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Fujitsu Network Communications TEST REPORT

SCOPE OF WORK

EMC TESTING – DUAL BAND RU FOR NORTH AMERICA

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EMC TEST REPORT
(FULL COMPLIANCE)

Report Number: 104509072LEX-004

Project Number: G104509072

Report Issue Date: 3/15/2021

Product Tested: Dual Band RU for North America

Model Number: DB 5G RU

Standards: Title 47 CFR Part 27

Tested by:
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Client:
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Table of Contents

1 Introduction and Conclusion..... 4

2 Test Summary for Band n66 (2110 - 2200MHz)..... 4

3 Test Summary for Band n70 (1995 - 2020MHz)..... 5

4 Client Information 6

5 Description of Equipment under Test and Variant Models..... 6

6 System Setup and Method 8

7 Measurement Procedures and Determination of Worst Case Modes 12

8 Occupied Bandwidth Data..... 13

9 Output Power and Peak / Average Ratio Data 15

10 Frequency Stability Data 19

11 Worst Case Conducted Spurious Emission Data 21

12 Worst Case Conducted Band Edge Emission Data 25

13 Worst Case Radiated Spurious Emissions Data 27

14 ANNEX A: Occupied Bandwidth Plots..... 29

15 ANNEX B: Output Power Plots 30

16 ANNEX C: Conducted Spurious Emission Plots..... 31

17 ANNEX D: Conducted Band Edge Plots..... 32

18 ANNEX E: Radiated Spurious Emission Plots 33

19 Revision History..... 34



1 Introduction and Conclusion

The tests indicated below were performed on the product described in section 5 The remaining test sections are the verbatim text from the actual data sheets used during the investigation. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

2 Test Summary for Band n66 (2110 - 2200MHz)

FCC Rule	Test Method	Test Description	Measured Value	Limit	Results
27.5(h)(j)	ANSI C63.26: 2015 Section 5.1	Frequency Ranges	20MHz BW Setting 2120 – 2190MHz 10MHz BW Setting 2115 – 2195MHz 5MHz BW Setting 2112.2 – 2197.5MHz	2110 – 2200MHz	Pass
2.1033(c)(4)	---	Modulation Type	QPSK, 16QAM, 64QAM, and 256QAM	Digital	Pass
27.50(d)(2)(ii)	ANSI C63.26: 2015 Section 5.2.4.2	Output Power	52.11dBm ¹	1640W/MHz EIRP (62.15dBm)	Pass
27.50(d)(5)	ANSI C63.26: 2015 Section 5.2.3.4	Peak to Average Power Ratio	8.56dB	13dB	Pass
2.1049(h)	ANSI C63.26: 2015 Section 5.4.4	99% Emission Bandwidth	20MHz BW Setting 19.12MHz 10MHz BW Setting 9.76MHz 5MHz BW Setting 4.52MHz	Stays within block	Pass
27.53(h)(3)	ANSI C62.26: 2015 Section 5.4.3	26dB Down Emission Bandwidth	20MHz BW Setting 21.92MHz 10MHz BW Setting 9.84 5MHz BW Setting 4.909MHz	Stays within block	Pass
27.54	ANSI C63.26: 2015 Section 5.6	Frequency Stability	Stays within block	Stays within block ²	Pass
27.53(h)(1)	ANSI C63.26: 2015 Section 5.7	Conducted Spurious Emissions	6.463GHz -13.95dBm	-13dBm ³	Pass ⁴
27.53(h)(1)	ANSI C63.26: 2015 Section 5.5	Radiated Spurious Emissions	16.730GHz 50.40dBuV/m	-13dBm 82.25dBuV/m @ 3m	Pass

1 Conducted RMS Measurement. EIRP is dependent on the antenna gain used in final installation and is not known at the time of this report.

2 A limit 1.5ppm was used during the testing in order to show that the emission remained within the block.

3 See KDB 662911 D01 Section 3 (a)(i) for summing emissions using a factor of $10\log_{10}(N_{ant})$ for “N” antenna ports.

4 Based on 1MHz RBW. In the 1MHz bands immediately outside the frequency block a RBW of at least 1% of the emission bandwidth was used per FCC Part 27.53(h)(3).

**3 Test Summary for Band n70 (1995 - 2020MHz)**

FCC Rule	Test Method	Test Description	Measured Value	Limit	Results
27.5(k) 27.5(j)	ANSI C63.26: 2015 Section 5.1	Frequency Ranges	20MHz BW Setting 2005 – 2010MHz 10MHz BW Setting 2000 – 2015MHz 5MHz BW Setting 1997.5 – 2017.5MHz	1995 – 2000MHz 2000 – 2020MHz	Pass
2.1033(c)(4)	---	Modulation Type	QPSK, 16QAM, 64QAM, and 256QAM	Digital	Pass
27.50(d)(2)(ii)	ANSI C63.26: 2015 Section 5.2.4.2	Output Power	52.25dBm ⁵	3280W EIRP (65.16dBm)	Pass
27.50(d)(5)	ANSI C63.26: 2015 Section 5.2.3.4	Peak to Average Power Ratio	7.82dB	13dB	Pass
2.1049(h)	ANSI C63.26: 2015 Section 5.4.4	99% Emission Bandwidth	20MHz BW Setting 19.12MHz 10MHz BW Setting 9.36MHz 5MHz BW Setting 4.52MHz	Stays within block	Pass
27.53(h)(3)	ANSI C63.26: 2015 Section 5.4.3	26dB Down Emission Bandwidth	20MHz BW Setting 20.24MHz 10MHz BW Setting 9.84MHz 5MHz BW Setting 4.90MHz	Stays within block	Pass
27.54	ANSI C63.26: 2015 Section 5.6	Frequency Stability	Stays within block	Stays within block ⁶	Pass
27.53(h)	ANSI C63.26: 2015 Section 5.7	Conducted Spurious Emissions	5.991GHz -13.72dBm	-13dBm ⁷	Pass ⁸
27.53(h)	ANSI C63.26: 2015 Section 5.5	Radiated Spurious Emissions	16.731GHz 51.81dBuV/	-13dBm 82.25dBuV/m @ 3m	Pass

5 Conducted RMS Measurement. EIRP is dependent on the antenna gain used in final installation and is not known at the time of this report.

6 A limit 1.5ppm was used during the testing in order to show that the emission remained within the block.

7 See KDB 662911 D01 Section 3 (a)(i) for summing emissions using a factor of $10\log_{10}(N_{ant})$ for “N” antenna ports.

8 Based on 1MHz RBW. In the 1MHz bands immediately outside the frequency block a RBW of at least 1% of the emission bandwidth was used per FCC Part 27.53(h)(3).



4 Client Information

This product was tested at the request of the following:

Client Information	
Client Name:	Fujitsu Network Communications
Address:	2801 Telcom Pkwy Richardson, TX 75082 USA
Contact:	Corey Dayton
Telephone:	1(972)479-2199
Email:	Corey.dayton@us.fujitsu.com
Manufacturer Information	
Manufacturer Name:	Fujitsu Network Communications
Manufacturer Address:	2801 Telcom Pkwy Richardson, TX 75082 USA

5 Description of Equipment under Test and Variant Models

Equipment Under Test	
Product Name	Dual Band RU for North America
Model Number	DB 5G RU
Serial Number	00018
Receive Date	2/8/2021
Test Start Date	2/8/2021
Test End Date	3/5/2021
Transmit Bands Supported	N66 (2110 – 2200MHz) N70 (1995 – 2020MHz)
Modulation Types Supported	QPSK, 16QAM, 64QAM, 256QAM
Device Received Condition	Good
Test Sample Type	Production
Rated Voltage	36 – 58VDC 36.5A 1300W
Software Used By EUT	0209
Description of Equipment Under Test (provided by client)	
<p>The product under test was the Dual Band RU for North America. It is a radio head unit supporting the 5GNR bands n66 and n70. The Dual Band RU for North America has 4 transmit ports that can operate in a correlated fashion. Photos of the device are included in a separate document.</p>	

5.1 Variant Models:

There were no variant models covered by this evaluation.



5.2 Supported Transmit Bands and Carrier Bandwidths (5G-NR):

5G-NR operation was supported in bands n66 and n70 in the downlink direction only. The table below outlines the specific bandwidths supported for QPSK, 16QAM, 64QAM, and 256QAM modulations. Testing was performed on the carrier frequencies as shown in the table.

Transmit Band	Carriers configuration	Center Freq. MHz
	Supported Bandwidths	Carrier (MHz)
N66 (2110 – 2200MHz)	5	2112.5
	5	2155
	5	2197.5
	10	2115
	10	2155
	10	2195
	20	2120
	20	2155
	20	2190
N70 (1995 - 2020MHz)	5	1997.5
	5	2007.5
	5	2017.5
	10	2000
	10	2007.5
	10	2015
	20	2005
	20	2007.5
	5	1997.5



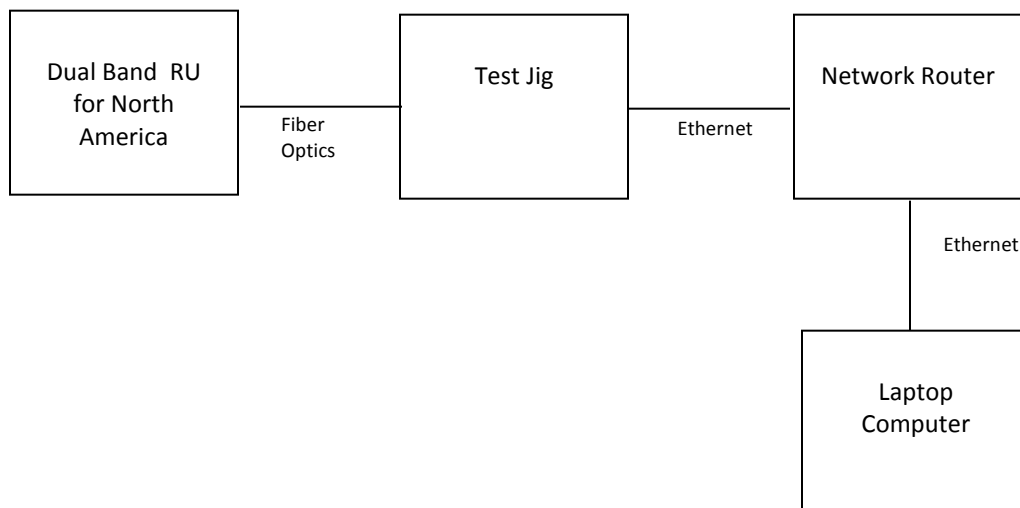
6 System Setup and Method

No.	Descriptions of EUT Exercising
1	<p>A laptop computer was used to send test commands to the Dual Band RU for North America that forced it to transmit the appropriate signal. Block diagrams are shown below for the conducted and radiated setups as well as for the connections to the test jig and computer.</p> <p>For conducted antenna port measurements three of the ports were terminated with 100W 50 Ohm terminators. The fourth port was connected to a spectrum analyzer or power meter through appropriate attenuation to protect the measurement equipment.</p> <p>For the radiated tests all four antenna ports were terminated with 100W 50Ohm terminators.</p>

Cables					
Qty	Description	Length	Shielding	Ferrites	Termination
1	DC Input Cable	10ft	Yes	None	-48VDC Power Source
1	Single Mode Fiber Optic Cable	50ft	None	None	Test Jig
1	AISG Cable	20ft	Yes	None	Un-Terminated

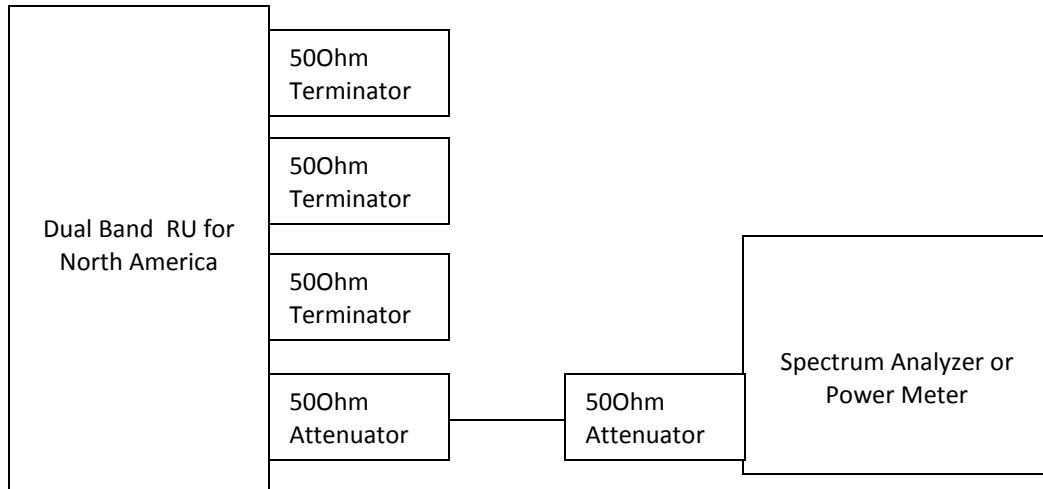
Support Equipment			
Description	Manufacturer	Model Number	Serial Number
Test Jig	Fujitsu Network Communications	TA22452-B101	JIG001
Network Router	Allied Telesis	AT-FS708	A043G1050000030
Laptop Computer	Fujitsu	Lifebook S	48416

6.1 EUT Block Diagram:





6.2 Block Diagram for Conducted Antenna Port Tests:



6.3 Block Diagram for Radiated Tests:



**6.4 Test Equipment Used (Conducted Antenna Port Tests):**

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
Vector Signal Generator	3884	Rohde&Schwarz	SMBV100A	9/22/2020	9/22/2021
Wideband Power Sensor	4022	Rohde&Schwarz	NRP-Z81	9/22/2020	9/22/2021
Spectrum Analyzer	3065	Rohde&Schwarz	FSP3	9/22/2020	9/22/2021
Spectrum Analyzer	3720	Rohde&Schwarz	FSEK0	10/13/2020	10/13/2021
Spectrum Analyzer	3981	Rohde&Schwarz	FSU8	9/22/2020	9/22/2021
Environmental Chamber	3581	Thermotron	Chamber 6	8/6/2020	8/6/2021
-48VDC Power Source	3389	Power Ten	P636-60125	Verify at Time of Use	Verify at Time of Use
Variable Power Supply	2399	Marconi	RHM200D50	Verify at Time of Use	Verify at Time of Use
Multimeter	3547	Fluke	115	8/5/2020	8/5/2021
Attenuator	Not Labeled	Bird	SA6S5W-10	Verify at Time of Use	Verify at Time of Use
Attenuator	0249	CentricRF	C18N1005-20	Verify at Time of Use	Verify at Time of Use
Power Divider	1799	Weinschel	1594	Verify at Time of Use	Verify at Time of Use
Network Analyzer	2538	Agilent	8753ES	2/8/2020	2/8/2021
High Pass Filter	7025	Wainwright	WHKX-2-2533.85-2710-18000-40SS	Verify at Time of Use	Verify at Time of Use

**6.5 Test Equipment Used (Radiated Tests):**

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	3900	Rohde&Schwarz	ESU40	10/5/2020	10/5/2021
Magnetic Loop Antenna	2366	ETS	6502	7/17/2020	7/17/2021
Bilog Antenna (JB6)	7085	SunAR	JB6	9/4/2020	9/4/2021
Horn Antenna	4001	ETS	3117	1/26/2021	1/26/2022
Horn Antenna (18-40GHz)	3779	ETS	3116c	7/23/2020	7/23/2021
Preamplifier (18-40GHz)	3921	Rohde & Schwarz	TS-PR40	12/21/2020	12/21/2021
Coaxial Cable (40GHz)	7020			12/21/2020	12/21/2021
Coaxial Cable (40GHz)	7021			12/21/2020	12/21/2021
System Controller	4096	ETS Lindgren	2090	Verify at Time of Use	Verify at Time of Use
System Controller	3957	Sunol Sciences	SC99V	Verify at Time of Use	Verify at Time of Use
Coaxial Cable	3074			12/21/2020	12/21/2021
3m Cable Preamplifier	3918	Rohde&Schwarz	TS-PR18	12/21/2020	12/21/2021
Coaxial Cable	2588			12/21/2020	12/21/2021
Coaxial Cable	2593			12/21/2020	12/21/2021
Coaxial Cable	2592			12/21/2020	12/21/2021
Coaxial Cable	3339			12/21/2020	12/21/2021

6.6 Software Utilized:

Name	Manufacturer	Version
EMC32	Rohde&Schwarz	Version 9.15.02
TILE7	ETS Lindgren	Version 7.0.6.545
GPIBShot	Rohde&Schwarz	Version 2.7.2
Power Viewer Plus	Rohde&Schwarz	Version 6.1



7 Measurement Procedures and Determination of Worst Case Modes

The occupied bandwidth, conducted spurious emissions, frequency stability and conducted band edge measurements were all performed with the Dual Band RU for North America connected to a spectrum analyzer. Measurements were performed per the procedures outlined in ANSI C63.26: 2015. See the summary tables for specific references to the appropriate sections that were used.

The output power and peak / average power ratio measurements were performed with the Dual Band RU for North America connected to a wideband power meter. This power meter used a complementary cumulative distribution function (CCDF) for the peak / average power ratio measurements since the signals being measured were noise-like”.

Frequency stability measurements were performed with the Dual Band RU for North America transmitting an unmodulated carrier wave signal which is the preferred method described in ANSI C63.26: 2015.

The four transmit ports onboard the Dual Band RU for North America were identical so all conducted measurements were performed on one port only. Pretesting was performed across all four ports and port A produced the highest output power in QPSK operation (see table below). Therefore, Port A was used for all conducted antenna port measurements.

TX Band	Modulation	BW Setting	Channel	Avg. Power (dBm) Port A	Avg. Power (dBm) Port B	Avg. Power (dBm) Port C	Avg. Power (dBm) Port D
Band 70	QPSK	5MHz	Mid	45.69	45.6	45.53	45.61
Band 66	QPSK	5MHz	Mid	46.83	46.67	46.58	46.71

Pre-Test output power study across all four conducted ports

Per KDB662911D01 for MIMO operation, a factor of $10\log_{10}(N_{ant})$ for “N” antenna ports was added to the conducted measurements in order to account for the multiple transmit ports. For 4 correlated output ports this factor was 6dB.

For conducted spurious emission measurements, testing was performed with all bandwidth and modulations supported. The worst case of these were included in the report (QPSK modulation)

For radiated spurious emission measurements, testing was performed with the bandwidth setting and modulation that produced the highest output power. The frequency spectrum was investigated from 9kHz to at least 10 times the highest frequency used or generated in the device or 40GHz (whichever was lower).



8 Occupied Bandwidth Data

TX Band	Modulation	BW Setting	Port	Channel	26dB BW	99% BW
Band 70	QPSK	20MHz	A	Low	19.76MHz	18.96MHz
				Mid	19.68MHz	18.96MHz
				High	19.76MHz	18.96MHz
		10MHz	A	Low	9.84MHz	9.30MHz
				Mid	9.84MHz	9.30MHz
				High	9.81MHz	9.30MHz
		5MHz	A	Low	4.88MHz	4.30MHz
				Mid	4.86MHz	4.32MHz
				High	4.90MHz	4.48MHz
Band 66	QPSK	20MHz	A	Low	19.68MHz	18.98MHz
				Mid	19.68MHz	18.96MHz
				High	19.68MHz	18.88MHz
		10MHz	A	Low	9.80MHz	9.32MHz
				Mid	9.80MHz	9.36MHz
				High	9.80MHz	9.32MHz
		5MHz	A	Low	4.88MHz	4.52MHz
				Mid	4.88MHz	4.52MHz
				High	4.88MHz	4.52MHz

Bandwidth Data, QPSK

TX Band	Modulation	BW Setting	Port	Channel	26dB BW	99% BW
Band 70	16QAM	20MHz	A	Low	19.68MHz	18.96MHz
				Mid	19.68MHz	18.96MHz
				High	19.68MHz	18.96MHz
		10MHz	A	Low	9.80MHz	9.28MHz
				Mid	9.80MHz	9.24MHz
				High	9.80MHz	9.28MHz
		5MHz	A	Low	4.86MHz	4.52MHz
				Mid	4.84MHz	4.52MHz
				High	4.84MHz	4.50MHz
Band 66	16QAM	20MHz	A	Low	19.76MHz	19.04MHz
				Mid	19.68MHz	19.04MHz
				High	19.76MHz	18.96MHz
		10MHz	A	Low	9.76MHz	9.28MHz
				Mid	9.84MHz	9.32MHz
				High	9.80MHz	9.24MHz
		5MHz	A	Low	4.86MHz	4.52MHz
				Mid	4.86MHz	4.52MHz
				High	4.86MHz	4.52MHz

Bandwidth Data, 16QAM



TX Band	Modulation	BW Setting	Port	Channel	26dB BW	99% BW
Band 70	64QAM	20MHz	A	Low	20.24MHz	19.04MHz
				Mid	20.16MHz	19.04MHz
				High	20.24MHz	19.12MHz
		10MHz	A	Low	9.80MHz	9.24MHz
				Mid	9.80MHz	9.24MHz
				High	9.80MHz	9.28MHz
		5MHz	A	Low	4.86MHz	4.50MHz
				Mid	4.84MHz	4.52MHz
				High	4.86MHz	4.50MHz
Band 66	64QAM	20MHz	A	Low	20.16MHz	19.12MHz
				Mid	20.16MHz	19.04MHz
				High	20.16MHz	19.12MHz
		10MHz	A	Low	9.24MHz	9.76MHz
				Mid	9.76MHz	9.24MHz
				High	9.76MHz	9.28MHz
		5MHz	A	Low	4.88MHz	4.52MHz
				Mid	4.86MHz	4.52MHz
				High	4.86MHz	4.52MHz

Bandwidth Data, 64QAM

TX Band	Modulation	BW Setting	Port	Channel	26dB BW	99% BW
Band 70	256QAM	20MHz	A	Low	20.24MHz	19.04MHz
				Mid	20.16MHz	19.04MHz
				High	20.16MHz	19.04MHz
		10MHz	A	Low	9.84MHz	9.32MHz
				Mid	9.84MHz	9.32MHz
				High	9.84MHz	9.36MHz
		5MHz	A	Low	4.84MHz	4.48MHz
				Mid	4.86MHz	4.50MHz
				High	4.84MHz	4.50MHz
Band 66	256QAM	20MHz	A	Low	20.24MHz	19.04MHz
				Mid	21.92MHz	19.04MHz
				High	20.16MHz	19.04MHz
		10MHz	A	Low	9.84MHz	9.28MHz
				Mid	9.84MHz	9.32MHz
				High	9.84MHz	9.32MHz
		5MHz	A	Low	4.90MHz	4.50MHz
				Mid	4.88MHz	4.50MHz
				High	4.88MHz	4.52MHz

Bandwidth Data, 256QAM

**9 Output Power and Peak / Average Ratio Data**

TX Band	Modulation	BW Setting	Port	Channel	Peak (dBm)	Average (dBm)	10log(N ports) (dB)	Total Avg. Power Across all Ports (dBm)	CCDF (0.1%)
Band 70	QPSK	20MHz	A	Low	53.38	45.4	6	51.40	7.44
				Mid	53.48	45.5	6	51.50	7.45
				High	53.38	45.4	6	51.40	7.44
		10MHz	A	Low	53.38	45.69	6	51.69	7.47
				Mid	53.18	45.63	6	51.63	7.40
				High	53.18	45.39	6	51.39	7.46
		5MHz	A	Low	53.78	46.13	6	52.13	7.45
				Mid	53.28	45.69	6	51.69	7.45
				High	52.68	44.88	6	50.88	7.44
Band 66	QPSK	20MHz	A	Low	53.89	45.98	6	51.98	7.48
				Mid	54.49	45.77	6	51.77	7.78
				High	54.28	45.57	6	51.57	7.44
		10MHz	A	Low	53.78	45.13	6	51.13	8.44
				Mid	55.79	45.72	6	51.72	8.56
				High	54.99	45.49	6	51.49	8.36
		5MHz	A	Low	54.88	45.82	6	51.82	8.43
				Mid	55.19	46.01	6	52.01	8.44
				High	55.09	46.11	6	52.11	8.46

Power Data, QPSK



TX Band	Modulation	BW Setting	Port	Channel	Peak (dBm)	Average (dBm)	10log(N ports) (dB)	Total Avg. Power Across all Ports (dBm)	CCDF (0.1%)
Band 70	16QAM	20MHz	A	Low	53.48	45.6	6	51.6	7.46
				Mid	53.28	45.4	6	51.4	7.45
				High	53.28	45.35	6	51.35	7.35
		10MHz	A	Low	53.78	45.78	6	51.78	7.45
				Mid	52.28	44.31	6	50.31	7.39
				High	51.38	43.6	6	49.6	7.4
		5MHz	A	Low	56.29	45.64	6	51.64	7.59
				Mid	53.28	45.66	6	51.66	7.5
				High	54.08	44.72	6	50.72	7.82
Band 66	16QAM	20MHz	A	Low	53.88	45.51	6	51.51	7.52
				Mid	54.79	45.27	6	51.27	7.79
				High	55.88	45.42	6	51.42	7.5
		10MHz	A	Low	53.28	44.65	6	50.65	8.38
				Mid	55.09	45.85	6	51.85	8.44
				High	53.38	44.63	6	50.63	7.35
		5MHz	A	Low	54.98	45.89	6	51.89	8.21
				Mid	55.19	46.01	6	52.01	8.32
				High	55.78	45.78	6	51.78	8.21

Power Data, 16QAM



TX Band	Modulation	BW Setting	Port	Channel	Peak (dBm)	Average (dBm)	10log(N ports) (dB)	Total Avg. Power Across all Ports (dBm)	CCDF (0.1%)
Band 70	64QAM	20MHz	A	Low	53.38	45.5	6	51.5	7.44
				Mid	53.18	45.48	6	51.48	7.5
				High	53.28	45.43	6	51.43	7.38
		10MHz	A	Low	53.28	45.59	6	51.59	7.45
				Mid	53.18	45.58	6	51.58	7.48
				High	53.08	45.34	6	51.34	7.36
		5MHz	A	Low	53.98	46.25	6	52.25	7.53
				Mid	52.08	44.29	6	50.29	7.44
				High	51.38	43.71	6	49.71	7.38
Band 66	64QAM	20MHz	A	Low	53.98	45.57	6	51.57	7.56
				Mid	56.79	45.26	6	51.26	7.65
				High	55.99	45.4	6	51.4	7.51
		10MHz	A	Low	54.78	45.26	6	51.26	8.37
				Mid	56.09	45.55	6	51.55	8.51
				High	55.28	45.83	6	51.83	8.28
		5MHz	A	Low	54.88	45.7	6	51.7	8.36
				Mid	55.19	45.88	6	51.88	8.24
				High	55.19	45.68	6	51.68	8.25

Power Data, 64QAM



TX Band	Modulation	BW Setting	Port	Channel	Peak (dBm)	Average (dBm)	10log(N ports) (dB)	Total Avg. Power Across all Ports (dBm)	CCDF (0.1%)
Band 70	256QAM	20MHz	A	Low	53.38	45.57	6	51.57	7.31
				Mid	53.38	45.46	6	51.46	7.52
				High	53.28	45.29	6	51.29	7.43
		10MHz	A	Low	53.68	45.71	6	51.71	7.38
				Mid	52.18	44.26	6	50.26	7.48
				High	51.58	43.6	6	49.6	7.4
		5MHz	A	Low	53.78	45.92	6	51.92	7.62
				Mid	53.28	45.6	6	51.6	7.57
				High	52.58	44.78	6	50.78	7.57
Band 66	256QAM	20MHz	A	Low	54.08	45.55	6	51.55	7.44
				Mid	55.76	45.59	6	51.59	7.7
				High	54.89	45.39	6	51.39	7.52
		10MHz	A	Low	54.88	45.26	6	51.26	8.41
				Mid	55.68	45.53	6	51.53	8.36
				High	55.28	45.79	6	51.79	8.23
		5MHz	A	Low	54.88	45.57	6	51.57	8.22
				Mid	55.09	45.78	6	51.78	8.26
				High	55.19	45.81	6	51.81	8.18

Power Data, 256QAM

**10 Frequency Stability Data**

Transmit Band: n66
Operating Frequency: 2,155,000,000 Hz
Reference Voltage: 48 VDC
Deviation Limit: 1.5 ppm

Voltage %	Voltage (VDC)	Temp (°C)	Measured Frequency (Hz)	Frequency Error (Hz)	Frequency Stability (ppm)	Limit (ppm)
100%	48	-40	2,154,999,995	-5	-0.0023202	1.50
100%	48	-30	2,154,999,995	-5	-0.0023202	1.50
100%	48	-20	2,154,999,995	-5	-0.0023202	1.50
100%	48	-10	2,155,000,000	0	0.0000000	1.50
100%	48	0	2,154,999,998	-2	-0.0009281	1.50
100%	48	10	2,154,999,998	-2	-0.0009281	1.50
100%	48	20	2,154,999,997	-3	-0.0013921	1.50
100%	48	30	2,154,999,998	-2	-0.0009281	1.50
100%	48	40	2,154,999,997	-3	-0.0013921	1.50
100%	48	50	2,154,999,995	-5	-0.0023202	1.50
100%	48	55	2,154,999,995	-5	-0.0023202	1.50
115%	55.2	20	2,154,999,997	-3	-0.0013921	1.50
85%	40.8	20	2,155,000,000	0	0.0000000	1.50
Manuf	58	20	2,155,000,000	0	0.0000000	1.50
Manuf	36	20	2,154,999,997	-3	-0.0013921	1.50

Frequency Stability, Band n66



Transmit Band: n70
Operating Frequency: 2,007,500,000 Hz
Reference Voltage: 48 VDC
Deviation Limit: 1.5 ppm

Voltage %	Voltage (VDC)	Temp (°C)	Measured Frequency (Hz)	Frequency Error (Hz)	Frequency Stability (ppm)	Limit (ppm)
100%	48	-40	2,007,499,998	-2	-0.0009963	1.50
100%	48	-30	2,007,499,997	-3	-0.0014944	1.50
100%	48	-20	2,007,499,995	-5	-0.0024907	1.50
100%	48	-10	2,007,499,997	-3	-0.0014944	1.50
100%	48	0	2,007,499,997	-3	-0.0014944	1.50
100%	48	10	2,007,499,997	-3	-0.0014944	1.50
100%	48	20	2,007,499,995	-5	-0.0024907	1.50
100%	48	30	2,007,500,000	0	0.0000000	1.50
100%	48	40	2,007,499,998	-2	-0.0009963	1.50
100%	48	50	2,007,499,998	-2	-0.0009963	1.50
100%	48	55	2,007,499,997	-3	-0.0014944	1.50
115%	55.2	20	2,007,499,998	-2	-0.0009963	1.50
85%	40.8	20	2,007,500,000	0	0.0000000	1.50
Manuf	58	20	2,007,499,998	-2	-0.0009963	1.50
Manuf	36	20	2,007,499,998	-2	-0.0009963	1.50

Frequency Stability, Band n70

**11 Worst Case Conducted Spurious Emission Data**

TX Band	Modulation	BW Setting	Channel	Spurious Frequency	RMS Amplitude (dBm)	10log(N ports) (dB)	Total RMS Across all Ports (dBm)	Limit (dBm)	Margin (dB)
Band n66	QPSK	20MHz	Low	6.342GHz	-24.5	6	-18.5	-13	5.50
			Mid	6.463GHz	-19.95	6	-13.95	-13	0.95
			High	6.345GHz	-24.16	6	-18.16	-13	5.16
Band n66	QPSK	10MHz	Low	6.342GHz	-24.51	6	-18.51	-13	5.51
			Mid	6.463GHz	-22.27	6	-16.27	-13	3.27
			High	6.345GHz	-24.17	6	-18.17	-13	5.17
Band n66	QPSK	5MHz	Low	6.335GHz	-30.64	6	-24.64	-13	11.64
			Mid	6.465GHz	-30.03	6	-24.03	-13	11.03
			High	6.590GHz	-29.19	6	-23.19	-13	10.19
Band n70	QPSK	20MHz	Low	6.001GHz	-29.43	6	-23.43	-13	10.43
			Mid	6.027GHz	-28.87	6	-22.87	-13	9.87
			High	6.030GHz	-29.12	6	-23.12	-13	10.12
Band n70	QPSK	10MHz	Low	6.342GHz	-24.38	6	-18.38	-13	5.38
			Mid	6.023GHz	-26.31	6	-20.31	-13	7.31
			High	6.047GHz	-25.41	6	-19.41	-13	6.41
Band n70	QPSK	5MHz	Low	5.992GHz	-22.51	6	-16.51	-13	3.51
			Mid	6.023GHz	-23.01	6	-17.01	-13	4.01
			High	6.052GHz	-22.86	6	-16.86	-13	3.86

Conducted Spurious Emissions, QPSK



TX Band	Modulation	BW Setting	Channel	Spurious Frequency	RMS Amplitude (dBm)	10log(N ports) (dB)	Total RMS Across all Ports (dBm)	Limit (dBm)	Margin (dB)
Band n66	16QAM	20MHz	Low	6.364GHz	-26.01	6	-20.01	-13	7.01
			Mid	6.465GHz	-22.89	6	-16.89	-13	3.89
			High	6.573GHz	-24.65	6	-18.65	-13	5.65
Band n66	16QAM	10MHz	Low	6.338GHz	-23.07	6	-17.07	-13	4.07
			Mid	6.465GHz	-21.18	6	-15.18	-13	2.18
			High	6.586GHz	-21.12	6	-15.12	-13	2.12
Band n66	16QAM	5MHz	Low	6.335GHz	-22.83	6	-16.83	-13	3.83
			Mid	6.436GHz	-30.43	6	-24.43	-13	11.43
			High	6.591GHz	-27.14	6	-21.14	-13	8.14
Band n70	16QAM	20MHz	Low	6.006GHz	-28.65	6	-22.65	-13	9.65
			Mid	6.020GHz	-29.51	6	-23.51	-13	10.51
			High	6.030GHz	-28.24	6	-22.24	-13	9.24
Band n70	16QAM	10MHz	Low	5.998GHz	-23.09	6	-17.09	-13	4.09
			Mid	6.023GHz	-26.35	6	-20.35	-13	7.35
			High	6.047GHz	-24.85	6	-18.85	-13	5.85
Band n70	16QAM	5MHz	Low	5.991GHz	-19.72	6	-13.72	-13	0.72
			Mid	6.023GHz	-22.89	6	-16.89	-13	3.89
			High	6.051GHz	-22.97	6	-16.97	-13	3.97

Conducted Spurious Emissions, 16QAM



TX Band	Modulation	BW Setting	Channel	Spurious Frequency	RMS Amplitude (dBm)	10log(N ports) (dB)	Total RMS Across all Ports (dBm)	Limit (dBm)	Margin (dB)
Band n66	64QAM	20MHz	Low	6.359GHz	-25.86	6	-19.86	-13	6.86
			Mid	6.467GHz	-22.86	6	-16.86	-13	3.86
			High	6.585GHz	-21.48	6	-15.48	-13	2.48
Band n66	64QAM	10MHz	Low	6.342GHz	-26.25	6	-20.25	-13	7.25
			Mid	6.463GHz	-21.53	6	-15.53	-13	2.53
			High	6.585GHz	-21.48	6	-15.48	-13	2.48
Band n66	64QAM	5MHz	Low	6.335GHz	-25.72	6	-19.72	-13	6.72
			Mid	6.463GHz	-21.34	6	-15.34	-13	2.34
			High	6.593GHz	-20.23	6	-14.23	-13	1.23
Band n70	64QAM	20MHz	Low	6.006GHz	-28.94	6	-22.94	-13	9.94
			Mid	6.025GHz	-29.43	6	-23.43	-13	10.43
			High	6.032GHz	-28.22	6	-22.22	-13	9.22
Band n70	64QAM	10MHz	Low	5.998GHz	-22.96	6	-16.96	-13	3.96
			Mid	6.025GHz	-28.51	6	-22.51	-13	9.51
			High	6.044GHz	-24.81	6	-18.81	-13	5.81
Band n70	64QAM	5MHz	Low	5.991GHz	-20.38	6	-14.38	-13	1.38
			Mid	6.023GHz	-24.94	6	-18.94	-13	5.94
			High	6.054GHz	-24.68	6	-18.68	-13	5.68

Conducted Spurious Emissions, 64QAM



TX Band	Modulation	BW Setting	Channel	Spurious Frequency	RMS Amplitude (dBm)	10log(N ports) (dB)	Total RMS Across all Ports (dBm)	Limit (dBm)	Margin (dB)
Band n66	256QAM	20MHz	Low	6.362GHz	-25.57	6	-19.57	-13	6.57
			Mid	6.463GHz	-23.18	6	-17.18	-13	4.18
			High	6.576GHz	-24.41	6	-18.41	-13	5.41
Band n66	256QAM	10MHz	Low	6.345GHz	-26.61	6	-20.61	-13	7.61
			Mid	6.465GHz	-22.28	6	-16.28	-13	3.28
			High	6.585GHz	-21.74	6	-15.74	-13	2.74
Band n66	256QAM	5MHz	Low	6.338GHz	-25.67	6	-19.67	-13	6.67
			Mid	6.465GHz	-21.61	6	-15.61	-13	2.61
			High	6.593GHz	-20.54	6	-14.54	-13	1.54
Band n70	256QAM	20MHz	Low	6.003GHz	-29.37	6	-23.37	-13	10.37
			Mid	6.021GHz	-29.09	6	-23.09	-13	10.09
			High	6.030GHz	-28.45	6	-22.45	-13	9.45
Band n70	256QAM	10MHz	Low	6.001GHz	-23.26	6	-17.26	-13	4.26
			Mid	6.025GHz	-26.16	6	-20.16	-13	7.16
			High	6.044GHz	-24.93	6	-18.93	-13	5.93
Band n70	256QAM	5MHz	Low	5.994GHz	-20.98	6	-14.98	-13	1.98
			Mid	6.463GHz	-22.24	6	-16.24	-13	3.24
			High	6.051GHz	-25.49	6	-19.49	-13	6.49

Conducted Spurious Emissions, 256QAM

**12 Worst Case Conducted Band Edge Emission Data**

TX Band	Modulation	BW Setting	Channel	Band Edge Frequency	RMS Amplitude (dBm)	10log(N ports) (dB)	Total RMS Across all Ports (dBm)	Limit (dBm)	Margin (dB)
Band n66	QPSK	20MHz	Low	2110MHz	-22.33	6	-16.33	-13	3.33
			High	2200MHz	-22.66	6	-16.66	-13	3.66
Band n66	QPSK	10MHz	Low	2110MHz	-20.4	6	-14.4	-13	1.40
			High	2200MHz	-19.46	6	-13.46	-13	0.46
Band n66	QPSK	5MHz	Low	2110MHz	-20.48	6	-14.48	-13	1.48
			High	2200MHz	-22.53	6	-16.53	-13	3.53
Band n70	QPSK	20MHz	Low	1995MHz	-26.83	6	-20.83	-13	7.83
			High	2020MHz	-24.12	6	-18.12	-13	5.12
Band n70	QPSK	10MHz	Low	1995MHz	-29.33	6	-23.33	-13	10.33
			High	2020MHz	-26.72	6	-20.72	-13	7.72
Band n70	QPSK	5MHz	Low	1995MHz	-23.83	6	-17.83	-13	4.83
			High	2020MHz	-24.18	6	-18.18	-13	5.18

Bandedge, QPSK

TX Band	Modulation	BW Setting	Channel	Band Edge Frequency	RMS Amplitude (dBm)	10log(N ports) (dB)	Total RMS Across all Ports (dBm)	Limit (dBm)	Margin (dB)
Band n66	16QAM	20MHz	Low	2110MHz	-23.94	6	-17.94	-13	4.94
			High	2200MHz	-22.74	6	-16.74	-13	3.74
Band n66	16QAM	10MHz	Low	2110MHz	-20.17	6	-14.17	-13	1.17
			High	2200MHz	-19.26	6	-13.26	-13	0.26
Band n66	16QAM	5MHz	Low	2110MHz	-20.75	6	-14.75	-13	1.75
			High	2200MHz	-22.21	6	-16.21	-13	3.21
Band n70	16QAM	20MHz	Low	1995MHz	-26.93	6	-20.93	-13	7.93
			High	2020MHz	-22.03	6	-16.03	-13	3.03
Band n70	16QAM	10MHz	Low	1995MHz	-27.71	6	-21.71	-13	8.71
			High	2020MHz	-28.56	6	-22.56	-13	9.56
Band n70	16QAM	5MHz	Low	1995MHz	-24.27	6	-18.27	-13	5.27
			High	2020MHz	-23.82	6	-17.82	-13	4.82

Bandedge, 16QAM



TX Band	Modulation	BW Setting	Channel	Band Edge Frequency	RMS Amplitude (dBm)	10log(N ports) (dB)	Total RMS Across all Ports (dBm)	Limit (dBm)	Margin (dB)
Band n66	64QAM	20MHz	Low	2110MHz	-23.6	6	-17.6	-13	4.60
			High	2200MHz	-23.45	6	-17.45	-13	4.45
Band n66	64QAM	10MHz	Low	2110MHz	-20.11	6	-14.11	-13	1.11
			High	2200MHz	-20.95	6	-14.95	-13	1.95
Band n66	64QAM	5MHz	Low	2110MHz	-20.21	6	-14.21	-13	1.21
			High	2200MHz	-23.12	6	-17.12	-13	4.12
Band n70	64QAM	20MHz	Low	1995MHz	-26.54	6	-20.54	-13	7.54
			High	2020MHz	-22.55	6	-16.55	-13	3.55
Band n70	64QAM	10MHz	Low	1995MHz	-28.06	6	-22.06	-13	9.06
			High	2020MHz	-24.88	6	-18.88	-13	5.88
Band n70	64QAM	5MHz	Low	1995MHz	-24.84	6	-18.84	-13	5.84
			High	2020MHz	-22.19	6	-16.19	-13	3.19

Bandedge, 64QAM

TX Band	Modulation	BW Setting	Channel	Band Edge Frequency	RMS Amplitude (dBm)	10log(N ports) (dB)	Total RMS Across all Ports (dBm)	Limit (dBm)	Margin (dB)
Band n66	256QAM	20MHz	Low	2110MHz	-21.45	6	-15.45	-13	2.45
			High	2200MHz	-29.18	6	-23.18	-13	10.18
Band n66	256QAM	10MHz	Low	2110MHz	-20.08	6	-14.08	-13	1.08
			High	2200MHz	-21.49	6	-15.49	-13	2.49
Band n66	256QAM	5MHz	Low	2110MHz	-20.46	6	-14.46	-13	1.46
			High	2200MHz	-22.15	6	-16.15	-13	3.15
Band n70	256QAM	20MHz	Low	1995MHz	-25.14	6	-19.14	-13	6.14
			High	2020MHz	-23.74	6	-17.74	-13	4.74
Band n70	256QAM	10MHz	Low	1995MHz	-20.41	6	-14.41	-13	1.41
			High	2020MHz	-25.24	6	-19.24	-13	6.24
Band n70	256QAM	5MHz	Low	1995MHz	-29.32	6	-23.32	-13	10.32
			High	2020MHz	-24.88	6	-18.88	-13	5.88

Bandedge, 256QAM

**13 Worst Case Radiated Spurious Emissions Data**

Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
50.423889	40.75	82.25	41.50	120.000	100.0	V	183.0	15.2
58.668889	35.94	82.25	46.31	120.000	105.2	V	192.0	14.8
3932.000000	36.59	82.25	45.66	1000.000	100.0	V	280.0	8.3
4915.000000	43.73	82.25	38.52	1000.000	100.0	V	338.0	10.0
5577.500000	41.40	82.25	40.85	1000.000	133.0	V	290.0	10.6
16732.500000	42.80	82.25	39.45	1000.000	100.0	V	336.0	25.1

Band 66, Low Channel

Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
49.292222	40.47	82.25	41.78	120.000	99.7	V	174.0	15.4
58.722778	38.80	82.25	43.45	120.000	99.8	V	99.0	14.8
4915.000000	34.28	82.25	47.97	1000.000	211.0	V	330.0	10.0
5577.000000	36.99	82.25	45.26	1000.000	291.0	V	12.0	10.6
16731.000000	43.35	82.25	38.90	1000.000	217.0	V	0.0	25.1

Band 66 Mid Channel

Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
50.423889	40.88	82.25	41.37	120.000	100.2	V	210.0	15.2
58.668889	36.37	82.25	45.88	120.000	107.4	V	90.0	14.8
4915.000000	32.00	82.25	50.25	1000.000	211.0	V	328.0	10.0
5576.500000	44.96	82.25	37.29	1000.000	134.0	V	288.0	10.6
16730.000000	50.40	82.25	31.85	1000.000	100.0	V	12.0	25.2

Band 66 High Channel



Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
49.669445	41.05	82.25	41.20	120.000	100.0	V	109.0	15.3
58.722778	39.15	82.25	43.10	120.000	100.0	V	117.0	14.8
4915.000000	32.02	82.25	50.23	1000.000	222.0	V	185.0	10.0
5576.500000	43.91	82.25	38.34	1000.000	132.0	V	291.0	10.6
16730.000000	46.16	82.25	36.09	1000.000	221.0	V	313.0	25.2

Band 70 Low Channel

Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
58.722778	38.10	82.25	44.15	120.000	106.7	V	192.0	14.8
78.284445	35.82	82.25	46.43	120.000	99.9	V	174.0	15.1
3932.000000	37.02	82.25	45.23	1000.000	100.0	V	287.0	8.3
4915.000000	43.23	82.25	39.02	1000.000	100.0	V	335.0	10.0
5577.000000	44.02	82.25	38.23	1000.000	289.0	V	19.0	10.6

Band 70 Mid Channel

Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
49.615556	42.61	82.25	39.64	120.000	105.7	V	52.0	15.3
52.040556	40.17	82.25	42.08	120.000	105.0	V	101.0	15.0
4915.000000	42.72	82.25	39.53	1000.000	100.0	V	334.0	10.0
5577.000000	45.66	82.25	36.59	1000.000	291.0	V	20.0	10.6
16731.000000	51.81	82.25	30.44	1000.000	164.0	V	0.0	25.1

Band 70 High Channel



14 ANNEX A: Occupied Bandwidth Plots



15 ANNEX B: Output Power Plots



16 ANNEX C: Conducted Spurious Emission Plots



17 ANNEX D: Conducted Band Edge Plots



18 ANNEX E: Radiated Spurious Emission Plots



19 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	3/15/2021	104509072LEX-004	BCT	BZ	Original Issue