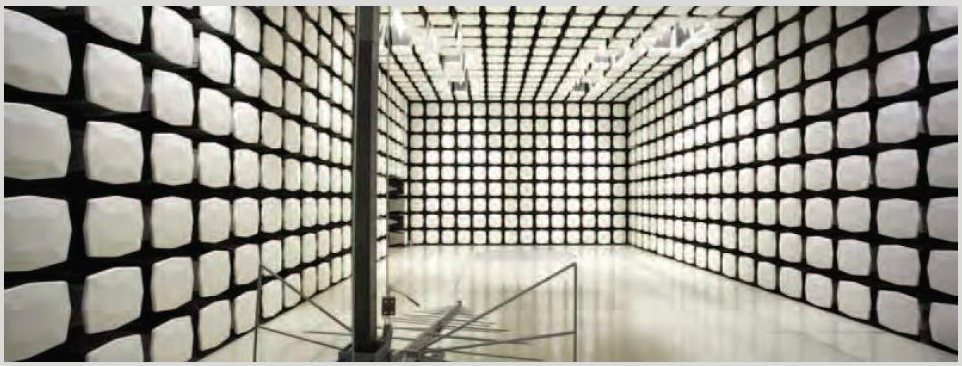
Nokia Solutions and Networks

Airscale Base Transceiver Station Remote Radio Head

Model: AHBOA

FCC 27:2019

Report # NOKI0003.1 Rev. 1



NVLAP LAB CODE: 201049-0

CERTIFICATE OF TEST

Last Date of Test: October 29, 2019
Nokia Solutions and Networks
EUT: Airscale Base Transceiver Station Remote Radio Head Model AHBOA

Radio Equipment Testing

Standards

Specification	Method
FCC 27:2019 FCC Part 2:2019 FCC 27.53:2019	ANSI C63.26:2015 with FCC KDB 971168 D01 v03r01 FCC KDB 971168 D03 v01 FCC KDB 662911D01 v02r01 ANSI C63.4:2014

Results

Method Clause	Test Description	Applied	Results	Comments
5.2.4	Average Output Power	Yes	Pass	
5.4	Occupied Bandwidth	Yes	Pass	
5.5	Spurious Radiated Emissions	Yes	Pass	
5.6	Frequency Stability	Yes	Pass	
5.7	Band Edge Compliance	Yes	Pass	
5.7	Spurious Conducted Emissions	Yes	Pass	
5.2.3.4	Peak to Average Power	Yes	Pass	Included for reference, not required by rule parts for the frequency band

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
01	Changed the table header from “617-652 MHz” to “746-756 MHz”.	2019-12-05	103

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

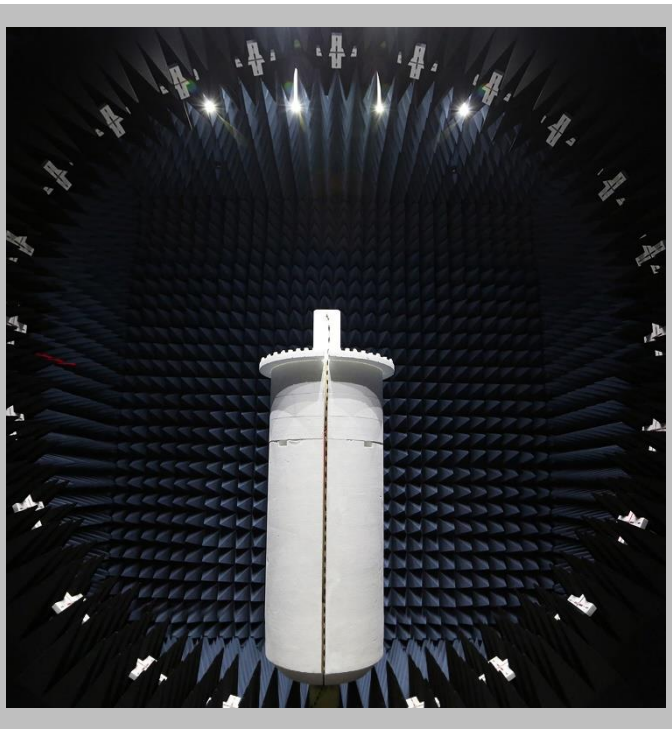
MIC – Recognized by MIC as a CAB for the acceptance of test data.

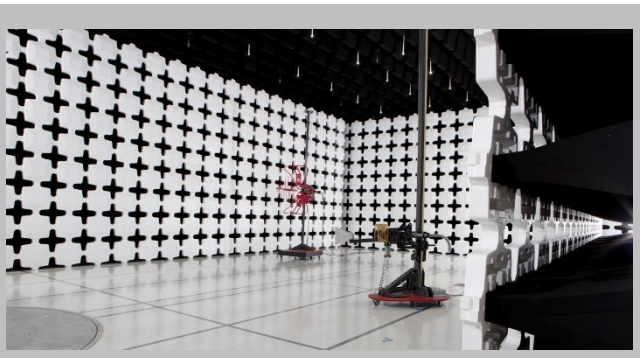
SCOPE

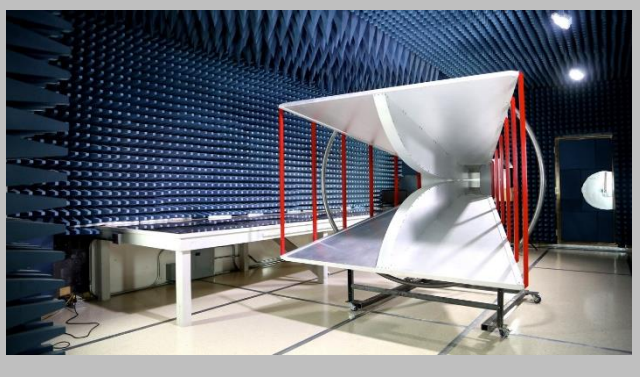
For details on the Scopes of our Accreditations, please visit:
https://www.nwemc.com/emc-testing-accreditations

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.

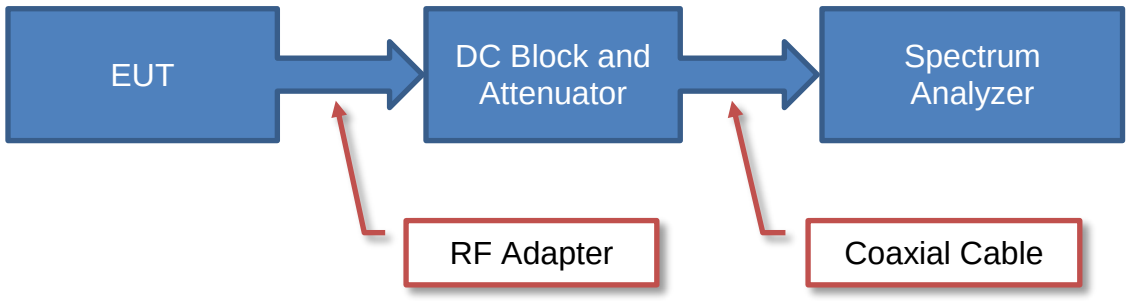
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable 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.

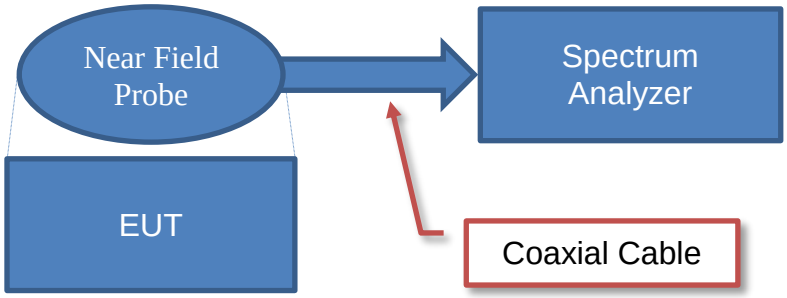
Test	+ MU	- MU
Frequency Accuracy	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	1.2 dB	-1.2 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field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

Test Setup Block Diagrams

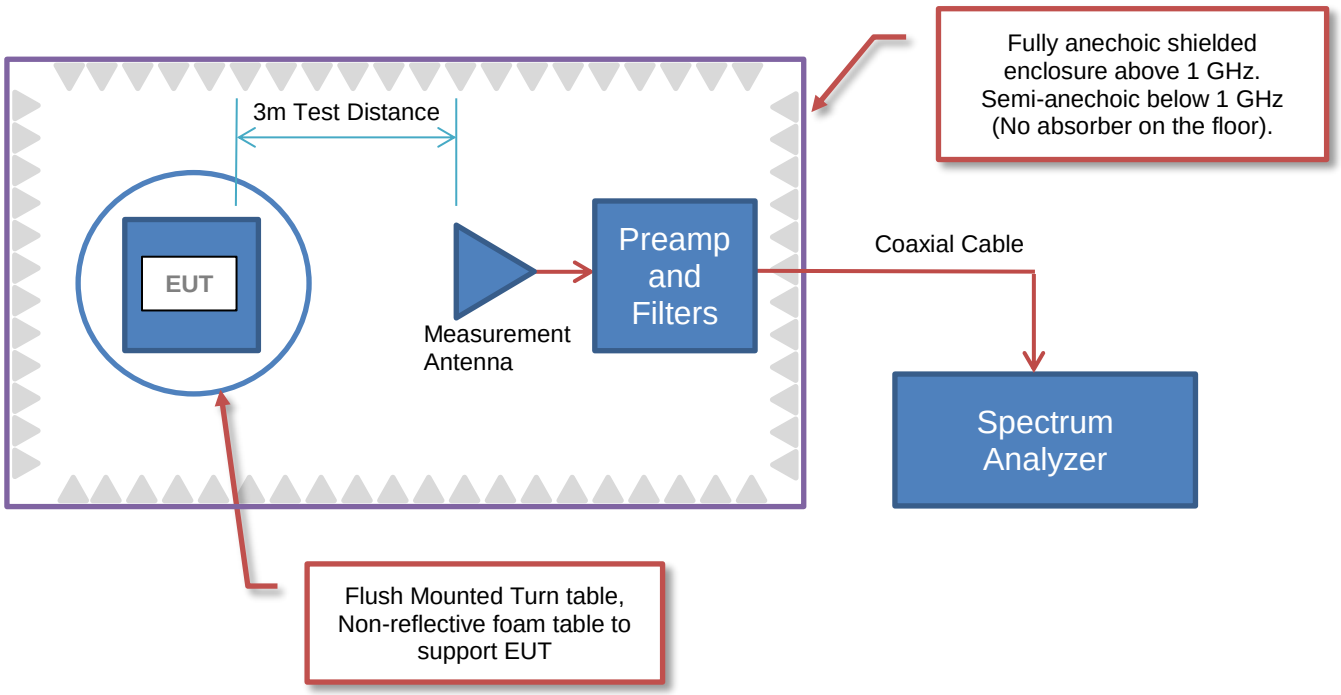
Antenna Port Conducted Measurements



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:	Airscale Base Transceiver Station Remote Radio Head Model AHBOA
First Date of Test:	October 21, 2019
Last Date of Test:	October 29, 2019
Receipt Date of Samples:	October 21, 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 AHBOA. The AHBOA 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 LTE-FDD operations.

The AHBOA RRH has four transmit/four receive antenna ports (4TX/4RX for Band 71 and 4TX/4RX for Band 13). Each antenna port supports 3GPP frequency band 71 (BTS Rx: 663 to 698 MHz/BTS TX: 617 to 652 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 240 Watts (60 watts per carrier, 60 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 5, 10, 15 and 20MHz for 3GPP frequency band 71 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). 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 RRH may be configured with optional cooling fan.

The AHBOA LTE downlink channel numbers and frequencies are as follows:

	Downlink EARFCN	Downlink Frequency (MHz)	LTE Channel Bandwidth			
			5 MHz	10 MHz	15 MHz	20 MHz
Band 71 (Ant 1, 2, 3, 4)	68586	617.0	Band Edge	Band Edge	Band Edge	Band Edge
	……					
	68611	619.5	Bottom Ch			
	……					
	68636	622.0		Bottom Ch		
	……					
	68661	624.5			Bottom Ch	
	……					
	68686	627.0				Bottom Ch
	……					
	68761	634.5	Middle Ch	Middle Ch	Middle Ch	Middle Ch
	……					
	68836	642.0				Top Channel
	……					
	68861	644.5			Top Channel	
	……					
	68886	647.0		Top Channel		
	……					
	68911	649.5	Top Channel			
	……					
	68936	652.0	Band Edge	Band Edge	Band Edge	Band Edge

AHBOA Downlink Band Edge LTE Band 71 Frequency Channels

Notes:
Multicarrier operations in band 71 with three LTE5 carriers (based upon KDB 971168 D03v01) using two carriers (with minimum spacing between carrier frequencies) at the lower band edge [619.5MHz and 624.5MHz] and a third carrier with maximum spacing between the other two carrier frequencies [649.5MHz] at the upper band edge. The smallest available LTE channel bandwidth (5MHz) was selected for multicarrier test cases because it has the highest spectral density (power/Hz).

Multiband Multicarrier operations (band 71 and band 13) with three LTE5 carriers (based upon KDB 971168 D03v01) using two carriers (with minimum spacing between carrier frequencies) at the band 71 lower band edge [619.5MHz and 624.5MHz] and a third carrier with maximum spacing between the other two carrier frequencies [753.5MHz] at the band 13 upper band edge.

	Downlink EARFCN	Downlink Frequency (MHz)	LTE Channel Bandwidth	
			5 MHz	10 MHz
AHBOA 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

AHBOA Downlink Band Edge LTE Band 13 Frequency Channels

Notes:
Multicarrier operations in band 13 with two LTE5 carriers at the lower and upper band edge channels [748.5MHz (ARFCN 5205) and 753.5MHz (ARFCN 5255)]. Two carriers cover the entire channel bandwidth so three carrier operation is not available.
Multiband Multicarrier operations (band 71 and band 13) with three LTE5 carriers (based upon KDB 971168 D03v01) using two carriers (with minimum spacing between carrier frequencies) at the band 71 lower band edge [619.5MHz and 624.5MHz] and a third carrier with maximum spacing between the other two carrier frequencies [753.5MHz] at the band 13 upper band edge.

Testing Objective:

Seeking to demonstrate compliance of the radio (617-652MHz & 746-756MHz).

CONFIGURATIONS

Configuration NOKI0003- 1

Software/Firmware Running during test	
Description	**Version**
BTS Software	SBTS00_ENB_9999_190814_002419
RRH Software	FRM59.08.R08

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Remote Radio Head Module	Nokia Solutions and Networks	AHBOA / 475250A.101	BL1934X1001

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
SFP+ 9.8G 300m 850 nm	Nokia	473842A.101	KR16090020071

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
40dB 250W Attenuator	API Weinschel, Inc.	58-40-53-LIM	TC909
Electric Fan	Electrix	L908	None
Power Supply(RRH)	HP	6032A	211754
Power Supply(Base Station)	Emerson	AA27050L	None
Laptop Computer	HP	ProBook 6470B	None
Power Supply(Laptop)	HP	608428-002	F12941232064008
USB Mouse	IBM	MO25UO	23-473462
Antenna Load 1	API Weinschel, Inc.	1433-3-LIM	TC867
Antenna Load 2	API Weinschel, Inc.	1433-3-LIM	TC870
Antenna Load 3	API Weinschel, Inc.	1433-3-LIM	TC866
AirScale Base Station (ASIA Module)	Nokia	473095A.203	AH173111443
AirScale Base Station (ABIA Module 1)	Nokia	473096A.102	L1164015939
AirScale Base Station (ABIA Module 2)	Nokia	473096A.103	AH173006372

CONFIGURATIONS

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
N Type SUCOFLEX_104	Yes	0.9m	No	40dB 250W Attenuator	Spectrum Analyzer
N Type SUCOFLEX_106	Yes	1.6m	No	40dB 250W Attenuator	Remote Radio Head Module
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
AC Power (Fan)	No	2m	No	AC Mains	Electric Fan
AC Power (PS RRH)	No	2.2m	No	AC Mains	Power Supply(RRH)
DC Power (PS RRH)	No	1.7m	No	Power Supply(RRH)	Remote Radio Head Module
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 Module)
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	1.8	No	Laptop Computer	AirScale Base Station (ASIA Module)
Optical Fiber	No	2m	No	AirScale Base Station (ABIA Module 1)	Remote Radio Head Module

CONFIGURATIONS

Configuration NOKI0003- 2

Software/Firmware Running during test	
Description	**Version**
BTS Software	SBTS00_ENB_9999_190814_002419
RRH Software	FRM59.08.R08

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Remote Radio Head Module	Nokia Solutions and Networks	AHBOA / 475250A.101	BL1934X1001

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
SFP+ 9.8G 300m 850 nm	Nokia	473842A.101	KR16090020071

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Electric Fan	Electrix	L908	None
Power Supply(RRH)	HP	6032A	211754
Power Supply(Base Station)	Emerson	AA27050L	None
Laptop Computer	HP	ProBook 6470B	None
Power Supply(Laptop)	HP	608428-002	F12941232064008
USB Mouse	IBM	MO25UO	23-473462
Antenna Load 1	API Weinschel, Inc.	1433-3-LIM	TC867
Antenna Load 2	API Weinschel, Inc.	1433-3-LIM	TC870
Antenna Load 3	API Weinschel, Inc.	1433-3-LIM	TC866
20dB 150W Attenuator	Aeroflex/Weinschel	66-20-33	BZ1165
10dB 150W Attenuator	Weinschel Corp.	6375	BJ2483
Low Pass Filter 1	Mini-Circuits	NLP-550	None
Low Pass Filter 2	Mini-Circuits	NLP-550	None
Low Pass Filter 3	Mini-Circuits	NLP-550	None
AirScale Base Station (ASIA Module)	Nokia	473095A.203	AH173111443
AirScale Base Station (ABIA Module 1)	Nokia	473096A.102	L1164015939
AirScale Base Station (ABIA Module 2)	Nokia	473096A.103	AH173006372

CONFIGURATIONS

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
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
AC Power (Fan)	No	2m	No	AC Mains	Electric Fan
AC Power (PS RRH)	No	2.2m	No	AC Mains	Power Supply(RRH)
DC Power (PS RRH)	No	1.7m	No	Power Supply(RRH)	Remote Radio Head Module
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 Module)
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	1.8	No	Laptop Computer	AirScale Base Station (ASIA Module)
Optical Fiber	No	2m	No	AirScale Base Station (ABIA Module 1)	Remote Radio Head Module
N Type SUCOFLEX_104	Yes	0.9m	No	Low Pass Filter 1	Spectrum Analyzer
N Type SUCOFLEX_106	Yes	1.6m	No	20dB 150W Attenuator	Remote Radio Head Module

CONFIGURATIONS

Configuration NOKI0003- 3

Software/Firmware Running during test	
Description	**Version**
BTS Software	SBTS00_ENB_9999_190814_002419
RRH Software	FRM59.08.R08

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Remote Radio Head Module	Nokia Solutions and Networks	AHBOA / 475250A.101	BL1934X1001

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
SFP+ 9.8G 300m 850 nm	Nokia	473842A.101	KR16090020071

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Electric Fan	Electrix	L908	None
Power Supply(RRH)	HP	6032A	211754
Power Supply(Base Station)	Emerson	AA27050L	None
Laptop Computer	HP	ProBook 6470B	None
Power Supply(Laptop)	HP	608428-002	F12941232064008
USB Mouse	IBM	MO25UO	23-473462
Antenna Load 1	API Weinschel, Inc.	1433-3-LIM	TC867
Antenna Load 2	API Weinschel, Inc.	1433-3-LIM	TC870
Antenna Load 3	API Weinschel, Inc.	1433-3-LIM	TC866
20dB 150W Attenuator	Aeroflex/Weinschel	66-20-33	BZ1165
3dB Attenuator	Aeroflex/Weinschel	47-3-33	CG5493
High Pass Filter	RLC ELECTRONICS	F-14699	0050
AirScale Base Station (ASIA Module)	Nokia	473095A.203	AH173111443
AirScale Base Station (ABIA Module 1)	Nokia	473096A.102	L1164015939
AirScale Base Station (ABIA Module 2)	Nokia	473096A.103	AH173006372

CONFIGURATIONS

element
2018-07-17

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
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
AC Power (Fan)	No	2m	No	AC Mains	Electric Fan
AC Power (PS RRH)	No	2.2m	No	AC Mains	Power Supply(RRH)
DC Power (PS RRH)	No	1.7m	No	Power Supply(RRH)	Remote Radio Head Module
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 Module)
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	1.8	No	Laptop Computer	AirScale Base Station (ASIA Module)
Optical Fiber	No	2m	No	AirScale Base Station (ABIA Module 1)	Remote Radio Head Module
N Type SUCOFLEX_104	Yes	0.9m	No	High Pass Filter	Spectrum Analyzer
N Type SUCOFLEX_106	Yes	1.6m	No	20dB 150W Attenuator	Remote Radio Head Module

CONFIGURATIONS

Configuration NOKI0003- 4

Software/Firmware Running during test	
Description	**Version**
BTS Software	SBTS00_ENB_9999_190814_002419
RRH Software	FRM59.08.R08

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Remote Radio Head Module	Nokia Solutions and Networks	AHBOA / 475250A.101	BL1934X1001

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
SFP+ 9.8G 300m 850 nm	Nokia	473842A.101	KR16090020071

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Electric Fan	Electrix	L908	None
Power Supply(Base Station)	Emerson	AA27050L	None
Laptop Computer	HP	ProBook 6470B	None
Power Supply(Laptop)	HP	608428-002	F12941232064008
USB Mouse	IBM	MO25UO	23-473462
Antenna Load 1	API Weinschel, Inc.	1433-3-LIM	TC867
Antenna Load 2	API Weinschel, Inc.	1433-3-LIM	TC870
Antenna Load 3	API Weinschel, Inc.	1433-3-LIM	TC866
AirScale Base Station (ASIA Module)	Nokia	473095A.203	AH173111443
AirScale Base Station (ABIA Module 1)	Nokia	473096A.102	L1164015939
AirScale Base Station (ABIA Module 2)	Nokia	473096A.103	AH173006372
DC Power Supply (Radiated)	Sorenson	SGA160X63C-0AAA	1421A03560
Antenna Load 4	API Weinschel, Inc.	1433-3-LIM	TV066

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 Module)
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	1.8	No	Laptop Computer	AirScale Base Station (ASIA Module)
AC Power (Sorenson)	No	4m	No	AC Mains	DC Power Supply (Radiated)
DC Power Leads (Sorenson)	No	7.5m	No	DC Power Supply (Radiated)	Remote Radio Head Module
Optical Fiber (Radiated)	No	7.5m	No	AirScale Base Station (ABIA Module 1)	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 NOKI0003- 5

Software/Firmware Running during test	
Description	**Version**
BTS Software	SBTS00_ENB_9999_190814_002419
RRH Software	FRM59.08.R08

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Remote Radio Head Module	Nokia Solutions and Networks	AHBOA / 475250A.101	BL1934X1001

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
SFP+ 9.8G 300m 850 nm	Nokia	473842A.101	KR16090020071

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
40dB 250W Attenuator	API Weinschel, Inc.	58-40-53-LIM	TC909
Power Supply(RRH)	HP	6032A	211754
Power Supply(Base Station)	Emerson	AA27050L	None
Laptop Computer	HP	ProBook 6470B	None
Power Supply(Laptop)	HP	608428-002	F12941232064008
USB Mouse	IBM	MO25UO	23-473462
AirScale Base Station (ASIA Module)	Nokia	473095A.203	AH173111443
AirScale Base Station (ABIA Module 1)	Nokia	473096A.102	L1164015939
AirScale Base Station (ABIA Module 2)	Nokia	473096A.103	AH173006372

CONFIGURATIONS

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
AC Power (PS RRH)	No	2.2m	No	AC Mains	Power Supply(RRH)
DC Power (PS RRH)	No	1.7m	No	Power Supply(RRH)	Remote Radio Head Module
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 Module)
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	1.8	No	Laptop Computer	AirScale Base Station (ASIA Module)
Optical Fiber	No	2m	No	AirScale Base Station (ABIA Module 1)	Remote Radio Head Module
Grounding	No	2.3m	No	Remote Radio Head Module	Turntable Ground
N Type MEGAPHASE (EUT to Atten)	Yes	2m	No	Remote Radio Head Module	40dB 250W Attenuator
N Type (MEGAPHASE (Atten to Spec An)	Yes	1m	No	40dB 250W Attenuator	Spectrum Analyzer

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2019-10-21	Average Output Power (Band 71 All Ports)	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	2019-10-21	Peak to Average Power (PAPR)CCDF (Band 71 All Ports)	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	2019-10-23	Peak to Average Power (PAPR)CCDF (Band 71 All Mods)	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	2019-10-23	Peak to Average Power (PAPR)CCDF (Band 71 All Bandwidths)	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	2019-10-23	Peak to Average Power (PAPR)CCDF (Band 13 All Ports)	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	2019-10-23	Average Output Power (Band 71 All Mods)	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	2019-10-23	Average Output Power (Band 71 All Bandwidths)	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	2019-10-23	Average Output Power (Band 71 Multicarrier)	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
9	2019-10-23	Average Output Power (Band 13 All Ports)	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
10	2019-10-23	Average Output Power (Band 13 All Mods)	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
11	2019-10-23	Average Output Power (Band 13 All Bandwidths)	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
12	2019-10-23	Average Output Power (Band 13 Multicarrier)	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
13	2019-10-23	Occupied Bandwidth (Band 71)	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.

MODIFICATIONS

Item	Date	Test	Modification	Note	Disposition of EUT
14	2019-10-23	Occupied Bandwidth (Band 13)	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
15	2019-10-23	Spurious Conducted Emissions (Band 71 Single, Band 13 Single)	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
16	2019-10-24	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.
17	2019-10-28	Band Edge Compliance (Band 71 Single Carrier)	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
18	2019-10-28	Band Edge Compliance (Band 71 Multicarrier)	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
19	2019-10-28	Band Edge Compliance (Band 13 Single Carrier)	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
20	2019-10-28	Band Edge Compliance (Band 13 Multicarrier)	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
21	2019-10-28	Band Edge Compliance (Band 71-13 Multicarrier)	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
22	2019-10-28	Spurious Conducted Emissions (Multiband Multicarrier)	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
23	2019-10-28	Peak to Average Power (PAPR)CCDF (Band 13 All Mods)	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
24	2019-10-28	Peak to Average Power (PAPR)CCDF (Band 13 All Bandwidths)	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
25	2019-10-29	Frequency Stability	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

AVERAGE OUTPUT 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 27.50(b)(4), the Effective Radiated Power (ERP) of the transceiver cannot exceed 1000 Watts/MHz.

AVERAGE OUTPUT POWER

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	**AHBOA Remote Radio Head (RRH)**			**Work Order:**	**NOKI0003**
Serial Number:	**BL1934X1001**			**Date:**	**21-Oct-19**
Customer:	**Nokia Solutions and Networks**			**Temperature:**	**22.7 °C**
Attendees:	**Hobert Smith, John Rattanavong, Mitchell Hill**			**Humidity:**	**36.6% RH**
Project:	**None**			**Barometric Pres.:**	**1020 mbar**
Tested by:	**Jonathan Kiefer**	**Power:**	**48VDC**	**Job Site:**	**TX09**

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

COMMENTS

Band 71 average power measurements on all four antenna ports. EUT is operated at 100% duty cycle. ERP depends on antenna gain, which is unknown.

DEVIATIONS FROM TEST STANDARD

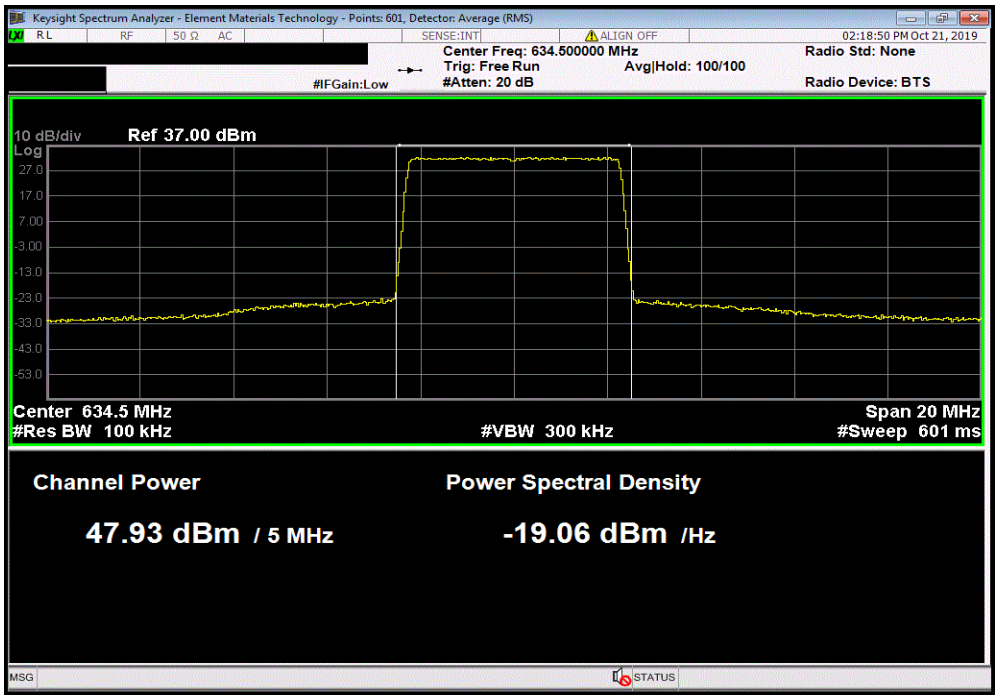
None

Configuration #	**1**	*Signature* Jonathan Kiefer

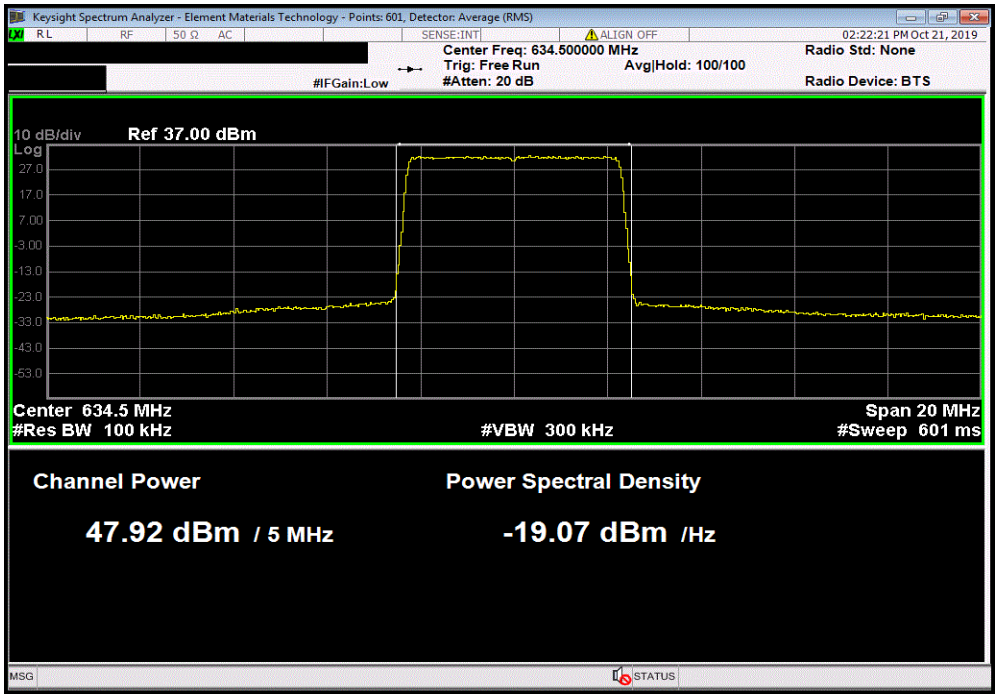
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Avg Cond Pwr (dBm)	Limit (W ERP)	Results
Band 71					
256QAM Modulation					
LTE5 Bandwidth					
Mid Channel, 634.5 MHz					
Antenna Port 1	47.925	0	47.9	1000	Pass
Antenna Port 2	47.92	0	47.9	1000	Pass
Antenna Port 3	47.82	0	47.8	1000	Pass
Antenna Port 4	47.927	0	47.9	1000	Pass

AVERAGE OUTPUT POWER

Band 71, 256QAM Modulation, LTE5 Bandwidth, Mid Channel, 634.5 MHz, Antenna Port 1						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Avg Cond Pwr (dBm)	Limit (W ERP)	Results
	47.925	0		47.9	1000	Pass

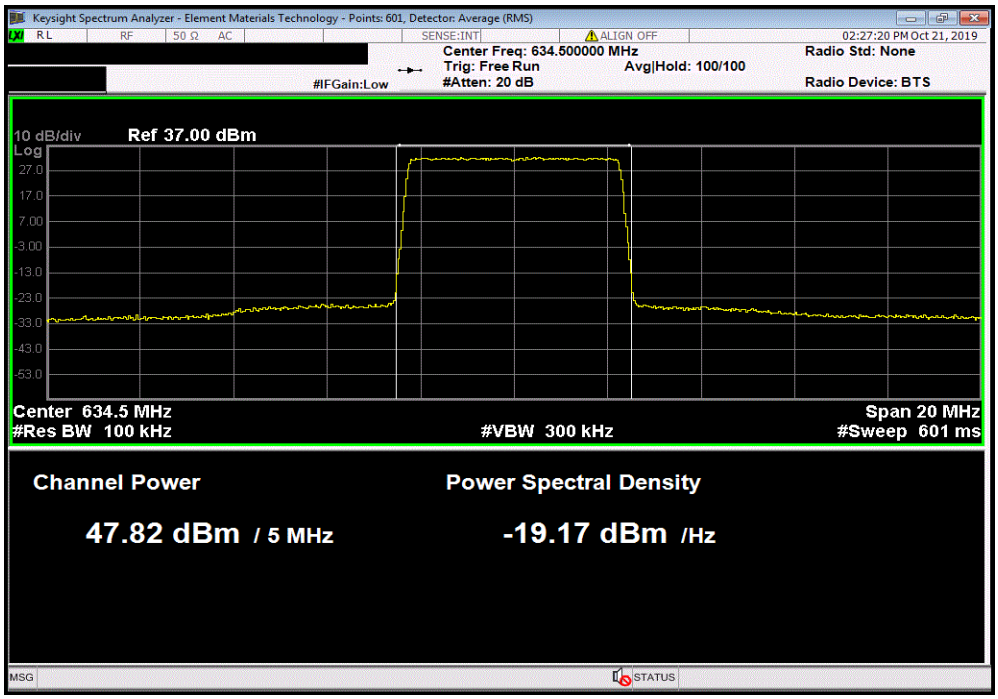


Band 71, 256QAM Modulation, LTE5 Bandwidth, Mid Channel, 634.5 MHz, Antenna Port 2						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Avg Cond Pwr (dBm)	Limit (W ERP)	Results
	47.92	0		47.9	1000	Pass

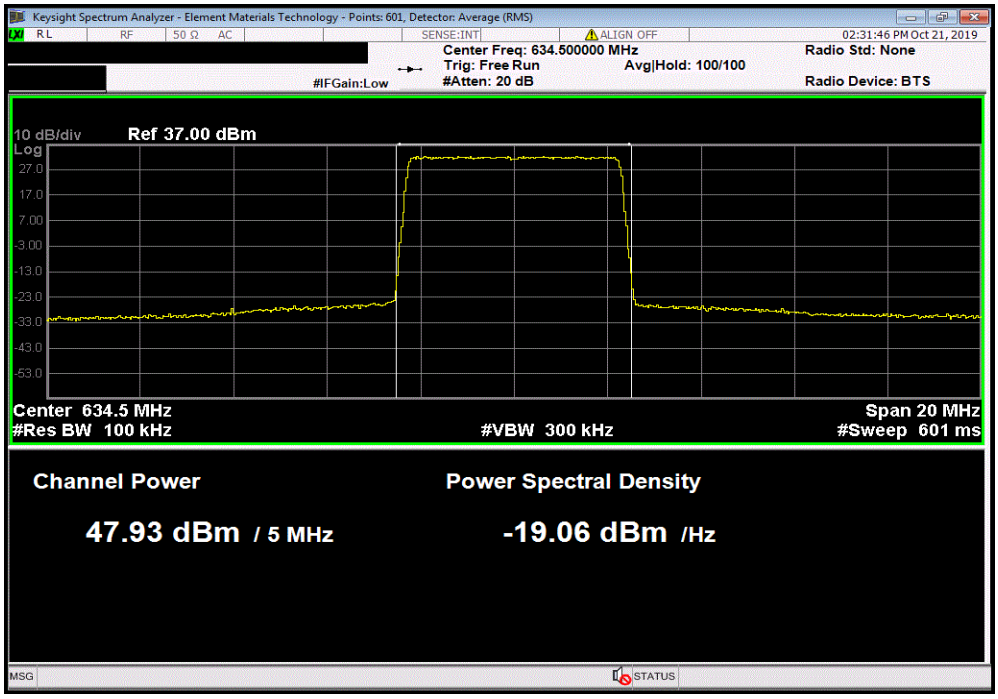


AVERAGE OUTPUT POWER

Band 71, 256QAM Modulation, LTE5 Bandwidth, Mid Channel, 634.5 MHz, Antenna Port 3						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Avg Cond Pwr (dBm)	Limit (W ERP)	Results
	47.82	0		47.8	1000	Pass



Band 71, 256QAM Modulation, LTE5 Bandwidth, Mid Channel, 634.5 MHz, Antenna Port 4						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Avg Cond Pwr (dBm)	Limit (W ERP)	Results
	47.927	0		47.9	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) and 27.50(b)(4), the Effective Radiated Power (ERP) of the transceiver cannot exceed 1000 Watts/MHz.

AVERAGE OUTPUT POWER

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	**AHBOA Remote Radio Head (RRH)**			**Work Order:**	**NOKI0003**
Serial Number:	**BL1934X1001**			**Date:**	**23-Oct-19**
Customer:	**Nokia Solutions and Networks**			**Temperature:**	**22 °C**
Attendees:	**Hobert Smith, John Rattanavong, Mitchell Hill**			**Humidity:**	**38.7% RH**
Project:	**None**			**Barometric Pres.:**	**1020 mbar**
Tested by:	**Jonathan Kiefer**	**Power:**	**48VDC**	**Job Site:**	**TX09**

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

COMMENTS

Band 71 average power measurements for LTE5 channel bandwidth at Mid Channel 634.5MHz for four modulation types (QPSK, 16QAM, 64QAM, 256QAM). Tested at highest antenna port (Port 1). EUT is operated at 100% duty cycle. ERP depends on antenna gain, which is unknown.

DEVIATIONS FROM TEST STANDARD

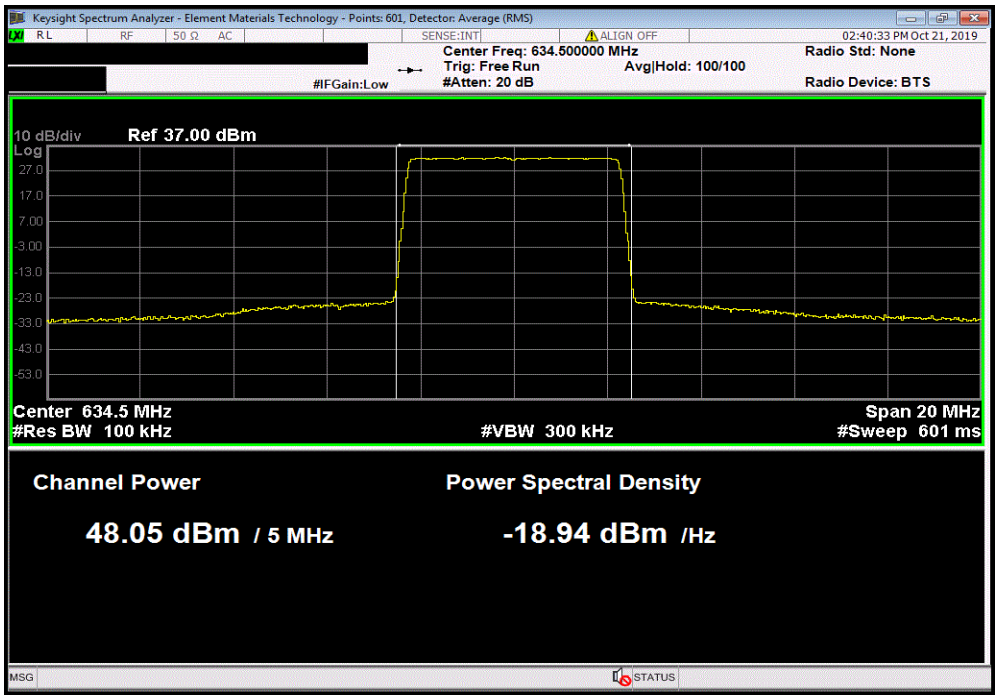
None

Configuration #	**1**	*Signature* Jonathan Kiefer

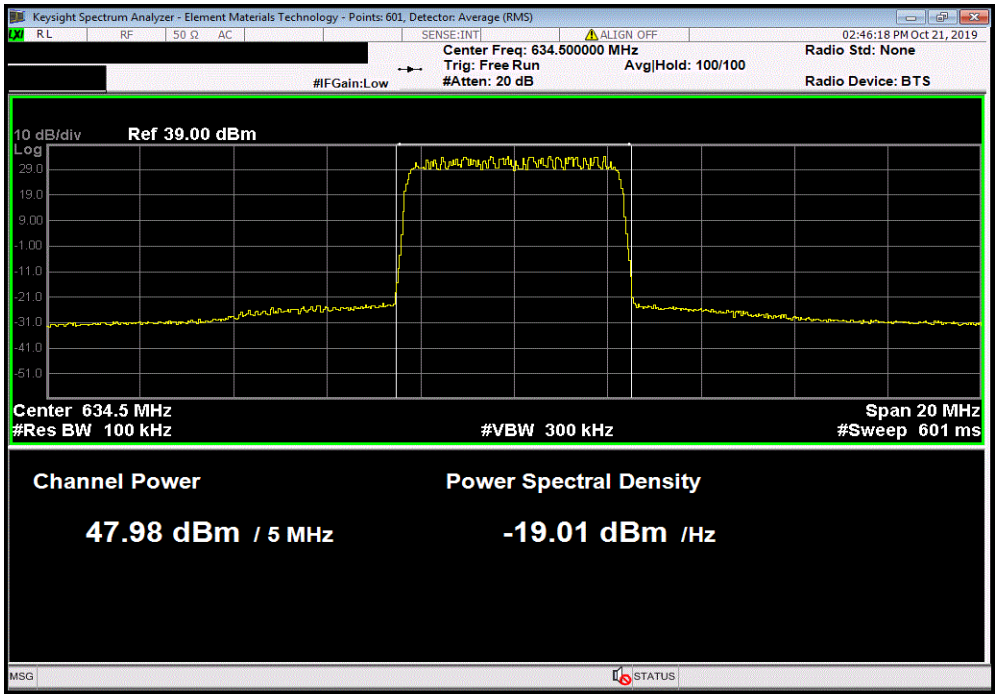
		Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (W ERP)	Results
Band 71						
	QPSK Modulation					
	LTE5 Bandwidth	48.045	0	48	1000	Pass
	16QAM Modulation					
	LTE5 Bandwidth	47.979	0	48	1000	Pass
	64QAM Modulation					
	LTE5 Bandwidth	48.084	0	48.1	1000	Pass
	256QAM Modulation					
	LTE5 Bandwidth	48	0	48	1000	Pass

AVERAGE OUTPUT POWER

Band 71, QPSK Modulation, LTE5 Bandwidth						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	48.045	0		48	1000	Pass

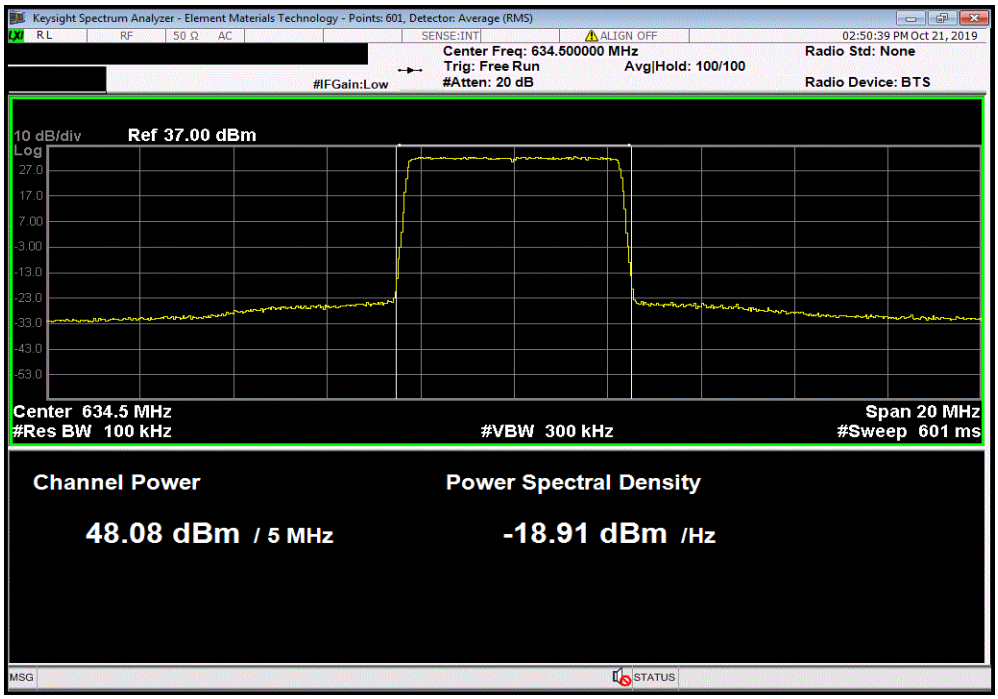


Band 71, 16QAM Modulation, LTE5 Bandwidth						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	47.979	0		48	1000	Pass

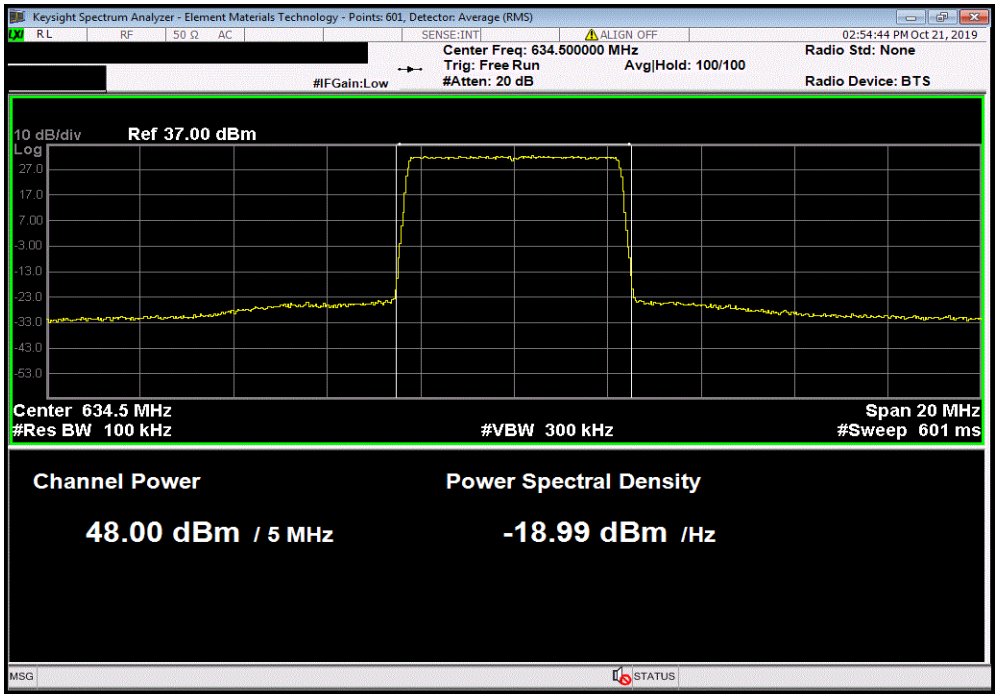


AVERAGE OUTPUT POWER

Band 71, 64QAM Modulation, LTE5 Bandwidth						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	48.084	0		48.1	1000	Pass



Band 71, 256QAM Modulation, LTE5 Bandwidth						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	48	0		48	1000	Pass



AVERAGE OUTPUT 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 27.50(b)(4), the Effective Radiated Power (ERP) of the transceiver cannot exceed 1000 Watts/MHz.

AVERAGE OUTPUT POWER

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	**AHBOA Remote Radio Head (RRH)**			**Work Order:**	**NOKI0003**
Serial Number:	**BL1934X1001**			**Date:**	**23-Oct-19**
Customer:	**Nokia Solutions and Networks**			**Temperature:**	**22.4 °C**
Attendees:	**Hobert Smith, John Rattanavong, Mitchell Hill**			**Humidity:**	**37.8% RH**
Project:	**None**			**Barometric Pres.:**	**1020 mbar**
Tested by:	**Jonathan Kiefer**	**Power:**	**48VDC**	**Job Site:**	**TX09**

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

COMMENTS

Band 71 average power measurements for 256QAM modulation type at Low, Mid and High channels for four (5,10,15, 20MHz) channel bandwidths. Tested at highest antenna port (Port 1). 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.

DEVIATIONS FROM TEST STANDARD

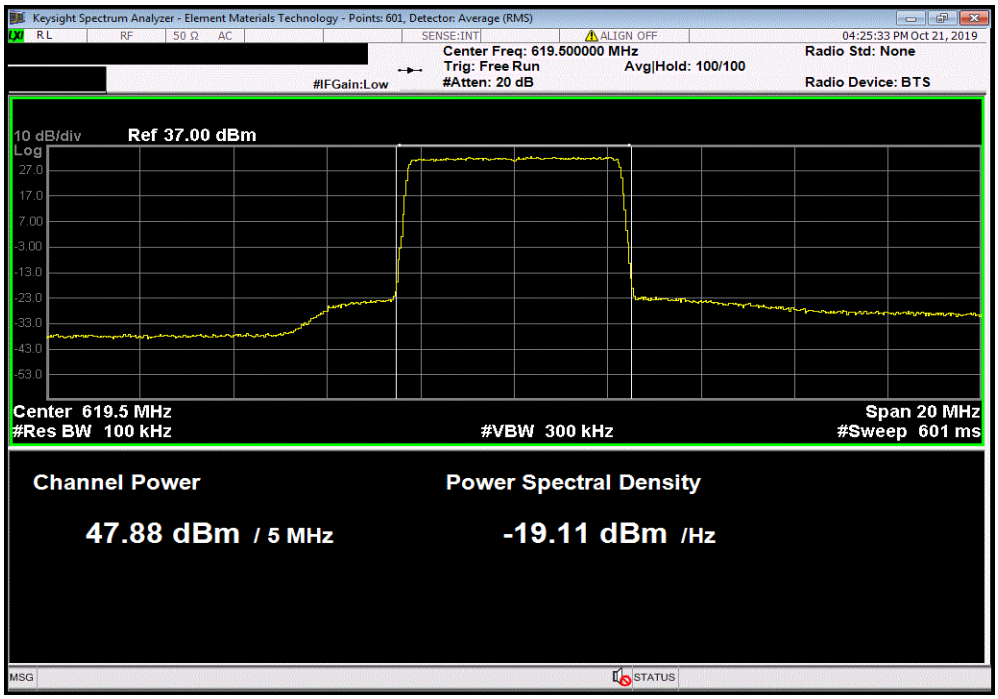
None

Configuration #	**1**	*Signature* Jonathan Kiefer

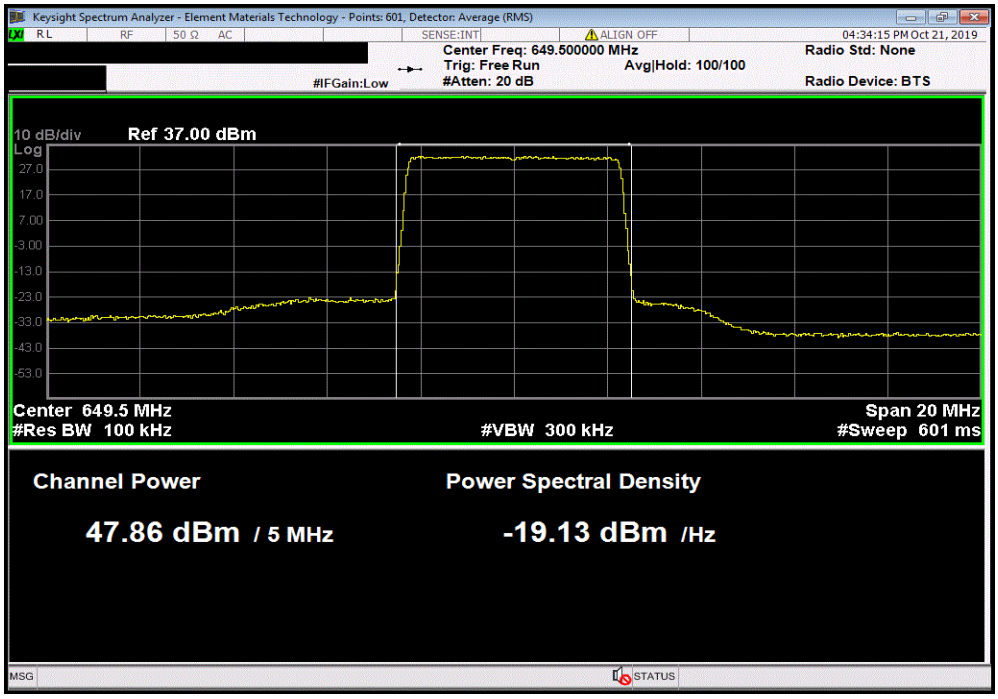
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (W ERP)	Results
Band 71					
256QAM Modulation					
LTE5 Bandwidth					
Low Channel, 619.5 MHz	47.875	0	47.9	1000	Pass
High Channel, 649.5 MHz	47.856	0	47.9	1000	Pass
LTE10 Bandwidth					
Low Channel, 622 MHz	47.975	0	48	1000	Pass
Mid Channel, 634.5 MHz	47.86	0	47.9	1000	Pass
High Channel, 647 MHz	47.972	0	48	1000	Pass
LTE15 Bandwidth					
Low Channel, 624.5 MHz	47.991	0	48	1000	Pass
Mid Channel, 634.5 MHz	47.847	0	47.8	1000	Pass
High Channel, 644.5 MHz	47.99	0	48	1000	Pass
LTE20 Bandwidth					
Low Channel, 627 MHz	48.029	0	48	1000	Pass
Mid Channel, 634.5 MHz	47.923	0	47.9	1000	Pass
High Channel, 642 MHz	48.064	0	48.1	1000	Pass

AVERAGE OUTPUT POWER

Band 71, 256QAM Modulation, LTE5 Bandwidth, Low Channel, 619.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	47.875	0		47.9	1000	Pass

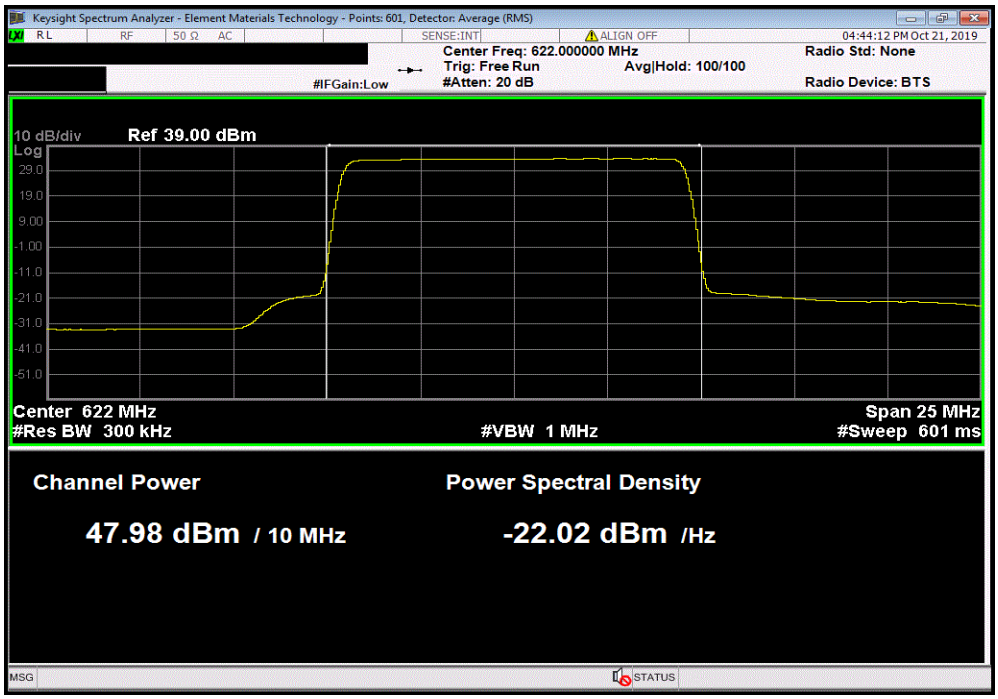


Band 71, 256QAM Modulation, LTE5 Bandwidth, High Channel, 649.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	47.856	0		47.9	1000	Pass

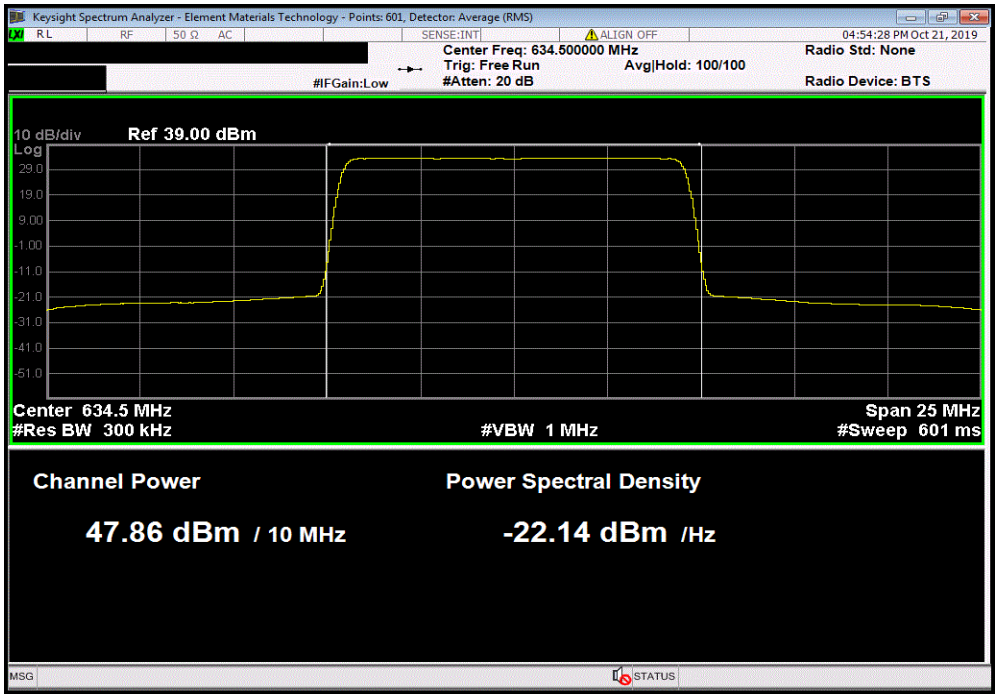


AVERAGE OUTPUT POWER

Band 71, 256QAM Modulation, LTE10 Bandwidth, Low Channel, 622 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	47.975	0		48	1000	Pass

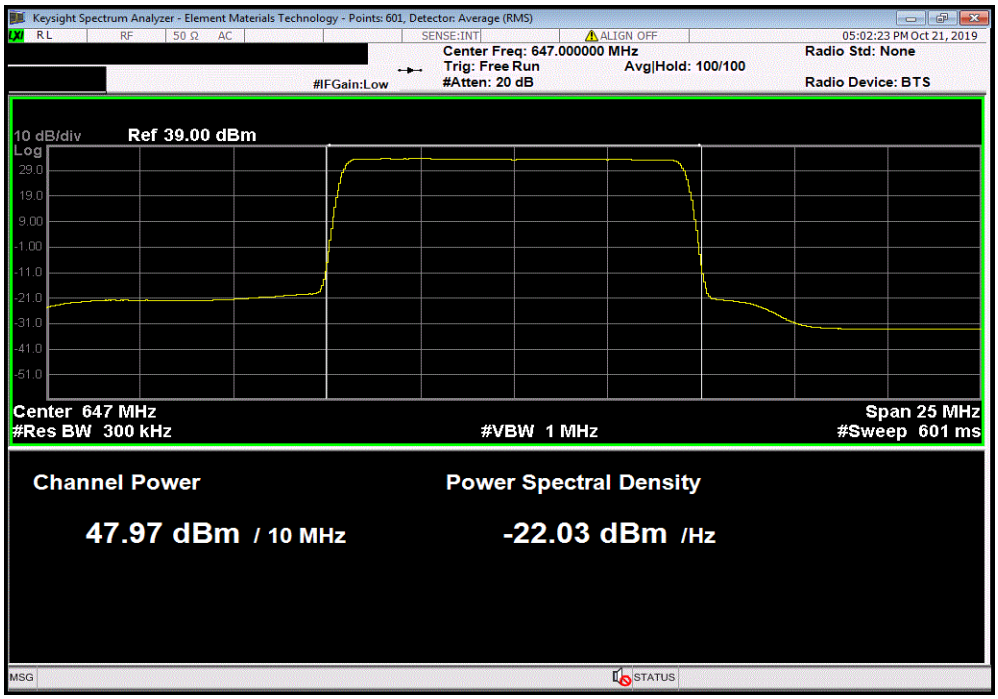


Band 71, 256QAM Modulation, LTE10 Bandwidth, Mid Channel, 634.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	47.86	0		47.9	1000	Pass

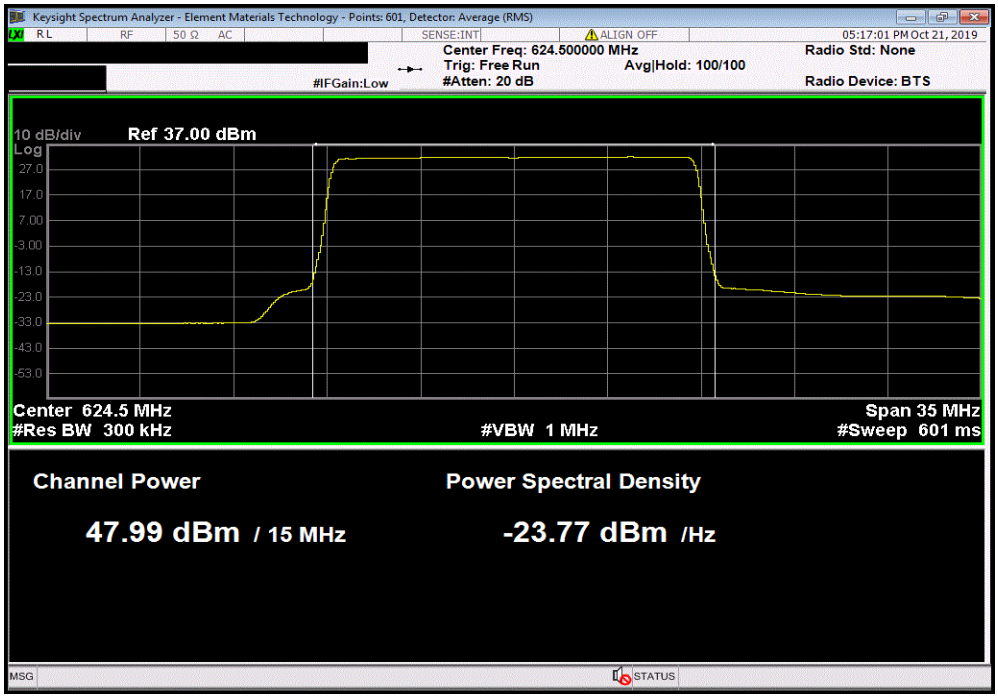


AVERAGE OUTPUT POWER

Band 71, 256QAM Modulation, LTE10 Bandwidth, High Channel, 647 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	47.972	0		48	1000	Pass

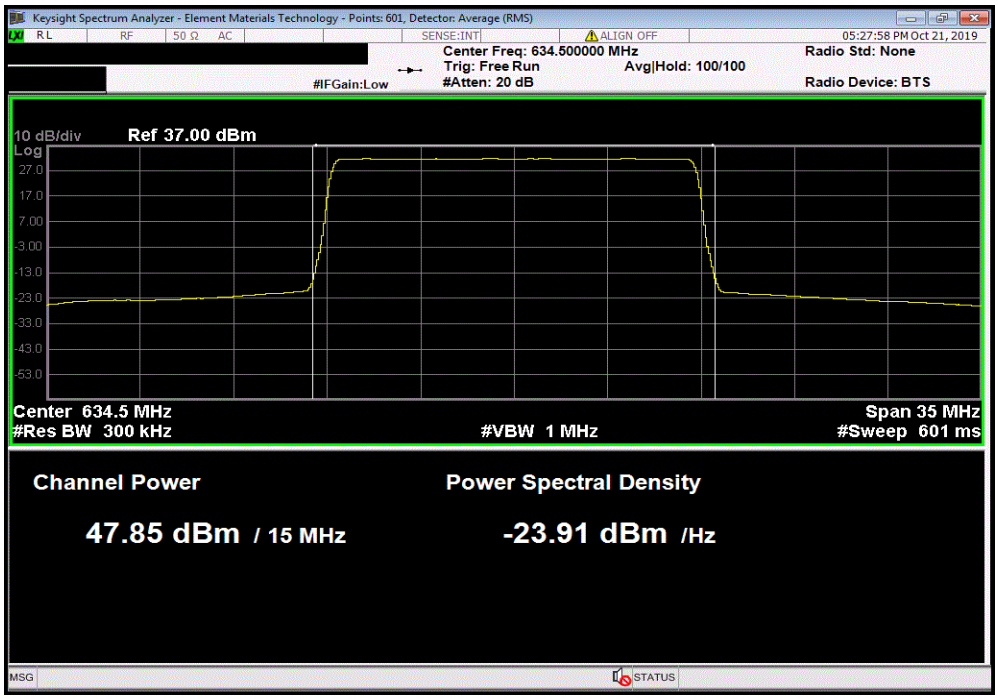


Band 71, 256QAM Modulation, LTE15 Bandwidth, Low Channel, 624.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	47.991	0		48	1000	Pass

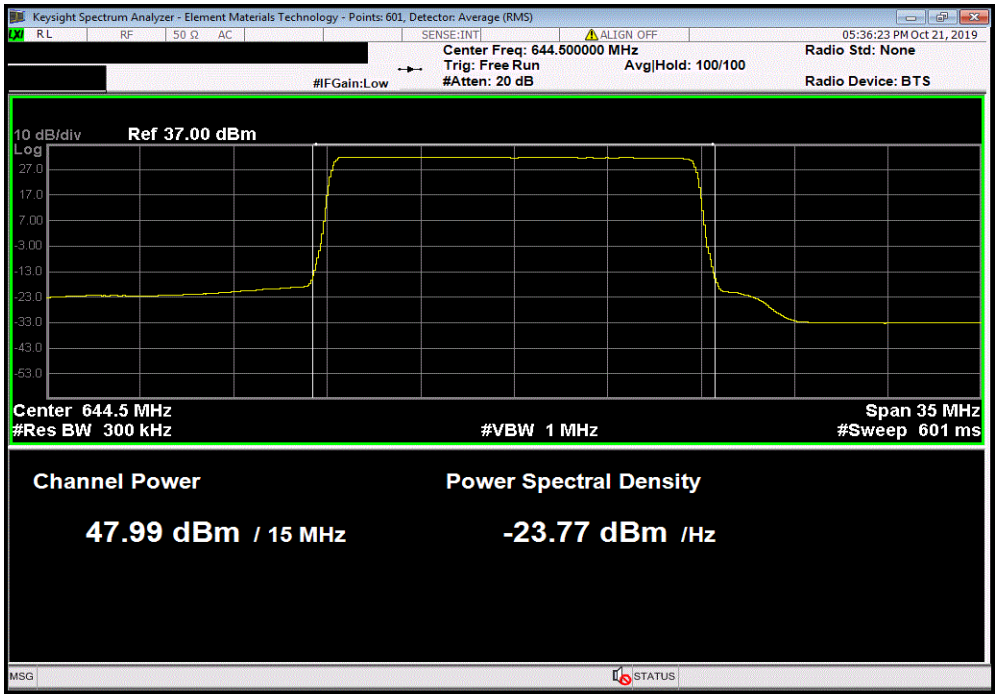


AVERAGE OUTPUT POWER

Band 71, 256QAM Modulation, LTE15 Bandwidth, Mid Channel, 634.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	47.847	0		47.8	1000	Pass

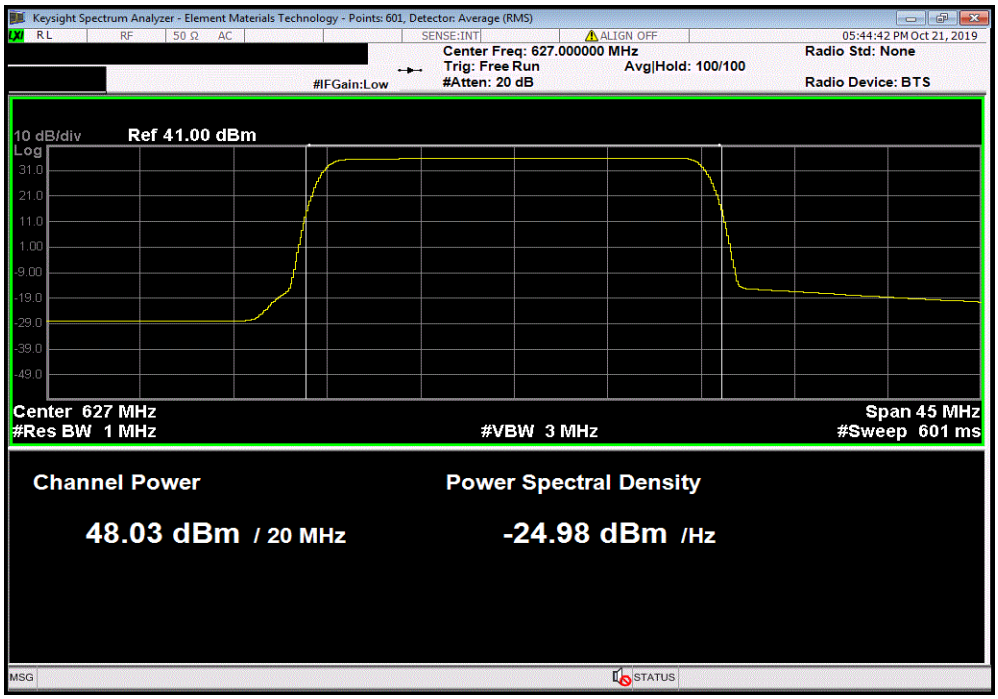


Band 71, 256QAM Modulation, LTE15 Bandwidth, High Channel, 644.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	47.99	0		48	1000	Pass

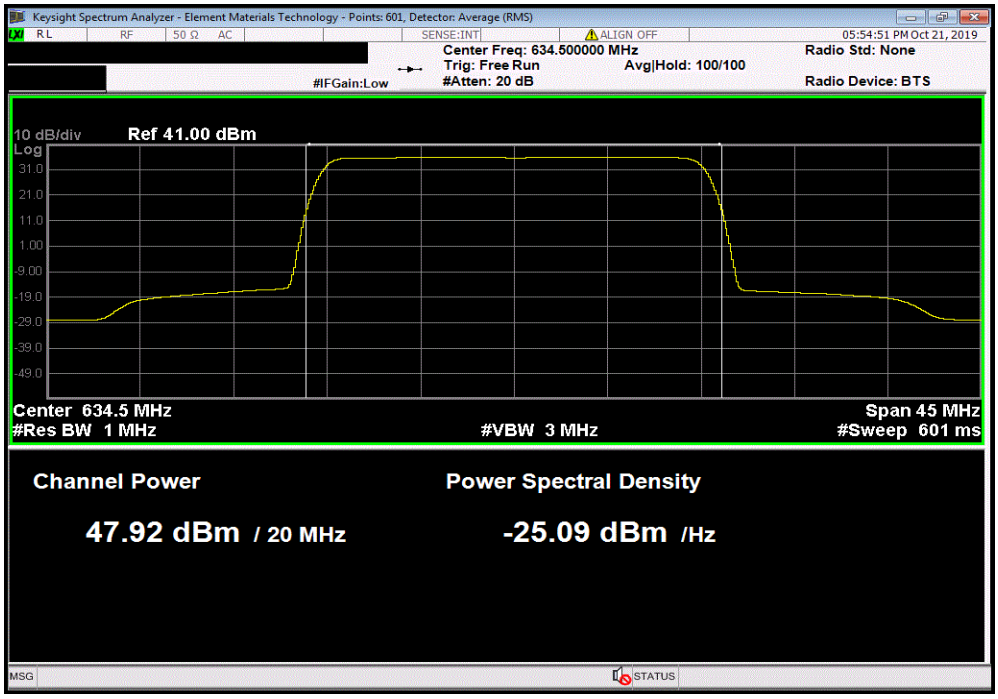


AVERAGE OUTPUT POWER

Band 71, 256QAM Modulation, LTE20 Bandwidth, Low Channel, 627 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	48.029	0		48	1000	Pass



Band 71, 256QAM Modulation, LTE20 Bandwidth, Mid Channel, 634.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	47.923	0		47.9	1000	Pass



AVERAGE OUTPUT POWER

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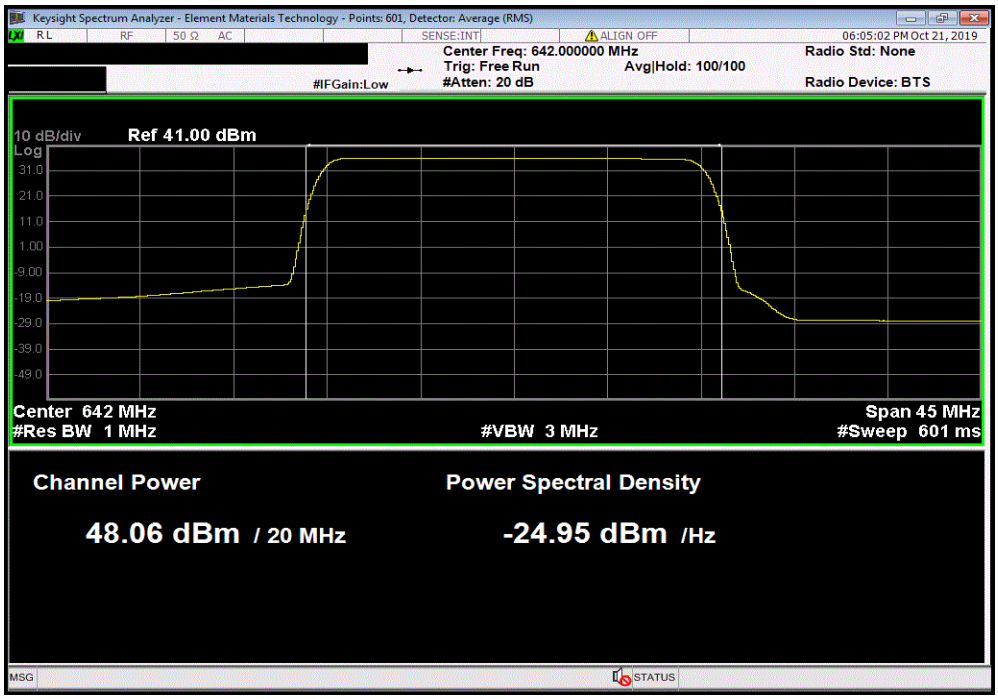
Band 71, 256QAM Modulation, LTE20 Bandwidth, High Channel, 642 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	48.064	0		48.1	1000	Pass



1000	Pass

AVERAGE OUTPUT 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 27.50(b)(4), the Effective Radiated Power (ERP) of the transceiver cannot exceed 1000 Watts/MHz.

AVERAGE OUTPUT POWER

element

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	AHBOA Remote Radio Head (RRH)			Work Order:	NOKI0003
Serial Number:	BL1934X1001			Date:	23-Oct-19
Customer:	Nokia Solutions and Networks			Temperature:	22.6 °C
Attendees:	Hobert Smith, John Rattanavong, Mitchell Hill			Humidity:	37.7% RH
Project:	None			Barometric Pres.:	1020 mbar
Tested by:	Jonathan Kiefer	Power:	48VDC	Job Site:	TX09

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

COMMENTS

Average power measurements were made for two multicarrier test cases on four modulation types (QPSK, 16QAM, 64QAM, 256QAM):
The first multicarrier test case is with three Band 71 LTE5 carriers (based upon KDB 971168 D03v01) using two carriers (with minimum spacing between carrier frequencies) at the Band 71 lower band edge [619.5MHz and 624.5MHz] and a third carrier with maximum spacing between the other two carrier frequencies [649.5MHz] at the Band 71 upper band edge.
The second multicarrier test case is with three Band 71/Band 13 LTE5 carriers (based upon KDB 971168 D03v01) using two carriers (with minimum spacing between carrier frequencies) at the Band 71 lower band edge [619.5MHz and 624.5MHz] and a third carrier with maximum spacing between the other two carrier frequencies [753.5MHz] at the Band 13 upper band edge. Tested at highest antenna port (Port 1). EUT is operated at 100% duty cycle. ERP depends on antenna gain, which is unknown.

DEVIATIONS FROM TEST STANDARD

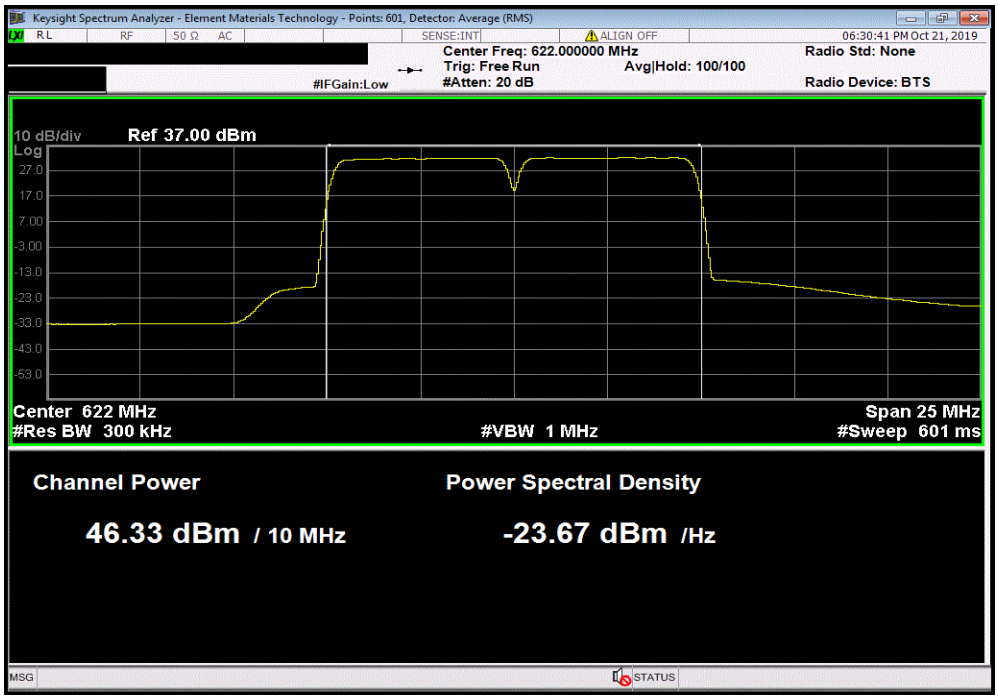
None

Configuration #	1	Signature	Jonathan Kiefer

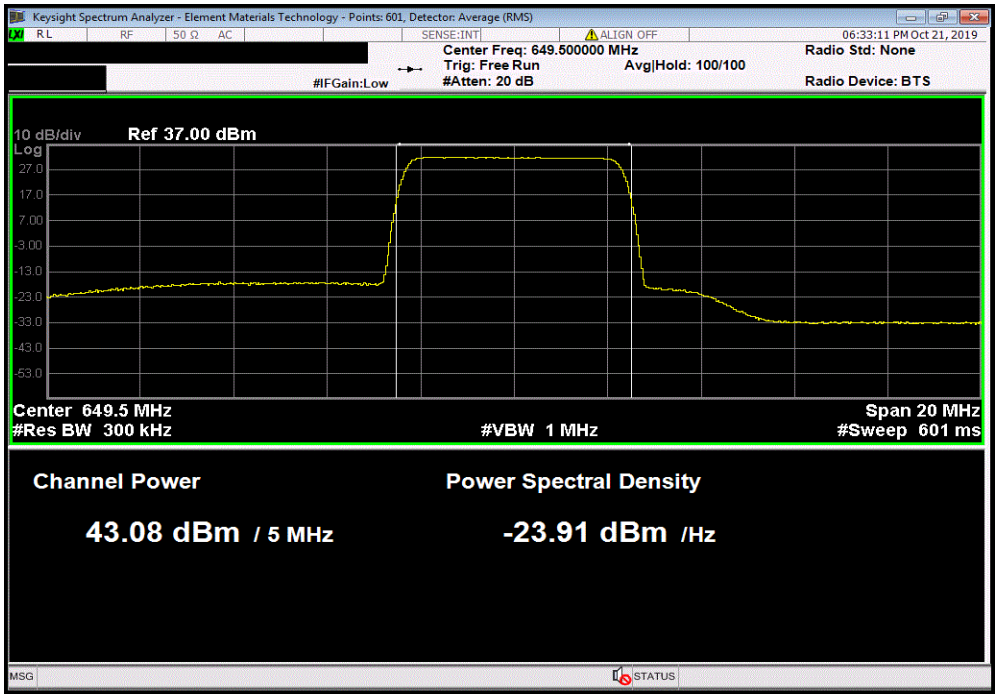
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (W ERP)	Results
Band 71					
QPSK Modulation					
LTE5 Bandwidth					
Multicarrier Test Case 1					
622 MHz	46.327	0	46.3	1000	Pass
649.5 MHz	43.081	0	43.1	1000	Pass
Multicarrier Test Case 2					
622 MHz	46.169	0	46.2	1000	Pass
753.5 MHz	43.085	0	43.1	1000	Pass
16QAM Modulation					
LTE5 Bandwidth					
Multicarrier Test Case 1					
622 MHz	46.342	0	46.3	1000	Pass
649.5 MHz	43.092	0	43.1	1000	Pass
Multicarrier Test Case 2					
622 MHz	46.155	0	46.2	1000	Pass
753.5 MHz	43.113	0	43.1	1000	Pass
64QAM Modulation					
LTE5 Bandwidth					
Multicarrier Test Case 1					
622 MHz	46.365	0	46.4	1000	Pass
649.5 MHz	43.103	0	43.1	1000	Pass
Multicarrier Test Case 2					
622 MHz	46.062	0	46.1	1000	Pass
753.5 MHz	42.973	0	43	1000	Pass
256QAM Modulation					
LTE5 Bandwidth					
Multicarrier Test Case 1					
622 MHz	46.281	0	46.3	1000	Pass
649.5 MHz	43.083	0	43.1	1000	Pass
Multicarrier Test Case 2					
622 MHz	45.986	0	46	1000	Pass
753.5 MHz	42.966	0	43	1000	Pass

AVERAGE OUTPUT POWER

Band 71, QPSK Modulation, LTE5 Bandwidth, Multicarrier Test Case 1, 622 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	46.327	0		46.3	1000	Pass

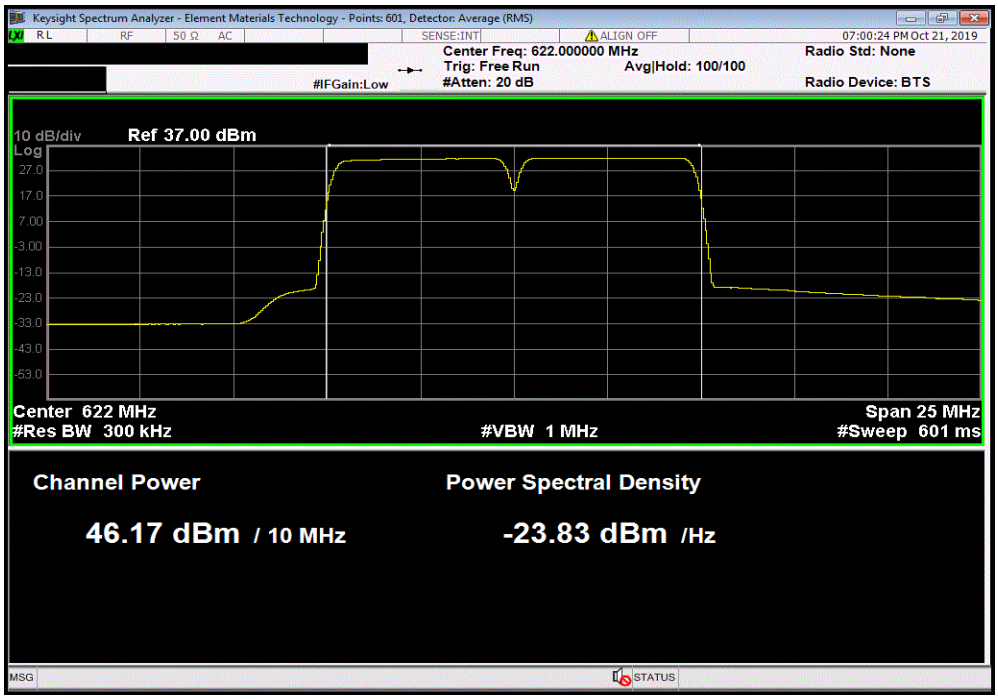


Band 71, QPSK Modulation, LTE5 Bandwidth, Multicarrier Test Case 1, 649.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	43.081	0		43.1	1000	Pass

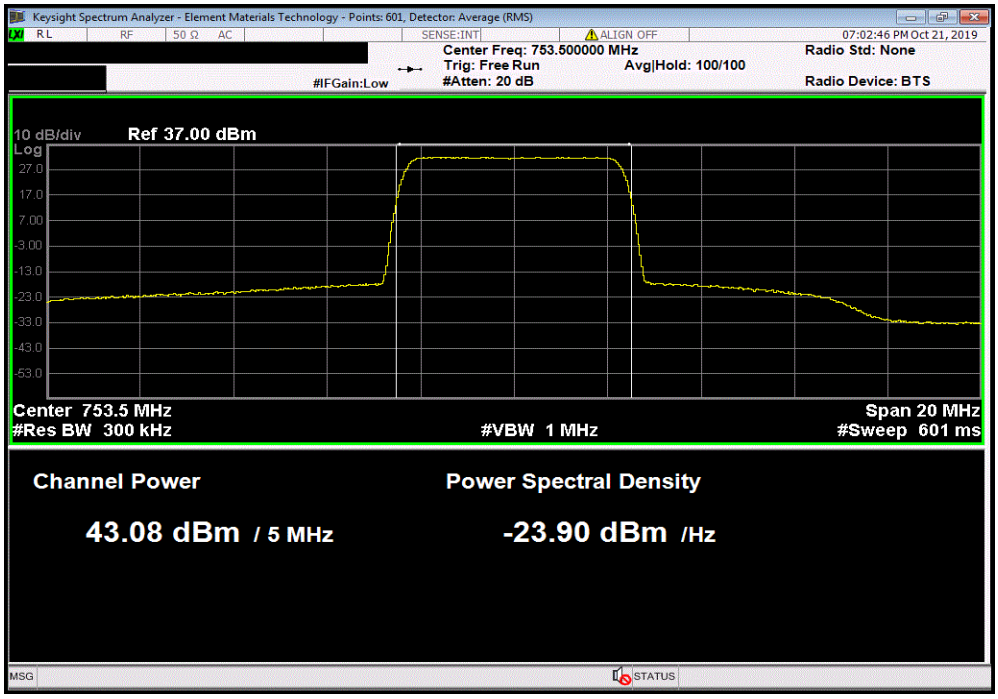


AVERAGE OUTPUT POWER

Band 71, QPSK Modulation, LTE5 Bandwidth, Multicarrier Test Case 2, 622 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	46.169	0		46.2	1000	Pass

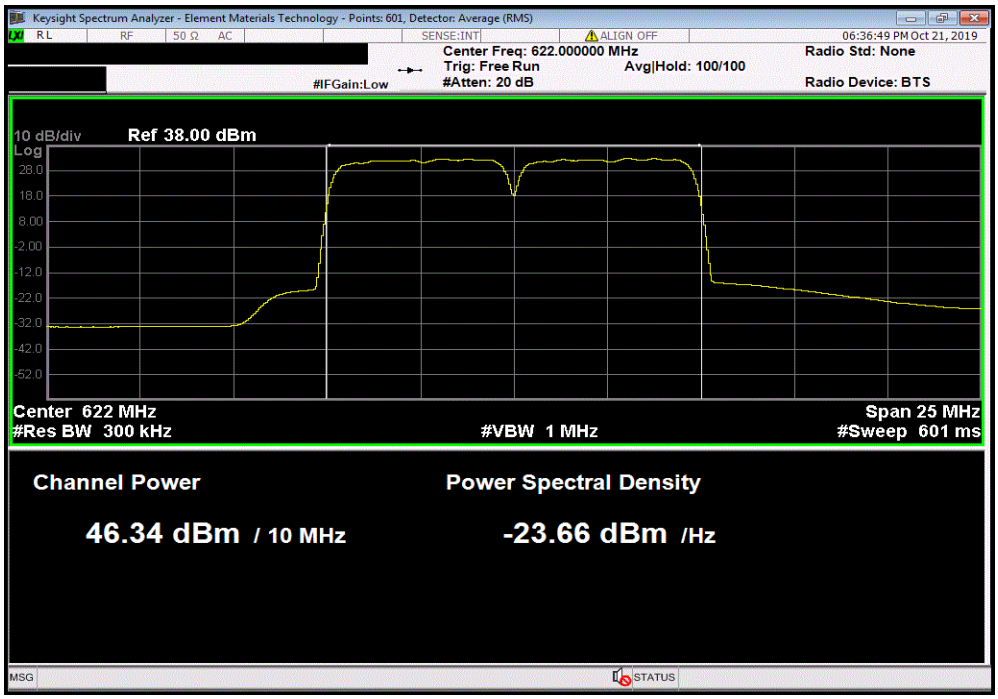


Band 13, QPSK Modulation, LTE5 Bandwidth, Multicarrier Test Case 2, 753.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	43.085	0		43.1	1000	Pass

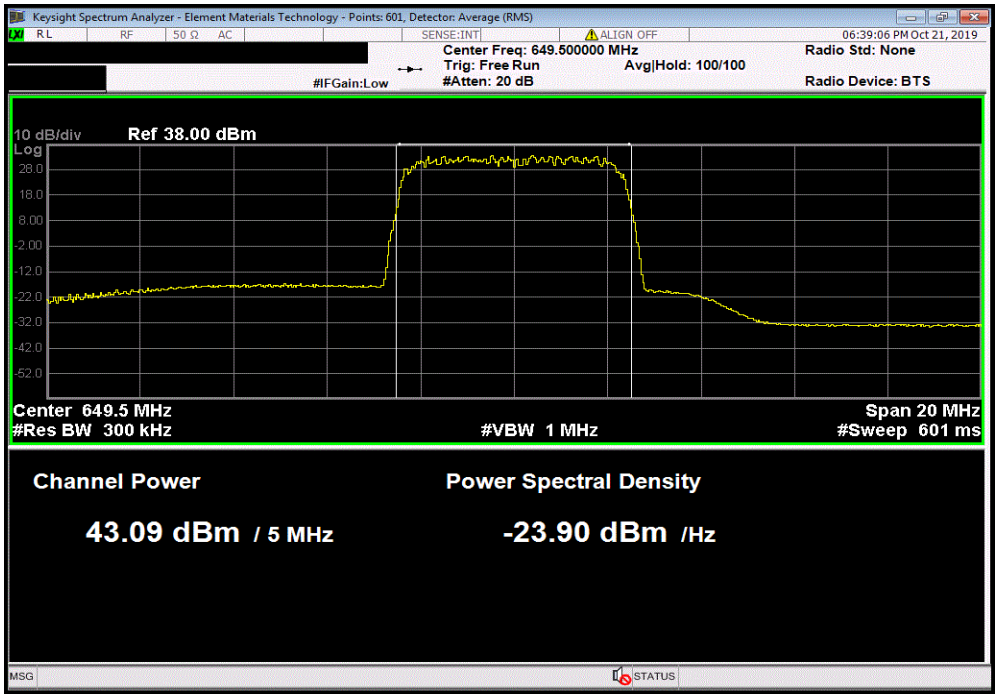


AVERAGE OUTPUT POWER

Band 71, 16QAM Modulation, LTE5 Bandwidth, Multicarrier Test Case 1, 622 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	46.342	0		46.3	1000	Pass

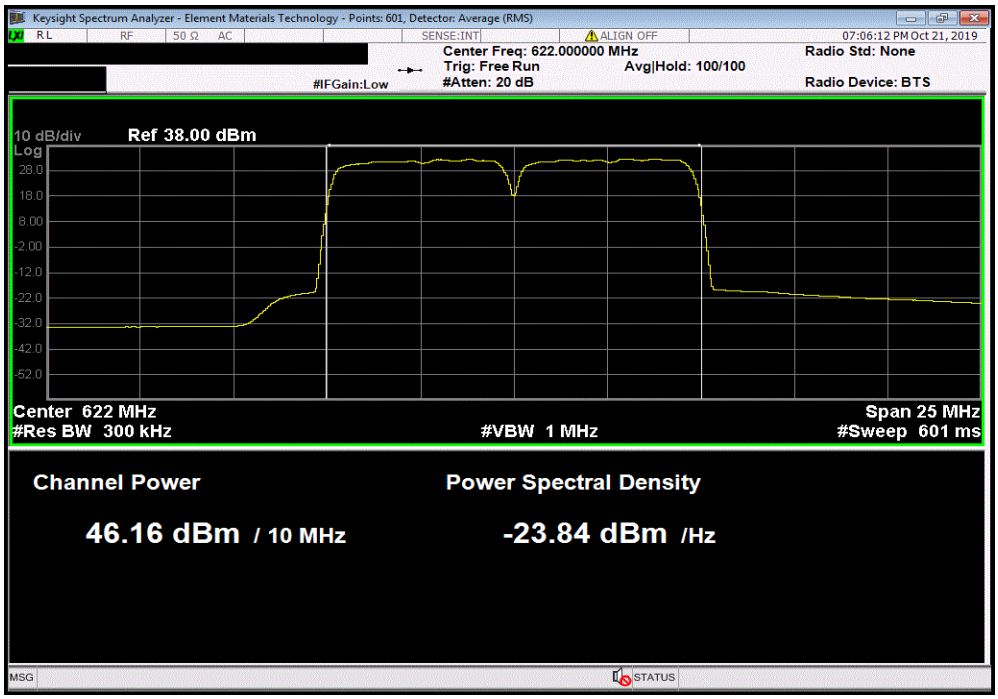


Band 71, 16QAM Modulation, LTE5 Bandwidth, Multicarrier Test Case 1, 649.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	43.092	0		43.1	1000	Pass

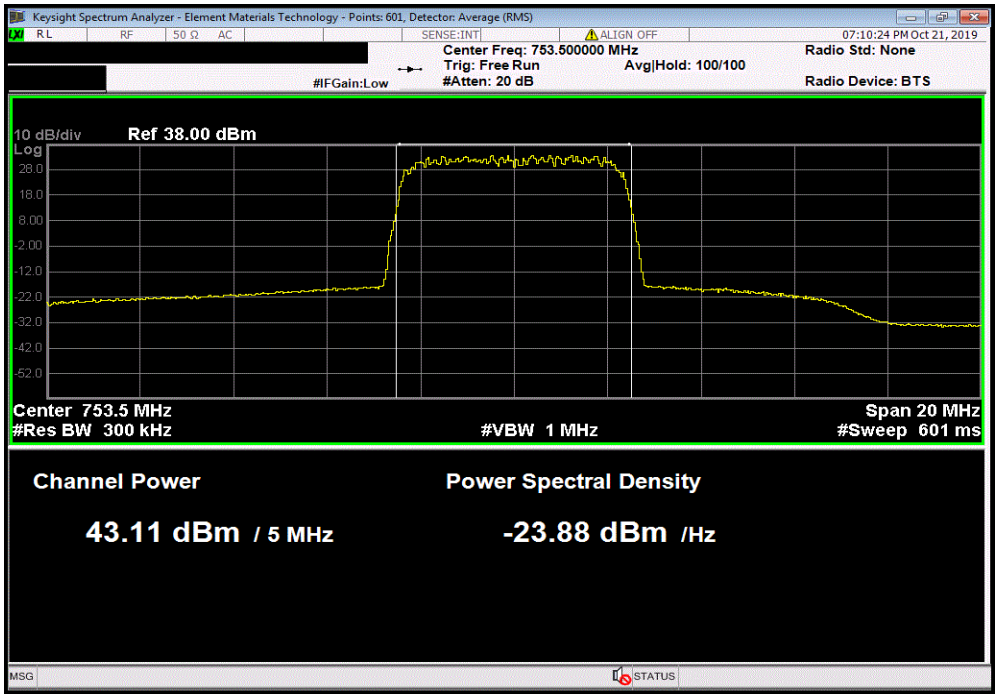


AVERAGE OUTPUT POWER

Band 71, 16QAM Modulation, LTE5 Bandwidth, Multicarrier Test Case 2, 622 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	46.155	0		46.2	1000	Pass

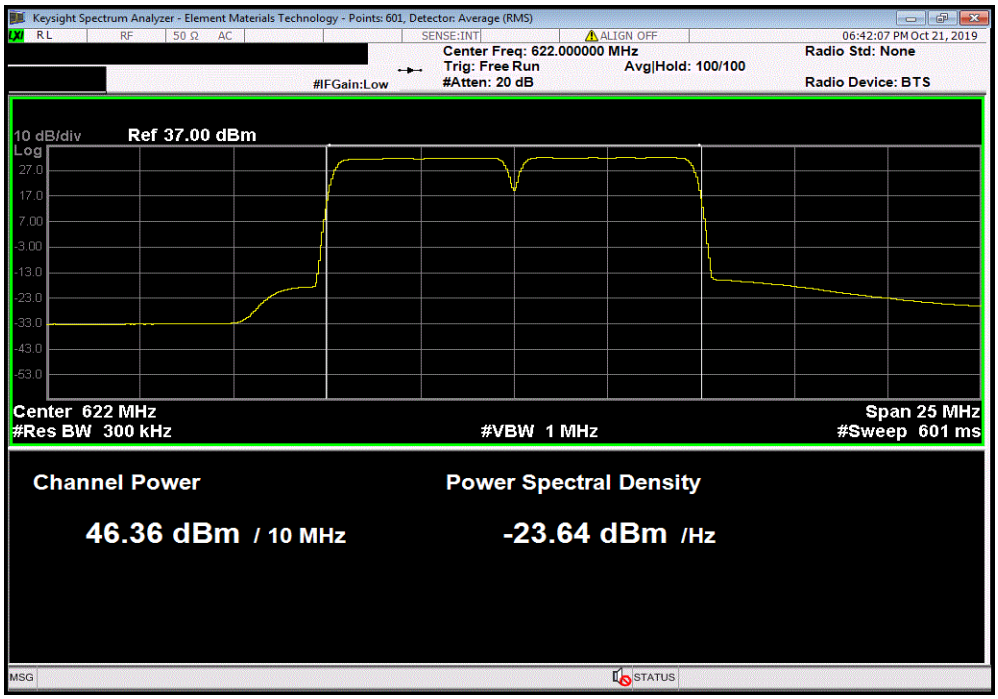


Band 13, 16QAM Modulation, LTE5 Bandwidth, Multicarrier Test Case 2, 753.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	43.113	0		43.1	1000	Pass

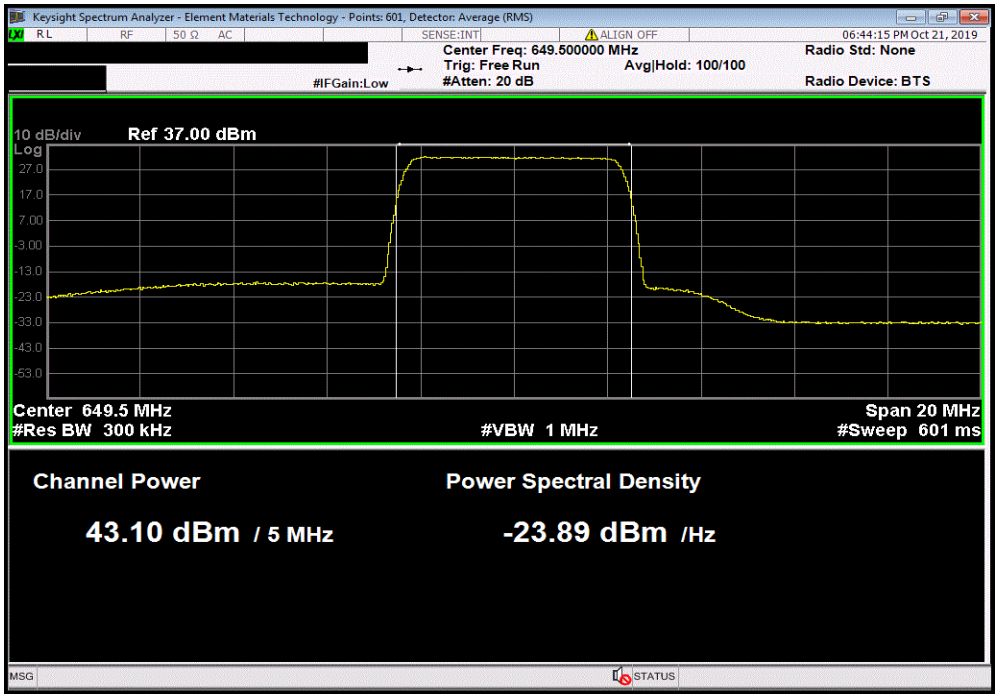


AVERAGE OUTPUT POWER

Band 71, 64QAM Modulation, LTE5 Bandwidth, Multicarrier Test Case 1, 622 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	46.365	0		46.4	1000	Pass

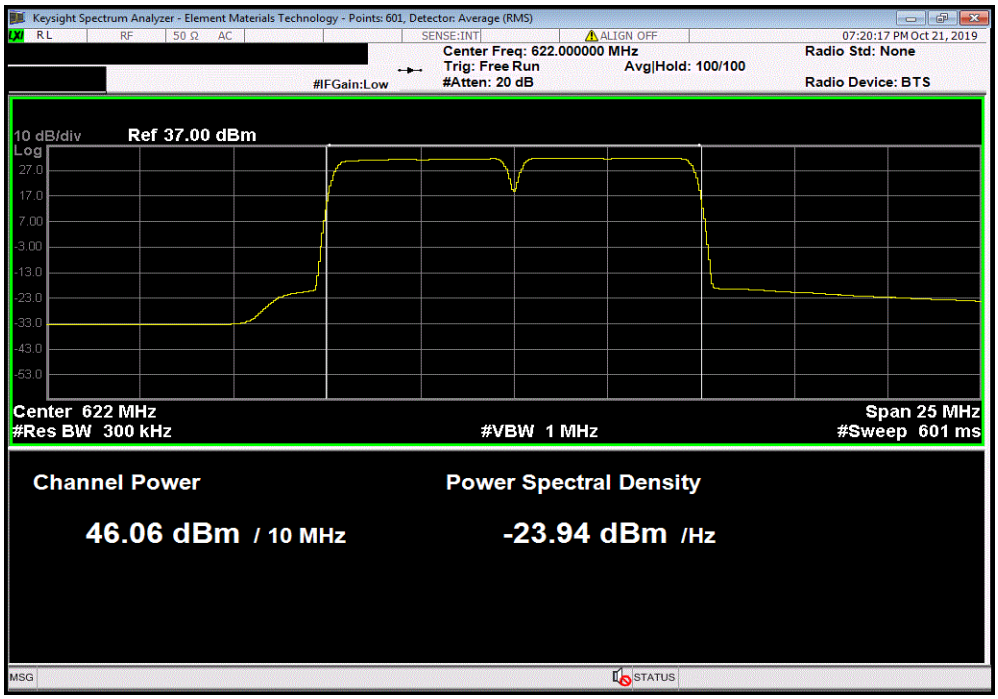


Band 71, 64QAM Modulation, LTE5 Bandwidth, Multicarrier Test Case 1, 649.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	43.103	0		43.1	1000	Pass

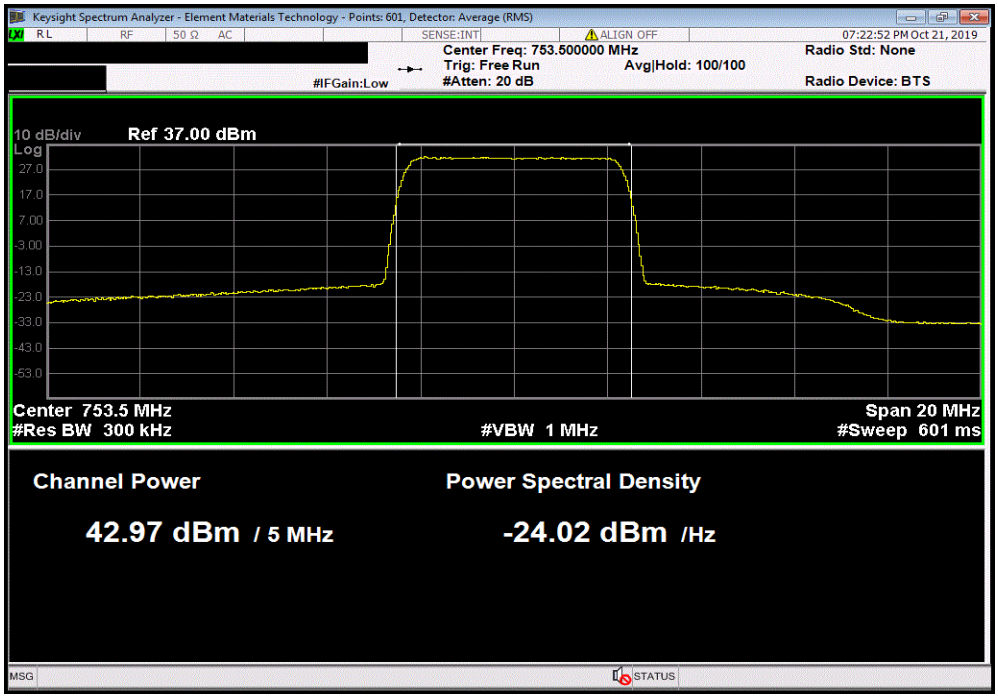


AVERAGE OUTPUT POWER

Band 71, 64QAM Modulation, LTE5 Bandwidth, Multicarrier Test Case 2, 622 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	46.062	0		46.1	1000	Pass

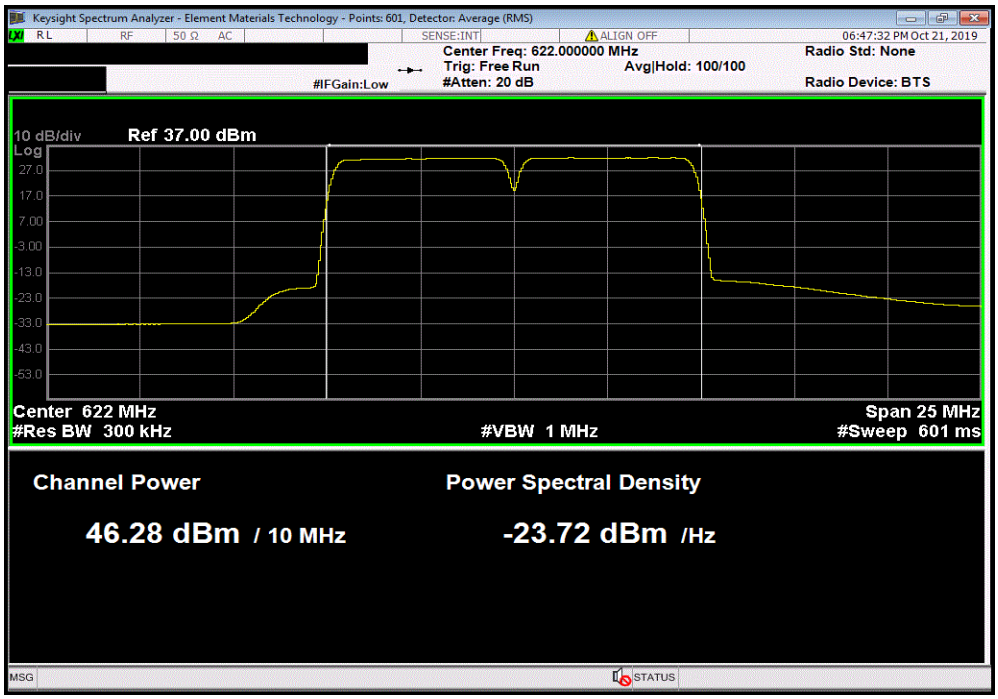


Band 13, 64QAM Modulation, LTE5 Bandwidth, Multicarrier Test Case 2, 753.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	42.973	0		43	1000	Pass

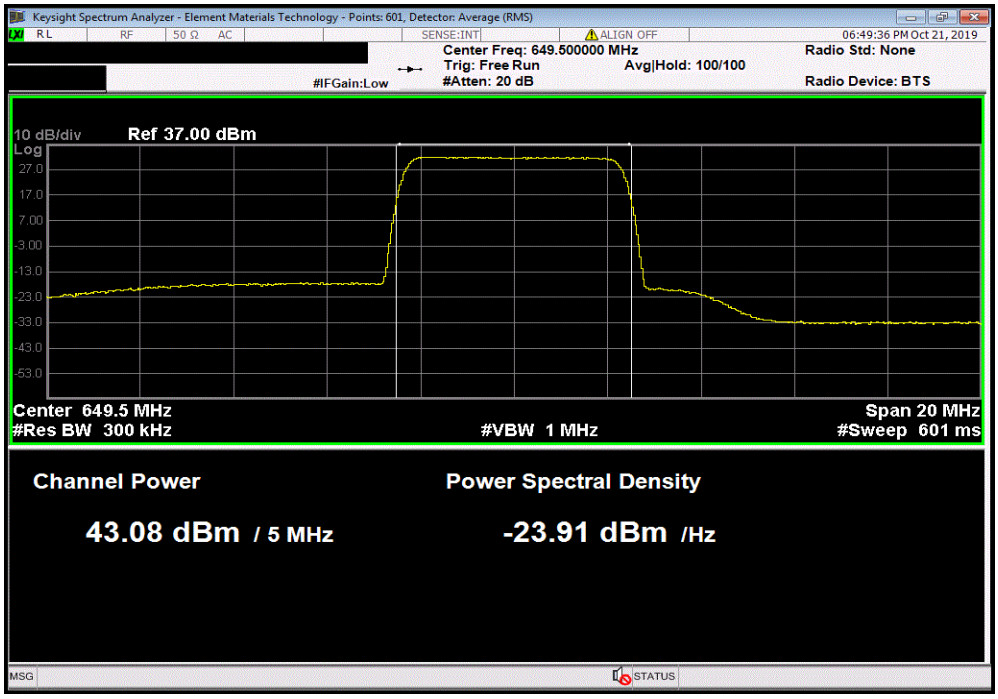


AVERAGE OUTPUT POWER

Band 71, 256QAM Modulation, LTE5 Bandwidth, Multicarrier Test Case 1, 622 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	46.281	0		46.3	1000	Pass

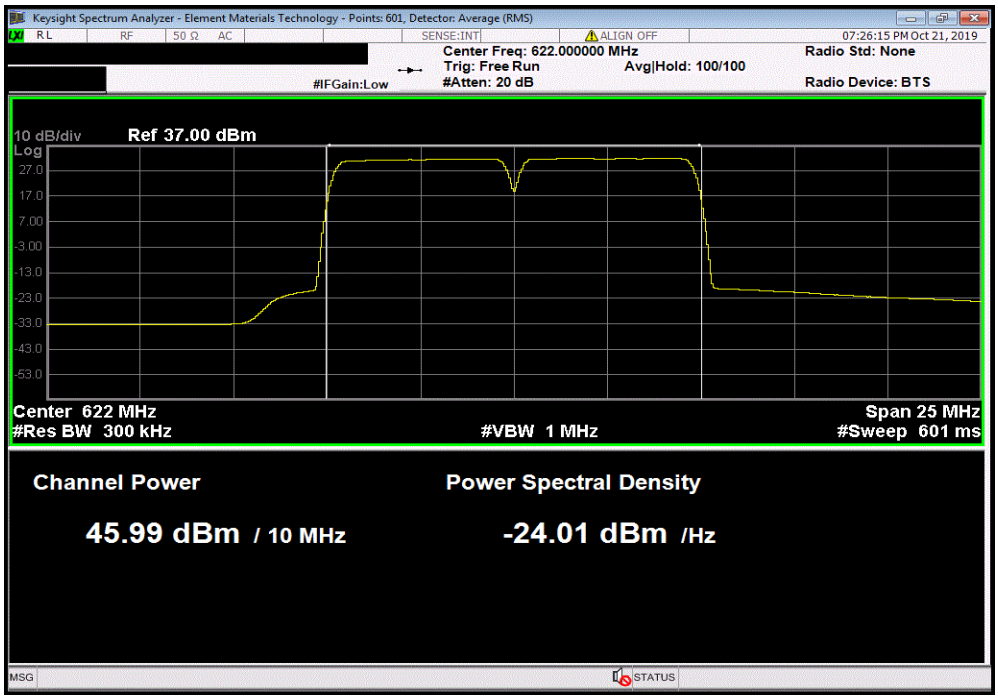


Band 71, 256QAM Modulation, LTE5 Bandwidth, Multicarrier Test Case 1, 649.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	43.083	0		43.1	1000	Pass

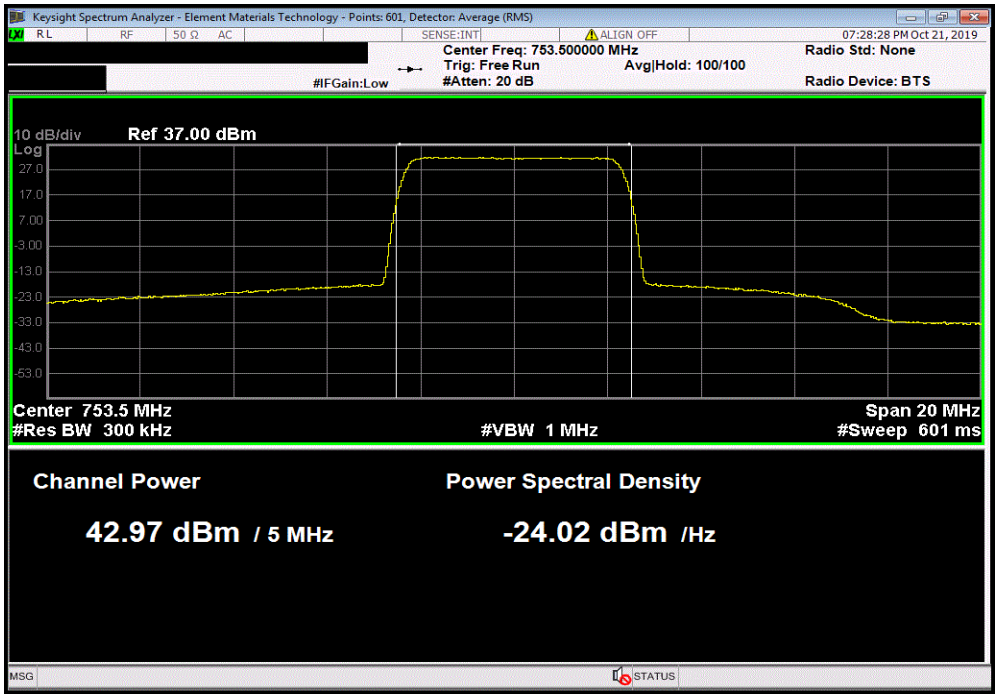


AVERAGE OUTPUT POWER

Band 71, 256QAM Modulation, LTE5 Bandwidth, Multicarrier Test Case 2, 622 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	45.986	0		46	1000	Pass



Band 13, 256QAM Modulation, LTE5 Bandwidth, Multicarrier Test Case 2, 753.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	42.966	0		43	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 27.50(b)(4), the Effective Radiated Power (ERP) of the transceiver cannot exceed 1000 Watts/MHz.

AVERAGE OUTPUT POWER

element

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	**AHBOA Remote Radio Head (RRH)**			**Work Order:**	**NOKI0003**
Serial Number:	**BL1934X1001**			**Date:**	**23-Oct-19**
Customer:	**Nokia Solutions and Networks**			**Temperature:**	**22.9 °C**
Attendees:	**Hobert Smith, John Rattanavong, Mitchell Hill**			**Humidity:**	**36.8% RH**
Project:	**None**			**Barometric Pres.:**	**1020 mbar**
Tested by:	**Jonathan Kiefer**	**Power:**	**48VDC**	**Job Site:**	**TX09**

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

COMMENTS

Band 13 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.

DEVIATIONS FROM TEST STANDARD

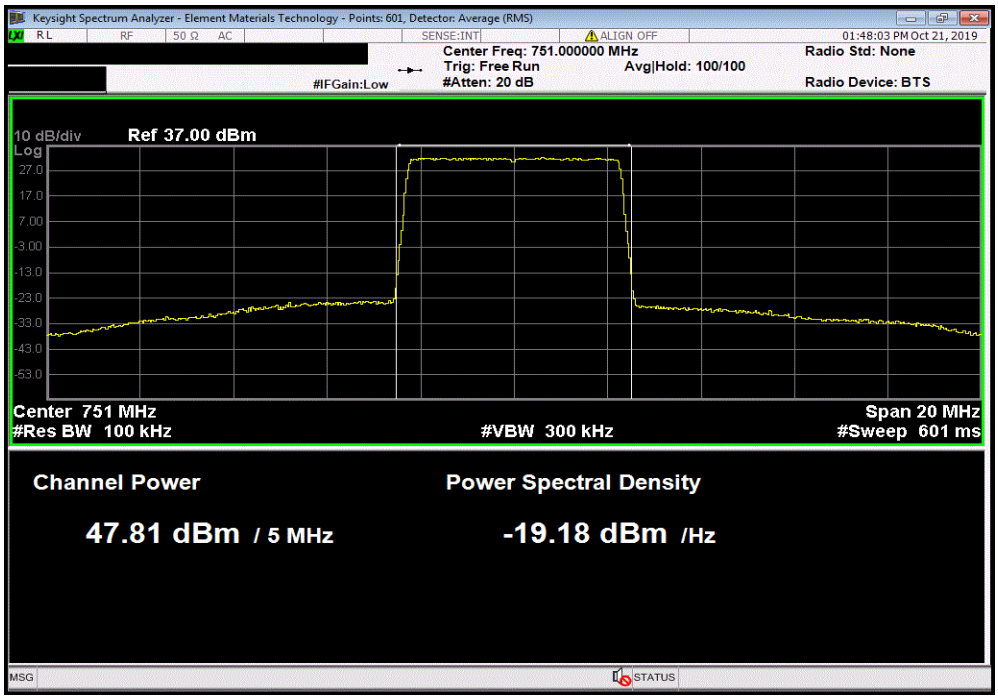
None

Configuration #	**1**	*Signature* Jonathan Kiefer

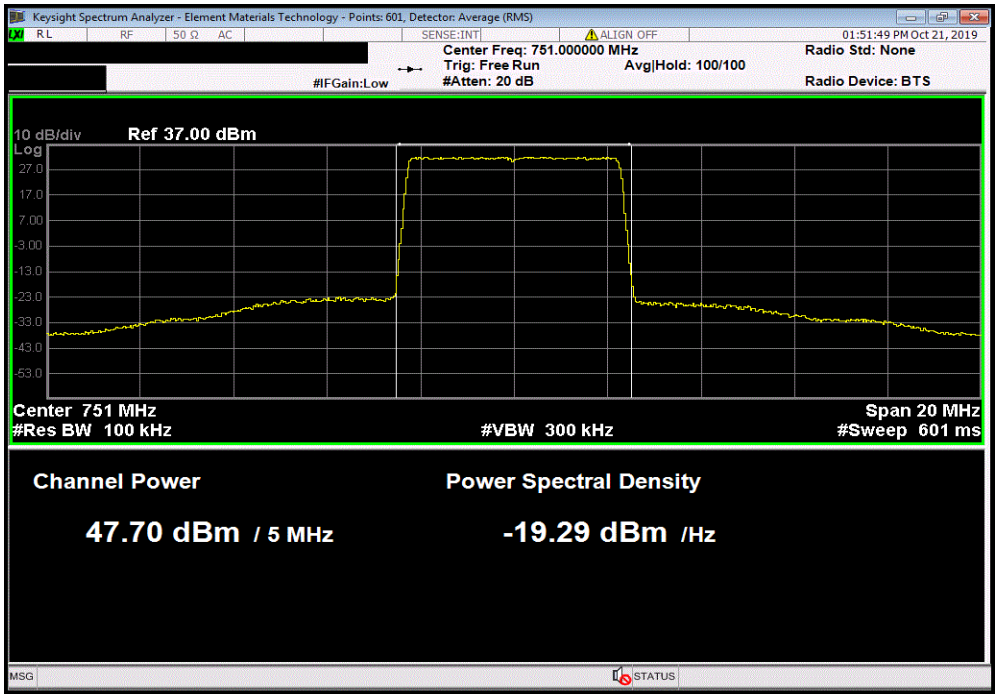
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (W ERP)	Results
Band 13					
256QAM Modulation					
LTE5 Bandwidth					
Mid Channel, 751 MHz					
Antenna Port 1	47.808	0	47.8	1000	Pass
Antenna Port 2	47.698	0	47.7	1000	Pass
Antenna Port 3	47.628	0	47.6	1000	Pass
Antenna Port 4	47.753	0	47.8	1000	Pass

AVERAGE OUTPUT POWER

Band 13, 256QAM Modulation, LTE5 Bandwidth, Mid Channel, 751 MHz, Antenna Port 1						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	47.808	0		47.8	1000	Pass

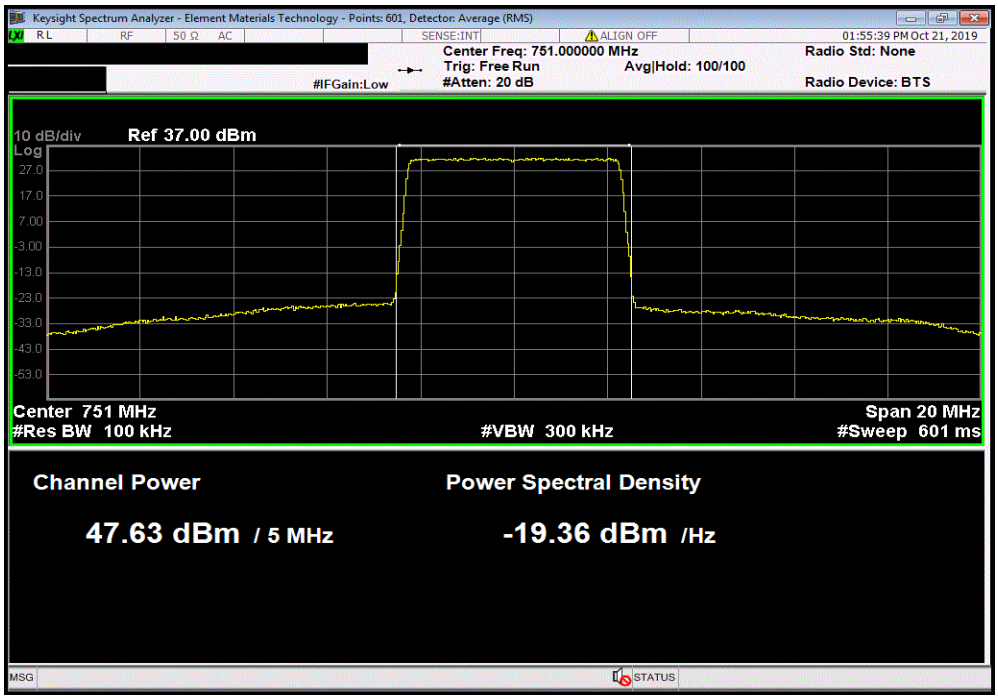


Band 13, 256QAM Modulation, LTE5 Bandwidth, Mid Channel, 751 MHz, Antenna Port 2						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	47.698	0		47.7	1000	Pass

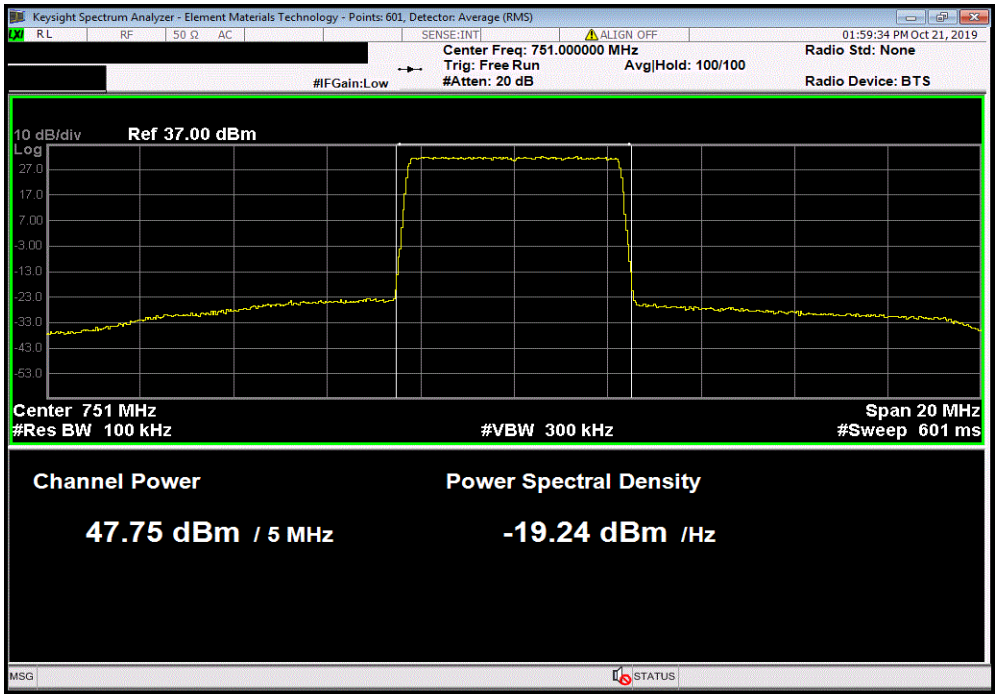


AVERAGE OUTPUT POWER

Band 13, 256QAM Modulation, LTE5 Bandwidth, Mid Channel, 751 MHz, Antenna Port 3						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	47.628	0		47.6	1000	Pass



Band 13, 256QAM Modulation, LTE5 Bandwidth, Mid Channel, 751 MHz, Antenna Port 4						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	47.753	0		47.8	1000	Pass



AVERAGE OUTPUT 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 27.50(b)(4), the Effective Radiated Power (ERP) of the transceiver cannot exceed 1000 Watts/MHz.

AVERAGE OUTPUT POWER

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	**AHBOA Remote Radio Head (RRH)**			**Work Order:**	**NOKI0003**
Serial Number:	**BL1934X1001**			**Date:**	**23-Oct-19**
Customer:	**Nokia Solutions and Networks**			**Temperature:**	**22.7 °C**
Attendees:	**Hobert Smith, John Rattanavong, Mitchell Hill**			**Humidity:**	**37.2% RH**
Project:	**None**			**Barometric Pres.:**	**1020 mbar**
Tested by:	**Jonathan Kiefer**	**Power:**	**48VDC**	**Job Site:**	**TX09**

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

COMMENTS

Band 13 average power measurements for LTE5 channel bandwidth at Mid channel 751MHz for four modulation types. Tested on highest power antenna port (Port 1). EUT is operated at 100% duty cycle. ERP depends on antenna gain, which is unknown.

DEVIATIONS FROM TEST STANDARD

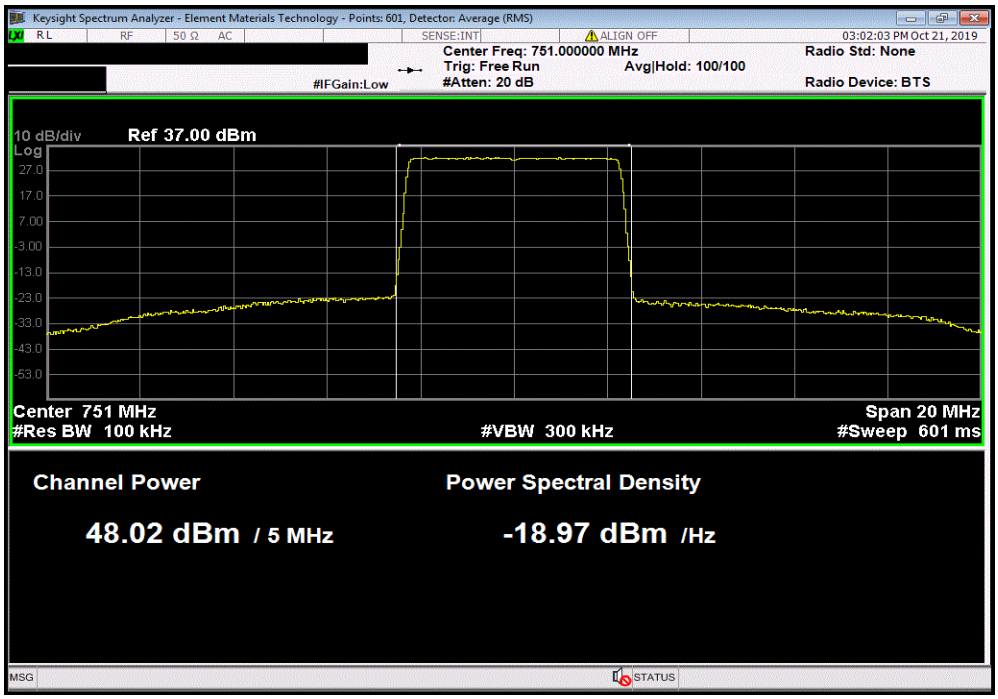
None

Configuration #	**1**	*Signature* Jonathan Kiefer

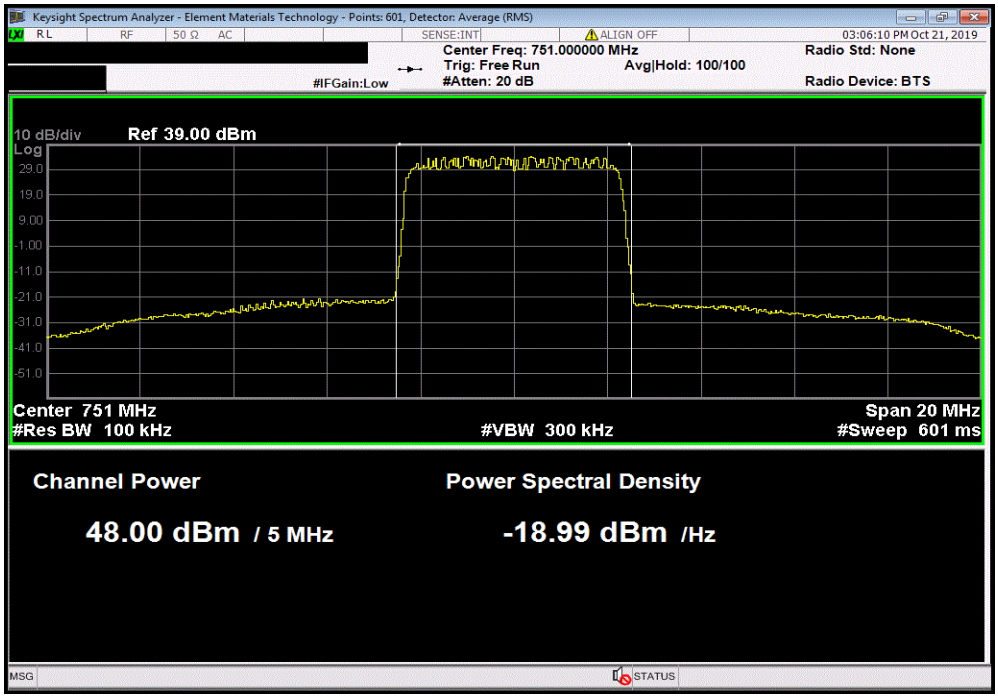
		Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (W ERP)	Results
Band 13						
	QPSK Modulation					
	LTE5 Bandwidth	48.022	0	48	1000	Pass
	16QAM Modulation					
	LTE5 Bandwidth	48.001	0	48	1000	Pass
	64QAM Modulation					
	LTE5 Bandwidth	48.012	0	48	1000	Pass
	256QAM Modulation					
	LTE5 Bandwidth	47.99	0	48	1000	Pass

AVERAGE OUTPUT POWER

Band 13, QPSK Modulation, LTE5 Bandwidth						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	48.022	0		48	1000	Pass

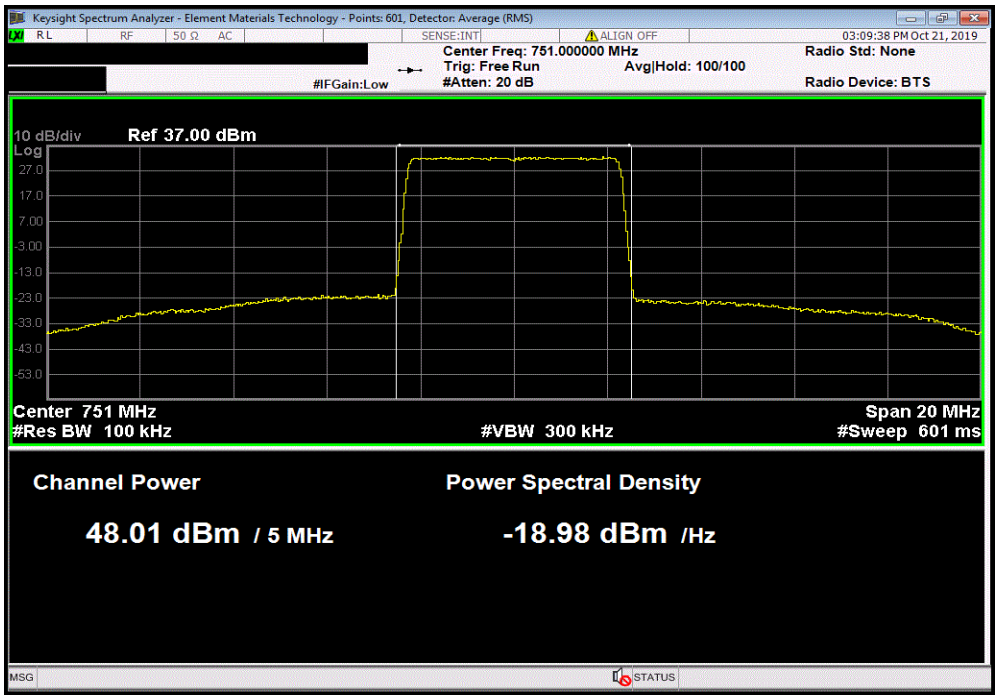


Band 13, 16QAM Modulation, LTE5 Bandwidth						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	48.001	0		48	1000	Pass

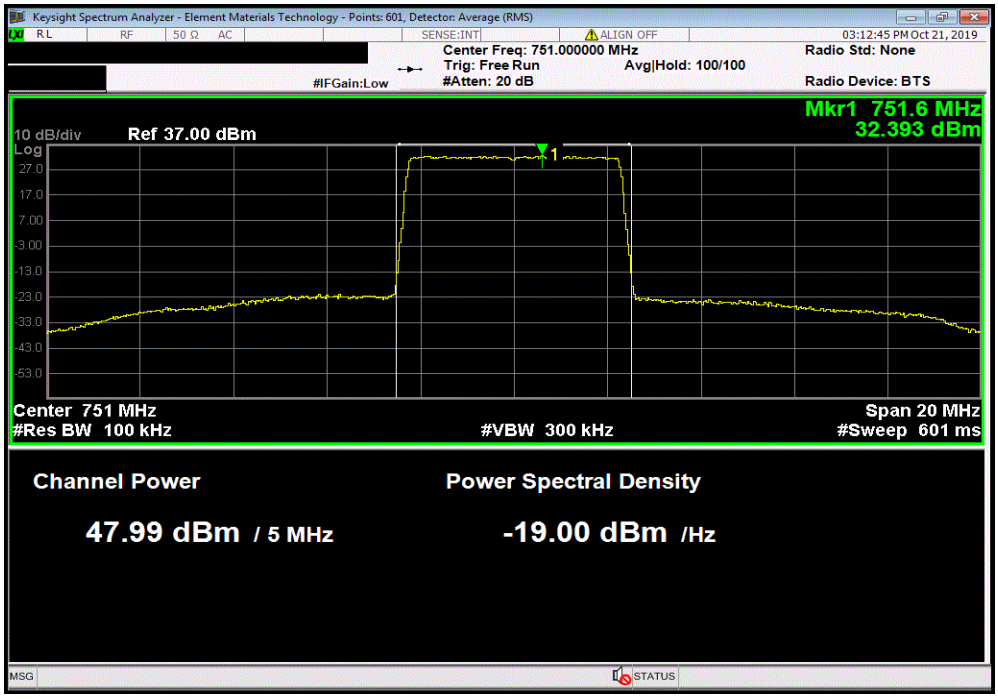


AVERAGE OUTPUT POWER

Band 13, 64QAM Modulation, LTE5 Bandwidth						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	48.012	0		48	1000	Pass



Band 13, 256QAM Modulation, LTE5 Bandwidth						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	47.99	0		48	1000	Pass



AVERAGE OUTPUT 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 27.50(b)(4), the Effective Radiated Power (ERP) of the transceiver cannot exceed 1000 Watts/MHz.

AVERAGE OUTPUT POWER

element

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	**AHBOA Remote Radio Head (RRH)**			**Work Order:**	**NOKI0003**
Serial Number:	**BL1934X1001**			**Date:**	**23-Oct-19**
Customer:	**Nokia Solutions and Networks**			**Temperature:**	**22.2 °C**
Attendees:	**Hobert Smith, John Rattanavong, Mitchell Hill**			**Humidity:**	**38.2% RH**
Project:	**None**			**Barometric Pres.:**	**1020 mbar**
Tested by:	**Jonathan Kiefer**	**Power:**	**48VDC**	**Job Site:**	**TX09**

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

COMMENTS

Band 13 average power for 256QAM modulation type at Low, Mid and High channels for LTE5 and LTE10 channel bandwidths. For Band 13, LTE10 only tested on Mid channel. Tested on highest power antenna port (Port 1). 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.

DEVIATIONS FROM TEST STANDARD

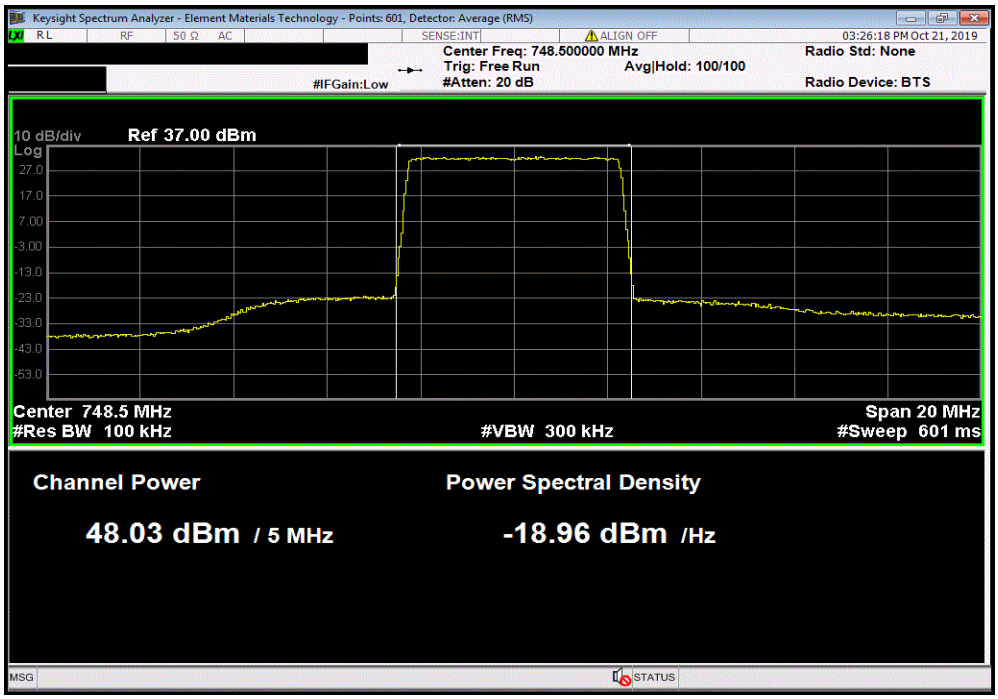
None

Configuration #	**1**	*Signature* Jonathan Kiefer

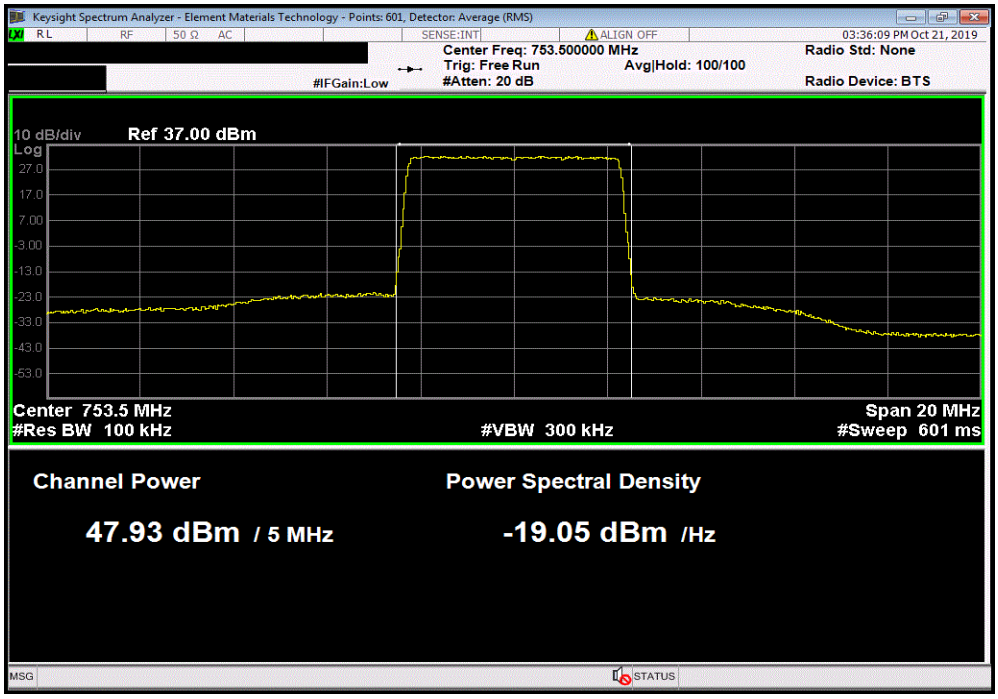
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (W ERP)	Results
Band 13					
256QAM Modulation					
LTE5 Bandwidth					
Low Channel, 748.5 MHz	48.03	0	48	1000	Pass
High Channel, 753.5 MHz	47.935	0	47.9	1000	Pass
LTE10 Bandwidth					
Mid Channel, 751 MHz	47.876	0	47.9	1000	Pass

AVERAGE OUTPUT POWER

Band 13, 256QAM Modulation, LTE5 Bandwidth, Low Channel, 748.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	48.03	0		48	1000	Pass

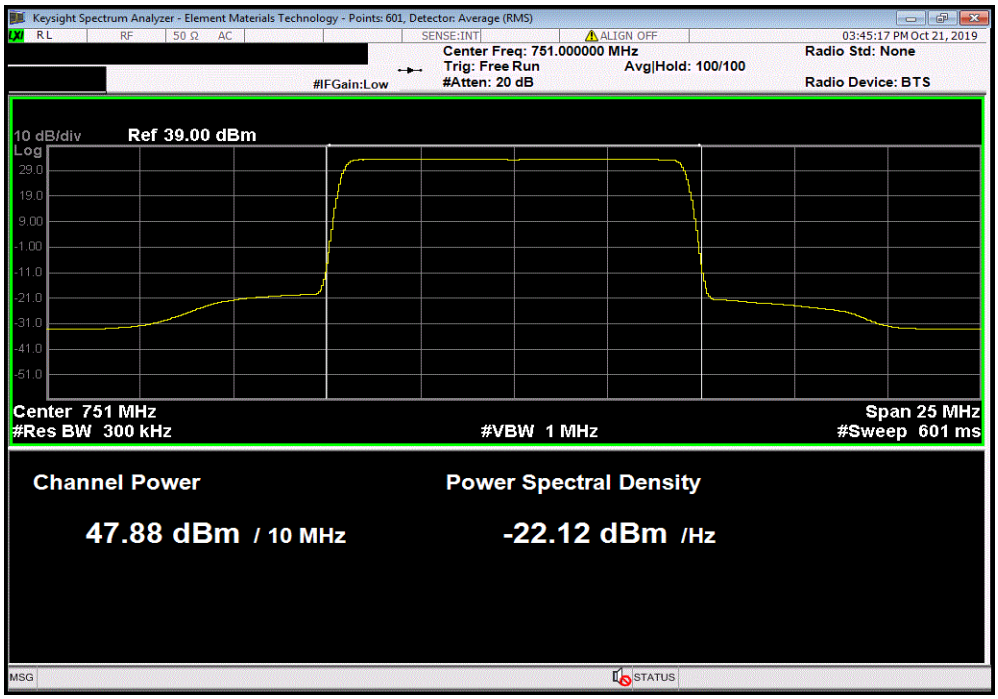


Band 13, 256QAM Modulation, LTE5 Bandwidth, High Channel, 753.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	47.935	0		47.9	1000	Pass



AVERAGE OUTPUT POWER

Band 13, 256QAM Modulation, LTE10 Bandwidth, Mid Channel, 751 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	47.876	0		47.9	1000	Pass



AVERAGE OUTPUT 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 27.50(b)(4), the Effective Radiated Power (ERP) of the transceiver cannot exceed 1000 Watts/MHz.

AVERAGE OUTPUT POWER

element

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	**AHBOA Remote Radio Head (RRH)**			**Work Order:**	**NOKI0003**
Serial Number:	**BL1934X1001**			**Date:**	**23-Oct-19**
Customer:	**Nokia Solutions and Networks**			**Temperature:**	**22.1 °C**
Attendees:	**Hobert Smith, John Rattanavong, Mitchell Hill**			**Humidity:**	**38.8% RH**
Project:	**None**			**Barometric Pres.:**	**1020 mbar**
Tested by:	**Jonathan Kiefer**	**Power:**	**48VDC**	**Job Site:**	**TX09**

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

COMMENTS

Band 13 average power measurements for multicarrier test case on four modulation types for LTE5 channel bandwidth. This multicarrier test case is with two LTE5 carriers at the Band 13 lower and upper band edge channels [748.5MHz and 753.5MHz]. Tested on highest power antenna port (Port 1). EUT is operated at 100% duty cycle. ERP depends on antenna gain, which is unknown.

DEVIATIONS FROM TEST STANDARD

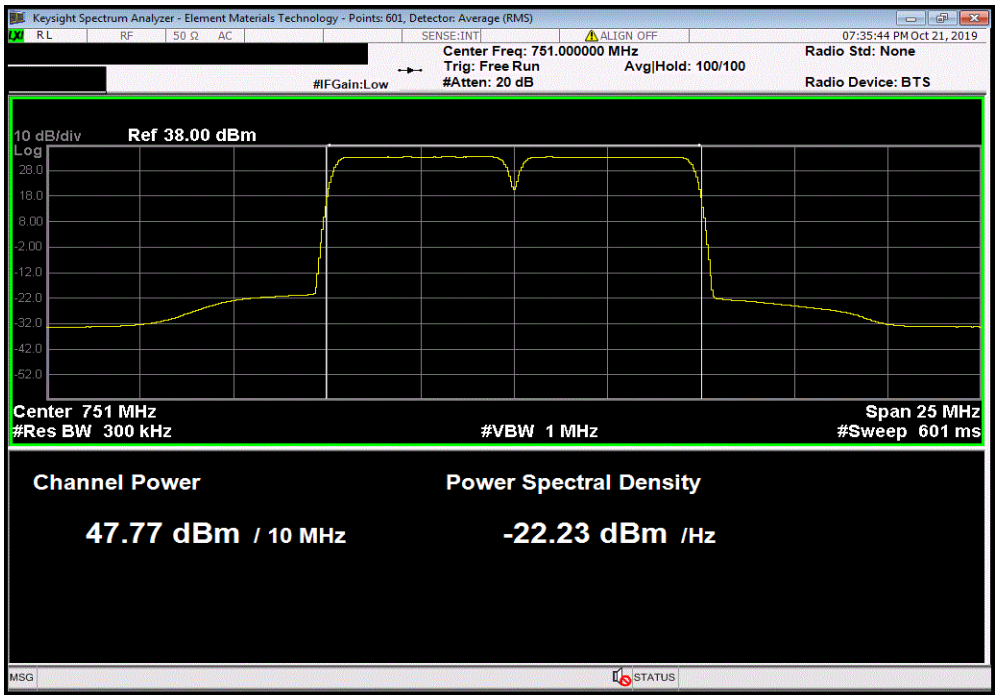
None

Configuration #	**1**	*Signature* Jonathan Kiefer

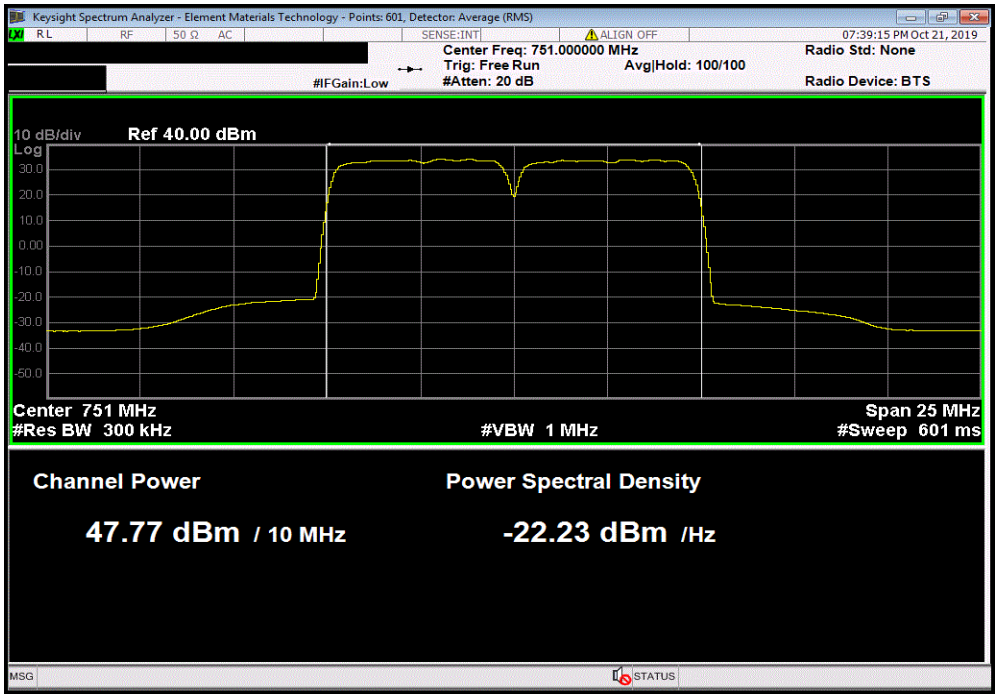
		Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (W ERP)	Results
Band 13						
	QPSK Modulation					
	LTE5 Bandwidth					
	Multicarrier Test Case 1					
	Mid Channel, 751 MHz	47.77	0	47.8	1000	Pass
	16QAM Modulation					
	LTE5 Bandwidth					
	Multicarrier Test Case 1					
	Mid Channel, 751 MHz	47.766	0	47.8	1000	Pass
	64QAM Modulation					
	LTE5 Bandwidth					
	Multicarrier Test Case 1					
	Mid Channel, 751 MHz	47.763	0	47.8	1000	Pass
	256QAM Modulation					
	LTE5 Bandwidth					
	Multicarrier Test Case 1					
	Mid Channel, 751 MHz	47.748	0	47.7	1000	Pass

AVERAGE OUTPUT POWER

Band 13, QPSK Modulation, LTE5 Bandwidth, Multicarrier Test Case 1, Mid Channel, 751 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	47.77	0		47.8	1000	Pass

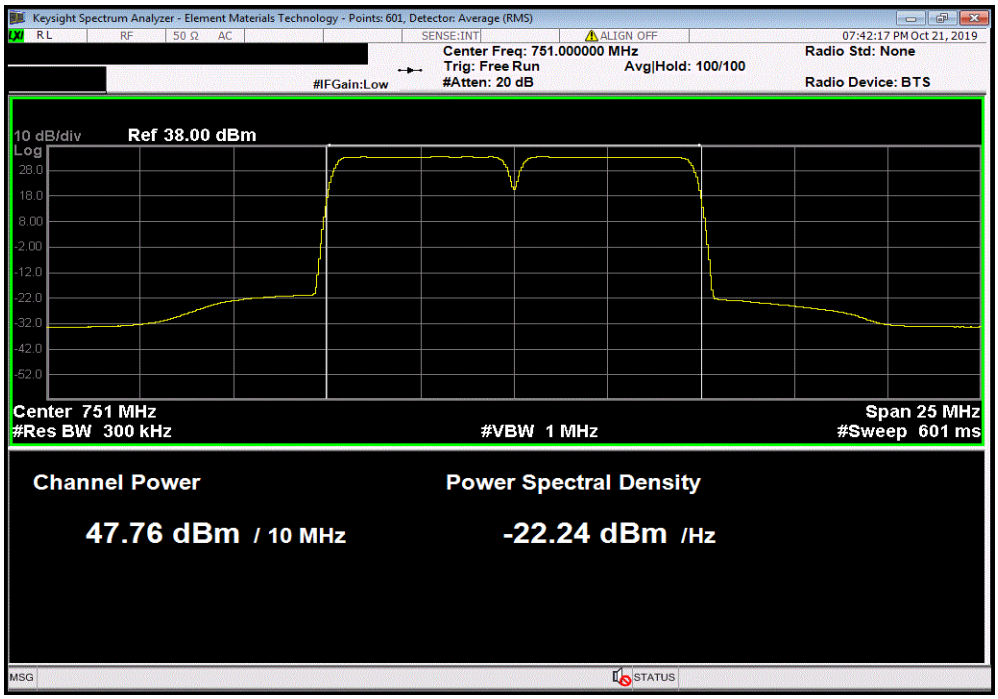


Band 13, 16QAM Modulation, LTE5 Bandwidth, Multicarrier Test Case 1, Mid Channel, 751 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	47.766	0		47.8	1000	Pass

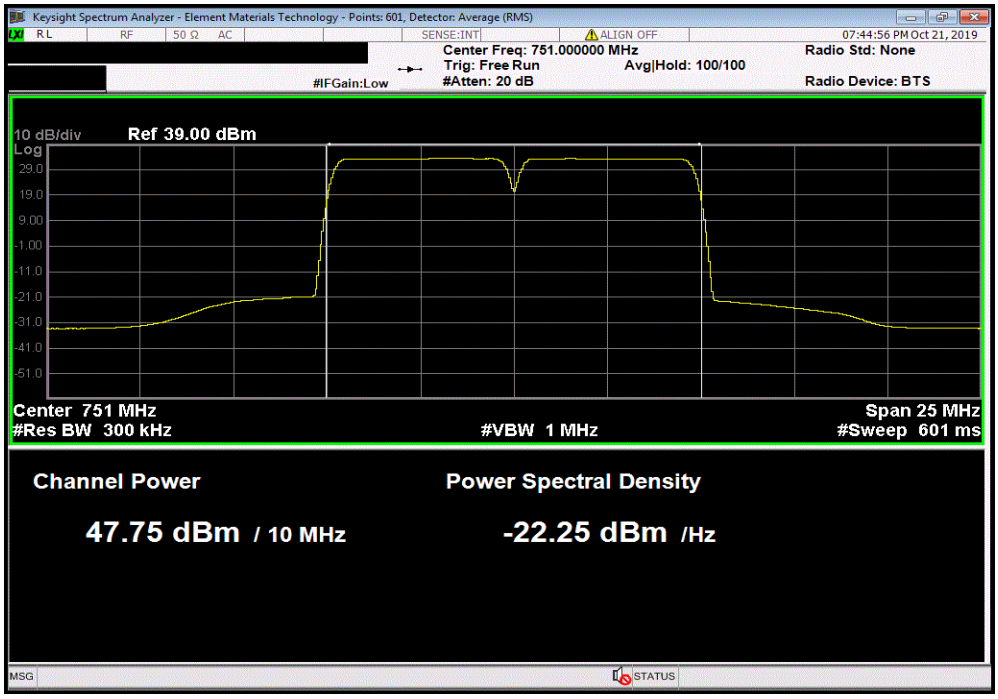


AVERAGE OUTPUT POWER

Band 13, 64QAM Modulation, LTE5 Bandwidth, Multicarrier Test Case 1, Mid Channel, 751 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	47.763	0		47.8	1000	Pass



Band 13, 256QAM Modulation, LTE5 Bandwidth, Multicarrier Test Case 1, Mid Channel, 751 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (W ERP)	Results
	47.748	0		47.7	1000	Pass



PEAK-TO-AVERAGE POWER RATIO (PAPR)

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.

Because the conducted Output Power was measured using a RMS Average detector, the Peak to Average Power Ratio (PAPR) was measured to show that the maximum peak-max-hold spectrum to the maximum of the average spectrum does not exceed 13 dB.

The PAPR measurement method is described in ANSI C63.26 section 5.2.3.4.
The PAPR was measured using the CCDF function of the spectrum analyzer.

PEAK-TO-AVERAGE POWER RATIO (PAPR)

element

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	**AHBOA Remote Radio Head (RRH)**			**Work Order:**	**NOKI0003**
Serial Number:	**BL1934X1001**			**Date:**	**21-Oct-19**
Customer:	**Nokia**			**Temperature:**	**22.7 °C**
Attendees:	**Hobert Smith, John Rattanavong, Mitchell Hill**			**Humidity:**	**36.6% RH**
Project:	**None**			**Barometric Pres.:**	**1020 mbar**
Tested by:	**Jonathan Kiefer**	**Power:**	**48VDC**	**Job Site:**	**TX09**

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

COMMENTS

Band 71 PAPR measurements for LTE5 channel bandwidth at mid channel using 256QAM on all four antenna ports. Using CCDF function of spectrum analyzer. EUT is operated at 100% duty cycle.

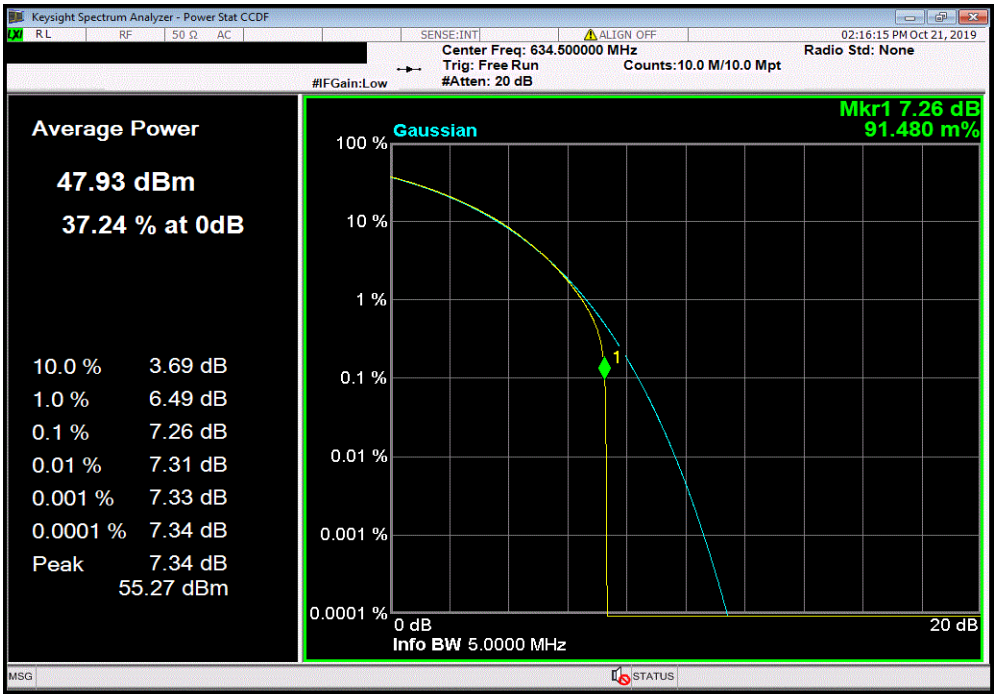
DEVIATIONS FROM TEST STANDARD

None

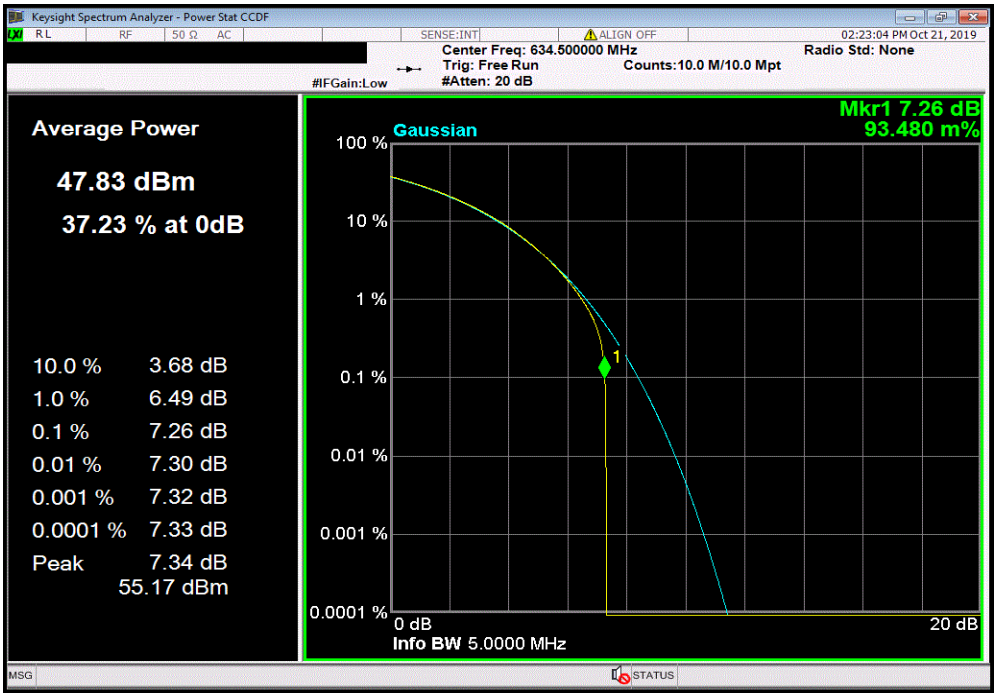
Configuration #	**1**	*Signature* Jonathan Kiefer

	PAPR Value (dB)	PAPR Limit (dBm)	Results
Band 71			
256QAM Modulation			
LTE5 Bandwidth			
Mid Channel, 634.5 MHz			
Antenna Port 1	7.26	13	Pass
Antenna Port 2	7.26	13	Pass
Antenna Port 3	7.25	13	Pass
Antenna Port 4	7.26	13	Pass

Band 71, 256QAM Modulation, LTE5 Bandwidth, Mid Channel, 634.5 MHz, Antenna Port 1						
				PAPR Value (dB)	PAPR Limit (dBm)	Results
				7.26	13	Pass

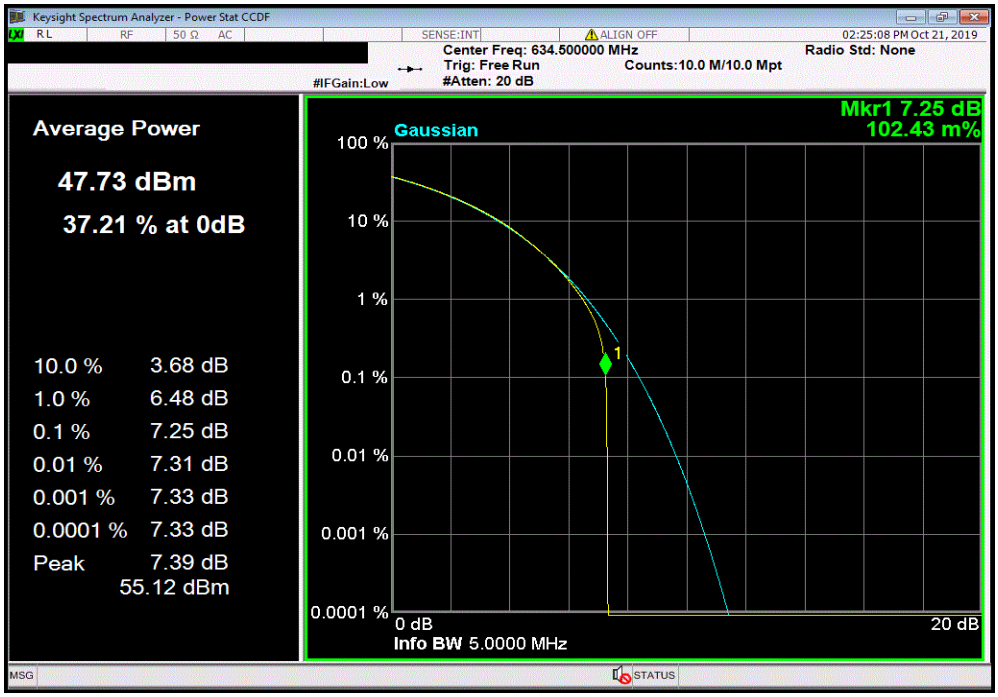


Band 71, 256QAM Modulation, LTE5 Bandwidth, Mid Channel, 634.5 MHz, Antenna Port 2						
				PAPR Value (dB)	PAPR Limit (dBm)	Results
				7.26	13	Pass



PEAK-TO-AVERAGE POWER RATIO (PAPR)

Band 71, 256QAM Modulation, LTE5 Bandwidth, Mid Channel, 634.5 MHz, Antenna Port 3						
				PAPR Value (dB)	PAPR Limit (dBm)	Results
				7.25	13	Pass



Band 71, 256QAM Modulation, LTE5 Bandwidth, Mid Channel, 634.5 MHz, Antenna Port 4						
				PAPR Value (dB)	PAPR Limit (dBm)	Results
				7.26	13	Pass