



Radio Test Report
Application for a Permissive Change of Equipment Authorization
FCC Part 24 and IC RSS-133
[1930MHz – 1990MHz]

FCC Part 27 and IC RSS-139
[2110MHz – 2170MHz]

FCC ID: VBNAHFII-01
IC ID: 661W-AHFII

Nokia Solutions and Networks
Airscale Base Transceiver Station Remote Radio Head
Model: AHFII

Report: NOKI0040, Issue Date: June 7, 2022



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CERTIFICATE OF TEST



Last Date of Test: May 16, 2022

Nokia Solutions and Networks

EUT: AirScale Base Transceiver Station Remote Radio Head Model AHFII

Radio Equipment Testing

Standards

Specification	Method
Code of Federal Regulations (CFR) Title 47 Part 2 (Radio Standards Specification) RSS-Gen Issue 5 CFR Title 47 Part 24 Subpart E – Broadband PCS RSS-133 Issue 6 - January 18, 2018 – 2GHz Personal Communications Services CFR Title 47 Part 27 RSS-139 Issue 3 - July 16, 2015 – Advanced Wireless Services (AWS)	ANSI C63.26-2015 with FCC KDB 971168 D01 v03r01 FCC KDB 971168 D03 v01 FCC KDB 662911D01 v02r01

Results

Test Description	Result	Comments
Power Spectral Density	Pass	
Conducted Output Power	Pass	
Frequency Stability	N/A	Not required when using a pre-certified module.
Occupied Bandwidth	Pass	
Peak to Average Power (PAPR)CCDF	Pass	
Band Edge Compliance	Pass	
Spurious Emissions at the Antenna Terminals	Pass	
Spurious Radiated Emissions	N/A	Not required when using a pre-certified module.

Deviations From Test Standards

None

Approved By:

Adam Bruno, 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 - Each laboratory is accredited by A2LA to ISO / IEC 17025, and as a product certifier to ISO / IEC 17065 which allows Element to certify transmitters to FCC and IC specifications.

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 – Recognized as an EU Notified Body validated for the EMCD and RED Directives.

United Kingdom

BEIS – Recognized by the UK as an Approved Body under the UK Radio Equipment and UK EMC Regulations.

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:

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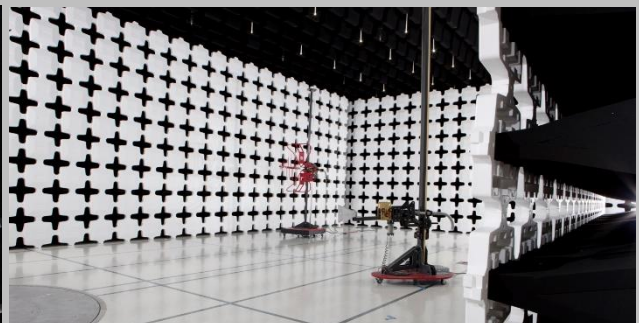
[Texas](#)

[Washington](#)

FACILITIES



California Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Minnesota Labs MN01-11 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Oregon Labs EV01-12 6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	Texas Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Washington Labs NC01-05 19201 120 th Ave NE Bothell, WA 98011 (425)984-6600
A2LA				
Lab Code: 3310.04	Lab Code: 3310.05	Lab Code: 3310.02	Lab Code: 3310.03	Lab Code: 3310.06
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

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 in the table below. A lab specific value may also be found in the applicable test description section. 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)	3.1 dB	-3.1 dB

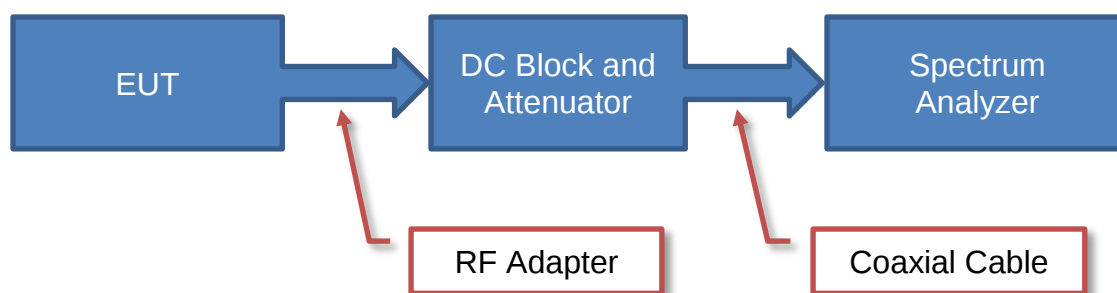
TEST SETUP BLOCK DIAGRAMS

Measurement Bandwidths

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

Unless otherwise stated, measurements were made using the bandwidths and detectors specified. No video filter was used.

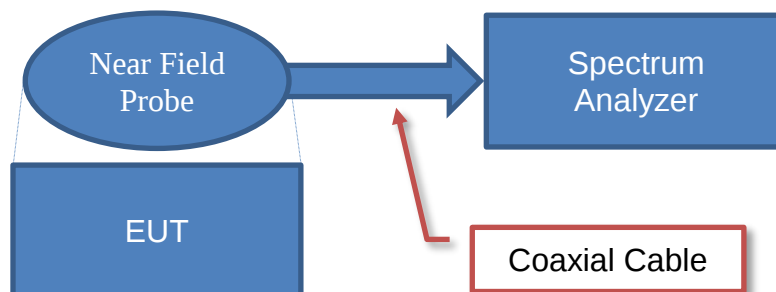
Antenna Port Conducted Measurements



Sample Calculation (logarithmic units)

Measured Value		Measured Level		Reference Level Offset
71.2	=	42.6	+	28.6

Near Field Test Fixture Measurements

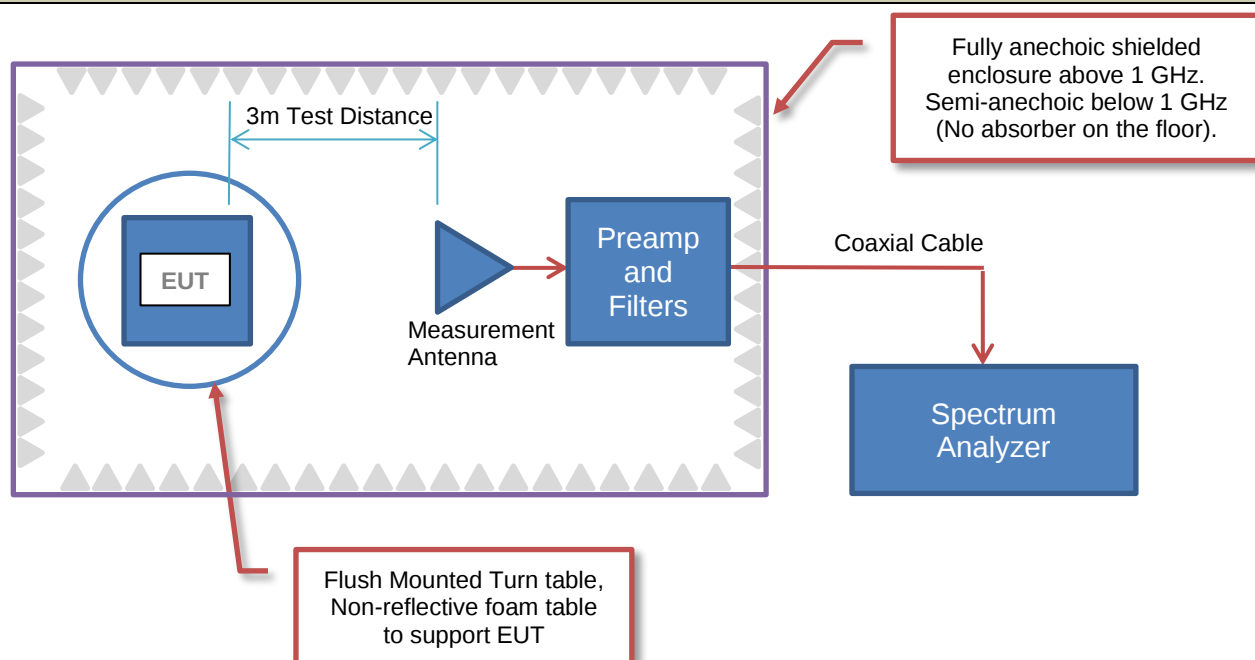


Sample Calculation (logarithmic units)

Measured Value		Measured Level		Reference Level Offset
71.2	=	42.6	+	28.6

TEST SETUP BLOCK DIAGRAMS

Emissions Measurements



Sample Calculation (logarithmic units)

Radiated Emissions:

Measured Level (Amplitude)	Factor			Distance Adjustment Factor	External Attenuation	Field Strength
	Antenna Factor	Cable Factor	Amplifier Gain			
42.6	28.6	3.1	40.8	0.0	0.0	33.5

Conducted Emissions:

Measured Level (Amplitude)	Factor		External Attenuation	Adjusted Level
	Transducer Factor	Cable Factor		
26.7	0.3	0.1	20.0	47.1

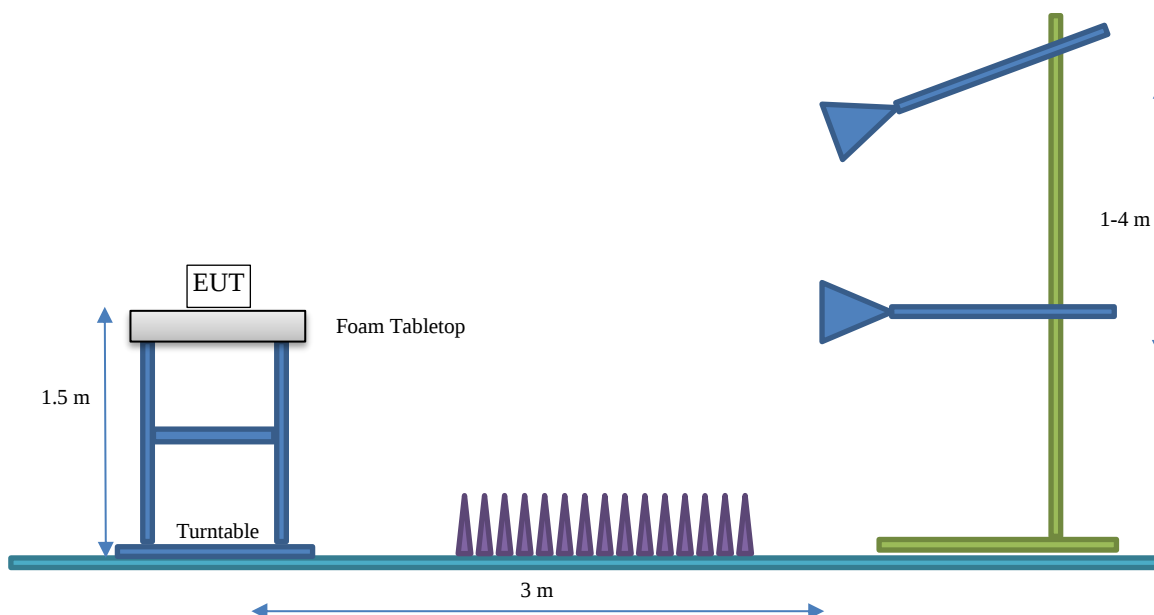
Radiated Power (ERP/EIRP):

Measured Level into Substitution Antenna (Amplitude dBm)	Substitution Antenna Factor (dBi)	EIRP to ERP (if applicable)	Measured power (dBm ERP/EIRP)
10.0	6.0	2.15	13.9/16.0

TEST SETUP BLOCK DIAGRAMS

Bore Sighting (>1GHz)

The diameter of the illumination area is the dimension of the line tangent to the EUT formed by 3 dB beamwidth of the measurement antenna at the measurement distance. At a 3 meter test distance, the diameter of the illumination area was 3.8 meters at 1 GHz and greater than 2.1 meters up to 6 GHz. Above 1 GHz, when required by the measurement standard, the antenna is pointed for both azimuth and elevation to maintain the receive antenna within the cone of radiation from the EUT. The specified measurement detectors were used for comparison of the emissions to the peak and average specification limits.



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	Nokia Solutions and Networks
Address:	3201 Olympus Blvd
City, State, Zip:	Dallas, TX 75019
Test Requested By:	Steve Mitchell
EUT:	AirScale Base Transceiver Station Remote Radio Head Model AHFII
First Date of Test:	May 13, 2022
Last Date of Test:	May 16, 2022
Receipt Date of Samples:	May 13, 2022
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 permissive change on the original filing is being pursued to add 3G WCDMA carriers to the AirScale Base Transceiver Station Remote Radio Head Model AHFII FCC and ISSED radio certifications. The original test effort includes testing for 4G 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 3G WCDMA carriers for this permissive change per correspondence/guidance from Nemko TCB. The same test methodology used in the original certification testing was used in this permissive change test effort. Tests performed under the change effort include RF power, PSD, CCDF, emission bandwidth (99% and 26 dB down), band edge spurious emissions, and conducted spurious emissions.

The testing was performed on the same hardware version (AHFII) as the original certification test. The base station and remote radio head software for this testing is an updated release that includes 3G WCDMA carrier support. The radiated emissions and frequency stability measurements performed in the original certification were 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.

Nokia Solutions and Networks AirScale Base Transceiver Station (BTS) Remote Radio Head (RRH) module, model AHFII is being developed under this effort. The AHFII remote radio head is a multi-standard multi-carrier radio module designed to support GSM/EDGE, WCDMA, LTE, LTE Narrow Band Internet of Things (NB IoT) operations (in-band, guard band, standalone), 5G NR and DSS (Dynamic Spectrum Sharing). The scope of testing in this effort is for 3G WCDMA FDD operations.

The AHFII RRH has four transmit/four receive antenna ports (4TX/4RX for Band II and 4TX/4RX for Band X). Each antenna port supports 3GPP frequency band II (BTS Rx: 1850 to 1910 MHz/BTS TX: 1930 to 1990 MHz) and 3GPP frequency band X (BTS Rx: 1710 to 1770 MHz/BTS TX: 2110 to 2170 MHz). The maximum RF output power of the RRH is 480 Watts (120 watts per port x 4 ports). The maximum power per band (Band II or Band X) is 80 watts. The maximum single WCDMA carrier power level is 30 watts. The TX and RX instantaneous bandwidth cover the full operational RRH bandwidth. Multi-carrier operation is supported. The RRH can be operated as a 2x2 MIMO or as non-MIMO for 3G WCDMA FDD. The RRH supports three WCDMA downlink modulation types (QPSK, 16QAM, and 64QAM). The WCDMA modulation types are setup according to 3GPP TS 25.141 UTRA Test Models (TM) as follows TM 1: QPSK, TM 5: 16QAM and TM 6: 64QAM.

Single WCDMA carriers are tested at the bottom, middle and top channels provided in PCS and AWS frequency channel tables. Multicarrier testing is performed at maximum port/carrier power per KDB 971168 D03v01 guidance.

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

PRODUCT DESCRIPTION

The PCS Band WCDMA channel bandwidth is 5MHz. The channel spacing is 200 kHz between channel numbers. The PCS Band WCDMA downlink channel numbers are provided in below.

	Downlink UARFCN UTRA Band II	Downlink Frequency (MHz)	WCDMA Channel
PCS Band_ AHFII Antennas 1, 2, 3, 4	9660	1930.0	Band edge
			
	9662	1932.4	Bottom Channel
	9663	1932.6	Bottom Channel + 1
			
	9800	1960.0	Middle Channel
			
	9937	1987.4	Top Channel - 1
	9938	1987.6	Top Channel
			
	9940	1990.0	Band edge

AHFII Downlink Band Edge 3G WCDMA PCS Band Frequency Channels

PCS Multicarrier Multiband Test Case: In the PCS band _Three WCDMA carriers using two carriers (with minimum spacing between carrier frequencies) at the lower band edge (1932.4 & 1937.4MHz) and a third carrier with maximum spacing between the other two carrier frequencies (1987.6MHz) at the upper band edge. In the AWS band _ Two WCDMA carriers at the band middle (2137.5 & 2142.5MHz). The carriers are operated at maximum power (~26.6W/PCS carrier and 20W/AWS carrier) with a total port power of 120 watts (80W for PCS band carriers + 40W for AWS band carriers).

PRODUCT DESCRIPTION

The AWS Band WCDMA channel bandwidth is 5MHz. The channel spacing is 200 kHz between channel numbers. The AWS Band WCDMA downlink channel numbers are provided in below.

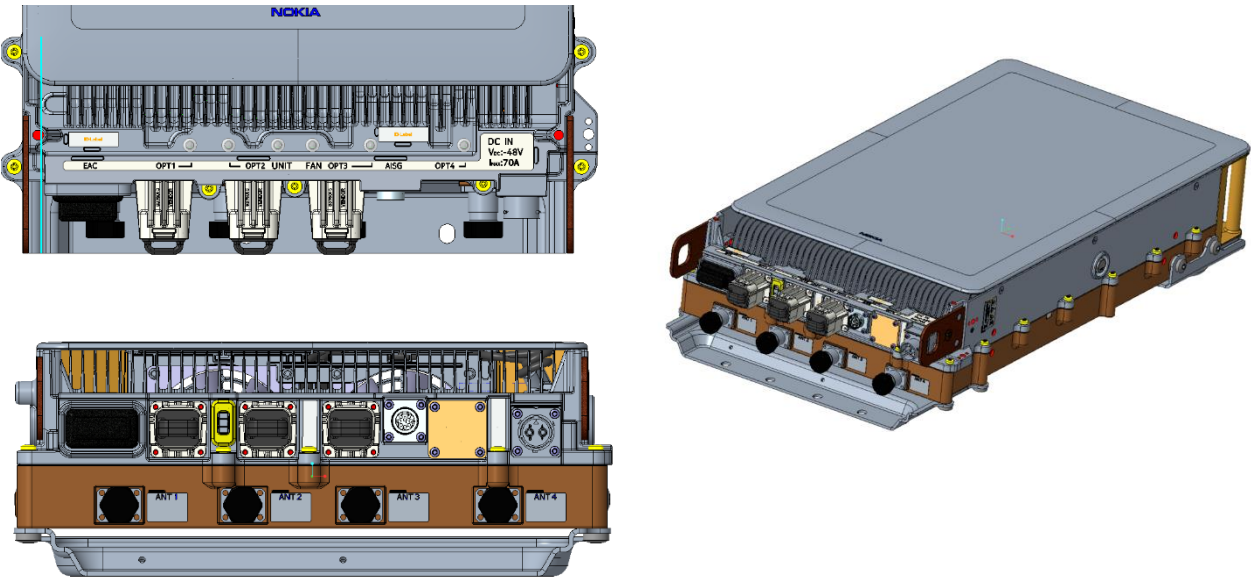
	Downlink UARFCN UTRA Band X	Downlink Frequency (MHz)	WCDMA Channel
AWS Band_ AHFII Antennas 1, 2, 3, 4	3100	2110.0	Band edge
			
	3112	2112.4	Bottom Channel
	3113	2112.6	Bottom Channel + 1
			
	3250	2140.0	Middle Channel
			
	3387	2167.4	Top Channel - 1
	3388	2167.6	Top Channel
			
	3400	2170.0	Band edge

AHFII Downlink Band Edge 3G WCDMA AWS Band Frequency Channels

AWS Multicarrier Multiband Test Case: In the AWS band _Three WCDMA carriers using two carriers (with minimum spacing between carrier frequencies) at the lower band edge (2112.4 & 2117.4MHz) and a third carrier with maximum spacing between the other two carrier frequencies (2167.6MHz) at the upper band edge. In the PCS band: Two WCDMA carriers at band middle (1957.5 & 1962.5MHz). The carriers are operated at maximum power (~26.6W/AWS carrier and 20W/PCS carrier) with a total port power of 120 watts (80W for AWS band carriers + 40W for PCS band carriers).

PRODUCT DESCRIPTION

AHFII Connector Layout



Name	Qty	Connector Type	Purpose (and Description)
DC In	1	APPG Amphenol	2-pole Power Input Terminal
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
OPT	3	SFP	Optical Interfaces
RET	1	8-pin circular connector	AISG 3.0 to external devices_ RET RS-485

EUT External Interfaces

Testing Objective:

A permissive change on the original filing is being pursued to add 3G WCDMA carrier operations to the Nokia Solutions and Networks AirScale Base Transceiver Station (BTS) Remote Radio Head (RRH) model AHFII FCC and ISED radio certifications.

CONFIGURATIONS



Configuration NOKI0040- 1

Software/Firmware Running during test	
Description	Version
3G BTS Software Version (22R3)	SBTS22R3 ENB 9900 220421 000002
3G RF_SW	RF.FRM6.trunk.20220419.013

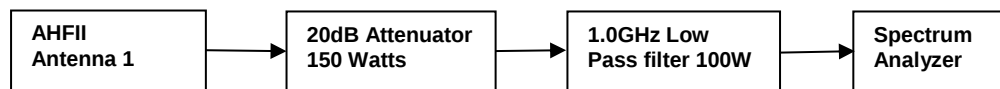
Equipment being tested (include Peripherals)			
Description	Manufacturer	Model/Part Number	Serial Number
AMIA (BTS Cabinet)	Nokia Solutions and Networks	473098A.203	RK182307104
ASIA (3G BTS System Module)	Nokia Solutions and Networks	473095A.203	AH173111443
ABIA (3G BTS Baseband Module)	Nokia Solutions and Networks	473096A.102	L1164121378
AHFII (Radio Remote Head)	Nokia Solutions and Networks	475656A.101	YK214000036
Low Pass Filter 1.4GHz/100W	Microwave Circuits, Inc.	L1G006G1	SN3972-01-DC0430
Attenuator 150W/20dB	Weinschel Corp	66-20-33	BZ1165
SFP+ 9.8G,300M,850NM	Nokia	474900A.101	VF2023004CK
SFP+ 9.8G,300M,850NM	Nokia	474900A.101	VF2023000RM
Lenovo T490	HP	T490	PF26RVZ0
Keysight N8757- DC System power supply	Keysight	N8757A	US21D4054S
FPAC (DC-pwr supply)	Nokia	472438A.101	G7111007170
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297385
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297387
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297384
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC865
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC867
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC866
Cat-5e cable	CSA	LL73189	E151955
6 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN528836/6
1 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_104	SN551432/4
Fiber Optic cable 2m	Amphenol Fiber Optic	VZ1701	995741A

CONFIGURATIONS

Cables (Peripheral)					
Description	Shield (Y/N)	Length (m)	Ferrite (Y/N)	Connection 1	Connection 2
Fiber Optic Cable	N	2 meters	N	ABIA	AHFII
Cat-5e Cable	Y	7 meters	N	ASIA	WebEM- PC
HS-SUCOFLEX_106 – RF CABLE	Y	2 meters	N	EUT [AHFII] Ant 2-4	250W -50ohm - Load

Cables					
Description	Shield (Y/N)	Length (m)	Ferrite (Y/N)	Connection 1	Connection 2
HS-SUCOFLEX_106 1.5dB cable attenuator	Y	6 meters	N	EUT [AHFII] Ant port #1	Attenuator 150W/20dB
Attenuator 150W/20dB	N	N/A	N	RF cable HS- SUCOFLEX_106	1.0GHz Low Pass filter 100W
1.0GHz Low Pass filter 100W	N	N/A	N	Attenuator 150W/20dB	RF cable HS- SUCOFLEX_104
HS-SUCOFLEX_104	Y	1 meter	N	1.0GHz Low Pass filter 100W	Analyzer

RF Test Setup Diagram:



CONFIGURATIONS



Configuration NOKI0040- 2

Software/Firmware Running during test	
Description	Version
3G BTS Software Version (22R3)	SBTS22R3 ENB 9900 220421 000002
3G RF_SW	RF.FRM6.trunk.20220419.013

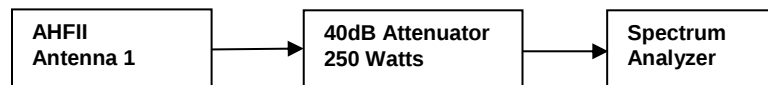
Equipment being tested (include Peripherals)			
Description	Manufacturer	Model/Part Number	Serial Number
AMIA (BTS Cabinet)	Nokia Solutions and Networks	473098A.203	RK182307104
ASIA (3G BTS System Module)	Nokia Solutions and Networks	473095A.203	AH173111443
ABIA (3G BTS Baseband Module)	Nokia Solutions and Networks	473096A.102	L1164121378
AHFII (Radio Remote Head)	Nokia Solutions and Networks	475656A.101	YK214000036
Attenuator 40dB/250W	API Weinschel	58-40-43-LIM	TC909
SFP+ 9.8G,300M,850NM	Nokia	474900A.101	VF2023004CK
SFP+ 9.8G,300M,850NM	Nokia	474900A.101	VF2023000RM
Lenovo T490	HP	T490	PF26RVZ0
Keysight N8757- DC System power supply	Keysight	N8757A	US21D4054S
FPAC (DC-pwr supply)	Nokia	472438A.101	G7111007170
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297385
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297387
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297384
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC865
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC867
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC866
Cat-5e cable	CSA	LL73189	E151955
6 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN528836/6
1 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_104	SN551432/4
Fiber Optic cable 2m	Amphenol Fiber Optic	VZ1701	995741A

CONFIGURATIONS

Cables (Peripheral)					
Description	Shield (Y/N)	Length (m)	Ferrite (Y/N)	Connection 1	Connection 2
Fiber Optic Cable	N	2 meters	N	ABIA	AHFII
Cat-5e Cable	Y	7 meters	N	ASIA	WebEM- PC
HS-SUCOFLEX_106 – RF CABLE	Y	2 meters	N	EUT [AHFII] Ant 2-4	250W -50ohm - Load

Cables					
Description	Shield (Y/N)	Length (m)	Ferrite (Y/N)	Connection 1	Connection 2
HS-SUCOFLEX_106	Y	6 meters	N	EUT [AHFII] Ant port #1	Attenuator 250W/40dB
Attenuator 250W/40dB	N	NA	N	RF cable HS- SUCOFLEX_106	RF cable HS- SUCOFLEX_104
HS-SUCOFLEX_104	Y	1 meter	N	Attenuator 250W/40dB	Analyzer

RF Test Setup Diagram:



CONFIGURATIONS



Configuration NOKI0040- 3

Software/Firmware Running during test	
Description	Version
3G BTS Software Version (22R3)	SBTS22R3 ENB 9900 220421 000002
3G RF_SW	RF.FRM6.trunk.20220419.013

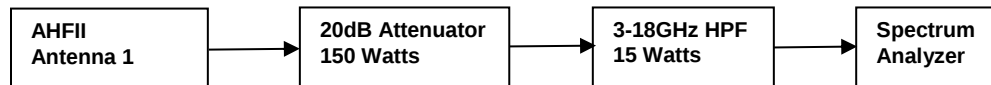
Equipment being tested (include Peripherals)			
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ASIA (3G BTS System Module)	Nokia Solutions and Networks	473095A.203	AH173111443
ABIA (3G BTS Baseband Module)	Nokia Solutions and Networks	473096A.102	L1164121378
AHFII (Radio Remote Head)	Nokia Solutions and Networks	475656A.101	YK214000036
High Pass Filter 3-18GHz/15W	RLC Electronics	F-100-3500-5-R	0011
Attenuator 150W/20dB	Aeroflex Weinschel	66-20-33	BZ2075
SFP+ 9.8G,300M,850NM	Nokia	474900A.101	VF2023004CK
SFP+ 9.8G,300M,850NM	Nokia	474900A.101	VF2023000RM
Lenovo T490	HP	T490	PF26RVZ0
Keysight N8757- DC System power supply	Keysight	N8757A	US21D4054S
FPAC (DC-pwr supply)	Nokia	472438A.101	G7111007170
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297385
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297387
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297384
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC865
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC867
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC866
Cat-5e cable	CSA	LL73189	E151955
6 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN528836/6
1 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_104	SN551432/4
Fiber Optic cable 2m	Amphenol Fiber Optic	VZ1701	995741A

CONFIGURATIONS

Cables (Peripheral)					
Description	Shield (Y/N)	Length (m)	Ferrite (Y/N)	Connection 1	Connection 2
Fiber Optic Cable	N	2 meters	N	ABIA	AHFII
Cat-5e Cable	Y	7 meters	N	ASIA	WebEM- PC
HS-SUCOFLEX_106 – RF CABLE	Y	2 meters	N	EUT [AHFII] Ant 2-4	250W -50ohm - Load

Cables					
Description	Shield (Y/N)	Length (m)	Ferrite (Y/N)	Connection 1	Connection 2
HS-SUCOFLEX_106	Y	6 meters	N	EUT [AHFII] Ant port #1	Attenuator 150W/20dB
Attenuator 150W/20dB	N	NA	N	RF cable HS- SUCOFLEX_106	High Pass Filter 3-18GHz/15W
High Pass Filter 3-18GHz/15W	N	NA	N	Attenuator 150W/20dB	RF cable HS- SUCOFLEX_104
HS-SUCOFLEX_104	Y	1 meter	N	High Pass Filter 3-18GHz/15W	Analyzer

RF Test Setup Diagram:



CONFIGURATIONS



Configuration NOKI0040- 4

Software/Firmware Running during test	
Description	Version
3G BTS Software Version (22R3)	SBTS22R3 ENB 9900 220421 000002
3G RF_SW	RF.FRM6.trunk.20220419.013

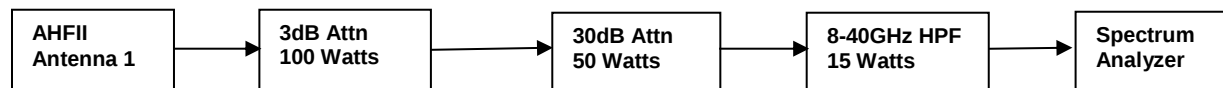
Equipment being tested (include Peripherals)			
Description	Manufacturer	Model/Part Number	Serial Number
AMIA (BTS Cabinet)	Nokia Solutions and Networks	473098A.203	RK182307104
ASIA (3G BTS System Module)	Nokia Solutions and Networks	473095A.203	AH173111443
ABIA (3G BTS Baseband Module)	Nokia Solutions and Networks	473096A.102	L1164121378
AHFII (Radio Remote Head)	Nokia Solutions and Networks	475656A.101	YK214000036
Attenuator 100W/3dB	API Weinschel	47-3-33	CC7387
Attenuator 50W/30dB	Narda	776B	30
High Pass Filter 8-40GHz/15W	RF-Lambda	RHPF23G08G40	17102700014
SFP+ 9.8G,300M,850NM	Nokia	474900A.101	VF2023004CK
SFP+ 9.8G,300M,850NM	Nokia	474900A.101	VF2023000RM
Lenovo T490	HP	T490	PF26RVZ0
Keysight N8757- DC System power supply	Keysight	N8757A	US21D4054S
FPAC (DC-pwr supply)	Nokia	472438A.101	G7111007170
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX 106	SN297385
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX 106	SN297387
2 Meter RF cable (Load Cable)	Huber + Suhner, Inc.	HS-SUCOFLEX 106	SN297384
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC865
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC867
250W -50ohm -Terminating Load	API Weinschel	1433-3-LIM	TC866
Cat-5e cable	CSA	LL73189	E151955
6 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX 106	SN528836/6
1 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX 104	SN551432/4
Fiber Optic cable 2m	Amphenol Fiber Optic	VZ1701	995741A

CONFIGURATIONS

Cables (Peripheral)					
Description	Shield (Y/N)	Length (m)	Ferrite (Y/N)	Connection 1	Connection 2
Fiber Optic Cable	N	2 meters	N	ABIA	AHFII
Cat-5e Cable	Y	7 meters	N	ASIA	WebEM- PC
HS-SUCOFLEX_106 – RF CABLE	Y	2 meters	N	EUT [AHFII] Ant 2-4	250W -50ohm - Load

Cables					
Description	Shield (Y/N)	Length (m)	Ferrite (Y/N)	Connection 1	Connection 2
HS-SUCOFLEX_106	Y	6 meters	N	EUT [AHFII] Ant port #1	Attenuator 100W/3dB
Attenuator 100W/3dB	N	NA	N	RF cable HS- SUCOFLEX_106	Attenuator 50W/30dB
Attenuator 50W/30dB	N	NA	N	Attenuator 100W/3dB	High Pass Filter 8-40GHz/15W
HS-SUCOFLEX_104	Y	1 meter	N	Attenuator 250W/40dB	Analyzer

RF Test Setup Diagram:



MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2022-05-13	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	2022-05-13	Power Spectral Density	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	2022-05-13	Peak to Average Power (PAPR)CCDF	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	2022-05-16	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	2022-05-16	Conducted 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.
6	2022-05-16	Spurious Emissions at the Antenna Terminals	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

POWER SPECTRAL DENSITY AND EIRP CALCULATIONS AWS



XMIT 2022.02.07.0

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
Block - DC	Fairview Microwave	SD3239	ANC	2022-03-02	2023-03-02
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2022-01-17	2023-01-17
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The fundamental emission power spectral density was measured using the channels and modes as called out on the following data sheets.

The method of ANSI C63.26-2015 section 5.2.4.5 was used to make this measurement.

The RF conducted emission testing was performed on one port. The AHFII antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in the "Output Power - All Ports" report section) and antenna port 1 was selected to perform the testing under this effort as allowed by ANSI C63.26-2015 paragraphs 5.2.5.3, 5.7.2i, and 6.4.

The total PSD for all antenna ports (at the radio output) were determined per ANSI C63.26-2015 paragraph 6.4.3.2.4. The EIRP calculations are based upon ANSI C63.26-2015 paragraphs 6.4 for a two port MIMO base station.

The AWS Band EIRP requirements are specified in FCC Part 27.50d and ISSED RSS-139 section 6.5/SRSP-513 section 5.1.1.

The EIRP requirements for PCS and AWS bands for channel bandwidths greater than 1MHz are in general a maximum of 3280 watts/MHz for rural (low population density) areas and 1640 watts/MHz for urban (high population density) areas.

POWER SPECTRAL DENSITY AND EIRP CALCULATIONS AWS



EUT: AHFII (FCC/ISED C2PC)		Work Order: NOKI0040	
Serial Number: YK214000036		Date: 13-May-22	
Customer: Nokia Solutions and Networks		Temperature: 21.9 °C	
Attendees: David Le, John Rattanavong		Humidity: 50.8% RH	
Project: None		Barometric Pres.: 1014 mbar	
Tested by: Brandon Hobbs		Job Site: TX05	
Power: 54 VDC			
TEST SPECIFICATIONS		Test Method	
FCC 27:2022		ANSI C63.26:2015	
RSS-139 Issue 3:2015		RSS-139 Issue 3:2015	
COMMENTS			
All measurement path losses were accounted for in the reference level offset including any attenuators, filters and DC blocks. The PSD was measured while transmitting one carrier on Port 1. The total PSD for multiport (2x2 MIMO) operation was determined based upon ANSI 63.26 clause 6.4.3.2.4 (10 Log Nout). The total PSD for two port operation is single port PSD +3dB [i.e. 10 Log(2)].			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	2	Signature	
		Initial Value dBm/MHz	Duty Cycle Factor (dB)
		Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD
AWS BAND X, 2110 MHz - 2170 MHz			
Port 1			
5 MHz Bandwidth			
QPSK Modulation			
	Low Channel, 2112.4 MHz	38.942	0
	Mid Channel, 2140 MHz	38.978	0
	High Channel, 2167.6 MHz	38.796	0
16-QAM Modulation			
	Low Channel, 2112.4 MHz	38.830	0
	Mid Channel, 2140 MHz	38.840	0
	High Channel, 2167.6 MHz	38.687	0
64-QAM Modulation			
	Low Channel, 2112.4 MHz	38.845	0
	Mid Channel, 2140 MHz	38.880	0
	High Channel, 2167.6 MHz	38.697	0

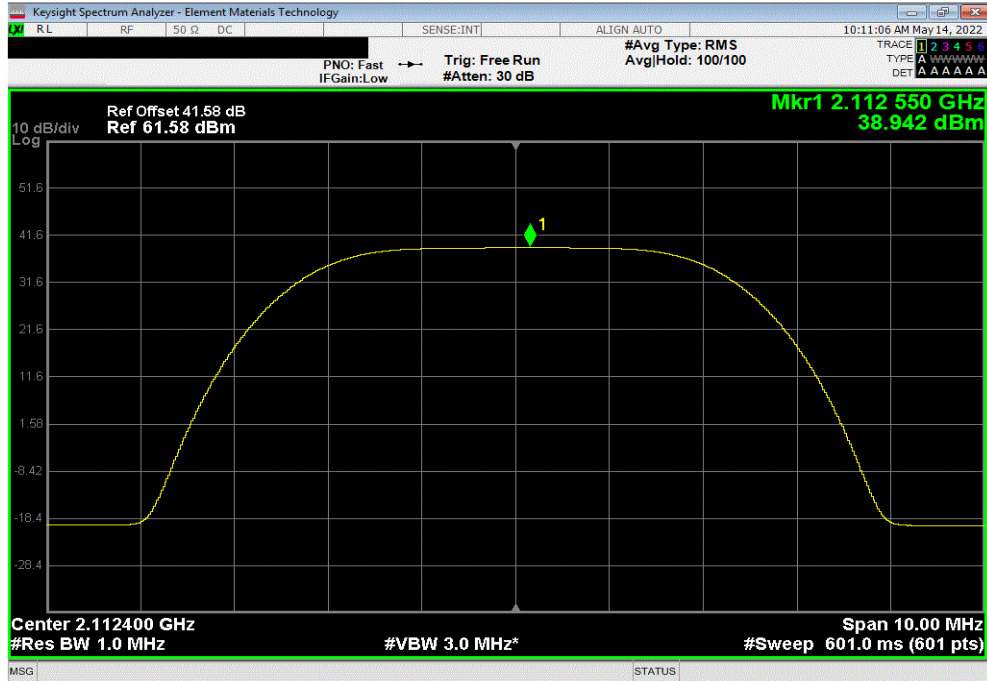
POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

AWS

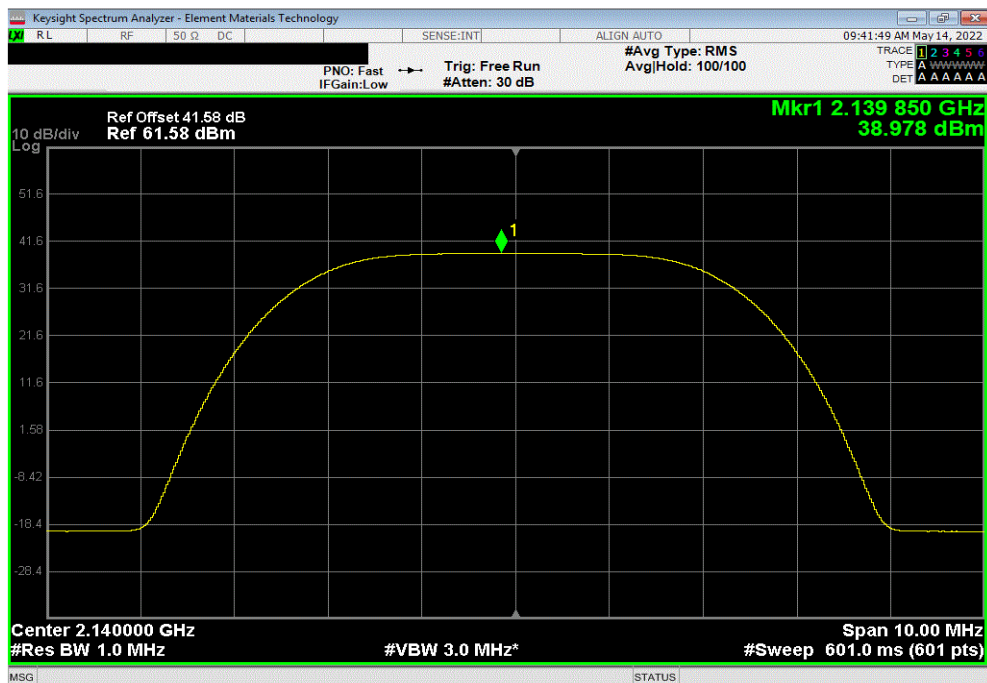


TbTx 2022.05.02.0 XMR 2022.02.07.0

AWS BAND X, 2110 MHz - 2170 MHz, Port 1, 5 MHz Bandwidth, QPSK Modulation , Low Channel, 2112.4 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD		
38.942	0	38.9	41.9		



AWS BAND X, 2110 MHz - 2170 MHz, Port 1, 5 MHz Bandwidth, QPSK Modulation , Mid Channel, 2140 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD		
38.978	0	39.0	42.0		



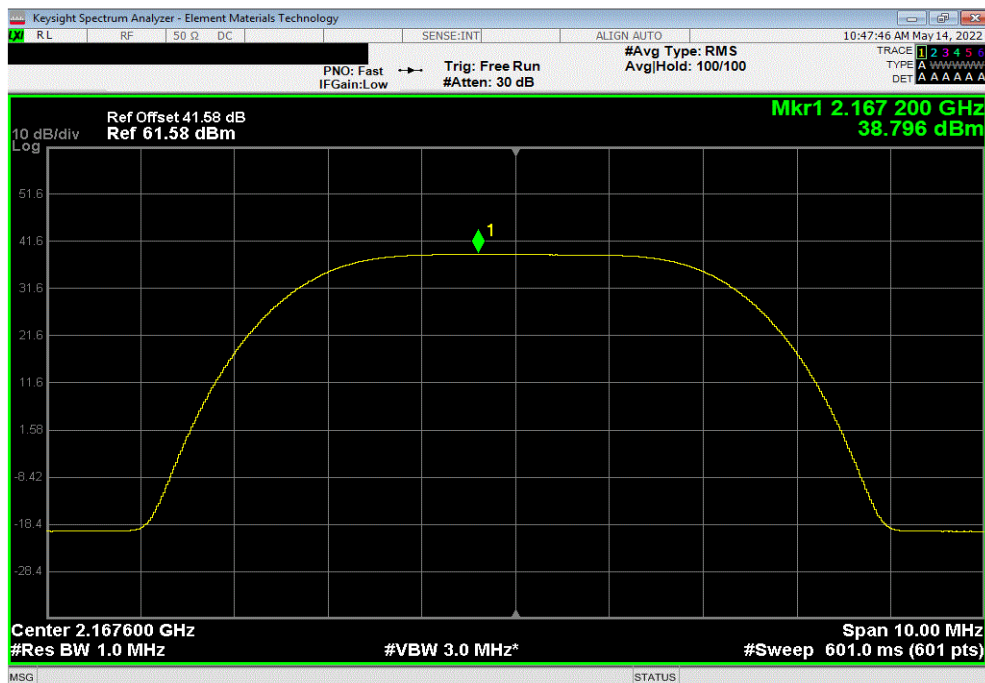
POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

AWS

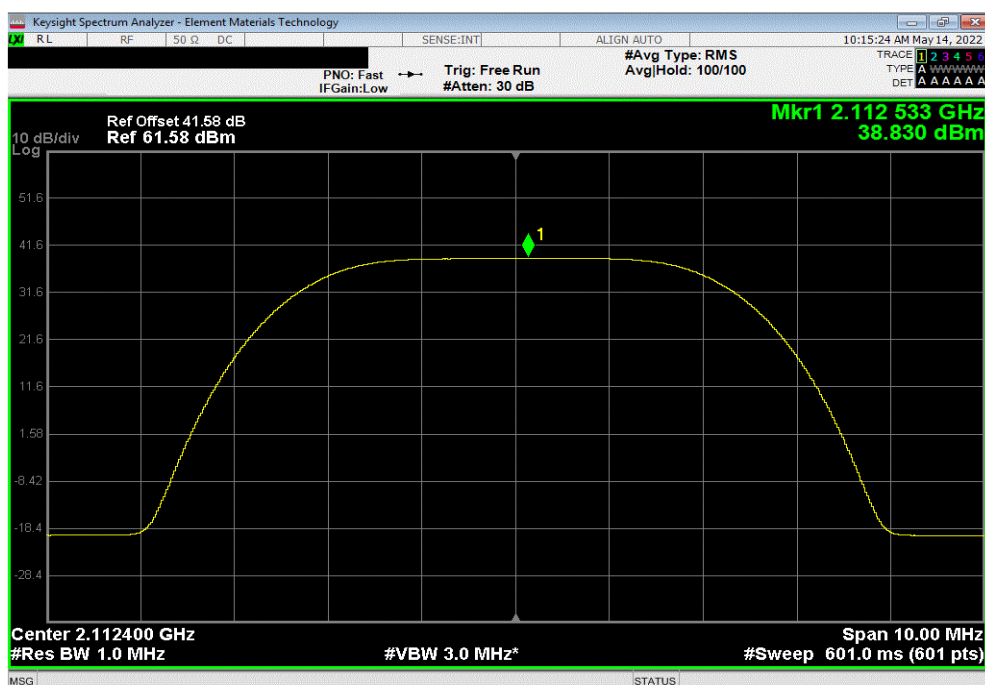


TMTx 2022.05.02.0 XMR 2022.02.07.0

AWS BAND X, 2110 MHz - 2170 MHz, Port 1, 5 MHz Bandwidth, QPSK Modulation, High Channel, 2167.6 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD		
38.796	0	38.8	41.8		



AWS BAND X, 2110 MHz - 2170 MHz, Port 1, 5 MHz Bandwidth, 16-QAM Modulation, Low Channel, 2112.4 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD		
38.83	0	38.8	41.8		



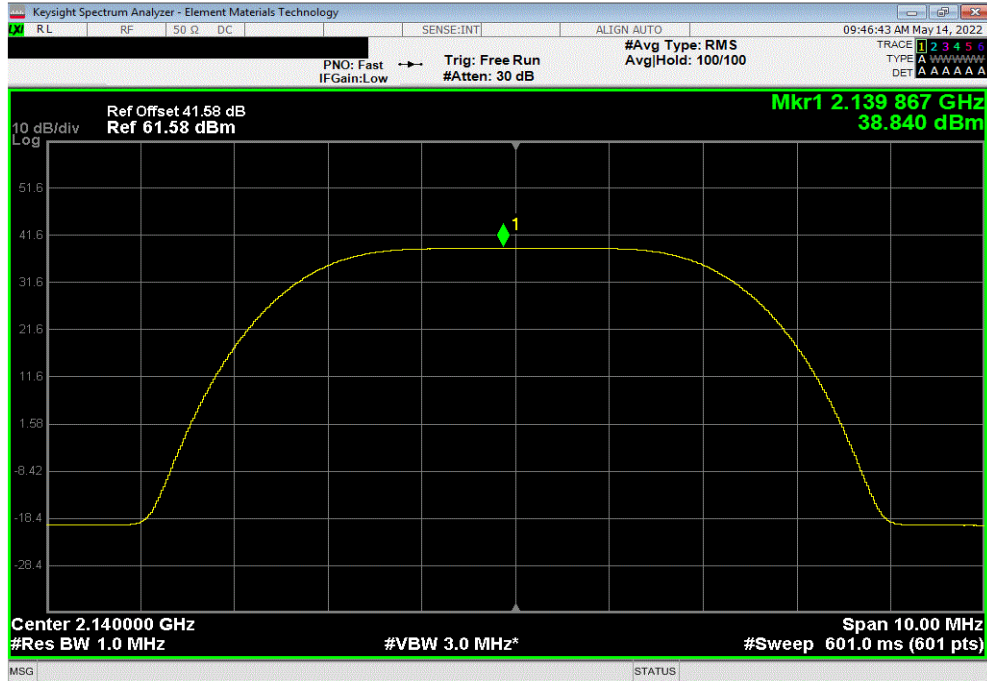
POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

AWS

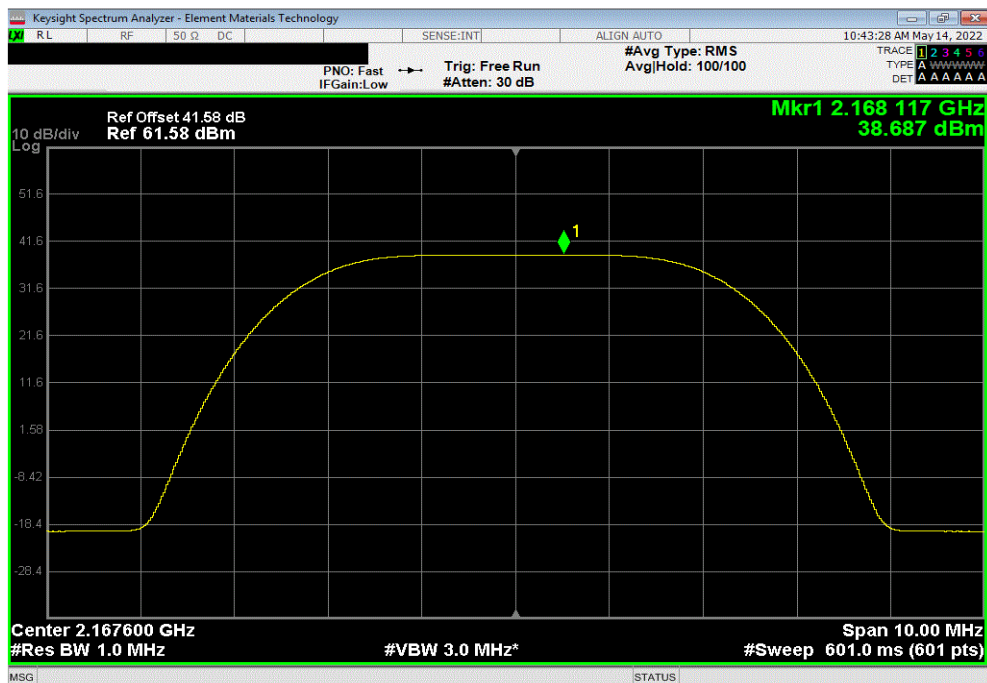


TMTx 2022.05.02.0 XMR 2022.02.07.0

AWS BAND X, 2110 MHz - 2170 MHz, Port 1, 5 MHz Bandwidth, 16-QAM Modulation, Mid Channel, 2140 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD		
38.84	0	38.8	41.8		



AWS BAND X, 2110 MHz - 2170 MHz, Port 1, 5 MHz Bandwidth, 16-QAM Modulation, High Channel, 2167.6 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD		
38.687	0	38.7	41.7		



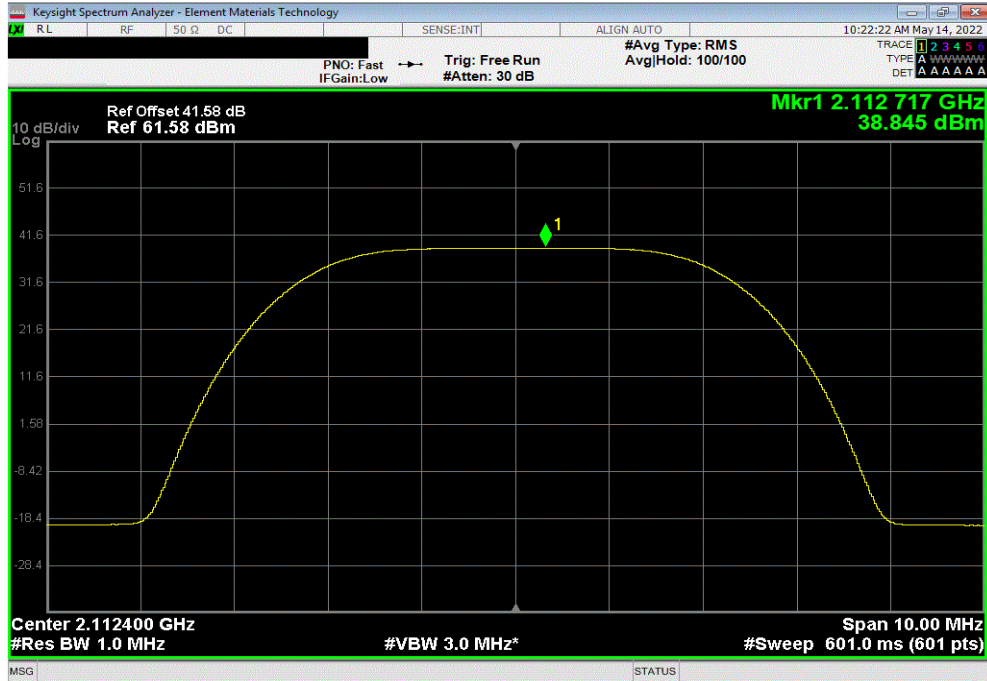
POWER SPECTRAL DENSITY AND EIRP CALCULATIONS

AWS

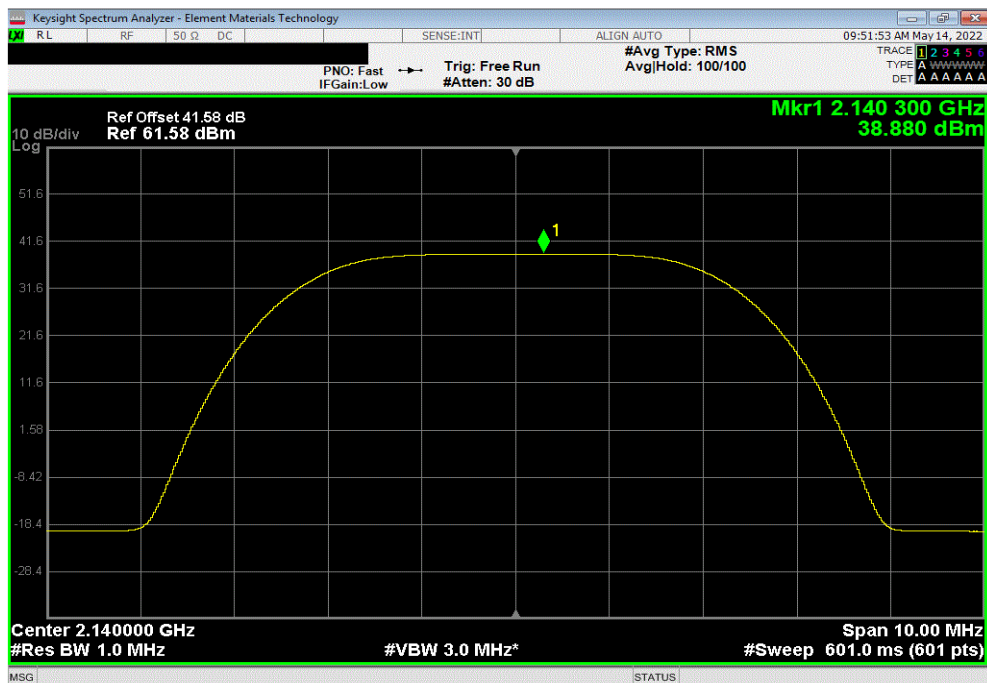


TMTx 2022.05.02.0 XMR 2022.02.07.0

AWS BAND X, 2110 MHz - 2170 MHz, Port 1, 5 MHz Bandwidth, 64-QAM Modulation, Low Channel, 2112.4 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD		
38.845	0	38.8	41.8		



AWS BAND X, 2110 MHz - 2170 MHz, Port 1, 5 MHz Bandwidth, 64-QAM Modulation, Mid Channel, 2140 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD		
38.88	0	38.9	41.9		

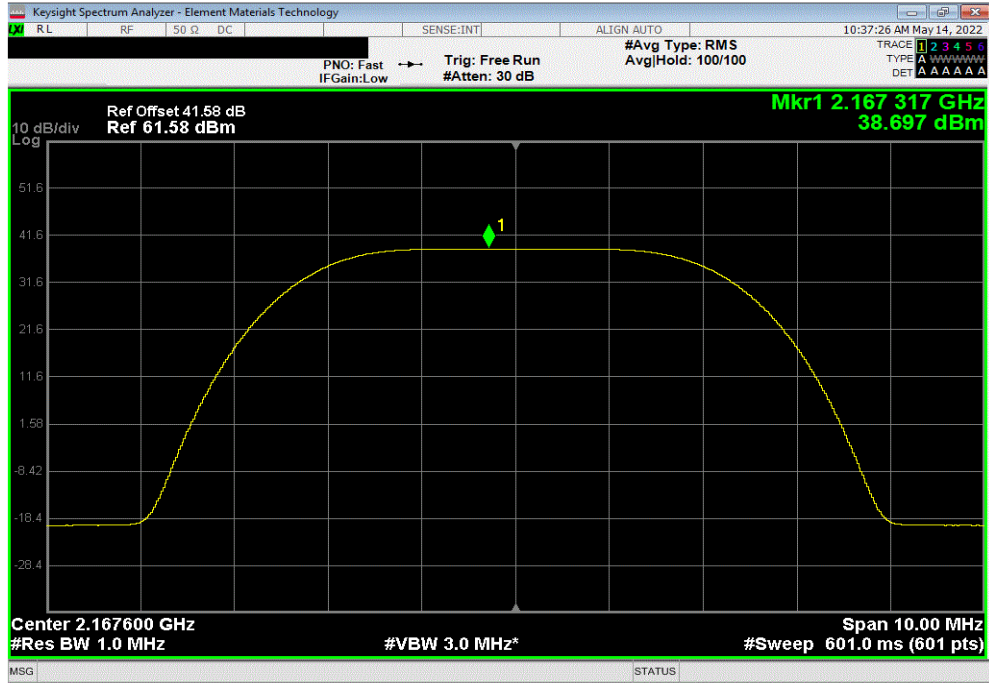


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS AWS



TbTtx 2022.05.02.0 XM8 2022.02.07.0

AWS BAND X, 2110 MHz - 2170 MHz, Port 1, 5 MHz Bandwidth, 64-QAM Modulation, High Channel, 2167.6 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD		
38.697	0	38.7	41.7		



0 0.0 3.0

POWER SPECTRAL DENSITY AND EIRP CALCULATIONS AWS



Telra 2022.05.02.0 XMit 2022.02.07.0

EIRP Calculations for Two Port MIMO Operations for Band X Single WCDMA Carriers

EIRP calculations are needed at each transmitter location to optimize base station operational performance while meeting regulatory requirements. Each cell site installation needs to consider the power measurements in the radio certification report as well as site specific regulatory requirements (such as antenna height, population density, etc.), site installation parameters (line loss between antenna and radio, antenna parameters, etc.) and base station operational parameters (MIMO operational setup, carrier power level, channel bandwidth, modulation type, etc.) to optimize performance. Transmitter output power may be reduced (from maximum) by base station setup parameters. Base station antennas are selected by the customer.

The base station antenna is selected by the customer and this EIRP calculation is based upon a sample worst case antenna. The EIRP calculation is based upon Kathrein antenna assembly model "80011867". The maximum Band X gain (18.2dBi) for this antenna was used for the EIRP calculation.

Equivalent Isotropically Radiated Power (EIRP) is calculated (as specified in ANSI C63.26-2015 section 6.4 for two port MIMO) from the results of power measurements (highest measured PSD for each channel bandwidth type). The total worst case PSD for two port MIMO is calculated as the worst case PSD for a single port + 3dB [10log (2)] based upon ANSI C63.26 clause 6.4.3.2.4 (10 Log N_{out}). The maximum antenna gain was used for this calculation. The cable loss between the antenna and transmitter is site dependent (will not be 0 dB) but for this worst case EIRP calculation 0 dB was used. Calculations of worst case EIRP for two port MIMO are as follows:

Parameter	5 MHz Channel Bandwidth
Worst Case PSD/Antenna Port	39.0 dBm/MHz
Total PSD for Two Port MIMO 10Log 2 = + 3dB	42.0 dBm/MHz
Cable Loss (site dependent)	0 dB
Maximum Antenna Gain	18.2 dBi
Worst Case Two Port MIMO EIRP Total	60.2 dBm/MHz

Calculation Summary

The worst case AHFII WCDMA two port MIMO AWS Band EIRP levels using antenna assembly model "80011867" are less than the FCC and ISDE EIRP Regulatory Limits.

POWER SPECTRAL DENSITY AND EIRP CALCULATIONS PCS



XMIT 2022.02.07.0

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
Block - DC	Fairview Microwave	SD3239	ANC	2022-03-02	2023-03-02
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2022-01-17	2023-01-17
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The fundamental emission power spectral density was measured using the channels and modes as called out on the following data sheets.

The method of ANSI C63.26-2015 section 5.2.4.5 was used to make this measurement.

The RF conducted emission testing was performed on one port. The AHFII antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in the "Output Power - All Ports" report section) and antenna port 1 was selected to perform the testing under this effort as allowed by ANSI C63.26-2015 paragraphs 5.2.5.3, 5.7.2i, and 6.4.

The total PSD for all antenna ports (at the radio output) were determined per ANSI C63.26-2015 paragraph 6.4.3.2.4. The EIRP calculations are based upon ANSI C63.26-2015 paragraphs 6.4 for a two port MIMO base station.

The PCS Band EIRP requirements are specified in FCC Part 24.232 and ISSED RSS-133 section 6.4/SRSP-510 section 5.1.1.

The EIRP requirements for PCS and AWS bands for channel bandwidths greater than 1MHz are in general a maximum of 3280 watts/MHz for rural (low population density) areas and 1640 watts/MHz for urban (high population density) areas.

POWER SPECTRAL DENSITY AND EIRP CALCULATIONS PCS



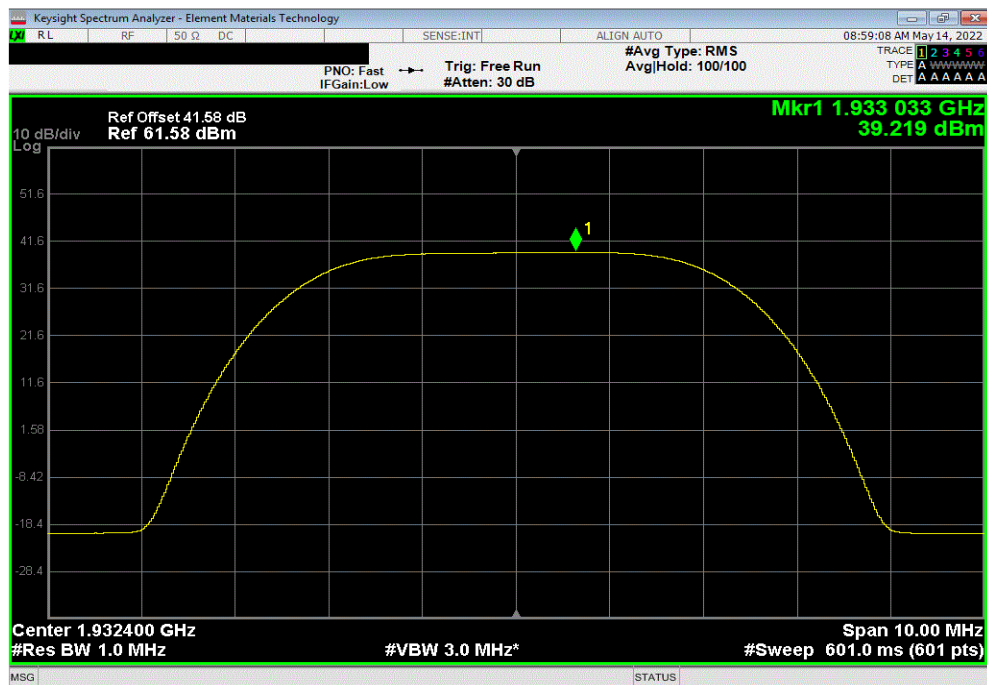
EUT: AHFIL (FCC/ISED C2PC)		Work Order: NOKI0040	
Serial Number: YK214000036		Date: 13-May-22	
Customer: Nokia Solutions and Networks		Temperature: 22.7 °C	
Attendees: David Le, John Rattanaovong		Humidity: 49.5% RH	
Project: None		Barometric Pres.: 1013 mbar	
Tested by: Brandon Hobbs	Power: 54 VDC	Job Site: TX05	
TEST SPECIFICATIONS		Test Method	
FCC 24E:2022		ANSI C63.26:2015	
RSS-133 Issue 6:2013+A1:2018		RSS-133 Issue 6:2013+A1:2018	
COMMENTS			
All measurement path losses were accounted for in the reference level offset including any attenuators, filters and DC blocks. The PSD was measured while transmitting one carrier on Port 1. The total PSD for multiport (2x2 MIMO) operation was determined based upon ANSI 63.26 clause 6.4.3.2.4 (10 Log Nout). The total PSD for two port operation is single port PSD +3dB [i.e. 10 Log(2)].			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	2	Signature	
		Initial Value dBm/MHz	Duty Cycle Factor (dB)
		Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD
PCS BAND II, 1930 MHz - 1990 MHz			
Port 1			
5 MHz Bandwidth			
QPSK Modulation			
	Low Channel, 1932.4 MHz	39.219	0
	Mid Channel, 1960 MHz	39.128	0
	High Channel, 1987.6 MHz	39.117	0
16-QAM Modulation			
	Low Channel, 1932.4 MHz	39.127	0
	Mid Channel, 1960 MHz	39.079	0
	High Channel, 1987.6 MHz	39.058	0
64-QAM Modulation			
	Low Channel, 1932.4 MHz	39.087	0
	Mid Channel, 1960 MHz	39.020	0
	High Channel, 1987.6 MHz	38.961	0

POWER SPECTRAL DENSITY AND EIRP CALCULATIONS PCS

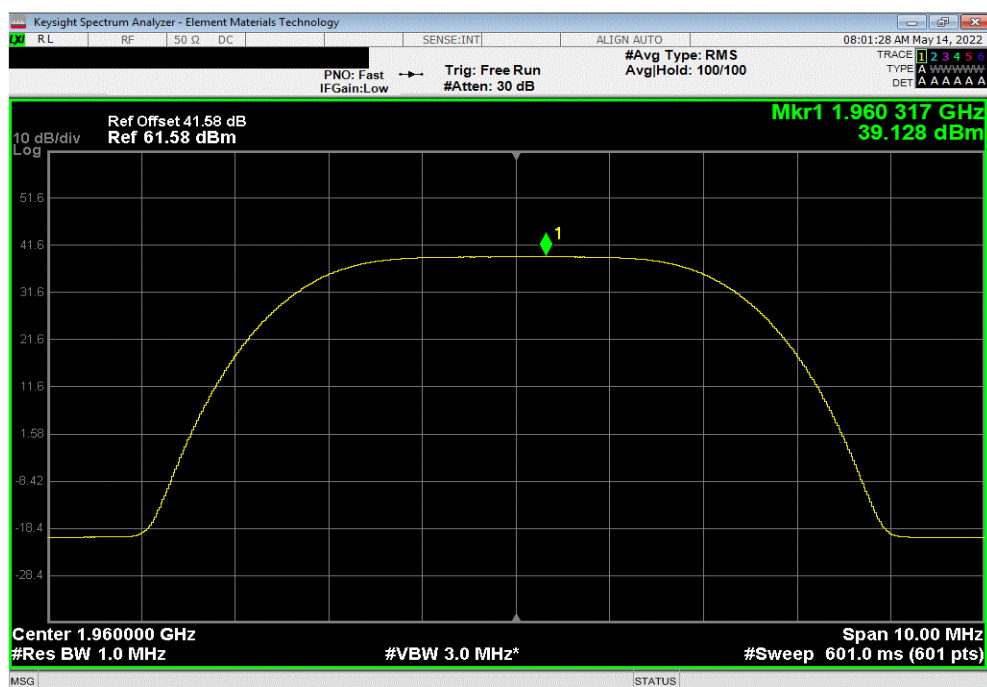


TbTb 2022.05.02.0 XMM 2022.02.07.0

PCS BAND II, 1930 MHz - 1990 MHz, Port 1, 5 MHz Bandwidth, QPSK Modulation, Low Channel, 1932.4 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD		
39.219	0	39.2	42.2		



PCS BAND II, 1930 MHz - 1990 MHz, Port 1, 5 MHz Bandwidth, QPSK Modulation, Mid Channel, 1960 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD		
39.128	0	39.128	42.128		

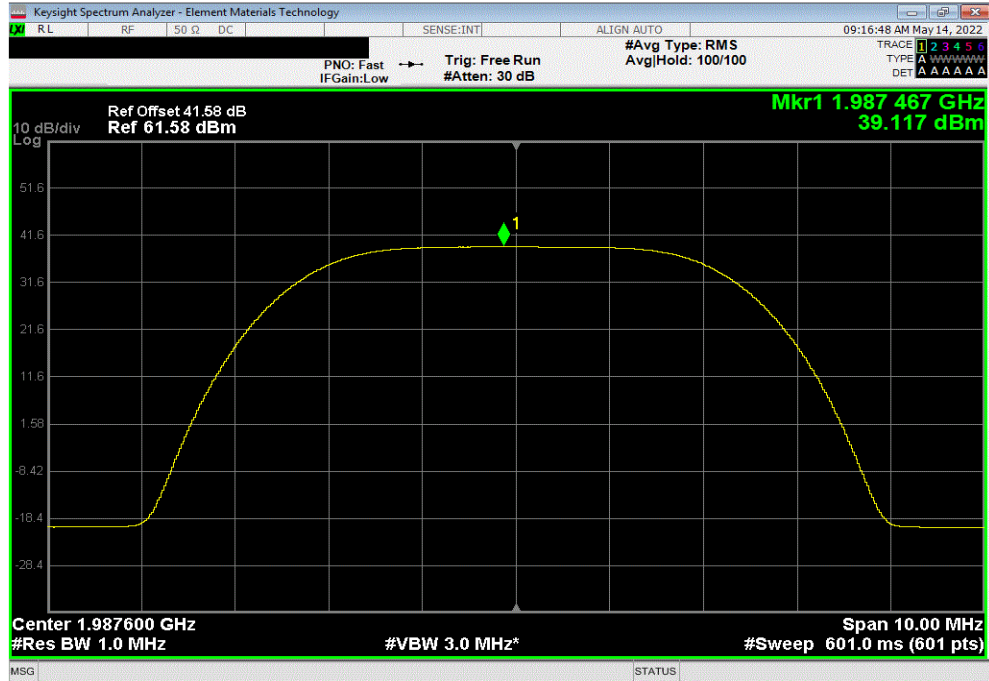


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS PCS

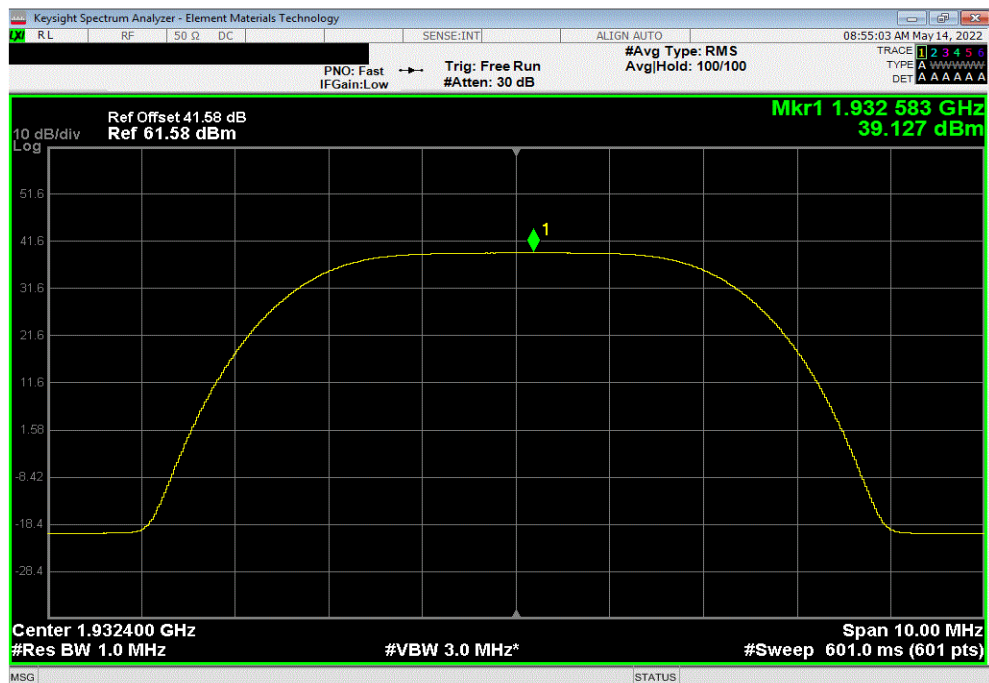


TbTb 2022.05.02.0 XMM 2022.02.07.0

PCS BAND II, 1930 MHz - 1990 MHz, Port 1, 5 MHz Bandwidth, QPSK Modulation, High Channel, 1987.6 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD		
39.117	0	39.1	42.1		



PCS BAND II, 1930 MHz - 1990 MHz, Port 1, 5 MHz Bandwidth, 16-QAM Modulation, Low Channel, 1932.4 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD		
39.127	0	39.127	42.127		

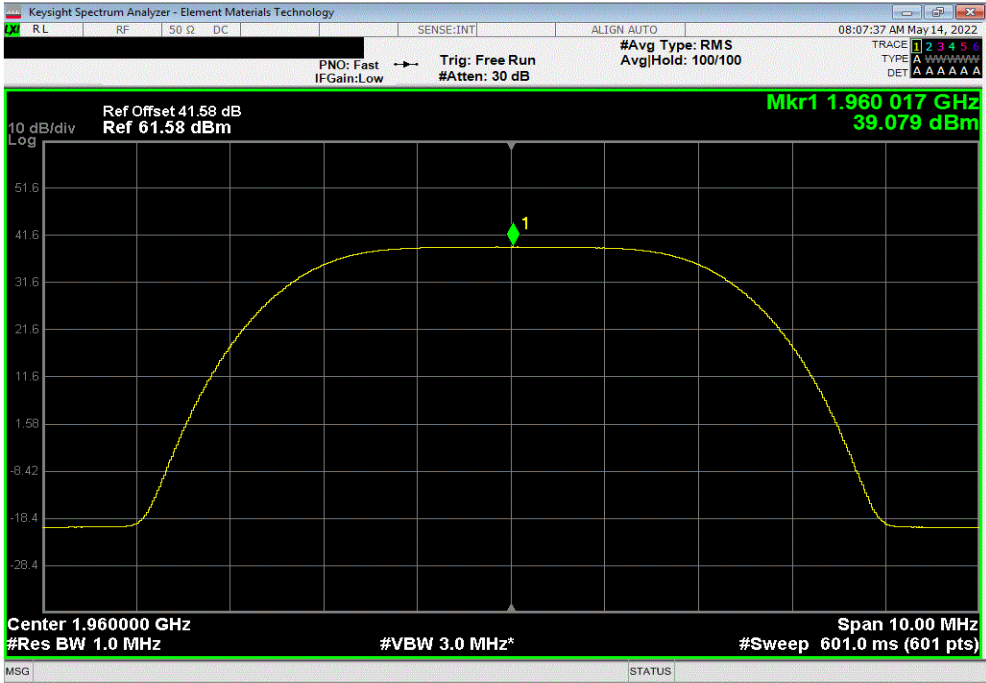


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS PCS

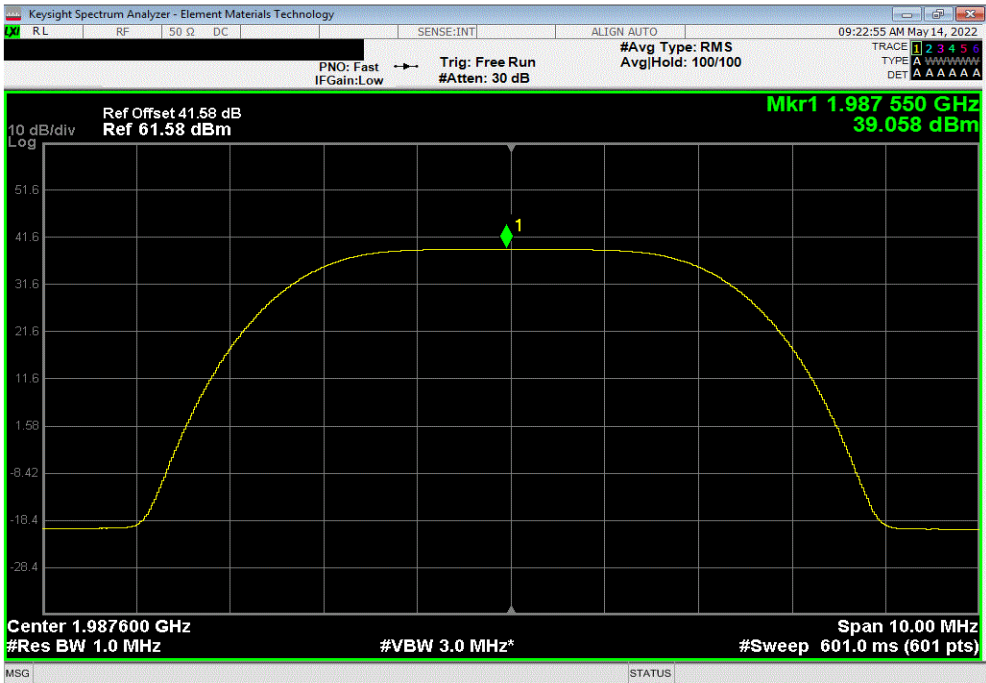


TbTb 2022.05.02.0 XMM 2022.02.07.0

PCS BAND II, 1930 MHz - 1990 MHz, Port 1, 5 MHz Bandwidth, 16-QAM Modulation, Mid Channel, 1960 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD		
39.079	0	39.1	42.1		



PCS BAND II, 1930 MHz - 1990 MHz, Port 1, 5 MHz Bandwidth, 16-QAM Modulation, High Channel, 1987.6 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD		
39.058	0	39.058	42.058		

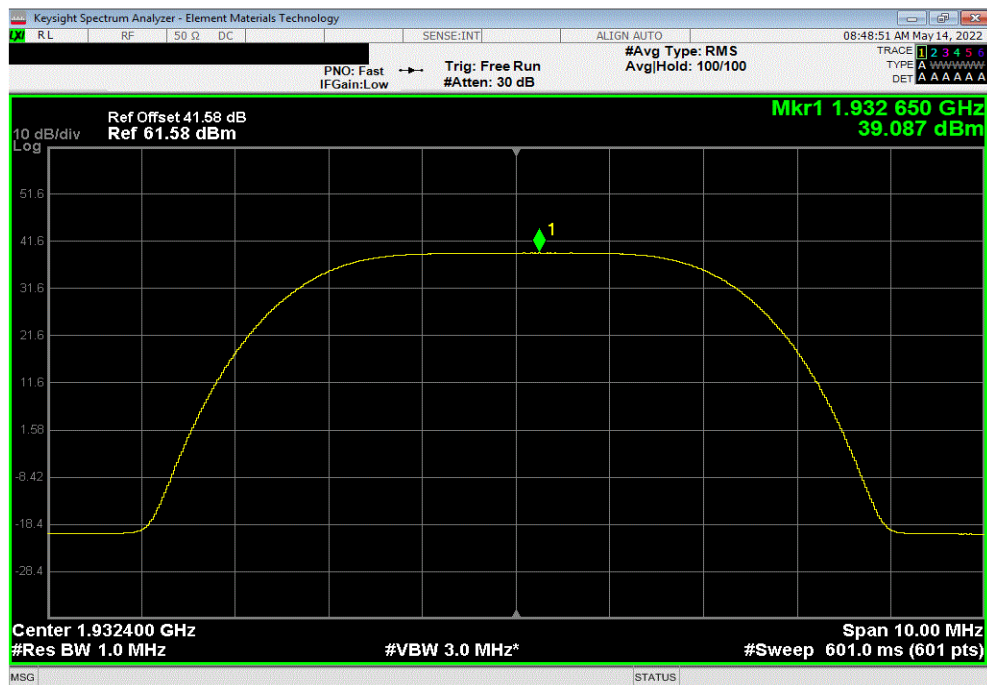


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS PCS

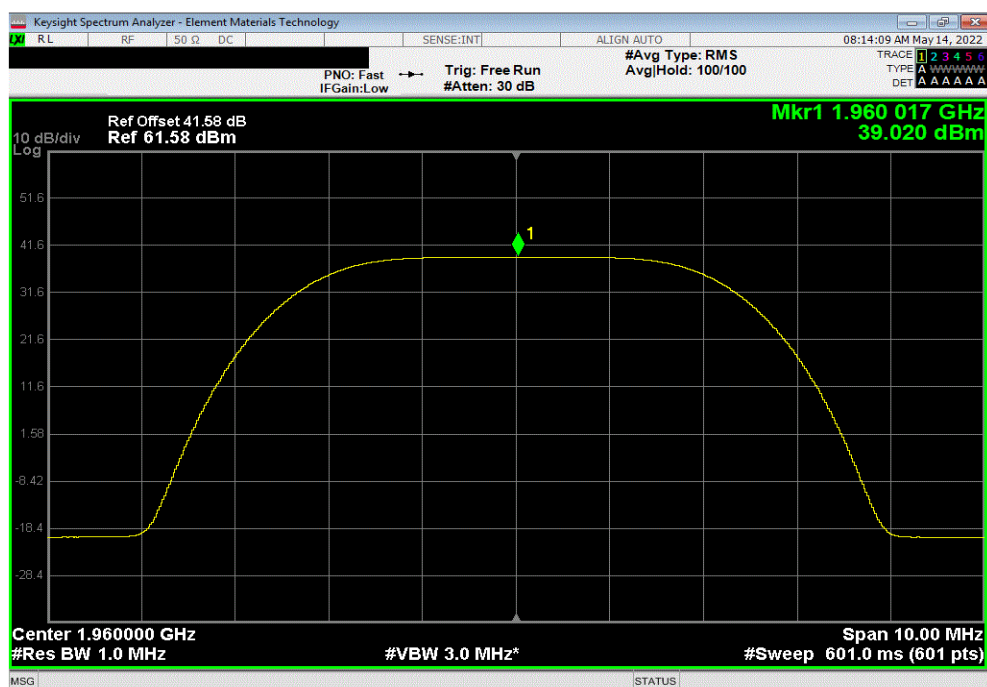


TbTb 2022.05.02.0 XMM 2022.02.07.0

PCS BAND II, 1930 MHz - 1990 MHz, Port 1, 5 MHz Bandwidth, 64-QAM Modulation, Low Channel, 1932.4 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD		
39.087	0	39.1	42.1		



PCS BAND II, 1930 MHz - 1990 MHz, Port 1, 5 MHz Bandwidth, 64-QAM Modulation, Mid Channel, 1960 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)		
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD		
39.02	0	39.02	42.02		

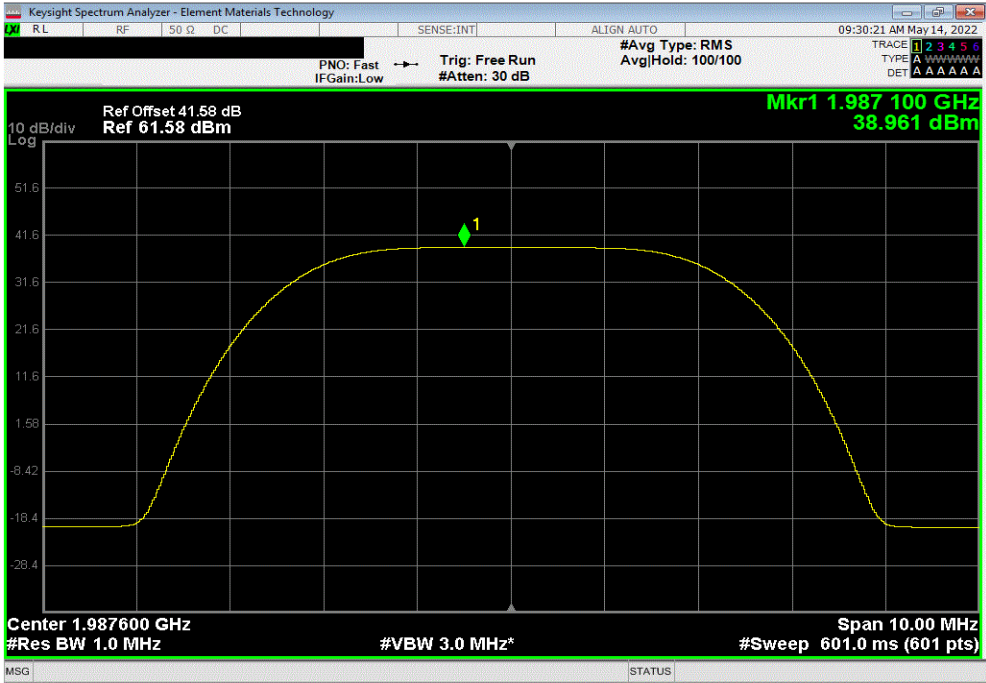


POWER SPECTRAL DENSITY AND EIRP CALCULATIONS PCS



TbTn 2022.05.02.0 XMI 2022.02.07.0

PCS BAND II, 1930 MHz - 1990 MHz, Port 1, 5 MHz Bandwidth, 64-QAM Modulation, High Channel, 1987.6 MHz					
Initial Value		Duty Cycle		Single Port	
dBm/MHz		Factor (dB)		Two Port (2x2 MIMO)	
				dBm/MHz == PSD	
38.961		0		39.0	
				42.0	



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POWER SPECTRAL DENSITY AND EIRP CALCULATIONS PCS



ThxTx 2022.05.02.0 XMII 2022.02.07.0

EIRP Calculations for Two Port MIMO Operations for Band II Single WCDMA Carriers

EIRP calculations are needed at each transmitter location to optimize base station operational performance while meeting regulatory requirements. Each cell site installation needs to consider the power measurements in the radio certification report as well as site specific regulatory requirements (such as antenna height, population density, etc.), site installation parameters (line loss between antenna and radio, antenna parameters, etc.) and base station operational parameters (MIMO operational setup, carrier power level, channel bandwidth, modulation type, etc.) to optimize performance. Transmitter output power may be reduced (from maximum) by base station setup parameters. Base station antennas are selected by the customer.

The base station antenna is selected by the customer and this EIRP calculation is based upon a sample worst case antenna. The EIRP calculation is based upon Kathrein antenna assembly model "80011867". The maximum Band II gain (17.9dBi) for this antenna was used for the EIRP calculation.

Equivalent Isotropically Radiated Power (EIRP) is calculated (as specified in ANSI C63.26-2015 section 6.4 for two port MIMO) from the results of power measurements (highest measured PSD for each channel bandwidth type). The total worst case PSD for two port MIMO is calculated as the worst case PSD for a single port + 3dB [10log (2)] based upon ANSI C63.26 clause 6.4.3.2.4 (10 Log N_{out}). The maximum antenna gain was used for this calculation. The cable loss between the antenna and transmitter is site dependent (will not be 0 dB) but for this worst case EIRP calculation 0 dB was used. Calculations of worst case EIRP for two port MIMO are as follows:

Parameter	5 MHz Channel Bandwidth
Worst Case PSD/Antenna Port	39.2 dBm/MHz
Total PSD for Two Port MIMO 10Log 2 = + 3dB	42.2 dBm/MHz
Cable Loss (site dependent)	0 dB
Maximum Antenna Gain	17.9 dBi
Worst Case Two Port MIMO EIRP Total	60.1 dBm/MHz

Calculation Summary

The worst case AHFII WCDMA two port MIMO PCS Band EIRP levels using antenna assembly model "80011867" are less than the FCC and ISSED EIRP Regulatory Limits.

CONDUCTED OUTPUT POWER - ALL PORTS



XMIT 2022.02.07.0

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
Block - DC	Fairview Microwave	SD3239	ANC	2022-03-02	2023-03-02
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2022-01-17	2023-01-17
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17

TEST DESCRIPTION

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

The method in section 5.2.4.4 of ANSI C63.26 was used to make the measurements. This method uses trace averaging across the 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 in decimal, to the measured power to compute the average power during the actual transmission times.

RF conducted emissions testing was performed on all ports at 5 MHz middle channel in order to prove the AHFII antenna ports are essentially electrically identical. Antenna port 1 was selected to perform the testing under this effort as allowed by ANSI C63.26-2015 paragraphs 5.2.5.3, 5.7.2i and 6.4.

CONDUCTED OUTPUT POWER - ALL PORTS



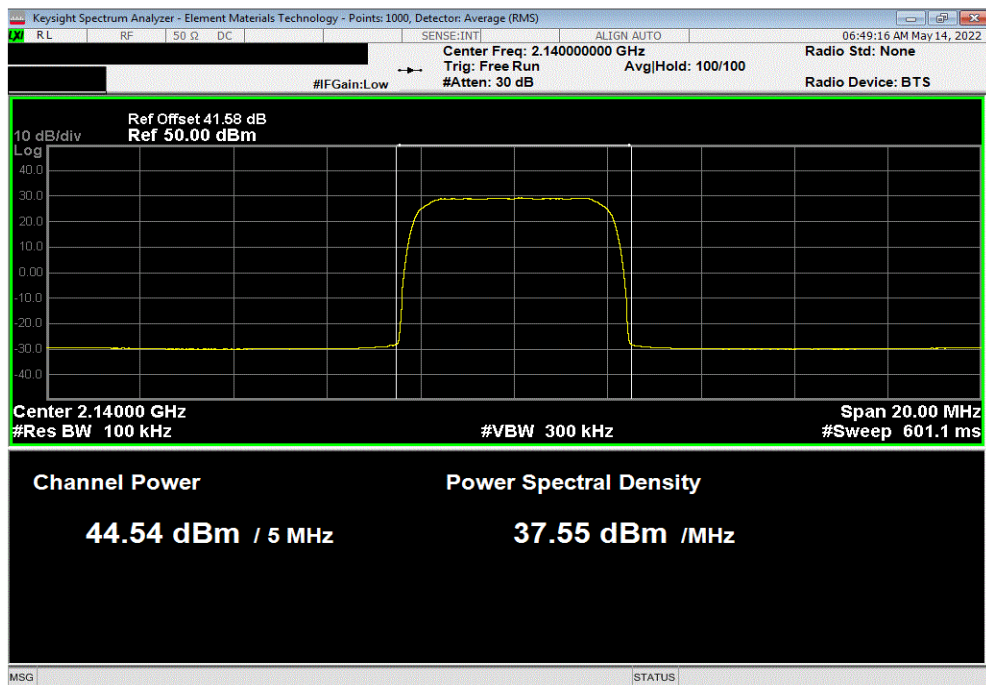
TbT v 2022.05.02.0 XMM 2022.02.07.0

EUT: AHFII (FCC/ISED C2PC)		Work Order: NOKI0040	
Serial Number: YK214000036		Date: 13-May-22	
Customer: Nokia Solutions and Networks		Temperature: 23.6 °C	
Attendees: David Le, John Rattanavong		Humidity: 47.9% RH	
Project: None		Barometric Pres.: 1014 mbar	
Tested by: Brandon Hobbs	Power: 54 VDC	Job Site: TX05	
TEST SPECIFICATIONS		Test Method	
FCC 24E:2022		ANSI C63.26:2015	
RSS-133 Issue 6:2013+A1:2018		RSS-133 Issue 6:2013+A1:2018	
FCC 27:2022		ANSI C63.26:2015	
RSS-139 Issue 3:2015		RSS-139 Issue 3:2015	
COMMENTS			
All losses in the measurement path were accounted for: attenuators, cables, DC block and filter when in use. PCS Band II / AWS Band X carriers were enabled at maximum power (30 watts/carrier).			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	2	Signature	
		Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)
		Value (dBm)	All Ports Value (dBm)
		Limit	Results
AWS AND PCS BANDS			
Port 1			
5 MHz Bandwidth			
64-QAM Modulation			
AWS Mid Channel, 2140 MHz		44.544	0
PCS Mid Channel, 1960 MHz		44.530	0
Port 2			
5 MHz Bandwidth			
64-QAM Modulation			
AWS Mid Channel, 2140 MHz		44.501	0
PCS Mid Channel, 1960 MHz		44.548	0
Port 3			
5 MHz Bandwidth			
64-QAM Modulation			
AWS Mid Channel, 2140 MHz		44.599	0
PCS Mid Channel, 1960 MHz		44.502	0
Port 4			
5 MHz Bandwidth			
64-QAM Modulation			
AWS Mid Channel, 2140 MHz		44.426	0
PCS Mid Channel, 1960 MHz		44.445	0
All Ports			
5 MHz Bandwidth			
64-QAM Modulation			
AWS Mid Channel, 2140 MHz		N/A	0
PCS Mid Channel, 1960 MHz		N/A	0

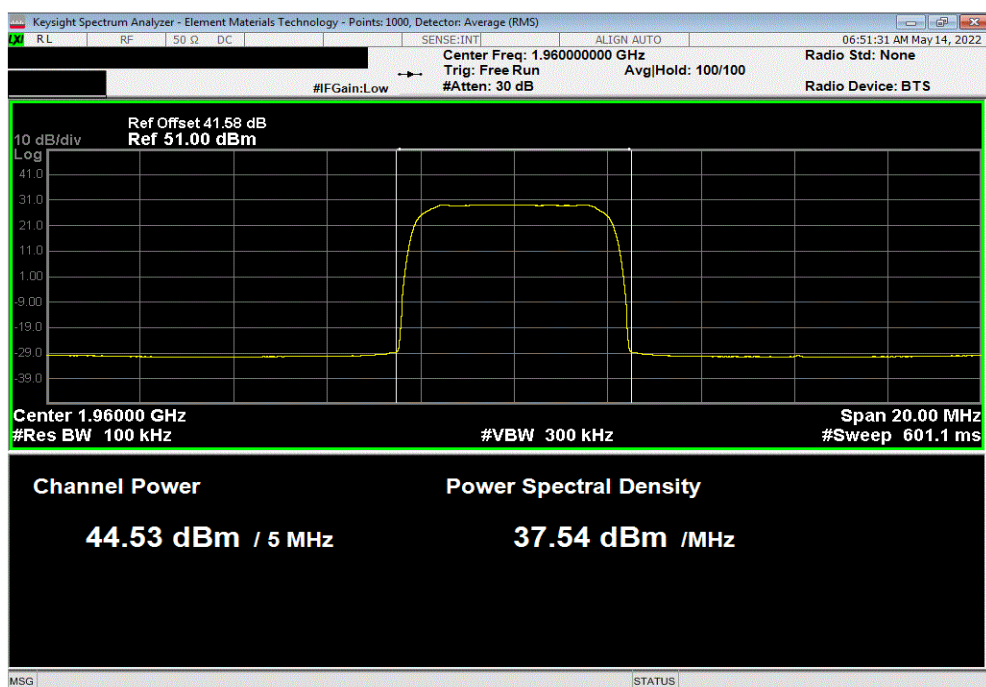
CONDUCTED OUTPUT POWER - ALL PORTS

TbT's 2022.05.02.0 XMII 2022.02.07.0

AWS AND PCS BANDS, Port 1, 5 MHz Bandwidth, 64-QAM Modulation, AWS Mid Channel, 2140 MHz						
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	All Ports Value (dBm)	Limit	Results	
44.544	0	44.5	N/A	Within Tolerance	N/A	



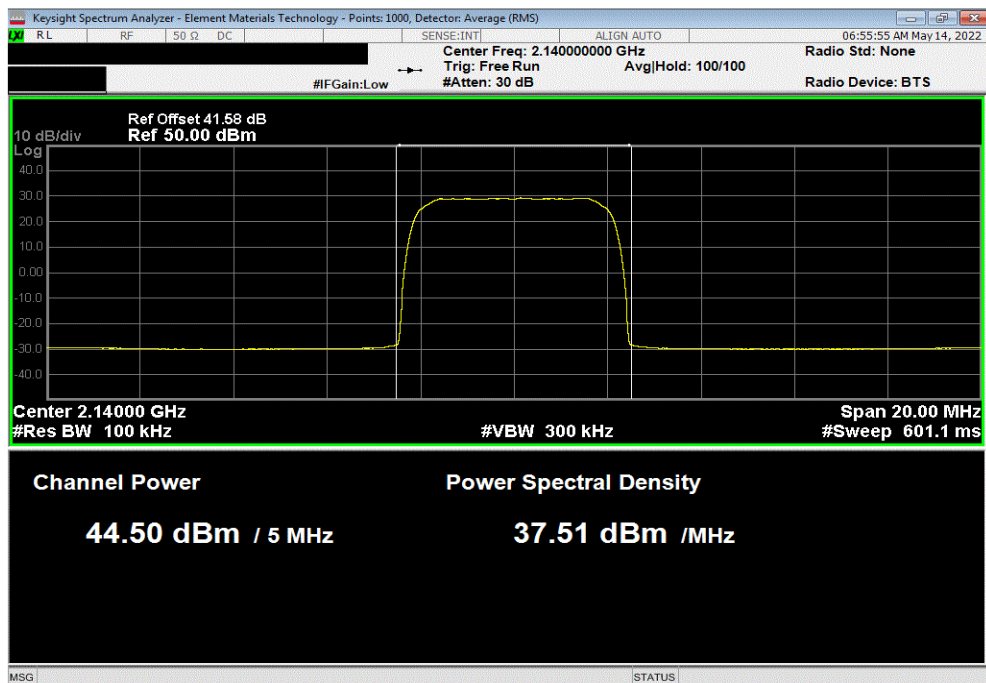
AWS AND PCS BANDS, Port 1, 5 MHz Bandwidth, 64-QAM Modulation, PCS Mid Channel, 1960 MHz						
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	All Ports Value (dBm)	Limit	Results	
44.53	0	44.5	N/A	Within Tolerance	N/A	



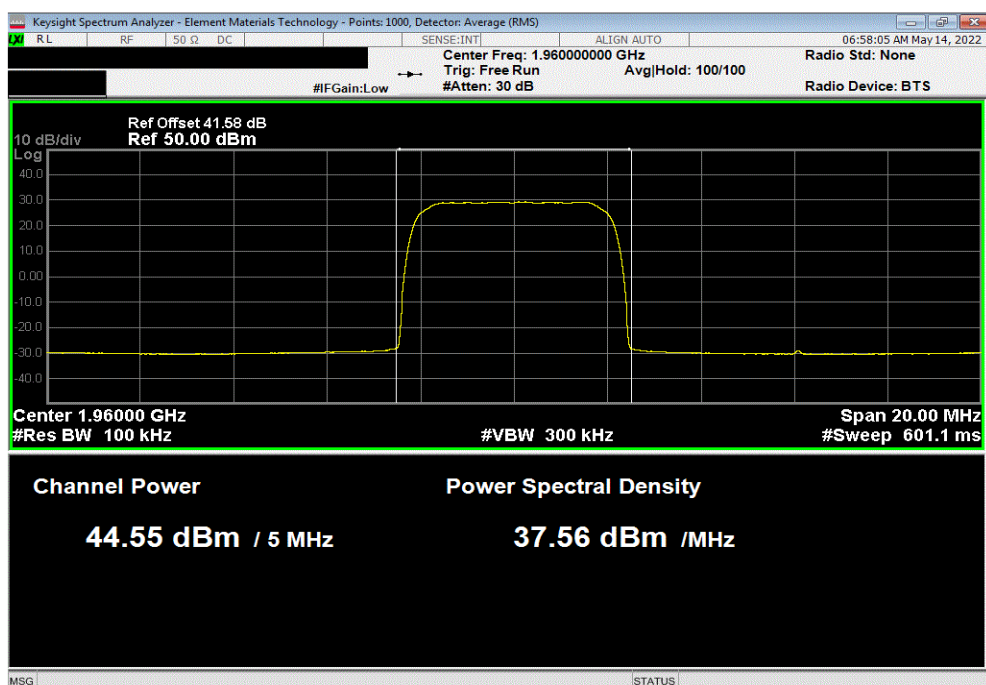
CONDUCTED OUTPUT POWER - ALL PORTS

TbT's 2022.05.02.0 XMII 2022.02.07.0

AWS AND PCS BANDS, Port 2, 5 MHz Bandwidth, 64-QAM Modulation, AWS Mid Channel, 2140 MHz						
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	All Ports Value (dBm)	Limit	Results	
44.501	0	44.5	N/A	Within Tolerance	N/A	



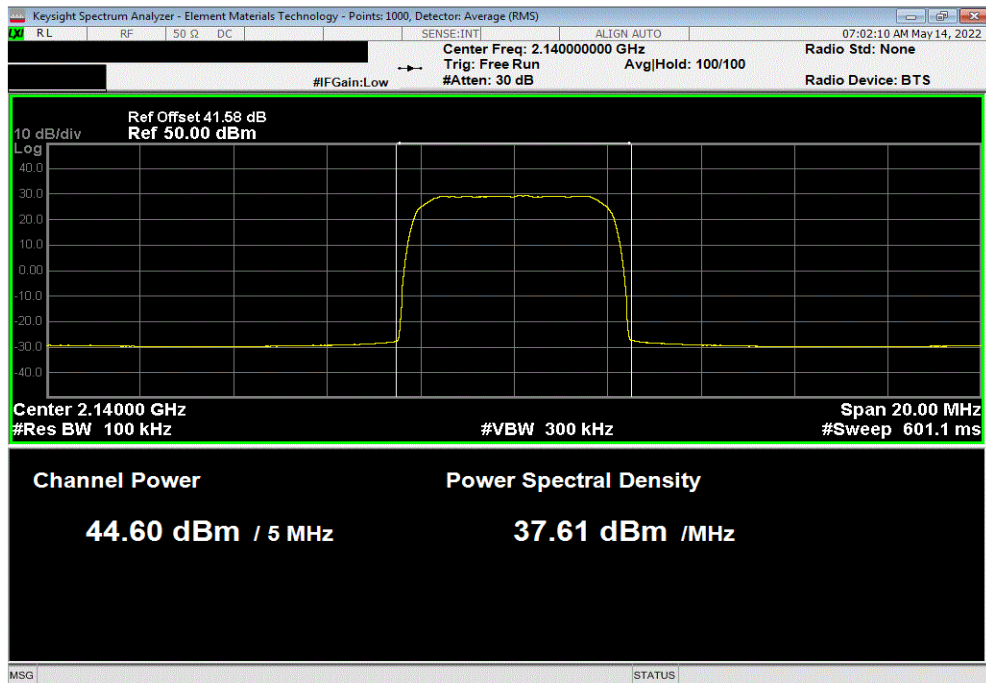
AWS AND PCS BANDS, Port 2, 5 MHz Bandwidth, 64-QAM Modulation, PCS Mid Channel, 1960 MHz						
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	All Ports Value (dBm)	Limit	Results	
44.548	0	44.5	N/A	Within Tolerance	N/A	



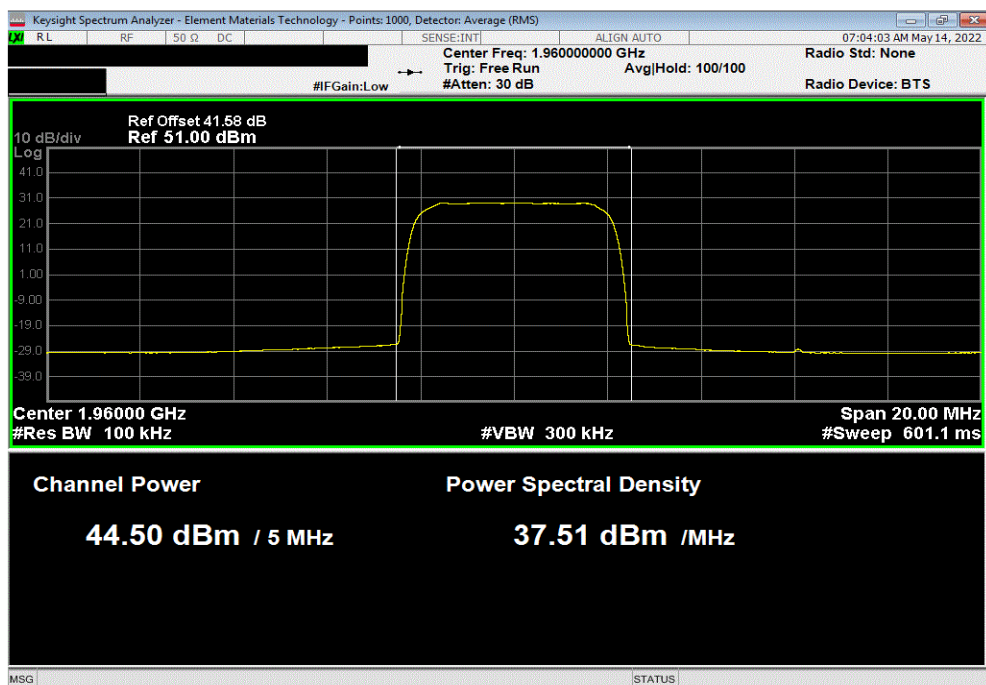
CONDUCTED OUTPUT POWER - ALL PORTS

TbT's 2022.05.02.0 XMII 2022.02.07.0

AWS AND PCS BANDS, Port 3, 5 MHz Bandwidth, 64-QAM Modulation, AWS Mid Channel, 2140 MHz						
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	All Ports Value (dBm)	Limit	Results	
44.599	0	44.6	N/A	Within Tolerance	N/A	



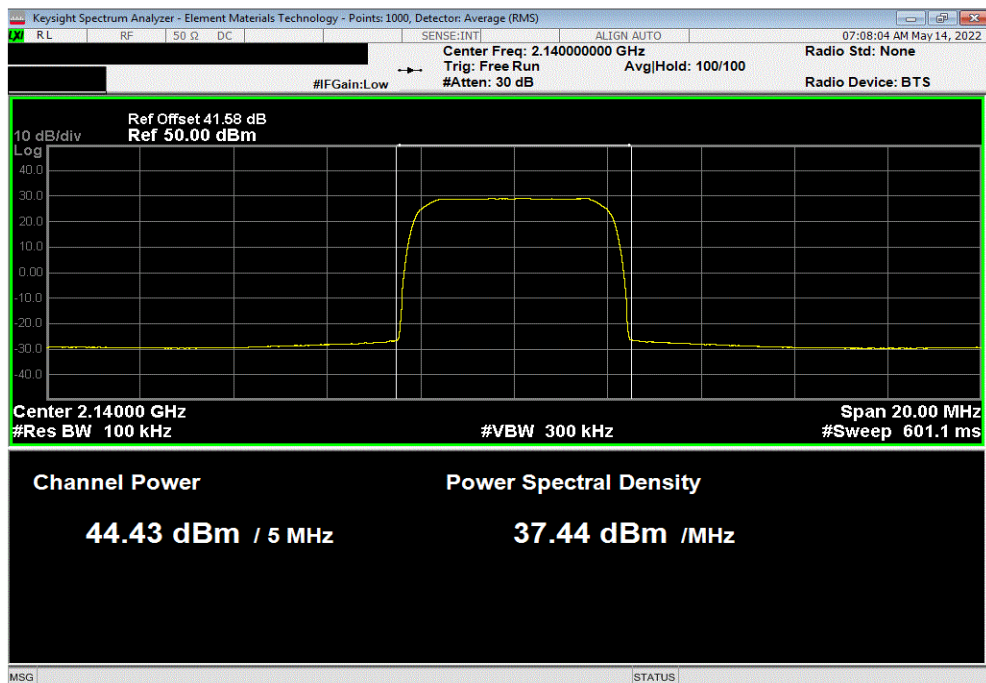
AWS AND PCS BANDS, Port 3, 5 MHz Bandwidth, 64-QAM Modulation, PCS Mid Channel, 1960 MHz						
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	All Ports Value (dBm)	Limit	Results	
44.502	0	44.5	N/A	Within Tolerance	N/A	



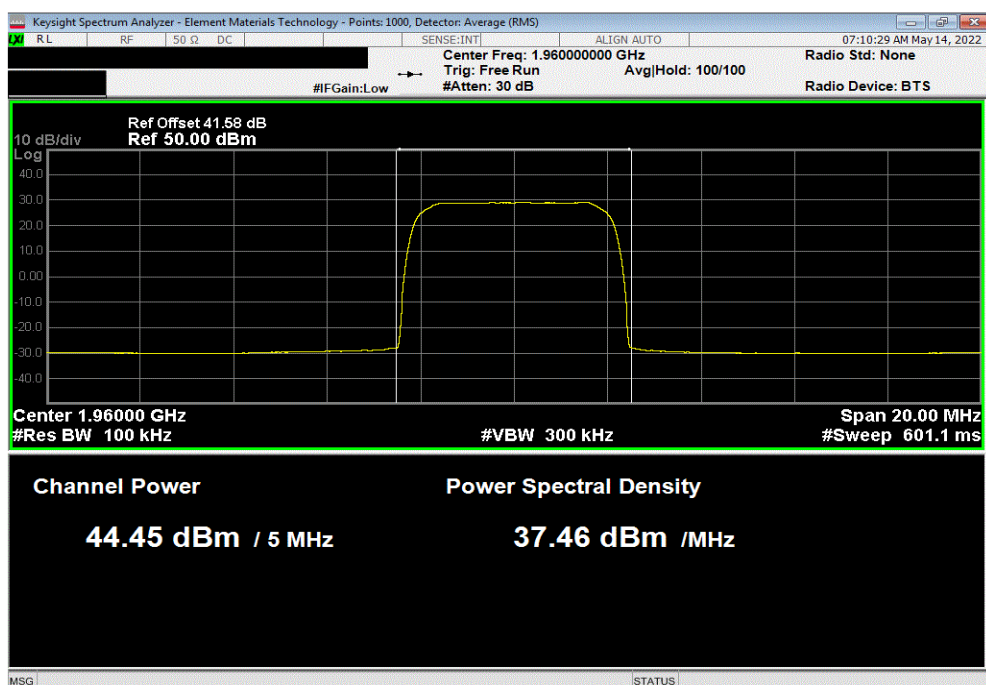
CONDUCTED OUTPUT POWER - ALL PORTS

TbT's 2022.05.02.0 XMII 2022.02.07.0

AWS AND PCS BANDS, Port 4, 5 MHz Bandwidth, 64-QAM Modulation, AWS Mid Channel, 2140 MHz						
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	All Ports Value (dBm)	Limit	Results	
44.426	0	44.4	N/A	Within Tolerance	N/A	



AWS AND PCS BANDS, Port 4, 5 MHz Bandwidth, 64-QAM Modulation, PCS Mid Channel, 1960 MHz						
Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	All Ports Value (dBm)	Limit	Results	
44.445	0	44.4	N/A	Within Tolerance	N/A	



CONDUCTED OUTPUT POWER - ALL PORTS



TbTx 2022.05.02.0 XMR 2022.02.07.0

AWS AND PCS BANDS, All Ports, 5 MHz Bandwidth, 64-QAM Modulation, AWS Mid Channel, 2140 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	All Ports Value (dBm)	Limit	Results
	N/A	0	N/A	50.5	N/A	N/A

AVERAGE POWER PORT SUMMING					
	PORT 1	PORT 2	PORT 3	PORT 4	SUM TOTAL
INITIAL VALUE (dBm)	44.5	44.5	44.6	44.4	N/A
INITIAL VALUE (Watts)	28.2	28.2	28.8	27.5	112.7
TOTAL VALUE (dBm)	N/A	N/A	N/A	N/A	50.5

AWS AND PCS BANDS, All Ports, 5 MHz Bandwidth, 64-QAM Modulation, PCS Mid Channel, 1960 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	All Ports Value (dBm)	Limit	Results
	N/A	0	N/A	50.5	N/A	N/A

AVERAGE POWER PORT SUMMING					
	PORT 1	PORT 2	PORT 3	PORT 4	SUM TOTAL
INITIAL VALUE (dBm)	44.5	44.5	44.5	44.4	N/A
INITIAL VALUE (Watts)	28.2	28.2	28.2	27.5	112.1
TOTAL VALUE (dBm)	N/A	N/A	N/A	N/A	50.5

CONDUCTED OUTPUT POWER AWS



XMIT 2022.02.07.0

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
Block - DC	Fairview Microwave	SD3239	ANC	2022-03-02	2023-03-02
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2022-01-17	2023-01-17
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17

TEST DESCRIPTION

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

The method in section 5.2.4.4 of ANSI C63.26 was used to make the measurements. This method uses trace averaging across the 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 in decimal, to the measured power to compute the average power during the actual transmission times

RF conducted emissions testing was performed only on one port. The testing was performed on the same version of hardware (AHFII) as the original certification test. The AHFII antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in this certification testing) and antenna port 1 was selected to perform the testing under this effort as allowed by ANSI C63.26-2015 paragraphs 5.2.5.3, 5.7.2i and 6.4.

The total average transmit power of all antenna ports was determined per ANSI C63.26-2105 paragraph 6.4.3.1.

CONDUCTED OUTPUT POWER AWS



TSMv 2022.05.02.0 XMI 2022.02.07.0

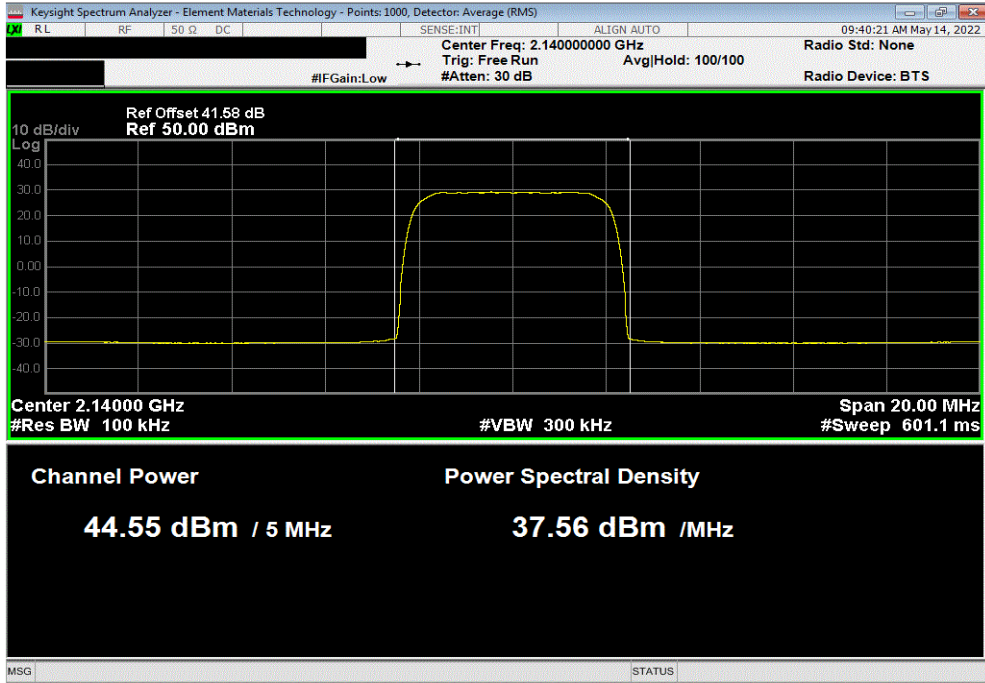
EUT: AHFI (FCC/ISED C2PC)		Work Order: NOKI0040	
Serial Number: YK214000036		Date: 13-May-22	
Customer: Nokia Solutions and Networks		Temperature: 22.4 °C	
Attendees: David Le, John Rattanaovong		Humidity: 49% RH	
Project: None		Barometric Pres.: 1014 mbar	
Tested by: Brandon Hobbs	Power: 54 VDC	Job Site: TX05	
TEST SPECIFICATIONS		Test Method	
FCC 27-2022		ANSI C63.26:2015	
RSS-139 Issue 3:2015		RSS-139 Issue 3:2015	
COMMENTS			
All measurement path losses were accounted for in the reference level offset including any attenuators, filters and DC blocks. AWS band X carriers are enabled at maximum power (30 watts/carrier). The following is the output power measurements at the radio output ports. The output power was measured for a single carrier over the carrier channel bandwidth on port 1. The total output power for multiport (2x2 MIMO) operation was determined based upon ANSI 63.26 clauses 6.4.3.1 and 6.4.3.2.4 (10 log Nout). The total output power for two port operation is single port power + 3dB [i.e. 10log(2)].			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	2	Signature	
		Initial Value dBm/MHz	Duty Cycle Factor (dB)
		Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW
AWS BAND X, 2110 MHz - 2170 MHz			
Port 1			
5 MHz Bandwidth			
QPSK Modulation			
Mid Channel, 2140 MHz		44.551	0
		44.6	47.6
16-QAM Modulation			
Mid Channel, 2140 MHz		44.442	0
		44.4	47.4
64-QAM Modulation			
Low Channel, 2112.4 MHz		44.410	0
		44.4	47.4
Mid Channel, 2140 MHz		44.431	0
		44.4	47.4
High Channel, 2167.6 MHz		44.343	0
		44.3	47.3

CONDUCTED OUTPUT POWER AWS

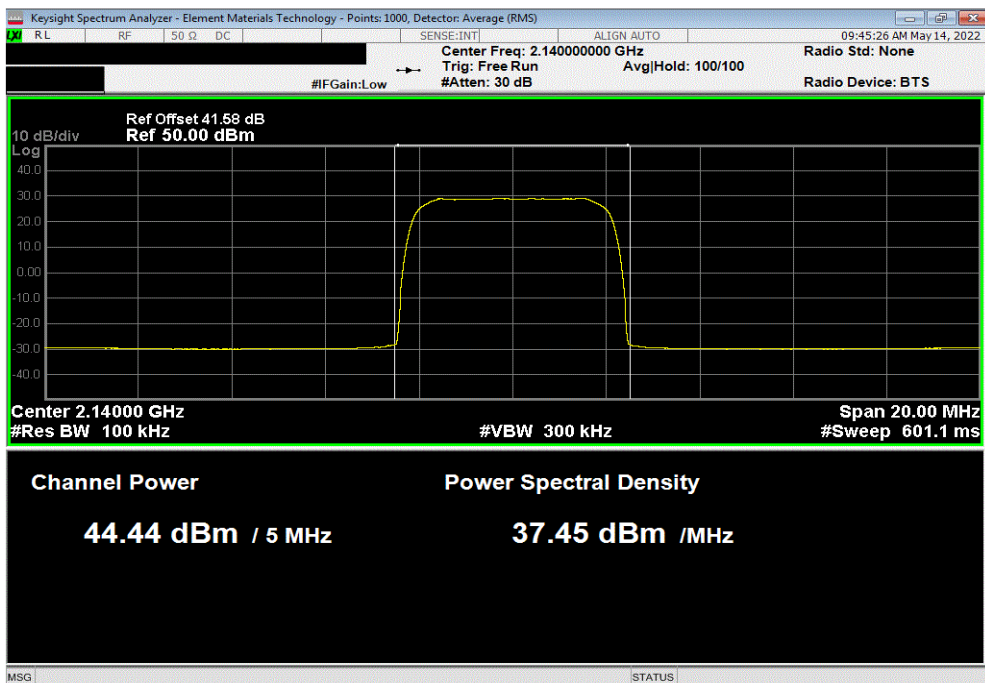


TbTx 2022.05.02.0 XMM 2022.02.07.0

AWS BAND X, 2110 MHz - 2170 MHz, Port 1, 5 MHz Bandwidth, QPSK Modulation, Mid Channel, 2140 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)		
dBm/MHz	Factor (dB)	dBm/Carrier BW	dBm/Carrier BW		
44.551	0	44.6	47.6		



AWS BAND X, 2110 MHz - 2170 MHz, Port 1, 5 MHz Bandwidth, 16-QAM Modulation, Mid Channel, 2140 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)		
dBm/MHz	Factor (dB)	dBm/Carrier BW	dBm/Carrier BW		
44.442	0	44.4	47.4		

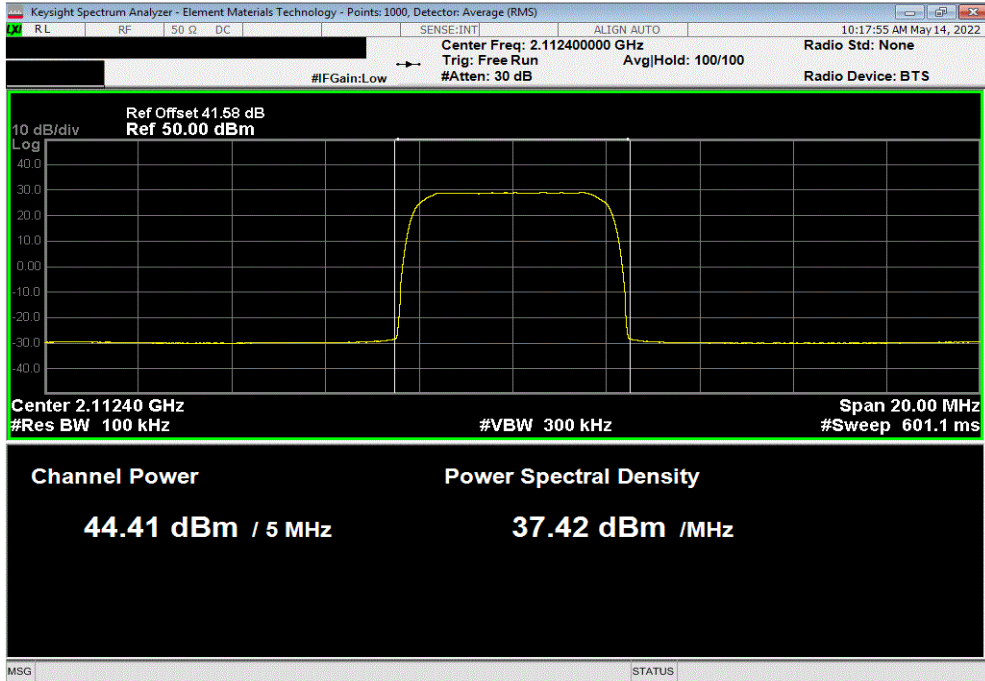


CONDUCTED OUTPUT POWER AWS

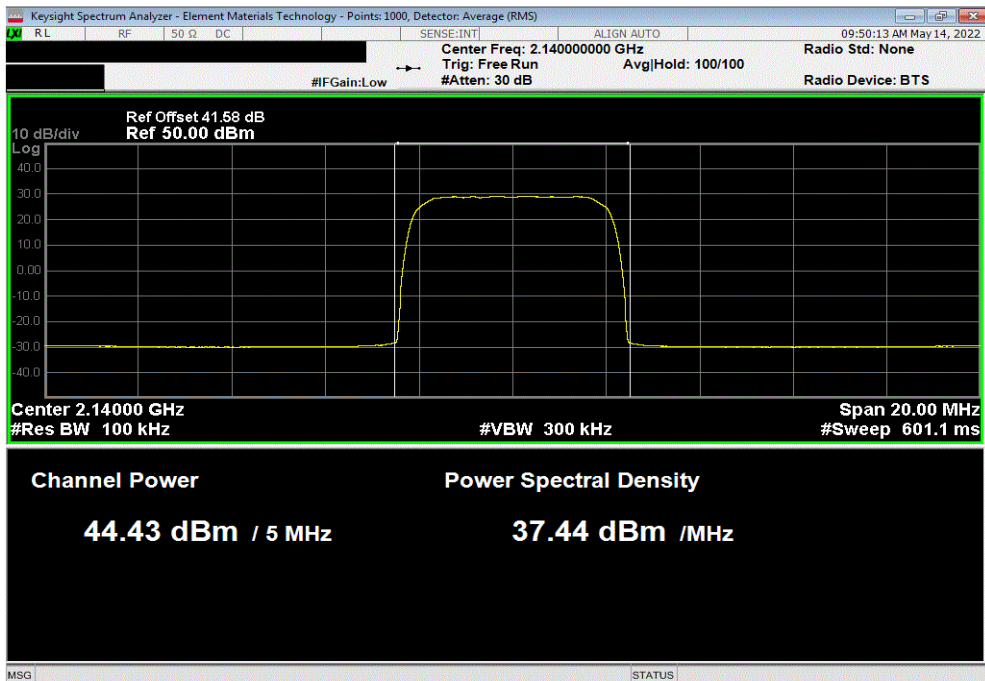


TbTx 2022.05.02.0 XMt 2022.02.07.0

AWS BAND X, 2110 MHz - 2170 MHz, Port 1, 5 MHz Bandwidth, 64-QAM Modulation, Low Channel, 2112.4 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)		
dBm/MHz	Factor (dB)	dBm/Carrier BW	dBm/Carrier BW		
44.41	0	44.4	47.4		



AWS BAND X, 2110 MHz - 2170 MHz, Port 1, 5 MHz Bandwidth, 64-QAM Modulation, Mid Channel, 2140 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)		
dBm/MHz	Factor (dB)	dBm/Carrier BW	dBm/Carrier BW		
44.431	0	44.4	47.4		

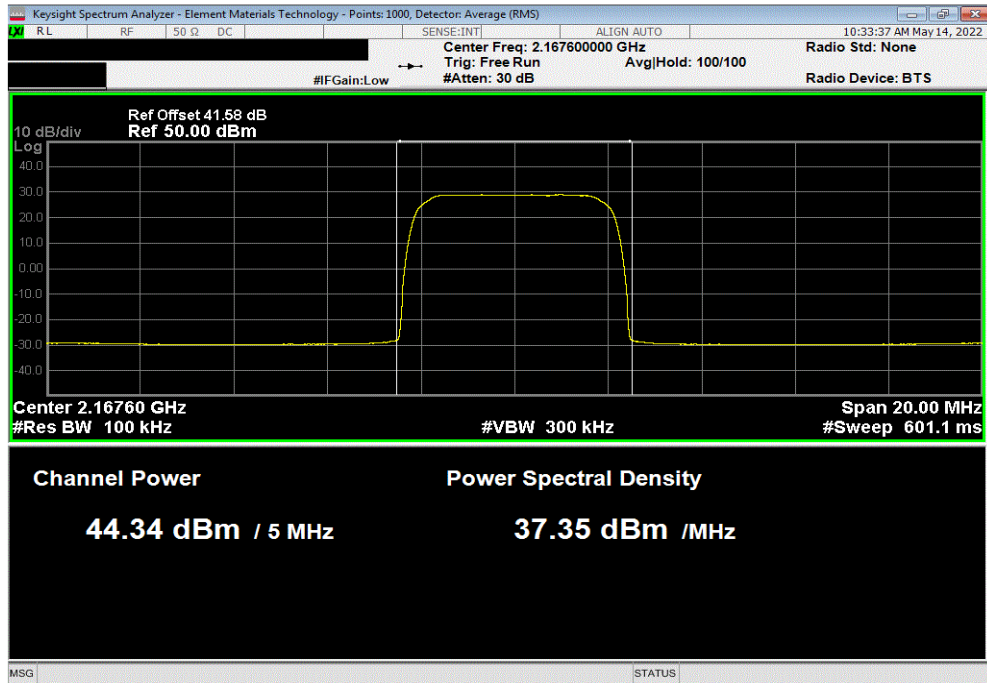


CONDUCTED OUTPUT POWER AWS



TbTx 2022.05.02.0 XMii 2022.02.07.0

AWS BAND X, 2110 MHz - 2170 MHz, Port 1, 5 MHz Bandwidth, 64-QAM Modulation, High Channel, 2167.6 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)		
dBm/MHz	Factor (dB)	dBm/Carrier BW	dBm/Carrier BW		
44.343	0	44.3	47.3		



CONDUCTED OUTPUT POWER PCS



XMIT 2022.02.07.0

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
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2022-01-17	2023-01-17
Block - DC	Fairview Microwave	SD3239	ANC	2022-03-02	2023-03-02
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17

TEST DESCRIPTION

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

The method in section 5.2.4.4 of ANSI C63.26 was used to make the measurements. This method uses trace averaging across the 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 in decimal, to the measured power to compute the average power during the actual transmission times

RF conducted emissions testing was performed only on one port. The testing was performed on the same version of hardware (AHFII) as the original certification test. The AHFII antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in this certification testing) and antenna port 1 was selected to perform the testing under this effort as allowed by ANSI C63.26-2015 paragraphs 5.2.5.3, 5.7.2i and 6.4.

The total average transmit power of all antenna ports was determined per ANSI C63.26-2105 paragraph 6.4.3.1

CONDUCTED OUTPUT POWER PCS



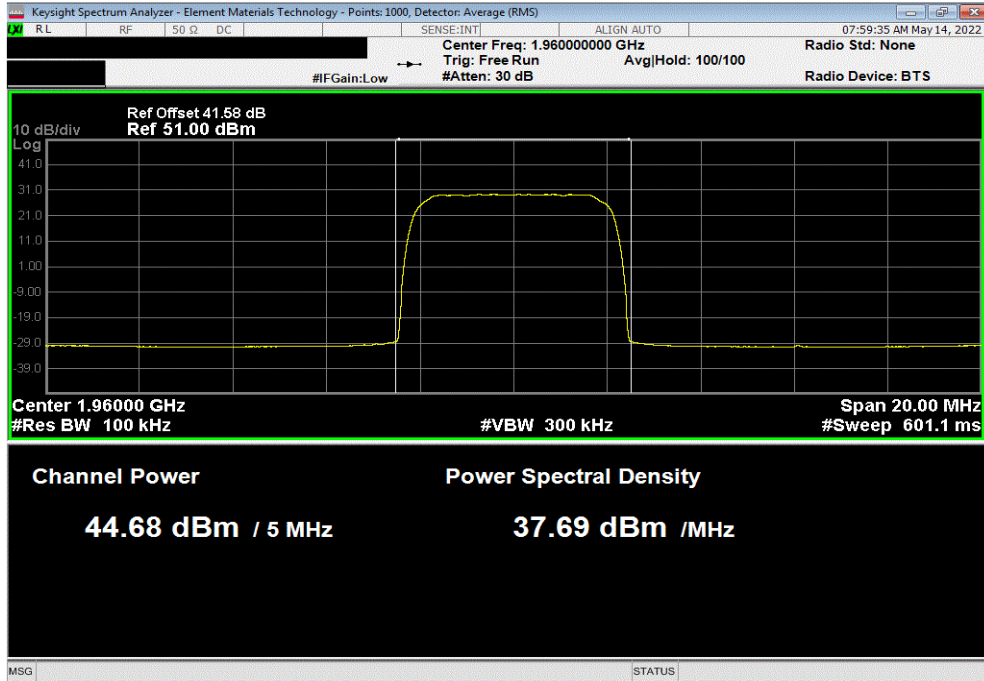
EUT: AHFII (FCC/ISED C2PC)		Work Order: NOKI0040	
Serial Number: YK214000036		Date: 13-May-22	
Customer: Nokia Solutions and Networks		Temperature: 22.5 °C	
Attendees: David Le, John Rattanaovong		Humidity: 49.9% RH	
Project: None		Barometric Pres.: 1013 mbar	
Tested by: Brandon Hobbs	Power: 54 VDC	Job Site: TX05	
TEST SPECIFICATIONS		Test Method	
FCC 24E:2022		ANSI C63.26:2015	
RSS-133 Issue 6:2013+A1:2018		RSS-133 Issue 6:2013+A1:2018	
COMMENTS			
All measurement path losses were accounted for in the reference level offset including any attenuators, filters and DC blocks. PCS Band II carriers are enabled at maximum power (30 watts/carrier). The following is the output power measurements at the radio output ports. The output power was measured for a single carrier over the carrier channel bandwidth on port 1. The total output power for multiport (2x2 MIMO) operation was determined based upon ANSI 63.26 clauses 6.4.3.1 and 6.4.3.2.4 (10 log Nout). The total output power for two port operation is single port power + 3dB [i.e. 10log(2)].			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	2	Signature	
		Initial Value dBm/MHz	Duty Cycle Factor (dB)
		Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW
PCS BAND II, 1930 MHz - 1990 MHz			
Port 1			
5 MHz Bandwidth			
QPSK Modulation			
	Mid Channel, 1960 MHz	44.680	0
		44.7	47.7
16-QAM Modulation			
	Mid Channel, 1960 MHz	44.601	0
		44.6	47.6
64-QAM Modulation			
	Low Channel, 1932.4 MHz	44.644	0
	Mid Channel, 1960 MHz	44.611	0
	High Channel, 1987.6 MHz	44.580	0
		44.6	47.6

CONDUCTED OUTPUT POWER PCS

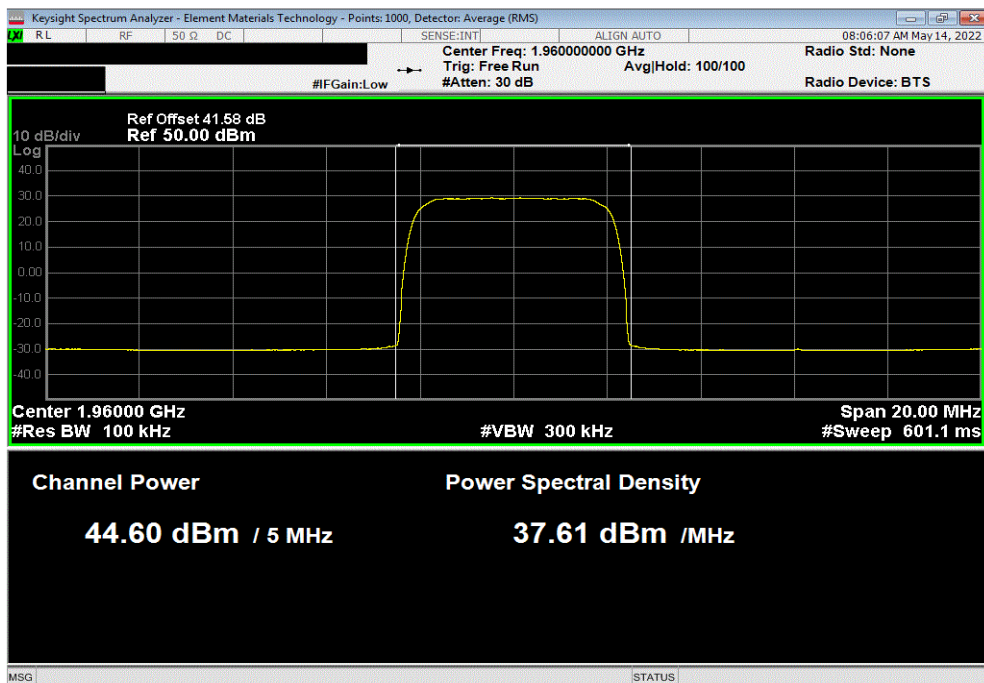


TMTx 2022.05.02.0 XMM 2022.02.07.0

PCS BAND II, 1930 MHz - 1990 MHz, Port 1, 5 MHz Bandwidth, QPSK Modulation, Mid Channel, 1960 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)		
dBm/MHz	Factor (dB)	dBm/Carrier BW	dBm/Carrier BW		
44.68	0	44.7	47.7		



PCS BAND II, 1930 MHz - 1990 MHz, Port 1, 5 MHz Bandwidth, 16-QAM Modulation, Mid Channel, 1960 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)		
dBm/MHz	Factor (dB)	dBm/Carrier BW	dBm/Carrier BW		
44.601	0	44.6	47.6		

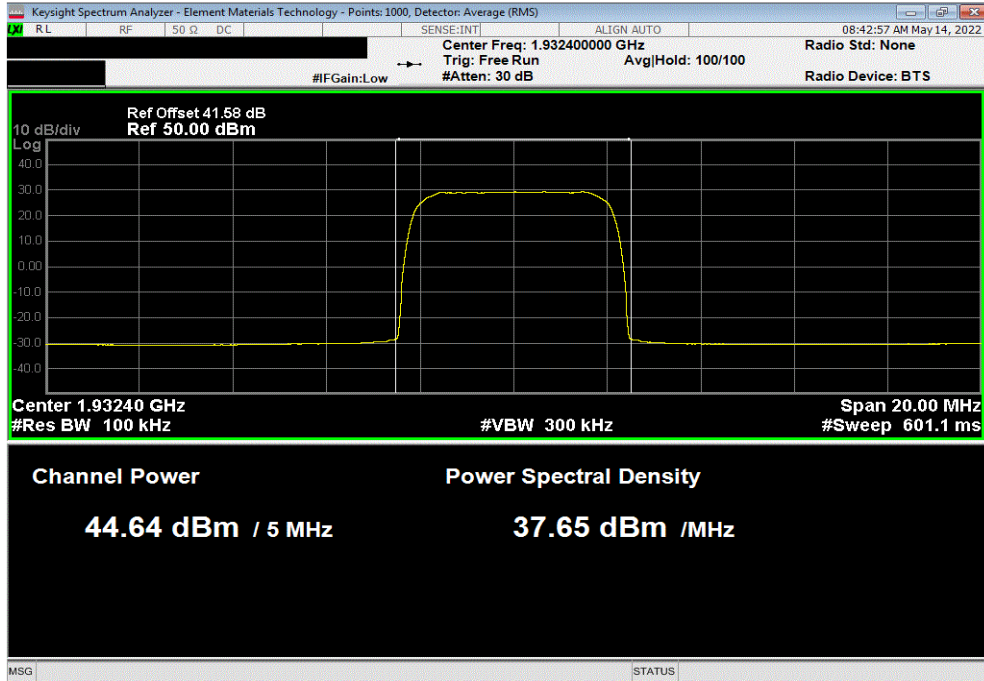


CONDUCTED OUTPUT POWER PCS

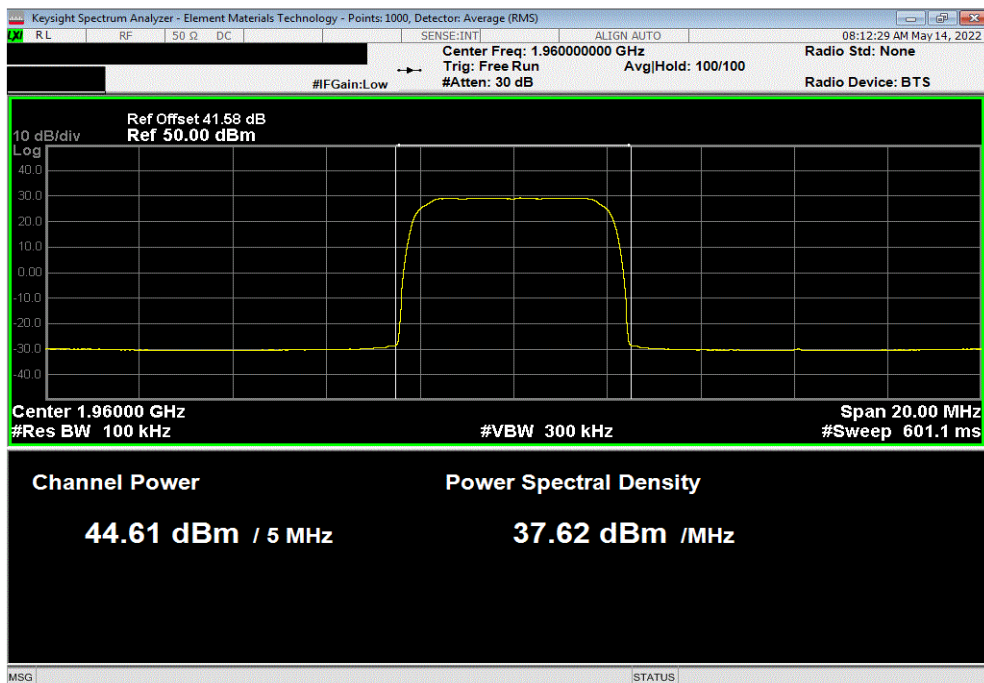


TMTx 2022.05.02.0 XMM 2022.02.07.0

PCS BAND II, 1930 MHz - 1990 MHz, Port 1, 5 MHz Bandwidth, 64-QAM Modulation, Low Channel, 1932.4 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)		
dBm/MHz	Factor (dB)	dBm/Carrier BW	dBm/Carrier BW		
44.644	0	44.6	47.6		



PCS BAND II, 1930 MHz - 1990 MHz, Port 1, 5 MHz Bandwidth, 64-QAM Modulation, Mid Channel, 1960 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)		
dBm/MHz	Factor (dB)	dBm/Carrier BW	dBm/Carrier BW		
44.611	0	44.6	47.6		

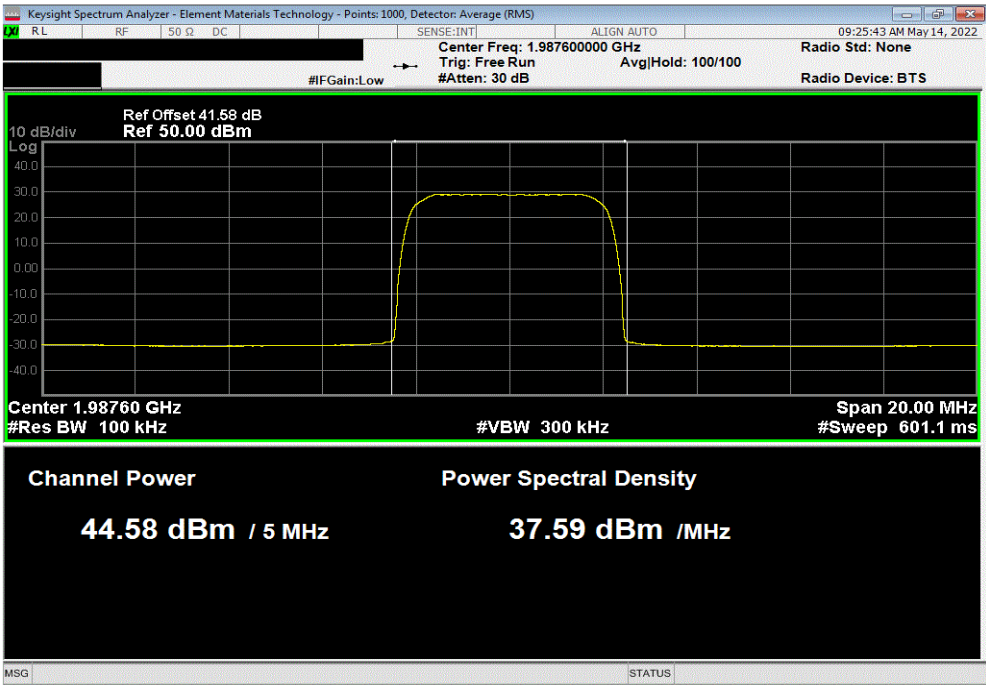


CONDUCTED OUTPUT POWER PCS



TMTx 2022.05.02.0 XMM 2022.02.07.0

PCS BAND II, 1930 MHz - 1990 MHz, Port 1, 5 MHz Bandwidth, 64-QAM Modulation, High Channel, 1987.6 MHz					
Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)		
dBm/MHz	Factor (dB)	dBm/Carrier BW	dBm/Carrier BW		
44.58	0	44.6	47.6		



0.0 3.0

CONDUCTED OUTPUT POWER - MULTIBAND



XMIT 2022.02.07.0

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
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2022-01-17	2023-01-17
Block - DC	Fairview Microwave	SD3239	ANC	2022-03-02	2023-03-02
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17

TEST DESCRIPTION

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

The method in section 5.2.4.4 of ANSI C63.26 was used to make the measurements. This method uses trace averaging across the 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 in decimal, to the measured power to compute the average power during the actual transmission times.

RF conducted emissions testing was performed only on one port. The AHFII antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown during 4 port output power testing) and antenna port 1 was selected to perform the testing under this effort as allowed by ANSI C63.26-2015 paragraphs 5.2.5.3, 5.7.2i and 6.4.

Multicarrier test cases have been developed and tested as shown below:

- PCS Multicarrier Multiband Test Case:** In the PCS band _Three WCDMA carriers using two carriers (with minimum spacing between carrier frequencies) at the lower band edge (1932.4 & 1937.4MHz) and a third carrier with maximum spacing between the other two carrier frequencies (1987.6MHz) at the upper band edge. In the AWS band _ Two WCDMA carriers at the band middle (2137.5 & 2142.5MHz). The carriers are operated at maximum power (~26.6W/PCS carrier and 20W/AWS carrier) with a total port power of 120 watts (80W for PCS band carriers + 40W for AWS band carriers).
- AWS Multicarrier Multiband Test Case:** In the AWS band _Three WCDMA carriers using two carriers (with minimum spacing between carrier frequencies) at the lower band edge (2112.4 & 2117.4MHz) and a third carrier with maximum spacing between the other two carrier frequencies (2167.6MHz) at the upper band edge. In the PCS band: Two WCDMA carriers at band middle (1957.5 & 1962.5MHz). The carriers are operated at maximum power (~26.6W/AWS carrier and 20W/PCS carrier) with a total port power of 120 watts (80W for AWS band carriers + 40W for PCS band carriers).

CONDUCTED OUTPUT POWER - MULTIBAND



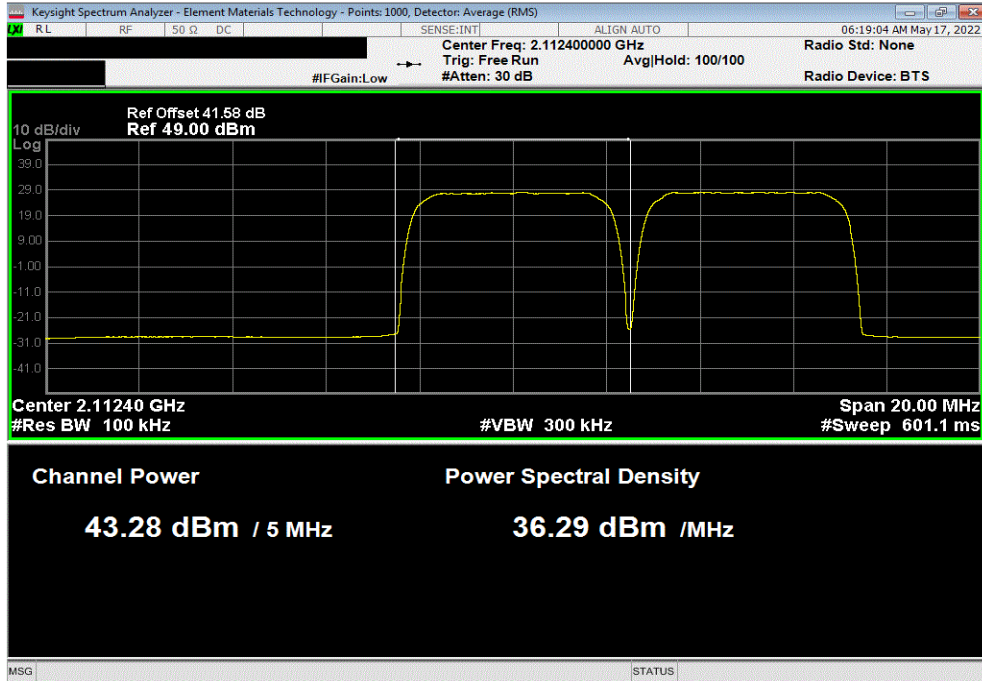
EUT: AHFII (FCC/ISED C2PC)		Work Order: NOKI0040	
Serial Number: YK214000036		Date: 16-May-22	
Customer: Nokia Solutions and Networks		Temperature: 23.5 °C	
Attendees: David Le, John Rattanavong		Humidity: 47.5% RH	
Project: None		Barometric Pres.: 1019 mbar	
Tested by: Brandon Hobbs		Job Site: TX05	
Power: 54 VDC			
TEST SPECIFICATIONS		Test Method	
FCC 24E:2022		ANSI C63.26:2015	
RSS-133 Issue 6:2013+A1:2018		RSS-133 Issue 6:2013+A1:2018	
FCC 27:2022		ANSI C63.26:2015	
RSS-139 Issue 3:2015		RSS-139 Issue 3:2015	
COMMENTS			
All measurement path losses were accounted for in the reference level offset including any attenuators, filters and DC blocks. PCS Band II / AWS Band X carriers are enabled at maximum power (30 watts/carrier, 80 watts/band and 120 watts/port). The following is the output power measurements at the radio's output port. The multiband output power was measured by single carrier, band and total port power on port 1.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	2	Signature	
		Avg Cond Initial Pwr (dBm)	Duty Cycle Factor (dB)
		Avg Cond Carrier Pwr (dBm)	Avg Cond Band Pwr (dBm)
		Avg Cond Port Pwr (dBm)	Limit (dBm)
			Results
AWS BAND X, 2110 MHz - 2170 MHz			
Port 1			
5 MHz Bandwidth			
64-QAM Modulation			
	Low Channel, 2112.4 MHz	43.284	0
	Low Inner Channel, 2117.4 MHz	43.440	0
	Mid Left Channel, 2137.5 MHz	42.791	0
	Mid Right Channel, 2142.5 MHz	42.795	0
	High Channel, 2167.6 MHz	44.155	0
PCS BAND II, 1930 MHz - 1990 MHz			
Port 1			
5 MHz Bandwidth			
64-QAM Modulation			
	Low Channel, 1932.4 MHz	43.302	0
	Low Inner Channel, 1937.4 MHz	43.606	0
	Mid Left Channel, 1957.5 MHz	42.694	0
	Mid Right Channel, 1962.5 MHz	42.718	0
	High Channel, 1987.6 MHz	44.223	0
AWS and PCS BANDS			
Port 1			
5 MHz Bandwidth			
64-QAM Modulation			
	Multicarrier Multiband Test Case 1	N/A	0
	Multicarrier Multiband Test Case 2	N/A	0

CONDUCTED OUTPUT POWER - MULTIBAND

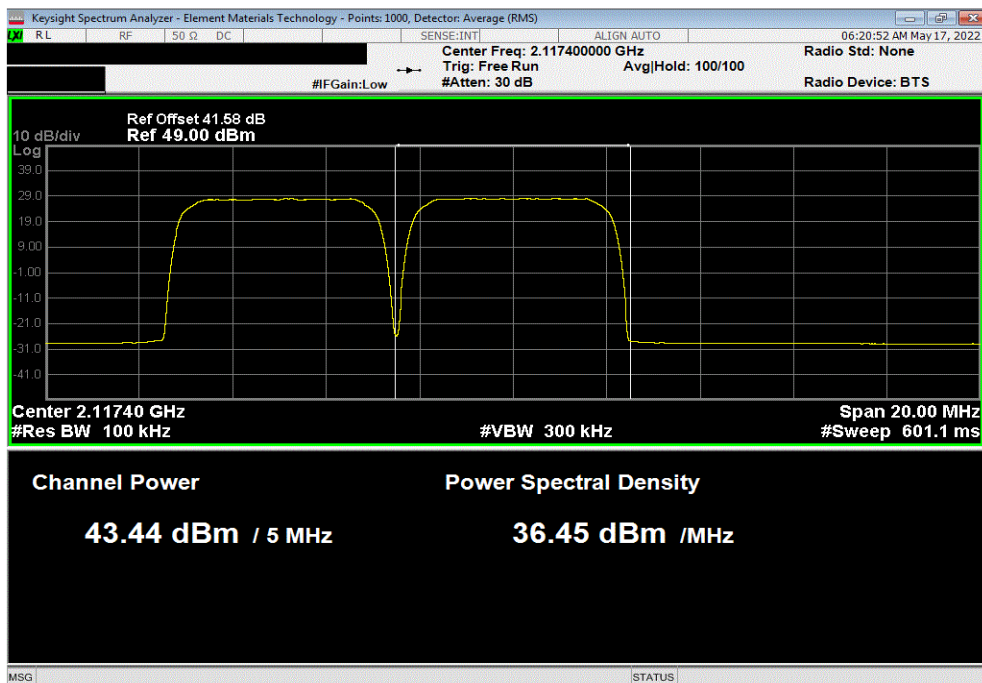


TbTtx 2022.05.02.0 XM8 2022.02.07.0

AWS BAND X, 2110 MHz - 2170 MHz, Port 1, 5 MHz Bandwidth, 64-QAM Modulation, Low Channel, 2112.4 MHz						
Avg Cond	Duty Cycle	Avg Cond	Avg Cond	Avg Cond	Limit	Results
Initial Pwr (dBm)	Factor (dB)	Carrier Pwr (dBm)	Band Pwr (dBm)	Port Pwr (dBm)	(dBm)	
43.284	0	43.3	N/A	N/A	Within Tolerance	Pass



AWS BAND X, 2110 MHz - 2170 MHz, Port 1, 5 MHz Bandwidth, 64-QAM Modulation, Low Inner Channel, 2117.4 MHz						
Avg Cond	Duty Cycle	Avg Cond	Avg Cond	Avg Cond	Limit	Results
Initial Pwr (dBm)	Factor (dB)	Carrier Pwr (dBm)	Band Pwr (dBm)	Port Pwr (dBm)	(dBm)	
43.44	0	43.4	N/A	N/A	Within Tolerance	Pass

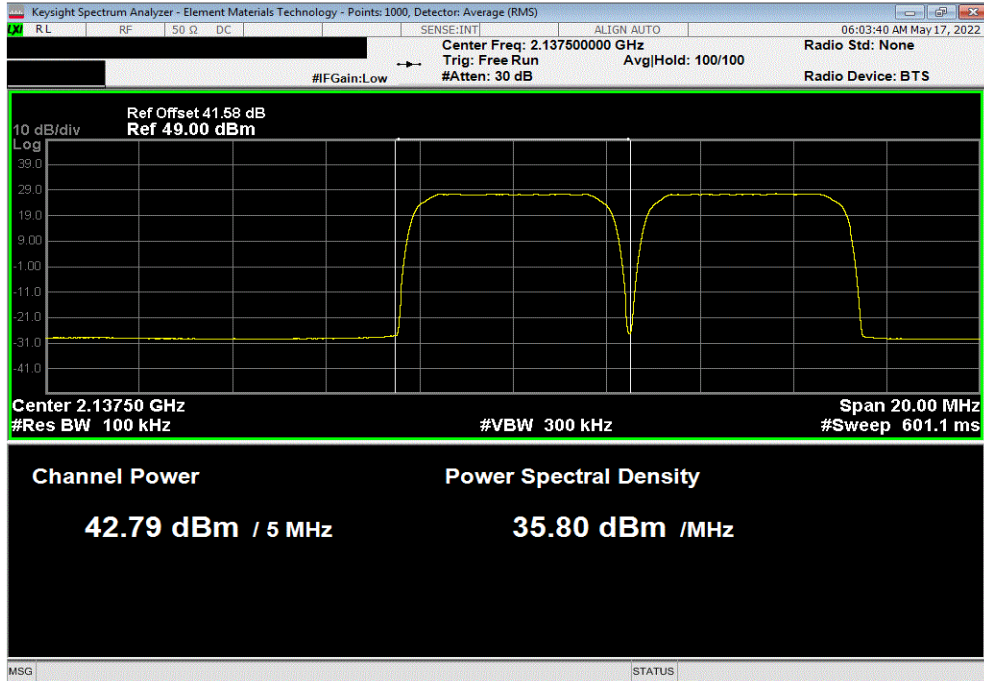


CONDUCTED OUTPUT POWER - MULTIBAND

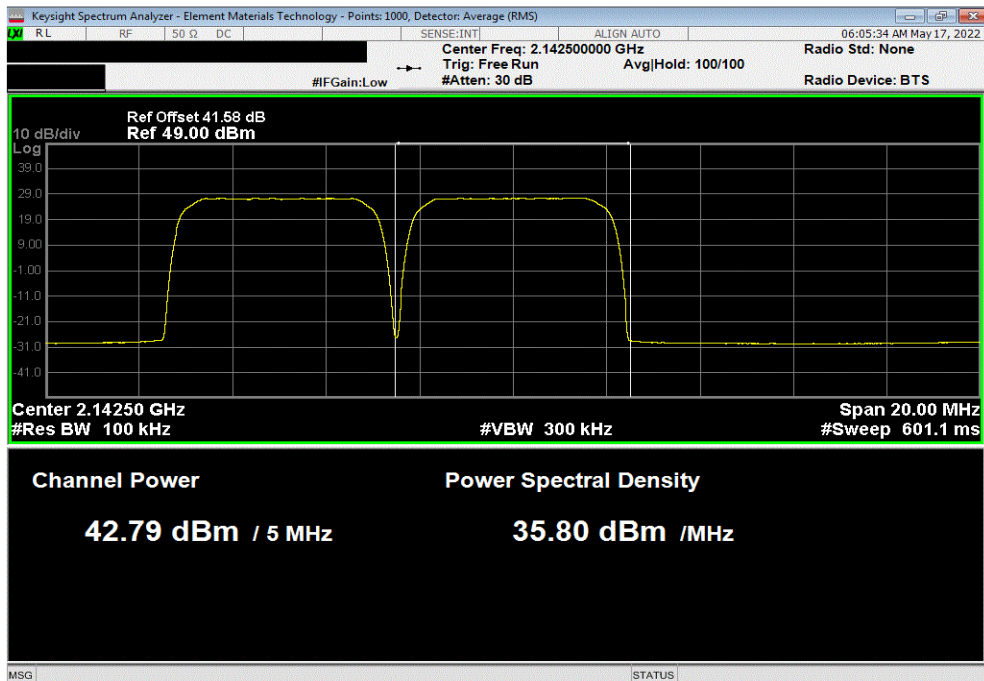


TbTtx 2022.05.02.0 XM8 2022.02.07.0

AWS BAND X, 2110 MHz - 2170 MHz, Port 1, 5 MHz Bandwidth, 64-QAM Modulation, Mid Left Channel, 2137.5 MHz						
Avg Cond	Duty Cycle	Avg Cond	Avg Cond	Avg Cond	Limit	Results
Initial Pwr (dBm)	Factor (dB)	Carrier Pwr (dBm)	Band Pwr (dBm)	Port Pwr (dBm)	(dBm)	
42.791	0	42.8	N/A	N/A	Within Tolerance	Pass



AWS BAND X, 2110 MHz - 2170 MHz, Port 1, 5 MHz Bandwidth, 64-QAM Modulation, Mid Right Channel, 2142.5 MHz						
Avg Cond	Duty Cycle	Avg Cond	Avg Cond	Avg Cond	Limit	Results
Initial Pwr (dBm)	Factor (dB)	Carrier Pwr (dBm)	Band Pwr (dBm)	Port Pwr (dBm)	(dBm)	
42.795	0	42.795	N/A	N/A	Within Tolerance	Pass

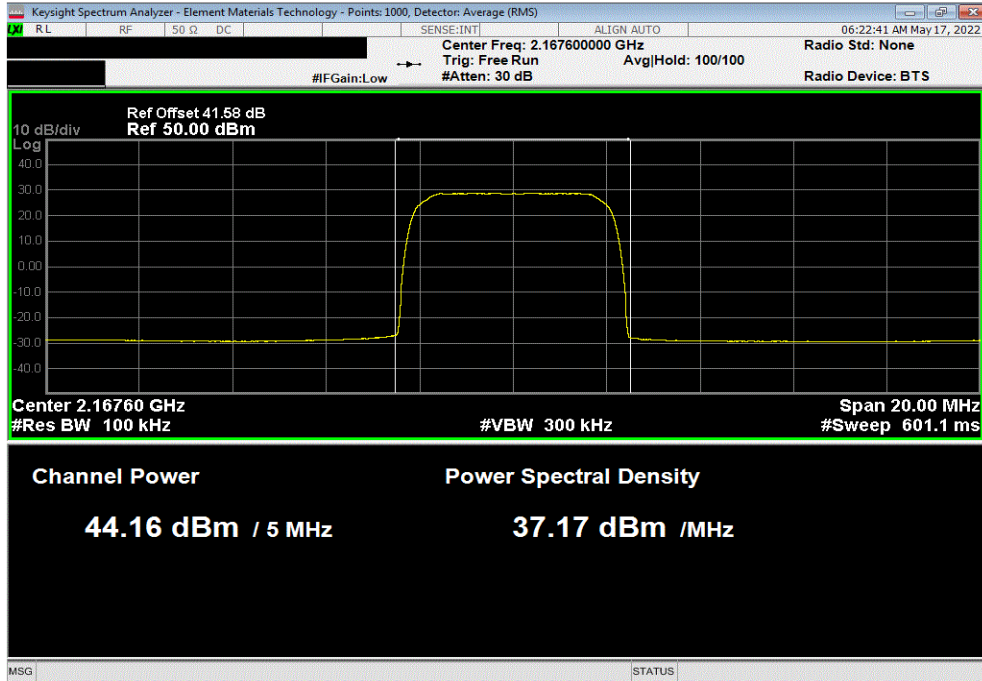


CONDUCTED OUTPUT POWER - MULTIBAND

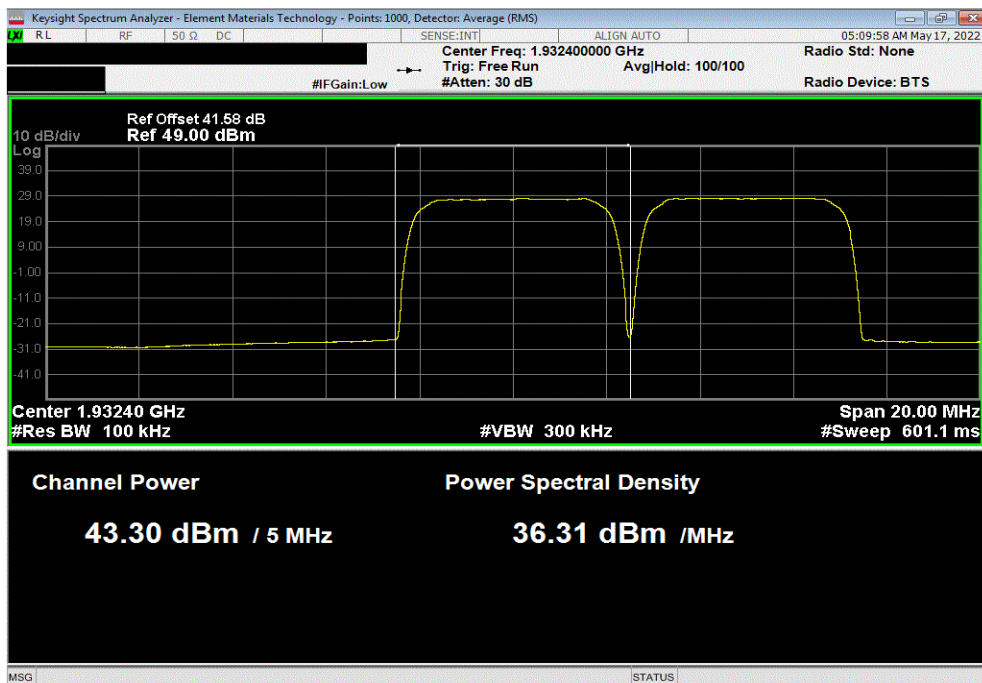


TbTtx 2022.05.02.0 XMt 2022.02.07.0

AWS BAND X, 2110 MHz - 2170 MHz, Port 1, 5 MHz Bandwidth, 64-QAM Modulation, High Channel, 2167.6 MHz							
Avg Cond	Duty Cycle	Avg Cond	Avg Cond	Avg Cond	Limit	Results	
Initial Pwr (dBm)	Factor (dB)	Carrier Pwr (dBm)	Band Pwr (dBm)	Port Pwr (dBm)	(dBm)		
44.155	0	44.2	N/A	N/A	Within Tolerance	Pass	



PCS BAND II, 1930 MHz - 1990 MHz, Port 1, 5 MHz Bandwidth, 64-QAM Modulation, Low Channel, 1932.4 MHz							
Avg Cond	Duty Cycle	Avg Cond	Avg Cond	Avg Cond	Limit	Results	
Initial Pwr (dBm)	Factor (dB)	Carrier Pwr (dBm)	Band Pwr (dBm)	Port Pwr (dBm)	(dBm)		
43.302	0	43.3	N/A	N/A	Within Tolerance	Pass	

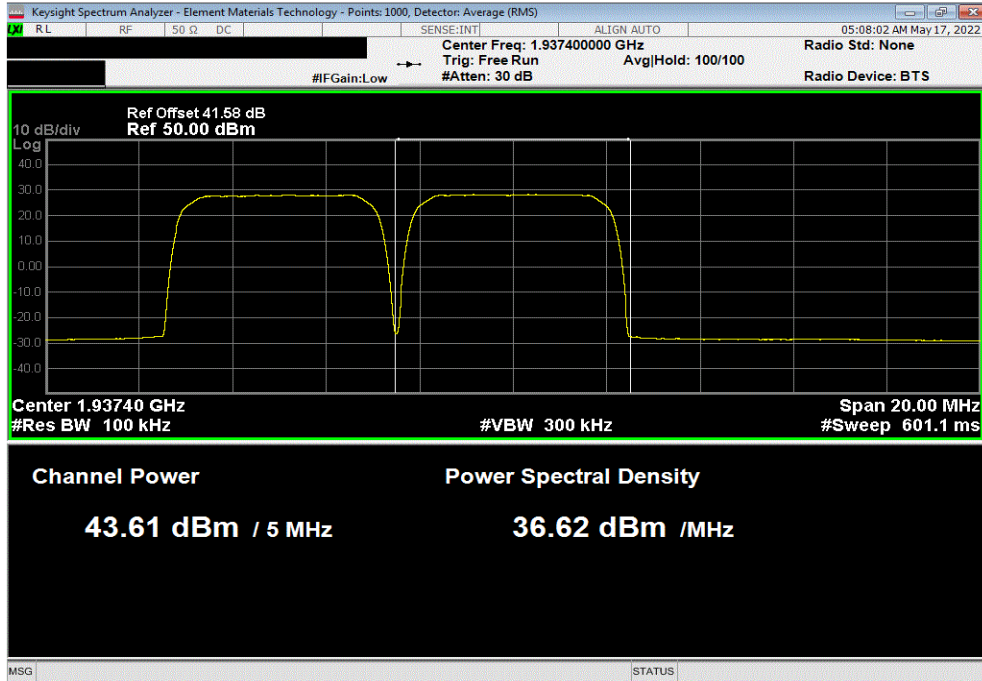


CONDUCTED OUTPUT POWER - MULTIBAND

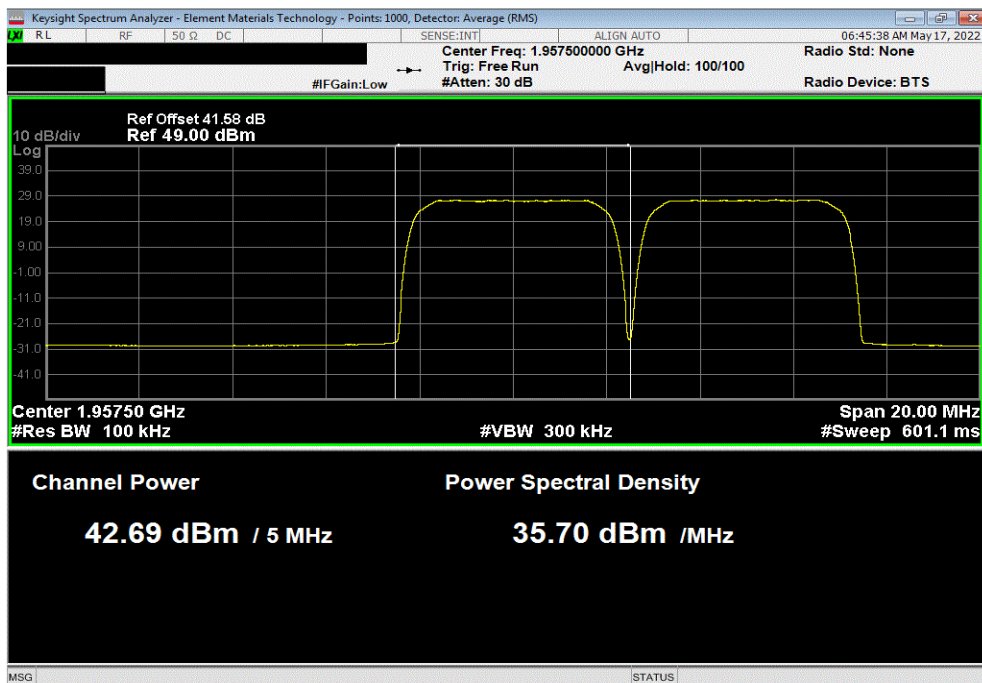


TbTtx 2022.05.02.0 XMt 2022.02.07.0

PCS BAND II, 1930 MHz - 1990 MHz, Port 1, 5 MHz Bandwidth, 64-QAM Modulation, Low Inner Channel, 1937.4 MHz						
Avg Cond	Duty Cycle	Avg Cond	Avg Cond	Avg Cond	Limit	Results
Initial Pwr (dBm)	Factor (dB)	Carrier Pwr (dBm)	Band Pwr (dBm)	Port Pwr (dBm)	(dBm)	
43.606	0	43.6	N/A	N/A	Within Tolerance	Pass



PCS BAND II, 1930 MHz - 1990 MHz, Port 1, 5 MHz Bandwidth, 64-QAM Modulation, Mid Left Channel, 1957.5 MHz						
Avg Cond	Duty Cycle	Avg Cond	Avg Cond	Avg Cond	Limit	Results
Initial Pwr (dBm)	Factor (dB)	Carrier Pwr (dBm)	Band Pwr (dBm)	Port Pwr (dBm)	(dBm)	
42.694	0	42.7	N/A	N/A	Within Tolerance	Pass

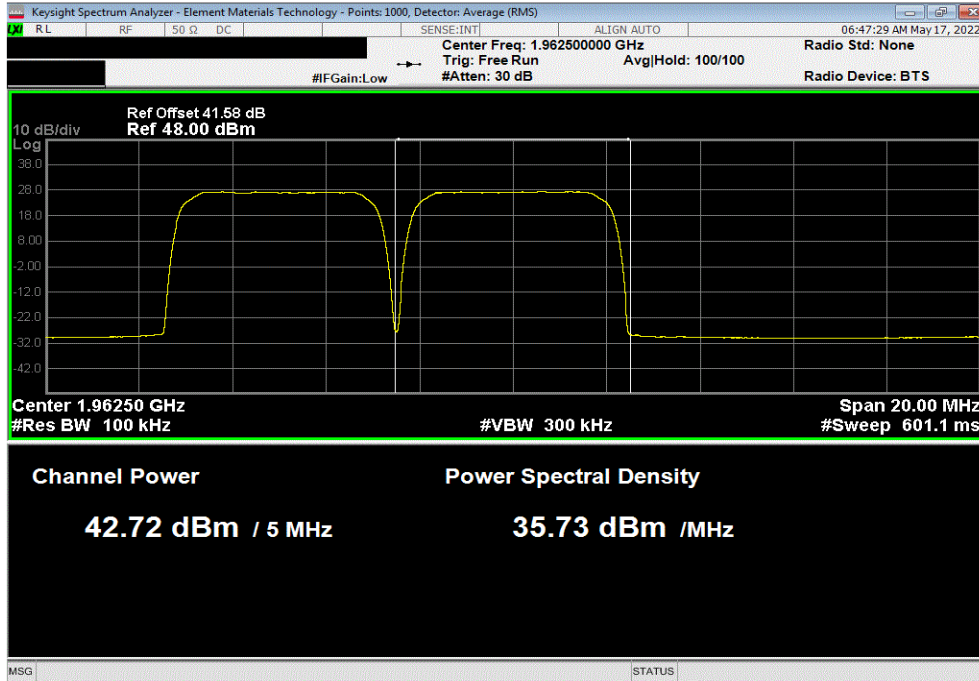


CONDUCTED OUTPUT POWER - MULTIBAND

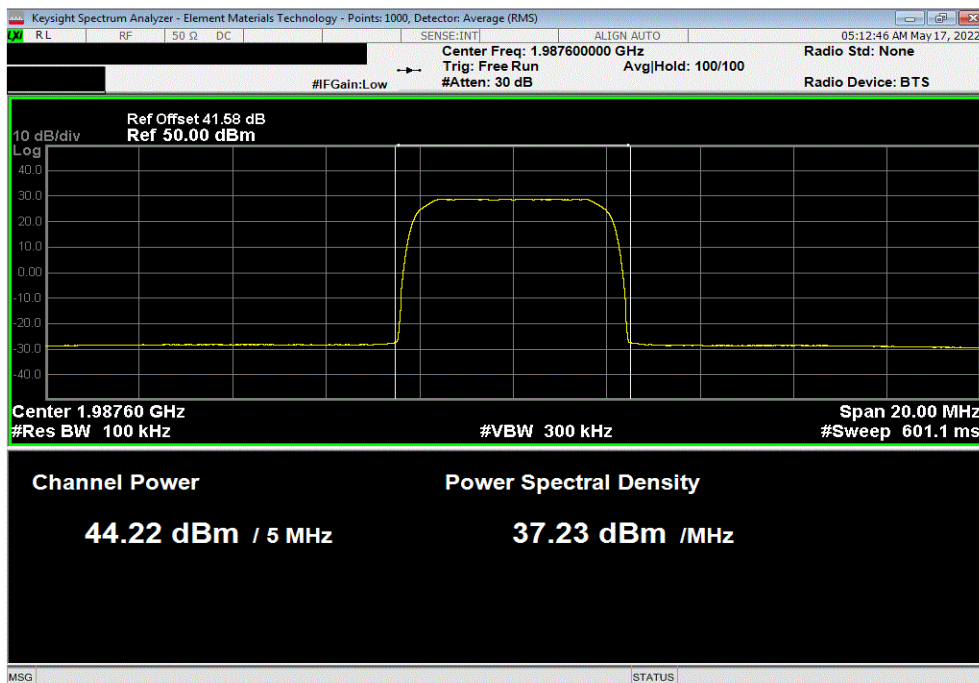


TbTtx 2022.05.02.0 XM8 2022.02.07.0

PCS BAND II, 1930 MHz - 1990 MHz, Port 1, 5 MHz Bandwidth, 64-QAM Modulation, Mid Right Channel, 1962.5 MHz						
Avg Cond	Duty Cycle	Avg Cond	Avg Cond	Avg Cond	Limit	Results
Initial Pwr (dBm)	Factor (dB)	Carrier Pwr (dBm)	Band Pwr (dBm)	Port Pwr (dBm)	(dBm)	
42.718	0	42.7	N/A	N/A	Within Tolerance	Pass



PCS BAND II, 1930 MHz - 1990 MHz, Port 1, 5 MHz Bandwidth, 64-QAM Modulation, High Channel, 1987.6 MHz						
Avg Cond	Duty Cycle	Avg Cond	Avg Cond	Avg Cond	Limit	Results
Initial Pwr (dBm)	Factor (dB)	Carrier Pwr (dBm)	Band Pwr (dBm)	Port Pwr (dBm)	(dBm)	
44.223	0	44.2	N/A	N/A	Within Tolerance	Pass



CONDUCTED OUTPUT POWER - MULTIBAND



TMX 2022.05.02.0 XMB 2022.02.07.0

AWS and PCS BANDS, Port 1, 5 MHz Bandwidth, 64-QAM Modulation, Multicarrier Multiband Test Case 1						
Avg Cond Initial Pwr (dBm)	Duty Cycle Factor (dB)	Avg Cond Carrier Pwr (dBm)	Avg Cond Band Pwr (dBm)	Avg Cond Port Pwr (dBm)	Limit (dBm)	Results
N/A	0	N/A	View Table	View Table	Within Tolerance	Pass

Carrier Band	Carrier Frequencies	Carrier Power (dBm)	Carrier Power (Watts)	Band Total Pwr (Watts)	Band Total Pwr (dBm)	Port Total Pwr (dBm)	Port Total Pwr (Watts)
PCS	Low 1932.4 MHz	43.3	21.4	N/A	N/A	N/A	N/A
PCS	Low 1937.4 MHz	43.6	22.9	N/A	N/A	N/A	N/A
PCS	High 1987.6 MHz	44.2	26.3	N/A	N/A	N/A	N/A
PCS	N/A	N/A	N/A	70.6	48.5	N/A	N/A
AWS	Mid 2137.5 MHz	42.8	19.1	N/A	N/A	N/A	N/A
AWS	Mid 2142.5 MHz	42.8	19.1	N/A	N/A	N/A	N/A
AWS	N/A	N/A	N/A	38.1	45.8	N/A	N/A
PCS and AWS	N/A	N/A	N/A	N/A	N/A	50.4	110

AWS and PCS BANDS, Port 1, 5 MHz Bandwidth, 64-QAM Modulation, Multicarrier Multiband Test Case 2						
Avg Cond Initial Pwr (dBm)	Duty Cycle Factor (dB)	Avg Cond Carrier Pwr (dBm)	Avg Cond Band Pwr (dBm)	Avg Cond Port Pwr (dBm)	Limit (dBm)	Results
N/A	0	N/A	View Table	View Table	Within Tolerance	Pass

Carrier Band	Carrier Frequencies	Carrier Power (dBm)	Carrier Power (Watts)	Band Total Pwr (Watts)	Band Total Pwr (dBm)	Port Total Pwr (dBm)	Port Total Pwr (Watts)
AWS	Low 2112.4 MHz	43.3	21.4	N/A	N/A	N/A	N/A
AWS	Low 2117.4 MHz	43.4	21.9	N/A	N/A	N/A	N/A
AWS	High 2167.6 MHz	44.2	26.3	N/A	N/A	N/A	N/A
AWS	N/A	N/A	N/A	69.6	48.4	N/A	N/A
PCS	Mid 1957.5 MHz	42.7	18.6	N/A	N/A	N/A	N/A
PCS	Mid 1962.5 MHz	42.7	18.6	N/A	N/A	N/A	N/A
PCS	N/A	N/A	N/A	37.2	45.7	N/A	N/A
PCS and AWS	N/A	N/A	N/A	N/A	N/A	50.3	107