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

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 FCC Part 2:2019	ANSI C63.26:2015 with 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

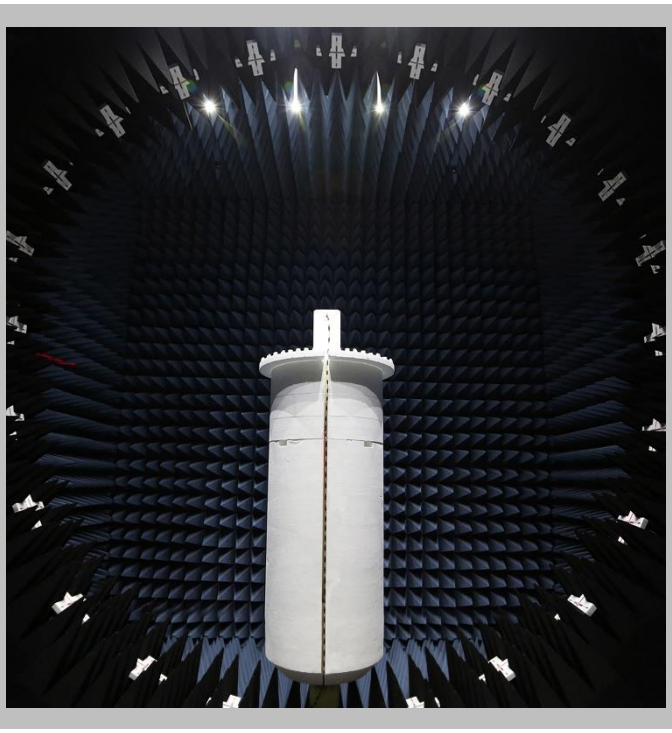
MIC – Recognized by MIC as a CAB for the acceptance of test data.

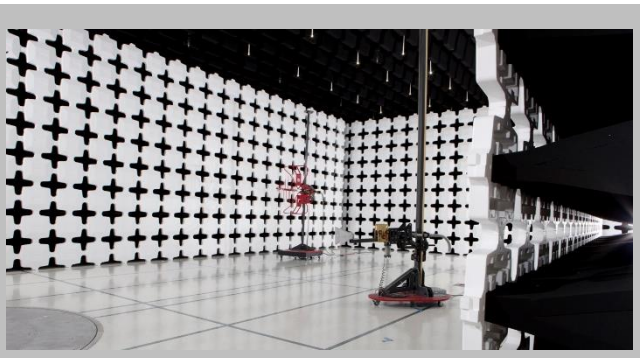
SCOPE

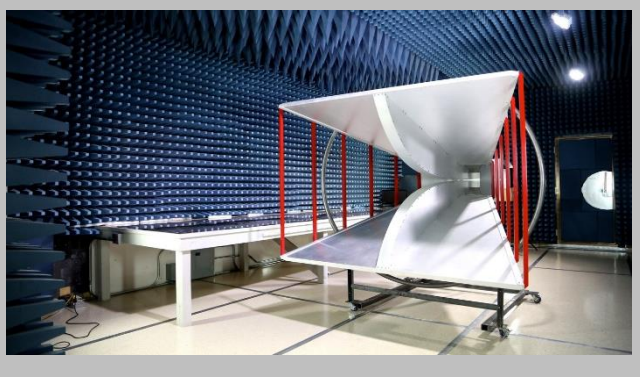
For details on the Scopes of our Accreditations, please visit:
https://www.nwemc.com/emc-testing-accreditations

FACILITIES

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.

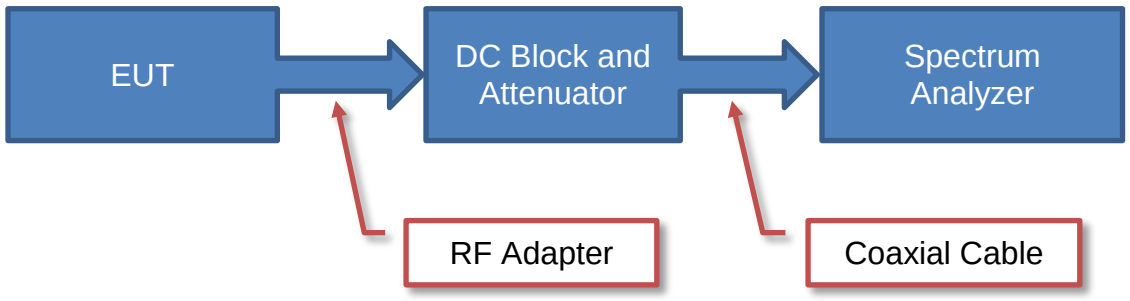
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable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

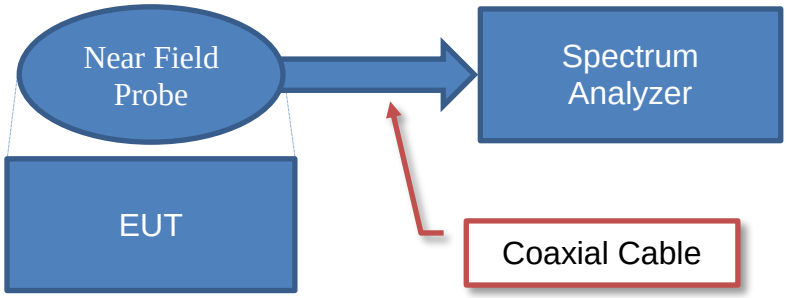
Test	+ MU	- MU
Frequency Accuracy	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	1.2 dB	-1.2 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field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

Test Setup Block Diagrams

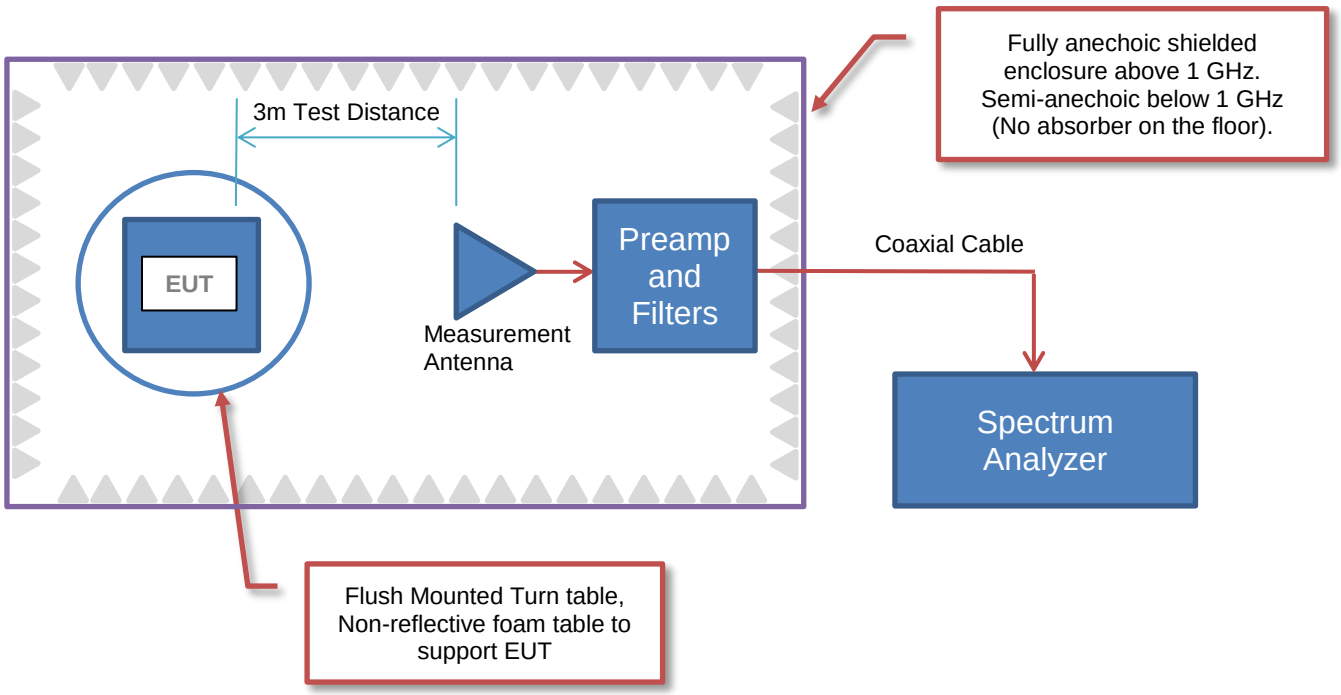
Antenna Port Conducted Measurements



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 AHBCC
First Date of Test:	December 4, 2019
Last Date of Test:	December 5, 2019
Receipt Date of Samples:	December 4, 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:

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.

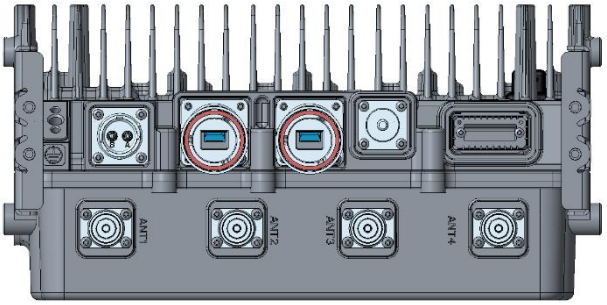
The AHBCC RRH has four transmit/four receive antenna ports (4TX/4RX for Band 5 and 4TX/4RX for Band 13). Each antenna port supports 3GPP frequency band 5 (BTS Rx: 824 to 849 MHz/BTS TX: 869 to 894 MHz) and 3GPP frequency band 13 (BTS Rx: 777 to 787 MHz/BTS TX: 746 to 756 MHz). The maximum RF output power 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.

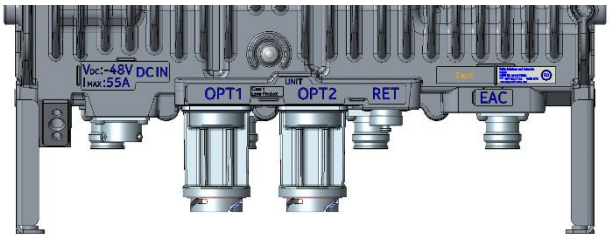
The AHBCC 5G NR downlink frequencies for Band n5 are as follows:

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

element
2018-07-17

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

element
2018-07-17

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	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

TbtTx 2019.08.30.0 XMit 2019.09.05

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

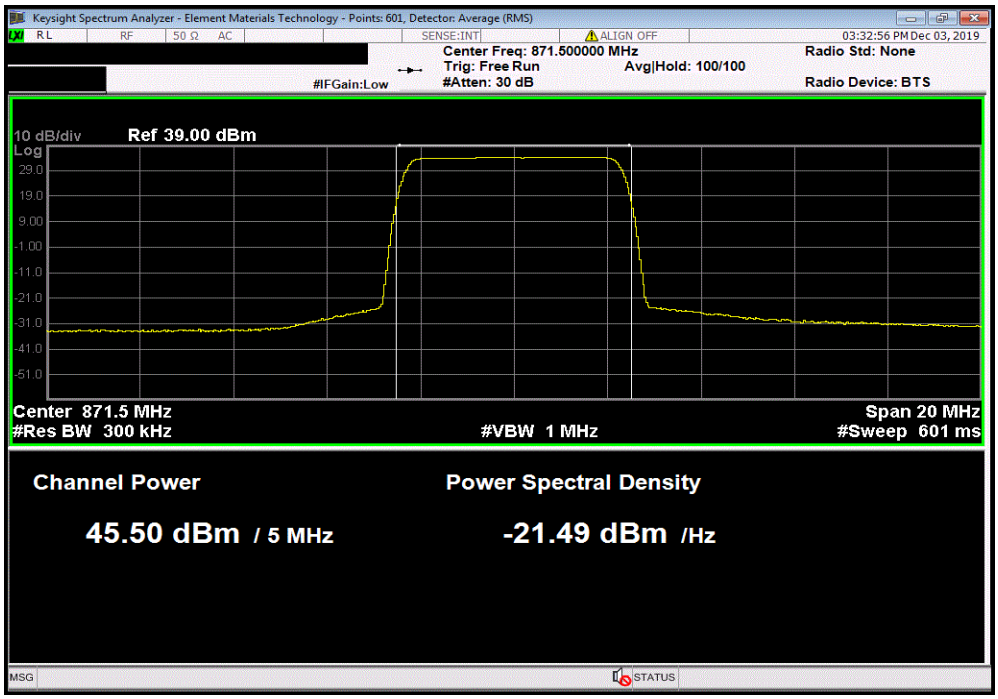
None

Configuration #	**1**	*Signature*

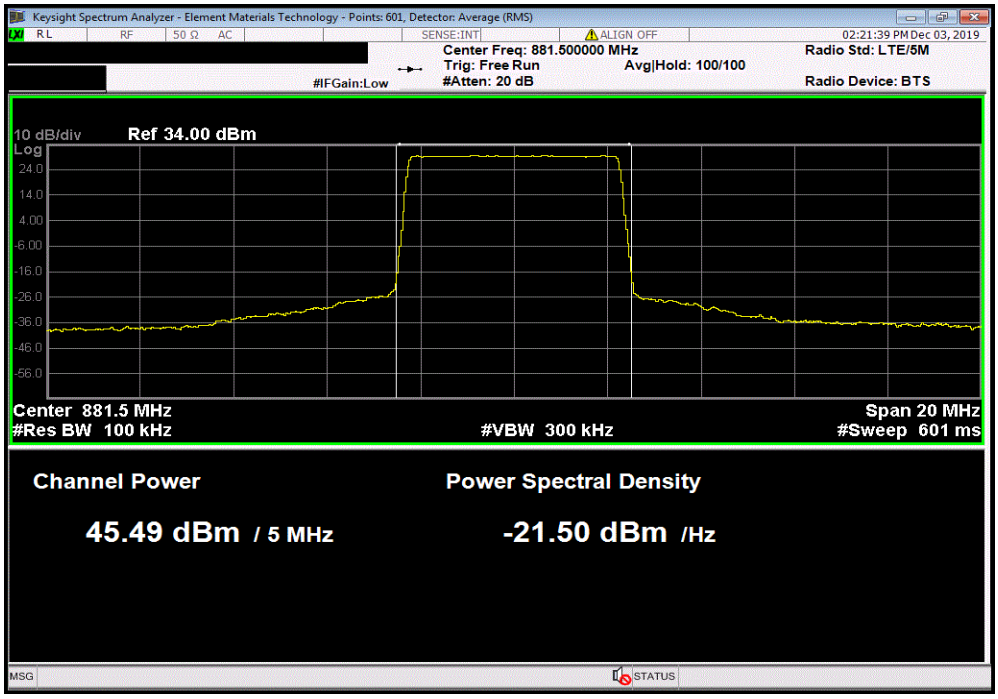
		Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (dBm)	Results
Band 5						
Port 4						
5 MHz Bandwidth						
QPSK						
	Low Channel, 871.5 MHz	45.5	0	45.5	57	Pass
	Mid Channel, 881.5 MHz	45.49	0	45.5	57	Pass
	High Channel, 891.5 MHz	45.355	0	45.4	57	Pass
16QAM						
	Low Channel, 871.5 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

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

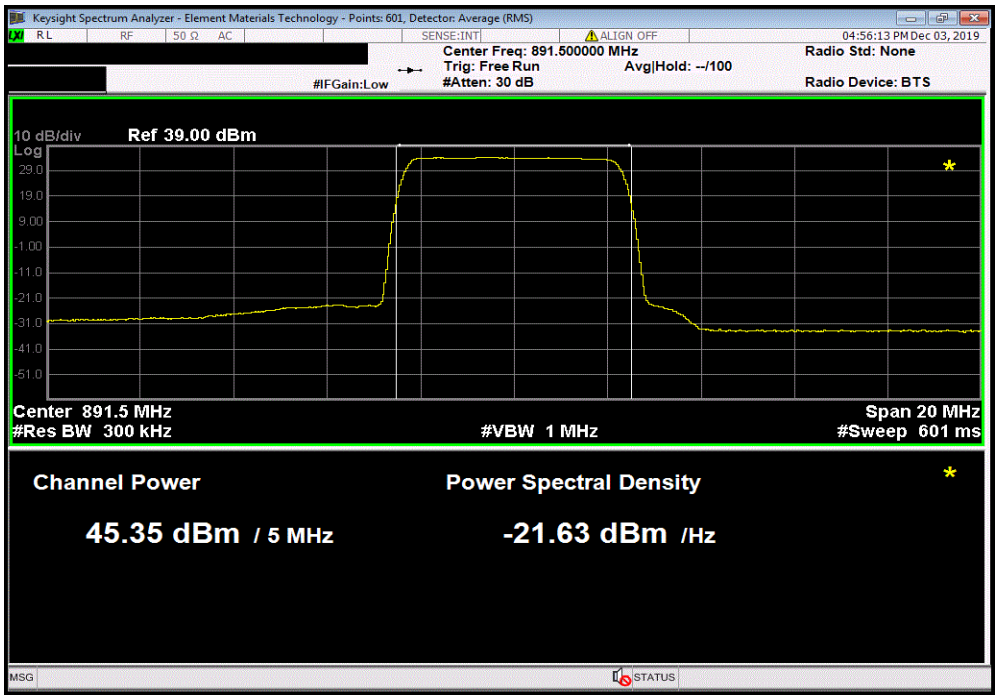


Band 5, Port 4, 5 MHz Bandwidth , QPSK, Mid Channel, 881.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	45.49	0		45.5	57	Pass

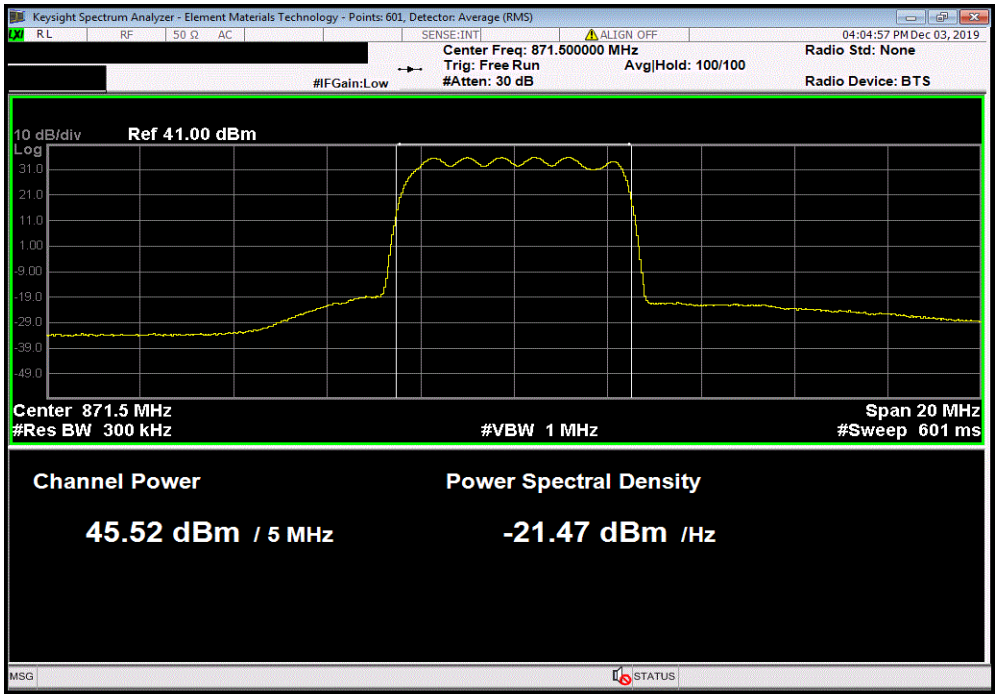


AVERAGE POWER

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

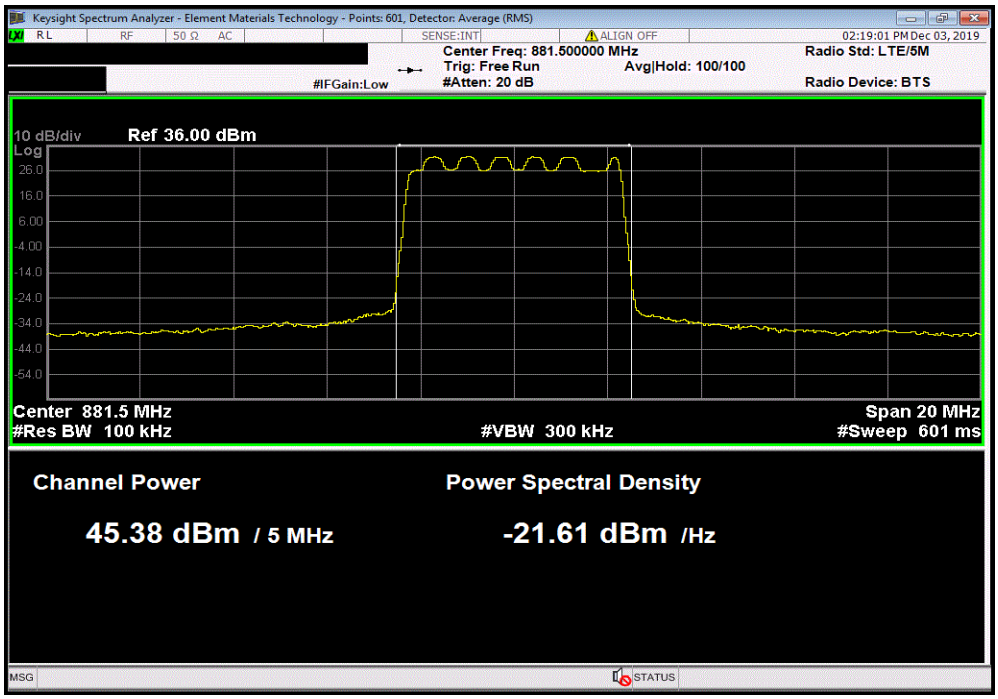


Band 5, Port 4, 5 MHz Bandwidth , 16QAM, Low Channel, 871.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	45.528	0		45.5	57	Pass

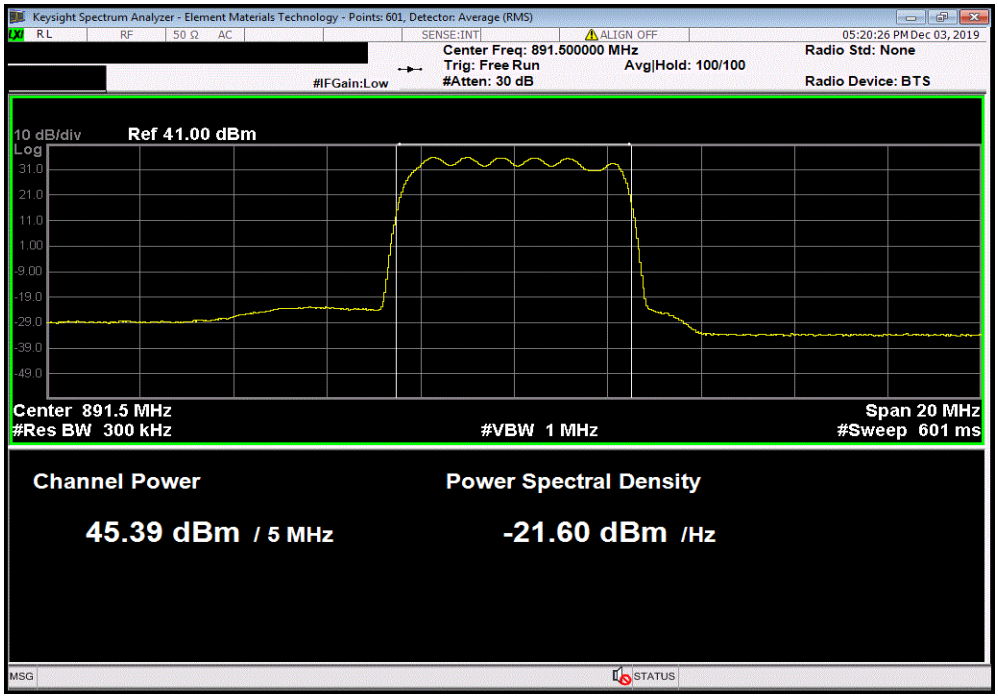


AVERAGE POWER

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

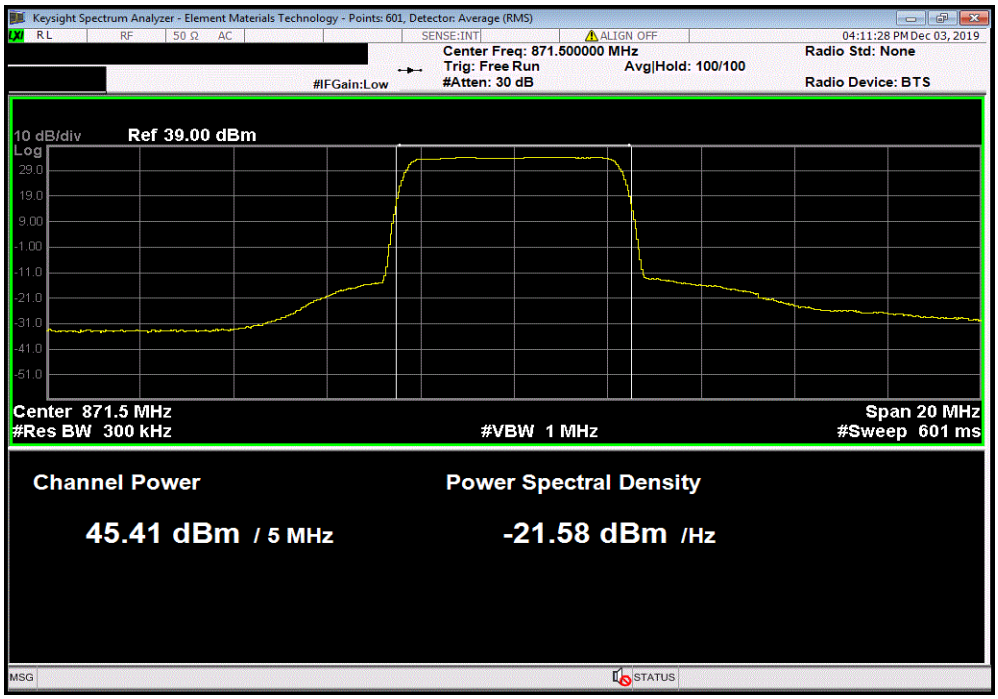


Band 5, Port 4, 5 MHz Bandwidth , 16QAM, High Channel, 891.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	45.39	0		45.4	57	Pass

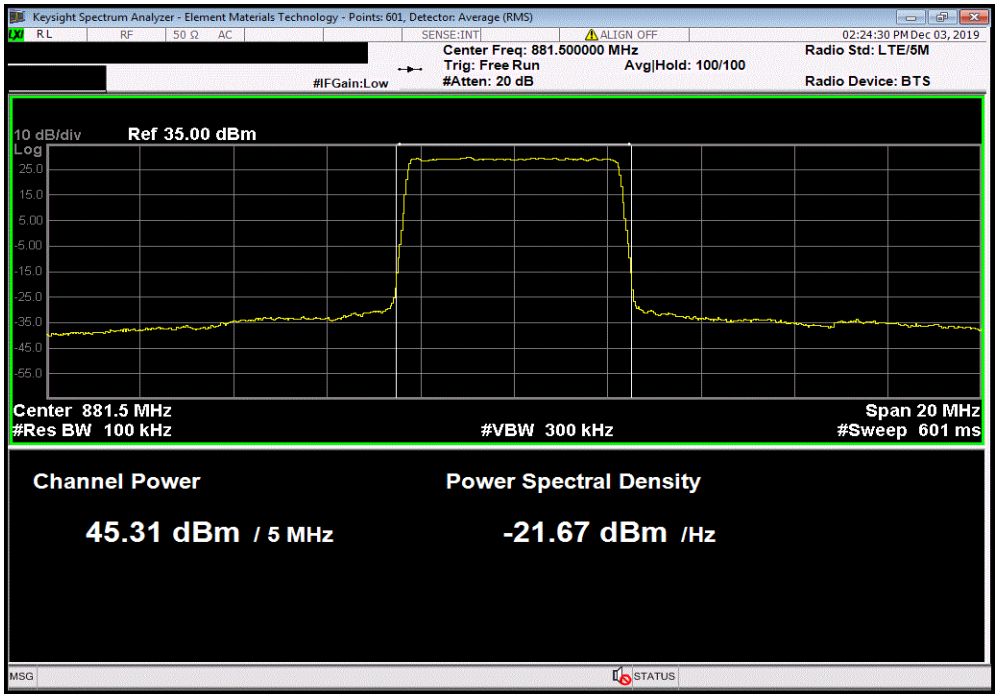


AVERAGE POWER

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

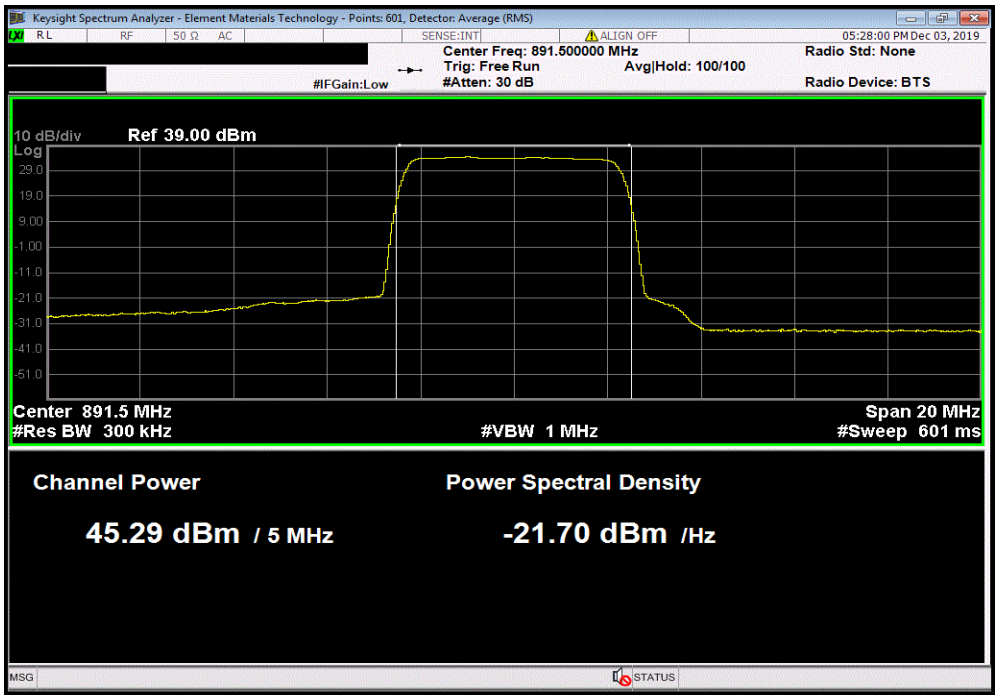


Band 5, Port 4, 5 MHz Bandwidth , 64QAM, Mid Channel, 881.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	45.315	0		45.3	57	Pass

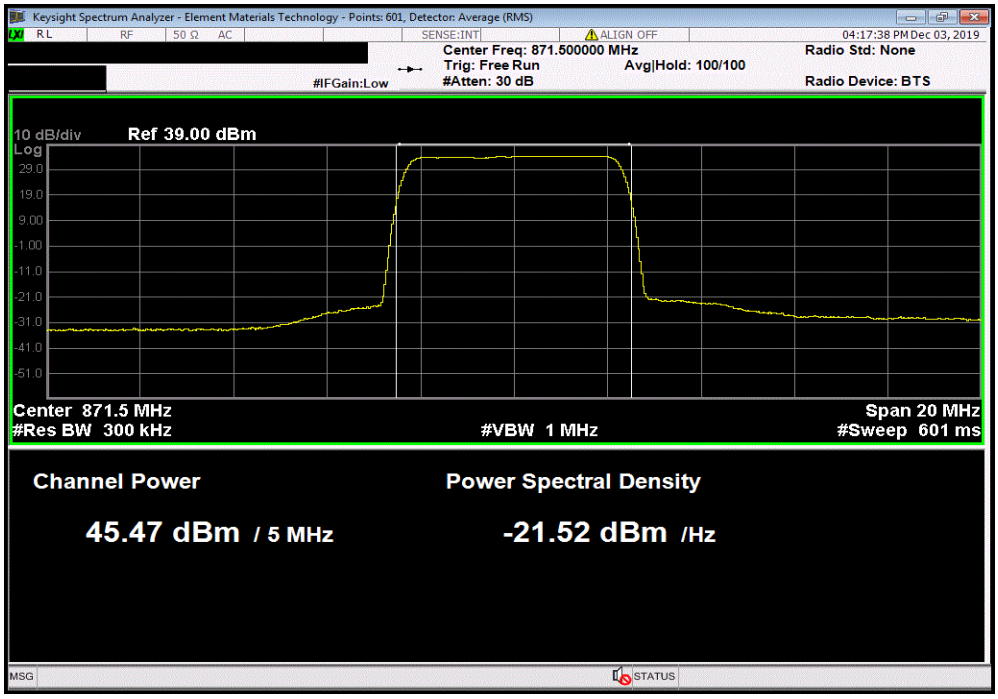


AVERAGE POWER

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

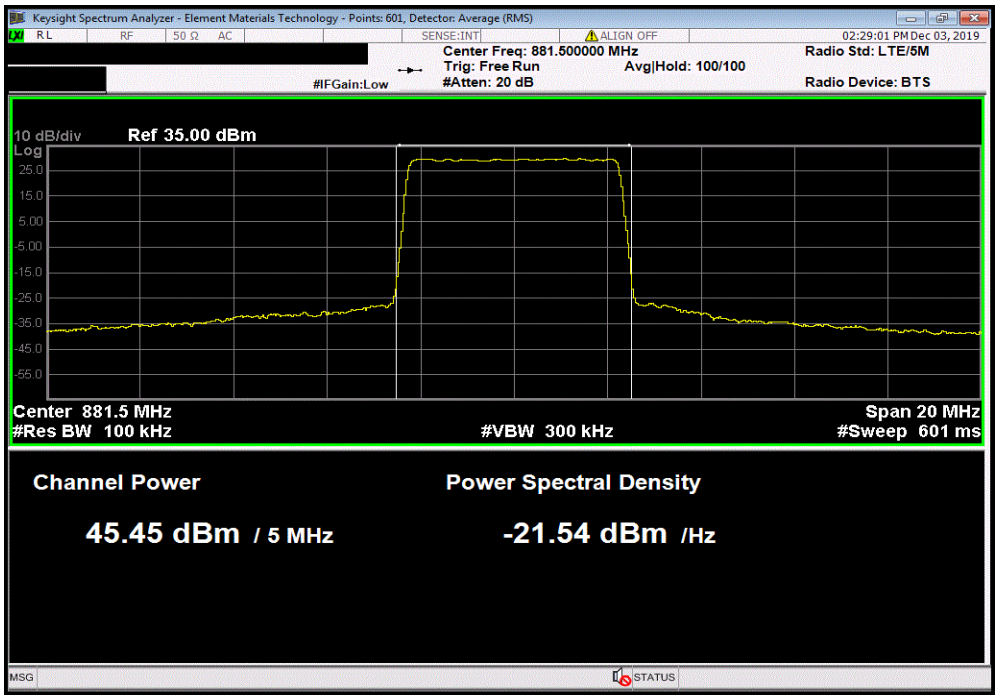


Band 5, Port 4, 5 MHz Bandwidth , 256QAM, Low Channel, 871.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	45.465	0		45.5	57	Pass

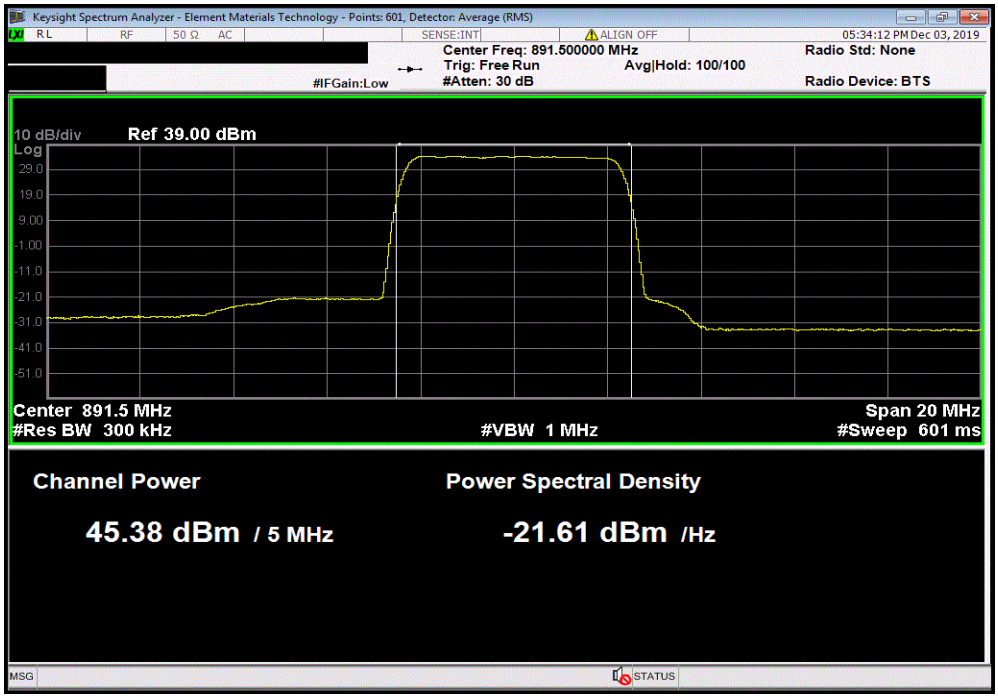


AVERAGE POWER

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

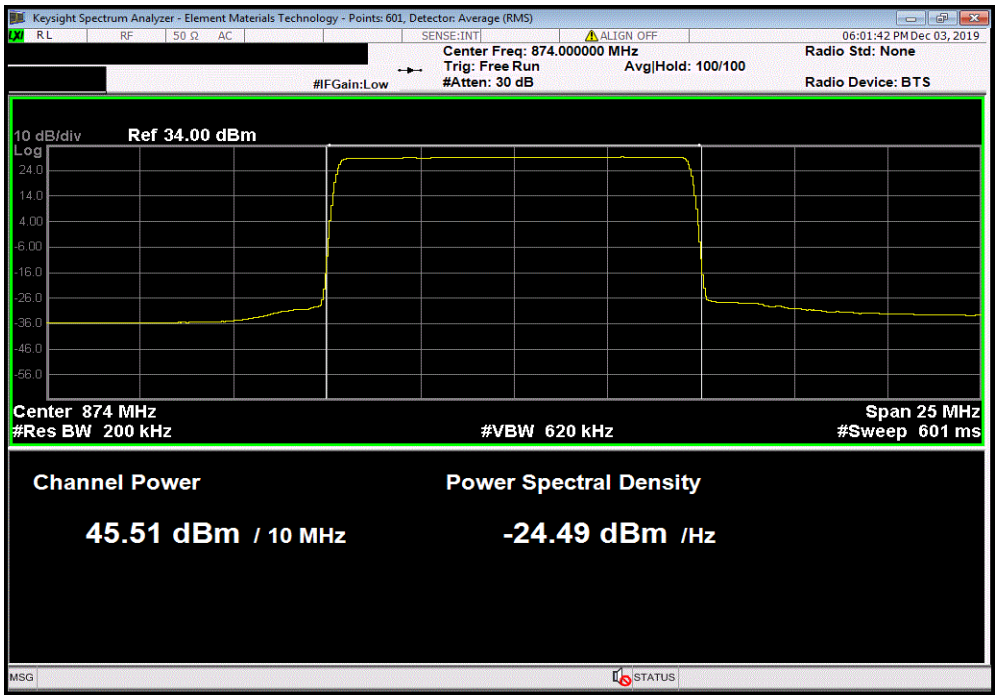


Band 5, Port 4, 5 MHz Bandwidth , 256QAM, High Channel, 891.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	45.384	0		45.4	57	Pass

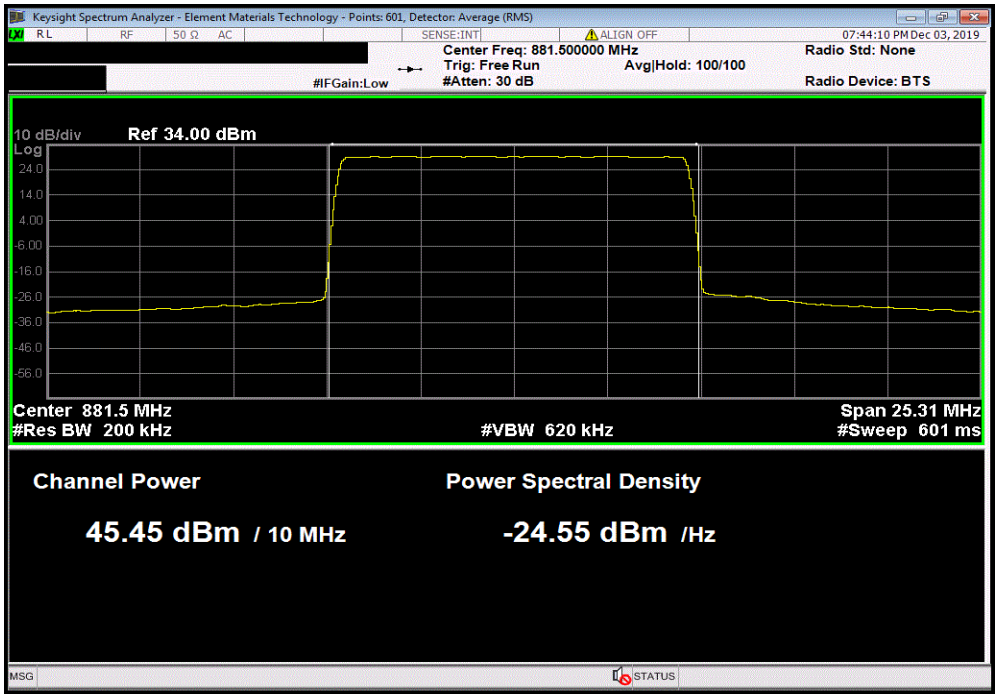


AVERAGE POWER

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

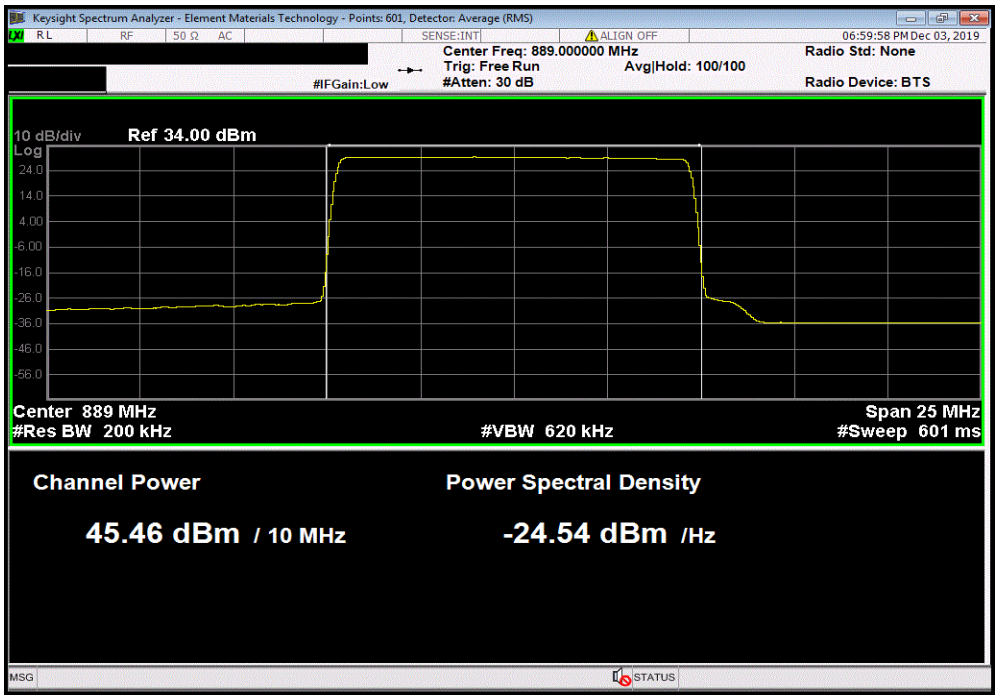


Band 5, Port 4, 10 MHz Bandwidth , QPSK, Mid Channel, 881.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	45.447	0		45.4	57	Pass

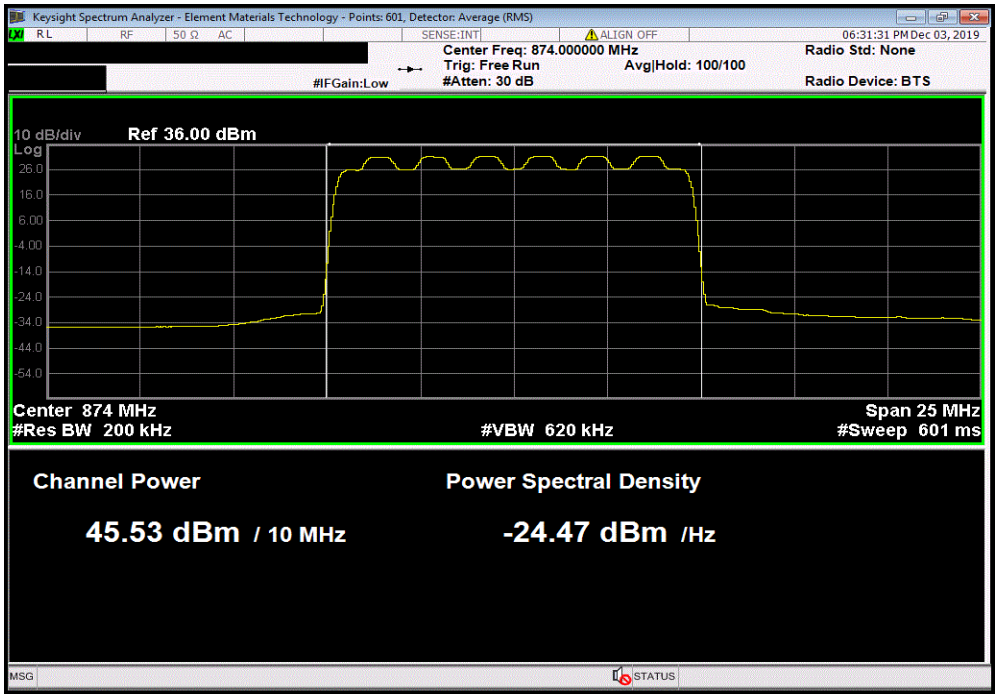


AVERAGE POWER

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

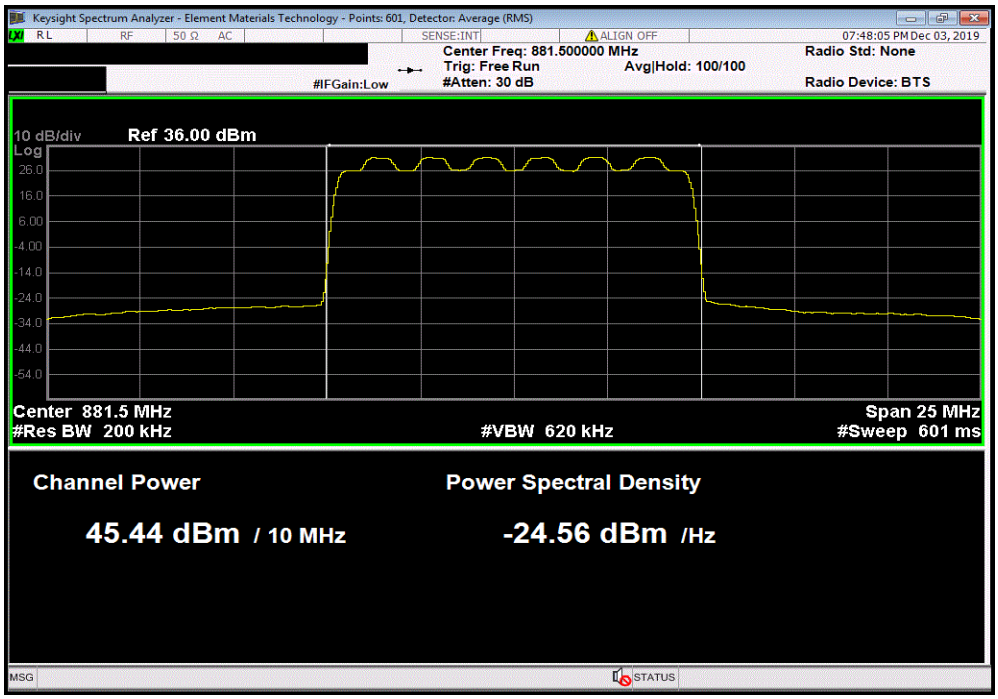


Band 5, Port 4, 10 MHz Bandwidth , 16QAM, Low Channel, 874 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	45.527	0		45.5	57	Pass

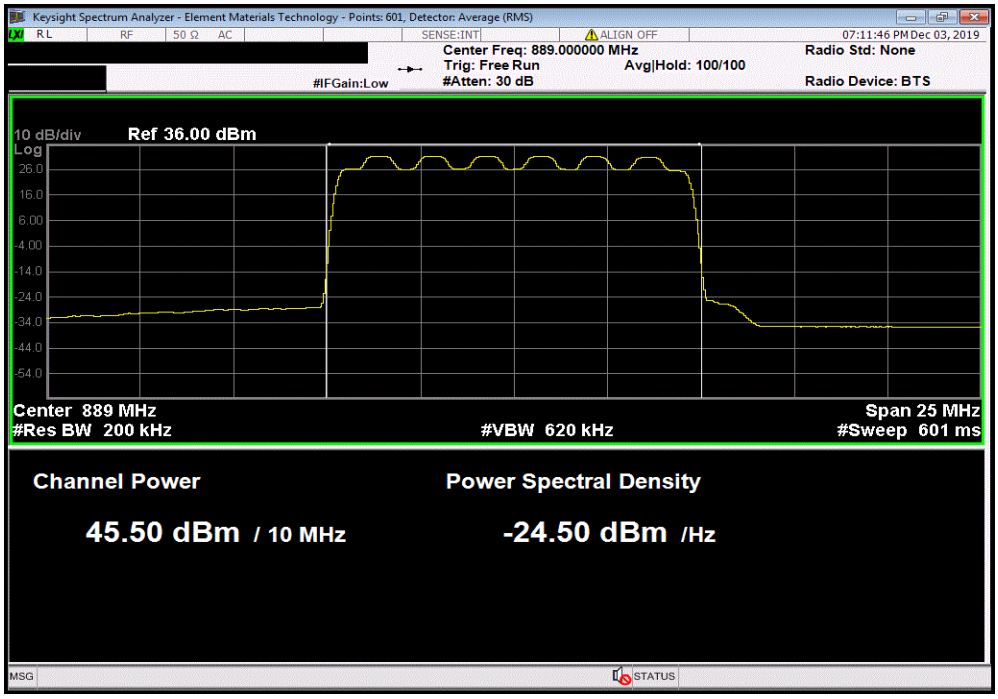


AVERAGE POWER

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

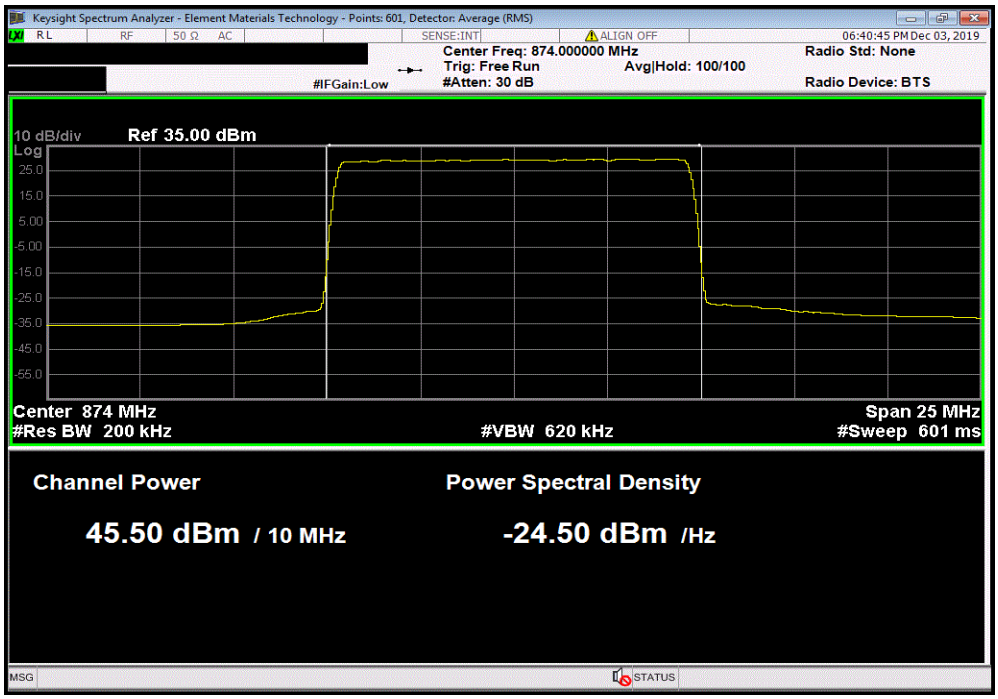


Band 5, Port 4, 10 MHz Bandwidth , 16QAM, High Channel, 889 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	45.503	0		45.5	57	Pass

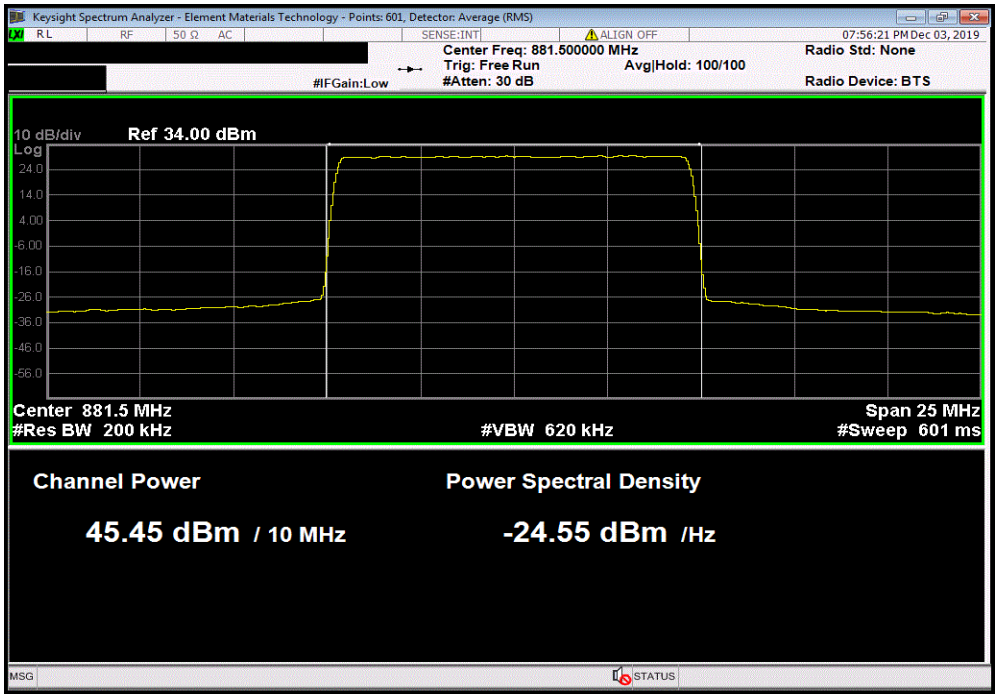


AVERAGE POWER

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

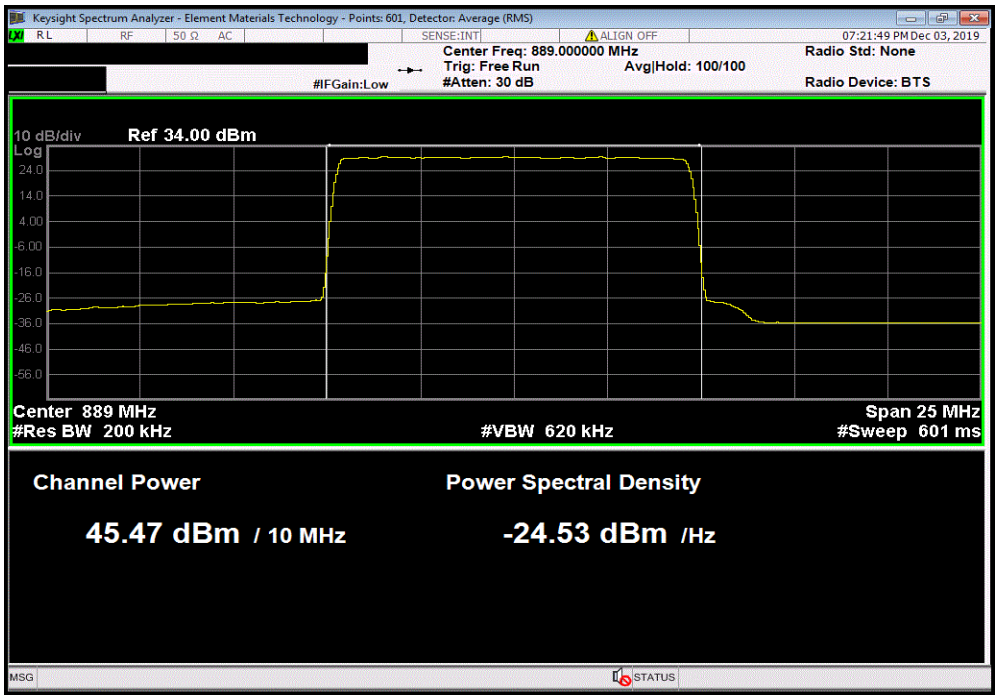


Band 5, Port 4, 10 MHz Bandwidth , 64QAM, Mid Channel, 881.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	45.452	0		45.5	57	Pass

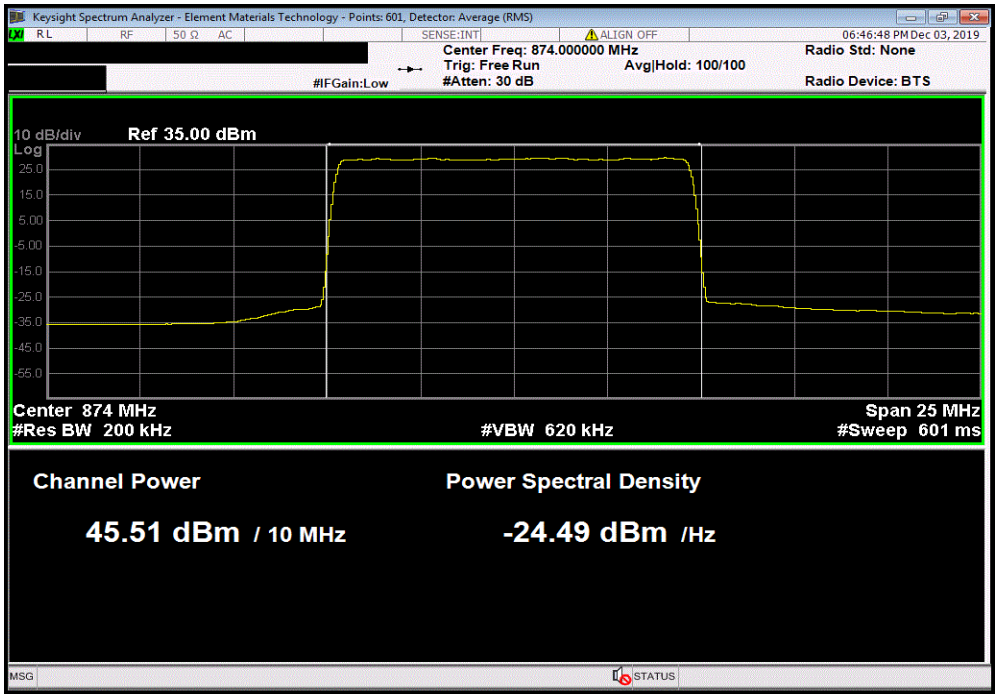


AVERAGE POWER

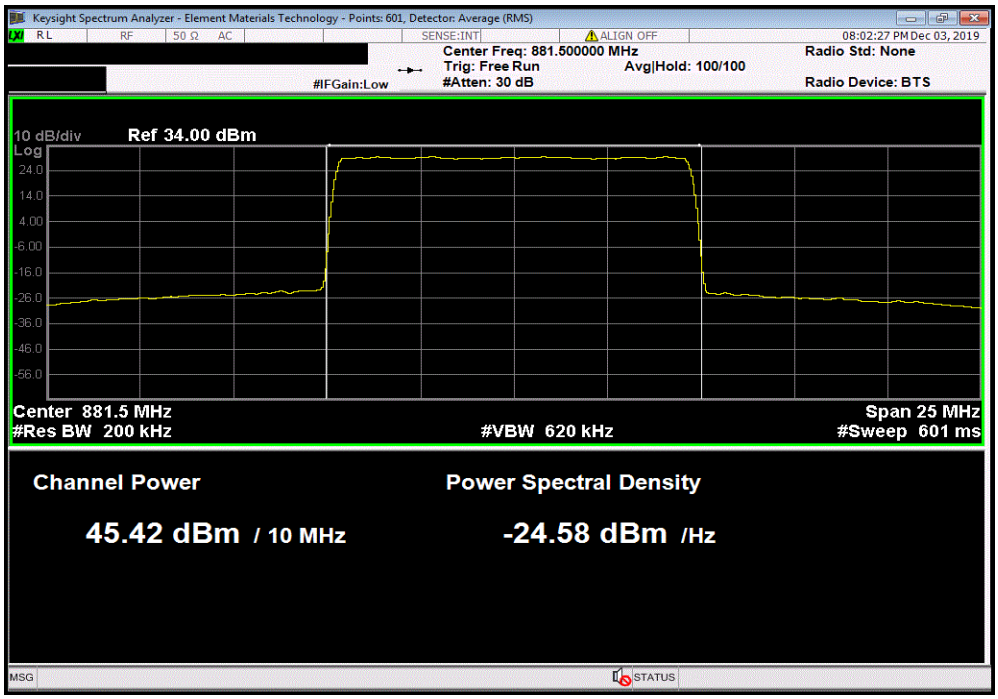
Band 5, Port 4, 10 MHz Bandwidth , 64QAM, High Channel, 889 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	45.467	0		45.5	57	Pass



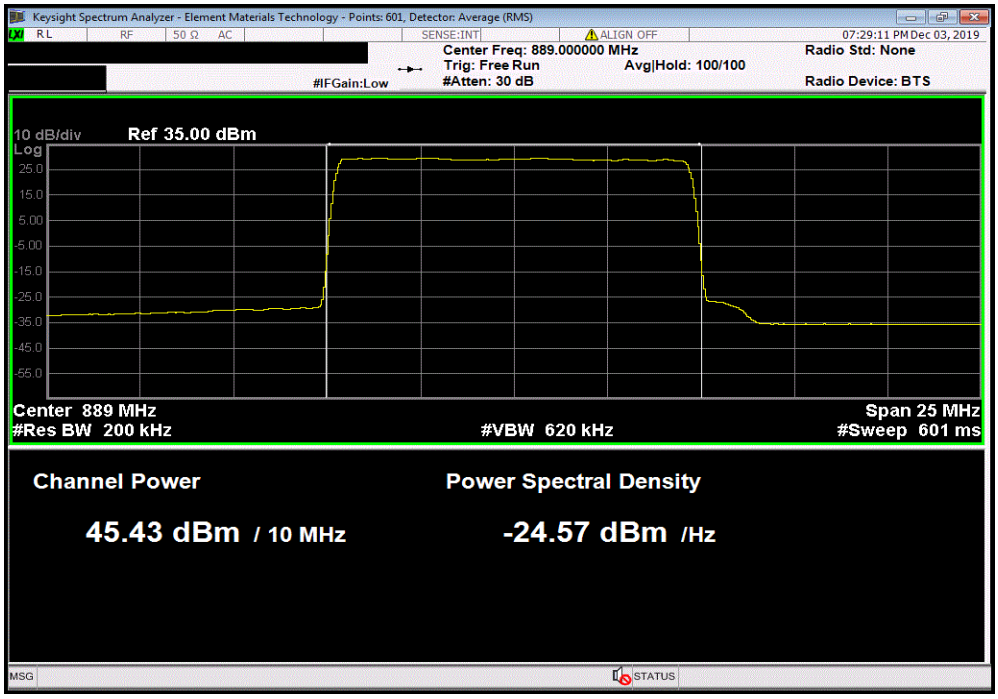
Band 5, Port 4, 10 MHz Bandwidth , 256QAM, Low Channel, 874 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	45.514	0		45.5	57	Pass



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



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

element

XMit 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**	**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). 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.

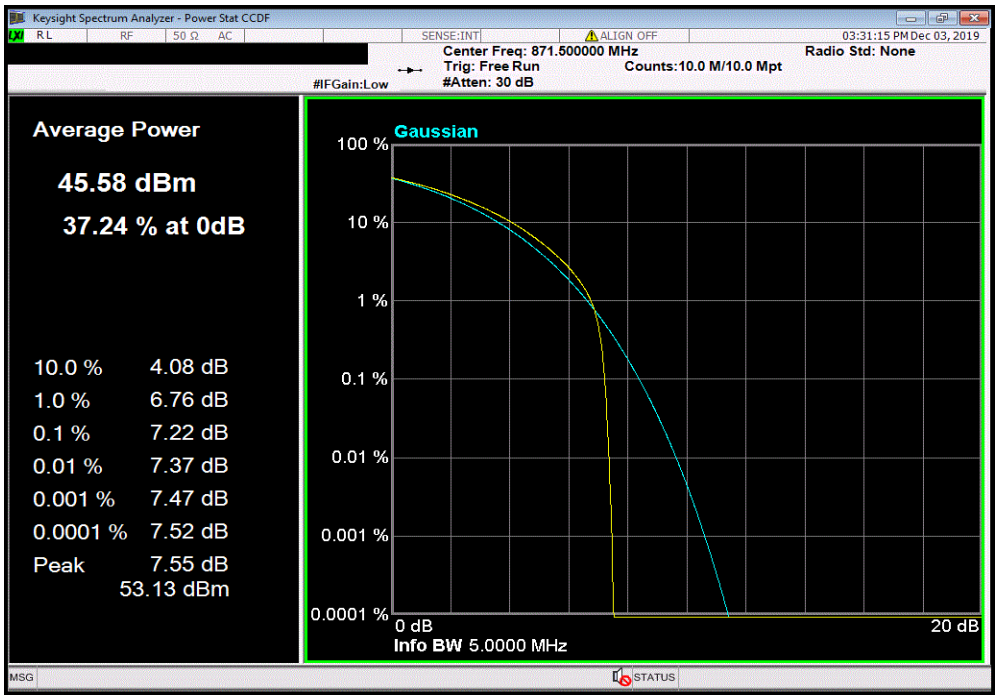
DEVIATIONS FROM TEST STANDARD

None

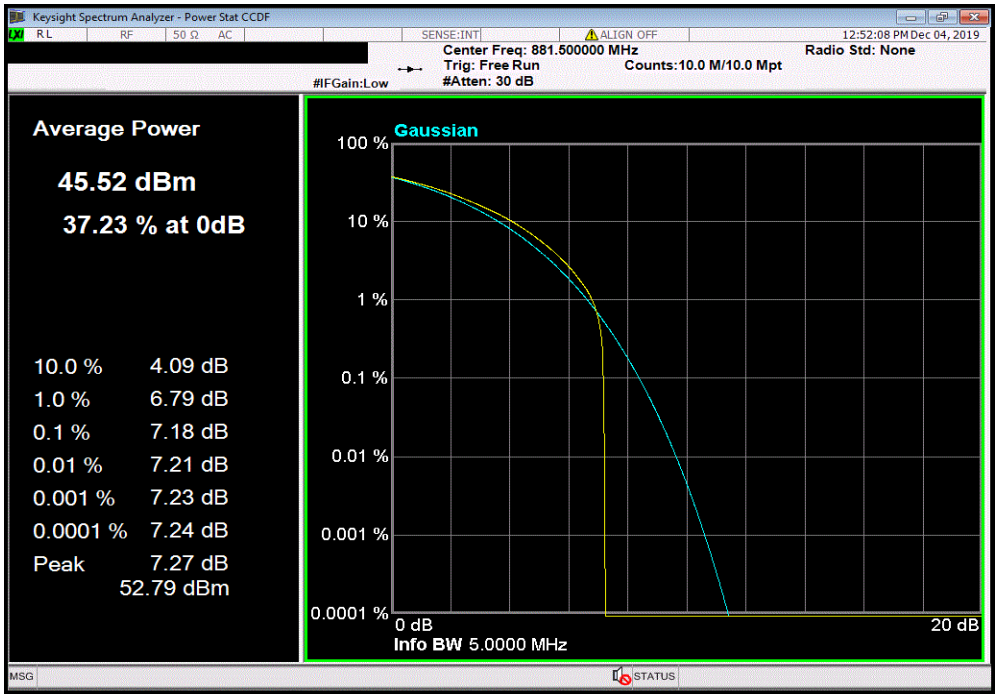
Configuration #	**1**	*Signature*

		PAPR Value (dB)	PAPR Limit (dBm)	Result
Band 5				
Port 4				
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

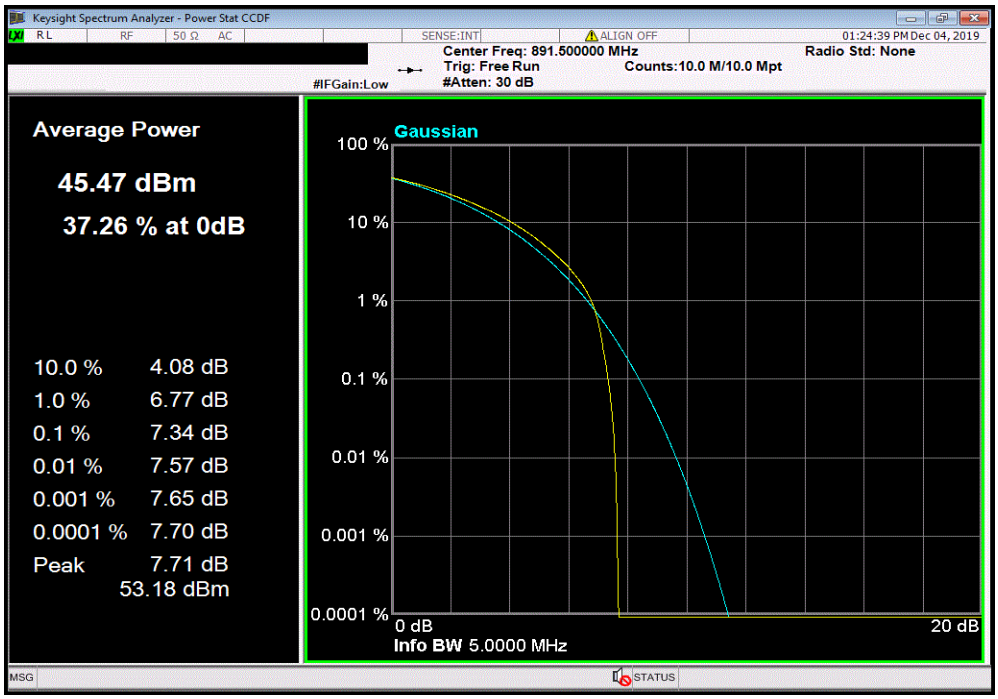
Band 5, Port 4, 5 MHz Bandwidth, QPSK, Low Channel, 871.5 MHz						
				PAPR Value (dB)	PAPR Limit (dBm)	Result
				7.22	13	Pass



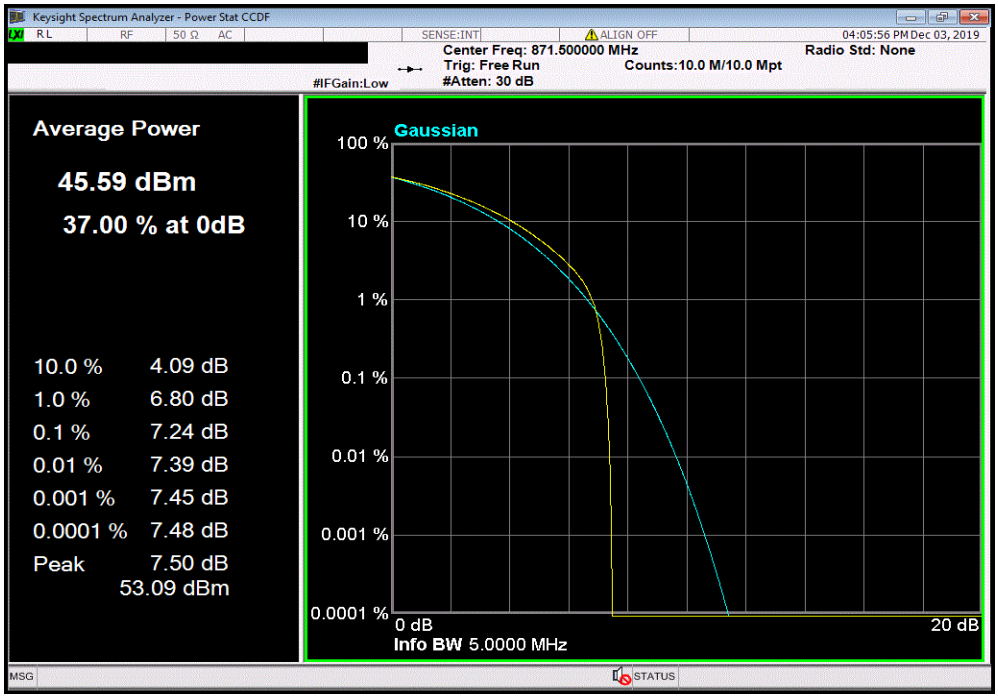
Band 5, Port 4, 5 MHz Bandwidth, QPSK, Mid Channel, 881.5 MHz						
				PAPR Value (dB)	PAPR Limit (dBm)	Result
				7.18	13	Pass



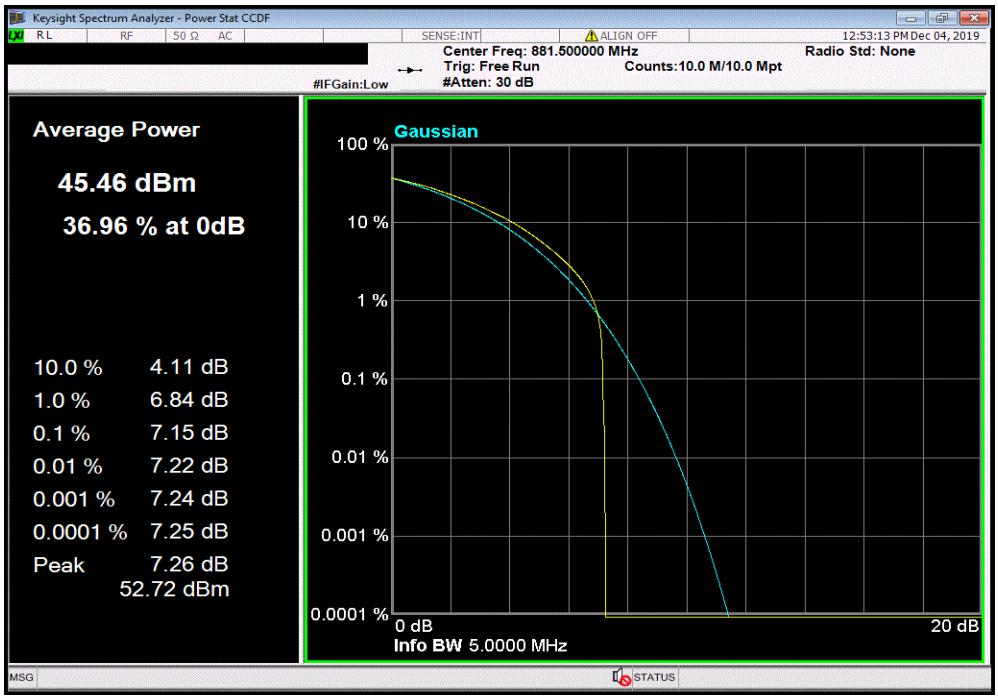
Band 5, Port 4, 5 MHz Bandwidth, QPSK, High Channel, 891.5 MHz						
				PAPR Value (dB)	PAPR Limit (dBm)	Result
				7.34	13	Pass



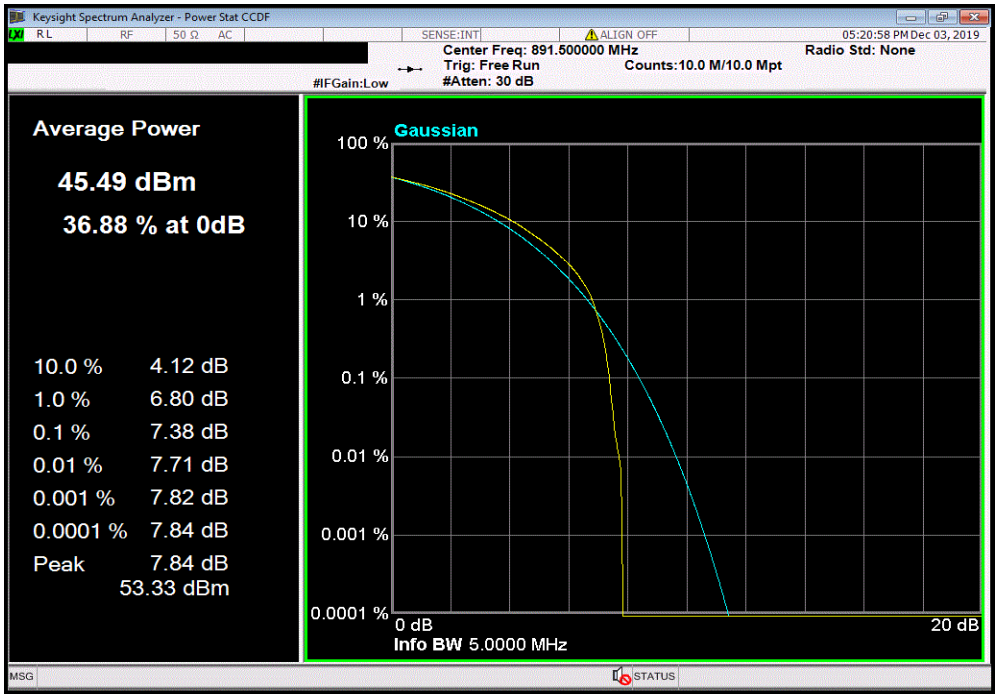
Band 5, Port 4, 5 MHz Bandwidth, 16QAM, Low Channel, 871.5 MHz						
				PAPR Value (dB)	PAPR Limit (dBm)	Result
				7.24	13	Pass



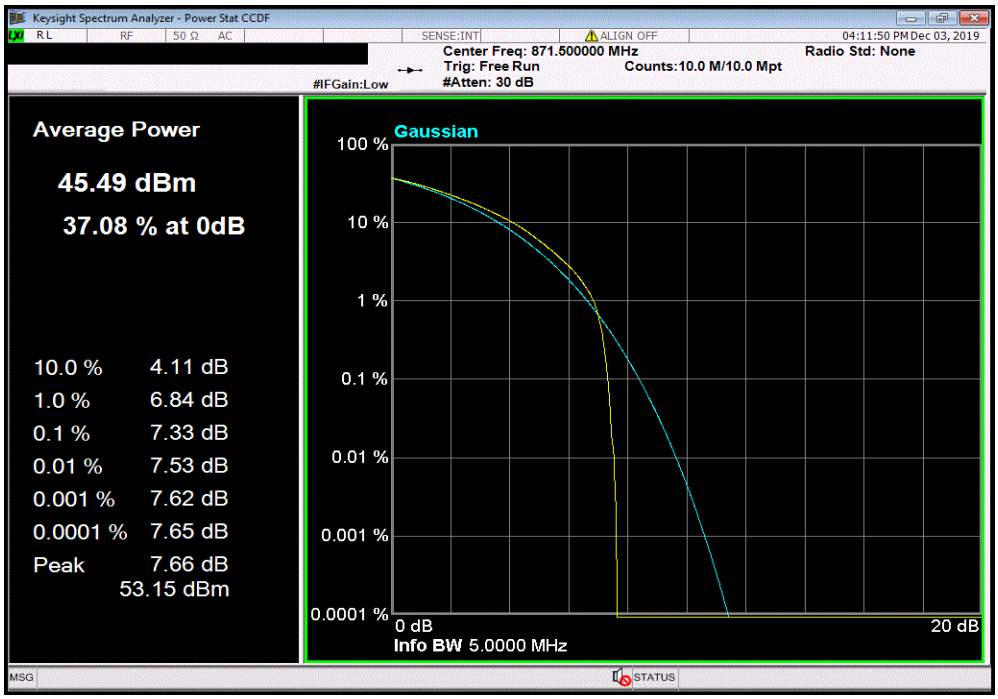
Band 5, Port 4, 5 MHz Bandwidth, 16QAM, Mid Channel, 881.5 MHz						
				PAPR Value (dB)	PAPR Limit (dBm)	Result
				7.15	13	Pass



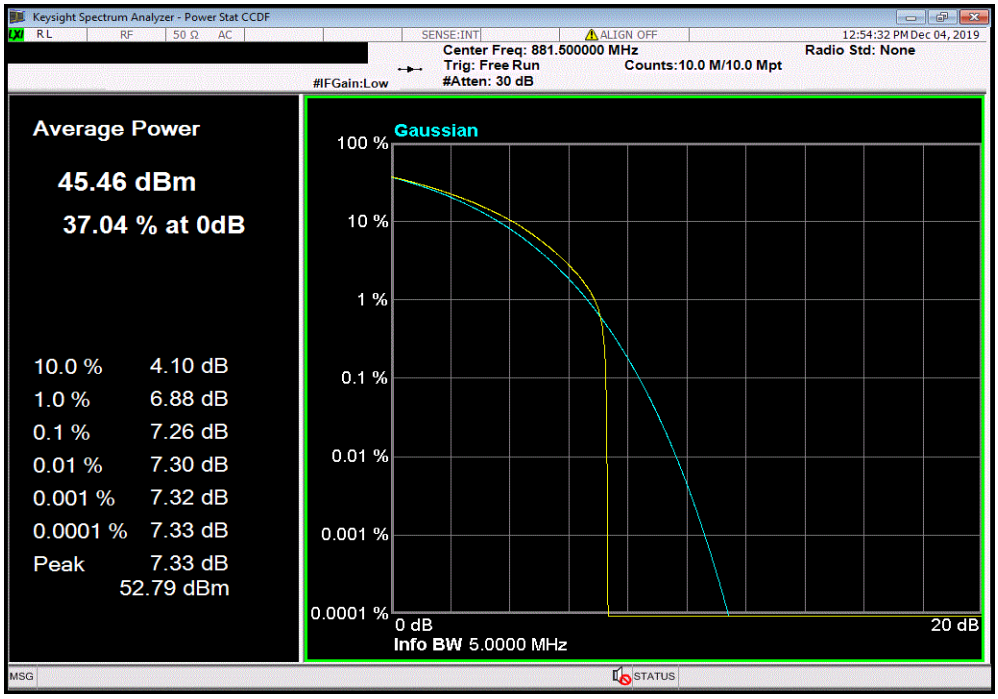
Band 5, Port 4, 5 MHz Bandwidth, 16QAM, High Channel, 891.5 MHz						
				PAPR Value (dB)	PAPR Limit (dBm)	Result
				7.38	13	Pass



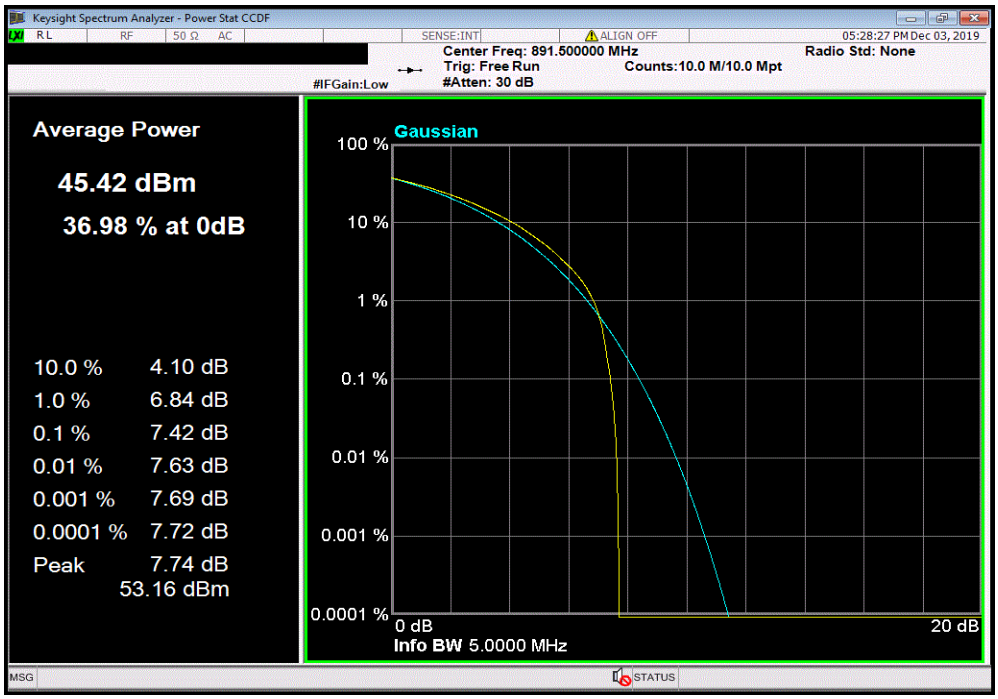
Band 5, Port 4, 5 MHz Bandwidth, 64QAM, Low Channel, 871.5 MHz						
				PAPR Value (dB)	PAPR Limit (dBm)	Result
				7.33	13	Pass



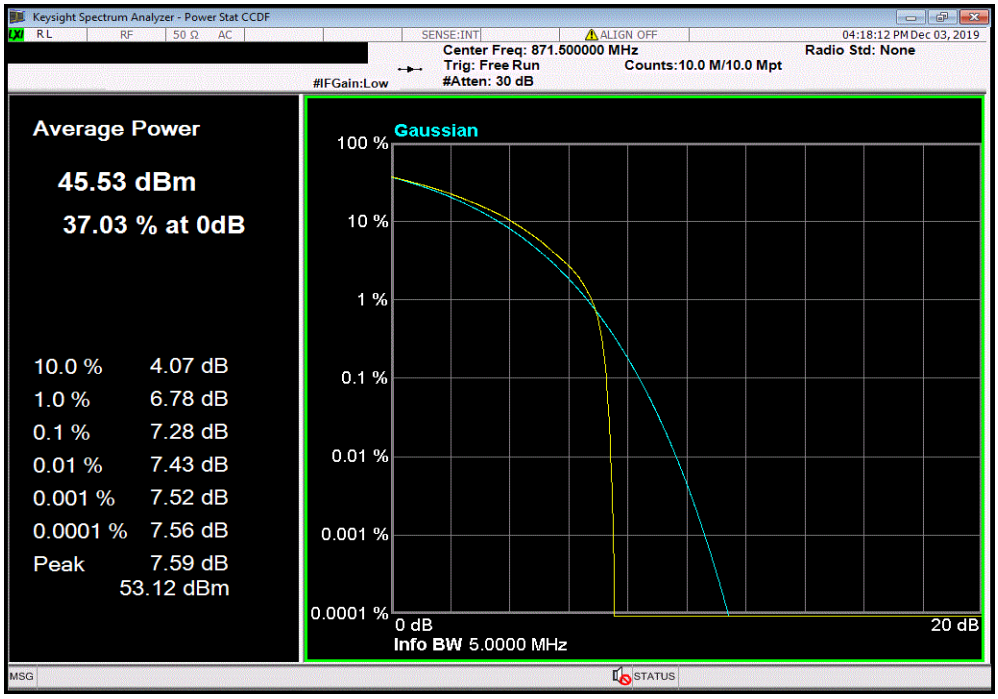
Band 5, Port 4, 5 MHz Bandwidth, 64QAM, Mid Channel, 881.5 MHz						
				PAPR Value (dB)	PAPR Limit (dBm)	Result
				7.26	13	Pass



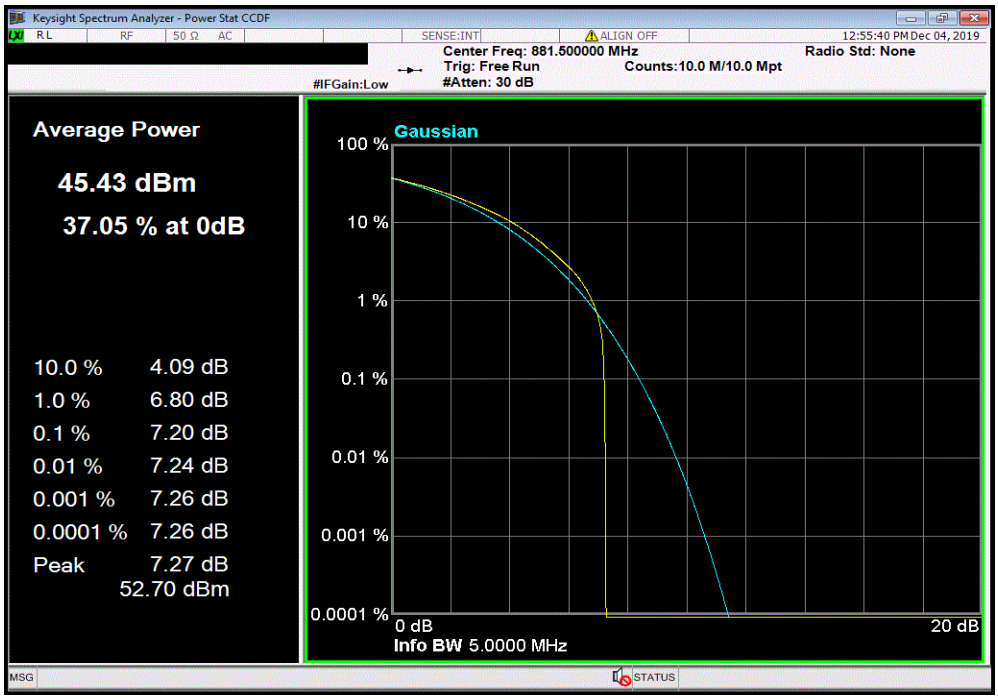
Band 5, Port 4, 5 MHz Bandwidth, 64QAM, High Channel, 891.5 MHz						
				PAPR Value (dB)	PAPR Limit (dBm)	Result
				7.42	13	Pass



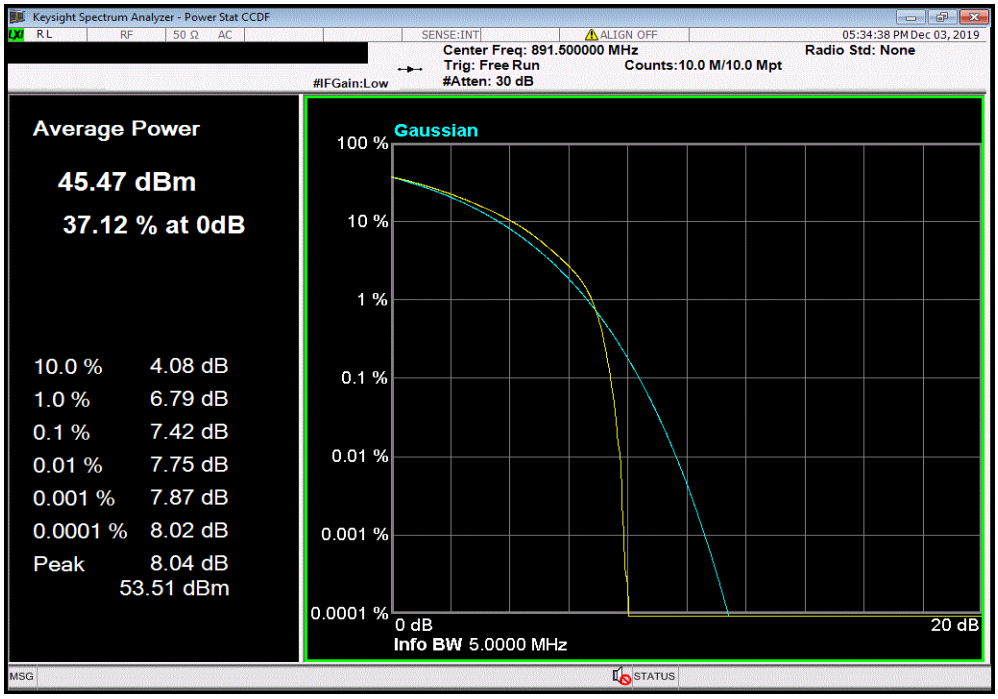
Band 5, Port 4, 5 MHz Bandwidth, 256QAM, Low Channel, 871.5 MHz						
				PAPR Value (dB)	PAPR Limit (dBm)	Result
				7.28	13	Pass



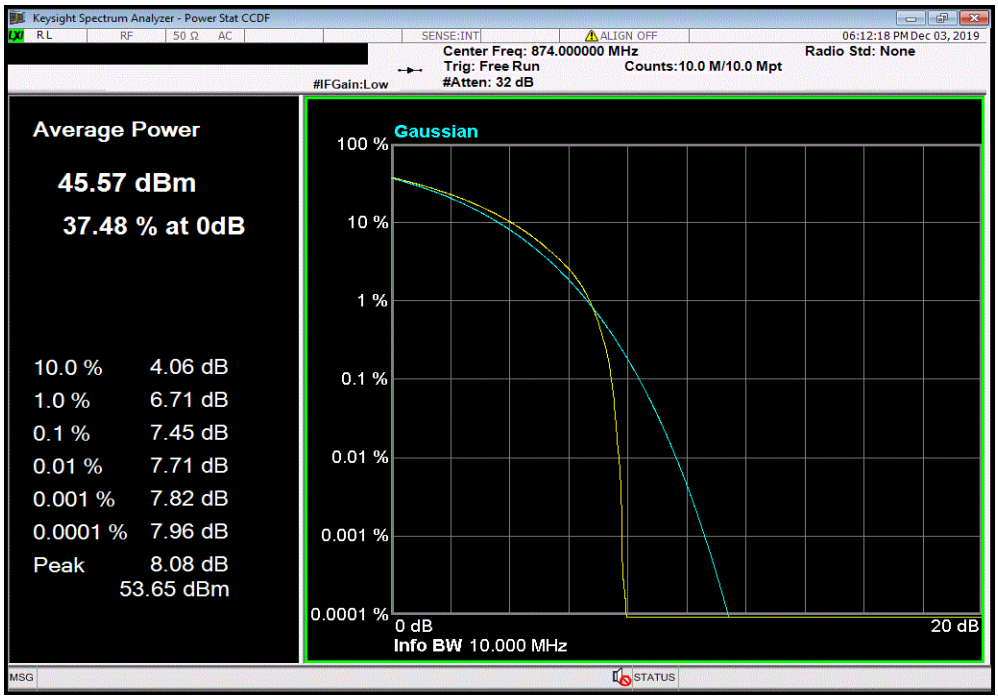
Band 5, Port 4, 5 MHz Bandwidth, 256QAM, Mid Channel, 881.5 MHz						
				PAPR Value (dB)	PAPR Limit (dBm)	Result
				7.2	13	Pass



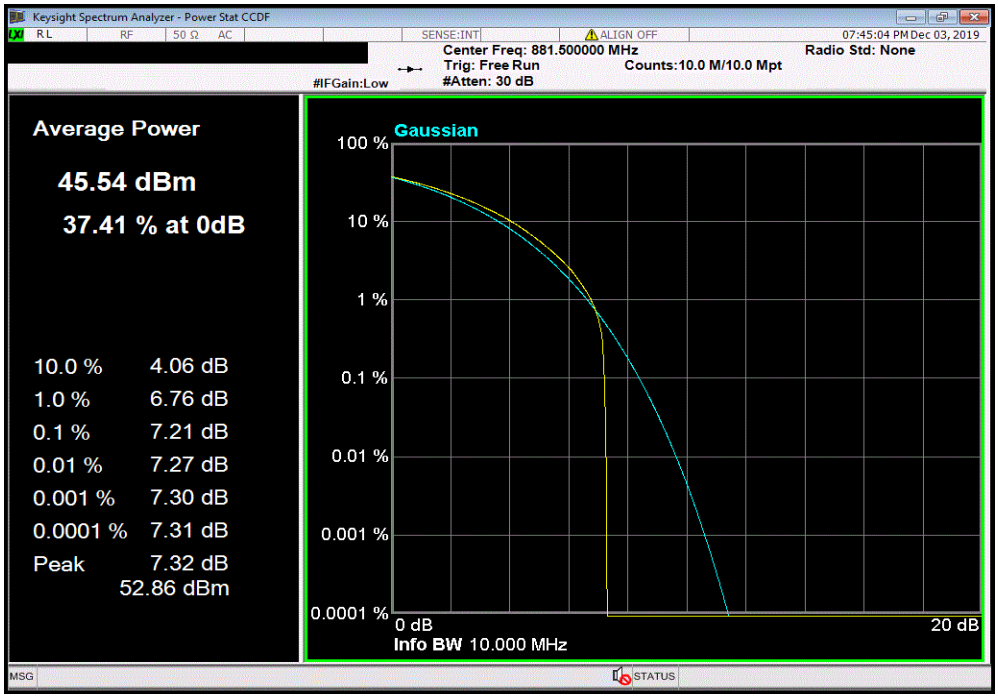
Band 5, Port 4, 5 MHz Bandwidth, 256QAM, High Channel, 891.5 MHz						
				PAPR Value (dB)	PAPR Limit (dBm)	Result
				7.42	13	Pass



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

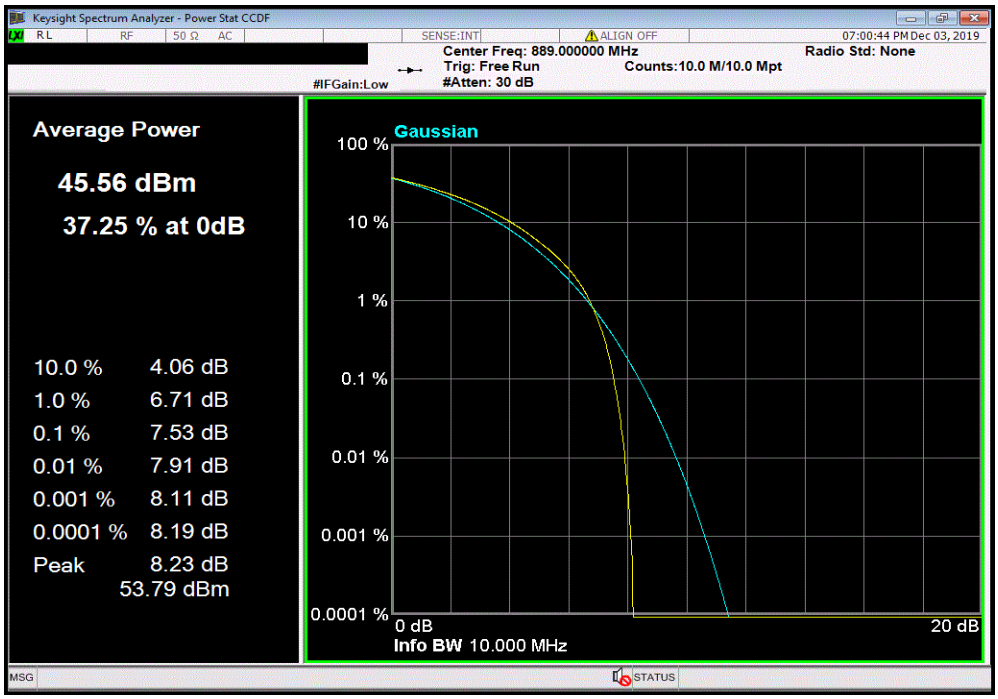


PEAK-TO-AVERAGE POWER RATIO (PAPR)

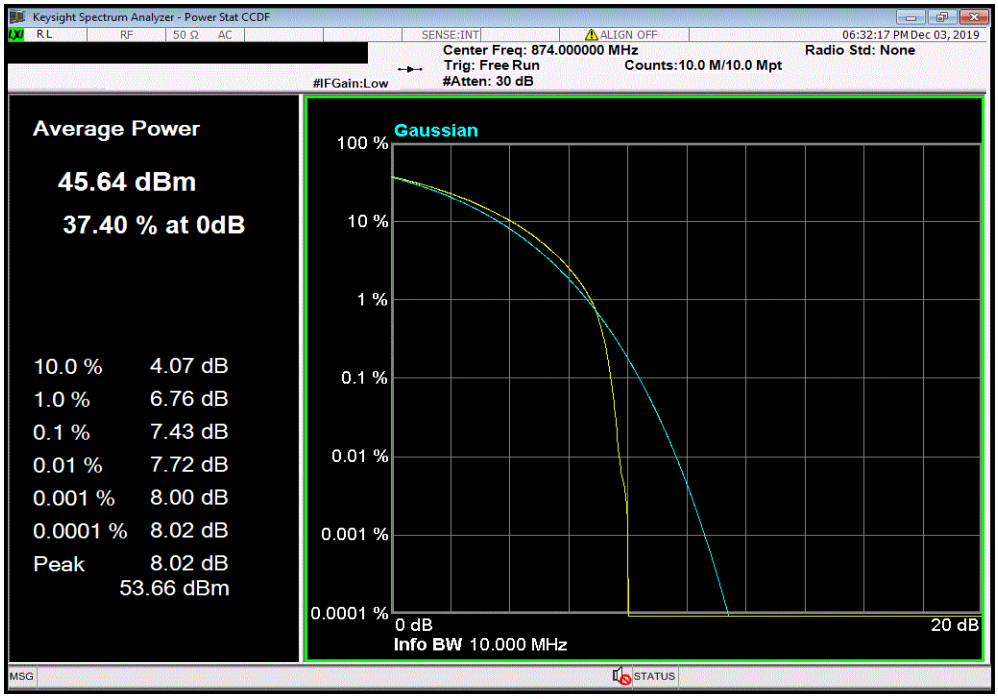
element

XMit 2019.06.11

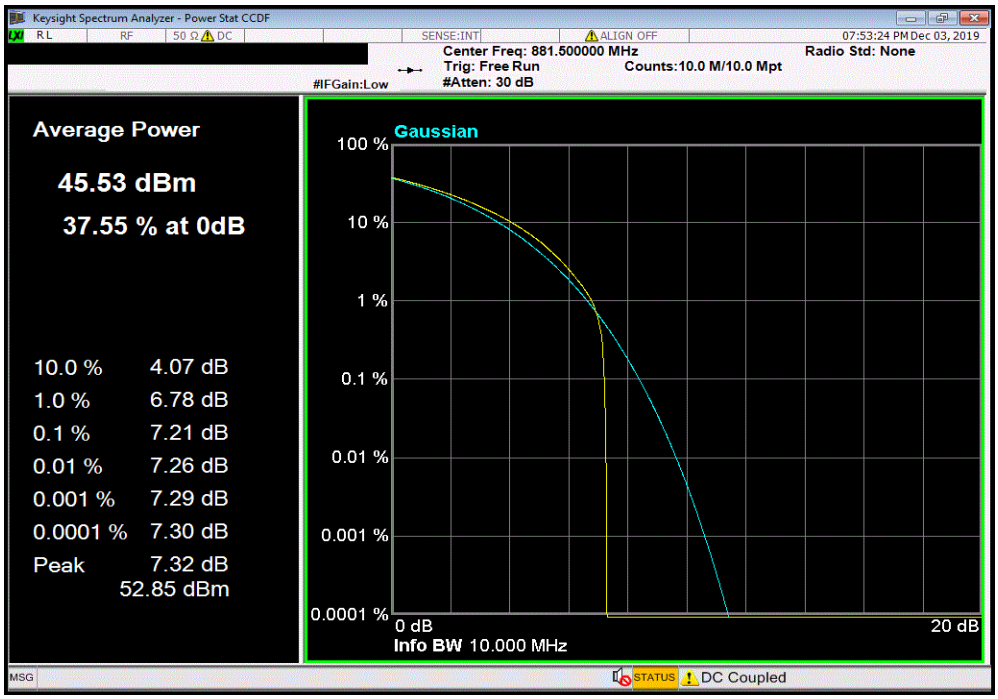
Band 5, Port 4, 10 MHz Bandwidth, QPSK, High Channel, 889 MHz						
				PAPR Value (dB)	PAPR Limit (dBm)	Result
				7.53	13	Pass



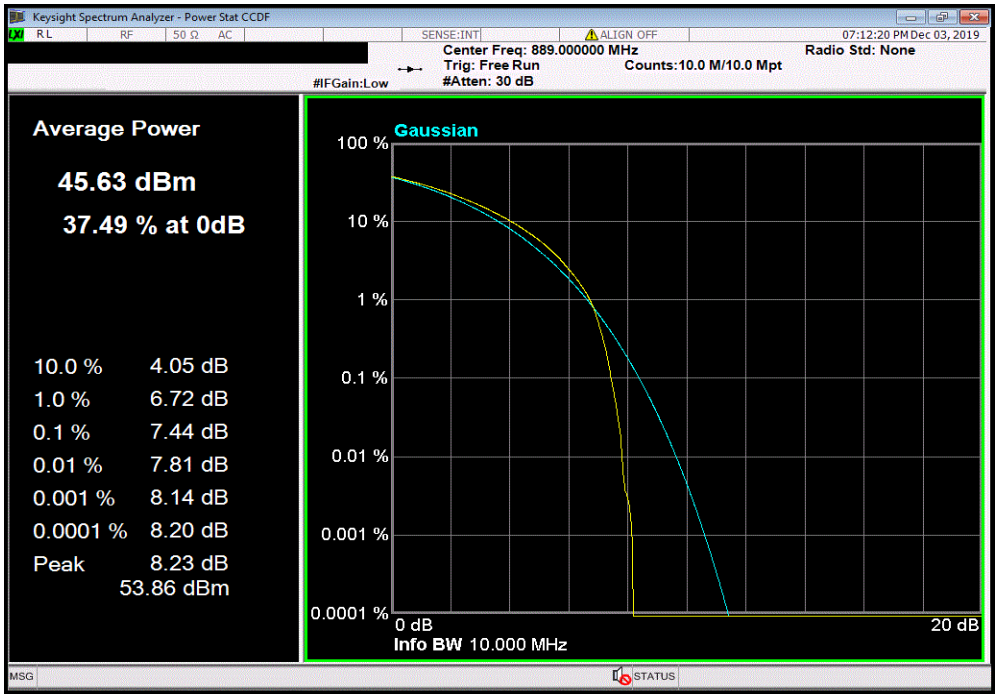
Band 5, Port 4, 10 MHz Bandwidth, 16QAM, Low Channel, 874 MHz						
				PAPR Value (dB)	PAPR Limit (dBm)	Result
				7.43	13	Pass



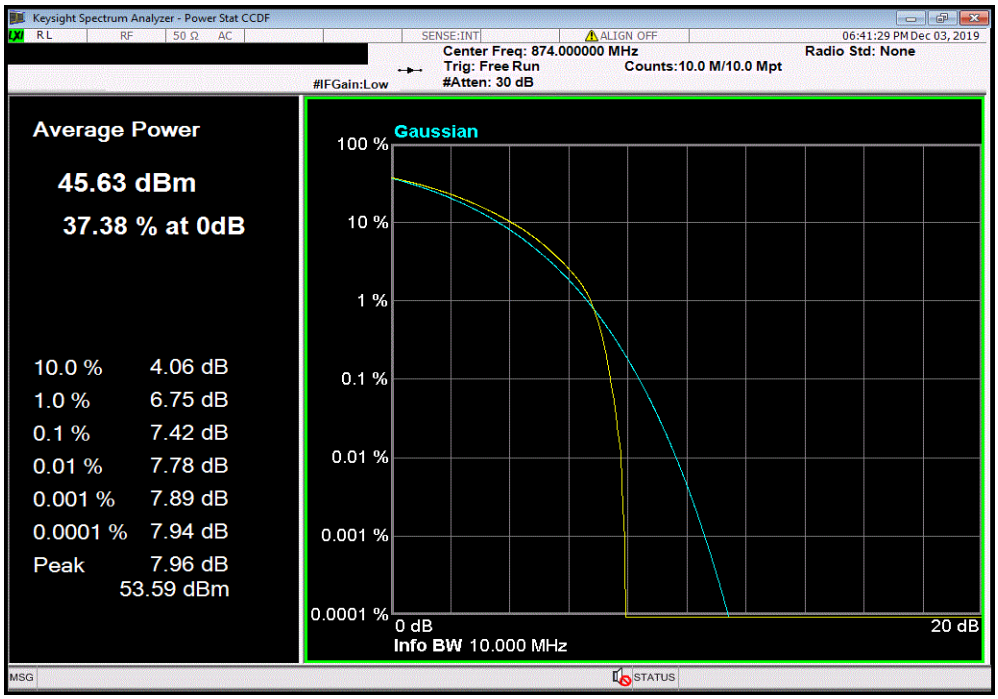
Band 5, Port 4, 10 MHz Bandwidth, 16QAM, Mid Channel, 881.5 MHz						
				PAPR Value (dB)	PAPR Limit (dBm)	Result
				7.21	13	Pass



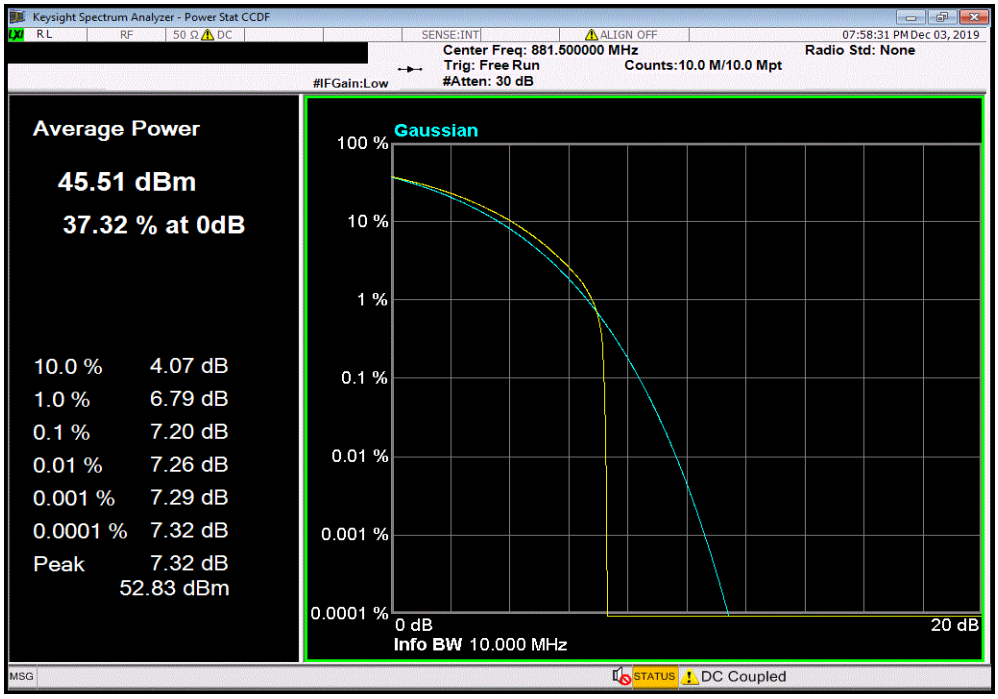
Band 5, Port 4, 10 MHz Bandwidth, 16QAM, High Channel, 889 MHz						
				PAPR Value (dB)	PAPR Limit (dBm)	Result
				7.44	13	Pass



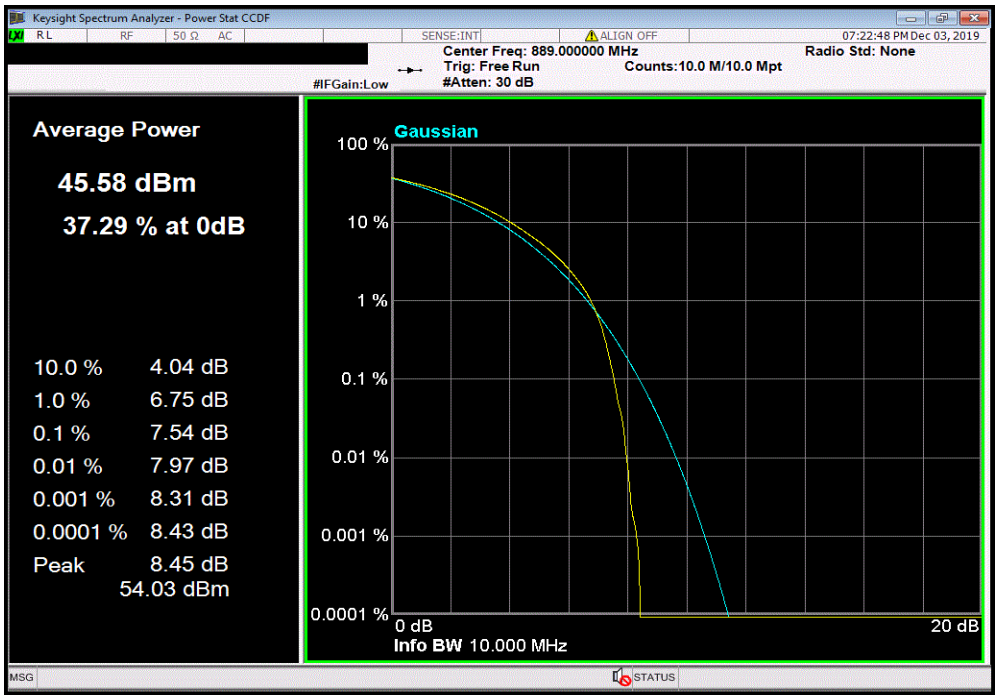
Band 5, Port 4, 10 MHz Bandwidth, 64QAM, Low Channel, 874 MHz						
				PAPR Value (dB)	PAPR Limit (dBm)	Result
				7.42	13	Pass



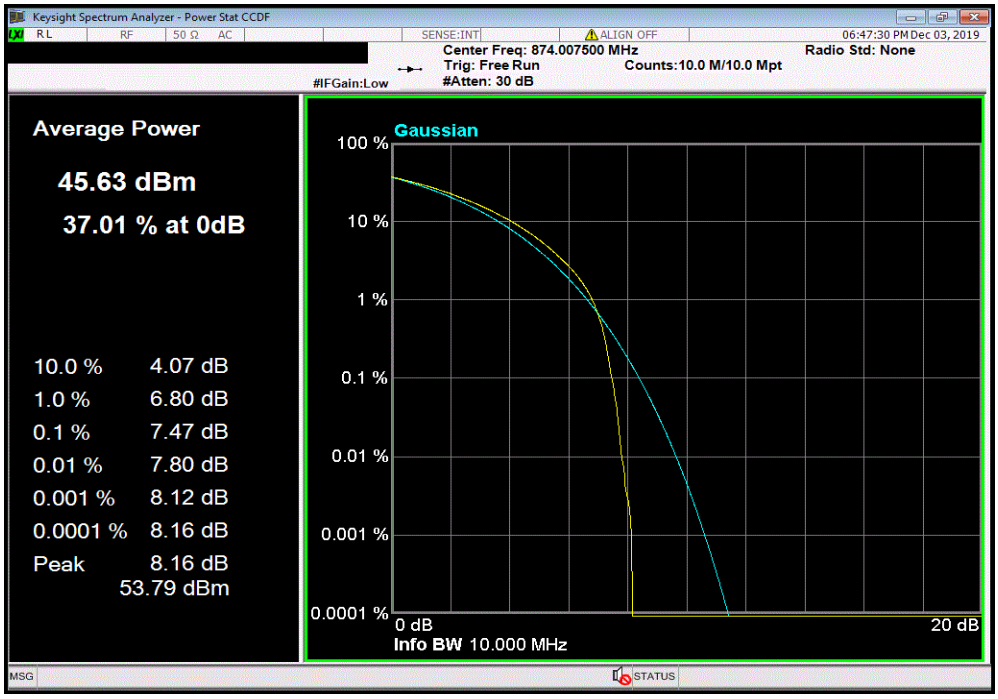
Band 5, Port 4, 10 MHz Bandwidth, 64QAM, Mid Channel, 881.5 MHz						
				PAPR Value (dB)	PAPR Limit (dBm)	Result
				7.2	13	Pass



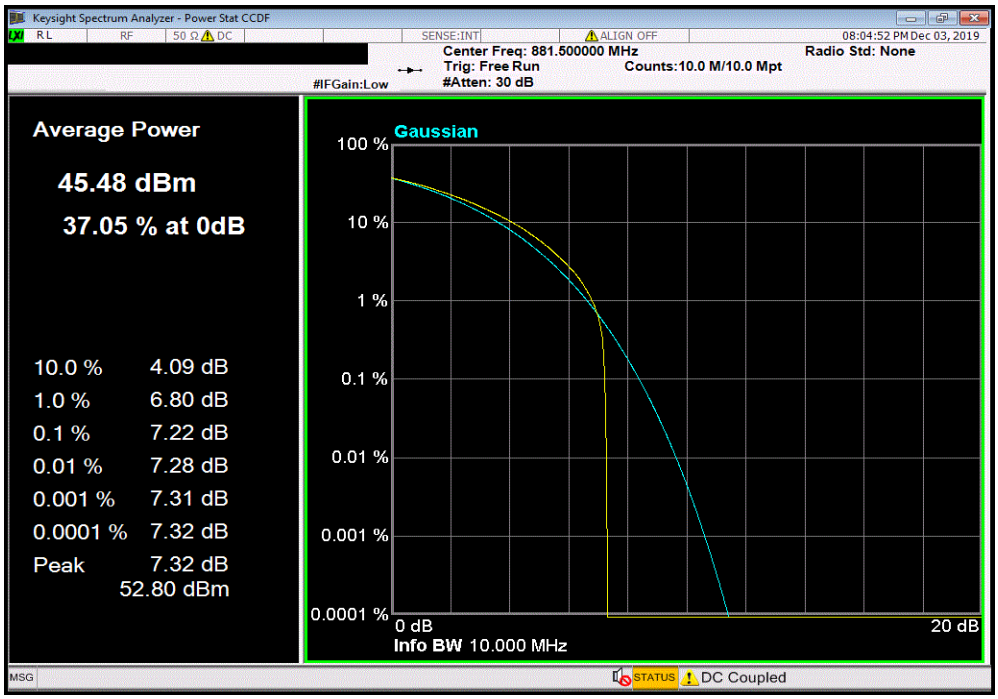
Band 5, Port 4, 10 MHz Bandwidth, 64QAM, High Channel, 889 MHz							
					PAPR Value (dB)	PAPR Limit (dBm)	Result
					7.54	13	Pass



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



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