TEST REPORT: FCC RF Test Report AWHHF FCC ID: 2AD8UAWHHF01

Oulu 16. Jul 2024
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AirScale Base Transceiver Station Remote Radio Head 4T4R n41 80W 2,5GHz
NR (TDD)
AWHHF
Nokia Solutions and Networks Oy
Kaapelitie 4, FI-90620, Oulu, Finland
Conformance test according to the specifications mentioned below
FCC 47 CFR part 2
FCC 47 CFR part 27
The EUT complies with the requirements of the specification

The results relate only to the items tested as described in this test report.

Signature

Approved by:DateJarkko KenttäläSquad Group Lead, TypeApprovalNokia Networks16 Jul 2024

Jullo Kartoil

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1 Summary

The following tests were performed according to the FCC rules in order to verify the compliance of the EUT with the FCC requirements:

Test No.	Measurement	FCC Rule	Page Number of this Report	Result
1	RF Output power	§ 2.1046, § 27.50,	9	compliant
2	Modulation Characteristics	§ 2.1047,	14	compliant
3	Occupied Bandwidth	§ 2.1049, § 2.201, § 27.53,	15	compliant
4	Spurious Emissions at Antenna Terminals	§ 2.1051, § 2.1057 § 27.53	17	compliant
5	Field Strength of Spurious Radiation	§27.53 §15.109	20	compliant
6	Frequency Stability	§27.54 §2.1055	23	compliant

Table 1 Results – Summary

In accordance with the FCC Rule §15.3 (z) the equipment was tested with the limits that are valid for an *unintentional radiator*.

Measurements guidance: FCC OET laboratory KDB: 662911 D01 Multiple Transmitter Output v01r02, 971168 D03 IM Emission Repeater Amp v01 and FCC KDB 971168 D01 Power Meas License Digital Systems v03r01: ANSI C63.26-2015.

Test Laboratory: Nokia Solutions and Networks Oy Kaapelitie 4, FI-90620, Oulu, Finland Jarkko Kenttälä FCC Reg. No: 261413 Testing laboratory accreditation number: T297

1.1 Time Schedule

Test No.	1, 2, 3, 4, 6	5
Start of Test:	28 Jun 2024	15 Jul 2024
End of Test:	10 Jul 2024	16 Jul 2024

1.2 Participants

Name	Function	Signature
Kimmo Huuki	Tests no: 1,2,3,4 and 6 Setup of EUT	Jim Muk
Onyumbe Olamba N´Djeka	Test no 5 Setup of EUT	Houforg www.

2 Equipment Under Test

The EUT is a AirScale Base Transceiver Station Remote Radio Head The BTS performs the full RAN function of NR system (New Radio).

2.1 Configuration of EUT

The used different EUT configurations are shown by the following table.

Module Type	Airscale BTS RRH 4T4R, B41 20W pe	Airscale BTS RRH 4T4R, B41 20W per antenna 80W per radio					
Radio Access Technology	NR						
Duplex mode	Time Division Duplex (TDD)	Time Division Duplex (TDD)					
Channel Bandwidth	NR Single slim carrier 49.5MHz (n41)	NR Single slim carrier 49.5MHz (n41) (Config. A)					
Supply Voltage	48.0 V DC						
	Single carrier						
Rated Output Power (Prat)	20W (43.0dBm) conducted / carrier						
Downlink/Uplink ratio	3:6						
	RX	ТХ					
Number of Antenna Ports	4 (ANT1 to ANT4) 4 (ANT1 to ANT4)						
МіМо	Yes	Yes					

Table 2 Overview of EUT configuration

The tests were performed with one EUT at the antenna ports from ANT1 to ANT4.

The used different EUT configurations are shown by the following table.

Module Name	Serial-No.	Module Type	Test No.		
AWHHF	AH211300441	RRH	1,2,3,4,5,6		

Table 3 Configuration of EUT

For a functional description of the modules, please refer to the appropriate related parts and exhibit sections of this certification application.

2.2 Operating Conditions

The EUT supports QPSK, 16QAM, 64QAM and 256QAM modulation. If not stated otherwise, the following standard setup procedure for the EUT was used:

The transmitter was set up according to 3GPP TS 38.141 NR Test Models (TM) for all tests:

- TM 1.1: All QPSK modulation testing



- TM 3.1: All 64QAM modulation testing
- TM 3.1A All 256QAM modulation testing
- TM 3.2: All 16QAM modulation testing

During the measurements, one carrier channel was tested at a time. The carrier was set to the maximum power level to ensure the maximum emission amplitudes during all measurements.

During the tests, the AirScale BTS is transmitting a pseudo random bit pattern on the data channels. This ensures that the measurements of the emission characteristics of the transmitter are pursuant to § 2.1049.

Test models TM1.1, TM3.1, TM3.1A and TM3.2, have uplink/Downlink ratio 3:6.

3 Test Configuration

If not stated otherwise, the following measurement configuration was used to perform all measurements (see figure below).

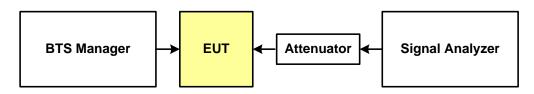


Figure 1 Test Configuration (single output)

The RF output of the transceiver (cell) under test is connected to a signal analyzer via a high-power attenuator to protect the input of the signal analyzer from high RF power levels. A description of the analyzer settings is given in each of the sections describing the measurements. The other transceivers are terminated.

A complete list of the measurement equipment is included on page 27 of this measurement report.

3.1 Calibration of the Test Equipment

All relevant test equipment has a valid calibration from an external calibration laboratory. Additionally, the signal analyzer has a built-in self-calibration procedure. This calibration procedure was activated prior to the measurements so that the analyzer is deemed accurate. High quality cables were used to connect the measurement equipment to the EUT. The actual loss of the attenuator and the cables was measured with a high precision network analyzer and taken into account for all measurements.

4 Test Results

4.1 Test No. 1: Transmitter Output Power (§ 2.1046, § 27.50)

4.1.1 Limits

The maximum output power of the equipment measured in terms of average values shall comply with the Total power limit:

EIRP limits are calculated and found in Appendix A.

BRS FCC EIRP limits: 33dBW + 10 log(X/Y) dBW + 10 log(360/beamwidth) dBW, where X is the channel width in MHz and Y is 5.5 or 6MHz. (§ 27.50(h)(ii)).

Peak to average power (PAPR) limit is 13dBm.

4.1.2 Test Procedure and Results

Detachable Antenna: The maximum output power at the antenna terminals was measured using a signal analyzer.

The RF power was measured with a frequency sweep across the carrier. The carrier power was calculated from the signal analyzer by integration over the result. The base station maximum output power was measured with signal analyzer with offset adjust in testcase. (Offset is measured connection loss of the test set up.)

For the MiMo output, RF power output was measured from each antenna port individually and the results summed mathematically in accordance with FCC KDB 662911 D01 and ANSI C63.26 -guidance.

All Tx ports were tested in Config A and one Tx port was selected for the remaining testing. The AWHHF antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in the results) and antenna port 2 was selected for the remaining testing based on ANSI C63.26-2015 clauses 5.2.5.3, 5.7.2i and 6.4.

Peak to average power (PAPR) was examined using CCDF method and 0.1% value recorded in dB to the tables below.

Average Power Spectral density was measured using FSW signal Analyzer.

The following table shows the measured output powers at the antenna connector.

Measured laboratory room temperature and humidity during the tests						
Date	Temperature	y Min-Max:				
28.06.2024 - 02.07.2024	22.9 °C	25.1 °C	31.0 RH%	61.4 RH%		

Config A:

	Channel Frequency	Antenna Port1	Antenna Port2	Antenna Port3	Antenna Port 4	Total power/unit
	(MHz)	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)	Power (W)
Test Model 1 Modulation QPSK	2592.99	42.07	42.07	42.03	42.04	64.17
Test Model 3.1 Modulation 64QAM	2592.99	42.06	42.08	42.03	42.02	64.09
Test Model 3.2 Modulation 16QAM	2592.99	41.92	41.96	41.92	41.90	62.31
Test Model 3.1A Modulation 256QAM	2592.99	42.06	42.05	42.03	42.03	64.02
Total power/antenna port (W)		63.80	63.98	63.43	63.36	

Table 4 RF Power Output (49.5 MHz BW NR Band 41)

Config A:

Test Model 1.1 Modulation QPSK		Modul	Modulation Mod		Test Model 3.2 Modulation 16QAM		del 3.1a ation AM	
Channel Fi 2520.7	• •	Channel Fi 2520.7	• •	Channel Fr 2520.7	• •	Channel Fi 2520.7	. ,	
Tx Port	(dBm)	Tx Port	(dBm)	Tx Port	(dBm)	Tx Port	(dBm)	
2	42.05	2	42.04	2	41.92	2	42.05	
	Channel Frequency 2592.99MHz		Channel Frequency 2592.99MHz		Channel Frequency 2592.99MHz		Channel Frequency 2592.99MHz	
Tx Port	(dBm)	Tx Port	(dBm)	Tx Port	(dBm)	Tx Port	(dBm)	
2	42.00	2	42.03	2	41.90	2	41.98	
Channel Frequency 2665.26MHz		Channel Fi 2665.2		Channel Fr 2665.2	• •	Channel Fi 2665.2		
Tx Port	(dBm)	Tx Port	(dBm)	Tx Port	(dBm)	Tx Port	(dBm)	
2	41.98	2	41.99	2	41.89	2	41.98	

Table 5 RF Power Output (Band 41 NR 49.5 MHz Channel BW)

The base station maximum output power was found to be compliant with the manufacturer's specifications and with all requirements of the FCC rules.

Config A:

Test M	odel 1.1	Test Model 3.1		Test Model 3.2		Test M	odel 3.1a
Modulation QPSK		Modulation 64QAM		Modulat	ion 16QAM	Modulation 256QAM	
	Frequency 75MHz		Frequency .75MHz		Frequency .75MHz		Frequency .75MHz
2520.	7 510112	2520	.7 510112	2520	.7 510112	2520	.7 510112
Tx Port	dBm/MHz	Tx Port	dBm/MHz	Tx Port	dBm/MHz	Tx Port	dBm/MHz
2	25.78	2	25.76	2	27.36	2	25.77
Channel I	Frequency	Channel	Frequency	Channel Frequency		Channel Frequency	
2592.9	99MHz	2592	2592.99MHz		.99MHz	2592	.99MHz
Tx Port	dBm/MHz	Tx Port	dBm/MHz	Tx Port	dBm/MHz	Tx Port	dBm/MHz
2	25.61	2	25.74	2	27.16	2	25.67
Channel I	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
2665.26MHz			.26MHz	2665.26MHz			.26MHz
Tx Port	dBm/MHz	Tx Port	dBm/MHz	Tx Port	dBm/MHz	Tx Port	dBm/MHz
2	25.68	2	25.79	2	27.26	2	25.72

Table 6 Power Spectral Density (B41 NR 49.5 MHz Channel BW)

The base station power spectral density was found to be compliant with the manufacturer's specifications and with all requirements of the FCC rules.

Config A:

Test Model 1.1		Test Model 3.1		Test Model 3.2		Test Model 3.1a	
Modulation		Modulation		Modulation		Modulation	
C	QPSK	64	QAM	16	QAM	25	6QAM
Channel Frequency 2520.75MHz			Frequency 75MHz	ncy Channel Free 2520.75N			Frequency 0.75MHz
Tx Port	CCDF 0.1%	Tx Port	CCDF 0.1%	Tx Port	CCDF 0.1%	Tx Port	CCDF 0.1%
2	8.00	2	7.98	2	8.08	2	8.02
	l Frequency 2.99MHz	Channel Frequency 2592.99MHz			Frequency .99MHz		Frequency 2.99MHz
Tx Port	CCDF 0.1%	Tx Port	CCDF 0.1%	Tx Port	CCDF 0.1%	Tx Port	CCDF 0.1%
2	7.92	2	7.92	2	8.04	2	7.94
Channel Frequency 2665.26MHz		Channel Frequency 2665.26MHz		Channel Frequency 2665.26MHz			Frequency 5.26MHz
Tx Port	CCDF 0.1%	Tx Port	CCDF 0.1%	Tx Port	CCDF 0.1%	Tx Port	CCDF 0.1%
2	8.02	2	8.04	2	8.10	2	8.06

Table 7 Peak to Average Power (B41 NR 49.5 MHz BW)

The base station peak to average power was found to be compliant with the manufacturer's specifications and with all requirements of the FCC rules.



4.2 Test No. 2: Modulation Characteristics (§ 2.1047)

The occupied bandwidth was measured to be compliant with the manufacturer's specifications and with all requirements of the FCC rules, which represents the 99% power bandwidth (see the following section and screenshots on page 34).

No further testing is required under this section of the FCC rules. No measurements other than the occupied bandwidth are required. Sample of modulation screenshots are on page 31, in I/Q constellation diagrams and tables, showing QPSK, 16QAM, 64QAM and 256QAM –modulation generation.

4.3 Test No. 3: Occupied Bandwidth (§ 2.1049, § 2.201, § 27.53)

4.3.1 Limits

Para. No. 2.1049. The 99% occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to 0.5% of the emitted power.

FCC § 27.53(m)(6) for BRS: The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

4.3.2 Test Procedure and Results

The 99% occupied bandwidth of the carrier emission is measured using a signal analyzer with Resolution Bandwidth set to 1MHz (1-5% of bandwidth; see screenshots on page 34 for details). The following tables summarize the results:

The Relative measurement procedure of OBW is measured as the width of the spectral envelope of the modulated signal, at an amplitude level reduced from a reference value by a specified ratio (or in decibels, a specified number of dB down from the reference value). The typical ratio for transmitters is –26 dB, corresponding to the 26 dB BW. The Relative measurement procedure emission is measured using a signal analyzer with Resolution Bandwidth set to 1MHz (1-5% of bandwidth; see screenshots on page 36 for details).

Emission designator summary tables are found in Appendix B.

The following tables summarize the results:

Measured laboratory room temperature and humidity during the tests							
Date	Temperature	Min-Max:	Humidity Min-Max:				
01.07.2024 - 02.07.2024	22.9 °C	24.0 °C	37.2 RH%	55.0 RH%			

Config A:

Test Model 1.1 Modulation QPSK		Test Model 3.1 Modulation 64QAM		Test Model 3.2 Modulation 16QAM		Test Model 3.1a Modulation 256QAM				
		Channel Frequency 2520.75MHz		Channel Frequency 2520.75MHz			Channel Frequency 2520.75MHz			
99% (MHz) 46.86	26dB (MHz) 49,45	Tx Port 2	Value 99% (MHz) 46.81	Value 26dB (MHz) 49.53	Tx Port 2	99% (MHz) 47.03	26dB (MHz) 49,49	Tx Port 2	99% (MHz) 46.82	26dB (MHz) 49.48
2 46.86 49.45 Channel Frequency 2592.99MHz		Channel Frequency 2592.99MHz		Channel Frequency 2592.99MHz			Channel Frequency 2592.99MHz			
99% (MHz)	26dB (MHz)	Tx Port	Value 99% (MHz)	Value 26dB (MHz)	Tx Port	99% (MHz)	26dB (MHz)	Tx Port	99% (MHz)	26dB (MHz)
46.90	49.45	2	46.85	49.56	2	47.07	49.44	2	46.88	49.49
		Channel Frequency 2665.26MHz		Channel Frequency 2665.26MHz		Channel Frequency 2665.26MHz				
99% (MHz)	26dB (MHz) 49 41	Tx Port 2	Value 99% (MHz) 46.81	Value 26dB (MHz) 49 41	Tx Port 2	99% (MHz) 47.03	26dB (MHz) 49 55	Tx Port 2	99% (MHz) 46.80	26dB (MHz) 49.48
	odulation nnel Freq 2520.75M 99% (MHz) 46.86 nnel Freq 2592.99M 99% (MHz) 46.90 nnel Freq 2665.26M	odulation QPSK nnel Frequency 2520.75MHz 99% 26dB (MHz) (MHz) 46.86 49.45 nnel Frequency 2592.99MHz 99% 26dB (MHz) 46.90 46.90 49.45 nnel Frequency 2665.26MHz 99% 26dB (MHz) 46.90 46.90 49.45 nnel Frequency 2665.26MHz	odulation QPSKModnnel FrequencyCha2520.75MHzCha99%26dBTx(MHz)(MHz)Port46.8649.452nnel FrequencyCha2592.99MHzCha99%26dBTx99%26dBTx99%26dBTx99%26dBTx99%26dBTx99%26dBTx99%26dBTx99%26dBTx99%26dBTx99%26dBTx99%26dBTx99%26dBTx99%26dBTx99%26dBTx99%26dBTx	odulation QPSKModulation 6nnel Frequency 2520.75MHzChannel Freq 2520.75MHz99% (MHz)26dB (MHz)Tx Port99% (MHz)26dB (MHz)Tx Port46.8649.45246.8649.45246.8649.4522592.99MHzChannel Freq 2592.99M99% (MHz)26dB (MHz)Tx Port99% (MHz)26dB (MHz)Tx 299% (MHz)26dB (MHz)Tx 299% (MHz)26dB (MHz)Value 99% (MHz)99% (MHz)26dB (MHz)Tx 99% (MHz)	odulation QPSKModulation 64QAMnnel Frequency 2520.75MHzChannel Frequency 2520.75MHz99% (MHz)26dB (MHz)Tx Port99% 99% (MHz)26dB (MHz)46.86 (MHz)49.45 (MHz)246.81 49.5346.86 (MHz)49.45 (MHz)246.81 49.5399% 2592.99MHz26dB (MHz)Tx 2592.99MHz99% 26dB (MHz)99% (MHz)26dB (MHz)Tx Port99% 99% (MHz)26dB (MHz)46.90 49.45246.85 49.5649.56nnel Frequency 2665.26MHzChannel Frequency 2665.26MHz299% (MHz)26dB (MHz)Tx 29% 26dB (MHz)Value 26dB (MHz)99% (MHz)26dB (MHz)Tx 29% 26dB (MHz)Value 26dB (MHz)	odulation QPSKModulation 64QAMModulation 64QAMnnel Frequency 2520.75MHzChannel Frequency 2520.75MHzCha Channel Frequency 26dBCha Tx99% (MHz)26dB (MHz)Tx99% Port26dB (MHz)Tx46.86 299% (2592.99MHz46.81 2249.45 2246.81 49.5349.53 222nnel Frequency 2592.99MHzChannel Frequency 2592.99MHzCha Cha 2592.99MHzCha 26dB 26dB (MHz)Value PortTx Port99% (MHz)26dB (MHz)Tx Port99% 26dB (MHz)Value PortTx Port46.90 2665.26MHz49.45 Port246.85 Port49.56 2299% (MHz)26dB (MHz)Tx PortPortCha Port99% (MHz)26dB (MHz)Tx PortPortCha Port99% (MHz)26dB (MHz)Tx PortPortCha Port	odulation QPSKModulation 64QAMModulation 1nnel Frequency 2520.75MHzChannel Frequency 2520.75MHzChannel Frequency 2520.75MHzChannel Freq 2520.75MHz99% (MHz)26dB (MHz)Tx Port99% (MHz)26dB (MHz)Tx Port99% (MHz)46.86 49.4549.45246.8149.53247.03nnel Frequency 2592.99MHzChannel Frequency 2592.99MHzChannel Frequency 2592.99MHzChannel Frequency 2592.99MHzChannel Frequency 2592.99MHz99% (MHz)26dB (MHz)Tx Port99% (MHz)26dB (MHz)Tx 29% 2665.26MHz99% 2665.26MHz99% (MHz)26dB (MHz)Tx Port99% (MHz)26dB 2665.26MHzTx 29% 2665.26MHz99% 26dB 26dB 266B7x Port99% (MHz)26dB (MHz)Tx Port99% (MHz)26dB 26dB (MHz)Tx Port99% 26dB99% (MHz)26dB (MHz)Tx Port99% (MHz)26dB PortTx Port99% (MHz)	Odulation QPSKModulation 64QAMModulation 16QAMnnel Frequency 2520.75MHz $Channel Frequency2520.75MHzChannel Frequency2520.75MHzChannel Frequency2520.75MHz99%(MHz)26dB(MHz)TxPort99%(MHz)26dB(MHz)TxPort99%26dB(MHz)26dB(MHz)TxPort99%26dB(MHz)26dB(MHz)TxPort99%26dB(MHz)26dB(MHz)16QAM46.8649.45246.8149.53247.0349.49nnel Frequency2592.99MHzChannel Frequency2592.99MHzChannel Frequency2592.99MHzChannel Frequency2592.99MHz99%(MHz)26dB(MHz)TxPort99%(MHz)26dB(MHz)TxPort99%(MHz)26dB(MHz)99%(MHz)26dB(MHz)TxPort99%(MHz)26dB(MHz)TxPort99%(MHz)26dB(MHz)99%(MHz)26dB(MHz)TxPort99%(MHz)26dB(MHz)TxPort99%(MHz)26dB(MHz)99%(MHz)26dB(MHz)TxPort99%(MHz)26dB(MHz)TxPort99%(MHz)26dB(MHz)$	odulation QPSKModulation 64QAMModulation 16QAMModulation 16QAMModulation 16QAMnnel Frequency 2520.75MHzChannel Frequency 2592.99MHzChannel Frequency 266BChannel Frequency 266BChannel Frequency 266BChannel Frequency 266BChannel Frequency 266B.26MHzChannel Frequency 266B.26MHz<	odulation QPSKModulation 64QAMModulation 16QAMModulation 22nnel Frequency 2520.75MHz $Channel Frequency2520.75MHzChannel Frequency2520.75MHzChannel Frequency2520.75MHzChannel Frequency2520.75MHzChannel Frequency2520.75MHzChannel Frequency2520.75MHzChannel Frequency2520.75MHzChannel Frequency2520.75MHzChannel Frequency2520.75MHz26dB(MHz)Tx(MHz)99\%(MHz)99\%(MHz)26dB(MHz)Tx(MHz)<$

Table 8 Occupied Bandwidth (B41 NR 49.5 MHz BW)

The occupied bandwidth was found to be compliant with the manufacturer's specifications and with all requirements of the FCC rules.

4.4 Test No. 4 Spurious Emissions at Antenna Terminals (§ 2.1051, § 2.1057, § 27.53)

4.4.1 Limits

FCC §27.53(m)(2) for BRS. The power of any emissions outside the licensee's frequency bands of operation shall be attenuated below the transmitter power (P) measured in watts.

The attenuation shall be not less than $43 + 10 \log (P) dB (P = transmitter power in Watts).$

The compliance limit was calculated in the following way:

Maximum transmitter output power [W]: P

Maximun	n trans	smit	ter output p	bower [dBr	n]:	30 + 10 log10 P (conversion from
					W to	dBm)

Attenuation required by FCC: 43 + 10 log10 P

Compliance limit = Maximum transmitter output power - Required attenuation

= 30 + 10 log10 P - (43 + 10 log10 P) = <u>-13 dBm</u>

For MiMo output from 4 TX antenna connectors, one antenna connector was measured individually, and the individual limit lime was reduced by 10log(4). Limit line was calculated to show -19 dBm emission limit, according to FCC KDB 662911 D01 and ANSI C6326-2015 guidance.

The AWHHF antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in the results of Test No.1) and antenna port 2 was selected for the remaining testing based on ANSI C63.26-2015 clauses 5.2.5.3, 5.7.2i and 6.4.

4.4.2 Test Procedure and Results

The tests were carried out in accordance with § 27.53. For all frequency ranges except two (immediately below and above the carrier frequency block) a 1 MHz resolution bandwidth was used for the measurements.

In the 1 MHz frequency bands immediately outside and adjacent to the carrier frequency block the resolution bandwidth is lowered to 1% of the 99%/ 26 dB occupied bandwidth of the transmitted carrier.

According to § 2.1057, all emissions including the fundamental frequency from the lowest radio frequency generated in the equipment, without going below 9 kHz, up to the 10th harmonic were investigated.

The following tables summarize the worst case detected emission levels (see screenshots on page 38 for details). The external attenuation (cable loss of the set up) is already added in the results.

Measured laboratory room temperature and humidity during the tests							
Date	Temperature	Min-Max:	Humidity Min-Max:				
01.07.2024 – 10.07 2024	22.9 °C	24.5 °C	30.5 RH%	60.5 RH%			

Config A Lower band edge:

Carrier Frequency: 2520.75 MHz									
Frequency Range [MHz]	Emission Frequency [MHz]	Maximum Emission Level [dBm]	Result						
QPSK-Modulation TX port 2									
	2496.00	-26.91	compliant						
64QAM-Modulation TX port	2								
	2496.00	-26.63	compliant						
16QAM-Modulation TX port	2								
	2496.00	-27.69	compliant						
256QAM-Modulation TX por	t 2								
	2496.00	-27.10	compliant						
		f < 1.0GHz: ±1.1dB,							
Measuremen	t Uncertainty:	1.0GHz ≤ f <3.6GHz: ±1.2dB,							
		3.6GHz ≤ f <8.0GHz: ±1.6dB, 8.0GHz ≤ f: ±1.9dB							
		8.0GHz ≤	f: ±1.9dB						

Table 9 Spurious Emissions (Lower band edge) (B41 NR 49.5 MHz BW)

Config A Upper band edge:

Carrier Frequency: 2665.26 MHz									
Frequency Range [MHz]	Emission Frequency [MHz]	Maximum Emission Level [dBm]	Result						
QPSK-Modulation TX port 2									
	2690.00	-27.46	compliant						
64QAM-Modulation TX port	2								
	2690.00	-27.45	compliant						
16QAM-Modulation TX port	2	•							
	2690.00	-28.05	compliant						
256QAM-Modulation TX por	t 2	•							
	2690.00	-27.39	compliant						
	f < 1.0GHz: ±1.1dB,								
		1.0GHz ≤ f <3.	6GHz: ±1.2dB,						
	Measurement Uncertainty:3.6GHz ≤ f <8.0GHz: ±1.6dB,								
		8.0GHz ≤	f: ±1.9dB						

Table 10 Spurious Emissions (Upper band edge) (B41 NR 49.5 MHz BW)

Config A Spurious emissions:

	Carrier Frequency: 2592.99 MHz							
Frequency Range [MHz]	Emission Frequency [MHz]	Maximum Emission Level [dBm]	Result					
QPSK-Modulation TX port 2								
0.009 – 27000	9231.56	-27.66	compliant					
64QAM-Modulation TX port	2							
0.009 – 27000	9230.77	-27.69	compliant					
16QAM-Modulation TX port	2							
0.009 – 27000	9232.35	-27.78	compliant					
256QAM-Modulation TX por	t 2							
0.009 – 27000	9225.23	-27.63	compliant					
		f < 1.0GHz: ±1.1dB,						
Measuremen	t Uncertainty:	1.0GHz ≤ f <3.6GHz: ±1.2dB,						
		3.6GHz ≤ f <8.0GHz: ±1.6dB,						
		8.0GHz ≤	f: ±1.9dB					

Table 11 Spurious Emissions (B41 NR 49.5 MHz BW)

The measured conducted emission levels were found to be compliant with the manufacturer's specifications and with all requirements of the FCC rules.

4.5 Test No. 5 Field Strength of Spurious Radiation (§ 2.1053, § 27.53)

4.5.1 FCC Section 2.1053 Field Strength of Spurious Emissions

Field strength measurements of radiated spurious emissions were made in an FCC registered 3m Semi-Anechoic Chamber which is maintained by Nokia in Oulu, Finland. A complete description and full measurement data for the site is on file with the FCC (Site Registration Number: 261413).

The spectrum from 30 MHz to beyond the tenth harmonic of the carrier 2.69 GHz, (26.9 GHz), was searched for spurious radiation. Measurements were made using both horizontally and vertically polarized broadband antennas. Per FCC regulations, the comparison of out of band spurious emissions directly to the limit is appropriately made using the substitution method. However, when the emissions are more than 20 dB below the specification limit, the use of field strength measurements for compliance determination is acceptable and those emissions are considered not reportable (FCC Section 2.1053). For this case the evaluation of acceptable radiated field strength is as follows.

4.5.2 Field Strength of Spurious Emissions - Limits

FCC Sections 2.1053 and 27.53 contain the requirements for the levels of spurious radiation as a function of the level of the unmodulated carrier. The reference level for the unmodulated carrier is calculated as the field produced by an ideal dipole excited by the transmitter output power according to the following relation taken from Reference Data for Radio Engineers, page 676, 4th edition, IT&T Corp.

$$20 \log (E^{*}10^{6}) - (43 + 10 \log P) = 82.23 dB\mu V/meter$$

Where:

E = Field Intensity in Volts/meter P = Transmitted Power in Watts

R = Measurement distance in meters = 3 m

The Part 27 Limit is 82.23 dBµV/m at 3m and 85.75 dBuV/m at 2m

The calculated emission levels were found by:

Measured level (dB μ V) + Cable Loss(dB)+Antenna Factor(dB) = Field Strength (dB μ V/m)

4.5.3 FCC 15.109 Class B Radiated Emissions Limits:

Frequency (MHz)	Field Strengh at 3m (dBµV/m)	Field Strengh at 3m (dBµV/m)	RBW (KHz)	Detector
	FCC §15.109	ICES-003		
30 - 88	40.0	40.0	100	QP
88 - 216	43.5	43.5	100	QP
216 - 960	46.0	46.0	100	QP
960 - 1000	54.0	54.0	100	QP
1000 – 10 th harmonic	54.0	54.0	1000	Average

Table 12 Radiated Emission Limits

4.5.4 RESULTS:

For compliance with 47CFR Part 2and 27, the field strength of any spurious radiation, measured at 3m, is required to be less than 82.23 dB μ V/meter (82.23 @ 3m). Over the out of band spectrum investigated from 30 MHz to beyond the tenth harmonic of the carrier (up to 26.9 GHz), no reportable spurious emissions were detected.

Measured laboratory room temperature and humidity during the tests								
Date	Temperature Mir	Temperature Min-Max: Humidity Min						
15.07.2024 - 16.07.2024	22.2 °C	24.6 °C	4.6 °C 47.3 RH%					
Frequency Range [MHz]	Emission Frequency [MHz]	Maximum Em	Maximum Emission Level [dBm]					
30 - 26900	16577.333280	-33	-33.81 dBm					
Measurement Uncertainty:	·	·		±5.33 dB				

Table 13 Field Strength of Spurious Radiation

The measured emission levels were found to be compliant with the manufacturer's specifications and with all requirements of the FCC.

4.6 Test No. 6: Frequency Stability (§27.54, §2.1055)

4.6.1 Purpose

Frequency stability measurements were performed to verify that the frequency deviation of the emission stays within the licensee's frequency block under extreme temperature.

4.6.2 Limits

Para. No. § 27.54. (-30 °C to +50 °C) and supply voltage conditions according to § 2.1055.

4.6.3 Test Configuration

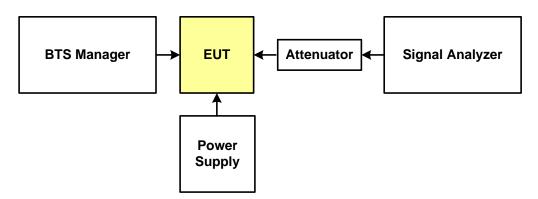


Figure 2 Test Configuration for frequency stability with voltage variation

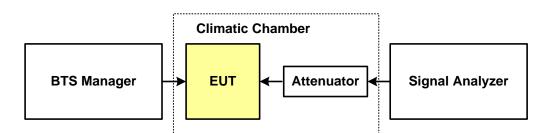


Figure 3 Test Configuration for frequency stability with temperature variation

A complete list of the measurement equipment is included on page 27 of this measurement report.

4.6.4 Test Procedure and Results

Measured laboratory room temperature and humidity during the tests							
Date	Temperature	Min-Max:	Humidity Min-Max:				
02.07.2024 - 08.07 2024	22.8 °C 24.5 °C		36.2 RH%	60.5 RH%			

Frequency Stability with Temperature Variation:

The supply voltage of the EUT was set to the nominal value and the temperature of the environmental chamber was varied in 10degree steps from -30 degrees Celsius to +50 degrees Celsius. The EUT was allowed to stabilize 60 min. at each temperature and the frequency error was measured.

Config A:

Carrier Frequency: 2592.99 MHz								
Supply Voltage (DC) [V]	Ambient Temperature	rature Specification		Frequency Deviation		Result		
	[°C]	[Hz]	[ppm]	[Hz]	[ppm]	-		
QPSK Modulation	TX port 2							
-48.0	-30.0	0.20894	0.000	124	0.05	compliant		
-48.0	-20.0	0.06804	0.000	124	0.05	compliant		
-48.0	-10.0	-0.42902	0.000	124	0.05	compliant		
-48.0	0.0	0.19654	0.000	124	0.05	compliant		
-48.0	10.0	0.21352	0.000	124	0.05	compliant		
-48.0	30.0	-0.57287	0.000	124	0.05	compliant		
-48.0	40.0	-0.06009	0.000	124	0.05	compliant		
-48.0	50.0	0.20324	0.000	124	0.05	compliant		
16QAM Modulatio	on TX port 2							
-48.0	-30.0	0.26573	0.000	124	0.05	compliant		
-48.0	-20.0	-0.09703	0.000	124	0.05	compliant		
-48.0	-10.0	0.03560	0.000	124	0.05	compliant		
-48.0	0.0	-0.63389	0.000	124	0.05	compliant		
-48.0	10.0	-0.00780	0.000	124	0.05	compliant		
-48.0	30.0	0.27237	0.000	124	0.05	compliant		
-48.0	40.0	-0.10359	0.000	124	0.05	compliant		
-48.0	50.0	0.61310	0.000	124	0.05	compliant		
64QAM Modulatio	on TX port 2				I	<u> </u>		
-48.0	-30.0	-0.08870	0.000	124	0.05	compliant		
-48.0	-20.0	-0.53768	0.000	124	0.05	compliant		
						1		

			-	-		
-48.0	-10.0	0.12150	0.000	124	0.05	compliant
-48.0	0.0	0.01366	0.000	124	0.05	compliant
-48.0	10.0	-0.39037	0.000	124	0.05	compliant
-48.0	30.0	-0.01349	0.000	124	0.05	compliant
-48.0	40.0	0.31100	0.000	124	0.05	compliant
-48.0	50.0	0.01556	0.000	124	0.05	compliant
256QAM Modulat	ion TX port 2					1
-48.0	-30.0	0.01063	0.000	124	0.05	compliant
-48.0	-20.0	0.15206	0.000	124	0.05	compliant
-48.0	-10.0	0.19781	0.000	124	0.05	compliant
-48.0	0.0	0.07311	0.000	124	0.05	compliant
-48.0	10.0	0.63482	0.000	124	0.05	compliant
-48.0	30.0	-0.08210	0.000	124	0.05	compliant
-48.0	40.0	0.59676	0.000	124	0.05	compliant
-48.0	50.0	0.11643	0.000	124	0.05	compliant
Measurement Une	Measurement Uncertainty:					

Table 14 Frequency stability with temp. var. (B41 NR 49.5 MHz BW)

Frequency Stability with Voltage Variation:

The EUT was placed in a climatic chamber and allowed to stabilize at +20 degrees Celsius for at least 60 minutes. With the supply voltage of the EUT set to 85% of the nominal value, the frequency error was measure. This procedure was repeated at 100% and 115% of the nominal supply voltage value.

Config A:

Carrier Frequency: 2592.99 MHz												
Supply Voltage (DC) [V]	Ambient Temperature	Frequenc	y Deviation	Manufa Specifi		Result						
	[°C]	[Hz]	[ppm]	[Hz]	[ppm]							
QPSK Modulation TX port 2												
-40.8	20.0	0.11555	0.000	124	0.05	compliant						
-48.0	20.0	-0.25052	0.000	124	0.05	compliant						
-55.2	20.0	0.17125	0.000	124	0.05	compliant						
16QAM Modulatio	on TX port 2		1									
-40.8	20.0	0.55307	0.000	124	0.05	compliant						
-48.0	20.0	-0.20418	0.000	124	0.05	compliant						
-55.2	20.0	-0.13830	0.000	124	0.05	compliant						
64QAM Modulatio	on TX port 2		1									
-40.8	20.0	-0.10165	0.000	124	0.05	compliant						
-48.0	20.0	-0.59814	0.000	124	0.05	compliant						
-55.2	20.0	-0.59814	0.000	124	0.05	compliant						
256QAM Modulat	tion TX port 2				1							
-40.8	20.0	-0.16568	0.000	124	0.05	compliant						
-48.0	20.0	0.57394	0.000	124	0.05	compliant						
-55.2	20.0	0.49513	0.000	124	0.05	compliant						
Measurement Un	Measurement Uncertainty:											

Table 15 Frequency stability with voltage var. (B41 NR 49.5 MHz BW)

The measured frequency stability was found to be compliant with the manufacturer's specifications and with all requirements of the FCC rules.

5 Test Data and Screenshots

5.1 Part List of the RF Measurement Test Equipment

No.	Test Equipment	Manufacturer & Type	Serial Number	Calibratio n date	Calibratio n due	Test No.
1	Signal Analyzer	Rohde & Schwarz: FSW-43	104598	12/2023	12/2024	1, 2, 3, 4, 6
2	Vector Network Analyzer	Rohde & Schwarz: ZVA40	100146	12/2023	12/2024	1, 2, 3, 4, 6
3	Calibration Unit	Rohde & Schwarz: ZV-Z54	100125	11/2023	11/2024	1, 2, 3, 4, 6
4	Calibration Unit	Hewlett Packard 85032B	2919A04843	07/2023	07/2024	1, 2, 3, 4, 6
5	Frequency Standard	Datum 8040	002300628	07/2023	07/2024	1, 2, 3, 4, 6
6	Multimeter	Fluke 83	DM8750386	12/2023	12/2024	1, 2, 3, 4, 6
7	Humidity and Temperature probe	HMP110	S0840831	12/2023	12/2024	1, 2, 3, 4
8	Humidity and Temperature probe	HMP110	T1540333	12/2023	12/2024	6
9	DC Power Supply	Elektro- AutomatikGmbH & Co:PS 9080-510 3U19 3HE 15000W	1373610001	cnn	-	1, 2, 3, 4, 6
10	Attenuator	Weinschel 66-30-33	BN0228	cnn	-	1, 2, 3, 6
11	Attenuator	SHX DTS100G- 20dB-24G	14111101	cnn	-	4
12	High Pass Filter	RF-Lambda RHPF23G06G40	21052000011	cnn	-	4
14	Temperature chamber	ATT DY 1000C 3ESS	TT01413	12/2023	12/2024	6
15	EMI Test Receiver	Rohde & Schwarz: ESW44	103055	12/2023	12/2024	5
16	Horn Antenna	ETS-Lindgren ETS3117	75823	12/2023	12/2024	5
17	Bilog Antenna	Schaffner Chase CBL6112B	2003	08/2023	08/2024	5
18	Horn Antenna	ETS-Lindgren 3116C-PA	150635	02/2024	02/2025	5
19	Amplifier	Miteq AFSX4	1829263	cnn	-	5
20	Band stop filter	Creowave Filters		cnn	-	5
21	High pass filter	Creowave Filters		cnn	-	5



						-
22	Mast Controller	Maturo NCD/281	21250317	cnn	-	5
23	4-meter mast	Maturo TAM4.0-E	123/21250317	cnn	-	5
24	Anechoic chamber	Comtest Nokia 3m Chamber	Nokia 3m Chamber	10/2022	10/2025	5
25	Humidity and temperature meter	Vaisala HMP113	T0841033	12/2023	12/2024	5

Table 16 Part List of the RF Measurement Test Equipment

5.2 Spectral Plots

NOTE: Only a sample of the spectral plots are used and visible in this report. All measured test results and data are saved in Oulu located server.

5.2.1 Test No. 1: RF Output Power

Power spectral density NR 49.5MHz BW

						Sector 1
MultiView = 9	Spectrum					
Ref Level 47.93 d	Bm Offset 33.93	dB 🖷 RBW 1 MHz				SGL
		2s VBW 5MHz Mo	de Sweep			
GAT:EXT1						
1 ACLR						1Rm Clrw
						M1[1] 25.61 dBm
40 dBm		-				2.576830 GHz
			Tx1			
30 dBm		M1				
		<u> </u>				
20 dBm		1			\	
		1				
10 dBm						
20 000						
0 dBm						
0 ubm						
-10 dBm						
-20 dBm						
-30-dBm		-				
-40 dBm		-				
-50 dBm						
CF 2.59299 GHz		. 275 pts		10.1 MHz/		Span 101.0 MHz
2 Result Summary			None			
Channel		width	Offset	Power 41.99 d		
Tx1 (Ref) Tx Total	49.500	J MHZ		41.99 di 41.99 di	siii Bm	
				42155 01	- Boadu	EI 02.07.2024

10:21:10 02.07.2024

Test Model 1.1, Modulation QPSK, Channel Frequency 2592.99MHz, TX port 2

									- 🗞
MultiView S	pectrum								-
Ref Level 47.93 dE	3m Offset 33.93 d	iB 🖷 RBW 1 MHz							SGL
	dB 🖷 SWT 2	s VBW 5 MHz Mo	de Sweep						
GAT:EXT1 1 ACLR									01Rm Clrw
								M1[1]	25.74 dBm
40 dBm									2.580870 GHz
			т	×1					
30 dBm		MI							
20 dBm		/							
						1			
10 dBm									
0 dBm									
o ubiii									
-10 dBm									
-20 dBm									
-30 dBm									
-40 dBm									
-50 dBm									
CF 2.59299 GHz		275 pts		10	0.1 MHz/			Sp	an 101.0 MHz
2 Result Summary			No	ne					
Channel Tx1 (Ref)	Bandy		Offset		Power				
Tx Total	49.500	MITZ			Power 42.02 dBm 42.02 dBm				
~					~	Re	ady	EXT REF	02.07.2024 11:26:53

11:26:53 02.07.2024

Test Model 3.2, Modulation 16QAM, Channel Frequency 2592.99MHz, TX port 2



							(*)
MultiView Spectru	Im						-
Ref Level 47.93 dBm Of	ifset 33.93 dB 🖷 RBW	1 MHz					SGL
 Att 19 dB SV 	VT 2s VBW	5 MHz Mode Swee	p				
GAT:EXT1 1 ACLR							01Rm Clrw
THOLE						M1[1]	25.74 dBm
40 dBm							2.580870 GHz
10 doin			T×1				
30 dBm							
20 dBm							
20 000							
10 dBm							
10 000							
0 dBm							
o ubii							
-10 dBm-							
10 000					1		
-20 dBm							
20 000							
-30 dBm							
-30 dBm							
-40 dBm							
-40 dBm							
-50 dBm CF 2.59299 GHz		275 pts		10.1 MHz/		Sn	an 101.0 MHz
2 Result Summary		270 pts	None	2012 111127		J	
Channel	Bandwidth	Offse		Power			
Tx1 (Ref)	49.500 MHz			42.02 dBm 42.02 dBm			
Tx Total				42.02 aBm			02.07.2024
· · · · · · · · · · · · · · · · · · ·					Ready		02.07.2024



Test Model 3.1, Modulation 64QAM, Channel Frequency 2592.99MHz, TX port 2

					4
AultiView Spect	rum				
Ref Level 47.93 dBm Att 19 dB ●		1 MHz 5 MHz Mode Sweep			SG
GAT:EXT1	501 2.5 000	Similar mode Sweep			
ACLR	· · · ·				o 1 Rm Clrv
					M1[1] 25.67 dB
dBm					2.577930 G
		Tx1			
dBm		M1			
dBm	/				
dBm					
				1	
dBm					
D dBm				<u>+</u>	
) dBm				H	
) dBm					
) dBm					
) dBm					
2.59299 GHz		275 pts	10.1 MHz/		Span 101.0 M
Result Summary		Non			
Channel Tx1 (Ref)	Bandwidth 49.500 MHz	Offset	Power 42.00 dBm		
Tx Total	49.000 MHZ		42.00 dBm		

12:14:21 02.07.2024

Test Model 3.1a, Modulation 256QAM, Channel Frequency 2592.99MHz, TX port 2



Peak-to-Average Power Ratio (PAPR) NR 49.5MHz BW



Test Model 1.1, Modulation QPSK, Channel Frequency 2592.99MHz, Tx Port2

5.2.2 Test No. 2: Modulation Characteristics

No additional measurements are required for the modulation characteristics. Please refer to test no. 3, occupied bandwidth on page 15.

Screenshots below shows information about the modulations I/Q constellation form and modulation information table, displaying error to ideal modulation symbols.

0 denuted at number of the line of												
Att 26 db Offset 33.9 db Frame Count 4 of 4(4) Frame 1 TRG: TG:	MultiView	Spectr	um ×	5G NR	×							
Att 26 db Offset 33.9 db Frame Count 4 of 4(4) Frame 1 TRG: TG:	Deftend 50	10 dPm F #	2 50200	∎ C⊟≂ Mada	Daum	lial. FO MHA	Conture Time	. 40.1 ma	DWD /CC All			ec.
TRG:EXT1 YIG Bypass Lachture Buffer			•					2 40.1 ms	DWP/33 A			50L
Copure Buffer Ge too area G1 Cirv 3 EVM vs Carrier O1 Avg @ 2 Min @ 3 Max 4 Allocation Summary Discrete Studien 0 4 Allocation Summary 0 1 Cirv 0 4 Allocation Summary 0 0 ms 0 ms 0 ms <t< td=""><td></td><td></td><td>iset 55.9</td><td>Sub Fram</td><td>le count</td><td>4 01 4(4)</td><td>Frame</td><td>1</td><td></td><td></td><td></td><td></td></t<>			iset 55.9	Sub Fram	le count	4 01 4(4)	Frame	1				
Strump Start Offset (15, 5965-3930) uh No off Rel Stadgen 10 % <td></td> <td></td> <td>G+ 1/0 Expr</td> <td>t O1 Clow</td> <td>3 EVM vs Ca</td> <td>rrier</td> <td></td> <td>lin 🗛 3 Max</td> <td>4 Allocation S</td> <td>ummary</td> <td>_</td> <td> TableConfig </td>			G+ 1/0 Expr	t O1 Clow	3 EVM vs Ca	rrier		lin 🗛 3 Max	4 Allocation S	ummary	_	 TableConfig
Solution 10.9												
0.0 ms 4.01 ms/ 40.1 ms 0.0 Hz 4.79 MHz/ 47.88 MHz PDSCH DMRS 0 0.000 PDSCH DMRS 1 0.000 PDSC	50 dBm								BWP/Sf/Slot			
0 dbm.htt 0.0 Hz 4.01 ms 0.0 Hz 4.79 MHz 47.88 MHz 0.00 ms 0.00 Hz 4.01 ms 0.0 Hz 4.79 MHz 47.88 MHz 0.00 ms 0.00 ms 0.0 Hz 4.79 MHz 47.88 MHz 0.00 ms 0.00 ms 0.00 ms 0.0 Hz 4.79 MHz 47.88 MHz 0.00 ms 0.00 ms 0.0 Hz 4.79 MHz 47.88 MHz 0.00 ms 0.00 ms 0.00 ms 0.0 Hz 4.79 MHz 47.88 MHz 0.00 ms 0.00 ms 0.00 ms 0.0 Hz 4.79 MHz 47.88 MHz 0.00 ms 0.00 ms <td< td=""><td></td><td></td><td></td><td></td><td>10.00</td><td></td><td></td><td></td><td></td><td></td><td>2</td><td></td></td<>					10.00						2	
Induction Induction <t< td=""><td>diada in contra</td><td>al</td><td>Hat & distant of</td><td>had to a reason</td><td>10 20</td><td></td><td></td><td></td><td>F</td><td></td><td></td><td></td></t<>	diada in contra	al	Hat & distant of	had to a reason	10 20				F			
D.0 ms 4.01 ms/ 40.1 ms/ <			and the second second	- 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 199							129	
2 Result Summary Selected frame Frame Averaged Is frame Is frame Frame Averaged Is frame Frame Averaged <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>DSCH DMRS I</td> <td></td> <td>0.000</td>										DSCH DMRS I		0.000
Frame Results Averaged Mean Limit Max Min EVM PDSCH QPSK (%) 2.53 18.50 2.53 2.53 -60 dbm/Hz <	0.0 ms	4.01 r	ns/	40.1 ms	0.0 Hz	4.79 M	Hz/ 4	17.88 MHz	2			•
EWP PDSCH QPSK (%) 2.53 18.50 2.53 2.53 EVM PDSCH 16QAM (%) 13.50 2.53 2.53 -60 dbm/Hz EVM PDSCH 26QAM (%) 4.50 -60 dbm/Hz -88 dbm/Hz -88 dbm/Hz -90 dbm/Hz <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>5 Powe</td> <td>r Spectru</td> <td>m O1 Clrw</td> <td></td> <td></td> <td>am</td>							5 Powe	r Spectru	m O 1 Clrw			am
Evin PoSch 1 6QAM (%) 2:00 13:50 2:0										Points Measured :	326208	
EVM PDSCH 260QAM (%) 9.00 EVM PDSCH 250QAM (%) 4.50 EVM PDSCH 250QAM (%) 4.50 EVM PDSCH 250QAM (%) 2.51 EVM Phys Signal (%) 2.52 3.04 2.12 EVM Phys Signal (%) 2.51 4.13 1.37 Sampling Error (hz) -0.01 2.38 - 3.33 Sampling Error (hz) -0.01 0.05 -0.10 I/Q Gas Labesco (dB) -72.07 -59.85 -88.01 V Grave Labesco (dB) -71.07 -59.85 -88.01 V Grave Labesco (dB) -71.07 -59.85 -88.01 0.0 Hz 61.44 MHz 0.0 Hz 61.44 MHz 0.0 Hz 61.44 MHz 9.9603 mm 7 UL 5 µs/ 9.9603 mm 7 UL 5 µs/ 9.9603 mm 7 UL 5 µs/ 9.9603 mm 7 UL 5 µs/ 9.9603 mm			2.53		2.53	2.53	-60 dBm/	Hz				
EVM PDSCh1256Q4M(%) 4.50 Results for Selection BWP/SS All, Subframe All, Slot All EVM All (%) 2.52 3.03 2.12 EVM Phys Channel (%) 2.52 3.03 2.12 EVM Phys Channel (%) 2.51 4.13 1.37 Frequency Error (hz) -0.01 2.38 -3.33 Sampling Error (ppm) -0.01 0.05 -0.10 I/Q Grain tablemed (48) -72.07 -59.85 -88.01 -120 dBm/Hz -120 dBm/Hz -120 dBm/Hz -100 dBm/Hz -120 dBm/Hz -100 dBm										· ·		
Limit Dock / Experts Subframe All, Slot All EVM Phys Channel (%) 2.52 3.04 2.12 EVM Phys Signal (%) 2.51 4.13 1.37 Frequency Error (hz) -0.01 2.38 -3.33 Sampling Error (ppm) -0.01 0.05 -0.10 I/Q Gan Labelese (dB) -72.07 -59.85 -88.01 I/S %							-90 dam/			· ·		·**
EVM All (%) 2.52 3.04 2.12 EVM Phys Signal (%) 2.51 3.03 2.12 sampling Error (hz) -0.01 2.38 -3.33 Sampling Error (pm) -0.01 0.05 -0.01 1/Q Gain Leblence (B) -72.07 -59.85 -88.01 7 EVM vs Symbol -120 dBm/Hz -10 dBm/Hz 110 % -120 dBm/Hz -10 dBm/Hz 10 % -72.07 -59.85 -88.01 7 EVM vs Symbol -10 dBm/Hz -10 dBm/Hz 0.0 Hz 61.44 MHz -10 dBm/Hz 10 % -10 dBm/Hz -10 dBm/Hz 0.0 ms 711.45 µs/ 9.9603 mz 0.0 ms 711.45 µs/ 9.9603 mz								112				
EVM Phys Channel (%) 2.52 3.03 2.12 EVM Phys Signal (%) 2.51 4.13 1.37 Frequency Error (hz) -0.01 2.38 -3.33 Sampling Error (pm) -0.01 0.05 -0.10 1/Q Offset (dB) -72.07 -59.85 -88.01 -120 dBm/Hz 1/Q Offset (dB) -72.07 -59.85 -88.01 -01 Chrw 1/S Gais taskelence (dB) -72.07 -59.85 -01.01 -0.01 Chrw 1/S %		ection Bmr				2.12						
EVM Phys Signal (%) 2.51 4.13 1.37 Frequency Error (Hz) -0.01 2.38 -3.33 Samping Error (ppm) -0.01 0.05 -0.10 1/Q Grain Explanes (dB) -72.07 -59.85 -88.01 -120 dBm/Hz 1/Q Grain Explanes (dB) -72.07 -59.85 -88.01 -0.01 ± 0.01		nel (%)					-100 dBm	/Hz				
Frequency Error (Hz) -0.01 2.38 -3.33 Sampling Error (ppm) -0.01 0.05 -0.10 //Q Offset (dB) -72.07 -59.85 -88.01 //Q Offset (dB) -72.07 -59.85 -61.44 MHz												
Sample (107 (pm)) -0.01 0.03 -0.10 1/Q Offset (dB) -72.07 -59.85 -88.01 0.0 Hz 61.44 MHz 1/Q Gista tasksloses (dB) -72.07 -59.85 -88.01 0.0 Hz 61.44 MHz 1/S % - - - - - - - - - 0.1 Clrw 1/S % -										•		٠
10 61.44 MHz 7 EVM vs Symbol 01.0 Hz 15 % 01.0 Hz 10 % 01.0 Hz 5 % 9.9603 ms 711.45 µs/ 9.9603 ms		ppm)					-120 dBm	/Hz				
7 EVM vs Symbol ●1 Clnw 15 % ●1 0 % 10 % 0 % 5 % 0 % 0 ms 711.45 µs/ 9.9603 ms 9.9603 ms			-72.07	7	-59.85	-88.01			61 44 MHz			
15 % 10 % 5 % M M M M M M M M M M M M M					-	-	0.0112		01,44 MI12			
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5 % 4 4 0.07.202	15 %											+
5 % 4 4 0.07.202												
0.0 ms 711.45 μs/ 9.9603 ms	10 %											+
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0.0 ms 711.45 μs/ 9.9603 ms	mm	www	Mohn	WWW	www.	~	mm	nnh	MMAN	nham	Ν.	
Eramo 1 Suno Found Page Page 01.07.2024				N I I N				·- ŋ ·	· · · ·	т <u>и ка</u> т. К		0.0603 mc
							15/					
		V			Frame 1 Sync	Found			Ready		REF 🚺	07:05:52

07:05:53 01.07.2024

I/Q constellation diagram with capture buffer – QPSK (2592.99MHz) (NR 49.5MHz Channel BW)

							-
MultiView Spectrum	× 5G NF	×					
Ref Level 50.62 dBm Freq	2.59299 GHz Mod	le Dowr	link, 50 MHz Ca	pture Time 40.1 m	ns BWP/SS All		SGL
Att 26 dB Offse		ne Count	4 of 4(4) Fr		1		
TRG:EXT1 YIG Bypass							
1 Capture Buffer	🖙 I/Q Export <mark>O1 Clrw</mark>	3 EVM vs Ca	arrier 🛛 🛛 1	. Avg●2 Min●3 M	ax 4 Allocation Su	ummary	▼ TableConfig
Frame Start Offset : 65.996929556 µs					BWP/Sf/Slot	Allocation No	
50 dBm							s Power [dB]
		10 %			0/0/0	PDSCH 0 2 DSCH DMRS 0	2 0.000
Tongon tongo and the state of t	<mark>la san ka lin <mark>an la fanilla</mark> san ku</mark>		4	يو سيه الم			5 1.714
					P	DSCH DMRS 1	1.714 💌
0.0 ms 4.01 ms/	/ 40.1 m	s 0.0 Hz	4.79 MHz	/ 47.88 M	Hz 1		b.
2 Result Summary			me Frame Averaged	5 Power Spect	rum ⊜1 Clrw	6 Constellation	Diagram
Frame Results Averaged	Mean Limit		Min			Points Measured : 32620	
EVM PDSCH QPSK (%)	1.99 18.50	2.00	1.99	-60 dBm/Hz			
EVM PDSCH 16QAM (%)	3.19 13.50		3.19			<u>*</u> *	
EVM PDSCH 64QAM (%)	9.00			-80 dBm/Hz		· · · · · · · · · · · · · · · · · · ·	.
EVM PDSCH 256QAM (%)	4.50			-80 dBm/Hz			
Results for Selection BWP/S			0.05				
EVM All (%) EVM Phys Channel (%)	2.62 2.62	3.19 3.06	2.25 2.22	-100 dBm/Hz			· ·
EVM Phys Channer (%) EVM Phys Signal (%)	2.53	5.09	1.38				
Frequency Error (Hz)	-0.19	4.67	-6.32				. 🔶
Sampling Error (ppm)	0.00	0.07	-0.08	-120 dBm/Hz			* *
I/Q Offset (dB)	-71.79	-64.73	-91.75	0.0 Hz	61.44 MHz		
L/O Gain Imbalanco (dB)			-	0.0 HZ	61.44 MHZ		- L O
7 EVM vs Symbol			1 1				●1 Clrw
15 %							
10 %							
5%				1		1	
han Marken M	Manhan	wh	- M	MMM	MMMM/	MANY -	
0.0 ms			711.45 µs				9.9603 ms
		Frame 1 Sync			 Ready 	EXT	01.07.2024
							07:41:09

07:41:09 01.07.2024

I/Q constellation diagram with capture buffer – 16QAM (2592.99 MHz) (NR 49.5MHz Channel BW)

								A
MultiView Spec	trum X	5G NR	×					
				nk, 50 MHz Ca			BWP/SS All	SGI
Att 26 dB TRG:EXT1 YIG Bypass	Offset 33.93	dB Fram	e Count	4 of 4(4) Fr	ame	1		
1 Capture Buffer	G+ I/Q Export	O1 Clrw	3 EVM vs Ca	rier o	1 Avg●2 Min●	3 Max	4 Allocation Summary	▼ TableConfi
Frame Start Offset : 85.99470311	3 µs						BWP/Sf/Slot Allocation	No of Rel
50-dBm							ID	RBs Power [dB]
			10 %				0/0/0 PDSCH	
Didision <mark>, Printles, Printles, Philipp</mark>	n data ta distani san	ua dentaar					PDSCH DMRS PDSCH	
a and a state of the second state of the	a shi a shi taka ma		- mark and the second	A second s	and the second	and makes	PDSCH PDSCH DMRS	
			**************************************	****	and the second		POSCITUMRS	1 0.000
)1 ms/	40.1 ms	0.0 Hz	4.79 MHz		8 MHz		· · · · · · · · · · · · · · · · · · ·
Result Summary				ne Frame Averaged	0.010.00	ectrum		
Frame Results Average	ed Mean	Limit	Мах	Min	-60 dBm/Hz		Points Measure	
EVM PDSCH QPSK (%)		18.50			-60/dBm/Hz		••	*****
EVM PDSCH 16QAM (%) EVM PDSCH 640AM (%)	2,59	13.50 9.00	2.59	2.59			• 💊	. 🛎 🐐 🌒 🛎 🦉 🛎 👘
EVM PDSCH 64QAM (%) EVM PDSCH 2560AM (%)		9.00 4.50	2.39	2.39	-80 dBm/Hz			
Results for Selection B			lot All	_				
EVM All (%)	2.58	, .	3.05	1.95				
EVM Phys Channel (%)	2.57		3.01	1.92	-100 dBm/Hz-			
EVM Phys Signal (%)	2.61		3.79	1.30				**
Frequency Error (Hz)	0.32		2.76	-2.63			• 🤊	🔸 😸 📥 🛸 🍝 👘
Sampling Error (ppm)	0.00		0.06	-0.06	-120 dBm/Hz-			
I/Q Offset (dB)	-72.15		-63.20	-87.97	0.0 Hz		61.44 MHz	
FVM vs Symbol	-				0.0112		01.44 [0][12]	•1 Clr
	1				1			
.5 %						_		
10 %						_		
5 %		<u> </u>	_					
Manfranka	NMMM	vhvv	m la	have	mm	Mr	mmm	Mr.
0.0 ms			•	711.45 µs		1.	and the second second	9.9603 m
					·/			EXT 10 01.07.202
~			Frame 1 Sync	ound			 Ready 	REF 07:23:2

07:23:24 01.07.2024

I/Q constellation diagram with capture buffer – 64QAM (2592.99 MHz) (NR 49.5MHz Channel BW)

							\$
MultiView 📮 Spectru	m 🗙 5G M	IR X					•
Ref Level 50.03 dBm Free Att 26 dB Offs TRG:EXT1 YIG Bypass Free Free		ode Downl rame Count	ink, 50 MHz Cap 4 of 4(4) Frai	ture Time 40.1 ms me 1	BWP/SS All		SGL
1 Capture Buffer	🖙 I/Q Export <mark>O1 Cl</mark>	rw 3 EVM vs Ca	rrier 🛛 🛛 🕽	Avg●2 Min 0 3 Max	4 Allocation Su	mmary	▼ TableConfig
Franc Start Offset : £5.997983638 µs 50:dBm 101:gBm - 114 rm - 117 - 117 - 117 - 117		10 %			0/0/0 PC	Allocation ID RBs PDSCH 0 2 DSCH DMRS 0 PDSCH 1 129 DSCH DMRS 1	Rel ▲ Power [dB] 0.000 0.000 0.000 0.000 0.000 0.000
		And the second s		*****			0.000
0.0 ms 4.01 ms	s/ 40.1 i		4.79 MHz/	47.88 MHz			
2 Result Summary			me Frame Averaged	5 Power Spectru		6 Constellation Dia	gram
Frame Results Averaged EVM PDSCH QPSK (%) EVM PDSCH 16QAM (%) EVM PDSCH 64QAM (%) EVM PDSCH 256QAM (%)	Mean Lin 18.5 13.5 9.0 2.55 4.5	50 50 20	Min	-60 dBm/Hz		Points Measured : 326208	
Results for Selection BWP/			2100				******
EVM All (%) EVM Phys Channel (%) EVM Phys Signal (%) Frequency Error (Hz)	2.55 2.55 2.60 -0.33	3.01 3.03 3.68 3.23	2.09 2.05 1.32 -2.33	-100 dBm/Hz			
Sampling Error (ppm)	-0.00	0.04	-0.06	-120 dBm/Hz			
I/Q Offset (dB)	-70.43	-62.88	-99.84	0.0 Hz	61.44 MHz	********	*****
L/O Gain Imbalance (dB)	-	-		0.0 HZ			
7 EVM vs Symbol							●1 Clrw
15 %							
10 %							
Marymon	mm	MM	h	mound	munt	mon	
0.0 ms			711.45 µs/				9.9603 ms
$\overline{\nabla}$		Frame 1 Sync	Found		 Ready 	EXT REF	01.07.2024 06:35:25

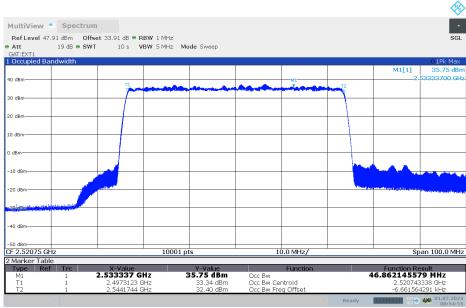
06:35:25 01.07.2024

I/Q constellation table with I/Q error -256QAM (2592.99 MHz) (NR 49.5MHz Channel BW)

5.2.3 Test No. 3: Occupied Bandwidth

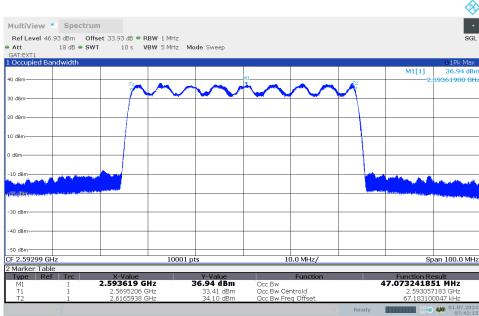
Occupied Bandwidth 99% plots

Occupied Bandwidth NR49.5MHz BW



08:54:56 01.07.2024

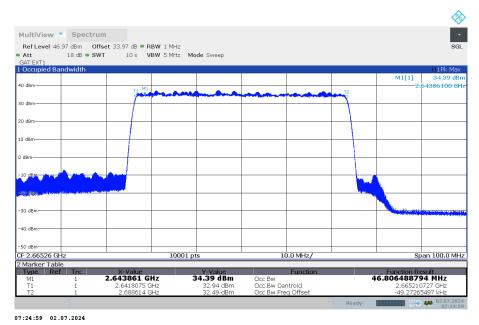
Test Model 1.1, Modulation QPSK, Channel Frequency 2520.75MHz, Tx Port 2



Occupied Bandwidth NR49.5MHz BW

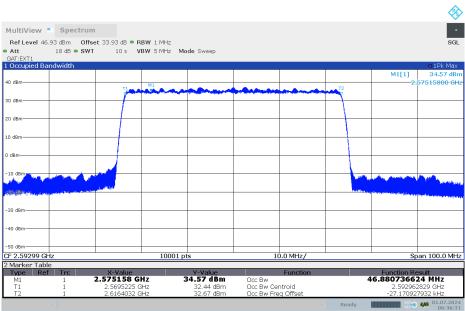
07:42:16 01.07.2024

Test Model 3.2, Modulation 16QAM, Channel Frequency 2592.99MHz, Tx Port 2



Occupied Bandwidth NR49.5MHz BW

Test Model 3.1, Modulation 64QAM, Channel Frequency 2665.26MHz, Tx Port 2



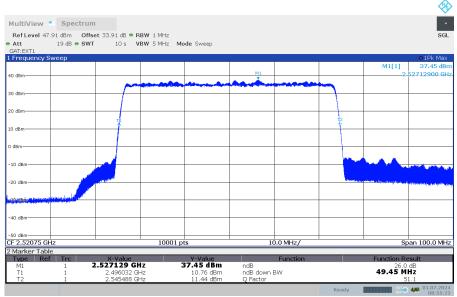
Occupied Bandwidth NR49.5MHz BW

06:36:31 01.07.2024

Test Model 3.1a, Modulation 256QAM, Channel Frequency 2592.99MHz, Tx Port 2

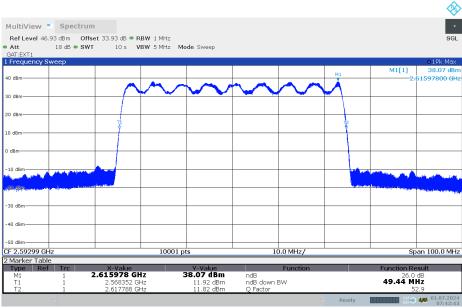
Occupied Bandwidth -26dB plots

Occupied Bandwidth NR 49.5MHz BW



08:55:23 01.07.2024

Test Model 1.1, Modulation QPSK, Channel Frequency 2520.75MHz, Tx Port 2

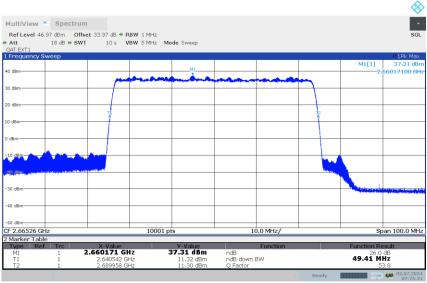


Occupied Bandwidth NR 49.5MHz BW

07:42:43 01.07.2024

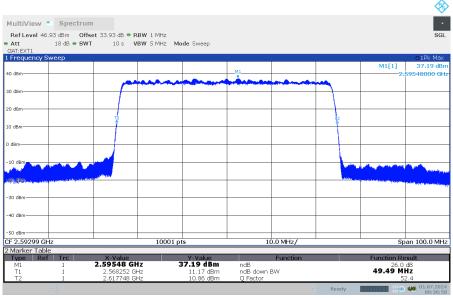
Test Model 3.2, Modulation 16QAM, Channel Frequency 2592.99MHz, Tx Port 2

Occupied Bandwidth NR 49.5MHz BW



07:25:31 02.07.2024

Test Model 3.1, Modulation 64QAM, Channel Frequency 2665.26MHz, Tx Port 2



Occupied Bandwidth NR 49.5MHz BW

06:36:59 01.07.2024

Test Model 3.1a, Modulation 256QAM, Channel Frequency 2592.99MHz, Tx Port 2

5.2.4 Test No. 4: Spurious Emissions at the Antenna Terminals

Config A TX port 2:

MultiView Spectrum					
Ref Level 9.00 dBm	 RBW (CHAN) 500 kHz 				SGL
	VBW 2 MHz Mode	e Sween			
GAT:EXT1 TDF "SSU" DC	- 1011 - 1104	6 61100p			
I Frequency Sweep					●1Rm Clrw
-18 dBminit Check T 9.000 dBm	PASS			M1[1]	-26.85 dBr
Line Spur	PASS				
pur				Z	49598960 GH
20 dBm					
20 dbii					
aa 10					
-22 dBm					
-24 dBm					
-26 dBm					M
					. want
-28 dBm				LATALAN LAMAAAA	ANNO.
Mannah	manuman	mmullin	monoround		
30 dBm					
-32 dBm					
-34 dBm					
51.00					
-36 dBm					
2.495 GHz	625 pts	1	00.0 kHz/		2.496 GH
	020 pt3		001010127	(V) -	
				Ready	14:22:3

14:22:31 10.07.2024

Figure 4 Spurious Emissions (Lower Band Edge) – QPSK (2520.75MHz) (49.5MHz Channel BW)

						~
MultiView Spectrum						•
Ref Level 8.00 dBm • RI						SGL
Att 25 dB • SWT 5 s • VI GAT:EXT1 TDF "SSU" DC	3W 2 MHz Mo	de Sweep				
l Frequency Sweep				-		o 1Rm Clrw
pur Limit Check [†] 8.000 dBm -20 dB lrine Spur	PAS	s s			M1[1]	-27.46 dBr 69000080 GH
		Ŭ			2.	69000080 GF
-22 dBm-						
22 000						
-24 dBm						
-26 dBm						
-28\dBm						
-28(JBM	mmmm	mmmm	AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA			
-30 dBm						www.r.c
-32 dBm						
-34 dBm						
-36 dBm						
-38 dBm						
2.69 GHz	625 pts		100.0 kHz/			2.691 GH
2.09 GH2	025 pts		100.0 KHZ/	Ready	EXT	

06:54:41 02.07.2024

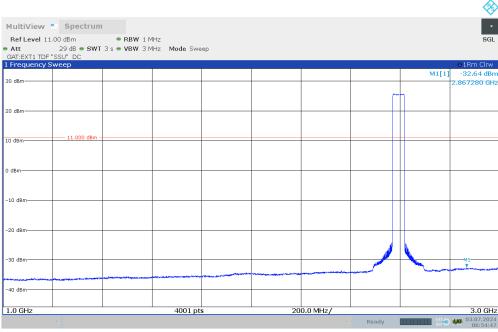
Figure 5 Spurious Emissions (Upper Band Edge) – QPSK (2685 MHz) (49.5MHz Channel BW)

Config A TX port 2:

								
MultiView - Spe	ectrum							
Ref Level 9.00 dBm	• RBW 1 MH	Ηz						SGL
Att 26 dB GAT:EXT1 TDF "SSU" D	SWT 3 s ● VBW 3 MH	Iz Mode Swee	p					
1 Frequency Sweep								●1Rm Clrw
Spur Limit Check 🕈 9.1	DOD dBm	PA					M1[1]	
Line Spur		PA	ss					550.929 MHz
-30 dBm								
-32 dBm								
-34 dBm								
-34 ubiii								
-36 dBm				M1				
			Mart Rock Law Bring Party	- and a state of the second states	and an international statements	woody a ball and the second	in an	water and the state of the stat
-38 dBm	and the state of t	agentur non cale name	47 ¹⁷					
-40, dBD	page of the second s							
-42 dBm-								
-42 UBIN								
-44 dBm								
-46 dBm								
-48 dBm-								
-50 dBm								
9.0 kHz		2101 pts	6	10	0.0 MHz/		IVI O	1.0 GHz
v						Ready	REF	03.07.2024 06:36:00

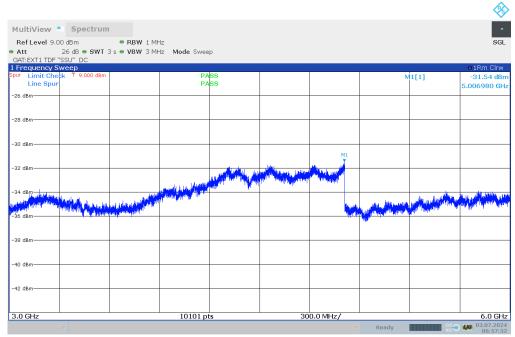
^{06:36:01 03.07.2024}

Figure 6 Spurious Emissions (9kHz – 1GHz) - QPSK (2592.99 MHz) (49.5MHz Channel BW)

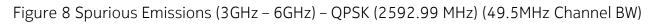


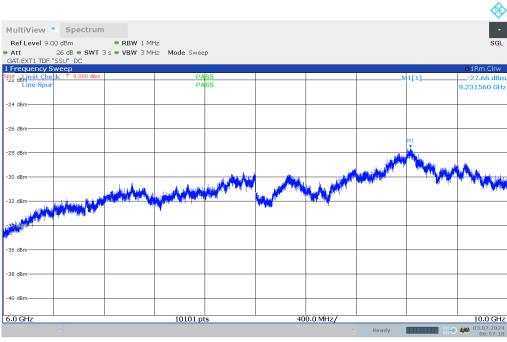
06:54:48 03.07.2024

Figure 7 Spurious Emissions (1GHz – 3GHz) – QPSK (2592.99 MHz) (49.5MHz Channel BW)



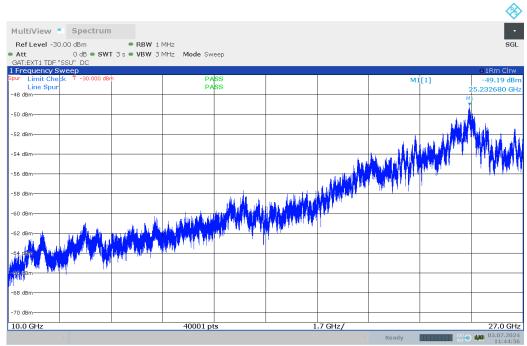
^{06:57:32 03.07.2024}





06:57:19 03.07.2024

Figure 9 Spurious Emissions (6GHz – 10GHz) – QPSK (2592.99 MHz) (49.5MHz Channel BW)



11:44:57 03.07.2024

Figure 10 Spurious Emissions (10GHz – 27GHz) – QPSK (2592.99 MHz) (49.5MHz Channel BW)

5.2.5 Test No. 5 Field Strength of Spurious Radiation

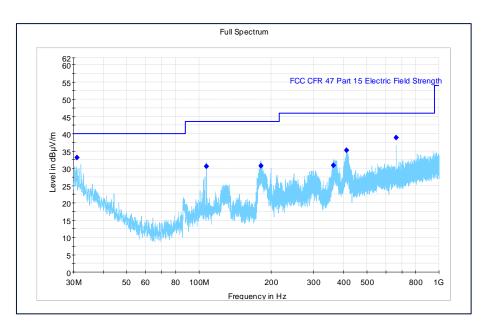


Figure 11 Field Strength of Spurious Radiation (30 MHz – 1 GHz) – QPSK (2520.75 MHz) (49.5 MHz Channel BW)

Frequency (MHz)	QuasiPeak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Polarisation	Angle (°)
31.056333	33.09	40.00	6.91	100.0	V	145.0
107.341333	30.57	43.50	12.93	102.0	V	222.0
180.874667	30.72	43.50	12.78	197.0	н	224.0
363.172333	30.79	46.00	15.21	109.0	V	90.0
411.437000	35.18	46.00	10.82	214.0	н	52.0
663.541667	38.90	46.00	7.10	204.0	V	267.0

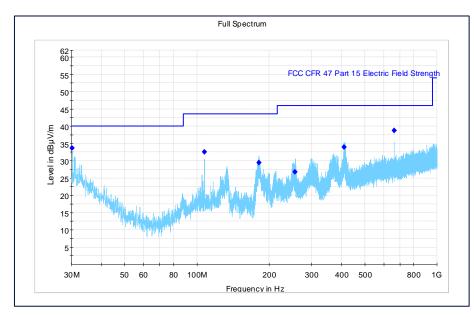


Figure 12 Field Strength of Spurious Radiation (30 MHz – 1 GHz) – QPSK (2592.99 MHz) (49.5 MHz Channel BW)

Frequency (MHz)	QuasiPeak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Polarisation	Angle (°)
30.210000	33.69	40.00	6.31	117.0	V	22.0
107.371333	32.51	43.50	10.99	109.0	V	294.0
180.662000	29.48	43.50	14.02	191.0	Н	222.0
255.664333	26.80	46.00	19.20	119.0	Н	92.0
410.845000	34.01	46.00	12.00	209.0	Н	53.0
663.541667	38.71	46.00	7.29	197.0	V	270.0

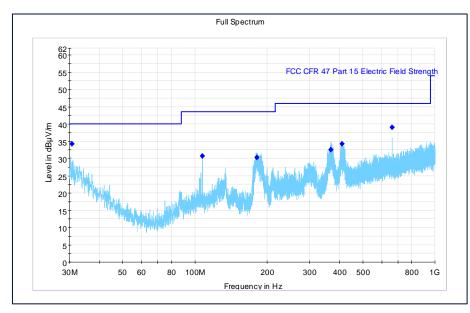


Figure 13 Field Strength of Spurious Radiation (30 MHz – 1 GHz) – QPSK (2665.26 MHz) (49.5 MHz Channel BW)

Frequency (MHz)	QuasiPeak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Polarisation	Angle (°)
30.780000	34.22	40.00	5.78	102.0	V	93.0
107.403667	30.69	43.50	12.81	100.0	V	92.0
180.797333	30.34	43.50	13.16	200.0	н	224.0
367.646000	32.54	46.00	13.46	100.0	н	257.0
410.348000	34.31	46.00	11.69	208.0	Н	56.0
663.541667	39.07	46.00	6.93	201.0	V	267.0

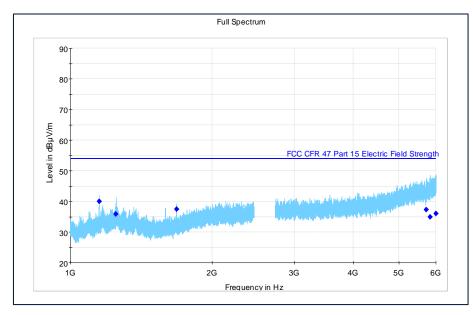


Figure 14 Field Strength of Spurious Radiation (1 GHz – 6 GHz) – QPSK (2520.75 MHz) (49.5 MHz Channel BW)

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Polarisation	Angle (°)
1150.167500	39.96	54.00	14.04	117.0	V	334.0
1249.877033	35.86	54.00	18.14	102.0	Н	301.0
1680.953600	37.39	54.00	16.61	256.0	Н	6.0
5722.819333	37.25	54.00	16.75	337.0	V	182.0
5833.276833	34.87	54.00	19.13	183.0	Н	153.0
6000.000000	36.07	54.00	17.93	100.0	V	90.0

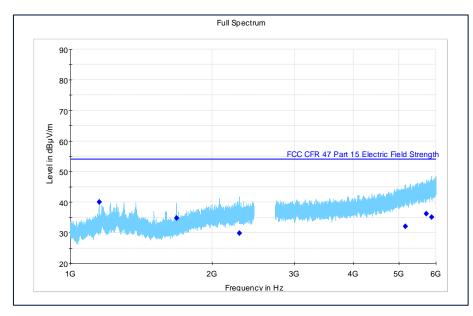


Figure 15 Field Strength of Spurious Radiation (1 GHz – 6 GHz) – QPSK (2592.99 MHz) (49.5 MHz Channel BW)

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Polarisation	Angle (°)
1150.151600	40.11	54.00	13.89	121.0	V	335.0
1680.983300	34.76	54.00	19.24	142.0	Н	300.0
2286.088400	29.93	54.00	24.07	121.0	V	179.0
5158.314500	32.04	54.00	21.96	325.0	V	116.0
5721.544000	36.19	54.00	17.81	110.0	V	180.0
5869.138167	35.16	54.00	18.84	229.0	Н	210.0

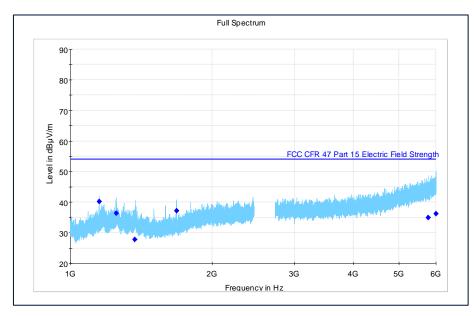


Figure 16 Field Strength of Spurious Radiation (1 GHz – 6 GHz) – QPSK (2665.26 MHz) (49.5 MHz Channel BW)

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Polarisation	Angle (°)
1150.148233	40.19	54.00	13.81	117.0	V	334.0
1250.104933	36.40	54.00	17.60	104.0	Н	301.0
1370.318900	27.75	54.00	26.25	197.0	Н	30.0
1680.929667	37.17	54.00	16.83	258.0	Н	5.0
5776.498500	34.98	54.00	19.02	108.0	V	182.0
5996.915209	36.24	54.00	17.76	194.0	Н	213.0

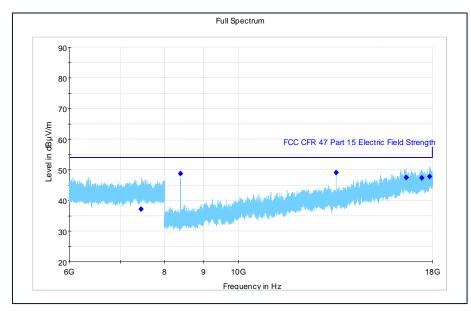


Figure 17 Field Strength of Spurious Radiation (6 GHz – 18 GHz) – QPSK (2520.75 MHz) (49.5 MHz Channel BW)

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Polarisation	Angle (°)
7454.793166	37.08	54.00	16.92	151.0	V	300.0
8399.990880	48.73	54.00	5.27	141.0	Н	135.0
13452.498560	49.01	54.00	4.99	264.0	V	38.0
16611.928292	47.48	54.00	6.52	107.0	V	36.0
17424.759880	47.23	54.00	6.77	242.0	V	147.0
17835.090308	47.80	54.00	6.20	107.0	V	195.0

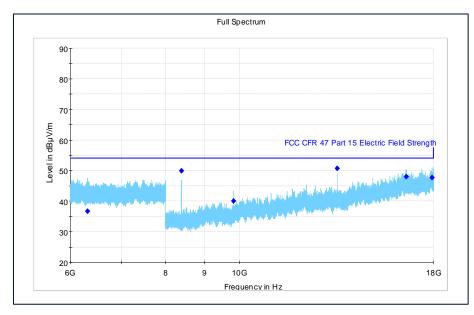


Figure 18 Field Strength of Spurious Radiation (6 GHz – 18 GHz) – QPSK (2592.99 MHz) (49.5 MHz Channel BW)

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Polarisation	Angle (°)
6317.612000	36.67	54.00	17.33	200.0	V	32.0
8399.998800	49.98	54.00	4.02	144.0	Н	124.0
9830.406960	40.00	54.00	14.00	198.0	Н	204.0
13452.505412	50.78	54.00	3.22	262.0	V	38.0
16577.333280	47.93	54.00	6.07	200.0	Н	1.0
17932.476732	47.63	54.00	6.37	175.0	V	114.0

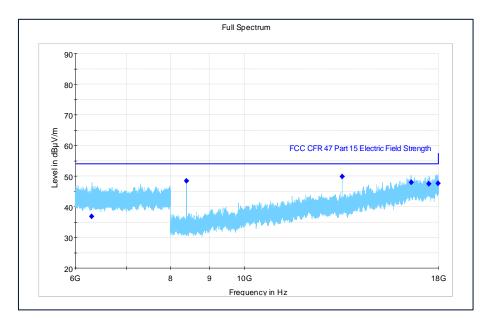


Figure 19 Field Strength of Spurious Radiation (6 GHz – 18 GHz) – QPSK (2665.26 MHz) (49.5 MHz Channel BW)

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Polarisation	Angle (°)
6302.332500	36.78	54.00	17.22	103.0	V	184.0
8399.995320	48.42	54.00	5.58	191.0	Н	180.0
13452.491000	49.87	54.00	4.13	187.0	V	25.0
16573.168160	47.95	54.00	6.05	131.0	V	86.0
17485.157360	47.48	54.00	6.52	117.0	V	335.0
17969.457588	47.62	54.00	6.38	138.0	V	40.0

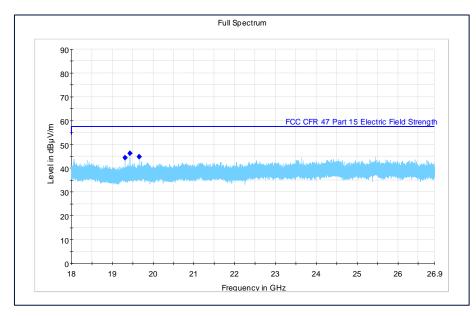


Figure 20 Field Strength of Spurious Radiation (18 GHz – 26.9 GHz) – QPSK (2520.75 MHz) (49.5 MHz Channel BW)

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Polarisation	Angle (°)
19312.310800	44.41	57.50	13.09	100.0	Н	147.0
19437.299748	46.27	57.50	11.23	100.0	Н	148.0
19660.630852	44.88	57.50	12.62	192.0	V	152.0

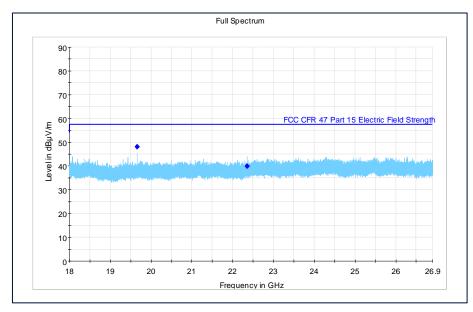


Figure 21 Field Strength of Spurious Radiation (18 GHz – 26.9 GHz) – QPSK (2592.99 MHz) (49.5 MHz Channel BW)

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Polarisation	Angle (°)
19660.629652	48.12	57.50	9.38	194.0	V	165.0
22353.250120	39.87	57.50	17.63	343.0	Н	272.0

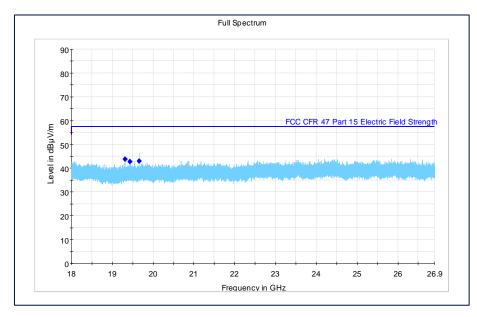


Figure 22 Field Strength of Spurious Radiation (18 GHz – 26.9 GHz) – QPSK (2665.26 MHz) (49.5 MHz Channel BW)

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Polarisation	Angle (°)
19312.305640	43.83	57.50	13.67	100.0	Н	147.0
19437.300108	42.73	57.50	14.77	195.0	Н	303.0
19660.624132	43.02	57.50	14.48	264.0	V	32.0

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Appendix A: AWHHF EIRP calculations

EIRP Calculations for Four Port MIMO Operations for Band 41 Single 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. This EIRP calculation is based upon Nokia antenna assembly model "AAHM". The maximum Band 41 gain (12.0dBi) for this antenna was used for the EIRP calculation. This antenna assembly has a pair of $\pm 45^{\circ}$ cross-polarized radiators used for Band 41. Four AWHHF 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 power 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. The cable loss 0 dB was used in this calculation since AAHM can be installed directly into the AWHHF. Calculations of worst-case EIRP for four port MIMO are as follows:

Parameter	NR 49.5 MHz	
	Ch BW	
Worst Case Power Output per Antenna Port	42.08 dBm	
Number of Ant Ports per Polarization	2	
Total Power per Polarization 10Log 2 = + 3dB	45.08 dBm	
Cable Loss (site dependent) = 0.0dB	45.08 dBm	
Dir Gain = Max Ant Gain (G _{Ant}) See Note 1	12.0 dBi	
EIRP per Polarization	57.08 dBm	
Number of Polarizations	2	
EIRP Total =		
Y1 <u>+</u> 45°and Y2 <u>+</u> 45°	57.08 dBm	
See Note 2		
Passing FCC EIRP Limit See Note 3	79.60 dBm	

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).

Note 3: The EIRP limit is defined by FCC part 27.50(h)(ii) as 33dBW+ 10Log(X/Y) dBW + 10 log(360/beamwidth) dBW where X is the channel width in MHz and Y is 5.5 or 6MHz. The Nokia AAHM antenna has a horizontal beamwidth of 65 degrees for the 2490 to 2690MHz frequency range. Y was selected to be 6MHz.

EIRP Calculation Summary

The worst case AWHHF Band 41 four port MIMO EIRP levels using antenna assembly model "AAHM" are less than the FCC EIRP Regulatory Limits.

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Appendix B: AWHHF Emission Designators

FCC Emission Designators for Band 41/n41 (2496MHz to 2690MHz) Single Carrier					
Ch	5G-NR				
BW	FCC				
49.5MHz	49M56G7W				
Note: FCC e	Note: FCC emission designators are based on 26dB emission bandwidth.				