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TESTING
NVLAP LAB CODE: 100275-0

FCC Test Report

Regulation:

FCC Part 2 and 27

Client:

Nokia Mobile Networks

Product Evaluated:

LTE 9442 RRH2X40-AWS

[AWS NG2 B4 RRH]

(Addition of 10 + 5 MHz)

Report Number:

TR-2018-0194-FCC2-27

Date Issued:

September 28, 2018

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Revisions

Date	Revision	Section	Change
9/28/2018	0		Initial Release

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Signed:  9/28/2018
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1. System Information and Requirements

Equipment Under Test (EUT):	LTE 9442 RRH2X40-AWS [AWS NG2 B4 RRH] FCCID: AS5BBTRX-02
Serial Number:	See Section 1.3
Cell Name / Number	GPCL Project Number:2018-0194
Company:	NOKIA SOLUTIONS AND NETWORKS OY KARAPORTTI 3, FI-02610 ESPOO FINLAND
Manufacturer:	NOKIA SOLUTIONS AND NETWORKS OY
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 Power Measurement Licensed Digital Systems v03r01 April 9, 2018 • KDB 662911 D01 Multiple Transmitter Output v02r01 Oct 2013
Measurement Procedure(s):	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
Test Results: The AWS NG2 B4 RRH, <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.	

1.1 Introduction

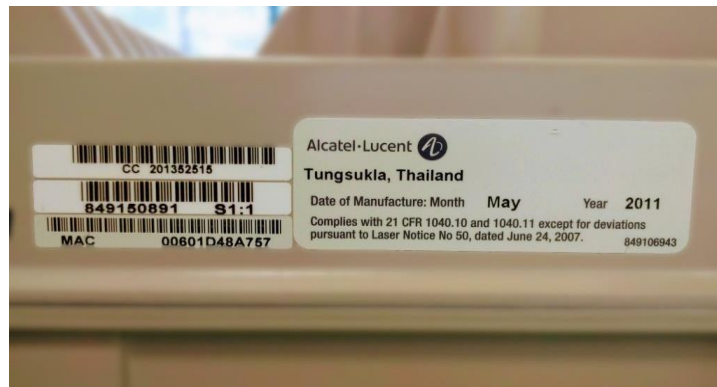
This Conformity test report applies to the **LTE 9442 RRH2X40-AWS** [AWS NG2 B4 RRH], hereinafter referred to as the Equipment Under Test (EUT).

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 10+5 MHz Contiguous and Non-Contiguous Dual Carriers 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. KDB 971168 D01 Power Measurement Licensed Digital Systems v03r01 April 9, 2018
 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

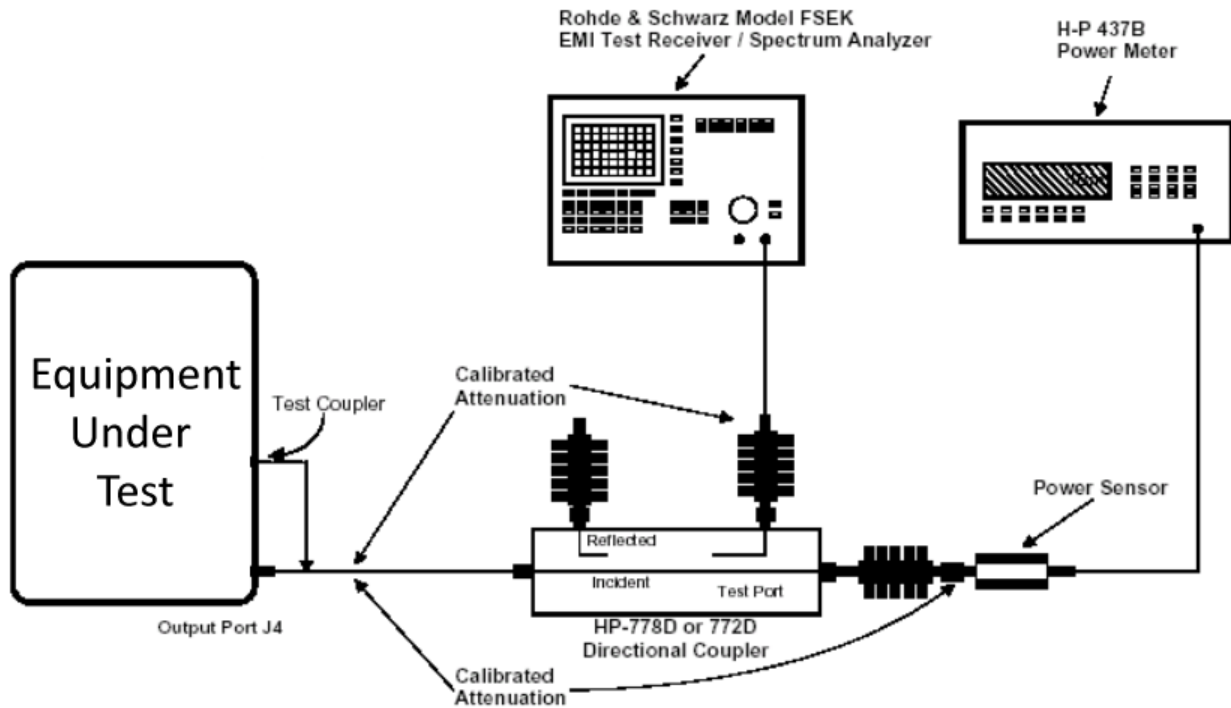
Antenna Port Test	Signal Bandwidth	Frequency Range	Expanded Uncertainty (k=2), Amplitude
Occupied Bandwidth, Edge of Band, Conducted Spurious Emissions	10 Hz	9 kHz to 20 MHz	1.78 dB
	100 Hz	20 MHz to 1 GHz	
	10 kHz to 1 MHz	1 GHz to 10 GHz	
	1MHz	10 GHz to 40 GHz:	
RF Power	10 Hz to 20 MHz	50 MHz to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

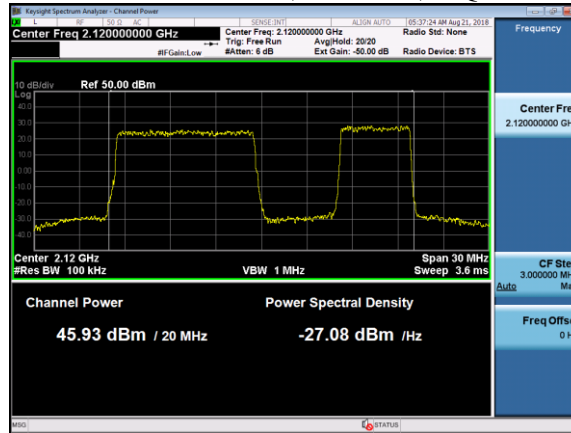
NOTE: Only a sample of all the plots taken have been used in this report. The full suite of raw data resides at the MH, New Jersey location.

Tabular Data – Channel RF Power

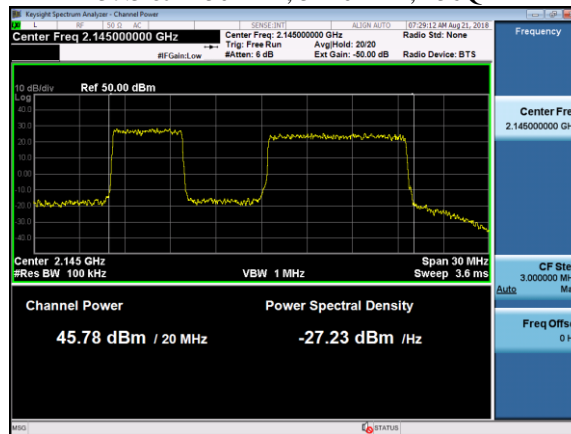
Channel Frequency MHz	Signal BW MHz	Modulation	Channel Power dBm
2115 & 2127.5	10+5 Non-Contiguous	64QAM	45.93
		256QAM	45.78
		QPSK+16QAM	45.75
2137.5 & 2150	5+10 Non-Contiguous	64QAM	45.58
		256QAM	45.78
		QPSK+16QAM	45.78
2132.5 & 2140	5+10 Contiguous	64QAM	46.05
		256QAM	45.87
		QPSK+16QAM	45.88

2.1.1 Channel RF Power - Plots.

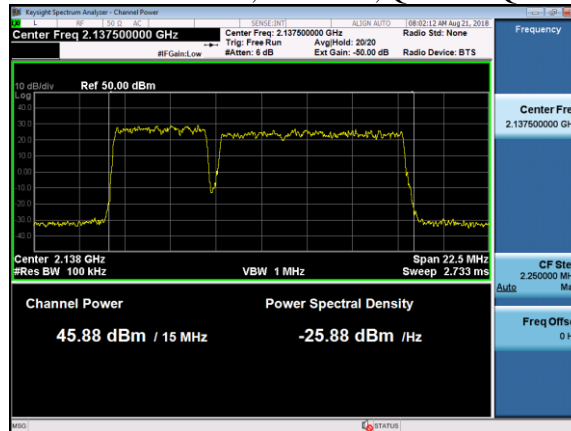
2115 & 2127.5MHz, 10+5MHz, 64QAM



2137.5 & 2150MHz, 5+10MHz, 256QAM



2132.5 & 2140MHz, 5+10MHz, QPSK+16QAM



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. All data was collected for QPSK+16QAM, 64QAM and 256QAM.

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.

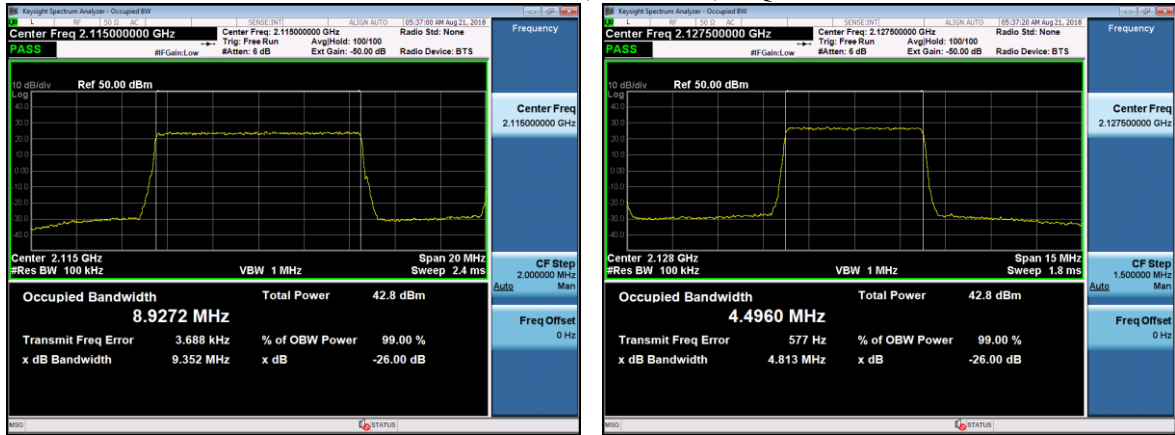
The transmitted signal occupied bandwidth was measured using a Keysight MXA Signal Analyzer. All emissions were within the parameters as previously filed. Sample Charts are below.

Tabular Data – Occupied Bandwidth

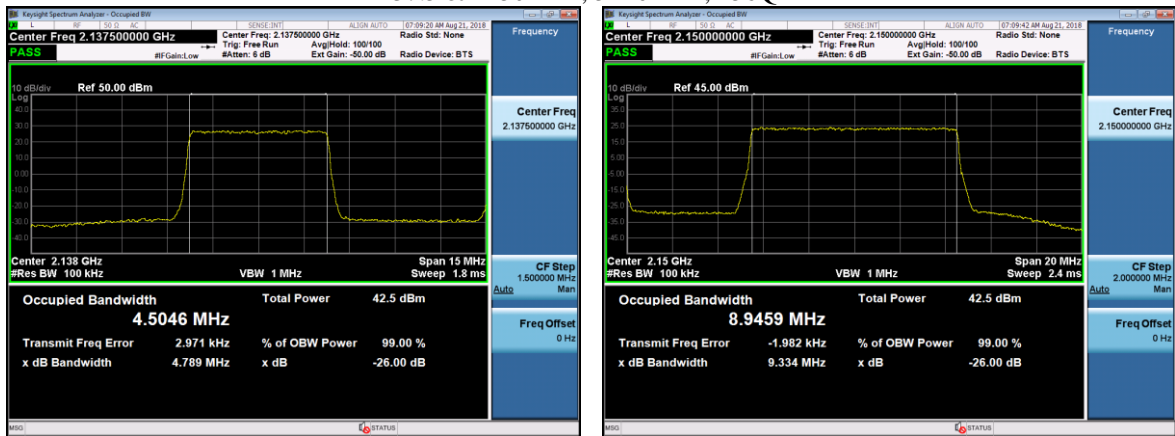
Channel Frequency MHz	Signal BW MHz	Modulation	OBW MHz
2115 & 2127.5	10+5 Non-Contiguous	64QAM	8.9272+4.4960
		256QAM	8.9385+4.5012
		QPSK+16QAM	8.9297+4.4873
2137.5 & 2150	5+10 Non-Contiguous	64QAM	4.5089+8.9297
		256QAM	4.5046+8.9459
		QPSK+16QAM	4.4873+8.9353
2132.5 & 2140	5+10 Contiguous	64QAM	14.133
		256QAM	14.127
		QPSK+16QAM	14.138

4.1.1 Occupied Bandwidth - Plots.

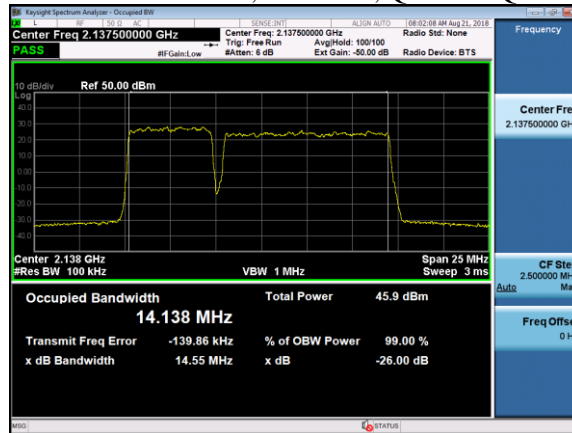
2115 & 2127.5MHz, 10+5MHz, 64QAM



2137.5 & 2150MHz, 5+10MHz, 256QAM



2132.5 & 2140MHz, 5+10MHz, QPSK+16QAM



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.

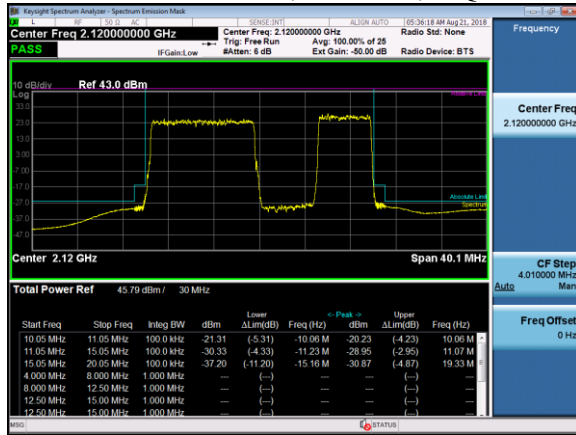
The Occupied Bandwidth was measured for all three modulations, at each signal bandwidth and at left center and right side of band. The mask on the plots meet the Block Edge requirements as specified in 47CFR 27.53.

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 - Plots.

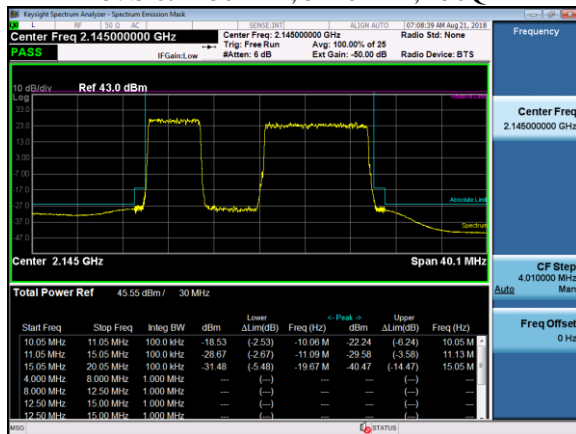
2115 & 2127.5MHz, 10+5MHz, 64QAM



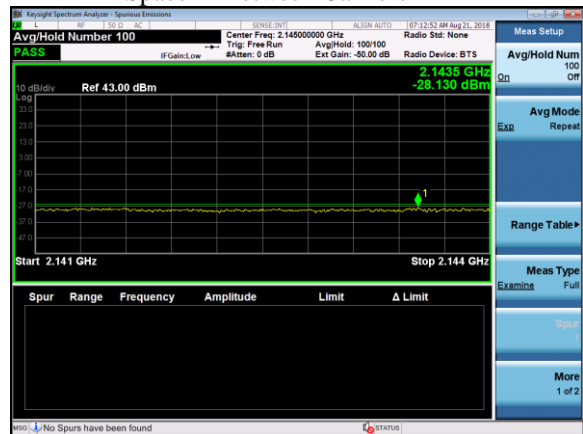
Space in Between Carriers



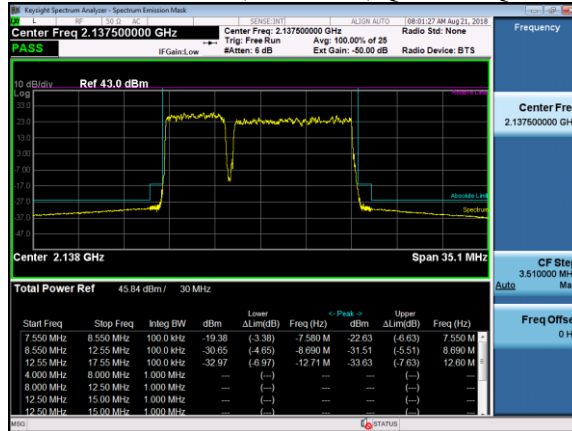
2137.5 & 2150MHz, 5+10MHz, 256QAM



Space in Between Carriers



2132.5 & 2140MHz, 5+10MHz, QPSK+16QAM



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

5.1 Measurement of Spurious Emissions at Transmit Antenna Port

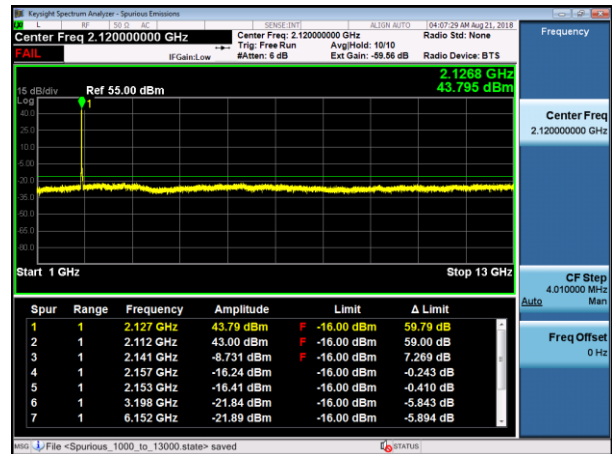
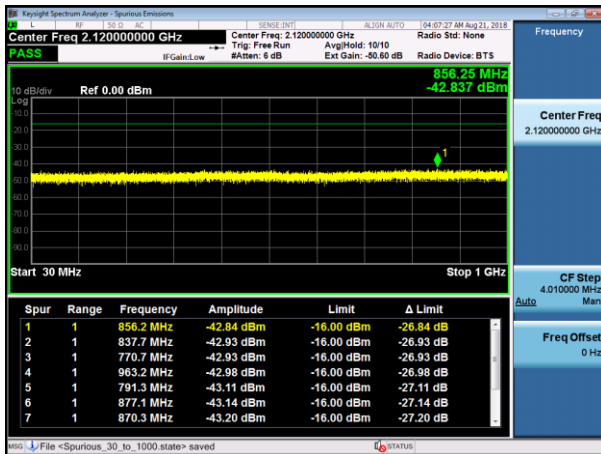
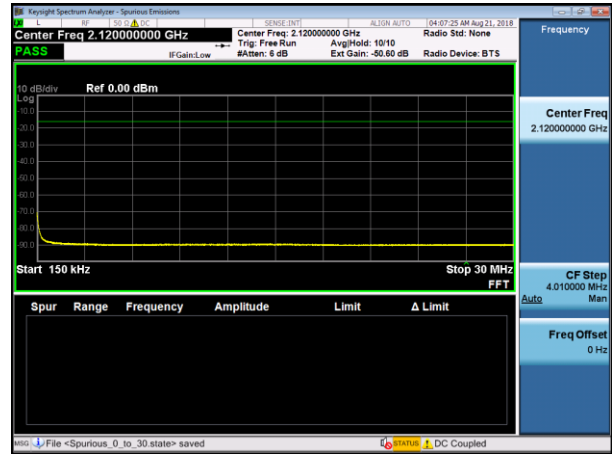
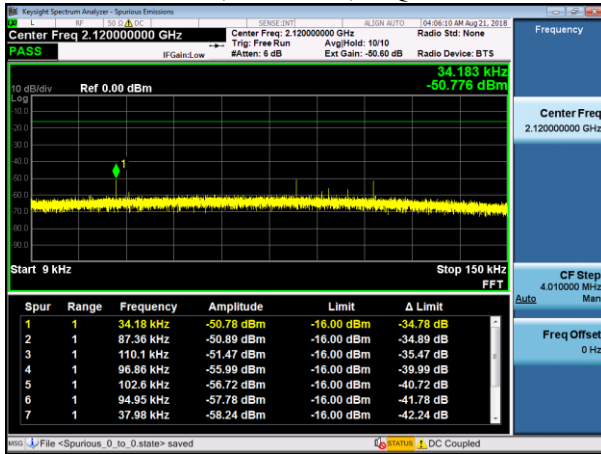
Spurious Emissions at the transmit-antenna terminals were investigated over the frequency range of 10 MHz to beyond the 10th harmonic of the specific transmit band. For this band of operation, the measurements were performed up to 22 GHz. Measurements were made using a Keysight MXA Signal Analyzer. The 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 22 GHz.

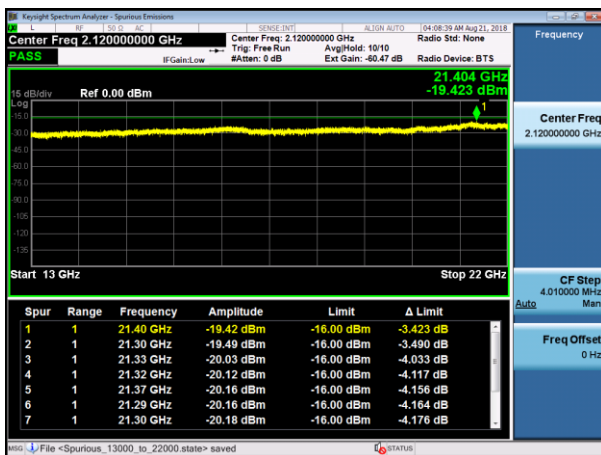
NOTE: Only a sample of all the data taken have been used in this report. The full suite of raw data resides at the MH, New Jersey location.

5.1.1 Plots - Spurious Emissions at Tx Port

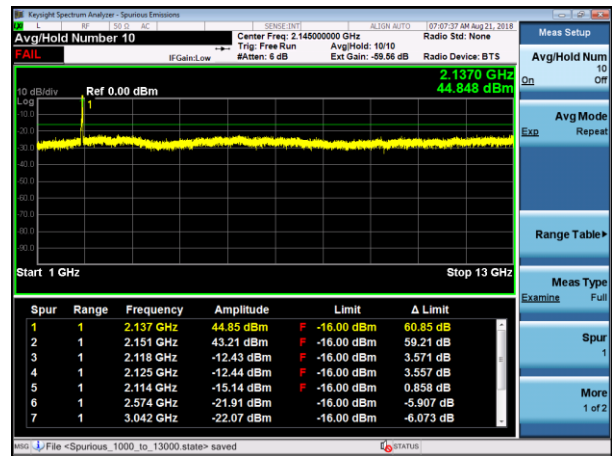
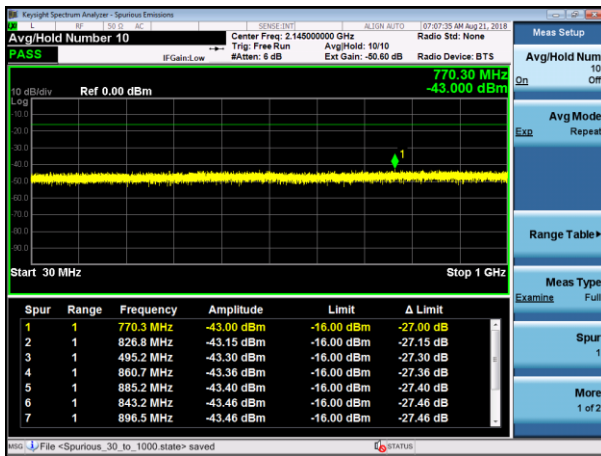
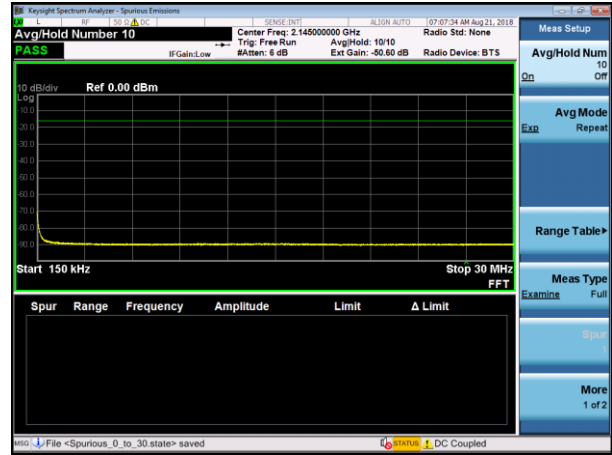
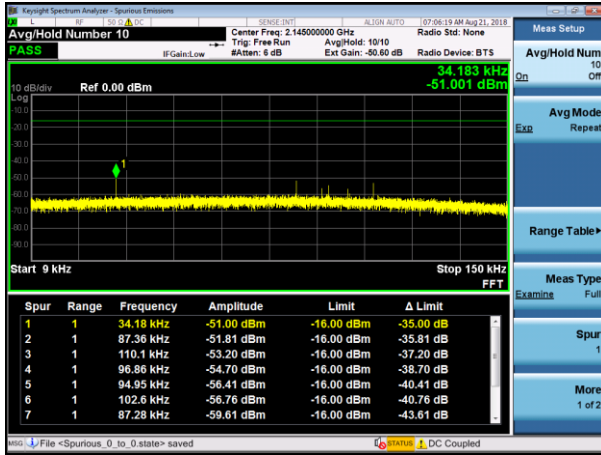
2115 & 2127.5MHz, 10+5MHz, 64QAM



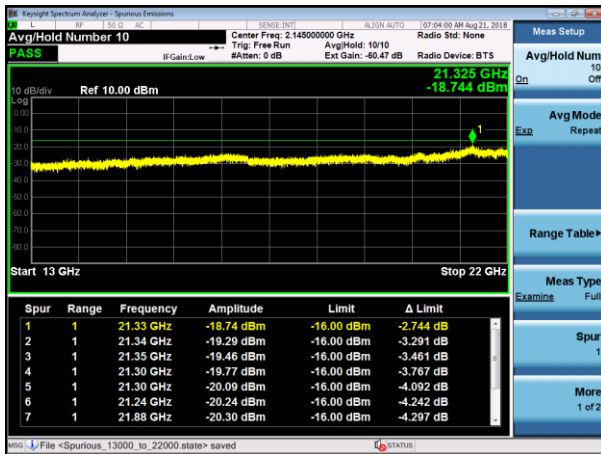
Tx Exempt



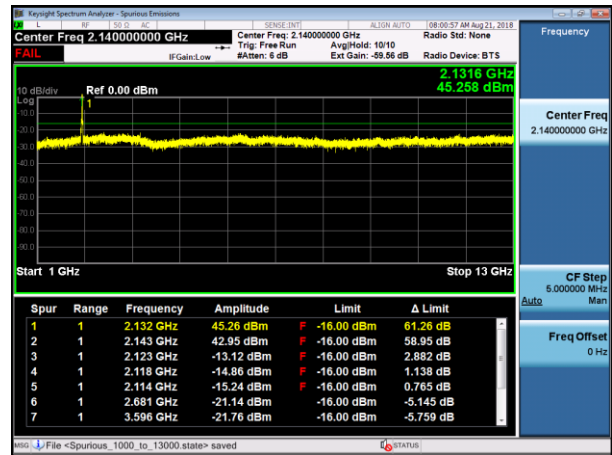
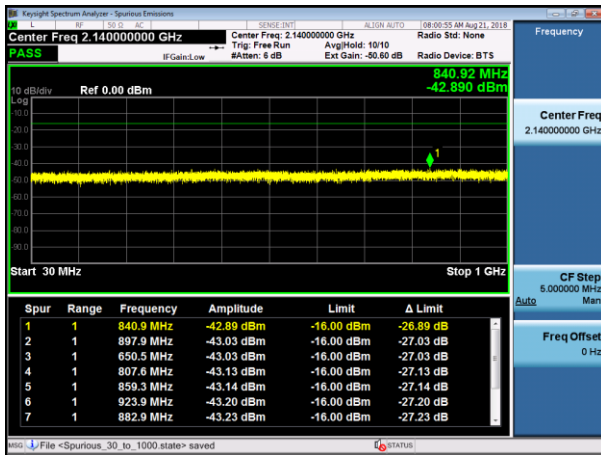
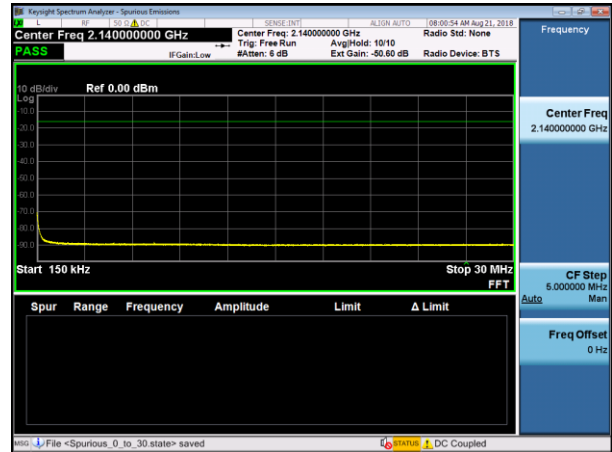
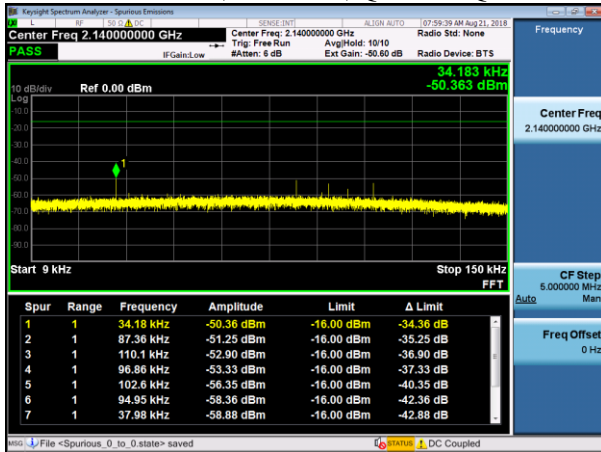
2137.5 & 2150MHz, 5+10MHz, 256QAM



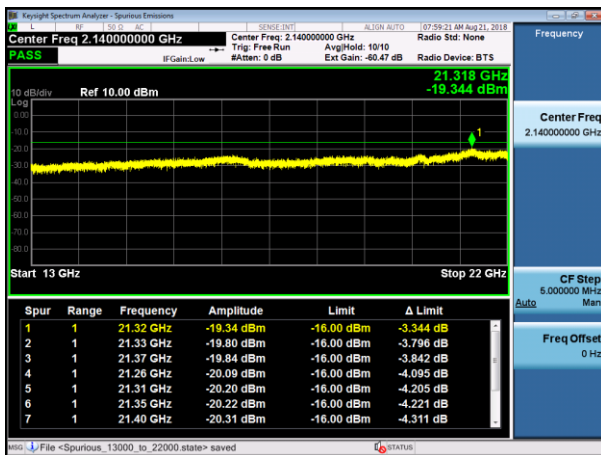
Tx Exempt



2132.5 & 2140MHz, 5+10MHz, QPSK+16QAM

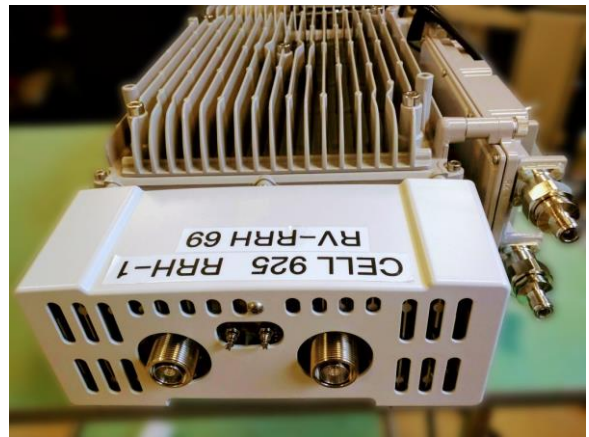
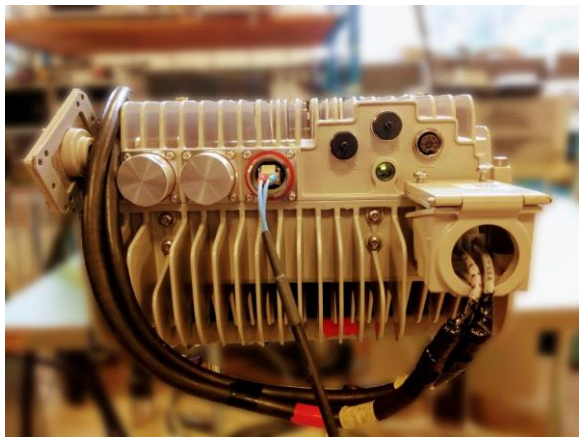
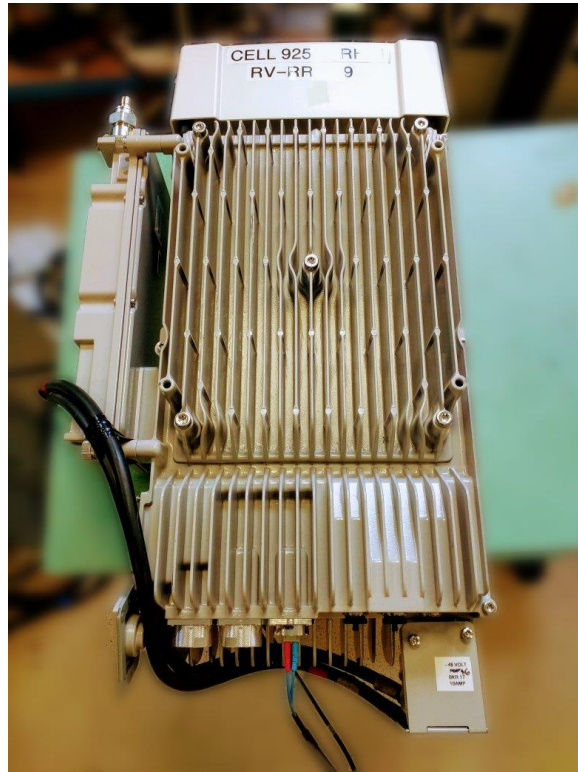


Tx Exempt



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 / 150 W	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 Bell Labs 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, 22 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 82.23 dBuV/m at 3m and 91.77 dBuV/m at 1m

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

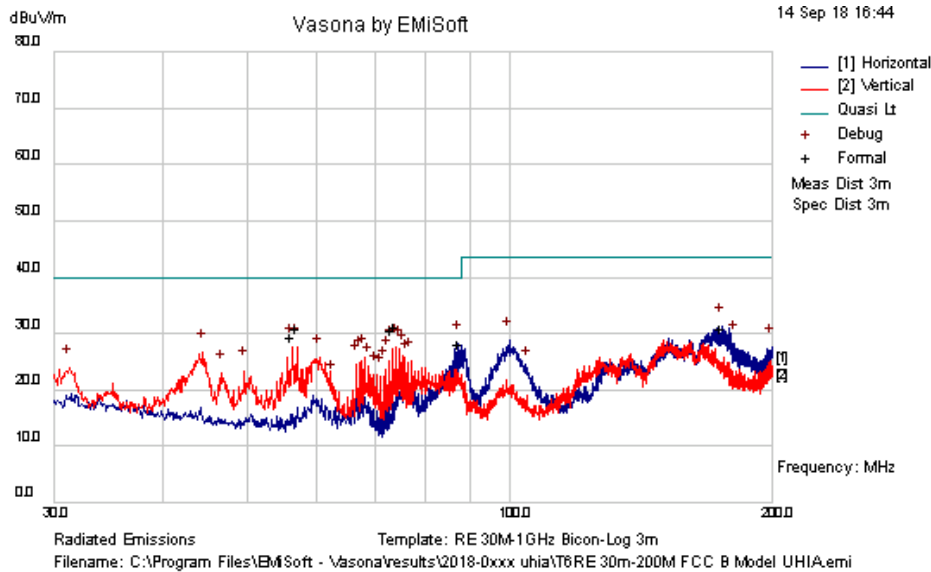
The calculated emission levels were found by:

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

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 dBuV/meter (82.23 @ 3m). Emissions equal to or less than 62.23 dBuV/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 22GHz), no reportable spurious emissions were detected. A representative set of measurement scans are included below.

6.3 Field Strength of Spurious Emissions Results



Results Title:	RE 30M-1GHz Bicon-Log 3m
File Name:	C:\Program Files\EMISoft - Vasona\results\2018-0xxx uhia\T6RE 30m-200M FCC B Model UHIA.emi
Test Laboratory:	GPCL AR6MH 24C 63%RH, 1006mB
Test Engineer:	GM
Test Software:	Vasona by EMISoft, version 2.161
Equipment:	Nokia
EUT Details:	Powered by -48Vdc, @9.5Amps: UHIA B4 2100MHz 10+5MHz 46dB, 10MHz @ 2115MHz QPSK,5MHz @ 2127.5MHz 256QAM, 20+20W= 40W. CC201352515/649150891 S1:1, MAC-00601D48A757, SN11W339R60014
Configuration:	Radiated Emissions 30MHz-200MHz FCC Part 15 B Class B, RCVR E1190, Preamp E512, 6dB Pad E891, Antenna E051, 3M Distance ESI using Peak and Quasi Detector. Analyzer Reference Level: 90 dBuV, Internal Attenuation: 10 dB.
Date:	2018-09-14 16:44:22

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
73.994	44.38	6.91	-23.8	27.48	Quasi Max	V	129	339	40	-12.52	Pass	
56.98	42.73	6.75	-22.3	27.14	Quasi Max	V	113	340	40	-12.86	Pass	
73.277	43.73	6.9	-23.8	26.8	Quasi Max	V	104	337	40	-13.2	Pass	
56.26	41.16	6.74	-22.3	25.65	Quasi Max	V	222	40	40	-14.35	Pass	
87.345	41.68	7.11	-24.4	24.39	Quasi Max	H	151	341	40	-15.61	Pass	
175.094	39.15	7.67	-19.6	27.25	Quasi Max	H	101	330	43.5	-16.25	Pass	

PREVIEW DATA

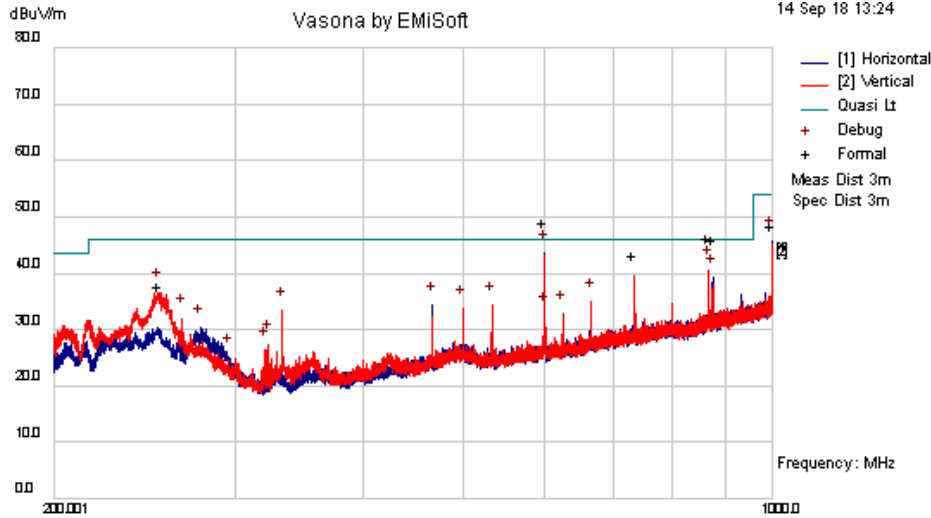
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
87.3307	45.48	7.11	-24.4	28.19	Preview	H	190	0	40	-11.81	Pass	
175.094	43.2	7.67	-19.6	31.31	Preview	H	105	315	43.5	-12.19	Pass	
74.0561	44.56	6.91	-23.8	27.66	Preview	V	205	315	40	-12.34	Pass	
56.2605	43.12	6.74	-22.3	27.61	Preview	V	205	45	40	-12.39	Pass	
57.0301	43.1	6.75	-22.4	27.5	Preview	V	205	0	40	-12.5	Pass	
73.2866	44.08	6.9	-23.8	27.15	Preview	V	205	315	40	-12.85	Pass	
74.8257	44.02	6.92	-23.8	27.15	Preview	V	205	315	40	-12.85	Pass	
44.4289	40.31	6.69	-20.3	26.68	Preview	V	205	135	40	-13.32	Pass	
75.499	43.11	6.93	-23.9	26.15	Preview	V	205	315	40	-13.85	Pass	
68.0922	42.79	6.83	-23.8	25.8	Preview	V	205	315	40	-14.2	Pass	
60.493	41.67	6.78	-22.8	25.65	Preview	V	205	90	40	-14.35	Pass	
67.4188	42.23	6.83	-23.8	25.26	Preview	V	205	270	40	-14.74	Pass	
72.6132	42.21	6.89	-23.8	25.26	Preview	V	205	315	40	-14.74	Pass	
99.9319	44.21	7.27	-22.8	28.68	Preview	H	190	0	43.5	-14.82	Pass	
77.0381	42.26	6.96	-24.2	25.01	Preview	V	205	315	40	-14.99	Pass	
76.2685	42.01	6.95	-24.1	24.9	Preview	V	205	315	40	-15.1	Pass	
181.138	39.76	7.69	-19.2	28.26	Preview	H	105	315	43.5	-15.24	Pass	
66.6493	41.33	6.82	-23.8	24.39	Preview	V	205	315	40	-15.61	Pass	
68.8617	41.09	6.84	-23.9	24.08	Preview	V	205	270	40	-15.92	Pass	
199.792	37.59	7.76	-17.9	27.48	Preview	H	190	0	43.5	-16.02	Pass	
31.2505	35.52	6.67	-18.2	23.97	Preview	V	205	90	40	-16.03	Pass	
71.8437	40.5	6.88	-23.9	23.52	Preview	V	205	315	40	-16.48	Pass	
49.6232	38.01	6.69	-21.2	23.46	Preview	V	205	135	40	-16.54	Pass	
46.7375	36.94	6.69	-20.7	22.9	Preview	V	205	180	40	-17.1	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
70.3046	39.66	6.85	-23.9	22.63	Preview	V	205	0	40	-17.37	Pass	
71.0741	39.37	6.86	-23.9	22.37	Preview	V	205	0	40	-17.63	Pass	
62.6092	37.64	6.79	-23.2	21.21	Preview	V	205	90	40	-18.79	Pass	
104.838	38.31	7.3	-22.1	23.51	Preview	H	190	0	43.5	-19.99	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.

14 Sep 18 13:24



Radiated Emissions Template: RE 30M-1GHz Bicon-Log 3m
 Filename: C:\Program Files\EMISoft - Vasona\results\2018-0xxx uhia\T5 RE 200M-1G FCC B Model UHIA.emi

Results Title:	RE 30M-1GHz Bicon-Log 3m
File Name:	C:\Program Files\EMISoft - Vasona\results\2018-0xxx uhia\T5 RE 200M-1G FCC B Model UHIA.emi
Test Laboratory:	GPCL AR6MH 24C 63%RH, 1006mB
Test Engineer:	GM
Test Software:	Vasona by EMISoft, version 2.161
Equipment:	Nokia
EUT Details:	Powered by -48Vdc, @9.5Amps; UHIA B4 2100MHz 10+5MHz 46dB, 10MHz @ 2115MHz QPSK,5MHz @ 2127.5MHz 256QAM, 20+20W= 40W. CC201352515/649150891 S1:1, MAC-00601D48A757, SN11W339R60014
Configuration:	Radiated Emissions 200MHz -1GHz FCC Part 15 B Class B, RCVR E1190, Preamp E512, 6dB Pad E891 1, Antenna E060, 3M Distance ESI using Peak and Quasi Detector. Preview BW (30 kHz RBW/ 3000 KHz VBW); Formal BW (1MHz RBW). Analyzer Reference Level: 100 dBuV, Internal Attenuation: 10 dB.
Date:	2018-09-14 13:24:13

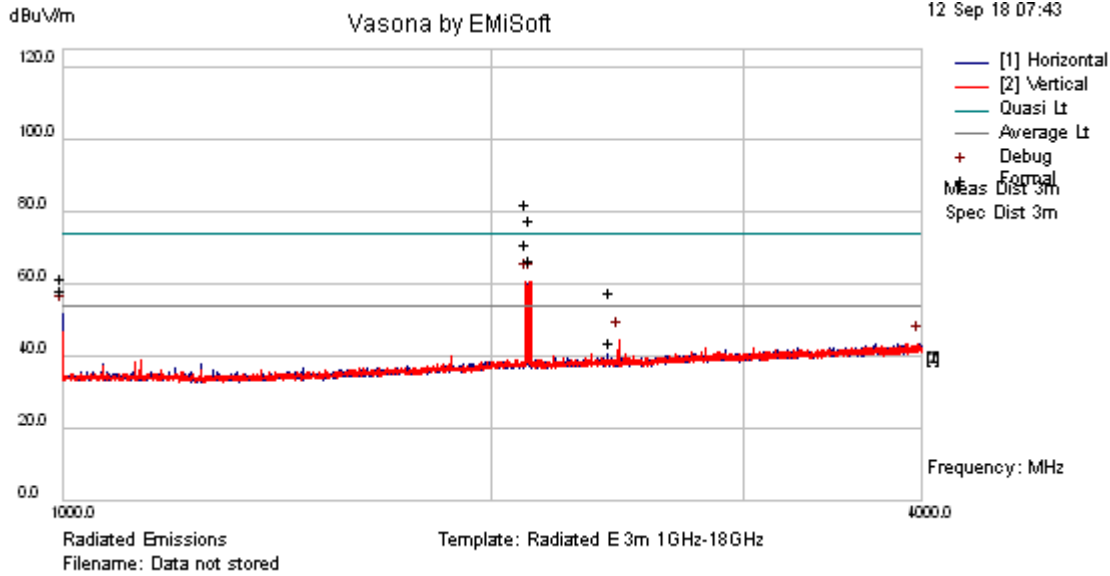
FORMAL DATA

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
600	48.31	9.13	-12.1	45.3	Quasi Max	H	162	89	46	-0.7	Pass	
866.675	40.97	9.83	-8.24	42.57	Quasi Max	V	100	11	46	-3.43	Pass	
875.006	40.44	9.85	-8.09	42.2	Quasi Max	H	127	254	46	-3.8	Pass	
733.325	40	9.46	-9.87	39.59	Quasi Max	V	190	345	46	-6.41	Pass	
999.995	40.3	10.15	-5.68	44.77	Quasi Max	H	176	358	54	-9.23	Pass	
252.685	44.98	7.93	-18.9	33.99	Quasi Max	V	118	242	46	-12.01	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
600.132	46.6	9.13	-12.1	43.59	Preview	H	190	90	46	-2.41	Pass	
866.681	38.99	9.83	-8.24	40.58	Preview	V	105	0	46	-5.42	Pass	
733.359	39.91	9.46	-9.87	39.51	Preview	V	205	0	46	-6.49	Pass	
875.05	37.52	9.85	-8.09	39.29	Preview	H	190	270	46	-6.71	Pass	
1000	41.46	10.15	-5.68	45.93	Preview	H	190	0	54	-8.07	Pass	
252.685	47.63	7.93	-18.9	36.64	Preview	V	105	225	46	-9.36	Pass	
666.697	36.67	9.29	-11.1	34.86	Preview	V	205	0	46	-11.14	Pass	
533.375	38.4	8.95	-13.1	34.26	Preview	V	205	135	46	-11.74	Pass	
466.713	39.46	8.74	-14	34.2	Preview	H	105	45	46	-11.8	Pass	
499.996	37.01	8.85	-12.2	33.7	Preview	V	105	0	46	-12.3	Pass	
333.295	42.18	8.21	-17	33.41	Preview	V	105	315	46	-12.59	Pass	
625.046	35.43	9.19	-11.7	32.88	Preview	V	305	0	46	-13.12	Pass	
601.094	35.33	9.13	-12.1	32.35	Preview	V	105	135	46	-13.65	Pass	
266.729	42.17	7.97	-18.2	31.99	Preview	V	105	270	46	-14.01	Pass	
277.695	40.35	8	-18.1	30.23	Preview	H	190	135	46	-15.77	Pass	
323.483	36.44	8.17	-17.2	27.37	Preview	V	105	225	46	-18.63	Pass	
321.078	35.52	8.16	-17.3	26.37	Preview	V	305	0	46	-19.63	Pass	
296.068	33.65	8.04	-16.8	24.94	Preview	H	290	270	46	-21.06	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.



Results Title:	Radiated E 3m 1GHz-18GHz
File Name:	c:\program files\emisoft - vasona\results\2018-0xxx uhia\2 re 1g-4g fccb uhia final.emi
Test Laboratory:	GPCL AR5-MH 23C, 55%RH, 1003mB
Test Engineer:	MJS/GM
Test Software:	Vasona by EMISoft, version 2.161
Equipment:	Nokia
EUT Details:	Powered by -48Vdc, @9.5Amps: UHIA B4 2100MHz 10+5MHz 46dB, 10MHz @ 2115MHz QPSK,5MHz @ 2127.5MHz 256QAM, 20+20W= 40W. CC201352515//649150891 S1:1, MAC-00601D48A757, SN11W339R60014
Configuration:	Radiated Emissions 1GHz-4GHz FCC Part 15 B Class B, RCVR E1190, Preamp E1166, 10dB Pad(E583) and 3dB pad (E1135) 13dB Total, Horn Antenna E393, 3M Distance offset, ESI-1G using Peak and Average Detector. Preview BW (30 kHz RBW/ 3000 KHz VBW); Formal BW (1MHz RBW). Analyzer Reference Level: 100 dBuV, Internal Attenuation: 10 dB.
Date:	2018-09-12 07:50:39

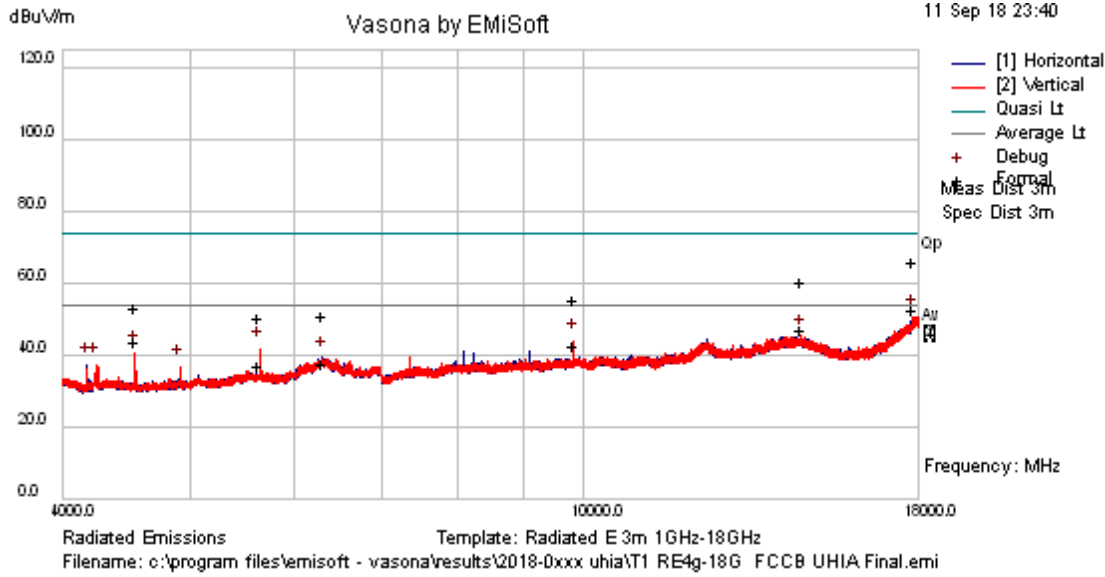
FORMAL DATA

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
2113.85	59.34	16.17	-10	65.5	AvgMax	V	101	142	54	11.5	Fail	TX Carrier (Exempt)
2125.28	55.18	16.17	-9.99	61.37	AvgMax	V	135	151	54	7.37	Fail	TX Carrier (Exempt)
2113.85	70.3	16.17	-10	76.46	Peak	V	101	142	74	2.46	Fail	TX Carrier (Exempt)
1000.02	51.91	14.86	-13.9	52.83	AvgMax	H	257	248	54	-1.17	Pass	
2125.28	66.37	16.17	-9.99	72.55	Peak	V	135	151	74	-1.45	Pass	TX Carrier (Exempt)
4004.19	30.8	17.22	-5.1	42.91	AvgMax	H	179	207	54	-11.09	Pass	
2423.28	31.82	16.36	-9.52	38.66	AvgMax	V	128	18	54	-15.34	Pass	
1000.02	55.37	14.86	-13.9	56.29	Peak	H	257	248	74	-17.71	Pass	
4004.19	43.07	17.22	-5.1	55.19	Peak	H	179	207	74	-18.81	Pass	
2423.28	45.33	16.36	-9.52	52.17	Peak	V	128	18	74	-21.83	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
2127.66	54.61	16.18	-9.99	60.79	Preview	V	102	22	54	6.79	Fail	
2113.19	54.47	16.17	-10	60.62	Preview	V	102	132	54	6.62	Fail	
1000	50.72	14.86	-13.9	51.64	Preview	H	190	264	54	-2.36	Pass	
2453.18	37.5	16.37	-9.47	44.4	Preview	V	102	242	54	-9.6	Pass	
3988.04	31.55	17.22	-5.13	43.64	Preview	H	190	242	54	-10.36	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.

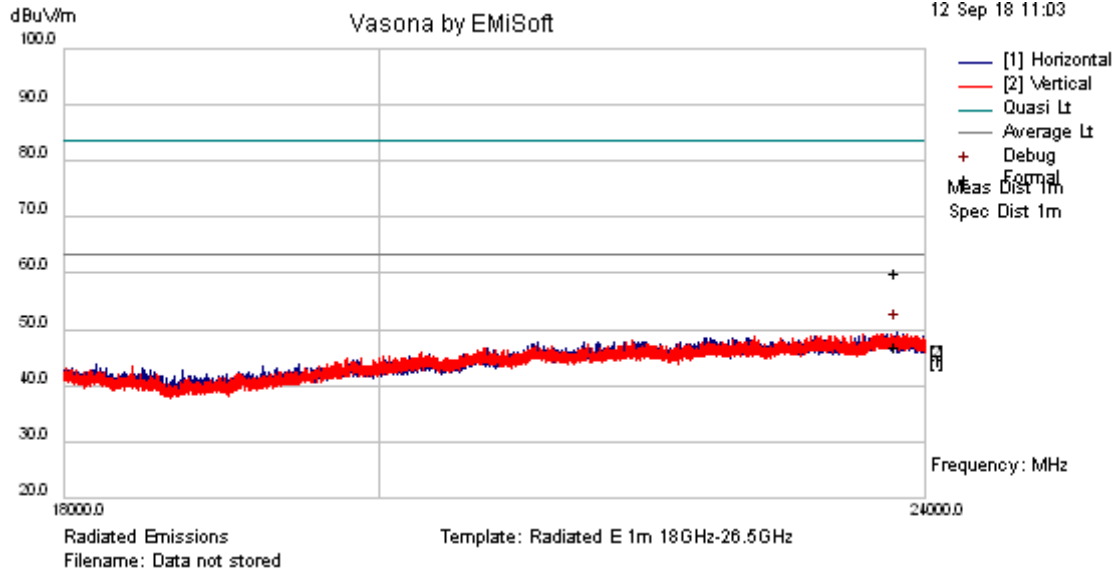


Results Title:	Radiated E 3m 1GHz-18GHz
File Name:	c:\program files\EMISoft - vasona\results\2018-0xxx uhia\T1 RE4g-18G FCCB UHIA Final.emi
Test Laboratory:	GPCL AR5-MH 23C, 55%RH, 1003mB
Test Engineer:	MJS/GM
Test Software:	Vasona by EMISoft, version 2.161
Equipment:	Nokia
EUT Details:	Powered by -48Vdc, @9.5Amps; UHIA B4 2100MHz 10+5MHz 46dB, 10MHz @ 2115MHz QPSK,5MHz @ 2127.5MHz 256QAM, 20+20W= 40W. CC201352515//649150891 S1:1, MAC-00601D48A757, SN11W339R60014
Configuration:	Radiated Emissions 4GHz -10GHz FCC Part 15 B Class B, RCVR E1190, Preamp E1166, E1336-HPF, Horn Antenna E393, 3M Distance offset, ESI-1G using Peak and Average Detector. Preview BW (30 kHz RBW/ 3000 KHz VBW); Formal BW (1MHz RBW). Analyzer Reference Level: 120 dBuV, Internal Attenuation: 10 dB.
Date:	2018-09-11 23:40:37

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
17887.8	28.3	9.89	9.34	47.52	Average	H	325	76	54	-6.48	Pass	
14655.7	27.6	8.76	5.59	41.95	Average	H	128	222	54	-12.05	Pass	
17887.8	41.31	9.89	9.34	60.54	Peak	H	325	76	74	-13.46	Pass	
4546.57	37.42	6.6	-5.38	38.64	Average	V	101	49	54	-15.36	Pass	
9830.41	29.73	7.68	-0.02	37.39	Average	V	181	81	54	-16.61	Pass	
14655.7	40.5	8.76	5.59	54.85	Peak	V	318	171	74	-19.15	Pass	
6319.78	29.49	6.21	-3.18	32.53	Average	H	243	242	54	-21.47	Pass	
5652.48	28.99	6.09	-3.31	31.77	Average	V	217	40	54	-22.23	Pass	
9830.41	42.26	7.68	-0.02	49.92	Peak	V	181	81	74	-24.08	Pass	
4546.57	46.5	6.6	-5.38	47.72	Peak	V	101	49	74	-26.28	Pass	
6319.78	42.67	6.21	-3.18	45.7	Peak	H	243	242	74	-28.3	Pass	
5652.48	42.13	6.09	-3.31	44.9	Peak	V	217	40	74	-29.1	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
17887.8	31.46	9.89	9.34	50.69	Preview	H	390	154	54	-3.31	Pass	
14655.7	31.05	8.76	5.59	45.4	Preview	V	102	154	54	-8.6	Pass	
9829.97	36.39	7.68	-0.02	44.05	Preview	V	102	330	54	-9.95	Pass	
5652.89	38.81	6.09	-3.31	41.59	Preview	V	102	0	54	-12.41	Pass	
4546.94	39.42	6.6	-5.38	40.64	Preview	V	102	44	54	-13.36	Pass	
6320	36.2	6.21	-3.18	39.23	Preview	H	102	132	54	-14.77	Pass	
4244.73	35.87	6.96	-5.29	37.53	Preview	V	102	286	54	-16.47	Pass	
4178.05	35.5	7.04	-5.24	37.3	Preview	H	190	308	54	-16.7	Pass	
4915.05	35.24	6.19	-4.58	36.85	Preview	V	102	286	54	-17.15	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.



Results Title:	Radiated E 1m 18GHz-26.5GHz
File Name:	c:\program files\emisoft - vasona\results\2018-0xxx uhia\3 re 18g-22g fccb uhia final.emi
Test Laboratory:	GPCL AR5-MH 24C, 57%RH, 1005mB
Test Engineer:	EEM/JCO
Test Software:	Vasona by EMISoft, version 2.161
Equipment:	Nokia
EUT Details:	Powered by -48Vdc, @9.5Amps: UHIA B4 2100MHz 10+5MHz 46dB, 10MHz @ 2115MHz QPSK,5MHz @ 2127.5MHz 256QAM, 20+20W= 40W. CC201352515/649150891 S1:1, MAC-00601D48A757, SN11W339R60014
Configuration:	Radiated Emissions 18GHz -24GHz FCC Part 15 B Class B, RCVR E1190, Preamp E1166, Horn Antenna E513, 1M Distance offset, ESI-1G using Peak and Average Detector. Preview BW (100 kHz RBW/ 3000 KHz VBW); Formal BW (1MHz RBW). Analyzer Reference Level: 100 dBuV, Internal Attenuation: 10 dB.
Date:	2018-09-12 11:04:38

FORMAL DATA

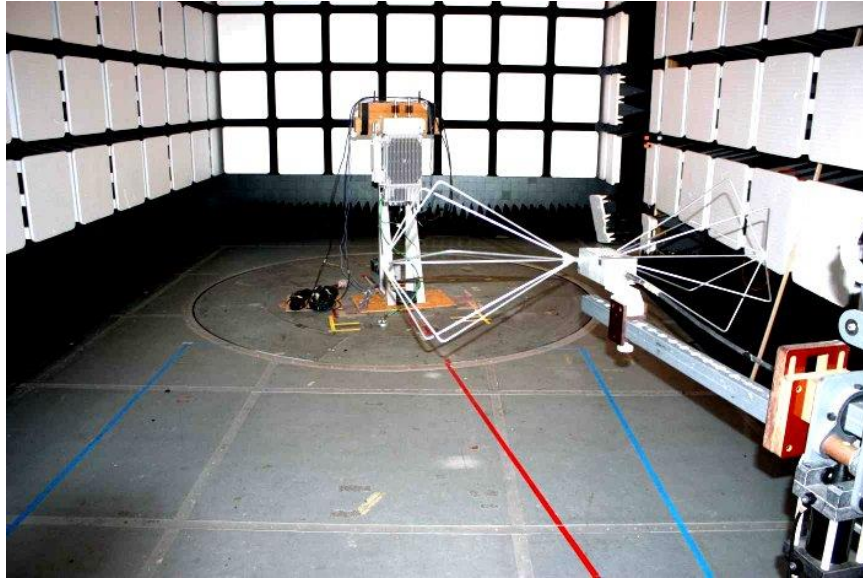
Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
23777	27.48	8.35	7.85	43.68	AvgMax	H	126	308	63.5	-19.82	Pass	
23777	40.51	8.35	7.85	56.71	Peak	H	126	308	83.5	-26.79	Pass	

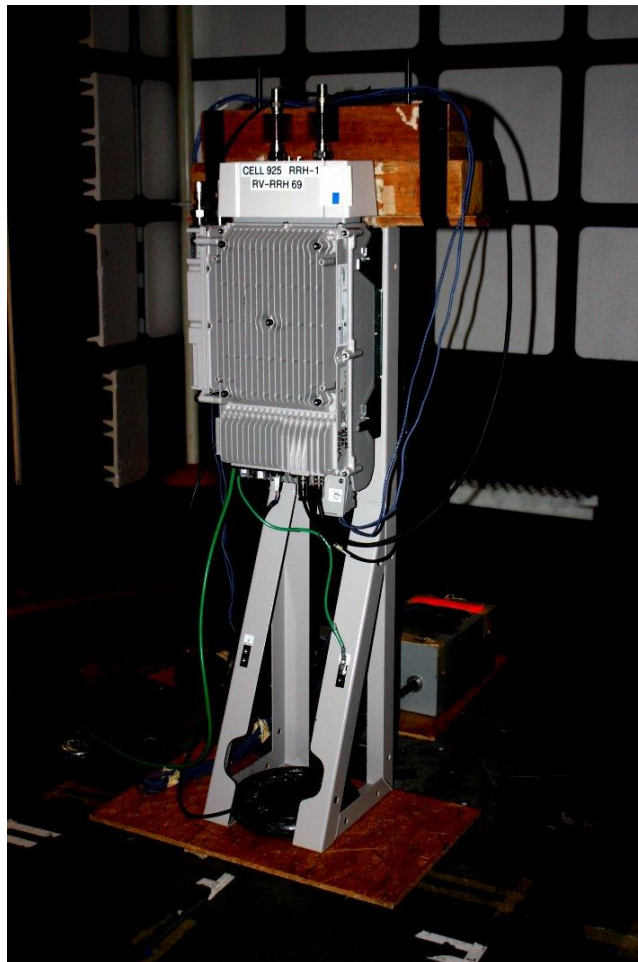
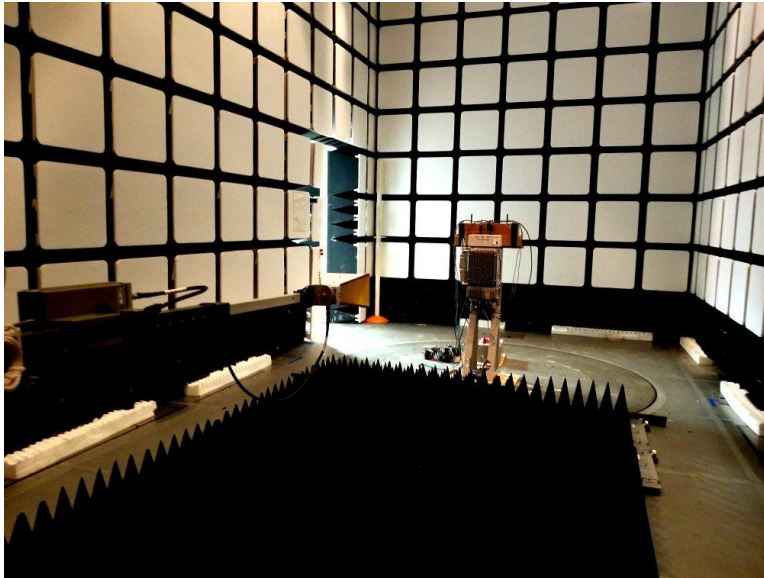
PREVIEW DATA

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
23777	33.27	8.35	7.85	49.47	Preview	H	200	135	63.5	-14.03	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.

6.4 Field Strength of Spurious Emissions Photographs





6.5 Field Strength of Spurious Emissions Test Equipment

Asset ID	Manufacturer	Type	Description	Model	Serial	Calibration Date	Calibration Due	Calibration Type	Status
E051	EMCO	Biconical Antenna		3109	2187	2016-12-01	2018-12-01	Requires Calibration	Active
E060	EMCO	Log Periodic Antenna	Log periodic antenna	3146	1458	2016-12-06	2018-12-06	Requires Calibration	Active
E1321	Extech	Data Logger	Barometric Pressure/Humidity/Temperature Datalogger	SD700	A075782				Active
E908	Rohde & Schwarz	Test Receiver	EMI (20Hz to 40 GHz)-150 +30dBm	ESIB40	100100	2018-03-12	2020-03-12	Requires Calibration	Active
E512	Sonoma Instrument Co.	Amplifier	9KHz-1GHz	310N	185826	2018-03-27	2020-03-27	Requires Calibration	Active
E891	Weinschel	Attenuator	6 dB DC-18GHz 5 Watt	2-6	BX3432	2018-06-26	2020-06-26	Requires Calibration	Active
E1166	Agilent Technologies	Pre-Amplifier	Pre-Amplifier 1-26.5GHz	8449B	3008A01740	2016-02-25	2018-09-25	Requires Calibration	Active
E583	Weinschel	Attenuator	10dB 25W DC-18 GHz	46-10-34	BL7552	2018-05-23	2020-05-23	Requires Calibration	Active
E1135	Weinschel	Attenuator	3dB	2-3	CC8594	2017-05-23	2019-05-23	Requires Calibration	Active
E513	EMC Test Systems	Horn Antenna	Double Ridged Horn 18-40 GHz	3116	2539	2017-06-16	2019-06-16	Requires Calibration	Active
E555	EMC Test Systems	Multi-Device Controller		2090	1577			Calibration Not Required	Active
E1190	Rohde & Schwarz	Test Receiver	EMI Test Receiver 20Hz-26.5GHz	ESI	832692/005	2018-03-19	2020-03-19	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
E1119	Extech	Data Logger	Pressure Humidity Temp data logger	SD700	Q668960	2016-08-15	2018-09-15	Requires Calibration	Active
E1336	Hewlett Packard	High Pass Filter	3.5 GHz	84300-80038	006			Calibration Not Required, Must Be Verified	Active

7. NVLAP Certificate of Accreditation

<p>United States Department of Commerce National Institute of Standards and Technology</p>  <hr/> <p>Certificate of Accreditation to ISO/IEC 17025:2005</p> <hr/> <p>NVLAP LAB CODE: 100275-0</p> <p>Nokia, Global Product Compliance Lab Murray Hill, NJ</p> <p><i>is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:</i></p> <p>Electromagnetic Compatibility & Telecommunications</p> <p><i>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).</i></p> <hr/> <table border="0" style="width: 100%;"><tr><td style="width: 40%; text-align: center;"><p>2017-08-17 through 2018-09-30 <i>Effective Dates</i></p></td><td style="width: 20%; text-align: center;"></td><td style="width: 40%; text-align: center;"> <i>For the National Voluntary Laboratory Accreditation Program</i></td></tr></table>		<p>2017-08-17 through 2018-09-30 <i>Effective Dates</i></p>		 <i>For the National Voluntary Laboratory Accreditation Program</i>
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