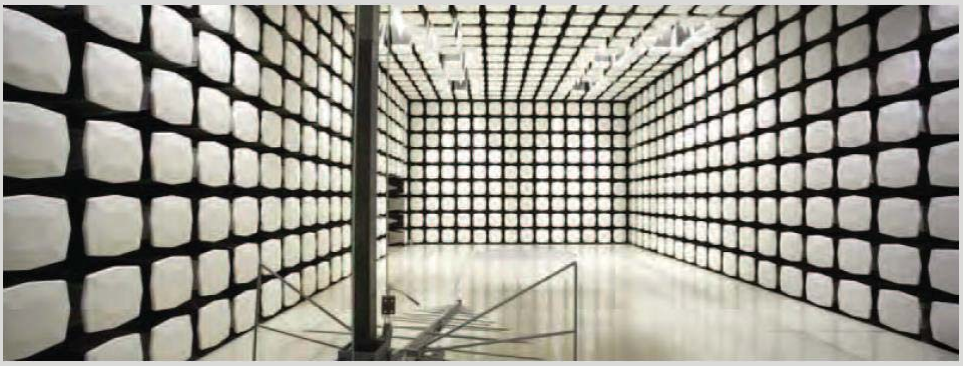
Radio Test Report
Application for a Permissive Change of Equipment Authorization
FCC Part 24 and IC RSS-133
[1930MHz – 1995MHz]

FCC Part 27, IC RSS-139
[2110MHz – 2200MHz]

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

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

Report: NOKI0070.0 Rev. 0, Issue Date: March 26, 2024



CERT #3310.03

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element
2023.04.17

CERTIFICATE OF TEST

Last Date of Test: March 5, 2024
Nokia Solutions and Networks
EUT: AHFII

Radio Equipment Testing

Standards

Specification	Method
Code of Federal Regulations (CFR) Title 47 Part 2 (Radio Standards Specification) RSS-Gen Issue 5 CFR Title 47 Part 24 Subpart E – Broadband PCS RSS-133 Issue 6 - January 18, 2018 – 2GHz Personal Communications Services CFR Title 47 Part 27 RSS-139 Issue 4 – September 29, 2022– Advanced Wireless Services (AWS) SRSP-510 Issue 5 – February 2009 SRSP-513 issue 4 – September 29, 2022 SRSP-519 issue 2 – September 29, 2022	ANSI C63.26-2015 with FCC KDB 971168 D01 v03r01 FCC KDB 971168 D03 v01 FCC KDB 662911D01 v02r01 FCC KDB 662911D02 v01

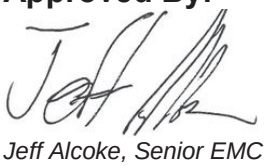
Results

Test Description	Result	Comments
Occupied Bandwidth	Pass	
Output Power	Pass	
Peak to Average Power (PAPR)CCDF	Pass	
Band Edge Compliance	Pass	
Spurious Conducted Emissions	Pass	
Spurious Radiated Emissions	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

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

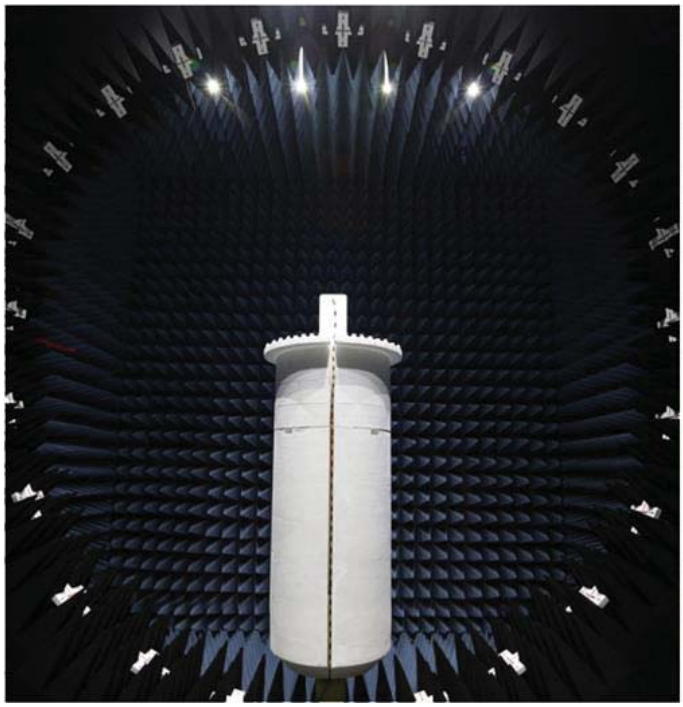
element
2023.09.21

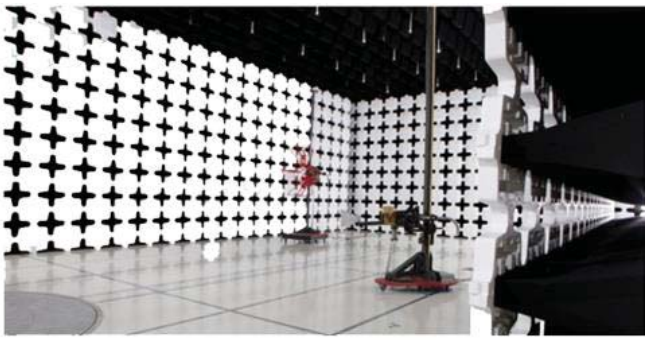
Testing was performed at the following location(s)

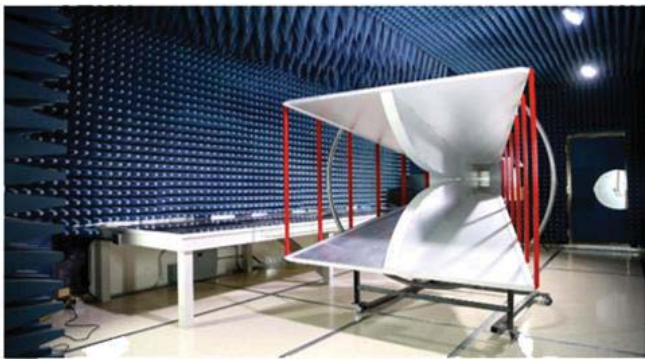
	Location	Labs (1)	Address	A2LA (2)	ISED (3)	BSMI (4)	VCCI (5)	CAB (6)	FDA (7)
☐	California	OC01-17	41 Tesla Irvine, CA 92618 (949) 861-8918	3310.04	2834B	SL2-IN-E-1154R	A-0029	US0158	TL-55
☐	Minnesota	MN01-11	9349 W Broadway Ave. Brooklyn Park, MN 55445 (612) 638-5136	3310.05	2834E	SL2-IN-E-1152R	A-0109	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

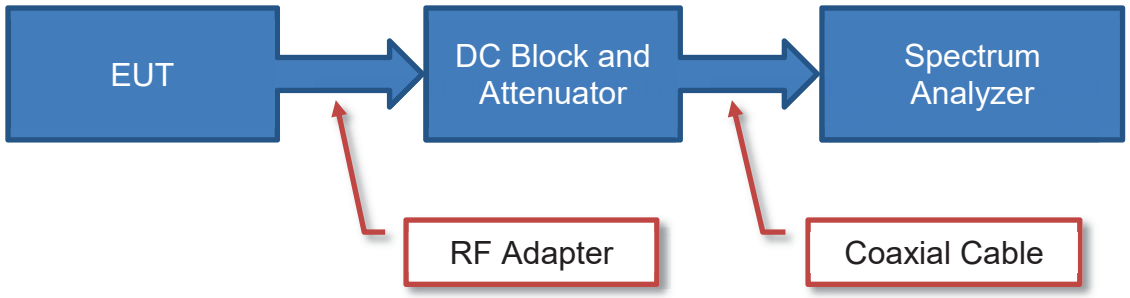
TEST SETUP BLOCK DIAGRAMS

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.

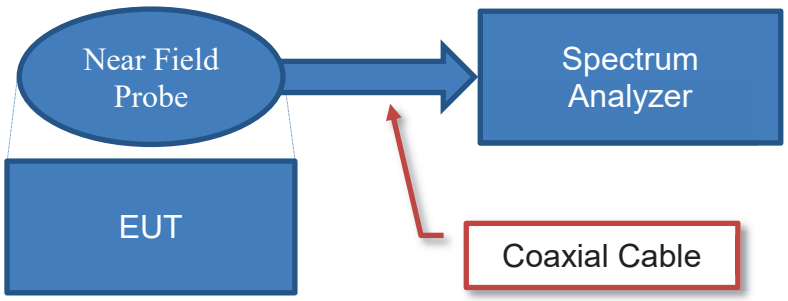
Antenna Port Conducted Measurements



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

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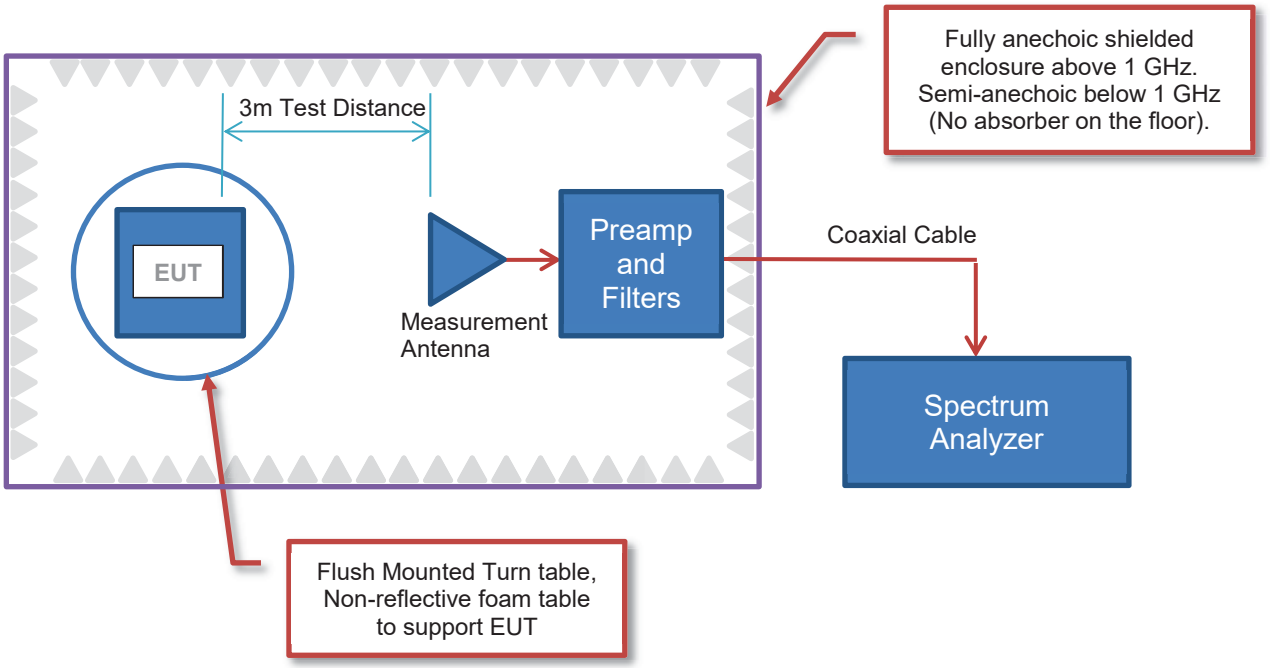
2022.04.22

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**

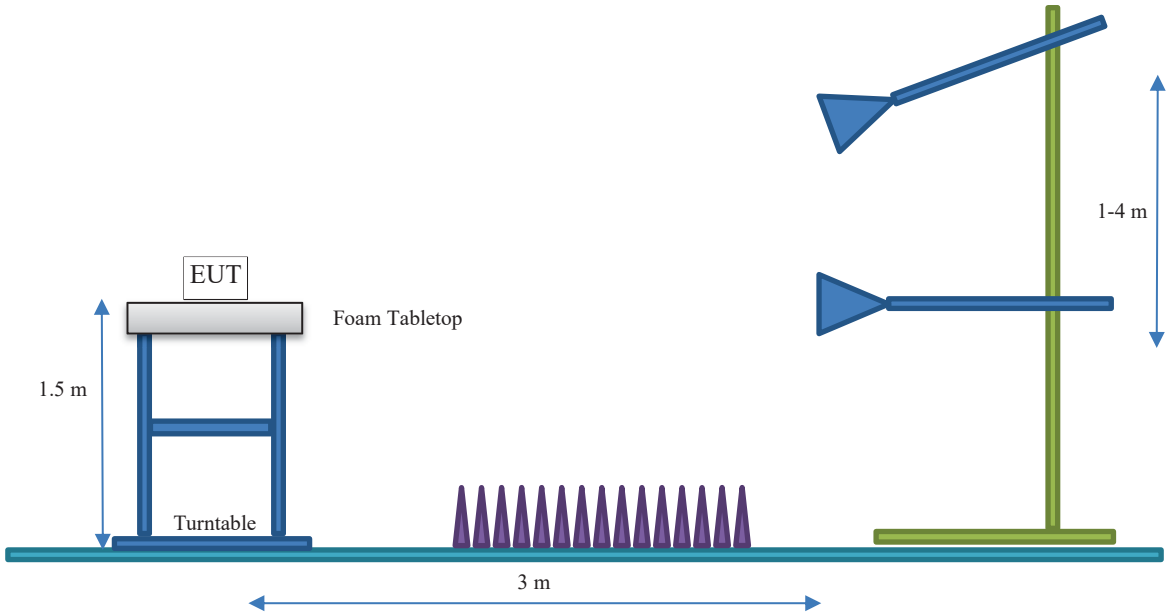
Radiated Power (ERP/EIRP) – Substitution Method:

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 AHFII
First Date of Test:	March 5, 2024
Last Date of Test:	March 5, 2024
Receipt Date of Samples:	March 5, 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 5G NR (new radio) carriers to the AirScale Base Transceiver Station Remote Radio Head Model AHFII FCC and ISED radio certifications. The original test effort includes testing for 4G LTE technologies. Please refer to the test report on the original certification for details on all required testing.

All conducted RF testing performed for the original certification testing has been repeated using 5G NR carriers for this permissive change per correspondence/guidance from Nemko TCB. The same test methodology used in the original certification testing was used in this permissive change test effort. Tests performed under the change effort include RF power, PSD, CCDF, emission bandwidth (99% and 26 dB down), band edge spurious emissions, and conducted spurious emissions.

The testing was performed on the same/similar hardware version (AHFII) as the original certification test. The base station and remote radio head software for this testing is an updated release that includes 5G NR carrier support.

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

Nokia Solutions and Networks AirScale Base Transceiver Station (BTS) Remote Radio Head (RRH) module, model AHFII is being developed under this effort. The AHFII remote radio head is a multi-standard multi-carrier radio module designed to support GSM/EDGE, WCDMA, LTE, LTE Narrow Band Internet of Things (NB IoT) operations (in-band, guard band, standalone) and 5G NR. The scope of testing in this effort is for the addition of 35MHz bandwidth in 5G NR FDD operations.

The AHFII RRH has four transmit/four receive antenna ports (4TX/4RX for Band n25 and 4TX/4RX for Band n66). Each antenna port supports 3GPP frequency band n25 (BTS Rx: 1850 to 1915 MHz/BTS TX: 1930 to 1995 MHz) and 3GPP frequency band n66 (BTS Rx: 1710 to 1780 MHz/BTS TX: 2110 to 2200 MHz). The maximum RF output power of the RRH is 480 Watts (120 watts per port x 4 ports). The maximum power per band (Band n25 or Band n66) is 80 watts. The maximum single carrier power level is 80 watts. The TX and RX instantaneous bandwidth cover the full operational RRH bandwidth. Multi-carrier operation is supported.

The RRH can be operated as a 4x4 MIMO, 2x2 MIMO or as non-MIMO for 5G NR FDD. The RRH supports 5, 10, 15, 20, 30, 40 and now 35MHz 5G NR bandwidths. The RRH supports four 5G NR downlink modulation types (QPSK, 16QAM, 64QAM and 256QAM). The 5G NR carriers/modulation types for this testing are setup according to 3GPP TS 38.141-1 Test Models and are NR-FR1-TM 1.1 (QPSK modulation type), NR-FR1-TM 3.2 (16QAM modulation type), NR-FR1-TM 3.1 (64QAM modulation type), and NR-FR1-TM 3.1a (256QAM modulation type).The RRH has external interfaces including DC power (DC In), ground, transmit/receive (ANT), external alarm (EAC), optical (OPT) and remote electrical tilt (RET). The RRH with applicable installation kit may be pole or wall mounted.

The PCS Band 5G NR channel bandwidths are 5, 10, 15, 20, 30, 35 and 40MHz. The downlink channel numbers for this 35MHz testing are provided below.

	Downlink 5G NR NR-ARFCN	Downlink Frequency (MHz)	5G NR Channel Bandwidth
			35 MHz
AHFII 5G NR Band n25	386000	1930.0	Band Edge
	389500	1947.5	Bottom Ch
	392500	1962.5	Middle Ch
	395500	1977.5	Top Channel
	399000	1995.0	Band Edge

AHFII Downlink Band Edge 5G NR Band n25 Frequency Channels

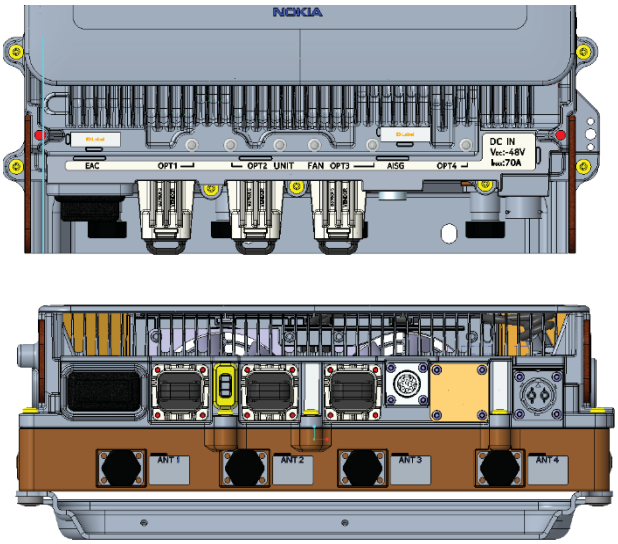
The AWS Band 5G NR channel bandwidths are 5, 10, 15, 20, 30, 35 and 40MHz. The downlink channel numbers for the 35MHz testing are provided below.

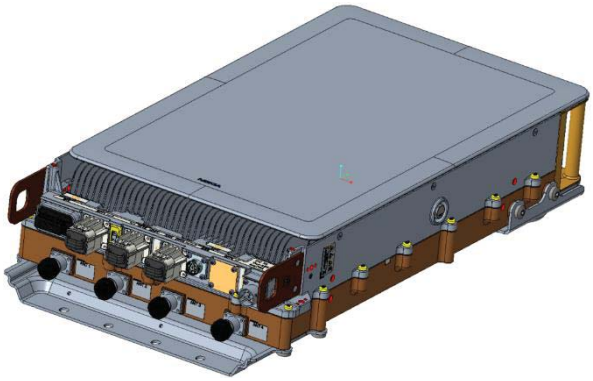
	Downlink 5G NR NR-ARFCN	Downlink Frequency (MHz)	5G NR Channel Bandwidth
			35 MHz
AHFII 5G NR Band n66	422000	2110.0	Band Edge
	425500	2127.5	Bottom Ch
	431000	2155.0	Middle Ch
	436500	2182.5	Top Channel
	440000	2200.0	Band Edge

AHFII Downlink Band Edge 5G NR Band n66 Frequency Channels

PRODUCT DESCRIPTION

AHFII Connector Layout





EUT 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	3	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 5G NR (new radio) 35 MHz carrier operations to the Nokia Solutions and Networks AirScale Base Transceiver Station (BTS) Remote Radio Head (RRH) model AHFII FCC and ISED radio certifications.

Configurations

element
2018-07-17

NOKI0070-1 Test Configuration 1

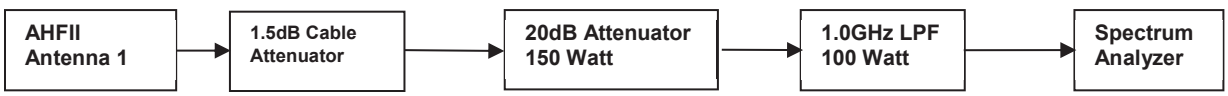
Software/Firmware Running during test	
Description	**Version**
Radio Module Software	RF.FRM6.trunk.20240214.022
BTS Software Version: (24R2)	SBTS24R2_ENB_9999_240215_00011

Equipment being tested (include Peripherals)			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
AMIA (BTS System Module)	Nokia Solutions and Networks	473098.204	UK222201001
ASIB (BTS System Module)	Nokia Solutions and Networks	473764A.102	K9214331950
ABIO (BTS System Module)	Nokia Solutions and Networks	475266A.103	DH233246457
ABIO (BTS System Module)	Nokia Solutions and Networks	475266A.103	L1214403575
AHFII (Radio Module Model)	Nokia Solutions and Networks	475656A.101	YK214000035
Low Pass Filter 1.0GHz/100W	Microwave Circuits,Inc.	L1G006G1	SN3972-01
Attenuator 150W/20dB	AeroflexWeinschel	66-20-33	BZ1165
SFP+ 9.8G,300M,850NM	Nokia	P306180	KR16090020071
SFP+ 9.8G,300M,850NM	Nokia	P306180	KR16050010001
SFP+ 9.8G,300M,850NM	Nokia	P306180	MA17331610206
SFP+ 9.8G,300M,850NM	Nokia	P306180	ME17220440006
HP ProBook 6470b	HP	B2G14EC#ABA	CNU246B8XP
Keysight- DC System power supply	Keysight	N8757A	US23L1724S
FPAD (DC-pwr supply)	Nokia	472805A.X21	A9124600282
1 Meter RF cable	Huber+suhner	SUCOFLEX 104	SN 551426 /4
6 Meter RF cable	Huber+suhner	SUCOFLEX 106	SN 528837 /6
2 Meter RF cable	Huber+suhner	SUCOFLEX 106	SN 297374
2 Meter RF cable	Huber+suhner	SUCOFLEX 106	SN 297376
250W -50ohm -Terminating Load	API Weinschel inc	1433-3-LIM	TC866
250W -50ohm -Terminating Load	API Weinschel inc	1433-3-LIM	TC863
250W -50ohm -Terminating Load	API Weinschel inc	1433-3-LIM	TC864
Fiber Optic cable 2m	Rosenberger	995741A	VZ1701
Fiber Optic cable 2m	Tyco Electronics	994807d	071109
CAT5e data cable	BELKIN	#R7J304	E178882
CAT5e data cable	LEONI L	64867m	146180
FYGB GPS receiver	Nokia	472748A	71231431
Cat-5e cable	CSA	LL73189	E151955
2 Meter RF cable	Maketron	993437a	706/1
2 Meter RF cable	Huber + Suhner, Inc.	993437a	706/2
2 Meter RF cable	Alpha wire	1354	9214

Cables (Peripheral)					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite(Y/N)**	**Connection 1**	**Connection 2**
Fiber Optic cable	N	2 meters	N	ABIO	AHFII
Fiber Optic cable	N	2 meters	N	ABIO	AHFII
Cat-5e cable (CSA)	Y	100 meters	N	ASIB	FYGB GPS receiver
Cat-5e cable	Y	15 meters	N	ASIB	WebEM- PC
Load-RF_Cable	Y	6 meters	N	EUT [RRH] Ant ports 2,3,4	250W -50ohm -Load

Cables					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
HS-SUCOFLEX_106/3pc	Y	10 meters	N	EUT [AHFII] Ant port #1	Attenuator 150W/40Db [BZ1165]
Attenuator 150W/40dB [BZ1165]	N	NA	N	RF cable HS-SUCOFLEX_106	LowPass filter 1.0GHz/100W
Low Pass Filter 1.0G/100W	N	NA	N	Attenuator 150W/40dB [BZ21165]	RF cable HS-SUCOFLEX_104
HS-SUCOFLEX_104	Y	1 meter	N	Low Pass Filter 1.0GHz/100W	Analyzer

RF Test Setup Diagram:



Configurations

element
2018-07-17

NOKI0070-2 Test Configuration 2

Software/Firmware Running during test	
Description	**Version**
Radio Module Software	RF.FRM6.trunk.20240214.022
BTS Software Version: (24R2)	SBTS24R2_ENB_9999_240215_00011

Equipment being tested (include Peripherals)			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
AMIA (BTS System Module)	Nokia Solutions and Networks	473098.204	UK222201001
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ABIO (BTS System Module)	Nokia Solutions and Networks	475266A.103	L1214403575
AHFII (Radio Module Model)	Nokia Solutions and Networks	475656A.101	YK214000035
Attenuator 250W/40dB	AeroflexWeinschel	58-40-33-LIM	UN619
SFP+ 9.8G,300M,850NM	Nokia	P306180	KR16090020071
SFP+ 9.8G,300M,850NM	Nokia	P306180	KR16050010001
SFP+ 9.8G,300M,850NM	Nokia	P306180	MA17331610206
SFP+ 9.8G,300M,850NM	Nokia	P306180	ME17220440006
HP ProBook 6470b	HP	B2G14EC#ABA	CNU246B8XP
Keysight- DC System power supply	Keysight	N8757A	US23L1724S
FPAD (DC-pwr supply)	Nokia	472805A.X21	A9124600282
1 Meter RF cable	Huber+suhner	SUCOFLEX 104	SN 551426 /4
6 Meter RF cable	Huber+suhner	SUCOFLEX 106	SN 528837 /6
2 Meter RF cable	Huber+suhner	SUCOFLEX 106	SN 297374
2 Meter RF cable	Huber+suhner	SUCOFLEX 106	SN 297376
250W -50ohm -Terminating Load	API Weinschel inc	1433-3-LIM	TC866
250W -50ohm -Terminating Load	API Weinschel inc	1433-3-LIM	TC863
250W -50ohm -Terminating Load	API Weinschel inc	1433-3-LIM	TC864
Fiber Optic cable 2m	Rosenberger	995741A	VZ1701
Fiber Optic cable 2m	Tyco Electronics	994807d	071109
CAT5e data cable	BELKIN	#R7J304	E178882
CAT5e data cable	LEONI L	64867m	146180
FYGB GPS receiver	Nokia	472748A	71231431

Cables (Peripheral)					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
Fiber Optic cable	N	2 meters	N	ABIO	AHFII
Fiber Optic cable	N	2 meters	N	ABIO	AHFII
Cat-5e cable (CSA)	Y	100 meters	N	ASIB	FYGB GPS receiver
Cat-5e cable	Y	15 meters	N	ASIB	WebEM- PC

Cables					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
HS-SUCOFLEX_106/3pc	Y	10 meters	N	EUT [AHFII] Ant port #1	Attenuator 150W/40dB [UN619]
Attenuator 150W/40dB [UN619]	N	NA	N	RF cable HS-SUCOFLEX_106	HS-SUCOFLEX_104
HS-SUCOFLEX_104	Y	1 meter	N	Attenuator 150W/40dB [UN619]	Analyzer

RF Test Setup Diagram:

Configurations

element
2018-07-17

NOKI0070-3 Test Configuration 3

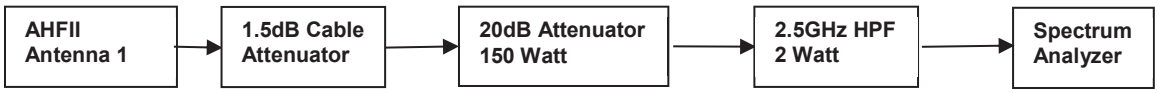
Software/Firmware Running during test	
Description	**Version**
Radio Module Software	RF.FRM6.trunk.20240214.022
BTS Software Version: (24R2)	SBTS24R2_ENB_9999_240215_00011

Equipment being tested (include Peripherals)			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
AMIA (BTS System Module)	Nokia Solutions and Networks	473098.204	UK222201001
ASIB (BTS System Module)	Nokia Solutions and Networks	473764A.102	K9214331950
ABIO (BTS System Module)	Nokia Solutions and Networks	475266A.103	DH233246457
ABIO (BTS System Module)	Nokia Solutions and Networks	475266A.103	L1214403575
AHFII (Radio Module Model)	Nokia Solutions and Networks	475656A.101	YK214000035
High Pass Filter 3.2-18GHz/15W	RF-Lambda	RHPF23G03G18	20121400045
Attenuator 150W/20dB	AeroflexWeinschel	66-20-33	BZ1165
SFP+ 9.8G,300M,850NM	Nokia	P306180	KR16090020071
SFP+ 9.8G,300M,850NM	Nokia	P306180	KR16050010001
SFP+ 9.8G,300M,850NM	Nokia	P306180	MA17331610206
SFP+ 9.8G,300M,850NM	Nokia	P306180	ME17220440006
HP ProBook 6470b	HP	B2G14EC#ABA	CNU246B8XP
Keysight- DC System power supply	Keysight	N8757A	US23L1724S
FPAD (DC-pwr supply)	Nokia	472805A.X21	A9124600282
1 Meter RF cable	Huber+suhner	SUCOFLEX 104	SN 551426 /4
6 Meter RF cable	Huber+suhner	SUCOFLEX 106	SN 528837 /6
2 Meter RF cable	Huber+suhner	SUCOFLEX 106	SN 297374
2 Meter RF cable	Huber+suhner	SUCOFLEX 106	SN 297376
250W -50ohm -Terminating Load	API Weinschel inc	1433-3-LIM	TC866
250W -50ohm -Terminating Load	API Weinschel inc	1433-3-LIM	TC863
250W -50ohm -Terminating Load	API Weinschel inc	1433-3-LIM	TC864
Fiber Optic cable 2m	Rosenberger	995741A	VZ1701
Fiber Optic cable 2m	Tyco Electronics	994807d	071109
CAT5e data cable	BELKIN	#R7J304	E178882
CAT5e data cable	LEONI L	64867m	146180
FYGB GPS receiver	Nokia	472748A	71231431
Cat-5e cable	CSA	LL73189	E151955

Cables (Peripheral)					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
Fiber Optic cable	N	2 meters	N	ABIO	AHFII
Fiber Optic cable	N	2 meters	N	ABIO	AHFII
Cat-5e cable (CSA)	Y	100 meters	N	ASIB	FYGB GPS receiver
Cat-5e cable	Y	15 meters	N	ASIB	WebEM- PC

Cables					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
HS-SUCOFLEX_106	Y	6 meters	N	EUT [RRH] RF port #1	Attenuator 150W/20dB [BZ1165]
Attenuator 150W/20dB	N	NA	N	HS-SUCOFLEX_106	High Pass Filter 3.5-18GHz
High Pass Filter 3.5-18GHz/15Watt	N	NA	N	Attenuator 150W/20dB [BZ1165]	RF cable HS-SUCOFLEX_104
HS-SUCOFLEX_104	Y	1 meter	N	High Pass Filter 3.5-18GHz	Analyzer

RF Test Setup Diagram:



Configurations

element
2018-07-17

Noki0070-4 Test Configuration 4

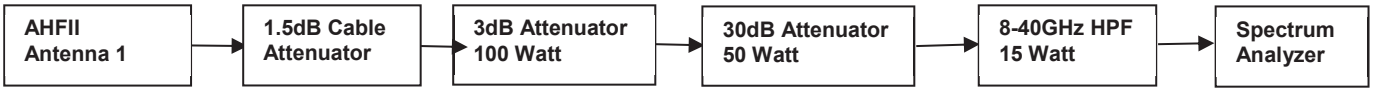
Software/Firmware Running during test	
Description	**Version**
Radio Module Software	RF.FRM6.trunk.20240214.022
BTS Software Version: (24R2)	SBTS24R2_ENB_9999_240215_00011

Equipment being tested (include Peripherals)			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
AMIA (BTS System Module)	Nokia Solutions and Networks	473098.204	UK222201001
ASIB (BTS System Module)	Nokia Solutions and Networks	473764A.102	K9214331950
ABIO (BTS System Module)	Nokia Solutions and Networks	475266A.103	DH233246457
ABIO (BTS System Module)	Nokia Solutions and Networks	475266A.103	L1214403575
AHFII (Radio Module Model)	Nokia Solutions and Networks	475656A.101	YK214000035
Attenuator 100W/3dB	AeroflexWeinschel	47-3-33	CC7387
Attenuator 50W/30dB	Narda	776B-30	776B-30
SFP+ 9.8G,300M,850NM	Nokia	P306180	KR16090020071
SFP+ 9.8G,300M,850NM	Nokia	P306180	KR16050010001
SFP+ 9.8G,300M,850NM	Nokia	P306180	MA17331610206
SFP+ 9.8G,300M,850NM	Nokia	P306180	ME17220440006
HP ProBook 6470b	HP	B2G14EC#ABA	CNU246B8XP
Keysight- DC System power supply	Keysight	N8757A	US23L1724S
FPAD (DC-pwr supply)	Nokia	472805A.X21	A9124600282
1 Meter RF cable	Huber+suhner	SUCOFLEX 104	SN 551426 /4
6 Meter RF cable	Huber+suhner	SUCOFLEX 106	SN 528837 /6
2 Meter RF cable	Huber+suhner	SUCOFLEX 106	SN 297374
2 Meter RF cable	Huber+suhner	SUCOFLEX 106	SN 297376
250W -50ohm -Terminating Load	API Weinschel inc	1433-3-LIM	TC866
250W -50ohm -Terminating Load	API Weinschel inc	1433-3-LIM	TC863
250W -50ohm -Terminating Load	API Weinschel inc	1433-3-LIM	TC864
Fiber Optic cable 2m	Rosenberger	995741A	VZ1701
Fiber Optic cable 2m	Tyco Electronics	994807d	071109
CAT5e data cable	BELKIN	#R7J304	E178882
CAT5e data cable	LEONI L	64867m	146180
FYGB_GPS receiver	Nokia	472748A	71231431
AMIA (BTS System Module)	Nokia Solutions and Networks	473098.204	UK222201001
ASIB (BTS System Module)	Nokia Solutions and Networks	473764A.102	K9214331950

Cables (Peripheral)					
Description	**Shield (Y/N)**	**Length (m)**	**Ferrite (Y/N)**	**Connection 1**	**Connection 2**
Fiber Optic cable	N	2 meters	N	ABIO	AHFII
Fiber Optic cable	N	2 meters	N	ABIO	AHFII
Cat-5e cable (CSA)	Y	100 meters	N	ASIB	FYGB_GPS receiver
Cat-5e cable	Y	15 meters	N	ASIB	WebEM- PC

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

RF Test Setup Diagram:



MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2024-03-05	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	2024-03-05	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	2024-03-05	Band Edge Compliance	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
4	2024-03-05	Spurious Conducted Emissions	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	2024-03-05	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.
6	2024-03-05	Power Spectral Density	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

OCCUPIED BANDWIDTH

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

FCC 27.53(H)(3) defines he 26dB emission bandwidth requirement.

RSS GEN Section 6.7 defines the 99% emission bandwidth requirement.

The occupied bandwidth was measured with the EUT configured in the modes called out in the data sheets.

FCC and ISED Emission Designators for Band n25 (1930MHz to 1995MHz)									
Ch BW	Radio Channel	5G-NR: QPSK		5G-NR: 16QAM		5G-NR: 64QAM		5G-NR: 256QAM	
		FCC	ISED	FCC	ISED	FCC	ISED	FCC	ISED
25MHz	Low							35M5G7W	33M6G7W
	Mid	35M5G7W	33M6G7W	35M5G7W	33M7G7W	35M5G7W	33M7G7W	35M6G7W	33M7G7W
	High							35M5G7W	33M6G7W
Note: FCC emission designators are based on 26dB emission bandwidth. ISED emission designators are based on 99% emission bandwidth.									

FCC and ISED Emission Designators for Band n66 (2110MHz to 2200MHz)									
Ch BW	Radio Channel	5G-NR: QPSK		5G-NR: 16QAM		5G-NR: 64QAM		5G-NR: 256QAM	
		FCC	ISED	FCC	ISED	FCC	ISED	FCC	ISED
25MHz	Low							35M5G7W	33M6G7W
	Mid	35M5G7W	33M7G7W	35M5G7W	33M7G7W	35M4G7W	33M6G7W	35M5G7W	33M6G7W
	High							35M6G7W	33M6G7W
Note: 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	AFL	2023-03-17	2024-03-17
Generator - Signal	Agilent	N5173B	TIW	2023-08-07	2026-08-07
Block - DC	Fairview Microwave	SD3379	AMT	2023-08-04	2024-08-04

OCCUPIED BANDWIDTH

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

EUT:	AHFII Remote Radio Head	Work Order:	NOKI0070
Serial Number:	BL2350N4CBR	Date:	2024-03-05
Customer:	Nokia Solutions and Networks	Temperature:	21°C
Attendees:	Mitch Hill, David Le	Relative Humidity:	52.5%
Customer Project:	None	Bar. Pressure (PMSL):	1009 mbar
Tested By:	Jarrod Brenden	Job Site:	TX07
Power:	54 VDC	Configuration:	NOKI0070-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 24E:2024	ANSI C63.26:2015
FCC 27:2024	ANSI C63.26:2015
RSS-133 Issue 6:2013 +A1:2018	ANSI C63.26:2015
RSS-139 Issue 4:2022	ANSI C63.26:2015

COMMENTS

Losses in the measurement path were accounted for: DC block, attenuators, cables, and filters where used. Band n25 and Band n66 carriers enabled individually at maximum power (80 watts/carrier).

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

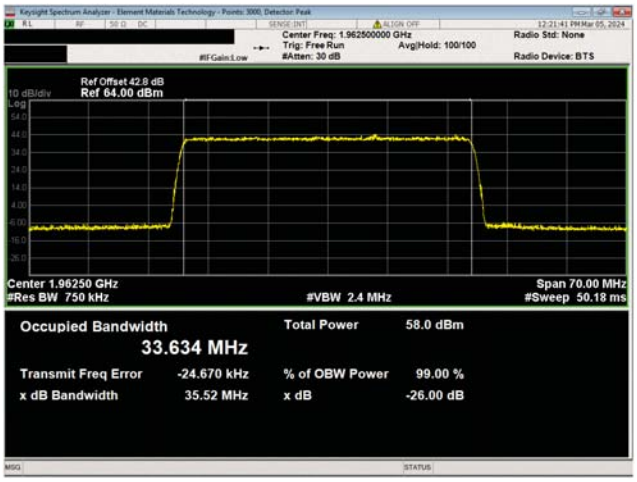
Pass

Tested By

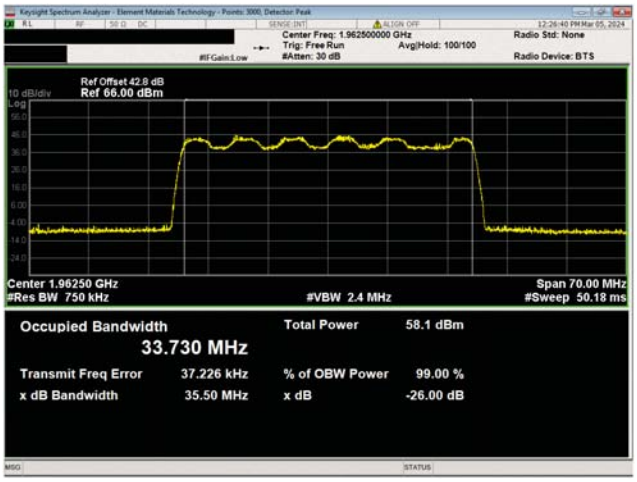
TEST RESULTS

	Value 99% (MHz)	Value 26dB (MHz)	Limit	Result
Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz				
35 MHz Channel Bandwidth				
QPSK Modulation				
Mid Channel, 1962.5 MHz	33.634	35.52	Within Band	Pass
16QAM Modulation				
Mid Channel, 1962.5 MHz	33.730	35.50	Within Band	Pass
64QAM Modulation				
Mid Channel, 1962.5 MHz	33.664	35.52	Within Band	Pass
256QAM Modulation				
Low Channel, 1947.5 MHz	33.622	35.48	Within Band	Pass
Mid Channel, 1962.5 MHz	33.651	35.56	Within Band	Pass
High Channel, 1977.5 MHz	33.637	35.46	Within Band	Pass
Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz				
35 MHz Channel Bandwidth				
QPSK Modulation				
Mid Channel, 2155.0 MHz	33.654	35.54	Within Band	Pass
16QAM Modulation				
Mid Channel, 2155.0 MHz	33.746	35.49	Within Band	Pass
64QAM Modulation				
Mid Channel, 2155.0 MHz	33.563	35.41	Within Band	Pass
256QAM Modulation				
Low Channel, 2127.5 MHz	33.626	35.50	Within Band	Pass
Mid Channel, 2155.0 MHz	33.645	35.46	Within Band	Pass
High Channel, 2182.5 MHz	33.632	35.56	Within Band	Pass

OCCUPIED BANDWIDTH

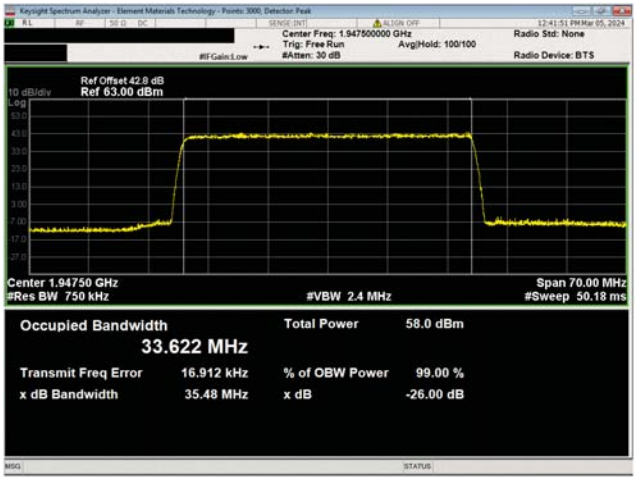


Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
QPSK Modulation
Mid Channel, 1962.5 MHz



Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
16QAM Modulation
Mid Channel, 1962.5 MHz

Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
64QAM Modulation
Mid Channel, 1962.5 MHz



Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Low Channel, 1947.5 MHz

OCCUPIED BANDWIDTH

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

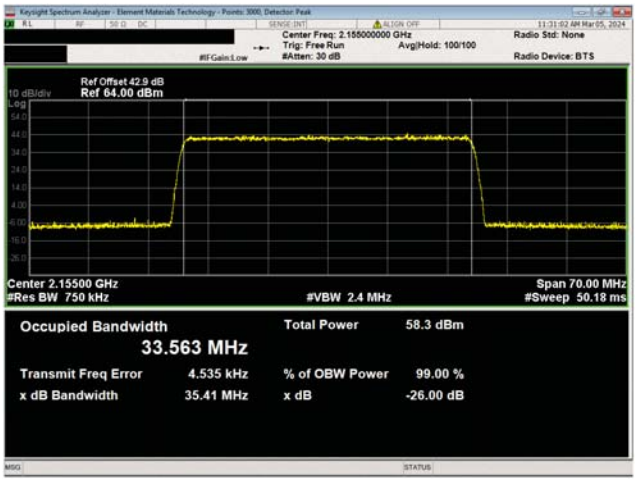
Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Mid Channel, 1962.5 MHz

Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
High Channel, 1977.5 MHz

Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
QPSK Modulation
Mid Channel, 2155.0 MHz

Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
16QAM Modulation
Mid Channel, 2155.0 MHz

OCCUPIED BANDWIDTH



Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
64QAM Modulation
Mid Channel, 2155.0 MHz

Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Low Channel, 2127.5 MHz

Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Mid Channel, 2155.0 MHz

Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
High Channel, 2182.5 MHz

OUTPUT POWER

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 method in section 5.2.4.4 of ANSI C63.26 was used to make the measurements. This method uses trace averaging across the ON and OFF times of the EUT transmissions in the spectrum analyzer channel power function using an RMS detector. Following the measurement a duty cycle correction was applied by adding [10 log (1/D)], where D is the duty cycle in decimal, to the measured power to compute the average power during the actual transmission times.

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

The 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)]. The total power for four port operations is single port power +6 dB [i.e. 10*log(4)].

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFL	2023-03-17	2024-03-17
Generator - Signal	Agilent	N5173B	TIW	2023-08-07	2026-08-07
Block - DC	Fairview Microwave	SD3379	AMT	2023-08-04	2024-08-04

OUTPUT POWER

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

EUT:	AHFII Remote Radio Head	Work Order:	NOKI0070
Serial Number:	BL2350N4CBR	Date:	2024-03-05
Customer:	Nokia Solutions and Networks	Temperature:	20.1°C
Attendees:	Mitch Hill, David Le	Relative Humidity:	53%
Customer Project:	None	Bar. Pressure (PMSL):	1009 mbar
Tested By:	Jarrod Brenden	Job Site:	TX07
Power:	54 VDC	Configuration:	NOKI0070-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 24E:2024	ANSI C63.26:2015
FCC 27:2024	ANSI C63.26:2015
RSS-133 Issue 6:2013 +A1:2018	ANSI C63.26:2015
RSS-139 Issue 4:2022	ANSI C63.26:2015

COMMENTS

Losses in the measurement path were accounted for: DC block, attenuators, cables, and filters where used. Band n25 and Band n66 carriers enabled individually at maximum power (80 watts/carrier).

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

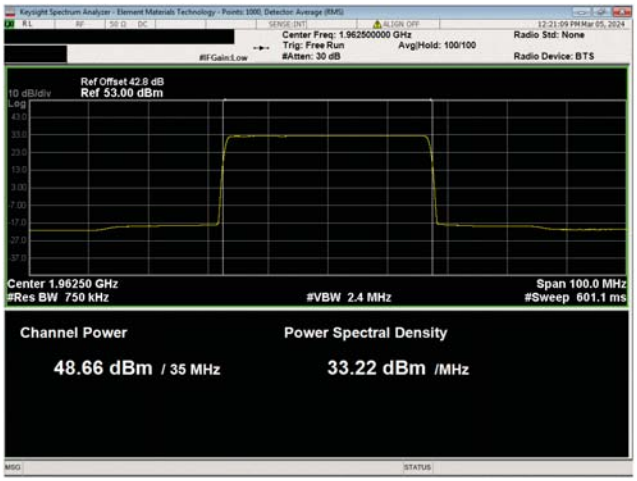
Pass

Tested By

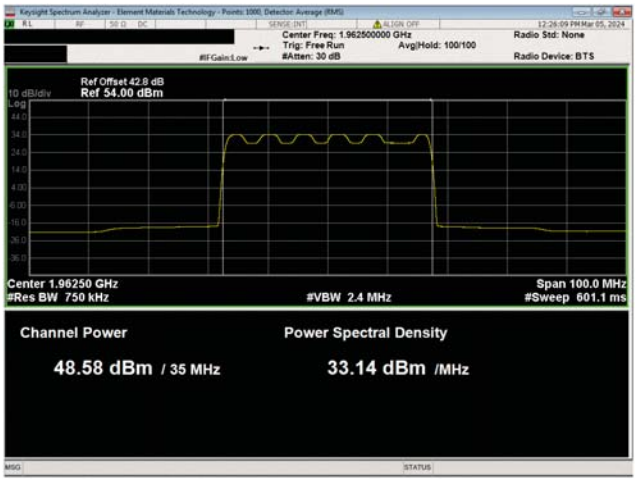
TEST RESULTS

	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Single Port dBm/Carrier BW	Two Port (2x2) MIMO dBm/Carrier BW	Four Port (4x4) MIMO dBm/Carrier BW
Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz					
35 MHz Channel Bandwidth					
QPSK Modulation					
Mid Channel, 1962.5 MHz	48.66	0	48.7	51.7	54.7
16QAM Modulation					
Mid Channel, 1962.5 MHz	48.582	0	48.6	51.6	54.6
64QAM Modulation					
Mid Channel, 1962.5 MHz	48.59	0	48.6	51.6	54.6
256QAM Modulation					
Low Channel, 1947.5 MHz	48.549	0	48.5	51.5	54.5
Mid Channel, 1962.5 MHz	48.462	0	48.5	51.5	54.5
High Channel, 1977.5 MHz	48.41	0	48.4	51.4	54.4
Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz					
35 MHz Channel Bandwidth					
QPSK Modulation					
Mid Channel, 2155.0 MHz	48.907	0	48.9	51.9	54.9
16QAM Modulation					
Mid Channel, 2155.0 MHz	48.823	0	48.8	51.8	54.8
64QAM Modulation					
Mid Channel, 2155.0 MHz	48.874	0	48.9	51.9	54.9
256QAM Modulation					
Low Channel, 2127.5 MHz	48.657	0	48.7	51.7	54.7
Mid Channel, 2155.0 MHz	48.843	0	48.8	51.8	54.8
High Channel, 2182.5 MHz	48.598	0	48.6	51.6	54.6

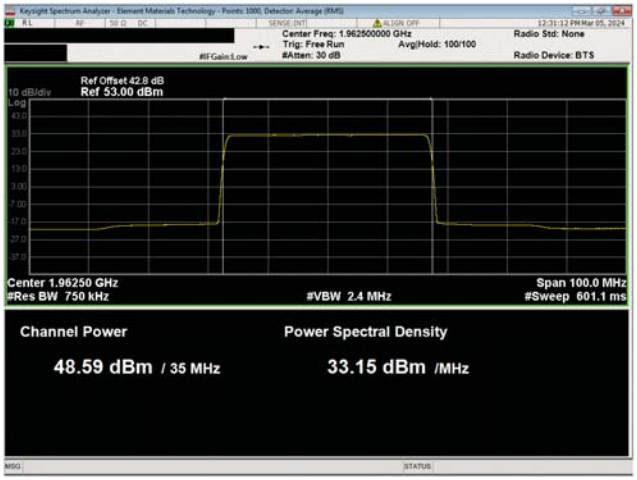
OUTPUT POWER



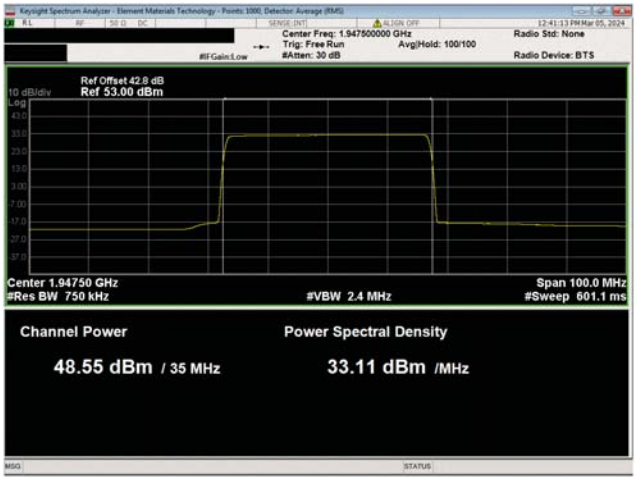
Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
QPSK Modulation
Mid Channel, 1962.5 MHz



Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
16QAM Modulation
Mid Channel, 1962.5 MHz



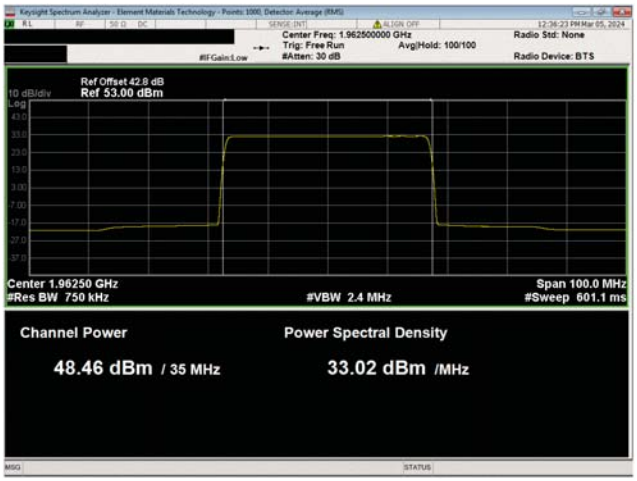
Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
64QAM Modulation
Mid Channel, 1962.5 MHz



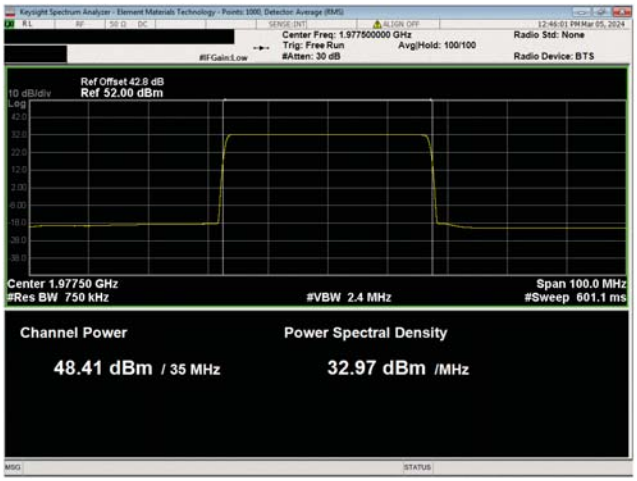
Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Low Channel, 1947.5 MHz

OUTPUT POWER

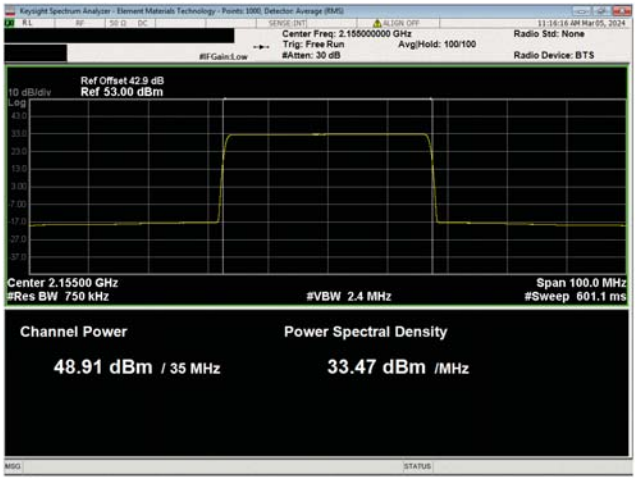
element
TbtTx 2023.12.06.3
WTD.2023.11.13.0



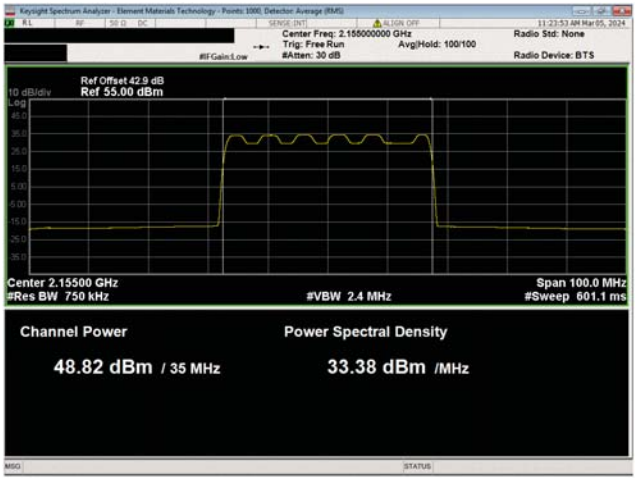
Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Mid Channel, 1962.5 MHz



Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
High Channel, 1977.5 MHz

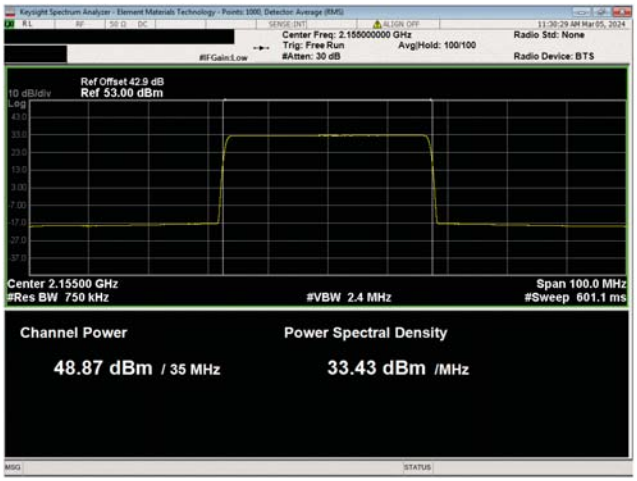


Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
QPSK Modulation
Mid Channel, 2155.0 MHz

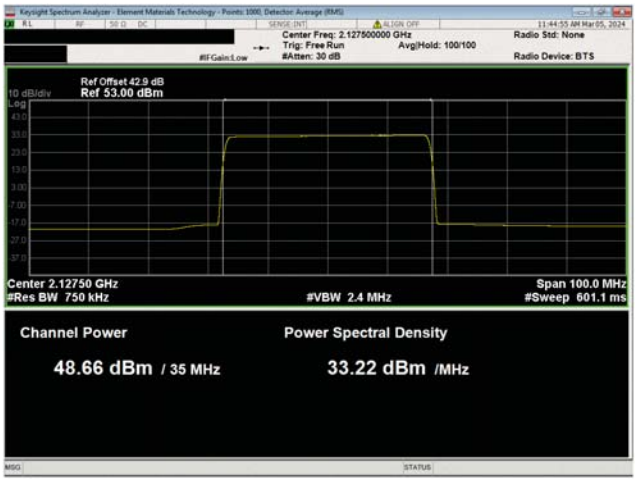


Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
16QAM Modulation
Mid Channel, 2155.0 MHz

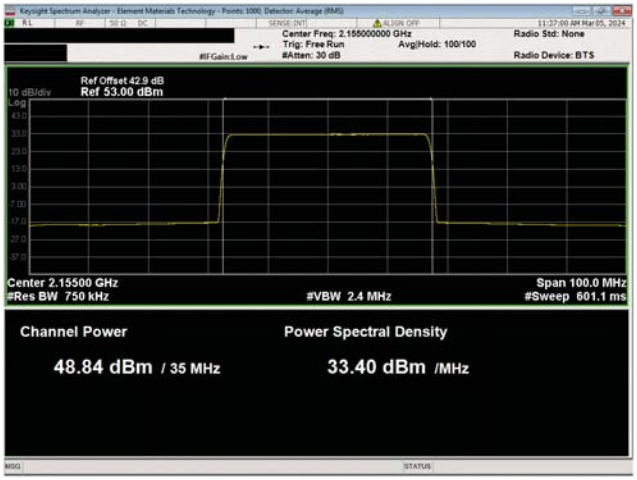
OUTPUT POWER



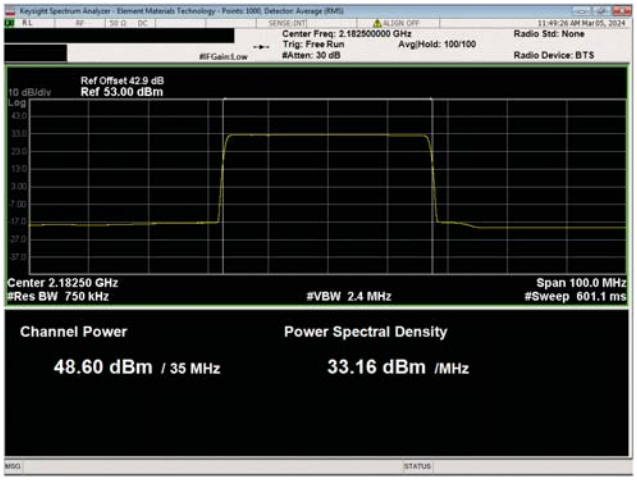
Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
64QAM Modulation
Mid Channel, 2155.0 MHz



Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Low Channel, 2127.5 MHz



Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Mid Channel, 2155.0 MHz



Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
High Channel, 2182.5 MHz

PEAK TO AVERAGE POWER (PAPR) CCDF

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.

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.

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

Per FCC 24.232(d), RSS-133 6.4, FCC 27.50(d)(5), and RSS-139 6.5 the peak to average power ratios (PAPR) of the equipment shall not exceed 13 dB for more than 0.1% of the time, using a signal that corresponds to the highest PAPR during periods of continuous transmission.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Spectrum Analyzer	Keysight Technologies, Inc.	N9030B	R336	2023-10-03	2024-10-03
Generator - Signal	Agilent	N5173B	TIW	2023-08-07	2026-08-07
Block - DC	Fairview Microwave	SD3379	AMT	2023-08-04	2024-08-04

PEAK TO AVERAGE POWER (PAPR) CCDF

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

EUT:	AHFII Remote Radio Head	Work Order:	NOKI0070
Serial Number:	BL2350N4CBR	Date:	1899-12-30
Customer:	Nokia Solutions and Networks	Temperature:	21.1°C
Attendees:	Mitch Hill, David Le	Relative Humidity:	51.5%
Customer Project:	None	Bar. Pressure (PMSL):	1009 mbar
Tested By:	Jarrod Brenden	Job Site:	TX07
Power:	54 VDC	Configuration:	NOKI0070-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 24E:2024	ANSI C63.26:2015
FCC 27:2024	ANSI C63.26:2015
RSS-133 Issue 6:2013 +A1:2018	ANSI C63.26:2015
RSS-139 Issue 4:2022	ANSI C63.26:2015

COMMENTS

Losses in the measurement path were accounted for: DC block, attenuators, cables, and filters where used. Band n25 and Band n66 carriers enabled individually at maximum power (80 watts/carrier).

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

Pass

Tested By

TEST RESULTS

	0.1% PAPR Value (dB)	PAPR Limit (dB)	Result
Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz			
35 MHz Channel Bandwidth			
QPSK Modulation			
Mid Channel, 1962.5 MHz	7.25	13	Pass
16QAM Modulation			
Mid Channel, 1962.5 MHz	7.33	13	Pass
64QAM Modulation			
Mid Channel, 1962.5 MHz	7.3	13	Pass
256QAM Modulation			
Low Channel, 1947.5 MHz	7.61	13	Pass
Mid Channel, 1962.5 MHz	7.23	13	Pass
High Channel, 1977.5 MHz	7.45	13	Pass
Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz			
35 MHz Channel Bandwidth			
QPSK Modulation			
Mid Channel, 2155.0 MHz	7.27	13	Pass
16QAM Modulation			
Mid Channel, 2155.0 MHz	7.07	13	Pass
64QAM Modulation			
Mid Channel, 2155.0 MHz	7.24	13	Pass

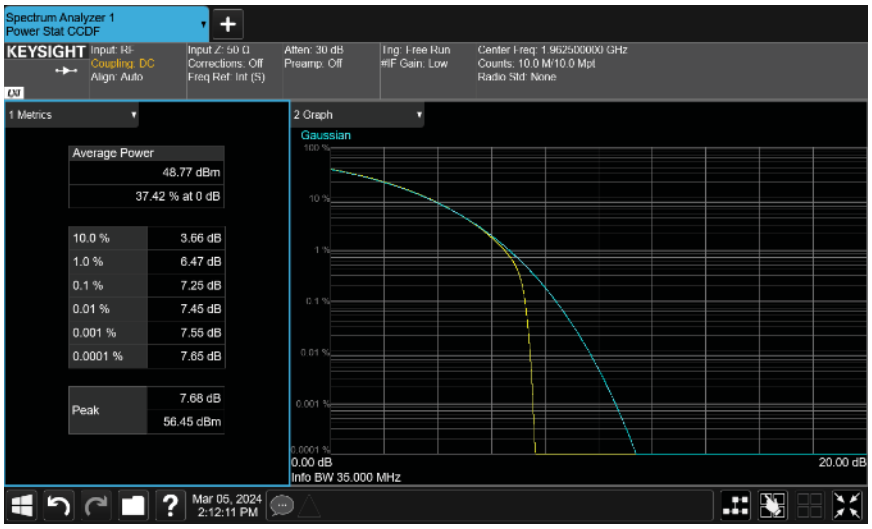
PEAK TO AVERAGE POWER (PAPR) CCDF

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

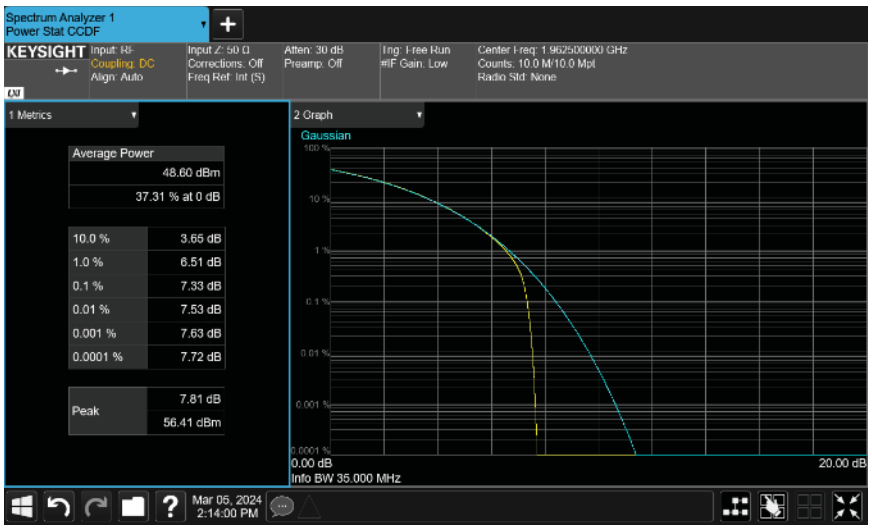
	0.1% PAPR Value (dB)	PAPR Limit (dB)	Result
256QAM Modulation			
Low Channel, 2127.5 MHz	7.44	13	Pass
Mid Channel, 2155.0 MHz	7.26	13	Pass
High Channel, 2182.5 MHz	7.39	13	Pass

PEAK TO AVERAGE POWER (PAPR) CCDF

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0



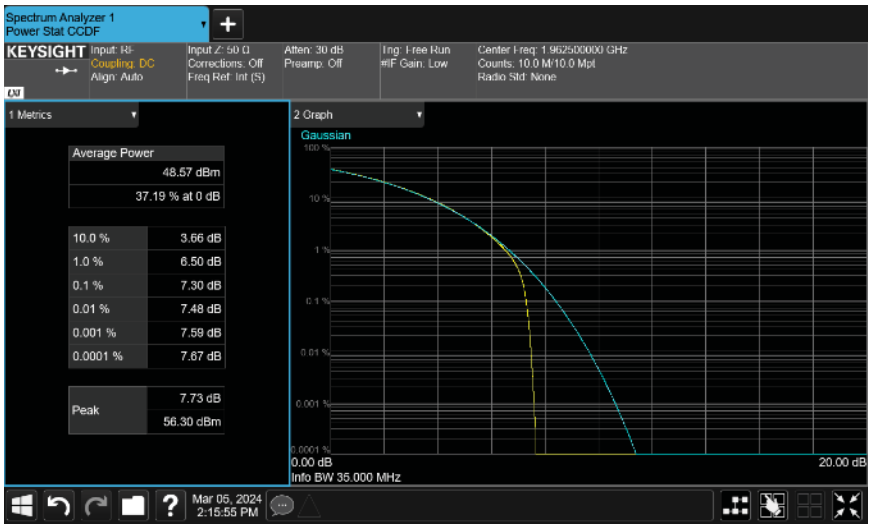
Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
QPSK Modulation
Mid Channel, 1962.5 MHz



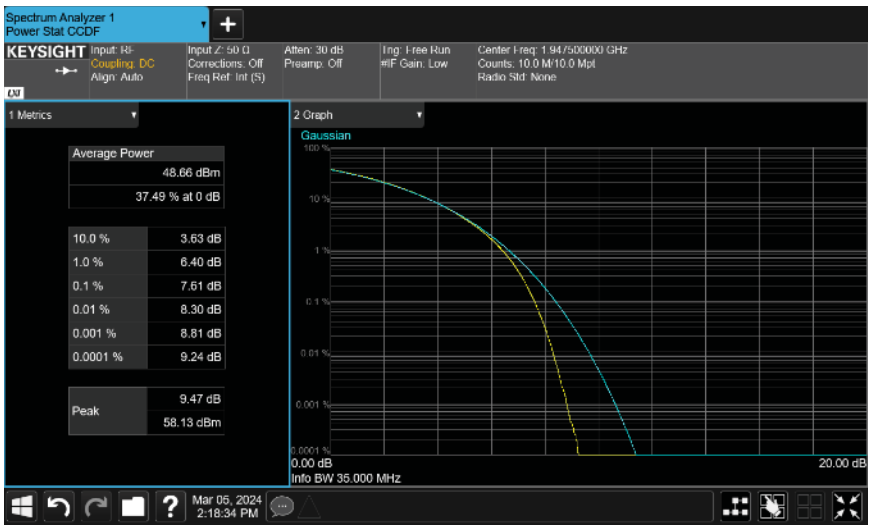
Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
16QAM Modulation
Mid Channel, 1962.5 MHz

PEAK TO AVERAGE POWER (PAPR) CCDF

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0



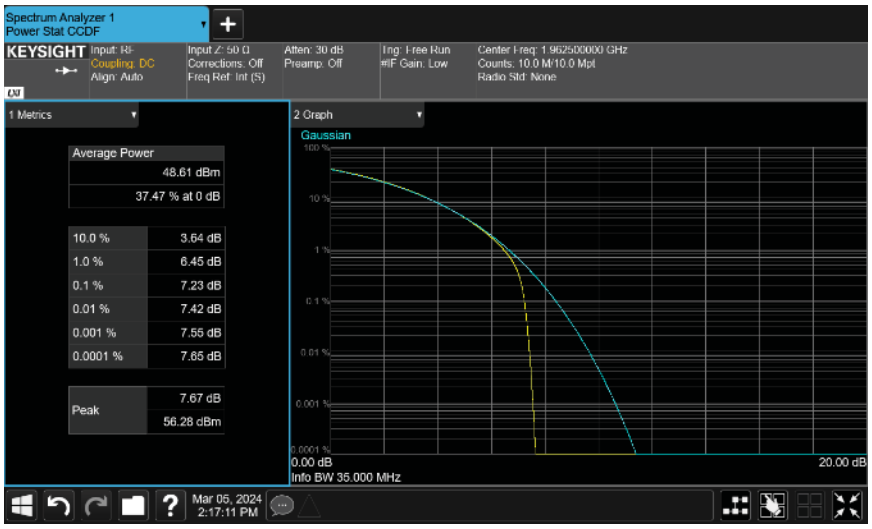
Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
64QAM Modulation
Mid Channel, 1962.5 MHz



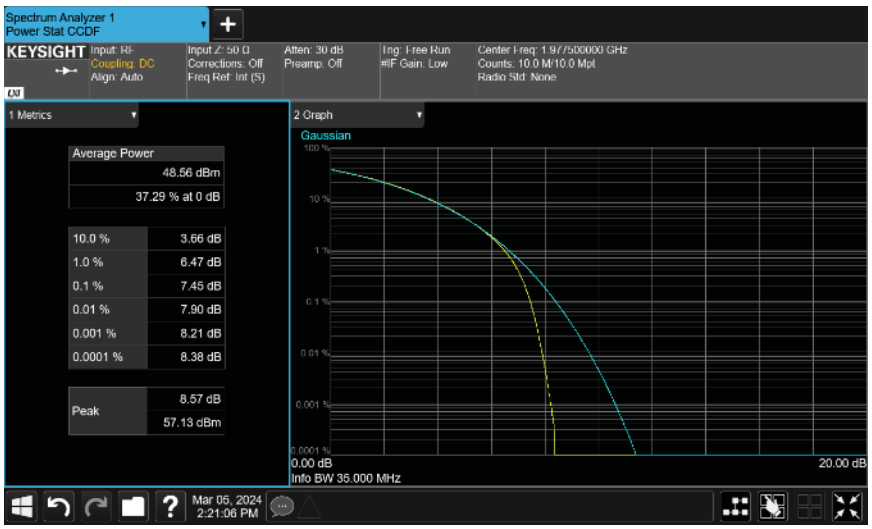
Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Low Channel, 1947.5 MHz

PEAK TO AVERAGE POWER (PAPR) CCDF

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0



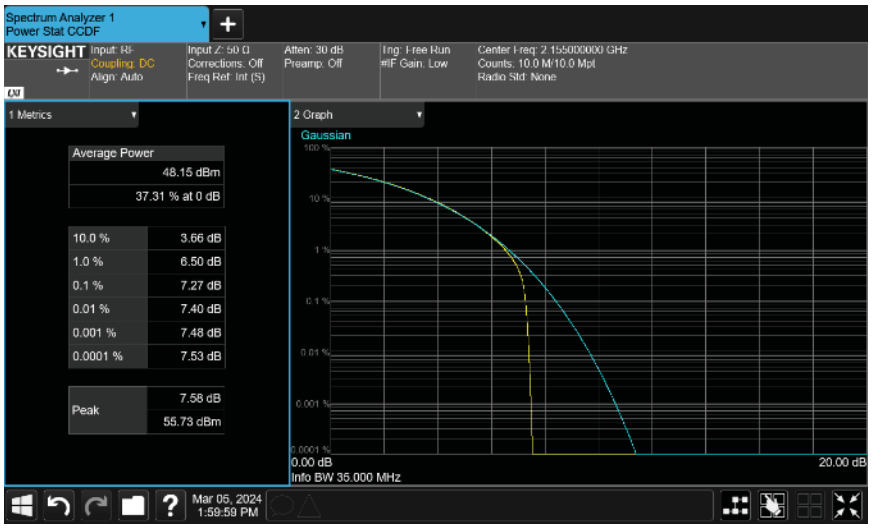
Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Mid Channel, 1962.5 MHz



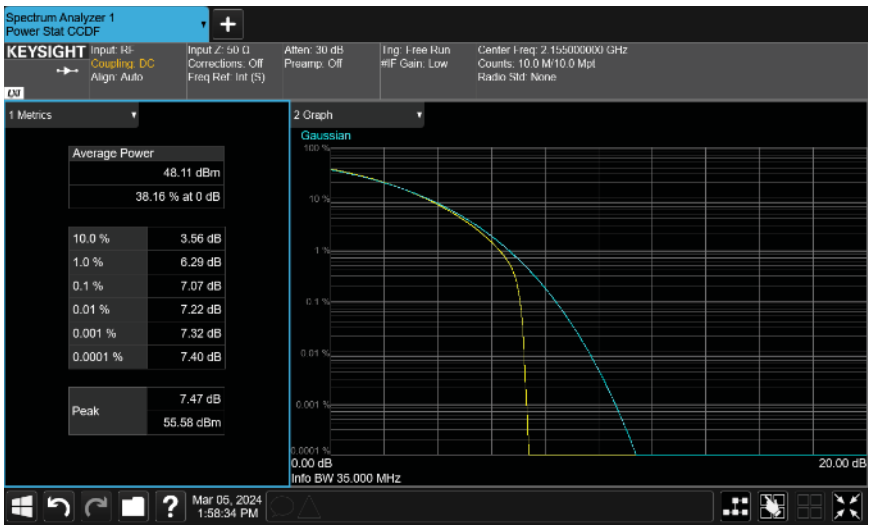
Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
High Channel, 1977.5 MHz

PEAK TO AVERAGE POWER (PAPR) CCDF

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0



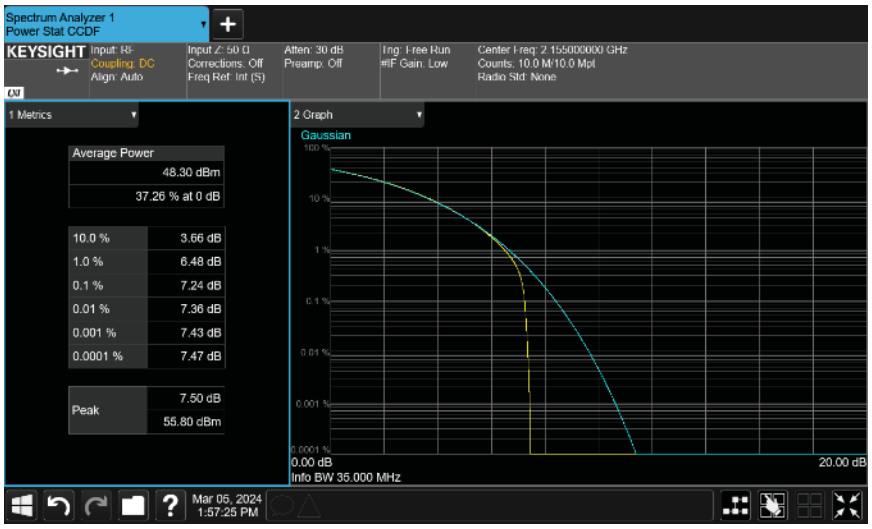
Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
QPSK Modulation
Mid Channel, 2155.0 MHz



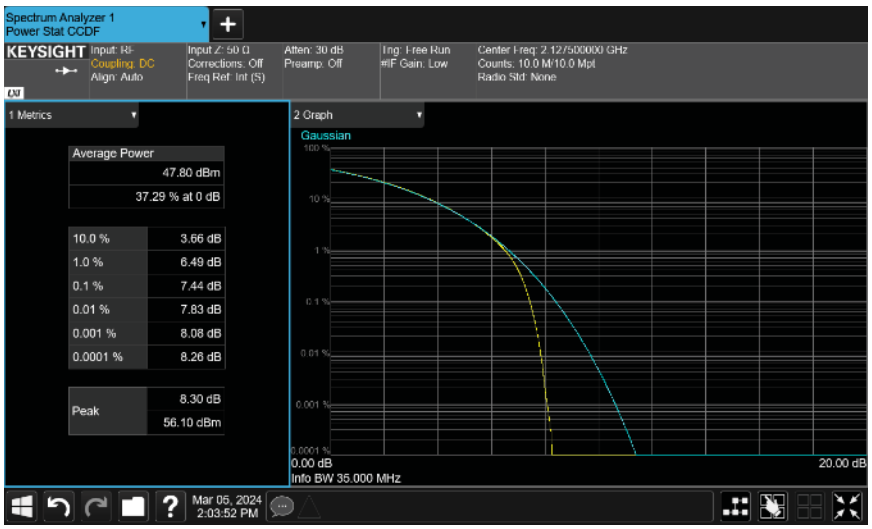
Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
16QAM Modulation
Mid Channel, 2155.0 MHz

PEAK TO AVERAGE POWER (PAPR) CCDF

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

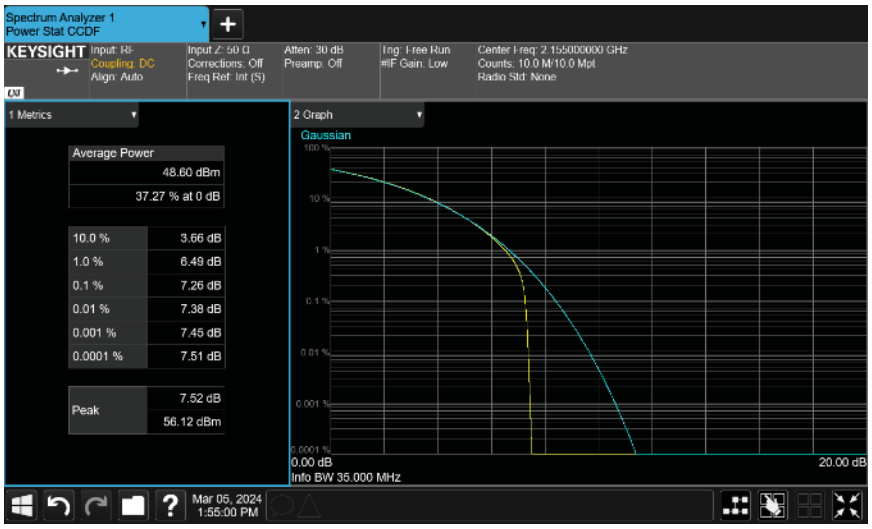


Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
64QAM Modulation
Mid Channel, 2155.0 MHz

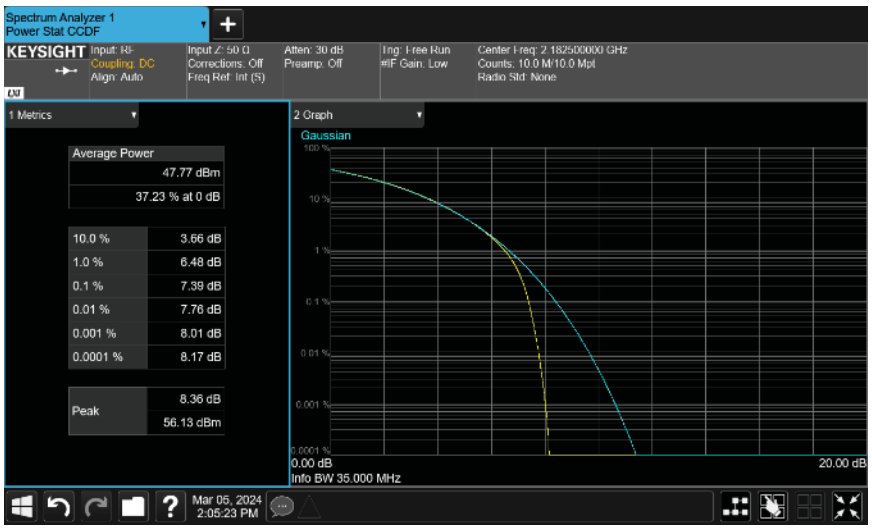


Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Low Channel, 2127.5 MHz

PEAK TO AVERAGE POWER (PAPR) CCDF



Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Mid Channel, 2155.0 MHz



Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
High Channel, 2182.5 MHz

BAND EDGE COMPLIANCE

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 spurious RF conducted emissions at the edges of the authorized bands were measured with the EUT set to low and high transmit frequencies of the available band. The channels closest to the band edges were selected. The EUT was transmitting at the data rate(s) listed in the datasheet.

The spectrum was scanned below the lower band edge and above the higher band edge.

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

The band edge testing was performed using only one modulation type because the Occupied Bandwidth variation between modulation types is small, the average output power variation between modulation types is small, and there was small variation in band edge measurements over modulation types from previous certification testing efforts. The highest rate modulation type (256QAM) was used. (See ANSI C63.26. clause 5.7.2e).

The resolution bandwidth to be used for these measurements are per FCC 24.238(b), RSS 133 6.5 (i), FCC 27.53(h)(3), and RSS-139 5.6. Compliance is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e.: 1 MHz or 1 percent of emission bandwidth, as specified).

Per FCC 24.238(a), RSS 133 6.5 (i), FCC 27.53(h)(1), and RSS-139 5.6 the power of any emission outside of the authorized operating frequency range cannot exceed -13 dBm. The limit is adjusted to -19 dBm [-13 dBm -10 log (4)] per FCC KDB 662911D01 v02r01 because the BTS may operate as a 4 port MIMO transmitter.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFL	2023-03-17	2024-03-17
Generator - Signal	Agilent	N5173B	TIW	2023-08-07	2026-08-07
Block - DC	Fairview Microwave	SD3379	AMT	2023-08-04	2024-08-04

BAND EDGE COMPLIANCE

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

EUT:	AHFII Remote Radio Head	Work Order:	NOKI0070
Serial Number:	BL2350N4CBR	Date:	2024-03-05
Customer:	Nokia Solutions and Networks	Temperature:	20.2°C
Attendees:	Mitch Hill, David Le	Relative Humidity:	52.8%
Customer Project:	None	Bar. Pressure (PMSL):	1009 mbar
Tested By:	Jarrod Brenden	Job Site:	TX07
Power:	54 VDC	Configuration:	NOKI0070-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 24E:2024	ANSI C63.26:2015
FCC 27:2024	ANSI C63.26:2015
RSS-133 Issue 6:2013 +A1:2018	ANSI C63.26:2015
RSS139 Issue 4:2022	ANSI C63.26:2015

COMMENTS

Losses in the measurement path were accounted for: DC block, attenuators, cables, and filters where used. Band n25 and Band n66 carriers enabled individually at maximum power (80 watts/carrier).

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

Pass

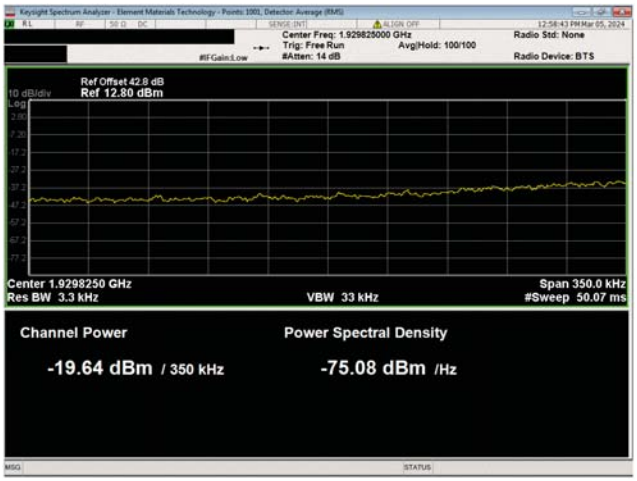
Tested By

TEST RESULTS

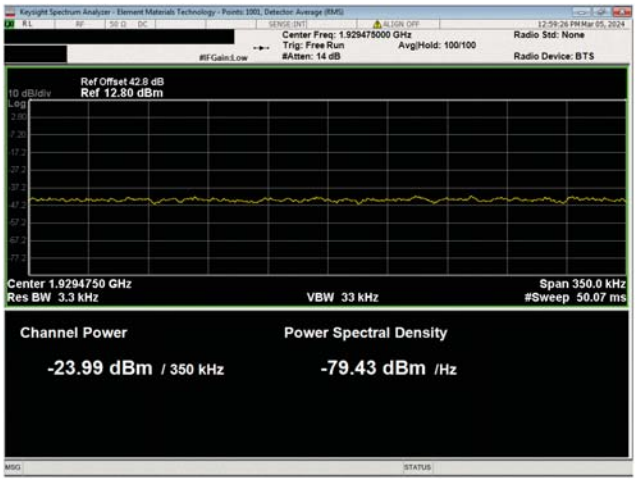
	Frequency Range	Value	Limit	Result
Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz				
35 MHz Channel Bandwidth				
256QAM Modulation				
Low Channel, 1947.5 MHz	1929.65 - 1930 MHz	-19.64	-19	Pass
	1929.3 - 1929.65 MHz	-23.99	-19	Pass
	1929 - 1929.35 MHz	-24.04	-19	Pass
	1928 - 1929 MHz	-19.88	-19	Pass
	1908 -1928 MHz	-19.649	-19	Pass
High Channel, 1977.5 MHz	1995 - 1995.35 MHz	-20.9	-19	Pass
	1995.35 - 1995.7 MHz	-25.93	-19	Pass
	1995.65 - 1996 MHz	-26.08	-19	Pass
	1996 - 1997 MHz	-21.39	-19	Pass
	1997 - 2017 MHz	-20.956	-19	Pass
Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz				
35 MHz Channel Bandwidth				
256QAM Modulation				
Low Channel, 2127.5 MHz	2109.65 - 2110 MHz	-20.19	-19	Pass
	2109.3 - 2109.65 MHz	-25.06	-19	Pass
	2109 - 2109.35 MHz	-25.34	-19	Pass
	2108 - 2109 MHz	-20.94	-19	Pass
	2088 - 2108 MHz	-20.524	-19	Pass
High Channel, 2182.5 MHz	2200 - 2200.35 MHz	-19.51	-19	Pass
	2200.35 - 2200.7 MHz	-23.73	-19	Pass
	2200.65 - 2201 MHz	-23.74	-19	Pass
	2201 -2202 MHz	-19.47	-19	Pass
	2202 - 2222 MHz	-19.245	-19	Pass

BAND EDGE COMPLIANCE

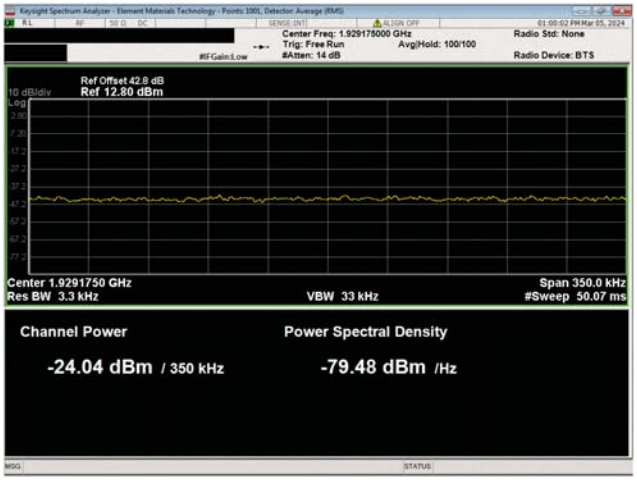
element
TbtTx 2023.12.06.3
WTD.2023.11.13.0



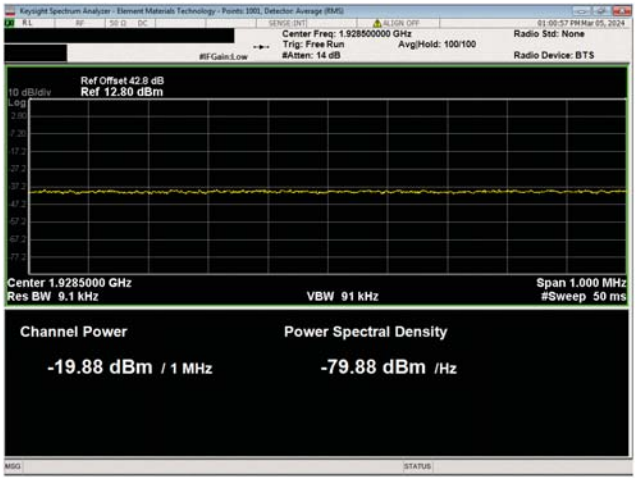
Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Low Channel, 1947.5 MHz



Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Low Channel, 1947.5 MHz



Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Low Channel, 1947.5 MHz

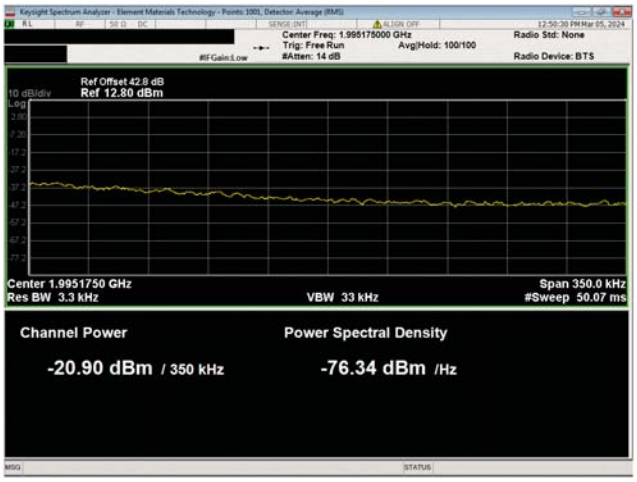


Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Low Channel, 1947.5 MHz

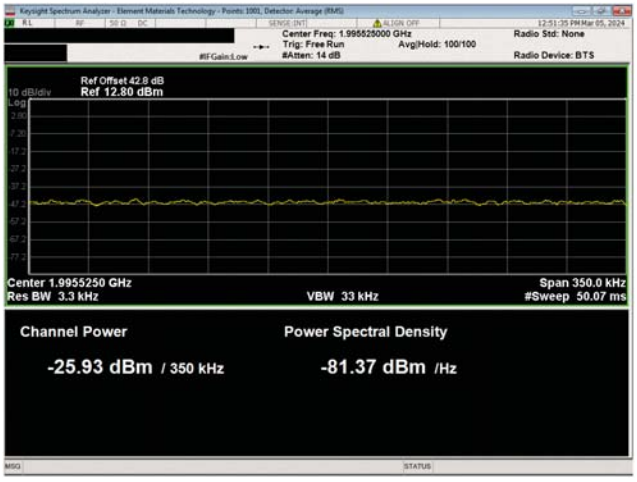
BAND EDGE COMPLIANCE

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

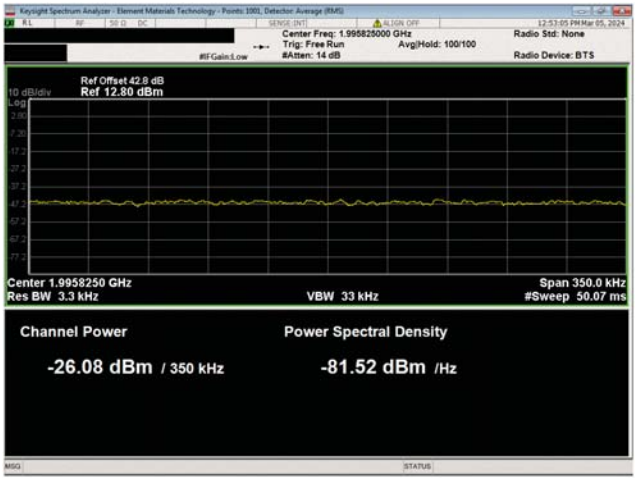
Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Low Channel, 1947.5 MHz



Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
High Channel, 1977.5 MHz



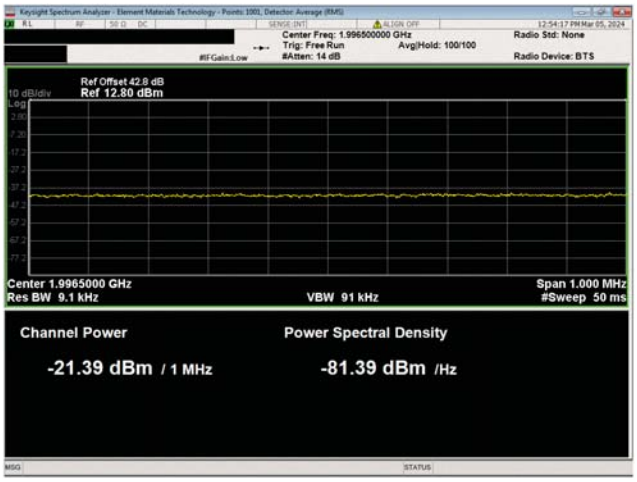
Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
High Channel, 1977.5 MHz



Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
High Channel, 1977.5 MHz

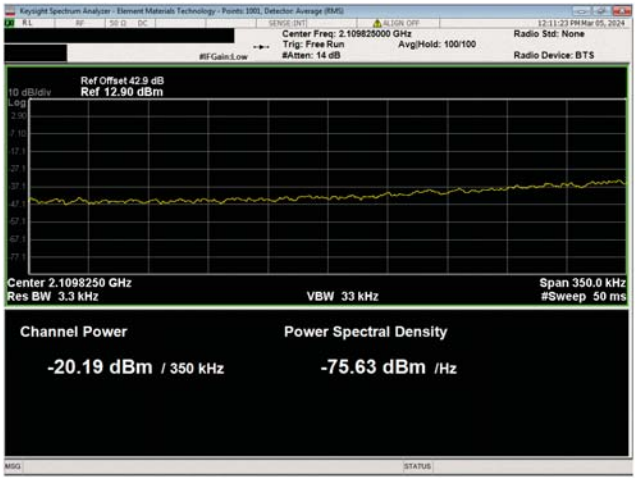
BAND EDGE COMPLIANCE

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

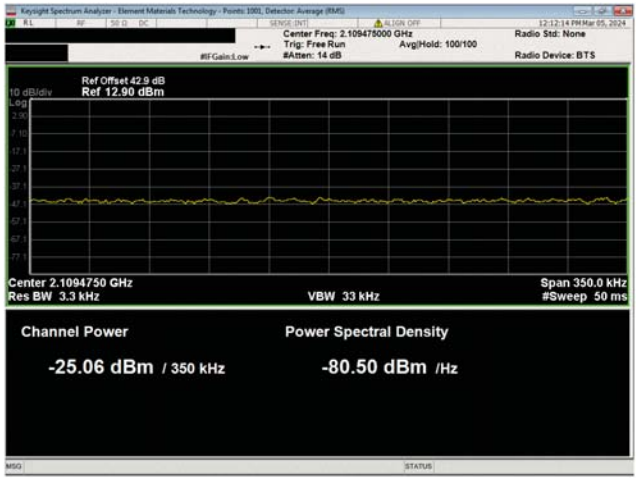


Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
High Channel, 1977.5 MHz

Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
High Channel, 1977.5 MHz



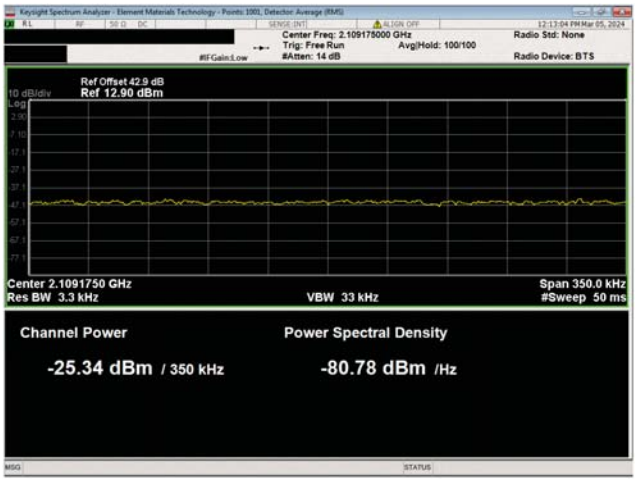
Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Low Channel, 2127.5 MHz



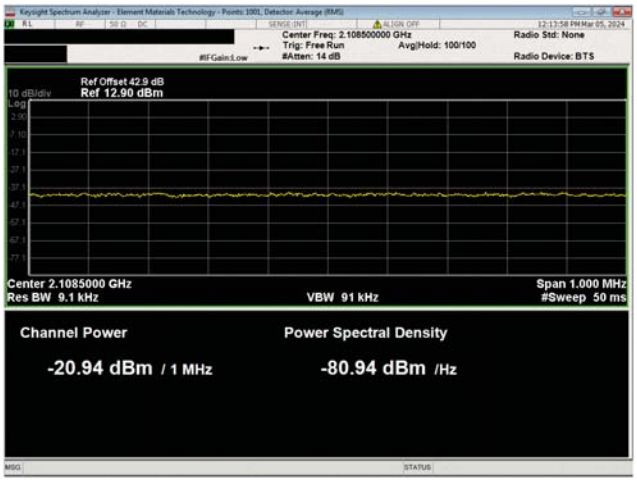
Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Low Channel, 2127.5 MHz

BAND EDGE COMPLIANCE

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

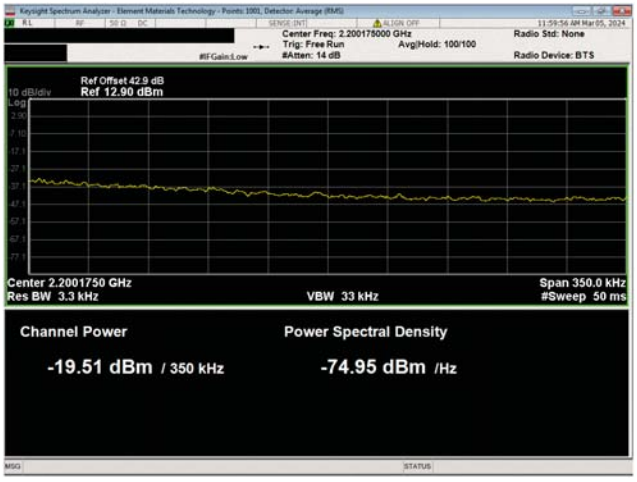


Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Low Channel, 2127.5 MHz



Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Low Channel, 2127.5 MHz

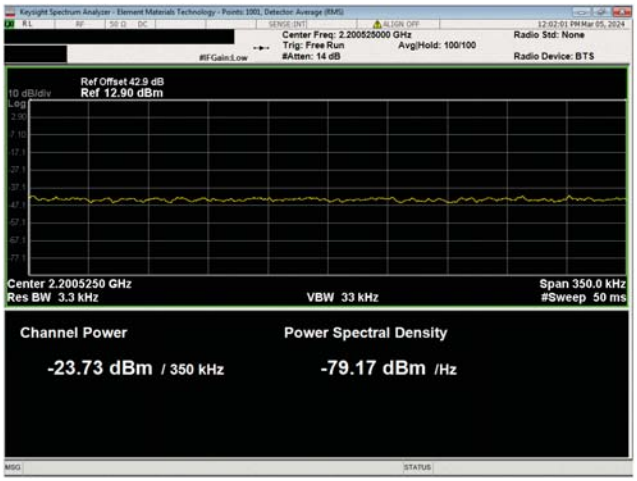
Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Low Channel, 2127.5 MHz



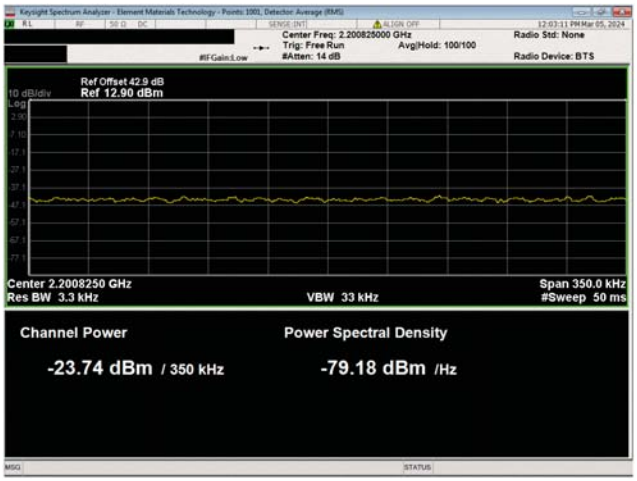
Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
High Channel, 2182.5 MHz

BAND EDGE COMPLIANCE

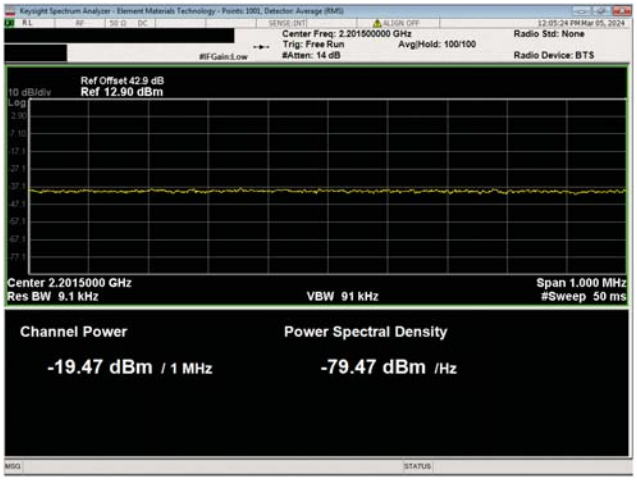
element
TbtTx 2023.12.06.3
WTD.2023.11.13.0



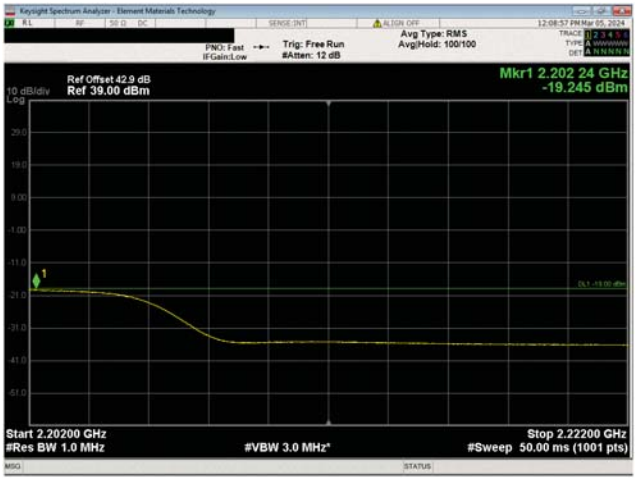
Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
High Channel, 2182.5 MHz



Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
High Channel, 2182.5 MHz



Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
High Channel, 2182.5 MHz



Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
High Channel, 2182.5 MHz

SPURIOUS CONDUCTED EMISSIONS

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 antenna port Spurious Emissions were measured at the RF output terminal of the EUT through four different attenuation configurations which continues through to the RF input of the spectrum analyzer. Analyzer plots utilizing a resolution bandwidth called out by the client's test approach were made for each modulation type from 9 kHz to 22 GHz. The conducted power of spurious emissions, up to the 10th harmonic of the transmit frequency, were investigated to ensure they were less than the limits also called out by the client's test plan shown below.

The measurement methods are detailed in KDB 971168 D01v03 section 6 and ANSI C63.26-2015.

Per FCC 2.1057(a)(1) and RSS Gen 6.13, the upper level of measurement is the 10th harmonic of the highest fundamental frequency.

These measurements are for the frequency band after the first 1.0 MHz bands immediately outside and adjacent to the frequency block.

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

The testing was performed using only one modulation type because the Occupied Bandwidth variation between modulation types is small, the average output power variation between modulation types is small, and there was small variation in measurements over modulation types from previous certification testing efforts. The highest rate modulation type (256QAM) was used. (See ANSI C63.26. clause 5.7.2e).

The resolution bandwidth to be used for these measurements is per FCC 24.238(b), RSS 133 6.5 (i), FCC 27.53(h)(3), and RSS-139 5.6. Compliance is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater.

Per FCC 24.238(a), RSS 133 6.5 (i), FCC 27.53(h)(1), and RSS-139 5.6 the power of any emission outside of the authorized operating frequency range cannot exceed -13 dBm. The limit is adjusted to -19 dBm [-13 dBm -10 log (4)] per FCC KDB 662911D01 v02r01 because the BTS may operate as a 4 port MIMO transmitter.

The limit for the 9kHz to 150kHz frequency range was adjusted to –49dBm to correct for a spectrum analyzer RBW of 1kHz versus required RBW of 1MHz [i.e.: -49dBm = -19dBm -10log(1MHz/1kHz)]. The limit for the 150kHz to 20MHz frequency range was adjusted to –39dBm to correct for a spectrum analyzer RBW of 10kHz versus required RBW of 1MHz [i.e.: -39dBm = -19dBm -10log(1MHz/10kHz)]. The required limit of -19dBm with a RBW of $\geq$ 1MHz was used for all other frequency ranges.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFL	2023-03-17	2024-03-17
Generator - Signal	Agilent	N5173B	TIW	2023-08-07	2026-08-07
Block - DC	Fairview Microwave	SD3379	AMT	2023-08-04	2024-08-04
Block - DC	Fairview Microwave	SD3239	ANE	2024-02-14	2025-02-14

SPURIOUS CONDUCTED EMISSIONS

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

EUT:	AHFII Remote Radio Head	Work Order:	NOKI0070
Serial Number:	BL2350N4CBR	Date:	2024-03-05
Customer:	Nokia Solutions and Networks	Temperature:	20.3°C
Attendees:	Mitch Hill, David Le	Relative Humidity:	53.2%
Customer Project:	None	Bar. Pressure (PMSL):	1009 mbar
Tested By:	Jarrod Brenden	Job Site:	TX07
Power:	54 VDC	Configuration:	NOKI0070-1 NOKI0070-2 NOKI0070-3 NOKI0070-4

TEST SPECIFICATIONS

Specification:	Method:
FCC 24E:2024	ANSI C63.26:2015
FCC 27:2024	ANSI C63.26:2015
RSS-133 Issue 6:2013 +A1:2018	ANSI C63.26:2015
RSS-139 Issue 4:2022	ANSI C63.26:2015

COMMENTS

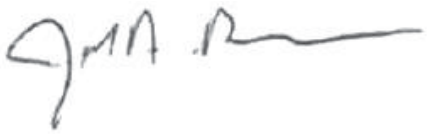
Losses in the measurement path were accounted for: DC block, attenuators, cables, and filters where used. Band n25 and Band n66 35 MHz carriers enabled individually at maximum power (80 watts/carrier). The port power was set at the maximum level of 120W (80W + 40W) for both test cases by enabling an NR5 carrier at the middle channel at 40W of the band not enabled for NR35.

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

Pass



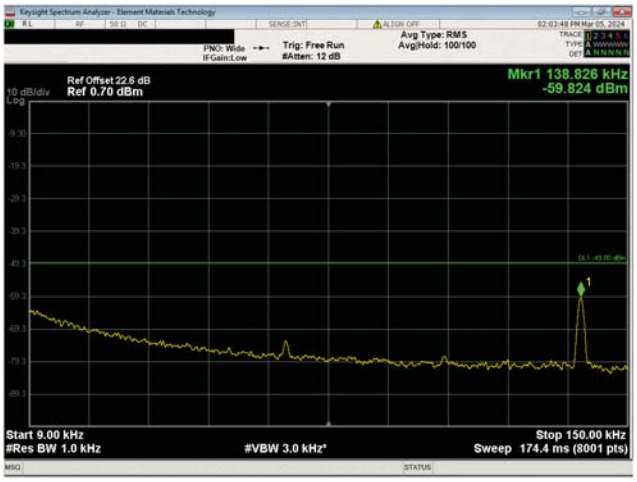
Tested By

TEST RESULTS

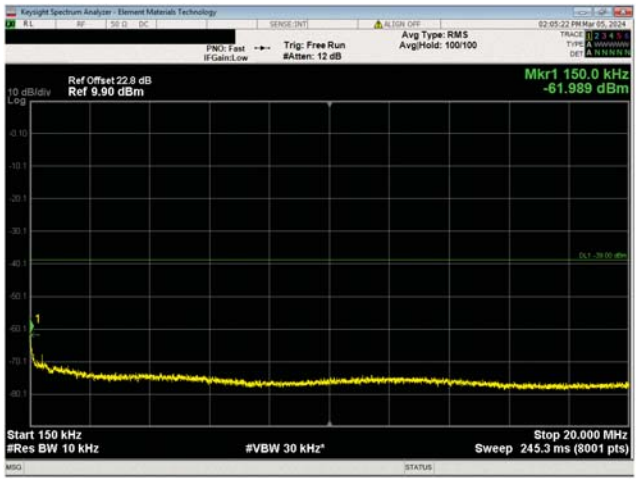
	Frequency Range	Measured Frequency (MHz)	Max Value (dBm)	Limit (dBm)	Result
Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz					
35 MHz Channel Bandwidth					
256QAM Modulation					
Mid Channel, 1962.5 MHz	9 kHz - 150 kHz	0.14	-59.82	-49	Pass
	150 kHz - 20 MHz	0.15	-61.99	-39	Pass
	20 MHz - 3.5 GHz	3200.38	-26.72	-19	Pass
	3.5 GHz - 13 GHz	3862.43	-43.99	-19	Pass
	13 GHz - 22 GHz	21685	-29.13	-19	Pass
Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz					
35 MHz Channel Bandwidth					
256QAM Modulation					
Mid Channel, 2155.0 MHz	9 kHz - 150 kHz	0.14	-56.06	-49	Pass
	150 kHz - 20 MHz	0.15	-60.76	-39	Pass
	20 MHz - 3.5 GHz	3194.29	-26.09	-19	Pass
	3.5 GHz - 13 GHz	3780.25	-43.96	-19	Pass
	13 GHz - 22 GHz	21676	-29.05	-19	Pass

SPURIOUS CONDUCTED EMISSIONS

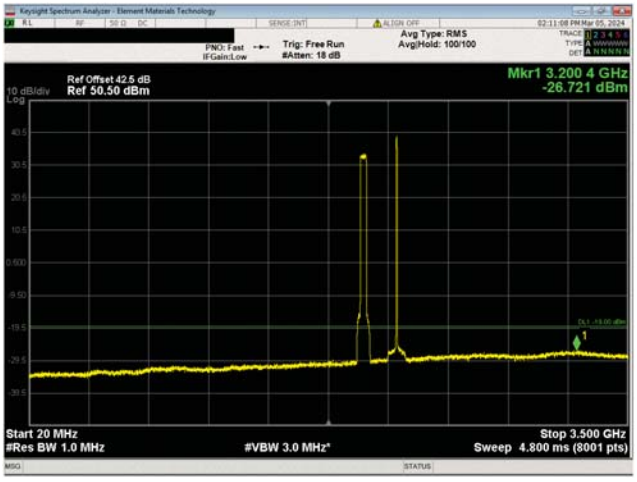
element
TbtTx 2023.12.06.3
WTD.2023.11.13.0



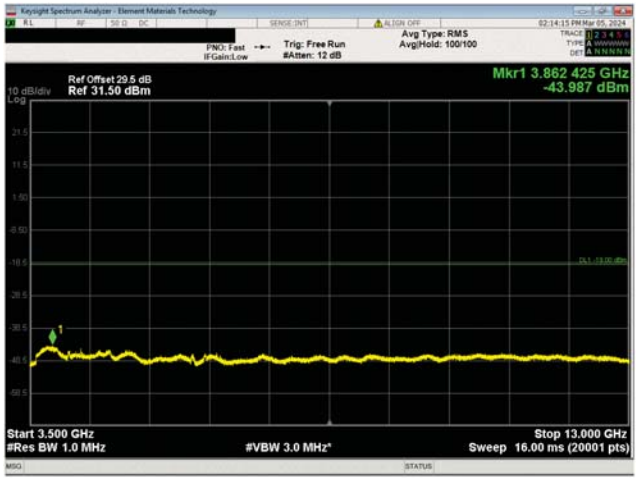
Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Mid Channel, 1962.5 MHz



Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Mid Channel, 1962.5 MHz



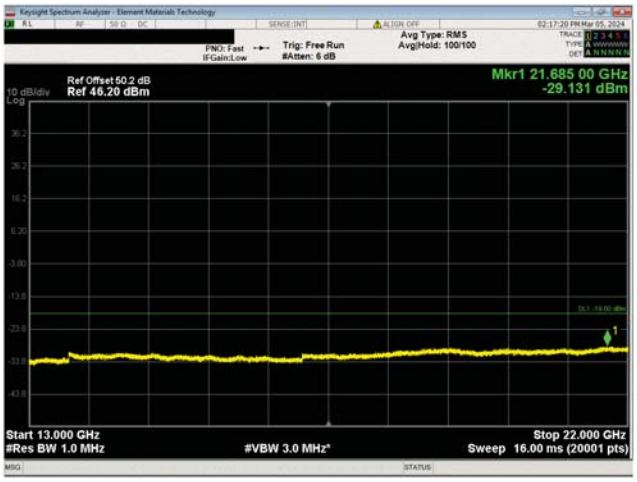
Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Mid Channel, 1962.5 MHz



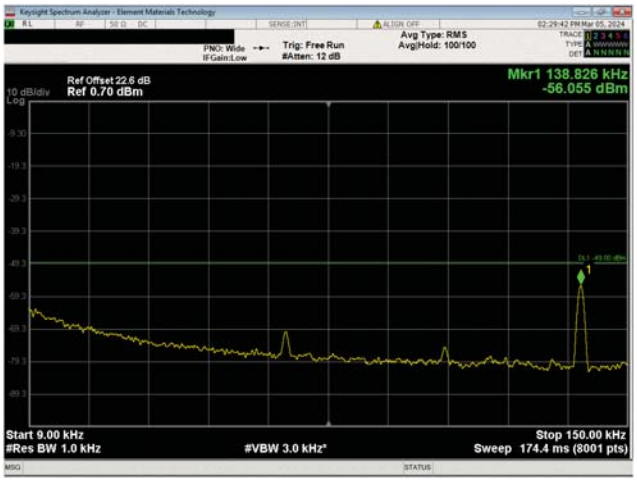
Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Mid Channel, 1962.5 MHz

SPURIOUS CONDUCTED EMISSIONS

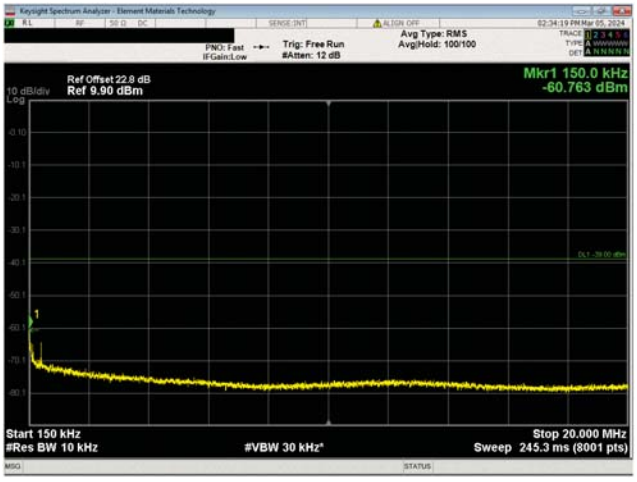
element
TbtTx 2023.12.06.3
WTD.2023.11.13.0



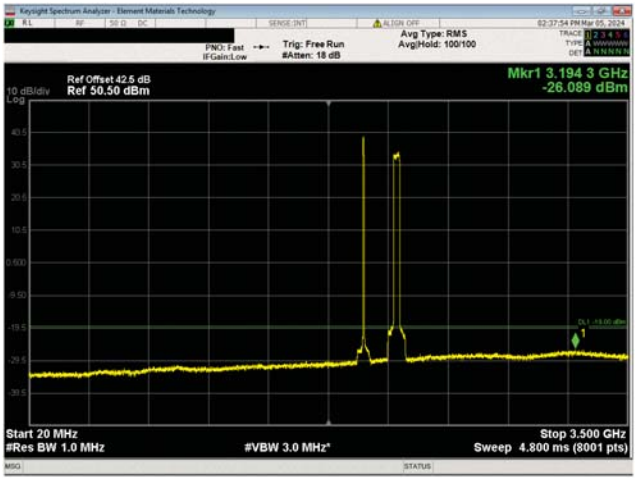
Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Mid Channel, 1962.5 MHz



Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Mid Channel, 2155.0 MHz



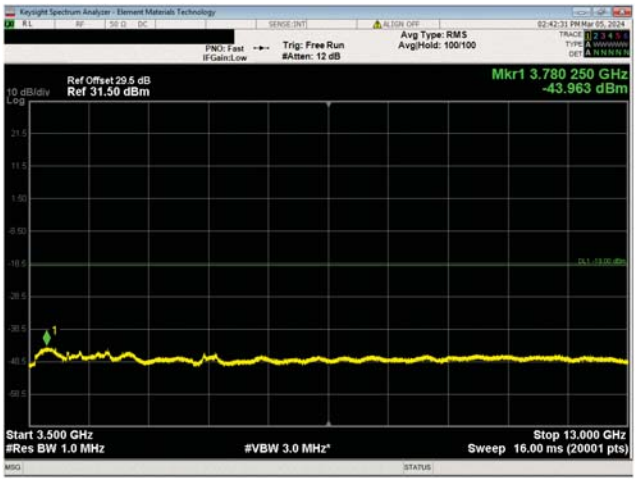
Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Mid Channel, 2155.0 MHz



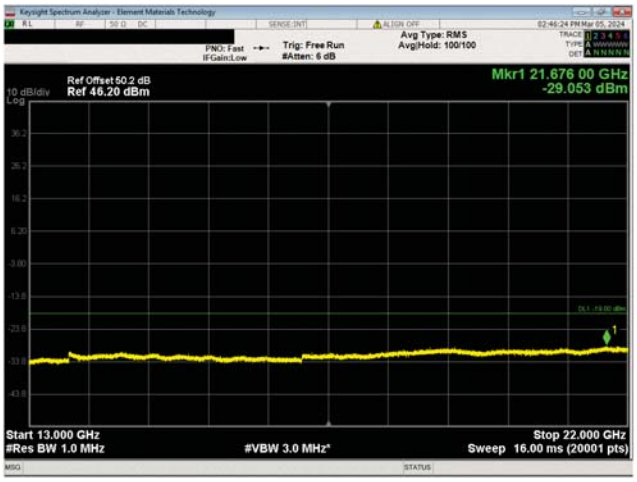
Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Mid Channel, 2155.0 MHz

SPURIOUS CONDUCTED EMISSIONS

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0



Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Mid Channel, 2155.0 MHz



Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Mid Channel, 2155.0 MHz

POWER SPECTRAL DENSITY

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 power spectral density was measured using the channels and modes as called out on the following data sheets.

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

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

The total PSD for 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)]. The total PSD for four port operation is single port PSD +6dB [i.e. 10 Log(4)]. The EIRP calculations are based upon ANSI C63.26-2015 paragraphs 6.4 for a four port MIMO base station.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFL	2023-03-17	2024-03-17
Generator - Signal	Agilent	N5173B	TIW	2023-08-07	2026-08-07
Block - DC	Fairview Microwave	SD3379	AMT	2023-08-04	2024-08-04

POWER SPECTRAL DENSITY

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

REQUIREMENTS FOR PCS BAND n25

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:

EIRP Calculations for Four Port MIMO Operations for Band n25 Single NR Carriers

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

The base station antenna is selected by the customer and this EIRP calculation is based upon a sample worst case antenna. The EIRP calculation is based upon Kathrein antenna assembly model “80011867”. The maximum Band n25 gain (17.9dBi) for this antenna was used for the EIRP calculation. This antenna assembly has a pair of ±45° cross-polarized radiators used for Band n25. The four antenna RF inputs (used for Band n25) on the antenna assembly are as follows: Y1+ L5 (+45°), Y1- L6 (-45°), Y2+ R7 (+45°) and Y2- R8 (-45°). Four AHFII 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 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 (will not be 0 dB) but for this worst case EIRP calculation 0 dB was used. Calculations of worst-case EIRP for four port MIMO are as follows:

POWER SPECTRAL DENSITY

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

Parameter	5G-NR 35 MHz Channel Bandwidth
Worst Case PSD/Antenna Port	35.4 dBm/MHz
Number of Ant Ports per Polarization	2
Total PSD per Polarization 10Log 2 = + 3dB	38.4 dBm/MHz
Cable Loss (site dependent)	0 dB
Dir Gain = Max Ant Gain (G_{Ant}) See Note 1	17.9 dBi
EIRP per Polarization	56.3 dBm/MHz
Number of Polarizations	2
EIRP Total = Y1 ±45°and Y2 ±45° See Note 2	56.3 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 AHFII Band n25 four port MIMO EIRP levels using antenna assembly model “80011867” are less than the FCC and ISED (65.16 dBm/MHz and 62.15 dBm/MHz) EIRP Regulatory Limits.

POWER SPECTRAL DENSITY

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

REQUIREMENTS FOR AWS BAND n66

FCC Requirements:

27.50(d) The following power and antenna height requirements apply to stations transmitting in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz and 2180-2200 MHz bands:

(1) The power of each fixed or base station transmitting in the 1995-2000 MHz, 2110-2155 MHz, 2155-2180 MHz or 2180-2200 MHz band and located in any county with population density of 100 or fewer persons per square mile, based upon the most recently available population statistics from the Bureau of the Census, is limited to:

(ii) An EIRP of 3280 watts/MHz when transmitting with an emission bandwidth greater than 1 MHz.

(2) The power of each fixed or base station transmitting in the 1995-2000 MHz, the 2110-2155 MHz 2155-2180 MHz band, or 2180-2200 MHz band and situated in any geographic location other than that described in paragraph (d)(1) of this section is limited to:

(ii) An EIRP of 1640 watts/MHz when transmitting with an emission bandwidth greater than 1 MHz.

ISED Requirements RSS-139 Section 5.5/SRSP-513 Section 6.1.2/SRSP-519 Section 6.1.2:
SRSP-513 6.1.3 E.i.r.p. limits and antenna height limits for non-AAS systems

21. For fixed and base stations operating in the band 2110-2180 MHz with a channel bandwidth greater than 1 MHz, the maximum permissible e.i.r.p. is 62 dBm/MHz (i.e. no more than 62 dBm e.i.r.p. in any 1 MHz band segment), with an antenna HAAT of up to 300 m.

22. Fixed and base stations operating in the band 2110-2180 MHz and located in geographic areas at a distance greater than 26 km from large or medium population centres may increase their e.i.r.p. to a maximum of 65 dBm/MHz (i.e. no more than 65 dBm e.i.r.p. in any 1 MHz band segment), with an antenna HAAT of up to 300 m.

SRSP-519 6.1.3 Radiated power and antenna height limits for base stations using non-AAS systems

22. For base stations operating in the bands 2000-2020 MHz and 2180-2200 MHz with an antenna HAAT of up to 300 m, the e.i.r.p. shall not exceed 62 dBm/MHz when transmitting with an emission bandwidth greater than 1 MHz.

23. Base stations located in geographic areas at a distance greater than 26 km from large or medium population centres may increase their e.i.r.p. to a maximum of 65 dBm when transmitting with an emission bandwidth of 1 MHz or less, and 65 dBm/MHz when transmitting with an emission bandwidth greater than 1 MHz, with an antenna HAAT of up to 300 m.

EIRP Calculations for Four Port MIMO Operations for Band n66 Single NR Carriers

EIRP calculations are needed at each transmitter location to optimize base station operational performance while meeting regulatory requirements. Each cell site installation needs to consider the power measurements in the radio certification report as well as site specific regulatory requirements (such as antenna height, population density, etc.), site installation parameters (line loss between antenna and radio, antenna parameters, etc.) and base station operational parameters (MIMO operational setup, carrier power level, channel bandwidth, modulation type, etc.) to optimize performance. Transmitter output power may be reduced (from maximum) by base station setup parameters. Base station antennas are selected by the customer.
The base station antenna is selected by the customer and this EIRP calculation is based upon a sample worst case antenna. The EIRP calculation is based upon Kathrein antenna assembly model “80011867”. The maximum Band n66 gain (18.2dBi) for this antenna was used for the EIRP calculation. This antenna assembly has a pair of ±45° cross-polarized radiators used for Band n66. The four antenna RF inputs (used for Band n66) on the antenna assembly are as follows: Y1+ L5 (+45°), Y1- L6 (-45°), Y2+ R7 (+45°) and Y2- R8 (-45°). Four AHFII 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 (will not be 0 dB) but for this worst case EIRP calculation 0 dB was used. ERIP was calculated as described in SRSP 513 clause 6.1.2 and SRSP 519 clause 6.1.2 “EIRP for non-ASS uncorrelated transmission”. Calculations of worst-case EIRP for four port MIMO are as follows:

Parameter	5G-NR 35 MHz Channel Bandwidth
Worst Case PSD/Antenna Port	35.7 dBm/MHz
Number of Ant Ports per Polarization	2
Total PSD per Polarization 10Log 2 = + 3dB	38.7 dBm/MHz
Cable Loss (site dependent)	0 dB
Dir Gain = Max Ant Gain (G_{Ant}) See Note 1	18.2 dBi
EIRP per Polarization	56.9 dBm/MHz
Number of Polarizations	2
EIRP Total = Y1 ±45°and Y2 ±45° See Note 2	56.9 dBm/MHz
Passing FCC EIRP Limit	62.15 & 65.16 dBm/MHz
Passing ISED EIRP Limit	62 & 65 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 AHFII Band n66 four port MIMO EIRP levels using antenna assembly model “80011867” are less than the FCC (65.16 dBm/MHz and 62.15 dBm/MHz) and ISED (65 dBm/MHz and 62 dBm/MHz) EIRP Regulatory Limits.

POWER SPECTRAL DENSITY

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

EUT:	AHFII Remote Radio Head	Work Order:	NOKI0070
Serial Number:	BL2350N4CBR	Date:	2024-03-05
Customer:	Nokia Solutions and Networks	Temperature:	21.6°C
Attendees:	Mitch Hill, David Le	Relative Humidity:	51.1%
Customer Project:	None	Bar. Pressure (PMSL):	1009 mbar
Tested By:	Jarrod Brenden	Job Site:	TX07
Power:	54 VDC	Configuration:	NOKI0070-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 24E:2024	ANSI C63.26:2015
FCC 27:2024	ANSI C63.26:2015
RSS-133 Issue 6:2013 +A1:2018	ANSI C63.26:2015
RSS-139 Issue 4:2022	ANSI C63.26:2015

COMMENTS

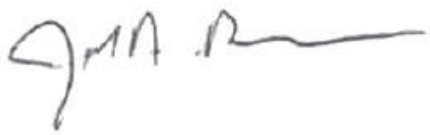
Losses in the measurement path were accounted for: DC block, attenuators, cables, and filters where used. Band n25 and Band n66 carriers enabled individually at maximum power (80 watts/carrier).

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

Pass



Tested By

TEST RESULTS

	Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2) MIMO dBm/MHz == PSD	Four Port (4x4) MIMO dBm/MHz == PSD
Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz					
35 MHz Channel Bandwidth					
QPSK Modulation					
Mid Channel, 1962.5 MHz	33.672	0	33.7	36.7	39.7
16QAM Modulation					
Mid Channel, 1962.5 MHz	35.374	0	35.4	38.4	41.4
64QAM Modulation					
Mid Channel, 1962.5 MHz	33.604	0	33.6	36.6	39.6
256QAM Modulation					
Low Channel, 1947.5 MHz	33.828	0	33.8	36.8	39.8
Mid Channel, 1962.5 MHz	33.632	0	33.6	36.6	39.6
High Channel, 1977.5 MHz	33.549	0	33.5	36.5	39.5
Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz					
35 MHz Channel Bandwidth					
QPSK Modulation					
Mid Channel, 2155.0 MHz	33.936	0	33.9	36.9	39.9
16QAM Modulation					
Mid Channel, 2155.0 MHz	35.689	0	35.7	38.7	41.7

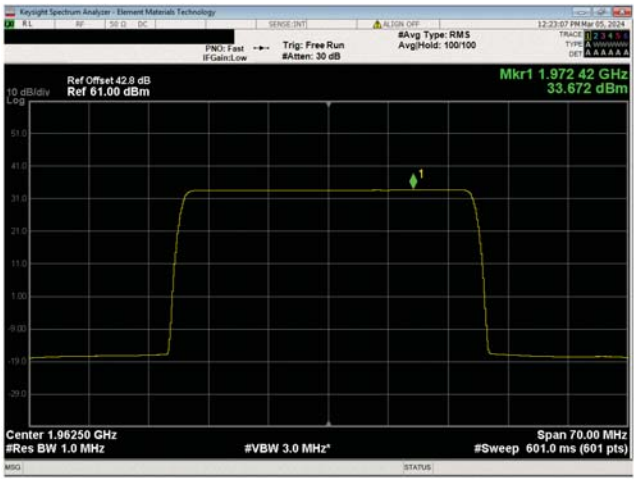
POWER SPECTRAL DENSITY

element
TbtTx 2023.12.06.3
WTD.2023.11.13.0

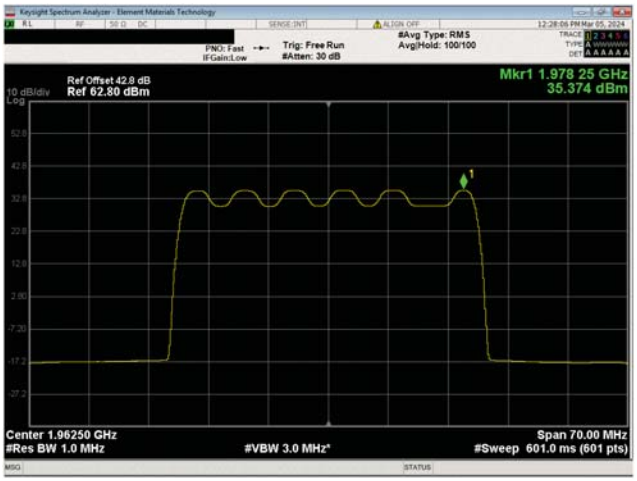
	Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2) MIMO dBm/MHz == PSD	Four Port (4x4) MIMO dBm/MHz == PSD
64QAM Modulation					
Mid Channel, 2155.0 MHz	33.956	0	34.0	37.0	40.0
256QAM Modulation					
Low Channel, 2127.5 MHz	33.946	0	33.9	36.9	39.9
Mid Channel, 2155.0 MHz	33.908	0	33.9	36.9	39.9
High Channel, 2182.5 MHz	33.582	0	33.6	36.6	39.6

POWER SPECTRAL DENSITY

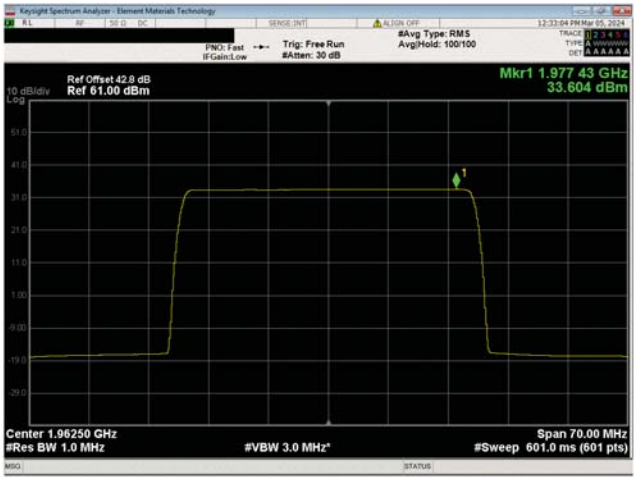
element
TbtTx 2023.12.06.3
WTD.2023.11.13.0



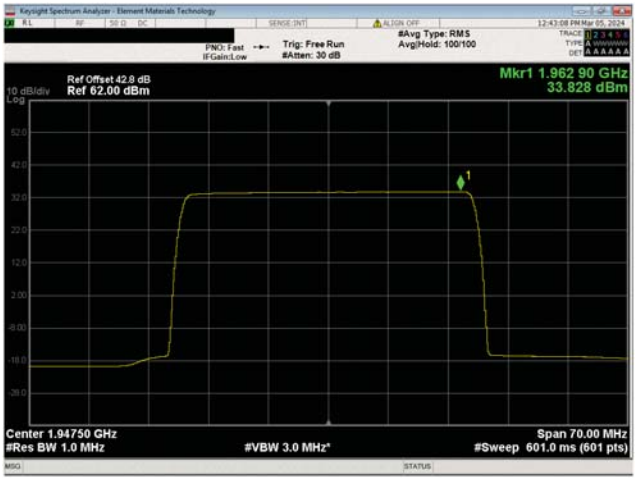
Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
QPSK Modulation
Mid Channel, 1962.5 MHz



Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
16QAM Modulation
Mid Channel, 1962.5 MHz



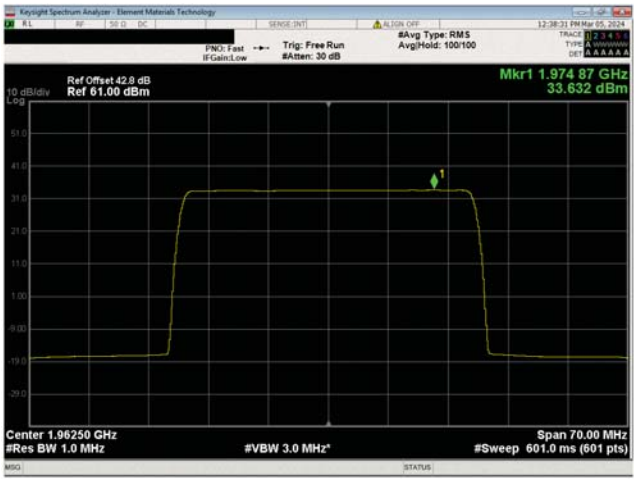
Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
64QAM Modulation
Mid Channel, 1962.5 MHz



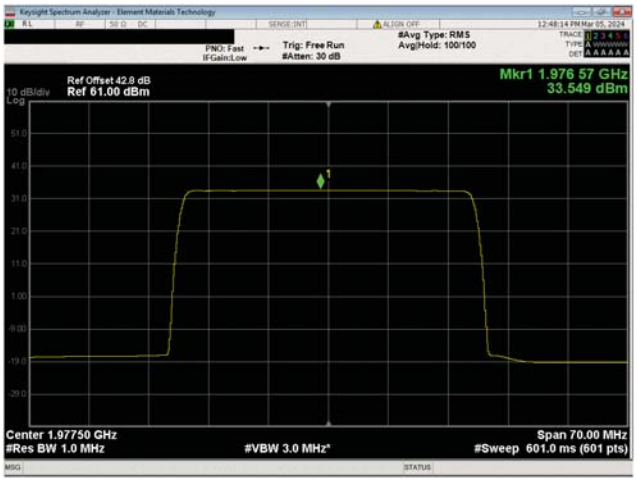
Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Low Channel, 1947.5 MHz

POWER SPECTRAL DENSITY

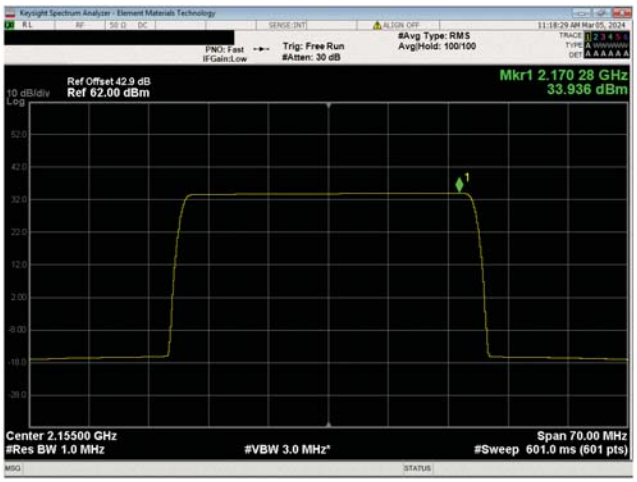
element
TbtTx 2023.12.06.3
WTD.2023.11.13.0



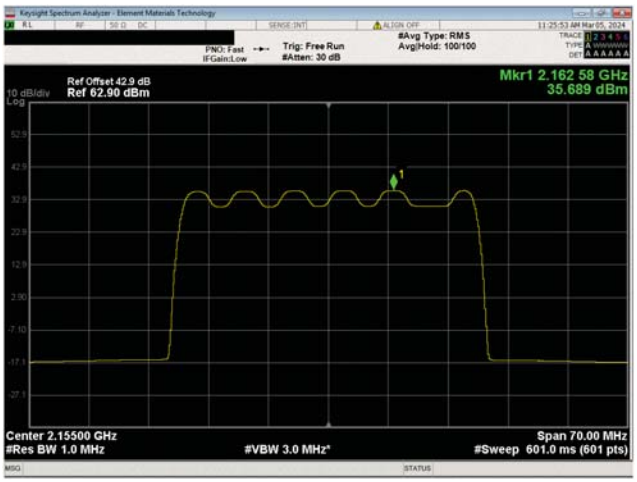
Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Mid Channel, 1962.5 MHz



Band n25, 5G NR, 1930.0 MHz - 1995.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
High Channel, 1977.5 MHz



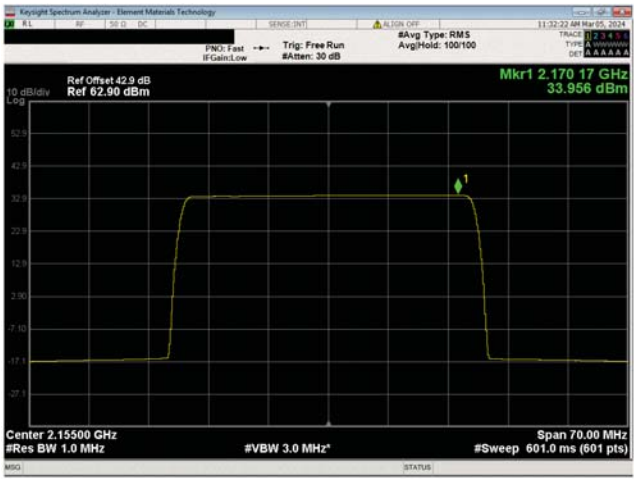
Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
QPSK Modulation
Mid Channel, 2155.0 MHz



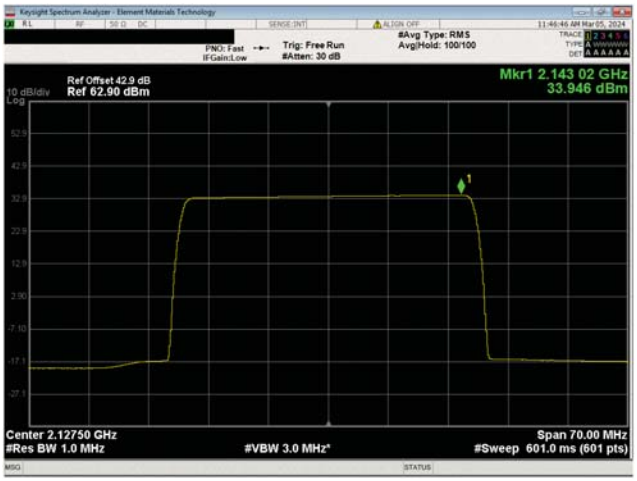
Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
16QAM Modulation
Mid Channel, 2155.0 MHz

POWER SPECTRAL DENSITY

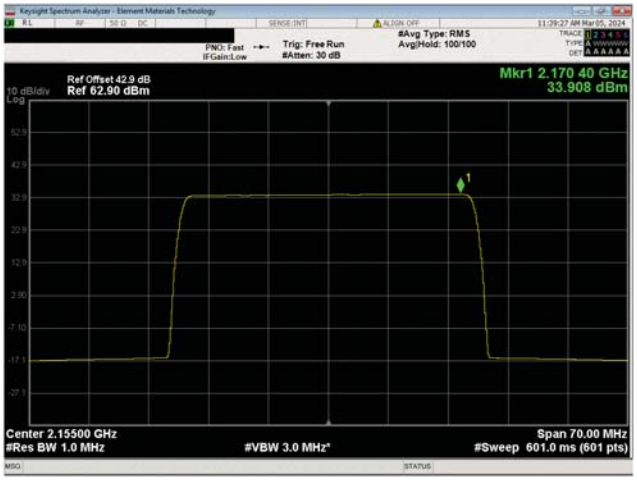
element
TbtTx 2023.12.06.3
WTD.2023.11.13.0



Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
64QAM Modulation
Mid Channel, 2155.0 MHz



Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Low Channel, 2127.5 MHz



Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
Mid Channel, 2155.0 MHz

Band n66, 5G NR, 2110.0 MHz - 2200.0 MHz
35 MHz Channel Bandwidth
256QAM Modulation
High Channel, 2182.5 MHz

End of Test Report