

TEST REPORT

	CTK Co., Ltd. (Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea Tel: +82-31-339-9970 Fax: +82-31-624-9501	Report No.: CTK-2025-00229 Page (1) / (60) pages	
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1. Applicant

- Name : EUCAST Co., Ltd.
- Address : (13595) 4th FL Sungok Bldg, 262,Hwangsaeul-ro Bundang-Gu, Seongnam-si,Gyeonggi-do, Korea
- Date of Receipt : 2025-01-07

2. Manufacturer

- Name : EUCAST Co., Ltd.
- Address : (13595) 4th FL Sungok Bldg, 262,Hwangsaeul-ro Bundang-Gu, Seongnam-si,Gyeonggi-do, Korea

3. Use of Report : For FCC Certification

4. Test Sample / Model: 5G small cell base station for CBRS / ENS2278-3823

5. Date of Test : 2025-01-07 to 2025-02-07

6. Test Standard(method) used : FCC 47 CFR Part 96, ANSI C63.26-2015

7. Testing Environment: refer to 9 page

8. Test Results : Compliance

9. Location of Test : ☒ Permanent Testing Lab ☐ On Site Testing

(Address : 5, Dongbu-ro 221 beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea)

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
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Approval	Tested by  Bong-jun Jang: (Signature)	Technical Manager  Young-taek Lee: (Signature)
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Remark. This report is not related to KOLAS accreditation and relevant regulation.

2025-02-11

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MEASUREMENT REPORT

FCC Rule Part 96

Mode	Total Bandwidth (MHz)	Max. PSD (dBm/1MHz)	Max. EIRP (dBm/10MHz)	Max. EIRP /Entire Band Width (dBm)	Max. EIRP /Entire Band Width (W)	Emission Designator	Modulation
n48_1C_20M	20	19.17	29.42	32.11	1.63	18M4G7D	QPSK
		19.69	29.50	32.07	1.61	18M4W7D	QAM
n48_1C_100M	100	18.74	27.55	37.64	5.81	97M3G7D	QPSK
		19.08	28.48	37.96	6.25	97M5W7D	QAM

EUT Overview

**CTK Co., Ltd.**

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1.0 REVISION RECORD

Issue Number	Issued Date	Revision History
CTK-2025-00229	02/11/2025	Initial Issue

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2.0 INTRODUCTION

2.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada.

2.2 Test Location

These measurement tests were conducted at the CTK Co., Ltd. facility located at (Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea

2.3 Laboratory Accreditations and Listings

Country	Agency	Registration Number
USA	FCC	805871
CANADA	ISED	CN : 8737A CAB ID : KR0025
KOREA	NRRA	KR0025

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3.0 PRODUCT INFORMATION

3.1 Equipment Description

The Equipment Under Test (EUT) is the **EUCAST Co., Ltd. FCC ID: 2AXTR-ENS2278-3823**. Per FCC Part 96, this device is evaluated under Citizens Band Category A Devices (CBD).

3.2 Device Capabilities

This device supports the following conditional features and filter information:

FCC ID:	2AXTR-ENS2278-3823		
FCC Classification	Citizens Band Category A Devices (CBD)		
EUT Type:	5G small cell base station for CBRS		
Model Name:	ENS2278-3823		
Test Device Serial No:	-		
Device Capabilities:	5G NR		
Operating Band/Frequency Range:	Band	Tx (Downlink)	Rx (Uplink)
	n48:	3550 MHz to 3700 MHz	3550 MHz to 3700 MHz
Supported Modulation:	QPSK, 16QAM, 64QAM, 256QAM		
Supported Number of Carriers and Channel Bandwidth:	20, 100MHz bandwidth for 5G NR Band n48		
Supported Configurations:	Single carrier		
Maximum Output Power	20MHz: 16 dBm/ANT 100MHz: 22 dBm/ANT		
RF Chain:	2T2R		
Antenna Gain:	PCB Internal antenna ANT A: 9.3dBi, ANT B: 9.6dBi, Correlated Directional gain 12.46 dBi (Antenna Gains provided by the client.)		
Input Voltage:	DC : +12V, +52V		

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3.3 Test Configuration

The setup is as follows:

- The EUT "ENS2278-3823" is powered by a DC 12V power supply.
- The EUT is connected to a test laptop via an ethernet cable acting as backhaul.
- An RF cable connects the signal analyzer and the EUT Ports for respective measurement.
- For POE DC 52V, Spot check verification was adopted to the following test case to check whether it is changed by power supply difference.

- Case #1: n48_1C_20M

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Reference
2.1055 96.41(e)	Frequency Stability	Fundamental emissions stay within authorized frequency block	Conducted	12V, 52V tested
2.1051 96.41(e)	Radiated unwanted emission	< -40dBm/MHz	Radiated	12V, 52V tested

The EUT was tested per the guidance of ANSI C63.26-2015 and KDB 971168 D01 v03r01. See Section 8.0 of this test report for a description of the radiated and antenna port conducted emissions tests.

The following information is about configurations of carrier frequency and output power per port declared by the manufacturer.

* Abbreviations:

- 1C: 1 carrier

Configuration	No. of Carriers	Total Carrier Bandwidth (MHz)	Carrier Frequency Configuration (MHz)			Rated Conducted Power (dBm/path)
			Lowest	Middle	Highest	
n48_1C_20M	1	20	3560	3625	3690	16 dBm/path
n48_1C_100M	1	100	3600	3625	3650	22 dBm/path

3.4 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added, and no modifications were made during testing.



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4.0 DESCRIPTION OF TESTS

4.1 Measurement Procedure

The measurement procedures described in the document titled “American National Standard for Compliance Testing of Transmitter Used in Licensed Radio Service” (ANSI C63.26-2015) and the guidance provided in KDB 971168 D01 v03r01, and KDB 662911 D01 v02r01 and KDB 940660 D01 v03 were used in the measurement of the EUT.

Occupied Bandwidth:

KDB 971168 D01 v03r01 – Section 4.3

ANSI C63.26-2015 – Section 5.4.4

Modulation Characteristics:

ANSI C63.26 - Section 5.3

Conducted Power Measurement and EIRP and PSD

KDB 971168 D01 v03r01 – Section 5.3

KDB 971168 D01 v03r01 – Section 5.4

KDB 662911 D01 v02r01 – Section E)1) In-Band Power Measurements

ANSI C63.26-2015 – Section 5.2.5

ANSI C63.26-2015 – Section 5.2.4

Peak-to-Average Power Ratio:

KDB 971168 D01 v03r01 – Section 5.7

ANSI C63.26-2015 – Section 5.2.3.4

Channel Edge Emissions at Antenna Terminal

KDB 971168 D01 v03r01 – Section 6

KDB 662911 D01 v02r01 – Section E)3) Out-of-Band and Spurious Emission Measurements

a) Absolute Emission Limits

iii) Measure and add $10 \log(N_{ANT})$ dB

ANSI C63.26-2015 – Section 5.7

Spurious and Harmonic Emissions at Antenna Terminal

KDB 971168 D01 v03r01 – Section 6

KDB 662911 D01 v02r01 – Section E)3) Out-of-Band and Spurious Emission Measurements

a) Absolute Emission Limits

iii) Measure and add $10 \log(N_{ANT})$ dB

ANSI C63.26-2015 – Section 5.7

Radiated unwanted emission

KDB 971168 D01 v03r01 – Section 7

ANSI C63.26-2015 – Section 5.8

Frequency Stability / Temperature Variation

KDB 971168 D01 v03r01 – Section 9

ANSI C63.26-2015 – Section 5.6

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4.2 Measurement Software

Test item	Name	Version
Conducted Measurement	Node B automation	1.0
Radiated Measurement	EP5RE	6.0.1.0
	ES10	10.001

4.3 Enviromental Conditions

The temperature is controlled within the range of 15°C to 35°C. The relative humidity is controlled within the range of 10% to 75%. The atmospheric pressure is monitored within the range 86-106kPa (860-1060mbar).

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5.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4-2014. All measurement uncertainty values are shown with a coverage factor of $k = 2$ to indicate a 95% level of confidence. The measurement uncertainty shown below meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Description	Uncertainty
Conducted Power Measurement and EIRP	1.5 dB (C.L. : Approx. 95%, $k = 2$)
Occupied bandwidth	0.1 MHz (C.L. : Approx. 95%, $k = 2$)
Peak-to-average power ratio	1.0 dB (C.L. : Approx. 95%, $k = 2$)
Band Edge Emissions at Antenna Terminal	3.0 dB (C.L. : Approx. 95%, $k = 2$)
Spurious and Harmonic Emissions at Antenna Terminal	3.0 dB (C.L. : Approx. 95%, $k = 2$)
Radiated Emissions ($f \leq 1$ GHz)	3.88 dB (C.L. : Approx. 95%, $k = 2$)
Radiated Emissions ($f > 1$ GHz)	4.50 dB (C.L. : Approx. 95%, $k = 2$)
Frequency Stability	0.1 kHz (C.L. : Approx. 95%, $k = 2$)

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6.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST). Measurement antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

Manufacture	Model	Description	Cal Date	Cal interval	Cal Due	Serial Number
Rohde & Schwarz	FSV30	SIGNAL ANALYZER	2024-11-26	Annual	2025-11-26	100925
Rohde & Schwarz	FSV40	SPECTRUM ANALYZER	2025-01-10	Annual	2026-01-10	101574
Rohde & Schwarz	ESW44	EMI TEST RECEIVER	2024-04-29	Annual	2025-04-29	102039
TESEQ	CBL6111D	Bilog Antenna	2024-08-21	Annual	2025-08-21	60654
PASTERNAK	PE7AP006-06	Attenuator	2024-07-31	Annual	2025-07-31	L20210504000 023
SONOMA	310N	AMPLIFIER	2024-07-31	Annual	2025-07-31	411011
Agilent	8449B	Preamplifier	2024-04-11	Annual	2025-04-11	3008A00620
ETS-Lindgren	3115	DOUBLE RIDGED GUIDE ANTENNA	2024-04-16	Annual	2025-04-16	00078895
ESPEC	EBE-2E20W6P3T-38	Temperature Chamber	2024-06-14	Annual	2025-06-14	3015007507
Agilent	6674A	SYSTEM DC POWER SUPPLY	2024-03-29	Annual	2025-03-29	US36372372
Keysight	N9030B	Signal Analyzer	2024-04-08	Annual	2025-04-08	MY57142018
BIRD	300-WA-FFN-30	Attenuator	2024-03-20	Annual	2025-03-20	0205453
BIRD	300-WA-FFN-30	Attenuator	2024-03-20	Annual	2025-03-20	0205452
K&L MICROWAVE	11SH10-6200/T18000-O/O	High Pass Filter	2024-07-10	Annual	2025-07-10	00002
WAINWRIGHT	WHW13000-18000-40000-40CC	High Pass Filter	2024-04-09	Annual	2025-04-09	0002

Table 6-1. Test Equipment

Notes:

1. For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.
2. All testing was performed before the calibration due date.

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7.0 SAMPLE CALCULATIONS

Emission Designator

QPSK Modulation

Emission Designator = 18M4G7D

Occupied Bandwidth = 18.44 MHz

G = Phase Modulation

7 = Quantized/Digital Info

D = Data transmission, telemetry, telecommand

QAM Modulation

Emission Designator = 18M4W7D

Occupied Bandwidth = 18.42 MHz

W = Amplitude/Angle Modulated

7 = Quantized/Digital Info

D = Data transmission, telemetry, telecommand

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8.0 TEST RESULTS

8.1 Summary

Company Name: EUCAST Co., Ltd.
FCC ID: 2AXTR-ENS2278-3823
Type of Radio Equipment: Citizens Band Category A Devices (CBD)
Mode(s): 5G NR

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
2.1049	Occupied Bandwidth	N/A	Conducted	PASS	Section 8.2
2.1046 96.41(a)	Modulation Characteristics	Digital modulation		PASS	Section 8.3
2.1046 96.41(b)	Power Spectral Density (PSD)	20 dBm/MHz (PSD)		PASS	Section 8.4
2.1046 96.41(b)	Equivalent Isotropic Radiated Power (EIRP)	30 dBm/10MHz (EIRP)		PASS	Section 8.5
96.41(g)	Peak-Average Ratio	≤ 13 dB		PASS	Section 8.6
2.1051 96.41(e)	Out of Band Emissions	Within 0 MHz to 10 MHz above and below the assigned channel ≤ -13 dBm/MHz Greater than 10 MHz above and below the assigned channel ≤ -25 dBm/MHz Any emission below 3530 MHz and above 3720 MHz ≤ -40 dBm/MHz		PASS	Section 8.7 Section 8.8
2.1055 96.41(e)	Frequency Stability	Fundamental emissions stay within authorized frequency block	Radiated	PASS	Section 8.9
2.1051 96.41(e)	Radiated unwanted emission	< -40dBm/MHz		PASS	Section 8.10

Table 8-1. Summary of Test Results

Notes:

- 1) All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
- 2) The analyzer plots were all taken with a correction table loaded into the analyzer.
- 3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables and attenuators.

8.2 Occupied Bandwidth

Test Overview

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be. All measured modes of operation were investigated, and the worst case configuration results are reported in this section.

Test Procedure Used

ANSI C63.26 - Section 5.4.4
 KDB 971168 D01 v03r01 - Section 4.3

Test Setting

The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The spectrum analyzer settings were as follows:

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% of the expected OBW
3. VBW $\geq 3 \times$ RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

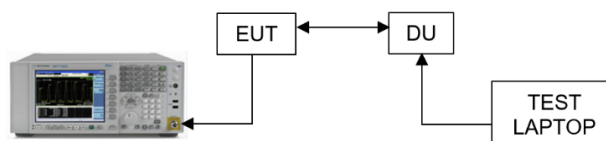


Figure 8-1. Test Instrument & Measurement Setup

Limit

N/A



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Channel	Port	OBW (MHz)			
		QPSK	16QAM	64QAM	256QAM
Low	1	18.44	18.38	18.42	18.39
	2	18.41	18.39	18.39	18.38
Mid	1	18.44	18.40	18.37	18.40
	2	18.44	18.37	18.41	18.41
High	1	18.39	18.37	18.40	18.41
	2	18.44	18.38	18.37	18.41

Table 8-2. Occupied Bandwidth Summary Data (n48_1C_20M)

Channel	Port	OBW (MHz)			
		QPSK	16QAM	64QAM	256QAM
Low	1	97.14	97.21	97.15	97.23
	2	97.28	97.25	97.30	97.22
Mid	1	97.34	97.21	97.27	97.22
	2	97.23	97.10	97.28	97.30
High	1	97.26	97.10	97.30	97.33
	2	97.27	97.13	97.49	97.32

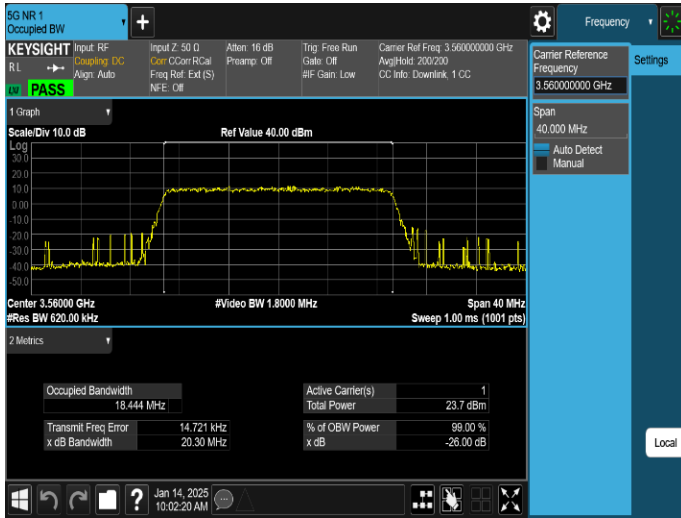
Table 8-3. Occupied Bandwidth Summary Data (n48_1C_100M)



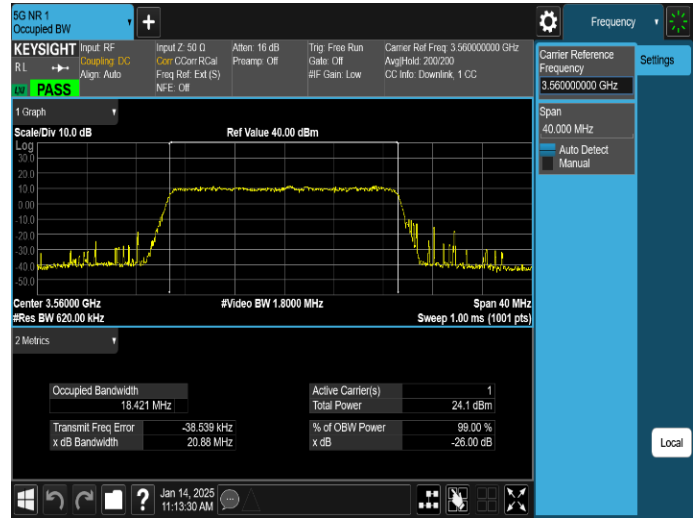
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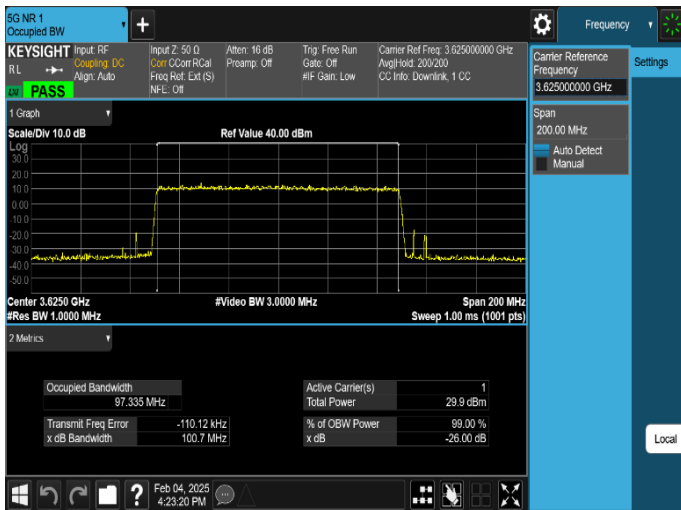
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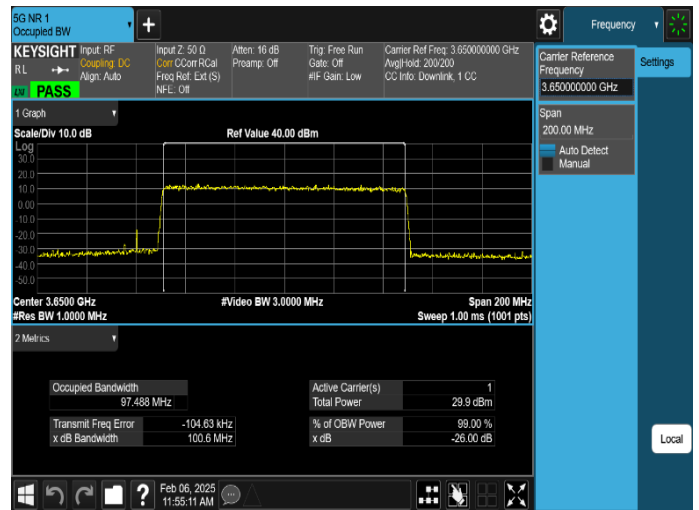
Plot 8-1. Occupied Bandwidth Plot
(n48_1C_20M_QPSK - Low Channel, Port 1)



Plot 8-2. Occupied Bandwidth Plot
(n48_1C_20M_64QAM - Low Channel, Port 1)



Plot 8-3. Occupied Bandwidth Plot
(n48_1C_100M_QPSK - Mid Channel, Port 1)



Plot 8-4. Occupied Bandwidth Plot
(n48_1C_100M_64QAM - High Channel, Port 2)

8.3 Modulation Characteristics

Test Overview

Verification of a curve or equivalent data that shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed.

Test Procedure Used

ANSI C63.26 - Section 5.3

Test Setting

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

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

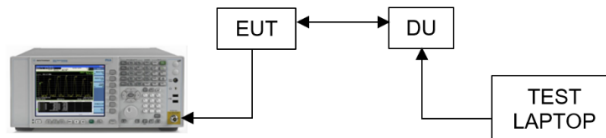


Figure 8-2. Test Instrument & Measurement Setup

Limit

96.41(a)

Systems operating in the Citizens Broadband Radio Service must use digital modulation techniques.

Test Notes

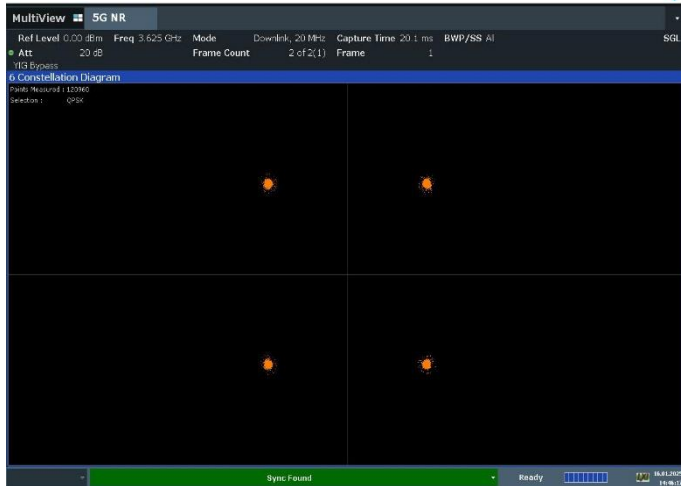
Systems operating in the Citizens Broadband Radio Service use digital modulation techniques of QPSK and QAM



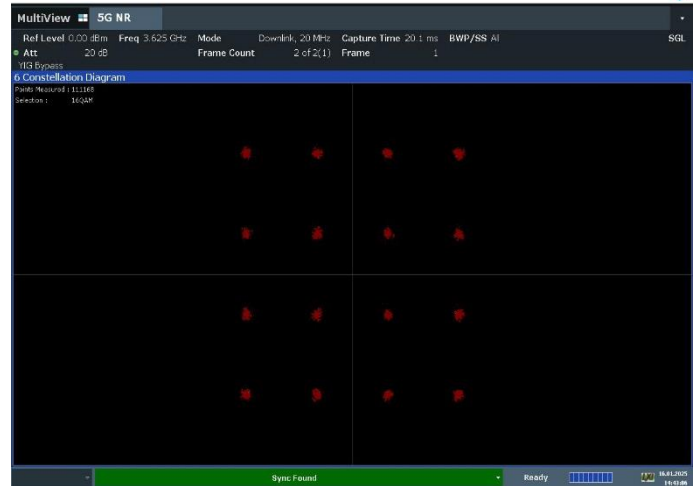
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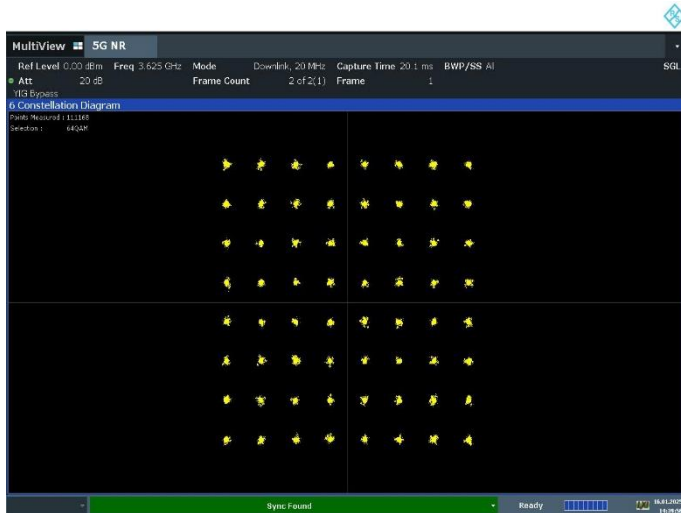
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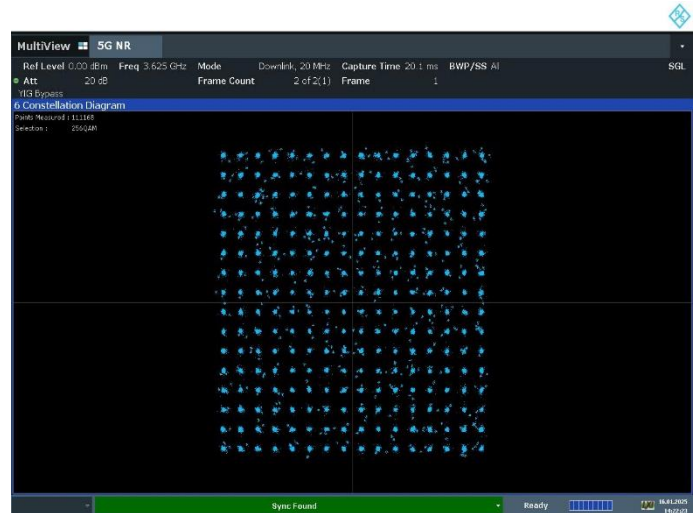
Plot 8-5. Modulation Characteristics Plot
(n48_1C_10M_QPSK Modulation)



Plot 8-6. Modulation Characteristics Plot
(n48_1C_10M_16QAM Modulation)



Plot 8-7. Modulation Characteristics Plot
(n48_1C_10M_64QAM Modulation)



Plot 8-8. Modulation Characteristics Plot
(n48_1C_10M_256QAM Modulation)

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8.4 Power Spectral Density

Test Overview

A transmitter port of EUT is connected to the input of a signal analyzer. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

Test Procedure Used

ANSI C63.26 - Section 5.2.4
ANSI C63.26 - Section 5.2.5
KDB 971168 D01 v03r01 - Section 5.3

ANSI C63.26 - Section 6.4.3.2.3
KDB 662911 D01 v02r01
- Section E)2) In-Band Power Spectral Density (PSD) Measurements
b) Measure and sum spectral maxima across the outputs.

Test Setting

The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The spectrum analyzer settings were as follows:

The PSD is measured following the same procedures described in 5.2.4.4 of ANSI C63.26 for measuring the total average power, but with the RBW set to the reference bandwidth specified by the applicable regulatory requirement, and by using the marker function to identify the maximum PSD instead of summing the power across the OBW. If the fundamental measurement condition cannot be realized, then one of the alternative procedures in 5.2.4.4.2 or 5.2.4.4.3 should be selected, based on whether the transmitter duty cycle is constant (variations $\leq \pm 2\%$) or non-constant (variations $> \pm 2\%$), respectively.

1. Conducted power measurements are performed using the signal analyzer's "SA mode" measurement capability for signals with continuous operation.
2. Set span to $2 \times$ to $3 \times$ the OBW.
3. Set RBW = 1 MHz (the reference bandwidth)
4. Set VBW $\geq 3 \times$ RBW.
5. Set number of measurement points in sweep $\geq 2 \times$ span / RBW.
6. Sweep time:
 - a) Set $\geq$ auto-couple, and enable trace averaging, or
 - b) Set $\geq [10 \times (\text{number of points in sweep}) \times (\text{transmission symbol period})]$ and enable a single sweep (automation-compatible) measurement. The sweep time should never be faster than the auto-coupled sweep time.
7. Detector = power averaging (rms).
8. The trace was allowed to stabilize
9. Use the peak marker function to determine the maximum amplitude level. ($=P_{\text{Meas}}$)
10. The relevant equation for determining the maximum EIRP from the measured RF output power is given in Equation as follows:
$$\text{EIRP} = P_{\text{Meas}} + G_T$$

where
GT: gain of the transmitting antenna, in dBi (EIRP).

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

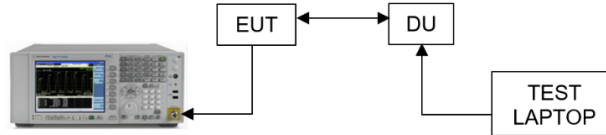


Figure 8-3. Test Instrument & Measurement Setup

Limit

§ 96.41 (b)

Category A CBSD : 20 dBm/MHz

Test Notes

- Consider the following factors for MIMO Power Spectral Density:
 The power spectral density is measured as dBm / MHz, with the resolution bandwidth of 1 MHz PSDs are summed up in linear using the measure-and-sum technique defined in KDB 971168 D01 v03r01 - Section E) 2).
- Periodic trigger was used with gating ON. Gate sweep time, Gate delay and gate length were set accordingly to capture ON time of the transmission.
- PSD per port (dBm/MHz) is converted to a linear value (mW). A summation of linear powers for all ports gives us the total MIMO conducted Power (mW). We convert this back to logarithmic scale for further PSD calculations.
- Unequal antenna gains, with equal transmit powers. For antenna gains given by $G_1, G_2, \dots, G_N$ dBi transmit signals are correlated

$$\text{Directional gain} = 10 \log[(10^{G_1/20} + 10^{G_2/20} + \dots + 10^{G_N/20})^2 / N_{\text{ANT}}] \text{ dBi}$$
- Applied antenna gain as below:

Antenna 1 Gain	Antenna 2 Gain	Correlated Directional gain
9.3 dBi	9.6 dBi	12.46 dBi

- Sample Calculation:
 Let us assume the following numbers:
 a) Total MIMO Conducted PSD as 4.69 mW
 b) Antenna Gain = 12.46 dBi

Factors	Value	Unit
Summed MIMO Conducted PSD (linear sum)	4.69	mW
Summed MIMO Conducted PSD (dBm) = $10 * \log(4.69) =$	6.71	dBm/MHz
Antenna Gain	12.46	dB
e.i.r.p PSD	19.17	dBm/MHz
Limit	20.00	dBm/MHz
Margin = Limit - e.i.r.p PSD = $19.17 - 20.00 =$	-0.83	dB



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Channel	Port	QPSK	16QAM	64QAM	256QAM
Low	1	3.48	3.91	3.91	3.99
	2	3.91	4.26	4.34	4.43
Total MIMO Conducted PSD (mW/MHz)		4.69	5.13	5.17	5.28
Total MIMO Conducted PSD (dBm/MHz)		6.71	7.10	7.14	7.23
Ant. Gain (dBi)		12.46	12.46	12.46	12.46
e.i.r.p PSD (dBm/MHz)		19.17	19.56	19.60	19.69
e.i.r.p PSD Limit (dBm/MHz)		20.00	20.00	20.00	20.00
Margin (dB)		-0.83	-0.44	-0.40	-0.31
Channel	Port	QPSK	16QAM	64QAM	256QAM
Middle	1	3.83	3.97	3.95	4.06
	2	3.43	3.68	3.70	3.82
Total MIMO Conducted PSD (mW/MHz)		4.62	4.83	4.82	4.96
Total MIMO Conducted PSD (dBm/MHz)		6.64	6.84	6.83	6.95
Ant. Gain (dBi)		12.46	12.46	12.46	12.46
e.i.r.p PSD (dBm/MHz)		19.10	19.30	19.29	19.41
e.i.r.p PSD Limit (dBm/MHz)		20.00	20.00	20.00	20.00
Margin (dB)		-0.90	-0.70	-0.71	-0.59
Channel	Port	QPSK	16QAM	64QAM	256QAM
High	1	4.09	4.31	4.30	4.34
	2	3.22	3.34	3.30	3.47
Total MIMO Conducted PSD (mW/MHz)		4.67	4.86	4.83	4.94
Total MIMO Conducted PSD (dBm/MHz)		6.69	6.86	6.84	6.94
Ant. Gain (dBi)		12.46	12.46	12.46	12.46
e.i.r.p PSD (dBm/MHz)		19.15	19.32	19.30	19.40
e.i.r.p PSD Limit (dBm/MHz)		20.00	20.00	20.00	20.00
Margin (dB)		-0.85	-0.68	-0.70	-0.60

Table 8-4. Power Spectral Density Table (n48_1C_20M)



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Channel	Port	QPSK	16QAM	64QAM	256QAM
Low	1	3.31	3.33	3.71	3.86
	2	3.23	3.14	3.50	3.55
Total MIMO Conducted PSD (mW/MHz)		4.24	4.21	4.59	4.70
Total MIMO Conducted PSD (dBm/MHz)		6.28	6.25	6.62	6.72
Ant. Gain (dBi)		12.46	12.46	12.46	12.46
e.i.r.p PSD (dBm/MHz)		18.74	18.71	19.08	19.18
e.i.r.p PSD Limit (dBm/MHz)		20.00	20.00	20.00	20.00
Margin (dB)		-1.26	-1.29	-0.92	-0.82
Channel	Port	QPSK	16QAM	64QAM	256QAM
Middle	1	1.81	2.08	2.69	2.54
	2	2.28	2.37	2.78	2.67
Total MIMO Conducted PSD (mW/MHz)		3.21	3.34	3.75	3.64
Total MIMO Conducted PSD (dBm/MHz)		5.06	5.24	5.74	5.62
Ant. Gain (dBi)		12.46	12.46	12.46	12.46
e.i.r.p PSD (dBm/MHz)		17.52	17.70	18.20	18.08
e.i.r.p PSD Limit (dBm/MHz)		20.00	20.00	20.00	20.00
Margin (dB)		-2.48	-2.30	-1.80	-1.92
Channel	Port	QPSK	16QAM	64QAM	256QAM
High	1	2.75	2.24	2.81	2.51
	2	2.56	2.18	2.67	2.53
Total MIMO Conducted PSD (mW/MHz)		3.68	3.33	3.76	3.57
Total MIMO Conducted PSD (dBm/MHz)		5.66	5.22	5.75	5.53
Ant. Gain (dBi)		12.46	12.46	12.46	12.46
e.i.r.p PSD (dBm/MHz)		18.12	17.68	18.21	17.99
e.i.r.p PSD Limit (dBm/MHz)		20.00	20.00	20.00	20.00
Margin (dB)		-1.88	-2.32	-1.79	-2.01

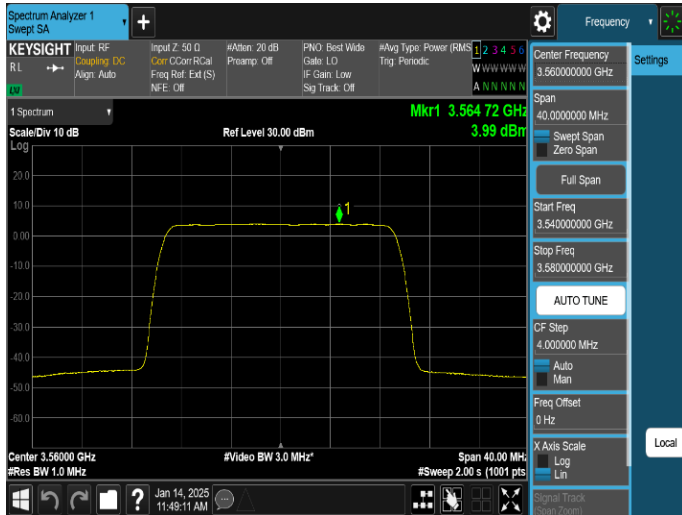
Table 8-5. Power Spectral Density Table (n48_1C_100M)



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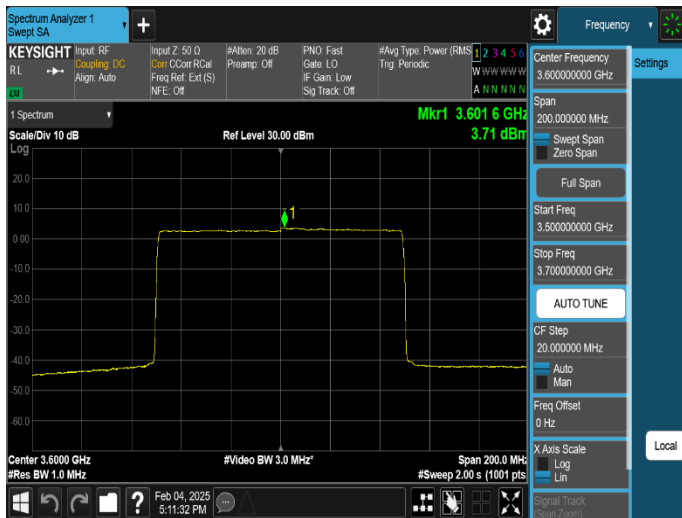
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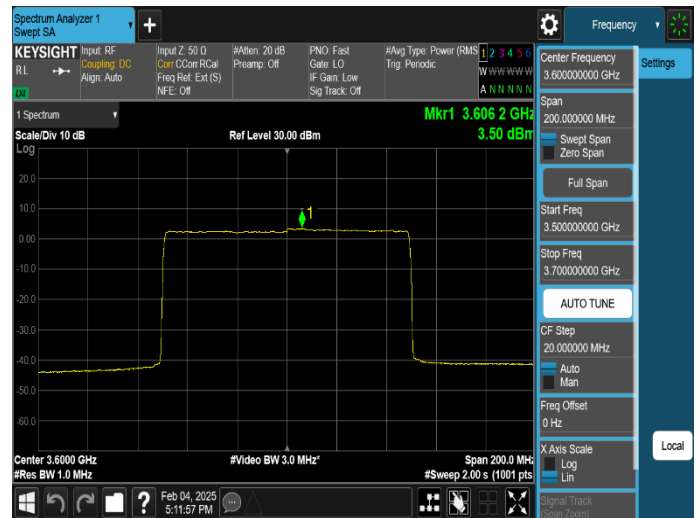
Plot 8-9. Power Spectral Density Plot
(n48_1C_20M_256QAM - Low Channel, Port 1)



Plot 8-10. Power Spectral Density Plot
(n48_1C_20M_256QAM - Low Channel, Port 2)



Plot 8-11. Power Spectral Density Plot
(n48_1C_100M_64QAM - Low Channel, Port 1)



Plot 8-12. Power Spectral Density Plot
(n48_1C_100M_64QAM - Low Channel, Port 2)

8.5 Equivalent Isotropic Radiated Power (EIRP)

Test Overview

A transmitter port of EUT is connected to the input of a signal analyzer. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

Test Description

KDB 971168 D01 v03r01 – Section 5.4

KDB 662911 D01 v02r01 – Section E)1) In-Band Power Measurements

ANSI C63.26-2015 – Section 5.2.4

ANSI C63.26 - Section 5.2.5

The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The spectrum analyzer settings were as follows:

1. Conducted power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation.
2. IBW = 10 MHz (the reference bandwidth)
3. RBW = 1 ~ 5% of the expected OBW
4. VBW $\geq 3 \times$ RBW
5. Span = 2 ~ 3 x OBW
6. No. of sweep points $\geq 2 \times$ span / RBW
7. Detector = RMS
8. Trace mode = Trace-Averaging (RMS) set to average over 100 sweeps
9. The trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

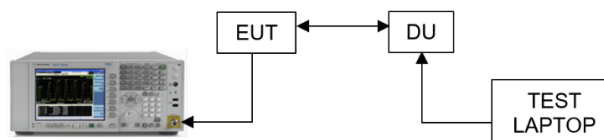


Figure 8-4. Test Instrument & Measurement Setup

Limit

§ 96.41 (b)

Category A CBSD: 30dBm/10 MHz

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Note

1. Periodic trigger was used with gating ON. Gate sweep time, Gate delay and gate length were set accordingly to capture ON time of the transmission.
2. MIMO Calculations are done considering output channel power for all ports and respective margins are calculated according to procedures in section 6.4 of ANSI C63.26 and section D of KDB 971168 D01 v03r01.
3. Consider the following factors for MIMO Power:
 - c) Conducted power for each port is measured in dBm.
 - d) Powers are summed up in linear using the measure-and-sum technique defined in KDB 971168 D01 v03r01- Section D.
 - e) Conducted power per port (dBm) is converted to a linear value (mW). A summation of linear powers for all ports gives us the total MIMO conducted power in milliWatts (mW).
4. Unequal antenna gains, with equal transmit powers. For antenna gains given by $G_1, G_2, \dots, G_N$ dBi transmit signals are correlated
Directional gain = $10 \log[(10^{G_1/20} + 10^{G_2/20} + \dots + 10^{G_N/20})^2 / N_{ANT}]$ dBi

5. Applied antenna gain as below:

Antenna 1 Gain	Antenna 2 Gain	Correlated Directional gain
9.3 dBi	9.6 dBi	12.46 dBi

6. Sample Calculation:

Let us assume the following numbers:

- a) Total MIMO Conducted Power as 49.61 mW
- b) Antenna Gain = 12.46 dBi

Factors		Value	Unit
Summed MIMO Conducted Power (linear sum)		49.61	mW
Summed MIMO Conducted Power (dBm)	= $10 * \log (49.61) =$	16.96	dBm/10MHz
Antenna Gain		12.46	dBi
e.i.r.p		29.42	dBm/10MHz
Limit		30.00	dBm/10 MHz
Margin = Limit - e.i.r.p	= $29.42 - 30.00 =$	-0.58	dB



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Channel	Port	QPSK	16QAM	64QAM	256QAM
Low	1	13.72	13.70	13.74	13.43
	2	14.16	14.03	14.17	13.87
Total MIMO Conducted power (mW/10MHz)		49.61	48.74	49.78	46.41
Total MIMO Conducted power (dBm/10MHz)		16.96	16.88	16.97	16.67
Ant. Gain (dBi)		12.46	12.46	12.46	12.46
e.i.r.p (dBm/10MHz)		29.42	29.34	29.43	29.13
e.i.r.p Limit (dBm/10MHz)		30.00	30.00	30.00	30.00
Margin (dB)		-0.58	-0.66	-0.57	-0.87
Channel	Port	QPSK	16QAM	64QAM	256QAM
Middle	1	14.06	14.17	13.75	13.94
	2	13.73	13.88	13.54	13.69
Total MIMO Conducted power (mW/10MHz)		49.07	50.56	46.31	48.16
Total MIMO Conducted power (dBm/10MHz)		16.91	17.04	16.66	16.83
Ant. Gain (dBi)		12.46	12.46	12.46	12.46
e.i.r.p (dBm/10MHz)		29.37	29.50	29.12	29.29
e.i.r.p Limit (dBm/10MHz)		30.00	30.00	30.00	30.00
Margin (dB)		-0.63	-0.50	-0.88	-0.71
Channel	Port	QPSK	16QAM	64QAM	256QAM
High	1	13.29	13.79	14.13	13.89
	2	12.38	12.75	13.12	13.00
Total MIMO Conducted power (mW/10MHz)		38.63	42.77	46.39	44.44
Total MIMO Conducted power (dBm/10MHz)		15.87	16.31	16.66	16.48
Ant. Gain (dBi)		12.46	12.46	12.46	12.46
e.i.r.p (dBm/10MHz)		28.33	28.77	29.12	28.94
e.i.r.p Limit (dBm/10MHz)		30.00	30.00	30.00	30.00
Margin (dB)		-1.67	-1.23	-0.88	-1.06

Table 8-6. Equivalent Isotropic Radiated Power Table (n48_1C_20M)



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Channel	Port	QPSK	16QAM	64QAM	256QAM
Low	1	12.11	12.91	12.63	13.15
	2	12.04	12.70	12.43	12.86
Total MIMO Conducted power (mW/10MHz)		32.25	38.16	35.82	39.97
Total MIMO Conducted power (dBm/10MHz)		15.09	15.82	15.54	16.02
Ant. Gain (dBi)		12.46	12.46	12.46	12.46
e.i.r.p (dBm/10MHz)		27.55	28.28	28.00	28.48
e.i.r.p Limit (dBm/10MHz)		30.00	30.00	30.00	30.00
Margin (dB)		-2.45	-1.72	-2.00	-1.52
Channel	Port	QPSK	16QAM	64QAM	256QAM
Middle	1	11.37	11.54	11.57	11.61
	2	11.75	11.74	11.56	11.70
Total MIMO Conducted power (mW/10MHz)		28.67	29.18	28.68	29.28
Total MIMO Conducted power (dBm/10MHz)		14.57	14.65	14.58	14.67
Ant. Gain (dBi)		12.46	12.46	12.46	12.46
e.i.r.p (dBm/10MHz)		27.03	27.11	27.04	27.13
e.i.r.p Limit (dBm/10MHz)		30.00	30.00	30.00	30.00
Margin (dB)		-2.97	-2.89	-2.96	-2.87
Channel	Port	QPSK	16QAM	64QAM	256QAM
High	1	11.37	11.54	11.57	11.61
	2	11.55	11.21	11.28	11.53
Total MIMO Conducted power (mW/10MHz)		28.00	27.47	27.78	28.71
Total MIMO Conducted power (dBm/10MHz)		14.47	14.39	14.44	14.58
Ant. Gain (dBi)		12.46	12.46	12.46	12.46
e.i.r.p (dBm/10MHz)		26.93	26.85	26.90	27.04
e.i.r.p Limit (dBm/10MHz)		30.00	30.00	30.00	30.00
Margin (dB)		-3.07	-3.15	-3.10	-2.96

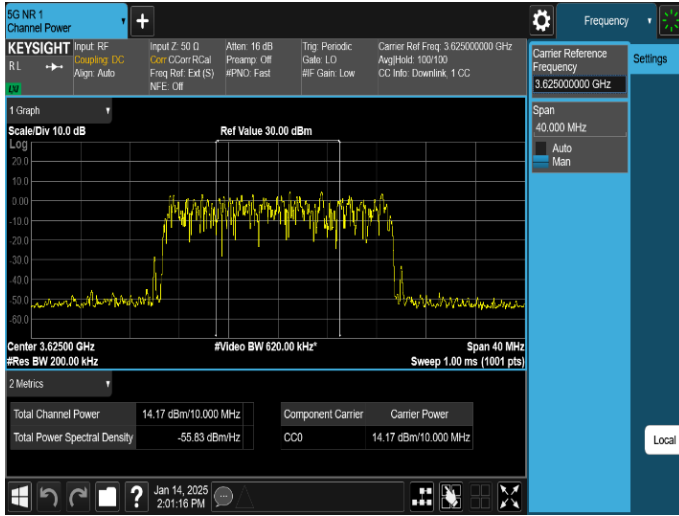
Table 8-7. Equivalent Isotropic Radiated Power Table (n48_1C_100M)



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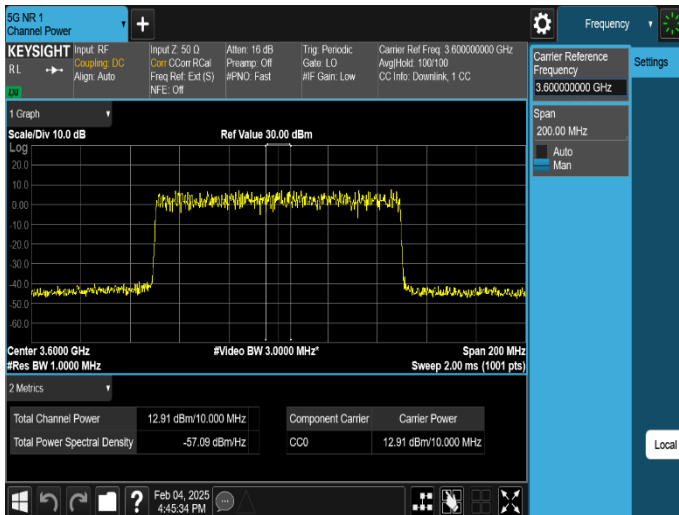
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Plot 8-13. Equivalent Isotropic Radiated Power Plot
(n48_1C_20M_16QAM – Middle Channel, Port 1)



Plot 8-14. Equivalent Isotropic Radiated Power Plot
(n48_1C_20M_16QAM – Middle Channel, Port 2)



Plot 8-15. Equivalent Isotropic Radiated Power Plot
(n48_1C_100M_16QAM – Low Channel, Port 1)



Plot 8-16. Equivalent Isotropic Radiated Power Plot
(n48_1C_100M_16QAM – Low Channel, Port 2)

8.6 Peak To Average Power Ratio (PAPR)

Test Overview

A peak to average ratio measurement is performed at the conducted port of the EUT. The spectrum analyzers Complementary Cumulative Distribution Function (CCDF) measurement profile is used to determine the largest deviation between the average and the peak power of the EUT in a given bandwidth. The CCDF curve shows how much time the peak waveform spends at or above a given average power level. The percent of time the signal spends at or above the level defines the probability for that particular power level.

Test Procedure Used

ANSI C63.26 - Section 5.2.3.4.
 KDB 971168 D01 v03r01 - Section 5.7

Test Setting

The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The spectrum analyzer settings were as follows:

1. The signal analyzer's CCDF function is enabled.
2. Frequency = carrier center frequency
3. Measurement BW $\geq$ OBW or specified reference bandwidth
4. The signal analyzer was set to collect one million samples to generate the CCDF curve
5. The measurement interval was set depending on the type of signal analyzed.
 For continuous signals (>98% duty cycle), the measurement interval was set to 1ms.

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

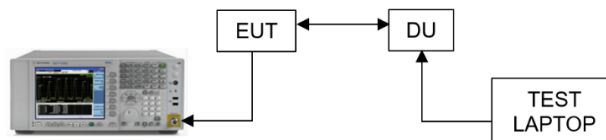


Figure 8-5. Test Instrument & Measurement Setup

Limit

§ 96.41 (g)
 Peak-to-average power ratio (PAPR) limit shall not exceed 13 dB for more than 0.1% of the time.



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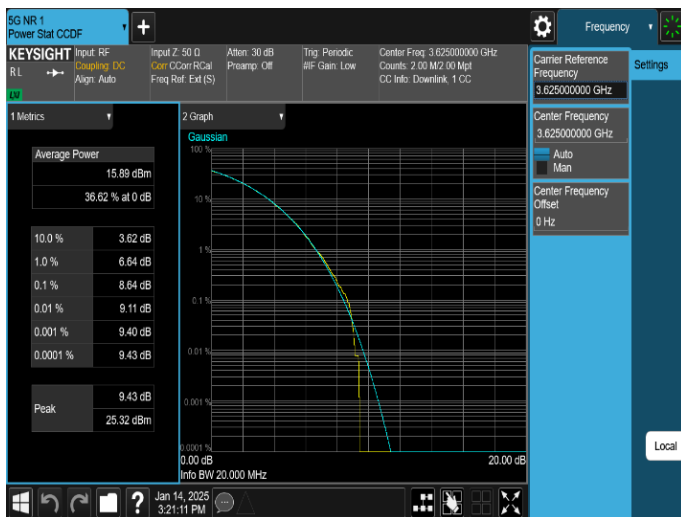
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Channel	Port	PAPR (dB)				Limit (dB)
		QPSK	16QAM	64QAM	256QAM	
Low	1	8.33	8.40	8.22	8.47	≤ 13
	2	8.35	8.47	8.21	8.53	
Middle	1	8.51	8.46	8.64	8.36	
	2	8.45	8.48	8.60	8.36	
High	1	8.50	8.57	8.61	8.21	
	2	8.50	8.62	8.63	8.26	

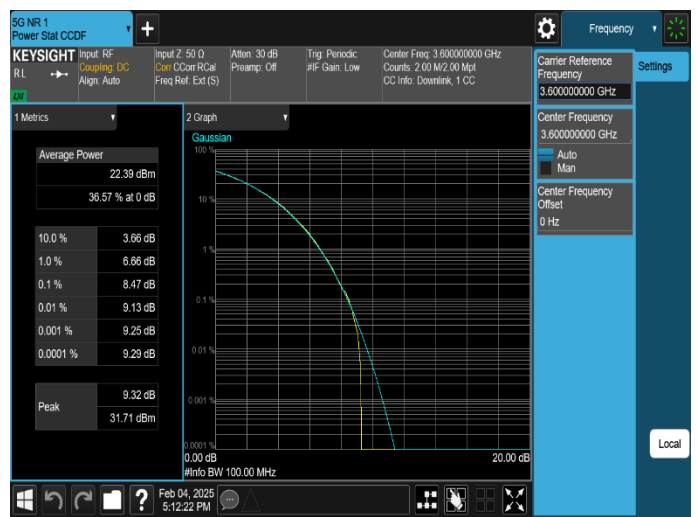
Table 8-8. Peak To Average Power Ratio Summary Data (n48_1C_20M)

Channel	Port	PAPR (dB)				Limit (dB)
		QPSK	16QAM	64QAM	256QAM	
Low	1	8.30	8.37	8.47	8.44	≤ 13
	2	8.32	8.44	8.33	8.42	
Middle	1	8.31	8.33	8.43	8.45	
	2	8.33	8.41	8.42	8.39	
High	1	8.33	8.23	8.37	8.36	
	2	8.30	8.21	8.40	8.38	

Table 8-9. Peak To Average Power Ratio Summary Data (n48_1C_100M)



Plot 8-17. Peak To Average Power Ratio Plot (n48_1C_20M_64QAM - Middle Channel, Port 1)



Plot 8-18. Peak To Average Power Ratio Plot (n48_1C_100M_64QAM - Low Channel, Port 1)



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8.7 Channel Edge Emissions at Antenna Terminal

Test Overview

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated, and the worst case configuration results are reported in this section.

Test Procedure Used

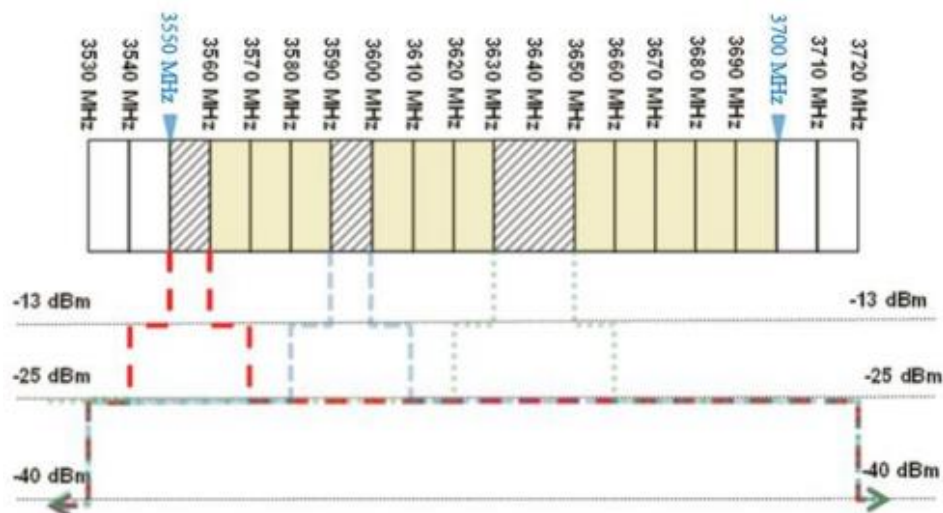
ANSI C63.26 - Section 5.2.3.4.
KDB 971168 D01 v03r01 - Section 5.7
KDB 662911 D01 v02r01 - Section E)3)

Test Setting

1. Start and stop frequency were set such that the Channel Edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the Channel Edge
3. RBW: 1% of fundamental for measurements within 1 MHz immediately outside the authorized channel
1 MHz for beyond 1 MHz outside the authorized channel.
4. VBW $\geq 3 \times$ RBW
5. Detector = RMS
6. Number of sweep points $\geq 2 \times$ Span/RBW
7. Trace mode = trace average
8. Sweep time = auto couple
9. The trace was allowed to stabilize

Limit

§ 96.41 (e)



- Within 0 MHz to 10 MHz above and below the assigned channel ≤ -13 dBm/MHz
- Greater than 10 MHz above and below the assigned channel ≤ -25 dBm/MHz
- Any emission below 3530 MHz and above 3720 MHz ≤ -40 dBm/MHz

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

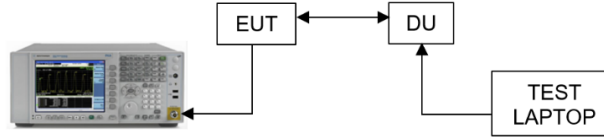


Figure 8-6. Test Instrument & Measurement Setup

Test Notes

1. All modes of operation were investigated and the worst configuration result plots are reported.
2. When detected Emission, this value has been applied as reference offset in the spectrum analyzer. Duty cycle correction factor was added to spectrum analyzer.
3. Per Section 96.41(e)(3)—resolution bandwidth 1% of fundamental for measurements within 1 MHz immediately outside the authorized channel; and 1 MHz for beyond 1 MHz outside the authorized channel.
4. The limits were adjusted by a factor of $[-10 \cdot \log(n)]$ dB to account for the device operation as a n port MIMO transmitter, as per FCC KDB 622911. MIMO Factor calculation as below:
5. When the channel edge detect with a margin of under 1dB to Limit, That used to integration method was performed using the spectrum analyzer's band power functions. The spectrum analyzer marker was placed at one-half of the RBW away from the band edge. The integration value was set to a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter.

Frequency range	Basic Limit (dBm/MHz)	MIMO Factor (dB)	Adjusted limit (dBm)
		2T	2T
0 MHz to 10 MHz above and below the assigned channel	-13.00	3.01	- 16.01
10 MHz above and below the assigned channel	-25.00	3.01	- 28.01
below 3530 MHz and above 3720 MHz	-40.00	3.01	- 43.01
Note: Adjusted limit (dBm/MHz) = Basic limit (dBm/1MHz) - MIMO Factor			

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Ch.	Port	Measured Range (GHz)	Max. Value (dBm)				Limit (dBm)	Worst Margin (dB)
			QPSK	16QAM	64QAM	256QAM		
Low	1	3.530 to 3.540	-52.53	-52.27	-52.05	-52.41	-28.01	-24.04
		3.540 to 3.549	-48.11	-47.12	-47.31	-47.39	-16.01	-31.11
		3.549 to 3.550	-41.19	-38.97	-39.91	-41.37	-16.01	-22.96
		3.570 to 3.571	-41.20	-41.90	-43.19	-42.44	-16.01	-25.19
		3.571 to 3.580	-48.84	-48.84	-48.29	-48.70	-16.01	-32.28
		3.580 to 3.720	-49.68	-47.22	-48.50	-48.79	-28.01	-19.21
	2	3.530 to 3.540	-51.85	-51.09	-51.50	-50.87	-28.01	-22.86
		3.540 to 3.549	-46.80	-46.60	-46.90	-47.01	-16.01	-30.59
		3.549 to 3.550	-40.47	-38.72	-38.41	-40.43	-16.01	-22.40
		3.570 to 3.571	-39.15	-39.76	-43.03	-38.98	-16.01	-22.97
		3.571 to 3.580	-48.14	-47.31	-46.63	-46.34	-16.01	-30.33
		3.580 to 3.720	-48.14	-47.57	-47.17	-47.17	-28.01	-19.16
Mid	1	3.530 to 3.605	-47.33	-48.57	-48.38	-48.20	-28.01	-19.32
		3.605 to 3.614	-45.88	-46.51	-46.33	-46.43	-16.01	-29.87
		3.614 to 3.615	-40.76	-39.43	-40.10	-42.98	-16.01	-23.42
		3.635 to 3.636	-37.62	-43.02	-43.79	-40.86	-16.01	-21.61
		3.636 to 3.645	-46.73	-46.67	-47.02	-46.60	-16.01	-30.59
		3.645 to 3.720	-48.52	-48.17	-49.18	-48.92	-28.01	-20.16
	2	3.530 to 3.605	-47.42	-47.50	-47.80	-47.69	-28.01	-19.41
		3.605 to 3.614	-46.24	-45.98	-45.75	-45.93	-16.01	-29.74
		3.614 to 3.615	-39.14	-40.28	-41.75	-39.53	-16.01	-23.13
		3.635 to 3.636	-41.39	-38.11	-41.10	-42.41	-16.01	-22.10
		3.636 to 3.645	-46.00	-46.52	-45.62	-45.47	-16.01	-29.46
		3.645 to 3.720	-46.43	-47.77	-48.17	-48.43	-28.01	-18.42
High	1	3.530 to 3.670	-46.09	-48.07	-48.13	-48.42	-28.01	-18.08
		3.670 to 3.679	-43.88	-43.38	-44.07	-43.92	-16.01	-27.37
		3.679 to 3.680	-40.97	-40.05	-37.53	-39.40	-16.01	-21.52
		3.700 to 3.701	-41.32	-39.02	-43.48	-41.51	-16.01	-23.01
		3.701 to 3.710	-45.25	-44.80	-45.17	-44.91	-16.01	-28.79
		3.710 to 3.720	-49.14	-49.61	-49.96	-49.59	-28.01	-21.13
	2	3.530 to 3.670	-46.51	-48.12	-47.99	-48.15	-28.01	-18.50
		3.670 to 3.679	-44.51	-44.44	-44.85	-45.06	-16.01	-28.43
		3.679 to 3.680	-40.33	-39.88	-38.00	-39.74	-16.01	-21.98
		3.700 to 3.701	-40.72	-39.62	-45.14	-39.55	-16.01	-23.54
		3.701 to 3.710	-44.77	-45.31	-45.28	-44.78	-16.01	-28.76
		3.710 to 3.720	-49.33	-49.28	-49.25	-49.07	-28.01	-21.06

Table 8-10. Channel Edge Emission Summary Data (n48_1C_20M)

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Ch.	Port	Measured Range (GHz)	Max. Value (dBm)				Limit (dBm)	Worst Margin (dB)
			QPSK	16QAM	64QAM	256QAM		
Low	1	3.530 to 3.540	-41.51	-46.03	-45.63	-46.48	-28.01	-13.50
		3.540 to 3.549	-39.45	-43.40	-42.80	-43.42	-16.01	-23.44
		3.549 to 3.550	-23.83	-22.52	-23.45	-23.56	-16.01	-6.51
		3.650 to 3.651	-23.39	-22.12	-23.29	-22.72	-16.01	-6.10
		3.651 to 3.660	-41.33	-44.20	-43.99	-43.85	-16.01	-25.32
		3.660 to 3.720	-43.29	-46.55	-44.59	-46.41	-28.01	-15.28
	2	3.530 to 3.540	-42.88	-46.70	-46.46	-46.82	-28.01	-14.87
		3.540 to 3.549	-39.83	-43.71	-43.37	-44.66	-16.01	-23.82
		3.549 to 3.550	-24.35	-22.51	-23.73	-23.98	-16.01	-6.50
		3.650 to 3.651	-23.34	-22.62	-23.52	-23.79	-16.01	-6.61
		3.651 to 3.660	-42.08	-43.86	-43.77	-43.67	-16.01	-26.07
		3.660 to 3.720	-43.47	-45.55	-43.03	-45.58	-28.01	-15.02
Mid	1	3.530 to 3.565	-46.33	-44.39	-44.55	-44.72	-28.01	-16.38
		3.565 to 3.574	-44.34	-42.87	-43.79	-44.44	-16.01	-26.86
		3.574 to 3.575	-23.75	-23.02	-23.88	-23.62	-16.01	-7.01
		3.675 to 3.676	-24.51	-24.28	-23.90	-24.87	-16.01	-7.89
		3.676 to 3.685	-45.03	-44.73	-44.84	-45.38	-16.01	-28.72
		3.685 to 3.720	-47.25	-46.69	-43.34	-46.45	-28.01	-15.33
	2	3.530 to 3.565	-44.90	-44.56	-44.26	-45.13	-28.01	-16.25
		3.565 to 3.574	-43.34	-44.05	-43.86	-44.16	-16.01	-27.33
		3.574 to 3.575	-23.57	-23.14	-23.42	-23.19	-16.01	-7.13
		3.675 to 3.676	-24.07	-24.44	-24.34	-24.63	-16.01	-8.06
		3.676 to 3.685	-43.54	-44.27	-44.90	-44.31	-16.01	-27.53
		3.685 to 3.720	-44.47	-46.12	-42.99	-46.22	-28.01	-14.98
High	1	3.530 to 3.590	-43.22	-40.44	-43.75	-43.09	-28.01	-12.43
		3.590 to 3.599	-43.51	-40.38	-43.13	-43.29	-16.01	-24.37
		3.599 to 3.600	-23.58	-22.89	-22.67	-22.53	-16.01	-6.52
		3.700 to 3.701	-24.55	-24.56	-24.39	-25.11	-16.01	-8.38
		3.701 to 3.710	-44.94	-41.41	-45.04	-45.24	-16.01	-25.40
		3.710 to 3.720	-46.18	-42.48	-45.81	-46.05	-28.01	-14.47
	2	3.530 to 3.590	-42.04	-39.03	-41.68	-42.67	-28.01	-11.02
		3.590 to 3.599	-41.67	-39.48	-42.78	-43.18	-16.01	-23.47
		3.599 to 3.600	-23.63	-23.01	-22.18	-23.04	-16.01	-6.17
		3.700 to 3.701	-25.52	-25.77	-23.38	-25.27	-16.01	-7.37
		3.701 to 3.710	-44.87	-41.68	-45.18	-45.02	-16.01	-25.67
		3.710 to 3.720	-45.89	-43.02	-46.13	-46.11	-28.01	-15.01

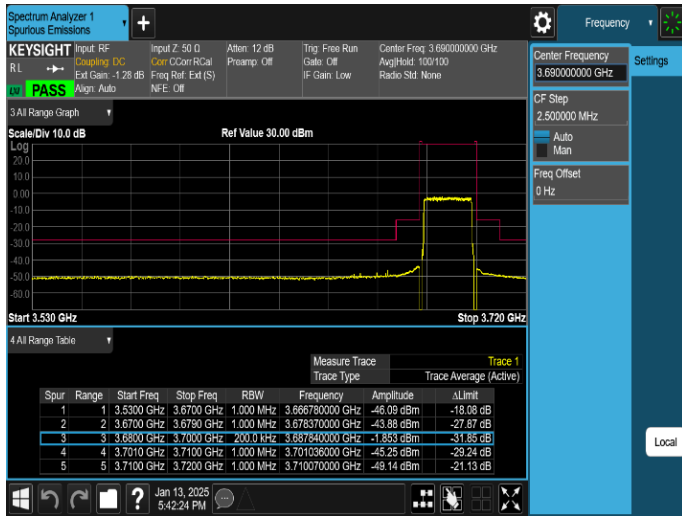
Table 8-11. Channel Edge Emission Summary Data (n48_1C_100M)



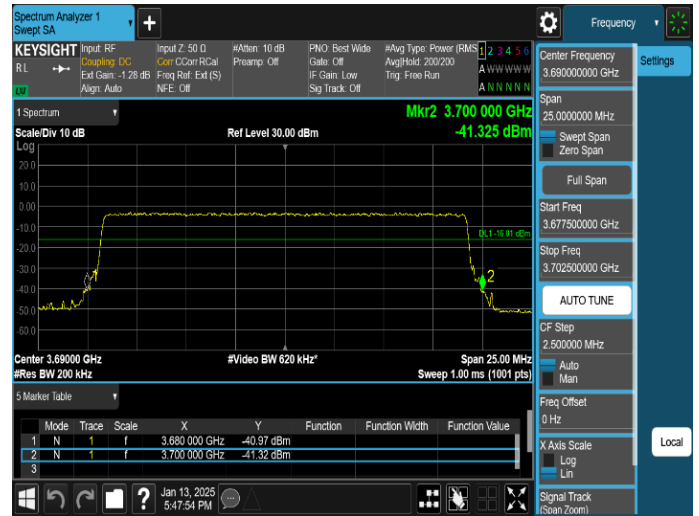
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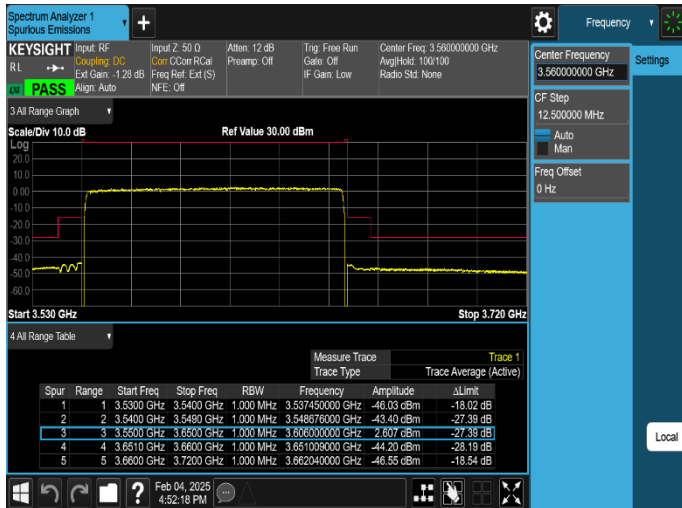
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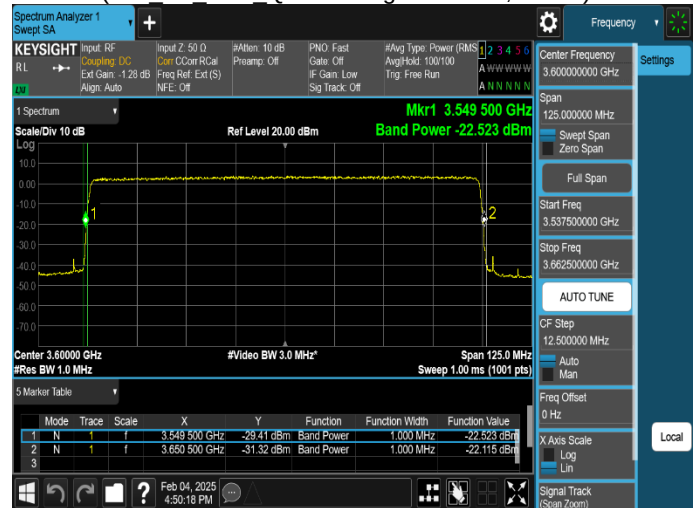
Plot 8-19. Channel Edge Emission Plot
(n48_1C_20M_QPSK – High Channel, Port 1)



Plot 8-20. Channel Edge Emission resolution bandwidth 1% of
fundamental within 1 MHz immediately outside Plot
(n48_1C_20M_QPSK – High Channel, Port 1)



Plot 8-21. Channel Edge Emission Plot
(n48_1C_100M_16QAM – Low Channel, Port 1)



Plot 8-22. Channel Edge Emission resolution bandwidth 1% of
fundamental within 1 MHz immediately outside Plot
(n48_1C_100M_16QAM – Low Channel, Port 1)

8.8 Spurious and Harmonic Emissions at Antenna Terminal

Test Overview

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

Test Procedure Used

ANSI C63.26 - Section 5.2.3.4.
 KDB 971168 D01 v03r01 - Section 6
 KDB 662911 D01 v02r01 - Section E)3)

Test Setting

1. Start frequency was set to 30 MHz and stop frequency was set to at least 10 * the fundamental frequency excluding the frequency range of the Channel Edge measurement.
2. RBW: 1 MHz
3. VBW $\geq 3 \times$ RBW
4. Detector = RMS
5. Number of sweep points $\geq 2 \times$ Span/RBW
6. Trace mode = trace average
7. Sweep time = auto couple
8. The trace was allowed to stabilize

Limit

§ 96.41 (e)

- Any emission below 3530 MHz and above 3720 MHz ≤ -40 dBm/MHz

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

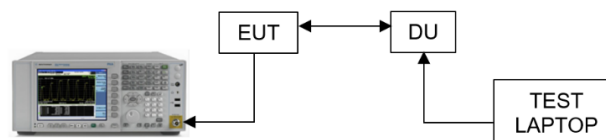


Figure 8-7. Test Instrument & Measurement Setup

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Test Notes

1. All modes of operation were investigated and the worst configuration result plots are reported.
2. When detected Emission, this value has been applied as reference offset in the spectrum analyzer. Duty cycle correction factor was added to spectrum analyzer.
3. The limits were adjusted by a factor of $[-10 \cdot \log(n)]$ dB to account for the device operation as a n port MIMO transmitter, as per FCC KDB 622911. MIMO Factor calculation as below:
4. When the channel edge detect with a margin of under 1dB to Limit, That used to integration method was performed using the spectrum analyzer's band power functions. The spectrum analyzer marker was placed at one-half of the RBW away from the band edge. The integration value was set to a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter.

Frequency range	Basic Limit (dBm/MHz)	MIMO Factor (dB)	Adjusted limit (dBm)
		2T	2T
below 3530 MHz and above 3720 MHz	-40.00	3.01	- 43.01
Note: Adjusted limit (dBm/MHz) = Basic limit (dBm/1MHz) - MIMO Factor			

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Ch.	Port	Measurement Range	Level (dBm)				Limit (dBm)	Worst Margin (dB)
			QPSK	16QAM	64QAM	256QAM		
Low	1	30 MHz to 3.53 GHz	-51.05	-52.47	-51.83	-53.49	-43.01	-8.04
		3.72 GHz to 6.2 GHz	-60.41	-59.62	-59.65	-59.87	-43.01	-16.61
		6.2 GHz to 18 GHz	-51.25	-51.31	-51.23	-51.16	-43.01	-8.15
		18 GHz to 40 GHz	-48.76	-48.20	-48.36	-47.92	-43.01	-4.91
	2	30 MHz to 3.53 GHz	-50.87	-52.35	-53.11	-53.08	-43.01	-7.86
		3.72 GHz to 6.2 GHz	-59.44	-58.47	-58.71	-58.70	-43.01	-15.46
		6.2 GHz to 18 GHz	-50.82	-50.31	-50.36	-50.43	-43.01	-7.30
		18 GHz to 40 GHz	-48.58	-48.67	-48.38	-48.57	-43.01	-5.36
Mid	1	30 MHz to 3.53 GHz	-54.30	-52.62	-53.23	-53.09	-43.01	-9.61
		3.72 GHz to 6.2 GHz	-59.55	-59.48	-59.79	-59.90	-43.01	-16.47
		6.2 GHz to 18 GHz	-51.22	-51.10	-51.48	-51.39	-43.01	-8.08
		18 GHz to 40 GHz	-48.20	-48.01	-48.45	-48.51	-43.01	-5.00
	2	30 MHz to 3.53 GHz	-53.80	-53.79	-53.60	-53.62	-43.01	-10.59
		3.72 GHz to 6.2 GHz	-58.77	-58.70	-58.41	-58.88	-43.01	-15.39
		6.2 GHz to 18 GHz	-50.54	-50.33	-50.69	-50.06	-43.01	-7.05
		18 GHz to 40 GHz	-48.28	-48.42	-48.79	-48.52	-43.01	-5.27
High	1	30 MHz to 3.53 GHz	-54.35	-52.51	-52.91	-52.68	-43.01	-9.50
		3.72 GHz to 6.2 GHz	-54.60	-54.99	-55.08	-54.66	-43.01	-11.59
		6.2 GHz to 18 GHz	-51.21	-51.37	-51.04	-51.10	-43.01	-8.03
		18 GHz to 40 GHz	-47.67	-48.20	-48.23	-48.39	-43.01	-4.66
	2	30 MHz to 3.53 GHz	-53.89	-53.82	-53.93	-53.83	-43.01	-10.81
		3.72 GHz to 6.2 GHz	-52.10	-54.70	-55.71	-56.00	-43.01	-9.09
		6.2 GHz to 18 GHz	-50.82	-50.56	-50.23	-50.34	-43.01	-7.22
		18 GHz to 40 GHz	-48.43	-48.46	-48.58	-48.46	-43.01	-5.42

Table 8-12. Conducted Spurious Emission Summary Data (n48_1C_20M)



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Ch.	Port	Measurement Range	Level (dBm)				Limit (dBm)	Worst Margin (dB)
			QPSK	16QAM	64QAM	256QAM		
Low	1	30 MHz to 3.53 GHz	-45.53	-46.22	-45.51	-46.04	-43.01	-2.50
		3.72 GHz to 6.2 GHz	-49.45	-48.60	-49.60	-48.78	-43.01	-5.59
		6.2 GHz to 18 GHz	-52.22	-51.99	-52.03	-51.97	-43.01	-8.96
		18 GHz to 40 GHz	-48.31	-48.29	-48.27	-48.02	-43.01	-5.01
	2	30 MHz to 3.53 GHz	-45.16	-46.61	-46.40	-46.32	-43.01	-2.15
		3.72 GHz to 6.2 GHz	-48.12	-48.77	-48.43	-48.74	-43.01	-5.11
		6.2 GHz to 18 GHz	-51.70	-51.46	-50.84	-51.22	-43.01	-7.83
		18 GHz to 40 GHz	-48.72	-48.27	-48.31	-48.63	-43.01	-5.26
Mid	1	30 MHz to 3.53 GHz	-48.33	-46.99	-47.42	-47.92	-43.01	-3.98
		3.72 GHz to 6.2 GHz	-50.36	-49.70	-49.71	-50.28	-43.01	-6.68
		6.2 GHz to 18 GHz	-51.81	-51.81	-51.53	-52.06	-43.01	-8.52
		18 GHz to 40 GHz	-48.72	-48.36	-48.40	-48.67	-43.01	-5.35
	2	30 MHz to 3.53 GHz	-47.39	-47.01	-47.27	-47.51	-43.01	-4.00
		3.72 GHz to 6.2 GHz	-49.20	-50.19	-50.84	-49.59	-43.01	-6.19
		6.2 GHz to 18 GHz	-51.12	-50.90	-51.25	-51.33	-43.01	-7.89
		18 GHz to 40 GHz	-48.45	-48.35	-48.25	-48.19	-43.01	-5.17
High	1	30 MHz to 3.53 GHz	-47.28	-47.81	-48.42	-48.19	-43.01	-4.26
		3.72 GHz to 6.2 GHz	-46.37	-45.14	-45.93	-46.49	-43.01	-2.13
		6.2 GHz to 18 GHz	-52.30	-51.92	-52.17	-52.18	-43.01	-8.91
		18 GHz to 40 GHz	-48.50	-48.34	-48.27	-48.56	-43.01	-5.26
	2	30 MHz to 3.53 GHz	-46.85	-46.96	-47.73	-47.62	-43.01	-3.84
		3.72 GHz to 6.2 GHz	-47.18	-44.97	-46.75	-47.64	-43.01	-1.96
		6.2 GHz to 18 GHz	-51.35	-51.19	-51.34	-50.88	-43.01	-7.87
		18 GHz to 40 GHz	-48.40	-48.19	-48.06	-48.63	-43.01	-5.05

Table 8-13. Conducted Spurious Emission Summary Data (n48_1C_100M)



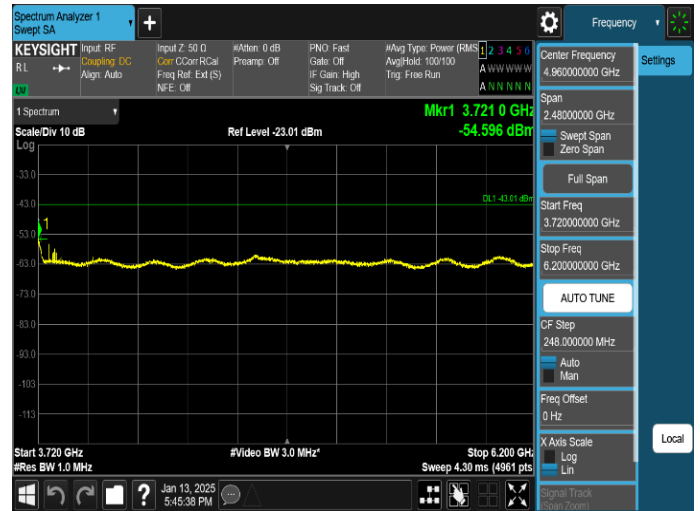
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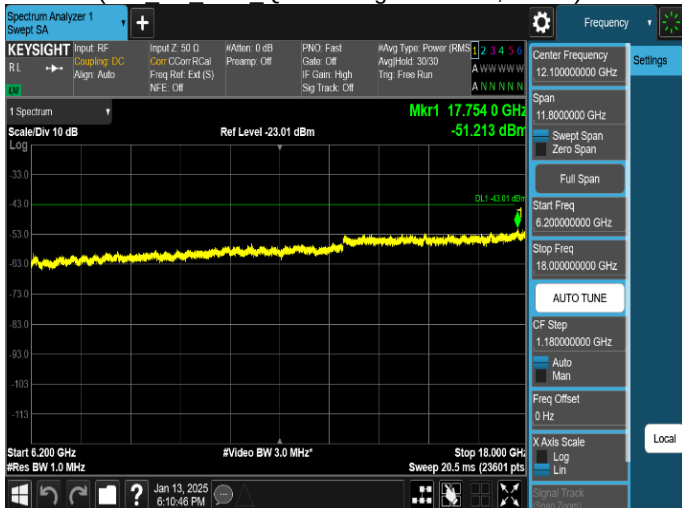
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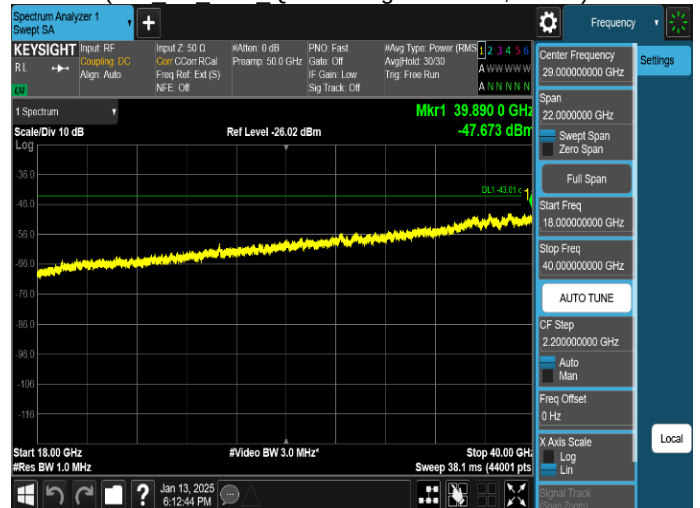
Plot 8-23. Conducted Spurious Emission Plot
30 MHz to 3.53 GHz
(n48_1C_20M_QPSK - High Channel, Port 1)



Plot 8-24. Conducted Spurious Emission Plot
3.72 GHz to 6.2 GHz
(n48_1C_20M_QPSK - High Channel, Port 1)



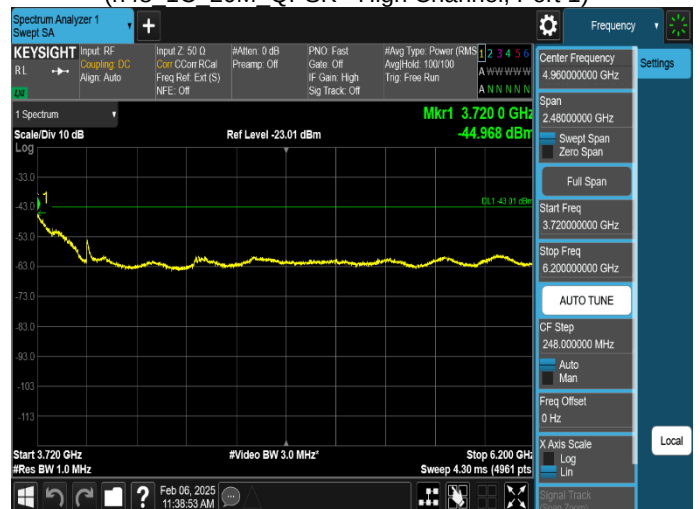
Plot 8-25. Conducted Spurious Emission Plot
6.2 GHz to 18 GHz
(n48_1C_20M_QPSK - High Channel, Port 1)



Plot 8-26. Conducted Spurious Emission Plot
18 GHz to 40 GHz
(n48_1C_20M_QPSK - High Channel, Port 1)



Plot 8-27. Conducted Spurious Emission Plot
30 MHz to 3.53 GHz
(n48_1C_100M_16QAM - High Channel, Port 2)



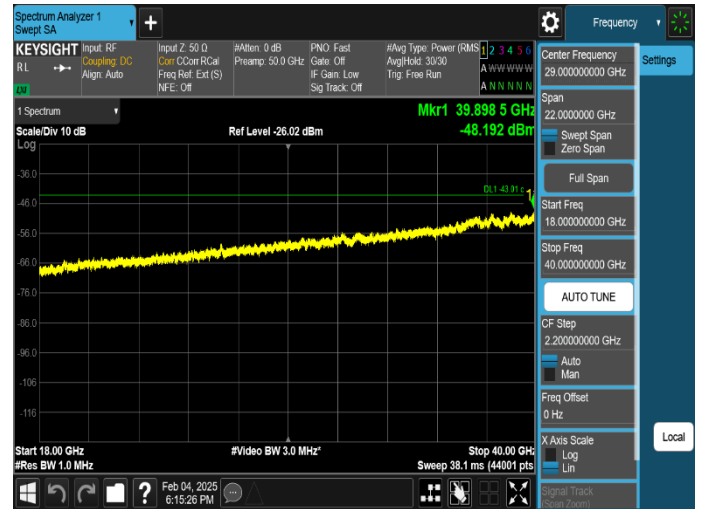
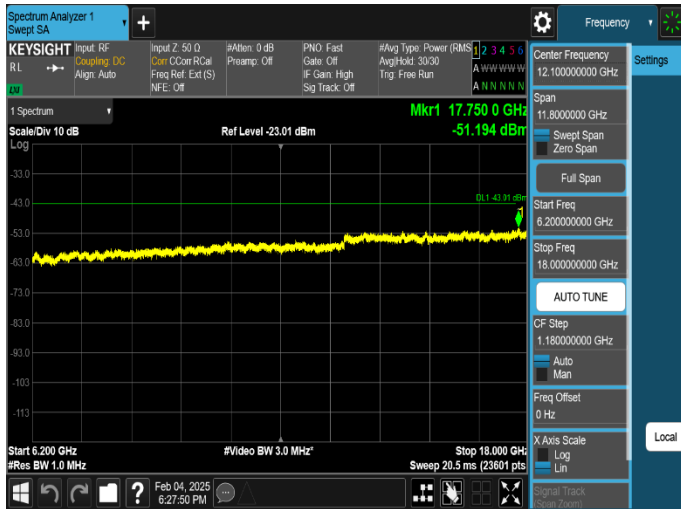
Plot 8-28. Conducted Spurious Emission Plot
3.72 GHz to 6.2 GHz
(n48_1C_100M_16QAM - High Channel, Port 2)



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8.9 Frequency Stability

Test Overview and Limit

Frequency stability testing is performed in accordance with the guidelines of KDB 971168 D01 v03r01. The frequency stability of the transmitter is measured by:

- a.) **Temperature:** The temperature is varied from -30°C to $+50^{\circ}\text{C}$ in 10°C increments using an environmental chamber.
- b.) **Primary Supply Voltage:** The primary supply voltage is varied from 85% to 115% of the nominal value for DC powered equipment.

Test Description

1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
2. The equipment is turned on in a “standby” condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.

Frequency measurements are made -30°C to $+50^{\circ}\text{C}$ in 10°C increments. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

Limit

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

Test Setup

The EUT was connected via an RF cable to a spectrum analyzer with the EUT placed inside an environmental chamber.

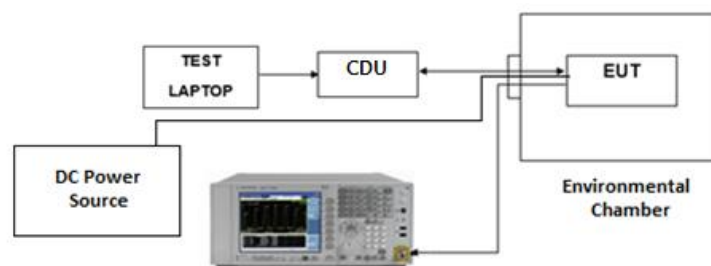


Figure 8-8. Test Instrument & Measurement Setup

Test Notes

For POE +52 V frequency stability test, operating uppermost point of voltage is 58V (111.5%) specified by the equipment manufacturer.

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OPERATING FREQUENCY: 3625,000,000 Hz
REFERENCE VOLTAGE: 12.00 VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	12.0	- 30	3,624,999,991	0.88	0.00000002
100 %		- 20	3,624,999,990	0.00	0.00000000
100 %		- 10	3,624,999,990	-0.55	-0.00000002
100 %		0	3,624,999,989	-1.48	-0.00000004
100 %		+ 10	3,624,999,990	-0.37	-0.00000001
100 %		+ 20	3,624,999,990	0.00	0.00000000
100 %		+ 30	3,624,999,990	-0.20	-0.00000001
100 %		+ 40	3,624,999,990	-0.72	-0.00000002
100 %		+ 50	3,624,999,990	-0.79	-0.00000002
85 %	10.2	+ 20	3,624,999,990	-0.14	0.00000000
115 %	13.8	+ 20	3,624,999,991	0.43	0.00000001

Table 8-14. Frequency Stability Summary Data (n48_1C_20M)

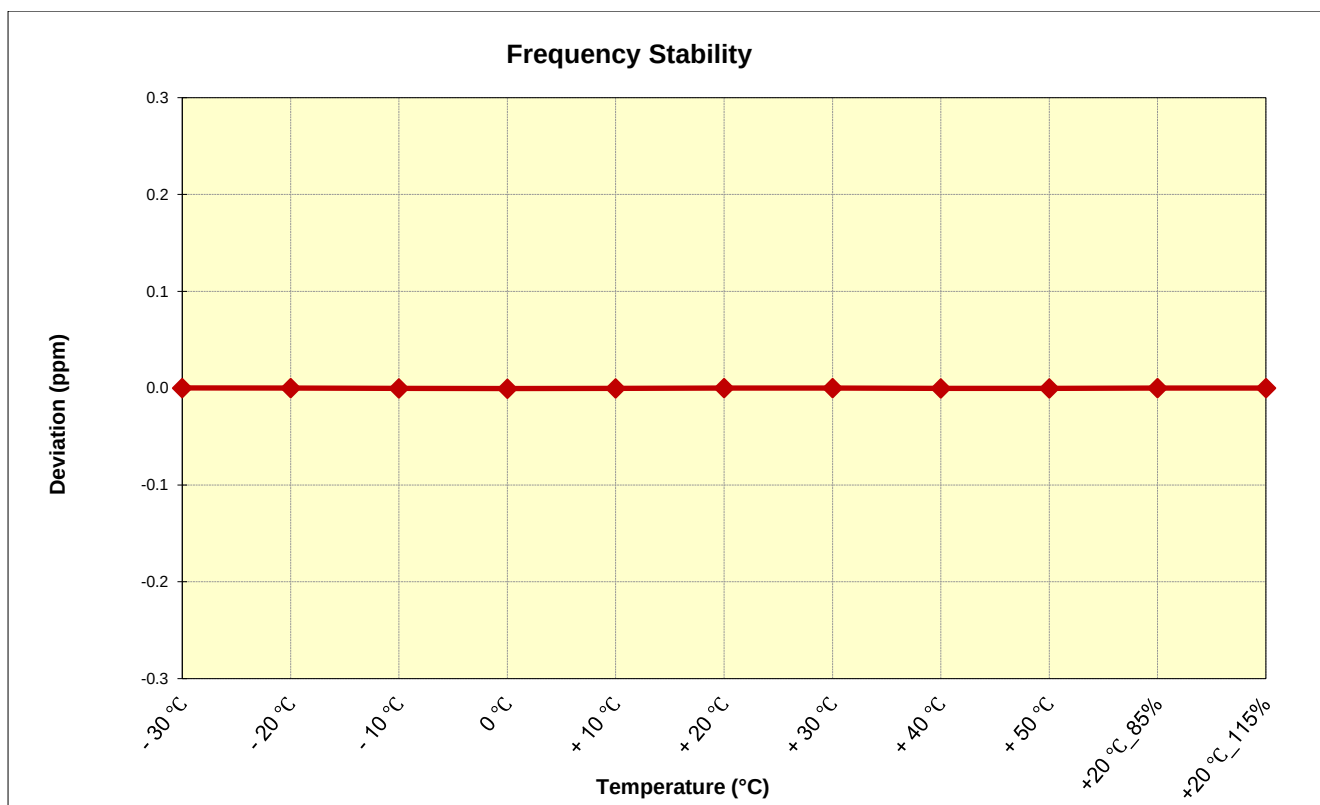


Figure 8-9. Frequency Stability Graph (n48_1C_20M)

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OPERATING FREQUENCY: 3625,000,000 Hz
REFERENCE VOLTAGE: 52.00 VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	52.0	- 30	3,624,999,991	0.77	0.00000002
100 %		- 20	3,624,999,989	-1.28	-0.00000004
100 %		- 10	3,624,999,988	-2.44	-0.00000007
100 %		0	3,624,999,988	-2.35	-0.00000006
100 %		+ 10	3,624,999,991	0.56	0.00000002
100 %		+ 20	3,624,999,990	0.00	0.00000000
100 %		+ 30	3,624,999,990	-0.67	-0.00000002
100 %		+ 40	3,624,999,989	-1.51	-0.00000004
100 %		+ 50	3,624,999,995	4.36	0.00000012
85 %	44.2	+ 20	3,624,999,991	0.16	0.00000000
111.5 %	58.0	+ 20	3,624,999,990	-0.05	0.00000000

Table 8-15. Frequency Stability Summary Data (n48_1C_20M)

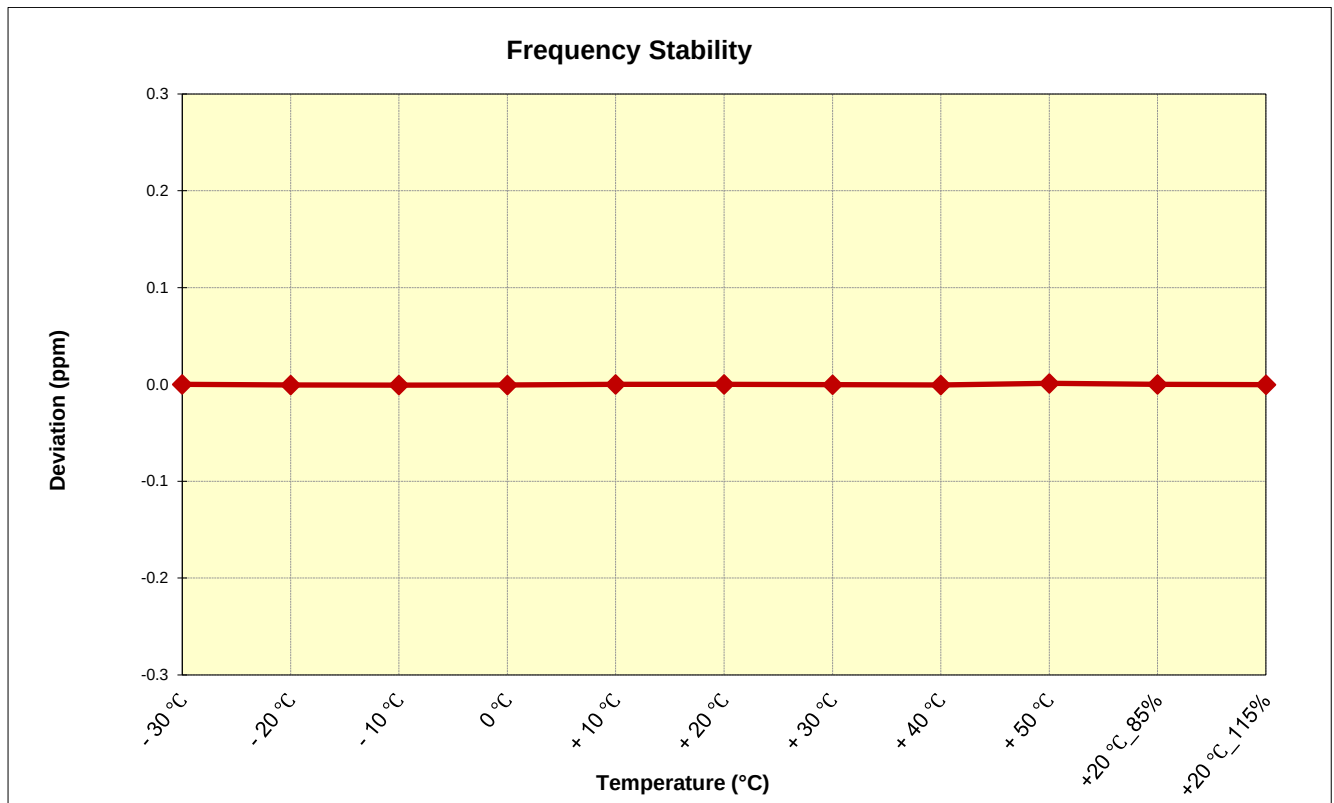


Figure 8-10. Frequency Stability Graph (n48_1C_20M)

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8.10 Radiated spurious emission

Test Overview

Radiated spurious emissions measurements are performed using the field strength method described in ANSI C63.26-2015 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using vertically and horizontally polarized broadband tri-log antennas. Measurements on signals operating above 1GHz are performed using vertically and horizontally polarized broadband horn antennas.

Test Procedure Used

ANSI C63.26 - Section 5.5.3.2

Test Setting

1. Start frequency was set to 30 MHz and stop frequency was set to at least 10 * the fundamental frequency
2. RBW = 100 kHz for emissions below 1 GHz and 1 MHz for emissions above 1GHz
3. VBW $\geq 3 \times$ RBW
4. No. of sweep points $\geq 2 \times$ span / RBW
5. Detector = RMS
6. Trace mode = Max Hold (In cases where the level is within 2 dB of the limit, the final measurement is taken using triggering/gating and trace averaging.)
7. The trace was allowed to stabilize.

Limit

§ 96.41 (e)

Any emission below 3530 MHz and above 3720 MHz ≤ -40 dBm/MHz

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

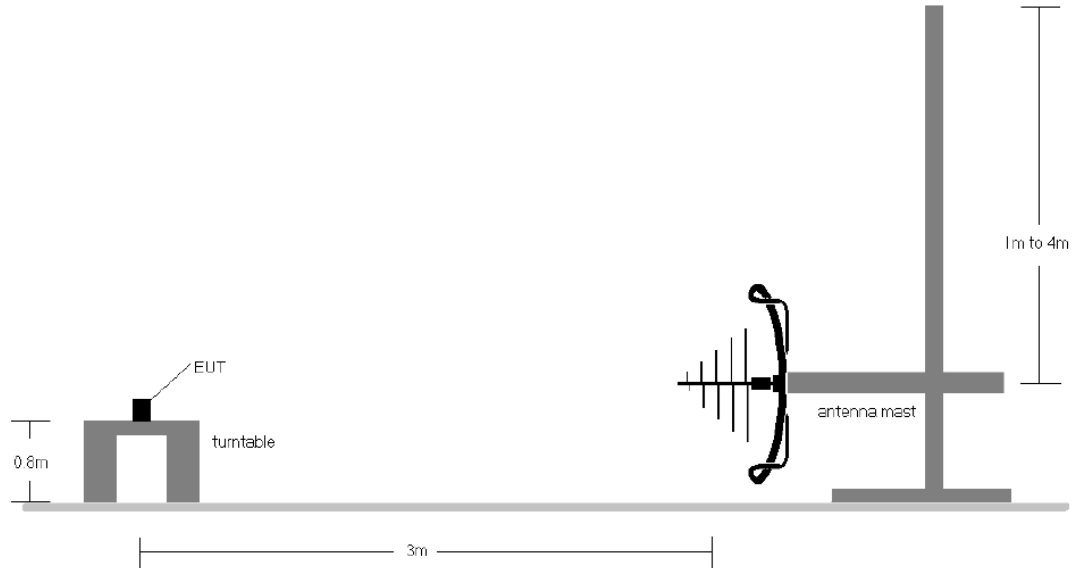


Figure 8-11. Test Instrument & Measurement Setup < 1 GHz

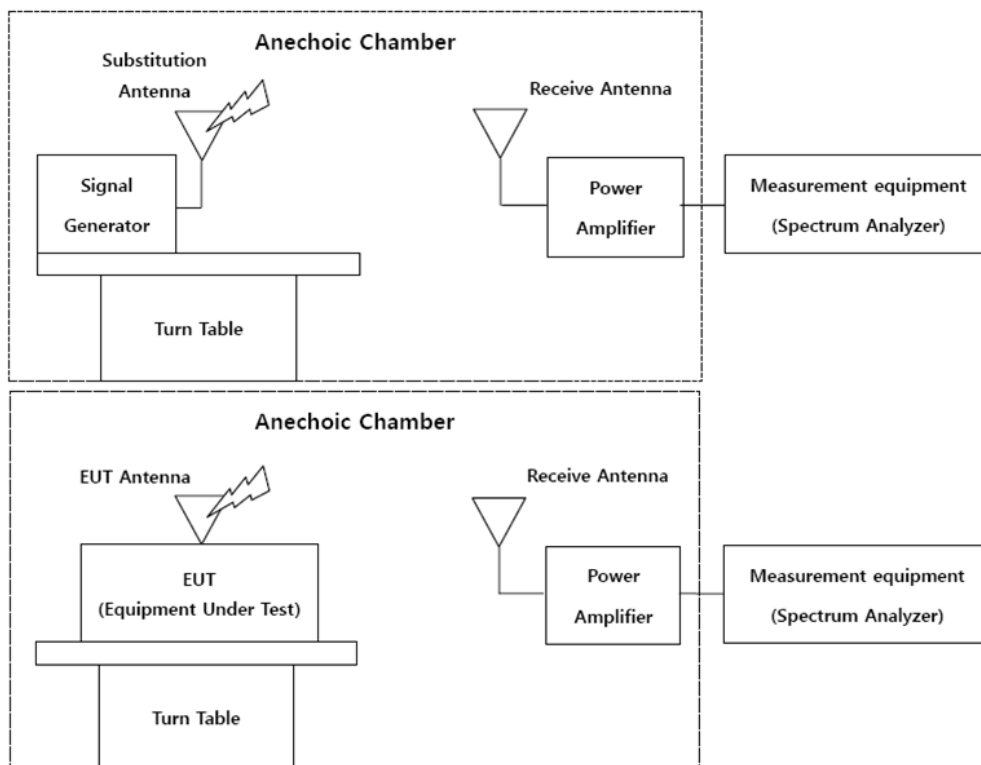


Figure 8-12. Test Instrument & Measurement Setup > 1 GHz

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Test Notes

1. The below 1GHz average EIRP reported below is calculated per 5.2.7 of ANSI C63.26-2015 which states:

The measured E-field in V/m is converted to e.i.r.p in dBm.

Effective Isotropic Radiated Power Sample Calculation

$$\begin{aligned}\text{Field Strength [dB}\mu\text{V/m]} &= \text{Measured Value [dB}\mu\text{V/m]} + \text{AFCL [dB/m]} \\ &= 63.2 \text{ [dB}\mu\text{V/m]} - 10.6 \text{ [dB/m]} = 52.6 \text{ dB}\mu\text{V/m}\end{aligned}$$

$$\begin{aligned}\text{e.i.r.p. [dBm]} &= E[\text{dB } \mu\text{V/m}] + 20 \log_{10}(d[\text{m}]) - 104.8 \\ &= 52.6 \text{ dB}[\mu\text{V/m}] + (20 * \log(3)) - 104.8 \\ &= -42.66 \text{ dBm}\end{aligned}$$

2. The above 1GHz average EIRP reported below is calculated per 5.5.3 of ANSI C63.26-2015 which states:

Effective Isotropic Radiated Power Sample Calculation**Substitution measurement**

$$\begin{aligned}\text{e.i.r.p. [dBm]} &= \text{EUT}_{\text{Prec}} [\text{dBm EIRP}] + P_L [\text{dB}] \\ &= -51.4 \text{ dBm} + 5.9 \text{ dB} \\ &= -45.5 \text{ dBm}\end{aligned}$$

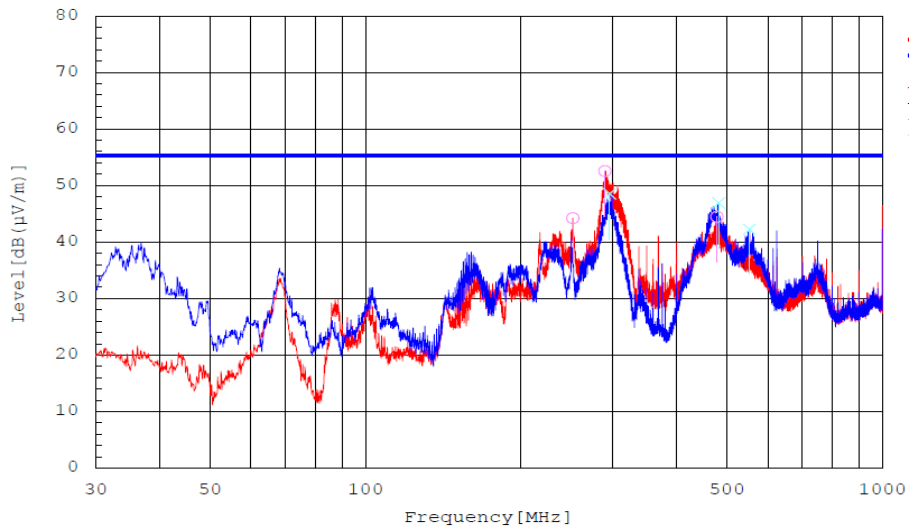
3. The EUT was tested in both horizontal and vertical antenna polarizations and in all possible test configurations and positioning. The worst case emissions are reported with the EUT positioning, modulations, channel bandwidth configurations shown in the tables below.
4. The spectrum is measured from 30 MHz to the 10th harmonic of the fundamental frequency of the transmitter. The worst-case emissions are reported.
5. All emissions were measured at a 3-meter test distance.
6. Spurious emissions were measured with all EUT antennas transmitting simultaneously and all antenna ports terminated.
7. The "-" shown in the following RSE tables are used to denote a noise floor measurement.
8. All modes of operation were investigated and the worst case configuration results are reported in this section.



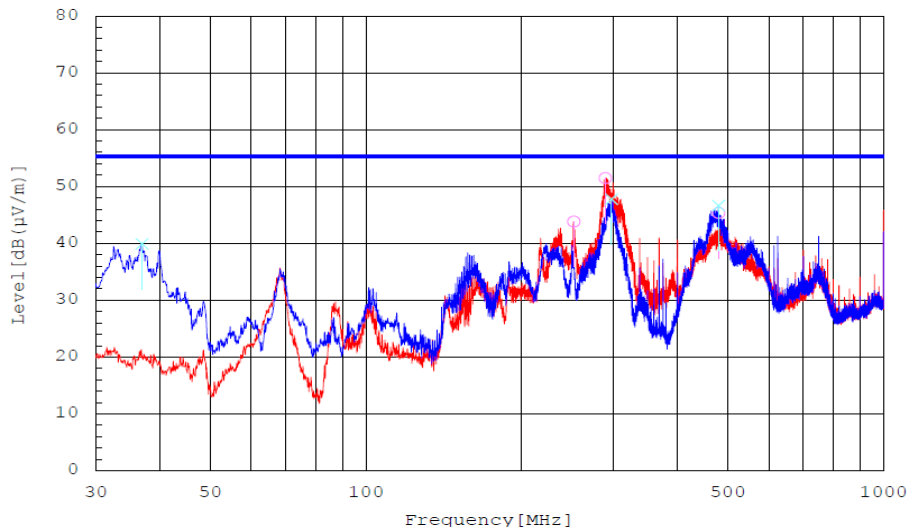
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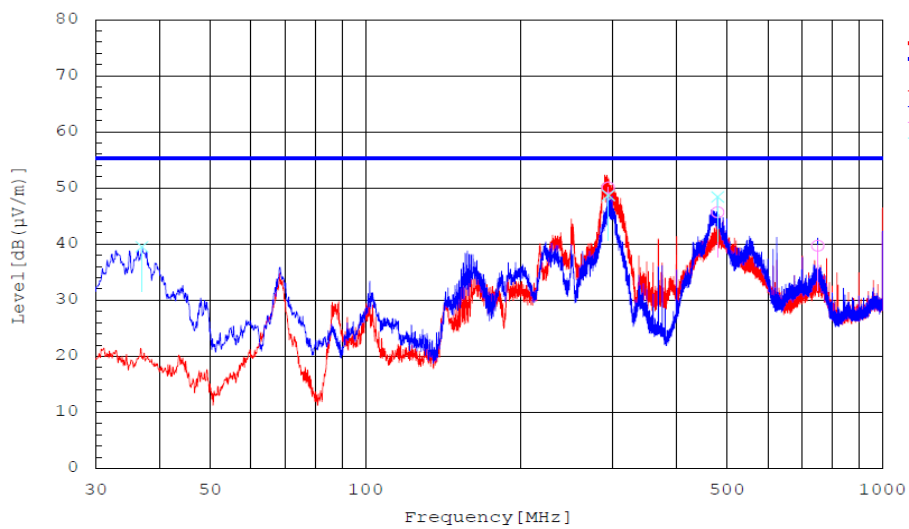
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**Plot 8-31. Radiated spurious emission Plot_30 MHz to 1000 MHz
(n48_1C_20M_Low Channel)**



**Plot 8-32. Radiated spurious emission Plot_30 MHz to 1000 MHz
(n48_1C_20M_Mid Channel)**

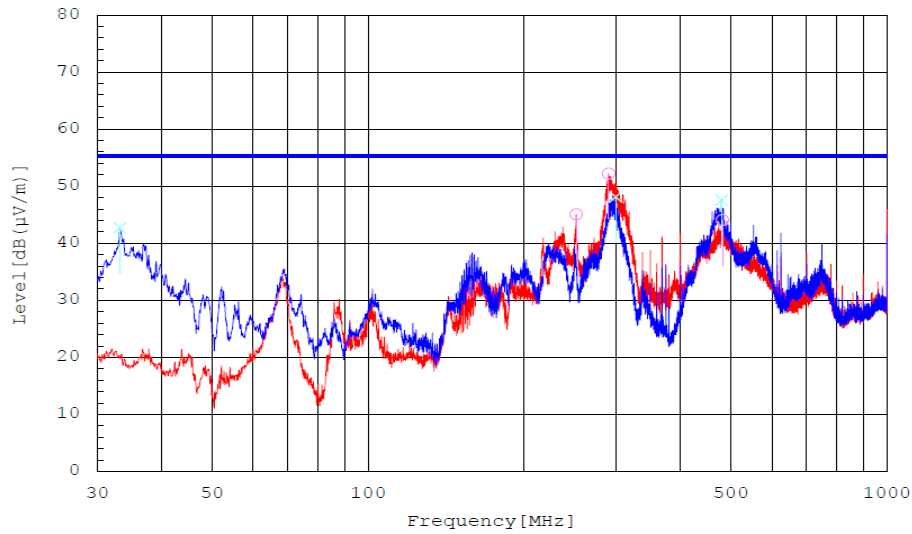


**Plot 8-33. Radiated spurious emission Plot_30 MHz to 1000 MHz
(n48_1C_20M_High Channel)**

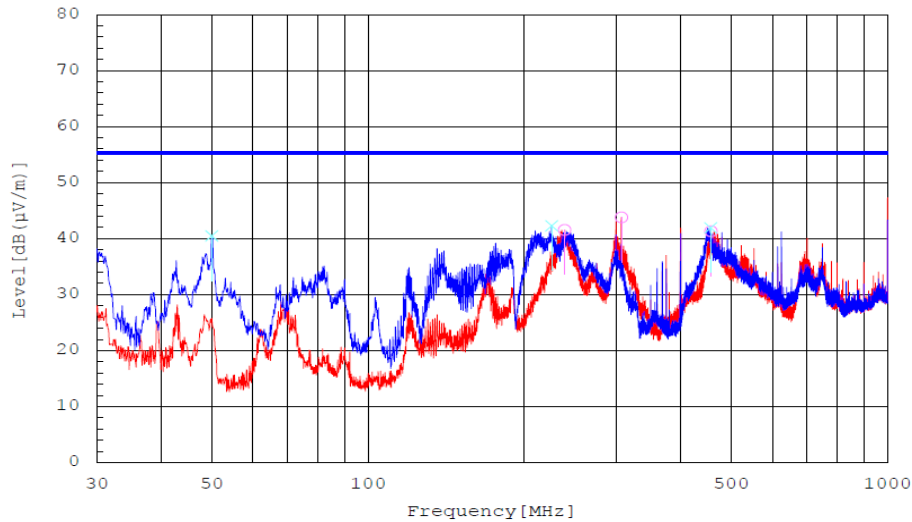
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**Plot 8-34. Radiated spurious emission Plot_30 MHz to 1000 MHz
(n48_1C_100M_Low Channel)**



**Plot 8-35. Radiated spurious emission Plot_30 MHz to 1000 MHz
(n48_1C_20M_POE)**

Mod	Frequency [MHz]	Ant. Pol. [H/V]	Analyzer Level [dBμV/m]	AFCL [dB]	Field Strength [dBμV/m]	EIRP [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]	Antenna Heigh [cm]	Turntable azimuth [degree]
n48_1C 20M_Low	290.45	H	63.2	-10.6	52.6	-42.66	-40	-2.7	100	287.2
	296.75	V	58.9	-10.4	48.5	-46.76	-40	-6.8	100	196.2
n48_1C 20M_Mid	290.06	H	62.1	-10.6	51.5	-43.76	-40	-3.8	100	292.9
	298.01	V	58.1	-10.3	47.8	-47.46	-40	-7.5	200	359.4
n48_1C 20M_High	294.71	H	60.6	-10.5	50.1	-45.16	-40	-5.2	100	328.5
	295.1	V	59.2	-10.5	48.7	-46.56	-40	-6.6	200	194.3
n48_1C 100M_High	290.64	H	62.8	-10.6	52.2	-43.06	-40	-3.1	100	301.0
	299.95	V	58.4	-10.3	48.1	-47.16	-40	-7.2	200	195.6
n48_1C 20M_PoE	225.55	V	56.6	-14.3	42.3	-52.96	-40	-13.0	100	323.3
	307.23	H	53.8	-10.0	43.8	-51.46	-40	-11.5	100.4	85.1

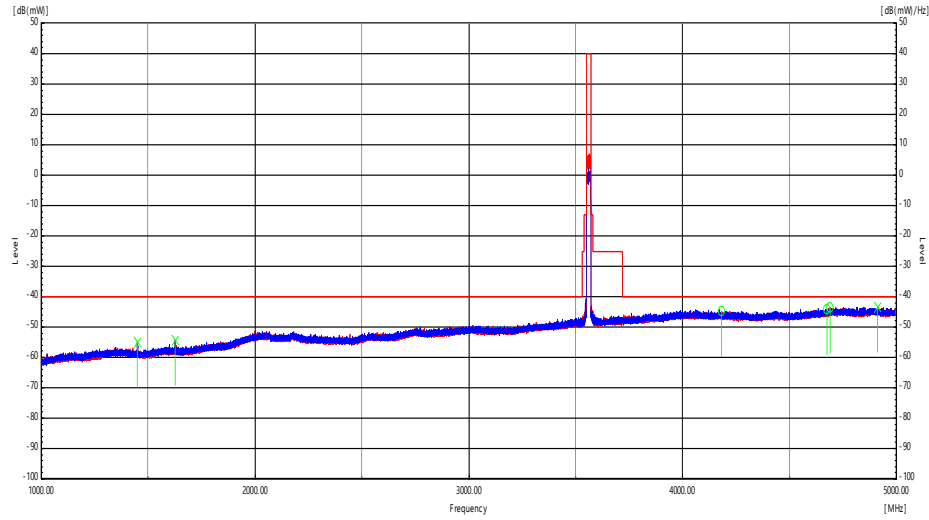
Table 8-16. Radiated spurious emission below 1GHz Worst mode Summary Data



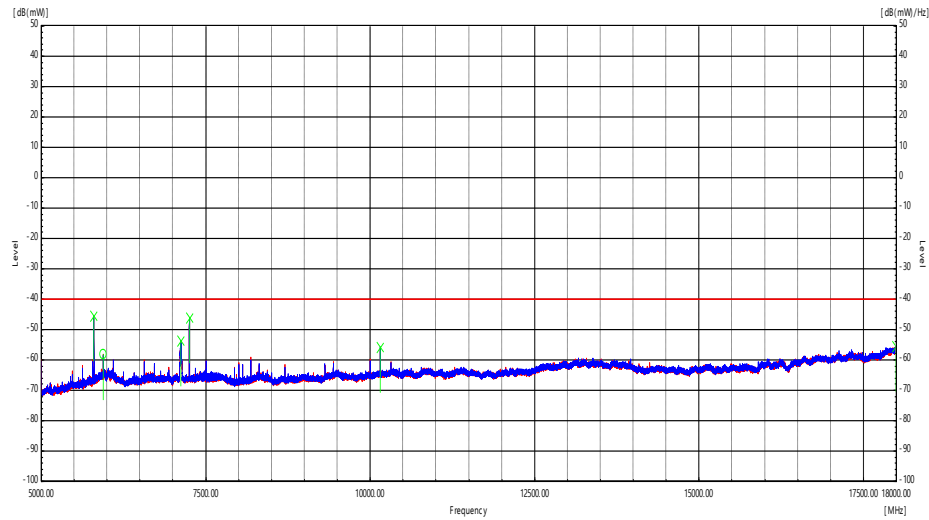
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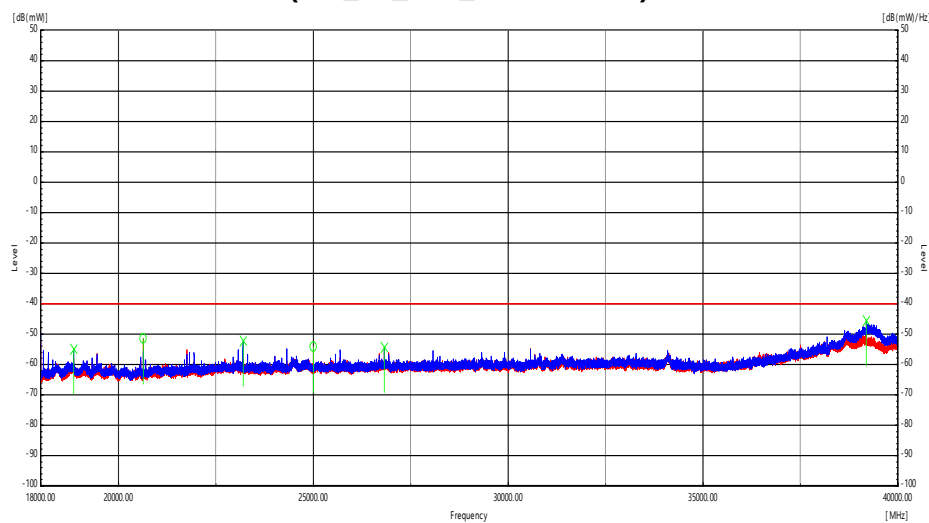
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**Plot 8-36. Radiated spurious emission Plot_1 GHz to 5 GHz
(n48_1C_20M_Low Channel)**



**Plot 8-37. Radiated spurious emission Plot_5 GHz to 18 GHz
(n48_1C_20M_Low Channel)**



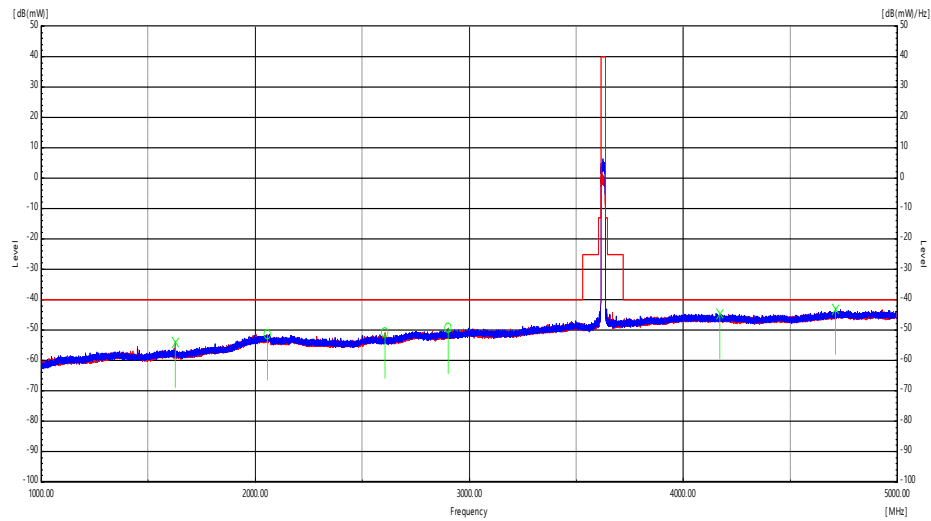
**Plot 8-38. Radiated spurious emission Plot_18 GHz to 40 GHz
(n48_1C_20M_Low Channel)**



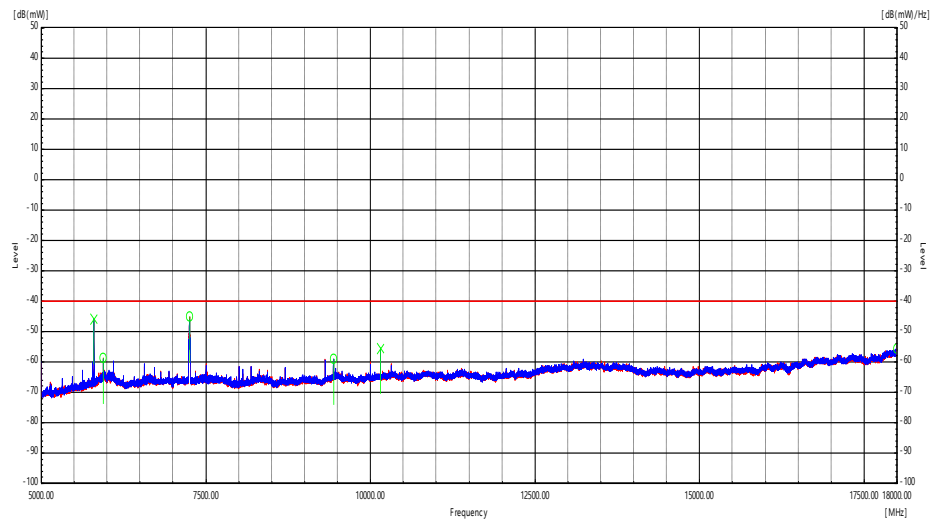
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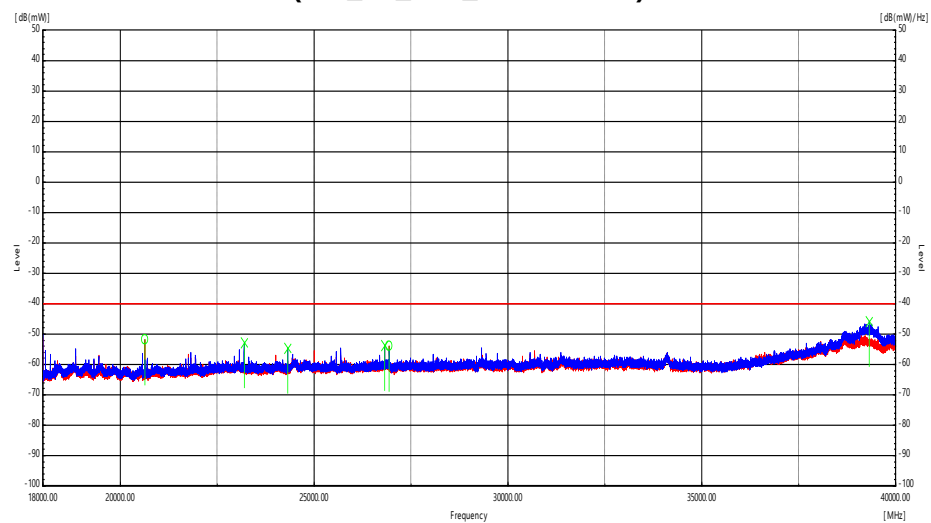
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**Plot 8-39. Radiated spurious emission Plot_1 GHz to 5 GHz
(n48_1C_20M_Mid Channel)**



**Plot 8-40. Radiated spurious emission Plot_5 GHz to 18 GHz
(n48_1C_20M_Mid Channel)**



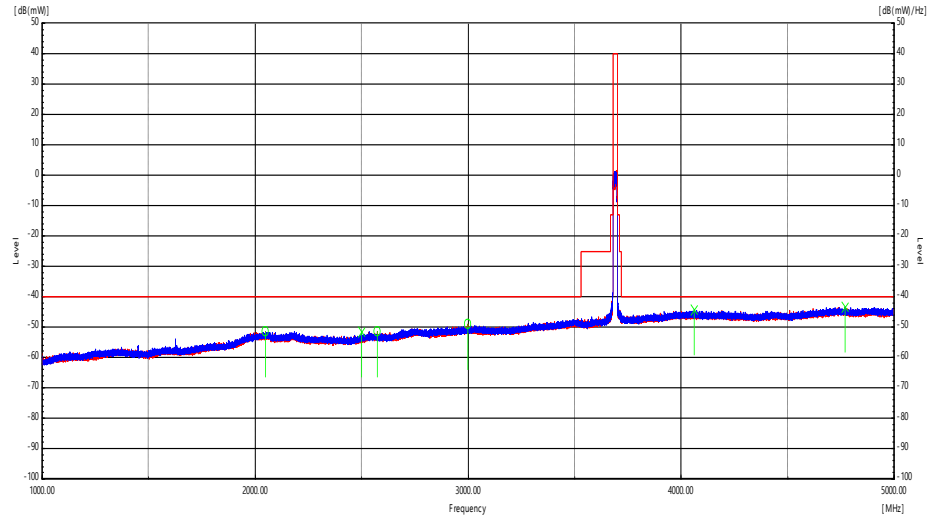
**Plot 8-41. Radiated spurious emission Plot_18 GHz to 40 GHz
(n48_1C_20M_Mid Channel)**



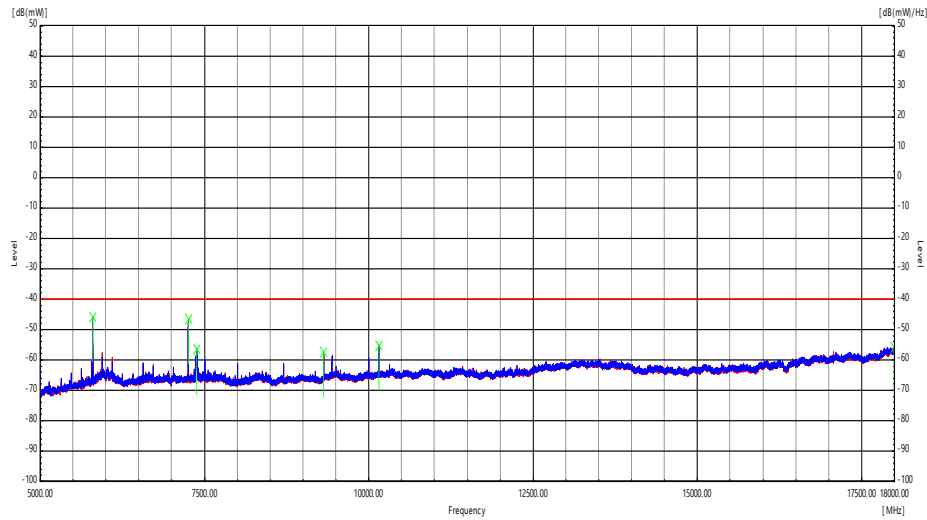
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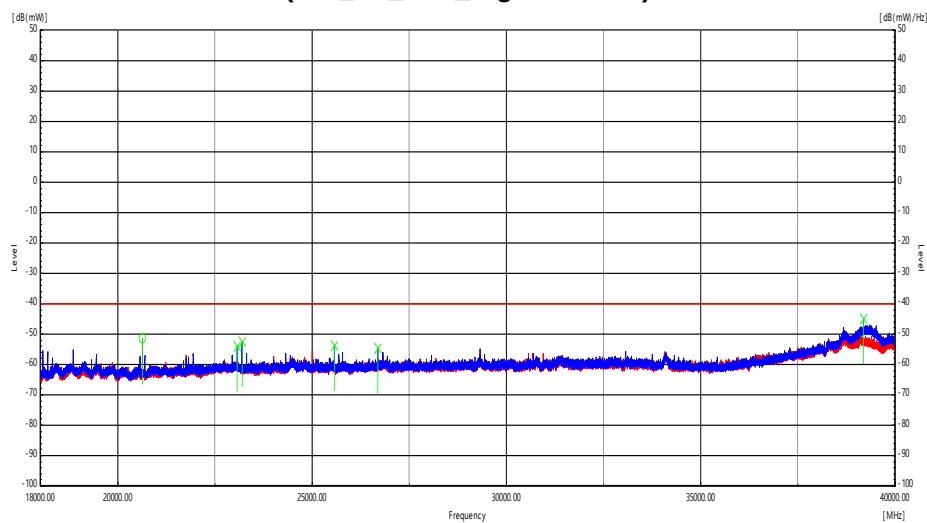
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**Plot 8-42. Radiated spurious emission Plot_1 GHz to 5 GHz
(n48_1C_20M_High Channel)**



**Plot 8-43. Radiated spurious emission Plot_5 GHz to 18 GHz
(n48_1C_20M_High Channel)**



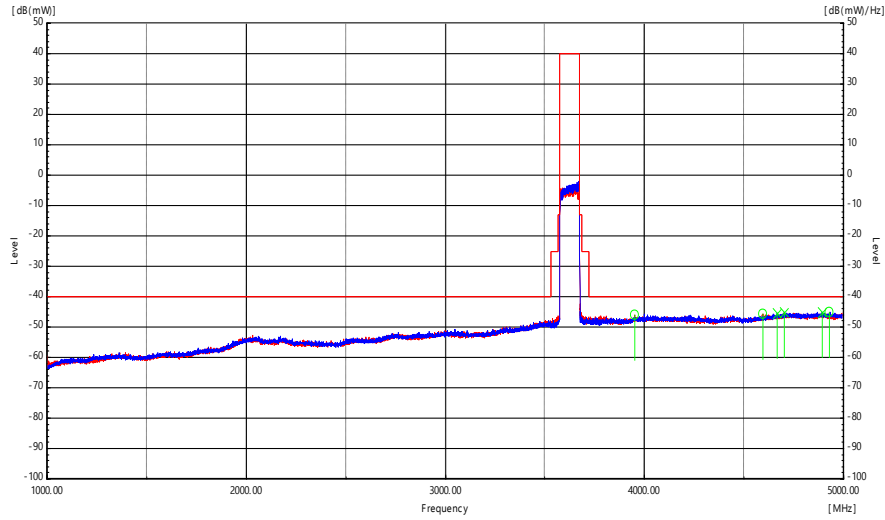
**Plot 8-44. Radiated spurious emission Plot_18 GHz to 40 GHz
(n48_1C_20M_High Channel)**



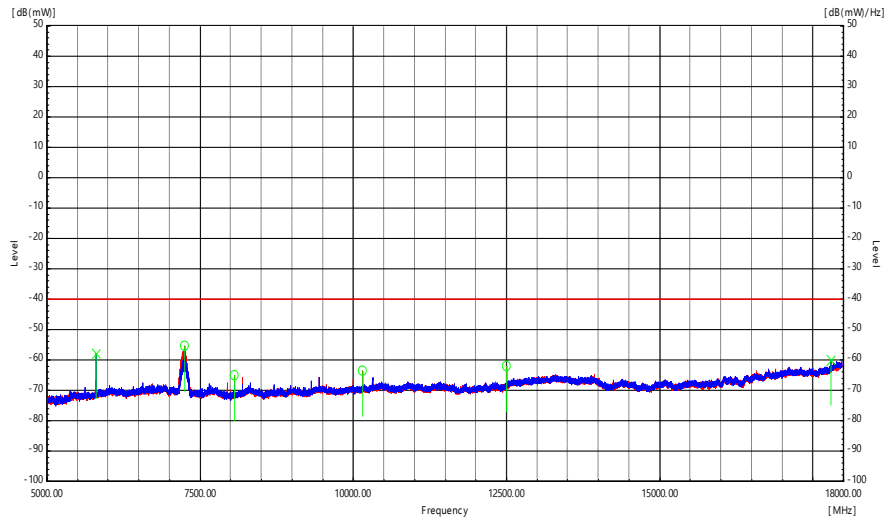
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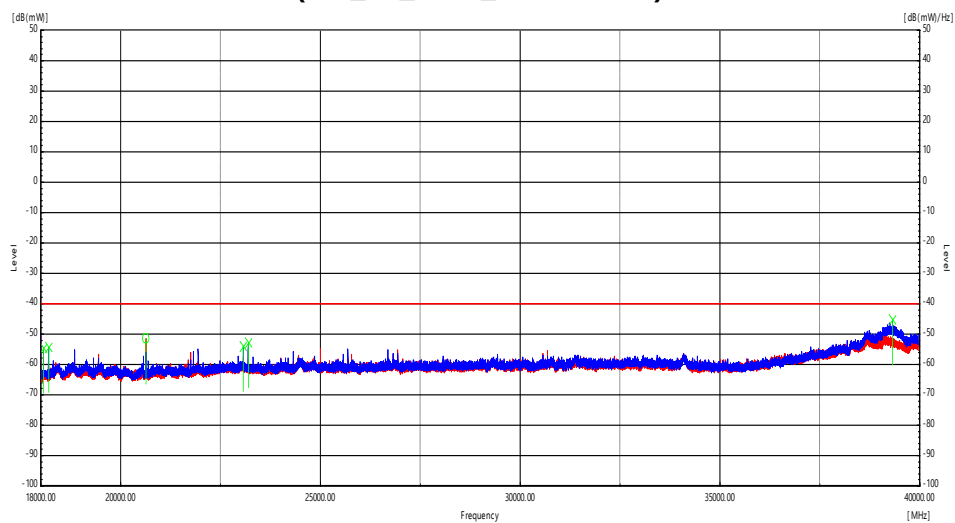
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**Plot 8-45. Radiated spurious emission Plot_1 GHz to 5 GHz
(n48_1C_100M_Mid Channel)**



**Plot 8-46. Radiated spurious emission Plot_5 GHz to 18 GHz
(n48_1C_100M_Mid Channel)**



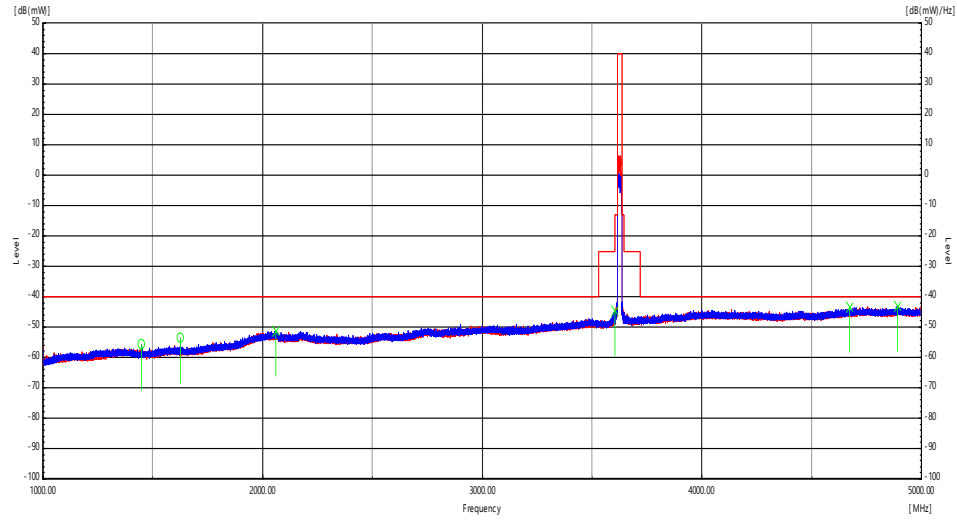
**Plot 8-47. Radiated spurious emission Plot_18 GHz to 40 GHz
(n48_1C_100M_Mid Channel)**



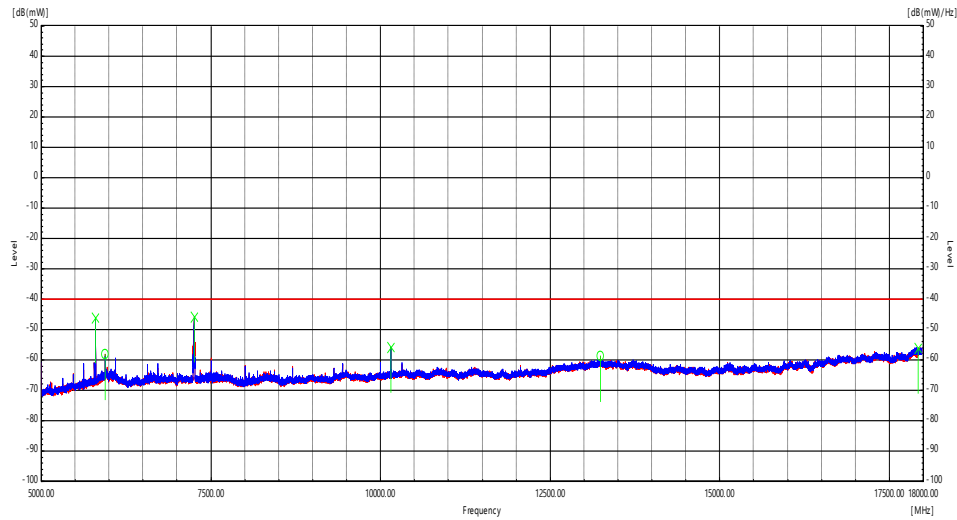
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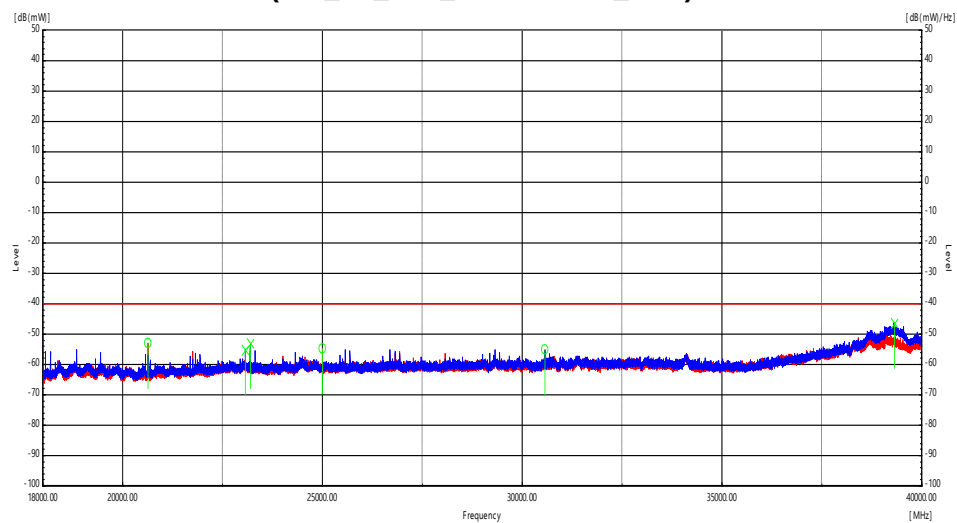
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**Plot 8-48. Radiated spurious emission Plot_1 GHz to 5 GHz
(n48_1C_20M_Mid Channel_POE)**



**Plot 8-49. Radiated spurious emission Plot_5 GHz to 18 GHz
(n48_1C_20M_Mid Channel_POE)**



**Plot 8-50. Radiated spurious emission Plot_18 GHz to 40 GHz
(n48_1C_20M_Mid Channel_POE)**



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Channel	Frequency [MHz]	Ant. Pol. [H/V]	Analyzer Level [dBm]	Path loss [dB]	RSE EIRP [dBm]	Limit [dBm/MHz]	Margin [dB]	Turntable azimuth [degree]
n48_1C_20M_Low	5799.93	V	-51.4	5.9	-45.5	-40.0	-5.5	82.5
	5937.73	H	-64.4	6.3	-58.1	-40.0	-18.1	119.8
	7119.87	V	-60.6	7.0	-53.6	-40.0	-13.6	82.5
	7249.87	V	-53.2	7.2	-46.0	-40.0	-6.0	75.1
n48_1C_20M_Mid	5799.93	V	-51.7	5.9	-45.8	-40.0	-5.8	83.5
	5937.73	H	-65.0	6.3	-58.7	-40.0	-18.7	119.7
	7249.87	H	-52.2	7.0	-45.2	-40.0	-5.2	136
	9437.33	H	-66.3	7.3	-59	-40.0	-19.0	104.3
n48_1C_20M_High	5799.93	V	-51.7	5.9	-45.8	-40.0	-5.8	80.6
	7249.87	V	-53.6	7.2	-46.4	-40.0	-6.4	72.1
	7379.87	V	-63.6	7.2	-56.4	-40.0	-16.4	89.4
	9312.53	V	-64.4	7.1	-57.3	-40.0	-17.3	80.6
n48_1C_100M_Mid	5799.93	V	-63.7	5.9	-57.8	-40.0	17.8	336.3
	7249.87	H	-62.4	7.0	-55.4	-40.0	15.4	13.9
	8062.80	H	-71.2	5.9	-65.3	-40.0	25.3	62.3
	10150.17	H	-71.3	7.8	-63.5	-40.0	23.5	337.3
n48_1C_20M_POE	5799.93	V	-51.8	5.9	-45.9	-40.0	-5.9	80.8
	5937.73	H	-64.5	6.3	-58.2	-40.0	-18.2	119.2
	7250.30	V	-52.9	7.2	-45.7	-40.0	-5.7	73.9
	10150.17	V	-63.7	7.9	-55.8	-40.0	-15.8	73.9

Table 8-17. Radiated spurious emission above 1GHz Worst mode Summary Data (n77_1C_60M)



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9.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **EUCAST Co., Ltd. FCC ID: 2AXTR-ENS2278-3823** complies with all of the requirements of Part 96 of the FCC Rules.

10.0 APPENDIX. A

10.1 Conducted Average Output Power

Test Overview

A transmitter port of EUT is connected to the input of a signal analyzer. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

Test Description

KDB 971168 D01 v03r01 – Section 5

KDB 662911 D01 v02r01 – Section E)1) In-Band Power Measurements

ANSI C63.26-2015 – Section 5.2.4.4.1

The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The spectrum analyzer settings were as follows:

1. Conducted power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation.
2. RBW = 1 ~ 5% of the expected OBW
3. VBW $\geq 3 \times$ RBW
4. Span = 2 ~ 3 x OBW
5. No. of sweep points $\geq 2 \times$ span / RBW
6. Detector = RMS
7. Trigger Settings is set to "RF Power" for signals with non-continuous operation with the sweep times set to "auto". Refer test note 3 for details.
8. Trace mode = Trace-Averaging (RMS) set to average over 100 sweeps
9. The trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

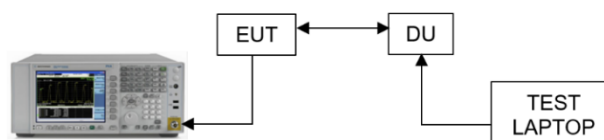


Figure 10-1. Test Instrument & Measurement Setup

Limit

N/A

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Note

1. Result for reference maximum output power of Grant of Authorization is under section 10.1.
2. Periodic trigger was used with gating ON. Gate sweep time, Gate delay and gate length were set accordingly to capture ON time of the transmission.
3. MIMO Calculations are done considering output channel power for all ports and respective margins are calculated according to procedures in section 6.4 of ANSI C63.26 and section D of KDB 971168 D01 v03r01.
4. Consider the following factors for MIMO Power:
Conducted power for each port is measured in dBm.
Powers are summed up in linear using the measure-and-sum technique defined in KDB 971168 D01 v03r01- Section D.
Conducted power per port (dBm) is converted to a linear value (mW). A summation of linear powers for all ports gives us the total MIMO conducted power in milliWatts (mW).
6. Unequal antenna gains, with equal transmit powers. For antenna gains given by $G_1, G_2, \dots, G_N$ dBi transmit signals are correlated
Directional gain = $10 \log[(10^{G_1/20} + 10^{G_2/20} + \dots + 10^{G_N/20})^2 / N_{ANT}]$ dBi
7. Applied antenna gain as below:

Antenna 1 Gain	Antenna 2 Gain	Correlated Directional gain
9.3 dBi	9.6 dBi	12.46 dBi

8. Sample Calculation:
Let us assume the following numbers:
 - a) Total MIMO Conducted Power as 92.25 mW
 - b) Antenna Gain = 12.46 dBi

Factors		Value	Unit
Summed MIMO Conducted Power (linear sum)		92.25	mW
Summed MIMO Conducted Power (dBm)	= $10 * \log(92.25) =$	19.65	dBm
Antenna Gain		12.46	dBi
Total MIMO EIRP		32.11	dBm



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Channel	Port	QPSK	16QAM	64QAM	256QAM
Low	1	16.44	16.39	16.11	16.59
	2	16.83	16.71	16.50	16.28
Total Conducted Power (mW)		92.25	90.43	85.50	88.07
Total Conducted Power (dBm)		19.65	19.56	19.32	19.45
Ant. Gain (dBi)		12.46	12.46	12.46	12.46
e.i.r.p (dBm)		32.11	32.02	31.78	31.91
Channel	Port	QPSK	16QAM	64QAM	256QAM
Mid	1	16.22	16.49	16.11	16.59
	2	16.27	16.24	15.93	16.37
Total Conducted Power (mW)		84.24	86.64	80.01	88.95
Total Conducted Power (dBm)		19.26	19.38	19.03	19.49
Ant. Gain (dBi)		12.46	12.46	12.46	12.46
e.i.r.p (dBm)		31.72	31.84	31.49	31.95
Channel	Port	QPSK	16QAM	64QAM	256QAM
High	1	16.60	16.43	16.82	16.12
	2	16.06	16.21	16.37	16.27
Total Conducted Power (mW)		86.07	85.74	91.44	83.29
Total Conducted Power (dBm)		19.35	19.33	19.61	19.21
Ant. Gain (dBi)		12.46	12.46	12.46	12.46
e.i.r.p (dBm)		31.81	31.79	32.07	31.67

Table 10-1. Conducted Average Output Power Table (n48_1C_20M)



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Channel	Port	QPSK	16QAM	64QAM	256QAM
Low	1	22.21	22.43	22.59	22.46
	2	22.08	22.18	22.34	22.13
Total Conducted Power (mW)		329.78	342.18	354.95	341.50
Total Conducted Power (dBm)		25.18	25.34	25.50	25.33
Ant. Gain (dBi)		12.46	12.46	12.46	12.46
e.i.r.p (dBm)		37.64	37.80	37.96	37.79
Channel	Port	QPSK	16QAM	64QAM	256QAM
Mid	1	21.10	21.33	21.48	21.55
	2	21.57	21.62	21.65	21.73
Total Conducted Power (mW)		274.37	283.04	288.82	293.83
Total Conducted Power (dBm)		24.38	24.52	24.61	24.68
Ant. Gain (dBi)		12.46	12.46	12.46	12.46
e.i.r.p (dBm)		36.84	36.98	37.07	37.14
Channel	Port	QPSK	16QAM	64QAM	256QAM
High	1	21.83	21.39	21.80	21.79
	2	21.64	21.27	21.61	21.75
Total Conducted Power (mW)		300.29	273.69	298.23	302.63
Total Conducted Power (dBm)		24.78	24.37	24.75	24.81
Ant. Gain (dBi)		12.46	12.46	12.46	12.46
e.i.r.p (dBm)		37.24	36.83	37.21	37.27

Table 10-2. Conducted Average Output Power Table (n48_1C_100M)



Plot 10-1. Conducted Average Output Power Plot
(n48_1C_20M_QPSK - Low Channel, Port 1)



Plot 10-2. Conducted Average Output Power Plot
(n48_1C_100M_QPSK - Low Channel, Port 1)