Radio Test Report
Application for a Class II Permissive Change Equipment Authorization

CERTIFICATE #: 0214.19

FCC Part 22 and IC RSS-132
[869MHz – 894MHz]
FCC Part 27 and IC RSS-130
[746MHz – 756MHz]

FCC ID: VBNAHBCC-01
IC ID: 661W-AHBCC

Product Name: Airscale Base Transceiver Station Remote Radio Head
Model: AHBCC

Applicant: Nokia Solutions and Networks
6000 Connection Drive
Irving, TX 75039

Test Sites: Nokia Solutions and Networks
6000 Connection Drive
Irving, TX 75039
and
National Technical Systems – Plano
1701 E Plano Pkwy #150
Plano, TX 75074
NTS Plano FCC Laboratory Designation No.: US1077
NTS Plano ISED Laboratory Assigned Code: 4319A

Test Dates: February 7, 2019
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REVISION HISTORY

Rev#	Date	Comments	Modified By
0	02/20/2019	Original Release	BreAnna Cheatham

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SCOPE

Tests have been performed on Nokia Solutions and Networks product Airscale Base Station Remote Radio Head (RRH) Model AHBCC, pursuant to the relevant requirements of the following standard(s) to obtain device certification against the regulatory requirements of the Federal Communications Commission (FCC) and Innovation, Science and Economic Development Canada (ISED).

- Code of Federal Regulations (CFR) Title 47 Part 2
- (Radio Standards Specification) RSS-Gen Issue 5 – April 2018
- CFR 47 Part 22 Subpart H
- RSS-132 Issue 3 - January 2013
- CFR Title 47 Part 27 Subpart C
- RSS-130 Issue 1 - October 2013

Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in the following reference standards:

ANSI C63.26-2015
ANSI C63.4-2014
ANSI TIA-603-E
FCC KDB 971168 D01 v03r01
FCC KDB 971168 D03 v01
FCC KDB 662911D01 v02r01
TIA-102.CAAA-D

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant FCC and ISED requirements.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

The test results recorded herein are based on a single type test of Nokia Solutions and Networks product Airscale Base Station Remote Radio Head (RRH) Model AHBCC and therefore apply only to the tested sample. The sample was selected and prepared by Hobert Smith and John Rattanavong of Nokia Solutions and Networks.

OBJECTIVE

The primary objective of the manufacturer is compliance with the regulations outlined in the previous section.

Prior to marketing in the USA and Canada, the device requires certification.

Certification is a procedure where the manufacturer submits test data and technical information to a certification body and receives a certificate or grant of equipment authorization upon successful completion of the certification body's review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units, which are subsequently manufactured.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

Testing was performed only on Model AHBCC. No additional models were described or supplied for testing.

STATEMENT OF COMPLIANCE

The tested sample of Nokia Solutions and Networks product Airscale Base Transceiver Station Remote Radio Head (RRH) Model AHBCC complied with the requirements of the standards and frequency bands declared in the scope of this test report.

Maintenance of compliance is the responsibility of the manufacturer. Any modifications to the product should be assessed to determine their potential impact on the compliance status of the device with respect to the standards detailed in this test report.

DEVIATIONS FROM THE STANDARDS

No deviations were made from the published requirements listed in the scope of this report.

TEST RESULTS SUMMARY

The following tables provide a summary of the test results:

FCC Part 22 Subpart H and IC RSS-132 Issue 3 (Base Stations Operating in the 869 to 894MHz Band)

AHBCC operating in 869MHz to 894MHz Frequency Band - LTE plus single Narrow Band IoT Guard Band carrier					
FCC	IC	Description	Measured	Limit	Results
Transmitter Modulation, output power and other characteristics					
§22.905	RSS-132 Section 5.1	Frequency Ranges	LTE10: 874.0 – 889.0MHz	869.0MHz to 894.0MHz	Pass
§2.1047	RSS-132 Section 5.2	Modulation Type	NB IoT Guard band (QPSK) with LTE10	Digital	Pass
§22.913	RSS-132 Section 5.4	Output Power	Highest Conducted Power Output RMS: 46.09 dBm ERP depends on antenna gain which is unknown	1000W ERP	Pass
	RSS-132 Section 5.4	Peak to Average Power Ratio	Highest Measured PAPR: 7.06dB	13dB	Pass
	RSS-Gen Section 6.6	99% Emission Bandwidth	LTE10: 9.2448MHz Emission Designator: 9M25F9W	Remain in Block	Pass
§22.917(b)		26dB down Emission Bandwidth	LTE10: 9.822MHz Emission Designator: 9M82F9W	Remain in Block	Pass
Transmitter Spurious Emissions					
§22.917	RSS-132 Section 5.5	At the antenna terminals	< -19dBm	-19dBm per Transmit Chain	Pass[1]
		Field Strength	50.247 dBuV/m at 3m Eq. to -44.943 dBm EIRP	-13dBm EIRP	Pass[2]
Other Details					
§2.1057	RSS-132 Section 5.3	Frequency Stability	0.0016ppm	1.5ppm	Pass[2]
§1.1310	RSS102	RF Exposure	N/A		Pass[3]

Note 1: Based on 100kHz RBW. In the 1MHz immediately outside and adjacent to the frequency block a RBW of at least 1% of the emission bandwidth was used. The measurement bandwidth is 100kHz for measurements more than 1MHz from the band edge.
Note 2: See the original FCC and IC radio certification report for details (NTS Test Report Number PR075288 Rev.1 dated March 18, 2018).
Note 3: Applicant's declaration on a separate exhibit based on hypothetical antenna gains.

FCC Part 27 Subpart C and IC RSS-130 Issue 1 (Base Stations Operating in the 746 to 756MHz Band)

AHBCC operating in the 746MHz to 756MHz Frequency Band- LTE plus single Narrow Band IoT Guard Band carrier					
FCC	IC	Description	Measured	Limit	Results
Transmitter Modulation, output power and other characteristics					
27.5(b)	RSS-130 Section 4.2	Frequency Ranges	LTE10: 751.0MHz	746.0 – 756.0MHz	Pass
2.1033(c)(4)	RSS-130 Section 4.1	Modulation Type	NB IoT Guard band (QPSK) with LTE10	Digital	Pass
27.50(b)	RSS-130 Section 4.4	Output Power	Highest Conducted Power Output RMS: 45.97dBm ERP depends on antenna gain which is unknown	1000W ERP	Pass
	RSS-130 Section 4.4	Peak to Average Power Ratio	Highest Measured PAPR: 6.83dB	13dB	Pass
2.1049	RSS-Gen Section 6.6	99% Emission Bandwidth	LTE10: 9.2394MHz Emission Designator: 9M24F9W	Remain in Block	Pass
		26dB down Emission Bandwidth	LTE10: 9.812MHz Emission Designator: 9M81F9W	Remain in Block	Pass
Transmitter Spurious Emissions					
27.53(c)	RSS-130 Section 4.6.1	At the antenna terminals	< -19dBm	-19dBm per Transmit Chain	Pass[1]
		Field strength	50.247 dBuV/m at 3m Eq. to -44.943 dBm EIRP	-13 dBm ERP	Pass[2]
27.53(c)(3)	RSS-130 Section 4.6.2	At the Ant terminals: Maximum emissions in 763-775 MHz and 793-806MHz bands	Conducted emissions were less than -55.332dBm for RBW of 6.25kHz	-52dBm per 6.25kHz bandwidth	Pass[3]
27.53f	RSS-130 Section 4.6.2	At the Ant terminals: Maximum emissions in 1559-1610MHz band	Conducted emissions were not observed above measurement instrumentation noise floor or less than -96.858dBW/MHz	EIRP≤ Wideband: -76dBW/MHz Discrete: -86dBW/MHz	Pass[4]
Other Details					
27.54	RSS-130 Sec 4.3	Frequency Stability	Stays within authorized frequency block 0.0016ppm	Stays within block	Pass[2]
1.1310	RSS102	RF Exposure	N/A		Pass[5]

Note 1: Based on 100kHz RBW. In the 100kHz immediately outside and adjacent to the frequency block a RBW of 30kHz was used. The measurement bandwidth is 100kHz for measurements more than 100kHz from the band edge. See Section 27.53(c)(5) and RSS 130 4.6 for details.
Note 2: See the original FCC and IC radio certification report for details (NTS Test Report Number PR075288 Rev.1 dated March 18, 2018).
Note 3: Section 27.53(c)(3) and RSS-130 4.6.2 requires an emission limit of -46dBm for any 6.25 kHz bandwidth between frequency bands 763-775 MHz and 793-806MHz. Adjusting for the four port MIMO requirement the emission limit in these frequency ranges is -52 dBm [i.e.: Limit = -46 dBm/6.25kHz (FCC/IC Limit) – 6dB (4 port MIMO)].
Note 4: Section 27.53(f) and RSS 130 4.6.2(b), the EIRP limit for the frequency range 1559-1610 MHz is -70dBW/MHz for wideband signals and -80dBW for discrete emissions of bandwidths less than 700Hz. Adjusting for the four port MIMO requirement, the limit is -76 dBW [-70 dBW -10 log (4)] for wideband signals and -86dBW [-80 dBW -10 log (4)] for discrete emissions.
Note 5: Applicant's declaration on a separate exhibit based on hypothetical antenna gains.

Extreme Conditions

Frequency stability is determined over extremes of temperature and voltage.

The extremes of voltage were 85 to 115 percent of the nominal value.

The extremes of temperature were -30°C to +50°C as specified in FCC §2.1055(a)(1).

Measurement Uncertainties

Measurement uncertainties of the test facility based on a 95% confidence level are as follows:

Test	**Uncertainty**
Radio frequency	± 0.2ppm
RF power conducted	±1.2 dB
RF power radiated	±3.3 dB
RF power density conducted	±1.2 dB
Spurious emissions conducted	±1.2 dB
Adjacent channel power	±0.4 dB
Spurious emissions radiated	±4 dB
Temperature	±1°C
Humidity	±1.6 %
Voltage (DC)	±0.2 %
Voltage (AC)	±0.3 %

EQUIPMENT UNDER TEST (EUT) DETAILS

General

A class II permissive change on the original filing is being pursued to add single Narrow Band IoT Guard Band (NB IoT GB here after) LTE carrier to the Airscale BTS RRH model AHBCC Federal Communication Commission and Industry Canada certifications. The original FCC and IC radio certification submittal was NTS Test Report Number PR075288 Revision 1 dated March 18, 2018. The original test effort includes testing for LTE technologies. Please refer to the test report on the original certification for details on all required testing.

All conducted RF testing performed for the original certification testing has been repeated using NB IoT GB for this class II permissive change per correspondence/guidance from Nemko TCB. The same test methodology used in the original certification testing was used in this class II permissive change test effort. NB IoT offsets from LTE carrier center frequencies were: LTE10: +/-4597.5 kHz. Tests performed under the class II change effort include RF power, peak to average power ratio, emission bandwidth (99% and 26 dB down), band edge spurious emissions, and conducted spurious emissions. The LTE modulation type for this testing was setup according to 3GPP TS 36.141 E-UTRA Test Models and is "E-TM 1.1 (QPSK modulation type) with N-TM (narrow band IoT)".

The testing was performed on the same hardware (AHBCC) as the original certification test. The same AHBCC RF port (Ant 4) determined in the original certification testing to be the highest power port was used for all testing in this effort. The base station and remote radio head software for this testing is an updated release that includes Narrow Band IoT Guard Band support.

The radiated emissions and frequency stability measurements performed in the original certification was not repeated under this effort per TCB guidance. The radiated emission and frequency stability/accuracy results from the original certification had enough margin to preclude requiring additional testing. The same frequency stability/accuracy radio design is the same for all radio technologies/modulation types.

The equipment under test (EUT) is a Nokia Solutions and Networks AirScale Base Transceiver Station (BTS) Remote Radio Head (RRH) module, model AHBCC. The AHBCC remote radio head is a multistandard multicarrier radio module designed to support LTE, and narrow band IoT (internet of things) operations (in-band, guard band, standalone). The scope of testing in this effort is for narrow band IoT guard band operations.

The AHBCC RRH has four transmit/four receive antenna ports (4TX/4RX for Band 5 and 4TX/4RX for Band 13). Each antenna port supports 3GPP frequency band 5 (BTS Rx: 824 to 849 MHz/BTS TX: 869 to 894 MHz) and 3GPP frequency band 13 (BTS Rx: 777 to 787 MHz/BTS TX: 746 to 756 MHz). The maximum RF output power of the RRH is 320 Watts (40 watts per carrier, 80 watts per antenna port). The RRH can be operated as a 4x4 MIMO, 2x2 MIMO or as non-MIMO. The TX and RX instantaneous bandwidth cover the full operational bandwidth. The RRH supports LTE bandwidths of 1.4, 3, 5 and 10MHz for 3GPP frequency band 5 operations. The RRH supports LTE bandwidths of 5 and 10MHz for 3GPP frequency band 13 operations. The RRH supports four LTE downlink modulation types (QPSK, 16QAM, 64QAM and 256QAM). Multi-carrier operation is supported.

The AHBCC LTE channel numbers and frequencies are as follows:

	Downlink EARFCN	Downlink Frequency (MHz)	LTE Channel Bandwidth			
			1.4 MHz	3 MHz	5 MHz	10 MHz
AHBCC Band 5 (Ant 1, 2, 3, 4)	2400	869.0	Band Edge	Band Edge	Band Edge	Band Edge
	……					
	2407	869.7	Bottom Ch			
	……					
	2415	870.5		Bottom Ch		
	……					
	2425	871.5			Bottom Ch	
	……					
	2450	874.0				Bottom Ch
	……					
	2525	881.5	Middle Ch	Middle Ch	Middle Ch	Middle Ch
	……					
	2600	889.0				Top Channel
	……					
	2625	891.5			Top Channel	
	……					
	2635	892.5		Top Channel		
	……					
	2643	893.3	Top Channel			
	……					
	2650	894.0	Band Edge	Band Edge	Band Edge	Band Edge

AHBCC Downlink Band Edge LTE Band 5 Frequency Channels

Note: The single Narrow Band IoT Guard Band is supported on the LTE 10 channel bandwidth only.

	Downlink EARFCN	Downlink Frequency (MHz)	LTE Channel Bandwidth	
			5 MHz	10 MHz
AHBCC Band 13 (Ant 1, 2, 3, 4)	5180	746.0	Band Edge	Band Edge
	……			
	5205	748.5	Bottom Channel	
	……			
	5230	751	Middle Channel	Bottom Channel Middle Channel Top Channel
	……			
	5255	753.5	Top Channel	
	……			
	5280	756	Band Edge	Band Edge

AHBCC Downlink Band Edge LTE Band 13 Frequency Channels

Note: The single Narrow Band IoT Guard Band is supported on the LTE 10 channel bandwidth only.

EUT Hardware

The EUT hardware used in testing on February 7, 2019.

Company	Model	Description	Part/Serial Number	FCC ID/IC Number
Nokia Solutions and Networks	AHBCC	AirScale BTS RRH	Part#: 474341A.101 Serial#: K91800332366	FCC ID: VBNAHBCC-01 IC ID: 661W-AHBCC

Enclosure

The EUT enclosure is made of heavy duty aluminum.

Support Equipment

Company	Model	Description	Part/Serial Number	FCC ID/IC Number
Nokia Solutions and Networks	ASIA	Airscale System Module	Part#: 473095A.101 Serial#: L1164309322	N/A
HP	Elite Book 6930p	Laptop PC	N/A	N/A
Dell	Studio XPS	Instrumentation PC	N/A	N/A

Auxillary Equipment

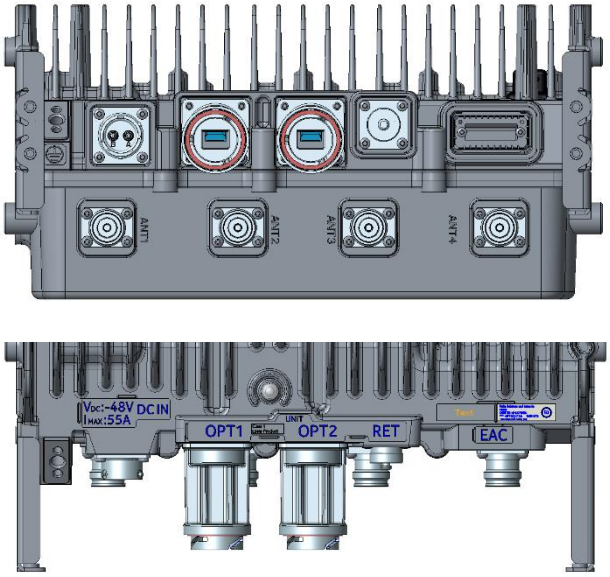
Company	Description	Part Number	Serial Number
Nokia	FOUC 10GHz SFP Module (Plugs into RRH Opt Ports)	473842A.101	KR16180010036
RLC Electronics	1.1GHz High Pass Filter[1]	F-14699	0050
Weinschel	Attenuator 40dB-250 Watt[1]	58-40-43-LIM	TC909
Weinschel	Attenuator 20dB-150 Watt[1]	66-20-33	BZ2075
Weinschel	Attenuator 3dB-100 Watt[1]	47-3-33	CG5493
Huber & Suhner	RF Cable – 0.5 meter[1]	Sucoflex 104	553624/4
Huber & Suhner	RF Cable - 1 meter[1]	Sucoflex 106	297370
Note 1: Used only in antenna port RF conducted emission testing.			

EUT Interface Ports

The I/O cabling configuration during testing was as follows:

Cable	Type	Shield	Length	Used in Test	Quantity	Termination
Power Input	Power	No	~ 3 m	Yes	1	Power Supply
Earth	Earth	No	~ 1 m	Yes	1	Lab earth ground
Antenna	RF	Yes	~ 3 m	Yes	4	50Ω Loads
External Alarm	Signal	Yes	~ 3 m	Yes	1	Un-terminated
Remote Electrical Tilt	Signal	Yes	~ 3 m	Yes	1	Un-terminated
Multimode Optical	Optical	No	>6 m	Yes	1	System Module

AHBCC Connector Layout:



EUT External Interfaces

Name	Qty	Connector Type	Purpose (and Description)
DC In	1	Quick Disconnect	2-pole Power Circular Connector
GND	1	Screw lug (2xM5/1xM8)	Ground
ANT	4	4.3-10	RF signal for Transmitter/Receiver (50 Ohm)
Unit	1	LED	Unit Status LED
EAC	1	MDR26	External Alarm Interface (4 alarms)
OPT	2	SFP+ cage	Optical CPRI Interface up to 10 Gps.
RET	1	8-pin circular connector conforming to IEC 60130-9 – Ed.3.0	AISG 2.0 to external devices
Fan	1	Molex Microfit	Power for RRH Fan. Located on the side of RRH.

EUT Operation

During testing, the EUT was transmitting continuously with 100% duty-cycle at full power on all chains.

EUT Software

The laptop PC connects to the System Module over the LMP (Ethernet) port. The system module controls the RRH via the optical (CPRI) interface. The laptop is used for changing configuration settings, monitoring tests and controlling the BTS. The following software versions are used for the testing:

(1) RRH Unit Software: FRM58.11.R16I
(2) System Module Software: FL18A_ENB_0000_000802_000000
(3) BTS Site Manager: BTSSiteEM-FL18A_0000_000590_000000

Modifications

No modifications were made to the EUT during testing.

TESTING

General Information

Antenna port measurements were taken with NTS personnel (Alex Mathews) at Nokia premises located at 6000 Connection Drive; Irving, Texas 75309.

Radiated emissions and frequency accuracy/stability measurements were taken at NTS Plano branch located at 1701 E Plano Pkwy #150 Plano, TX 75074 during the original certification effort (See NTS Test Report Number PR075288 Revision 1 dated March 18, 2018 for details).

Measurement Procedures

The RMS average output power, emission bandwidth, conducted spurious and conducted band edge measurements were performed with a spectrum analyzer. The carrier frequency accuracy/stability and complementary cumulative distribution function (CCDF) measurements were performed with an LTE signal analyzer. The EUT was operated at maximum RF output power for all tests. While measuring one transmit chain, the others were terminated with termination blocks. All measurements were corrected for the insertion loss of the RF network (attenuators, filters, and cables) inserted between the RF port of the EUT and the spectrum analyzer/signal analyzer. Block diagrams and photographs of the test setups are provided below.

The 26dB emission bandwidth was measured in accordance with Section 4.1 of FCC KDB 971168 D01v03r01 and ANSI C63.26 section 5.4. The 99% occupied bandwidth was measured in accordance with Section 6.7 of RSS-Gen Issue 5. For both measurements, an occupied bandwidth built-in function in the spectrum analyzer was used and Keysight Benchvue Software was used to capture the spectrum analyzer screenshots. Spectrum analyzer settings are shown on their corresponding plots in test results section.

The emissions at the band edges were captured with Keysight Benchvue Software with settings described in the corresponding sections of the FCC and IC regulatory requirements. Spectrum analyzer settings are shown on their corresponding plots in test results section.

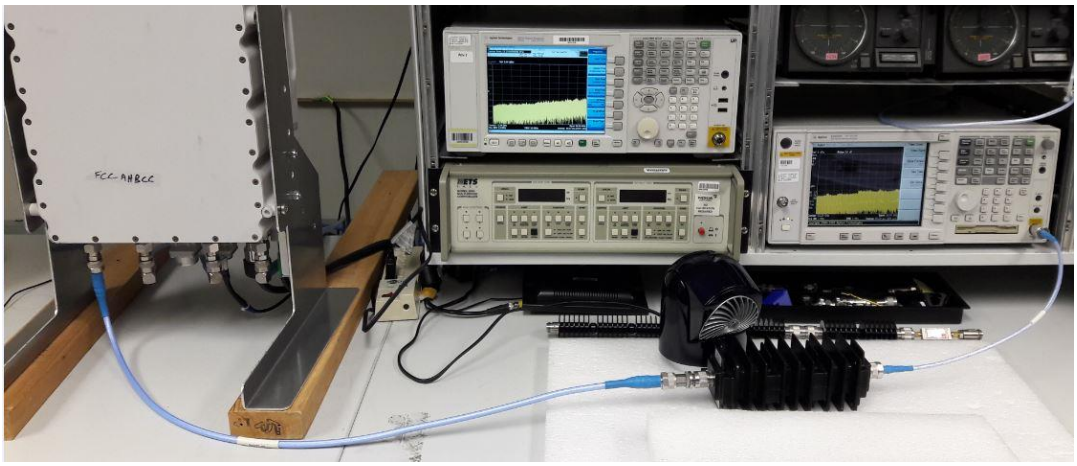
Average output power measurements were performed in accordance with sections 5.4 of FCC KDB 971168 D01v03r01 and ANSI C63.26. Measurements were performed with the built-in power meter function found in the spectrum analyzer and the screenshots were captured using Keysight Benchvue Software. Peak to average power ratio (PAPR) was measured in accordance with Section 5.7.2 of FCC KDB 971168 D01v03r01 and ANSI C63.26 section 5.2.3.4. Signal Analyzer CCDF screenshots were captured using Keysight Benchvue Software. Analyzer settings are shown on their corresponding plots in test results section.

Conducted spurious emissions were captured with Keysight Benchvue Software across the 9kHz-9GHz frequency span. A high pass filter was used to reduce measurement instrumentation noise floor for the frequency ranges above 1.1GHz. The total measurement RF path loss of the test setup (attenuators, high pass filter and test cables) were accounted for by the spectrum analyzer reference level offset. Spectrum analyzer settings are described in the corresponding test result section.

Antenna Port Conducted RF Measurement Test Setup Diagrams

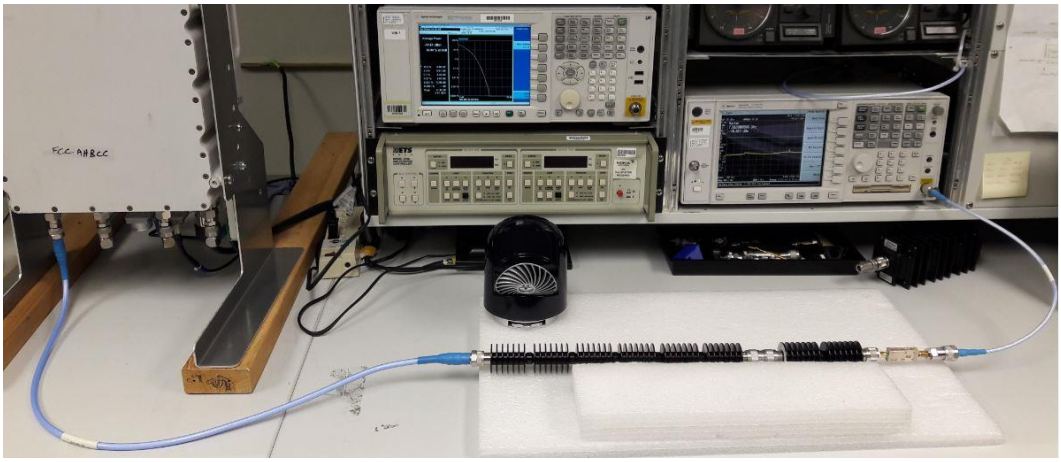
The following setups were used in the RF conducted emissions testing. Photographs of the test setups are also provided.

Setup for 9kHz to 150kHz, 150kHz to 20MHz, 20MHz to 700MHz, and 700MHz to 1.1GHz Measurements



Photograph of 9kHz to 150kHz, 150kHz to 20MHz, 20MHz to 700MHz, and 700MHz to 1.1GHz Test Setup

Setup for 1.1GHz to 9GHz Measurements



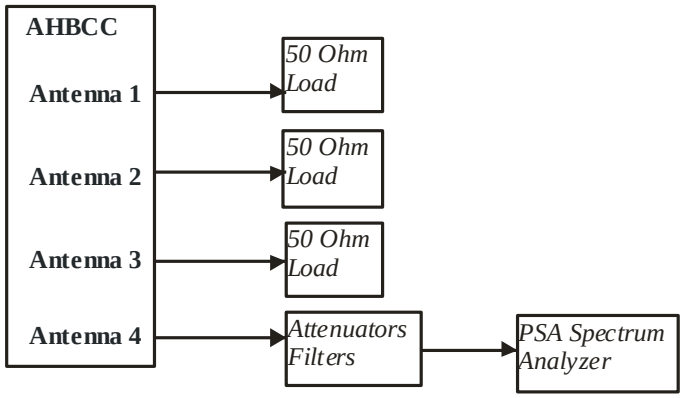
Photograph of 1.1GHz to 9GHz Test Setup

Test Measurement Equipment

Nokia Equipment #	Description	Manufacturer	Model	Calibration Duration	Calibration Due Date
120194	PSA Spectrum Analyzer	Agilent	E4440A	12 Months	10/17/2019
NM04509	Network Analyzer	Rohde & Schwarz	ZVL 3	12 Months	02/15/2019
NM06345	Network Analyzer	Keysight	E5063A	12 Months	12/15/2019
NM04508	MXA Signal Analyzer	Agilent	N9020A	24 Months	5/2/2019

APPENDIX A: ANTENNA PORT TEST DATA FOR BAND 5 (869-894MHZ)

All conducted RF measurements in this section were made at AHBCC antenna port 4. The testing was performed on the same hardware (EUT) as the original certification test. The same EUT RF port (Ant 4) determined in the original certification testing to be the highest power port was used for all testing in this effort. All testing in this section was performed with the single Narrow Band IoT Guard Band LTE10 carrier. NB IoT guard band offsets from LTE carrier center frequencies were LTE10: ±4597.5 kHz. The LTE modulation type for this testing was setup according to 3GPP TS 36.141 E-UTRA Test Models and is "E-TM 1.1 (QPSK modulation type) with N-TM (narrow band IoT)". The test setup used is provided below.



Test Setup Used for Conducted RF Measurements on AHBCC

RF Output Power

RF output power has been measured in RMS Average terms at the AHBCC Antenna Port 4 Band 5 (869 to 894MHz) transmit chain at the bottom, middle and top channels for the single Narrow Band IoT Guard Band LTE10 carrier as described in section 5.2 of KDB 971168 D01v03r01 and ANSI C63.26-2015 section 5.2.4.4. The AHBCC was operated at maximum RF output power. The peak to average power ratio (PAPR) has been measured using the signal analyzer complementary cumulative distribution function (CCDF) for a probability of 0.1% as described in section 5.7.2 of KDB971168 D01v03r01 and ANSI C63.26-2015 section 5.2.3.4. Measurements were performed for both the upper and lower narrow band IoT guard band carriers. All results are presented in tabular form below. The highest measured values are highlighted.

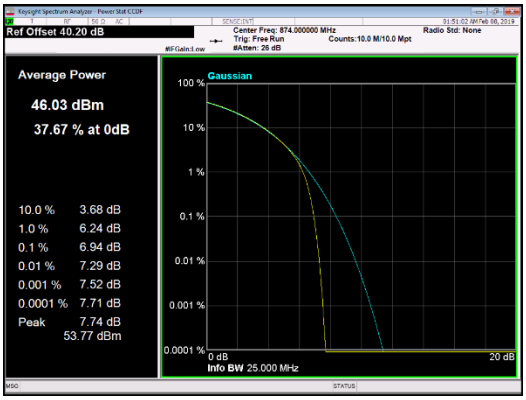
Antenna 4 LTE Channel	LTE Bandwidth	Band 5 Single Narrow Band IoT Lower Guard Band Carrier	
		PAPR (dB)	Average (dBm)
Bottom Channel	**10M**	6.94	46.02
Middle Channel	**10M**	6.66	46.06
Top Channel	**10M**	6.97	**46.09**

Antenna 4 LTE Channel	LTE Bandwidth	Band 5 Single Narrow Band IoT Upper Guard Band Carrier	
		PAPR (dB)	Average (dBm)
Bottom Channel	**10M**	6.88	46.07
Middle Channel	**10M**	6.66	46.03
Top Channel	**10M**	**7.06**	46.07

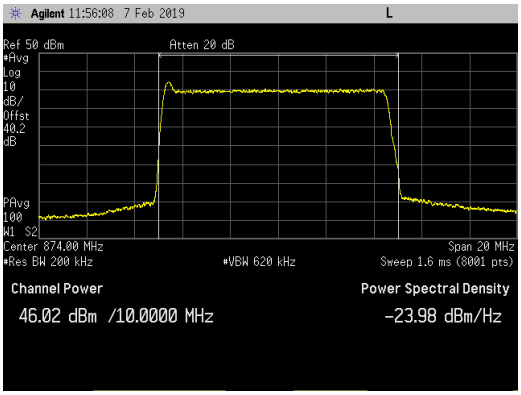
All measurement results are provided in the following pages. The total measurement RF path loss of the test setup (attenuator and test cables) was 40.2 dB and is accounted for by the spectrum analyzer reference level offset.

LTE10 Channel Power Plots for a Single Narrow Band IoT Lower Guard Band Carrier:

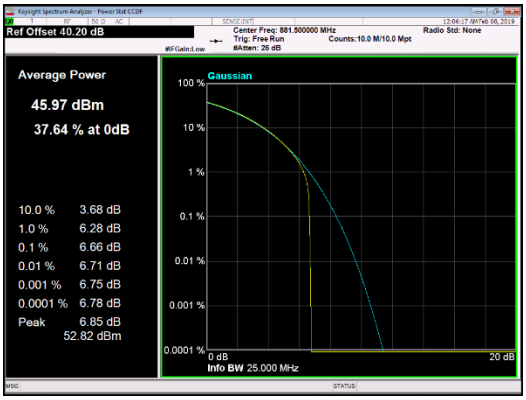
Port 4 – Bottom Channel_ CCDF



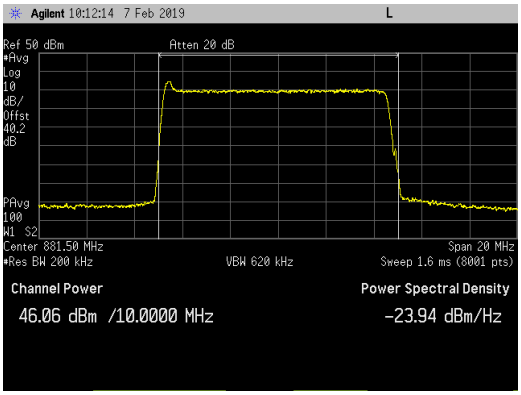
Port 4 – Bottom Channel_ Average



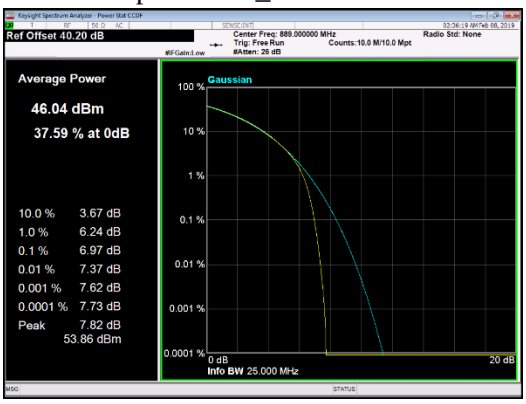
Port 4 – Middle Channel_ CCDF



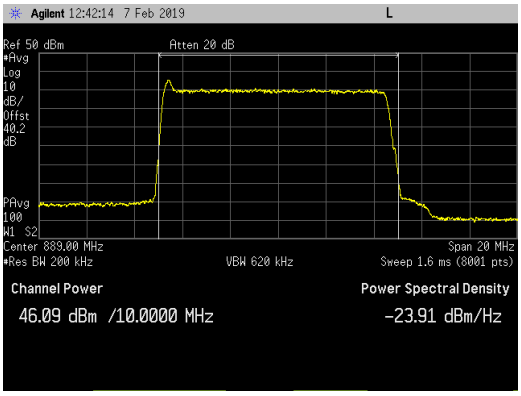
Port 4 – Middle Channel_ Average



Port 4 – Top Channel_ CCDF

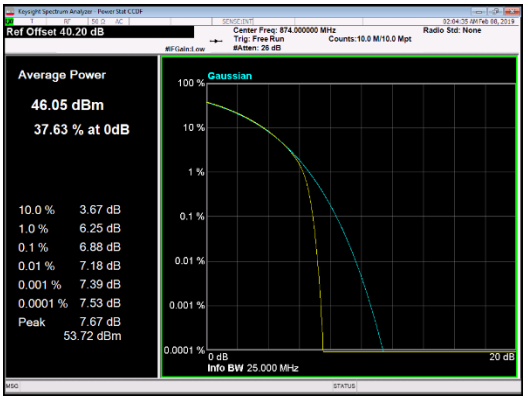


Port 4 – Top Channel_ Average

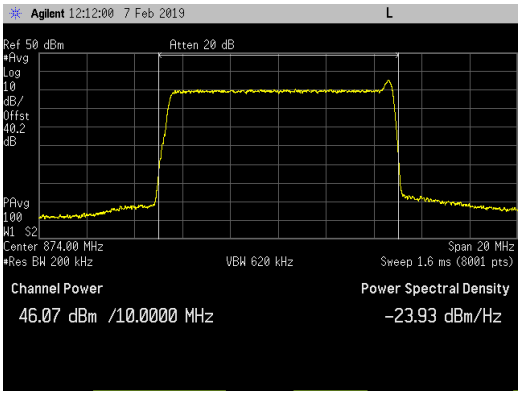


LTE10 Channel Power Plots for a Single Narrow Band IoT Upper Guard Band Carrier:

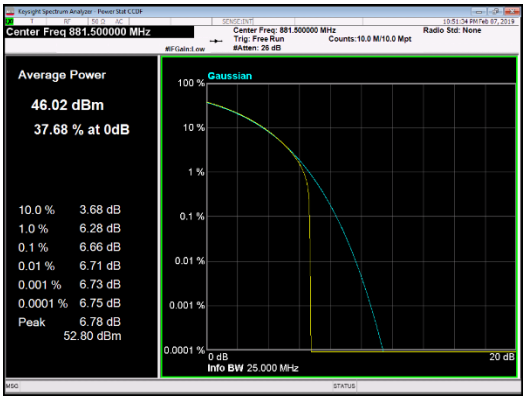
Port 4 – Bottom Channel_ CCDF



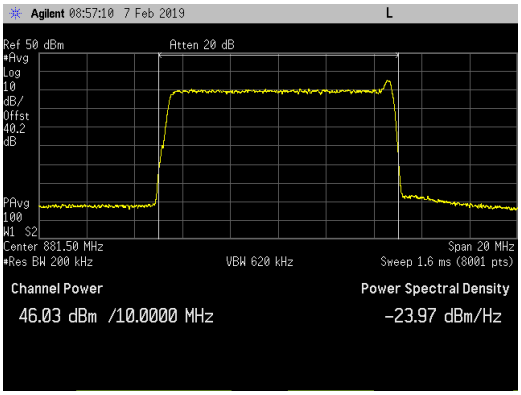
Port 4 – Bottom Channel_ Average



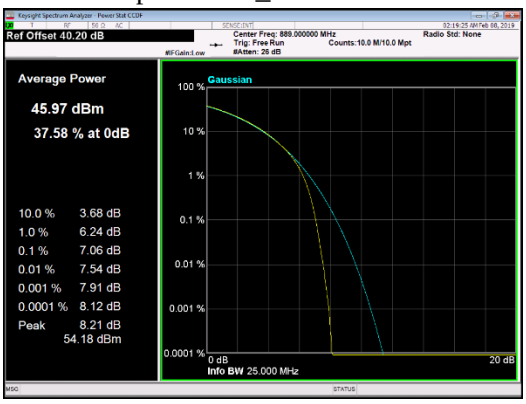
Port 4 – Middle Channel_ CCDF



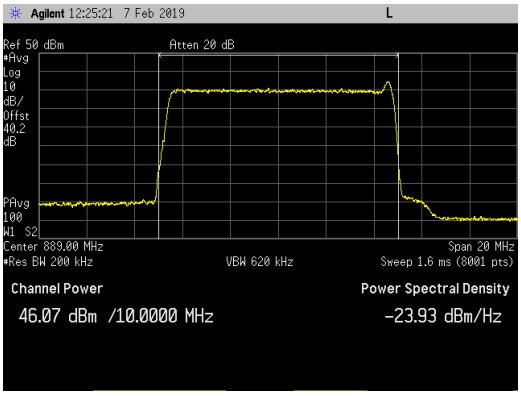
Port 4 – Middle Channel_ Average



Port 4 – Top Channel_ CCDF



Port 4 – Top Channel_ Average



Emission Bandwidth (26 dB down and 99%)

Emission bandwidth measurements were made at the AHBCC Antenna Port 4 Band 5 (869 to 894MHz) transmit chain at the bottom, middle and top channels for the single Narrow Band IoT Guard Band LTE10 carrier with maximum RF output power. Measurements were performed for both the upper and lower narrow band IoT guard band carriers. The 26dB emission bandwidth was measured in accordance with section 4 of FCC KDB 971168 D01v03r01 and ANSI C63.26 section 5.4. The 99% occupied bandwidth was measured in accordance with section 6.7 of RSS-Gen Issue 5. For both measurements, an occupied bandwidth built-in function in the spectrum analyzer was used. The results are provided in the following table. The largest emission bandwidths are highlighted.

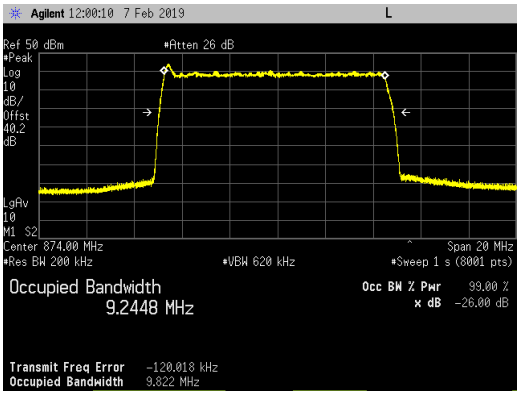
Antenna 4 LTE Channel	LTE Bandwidth	Band 5 Single Narrow Band IoT Lower Guard Band Carrier	
		26dB Emission Bandwidth	99% Emission Bandwidth
Bottom Channel	**10M**	**9.822 MHz**	**9.2448 MHz**
Middle Channel	**10M**	9.791 MHz	9.2371 MHz
Top Channel	**10M**	9.805 MHz	9.2329 MHz

Antenna 4 LTE Channel	LTE Bandwidth	Band 5 Single Narrow Band IoT Upper Guard Band Carrier	
		26dB Emission Bandwidth	99% Emission Bandwidth
Bottom Channel	**10M**	9.804 MHz	9.2376 MHz
Middle Channel	**10M**	9.811 MHz	9.2412 MHz
Top Channel	**10M**	9.814 MHz	9.2405 MHz

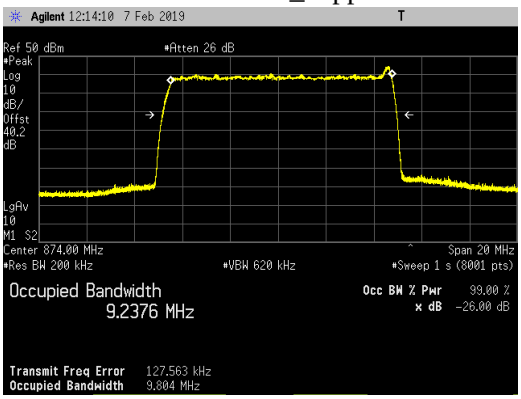
Emission bandwidth measurement data are provided in the following pages.

LTE10 Channel Emission Bandwidth Plots for a Single Narrow Band IoT Guard Band Carrier:

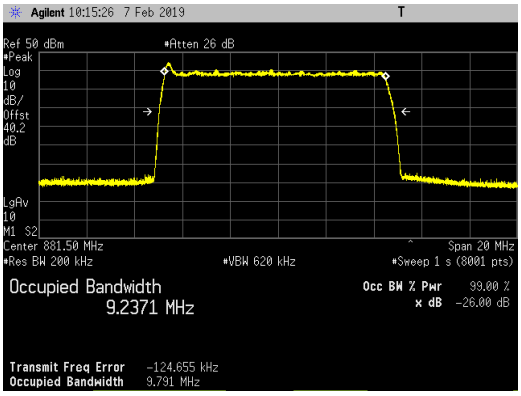
Port 4 – Bottom Channel_ Lower Guard Band



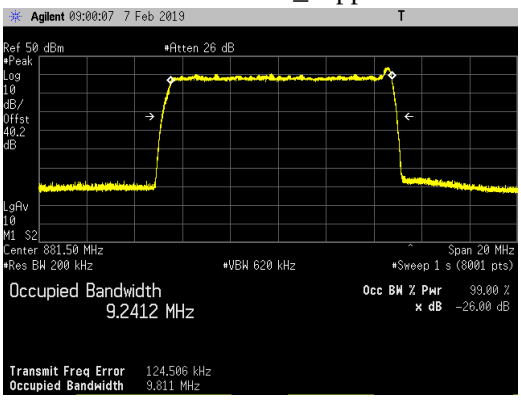
Port 4 – Bottom Channel_ Upper Guard Band



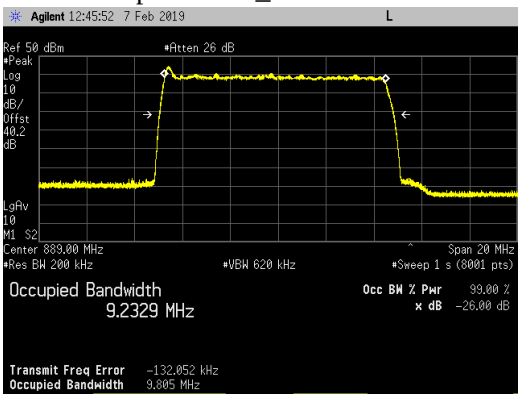
Port 4 – Middle Channel_ Lower Guard Band



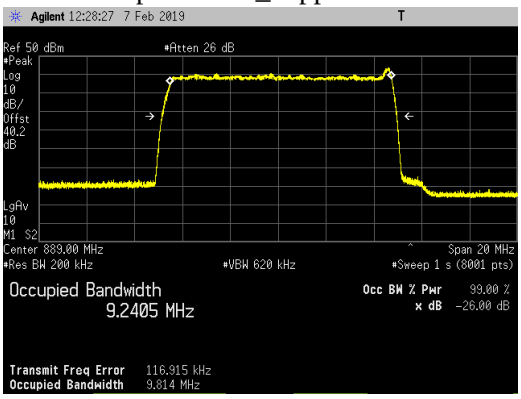
Port 4 – Middle Channel_ Upper Guard Band



Port 4 – Top Channel_ Lower Guard Band



Port 4 – Top Channel_ Upper Guard Band



Antenna Port Conducted Band Edge

Conducted band edge measurements were made at RRH antenna port 4. The AHBCC was operated at the band edge frequencies with a single upper and lower NB IoT GB carrier for 10MHz LTE bandwidth at maximum power.

The same limit of -19dBm used in the original certification testing is used for this testing. The limit is adjusted to -19dBm [-13dBm -10 log (4)] per FCC KDB 662911D01 v02r01 because the BTS may operate as a 4 port MIMO transmitter.

Measurements were performed with the spectrum analyzer in the RMS average mode over 100 traces. In the 1MHz bands outside and adjacent to the frequency block, a resolution bandwidth of 1% of the emission bandwidth was used. In the 1 to 20MHz frequency range outside the band edge (i.e.: 848 to 868MHz and 895 to 915MHz bands) a 100kHz RBW and 300kHz VBW was used.

The results are summarized in the following table. The highest (worst case) emissions from the measurement data are provided. The worst case (highest) measurement is -22.470 dBm.

NB IoT Guard Band Placement	LTE Frequency & Bandwidth	Band 5 Single Narrow Band IoT Guard Band Carrier	
		Lower Band Edge (dBm)	Upper Band Edge (dBm)
Lower	**874.0 MHz 10M**	-23.121	Not Applicable
Upper	**874.0 MHz 10M**	-31.689	Not Applicable
Lower	**889.0 MHz 10M**	Not Applicable	-29.557
Upper	**889.0 MHz 10M**	Not Applicable	**-22.470**

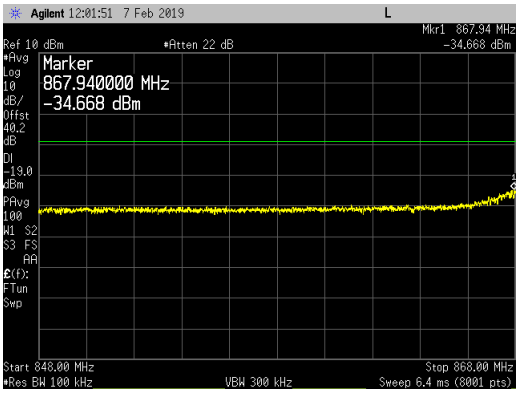
The total measurement RF path loss of the test setup (attenuator and test cables) was 40.2 dB and is accounted for by the spectrum analyzer reference level offset. The display line on the plots reflects the required limit.

Conducted band edge measurements are provided in the following pages.

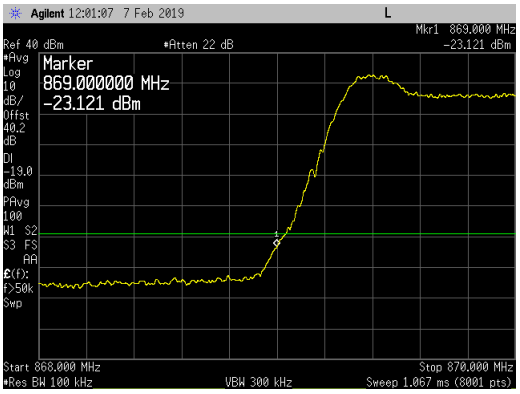
Band 5 LTE10 at Bot Ch (874.0MHz) 40W Single Narrow Band IoT Guard Band Carrier -Lower Band Edge Plots:

IoT Guard Band Carrier at Lower Placement

Ant Port 4 _ LBE _848 to 868MHz

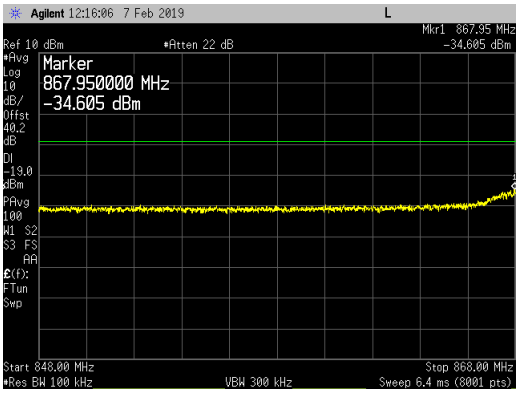


Ant Port 4 _ LBE _868 to 870MHz

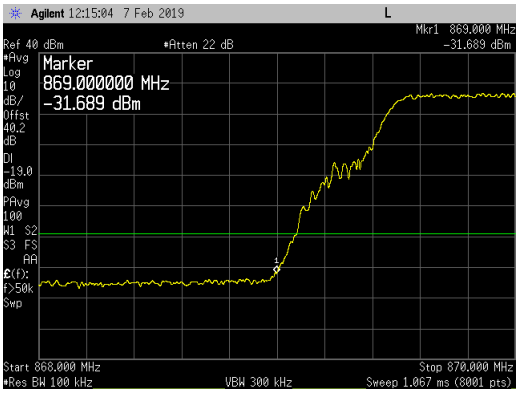


IoT Guard Band Carrier at Upper Placement

Ant Port 4 _ LBE _848 to 868MHz



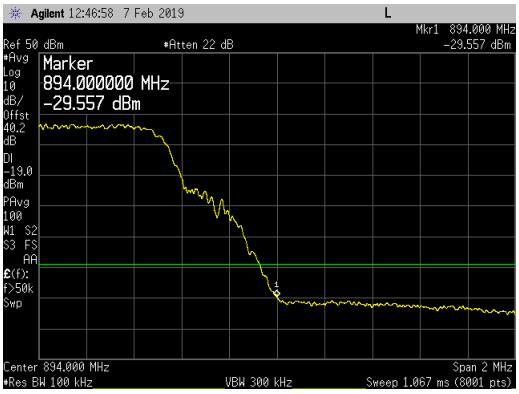
Ant Port 4 _ LBE _868 to 870MHz



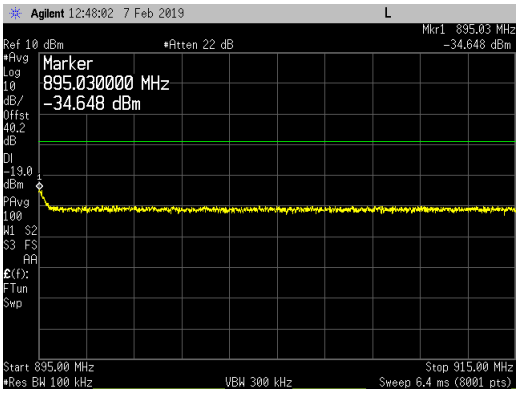
Band 5 LTE10 at Top Ch (889.0MHz) 40W Single Narrow Band IoT Guard Band Carrier -Upper Band Edge Plots:

IoT Guard Band Carrier at Lower Placement

Ant Port 4_UBE _893 to 895MHz

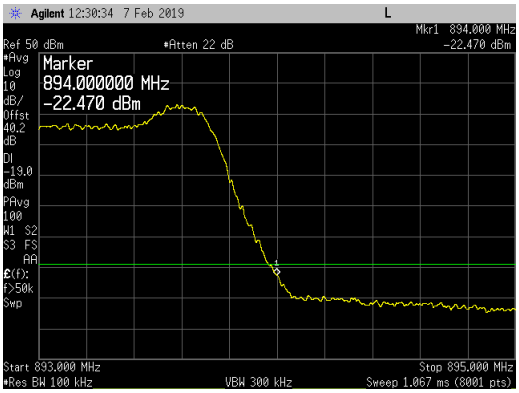


Ant Port 4_UBE _895 to 915MHz

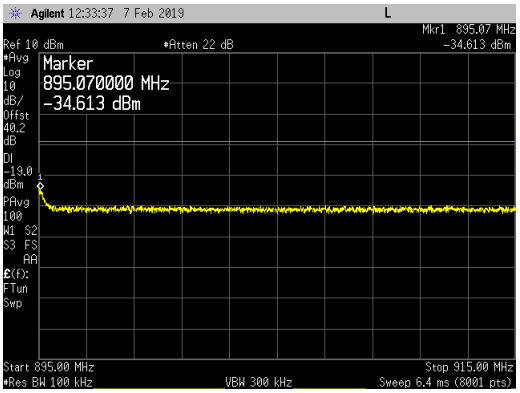


IoT Guard Band Carrier at Upper Placement

Ant Port 4_UBE _893 to 895MHz



Ant Port 4_UBE _895 to 915MHz



Transmitter Antenna Port Conducted Emissions

Transmitter conducted emission measurements were made at RRH antenna port 4. Measurements were performed over the 9kHz to 9GHz frequency range. The AHBCC was operated on the Band 5 middle channel (881.5MHz) and Band 13 middle channel (751.0MHz) simultaneously with a single upper and lower NB IoT GB carrier for 10MHz LTE bandwidth at maximum power (40W/carrier and 80W/port). The same narrow band IoT guard band placement was used for both frequency bands.

The same limit of -19dBm used in the original certification testing is used for this testing. The limit is adjusted to -19dBm [-13dBm -10 log (4)] per FCC KDB 662911D01 v02r01 because the BTS may operate as a 4 port MIMO transmitter. The required measurement parameters include a 100kHz bandwidth with power measured in average value (since transmitter power was measured in average value).

Measurements were performed with a spectrum analyzer using a peak detector with max hold over 50 sweeps (except for the 9kHz to 150kHz and 700MHz to 1100MHz frequency range). Measurements for the 9kHz to 150kHz and 700MHz to 1100MHz frequency ranges were performed with the spectrum analyzer in the RMS average mode over 100 traces.

The limit for the 9kHz to 150kHz frequency range was adjusted to –39dBm to correct for a spectrum analyzer RBW of 1kHz versus required RBW of 100kHz [i.e.: -39dBm = -19dBm -10log(100kHz/1kHz)]. The limit for the 150kHz to 20MHz frequency range was adjusted to –29dBm to correct for a spectrum analyzer RBW of 10kHz versus required RBW of 100kHz [i.e.: -29dBm = -19dBm -10log(100kHz/10kHz)]. The required limit of -19dBm with a RBW of $\geq$100kHz was used for all other frequency ranges. The spectrum analyzer settings that were used for this test are summarized in the following table.

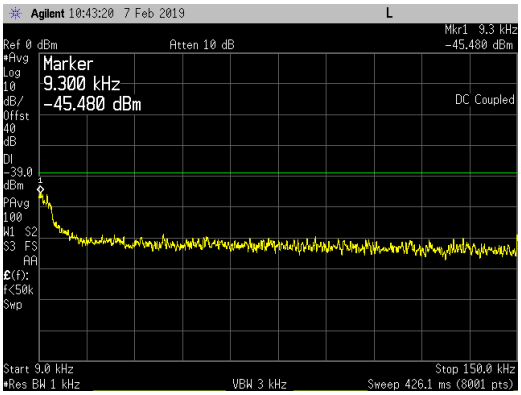
Frequency Range	RBW	VBW	Number of Data Points	Detector	Sweep Time	Max Hold over	Offset Note 1
9kHz to 150kHz	1kHz	3kHz	8001	Average	Auto	Note 2	40.0dB
150kHz to 20MHz	10kHz	30kHz	8001	Peak	Auto	50 Sweeps	40.0dB
20MHz to 700MHz	300kHz	910kHz	8001	Peak	Auto	50 Sweeps	40.2dB
700MHz to 1.1GHz	100kHz	300kHz	8192	Average	Auto	Note 2	40.2dB
1.1GHz to 9GHz	2MHz	6MHz	8192	Peak	Auto	50 Sweeps	25.0dB

Note 1: The total measurement RF path loss of the test setup (attenuators, filters and test cables) is accounted for by the spectrum analyzer reference level offset.
Note 2: Max Hold not used and instead measurements were performed with the spectrum analyzer in the RMS average mode over 100 traces.

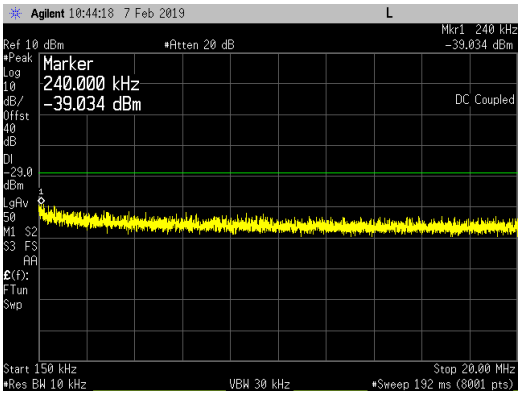
A high pass filter was used to reduce measurement instrumentation noise floor for the frequency ranges above 1100MHz. The total measurement RF path loss of the test setup (attenuators, high pass filter and test cables) as shown in the table is accounted for by the spectrum analyzer reference level offset. The display line on the plots reflects the required limit.
Conducted spurious emission plots/measurements are provided in the following pages.

Band 5 and LTE10 Single Narrow Band IoT Lower Guard Band Carriers
- Middle Channels (881.5MHz and 751.0MHz) at 40 watts/carrier and 80 watts/port:

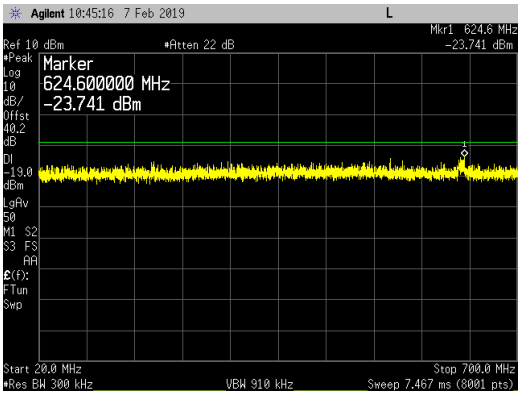
9kHz to 150kHz



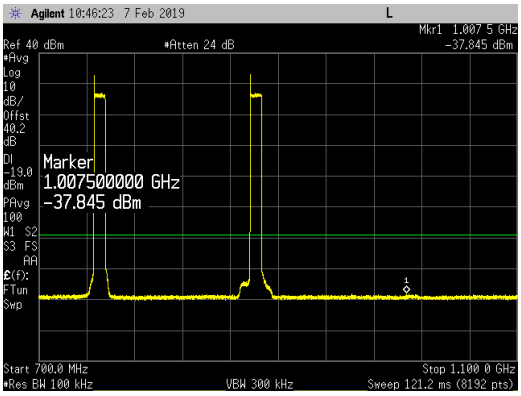
150kHz to 20MHz



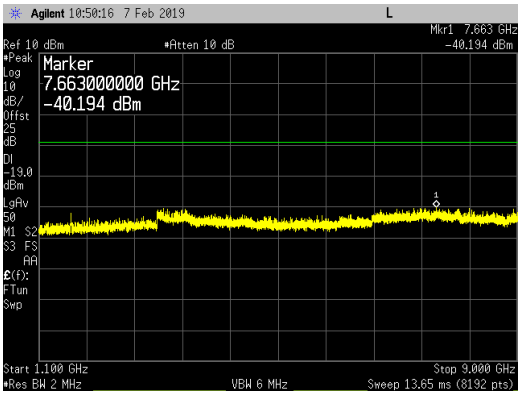
20MHz to 700MHz



700MHz to 1.1GHz

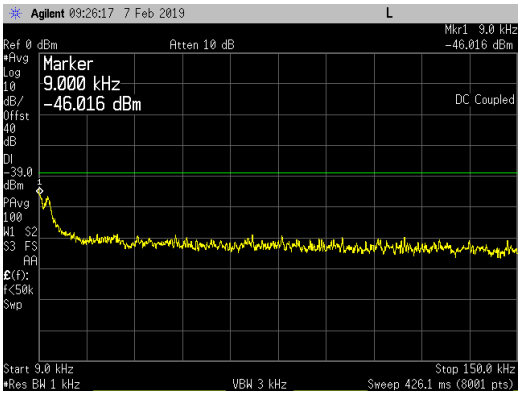


1.1GHz to 9GHz

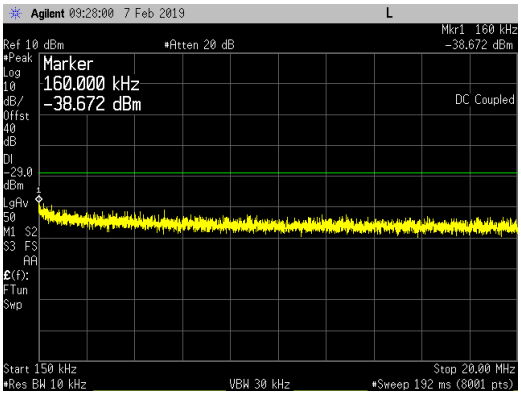


Band 5 and Band 13 LTE10 Single Narrow Band IoT Upper Guard Band Carriers - Middle Channels (881.5MHz and 751.0MHz) at 40 watts/carrier and 80 watts/port:

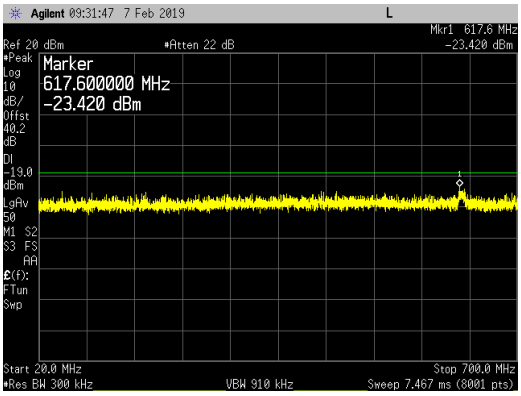
9kHz to 150kHz



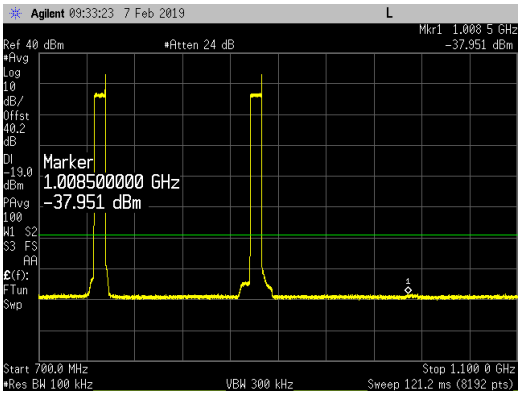
150kHz to 20MHz



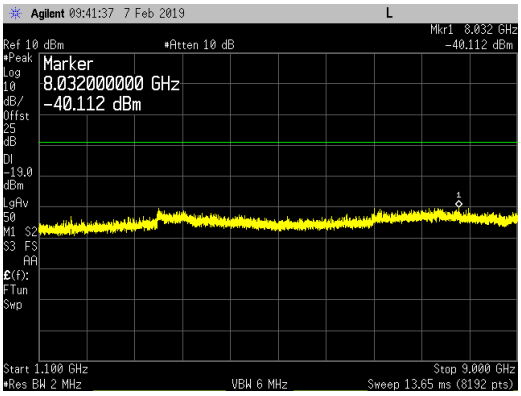
20MHz to 700MHz



700MHz to 1.1GHz



1.1GHz to 9GHz



Transmitter Radiated Spurious Emissions

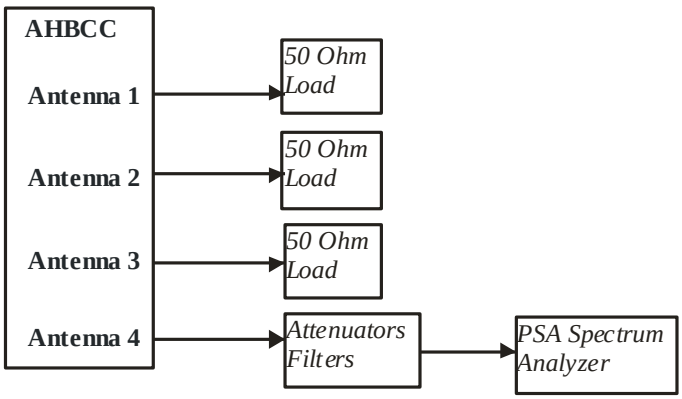
Radiated spurious emission plots/measurement results are in the original FCC and IC radio certification submittal (NTS Test Report Number PR075288 Revision 1 dated March 18, 2018).

Frequency Stability/Accuracy

Frequency Stability/Accuracy measurement results are in the original FCC and IC radio certification submittal (NTS Test Report Number PR075288 Revision 1 dated March 18, 2018).

APPENDIX B: ANTENNA PORT TEST DATA FOR BAND 13 (746-756MHZ)

All conducted RF measurements in this section were made at AHBCC antenna port 4. The testing was performed on the same hardware (EUT) as the original certification test. The same EUT RF port (Ant 4) determined in the original certification testing to be the highest power port was used for all testing in this effort. All testing in this section was performed with the single Narrow Band IoT Guard Band LTE10 carrier. NB IoT guard band offsets from LTE carrier center frequencies were LTE10: ±4597.5 kHz. The LTE modulation type for this testing was setup according to 3GPP TS 36.141 E-UTRA Test Models and is "E-TM 1.1 (QPSK modulation type) with N-TM (narrow band IoT)". The test setup used is provided below.



Test Setup Used for Conducted RF Measurements on AHBCC

RF Output Power

RF output power has been measured in RMS Average terms at the AHBCC Antenna Port 4 Band 13 (746 to 756MHz) transmit chain at the bottom, middle and top channels for the single Narrow Band IoT Guard Band LTE10 carrier as described in section 5.2 of KDB 971168 D01v03r01 and ANSI C63.26-2015 section 5.2.4.4. The AHBCC was operated at maximum RF output power. The peak to average power ratio (PAPR) has been measured using the signal analyzer complementary cumulative distribution function (CCDF) for a probability of 0.1% as described in section 5.7.2 of KDB971168 D01v03r01 and ANSI C63.26-2015 section 5.2.3.4. Measurements were performed for both the upper and lower narrow band IoT guard band carriers. All results are presented in tabular form below. The highest measured values are highlighted.

Antenna 4 LTE Channel	LTE Bandwidth	Band 5 Single Narrow Band IoT Lower Guard Band Carrier	
		PAPR (dB)	Average (dBm)
Bottom, Middle, Top Channel	**10M**	6.77	45.92

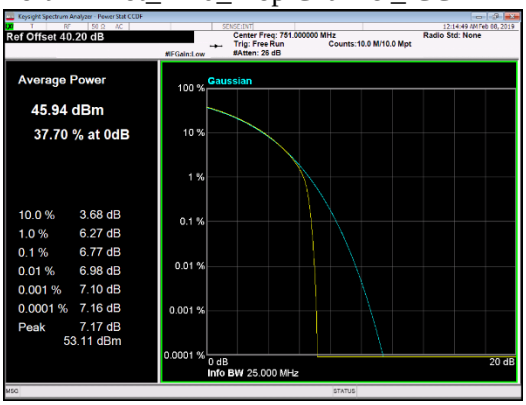
Antenna 4 LTE Channel	LTE Bandwidth	Band 5 Single Narrow Band IoT Upper Guard Band Carrier	
		PAPR (dB)	Average (dBm)
Bottom, Middle, Top Channel	**10M**	**6.83**	**45.97**

All measurement results are provided in the following pages. The total measurement RF path loss of the test setup (attenuator and test cables) was 40.2 dB and is accounted for by the spectrum analyzer reference level offset.

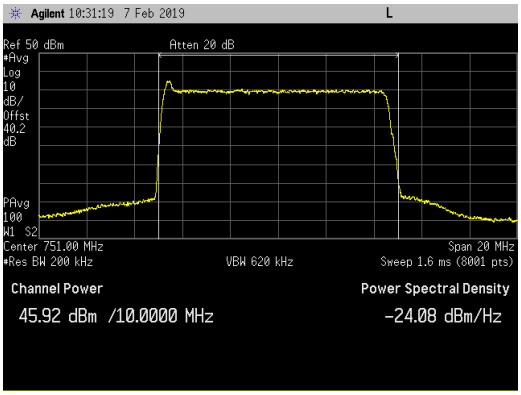
LTE10 Channel Power Plots for a Single Narrow Band IoT Guard Band Carrier:

Lower Guard Band Carrier

Port 4 – Bot_ Mid_ Top Channel_ CCDF

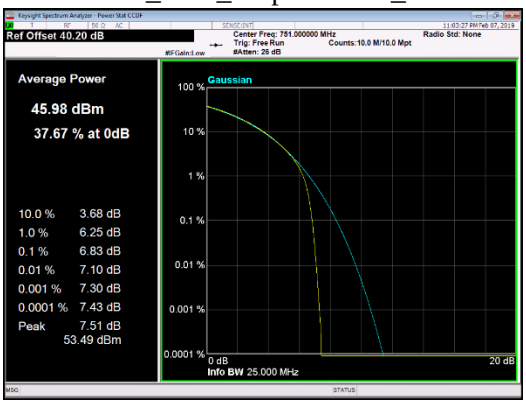


Port 4 – Bot_ Mid_ Top Channel_ Average

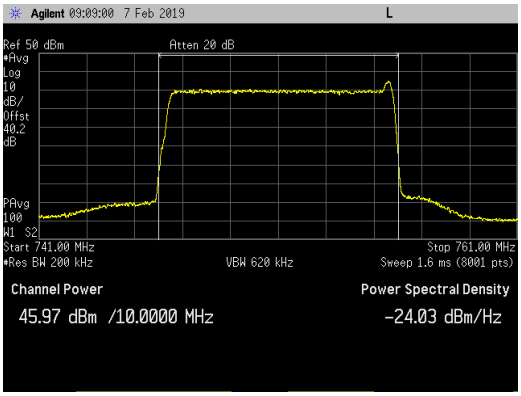


Upper Guard Band Carrier

Port 4 – Bot_ Mid_ Top Channel_ CCDF



Port 4 – Bot_ Mid_ Top Channel_ Average



Emission Bandwidth (26 dB down and 99%)

Emission bandwidth measurements were made at the AHBCC Antenna Port 4 Band 13 (746 to 756MHz) transmit chain at the bottom, middle and top channels for the single Narrow Band IoT Guard Band LTE10 carrier with maximum RF output power. Measurements were performed for both the upper and lower narrow band IoT guard band carriers. The 26dB emission bandwidth was measured in accordance with section 4 of FCC KDB 971168 D01v03r01 and ANSI C63.26 section 5.4. The 99% occupied bandwidth was measured in accordance with section 6.7 of RSS-Gen Issue 5. For both measurements, an occupied bandwidth built-in function in the spectrum analyzer was used. The results are provided in the following tables. The largest emission bandwidths are highlighted.

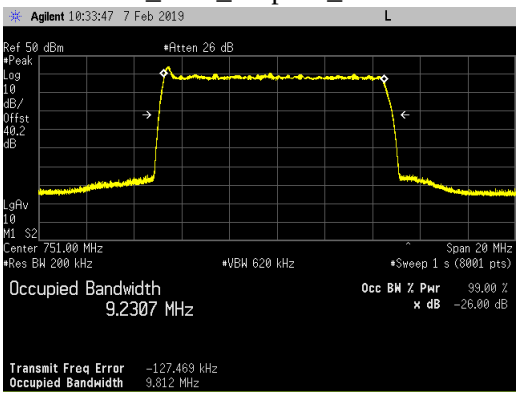
Antenna 4 LTE Channel	LTE Bandwidth	Band 5 Single Narrow Band IoT Lower Guard Band Carrier	
		26dB Emission Bandwidth	99% Emission Bandwidth
Bottom, Middle, Top Channel	**10M**	**9.812 MHz**	9.2307 MHz

Antenna 4 LTE Channel	LTE Bandwidth	Band 5 Single Narrow Band IoT Upper Guard Band Carrier	
		26dB Emission Bandwidth	99% Emission Bandwidth
Bottom, Middle, Top Channel	**10M**	9.809 MHz	**9.2394 MHz**

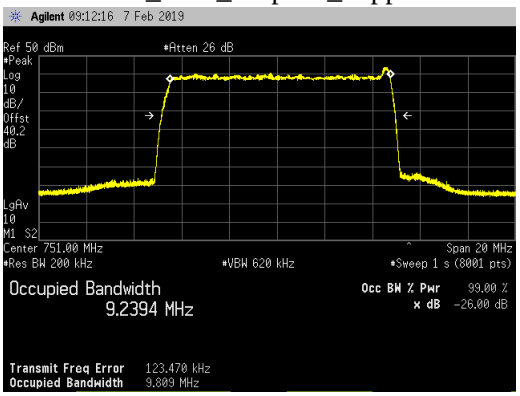
Emission bandwidth measurement data are provided in the following pages.

LTE10 Channel Emission Bandwidth Plots for a Single Narrow Band IoT Guard Band Carrier:

Port 4 – Bot_ Mid_ Top Ch_ Lower Guard Band



Port 4 – Bot_ Mid_ Top Ch_ Upper Guard Band



Antenna Port Conducted Band Edge

Conducted band edge measurements were made at RRH antenna port 4. The AHBCC was operated at the band edge frequencies with a single upper and lower NB IoT GB carrier for 10MHz LTE bandwidth at maximum power.

In the frequency ranges below 746MHz, 756MHz to 763MHz, 775MHz to 793MHz and above 806MHz the limit of (-19dBm) is used for this testing per FCC 27.53(c) and RSS-130 4.6. The same limit of -19dBm used in the original certification testing is used for this testing. The limit is adjusted to -19dBm [-13dBm -10 log (4)] per FCC KDB 662911D01 v02r01 because the BTS may operate as a 4 port MIMO transmitter.

Measurements were performed with the spectrum analyzer in the RMS average mode over 100 traces. In the 100kHz bands outside and adjacent to the frequency block, a resolution bandwidth of 30kHz as allowed by FCC 27.53(f) and RSS-130 4.6 was used. Outside the 100kHz band edge noted above, a 100kHz RBW and 300kHz VBW was used.

The results are summarized in the following table. The highest (worst case) emissions from the measurement data are provided. The worst case (highest) measurement is -29.526 dBm.

Frequency ranges below 746MHz, 756MHz to 763MHz, 775MHz to 793MHz and above 806MHz:

Frequency Ranges below 746MHz, 756MHz to 763MHz, 775MHz to 793MHz and above 806MHz			
NB IoT Guard Band Placement	**LTE Frequency & Bandwidth**	**Band 13 Single Narrow Band IoT Guard Band Carrier**	
		Lower Band Edge (dBm)	**Upper Band Edge (dBm)**
Lower	**751.0 MHz 10M**	-32.470	-29.934
Upper	**751.0 MHz 10M**	-32.477	**-29.526**

Section 27.53(c)(3) and RSS-130 4.6.2 requires an emission limit of -46dBm for any 6.25 kHz bandwidth between frequency bands 763-775 MHz and 793-806MHz. Adjusting for the four port MIMO requirement the emission limit in these frequency ranges is -52dBm [i.e.: Limit = -46 dBm/6.25kHz (FCC/IC Limit) – 6dB (4 port MIMO)]. A RBW of 6.8kHz was used for these frequency ranges because a 6.25kHz bandwidth was not available on the spectrum analyzer (a RBW>6.25kHz was selected). The same limit and measurement method used in the original certification testing is used for this testing. Measurements were performed with the spectrum analyzer in the RMS average mode over 100 traces. The results are summarized in the following table.

The worst case (highest) measurement is -55.332 dBm.

Frequency ranges of 763MHz to 775MHz and 793MHz to 806MHz:

Frequency Ranges of 763MHz to 775MHz and 793MHz to 806MHz			
NB IoT Guard Band Placement	**LTE Frequency & Bandwidth**	**Band 13 Single Narrow Band IoT Guard Band Carrier**	
		763MHz to 775MHz (dBm)	**793MHz to 806MHz (dBm)**
Lower	**751.0 MHz 10M**	-56.554	-66.815
Upper	**751.0 MHz 10M**	**-55.332**	-66.766

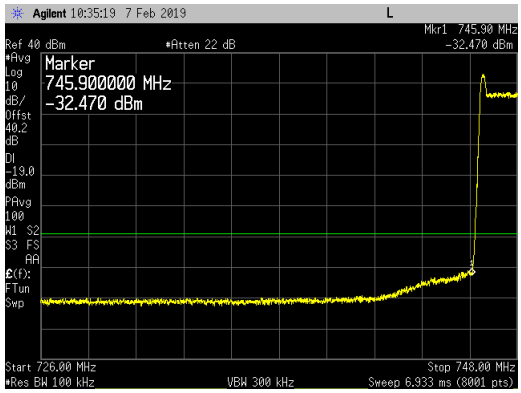
The total measurement RF path loss of the test setup (attenuator and test cables) was 40.2 dB and is accounted for by the spectrum analyzer reference level offset. The display line on the plots reflects the required limit.

Conducted band edge measurements are provided in the following pages.

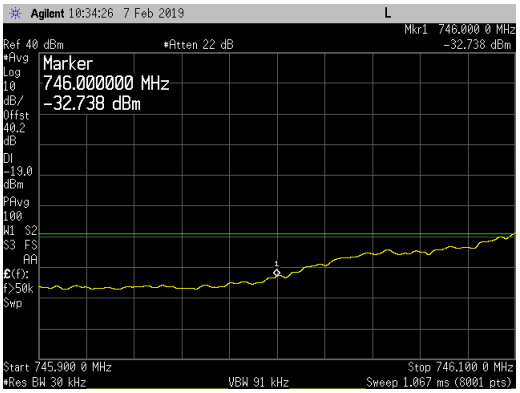
Band 13 LTE10 40W Single Narrow Band IoT Guard Band Carrier Lower and Upper Band Edge Plots:

IoT Guard Band Carrier at Lower Placement and LTE10 Carrier at Bot_ Mid_ Top Channel (751MHz)

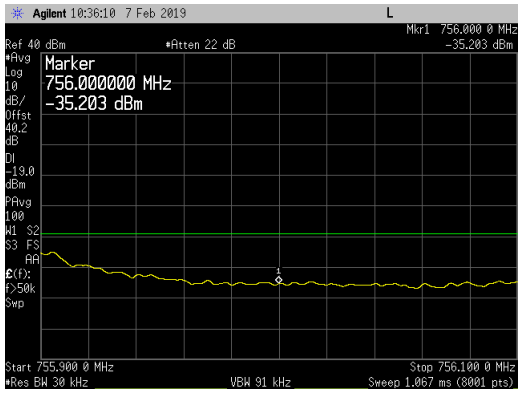
Ant Port 4_ LBE_726MHz to 748MHz



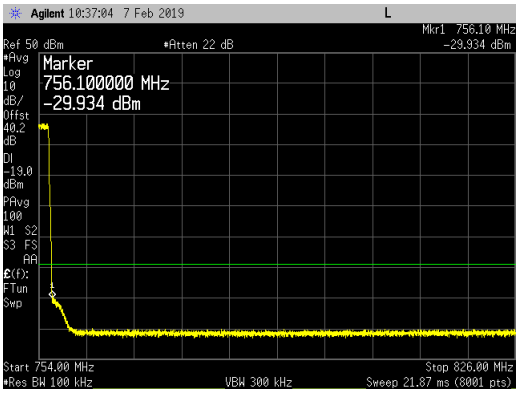
Ant Port 4_ LBE_745.9Mz to 746.1MHz



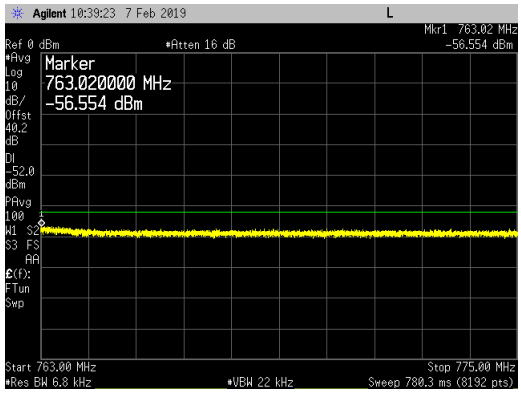
Ant Port 4_ UBE_ 755.9MHz to 756.1MHz



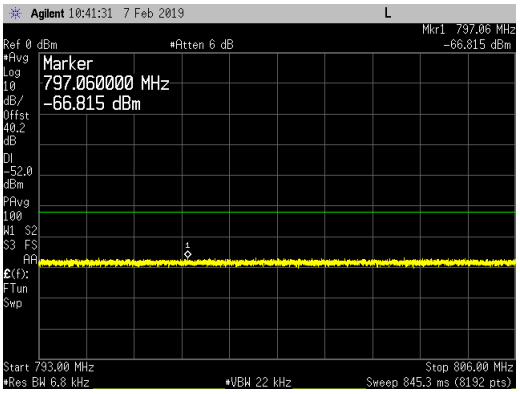
Ant Port 4_ UBE_754Mz to 826MHz



Ant Port 4_ UBE_ 763MHz to 775MHz



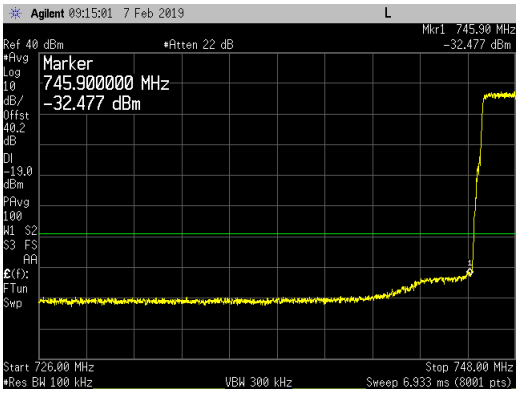
Ant Port 4_ UBE_ 793MHz to 806MHz



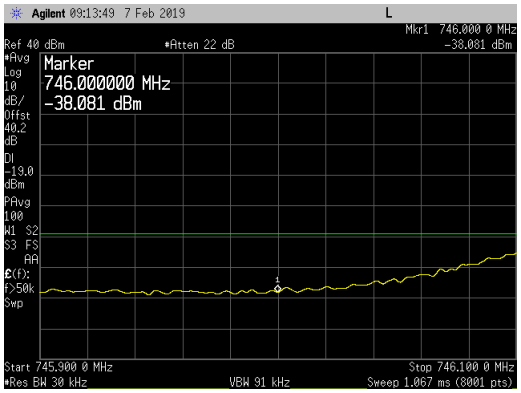
Band 13 LTE10 40W Single Narrow Band IoT Guard Band Carrier Lower and Upper Band Edge Plots:

IoT Guard Band Carrier at Upper Placement and LTE10 Carrier at Bot_ Mid_ Top Channel (751MHz)

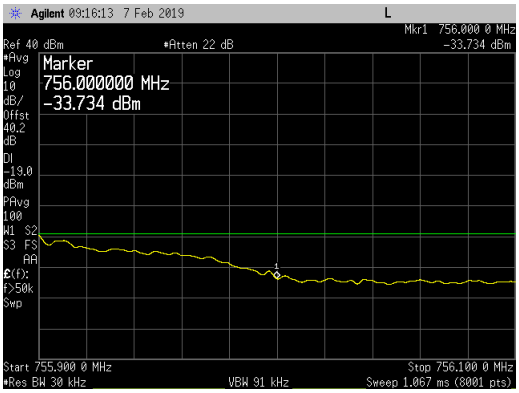
Ant Port 4_ LBE_726MHz to 748MHz



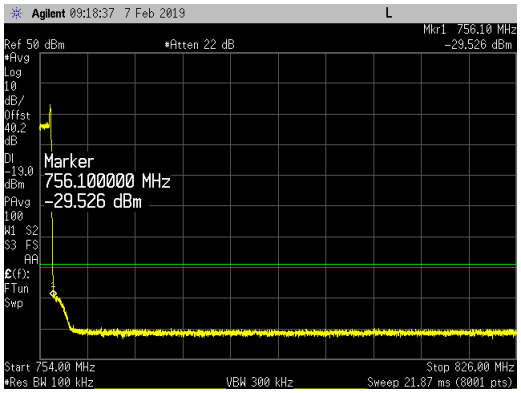
Ant Port 4_ LBE_745.9Mz to 746.1MHz



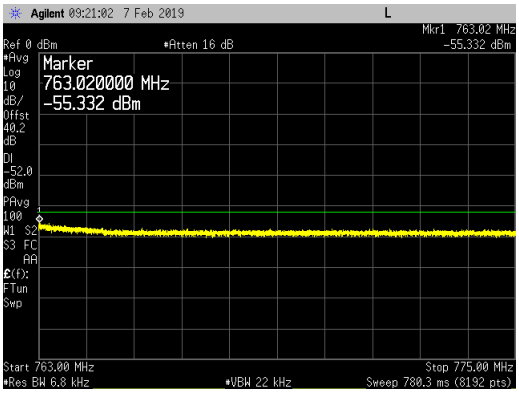
Ant Port 4_ UBE_ 755.9MHz to 756.1MHz



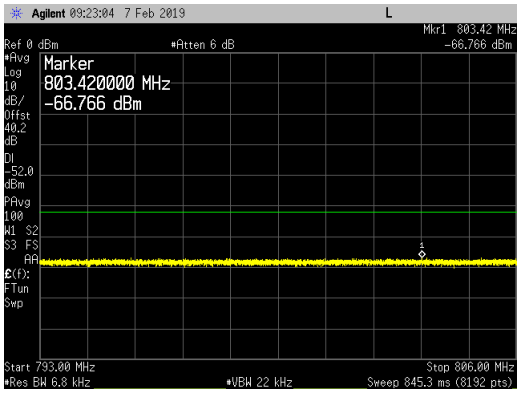
Ant Port 4_ UBE_754Mz to 826MHz



Ant Port 4_ UBE_ 763MHz to 775MHz



Ant Port 4_ UBE_ 793MHz to 806MHz



Transmitter Antenna Port Conducted Emissions

Transmitter conducted emission measurements were made at RRH antenna port 4. Measurements were performed over the 9kHz to 9GHz frequency range. The AHBCC was operated on the Band 5 middle channel (881.5MHz) and Band 13 middle channel (751.0MHz) simultaneously with a single upper and lower NB IoT GB carrier for 10MHz LTE bandwidth at maximum power (40W/carrier and 80W/port). The same narrow band IoT guard band placement was used for both frequency bands.

The same limit of -19dBm used in the original certification testing is used for this testing. The limit is adjusted to -19dBm [-13dBm -10 log (4)] per FCC KDB 662911D01 v02r01 because the BTS may operate as a 4 port MIMO transmitter. The required measurement parameters include a 100kHz bandwidth with power measured in average value (since transmitter power was measured in average value).

Measurements were performed with a spectrum analyzer using a peak detector with max hold over 50 sweeps (except for the 9kHz to 150kHz and 700MHz to 1100MHz frequency range). Measurements for the 9kHz to 150kHz and 700MHz to 1100MHz frequency ranges were performed with the spectrum analyzer in the RMS average mode over 100 traces.

The limit for the 9kHz to 150kHz frequency range was adjusted to –39dBm to correct for a spectrum analyzer RBW of 1kHz versus required RBW of 100kHz [i.e.: -39dBm = -19dBm -10log(100kHz/1kHz)]. The limit for the 150kHz to 20MHz frequency range was adjusted to –29dBm to correct for a spectrum analyzer RBW of 10kHz versus required RBW of 100kHz [i.e.: -29dBm = -19dBm -10log(100kHz/10kHz)]. The required limit of -19dBm with a RBW of $\geq$100kHz was used for all other frequency ranges. The spectrum analyzer settings that were used for this test are summarized in the following table.

Frequency Range	RBW	VBW	Number of Data Points	Detector	Sweep Time	Max Hold over	Offset Note 1
9kHz to 150kHz	1kHz	3kHz	8001	Average	Auto	Note 2	40.0dB
150kHz to 20MHz	10kHz	30kHz	8001	Peak	Auto	50 Sweeps	40.0dB
20MHz to 700MHz	300kHz	910kHz	8001	Peak	Auto	50 Sweeps	40.2dB
700MHz to 1.1GHz	100kHz	300kHz	8192	Average	Auto	Note 2	40.2dB
1.1GHz to 9GHz	2MHz	6MHz	8192	Peak	Auto	50 Sweeps	25.0dB

Note 1: The total measurement RF path loss of the test setup (attenuators, filters and test cables) is accounted for by the spectrum analyzer reference level offset.
Note 2: Max Hold not used and instead measurements were performed with the spectrum analyzer in the RMS average mode over 100 traces.

A high pass filter was used to reduce measurement instrumentation noise floor for the frequency ranges above 1100MHz. The total measurement RF path loss of the test setup (attenuators, high pass filter and test cables) as shown in the table is accounted for by the spectrum analyzer reference level offset. The display line on the plots reflects the required limit.

Conducted spurious emission plots/measurements are provided in Appendix A.

Transmitter Antenna Port Conducted Emissions in 1559MHz to 1610MHz Frequency Range

Conducted emissions in the frequency range 1559MHz to 1610MHz were measured. The EIRP limit in this band is -70dBW/MHz for wideband signals and -80dBW for discrete emissions of bandwidths less than 700Hz as shown in FCC 27.53(f) and RSS-130 section 4.6.2(b). This equates to an EIRP of -40dBm/MHz for wideband emissions and -50dBm/MHz for discrete emissions.

The limit is adjusted to -46 dBm [-40 dBm -10 log (4)] for wideband signals and -56dBm [-50 dBm -10 log (4)] for discrete emissions per FCC KDB 662911D01 v02r01 because the BTS may operate as a 4 port MIMO transmitter.

Measurements were made at AHBCC antenna port 4. The AHBCC was operated on the Band 5 middle channel (881.5MHz) and Band 13 middle channel (751.0MHz) simultaneously with a single upper and lower NB IoT GB carrier for 10MHz LTE bandwidth at maximum power (40W/carrier and 80W/port). The same narrow band IoT guard band placement was used for both frequency bands. The AHBCC configured for Band 13 LTE10 may operate only on the middle channel since the operational bandwidth is 10MHz wide.

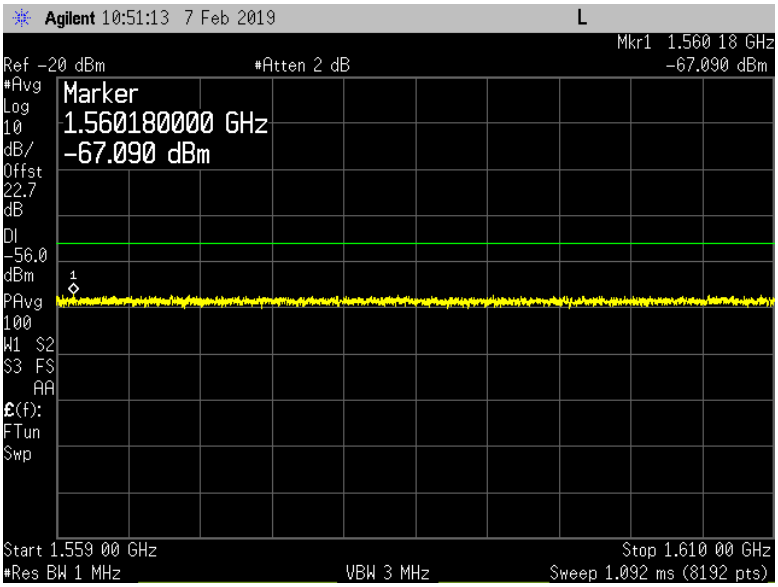
Measurements were performed with the spectrum analyzer in the RMS average mode over 100 traces. A 1MHz RBW and 3MHz VBW was used for all measurements. A 1GHz high pass filter was used to block the carrier fundamental frequency to reduce the measurement instrumentation noise floor level. The total measurement RF path loss of the test setup for frequency range 1559MHz to 1610MHz (attenuators, filters and test cables) of 22.7dB is accounted for by the spectrum analyzer reference level offset.

All readings were at the measurement instrumentation noise floor. The highest (worst case) emission from the measurement data was -66.858 dBm or -96.858 dBW. The results are summarized in the following table.

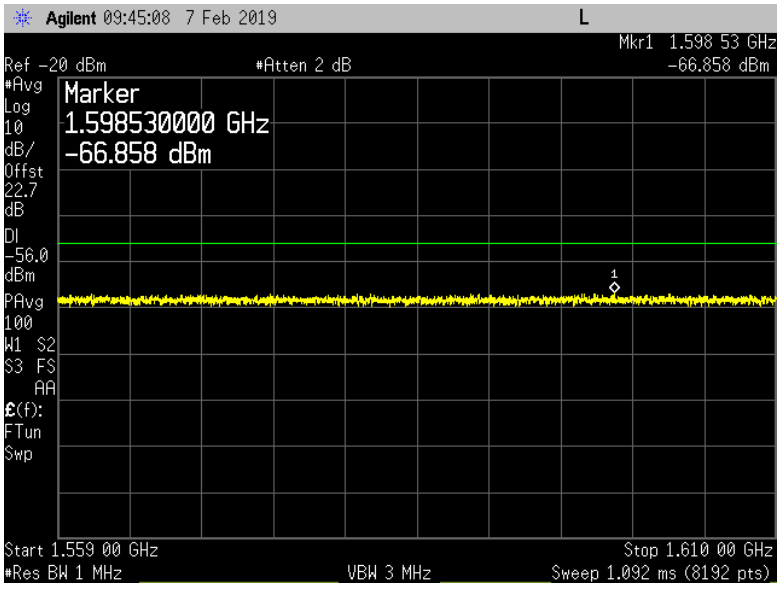
NB IoT Guard Band Placement	LTE Frequency & Bandwidth	Conducted Emissions in 1559MHz to 1610MHz Frequency Range (dBm)
Lower	**751.0 MHz 10M**	-67.090
Upper	**751.0 MHz 10M**	**-66.858**

Conducted emission plots/measurements for the 1559MHz to 1610MHz frequency range are provided in the following pages. The display line on the plots reflects the required worse case limit (-56dBm).

Band 13 and Band 5 LTE10 Single Narrow Band IoT Lower Guard Band Carriers - Middle Channels (751.0MHz and 881.5MHz) at 40 watts/carrier and 80 watts/port:
1559 to 1610 MHz



Band 13 and Band 5 LTE10 Single Narrow Band IoT Upper Guard Band Carriers - Middle Channels (751.0MHz and 881.5MHz) at 40 watts/carrier and 80 watts/port:
1559 to 1610 MHz



Transmitter Radiated Spurious Emissions

Radiated spurious emission plots/measurement results are in the original FCC and IC radio certification submittal (NTS Test Report Number PR075288 Revision 1 dated March 18, 2018).

Frequency Stability/Accuracy

Frequency Stability/Accuracy measurement results are in the original FCC and IC radio certification submittal (NTS Test Report Number PR075288 Revision 1 dated March 18, 2018).

End of Report