

POWER SPECTRAL DENSITY

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 power spectral density 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 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 $[10\log(1/D)]$, where D is the duty cycle, to the measured power to compute the PSD during the transmit times.

RF conducted emissions testing was performed only on one port. The testing was performed on the same version of hardware (FHFB) as the original certification test. The FHFB antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in the original 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.

The total PSD of all antenna ports (at the radio output) were 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

The applicable FCC and ISED regulatory requirement for EIRP are provided below:

FCC Requirements:

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.

(3) Base station antenna heights may exceed 300 meters HAAT with a corresponding reduction in power; see Tables 3 and 4 of this section.

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:

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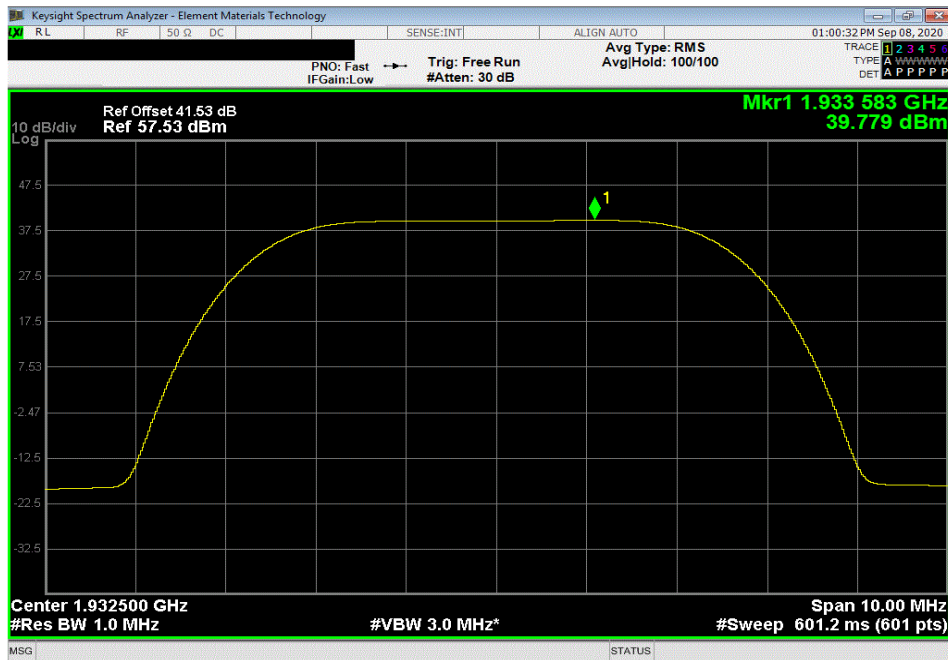
EUT: FHFB (FCC C2PC)			Work Order: NOK10021			
Serial Number: L9144200604			Date: 10-Sep-20			
Customer: Nokia Solutions and Networks			Temperature: 22.7 °C			
Attendees: Mitchell Hill, John Rattanavong			Humidity: 49.3% RH			
Project: None			Barometric Pres.: 1022 mbar			
Tested by: Brandon Hobbs		Power: 54 VDC	Job Site: TX05			
TEST SPECIFICATIONS			Test Method			
FCC 24E:2020			ANSI C63.26:2015			
RSS-133:2018			RSS-133:2018			
COMMENTS						
All measurement path losses were accounted for in the reference level offset including any attenuators, filters and DC blocks. The carrier power was set to maximum except for the 15MHz channel bandwidth band edge frequencies. The power was reduced by 1 dB at the 15MHz channel bandwidth "High Channel" (1987.5MHz) and "Low Channel" (1937.5MHz). The following is the power spectral density (PSD) measurements at the radio output ports. The PSD was measured for a single carrier on port 1. The total PSD for multiport (2x2 MIMO & 4x4 MIMO) operation was determined 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)].						
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
Band 25, 1930 MHz - 1995 MHz, 5G						
Port 1						
5 MHz Bandwidth						
QPSK Modulation						
Low Channel, 1932.5 MHz		39.779	0	39.8	42.8	45.8
Mid Channel, 1962.5 MHz		40.225	0	40.2	43.2	46.2
High Channel, 1992.5 MHz		39.946	0	39.9	42.9	45.9
16-QAM Modulation						
Low Channel, 1932.5 MHz		39.802	0	39.8	42.8	45.8
Mid Channel, 1962.5 MHz		40.094	0	40.1	43.1	46.1
High Channel, 1992.5 MHz		39.892	0	39.9	42.9	45.9
64-QAM Modulation						
Low Channel, 1932.5 MHz		39.939	0	39.9	42.9	45.9
Mid Channel, 1962.5 MHz		40.299	0	40.3	43.3	46.3
High Channel, 1992.5 MHz		39.861	0	39.9	42.9	45.9
256-QAM Modulation						
Low Channel, 1932.5 MHz		39.819	0	39.8	42.8	45.8
Mid Channel, 1962.5 MHz		40.107	0	40.1	43.1	46.1
High Channel, 1992.5 MHz		39.803	0	39.8	42.8	45.8
10 MHz Bandwidth						
QPSK Modulation						
Low Channel, 1935.0 MHz		36.881	0	36.9	39.9	42.9
Mid Channel, 1962.5 MHz		37.064	0	37.1	40.1	43.1
High Channel, 1990 MHz		37.039	0	37.0	40.0	43.0
16-QAM Modulation						
Low Channel, 1935.0 MHz		37.589	0	37.6	40.6	43.6
Mid Channel, 1962.5 MHz		37.754	0	37.8	40.8	43.8
High Channel, 1990 MHz		37.635	0	37.6	40.6	43.6
64-QAM Modulation						
Low Channel, 1935.0 MHz		36.813	0	36.8	39.8	42.8
Mid Channel, 1962.5 MHz		37.045	0	37.0	40.0	43.0
High Channel, 1990 MHz		37.186	0	37.2	40.2	43.2
256-QAM Modulation						
Low Channel, 1935.0 MHz		36.903	0	36.9	39.9	42.9
Mid Channel, 1962.5 MHz		36.986	0	37.0	40.0	43.0
High Channel, 1990 MHz		37.022	0	37.0	40.0	43.0
15 MHz Bandwidth						
QPSK Modulation						
Low Channel, 1937.5 MHz		34.231	0	34.2	37.2	40.2
Mid Channel, 1962.5 MHz		35.176	0	35.2	38.2	41.2
High Channel, 1987.5 MHz		34.410	0	34.4	37.4	40.4
16-QAM Modulation						
Low Channel, 1937.5 MHz		35.665	0	35.7	38.7	41.7
Mid Channel, 1962.5 MHz		36.702	0	36.7	39.7	42.7
High Channel, 1987.5 MHz		35.890	0	35.9	38.9	41.9
64-QAM Modulation						
Low Channel, 1937.5 MHz		34.492	0	34.5	37.5	40.5
Mid Channel, 1962.5 MHz		34.207	0	34.2	37.2	40.2
High Channel, 1987.5 MHz		35.240	0	35.2	38.2	41.2
256-QAM Modulation						
Low Channel, 1937.5 MHz		34.296	0	34.3	37.3	40.3
Mid Channel, 1962.5 MHz		35.212	0	35.2	38.2	41.2
High Channel, 1987.5 MHz		34.431	0	34.4	37.4	40.4
20 MHz Bandwidth						
QPSK Modulation						
Low Channel, 1940 MHz		34.015	0	34.0	37.0	40.0
Mid Channel, 1962.5 MHz		34.027	0	34.0	37.0	40.0
High Channel, 1985 MHz		33.318	0	33.3	36.3	39.3
16-QAM Modulation						
Low Channel, 1940 MHz		35.642	0	35.6	38.6	41.6
Mid Channel, 1962.5 MHz		35.637	0	35.6	38.6	41.6
High Channel, 1985 MHz		34.860	0	34.9	37.9	40.9
64-QAM Modulation						
Low Channel, 1940 MHz		34.151	0	34.2	37.2	40.2
Mid Channel, 1962.5 MHz		34.154	0	34.2	37.2	40.2
High Channel, 1985 MHz		33.312	0	33.3	36.3	39.3
256-QAM Modulation						
Low Channel, 1940 MHz		34.102	0	34.1	37.1	40.1
Mid Channel, 1962.5 MHz		34.067	0	34.1	37.1	40.1
High Channel, 1985 MHz		33.380	0	33.4	36.4	39.4

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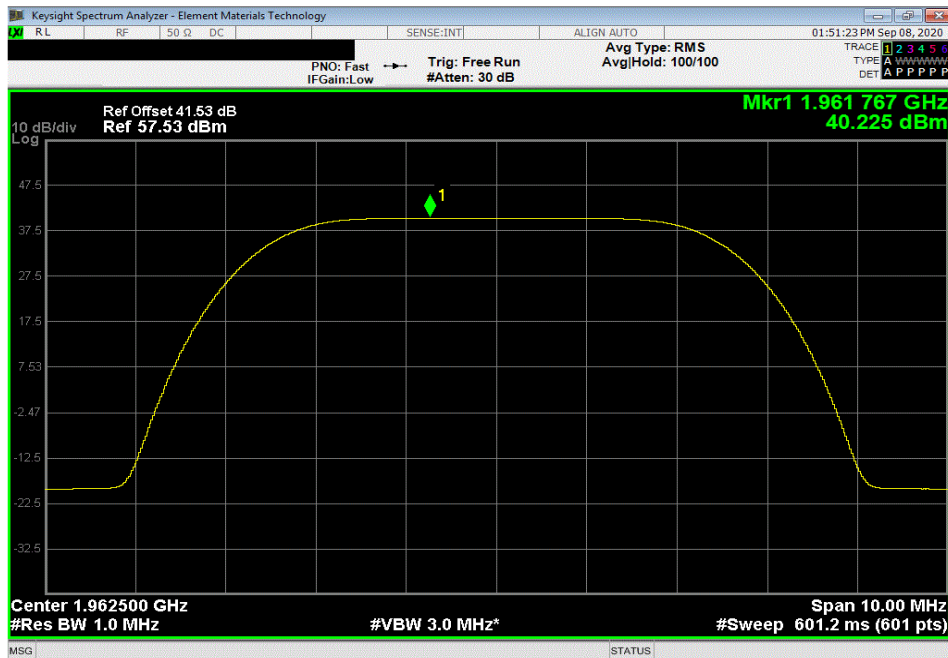


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Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwidth, QPSK Modulation , Low Channel, 1932.5 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
39.779	0	39.779	42.779	45.779		



Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwidth, QPSK Modulation , Mid Channel, 1962.5 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
40.225	0	40.225	43.225	46.225		

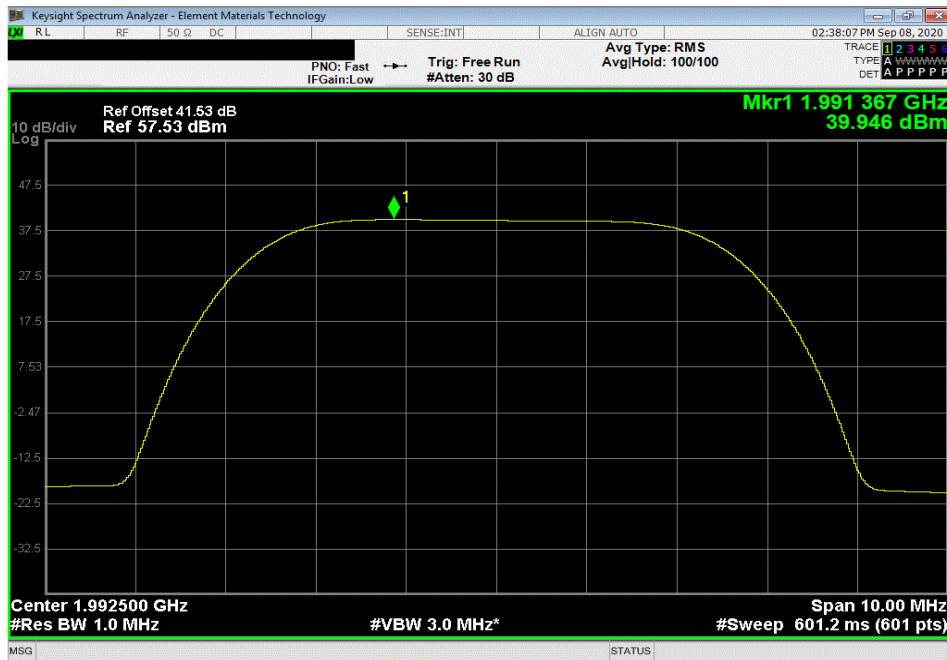


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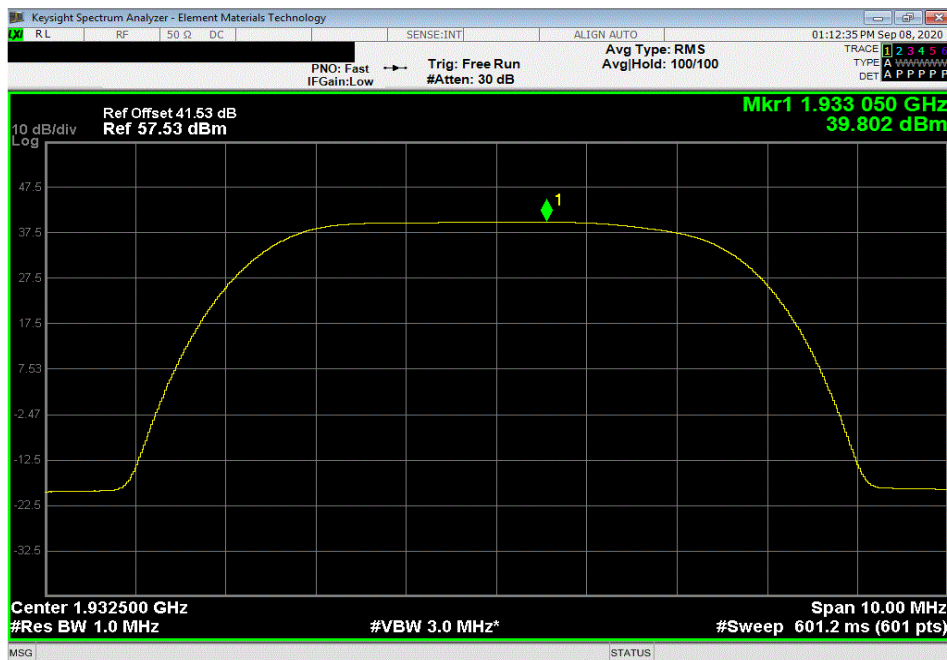


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Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwidth, QPSK Modulation, High Channel, 1992.5 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
39.946	0	39.946	42.946	45.946		



Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwidth, 16-QAM Modulation, Low Channel, 1932.5 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
39.802	0	39.802	42.802	45.802		

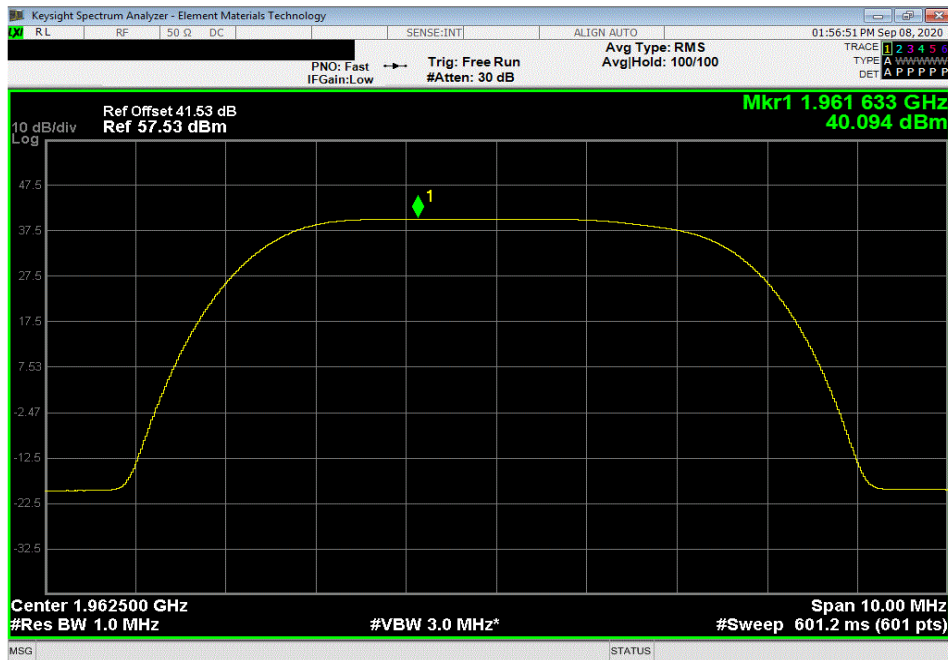


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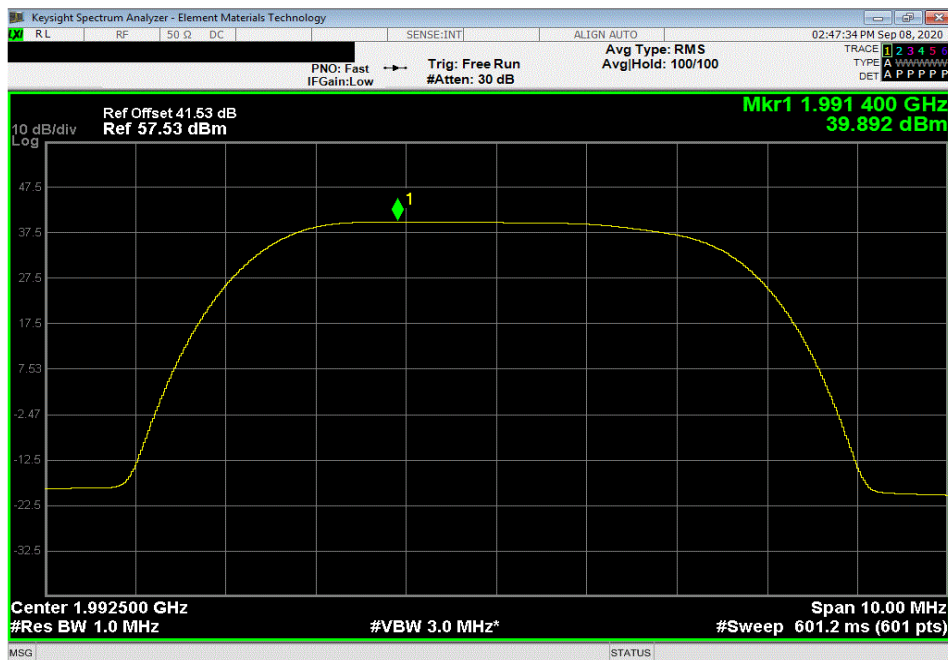


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Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwidth, 16-QAM Modulation, Mid Channel, 1962.5 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
40.094	0	40.094	43.094	46.094		



Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwidth, 16-QAM Modulation, High Channel, 1992.5 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
39.892	0	39.892	42.892	45.892		

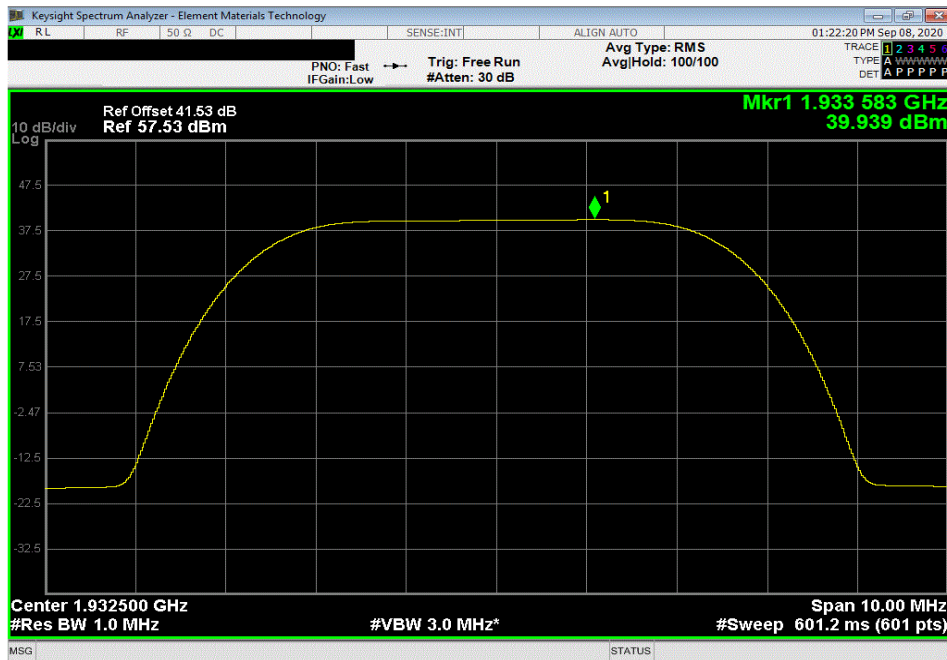


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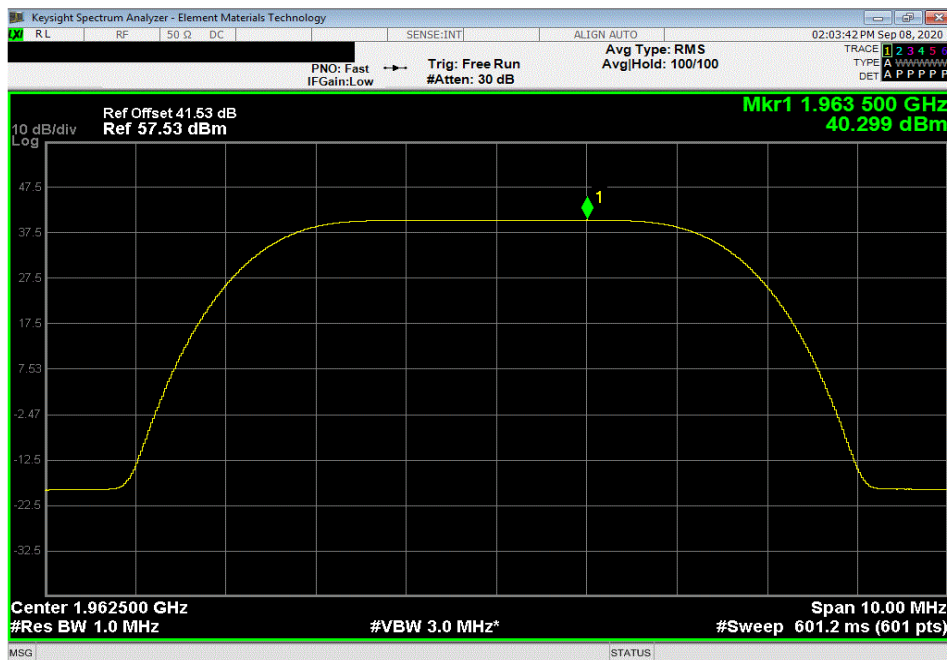


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Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwidth, 64-QAM Modulation, Low Channel, 1932.5 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
39.939	0	39.939	42.939	45.939		



Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwidth, 64-QAM Modulation, Mid Channel, 1962.5 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
40.299	0	40.299	43.299	46.299		

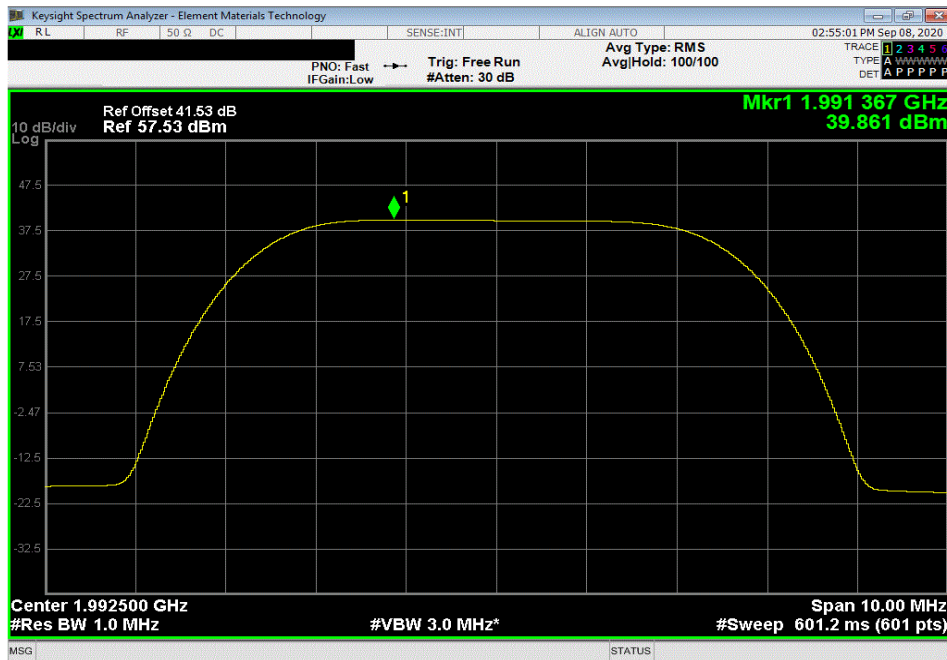


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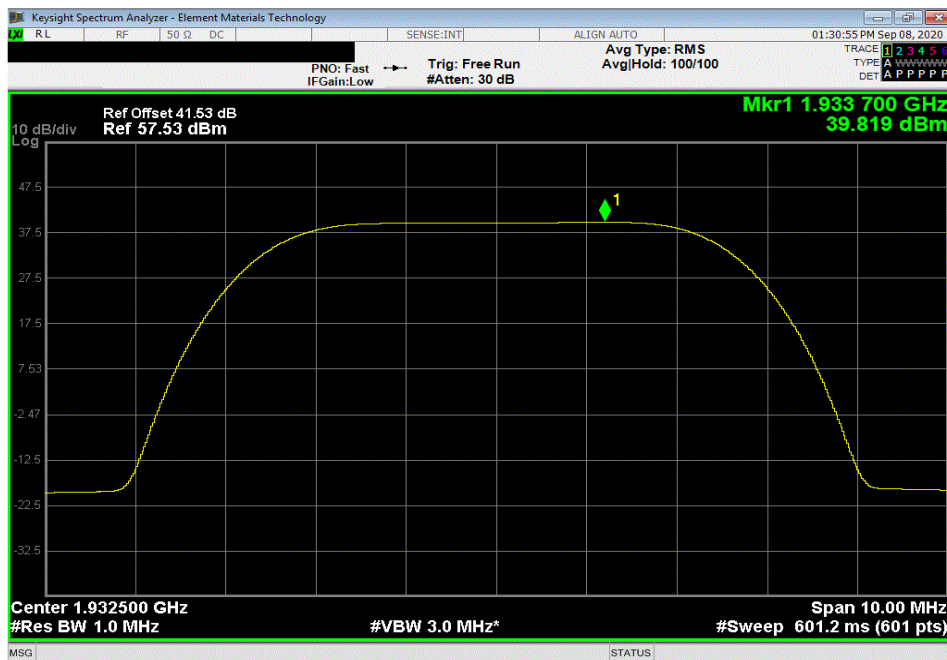


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Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwidth, 64-QAM Modulation, High Channel, 1992.5 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)	
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD	
39.861	0	39.861	42.861	45.861	



Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwidth, 256-QAM Modulation, Low Channel, 1932.5 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)	
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD	
39.819	0	39.819	42.819	45.819	

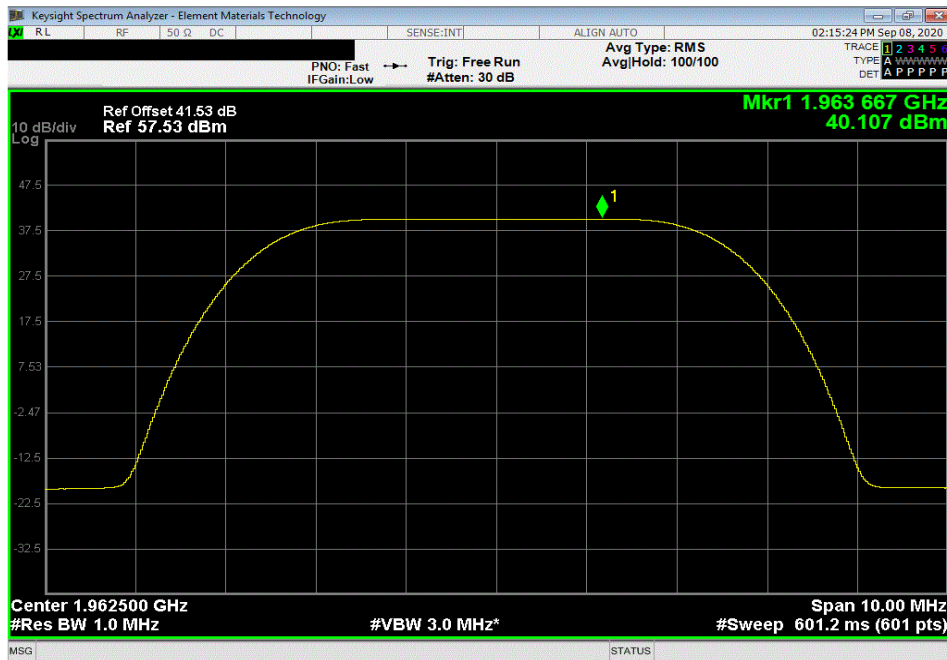


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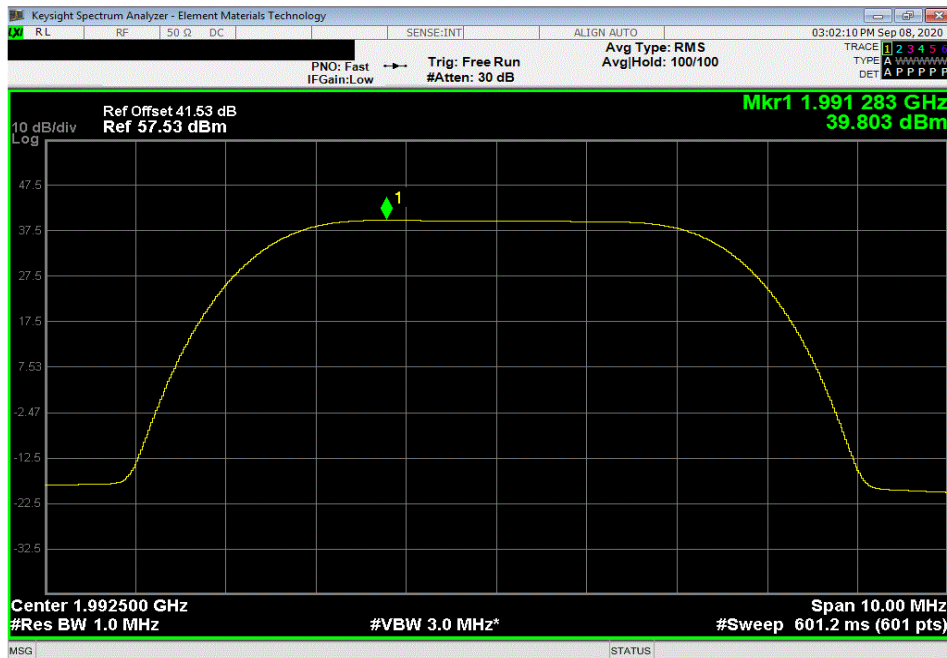


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Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwidth, 256-QAM Modulation, Mid Channel, 1962.5 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
40.107	0	40.107	43.107	46.107		



Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 5 MHz Bandwidth, 256-QAM Modulation, High Channel, 1992.5 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
39.803	0	39.803	42.803	45.803		

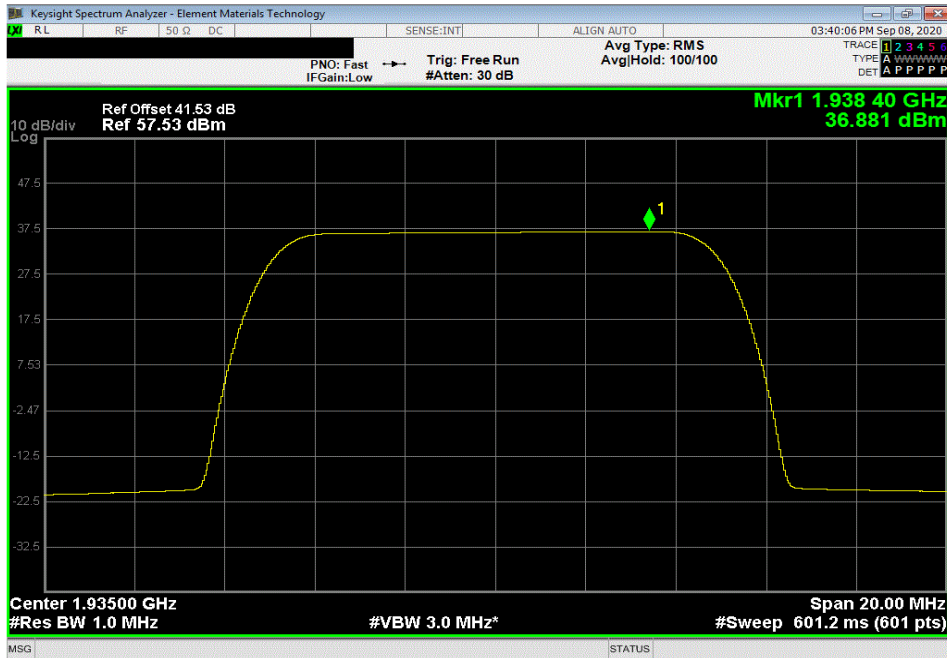


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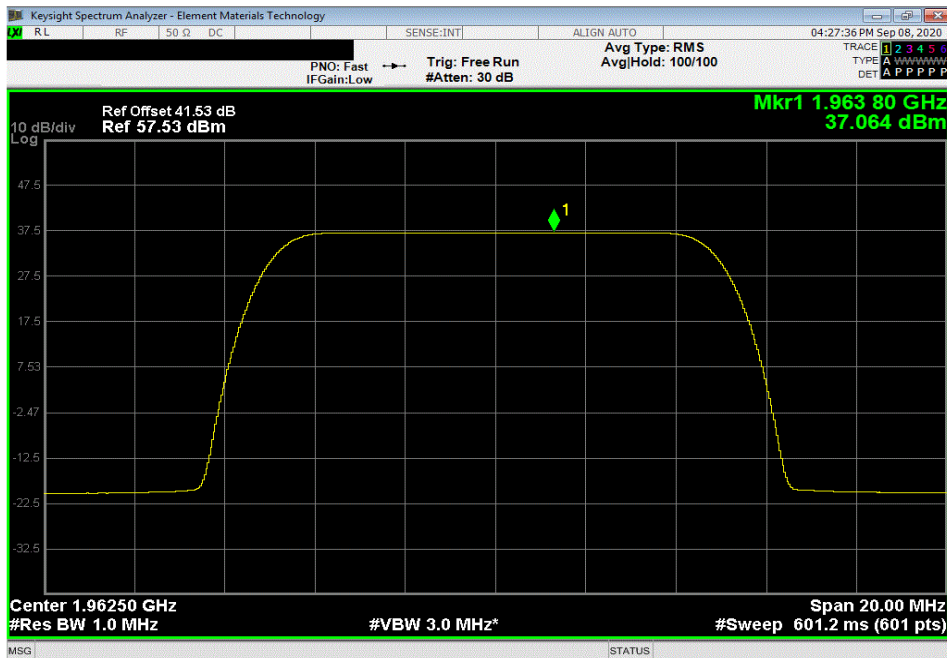


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Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 10 MHz Bandwidth, QPSK Modulation , Low Channel, 1935.0 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
36.881	0	36.881	39.881	42.881		



Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 10 MHz Bandwidth, QPSK Modulation , Mid Channel, 1962.5 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
37.064	0	37.064	40.064	43.064		

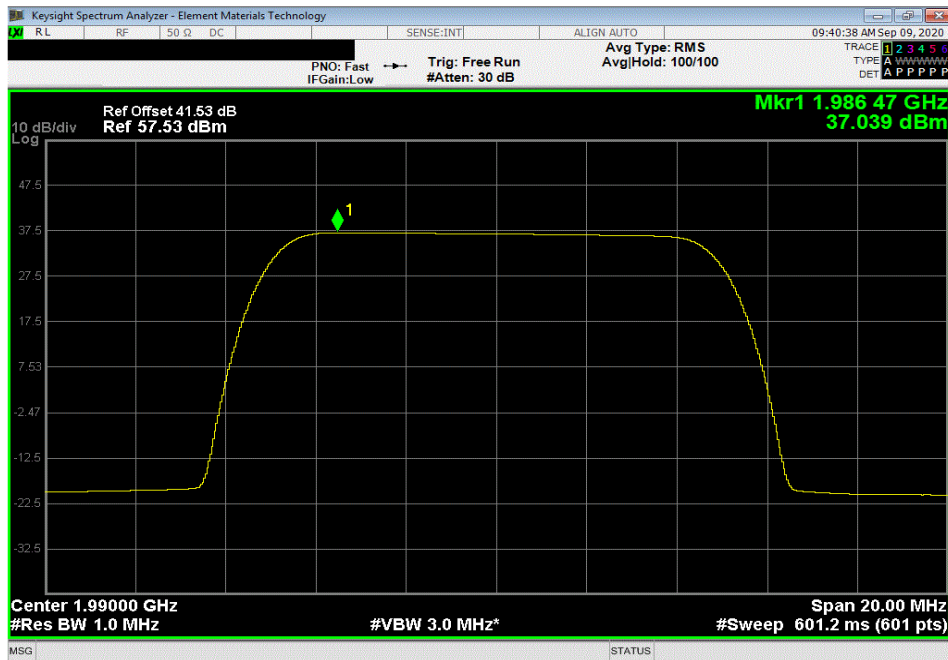


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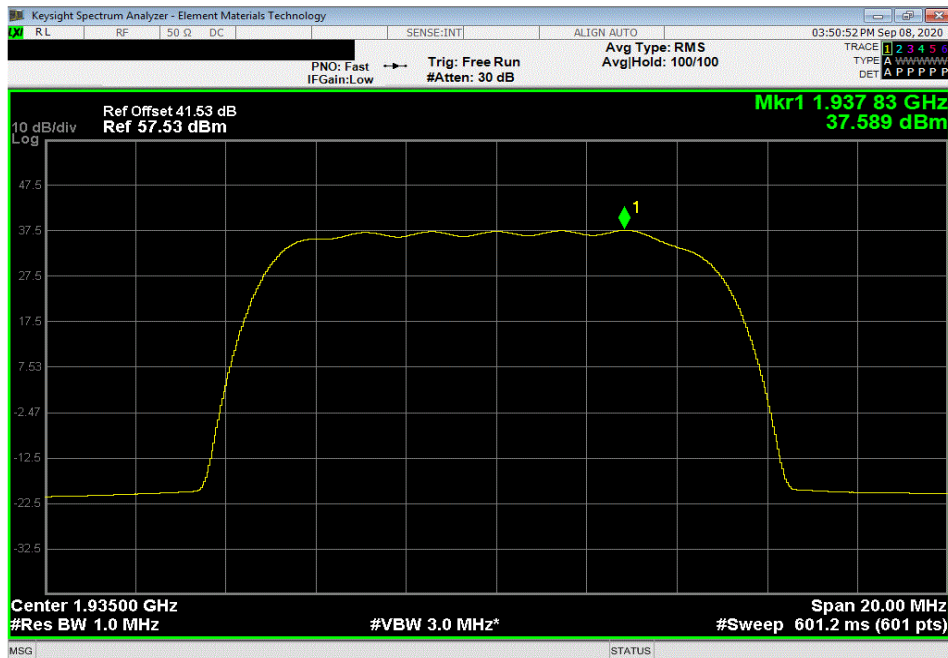


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Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 10 MHz Bandwidth, QPSK Modulation, High Channel, 1990 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
37.039	0	37.039	40.039	43.039		



Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 10 MHz Bandwidth, 16-QAM Modulation, Low Channel, 1935.0 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
37.589	0	37.589	40.589	43.589		

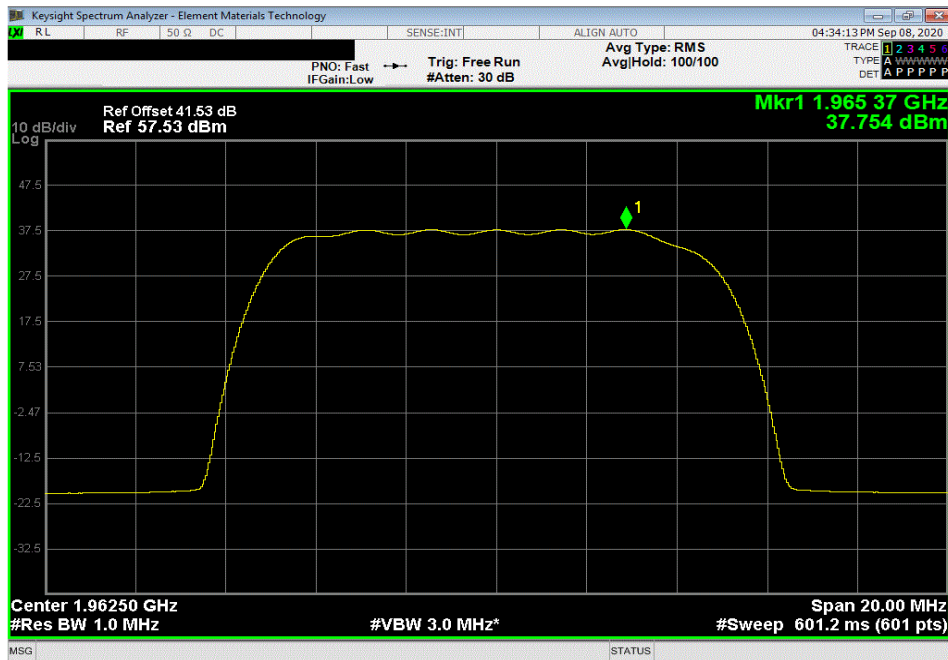


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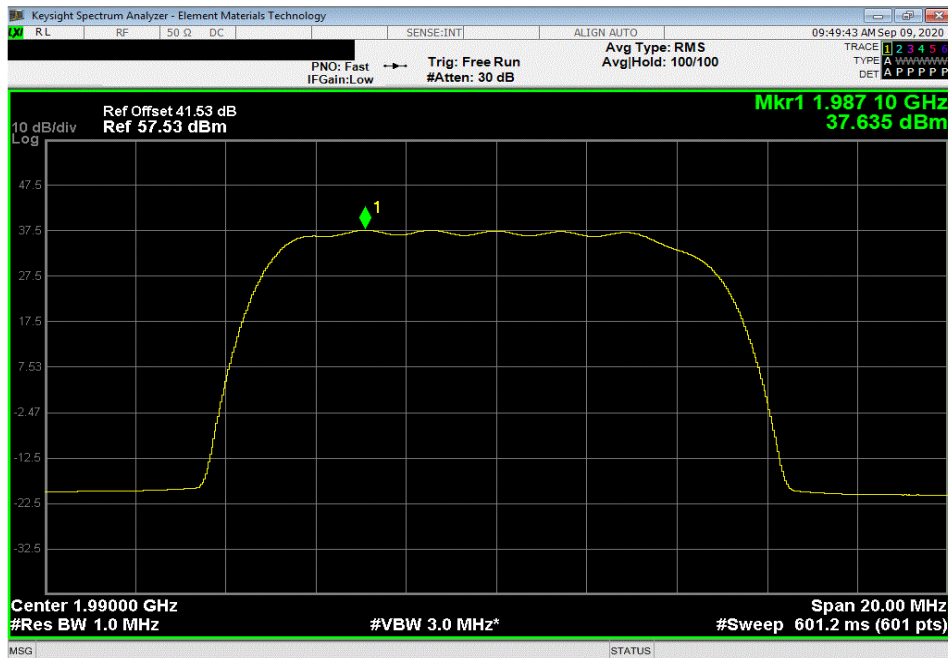


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Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 10 MHz Bandwidth, 16-QAM Modulation, Mid Channel, 1962.5 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
37.754	0	37.754	40.754	43.754		



Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 10 MHz Bandwidth, 16-QAM Modulation, High Channel, 1990 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
37.635	0	37.635	40.635	43.635		

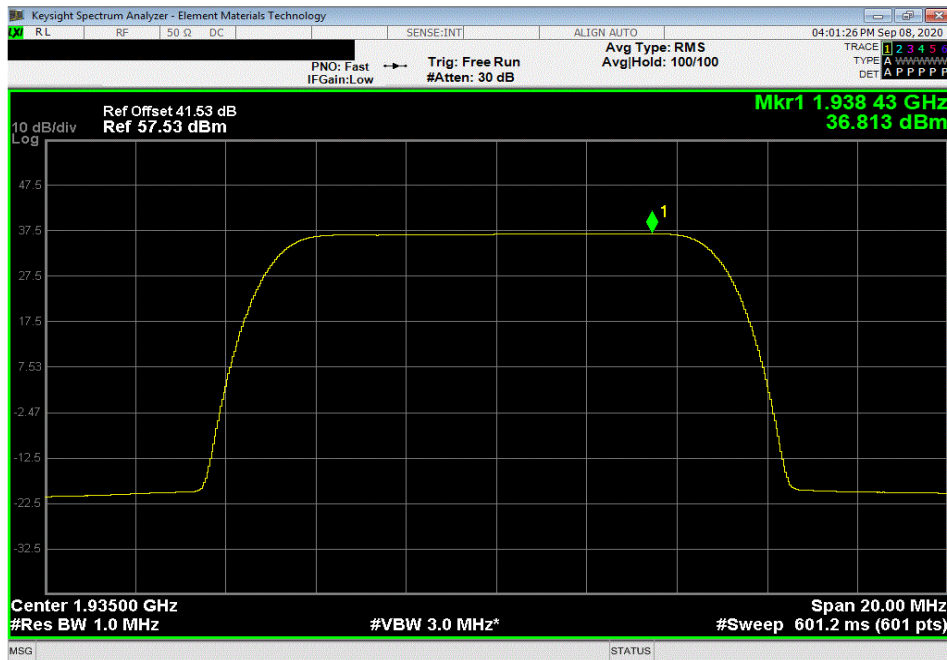


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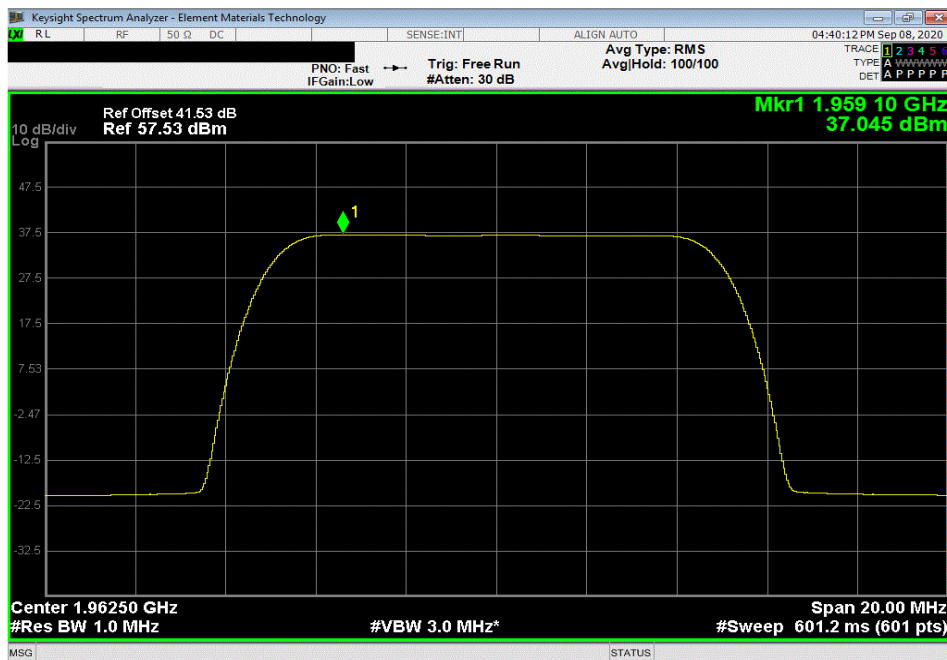


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Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 10 MHz Bandwidth, 64-QAM Modulation, Low Channel, 1935.0 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
36.813	0	36.813	39.813	42.813		



Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 10 MHz Bandwidth, 64-QAM Modulation, Mid Channel, 1962.5 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
37.045	0	37.045	40.045	43.045		

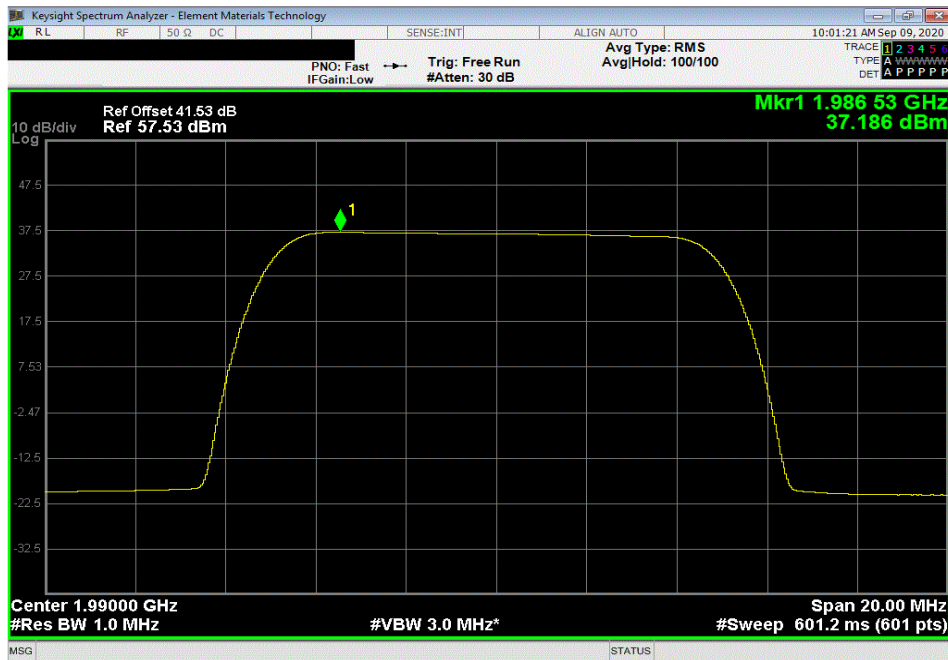


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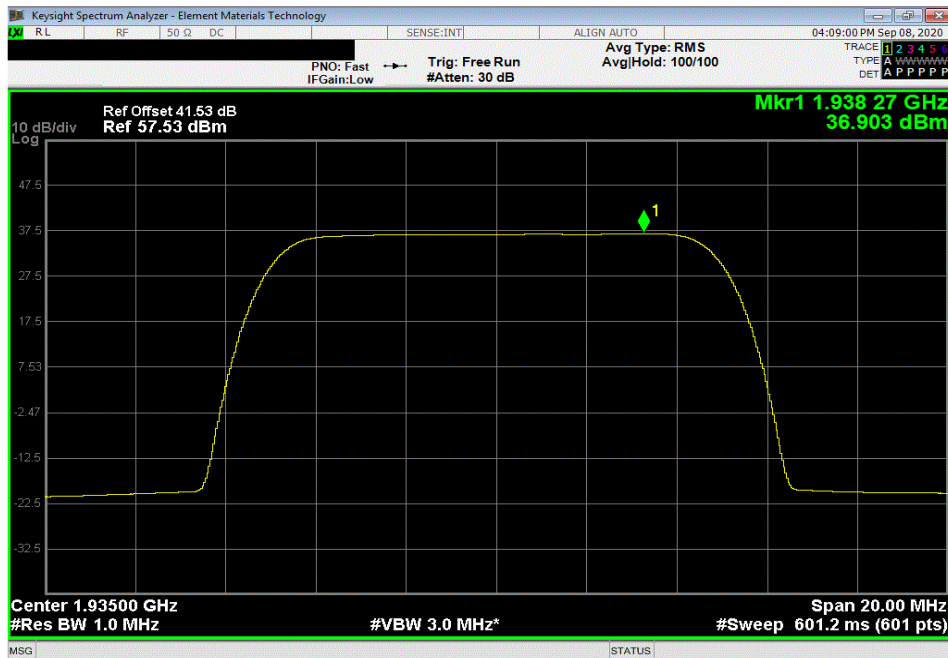


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Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 10 MHz Bandwidth, 64-QAM Modulation, High Channel, 1990 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)	
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD	
37.186	0	37.186	40.186	43.186	



Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 10 MHz Bandwidth, 256-QAM Modulation, Low Channel, 1935.0 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)	
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD	
36.903	0	36.903	39.903	42.903	

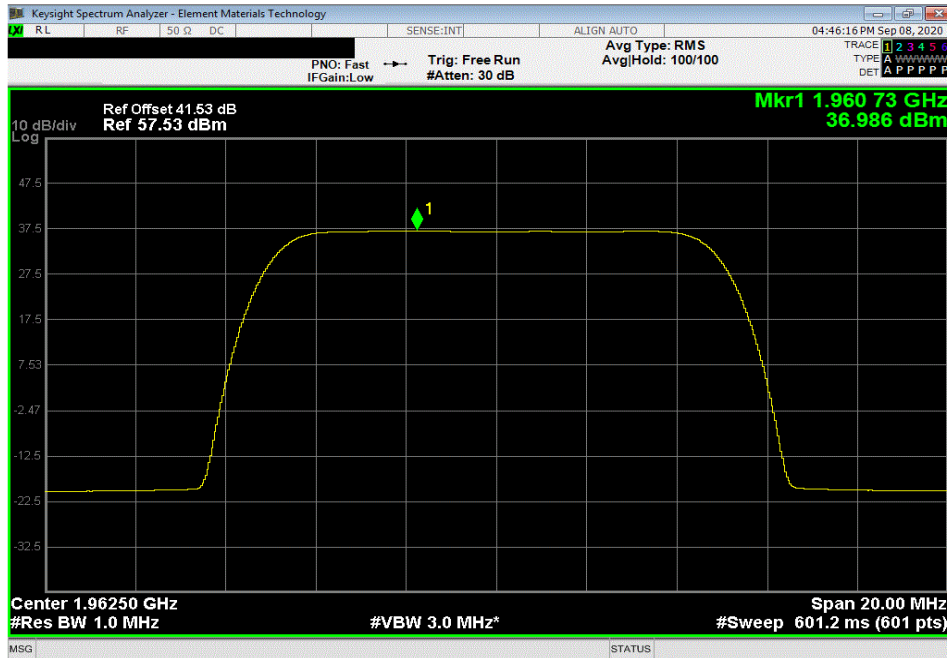


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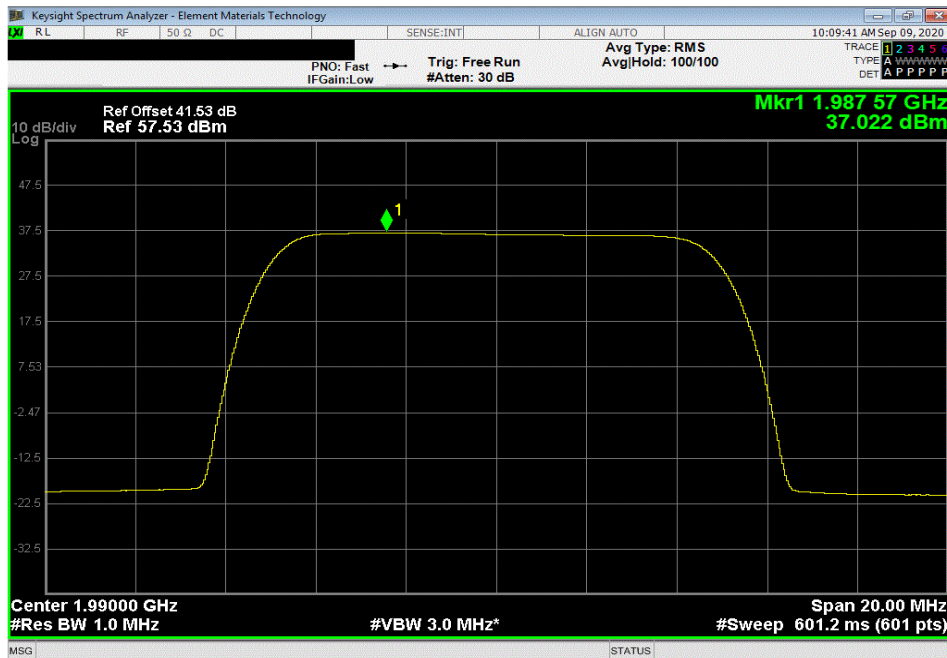


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Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 10 MHz Bandwidth, 256-QAM Modulation, Mid Channel, 1962.5 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)	
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD	
36.986	0	36.986	39.986	42.986	



Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 10 MHz Bandwidth, 256-QAM Modulation, High Channel, 1990 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)	
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD	
37.022	0	37.022	40.022	43.022	

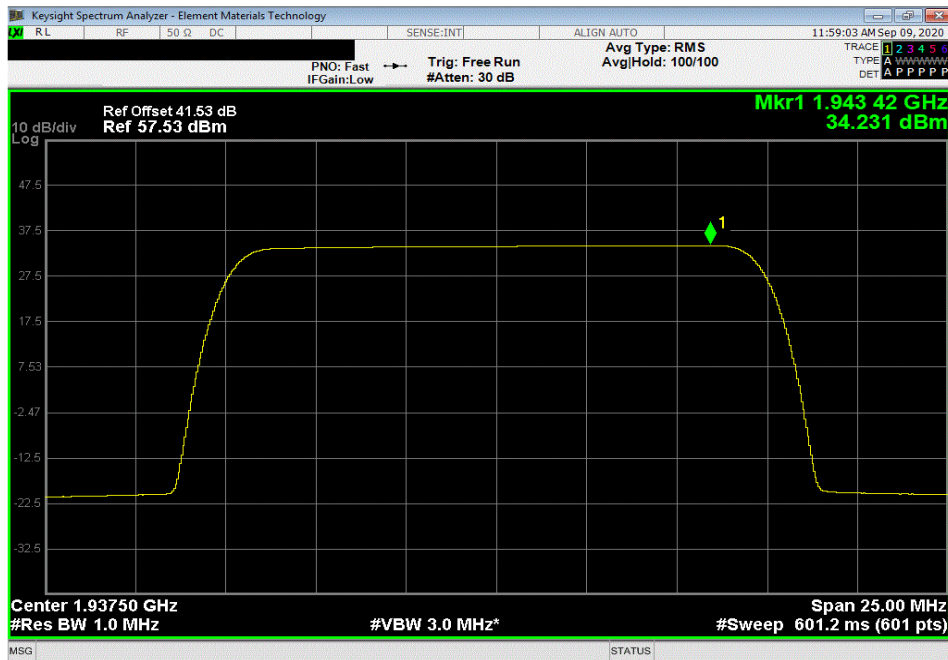


POWER SPECTRAL DENSITY

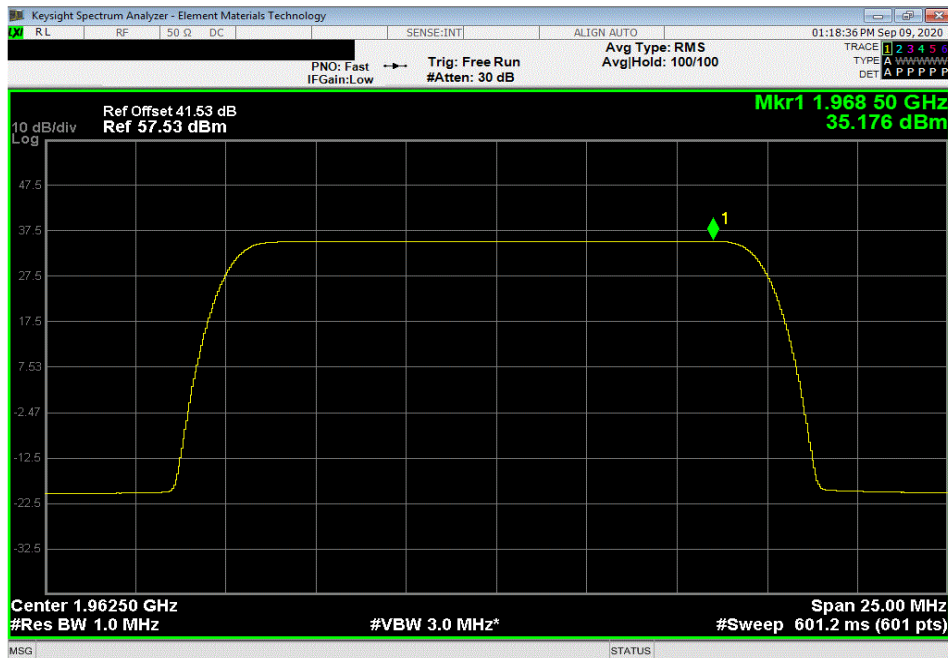


Thx 2020.08.08.0 BETA XMI 2020.03.25.0

Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 15 MHz Bandwidth, QPSK Modulation , Low Channel, 1937.5 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
34.231	0	34.231	37.231	40.231		



Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 15 MHz Bandwidth, QPSK Modulation , Mid Channel, 1962.5 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
35.176	0	35.176	38.176	41.176		

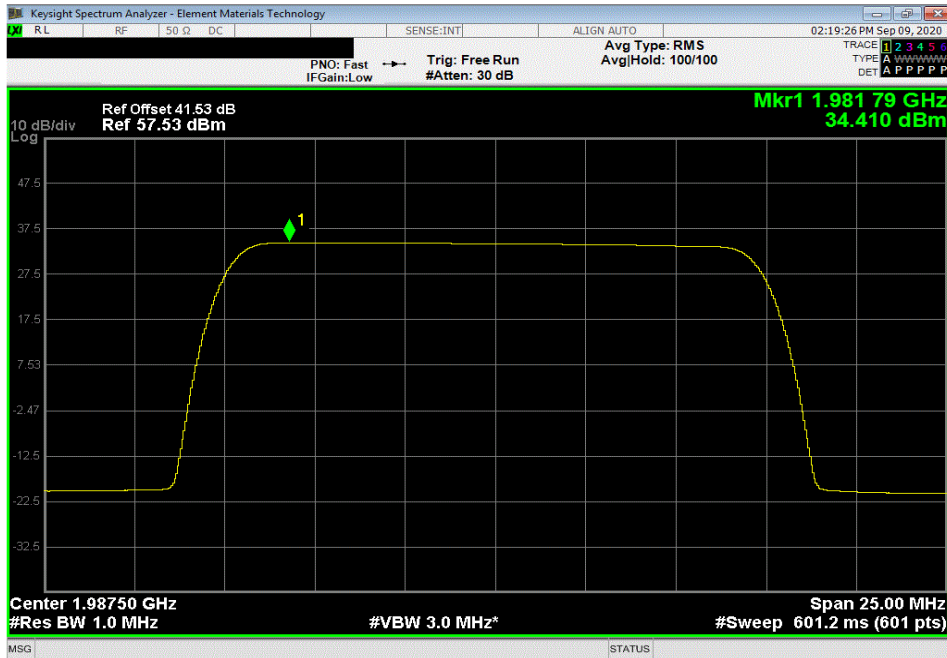


POWER SPECTRAL DENSITY

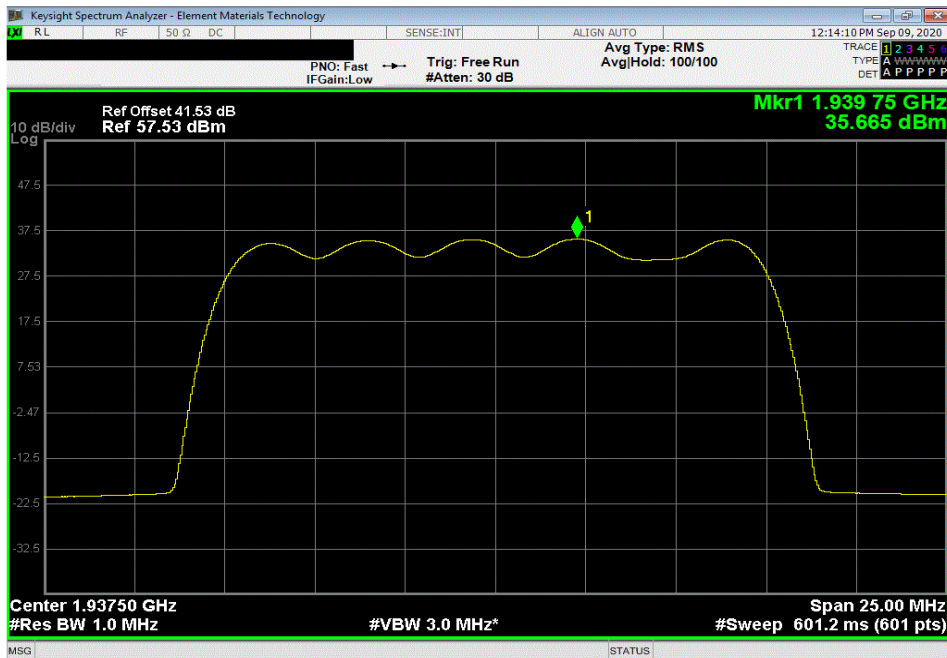


TMTx 2020.08.08.0 BETA XMI 2020.03.25.0

Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 15 MHz Bandwidth, QPSK Modulation, High Channel, 1987.5 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
34.41	0	34.41	37.41	40.41		



Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 15 MHz Bandwidth, 16-QAM Modulation, Low Channel, 1937.5 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
35.665	0	35.665	38.665	41.665		

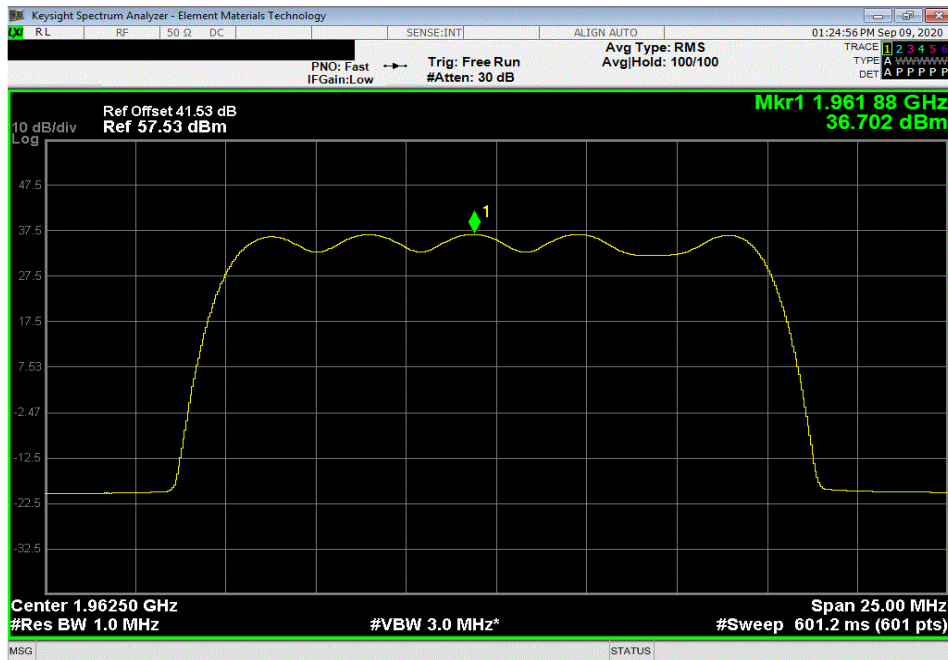


POWER SPECTRAL DENSITY

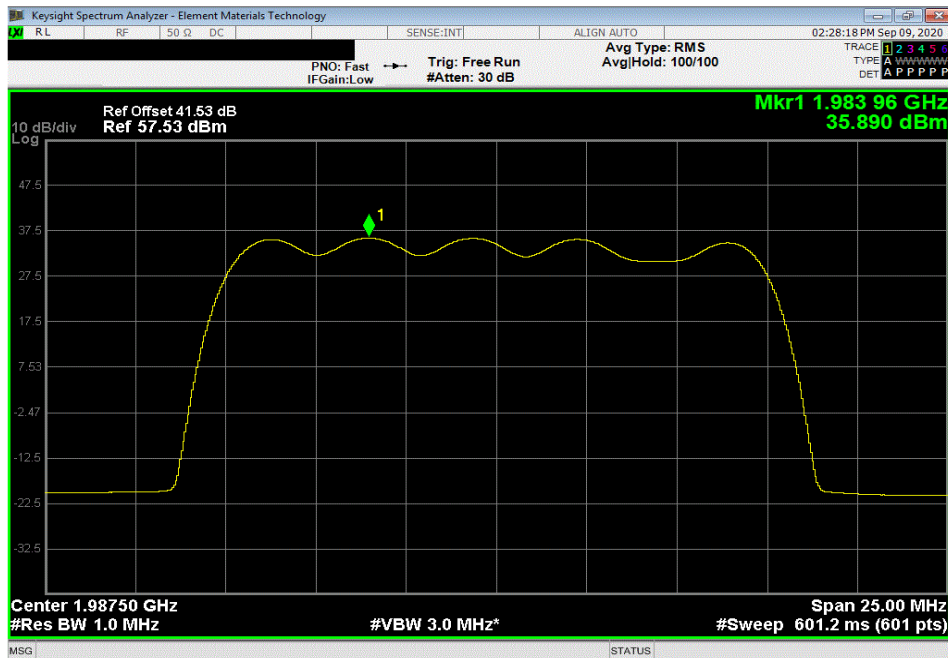


TMTx 2020.08.08.0 BETA XMI 2020.03.25.0

Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 15 MHz Bandwidth, 16-QAM Modulation, Mid Channel, 1962.5 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
36.702	0	36.702	39.702	42.702		



Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 15 MHz Bandwidth, 16-QAM Modulation, High Channel, 1987.5 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
35.89	0	35.89	38.89	41.89		

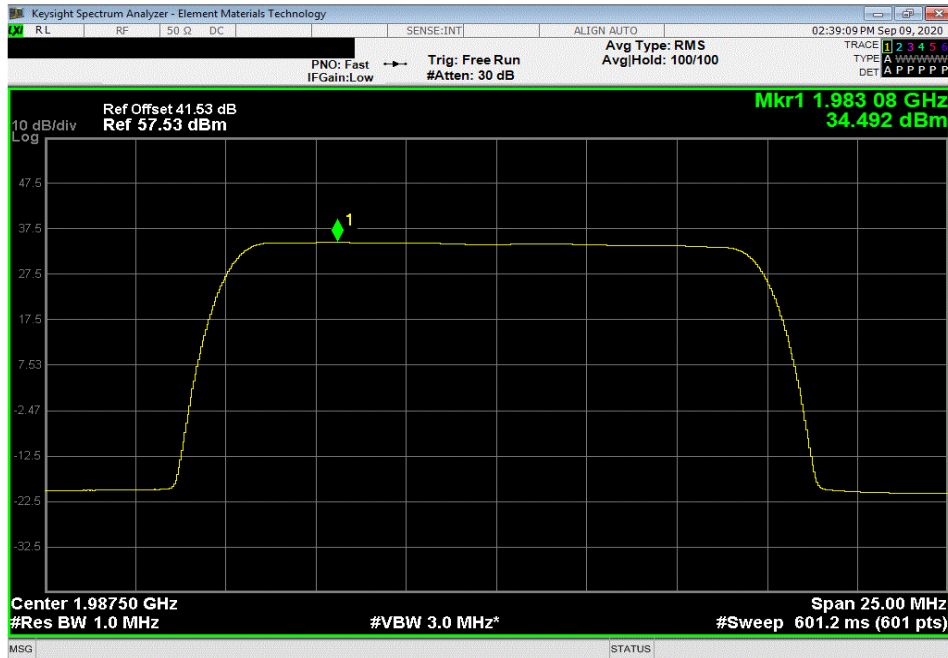


POWER SPECTRAL DENSITY

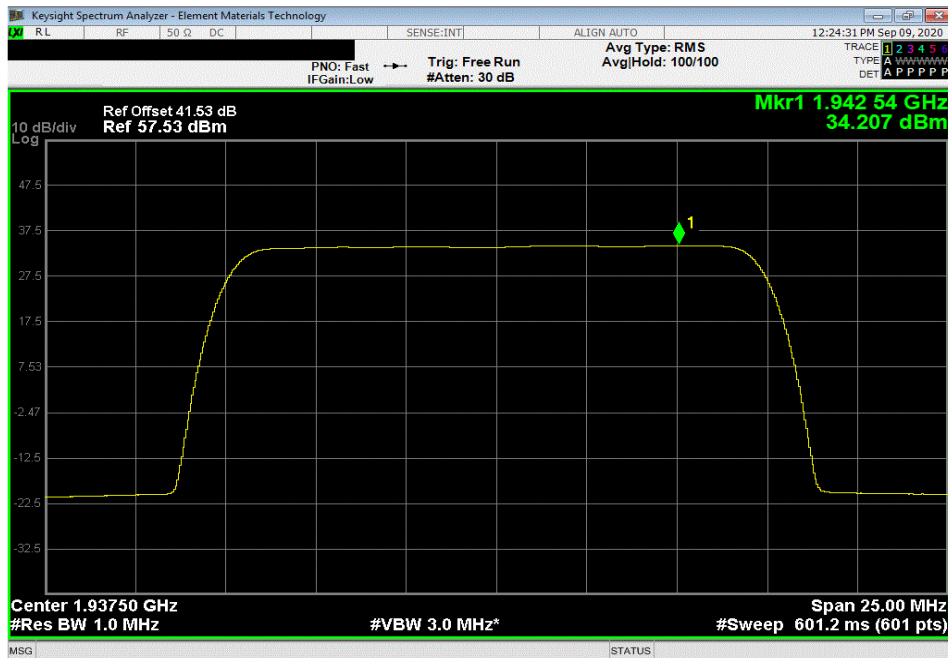


Thx 2020.08.08.0 BETA XMI 2020.03.25.0

Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 15 MHz Bandwidth, 64-QAM Modulation, Low Channel, 1937.5 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
34.492	0	34.492	37.492	40.492		



Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 15 MHz Bandwidth, 64-QAM Modulation, Mid Channel, 1962.5 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
34.207	0	34.207	37.207	40.207		

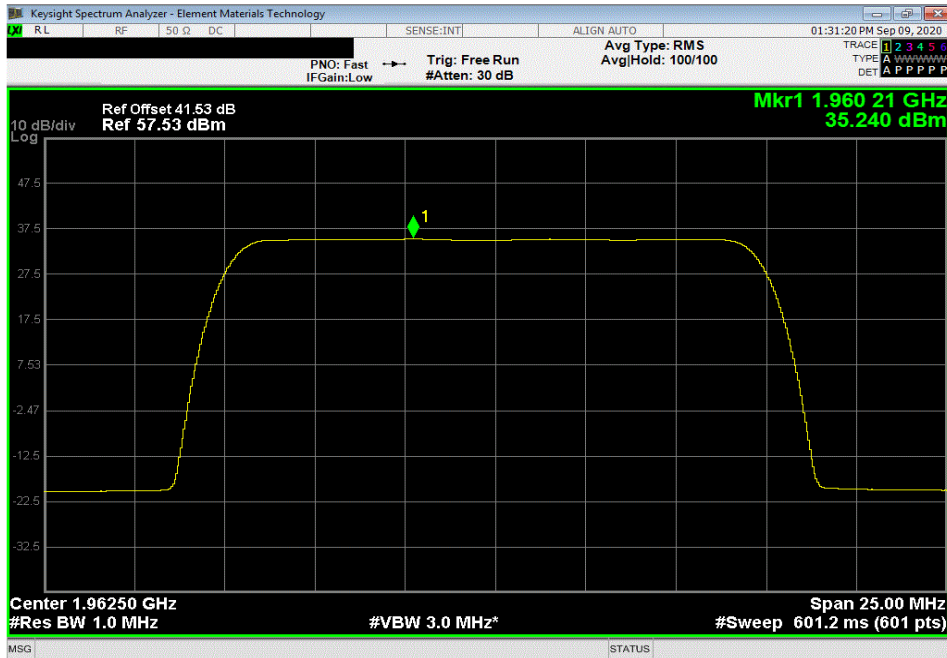


POWER SPECTRAL DENSITY

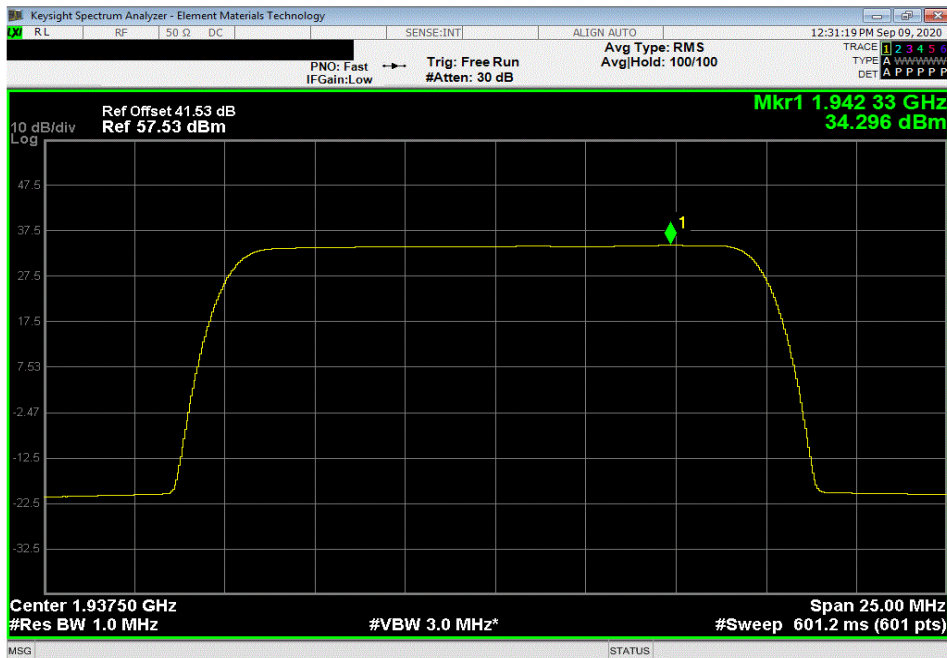


Thx 2020.08.08.0 BETA XMI 2020.03.25.0

Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 15 MHz Bandwidth, 64-QAM Modulation, High Channel, 1987.5 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
35.24	0	35.24	38.24	41.24		



Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 15 MHz Bandwidth, 256-QAM Modulation, Low Channel, 1937.5 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
34.296	0	34.296	37.296	40.296		

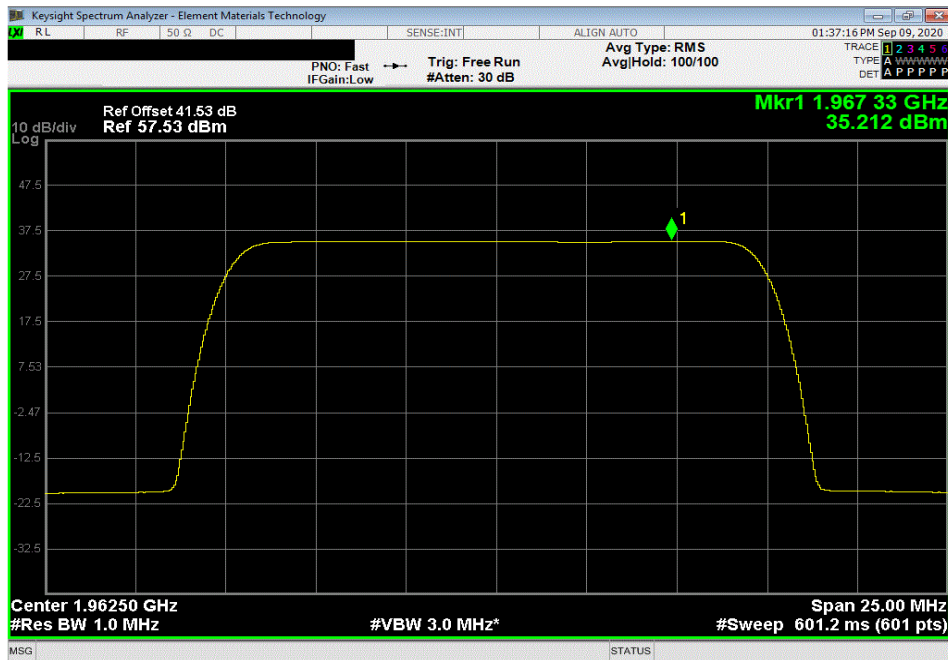


POWER SPECTRAL DENSITY

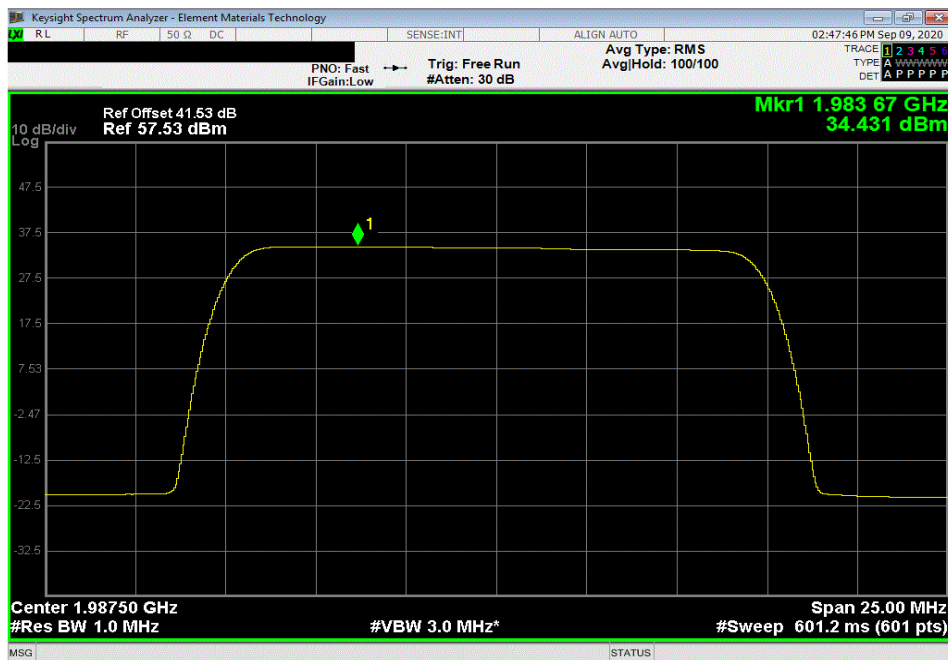


ThxTx 2020.08.08.0 BETA XMI 2020.03.25.0

Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 15 MHz Bandwidth, 256-QAM Modulation, Mid Channel, 1962.5 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
35.212	0	35.212	38.212	41.212		



Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 15 MHz Bandwidth, 256-QAM Modulation, High Channel, 1987.5 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
34.431	0	34.431	37.431	40.431		

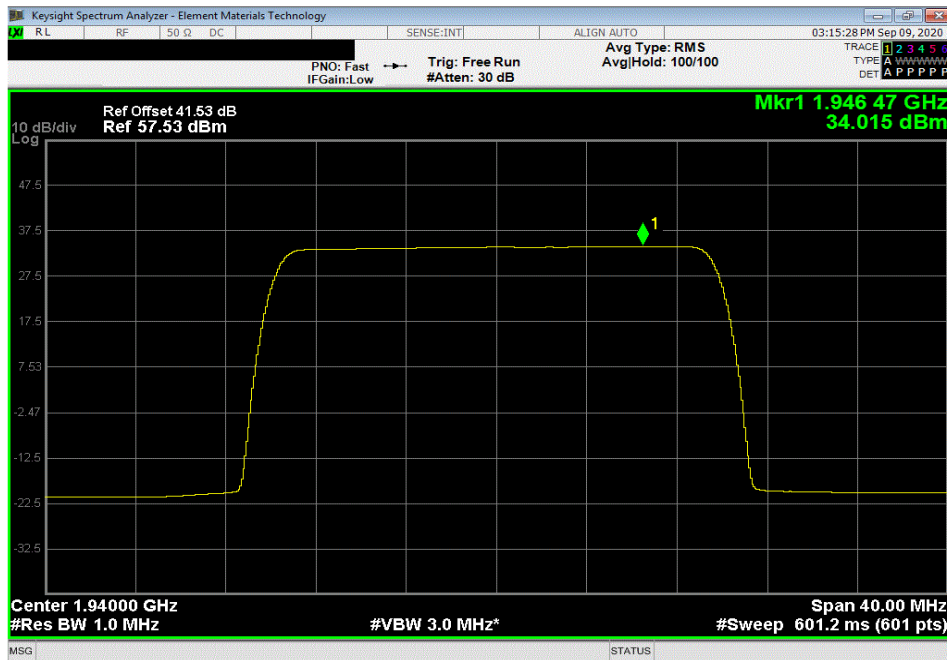


POWER SPECTRAL DENSITY

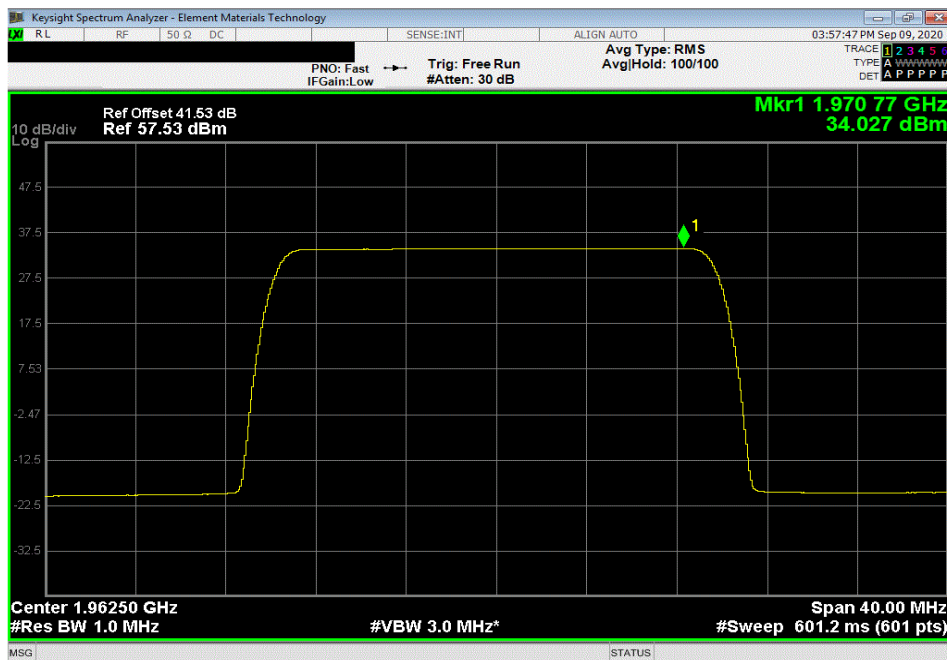


Thx 2020.08.0 BETA XMI 2020.03.25.0

Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 20 MHz Bandwidth, QPSK Modulation , Low Channel, 1940 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
34.015	0	34.015	37.015	40.015		



Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 20 MHz Bandwidth, QPSK Modulation , Mid Channel, 1962.5 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
34.027	0	34.027	37.027	40.027		

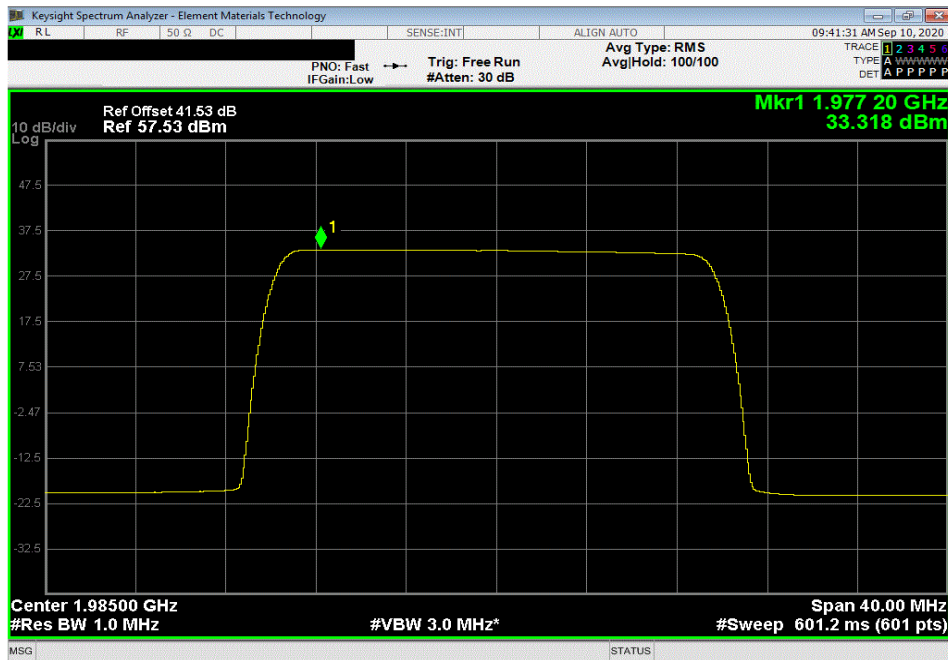


POWER SPECTRAL DENSITY

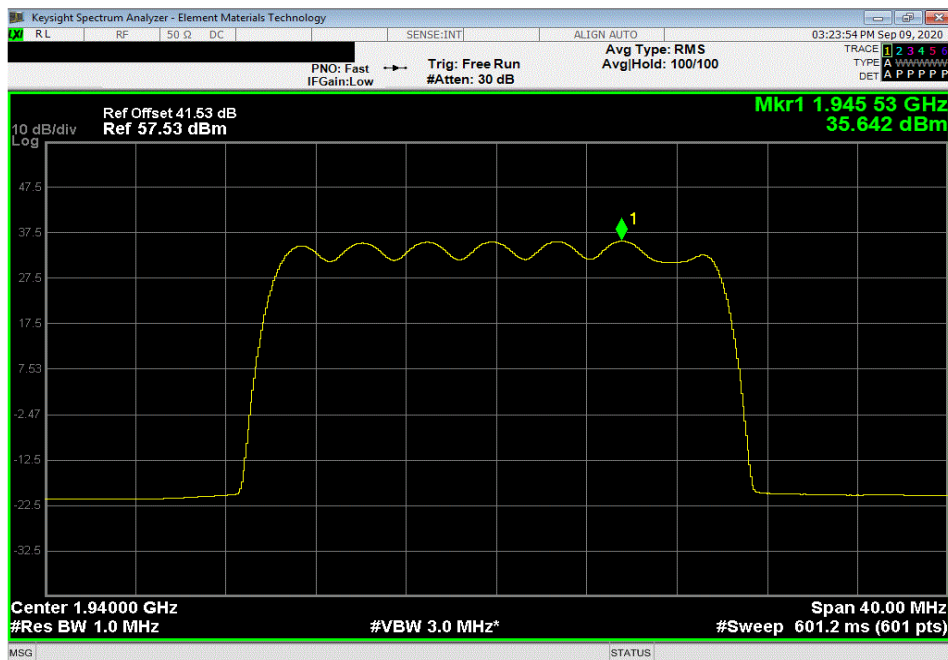


Thx 2020.08.0 BETA XMI 2020.03.25.0

Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 20 MHz Bandwidth, QPSK Modulation, High Channel, 1985 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
33.318	0	33.318	36.318	39.318		



Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 20 MHz Bandwidth, 16-QAM Modulation, Low Channel, 1940 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
35.642	0	35.642	38.642	41.642		

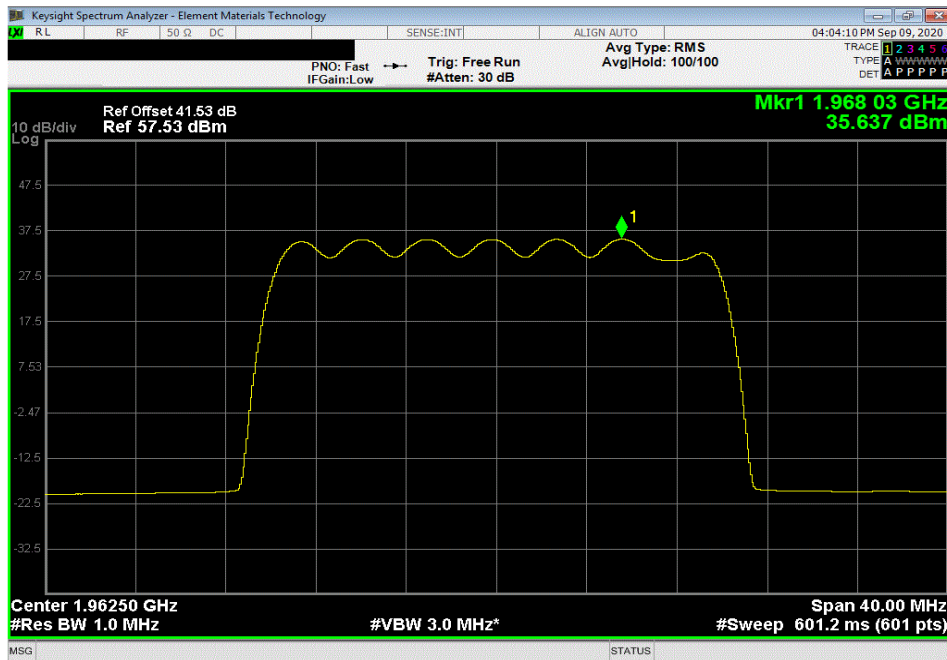


POWER SPECTRAL DENSITY

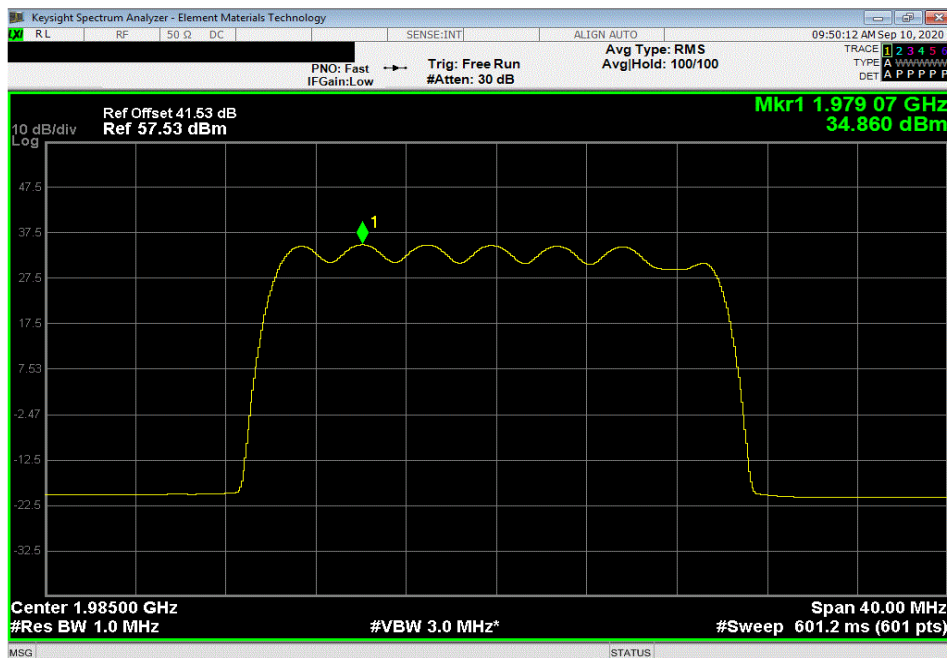


Thx 2020.08.0 BETA XMI 2020.03.25.0

Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 20 MHz Bandwidth, 16-QAM Modulation, Mid Channel, 1962.5 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
35.637	0	35.637	38.637	41.637		



Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 20 MHz Bandwidth, 16-QAM Modulation, High Channel, 1985 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
34.86	0	34.86	37.86	40.86		

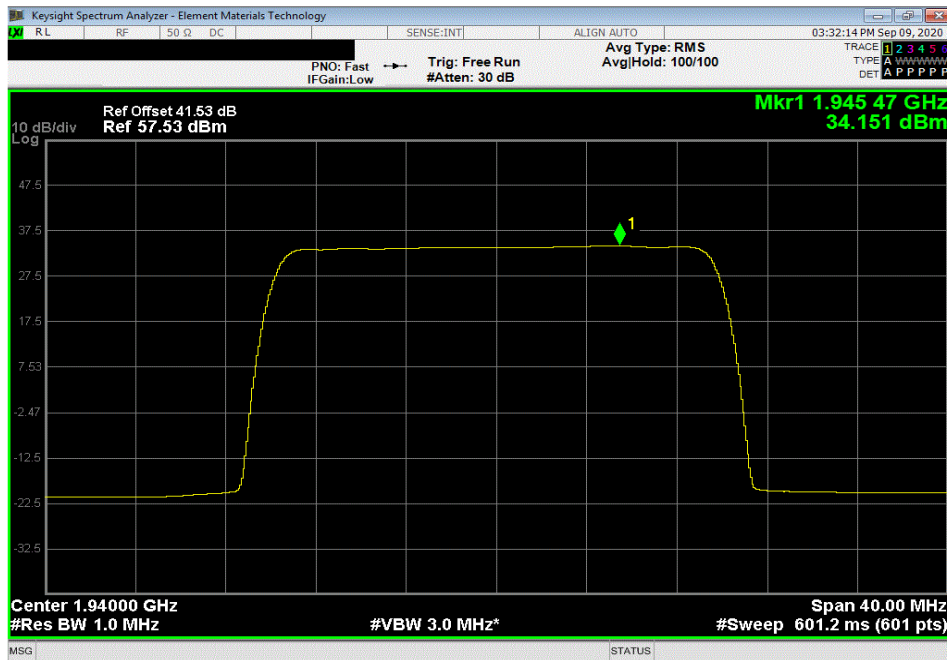


POWER SPECTRAL DENSITY

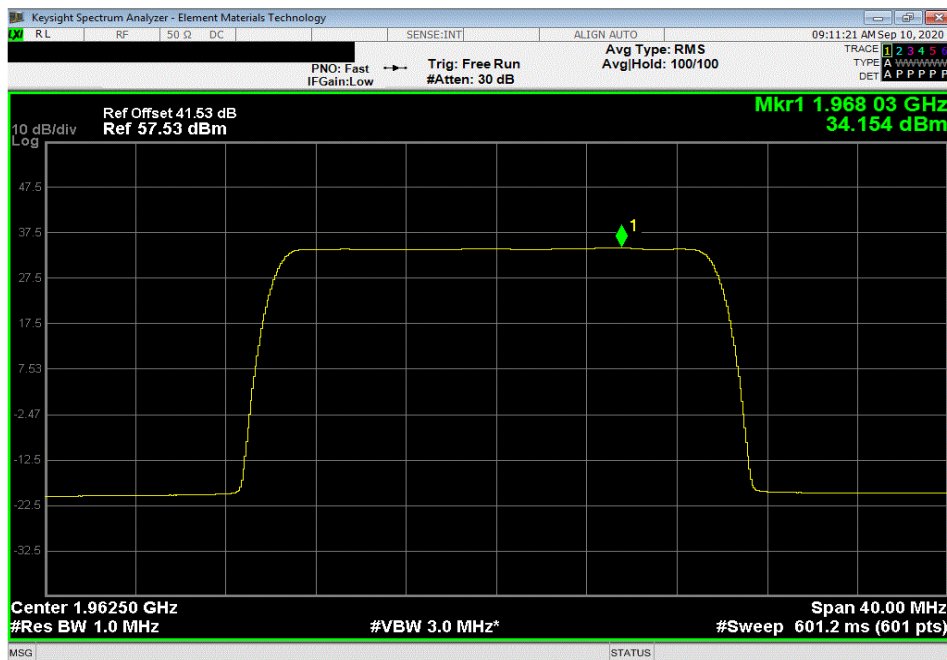


Thx 2020.08.08.0 BETA XMI 2020.03.25.0

Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 20 MHz Bandwidth, 64-QAM Modulation, Low Channel, 1940 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
34.151	0	34.151	37.151	40.151		



Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 20 MHz Bandwidth, 64-QAM Modulation, Mid Channel, 1962.5 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
34.154	0	34.154	37.154	40.154		

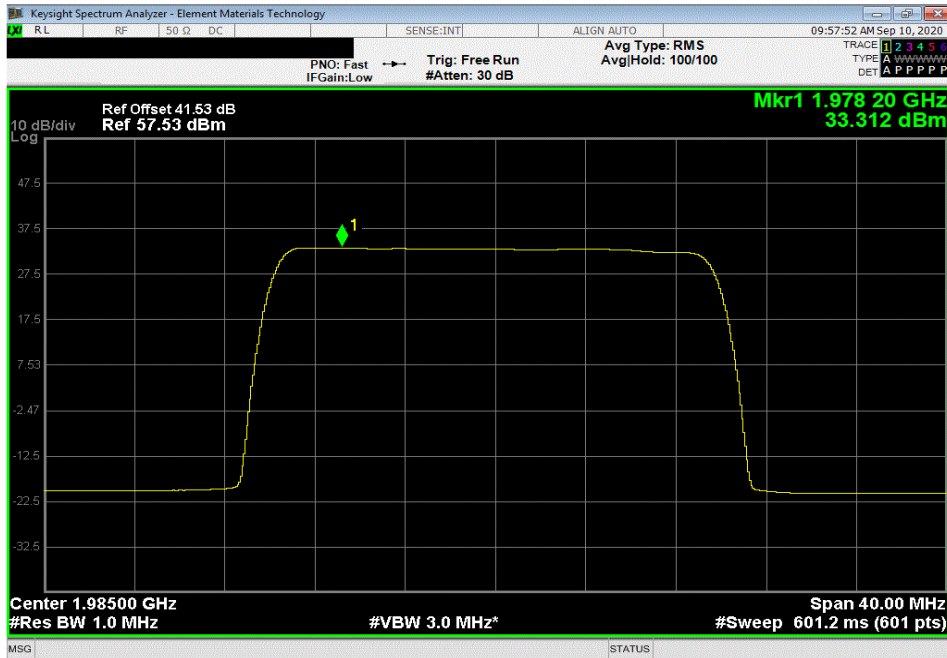


POWER SPECTRAL DENSITY

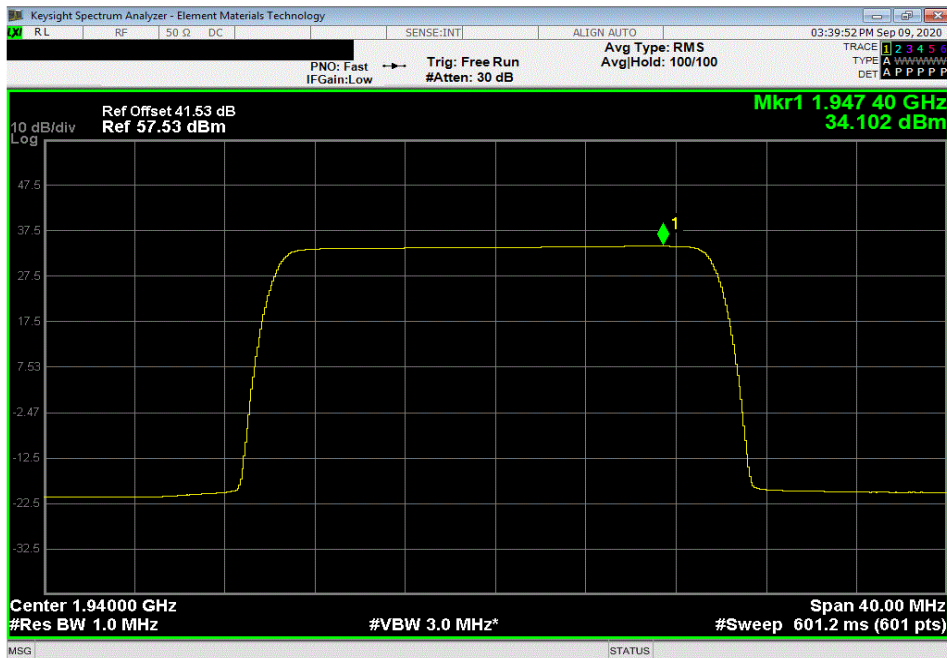


Thx 2020.08.08.0 BETA XMI 2020.03.25.0

Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 20 MHz Bandwidth, 64-QAM Modulation, High Channel, 1985 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
33.312	0	33.312	36.312	39.312		



Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 20 MHz Bandwidth, 256-QAM Modulation, Low Channel, 1940 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
34.102	0	34.102	37.102	40.102		

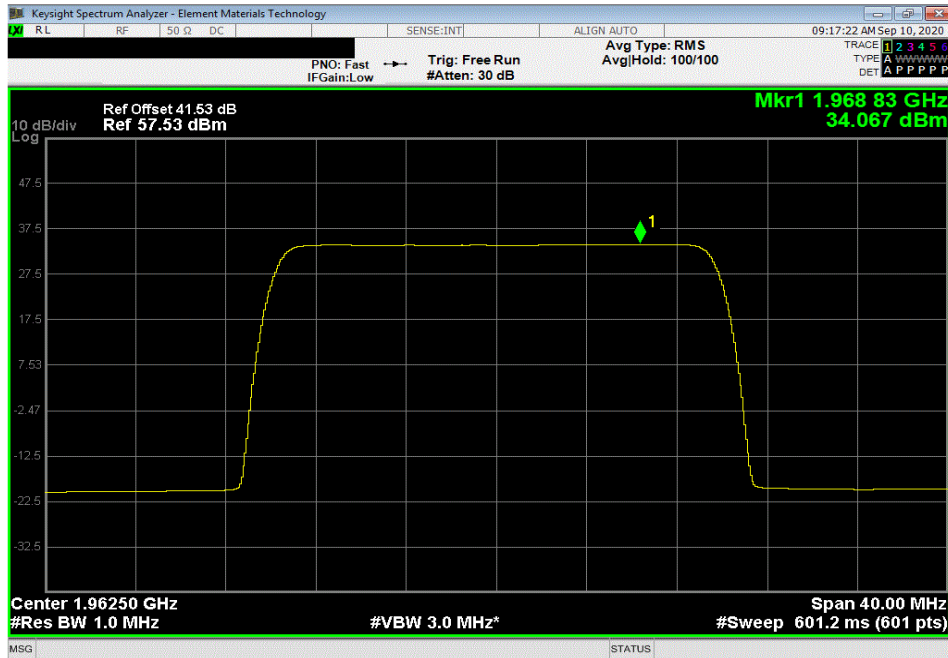


POWER SPECTRAL DENSITY

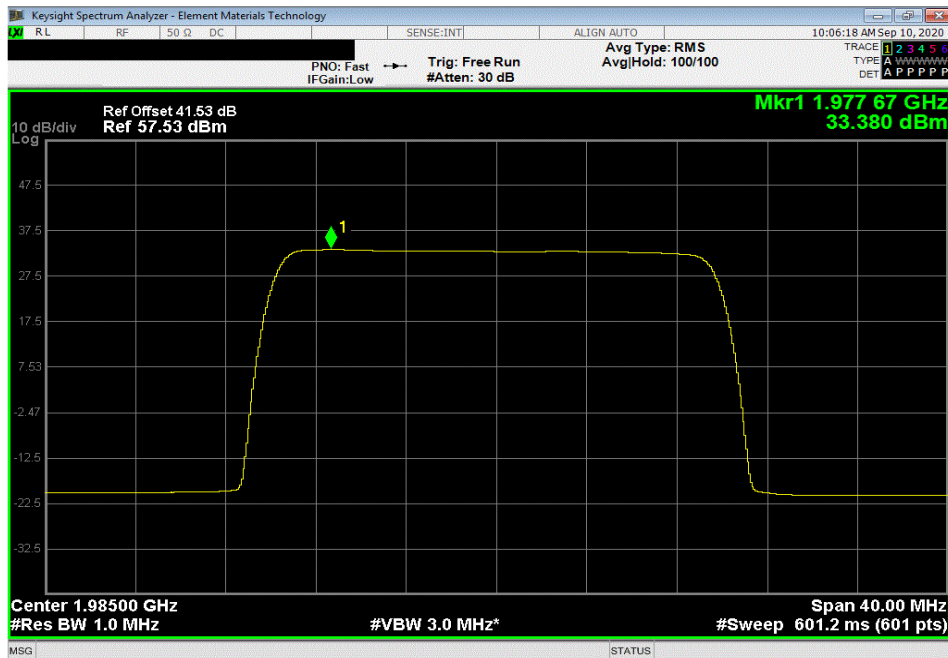


Thx 2020.08.08.0 BETA XMI 2020.03.25.0

Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 20 MHz Bandwidth, 256-QAM Modulation, Mid Channel, 1962.5 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
34.067	0	34.067	37.067	40.067		



Band 25, 1930 MHz - 1995 MHz, 5G, Port 1, 20 MHz Bandwidth, 256-QAM Modulation, High Channel, 1985 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
33.38	0	33.38	36.38	39.38		



POWER SPECTRAL DENSITY



Thru: 2020 09 08 0 BETA XM: 2020 03 25 0

EIRP Calculations

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 (whether to operate two port or four port MIMO, carrier power level, channel bandwidth, modulation type, etc.) to optimize performance. Transmitter output power may be reduced in 0.1dB increments (from maximum) by base station setup parameters. Base station antennas are selected by the customer.

Kathrein antenna assembly model "80011867(Y2)" has a gain (dBi) of 17.3 ±0.3dB (maximum gain of 17.6dBi was used for the EIRP calculation) for Band n25 noted in the TUV RF Exposure Report document number 75933222-02 Issue 2 dated 03 October 2019. This antenna assembly has a pair of ±45° cross-polarized radiators used for Band n25. The four antenna RF inputs (used for Band n25) on the antenna assembly are as follows: Y1+ L5 (+45°), Y1- L6 (-45°), Y2+ R7 (+45°) and Y2- R8 (-45°). The four FHFB transmitter outputs are connected to the antenna assembly RF inputs.

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 PSD for each channel bandwidth type). The maximum antenna 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 four 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	40.3 dBm /MHz	37.8 dBm /MHz	36.8 dBm /MHz	35.6 dBm /MHz
Cable Loss (site dependent)	0 dB	0 dB	0 dB	0 dB
Maximum Antenna Gain (G_{Ave})	17.6 dB	17.6 dB	17.6 dB	17.6 dB
Directional Gain = $G_{Ave} + 10\log(2)$ Note 1	20.6 dB	20.6 dB	20.6 dB	20.6 dB
EIRP for Antenna Y1 +45° EIRP for Ant Y1 +45°= PSD/ant port - Cable Loss + Dir Gain	60.9 dBm /MHz	58.4 dBm /MHz	57.4 dBm /MHz	56.2 dBm /MHz
EIRP for Antenna Y1 -45°	60.9 dBm /MHz	58.4 dBm /MHz	57.4 dBm /MHz	56.2 dBm /MHz
EIRP subtotal for Y1 +45° and Y1 -45° See Note 2	1230 Watts/MHz	692 Watts/MHz	550 Watts/MHz	417 Watts/MHz
EIRP for Antenna Y2 +45°	60.9 dBm /MHz	58.4 dBm /MHz	57.4 dBm /MHz	56.2 dBm /MHz
EIRP for Antenna Y2 -45°	60.9 dBm /MHz	58.4 dBm /MHz	57.4 dBm /MHz	56.2 dBm /MHz
EIRP subtotal for Y2 +45° and Y2 -45° See Note 2	1230 Watts/MHz	692 Watts/MHz	550 Watts/MHz	417 Watts/MHz
EIRP Total = Y1 ±45° and Y2 ±45° See Note 3	2460 Watts/MHz	1384 Watts/MHz	1100 Watts/MHz	834 Watts/MHz
	63.9 dBm /MHz	61.4 dBm /MHz	60.4 dBm /MHz	59.2 dBm /MHz

Note 1: The directional gain was calculated for two antennas since there are a pair of cross-polarized radiators. See ANSI C63.26 sections 6.4.5.3.3a) & 6.4.5.3.1a), and KDB 662911D01v02r01 paragraphs F)2)c)(i) & F)2)a)(i) for guidance.

Note 2: 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 3: Antenna Y1 and Y2 are correlated - the EIRPs are required to be summed and be below the regulatory limit as described in ANSI C63.26-2015 section 6.4.6.3 b)3) and KDB 662911 D02v01 page 3 example (3).

Calculation Summary

The worst case FHFB four port MIMO EIRP levels using antenna assembly model "80011867(Y2)" 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 10, 15 & 20MHz channel bandwidths
- (3) Over the FCC and ISED (1640 W/MHz or 62.15 ~~dBm~~/MHz) EIRP Regulatory Limits by 1.75 dB for the 5MHz channel bandwidth. EIRP calculations are needed at each transmitter location to optimize base station operational performance while meeting regulatory requirements as noted above.

POWER SPECTRAL DENSITY INNER CHANNELS



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 power spectral density 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 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 $[10\log(1/D)]$, where D is the duty cycle, to the measured power to compute the PSD during the transmit times.

RF conducted emissions testing was performed only on one port. The testing was performed on the same version of hardware (FHFB) as the original certification test. The FHFB antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in the original 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. The total PSD of all antenna ports (at the radio output) were 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

POWER SPECTRAL DENSITY INNER CHANNELS



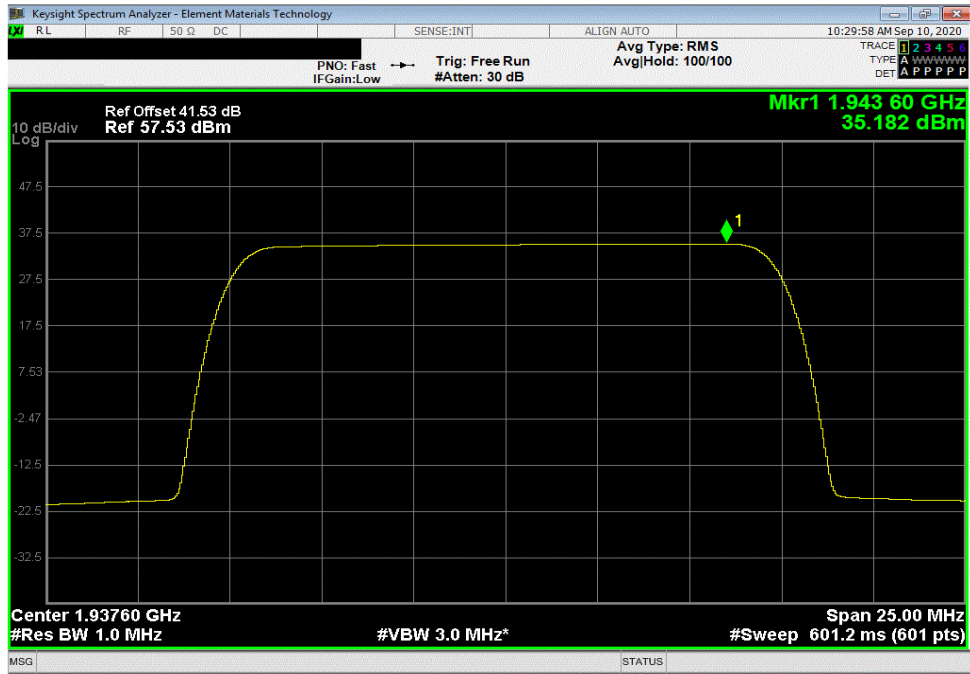
EUT: FHFB (FCC C2PC)		Work Order: NOKI0021	
Serial Number: L9144200604		Date: 10-Sep-20	
Customer: Nokia Solutions and Networks		Temperature: 22.4 °C	
Attendees: Mitchell Hill, John Rattanavong		Humidity: 48.9% RH	
Project: None		Barometric Pres.: 1024 mbar	
Tested by: Brandon Hobbs	Power: 54 VDC	Job Site: TX05	
TEST SPECIFICATIONS		Test Method	
FCC 24E:2020		ANSI C63.26:2015	
RSS-133:2018		RSS-133:2018	
COMMENTS			
All measurement path losses were accounted for in the reference level offset including any attenuators, filters and DC blocks. The carrier power was set to maximum for all testing. The following is the power spectral density (PSD) measurements at the radio output ports. The PSD was measured for a single carrier on port 1. The total PSD for multiport (2x2 MIMO & 4x4 MIMO) operation was determined 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)].			
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	
Port 1, Band n25, 1930 MHz - 1995 MHz			
15 MHz Bandwidth			
QPSK Modulation			
	Low Channel +100kHz: 1937.6 MHz	35.182	0
	High Channel -100kHz: 1987.4 MHz	35.386	0
16-QAM Modulation			
	Low Channel +100kHz: 1937.6 MHz	36.652	0
	High Channel -100kHz: 1987.4 MHz	36.823	0
64-QAM Modulation			
	Low Channel +100kHz: 1937.6 MHz	35.205	0
	High Channel -100kHz: 1987.4 MHz	35.441	0
256-QAM Modulation			
	Low Channel +100kHz: 1937.6 MHz	35.234	0
	High Channel -100kHz: 1987.4 MHz	35.364	0

POWER SPECTRAL DENSITY INNER CHANNELS

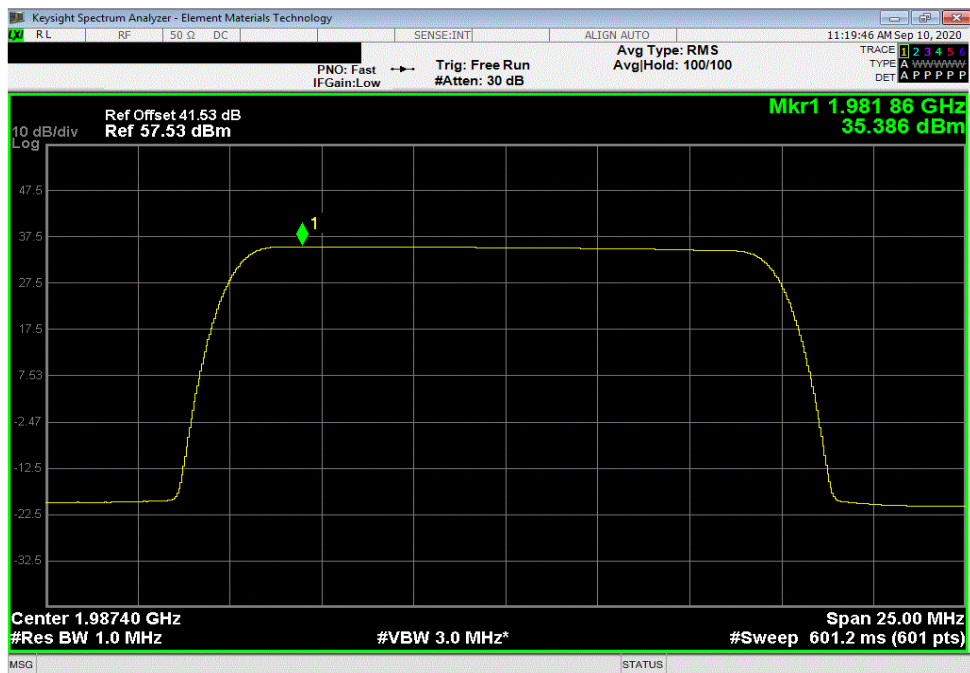


TkTx 2020.09.06.0 BETA XMM 2020.03.25.0

Port 1, Band n25, 1930 MHz - 1995 MHz, 15 MHz Bandwidth, QPSK Modulation, Low Channel +100kHz: 1937.6 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)	
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD	
35.182	0	35.182	38.182	41.182	



Port 1, Band n25, 1930 MHz - 1995 MHz, 15 MHz Bandwidth, QPSK Modulation, High Channel -100kHz: 1987.4 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)	
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD	
35.386	0	35.386	38.386	41.386	

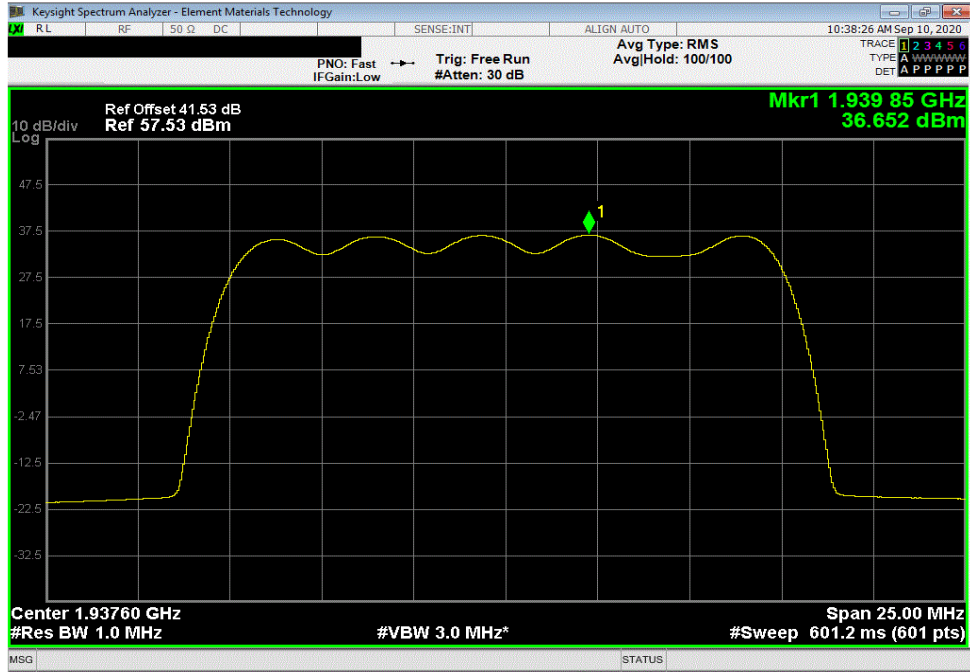


POWER SPECTRAL DENSITY INNER CHANNELS

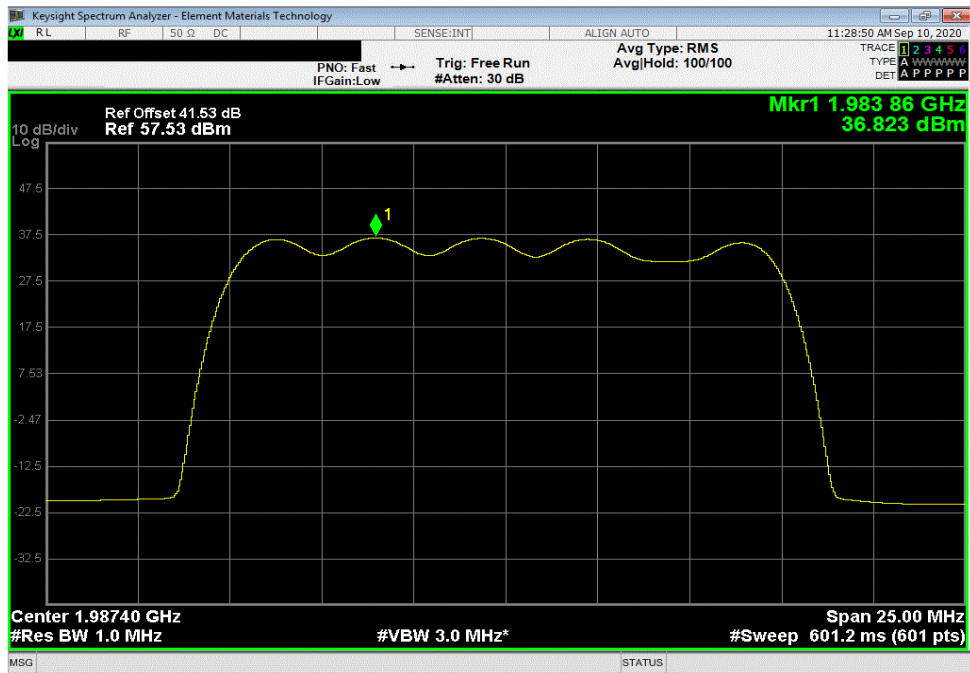


TkTx 2020.09.06.0 BETA XMM 2020.03.25.0

Port 1, Band n25, 1930 MHz - 1995 MHz, 15 MHz Bandwidth, 16-QAM Modulation, Low Channel +100kHz: 1937.6 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
36.652	0	36.652	39.652	42.652		



Port 1, Band n25, 1930 MHz - 1995 MHz, 15 MHz Bandwidth, 16-QAM Modulation, High Channel -100kHz: 1987.4 MHz						
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		
36.823	0	36.823	39.823	42.823		

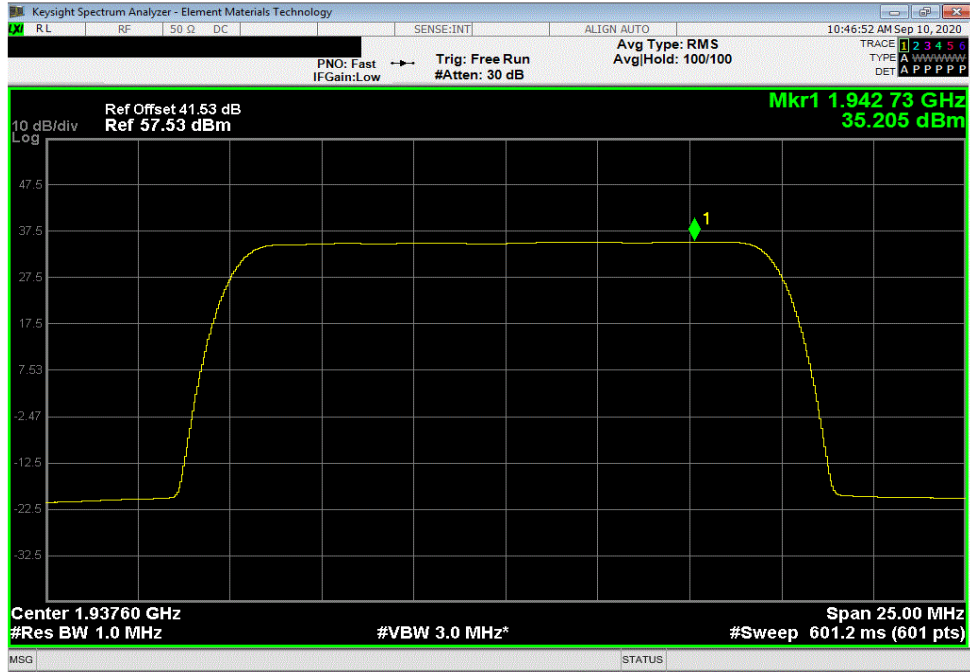


POWER SPECTRAL DENSITY INNER CHANNELS

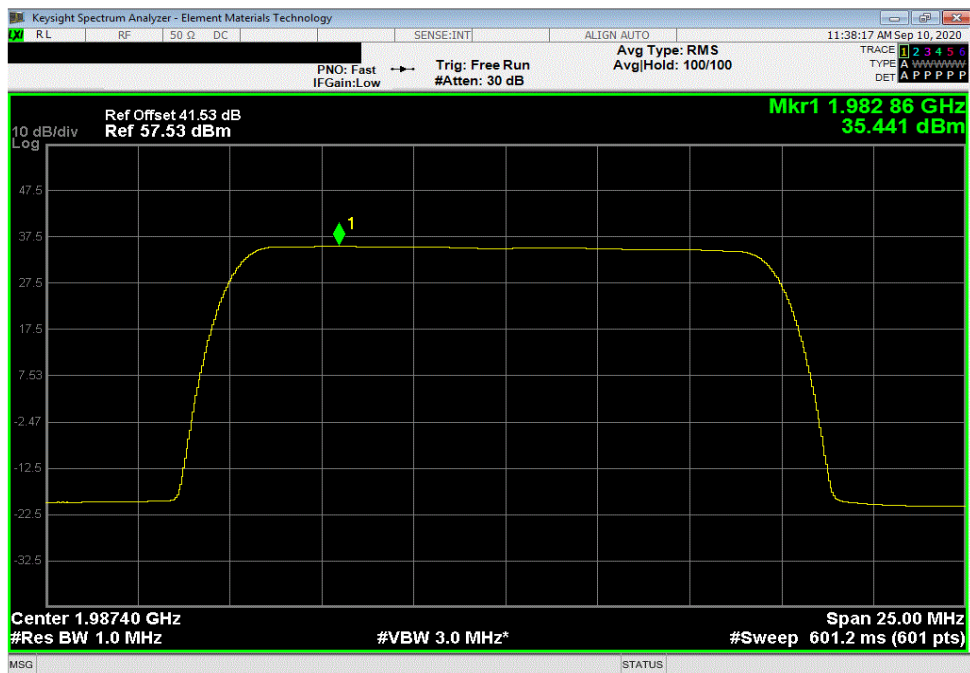


TkTx 2020.09.06.0 BETA XMM 2020.03.25.0

Port 1, Band n25, 1930 MHz - 1995 MHz, 15 MHz Bandwidth, 64-QAM Modulation, Low Channel +100kHz: 1937.6 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)	
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD	
35.205	0	35.205	38.205	41.205	



Port 1, Band n25, 1930 MHz - 1995 MHz, 15 MHz Bandwidth, 64-QAM Modulation, High Channel -100kHz: 1987.4 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)	
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD	
35.441	0	35.441	38.441	41.441	

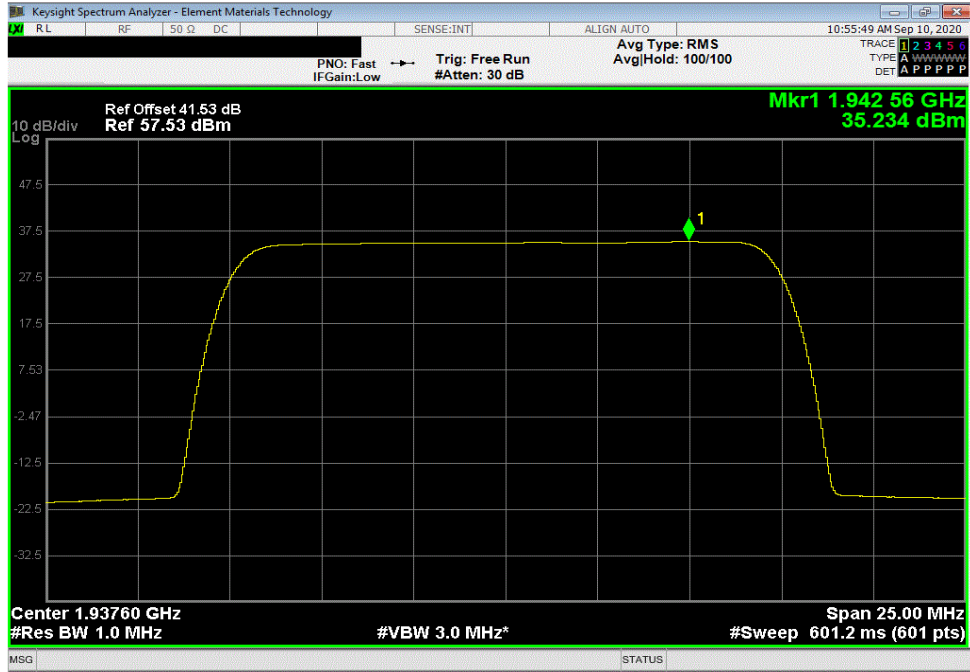


POWER SPECTRAL DENSITY INNER CHANNELS

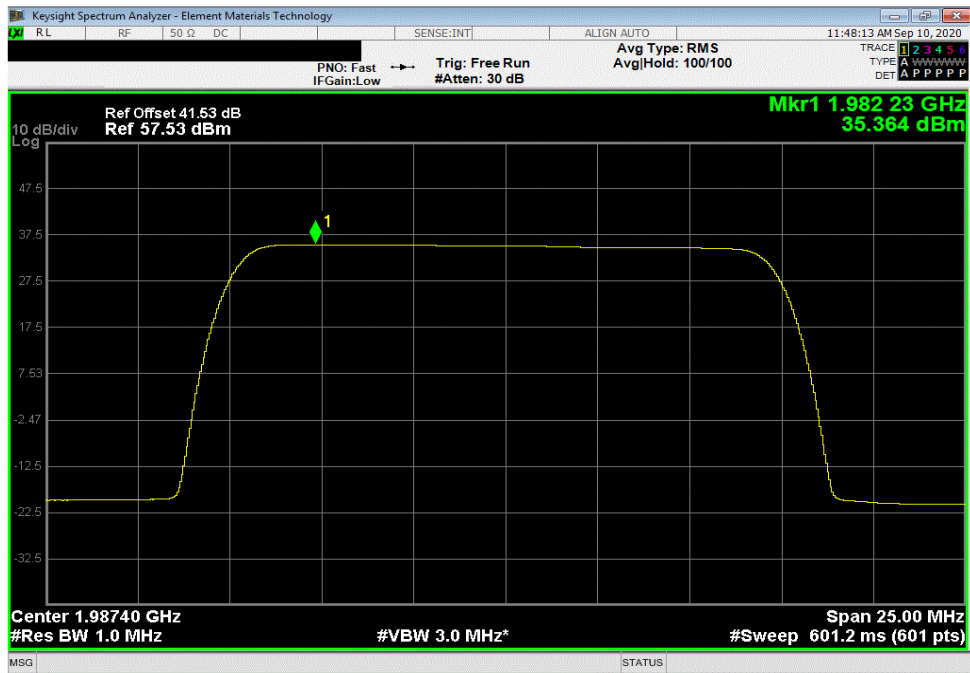


TkTx 2020.09.06.0 BETA XMM 2020.03.25.0

Port 1, Band n25, 1930 MHz - 1995 MHz, 15 MHz Bandwidth, 256-QAM Modulation, Low Channel +100kHz: 1937.6 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)	
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD	
35.234	0	35.234	38.234	41.234	



Port 1, Band n25, 1930 MHz - 1995 MHz, 15 MHz Bandwidth, 256-QAM Modulation, High Channel -100kHz: 1987.4 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)	
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD	
35.364	0	35.364	38.364	41.364	



POWER SPECTRAL DENSITY INNER CHANNELS



TbTx 2020.09.08.0 BETA XMI 2020.03.25.0

EIRP Calculations:

See details from previous report section on EIRP calculations.