BAND EDGE COMPLIANCE

XMit 2019.09.05

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	19-Mar-19	19-Mar-20
Generator - Signal	Keysight	N5171B-506	TEW	2-May-18	2-May-21

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The spurious RF conducted emissions at the edges of the authorized bands were measured with the EUT set to low and high transmit frequencies in the available band. The channels closest to the band edges were selected. The EUT was transmitting at the data rate(s) listed in the datasheet.

The spectrum was scanned below the lower band edge and above the higher band edge.

All limits were adjusted by a factor of [-10*log(16)] dB to account for the device operation as a 16 port MIMO transmitter, as per FCC KDB 622911.

Per FCC 27.53(h)(1), RSS-139 6.6 and RSS-170 5.4 & 5.4.1.2, the power of any emission outside of the authorized operating frequency range cannot exceed -13 dBm. The limit is adjusted to -25 dBm [-13 dBm -10 log (16)] per FCC KDB 662911D01 v02r01 because the BTS may operate as a 16 port MIMO transmitter.

Per FCC 27.53(h)(3), RSS-139 6.6 and RSS-170 5.4, emissions seen up to 1 MHz outside of authorized operating frequency range band edges shall be measured with a RBW of 1% of the measured emission bandwidth. Any emission seen to be > 1 MHz further outside the band edges shall be measured with a RBW of 1 MHz. However, a narrower RBW of at least 1% of the emission bandwidth is still allowed provided that the measured power is integrated over the full reference bandwidth of 1 MHz.

BAND EDGE COMPLIANCE

XMit 2019.09.05

EUT:	AAIB			Work Order:	NOKI0006
Serial Number:	YK183800029			Date:	30-Jan-20
Customer:	Nokia Solutions and Networks			Temperature:	22 °C
Attendees:	Mitch Hill, John Rattanavong			Humidity:	33.6% RH
Project:	None			Barometric Pres.:	1013 mbar
Tested by:	Willie Love, Brandon Hobbs	Power:	54VDC	Job Site:	TX09

TEST SPECIFICATIONS	Test Method
FCC 27:2020	ANSI C63.26:2015
RSS-139:2015, RSS-170:2015	RSS-Gen:2019

COMMENTS

All losses in the measurement path were accounted for. The highest power port operating at maximum power was used for these measurements. The highest power port was determined by measuring the average power on each of the 16 antenna ports using a 10 MHz channel bandwidth at the middle channel shown elsewhere in the report.

DEVIATIONS FROM TEST STANDARD

None

Configuration #	1	Signature

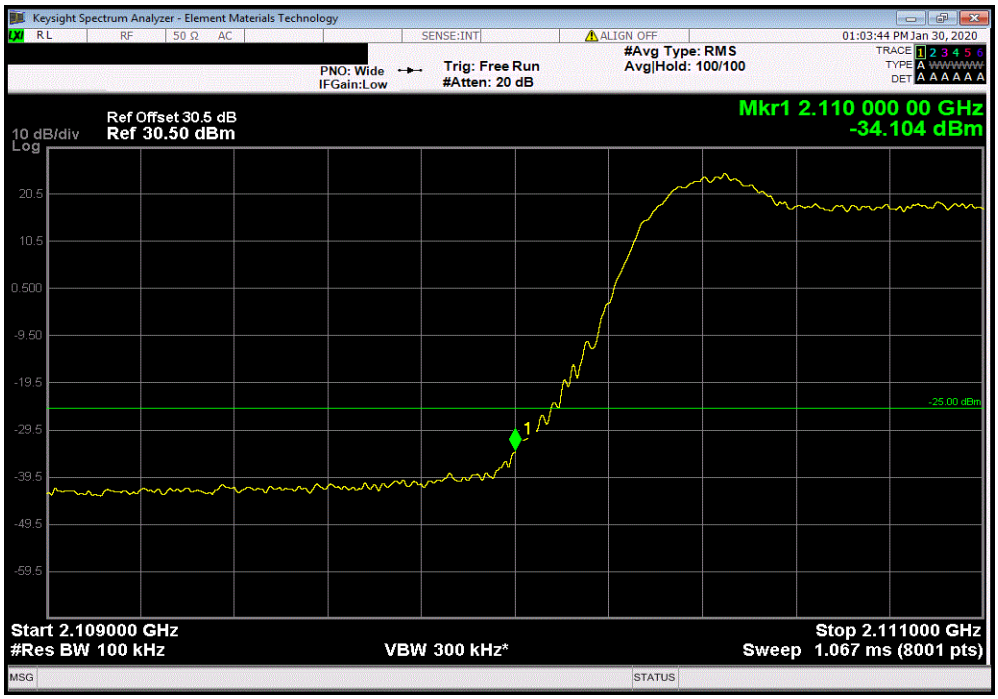
				Value	Limit	Result
Band 66 (Single Carrier) Port 2						
	10 MHz					
		NB-IoT				
			Low Channel, 2115 MHz			
			Low Channel Range 1 (2.111 GHz - 2.109 GHz)	-34.1	-25	Pass
			Low Channel Range 2 (2.109 GHz - 2.108 GHz)	-33.6	-25	Pass
			Low Channel Range 3 (2.108 GHz - 2.088 GHz)	-32.9	-25	Pass
			High Channel, 2195 MHz			
			High Channel Range 1 (2.19 GHz - 2.201 GHz)	-33.6	-25	Pass
			High Channel Range 2 (2.201 GHz - 2.202 GHz)	-32.7	-25	Pass
			High Channel Range 3 (2.202 GHz - 2.222 GHz)	-31.8	-25	Pass
	15 MHz					
		NB-IoT				
			Low Channel, 2117.5 MHz			
			Low Channel Range 1 (2.111 GHz - 2.109 GHz)	-32.6	-25	Pass
			Low Channel Range 2 (2.109 GHz - 2.108 GHz)	-33.9	-25	Pass
			Low Channel Range 3 (2.108 GHz - 2.088 GHz)	-33.0	-25	Pass
			High Channel, 2192.5 MHz			
			High Channel Range 1 (2.19 GHz - 2.201 GHz)	-33.2	-25	Pass
			High Channel Range 2 (2.201 GHz - 2.202 GHz)	-33.0	-25	Pass
			High Channel Range 3 (2.202 GHz - 2.222 GHz)	-32.6	-25	Pass
	20 MHz					
		NB-IoT				
			Low Channel, 2120 MHz			
			Low Channel Range 1 (2.111 GHz - 2.109 GHz)	-35.3	-25	Pass
			Low Channel Range 2 (2.109 GHz - 2.108 GHz)	-34.4	-25	Pass
			Low Channel Range 3 (2.108 GHz - 2.088 GHz)	-33.2	-25	Pass
			High Channel, 2190 MHz			
			High Channel Range 1 (2.19 GHz - 2.201 GHz)	-35.1	-25	Pass
			High Channel Range 2 (2.201 GHz - 2.202 GHz)	-33.7	-25	Pass
			High Channel Range 3 (2.202 GHz - 2.222 GHz)	-32.7	-25	Pass

BAND EDGE COMPLIANCE

XMit 2019.09.05

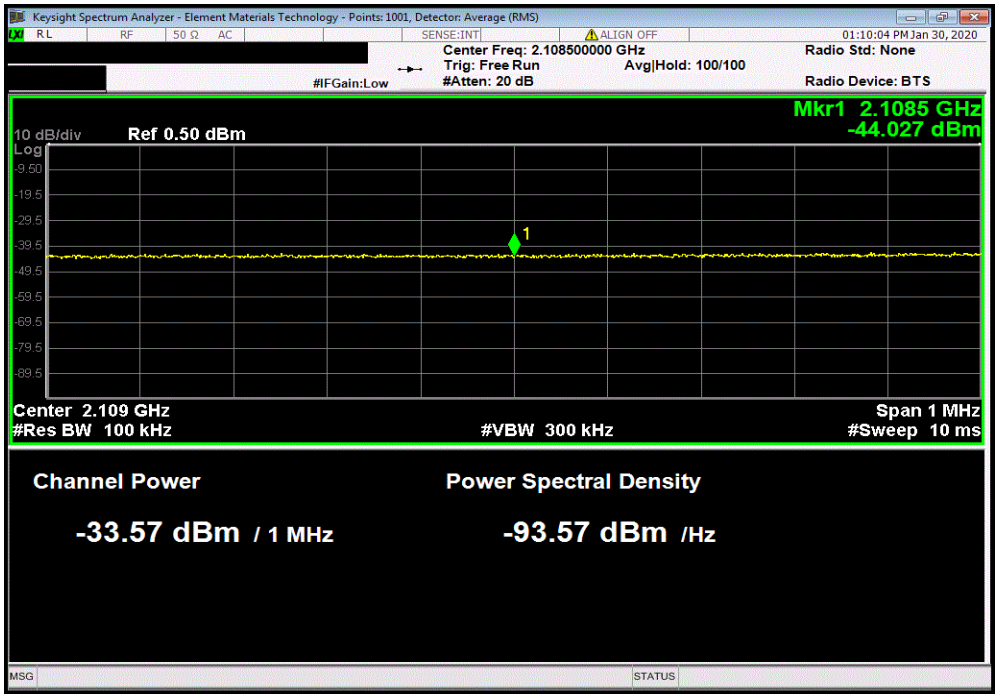
Band 66 (Single Carrier) Port 2, 10 MHz, NB-IoT, Low Channel, 2115 MHz, Low Channel Range 1 (2.111 GHz - 2.109 GHz)

				Value	Limit	Result
				-34.104	-25	Pass



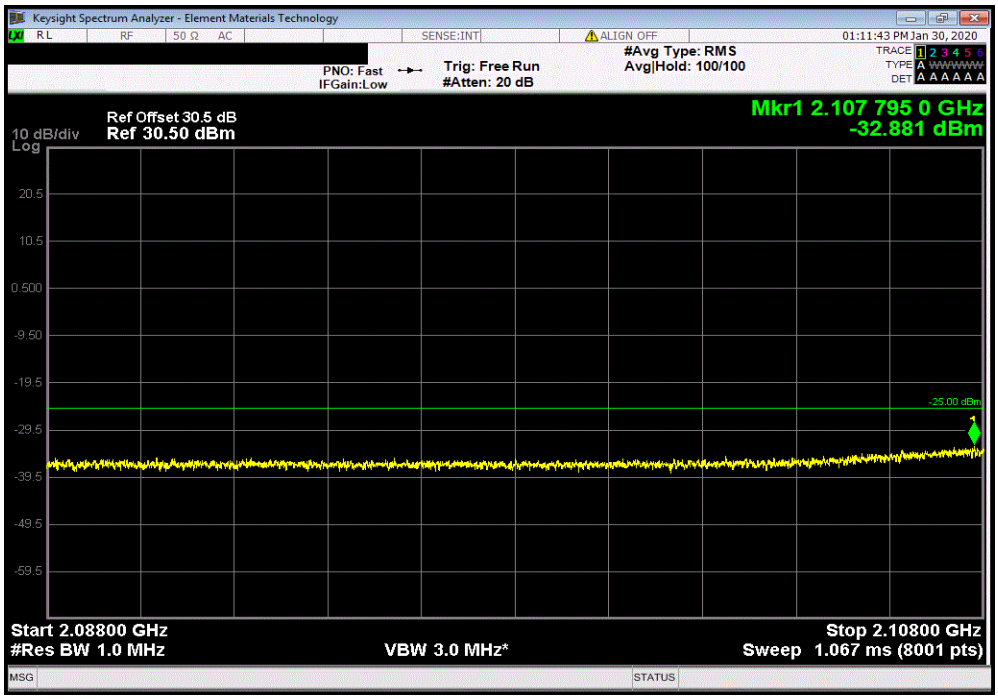
Band 66 (Single Carrier) Port 2, 10 MHz, NB-IoT, Low Channel, 2115 MHz, Low Channel Range 2 (2.109 GHz - 2.108 GHz)

				Value	Limit	Result
				-33.57	-25	Pass



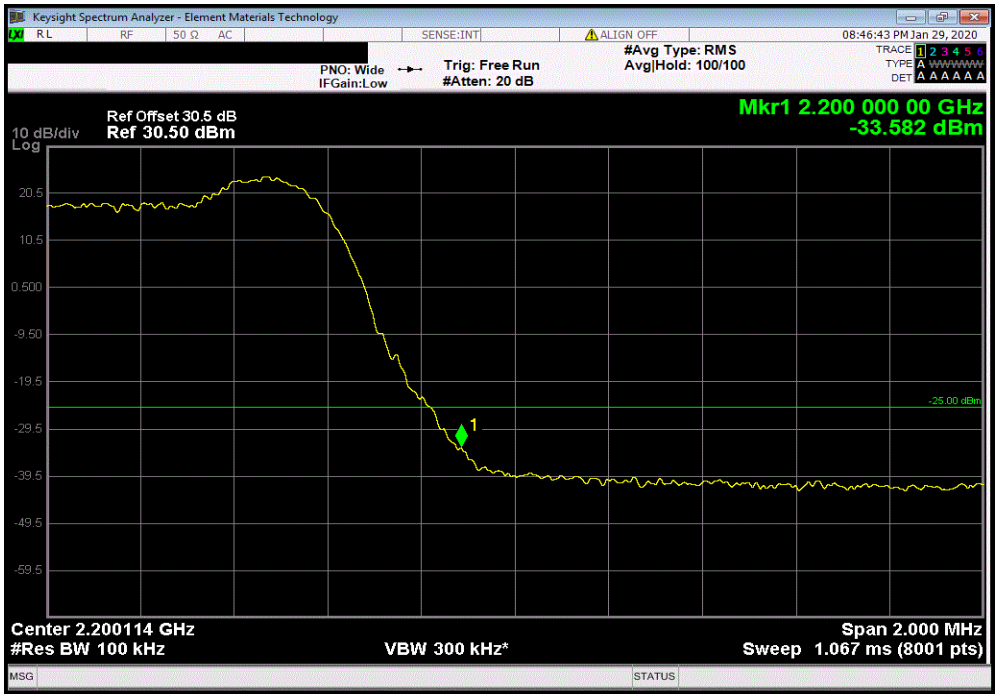
Band 66 (Single Carrier) Port 2, 10 MHz, NB-IoT, Low Channel, 2115 MHz, Low Channel Range 3 (2.108 GHz - 2.088 GHz)

				Value	Limit	Result
				-32.881	-25	Pass



Band 66 (Single Carrier) Port 2, 10 MHz, NB-IoT, High Channel, 2195 MHz, High Channel Range 1 (2.19 GHz - 2.201 GHz)

				Value	Limit	Result
				-33.582	-25	Pass

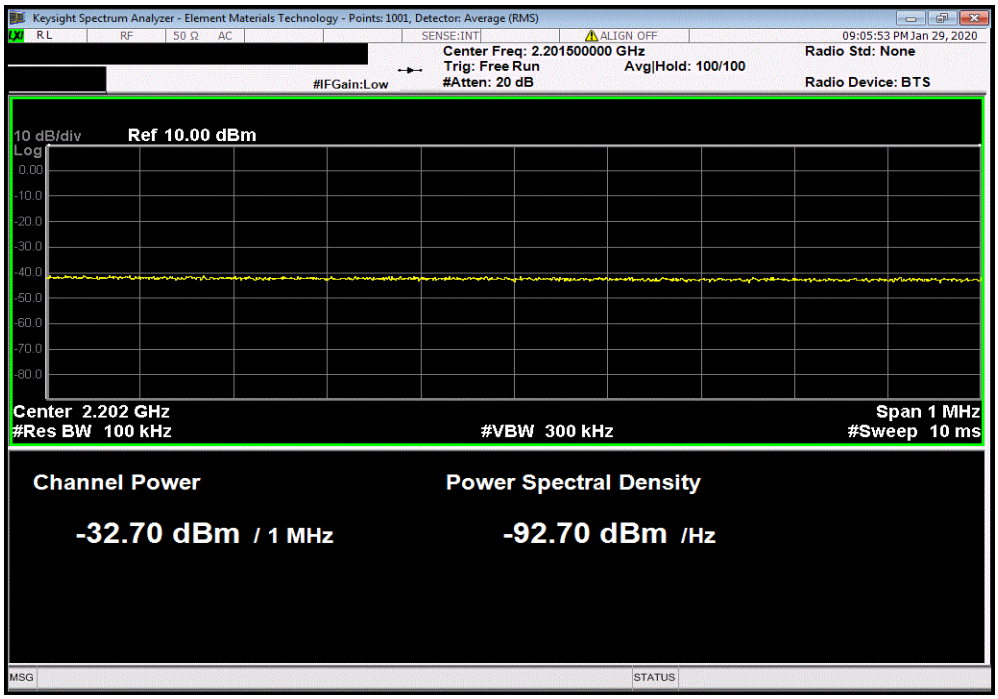


BAND EDGE COMPLIANCE

XMit 2019.09.05

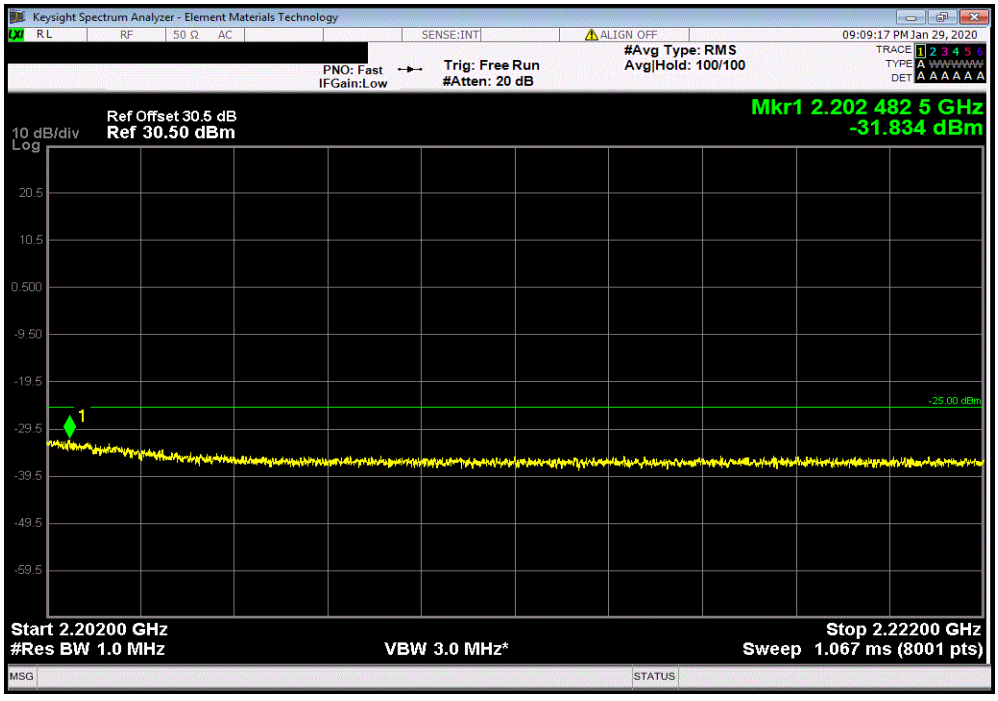
Band 66 (Single Carrier) Port 2, 10 MHz, NB-IoT, High Channel, 2195 MHz, High Channel Range 2 (2.201 GHz - 2.202 GHz)

				Value	Limit	Result
				-32.7	-25	Pass



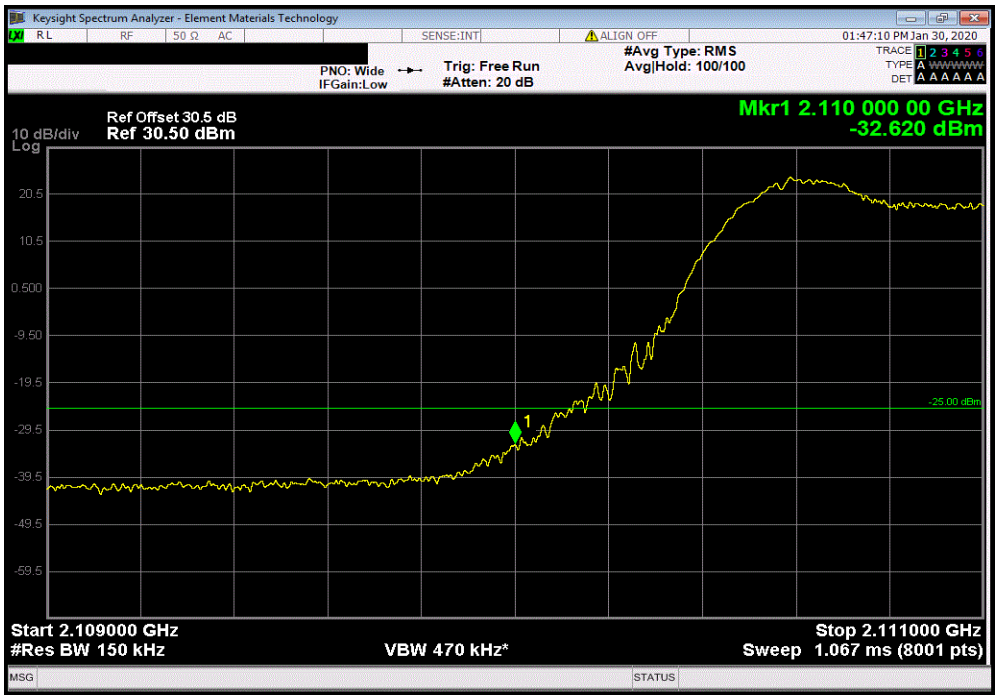
Band 66 (Single Carrier) Port 2, 10 MHz, NB-IoT, High Channel, 2195 MHz, High Channel Range 3 (2.202 GHz - 2.222 GHz)

				Value	Limit	Result
				-31.834	-25	Pass



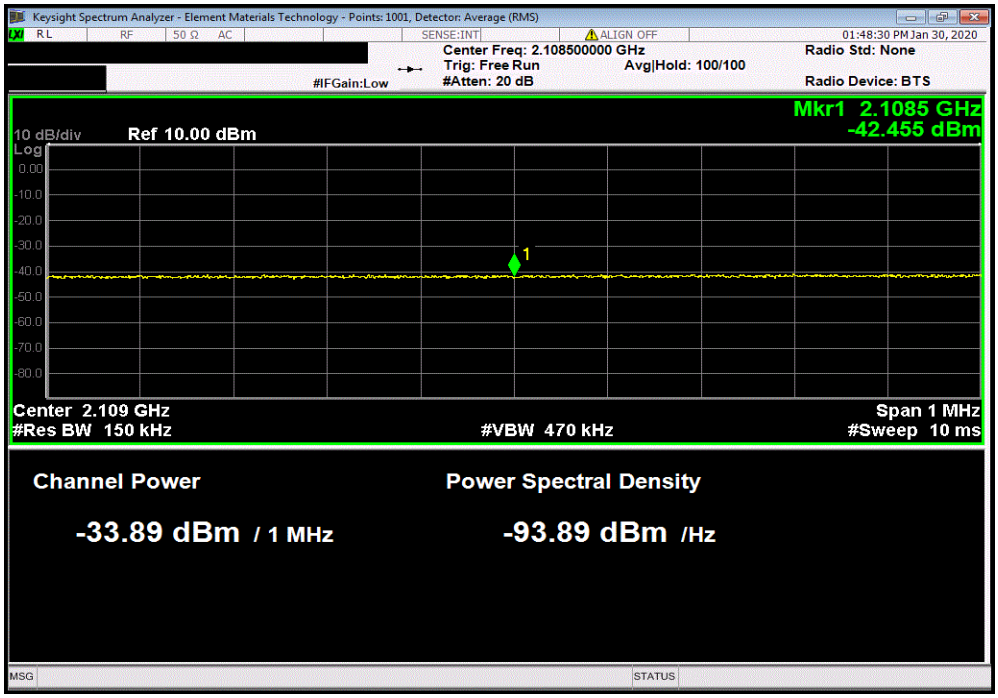
Band 66 (Single Carrier) Port 2, 15 MHz, NB-IoT, Low Channel, 2117.5 MHz, Low Channel Range 1 (2.111 GHz - 2.109 GHz)

				Value	Limit	Result
				-32.62	-25	Pass



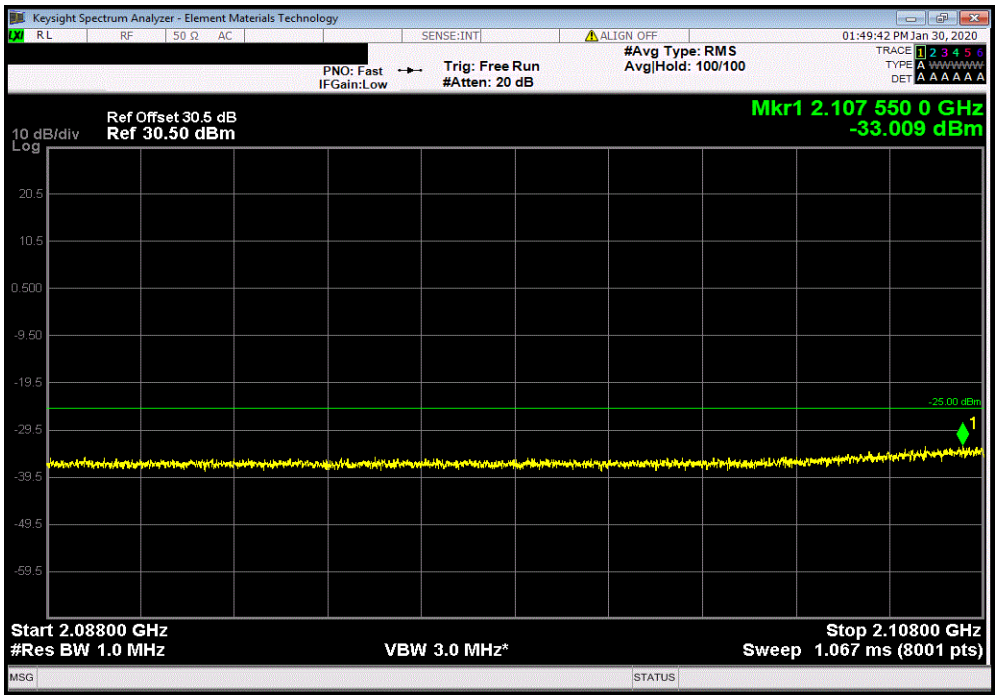
Band 66 (Single Carrier) Port 2, 15 MHz, NB-IoT, Low Channel, 2117.5 MHz, Low Channel Range 2 (2.109 GHz - 2.108 GHz)

				Value	Limit	Result
				-33.89	-25	Pass



Band 66 (Single Carrier) Port 2, 15 MHz, NB-IoT, Low Channel, 2117.5 MHz, Low Channel Range 3 (2.108 GHz - 2.088 GHz)

				Value	Limit	Result
				-33	-25	Pass

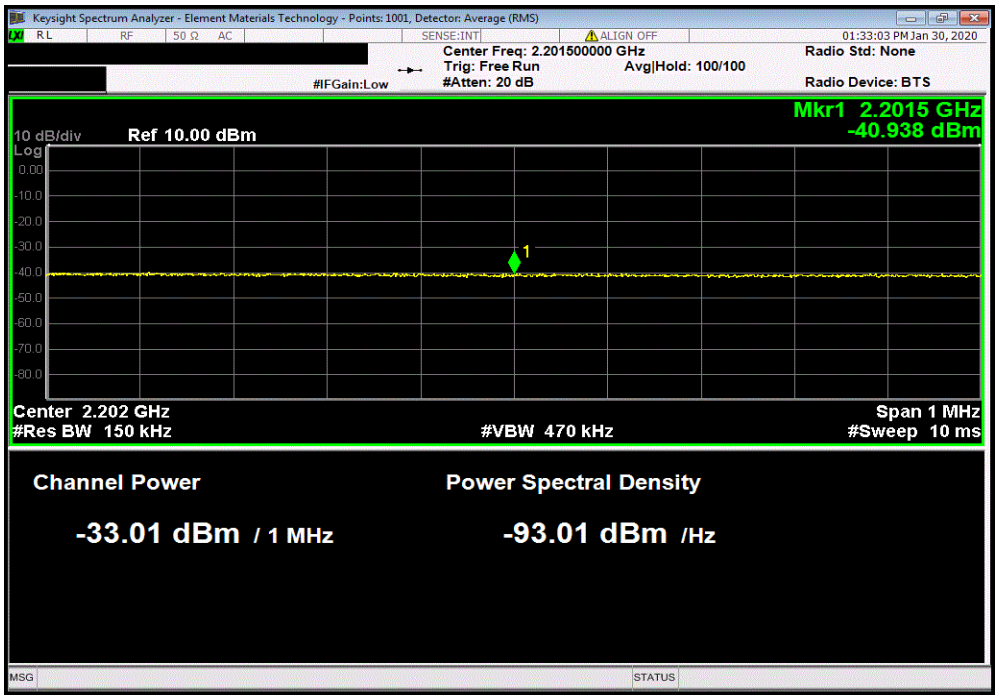


Band 66 (Single Carrier) Port 2, 15 MHz, NB-IoT, High Channel, 2192.5 MHz, High Channel Range 1 (2.19 GHz - 2.201 GHz)

				Value	Limit	Result
				-33.161	-25	Pass

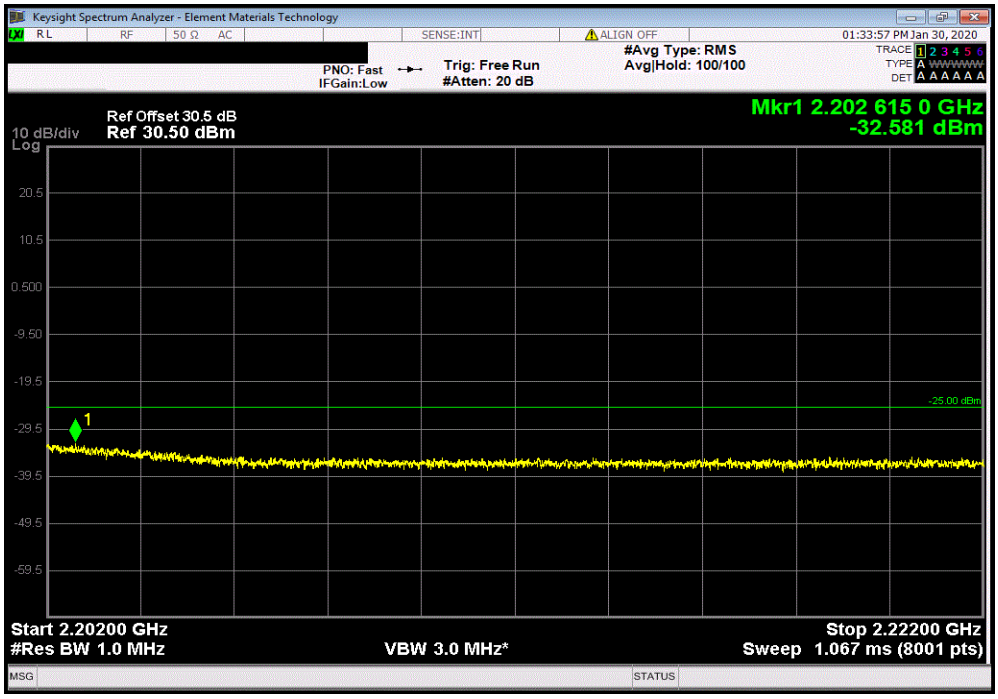
Band 66 (Single Carrier) Port 2, 15 MHz, NB-IoT, High Channel, 2192.5 MHz, High Channel Range 2 (2.201 GHz - 2.202 GHz)

				Value	Limit	Result
				-33.01	-25	Pass



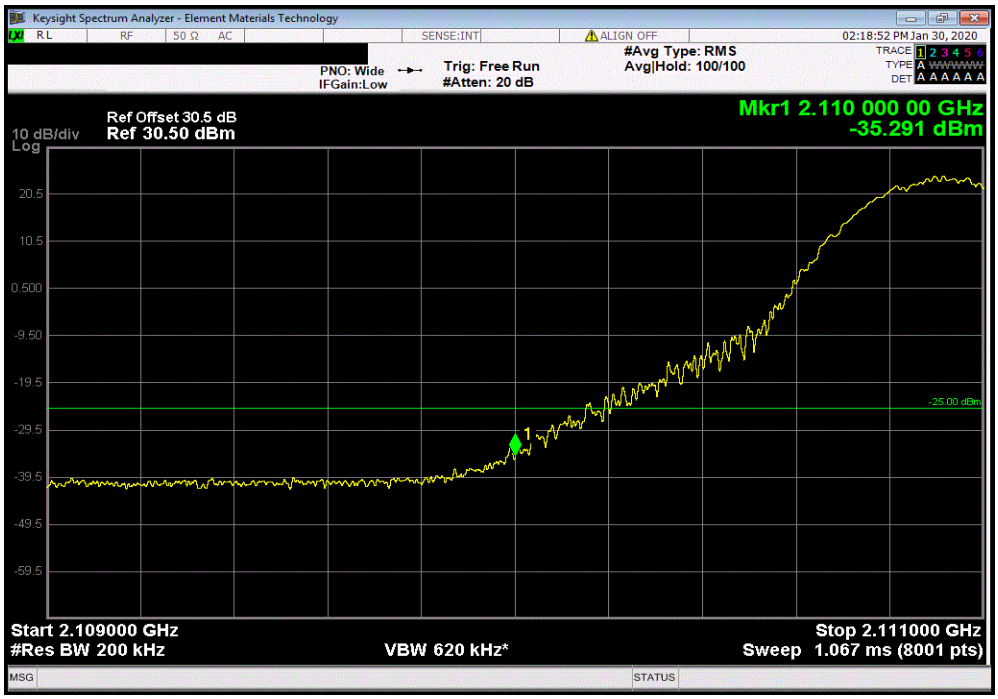
Band 66 (Single Carrier) Port 2, 15 MHz, NB-IoT, High Channel, 2192.5 MHz, High Channel Range 3 (2.202 GHz - 2.222 GHz)

				Value	Limit	Result
				-32.581	-25	Pass



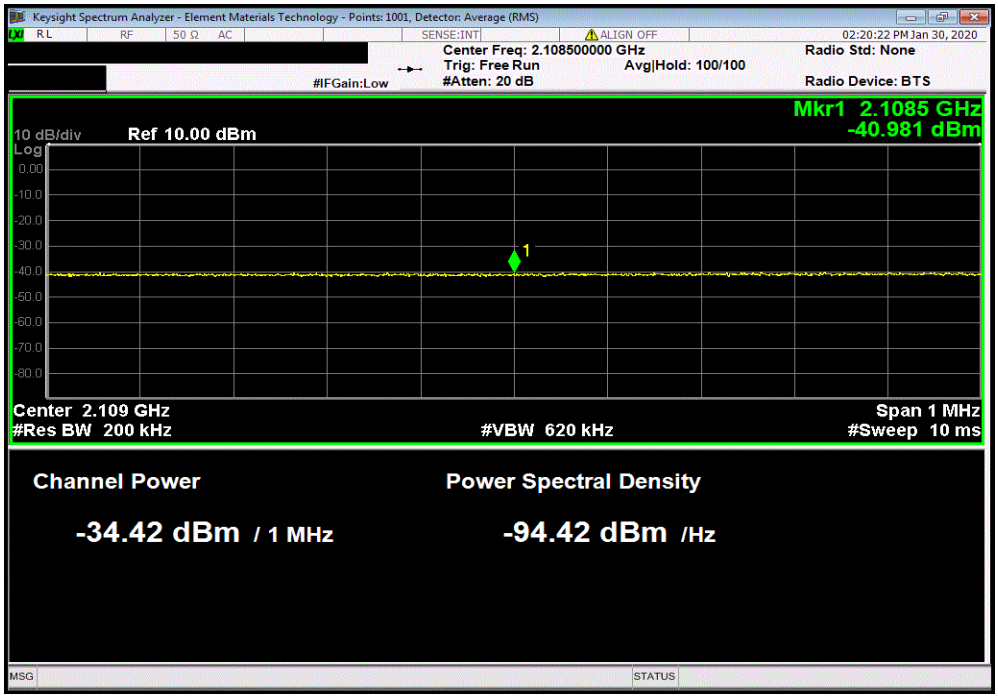
Band 66 (Single Carrier) Port 2, 20 MHz, NB-IoT, Low Channel, 2120 MHz, Low Channel Range 1 (2.111 GHz - 2.109 GHz)

				Value	Limit	Result
				-35.291	-25	Pass



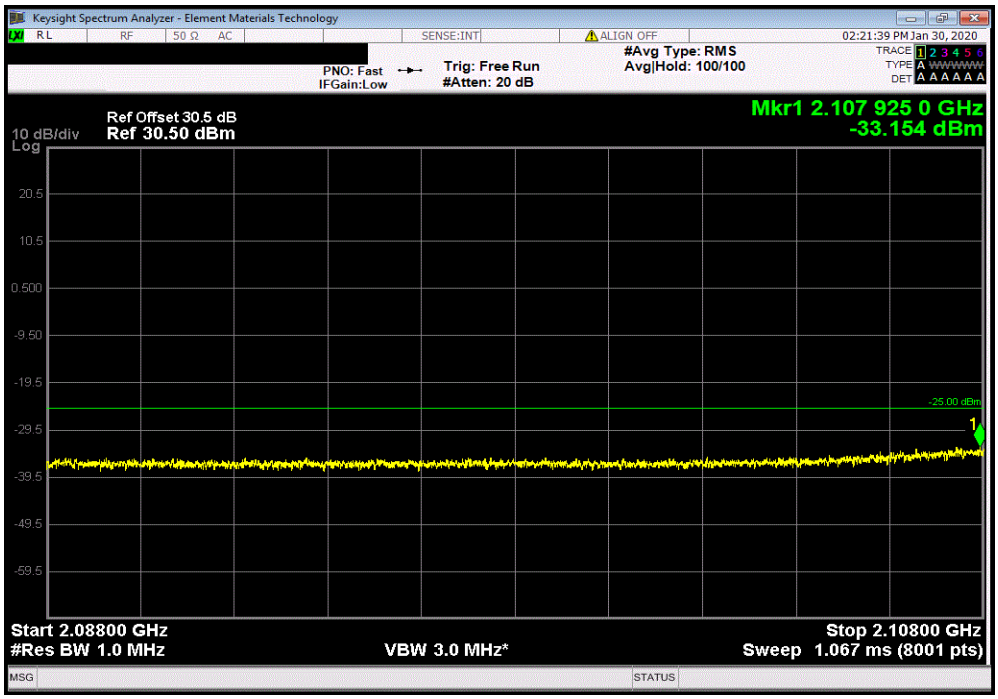
Band 66 (Single Carrier) Port 2, 20 MHz, NB-IoT, Low Channel, 2120 MHz, Low Channel Range 2 (2.109 GHz - 2.108 GHz)

				Value	Limit	Result
				-34.42	-25	Pass



Band 66 (Single Carrier) Port 2, 20 MHz, NB-IoT, Low Channel, 2120 MHz, Low Channel Range 3 (2.108 GHz - 2.088 GHz)

				Value	Limit	Result
				-33.154	-25	Pass

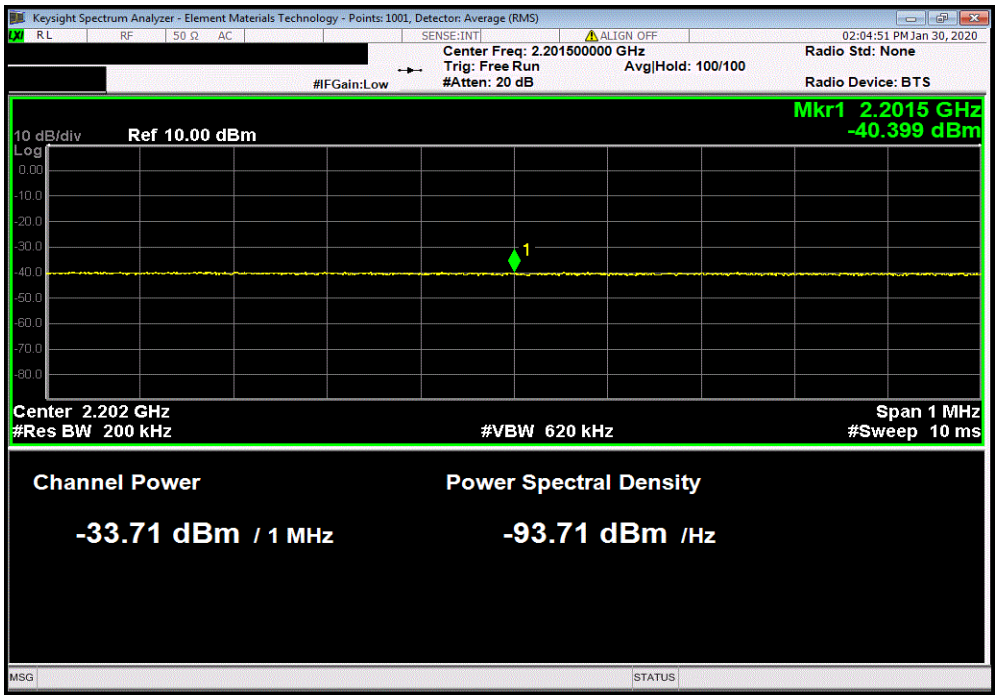


Band 66 (Single Carrier) Port 2, 20 MHz, NB-IoT, High Channel, 2190 MHz, High Channel Range 1 (2.19 GHz - 2.201 GHz)

				Value	Limit	Result
				-35.068	-25	Pass

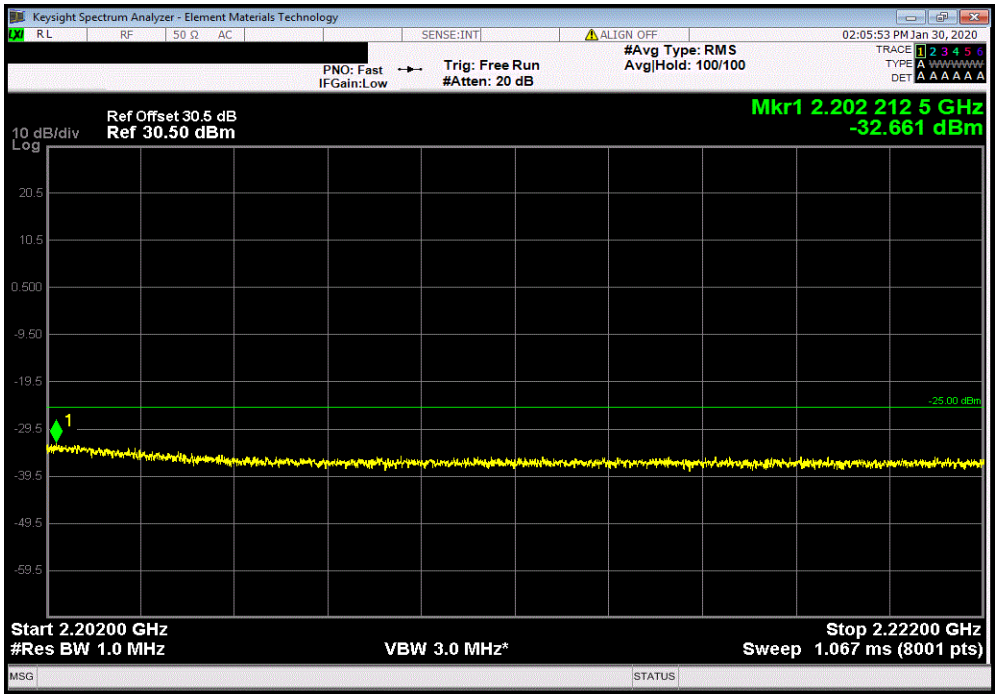
Band 66 (Single Carrier) Port 2, 20 MHz, NB-IoT, High Channel, 2190 MHz, High Channel Range 2 (2.201 GHz - 2.202 GHz)

				Value	Limit	Result
				-33.71	-25	Pass



Band 66 (Single Carrier) Port 2, 20 MHz, NB-IoT, High Channel, 2190 MHz, High Channel Range 3 (2.202 GHz - 2.222 GHz)

				Value	Limit	Result
				-32.661	-25	Pass



SPURIOUS CONDUCTED EMISSIONS

XMit 2019.09.05

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	Keysight	N5171B-506	TEW	2-May-18	2-May-21
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	19-Mar-19	19-Mar-20
Analyzer - Spectrum Analyzer	Keysight	N5183A	TID	26-Apr-19	26-Apr-21

TEST DESCRIPTION

The antenna port spurious emissions were measured at the RF output terminal of the EUT with 30dB of external attenuation on the RF input of the spectrum analyzer. Analyzer plots utilizing a resolution bandwidth called out by the client's test plan were made for each modulation type from 9 KHz to 22 GHz. The peak conducted power of spurious emissions, up to the 10th harmonic of the transmit frequency, were investigated to ensure they were less than the limits also called out by the client's test plan shown below.

The measurement methods are detailed in KDB971168 D01v03 section 6 and ANSI C63.26-2015.

Per FCC 2.1057(a)(1) and RSS Gen 6.13, the upper level of measurement is the 10th harmonic of the highest fundamental frequency.

These measurements are for frequency band after the first 1.0 MHz bands immediately outside and adjacent to the frequency block.

Per FCC 27.53(h)(1), RSS-Gen 6.13, RSS-139 6.6 and RSS-170 5.4 & 5.4.1.2, The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB which was given to be -13 dBm. The limit was then adjusted to -25 dBm [-13 dBm -10 log (16)] per FCC KDB 662911D01 v02r01 because the BTS may operate as a 16 port MIMO transmitter.

The measurement methods are detailed in KDB971168 D01v03 section 6 and ANSI C63.26-2015. The conducted spurious emission measurements were performed over 9kHz to 22GHz frequency range.
Per FCC 2.1057(a)(1) and RSS Gen 6.13, the upper level of measurement is the 10th harmonic of the highest fundamental frequency.

These measurements are for frequency band after the first 1.0 MHz bands immediately outside and adjacent to the frequency block.

The limit for the 9kHz to 150kHz frequency range was adjusted to -55dBm to correct for a spectrum analyzer RBW of 1kHz versus required RBW of 1MHz [i.e.: -55dBm = -25dBm -10log(1MHz/1kHz)]. The limit for the 150kHz to 20MHz frequency range was adjusted to -45dBm to correct for a spectrum analyzer RBW of 10kHz versus required RBW of 1MHz [i.e.: -45dBm = -25dBm -10log(1MHz/10kHz)]. The required limit of -25dBm with a RBW of >1MHz was used for all other frequency ranges.

SPURIOUS CONDUCTED EMISSIONS

element

XMit 2019.09.05

EUT:	**AAIB**			**Work Order:**	**NOKI0006**
Serial Number:	**YK183800029**			**Date:**	**30-Jan-20**
Customer:	**Nokia Solutions and Networks**			**Temperature:**	**21.9 °C**
Attendees:	**Mitch Hill, John Rattanavong**			**Humidity:**	**34.3% RH**
Project:	**None**			**Barometric Pres.:**	**1015 mbar**
Tested by:	**Willie Love, Brandon Hobbs**	**Power:**	**54VDC**	**Job Site:**	**TX09**

TEST SPECIFICATIONS	**Test Method**
FCC 27:2020	ANSI C63.26:2015
RSS-139:2015, RSS-170:2015	RSS-Gen:2019

COMMENTS

All losses in the measurement path were accounted for. The highest power port operating at maximum power was used for these measurements. The highest power port was determined by measuring the average power on each of the 16 antenna ports using a 10 MHz channel bandwidth at the middle channel shown elsewhere in the report.

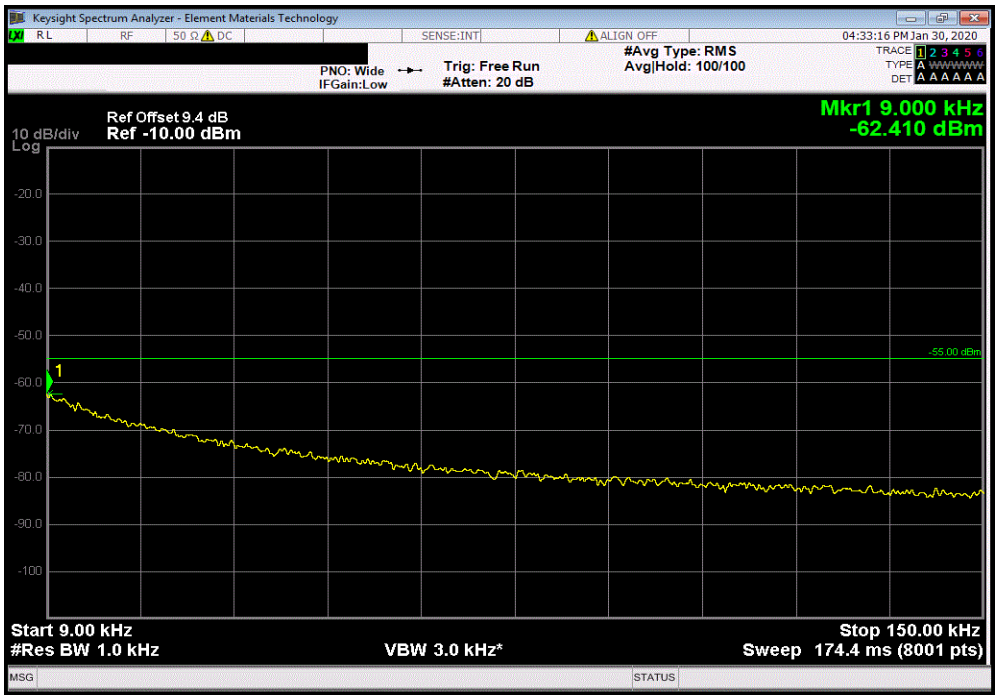
DEVIATIONS FROM TEST STANDARD

None

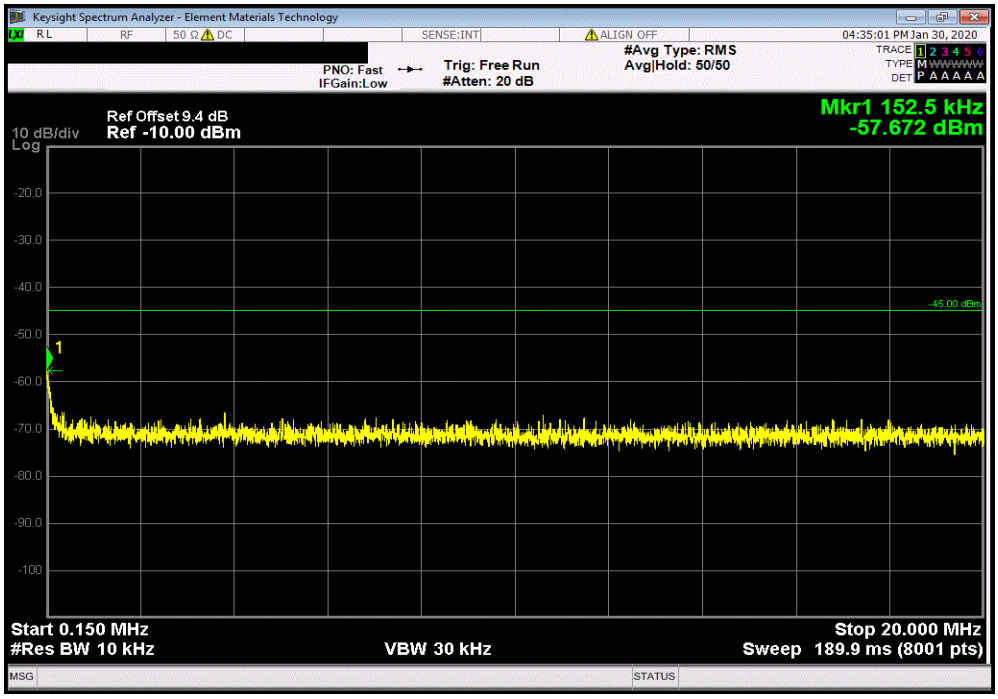
Configuration #	**1,2,3**	*Signature*

			Value	Limit	Result
Band 66 (Single Carrier) Port 2					
10 MHz					
	NB-IoT				
		Mid Channel, 2155 MHz			
		9 KHz - 150 KHz	-62.4	-55	Pass
		150 KHz - 20 MHz	-57.7	-45	Pass
		20 MHz - 3 GHz	-32.8	-25	Pass
		3 GHz - 10 GHz	-33.0	-25	Pass
		10 GHz - 18 GHz	-28.5	-25	Pass
		18 GHz - 22 GHz	-35.0	-25	Pass
15 MHz					
	NB-IoT				
		Mid Channel, 2155 MHz			
		9 KHz - 150 KHz	-61.9	-55	Pass
		150 KHz - 20 MHz	-56.1	-45	Pass
		20 MHz - 3 GHz	-31.8	-25	Pass
		3 GHz - 10 GHz	-34.6	-25	Pass
		10 GHz - 18 GHz	-28.9	-25	Pass
		18 GHz - 22 GHz	-35.5	-25	Pass
20 MHz					
	NB-IoT				
		Mid Channel, 2155 MHz			
		9 KHz - 150 KHz	-62.7	-55	Pass
		150 KHz - 20 MHz	-55.1	-45	Pass
		20 MHz - 3 GHz	-32.0	-25	Pass
		3 GHz - 10 GHz	-34.4	-25	Pass
		10 GHz - 18 GHz	-29.1	-25	Pass
		18 GHz - 22 GHz	-35.1	-25	Pass

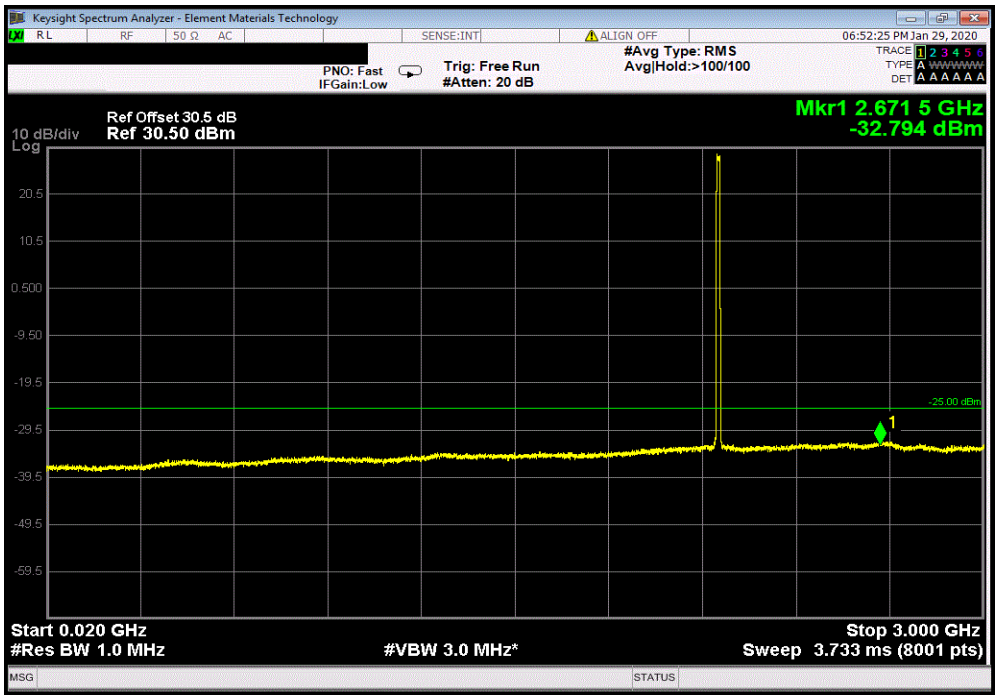
Band 66 (Single Carrier) Port 2, 10 MHz, NB-IoT, Mid Channel, 2155 MHz, 9 KHz - 150 KHz						
				Value	Limit	Result
				-62.41	-55	Pass



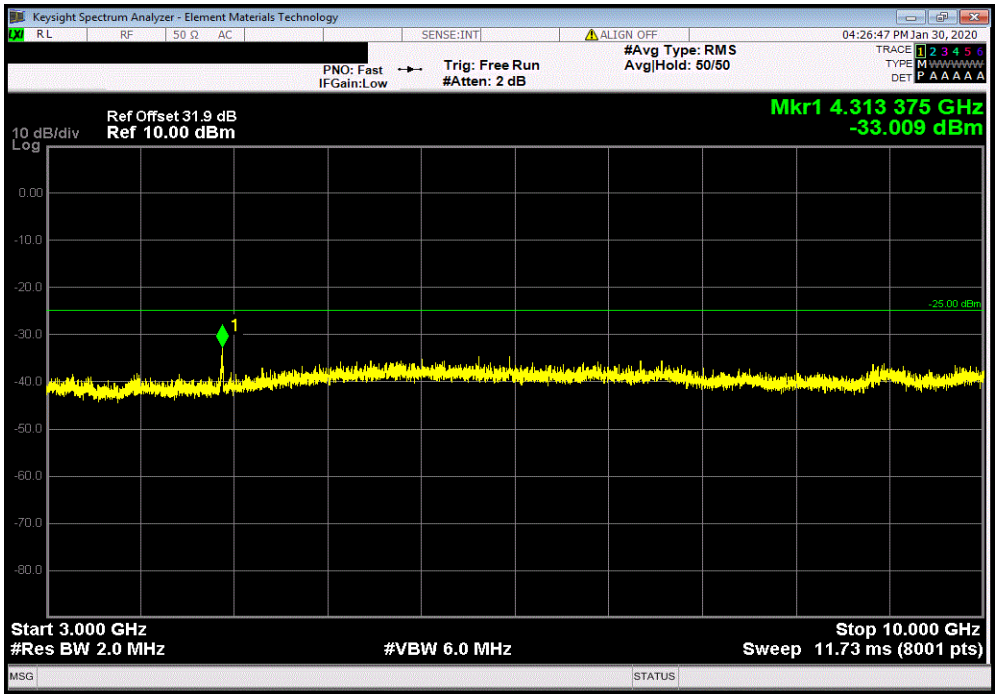
Band 66 (Single Carrier) Port 2, 10 MHz, NB-IoT, Mid Channel, 2155 MHz, 150 KHz - 20 MHz						
				Value	Limit	Result
				-57.672	-45	Pass



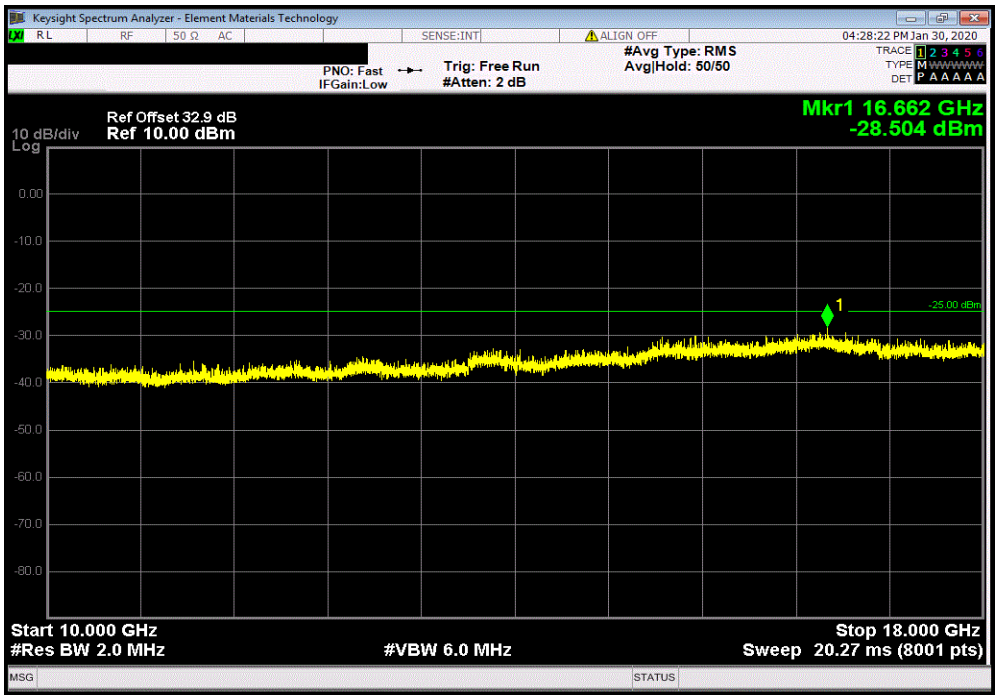
Band 66 (Single Carrier) Port 2, 10 MHz, NB-IoT, Mid Channel, 2155 MHz, 20 MHz - 3 GHz						
				Value	Limit	Result
				-32.794	-25	Pass



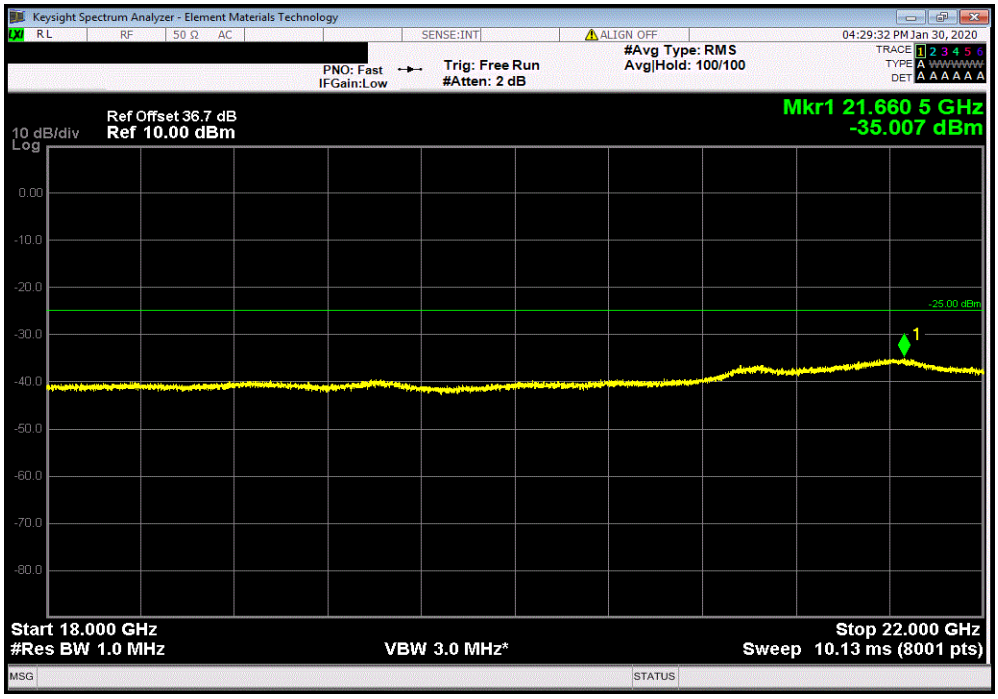
Band 66 (Single Carrier) Port 2, 10 MHz, NB-IoT, Mid Channel, 2155 MHz, 3 GHz - 10 GHz						
				Value	Limit	Result
				-33	-25	Pass



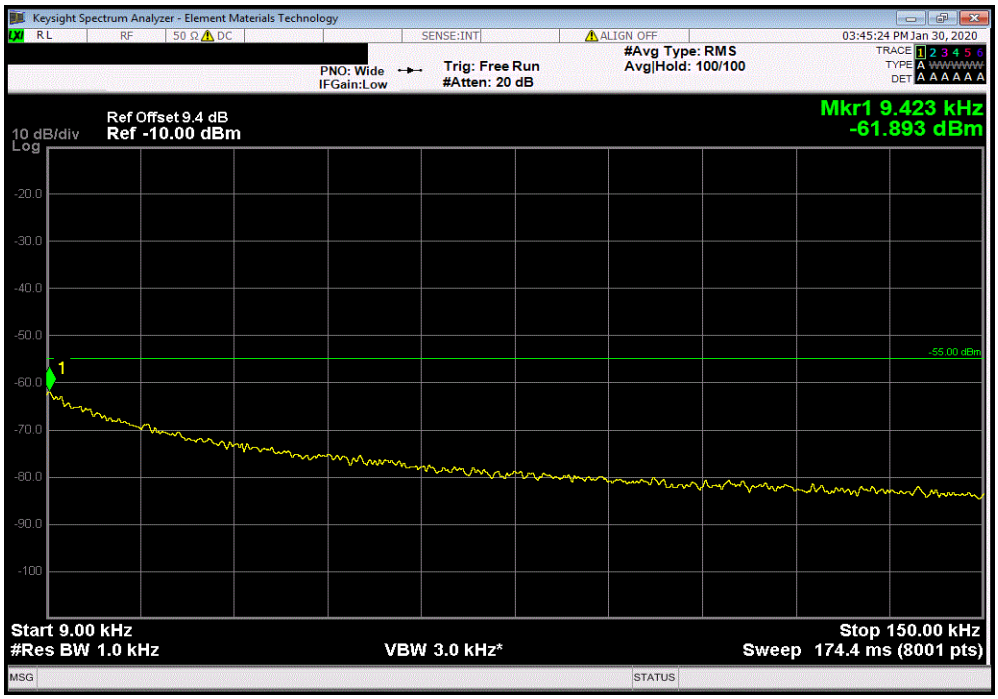
Band 66 (Single Carrier) Port 2, 10 MHz, NB-IoT, Mid Channel, 2155 MHz, 10 GHz - 18 GHz						
				Value	Limit	Result
				-28.504	-25	Pass



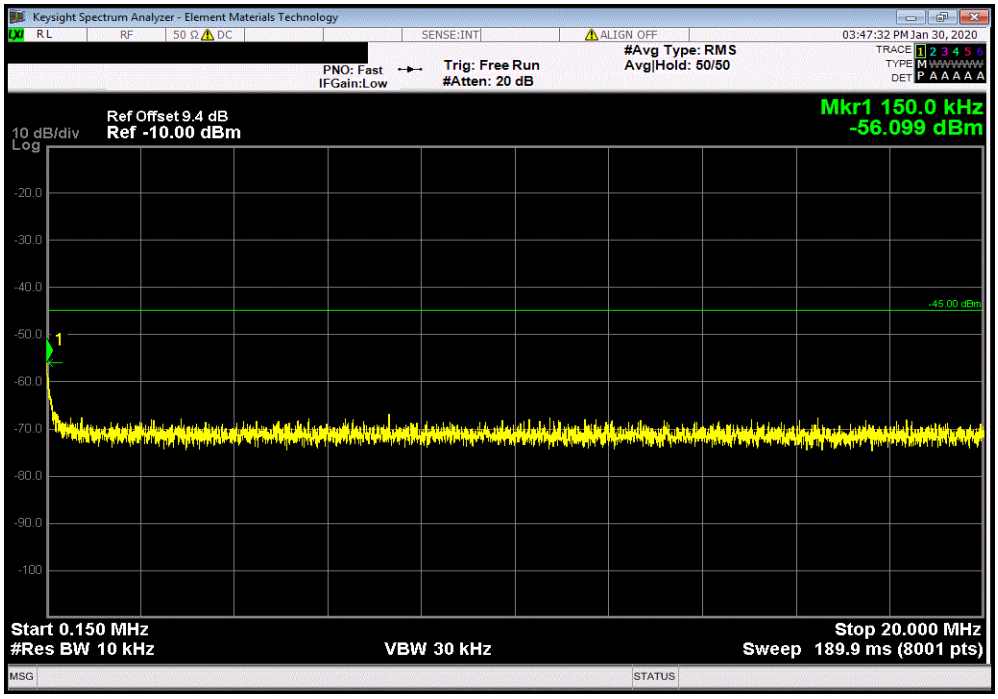
Band 66 (Single Carrier) Port 2, 10 MHz, NB-IoT, Mid Channel, 2155 MHz, 18 GHz - 22 GHz						
				Value	Limit	Result
				-35.007	-25	Pass



Band 66 (Single Carrier) Port 2, 15 MHz, NB-IoT, Mid Channel, 2155 MHz, 9 KHz - 150 KHz						
				Value	Limit	Result
				-61.893	-55	Pass

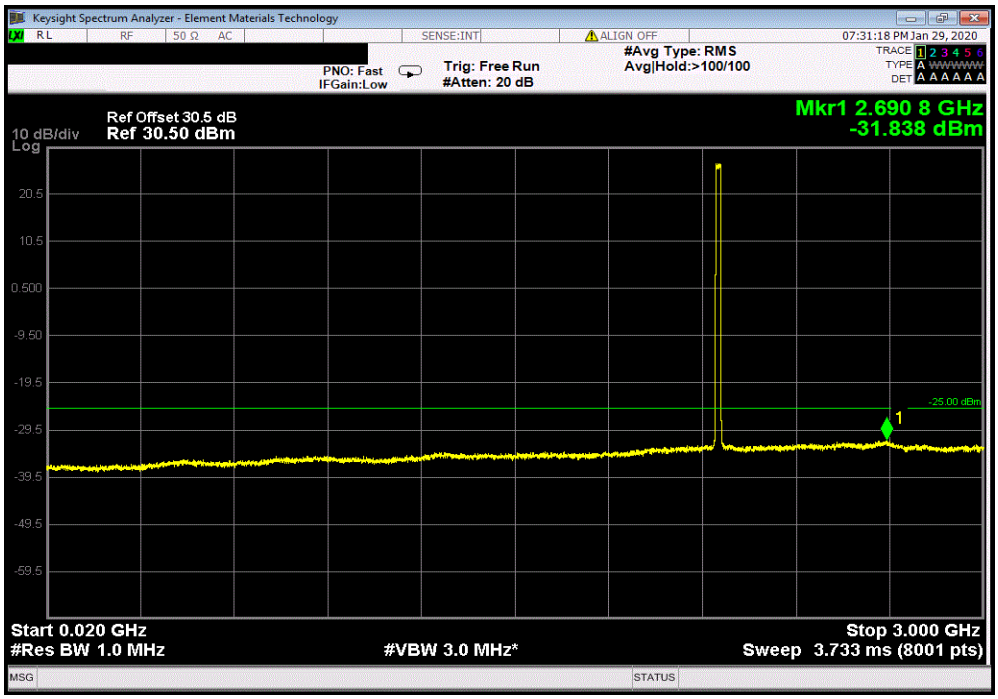


Band 66 (Single Carrier) Port 2, 15 MHz, NB-IoT, Mid Channel, 2155 MHz, 150 KHz - 20 MHz						
				Value	Limit	Result
				-56.099	-45	Pass



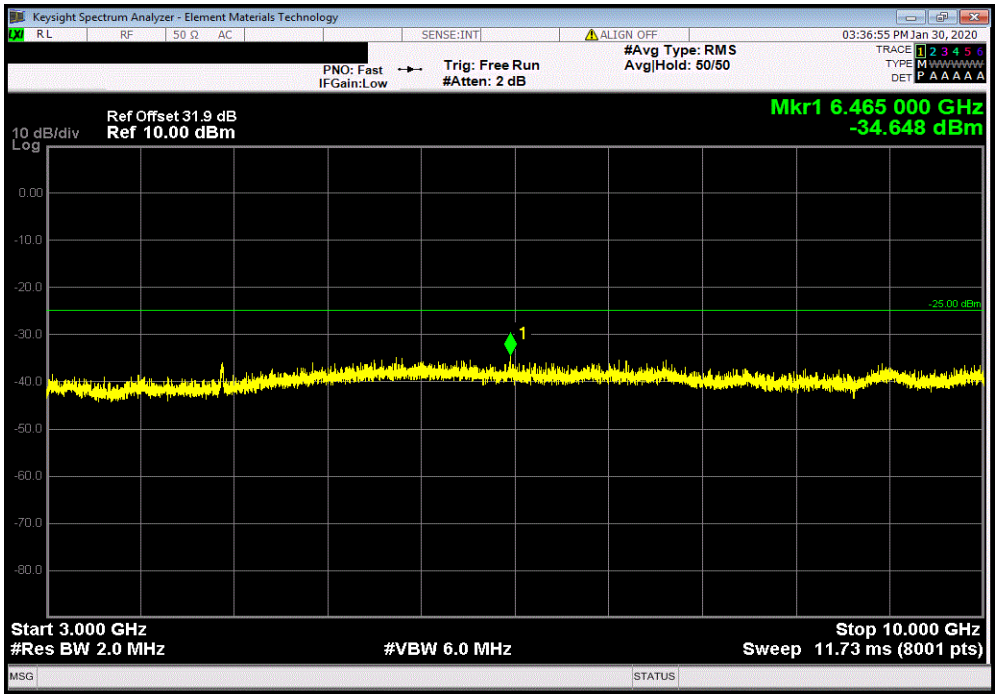
Band 66 (Single Carrier) Port 2, 15 MHz, NB-IoT, Mid Channel, 2155 MHz, 20 MHz - 3 GHz

				Value	Limit	Result
				-31.838	-25	Pass



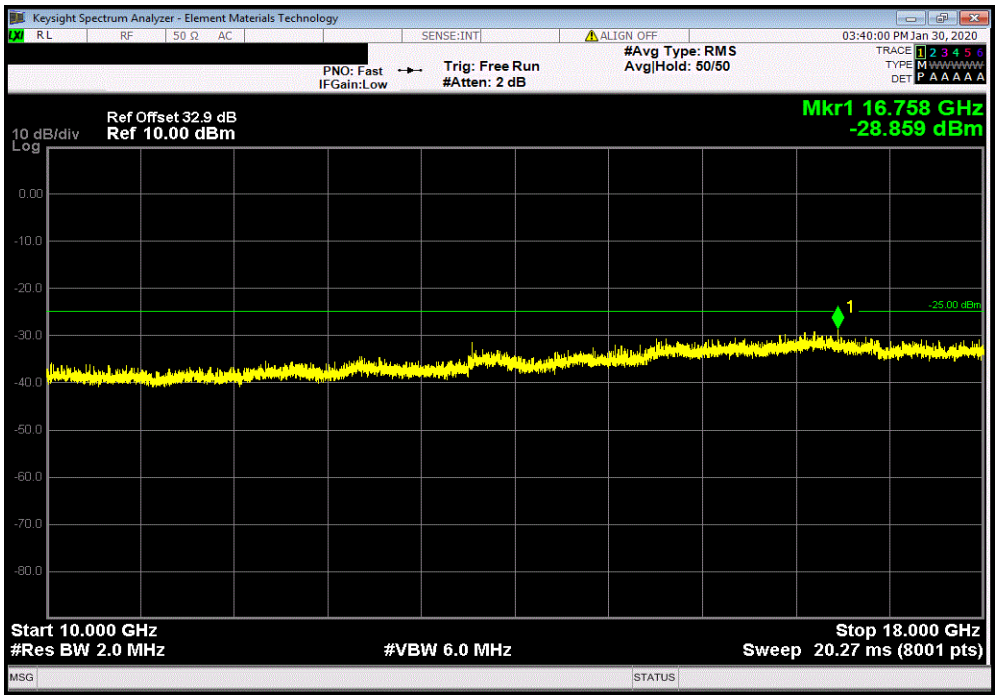
Band 66 (Single Carrier) Port 2, 15 MHz, NB-IoT, Mid Channel, 2155 MHz, 3 GHz - 10 GHz

				Value	Limit	Result
				-34.648	-25	Pass



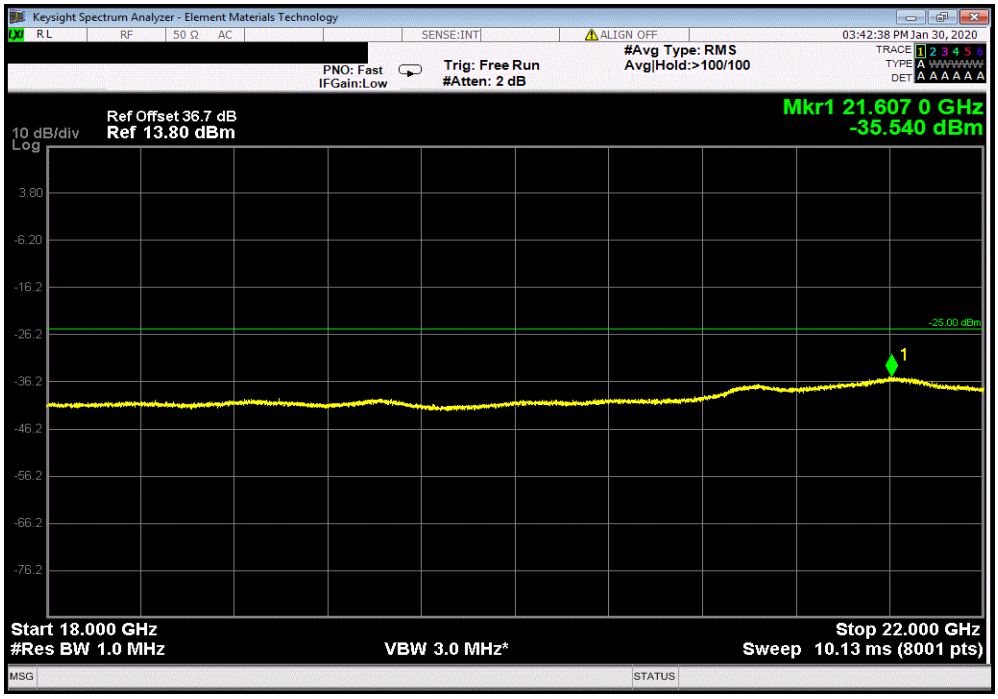
Band 66 (Single Carrier) Port 2, 15 MHz, NB-IoT, Mid Channel, 2155 MHz, 10 GHz - 18 GHz

				Value	Limit	Result
				-28.859	-25	Pass

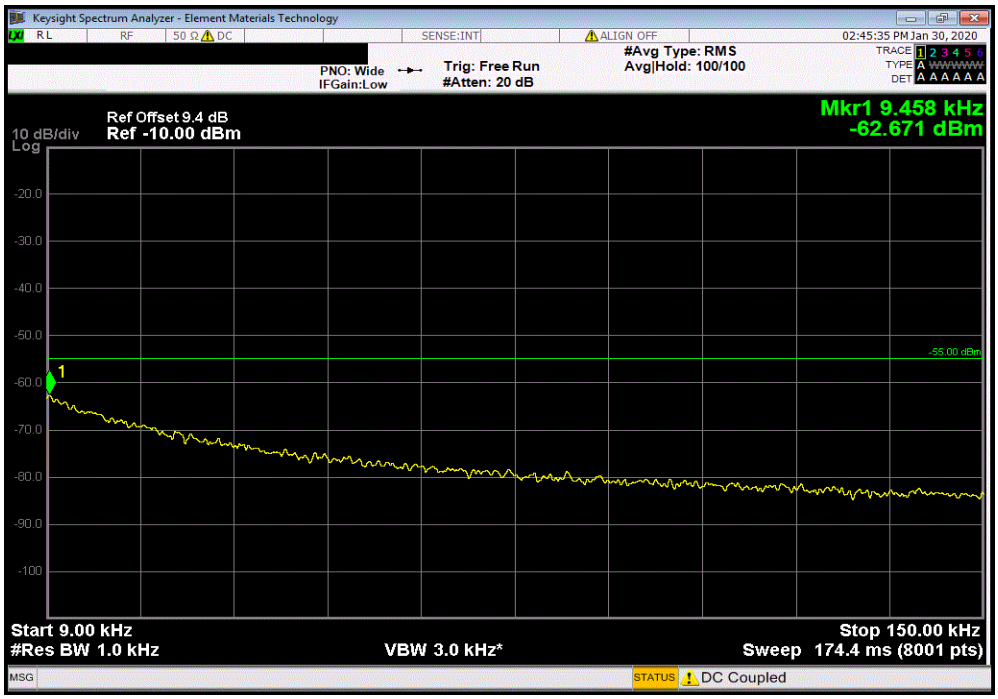


Band 66 (Single Carrier) Port 2, 15 MHz, NB-IoT, Mid Channel, 2155 MHz, 18 GHz - 22 GHz

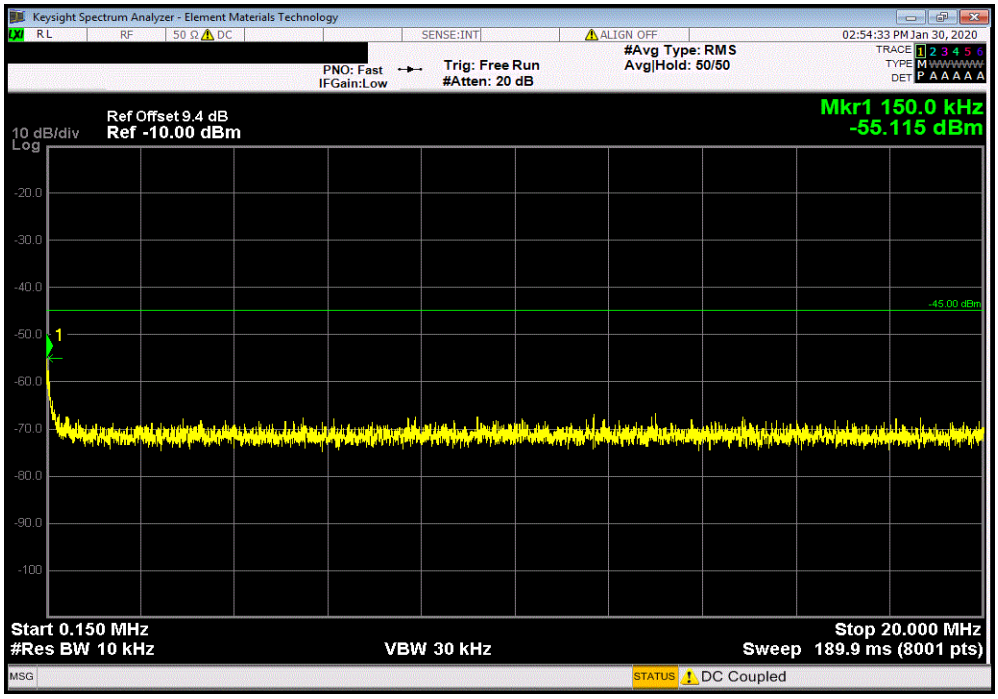
				Value	Limit	Result
				-35.54	-25	Pass



Band 66 (Single Carrier) Port 2, 20 MHz, NB-IoT, Mid Channel, 2155 MHz, 9 KHz - 150 KHz						
				Value	Limit	Result
				-62.671	-55	Pass

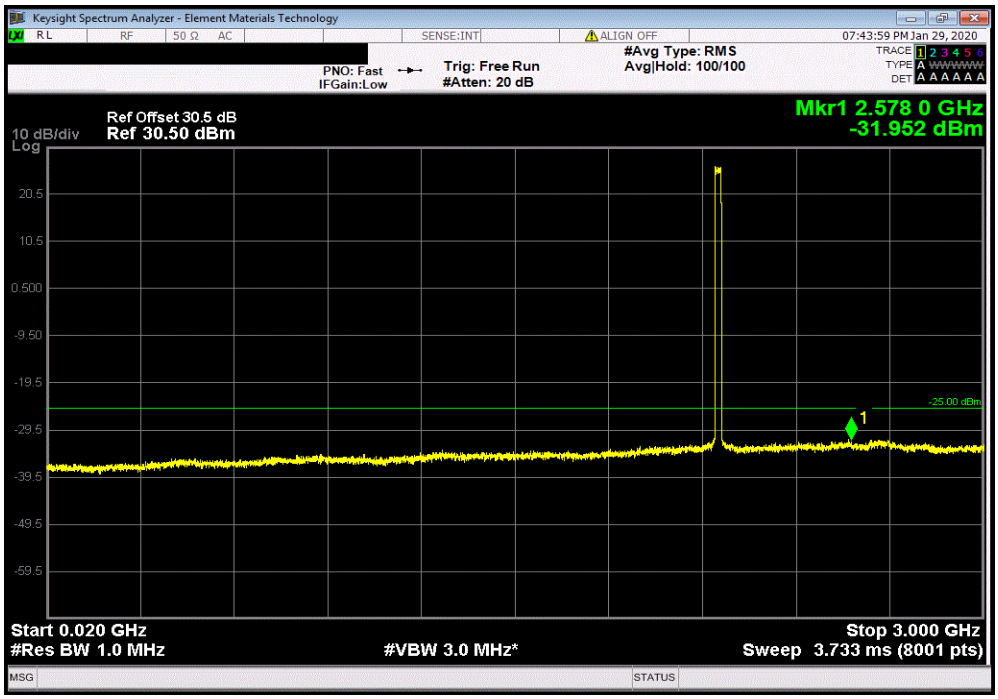


Band 66 (Single Carrier) Port 2, 20 MHz, NB-IoT, Mid Channel, 2155 MHz, 150 KHz - 20 MHz						
				Value	Limit	Result
				-55.115	-45	Pass



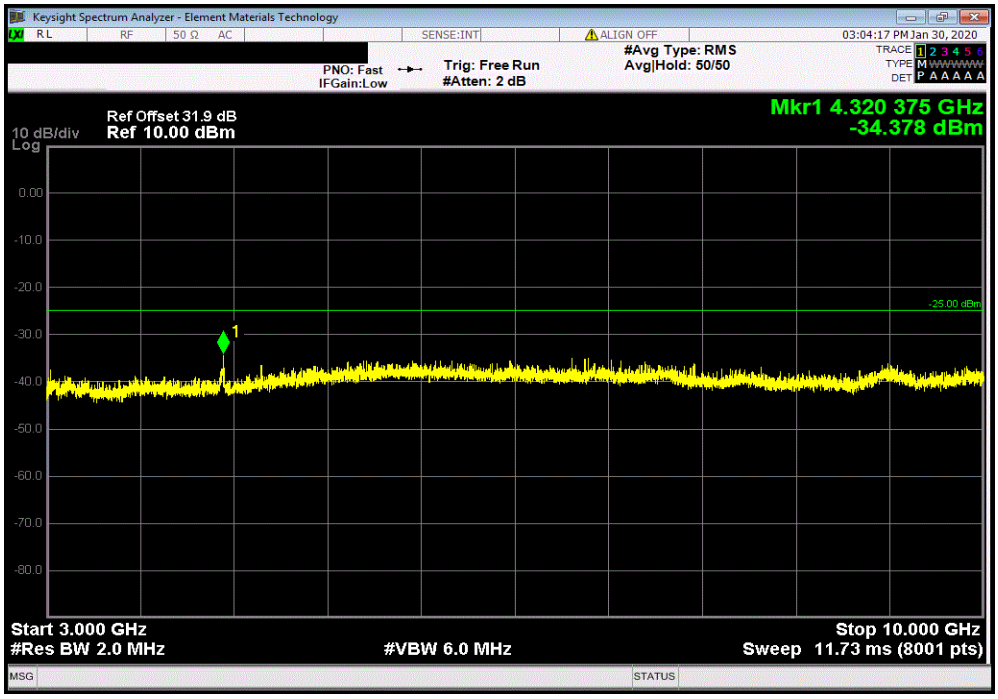
Band 66 (Single Carrier) Port 2, 20 MHz, NB-IoT, Mid Channel, 2155 MHz, 20 MHz - 3 GHz

				Value	Limit	Result
				-31.952	-25	Pass



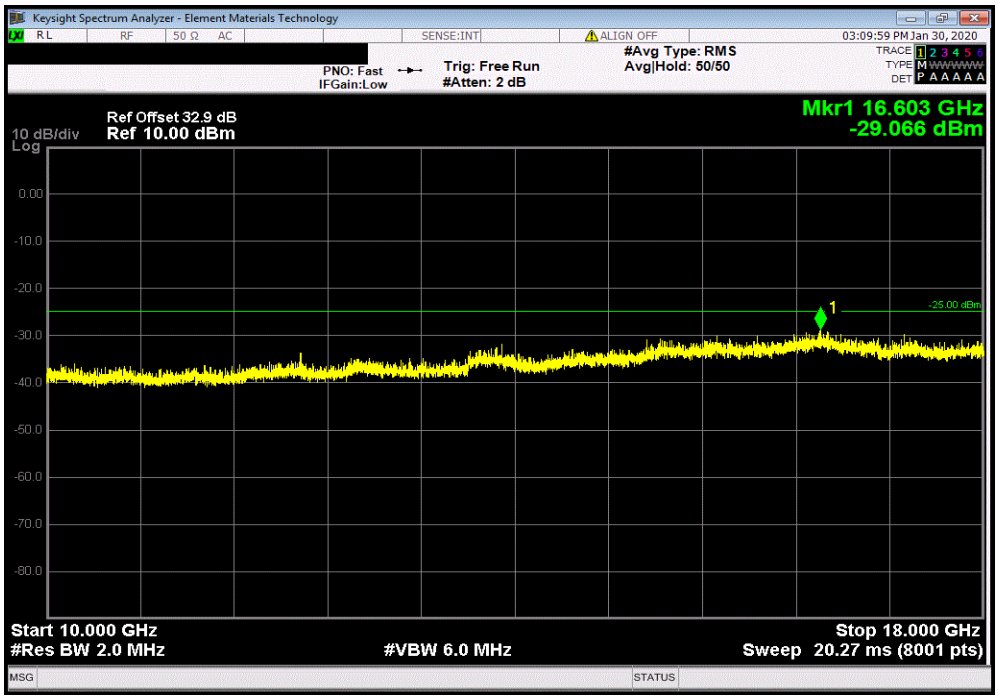
Band 66 (Single Carrier) Port 2, 20 MHz, NB-IoT, Mid Channel, 2155 MHz, 3 GHz - 10 GHz

				Value	Limit	Result
				-34.378	-25	Pass



Band 66 (Single Carrier) Port 2, 20 MHz, NB-IoT, Mid Channel, 2155 MHz, 10 GHz - 18 GHz

				Value	Limit	Result
				-29.066	-25	Pass



Band 66 (Single Carrier) Port 2, 20 MHz, NB-IoT, Mid Channel, 2155 MHz, 18 GHz - 22 GHz

				Value	Limit	Result
				-35.082	-25	Pass