



# element

## Nokia Solutions and Networks

### Radio Test Report

#### Application for a Class II Permissive Change of Equipment Authorization

FCC 22H:2019

(869MHz to 894MHz)

FCC ID: VBNAHBCC-01

Airscale Base Transceiver Station Remote Radio Head

Model: AHBCC

Report # NOKI0002



NVLAP LAB CODE: 201049-0



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# CERTIFICATE OF TEST



Last Date of Test: December 5, 2019  
Nokia Solutions and Networks

EUT: Airscale Base Transceiver Station Remote Radio Head Model AHBCC

## Radio Equipment Testing

### Standards

Specification	Method
FCC 22H:2019	ANSI C63.26:2015 with
FCC Part 2:2019	FCC KDB 971168 D01 v03r01 FCC KDB 662911D01 v02r01

### Results

Method Clause	Test Description	Applied	Results	Comments
5.2.4	Average Output Power	Yes	Pass	
5.2.6	Peak to Average Power (PAPR)	Yes	Pass	
5.4	Emission Bandwidth	Yes	Pass	
5.7	Band Edge Compliance	Yes	Pass	
5.7	Spurious Conducted Emissions	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

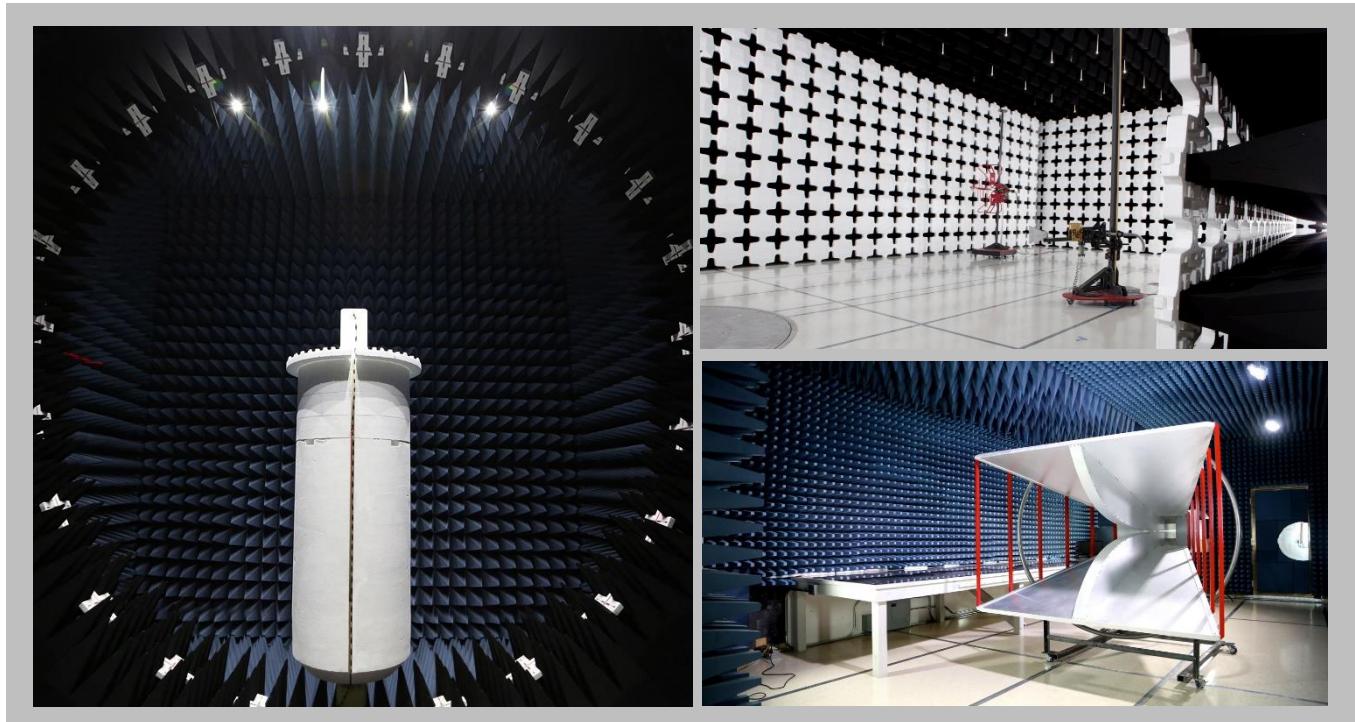
For details on the Scopes of our Accreditations, please visit:

<https://www.nwemc.com/emc-testing-accreditations>

# FACILITIES



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



# MEASUREMENT UNCERTAINTY



## 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.

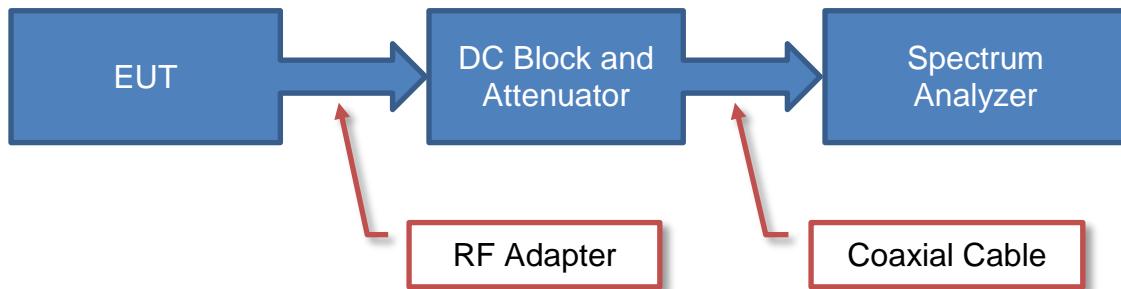
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty ( $K=2$ ) can be found included as part of the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

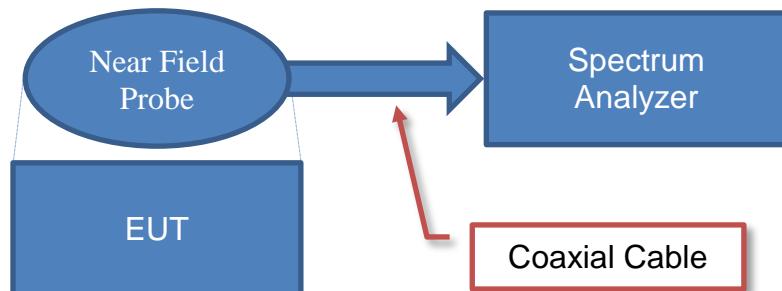
Test	+ MU	- MU
Frequency Accuracy	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	1.2 dB	-1.2 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field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

# Test Setup Block Diagrams

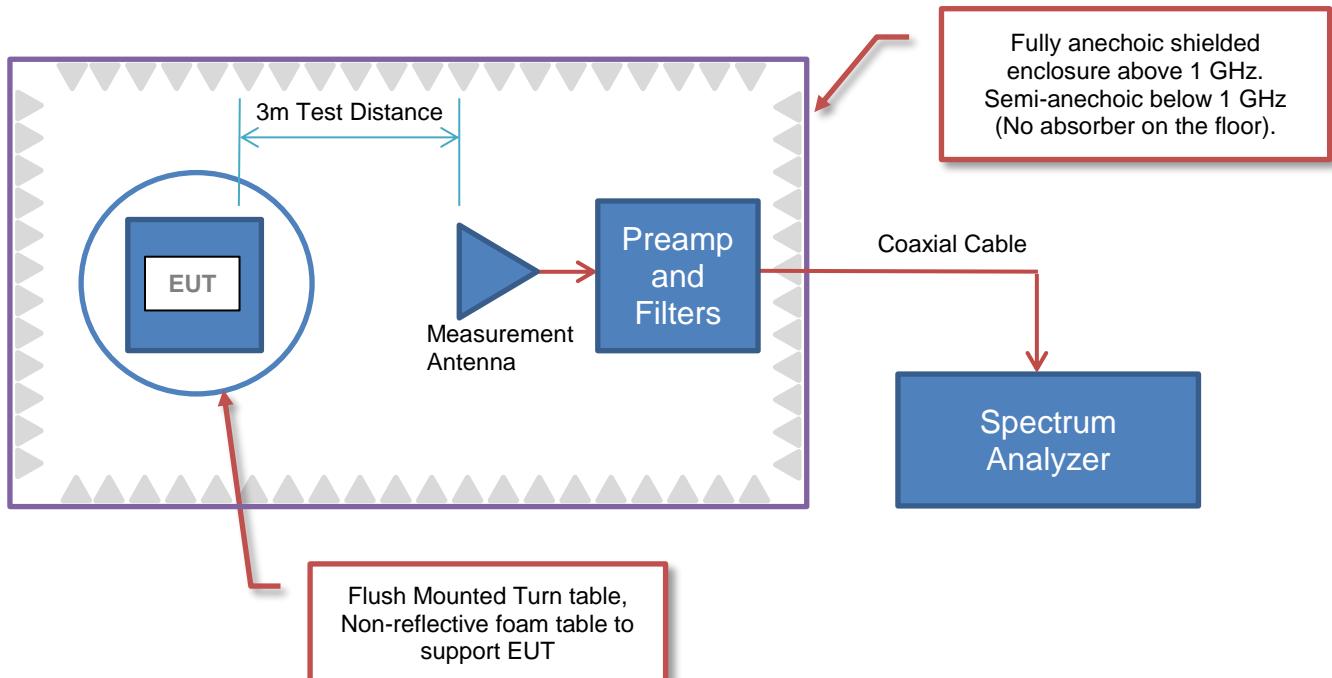
## Antenna Port Conducted Measurements



## Near Field Test Fixture Measurements



## Spurious Radiated Emissions



# PRODUCT DESCRIPTION



## Client and Equipment Under Test (EUT) Information

<b>Company Name:</b>	Nokia Solutions and Networks
<b>Address:</b>	3201 Olympus Blvd
<b>City, State, Zip:</b>	Dallas, Texas 75019
<b>Test Requested By:</b>	Steve Mitchell
<b>EUT:</b>	Airscale Base Transceiver Station Remote Radio Head Model AHBCC
<b>First Date of Test:</b>	December 4, 2019
<b>Last Date of Test:</b>	December 5, 2019
<b>Receipt Date of Samples:</b>	December 4, 2019
<b>Equipment Design Stage:</b>	Production
<b>Equipment Condition:</b>	No Damage
<b>Purchase Authorization:</b>	Verified

## Information Provided by the Party Requesting the Test

### Functional Description of the EUT:

A class II permissive change on the original filing is being pursued to add 5G NR (new radio) carriers to the Airscale BTS RRH model AHBCC Federal Communication Commission certifications. The original FCC certification submittal was NTS Test Report Number PR075288 Revision 1 dated March 18, 2018. The original test effort includes testing for LTE technologies. Please refer to the test report on the original certification for details on all required testing.

All conducted RF testing performed for the original certification testing has been repeated using 5G NR carriers for this class II permissive change per correspondence/guidance from Nemko TCB. The same test methodology used in the original certification testing was used in this class II permissive change test effort. 5G NR carrier bandwidths of 5MHz and 10MHz with QPSK, 16QAM, 64QAM and 256QAM modulation types were verified under this effort. Tests performed under the class II change effort include RF power, peak to average power ratio, emission bandwidth (99% and 26 dB down), band edge spurious emissions, and conducted spurious emissions. The 5G NR carriers/modulation types for this testing are based upon 3GPP TS 38.141-1 Test Models and are NR-FR1-TM 1.1 (QPSK modulation type), NR-FR1-TM 3.2 (16QAM modulation type), NR-FR1-TM 3.1 (64QAM modulation type), and NR-FR1-TM 3.1a (256QAM modulation type).

The testing was performed on the same hardware (AHBCC) as the original certification test. The same AHBCC RF port (Ant 4) determined in the original certification testing to be the highest power port was used for all testing in this effort. The base station and remote radio head software for this testing is an updated release that includes 5G NR carrier support.

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

The equipment under test (EUT) is a Nokia Solutions and Networks AirScale Base Transceiver Station (BTS) Remote Radio Head (RRH) module, model AHBCC. The AHBCC remote radio head is a multistandard multicarrier radio module designed to support LTE, narrow band IoT (internet of things) operations (in-band, guard band, standalone) and 5G NR. The scope of testing in this effort is for 5G NR operations.

The AHBCC RRH has four transmit/four receive antenna ports (4TX/4RX for Band 5 and 4TX/4RX for Band 13). Each antenna port supports 3GPP frequency band 5 (BTS Rx: 824 to 849 MHz/BTS TX: 869 to 894 MHz) and 3GPP frequency band 13 (BTS Rx: 777 to 787 MHz/BTS TX: 746 to 756 MHz). The maximum RF output power of the RRH is 320 Watts (40 watts per carrier, 80 watts per antenna port). The RRH can be operated as a 4x4 MIMO, 2x2 MIMO or as non-MIMO. The TX and RX instantaneous bandwidth cover the full operational bandwidth. The RRH supports 5G-NR channel bandwidths of 5 and 10MHz for 3GPP frequency band n5 operations. The RRH supports four 5G-NR downlink modulation types (QPSK, 16QAM, 64QAM and 256QAM). 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.

# PRODUCT DESCRIPTION

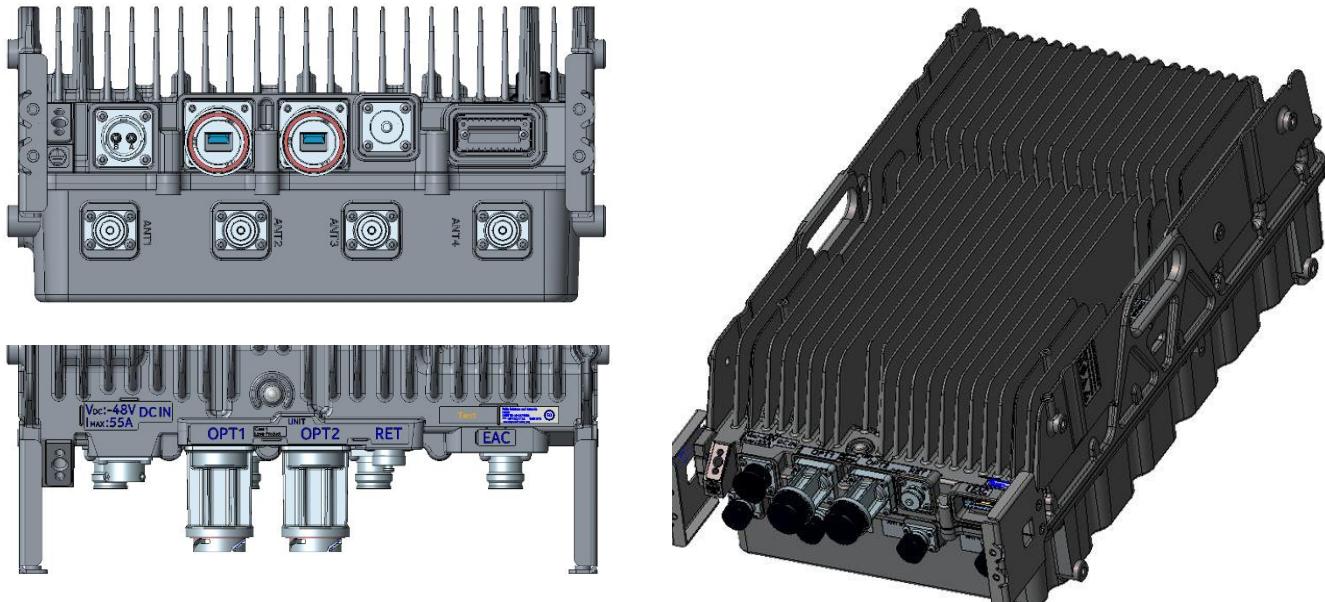


The AHBCC 5G NR downlink frequencies for Band n5 are as follows:

AHBCC 5G NR Band n5 (Ant 1, 2, 3, 4)	Downlink Frequency (MHz)	5G-NR Channel Bandwidth	
		5 MHz	10 MHz
	869.0	Band Edge	Band Edge
	871.5	Bottom Ch	
	874.0		Bottom Ch
	881.5	Middle Ch	Middle Ch
	889.0		Top Channel
	891.5	Top Channel	
	894.0	Band Edge	Band Edge

AHBCC Downlink Band Edge 5G-NR Band n5 Frequencies

AHBCC Connector Layout:



# PRODUCT DESCRIPTION



## EUT External Interfaces

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

## Testing Objective:

A class II permissive change on the original filing is being pursued to add 5G NR (new radio) carriers to the Airscale BTS RRH model AHBCC Federal Communication Commission certifications. The original FCC certification submittal (FCC ID: VBNAHBCC-01) was NTS Test Report Number PR075288 Revision 1 dated March 18, 2018. The original test effort includes testing for LTE technologies. Please refer to the test report on the original certification for details on all required testing.

# CONFIGURATIONS



## Configuration NOKI0002- 1

Software/Firmware Running during test	
Description	Version
BTS Software	5G19A_6.28451.102
RRH Software	FRM59.10.R11L

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Remote Radio Head	Nokia	AHBCC / 474341A. 101	K9180332366

Peripherals in 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(RH)	HP	6032A	3440A-10308
Power Supply(Base Station)	Emerson	AA27050L	None
Laptop Computer	HP	ProBook 6470B	None
Power Supply(Laptop)	HP	608428-002	F12941232064008
USB Mouse	HP	672654-001	None
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	TV066
SFP+ 10.Gb 300m 850nm 1 (RF module)	Nokia	473471A. 101	FR182418340
SFP+ 10.Gb 300m 850nm 1 (System module)	Nokia	473471A. 101	FR182418394
Baseband Module (ABIL AirScale Capacity)	Nokia	474020A.102	L1183605740
System Module (ASIK AirScale Common)	Nokia	474021A.101	L1183605867
Cabinet (AMIA AirScale Indoor Subrack)	Nokia	473098A	None
GPS Antenna	Trimble	fygb 472748A	71231431

# 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 RH)	No	2.2m	No	AC Mains	Power Supply(RH)
DC Power (PS RH)	No	1.7m	No	Power Supply(RH)	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)	System Module (ASIK AirScale Common)
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	System Module (ASIK AirScale Common)
Optical Fiber	No	2m	No	System Module (ASIK AirScale Common)	Remote Radio Head Module
N Type SUCOFLEX_106 Load 1	Yes	1.6m	No	Radio Head Module	Antenna Load 1
N Type SUCOFLEX_106 Load 2	Yes	1.6m	No	Radio Head Module	Antenna Load 2
N Type SUCOFLEX_106 Load 3	Yes	1.6m	No	Radio Head Module	Antenna Load 3
N Type MEGAPHASE (EUT to Atten)	Yes	2m	No	Radio Head Module	40dB 250W Attenuator
N Type (MEGAPHASE (Atten to Spec An)	Yes	1m	No	40dB 250W Attenuator	Spectrum Analyzer
GPS Cable	No	30m	No	GPS Cable	System Module

# CONFIGURATIONS



## Configuration NOKI0002- 2

Software/Firmware Running during test	
Description	Version
BTS Software	5G19A_6.28451.102
RRH Software	FRM59.10.R11L

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Remote Radio Head	Nokia	AHBCC / 474341A. 101	K9180332366

Peripherals in 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(RH)	HP	6032A	3440A-10308
Power Supply(Base Station)	Emerson	AA27050L	None
Laptop Computer	HP	ProBook 6470B	None
Power Supply(Laptop)	HP	608428-002	F12941232064008
USB Mouse	HP	672654-001	None
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	TV066
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
SFP+ 10.Gb 300m 850nm 1 (RF module)	Nokia	473471A. 101	FR182418340
SFP+ 10.Gb 300m 850nm 1 (System module)	Nokia	473471A. 101	FR182418394
Baseband Module (ABIL AirScale Capacity)	Nokia	474020A.102	L1183605740
System Module (ASIK AirScale Common)	Nokia	474021A.101	L1183605867
Cabinet (AMIA AirScale Indoor Subrack)	Nokia	473098A	None
GPS Antenna	Trimble	fygb 472748A	71231431

# 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 RH)	No	2.2m	No	AC Mains	Power Supply(RH)
DC Power (PS RH)	No	1.7m	No	Power Supply(RH)	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)	System Module (ASIK AirScale Common)
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	System Module (ASIK AirScale Common)
Optical Fiber	No	2m	No	System Module (ASIK AirScale Common)	Remote Radio Head Module
N Type SUCOFLEX_104	Yes	0.9m	No	Low Pass Filter 1	Spectrum Analyzer
N Type SUCOFLEX_106 Load 1	Yes	1.6m	No	Radio Head Module	Antenna Load 1
N Type SUCOFLEX_106 Load 2	Yes	1.6m	No	Radio Head Module	Antenna Load 2
N Type SUCOFLEX_106 Load 3	Yes	1.6m	No	Radio Head Module	Antenna Load 3
N Type MEGAPHASE (EUT to Atten)	Yes	2m	No	Radio Head Module	40dB 250W Attenuator
GPS Cable	No	30m	No	GPS Cable	System Module

# CONFIGURATIONS



## Configuration NOKI0002- 3

Software/Firmware Running during test	
Description	Version
BTS Software	5G19A_6.28451.102
RRH Software	FRM59.10.R11L

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Remote Radio Head	Nokia	AHBCC / 474341A. 101	K9180332366

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Electric Fan	Electrix	L908	None
Power Supply(RH)	HP	6032A	3440A-10308
Power Supply(Base Station)	Emerson	AA27050L	None
Laptop Computer	HP	ProBook 6470B	None
Power Supply(Laptop)	HP	608428-002	F12941232064008
USB Mouse	HP	672654-001	None
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	TV066
20dB 150W Attenuator	Aeroflex/Weinschel	66-20-33	BZ1165
High Pass Filter	RLC ELECTRONICS	F-14699	0050
SFP+ 10.Gb 300m 850nm 1 (RF module)	Nokia	473471A. 101	FR182418340
SFP+ 10.Gb 300m 850nm 1 (System module)	Nokia	473471A. 101	FR182418394
Baseband Module (ABIL AirScale Capacity)	Nokia	474020A.102	L1183605740
System Module (ASIK AirScale Common)	Nokia	474021A.101	L1183605867
Cabinet (AMIA AirScale Indoor Subrack)	Nokia	473098A	None
GPS Antenna	Trimble	fygb 472748A	71231431

# CONFIGURATIONS



<b>Cables</b>					
<b>Cable Type</b>	<b>Shield</b>	<b>Length (m)</b>	<b>Ferrite</b>	<b>Connection 1</b>	<b>Connection 2</b>
AC Power (Fan)	No	2m	No	AC Mains	Electric Fan
AC Power (PS RH)	No	2.2m	No	AC Mains	Power Supply(RH)
DC Power (PS RH)	No	1.7m	No	Power Supply(RH)	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)	System Module (ASIK AirScale Common)
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	System Module (ASIK AirScale Common)
Optical Fiber	No	2m	No	System Module (ASIK AirScale Common)	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
N Type SUCOFLEX_106 Load 1	Yes	1.6m	No	Radio Head Module	Antenna Load 1
N Type SUCOFLEX_106 Load 2	Yes	1.6m	No	Radio Head Module	Antenna Load 2
N Type SUCOFLEX_106 Load 3	Yes	1.6m	No	Radio Head Module	Antenna Load 3
GPS Cable	No	30m	No	GPS Cable	System Module

# MODIFICATIONS



## Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2019-12-04	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.
2	2019-12-04	Average Output 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.
3	2019-12-05	Peak to Average Power (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	2019-12-05	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	2019-12-05	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 peak output power was measured with the EUT set to the parameters called out in the data sheets. Prior to making the measurements the setup including cables and attenuator was calibrated with a signal generator and a power meter.

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 22.913(a)(1)(i), the Effective Radiated Power (ERP) of the transceiver cannot exceed 500 Watts.

# AVERAGE POWER



TbTx 2019.08.30.0

XMI 2019.08.05

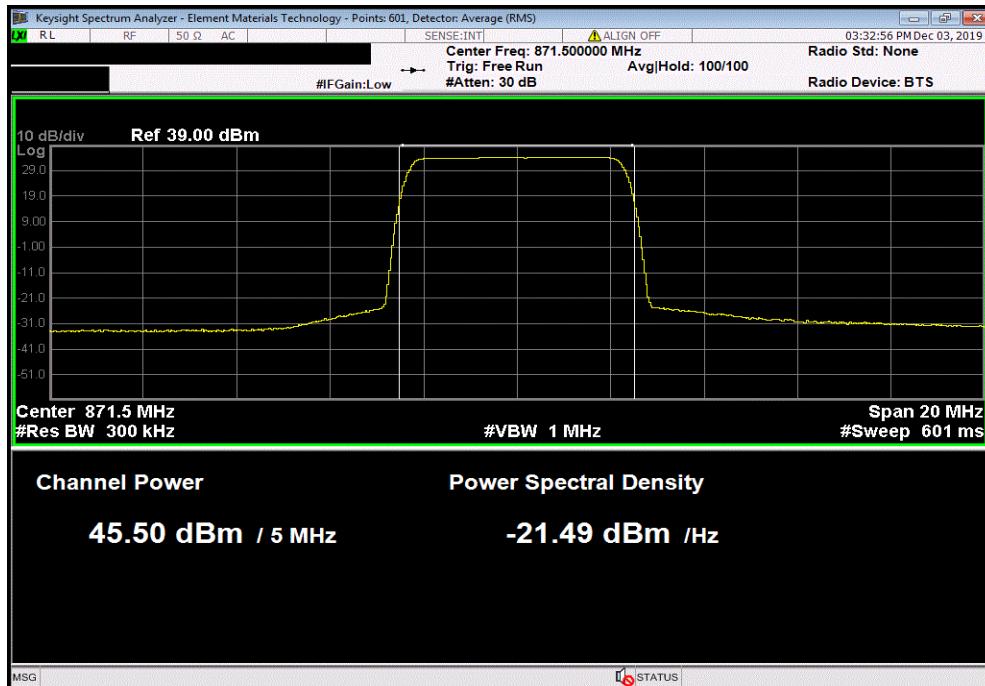
EUT:	AHBCC Remote Radio Head (RRH)		Work Order:	NOKI0002			
Serial Number:	K9180332366		Date:	4-Dec-19			
Customer:	Nokia Solutions and Networks		Temperature:	23.6 °C			
Attendees:	Mitchell Hill, John Rattanavong		Humidity:	30.6% RH			
Project:	None		Barometric Pres.:	1020 mbar			
Tested by:	Brandon Hobbs	Power:	54VDC	Job Site:	TX09		
TEST SPECIFICATIONS	Test Method						
FCC 22H:2019	ANSI C63.26:2015						
COMMENTS	Testing was completed on the highest output power antenna port (Port 4). The highest power port was determined in the original AHBCC radio certification effort. All conducted losses were accounted for between the radio and the spectrum analyzer. The EUT was operating at 100% duty cycle for all measurements made.						
DEVIATIONS FROM TEST STANDARD	None						
Configuration #	1	Signature	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (dBm)	Results
Band 5							
Port 4							
5 MHz Bandwidth							
QPSK							
	Low Channel, 871.5 MHz	45.5	0	45.5	57	Pass	
	Mid Channel, 881.5 MHz	45.49	0	45.5	57	Pass	
	High Channel, 891.5 MHz	45.355	0	45.4	57	Pass	
16QAM							
	Low Channel, 871.5 MHz	45.528	0	45.5	57	Pass	
	Mid Channel, 881.5 MHz	45.378	0	45.4	57	Pass	
	High Channel, 891.5 MHz	45.39	0	45.4	57	Pass	
64QAM							
	Low Channel, 871.5 MHz	45.408	0	45.4	57	Pass	
	Mid Channel, 881.5 MHz	45.315	0	45.3	57	Pass	
	High Channel, 891.5 MHz	45.292	0	45.3	57	Pass	
256QAM							
	Low Channel, 871.5 MHz	45.465	0	45.5	57	Pass	
	Mid Channel, 881.5 MHz	45.448	0	45.4	57	Pass	
	High Channel, 891.5 MHz	45.384	0	45.4	57	Pass	
10 MHz Bandwidth							
QPSK							
	Low Channel, 874 MHz	45.511	0	45.5	57	Pass	
	Mid Channel, 881.5 MHz	45.447	0	45.4	57	Pass	
	High Channel, 889 MHz	45.462	0	45.5	57	Pass	
16QAM							
	Low Channel, 874 MHz	45.527	0	45.5	57	Pass	
	Mid Channel, 881.5 MHz	45.444	0	45.4	57	Pass	
	High Channel, 889 MHz	45.503	0	45.5	57	Pass	
64QAM							
	Low Channel, 874 MHz	45.503	0	45.5	57	Pass	
	Mid Channel, 881.5 MHz	45.452	0	45.5	57	Pass	
	High Channel, 889 MHz	45.467	0	45.5	57	Pass	
256QAM							
	Low Channel, 874 MHz	45.514	0	45.5	57	Pass	
	Mid Channel, 881.5 MHz	45.423	0	45.4	57	Pass	
	High Channel, 889 MHz	45.434	0	45.4	57	Pass	

# AVERAGE POWER

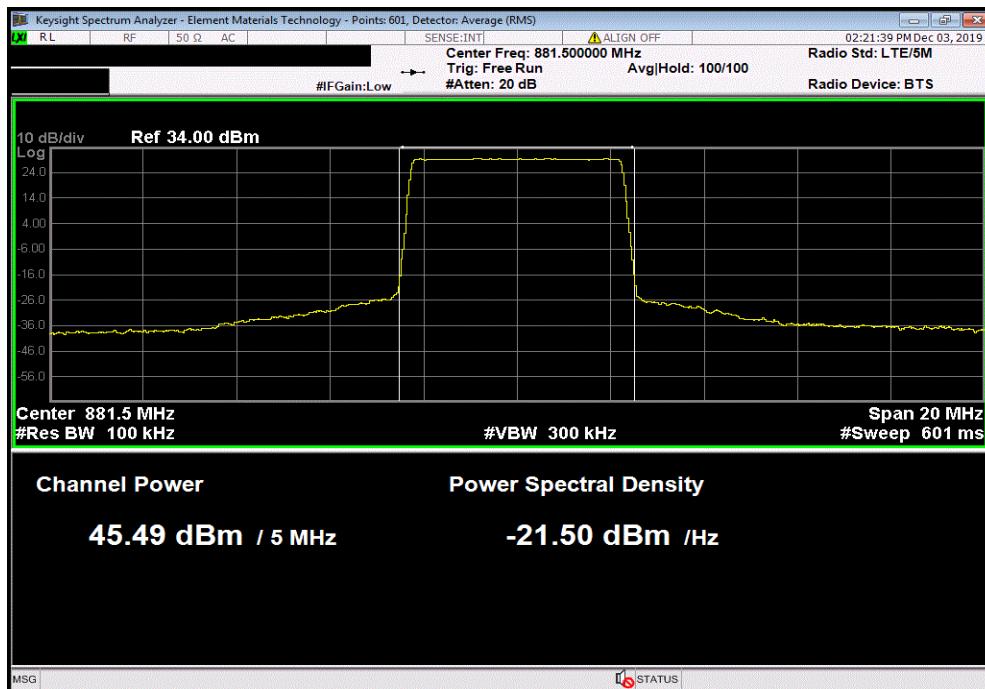


TbtTx 2019.08.30.0 XMI 2019.09.05

Band 5, Port 4, 5 MHz Bandwidth , QPSK, Low Channel, 871.5 MHz					
Avg Cond	Duty Cycle	Value	Limit		Results
Pwr (dBm)	Factor (dB)	(dBm)	(dBm)		
45.5	0	45.5	57		Pass



Band 5, Port 4, 5 MHz Bandwidth , QPSK, Mid Channel, 881.5 MHz					
Avg Cond	Duty Cycle	Value	Limit		Results
Pwr (dBm)	Factor (dB)	(dBm)	(dBm)		
45.49	0	45.5	57		Pass

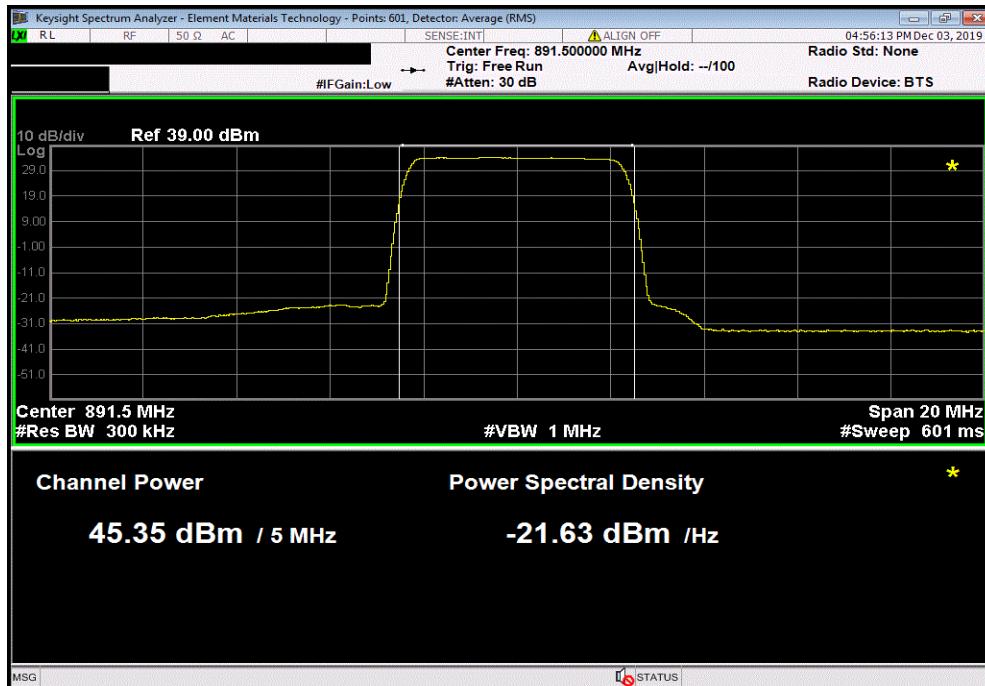


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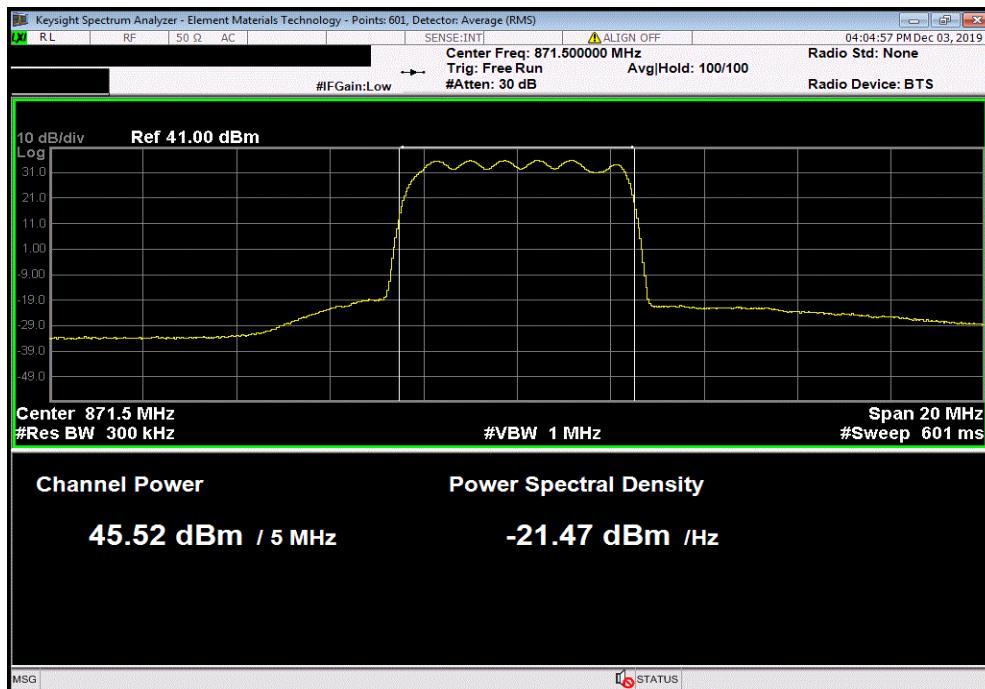


TbtTx 2019.08.30.0 XMI 2019.09.05

Band 5, Port 4, 5 MHz Bandwidth , QPSK, High Channel, 891.5 MHz					
Avg Cond	Duty Cycle	Value	Limit		Results
Pwr (dBm)	Factor (dB)	(dBm)	(dBm)		
45.355	0	45.4	57		Pass



Band 5, Port 4, 5 MHz Bandwidth , 16QAM, Low Channel, 871.5 MHz					
Avg Cond	Duty Cycle	Value	Limit		Results
Pwr (dBm)	Factor (dB)	(dBm)	(dBm)		
45.528	0	45.5	57		Pass

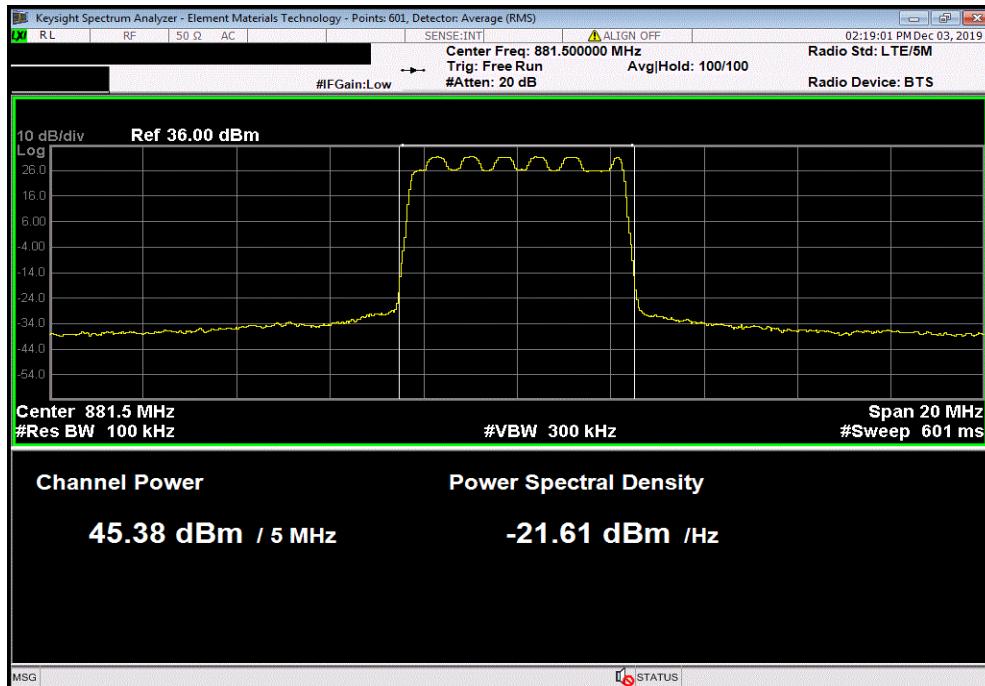


# AVERAGE POWER

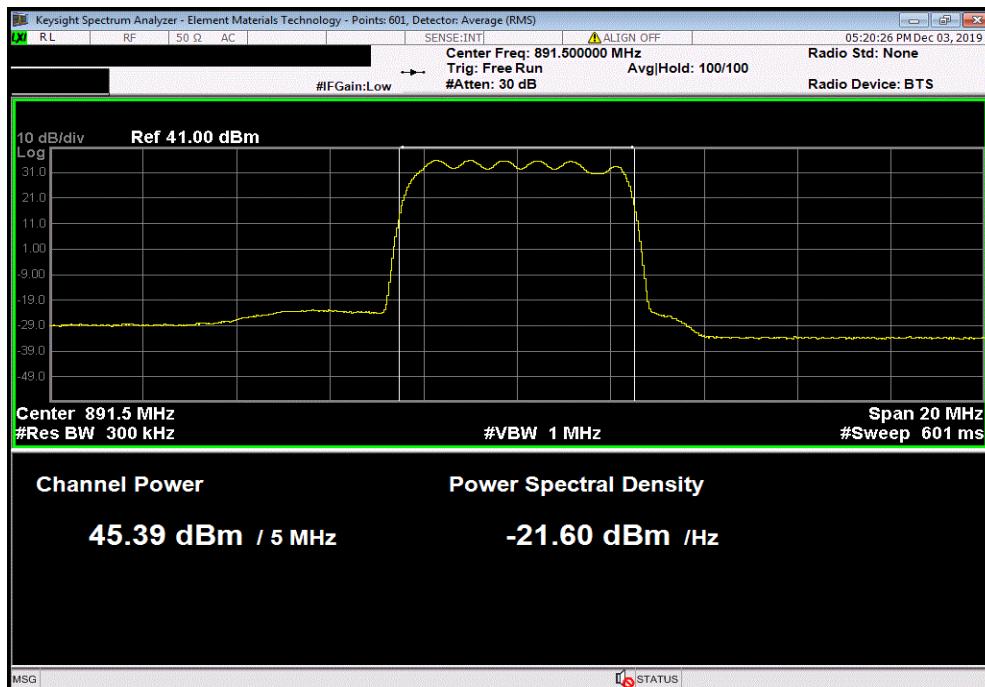


TbtTx 2019.08.30.0 XMI 2019.09.05

Band 5, Port 4, 5 MHz Bandwidth , 16QAM, Mid Channel, 881.5 MHz					
Avg Cond	Duty Cycle	Value	Limit		Results
Pwr (dBm)	Factor (dB)	(dBm)	(dBm)		
45.378	0	45.4	57		Pass



Band 5, Port 4, 5 MHz Bandwidth , 16QAM, High Channel, 891.5 MHz					
Avg Cond	Duty Cycle	Value	Limit		Results
Pwr (dBm)	Factor (dB)	(dBm)	(dBm)		
45.39	0	45.4	57		Pass

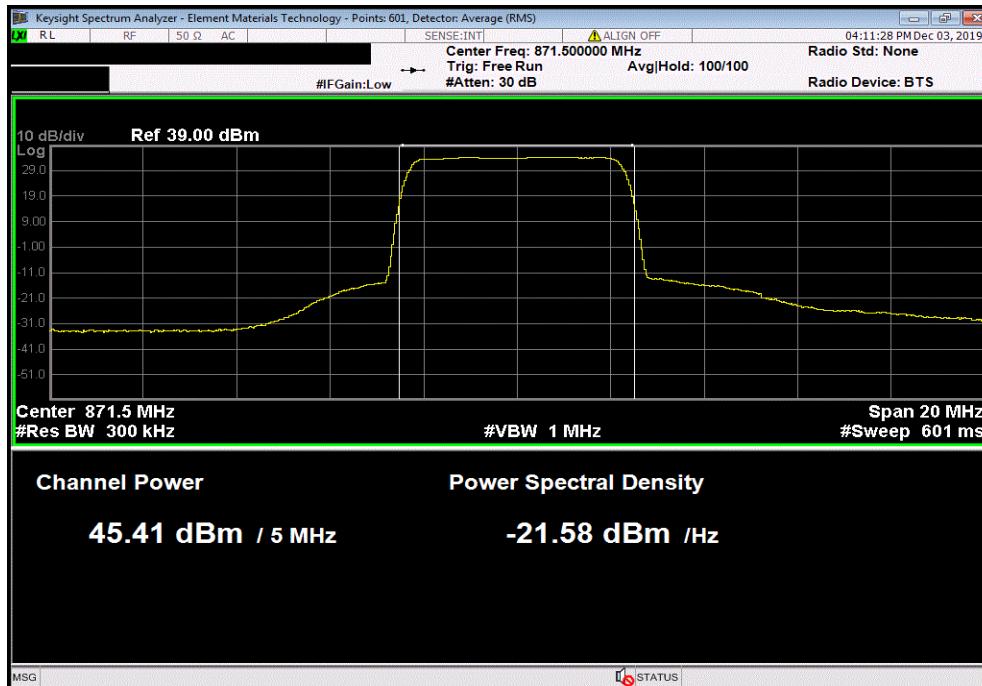


# AVERAGE POWER

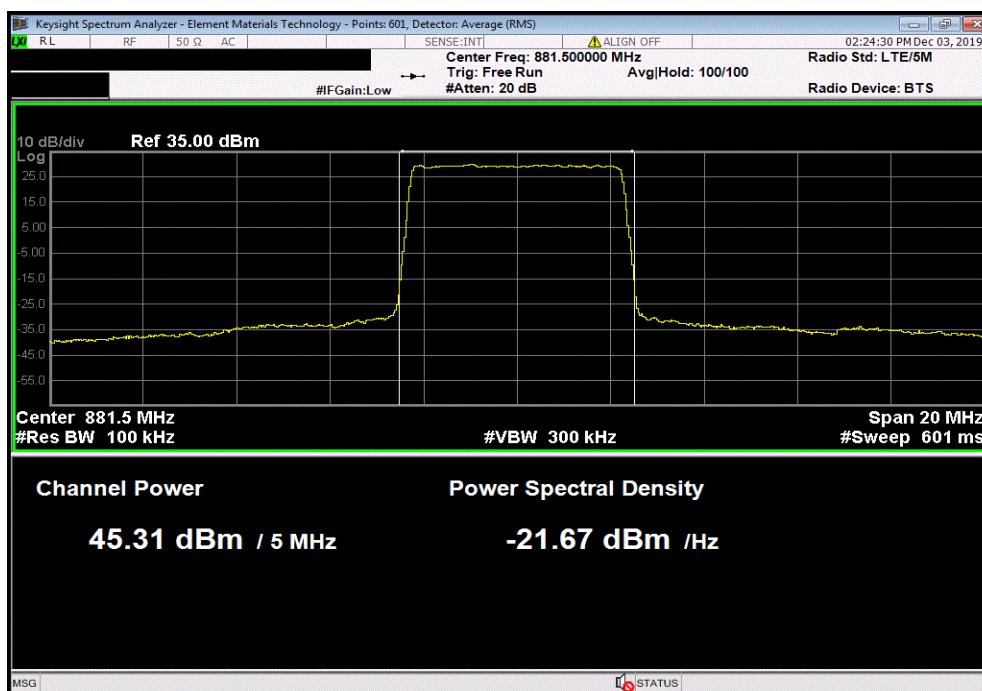


TbtTx 2019.08.30.0 XMI 2019.09.05

Band 5, Port 4, 5 MHz Bandwidth , 64QAM, Low Channel, 871.5 MHz					
Avg Cond	Duty Cycle	Value	Limit		Results
Pwr (dBm)	Factor (dB)	(dBm)	(dBm)		
45.408	0	45.4	57		Pass



Band 5, Port 4, 5 MHz Bandwidth , 64QAM, Mid Channel, 881.5 MHz					
Avg Cond	Duty Cycle	Value	Limit		Results
Pwr (dBm)	Factor (dB)	(dBm)	(dBm)		
45.315	0	45.3	57		Pass

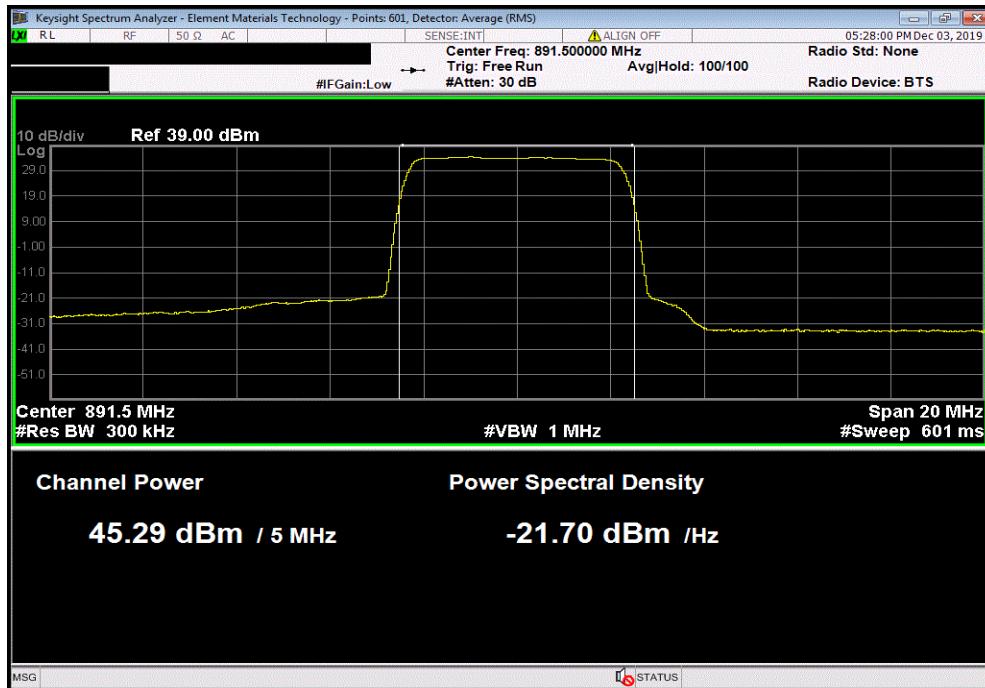


# AVERAGE POWER

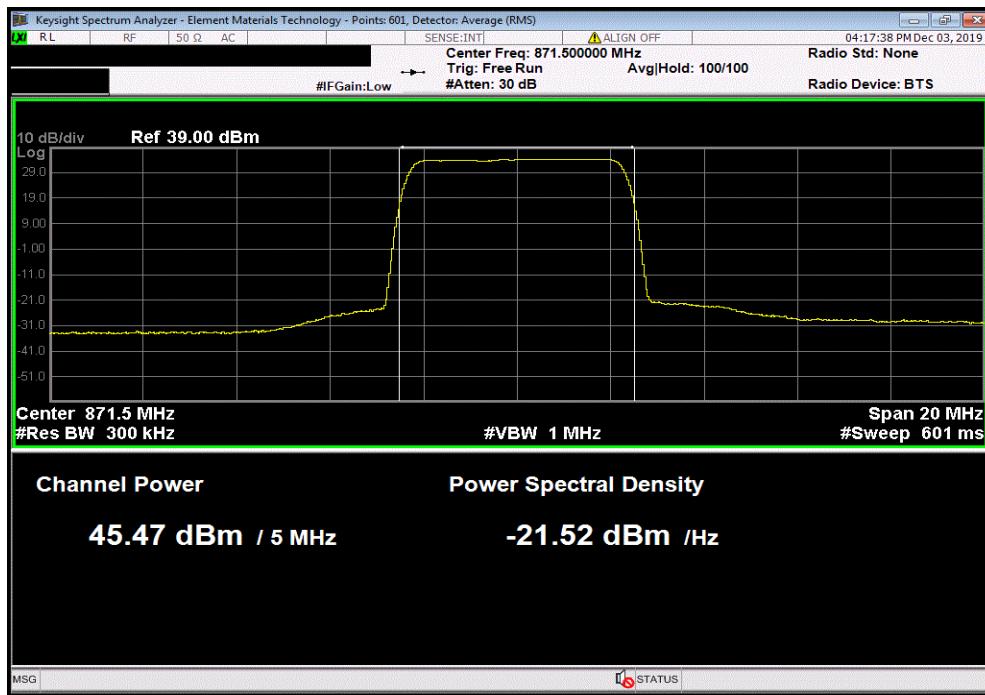


TbtTx 2019.08.30.0 XMI 2019.09.05

Band 5, Port 4, 5 MHz Bandwidth , 64QAM, High Channel, 891.5 MHz					
Avg Cond	Duty Cycle	Value	Limit		Results
Pwr (dBm)	Factor (dB)	(dBm)	(dBm)		
45.292	0	45.3	57		Pass



Band 5, Port 4, 5 MHz Bandwidth , 256QAM, Low Channel, 871.5 MHz					
Avg Cond	Duty Cycle	Value	Limit		Results
Pwr (dBm)	Factor (dB)	(dBm)	(dBm)		
45.465	0	45.5	57		Pass

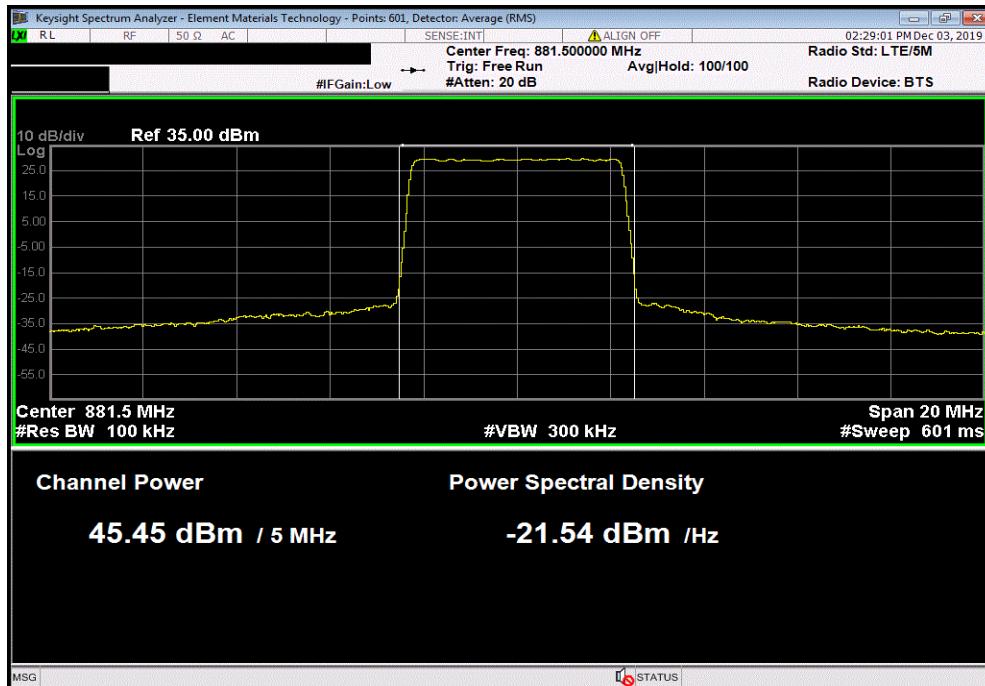


# AVERAGE POWER

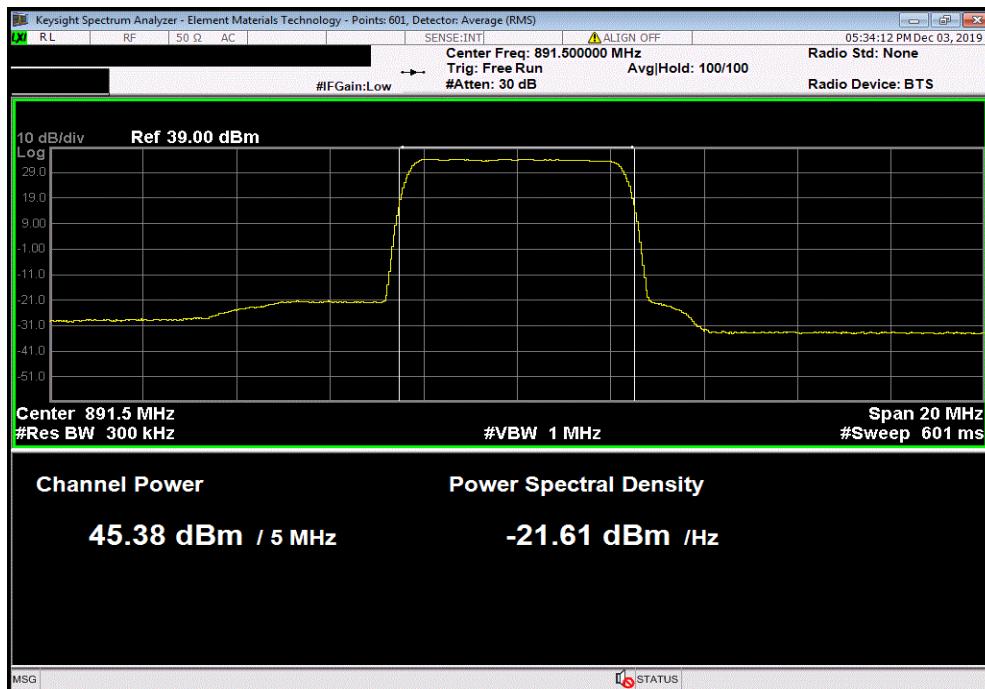


TbtTx 2019.08.30.0 XMI 2019.09.05

Band 5, Port 4, 5 MHz Bandwidth , 256QAM, Mid Channel, 881.5 MHz					
Avg Cond	Duty Cycle	Value	Limit		Results
Pwr (dBm)	Factor (dB)	(dBm)	(dBm)		
45.448	0	45.4	57		Pass



Band 5, Port 4, 5 MHz Bandwidth , 256QAM, High Channel, 891.5 MHz					
Avg Cond	Duty Cycle	Value	Limit		Results
Pwr (dBm)	Factor (dB)	(dBm)	(dBm)		
45.384	0	45.4	57		Pass

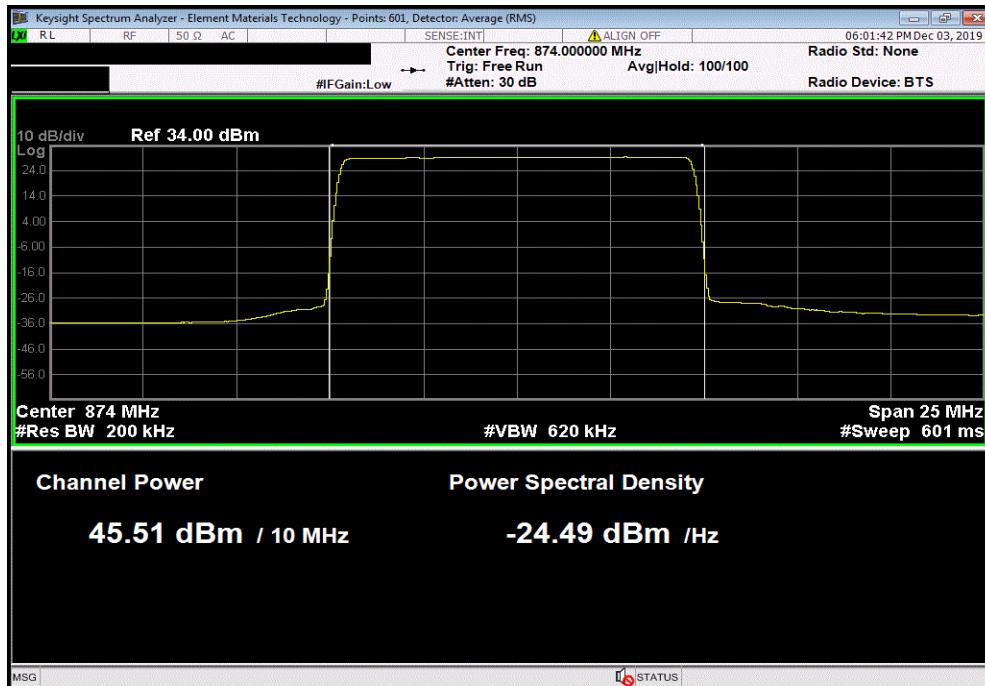


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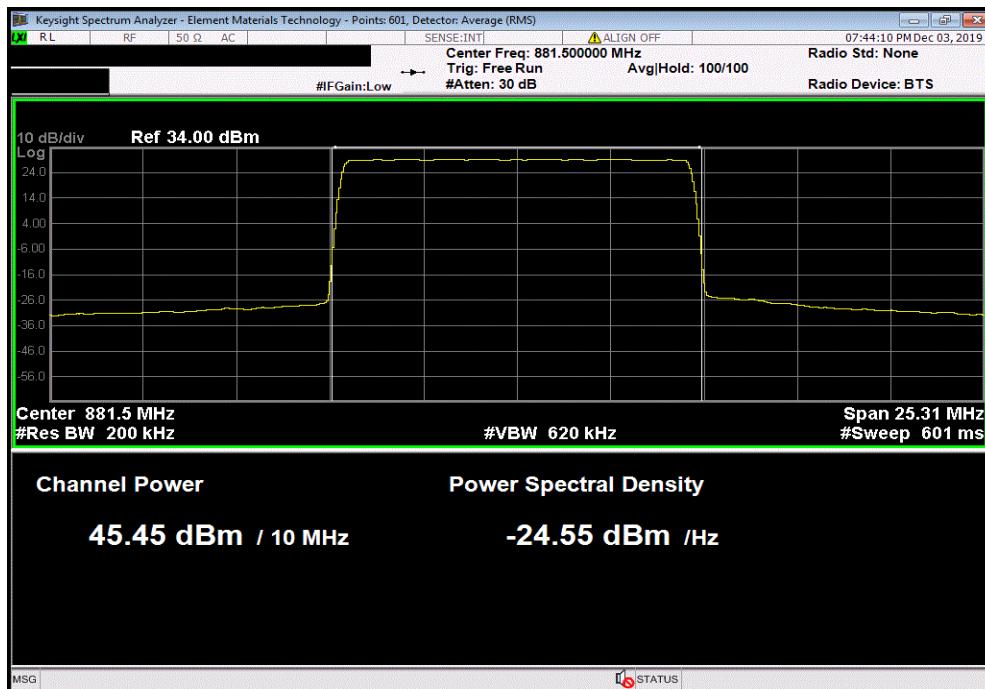


TbtTx 2019.08.30.0 XMI 2019.09.05

Band 5, Port 4, 10 MHz Bandwidth , QPSK, Low Channel, 874 MHz					
Avg Cond	Duty Cycle	Value	Limit		Results
Pwr (dBm)	Factor (dB)	(dBm)	(dBm)		
45.511	0	45.5	57		Pass



Band 5, Port 4, 10 MHz Bandwidth , QPSK, Mid Channel, 881.5 MHz					
Avg Cond	Duty Cycle	Value	Limit		Results
Pwr (dBm)	Factor (dB)	(dBm)	(dBm)		
45.447	0	45.4	57		Pass

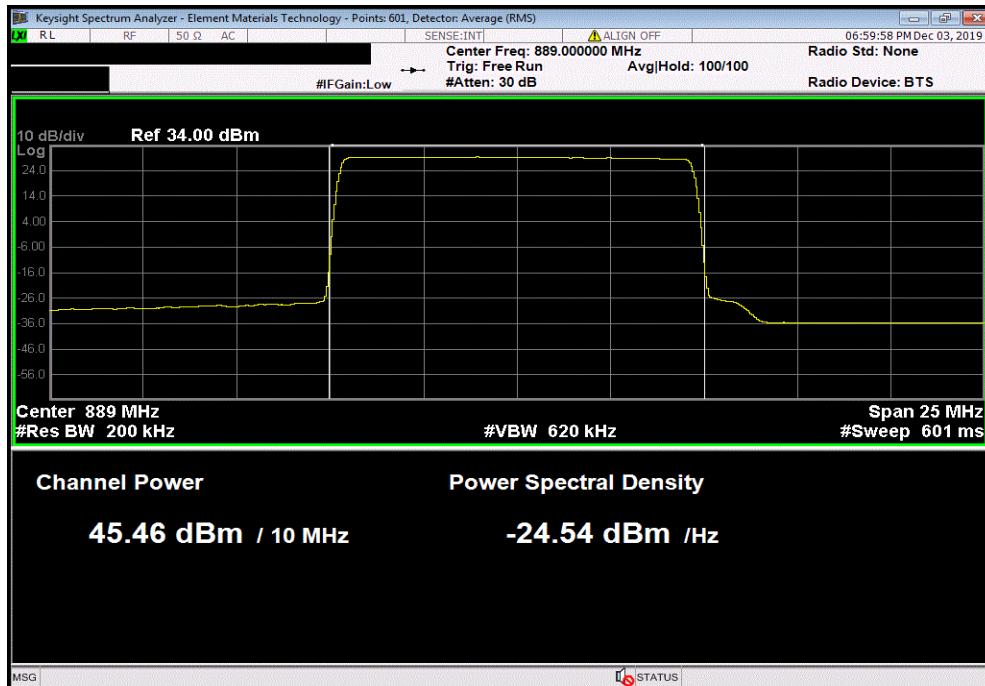


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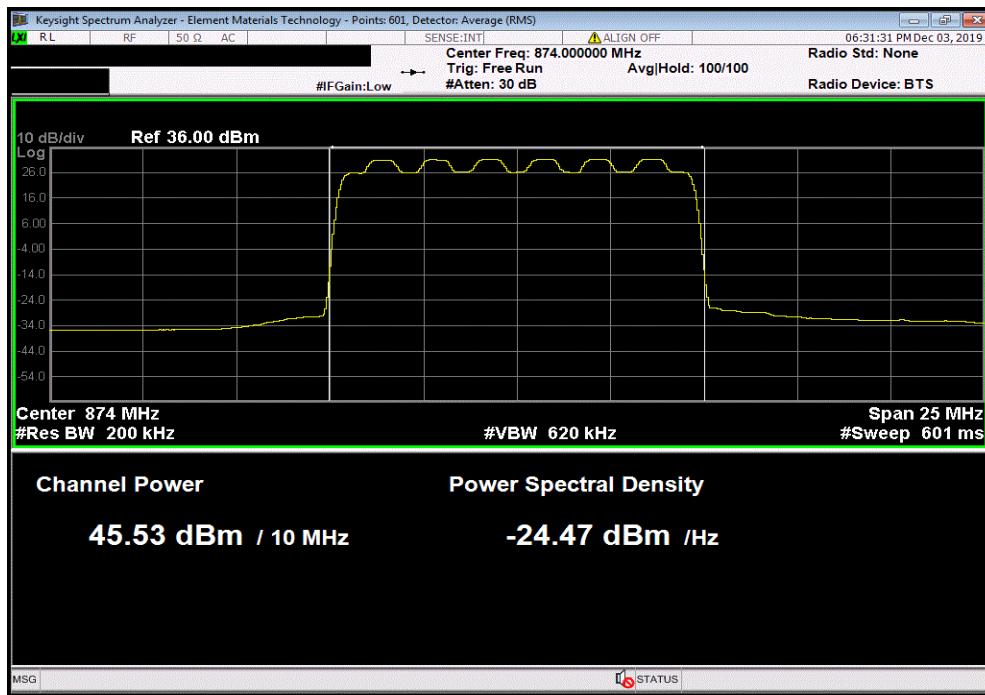


TbtTx 2019.08.30.0 XMI 2019.09.05

Band 5, Port 4, 10 MHz Bandwidth , QPSK, High Channel, 889 MHz					
Avg Cond	Duty Cycle	Value	Limit		Results
Pwr (dBm)	Factor (dB)	(dBm)	(dBm)		
45.462	0	45.5	57		Pass



Band 5, Port 4, 10 MHz Bandwidth , 16QAM, Low Channel, 874 MHz					
Avg Cond	Duty Cycle	Value	Limit		Results
Pwr (dBm)	Factor (dB)	(dBm)	(dBm)		
45.527	0	45.5	57		Pass

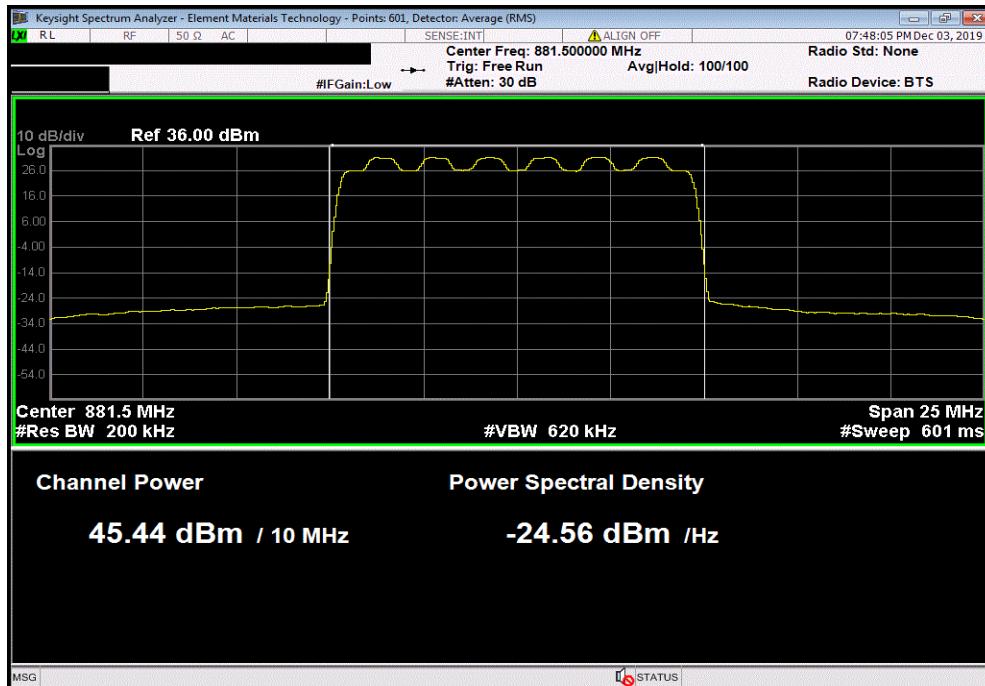


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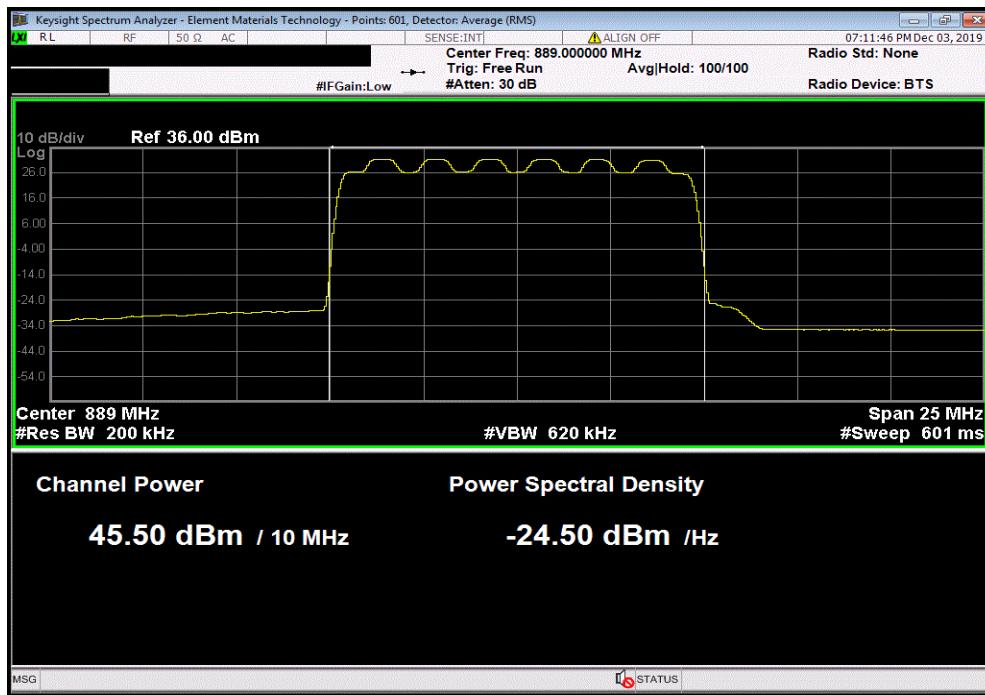


TbtTx 2019.08.30.0 XMI 2019.09.05

Band 5, Port 4, 10 MHz Bandwidth , 16QAM, Mid Channel, 881.5 MHz					
Avg Cond	Duty Cycle	Value	Limit		Results
Pwr (dBm)	Factor (dB)	(dBm)	(dBm)		
45.444	0	45.4	57		Pass



Band 5, Port 4, 10 MHz Bandwidth , 16QAM, High Channel, 889 MHz					
Avg Cond	Duty Cycle	Value	Limit		Results
Pwr (dBm)	Factor (dB)	(dBm)	(dBm)		
45.503	0	45.5	57		Pass

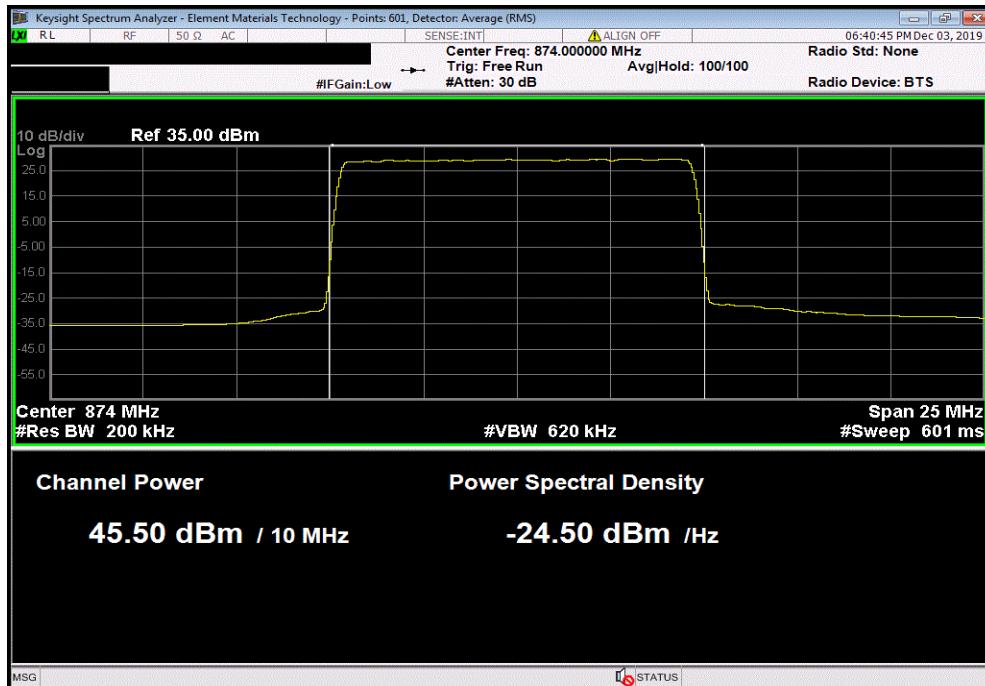


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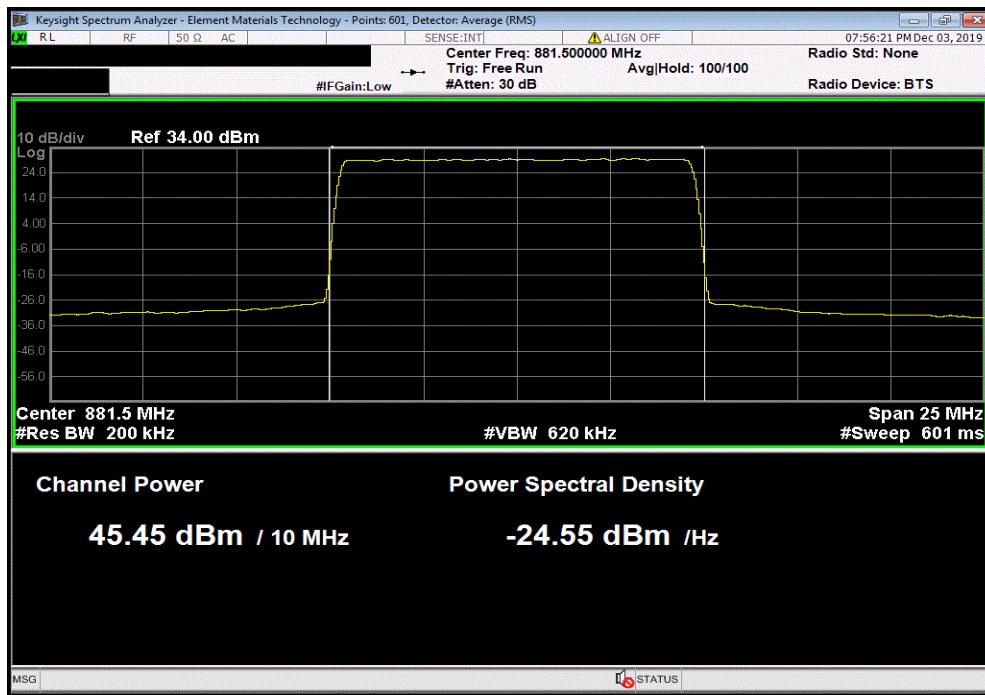


TbtTx 2019.08.30.0 XMI 2019.09.05

Band 5, Port 4, 10 MHz Bandwidth , 64QAM, Low Channel, 874 MHz					
Avg Cond	Duty Cycle	Value	Limit		Results
Pwr (dBm)	Factor (dB)	(dBm)	(dBm)		
45.503	0	45.5	57		Pass



Band 5, Port 4, 10 MHz Bandwidth , 64QAM, Mid Channel, 881.5 MHz					
Avg Cond	Duty Cycle	Value	Limit		Results
Pwr (dBm)	Factor (dB)	(dBm)	(dBm)		
45.452	0	45.5	57		Pass

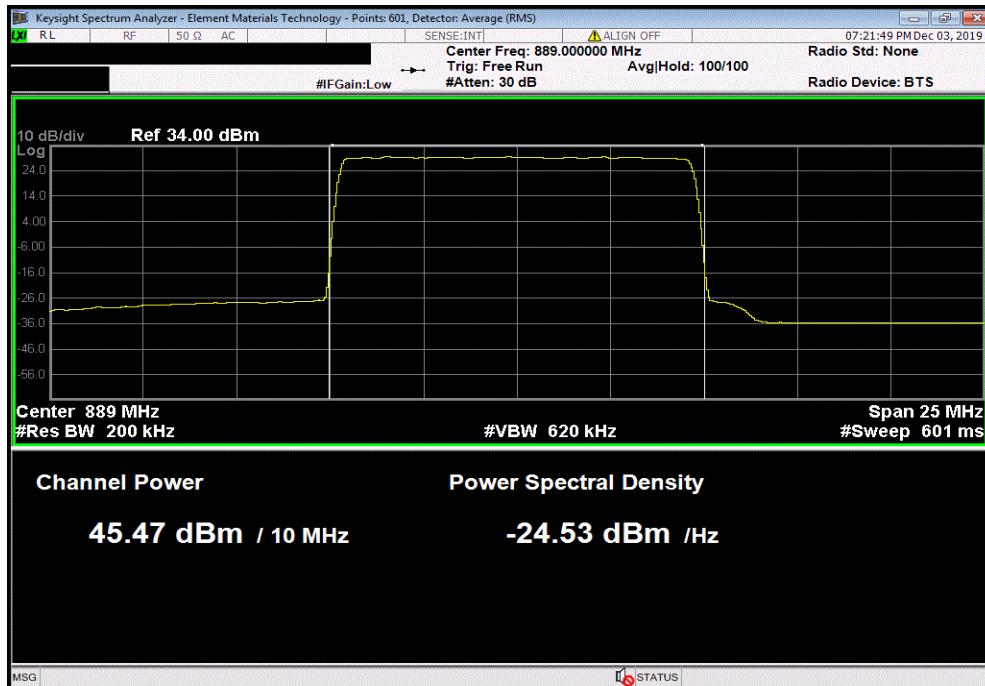


# AVERAGE POWER

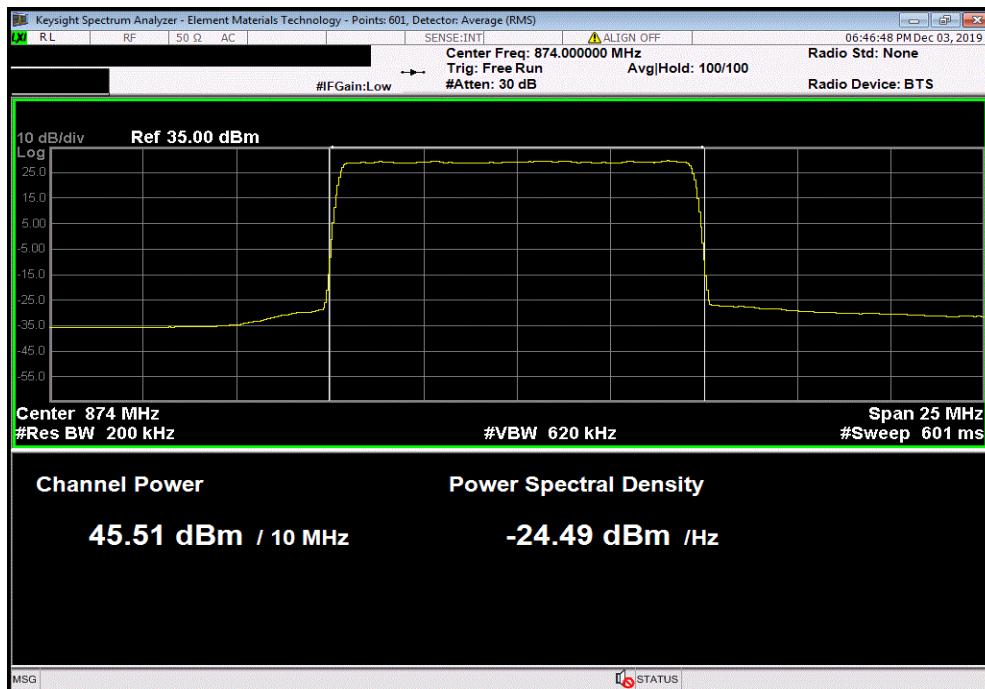


TbtTx 2019.08.30.0 XMI 2019.09.05

Band 5, Port 4, 10 MHz Bandwidth , 64QAM, High Channel, 889 MHz					
Avg Cond	Duty Cycle	Value	Limit		Results
Pwr (dBm)	Factor (dB)	(dBm)	(dBm)		
45.467	0	45.5	57		Pass



Band 5, Port 4, 10 MHz Bandwidth , 256QAM, Low Channel, 874 MHz					
Avg Cond	Duty Cycle	Value	Limit		Results
Pwr (dBm)	Factor (dB)	(dBm)	(dBm)		
45.514	0	45.5	57		Pass

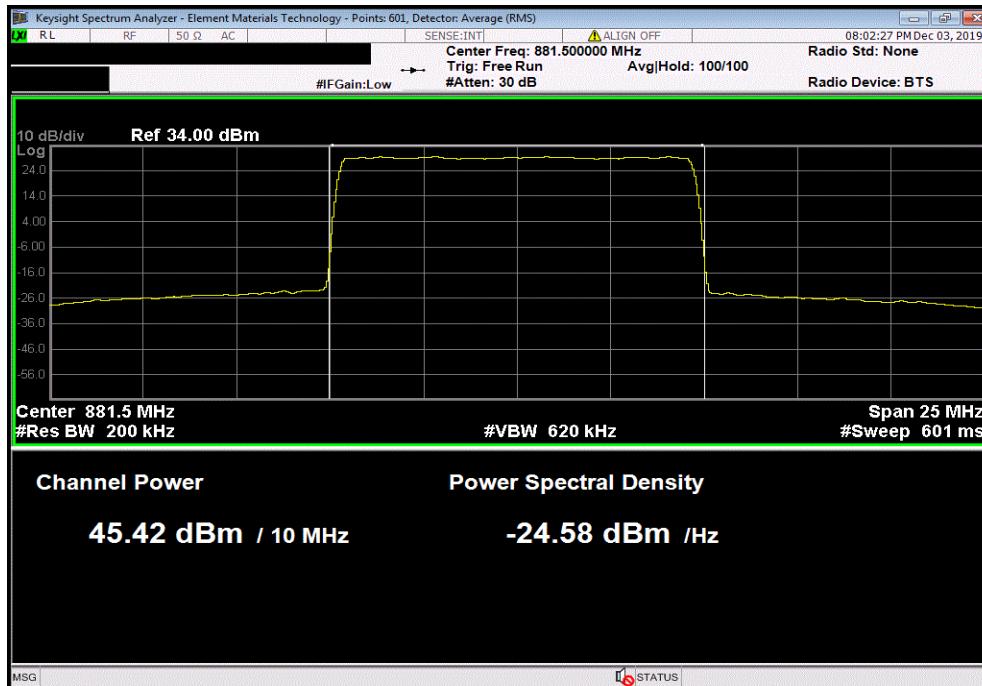


# AVERAGE POWER

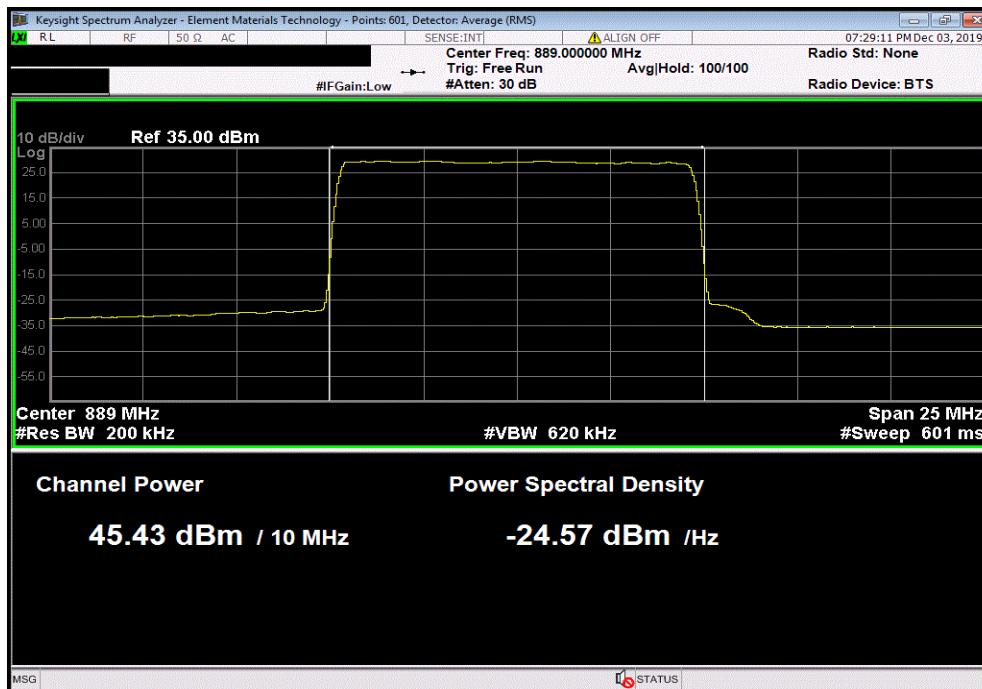


TbtTx 2019.08.30.0 XMI 2019.09.05

Band 5, Port 4, 10 MHz Bandwidth , 256QAM, Mid Channel, 881.5 MHz					
Avg Cond	Duty Cycle	Value	Limit		Results
Pwr (dBm)	Factor (dB)	(dBm)	(dBm)		
45.423	0	45.4	57		Pass



Band 5, Port 4, 10 MHz Bandwidth , 256QAM, High Channel, 889 MHz					
Avg Cond	Duty Cycle	Value	Limit		Results
Pwr (dBm)	Factor (dB)	(dBm)	(dBm)		
45.434	0	45.4	57		Pass



# PEAK-TO-AVERAGE POWER RATIO (PAPR)



XMIT 2019.06.11

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 the rule part defined limit.

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.

Per 22.913(d), the PAPR limit shall not exceed 13 dB for more than the ANSI described 0.1% of the time.

# PEAK-TO-AVERAGE POWER RATIO (PAPR)



XMI 2019.06.11

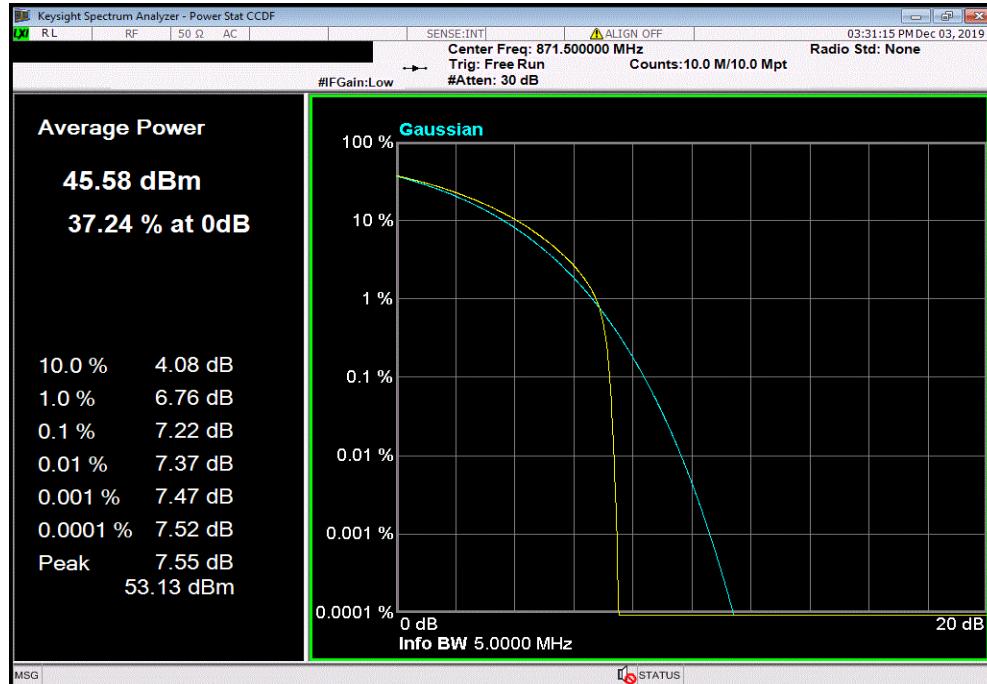
EUT:	AHBCC Remote Radio Head (RRH)	Work Order:	NOKI0002	
Serial Number:	K9180332366	Date:	5-Dec-19	
Customer:	Nokia Solutions and Networks	Temperature:	23 °C	
Attendees:	Mitchell Hill, John Rattanavong	Humidity:	30.8% RH	
Project:	None	Barometric Pres.:	1018 mbar	
Tested by:	Brandon Hobbs	Power:	54VDC	
TEST SPECIFICATIONS		Test Method	ANSI C63.26:2015	
FCC 22H:2019				
COMMENTS				
Testing was completed on the highest output power antenna port (Port 4). All conducted losses were accounted for between the radio and the spectrum analyzer. The EUT was operating at 100% duty cycle for all measurements made.				
DEVIATIONS FROM TEST STANDARD				
None				
Configuration #	1	Signature		
Band 5	Port 4	PAPR Value (dB)	PAPR Limit (dBm)	Result
	5 MHz Bandwidth			
	QPSK			
	Low Channel, 871.5 MHz	7.22	13	Pass
	Mid Channel, 881.5 MHz	7.18	13	Pass
	High Channel, 891.5 MHz	7.34	13	Pass
	16QAM			
	Low Channel, 871.5 MHz	7.24	13	Pass
	Mid Channel, 881.5 MHz	7.15	13	Pass
	High Channel, 891.5 MHz	7.38	13	Pass
	64QAM			
	Low Channel, 871.5 MHz	7.33	13	Pass
	Mid Channel, 881.5 MHz	7.26	13	Pass
	High Channel, 891.5 MHz	7.42	13	Pass
	256QAM			
	Low Channel, 871.5 MHz	7.28	13	Pass
	Mid Channel, 881.5 MHz	7.2	13	Pass
	High Channel, 891.5 MHz	7.42	13	Pass
	10 MHz Bandwidth			
	QPSK			
	Low Channel, 874 MHz	7.45	13	Pass
	Mid Channel, 881.5 MHz	7.21	13	Pass
	High Channel, 889 MHz	7.53	13	Pass
	16QAM			
	Low Channel, 874 MHz	7.43	13	Pass
	Mid Channel, 881.5 MHz	7.21	13	Pass
	High Channel, 889 MHz	7.44	13	Pass
	64QAM			
	Low Channel, 874 MHz	7.42	13	Pass
	Mid Channel, 881.5 MHz	7.2	13	Pass
	High Channel, 889 MHz	7.54	13	Pass
	256QAM			
	Low Channel, 874 MHz	7.47	13	Pass
	Mid Channel, 881.5 MHz	7.22	13	Pass
	High Channel, 889 MHz	7.54	13	Pass

# PEAK-TO-AVERAGE POWER RATIO (PAPR)

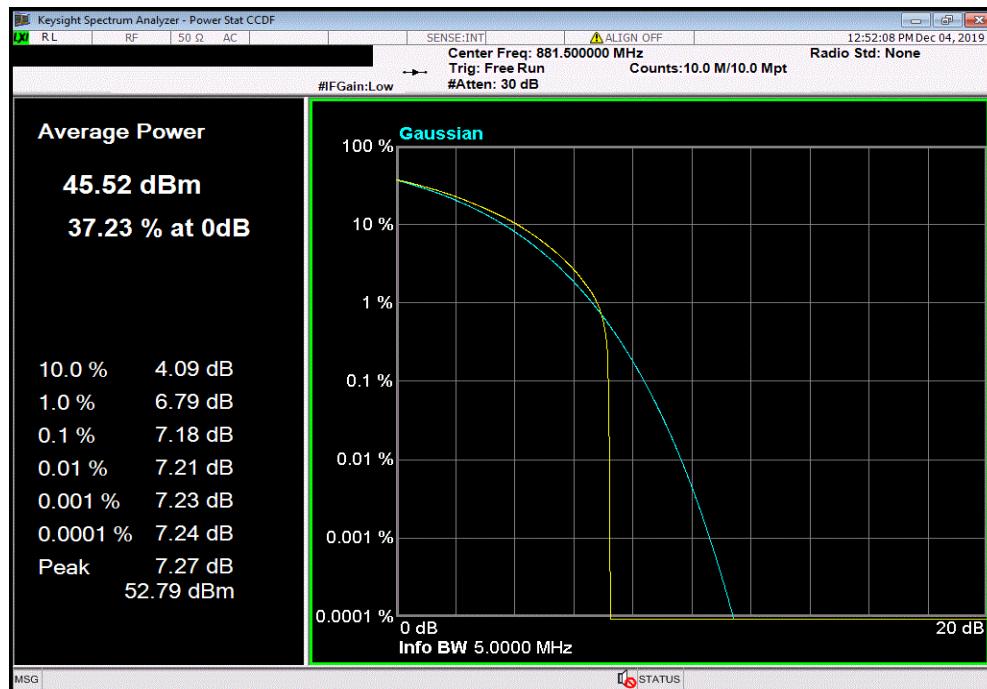


XMI 2019.06.11

Band 5, Port 4, 5 MHz Bandwidth, QPSK, Low Channel, 871.5 MHz			
PAPR Value (dB)	PAPR Limit (dBm)	Result	
7.22	13	Pass	



Band 5, Port 4, 5 MHz Bandwidth, QPSK, Mid Channel, 881.5 MHz			
PAPR Value (dB)	PAPR Limit (dBm)	Result	
7.18	13	Pass	

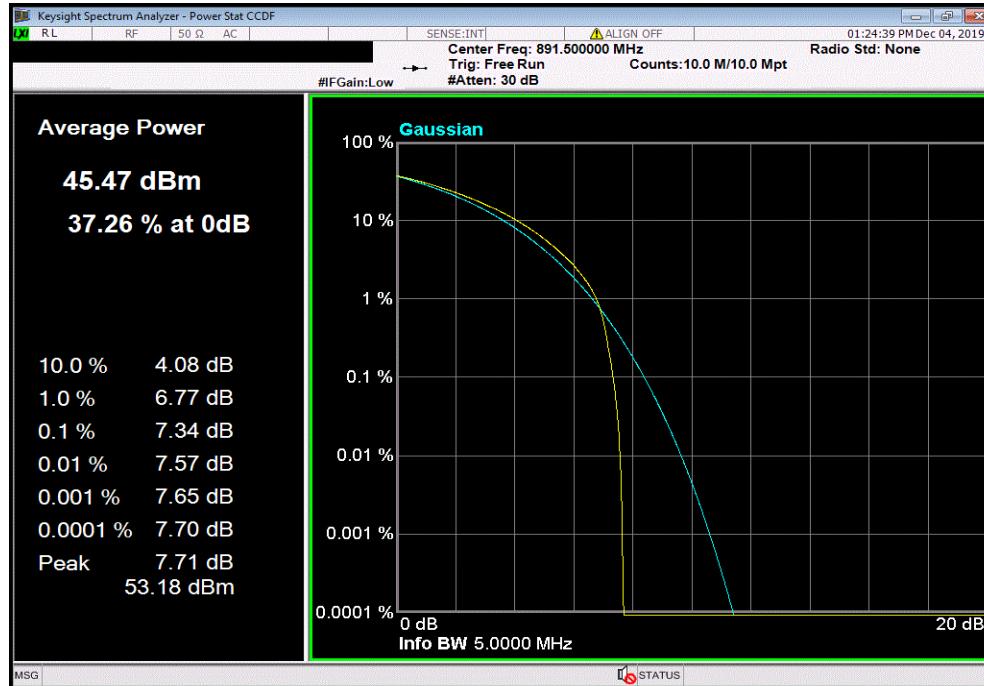


# PEAK-TO-AVERAGE POWER RATIO (PAPR)

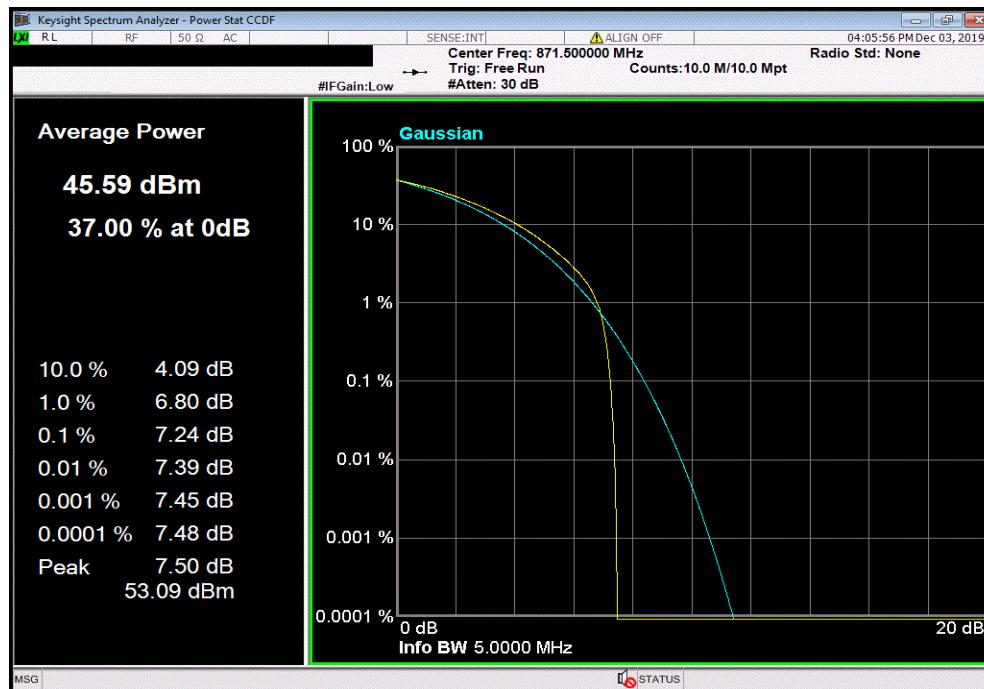


XMI 2019.06.11

Band 5, Port 4, 5 MHz Bandwidth, QPSK, High Channel, 891.5 MHz			
PAPR Value (dB)	PAPR Limit (dBm)	Result	
7.34	13	Pass	



Band 5, Port 4, 5 MHz Bandwidth, 16QAM, Low Channel, 871.5 MHz			
PAPR Value (dB)	PAPR Limit (dBm)	Result	
7.24	13	Pass	

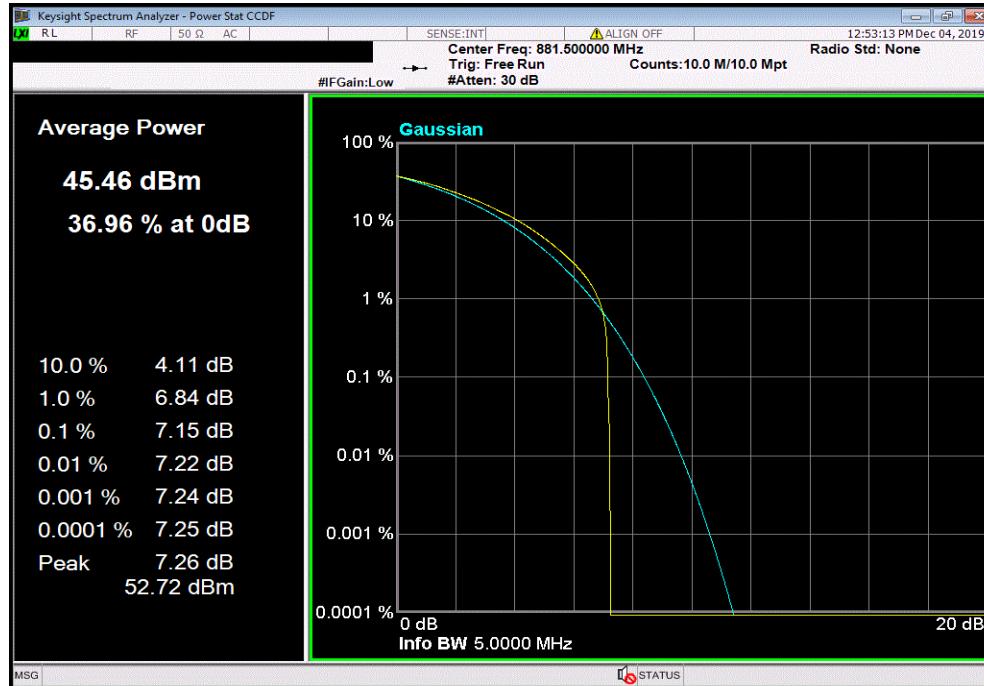


# PEAK-TO-AVERAGE POWER RATIO (PAPR)

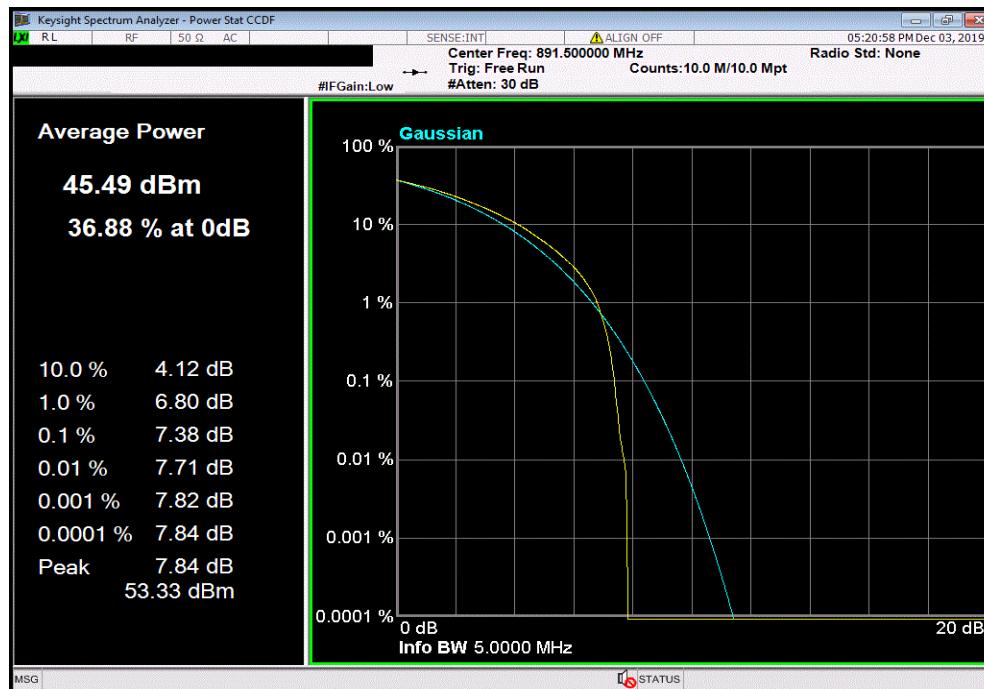


XMI 2019.06.11

Band 5, Port 4, 5 MHz Bandwidth, 16QAM, Mid Channel, 881.5 MHz				PAPR	PAPR	
	Value (dB)	Limit (dBm)	Result			
	7.15	13	Pass			



Band 5, Port 4, 5 MHz Bandwidth, 16QAM, High Channel, 891.5 MHz				PAPR	PAPR	
	Value (dB)	Limit (dBm)	Result			
	7.38	13	Pass			

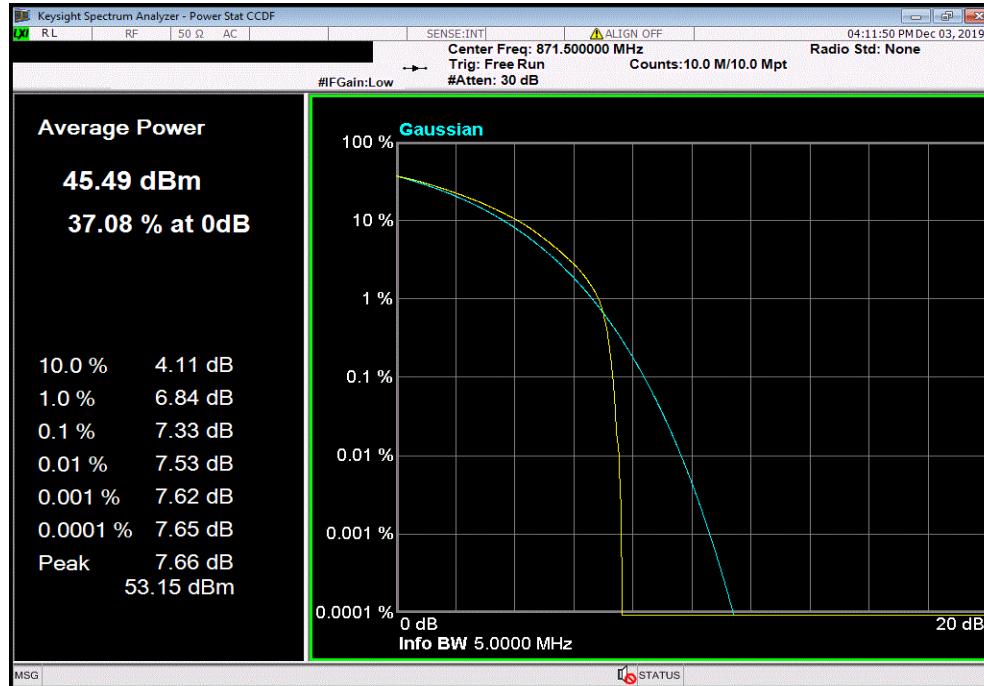


# PEAK-TO-AVERAGE POWER RATIO (PAPR)

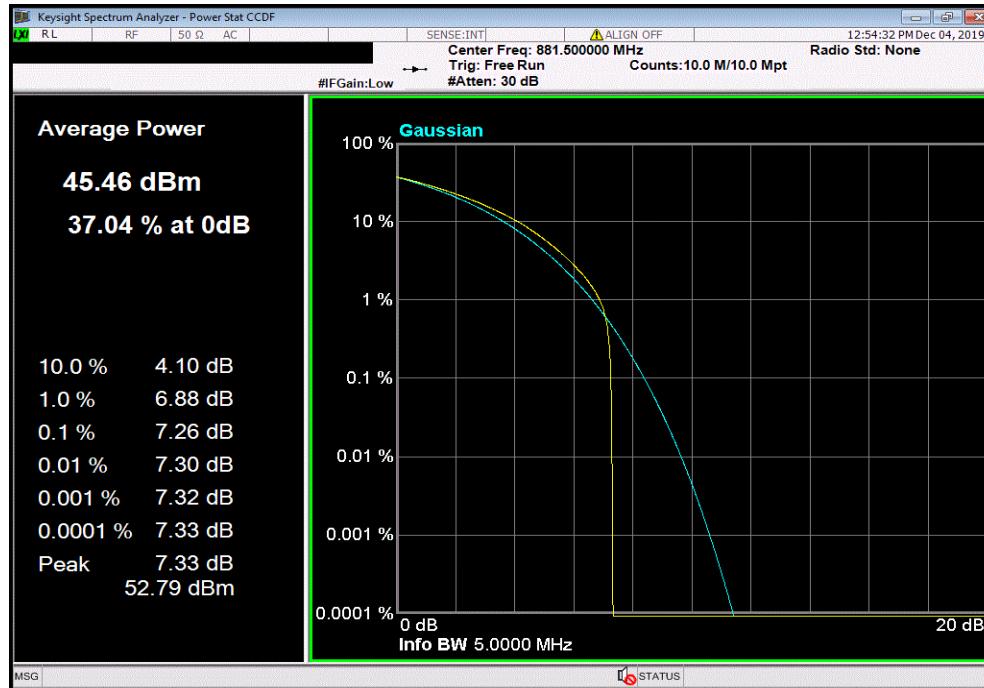


XMI 2019.06.11

Band 5, Port 4, 5 MHz Bandwidth, 64QAM, Low Channel, 871.5 MHz			
PAPR Value (dB)	PAPR Limit (dBm)	Result	
7.33	13	Pass	



Band 5, Port 4, 5 MHz Bandwidth, 64QAM, Mid Channel, 881.5 MHz			
PAPR Value (dB)	PAPR Limit (dBm)	Result	
7.26	13	Pass	

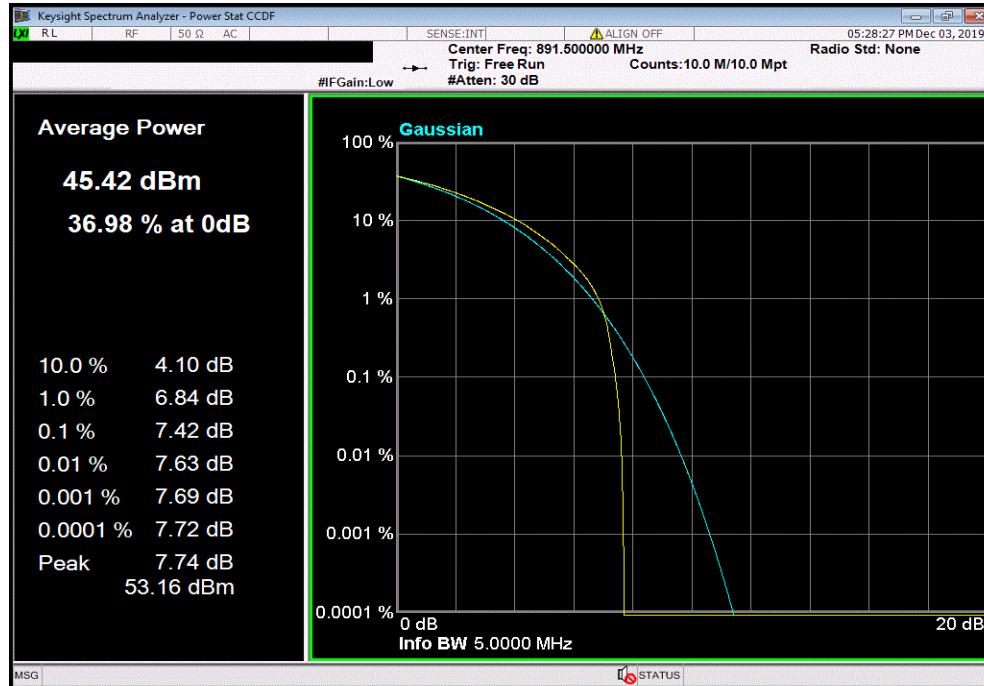


# PEAK-TO-AVERAGE POWER RATIO (PAPR)

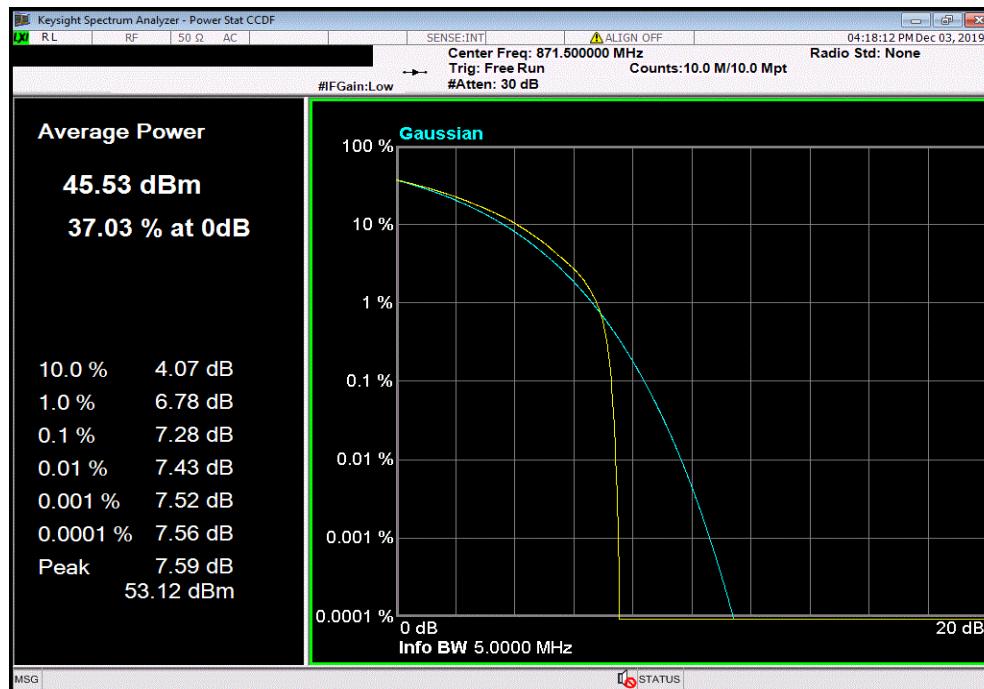


XMI 2019.06.11

Band 5, Port 4, 5 MHz Bandwidth, 64QAM, High Channel, 891.5 MHz			
PAPR Value (dB)	PAPR Limit (dBm)	Result	
7.42	13	Pass	



Band 5, Port 4, 5 MHz Bandwidth, 256QAM, Low Channel, 871.5 MHz			
PAPR Value (dB)	PAPR Limit (dBm)	Result	
7.28	13	Pass	

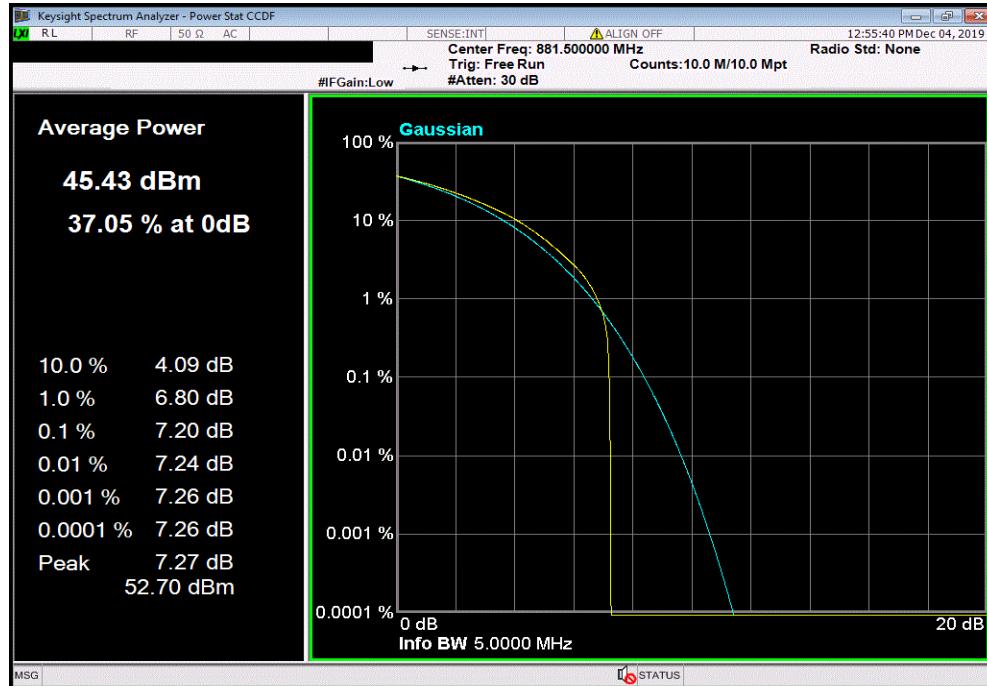


# PEAK-TO-AVERAGE POWER RATIO (PAPR)

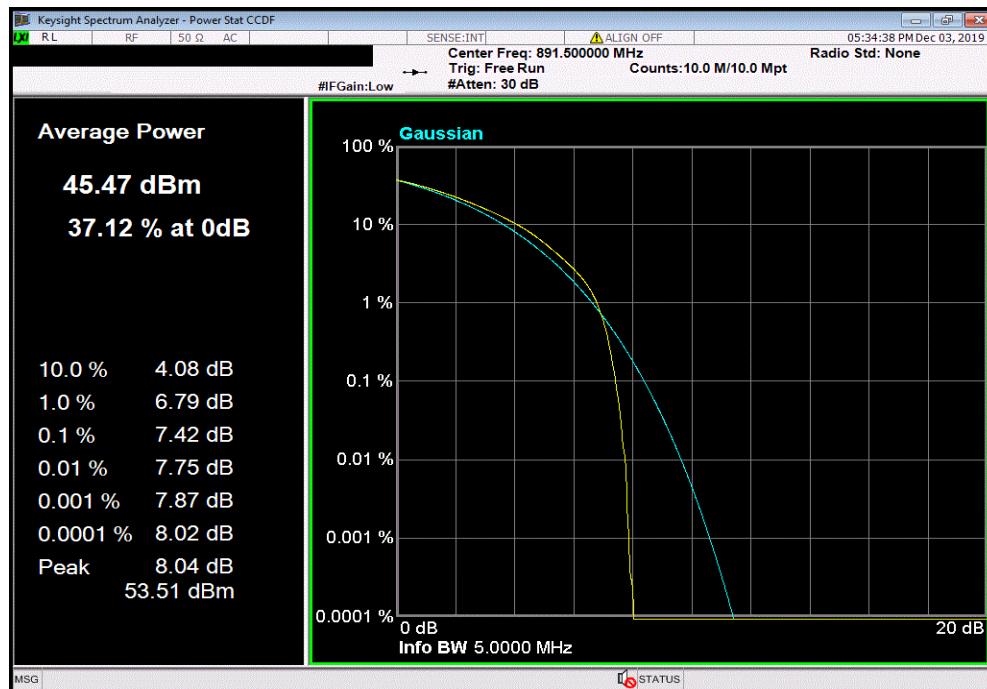


XMI 2019.06.11

Band 5, Port 4, 5 MHz Bandwidth, 256QAM, Mid Channel, 881.5 MHz			
PAPR Value (dB)	PAPR Limit (dBm)	Result	
7.2	13	Pass	



Band 5, Port 4, 5 MHz Bandwidth, 256QAM, High Channel, 891.5 MHz			
PAPR Value (dB)	PAPR Limit (dBm)	Result	
7.42	13	Pass	

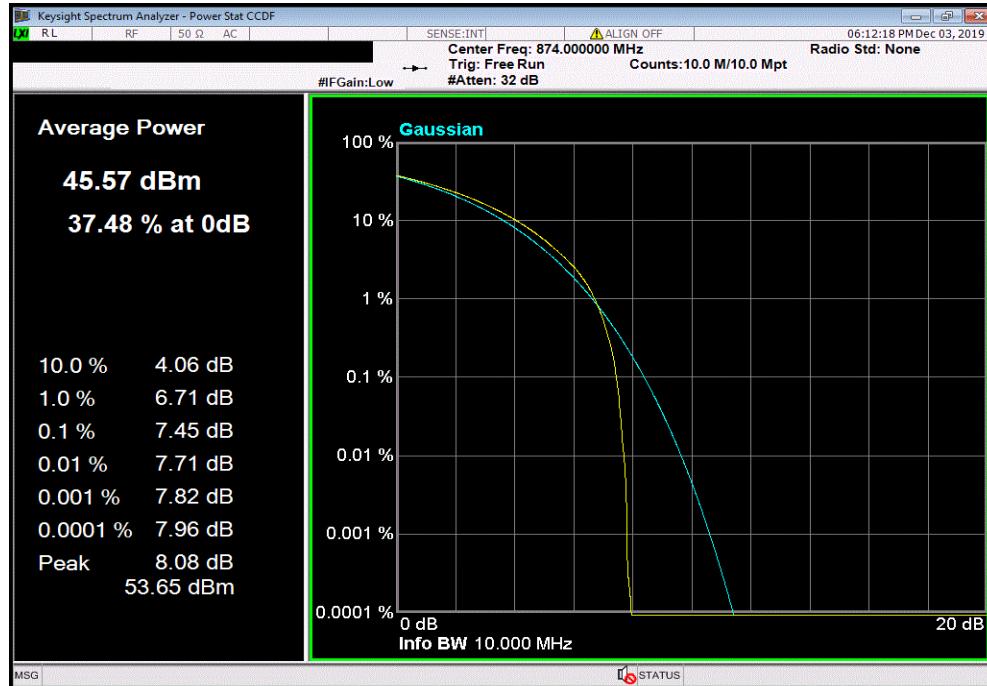


# PEAK-TO-AVERAGE POWER RATIO (PAPR)

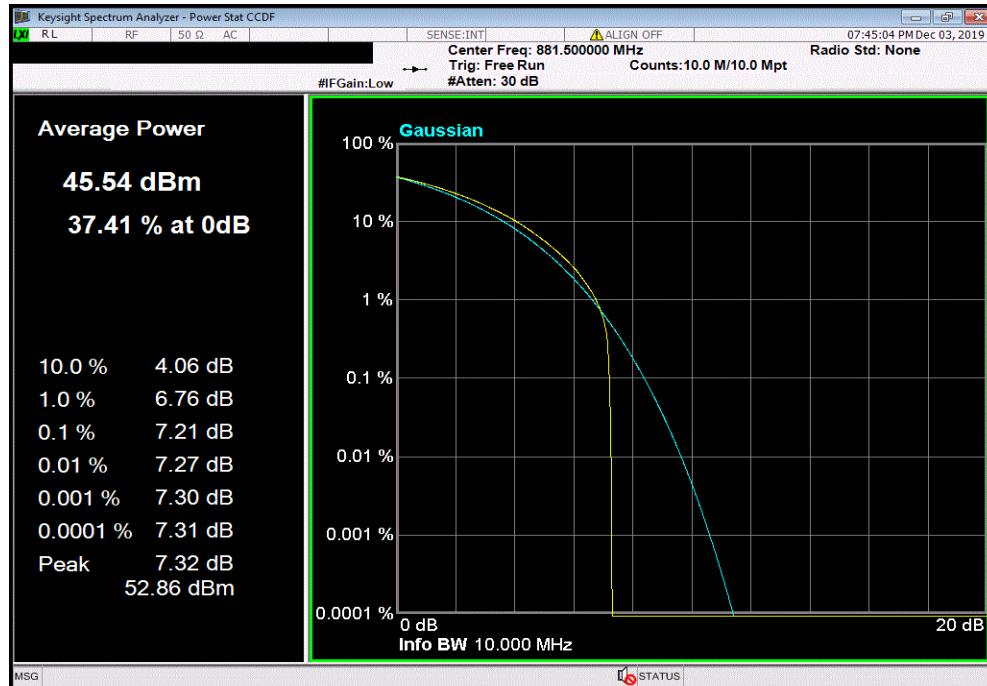


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Band 5, Port 4, 10 MHz Bandwidth, QPSK, Low Channel, 874 MHz			
PAPR Value (dB)	PAPR Limit (dBm)	Result	
7.45	13	Pass	



Band 5, Port 4, 10 MHz Bandwidth, QPSK, Mid Channel, 881.5 MHz			
PAPR Value (dB)	PAPR Limit (dBm)	Result	
7.21	13	Pass	

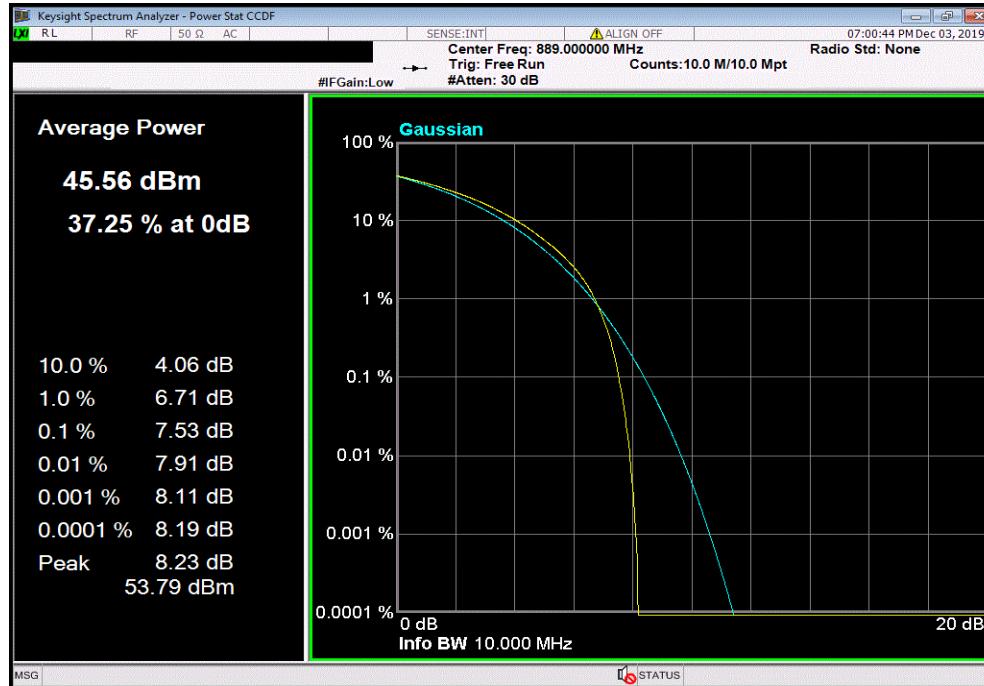


# PEAK-TO-AVERAGE POWER RATIO (PAPR)

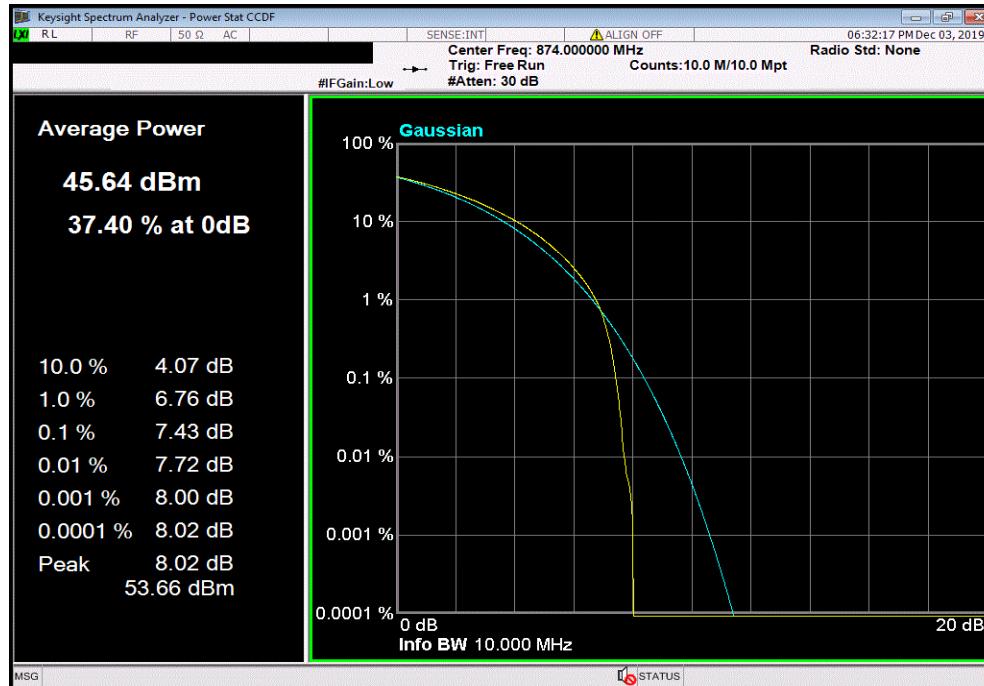


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Band 5, Port 4, 10 MHz Bandwidth, QPSK, High Channel, 889 MHz			
	PAPR Value (dB)	PAPR Limit (dBm)	Result
	7.53	13	Pass



Band 5, Port 4, 10 MHz Bandwidth, 16QAM, Low Channel, 874 MHz			
	PAPR Value (dB)	PAPR Limit (dBm)	Result
	7.43	13	Pass

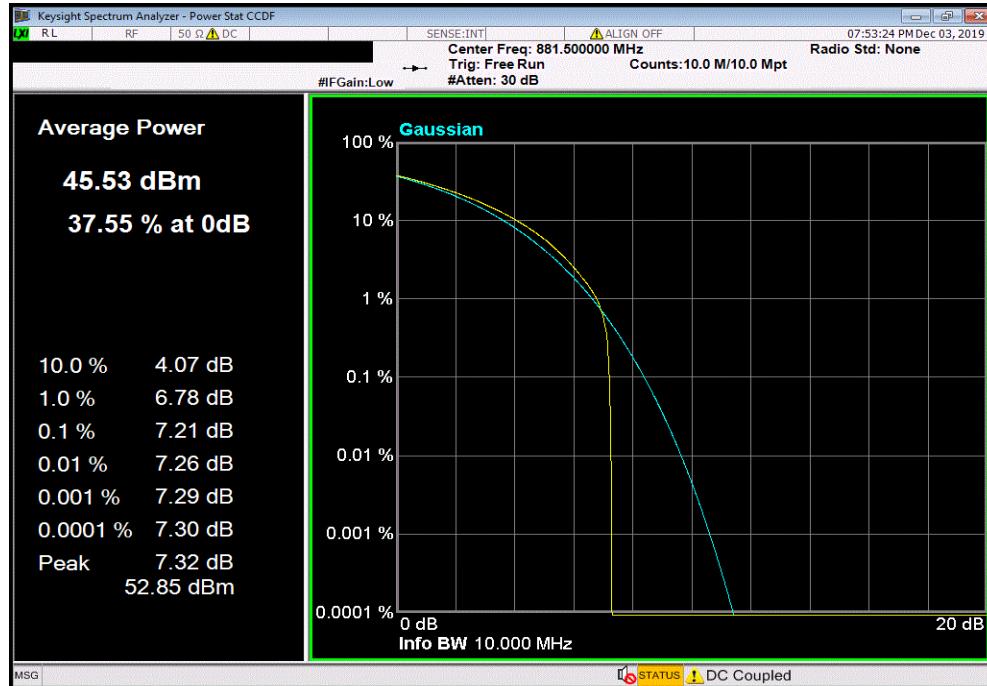


# PEAK-TO-AVERAGE POWER RATIO (PAPR)

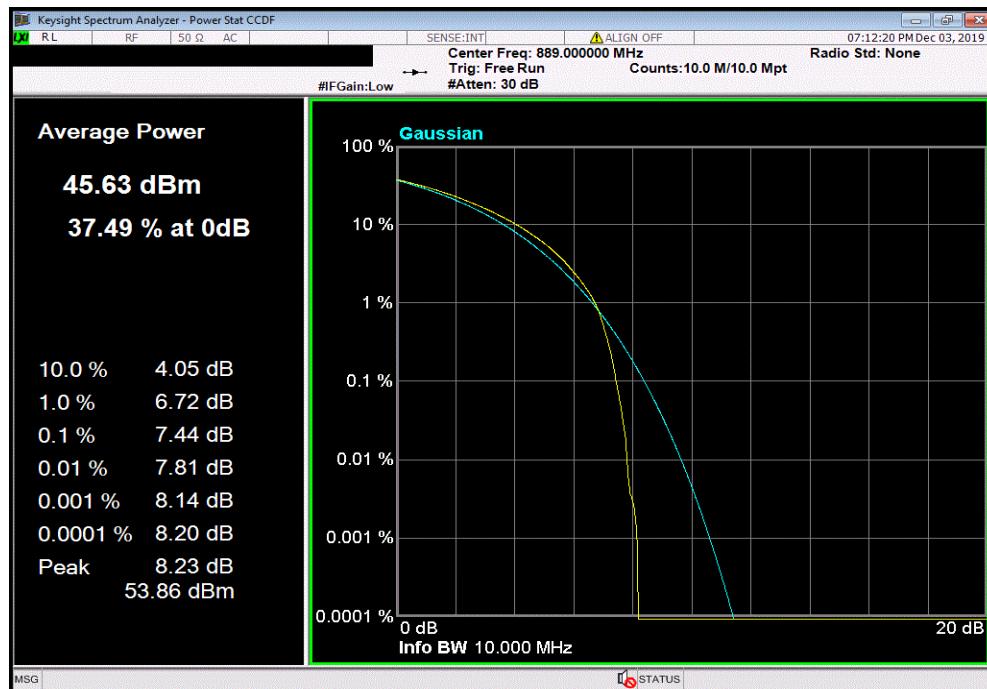


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Band 5, Port 4, 10 MHz Bandwidth, 16QAM, Mid Channel, 881.5 MHz			
PAPR Value (dB)	PAPR Limit (dBm)	Result	
7.21	13	Pass	



Band 5, Port 4, 10 MHz Bandwidth, 16QAM, High Channel, 889 MHz			
PAPR Value (dB)	PAPR Limit (dBm)	Result	
7.44	13	Pass	

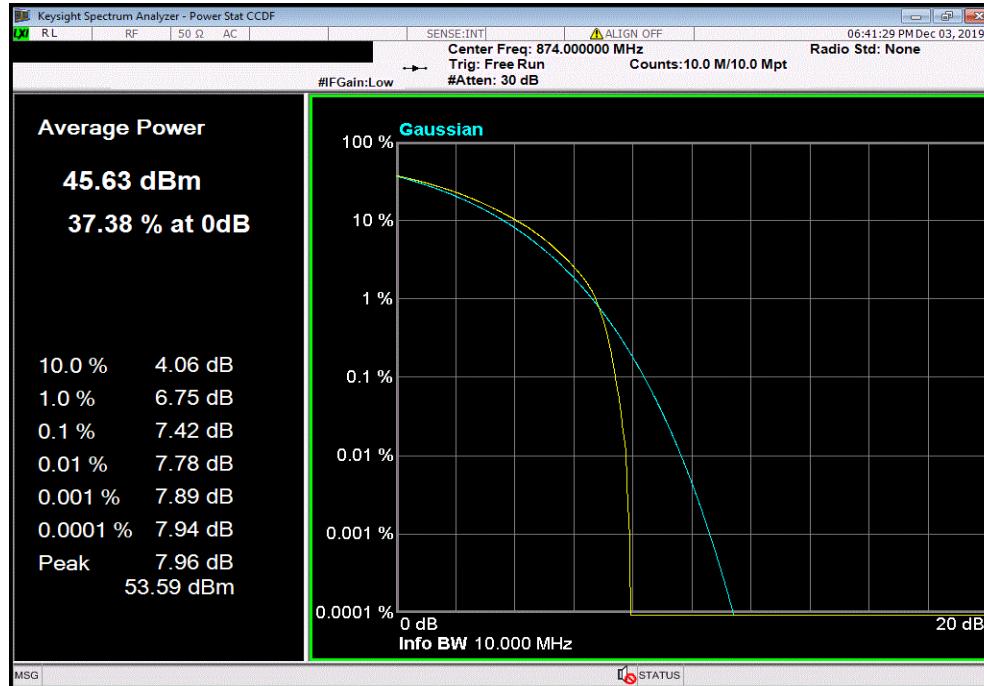


# PEAK-TO-AVERAGE POWER RATIO (PAPR)



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Band 5, Port 4, 10 MHz Bandwidth, 64QAM, Low Channel, 874 MHz			
PAPR Value (dB)	PAPR Limit (dBm)	Result	
7.42	13	Pass	



Band 5, Port 4, 10 MHz Bandwidth, 64QAM, Mid Channel, 881.5 MHz			
PAPR Value (dB)	PAPR Limit (dBm)	Result	
7.2	13	Pass	

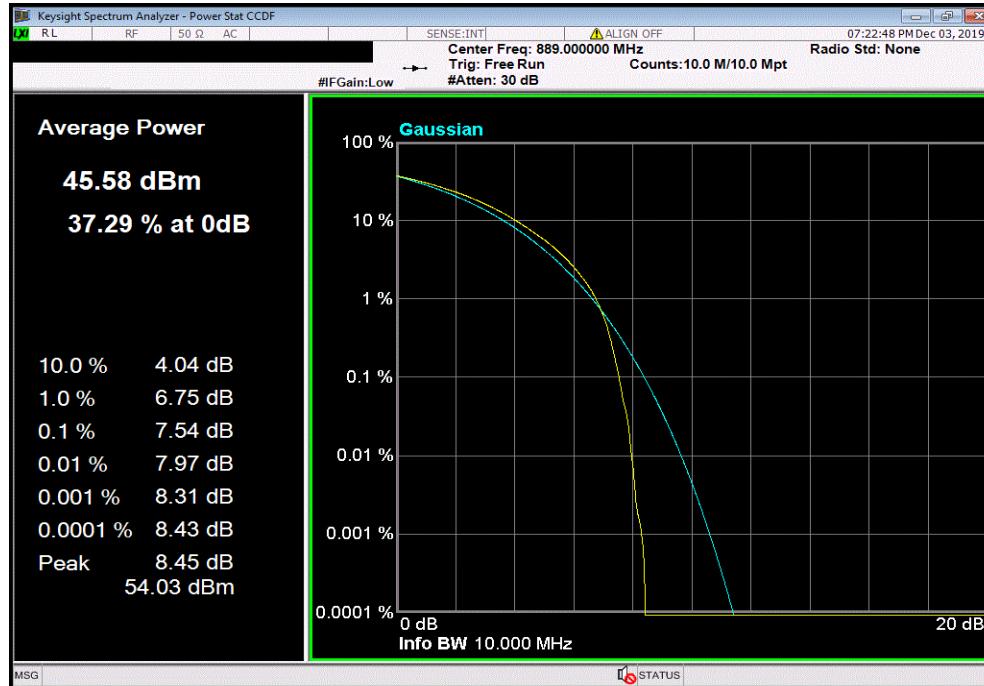


# PEAK-TO-AVERAGE POWER RATIO (PAPR)

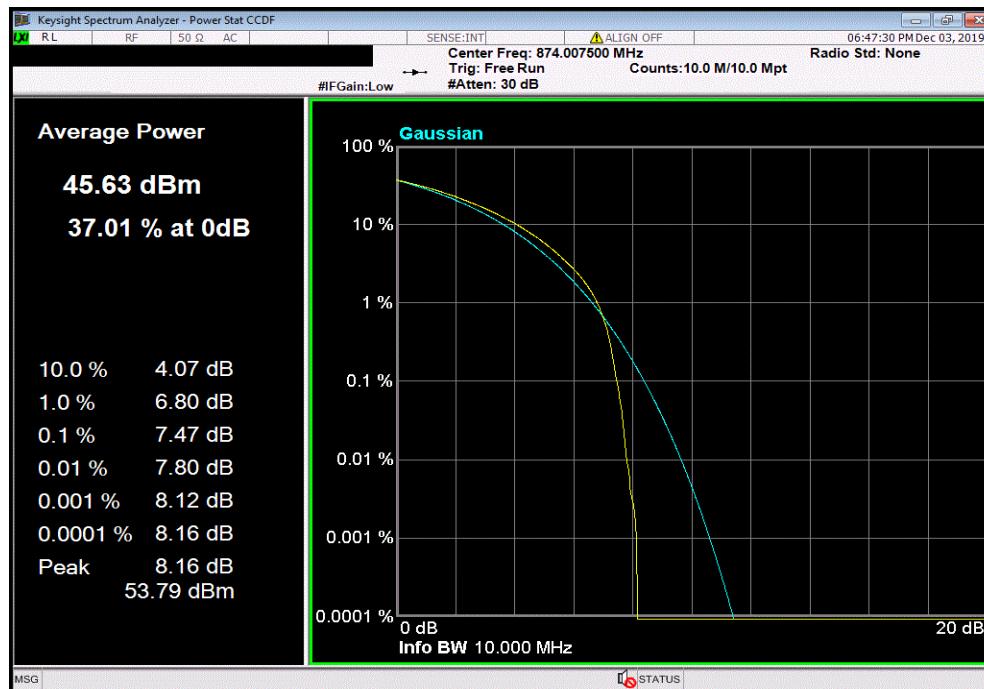


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Band 5, Port 4, 10 MHz Bandwidth, 64QAM, High Channel, 889 MHz			
PAPR	PAPR		
Value (dB)	Limit (dBm)	Result	
7.54	13	Pass	



Band 5, Port 4, 10 MHz Bandwidth, 256QAM, Low Channel, 874 MHz			
PAPR	PAPR		
Value (dB)	Limit (dBm)	Result	
7.47	13	Pass	



# PEAK-TO-AVERAGE POWER RATIO (PAPR)



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Band 5, Port 4, 10 MHz Bandwidth, 256QAM, Mid Channel, 881.5 MHz			
PAPR Value (dB)	PAPR Limit (dBm)	Result	
7.22	13	Pass	



Band 5, Port 4, 10 MHz Bandwidth, 256QAM, High Channel, 889 MHz			
PAPR Value (dB)	PAPR Limit (dBm)	Result	
7.54	13	Pass	

