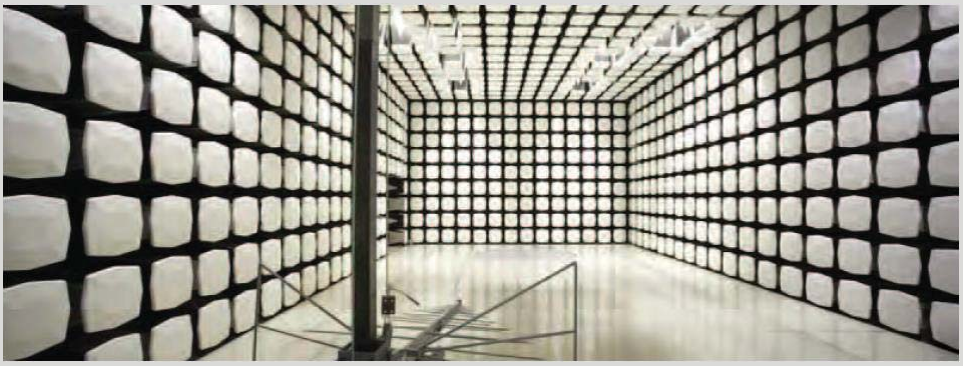
element

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

FCC ID: VBNAHFIHA-01
IC ID: 661W-AHFIHA

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

Report: NOKI0074.0 Rev. 0, Issue Date: April 8, 2024



ilac-MRA

A2LA ACCREDITED
CERT #3310.03

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2023.04.17

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CERTIFICATE OF TEST

Last Date of Test: March 21, 2024
Nokia Solutions and Networks
EUT: Airscale Base Transceiver Station Remote Radio Head Model AHFIHA

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 SRSP-510 Issue 5 – February 2009	ANSI C63.26-2015 with FCC KDB 971168 D01 v03r01 FCC KDB 971168 D03 v01 FCC KDB 662911D01 v02r01 FCC KDB 662911D02 v01

Results

Test Description	Result	Comments
Conducted Output Power/Average Power	Pass	
Power Spectral Density and EIRP Calculations	Pass	
Peak to Average Power	Pass	
Occupied Bandwidth	Pass	
Band Edge Compliance	Pass	
Spurious Emissions at the Antenna Terminals	Pass	
Spurious Radiated Emissions	N/A	Not requested.
Frequency Stability	N/A	Not requested.

Deviations From Test Standards

None

Approved By:

Jeff Alcoke, Senior EMC Test Engineer

Product compliance is the responsibility of the client; therefore, the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information. As indicated in the Statement of Work sent with the quotation, Element's standard process is to always use the latest published version of the test methods even when earlier versions are cited in the test specification. Issuance of a purchase order was de facto acceptance of this approach. Otherwise, the client would have advised Element in writing of the specific version of the test methods they wanted applied to the subject testing.

REVISION HISTORY

Revision Number	Description	Date (yyyy-mm-dd)	Page Number
00	None		

ACCREDITATIONS AND AUTHORIZATIONS

element
2021.09.01

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 Minnesota Oregon Texas Washington

FACILITIES

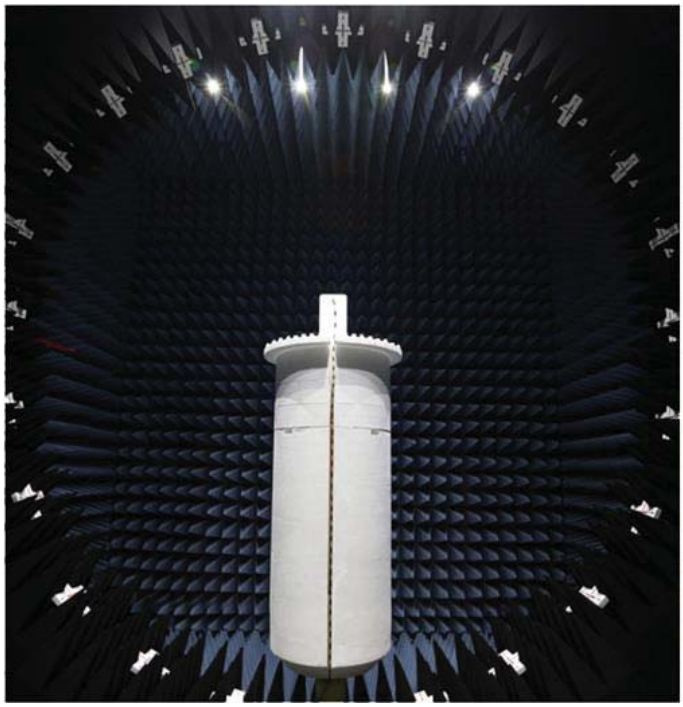
element
2023.09.21

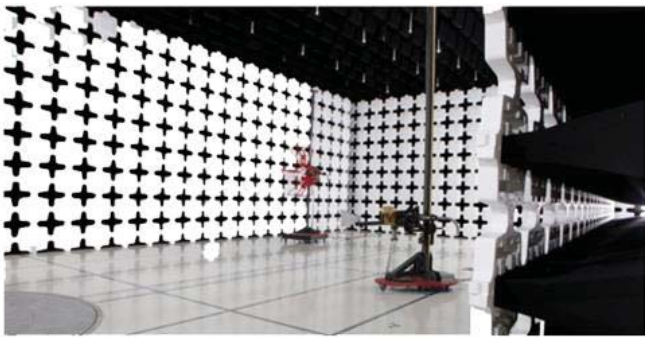
Testing was performed at the following location(s)

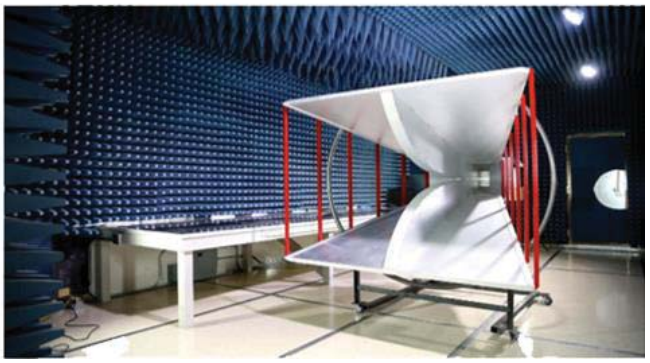
	Location	Labs (1)	Address	A2LA (2)	ISED (3)	BSMI (4)	VCCI (5)	CAB (6)	FDA (7)
☐	California	OC01-17	41 Tesla Irvine, CA 92618 (949) 861-8918	3310.04	2834B	SL2-IN-E-1154R	A-0029	US0158	TL-55
☐	Minnesota	MN01-11	9349 W Broadway Ave. Brooklyn Park, MN 55445 (612) 638-5136	3310.05	2834E	SL2-IN-E-1152R	A-0109	US0175	TL-57
☐	Oregon	EV01-12	6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	3310.02	2834D	SL2-IN-E-1017	A-0108	US0017	TL-56
☒	Texas	TX01-09	3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	3310.03	2834G	SL2-IN-E-1158R	A-0201	US0191	TL-54
☐	Washington	NC01-05	19201 120th Ave NE Bothell, WA 98011 (425) 984-6600	3310.06	2834F	SL2-IN-E-1153R	A-0110	US0157	TL-67
☐	Offsite	N/A	See Product Description	N/A	N/A	N/A	N/A	N/A	N/A

See data sheets for specific labs

(1) The lab designations denote individual rooms within each location. (OC01, OC02, OC03, etc.)
(2) A2LA Certificate No.
(3) ISED Company No.
(4) BSMI No.
(5) VCCI Site Filing No.
(6) CAB Identifier. Recognized Phase I CAB for ISED, ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA
(7) FDA ASCA No.







MEASUREMENT UNCERTAINTY

element
TMU.2015.07.10

Measurement Uncertainty

When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. Measurement uncertainty is a statistical expression of measurement error qualified by a probability distribution.

A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found in the table below. A lab specific value may also be found in the applicable test description section. Our measurement data meets or exceeds the measurement uncertainty requirements of the applicable specification; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for estimating measurement uncertainty are based upon ETSI TR 100 028 (or CISPR 16-4-2 as applicable), and are available upon request.

The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

Test	+ MU	- MU
Frequency Accuracy	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	1.2 dB	-1.2 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.1 dB	-5.1 dB
AC Powerline Conducted Emissions (dB)	3.1 dB	-3.1 dB

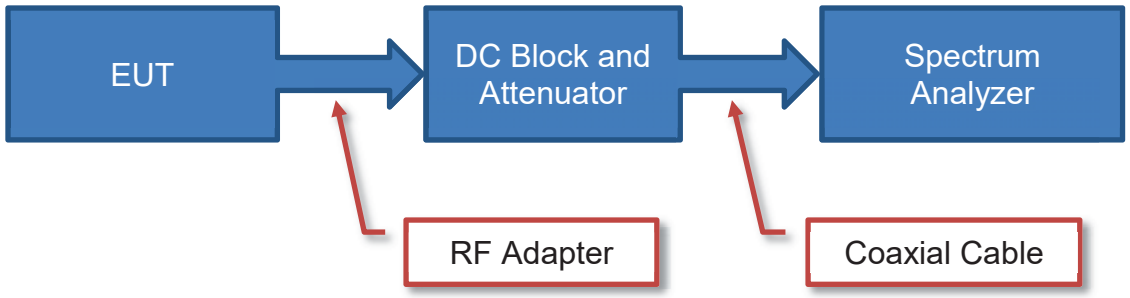
TEST SETUP BLOCK DIAGRAMS

Measurement Bandwidths

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

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

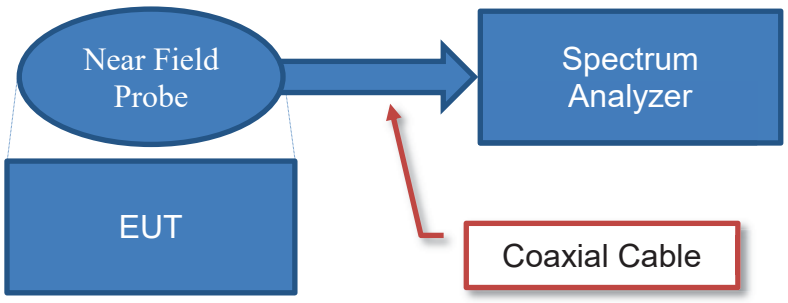
Antenna Port Conducted Measurements



Sample Calculation (logarithmic units)

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

Near Field Test Fixture Measurements

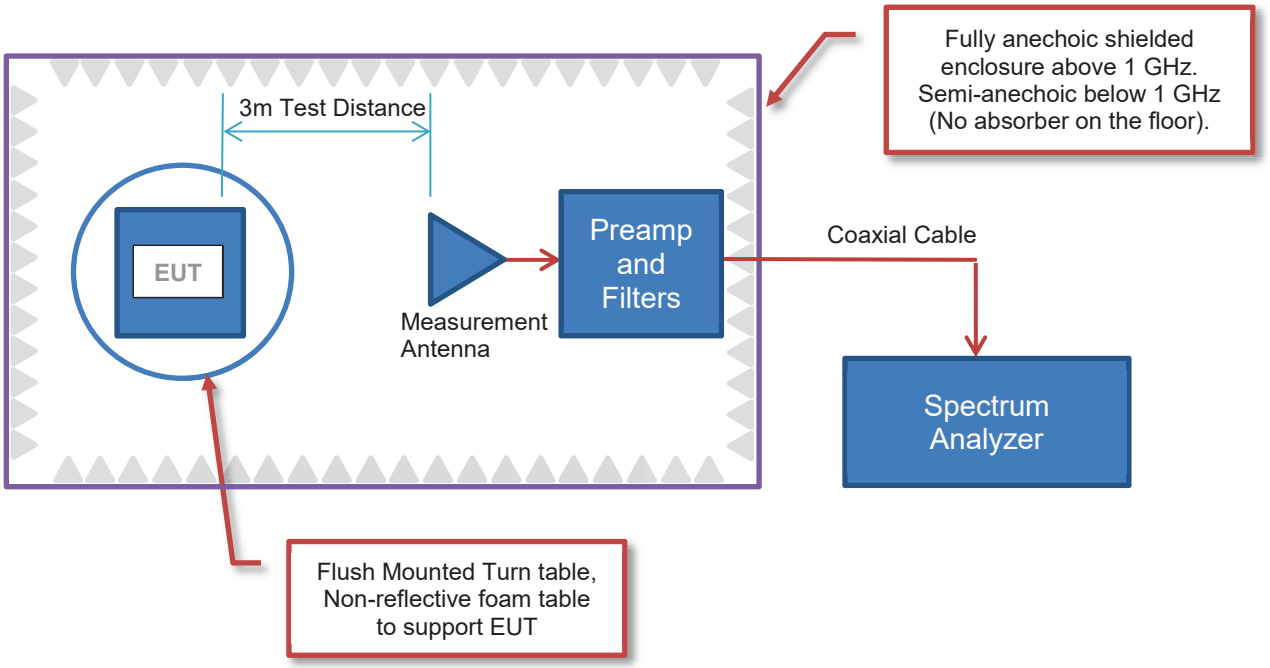


Sample Calculation (logarithmic units)

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

TEST SETUP BLOCK DIAGRAMS

Emissions Measurements



Sample Calculation (logarithmic units)

Radiated Emissions:

Measured Level (Amplitude)		Factor: Antenna Factor		Factor: Cable Factor		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:

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

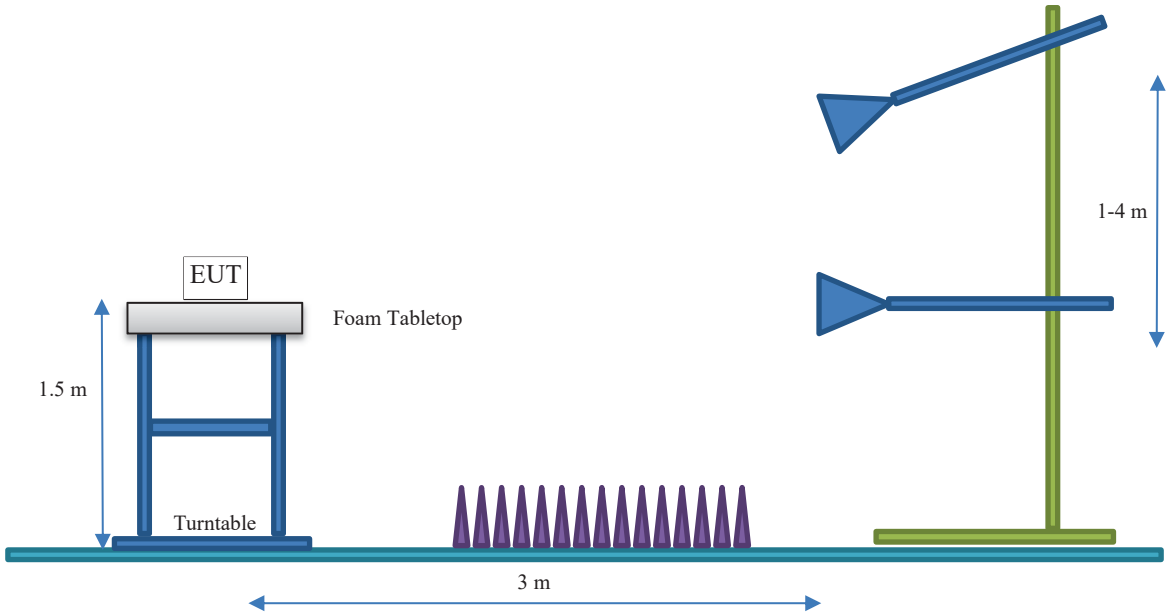
Radiated Power (ERP/EIRP) – Substitution Method:

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

TEST SETUP BLOCK DIAGRAMS

Bore Sighting (>1GHz)

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



PRODUCT DESCRIPTION

Client and Equipment under Test (EUT) Information

Company Name:	Nokia Solutions and Networks
Address:	3201 Olympus Blvd
City, State, Zip:	Dallas, TX 75019
Test Requested By:	Steve Mitchell
EUT:	AirScale Base Transceiver Station Remote Radio Head Model AHFIHA
First Date of Test:	March 18, 2024
Last Date of Test:	March 21, 2024
Receipt Date of Samples:	March 18, 2024
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:

A permissive change on the original filing is being pursued to add 2G and 3G GSM and WCDMA carriers to the AirScale Base Transceiver Station Remote Radio Head Model AHFIHA FCC and ISED radio certifications. The original test effort includes testing for 4G LTE and 5G NR 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 2G and 3G GSM and 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, peak power, emission bandwidth (99% and 26 dB down), band edge spurious emissions, and conducted spurious emissions.

The testing was performed on the same hardware version (AHFIHA) as the original certification test. The base station and remote radio head software for this testing is an updated release that includes 2G GSM and 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.

Remote Radio Head (RRH) variant AHFIHA is being developed under this effort. The AHFIHA 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) and 5G NR. The scope of testing in this effort is for GSM/EDGE and WCDMA FDD operations.

The AHFIHA RRH has four transmit/four receive antenna ports (4TX/4RX for Band 25, 4TX/4RX for Band 66 and 4TX/4RX for Band 7). Each antenna port supports 3GPP frequency band 25 (BTS Rx: 1850 to 1915 MHz/BTS TX: 1930 to 1995 MHz), 3GPP frequency band 66 (BTS Rx: 1710 to 1780 MHz/BTS TX: 2110 to 2200 MHz, and 3GPP frequency band 7 (BTS Rx: 2500 to 2570 MHz/BTS TX: 2620 to 2690 MHz). The maximum RF output power of the RRH is 640 Watts (160 watts per port x 4 ports). The maximum power per band is 60 watts. The maximum single carrier power level is 60 watts. The TX and RX instantaneous bandwidth cover the full operational RRH bandwidth. Multi-carrier operation is supported. The maximum RF output power for single carriers is provided below.

Single Carrier Maximum RF Output Power per Port for each Channel Bandwidth		
LTE1.4, LTE3, NB IoT SA, GSM	**LTE5, NR5, WCDMA**	**LTE10, NR10, LTE15, NR15, LTE20, NR20, NR25, NR30, NR40, NR50**
20.0 Watts or 43.0 dBm	40.0 Watts or 46.0 dBm	60.0 Watts or 47.8 dBm

The RRH may be operated as non-MIMO for GSM/EDGE over 3GPP frequency band 2 “PCS 1900” (BTS Rx: 1850 to 1910 MHz/BTS TX: 1930 to 1990 MHz). The RRH supports two GSM/EDGE downlink modulation types (GMSK and 8PSK).

The RRH may be operated as a 2x2 MIMO or as non-MIMO for 3G WCDMA FDD over 3GPP frequency band 2 (BTS Rx: 1850 to 1910 MHz/BTS TX: 1930 to 1990 MHz). 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.

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.

Single Carrier Test Case Descriptions:
2G and 3G single GSM carrier and single WCDMA carrier are tested at the bottom, middle and top channels provided in PCS frequency channel table.

2G single GSM carriers in 3GPP frequency band 2 “PCS 1900” GSM/EDGE channel bandwidth is 200kHz. The minimum spacing between adjacent GSM/EDGE carriers is 400kHz. The spacing is 200 kHz between channel numbers. The PCS 1900 Band GSM/EDGE downlink channel numbers are provided below.

	Downlink ARFCN UTRA Band 2	Downlink Frequency (MHz)	GSM/EDGE Channels
PCS Band_ AHFIHA Antennas 1, 2, 3, 4	……	1930.0	Band Edge
	512	1930.2	Bottom Channel
	513	1930.4	Bottom Channel + 1
	…		
	661	1960.0	Middle Channel
	…		
	809	1989.6	Top Channel – 1
	810	1989.8	Top Channel
	……	1990.0	Band Edge

AHFIHA Downlink Band Edge 2G GSM/EDGE PCS Band Frequency Channels

3G single WCDMA carriers in 3GPP frequency band 2 “PCS 1900” channel bandwidth is 5MHz. The channel spacing is 200KHz between channel numbers. The PCS 1900 band WCDMA downlink and channel number are provided below.

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

AHFIHA Downlink Band Edge 3G WCDMA PCS Band Frequency Channels

Multi-Carrier Test Case Descriptions:
GSM multi-carrier operations - GSM carriers must be enabled with another multi-RAT (WCDMA. LTE, NR) carrier (in the PCS Band). The antenna port power is enabled at maximum (160 watts/port) for all multicarrier multi-band testing. A LTE10 carrier will be enabled at 60W at 2155.0 MHz (AWS band center channel) using QPSK modulation and a LTE5 carrier will be enabled at 40W at 2655.0 MHz (BRS band center frequency) using QPSK modulation to maximize port power for these multicarrier test cases. The first full power GSM channels (from the single carrier test cases) are used for these test cases. This testing is being performed per KDB 971168 D03v01 guidance.

2G GSM multi-carriers test cases are as follows:

Multicarrier Test Case 1: In the PCS band (Band 2) _Two contiguous GSM/EDGE carriers (operating at maximum power –> 20W/carrier) using two carriers (with minimum spacing between carrier frequencies) at the lower band edge +1 (1930.4 & 1930.8MHz). A single LTE1.4 carrier operating at maximum power (20W) at Band 2 middle channel (1960.0MHz).
In the AWS band _ Single LTE10 carrier at 60W at the middle channel (2155.0MHz).
In the BRS band _ Single LTE5 carrier at 40W at the middle channel (2655.0MHz).
The carriers are operated at maximum power (~20W/PCS carrier, 60W/AWS carrier and 40W/BRS carrier) with a total port power of 160 watts (60W for PCS band carriers + 60W for AWS band carrier + 40W for BRS band carrier).

Multicarrier Test Case 2: In the PCS band (Band 2) _Two contiguous GSM/EDGE carriers (operating at maximum power –> 20W/carrier) using two carriers (with minimum spacing between carrier frequencies) at the upper band edge -1 (1989.2 & 1989.6MHz). A single LTE1.4 carrier operating at maximum power (20W) at Band 2 middle channel (1960.0MHz).
In the AWS band _ Single LTE10 carrier at 60W at the middle channel (2155.0MHz).
In the BRS band _ Single LTE5 carrier at 40W at the middle channel (2655.0MHz).
The carriers are operated at maximum power (~20W/PCS carrier, 60W/AWS carrier and 40W/BRS carrier) with a total port power of 160 watts (60W for PCS band carriers + 60W for AWS band carrier + 40W for BRS band carrier).

Multicarrier Test Case 3: In the PCS band (Band 2) _ Two non-contiguous GSM/EDGE carriers (operating at maximum power –> 20W/carrier) with maximum spacing between carrier frequencies at the lower band edge (1930.4MHz) and upper band edge (1989.6MHz). A single LTE1.4 carrier operating at maximum power (20W) at Band 2 middle channel (1960.0MHz).
In the AWS band _ Single LTE10 carrier at 60W at the middle channel (2155.0MHz).
In the BRS band _ Single LTE5 carrier at 40W at the middle channel (2655.0MHz).
The carriers are operated at maximum power (~20W/PCS carrier, 60W/AWS carrier and 40W/BRS carrier) with a total port power of 160 watts (60W for PCS band carriers + 60W for AWS band carrier + 40W for BRS band carrier).

WCDMA multi-carrier operations - The antenna port power is enabled at maximum (160 watts/port) for all multicarrier multi-band testing. A LTE10 carrier will be enabled at 60W at 2155.0 MHz (AWS band center channel) using QPSK modulation and a LTE5 carrier will be enabled at 40W at 2655.0 MHz (BRS band center frequency) using QPSK modulation to maximize port power for this multicarrier test case. This testing is being performed per KDB 971168 D03v01 guidance.

3G WCDMA multiband/multi-carrier test case is as follows:

a) *PCS Multicarrier:* 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. The carriers are operated at maximum power (~20W/PCS carrier) with a total PCS band carrier power of 60 watts.
b) In the AWS band _One LTE10 carrier at the middle channel (2155 MHz) at maximum power (60W).
c) In the BRS band _One LTE5 carrier at the middle channel (2655 MHz) at maximum power (40W).

PRODUCT DESCRIPTION

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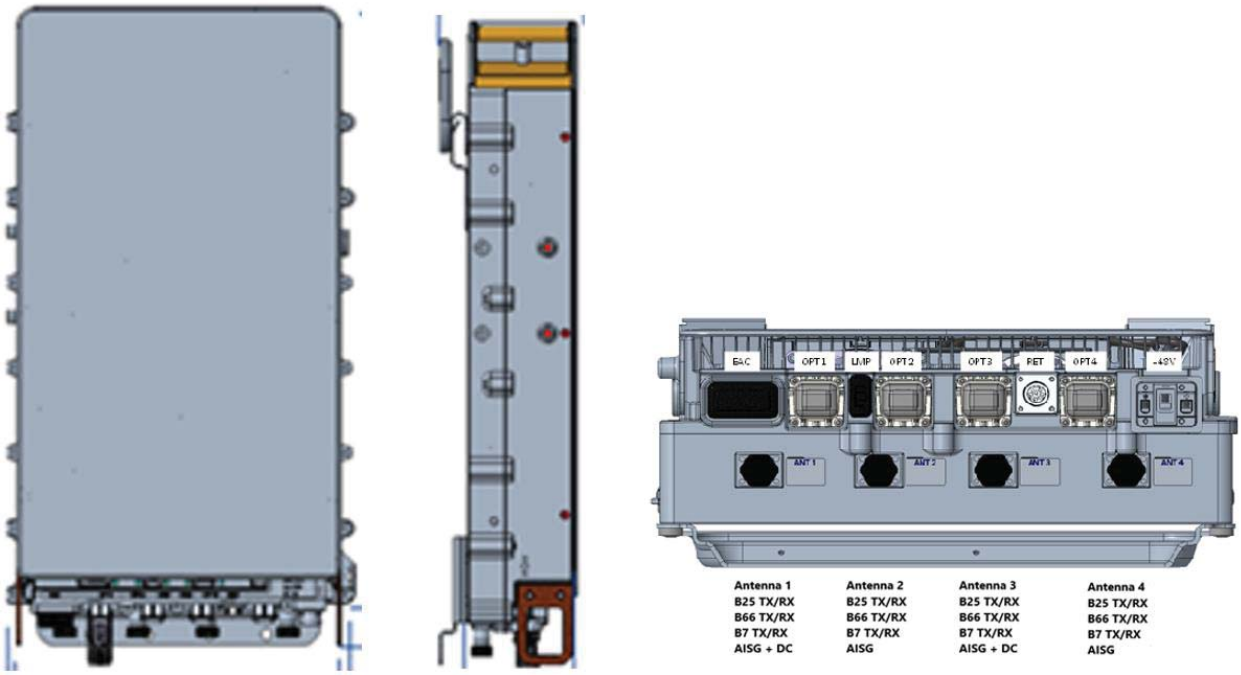
2018-07-17

AHFIHA Connector Layout



AHFIHA External Interfaces

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	4	SFP	Optical Interfaces
RET	1	8-pin circular connector	AISG 3.0 to external devices_ RET RS-485

Testing Objective:

A permissive change on the original filing is being pursued to add 2G and 3G GSM and WCDMA carrier operations to the Nokia Solutions and Networks AirScale Base Transceiver Station (BTS) Remote Radio Head (RRH) model AHFIHA FCC and ISED radio certifications.

CONFIGURATIONS

Test Configuration 1

Software/Firmware Running during test	
Description	**Version**
Radio Module Software	RF.FRM6.23R4.20231202.001
BTS Software Version: 23R4	SBTS23R4_ENB_0000_000936

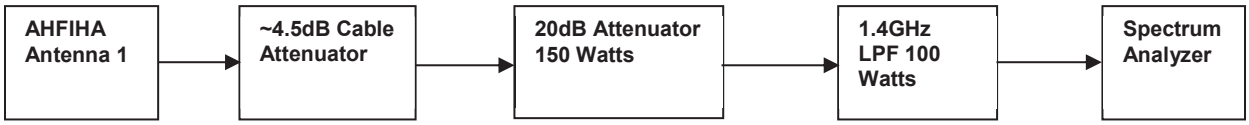
Equipment being tested (include Peripherals)			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
AMIA (BTS System Module)	Nokia Solutions and Networks	473098A.101	J8164063259
ASIA (BTS System Module)	Nokia Solutions and Networks	473095A.101	L1164309322
ABIA (BTS System Module)	Nokia Solutions and Networks	473096A.103	AH173006371
AHFIHA (Radio Module Model)	Nokia Solutions and Networks	475964A.A101	RW233800370
Low Pass Filter 1.4GHz/100W	Microwave Circuits, INC.	L13502G1	SN2454-01
Attenuator 150W/20dB	AeroflexWeinschel	66-20-33	BZ2075
1 Meter RF cable	Huber+suhner	SUCOFLEX 104	SN 554428 /4
2 Meter RF cable	Huber+suhner	SUCOFLEX 106	SN 297372
6 Meter RF cable	Huber+suhner	SUCOFLEX 106	SN528836/6
6 Meter RF cable	Huber+suhner	SUCOFLEX 106	SN528837/6
SFP+ 9.8G,300M,850NM	WTD	RTXM330-541-C39	FR213800502
SFP+ 9.8G,300M,850NM	HG GENUINE	MTRS-1A11-01	KR17030010035
Lenovo	HP	Thinkpad	PF26RRVZ0
Keysight- DC System power supply	HP	N8757A	US21D5054S
FPAD (DC-pwr supply)	Nokia	472805A.101	A9124600282
500W -50ohm -Terminating Load	API Weinschel inc	1434-3-LIM	US882
500W -50ohm -Terminating Load	API Weinschel inc	1434-3-LIM	US879
500W -50ohm -Terminating Load	API Weinschel inc	1434-3-LIM	US880
Fiber Optic cable 2 meters	Rosenberger Fiber Optical	995741A	VZ1701
CAT5e data cable	BELKIN	#R7J304	E178882
2 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN531429/6
2 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297386
2 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN5314432/6

CONFIGURATIONS

Cables (Peripheral)					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
Fiber Optic cable	N	2 meters	N	ABIA	AHFIHA
Cat-5e cable	Y	6 meters	N	ASIB	WebEM- PC
(2) 2 Meters RF cables - HS-SUCOFLEX_106	Y	2 meters	N	EUT [AHFIHA] Ant ports 2, 3, 4	500W -50ohm - Load

Cables					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
HS-SUCOFLEX Cable attenuation	Y	14 meters	N	EUT [AHFIHA] Ant port #1	20dB/150W Attenuator
20dB/150W Attenuator	N	NA	N	RF cable HS - SUCOFLEX_104	Low Pass Filter 1.4GHz/100W
Low Pass Filter 1.4GHz/100W	N	NA	N	20dB/150W Attenuator	RF cable HS-SUCOFLEX_104
HS-SUCOFLEX_104	Y	1 meter	N	Low Pass Filter 1.4GHz/100W	Analyzer

RF Test Setup Diagram:



CONFIGURATIONS

Test Configuration 2

Software/Firmware Running during test	
Description	**Version**
Radio Module Software	RF.FRM6.23R4.20231202.001
BTS Software Version: 23R4	SBTS23R4_ENB_0000_000936

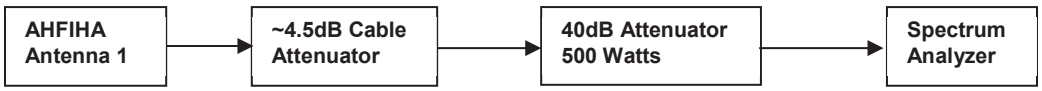
Equipment being tested (include Peripherals)			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
AMIA (BTS System Module)	Nokia Solutions and Networks	473098A.101	J8164063259
ASIA (BTS System Module)	Nokia Solutions and Networks	473095A.101	L1164309322
ABIA (BTS System Module)	Nokia Solutions and Networks	473096A.103	AH173006371
AHFIHA (Radio Module Model)	Nokia Solutions and Networks	475964A.A101	RW233800370
Attenuator 500W/40dB	API Weinschel	253-40-33-LIM	UP093
1 Meter RF cable	Huber+suhner	SUCOFLEX 104	SN 554428 /4
2 Meter RF cable	Huber+suhner	SUCOFLEX 106	SN 297372
6 Meter RF cable	Huber+suhner	SUCOFLEX 106	SN528836/6
6 Meter RF cable	Huber+suhner	SUCOFLEX 106	SN528837/6
SFP+ 9.8G,300M,850NM	WTD	RTXM330-541-C39	FR213800502
SFP+ 9.8G,300M,850NM	HG GENUINE	MTRS-1A11-01	KR17030010035
Lenovo	HP	Thinkpad	PF26RRVZ0
Keysight- DC System power supply	HP	N8757A	US21D5054S
FPAD (DC-pwr supply)	Nokia	472805A.101	A9124600282
500W -50ohm -Terminating Load	API Weinschel inc	1434-3-LIM	US882
500W -50ohm -Terminating Load	API Weinschel inc	1434-3-LIM	US879
500W -50ohm -Terminating Load	API Weinschel inc	1434-3-LIM	US880
Fiber Optic cable 2 meters	Rosenberger Fiber Optical	995741A	VZ1701
CAT5e data cable	BELKIN	#R7J304	E178882
2 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN531429/6
2 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297386
2 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN5314432/6

CONFIGURATIONS

Cables (Peripheral)					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
Fiber Optic cable	N	2 meters	N	ABIA	AHFIHA
Cat-5e cable	Y	6 meters	N	ASIB	WebEM- PC
(2) 2 Meters RF cables - HS-SUCOFLEX_106	Y	2 meters	N	EUT [AHFIHA] Ant ports 2, 3, 4	500W -50ohm - Load

Cables					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
HS-SUCOFLEX Cable attenuation	Y	14 meters	N	EUT [AHFIHA] Ant port #1	40dB/500W Attenuator
40dB/500W Attenuator	N	NA	N	HS-SUCOFLEX Cable attenuation	RF cable HS-SUCOFLEX_104
RF cable HS-SUCOFLEX_104	N	1 Meter	N	40dB/500W Attenuator	Spectrum Analyzer

RF Test Setup Diagram:



CONFIGURATIONS

Test Configuration 3

Software/Firmware Running during test	
Description	**Version**
Radio Module Software	RF.FRM6.23R4.20231202.001
BTS Software Version: 23R4	SBTS23R4_ENB_0000_000936

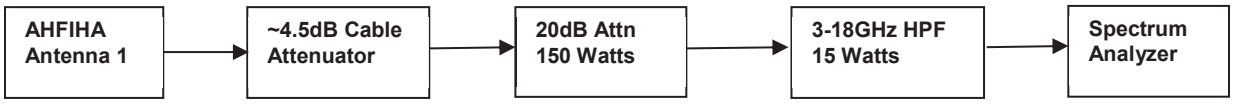
Equipment being tested (include Peripherals)			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
AMIA (BTS System Module)	Nokia Solutions and Networks	473098A.101	J8164063259
ASIA (BTS System Module)	Nokia Solutions and Networks	473095A.101	L1164309322
ABIA (BTS System Module)	Nokia Solutions and Networks	473096A.103	AH173006371
AHFIHA (Radio Module Model)	Nokia Solutions and Networks	475964A.A101	RW233800370
Attenuator 150W/20dB	AeroflexWeinschel	66-20-33	BZ2075
3-18GHz HPF 15 Watts	RF-Lambda	RHPF23G03G18	20121400045
1 Meter RF cable	Huber+suhner	SUCOFLEX 104	SN 554428 /4
2 Meter RF cable	Huber+suhner	SUCOFLEX 106	SN 297372
6 Meter RF cable	Huber+suhner	SUCOFLEX 106	SN528836/6
6 Meter RF cable	Huber+suhner	SUCOFLEX 106	SN528837/6
SFP+ 9.8G,300M,850NM	WTD	RTXM330-541-C39	FR213800502
SFP+ 9.8G,300M,850NM	HG GENUINE	MTRS-1A11-01	KR17030010035
Lenovo	HP	Thinkpad	PF26RRVZ0
Keysight- DC System power supply	HP	N8757A	US21D5054S
FPAD (DC-pwr supply)	Nokia	472805A.101	A9124600282
500W -50ohm -Terminating Load	API Weinschel inc	1434-3-LIM	US882
500W -50ohm -Terminating Load	API Weinschel inc	1434-3-LIM	US879
500W -50ohm -Terminating Load	API Weinschel inc	1434-3-LIM	US880
Fiber Optic cable 2 meters	Rosenberger Fiber Optical	995741A	VZ1701
CAT5e data cable	BELKIN	#R7J304	E178882
2 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN531429/6
2 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297386
2 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN5314432/6

CONFIGURATIONS

Cables (Peripheral)					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
Fiber Optic cable	N	2 meters	N	ABIA	AHFIHA
Cat-5e cable	Y	6 meters	N	ASIB	WebEM- PC
(2) 2 Meters RF cables - HS-SUCOFLEX_106	Y	2 meters	N	EUT [AHFIHA] Ant ports 2, 3, 4	500W -50ohm - Load

Cables					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
HS-SUCOFLEX Cable attenuation	Y	14 meters	N	EUT [AHFIHA] Ant port #1	20dB/150W Attenuator
20dB/150W Attenuator	N	NA	N	HS-SUCOFLEX Cable attenuation	3-18GHz HPF 15 Watts
3-18GHz HPF 15 Watts	N	NA	Na	20dB/150W Attenuator	RF cable HS-SUCOFLEX_104
RF cable HS-SUCOFLEX_104	N	1 meter	N	3-18GHz HPF 15 Watts	Spectrum Analyzer

RF Test Setup Diagram:



CONFIGURATIONS

Test Configuration 4

Software/Firmware Running during test	
Description	**Version**
Radio Module Software	RF.FRM6.23R4.20231202.001
BTS Software Version: 23R4	SBTS23R4_ENB_0000_000936

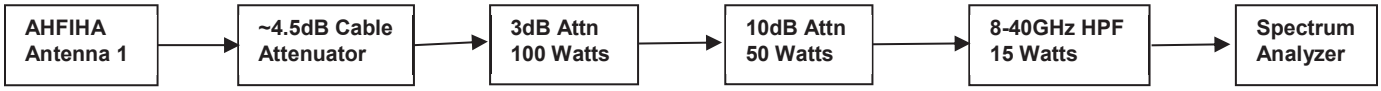
Equipment being tested (include Peripherals)			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
AMIA (BTS System Module)	Nokia Solutions and Networks	473098A.101	J8164063259
ASIA (BTS System Module)	Nokia Solutions and Networks	473095A.101	L1164309322
ABIA (BTS System Module)	Nokia Solutions and Networks	473096A.103	AH173006371
AHFIHA (Radio Module Model)	Nokia Solutions and Networks	475964A.A101	RW233800370
Attenuator 100W/3dB	Aeroflex Weinschel	47-3-33	CG5493
Attenuator 50W/10dB	RF-Lambda	RFS50G26S10FF	200331701
8-40GHz HPF 15 Watts	RF-Lambda	RHPF23G08G40	17102700014
1 Meter RF cable	RF-Lambda	RFC6767A-B7RU1219	SN AC20040003
2 Meter RF cable	Huber+suhner	SUCOFLEX 106	SN 297372
6 Meter RF cable	Huber+suhner	SUCOFLEX 106	SN528836/6
6 Meter RF cable	Huber+suhner	SUCOFLEX 106	SN528837/6
SFP+ 9.8G,300M,850NM	WTD	RTXM330-541-C39	FR213800502
SFP+ 9.8G,300M,850NM	HG GENUINE	MTRS-1A11-01	KR17030010035
Lenovo	HP	Thinkpad	PF26RRVZ0
Keysight- DC System power supply	HP	N8757A	US21D5054S
FPAD (DC-pwr supply)	Nokia	472805A.101	A9124600282
500W -50ohm -Terminating Load	API Weinschel inc	1434-3-LIM	US882
500W -50ohm -Terminating Load	API Weinschel inc	1434-3-LIM	US879
500W -50ohm -Terminating Load	API Weinschel inc	1434-3-LIM	US880
Fiber Optic cable 2 meters	Rosenberger Fiber Optical	995741A	VZ1701
CAT5e data cable	BELKIN	#R7J304	E178882
2 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN531429/6
2 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN297386
2 Meter RF cable	Huber + Suhner, Inc.	HS-SUCOFLEX_106	SN5314432/6

CONFIGURATIONS

Cables (Peripheral)					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
Fiber Optic cable	N	2 meters	N	ABIA	AHFIHA
Cat-5e cable	Y	6 meters	N	ASIB	WebEM- PC
(2) 2 Meters RF cables - HS-SUCOFLEX_106	Y	2 meters	N	EUT [AHFIHA] Ant ports 2, 3, 4	500W -50ohm - Load

Cables					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
HS-SUCOFLEX Cable attenuation	Y	14 meters	N	EUT [AHFIHA] Ant port #1	3dB/100W Attenuator
10dB/50W Attenuator	N	NA	N	3dB/100W Attenuator	8-40GHz HPF 15 Watts
8-40GHz HPF 15 Watts	N	NA	Na	10dB/50W Attenuator	RF Lambda Cable
RF Lambda Cable	N	1 meter	N	8-40GHz HPF 15 Watts	Spectrum Analyzer

RF Test Setup Diagram:



MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2024-03-20	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.
2	2024-03-20	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.
3	2024-03-20	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.
4	2024-03-20	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.
5	2024-03-20	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.
6	2024-03-21	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.

CONDUCTED OUTPUT POWER / AVERAGE POWER - ALL PORTS

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

TEST DESCRIPTION

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.

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.

RF conducted emissions testing was performed on all ports at the middle channel in order to prove the AHFIHA antenna ports are all within the manufacturer's rate output power tolerances (the RF power variation between antenna ports is small as shown in this certification testing).

The RMS average power measurement method for FCC/IC Broadband signal is detailed in section 5.2 of KDB 971168 D01v03r01 and ANSI C63.26-2015 section 5.2.4.4. 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.

The RMS average power measurement method for a narrowband signal (CW-like or noise-like signals) is detailed in ANSI C63.26 section 5.2.4.3.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFJ	2024-02-14	2025-02-14
Block - DC	Fairview Microwave	SD3379	AMM	2023-08-04	2024-08-04
Generator - Signal	Agilent	N5173B	TIW	2023-08-07	2026-08-07

CONDUCTED OUTPUT POWER / AVERAGE POWER - ALL PORTS

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

EUT:	AirScale Base Transceiver Station Remote Radio Head Model AHFIHA	Work Order:	NOKI0074
Serial Number:	RW233800370	Date:	2024-03-20
Customer:	Nokia Solutions and Networks	Temperature:	25.2°C
Attendees:	John Rattanavong, Mitch Hill, David Le	Relative Humidity:	30.2%
Customer Project:	None	Bar. Pressure (PMSL):	998 mbar
Tested By:	Jarrod Brenden	Job Site:	TX07
Power:	54 VDC	Configuration:	NOKI0074-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 24E:2024	ANSI C63.26:2015
RSS-133 Issue 6:2013 +A1:2018	ANSI C63.26:2015

COMMENTS

All losses in the measurement path were accounted for: attenuators, cables, DC block, and filters were used. While not displayed in the Spectrum analyzer/Channel power screen captures, measurements were performed with an internal reference level offsets of 44.09dB.

GSM/EDGE carriers are required to be operated with 3G(WCDMA) 4G(LTE) or 5G(5GNR) RAT carriers in the PCS band. Single 2G(GSM) carriers in PCS band: GSM/EDGE carriers were enabled at maximum power (20 watts/carrier) and LTE 5MHz carrier were enable at maximum power (40 watts/carrier) at 1970MHz. Single 3G(WCDMA) carriers in PCS band; WCDMA carriers were enable at maximum power (40 watts/carrier) at middle channel (1960MHz).

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

Pass

Tested By

TEST RESULTS

	Measured Value (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Value (Watts)	All Ports Value (dBm)	Result
2G GSM/EDGE Band 2, 1930 MHz - 1990 MHz						
GMSK Modulation						
Mid Channel, 1960.0 MHz						
Port 1	43.219	0	43.2	21.0	N/A	Within Tolerance
Port 2	42.885	0	42.9	19.4	N/A	Within Tolerance
Port 3	43.197	0	43.2	20.9	N/A	Within Tolerance
Port 4	42.86	0	42.9	19.3	N/A	Within Tolerance
All Ports	N/A	N/A	N/A	80.6	49.1	N/A
LTE, 1970.0 MHz						

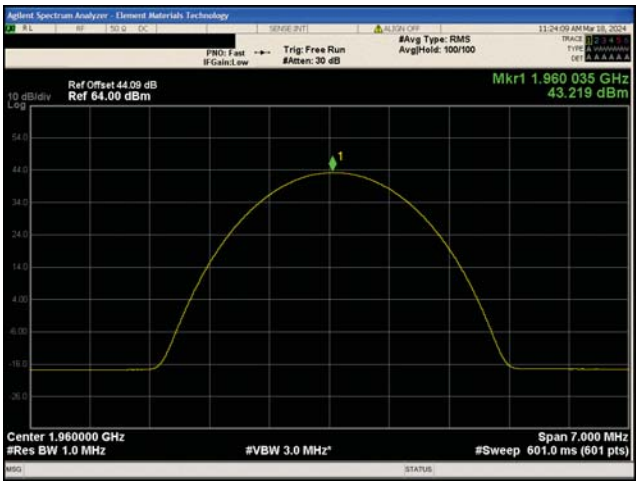
CONDUCTED OUTPUT POWER / AVERAGE POWER - ALL PORTS

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

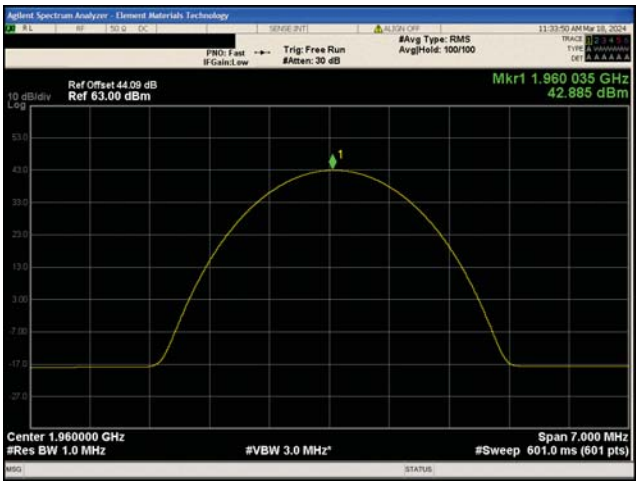
	Measured Value (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Value (Watts)	All Ports Value (dBm)	Result
Port 1	46.247	0	46.2	42.1	N/A	Within Tolerance
Port 2	45.926	0	45.9	39.1	N/A	Within Tolerance
Port 3	46.086	0	46.1	40.6	N/A	Within Tolerance
Port 4	45.768	0	45.8	37.7	N/A	Within Tolerance
All Ports	N/A	N/A	N/A	159.6	52.0	N/A
3G WCDMA PCS Band II, 1930 MHz - 1990 MHz						
64QAM Modulation						
Mid Channel, 1960.0 MHz						
Port 1	46.15	0	46.2	41.2	N/A	Within Tolerance
Port 2	45.8	0	45.8	38.0	N/A	Within Tolerance
Port 3	46.148	0	46.1	41.2	N/A	Within Tolerance
Port 4	45.813	0	45.8	38.1	N/A	Within Tolerance
All Ports	N/A	N/A	N/A	158.6	52.0	N/A

CONDUCTED OUTPUT POWER / AVERAGE POWER - ALL PORTS

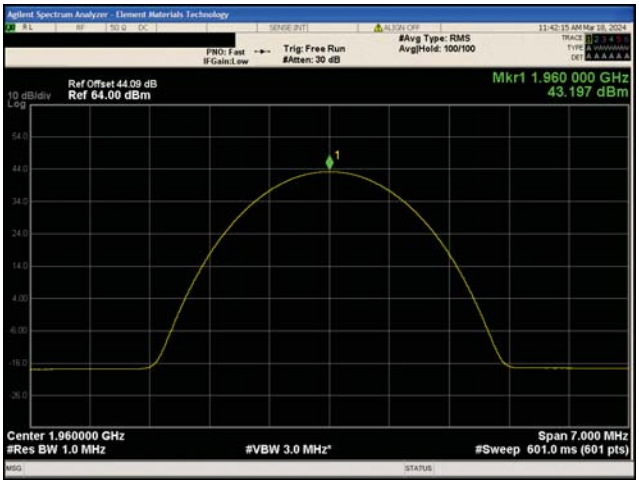
element
TbtTx 2023.12.06.3
WTD.2023.11.13.0



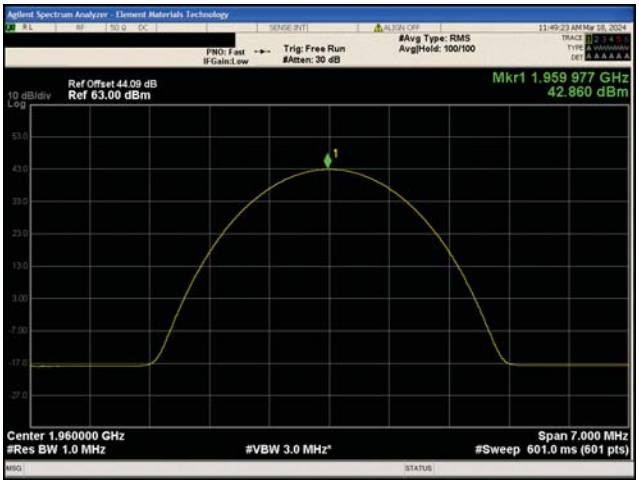
2G GSM/EDGE Band 2
GMSK Modulation
Mid Channel, 1960.0 MHz
Port 1



2G GSM/EDGE Band 2
GMSK Modulation
Mid Channel, 1960.0 MHz
Port 2



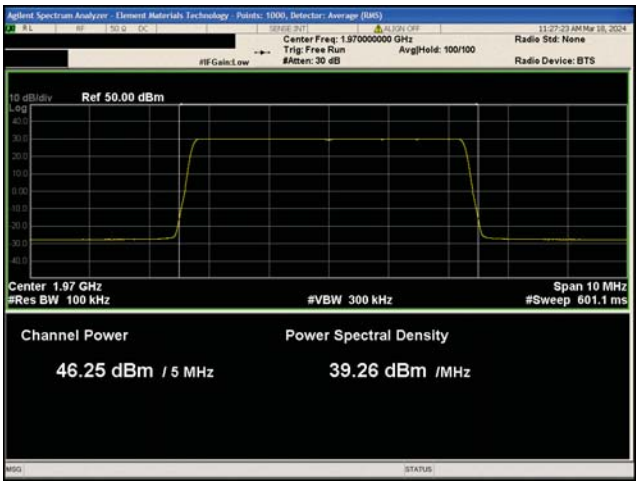
2G GSM/EDGE Band 2
GMSK Modulation
Mid Channel, 1960.0 MHz
Port 3



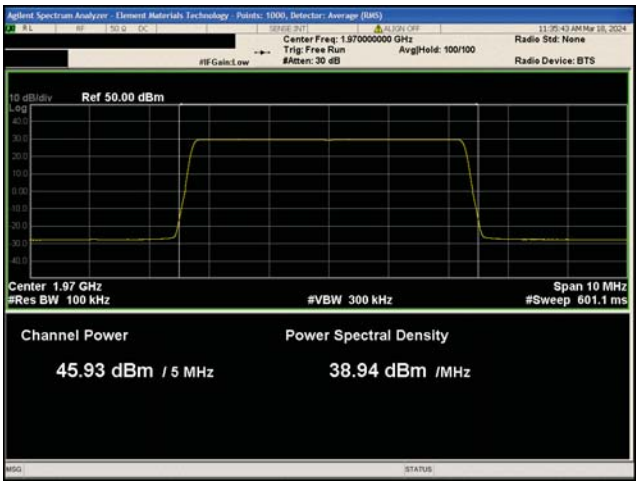
2G GSM/EDGE Band 2
GMSK Modulation
Mid Channel, 1960.0 MHz
Port 4

CONDUCTED OUTPUT POWER / AVERAGE POWER - ALL PORTS

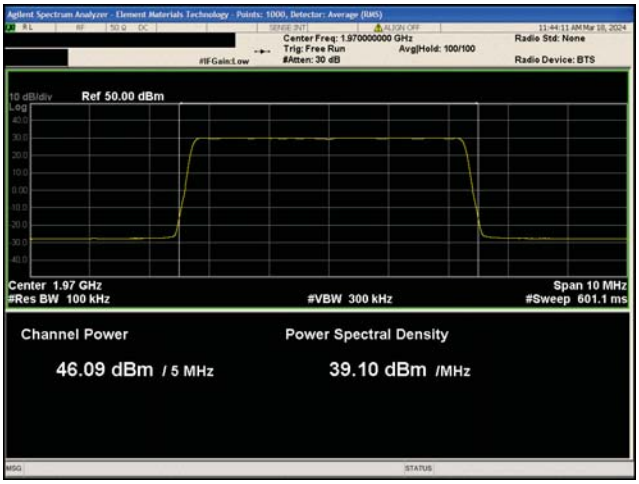
element
TbtTx 2023.12.06.3
WTD.2023.11.13.0



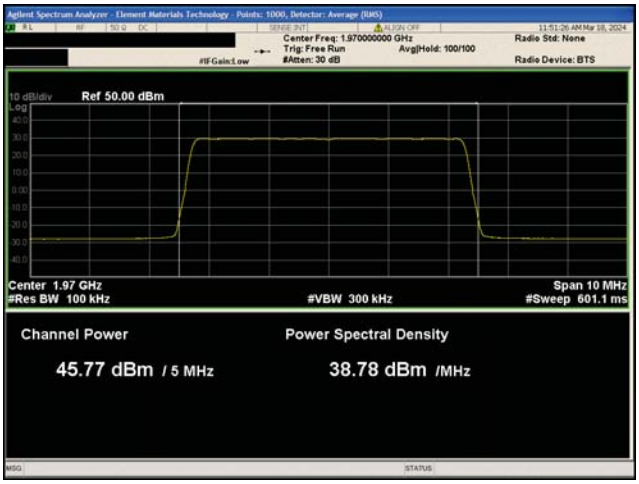
2G GSM/EDGE Band 2
LTE5 QPSK Modulation
1970.0 MHz
Port 1



2G GSM/EDGE Band 2
LTE5 QPSK Modulation
1970.0 MHz
Port 2



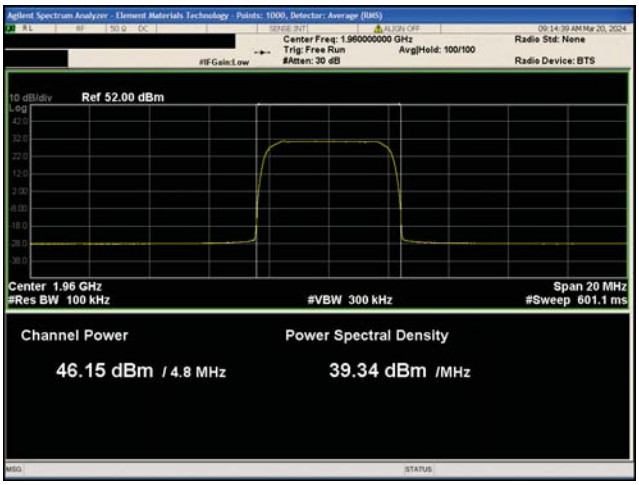
2G GSM/EDGE Band 2
LTE5 QPSK Modulation
1970.0 MHz
Port 3



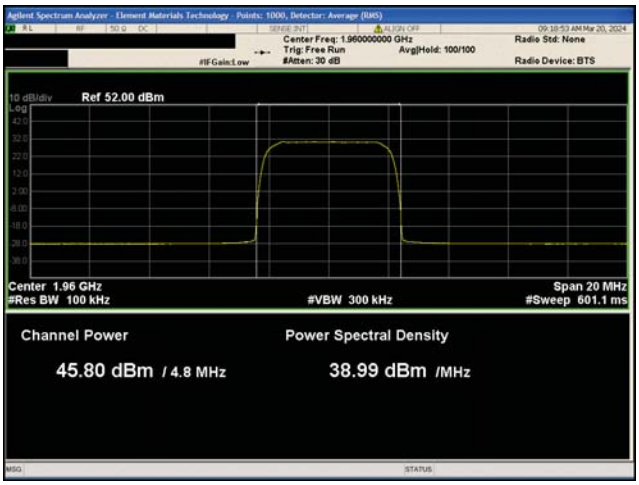
2G GSM/EDGE Band 2
LTE5 QPSK Modulation
1970.0 MHz
Port 4

CONDUCTED OUTPUT POWER / AVERAGE POWER - ALL PORTS

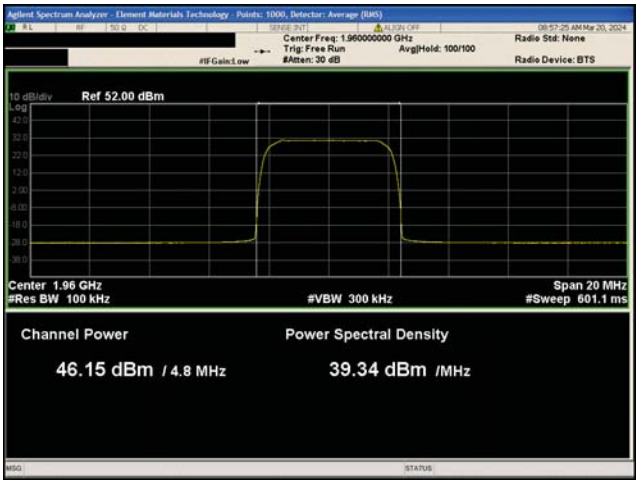
element
TbtTx 2023.12.06.3
WTD.2023.11.13.0



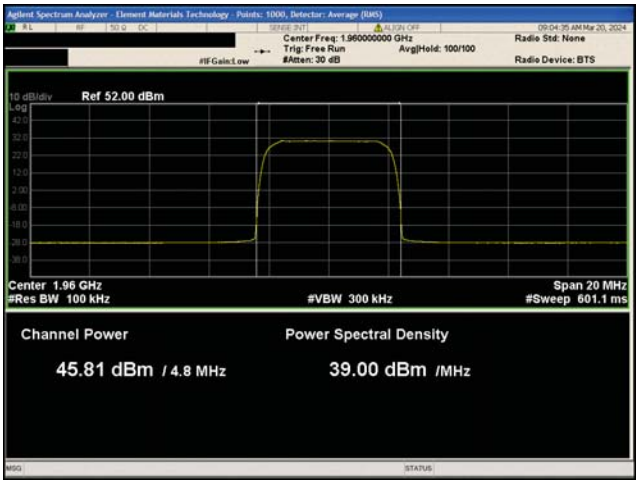
3G WCDMA PCS Band II
64QAM Modulation
Mid Channel, 1960.0 MHz
Port 1



3G WCDMA PCS Band II
64QAM Modulation
Mid Channel, 1960.0 MHz
Port 2



3G WCDMA PCS Band II
64QAM Modulation
Mid Channel, 1960.0 MHz
Port 3



3G WCDMA PCS Band II
64QAM Modulation
Mid Channel, 1960.0 MHz
Port 4

CONDUCTED OUTPUT POWER / AVERAGE POWER - MULTICARRIER

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0

TEST DESCRIPTION

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.

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

RF conducted emissions testing was performed only on one port. The testing was performed on the same version of hardware (AHFIHA) as the original certification test. The AHFIHA 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 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 for a broadband signal. 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.

The RMS average power measurement method for a narrowband signal (CW-like or noise-like signals) is detailed in ANSI C63.26 section 5.2.4.3

The output power was measured for a single carrier over the carrier channel bandwidth. The total output power for multiport (2x2 MIMO, 4x4 MIMO) operations was determined based per ANSI C63.26 clauses 6.4.3.1 and 6.4.3.2.4 (10 log N_{out}). The total output power for two port operation is the single port power +3 dB [i.e. 10*log(2)].

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFJ	2024-02-14	2025-02-14
Block - DC	Fairview Microwave	SD3379	AMM	2023-08-04	2024-08-04
Generator - Signal	Agilent	N5173B	TIW	2023-08-07	2026-08-07

CONDUCTED OUTPUT POWER / AVERAGE POWER - MULTICARRIER

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0

EUT:	AirScale Base Transceiver Station Remote Radio Head Model AHFIHA	Work Order:	NOKI0074
Serial Number:	RW233800370	Date:	2024-03-20
Customer:	Nokia Solutions and Networks	Temperature:	23.3°C
Attendees:	John Rattanavong, Mitch Hill, David Le	Relative Humidity:	42.1%
Customer Project:	None	Bar. Pressure (PMSL):	998 mbar
Tested By:	Jarrod Brenden	Job Site:	TX07
Power:	54 VDC	Configuration:	NOKI0074-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 24E:2024	ANSI C63.26:2015
RSS-133 Issue 6:2013 +A1:2018	ANSI C63.26:2015

COMMENTS

All losses in the measurement path were accounted for: attenuators, cables, DC block, and filters were used. While not displayed in the Spectrum analyzer/Channel power screen captures, measurements were performed with an internal reference level offsets of 44.09dB.

GSM/EDGE carriers are required to be operated with 3G(WCDMA) 4G(LTE) or 5G(5GNR) RAT carriers in the PCS band. Multi-Carrier 2G GSM/EDGE: in PCS band two contiguous/non-contiguous GSM/EDEG carriers were enabled at maximum power (20 watts/carrier) and single LTE 1.4MHz carrier were enabled at 20 watts for a total of 60 watts. In the AWS band a single LTE 10MHz carrier were enabled at maximum power 60 watts at the middle channel (2155.0MHz) and in the BRS band a single LTE 5MHz carrier were enabled at maximum power at 40 watts at the middle channel (2655.0MHz).

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

Pass

Tested By

TEST RESULTS

	Measured Value (dBm)	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW
2G GSM/EDGE PCS Band 2, 1930 MHz - 1990 MHz				
Test Case 1				
GMSK Modulation (GSM) and QPSK Modulation (LTE)				
Low Channel +1, 1930.4 MHz	42.866	0	42.9	N/A
Low Channel +1, 1930.8 MHz	42.906	0	42.9	N/A
Mid Channel, 1960.0 MHz	43.552	0	43.6	N/A
Mid Channel, 2155.0 MHz	47.729	0	47.7	N/A
Mid Channel, 2655.0 MHz	45.816	0	45.8	N/A

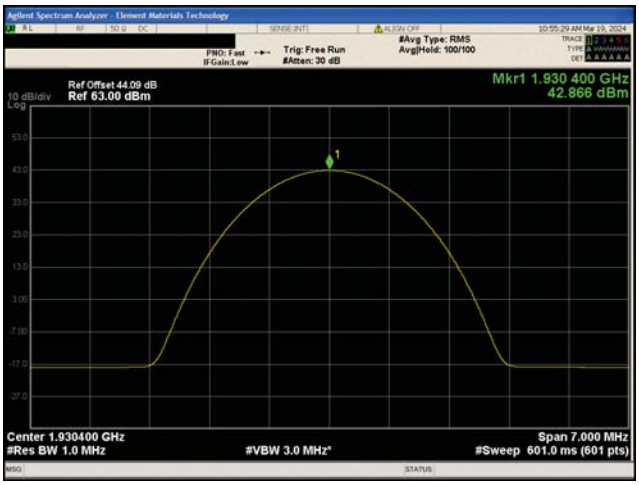
CONDUCTED OUTPUT POWER / AVERAGE POWER - MULTICARRIER

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0

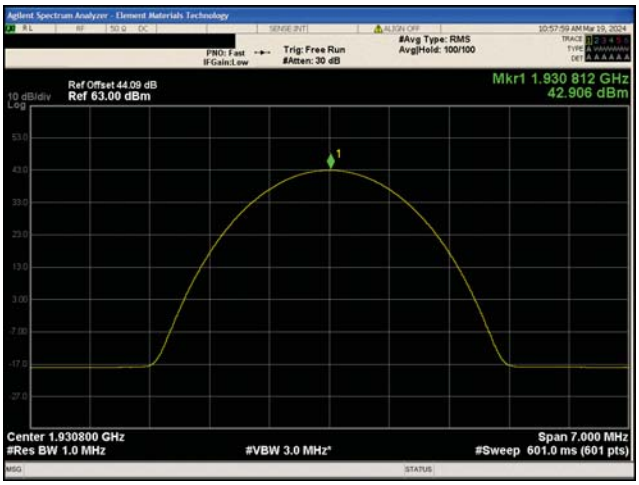
	Measured Value (dBm)	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW
8PSK Modulation (GSM) and QPSK Modulation (LTE)				
Low Channel +1, 1930.4 MHz	42.845	0	42.8	N/A
Low Channel +1, 1930.8 MHz	42.888	0	42.9	N/A
Mid Channel, 1960.0 MHz	43.713	0	43.7	N/A
Mid Channel, 2155.0 MHz	47.724	0	47.7	N/A
Mid Channel, 2655.0 MHz	45.965	0	46.0	N/A
Test Case 2				
GMSK Modulation (GSM) and QPSK Modulation (LTE)				
High Channel -1, 1989.2 MHz	43.219	0	43.2	N/A
High Channel -1, 1989.6 MHz	43.237	0	43.2	N/A
Mid Channel, 1960.0 MHz	43.564	0	43.6	N/A
Mid Channel, 2155.0 MHz	47.732	0	47.7	N/A
Mid Channel, 2655.0 MHz	45.988	0	46.0	N/A
8PSK Modulation (GSM) and QPSK Modulation (LTE)				
High Channel -1, 1989.2 MHz	43.188	0	43.2	N/A
High Channel -1, 1989.6 MHz	43.188	0	43.2	N/A
Mid Channel, 1960.0 MHz	43.55	0	43.6	N/A
Mid Channel, 2155.0 MHz	47.744	0	47.7	N/A
Mid Channel, 2655.0 MHz	45.998	0	46.0	N/A
Test Case 3				
GMSK Modulation (GSM) and QPSK Modulation (LTE)				
Low Channel +1, 1930.4 MHz	42.871	0	42.9	N/A
High Channel -1, 1989.6 MHz	43.231	0	43.2	N/A
Mid Channel, 1960.0 MHz	43.565	0	43.6	N/A
Mid Channel, 2155.0 MHz	47.658	0	47.7	N/A
Mid Channel, 2655.0 MHz	45.909	0	45.9	N/A
8PSK Modulation (GSM) and QPSK Modulation (LTE)				
Low Channel +1, 1930.4 MHz	42.625	0	42.6	N/A
High Channel -1, 1989.6 MHz	43.067	0	43.1	N/A
Mid Channel, 1960.0 MHz	43.386	0	43.4	N/A
Mid Channel, 2155.0 MHz	47.516	0	47.5	N/A
Mid Channel, 2655.0 MHz	45.761	0	45.8	N/A
3G WCDMA PCS Band II, 1930 MHz - 1990 MHz				
Test Case 1				
64QAM Modulation (WCDMA) and QPSK Modulation (LTE)				
Low Channel, 1932.4 MHz	42.364	0	42.4	45.4
Low Channel, 1937.4 MHz	42.536	0	42.5	45.5
High Channel, 1987.6 MHz	42.679	0	42.7	45.7
Mid Channel, 2155.0 MHz	47.684	0	47.7	50.7
Mid Channel, 2655.0 MHz	45.723	0	45.7	48.7

CONDUCTED OUTPUT POWER / AVERAGE POWER - MULTICARRIER

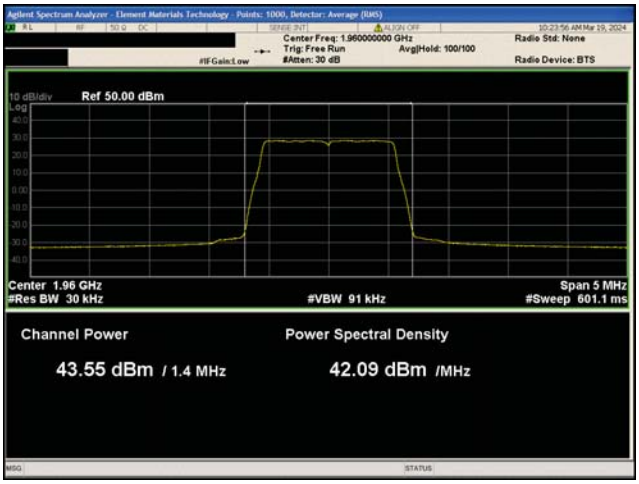
element
TbtTx 2023.12.06.3
WTD.2024.01.16.0



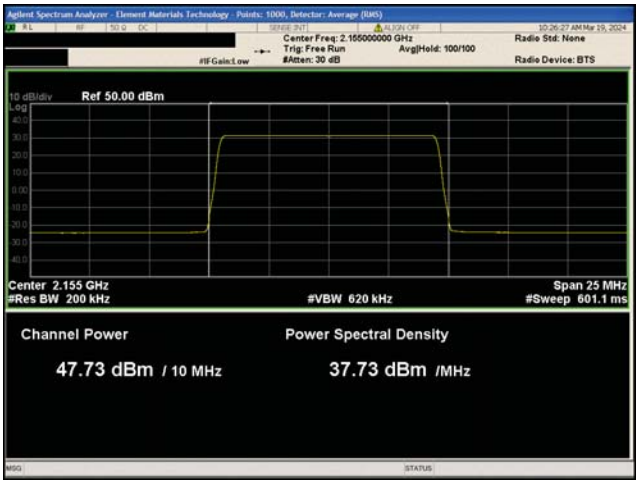
2G GSM/EDGE PCS Band 2
Test Case 1
GMSK Modulation
Low Channel +1, 1930.4 MHz



2G GSM/EDGE PCS Band 2
Test Case 1
GMSK Modulation
Low Channel +1, 1930.8 MHz



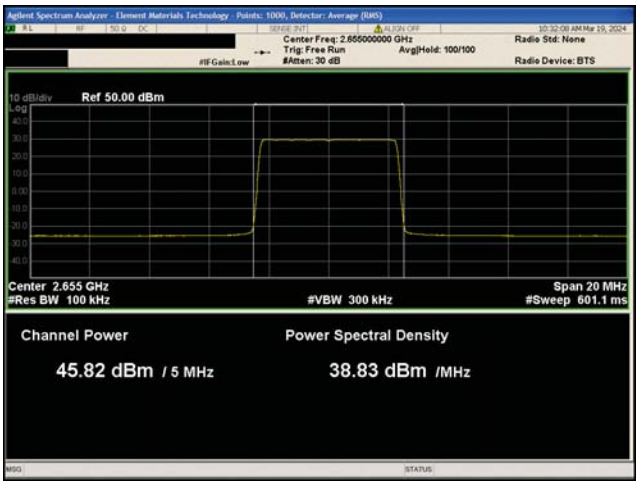
2G GSM/EDGE PCS Band 2
Test Case 1
LTE1.4 QPSK Modulation
Mid Channel, 1960.0 MHz



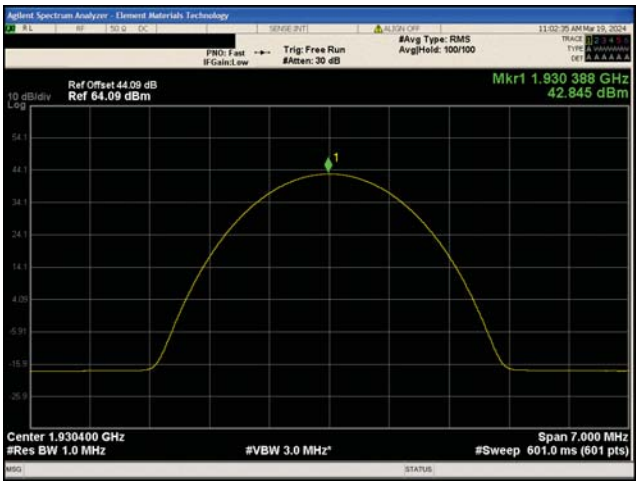
2G GSM/EDGE PCS Band 2
Test Case 1
LTE10 QPSK Modulation
Mid Channel, 2155.0 MHz

CONDUCTED OUTPUT POWER / AVERAGE POWER - MULTICARRIER

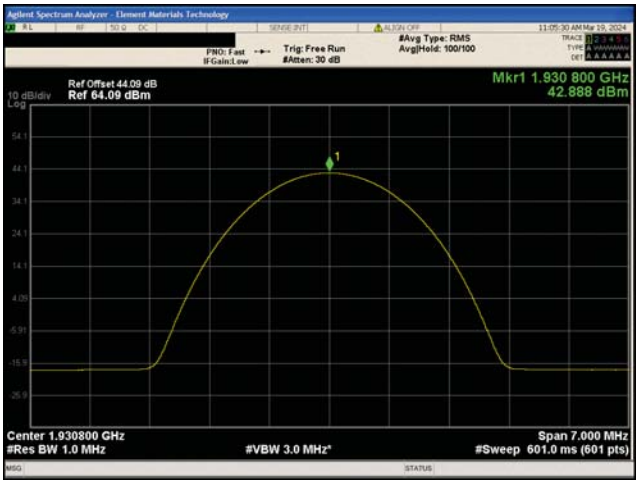
element
TbtTx 2023.12.06.3
WTD.2024.01.16.0



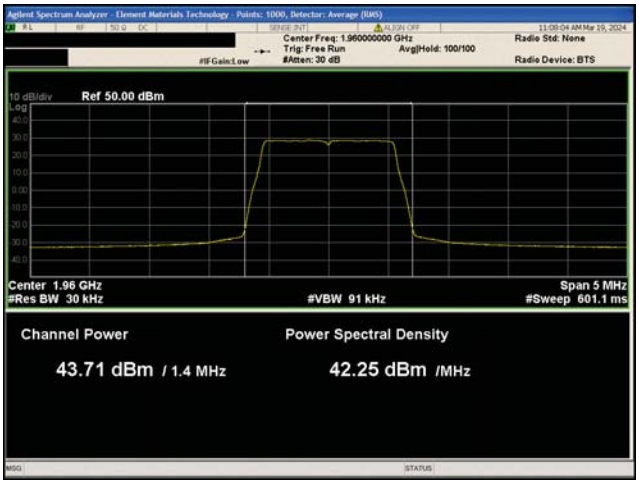
2G GSM/EDGE PCS Band 2
Test Case 1
LTE5 QPSK Modulation
Mid Channel, 2655.0 MHz



2G GSM/EDGE PCS Band 2
Test Case 1
8PSK Modulation
Low Channel +1, 1930.4 MHz



2G GSM/EDGE PCS Band 2
Test Case 1
8PSK Modulation
Low Channel +1, 1930.8 MHz



2G GSM/EDGE PCS Band 2
Test Case 1
LTE1.4 QPSK Modulation
Mid Channel, 1960.0 MHz

CONDUCTED OUTPUT POWER / AVERAGE POWER - MULTICARRIER

element
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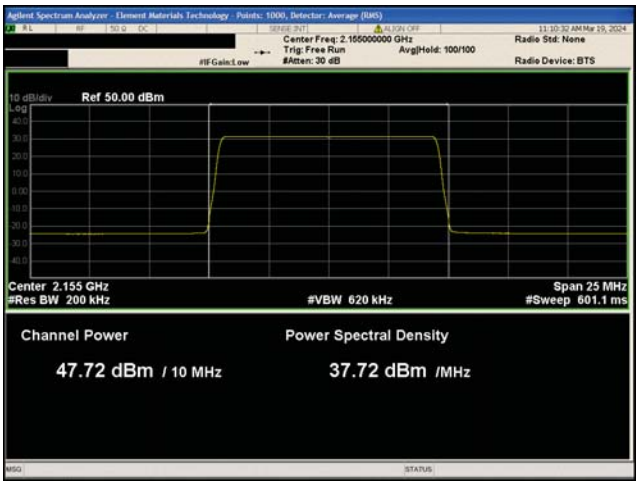
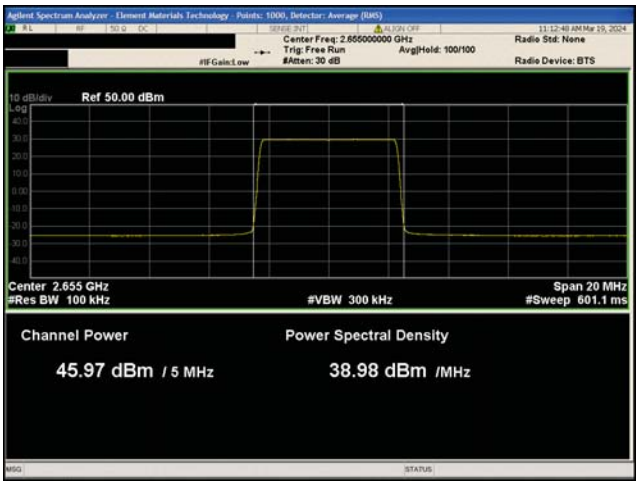
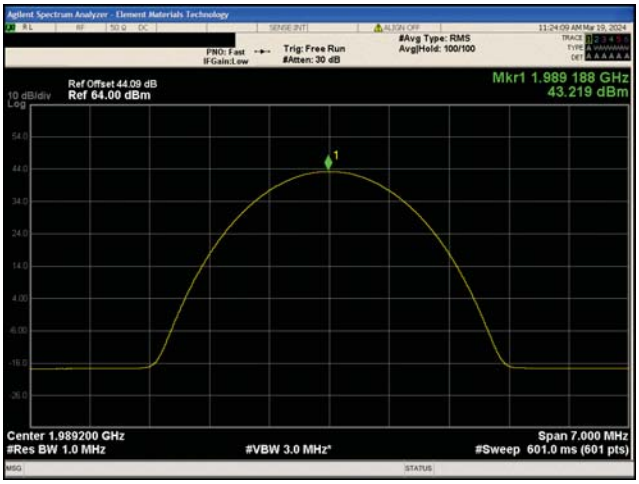


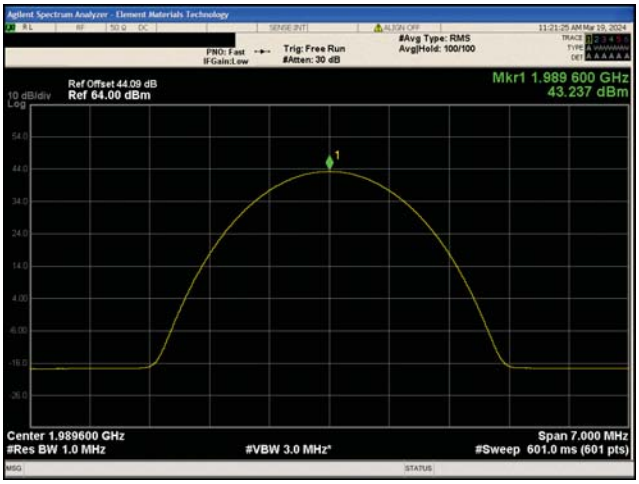
2G GSM/EDGE PCS Band 2
Test Case 1
LTE10 QPSK Modulation
Mid Channel, 2155.0 MHz



2G GSM/EDGE PCS Band 2
Test Case 1
LTE5 QPSK Modulation
Mid Channel, 2655.0 MHz



2G GSM/EDGE PCS Band 2
Test Case 2
GMSK Modulation
High Channel -1, 1989.2 MHz



2G GSM/EDGE PCS Band 2
Test Case 2
GMSK Modulation
High Channel -1, 1989.6 MHz

CONDUCTED OUTPUT POWER / AVERAGE POWER - MULTICARRIER

element
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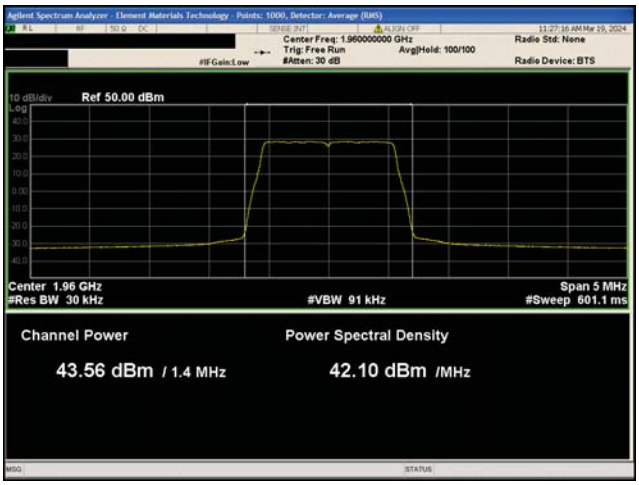
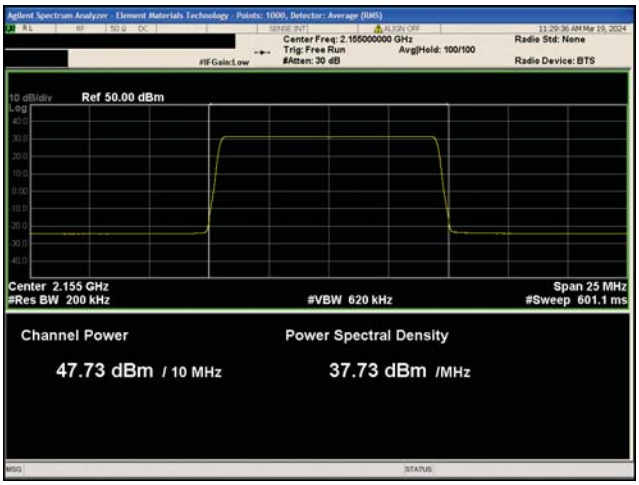
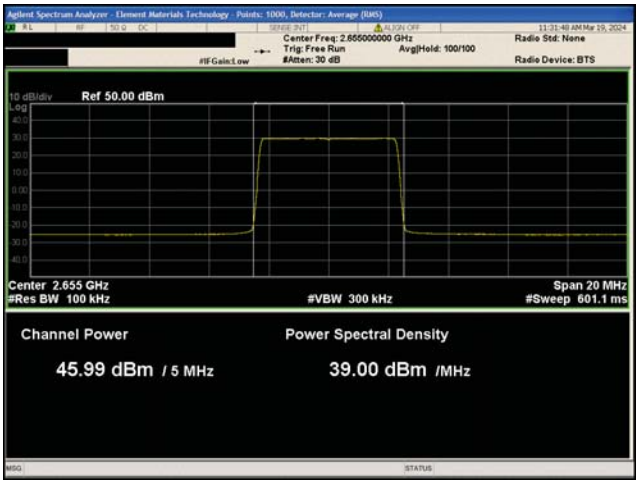


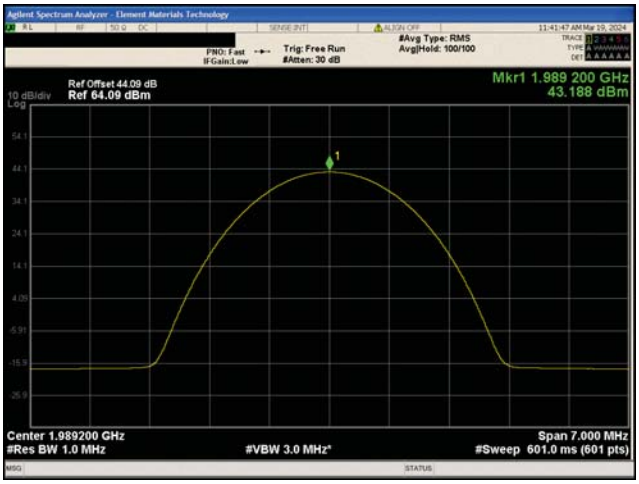
2G GSM/EDGE PCS Band 2
Test Case 2
LTE1.4 QPSK Modulation
Mid Channel, 1960.0 MHz



2G GSM/EDGE PCS Band 2
Test Case 2
LTE10 QPSK Modulation
Mid Channel, 2155.0 MHz



2G GSM/EDGE PCS Band 2
Test Case 2
LTE5 QPSK Modulation
Mid Channel, 2655.0 MHz



2G GSM/EDGE PCS Band 2
Test Case 2
8PSK Modulation
High Channel -1, 1989.2 MHz

CONDUCTED OUTPUT POWER / AVERAGE POWER - MULTICARRIER

element
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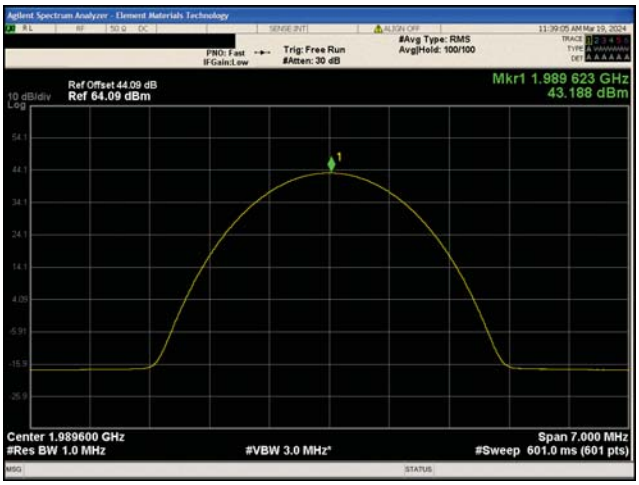
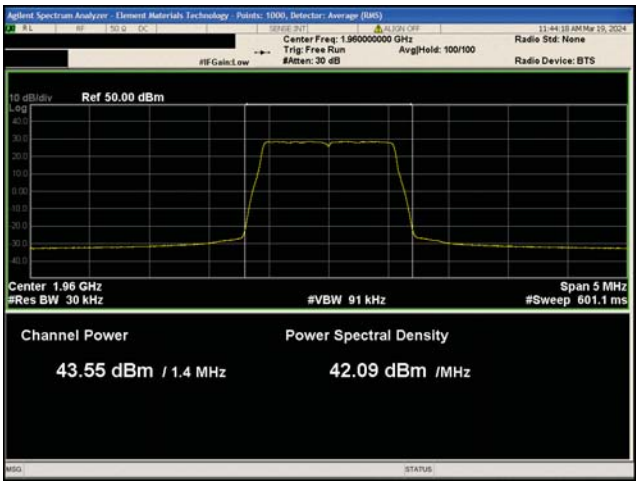
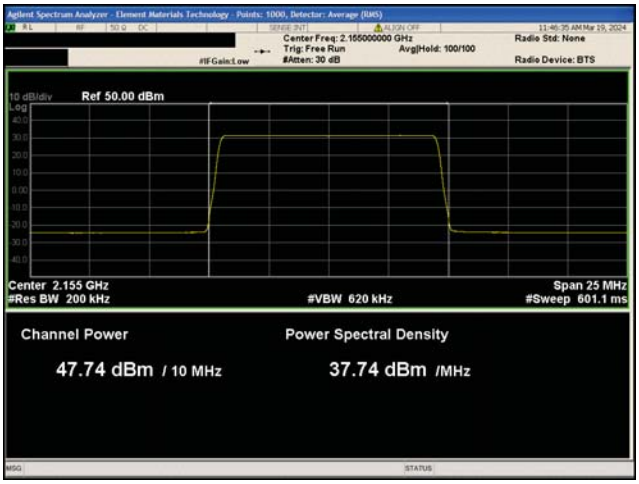
WTD.2024.01.16.0



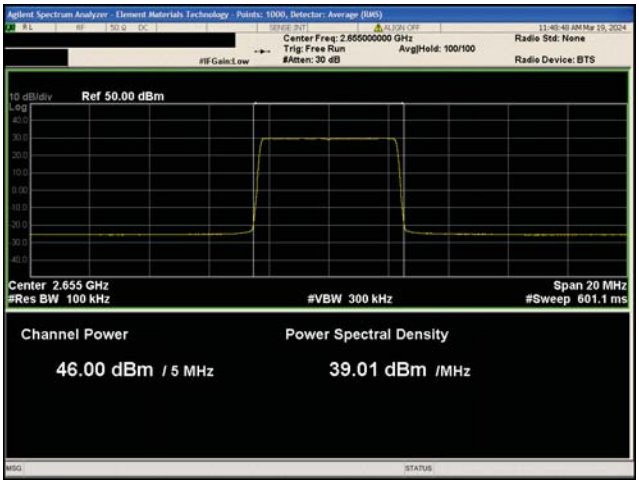
2G GSM/EDGE PCS Band 2
Test Case 2
8PSK Modulation
High Channel -1, 1989.6 MHz



2G GSM/EDGE PCS Band 2
Test Case 2
LTE1.4 QPSK Modulation
Mid Channel, 1960.0 MHz



2G GSM/EDGE PCS Band 2
Test Case 2
LTE10 QPSK Modulation
Mid Channel, 2155.0 MHz



2G GSM/EDGE PCS Band 2
Test Case 2
LTE5 QPSK Modulation
Mid Channel, 2655.0 MHz

CONDUCTED OUTPUT POWER / AVERAGE POWER - MULTICARRIER

element
TbtTx 2023.12.06.3
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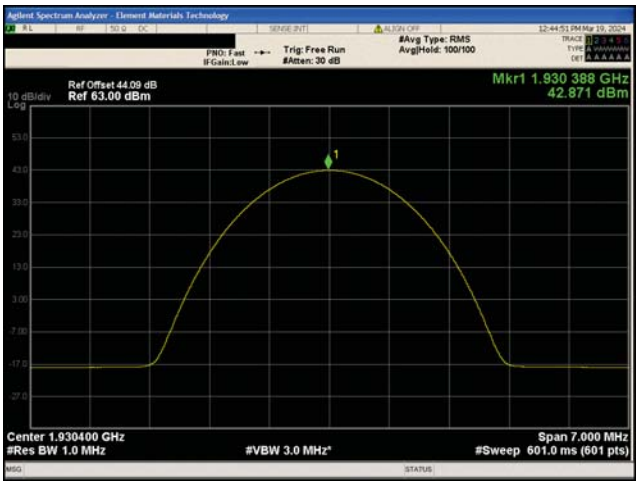
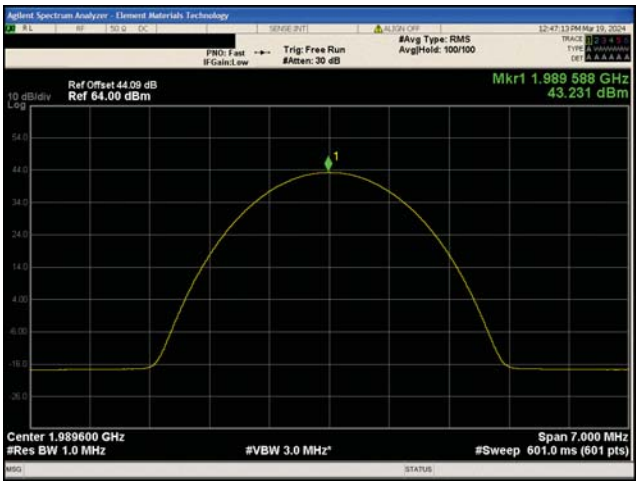
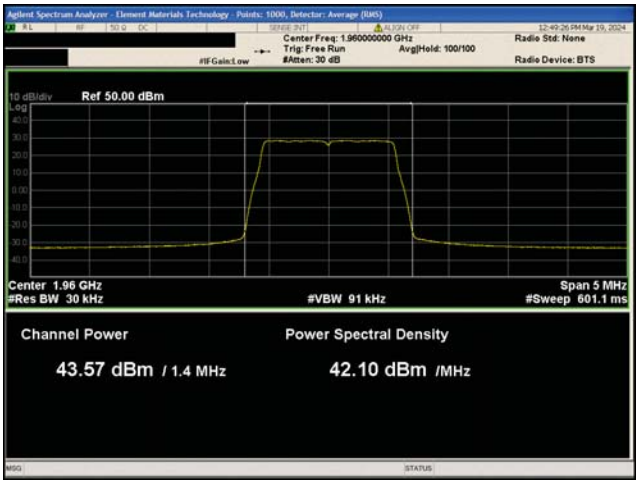


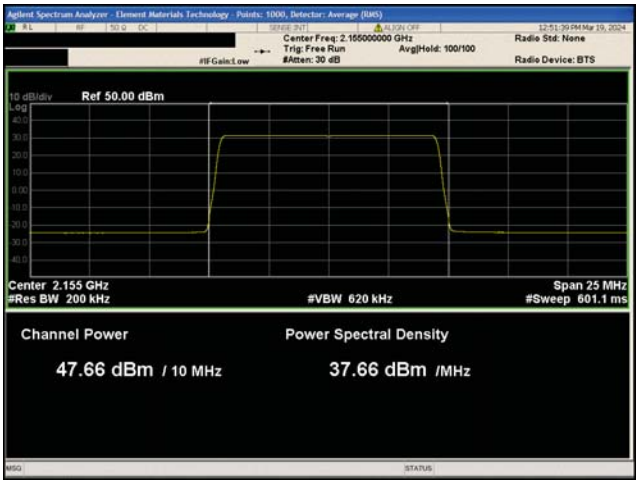
2G GSM/EDGE PCS Band 2
Test Case 3
GMSK Modulation
Low Channel +1, 1930.4 MHz



2G GSM/EDGE PCS Band 2
Test Case 3
GMSK Modulation
High Channel -1, 1989.6 MHz



2G GSM/EDGE PCS Band 2
Test Case 3
LTE1.4 QPSK Modulation
Mid Channel, 1960.0 MHz



2G GSM/EDGE PCS Band 2
Test Case 3
LTE10 QPSK Modulation
Mid Channel, 2155.0 MHz

CONDUCTED OUTPUT POWER / AVERAGE POWER - MULTICARRIER

element
TbtTx 2023.12.06.3
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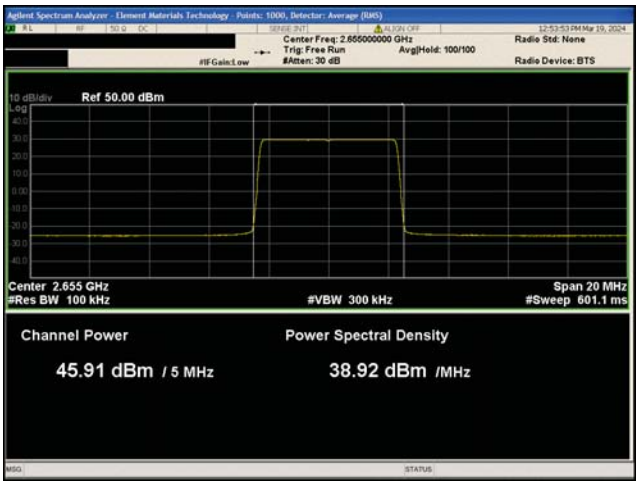
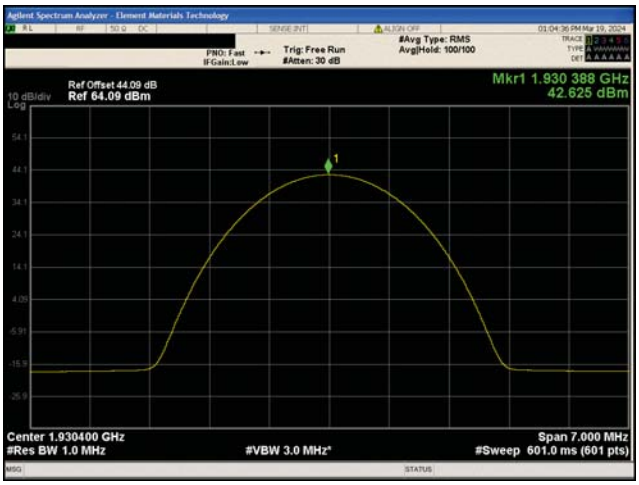
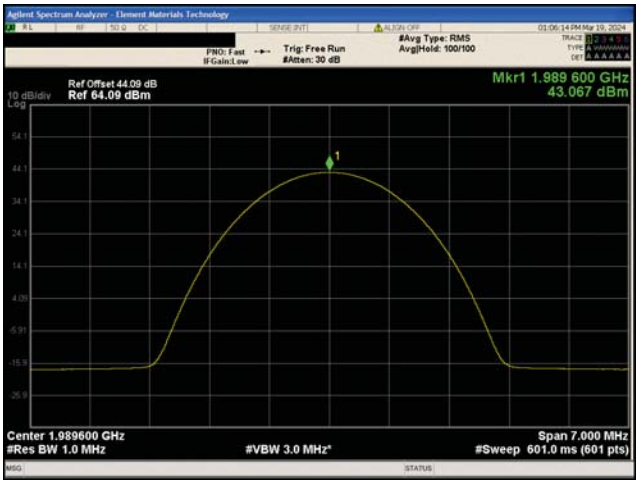


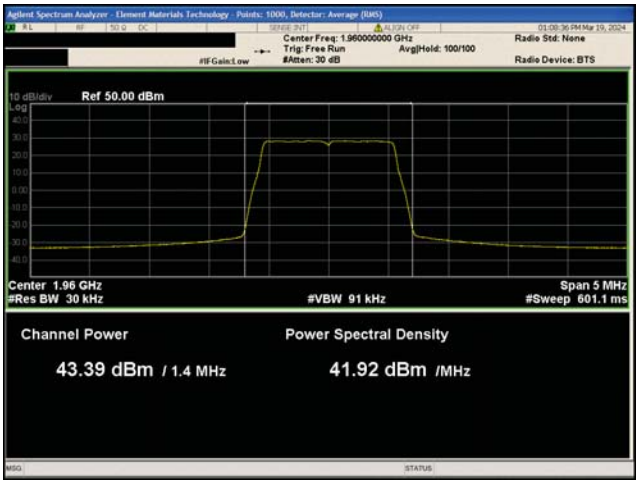
2G GSM/EDGE PCS Band 2
Test Case 3
LTE5 QPSK Modulation
Mid Channel, 2655.0 MHz



2G GSM/EDGE PCS Band 2
Test Case 3
8PSK Modulation
Low Channel +1, 1930.4 MHz



2G GSM/EDGE PCS Band 2
Test Case 3
8PSK Modulation
High Channel -1, 1989.6 MHz



2G GSM/EDGE PCS Band 2
Test Case 3
LTE1.4 QPSK Modulation
Mid Channel, 1960.0 MHz

CONDUCTED OUTPUT POWER / AVERAGE POWER - MULTICARRIER

element
TbtTx 2023.12.06.3
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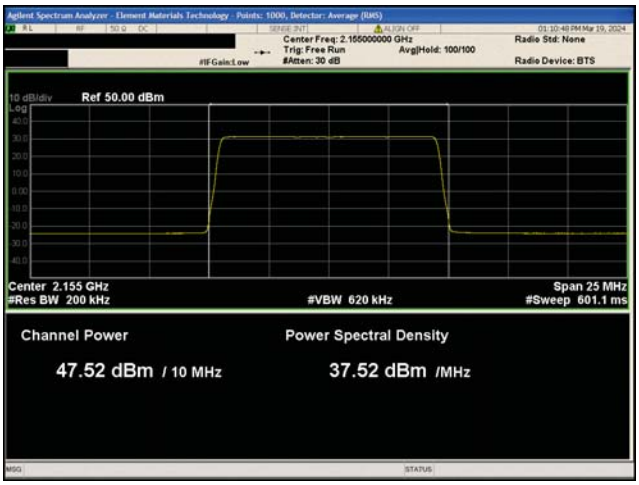
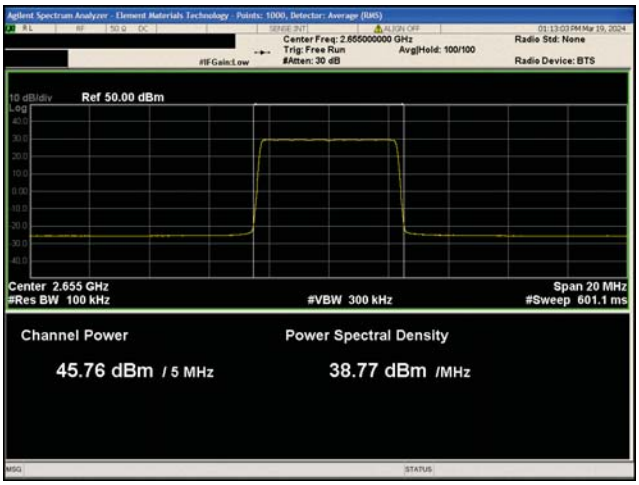
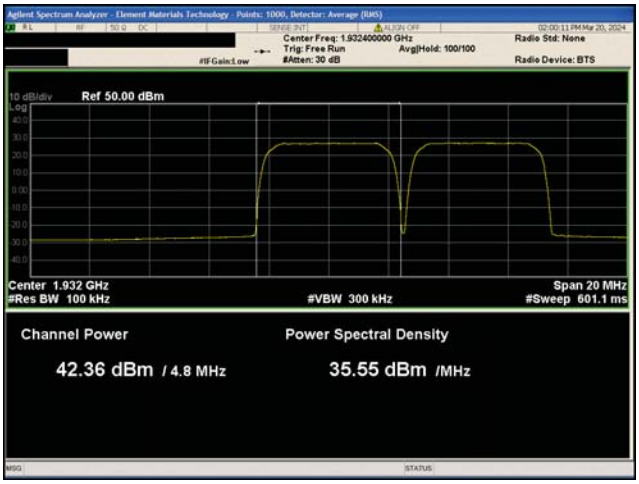


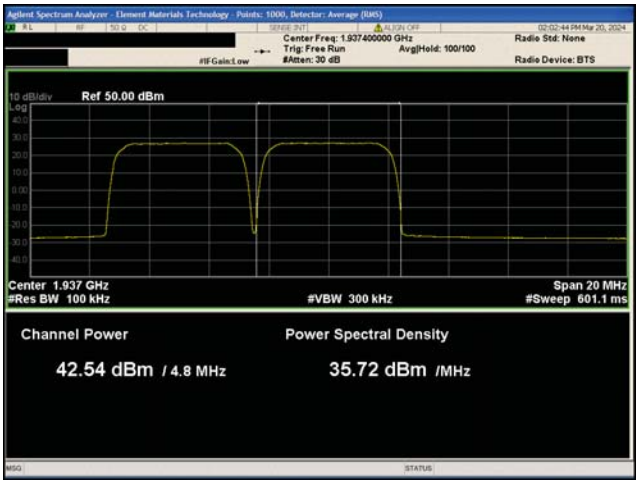
2G GSM/EDGE PCS Band 2
Test Case 3
LTE10 QPSK Modulation
Mid Channel, 2155.0 MHz



2G GSM/EDGE PCS Band 2
Test Case 3
LTE5 QPSK Modulation
Mid Channel, 2655.0 MHz



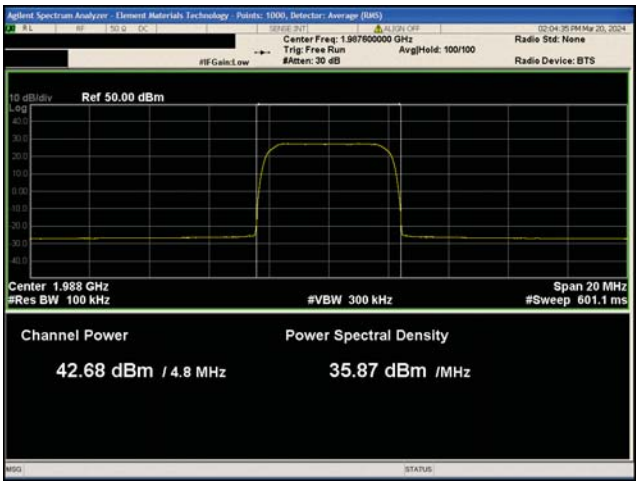
3G WCDMA PCS Band II
Test Case 1
64QAM Modulation
Low Channel, 1932.4 MHz



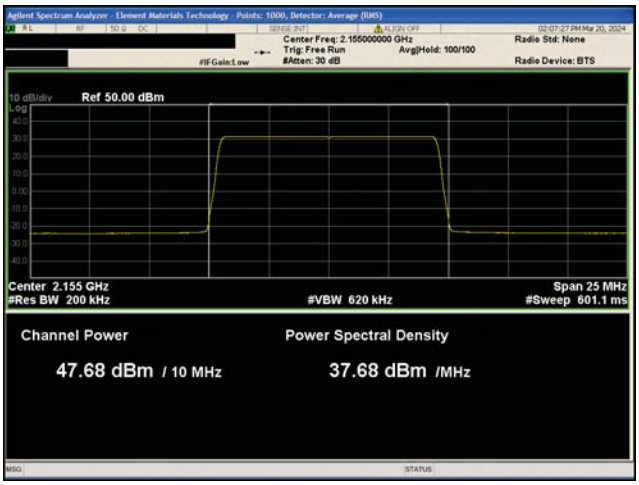
3G WCDMA PCS Band II
Test Case 1
64QAM Modulation
Low Channel, 1937.4 MHz

CONDUCTED OUTPUT POWER / AVERAGE POWER - MULTICARRIER

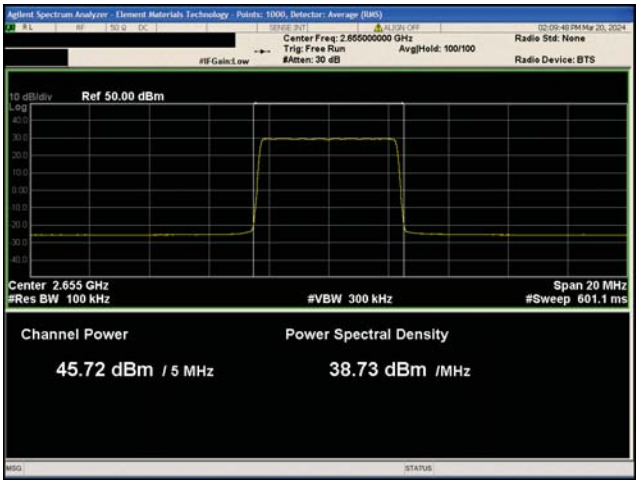
element
TbtTx 2023.12.06.3
WTD.2024.01.16.0



3G WCDMA PCS Band II
Test Case 1
64QAM Modulation
High Channel, 1987.6 MHz



3G WCDMA PCS Band II
Test Case 1
LTE10 QPSK Modulation
Mid Channel, 2155.0 MHz



3G WCDMA PCS Band II
Test Case 1
LTE5 QPSK Modulation
Mid Channel, 2655.0 MHz

CONDUCTED OUTPUT POWER / AVERAGE POWER - WCDMA

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0

TEST DESCRIPTION

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.

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

RF conducted emissions testing was performed only on one port. The testing was performed on the same version of hardware (AHFIHA) as the original certification test. The AHFIHA 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 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.

The output power was measured for a single carrier over the carrier channel bandwidth. The total output power for multiport (2x2 MIMO, 4x4 MIMO) operations was determined based per ANSI C63.26 clauses 6.4.3.1 and 6.4.3.2.4 (10 log N_{out}). The total output power for two port operation is the single port power +3 dB [i.e. 10*log(2)].

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFJ	2024-02-14	2025-02-14
Block - DC	Fairview Microwave	SD3379	AMM	2023-08-04	2024-08-04
Generator - Signal	Agilent	N5173B	TIW	2023-08-07	2026-08-07

CONDUCTED OUTPUT POWER / AVERAGE POWER - WCDMA

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0

EUT:	AirScale Base Transceiver Station Remote Radio Head Model AHFIHA	Work Order:	NOKI0074
Serial Number:	RW233800370	Date:	2024-03-20
Customer:	Nokia Solutions and Networks	Temperature:	23.1°C
Attendees:	John Rattanavong, David Le	Relative Humidity:	37.7%
Customer Project:	None	Bar. Pressure (PMSL):	998 mbar
Tested By:	Jarrod Brenden	Job Site:	TX07
Power:	54 VDC	Configuration:	NOKI0074-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 24E:2024	ANSI C63.26:2015
RSS-133 Issue 6:2013 +A1:2018	ANSI C63.26:2015

COMMENTS

All losses in the measurement path were accounted for: attenuators, cables, DC block, and filters were used. While not displayed in the Spectrum analyzer/Channel power screen captures, measurements were performed with an internal reference level offsets of 44.09dB.

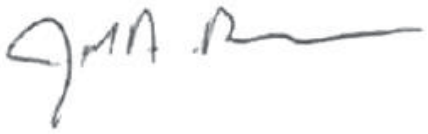
3G (WCDMA) single carrier: In PCS band a single WCDMA carrier were enabled at maximum power (40 watts/carrier).

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

Pass



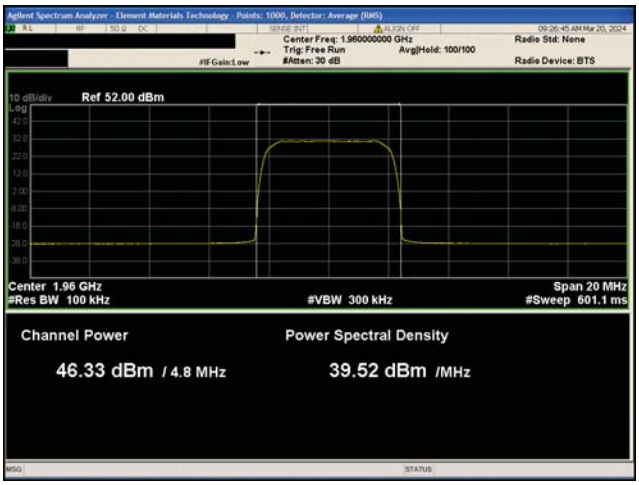
Tested By

TEST RESULTS

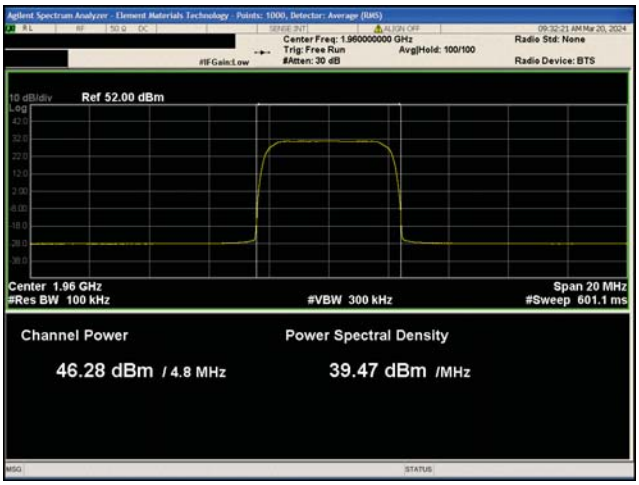
	Channel Power dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2 MIMO) dBm/Carrier BW
3G WCDMA PCS Band II, 1930 MHz - 1990 MHz				
QPSK Modulation				
Mid Channel, 1960.0 MHz	46.331	0	46.3	49.3
16QAM Modulation				
Mid Channel, 1960.0 MHz	46.278	0	46.3	49.3
64QAM Modulation				
Low Channel, 1932.4 MHz	46.357	0	46.4	49.4
Mid Channel, 1960.0 MHz	46.288	0	46.3	49.3
High Channel, 1987.6 MHz	46.431	0	46.4	49.4

CONDUCTED OUTPUT POWER / AVERAGE POWER - WCDMA

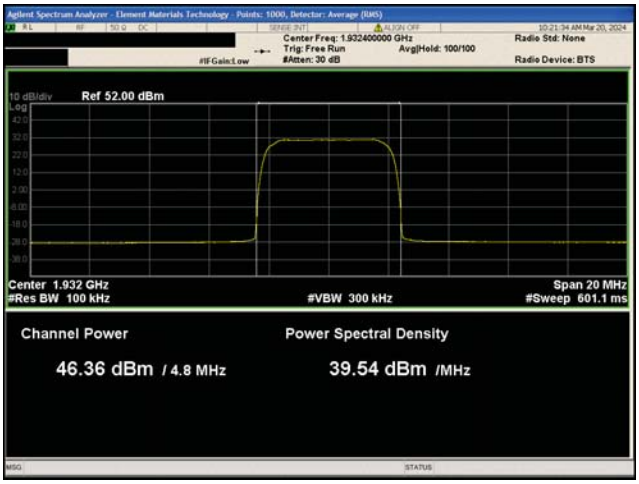
element
TbtTx 2023.12.06.3
WTD.2024.01.16.0



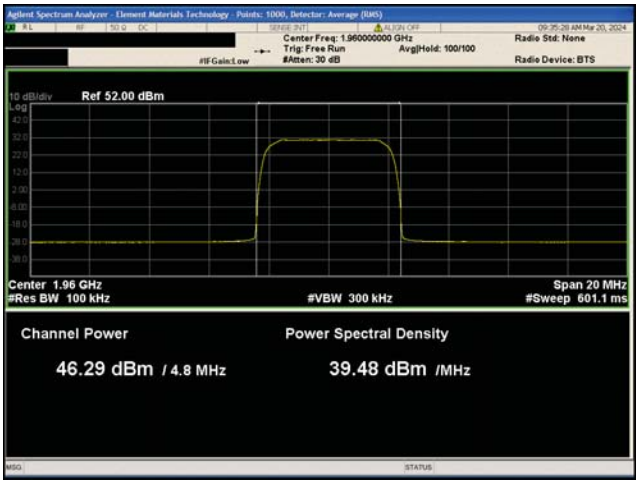
3G WCDMA PCS Band II
QPSK Modulation
Mid Channel, 1960.0 MHz



3G WCDMA PCS Band II
16QAM Modulation
Mid Channel, 1960.0 MHz

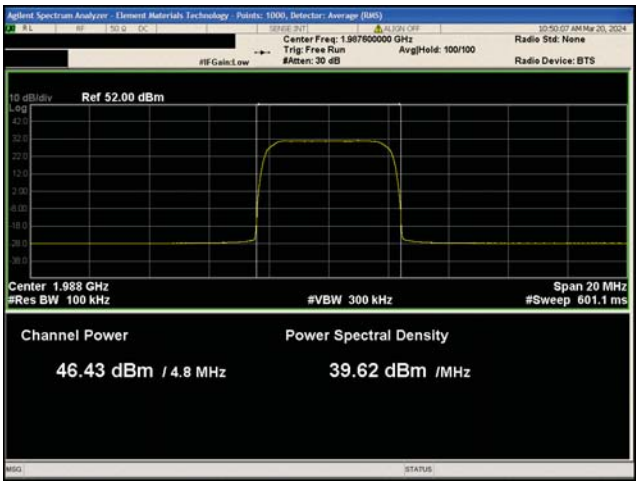


3G WCDMA PCS Band II
64QAM Modulation
Low Channel, 1932.4 MHz



3G WCDMA PCS Band II
64QAM Modulation
Mid Channel, 1960.0 MHz

CONDUCTED OUTPUT POWER / AVERAGE POWER - WCDMA



3G WCDMA PCS Band II
64QAM Modulation
High Channel, 1987.6 MHz

POWER SPECTRAL DENSITY and EIRP CALCULATIONS - WCDMA

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0

TEST DESCRIPTION

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.

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

The RF conducted emission testing was performed on one port. The AHFIHA antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in the "Output Power" 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 method of ANSI C63.26-2015 section 5.2.4.5 was used to make this measurement.

The total PSD for multiport (2x2, 4x4 MIMO) operation was determined based upon ANSI 63.26 clause 6.4.3.2.4 (10 Log Nout). The total PSD for two port operation is single port PSD +3dB [i.e. 10 Log(2)].

EIRP Requirements for PCS Band using 3G WCDMA Technology

FCC Requirements: Part 24.232 Power and antenna height limits.

(a)(2) Base stations with an emission bandwidth greater than 1 MHz are limited to 1640 watts/MHz equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT, except as described in paragraph (b) below.

(a)(3) Base station antenna heights may exceed 300 meters HAAT with a corresponding reduction in power; *see* Tables 1 and 2 of this section.

(b)(2) Base stations that are located in counties with population densities of 100 persons or fewer per square mile, based upon the most recently available population statistics from the Bureau of the Census, with an emission bandwidth greater than 1 MHz are limited to 3280 watts/MHz equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT.

ISED Requirements RSS-133 Section 6.4/SRSP-510 section 5.1.1:

SRSP-510 section 5.1 Radiated power and antenna height limits for base stations

For base stations with a channel bandwidth greater than 1 MHz, the maximum e.i.r.p. is limited to 3280 watts/MHz e.i.r.p. (i.e., no more than 3280 watts e.i.r.p. in any 1 MHz band segment) with an antenna height above average terrain (HAAT) up to 300 metres. Fixed or base stations operating in urban areas are limited to a maximum allowable e.i.r.p. of 1640 watts/MHz e.i.r.p. Base station antenna heights above average terrain may exceed 300 metres with a corresponding reduction in e.i.r.p. according to the following table:….

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFJ	2024-02-14	2025-02-14
Block - DC	Fairview Microwave	SD3379	AMM	2023-08-04	2024-08-04
Generator - Signal	Agilent	N5173B	TIW	2023-08-07	2026-08-07

POWER SPECTRAL DENSITY and EIRP CALCULATIONS - WCDMA

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0

EUT:	AirScale Base Transceiver Station Remote Radio Head Model AHFIHA	Work Order:	NOKI0074
Serial Number:	RW233800370	Date:	2024-03-20
Customer:	Nokia Solutions and Networks	Temperature:	22.9°C
Attendees:	John Rattanavong, David Le	Relative Humidity:	41.2%
Customer Project:	None	Bar. Pressure (PMSL):	997 mbar
Tested By:	Jarrod Brenden	Job Site:	TX07
Power:	54 VDC	Configuration:	NOKI0074-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 24E:2024	ANSI C63.26:2015
RSS-133 Issue 6:2013 +A1:2018	ANSI C63.26:2015

COMMENTS

All losses in the measurement path were accounted for: attenuators, cables, DC block, and filters were used. While not displayed in the Spectrum analyzer/Channel power screen captures, measurements were performed with an internal reference level offsets of 44.09dB.

3G (WCDMA) single carrier: In PCS band a single WCDMA carrier were enabled at maximum power (40 watts/carrier)

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

Pass

Tested By

TEST RESULTS

	Measured Value dB/MHz	Duty Cycle Factor	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD
3G WCDMA PCS Band II, 1930 MHz - 1990 MHz				
QPSK Modulation				
Low Channel, 1932.4 MHz	40.898	0	40.9	43.9
Mid Channel, 1960.0 MHz	40.81	0	40.8	43.8
High Channel, 1987.6 MHz	40.899	0	40.9	43.9
16QAM Modulation				
Low Channel, 1932.4 MHz	40.888	0	40.9	43.9
Mid Channel, 1960.0 MHz	40.81	0	40.8	43.8
High Channel, 1987.6 MHz	40.952	0	41.0	44.0
64QAM Modulation				
Low Channel, 1932.4 MHz	40.898	0	40.9	43.9
Mid Channel, 1960.0 MHz	40.76	0	40.8	43.8
High Channel, 1987.6 MHz	40.904	0	40.9	43.9

POWER SPECTRAL DENSITY and EIRP CALCULATIONS - WCDMA

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0

EIRP Calculations for Two Port (2x2 MIMO) Operations for PCS Band 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 two port (2x2-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 Commscope antenna assembly model “FFV4Q4-65B-R7-V2”. The maximum PCS Band gain (17.1dBi) for this antenna was used for the EIRP calculation. This antenna assembly has a pair of ±45° cross-polarized radiators used for PCS Band. Four AHFIHA transmitter outputs are connected to the antenna assembly RF inputs.

Equivalent Isotropically Radiated Power (EIRP) is calculated (as specified in ANSI C63.26-2015 section 6.4 for uncorrelated output signals) from the results of power measurements (highest measured PSD for each channel bandwidth type). The maximum antenna gain was used for this calculation. The cable loss between the antenna and transmitter is site dependent and a typical loss of 1.0dB for this frequency range was used. Calculations of worst-case EIRP for two port MIMO operation are as follows:

Parameter	5 MHz Ch BW
Worst Case PSD/Antenna Port	41.0 dBm/MHz
Number of Ant Ports per Polarization	1
Total PSD per Polarization 10Log 1 = + 0dB	41.0 dBm/MHz
Cable Loss (site dependent) = 1.0dB	40.0 dBm/MHz
Dir Gain = Max Ant Gain (G_{Ant}) See Note 1	17.1 dBi
EIRP per Polarization	57.1 dBm/MHz
Number of Polarizations	2
EIRP Total = Y1 ±45° or Y2 ±45°See Note 2	57.1 dBm/MHz
Passing FCC & ISED EIRP Limit	62.15 & 65.16 dBm/MHz

Note 1: The directional gain is equal to antenna gain since the transmit signals are completely uncorrelated. See ANSI C63.26 sections 6.4.5.2.3b) and 6.4.5.3.1b) for guidance.
Note 2: The EIRP per antenna polarity is required to be below the regulatory limit as described in ANSI C63.26-2015 section 6.4.6.3 b)2) and KDB 662911 D02v01 page 3 example (2) since the two transmitter outputs to each antenna are 90 degree-phase shifted relative to each other (cross-polarized radiators).

EIRP Calculation Summary
The worst case AHFIHA PCS band two port MIMO EIRP levels for WCDMA carriers using antenna assembly model “FFV4Q4-65B-R7-V2” are less than the FCC and ISED (65.16 dBm/MHz and 62.15 dBm/MHz) EIRP Regulatory Limits.

POWER SPECTRAL DENSITY and EIRP CALCULATIONS - WCDMA

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0

3G WCDMA PCS Band II
QPSK Modulation
Low Channel, 1932.4 MHz

3G WCDMA PCS Band II
QPSK Modulation
Mid Channel, 1960.0 MHz

3G WCDMA PCS Band II
QPSK Modulation
High Channel, 1987.6 MHz

3G WCDMA PCS Band II
16QAM Modulation
Low Channel, 1932.4 MHz

POWER SPECTRAL DENSITY and EIRP CALCULATIONS - WCDMA

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0

3G WCDMA PCS Band II
16QAM Modulation
Mid Channel, 1960.0 MHz

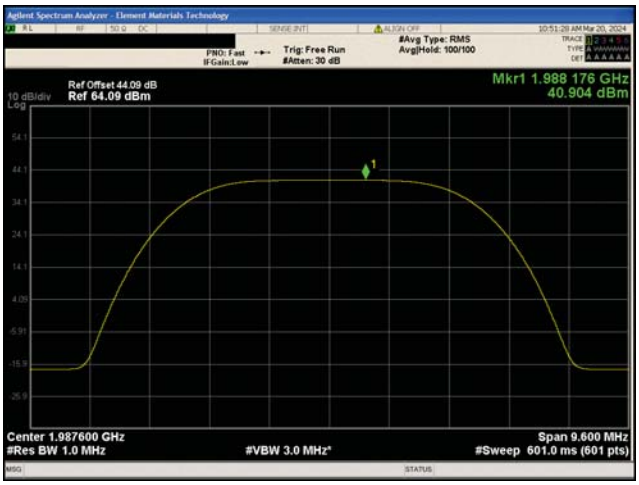
3G WCDMA PCS Band II
16QAM Modulation
High Channel, 1987.6 MHz

3G WCDMA PCS Band II
64QAM Modulation
Low Channel, 1932.4 MHz

3G WCDMA PCS Band II
64QAM Modulation
Mid Channel, 1960.0 MHz

POWER SPECTRAL DENSITY and EIRP CALCULATIONS - WCDMA

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0



3G WCDMA PCS Band II
64QAM Modulation
High Channel, 1987.6 MHz

AVERAGE POWER (PSD) AND EIRP CALCULATIONS – GSM

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

TEST DESCRIPTION

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.

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 RMS average power measurement method for FCC/IC is detailed in section 5.2 of KDB 971168 D01v03r01 and ANSI C63.26-2015 section 5.2.4.3. 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 (AHFIHA) as the original certification test. The AHFIHA 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 method detailed in ANSI C63.26 - 2015 section 5.2.4.5 was used to make this measurement.

The output power was measured for a single carrier over the carrier channel bandwidth. The Bottom and Top channels shall be measured at the maximum allowable (reduced) power levels as determined from the Spurious Emissions at Antenna Terminals Frequency Band Edges measurements. In addition, the first full-power Bottom and Top channel shall be measured. To also meet Power Spectral Density requirements, the Average Power was measured using an RBW of 1 MHz.

Per FCC section 24.232(a & b) and SRSP-510 5.1.1, the Equivalent Isotropically Radiated Power (EIRP) of the transceiver cannot exceed 1640 W/MHz (62.15 dBm/MHz) for urban areas and 3280 W/MHz (65.16 dBm/MHz) for rural areas.

EIRP Requirements for PCS Band using 2G GSM Technology

FCC Requirements: Part 24.232 Power and antenna height limits.

(a)(1) Base stations with an emission bandwidth of 1 MHz or less are limited to 1640 watts equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT, except as described in paragraph (b) below.
(a)(3) Base station antenna heights may exceed 300 meters HAAT with a corresponding reduction in power; *see* Tables 1 and 2 of this section.
(b)(2) Base stations that are located in counties with population densities of 100 persons or fewer per square mile, based upon the most recently available population statistics from the Bureau of the Census, with an emission bandwidth of 1 MHz or less are limited to 3280 watts equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT.

ISED Requirements RSS-133 Section 6.4/SRSP-510 section 5.1.1:

SRSP-510 section 5.1.1 Radiated power and antenna height limits for base stations

For base stations with channel bandwidth equal to or less than 1 MHz, the maximum equivalent isotropically radiated power (e.i.r.p.) is limited to 3280 watts with an antenna height above average terrain (HAAT) up to 300 metres. Base stations operating in urban areas are limited to a maximum allowable e.i.r.p. of 1640 watts. Base station antenna heights above average terrain may exceed 300 metres with a corresponding reduction in e.i.r.p. according to the following table.

AVERAGE POWER (PSD) AND EIRP CALCULATIONS – GSM

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFJ	2024-02-14	2025-02-14
Block - DC	Fairview Microwave	SD3379	AMM	2023-08-04	2024-08-04
Generator - Signal	Agilent	N5173B	TIW	2023-08-07	2026-08-07

AVERAGE POWER (PSD) AND EIRP CALCULATIONS – GSM

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

EUT:	AirScale Base Transceiver Station Remote Radio Head Model AHFIHA	Work Order:	NOKI0074
Serial Number:	RW233800370	Date:	2024-03-18
Customer:	Nokia Solutions and Networks	Temperature:	23.3°C
Attendees:	John Rattanavong, Mitch Hill	Relative Humidity:	33.7%
Customer Project:	None	Bar. Pressure (PMSL):	997 mbar
Tested By:	Jarrod Brenden	Job Site:	TX07
Power:	54 VDC	Configuration:	NOKI0074-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 24E:2024	ANSI C63.26:2015
RSS-133 Issue 6:2013 +A1:2018	ANSI C63.26:2015

COMMENTS

All losses in the measurement path were accounted for in the spectrum analyzer reference level offsets for: attenuators, cables, DC block, and filters were used.

GSM/EDGE carriers are required to be operated with 3G(WCDMA) 4G(LTE) or 5G(5GNR) RAT carriers in the PCS band. Single 2G(GSM) carriers in PCS band: GSM/EDGE carriers were enabled at maximum power (20 watts/carrier) and LTE 5MHz carrier were enable at maximum power (40 watts/carrier) at 1970MHz.

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

Pass

Tested By

TEST RESULTS

	Avg Power [PSD] dBm/MHz (dBm)	Duty Cycle Factor (dBm)	Single Port dBm/MHz (dBm)
2G GSM/EDGE PCS Band 2, 1930 MHz - 1990 MHz			
GMSK Modulation			
Low Channel, 1930.2 MHz	42.825	0	42.8
Low Channel, 1930.2 MHz - Reduced Power	36.813	0	36.8
Low Channel +1, 1930.4 MHz	42.8	0	42.8
Mid Channel, 1960.0 MHz	43.181	0	43.2
High Channel -1, 1989.6 MHz	43.145	0	43.1
High Channel, 1989.8 MHz	43.186	0	43.2
High Channel, 1989.8 MHz - Reduced Power	37.142	0	37.1
8PSK Modulation			
Low Channel, 1930.2 MHz	42.972	0	43.0
Low Channel, 1930.2 MHz - Reduced Power	36.628	0	36.6
Low Channel +1, 1930.4 MHz	42.774	0	42.8
Mid Channel, 1960.0 MHz	43.302	0	43.3
High Channel -1, 1989.6 MHz	43.076	0	43.1
High Channel, 1989.8 MHz	43.315	0	43.3
High Channel, 1989.8 MHz - Reduced Power	36.987	0	37.0

AVERAGE POWER (PSD) AND EIRP CALCULATIONS – GSM

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

EIRP Calculations for single port (non-MIMO) Operations for PCS Band Single GSM 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 (single port (non-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 Commscope antenna assembly model “FFV4Q4-65B-R7-V2”. The maximum PCS Band gain (17.1dBi) for this antenna was used for the EIRP calculation. This antenna assembly has a pair of ±45° cross-polarized radiators used for PCS Band. Four AHFIHA transmitter outputs are connected to the antenna assembly RF inputs.

Equivalent Isotropically Radiated Power (EIRP) is calculated (as specified in ANSI C63.26-2015 section 6.4 for uncorrelated output signals) from the results of power measurements (highest measured PSD for each channel bandwidth type). The maximum antenna gain was used for this calculation. The cable loss between the antenna and transmitter is site dependent and a typical loss of 1.0dB for this frequency range was used. Calculations of worst-case EIRP for single port operation are as follows:

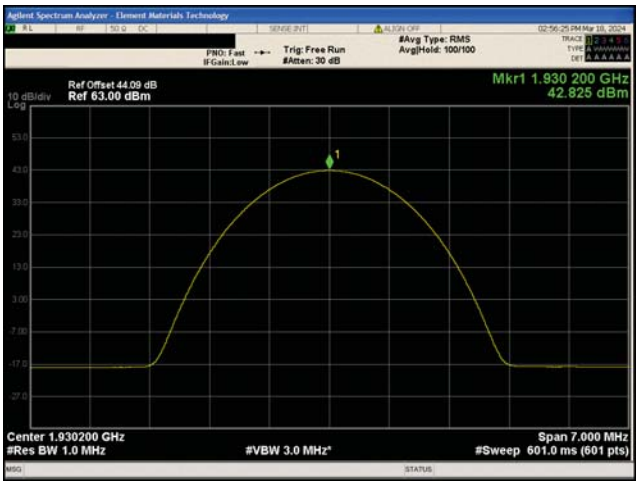
Parameter	GSM/EDGE Carrier
Worst Case PSD/Antenna Port	43.3 dBm/MHz
Cable Loss (site dependent) = 1.0dB	42.3 dBm/MHz
Maximum Antenna Gain (G_{Ant})	17.1 dBi
EIRP Total = PSD/Ant port – Cable loss + Ant Gain	59.4 dBm/MHz
Passing FCC & ISED EIRP Limit	62.15 & 65.16 dBm/MHz

EIRP Calculation Summary

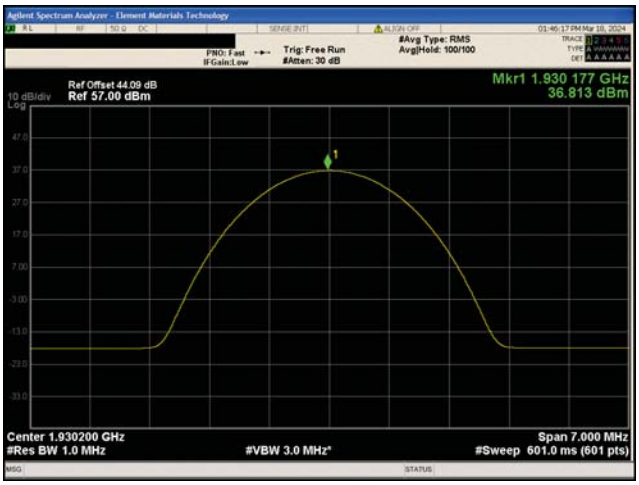
The worst case AHFIHA PCS band EIRP levels for GSM carriers using antenna assembly model “FFV4Q4-65B-R7-V2” are less than the FCC and ISED (65.16 dBm/MHz and 62.15 dBm/MHz) EIRP Regulatory Limits.

AVERAGE POWER (PSD) AND EIRP CALCULATIONS – GSM

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

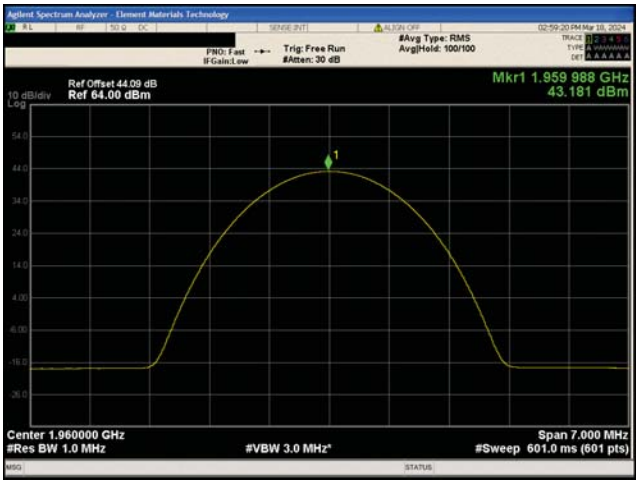


2G GSM/EDGE Band 2
GMSK Modulation
Low Channel, 1930.2 MHz



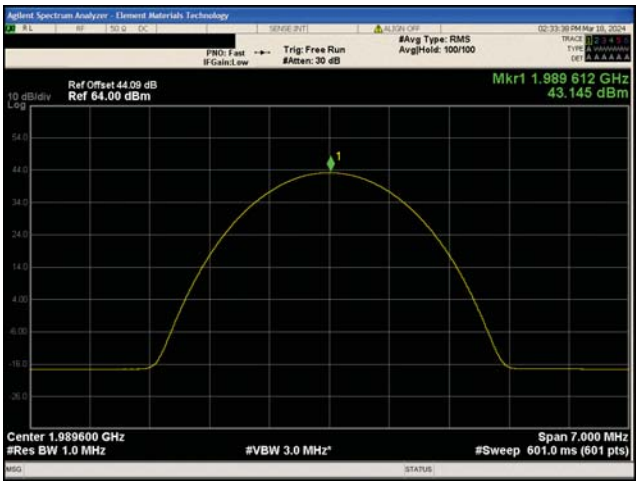
2G GSM/EDGE Band 2
GMSK Modulation
Low Channel, 1930.2 MHz - Reduced Power

2G GSM/EDGE Band 2
GMSK Modulation
Low Channel +1, 1930.4 MHz

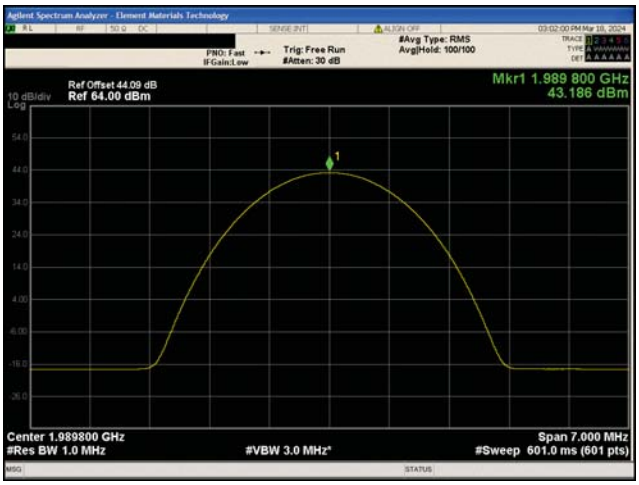


2G GSM/EDGE Band 2
GMSK Modulation
Mid Channel, 1960.0 MHz

AVERAGE POWER (PSD) AND EIRP CALCULATIONS – GSM



2G GSM/EDGE Band 2
GMSK Modulation
High Channel -1, 1989.6 MHz



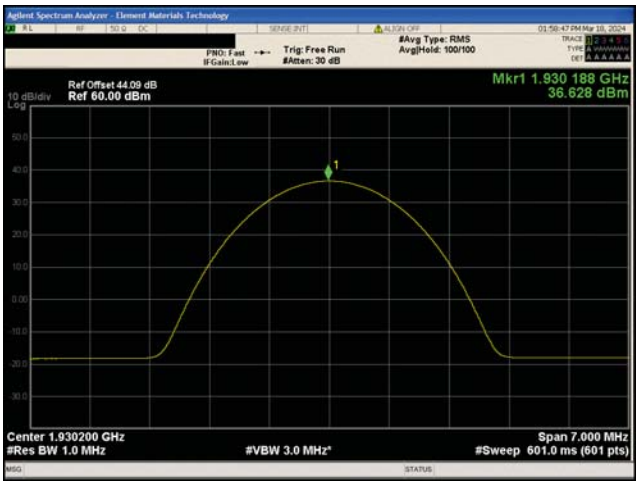
2G GSM/EDGE Band 2
GMSK Modulation
High Channel, 1989.8 MHz

2G GSM/EDGE Band 2
GMSK Modulation
High Channel, 1989.8 MHz - Reduced Power

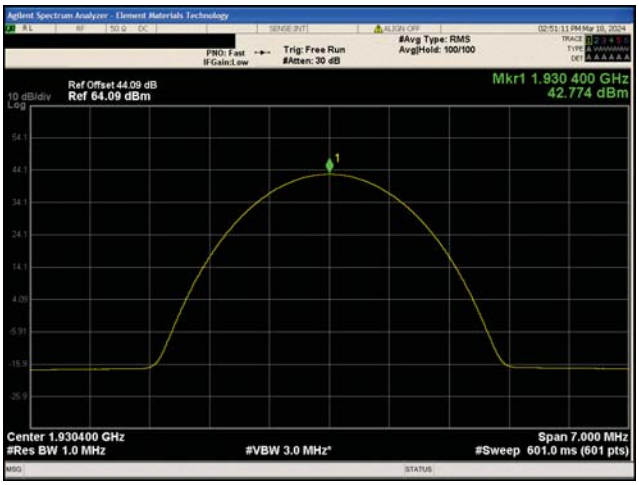
2G GSM/EDGE Band 2
8PSK Modulation
Low Channel, 1930.2 MHz

AVERAGE POWER (PSD) AND EIRP CALCULATIONS – GSM

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0



2G GSM/EDGE Band 2
8PSK Modulation
Low Channel, 1930.2 MHz - Reduced Power



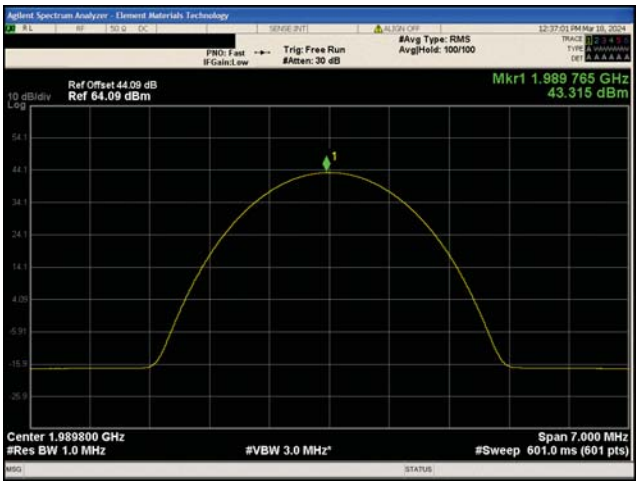
2G GSM/EDGE Band 2
8PSK Modulation
Low Channel +1, 1930.4 MHz

2G GSM/EDGE Band 2
8PSK Modulation
Mid Channel, 1960.0 MHz

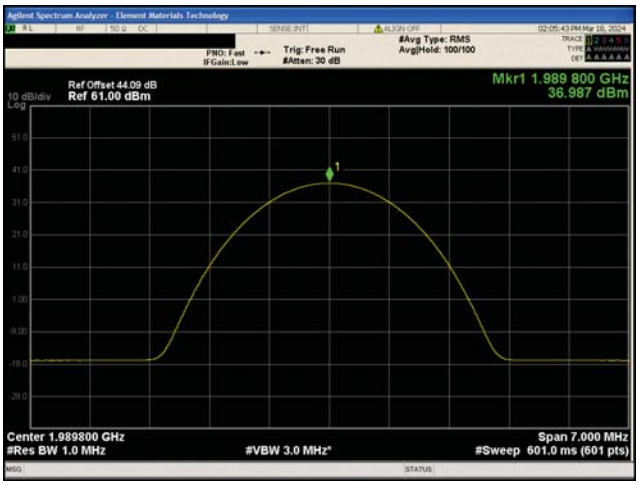
2G GSM/EDGE Band 2
8PSK Modulation
High Channel -1, 1989.6 MHz

AVERAGE POWER (PSD) AND EIRP CALCULATIONS – GSM

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0



2G GSM/EDGE Band 2
8PSK Modulation
High Channel, 1989.8 MHz



2G GSM/EDGE Band 2
8PSK Modulation
High Channel, 1989.8 MHz - Reduced Power

PEAK TO AVERAGE POWER (PAPR) CCDF - GSM

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0

TEST DESCRIPTION

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.

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

The Peak Power measurement method is described in ANSI C63.26 section 5.2.3.3.

The Average Power measurement method is described in ANSI C63.26 section 5.2.4.3.1.

The Peak to Average Power Ratio (PAPR) has been calculated as described in ANSI C63.26-2015 section 5.2.6.

RF conducted emissions testing was performed only on one port. The testing was performed on the same version of hardware (AHFIHA) as the original certification test. The AHFIHA 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.

Per FCC section 24.232(d) and RSS 133 section 6.4, the transmitter peak to average power ratio (PAPR) shall not exceed 13dB for more than 0.1% of the time. The CCDF measurement method for FCC/IC is detailed in section 5.7.2 of KDB971168 D01v03r01 and ANSI C63.26-2015 section 5.2.3.4.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFJ	2024-02-14	2025-02-14
Block - DC	Fairview Microwave	SD3379	AMM	2023-08-04	2024-08-04
Generator - Signal	Agilent	N5173B	TIW	2023-08-07	2026-08-07

PEAK TO AVERAGE POWER (PAPR) CCDF - GSM

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0

EUT:	AirScale Base Transceiver Station Remote Radio Head Model AHFIHA	Work Order:	NOKI0074
Serial Number:	RW233800370	Date:	2024-03-18
Customer:	Nokia Solutions and Networks	Temperature:	23.3°C
Attendees:	John Rattanavong, Mitch Hill	Relative Humidity:	34.5%
Customer Project:	None	Bar. Pressure (PMSL):	997 mbar
Tested By:	Jarrod Brenden	Job Site:	TX07
Power:	54 VDC	Configuration:	NOKI0074-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 24E:2024	ANSI C63.26:2015
RSS-133 Issue 6:2013 +A1:2018	ANSI C63.26:2015

COMMENTS

All losses in the measurement path were accounted for in the spectrum analyzer reference level offsets for: attenuators, cables, DC block, and filters were used.

GSM/EDGE carriers are required to be operated with 3G(WCDMA) 4G(LTE) or 5G(5GNR) RAT carriers in the PCS band. Single 2G(GSM) carriers in PCS band: GSM/EDGE carriers were enabled at maximum power (20 watts/carrier) and LTE 5MHz carrier were enable at maximum power (40 watts/carrier) at 1970MHz.

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

Pass

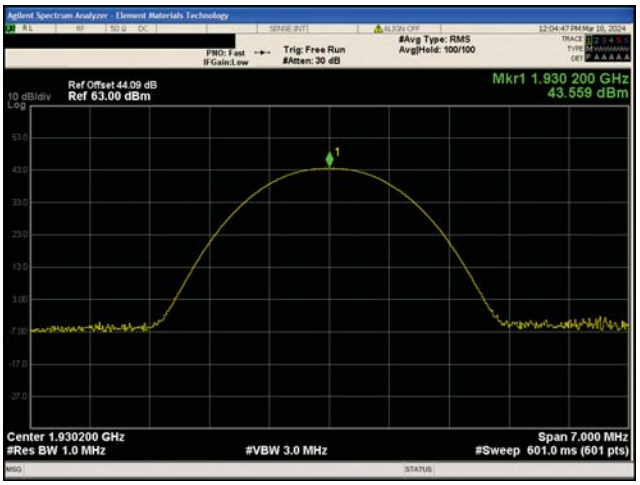
Tested By

TEST RESULTS

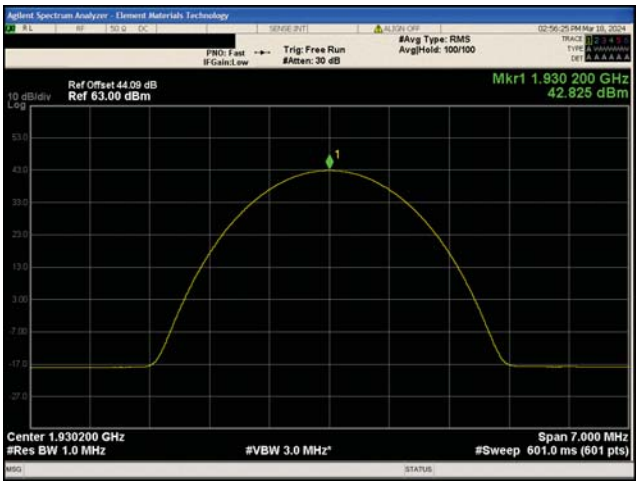
	Peak Detector dBm/MHz (dBm)	Avg Detector dBm/MHz (dBm)	PAPR (dB)	PAPR Limit (dB)	Results
2G GSM/EDGE PCS Band 2, 1930 MHz - 1990 MHz					
GMSK Modulation					
Low Channel, 1930.2 MHz	43.559	42.8	0.7	13	Pass
Low Channel, 1930.2 MHz - Reduced Power	37.526	36.8	0.7	13	Pass
Low Channel +1, 1930.4 MHz	43.335	42.8	0.5	13	Pass
Mid Channel, 1960.0 MHz	43.873	43.2	0.7	13	Pass
High Channel -1, 1989.6 MHz	43.675	43.1	0.5	13	Pass
High Channel, 1989.8 MHz	43.917	43.2	0.7	13	Pass
High Channel, 1989.8 MHz - Reduced Power	37.725	37.1	0.6	13	Pass
8PSK Modulation					
Low Channel, 1930.2 MHz	46.707	43.0	3.7	13	Pass
Low Channel, 1930.2 MHz - Reduced Power	40.381	36.6	3.8	13	Pass
Low Channel +1, 1930.4 MHz	46.426	42.8	3.7	13	Pass
Mid Channel, 1960.0 MHz	47.004	43.3	3.7	13	Pass
High Channel -1, 1989.6 MHz	46.677	43.1	3.6	13	Pass
High Channel, 1989.8 MHz	46.951	43.3	3.6	13	Pass
High Channel, 1989.8 MHz - Reduced Power	40.785	37.0	3.8	13	Pass

PEAK TO AVERAGE POWER (PAPR)
CCDF - GSM

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0

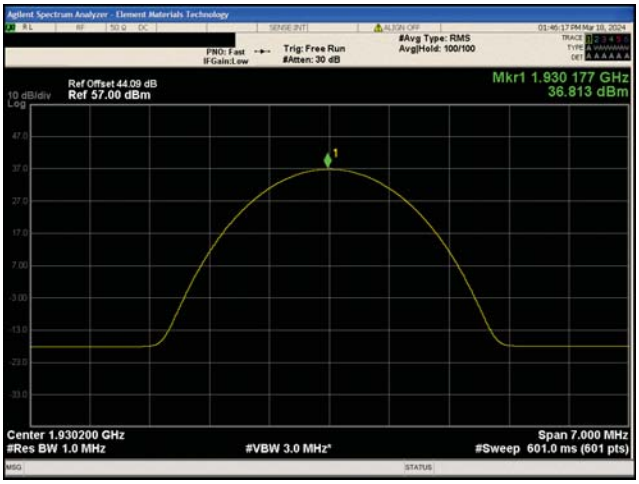


2G GSM/EDGE Band 2
GMSK Modulation
Low Channel, 1930.2 MHz



2G GSM/EDGE Band 2
GMSK Modulation
Low Channel, 1930.2 MHz

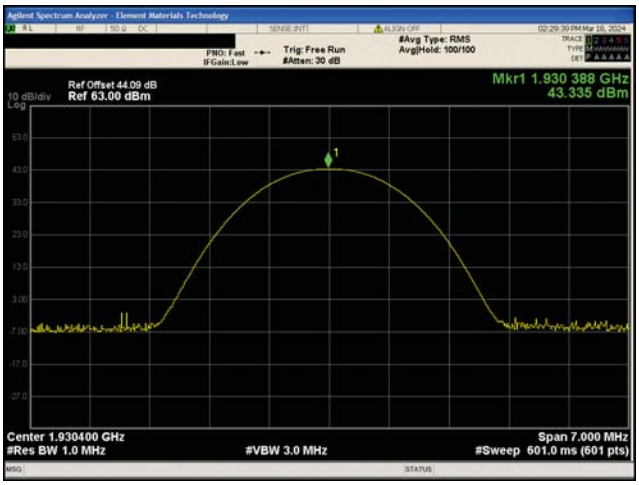
2G GSM/EDGE Band 2
GMSK Modulation
Low Channel, 1930.2 MHz - Reduced Power



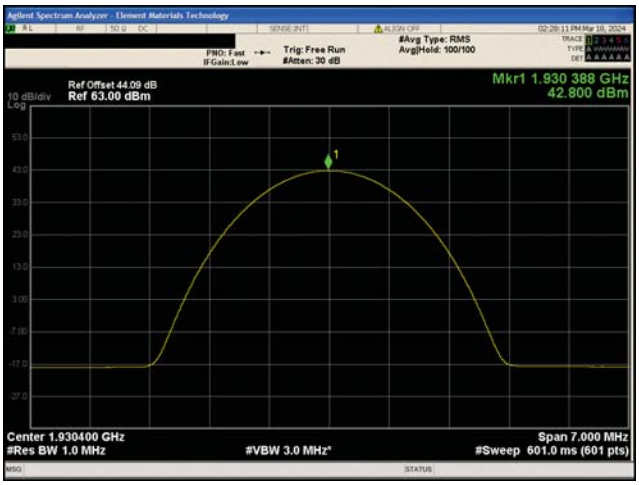
2G GSM/EDGE Band 2
GMSK Modulation
Low Channel, 1930.2 MHz - Reduced Power

PEAK TO AVERAGE POWER (PAPR)
CCDF - GSM

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0

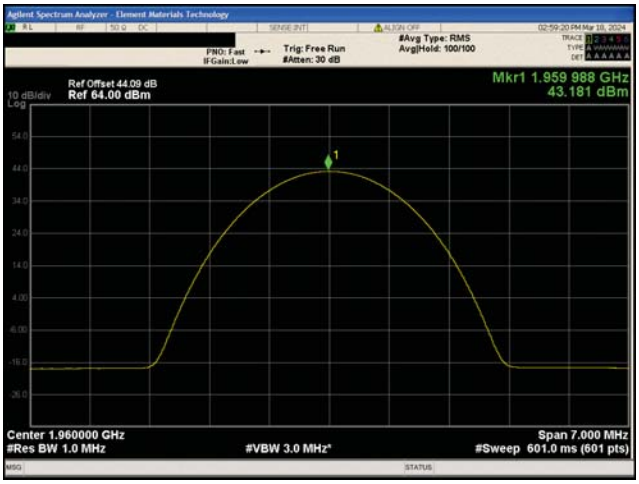


2G GSM/EDGE Band 2
GMSK Modulation
Low Channel +1, 1930.4 MHz



2G GSM/EDGE Band 2
GMSK Modulation
Low Channel +1, 1930.4 MHz

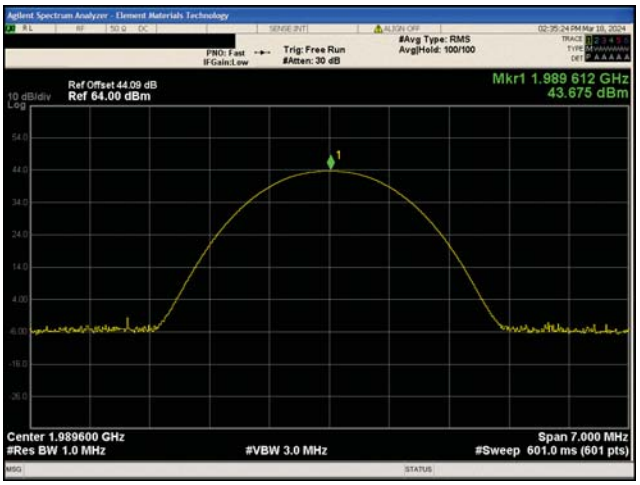
2G GSM/EDGE Band 2
GMSK Modulation
Mid Channel, 1960.0 MHz



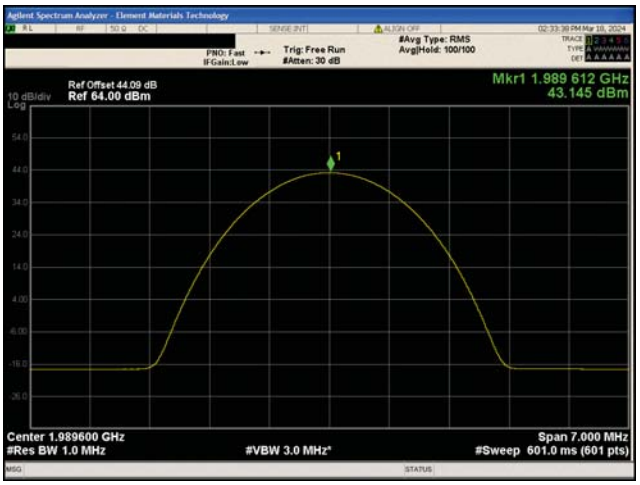
2G GSM/EDGE Band 2
GMSK Modulation
Mid Channel, 1960.0 MHz

PEAK TO AVERAGE POWER (PAPR)
CCDF - GSM

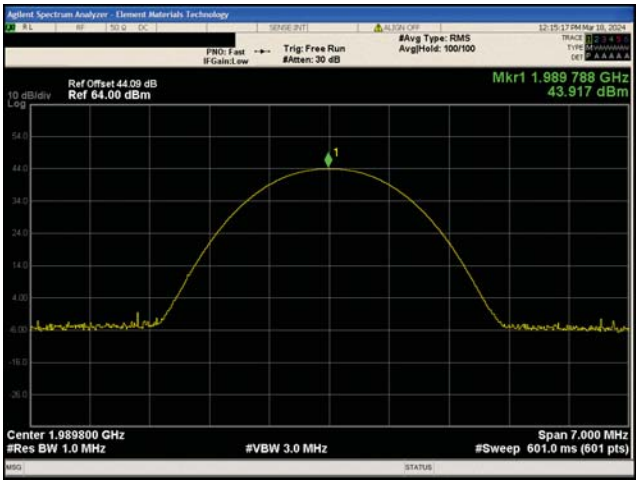
element
TbtTx 2023.12.06.3
WTD.2024.01.16.0



2G GSM/EDGE Band 2
GMSK Modulation
High Channel -1, 1989.6 MHz



2G GSM/EDGE Band 2
GMSK Modulation
High Channel -1, 1989.6 MHz

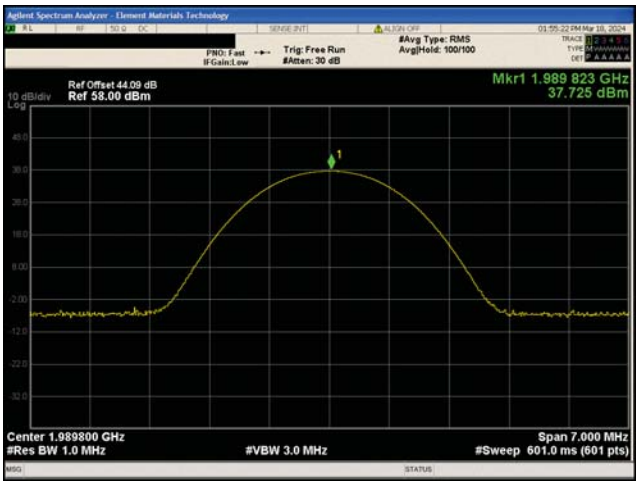


2G GSM/EDGE Band 2
GMSK Modulation
High Channel, 1989.8 MHz

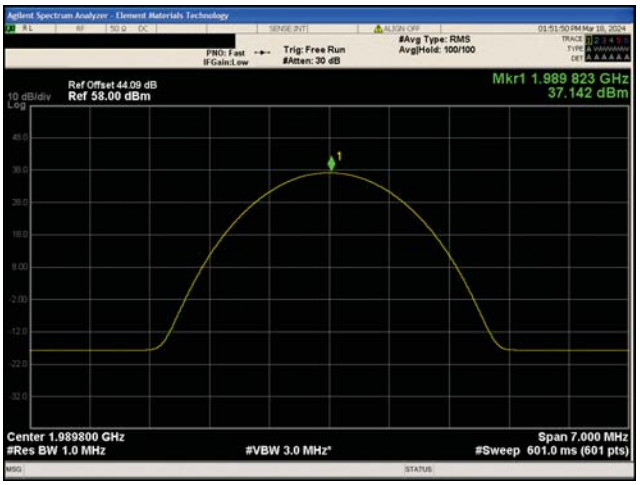
2G GSM/EDGE Band 2
GMSK Modulation
High Channel, 1989.8 MHz

PEAK TO AVERAGE POWER (PAPR)
CCDF - GSM

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0



2G GSM/EDGE Band 2
GMSK Modulation
High Channel, 1989.8 MHz - Reduced Power



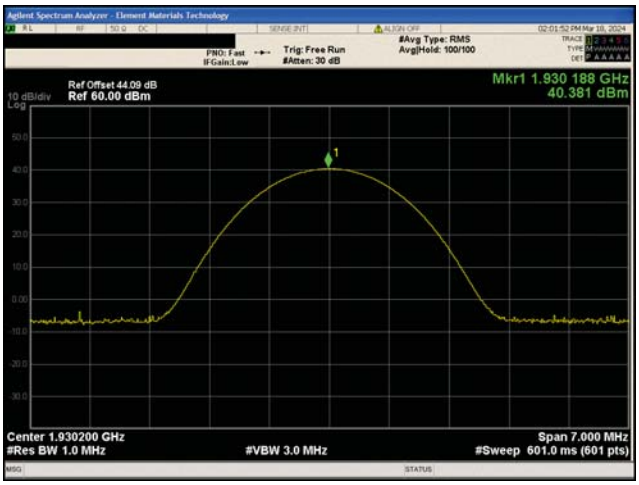
2G GSM/EDGE Band 2
GMSK Modulation
High Channel, 1989.8 MHz - Reduced Power

2G GSM/EDGE Band 2
8PSK Modulation
Low Channel, 1930.2 MHz

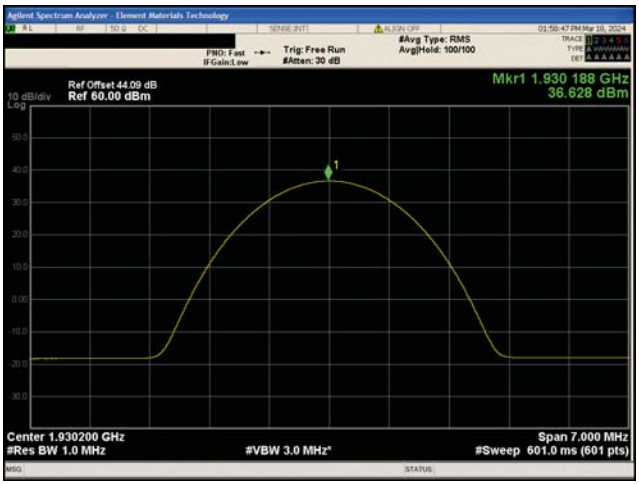
2G GSM/EDGE Band 2
8PSK Modulation
Low Channel, 1930.2 MHz

PEAK TO AVERAGE POWER (PAPR)
CCDF - GSM

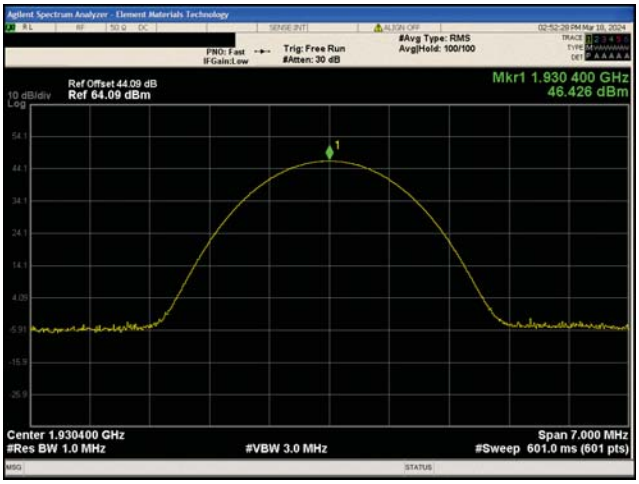
element
TbtTx 2023.12.06.3
WTD.2024.01.16.0



2G GSM/EDGE Band 2
8PSK Modulation
Low Channel, 1930.2 MHz - Reduced Power



2G GSM/EDGE Band 2
8PSK Modulation
Low Channel, 1930.2 MHz - Reduced Power

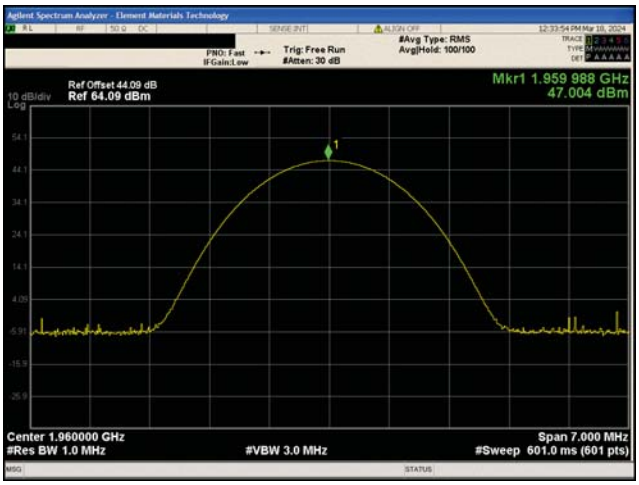


2G GSM/EDGE Band 2
8PSK Modulation
Low Channel +1, 1930.4 MHz

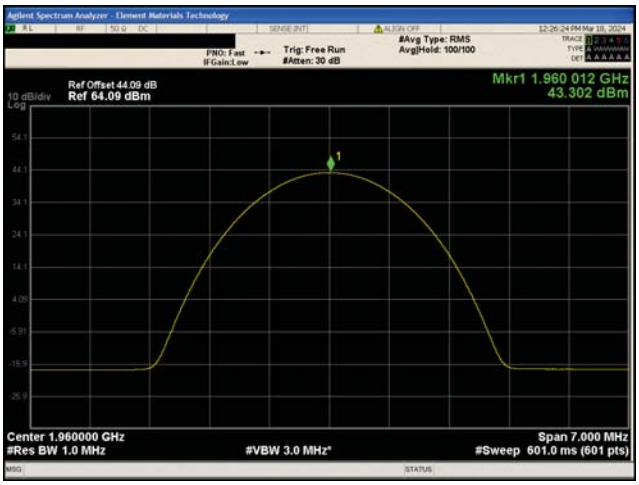
2G GSM/EDGE Band 2
8PSK Modulation
Low Channel +1, 1930.4 MHz

PEAK TO AVERAGE POWER (PAPR)
CCDF - GSM

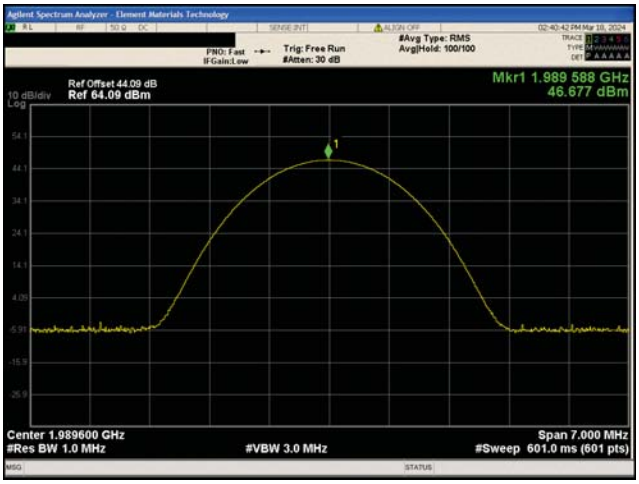
element
TbtTx 2023.12.06.3
WTD.2024.01.16.0



2G GSM/EDGE Band 2
8PSK Modulation
Mid Channel, 1960.0 MHz



2G GSM/EDGE Band 2
8PSK Modulation
Mid Channel, 1960.0 MHz

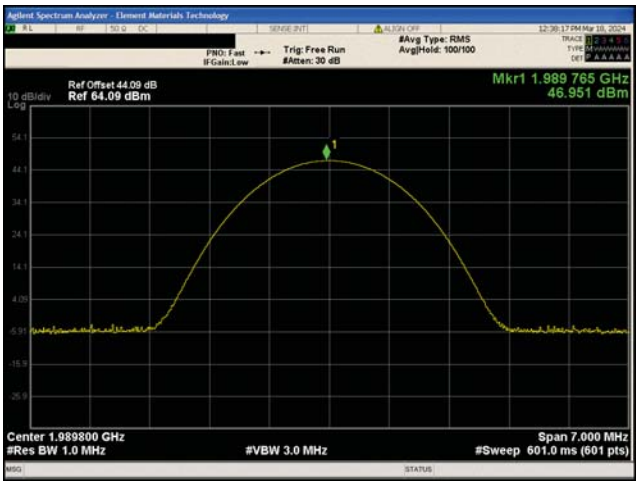


2G GSM/EDGE Band 2
8PSK Modulation
High Channel -1, 1989.6 MHz

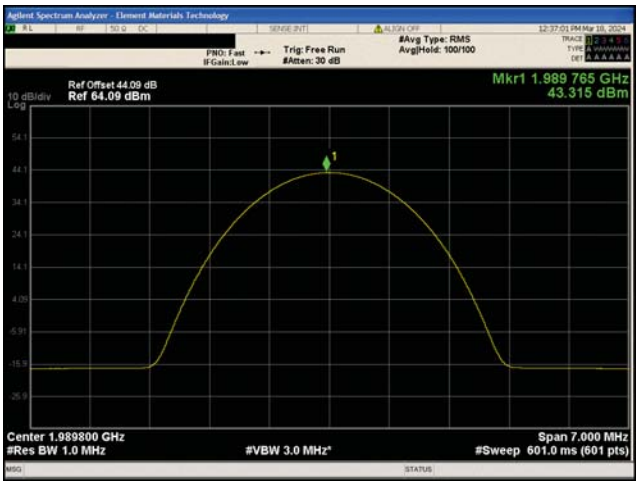
2G GSM/EDGE Band 2
8PSK Modulation
High Channel -1, 1989.6 MHz

PEAK TO AVERAGE POWER (PAPR)
CCDF - GSM

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0

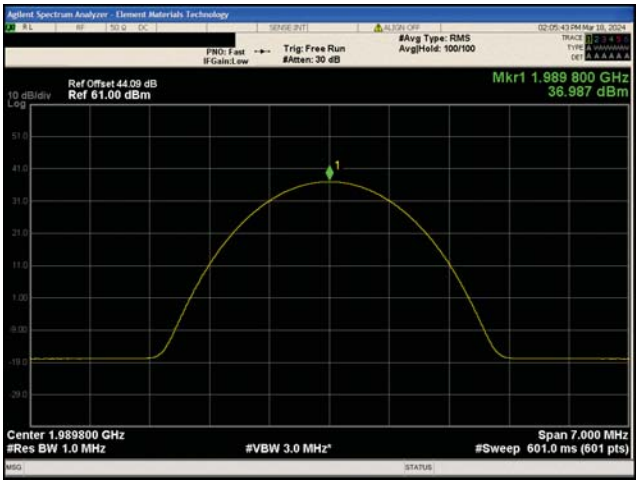


2G GSM/EDGE Band 2
8PSK Modulation
High Channel, 1989.8 MHz



2G GSM/EDGE Band 2
8PSK Modulation
High Channel, 1989.8 MHz

2G GSM/EDGE Band 2
8PSK Modulation
High Channel, 1989.8 MHz - Reduced Power



2G GSM/EDGE Band 2
8PSK Modulation
High Channel, 1989.8 MHz - Reduced Power

PEAK TO AVERAGE (PAPR) CCDF - WCDMA

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0

TEST DESCRIPTION

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.

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

RF conducted emissions testing was performed only on one port. The testing was performed on the same version of hardware (AHFIHA) as the original certification test. The AHFIHA 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.

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

The PAPR measurement method is described in ANSI C63.26 section 5.2.3.4.

The PAPR was measured using the CCDF function of the spectrum analyzer.

Per 27.50(d)(5), and RSS-139 5.5, the peak-to-average power ratio (PAPR) shall not exceed 13dB. The CCDF measurement method for FCC/IC is detailed in section 5.7.2 of KDB971168 D01v03r01 and ANSI C63.26-2015 section 5.2.3.4.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFJ	2024-02-14	2025-02-14
Block - DC	Fairview Microwave	SD3379	AMM	2023-08-04	2024-08-04
Generator - Signal	Agilent	N5173B	TIW	2023-08-07	2026-08-07

PEAK TO AVERAGE (PAPR) CCDF - WCDMA

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0

EUT:	AirScale Base Transceiver Station Remote Radio Head Model AHFIHA	Work Order:	NOKI0074
Serial Number:	RW233800370	Date:	2024-03-20
Customer:	Nokia Solutions and Networks	Temperature:	23.4°C
Attendees:	John Rattanavong, David Le	Relative Humidity:	38.7%
Customer Project:	None	Bar. Pressure (PMSL):	998 mbar
Tested By:	Jarrod Brenden	Job Site:	TX07
Power:	54 VDC	Configuration:	NOKI0074-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 24E:2024	ANSI C63.26:2015
RSS-133 Issue 6:2013 +A1:2018	ANSI C63.26:2015

COMMENTS

All losses in the measurement path were accounted for: attenuators, cables, DC block, and filters were used. While not displayed in the Spectrum analyzer CCDF screen captures, measurements were performed with an internal reference level offsets of 44.09dB.

3G (WCDMA) single carrier: In PCS band a single WCDMA carrier were enabled at maximum power (40 watts/carrier).

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

Pass

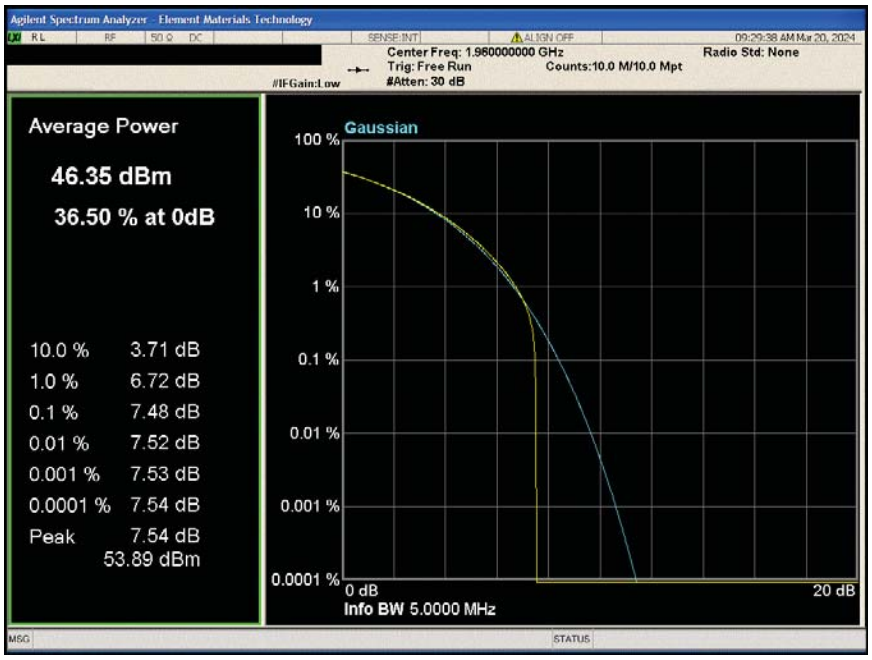
Tested By

TEST RESULTS

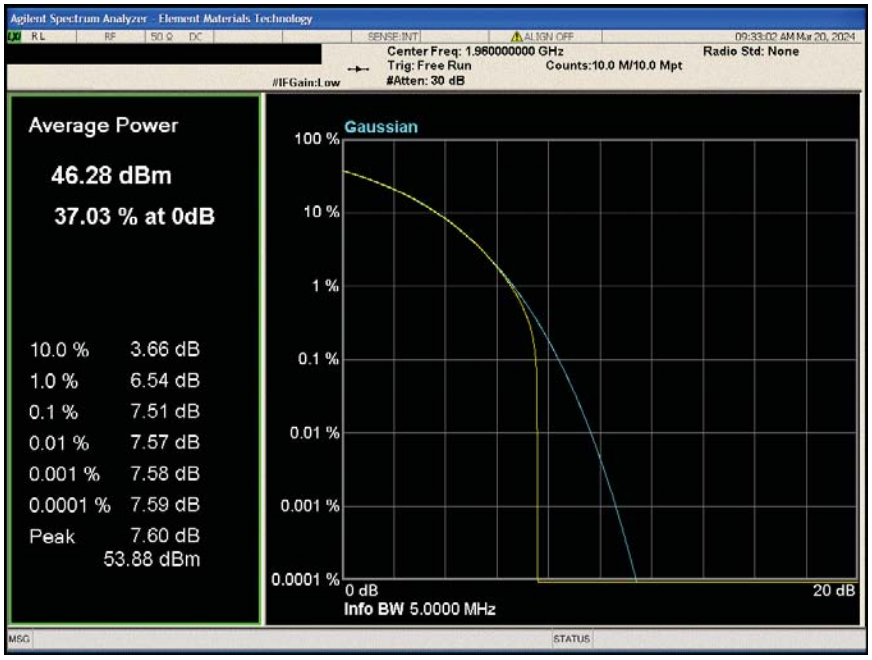
	0.1% PAPR Value (dB)	0.1% PAPR Limit (dB)	Results
3G WCDMA PCS Band II, 1930 MHz - 1990 MHz			
QPSK Modulation			
Mid Channel, 1960.0 MHz	7.48	13	Pass
16QAM Modulation			
Mid Channel, 1960.0 MHz	7.51	13	Pass
64QAM Modulation			
Low Channel, 1932.4 MHz	7.51	13	Pass
Mid Channel, 1960.0 MHz	7.51	13	Pass
High Channel, 1987.6 MHz	7.51	13	Pass

PEAK TO AVERAGE (PAPR) CCDF - WCDMA

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0



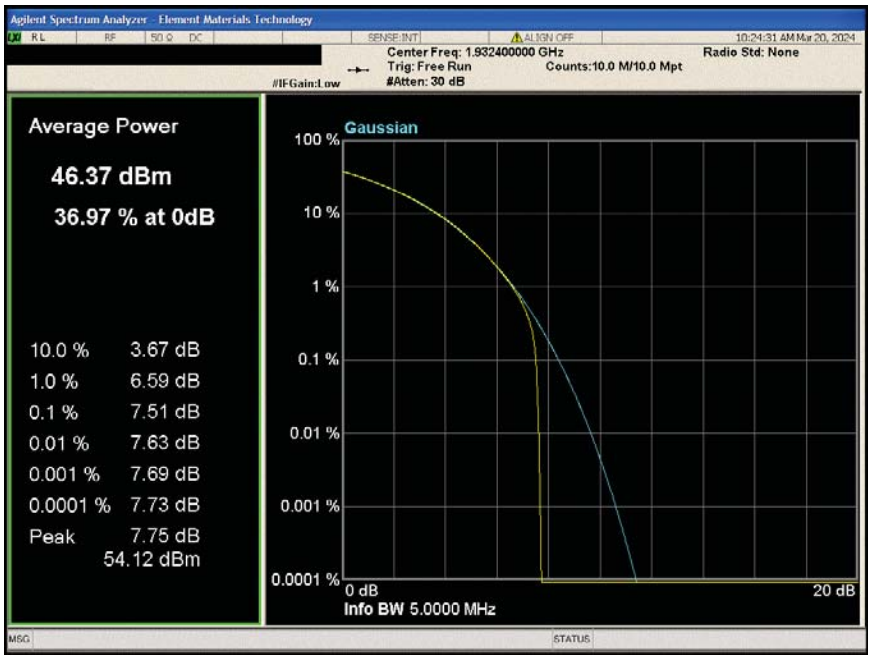
3G WCDMA PCS Band II
QPSK Modulation
Mid Channel, 1960.0 MHz



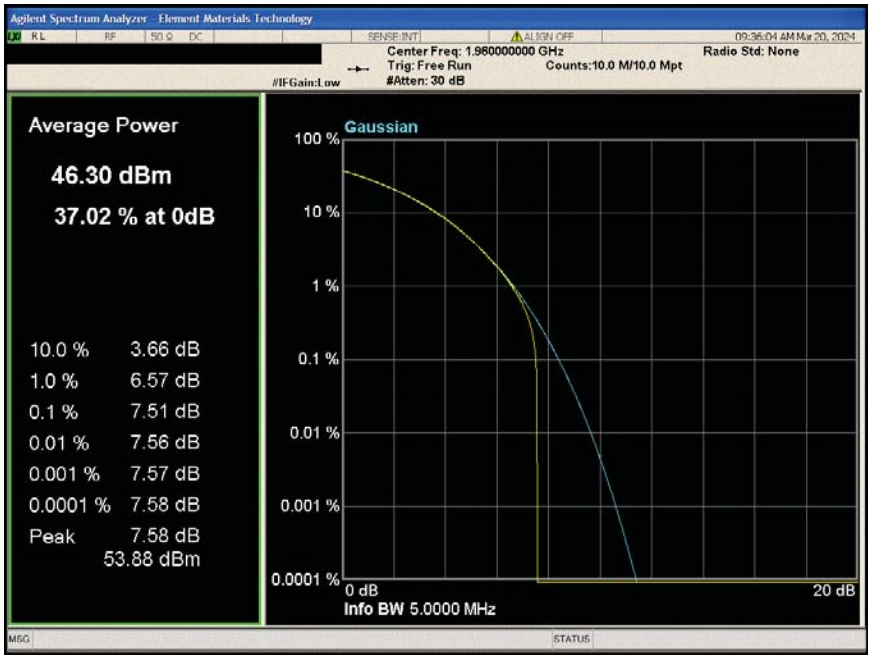
3G WCDMA PCS Band II
16QAM Modulation
Mid Channel, 1960.0 MHz

PEAK TO AVERAGE (PAPR) CCDF - WCDMA

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0



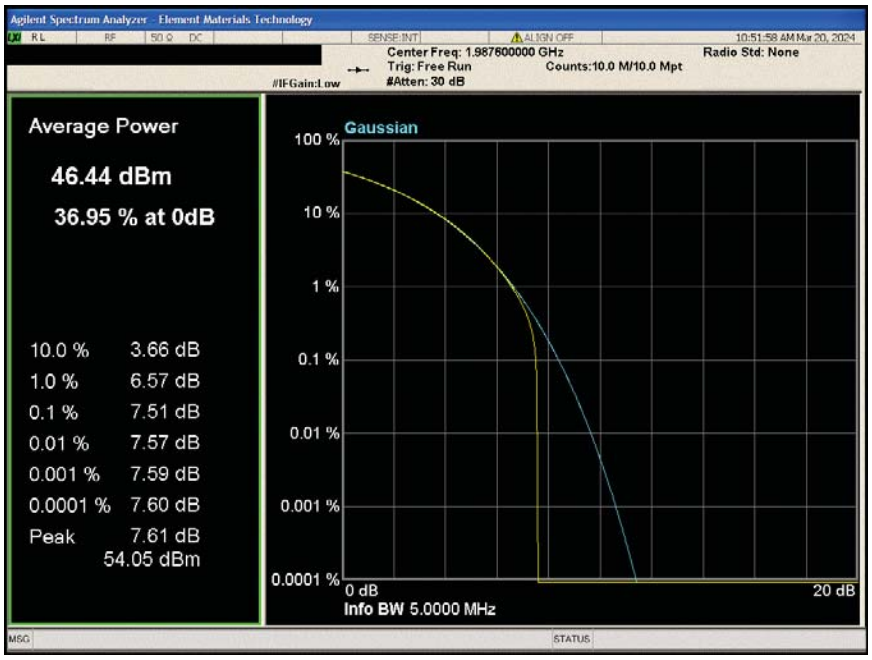
3G WCDMA PCS Band II
64QAM Modulation
Low Channel, 1932.4 MHz



3G WCDMA PCS Band II
64QAM Modulation
Mid Channel, 1960.0 MHz

PEAK TO AVERAGE (PAPR) CCDF - WCDMA

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0



3G WCDMA PCS Band II
64QAM Modulation
High Channel, 1987.6 MHz

OCCUPIED BANDWIDTH EMISSION MASK- GSM

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0

TEST DESCRIPTION

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.

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

The fundamental emission Occupied Bandwidth was measured using the channels and modes as called out on the following data sheets. The transmit power was set to its default maximum.

RF conducted emissions testing was performed only on one port. The testing was performed on the same version of hardware (AHFIHA) as the original certification test. The AHFIHA 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 method in section 5.4 of ANSI C63.26 was used to make this measurement. The spectrum analyzer settings were as follows:

- RBW is 1% - 5% of the occupied bandwidth
- VBW is ≥ 3x the RBW
- Peak Detector was used
- Trace max hold was used

The 26dB emission bandwidth is measured in accordance with section 4 of FCC KDB 971168 D01v03r01 and ANSI C63.26 section 5.4. The 99% occupied bandwidth is measured in accordance with section 6.7 of RSS-Gen Issue 5. The FCC 24.238(b) defines the 26dB bandwidth measurement procedure. The RSS Gen 6.7 defines the 99% bandwidth measurement procedure. Measurements shall be performed with 3GPP Band 2 transmitter at full power on the middle channel for all bandwidths and modulation types.

FCC and ISED Emission Designators for PCS Band (1930MHz to 1990MHz) Single Carrier – GSM and EDGE				
Radio Channel	GSM - GMSK		EDGE - 8PSK	
	FCC	ISED	FCC	ISED
Low	318KGXW	243KGXW	307KG7W	243KG7W
Mid	317KGXW	245KGXW	307KG7W	241KG7W
High	315KGXW	243KGXW	305KG7W	243KG7W
FCC emission designators are based on 26dB emission bandwidth. ISED emission designators are based on 99% emission bandwidth.				

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFJ	2024-02-14	2025-02-14
Block - DC	Fairview Microwave	SD3379	AMM	2023-08-04	2024-08-04
Generator - Signal	Agilent	N5173B	TIW	2023-08-07	2026-08-07

OCCUPIED BANDWIDTH EMISSION MASK- GSM

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0

EUT:	AirScale Base Transceiver Station Remote Radio Head Model AHFIHA	Work Order:	NOKI0074
Serial Number:	RW233800370	Date:	2024-03-18
Customer:	Nokia Solutions and Networks	Temperature:	22.6°C
Attendees:	John Rattanavong, Mitch Hill	Relative Humidity:	39.7%
Customer Project:	None	Bar. Pressure (PMSL):	1001 mbar
Tested By:	Jarrod Brenden	Job Site:	TX07
Power:	54 VDC	Configuration:	NOKI0074-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 24E:2024	ANSI C63.26:2015
RSS-133 Issue 6:2013 +A1:2018	ANSI C63.26:2015

COMMENTS

All losses in the measurement path were accounted for in the spectrum analyzer reference level offsets for: attenuators, cables, DC block, and filters were used.

GSM/EDGE carriers are required to be operated with 3G(WCDMA) 4G(LTE) or 5G(5GNR) RAT carriers in the PCS band. Single 2G(GSM) carriers in PCS band: GSM/EDGE carriers were enabled at maximum power (20 watts/carrier) and LTE 5MHz carrier were enable at maximum power (40 watts/carrier) at 1970MHz.

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

Pass

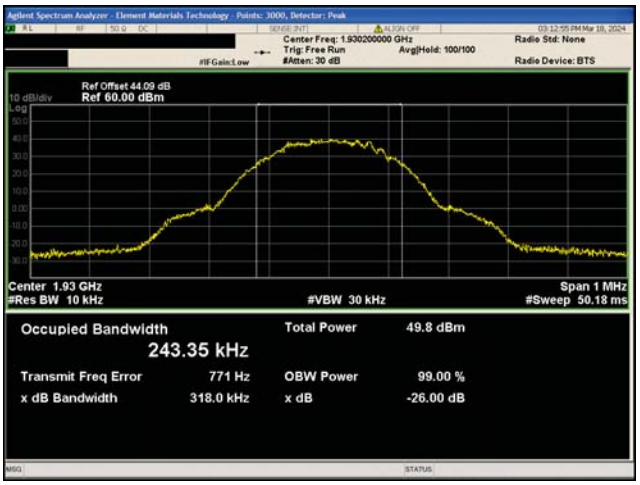
Tested By

TEST RESULTS

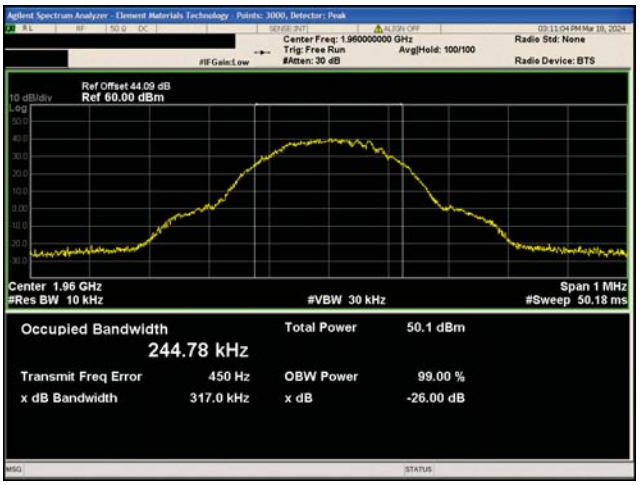
	Value 99%	Value 26 dB	Limit	Result
2G GSM/EDGE PCS Band 2, 1930 MHz - 1990 MHz				
GMSK Modulation				
Low Channel, 1930.2 MHz	243.35 kHz	317.979 kHz	N/A	N/A
Mid Channel, 1960.0 MHz	244.78 kHz	316.951 kHz	N/A	N/A
High Channel, 1989.8 MHz	243.13 kHz	314.567 kHz	N/A	N/A
8PSK Modulation				
Low Channel, 1930.2 MHz	242.82 kHz	306.817 kHz	N/A	N/A
Mid Channel, 1960.0 MHz	240.73 kHz	306.737 kHz	N/A	N/A
High Channel, 1989.8 MHz	243.08 kHz	305.058 kHz	N/A	N/A

OCCUPIED BANDWIDTH EMISSION MASK- GSM

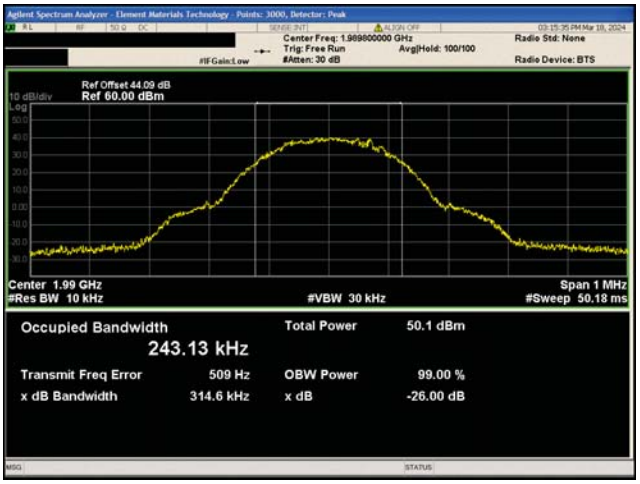
element
TbtTx 2023.12.06.3
WTD.2024.01.16.0



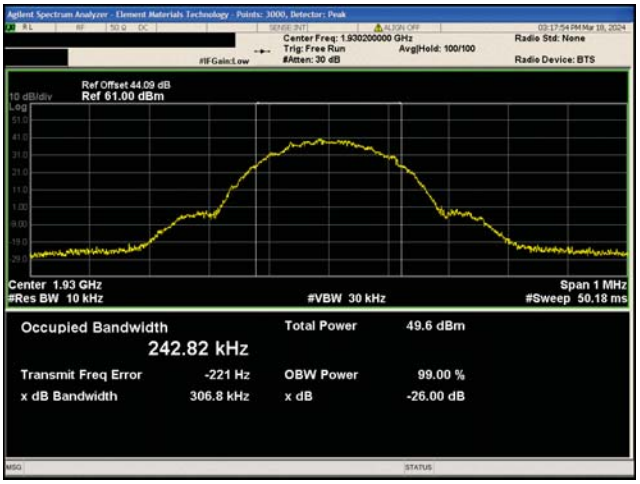
2G GSM/EDGE Band 2
GMSK Modulation
Low Channel, 1930.2 MHz



2G GSM/EDGE Band 2
GMSK Modulation
Mid Channel, 1960.0 MHz



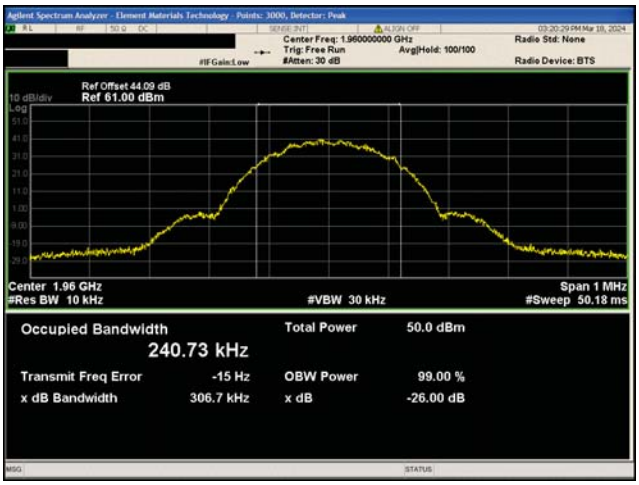
2G GSM/EDGE Band 2
GMSK Modulation
High Channel, 1989.8 MHz



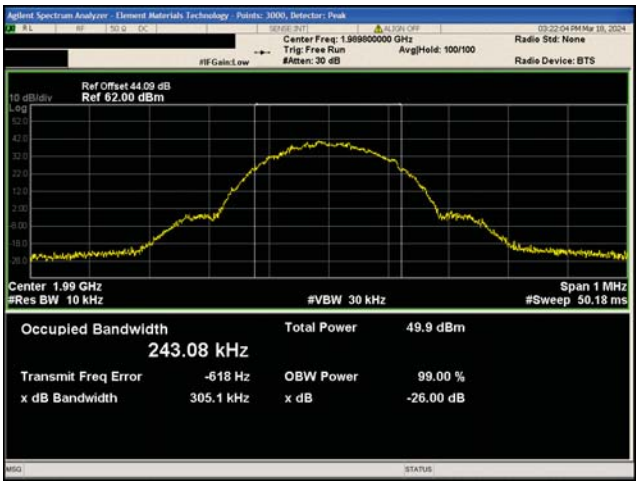
2G GSM/EDGE Band 2
8PSK Modulation
Low Channel, 1930.2 MHz

OCCUPIED BANDWIDTH EMISSION MASK- GSM

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0



2G GSM/EDGE Band 2
8PSK Modulation
Mid Channel, 1960.0 MHz



2G GSM/EDGE Band 2
8PSK Modulation
High Channel, 1989.8 MHz

OCCUPIED BANDWIDTH EMISSION MASK- WCDMA

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0

TEST DESCRIPTION

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.

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

The fundamental emission Occupied Bandwidth 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 5.4 of ANSI C63.26 was used to make this measurement. The spectrum analyzer settings were as follows:

- RBW is 1% - 5% of the occupied bandwidth
- VBW is ≥ 3x the RBW
- Peak Detector was used
- Trace max hold was used

RF conducted emissions testing was performed only on one port. The testing was performed on the same version of hardware (AHFIHA) as the original certification test. The AHFIHA 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 26dB emission bandwidth is measured in accordance with section 4 of FCC KDB 971168 D01v03r01 and ANSI C63.26 section 5.4. The 99% occupied bandwidth is measured in accordance with section 6.7 of RSS-Gen Issue 5. The FCC 24.238(b) defines the 26dB bandwidth measurement procedure. The RSS Gen 6.7 defines the 99% bandwidth measurement procedure. Measurements shall be performed with 3GPP Band 2 transmitter at full power on the middle channel for all bandwidths and modulation types.

FCC and ISED Emission Designators for Band PCS (1930MHz to 1990MHz) Single Carrier – WCDMA							
Ch BW	Radio Channel	WCDMA: QPSK		WCDMA : 16QAM		WCDMA : 64QAM	
		FCC	ISED	FCC	ISED	FCC	ISED
5MHz	Low	4M60F9W	4M16F9W	4M61F9W	4M15F9W	4M59F9W	4M14F9W
	Mid	4M61F9W	4M16F9W	4M61F9W	4M15F9W	4M62F9W	4M15F9W
	High	4M60F9W	4M16F9W	4M60F9W	4M15F9W	4M58F9W	4M15F9W
FCC emission designators are based on 26dB emission bandwidth. ISED emission designators are based on 99% emission bandwidth.							

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFJ	2024-02-14	2025-02-14
Block - DC	Fairview Microwave	SD3379	AMM	2023-08-04	2024-08-04
Generator - Signal	Agilent	N5173B	TIW	2023-08-07	2026-08-07

OCCUPIED BANDWIDTH EMISSION MASK- WCDMA

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0

EUT:	AirScale Base Transceiver Station Remote Radio Head Model AHFIHA	Work Order:	NOKI0074
Serial Number:	RW233800370	Date:	2024-03-20
Customer:	Nokia Solutions and Networks	Temperature:	23.3°C
Attendees:	John Rattanavong, David Le	Relative Humidity:	45.4%
Customer Project:	None	Bar. Pressure (PMSL):	999 mbar
Tested By:	Jarrod Brenden	Job Site:	TX07
Power:	54 VDC	Configuration:	NOKI0074-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 24E:2024	ANSI C63.26:2015
RSS-133 Issue 6:2013 +A1:2018	ANSI C63.26:2015

COMMENTS

All losses in the measurement path were accounted for in the spectrum analyzer reference level offsets for: attenuators, cables, DC block, and filters were used.

3G (WCDMA) single carrier: In PCS band a single WCDMA carrier were enabled at maximum power (40 watts/carrier).

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

Pass

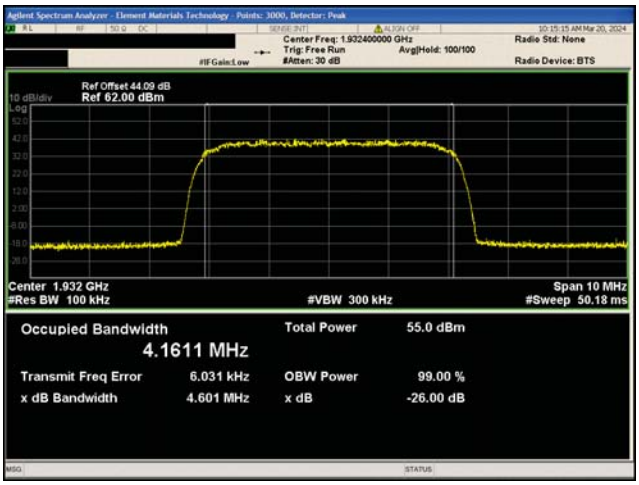
Tested By

TEST RESULTS

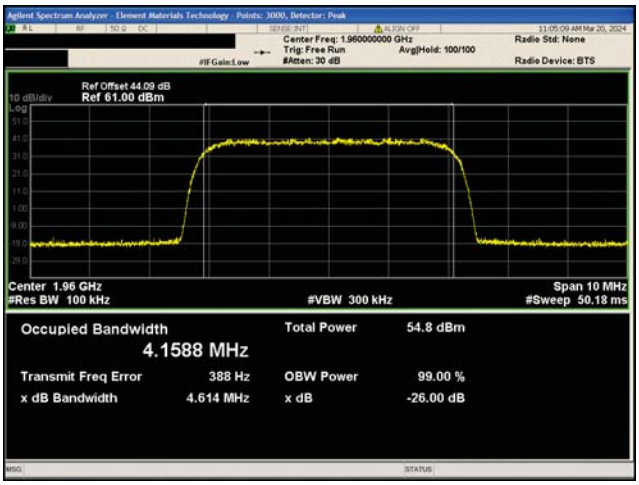
	Value 99%	Value 26 dB	Limit	Result
3G WCDMA PCS Band II, 1930 MHz - 1990 MHz				
QPSK Modulation				
Low Channel, 1932.4 MHz	4.1611 MHz	4.601 MHz	N/A	N/A
Mid Channel, 1960.0 MHz	4.1588 MHz	4.614 MHz	N/A	N/A
High Channel, 1987.6 MHz	4.1565 MHz	4.6 MHz	N/A	N/A
16QAM Modulation				
Low Channel, 1932.4 MHz	4.1489 MHz	4.609 MHz	N/A	N/A
Mid Channel, 1960.0 MHz	4.1508 MHz	4.605 MHz	N/A	N/A
High Channel, 1987.6 MHz	4.1486 MHz	4.603 MHz	N/A	N/A
64QAM Modulation				
Low Channel, 1932.4 MHz	4.1378 MHz	4.585 MHz	N/A	N/A
Mid Channel, 1960.0 MHz	4.151 MHz	4.618 MHz	N/A	N/A
High Channel, 1987.6 MHz	4.1479 MHz	4.582 MHz	N/A	N/A

OCCUPIED BANDWIDTH EMISSION MASK- WCDMA

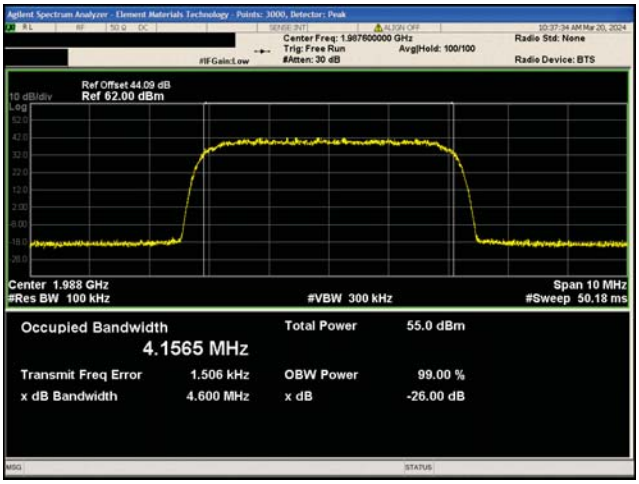
element
TbtTx 2023.12.06.3
WTD.2024.01.16.0



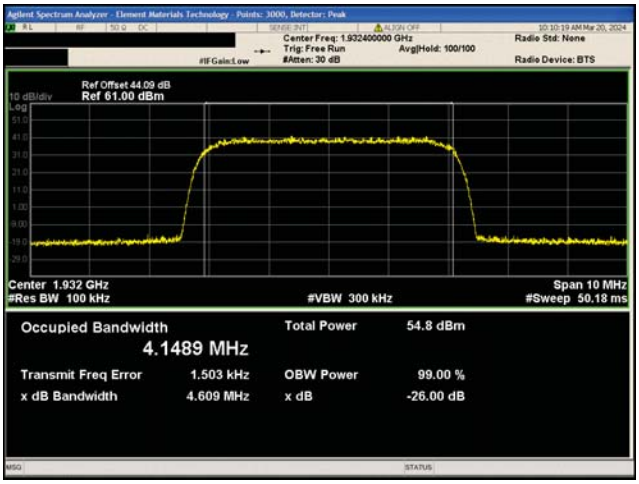
3G WCDMA PCS Band II
QPSK Modulation
Low Channel, 1932.4 MHz



3G WCDMA PCS Band II
QPSK Modulation
Mid Channel, 1960.0 MHz



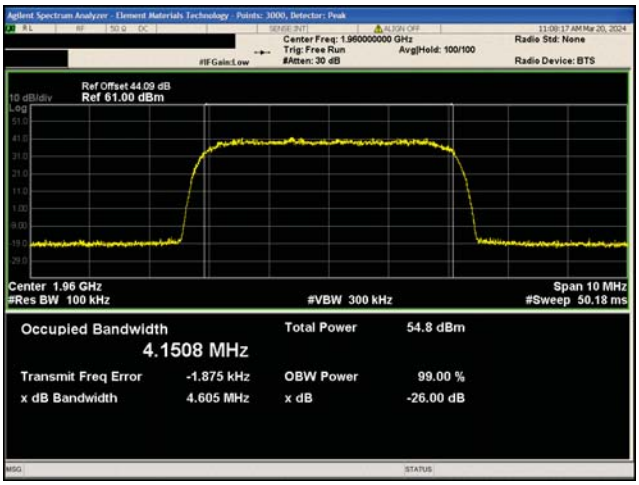
3G WCDMA PCS Band II
QPSK Modulation
High Channel, 1987.6 MHz



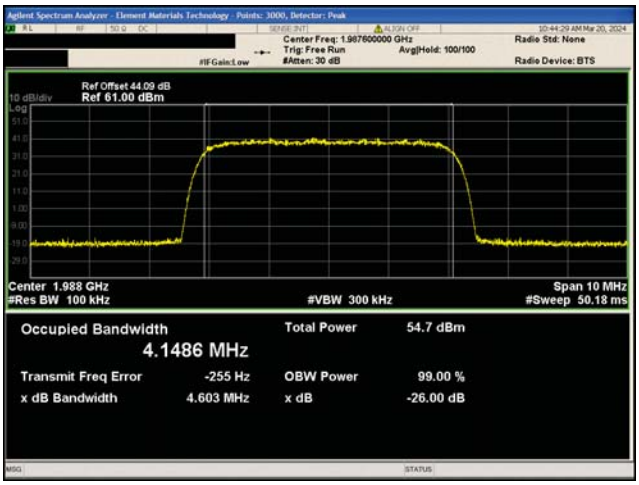
3G WCDMA PCS Band II
16QAM Modulation
Low Channel, 1932.4 MHz

OCCUPIED BANDWIDTH EMISSION MASK- WCDMA

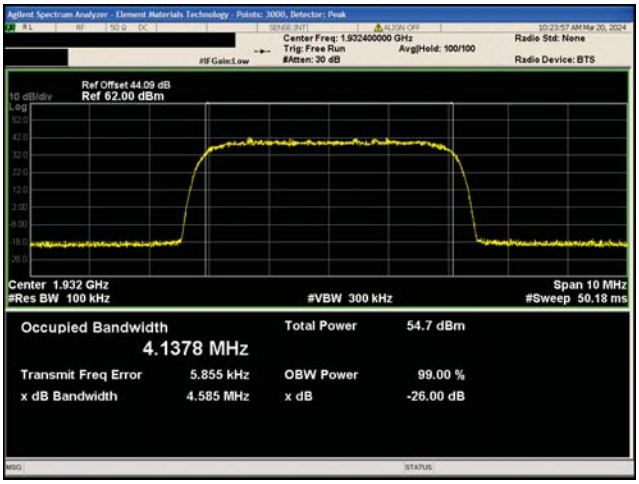
element
TbtTx 2023.12.06.3
WTD.2024.01.16.0



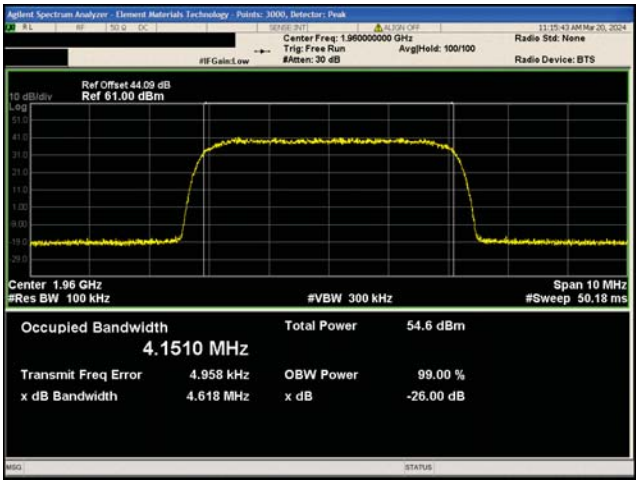
3G WCDMA PCS Band II
16QAM Modulation
Mid Channel, 1960.0 MHz



3G WCDMA PCS Band II
16QAM Modulation
High Channel, 1987.6 MHz



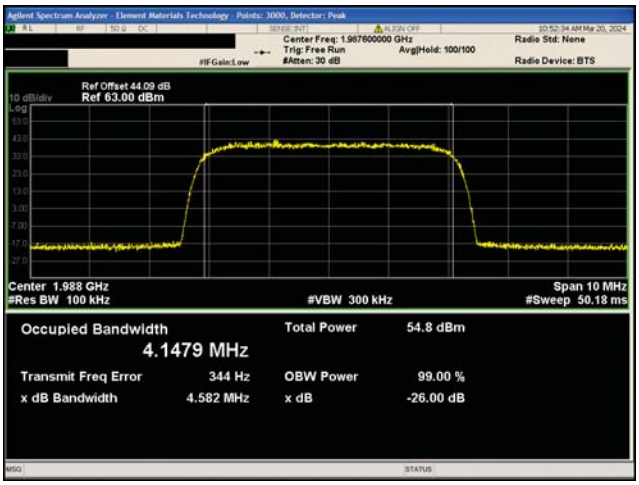
3G WCDMA PCS Band II
64QAM Modulation
Low Channel, 1932.4 MHz



3G WCDMA PCS Band II
64QAM Modulation
Mid Channel, 1960.0 MHz

OCCUPIED BANDWIDTH EMISSION MASK- WCDMA

element
TbtTx 2023.12.06.3
WTD.2024.01.16.0



3G WCDMA PCS Band II
64QAM Modulation
High Channel, 1987.6 MHz