

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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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



Revisior 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.

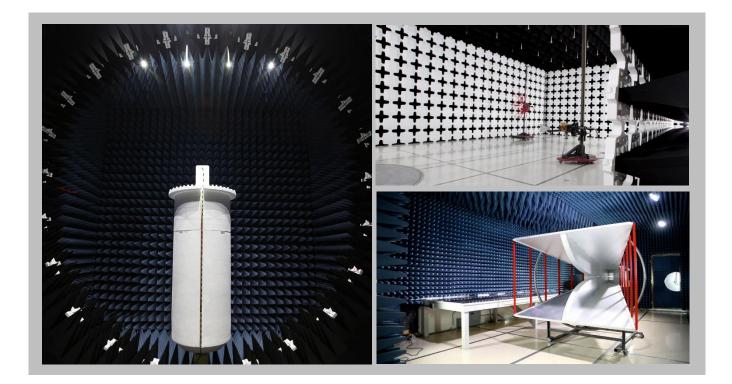
	SCOPE						
	For details on the Scopes of our Accreditations, please visit:						
California	<u>Minnesota</u>	<u>Oregon</u>	<u>Texas</u>	Washington			

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

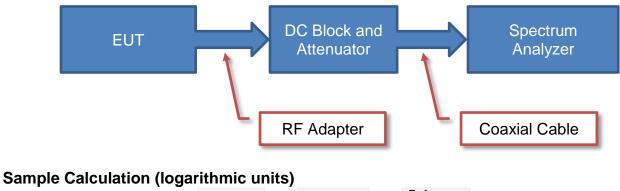


Measurement Bandwidths

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

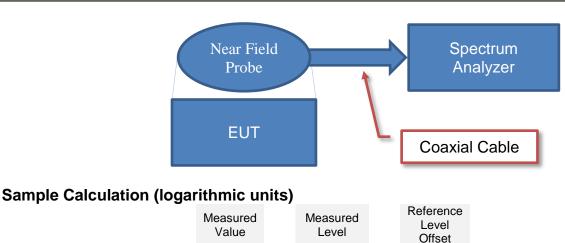
Unless otherwise stated, measurements were made using the bandwidths and detectors specified. No video filter was used.

Antenna Port Conducted Measurements



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

Near Field Test Fixture Measurements



42.6

+

28.6

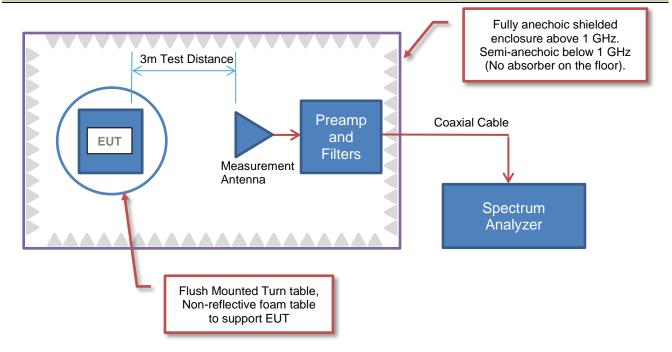
71.2

=

TEST SETUP BLOCK DIAGRAMS



Emissions Measurements

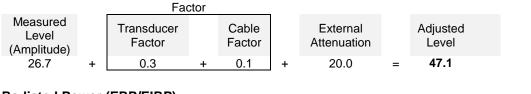


Sample Calculation (logarithmic units)

Radiated Emissions:

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

Conducted Emissions:



Radiated Power (ERP/EIRP):

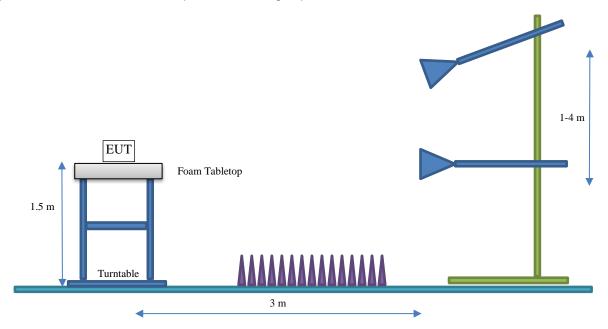
Measured Level into Substitution Antenna (Amplitude dBm)		Substitution Antenna Factor (dBi)		EIRP to ERP (if applicable)		Measured power (dBm ERP/EIRP)
10.0	+	6.0	-	2.15	=	13.9/16.0

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.





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 AHFI
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

Client and Equipment Under Test (EUT) Information

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 ISED 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.



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
ર્ભ	9660	1930.0	Band edge
, 2,			
1	9662	1932.4	Bottom Channel
enn (9663	1932.6	Bottom Channel + 1
Antennas			
	9800	1960.0	Middle Channel
AHFII 4			
ì	9937	1987.4	Top Channel - 1
Band	9938	1987.6	Top Channel
PCS]			
P	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).



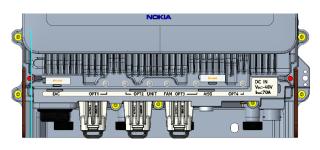
The AWS Band WCDMA channel bandwidth is 5MHz. The channel spacing is 200 kHz between channel numbers. The AWS Band WCDMA downlink channel numbers are provided in below.

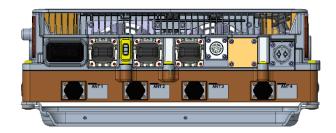
	Downlink UARFCN UTRA Band X	Downlink Frequency (MHz)	WCDMA Channel
З,	3100	2110.0	Band edge
, 2,			
as 1	3112	2112.4	Bottom Channel
Antennas	3113	2112.6	Bottom Channel + 1
Ant			
EII 4	3250	2140.0	Middle Channel
AHFII 4			
p	3387	2167.4	Top Channel - 1
Band	3388	2167.6	Top Channel
AWS			
Ā	3400	2170.0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

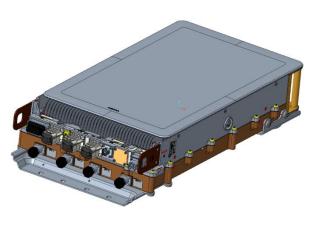
AHFII Downlink Band Edge 3G WCDMA AWS Band Frequency Channels *AWS Multicarrier Multiband Test Case*: In the AWS band _Three WCDMA carriers using two carriers (with minimum spacing between carrier frequencies) at the lower band edge (2112.4 & 2117.4MHz) and a third carrier with maximum spacing between 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).



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.



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			

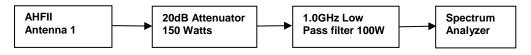
Description	Manufacturer	Model/Part Number	Serial Number	
AMIA (BTS Cabinet)	Nokia Solutions and Networks	473098A.203	RK182307104	
ASIA (3G BTS System Module)	Nokia Solutions and Networks	473095A.203	AH173111443	
ABIA (3G BTS Baseband Module)	Nokia Solutions and Networks	473096A.102	L1164121378	
AHFII (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	



Cables (Peripheral)					
Description	Shield (Y/N)	Length (m)	Ferrite (Y/N)	Connection 1	Connection 2
Fiber Optic Cable	N	2 meters	Ν	ABIA	AHFII
Cat-5e Cable	Y	7 meters	Ν	ASIA	WebEM- PC
HS-SUCOFLEX_106 – RF CABLE	Y	2 meters	Ν	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:





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			

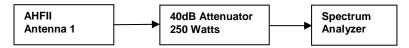
Equipment being tested (include Peripherals)						
Description	Manufacturer	Model/Part Number	Serial Number			
AMIA (BTS Cabinet)	Nokia Solutions and Networks	473098A.203	RK182307104			
ASIA (3G BTS System Module)	Nokia Solutions and Networks	473095A.203	AH173111443			
ABIA (3G BTS Baseband Module)	Nokia 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			



Cables (Peripheral)					
Description	Shield (Y/N)	Length (m)	Ferrite (Y/N)	Connection 1	Connection 2
Fiber Optic Cable	Ν	2 meters	Ν	ABIA	AHFII
Cat-5e Cable	Y	7 meters	Ν	ASIA	WebEM- PC
HS-SUCOFLEX_106 – RF CABLE	Y	2 meters	Ν	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:





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			

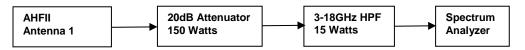
Description	Manufacturer	Model/Part Number	Serial Number	
AMIA (BTS Cabinet)	Nokia Solutions and Networks	473098A.203	RK182307104	
ASIA (3G BTS System Module)	Nokia Solutions and Networks	473095A.203	AH173111443	
ABIA (3G BTS Baseband Module)	Nokia Solutions and Networks	473096A.102	L1164121378	
AHFII (Radio Remote Head)	Nokia Solutions and Networks	475656A.101	YK214000036	
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	



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	Ν	EUT [AHFII] Ant 2-4	250W -50ohm - Load

Cables					
Description	Shield Length Ferrite (Y/N) (m) (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:





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

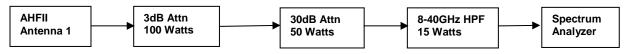
Description	Manufacturer	Model/Part Number	Serial Number
AMIA (BTS Cabinet)	Nokia Solutions and Networks	473098A.203	RK182307104
ASIA (3G BTS System Module)	Nokia Solutions and Networks	473095A.203	AH173111443
ABIA (3G BTS Baseband Module)	Nokia Solutions and Networks	473096A.102	L1164121378
AHFII (Radio 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



Cables (Peripheral)					
Description	Shield (Y/N)	Length (m)	Ferrite (Y/N)	Connection 1	Connection 2
Fiber Optic Cable	Ν	2 meters	Ν	ABIA	AHFII
Cat-5e Cable	Y	7 meters	Ν	ASIA	WebEM- PC
HS-SUCOFLEX_106 – RF CABLE	Y	2 meters	Ν	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	Ν	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.



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.

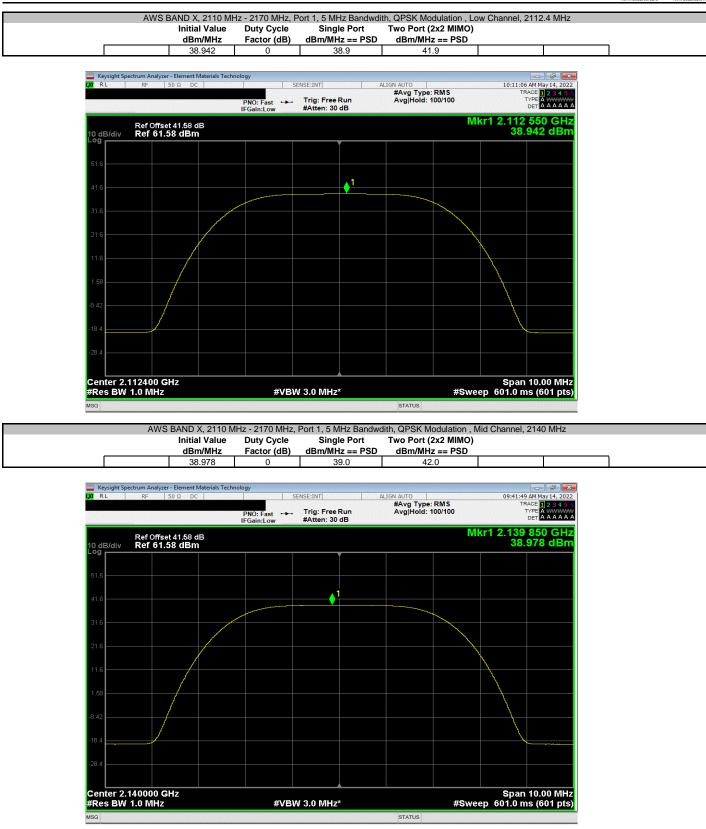
The AWS Band EIRP requirements are specified in FCC Part 27.50d and ISED RSS-139 section 6.5/SRSP-513 section 5.1.1.

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.

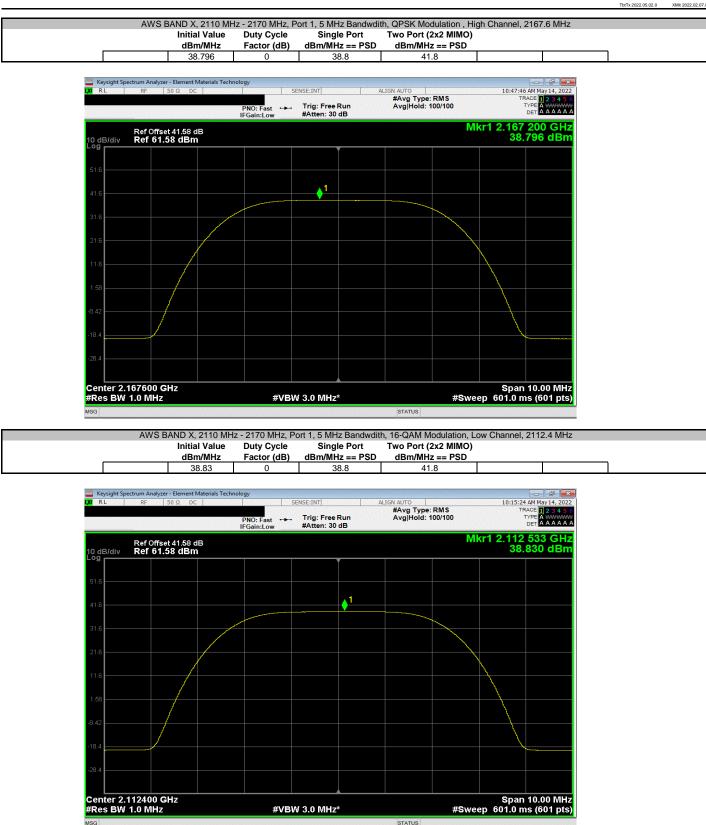


	AHFII (FCC/ISED C2PC)					Work Order: N	
Serial Number:	YK214000036					Date: 13	3-May-22
Customer:	Nokia Solutions and Ne	tworks				Temperature: 2 ²	1.9 °C
	David Le, John Rattana	vong				Humidity: 50	0.8% RH
Project:						Barometric Pres.: 10	
	Brandon Hobbs		Power: 54 VDC			Job Site: T	X05
EST SPECIFICAT	IONS		Test Method				
CC 27:2022			ANSI C63.26:2015				
RSS-139 Issue 3:20	015		RSS-139 Issue 3:2	015			
COMMENTS							
nultiport (2x2 MIM	O) operation was detern	ted for in the reference level offest includ ninded based upon ANSI 63.26 clause 6.4					
	M TEST STANDARD						
lone							
Configuration #	2	Signature	J-1				
Configuration #	2	Signature	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	
WS BAND X, 2110) MHz - 2170 MHz	Signature					
WS BAND X, 2110) MHz - 2170 MHz Port 1	,					
WS BAND X, 2110) MHz - 2170 MHz	Jwdith					
WS BAND X, 2110) MHz - 2170 MHz Port 1	twdith OPSK Modulation	dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	
WS BAND X, 2110) MHz - 2170 MHz Port 1	wdith QPSK Modulation Low Channel, 2112.4 MHz	dBm/MHz 38.942	Factor (dB)	dBm/MHz == PSD 38.9	dBm/MHz == PSD 41.9	
WS BAND X, 2110) MHz - 2170 MHz Port 1	wdith QPSK Modulation Low Channel, 2112.4 MHz Mid Channel, 2140 MHz	dBm/MHz 38.942 38.978	Factor (dB) 0 0	dBm/MHz == PSD 38.9 39.0	dBm/MHz == PSD 41.9 42.0	
WS BAND X, 2110) MHz - 2170 MHz Port 1	twdith QPSK Modulation Low Channel, 2112.4 MHz Mid Channel, 2140 MHz High Channel, 2167.6 MHz	dBm/MHz 38.942	Factor (dB)	dBm/MHz == PSD 38.9	dBm/MHz == PSD 41.9	
WS BAND X, 2110) MHz - 2170 MHz Port 1	wdith QPSK Modulation Low Channel, 2112.4 MHz Mid Channel, 2140 MHz High Channel, 2167.6 MHz 16-QAM Modulation	dBm/MHz 38.942 38.978 38.796	Factor (dB) 0 0	dBm/MHz == PSD 38.9 39.0 38.8	dBm/MHz == PSD 41.9 42.0 41.8	
WS BAND X, 2110) MHz - 2170 MHz Port 1	twdith QPSK Modulation Low Channel, 2112.4 MHz Mid Channel, 2140 MHz High Channel, 2167.6 MHz 16-QAM Modulation Low Channel, 2112.4 MHz	dBm/MHz 38.942 38.978 38.796 38.830	Factor (dB) 0 0 0	dBm/MHz == PSD 38.9 39.0 38.8 38.8	dBm/MHz == PSD 41.9 42.0 41.8 41.8	
WS BAND X, 2110) MHz - 2170 MHz Port 1	twdith QPSK Modulation Low Channel, 2112.4 MHz Mid Channel, 2140 MHz High Channel, 2167.6 MHz 16-QAM Modulation Low Channel, 2112.4 MHz Mid Channel, 2140 MHz	dBm/MHz 38.942 38.978 38.796 38.830 38.830 38.840	Factor (dB) 0 0 0 0	dBm/MHz == PSD 38.9 39.0 38.8 38.8 38.8 38.8	dBm/MHz == PSD 41.9 42.0 41.8 41.8 41.8	
WS BAND X, 2110) MHz - 2170 MHz Port 1	Jwdith QPSK Modulation Low Channel, 2112.4 MHz Mid Channel, 2140 MHz High Channel, 2167.6 MHz 16-QAM Modulation Low Channel, 2112.4 MHz Mid Channel, 2167.6 MHz	dBm/MHz 38.942 38.978 38.796 38.830	Factor (dB) 0 0 0 0 0 0 0 0 0	dBm/MHz == PSD 38.9 39.0 38.8 38.8	dBm/MHz == PSD 41.9 42.0 41.8 41.8	
AWS BAND X, 2110) MHz - 2170 MHz Port 1	twdith OPSK Modulation Low Channel, 2112.4 MHz Mid Channel, 2140 MHz High Channel, 2167.6 MHz 16-QAM Modulation Low Channel, 2112.4 MHz Mid Channel, 2140 MHz High Channel, 2167.6 MHz 64-QAM Modulation	dBm/MHz 38.942 38.976 38.830 38.840 38.840 38.667	Factor (dB) 0 0 0 0 0 0 0 0 0	dBm/MHz == PSD 38.9 39.0 38.8 38.8 38.8 38.8 38.7	dBm/MHz == PSD 41.9 42.0 41.8 41.8 41.8 41.8 41.7	
WS BAND X, 2110) MHz - 2170 MHz Port 1	Jwdith QPSK Modulation Low Channel, 2112.4 MHz Mid Channel, 2140 MHz High Channel, 2167.6 MHz 16-QAM Modulation Low Channel, 2112.4 MHz Mid Channel, 2167.6 MHz	dBm/MHz 38.942 38.978 38.796 38.830 38.830 38.840	Factor (dB) 0 0 0 0 0 0 0 0 0	dBm/MHz == PSD 38.9 39.0 38.8 38.8 38.8 38.8	dBm/MHz == PSD 41.9 42.0 41.8 41.8 41.8	

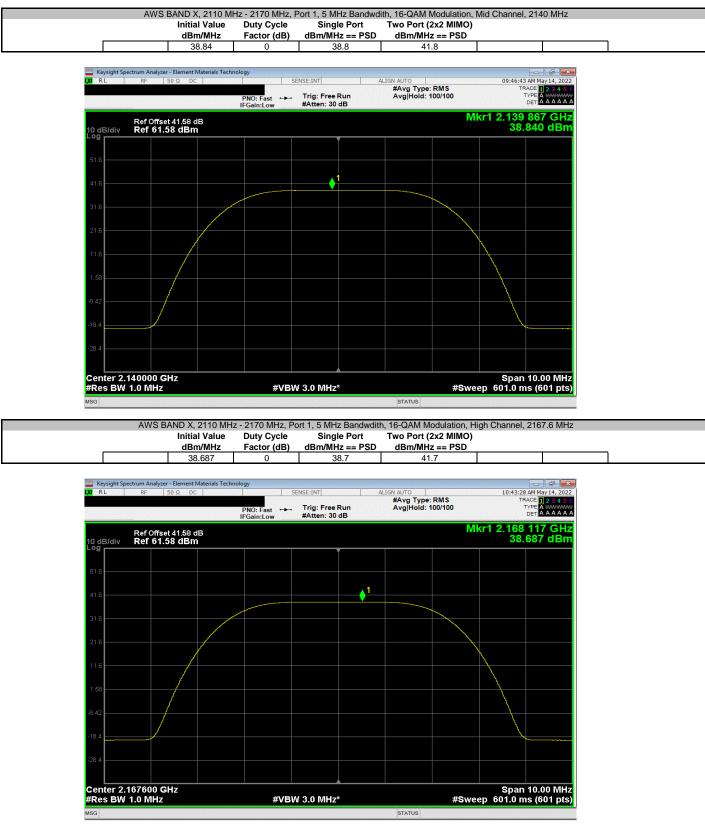




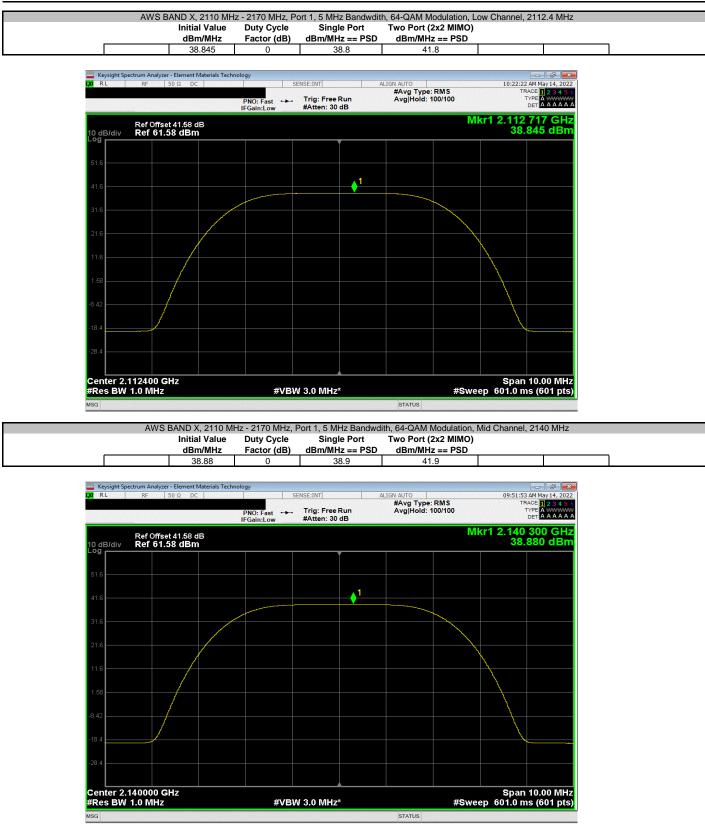
















0 0.0 3.0



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 ISED EIRP Regulatory Limits.



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.

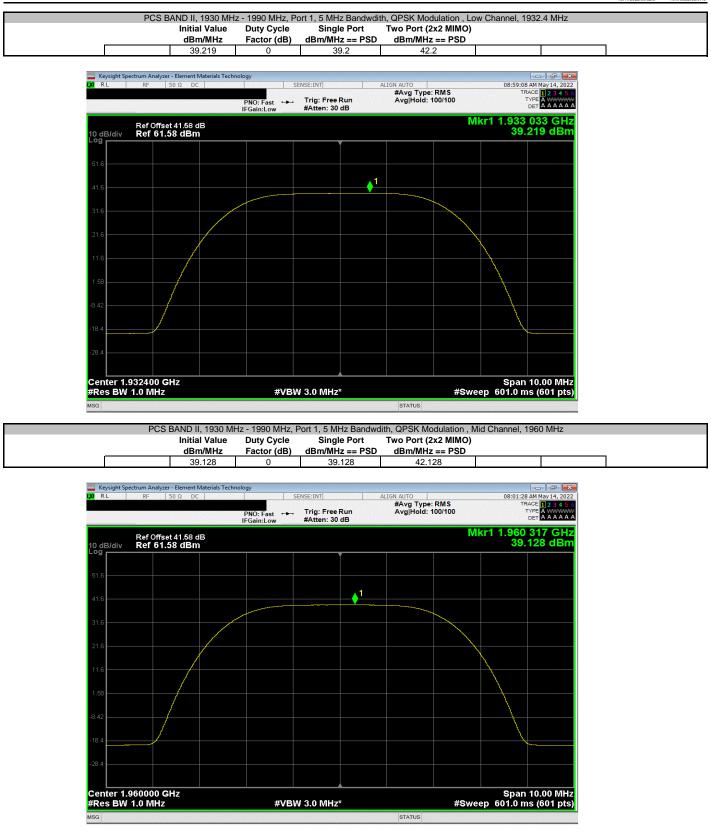
The PCS Band EIRP requirements are specified in FCC Part 24.232 and ISED RSS-133 section 6.4/SRSP-510 section 5.1.1.

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.

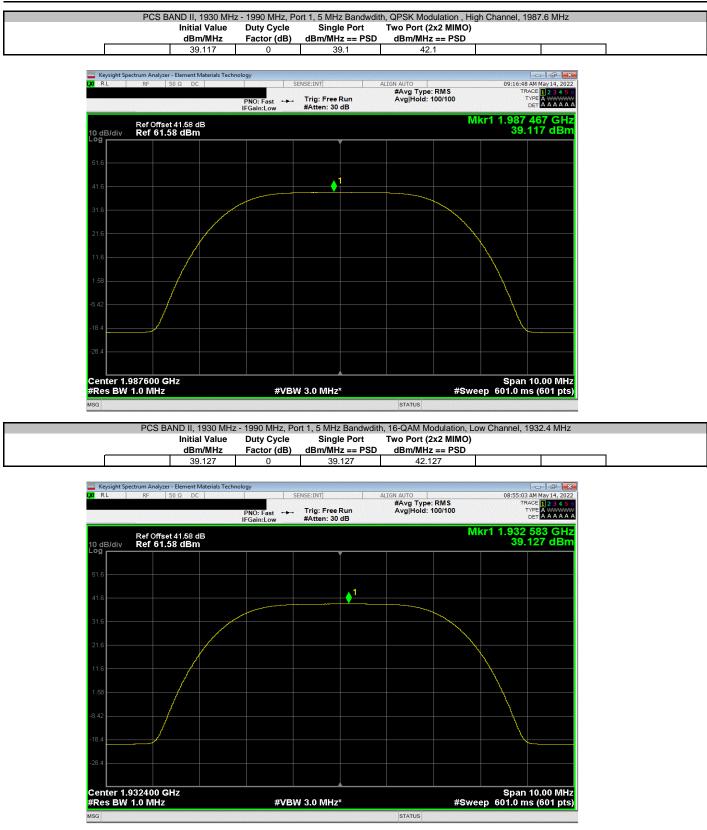


							TbtTx 2022.05.02.0 XMit 2022
	AHFII (FCC/ISED C2PC)					Work Order: N	
Serial Number:							3-May-22
Customer:	Nokia Solutions and Ne	tworks				Temperature: 22	2.7 °C
Attendees:	David Le, John Rattana	vong				Humidity: 49	9.5% RH
Project:	None					Barometric Pres.: 10	013 mbar
	Brandon Hobbs		Power: 54 VDC			Job Site: T	K05
EST SPECIFICAT	IONS		Test Method				
CC 24E:2022			ANSI C63.26:2015				
SS-133 Issue 6:20	013+A1:2018		RSS-133 Issue 6:20	13+A1:2018			
OMMENTS					_		
Il measurement p	oath losses were account	ted for in the reference level offest includin	ng any attenuators, filters and DC b	locks. The PSD	was measured while	transmitting one carrier of	on Port 1. The total PSD for
ultiport (2x2 MIM	O) operation was determ	ninded based upon ANSI 63.26 clause 6.4.3	.2.4 (10 Log Nout). The total PSD for	or two port operation	ation is single port P	SD +3dB [i.e. 10 Log(2)].	
		-	/				
	M TEST STANDARD						
one		-					
			1.				
onfiguration #	2	1	- And				
		Signature					
	I	Signature	Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	
		Signature	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	
		Signature					
	Port 1	·					
		twdith					
	Port 1	wdith QPSK Modulation	dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	
	Port 1	wdith QPSK Modulation Low Channel, 1932.4 MHz	dBm/MHz 39.219	Factor (dB)	dBm/MHz == PSD 39.2	dBm/MHz == PSD 42.2	
	Port 1	wdith QPSK Modulation Low Channel, 1932.4 MHz Mid Channel, 1960 MHz	dBm/MHz 39.219 39.128	Factor (dB) 0 0	<u>dBm/MHz == PSD</u> 39.2 39.1	dBm/MHz == PSD 42.2 42.1	
	Port 1	twdith OPSK Modulation Low Channel, 1932.4 MHz Mid Channel, 1960 MHz High Channel, 1987.6 MHz	dBm/MHz 39.219	Factor (dB)	dBm/MHz == PSD 39.2	dBm/MHz == PSD 42.2	
	Port 1	wdith QPSK Modulation Low Channel, 1932.4 MHz Mid Channel, 1960 MHz High Channel, 1987.6 MHz 16-QAM Modulation	dBm/MHz 39.219 39.128 39.117	Factor (dB) 0 0 0 0 0	dBm//MHz == PSD 39.2 39.1 39.1	dBm/MHz == PSD 42.2 42.1 42.1	
	Port 1	wdith QPSK Modulation Low Channel, 1932.4 MHz Mid Channel, 1960 MHz High Channel, 1987.6 MHz 16-QAM Modulation Low Channel, 1932.4 MHz	dBm/MHz 39.219 39.128 39.117 39.127	Factor (dB) 0 0 0 0 0 0	dBm//MHz == PSD 39.2 39.1 39.1 39.1	dBm/MHz == PSD 42.2 42.1 42.1 42.1	
	Port 1	Wdith QPSK Modulation Low Channel, 1932.4 MHz Mid Channel, 1960 MHz High Channel, 1987.6 MHz 16-QAM Modulation Low Channel, 1960 MHz Mid Channel, 1960 MHz	dBm/MHz 39.219 39.128 39.117 39.127 39.079	Factor (dB) 0 0 0 0 0 0 0 0 0 0 0	dBm//MHz == PSD 39.2 39.1 39.1 39.1 39.1	dBm/MHz == PSD 42.2 42.1 42.1 42.1 42.1	
CS BAND II, 1930	Port 1	twdith QPSK Modulation Low Channel, 1932.4 MHz Mid Channel, 1960 MHz High Channel, 1987.6 MHz 16-QAM Modulation Low Channel, 1932.4 MHz Mid Channel, 1930 MHz High Channel, 1987.6 MHz	dBm/MHz 39.219 39.128 39.117 39.127	Factor (dB) 0 0 0 0 0 0	dBm//MHz == PSD 39.2 39.1 39.1 39.1	dBm/MHz == PSD 42.2 42.1 42.1 42.1	
	Port 1	wdith OPSK Modulation Low Channel, 1932.4 MHz Mid Channel, 1960 MHz High Channel, 1987.6 MHz 16-QAM Modulation Low Channel, 1932.4 MHz Mid Channel, 1987.6 MHz High Channel, 1987.6 MHz 64-QAM Modulation	dBm/MHz 39.219 39.128 39.117 39.127 39.079 39.058	Factor (dB) 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	dBm/MHz == PSD 39.2 39.1 39.1 39.1 39.1 39.1 39.1 39.1	dBm/MHz == PSD 42.2 42.1 42.1 42.1 42.1 42.1 42.1	
	Port 1	Wdith OPSK Modulation Low Channel, 1932.4 MHz Mid Channel, 1960 MHz High Channel, 1967.6 MHz 16-QAM Modulation Low Channel, 1987.6 MHz High Channel, 1987.6 MHz 64-QAM Modulation Low Channel, 1932.4 MHz	dBm/MHz 39.219 39.128 39.117 39.127 39.079 39.058 39.087	Factor (dB) 0 0 0 0 0 0 0 0 0 0 0 0 0	dBm/MHz == PSD 39.2 39.1 39.1 39.1 39.1 39.1 39.1	dBm/MHz == PSD 42.2 42.1 42.1 42.1 42.1 42.1 42.1 42.1	
	Port 1	wdith OPSK Modulation Low Channel, 1932.4 MHz Mid Channel, 1960 MHz High Channel, 1987.6 MHz 16-QAM Modulation Low Channel, 1932.4 MHz Mid Channel, 1987.6 MHz High Channel, 1987.6 MHz 64-QAM Modulation	dBm/MHz 39.219 39.128 39.117 39.127 39.079 39.058	Factor (dB) 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	dBm/MHz == PSD 39.2 39.1 39.1 39.1 39.1 39.1 39.1 39.1	dBm/MHz == PSD 42.2 42.1 42.1 42.1 42.1 42.1 42.1	

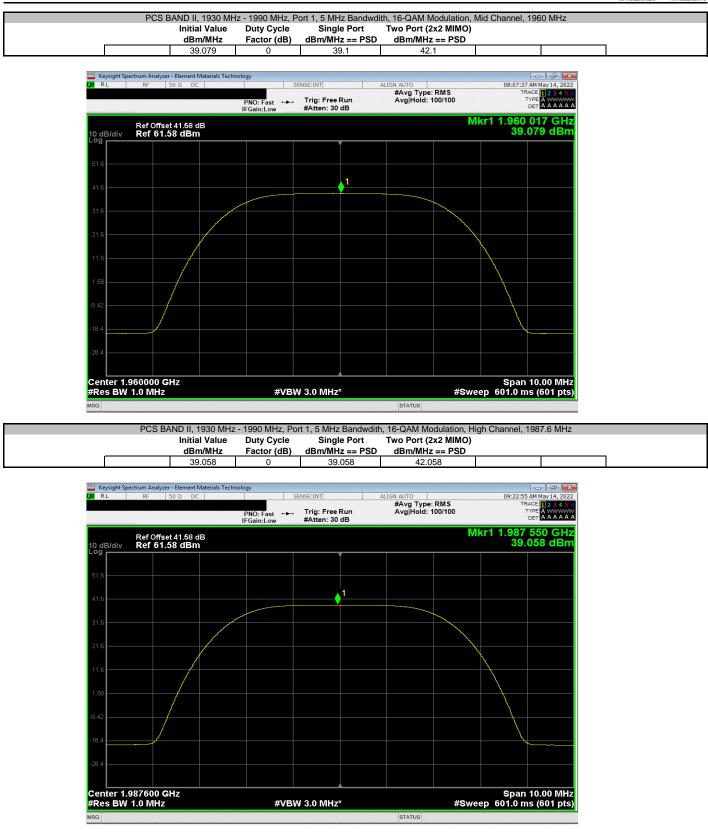




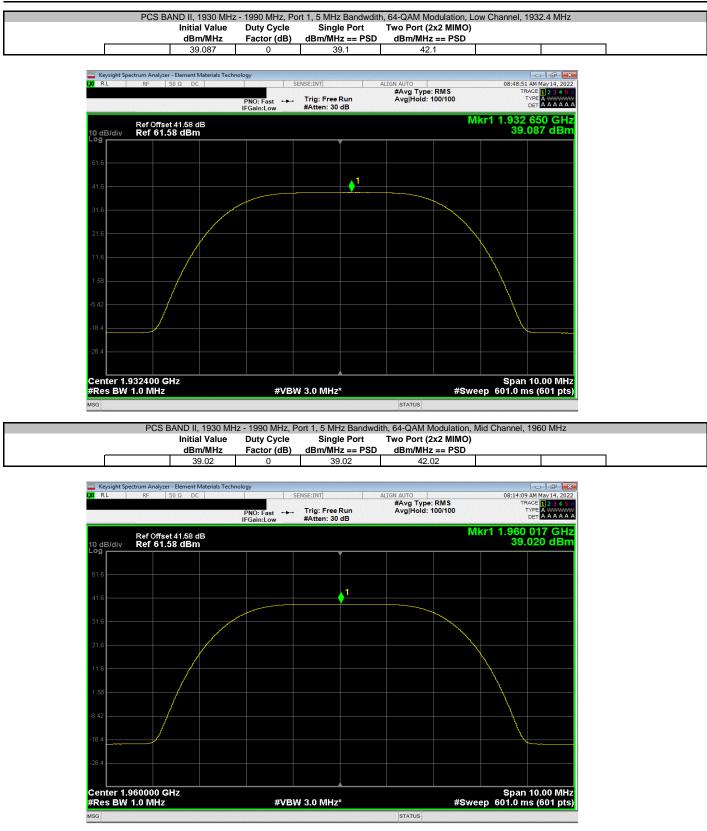












POWER SPECTRAL DENSITY AND EIRP CALCULATIONS PCS





0 0 3

POWER SPECTRAL DENSITY AND EIRP CALCULATIONS PCS



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 ISED EIRP Regulatory Limits.



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.

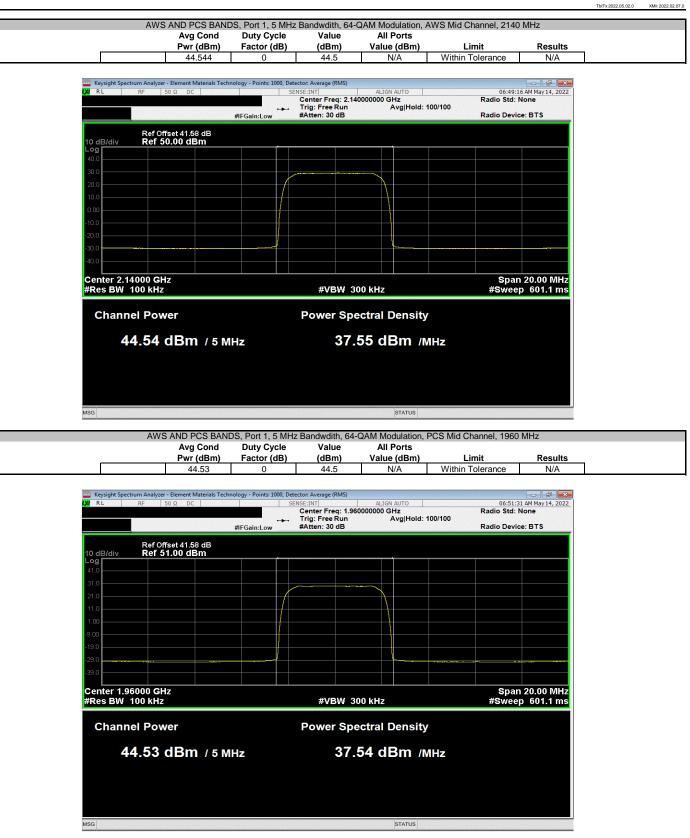
The method in section 5.2.4.4 of ANSI C63.26 was used to make the measurements. This method uses trace averaging across the ON and OFF times of the EUT transmissions in the spectrum analyzer channel power function using an RMS detector. Following the measurement a duty cycle correction was applied by 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.



								1Dt1 X 2022.05.02.0	AMIT 2022.02.07.0
EUT:	AHFII (FCC/I	SED C2PC)					Work Order:	NOKI0040	
Serial Number:	YK21400003	6					Date:	13-May-22	
Customer:	Nokia Soluti	ons and Network	S				Temperature:	23.6 °C	
		hn Rattanavong						47.9% RH	
Project:							Barometric Pres.:		
	Brandon Hol	obs		Power: 54 VDC			Job Site:	TX05	
TEST SPECIFICAT	IONS			Test Method					
FCC 24E:2022				ANSI C63.26:2015					
RSS-133 Issue 6:20	013+A1:2018			RSS-133 Issue 6:20)13+A1:2018				
FCC 27:2022				ANSI C63.26:2015					
RSS-139 Issue 3:20	015			RSS-139 Issue 3:20)15				
COMMENTS									
			ted for: attenuators, cables, DC block and	d filter when in use. PCS Band II / A	WS Band X carriers	s were enabled a	t maximum power (3	30 watts/carrier).	
DEVIATIONS FROM	M TEST STAN	DARD							
None									
Configuration #	2	2	Signature	Jar					
		-		Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	All Ports Value (dBm)	Limit	Results
AWS AND PCS BA									
	Port 1								
		5 MHz Bandwdith							
		64-0	QAM Modulation						
			AWS Mid Channel, 2140 MHz	44.544	0	44.5	N/A	Within Tolerance	N/A
			PCS Mid Channel, 1960 MHz	44.530	0	44.5	N/A	Within Tolerance	N/A
	Port 2								
		5 MHz Bandwdith							
		64-0	QAM Modulation AWS Mid Channel, 2140 MHz	11 501	0	44.5	N1/A	Within Tolerance	N1/A
			PCS Mid Channel, 2140 MHz	44.501 44.548	0	44.5 44.5	N/A N/A	Within Tolerance	N/A N/A
	Port 3		PC3 Mid Charliner, 1900 MHz	44.346	0	44.5	IN/A	Within Tolerance	IN/A
		5 MHz Bandwdith							
			QAM Modulation						
		0.0	AWS Mid Channel, 2140 MHz	44,599	0	44.6	N/A	Within Tolerance	N/A
			PCS Mid Channel, 1960 MHz	44.502	õ	44.5	N/A	Within Tolerance	N/A
	Port 4					-			
		5 MHz Bandwdith							
		64-0	QAM Modulation						
			AWS Mid Channel, 2140 MHz	44.426	0	44.4	N/A	Within Tolerance	N/A
			PCS Mid Channel, 1960 MHz	44.445	0	44.4	N/A	Within Tolerance	N/A
	All Ports								
		5 MHz Bandwdith							
		64-0	QAM Modulation						
			AWS Mid Channel, 2140 MHz	N/A	0	N/A	50.5	N/A	N/A
			PCS Mid Channel, 1960 MHz	N/A	0	N/A	50.5	N/A	N/A

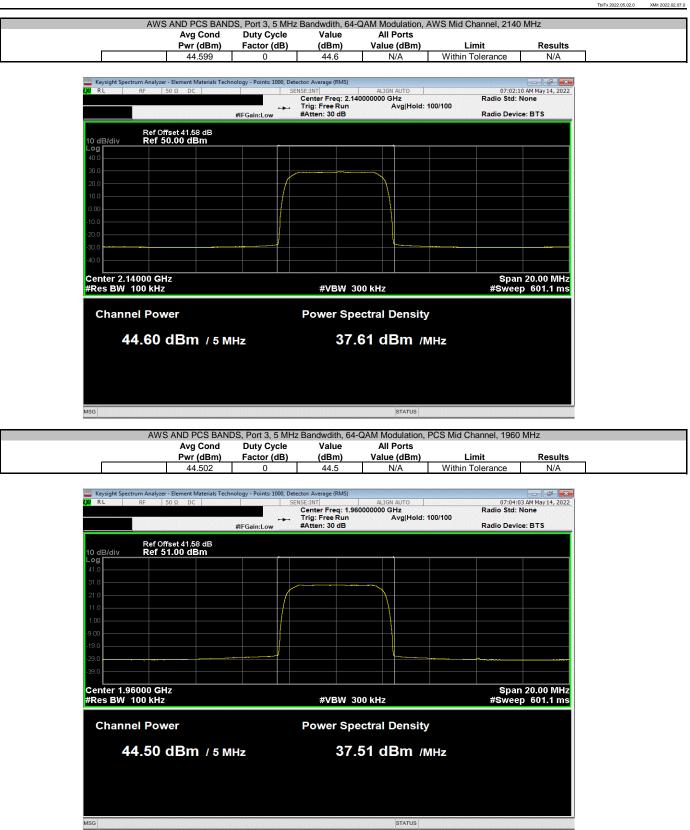




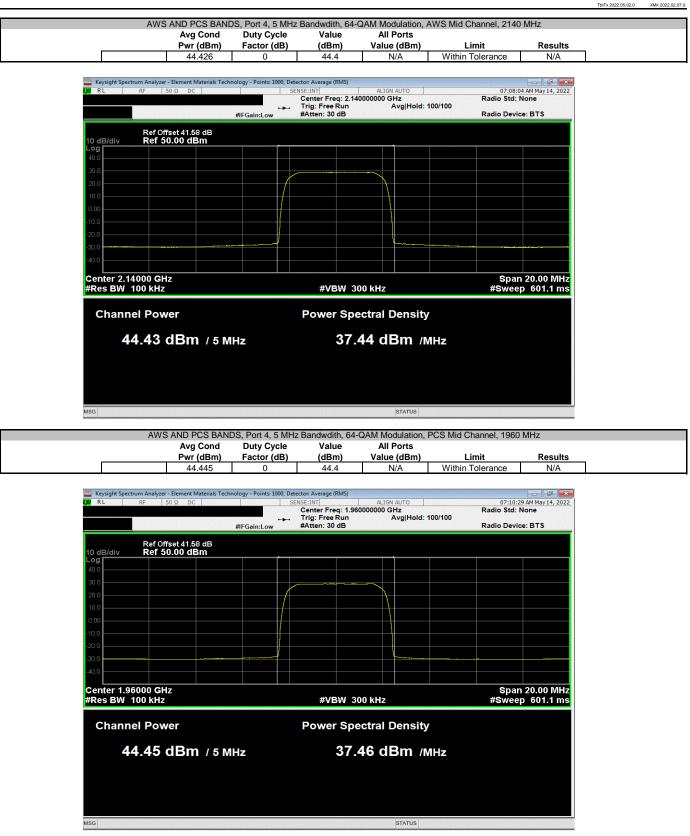


	Pwr (dBm) 44.501	Factor (dB) 0	(dBm) 44.5	Value (dBm)	Within To		Results N/A	
			•					
Keysight Spectrum Ana	lyzer - Element Materials Techn 50 Ω DC		ENSE:INT	ALIGN AUTO		06:55:55 Radio Std: N	5 AM May 14, 2022	
		#IFGain:Low	Trig: Free Run #Atten: 30 dB		1: 100/100	Radio Devic		
Re	f Offset 41.58 dB							
Log	f 50.00 dBm							
40.0 30.0								
20.0								
10.0 0.00								
-10.0								
-30.0								
-40.0								
Center 2.14000 #Res BW 100 k			#VBW	300 kHz			20.00 MHz 601.1 ms	
Channel P			Douver O	a ofral Dorrei	6.			
				pectral Densi				
44.5	0 dBm / 5 мі	Hz	37	7.51 dBm	/MHz			
	WS AND PCS BAND	DS Port 2 5 ME	łz Bandwdith 6	STATUS	PCS Mid Ch	annel 1960	MHz	
	WS AND PCS BAND Avg Cond Pwr (dBm)	DS, Port 2, 5 MF Duty Cycle Factor (dB)	łz Bandwdith, 6 Value (dBm)				MHz Results	_
MSG	Avg Cond	Duty Cycle	Value	4-QAM Modulation All Ports		nit		7
Keysight Spectrum Anu	Avg Cond Pwr (dBm) 44.548	Duty Cycle Factor (dB) 0	Value (dBm) 44.5	4-QAM Modulation All Ports Value (dBm) N/A	Lin	hit Nerance	Results N/A	
A	Avg Cond Pwr (dBm) 44.548	Duty Cycle Factor (dB) 0 hology - Points: 1000, De	Value (dBm) 44.5 tector: Average (RMS) EENSE:INT Center Freq: 1. Trig: Free Run	4-QAM Modulation All Ports Value (dBm) N/A	Lin	lerance 06:58:01 Radio Std: N	Results N/A	7
A Keysight Spectrum And RL RF	Avg Cond Pwr (dBm) 44.548 Ilyzer - Element Materials Techn 50 Ω DC	Duty Cycle Factor (dB) 0	Value (dBm) 44.5 etector: Average (RMS) ENSE:INT Center Freq: 1.	4-QAM Modulation All Ports Value (dBm) N/A	U Uithin To	nit Nerance	Results N/A	
A Keysight Spectrum Ann R L RF 10 dB/div Re Log	Avg Cond Pwr (dBm) 44.548	Duty Cycle Factor (dB) 0 hology - Points: 1000, De	Value (dBm) 44.5 tector: Average (RMS) EENSE:INT Center Freq: 1. Trig: Free Run	4-QAM Modulation All Ports Value (dBm) N/A	U Uithin To	lerance 06:58:01 Radio Std: N	Results N/A	1
A Keysight Spectrum Ana Z RL RF B B 10 dB}diy Re	Avg Cond Pwr (dBm) 44.548 Ilyzer - Element Materials Techn 50 Ω DC	Duty Cycle Factor (dB) 0 hology - Points: 1000, De	Value (dBm) 44.5 tector: Average (RMS) EENSE:INT Center Freq: 1. Trig: Free Run	4-QAM Modulation All Ports Value (dBm) N/A	U Uithin To	lerance 06:58:01 Radio Std: N	Results N/A	
Keysight Spectrum Ana RL RF 10 dB/div Re 40.0 30.0 20.0	Avg Cond Pwr (dBm) 44.548 Ilyzer - Element Materials Techn 50 Ω DC	Duty Cycle Factor (dB) 0 hology - Points: 1000, De	Value (dBm) 44.5 tector: Average (RMS) EENSE:INT Center Freq: 1. Trig: Free Run	4-QAM Modulation All Ports Value (dBm) N/A	U Uithin To	lerance 06:58:01 Radio Std: N	Results N/A	
Keysight Spectrum Ana Keysight Spectrum Ana Keysight RL RF Cog 40.0 30.0	Avg Cond Pwr (dBm) 44.548 Ilyzer - Element Materials Techn 50 Ω DC	Duty Cycle Factor (dB) 0 hology - Points: 1000, De	Value (dBm) 44.5 tector: Average (RMS) EENSE:INT Center Freq: 1. Trig: Free Run	4-QAM Modulation All Ports Value (dBm) N/A	U Uithin To	lerance 06:58:01 Radio Std: N	Results N/A	
A Keysight Spectrum And R L RF 10 dB/div Re Log 40.0 30.0 20.0 10.0 0.00 -10.0	Avg Cond Pwr (dBm) 44.548	Duty Cycle Factor (dB) 0 hology - Points: 1000, De	Value (dBm) 44.5 tector: Average (RMS) EENSE:INT Center Freq: 1. Trig: Free Run	4-QAM Modulation All Ports Value (dBm) N/A	U Uithin To	lerance 06:58:01 Radio Std: N	Results N/A	
A Keysight Spectrum An RE 10 dB/div Re 10 dB/div 10 d	Avg Cond Pwr (dBm) 44.548	Duty Cycle Factor (dB) 0 hology - Points: 1000, De	Value (dBm) 44.5 tector: Average (RMS) EENSE:INT Center Freq: 1. Trig: Free Run	4-QAM Modulation All Ports Value (dBm) N/A	U Uithin To	lerance 06:58:01 Radio Std: N	Results N/A	
A Keysight Spectrum Ans RL RF 10 dB/div Re 40.0 30.0 20.0 10.0 -20.0 -30.0 -40.0 -40.0 -40.0 RE RE RE RE RE RE RE R	Avg Cond Pwr (dBm) 44.548 ilyzer - Element Materials Techn 50 Ω DC f 0ffset 41.58 dB f 50.00 dBm	Duty Cycle Factor (dB) 0 hology - Points: 1000, De	Value (dBm) 44.5 tector: Average (RMS) EENSE:INT Center Freq: 1. Trig: Free Run	4-QAM Modulation All Ports Value (dBm) N/A	U Uithin To	lerance 06:58:00 Radio Std: N Radio Devic	Results N/A	
A Keysight Spectrum And RL RF 10 dB/div Re Log 40.0 30.0 20.0 10.0 0.00 -10.0 -20.0 -30.0	Avg Cond Pwr (dBm) 44.548 ilyzer - Element Materials Techn 50 Ω DC f 50 Ω DC f 50.00 dBm gHz	Duty Cycle Factor (dB) 0 hology - Points: 1000, De	Value (dBm) 44.5 tector: Average (RMS) EENSE:INT Center Freq: 1. Trig: Free Run #Atten: 30 dB	4-QAM Modulation All Ports Value (dBm) N/A	U Uithin To	nit Ilerance Radio Std: N Radio Devic	Results N/A	
A Keysight Spectrum Ann Ann Keysight Sp	Avg Cond Pwr (dBm) 44.548 Avg Cond Pwr (dBm) 44.548 Avg Cond Formation (dBm) Formation (dBm) Forma	Duty Cycle Factor (dB) 0 hology - Points: 1000, De	Value (dBm) 44.5 tector: Average (RMS) EENSE:INT Center Freq: 1. Trig: Free Run #Atten: 30 dB	4-QAM Modulation All Ports Value (dBm) N/A ALISM AUTO 960000000 GHz Avg Hold	4: 100/100	nit Ilerance Radio Std: N Radio Devic	Results N/A AM May 14, 2022 Ione e: BTS 20.00 MHz	
A Keysight Spectrum Ana RL RF Cog 40.0 30.0 20.0 10.0 20.0 30.0 20.0 40.0 Center 1.96000 #Res BW 100 k Channel PA	Avg Cond Pwr (dBm) 44.548	Duty Cycle Factor (dB) 0	Value (dBm) 44.5 tector Average (RMS) ENSE:INT Center Freq: 1. Trig: Free Run #Atten: 30 dB #WBW #VBW	4-QAM Modulation All Ports Value (dBm) N/A 96000000 GHz Avg Hol	Lin Within To	nit Ilerance Radio Std: N Radio Devic	Results N/A AM May 14, 2022 Ione e: BTS 20.00 MHz	
A Keysight Spectrum Ann Keysight Spectrum Ann Keysight Spectrum Ann Keysight Spectrum Ann Keysight Spectrum Ann Re 10 dB/div Re 10 dB/div Re Re 10 dB/div Re Re 10 dB/div Re Re 10 dB/div Re Re 10 dB/div Re Re 10 dB/div Re Re 10 dB/div Re Re 10 dB/div Re Re 10 dB/div Re Re Re Re Re Re Re R	Avg Cond Pwr (dBm) 44.548 Avg Cond Pwr (dBm) 44.548 Avg Cond Formation (dBm) Formation (dBm) Forma	Duty Cycle Factor (dB) 0	Value (dBm) 44.5 tector Average (RMS) ENSE:INT Center Freq: 1. Trig: Free Run #Atten: 30 dB #WBW #VBW	4-QAM Modulation All Ports Value (dBm) N/A ALISM AUTO 960000000 GHz Avg Hold	Lin Within To	nit Ilerance Radio Std: N Radio Devic	Results N/A AM May 14, 2022 Ione e: BTS 20.00 MHz	











AWS AND PCS BANDS, All F	Ports, 5 MHz Ban	dwdith, 64-QAM	Modulation, AWS	Mid Channel, 21	I40 MHz	
Avg Cond	Duty Cycle	Value	All Ports			
 Pwr (dBm)	Factor (dB)	(dBm)	Value (dBm)	Limit	Results	_
N/A	0	N/A	50.5	N/A	N/A	1

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 F	PCS BANDS, All I	Ports, 5 MHz Bar	dwdith, 64-QAM	Modulation, PCS	Mid Channel, 19	60 MHz	
	Avg Cond	Duty Cycle	Value	All Ports			
	Pwr (dBm)	Factor (dB)	(dBm)	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		



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

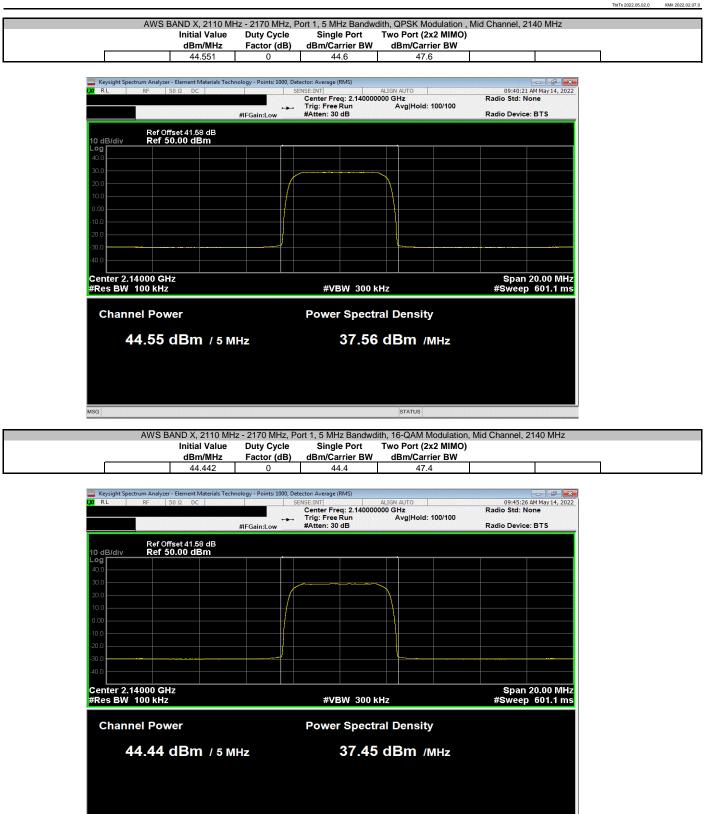
RF conducted emissions testing was performed only on one port. The testing was performed on the same version of hardware (AHFII) as the original certification test. The AHFII antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in this certification 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.



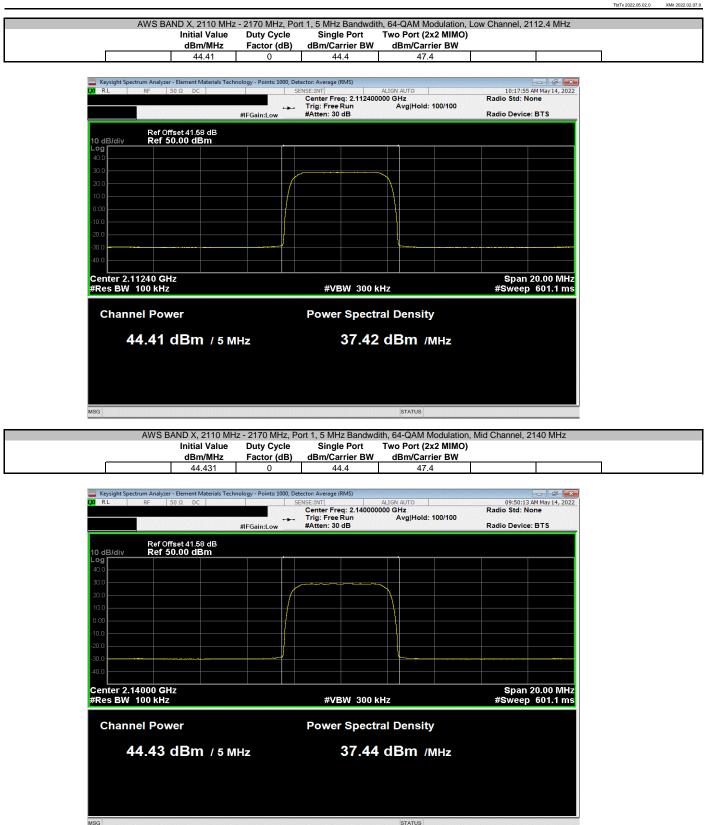
I measurement path losses were accounted for in the reference level offest including any attenuators, filters and DC blocks. AWS band X carriers are enabled at maximum power (30 watts/carrier). The following is utput power measurements at the radio output ports. The output power was measured for a single carrier over the carrier channel bandwidth on port 1. The total output power for multiport (2x2 MIMO) operation was termined 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)]. EVIATIONS FROM TEST STANDARD one								Th/Tx 2022 05 02 0 XMit 2022
Berial Number: Type: Date: 13-May-22 Attendees: Date: 13-May-22 Project: None Humidity: 49%, RH Tested by: Barometric Pres: 1016 mbar 251 SPECIFICATIONS Test Method Job Site: TX05 C2 7:2022 ANSI C63.26:2015 SC SC SS-139 Issue 3:2015 MENTS RSS-139 Issue 3:2015 Method Duty up over measurements at the radio output ports. The output power as measured for a single carrier over the carrier channel bandwidth on port 1. The total output power for multiport (2x2 MIMO) operation was termined based upon ANSI 63.26 clauses 6.4.3.1 and 6.4.3.2.4 (10 log Nout). The total output power or two port operation is single port power + 3dB [i.e. 10log(2)]. EVATIONS FROM TEST STANDARD Initial Value Duty Cycle Single Port Two Port (2x2 MIMO) operation was termined Addith VIS BAND X, 2110 MHz - 2170 MHz Mid Channel, 2140 MHz 44.551 0 44.6 47.6 Mid Channel, 2140 MHz 44.451 0 44.4 47.4 Inco Channel, 2140 MHz 44.421 0 44.4 47.4								
Customer: Nokia Solutions and Metworks Temperature: 22.4 *C. Attendees: David Le, John Rattanavong Humidity: 49% RH Project: None Barometric Press: 1014 mbar Tested by: Barandon Hobbs Job Site: 17X05 ST SPECIFICATIONS Test Method Job Site: 17X05 ST SPECIFICATIONS Test Method Job Site: 17X05 ST SPECIFICATIONS RSS-139 Issue 3:2015 Starting Site: 17X05 OMMENTS Inessurement path losses were accounted for in the reference level offest including any attenuators, filters and DC blocks. AWS band X carriers are enabled at maximum power (30 watts/carrier). The following is in the treation 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 termined 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)]. EVIATIONS FROM TEST STANDARD Initial Value Duty Cycle Single Port Two Port (2x2 MIMO) Mid Channel, 2140 MHz 44.551 0 44.6 47.6 16-QAM Modulation Mid Channel, 2140 MHz 44.451 0 44.4 47.4 Mid Channel, 2140 MHz 4								
Attendees: David Le, John Rattanavong Humidity: Barometric Pres. 1014 mbar Tested by: Brandon Hobbs Power: 54 VDC Job Site: 17x05 C2 7:202 ANSI C63.26.2015 SS:139 Issue 3:2015 SS:139 Issue 3:2015 SS:139 Issue 3:2015 In measurement path losses were accounted for in the reference level offest including any attenuators, filters and DC blocks. AWS band X carriers are enabled at maximum power (30 watts/carrier). The following is input 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 termined based upon ANSI 63.26 clauses 6.4.3.1 and 6.4.3.2.4 (10 log Nout). The total output power rot row port operation is single port power + 3dB [i.e. 10log(2)]. EVIATIONS FROM TEST STANDARD Signature Initial Value Duty Cycle Single Port Two Port (2x2 MIMO) Onfiguration # 2 Signature Initial Value Duty Cycle Single Port Two Port (2x2 MIMO) I for QAM Modulation Mid Channel, 2140 MHz 44.4551 0 44.4 47.4 I fo-QAM Modulation Mid Channel, 2140 MHz 44.401 0 44.4 47.4 I fo-QAM Modulation Id-QAM Modulation Id-QAM Midu Miz Id-QAM Midu Miz								
Project: None Barometric Pres. 1014 mbar Tested by: Brandon Hobbs Job Site: TX05 EST SPECIFICATIONS Test Method Job Site: TX05 SS 139 Issue 3:2015 ANSI C63.26.2015 SS SS DMMENTS RSS-139 Issue 3:2015 SS SSS SS SS								
Tested by: Brandom Hobbs Job Site: TX05 EST SPECIFICATIONS Test Method C <td< td=""><td></td><td></td><td>ong</td><td></td><td></td><td></td><td></td><td></td></td<>			ong					
ST SPECIFICATIONS Test Method C2 27:2022 ANSI C63.26:2015 SS139 Issue 3:2015 RSS:139 Issue 3:2015 OMMENTS RSS:139 Issue 3:2015 I measurement path losses were accounted for in the reference level offest including any attenuators, filters and DC blocks. AWS band X carriers are enabled at maximum power (30 watts/carrier). The following is in the reference level offest including any attenuators, filters and DC blocks. AWS band X carriers are enabled at maximum power (30 watts/carrier). The following is a the radio 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 teermined 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)]. EVIATIONS FROM TEST STANDARD one onfiguration # 2 Signature Initial Value Bm/MHz Factor (dB) Single Port Two Port (2x2 MIMO) WS BAND X, 2110 MHz - 2170 MHz Mid Channel, 2140 MHz 44.551 0 44.6 47.6 Mid Channel, 2140 MHz 44.410 0 44.4 47.4 Mid Channel, 2140 MHz 44.410 0 44.4 47.4 Mid Channel, 2140 MHz 44.410 0 44.4 47.4								
ANSI C63.26:2015 RSS-139 Issue 3:2015 Ineasurement path losses were accounted for in the reference level offest including any attenuators, filters and DC blocks. AWS band X carriers are enabled at maximum power (30 watts/carrier). The following is input power measurements at the radio 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 termined 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)]. EVIATIONS FROM TEST STANDARD Done Done Done Done Done Done Done Don							Job Site: TX	05
SS-139 Issue 3:2015 RSS-139 Issue 3:2015 DMMENTS Imeasurement path losses were accounted for in the reference level offest including any attenuators, filters and DC blocks. AWS band X carriers are enabled at maximum power (30 watts/carrier). The following is input power measurements at the radio 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 been mined 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)]. EVIATIONS FROM TEST STANDARD one Initial Value Duty Cycle Single Port Two Port (2x2 MIMO) onfiguration # 2 Signature Initial Value Duty Cycle Single Port Two Port (2x2 MIMO) VIS BAND X, 2110 MHz - 2170 MHz 5 MHz Bandwdith QPSK Modulation Gammed A4.551 0 44.6 47.6 Mid Channel, 2140 MHz 44.451 0 44.4 47.4 Mid Channel, 2140 MHz 44.410 0 44.4 47.4								
OMMENTS If measurement path losses were accounted for in the reference level offest including any attenuators, filters and DC blocks. AWS band X carriers are enabled at maximum power (30 watts/carrier). The following is input power measurements at the radio output poxer. 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 the measurements at the radio output power for multiport (2x2 MIMO) operation was the termined 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)]. EVIATIONS FROM TEST STANDARD Onfiguration # 2 Signature Two Port (2x2 MIMO) Onfiguration # 2 Signature Initial Value Duty Cycle Single Port Two Port (2x2 MIMO) Mintial Value Onfiguration # 2 Signature Two Port (2x2 MIMO) Mintial Value Duty Cycle Single Port Two Port (2x2 MIMO)								
In measurement path losses were accounted for in the reference level offest including any attenuators, filters and DC blocks. AWS band X carriers are enabled at maximum power (30 watts/carrier). The following is input 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 tearmined 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)].				RSS-139 Issue 3:2	015			
the 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 termined 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)].	COMMENTS							
termined 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)]. EVIATIONS FROM TEST STANDARD One Signature Initial Value dBm/MHz Duty Cycle Single Port GBm/Carrier BW Two Port (2x2 MIMO) dBm/Carrier BW The total dBm/Carrier BW The total dBm/Carrier BW Total dBm/Carrier BW Total dBm/Carrier BW The total dBm/Carrier	All measurement path lo	osses were accounte	d for in the reference level offest including	any attenuators, filters and DC bloo	cks. AWS band X	carriers are enabled	at maximum power (30 w	atts/carrier). The following is
termined 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)]. EVIATIONS FROM TEST STANDARD One Signature Initial Value dBm/MHz Duty Cycle Single Port GBm/Carrier BW Two Port (2x2 MIMO) dBm/Carrier BW The total dBm/Carrier BW The total dBm/Carrier BW Total dBm/Carrier BW Total dBm/Carrier BW The total dBm/Carrier	utput power measurem	nents at the radio ou	tput ports. The output power was measured	for a single carrier over the carrie	r channel bandwid	th on port 1. The to	al output power for multi	port (2x2 MIMO) operation wa
Initial Value Duty Cycle Single Port Two Port (2x2 MIMO) dBm//Larrier BW dBm//Carrier BW dBm//Carrier BW MS BAND X, 2110 MHz - 2170 MHz Port 1 5 MHz Bandwdith 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	EVIATIONS FROM TES	ST STANDARD						
WS BAND X, 2110 MHz - 2170 MHz Visit Channel, 2140 MHz Visit Channel, 2112, Visit Channe	None		Signature	Jan				
Port 1 5 MHz Bandwdith QPSK Modulation Mid Channel, 2140 MHz 44.551 0 44.6 47.6 16-QAM Modulation 10 44.4 47.4 Low Channel, 2112.4 MHz 44.410 0 44.4 47.4 Mid Channel, 2140 MHz 44.431 0 44.4 47.4	None		Signature		Duty Cycle	Single Port	Two Port (2x2 MIMO)	
5 MHz Bandwdith OPSK Modulation Mid Channel, 2140 MHz 44.551 0 44.6 47.6 16-QAM Modulation U Mid Channel, 2140 MHz 44.442 0 44.4 47.4 64-QAM Modulation U Low Channel, 2112.4 MHz 44.410 0 44.4 47.4 Mid Channel, 2140 MHz 44.431 0 44.4 47.4	lone		Signature					
QPSK Modulation Mid Channel, 2140 MHz 44.551 0 44.6 47.6 16-QAM Modulation	one configuration #	2	Signature					
Mid Channel, 2140 MHz 44.551 0 44.6 47.6 16-QAM Modulation	Configuration #	2 - 2170 MHz	Signature					
16-QAM Modulation Mid Channel, 2140 MHz 44.442 0 44.4 47.4 64-QAM Modulation	Configuration #	2 : - 2170 MHz 1	• • •					
Mid Channel, 2140 MHz 44.442 0 44.4 47.4 64-QAM Modulation	Configuration #	2 : - 2170 MHz 1	wdith					
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	ione configuration # WS BAND X, 2110 MHz	2 : - 2170 MHz 1	wdith QPSK Modulation	dBm/MHz	Factor (dB)	dBm/Carrier BW	dBm/Carrier BW	
Low Channel, 2112.4 MHz 44.410 0 44.4 47.4 Mid Channel, 2140 MHz 44.431 0 44.4 47.4	Configuration #	2 : - 2170 MHz 1	wdith QPSK Modulation Mid Channel, 2140 MHz	dBm/MHz	Factor (dB)	dBm/Carrier BW	dBm/Carrier BW	
Mid Channel, 2140 MHz 44.431 0 44.4 47.4	ione configuration # WS BAND X, 2110 MHz	2 : - 2170 MHz 1	wdith QPSK Modulation Mid Channel, 2140 MHz 16-QAM Modulation	dBm/MHz 44.551	Factor (dB)	dBm/Carrier BW 44.6	dBm/Carrier BW	
Mid Channel, 2140 MHz 44.431 0 44.4 47.4	Configuration #	2 : - 2170 MHz 1	wdith QPSK Modulation Mid Channel, 2140 MHz 16-QAM Modulation Mid Channel, 2140 MHz	dBm/MHz 44.551	Factor (dB)	dBm/Carrier BW 44.6	dBm/Carrier BW	
High Channel, 2167.6 MHz 44.343 0 44.3 47.3	Configuration #	2 : - 2170 MHz 1	wdith QPSK Modulation Mid Channel, 2140 MHz 16-QAM Modulation 64-QAM Modulation	dBm/MHz 44.551 44.442	Factor (dB)	dBm/Čarrier BW 44.6 44.4	dBm/Carrier BW 47.6 47.4	
	None Configuration # AWS BAND X, 2110 MHz	2 : - 2170 MHz 1	wdith QPSK Modulation Mid Channel, 2140 MHz 16-QAM Modulation Mid Channel, 2140 MHz 64-QAM Modulation Low Channel, 2112.4 MHz	dBm/MHz 44.551 44.442 44.410	Factor (dB)	dBm/Čarrier BW 44.6 44.4 44.4	dBm/Carrier BW 47.6 47.4 47.4	



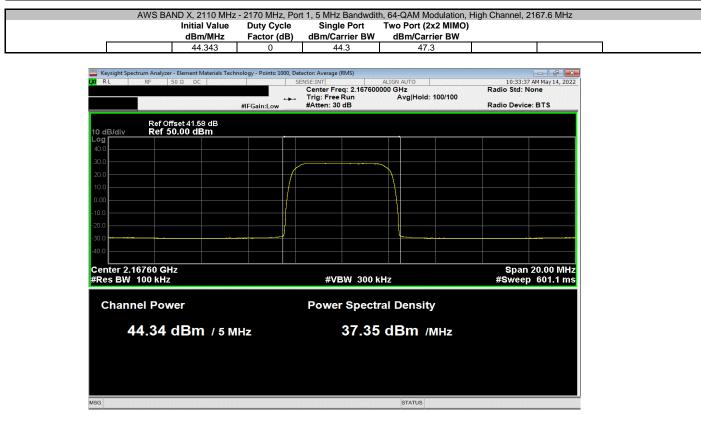


STATUS









3



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

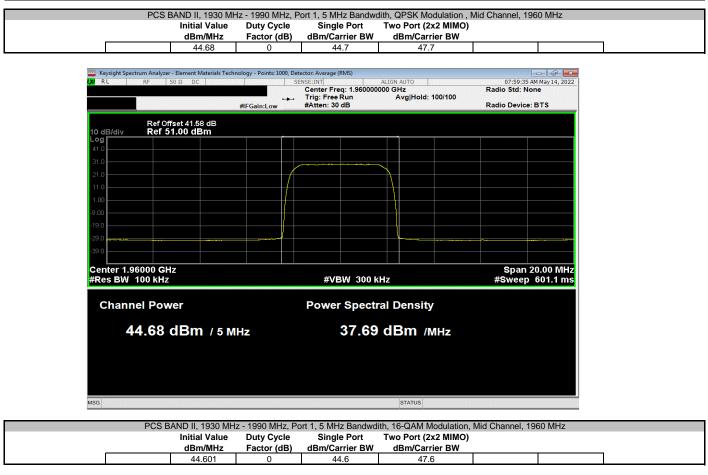
RF conducted emissions testing was performed only on one port. The testing was performed on the same version of hardware (AHFII) as the original certification test. The AHFII antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in this certification 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



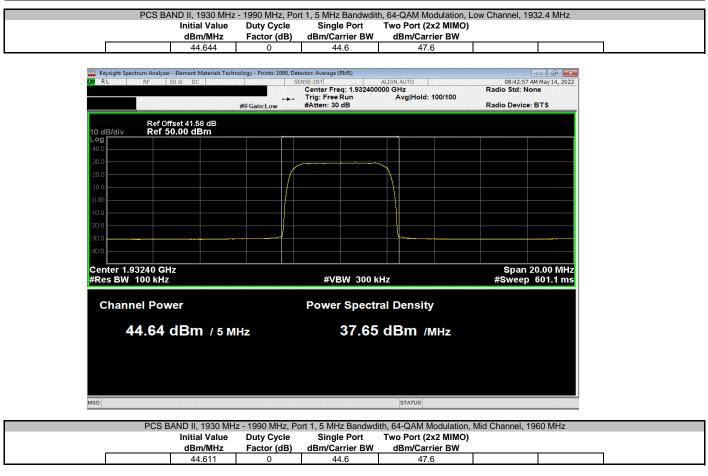
	AHFII (FCC/ISED C2PC)					Work Order:	
Serial Number:							13-May-22
	Nokia Solutions and Net					Temperature:	
	David Le, John Rattanav	/ong					49.9% RH
Project:						Barometric Pres.:	
	Brandon Hobbs		Power: 54 VDC			Job Site:	TX05
TEST SPECIFICAT	FIONS		Test Method				
FCC 24E:2022			ANSI C63.26:2015				
RSS-133 Issue 6:20	013+A1:2018		RSS-133 Issue 6:2	2013+A1:2018			
COMMENTS							
All measurement p	path losses were account	ed for in the reference level offest includ	ling any attenuators, filters and DC b	locks. PCS Band	Il carriers are enable	ed at maximum power (3	30 watts/carrier). The following is
the output power n	measurements at the radi	o output ports. The output power was m	easured for a single carrier over the	carrier channel b	andwidth on port 1.	The total output power	for multiport (2x2 MIMO) operatio
		uses 6.4.3.1 and 6.4.3.2.4 (10 log Nout).					
			· · · · · · · · · · · · · · · · · · ·			50.12	
DEVIATIONS FROM	M TEST STANDARD						
	M TEST STANDARD						
DEVIATIONS FROM							
DEVIATIONS FROM	M TEST STANDARD		- A-A				
DEVIATIONS FROM		Signature	-J-1				
DEVIATIONS FROM		Signature	Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	
DEVIATIONS FROM None Configuration #	2	Signature	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW	
DEVIATIONS FROM None Configuration # PCS BAND II, 1930	2) MHz - 1990 MHz	Signature					
DEVIATIONS FROM None Configuration # PCS BAND II, 1930	2) MHz - 1990 MHz Port 1						
DEVIATIONS FROM None Configuration # PCS BAND II, 1930	2) MHz - 1990 MHz	wdith					
DEVIATIONS FROM None Configuration # PCS BAND II, 1930	2) MHz - 1990 MHz Port 1	wdith QPSK Modulation	dBm/MHz	Factor (dB)	dBm/Carrier BW	dBm/Carrier BW	
DEVIATIONS FROM None Configuration # PCS BAND II, 1930	2) MHz - 1990 MHz Port 1	wdith QPSK Modulation Mid Channel, 1960 MHz					
DEVIATIONS FROM None Configuration # PCS BAND II, 1930	2) MHz - 1990 MHz Port 1	wdith QPSK Modulation Mid Channel, 1960 MHz 16-QAM Modulation	dBm/MHz 44.680	Factor (dB)	dBm/Carrier BW 44.7	dBm/Carrier BW	
DEVIATIONS FROM None Configuration # PCS BAND II, 1930	2) MHz - 1990 MHz Port 1	wdith QPSK Modulation Mid Channel, 1960 MHz 16-QAM Modulation Mid Channel, 1960 MHz	dBm/MHz	Factor (dB)	dBm/Carrier BW	dBm/Carrier BW	
DEVIATIONS FROM None Configuration # PCS BAND II, 1930	2) MHz - 1990 MHz Port 1	wdith QPSK Modulation Mid Channel, 1960 MHz 16-QAM Modulation 64-QAM Modulation	dBm/MHz 44.680 44.601	Factor (dB) 0 0	44.7 44.6	dBm/Carrier BW 47.7 47.6	
DEVIATIONS FROM None Configuration # PCS BAND II, 1930	2) MHz - 1990 MHz Port 1	wdith QPSK Modulation Mid Channel, 1960 MHz 16-QAM Modulation Mid Channel, 1960 MHz 64-QAM Modulation Low Channel, 1932.4 MHz	dBm/MHz 44.680 44.601 44.644	Factor (dB) 0 0	dBm/Carrier BW 44.7 44.6 44.6	dBm/Carrier BW 47.7 47.6 47.6	
DEVIATIONS FROM None Configuration # PCS BAND II, 1930	2) MHz - 1990 MHz Port 1	wdith QPSK Modulation Mid Channel, 1960 MHz 16-QAM Modulation 64-QAM Modulation	dBm/MHz 44.680 44.601	Factor (dB) 0 0	44.7 44.6	dBm/Carrier BW 47.7 47.6	





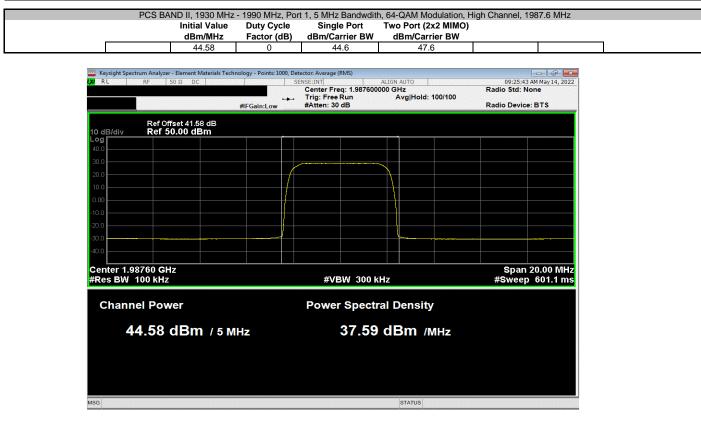
RL	trum Analyzer - Element Materials T RF 50 Ω DC	centrology / bints, 1000,	SENSE:INT		GN AUTO	08:06	07 AM May 14, 20	
KAR TURBER I ISA	10 0035 00		Center Free	q: 1.96000000	GHz		Radio Std: None	
		#IFGain:Low	Trig: Free Run Avg Hold: 100/100 W #Atten: 30 dB			Radio Dev	Radio Device: BTS	
1001.0	Ref Offset 41.58 dB Ref 50.00 dBm							
dB/div	Rei Suluu aBm							
).0								
).0								
					\			
		/						
.0								
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							- 00 00 540	
	6000 GHz 100 kHz		#\/B	W 300 kHz		spa #Swoo	n 20.00 MH ep 601.1 m	
Ces DW	TOO KITZ		# V D	WW 300 KH2	•	#Swee	<i>р</i> оот. г п	
Chann	el Power		Dower	Spectral	Density			
Chann	lei Powei		Power	Spectral	Density			
Л	4.60 dBm / 5			27 61 6	IBm /мнz			
4	4.00 UDIII / 5	MHZ		37.010				
					STATUS			





RL	ctrum Analyzer - Element Materials Tech RF 50 Ω DC		SENSE:INT		IGN AUTO		08:12:2	29 AM May 14, 20
				eq: 1.96000000		1	Radio Std:	
			Trig: Free	Run	Avg Hold	I: 100/100		
		#IFGain:Low	#Atten: 30	dB			Radio Devi	ce: BTS
	Ref Offset 41.58 dB							
) dB/div	Ref 50.00 dBm							_
-9 10								
).0								
0.0			A		<u> </u>			
).0								
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	96000 GHz						Spar	n 20.00 MH
Res BW	100 kHz		#VE	3W 300 kH:	z		#Swee	p 601.1 m
Chanr	nel Power		Powe	r Spectra	l Densi	hv		
ontain				opeena	Benor	-9		
4	I4.61 dBm / 5 м	Hz		37.62	dBm	MHz		





3.0

0.0



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.

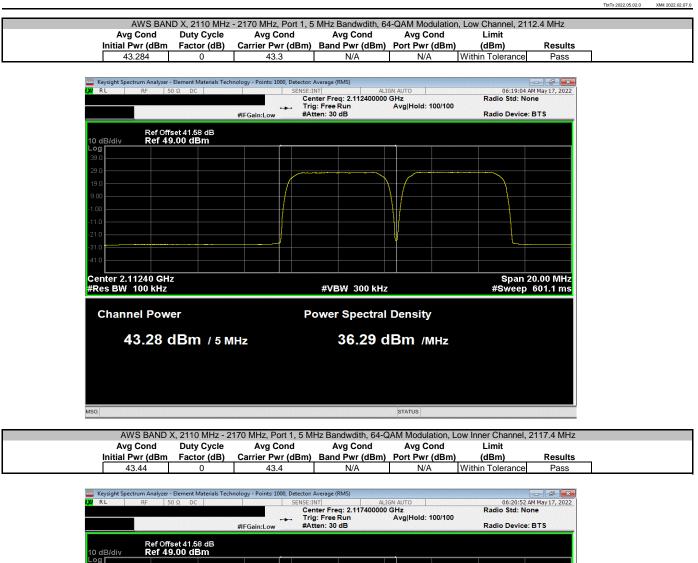
RF conducted emissions testing was performed only on one port. The AHFII antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown during 4 port output power testing) and antenna port 1 was selected to perform the testing under this effort as 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: a) 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).
 - b) 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).



					1			TbtTx 2022.05.02.0	XMit 2022.0
	AHFII (FCC/ISED C2PC)						Work Order:		
Serial Number:		transfer						16-May-22	
	Nokia Solutions and Net					Temperature: 23.5 °C			
	David Le, John Rattanav	/ong				Humidity: 47.5% RH Barometric Pres.: 1019 mbar			
Project:	None Brandon Hobbs		Power:	54.1/00			Job Site:		
TEST SPECIFICAT				54 VDC Test Method			Job Site:	1 X05	
	IUNS				~				
CC 24E:2022				ANSI C63.26:201					
RSS-133 Issue 6:20	U13+A1:2018			RSS-133 Issue 6:					
FCC 27:2022				ANSI C63.26:201					
RSS-139 Issue 3:20	015			RSS-139 Issue 3:	2015				
COMMENTS		ed for in the reference level offest including a							
EVIATIONS FROM	M TEST STANDARD		<i>.</i>						
Configuration #	2	Signature	<u> </u>	1					
			Avg Cond Initial Pwr (dBm)	Duty Cycle Factor (dB)	Avg Cond Carrier Pwr (dBm)	Avg Cond Bond Bwr (dBm)	Avg Cond	Limit (dBm)	Results
AWS BAND X, 2110			initial Fwr (ubili)	Factor (ub)	Carrier Pwr (ubili)	Banu Pwr (uBin)	FOIL FWI (UBIII)	(авп)	Results
AWS BAND A, 2110	Port 1								
	5 MHz Band	wdith							
	o miniz Bana								
		64-QAM Modulation							
		64-QAM Modulation	43,284	0	43.3	N/A	N/A	Within Tolerance	Pass
		64-QAM Modulation Low Channel, 2112.4 MHz Low Inner Channel, 2117.4 MHz	43.284 43.440	0	43.3 43.4	N/A N/A	N/A N/A	Within Tolerance Within Tolerance	Pass Pass
		Low Channel, 2112.4 MHz							
		Low Channel, 2112.4 MHz Low Inner Channel, 2117.4 MHz	43.440	0	43.4	N/A	N/A	Within Tolerance	Pass
		Low Channel, 2112.4 MHz Low Inner Channel, 2117.4 MHz Mid Left Channel, 2137.5 MHz	43.440 42.791	0	43.4 42.8	N/A N/A	N/A N/A	Within Tolerance Within Tolerance	Pass Pass
PCS BAND II, 1930	Port 1	Low Channel, 2112.4 MHz Low Inner Channel, 2117.4 MHz Mid Left Channel, 2137.5 MHz Mid Right Channel, 2142.5 MHz High Channel, 2167.6 MHz	43.440 42.791 42.795	0 0 0	43.4 42.8 42.8	N/A N/A N/A	N/A N/A N/A	Within Tolerance Within Tolerance Within Tolerance	Pass Pass Pass
PCS BAND II, 1930		Low Channel, 2112.4 MHz Low Inner Channel, 2117.4 MHz Mid Left Channel, 2137.5 MHz Mid Right Channel, 2142.5 MHz High Channel, 2167.6 MHz	43.440 42.791 42.795	0 0 0	43.4 42.8 42.8	N/A N/A N/A	N/A N/A N/A	Within Tolerance Within Tolerance Within Tolerance	Pass Pass Pass
PCS BAND II, 1930	Port 1	Low Channel, 2112.4 MHz Low Inner Channel, 2117.4 MHz Mid Left Channel, 2137.5 MHz Mid Right Channel, 2142.5 MHz High Channel, 2167.6 MHz wdith	43.440 42.791 42.795	0 0 0	43.4 42.8 42.8	N/A N/A N/A	N/A N/A N/A	Within Tolerance Within Tolerance Within Tolerance	Pass Pass Pass
PCS BAND II, 1930	Port 1	Low Channel, 2112.4 MHz Low Inner Channel, 2117.4 MHz Mid Left Channel, 2137.5 MHz Mid Right Channel, 2142.5 MHz High Channel, 2167.6 MHz wdith 64-QAM Modulation	43.440 42.791 42.795 44.155	0 0 0	43.4 42.8 42.8 44.2	N/A N/A N/A N/A	N/A N/A N/A N/A	Within Tolerance Within Tolerance Within Tolerance Within Tolerance	Pass Pass Pass Pass
PCS BAND II, 1930	Port 1	Low Channel, 2112.4 MHz Low Inner Channel, 2117.4 MHz Mid Left Channel, 2137.5 MHz Mid Right Channel, 2142.5 MHz High Channel, 2167.6 MHz wdith 64-QAM Modulation Low Channel, 1932.4 MHz	43.440 42.791 42.795 44.155 43.302	0 0 0 0	43.4 42.8 42.8 44.2 43.3	N/A N/A N/A N/A	N/A N/A N/A N/A	Within Tolerance Within Tolerance Within Tolerance Within Tolerance	Pass Pass Pass Pass Pass
PCS BAND II, 1930	Port 1	Low Channel, 2112.4 MHz Low Inner Channel, 2137.4 MHz Mid Left Channel, 2137.5 MHz Mid Right Channel, 2142.5 MHz High Channel, 2167.6 MHz Wdith 64-QAM Modulation Low Channel, 1932.4 MHz Low Inner Channal, 1937.4 MHz	43.440 42.791 42.795 44.155 43.302 43.606	0 0 0 0	43.4 42.8 42.8 44.2 43.3 43.6	N/A N/A N/A N/A	N/A N/A N/A N/A	Within Tolerance Within Tolerance Within Tolerance Within Tolerance	Pass Pass Pass Pass Pass Pass
PCS BAND II, 1930	Port 1	Low Channel, 2112.4 MHz Low Inner Channel, 2117.4 MHz Mid Left Channel, 2137.5 MHz Mid Right Channel, 2142.5 MHz High Channel, 2167.6 MHz G4-QAM Modulation Low Channel, 1932.4 MHz Low Inner Channel, 1937.4 MHz Mid Left Channel, 1937.5 MHz	43.440 42.791 42.795 44.155 43.302 43.606 42.684	0 0 0 0	43.4 42.8 42.8 44.2 43.3 43.6 42.7	N/A N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A	Within Tolerance Within Tolerance Within Tolerance Within Tolerance Within Tolerance Within Tolerance Within Tolerance	Pass Pass Pass Pass Pass Pass Pass
	Port 1 5 MHz Band	Low Channel, 2112.4 MHz Low Inner Channel, 2117.4 MHz Mid Left Channel, 2137.5 MHz Mid Right Channel, 2142.5 MHz High Channel, 2167.6 MHz Wdith 64-QAM Modulation Low Inner Channel, 1932.4 MHz Low Inner Channel, 1937.4 MHz Mid Left Channel, 1957.5 MHz Mid Right Channel, 1952.5 MHz High Channel, 1987.6 MHz	43.440 42.791 42.795 44.155 43.302 43.606 42.694 42.718		43.4 42.8 42.8 44.2 43.3 43.6 42.7 42.7	N/A N/A N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A N/A N/A	Within Tolerance Within Tolerance Within Tolerance Within Tolerance Within Tolerance Within Tolerance Within Tolerance	Pass Pass Pass Pass Pass Pass Pass Pass
	Port 1 5 MHz Band	Low Channel, 2112.4 MHz Low Channel, 2137.4 MHz Mid Left Channel, 2137.5 MHz Mid Right Channel, 2137.5 MHz High Channel, 2167.6 MHz Wdith 64-QAM Modulation Low Channel, 1932.4 MHz Low Inner Channel, 1937.4 MHz Mid Right Channel, 1957.5 MHz High Channel, 1987.6 MHz Wdith 64-QAM Modulation	43,440 42,791 42,795 44,155 43,302 43,606 42,694 42,718 44,223	0 0 0 0 0 0 0 0 0 0	43.4 42.8 42.8 44.2 43.3 43.6 42.7 42.7 42.7 42.7 44.2	N/A N/A N/A N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A N/A N/A N/A	Within Tolerance Within Tolerance Within Tolerance Within Tolerance Within Tolerance Within Tolerance Within Tolerance Within Tolerance	Pass Pass Pass Pass Pass Pass Pass Pass
PCS BAND II, 1930	Port 1 5 MHz Band	Low Channel, 2112.4 MHz Low Inner Channel, 2117.4 MHz Mid Left Channel, 2137.5 MHz Mid Right Channel, 2142.5 MHz High Channel, 2167.6 MHz Wdith 64-QAM Modulation Low Inner Channel, 1932.4 MHz Low Inner Channel, 1937.4 MHz Mid Left Channel, 1957.5 MHz Mid Right Channel, 1952.5 MHz High Channel, 1987.6 MHz	43,440 42,791 42,795 44,155 43,302 43,606 42,694 42,718 44,223		43.4 42.8 42.8 44.2 43.3 43.6 42.7 42.7	N/A N/A N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A N/A N/A	Within Tolerance Within Tolerance Within Tolerance Within Tolerance Within Tolerance Within Tolerance Within Tolerance	Pass Pass Pass Pass Pass Pass Pass Pass

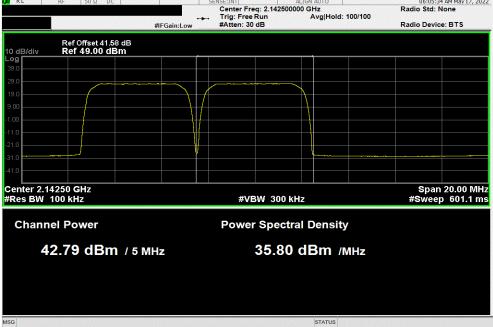




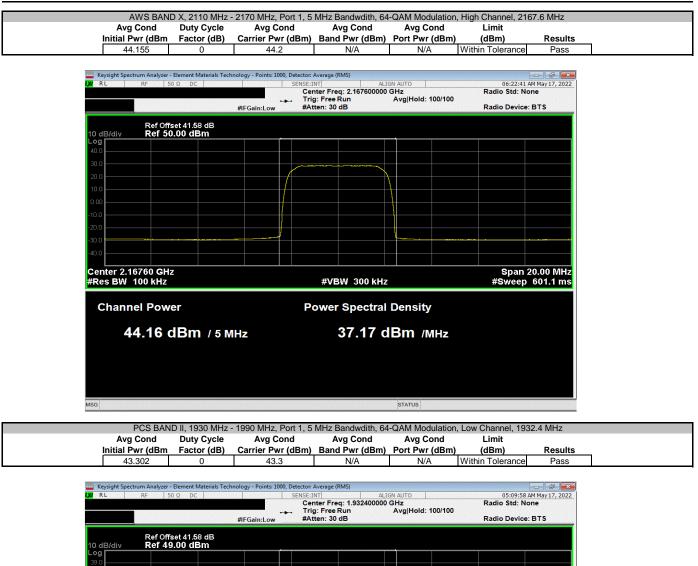
31.0 41.0		
Center 2.11740 GHz #Res BW 100 kHz	#VBW 300 kHz	Span 20.00 MHz #Sweep 601.1 ms
Channel Power	Power Spectral Density	
43.44 dBm / 5 мнz	36.45 dBm /мн	łz
MSG	STATUS	











29.0						
19.0						
9.00						
-1.00						
-11.0						
-21.0						
-31.0						
-41.0						
Center 1.93240 GHz #Res BW 100 kHz	#VBW 300 kHz	Span 20.00 MHz #Sweep 601.1 ms				
Channel Power	Power Spectral Density					
43.30 dBm / 5 мнz	36.31 dBm /мнz					
	STATUS					





39.0	·										
29.0											
19.0											
9.00											
-1.00											
-11.0											
-21.0							I V				
-31.0											
-41.0							ا ک				
Cen	ter 1.9575	0 GHz								Spar	20.00 MHz
#Res BW 100 kHz					#VBW 300 kHz						- 604 4
#Re	SBW 100	KHZ				#VBW 300K	HZ			#Swee	p 601.1 ms
						₽VBW 300 K	Hz			#Swee	p 601.1 ms
	s BW 100 Channel F					wer Spectr		ensity		#Swee	5 601.1 MS
	Channel F	Power				wer Spectr	al De	-		#Swee	5-601.1 MS
	Channel F	Power	n / 5 MH:	z			al De	-		#Swee	5 601.1 Ms
	Channel F	Power	n / 5 MHz	z		wer Spectr	al De	-		#Swee	5 601.1 MS
	Channel F	Power	n / 5 MH:	z		wer Spectr	al De	-		#Swee	5 601.1 MS
	Channel F	Power	n / 5 MH:	z		wer Spectr	al De	-		#Swee	5 601 .1 ms
	Channel F	Power	n / 5 MH:	Z		wer Spectr	al De	-		#Swee	5 601.1 MS
	Channel F	Power	n / 5 MH;	Z		wer Spectr	al De	-		#Swee	5 601.1 MS





10.0 0.00 -10.0 -20.0 -30.0 -40.0		
Center 1.98760 GHz #Res BW 100 kHz	#VBW 300 kHz	Span 20.00 MHz #Sweep 601.1 ms
Channel Power	Power Spectral Density	
44.22 dBm / 5 мнz	37.23 dBm /мнz	



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

Carrier Band	Carrier Freqencies	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 Bandwdith, 64-QAM Modulation, Multicarrier Multband Test Case 2								
	Avg Cond Duty Cycle Avg Cond Avg Cond Limit								
_	Initial Pwr (dBm)	Factor (dB)	Carrier Pwr (dBm)	Band Pwr (dBm)	Port Pwr (dBm)	(dBm)	Results		
	N/A	0	N/A	View Table	View Table	Within Tolerance	Pass		

Carrier Band	Carrier Freqencies	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