POWER SPECTRAL DENSITY AND EIRP CALCULATIONS - IN-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.

POWER SPECTRAL DENSITY AND EIRP CALCULATIONS - IN-BAND

TbITx 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	Job Site:	TX09
Power:	54 VDC		

TEST SPECIFICATIONS	Test Method
FCC 24E:2022	ANSI C63.26:2015
RSS-133 Issue 6:2013+A1:2018	RSS-133 Issue 6:2013+A1:2018

COMMENTS

All measurement path loses accounted for in the reference level offest 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 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)]. The carrier power was set to maximum for all testing.

DEVIATIONS FROM TEST STANDARD

None

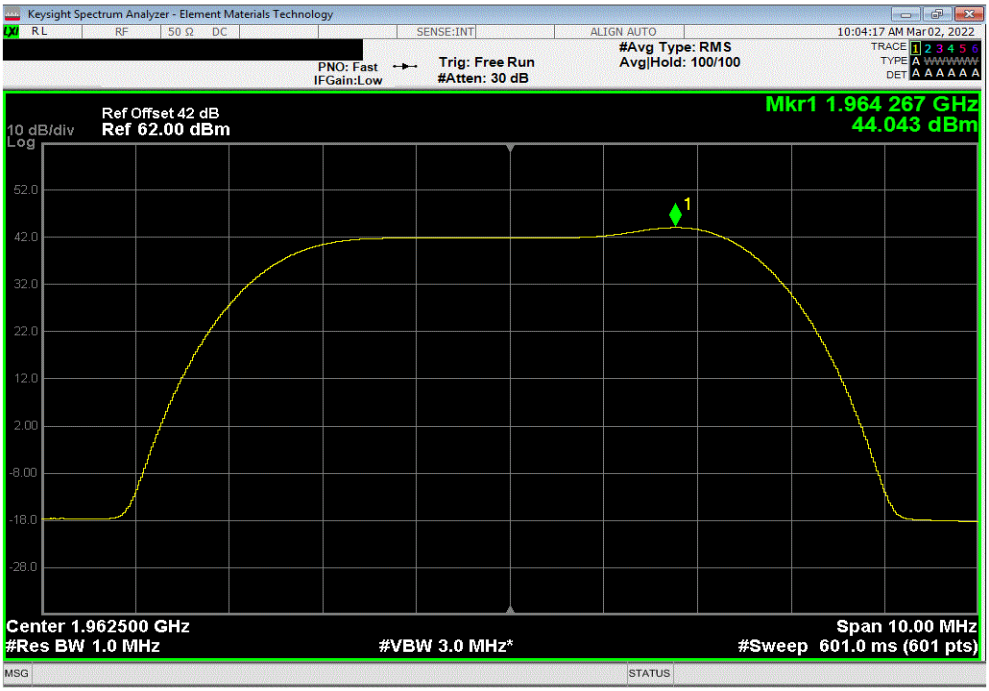
Configuration #	2	Signature

	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 In-Band					
Port 1					
5 MHz Bandwdith					
E-TM1.1 with N-TM					
Mid Channel, 1962.5 MHz	44.043	0	44.0	47.0	50.0
10 MHz Bandwdith					
E-TM1.1 with N-TM					
Mid Channel, 1962.5 MHz	41.285	0	41.3	44.3	47.3
15 MHz Bandwdith					
E-TM1.1 with N-TM					
Mid Channel, 1962.5 MHz	39.211	0	39.2	42.2	45.2
20 MHz Bandwdith					
E-TM1.1 with N-TM					
Mid Channel, 1962.5 MHz	38.377	0	38.4	41.4	44.4

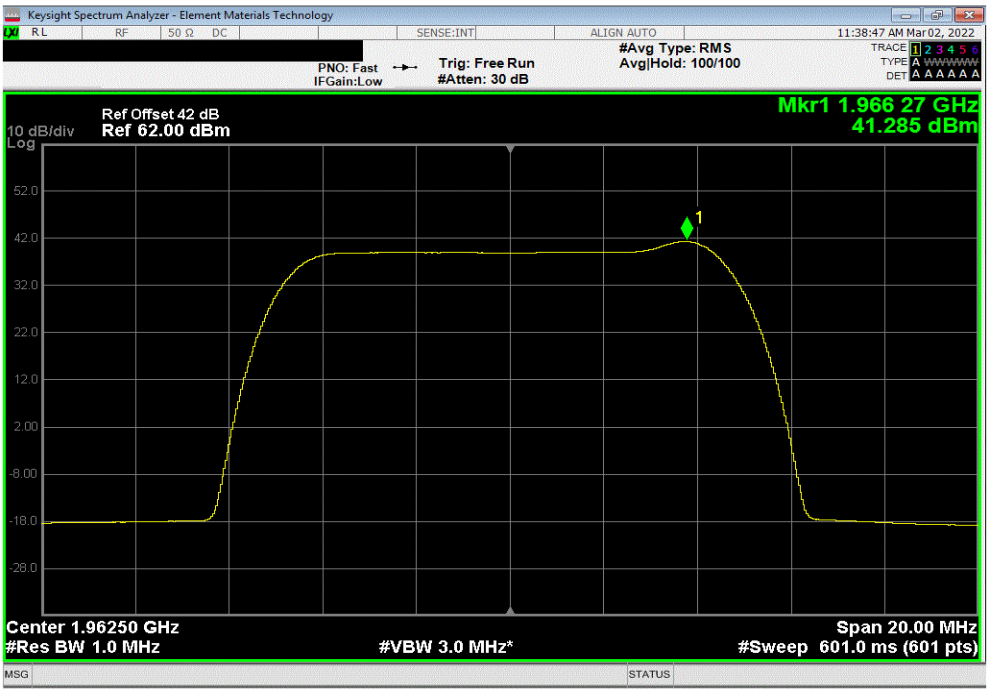
POWER SPECTRAL DENSITY AND EIRP CALCULATIONS - IN-BAND

TbtTx 2021.12.14.1 XMit 2022.02.07.0

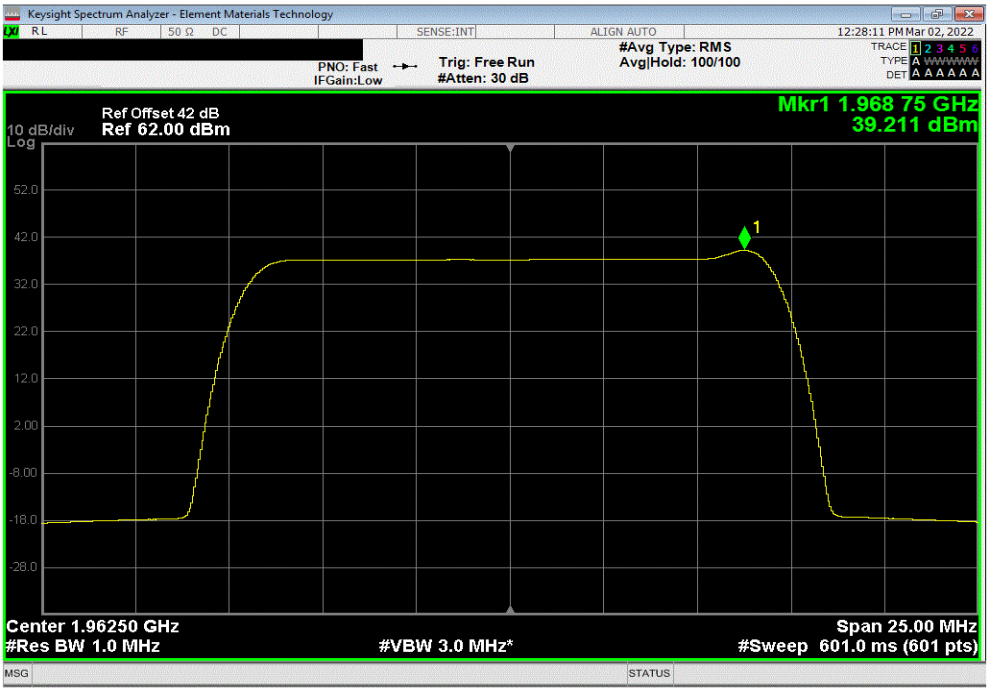
Band 25, 1930 MHz - 1995 MHz, LTE Narrow Band IoT In-Band, Port 1, 5 MHz Bandwdith, E-TM1.1 with N-TM, Mid Channel, 1962.5 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD		
44.043	0	44.0	47.0	50.0		



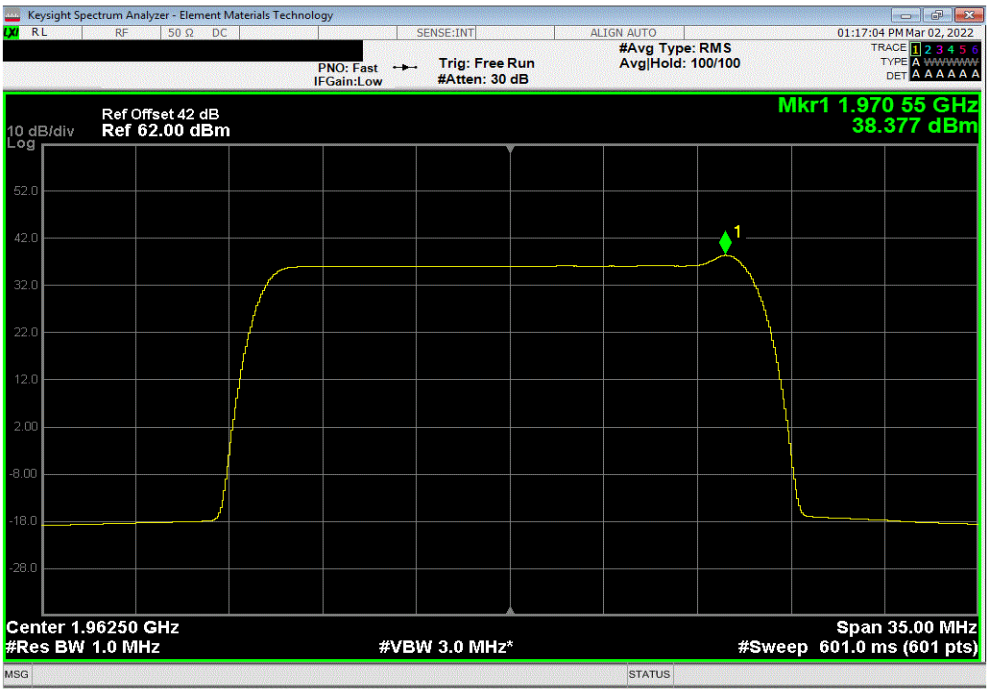
Band 25, 1930 MHz - 1995 MHz, LTE Narrow Band IoT In-Band, Port 1, 10 MHz Bandwdith, E-TM1.1 with N-TM, Mid Channel, 1962.5 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO dBm/MHz == PSD	Four Port (4x4 MIMO dBm/MHz == PSD		
41.285	0	41.3	44.3	47.3		



Band 25, 1930 MHz - 1995 MHz, LTE Narrow Band IoT In-Band, Port 1, 15 MHz Bandwdith, 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		
39.211	0	39.2	42.2	45.2		



Band 25, 1930 MHz - 1995 MHz, LTE Narrow Band IoT In-Band, Port 1, 20 MHz Bandwdith, 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		
38.377	0	38.4	41.4	44.4		



EIRP Calculations for Four Port MIMO Operations for Band 25 NB IoT In-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	5 MHz Ch BW	10 MHz Ch BW	15 MHz Ch BW	20 MHz Ch BW
Worst Case PSD/Antenna Port	44 dBm/MHz	41.3 dBm/MHz	39.2 dBm/MHz	38.4 dBm/MHz
Total PSD for Four Port MIMO 10Log 4 = + 6dB	50 dBm/MHz	47.3 dBm/MHz	45.2 dBm/MHz	44.4 dBm/MHz
Cable Loss (site dependent)	0 dB	0 dB	0 dB	0 dB
Maximum Antenna Gain	17.9 dBi	17.9 dBi	17.9 dBi	17.9 dBi
Worst Case Four Port MIMO EIRP Total	67.9 dBm/MHz	65.2 dBm/MHz	63.1 dBm/MHz	62.3 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 15MHz and 20MHz channel bandwidths.

(2) Over the FCC/ISED (3280 W/MHz or 65.16 dBm/MHz) EIRP Regulatory Limits by 2.74 dB (67.9dBm/MHz – 65.16dBm/MHz) for the 5MHz channel bandwidth and by 0.04 dB (65.2dBm/MHz – 65.16dBm/MHz) for the 10MHz channel bandwidth. EIRP calculations are needed at each transmitter location to optimize base station operational performance while meeting regulatory requirements as noted above.

(3) Over the FCC/ISED (1640 W/MHz or 62.15 dBm/MHz) EIRP Regulatory Limits by 5.75 dB (67.9dBm/MHz – 62.15dBm/MHz) for the 5MHz channel bandwidth, by 3.05 dB (65.2 dBm/MHz – 62.15dBm/MHz) for the 10MHz channel bandwidth, by 0.95 dB (63.1dBm/MHz – 62.15dBm/MHz) for the 15MHz channel bandwidth, and by 0.15 dB (62.3 dBm/MHz – 62.15dBm/MHz) for the 20MHz 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 conf iguration file power output parameters.

POWER SPECTRAL DENSITY AND EIRP CALCULATIONS - IN-BAND

TbtTx 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	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 loses accounted for in the reference level offest 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 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)]. The carrier power was set to maximum for all testing.

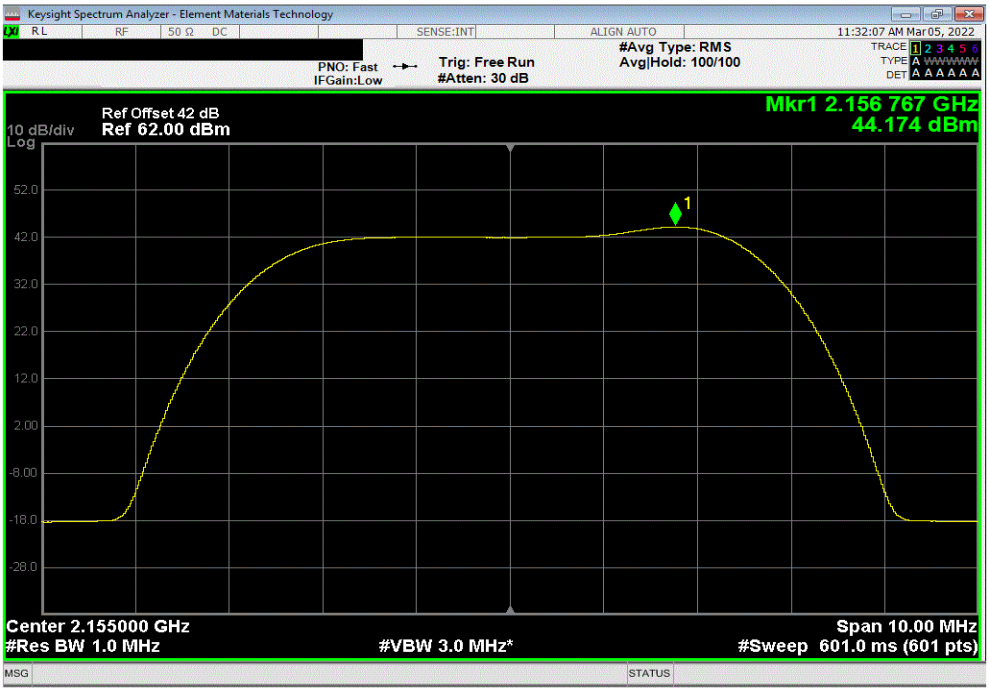
DEVIATIONS FROM TEST STANDARD

None

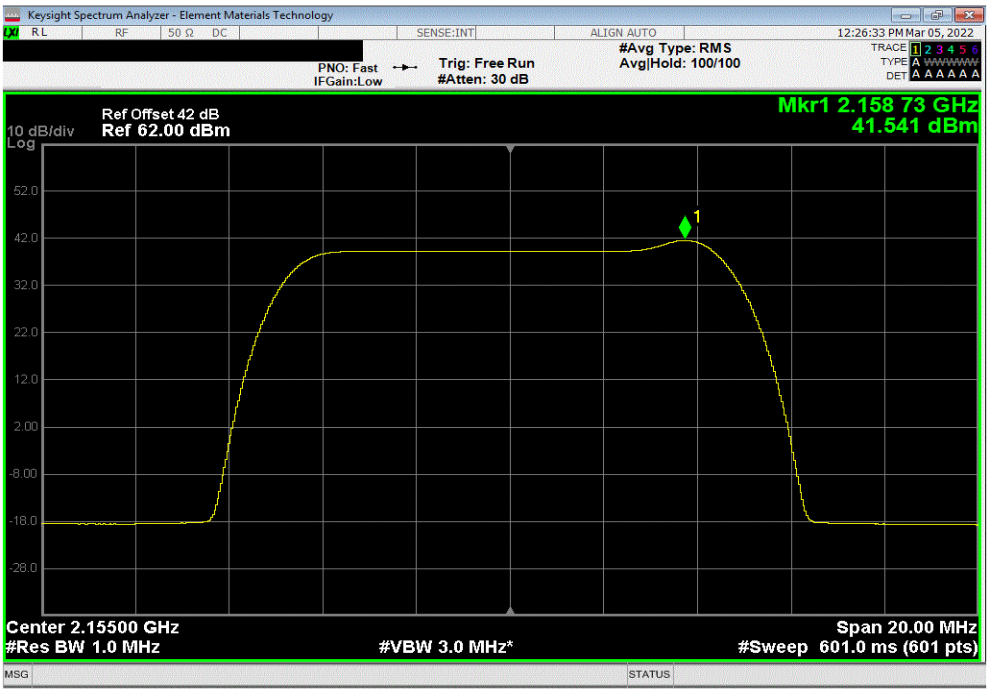
Configuration #	2	Signature

	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 In Band					
Port 1					
5 MHz Bandwdith					
E-TM1.1 with N-TM					
Mid Channel, 2155 MHz	44.174	0	44.2	47.2	50.2
10 MHz Bandwdith					
E-TM1.1 with N-TM					
Mid Channel, 2155 MHz.	41.541	0	41.5	44.5	47.5
15 MHz Bandwdith					
E-TM1.1 with N-TM					
Mid Channel, 2155 MHz..	39.624	0	39.6	42.6	45.6
20 MHz Bandwdith					
E-TM1.1 with N-TM					
Mid Channel, 2155 MHz...	38.919	0	38.9	41.8	44.8

Band 66, 2110 MHz - 2200 MHz, LTE Narrow Band IoT In Band, Port 1, 5 MHz Bandwdith, E-TM1.1 with N-TM, 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		
44.174	0	44.2	47.2	50.2		

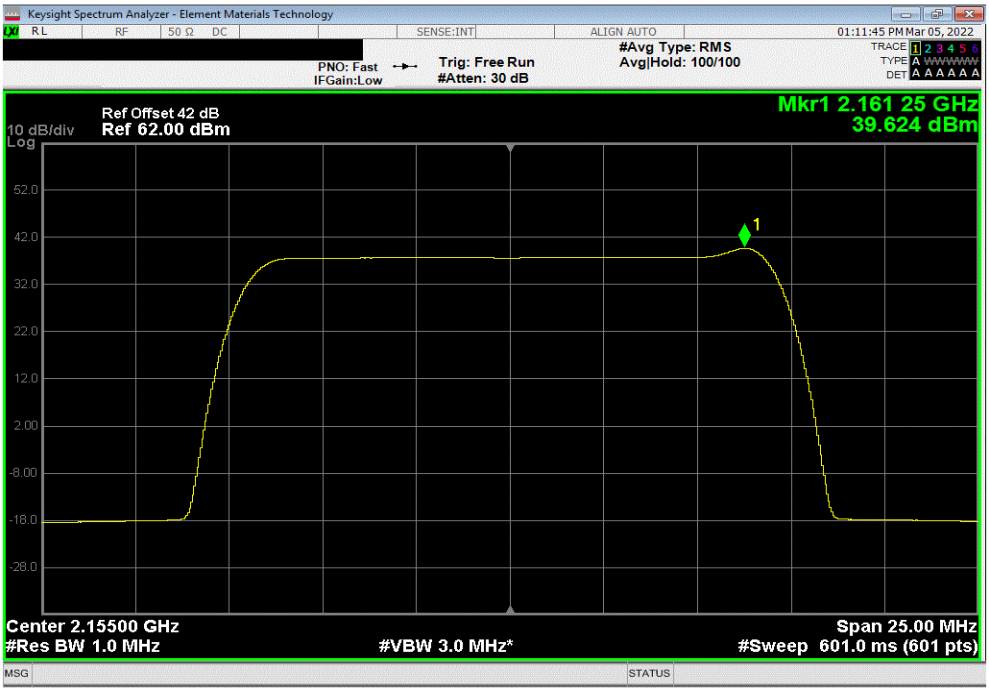


Band 66, 2110 MHz - 2200 MHz, LTE Narrow Band IoT In Band, Port 1, 10 MHz Bandwdith, E-TM1.1 with N-TM, Mid Channel, 2155 MHz.						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD		
41.541	0	41.5	44.5	47.5		



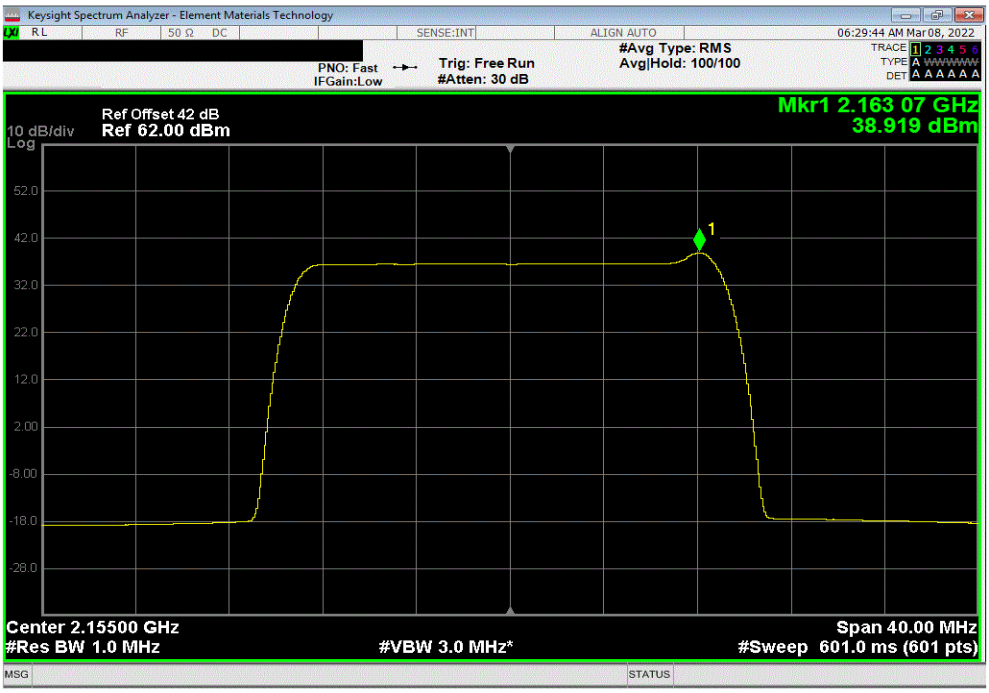
Band 66, 2110 MHz - 2200 MHz, LTE Narrow Band IoT In Band, Port 1, 15 MHz Bandwdith, E-TM1.1 with N-TM, Mid Channel, 2155 MHz..

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		
39.624	0	39.6	42.6	45.6		



Band 66, 2110 MHz - 2200 MHz, LTE Narrow Band IoT In Band, Port 1, 20 MHz Bandwdith, E-TM1.1 with N-TM, 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		
38.919	0	38.9	41.8	44.8		



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

EIRP calculations are needed at each transmitter location to optimize base station operational performance while meeting regu latory requirements. Each cell site installation needs to consider the power measurements in the radio certification report as well as site specific regulatory r equirements (such as antenna height, population density, etc.), site installation parameters (line loss between antenna and radio, antenna parameters, etc.) and b ase 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 calcula tion.

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 calculate d 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. Calculat ions 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	44.2 dBm/MHz	41.5 dBm/MHz	39.6 dBm/MHz	38.9 dBm/MHz
Total PSD for Four Port MIMO 10Log 4 = + 6dB	50.2 dBm/MHz	47.5 dBm/MHz	45.6 dBm/MHz	44.9 dBm/MHz
Cable Loss (site dependent)	0 dB	0 dB	0 dB	0 dB
Maximum Antenna Gain	18.2 dBi	18.2 dBi	18.2 dBi	18.2 dBi
Worst Case Four Port MIMO EIRP Total	68.4 dBm/MHz	65.7 dBm/MHz	63.8 dBm/MHz	63.1 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 15 & 20MHz channel bandwidths.

(2) Over the FCC/ISED (3280 W/MHz or 65.16 dBm/MHz) EIRP Regulatory Limits by 3.24 dB (68.4dBm/MHz – 65.16dBm/MHz) for the 5MHz channel bandwidth and by 0.54 dB (65.7dBm/MHz – 65.16dBm/MHz) for the 10MHz channel bandwidth. EIRP calculations are needed at each transmitter lo cation to optimize base station operational performance while meeting regulatory requirements as noted above.

(3) Over the FCC/ISED (1640 W/MHz or 62.15 dBm/MHz) EIRP Regulatory Limits by 6.25 dB (68.4dBm/MHz – 62.15dBm/MHz) for the 5MHz channel bandwidth, by 3.55 dB (65.7dBm/MHz – 62.15dBm/MHz) for the 10MHz channel bandwidth, by 1.65 dB (63.8dBm/MHz – 62.15dBm/MHz) for the 15MHz channel bandwidth, and by 0.95 dB (63.1dBm/MHz – 62.15dBm/MHz) for the 10MHz channel bandwidth EIRP calculations are needed at each tran smitter 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 conf iguration file power output parameters.

POWER SPECTRAL DENSITY AND EIRP CALCULATIONS - STAND ALONE

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.

POWER SPECTRAL DENSITY AND EIRP CALCULATIONS - STAND ALONE

TbtTx 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	Test Method
FCC 24E:2022	ANSI C63.26:2015
RSS-133 Issue 6:2013+A1:2018	RSS-133 Issue 6:2013+A1:2018

COMMENTS

All measurement path loses accounted for in the reference level offest including any attenuators, filters, and DC blocks. The Band 25 NB IoT Standalone carrier was enabled at maximum power of 20 watts/carrier. The PSD was measured while transmitting one carrier on Port 1. 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)]. The carrier power was set to maximum for all

DEVIATIONS FROM TEST STANDARD

None

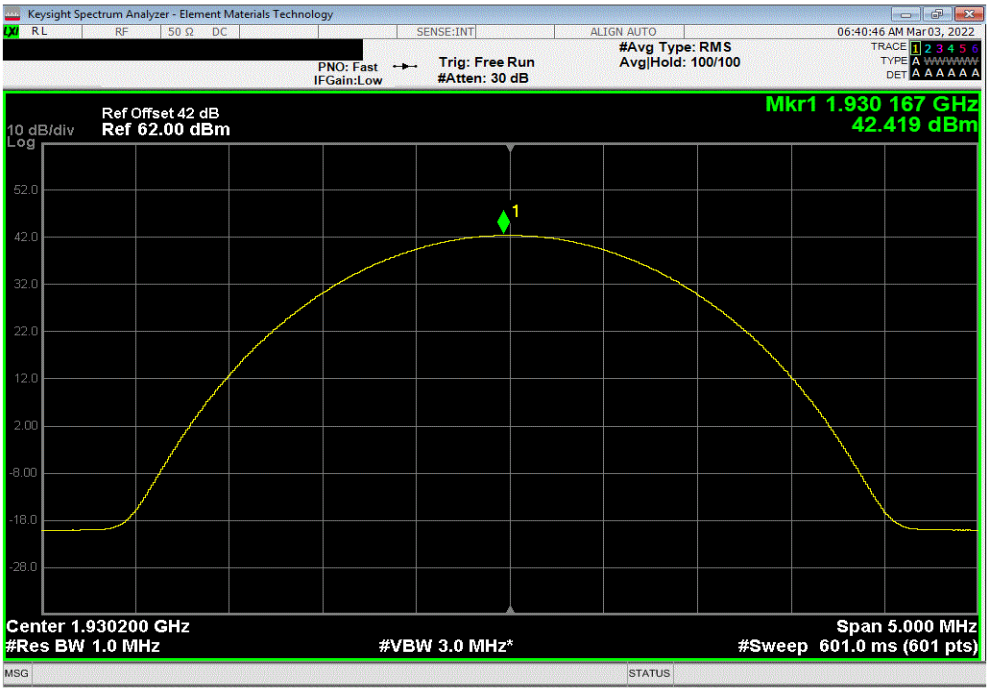
Configuration #	2	Signature

	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 Stand Alone					
Port 1					
200 kHz Bandwidth					
N-TM					
Low Channel, 1930.2 MHz	42.419	0	42.4	45.4	48.4
Mid Channel, 1962.5 MHz	42.522	0	42.5	45.5	48.5
High Channel, 1994.8 MHz	42.708	0	42.7	45.7	48.7

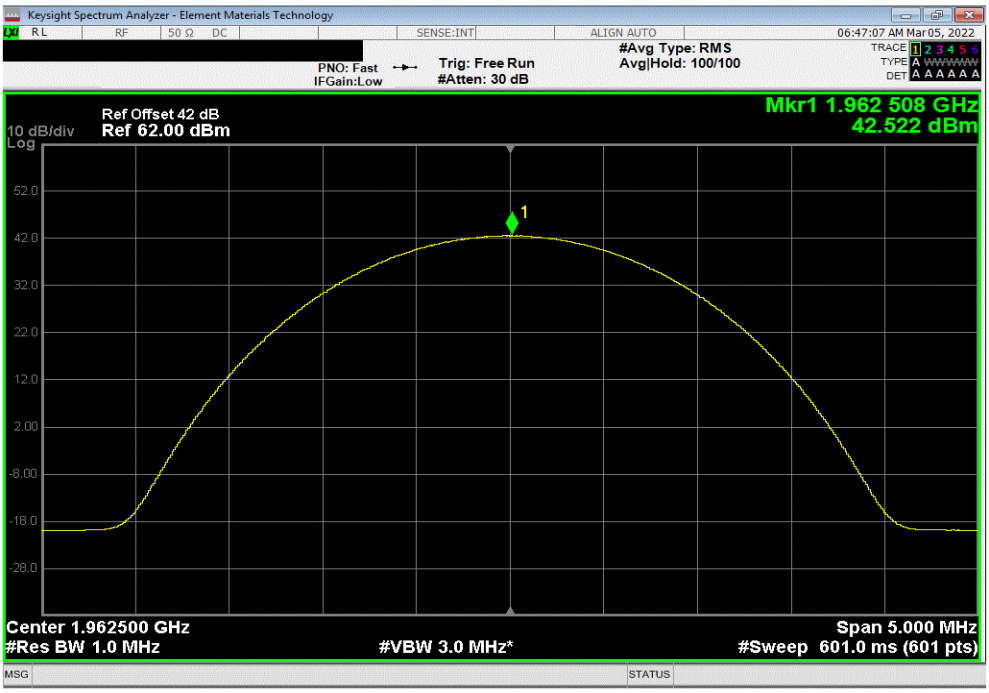
POWER SPECTRAL DENSITY AND EIRP CALCULATIONS - STAND ALONE

TbtTx 2021.12.14.1 XMit 2022.02.07.0

Band 25, 1930 MHz - 1995 MHz, LTE Narrow Band IoT Stand Alone, Port 1, 200 kHz Bandwidth, N-TM, Low Channel, 1930.2 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		
42.419	0	42.4	45.4	48.4		



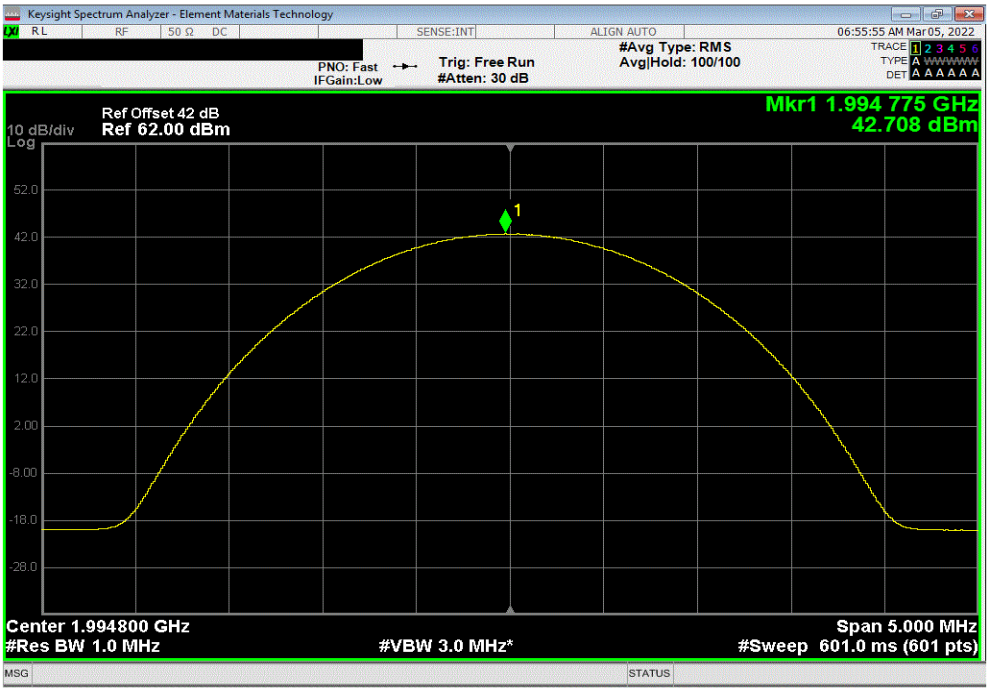
Band 25, 1930 MHz - 1995 MHz, LTE Narrow Band IoT Stand Alone, Port 1, 200 kHz Bandwidth, N-TM, Mid Channel, 1962.5 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD		
42.522	0	42.5	45.5	48.5		



POWER SPECTRAL DENSITY AND EIRP CALCULATIONS - STAND ALONE

TbtTx 2021.12.14.1 XMit 2022.02.07.0

Band 25, 1930 MHz - 1995 MHz, LTE Narrow Band IoT Stand Alone, Port 1, 200 kHz Bandwidth, N-TM, High Channel, 1994.8 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		
42.708	0	42.7	45.7	48.7		



EIRP Calculations for Four Port MIMO Operations for Band 25 NB IoT Standalone 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	NB IoT SA Carrier
Worst Case PSD/Antenna Port	42.7 dBm/MHz
Total PSD for Four Port MIMO 10Log 4 = + 6dB	48.7 dBm/MHz
Cable Loss (site dependent)	0 dB
Maximum Antenna Gain (G_{Ant})	17.9 dBi
Worst Case Four Port MIMO EIRP Total	66.6 dBm/MHz

Calculation Summary

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

(1) Over the FCC/ISED (3280 W/MHz or 65.16 dBm/MHz) EIRP Regulatory Limits by 1.44 dB (66.6dBm/MHz – 65.16dBm/MHz) for the NB IoT Standalone carrier. EIRP calculations are needed at each transmitter location to optimize base station operational performance while meeting regulatory requirements as noted above.

(2) Over the FCC/ISED (1640 W/MHz or 62.15 dBm/MHz) EIRP Regulatory Limits by 4.45 dB (66.6dBm/MHz – 62.15dBm/MHz for the NB IoT Standalone carrier. EIRP calculations are needed at each transmitter location to optimize base station operational performance while meeting regulatory requirements as noted above.

(3) See reduced average power and reduced PSD sections of this report for details of compliance verification by changing BTS conf iguration file power output parameters.

POWER SPECTRAL DENSITY AND EIRP CALCULATIONS - STAND ALONE

TbtTx 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	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 loses accounted for in the reference level offest including any attenuators, filters, and DC blocks. The Band 66 NB IoT Standalone carrier was enabled at maximum power of 20 watts/carrier. The PSD was measured while transmitting one carrier on Port 1. 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)]. The carrier power was set to maximum for all testing.

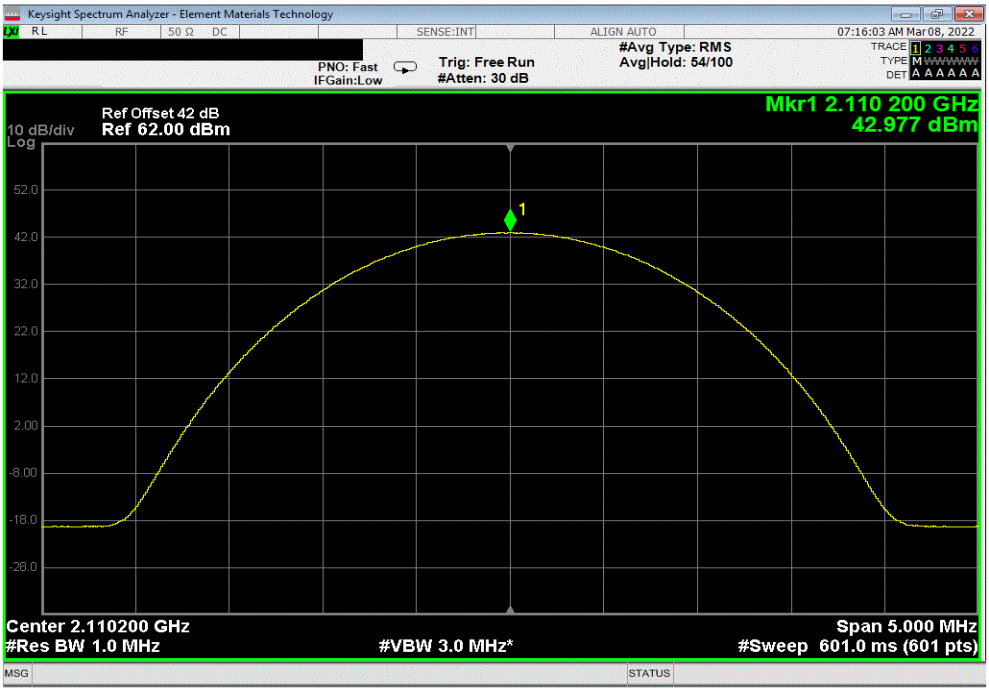
DEVIATIONS FROM TEST STANDARD

None

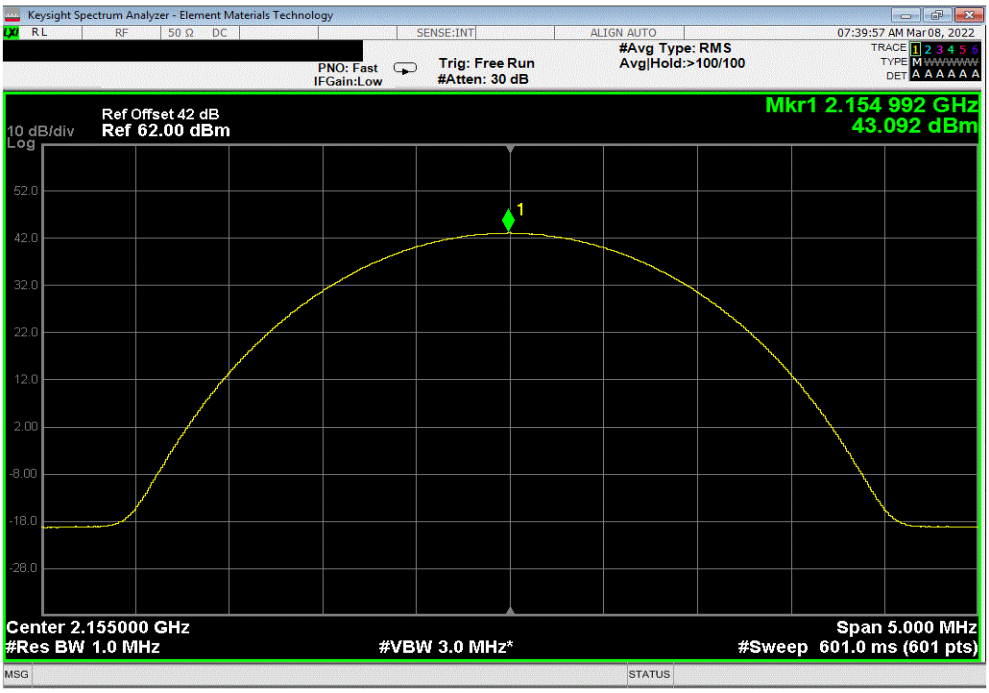
Configuration #	2	Signature

	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 Stand Alone					
Port 1					
200 kHz Bandwdith					
N-TM					
Low Channel, 2110.2 MHz	42.977	0	43.0	50.0	53.0
Mid Channel, 2155 MHz	43.092	0	43.1	46.1	49.1
High Channel, 2199.8 MH:	43.108	0	43.1	46.1	49.1

Band 66, 2110 MHz - 2200 MHz, LTE Narrow Band IoT Stand Alone, Port 1, 200 kHz Bandwdith, N-TM, Low Channel, 2110.2 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		
42.977	0	43.0	50.0	53.0		



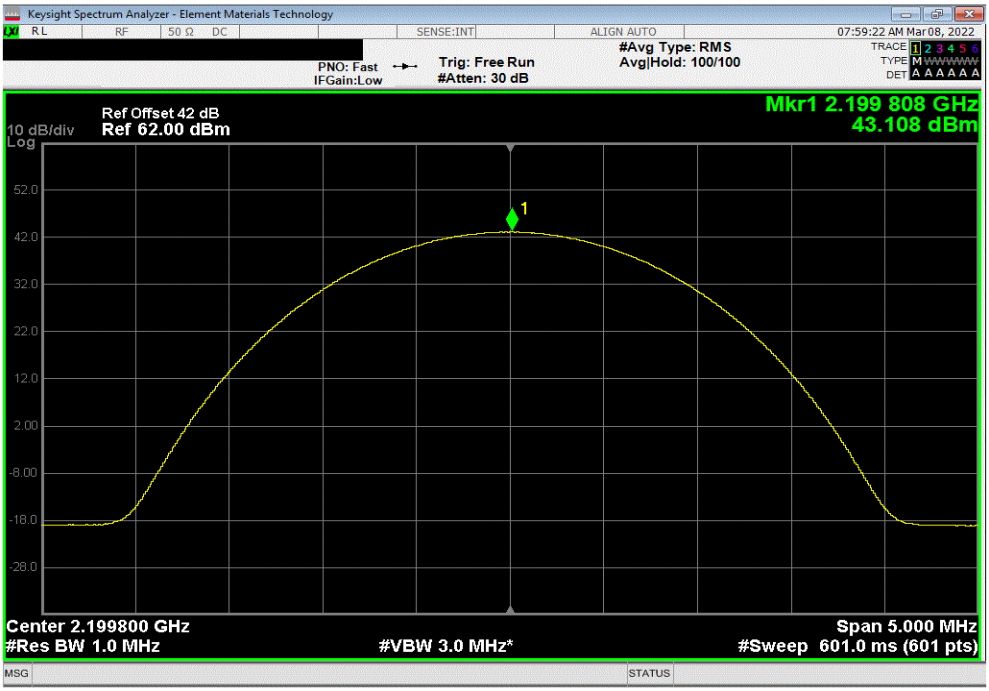
Band 66, 2110 MHz - 2200 MHz, LTE Narrow Band IoT Stand Alone, Port 1, 200 kHz Bandwdith, N-TM, Mid Channel, 2155 MHz						
Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Four Port (4x4 MIMO) dBm/MHz == PSD		
43.092	0	43.1	46.1	49.1		



POWER SPECTRAL DENSITY AND EIRP CALCULATIONS - STAND ALONE

TbtTx 2021.12.14.1 XMit 2022.02.07.0

Band 66, 2110 MHz - 2200 MHz, LTE Narrow Band IoT Stand Alone, Port 1, 200 kHz Bandwdith, N-TM, High Channel, 2199.8 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		
43.108	0	43.1	46.1	49.1		



EIRP Calculations for Four Port MIMO Operations for Band 66 NB IoT Standalone 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	NB IoT SA Carrier
Worst Case PSD/Antenna Port	43.1 dBm/MHz
Total PSD for Four Port MIMO 10Log 4 = + 6dB	49.1 dBm/MHz
Cable Loss (site dependent)	0 dB
Maximum Antenna Gain (G_{Ant})	18.2 dBi
Worst Case Four Port MIMO EIRP Total	67.3 dBm/MHz

Calculation Summary

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

(1) Over the FCC/ISED (3280 W/MHz or 65.16 dBm/MHz) EIRP Regulatory Limits by 2.14 dB (67.3dBm/MHz – 65.16dBm/MHz) for the NB IoT Standalone carrier. EIRP calculations are needed at each transmitter location to optimize base station operational performance while meeting regulatory requirements as noted above.

(2) Over the FCC/ISED (1640 W/MHz or 62.15 dBm/MHz) EIRP Regulatory Limits by 5.15 dB (67.3dBm/MHz – 62.15dBm/MHz for the NB IoT Standalone carrier. EIRP calculations are needed at each transmitter location to optimize base station operational performance while meeting regulatory requirements as noted above.

(3) 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 - REDUCED POWER

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.

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

Compliance check for EIRP Limit of 3280W/MHz or 65.16 dBm/MHz:
As shown in the EIRP calculation table of the "PSD and EIRP Calculations" report section, the highest AHFII antenna port 1 PSD levels that will not cause the calculated EIRP to exceed the EIRP limit is 41.2 dBm/MHz for Band 25 and 40.9 dBm/MHz for Band 66.

Compliance check for EIRP Limit of 1640W/MHz or 62.15 dBm/MHz:
As shown in the EIRP calculation table of the "PSD and EIRP Calculations" report section, the highest AHFII antenna port 1 PSD levels that will not cause the calculated EIRP to exceed the EIRP limit is 38.2 dBm/MHz for Band 25 and 37.9 dBm/MHz for Band 66.

POWER SPECTRAL DENSITY - REDUCED POWER

TbtTx 2021.12.14.1 XMit 2022.02.07.0

EUT:	AHFII Remote Radio Head	Work Order:	NOKI0037
Serial Number:	YK214000036	Date:	16-Mar-22
Customer:	Nokia Solutions and Networks	Temperature:	
Attendees:	David Le, John Rattanavong	Humidity:	
Project:	None	Barometric Pres.:	
Tested by:	Brandon Hobbs	Power: 54 VDC	Job Site: TX09

TEST SPECIFICATIONS	Test Method
FCC 24E:2022	ANSI C63.26:2015
RSS-133 Issue 6:2013+A1:2018	RSS-133 Issue 6:2013+A1:2018

COMMENTS

All measurement path loses accounted for in the reference level offest including any attenuators, filters, and DC blocks. The carriers for LTE bandwidths: 200 kHz, 1.4 MHz, 3 MHz, 5 MHz, 10 MHz were reduced to demonstrate compliance with EIRP limits. The maximum Port 1 PSD level is 41.2 dBm/MHz for the calculated base station EIRP not to exceed the regulatory EIRP limit of 65.16 dBm/MHz. See the "Conducted Output Power Reduced Power" section for the required carrier power reductions.

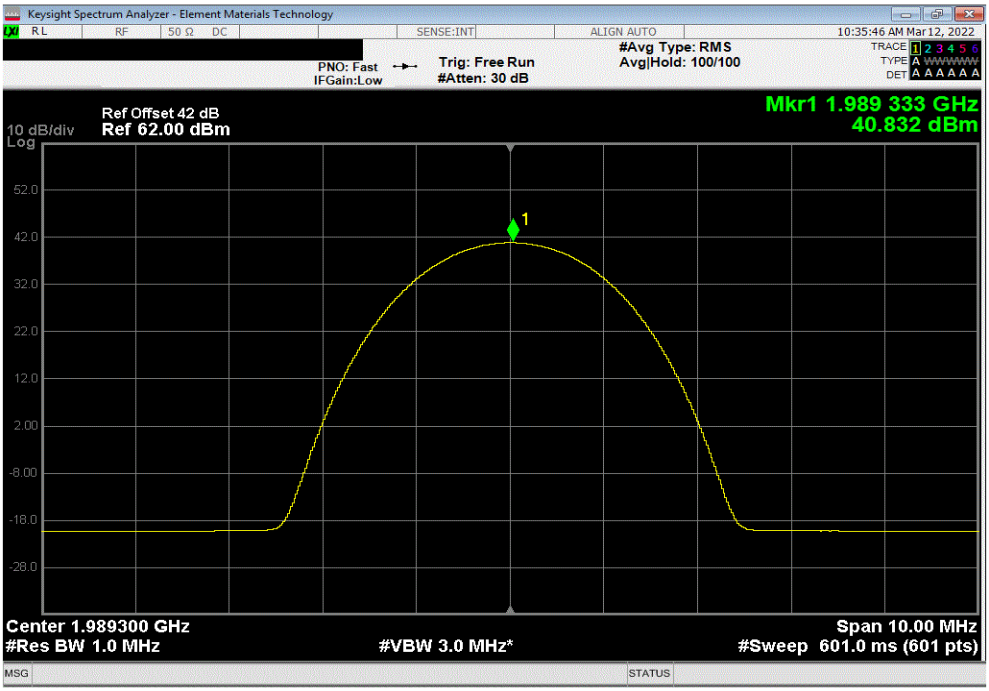
DEVIATIONS FROM TEST STANDARD

None

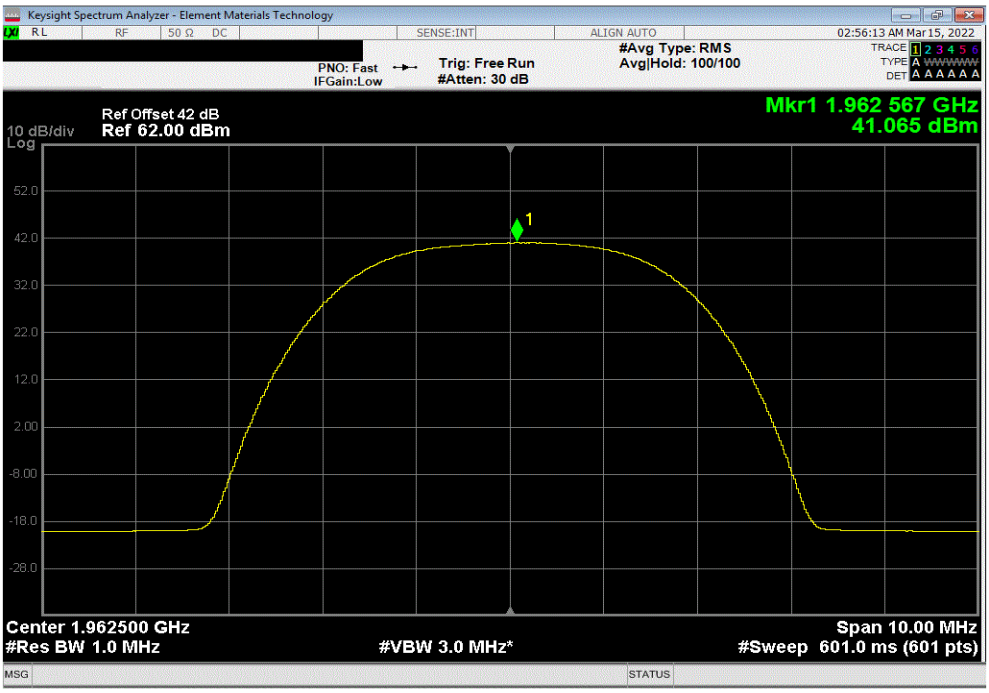
Configuration #	2	Signature

	Initial Value dBm/MHz == PSD	Duty Cycle	Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
Port 1, Band 25, 1930 MHz - 1995 MHz, LTE					
256-QAM Modulation					
Single Carrier					
1.4 MHz Bandwidth					
High Channel, 1989.3 MH:	40.832	0	40.8	41.2	Pass
16-QAM Modulation					
Single Carrier					
3 MHz Bandwidth					
Mid Channel, 1962.5 MHz	41.065	0	41.1	41.2	Pass
5 MHz Bandwidth					
Mid Channel, 1962.5 MHz	40.851	0	40.9	41.2	Pass
E-TM1.1 w N-TM Modulation					
In-band					
5 MHz Bandwidth					
Mid Channel, 1962.5 MHz	40.493	0	40.5	41.2	Pass
10 MHz Bandwidth					
Mid Channel, 1962.5 MHz	40.31	0	40.3	41.2	Pass
N-TM Modulation					
Standalone					
200 kHz Bandwidth					
High Channel, 1994.8 MH:	40.383	0	40.4	41.2	Pass

Port 1, Band 25, 1930 MHz - 1995 MHz, LTE, 256-QAM Modulation, Single Carrier, 1.4 MHz Bandwidth, High Channel, 1989.3 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	40.832	0		40.8	41.2	Pass



Port 1, Band 25, 1930 MHz - 1995 MHz, LTE, 16-QAM Modulation, Single Carrier, 3 MHz Bandwidth, Mid Channel, 1962.5 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	41.065	0		41.1	41.2	Pass

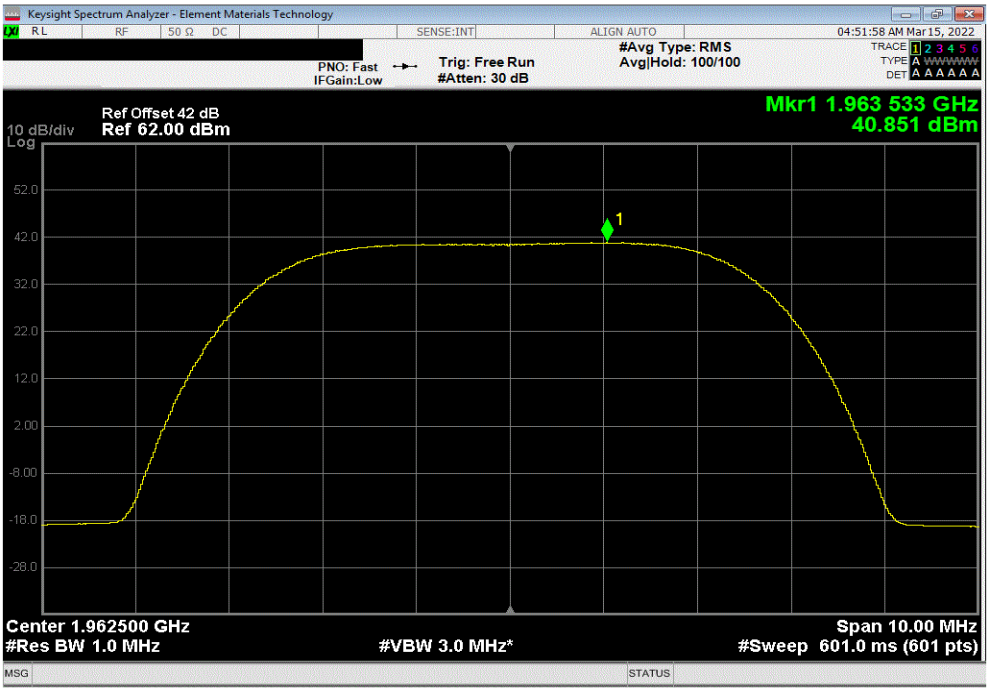


POWER SPECTRAL DENSITY - REDUCED POWER

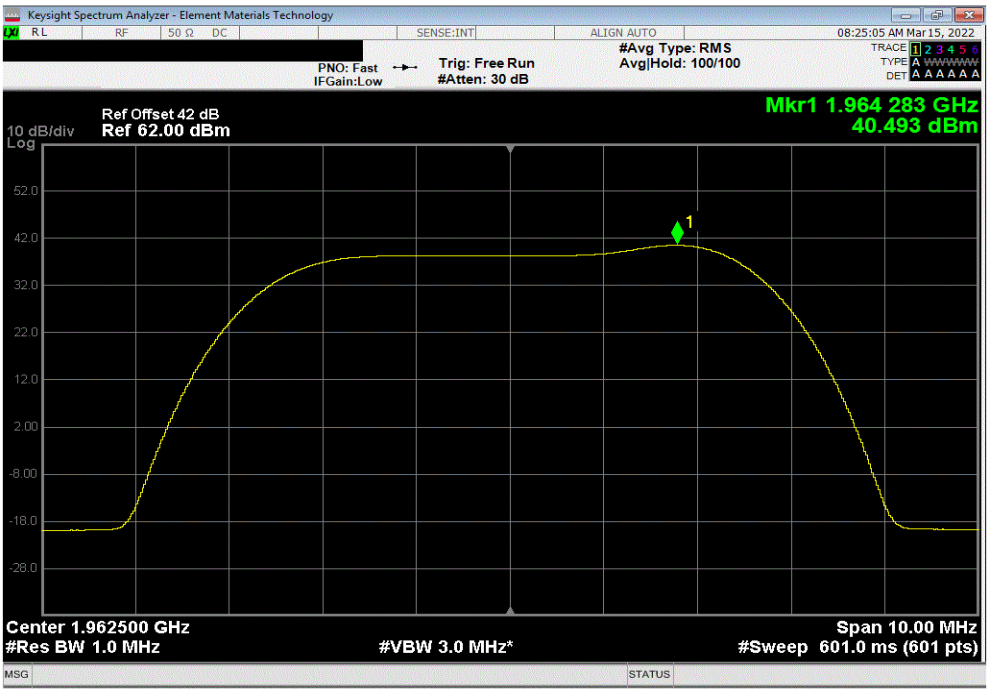
element

TbtTx 2021.12.14.1 XMit 2022.02.07.0

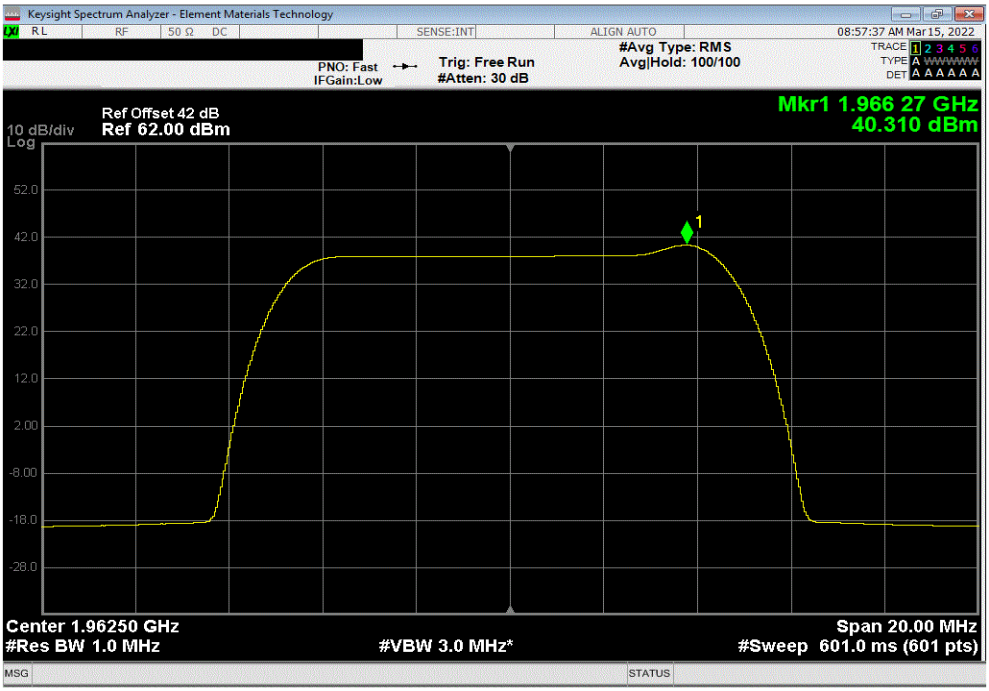
Port 1, Band 25, 1930 MHz - 1995 MHz, LTE, 16-QAM Modulation, Single Carrier, 5 MHz Bandwidth, Mid Channel, 1962.5 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	40.851	0		40.9	41.2	Pass



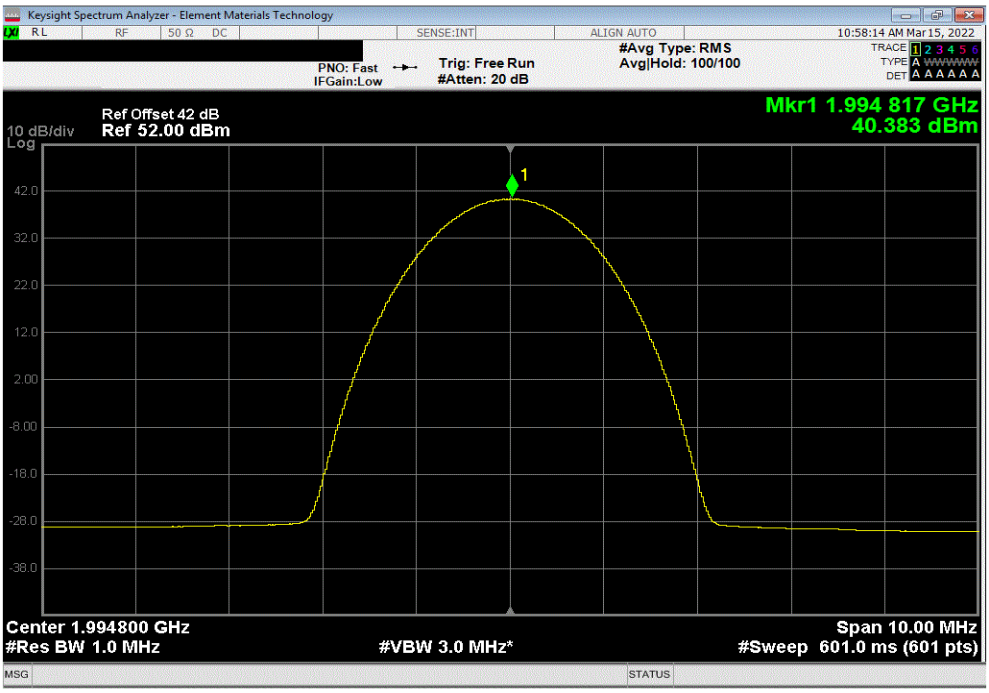
Port 1, Band 25, 1930 MHz - 1995 MHz, LTE, E-TM1.1 w N-TM Modulation, In-band, 5 MHz Bandwidth, Mid Channel, 1962.5 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	40.493	0		40.5	41.2	Pass



Port 1, Band 25, 1930 MHz - 1995 MHz, LTE, E-TM1.1 w N-TM Modulation, In-band, 10 MHz Bandwidth, Mid Channel, 1962.5 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	40.31	0		40.3	41.2	Pass



Port 1, Band 25, 1930 MHz - 1995 MHz, LTE, N-TM Modulation, Standalone, 200 kHz Bandwidth, High Channel, 1994.8 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	40.383	0		40.4	41.2	Pass



POWER SPECTRAL DENSITY - REDUCED POWER

TbtTx 2021.12.14.1 XMit 2022.02.07.0

EUT:	AHFII Remote Radio Head	Work Order:	NOKI0037
Serial Number:	YK214000036	Date:	16-Mar-22
Customer:	Nokia Solutions and Networks	Temperature:	21 °C
Attendees:	David Le, John Rattanavong	Humidity:	42% RH
Project:	None	Barometric Pres.:	1016 mbar
Tested by:	Brandon Hobbs	Power: 54 VDC	Job Site: TX09

TEST SPECIFICATIONS	Test Method
FCC 24E:2022	ANSI C63.26:2015
RSS-133 Issue 6:2013+A1:2018	RSS-133 Issue 6:2013+A1:2018

COMMENTS

All measurement path loses accounted for in the reference level offest including any attenuators, filters, and DC blocks. The carriers for LTE bandwidths: 200 kHz, 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz were reduced to demonstrate compliance with EIRP limits. The maximum Port 1 PSD level is 38.2 dBm/MHz for the calculated base station EIRP not to exceed the regulatory EIRP limit of 62.15 dBm/MHz. See the "Conducted Output Power Reduced Power" section for the required carrier power reductions.

DEVIATIONS FROM TEST STANDARD

None

Configuration #	2	Signature

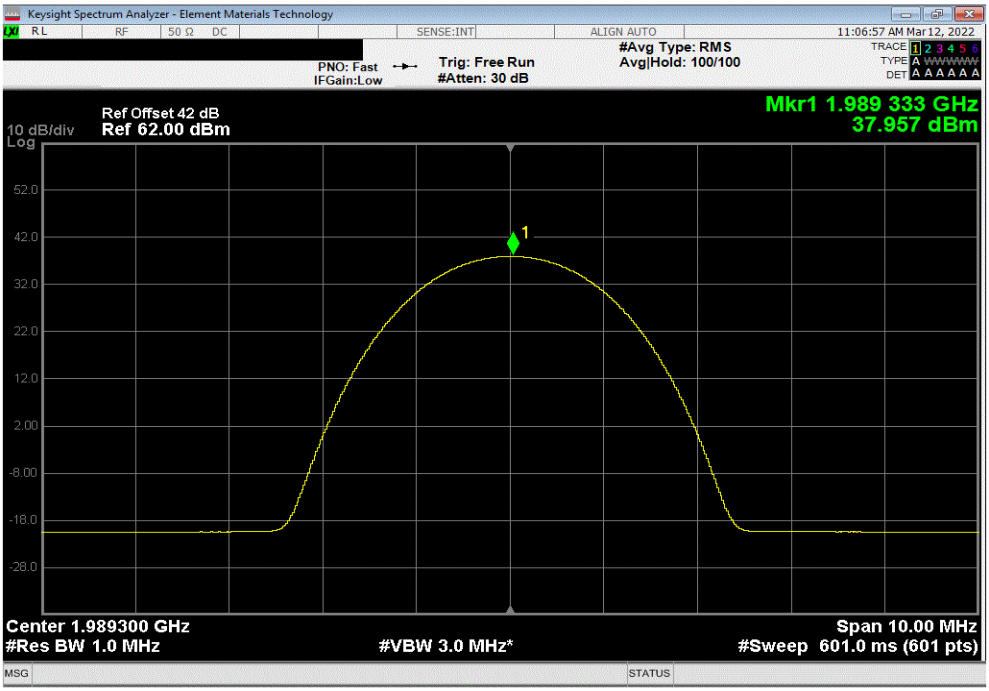
	Initial Value dBm/MHz == PSD	Duty Cycle	Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
Port 1, Band 25, 1930 MHz - 1995 MHz, LTE					
256-QAM Modulation					
Single Carrier					
1.4 MHz Bandwidth					
High Channel, 1989.3 MH:	37.957	0	38.0	38.2	Pass
16-QAM Modulation					
Single Carrier					
3 MHz Bandwidth					
Mid Channel, 1962.5 MHz	38.064	0	38.1	38.2	Pass
5 MHz Bandwidth					
Mid Channel, 1962.5 MHz	37.732	0	37.7	38.2	Pass
10 MHz Bandwidth					
Mid Channel, 1962.5 MHz	37.525	0	37.5	38.2	Pass
15 MHz Bandwidth					
Mid Channel, 1962.5 MHz	37.671	0	37.7	38.2	Pass
E-TM1.1 w N-TM Modulation					
Guard Band					
10 MHz Bandwidth					
Mid Channel, 1962.5 MHz	37.905	0	37.9	38.2	Pass
15 MHz Bandwidth					
Mid Channel, 1962.5 MHz	37.62	0	37.6	38.2	Pass
In-band					
5 MHz Bandwidth					
Mid Channel, 1962.5 MHz	37.493	0	37.5	38.2	Pass
10 MHz Bandwidth					
Mid Channel, 1962.5 MHz	37.615	0	37.6	38.2	Pass
15 MHz Bandwidth					
Mid Channel, 1962.5 MHz	37.509	0	37.5	38.2	Pass
20 MHz Bandwidth					
Mid Channel, 1962.5 MHz	37.468	0	37.5	38.2	Pass
N-TM Modulation					
Standalone					
200 kHz Bandwidth					
High Channel, 1994.8 MH:	37.063	0	37.1	38.2	Pass

POWER SPECTRAL DENSITY - REDUCED POWER

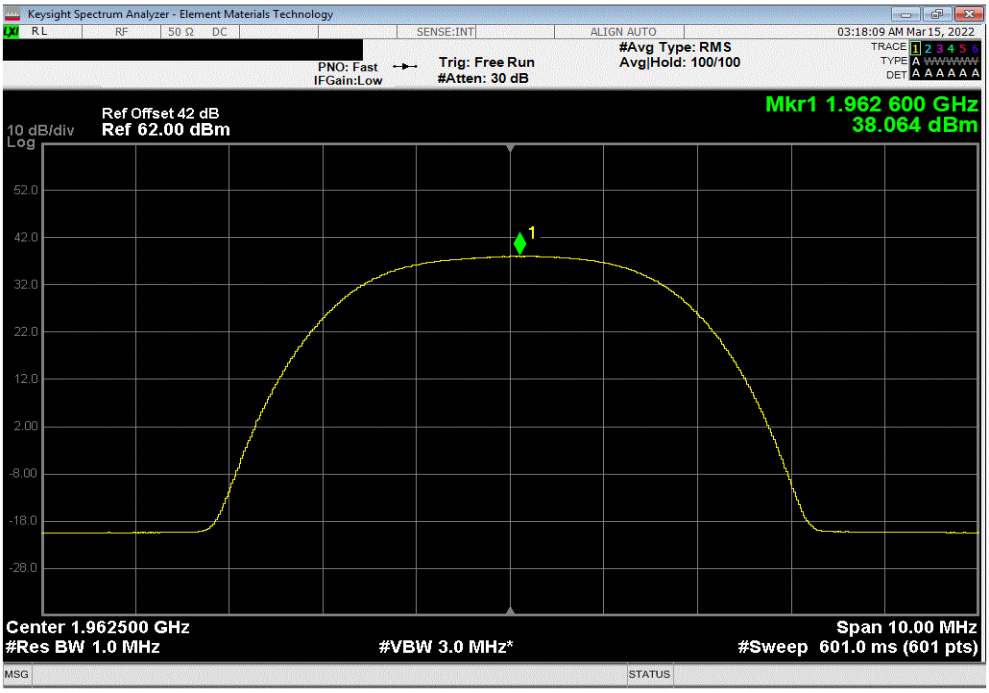
element

TbtTx 2021.12.14.1 XMit 2022.02.07.0

Port 1, Band 25, 1930 MHz - 1995 MHz, LTE, 256-QAM Modulation, Single Carrier, 1.4 MHz Bandwidth, High Channel, 1989.3 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	37.957	0		38.0	38.2	Pass



Port 1, Band 25, 1930 MHz - 1995 MHz, LTE, 16-QAM Modulation, Single Carrier, 3 MHz Bandwidth, Mid Channel, 1962.5 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	38.064	0		38.1	38.2	Pass

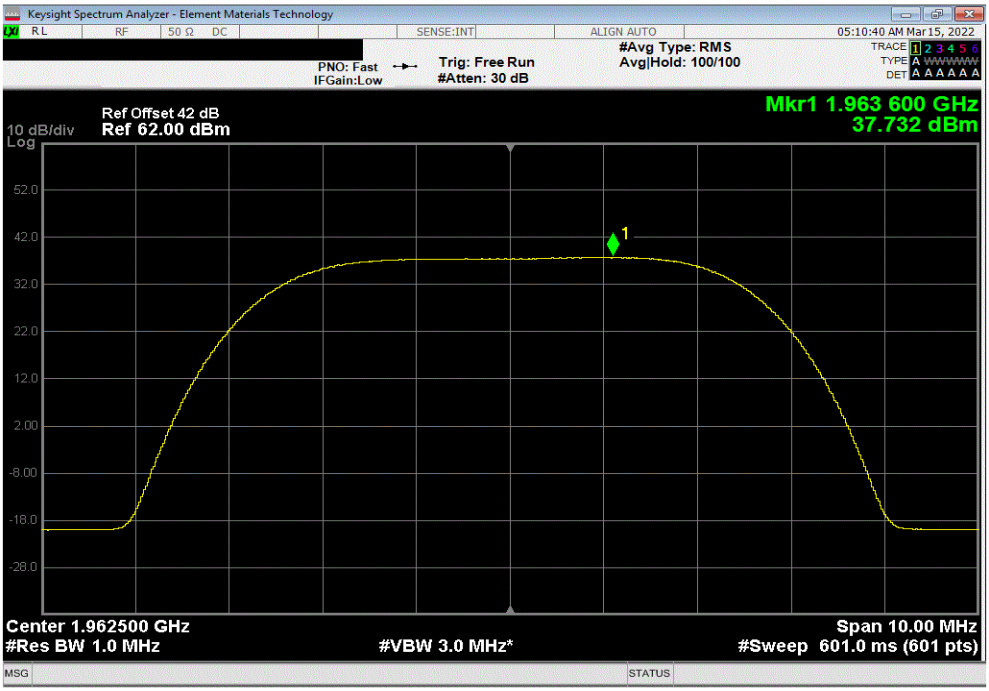


POWER SPECTRAL DENSITY - REDUCED POWER

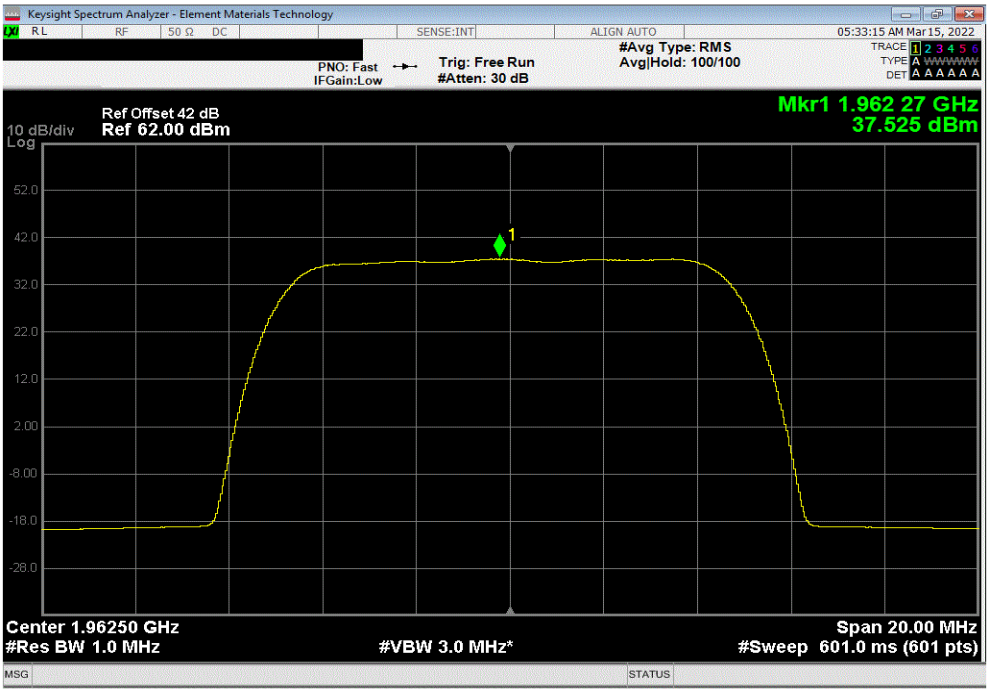
element

TbtTx 2021.12.14.1 XMit 2022.02.07.0

Port 1, Band 25, 1930 MHz - 1995 MHz, LTE, 16-QAM Modulation, Single Carrier, 5 MHz Bandwidth, Mid Channel, 1962.5 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	37.732	0		37.7	38.2	Pass



Port 1, Band 25, 1930 MHz - 1995 MHz, LTE, 16-QAM Modulation, Single Carrier, 10 MHz Bandwidth, Mid Channel, 1962.5 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	37.525	0		37.5	38.2	Pass

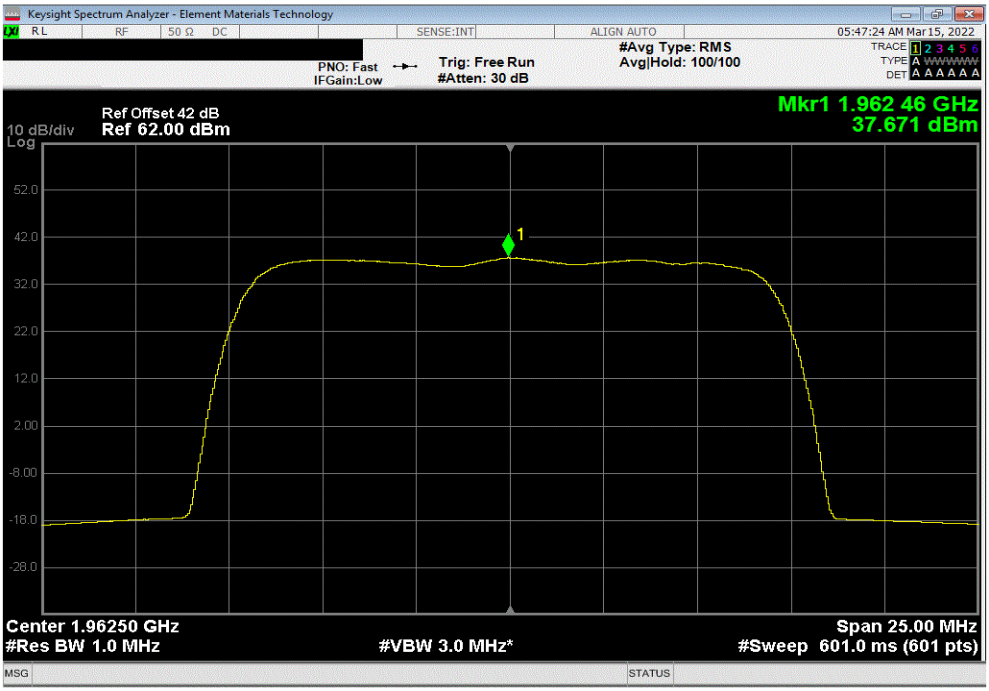


POWER SPECTRAL DENSITY - REDUCED POWER

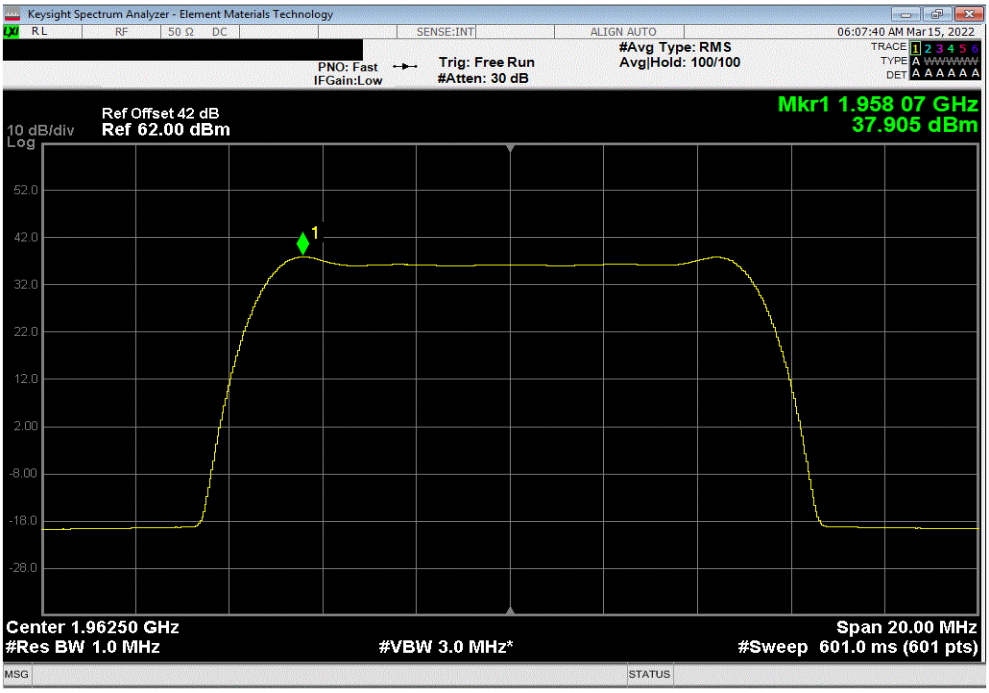
element

TbtTx 2021.12.14.1 XMit 2022.02.07.0

Port 1, Band 25, 1930 MHz - 1995 MHz, LTE, 16-QAM Modulation, Single Carrier, 15 MHz Bandwidth, Mid Channel, 1962.5 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	37.671	0		37.7	38.2	Pass



Port 1, Band 25, 1930 MHz - 1995 MHz, LTE, E-TM1.1 w N-TM Modulation, Guard Band, 10 MHz Bandwidth, Mid Channel, 1962.5 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	37.905	0		37.9	38.2	Pass

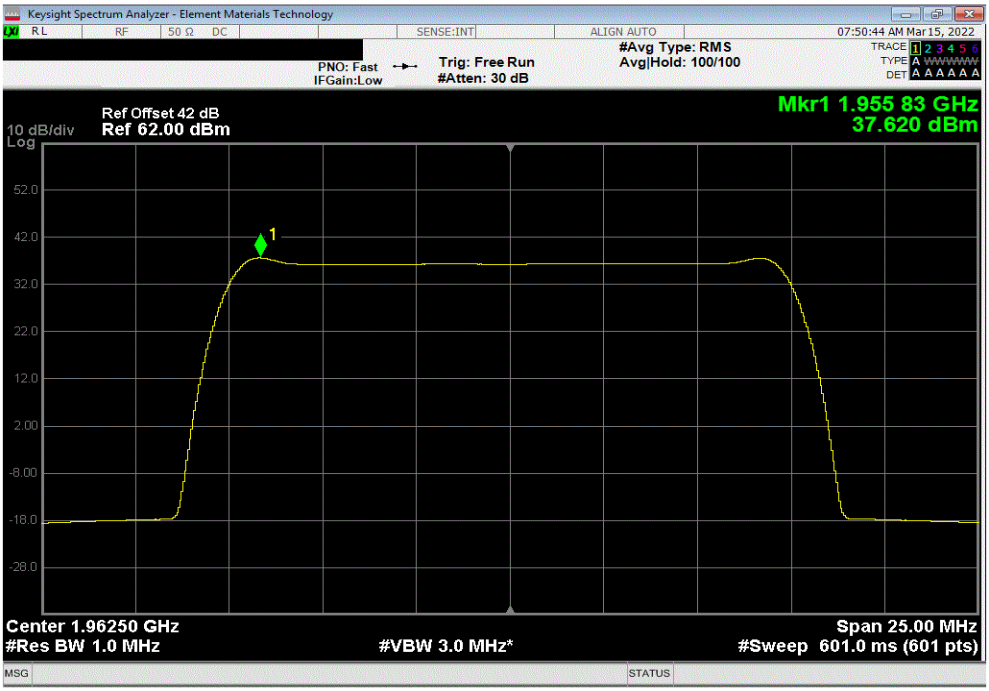


POWER SPECTRAL DENSITY - REDUCED POWER

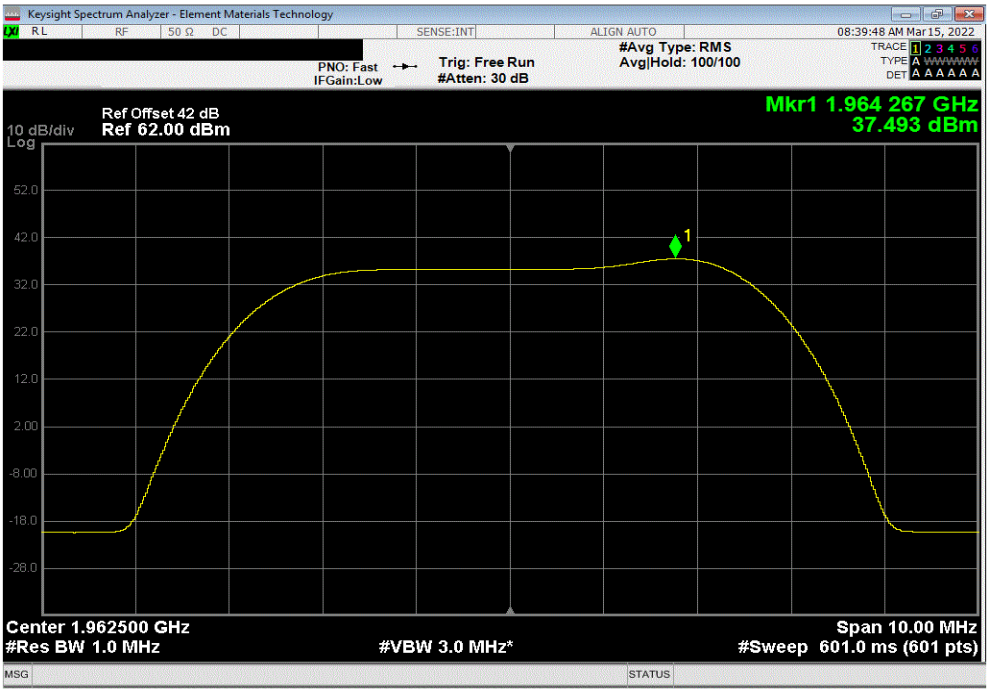
element

TbtTx 2021.12.14.1 XMit 2022.02.07.0

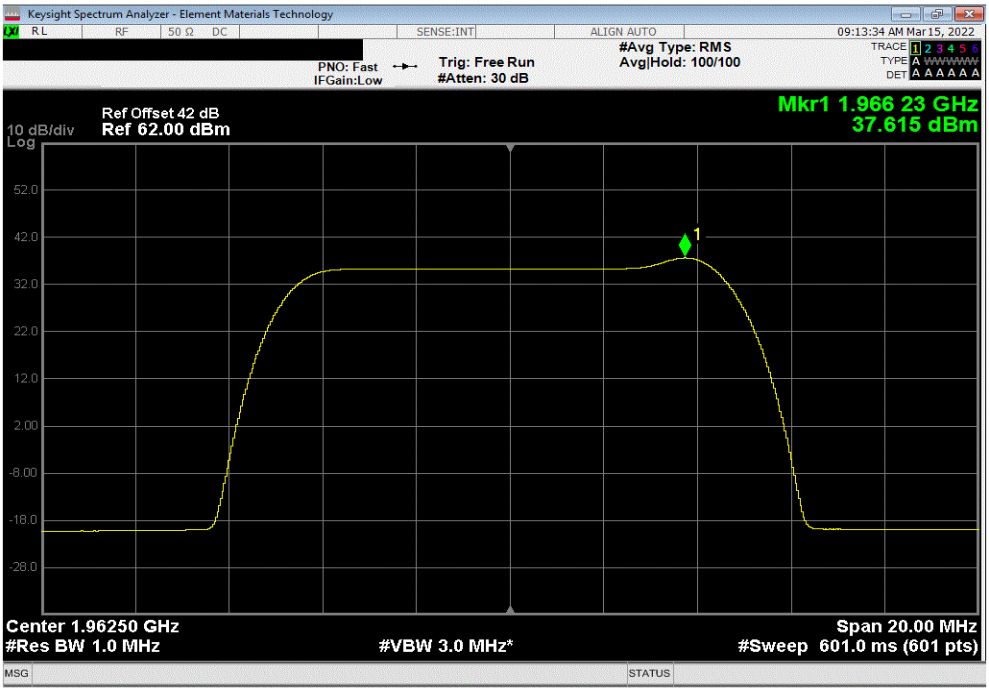
Port 1, Band 25, 1930 MHz - 1995 MHz, LTE, E-TM1.1 w N-TM Modulation, Guard Band, 15 MHz Bandwidth, Mid Channel, 1962.5 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	37.62	0		37.6	38.2	Pass



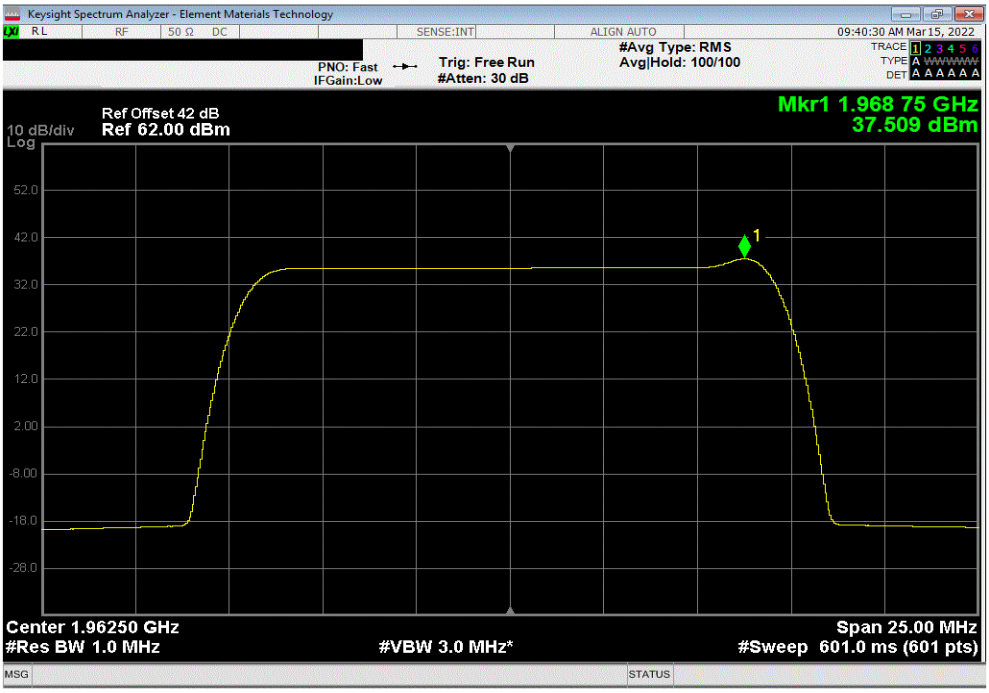
Port 1, Band 25, 1930 MHz - 1995 MHz, LTE, E-TM1.1 w N-TM Modulation, In-band, 5 MHz Bandwidth, Mid Channel, 1962.5 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	37.493	0		37.5	38.2	Pass



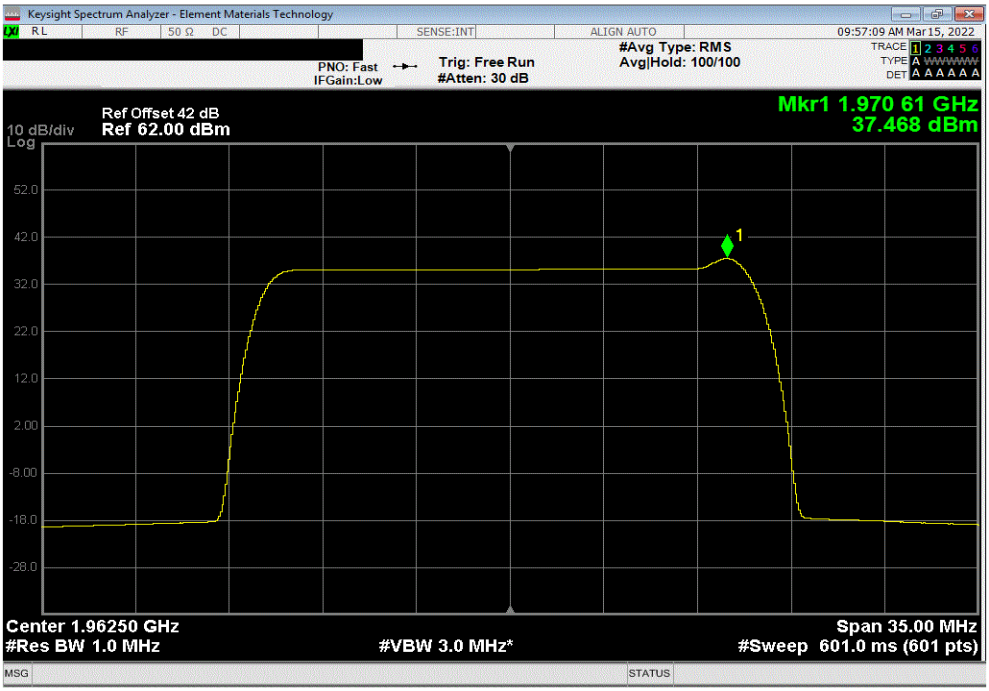
Port 1, Band 25, 1930 MHz - 1995 MHz, LTE, E-TM1.1 w N-TM Modulation, In-band, 10 MHz Bandwidth, Mid Channel, 1962.5 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	37.615	0		37.6	38.2	Pass



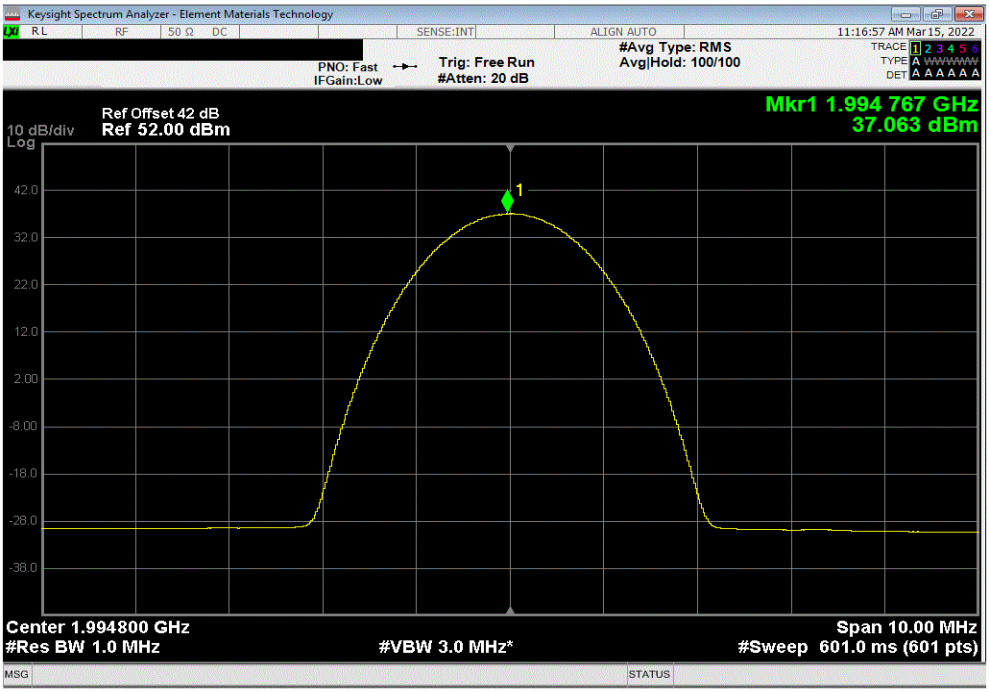
Port 1, Band 25, 1930 MHz - 1995 MHz, LTE, E-TM1.1 w N-TM Modulation, In-band, 15 MHz Bandwidth, Mid Channel, 1962.5 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	37.509	0		37.5	38.2	Pass



Port 1, Band 25, 1930 MHz - 1995 MHz, LTE, E-TM1.1 w N-TM Modulation, In-band, 20 MHz Bandwidth, Mid Channel, 1962.5 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	37.468	0		37.5	38.2	Pass



Port 1, Band 25, 1930 MHz - 1995 MHz, LTE, N-TM Modulation, Standalone, 200 kHz Bandwidth, High Channel, 1994.8 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	37.063	0		37.1	38.2	Pass



POWER SPECTRAL DENSITY - REDUCED POWER

TbtTx 2021.12.14.1 XMit 2022.02.07.0

EUT:	AHFII Remote Radio Head	Work Order:	NOKI0037
Serial Number:	YK214000036	Date:	16-Mar-22
Customer:	Nokia Solutions and Networks	Temperature:	21.9 °C
Attendees:	David Le, John Rattanavong	Humidity:	39.7% RH
Project:	None	Barometric Pres.:	1016 mbar
Tested by:	Brandon Hobbs	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 loses accounted for in the reference level offest including any attenuators, filters, and DC blocks. The carriers for LTE bandwidths: 200 kHz, 1.4 MHz, 3 MHz, 5 MHz, 10 MHz were reduced to demonstrate compliance with EIRP limits. The maximum Port 1 PSD level is 40.9 dBm/MHz for the calculated base station EIRP not to exceed the regulatory EIRP limit of 65.16 dBm/MHz. See the "Conducted Output Power Reduced Power" section for the required carrier power reductions.

DEVIATIONS FROM TEST STANDARD

None

Configuration #	2	Signature

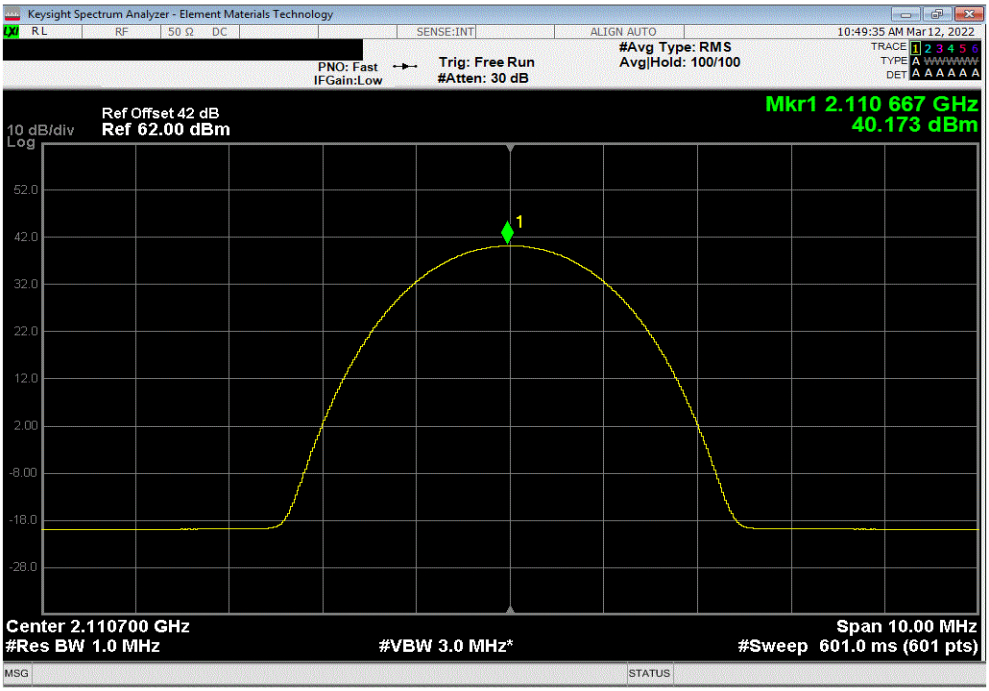
	Initial Value dBm/MHz == PSD	Duty Cycle	Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
Port 1, Band 66, 2110 MHz - 2200 MHz, LTE					
QPSK Modulation					
Single Carrier					
1.4 MHz Bandwidth					
Low Channel, 2110.7 MHz	40.173	0	40.2	40.9	Pass
16-QAM Modulation					
Single Carrier					
3 MHz Bandwidth					
Mid Channel, 2155 MHz	39.769	0	39.8	40.9	Pass
5 MHz Bandwidth					
Mid Channel, 2155 MHz	40.424	0	40.4	40.9	Pass
E-TM1.1 w N-TM Modulation					
In-band					
5 MHz Bandwidth					
Mid Channel, 2155 MHz	40.057	0	40.1	40.9	Pass
10 MHz Bandwidth					
Mid Channel, 2155 MHz	39.927	0	39.9	40.9	Pass
N-TM Modulation					
Standalone					
200 kHz Bandwidth					
High Channel, 2199.8 MHz	39.532	0	39.5	40.9	Pass

POWER SPECTRAL DENSITY - REDUCED POWER

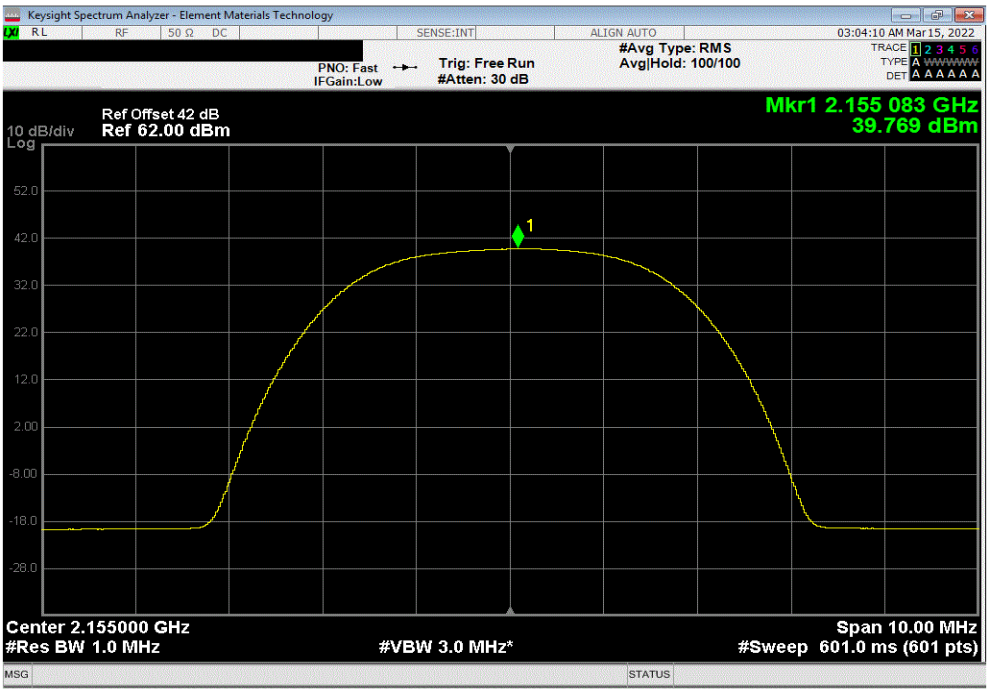
element

TbtTx 2021.12.14.1 XMit 2022.02.07.0

Port 1, Band 66, 2110 MHz - 2200 MHz, LTE, QPSK Modulation, Single Carrier, 1.4 MHz Bandwidth, Low Channel, 2110.7 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	40.173	0		40.2	40.9	Pass



Port 1, Band 66, 2110 MHz - 2200 MHz, LTE, 16-QAM Modulation, Single Carrier, 3 MHz Bandwidth, Mid Channel, 2155 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	39.769	0		39.8	40.9	Pass

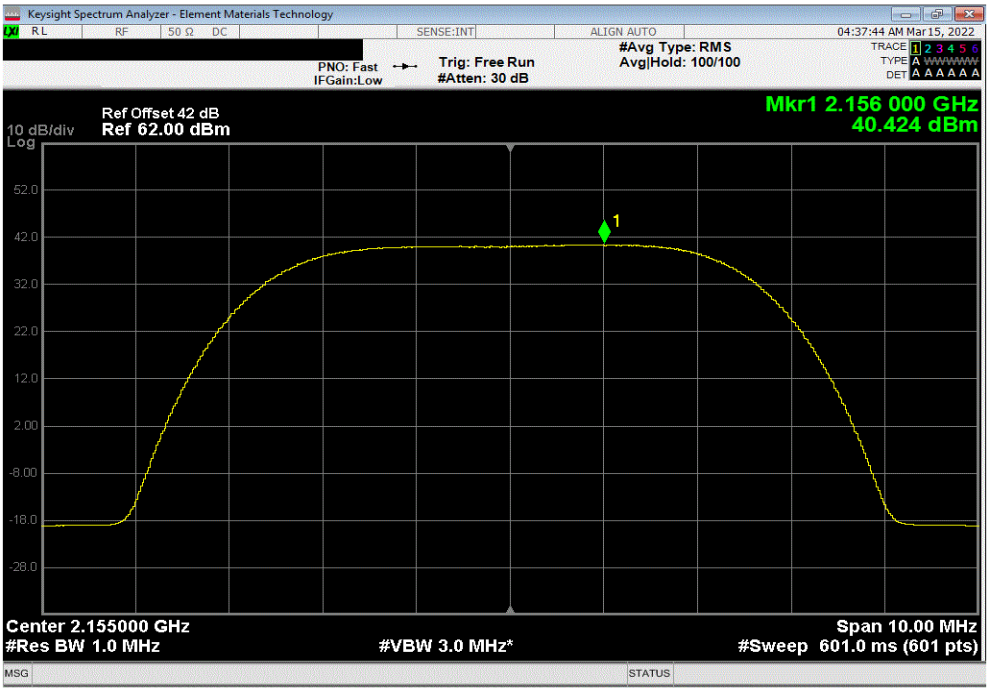


POWER SPECTRAL DENSITY - REDUCED POWER

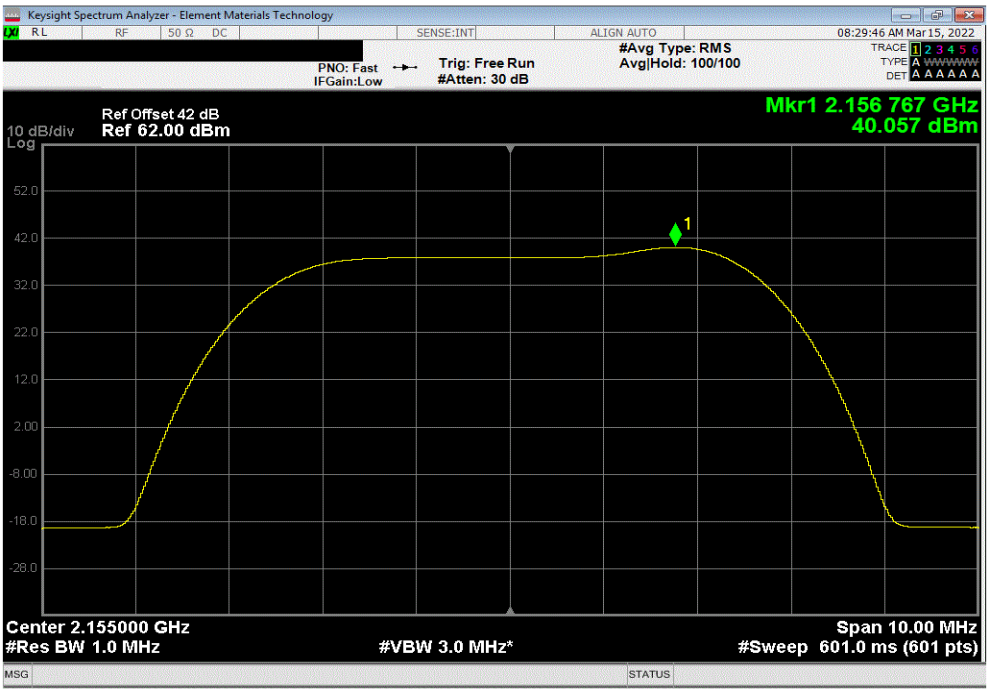
element

TbtTx 2021.12.14.1 XMit 2022.02.07.0

Port 1, Band 66, 2110 MHz - 2200 MHz, LTE, 16-QAM Modulation, Single Carrier, 5 MHz Bandwidth, Mid Channel, 2155 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	40.424	0		40.4	40.9	Pass



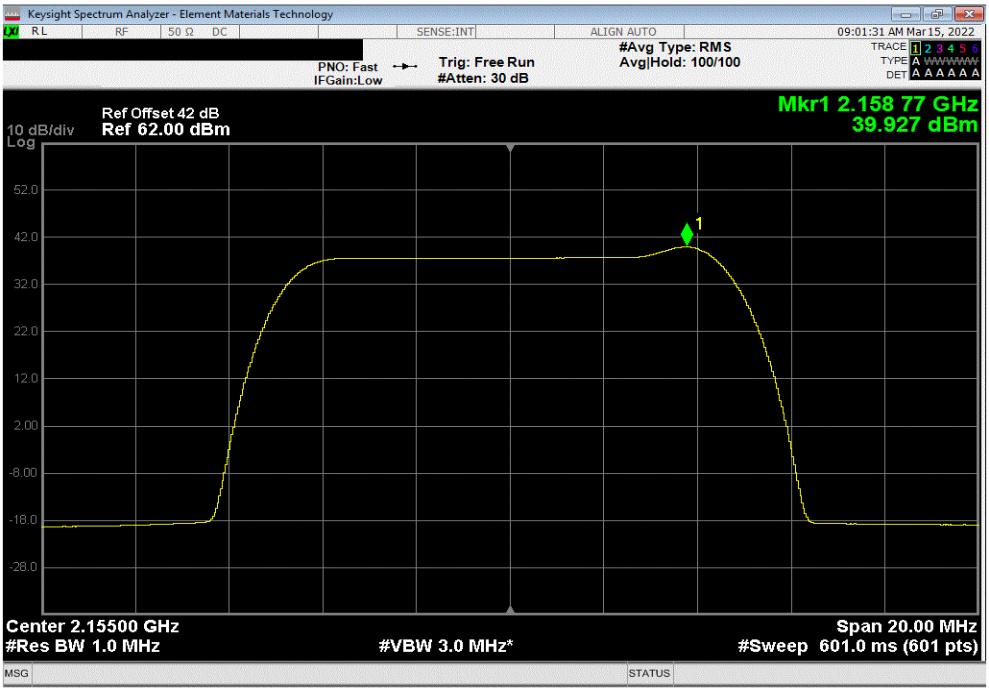
Port 1, Band 66, 2110 MHz - 2200 MHz, LTE, E-TM1.1 w N-TM Modulation, In-band, 5 MHz Bandwidth, Mid Channel, 2155 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	40.057	0		40.1	40.9	Pass



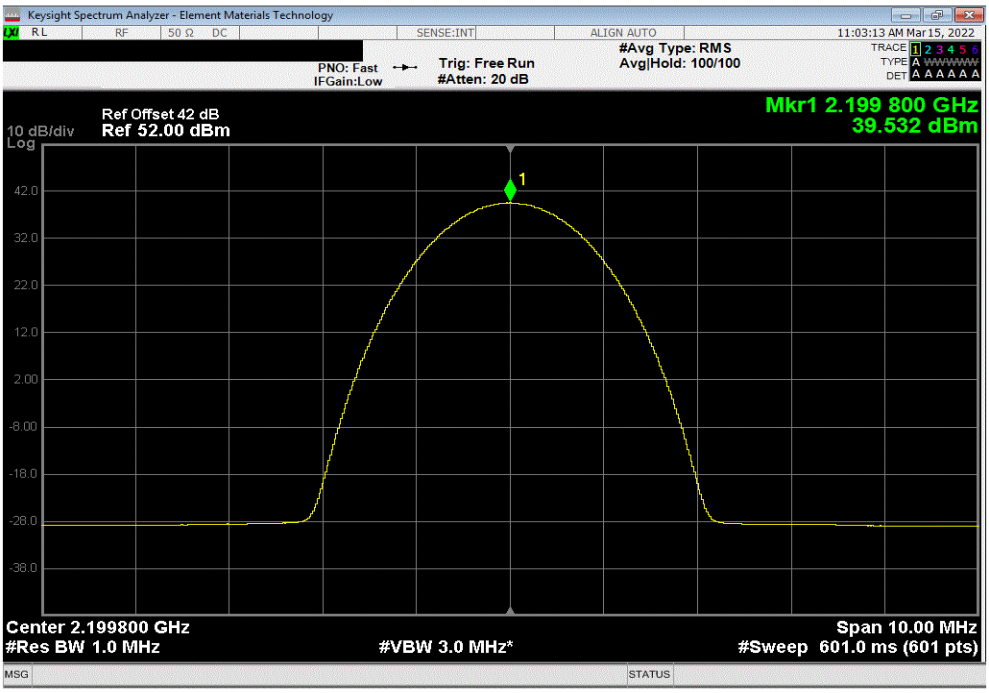
POWER SPECTRAL DENSITY - REDUCED POWER

TbtTx 2021.12.14.1 XMit 2022.02.07.0

Port 1, Band 66, 2110 MHz - 2200 MHz, LTE, E-TM1.1 w N-TM Modulation, In-band, 10 MHz Bandwidth, Mid Channel, 2155 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	39.927	0		39.9	40.9	Pass



Port 1, Band 66, 2110 MHz - 2200 MHz, LTE, N-TM Modulation, Standalone, 200 kHz Bandwidth, High Channel, 2199.8 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	39.532	0		39.5	40.9	Pass



POWER SPECTRAL DENSITY - REDUCED POWER

TbtTx 2021.12.14.1 XMit 2022.02.07.0

EUT:	AHFII Remote Radio Head	Work Order:	NOKI0037
Serial Number:	YK214000036	Date:	16-Mar-22
Customer:	Nokia Solutions and Networks	Temperature:	23 °C
Attendees:	David Le, John Rattanavong	Humidity:	38.2% RH
Project:	None	Barometric Pres.:	1016 mbar
Tested by:	Brandon Hobbs	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 loses accounted for in the reference level offest including any attenuators, filters, and DC blocks. The carriers for LTE bandwidths: 200 kHz, 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz were reduced to demonstrate compliance with EIRP limits. The maximum Port 1 PSD level is 37.9 dBm/MHz for the calculated base station EIRP not to exceed the regulatory EIRP limit of 62.15 dBm/MHz. See the "Conducted Output Power Reduced Power" section for the required carrier power reductions.

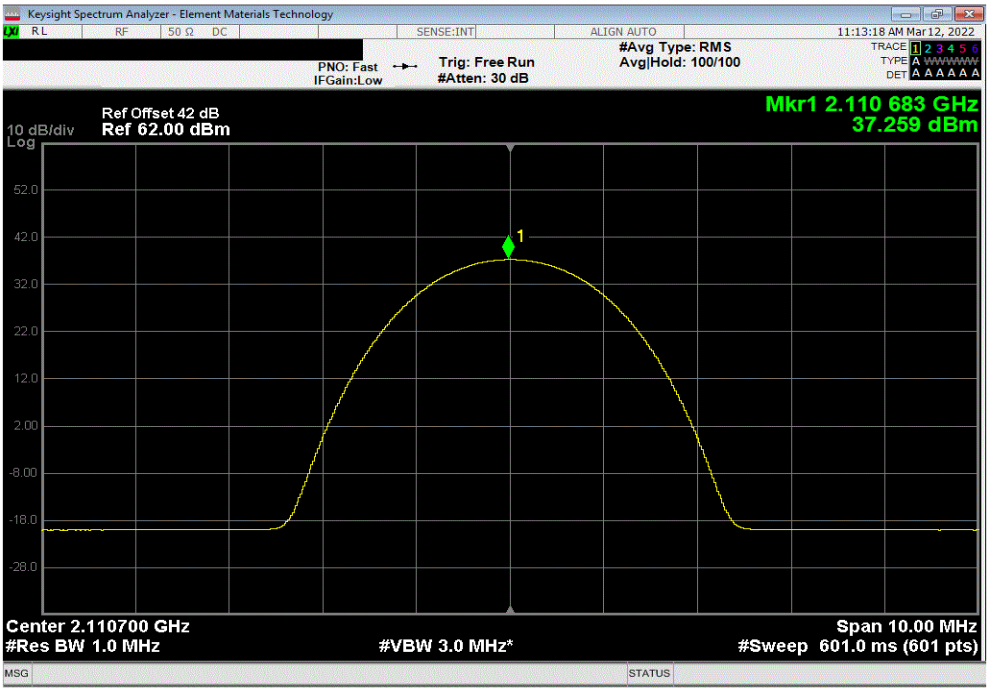
DEVIATIONS FROM TEST STANDARD

None

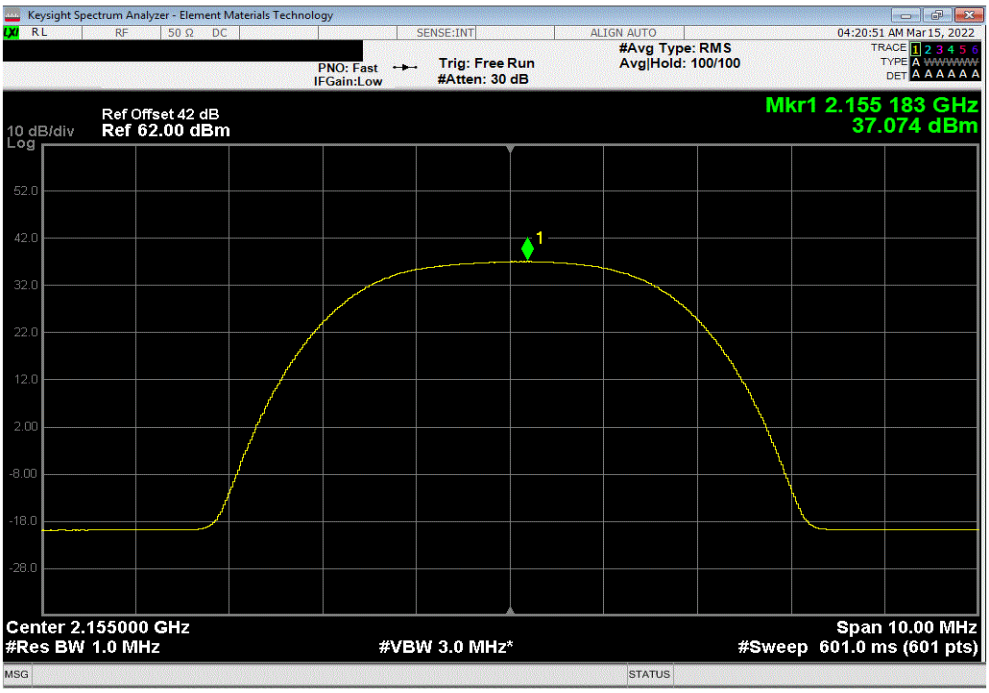
Configuration #	2	Signature

	Initial Value dBm/MHz == PSD	Duty Cycle	Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
Port 1, Band 66, 2110 MHz - 2200 MHz, LTE					
QPSK Modulation					
Single Carrier					
1.4 MHz Bandwidth					
Low Channel, 2110.7 MHz	37.259	0	37.3	37.9	Pass
16-QAM Modulation					
Single Carrier					
3 MHz Bandwidth					
Mid Channel, 2155 MHz	37.074	0	37.1	37.9	Pass
5 MHz Bandwidth					
Mid Channel, 2155 MHz	36.978	0	37.0	37.9	Pass
10 MHz Bandwidth					
Mid Channel, 2155 MHz	36.983	0	37.0	37.9	Pass
15 MHz Bandwidth					
Mid Channel, 2155 MHz	36.675	0	36.7	37.9	Pass
E-TM1.1 w N-TM Modulation					
Guard Band					
10 MHz Bandwidth					
Mid Channel, 2155 MHz	36.988	0	37.0	37.9	Pass
15 MHz Bandwidth					
Mid Channel, 2155 MHz	37.083	0	37.1	37.9	Pass
In-band					
5 MHz Bandwidth					
Mid Channel, 2155 MHz	37.089	0	37.1	37.9	Pass
10 MHz Bandwidth					
Mid Channel, 2155 MHz	37.181	0	37.2	37.9	Pass
15 MHz Bandwidth					
Mid Channel, 2155 MHz	36.971	0	37.0	37.9	Pass
20 MHz Bandwidth					
Mid Channel, 2155 MHz	36.778	0	36.8	37.9	Pass
N-TM Modulation					
Standalone					
200 kHz Bandwidth					
High Channel, 2199.8 MHz	36.715	0	36.7	37.9	Pass

Port 1, Band 66, 2110 MHz - 2200 MHz, LTE, QPSK Modulation, Single Carrier, 1.4 MHz Bandwidth, Low Channel, 2110.7 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	37.259	0		37.3	37.9	Pass



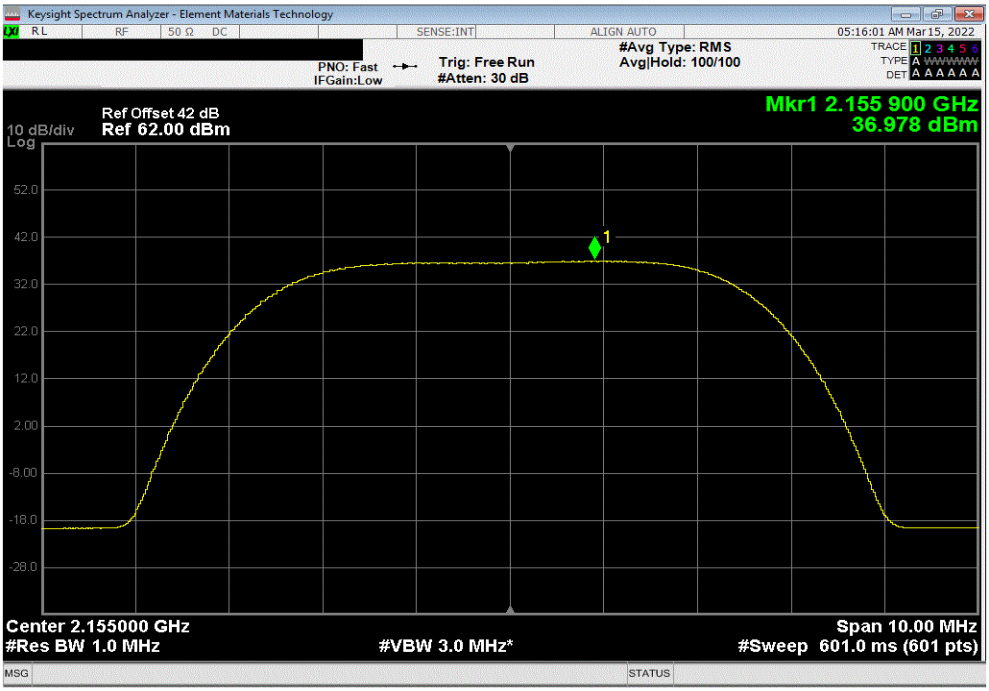
Port 1, Band 66, 2110 MHz - 2200 MHz, LTE, 16-QAM Modulation, Single Carrier, 3 MHz Bandwidth, Mid Channel, 2155 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	37.074	0		37.1	37.9	Pass



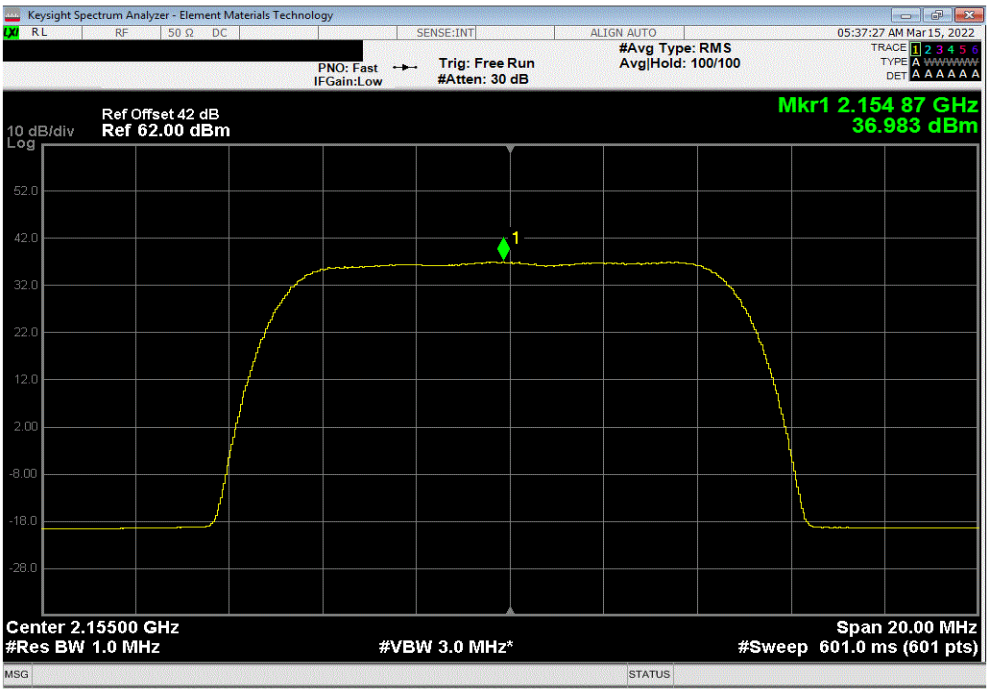
POWER SPECTRAL DENSITY - REDUCED POWER

TbtTx 2021.12.14.1 XMit 2022.02.07.0

Port 1, Band 66, 2110 MHz - 2200 MHz, LTE, 16-QAM Modulation, Single Carrier, 5 MHz Bandwidth, Mid Channel, 2155 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	36.978	0		37.0	37.9	Pass



Port 1, Band 66, 2110 MHz - 2200 MHz, LTE, 16-QAM Modulation, Single Carrier, 10 MHz Bandwidth, Mid Channel, 2155 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	36.983	0		37.0	37.9	Pass

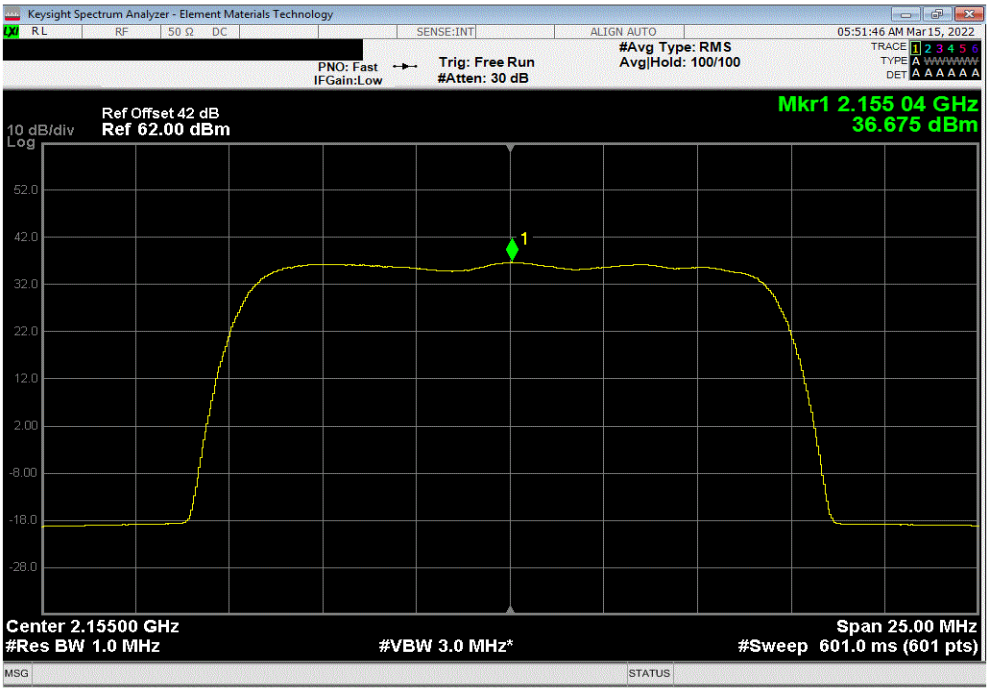


POWER SPECTRAL DENSITY - REDUCED POWER

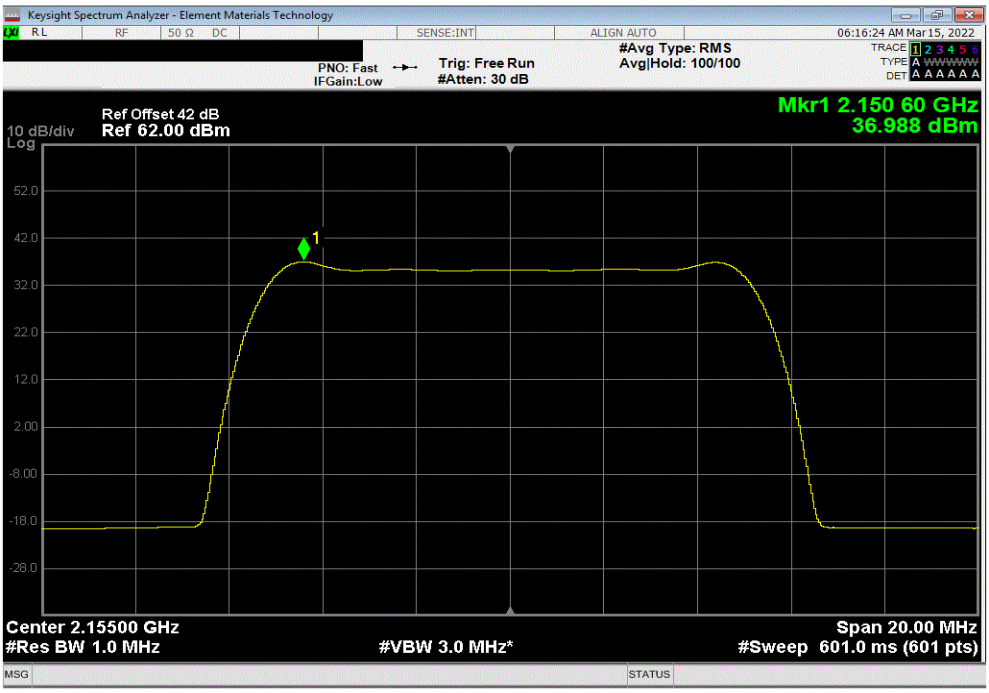
element

TbtTx 2021.12.14.1 XMit 2022.02.07.0

Port 1, Band 66, 2110 MHz - 2200 MHz, LTE, 16-QAM Modulation, Single Carrier, 15 MHz Bandwidth, Mid Channel, 2155 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	36.675	0		36.7	37.9	Pass



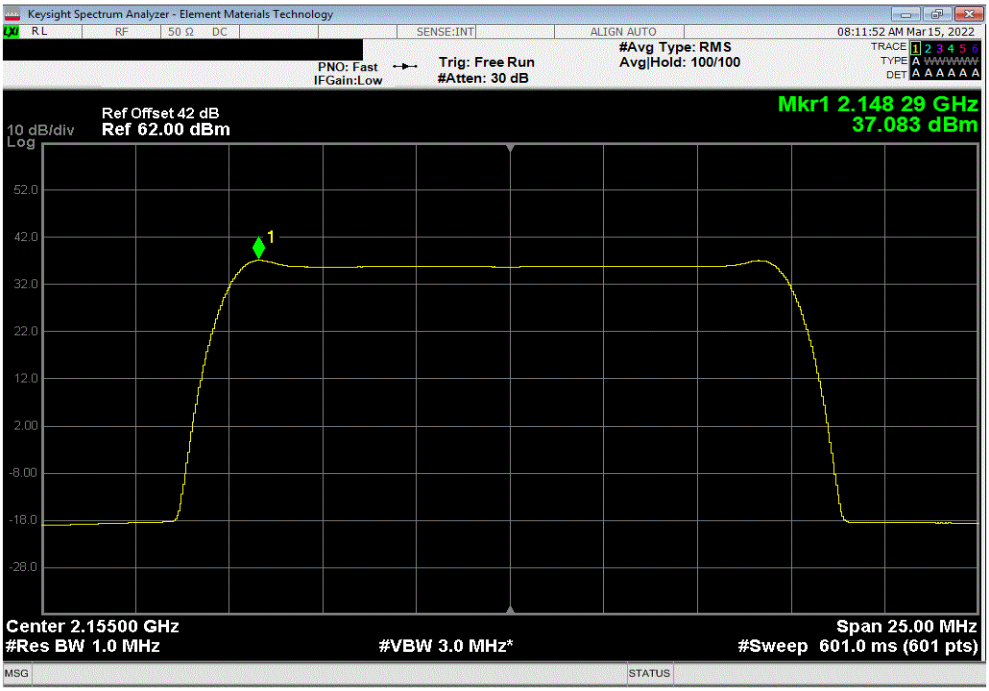
Port 1, Band 66, 2110 MHz - 2200 MHz, LTE, E-TM1.1 w N-TM Modulation, Guard Band, 10 MHz Bandwidth, Mid Channel, 2155 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	36.988	0		37.0	37.9	Pass



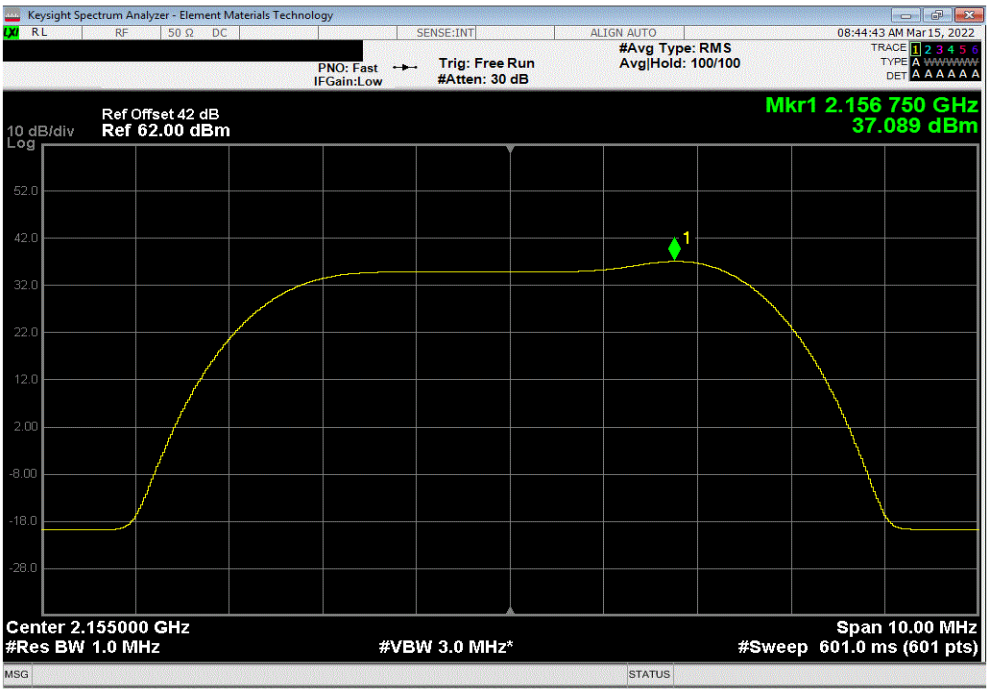
POWER SPECTRAL DENSITY - REDUCED POWER

TbtTx 2021.12.14.1 XMit 2022.02.07.0

Port 1, Band 66, 2110 MHz - 2200 MHz, LTE, E-TM1.1 w N-TM Modulation, Guard Band, 15 MHz Bandwidth, Mid Channel, 2155 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	37.083	0		37.1	37.9	Pass



Port 1, Band 66, 2110 MHz - 2200 MHz, LTE, E-TM1.1 w N-TM Modulation, In-band, 5 MHz Bandwidth, Mid Channel, 2155 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	37.089	0		37.1	37.9	Pass

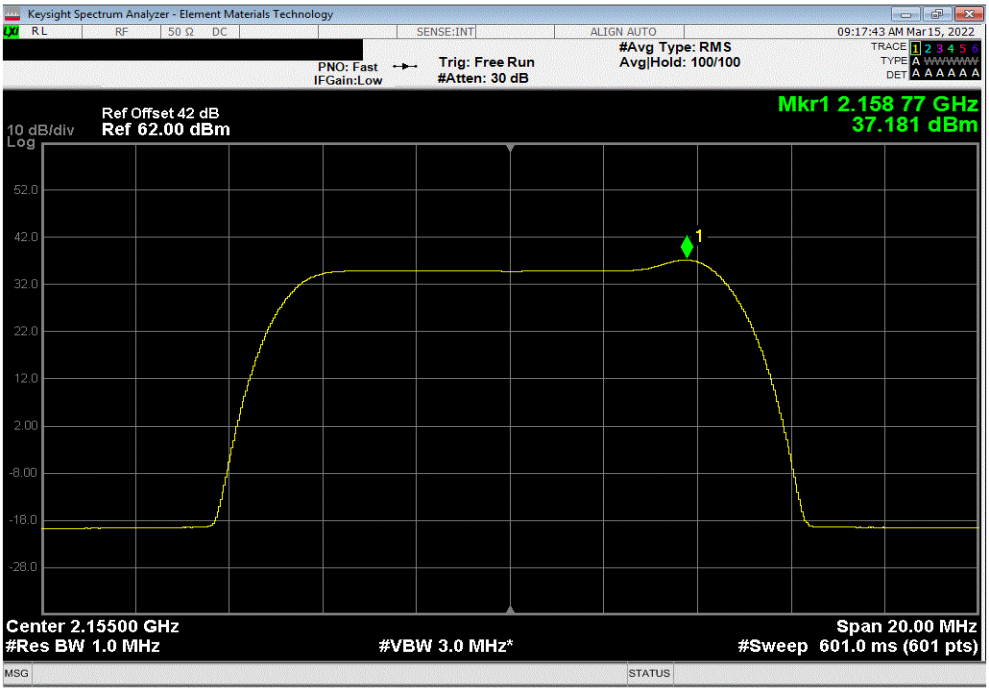


POWER SPECTRAL DENSITY - REDUCED POWER

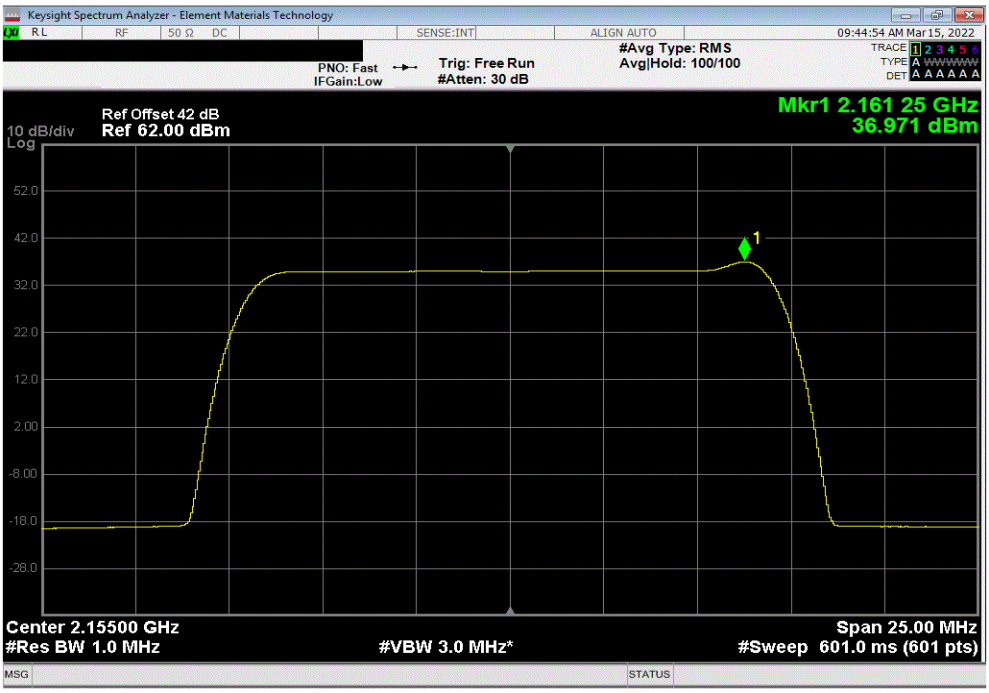
element

TbtTx 2021.12.14.1 XMit 2022.02.07.0

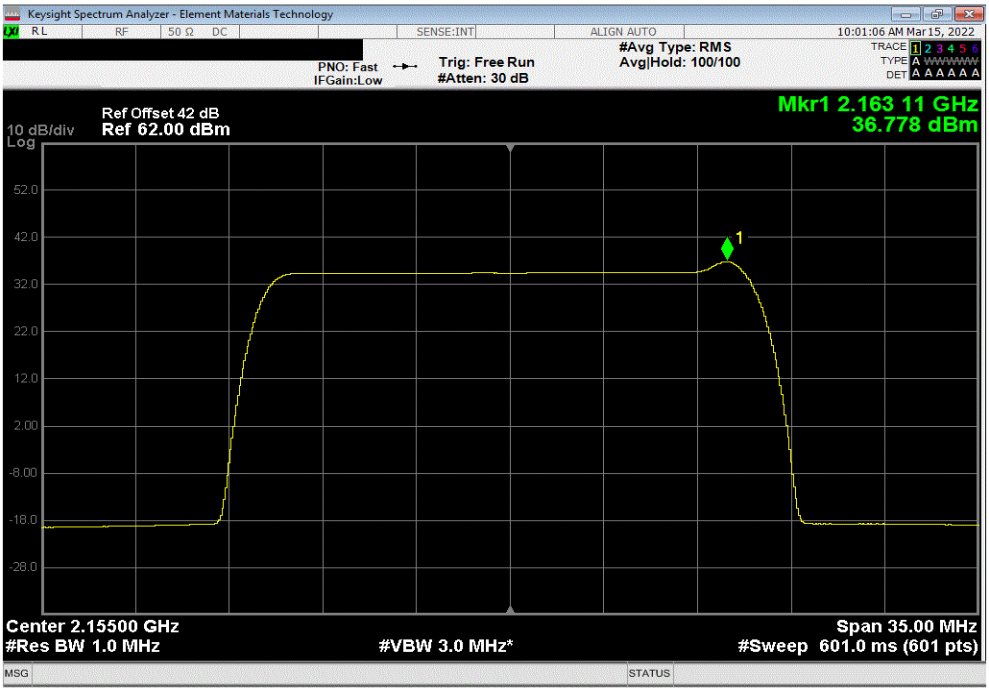
Port 1, Band 66, 2110 MHz - 2200 MHz, LTE, E-TM1.1 w N-TM Modulation, In-band, 10 MHz Bandwidth, Mid Channel, 2155 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	37.181	0		37.2	37.9	Pass



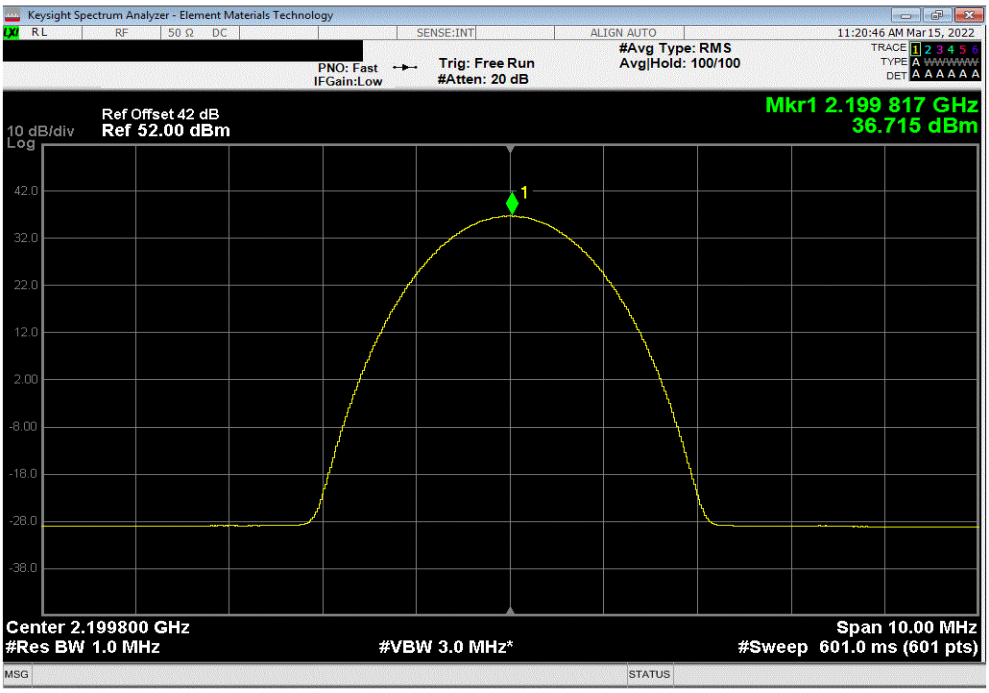
Port 1, Band 66, 2110 MHz - 2200 MHz, LTE, E-TM1.1 w N-TM Modulation, In-band, 15 MHz Bandwidth, Mid Channel, 2155 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	36.971	0		37.0	37.9	Pass



Port 1, Band 66, 2110 MHz - 2200 MHz, LTE, E-TM1.1 w N-TM Modulation, In-band, 20 MHz Bandwidth, Mid Channel, 2155 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	36.778	0		36.8	37.9	Pass



Port 1, Band 66, 2110 MHz - 2200 MHz, LTE, N-TM Modulation, Standalone, 200 kHz Bandwidth, High Channel, 2199.8 MHz						
	Initial Value dBm/MHz == PSD	Duty Cycle		Single Port dBm/MHz == PSD	Limit (dBm/MHz)	Results
	36.715	0		36.7	37.9	Pass



End of Test Report