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TESTING
NVLAP LAB CODE: 100275-0

Test Report

Regulation:
FCC Part 2 and 27

Client:
Nokia of America Corporation

Product Evaluated:
UHBA (Asset 1.0) B13
2x60W & 4x30W

Report Number:
TR-2018-0113-FCC2-27

Date Issued:
September 14, 2018

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Revisions

Date	Revision	Section	Change
9/14/2018	0		Initial Release

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1. System Information and Requirements

Equipment Under Test (EUT):	UHBA (Asset 1.0) B13
Serial Number:	LBALLU-YD152000FF3
Cell Name / Number	GPCL Project Number:2018-0113
FCC ID:	AS5BBTRX-23
Company:	Nokia of America Corporation Bldg. 5B-111 600-700 Mountain Avenue Murray Hill, NJ 07974
Manufacturer:	Nokia of America Corporation
Test Requirement(s):	47 CFR FCC Part 2 and Part 27
Test Standards	<ul style="list-style-type: none"> • 47 CFR FCC Parts 2 and 27 • KDB 971168 D01 Licensed DTS Guidance v02 June 4, 2013 • KDB 662911 D01 Multiple Transmitter Output v02r01 Oct 2013
Measurement Procedure(s):	FCC-IC-OBSC – GPCL FCC and IC Occupied Bandwidth and Spurious Emission Test Procedure 3-15-2016 FCC-IC-OB - GPCL Occupied Bandwidth and Power Measurement Test Procedure 12-4-2017 FCC-IC-SE - GPCL Spurious Emissions Test Procedure 12-4-2017
Reference(s):	<ul style="list-style-type: none"> • ANSI C63.26 (2015) • ANSI C63.4 (2014)
Test Date(s):	July/August 2018
Test Performed By:	Nokia Global Product Compliance Laboratory 600-700 Mountain Ave. P.O. Box 636 Murray Hill, NJ 07974-0636
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Product Engineer(s):	Ron Remy
Lead Engineer	Steve Gordon
Test Engineer (s):	Jaideep Yadav, Eugene Mitchell, Mike Soli
<p>Test Results: The UHBA (Asset 1.0) B13, <i>as tested</i> met the above listed requirements. Report copies and other information not contained in this report are held by either the product engineer or in an identified file at the Global Product Compliance Laboratory in New Providence, NJ.</p>	

1.1 Introduction

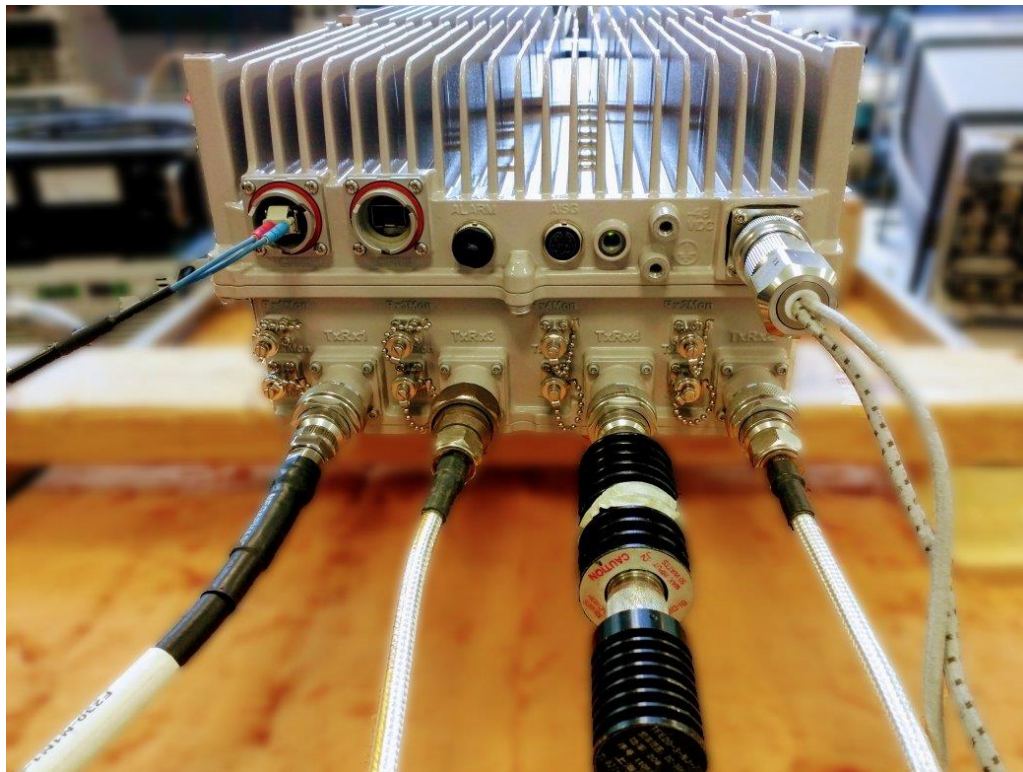
This Conformity test report applies to the UHBA (Asset 1.0) B13, hereinafter referred to as the Equipment Under Test (EUT).

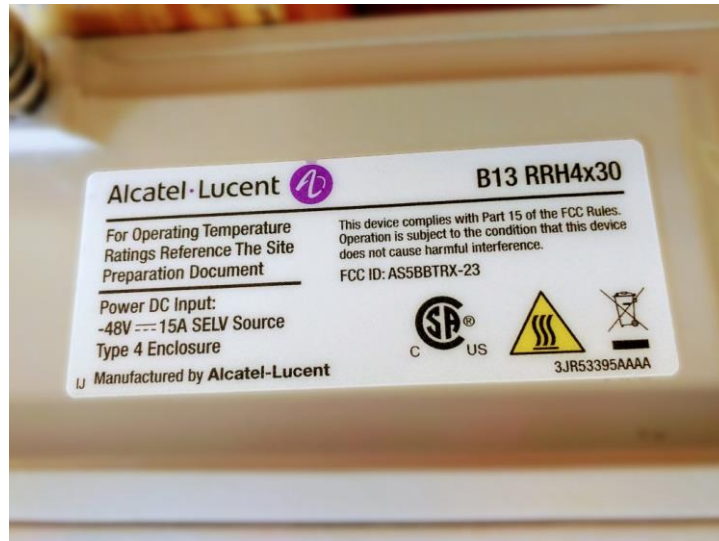
1.2 Purpose and Scope

The purpose of this document is to provide the testing data required for qualifying the EUT in compliance with FCC Parts 2 and 27, measured in accordance with the procedures set out in Section 2.1033 (c) (14) of the Rules.

The EUT was tested for Class II Permissive change to add 10MHz Bandwidth with NB IoT and 5MHz Bandwidth without NB IoT to the existing Grant.

1.3 EUT Details





1.3.1 Test Requirements

Each required measurement is listed below:

47 CFR FCC Sections	Description of Tests	Test Required
2.1046	RF Power Output	Yes
2.1047	Modulation Characteristics	Yes
2.1049	(a) Occupied Bandwidth (b) Out-of-Band Emissions	Yes
2.1051	Spurious Emissions at Antenna Terminals	Yes
2.1053	Field Strength of Spurious Radiation	Yes

1.4 Reference Documents, Test Specifications & Procedures

A list of the applicable documents is provided in Section 1.0.

1.4.1 Test Specifications

- Title 47 Code of Federal Regulations, Federal Communications Commission Part 2.
- Title 47 Code of Federal Regulations, Federal Communications Commission Part 27.

1.4.2 Procedures

1. FCC-IC-0B and FCC-IC-SE
2. ANSI C63.4 (2014) entitled: “American National Standard for Methods of Measurement of Radio-Noise Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40 GHz”, American National Standards Institute, Institute of Electrical and Electronic Engineers, Inc., New York, NY 10017-2394, USA.
3. FCC KDB 971168 D01 Power Measurement Digital Systemsv02r02 Oct 2014
 FCC KDB 662911 D01 Multiple Transmitter Output v02r01 Oct 2013

1.4.3 MEASUREMENT UNCERTAINTY

The results of the calculations to estimate uncertainties for the several test methods and standards are shown in the Table below. These are the worst-case values.

Worst-Case Estimated Measurement Uncertainties

Standard, Method or Procedure	Condition	Frequency MHz	Expanded Uncertainty (k=2)
a. Classical Emissions, (e.g., ANSI C63.4, CISPR 11, 14, 22, etc., using ESHS 30,	Conducted Emissions	0.009 - 30	±3.5 dB
	Radiated Emissions (AR-6 Semi-Anechoic Chamber)	30 MHz – 200MHz H 30 MHz – 200 MHz V 200 MHz – 1000 MHz H 200 MHz – 1000 MHz V 1 GHz - 18 GHz	±5.1 dB ±5.1 dB ±4.7 dB ±4.7 dB ±3.3 dB

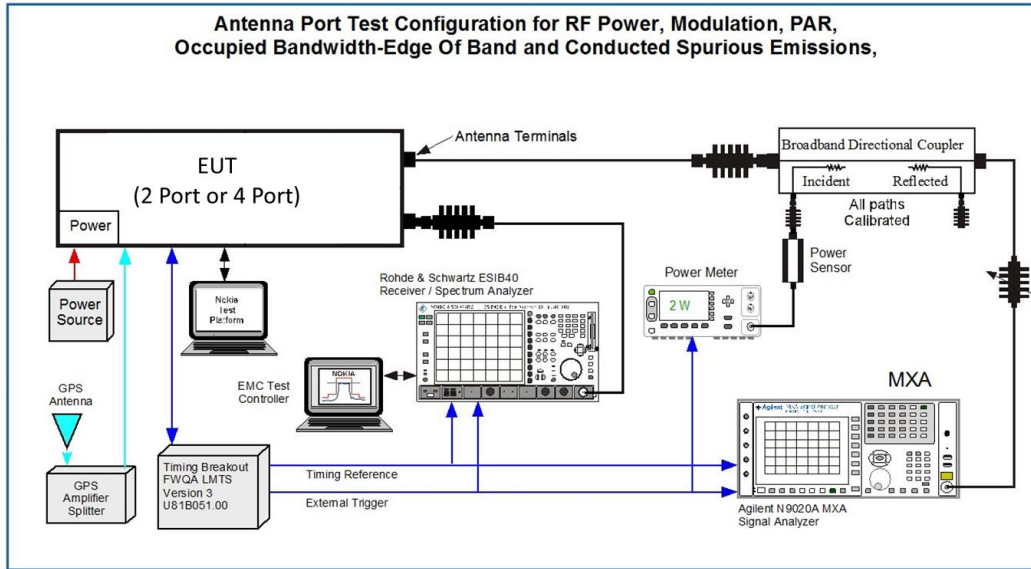
Antenna Port Test	Signal Bandwidth	Frequency Range	Expanded Uncertainty (k=2), Amplitude
Occupied Bandwidth, Edge of Band, Conducted Spurious Emissions	10 Hz	9 kHz to 20 MHz	1.78 dB
	100 Hz	20 MHz to 1 GHz	
	10 kHz to 1 MHz	1 GHz to 10 GHz	
	1MHz	10 GHz to 40 GHz:	
RF Power	10 Hz to 20 MHz	50 MHz to 18 GHz	0.5 dB

1.5 Executive Summary

Requirement	Description	Result
47 CFR FCC Parts 2 and 27		
2.1046	RF Power Output Peak to Average Power Ratio	COMPLIES
2.1047	Modulation Characteristics	COMPLIES
2.1049	Occupied Bandwidth (a) Emissions Signal Bandwidth (b) Occupied Bandwidth/ Edge of Band Emissions	COMPLIES
2.1051	Spurious Emissions at Antenna Terminals	COMPLIES
2.1053	Field Strength of Spurious Radiation	COMPLIES

1. **COMPLIES** - Passed all applicable tests.
2. **N/A** – Not Applicable.
3. **NT** – Not Tested.

1.6 Test Configuration for all Antenna Port Measurements.



2. FCC Section 2.1046 - RF Power Output

2.1 RF Power Output

This test is a measurement of the total RF power level transmitted at the antenna-transmitting terminal. The product was configured for test as shown in section 1.6 above and allowed to warm up and stabilize per KDB 971168 D01 and ANSI C63.26.

Power measurements were made with a broadband Power Meter in the average mode. Before the testing was started, the Base Station was given a sufficient “warm-up” period as required.

NOTE: Only a sample of all the plots taken have been used in this report. The full suite of raw data resides at the MH, New Jersey location.

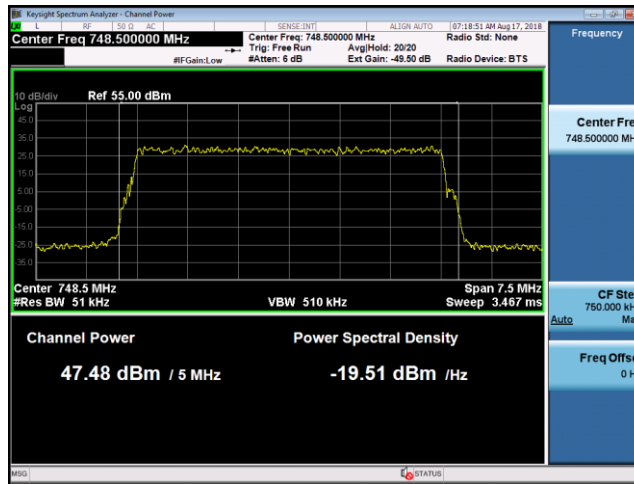
Tabular Data – Channel RF Power 2X60Watts

Channel Frequency MHz	Signal BW MHz	Modulation	Channel Power dBm
748.5	5	64QAM	47.48
		256QAM	47.41
		QPSK+16QAM	47.42
751	10	QPSK+16QAM	47.47
753.5	5	64QAM	47.48
		256QAM	47.47
		QPSK+16QAM	47.65

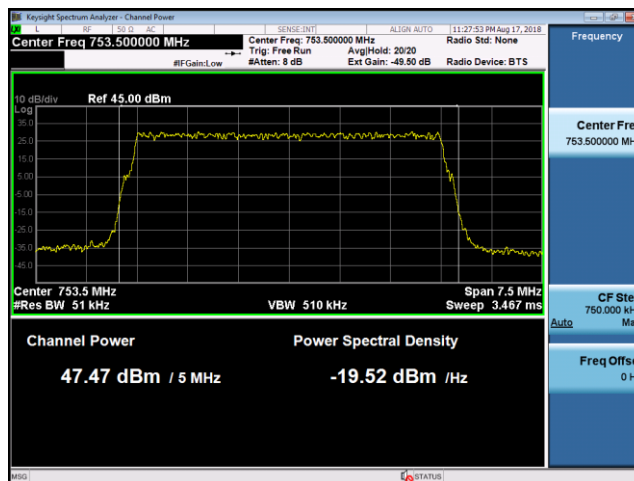
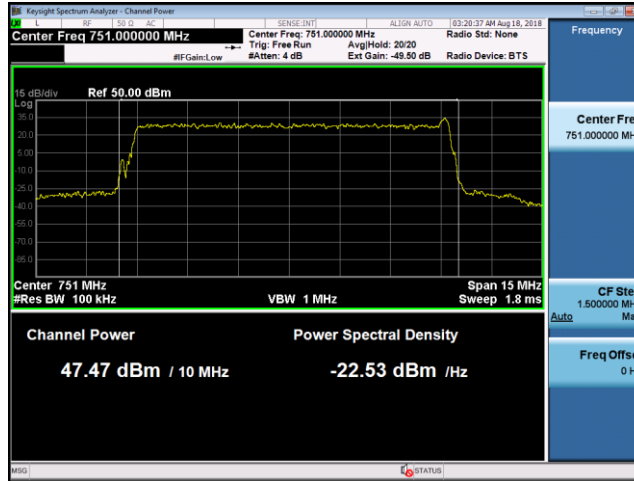
Tabular Data – Channel RF Power 4X30Watts

Channel Frequency MHz	Signal BW MHz	Modulation	Channel Power dBm
748.5	5	64QAM	44.70
		256QAM	44.70
		QPSK+16QAM	44.39
751	10	QPSK+16QAM	44.75
753.5	5	64QAM	44.72
		256QAM	44.72
		QPSK+16QAM	44.66

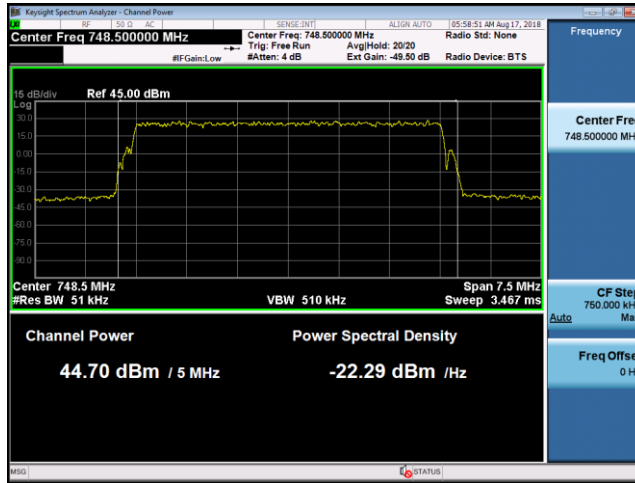
2.1.1 Channel RF Power - Sample Plots 2x60W.



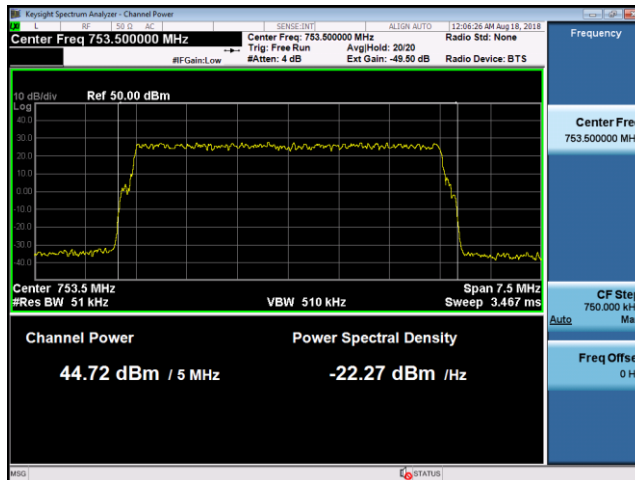
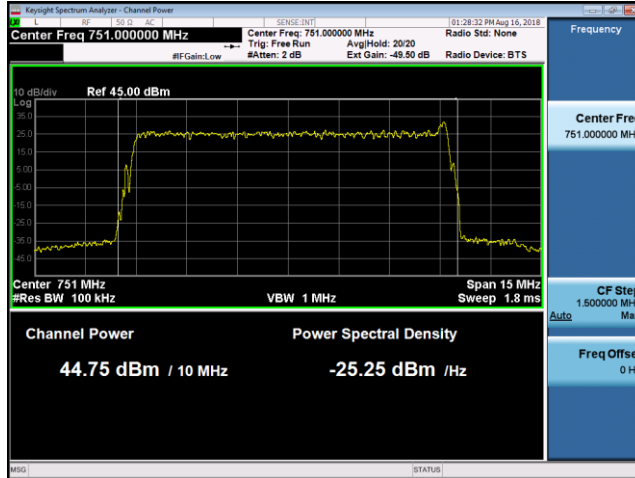
10MHz NB-IoT Guard Band



2.1.2 Channel RF Power - Sample Plots 4X30W.



10MHz NB-IoT Guard Band



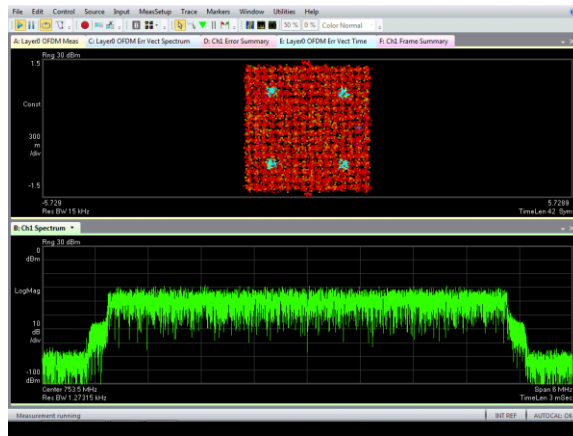
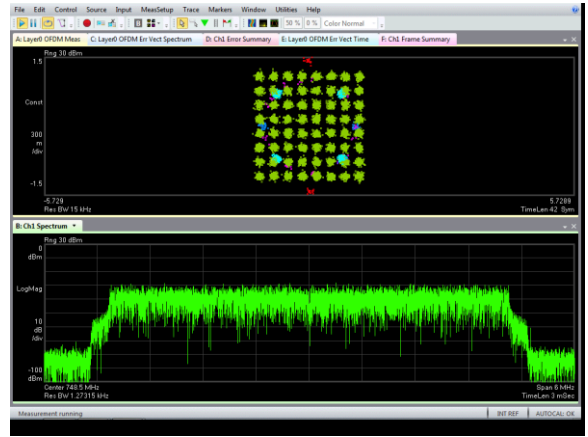
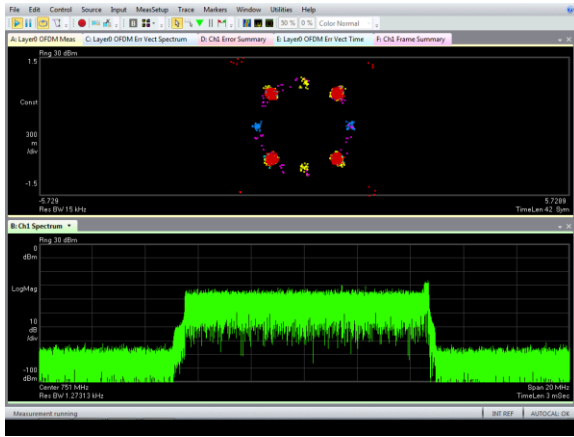
3. FCC Section 2.1047 - Modulation Characteristics

3.1 Modulation Characteristics

The RF signal at the antenna port was demodulated and verified for correctness of the modulation signal used before each test was performed. For these products the operation with 256QAM modulation was evaluated and verified.

NOTE: Only a sample of all the data taken have been used in this report. The full suite of raw data resides at the MH, New Jersey location.

3.1.1 Modulation Characteristics – Sample Plots.



4. FCC Section 2.1049 – Occupied Bandwidth

4.1 Occupied Bandwidth

In 47CFR 2.1049 the FCC requires:

“The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable.”

This required measurement is the 99% Occupied Bandwidth, also called the designated signal bandwidth and needs to be within the parameters of the products specified emissions designator. The -26 dB bandwidth values were also recorded.

During these measurements it is customary to evaluate the Edge of Band emissions at block/band edges.

The transmitted signal occupied bandwidth was measured using a Keysight MXA Signal Analyzer. All emissions were within the parameters as previously filed. Sample Charts are below.

Tabular Data – Occupied Bandwidth 2x60W

Channel Frequency MHz	Signal BW MHz	Modulation	OBW MHz
748.5	5	64QAM	4.4941
		256QAM	4.5083
		QPSK+16QAM	4.4808
751	10	QPSK+16QAM	9.1696
753.5	5	64QAM	4.5053
		256QAM	4.5129
		QPSK+16QAM	4.4901

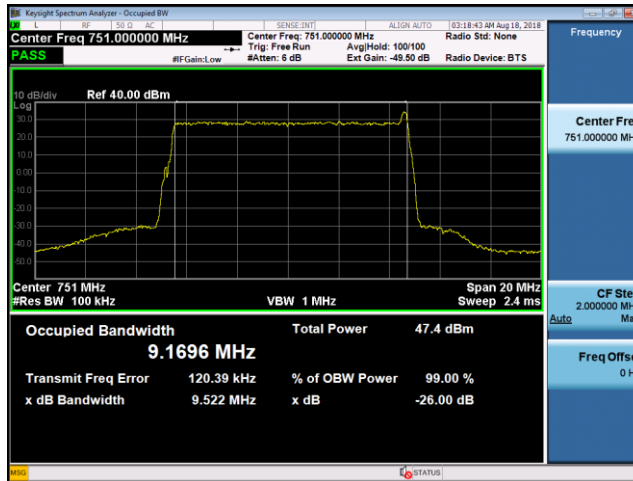
Tabular Data – Occupied Bandwidth 4x30W

Channel Frequency MHz	Signal BW MHz	Modulation	OBW MHz
748.5	5	64QAM	4.5052
		256QAM	4.5049
		QPSK+16QAM	4.4806
751	10	QPSK+16QAM	9.1666
753.5	5	64QAM	4.4999
		256QAM	4.5111
		QPSK+16QAM	4.4855

4.1.1 Occupied Bandwidth – Sample Plots 2x60W.



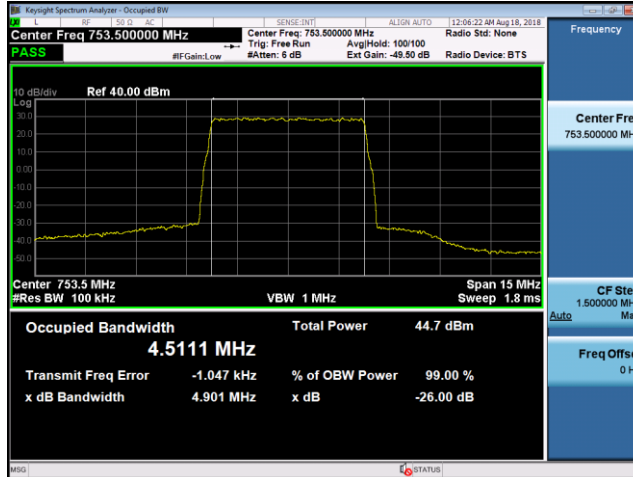
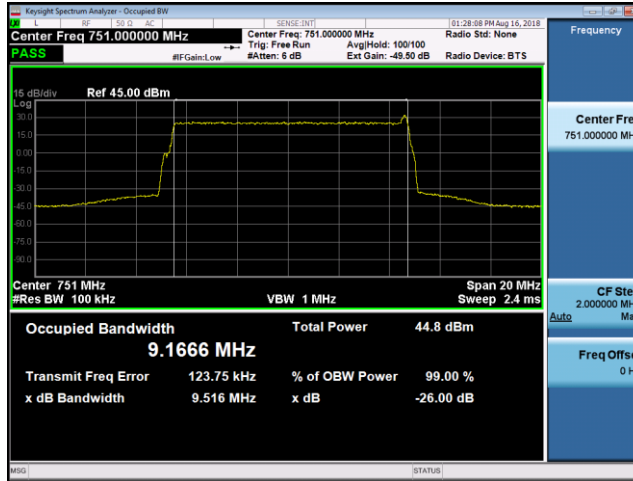
10MHz NB-IoT Guard Band



4.1.2 Occupied Bandwidth – Sample Plots 4x30W.



10MHz NB-IoT Guard Band



4.2 Occupied Bandwidth/ Edge of band Emissions

The Edge of Band emissions of the EUT at the external antenna connector (EAC) were measured using a Keysight MXA Signal Analyzer. The RF power level was continuously measured using a RF broadband power meter. The RF output from the EAC port to spectrum analyzer was reduced (to an amplitude usable by the spectrum analyzer) by using a calibrated attenuator and test coupler. The path attenuation was offset on the display and the signal for single carrier was adjusted to the corrected RF power level for the resolution bandwidth used for the transmit signal. All mask values were adjusted based upon the designated signal bandwidth and measurement bandwidths. The Top of Mask corresponds to the set rated power level as confirmed by the RF power meter.

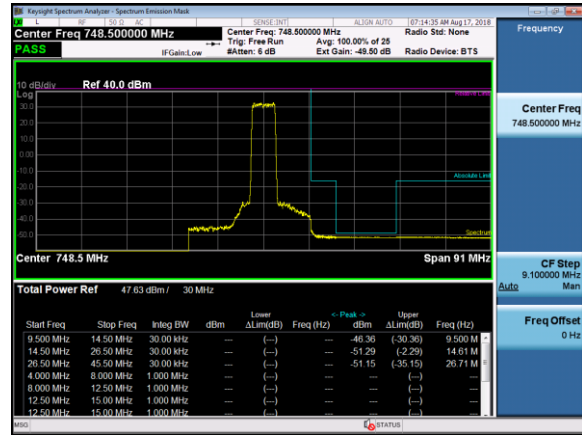
4.2.1 Occupied Bandwidth Results.

The Occupied Bandwidth was measured for all three modulations, at each signal bandwidth and at left center and right side of band. The mask on the plots meet the Block Edge requirements as specified in 47CFR 27.53.

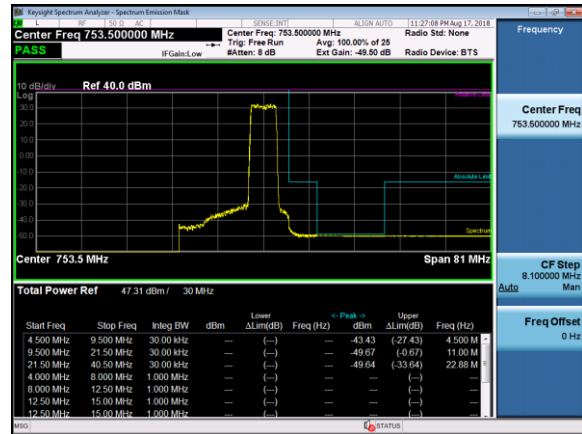
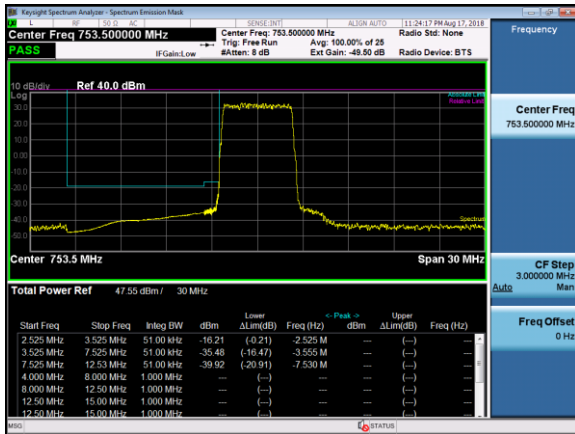
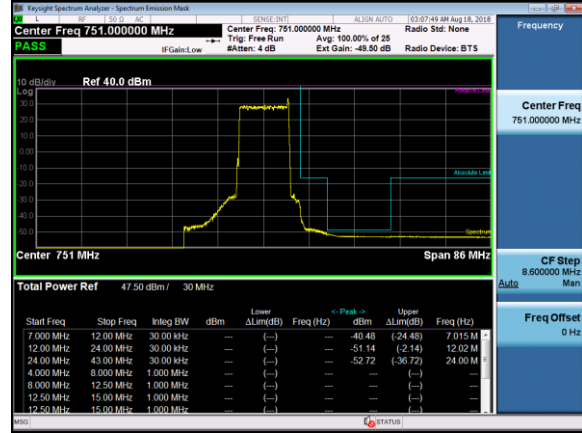
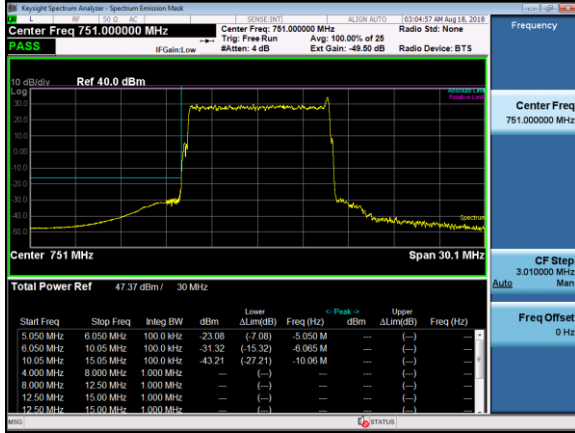
All of the measurements met the requirements of Part 27.53 when measured per Part 2.1049.

NOTE: Only a sample of all the data taken have been used in this report. The full suite of data resides at the MH, New Jersey location.

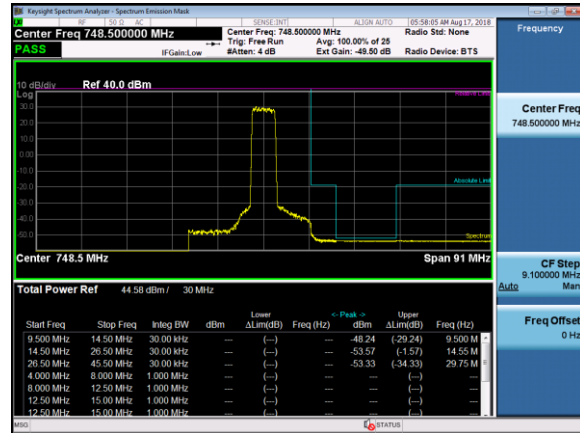
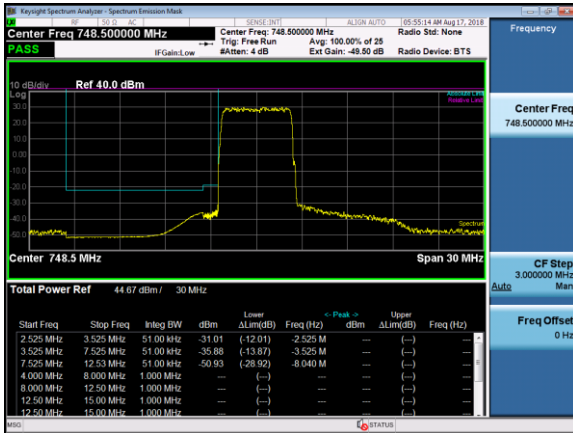
4.2.2 Edge of band Emissions - Sample Plots 2x60W.



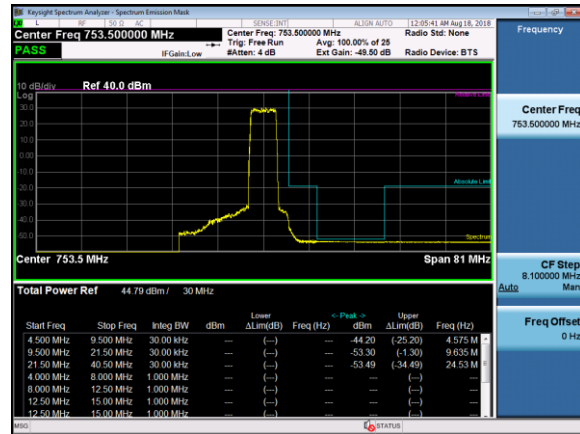
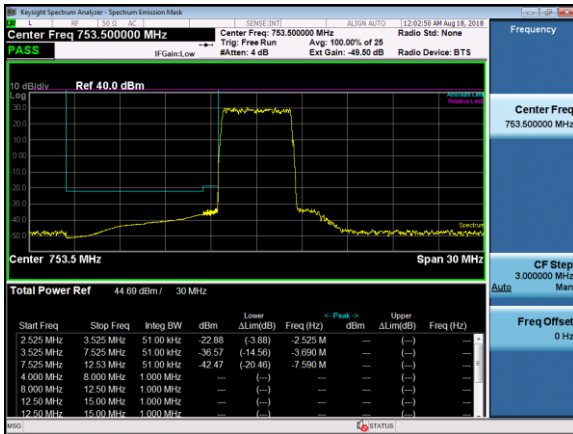
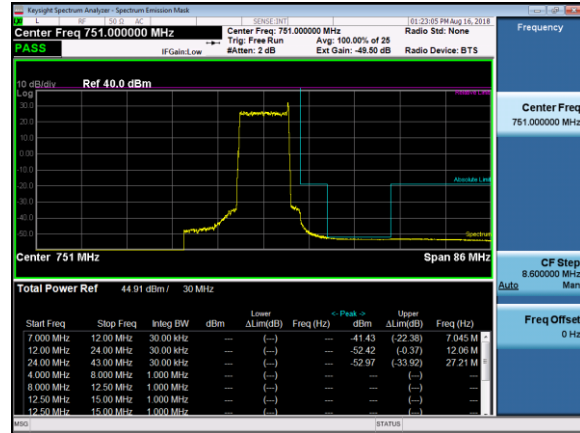
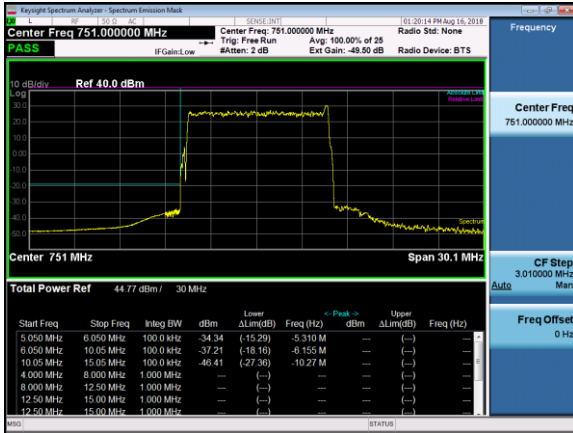
10MHz NB-IoT Guard Band



4.2.3 Edge of band Emissions - Sample Plots 4x30W.



10MHz NB-IoT Guard Band



5. FCC Section 2.1051 - Spurious Emissions at Transmit Antenna Port

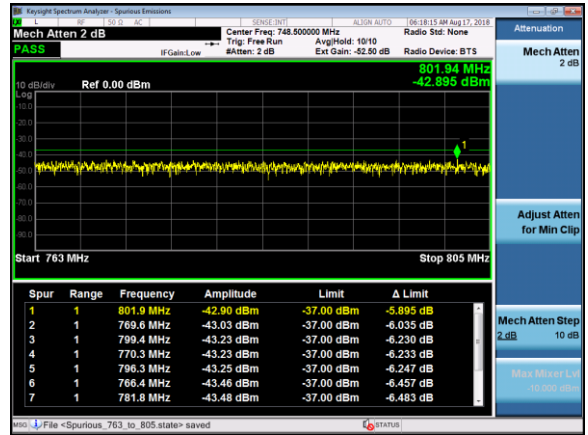
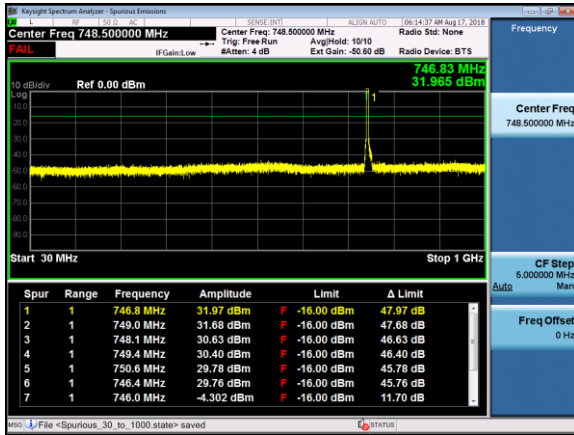
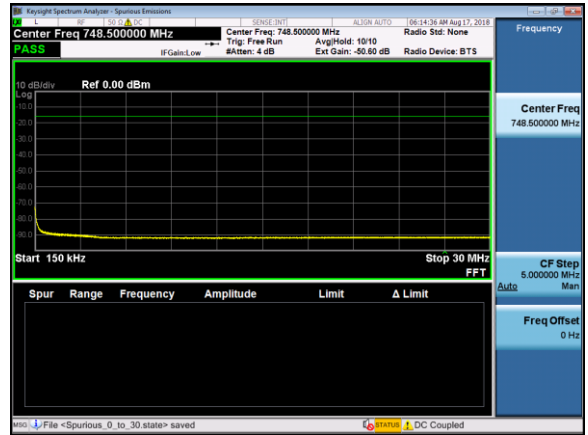
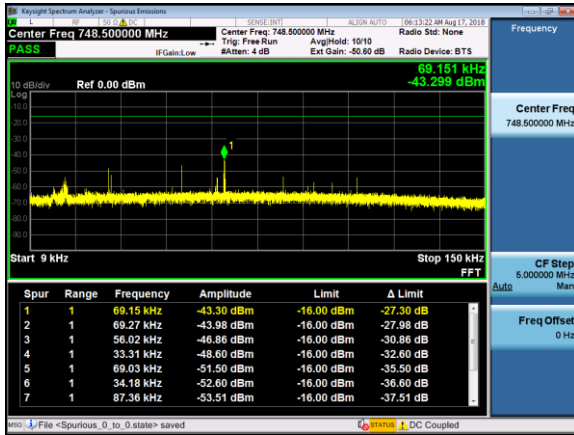
5.1 Measurement of Spurious Emissions at Transmit Antenna Port

Spurious Emissions at the transmit-antenna terminals were investigated over the frequency range of 10 MHz to beyond the 10th harmonic of the specific transmit band. For this band of operation, the measurements were performed up to 22GHz. Measurements were made using a Keysight MXA Signal Analyzer. The RF output from the transmitter was reduced (to an amplitude usable by the receivers) using calibrated attenuators. The RF power level was continuously monitored via a coupled RF Power Meter.

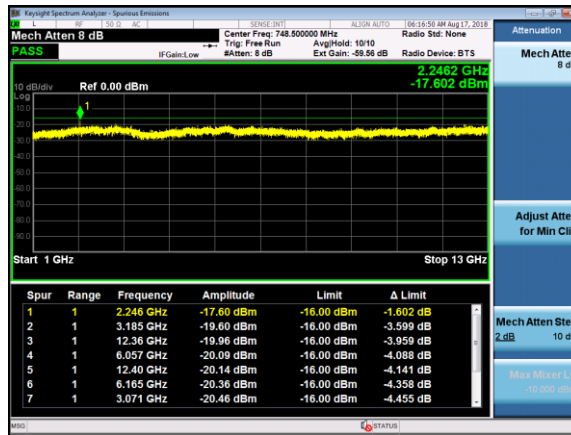
The required emission limitation is specified as appropriate in 27.53. The measured spurious emission levels were plotted for the frequency range as specified in 2.1057. There were no reportable emissions. Data below documents performance up to 13 GHz.

NOTE: Only a sample of all the data taken have been used in this report. The full suite of raw data resides at the MH, New Jersey location.

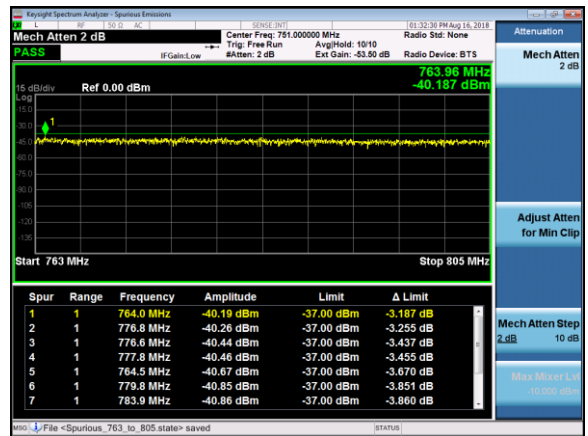
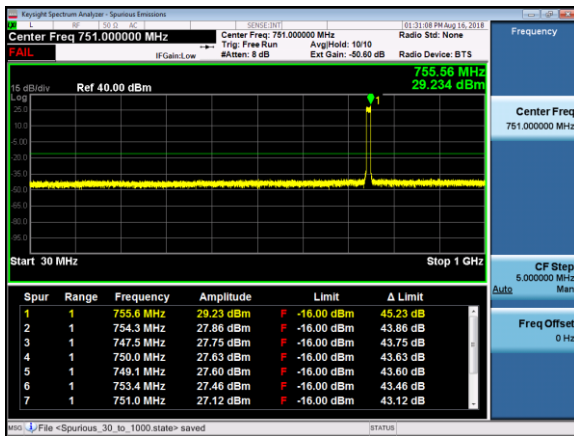
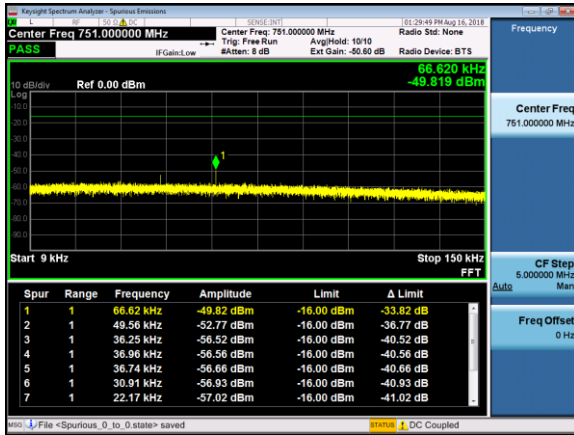
5.1.1 Sample Plots – Spurious Emissions at Tx Port 2x60W.



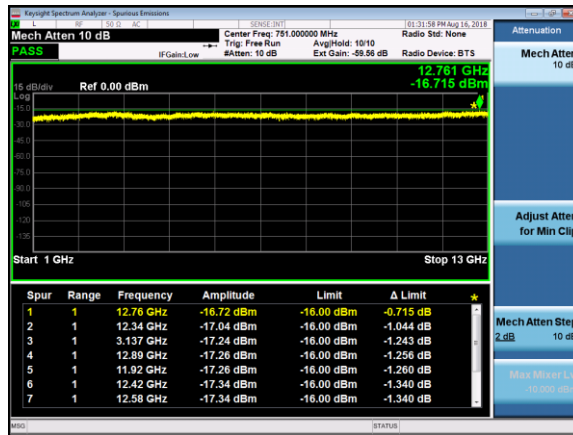
Tx Exempt



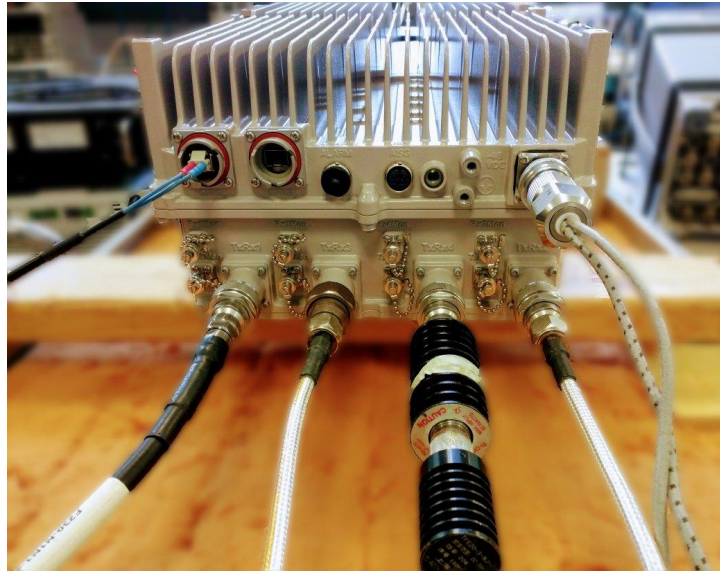
5.1.2 Sample Plots - Spurious Emissions at Tx Port 4x30W.



Tx Exempt



Photographs



Test Equipment

Asset ID	Manufacturer	Type	Description	Model	Serial	Calibration Date	Calibration Due	Calibration Type	Status
E831	Agilent Technologies	MXA Signal Analyzer	20Hz-26.5GHz	N9020A	MY48011791	2018-02-15	2020-02-15	Requires Calibration	Active
E1005	Weinschel	Attenuator	20 dB DC-18GHz 25W	46-20-34-LIM	BN3127			CNR, Must Be Verified	Active
E1272	Weinschel	Attenuator	30 dB / 150W	66-30-33	BV2473			CNR, Must Be Verified	Active
E1250	Weinschel	Attenuator	3dB Attenuator 100W	24-3-43	BB9072			CNR, Must Be Verified	Active

CNR = Calibration Not Required

6. FCC Section 2.1053

6.1 Section 2.1053 Field Strength of Spurious Emissions

Field strength measurements of radiated spurious emissions were made in 3m Semi-Anechoic Chambers the of Global Product Compliance Laboratories of Nokia of America Corporation in Murray Hill NJ. A complete description and full measurement data for the site is on file with the Commission (FCC File 515091).

The spectrum from 30 MHz to beyond the tenth harmonic of the carrier, 8 GHz, was searched for spurious radiation. Measurements were made using both horizontally and vertically polarized broadband antennas. Per FCC regulations, the comparison of out of band spurious emissions directly to the limit is appropriately made using the substitution method. However, when the emissions are more than 20 dB below the specification limit, the use of field strength measurements for compliance determination is acceptable and those emissions are considered not reportable (Section 2.1053 and the FCC Interpretive database for 2.1053). For this case the evaluation of acceptable radiated field strength is as follows.

6.2 Field Strength of Spurious Emissions - Limits

Sections 2.1053 and 27.53 contain the requirements for the levels of spurious radiation as a function of the level of the unmodulated carrier. The reference level for the unmodulated carrier is calculated as the field produced by an ideal dipole excited by the transmitter output power according to the following relation taken from Reference Data for Radio Engineers, page 676, 4th edition, IT&T Corp.

$$E = [(30 * P)^{1/2}] / R$$

$$20 \log (E * 10^6) - (43 + 10 \log P) = 82.23 \text{ dB}\mu\text{V/meter}$$

Where:

E = Field Intensity in Volts/meter

P = Transmitted Power in Watts

R = Measurement distance in meters = 3 m

The Part 27 Limit is 62.23 dBuV/m at 3m and 91.77 dBuV/m at 1m

The Part 27 non-report level is 62.23 dBuV/m at 3m.

The calculated emission levels were found by:

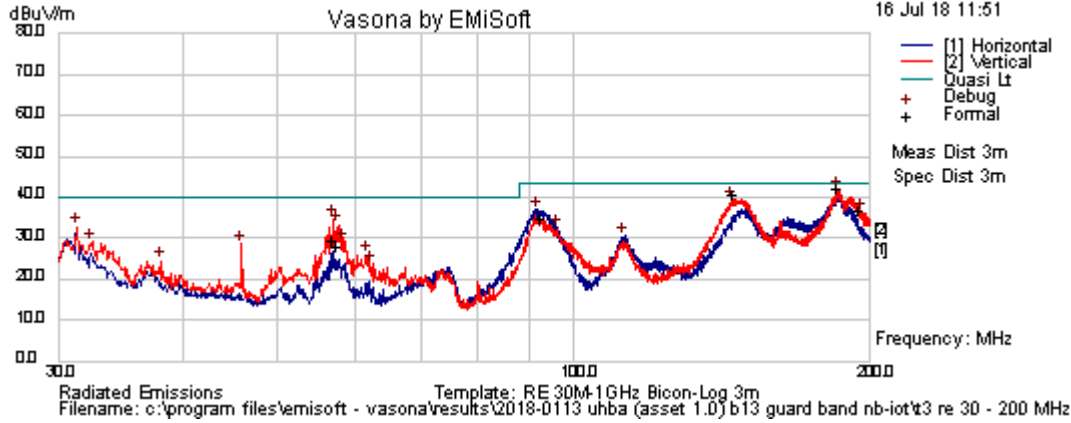
$$\text{Measured level (dB}\mu\text{V)} + \text{Cable Loss(dB)} + \text{Antenna Factor(dB)} = \text{Field Strength (dB}\mu\text{V/m)}$$

RESULTS:

For compliance with 47CFR Parts 2 and 27, the field strength of any spurious radiation, measured at 3m, is required to be less than 82.23 dBμV/meter (82.23 @ 3m). Emissions equal to or less than 62.23 dBμV/meter at 3m are not reportable and may be verified using field strength measurements and broadband antennas. Over the out of band spectrum investigated from 30 MHz to beyond the tenth harmonic of the carrier (up to 27GHz), no reportable spurious emissions were detected. A representative set of measurement scans are included below.

Field Strength of Spurious Emissions Results

T3 RE 30 MHz – 200 MHz_FCC Class B_QPSK 10M BW



Results Title:	RE 30M-1GHz Bicon-Log 3m
File Name:	c:\program files\emisoft - vasona\results\2018-0113 uhba (asset 1.0) b13 guard band nb-iot\3 re 30 - 200 MHz_QPSK.emi
Test Laboratory:	GPCL AR6MH 22C,40%RH, 1006mB
Test Engineer:	SEG
Test Software:	Vasona by EMISoft, version 2.161
Equipment:	Nokia of America Corporation
EUT Details:	UHBA (Asset 1.0) B13 Guard band NB-IoT
Configuration:	UHBA (Asset 1.0) B13 Guard band NB-IoT, -48VDC, E-TM1.1 751 MHz Carrier, 10MHz BW Radiated Emissions 30 MHz - 200 MHz 3 meters, ESI E908, Pre-Amp E507, Ant E051, 6 dB Pad E889
Date:	2018-07-16 11:51:31

FORMAL DATA

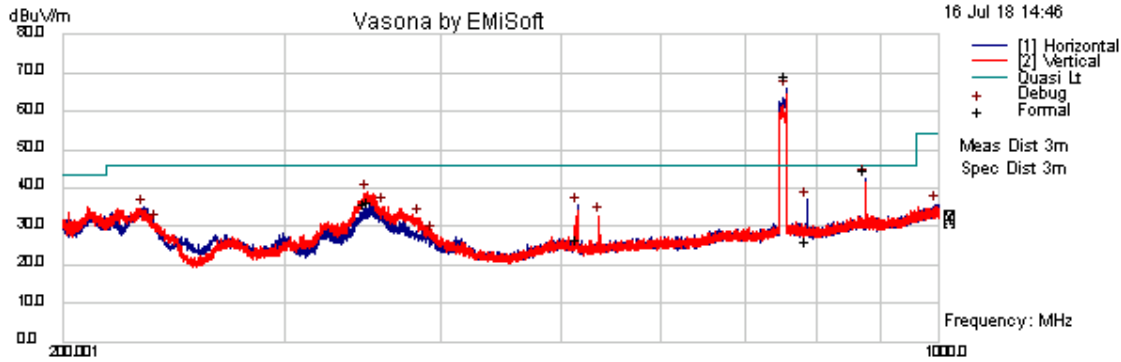
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
185.667	51.08	7.78	-19	39.89	Quasi Max	V	123	141	43.5	-3.61	Pass	
145.862	49.85	7.61	-19.3	38.14	Quasi Max	V	251	325	43.5	-5.36	Pass	
196.034	44.53	7.82	-18	34.35	Quasi Max	V	165	185	43.5	-9.15	Pass	
92.747	49.13	7.26	-23.8	32.55	Quasi Max	H	156	311	43.5	-10.95	Pass	
56.986	42.46	6.83	-22.4	26.85	Quasi Max	V	117	302	40	-13.15	Pass	
57.685	41.08	6.84	-22.5	25.4	Quasi Max	V	109	35	40	-14.6	Pass	

PREVIEW DATA

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
185.828	52.96	7.78	-19	41.78	Preview	V	105	135	43.5	-1.72	Pass	
145.431	51.01	7.61	-19.3	39.29	Preview	V	205	315	43.5	-4.21	Pass	
57.0301	50.36	6.83	-22.5	34.74	Preview	V	105	45	40	-5.26	Pass	
91.9479	53.57	7.25	-23.9	36.89	Preview	H	190	180	43.5	-6.61	Pass	
57.7034	48.9	6.84	-22.5	33.21	Preview	V	105	135	40	-6.79	Pass	
196.457	46.65	7.82	-18	36.47	Preview	V	205	135	43.5	-7.03	Pass	
31.2505	44.38	6.74	-18.3	32.78	Preview	H	290	90	40	-7.22	Pass	
32.4048	41.02	6.74	-18.5	29.23	Preview	V	105	315	40	-10.77	Pass	
58.4729	44.83	6.84	-22.6	29.05	Preview	V	105	90	40	-10.95	Pass	
96.3727	48.6	7.31	-23.4	32.53	Preview	H	190	180	43.5	-10.97	Pass	
45.9679	42.44	6.77	-20.7	28.52	Preview	V	205	180	40	-11.48	Pass	
112.725	44.23	7.43	-21.2	30.49	Preview	H	190	180	43.5	-13.01	Pass	
61.9359	42.3	6.87	-23.2	25.98	Preview	V	105	90	40	-14.02	Pass	
38.0802	37.18	6.75	-19.4	24.5	Preview	V	105	90	40	-15.5	Pass	
62.513	40.1	6.87	-23.3	23.67	Preview	V	105	45	40	-16.33	Pass	

Note: Preview data was measured using a peak detector to identify frequencies of interest for formal measurement. Formal data consist of all frequencies in the preview list within 6 dB of specification limit or the top six frequencies. Failure in preview data does not necessarily constitute failure in formal data.

T4 RE 200 MHz – 1 GHz FCC Class B_QPSK 10M BW



Radiated Emissions Template: RE 30M-1GHz Bicon-Log 3m
 Filename: c:\program files\emisoft - vasona\results\2018-0113 uhba (asset 1.0) b13 guard band nb-iot\4 re 200 - 1000 MHz_qpsk.emi

Results Title:	RE 30M-1GHz Bicon-Log 3m
File Name:	c:\program files\emisoft - vasona\results\2018-0113 uhba (asset 1.0) b13 guard band nb-iot\4 re 200 - 1000 MHz_qpsk.emi
Test Laboratory:	GPCL AR6MH 22C,40%RH, 1006mB
Test Engineer:	SEG
Test Software:	Vasona by EMISoft, version 2.161
Equipment:	Nokia of America Corporation
EUT Details:	UHBA (Asset 1.0) B13 Guard band NB-IoT
Configuration:	UHBA (Asset 1.0) B13 Guard band NB-IoT, -48VDC, E-TM1.1 751 MHz Carrier, 10MHz BW Radiated Emissions 200 MHz - 1000 MHz 3 meters, ESI E908, Pre-Amp E507, Ant E060, 6 dB Pad E889
Date:	2018-07-16 14:46:55

FORMAL DATA

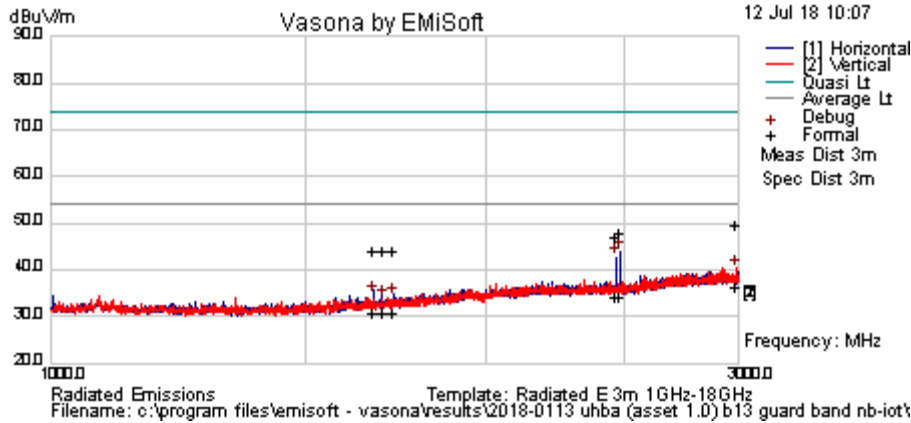
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
755.643	67.15	9.54	-10.1	66.61	Quasi Max	H	112	166	46	20.61	Fail	Tx Exempt
875.002	41.45	9.89	-9.04	42.3	Quasi Max	H	104	255	46	-3.7	Pass	
351.347	42.18	8.33	-16.8	33.69	Quasi Max	V	104	247	46	-12.31	Pass	
348.493	41.82	8.32	-16.8	33.31	Quasi Max	V	109	255	46	-12.69	Pass	
514.745	28.52	8.86	-13.5	23.87	Quasi Max	H	134	240	46	-22.13	Pass	
786.503	24.78	9.64	-11	23.46	Quasi Max	H	184	265	46	-22.54	Pass	

PREVIEW DATA

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
755.579	66.37	9.54	-10.1	65.84	Preview	H	105	180	46	19.84	Fail	
875.05	41.77	9.89	-9.04	42.62	Preview	H	105	270	46	-3.38	Pass	
349.263	47.52	8.33	-16.8	39.03	Preview	V	105	225	46	-6.97	Pass	
786.361	38.17	9.64	-11	36.86	Preview	H	105	180	46	-9.14	Pass	
514.906	40.21	8.86	-13.5	35.56	Preview	H	105	135	46	-10.44	Pass	
361.094	43.82	8.37	-16.9	35.27	Preview	V	105	225	46	-10.73	Pass	
231.619	47.43	7.94	-20.4	34.99	Preview	H	105	0	46	-11.01	Pass	
536.164	37.31	8.93	-13.5	32.74	Preview	V	105	90	46	-13.26	Pass	
384.854	40.81	8.46	-16.9	32.36	Preview	V	105	225	46	-13.64	Pass	
237.198	42.96	7.96	-20.1	30.78	Preview	V	105	180	46	-15.22	Pass	
395.339	35.91	8.49	-16.5	27.95	Preview	V	105	225	46	-18.05	Pass	
998.657	31.4	10.2	-5.94	35.66	Preview	H	390	225	54	-18.34	Pass	

Note: Preview data was measured using a peak detector to identify frequencies of interest for formal measurement. Formal data consist of all frequencies in the preview list within 6 dB of specification limit or the top six frequencies. Failure in preview data does not necessarily constitute failure in formal data.

T2 RE 1 GHz – 3 GHz_FCC Class B_QPSK 10M BW



Results Title:	Radiated E 3m 1GHz-18GHz
File Name:	c:\program files\emisoft - vasona\results\2018-0113 uhba (asset 1.0) b13 guard band nb-iot\re 1 - 3 ghz_256qam.emi
Test Laboratory:	GPCL AR6MH 22C,40%RH, 1006mB
Test Engineer:	SEG
Test Software:	Vasona by EMIsoft, version 2.161
Equipment:	Nokia of America Corporation
EUT Details:	UHBA (Asset 1.0) B13 Guard band NB-IoT
Configuration:	UHBA (Asset 1.0) B13 Guard band NB-IoT, -48VDC, QPSK (E_TM 1.1), 751 MHz Carrier, 10MHz BW with NB-IoT, 2x 60 MIMO. Radiated Emissions 1 - 3000 MHz 3 meters, ESI E908, Pre-Amp E1166, Ant E393, 6dB Pad E889
Date:	2018-07-12 10:07:23

FORMAL DATA

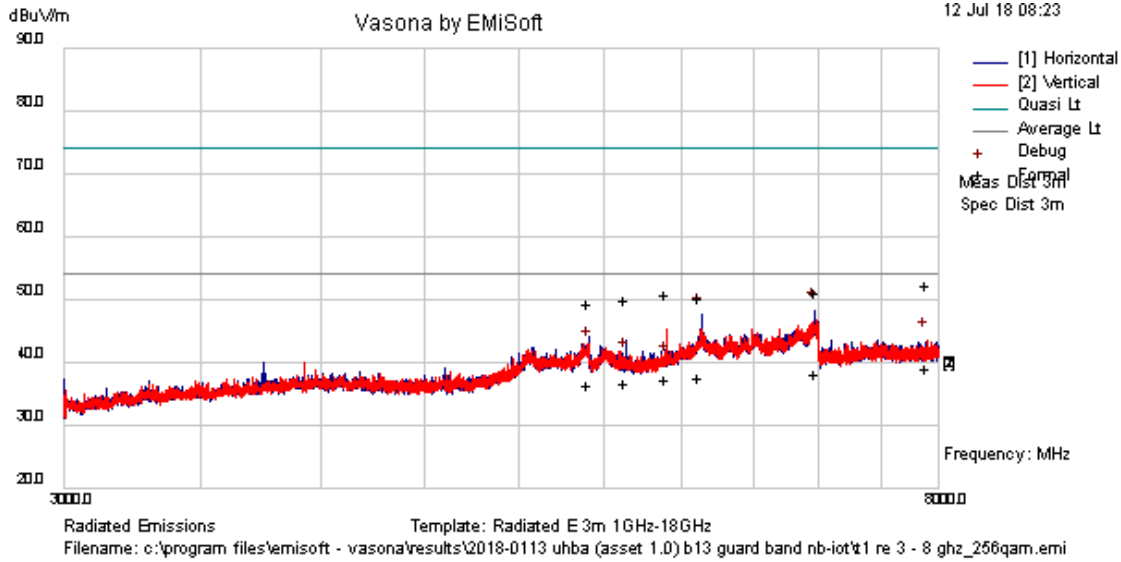
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
2479.92	45.13	10.05	-9.43	45.75	Peak	H	275	210	74	-28.25	Pass	
2467.32	44.51	10.02	-9.45	45.08	Peak	H	168	11	74	-28.92	Pass	
2983.12	44.14	11.16	-7.76	47.53	Peak	V	142	51	74	-26.47	Pass	
1672.42	45.86	8.54	-12.3	42.14	Peak	V	360	245	74	-31.86	Pass	
1729.61	45.25	8.58	-11.9	41.96	Peak	V	255	39	74	-32.04	Pass	
1697.98	45.38	8.56	-12.1	41.85	Peak	V	333	279	74	-32.15	Pass	
2479.92	31.48	10.05	-9.43	32.1	AvgMax	H	275	210	54	-21.9	Pass	
2467.32	31.4	10.02	-9.45	31.97	AvgMax	H	168	11	54	-22.03	Pass	
2983.12	30.96	11.16	-7.76	34.36	AvgMax	V	142	51	54	-19.64	Pass	
1672.42	32.29	8.54	-12.3	28.57	AvgMax	V	360	245	54	-25.43	Pass	
1729.61	32.15	8.58	-11.9	28.86	AvgMax	V	255	39	54	-25.14	Pass	
1697.98	32.11	8.56	-12.1	28.58	AvgMax	V	333	279	54	-25.42	Pass	

PREVIEW DATA

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
2480.5	43.4	10.06	-9.43	44.02	Preview	H	205	225	54	-9.98	Pass	
2462.82	42.06	10.01	-9.46	42.61	Preview	H	105	135	54	-11.39	Pass	
2988.1	36.86	11.17	-7.75	40.28	Preview	V	293	315	54	-13.72	Pass	
1672.42	38.24	8.54	-12.3	34.52	Debug	V	108	317	54	-19.48	Pass	
1697.98	37.38	8.56	-12.1	33.85	Debug	V	108	317	54	-20.15	Pass	
1729.61	37.68	8.58	-11.9	34.39	Debug	V	108	317	54	-19.61	Pass	

Note: Preview data was measured using a peak detector to identify frequencies of interest for formal measurement. Formal data consist of all frequencies in the preview list within 6 dB of specification limit or the top six frequencies. Failure in preview data does not necessarily constitute failure in formal data.

T1 RE 3 GHz – 8 GHz FCC Class B QPSK 10M BW



Results Title:	Radiated E 3m 1GHz-18GHz
File Name:	c:\program files\emisoft - vasona\results\2018-0113 uhba (asset 1.0) b13 guard band nb-iot\t1 re 3 - 8 GHz_256QAM.emi
Test Laboratory:	GPCL AR6MH 22C,40%RH, 1006mB
Test Engineer:	SEG
Test Software:	Vasona by EMIsoft, version 2.161
Equipment:	Nokia of America Corporation
EUT Details:	UHBA (Asset 1.0) B13 Guard band NB-IoT
Configuration:	UHBA (Asset 1.0) B13 Guard band NB-IoT, -48VDC, 256QAM (E_THM 3.1A), 751 MHz Carrier, 10MHz BW Radiated Emissions 3 - 8000 MHz 3 meters, ESI E908, Pre-Amp E1166, Ant E393, HPF E963
Date:	2018-07-12 08:23:04

FORMALS

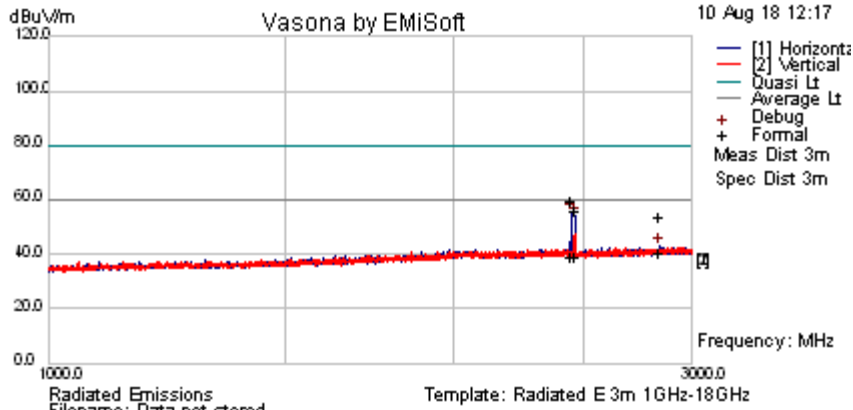
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
6975.98	41.99	8.56	-2.4	48.15	Peak	H	284	266	74	-25.85	Pass	
6127.4	41.72	8.75	-3.19	47.28	Peak	H	130	203	74	-26.72	Pass	
7901.46	41.86	8.69	-1.29	49.25	Peak	V	147	129	74	-24.75	Pass	
5408.24	41.46	8.46	-3.55	46.37	Peak	V	233	349	74	-27.63	Pass	
5637.62	41.46	8.59	-3.32	46.73	Peak	V	248	78	74	-27.27	Pass	
5903.49	42.24	8.73	-3.23	47.74	Peak	V	145	291	74	-26.26	Pass	
6975.98	28.94	8.56	-2.4	35.1	AvgMax	H	284	266	54	-18.9	Pass	
6127.4	28.84	8.75	-3.19	34.39	AvgMax	H	130	203	54	-19.61	Pass	
7901.46	28.46	8.69	-1.29	35.86	AvgMax	V	147	129	54	-18.14	Pass	
5408.24	28.46	8.46	-3.55	33.37	AvgMax	V	233	349	54	-20.63	Pass	
5637.62	28.3	8.59	-3.32	33.56	AvgMax	V	248	78	54	-20.44	Pass	
5903.49	28.84	8.73	-3.23	34.34	AvgMax	V	145	291	54	-19.66	Pass	

PREVIEW DATA

	Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
1	6960.59	42.2	8.56	-2.42	48.34	Preview	H	305	270	54	-5.66	Pass	
2	6131.12	42	8.75	-3.19	47.55	Preview	H	305	225	54	-6.45	Pass	
3	7896.52	36.19	8.69	-1.29	43.58	Preview	V	105	180	54	-10.42	Pass	
4	5903.49	34.24	8.73	-3.23	39.74	Debug	V	100	317	54	-14.26	Pass	
5	5637.62	35.21	8.59	-3.32	40.48	Debug	V	100	317	54	-13.52	Pass	
6	5408.24	37.31	8.46	-3.55	42.22	Debug	V	100	317	54	-11.78	Pass	

Note: Preview data was measured using a peak detector to identify frequencies of interest for formal measurement. Formal data consist of all frequencies in the preview list within 6 dB of specification limit or the top six frequencies. Failure in preview data does not necessarily constitute failure in formal data.

RE 1 GHz – 3 GHz 256QAM /5 MHz BW (No NB-IOT)



Results Title:	Radiated E 3m 1GHz-18GHz
File Name:	c:\program files\emisoft - vasona\results\2018-0113 uhba (asset 1.0) b13 guard band nb-iot\RE T1 256QAM_5BW- 1GHz- 3GHz.emi
Test Laboratory:	GPCL AR5-MH 22C, 69%RH, 994mB
Test Engineer:	EEM
Test Software:	Vasona by EMISoft, version 2.161
Equipment:	Nokia of America Corporation
EUT Details:	UHBA (Asset 1.0) B13
Configuration:	UHBA (Asset 1.0) B13 -48VDS , 256QAM, 748 MHz Carrier, 5 MHz BW, 2 x 60 MINIM.AISG)BIAS-T)and Alarm Cable Installed. Radiated Emissions 1 GHz- 3 GHz, 3 meters, ESI 1190, Preamp E1166, Ant., E057, 10 dB pad (E583)
Date:	2018-08-10 13:19:24

FORMAL DATA

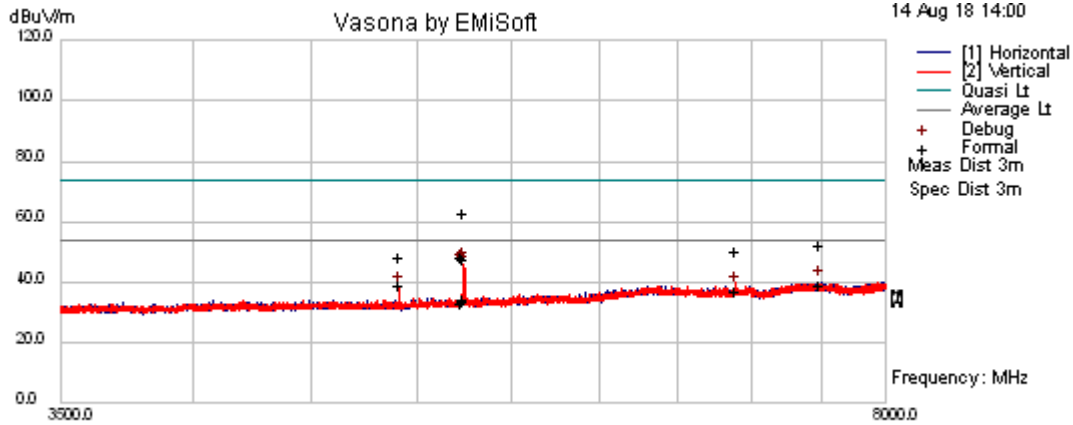
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
2445.59	52	14.13	-10	56.1	Peak	H	118	235	80	-23.9	Pass	
2460.9	47.93	14.15	-10	52.04	Peak	H	267	90	80	-27.96	Pass	
2837.46	44.44	14.58	-9.23	49.8	Peak	H	377	248	80	-30.2	Pass	
2445.59	31.28	14.13	-10	35.39	AvgMax	H	118	235	60	-24.61	Pass	
2460.9	31.32	14.15	-10	35.44	AvgMax	H	267	90	60	-24.56	Pass	
2837.46	31.16	14.58	-9.23	36.52	AvgMax	H	377	248	60	-23.48	Pass	

PREVIEW DATA

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
2442.73	51.4	14.13	-10	55.5	Preview	H	290	0	60	-4.5	Pass	
2459.61	49.99	14.15	-10	54.11	Preview	H	190	45	60	-5.89	Pass	
2839.02	37.58	14.58	-9.22	42.94	Preview	H	290	90	60	-17.06	Pass	

Note: Preview data was measured using a peak detector to identify frequencies of interest for formal measurement. Formal data consist of all frequencies in the preview list within 6 dB of specification limit or the top six frequencies. Failure in preview data does not necessarily constitute failure in formal data.

RE 3.5 GHz – 8 GHz 256QAM /5 MHz BW (No NB-IOT)



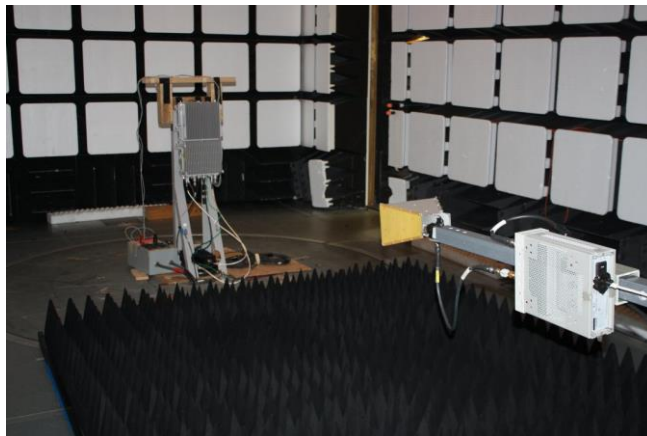
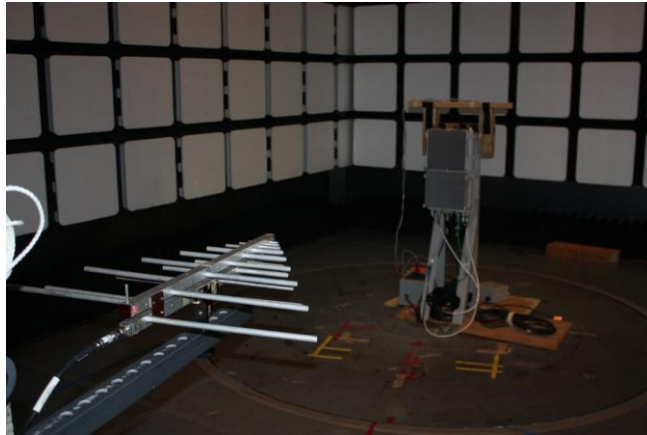
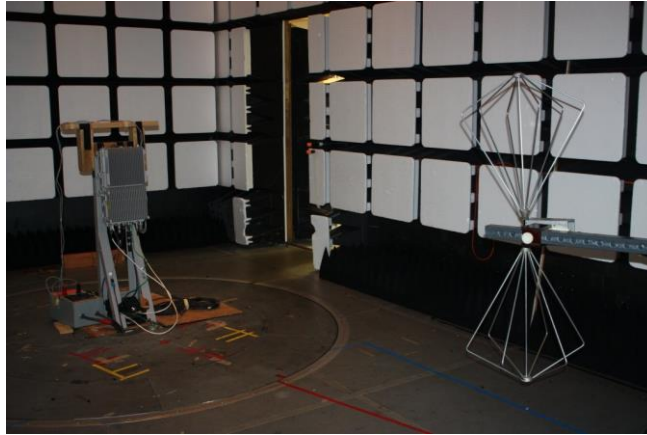
Radiated Emissions
 Template: Radiated E 3m 1GHz-18GHz
 Filename: c:\program files\emisoft - vasona\results\2018-0113 uhba (asset 1.0) b13 guard band nb-iot\re t2a 256qam_5bw-

Results Title:	Radiated E 3m 1GHz-18GHz
File Name:	c:\program files\emisoft - vasona\results\2018-0113 uhba (asset 1.0) b13 guard band nb-iot\re t2a 256qam_5bw- 3.5ghz- 8ghz.emi
Test Laboratory:	GPCL AR5-MH 22C, 69%RH, 994mB
Test Engineer:	GM/ EEM
Test Software:	Vasona by EMISoft, version 2.161
Equipment:	Nokia of America Corporation
EUT Details:	UHBA (Asset 1.0) B13
Configuration:	UHBA (Asset 1.0) B13 -48VDS , 256QAM, 748 MHz Carrier, 5 MHz BW, 2 x 60 MINIM.AISG)BIAS-T)and Alarm Cable Installed. Radiated Emissions 3 GHz- 8 GHz, 3 meters, ESI 1190, Preamp E1166, Ant., E057, HFP=2 (E063), (E583) Preview: RBW-; 100 kHz/ VBW:3 MHz
Date:	2018-08-13 10:43:43

FORMAL DATA												
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
5243.786	58.3	4.67	-4.4	58.57	Quasi Max	V	226	262	74	-15.43	Pass	
7500.7097	28.89	6.87	-0.97	34.79	AvgMax	H	222	130	54	-19.21	Pass	
4915.194	35.14	4.49	-4.95	34.68	AvgMax	V	116	0	54	-19.32	Pass	
6887.273	28.68	6.47	-2.03	33.12	AvgMax	H	227	218	54	-20.88	Pass	
5243.786	30.28	4.67	-4.4	30.55	AvgMax	V	226	262	54	-23.45	Pass	
5247.805	28.99	4.67	-4.39	29.27	AvgMax	V	302	225	54	-24.73	Pass	
5239.768	28.99	4.66	-4.4	29.25	AvgMax	V	267	222	54	-24.75	Pass	
7500.7097	42.23	6.87	-0.97	48.13	Quasi Max	H	222	130	74	-25.87	Pass	
6887.273	41.55	6.47	-2.03	45.99	Quasi Max	H	227	218	74	-28.01	Pass	
4915.194	44.64	4.49	-4.95	44.18	Quasi Max	V	116	0	74	-29.82	Pass	
5239.768	43.7	4.66	-4.4	43.96	Quasi Max	V	267	222	74	-30.04	Pass	
5247.805	42.91	4.67	-4.39	43.19	Quasi Max	V	302	225	74	-30.81	Pass	

PREVIEW DATA												
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
5243.7868	45.75	4.67	-4.4	46.02	Preview	V	390	154	54	-7.98	Pass	
5239.768	44.9	4.66	-4.4	45.16	Preview	V	390	242	54	-8.84	Pass	
5247.8055	44.49	4.67	-4.39	44.77	Preview	V	102	154	54	-9.23	Pass	
7500.7097	33.96	6.87	-0.97	39.86	Preview	H	102	132	54	-14.14	Pass	
6887.2733	33.91	6.47	-2.03	38.35	Debug	H	100	355	54	-15.65	Pass	
4915.054	38.56	4.49	-4.95	38.1	Preview	V	102	352	54	-15.9	Pass	

6.3 Field Strength of Spurious Emissions Photographs



6.4 Field Strength of Spurious Emissions Test Equipment

Asset ID	Manufacturer	Type	Description	Model	Serial	Calibration Date	Calibration Due	Calibration Type	Status
E1166	Agilent Technologies	Pre-Amplifier	Pre-Amplifier 1-26.5GHz	8449B	3008A01740	2016-02-25	2018-08-25	Requires Calibration	Active
E051	EMCO	Biconical Antenna		3109	2187	2016-12-01	2018-12-01	Requires Calibration	Active
E393	EMCO	Horn Antenna	Double Ridged Horn 1-18 Ghz	3115	9903-5769	2017-06-05	2019-06-05	Requires Calibration	Active
E060	EMCO	Log Periodic Antenna	Log periodic antenna	3146	1458	2016-12-06	2018-12-06	Requires Calibration	Active
E908	Rohde & Schwarz	Test Receiver	EMI (20Hz to 40 GHz)-150 +30dBm	ESIB40	100100	2018-03-12	2020-03-12	Requires Calibration	Active
E507	Sonoma Instrument Co.	Amplifier	9KHz-1GHz	310	185794	2018-08-14	2020-08-14	Requires Calibration	Active
E963	Trilithic	High Pass Filter	Cellular	4HC1400/8000-1-KK	850-HPF-2			Calibration Not Required	Active
E889	Weinschel	Attenuator	6 dB DC-18GHz 5 Watt	2-6	BX3438	2018-05-23	2020-05-23	Requires Calibration	Active

7. NVLAP Certificate of Accreditation

**United States Department of Commerce
National Institute of Standards and Technology**

NVLAP[®]

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 100275-0

Nokia, Global Product Compliance Lab
Murray Hill, NJ

*is accredited by the National Voluntary Laboratory Accreditation Program for specific services,
listed on the Scope of Accreditation, for:*

Electromagnetic Compatibility & Telecommunications

*This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005.
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality
management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).*

2017-08-17 through 2018-09-30
Effective Dates




For the National Voluntary Laboratory Accreditation Program