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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
Block - DC	Fairview Microwave	SD3464	ANA	25-Sep-20	25-Sep-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 [10log(1/D)], where D is the duty cycle, to the measured power to compute the PSD during the transmit times.

RF conducted emissions testing was performed on one port. The FRIJ antenna ports are essentially electrically identical (the RF power variation between antenna ports is small) and port 4 was selected to perform the testing under this effort as allowed by ANSI C63.26-2015 paragraphs 5.2.5.3, 5.7.2i and 6.4.

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

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

The applicable FCC and ISED regulatory requirements for EIRP are as follows.
FCC Requirements:
27.50(d) The following power and antenna height requirements apply to stations transmitting in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz and 2180-2200 MHz bands:
(1) The power of each fixed or base station transmitting in the 1995-2000 MHz, 2110-2155 MHz, 2155-2180 MHz or 2180-2200 MHz band and located in any county with population density of 100 or fewer persons per square mile, based upon the most recently available population statistics from the Bureau of the Census, is limited to:
(ii) An EIRP of 3280 watts/MHz when transmitting with an emission bandwidth greater than 1 MHz.
(2) The power of each fixed or base station transmitting in the 1995-2000 MHz, the 2110-2155 MHz 2155-2180 MHz band, or 2180-2200 MHz band and situated in any geographic location other than that described in paragraph (d)(1) of this section is limited to:
(ii) An EIRP of 1640 watts/MHz when transmitting with an emission bandwidth greater than 1 MHz.
ISED Requirements RSS-139 Section 6.5/SRSP-513 Section 5.1.1
SRSP-513 5.1 Radiated Power and Antenna Height Limits
5.1.1 Fixed and Base Stations
5.1.1.2 For fixed and base stations operating within the frequency range 2110-2180 MHz with a channel bandwidth greater than 1 MHz, the maximum permissible e.i.r.p. is 1640 watts/MHz e.i.r.p. (i.e. no more than 1640 watts e.i.r.p. in any 1 MHz band segment) with an antenna height above average terrain (HAAT) up to 300 metres.
5.1.1.3 Fixed and base stations located in geographic areas at a distance greater than 26 km from large or medium population centres and transmitting within the frequency range 2110-2180 MHz, may increase their e.i.r.p. up to a maximum of 3280 watts/MHz (i.e. no more than 3280 watts e.i.r.p. in any 1 MHz band segment), with an antenna HAAT up to 300 metres. …….
5.1.1.4 Fixed and base station antenna heights above average terrain may exceed 300 metres with a reduction in e.i.r.p. The maximum permissible e.i.r.p. for installations with antenna HAAT in excess of 300 metres is given in the following table: …….
ISED Requirements RSS-170 Section 5.3.1/SRSP-519 Section 5.1
SRSP-519 5.1 Radiated Power and Antenna Height Limits for Base Stations

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EUT:	FRIJ	Work Order:	NOKI0019
Serial Number:	YK160800020	Date:	30-Oct-20
Customer:	Nokia Solutions and Networks	Temperature:	23.3 °C
Attendees:	Mitchell Hill, John Rattanavong	Humidity:	34.2% RH
Project:	None	Barometric Pres.:	1037 mbar
Tested by:	Brandon Hobbs	Job Site:	TX05
Power:	54 VDC		

TEST SPECIFICATIONS	Test Method
FCC 27:2020	ANSI C63.26:2015
RSS-139:2015, RSS-170:2015	RSS-139:2015, RSS-170:2015

COMMENTS

All measurement path losses were accounted for in the reference level offest including any attenuators, filters and DC blocks. Band n66 carriers are enabled at maximum power (40 watts/carrier). The PSD was measured while transmitting one carrier on Port 4. The total PSD for multiport (2x2 MIMO & 4x4 MIMO) operation was determinded based upon ANSI 63.26 clause 6.4.3.2.4 (10 Log Nout). The total PSD for two port operation is single port PSD +3dB [i.e. 10 Log(2)]. The total PSD for four port operation is single port PSD +6dB [i.e. 10 Log(4)].

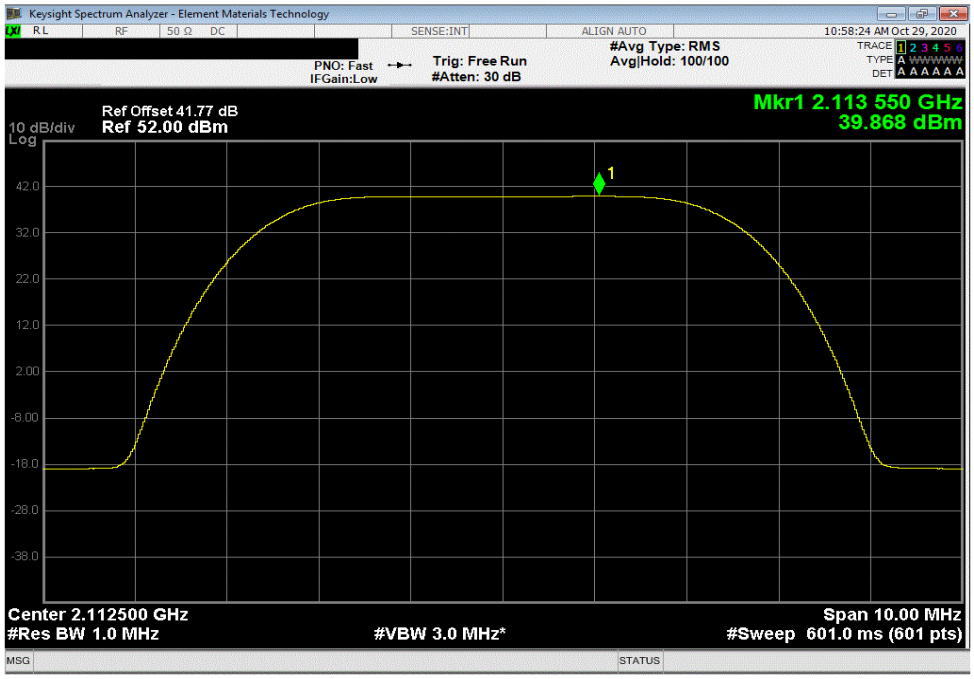
DEVIATIONS FROM TEST STANDARD

None

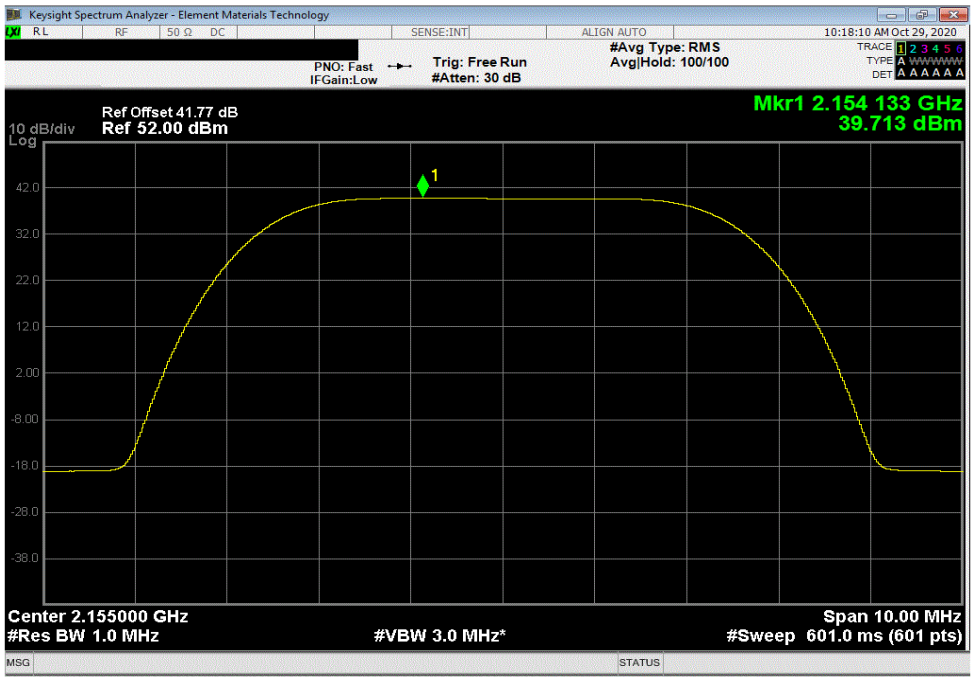
Configuration #	2	Signature

	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 4, Band n66, 2110 MHz - 2200 MHz					
5 MHz Bandwidth					
QPSK Modulation					
Low Channel 2112.5 MHz	39.868	0	39.87	42.87	45.87
Mid Channel 2155 MHz	39.713	0	39.71	42.71	45.71
High Channel 2197.5 MHz	39.692	0	39.69	42.69	45.69
16-QAM Modulation					
Low Channel 2112.5 MHz	39.852	0	39.85	42.85	45.85
Mid Channel 2155 MHz	39.668	0	39.67	42.67	45.67
High Channel 2197.5 MHz	39.672	0	39.67	42.67	45.67
64-QAM Modulation					
Low Channel 2112.5 MHz	39.903	0	39.90	42.90	45.90
Mid Channel 2155 MHz	39.875	0	39.88	42.88	45.88
High Channel 2197.5 MHz	39.689	0	39.69	42.69	45.69
256-QAM Modulation					
Low Channel 2112.5 MHz	39.751	0	39.75	42.75	45.75
Mid Channel 2155 MHz	39.594	0	39.59	42.59	45.59
High Channel 2197.5 MHz	39.621	0	39.62	42.62	45.62
10 MHz Bandwidth					
QPSK Modulation					
Low Channel 2115 MHz	36.804	0	36.80	39.80	42.80
Mid Channel 2155 MHz	36.672	0	36.67	39.67	42.67
High Channel 2195 MHz	36.696	0	36.70	39.70	42.70
16-QAM Modulation					
Low Channel 2115 MHz	37.318	0	37.32	40.32	43.32
Mid Channel 2155 MHz	37.376	0	37.38	40.38	43.38
High Channel 2195 MHz	37.291	0	37.29	40.29	43.29
64-QAM Modulation					
Low Channel 2115 MHz	36.621	0	36.62	39.62	42.62
Mid Channel 2155 MHz	36.858	0	36.86	39.86	42.86
High Channel 2195 MHz	36.666	0	36.67	39.67	42.67
256-QAM Modulation					
Low Channel 2115 MHz	36.753	0	36.75	39.75	42.75
Mid Channel 2155 MHz	36.690	0	36.69	39.69	42.69
High Channel 2195 MHz	36.604	0	36.60	39.60	42.60
15 MHz Bandwidth					
QPSK Modulation					
Low Channel 2117.5 MHz	35.107	0	35.11	38.11	41.11
Mid Channel 2155 MHz	34.930	0	34.93	37.93	40.93
High Channel 2192.5 MHz	34.893	0	34.89	37.89	40.89
16-QAM Modulation					
Low Channel 2117.5 MHz	36.561	0	36.56	39.56	42.56
Mid Channel 2155 MHz	36.293	0	36.29	39.29	42.29
High Channel 2192.5 MHz	36.336	0	36.34	39.34	42.34
64-QAM Modulation					
Low Channel 2117.5 MHz	35.050	0	35.05	38.05	41.05
Mid Channel 2155 MHz	34.563	0	34.56	37.56	40.56
High Channel 2192.5 MHz	34.937	0	34.94	37.94	40.94
256-QAM Modulation					
Low Channel 2117.5 MHz	35.169	0	35.17	38.17	41.17
Mid Channel 2155 MHz	34.842	0	34.84	37.84	40.84
High Channel 2192.5 MHz	34.937	0	34.94	37.94	40.94
20 MHz Bandwidth					
QPSK Modulation					
Low Channel 2120 MHz	33.876	0	33.88	36.88	39.88
Mid Channel 2155 MHz	33.733	0	33.73	36.73	39.73
High Channel 2190 MHz	33.880	0	33.88	36.88	39.88
16-QAM Modulation					
Low Channel 2120 MHz	35.531	0	35.53	38.53	41.53
Mid Channel 2155 MHz	35.302	0	35.30	38.30	41.30
High Channel 2190 MHz	35.425	0	35.43	38.43	41.43
64-QAM Modulation					
Low Channel 2120 MHz	34.072	0	34.07	37.07	40.07
Mid Channel 2155 MHz	33.704	0	33.70	36.70	39.70
High Channel 2190 MHz	33.904	0	33.90	36.90	39.90
256-QAM Modulation					
Low Channel 2120 MHz	33.989	0	33.99	36.99	39.99
Mid Channel 2155 MHz	33.822	0	33.82	36.82	39.82
High Channel 2190 MHz	33.959	0	33.96	36.96	39.96

Port 4, Band n66, 2110 MHz - 2200 MHz, 5 MHz Bandwidth , QPSK Modulation, Low Channel 2112.5 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	39.868	0	39.87	42.87	45.87	



Port 4, Band n66, 2110 MHz - 2200 MHz, 5 MHz Bandwidth , QPSK Modulation, Mid Channel 2155 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	39.713	0	39.713	42.713	45.713	



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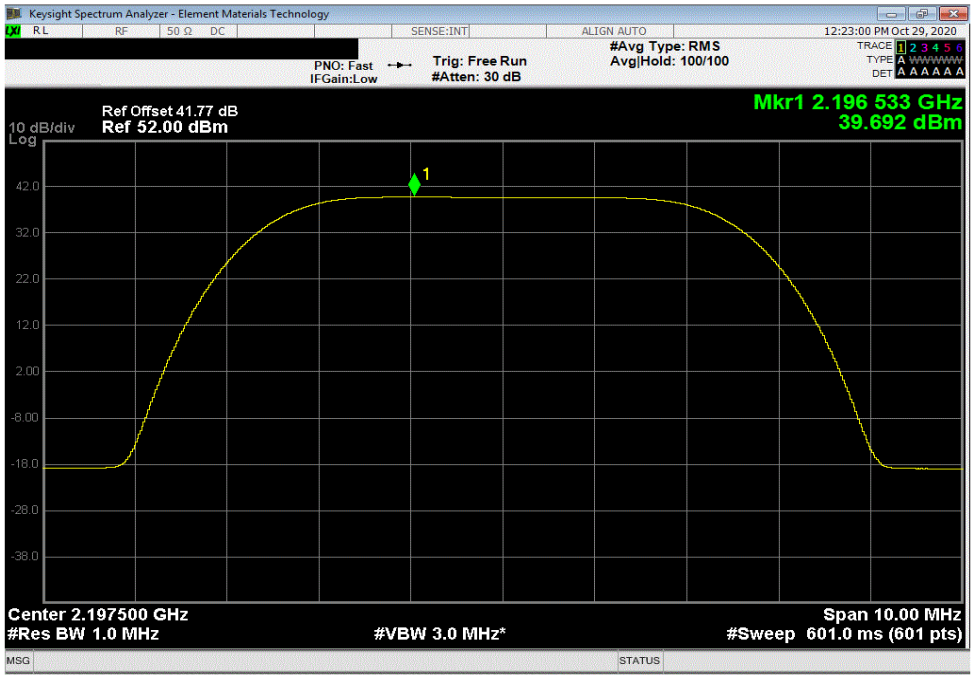
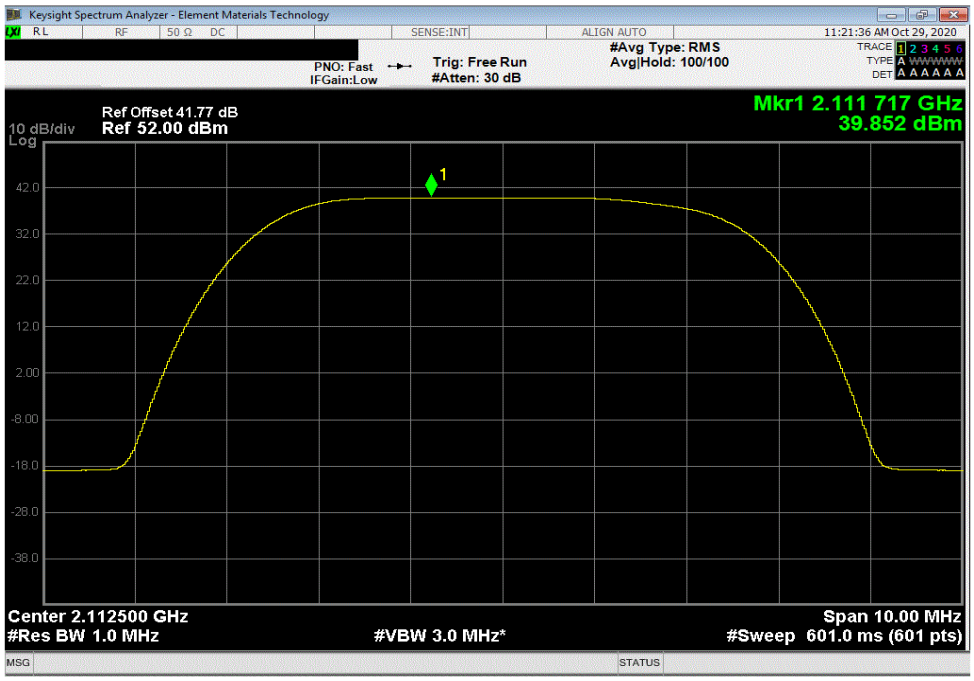
Port 4, Band n66, 2110 MHz - 2200 MHz, 5 MHz Bandwidth , QPSK Modulation, High Channel 2197.5 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	39.692	0	39.69	42.69	45.69	



Port 4, Band n66, 2110 MHz - 2200 MHz, 5 MHz Bandwidth , 16-QAM Modulation, Low Channel 2112.5 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	39.852	0	39.852	42.852	45.852	



POWER SPECTRAL DENSITY

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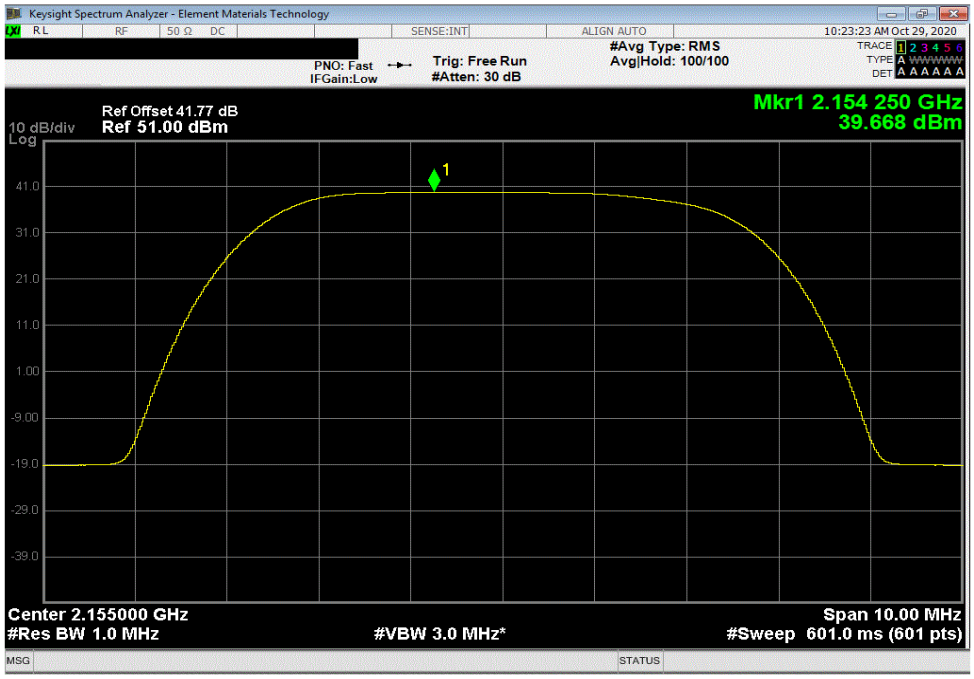
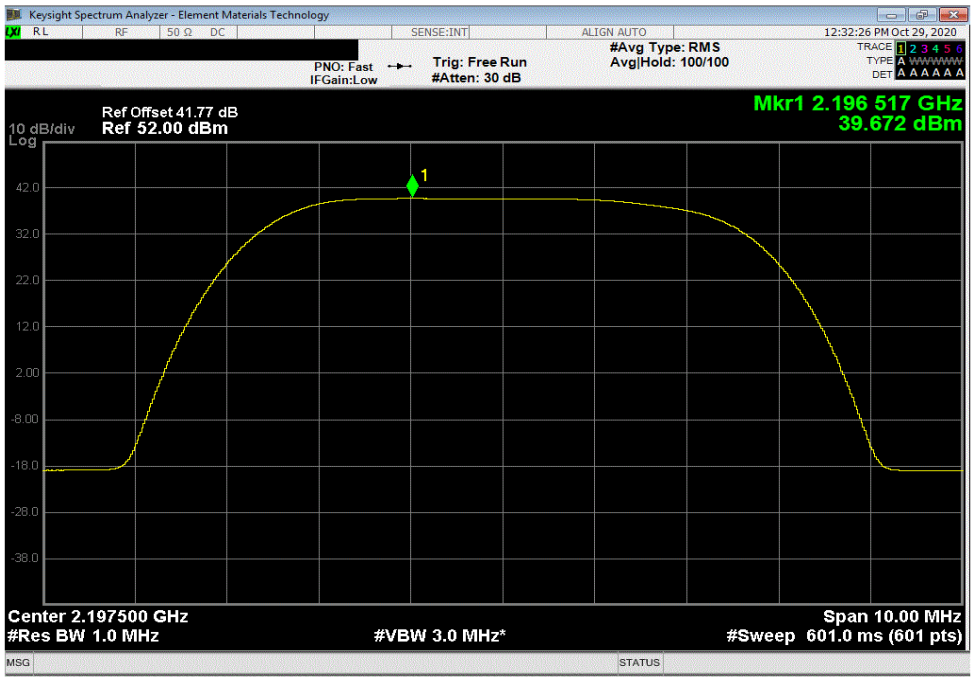
Port 4, Band n66, 2110 MHz - 2200 MHz, 5 MHz Bandwidth , 16-QAM Modulation, Mid Channel 2155 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	39.668	0	39.67	42.67	45.67	



Port 4, Band n66, 2110 MHz - 2200 MHz, 5 MHz Bandwidth , 16-QAM Modulation, High Channel 2197.5 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	39.672	0	39.672	42.672	45.672	



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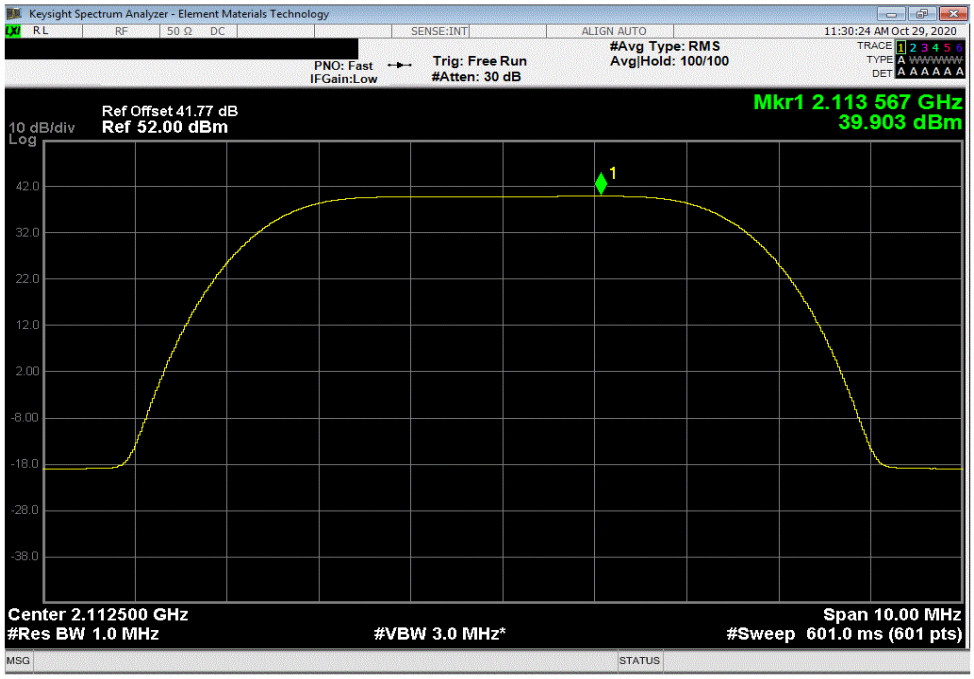
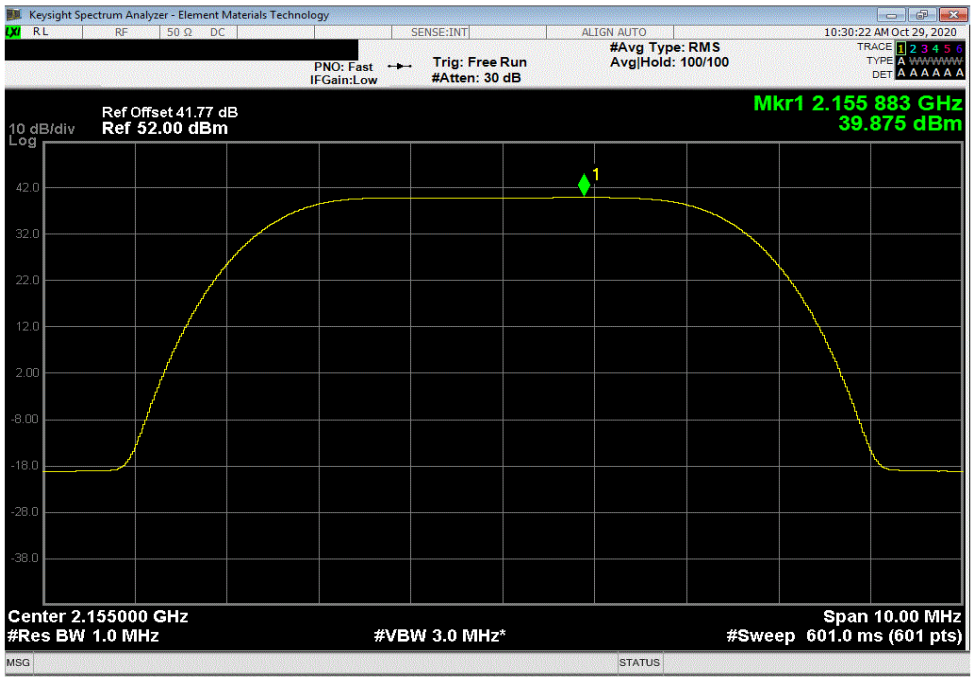
Port 4, Band n66, 2110 MHz - 2200 MHz, 5 MHz Bandwidth , 64-QAM Modulation, Low Channel 2112.5 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	39.903	0	39.90	42.90	45.90	



Port 4, Band n66, 2110 MHz - 2200 MHz, 5 MHz Bandwidth , 64-QAM Modulation, Mid Channel 2155 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	39.875	0	39.875	42.875	45.875	



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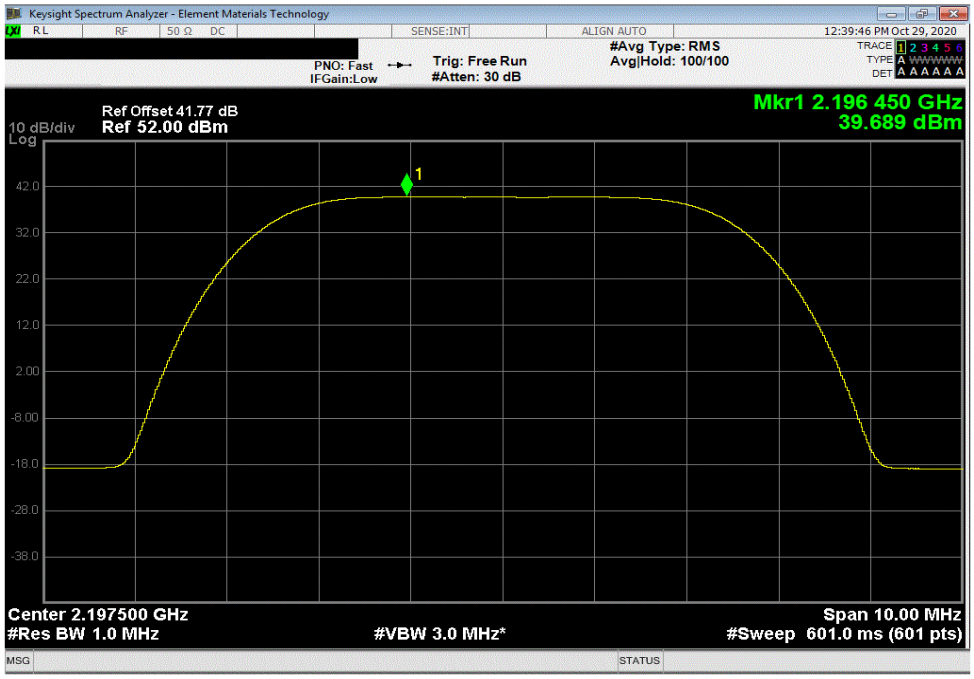
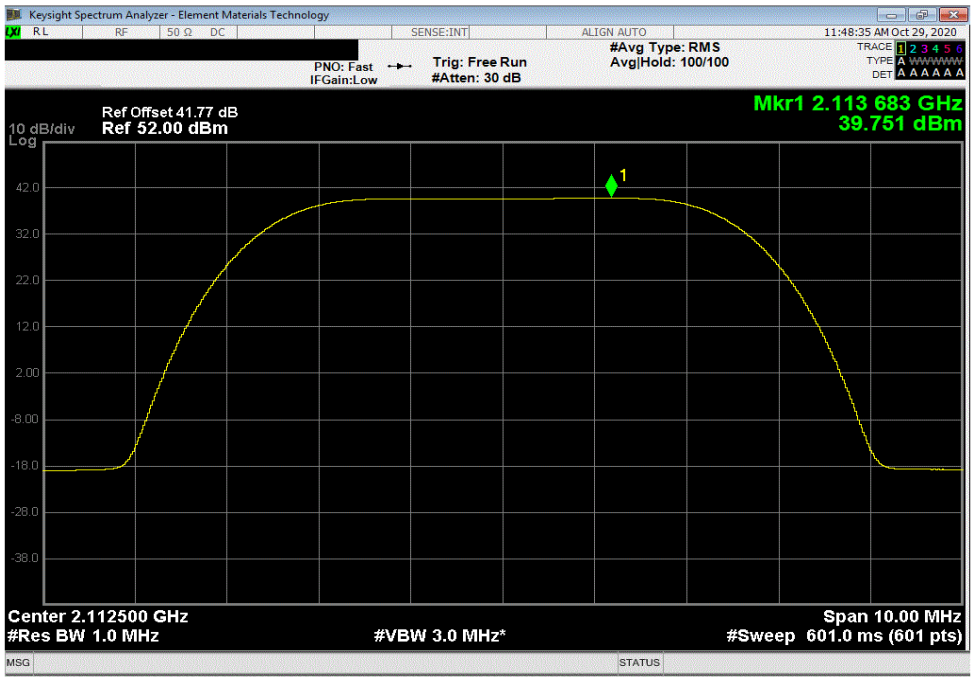
Port 4, Band n66, 2110 MHz - 2200 MHz, 5 MHz Bandwidth , 64-QAM Modulation, High Channel 2197.5 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	39.689	0	39.69	42.69	45.69	



Port 4, Band n66, 2110 MHz - 2200 MHz, 5 MHz Bandwidth , 256-QAM Modulation, Low Channel 2112.5 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	39.751	0	39.751	42.751	45.751	



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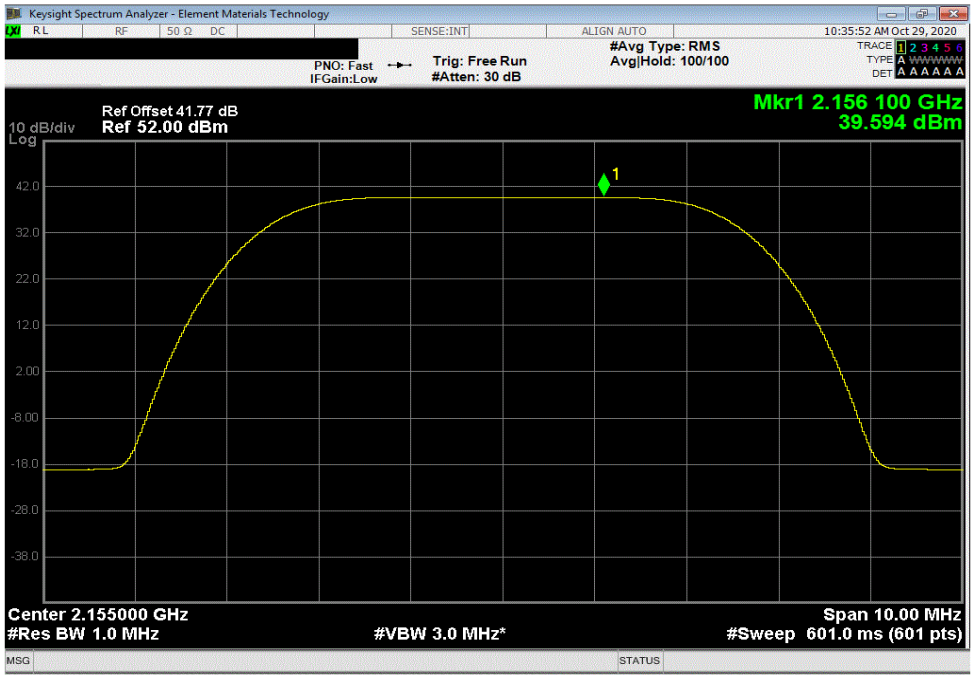
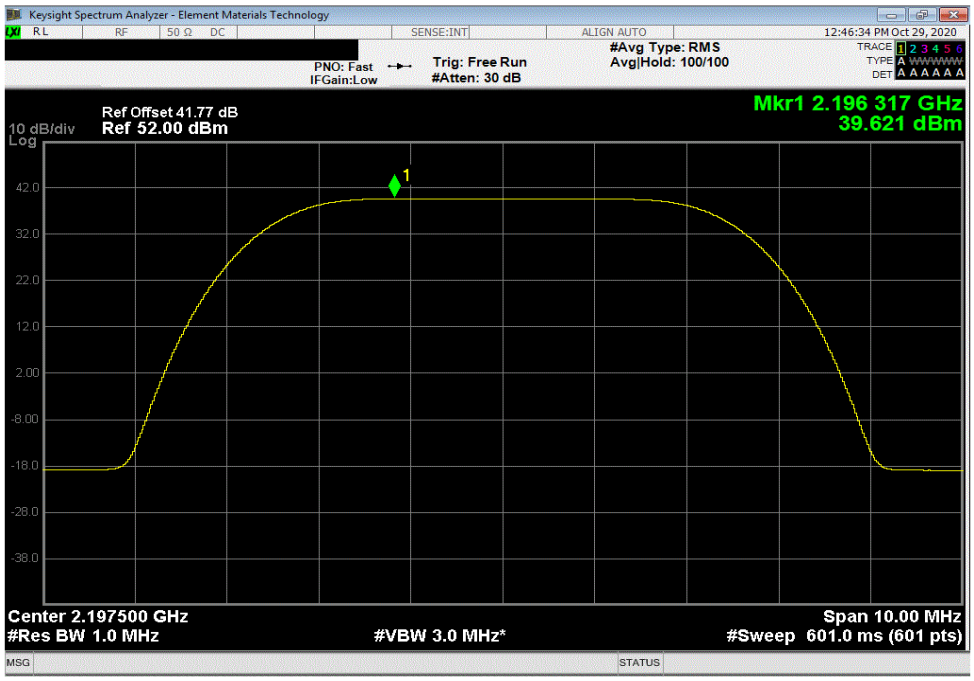
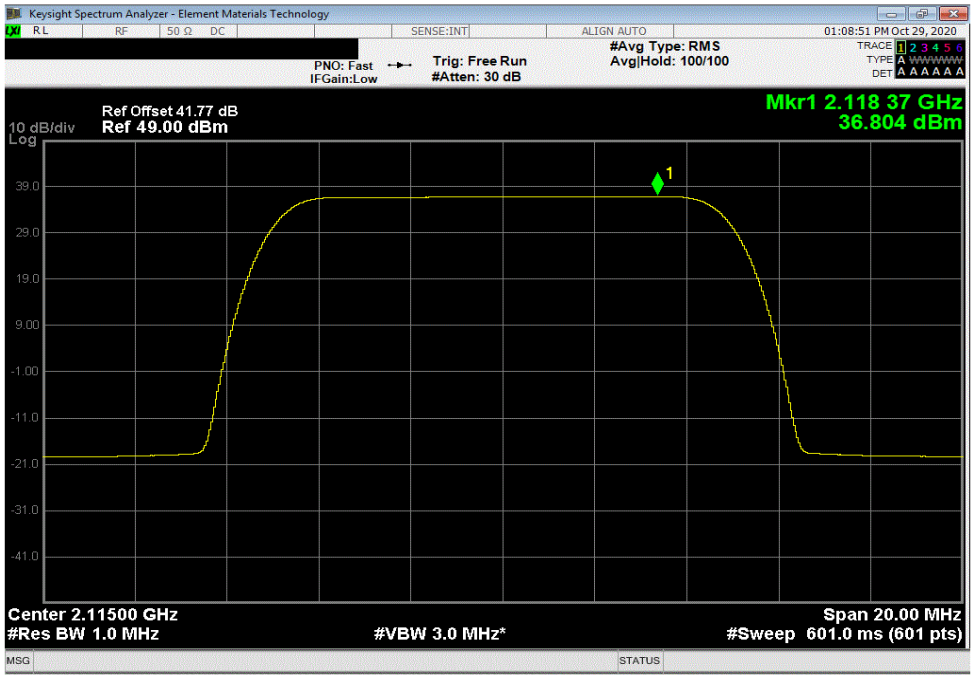
Port 4, Band n66, 2110 MHz - 2200 MHz, 5 MHz Bandwidth , 256-QAM Modulation, Mid Channel 2155 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	39.594	0	39.59	42.59	45.59	



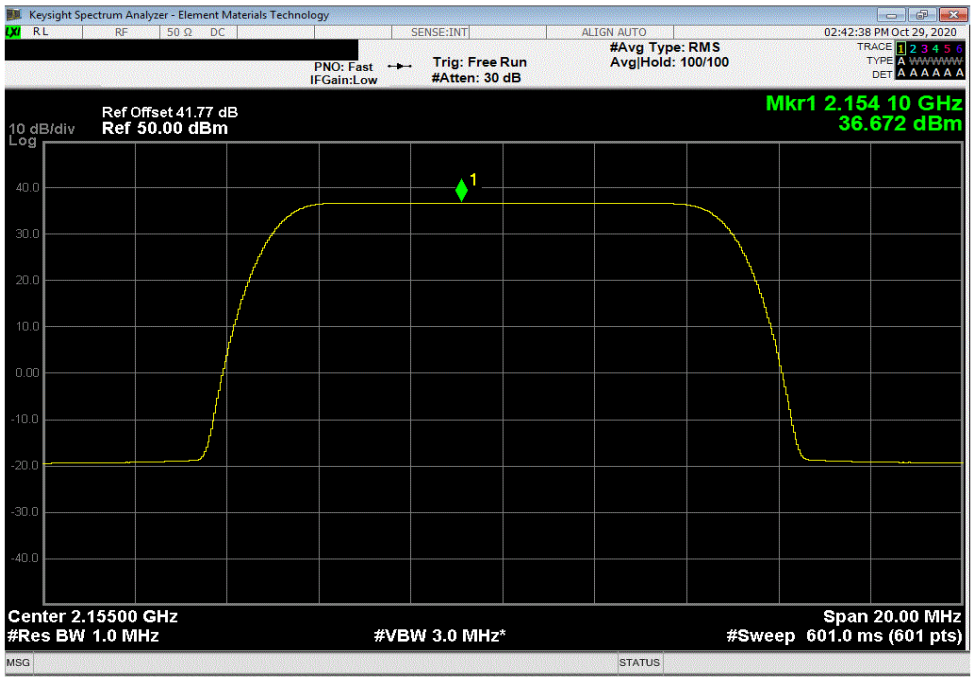
Port 4, Band n66, 2110 MHz - 2200 MHz, 5 MHz Bandwidth , 256-QAM Modulation, High Channel 2197.5 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	39.621	0	39.621	42.621	45.621	



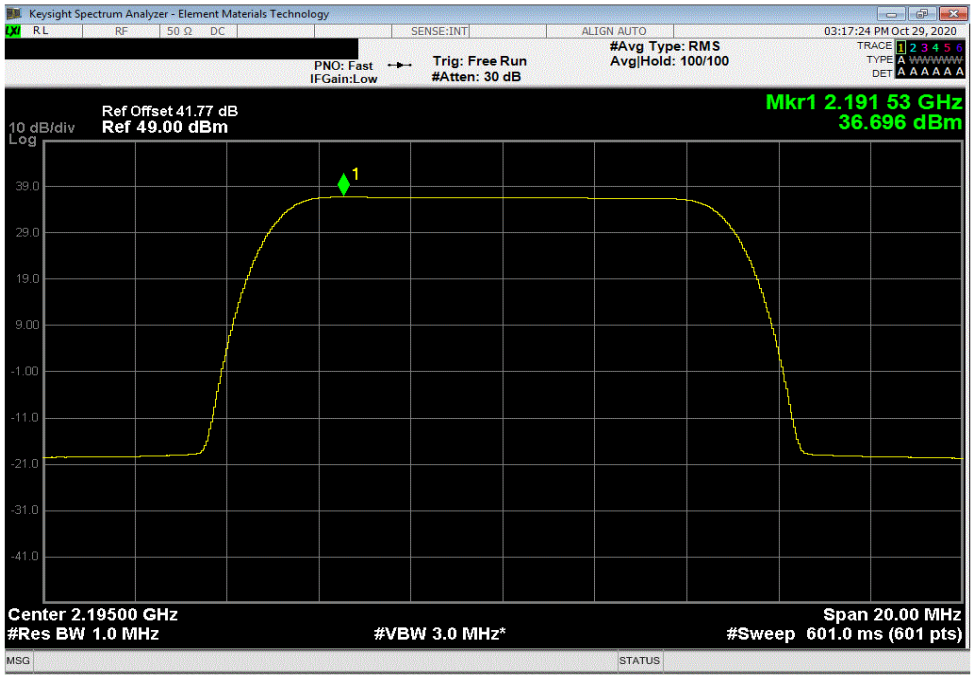
Port 4, Band n66, 2110 MHz - 2200 MHz, 10 MHz Bandwidth , QPSK Modulation, Low Channel 2115 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	36.804	0	36.80	39.80	42.80	



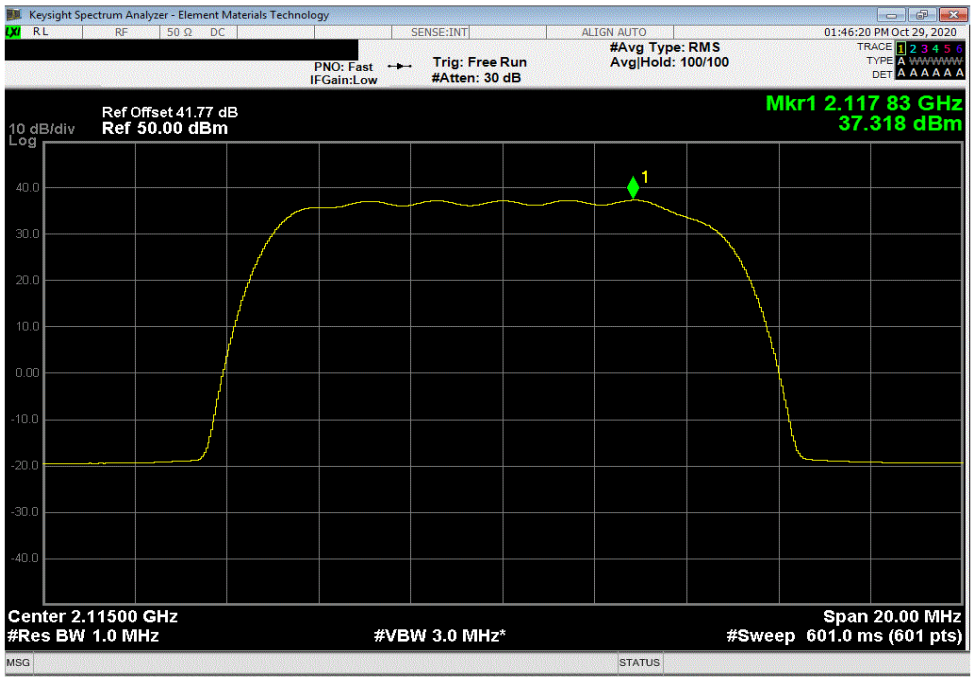
Port 4, Band n66, 2110 MHz - 2200 MHz, 10 MHz Bandwidth , QPSK Modulation, Mid Channel 2155 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	36.672	0	36.672	39.672	42.672	



Port 4, Band n66, 2110 MHz - 2200 MHz, 10 MHz Bandwidth , QPSK Modulation, High Channel 2195 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	36.696	0	36.70	39.70	42.70	



Port 4, Band n66, 2110 MHz - 2200 MHz, 10 MHz Bandwidth , 16-QAM Modulation, Low Channel 2115 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	37.318	0	37.318	40.318	43.318	



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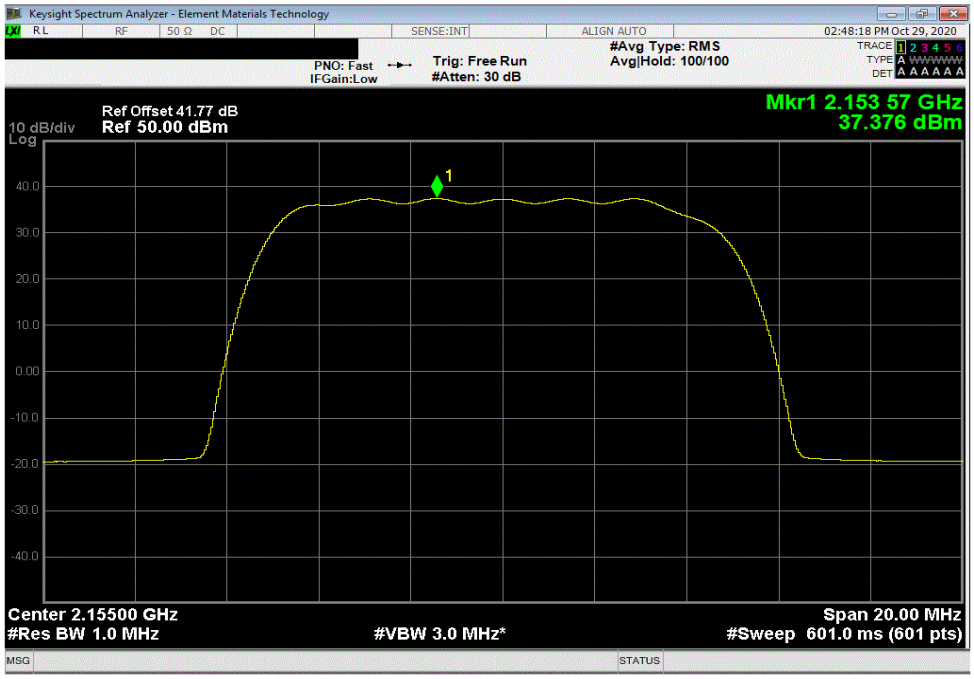
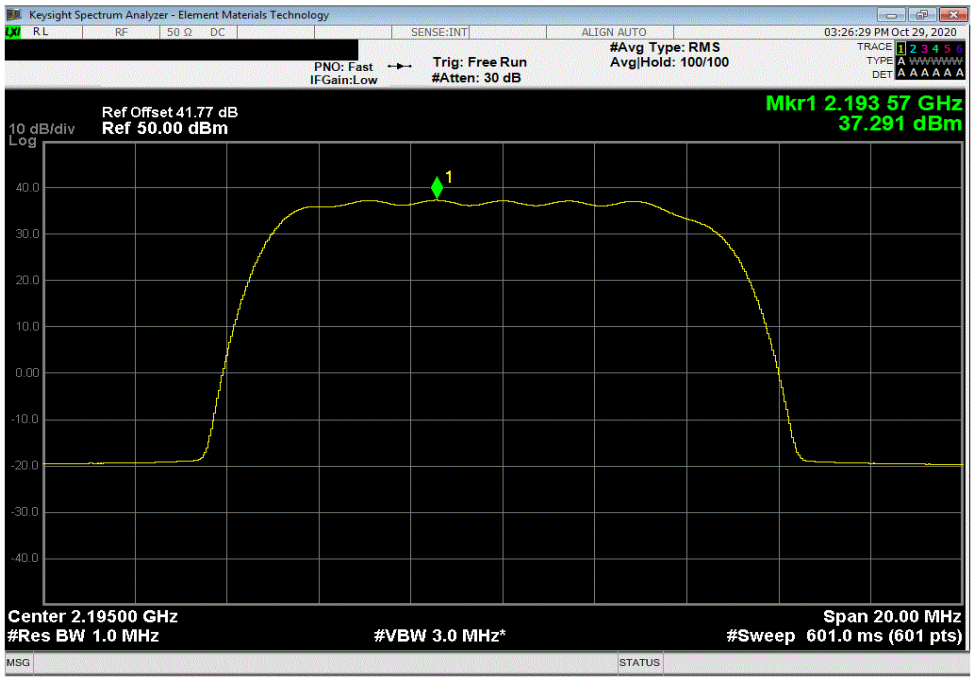
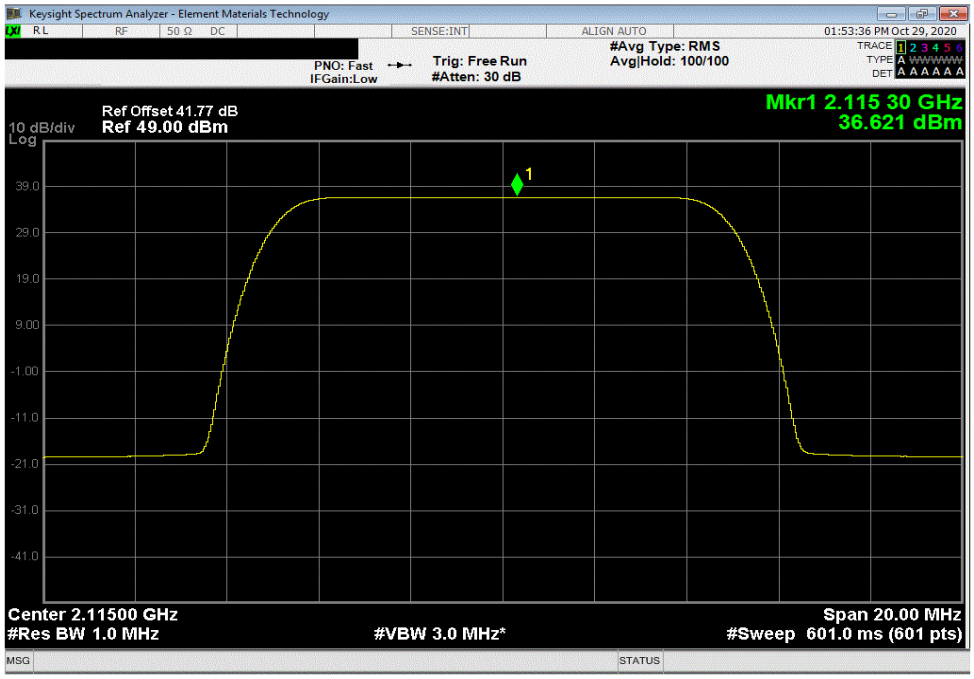
Port 4, Band n66, 2110 MHz - 2200 MHz, 10 MHz Bandwidth , 16-QAM Modulation, Mid Channel 2155 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	37.376	0	37.38	40.38	43.38	



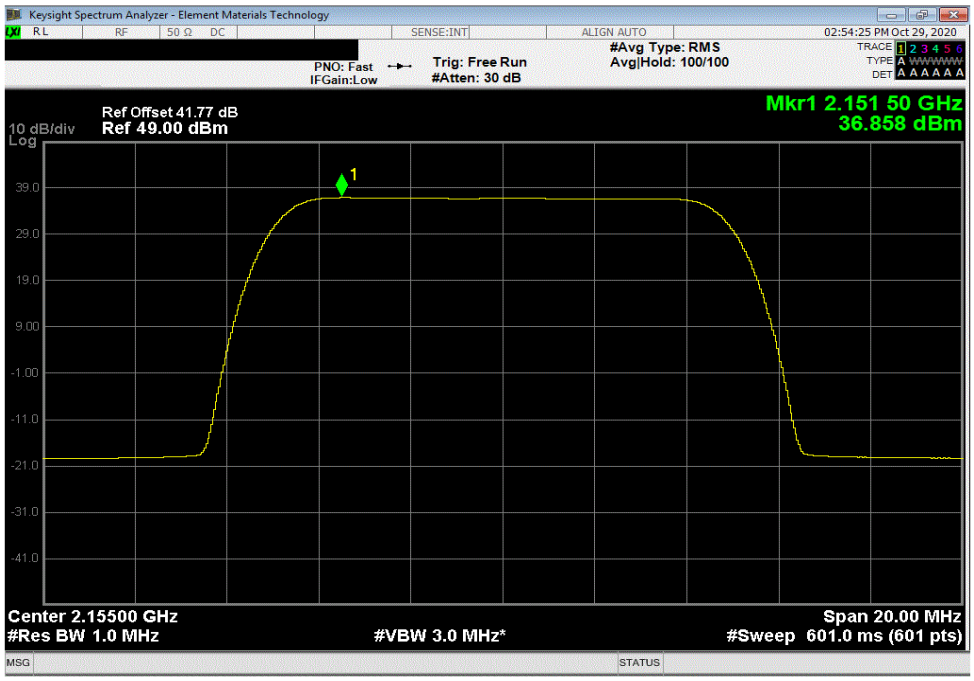
Port 4, Band n66, 2110 MHz - 2200 MHz, 10 MHz Bandwidth , 16-QAM Modulation, High Channel 2195 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	37.291	0	37.291	40.291	43.291	



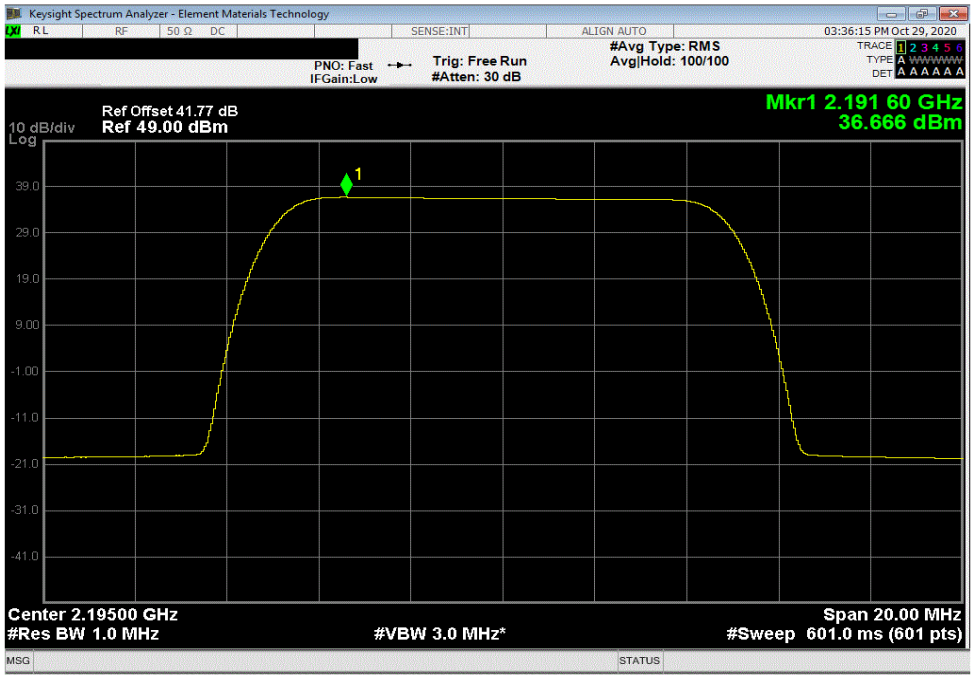
Port 4, Band n66, 2110 MHz - 2200 MHz, 10 MHz Bandwidth , 64-QAM Modulation, Low Channel 2115 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	36.621	0	36.62	39.62	42.62	



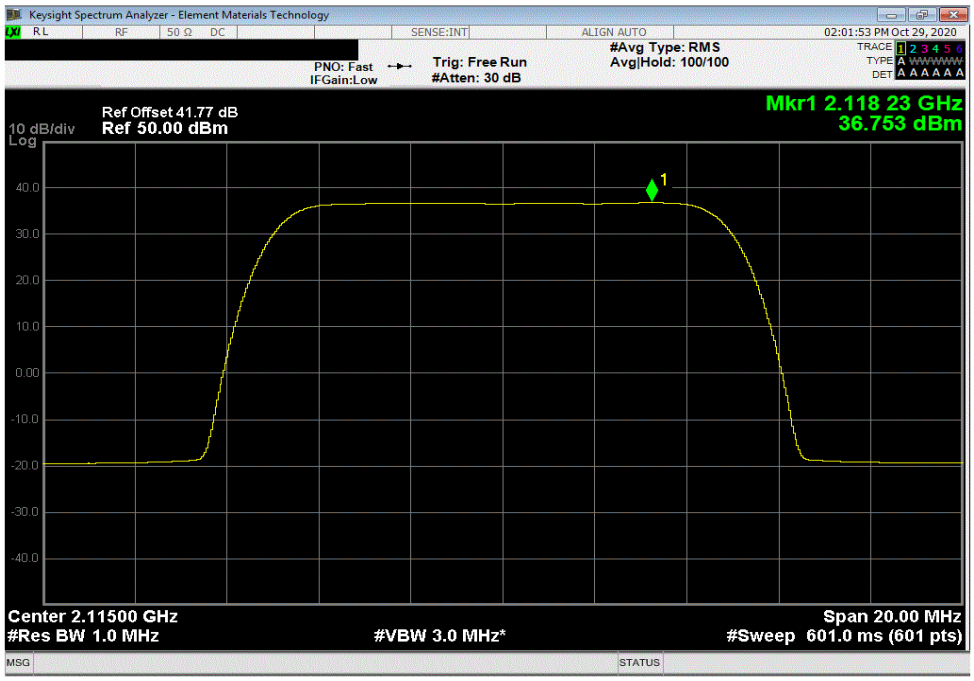
Port 4, Band n66, 2110 MHz - 2200 MHz, 10 MHz Bandwidth , 64-QAM Modulation, Mid Channel 2155 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	36.858	0	36.858	39.858	42.858	



Port 4, Band n66, 2110 MHz - 2200 MHz, 10 MHz Bandwidth , 64-QAM Modulation, High Channel 2195 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	36.666	0	36.67	39.67	42.67	



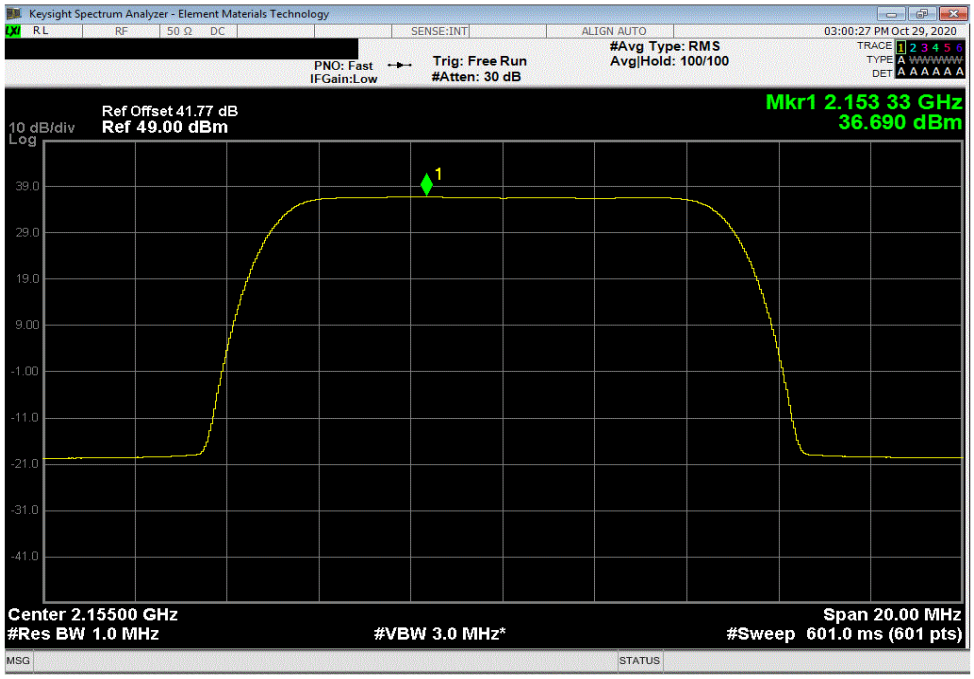
Port 4, Band n66, 2110 MHz - 2200 MHz, 10 MHz Bandwidth , 256-QAM Modulation, Low Channel 2115 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	36.753	0	36.753	39.753	42.753	



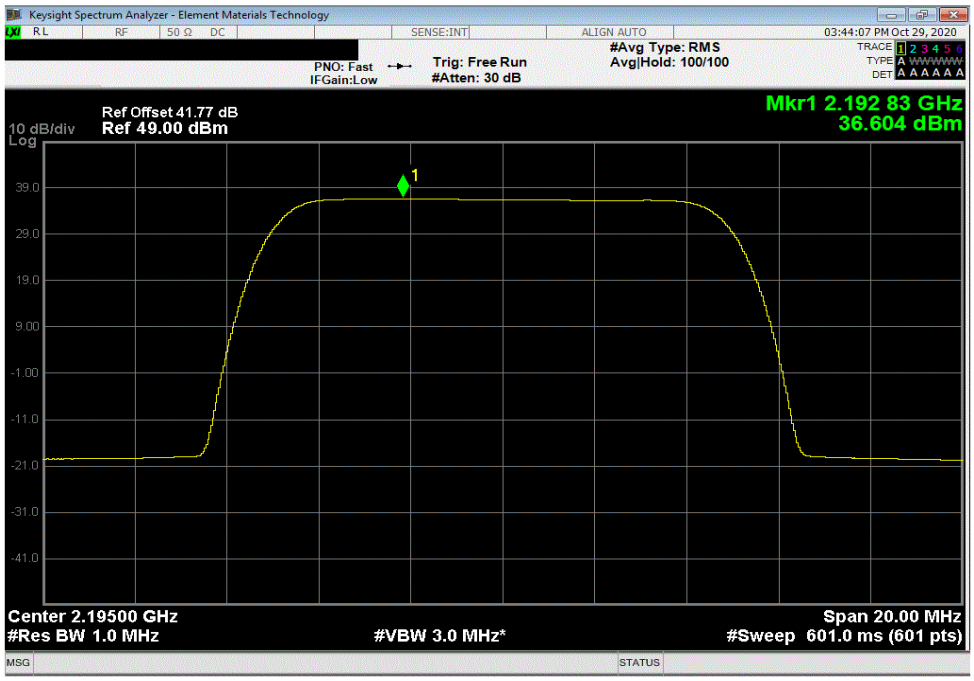
POWER SPECTRAL DENSITY

TbtTx 2020.10.20.0 BETA XMit 2020.03.25.0

Port 4, Band n66, 2110 MHz - 2200 MHz, 10 MHz Bandwidth , 256-QAM Modulation, Mid Channel 2155 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	36.69	0	36.69	39.69	42.69	



Port 4, Band n66, 2110 MHz - 2200 MHz, 10 MHz Bandwidth , 256-QAM Modulation, High Channel 2195 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	36.604	0	36.604	39.604	42.604	



POWER SPECTRAL DENSITY

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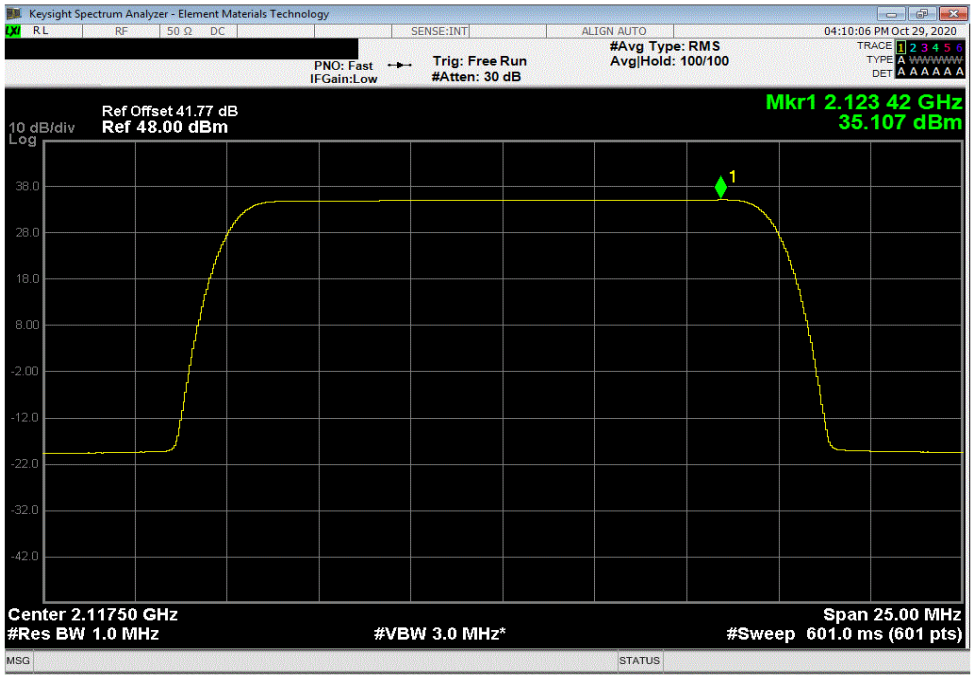
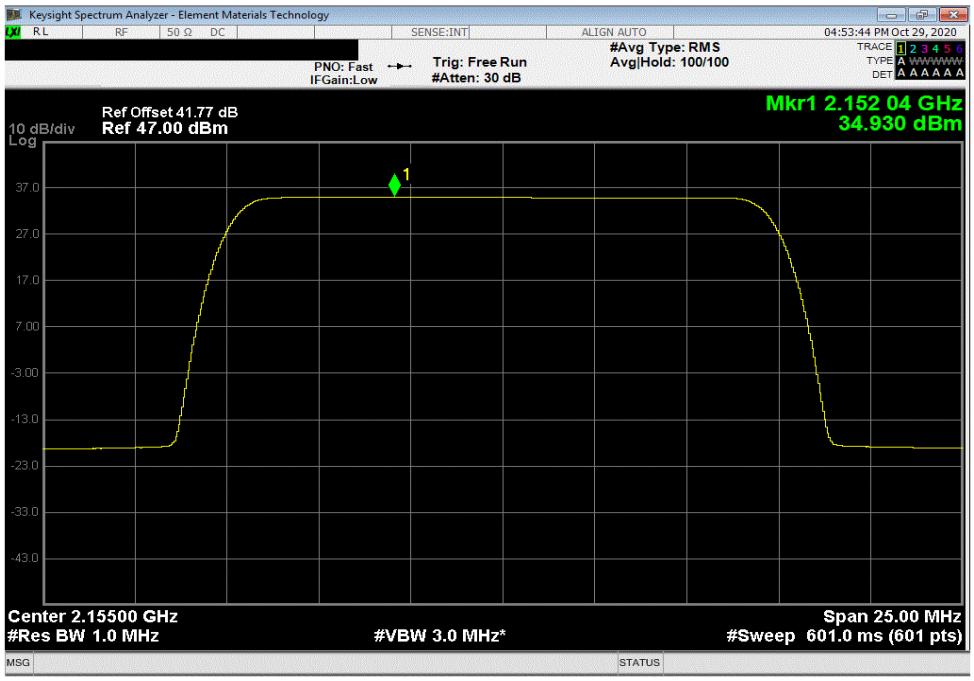
Port 4, Band n66, 2110 MHz - 2200 MHz, 15 MHz Bandwidth , QPSK Modulation, Low Channel 2117.5 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	35.107	0	35.11	38.11	41.11	



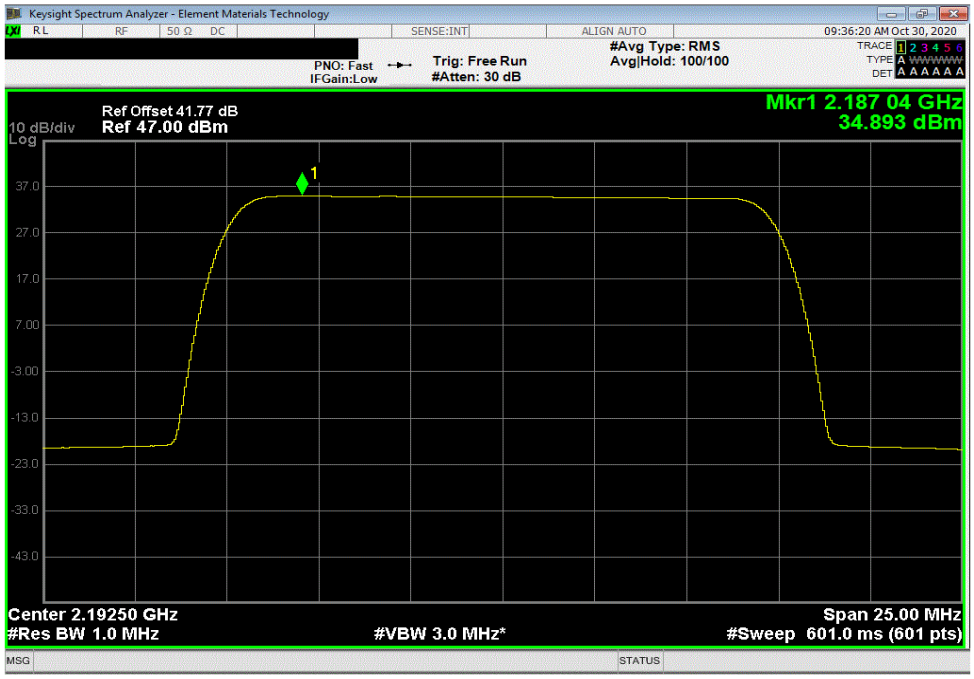
Port 4, Band n66, 2110 MHz - 2200 MHz, 15 MHz Bandwidth , QPSK Modulation, Mid Channel 2155 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	34.93	0	34.93	37.93	40.93	



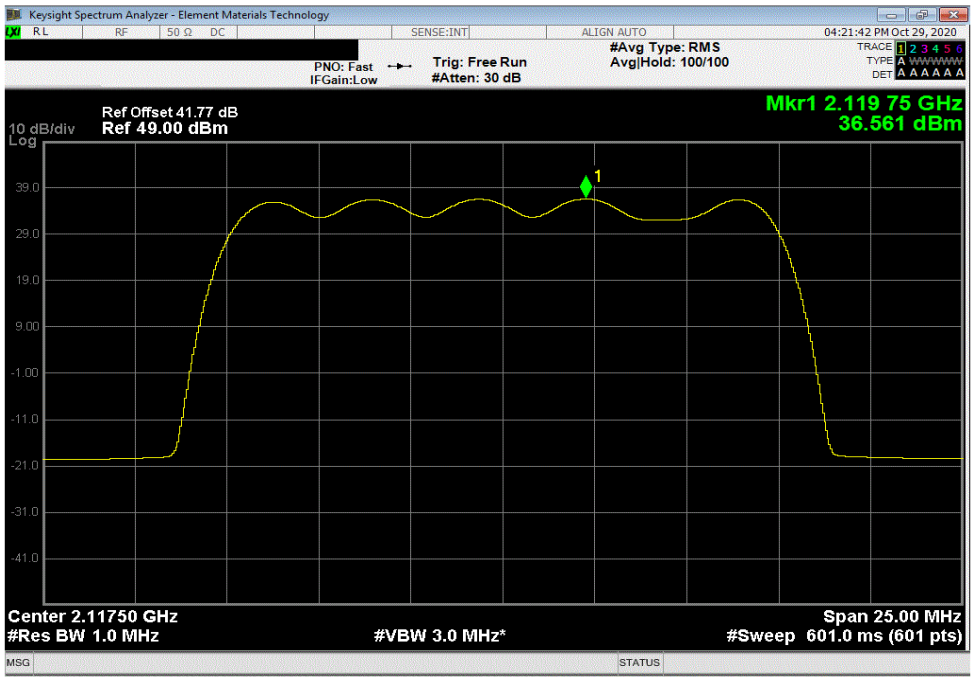
POWER SPECTRAL DENSITY

TbtTx 2020.10.20.0 BETA XMit 2020.03.25.0

Port 4, Band n66, 2110 MHz - 2200 MHz, 15 MHz Bandwidth , QPSK Modulation, High Channel 2192.5 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	34.893	0	34.89	37.89	40.89	



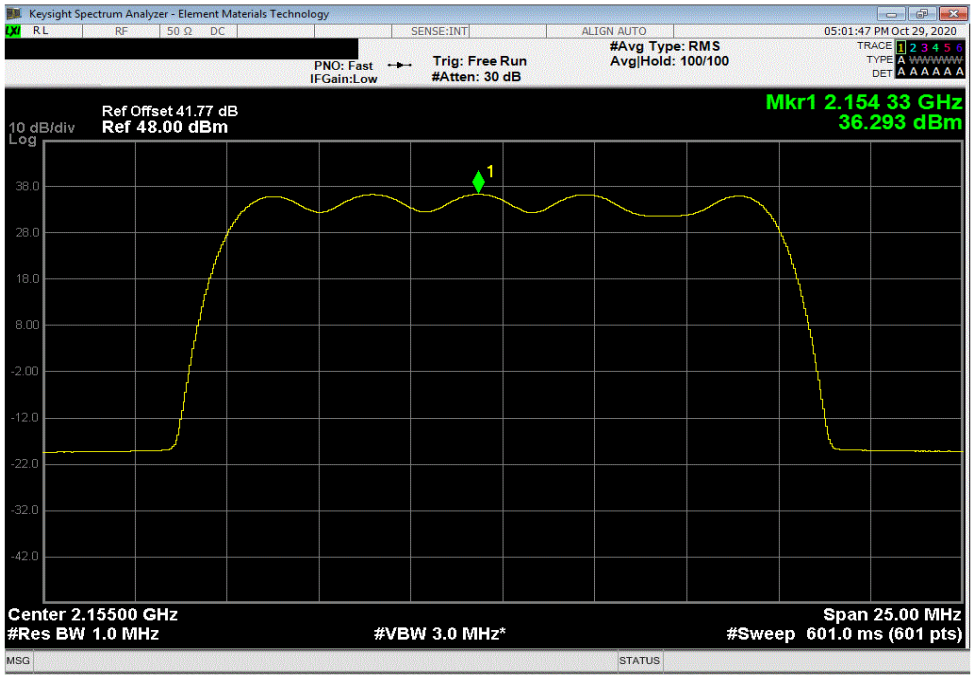
Port 4, Band n66, 2110 MHz - 2200 MHz, 15 MHz Bandwidth , 16-QAM Modulation, Low Channel 2117.5 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	36.561	0	36.561	39.561	42.561	



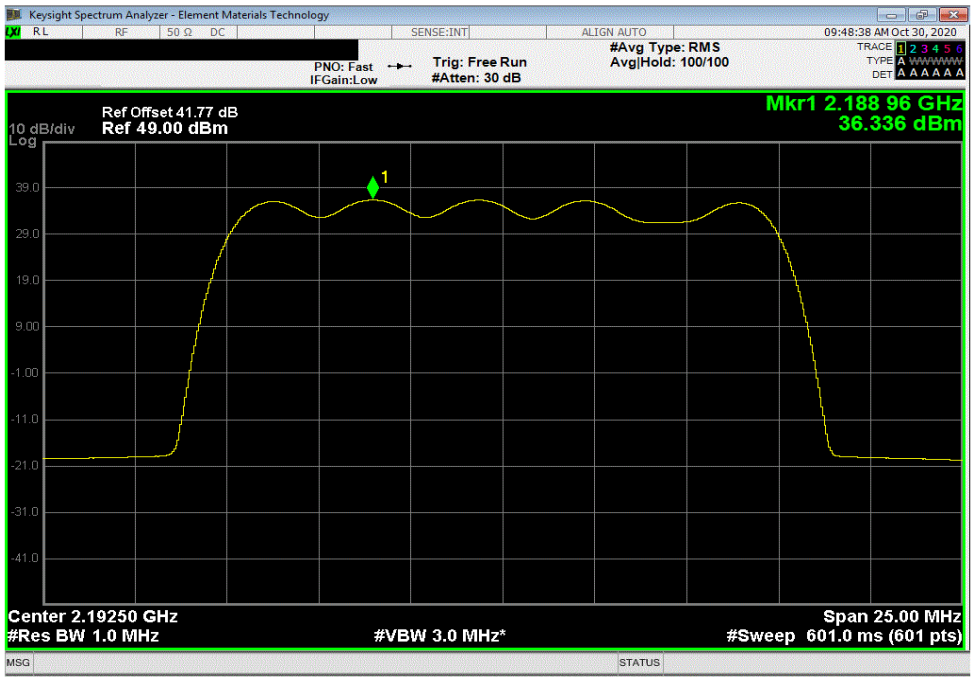
POWER SPECTRAL DENSITY

TbtTx 2020.10.20.0 BETA XMit 2020.03.25.0

Port 4, Band n66, 2110 MHz - 2200 MHz, 15 MHz Bandwidth , 16-QAM Modulation, Mid Channel 2155 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	36.293	0	36.29	39.29	42.29	



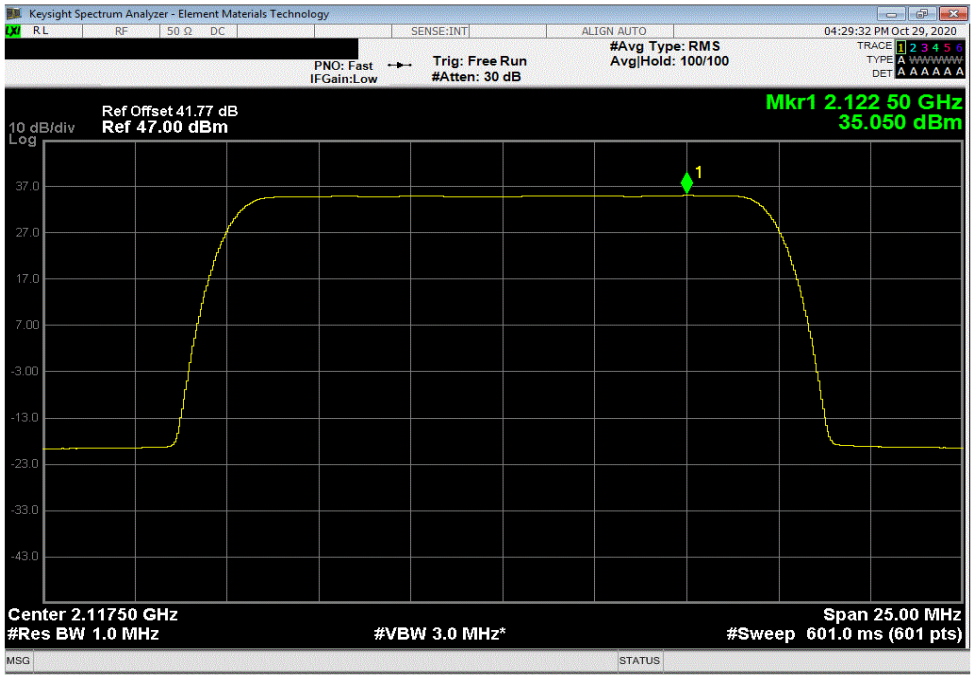
Port 4, Band n66, 2110 MHz - 2200 MHz, 15 MHz Bandwidth , 16-QAM Modulation, High Channel 2192.5 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	36.336	0	36.336	39.336	42.336	



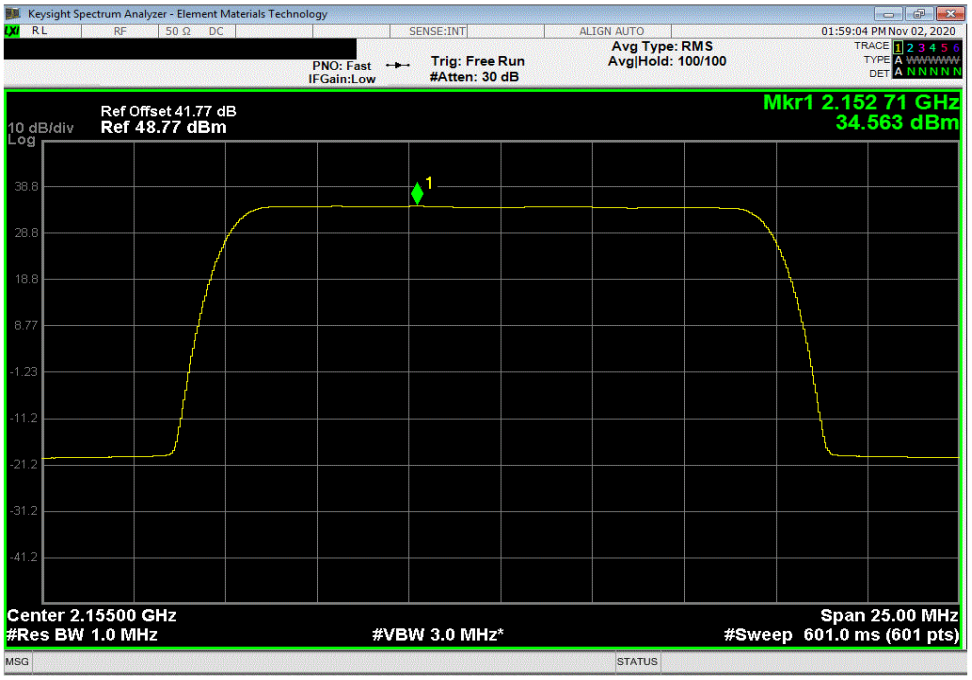
POWER SPECTRAL DENSITY

TbtTx 2020.10.20.0 BETA XMit 2020.03.25.0

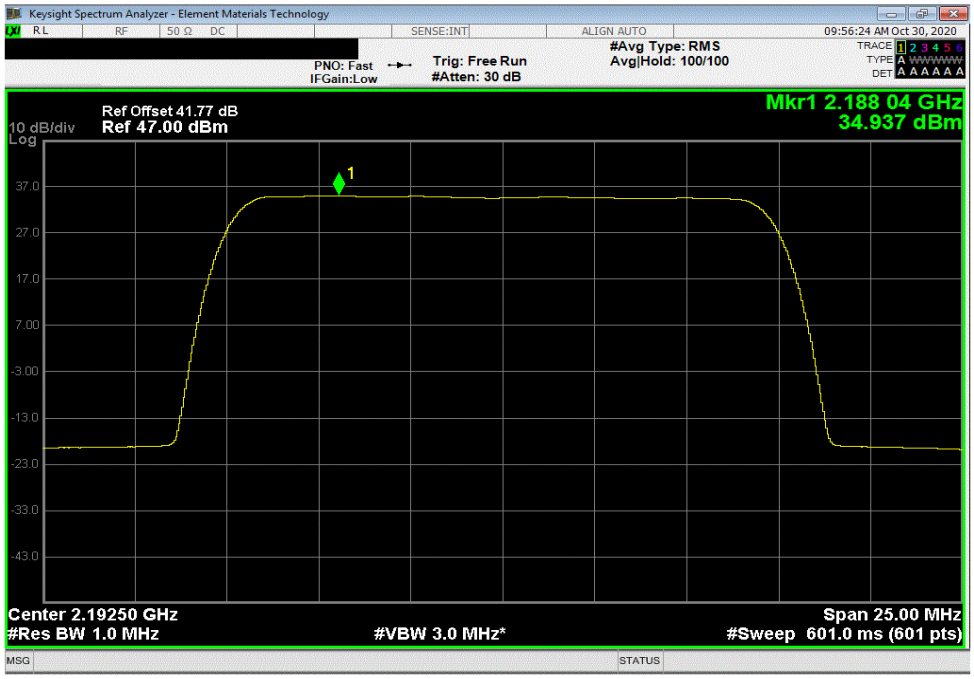
Port 4, Band n66, 2110 MHz - 2200 MHz, 15 MHz Bandwidth , 64-QAM Modulation, Low Channel 2117.5 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	35.05	0	35.05	38.05	41.05	



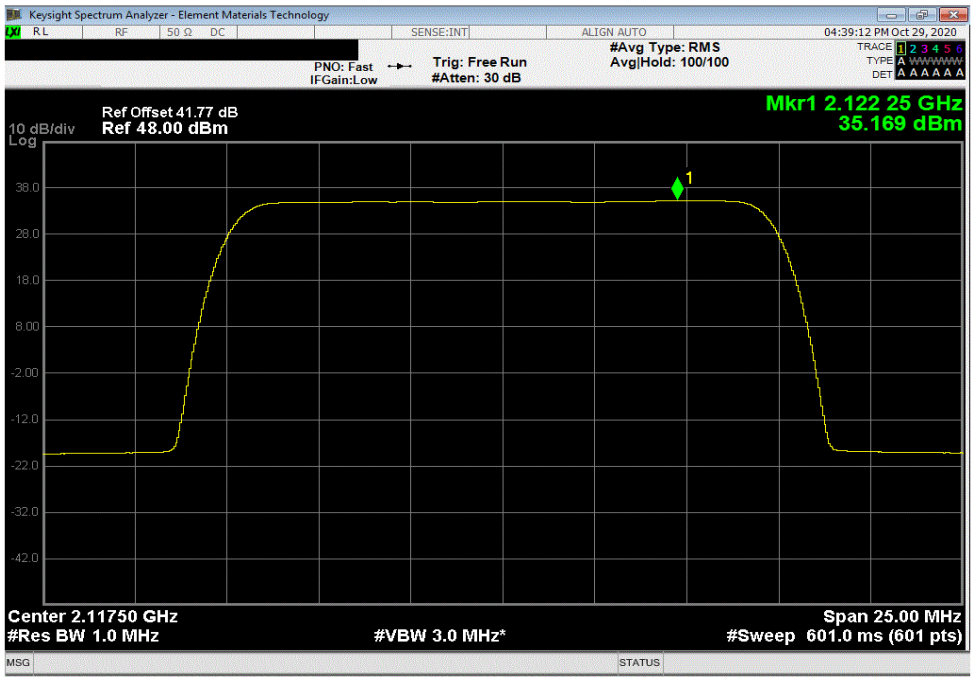
Port 4, Band n66, 2110 MHz - 2200 MHz, 15 MHz Bandwidth , 64-QAM Modulation, Mid Channel 2155 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	34.563	0	34.563	37.563	40.563	



Port 4, Band n66, 2110 MHz - 2200 MHz, 15 MHz Bandwidth , 64-QAM Modulation, High Channel 2192.5 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	34.937	0	34.94	37.94	40.94	



Port 4, Band n66, 2110 MHz - 2200 MHz, 15 MHz Bandwidth , 256-QAM Modulation, Low Channel 2117.5 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	35.169	0	35.169	38.169	41.169	



POWER SPECTRAL DENSITY

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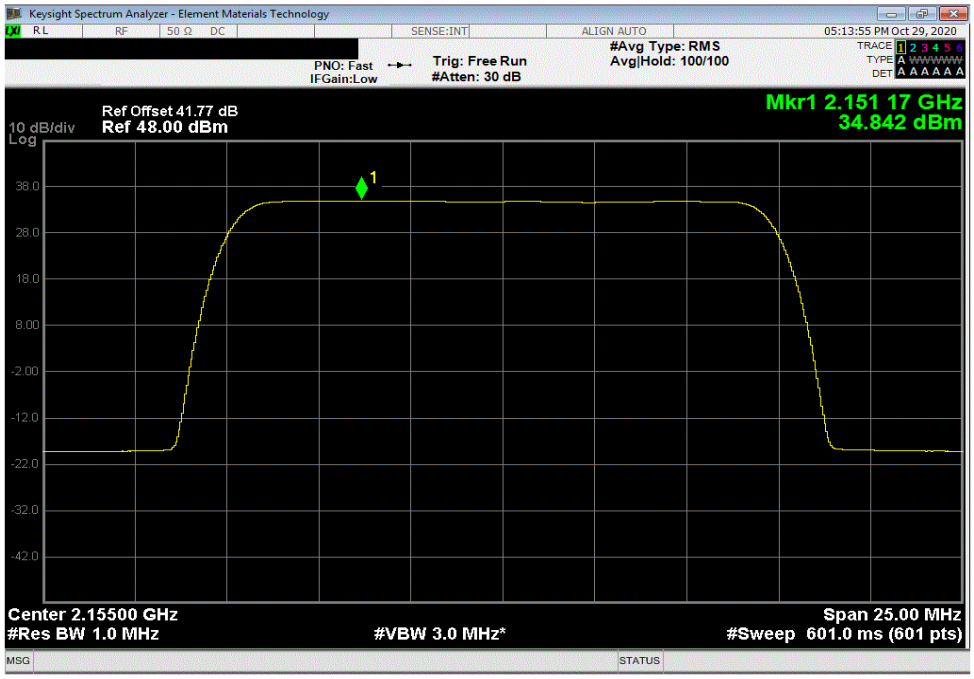
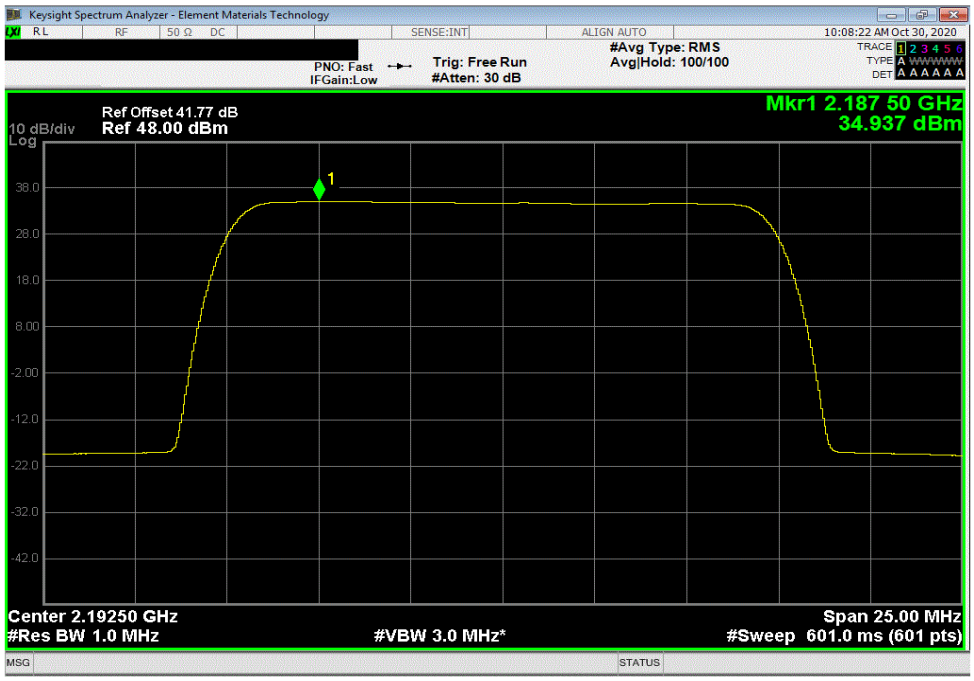
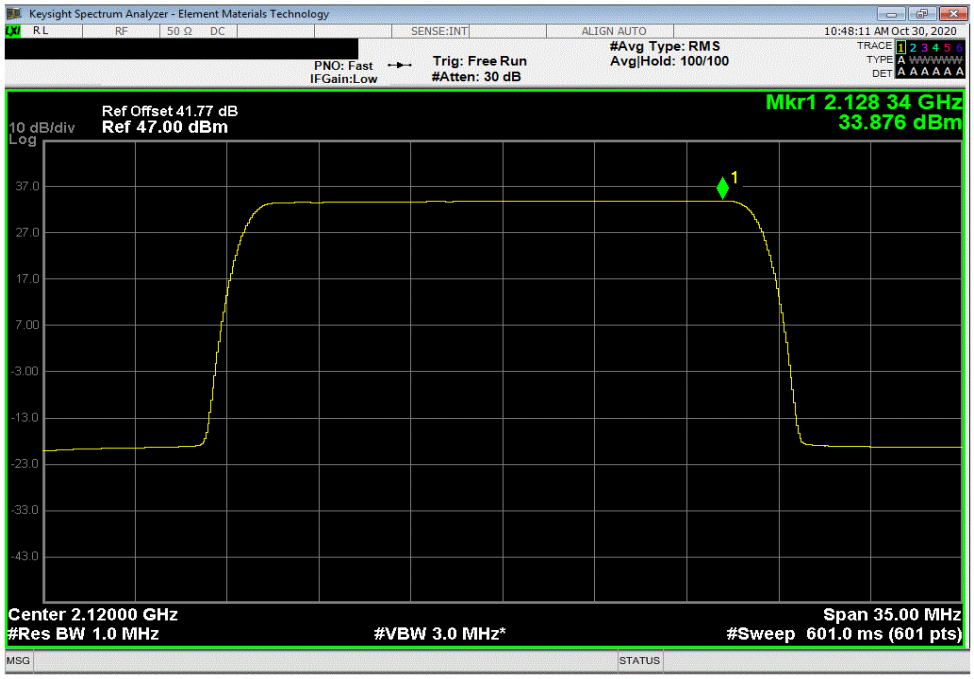
Port 4, Band n66, 2110 MHz - 2200 MHz, 15 MHz Bandwidth , 256-QAM Modulation, Mid Channel 2155 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	34.842	0	34.84	37.84	40.84	



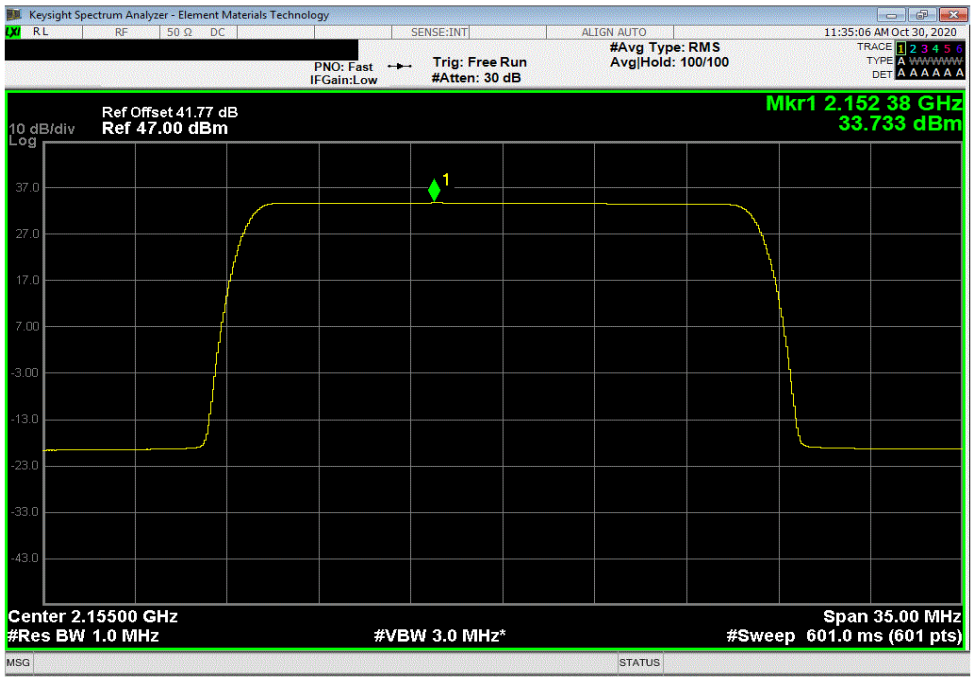
Port 4, Band n66, 2110 MHz - 2200 MHz, 15 MHz Bandwidth , 256-QAM Modulation, High Channel 2192.5 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	34.937	0	34.937	37.937	40.937	



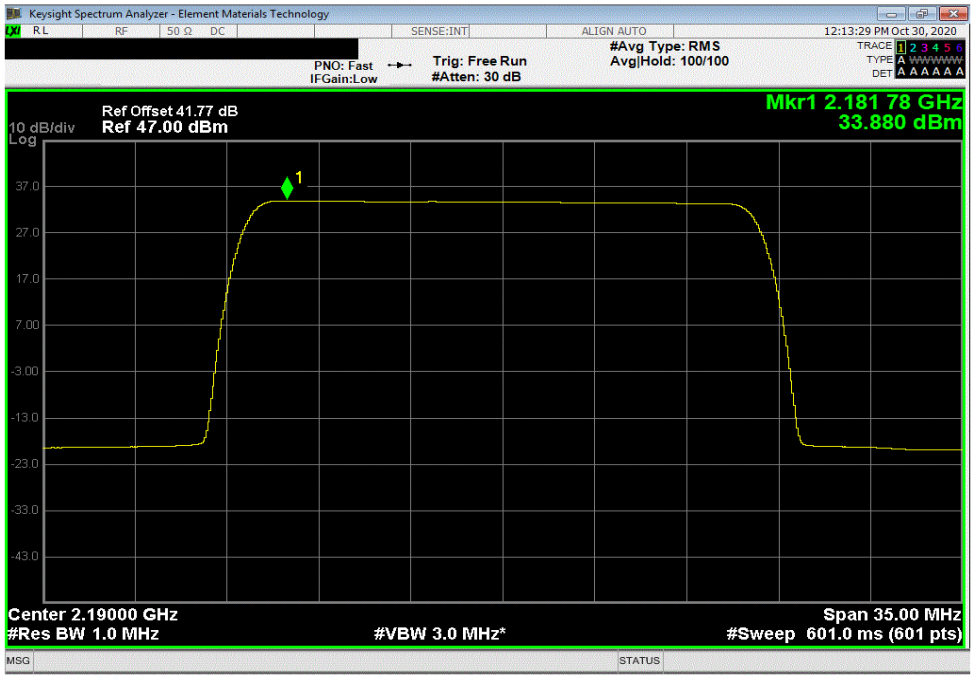
Port 4, Band n66, 2110 MHz - 2200 MHz, 20 MHz Bandwidth, QPSK Modulation, Low Channel 2120 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	33.876	0	33.88	36.88	39.88	



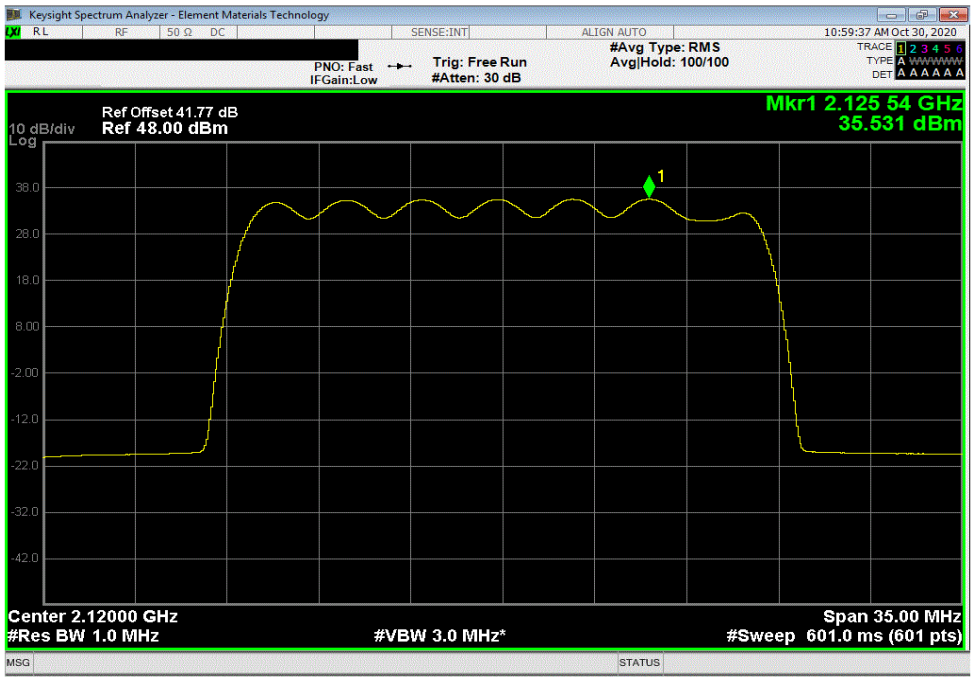
Port 4, Band n66, 2110 MHz - 2200 MHz, 20 MHz Bandwidth, QPSK Modulation, Mid Channel 2155 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	33.733	0	33.733	36.733	39.733	



Port 4, Band n66, 2110 MHz - 2200 MHz, 20 MHz Bandwidth, QPSK Modulation, High Channel 2190 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	33.88	0	33.88	36.88	39.88	



Port 4, Band n66, 2110 MHz - 2200 MHz, 20 MHz Bandwidth, 16-QAM Modulation, Low Channel 2120 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	35.531	0	35.531	38.531	41.531	



POWER SPECTRAL DENSITY

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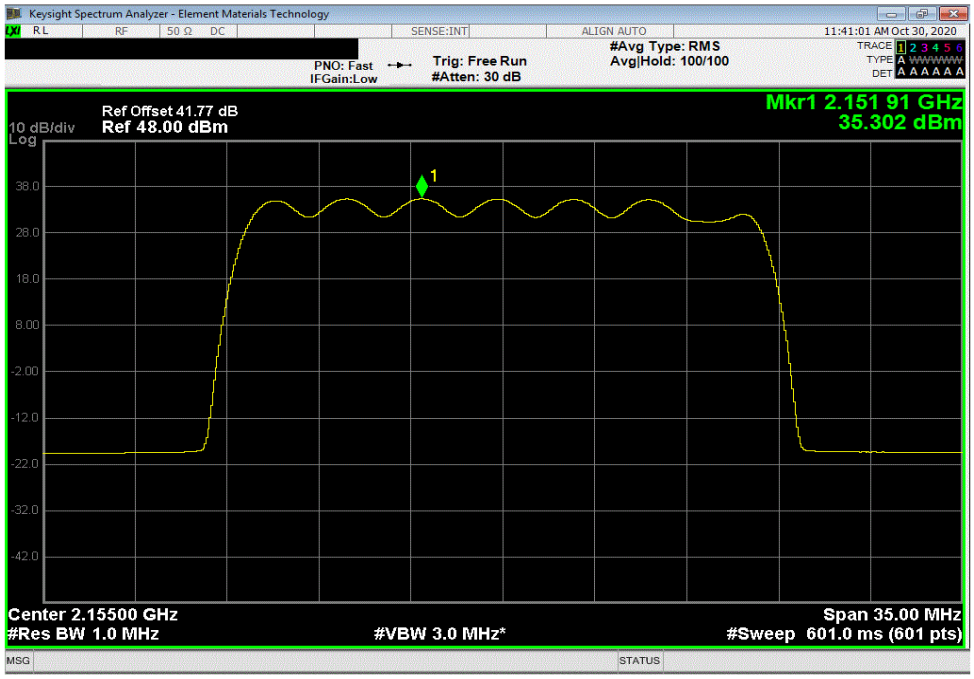
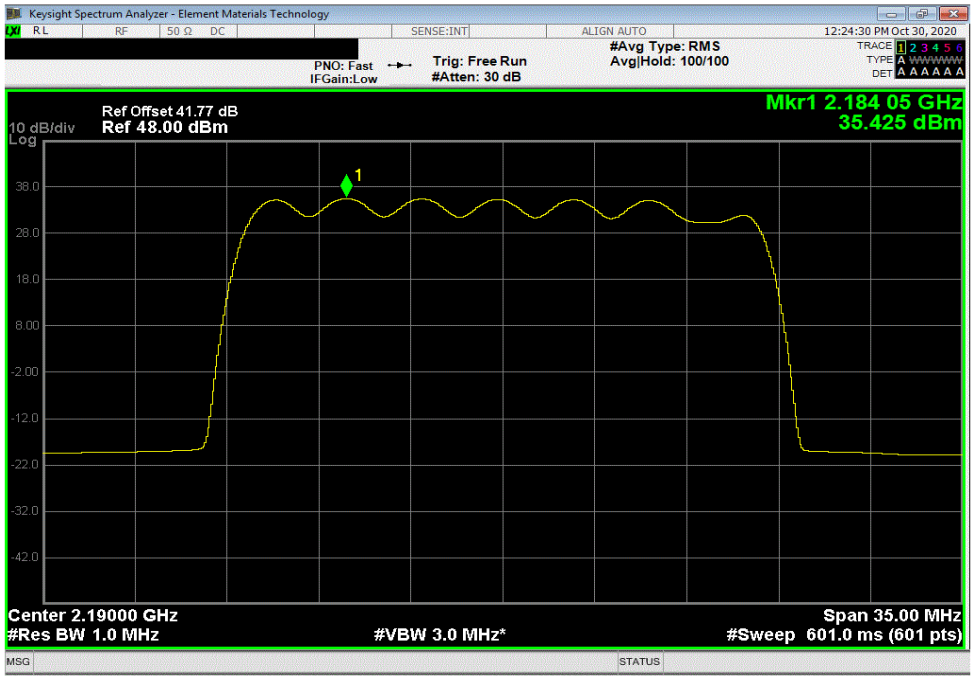
Port 4, Band n66, 2110 MHz - 2200 MHz, 20 MHz Bandwidth, 16-QAM Modulation, Mid Channel 2155 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	35.302	0	35.30	38.30	41.30	



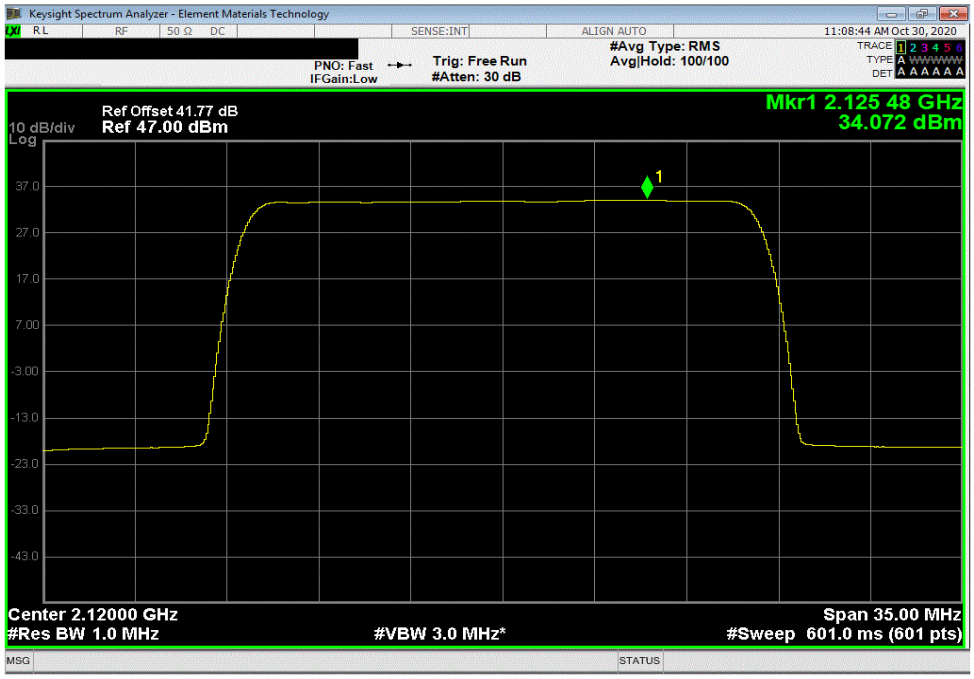
Port 4, Band n66, 2110 MHz - 2200 MHz, 20 MHz Bandwidth, 16-QAM Modulation, High Channel 2190 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	35.425	0	35.425	38.425	41.425	



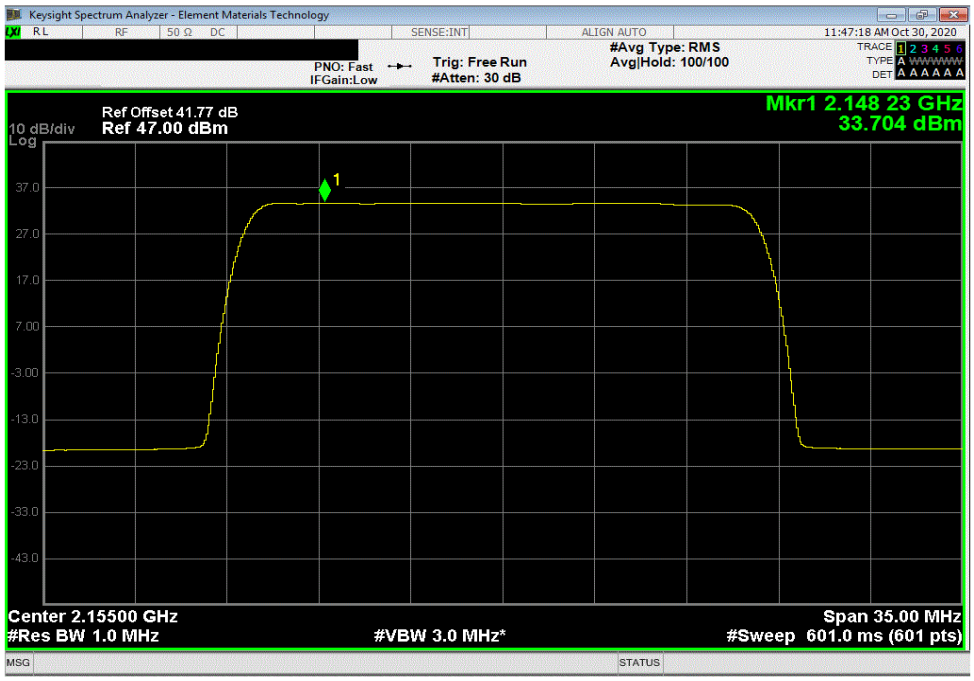
POWER SPECTRAL DENSITY

TbtTx 2020.10.20.0 BETA XMit 2020.03.25.0

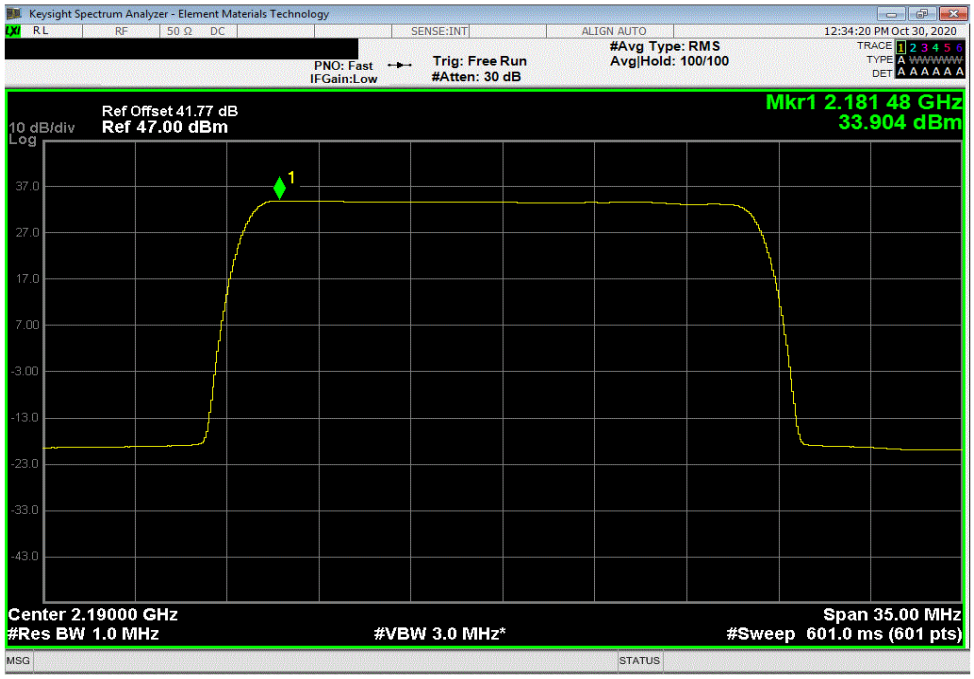
Port 4, Band n66, 2110 MHz - 2200 MHz, 20 MHz Bandwidth, 64-QAM Modulation, Low Channel 2120 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	34.072	0	34.07	37.07	40.07	



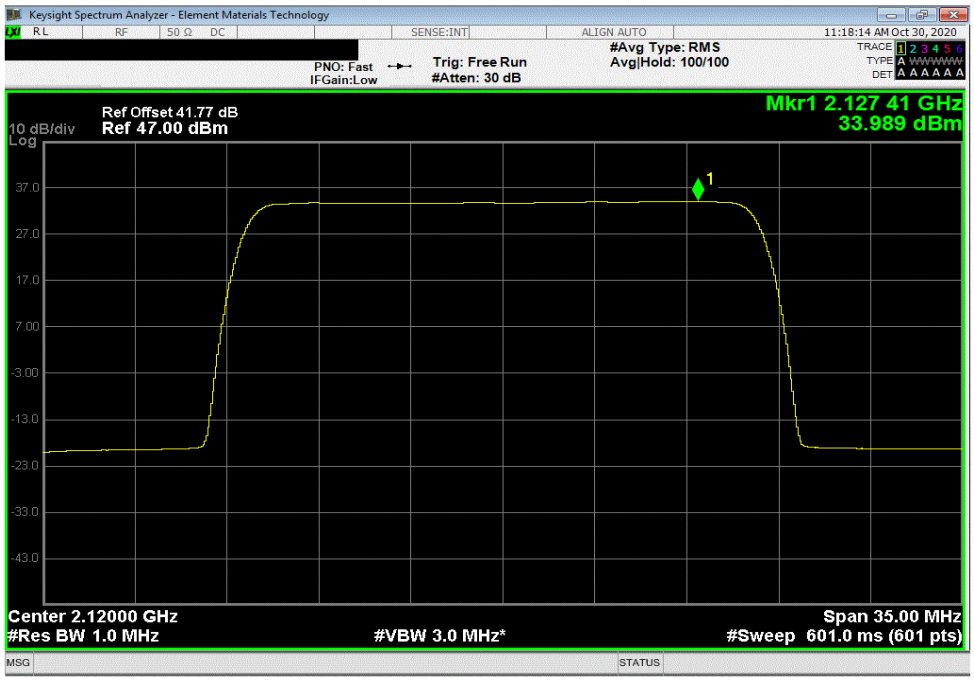
Port 4, Band n66, 2110 MHz - 2200 MHz, 20 MHz Bandwidth, 64-QAM Modulation, Mid Channel 2155 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	33.704	0	33.704	36.704	39.704	



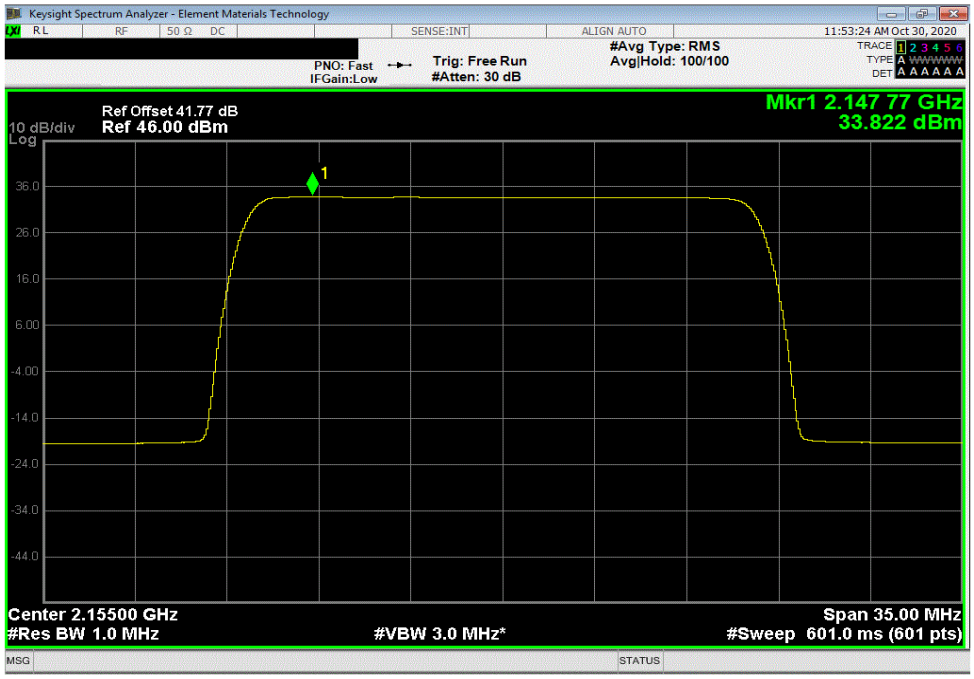
Port 4, Band n66, 2110 MHz - 2200 MHz, 20 MHz Bandwidth, 64-QAM Modulation, High Channel 2190 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	33.904	0	33.90	36.90	39.90	



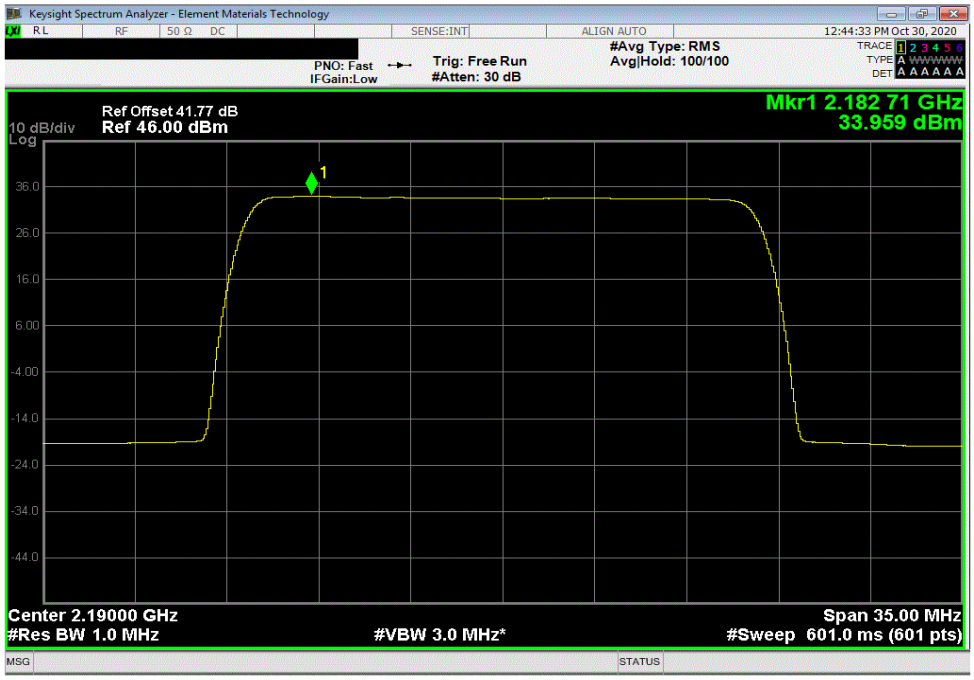
Port 4, Band n66, 2110 MHz - 2200 MHz, 20 MHz Bandwidth, 256-QAM Modulation, Low Channel 2120 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	33.989	0	33.989	36.989	39.989	



Port 4, Band n66, 2110 MHz - 2200 MHz, 20 MHz Bandwidth, 256-QAM Modulation, Mid Channel 2155 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	33.822	0	33.82	36.82	39.82	



Port 4, Band n66, 2110 MHz - 2200 MHz, 20 MHz Bandwidth, 256-QAM Modulation, High Channel 2190 MHz						
	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD	
	33.959	0	33.959	36.959	39.959	



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 n66 was used for the EIRP calculation. This antenna assembly has a pair of +45° cross-polarized radiators used for Band n66. The four antenna RF inputs (used for Band n66) on the antenna assembly are as follows: Y1+ L5 (+45°), Y1- L6 (-45°), Y2+ R7 (+45°) and Y2- R8 (-45°). The four FRIJ 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	39.9 dBm/MHz	37.4 dBm/MHz	36.6 dBm/MHz	35.5 dBm/MHz
Cable Loss (site dependent)	0 dB	0 dB	0 dB	0 dB
Maximum Antenna Gain (G_{Ant})	17.6 dBi	17.6 dBi	17.6 dBi	17.6 dBi
Directional Gain = G_{Ant} + 10Log (2) Note 1	20.6 dBi	20.6 dBi	20.6 dBi	20.6 dBi
EIRP for Antenna Y1 +45° EIRP for Ant Y1 +45°= PSD/ant port - Cable Loss + Dir Gain	60.5 dBm/MHz	58.0 dBm/MHz	57.2 dBm/MHz	56.1 dBm/MHz
EIRP for Antenna Y1 -45°	60.5 dBm/MHz	58.0 dBm/MHz	57.2 dBm/MHz	56.1 dBm/MHz
EIRP subtotal for Y1 +45°and Y1 -45° See Note 2	60.5 dBm/MHz or 1120 Watts/MHz	58.0 dBm/MHz or 631 Watts/MHz	57.2 dBm/MHz or 525 Watts/MHz	56.1 dBm/MHz or 407 Watts/MHz
EIRP for Antenna Y2 +45°	60.5 dBm/MHz	58.0 dBm/MHz	57.2 dBm/MHz	56.1 dBm/MHz
EIRP for Antenna Y2 -45°	60.5 dBm/MHz	58.0 dBm/MHz	57.2 dBm/MHz	56.1 dBm/MHz
EIRP subtotal for Y2 +45°and Y2 -45° See Note 2	60.5 dBm/MHz or 1120 Watts/MHz	58.0 dBm/MHz or 631 Watts/MHz	57.2 dBm/MHz or 525 Watts/MHz	56.1 dBm/MHz or 407 Watts/MHz
EIRP Total = Y1 ±45°and Y2 ±45° See Note 3	2240 Watts/MHz or 63.5 dBm/MHz	1262 Watts/MHz or 61.0 dBm/MHz	1050 Watts/MHz or 60.2 dBm/MHz	813 Watts/MHz or 59.1 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 an 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 FRIJ 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 1.35 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.