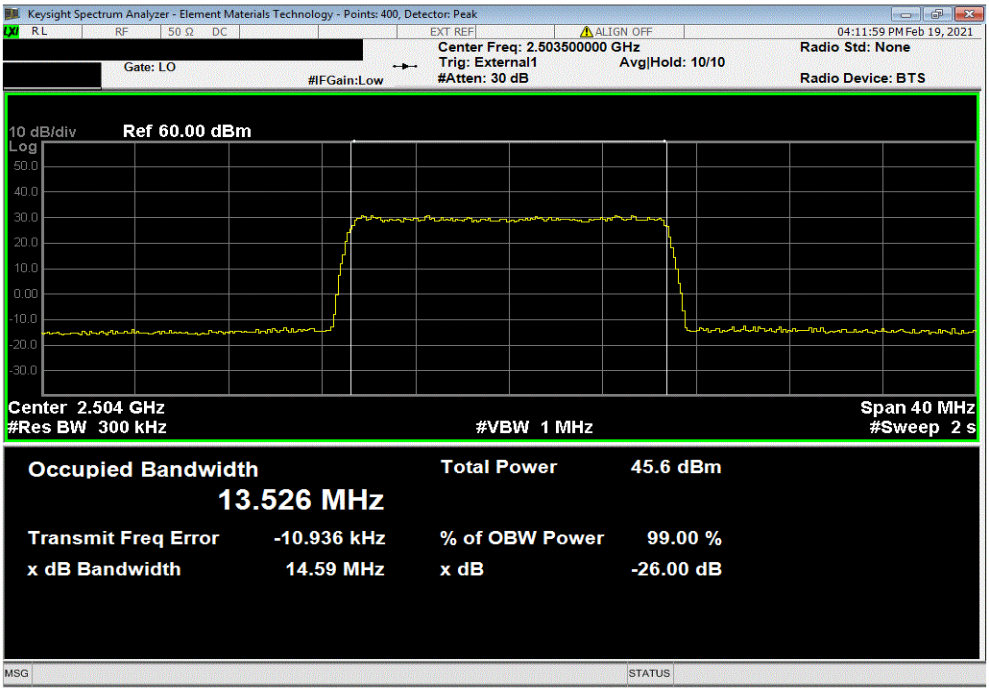
4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE15 (15MHz), 16QAM, Mid Channel 2593 MHz						
				Value (26 dB)	Limit	Result
				14.498 MHz	Within Band	Pass



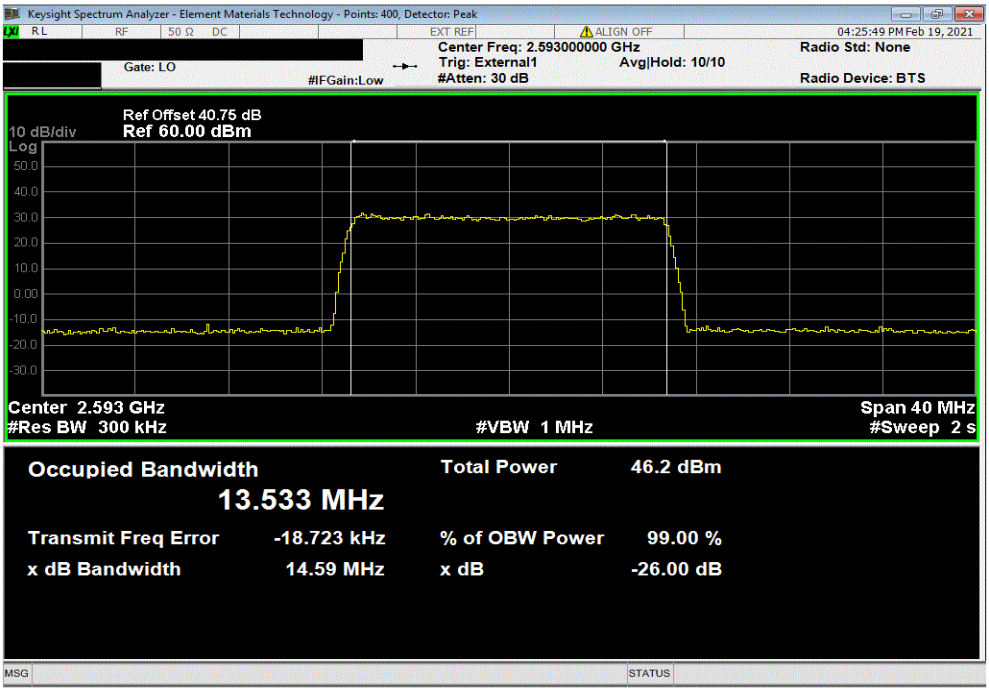
4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE15 (15MHz), 64QAM, Mid Channel 2593 MHz						
				Value (26 dB)	Limit	Result
				14.608 MHz	Within Band	Pass



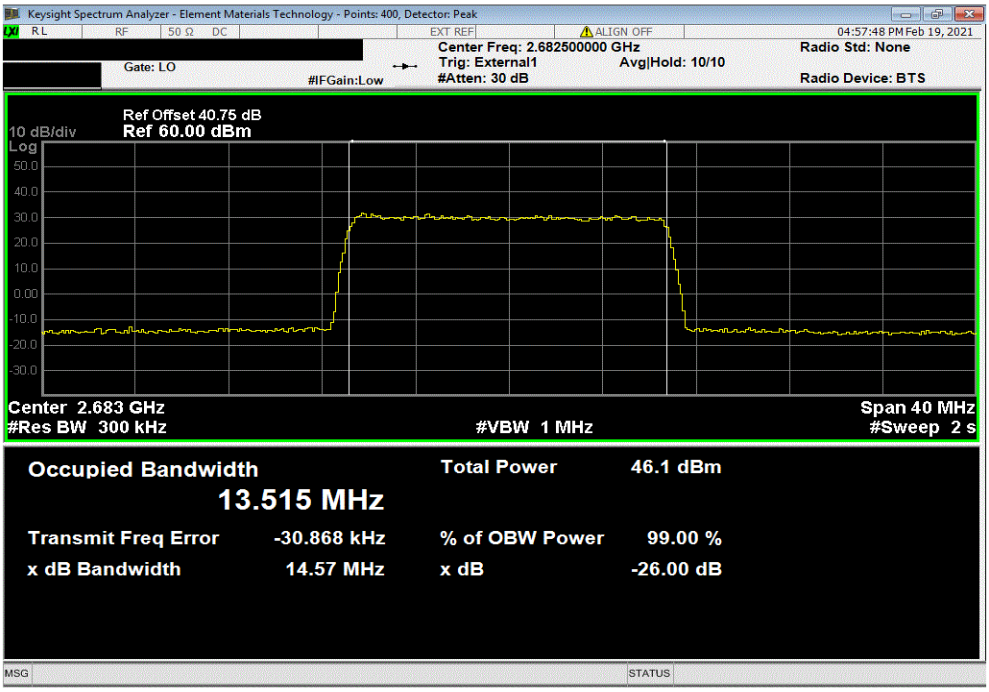
4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE15 (15MHz), 256QAM, Low Channel 2503.5 MHz						
				Value (26 dB)	Limit	Result
				14.586 MHz	Within Band	Pass



4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE15 (15MHz), 256QAM, Mid Channel 2593 MHz						
				Value (26 dB)	Limit	Result
				14.585 MHz	Within Band	Pass

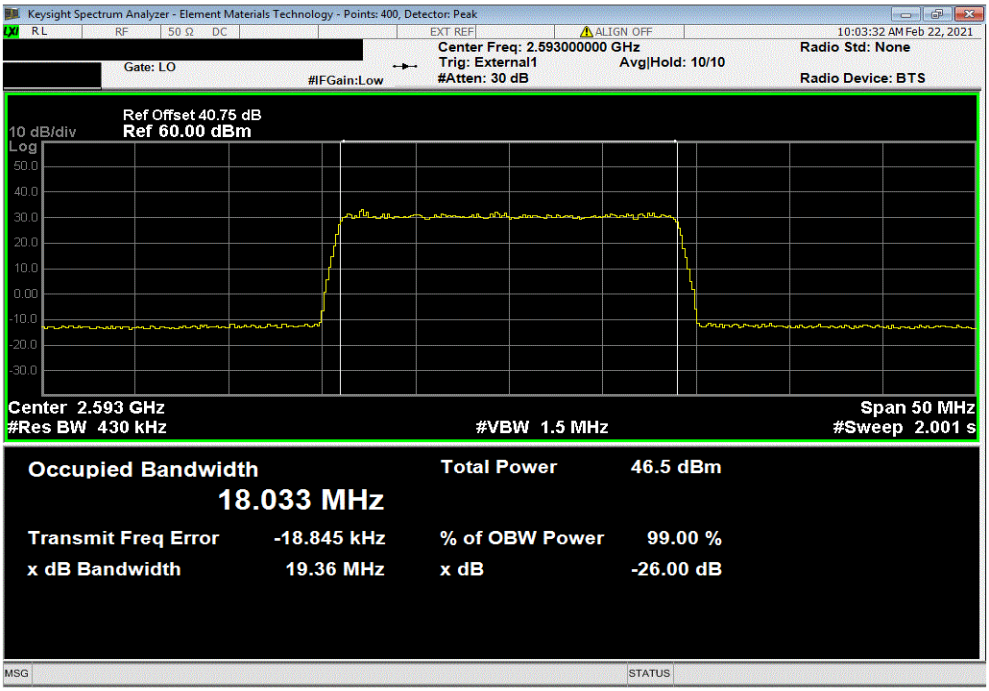


4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE15 (15MHz), 256QAM, High Channel 2682.5 MHz						
				Value (26 dB)	Limit	Result
				14.573 MHz	Within Band	Pass

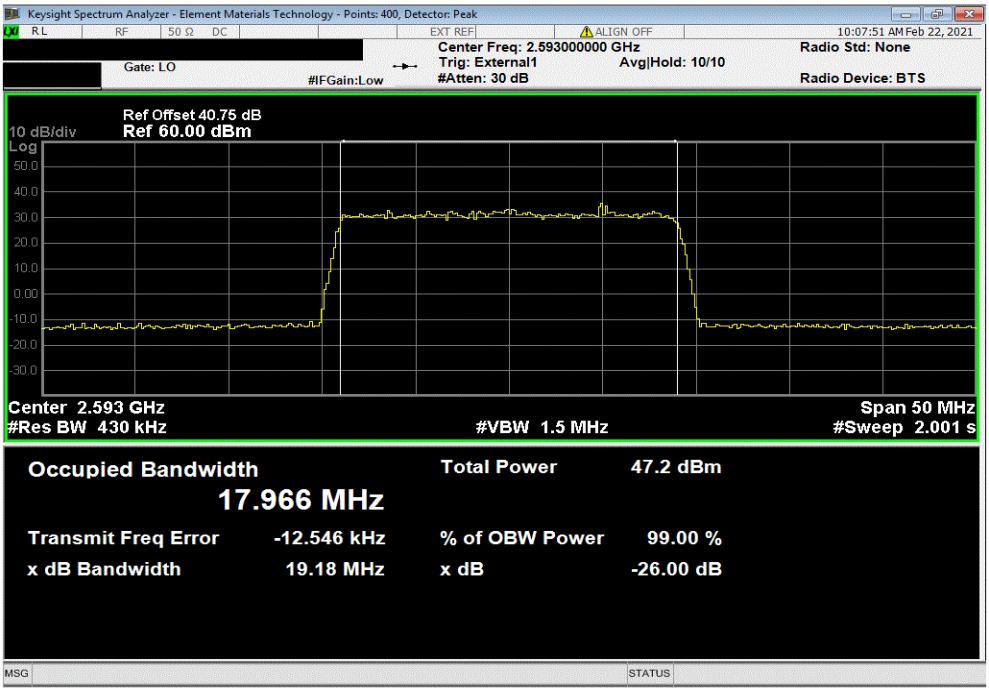


OCCUPIED BANDWIDTH LTE

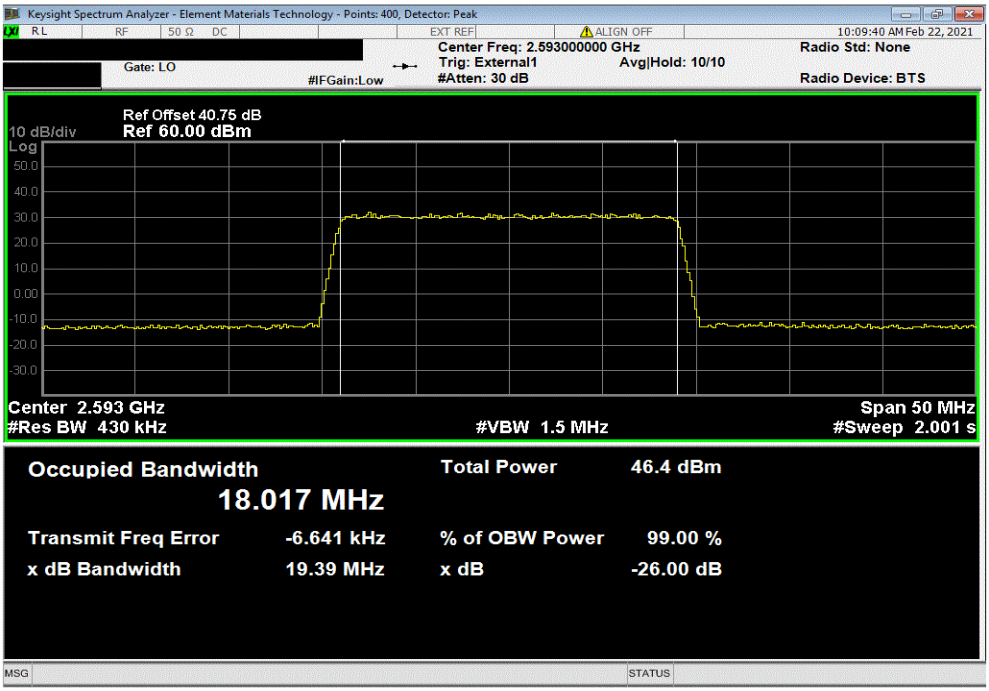
4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE20 (20MHz), QPSK, Mid Channel 2593 MHz						
				Value (26 dB)	Limit	Result
				19.361 MHz	Within Band	Pass



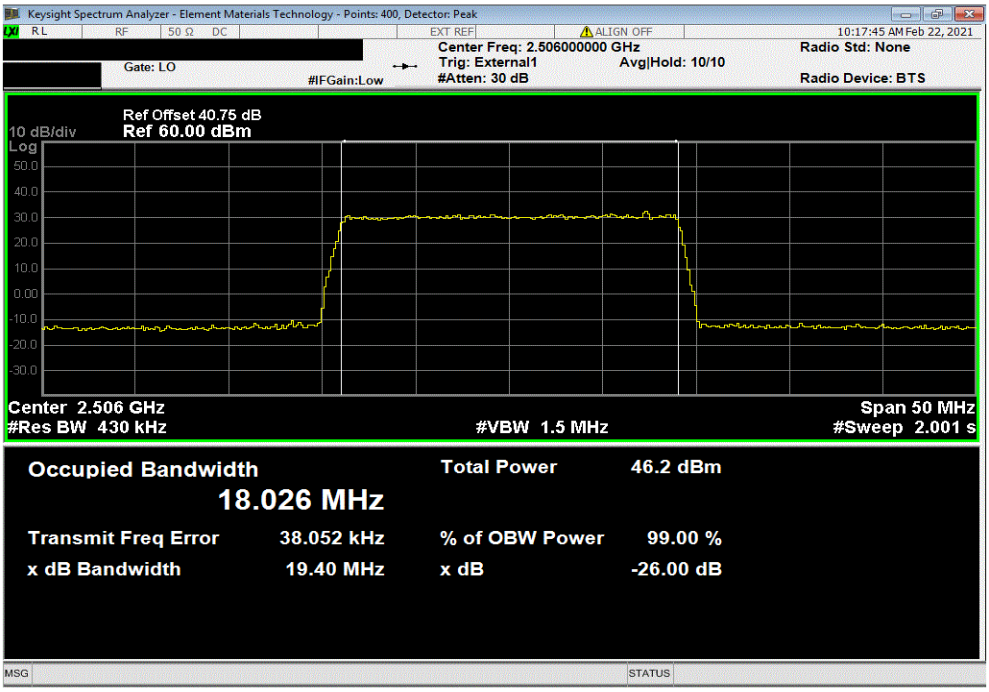
4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE20 (20MHz), 16QAM, Mid Channel 2593 MHz						
				Value (26 dB)	Limit	Result
				19.177 MHz	Within Band	Pass



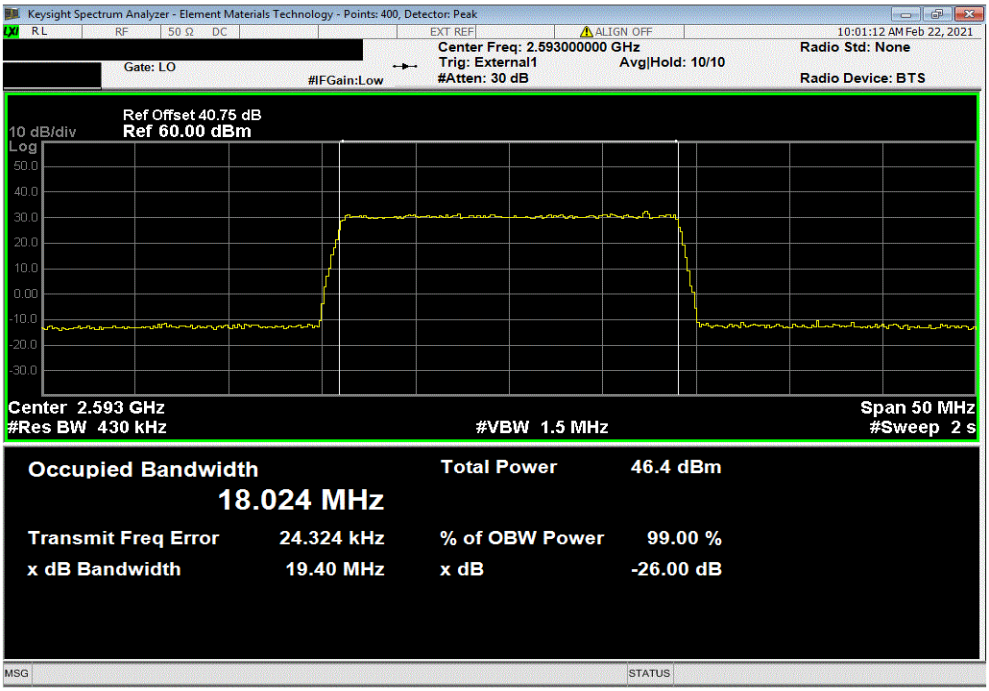
4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE20 (20MHz), 64QAM, Mid Channel 2593 MHz						
				Value (26 dB)	Limit	Result
				19.393 MHz	Within Band	Pass



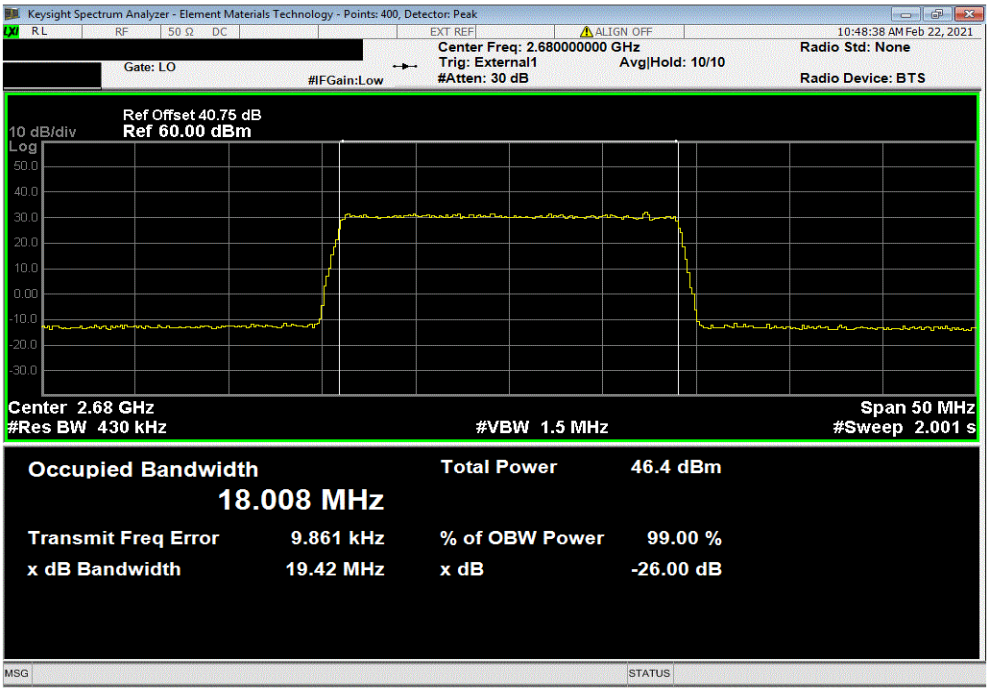
4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE20 (20MHz), 256QAM, Low Channel 2506 MHz						
				Value (26 dB)	Limit	Result
				19.403 MHz	Within Band	Pass



4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE20 (20MHz), 256QAM, Mid Channel 2593 MHz						
				Value (26 dB)	Limit	Result
				19.404 MHz	Within Band	Pass



4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE20 (20MHz), 256QAM, High Channel 2680 MHz						
				Value (26 dB)	Limit	Result
				19.422 MHz	Within Band	Pass



FREQUENCY STABILITY

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
Thermometer	Omega Engineering, Inc.	HH311	DUI	2021-02-02	2024-02-02
Chamber - Temperature/Humidity	Cincinnati Sub Zero (CSZ)	ZPH-8-2-SCT/AC	TBH	NCR	NCR
Meter - Multimeter	Fluke	77-IV	MLT	2020-10-15	2023-10-15
Block - DC	Fairview Microwave	SD3379	AMT	2020-09-18	2021-09-18
Analyzer - Signal Analyzer	Keysight Technologies	N9030B	R275	2020-06-13	2021-06-13

TEST DESCRIPTION

The spectrum analyzer is equipped with a precision frequency reference that exceeds the stability requirement of the EUT.

Measurements were made on the single transmit frequency as called out on the data sheets. Testing was done while the EUT was continuously operating.

The primary supply voltage was varied from 85 % to 115% of the nominal voltage while at ambient temperature. Using a temperature chamber, the transmit frequency was recorded at the extremes of the specified temperature range of -30 ° to +50° C and at 10°C intervals.

FCC Part 27.54 defines the frequency deviation limit as follows: “The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation."

While there are no specific limits defined, results with a frequency error of less than 1000 Hz will show the carrier to be operating within the band. The frequency stability/accuracy radio design is the same for all radio technologies and modulation types. The radio was configured for 5G NR100 to show compliance.

FREQUENCY STABILITY

XMit 2020.12.30.0

EUT:	AZHL			Work Order:	NOKI0018
Serial Number:	YK203400016			Date:	26-Feb-21
Customer:	Nokia Solutions and Networks			Temperature:	23.9 °C
Attendees:	John Rattanavong, David Le			Humidity:	31% RH
Project:	None			Barometric Pres.:	1018 mbar
Tested by:	Marty Martin	Power:	Refer to Chart	Job Site:	TX05

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

COMMENTS

All measurement path losses were accounted for in the reference level offset including any attenuators, filters and DC blocks. The EUT temperature was stabilized at each temperature step (for a minimum of 30 minutes) prior to measurements. EUT operated at 100% duty cycle.

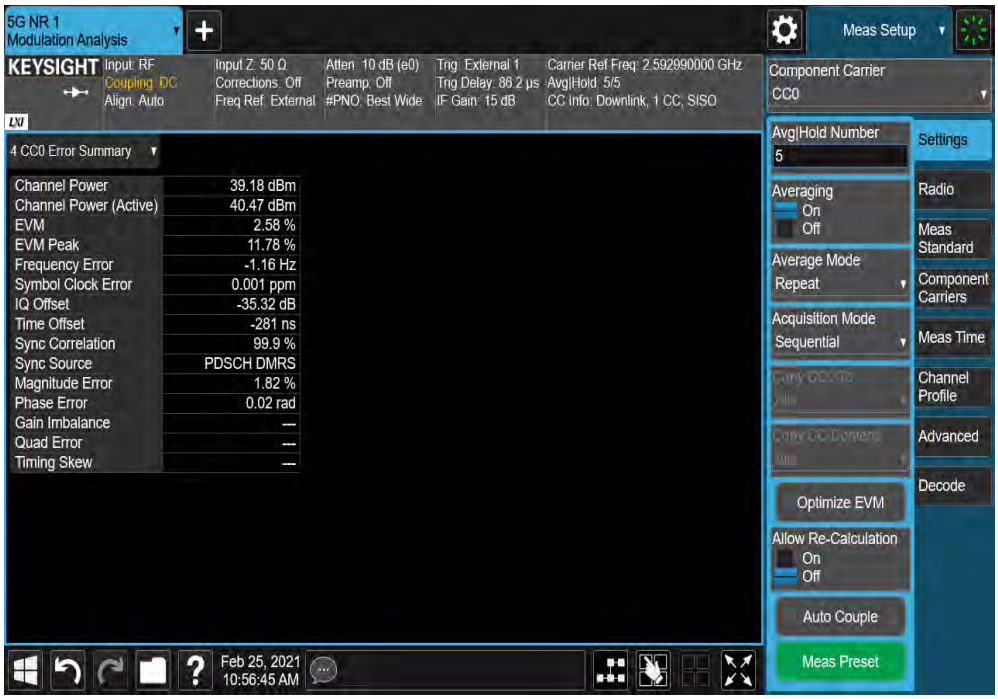
DEVIATIONS FROM TEST STANDARD

None

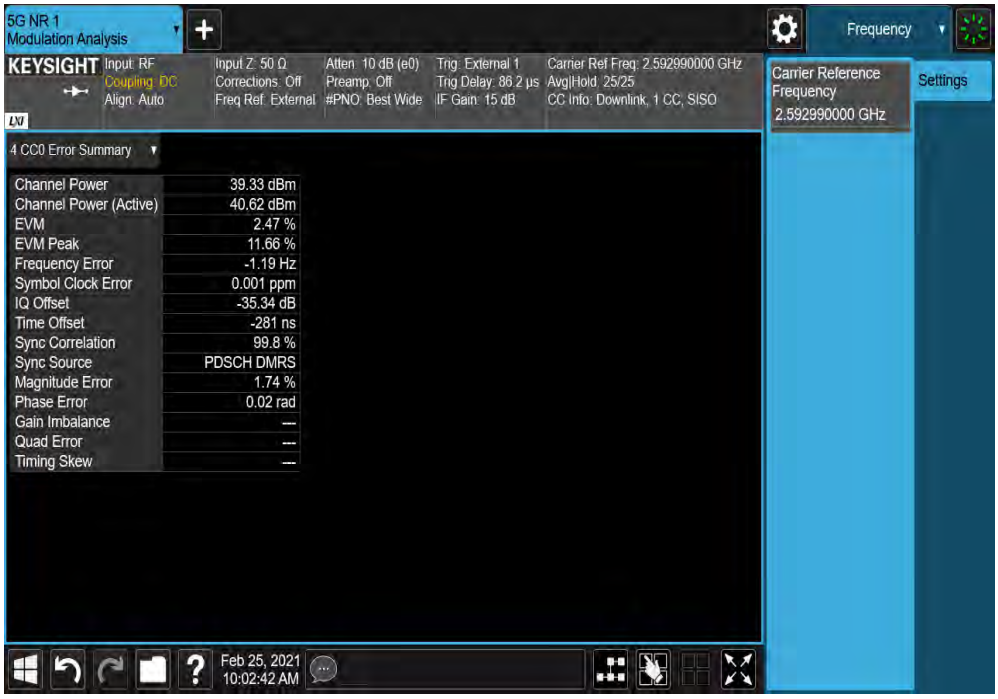
Configuration #	6	Signature

		Frequency Error Value in Hz	Limit	Result
5G NR Band n41 Carrier 2592.99 MHz NR 100				
-30 ºC				
	48 VDC	-1.16	1000 Hz	Pass
-20 ºC				
	48 VDC	-1.19	1000 Hz	Pass
-10 ºC				
	48 VDC	-1.09	1000 Hz	Pass
0 ºC				
	48 VDC	-1.14	1000 Hz	Pass
10 ºC				
	48 VDC	-1.27	1000 Hz	Pass
20 ºC				
	40.8 VDC	-1.24	1000 Hz	Pass
	48 VDC	-1.15	1000 Hz	Pass
	55.2 VDC	-1.41	1000 Hz	Pass
30 ºC				
	48 VDC	-1.65	1000 Hz	Pass
40 ºC				
	48 VDC	-1.39	1000 Hz	Pass
50 ºC				
	48 VDC	-1.5	1000 Hz	Pass

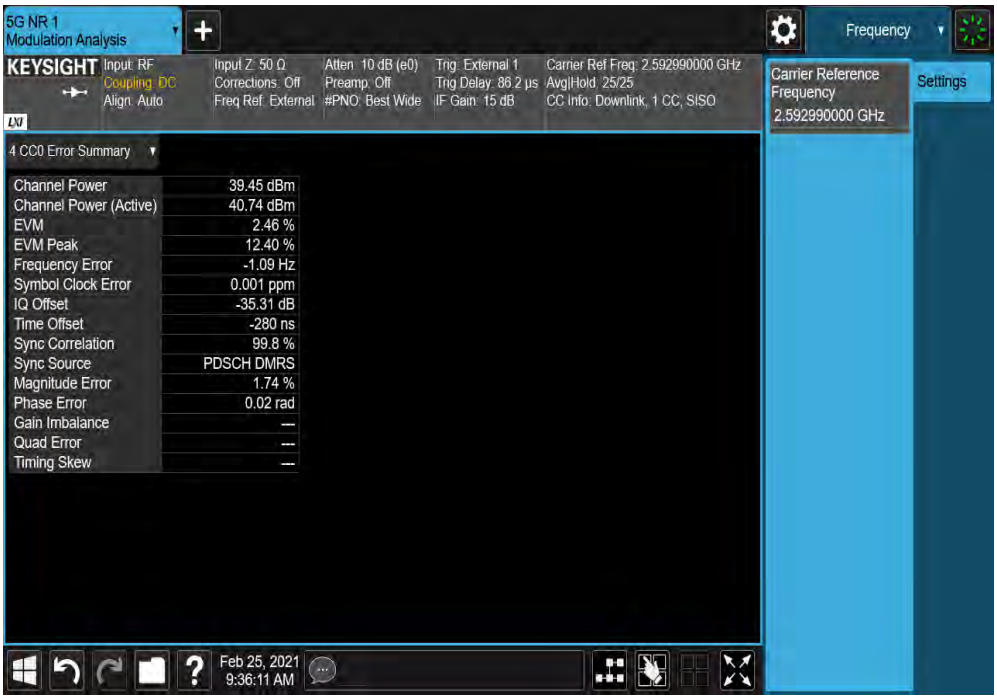
5G NR Band n41 Carrier 2592.99 MHz NR 100, -30 ºC, 48 VDC						
				Frequency Error		
				Value in Hz	Limit	Result
				-1.16	1000 Hz	Pass



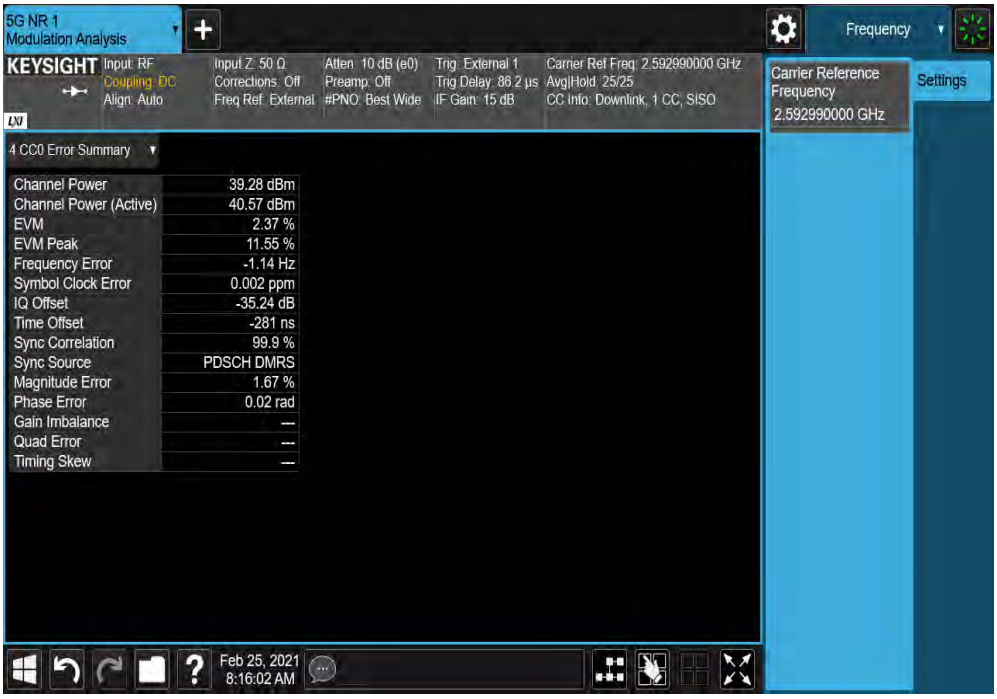
5G NR Band n41 Carrier 2592.99 MHz NR 100, -20 ºC, 48 VDC						
				Frequency Error		
				Value in Hz	Limit	Result
				-1.19	1000 Hz	Pass



5G NR Band n41 Carrier 2592.99 MHz NR 100, -10 °C, 48 VDC						
				Frequency Error		
				Value in Hz	**Limit**	**Result**
				-1.09	1000 Hz	Pass



5G NR Band n41 Carrier 2592.99 MHz NR 100, 0 °C, 48 VDC						
				Frequency Error		
				Value in Hz	**Limit**	**Result**
				-1.14	1000 Hz	Pass



FREQUENCY STABILITY

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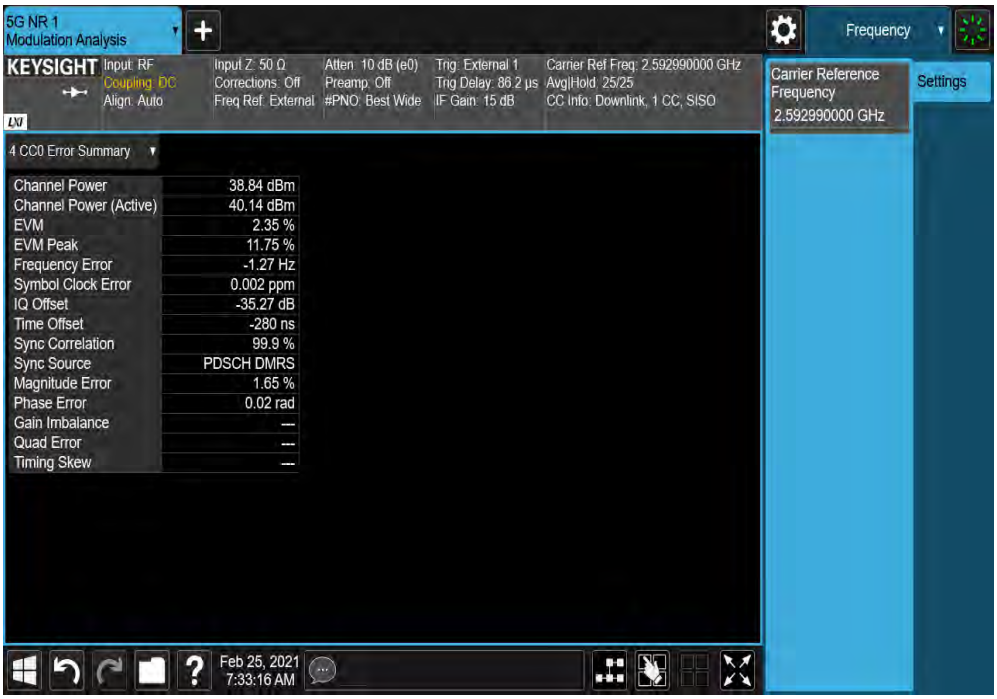
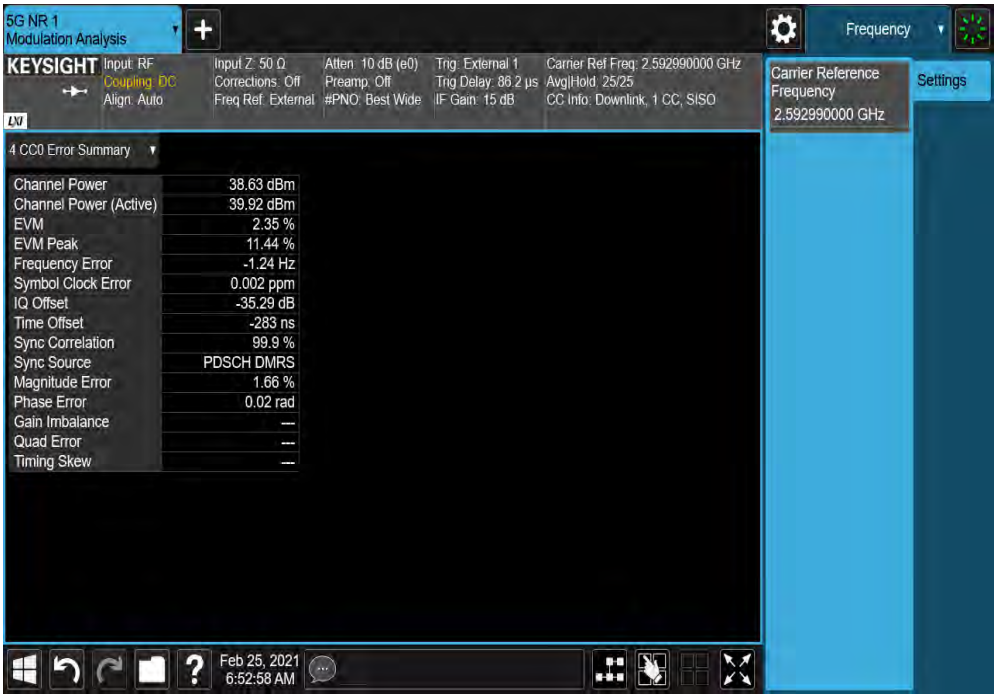
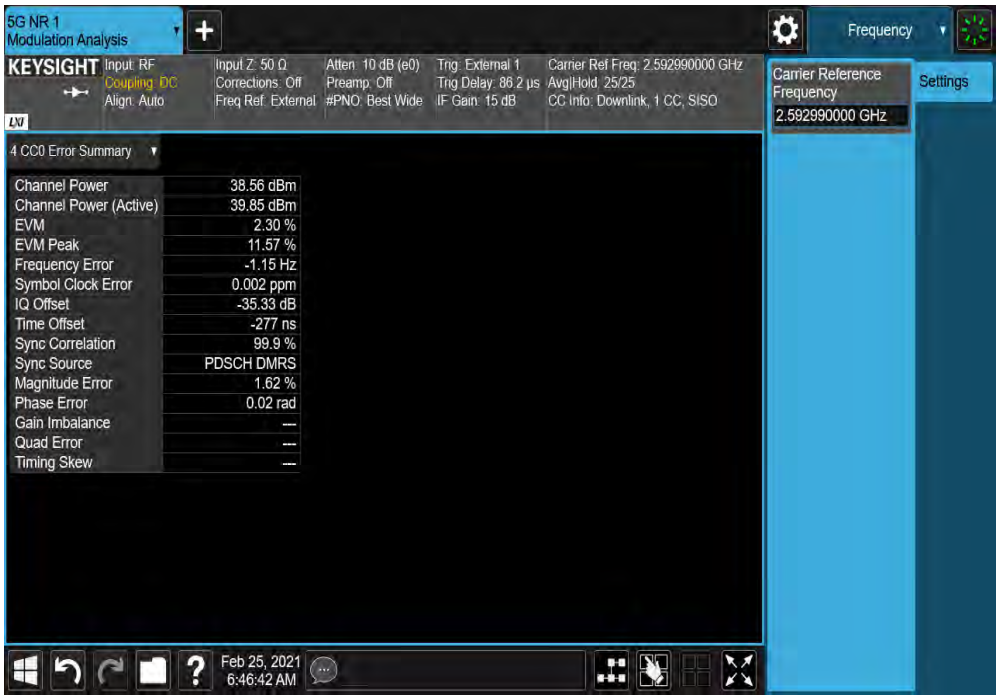
5G NR Band n41 Carrier 2592.99 MHz NR 100, 10 ºC, 48 VDC						
				Frequency Error		
				Value in Hz	Limit	Result
				-1.27	1000 Hz	Pass



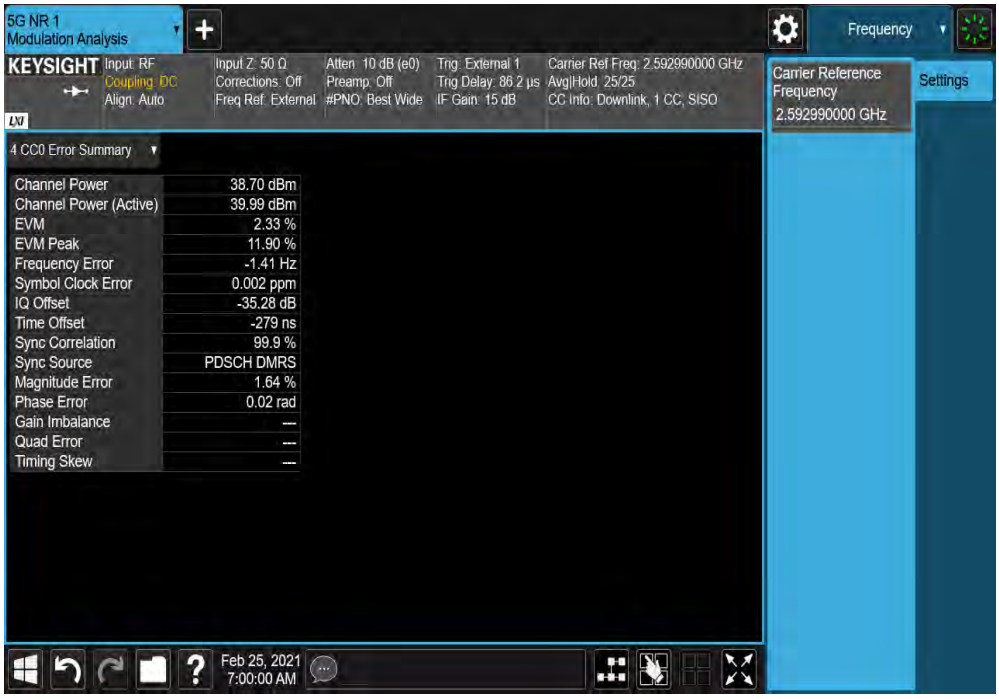
5G NR Band n41 Carrier 2592.99 MHz NR 100, 20 ºC, 40.8 VDC						
				Frequency Error		
				Value in Hz	Limit	Result
				-1.24	1000 Hz	Pass



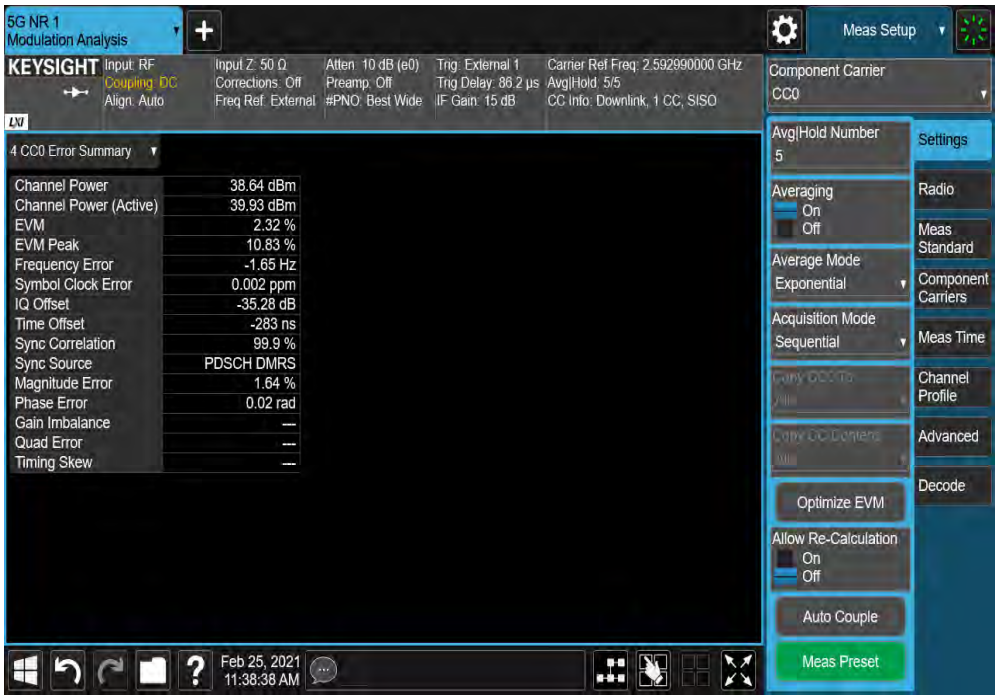
5G NR Band n41 Carrier 2592.99 MHz NR 100, 20 ºC, 48 VDC						
				Frequency Error		
				Value in Hz	**Limit**	**Result**
				-1.15	1000 Hz	Pass



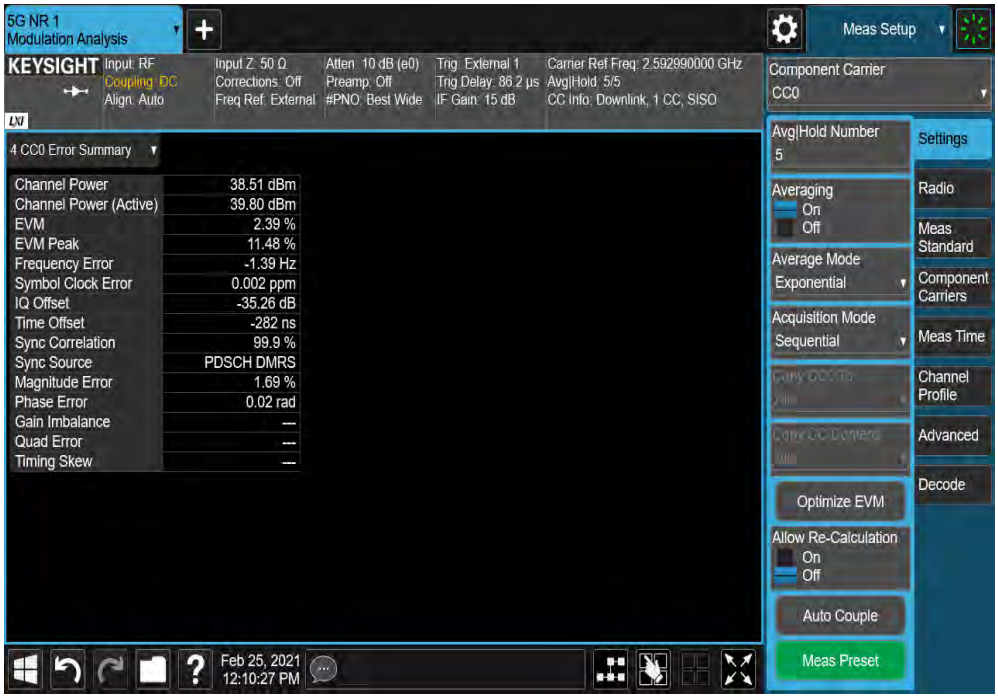
5G NR Band n41 Carrier 2592.99 MHz NR 100, 20 ºC, 55.2 VDC						
				Frequency Error		
				Value in Hz	**Limit**	**Result**
				-1.41	1000 Hz	Pass



5G NR Band n41 Carrier 2592.99 MHz NR 100, 30 ºC, 48 VDC						
				Frequency Error		
				Value in Hz	**Limit**	**Result**
				-1.65	1000 Hz	Pass



5G NR Band n41 Carrier 2592.99 MHz NR 100, 40 ºC, 48 VDC						
				Frequency Error		
				Value in Hz	**Limit**	**Result**
				-1.39	1000 Hz	Pass



FREQUENCY STABILITY

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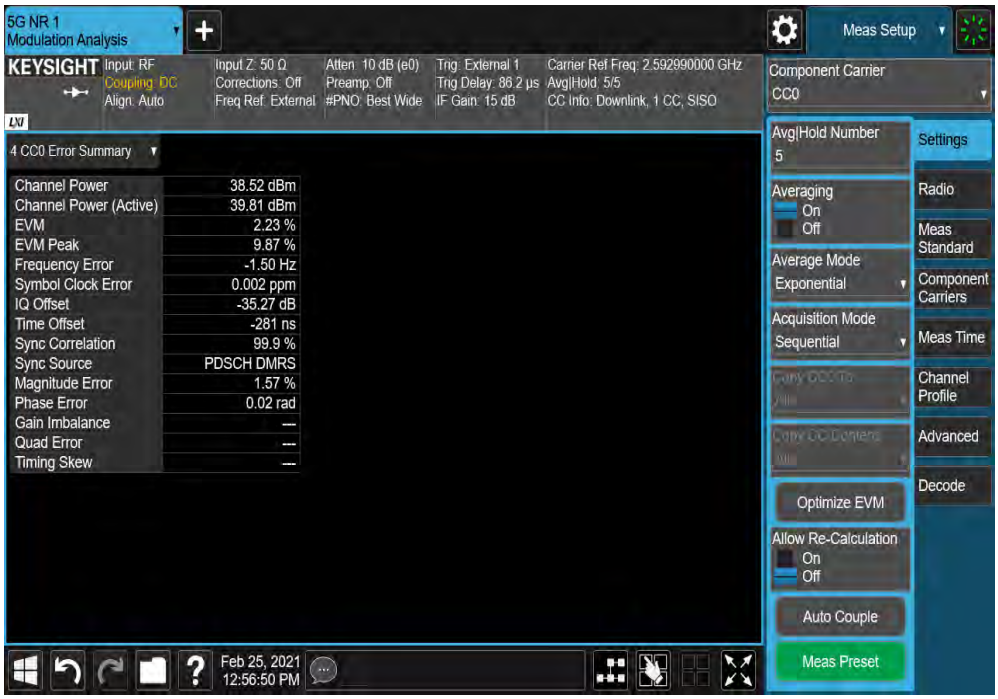
5G NR Band n41 Carrier 2592.99 MHz NR 100, 50 ºC, 48 VDC						
				Frequency Error		
				Value in Hz	Limit	Result
				-1.5	1000 Hz	Pass



OUTPUT POWER 01 - 8 PORTS

XMit 2020.03.25.0

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	27-Feb-20	27-Feb-21
Generator - Signal	Keysight	N5171B-506	TEW	2-May-18	2-May-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 output power (maximum average conducted output power) was measured using the channels and modes as called out on the follwoing 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 measurements. This method uses trace averaging across the 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 in decimal, to the measured power to compute the average power during the actual transmission times.

RF conducted emissions testing was performed on all ports at NR100 middle channel in order to prove the AZHL antenna ports are essentially electrically identical. 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.

OUTPUT POWER 01 - 8 PORTS

element

TbtTx 2019.08.30.0 XMit 2020.12.30.0

EUT:	**AZHL**			**Work Order:**	**NOKI0018**
Serial Number:	**YK203400016**			**Date:**	**19-Feb-21**
Customer:	**Nokia Solutions and Networks**			**Temperature:**	**23.6 °C**
Attendees:	**John Rattanavong, Mitchell Hill, David Le**			**Humidity:**	**14.9% RH**
Project:	**None**			**Barometric Pres.:**	**1037 mbar**
Tested by:	**Mark Baytan**	**Power:**	**54 VDC**	**Job Site:**	**TX05**

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

COMMENTS

External 1 gating was set using a trig delay = 86.2us and a gate length = 3.714ms. Reference level offset adjusted to include (2) coax cables, DC block, and attenuator. The carrier power was set to maximum for all testing. The following is the output power measurements at the radio output ports. The output power was measured for a single carrier channel bandwidth on ports 1-8.

DEVIATIONS FROM TEST STANDARD

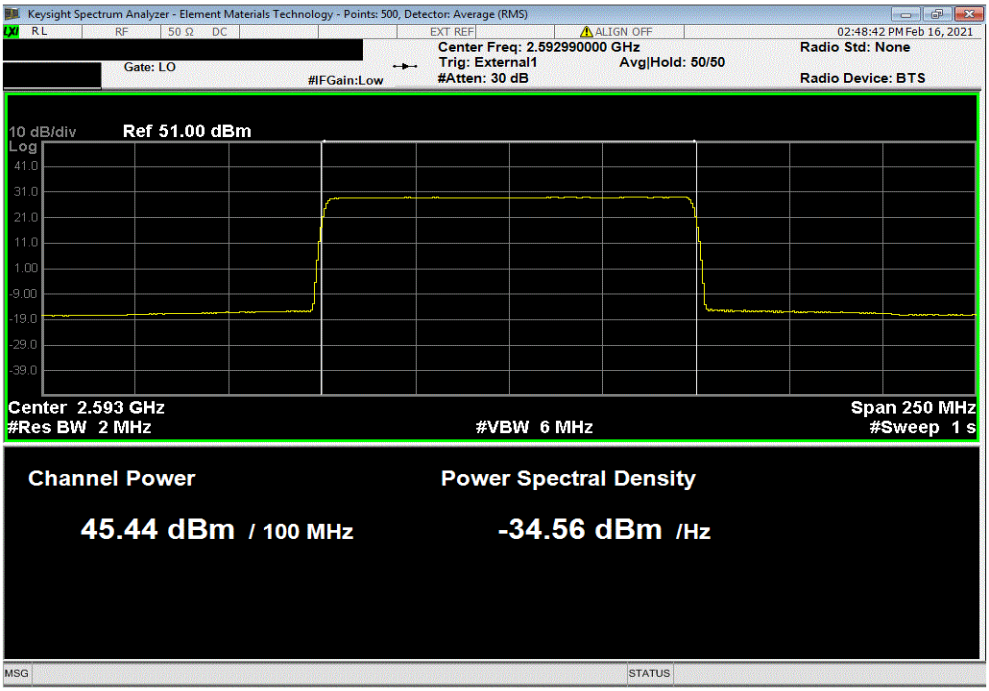
None

Configuration #	**2**	*Signature*

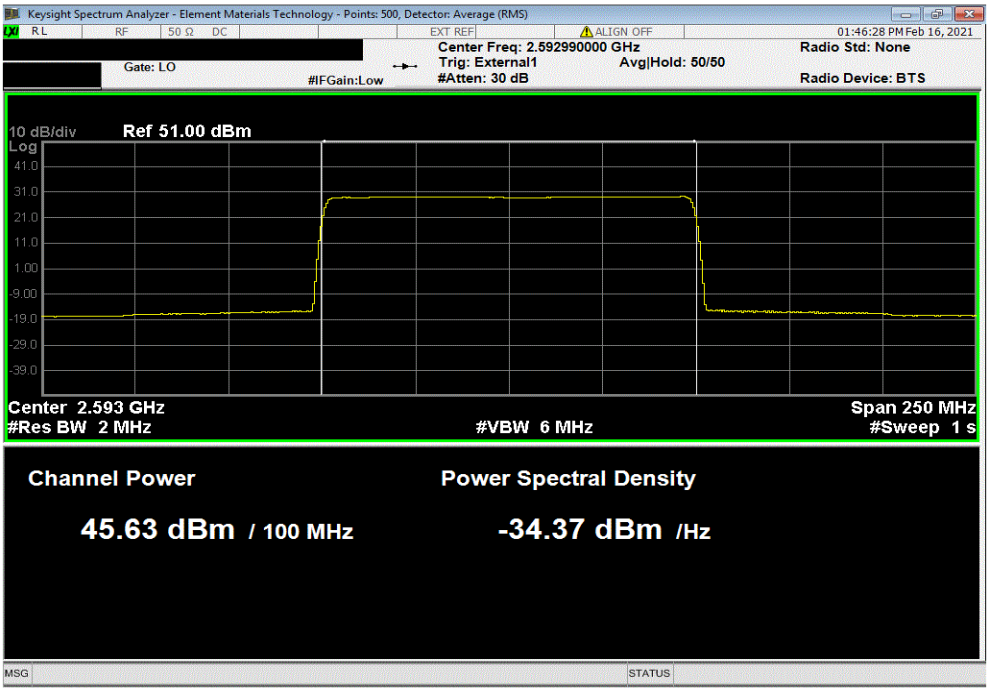
			Avg Cond Pwr (dBm)	**Duty Cycle Factor (dB)**	**Value (dBm)**
5G NR, Band n41, 2496 MHz - 2690 MHz					
Port 1					
	NR100 (100MHz)				
		256QAM			
		Middle Ch. 2592.99 MHz	45.444	0	45.4
Port 2					
	NR100 (100MHz)				
		256QAM			
		Middle Ch. 2592.99 MHz	45.626	0	45.6
Port 3					
	NR100 (100MHz)				
		256QAM			
		Middle Ch. 2592.99 MHz	45.864	0	45.9
Port 4					
	NR100 (100MHz)				
		256QAM			
		Middle Ch. 2592.99 MHz	45.894	0	45.9
Port 5					
	NR100 (100MHz)				
		256QAM			
		Middle Ch. 2592.99 MHz	45.805	0	45.8
Port 6					
	NR100 (100MHz)				
		256QAM			
		Middle Ch. 2592.99 MHz	45.516	0	45.5
Port 7					
	NR100 (100MHz)				
		256QAM			
		Middle Ch. 2592.99 MHz	45.534	0	45.5
Port 8					
	NR100 (100MHz)				
		256QAM			
		Middle Ch. 2592.99 MHz	45.632	0	45.6

OUTPUT POWER 01 - 8 PORTS

5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR100 (100MHz), 256QAM, Middle Ch. 2592.99 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)		
	45.444	0		45.4		

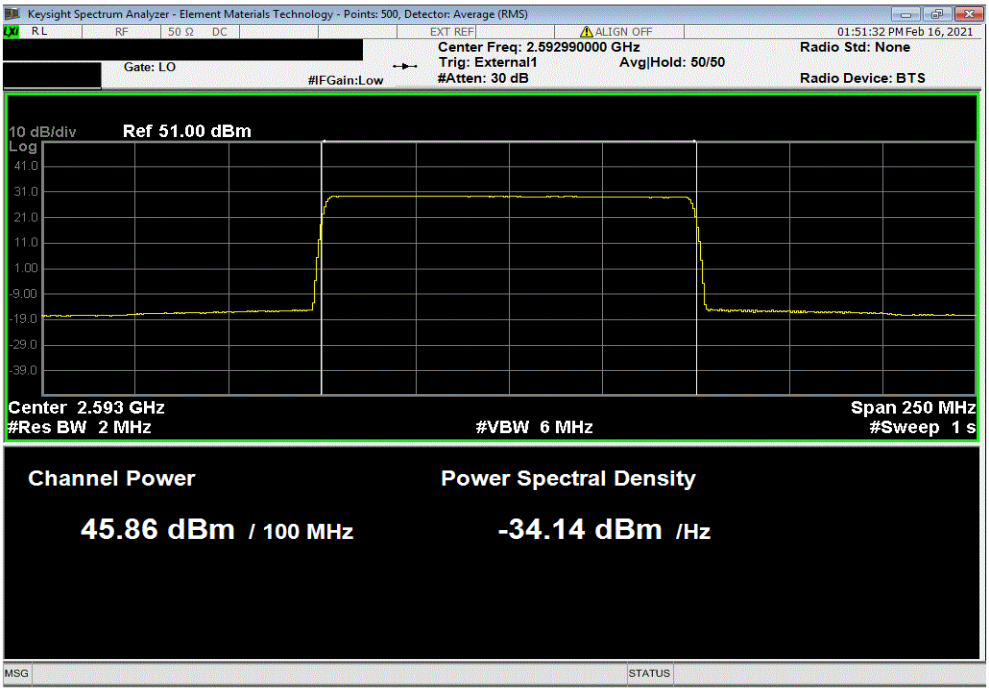


5G NR, Band n41, 2496 MHz - 2690 MHz, Port 2, NR100 (100MHz), 256QAM, Middle Ch. 2592.99 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)		
	45.626	0		45.6		

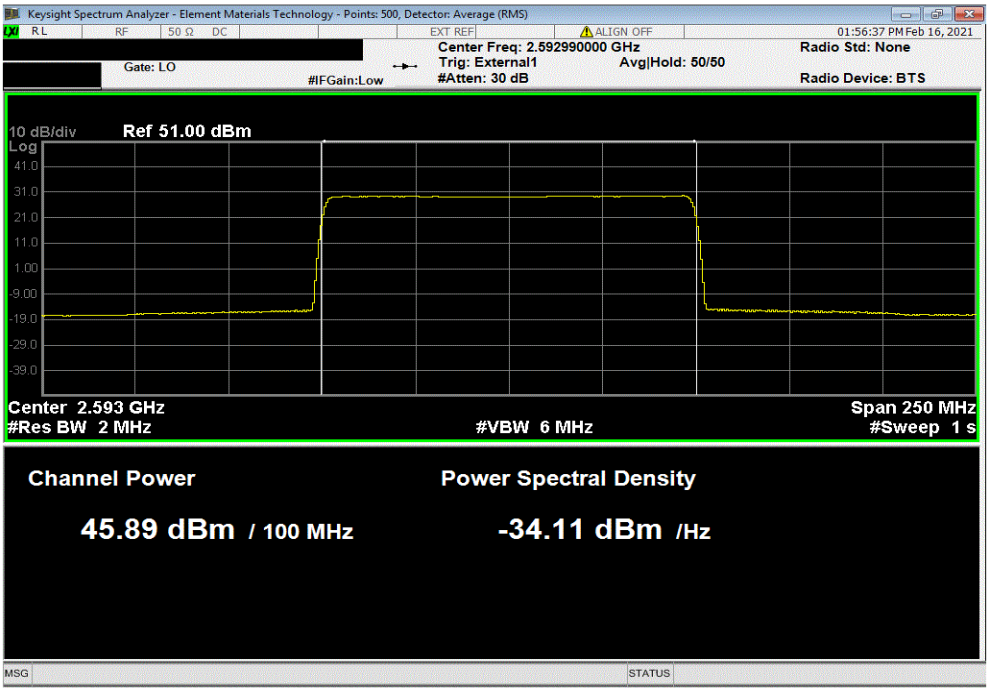


OUTPUT POWER 01 - 8 PORTS

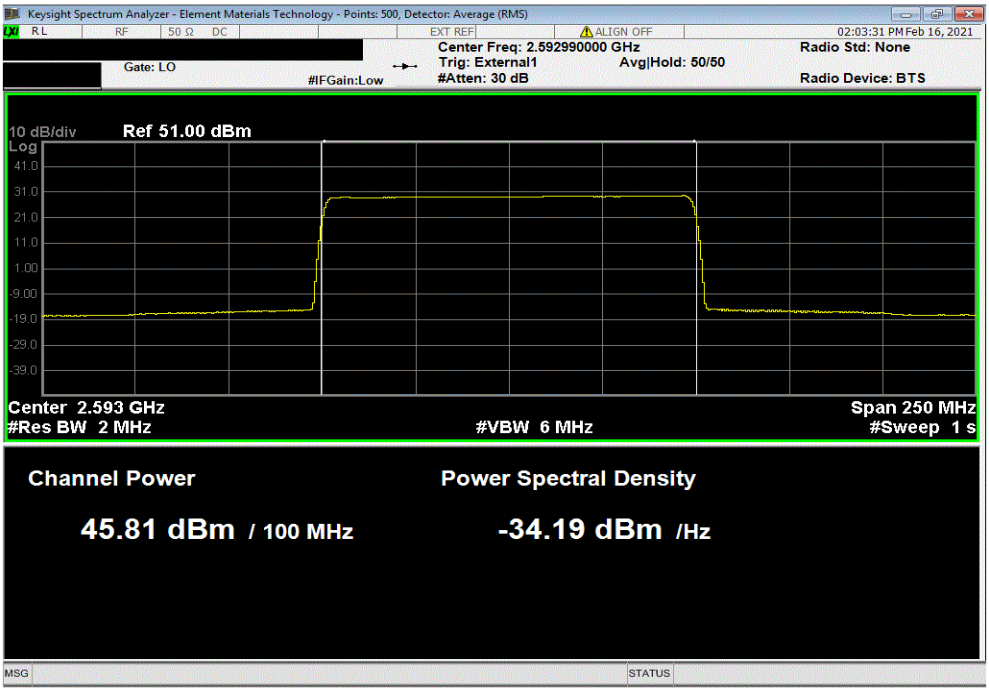
5G NR, Band n41, 2496 MHz - 2690 MHz, Port 3, NR100 (100MHz), 256QAM, Middle Ch. 2592.99 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)		
	45.864	0		45.9		



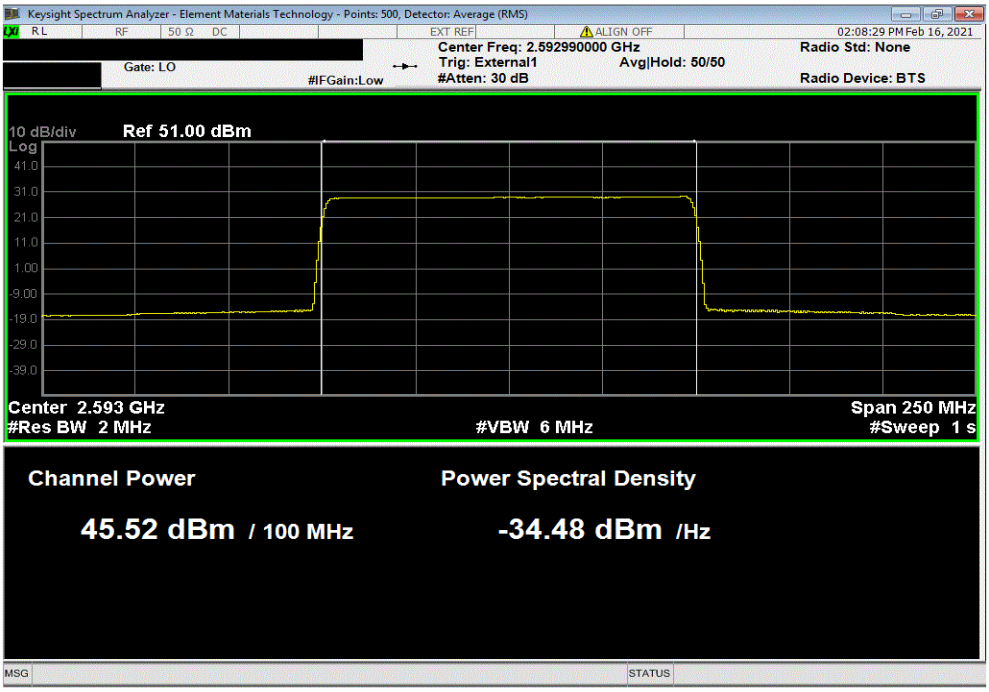
5G NR, Band n41, 2496 MHz - 2690 MHz, Port 4, NR100 (100MHz), 256QAM, Middle Ch. 2592.99 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)		
	45.894	0		45.9		



5G NR, Band n41, 2496 MHz - 2690 MHz, Port 5, NR100 (100MHz), 256QAM, Middle Ch. 2592.99 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)		
	45.805	0		45.8		

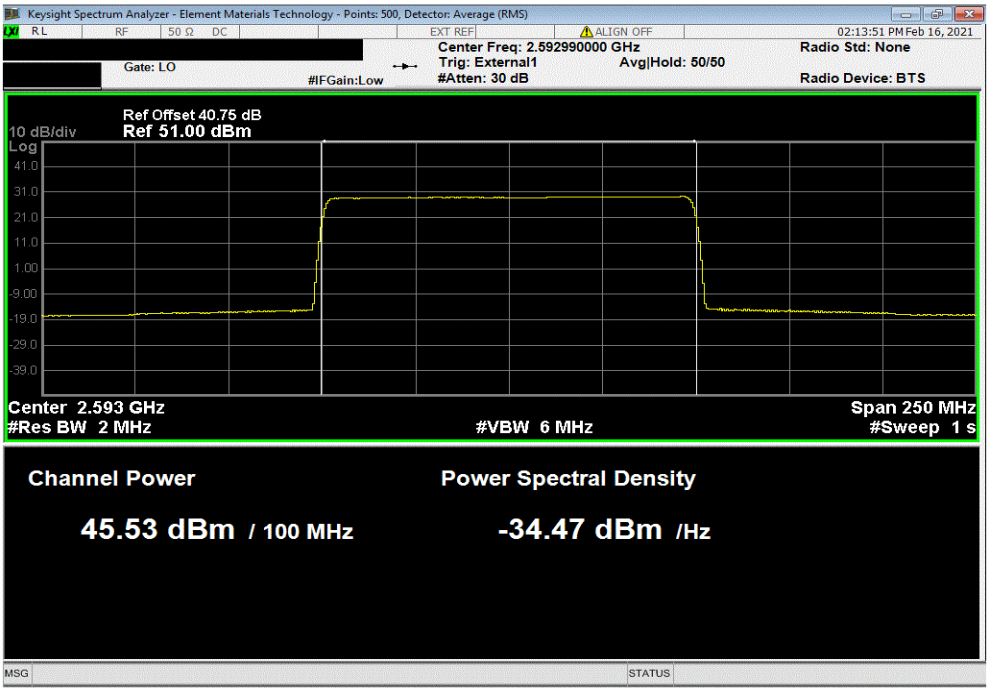


5G NR, Band n41, 2496 MHz - 2690 MHz, Port 6, NR100 (100MHz), 256QAM, Middle Ch. 2592.99 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)		
	45.516	0		45.5		

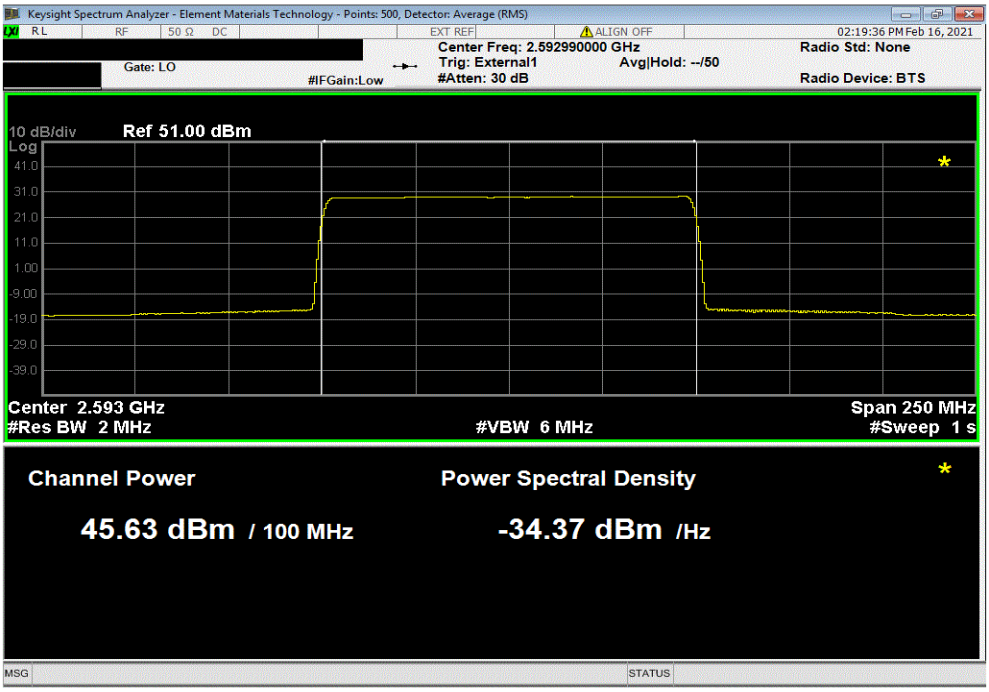


OUTPUT POWER 01 - 8 PORTS

5G NR, Band n41, 2496 MHz - 2690 MHz, Port 7, NR100 (100MHz), 256QAM, Middle Ch. 2592.99 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)		
	45.534	0		45.5		



5G NR, Band n41, 2496 MHz - 2690 MHz, Port 8, NR100 (100MHz), 256QAM, Middle Ch. 2592.99 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)		
	45.632	0		45.6		



OUTPUT POWER 02 5G & EIRP CALCULATION

XMit 2020.03.25.0

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	27-Feb-20	27-Feb-21
Generator - Signal	Keysight	N5171B-506	TEW	2-May-18	2-May-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 output power (maximum average conducted output power) was measured using the channels and modes as called out on the follwoing 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 measurements. This method uses trace averaging across the 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 in decimal, to the measured power to compute the average power during the actual transmission times.

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 8 port 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.

The total average transmit power of all antenna ports was determined per ANSI C63.26-2105 paragraph 6.4.3.1.

The EIRP limit is defined by FCC Part27.50(h)(ii) as 33dBW+ 10Log(X/Y) dBW + 10 log(360/beamwidth) dBW where X is the channel width in MHz and Y is 5.5 or 6MHz. PSD (power/1MHz) measurements are not required for this radio since the FCC limits for EIRP are defined in watts.

OUTPUT POWER 02 5G & EIRP CALCULATION

element

TbtTx 2019.08.30.0 XMit 2020.12.30.0

EUT:	AZHL			**Work Order:**	NOKI0018
Serial Number:	YK203400016			**Date:**	19-Feb-21
Customer:	Nokia Solutions and Networks			**Temperature:**	23.6 °C
Attendees:	John Rattanavong, Mitchell Hill, David Le			**Humidity:**	14.9% RH
Project:	None			**Barometric Pres.:**	1037 mbar
Tested by:	Mark Baytan	**Power:**	54 VDC	**Job Site:**	TX05

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

COMMENTS

External 1 gating was set using a trig delay = 86.2us and a gate length = 3.714ms. Reference level offset adjusted to include (2) coax cables, DC block, and attenuator. The carrier power was set to maximum for all testing. The following is the output power measurements at the radio output ports. The output power was measured for a single carrier channel bandwidth on port 1. The total output power for multiport (2x2 MIMO, 4x4 MIMO and 8x8 MIMO) operation was determined based upon ANSI C63.26 clauses 6.4.3.1 and 6.4.3.2.4 (10 Log Nout). The total output power for two port operation is single port power + 3dB [i.e.: 10 Log(2)]. The total output power for four port operation is single port power + 6dB [i.e.: 10 Log(4)]. The total output power for eight port operation is single port power + 9dB [i.e.: 10 Log(8)].

DEVIATIONS FROM TEST STANDARD

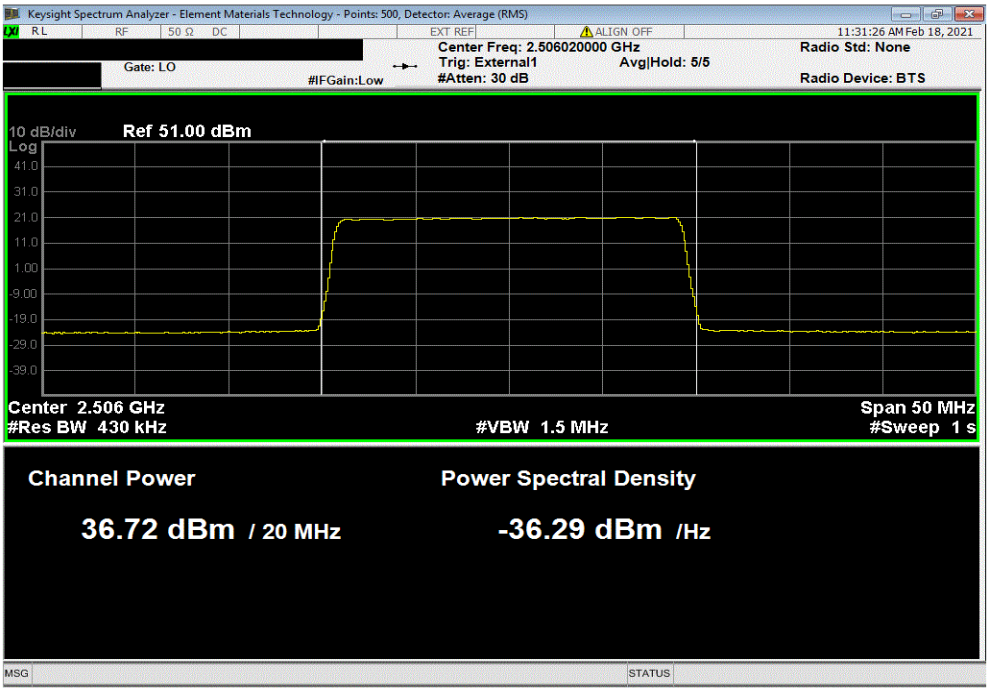
None

Configuration #	2	Signature

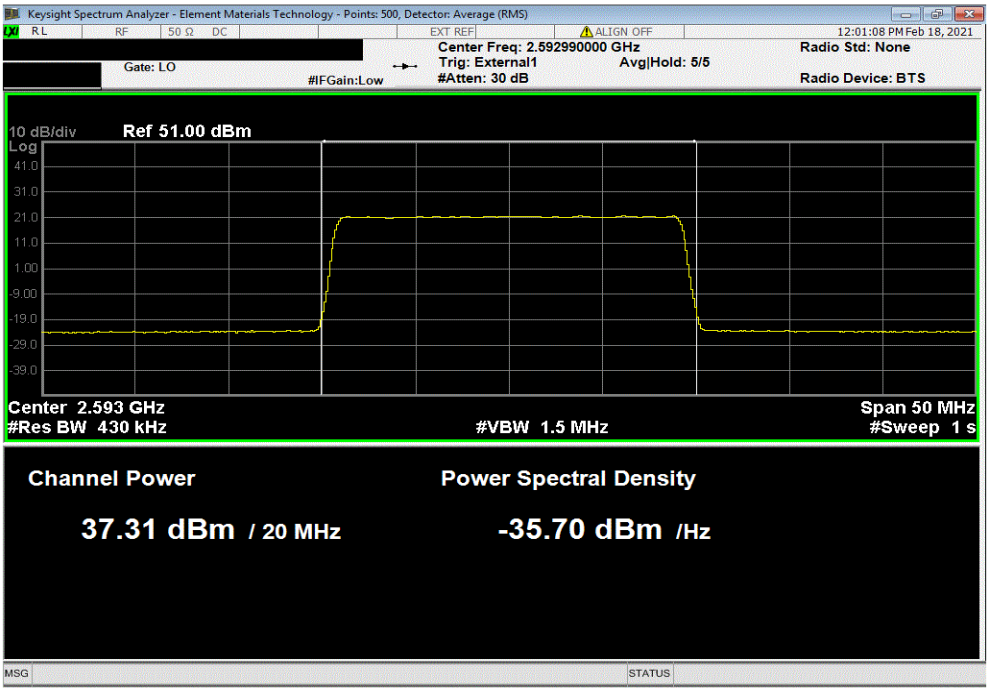
			Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	2 Port (2x2 MIMO) dBm/Carrier BW	4 Port (4x4 MIMO) dBm/Carrier BW	8 Port (8x8 MIMO) dBm/Carrier BW
5G NR, Band n41, 2496 MHz - 2690 MHz								
Port 1								
	NR20 (20MHz)							
		256QAM						
		Low Channel 2506.02 MHz	36.718	0	36.718	39.718	42.718	45.718
		Mid Channel 2592.99 MHz	37.313	0	37.313	40.313	43.313	46.313
		High Channel 2679.99 MHz	37.477	0	37.477	40.477	43.477	46.477
	NR40 (40MHz)							
		256QAM						
		Low Channel 2516.01 MHz	39.229	0	39.229	42.229	45.229	48.229
		Mid Channel 2592.99 MHz	39.562	0	39.562	42.562	45.562	48.562
		High Channel 2670 MHz	39.788	0	39.788	42.788	45.788	48.788
	NR60 (60MHz)							
		256QAM						
		Low Channel 2526 MHz	40.992	0	40.992	43.992	46.992	49.992
		Mid Channel 2592.99 MHz	41.206	0	41.206	44.206	47.206	50.206
		High Channel 2659.98 MHz	41.443	0	41.443	44.443	47.443	50.443
	NR80 (80MHz)							
		256QAM						
		Low Channel 2536.02 MHz	42.264	0	42.264	45.264	48.264	51.264
		Mid Channel 2592.99 MHz	42.239	0	42.239	45.239	48.239	51.239
		High Channel 2649.99 MHz	42.648	0	42.648	45.648	48.648	51.648
	NR100 (100MHz)							
		QPSK						
		Mid Channel 2592.99 MHz	45.381	0	45.381	48.381	51.381	54.381
		16QAM						
		Mid Channel 2592.99 MHz	45.313	0	45.313	48.313	51.313	54.313
		64QAM						
		Mid Channel 2592.99 MHz	45.375	0	45.375	48.375	51.375	54.375
		256QAM						
		Low Channel 2546.01 MHz	45.69	0	45.69	48.69	51.69	54.69
		Mid Channel 2592.99 MHz	45.53	0	45.53	48.53	51.53	54.53
		High Channel 2640 MHz	45.293	0	45.293	48.293	51.293	54.293

OUTPUT POWER 02 5G & EIRP CALCULATION

5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR20 (20MHz), 256QAM, Low Channel 2506.02 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Port (2x2 MIMO) dBm/Carrier BW	Port (4x4 MIMO) dBm/Carrier BW	Port (8x8 MIMO) dBm/Carrier BW
	36.718	0	36.718	39.718	42.718	45.718

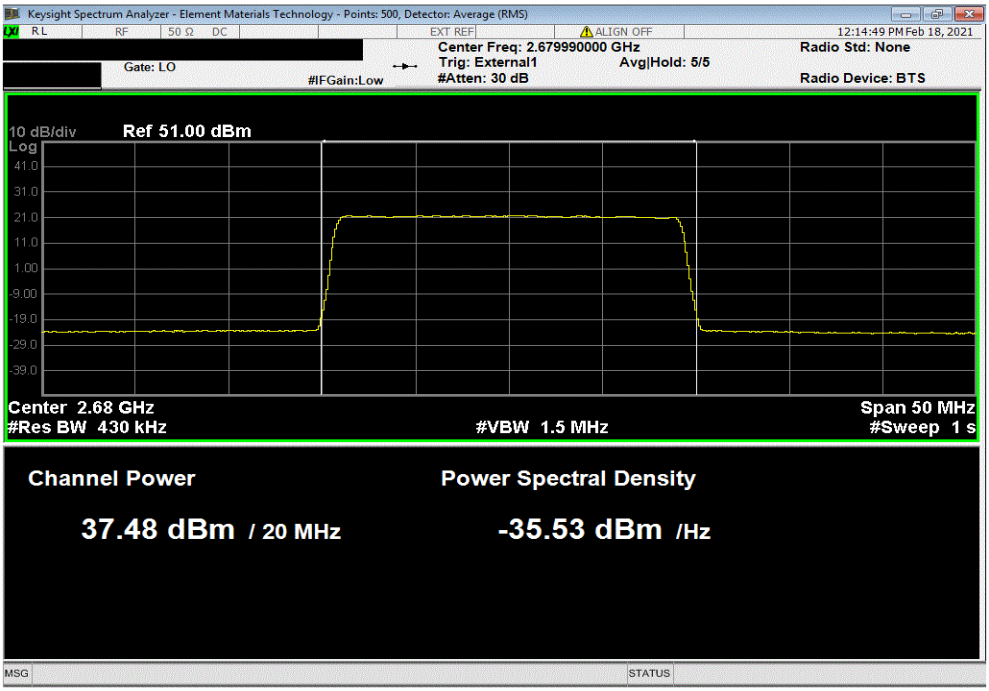


5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR20 (20MHz), 256QAM, Mid Channel 2592.99 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Port (2x2 MIMO) dBm/Carrier BW	Port (4x4 MIMO) dBm/Carrier BW	Port (8x8 MIMO) dBm/Carrier BW
	37.313	0	37.313	40.313	43.313	46.313

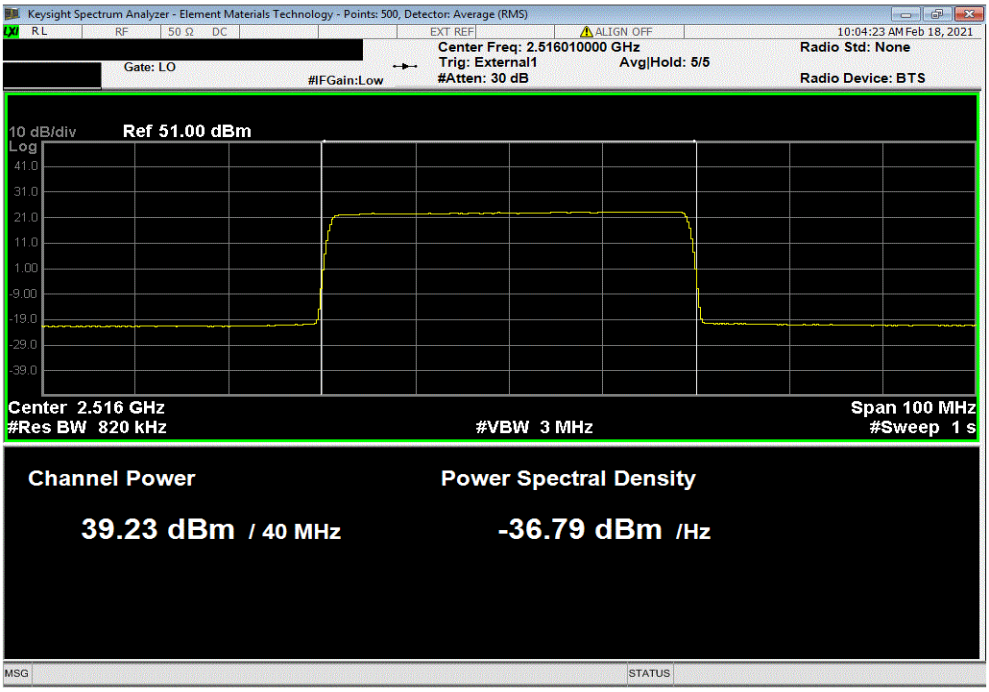


OUTPUT POWER 02 5G & EIRP CALCULATION

5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR20 (20MHz), 256QAM, High Channel 2679.99 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Port (2x2 MIMO) dBm/Carrier BW	Port (4x4 MIMO) dBm/Carrier BW	Port (8x8 MIMO) dBm/Carrier BW
	37.477	0	37.477	40.477	43.477	46.477

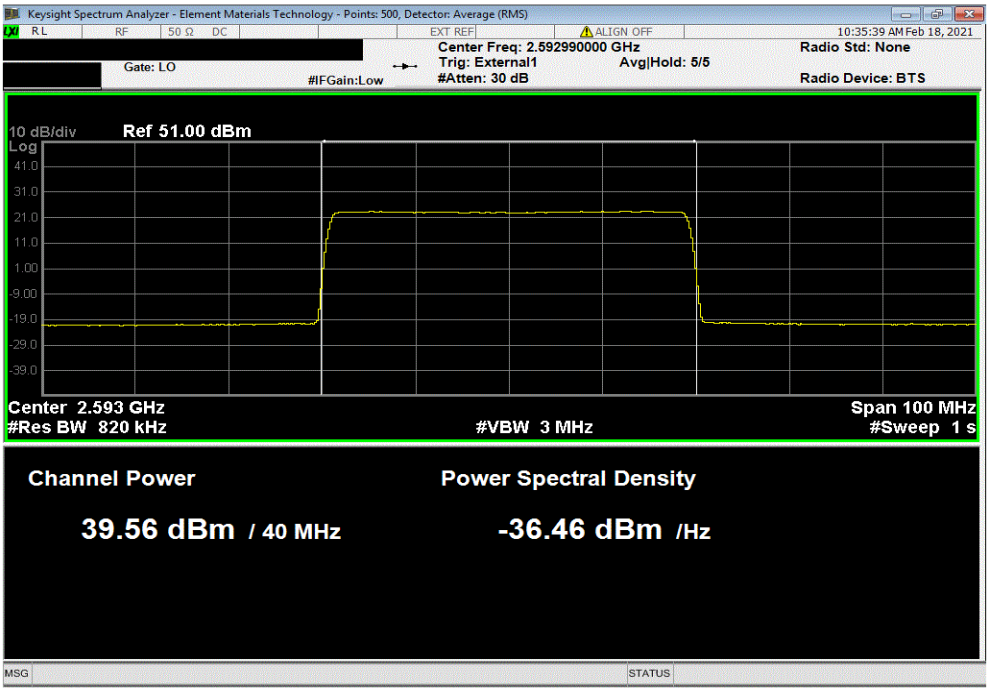


5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR40 (40MHz), 256QAM, Low Channel 2516.01 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Port (2x2 MIMO) dBm/Carrier BW	Port (4x4 MIMO) dBm/Carrier BW	Port (8x8 MIMO) dBm/Carrier BW
	39.229	0	39.229	42.229	45.229	48.229

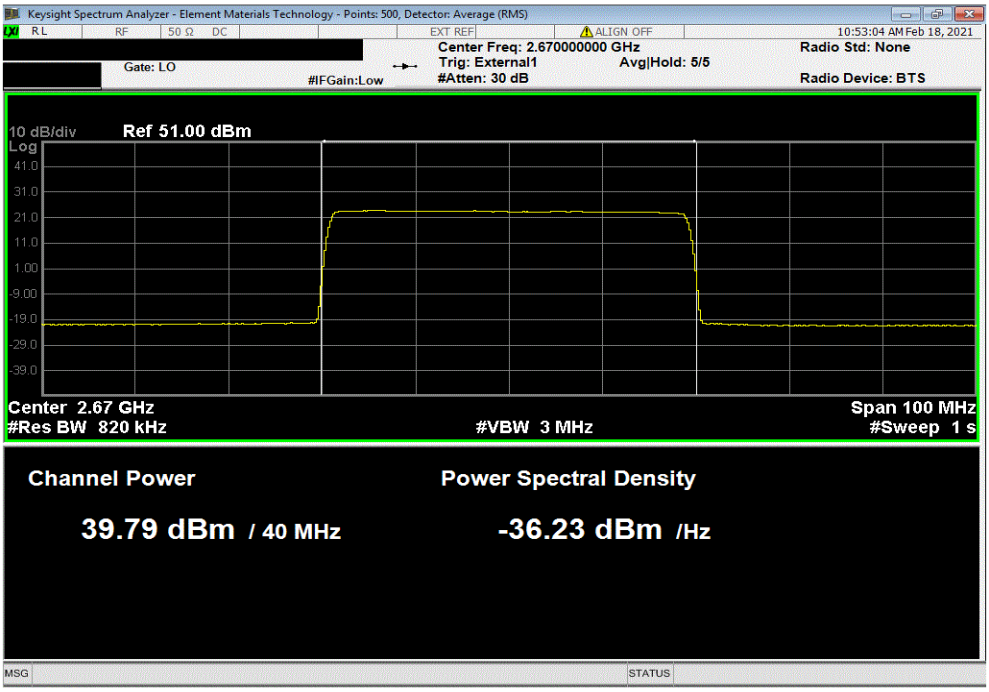


OUTPUT POWER 02 5G & EIRP CALCULATION

5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR40 (40MHz), 256QAM, Mid Channel 2592.99 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Port (2x2 MIMO) dBm/Carrier BW	Port (4x4 MIMO) dBm/Carrier BW	Port (8x8 MIMO) dBm/Carrier BW
	39.562	0	39.562	42.562	45.562	48.562

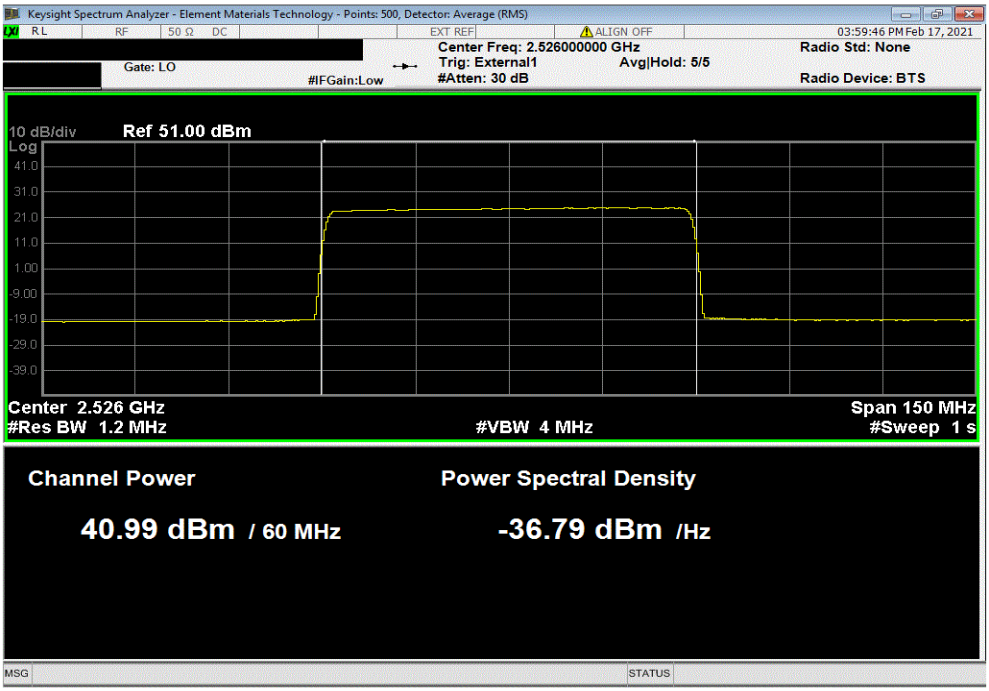


5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR40 (40MHz), 256QAM, High Channel 2670 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Port (2x2 MIMO) dBm/Carrier BW	Port (4x4 MIMO) dBm/Carrier BW	Port (8x8 MIMO) dBm/Carrier BW
	39.788	0	39.788	42.788	45.788	48.788

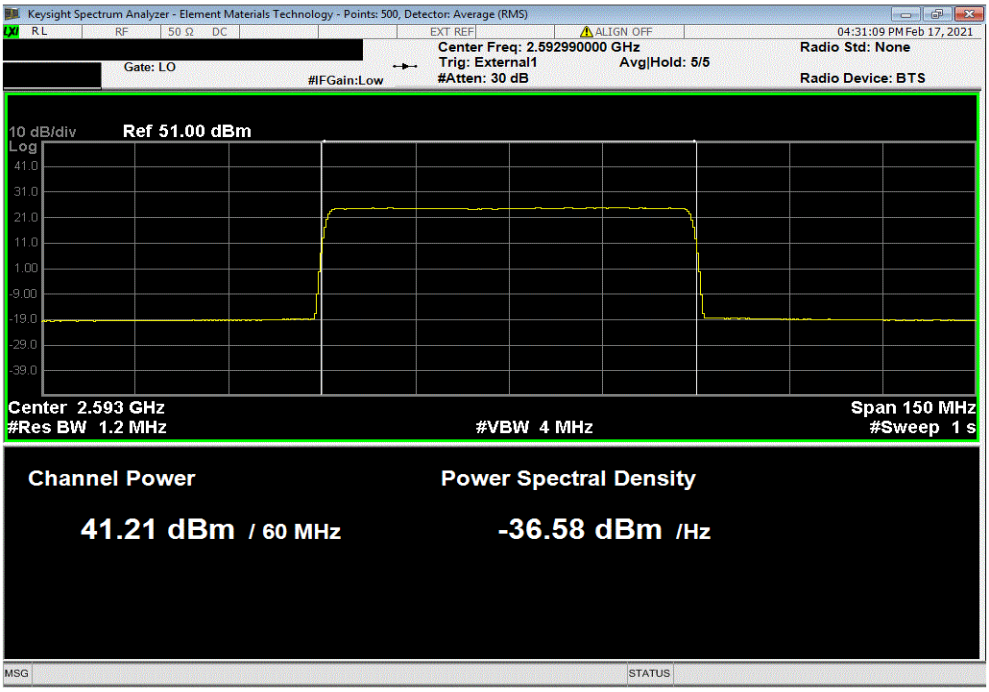


OUTPUT POWER 02 5G & EIRP CALCULATION

5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR60 (60MHz), 256QAM, Low Channel 2526 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Port (2x2 MIMO) dBm/Carrier BW	Port (4x4 MIMO) dBm/Carrier BW	Port (8x8 MIMO) dBm/Carrier BW
	40.992	0	40.992	43.992	46.992	49.992

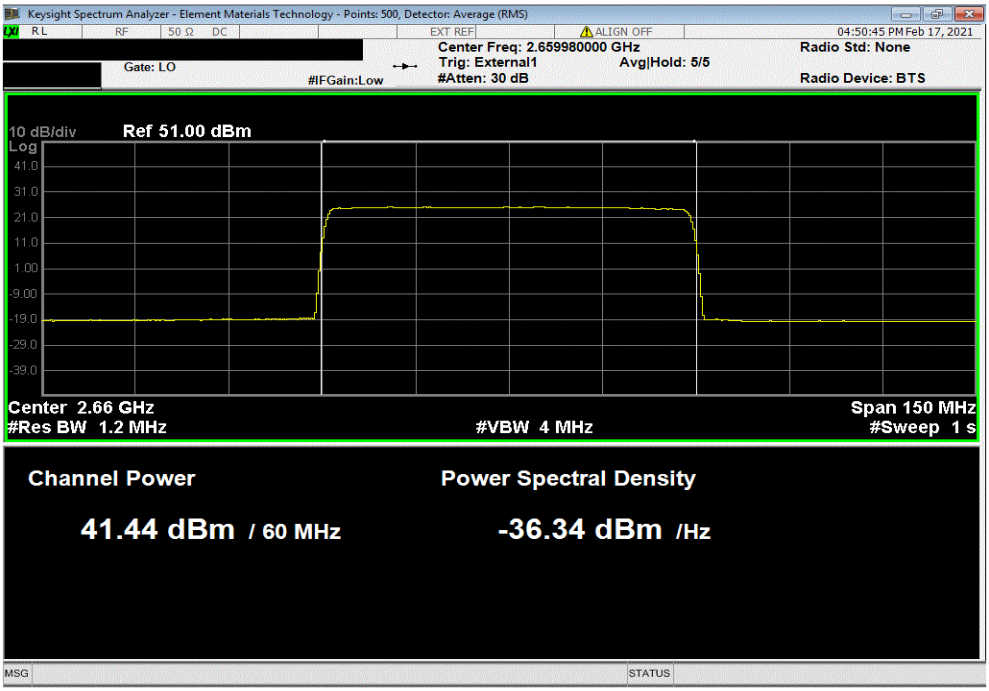


5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR60 (60MHz), 256QAM, Mid Channel 2592.99 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Port (2x2 MIMO) dBm/Carrier BW	Port (4x4 MIMO) dBm/Carrier BW	Port (8x8 MIMO) dBm/Carrier BW
	41.206	0	41.206	44.206	47.206	50.206

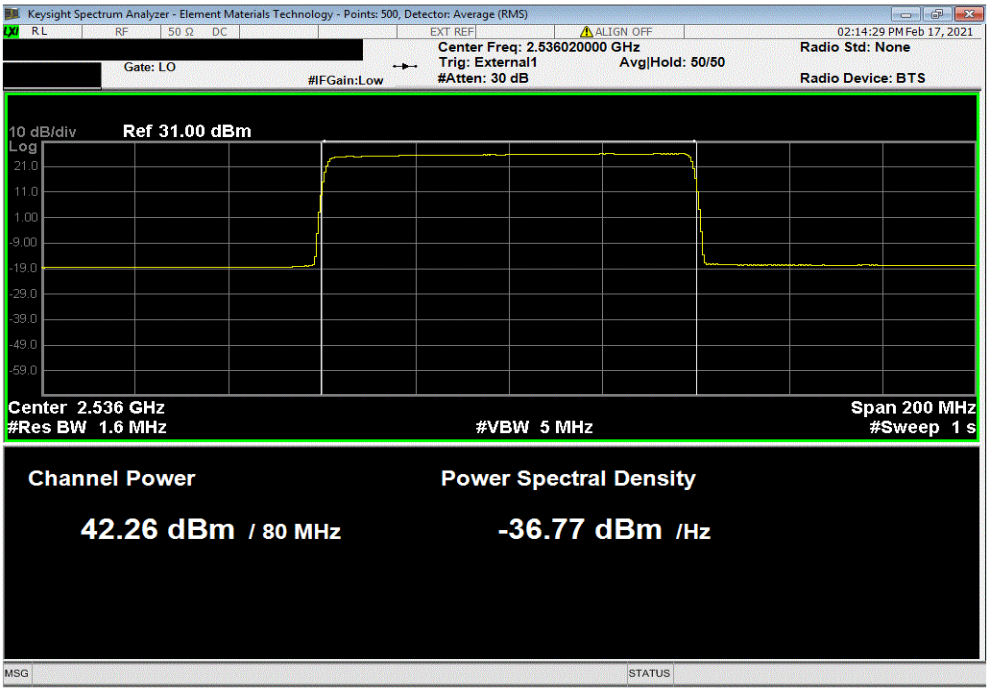


OUTPUT POWER 02 5G & EIRP CALCULATION

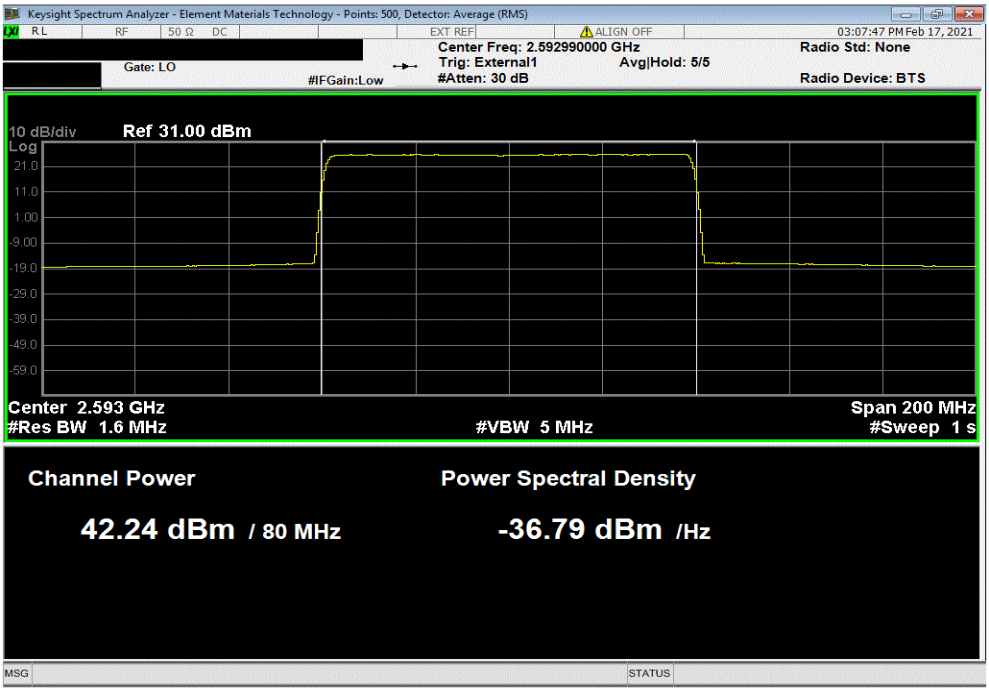
5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR60 (60MHz), 256QAM, High Channel 2659.98 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Port (2x2 MIMO) dBm/Carrier BW	Port (4x4 MIMO) dBm/Carrier BW	Port (8x8 MIMO) dBm/Carrier BW
	41.443	0	41.443	44.443	47.443	50.443



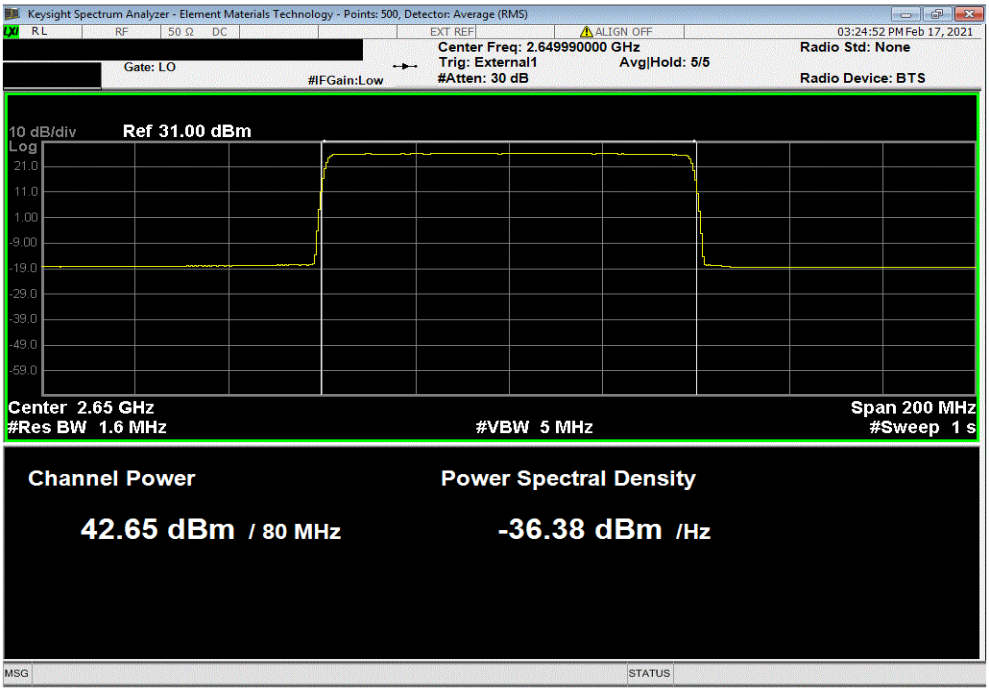
5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR80 (80MHz), 256QAM, Low Channel 2536.02 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Port (2x2 MIMO) dBm/Carrier BW	Port (4x4 MIMO) dBm/Carrier BW	Port (8x8 MIMO) dBm/Carrier BW
	42.264	0	42.264	45.264	48.264	51.264



5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR80 (80MHz), 256QAM, Mid Channel 2592.99 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Port (2x2 MIMO) dBm/Carrier BW	Port (4x4 MIMO) dBm/Carrier BW	Port (8x8 MIMO) dBm/Carrier BW
	42.239	0	42.239	45.239	48.239	51.239

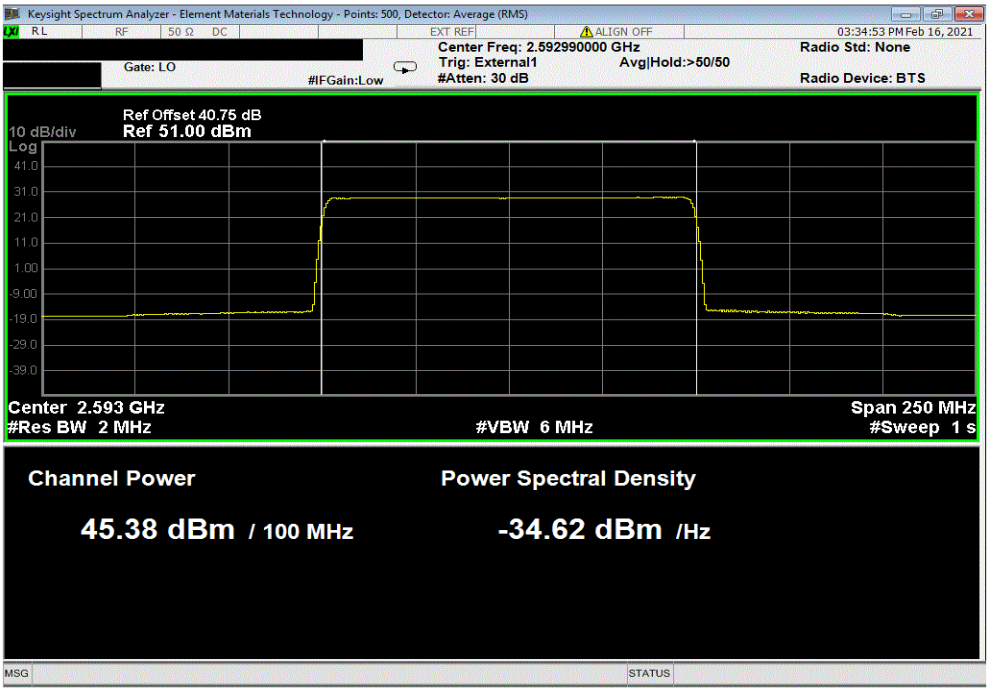


5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR80 (80MHz), 256QAM, High Channel 2649.99 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Port (2x2 MIMO) dBm/Carrier BW	Port (4x4 MIMO) dBm/Carrier BW	Port (8x8 MIMO) dBm/Carrier BW
	42.648	0	42.648	45.648	48.648	51.648

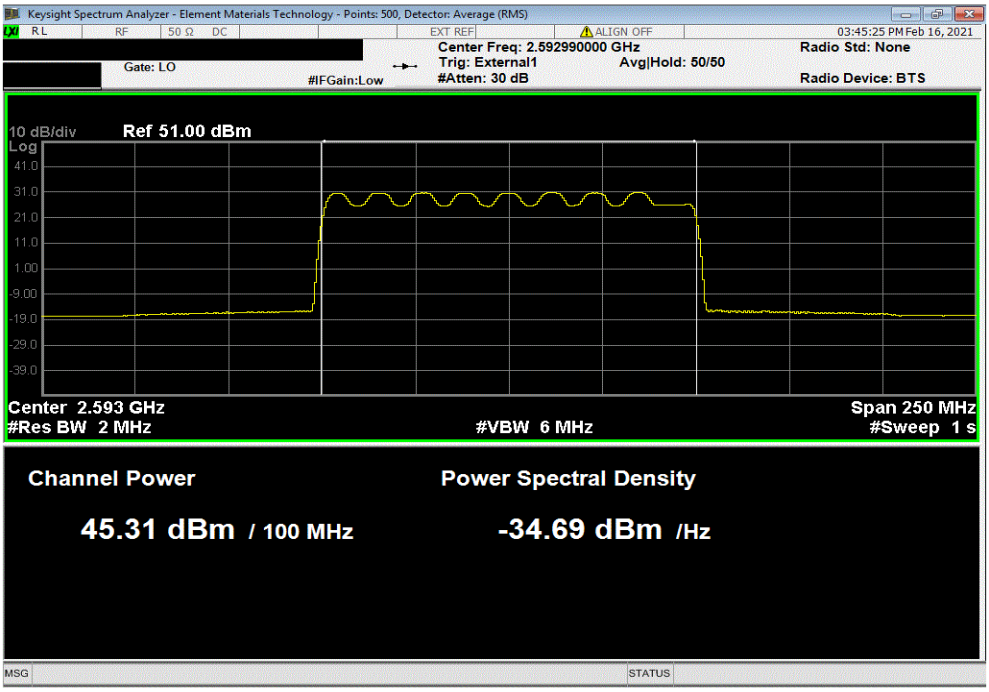


OUTPUT POWER 02 5G & EIRP CALCULATION

5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR100 (100MHz), QPSK, Mid Channel 2592.99 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Port (2x2 MIMO) dBm/Carrier BW	Port (4x4 MIMO) dBm/Carrier BW	Port (8x8 MIMO) dBm/Carrier BW
	45.381	0	45.381	48.381	51.381	54.381

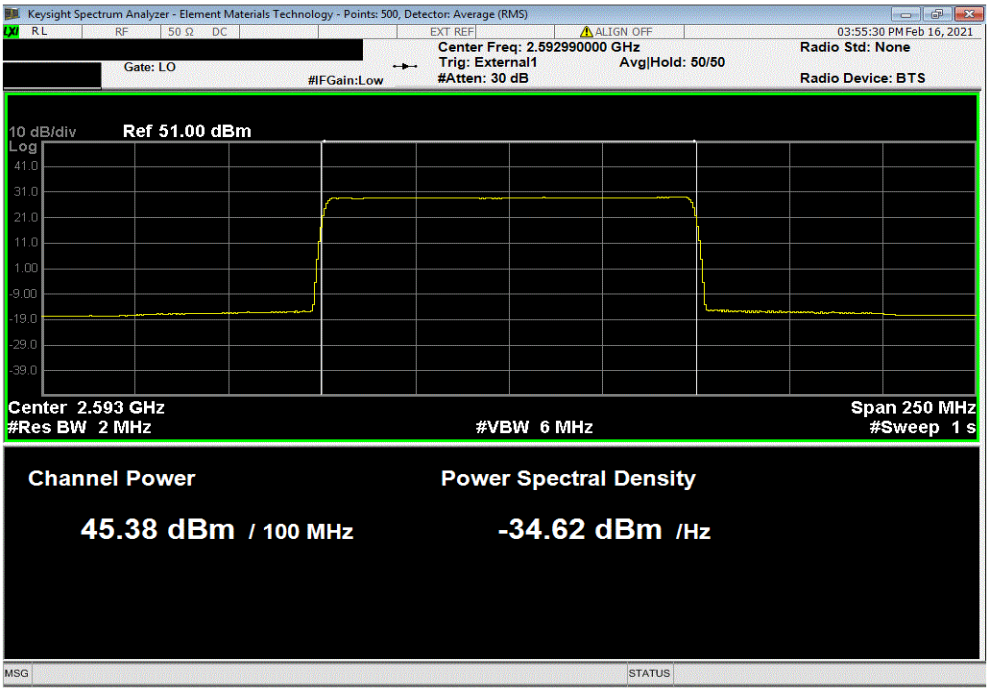


5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR100 (100MHz), 16QAM, Mid Channel 2592.99 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Port (2x2 MIMO) dBm/Carrier BW	Port (4x4 MIMO) dBm/Carrier BW	Port (8x8 MIMO) dBm/Carrier BW
	45.313	0	45.313	48.313	51.313	54.313

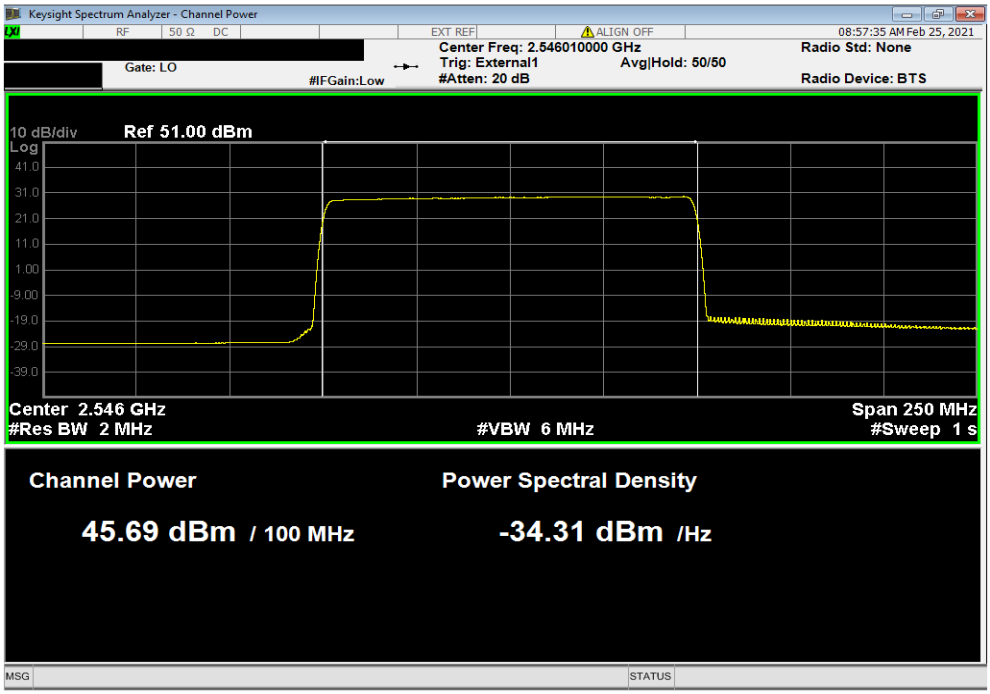


OUTPUT POWER 02 5G & EIRP CALCULATION

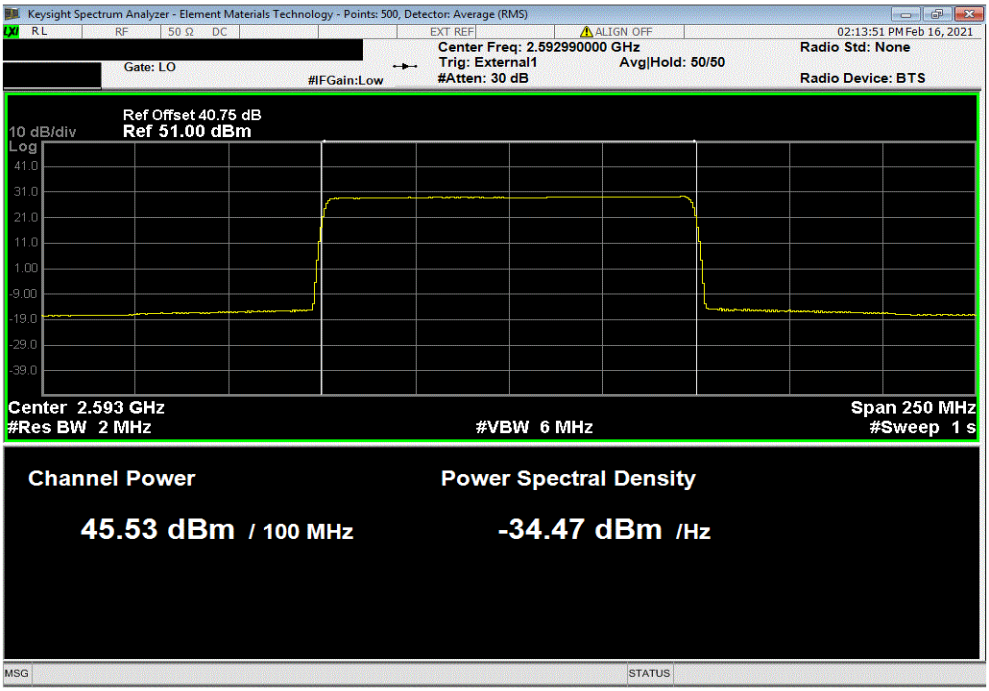
5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR100 (100MHz), 64QAM, Mid Channel 2592.99 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Port (2x2 MIMO) dBm/Carrier BW	Port (4x4 MIMO) dBm/Carrier BW	Port (8x8 MIMO) dBm/Carrier BW
	45.375	0	45.375	48.375	51.375	54.375



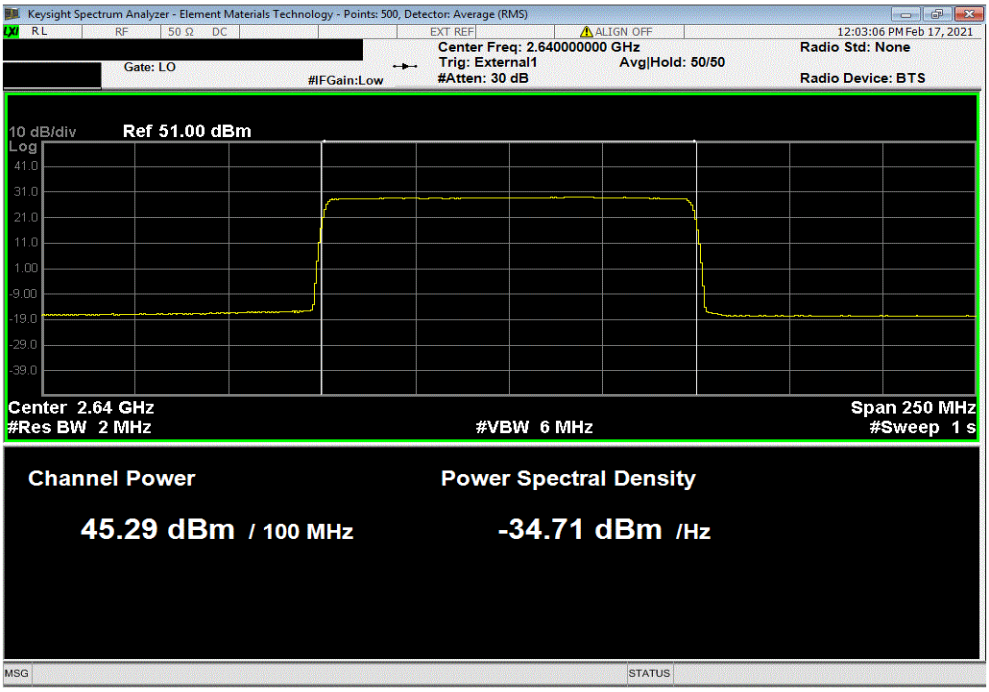
5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR100 (100MHz), 256QAM, Low Channel 2546.01 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Port (2x2 MIMO) dBm/Carrier BW	Port (4x4 MIMO) dBm/Carrier BW	Port (8x8 MIMO) dBm/Carrier BW
	45.69	0	45.69	48.69	51.69	54.69



5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR100 (100MHz), 256QAM, Mid Channel 2592.99 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Port (2x2 MIMO) dBm/Carrier BW	Port (4x4 MIMO) dBm/Carrier BW	Port (8x8 MIMO) dBm/Carrier BW
	45.53	0	45.53	48.53	51.53	54.53



5G NR, Band n41, 2496 MHz - 2690 MHz, Port 1, NR100 (100MHz), 256QAM, High Channel 2640 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Port (2x2 MIMO) dBm/Carrier BW	Port (4x4 MIMO) dBm/Carrier BW	Port (8x8 MIMO) dBm/Carrier BW
	45.293	0	45.293	48.293	51.293	54.293



OUTPUT POWER 02 5G & EIRP CALCULATION

element

5G NR EIRP Calculations for Eight 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. Base station antennas are selected by the customer.

The base station antenna is selected by the customer and this EIRP calculation is based upon a sample worst case antenna. The EIRP calculation is based upon the Commscope Planar Array Antenna model T4-90A-R1-V2. This antenna assembly has four columns with a maximum beamforming gain of 22.3 ± 0.8dBi. The columns within the antenna have ±45° cross-polarized (orthogonal) radiators. The eight AZHL transmitter outputs are connected to the columns (four are connected to +45° radiators/antennas and four are connected to the -45° radiators/antennas). The AZHL provides transmitter outputs for one 4-column antenna.

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 power measurements (highest measured average power for each channel bandwidth type). The maximum antenna assembly beamforming gain was used for this calculation. The cable loss between the antenna and transmitter is site dependent (will not be 0 dB) but for this worst case EIRP calculation 0 dB was used. Calculations of worst-case EIRP for eight port MIMO are as follows:

Parameter	20 MHz Ch BW	40 MHz Ch BW	60 MHz Ch BW	80 MHz Ch BW	100 MHz Ch BW
Power Out /Radio Antenna Port	37.5 dBm or 5.62 W	39.8 dBm or 9.55 W	41.4 dBm or 13.8 W	42.7 dBm or 18.6 W	45.7 dBm or 37.2 W
Cable Loss	0 dB	0 dB	0 dB	0 dB	0 dB
Number of Ant Ports per Polarization	4	4	4	4	4
Total Power per Polarization	22.5 Watts or 43.5 dBm	38.2 Watts or 45.8 dBm	55.2 Watts or 47.4 dBm	74.4 Watts or 48.7 dBm	149 Watts or 51.7 dBm
Maximum Antenna Beamforming Gain per Polarization	23.1 dBi	23.1 dBi	23.1 dBi	23.1 dBi	23.1 dBi
EIRP per Polarization	66.6 dBm or 4.57 kW	68.9 dBm or 7.76 kW	70.5 dBm or 11.2 kW	71.8 dBm or 15.1 kW	74.8 dBm or 30.2 kW
Number of Polarizations	2	2	2	2	2
EIRP Total (See Note 1)	66.6 dBm or 4.57 kW	68.9 dBm or 7.76 kW	70.5 dBm or 11.2 kW	71.8 dBm or 15.1 kW	74.8 dBm or 30.2 kW
EIRP Limit Calculation (See Note 2)	79.6 dBm	82.6 dBm	84.4 dBm	85.6 dBm	86.6 dBm

Note 1: The EIRP per antenna polarity 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).
Note 2: The EIRP limit is defined by FCC part 27.50(h)(ii) as 33dBW+ 10Log(X/Y) dBW + 10 log(360/beamwidth) dBW where X is the channel width in MHz and Y is 5.5 or 6MHz. The Commscope model T4-90A-R1-V2 antenna has a horizontal beamwidth of 26 degrees. Y was selected to be 6MHz for this calculation.

Calculation Summary

The worst case AZHL eight port MIMO EIRP levels for all 5G NR channel bandwidths using the Commscope antenna assembly model "T4-90A-R1-V2" are less than the FCC regulatory limits.

OUTPUT POWER 03 LTE & EIRP CALCULATION

XMit 2020.03.25.0

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	27-Feb-20	27-Feb-21
Generator - Signal	Keysight	N5171B-506	TEW	2-May-18	2-May-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 output power (maximum average conducted output power) was measured using the channels and modes as called out on the follwoing 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 measurements. This method uses trace averaging across the 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 in decimal, to the measured power to compute the average power during the actual transmission times.

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 8 port 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.

The total average transmit power of all antenna ports was determined per ANSI C63.26-2105 paragraph 6.4.3.1.

The EIRP limit is defined by FCC Part 27.50(h)(ii) as 33dBW+ 10Log(X/Y) dBW + 10 log(360/beamwidth) dBW where X is the channel width in MHz and Y is 5.5 or 6MHz. PSD (power/1MHz) measurements are not required for this radio since the FCC limits for EIRP are defined in watts.

OUTPUT POWER 03 LTE & EIRP CALCULATION

element

TbtTx 2019.08.30.0 XMit 2020.12.30.0

EUT:	**AZHL**			**Work Order:**	**NOKI0018**
Serial Number:	**YK203400016**			**Date:**	**22-Feb-21**
Customer:	**Nokia Solutions and Networks**			**Temperature:**	**23.6 °C**
Attendees:	**John Rattanavong, Mitchell Hill, David Le**			**Humidity:**	**14.9% RH**
Project:	**None**			**Barometric Pres.:**	**1037 mbar**
Tested by:	**Mark Baytan**	**Power:**	**54 VDC**	**Job Site:**	**TX05**

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

COMMENTS

External 1 gating was set using a trig delay = 5.0us and a gate length = 6.786ms. Reference level offset adjusted to include (2) coax cables, DC block, and attenuator. The carrier power was set to maximum for all testing. The following is the output power measurements at the radio output ports. The output power was measured for a single carrier channel bandwidth on port 1. The total output power for multiport (2x2 MIMO, 4x4 MIMO and 8x8 MIMO) operation was determined based upon ANSI C63.26 clauses 6.4.3.1 and 6.4.3.2.4 (10 Log Nout). The total output power for two port operation is single port power + 3dB [i.e.: 10 Log(2)]. The total output power for four port operation is single port power + 6dB [i.e.: 10 Log(4)]. The total output power for eight port operation is single port power + 9dB [i.e.: 10 Log(8)].

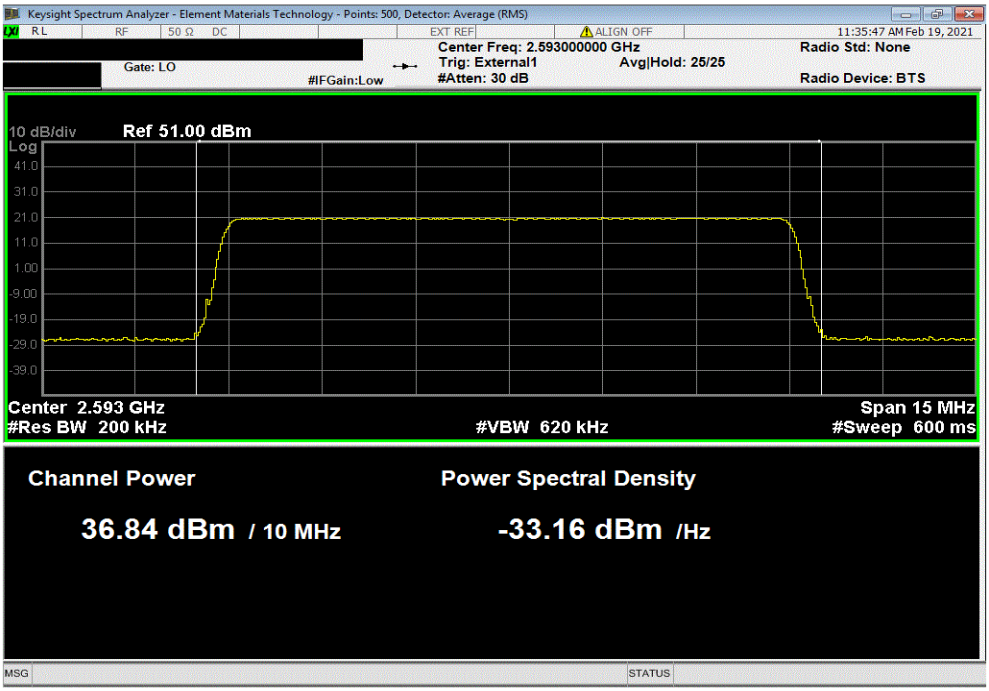
DEVIATIONS FROM TEST STANDARD

None

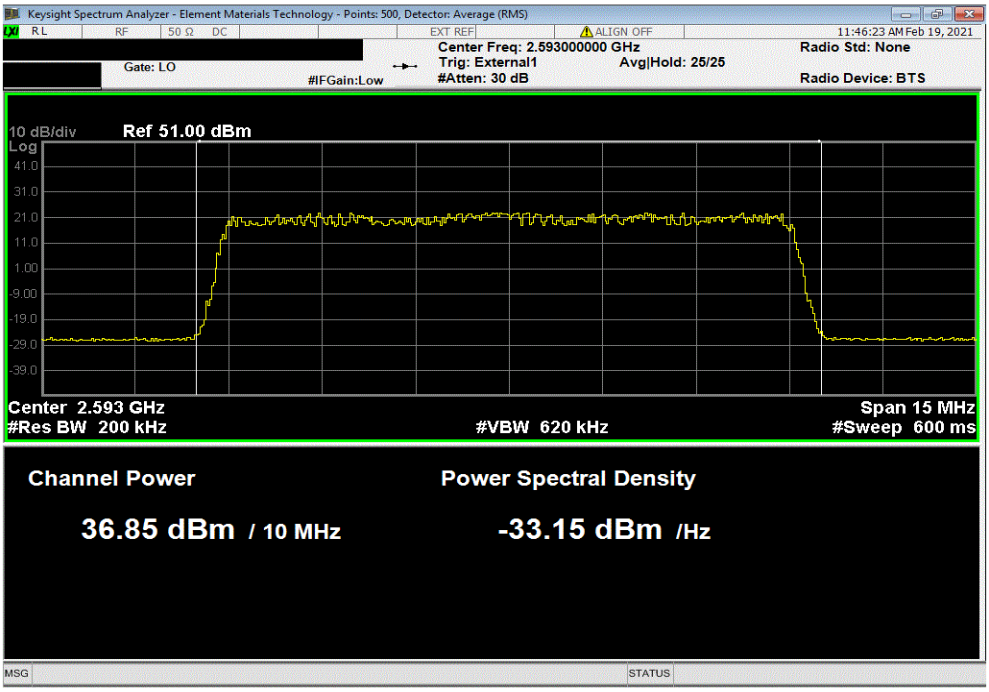
Configuration #	**2**	*Signature*

		Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	2 Port (2x2 MIMO) dBm/Carrier BW	4 Port (4x4 MIMO) dBm/Carrier BW	8 Port (8x8 MIMO) dBm/Carrier BW
4G LTE, Band 41, 2496 MHz - 2690 MHz							
Port 1							
LTE10 (10MHz)							
QPSK							
	Mid Channel 2593 MHz	36.842	0	36.842	39.842	42.842	45.842
16QAM							
	Mid Channel 2593 MHz	36.855	0	36.855	39.855	42.855	45.855
64QAM							
	Mid Channel 2593 MHz	36.867	0	36.867	39.867	42.867	45.867
256QAM							
	Low Channel 2501 MHz	36.385	0	36.385	39.385	42.385	45.385
	Mid Channel 2593 MHz	36.815	0	36.815	39.815	42.815	45.815
	High Channel 2685 MHz	36.607	0	36.607	39.607	42.607	45.607
LTE15 (15MHz)							
256QAM							
	Low Channel 2503.5 MHz	36.41	0	36.41	39.41	42.41	45.41
	Mid Channel 2593 MHz	36.847	0	36.847	39.847	42.847	45.847
	High Channel 2682.5 MHz	36.849	0	36.849	39.849	42.849	45.849
LTE20 (20MHz)							
256QAM							
	Low Channel 2506 MHz	36.525	0	36.525	39.525	42.525	45.525
	Mid Channel 2593 MHz	36.908	0	36.908	39.908	42.908	45.908
	High Channel 2680 MHz	37.105	0	37.105	40.105	43.105	46.105

4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE10 (10MHz), QPSK, Mid Channel 2593 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Port (2x2 MIMO) dBm/Carrier BW	Port (4x4 MIMO) dBm/Carrier BW	Port (8x8 MIMO) dBm/Carrier BW
	36.842	0	36.842	39.842	42.842	45.842



4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE10 (10MHz), 16QAM, Mid Channel 2593 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Port (2x2 MIMO) dBm/Carrier BW	Port (4x4 MIMO) dBm/Carrier BW	Port (8x8 MIMO) dBm/Carrier BW
	36.855	0	36.855	39.855	42.855	45.855

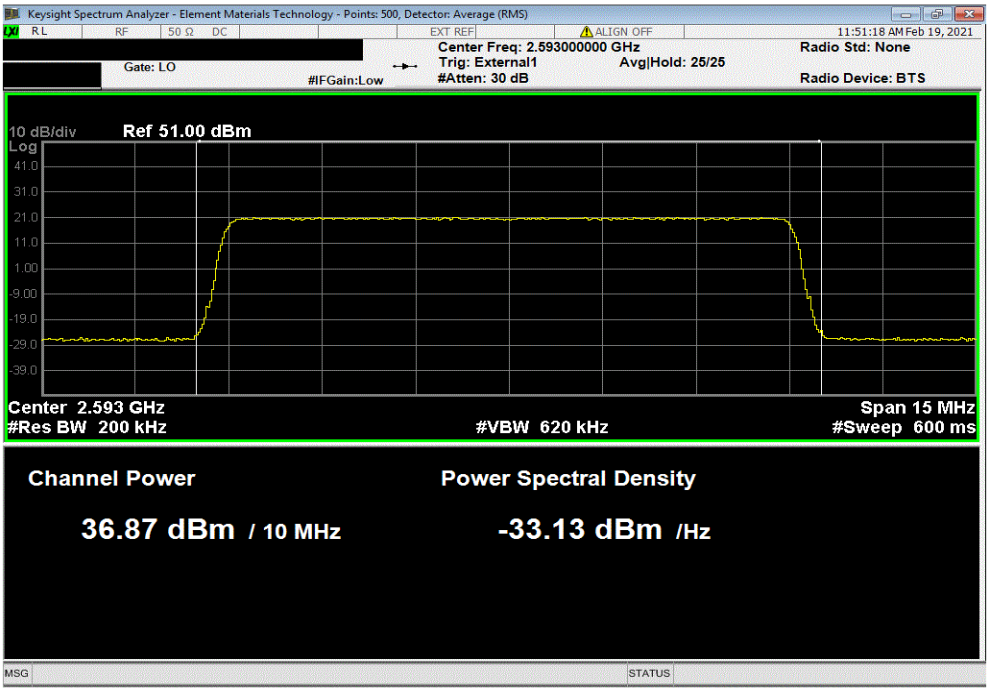


OUTPUT POWER 03 LTE & EIRP CALCULATION

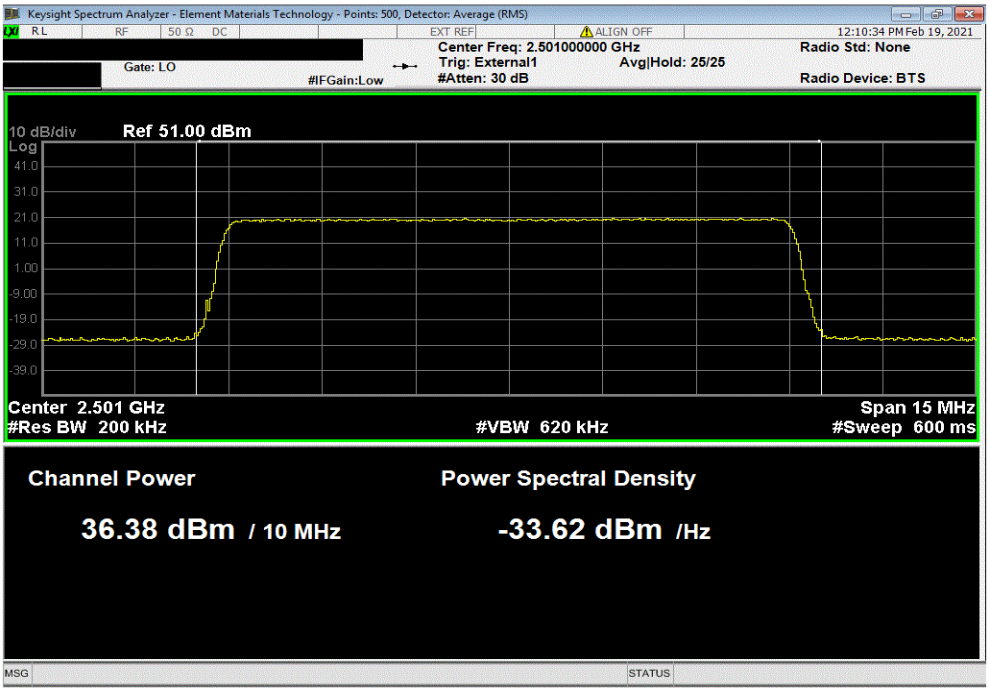
element

TbtTx 2019.08.30.0 XMit 2020.12.30.0

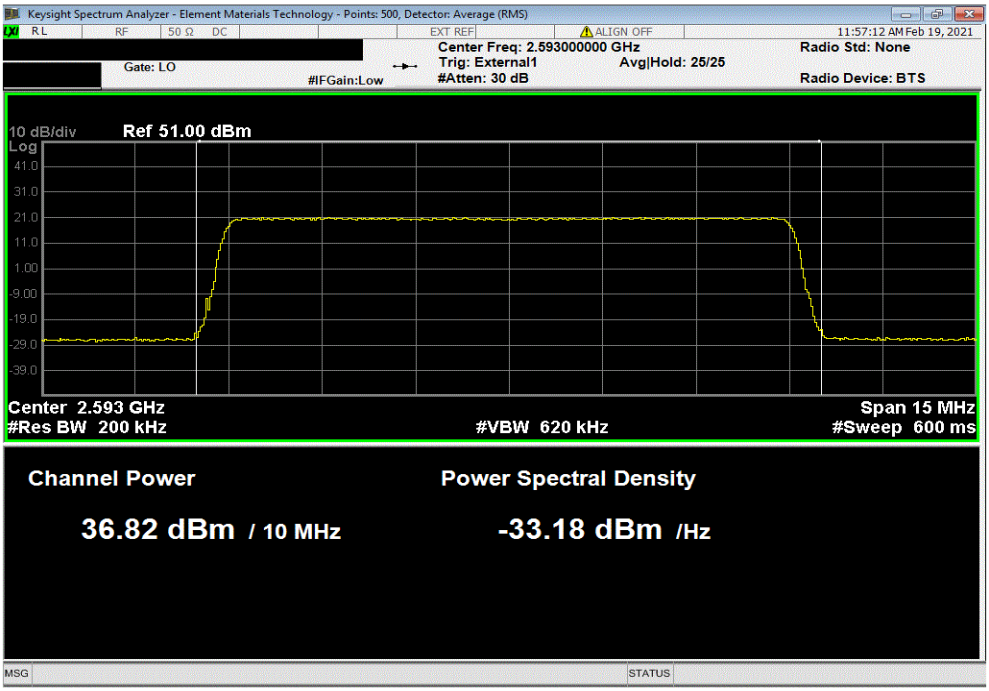
4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE10 (10MHz), 64QAM, Mid Channel 2593 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Port (2x2 MIMO) dBm/Carrier BW	Port (4x4 MIMO) dBm/Carrier BW	Port (8x8 MIMO) dBm/Carrier BW
	36.867	0	36.867	39.867	42.867	45.867



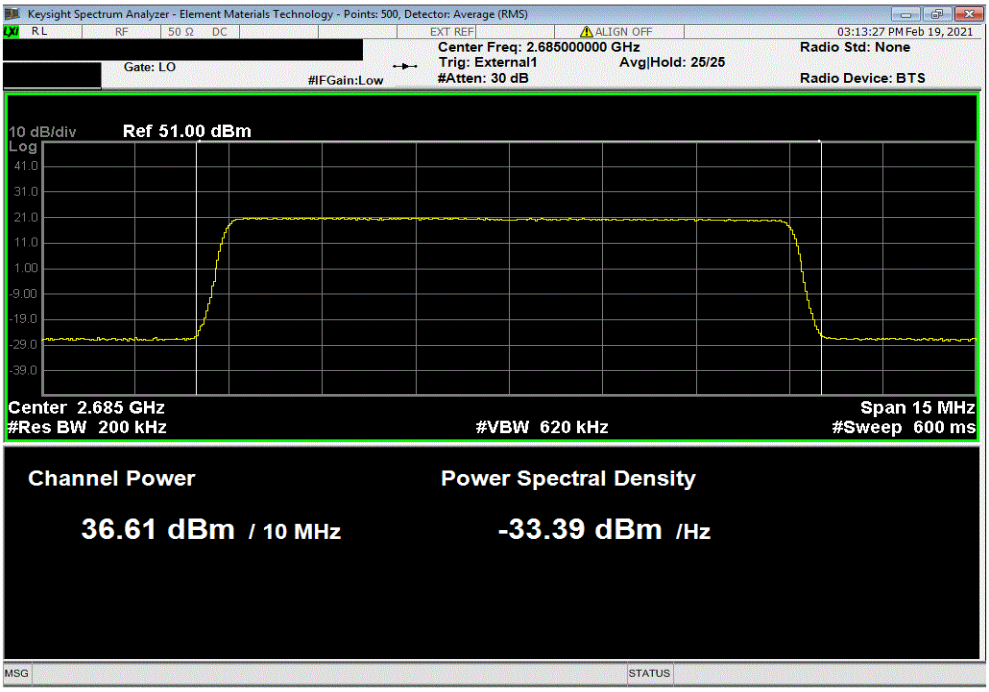
4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE10 (10MHz), 256QAM, Low Channel 2501 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Port (2x2 MIMO) dBm/Carrier BW	Port (4x4 MIMO) dBm/Carrier BW	Port (8x8 MIMO) dBm/Carrier BW
	36.385	0	36.385	39.385	42.385	45.385



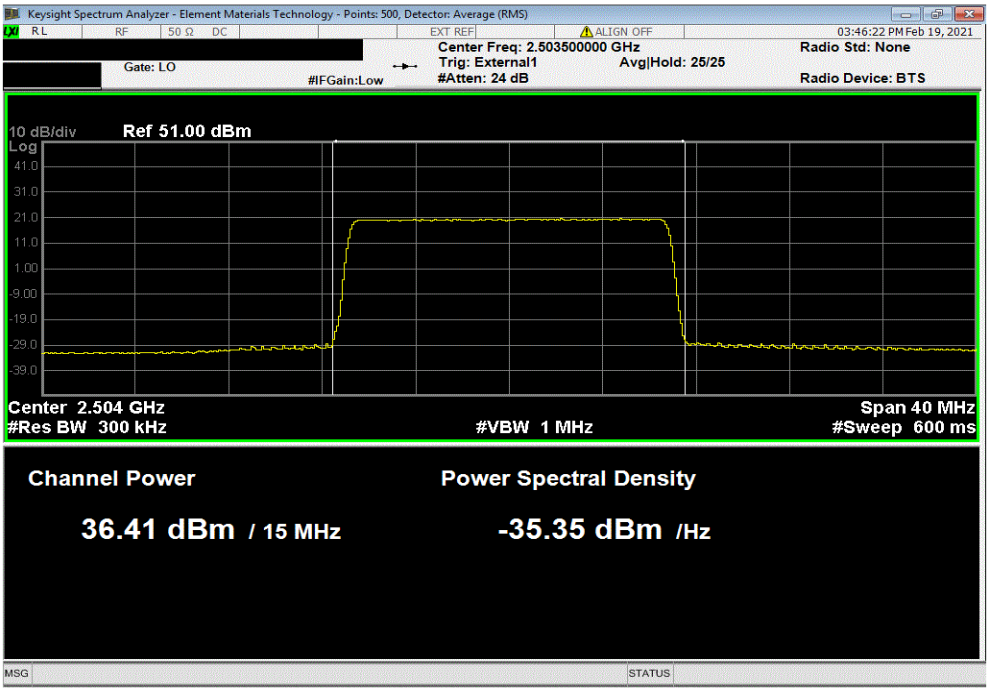
4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE10 (10MHz), 256QAM, Mid Channel 2593 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Port (2x2 MIMO) dBm/Carrier BW	Port (4x4 MIMO) dBm/Carrier BW	Port (8x8 MIMO) dBm/Carrier BW
	36.815	0	36.815	39.815	42.815	45.815



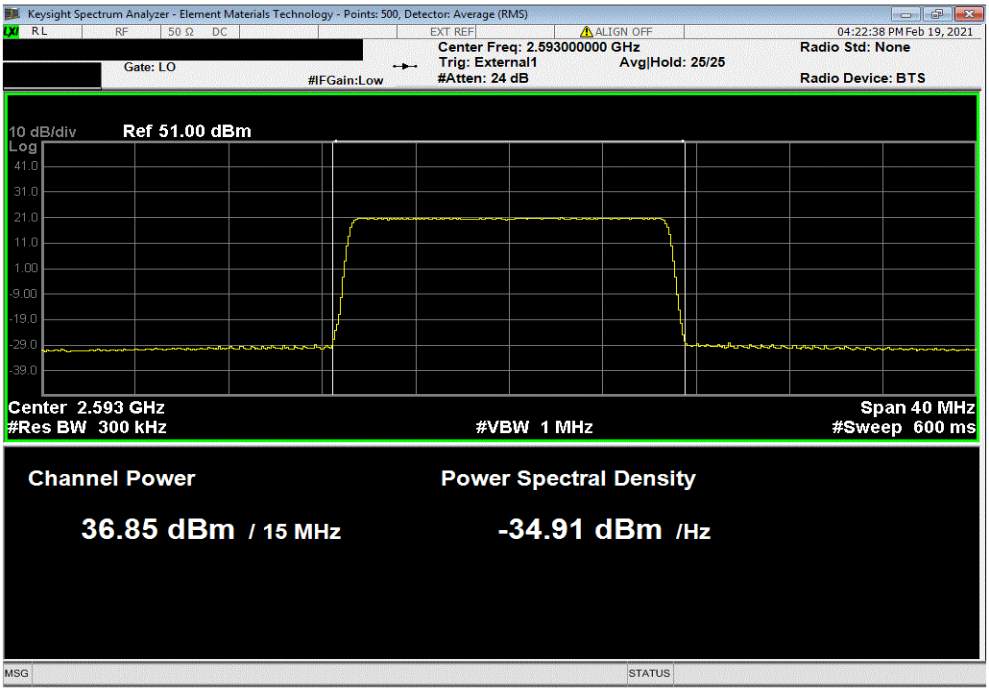
4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE10 (10MHz), 256QAM, High Channel 2685 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Port (2x2 MIMO) dBm/Carrier BW	Port (4x4 MIMO) dBm/Carrier BW	Port (8x8 MIMO) dBm/Carrier BW
	36.607	0	36.607	39.607	42.607	45.607



4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE15 (15MHz), 256QAM, Low Channel 2503.5 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Port (2x2 MIMO) dBm/Carrier BW	Port (4x4 MIMO) dBm/Carrier BW	Port (8x8 MIMO) dBm/Carrier BW
	36.41	0	36.41	39.41	42.41	45.41

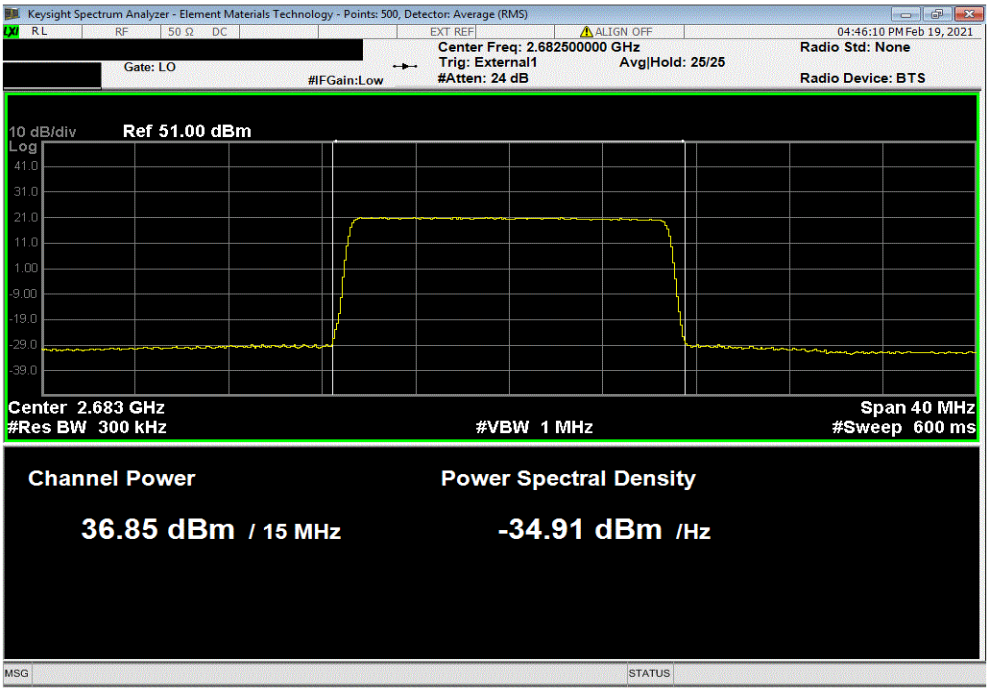


4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE15 (15MHz), 256QAM, Mid Channel 2593 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Port (2x2 MIMO) dBm/Carrier BW	Port (4x4 MIMO) dBm/Carrier BW	Port (8x8 MIMO) dBm/Carrier BW
	36.847	0	36.847	39.847	42.847	45.847

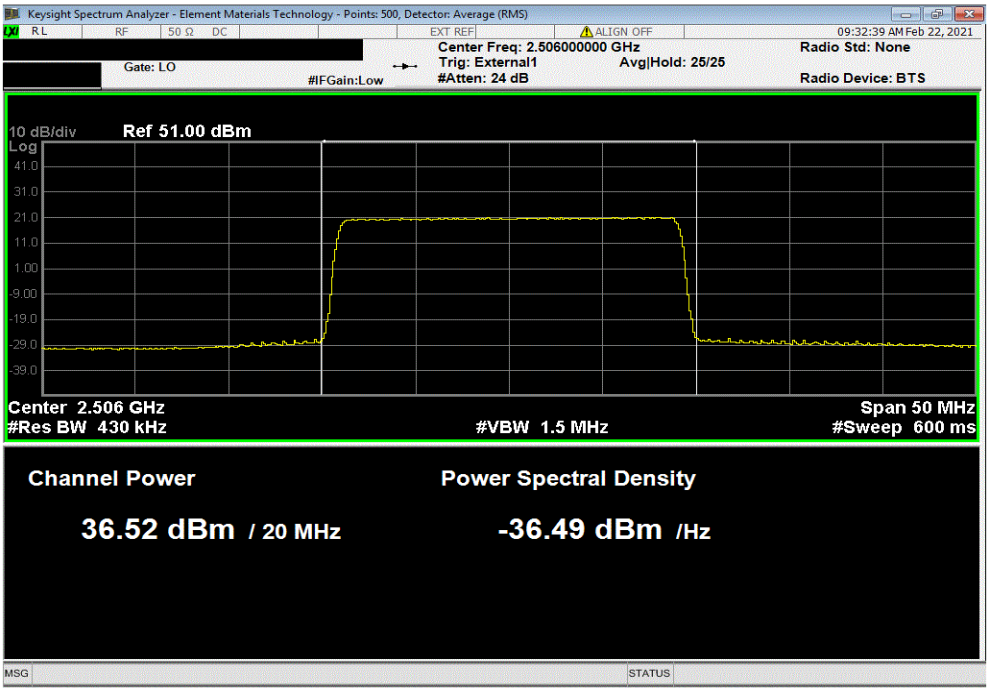


OUTPUT POWER 03 LTE & EIRP CALCULATION

4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE15 (15MHz), 256QAM, High Channel 2682.5 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Port (2x2 MIMO) dBm/Carrier BW	Port (4x4 MIMO) dBm/Carrier BW	Port (8x8 MIMO) dBm/Carrier BW
	36.849	0	36.849	39.849	42.849	45.849

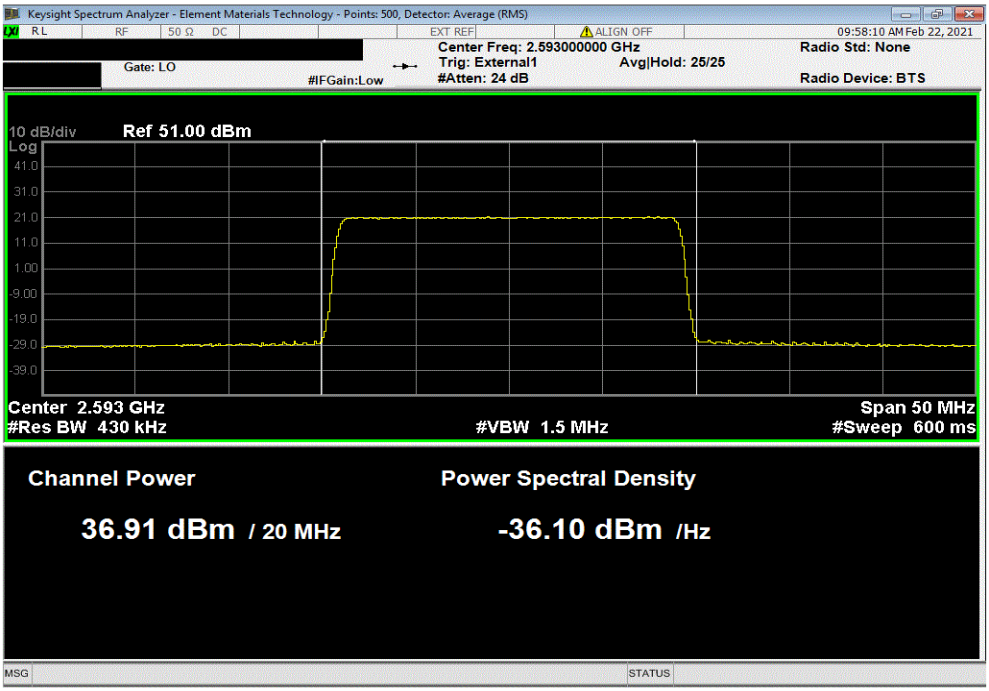


4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE20 (20MHz), 256QAM, Low Channel 2506 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Port (2x2 MIMO) dBm/Carrier BW	Port (4x4 MIMO) dBm/Carrier BW	Port (8x8 MIMO) dBm/Carrier BW
	36.525	0	36.525	39.525	42.525	45.525

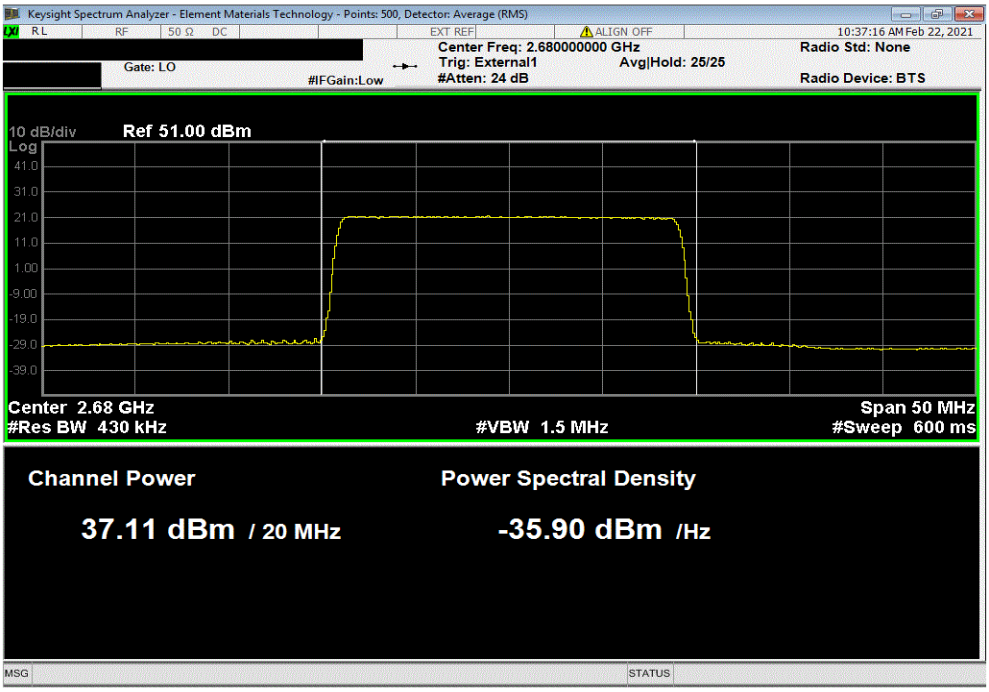


OUTPUT POWER 03 LTE & EIRP CALCULATION

4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE20 (20MHz), 256QAM, Mid Channel 2593 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Port (2x2 MIMO) dBm/Carrier BW	Port (4x4 MIMO) dBm/Carrier BW	Port (8x8 MIMO) dBm/Carrier BW
	36.908	0	36.908	39.908	42.908	45.908



4G LTE, Band 41, 2496 MHz - 2690 MHz, Port 1, LTE20 (20MHz), 256QAM, High Channel 2680 MHz						
	Initial Value dBm/Carrier BW	Duty Cycle	Single Port dBm/Carrier BW	Port (2x2 MIMO) dBm/Carrier BW	Port (4x4 MIMO) dBm/Carrier BW	Port (8x8 MIMO) dBm/Carrier BW
	37.105	0	37.105	40.105	43.105	46.105



OUTPUT POWER 03 LTE & EIRP CALCULATION

4G LTE EIRP Calculations for Eight 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. Base station antennas are selected by the customer.

The base station antenna is selected by the customer and this EIRP calculation is based upon a sample worst case antenna. The EIRP calculation is based upon the Commscope Planar Array Antenna model T4-90A-R1-V2. This antenna assembly has four columns with a maximum beamforming gain of 22.3 ± 0.8dBi. The columns within the antenna have ±45° cross-polarized (orthogonal) radiators. The eight AZHL transmitter outputs are connected to the columns (four are connected to +45° radiators/antennas and four are connected to the -45° radiators/antennas). The AZHL provides transmitter outputs for one 4-column antenna.

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 power measurements (highest measured average power for each channel bandwidth type). The maximum antenna assembly beamforming gain was used for this calculation. The cable loss between the antenna and transmitter is site dependent (will not be 0 dB) but for this worst case EIRP calculation 0 dB was used. Calculations of worst-case EIRP for eight port MIMO are as follows:

Parameter	10 MHz Ch BW	15 MHz Ch BW	20 MHz Ch BW
Power Out /Radio Antenna Port	36.9 dBm or 4.90 W	36.9 dBm or 4.90 W	37.1 dBm or 5.13 W
Cable Loss	0 dB	0 dB	0 dB
Number of Ant Ports per Polarization	4	4	4
Total Power per Polarization	19.6 Watts or 42.9 dBm	19.6 Watts or 42.9 dBm	20.5 Watts or 43.1 dBm
Maximum Antenna Beamforming Gain per Polarization	23.1 dBi	23.1 dBi	23.1 dBi
EIRP per Polarization	66.0 dBm or 3.98 kW	66.0 dBm or 3.98 kW	66.2 dBm or 4.17 kW
Number of Polarizations	2	2	2
EIRP Total (See Note 1)	66.0 dBm or 3.98 kW	66.0 dBm or 3.98 kW	66.2 dBm or 4.17 kW
EIRP Limit Calculation (See Note 2)	76.6 dBm	78.4 dBm	79.6 dBm

Note 1: The EIRP per antenna polarity 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).
Note 2: The EIRP limit is defined by FCC part 27.50(h)(ii) as 33dBW+ 10Log(X/Y) dBW + 10 log(360/beamwidth) dBW where X is the channel width in MHz and Y is 5.5 or 6MHz. The Commscope model T4-90A-R1-V2 antenna has a horizontal beamwidth of 26 degrees. Y was selected to be 6MHz for this calculation.

Calculation Summary
The worst case AZHL eight port MIMO EIRP levels for all 4G LTE channel bandwidths using the Commscope antenna assembly model "T4-90A-R1-V2" are less than the FCC regulatory limits.