Nokia Solutions and Networks

Airscale Base Transceiver Station Remote Radio Head

Model: AHLBBA

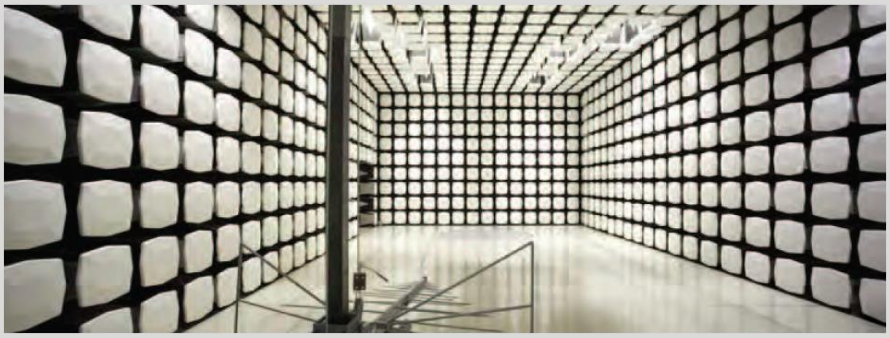
FCC 27:2019

FCC 27.53:2019

FCC 90:2019

FCC 90I:2019

Report # NOKI0004.1



NVLAP LAB CODE: 201049-0

CERTIFICATE OF TEST

Last Date of Test: November 20, 2019
Nokia Solutions and Networks
EUT: AHLBBA RRH

Radio Equipment Testing

Standards

Specification	Method
FCC 27:2019	ANSI C63.26:2015 FCC KDB 971168 D01 v03r01 FCC KDB 971168 D03 v01r01 FCC KDB 662911 D01 v02r01
FCC 27.53:2019	
FCC 90:2019	
FCC 90I:2019	
FCC Part 2:2019	

Results

	Test Description	Applied	Results	Comments
5.2.4	Average Output Power	Yes	Pass	For all testing, ERP depends on antenna gain, which is unknown. Only the highest dBm value is plotted per customer requirements and a Watt/MHz calculation was not made due to the unknown antenna value.
5.2.3.4	Peak to Average Power Ratio (PAPR)	Yes	Pass	Includes for reference, not required by rule parts for the frequency band
5.4	Occupied Bandwidth	Yes	Pass	
5.7	Band Edge Compliance	Yes	Pass	
5.7	Spurious Conducted Emissions	Yes	Pass	
5.5	Spurious Radiated Emissions	Yes	Pass	
5.6	Frequency Stability	Yes	Pass	

Deviations From Test Standards

None

Approved By:

Jeremiah Darden, Operations Manager

Product compliance is the responsibility of the client; therefore, the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information. As indicated in the Statement of Work sent with the quotation, Element's standard process is to always use the latest published version of the test methods even when earlier versions are cited in the test specification. Issuance of a purchase order was de facto acceptance of this approach. Otherwise, the client would have advised Element in writing of the specific version of the test methods they wanted applied to the subject testing.

REVISION HISTORY

Revision Number	Description	Date (yyyy-mm-dd)	Page Number
00	None		

ACCREDITATIONS AND AUTHORIZATIONS

United States

FCC - Designated by the FCC as a Telecommunications Certification Body (TCB). Certification chambers, Open Area Test Sites, and conducted measurement facilities are listed with the FCC.

A2LA - Accredited by A2LA to ISO / IEC 17065 as a product certifier. This allows Element to certify transmitters to FCC and IC specifications.

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

ISED - Recognized by Innovation, Science and Economic Development Canada as a Certification Body (CB) and as a CAB for the acceptance of test data.

European Union

European Commission – Within Element, we have a EU Notified Body validated for the EMCD and RED Directives.

Australia/New Zealand

ACMA - Recognized by ACMA as a CAB for the acceptance of test data.

Korea

MSIT / RRA - Recognized by KCC's RRA as a CAB for the acceptance of test data.

Japan

VCCI - Associate Member of the VCCI. Conducted and radiated measurement facilities are registered.

Taiwan

BSMI – Recognized by BSMI as a CAB for the acceptance of test data.

NCC - Recognized by NCC as a CAB for the acceptance of test data.

Singapore

IDA – Recognized by IDA as a CAB for the acceptance of test data.

Israel

MOC – Recognized by MOC as a CAB for the acceptance of test data.

Hong Kong

OFCA – Recognized by OFCA as a CAB for the acceptance of test data.

Vietnam

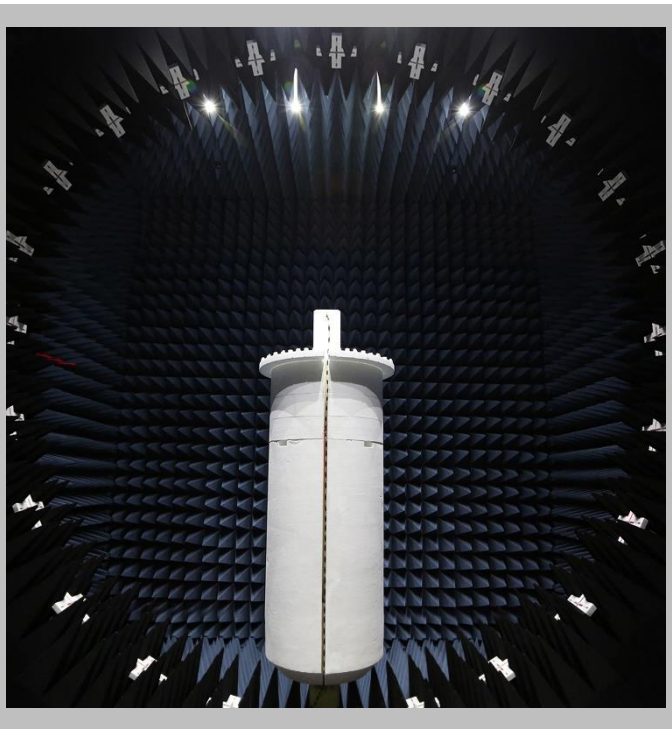
MIC – Recognized by MIC as a CAB for the acceptance of test data.

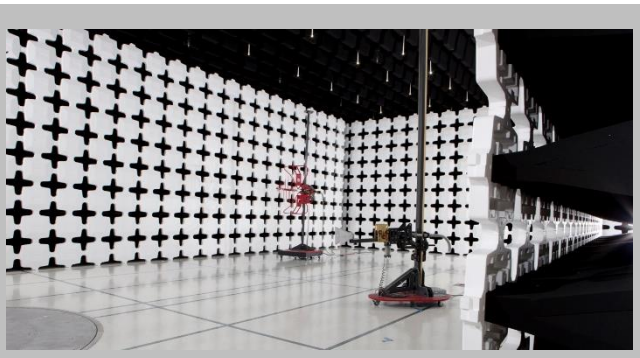
SCOPE

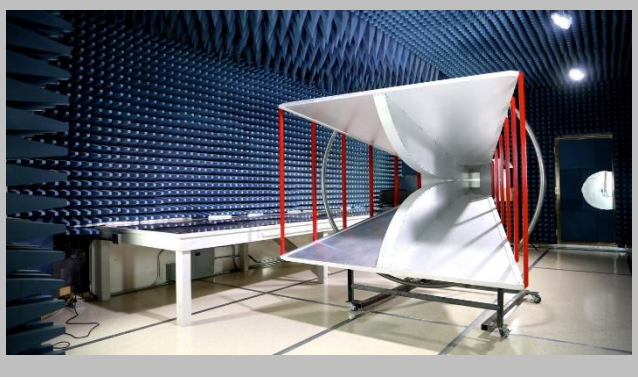
For details on the Scopes of our Accreditations, please visit:
https://www.nwemc.com/emc-testing-accreditations

FACILITIES

California	Minnesota	Oregon	Texas	Washington
Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs MN01-10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Labs EV01-12 6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Labs NC01-05 19201 120th Ave NE Bothell, WA 98011 (425)984-6600
NVLAP				
NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200630-0	NVLAP Lab Code:201049-0	NVLAP Lab Code: 200629-0
Innovation, Science and Economic Development Canada				
2834B-1, 2834B-3	2834E-1, 2834E-3	2834D-1	2834G-1	2834F-1
BSMI				
SL2-IN-E-1154R	SL2-IN-E-1152R	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI				
A-0029	A-0109	A-0108	A-0201	A-0110
Recognized Phase I CAB for ISED, ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA				
US0158	US0175	US0017	US0191	US0157







MEASUREMENT UNCERTAINTY

element
TMU.2015.07.10

Measurement Uncertainty

When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. Measurement uncertainty is a statistical expression of measurement error qualified by a probability distribution.

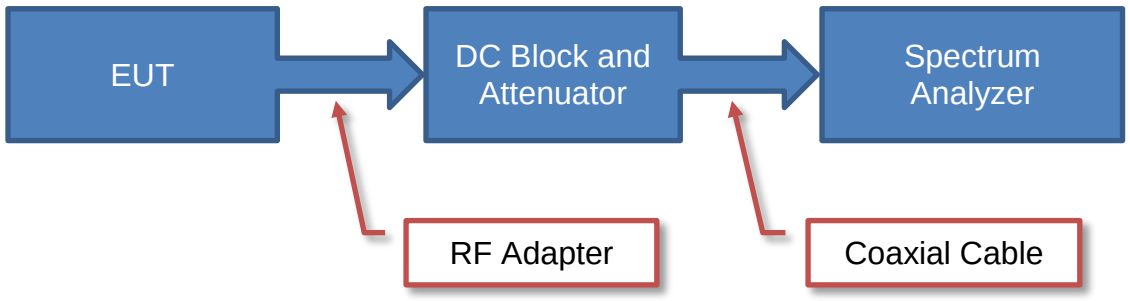
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable test description page. Our measurement data meets or exceeds the measurement uncertainty requirements of the applicable specification; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for estimating measurement uncertainty are based upon ETSI TR 100 028 (or CISPR 16-4-2 as applicable), and are available upon request.

The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

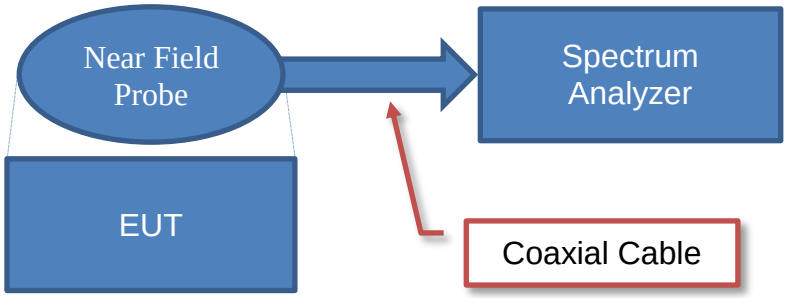
Test	+ MU	- MU
Frequency Accuracy	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	1.2 dB	-1.2 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.1 dB	-5.1 dB
AC Powerline Conducted Emissions (dB)	2.4 dB	-2.4 dB

Test Setup Block Diagrams

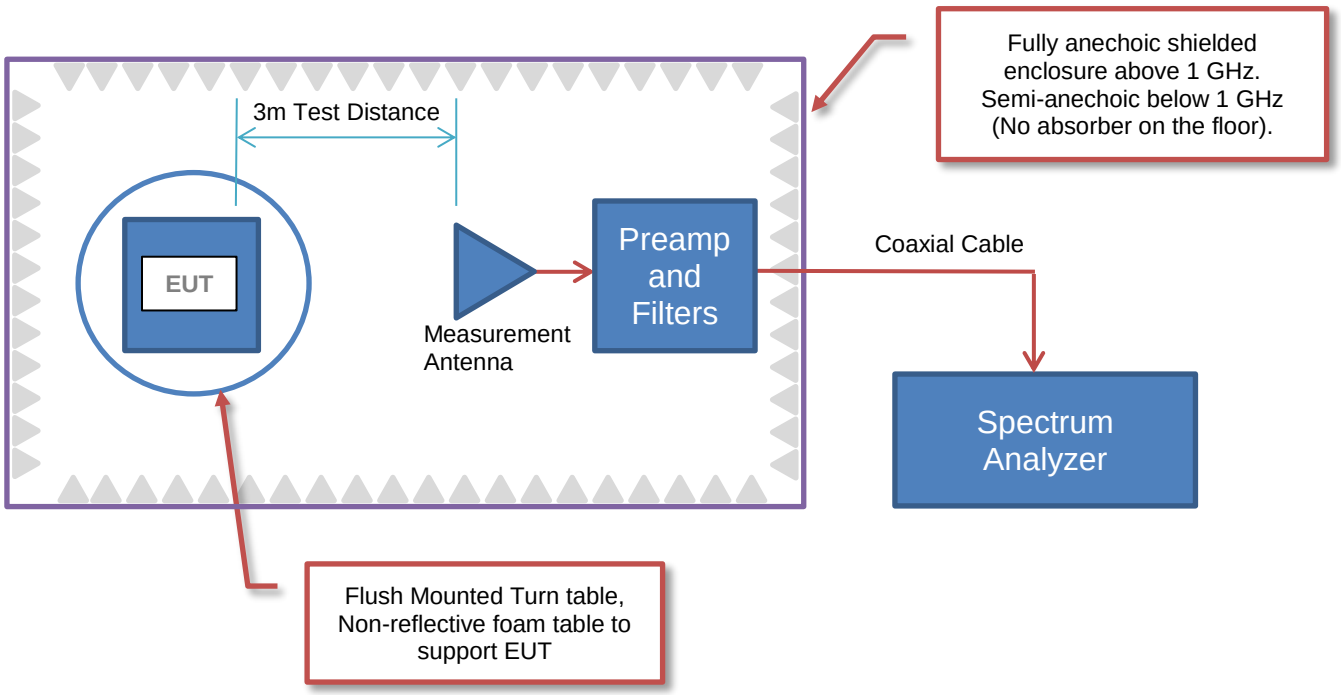
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	Nokia Solutions and Networks
Address:	3201 Olympus Blvd
City, State, Zip:	Dallas, Texas 75019
Test Requested By:	Steve Mitchell
EUT:	AHLBBA RRH
First Date of Test:	November 8, 2019
Last Date of Test:	November 20, 2019
Receipt Date of Samples:	November 7, 2019
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:

The equipment under test (EUT) is a Nokia Solutions and Networks Airscale Base Transceiver Station (BTS) Remote Radio Head (RRH) module, model AHLBBA. The AHLBBA remote radio head is a multi-standard multi-carrier radio module designed to support LTE and 5G-NR (fifth generation – new radio). The scope of testing in this effort is for LTE-FDD operations.

The AHLBBA RRH has four transmit/four receive antenna ports (4TX/4RX for Band 12, 4TX/4RX for Band 14 and 2TX for Band 29). Antenna ports 1-4 support 3GPP frequency band 12 (BTS Rx: 699 to 714 MHz/BTS TX: 729 to 744 MHz) and 3GPP frequency band 14 (BTS Rx: 788 to 798 MHz/BTS TX: 758 to 768 MHz) at 80 watts/carrier. Antenna ports 1 & 4 support 3GPP frequency band 29 downlink (BTS TX: 718 to 728 MHz) at 25 watts/carrier. The total output power is 105 watts for antenna ports 1 & 4 (supports frequency bands 12, 14 & 29) and 80 watts for antenna ports 2 & 3 (supports frequency bands 12 & 14 only). The maximum RRH RF output power for all antenna ports (1 – 4) is 370 Watts. The RRH can be operated as a 4x4 MIMO, 2x2 MIMO or as non-MIMO for Bands 12 & 14 and 2port MIMO or as non-MIMO for Band 29. The TX and RX instantaneous bandwidth cover the full operational bandwidth. The RRH supports LTE bandwidths of 5 and 10MHz for 3GPP frequency band 12, band 14 and band 29 operations. The RRH supports four LTE downlink modulation types (QPSK, 16QAM, 64QAM and 256QAM). The LTE modulation types are setup according to 3GPP TS 36.141 E-UTRA Test Models (E-TM) as follows E-TM 1.1: QPSK, E-TM 3.1: 64QAM, E-TM3.1a: 256QAM and E-TM 3.2: 16QAM. Multi-carrier operation is supported.

The RRH has external interfaces including DC power (DC In), ground, transmit/receive (ANT), external alarm (EAC), optical CPRI (OPT) and remote electrical tilt (RET). The RRH with applicable installation kit may be pole or wall mounted.

The AHLBBA LTE Band 12 downlink channel numbers and frequencies are as follows:

	Downlink EARFCN	Downlink Frequency (MHz)	LTE Channel Bandwidth	
			5 MHz	10 MHz
Band 12 (Ant 1, 2, 3, 4)	5010	729.0	Band Edge	Band Edge
	……			
	5035	731.5	Bottom Ch	
	……			
	5060	734.0		Bottom Ch
	……			
	5085	736.5	Middle Ch	Middle Ch
	……			
	5110	739.0		Top Channel
	……			
	5135	741.5	Top Channel	
	……			
	5160	744.0	Band Edge	Band Edge

AHLBBA Downlink Band Edge LTE Band 12 Frequency Channels

Notes:

Antenna Ports 1 or 4 Multicarrier Test Cases:

Multicarrier operations in band 12 with three LTE5 carriers (based upon KDB 971168 D03v01) using two carriers (with minimum spacing between carrier frequencies) at the band 12 lower band edge [731.5MHz and 736.5MHz] and a third carrier with maximum spacing between the other two carrier frequencies [741.5MHz] at the band 12 upper band edge. Three carriers cover the entire channel bandwidth.

Multiband Multicarrier operations (band 12 and band 14) with three LTE5 carriers (based upon KDB 971168 D03v01) using two carriers (with minimum spacing between carrier frequencies) at the band 12 lower band edge [731.5MHz and 736.5MHz] and a third carrier with maximum spacing between the other two carrier frequencies [765.5MHz] at the band 14 upper band edge.

Multiband Multicarrier operations (band 29 and band 12) with three LTE5 carriers (based upon KDB 971168 D03v01) using two carriers (with minimum spacing between carrier frequencies) at the band 29 lower band edge [720.5MHz and 725.5MHz] and a third carrier with maximum spacing between the other two carrier frequencies [741.5MHz] at the band 12 upper band edge.

Antenna Ports 2 or 3 Multicarrier Test Cases:

Multicarrier operations in band 12 with three LTE5 carriers (based upon KDB 971168 D03v01) using two carriers (with minimum spacing between carrier frequencies) at the band 12 lower band edge [731.5MHz and 736.5MHz] and a third carrier with maximum spacing between the other two carrier frequencies [741.5MHz] at the band 12 upper band edge will be verified. Three carriers cover the entire channel bandwidth.

Multiband Multicarrier operations (band 12 and band 14) with three LTE5 carriers (based upon KDB 971168 D03v01) using two carriers (with minimum spacing between carrier frequencies) at the band 12 lower band edge [731.5MHz and 736.5MHz] and a third carrier with maximum spacing between the other two carrier frequencies [765.5MHz] at the band 14 upper band edge will be verified.

The AHLBBA LTE Band 14 downlink channel numbers and frequencies are as follows:

	Downlink EARFCN	Downlink Frequency (MHz)	LTE Channel Bandwidth	
			5 MHz	10 MHz
Band 14 (Ant 1, 2, 3, 4)	5280	758.0	Band Edge	Band Edge
	……			
	5305	760.5	Bottom Ch	
	……			
	5330	763.0	Middle Ch	Bottom Ch Middle Ch Top Channel
	……			
	5355	765.5	Top Channel	
	……			
	5380	768.0	Band Edge	Band Edge

AHLBBA Downlink Band edge LTE Band 14 Frequency Channels

Notes:

Antenna Ports 1 or 4 Multicarrier Test Cases:

Multicarrier operations in band 14 with two LTE5 carriers at the lower and upper band edge channels [760.5MHz and 765.5MHz]. Two carriers cover the entire channel bandwidth so three carrier operation is not available.

Multiband Multicarrier operations (band 12 and band 14) with three LTE5 carriers (based upon KDB 971168 D03v01) using two carriers (with minimum spacing between carrier frequencies) at the band 12 lower band edge [731.5MHz and 736.5MHz] and a third carrier with maximum spacing between the other two carrier frequencies [765.5MHz] at the band 14 upper band edge.

Multiband Multicarrier operations (band 29 and band 14) with three LTE5 carriers (based upon KDB 971168 D03v01) using two carriers (with minimum spacing between carrier frequencies) at the band 29 lower band edge [720.5MHz and 725.5MHz] and a third carrier with maximum spacing between the other two carrier frequencies [765.5MHz] at the band 14 upper band edge.

Antenna Ports 2 or 3 Multicarrier Test Cases:

Multicarrier operations in band 14 with two LTE5 carriers at the lower and upper band edge channels [760.5MHz and 765.5MHz]. Two carriers cover the entire channel bandwidth so three carrier operation is not available.

Multiband Multicarrier operations (band 12 and band 14) with three LTE5 carriers (based upon KDB 971168 D03v01) using two carriers (with minimum spacing between carrier frequencies) at the band 12 lower band edge [731.5MHz and 736.5MHz] and a third carrier with maximum spacing between the other two carrier frequencies [765.5MHz] at the band 14 upper band edge.

The AHLBBA LTE Band 29 downlink channel numbers and frequencies are as follows:

	Downlink EARFCN	Downlink Frequency (MHz)	LTE Channel Bandwidth	
			5 MHz	10 MHz
AHLBBA Band 29 (Ant 1, 4)	9670	718.0	Band Edge	Band Edge
	……			
	9695	720.5	Bottom Channel	
	……			
	9720	723.0	Middle Channel	Bottom Ch Middle Ch Top Channel
	……			
	9745	725.5	Top Channel	
	……			
	9770	728.0	Band Edge	Band Edge

Table 8 AHLBBA Downlink Band Edge LTE Band 29 Frequency Channels

Notes:

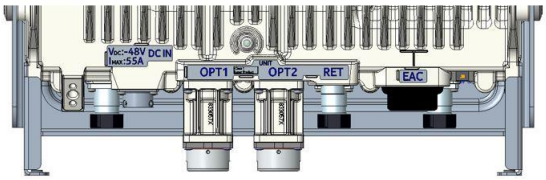
Antenna Ports 1 or 4 Multicarrier Test Cases:

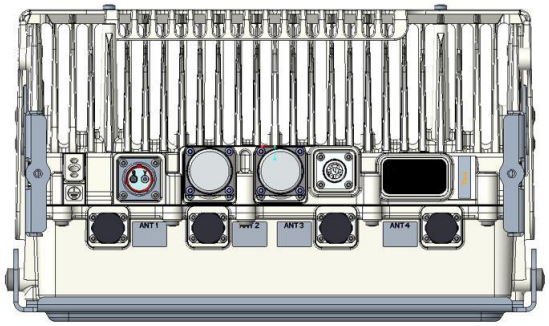
Multiband Multicarrier operations (band 29 and band 12) with three LTE5 carriers (based upon KDB 971168 D03v01) using two carriers (with minimum spacing between carrier frequencies) at the band 29 lower band edge [720.5MHz and 725.5MHz] and a third carrier with maximum spacing between the other two carrier frequencies [741.5MHz] at the band 12 upper band edge.

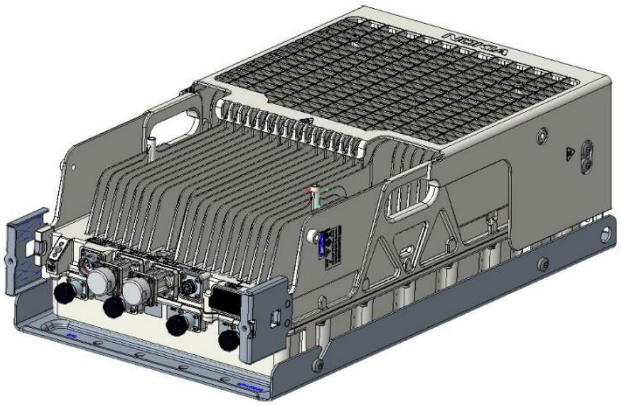
Multiband Multicarrier operations (band 29 and band 14) with three LTE5 carriers (based upon KDB 971168 D03v01) using two carriers (with minimum spacing between carrier frequencies) at the band 29 lower band edge [720.5MHz and 725.5MHz] and a third carrier with maximum spacing between the other two carrier frequencies [765.5MHz] at the band 14 upper band edge will be verified.

PRODUCT DESCRIPTION

AHLBBA Connector Layout:







AHLBBA 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

Testing Objective:

Seeking to demonstrate compliance of the Cellular radio (718 to 728MHz, 729 to 744MHz, and 758 to 768MHz).

CONFIGURATIONS

Configuration NOKI0004- 1

Software/Firmware Running during test	
Description	**Version**
BTS Software	SBTS20A_ENB_9999_191028_003503
RRH Software	FRM59.11.R03

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Remote Radio Head Module	Nokia Solutions and Networks	AHLBBA / 475082A.101	K9193514835

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
SFP+ 9.8G 300m 850 nm	Nokia Solutions and Networks	473842A.101	MA17331610209

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Electric Fan	Electrix	L908	None
Power Supply (Base Station)	Emerson	700-011721-0000	A9124600282
Laptop Computer	HP	ProBook 6470B	None
Power Supply (Laptop)	HP	608428-002	F12941232064008
USB Mouse	HP	MSU1158	None
Antenna Load 1	API Weinschel, Inc.	1433-3-LIM	TC867
Antenna Load 2	API Weinschel, Inc.	1433-3-LIM	TC866
Antenna Load 3	API Weinschel, Inc.	1433-3-LIM	TC870
Antenna Load 4	API Weinschel, Inc.	1433-3-LIM	TV066
AirScale Base Station (AMIA)	Nokia Solutions and Networks	473098A.101	J8163420419
AirScale Base Station (ABIA)	Nokia Solutions and Networks	473096A.102	L1164121378
AirScale Base Station (ASIA)	Nokia Solutions and Networks	473095A.101	L1164105428
DC Power Supply (Radiated)	Sorenson	SGA160X63C-0AAA	1421A03560

CONFIGURATIONS

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
AC Power (Fan)	No	2m	No	AC Mains	Electric Fan
AC Power (PS Base Station)	No	2m	No	AC Mains	Power Supply (Base Station)
DC Power (PS Base Station)	No	0.5m	No	Power Supply (Base Station)	AirScale Base Station (ASIA)
AC Power (Laptop)	No	1.65m	No	AC Mains	Power Supply (Laptop)
DC Power (Laptop)	No	1.7m	Yes	Power Supply (Laptop)	Laptop Computer
USB (Mouse)	Yes	1.8m	No	USB Mouse	Laptop Computer
Ethernet	No	1.8m	No	AirScale Base Station (ASIA)	Laptop Computer
AC Power (Sorenson)	No	4m	No	AC Mains	DC Power Supply (Radiated)
DC Power Leads (Sorenson)	No	7.5m	Yes	DC Power Supply (Radiated)	Remote Radio Head Module
Optical Fiber	No	7.5m	No	AirScale Base Station (ABIA)	Remote Radio Head Module
RET	No	2.4m	No	Remote Radio Head Module	Unterminated
EAC	No	5.4m	No	Remote Radio Head Module	Unterminated
Grounding	No	2.3m	No	Remote Radio Head Module	Turntable Ground
N Type SUCOFLEX_106 Load 1	Yes	1.6m	No	Remote Radio Head Module	Antenna Load 1
N Type SUCOFLEX_106 Load 2	Yes	1.6m	No	Remote Radio Head Module	Antenna Load 2
N Type SUCOFLEX_106 Load 3	Yes	1.6m	No	Remote Radio Head Module	Antenna Load 3
N Type SUCOFLEX_106 Load 4	Yes	1.6m	No	Remote Radio Head Module	Antenna Load 4

CONFIGURATIONS

Configuration NOKI0004- 2

Software/Firmware Running during test	
Description	**Version**
BTS Software	SBTS00_ENB_9999_191108_003654
RRH Software	FRM59.11.R08

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Remote Radio Head Module	Nokia Solutions and Networks	AHLBBA / 475082A.101	K9193514835

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
SFP+ 9.8G 300m 850 nm	Nokia Solutions and Networks	473842A.101	MA17331610209

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Electric Fan	Electrix	L908	None
Power Supply (Base Station)	Emerson	700-011721-0000	A9124600282
Laptop Computer	HP	ProBook 6470B	None
Power Supply (Laptop)	HP	608428-002	F12941232064008
USB Mouse	HP	MSU1158	None
Antenna Load 1	API Weinschel, Inc.	1433-3-LIM	TC867
Antenna Load 2	API Weinschel, Inc.	1433-3-LIM	TC866
Antenna Load 3	API Weinschel, Inc.	1433-3-LIM	TC870
AirScale Base Station (AMIA)	Nokia Solutions and Networks	473098A.101	J8163420419
AirScale Base Station (ABIA)	Nokia Solutions and Networks	473096A.102	L1164121378
AirScale Base Station (ASIA)	Nokia Solutions and Networks	473095A.101	L1164105428
40dB 250W Attenuator	API Weinschel, Inc.	58-40-53-LIM	TC909
Power Supply (RRH)	HP	6032A	211754

CONFIGURATIONS

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
AC Power (Fan)	No	2m	No	AC Mains	Electric Fan
AC Power (PS Base Station)	No	2m	No	AC Mains	Power Supply (Base Station)
DC Power (PS Base Station)	No	0.5m	No	Power Supply (Base Station)	AirScale Base Station (ASIA)
AC Power (Laptop)	No	1.65m	No	AC Mains	Power Supply (Laptop)
DC Power (Laptop)	No	1.7m	Yes	Power Supply (Laptop)	Laptop Computer
USB (Mouse)	Yes	1.8m	No	USB Mouse	Laptop Computer
Ethernet	No	1.8m	No	AirScale Base Station (ASIA)	Laptop Computer
Optical Fiber	No	7.5m	No	AirScale Base Station (ABIA)	Remote Radio Head Module
N Type Load 1	Yes	1.6m	No	Remote Radio Head Module	Antenna Load 1
N Type Load 2	Yes	1.6m	No	Remote Radio Head Module	Antenna Load 2
N Type Load 3	Yes	1.6m	No	Remote Radio Head Module	Antenna Load 3
N Type SUCOFLEX_104	Yes	1.0m	No	40dB 250W Attenuator	Spectrum Analyzer
N Type SUCOFLEX_106	Yes	1.0m	No	Remote Radio Head Module	40dB 250W Attenuator
AC Power (PS RRH)	No	2m	No	AC Mains	Power Supply (RRH)
DC Power (PS RRH)	No	1.7m	Yes	Power Supply (RRH)	Remote Radio Head Module

CONFIGURATIONS

Configuration NOKI0004- 3

Software/Firmware Running during test	
Description	**Version**
BTS Software	SBTS00_ENB_9999_191108_003654
RRH Software	FRM59.11.R08

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Remote Radio Head Module	Nokia Solutions and Networks	AHLBBA / 475082A.101	K9193514835

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
SFP+ 9.8G 300m 850 nm	Nokia Solutions and Networks	473842A.101	MA17331610209

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Electric Fan	Electrix	L908	None
Power Supply (Base Station)	Emerson	700-011721-0000	A9124600282
Laptop Computer	HP	ProBook 6470B	None
Power Supply (Laptop)	HP	608428-002	F12941232064008
USB Mouse	HP	MSU1158	None
Antenna Load 1	API Weinschel, Inc.	1433-3-LIM	TC867
Antenna Load 2	API Weinschel, Inc.	1433-3-LIM	TC866
Antenna Load 3	API Weinschel, Inc.	1433-3-LIM	TC870
AirScale Base Station (AMIA)	Nokia Solutions and Networks	473098A.101	J8163420419
AirScale Base Station (ABIA)	Nokia Solutions and Networks	473096A.102	L1164121378
AirScale Base Station (ASIA)	Nokia Solutions and Networks	473095A.101	L1164105428
40dB 250W Attenuator	API Weinschel, Inc.	58-40-53-LIM	TC909
Power Supply (RRH)	HP	6032A	211754
Inline Filter (Conducted Band Edge)	Nokia Solutions and Networks	TRI-BSBP	None

CONFIGURATIONS

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
AC Power (Fan)	No	2m	No	AC Mains	Electric Fan
AC Power (PS Base Station)	No	2m	No	AC Mains	Power Supply (Base Station)
DC Power (PS Base Station)	No	0.5m	No	Power Supply (Base Station)	AirScale Base Station (ASIA)
AC Power (Laptop)	No	1.65m	No	AC Mains	Power Supply (Laptop)
DC Power (Laptop)	No	1.7m	Yes	Power Supply (Laptop)	Laptop Computer
USB (Mouse)	Yes	1.8m	No	USB Mouse	Laptop Computer
Ethernet	No	1.8m	No	AirScale Base Station (ASIA)	Laptop Computer
Optical Fiber	No	7.5m	No	AirScale Base Station (ABIA)	Remote Radio Head Module
N Type Load 1	Yes	1.6m	No	Remote Radio Head Module	Antenna Load 1
N Type Load 2	Yes	1.6m	No	Remote Radio Head Module	Antenna Load 2
N Type Load 3	Yes	1.6m	No	Remote Radio Head Module	Antenna Load 3
N Type SUCOFLEX_106	Yes	1.0m	No	Remote Radio Head Module	40dB 250W Attenuator
AC Power (PS RRH)	No	2m	No	AC Mains	Power Supply (RRH)
DC Power (PS RRH)	No	1.7m	Yes	Power Supply (RRH)	Remote Radio Head Module
N Type SUCOFLEX_104	Yes	1.0m	No	40dB 250W Attenuator	Inline Filter (Conducted Band Edge)
N Type SUCOFLEX_104	Yes	1.0m	No	Inline Filter (Conducted Band Edge)	Spectrum Analyzer

CONFIGURATIONS

Configuration NOKI0004- 4

Software/Firmware Running during test	
Description	**Version**
BTS Software	SBTS00_ENB_9999_191108_003654
RRH Software	FRM59.11.R08

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Remote Radio Head Module	Nokia Solutions and Networks	AHLBBA / 475082A.101	K9193514835

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
SFP+ 9.8G 300m 850 nm	Nokia Solutions and Networks	473842A.101	MA17331610209

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Electric Fan	Electrix	L908	None
Power Supply (Base Station)	Emerson	700-011721-0000	A9124600282
Laptop Computer	HP	ProBook 6470B	None
Power Supply (Laptop)	HP	608428-002	F12941232064008
USB Mouse	HP	MSU1158	None
Antenna Load 1	API Weinschel, Inc.	1433-3-LIM	TC867
Antenna Load 2	API Weinschel, Inc.	1433-3-LIM	TC866
Antenna Load 3	API Weinschel, Inc.	1433-3-LIM	TC870
AirScale Base Station (AMIA)	Nokia Solutions and Networks	473098A.101	J8163420419
AirScale Base Station (ABIA)	Nokia Solutions and Networks	473096A.102	L1164121378
AirScale Base Station (ASIA)	Nokia Solutions and Networks	473095A.101	L1164105428
Power Supply (RRH)	HP	6032A	211754
Low Pass Filter (3 pieces)	Mini-Circuits	NLP-550	None
10dB 100W Attenuator	Weinschel, Inc.	48-10-34-LIM	BJ1771
20dB 150W Attenuator	Aeroflex/Weinschel	66-20-33	BZ2075

CONFIGURATIONS

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
AC Power (Fan)	No	2m	No	AC Mains	Electric Fan
AC Power (PS Base Station)	No	2m	No	AC Mains	Power Supply (Base Station)
DC Power (PS Base Station)	No	0.5m	No	Power Supply (Base Station)	AirScale Base Station (ASIA)
AC Power (Laptop)	No	1.65m	No	AC Mains	Power Supply (Laptop)
DC Power (Laptop)	No	1.7m	Yes	Power Supply (Laptop)	Laptop Computer
USB (Mouse)	Yes	1.8m	No	USB Mouse	Laptop Computer
Ethernet	No	1.8m	No	AirScale Base Station (ASIA)	Laptop Computer
Optical Fiber	No	7.5m	No	AirScale Base Station (ABIA)	Remote Radio Head Module
N Type Load 1	Yes	1.6m	No	Remote Radio Head Module	Antenna Load 1
N Type Load 2	Yes	1.6m	No	Remote Radio Head Module	Antenna Load 2
N Type Load 3	Yes	1.6m	No	Remote Radio Head Module	Antenna Load 3
AC Power (PS RRH)	No	2m	No	AC Mains	Power Supply (RRH)
DC Power (PS RRH)	No	1.7m	Yes	Power Supply (RRH)	Remote Radio Head Module
N Type SUCOFLEX_106	Yes	1.0m	No	Remote Radio Head Module	20dB 150W Attenuator
N Type SUCOFLEX_104	Yes	1.0m	No	Spectrum Analyzer	Low Pass Filter (3 pieces)

CONFIGURATIONS

Configuration NOKI0004- 5

Software/Firmware Running during test	
Description	**Version**
BTS Software	SBTS00_ENB_9999_191108_003654
RRH Software	FRM59.11.R08

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Remote Radio Head Module	Nokia Solutions and Networks	AHLBBA / 475082A.101	K9193514835

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
SFP+ 9.8G 300m 850 nm	Nokia Solutions and Networks	473842A.101	MA17331610209

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Electric Fan	Electrix	L908	None
Power Supply (Base Station)	Emerson	700-011721-0000	A9124600282
Laptop Computer	HP	ProBook 6470B	None
Power Supply (Laptop)	HP	608428-002	F12941232064008
USB Mouse	HP	MSU1158	None
Antenna Load 1	API Weinschel, Inc.	1433-3-LIM	TC867
Antenna Load 2	API Weinschel, Inc.	1433-3-LIM	TC866
Antenna Load 3	API Weinschel, Inc.	1433-3-LIM	TC870
AirScale Base Station (AMIA)	Nokia Solutions and Networks	473098A.101	J8163420419
AirScale Base Station (ABIA)	Nokia Solutions and Networks	473096A.102	L1164121378
AirScale Base Station (ASIA)	Nokia Solutions and Networks	473095A.101	L1164105428
Power Supply (RRH)	HP	6032A	211754
20dB 150W Attenuator	Aeroflex/Weinschel	66-20-33	BZ2075
3dB 100W Attenuator	Aeroflex/Weinschel	47-3-33	CG5493
High Pass Filter	RLC ELECTRONICS	F-14699	0050

CONFIGURATIONS

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
AC Power (Fan)	No	2m	No	AC Mains	Electric Fan
AC Power (PS Base Station)	No	2m	No	AC Mains	Power Supply (Base Station)
DC Power (PS Base Station)	No	0.5m	No	Power Supply (Base Station)	AirScale Base Station (ASIA)
AC Power (Laptop)	No	1.65m	No	AC Mains	Power Supply (Laptop)
DC Power (Laptop)	No	1.7m	Yes	Power Supply (Laptop)	Laptop Computer
USB (Mouse)	Yes	1.8m	No	USB Mouse	Laptop Computer
Ethernet	No	1.8m	No	AirScale Base Station (ASIA)	Laptop Computer
Optical Fiber	No	7.5m	No	AirScale Base Station (ABIA)	Remote Radio Head Module
N Type Load 1	Yes	1.6m	No	Remote Radio Head Module	Antenna Load 1
N Type Load 2	Yes	1.6m	No	Remote Radio Head Module	Antenna Load 2
N Type Load 3	Yes	1.6m	No	Remote Radio Head Module	Antenna Load 3
AC Power (PS RRH)	No	2m	No	AC Mains	Power Supply (RRH)
DC Power (PS RRH)	No	1.7m	Yes	Power Supply (RRH)	Remote Radio Head Module
N Type SUCOFLEX_106	Yes	1.0m	No	Remote Radio Head Module	20dB 150W Attenuator
N Type SUCOFLEX_104	Yes	1.0m	No	High Pass Filter	Spectrum Analyzer

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2019-11-08	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
2	2019-11-18	Occupied Bandwidth	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
3	2019-11-18	Peak to Average Power Ratio (PAPR)	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
4	2019-11-19	Band Edge Compliance	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
5	2019-11-19	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
6	2019-11-19	Frequency Stability	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
7	2019-11-19	Average Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
8	2019-11-20	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

AVERAGE POWER

XMit 2019.09.05

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

TEST EQUIPMENT

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

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The fundamental emission output power (maximum average conducted output power) was measured using the channels and modes as called out on the following data sheets. The transmit power was set to its default maximum.

The method in section 5.2.4.4 of ANSI C63.26 was used to make the measurement. This method uses trace averaging across ON and OFF times of the EUT transmissions in the spectrum analyzer channel power function using an RMS detector. Following the measurement a duty cycle correction was applied by adding [10 log (1 / D)], where D is the duty cycle, to the measured power to compute the average power during the actual transmission times.

Per FCC sections 27.50(c)(3), the Effective Radiated Power (ERP) of the transceiver cannot exceed 1000 Watts/MHz.

AVERAGE POWER

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	AHLBBA RRH			Work Order:	NOKI0004
Serial Number:	K9193514835			Date:	18-Nov-19
Customer:	Nokia Solutions and Networks			Temperature:	22.4 °C
Attendees:	John Rattanavong			Humidity:	29.7% RH
Project:	None			Barometric Pres.:	1019 mbar
Tested by:	Jonathan Kiefer	Power:	54VDC	Job Site:	TX09

TEST SPECIFICATIONS	Test Method
FCC 27:2019	ANSI C63.26:2015

COMMENTS

Band 12 average power measurements for LTE5 channel bandwidth at Mid channel using 256QAM on all four antenna ports. EUT is operated at 100% duty cycle. ERP depends on antenna gain, which is unknown. Only the highest dBm value is plotted per customer requirements and a Watt/MHz calculation was not made due to the unknown antenna value.

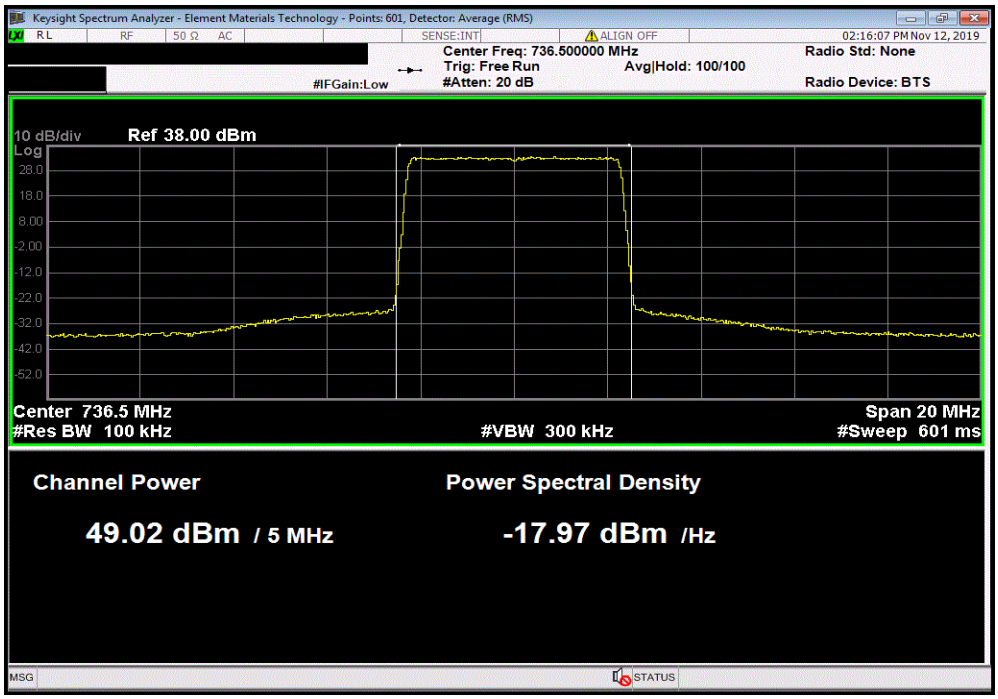
DEVIATIONS FROM TEST STANDARD

None

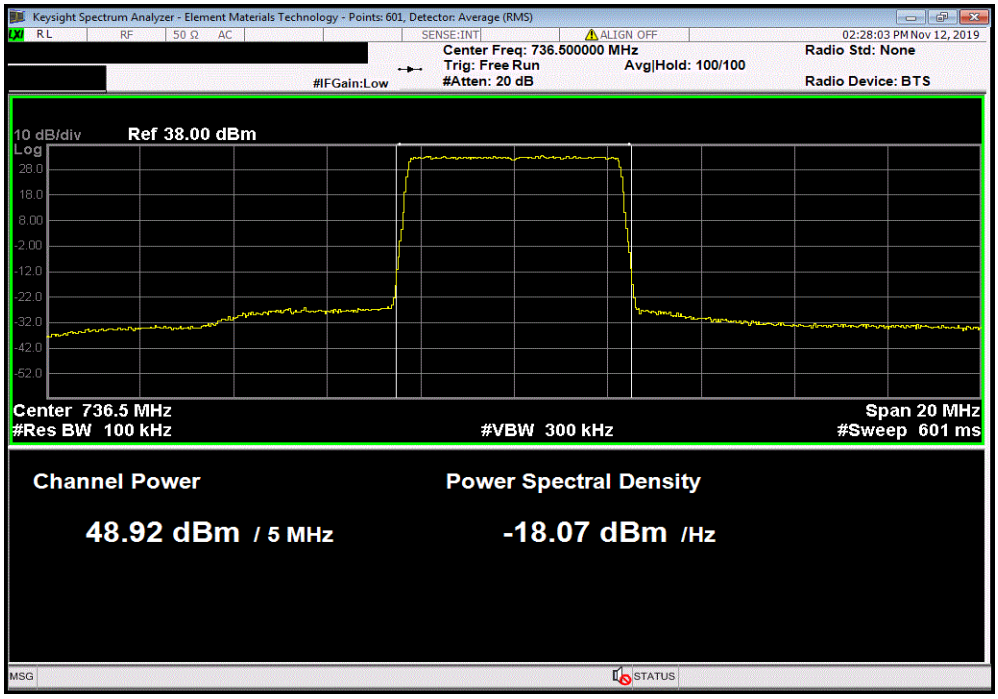
Configuration #	2	Signature	Jonathan Kiefer

	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (W ERP/MHz)	Results
Band 12					
256QAM Modulation					
LTE5 Bandwidth					
Mid Channel, 736.5 MHz					
Antenna Port 1	49.02	0	49	1000	Pass
Antenna Port 2	48.921	0	48.9	1000	Pass
Antenna Port 3	48.727	0	48.7	1000	Pass
Antenna Port 4	48.879	0	48.9	1000	Pass

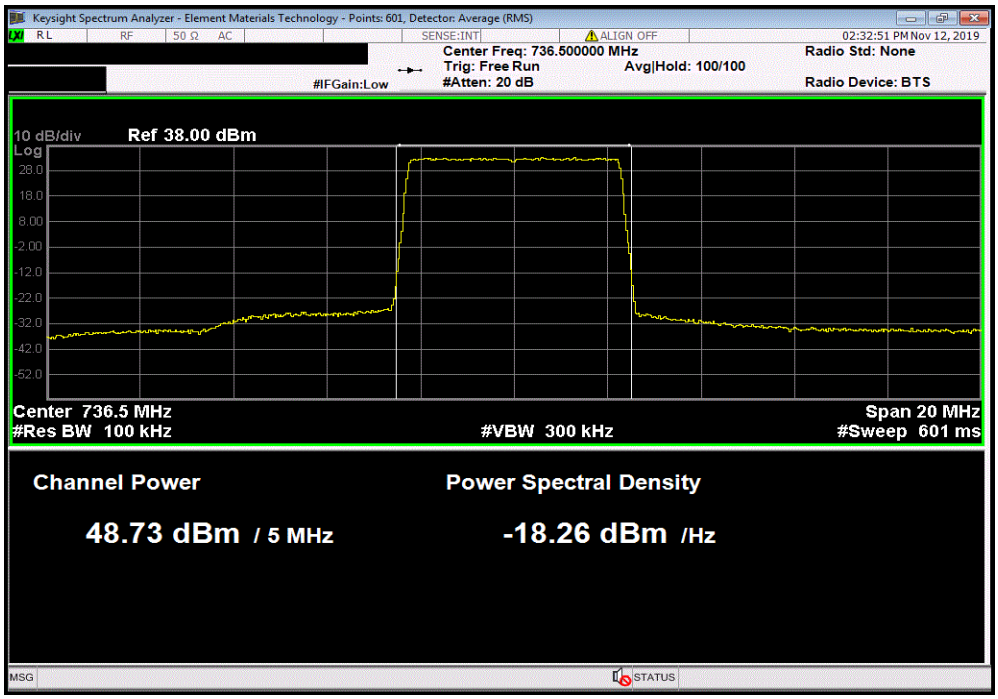
Band 12, 256QAM Modulation, LTE5 Bandwidth, Mid Channel, 736.5 MHz, Antenna Port 1						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	49.02	0		49	1000	Pass



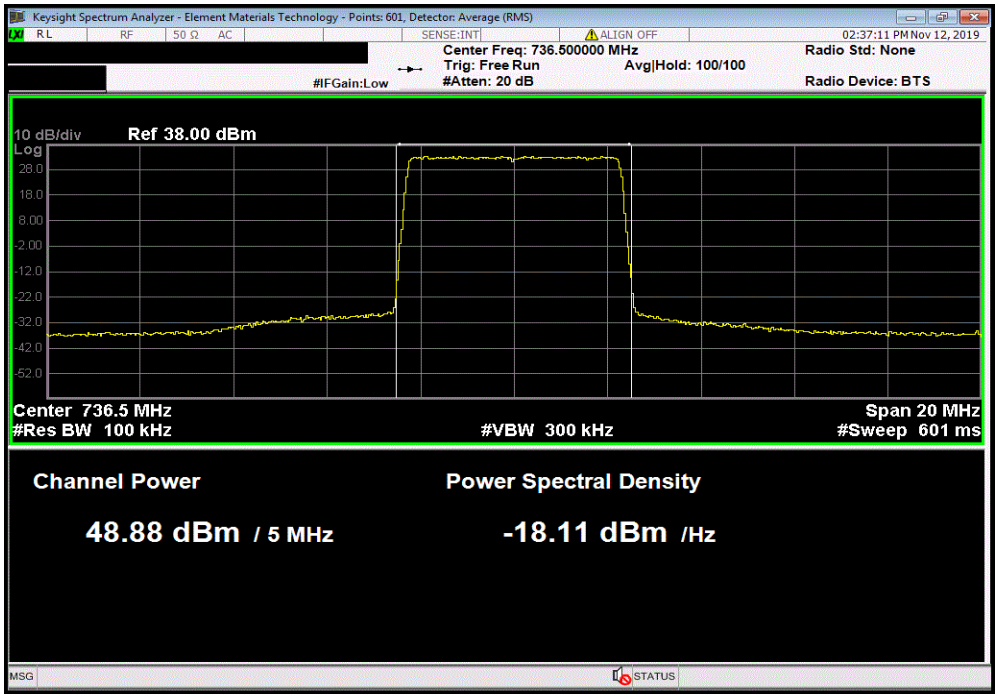
Band 12, 256QAM Modulation, LTE5 Bandwidth, Mid Channel, 736.5 MHz, Antenna Port 2						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	48.921	0		48.9	1000	Pass



Band 12, 256QAM Modulation, LTE5 Bandwidth, Mid Channel, 736.5 MHz, Antenna Port 3						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	48.727	0		48.7	1000	Pass



Band 12, 256QAM Modulation, LTE5 Bandwidth, Mid Channel, 736.5 MHz, Antenna Port 4						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	48.879	0		48.9	1000	Pass



AVERAGE POWER

XMit 2019.09.05

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

TEST EQUIPMENT

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

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The fundamental emission output power (maximum average conducted output power) was measured using the channels and modes as called out on the following data sheets. The transmit power was set to its default maximum.

The method in section 5.2.4.4 of ANSI C63.26 was used to make the measurement. This method uses trace averaging across ON and OFF times of the EUT transmissions in the spectrum analyzer channel power function using an RMS detector. Following the measurement a duty cycle correction was applied by adding [10 log (1 / D)], where D is the duty cycle, to the measured power to compute the average power during the actual transmission times.

Per FCC sections 27.50(c)(3), the Effective Radiated Power (ERP) of the transceiver cannot exceed 1000 Watts/MHz.

AVERAGE POWER

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	AHLBBA RRH			Work Order:	NOKI0004
Serial Number:	K9193514835			Date:	18-Nov-19
Customer:	Nokia Solutions and Networks			Temperature:	22.4 °C
Attendees:	John Rattanavong			Humidity:	29.6% RH
Project:	None			Barometric Pres.:	1019 mbar
Tested by:	Jonathan Kiefer	Power:	54VDC	Job Site:	TX09

TEST SPECIFICATIONS	Test Method
FCC 27:2019	ANSI C63.26:2015

COMMENTS

Band 12 average power measurements for LTE5 channel bandwidth at Mid channel for four modulation types. Tested on highest power antenna port (Port 1) determined from antenna ports 1 & 4 measurements for LTE5/256QAM/Mid Channel. EUT is operated at 100% duty cycle. ERP depends on antenna gain, which is unknown. Only the highest dBm value is plotted per customer requirements and a Watt/MHz calculation was not made due to the unknown antenna value.

DEVIATIONS FROM TEST STANDARD

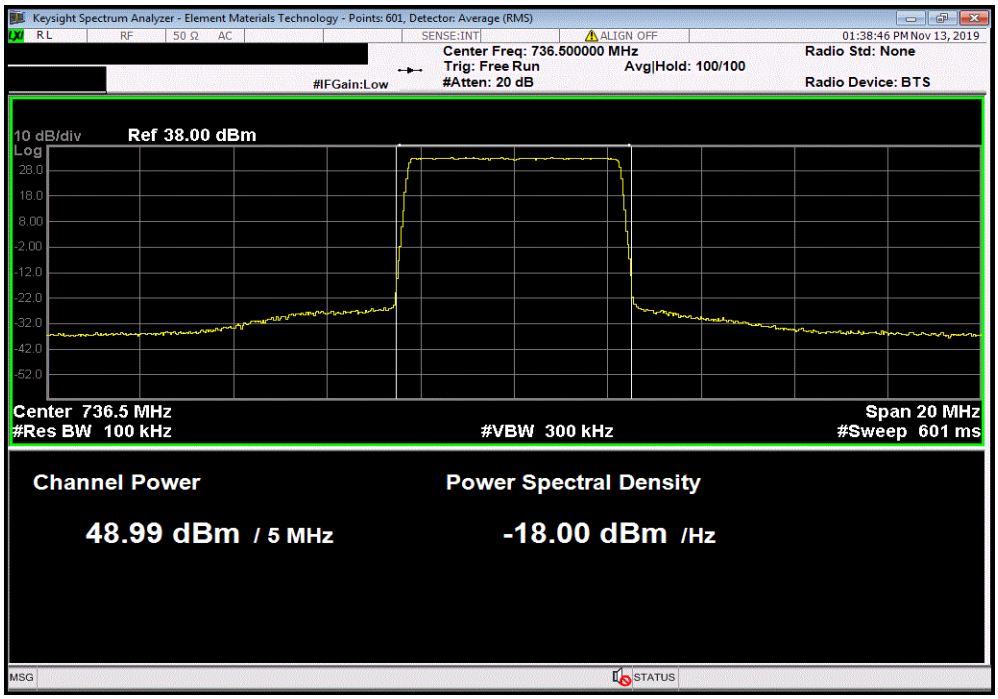
None

Configuration #	2	Signature	Jonathan Kiefer

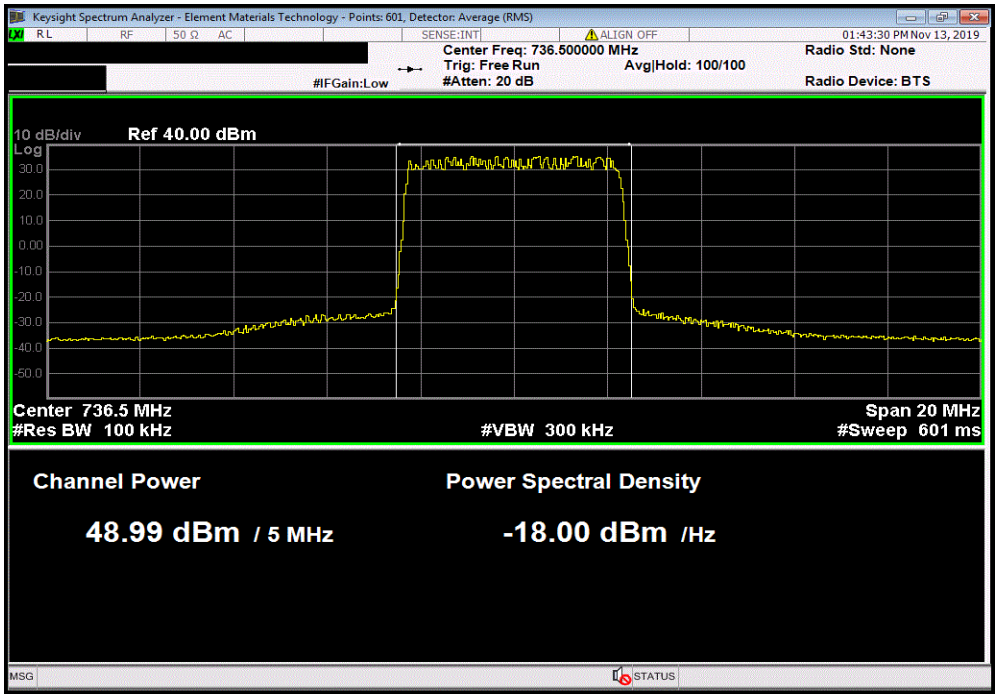
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (W ERP/MHz)	Results
Band 12					
QPSK Modulation					
LTE5 Bandwidth					
Mid Channel, 736.5 MHz	48.994	0	49	1000	Pass
16QAM Modulation					
LTE5 Bandwidth					
Mid Channel, 736.5 MHz	48.987	0	49	1000	Pass
64QAM Modulation					
LTE5 Bandwidth					
Mid Channel, 736.5 MHz	48.98	0	49	1000	Pass

AVERAGE POWER

Band 12, QPSK Modulation, LTE5 Bandwidth, Mid Channel, 736.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	48.994	0		49	1000	Pass



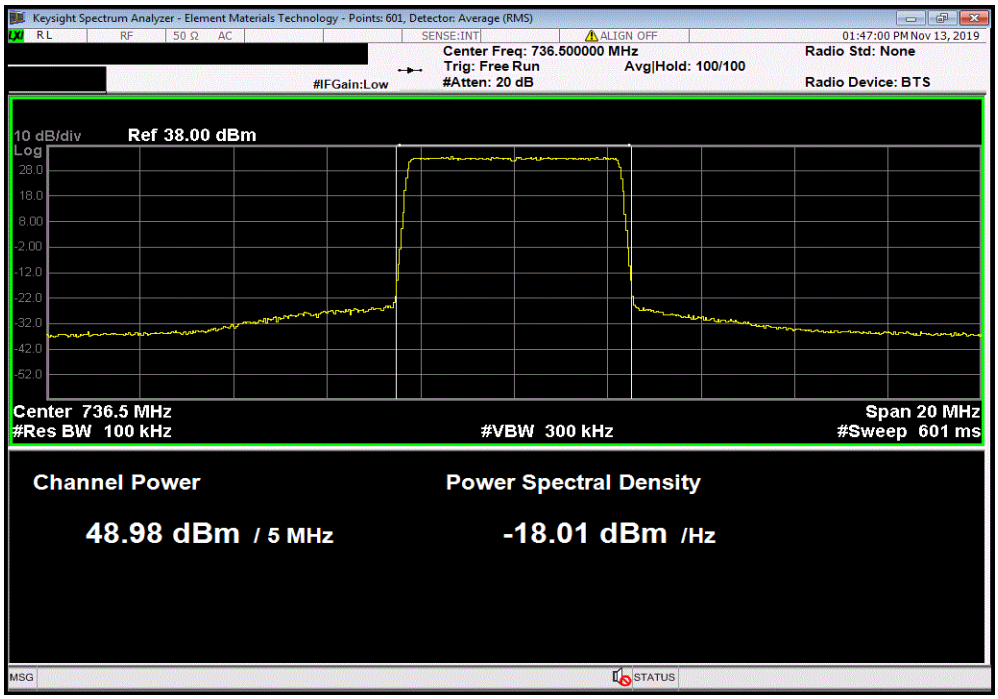
Band 12, 16QAM Modulation, LTE5 Bandwidth, Mid Channel, 736.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	48.987	0		49	1000	Pass



AVERAGE POWER

TbtTx 2019.08.30.0 XMit 2019.09.05

Band 12, 64QAM Modulation, LTE5 Bandwidth, Mid Channel, 736.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	48.98	0		49	1000	Pass



AVERAGE POWER

XMit 2019.09.05

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

TEST EQUIPMENT

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

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The fundamental emission output power (maximum average conducted output power) was measured using the channels and modes as called out on the following data sheets. The transmit power was set to its default maximum.

The method in section 5.2.4.4 of ANSI C63.26 was used to make the measurement. This method uses trace averaging across ON and OFF times of the EUT transmissions in the spectrum analyzer channel power function using an RMS detector. Following the measurement a duty cycle correction was applied by adding [10 log (1 / D)], where D is the duty cycle, to the measured power to compute the average power during the actual transmission times.

Per FCC sections 27.50(c)(3) and 90.542, the Effective Radiated Power (ERP) of the transceiver cannot exceed 1000 Watts/MHz.

AVERAGE POWER

element

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	**AHLBBA RRH**			**Work Order:**	**NOKI0004**
Serial Number:	**K9193514835**			**Date:**	**18-Nov-19**
Customer:	**Nokia Solutions and Networks**			**Temperature:**	**22.4 °C**
Attendees:	**John Rattanavong**			**Humidity:**	**29.7% RH**
Project:	**None**			**Barometric Pres.:**	**1019 mbar**
Tested by:	**Jonathan Kiefer**	**Power:**	**54VDC**	**Job Site:**	**TX09**

TEST SPECIFICATIONS	**Test Method**
FCC 27:2019	ANSI C63.26:2015

COMMENTS

Band 12 average power for 256QAM modulation type at Low, Mid and High channels for LTE5 and LTE10 channel bandwidths. Tested on highest power antenna port (Port 1) determined from antenna ports 1 & 4 measurements for LTE5/256QAM/Mid Channel. EUT is operated at 100% duty cycle. Note: 256QAM LTE5 BW Mid Channel data shown elsewhere in the report. ERP depends on antenna gain, which is unknown. Only the highest dBm value is plotted per customer requirements and a Watt/MHz calculation was not made due to the unknown antenna value.

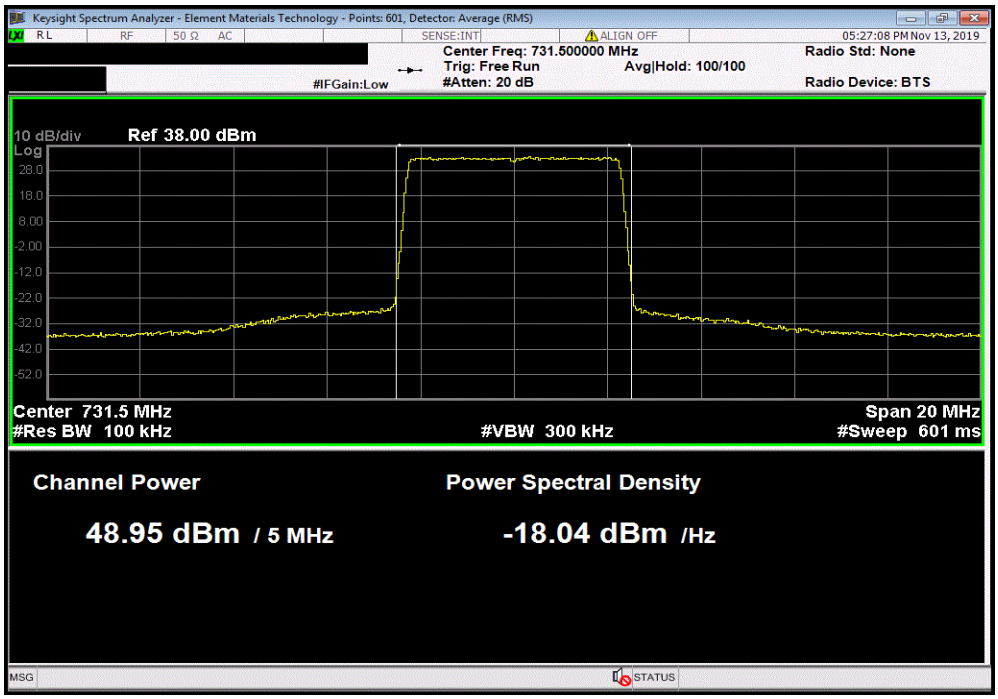
DEVIATIONS FROM TEST STANDARD

None

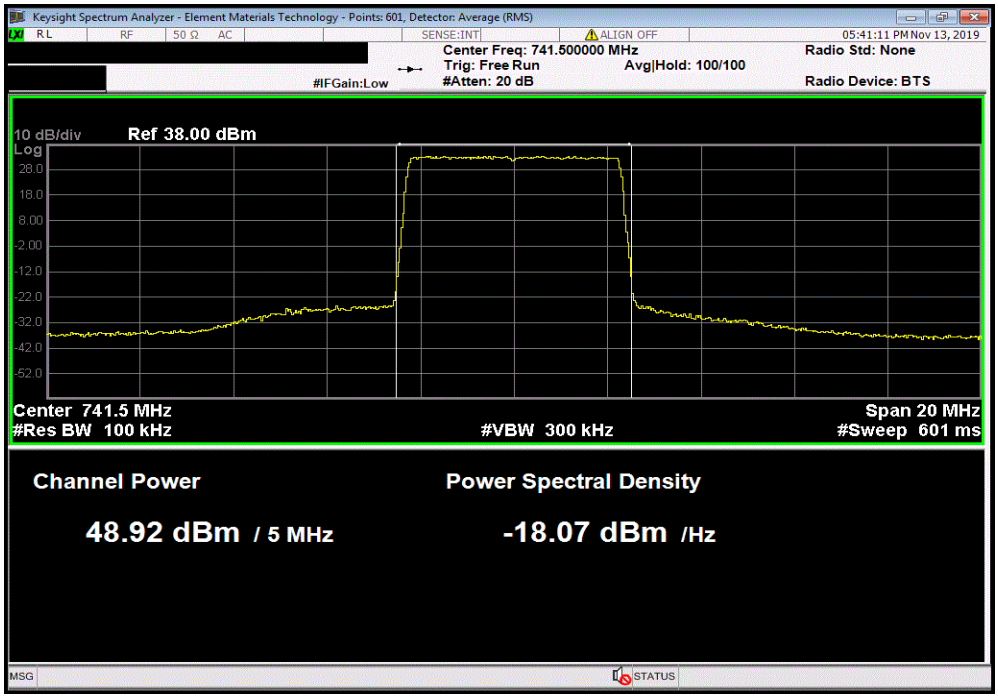
Configuration #	**2**	*Signature* Jonathan Kiefer

	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (W ERP/MHz)	Results
Band 12					
256QAM Modulation					
LTE5 Bandwidth					
Low Channel, 731.5 MHz	48.949	0	48.9	1000	Pass
High Channel, 741.5 MHz	48.919	0	48.9	1000	Pass
LTE10 Bandwidth					
Mid Channel, 736.5 MHz	48.96	0	49	1000	Pass
Low Channel, 734.0 MHz	48.987	0	49	1000	Pass
High Channel, 739.0 MHz	48.99	0	49	1000	Pass

Band 12, 256QAM Modulation, LTE5 Bandwidth, Low Channel, 731.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	48.949	0		48.9	1000	Pass

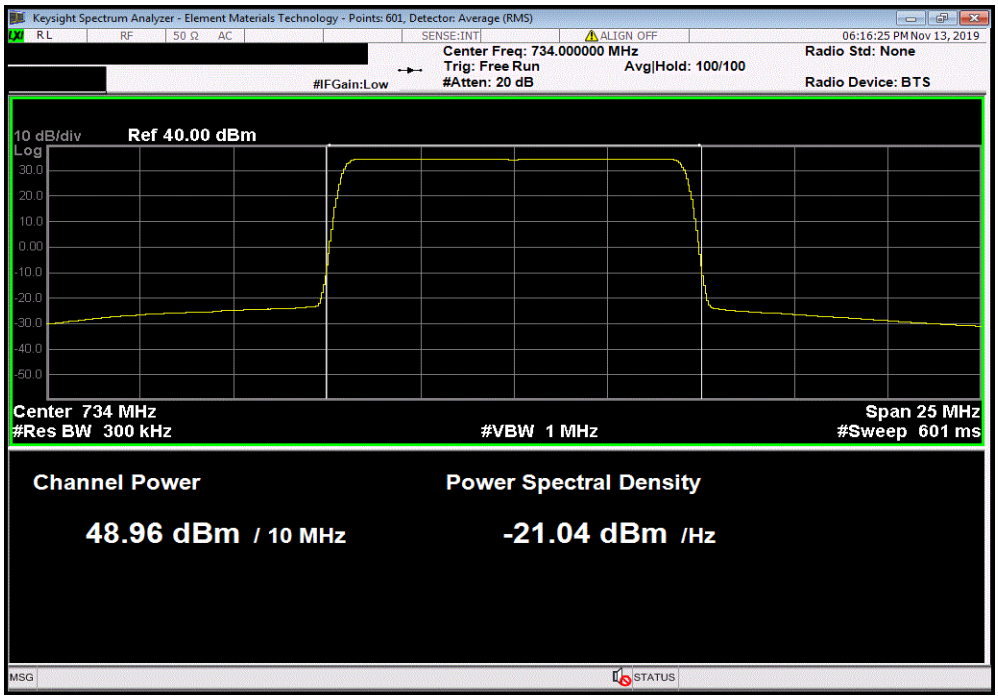


Band 12, 256QAM Modulation, LTE5 Bandwidth, High Channel, 741.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	48.919	0		48.9	1000	Pass

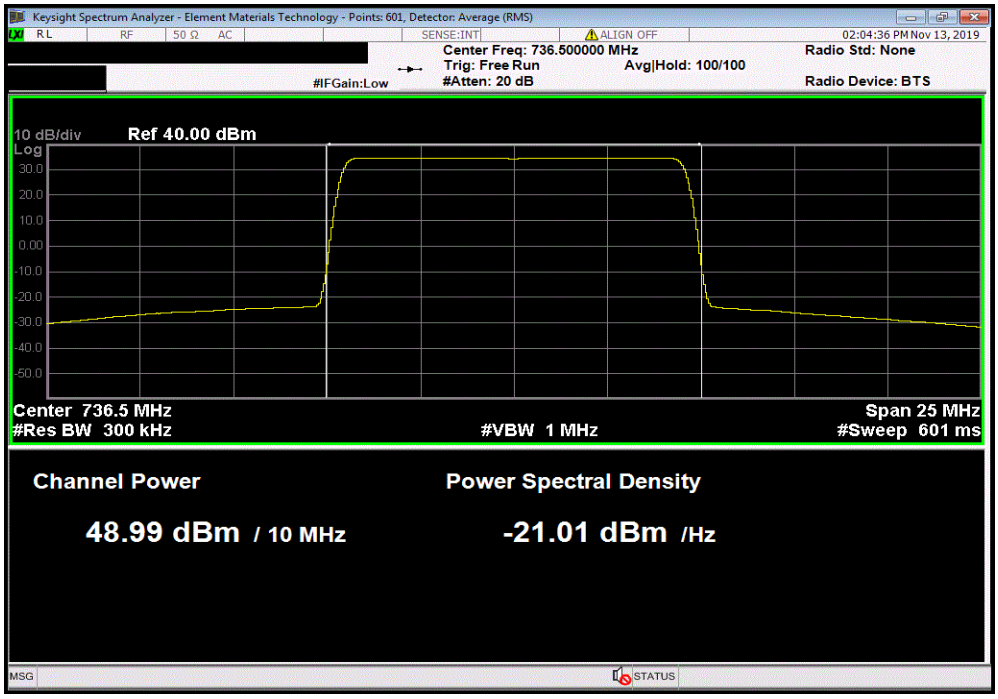


AVERAGE POWER

Band 12, 256QAM Modulation, LTE10 Bandwidth, Mid Channel, 736.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	48.96	0		49	1000	Pass

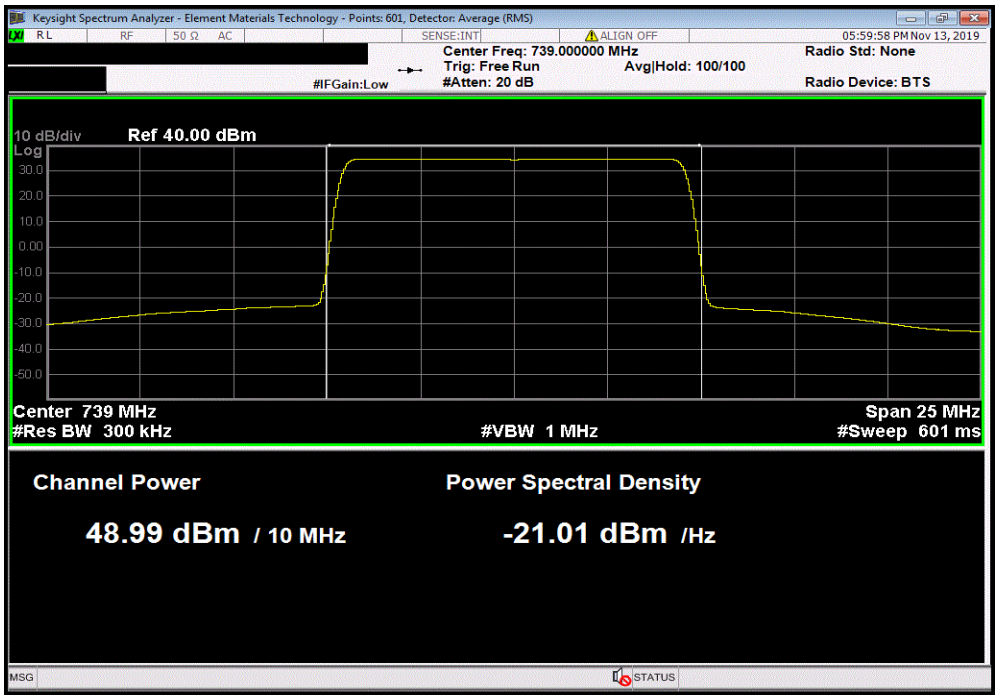


Band 12, 256QAM Modulation, LTE10 Bandwidth, Low Channel, 734.0 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	48.987	0		49	1000	Pass



AVERAGE POWER

Band 12, 256QAM Modulation, LTE10 Bandwidth, High Channel, 739.0 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	48.99	0		49	1000	Pass



AVERAGE POWER

XMit 2019.09.05

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

TEST EQUIPMENT

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

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The fundamental emission output power (maximum average conducted output power) was measured using the channels and modes as called out on the following data sheets. The transmit power was set to its default maximum.

The method in section 5.2.4.4 of ANSI C63.26 was used to make the measurement. This method uses trace averaging across ON and OFF times of the EUT transmissions in the spectrum analyzer channel power function using an RMS detector. Following the measurement a duty cycle correction was applied by adding [10 log (1 / D)], where D is the duty cycle, to the measured power to compute the average power during the actual transmission times.

Per FCC sections 27.50(c)(3), the Effective Radiated Power (ERP) of the transceiver cannot exceed 1000 Watts/MHz.

AVERAGE POWER

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	AHLBBA RRH			Work Order:	NOKI0004
Serial Number:	K9193514835			Date:	18-Nov-19
Customer:	Nokia Solutions and Networks			Temperature:	22.4 °C
Attendees:	John Rattanavong			Humidity:	29.7% RH
Project:	None			Barometric Pres.:	1019 mbar
Tested by:	Jonathan Kiefer	Power:	54VDC	Job Site:	TX09

TEST SPECIFICATIONS	Test Method
FCC 27:2019	ANSI C63.26:2015

COMMENTS

Band 12 average power measurements for LTE5 channel bandwidth at Mid channel for four modulation types. Tested on highest power antenna port (Port 2) determined from antenna ports 2 & 3 measurements for LTE5/256QAM/Mid Channel. EUT is operated at 100% duty cycle. ERP depends on antenna gain, which is unknown. Note: 256QAM modulation data is shown elsewhere in the report. Only the highest dBm value is plotted per customer requirements and a Watt/MHz calculation was not made due to the unknown antenna value.

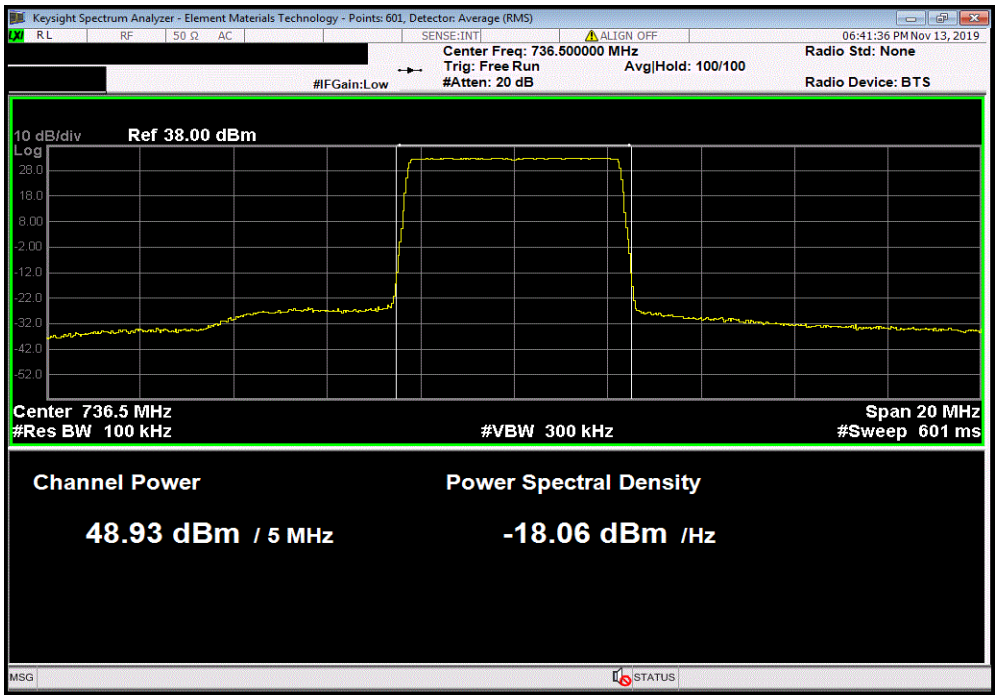
DEVIATIONS FROM TEST STANDARD

None

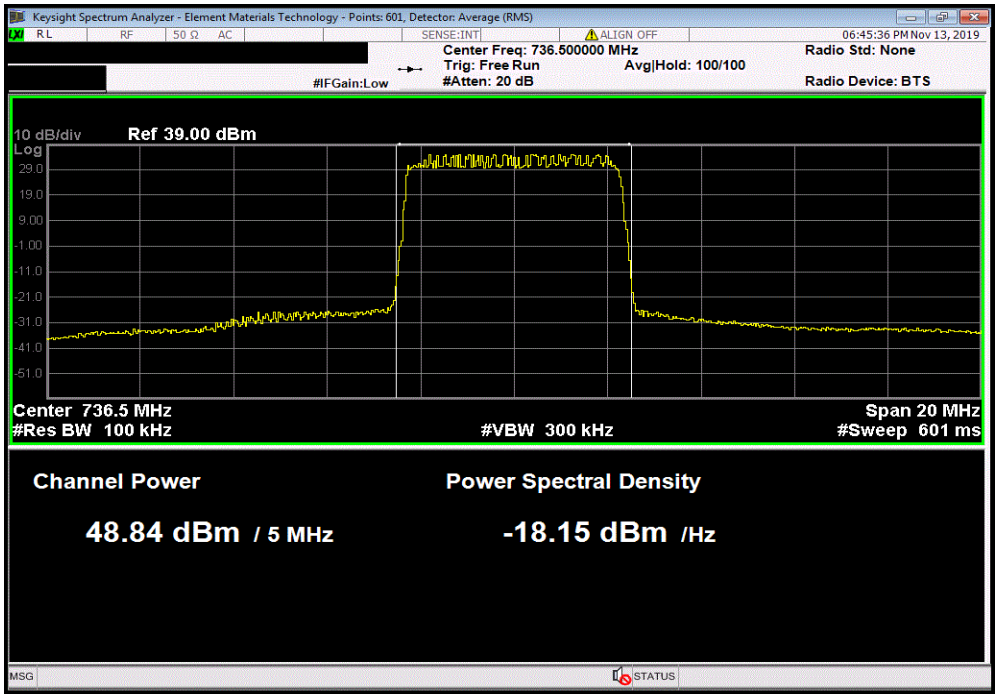
Configuration #	2	Signature	Jonathan Kiefer

	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (W ERP/MHz)	Results
Band 12					
QPSK Modulation					
LTE5 Bandwidth					
Mid Channel, 736.5 MHz	48.928	0	48.9	1000	Pass
16QAM Modulation					
LTE5 Bandwidth					
Mid Channel, 736.5 MHz	48.838	0	48.8	1000	Pass
64QAM Modulation					
LTE5 Bandwidth					
Mid Channel, 736.5 MHz	48.836	0	48.8	1000	Pass

Band 12, QPSK Modulation, LTE5 Bandwidth, Mid Channel, 736.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	48.928	0		48.9	1000	Pass



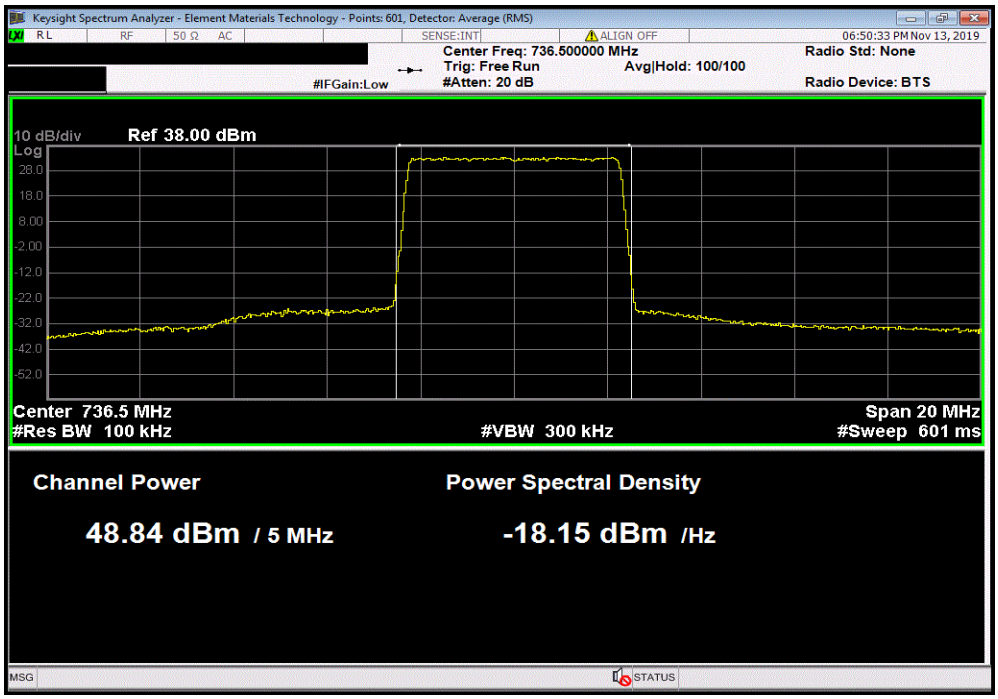
Band 12, 16QAM Modulation, LTE5 Bandwidth, Mid Channel, 736.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	48.838	0		48.8	1000	Pass



AVERAGE POWER

TbtTx 2019.08.30.0 XMit 2019.09.05

Band 12, 64QAM Modulation, LTE5 Bandwidth, Mid Channel, 736.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	48.836	0		48.8	1000	Pass



AVERAGE POWER

XMit 2019.09.05

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

TEST EQUIPMENT

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

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The fundamental emission output power (maximum average conducted output power) was measured using the channels and modes as called out on the following data sheets. The transmit power was set to its default maximum.

The method in section 5.2.4.4 of ANSI C63.26 was used to make the measurement. This method uses trace averaging across ON and OFF times of the EUT transmissions in the spectrum analyzer channel power function using an RMS detector. Following the measurement a duty cycle correction was applied by adding [10 log (1 / D)], where D is the duty cycle, to the measured power to compute the average power during the actual transmission times.

Per FCC sections 27.50(c)(3), the Effective Radiated Power (ERP) of the transceiver cannot exceed 1000 Watts/MHz.

AVERAGE POWER

element

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	**AHLBBA RRH**			**Work Order:**	**NOKI0004**
Serial Number:	**K9193514835**			**Date:**	**18-Nov-19**
Customer:	**Nokia Solutions and Networks**			**Temperature:**	**22.4 °C**
Attendees:	**John Rattanavong**			**Humidity:**	**29.7% RH**
Project:	**None**			**Barometric Pres.:**	**1019 mbar**
Tested by:	**Jonathan Kiefer**	**Power:**	**54VDC**	**Job Site:**	**TX09**

TEST SPECIFICATIONS	**Test Method**
FCC 27:2019	ANSI C63.26:2015

COMMENTS

Band 12 average power for 256QAM modulation type at Low, Mid and High channels for LTE5 and LTE10 channel bandwidths. Tested on highest power antenna port (Port 2) determined from antenna ports 2 & 3 measurements for LTE5/256QAM/Mid Channel. EUT is operated at 100% duty cycle. Note: 256QAM LTE5 BW Mid Channel data shown elsewhere in the report. ERP depends on antenna gain, which is unknown. Only the highest dBm value is plotted per customer requirements and a Watt/MHz calculation was not made due to the unknown antenna value.

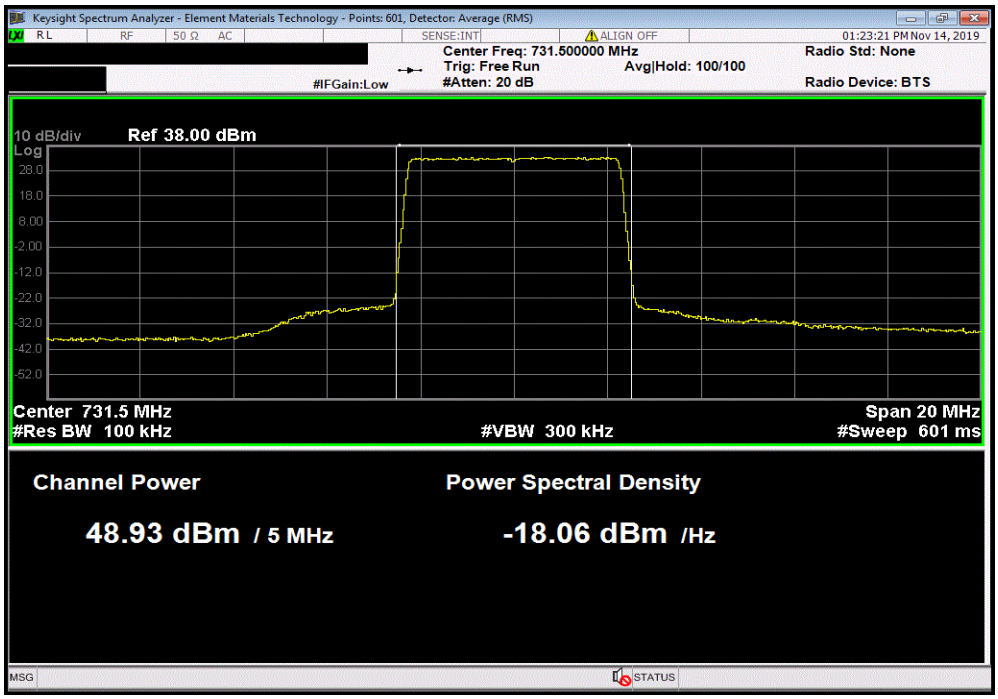
DEVIATIONS FROM TEST STANDARD

None

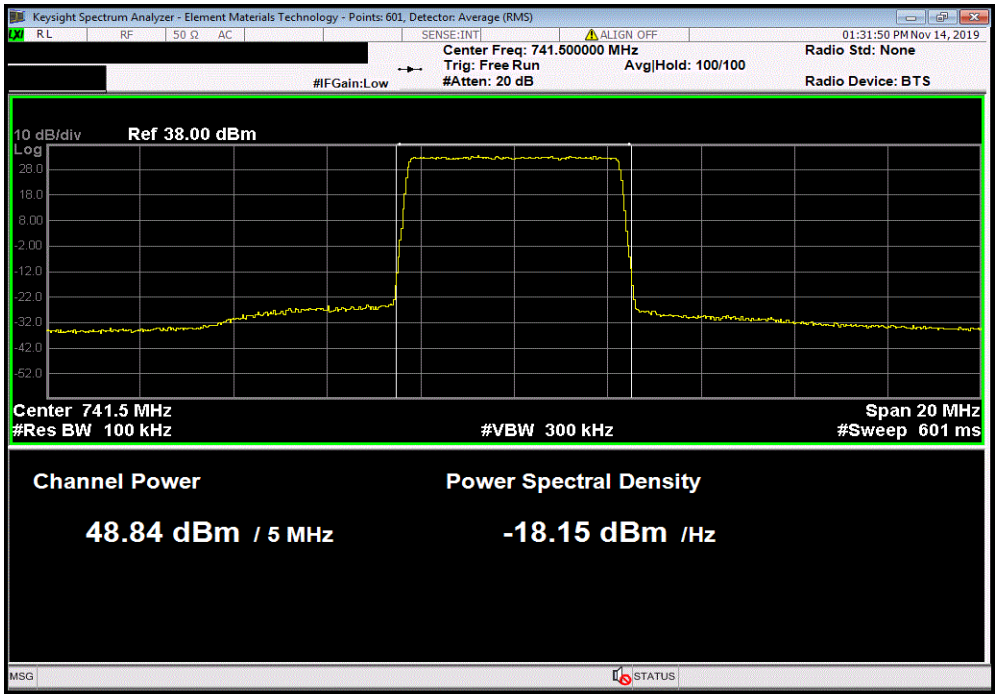
Configuration #	**2**	*Signature* Jonathan Kiefer

	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (W ERP/MHz)	Results
Band 12					
256QAM Modulation					
LTE5 Bandwidth					
Low Channel, 731.5 MHz	48.929	0	48.9	1000	Pass
High Channel, 741.5 MHz	48.843	0	48.8	1000	Pass
LTE10 Bandwidth					
Mid Channel, 736.5 MHz	49.07	0	49.1	1000	Pass
Low Channel, 734.0 MHz	49.05	0	49	1000	Pass
High Channel, 739.0 MHz	49.012	0	49	1000	Pass

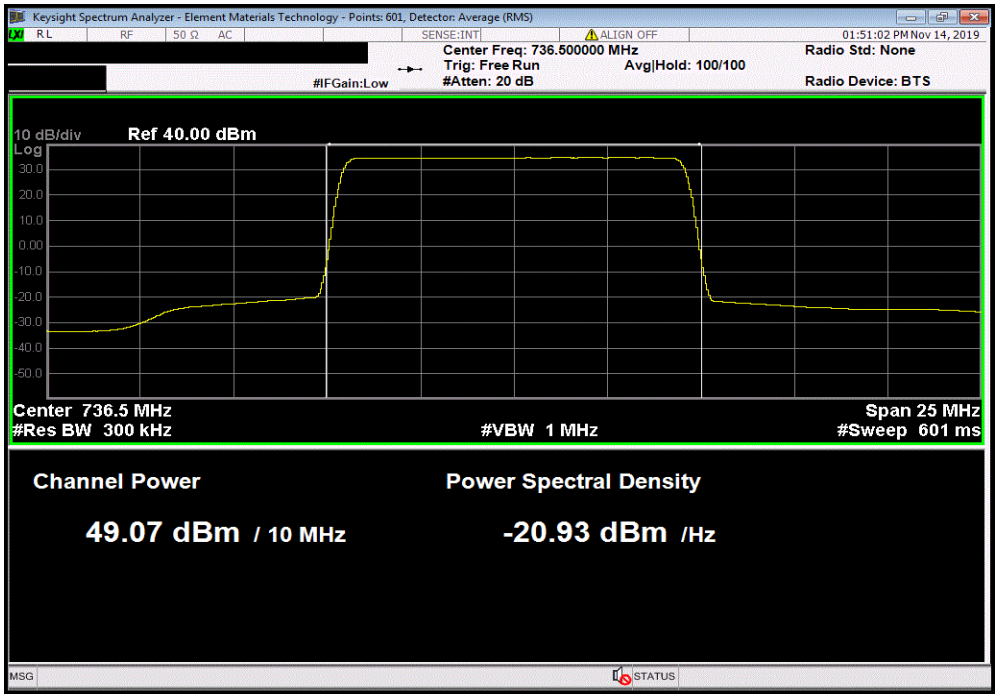
Band 12, 256QAM Modulation, LTE5 Bandwidth, Low Channel, 731.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	48.929	0		48.9	1000	Pass



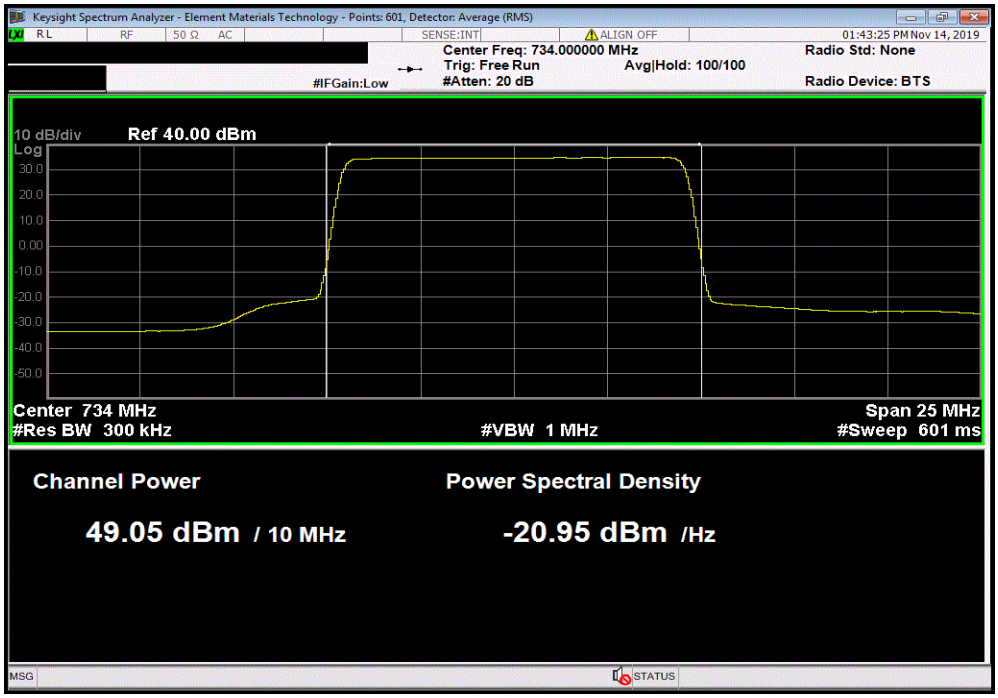
Band 12, 256QAM Modulation, LTE5 Bandwidth, High Channel, 741.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	48.843	0		48.8	1000	Pass



Band 12, 256QAM Modulation, LTE10 Bandwidth, Mid Channel, 736.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	49.07	0		49.1	1000	Pass

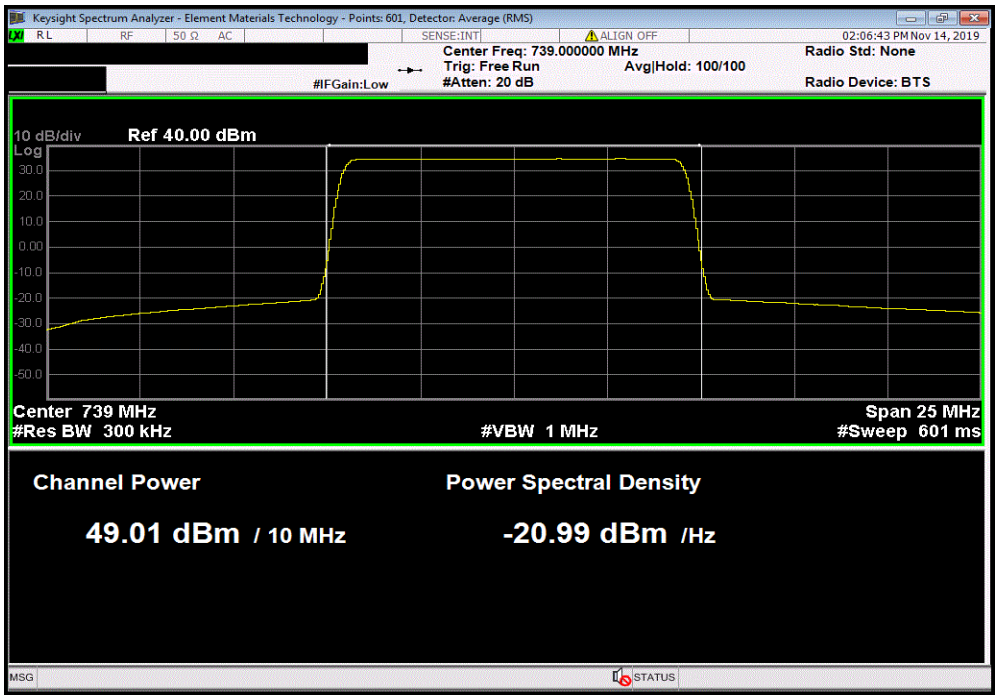


Band 12, 256QAM Modulation, LTE10 Bandwidth, Low Channel, 734.0 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	49.05	0		49	1000	Pass



AVERAGE POWER

Band 12, 256QAM Modulation, LTE10 Bandwidth, High Channel, 739.0 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	49.012	0		49	1000	Pass



AVERAGE POWER

XMit 2019.09.05

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

TEST EQUIPMENT

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

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The fundamental emission output power (maximum average conducted output power) was measured using the channels and modes as called out on the following data sheets. The transmit power was set to its default maximum.

The method in section 5.2.4.4 of ANSI C63.26 was used to make the measurement. This method uses trace averaging across ON and OFF times of the EUT transmissions in the spectrum analyzer channel power function using an RMS detector. Following the measurement a duty cycle correction was applied by adding [10 log (1 / D)], where D is the duty cycle, to the measured power to compute the average power during the actual transmission times.

Per FCC section 90.542, the Effective Radiated Power (ERP) of the transceiver cannot exceed 1000 Watts/MHz.

AVERAGE POWER

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	**AHLBBA RRH**			**Work Order:**	**NOKI0004**
Serial Number:	**K9193514835**			**Date:**	**18-Nov-19**
Customer:	**Nokia Solutions and Networks**			**Temperature:**	**22.4 °C**
Attendees:	**John Rattanavong**			**Humidity:**	**29.6% RH**
Project:	**None**			**Barometric Pres.:**	**1019 mbar**
Tested by:	**Jonathan Kiefer**	**Power:**	**54VDC**	**Job Site:**	**TX09**

TEST SPECIFICATIONS	**Test Method**
FCC 90I:2019	ANSI C63.26:2015

COMMENTS

Band 14 average power measurements for LTE5 channel bandwidth at Mid channel using 256QAM on all four antenna ports. EUT is operated at 100% duty cycle. ERP depends on antenna gain, which is unknown. Only the highest dBm value is plotted per customer requirements and a Watt/MHz calculation was not made due to the unknown antenna value.

DEVIATIONS FROM TEST STANDARD

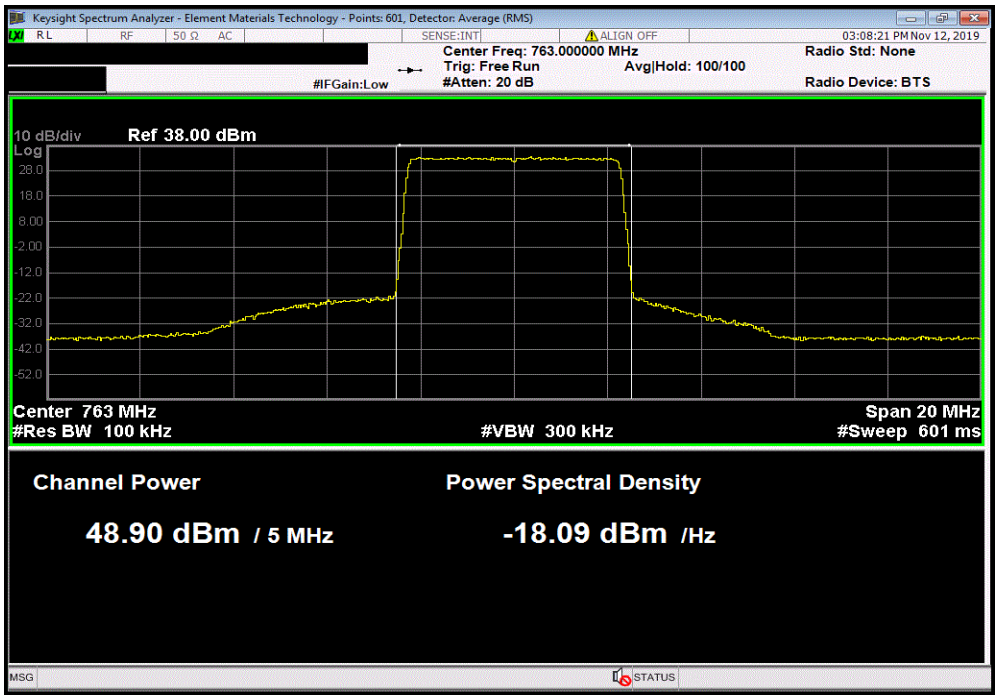
None

Configuration #	**2**	*Signature* Jonathan Kiefer

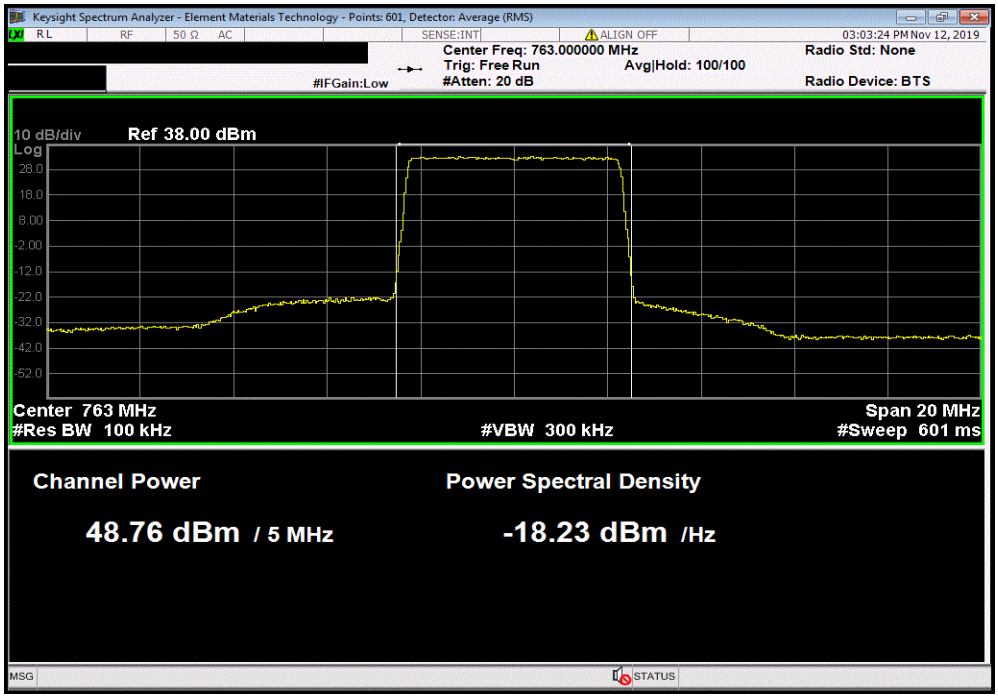
		Avg Cond Pwr (dBm)	**Duty Cycle Factor (dB)**	**Value (dBm)**	**Limit (W ERP/MHz)**	**Results**
Band 14						
256QAM Modulation						
LTE5 Bandwidth						
Mid Channel, 763.0 MHz						
	Antenna Port 1	48.902	0	48.9	1000	Pass
	Antenna Port 2	48.759	0	48.8	1000	Pass
	Antenna Port 3	48.715	0	48.7	1000	Pass
	Antenna Port 4	48.878	0	48.9	1000	Pass

AVERAGE POWER

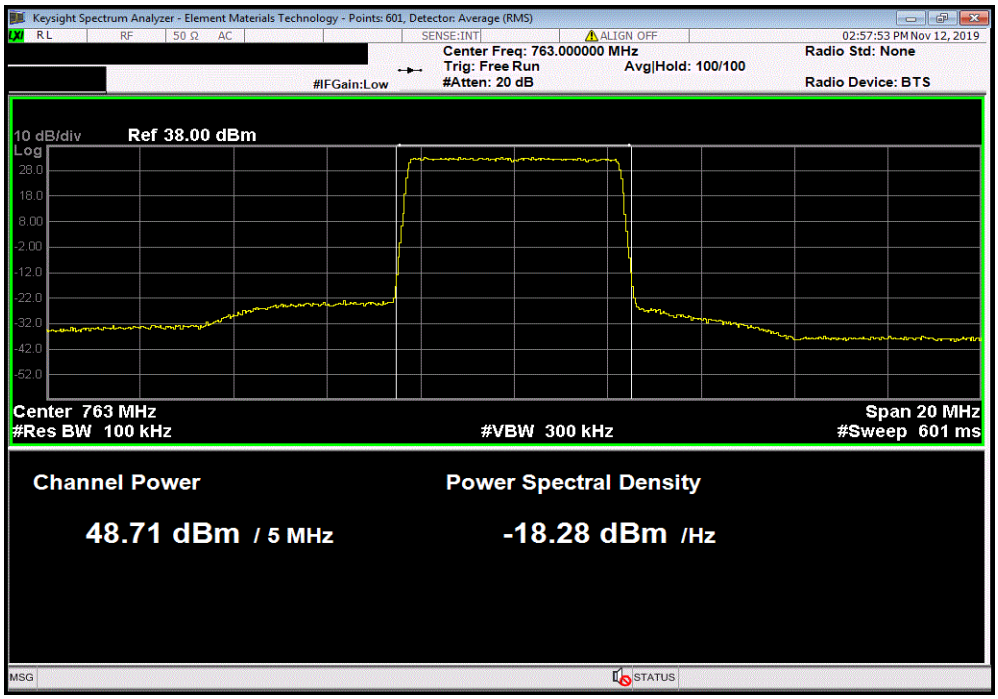
Band 14, 256QAM Modulation, LTE5 Bandwidth, Mid Channel, 763.0 MHz, Antenna Port 1						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	48.902	0		48.9	1000	Pass



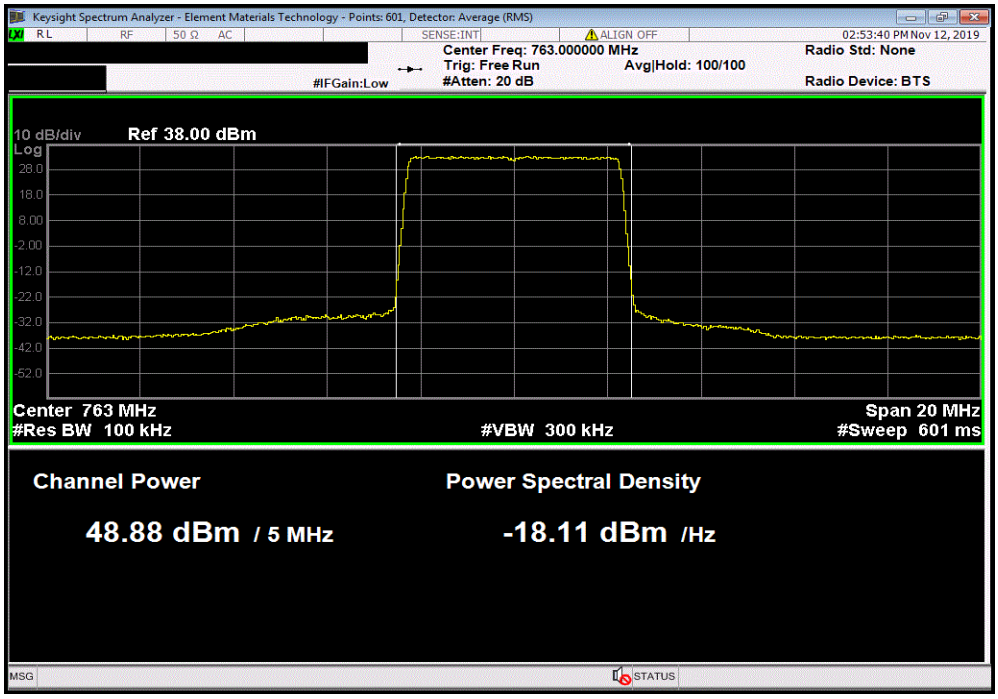
Band 14, 256QAM Modulation, LTE5 Bandwidth, Mid Channel, 763.0 MHz, Antenna Port 2						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	48.759	0		48.8	1000	Pass



Band 14, 256QAM Modulation, LTE5 Bandwidth, Mid Channel, 763.0 MHz, Antenna Port 3						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	48.715	0		48.7	1000	Pass



Band 14, 256QAM Modulation, LTE5 Bandwidth, Mid Channel, 763.0 MHz, Antenna Port 4						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	48.878	0		48.9	1000	Pass



AVERAGE POWER

XMit 2019.09.05

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

TEST EQUIPMENT

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

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The fundamental emission output power (maximum average conducted output power) was measured using the channels and modes as called out on the following data sheets. The transmit power was set to its default maximum.

The method in section 5.2.4.4 of ANSI C63.26 was used to make the measurement. This method uses trace averaging across ON and OFF times of the EUT transmissions in the spectrum analyzer channel power function using an RMS detector. Following the measurement a duty cycle correction was applied by adding [10 log (1 / D)], where D is the duty cycle, to the measured power to compute the average power during the actual transmission times.

Per FCC section 90.542, the Effective Radiated Power (ERP) of the transceiver cannot exceed 1000 Watts/MHz.

AVERAGE POWER

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	AHLBBA RRH			Work Order:	NOKI0004
Serial Number:	K9193514835			Date:	18-Nov-19
Customer:	Nokia Solutions and Networks			Temperature:	22.4 °C
Attendees:	John Rattanavong			Humidity:	29.6% RH
Project:	None			Barometric Pres.:	1019 mbar
Tested by:	Jonathan Kiefer	Power:	54VDC	Job Site:	TX09

TEST SPECIFICATIONS	Test Method
FCC 90I:2019	ANSI C63.26:2015

COMMENTS

Band 14 average power measurements for LTE5 channel bandwidth at Mid channel for four modulationt types. Tested on highest power antenna port (Port 1) determined from antenna ports 1 & 4 measurements for LTE5/256QAM/Mid Channel. EUT is operated at 100% duty cycle. ERP depends on antenna gain, which is unknown. Note 256QAM modulation LTE5 Mid channel data is shown elsewhere in this report. Only the highest dBm value is plotted per customer requirements and a Watt/MHz calculation was not made due to the unknown antenna value.

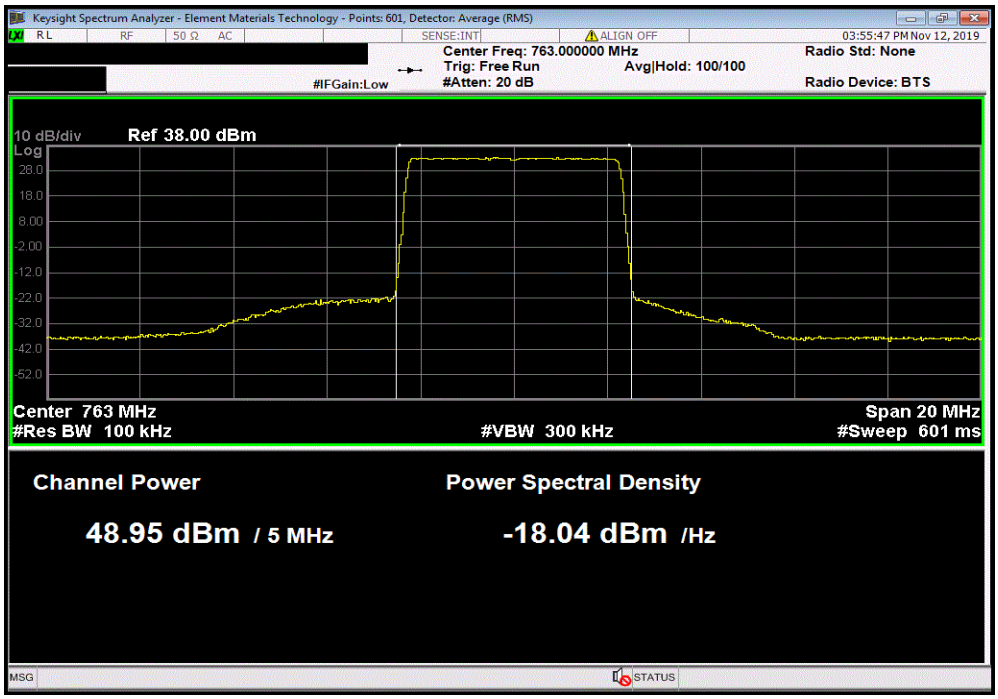
DEVIATIONS FROM TEST STANDARD

None

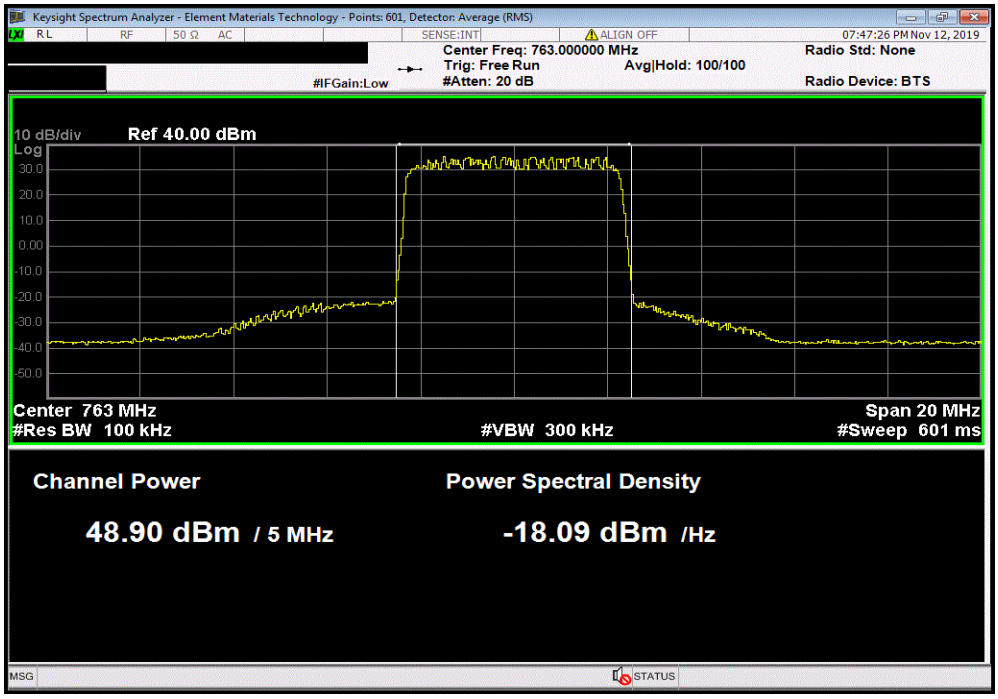
Configuration #	2	Signature	Jonathan Kiefer

	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (W ERP/MHz)	Results
Band 14					
QPSK Modulation					
LTE5 Bandwidth					
Mid Channel, 763.0 MHz	48.953	0	49	1000	Pass
16QAM Modulation					
LTE5 Bandwidth					
Mid Channel, 763.0 MHz	48.899	0	48.9	1000	Pass
64QAM Modulation					
LTE5 Bandwidth					
Mid Channel, 763.0 MHz	48.936	0	48.9	1000	Pass

Band 14, QPSK Modulation, LTE5 Bandwidth, Mid Channel, 763.0 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	48.953	0		49	1000	Pass



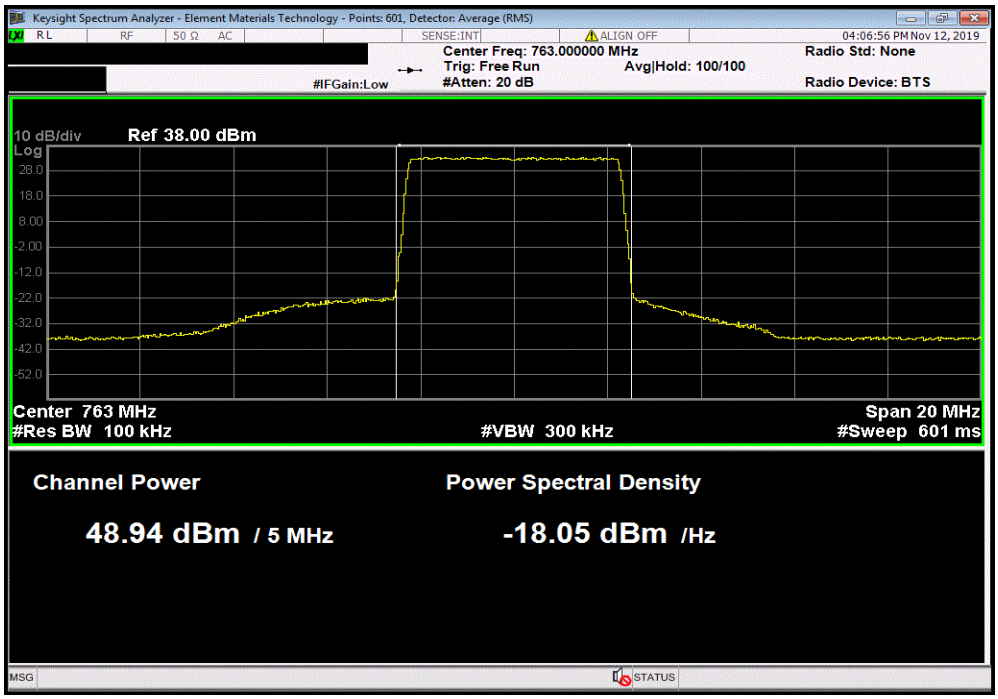
Band 14, 16QAM Modulation, LTE5 Bandwidth, Mid Channel, 763.0 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	48.899	0		48.9	1000	Pass



AVERAGE POWER

TbtTx 2019.08.30.0 XMit 2019.09.05

Band 14, 64QAM Modulation, LTE5 Bandwidth, Mid Channel, 763.0 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	48.936	0		48.9	1000	Pass



AVERAGE POWER

XMit 2019.09.05

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

TEST EQUIPMENT

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

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The fundamental emission output power (maximum average conducted output power) was measured using the channels and modes as called out on the following data sheets. The transmit power was set to its default maximum.

The method in section 5.2.4.4 of ANSI C63.26 was used to make the measurement. This method uses trace averaging across ON and OFF times of the EUT transmissions in the spectrum analyzer channel power function using an RMS detector. Following the measurement a duty cycle correction was applied by adding [10 log (1 / D)], where D is the duty cycle, to the measured power to compute the average power during the actual transmission times.

Per FCC sections 90.542, the Effective Radiated Power (ERP) of the transceiver cannot exceed 1000 Watts/MHz.

AVERAGE POWER

element

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	**AHLBBA RRH**			**Work Order:**	**NOKI0004**
Serial Number:	**K9193514835**			**Date:**	**18-Nov-19**
Customer:	**Nokia Solutions and Networks**			**Temperature:**	**22.4 °C**
Attendees:	**John Rattanavong**			**Humidity:**	**29.6% RH**
Project:	**None**			**Barometric Pres.:**	**1019 mbar**
Tested by:	**Jonathan Kiefer**	**Power:**	**54VDC**	**Job Site:**	**TX09**

TEST SPECIFICATIONS	**Test Method**
FCC 90I:2019	ANSI C63.26:2015

COMMENTS

Band 14 average power for 256QAM modulation type at Low, Mid and High channels for LTE5 and LTE10 channel bandwidths. Tested on highest power antenna port (Port 1) determined from antenna ports 1 & 4 measurements for LTE5/256QAM/Mid Channel. EUT is operated at 100% duty cycle. Note 256QAM LTE5 BW Mid channel data shown elsewhere in the report. ERP depends on antenna gain, which is unknown. Only the highest dBm value is plotted per customer requirements and a Watt/MHz calculation was not made due to the unknown antenna value.

DEVIATIONS FROM TEST STANDARD

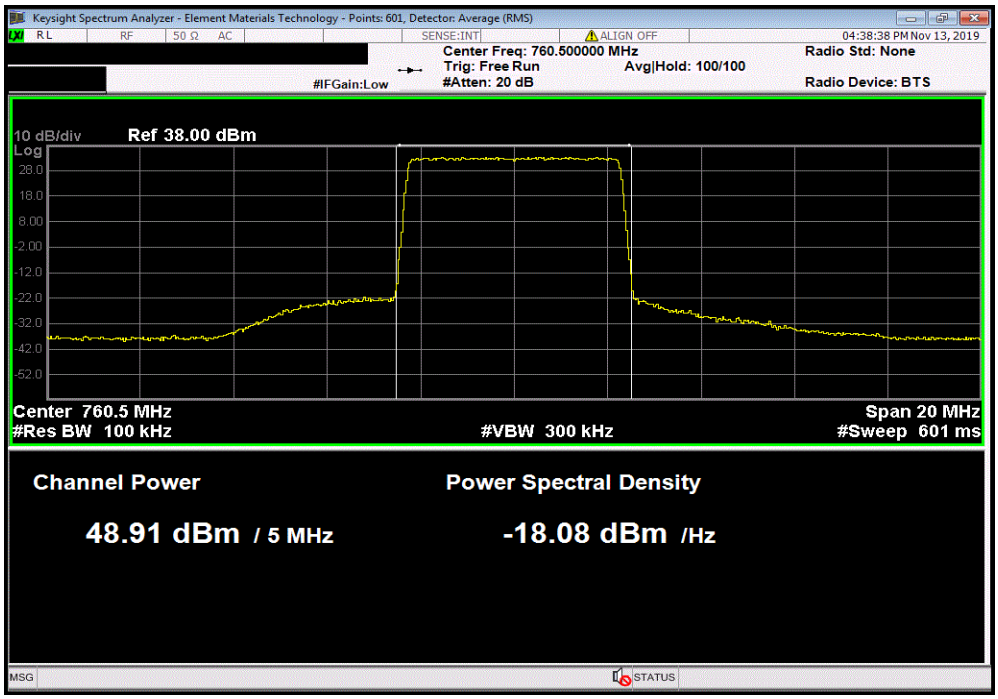
None

Configuration #	**2**	*Signature* Jonathan Kiefer

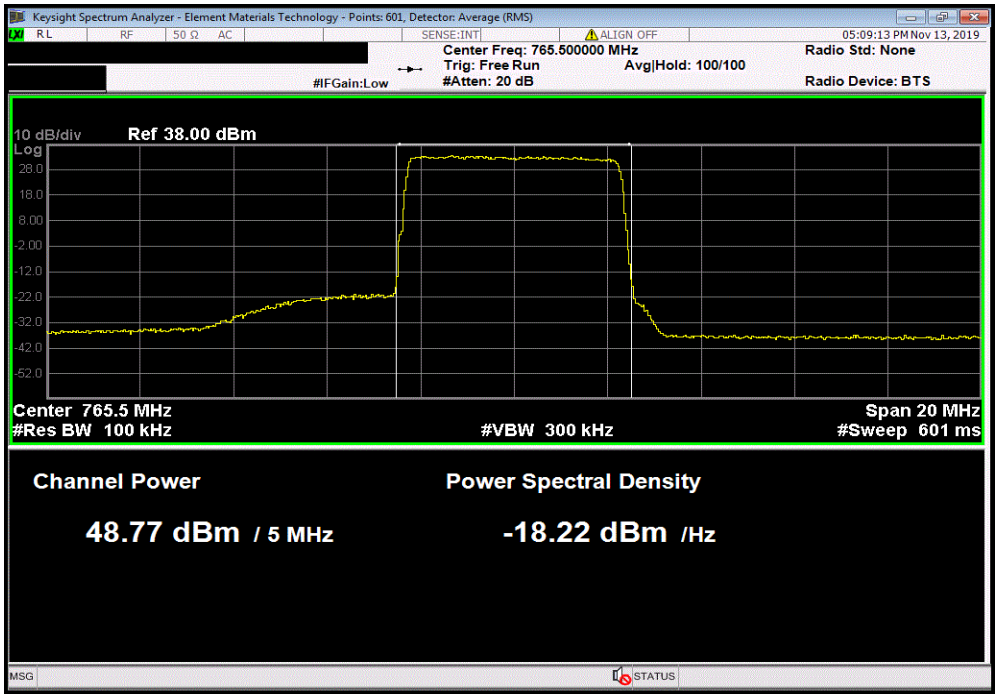
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (W ERP/MHz)	Results
Band 14					
256QAM Modulation					
LTE5 Bandwidth					
Low Channel, 760.5 MHz	48.908	0	48.9	1000	Pass
High Channel, 765.5 MHz	48.766	0	48.8	1000	Pass
LTE10 Bandwidth					
Single Channel, 763.0 MHz	48.79	0	48.8	1000	Pass

AVERAGE POWER

Band 14, 256QAM Modulation, LTE5 Bandwidth, Low Channel, 760.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	48.908	0		48.9	1000	Pass



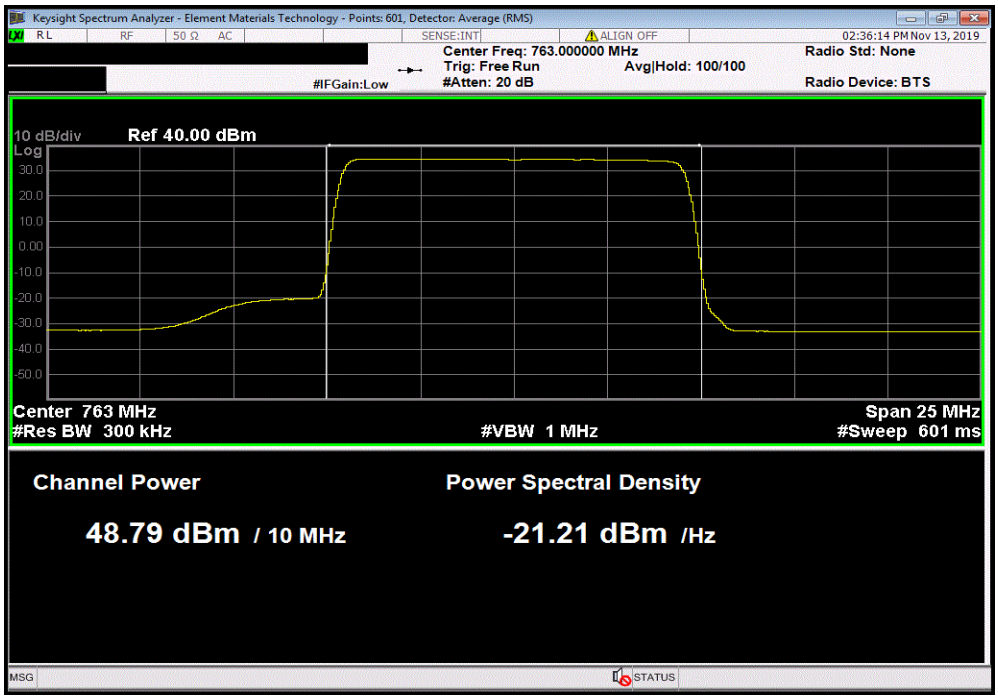
Band 14, 256QAM Modulation, LTE5 Bandwidth, High Channel, 765.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	48.766	0		48.8	1000	Pass



AVERAGE POWER

TbtTx 2019.08.30.0 XMit 2019.09.05

Band 14, 256QAM Modulation, LTE10 Bandwidth, Single Channel, 763.0 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	48.79	0		48.8	1000	Pass



AVERAGE POWER

XMit 2019.09.05

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

TEST EQUIPMENT

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

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The fundamental emission output power (maximum average conducted output power) was measured using the channels and modes as called out on the following data sheets. The transmit power was set to its default maximum.

The method in section 5.2.4.4 of ANSI C63.26 was used to make the measurement. This method uses trace averaging across ON and OFF times of the EUT transmissions in the spectrum analyzer channel power function using an RMS detector. Following the measurement a duty cycle correction was applied by adding [10 log (1 / D)], where D is the duty cycle, to the measured power to compute the average power during the actual transmission times.

Per FCC sections 90.542, the Effective Radiated Power (ERP) of the transceiver cannot exceed 1000 Watts/MHz.

AVERAGE POWER

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	AHLBBA RRH			Work Order:	NOKI0004
Serial Number:	K9193514835			Date:	18-Nov-19
Customer:	Nokia Solutions and Networks			Temperature:	22.4 °C
Attendees:	John Rattanavong			Humidity:	29.7% RH
Project:	None			Barometric Pres.:	1019 mbar
Tested by:	Jonathan Kiefer	Power:	54VDC	Job Site:	TX09

TEST SPECIFICATIONS	Test Method
FCC 90I:2019	ANSI C63.26:2015

COMMENTS

Band 14 average power measurements for LTE5 channel bandwidth at Mid channel for four modulation types. Tested on highest power antenna port (Port 2) determined from antenna ports 2 & 3 measurements for LTE5/256QAM/Mid Channel.. EUT is operated at 100% duty cycle. ERP depends on antenna gain, which is unknown. Only the highest dBm value is plotted per customer requirements and a Watt/MHz calculation was not made due to the unknown antenna value.

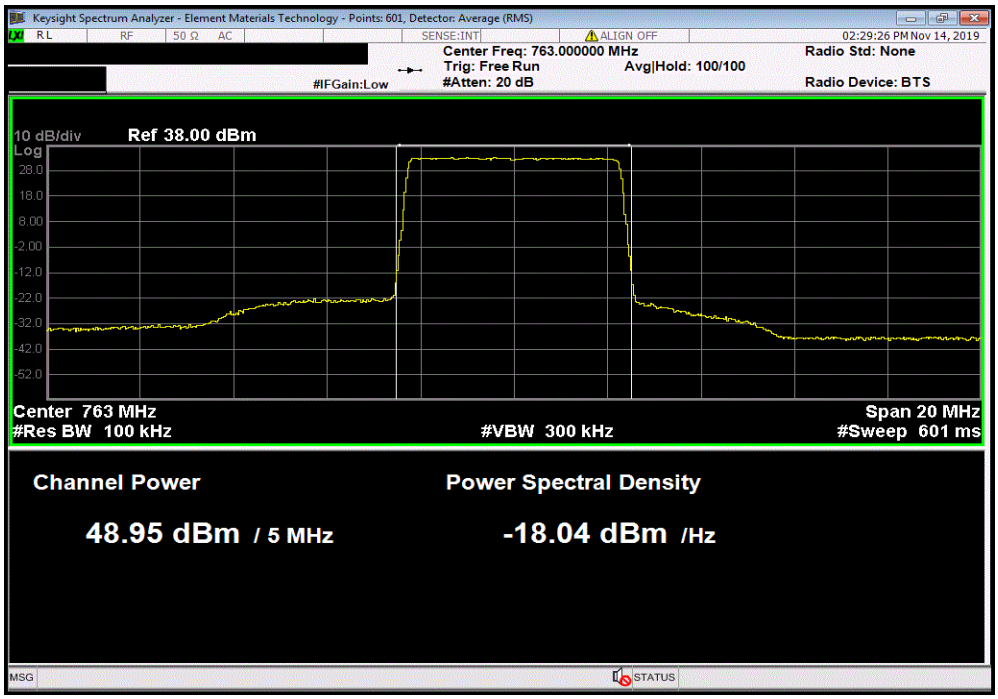
DEVIATIONS FROM TEST STANDARD

None

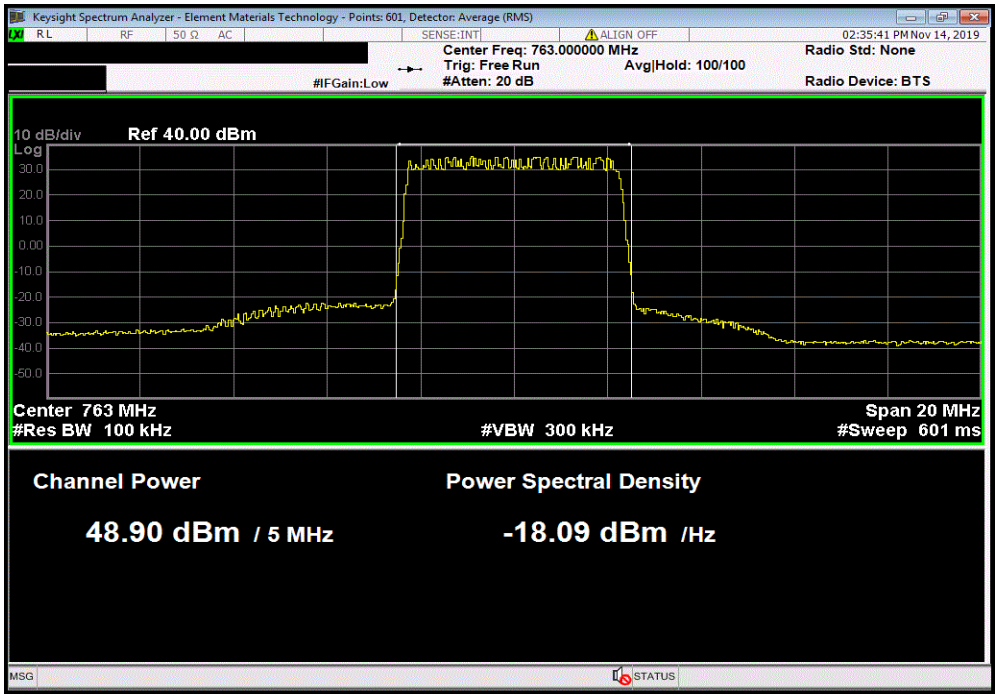
Configuration #	2	Signature	Jonathan Kiefer

	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (W ERP/MHz)	Results
Band 14					
QPSK Modulation					
LTE5 Bandwidth					
Mid Channel, 763.0 MHz	48.948	0	48.9	1000	Pass
16QAM Modulation					
LTE5 Bandwidth					
Mid Channel, 763.0 MHz	48.896	0	48.9	1000	Pass
64QAM Modulation					
LTE5 Bandwidth					
Mid Channel, 763.0 MHz	48.889	0	48.9	1000	Pass

Band 14, QPSK Modulation, LTE5 Bandwidth, Mid Channel, 763.0 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	48.948	0		48.9	1000	Pass



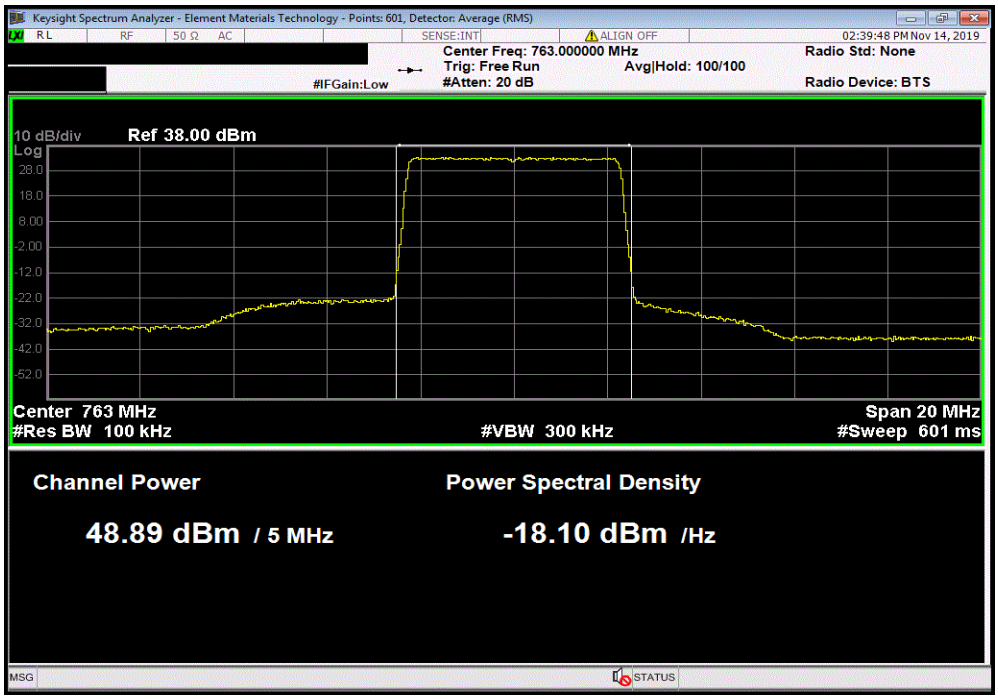
Band 14, 16QAM Modulation, LTE5 Bandwidth, Mid Channel, 763.0 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	48.896	0		48.9	1000	Pass



AVERAGE POWER

TbtTx 2019.08.30.0 XMit 2019.09.05

Band 14, 64QAM Modulation, LTE5 Bandwidth, Mid Channel, 763.0 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	48.889	0		48.9	1000	Pass



AVERAGE POWER

XMit 2019.09.05

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

TEST EQUIPMENT

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

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The fundamental emission output power (maximum average conducted output power) was measured using the channels and modes as called out on the following data sheets. The transmit power was set to its default maximum.

The method in section 5.2.4.4 of ANSI C63.26 was used to make the measurement. This method uses trace averaging across ON and OFF times of the EUT transmissions in the spectrum analyzer channel power function using an RMS detector. Following the measurement a duty cycle correction was applied by adding [10 log (1 / D)], where D is the duty cycle, to the measured power to compute the average power during the actual transmission times.

Per FCC section 90.542, the Effective Radiated Power (ERP) of the transceiver cannot exceed 1000 Watts/MHz.

AVERAGE POWER

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	AHLBBA RRH			Work Order:	NOKI0004
Serial Number:	K9193514835			Date:	18-Nov-19
Customer:	Nokia Solutions and Networks			Temperature:	22.4 °C
Attendees:	John Rattanavong			Humidity:	29.7% RH
Project:	None			Barometric Pres.:	1019 mbar
Tested by:	Jonathan Kiefer	Power:	54VDC	Job Site:	TX09

TEST SPECIFICATIONS	Test Method
FCC 90I:2019	ANSI C63.26:2015

COMMENTS

Band 14 average power for 256QAM modulation type at Low, Mid and High channels for LTE5 and LTE10 channel bandwidths. Tested on highest power antenna port (Port 2) determined from antenna ports 2 & 3 measurements for LTE5/256QAM/Mid Channel.. EUT is operated at 100% duty cycle. Note: 256QAM LTE5 BW Mid Channel data shown elsewhere in the report. ERP depends on antenna gain, which is unknown. Only the highest dBm value is plotted per customer requirements and a Watt/MHz calculation was not made due to the unknown antenna value.

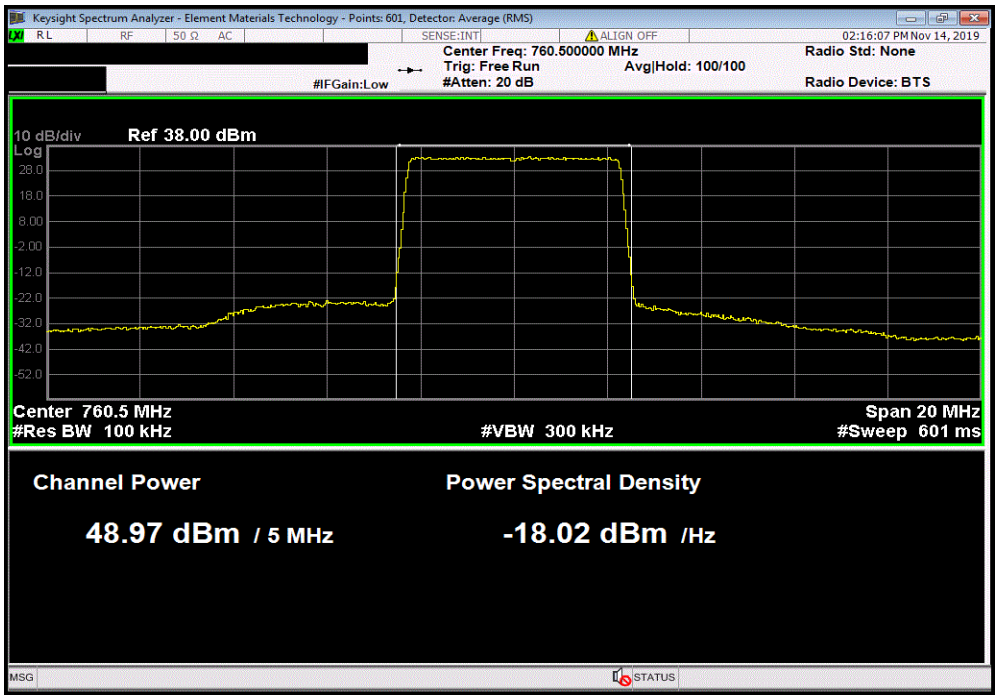
DEVIATIONS FROM TEST STANDARD

None

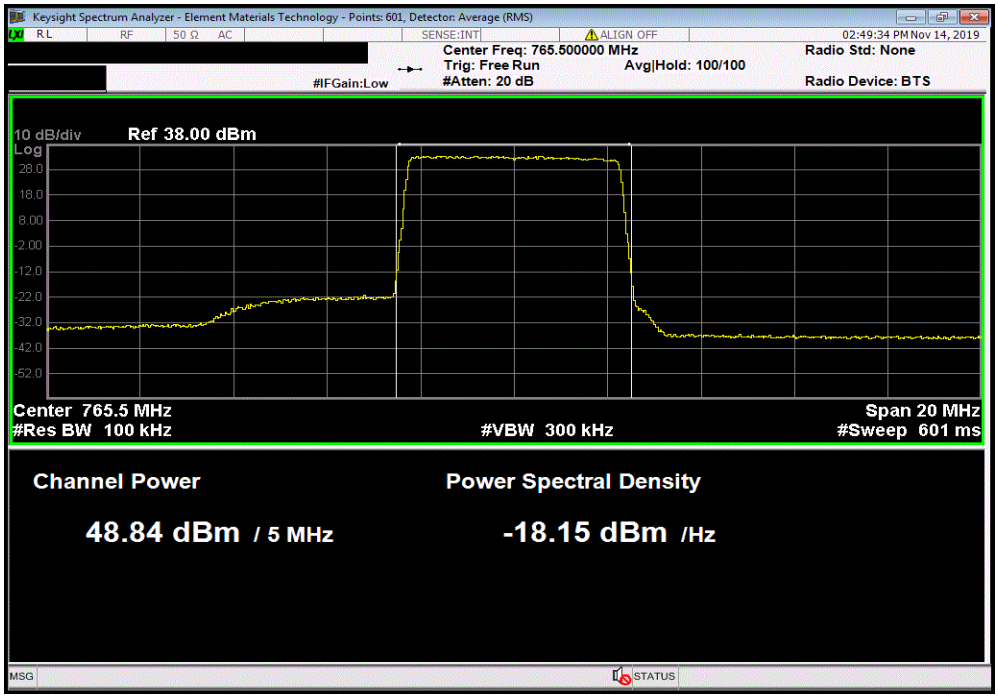
Configuration #	2	Signature	Jonathan Kiefer

	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (W ERP/MHz)	Results
Band 14					
256QAM Modulation					
LTE5 Bandwidth					
Low Channel, 760.5 MHz	48.966	0	49	1000	Pass
High Channel, 765.5 MHz	48.838	0	48.8	1000	Pass
LTE10 Bandwidth					
Single Channel, 763.0 MHz	48.857	0	48.9	1000	Pass

Band 14, 256QAM Modulation, LTE5 Bandwidth, Low Channel, 760.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	48.966	0		49	1000	Pass

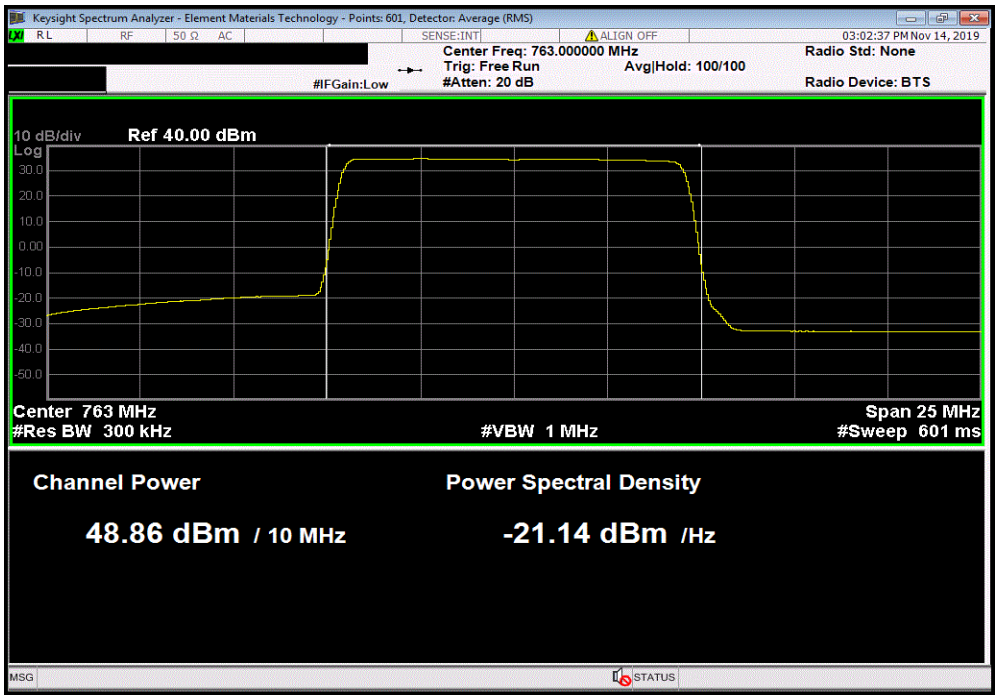


Band 14, 256QAM Modulation, LTE5 Bandwidth, High Channel, 765.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	48.838	0		48.8	1000	Pass



AVERAGE POWER

Band 14, 256QAM Modulation, LTE10 Bandwidth, Single Channel, 763.0 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	48.857	0		48.9	1000	Pass



AVERAGE POWER

XMit 2019.09.05

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

TEST EQUIPMENT

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

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The fundamental emission output power (maximum average conducted output power) was measured using the channels and modes as called out on the following data sheets. The transmit power was set to its default maximum.

The method in section 5.2.4.4 of ANSI C63.26 was used to make the measurement. This method uses trace averaging across ON and OFF times of the EUT transmissions in the spectrum analyzer channel power function using an RMS detector. Following the measurement a duty cycle correction was applied by adding [10 log (1 / D)], where D is the duty cycle, to the measured power to compute the average power during the actual transmission times.

Per FCC section 27.50(c)(3), the Effective Radiated Power (ERP) of the transceiver cannot exceed 1000 Watts/MHz.

AVERAGE POWER

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	**AHLBBA RRH**			**Work Order:**	**NOKI0004**
Serial Number:	**K9193514835**			**Date:**	**18-Nov-19**
Customer:	**Nokia Solutions and Networks**			**Temperature:**	**22.4 °C**
Attendees:	**John Rattanavong**			**Humidity:**	**29.6% RH**
Project:	**None**			**Barometric Pres.:**	**1019 mbar**
Tested by:	**Jonathan Kiefer**	**Power:**	**54VDC**	**Job Site:**	**TX09**

TEST SPECIFICATIONS	**Test Method**
FCC 27:2019	ANSI C63.26:2015

COMMENTS

Band 29 average power measurements for LTE5 channel bandwidth at Mid channel using 256QAM on Antenna Ports 1 & 4. EUT is operated at 100% duty cycle. ERP depends on antenna gain, which is unknown. Only the highest dBm value is plotted per customer requirements and a Watt/MHz calculation was not made due to the unknown antenna value.

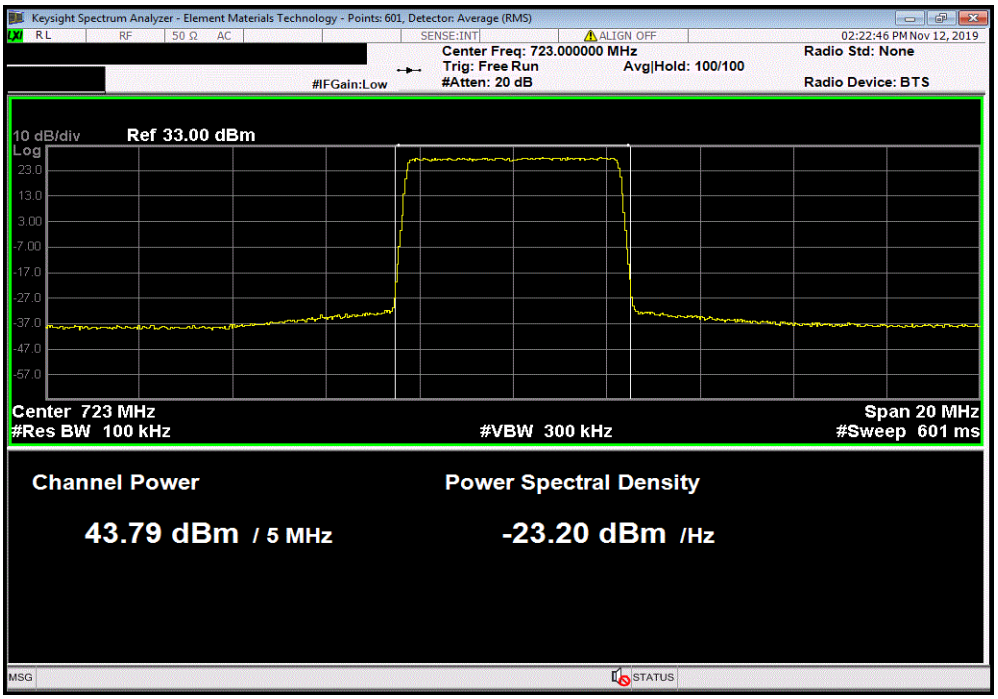
DEVIATIONS FROM TEST STANDARD

None

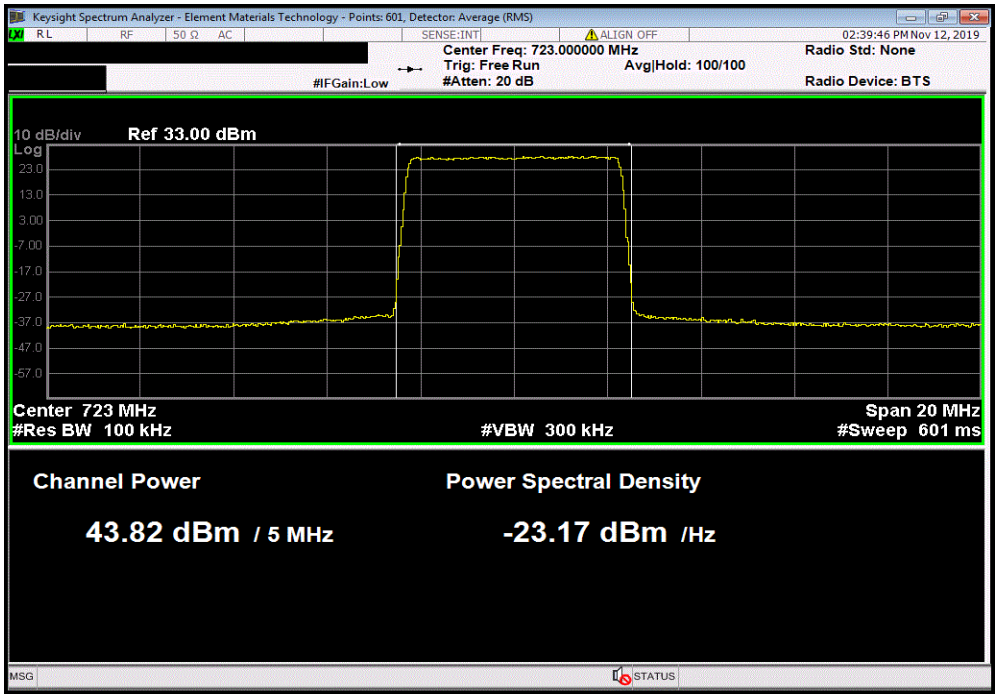
Configuration #	**2**	*Signature* Jonathan Kiefer

	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (W ERP/MHz)	Results
Band 29					
256QAM Modulation					
LTE5 Bandwidth					
Mid Channel, 723.0 MHz					
Antenna Port 1	43.791	0	43.8	1000	Pass
Antenna Port 4	43.816	0	43.8	1000	Pass

Band 29, 256QAM Modulation, LTE5 Bandwidth, Mid Channel, 723.0 MHz, Antenna Port 1						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	43.791	0		43.8	1000	Pass



Band 29, 256QAM Modulation, LTE5 Bandwidth, Mid Channel, 723.0 MHz, Antenna Port 4						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	43.816	0		43.8	1000	Pass



AVERAGE POWER

XMit 2019.09.05

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

TEST EQUIPMENT

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

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The fundamental emission output power (maximum average conducted output power) was measured using the channels and modes as called out on the following data sheets. The transmit power was set to its default maximum.

The method in section 5.2.4.4 of ANSI C63.26 was used to make the measurement. This method uses trace averaging across ON and OFF times of the EUT transmissions in the spectrum analyzer channel power function using an RMS detector. Following the measurement a duty cycle correction was applied by adding [10 log (1 / D)], where D is the duty cycle, to the measured power to compute the average power during the actual transmission times.

Per FCC section 27.50(c)(3), the Effective Radiated Power (ERP) of the transceiver cannot exceed 1000 Watts/MHz.

AVERAGE POWER

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	**AHLBBA RRH**			**Work Order:**	**NOKI0004**
Serial Number:	**K9193514835**			**Date:**	**18-Nov-19**
Customer:	**Nokia Solutions and Networks**			**Temperature:**	**22.4 °C**
Attendees:	**John Rattanavong**			**Humidity:**	**29.6% RH**
Project:	**None**			**Barometric Pres.:**	**1019 mbar**
Tested by:	**Jonathan Kiefer**	**Power:**	**54VDC**	**Job Site:**	**TX09**

TEST SPECIFICATIONS	**Test Method**
FCC 27:2019	ANSI C63.26:2015

COMMENTS

Band 29 average power measurements for LTE5 channel bandwidth at Mid channel for four modulation types. Tested on highest power antenna port (Port 1) determined from antenna ports 1 & 4 measurements for LTE5/256QAM/Mid Channel. EUT is operated at 100% duty cycle. ERP depends on antenna gain, which is unknown. Only the highest dBm value is plotted per customer requirements and a Watt/MHz calculation was not made due to the unknown antenna value. Note 256QAM modulation data is shown elsewhere in the report.

DEVIATIONS FROM TEST STANDARD

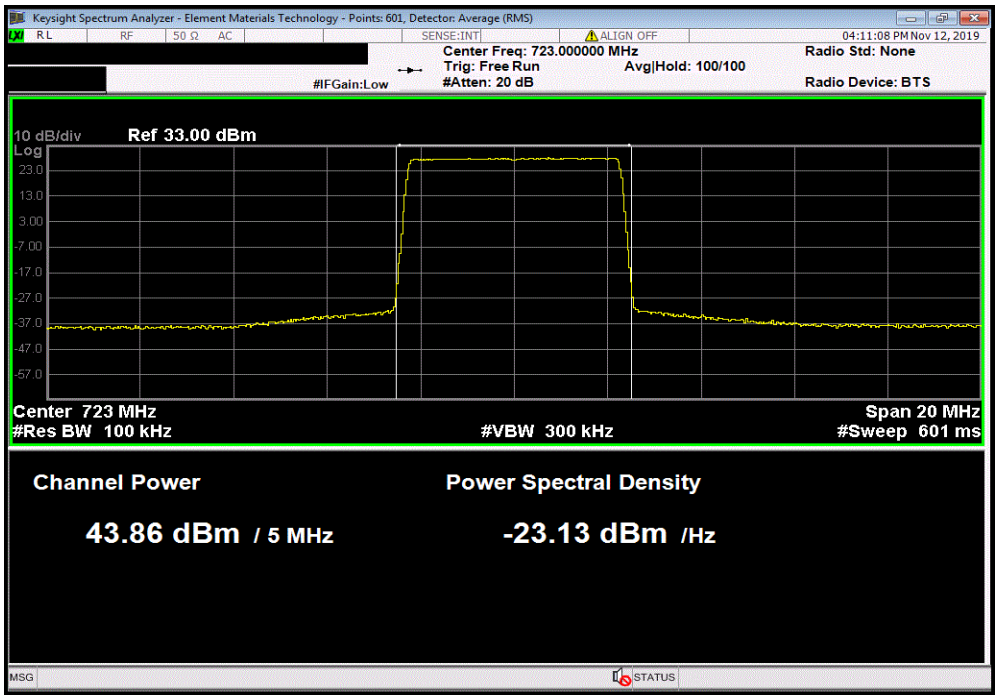
None

Configuration #	**2**	*Signature* Jonathan Kiefer

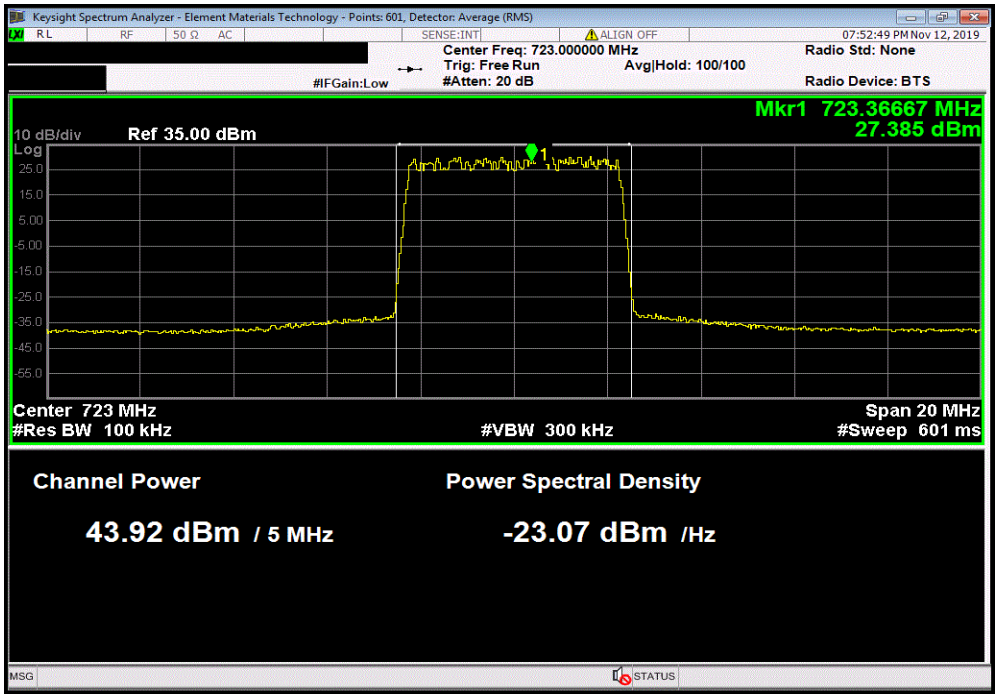
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (W ERP/MHz)	Results
Band 29					
QPSK Modulation					
LTE5 Bandwidth					
Mid Channel, 723.0 MHz	43.857	0	43.9	1000	Pass
16QAM Modulation					
LTE5 Bandwidth					
Mid Channel, 723.0 MHz	43.919	0	43.9	1000	Pass
64QAM Modulation					
LTE5 Bandwidth					
Mid Channel, 723.0 MHz	43.86	0	43.9	1000	Pass

AVERAGE POWER

Band 29, QPSK Modulation, LTE5 Bandwidth, Mid Channel, 723.0 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	43.857	0		43.9	1000	Pass



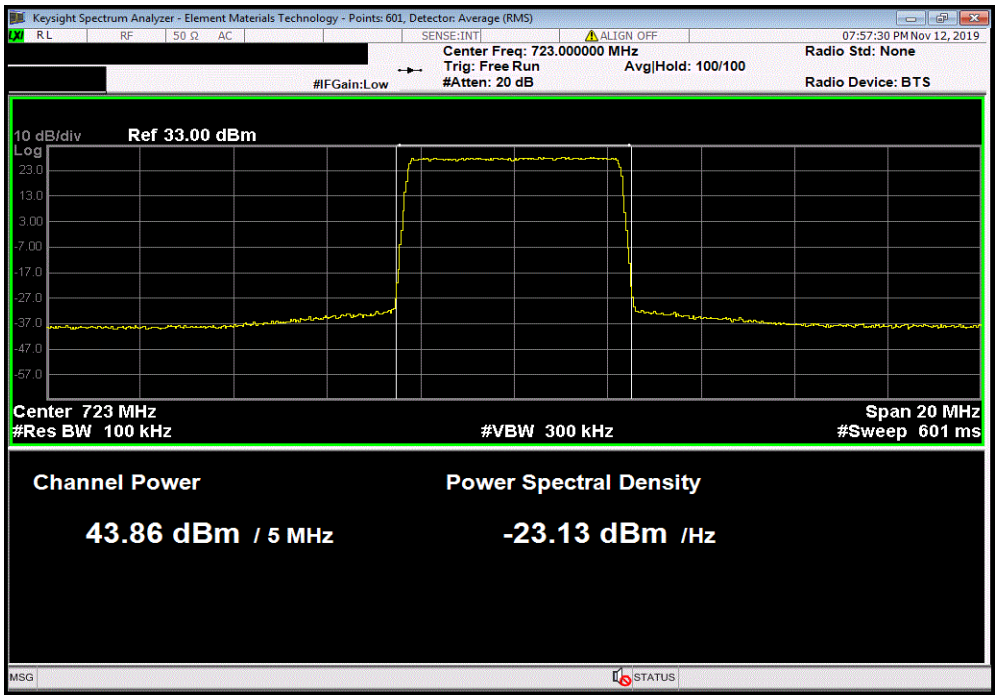
Band 29, 16QAM Modulation, LTE5 Bandwidth, Mid Channel, 723.0 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	43.919	0		43.9	1000	Pass



AVERAGE POWER

TbtTx 2019.08.30.0 XMit 2019.09.05

Band 29, 64QAM Modulation, LTE5 Bandwidth, Mid Channel, 723.0 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	43.86	0		43.9	1000	Pass



AVERAGE POWER

XMit 2019.09.05

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

TEST EQUIPMENT

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

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The fundamental emission output power (maximum average conducted output power) was measured using the channels and modes as called out on the following data sheets. The transmit power was set to its default maximum.

The method in section 5.2.4.4 of ANSI C63.26 was used to make the measurement. This method uses trace averaging across ON and OFF times of the EUT transmissions in the spectrum analyzer channel power function using an RMS detector. Following the measurement a duty cycle correction was applied by adding [10 log (1 / D)], where D is the duty cycle, to the measured power to compute the average power during the actual transmission times.

Per FCC section 27.50(c)(3), the Effective Radiated Power (ERP) of the transceiver cannot exceed 1000 Watts/MHz.

AVERAGE POWER

element

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	**AHLBBA RRH**			**Work Order:**	**NOKI0004**
Serial Number:	**K9193514835**			**Date:**	**18-Nov-19**
Customer:	**Nokia Solutions and Networks**			**Temperature:**	**22.4 °C**
Attendees:	**John Rattanavong**			**Humidity:**	**29.6% RH**
Project:	**None**			**Barometric Pres.:**	**1019 mbar**
Tested by:	**Jonathan Kiefer**	**Power:**	**54VDC**	**Job Site:**	**TX09**

TEST SPECIFICATIONS	**Test Method**
FCC 27:2019	ANSI C63.26:2015

COMMENTS

Band 29 average power measurements for 256QAM modulation type at Low, Mid and High channels for LTE5 and LTE10 channel bandwidths. Tested on highest power antenna port (Port 1) determined from antenna ports 1 & 4 measurements for LTE5/256QAM/Mid Channel. EUT is operated at 100% duty cycle. Note: 256QAM LTE5 BW Mid channel data shown elsewhere in the report. ERP depends on antenna gain, which is unknown. Only the highest dBm value is plotted per customer requirements and a Watt/MHz calculation was not made due to the unknown antenna value.

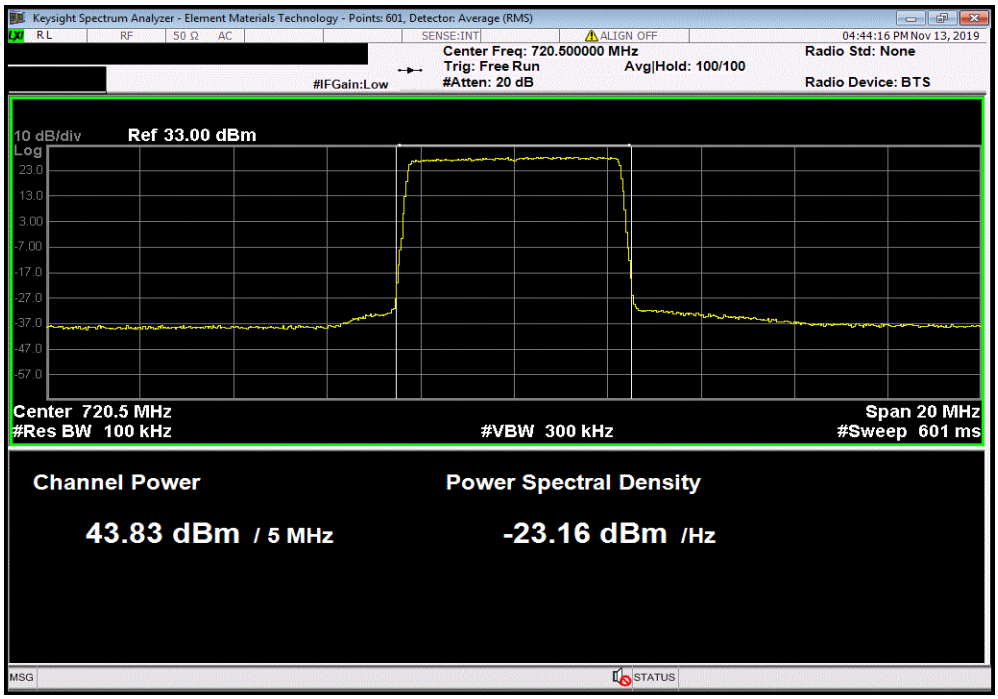
DEVIATIONS FROM TEST STANDARD

None

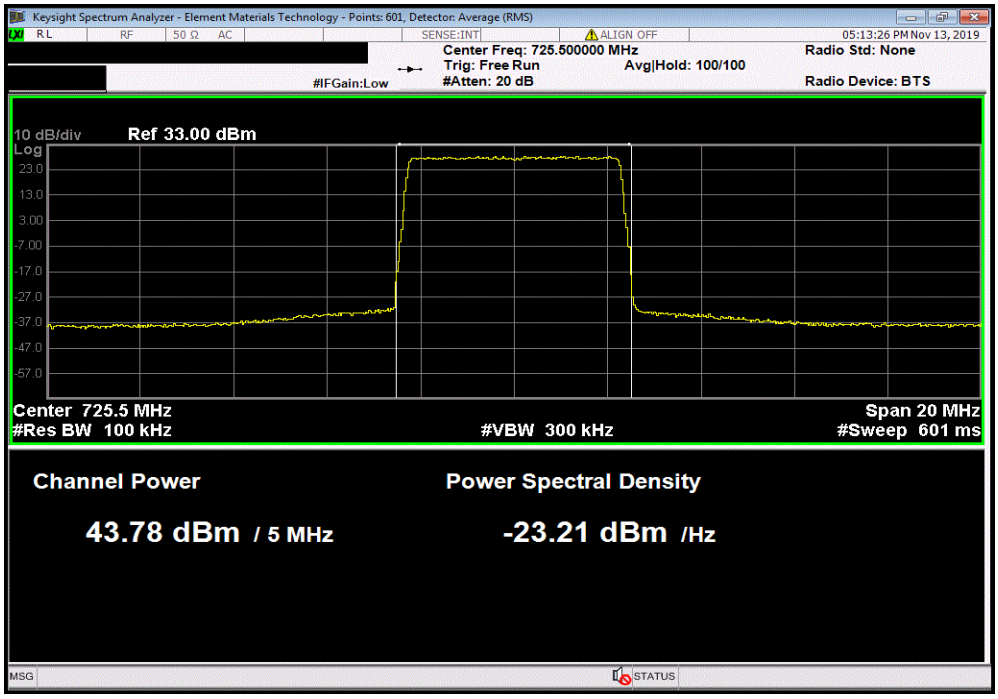
Configuration #	**2**	*Signature* Jonathan Kiefer

	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (W ERP/MHz)	Results
Band 29					
256QAM Modulation					
LTE5 Bandwidth					
Low Channel, 720.5 MHz	43.834	0	43.8	1000	Pass
High Channel, 725.5 MHz	43.784	0	43.8	1000	Pass
LTE10 Bandwidth					
Single Channel, 723.0 MHz	43.723	0	43.7	1000	Pass

Band 29, 256QAM Modulation, LTE5 Bandwidth, Low Channel, 720.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	43.834	0		43.8	1000	Pass



Band 29, 256QAM Modulation, LTE5 Bandwidth, High Channel, 725.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	43.784	0		43.8	1000	Pass



AVERAGE POWER

Band 29, 256QAM Modulation, LTE10 Bandwidth, Single Channel, 723.0 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP/MHz)	Results
	43.723	0		43.7	1000	Pass