

POWER SPECTRAL DENSITY AND EIRP CALCULATIONS



XMIT 2022.02.07.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17
Block - DC	Fairview Microwave	SD3379	AMT	2021-09-14	2022-09-14
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2022-01-17	2023-01-17

TEST DESCRIPTION

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

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

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

The total PSD for all antenna ports (at the radio output) were determined per ANSI C63.26-2015 paragraph 6.4.3.2.4. The EIRP calculations are based upon ANSI C63.26-2015 paragraphs 6.4 for a four port MIMO base station.

EIRP Requirements:

FCC Requirements: Part 24.232 Power and antenna height limits.

(a)(2) Base stations with an emission bandwidth greater than 1 MHz are limited to 1640 watts/MHz equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT, except as described in paragraph (b) below.

(a)(3) Base station antenna heights may exceed 300 meters HAAT with a corresponding reduction in power; see Tables 1 and 2 of this section.

(b)(2) Base stations that are located in counties with population densities of 100 persons or fewer per square mile, based upon the most recently available population statistics from the Bureau of the Census, with an emission bandwidth greater than 1 MHz are limited to 3280 watts/MHz equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT.

ISED Requirements RSS-133 Section 6.4/SRSP-510 section 5.1.1:

SRSP-510 section 5.1 Radiated power and antenna height limits for base stations

For base stations with a channel bandwidth greater than 1 MHz, the maximum e.i.r.p. is limited to 3280 watts/MHz e.i.r.p. (i.e., no more than 3280 watts e.i.r.p. in any 1 MHz band segment) with an antenna height above average terrain (HAAT) up to 300 metres. Fixed or base stations operating in urban areas are limited to a maximum allowable e.i.r.p. of 1640 watts/MHz e.i.r.p. Base station antenna heights above average terrain may exceed 300 metres with a corresponding reduction in e.i.r.p. according to the following table:

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.

POWER SPECTRAL DENSITY AND EIRP CALCULATIONS



TRFV 2021.12.14.1 XMI 2022.02.07.0

EUT: AHFII Remote Radio Head		Work Order: NOKI0037
Serial Number: YK214000036		Date: 28-Feb-22
Customer: Nokia Solutions and Networks		Temperature: 22.6 °C
Attendees: David Le, John Rattanavong		Humidity: 23.7% RH
Project: None		Barometric Pres.: 1026 mbar
Tested by: Mark Baytan	Power: 54 VDC	Job Site: TX09
TEST SPECIFICATIONS		
FCC 24E:2022		Test Method
RSS-133 Issue 6:2013+A1:2018		ANSI C63.26:2015
		RSS-133 Issue 6:2013+A1:2018
COMMENTS		
All measurement path losses accounted for in the reference level offset including any attenuators, filters, and DC blocks. Band 25 carriers enabled at maximum power is 80 watts/carrier. The PSD was measured while transmitting one carrier on Port 1. The total PSD for multipoint (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)]. The carrier power was set to maximum for all testing.		
DEVIATIONS FROM TEST STANDARD		
None		
Configuration #	2	Signature
	Initial Value	Duty Cycle
	dBm/MHz	Factor (dB)
		Single Port
		Two Port (2x2 MIMO)
		Four Port (4x4 MIMO)
		dBm/MHz == PSD
		dBm/MHz == PSD
		dBm/MHz == PSD

Band 25, 1930 MHz - 1995 MHz, LTE Single Carrier
Port 1

1.4 MHz Bandwidth

QPSK Modulation

Low Channel, 1930.7 MHz	47.508	0	47.5	50.5	53.7
Mid Channel, 1962.5 MHz	47.558	0	47.6	50.6	53.6
High Channel, 1989.3 MHz	47.778	0	47.8	50.8	53.8

16-QAM Modulation

Low Channel, 1930.7 MHz	47.557	0	47.6	50.6	53.7
Mid Channel, 1962.5 MHz	47.596	0	47.6	50.6	53.6
High Channel, 1989.3 MHz	47.788	0	47.8	50.8	53.8

64-QAM Modulation

Low Channel, 1930.7 MHz	47.506	0	47.5	50.7	53.7
Mid Channel, 1962.5 MHz	47.588	0	47.6	50.6	53.6
High Channel, 1989.3 MHz	47.788	0	47.8	50.8	53.8

256-QAM Modulation

Low Channel, 1930.7 MHz	47.557	0	47.6	50.6	53.6
Mid Channel, 1962.5 MHz	47.656	0	47.7	50.7	53.7
High Channel, 1989.3 MHz	47.830	0	47.8	50.8	53.8

3 MHz Bandwidth

QPSK Modulation

Mid Channel, 1962.5 MHz	44.545	0	44.5	47.5	50.5
-------------------------	--------	---	------	------	------

16-QAM Modulation

Mid Channel, 1962.5 MHz	44.965	0	45.0	48.0	51.0
-------------------------	--------	---	------	------	------

64-QAM Modulation

Mid Channel, 1962.5 MHz	44.547	0	44.5	47.5	50.5
-------------------------	--------	---	------	------	------

256-QAM Modulation

Mid Channel, 1962.5 MHz	44.627	0	44.6	47.6	50.6
-------------------------	--------	---	------	------	------

5 MHz Bandwidth

QPSK Modulation

Mid Channel, 1962.5 MHz	42.079	0	42.1	45.1	48.1
-------------------------	--------	---	------	------	------

16-QAM Modulation

Mid Channel, 1962.5 MHz	42.389	0	42.4	45.4	48.4
-------------------------	--------	---	------	------	------

64-QAM Modulation

Mid Channel, 1962.5 MHz	41.933	0	41.9	44.9	47.9
-------------------------	--------	---	------	------	------

256-QAM Modulation

Mid Channel, 1962.5 MHz	41.972	0	42.0	45.0	48.0
-------------------------	--------	---	------	------	------

10 MHz Bandwidth

QPSK Modulation

Mid Channel, 1962.5 MHz	39.440	0	39.4	42.4	45.4
-------------------------	--------	---	------	------	------

16-QAM Modulation

Mid Channel, 1962.5 MHz	39.845	0	39.8	42.8	45.8
-------------------------	--------	---	------	------	------

64-QAM Modulation

Mid Channel, 1962.5 MHz	39.454	0	39.5	42.5	45.5
-------------------------	--------	---	------	------	------

256-QAM Modulation

Mid Channel, 1962.5 MHz	39.472	0	39.5	42.5	45.5
-------------------------	--------	---	------	------	------

15 MHz Bandwidth

QPSK Modulation

Mid Channel, 1962.5 MHz	37.740	0	37.7	40.7	43.7
-------------------------	--------	---	------	------	------

16-QAM Modulation

Mid Channel, 1962.5 MHz	38.615	0	38.6	41.6	44.6
-------------------------	--------	---	------	------	------

64-QAM Modulation

Mid Channel, 1962.5 MHz	37.745	0	37.7	40.7	43.7
-------------------------	--------	---	------	------	------

256-QAM Modulation

Mid Channel, 1962.5 MHz	37.753	0	37.8	40.8	43.8
-------------------------	--------	---	------	------	------

20 MHz Bandwidth

QPSK Modulation

Mid Channel, 1962.5 MHz	36.469	0	36.5	39.5	42.5
-------------------------	--------	---	------	------	------

16-QAM Modulation

Mid Channel, 1962.5 MHz	36.895	0	36.9	39.9	42.9
-------------------------	--------	---	------	------	------

64-QAM Modulation

Mid Channel, 1962.5 MHz	36.508	0	36.5	39.5	42.5
-------------------------	--------	---	------	------	------

256-QAM Modulation

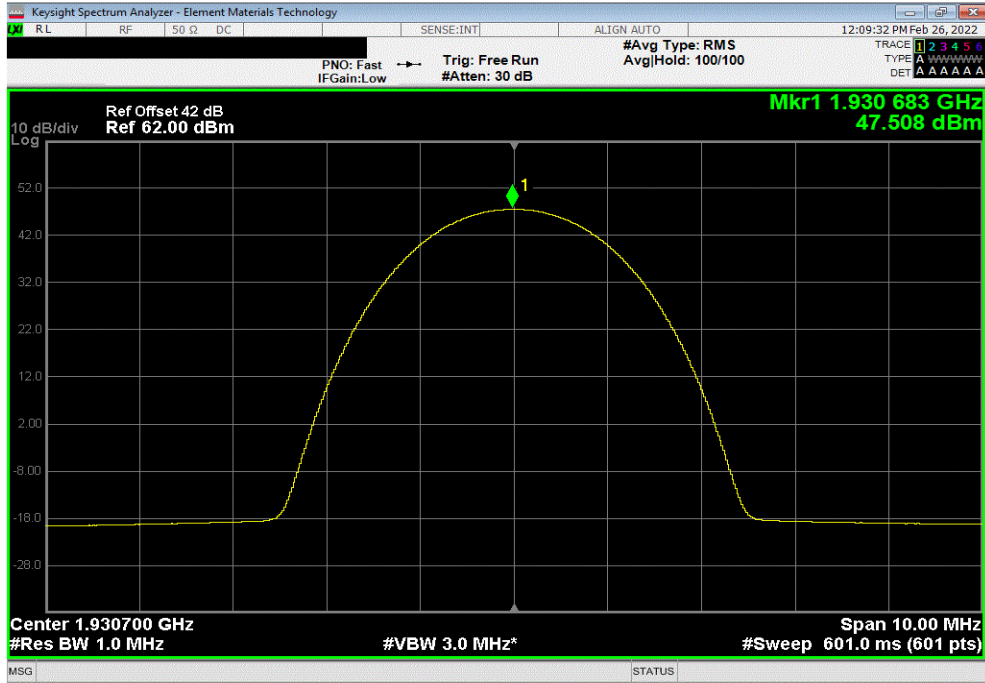
Mid Channel, 1962.5 MHz	36.523	0	36.5	39.5	42.5
-------------------------	--------	---	------	------	------

POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

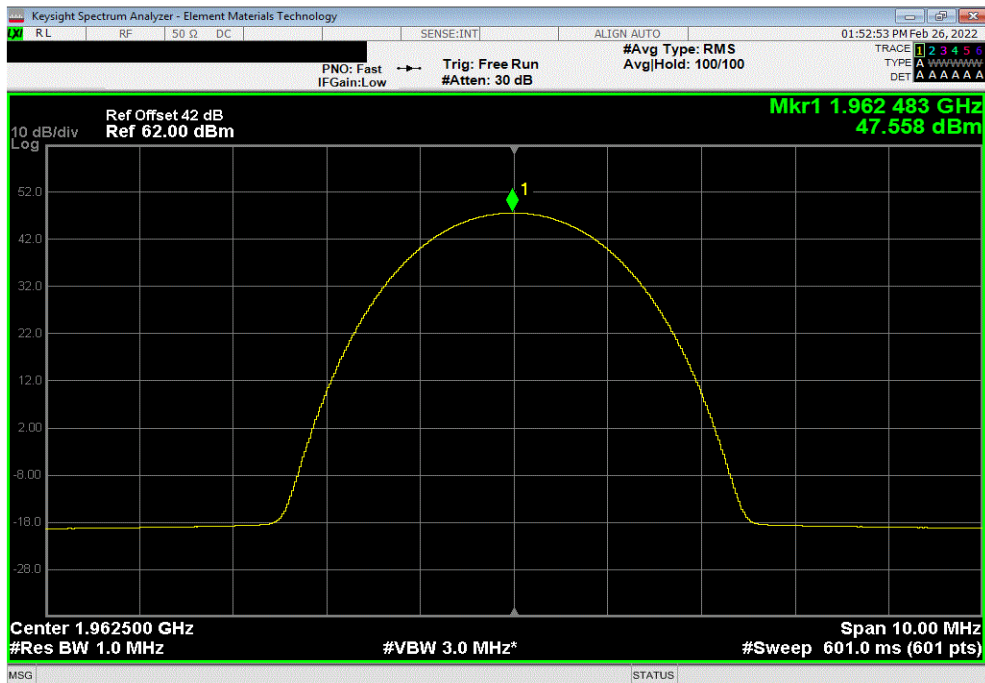


TbTx 2021.12.14.1 XMI 2022.02.07.0

Band 25, 1930 MHz - 1995 MHz, LTE Single Carrier, Port 1, 1.4 MHz Bandwidth, QPSK Modulation, Low Channel, 1930.7 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	
47.508	0	47.5	50.5	53.7	



Band 25, 1930 MHz - 1995 MHz, LTE Single Carrier, Port 1, 1.4 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	
47.558	0	47.6	50.6	53.6	

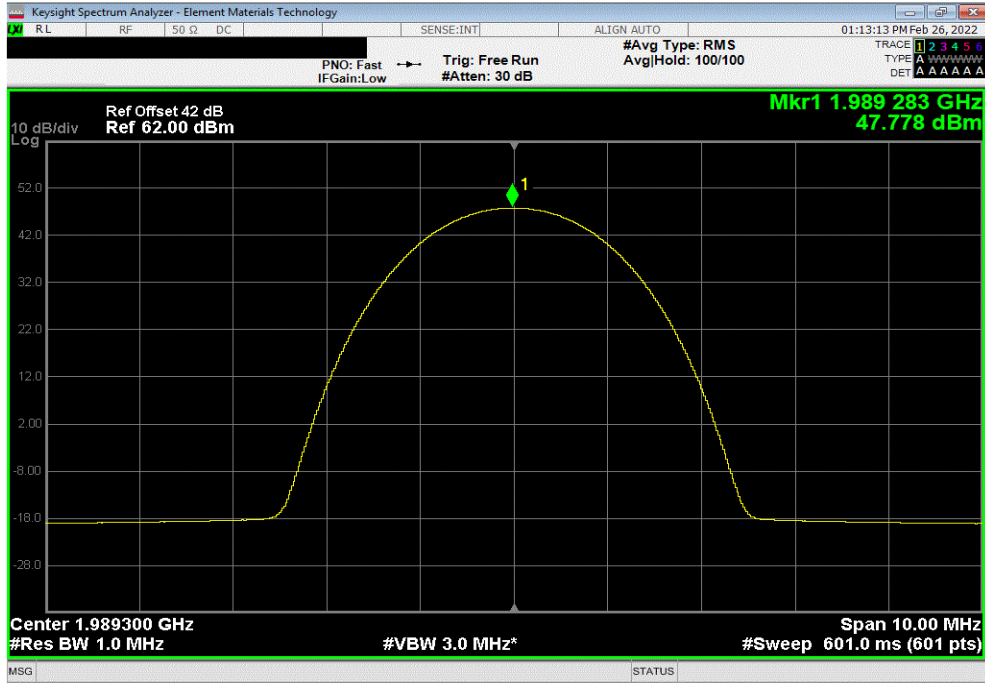


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

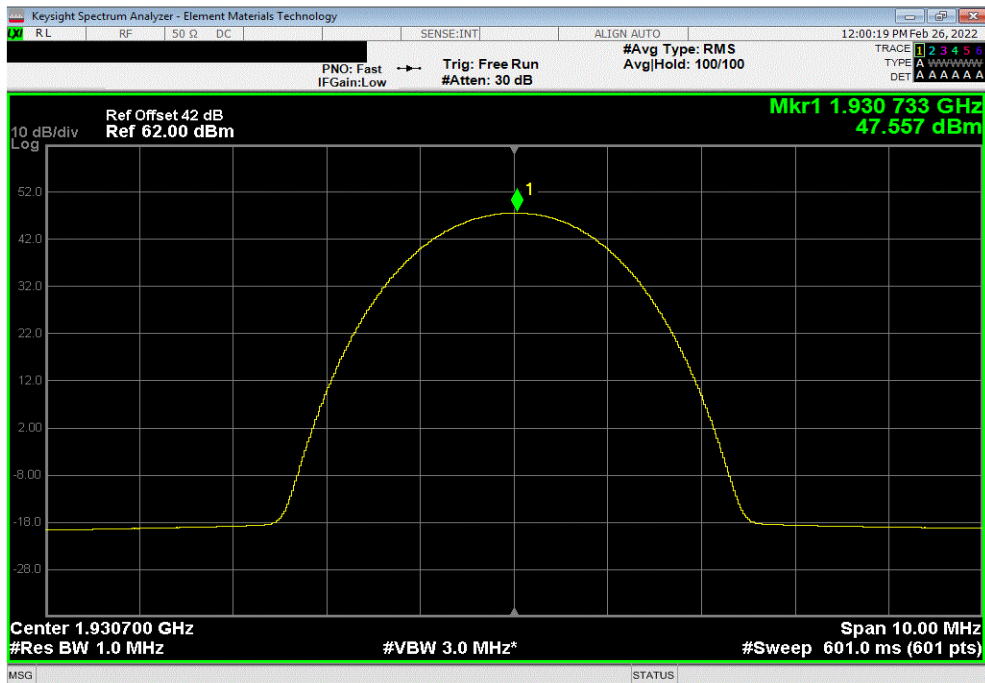


TbTx 2021.12.14.1 XMI 2022.02.07.0

Band 25, 1930 MHz - 1995 MHz, LTE Single Carrier, Port 1, 1.4 MHz Bandwidth, QPSK Modulation, High Channel, 1989.3 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	
47.778	0	47.8	50.8	53.8	



Band 25, 1930 MHz - 1995 MHz, LTE Single Carrier, Port 1, 1.4 MHz Bandwidth, 16-QAM Modulation, Low Channel, 1930.7 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	
47.557	0	47.6	50.6	53.7	

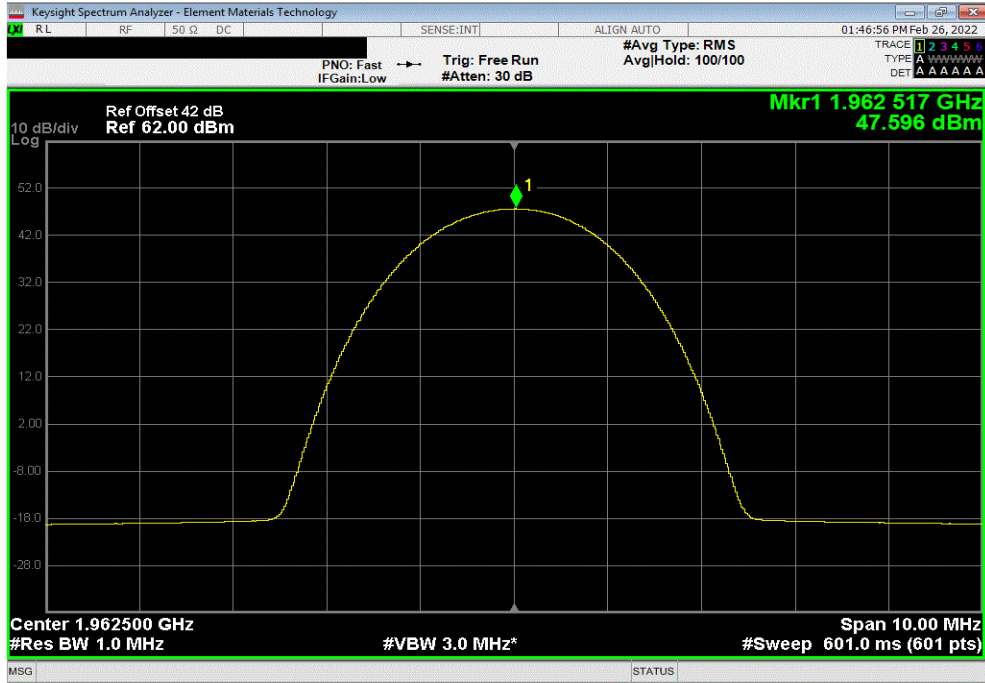


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

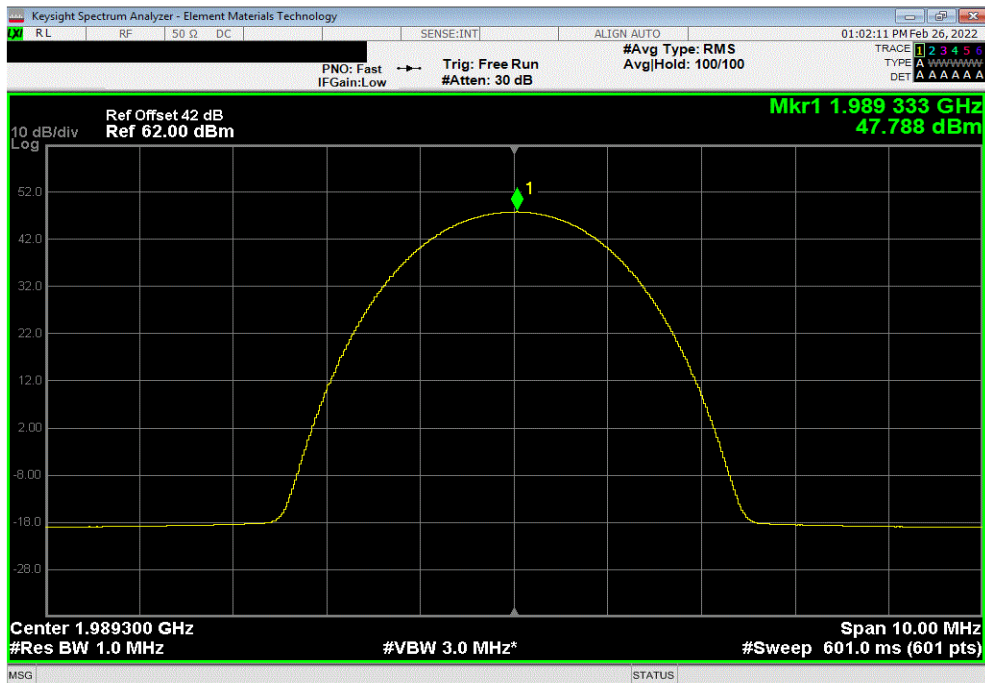


TbTx 2021.12.14.1 XMI 2022.02.07.0

Band 25, 1930 MHz - 1995 MHz, LTE Single Carrier, Port 1, 1.4 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	
47.596	0	47.6	50.6	53.6	



Band 25, 1930 MHz - 1995 MHz, LTE Single Carrier, Port 1, 1.4 MHz Bandwidth, 16-QAM Modulation, High Channel, 1989.3 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	
47.788	0	47.8	50.8	53.8	

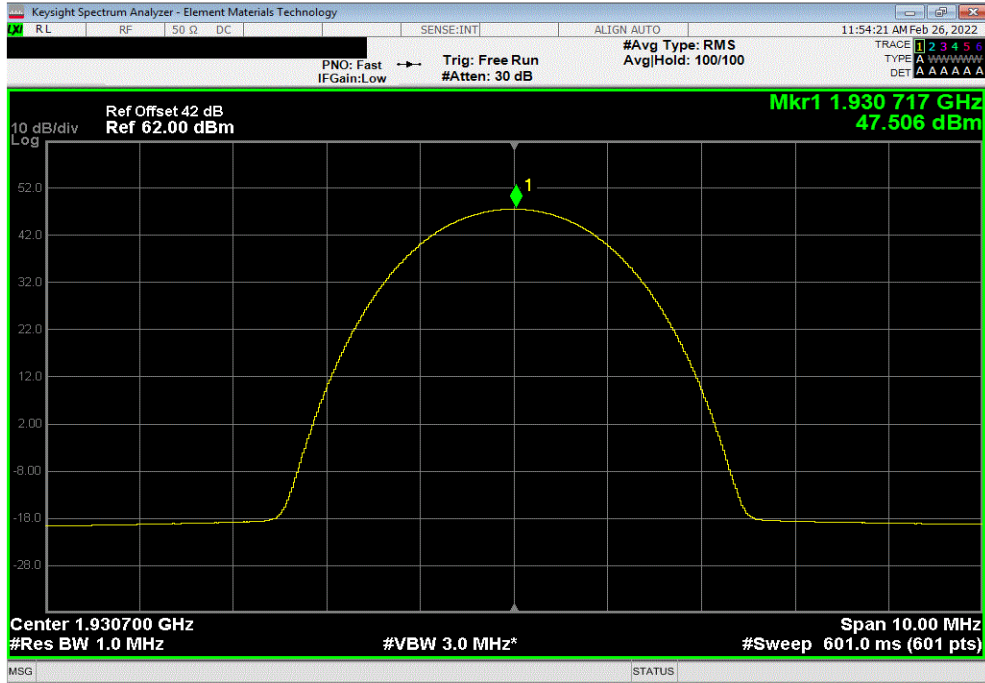


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

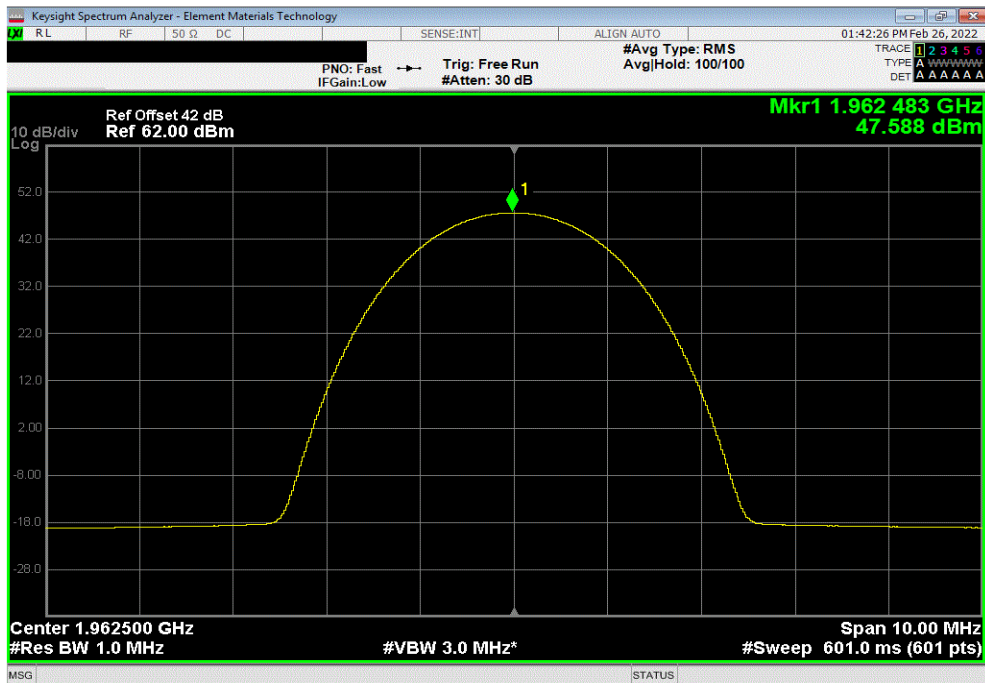


TbTx 2021.12.14.1 XMI 2022.02.07.0

Band 25, 1930 MHz - 1995 MHz, LTE Single Carrier, Port 1, 1.4 MHz Bandwidth, 64-QAM Modulation, Low Channel, 1930.7 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	
47.506	0	47.5	50.7	53.7	



Band 25, 1930 MHz - 1995 MHz, LTE Single Carrier, Port 1, 1.4 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	
47.588	0	47.6	50.6	53.6	

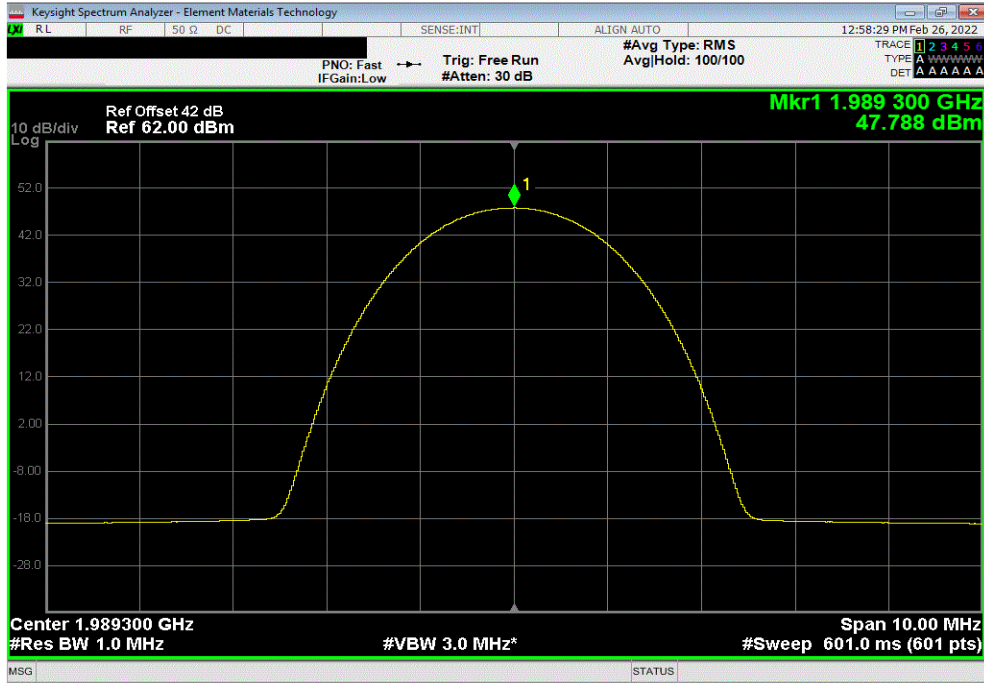


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

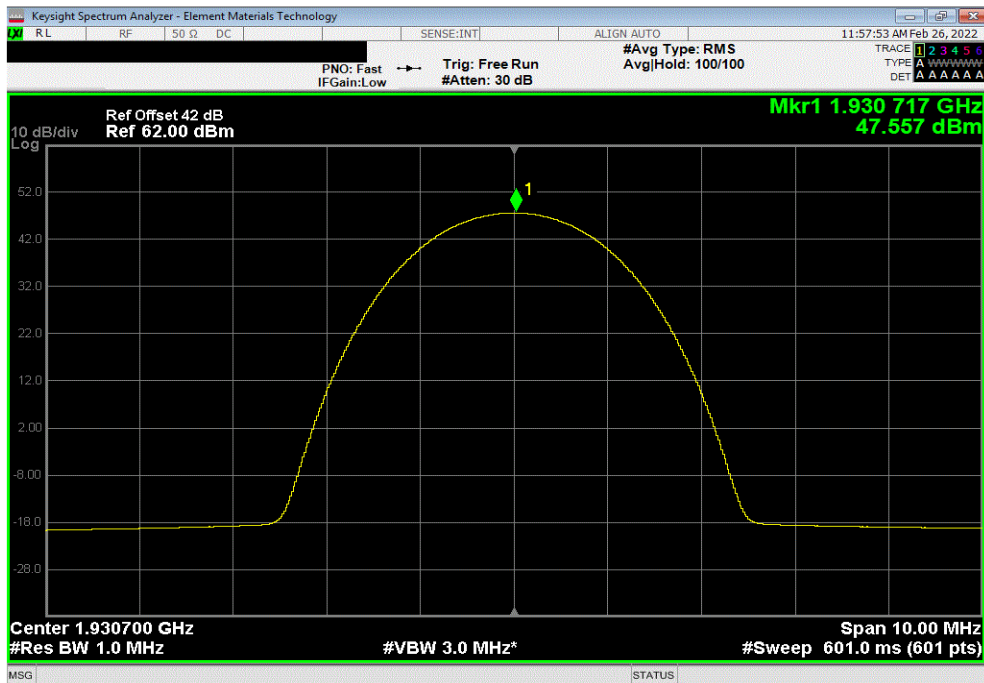


TbTx 2021.12.14.1 XMI 2022.02.07.0

Band 25, 1930 MHz - 1995 MHz, LTE Single Carrier, Port 1, 1.4 MHz Bandwidth, 64-QAM Modulation, High Channel, 1989.3 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	
47.788	0	47.8	50.8	53.8	



Band 25, 1930 MHz - 1995 MHz, LTE Single Carrier, Port 1, 1.4 MHz Bandwidth, 256-QAM Modulation, Low Channel, 1930.7 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	
47.557	0	47.6	50.6	53.6	

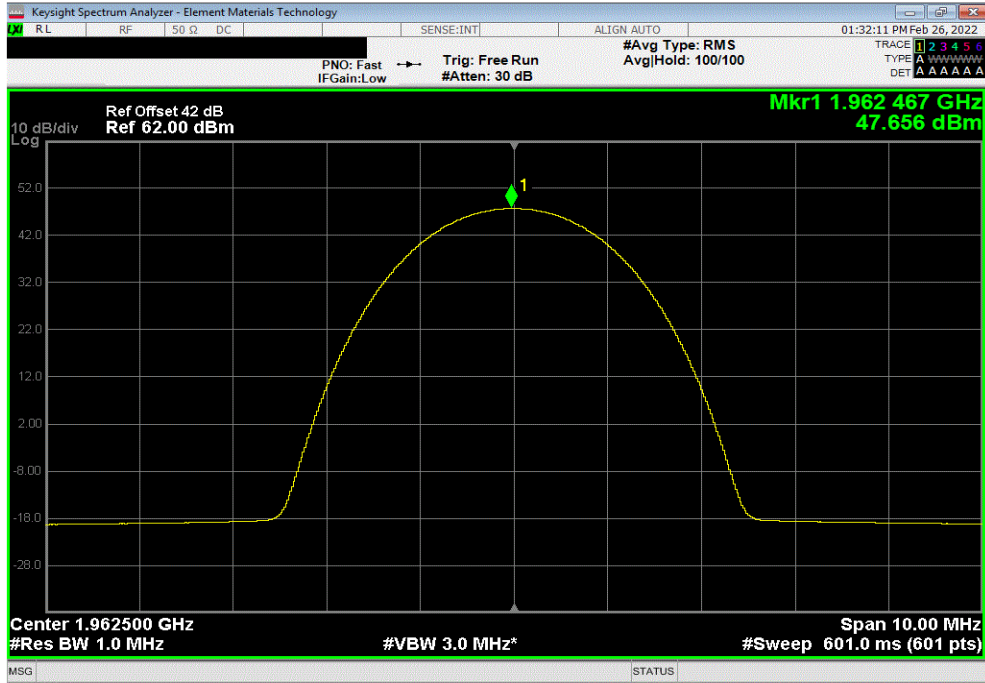


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

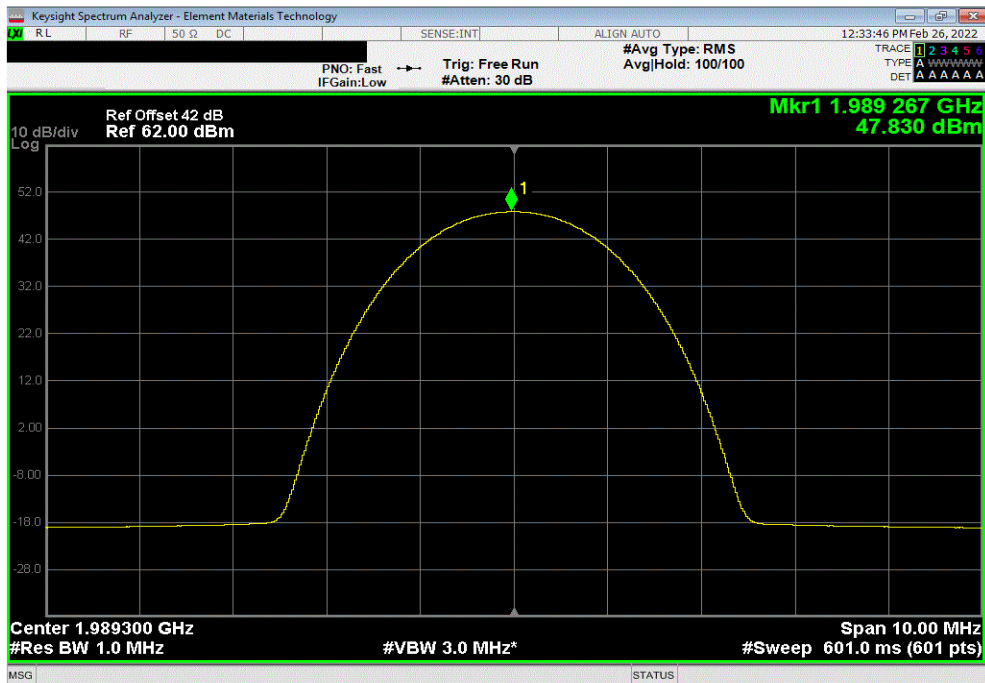


TbTx 2021.12.14.1 XMI 2022.02.07.0

Band 25, 1930 MHz - 1995 MHz, LTE Single Carrier, Port 1, 1.4 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	
47.656	0	47.7	50.7	53.7	



Band 25, 1930 MHz - 1995 MHz, LTE Single Carrier, Port 1, 1.4 MHz Bandwidth, 256-QAM Modulation, High Channel, 1989.3 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	
47.830	0	47.8	50.8	53.8	

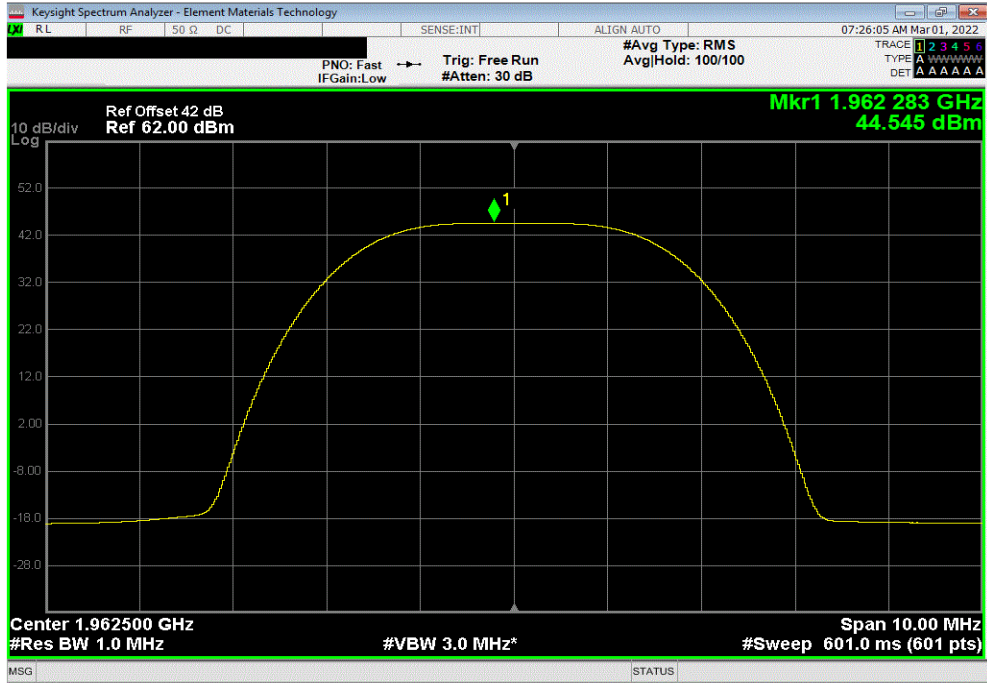


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

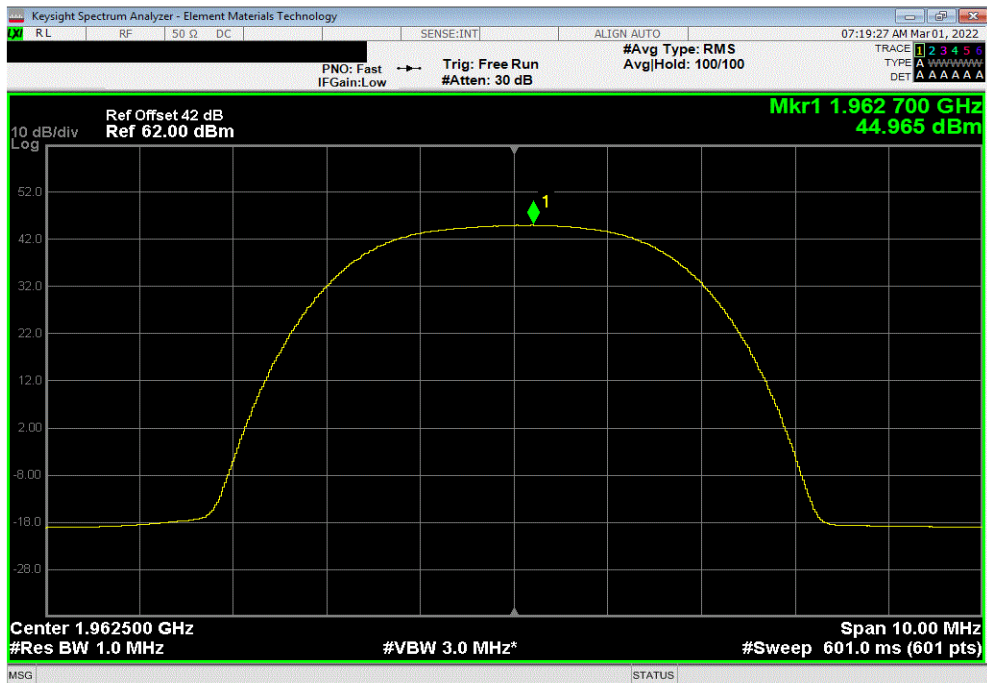


TbTx 2021.12.14.1 XMI 2022.02.07.0

Band 25, 1930 MHz - 1995 MHz, LTE Single Carrier, Port 1, 3 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	
44.545	0	44.5	47.5	50.5	



Band 25, 1930 MHz - 1995 MHz, LTE Single Carrier, Port 1, 3 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	
44.965	0	45.0	48.0	51.0	

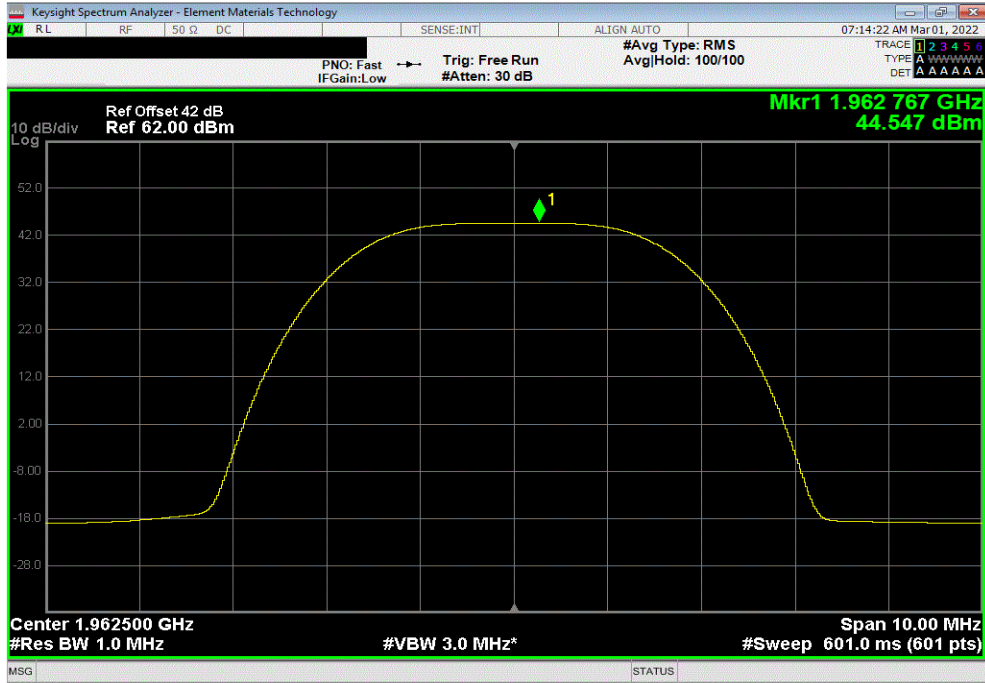


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

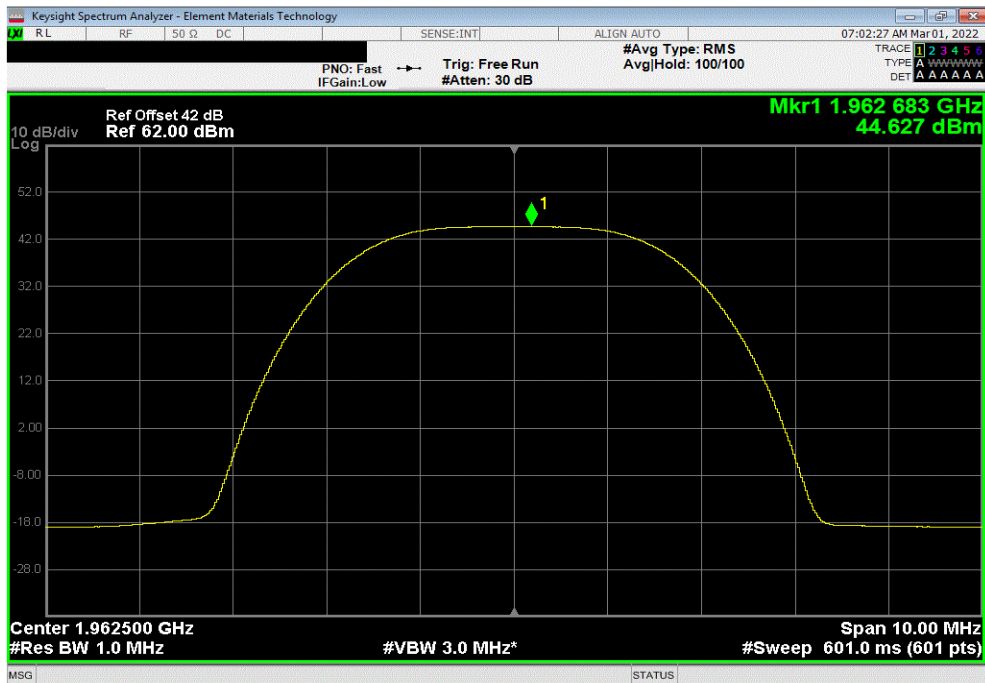


TbTx 2021.12.14.1 XMI 2022.02.07.0

Band 25, 1930 MHz - 1995 MHz, LTE Single Carrier, Port 1, 3 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	
44.547	0	44.5	47.5	50.5	



Band 25, 1930 MHz - 1995 MHz, LTE Single Carrier, Port 1, 3 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	
44.627	0	44.6	47.6	50.6	

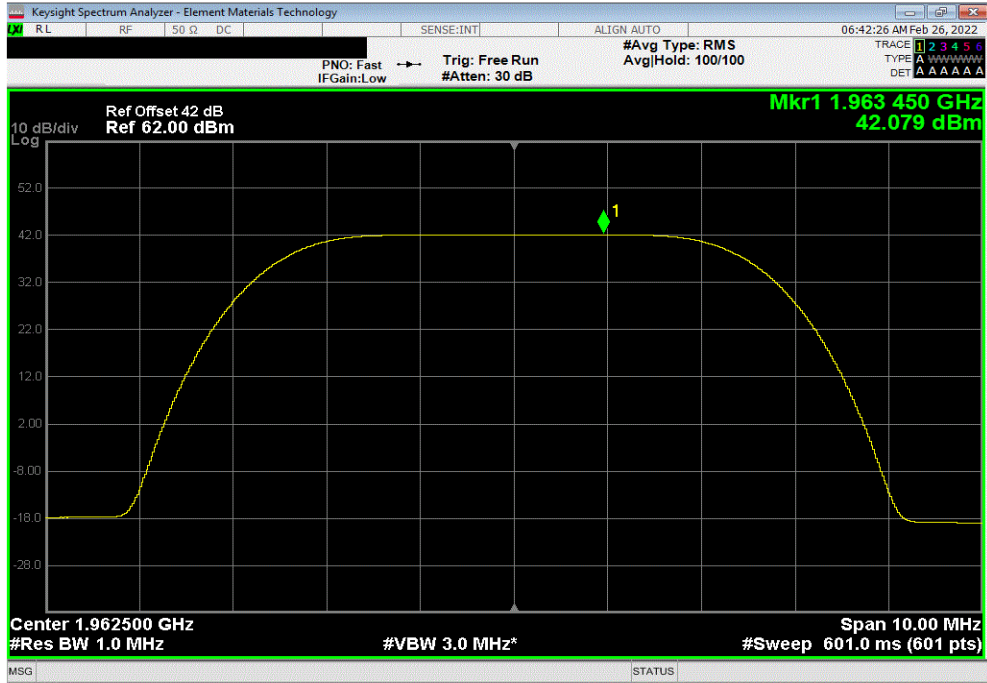


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

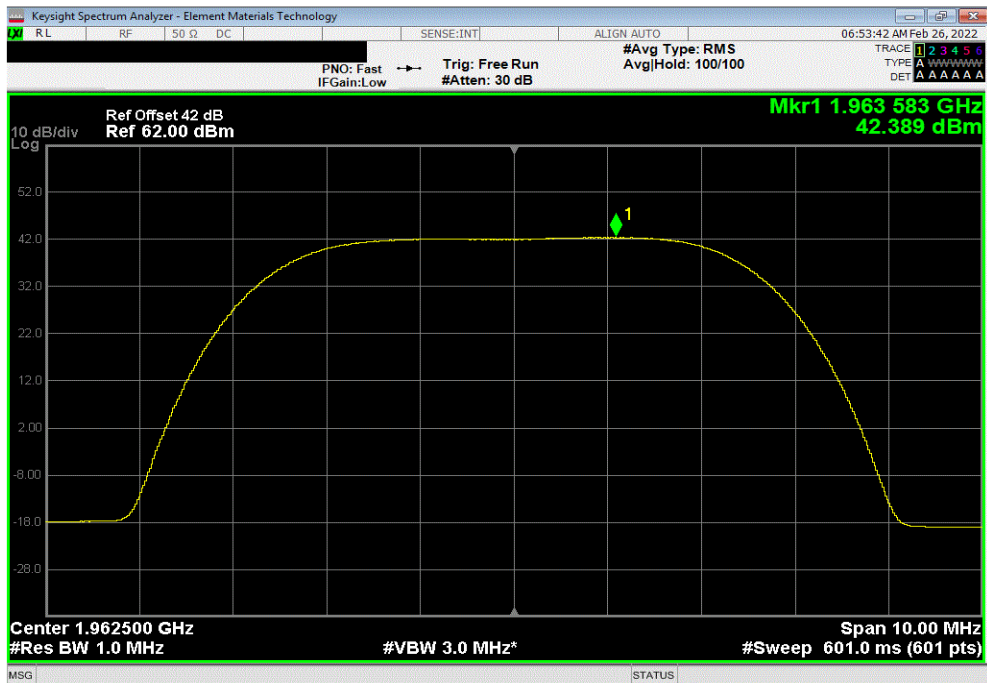


TbTx 2021.12.14.1 XMI 2022.02.07.0

Band 25, 1930 MHz - 1995 MHz, LTE Single Carrier, 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	
42.079	0	42.1	45.1	48.1	



Band 25, 1930 MHz - 1995 MHz, LTE Single Carrier, 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	
42.389	0	42.4	45.4	48.4	

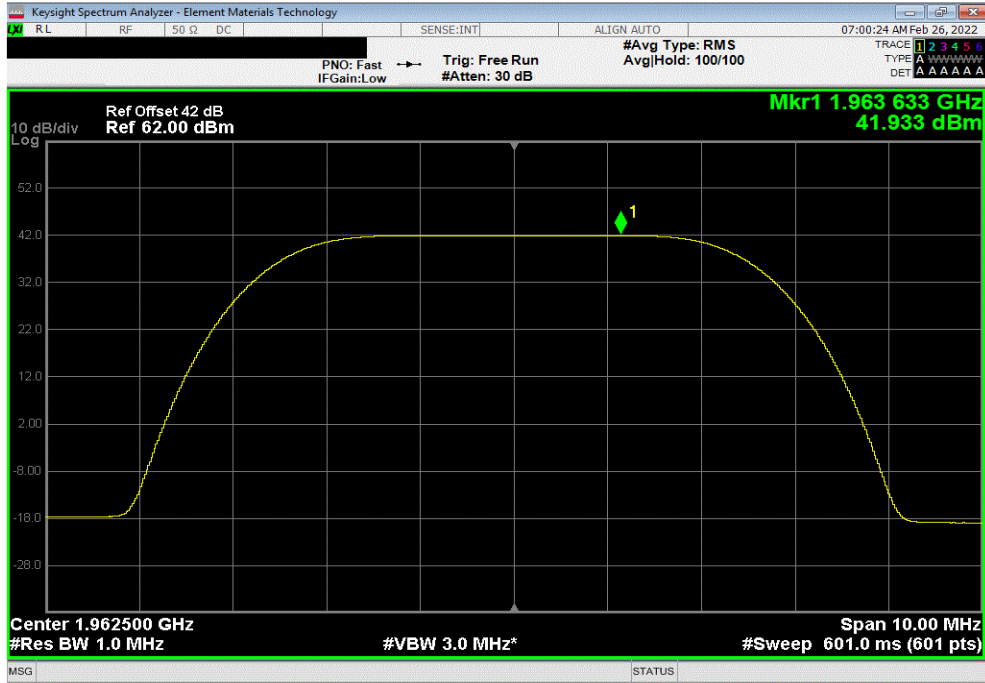


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

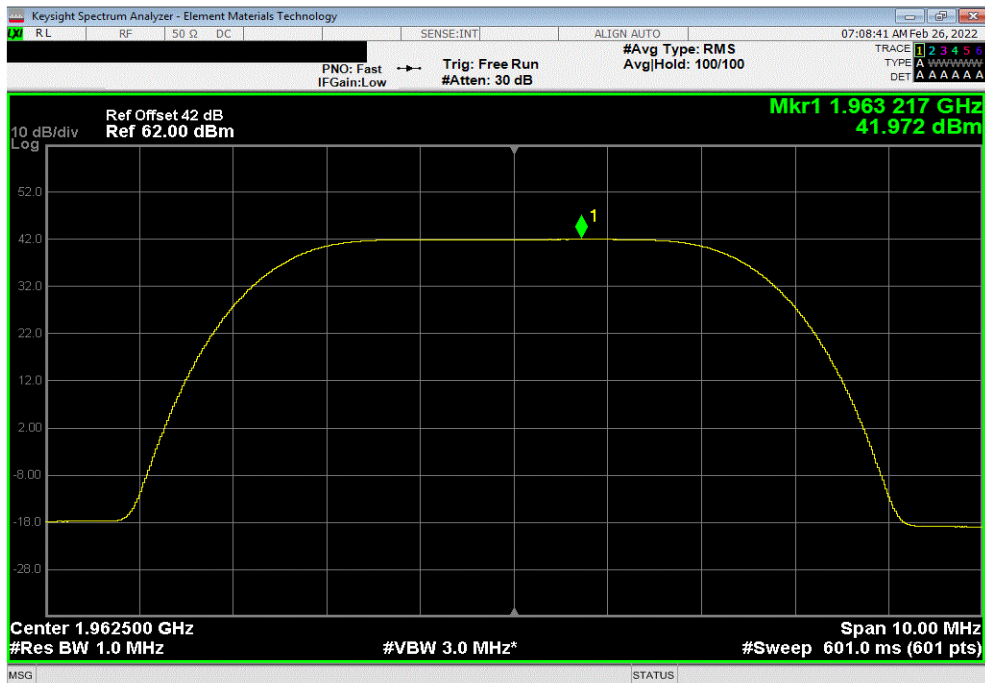


TotTx 2021.12.14.1 XMit 2022.02.07.0

Band 25, 1930 MHz - 1995 MHz, LTE Single Carrier, 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	
41.933	0	41.9	44.9	47.9	



Band 25, 1930 MHz - 1995 MHz, LTE Single Carrier, 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	
41.972	0	42.0	45.0	48.0	

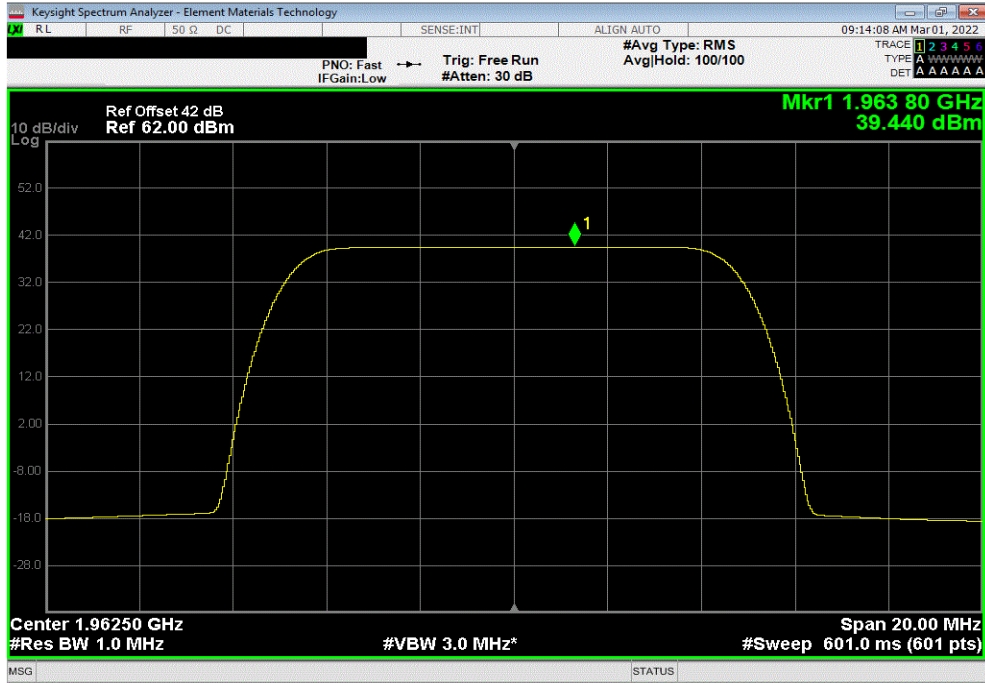


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

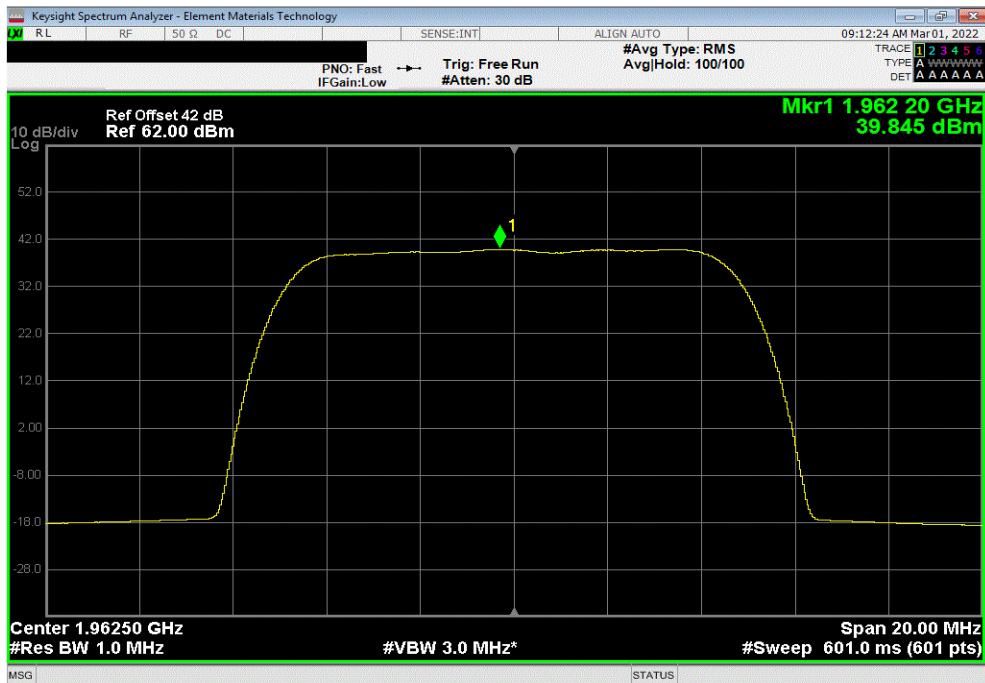


TotTx 2021.12.14.1 XMit 2022.02.07.0

Band 25, 1930 MHz - 1995 MHz, LTE Single Carrier, 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	
39.440	0	39.4	42.4	45.4	



Band 25, 1930 MHz - 1995 MHz, LTE Single Carrier, 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	
39.845	0	39.8	42.8	45.8	

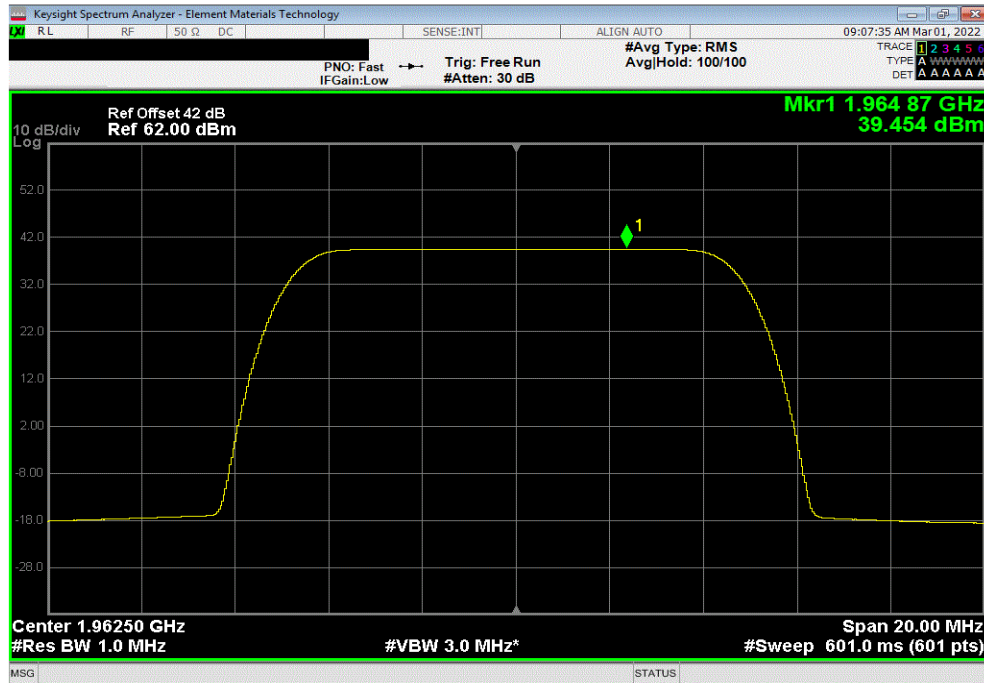


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

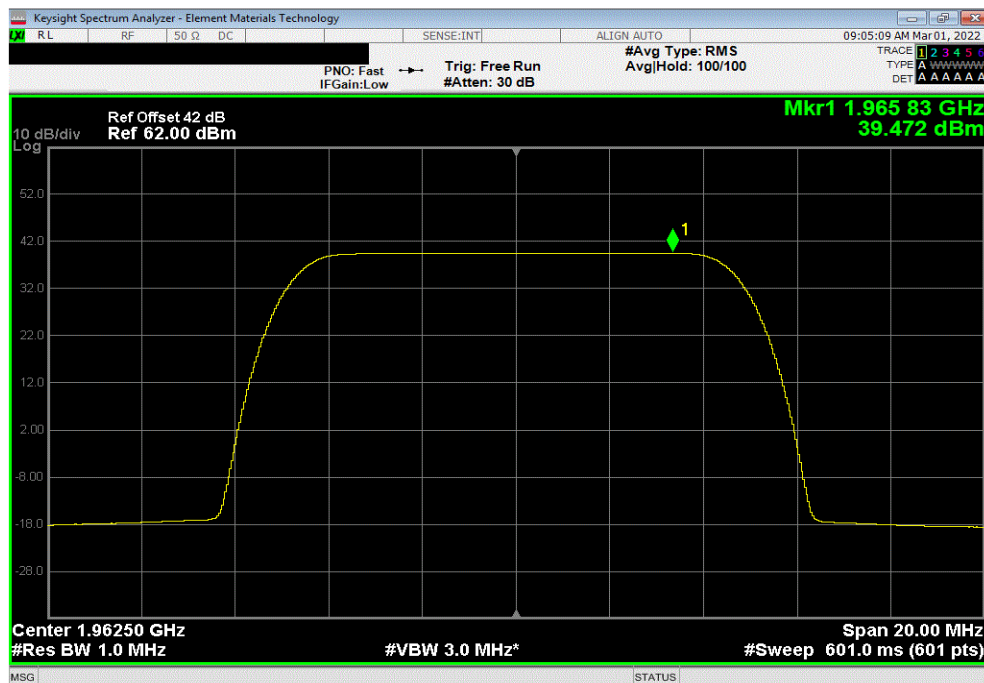


TotTx 2021.12.14.1 XMI 2022.02.07.0

Band 25, 1930 MHz - 1995 MHz, LTE Single Carrier, 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	
39.454	0	39.5	42.5	45.5	



Band 25, 1930 MHz - 1995 MHz, LTE Single Carrier, 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	
39.472	0	39.5	42.5	45.5	

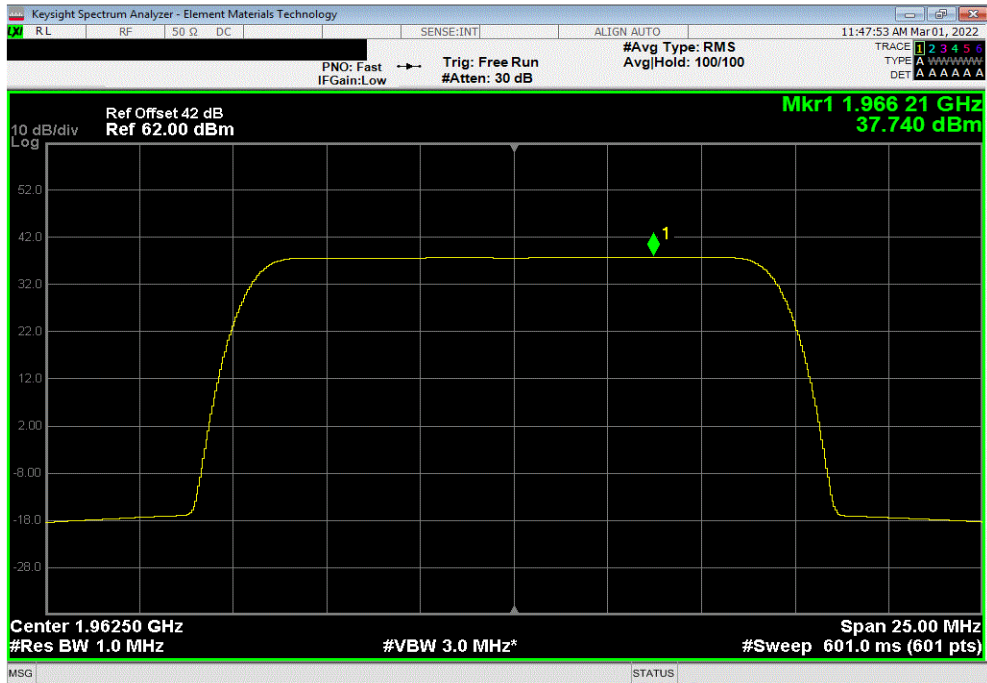


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

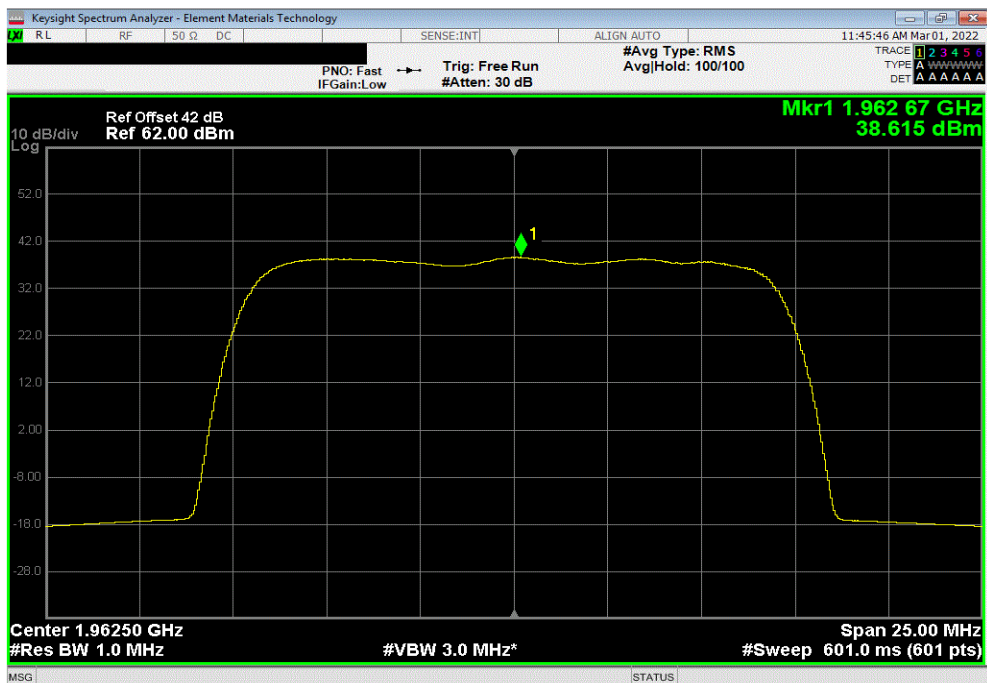


TbTx 2021.12.14.1 XMI 2022.02.07.0

Band 25, 1930 MHz - 1995 MHz, LTE Single Carrier, 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	
37.740	0	37.7	40.7	43.7	



Band 25, 1930 MHz - 1995 MHz, LTE Single Carrier, 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	
38.615	0	38.6	41.6	44.6	

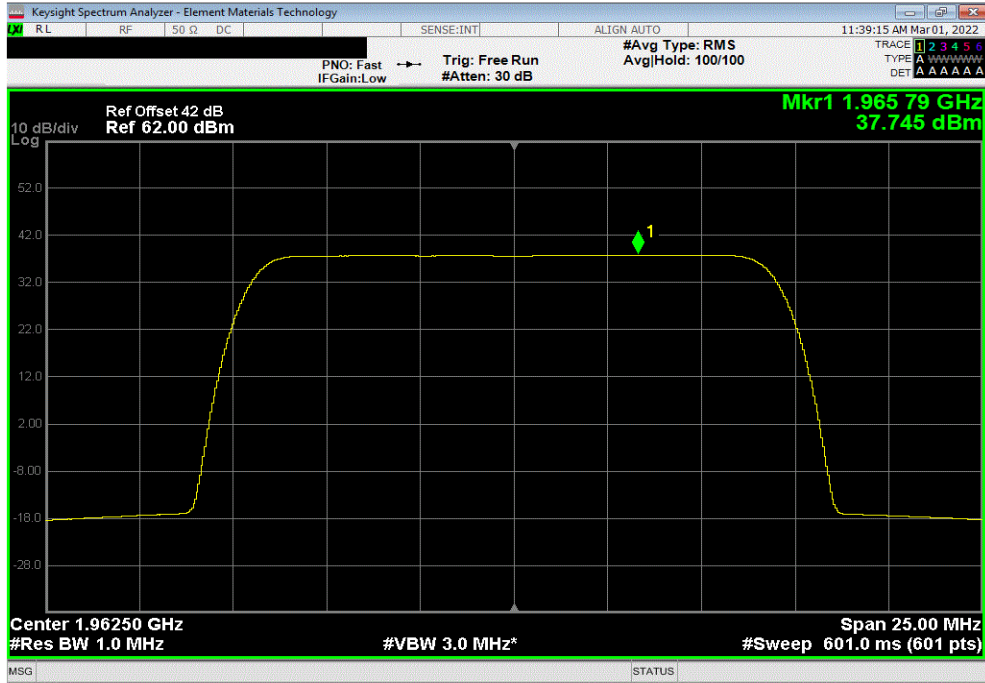


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

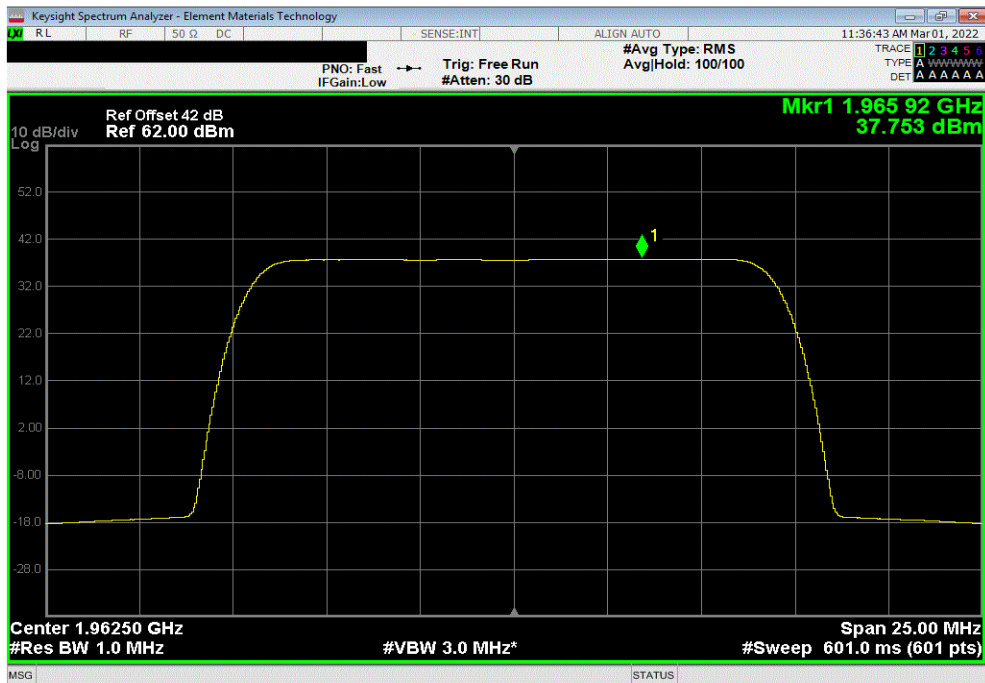


TotTx 2021.12.14.1 XMit 2022.02.07.0

Band 25, 1930 MHz - 1995 MHz, LTE Single Carrier, 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	
37.745	0	37.7	40.7	43.7	



Band 25, 1930 MHz - 1995 MHz, LTE Single Carrier, 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	
37.753	0	37.8	40.8	43.8	

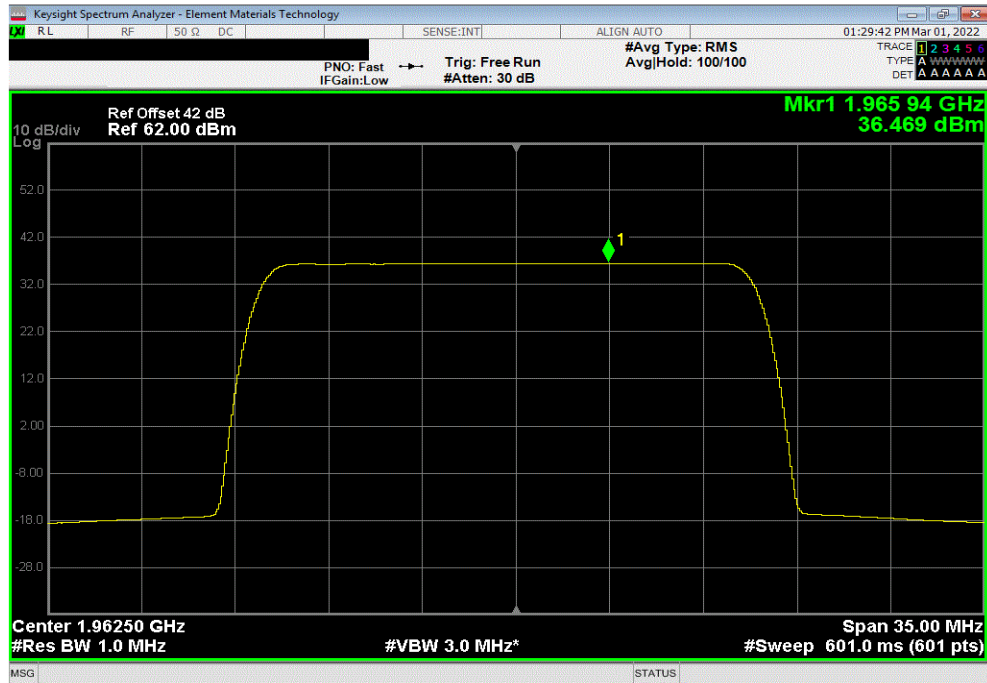


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

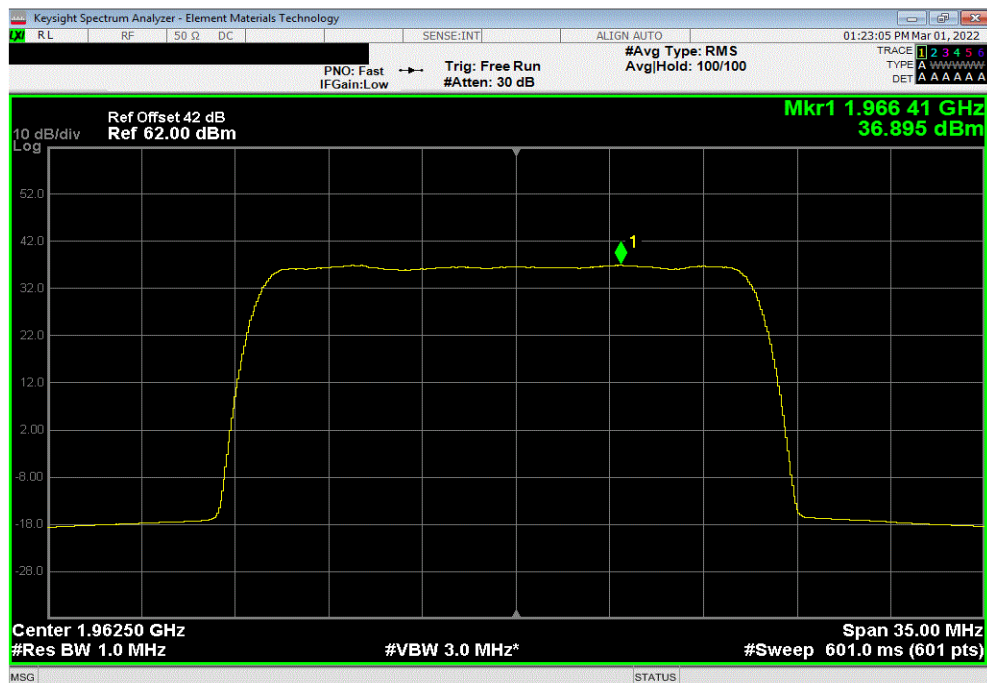


TotTx 2021.12.14.1 XMit 2022.02.07.0

Band 25, 1930 MHz - 1995 MHz, LTE Single Carrier, 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	
36.469	0	36.5	39.5	42.5	



Band 25, 1930 MHz - 1995 MHz, LTE Single Carrier, 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	
36.895	0	36.9	39.9	42.9	

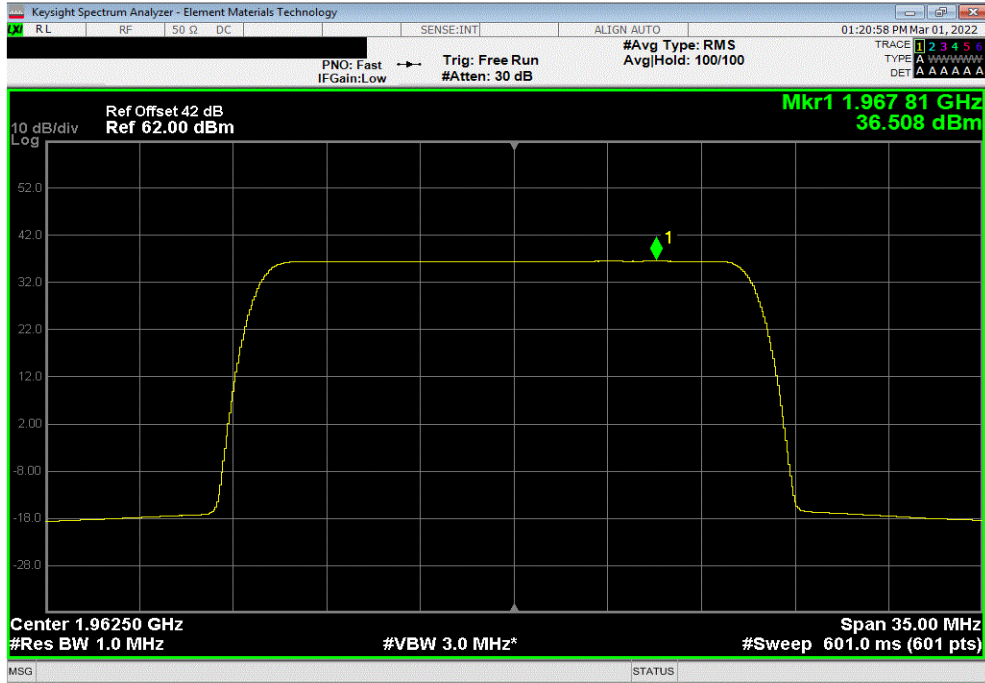


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

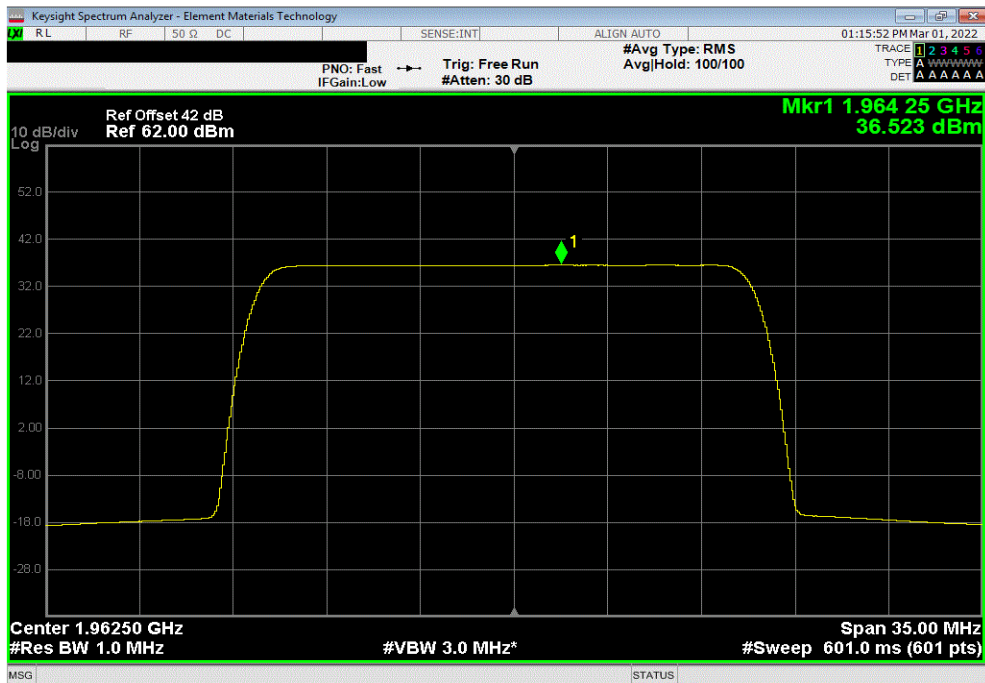


TbTx 2021.12.14.1 XMI 2022.02.07.0

Band 25, 1930 MHz - 1995 MHz, LTE Single Carrier, 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	
36.508	0	36.5	39.5	42.5	



Band 25, 1930 MHz - 1995 MHz, LTE Single Carrier, 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	
36.523	0	36.5	39.5	42.5	



POWER SPECTRAL DENSITY AND EIRP CALCULATIONS



TbTfX 2021.12.14.1 XMt 2022.02.07.0

EIRP Calculations for Four Port MIMO Operations for Band 25 Single LTE Carriers

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 Kathrein antenna assembly model "80011867". The maximum Band 25 gain (17.9dBi) for this antenna was used for the EIRP calculation.

Equivalent Isotropically Radiated Power (EIRP) is calculated (as specified in ANSI C63.26-2015 section 6.4 for four port MIMO) from the results of power measurements (highest measured PSD for each channel bandwidth type). The total worst case PSD for four port MIMO is calculated as the worst case PSD for a single port + 6dB [10log (4)] based upon ANSI C63.26 clause 6.4.3.2.4 (10 Log N_{out}). 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	1.4 MHz Ch BW	3 MHz Ch BW	5 MHz Ch BW	10 MHz Ch BW	15 MHz Ch BW	20 MHz Ch BW
Worst Case PSD/Antenna Port	47.8 dBm/MHz	45.0 dBm/MHz	42.4 dBm/MHz	39.8 dBm/MHz	38.6 dBm/MHz	36.9 dBm/MHz
Total PSD for Four Port MIMO 10Log 4 = + 6dB	53.8 dBm/MHz	51.0 dBm/MHz	48.4 dBm/MHz	45.8 dBm/MHz	44.6 dBm/MHz	42.9 dBm/MHz
Cable Loss (site dependent)	0 dB	0 dB	0 dB	0 dB	0 dB	0 dB
Maximum Antenna Gain	17.9 dBi	17.9 dBi	17.9 dBi	17.9 dBi	17.9 dBi	17.9 dBi
Worst Case Four Port MIMO EIRP Total	71.7 dBm/MHz	68.9 dBm/MHz	66.3 dBm/MHz	63.7 dBm/MHz	62.5 dBm/MHz	60.8 dBm/MHz

Calculation Summary

The worst case AHFII four port MIMO Band 25 EIRP levels using antenna assembly model "80011867" are:

- (1) Less than the FCC and ISED (3280 W/MHz or 65.16 dBm/MHz) EIRP Regulatory Limits for 10, 15 & 20MHz channel bandwidths.
- (2) Over the FCC/ISED (3280 W/MHz or 65.16 dBm/MHz) EIRP Regulatory Limits by 6.54 dB (71.7dBm/MHz – 65.16dBm/MHz) for the 1.4MHz channel bandwidth, by 3.74 dB (68.9dBm/MHz – 65.16dBm/MHz) for the 3MHz channel bandwidth and by 1.14 dB (66.3dBm/MHz – 65.16dBm/MHz) 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.
- (3) Less than the FCC and ISED (1640 W/MHz or 62.15 dBm/MHz) EIRP Regulatory Limits for the 20MHz channel bandwidth.
- (4) Over the FCC/ISED (1640 W/MHz or 62.15 dBm/MHz) EIRP Regulatory Limits by 9.55 dB (71.7dBm/MHz – 62.15dBm/MHz) for the 1.4MHz channel bandwidth, by 6.75 dB (68.9dBm/MHz – 62.15dBm/MHz) for the 3MHz channel bandwidth, by 4.15 dB (66.3dBm/MHz – 62.15dBm/MHz) for the 5MHz channel bandwidth, by 1.55 dB (63.7dBm/MHz – 62.15dBm/MHz) for the 10MHz channel bandwidth and by 0.35 dB (62.5dBm/MHz – 62.15dBm/MHz) for the 15MHz channel bandwidth. EIRP calculations are needed at each transmitter location to optimize base station operational performance while meeting regulatory requirements as noted above.
- (5) See reduced average power and reduced PSD sections of this report for details of compliance verification by changing BTS configuration file power output parameters.

POWER SPECTRAL DENSITY AND EIRP CALCULATIONS



TstTx 2021.12.14.1 XMit 2022.02.07.0

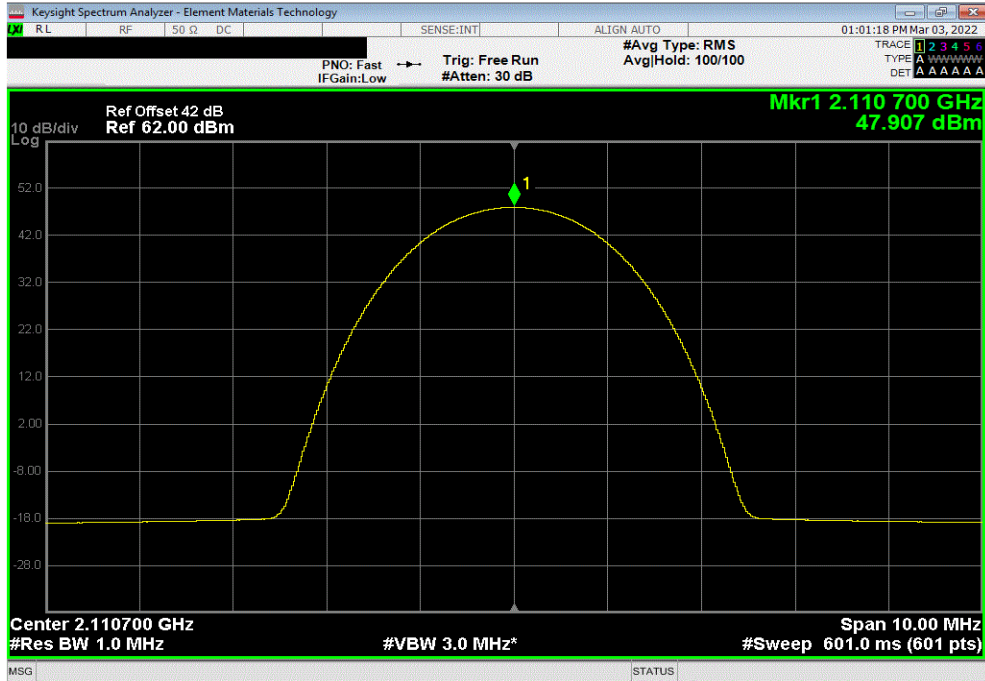
EUT: AHFII Remote Radio Head		Work Order: NOKI0037	
Serial Number: YK214000036		Date: 28-Feb-22	
Customer: Nokia Solutions and Networks		Temperature: 22.6 °C	
Attendees: David Le, John Rattanavong		Humidity: 23.7% RH	
Project: None		Barometric Pres.: 1026 mbar	
Tested by: Mark Baytan		Power: 54 VDC	
Job Site: TX09			
TEST SPECIFICATIONS			
FCC 27:2022		Test Method	
RSS-139 Issue 3:2015		ANSI C63.26:2015	
RSS-170 Issue 3:2015		RSS-139 Issue 3:2015	
RSS-170 Issue 3:2015		RSS-170 Issue 3:2015	
COMMENTS			
All measurement path losses accounted for in the reference level offset including any attenuators, filters, and DC blocks. Band 66 carriers enabled at maximum power is 80 watts/carrier. The PSD was measured while transmitting one 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)]. The carrier power was set to maximum for all testing.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	2	Signature	
		Initial Value	Duty Cycle
		dBm/MHz	Factor (dB)
		Single Port	Two Port (2x2 MIMO)
		dBm/MHz == PSD	dBm/MHz == PSD
		Four Port (4x4 MIMO)	dBm/MHz == PSD
Band 66, 2110 MHz - 2200 MHz, LTE Single Carrier			
Port 1			
1.4 MHz Bandwidth			
QPSK Modulation			
	Low Channel, 2110.7 MHz	47.907	0
	Mid Channel, 2155 MHz	47.756	0
	High Channel, 2199.3 MHz	47.764	0
		47.9	50.9
		47.8	50.8
		47.8	50.8
16-QAM Modulation			
	Low Channel, 2110.7 MHz	47.868	0
	Mid Channel, 2155 MHz	47.817	0
	High Channel, 2199.3 MHz	47.822	0
		47.9	50.9
		47.8	50.9
		47.8	50.8
64-QAM Modulation			
	Low Channel, 2110.7 MHz	47.575	0
	Mid Channel, 2155 MHz	47.78	0
	High Channel, 2199.3 MHz	47.782	0
		47.6	50.6
		47.8	50.8
		47.8	50.8
256-QAM Modulation			
	Low Channel, 2110.7 MHz	47.674	0
	Mid Channel, 2155 MHz	47.813	0
	High Channel, 2199.3 MHz	47.867	0
		47.8	50.7
		47.8	50.8
		47.9	50.9
3 MHz Bandwidth			
QPSK Modulation			
	Mid Channel, 2155 MHz	44.79	0
		44.8	47.8
		47.8	50.8
16-QAM Modulation			
	Mid Channel, 2155 MHz	45.163	0
		45.2	48.2
		48.2	51.8
64-QAM Modulation			
	Mid Channel, 2155 MHz	44.677	0
		44.7	47.7
		47.7	50.7
256-QAM Modulation			
	Mid Channel, 2155 MHz	44.714	0
		44.7	47.7
		47.7	50.7
5 MHz Bandwidth			
QPSK Modulation			
	Mid Channel, 2155 MHz	42.56	0
		42.6	45.6
		45.6	47.6
16-QAM Modulation			
	Mid Channel, 2155 MHz	42.971	0
		43.0	46.0
		46.0	49.0
64-QAM Modulation			
	Mid Channel, 2155 MHz	42.578	0
		42.6	45.6
		45.6	48.6
256-QAM Modulation			
	Mid Channel, 2155 MHz	42.671	0
		42.7	45.7
		45.7	48.7
10 MHz Bandwidth			
QPSK Modulation			
	Mid Channel, 2155 MHz	39.611	0
		39.6	42.6
		42.6	45.6
16-QAM Modulation			
	Mid Channel, 2155 MHz	40.057	0
		40.1	43.1
		43.1	46.1
64-QAM Modulation			
	Mid Channel, 2155 MHz	39.666	0
		39.7	42.7
		42.7	45.7
256-QAM Modulation			
	Mid Channel, 2155 MHz	39.688	0
		39.7	42.7
		42.7	45.7
15 MHz Bandwidth			
QPSK Modulation			
	Mid Channel, 2155 MHz	37.871	0
		37.9	40.9
		40.9	43.9
16-QAM Modulation			
	Mid Channel, 2155 MHz	38.763	0
		38.8	41.8
		41.8	44.8
64-QAM Modulation			
	Mid Channel, 2155 MHz	37.929	0
		37.9	40.9
		40.9	43.9
256-QAM Modulation			
	Mid Channel, 2155 MHz	38.018	0
		38.0	41.0
		41.0	44.0
20 MHz Bandwidth			
QPSK Modulation			
	Mid Channel, 2155 MHz	36.751	0
		36.8	39.8
		39.8	42.8
16-QAM Modulation			
	Mid Channel, 2155 MHz	37.083	0
		37.1	40.1
		40.1	43.1
64-QAM Modulation			
	Mid Channel, 2155 MHz	36.675	0
		36.7	39.7
		39.7	42.7
256-QAM Modulation			
	Mid Channel, 2155 MHz	36.678	0
		36.7	39.7
		39.7	42.7

POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

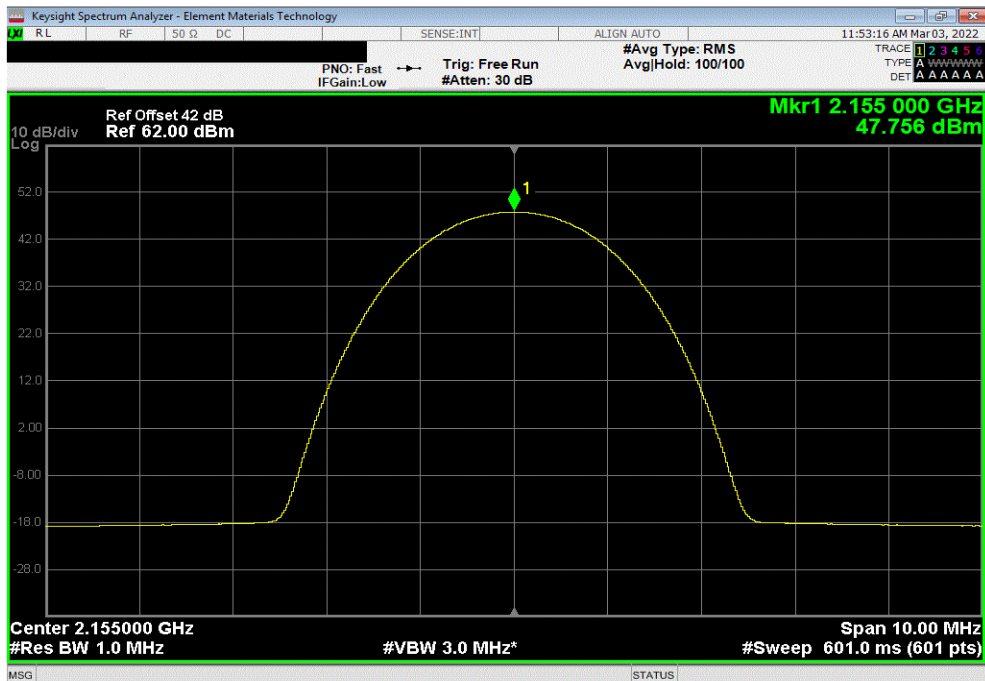


TbTx 2021.12.14.1 XMI 2022.02.07.0

Band 66, 2110 MHz - 2200 MHz, LTE Single Carrier, Port 1, 1.4 MHz Bandwidth, QPSK Modulation, Low Channel, 2110.7 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	
47.907	0	47.9	50.9	53.9	



Band 66, 2110 MHz - 2200 MHz, LTE Single Carrier, Port 1, 1.4 MHz Bandwidth, QPSK Modulation, Mid Channel, 2155 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	
47.756	0	47.8	50.8	53.8	

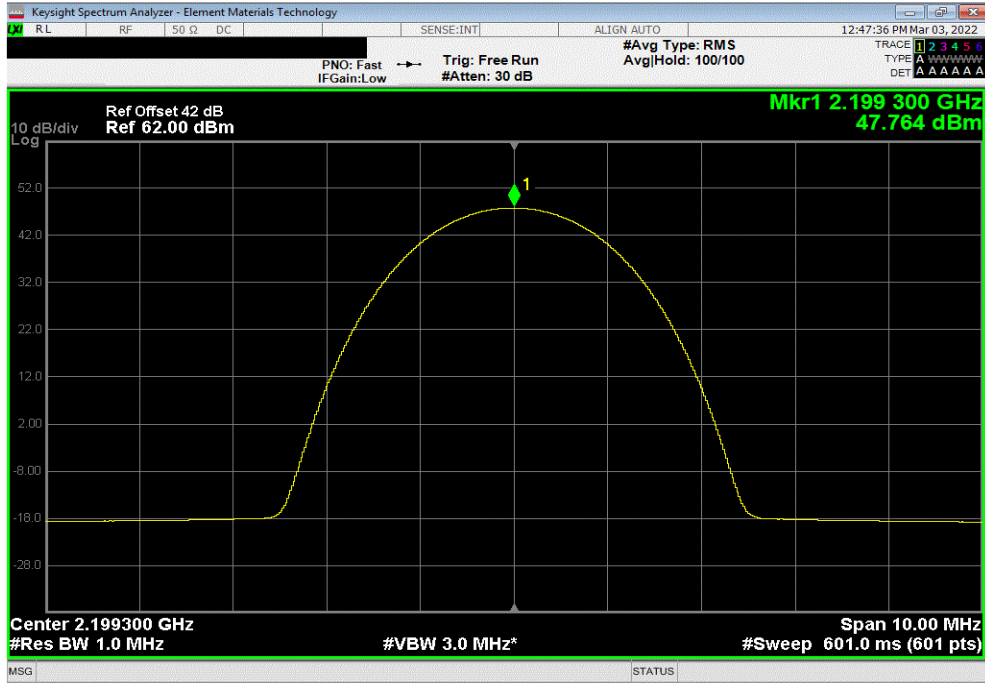


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

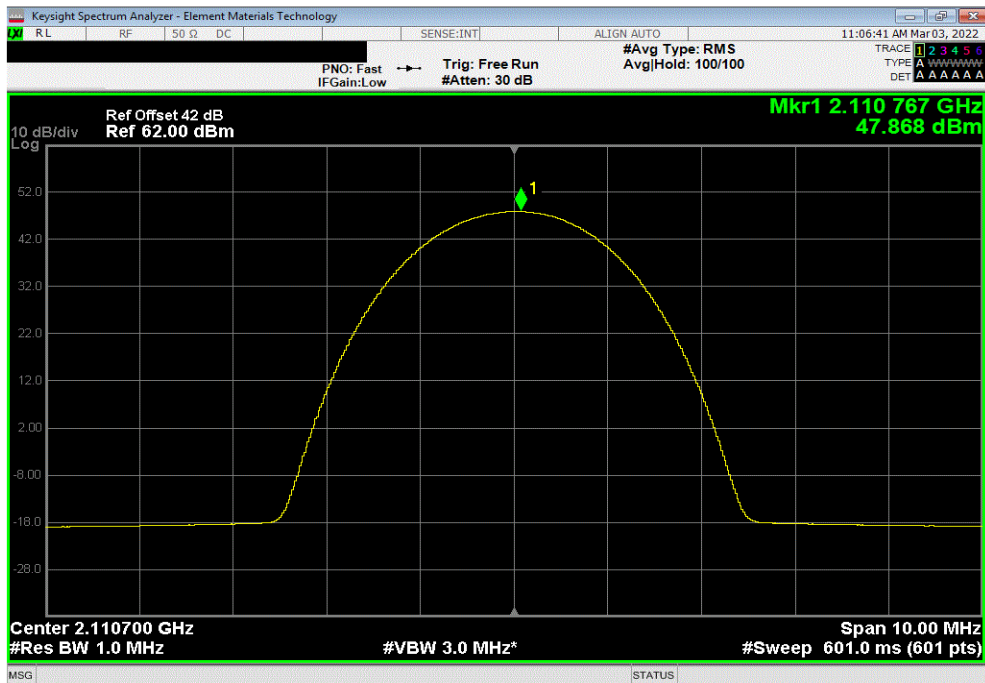


TbTx 2021.12.14.1 XMI 2022.02.07.0

Band 66, 2110 MHz - 2200 MHz, LTE Single Carrier, Port 1, 1.4 MHz Bandwidth, QPSK Modulation, High Channel, 2199.3 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	
47.764	0	47.8	50.8	53.8	



Band 66, 2110 MHz - 2200 MHz, LTE Single Carrier, Port 1, 1.4 MHz Bandwidth, 16-QAM Modulation, Low Channel, 2110.7 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	
47.868	0	47.9	50.9	53.9	

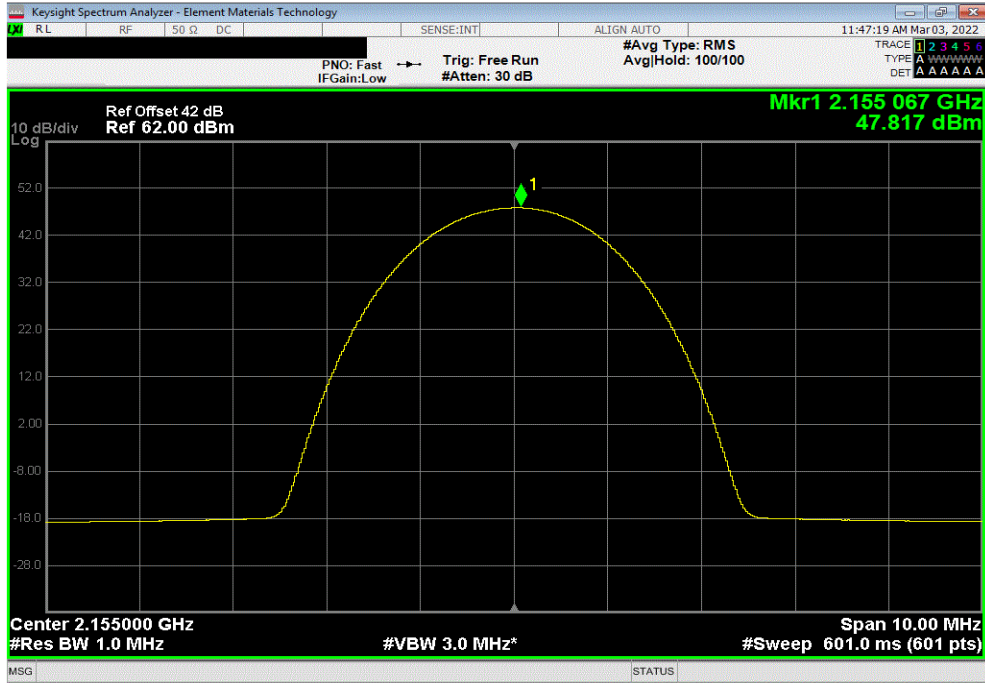


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

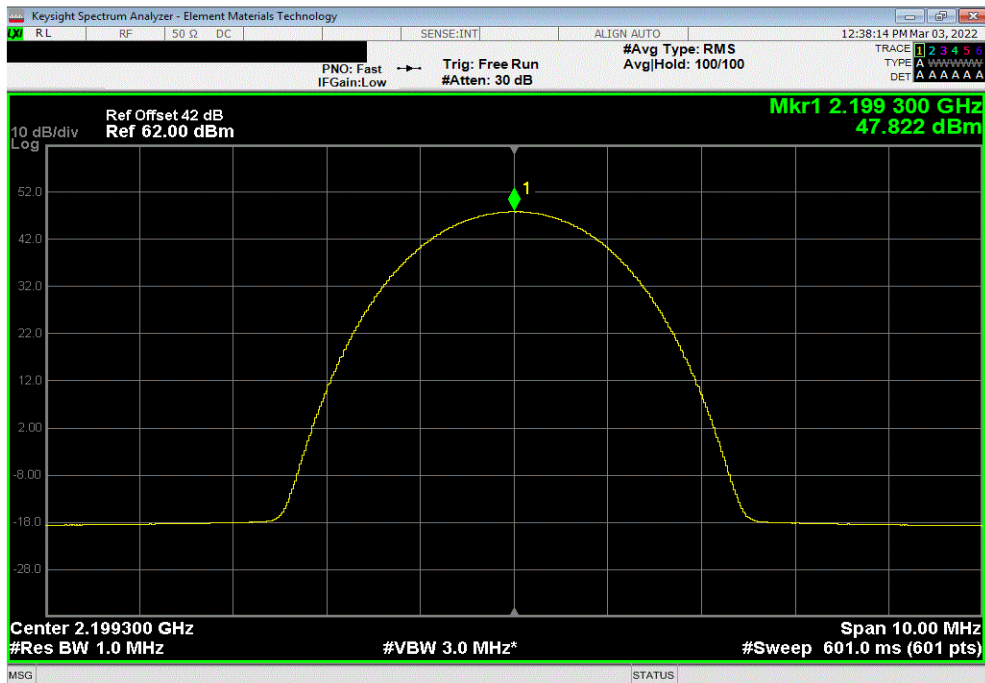


TbTx 2021.12.14.1 XMI 2022.02.07.0

Band 66, 2110 MHz - 2200 MHz, LTE Single Carrier, Port 1, 1.4 MHz Bandwidth, 16-QAM Modulation, Mid Channel, 2155 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	
47.817	0	47.8	50.9	53.8	



Band 66, 2110 MHz - 2200 MHz, LTE Single Carrier, Port 1, 1.4 MHz Bandwidth, 16-QAM Modulation, High Channel, 2199.3 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	
47.822	0	47.8	50.8	53.8	

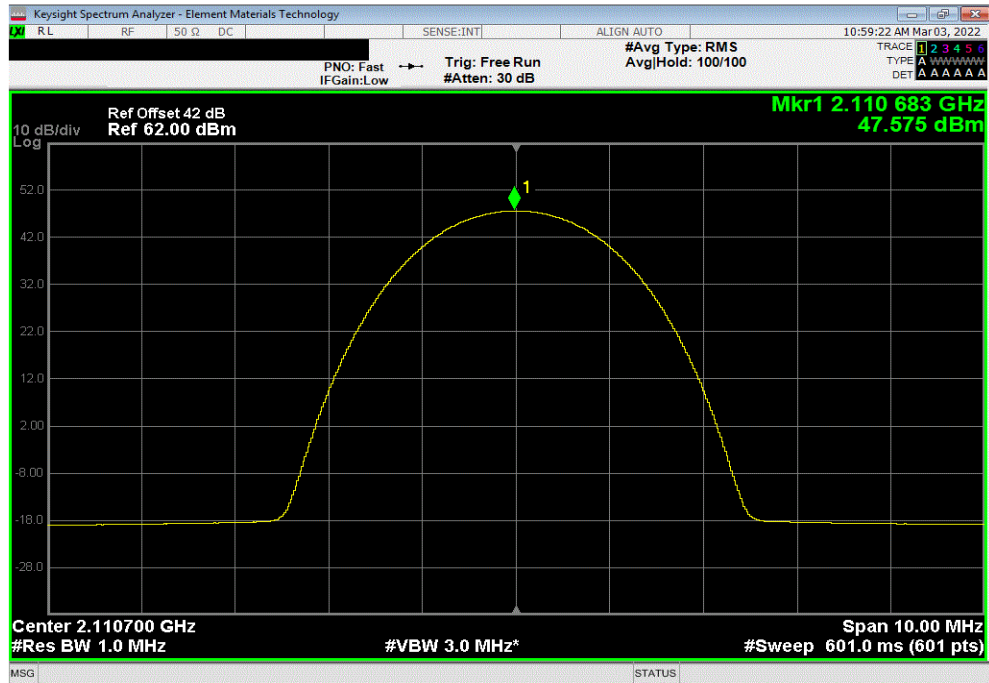


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

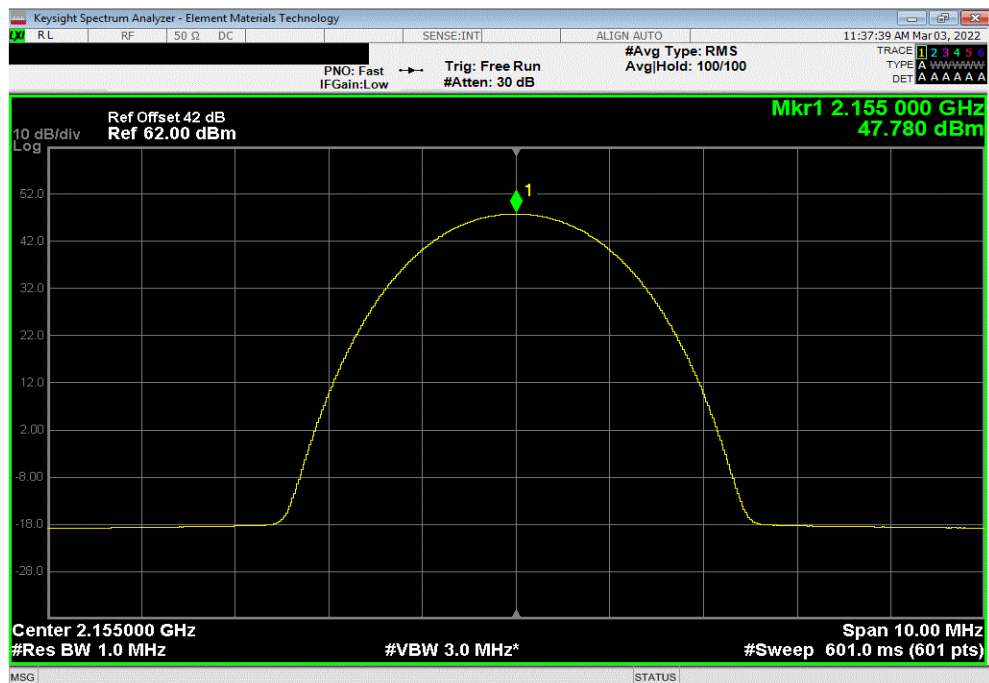


TbTx 2021.12.14.1 XMI 2022.02.07.0

Band 66, 2110 MHz - 2200 MHz, LTE Single Carrier, Port 1, 1.4 MHz Bandwidth, 64-QAM Modulation, Low Channel, 2110.7 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	
47.575	0	47.6	50.6	53.6	



Band 66, 2110 MHz - 2200 MHz, LTE Single Carrier, Port 1, 1.4 MHz Bandwidth, 64-QAM Modulation, Mid Channel, 2155 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	
47.78	0	47.8	50.8	53.8	

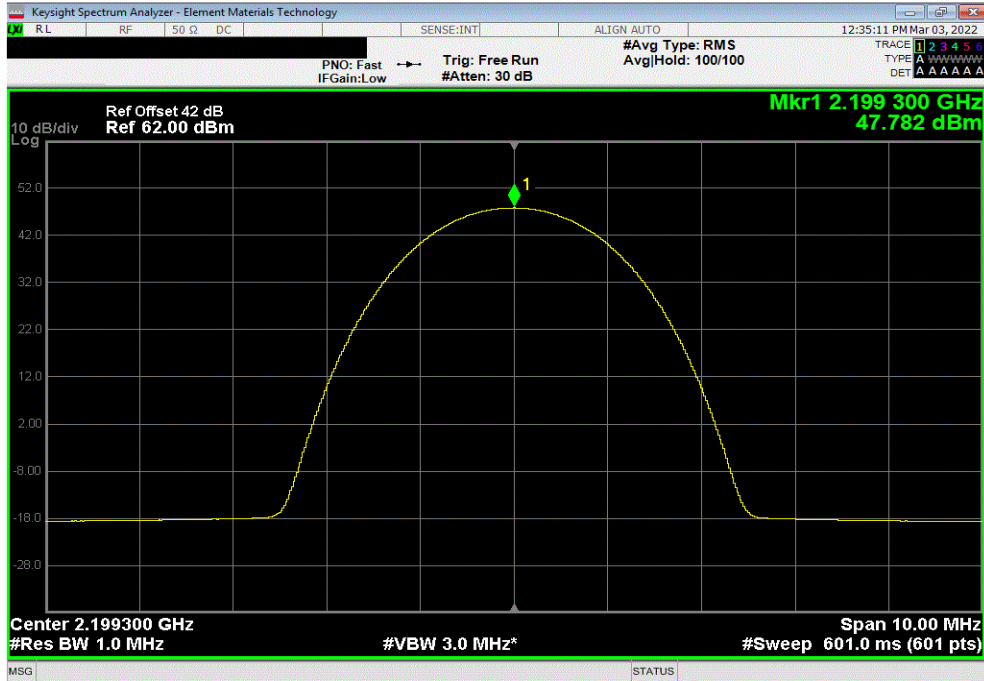


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

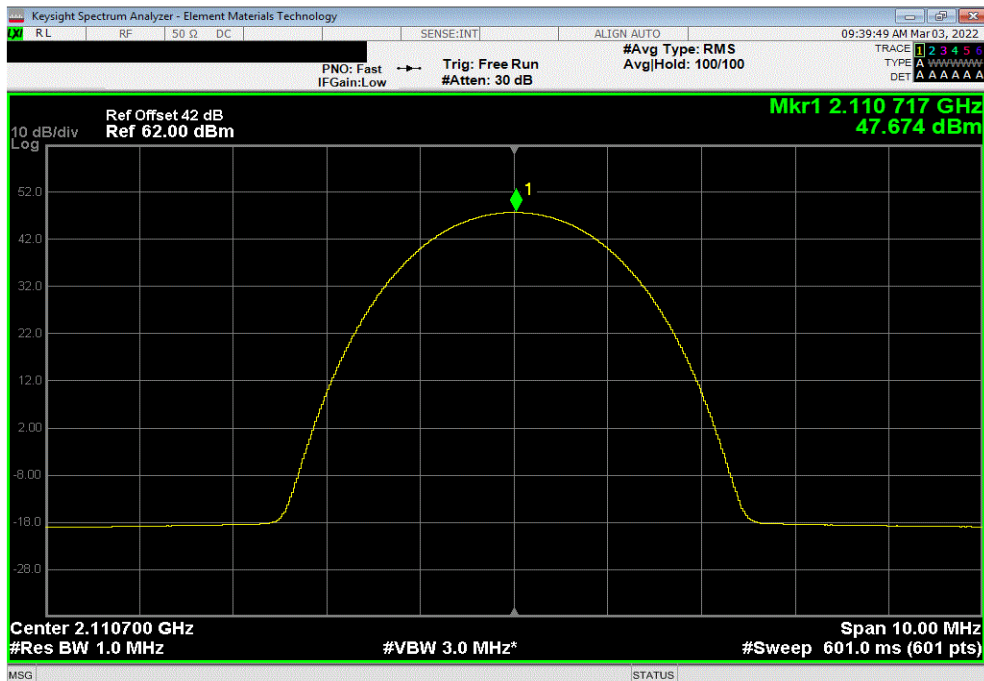


TbTx 2021.12.14.1 XMI 2022.02.07.0

Band 66, 2110 MHz - 2200 MHz, LTE Single Carrier, Port 1, 1.4 MHz Bandwidth, 64-QAM Modulation, High Channel, 2199.3 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	
47.782	0	47.8	50.8	53.8	



Band 66, 2110 MHz - 2200 MHz, LTE Single Carrier, Port 1, 1.4 MHz Bandwidth, 256-QAM Modulation, Low Channel, 2110.7 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	
47.674	0	47.8	50.7	53.7	

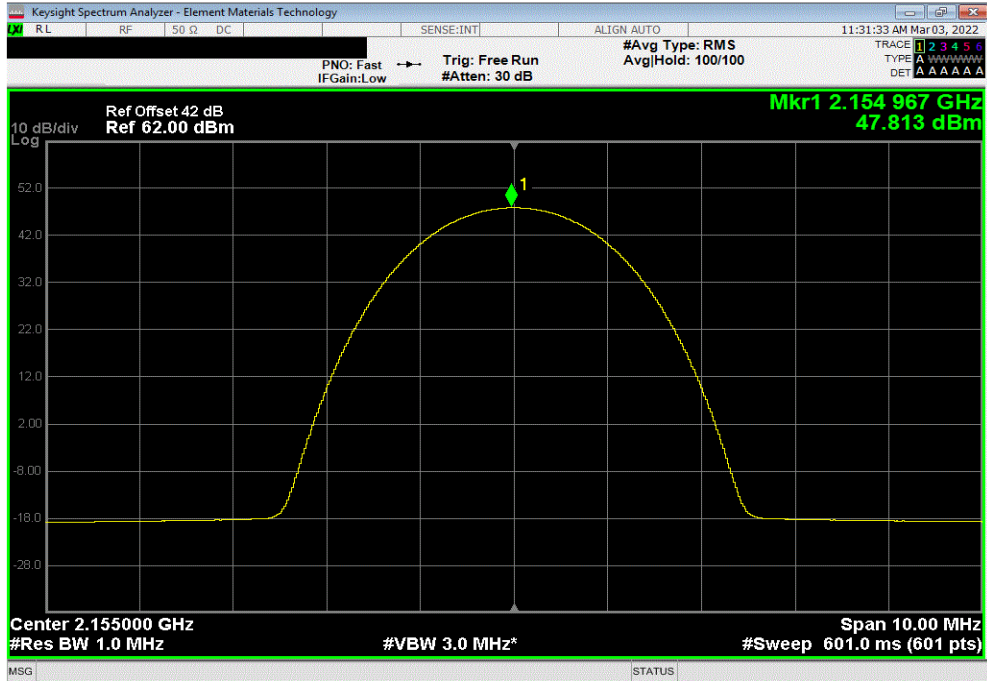


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

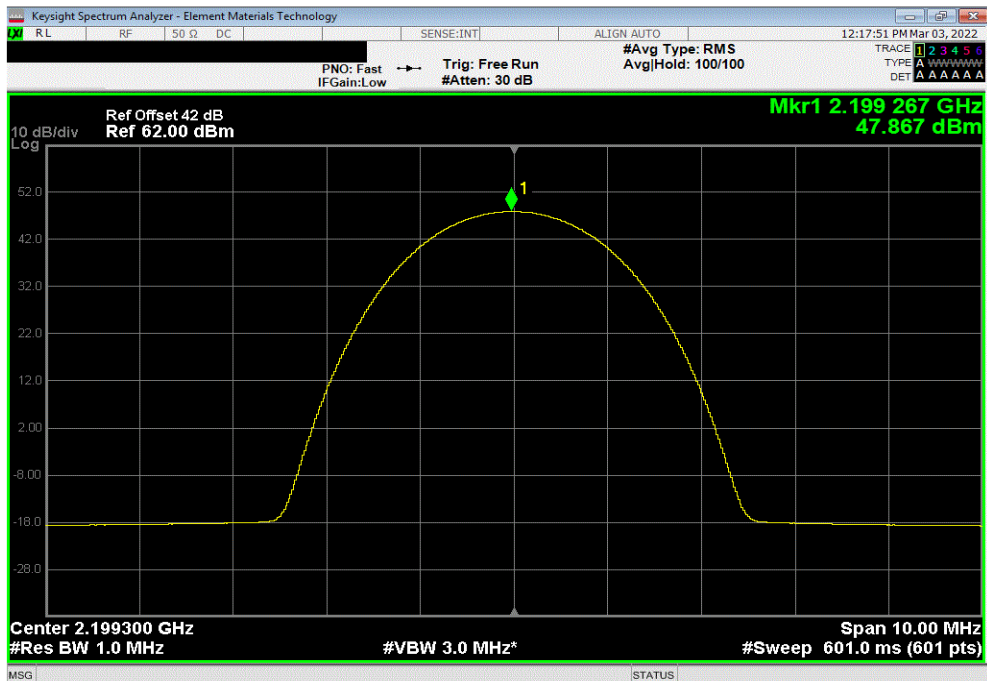


TbTx 2021.12.14.1 XMI 2022.02.07.0

Band 66, 2110 MHz - 2200 MHz, LTE Single Carrier, Port 1, 1.4 MHz Bandwidth, 256-QAM Modulation, Mid Channel, 2155 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	
47.813	0	47.8	50.8	53.8	



Band 66, 2110 MHz - 2200 MHz, LTE Single Carrier, Port 1, 1.4 MHz Bandwidth, 256-QAM Modulation, High Channel, 2199.3 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	
47.867	0	47.9	50.9	53.9	

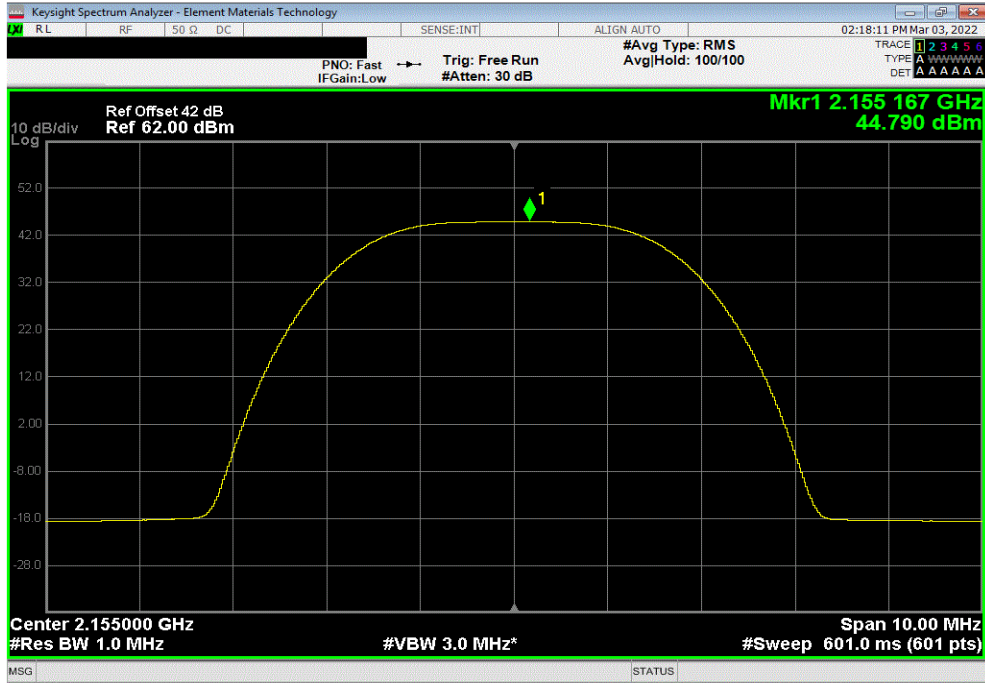


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

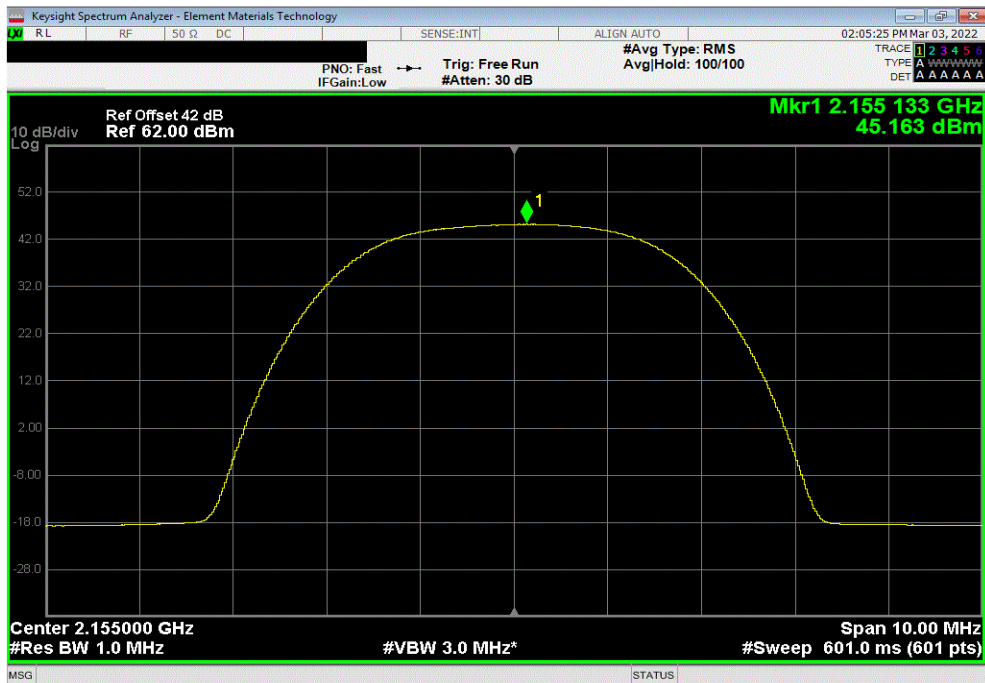


TbTx 2021.12.14.1 XMI 2022.02.07.0

Band 66, 2110 MHz - 2200 MHz, LTE Single Carrier, Port 1, 3 MHz Bandwidth, QPSK Modulation, Mid Channel, 2155 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	
44.79	0	44.8	47.8	50.8	



Band 66, 2110 MHz - 2200 MHz, LTE Single Carrier, Port 1, 3 MHz Bandwidth, 16-QAM Modulation, Mid Channel, 2155 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	
45.163	0	45.2	48.2	51.8	

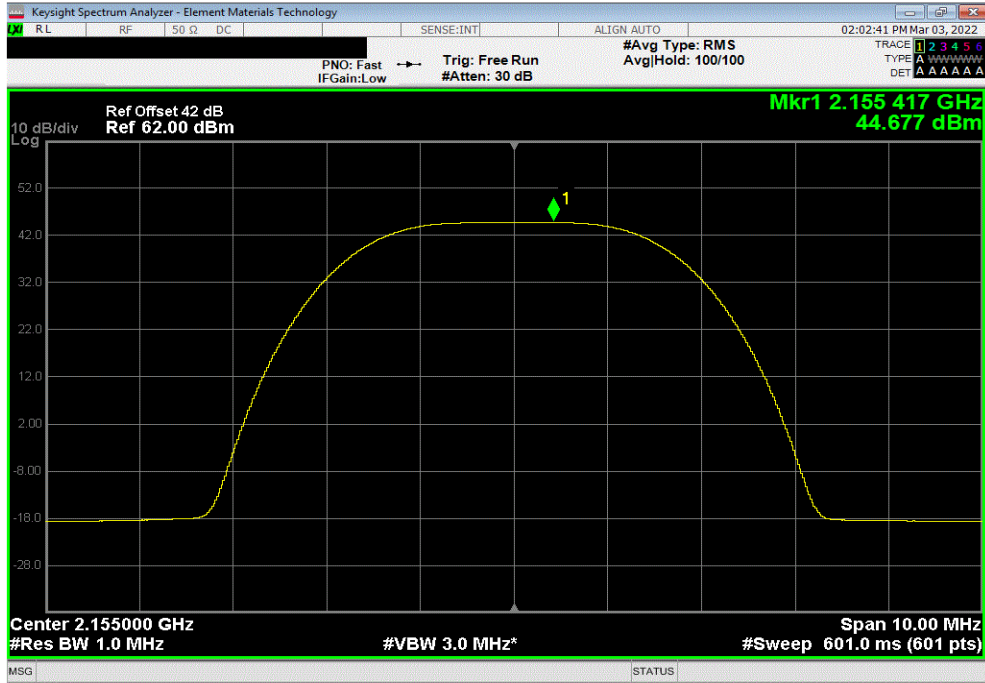


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

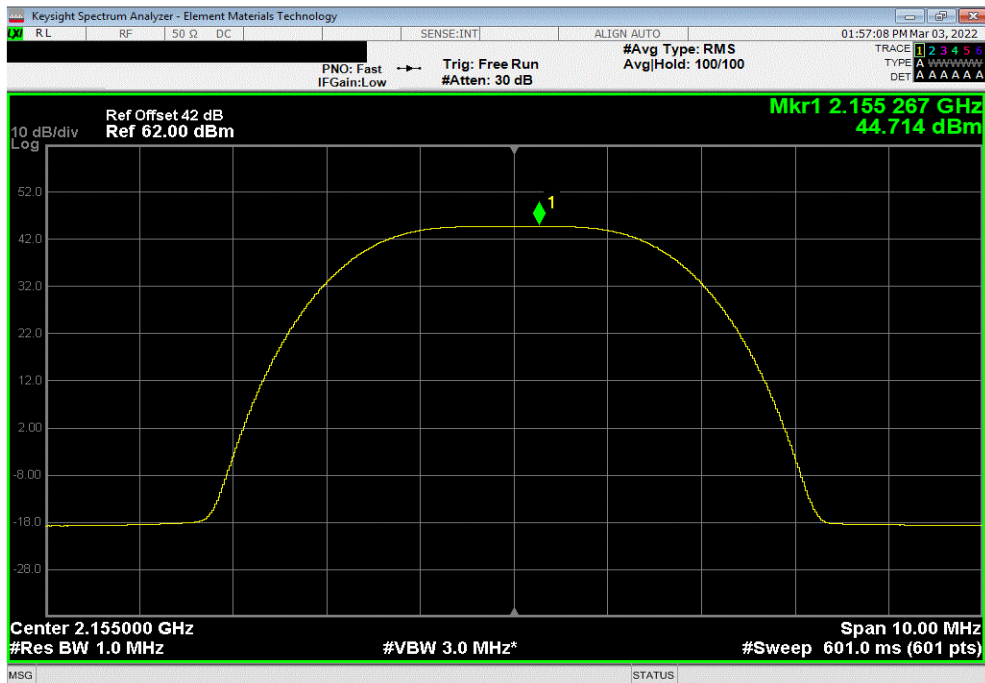


TotTx 2021.12.14.1 XMit 2022.02.07.0

Band 66, 2110 MHz - 2200 MHz, LTE Single Carrier, Port 1, 3 MHz Bandwidth, 64-QAM Modulation, Mid Channel, 2155 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	
44.677	0	44.7	47.7	50.7	



Band 66, 2110 MHz - 2200 MHz, LTE Single Carrier, Port 1, 3 MHz Bandwidth, 256-QAM Modulation, Mid Channel, 2155 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	
44.714	0	44.7	47.7	50.7	

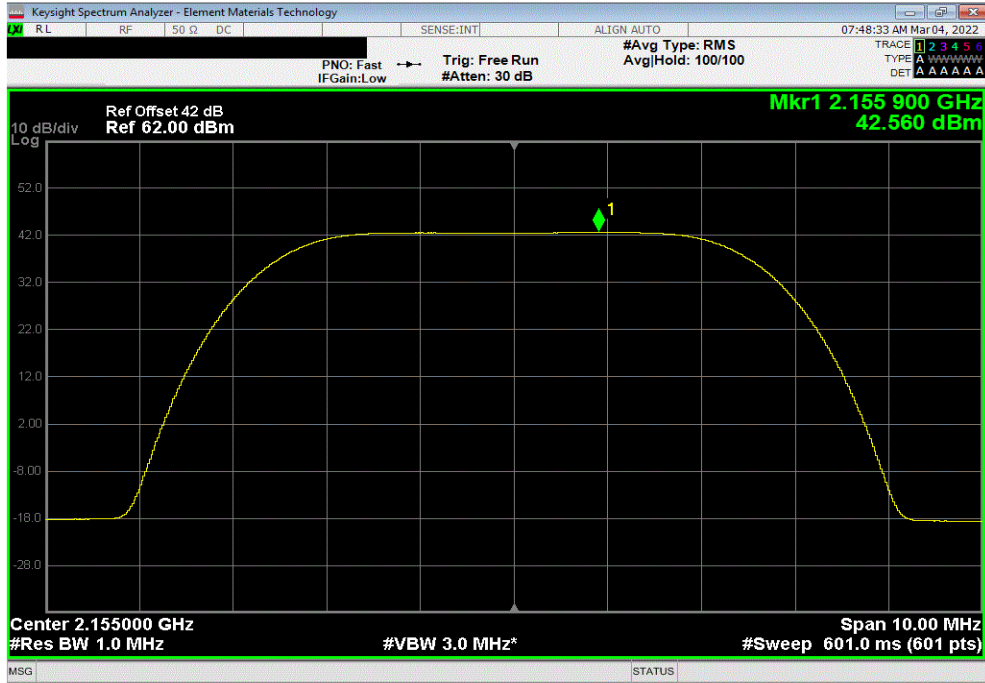


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

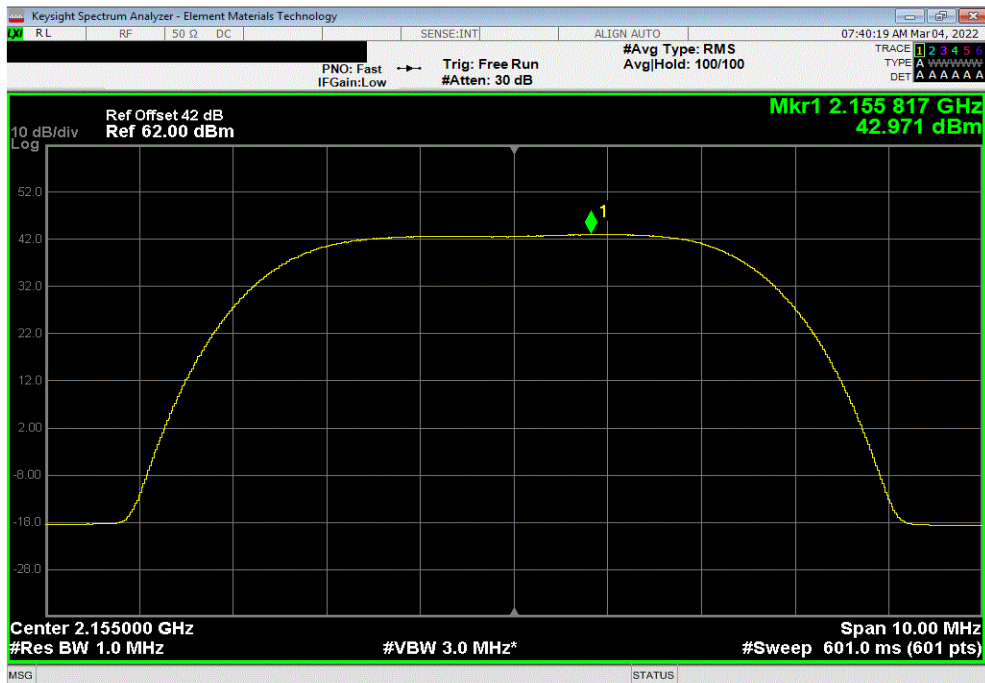


TbTx 2021.12.14.1 XMI 2022.02.07.0

Band 66, 2110 MHz - 2200 MHz, LTE Single Carrier, Port 1, 5 MHz Bandwidth, QPSK Modulation, Mid Channel, 2155 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	
42.56	0	42.6	45.6	47.6	



Band 66, 2110 MHz - 2200 MHz, LTE Single Carrier, Port 1, 5 MHz Bandwidth, 16-QAM Modulation, Mid Channel, 2155 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	
42.971	0	43.0	46.0	49.0	

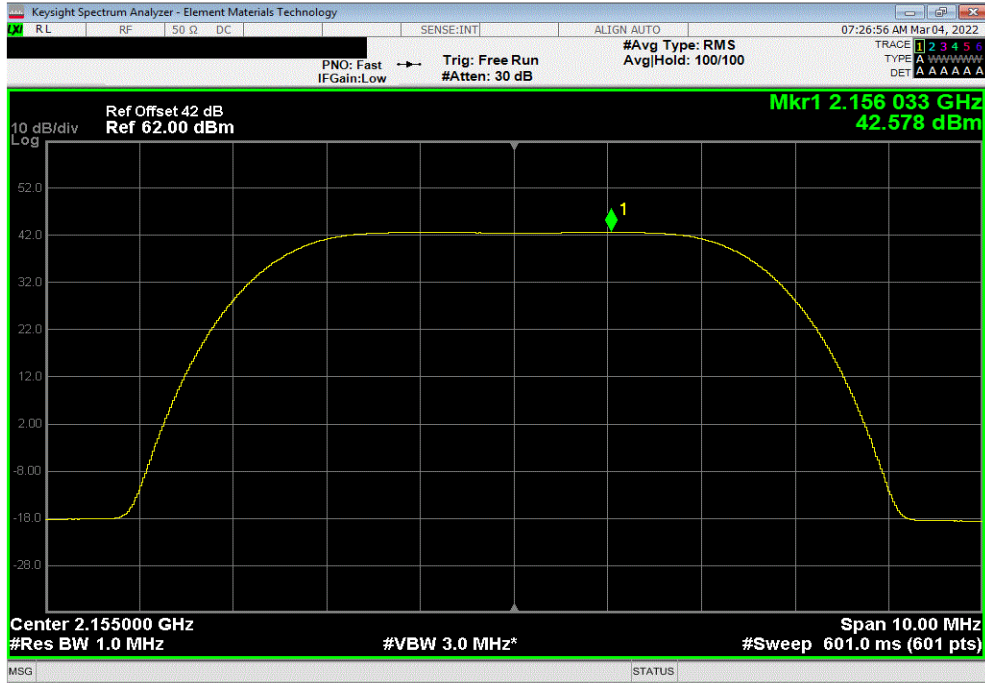


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

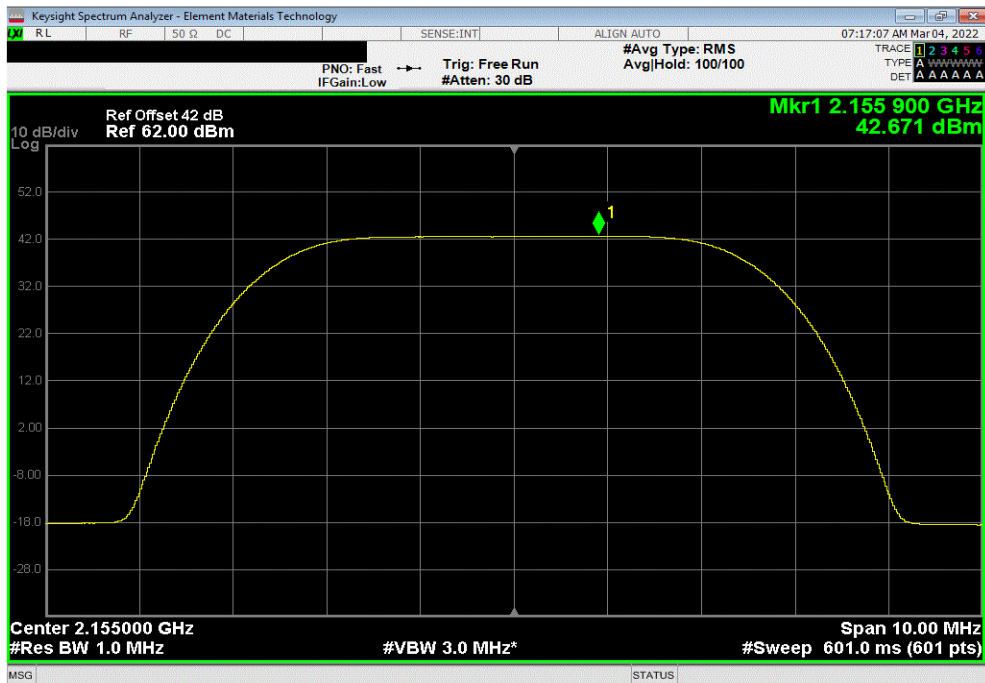


TotTx 2021.12.14.1 XMit 2022.02.07.0

Band 66, 2110 MHz - 2200 MHz, LTE Single Carrier, Port 1, 5 MHz Bandwidth, 64-QAM Modulation, Mid Channel, 2155 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	
42.578	0	42.6	45.6	48.6	



Band 66, 2110 MHz - 2200 MHz, LTE Single Carrier, Port 1, 5 MHz Bandwidth, 256-QAM Modulation, Mid Channel, 2155 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	
42.671	0	42.7	45.7	48.7	

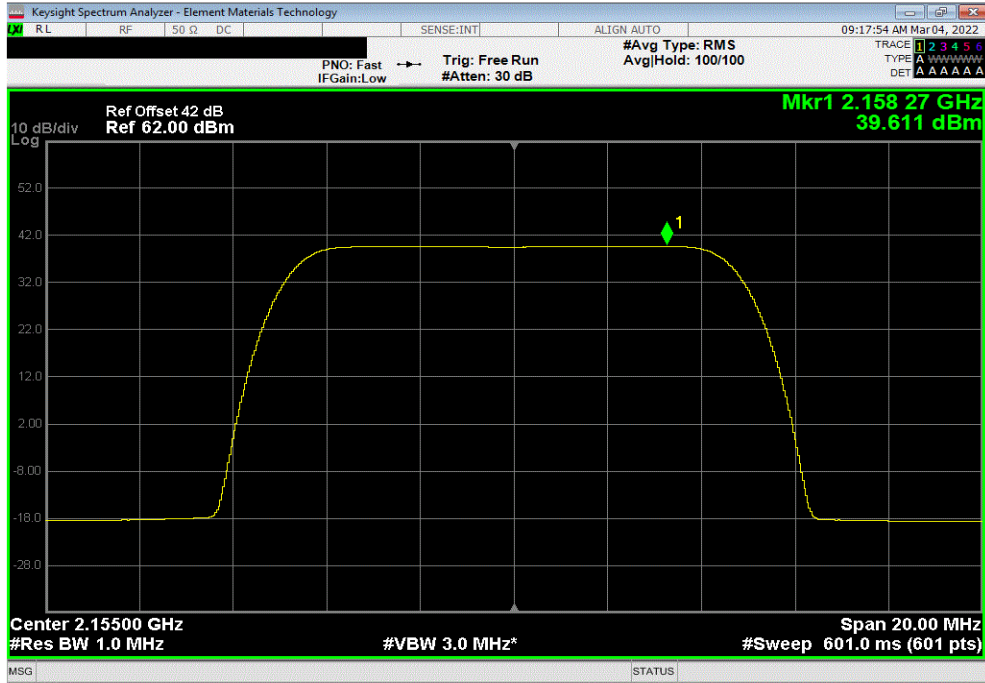


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

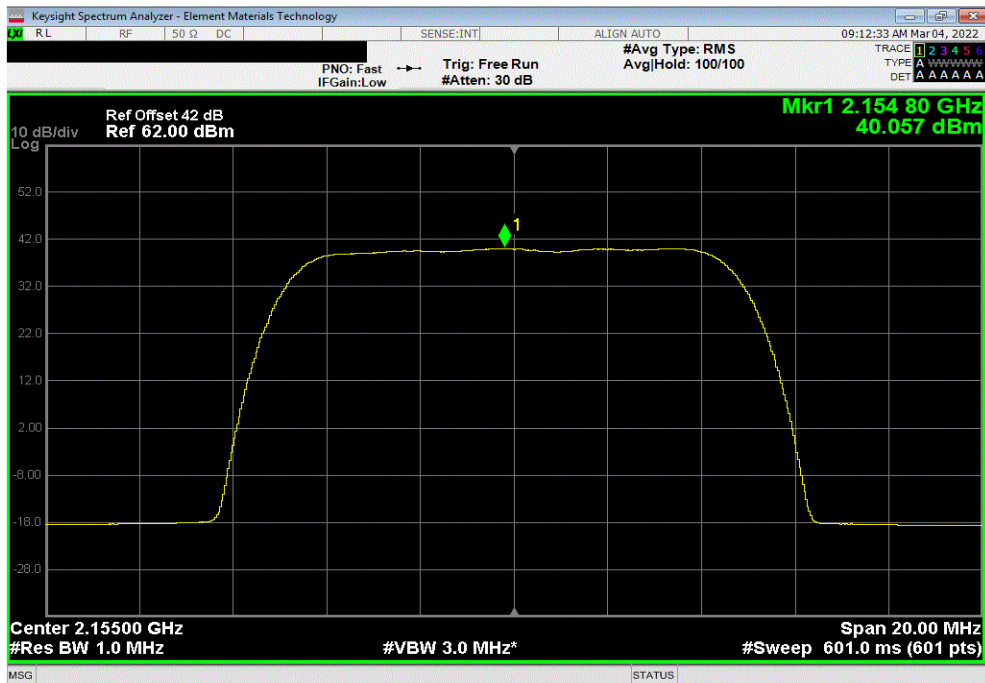


TotTx 2021.12.14.1 XMit 2022.02.07.0

Band 66, 2110 MHz - 2200 MHz, LTE Single Carrier, Port 1, 10 MHz Bandwidth, QPSK Modulation, Mid Channel, 2155 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	
39.611	0	39.6	42.6	45.6	



Band 66, 2110 MHz - 2200 MHz, LTE Single Carrier, Port 1, 10 MHz Bandwidth, 16-QAM Modulation, Mid Channel, 2155 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	
40.057	0	40.1	43.1	46.1	

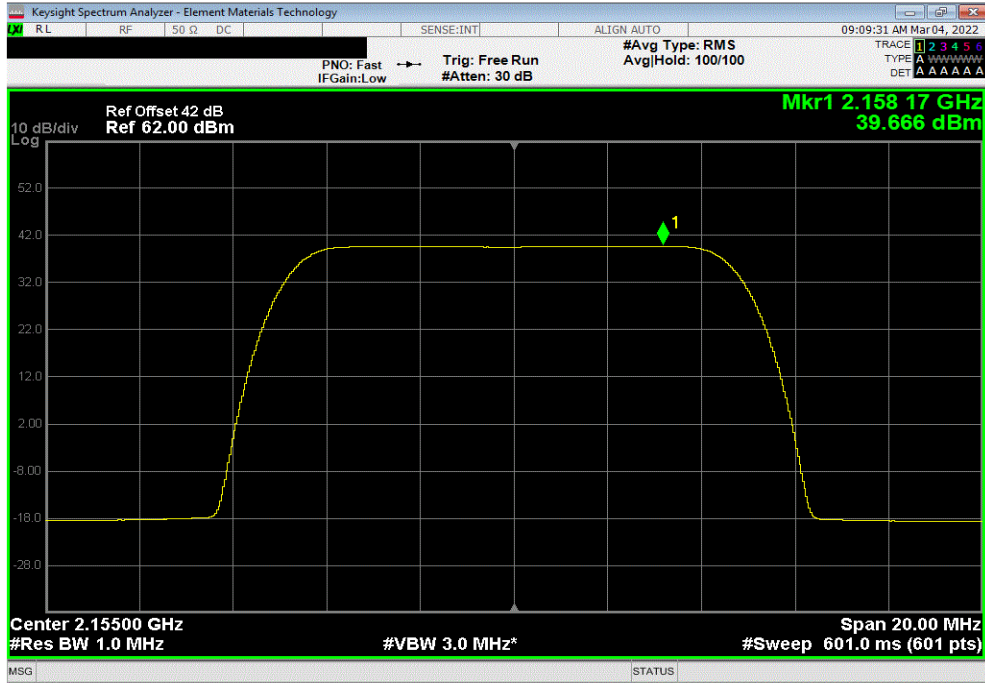


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

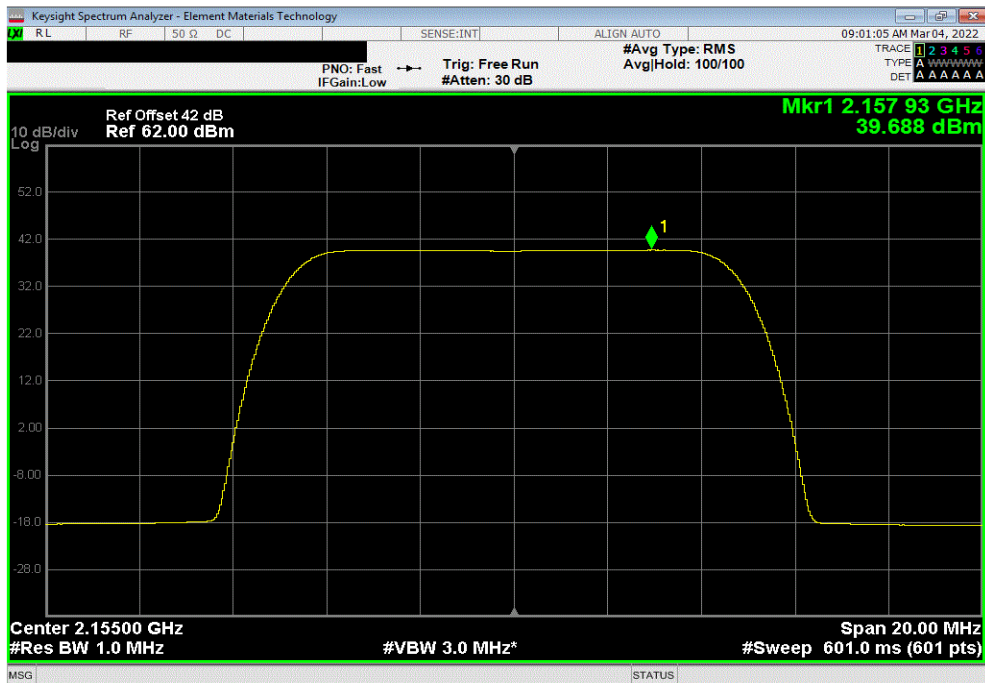


TotTx 2021.12.14.1 XMI 2022.02.07.0

Band 66, 2110 MHz - 2200 MHz, LTE Single Carrier, Port 1, 10 MHz Bandwidth, 64-QAM Modulation, Mid Channel, 2155 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	
39.666	0	39.7	42.7	45.7	



Band 66, 2110 MHz - 2200 MHz, LTE Single Carrier, Port 1, 10 MHz Bandwidth, 256-QAM Modulation, Mid Channel, 2155 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	
39.688	0	39.7	42.7	45.7	

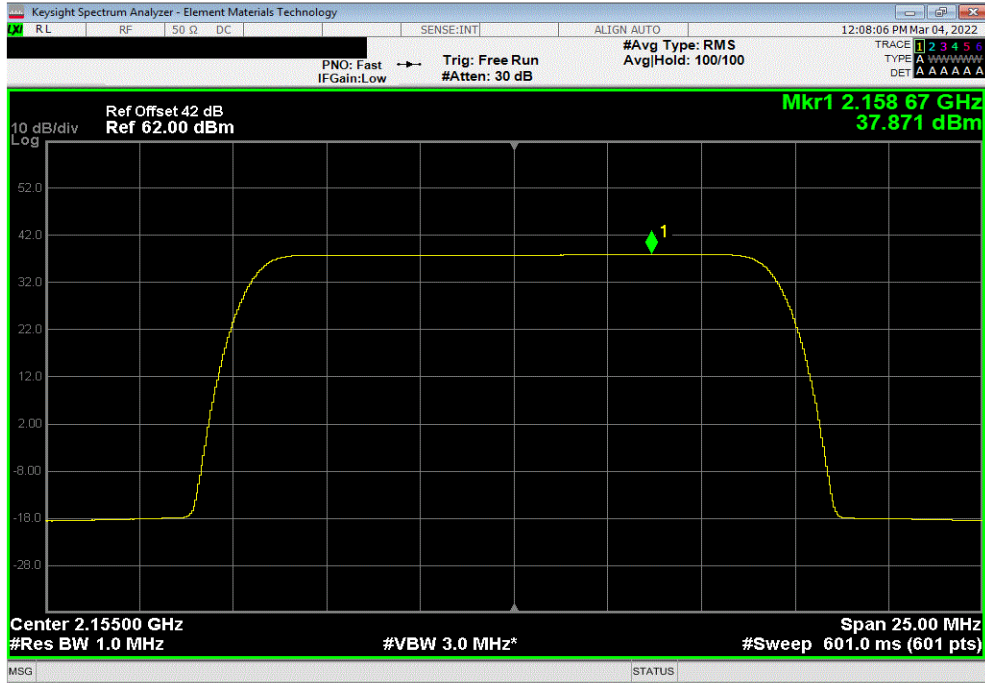


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

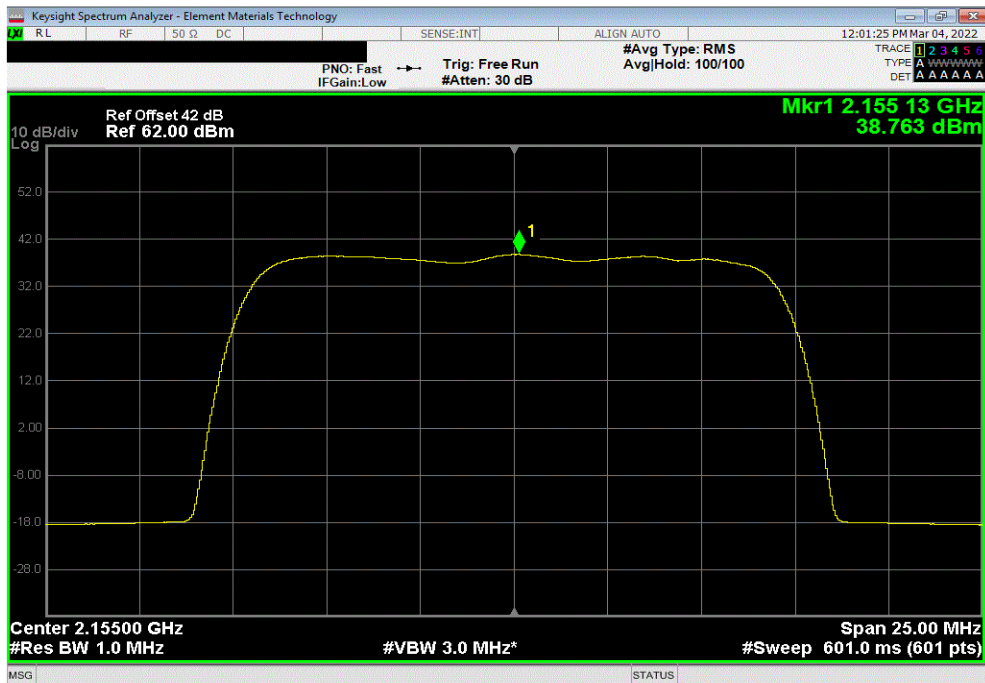


TbTx 2021.12.14.1 XMI 2022.02.07.0

Band 66, 2110 MHz - 2200 MHz, LTE Single Carrier, Port 1, 15 MHz Bandwidth, QPSK Modulation, Mid Channel, 2155 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	
37.871	0	37.9	40.9	43.9	



Band 66, 2110 MHz - 2200 MHz, LTE Single Carrier, Port 1, 15 MHz Bandwidth, 16-QAM Modulation, Mid Channel, 2155 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	
38.763	0	38.8	41.8	44.8	

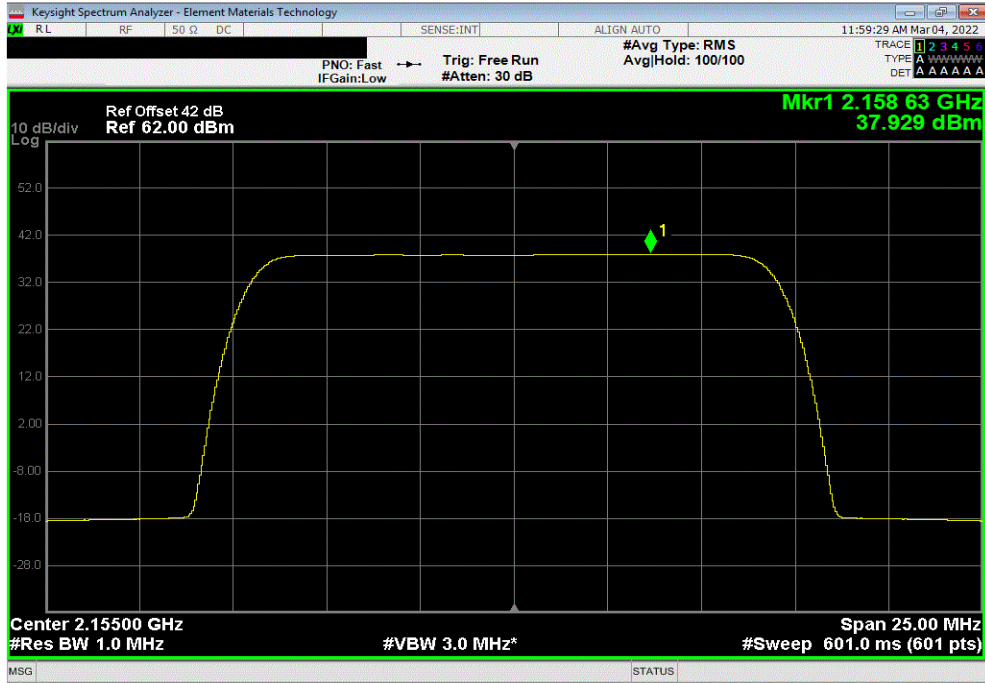


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

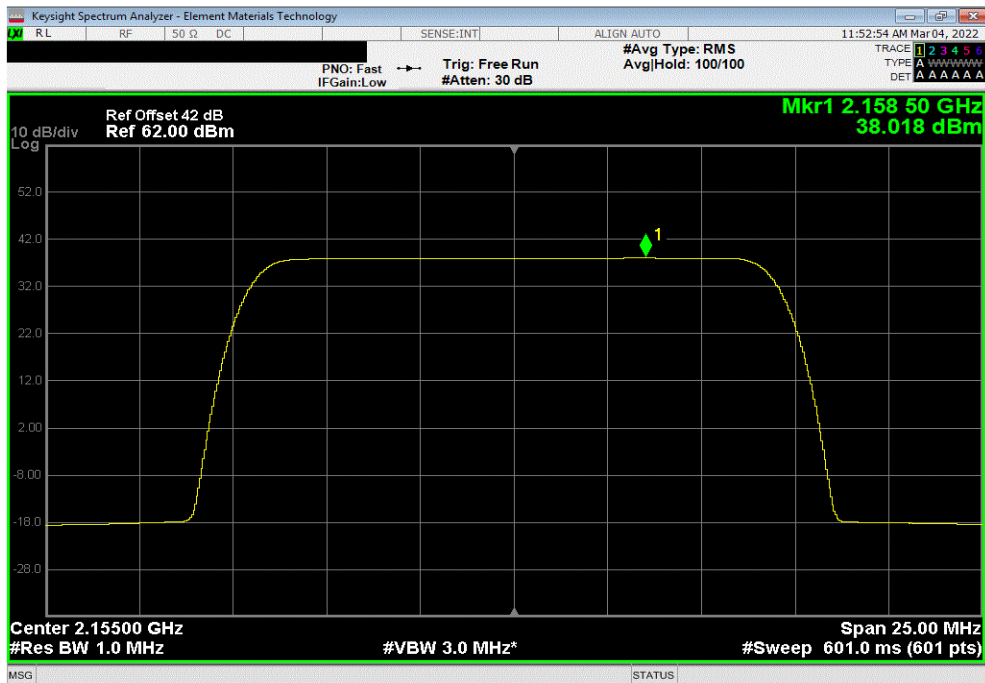


TbTx 2021.12.14.1 XMit 2022.02.07.0

Band 66, 2110 MHz - 2200 MHz, LTE Single Carrier, Port 1, 15 MHz Bandwidth, 64-QAM Modulation, Mid Channel, 2155 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	
37.929	0	37.9	40.9	43.9	



Band 66, 2110 MHz - 2200 MHz, LTE Single Carrier, Port 1, 15 MHz Bandwidth, 256-QAM Modulation, Mid Channel, 2155 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	
38.018	0	38.0	41.0	44.0	

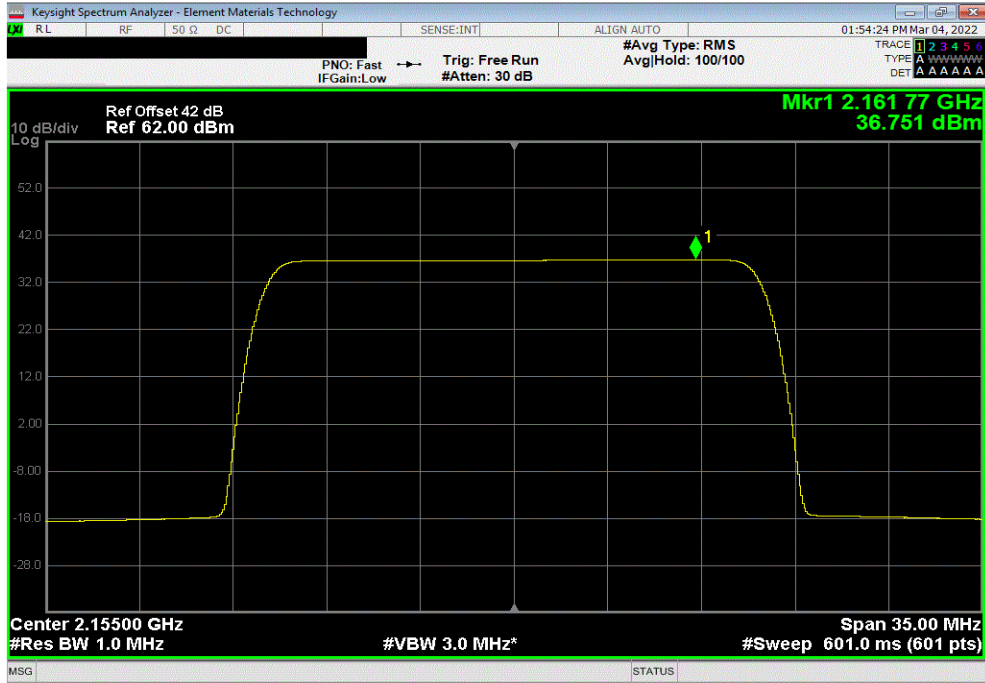


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

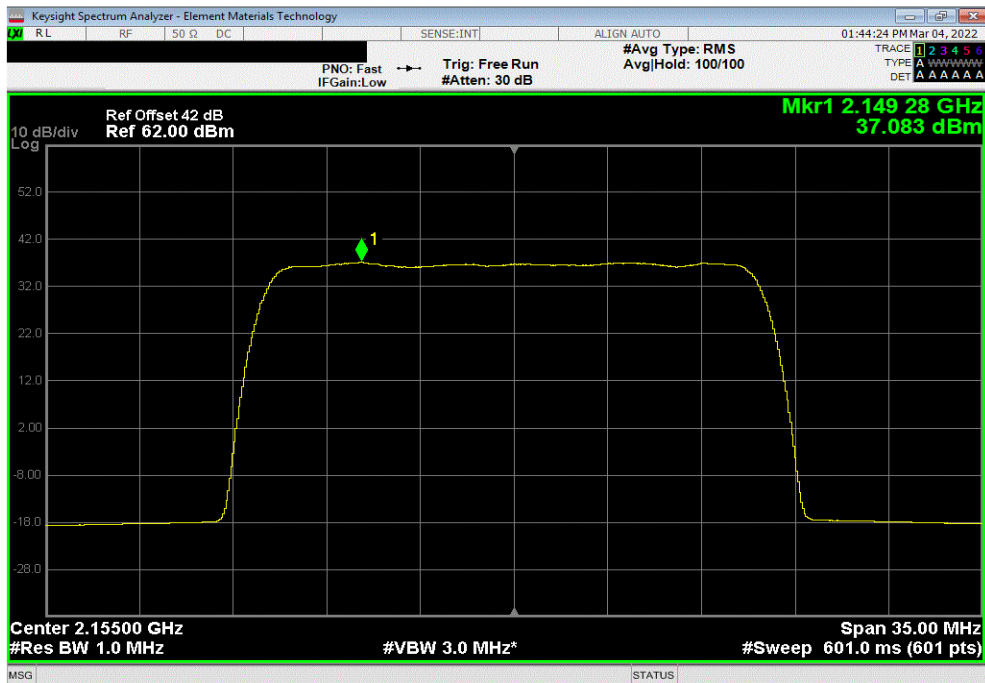


TotTx 2021.12.14.1 XMit 2022.02.07.0

Band 66, 2110 MHz - 2200 MHz, LTE Single Carrier, Port 1, 20 MHz Bandwidth, QPSK Modulation, Mid Channel, 2155 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	
36.751	0	36.8	39.8	42.8	



Band 66, 2110 MHz - 2200 MHz, LTE Single Carrier, Port 1, 20 MHz Bandwidth, 16-QAM Modulation, Mid Channel, 2155 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	
37.083	0	37.1	40.1	43.1	

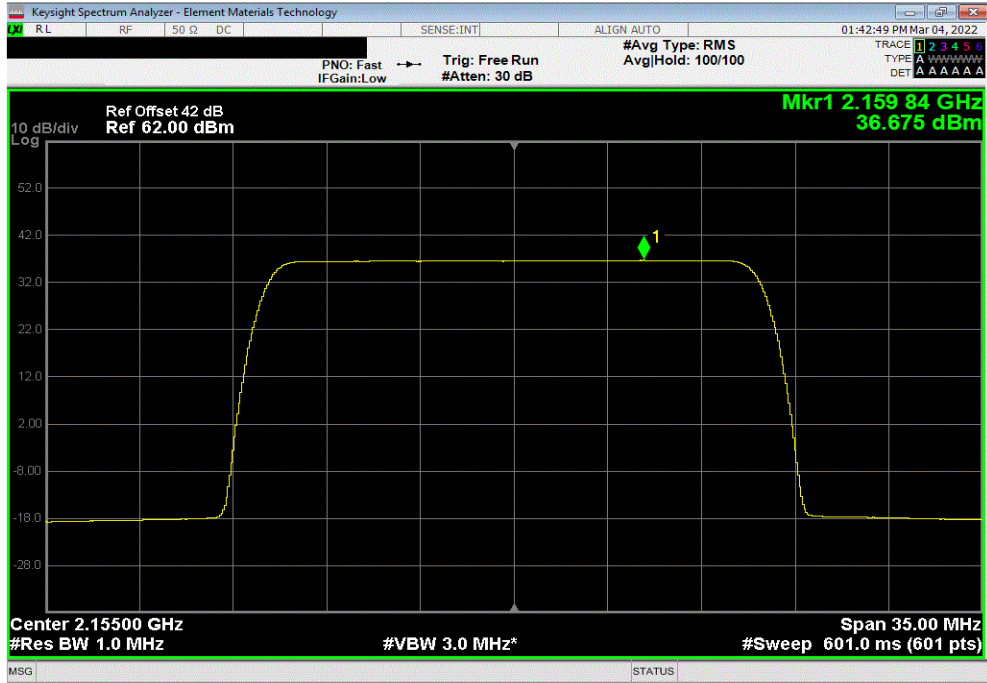


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

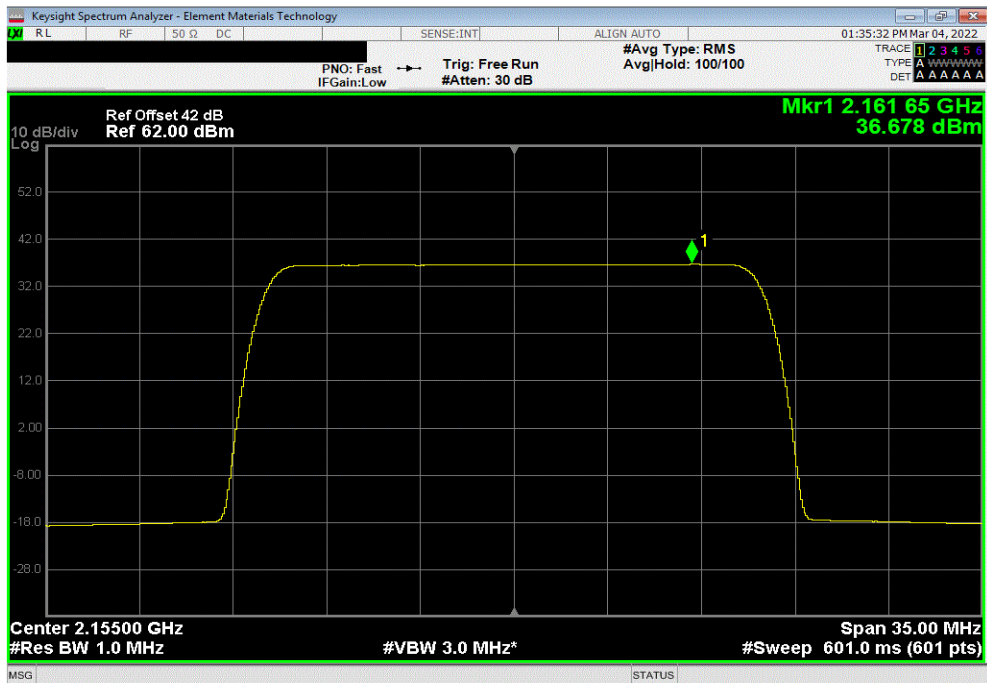


TotTx 2021.12.14.1 XMit 2022.02.07.0

Band 66, 2110 MHz - 2200 MHz, LTE Single Carrier, Port 1, 20 MHz Bandwidth, 64-QAM Modulation, Mid Channel, 2155 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	
36.675	0	36.7	39.7	42.7	



Band 66, 2110 MHz - 2200 MHz, LTE Single Carrier, Port 1, 20 MHz Bandwidth, 256-QAM Modulation, Mid Channel, 2155 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	
36.678	0	36.7	39.7	42.7	



POWER SPECTRAL DENSITY AND EIRP CALCULATIONS



TbTx 2021.12.14.1 XMI 2022.02.07.0

EIRP Calculations for Four Port MIMO Operations for Band 66 Single LTE Carriers

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 Kathrein antenna assembly model “80011867”. The maximum Band 66 gain (18.2dBi) for this antenna was used for the EIRP calculation.

Equivalent Isotropically Radiated Power (EIRP) is calculated (as specified in ANSI C63.26-2015 section 6.4 for four port MIMO) from the results of power measurements (highest measured PSD for each channel bandwidth type). The total worst case PSD for four port MIMO is calculated as the worst case PSD for a single port + 6dB [10log (4)] based upon ANSI C63.26 clause 6.4.3.2.4 (10 Log N_{out}). 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	1.4 MHz Ch BW	3 MHz Ch BW	5 MHz Ch BW	10 MHz Ch BW	15 MHz Ch BW	20 MHz Ch BW
Worst Case PSD/Antenna Port	47.9 dBm/MHz	45.2 dBm/MHz	43 dBm/MHz	40.1 dBm/MHz	38.8 dBm/MHz	37.1 dBm/MHz
Total PSD for Four Port MIMO 10Log 4 = + 6dB	53.9 dBm/MHz	51.2 dBm/MHz	49 dBm/MHz	46.1 dBm/MHz	44.8 dBm/MHz	43.1 dBm/MHz
Cable Loss (site dependent)	0 dB	0 dB	0 dB	0 dB	0 dB	0 dB
Maximum Antenna Gain	18.2 dBi	18.2 dBi	18.2 dBi	18.2 dBi	18.2 dBi	18.2 dBi
Worst Case Four Port MIMO EIRP Total	72.1 dBm/MHz	69.4 dBm/MHz	67.2 dBm/MHz	64.3 dBm/MHz	63.0 dBm/MHz	61.3 dBm/MHz

Calculation Summary

The worst case AHFII four port MIMO Band 66 EIRP levels using antenna assembly model “80011867” are:

- (1) Less than the FCC and ISED (3280 W/MHz or 65.16 dBm/MHz) EIRP Regulatory Limits for 10, 15 & 20MHz channel bandwidths.
- (2) Over the FCC/ISED (3280 W/MHz or 65.16 dBm/MHz) EIRP Regulatory Limits by 6.94 dB (72.1dBm/MHz – 65.16dBm/MHz) for the 1.4MHz channel bandwidth, by 4.24 dB (69.4dBm/MHz – 65.16dBm/MHz) for the 3MHz channel bandwidth and by 2.04 dB (67.2dBm/MHz – 65.16dBm/MHz) for the 5MHz channel bandwidth.
- (3) Less than the FCC and ISED (1640 W/MHz or 62.15 dBm/MHz) EIRP Regulatory Limits for the 20MHz channel bandwidth.
- (4) Over the FCC/ISED (1640 W/MHz or 62.15 dBm/MHz) EIRP Regulatory Limits by 9.95 dB (72.1dBm/MHz – 62.15dBm/MHz) for the 1.4MHz channel bandwidth, by 7.25 dB (69.4dBm/MHz – 62.15dBm/MHz) for the 3MHz channel bandwidth, by 5.05 dB (67.2dBm/MHz – 62.15dBm/MHz) for the 5MHz channel bandwidth, by 2.15 dB (64.3dBm/MHz – 62.15dBm/MHz) for the 10MHz channel bandwidth and by 0.85 dB (63.0dBm/MHz – 62.15dBm/MHz) for the 15MHz channel bandwidth. EIRP calculations are needed at each transmitter location to optimize base station operational performance while meeting regulatory requirements as noted above.
- (5) See reduced average power and reduced PSD sections of this report for details of compliance verification by changing BTS configuration file power output parameters.

POWER SPECTRAL DENSITY AND EIRP CALCULATIONS - GUARD BAND



XMIT 2022.02.07.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17
Block - DC	Fairview Microwave	SD3379	AMT	2021-09-14	2022-09-14
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2022-01-17	2023-01-17

TEST DESCRIPTION

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

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

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

The total PSD for all antenna ports (at the radio output) were determined per ANSI C63.26-2015 paragraph 6.4.3.2.4. The EIRP calculations are based upon ANSI C63.26-2015 paragraphs 6.4 for a four port MIMO base station.

EIRP Requirements:

FCC Requirements: Part 24.232 Power and antenna height limits.

(a)(2) Base stations with an emission bandwidth greater than 1 MHz are limited to 1640 watts/MHz equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT, except as described in paragraph (b) below.

(a)(3) Base station antenna heights may exceed 300 meters HAAT with a corresponding reduction in power; see Tables 1 and 2 of this section.

(b)(2) Base stations that are located in counties with population densities of 100 persons or fewer per square mile, based upon the most recently available population statistics from the Bureau of the Census, with an emission bandwidth greater than 1 MHz are limited to 3280 watts/MHz equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT.

ISED Requirements RSS-133 Section 6.4/SRSP-510 section 5.1.1:

SRSP-510 section 5.1 Radiated power and antenna height limits for base stations

For base stations with a channel bandwidth greater than 1 MHz, the maximum e.i.r.p. is limited to 3280 watts/MHz e.i.r.p. (i.e., no more than 3280 watts e.i.r.p. in any 1 MHz band segment) with an antenna height above average terrain (HAAT) up to 300 metres. Fixed or base stations operating in urban areas are limited to a maximum allowable e.i.r.p. of 1640 watts/MHz e.i.r.p. Base station antenna heights above average terrain may exceed 300 metres with a corresponding reduction in e.i.r.p. according to the following table:

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

POWER SPECTRAL DENSITY AND EIRP CALCULATIONS - GUARD BAND



TbTx 2021.12.14.1 XMI 2022.02.07.0

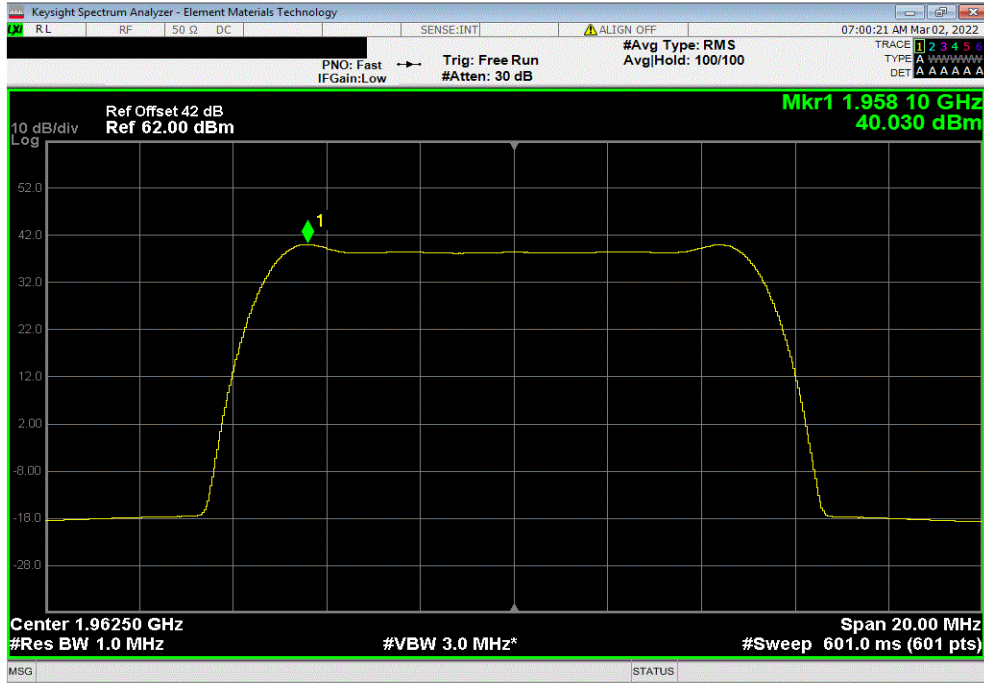
EUT: AHFII Remote Radio Head		Work Order: NOKI0037	
Serial Number: YK214000036		Date: 28-Feb-22	
Customer: Nokia Solutions and Networks		Temperature: 22.6 °C	
Attendees: David Le, John Rattanavong		Humidity: 23.7% RH	
Project: None		Barometric Pres.: 1026 mbar	
Tested by: Mark Baytan		Power: 54 VDC	
TEST SPECIFICATIONS		Job Site: TX09	
FCC 24E:2022		Test Method	
RSS-133 Issue 6:2013+A1:2018		ANSI C63.26:2015	
COMMENTS		RSS-133 Issue 6:2013+A1:2018	
All measurement path losses accounted for in the reference level offset including any attenuators, filters, and DC blocks. Band 25 carriers enabled at maximum power is 80 watts/carrier. The PSD was measured while transmitting one 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)]. The carrier power was set to maximum for all testing.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	2	Signature	
		Initial Value dBm/MHz	Duty Cycle Factor (dB)
		Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD
		Four Port (4x4 MIMO) dBm/MHz == PSD	
Band 25, 1930 MHz - 1995 MHz, LTE Narrow Band IoT Guard Band			
Port 1			
10 MHz Bandwidth			
E-TM1.1 with N-TM			
Mid Channel, 1962.5 MHz			
		40.030	0
		40.0	43.0
		46.0	
15 MHz Bandwidth			
E-TM1.1 with N-TM			
Mid Channel, 1962.5 MHz			
		38.446	0
		38.4	41.4
		44.4	
20 MHz Bandwidth			
E-TM1.1 with N-TM			
Mid Channel, 1962.5 MHz			
		37.355	0
		37.4	40.4
		43.4	

POWER SPECTRAL DENSITY AND EIRP CALCULATIONS - GUARD BAND

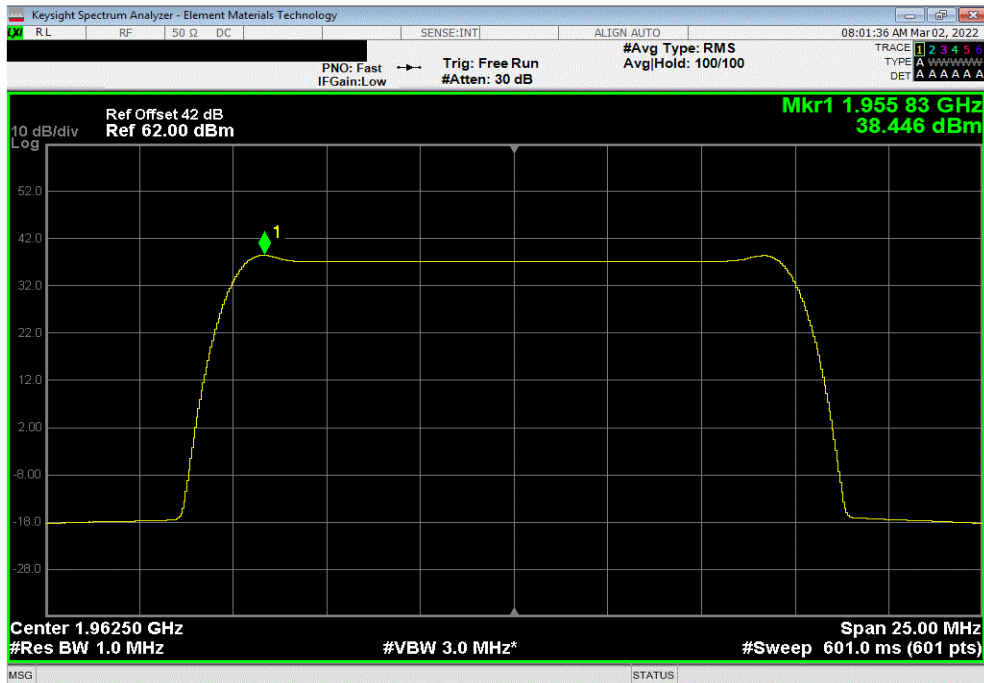


TbTx 2021.12.14.1 XMI 2022.02.07.0

Band 25, 1930 MHz - 1995 MHz, LTE Narrow Band IoT Guard Band, Port 1, 10 MHz Bandwidth, E-TM1.1 with N-TM, 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	
40.030	0	40.0	43.0	46.0	



Band 25, 1930 MHz - 1995 MHz, LTE Narrow Band IoT Guard Band, Port 1, 15 MHz Bandwidth, E-TM1.1 with N-TM, 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	
38.446	0	38.4	41.4	44.4	

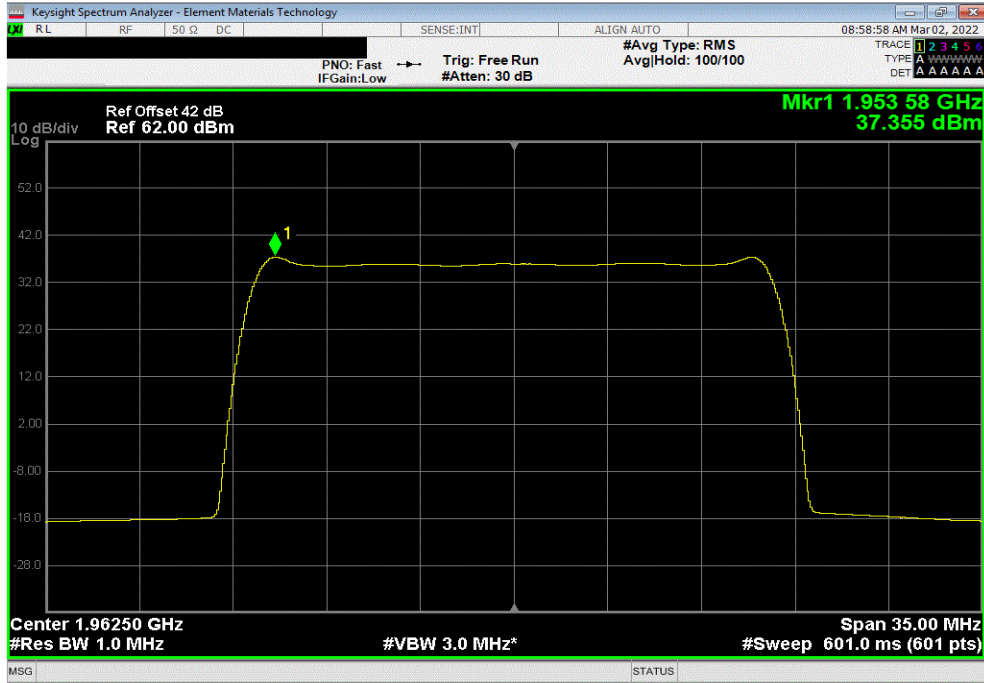


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS - GUARD BAND



TbTx 2021.12.14.1 XMit 2022.02.07.0

Band 25, 1930 MHz - 1995 MHz, LTE Narrow Band IoT Guard Band, Port 1, 20 MHz Bandwidth, E-TM1.1 with N-TM, 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	
37.355	0	37.4	40.4	43.4	



POWER SPECTRAL DENSITY AND EIRP CALCULATIONS - GUARD BAND



TotTx 2021.12.14.1 XMit 2022.02.07.0

EIRP Calculations for Four Port MIMO Operations for Band 25 NB IoT Guard Band Carriers

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 Kathrein antenna assembly model "80011867". The maximum Band 25 gain (17.9dBi) for this antenna was used for the EIRP calculation.

Equivalent Isotropically Radiated Power (EIRP) is calculated (as specified in ANSI C63.26-2015 section 6.4 for four port MIMO) from the results of power measurements (highest measured PSD for each channel bandwidth type). The total worst case PSD for four port MIMO is calculated as the worst case PSD for a single port + 6dB [10log (4)] based upon ANSI C63.26 clause 6.4.3.2.4 (10 Log N_{out}). 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	10 MHz Ch BW	15 MHz Ch BW	20 MHz Ch BW
Worst Case PSD/Antenna Port	40 dBm/MHz	38.4 dBm/MHz	37.4 dBm/MHz
Total PSD for Four Port MIMO 10Log 4 = + 6dB	46 dBm/MHz	44.4 dBm/MHz	43.4 dBm/MHz
Cable Loss (site dependent)	0 dB	0 dB	0 dB
Maximum Antenna Gain	17.9 dBi	17.9 dBi	17.9 dBi
Worst Case Four Port MIMO EIRP Total	63.9 dBm/MHz	62.3 dBm/MHz	61.3 dBm/MHz

Calculation Summary

The worst case AHFII four port MIMO Band 25 EIRP levels using antenna assembly model "80011867" are:

- (1) Less than the FCC and ISED (3280 W/MHz or 65.16 dBm/MHz) EIRP Regulatory Limits for 10, 15 & 20MHz channel bandwidths.
- (2) Less than the FCC and ISED (1640 W/MHz or 62.15 dBm/MHz) EIRP Regulatory Limits for the 20MHz channel bandwidth.
- (3) Over the FCC/ISED (1640 W/MHz or 62.15 dBm/MHz) EIRP Regulatory Limits by 1.75 dB (63.9dBm/MHz – 62.15dBm/MHz) for the 10MHz channel bandwidth and by 0.15 dB (62.3dBm/MHz – 62.15dBm/MHz) for the 15MHz channel bandwidth. EIRP calculations are needed at each transmitter location to optimize base station operational performance while meeting regulatory requirements as noted above.
- (4) See reduced average power and reduced PSD sections of this report for details of compliance verification by changing BTS configuration file power output parameters.

POWER SPECTRAL DENSITY AND EIRP CALCULATIONS - GUARD BAND



TstTx 2021.12.14.1 XMI 2022.02.07.0

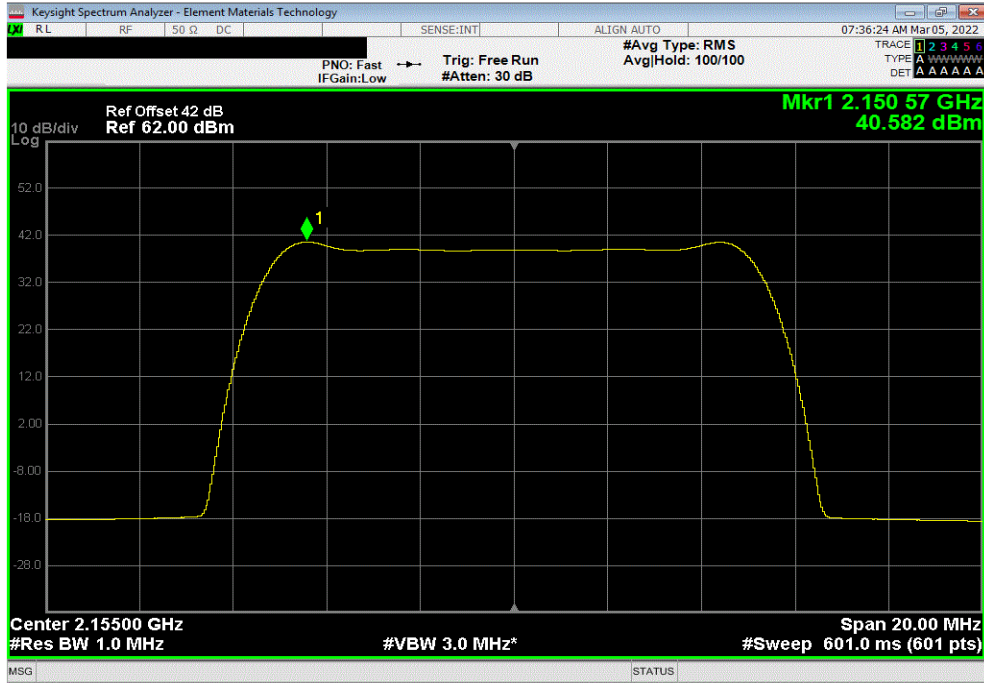
EUT:	AHFII Remote Radio Head	Work Order:	NOKI0037
Serial Number:	YK214000036	Date:	28-Feb-22
Customer:	Nokia Solutions and Networks	Temperature:	22.6 °C
Attendees:	David Le, John Rattanavong	Humidity:	23.7% RH
Project:	None	Barometric Pres.:	1026 mbar
Tested by:	Mark Baytan	Power:	54 VDC
		Job Site:	TX09
TEST SPECIFICATIONS		Test Method	
FCC 27:2022		ANSI C63.26:2015	
RSS-139 Issue 3:2015		RSS-139 Issue 3:2015	
RSS-170 Issue 3:2015		RSS-170 Issue 3:2015	
COMMENTS			
All measurement path losses accounted for in the reference level offset including any attenuators, filters, and DC blocks. Band 66 carriers enabled at maximum power is 80 watts/carrier. The PSD was measured while transmitting one carrier on Port 1. The total PSD for multipoint (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)]. The carrier power was set to maximum for all testing.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	2	Signature	
		Initial Value dBm/MHz	Duty Cycle Factor (dB)
		Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD
		Four Port (4x4 MIMO) dBm/MHz == PSD	
Band 66, 2110 MHz - 2200 MHz, LTE Narrow Band IoT Guard Band			
Port 1			
10 MHz Bandwidth			
E-TM1.1 with N-TM			
	Mid Channel, 2155 MHz	40.582	0
		40.9	43.9
			46.9
15 MHz Bandwidth			
E-TM1.1 with N-TM			
	Mid Channel, 2155 MHz	38.878	0
		38.9	41.9
			44.9
20 MHz Bandwidth			
E-TM1.1 with N-TM			
	Mid Channel, 2155 MHz	37.808	0
		37.8	40.8
			43.8

POWER SPECTRAL DENSITY AND EIRP CALCULATIONS - GUARD BAND

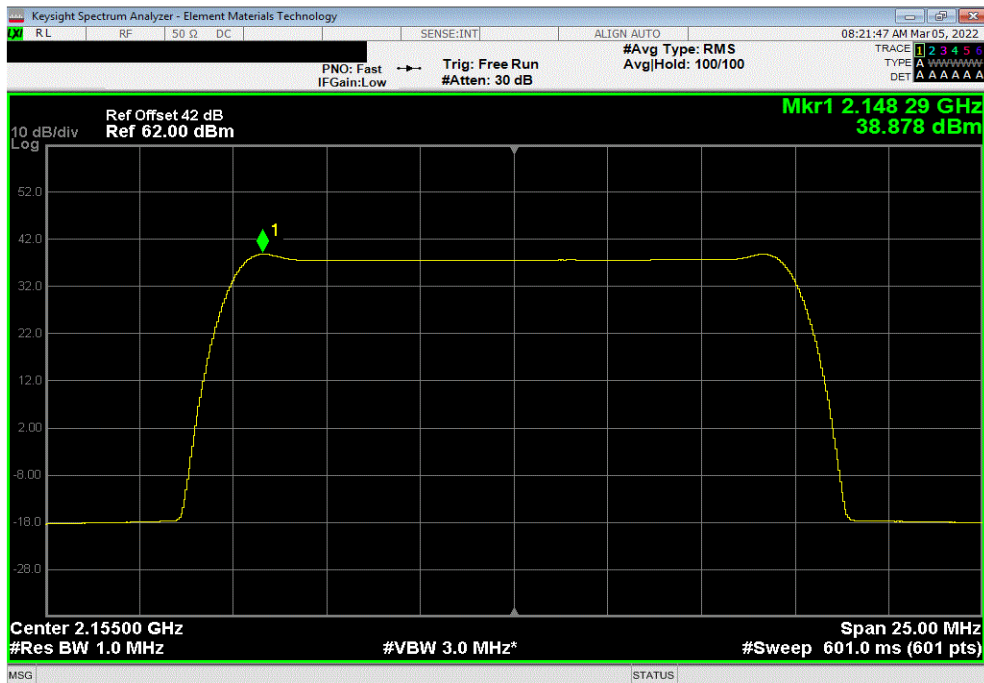


TbTx 2021.12.14.1 XMI 2022.02.07.0

Band 66, 2110 MHz - 2200 MHz, LTE Narrow Band IoT Guard Band, Port 1, 10 MHz Bandwidth, E-TM1.1 with N-TM, Mid Channel, 2155 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	
40.582	0	40.9	43.9	46.9	



Band 66, 2110 MHz - 2200 MHz, LTE Narrow Band IoT Guard Band, Port 1, 15 MHz Bandwidth, E-TM1.1 with N-TM, Mid Channel, 2155 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	
38.878	0	38.9	41.9	44.9	

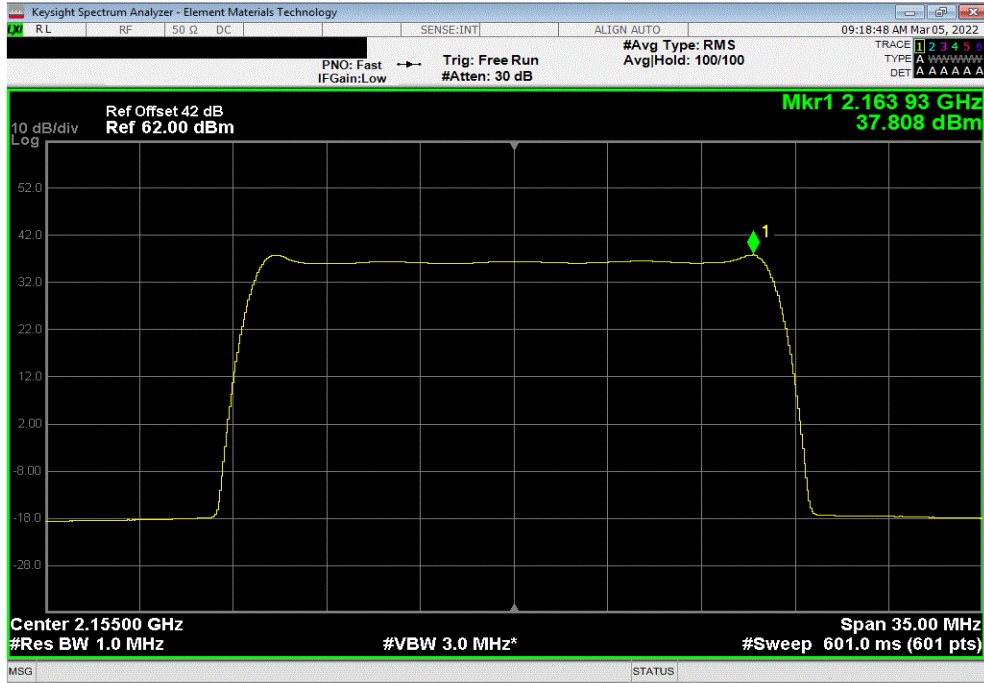


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS - GUARD BAND



TbTx 2021.12.14.1 XMit 2022.02.07.0

Band 66, 2110 MHz - 2200 MHz, LTE Narrow Band IoT Guard Band, Port 1, 20 MHz Bandwidth, E-TM1.1 with N-TM, Mid Channel, 2155 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	
37.808	0	37.8	40.8	43.8	



POWER SPECTRAL DENSITY AND EIRP CALCULATIONS - GUARD BAND



TbTx 2021.12.14.1 XMit 2022.02.07.0

EIRP Calculations for Four Port MIMO Operations for Band 66 NB IoT Guard Band Carriers

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 Kathrein antenna assembly model "80011867". The maximum Band 66 gain (18.2dBi) for this antenna was used for the EIRP calculation.

Equivalent Isotropically Radiated Power (EIRP) is calculated (as specified in ANSI C63.26-2015 section 6.4 for four port MIMO) from the results of power measurements (highest measured PSD for each channel bandwidth type). The total worst case PSD for four port MIMO is calculated as the worst case PSD for a single port + 6dB [10log (4)] based upon ANSI C63.26 clause 6.4.3.2.4 (10 Log N_{out}). 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	10 MHz Ch BW	15 MHz Ch BW	20 MHz Ch BW
Worst Case PSD/Antenna Port	40.9 dBm/MHz	38.9 dBm/MHz	37.8 dBm/MHz
Total PSD for Four Port MIMO 10Log 4 = + 6dB	46.9 dBm/MHz	44.9 dBm/MHz	43.8 dBm/MHz
Cable Loss (site dependent)	0 dB	0 dB	0 dB
Maximum Antenna Gain	18.2 dBi	18.2 dBi	18.2 dBi
Worst Case Four Port MIMO EIRP Total	65.1 dBm/MHz	63.1 dBm/MHz	62.0 dBm/MHz

Calculation Summary

The worst case AHFII four port MIMO Band 66 EIRP levels using antenna assembly model "80011867" are:

- (1) Less than the FCC and ISED (3280 W/MHz or 65.16 dBm/MHz) EIRP Regulatory Limits for 10, 15 & 20MHz channel bandwidths.
- (2) Less than the FCC and ISED (1640 W/MHz or 62.15 dBm/MHz) EIRP Regulatory Limits for the 20MHz channel bandwidth.
- (3) Over the FCC/ISED (1640 W/MHz or 62.15 dBm/MHz) EIRP Regulatory Limits by 2.95 dB (65.1dBm/MHz – 62.15dBm/MHz) for the 10MHz channel bandwidth and by 0.95 dB (63.1dBm/MHz – 62.15dBm/MHz) for the 15MHz channel bandwidth. EIRP calculations are needed at each transmitter location to optimize base station operational performance while meeting regulatory requirements as noted above.
- (4) See reduced average power and reduced PSD sections of this report for details of compliance verification by changing BTS configuration file power output parameters.