



REGULATORY COMPLIANCE TEST REPORT

FCC Part 24E, 27C

IC RSS 130 Issue 2, RSS 133 Issue 6

Report No.: KUMU06-U4 Rev A

Company: Kumu Networks Inc

Model: Relay 2.0



REGULATORY COMPLIANCE TEST REPORT

Company: Kumu Networks Inc Relay

Model: Relay 2.0

Standard: FCC Part 24E, 27C & IC RSS 130, RSS 133

Test Report Serial No.: KUMU06-U4 Rev A

This report supersedes: NONE

Applicant: Kumu Networks Inc
960 Hamlin Court
Sunnyvale, California 94089
USA

Issue Date: 14th September 2020

This Test Report is Issued Under the Authority of:

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MiCOM Labs is an ISO 17025 Accredited Testing Laboratory

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1. ACCREDITATION, LISTINGS & RECOGNITION

1.1. TESTING ACCREDITATION

MiCOM Labs, Inc. is an accredited Electrical testing laboratory per the international standard ISO/IEC 17025:2017. The company is accredited by the American Association for Laboratory Accreditation (A2LA) www.a2la.org test laboratory number 2381.01. MiCOM Labs test schedule is available at the following URL; <http://www.a2la.org/scopepdf/2381-01.pdf>



1.2. RECOGNITION

MiCOM Labs, Inc has widely recognized wireless testing and certification capabilities. In addition to being recognized for Testing and Certification under Phase 2 agreements with Canada, Europe and Japan, our international recognition includes Conformity Assessment Body designation under Phase 1 agreements with APEC MRA countries. MiCOM Labs test reports are accepted globally.

Country	Recognition Body	Status	MRA Phase	Identification No.
USA	Federal Communications Commission (FCC)	TCB	-	US0159 Test Firm Designation#: US1084
Canada	Industry Canada (ISED)	FCB	APEC MRA 2	US0159 ISED#: 4143A
Japan	MIC (Ministry of Internal Affairs and Communication)	CAB	Japan MRA 2	RCB 210
	Japan Approvals Institute for Telecommunication Equipment (JATE)			
	VCCI			
Europe	European Commission	NB	EU MRA 2	NB 2280
Mexico	Instituto Federal de Telecomunicaciones (IFT)	CAB	Mexico MRA 1	US0159
Australia	Australian Communications and Media Authority (ACMA)	CAB	APEC MRA 1	US0159
Hong Kong	Office of the Telecommunication Authority (OFTA)			
Korea	Ministry of Information and Communication Radio Research Laboratory (RRL)			
Singapore	Infocomm Development Authority (IDA)			
Taiwan	National Communications Commission (NCC) Bureau of Standards, Metrology and Inspection (BSMI)			
Vietnam	Ministry of Communication (MIC)			

EU MRA – European Union Mutual Recognition Agreement

NB – Notified Body

APEC MRA – Asia Pacific Economic Community Mutual Recognition Agreement. Recognition agreement under which test lab is accredited to regulatory standards of the APEC member countries.

MRA Phase I - recognition for product testing

Phase II – recognition for both product testing and certification

1.3. PRODUCT CERTIFICATION

MiCOM Labs, Inc. is an accredited Product Certification Body per the international standard ISO/IEC 17065:2012. The company is accredited by the American Association for Laboratory Accreditation (A2LA) www.a2la.org test laboratory number 2381.02. MiCOM Labs test schedule is available at the following URL; <http://www.a2la.org/scopepdf/2381-02.pdf>



Accredited Product Certification Body

A2LA has accredited

MiCOM LABS

Pleasanton, CA

This product certification body is accredited in accordance with the recognized International Standard ISO/IEC 17065:2012 Requirements for bodies certifying products, processes and services. This product certification body also meets the A2LA R322 – Specific Requirements – Notified Body Accreditation Requirements and A2LA R308 – Specific Requirements – ISO-IEC 17065 - Telecommunication Certification Body Accreditation Program. This accreditation demonstrates technical competence for a defined scope and the operation of a management system.

Presented this 24th day of February 2020



Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 2381.02
Valid to November 30, 2021



For the product certification schemes to which this accreditation applies, please refer to the organization's Product Certification Scope of Accreditation.

United States of America – Telecommunication Certification Body (TCB)

Industry Canada – Certification Body, CAB Identifier – US0159

Europe – Notified Body (NB), NB Identifier - 2280

Japan – Recognized Certification Body (RCB), RCB Identifier - 210

2. DOCUMENT HISTORY

Document History		
Revision	Date	Comments
Draft	4 th September 2020	
Rev A	14 th September 2020	Initial Release

In the above table the latest report revision will replace all earlier versions.

3. TEST RESULT CERTIFICATE

Manufacturer: Kumu Networks Inc
960 Hamlin Court
Sunnyvale
California 94089 USA

Tested By: MiCOM Labs, Inc.
575 Boulder Court
Pleasanton
California 94566 USA

Model: KR5192

Telephone: +1 925 462 0304
Fax: +1 925 462 0306

Equipment Type: Backhaul Relay

S/N's: #3

Test Date(s): 11th May – 31st August 2020

Website: www.micomlabs.com

STANDARD(S)

FCC Part 24E, 27C & IC RSS 130, RSS 133

TEST RESULTS

EQUIPMENT COMPLIES

MiCOM Labs, Inc. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.

Notes:

1. This document reports conditions under which testing was conducted and the results of testing performed.
2. Details of test methods used have been recorded and kept on file by the laboratory.
3. Test results apply only to the item(s) tested.

Approved & Released for MiCOM Labs, Inc. by:



Graeme Grieve
Quality Manager MiCOM Labs, Inc.

Gordon Hurst
President & CEO MiCOM Labs, Inc.

4. REFERENCES AND MEASUREMENT UNCERTAINTY

4.1. Normative References

REF.	PUBLICATION	YEAR	TITLE
I	A2LA	October 2019	R105 - Requirement's When Making Reference to A2LA Accreditation Status
II	ETSI TR 100 028	2001-12	Parts 1 and 2 Electromagnetic compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics
III	M 3003	Edition 3 Nov.2012	Expression of Uncertainty and Confidence in Measurements
IV	KDB 412172 D01	August 7, 2015	EIRP and ERP are similarly defined as the product of the power supplied to the antenna and the antenna gain (when the power and gain are represented in linear terms). The primary difference is that for ERP the antenna gain is expressed relative to an ideal half-wave dipole antenna, whereas with EIRP the antenna gain is expressed relative to an ideal (theoretical) isotropic antenna. EIRP and ERP can be expressed mathematically as described in the following sections.1
V	RSS-130 Issue 2	February 2019	RSS-130 Equipment Operating in the Frequency Bands 617-652 MHz, 663-698 MHz, 698-756 MHz and 777-787 MHz
VI	RSS-133 Issue 6, Amendment 1	January 2018	RSS-133 2GHz Personal Communications Services. This Radio Standards Specification (RSS) sets out the requirements for certification of transmitters and receivers used in radio communications systems to provide Personal Communications Services (PCS) in the bands 1850-1915 MHz and 1930-1995 MHz.
VII	FCC Part 24E	August 25, 2020	Subpart E—Broadband PCS; This subpart sets out the regulations governing the licensing and operations of personal communications services authorized in the 1850-1910 and 1930-1990 MHz bands.
VIII	FCC Part 27	August 25, 2020	Miscellaneous Wireless Communications Services This part states the conditions under which spectrum is made available and licensed for the provision of wireless communications services in the following bands. --- (2) 746-758 MHz, 775-788 MHz, and 805-806 MHz. (3) 698-746 MHz. ----

4.2. Test and Uncertainty Procedure

Conducted and radiated emission measurements were conducted in accordance with American National Standards Institute ANSI C63.4, listed in the Normative References section of this report.

Measurement uncertainty figures are calculated in accordance with ETSI TR 100 028 Parts 1 and 2.

Measurement uncertainties stated are based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95 % in accordance with UKAS document M 3003 listed in the Normative References section of this report.

5. PRODUCT DETAILS AND TEST CONFIGURATIONS

5.1. Technical Details

Details	Description
Purpose:	Test of the Kumu Networks Inc Relay 2.0 to requirements of FCC Part 24E & IC RSS-133 Issue 6.
Applicant:	Kumu Networks Inc 960 Hamlin Court Sunnyvale California 94089 USA
Manufacturer:	Same as Applicant
Laboratory performing the tests:	MiCOM Labs, Inc. 575 Boulder Court Pleasanton California 94566 USA
Test report reference number:	KUMU06 - Relay 2.0 FCC
Date EUT received:	11 May 2020
Standard(s) applied:	FCC Part 24E & IC RSS 133
Dates of test (from - to):	11 th May – 31 st August 2020
No of Units Tested:	1
Product Family Name:	Relay
Model(s):	KR5192
Equipment Secondary Function(s):	None
Type of Technology:	LTE Backhaul Relay
Installation type:	Fixed installation
Construction/Location for Use:	Outdoor
Rated Input Voltage and Current:	120VAC, 0.8A -48VDC, 1.9A
Operating Temperature Range:	-40°C - 55°C
Equipment Dimensions:	18 / 10.5 / 6 in
Weight:	33 Lb
Hardware Rev:	Rev-1
Software Rev:	de30b91

5.2. Scope Of Test Program

Kumu Networks Inc KR5192

The scope of the test program was to test the Kumu Networks Self Backhaul UE Relay configurations in the specified frequency bands for compliance against the following IMT Cellular Network specifications:

FCC Part 24 Subpart E – Broadband PCS

This subpart sets out the regulations governing the licensing and operations of personal communications services authorized in the 1850-1910 and 1930-1990 MHz bands.

FCC Part 27 - Miscellaneous Wireless Communications Services

This part states the conditions under which spectrum is made available and licensed for the provision of wireless communications services in the following bands... 746-758 MHz, 775-788 MHz, and 805-806 MHz, 698-746 MHz.

Industry Canada RSS-130 Issue 2

This Radio Standards Specification (RSS) sets out the requirements for equipment operating in the Frequency Bands 617-652 MHz, 663-698 MHz, 698-756 MHz and 777-787 MHz bands.

Industry Canada RSS-133 Issue 6

This Radio Standards Specification (RSS) sets out the requirements for certification of transmitters and receivers used in radio communications systems to provide Personal Communications Services (PCS) in the bands 1850-1915 MHz and 1930-1995 MHz.

5.3. Equipment Model(s) and Serial Number(s)

Type (EUT/ Support)	Equipment Description (Including Brand Name)	Mfr	Model No.	Serial No.
EUT	Relay 2.0 Backhaul	Kumu Networks	KR5192	3
Support	Laptop	Dell	D620	-

5.4. Antenna Details

No Antennas were included in this test program

5.5. Cabling and I/O Ports

Port Type	Port Description	Qty	Screened (Yes/ No)	Length
RJ45	Ethernet	1	N	>10m
SMA	LTE Ports	2	Y	
TNC	Data	4	Y	
DC Leads	DC Power	1	N	
AC Power Triax	AC	1	N	

5.6. Test Configurations

Test configurations are as noted in the test results.

LTE Band No.	Bandwidth (MHz)	Channels No.'s	Frequencies (MHz)
2	5	18625, 18900, 19175	1852.5, 1880.0, 1907.5
	10	18650, 18900, 19150	1855.0, 1880.0, 1905.0
	15	18675, 18900, 19125	1857.5, 1880.0, 1902.5
	20	18700, 18900, 19100	1860.0, 1880.0, 1900.0

5.7. Equipment Modifications

The following modifications were required to bring the equipment into compliance:

1. NONE

5.8. Deviations from the Test Standard

The following deviations from the test standard were required in order to complete the test program:

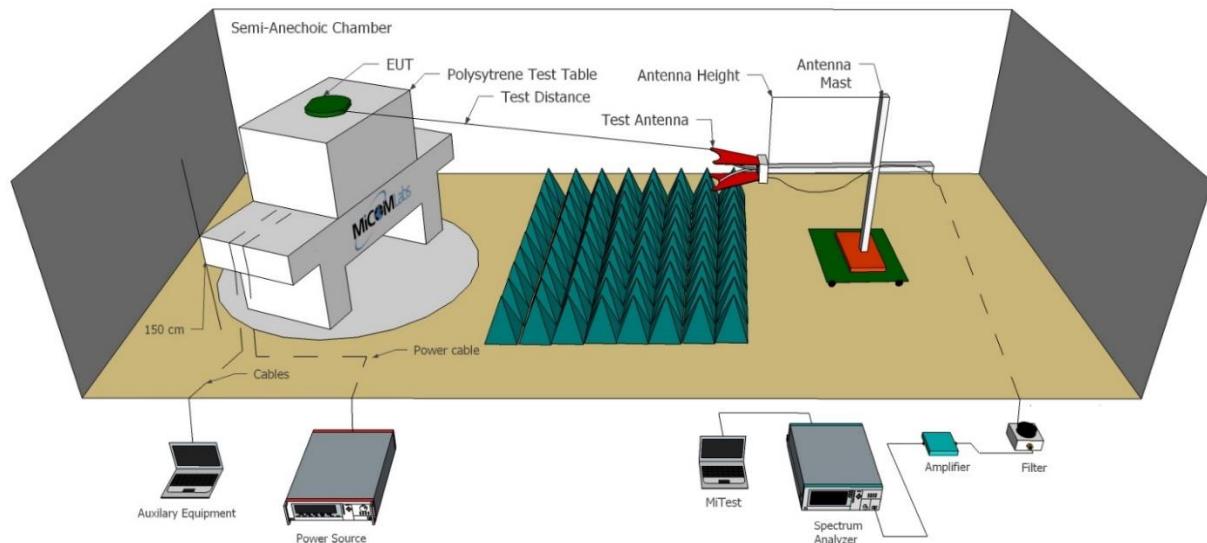
1. NONE

6. TEST EQUIPMENT CONFIGURATION(S)

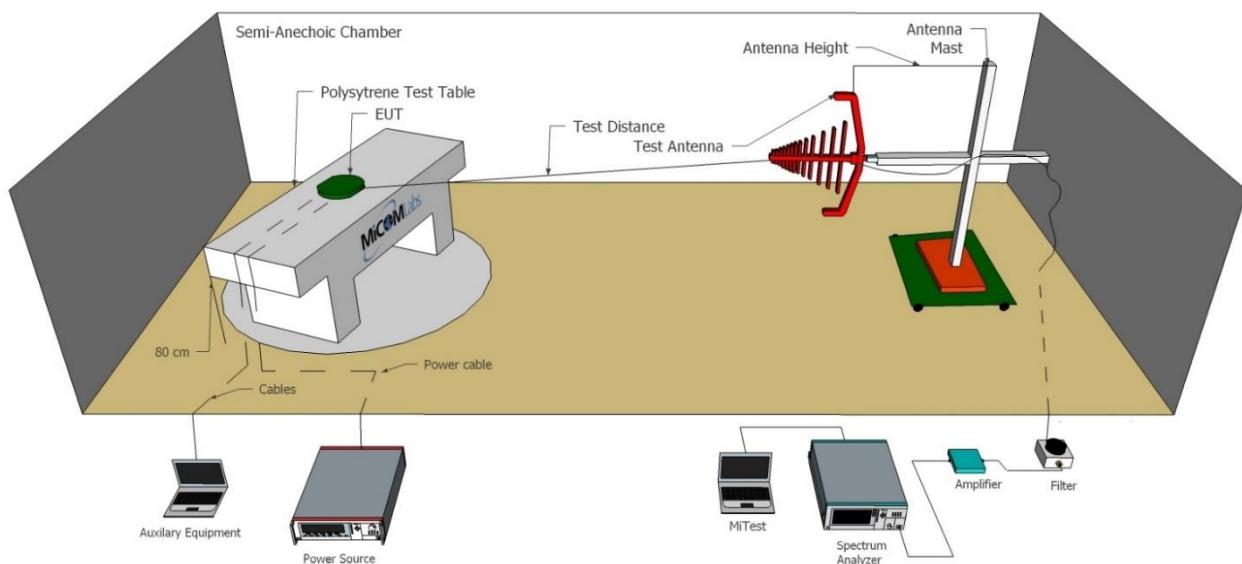
6.1. Radiated Emissions - 3m Chamber

The following tests were performed using the radiated test set-up shown in the diagram below. Radiated emissions above and below 1GHz.

Radiated Emissions Above 1GHz Test Setup



Radiated Emissions Below 1GHz Test Setup



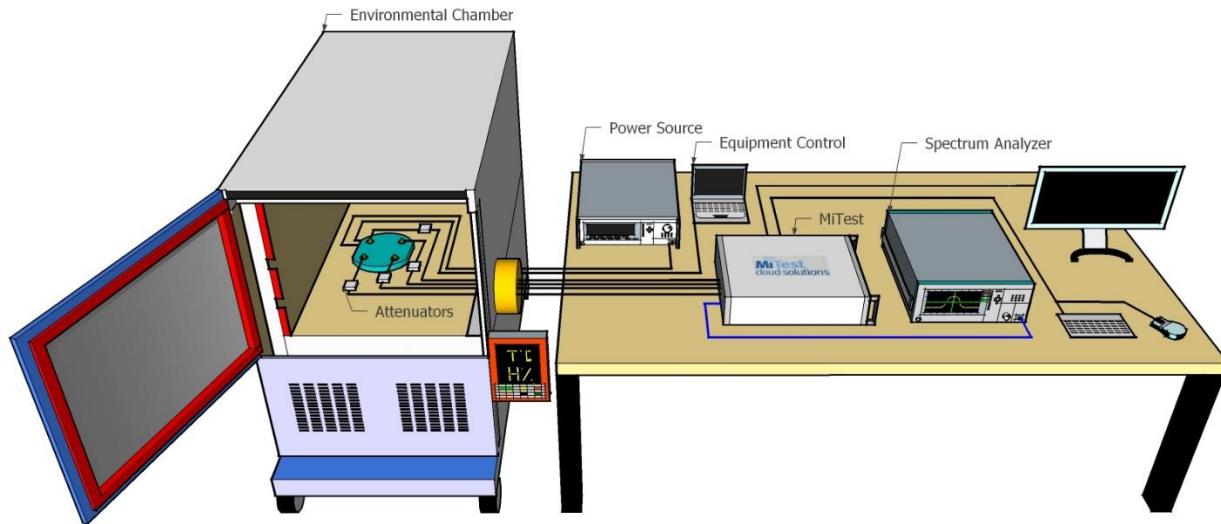


Title: Kumu Networks Inc Relay 2.0
To: FCC Part 24E, 27C & IC RSS 130, RSS 133
Serial #: KUMU06-U2 Rev A

Asset#	Description	Manufacturer	Model#	Serial#	Calibration Due Date
170	Video System Controller for Semi Anechoic Chamber	Panasonic	WV-CU101	04R08507	Not Required
287	Rohde & Schwarz 40 GHz Receiver	Rhode & Schwarz	ESIB40	100201	8 Oct 2020
338	Sunol 30 to 3000 MHz Antenna	Sunol	JB3	A052907	4 Apr 2021
397	Amp 10 - 2500MHz	MiCOM Labs	Amp 10 - 2500 MHz	NA	6 Sep 2020
399	ETS 1-18 GHz Horn Antenna	ETS	3117	00154575	12 Oct 2020
406	Amplifier for Radiated Emissions	MiCOM Labs	40dB 1 to 18GHz Amp	0406	9 Sep 2020
410	Desktop Computer	Dell	Inspiron 620	WS38	Not Required
411	Mast/Turntable Controller	Sunol Sciences	SC98V	060199-1D	Not Required
412	USB to GPIB Interface	National Instruments	GPIB-USB HS	11B8DC2	Not Required
413	Mast Controller	Sunol Science	TWR95-4	030801-3	Not Required
414	DC Power Supply 0-60V	HP	6274	1029A01285	Cal when used
415	Turntable Controller	Sunol Sciences	Turntable Controller	None	Not Required
416	Gigabit ethernet filter	ETS-Lingren	Gigafoil 260366	None	Not Required
447	MiTest Rad Emissions Test Software	MiCOM	Rad Emissions Test Software Version 1.0	447	Not Required
462	Schwarzbeck cable from Antenna to Amplifier.	Schwarzbeck	AK 9513	462	5 Sep 2020
463	Schwarzbeck cable from Amplifier to Bulkhead.	Schwarzbeck	AK 9513	463	5 Sep 2020
464	Schwarzbeck cable from Bulkhead to Receiver	Schwarzbeck	AK 9513	464	9 Sep 2020
469	Low pass filter	Mini Circuit	SLP-1000	None	3 Sep 2020
480	Cable - Bulkhead to Amp	SRC Haverhill	157-3050360	480	9 Sep 2020
481	Cable - Bulkhead to Receiver	SRC Haverhill	151-3050787	481	9 Sep 2020
510	Barometer/Thermometer	Control Company	68000-49	170871375	20 Dec 2020
518	Cable - Amp to Antenna	SRC Haverhill	157-3051574	518	9 Sep 2020

6.2. Conducted

MiTest Automated Test System



A full system calibration was performed on the test station and any resulting system losses (or gains) were considered in the production of all final measurement data.

Asset#	Description	Manufacturer	Model#	Serial#	Calibration Due Date
#3 SA	MiTest Box to SA	Fairview Microwave	SCA1814-0101-72	#3 SA	9 Sep 2020
#3P1	EUT to MiTest box port 1	Fairview Microwave	SCA1814-0101-72	#3P1	9 Sep 2020
#3P2	EUT to MiTest box port 2	Fairview Microwave	SCA1814-0101-72	#3P2	9 Sep 2020
#3P3	EUT to MiTest box port 3	Fairview Microwave	SCA1814-0101-72	#3P3	9 Sep 2020
#3P4	EUT to MiTest box port 4	Fairview Microwave	SCA1812-0101-72	#3P4	9 Sep 2020
249	Thermocouple; Resistance Thermometer	Thermotronics	GR2105-02	9340 #2	30 Oct 2020
287	Rohde & Schwarz 40 GHz Receiver	Rhode & Schwarz	ESIB40	100201	8 Oct 2020
378	Rohde & Schwarz 40 GHz Receiver with Generator	Rhode & Schwarz	ESIB40	100107/040	12 Oct 2020
398	MiTest RF Conducted Test Software	MiCOM	MiTest ATS	Version 4.1	Not Required
405	DC Power Supply 0-60V	Agilent	6654A	MY4001826	Cal when used
408	USB to GPIB interface	National Instruments	GPIB-USB HS	14C0DE9	Not Required



Title: Kumu Networks Inc Relay 2.0
To: FCC Part 24E, 27C & IC RSS 130, RSS 133
Serial #: KUMU06-U2 Rev A

440	USB Wideband Power Sensor	Boonton	55006	9178	22 Sep 2020
441	USB Wideband Power Sensor	Boonton	55006	9179	20 Sep 2020
442	USB Wideband Power Sensor	Boonton	55006	9181	19 Sep 2020
445	PoE Injector	D-Link	DPE-101GL	QTAH1E2000625	Not Required
461	Spectrum Analyzer	Agilent	E4440A	MY46185537	20 Sep 2020
510	Barometer/Thermometer	Control Company	68000-49	170871375	20 Dec 2020
515	MiTest Cloud Solutions RF Test Box	MiCOM	2nd Gen with DFS	515	9 Sep 2020
534	Power Sensor 50 GHz - 70dBm to +20dBm	R&S	NRP50SN	1419.0093K02-100888-SB	26 Feb 2021
75	Environmental Chamber	Thermatron	SE-300-2-2	27946	20 Feb 2021

7. MEASUREMENT AND PRESENTATION OF TEST DATA

The measurement and graphical data presented in this test report was generated automatically using state-of-the-art technology creating an easy to read report structure. Numerical measurement data is separated from supporting graphical data (plots) through hyperlinks. Numerical measurement data can be reviewed without scrolling through numerous graphical pages to arrive at the next data matrix.

Plots have been relegated into the Appendix 'Graphical Data'.

Test and report automation was performed by [MiTest](#). [MiTest](#) is an automated test system developed by MiCOM Labs. [MiTest](#) is the first cloud based modular test system enabling end-to-end automation of regulatory compliance testing for conducted RF testing.



The MiCOM Labs "[MiTest](#)" Automated Test System" (Patent Pending)

8. TEST SUMMARY

Test Header	Result	Data Link
Transmitter Test Parameters		
Output Power	Complies	View Data
Peak-to-average power ratio	Complies	View Data
Frequency Stability	Complies	View Data
Emission Bandwidth	Complies	View Data
Out of Band Emissions	Complies	View Data
Receiver Spurious Emissions	Complies	View Data

9. TEST RESULTS

9.1. Conducted Output Power

Conducted Test Conditions for Output Power			
Standard:	FCC Part 24E, 27C IC RSS-130 RSS-133	Ambient Temp. (°C):	24.0 - 27.5
Test Heading:	Output Power	Rel. Humidity (%):	32 - 45
Standard Section(s):	FCC 24E: 24.232 (d) FCC 27C: 27.50 (b), (c) RSS-130: 4.6, RSS-133: 6.4	Pressure (mBars):	999 - 1001
Reference Document(s):	See Normative References		

Test Procedure for Output Power

With reference to the test configuration identified in Section 8.1 Conducted Test Setup the EUT was set to transmit on the appropriate centre frequency of the selected frequency band and bandwidth. Output Power was measured on each of the active chain(s) (antenna outputs) using a power sensor connected to each antenna terminal.

Testing was performed under ambient conditions.

Limits Output Power - Band 2:

FCC 24E: (c) Mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

RSS-133: 6.4 Transmitter Output Power and Equivalent Isotropically Radiated Power:

The equivalent isotropically radiated power (e.i.r.p.) for transmitters shall not exceed the limits given in SRSP-510. Moreover, base station transmitters operating in the band 1930-1995 MHz shall not have output power exceeding 100 watts

Limits Output Power - Band 12,13, 17:

FCC 27.50

(b) (10) Portable stations (hand-held devices) transmitting in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands are limited to 3 watts ERP.
(c)(9) Fixed and mobile stations in the 600 MHz uplink band are limited to 3 watts ERP.

RSS-130: 4.6 Transmitter Output Power and Effective Radiated Power:

For base and fixed equipment other than fixed subscriber equipment, refer to SRSP-518 for the e.i.r.p. limits.

Band 2: Output Power

Equipment Configuration for Output Power

Band:	2	Duty Cycle (%):	99.00
Modulation:	QPSK	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48.0	Tested By:	SB
Engineering Test Notes:	None		

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	O/P Power (dBm)	EIRP (dBm)	ERP	EIRP Limit (dBm)	Margin (dB)
5	18625	1852.5	0	1	23.47	23.47	21.32	33.00	-9.53
			0	8	24.02	24.02	21.87	33.00	-8.98
			0	25	22.65	22.65	20.50	33.00	-10.35
	18900	1880	0	1	22.65	22.65	20.50	33.00	-10.35
			0	8	23.35	23.35	21.20	33.00	-9.65
			0	25	22.19	22.19	20.04	33.00	-10.81
	19175	1907.5	0	1	23.06	23.06	20.91	33.00	-9.94
			0	8	23.40	23.40	21.25	33.00	-9.60
			0	25	22.57	22.57	20.42	33.00	-10.43

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	O/P Power (dBm)	EIRP (dBm)	ERP	EIRP Limit (dBm)	Margin (dB)
10	18650	1855	0	1	23.21	23.21	21.06	33.00	-9.79
			0	12	24.05	24.05	21.90	33.00	-8.95
			0	50	23.55	23.55	21.40	33.00	-9.45
	18900	1880	0	1	23.32	23.32	21.17	33.00	-9.68
			0	12	23.31	23.31	21.16	33.00	-9.69
			0	50	22.61	22.61	20.46	33.00	-10.39
	19150	1905	0	1	23.30	23.30	21.15	33.00	-9.70
			0	12	23.48	23.48	21.33	33.00	-9.52
			0	50	22.75	22.75	20.60	33.00	-10.25

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	O/P Power (dBm)	EIRP (dBm)	ERP	EIRP Limit (dBm)	Margin (dB)
15	18675	1857.5	0	1	24.12	24.12	21.97	33.00	-8.88
			0	16	23.65	23.65	21.50	33.00	-9.35
			0	75	23.24	23.24	21.09	33.00	-9.76
	18900	1880	0	1	23.65	23.65	21.50	33.00	-9.35
			0	16	23.40	23.40	21.25	33.00	-9.60
			0	75	22.78	22.78	20.63	33.00	-10.22
	19125	1902.5	0	1	23.56	23.56	21.41	33.00	-9.44
			0	16	23.30	23.30	21.15	33.00	-9.70
			0	75	23.12	23.12	20.97	33.00	-9.88

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	O/P Power (dBm)	EIRP (dBm)	ERP	EIRP Limit (dBm)	Margin (dB)
20	18700	1860	0	1	24.10	24.10	21.95	33.00	-8.90
			0	18	24.02	24.02	21.87	33.00	-8.98
			0	100	23.57	23.57	21.42	33.00	-9.43
	18900	1880	0	1	23.96	23.96	21.81	33.00	-9.04
			0	18	23.61	23.61	21.46	33.00	-9.39
			0	100	22.88	22.88	20.73	33.00	-10.12
	19100	1900	0	1	23.58	23.58	21.43	33.00	-9.42
			0	18	23.28	23.28	21.13	33.00	-9.72
			0	100	23.80	23.80	21.65	33.00	-9.20

Traceability to Industry Recognized Test Methodologies

Work Instruction: WI-01 MEASURING RF OUTPUT POWER

Uncertainty: 1.33 dB



Title: Kumu Networks Inc Relay 2.0
To: FCC Part 24E, 27C & IC RSS 130, RSS 133
Serial #: KUMU06-U2 Rev A

Equipment Configuration for Output Power

Band:	2	Duty Cycle (%):	99.00
Modulation:	16 QAM	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48.0	Tested By:	SB
Engineering Test Notes:	None		

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	O/P Power (dBm)	EIRP (dBm)	ERP	EIRP Limit (dBm)	Margin (dB)
5	18625	1852.5	0	1					
			0	8	22.97	22.97	20.82	33.00	-10.03
			0	25	21.74	21.74	19.59	33.00	-11.26
	18900	1880	0	1					
			0	8	23.39	23.39	21.24	33.00	-9.61
			0	25	21.14	21.14	18.99	33.00	-11.86
	19175	1907.5	0	1					
			0	8	22.34	22.34	20.19	33.00	-10.66
			0	25	21.33	21.33	19.18	33.00	-11.67

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	O/P Power (dBm)	EIRP (dBm)	ERP	EIRP Limit (dBm)	Margin (dB)
10	18650	1855	0	1					
			0	12	23.11	23.11	20.96	33.00	-9.89
			0	50	23.06	23.06	20.91	33.00	-9.94
	18900	1880	0	1					
			0	12	22.54	22.54	20.39	33.00	-10.46
			0	50	21.71	21.71	19.56	33.00	-11.29
	19150	1905	0	1					
			0	12	22.55	22.55	20.40	33.00	-10.45
			0	50	21.75	21.75	19.60	33.00	-11.25

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	O/P Power (dBm)	EIRP (dBm)	ERP	EIRP Limit (dBm)	Margin (dB)
15	18675	1857.5	0	1					
			0	16	22.68	22.68	20.53	33.00	-10.32
			0	75	22.11	22.11	19.96	33.00	-10.89
	18900	1880	0	1					
			0	16	22.37	22.37	20.22	33.00	-10.63
			0	75	21.85	21.85	19.70	33.00	-11.15
	19125	1902.5	0	1					
			0	16	22.14	22.14	19.99	33.00	-10.86
			0	75	22.01	22.01	19.86	33.00	-10.99

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	O/P Power (dBm)	EIRP (dBm)	ERP	EIRP Limit (dBm)	Margin (dB)
20	18700	1860	0	1					
			0	18	23.21	23.21	21.06	33.00	-9.79
			0	100	22.59	22.59	20.44	33.00	-10.41
	18900	1880	0	1					
			0	18	22.84	22.84	20.69	33.00	-10.16
			0	100	22.00	22.00	19.85	33.00	-11.00
	19100	1900	0	1					
			0	18	22.81	22.81	20.66	33.00	-10.19
			0	100	22.14	22.14	19.99	33.00	-10.86

Traceability to Industry Recognized Test Methodologies

Work Instruction: WI-01 MEASURING RF OUTPUT POWER

Uncertainty: 1.33 dB

Band 12: Output Power

Equipment Configuration for Output Power

Band:	12	Duty Cycle (%):	99.00
Modulation:	QPSK	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48.0	Tested By:	JRK
Engineering Test Notes: None			

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	O/P Power (dBm)	EIRP (dBm)	ERP	EIRP Limit (dBm)	Margin (dB)
5	23035	701.5	0	1	22.05	22.05	19.90	34.77	-12.72
			0	8	22.53	22.53	20.38	34.77	-12.24
			0	25	21.43	21.43	19.28	34.77	-13.34
	23095	707.5	0	1	23.2	23.2	21.05	34.77	-11.57
			0	8	23.44	23.44	21.29	34.77	-11.33
			0	25	21.98	21.98	19.83	34.77	-12.79
	23155	713.5	24	1	23.37	23.37	21.22	34.77	-11.40
			17	8	23.52	23.52	21.37	34.77	-11.25
			0	25	22.36	22.36	20.21	34.77	-12.41

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	O/P Power (dBm)	EIRP (dBm)	ERP	EIRP Limit (dBm)	Margin (dB)
10	23060	704	0	1	22.48	20.33	34.77	-12.29	22.48
			0	12	22.66	20.51	34.77	-12.11	22.66
			0	50	22.22	20.07	34.77	-12.55	22.22
	23095	707.5	0	1	23.07	20.92	34.77	-11.70	23.07
			0	12	23.37	21.22	34.77	-11.40	23.37
			0	50	22.34	20.19	34.77	-12.43	22.34
	23130	711	49	1	23.81	21.66	34.77	-10.96	23.81
			38	12	23.72	21.57	34.77	-11.05	23.72
			0	50	22.31	20.16	34.77	-12.46	22.31

Equipment Configuration for Output Power

Band:	12	Duty Cycle (%):	99.00
Modulation:	16 QAM	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48.0	Tested By:	JRK
Engineering Test Notes:	None		

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	O/P Power (dBm)	EIRP (dBm)	ERP	EIRP Limit (dBm)	Margin (dB)
5	23035	701.5	0	1					
			0	8	21.4	21.4	19.25	34.77	-13.37
			0	25	20.27	20.27	18.12	34.77	-14.50
	23095	707.5	0	1					
			17	8	21.64	21.64	19.49	34.77	-13.13
			0	25	20.89	20.89	18.74	34.77	-13.88
	23155	713.5	0	1					
			0	8	22.44	22.44	20.29	34.77	-12.33
			0	25	21.22	21.22	19.07	34.77	-13.55

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	O/P Power (dBm)	EIRP (dBm)	ERP	EIRP Limit (dBm)	Margin (dB)
10	23060	704	0	1					
			0	12	21.39	21.39	19.24	34.77	-13.38
			0	50	20.73	20.73	18.58	34.77	-14.04
	23095	707.5	0	1					
			38	12	22.2	22.2	20.05	34.77	-12.57
			0	50	20.97	20.97	18.82	34.77	-13.80
	23130	711	0	1					
			0	12	22.69	22.69	20.54	34.77	-12.08
			0	50	21.08	21.08	18.93	34.77	-13.69

Band 13: Output Power

Equipment Configuration for Output Power

Band:	12	Duty Cycle (%):	99.00
Modulation:	QPSK	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48.0	Tested By:	JRK
Engineering Test Notes:	None		

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	O/P Power (dBm)	EIRP (dBm)	ERP	EIRP Limit (dBm)	Margin (dB)
5	23205	779.5	0	1	22.61	22.61	20.46	34.77	-12.16
			0	8	23.07	23.07	20.92	34.77	-11.70
			0	25	21.59	21.59	19.44	34.77	-13.18
	23230	782.0	0	1	22.07	22.07	19.92	34.77	-12.70
			0	8	22.78	22.78	20.63	34.77	-11.99
			0	25	21.64	21.64	19.49	34.77	-13.13
	23255	784.5	24	1	22.22	22.22	20.07	34.77	-12.55
			17	8	22.24	22.24	20.09	34.77	-12.53
			0	25	21.45	21.45	19.3	34.77	-13.32

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	O/P Power (dBm)	EIRP (dBm)	ERP	EIRP Limit (dBm)	Margin (dB)
10	23230	782.0	0	1	23.05	23.05	20.9	34.77	-11.72
			0	12	22.77	22.77	20.62	34.77	-12.00
			0	50	21.74	21.74	19.59	34.77	-13.03

Equipment Configuration for Output Power

Band:	13	Duty Cycle (%):	99.00
Modulation:	16 QAM	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48.0	Tested By:	JRK
Engineering Test Notes:	None		

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	O/P Power (dBm)	EIRP (dBm)	ERP	EIRP Limit (dBm)	Margin (dB)
5	23205	779.5	0	1					
			0	8	22.18	22.18	20.03	34.77	-12.59
			0	25	20.6	20.6	18.45	34.77	-14.17
	23230	782.0	0	1					
			0	8	21.76	21.76	19.61	34.77	-13.01
			0	25	20.59	20.59	18.44	34.77	-14.18
	23255	784.5	24	1					
			17	8	21.9	21.9	19.75	34.77	-12.87
			0	25	20.58	20.58	18.43	34.77	-14.19

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	O/P Power (dBm)	EIRP (dBm)	ERP	EIRP Limit (dBm)	Margin (dB)
10	23230	782.0	0	1					
			0	12	21.81	21.81	19.66	34.77	-12.96
			0	50	20.74	20.74	18.59	34.77	-14.03

Band 17: Output Power

Equipment Configuration for Output Power

Band:	17	Duty Cycle (%):	99.00
Modulation:	QPSK	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48.0	Tested By:	JRK
Engineering Test Notes: None			

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	O/P Power (dBm)	EIRP (dBm)	ERP	EIRP Limit (dBm)	Margin (dB)
5	23755	706.5	0	1	22.66	22.66	20.51	34.77	-12.11
			0	8	23.37	23.37	21.22	34.77	-11.40
			0	25	22.03	22.03	19.88	34.77	-12.74
	23790	710.0	0	1	22.65	22.65	20.5	34.77	-12.12
			0	8	23.18	23.18	21.03	34.77	-11.59
			0	25	21.83	21.83	19.68	34.77	-12.94
	23825	713.5	24	1	23.23	23.23	21.08	34.77	-11.54
			17	8	23.35	23.35	21.2	34.77	-11.42
			0	25	22.25	22.25	20.1	34.77	-12.52

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	O/P Power (dBm)	EIRP (dBm)	ERP	EIRP Limit (dBm)	Margin (dB)
10	23780	709	0	1	23.11	23.11	20.96	34.77	-11.66
			0	12	23.22	23.22	21.07	34.77	-11.55
			0	50	22.18	22.18	20.03	34.77	-12.59
	2395	710.0	0	1	23.16	23.16	21.01	34.77	-11.61
			0	12	23.17	23.17	21.02	34.77	-11.60
			0	50	22.2	22.2	20.05	34.77	-12.57
	23800	711	49	1	23.69	23.69	21.54	34.77	-11.08
			38	12	23.57	23.57	21.42	34.77	-11.20
			0	50	22.26	22.26	20.11	34.77	-12.51

Equipment Configuration for Output Power

Band:	17	Duty Cycle (%):	99.00
Modulation:	16 QAM	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48.0	Tested By:	JRK
Engineering Test Notes:	None		

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	O/P Power (dBm)	EIRP (dBm)	ERP	EIRP Limit (dBm)	Margin (dB)
5	23755	706.5	0	1					
			0	8	22.34	22.34	20.19	34.77	-12.43
			0	25	21.09	21.09	18.94	34.77	-13.68
	23790	710.0	0	1					
			0	8	22.21	22.21	20.06	34.77	-12.56
			0	25	20.92	20.92	18.77	34.77	-13.85
	23825	713.5	0	1					
			17	8	22.36	22.36	20.21	34.77	-12.41
			0	25	21.21	21.21	19.06	34.77	-13.56

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	O/P Power (dBm)	EIRP (dBm)	ERP	EIRP Limit (dBm)	Margin (dB)
10	23780	709	0	1					
			0	12	22.25	22.25	20.1	34.77	-12.52
			0	50	21.13	21.13	18.98	34.77	-13.64
	23790	710.0	0	1					
			38	12	22.07	22.07	19.92	34.77	-12.70
			0	50	21.26	21.26	19.11	34.77	-13.51
	23800	711	0	1					
			38	12	22.5	22.5	20.35	34.77	-12.27
			0	50	21.27	21.27	19.12	34.77	-13.50

9.2. Peak to Average Power Ratio

Conducted Test Conditions for Peak-to-average power ratio			
Standard:	FCC Part 24E, 27C IC RSS-130 RSS-133	Ambient Temp. (°C):	24.0 - 27.5
Test Heading:	Peak-to-average power ratio	Rel. Humidity (%):	32 - 45
Standard Section(s):	FCC 24E: 24.232 (d) FCC 27C: 27.50 (b), (c) RSS-130: 4.6, RSS-133: 6.4	Pressure (mBars):	999 - 1001
Reference Document(s):	See Normative References		

Test Procedure for Peak-to-average power ratio

With reference to the test configuration identified in Section 8.1 Conducted Test Setup the EUT was set to transmit on the appropriate centre frequency of the selected frequency band and bandwidth.

Testing was performed under ambient conditions.

Band 2:

Limits Peak-to-average power ratio

FCC 24E (d) Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (e) of this section. In both instances, equipment employed must be authorized in accordance with the provisions of §24.51. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

RSS-133: 6.4 In addition, the transmitter's peak-to-average power ratio (PAPR) shall not exceed 13 dB for more than 0.1% of the time using a signal corresponding to the highest PAPR during periods of continuous transmission.

Band 12, 13, 17:

Limits Peak-to-average power ratio

FCC 27C (b) For transmissions in the 746-757 and 776-787 MHz bands, licensees may employ equipment operating in compliance with either the measurement techniques described in paragraph (b)(11) of this section or a Commission-approved average power technique. In both instances, equipment employed must be authorized in accordance with the provisions of §27.51.

(c) Licensees may employ equipment operating in compliance with either the measurement techniques described in paragraph (b)(11) of this section or a Commission-approved average power technique. In both instances, equipment employed must be authorized in accordance with the provisions of §27.51.

RSS-133: 4.6 In addition, the transmitter's peak-to-average power ratio (PAPR) shall not exceed 13 dB for more than 0.1% of the time using a signal corresponding to the highest PAPR during periods of continuous transmission.

Band 2: Peak to Average Ratio

Equipment Configuration for Peak-to-Average Power Ratio (PAPR)

Band:	2	Duty Cycle (%):	99.00
Modulation:	QPSK	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48.0	Tested By:	SB
Engineering Test Notes:	None		

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	PAPR (dB)	Limit (dB)	Margin (dB)
5	18625	1852.5					
			0	8	4.26	13.0	-8.74
	18900	1880		25	6.04	13.0	-6.96
			0	8	4.43	13.0	-8.57
	19175	1907.5		25	5.97	13.0	-7.03
			0	8	3.13	13.0	-9.87
			0	25	4.84	13.0	-8.16

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	PAPR (dB)	Limit (dB)	Margin (dB)
10	18650	1855					
			0	12	4.80	13.0	-8.2
	18900	1880		50	6.04	13.0	-6.96
			0	12	4.90	13.0	-8.1
	19150	1905		50	6.33	13.0	-6.67
			0	12	4.25	13.0	-7.51
			0	50	5.49	13.0	-8.2



Title: Kumu Networks Inc Relay 2.0
To: FCC Part 24E, 27C & IC RSS 130, RSS 133
Serial #: KUMU06-U2 Rev A

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	PAPR (dB)	Limit (dB)	Margin (dB)
15	18675	1857.5					
			0	16	6.92	13.0	-6.08
			0	75	6.80	13.0	-6.2
	18900	1880					
			0	16	7.20	13.0	-5.8
			0	75	6.80	13.0	-6.2
	19125	1902.5					
			0	16	6.91	13.0	-6.09
			0	75	6.18	13.0	-6.82

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	PAPR (dB)	Limit (dB)	Margin (dB)
20	18700	1860					
			0	18	10.33	13.0	-2.67
			0	100	8.09	13.0	-4.91
	18900	1880					
			0	18	10.17	13.0	-2.83
			0	100	7.19	13.0	-5.81
	19100	1900					
			0	18	12.06	13.0	-0.94
			0	100	7.04	13.0	-5.96

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-01 MEASURING OUTPUT-POWER
Uncertainty:	1.33 dB



Title: Kumu Networks Inc Relay 2.0
To: FCC Part 24E, 27C & IC RSS 130, RSS 133
Serial #: KUMU06-U2 Rev A

Equipment Configuration for Peak-to-Average Power Ratio (PAPR)

Band:	2	Duty Cycle (%):	99.00
Modulation:	16 QAM	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48.0	Tested By:	SB
Engineering Test Notes:	None		

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	PAPR (dB)	Limit (dB)	Margin (dB)
5	18625	1852.5					
			0	8	5.13	13.0	-7.87
			0	25	6.84	13.0	-6.16
	18900	1880					
			0	8	5.20	13.0	-7.8
			0	25	6.98	13.0	-6.02
	19175	1907.5					
			0	8	4.16	13.0	-8.84
			0	25	5.82	13.0	-7.18

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	PAPR (dB)	Limit (dB)	Margin (dB)
10	18650	1855					
			0	12	5.78	13.0	-7.22
			0	50	7.39	13.0	-5.61
	18900	1880					
			0	12	5.83	13.0	-7.17
			0	50	6.92	13.0	-6.08
	19150	1905					
			0	12	5.14	13.0	-7.86
			0	50	6.87	13.0	-6.13

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	PAPR (dB)	Limit (dB)	Margin (dB)
15	18675	1857.5					
			0	16	7.95	13.0	-5.05
			0	75	7.92	13.0	-5.08
	18900	1880					
			0	16	8.58	13.0	-4.42
			0	75	8.13	13.0	-4.87
	19125	1902.5					
			0	16	8.49	13.0	-4.51
			0	75	7.62	13.0	-5.38

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	PAPR (dB)	Limit (dB)	Margin (dB)
20	18700	1860					
			0	18	9.00	13.0	-4.00
			0	100	8.51	13.0	-4.49
	18900	1880					
			0	18	11.68	13.0	-1.32
			0	100	8.81	13.0	-4.19
	19100	1900					
			0	18	11.46	13.0	-1.54
			0	100	8.66	13.0	-4.34

Traceability to Industry Recognized Test Methodologies

Work Instruction: WI-01 MEASURING OUTPUT-POWER

Uncertainty: 1.33 dB

Band 12: Peak to Average Ratio

Equipment Configuration for Peak-to-Average Power Ratio (PAPR)

Band:	12	Duty Cycle (%):	99.00
Modulation:	QPSK	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48.0	Tested By:	JRK
Engineering Test Notes:	None		

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	PAPR (dB)	Limit (dB)	Margin (dB)
5	23035	701.5					
			0	8	6.42	13.0	-6.58
			0	25	6.94	13.0	-6.06
	23095	707.5	0				
			0	8	4.9	13.0	-8.10
			0	25	6.28	13.0	-6.72
	23155	713.5					
			0	8	5.55	13.0	-7.45
			0	25	5.99	13.0	-7.01

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	PAPR (dB)	Limit (dB)	Margin (dB)
10	23060	704.0					
			0	12	6.01	13.0	-6.99
			0	50	6.38	13.0	-6.62
	23095	707.5					
			0	12	5.09	13.0	-7.91
			0	50	6.43	13.0	-6.57
	23130	711.0					
			0	12	5.18	13.0	-7.82
			0	50	6.45	13.0	-6.55

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-01 MEASURING OUTPUT-POWER
Uncertainty:	1.33 dB



Title: Kumu Networks Inc Relay 2.0
To: FCC Part 24E, 27C & IC RSS 130, RSS 133
Serial #: KUMU06-U2 Rev A

Equipment Configuration for Peak-to-Average Power Ratio (PAPR)

Band:	12	Duty Cycle (%):	99.00
Modulation:	16 QAM	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48.0	Tested By:	JRK
Engineering Test Notes:	None		

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	PAPR (dB)	Limit (dB)	Margin (dB)
5	23035	701.5					
			0	8	7.33	13.0	-5.67
	23095	707.5	0	25	7.98	13.0	-5.02
			0	8	5.69	13.0	-7.31
			0	25	7.7	13.0	-5.30
	23155	713.5					
			0	8	6.54	13.0	-6.46
			0	25	7.52	13.0	-5.48

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	PAPR (dB)	Limit (dB)	Margin (dB)
10	23060	704.0					
			0	12	7.48	13.0	-5.52
			0	50	7.6	13.0	-5.40
	23095	707.5					
			0	12	6.28	13.0	-6.72
			0	50	7.31	13.0	-5.69
	23130	711.0					
			0	12	6.41	13.0	-6.59
			0	50	7.43	13.0	-5.57

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-01 MEASURING OUTPUT-POWER
Uncertainty:	1.33 dB

Band 13: Peak to Average Ratio

Equipment Configuration for Peak-to-Average Power Ratio (PAPR)

Band:	13	Duty Cycle (%):	99.00
Modulation:	QPSK	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48.0	Tested By:	SB
Engineering Test Notes:	None		

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	PAPR (dB)	Limit (dB)	Margin (dB)
5	23205	779.5					
			0	8	5.43	13.0	-7.57
			0	25	6.73	13.0	-6.27
	23230	782.0					
			0	8	5.86	13.0	-7.14
			0	25	6.73	13.0	-6.27
	23255	784.5					
			0	8	5.35	13.0	-7.65
			0	25	6.47	13.0	-6.53

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	PAPR (dB)	Limit (dB)	Margin (dB)
10	23230	782.0					
			0	12	5.69	13.0	-7.31
			0	50	6.41	13.0	-6.59

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-01 MEASURING OUTPUT-POWER
Uncertainty:	1.33 dB



Title: Kumu Networks Inc Relay 2.0
To: FCC Part 24E, 27C & IC RSS 130, RSS 133
Serial #: KUMU06-U2 Rev A

Equipment Configuration for Peak-to-Average Power Ratio (PAPR)

Band:	13	Duty Cycle (%):	99.00
Modulation:	16 QAM	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48.0	Tested By:	JRK
Engineering Test Notes:	None		

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	PAPR (dB)	Limit (dB)	Margin (dB)
5	23205	779.5					
			0	8	6.15	13.0	-6.85
			0	25	7.84	13.0	-5.16
	23230	782.0					
			0	8	6.61	13.0	-6.39
			0	25	7.93	13.0	-5.07
	23255	784.5					
			0	8	6.32	13.0	-6.68
			0	25	7.66	13.0	-5.34

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	PAPR (dB)	Limit (dB)	Margin (dB)
10	23230	782.0					
			0	12	7.01	13.0	-5.99
			0	50	7.57	13.0	-5.43

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-01 MEASURING OUTPUT-POWER
Uncertainty:	1.33 dB

Band 17: Peak to Average Ratio

Equipment Configuration for Peak-to-Average Power Ratio (PAPR)

Band:	17	Duty Cycle (%):	99.00
Modulation:	QPSK	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48.0	Tested By:	JRK
Engineering Test Notes:	None		

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	PAPR (dB)	Limit (dB)	Margin (dB)
5	23755	706.5					
			0	8	5.07	13.0	-7.93
			0	25	6.32	13.0	-6.68
	23790	710.0	0	1		13.0	
			0	8	5.11	13.0	-7.89
			0	25	6.56	13.0	-6.44
	23825	713.5					
			0	8	5.77	13.0	-7.23
			0	25	6.18	13.0	-6.82

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	PAPR (dB)	Limit (dB)	Margin (dB)
10	23780	709					
			0	12	5.09	13.0	-7.91
			0	50	6.63	13.0	-6.37
	23790	710					
			0	12	5.16	13.0	-7.84
			0	50	6.49	13.0	-6.51
	23800	711					
			0	12	5.27	13.0	-7.73
			0	50	6.24	13.0	-6.76

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-01 MEASURING OUTPUT-POWER
Uncertainty:	1.33 dB

Equipment Configuration for Peak-to-Average Power Ratio (PAPR)

Band:	17	Duty Cycle (%):	99.00
Modulation:	16 QAM	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48VDC	Tested By:	JRK
Engineering Test Notes:	None		

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	PAPR (dB)	Limit (dB)	Margin (dB)
5	23755	706.5					
			0	8	5.82	13.0	-7.18
			0	25	7.74	13.0	-5.26
	23790	710.0					
			0	8	6.07	13.0	-6.93
			0	25	7.96	13.0	-5.04
	23825	713.5					
			0	8	6.71	13.0	-6.29
			0	25	7.53	13.0	-5.47

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	PAPR (dB)	Limit (dB)	Margin (dB)
10	23780	709					
			0	12	6.14	13.0	-6.86
			0	50	7.14	13.0	-5.86
	23790	710					
			0	12	6.37	13.0	-6.63
			0	50	8.11	13.0	-4.89
	23800	711					
			0	12	6.46	13.0	-6.54
			0	50	7.84	13.0	-5.16

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-01 MEASURING OUTPUT-POWER
Uncertainty:	1.33 dB

9.3. Frequency Stability

Conducted Test Conditions for Frequency Stability			
Standard:	FCC Part 24E, 27C IC RSS-130, RSS-133	Ambient Temp. (°C):	20.0 - 24.5
Test Heading:	Frequency Stability	Rel. Humidity (%):	32 - 45
Standard Section(s):	FCC 24E: 24.235, FCC 27C: 27.54 RSS-130: 4.5 RSS-133: 6.3	Pressure (mBars):	999 - 1001
Reference Document(s):	See Normative References		

Test Procedure for Frequency Stability

The center frequency is the center of the channel declared by the manufacturer as part of the declared channel plan(s). Centre

Testing was performed over environmental extremes of voltage and temperature and results reported are for a single antenna port. Test configuration and setup used for the measurement was per the Conducted Test Set-up specified in this document.

Limits Frequency Stability

Band 2:

FCC 24E: The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

RSS-133: The carrier frequency shall not depart from the reference frequency, in excess of ± 2.5 ppm for mobile stations and ± 1.0 ppm for base stations. In lieu of meeting the above stability values, the test report may show that the frequency stability is sufficient to ensure that the emission bandwidth stays within the operating frequency block when tested to the temperature and supply voltage variations specified in RSS-Gen.

Band 12,13,17:

FCC 27C: The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized bands of operation.

RSS-130: The frequency stability shall be sufficient to ensure that the occupied bandwidth remains within each frequency block range when tested at the temperature and supply voltage variations specified in RSS-Gen.

Band 2: Frequency Stability

Equipment Configuration for Frequency Stability

Band:	2	Duty Cycle (%):	Not Applicable
Modulation:	QPSK	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48	Tested By:	SB
Engineering Test Notes:	None		

Bandwidth (MHz)	Chanel #	Frequency (MHz)	Temperature C	Frequency Error			Limit	Margin
				Vdc	Hz	ppm	ppm	ppm
5	18625	1852.5	-40	-48	-2.30	-0.001241565	±2.5	-2.50
			-30	-48	0.80	0.000431849	±2.5	-2.50
			-20	-48	-1.30	-0.000701754	±2.5	-2.50
			-10	-48	0.80	0.000431849	±2.5	-2.50
			0	-48	0.20	0.000107962	±2.5	-2.50
			10	-48	-1.50	-0.000809717	±2.5	-2.50
			20	-48	6.10	0.003292847	±2.5	-2.50
			20	-45	3.80	0.002051282	±2.5	-2.50
			20	-52	-7.00	-0.003778677	±2.5	-2.50
			30	-48	2.20	0.001187584	±2.5	-2.50
			40	-48	-2.60	-0.001403509	±2.5	-2.50
			50	-48	6.70	0.003616734	±2.5	-2.50
			55	-48	-1.00	-0.000539811	±2.5	-2.50



Title: Kumu Networks Inc Relay 2.0
To: FCC Part 24E, 27C & IC RSS 130, RSS 133
Serial #: KUMU06-U2 Rev A

Equipment Configuration for Frequency Stability

Band:	2	Duty Cycle (%):	Not Applicable
Modulation:	QPSK	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48	Tested By:	SB
Engineering Test Notes:	None		

Bandwidth (MHz)	Chanel #	Frequency (MHz)	Temperature C	Frequency Error			Limit	Margin
				Vdc	Hz	ppm		
5	18900	1880	-40	-48	3.20	0.001702128	±2.5	-2.50
			-30	-48	-3.20	-0.001702128	±2.5	-2.50
			-20	-48	1.20	0.000638298	±2.5	-2.50
			-10	-48	2.60	0.001382979	±2.5	-2.50
			0	-48	-0.40	-0.000212766	±2.5	-2.50
			10	-48	1.20	0.000638298	±2.5	-2.50
			20	-48	-1.90	-0.001010638	±2.5	-2.50
			20	-45	2.30	0.001223404	±2.5	-2.50
			20	-52	2.60	0.001382979	±2.5	-2.50
			30	-48	9.00	0.004787234	±2.5	-2.50
			40	-48	-1.00	-0.000531915	±2.5	-2.50
			50	-48	-2.00	-0.00106383	±2.5	-2.50
			55	-48	3.50	0.001861702	±2.5	-2.50

Equipment Configuration for Frequency Stability

Band:	2	Duty Cycle (%):	Not Applicable
Modulation:	QPSK	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48	Tested By:	SB
Engineering Test Notes:	None		

Bandwidth (MHz)	Chanel #	Frequency (MHz)	Temperature C	Frequency Error			Limit	Margin
				Vdc	Hz	ppm		
5	19175	1907.5	-40	-48	-1.60	-0.000838794	±2.5	-2.50
			-30	-48	-2.90	-0.001520315	±2.5	-2.50
			-20	-48	1.10	0.000576671	±2.5	-2.50
			-10	-48	0.10	0.000052425	±2.5	-2.50
			0	-48	1.50	0.00078637	±2.5	-2.50
			10	-48	-1.90	-0.000996068	±2.5	-2.50
			20	-48	5.00	0.002621232	±2.5	-2.50
			20	-45	1.00	0.000524246	±2.5	-2.50
			20	-52	4.60	0.002411533	±2.5	-2.50
			30	-48	0.40	0.000209699	±2.5	-2.50
			40	-48	-4.60	-0.002411533	±2.5	-2.50
			50	-48	6.70	0.003512451	±2.5	-2.50
			55	-48	-0.60	-0.000314548	±2.5	-2.50

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-02 MEASURING FREQUENCY
Measurement Uncertainty:	±0.86 ppm



Title: Kumu Networks Inc Relay 2.0
To: FCC Part 24E, 27C & IC RSS 130, RSS 133
Serial #: KUMU06-U2 Rev A

Equipment Configuration for Frequency Stability

Band:	2	Duty Cycle (%):	Not Applicable
Modulation:	QPSK	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48	Tested By:	SB
Engineering Test Notes:	None		

Bandwidth (MHz)	Chanel #	Frequency (MHz)	Temperature C	Frequency Error			Limit	Margin
				Vdc	Hz	ppm		
20	18700	1860	-40	-48	1.60	0.000860215	±2.5	-2.50
			-30	-48	-2.20	-0.001182796	±2.5	-2.50
			-20	-48	1.60	0.000860215	±2.5	-2.50
			-10	-48	5.00	0.002688172	±2.5	-2.50
			0	-48	1.80	0.000967742	±2.5	-2.50
			10	-48	-0.40	-0.000215054	±2.5	-2.50
			20	-48	-0.30	-0.00016129	±2.5	-2.50
			20	-45	1.20	0.000645161	±2.5	-2.50
			20	-52	-1.00	-0.000537634	±2.5	-2.50
			30	-48	-3.50	-0.00188172	±2.5	-2.50
			40	-48	3.70	0.001989247	±2.5	-2.50
			50	-48	11.60	0.006236559	±2.5	-2.49
			55	-48	8.60	0.004623656	±2.5	-2.50

Equipment Configuration for Frequency Stability

Band:	2	Duty Cycle (%):	Not Applicable
Modulation:	QPSK	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48	Tested By:	SB
Engineering Test Notes:	None		

Bandwidth (MHz)	Chanel #	Frequency (MHz)	Temperature C	Frequency Error			Limit	Margin
				Vdc	Hz	ppm		
20	18900	1880	-40	-48	-3.30	-0.001755319	±2.5	-2.50
			-30	-48	0.00	0.0000000	±2.5	-2.50
			-20	-48	-3.00	-0.001595745	±2.5	-2.50
			-10	-48	-1.60	-0.000851064	±2.5	-2.50
			0	-48	16.40	0.008723404	±2.5	-2.49
			10	-48	3.50	0.001861702	±2.5	-2.50
			20	-48	3.00	0.001595745	±2.5	-2.50
			20	-45	-1.60	-0.000851064	±2.5	-2.50
			20	-52	-12.50	-0.006648936	±2.5	-2.49
			30	-48	-9.10	-0.004840426	±2.5	-2.50
			40	-48	6.80	0.003617021	±2.5	-2.50
			50	-48	3.40	0.001808511	±2.5	-2.50
			55	-48	-1.00	-0.000531915	±2.5	-2.50

Equipment Configuration for Frequency Stability

Band:	2	Duty Cycle (%):	Not Applicable
Modulation:	QPSK	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48	Tested By:	SB
Engineering Test Notes:	None		

Bandwidth (MHz)	Chanel #	Frequency (MHz)	Temperature C	Frequency Error			Limit	Margin
				Vdc	Hz	ppm		
20	19100	1900	-40	-48	-4.00	-0.002105263	±2.5	-2.50
			-30	-48	-5.00	-0.002631579	±2.5	-2.50
			-20	-48	-2.00	-0.001052632	±2.5	-2.50
			-10	-48	1.00	0.000526316	±2.5	-2.50
			0	-48	0.90	0.000473684	±2.5	-2.50
			10	-48	-8.20	-0.004315789	±2.5	-2.50
			20	-48	-3.50	-0.001842105	±2.5	-2.50
			20	-45	-5.50	-0.002894737	±2.5	-2.50
			20	-52	0.40	0.000210526	±2.5	-2.50
			30	-48	-3.50	-0.001842105	±2.5	-2.50
			40	-48	-7.80	-0.004105263	±2.5	-2.50
			50	-48	6.30	0.003315789	±2.5	-2.50
			55	-48	2.40	0.001263158	±2.5	-2.50

Band 12: Frequency Stability

Equipment Configuration for Frequency Stability

Band:	12	Duty Cycle (%):	Not Applicable
Modulation:	QPSK	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48	Tested By:	JRK
Engineering Test Notes:	None		

Bandwidth (MHz)	Chanel #	Frequency (MHz)	Temperature C	Frequency Error			Limit	Margin
				Vdc	Hz	ppm		
5	23095	707.5	-40	-48	-0.5000	-0.0007	±2.5	-2.499
			-30	-48	-0.3000	-0.0004	±2.5	-2.500
			-20	-48	-0.4000	-0.0006	±2.5	-2.499
			-10	-48	-0.2000	-0.0003	±2.5	-2.500
			0	-48	-0.9000	-0.0013	±2.5	-2.499
			10	-48	0.3000	0.0004	±2.5	-2.500
			20	-48	0.0000	0.0000	±2.5	-2.500
			20	-45	0.0000	0.0000	±2.5	-2.500
			20	-52	0.0000	0.0000	±2.5	-2.500
			30	-48	-0.8000	-0.0011	±2.5	-2.499
			40	-48	0.0000	0.0000	±2.5	-2.500
			50	-48	0.8000	0.0011	±2.5	-2.499

Bandwidth (MHz)	Chanel #	Frequency (MHz)	Temperature C	Frequency Error			Limit	Margin
				Vdc	Hz	ppm		
10	23095	707.5	-40	-48	0.5000	0.0007	±2.5	-2.49929
			-30	-48	0.7000	0.0010	±2.5	-2.49901
			-20	-48	-0.2000	-0.0003	±2.5	-2.49972
			-10	-48	-1.8000	-0.0025	±2.5	-2.49746
			0	-48	0.0000	0.0000	±2.5	-2.50000
			10	-48	0.0000	0.0000	±2.5	-2.50000
			20	-48	0.6000	0.0008	±2.5	-2.49915
			20	-45	0.0000	0.0000	±2.5	-2.50000
			20	-52	0.0000	0.0000	±2.5	-2.50000
			30	-48	0.0000	0.0000	±2.5	-2.50000
			40	-48	-0.4000	-0.0006	±2.5	-2.49943
			50	-48	-0.2000	-0.0003	±2.5	-2.49972

Band 13: Frequency Stability

Equipment Configuration for Frequency Stability

Band:	12	Duty Cycle (%):	Not Applicable
Modulation:	QPSK	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48	Tested By:	JRK
Engineering Test Notes:	None		

Bandwidth (MHz)	Chanel #	Frequency (MHz)	Temperature C	Frequency Error			Limit	Margin
				Vdc	Hz	ppm	ppm	ppm
5	23230	782.0	-40	-48	0.4000	0.0005	±2.5	-2.49949
			-30	-48	0.5000	0.0006	±2.5	-2.49936
			-20	-48	0.9000	0.0012	±2.5	-2.49885
			-10	-48	-1.0000	-0.0013	±2.5	-2.49872
			0	-48	0.9000	0.0012	±2.5	-2.49885
			10	-48	-0.5000	-0.0006	±2.5	-2.49936
			20	-48	1.8000	0.0023	±2.5	-2.49770
			20	-45	0.0130	0.01662	±2.5	-2.4834
			20	-52	0.0070	0.00895	±2.5	-2.4910
			30	-48	1.8000	0.0023	±2.5	-2.49770
			40	-48	-0.4000	-0.0005	±2.5	-2.49949
			50	-48	-1.1000	-0.0014	±2.5	-2.49859

Bandwidth (MHz)	Chanel #	Frequency (MHz)	Temperature C	Frequency Error			Limit	Margin
				Vdc	Hz	ppm	ppm	ppm
10	23230	782.0	-40	-48	-0.6000	-0.0008	±2.5	-2.49923
			-30	-48	0.4000	0.0005	±2.5	-2.49949
			-20	-48	-2.0000	-0.0026	±2.5	-2.49744
			-10	-48	0.8000	0.0010	±2.5	-2.49898
			0	-48	-0.1000	-0.0001	±2.5	-2.49987
			10	-48	-0.5000	-0.0006	±2.5	-2.49936
			20	-48	0.3000	0.0004	±2.5	-2.49962
			20	-45	0.0010	0.0012	±2.5	-2.4987
			20	-52	0.1360	0.1739	±2.5	-2.3261
			30	-48	-1.2000	-0.0015	±2.5	-2.49847
			40	-48	-0.5000	-0.0006	±2.5	-2.49936
			50	-48	0.1000	0.0001	±2.5	-2.49987

Band 17: Frequency Stability

Bandwidth (MHz)	Chanel #	Frequency (MHz)	Temperature C	Frequency Error			Limit	Margin
				Vdc	Hz	ppm		
5	23790	710.0	-40	-48	9.0000	0.0127	±2.5	-2.48732
			-30	-48	-0.2000	-0.0003	±2.5	-2.49972
			-20	-48	0.8000	0.0011	±2.5	-2.49887
			-10	-48	-0.8000	-0.0011	±2.5	-2.49887
			0	-48	-1.0000	-0.0014	±2.5	-2.49859
			10	-48	0.4000	0.0006	±2.5	-2.49944
			20	-48	0.6000	0.0008	±2.5	-2.49915
			20	-45	-0.1010	-0.14225	±2.5	-2.3577
			20	-52	-0.0010	-0.00140	±2.5	-2.4986
			30	-48	2.0000	0.0028	±2.5	-2.49718
			40	-48	-1.0000	-0.0014	±2.5	-2.49859
			50	-48	-0.1000	-0.0001	±2.5	-2.49986

Bandwidth (MHz)	Chanel #	Frequency (MHz)	Temperature C	Frequency Error			Limit	Margin
				Vdc	Hz	ppm		
10	23790	710.0	-40	-48	-1.1000	-0.0015	±2.5	-2.49845
			-30	-48	0.1000	0.0001	±2.5	-2.49986
			-20	-48	0.2000	0.0003	±2.5	-2.49972
			-10	-48	-1.1000	-0.0015	±2.5	-2.49845
			0	-48	0.2000	0.0003	±2.5	-2.49972
			10	-48	-0.5000	-0.0007	±2.5	-2.49930
			20	-48	0.1000	0.0001	±2.5	-2.49986
			20	-45	0.0000	0.0000	±2.5	-2.500
			20	-52	0.0000	0.0000	±2.5	-2.500
			30	-48	0.5000	0.0007	±2.5	-2.49930
			40	-48	-0.1000	-0.0001	±2.5	-2.49986
			50	-48	-1.3000	-0.0018	±2.5	-2.49817

9.4. Emission Bandwidth

Conducted Test Conditions for Emission Bandwidth			
Standard:	FCC Part 24E & IC RSS-133	Ambient Temp. (°C):	20.0 - 24.5
Test Heading:	Emission Bandwidth	Rel. Humidity (%):	32 - 45
Standard Section(s):	FCC 24E: 24.238 (b) FCC 27C: 27.53 RSS-130: RSS-133:	Pressure (mBars):	999 - 1001
Reference Document(s):	See Normative References		
Test Procedure for Emission Bandwidth Per the standard emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power. Testing was performed under ambient conditions. Test configuration and setup used for the measurement was per the Conducted Test Set-up specified in this document.			

Band 2: Emissions Bandwidth

Equipment Configuration for Emissions Bandwidth

Band:	2	Duty Cycle (%):	99.00
Modulation:	QPSK	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48	Tested By:	SB
Engineering Test Notes:	None		

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	99% Occupied Bandwidth (MHz)	26 dB Occupied Bandwidth (MHz)
5	18625	1852.5	0	25	4.4682	5.220
	18900	1880	0	25	4.4656	5.121
	19175	1907.5	0	25	4.4880	5.428

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	99% Occupied Bandwidth (MHz)	26 dB Occupied Bandwidth (MHz)
10	18650	1855	0	50	8.9375	9.909
	18900	1880	0	50	8.9494	9.877
	19150	1905	0	50	8.9560	10.025

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	99% Occupied Bandwidth (MHz)	26 dB Occupied Bandwidth (MHz)
15	18675	1857.5	0	75	13.3650	14.549
	18900	1880	0	75	13.3468	14.315
	19125	1902.5	0	75	13.745	14.458

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	99% Occupied Bandwidth (MHz)	26 dB Occupied Bandwidth (MHz)
20	18700	1860	0	100	17.8680	19.085
	18900	1880	0	100	17.8218	19.073
	19100	1900	0	100	17.7985	18.926

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Band 12: Emissions Bandwidth

Equipment Configuration for Emissions Bandwidth

Band:	12	Duty Cycle (%):	99.00
Modulation:	QPSK & 16 QAM	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48	Tested By:	JRK
Engineering Test Notes:	None		

QPSK:

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	99% Occupied Bandwidth (MHz)	26 dB Occupied Bandwidth (MHz)
5	23035	701.5	0	25	4.4945	5.286
	23095	707.5	0	25	4.5047	5.202
	23155	713.5	0	25	4.4849	5.199

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	99% Occupied Bandwidth (MHz)	26 dB Occupied Bandwidth (MHz)
10	23060	704	0	50	8.821	9.971
	23095	707.5	0	50	8.9391	10.017
	23130	711	0	50	8.9526	9.91

16QAM:

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	99% Occupied Bandwidth (MHz)	26 dB Occupied Bandwidth (MHz)
5	23035	701.5	0	25	4.5018	5.249
	23095	707.5	0	25	4.4875	5.293
	23155	713.5	0	25	4.4883	5.182

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	99% Occupied Bandwidth (MHz)	26 dB Occupied Bandwidth (MHz)
10	23060	704	0	50	8.9262	9.986
	23095	707.5	0	50	8.9436	10.011
	23130	711	0	50	8.9234	9.913

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Band 13: Emissions Bandwidth

Equipment Configuration for Emissions Bandwidth

Band:	13	Duty Cycle (%):	99.00
Modulation:	QPSK & 16 QAM	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48	Tested By:	JRK
Engineering Test Notes:	None		

QPSK:

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	99% Occupied Bandwidth (MHz)	26 dB Occupied Bandwidth (MHz)
5	23205	779.5	0	25	4.4872	5.243
	23095	707.5	0	25	4.4862	5.305
	23230	782	0	25	4.5067	5.281

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	99% Occupied Bandwidth (MHz)	26 dB Occupied Bandwidth (MHz)
10	782	0	50	782	8.9297	9.932

16QAM:

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	99% Occupied Bandwidth (MHz)	26 dB Occupied Bandwidth (MHz)
5	23205	779.5	0	25	4.4792	5.21
	23095	707.5	0	25	4.4744	5.128
	23230	782	0	25	4.4919	5.212

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	99% Occupied Bandwidth (MHz)	26 dB Occupied Bandwidth (MHz)
10	782	0	50	782	8.9221	9.858

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Band 17: Emissions Bandwidth

Equipment Configuration for Emissions Bandwidth

Band:	17	Duty Cycle (%):	99.00
Modulation:	QPSK & 16 QAM	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48	Tested By:	JRK
Engineering Test Notes:	None		

QPSK:

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	99% Occupied Bandwidth (MHz)	26 dB Occupied Bandwidth (MHz)
5	23755	706.5	0	25	4.5094	5.283
	23790	710	0	25	4.506	5.34
	23825	713.5	0	25	4.4925	5.256

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	99% Occupied Bandwidth (MHz)	26 dB Occupied Bandwidth (MHz)
10	23780	709	0	50	7.583	10.008
	23790	710	0	50	8.9283	9.917
	23800	711	0	50	8.9528	9.909

16QAM:

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	99% Occupied Bandwidth (MHz)	26 dB Occupied Bandwidth (MHz)
5	23755	706.5	0	25	4.4872	5.213
	23790	710	0	25	4.5002	5.196
	23825	713.5	0	25	4.4881	5.129

Bandwidth (MHz)	Chanel #	Frequency (MHz)	RB (Starting)	RB #	99% Occupied Bandwidth (MHz)	26 dB Occupied Bandwidth (MHz)
10	23780	709	0	50	8.952	10.001
	23790	710	0	50	8.9414	9.972
	23800	711	0	50	8.9202	9.965

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

9.5. Out-of-Band Emissions

Conducted Test Conditions for Out of Band Emissions			
Standard:	FCC Part 24E, 27C IC RSS-130, RSS-133	Ambient Temp. (°C):	20.0 - 24.5
Test Heading:	Out of Band Emissions	Rel. Humidity (%):	32 - 45
Standard Section(s):	FCC 24E: 24.238 a & b FCC 27C: 27.53c & g RSS-130:4.7.1 RSS-133: 6.5	Pressure (mBars):	999 - 1001
Reference Document(s):	See Normative References		

Test Procedure for Out of Band Emissions

With reference to the test configuration identified in Section 8.1 Conducted Test Setup the EUT was set to transmit on the appropriate center frequency of the selected frequency band and bandwidth. Out of Band emissions was tested under QPSK.

Testing was performed under ambient conditions.

Limits Out of Band Emissions

Band 2:

FCC 24E: §24.238 Emission limitations for Broadband PCS equipment.

(a) *Out of band emissions.* The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

RSS-133: 6.5 (i) In the 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p$ (watts). 2 GHz Personal Communications Services RSS-133 4

(ii) After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p$ (watts). If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.

(b) *Measurement procedure.* Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

Band 12,13,17:

FCC 27C: §27.53 Emission limits for Miscellaneous Wireless Communications Services.

(c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log(P)$ dB;

(g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log(P)$ dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

RSS-130: 4.7.1 The unwanted emissions in any 100 kHz bandwidth on any frequency outside the low frequency edge and the high frequency edge of each frequency block range(s), shall be attenuated below the transmitter power, P (dBW), by at least $43 + 10 \log_{10} p$ (watts), dB. However, in the 100 kHz band immediately outside of the equipment's frequency block range, a resolution bandwidth of 30 kHz may be employed.

Band 2: Out of Band Emissions

Equipment Configuration for Out Of Band Emissions

Band:	2	Duty Cycle (%):	99.00
Modulation:	QPSK	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48	Tested By:	SB
Engineering Test Notes:	None		

Channel #	Test Frequency (MHz)	Bandwidth (MHz)	RB (Starting)	RB #	Frequency Range (MHz)	Limit dBm	Amplitude dBm	Margin dB	Pass/Fail
18625	1852.5	5	0	1	30.00 – 1000.00	-13	-62.02	-49.02	Pass
			0	25	30.00 – 1000.00	-13	-62.33	-49.33	Pass
			0	1	1000.00 – 1850.0	-13	22.29*	-	-
			0	25	1000.00 – 1850.0	-13	12.77*	-	-
			0	1	1849.00 - 1851.00	-13	-14.46	-1.46	Pass
			0	25	1849.00 - 1851.00	-13	-27.17	-14.17	Pass
			0	1	1910.00 – 26000.0	-13	-44.51	-31.51	Pass
			0	25	1910.00 – 26000.0	-13	-44.85	-31.85	Pass

*Due to the extended frequency sweep (1,000.00 – 1,850.00 MHz) further investigation was required to comply with the band-edge limit at 1850 MHz. The unit was found to comply with the band-edge requirements.

Channel #	Test Frequency (MHz)	Bandwidth (MHz)	RB (Starting)	RB #	Frequency Range (MHz)	Limit dBm	Amplitude dBm	Margin dB	Pass/Fail
18900	1880	5	0	1	30.00 – 1000.00	-13	-62.24	-49.24	Pass
			0	25	30.00 – 1000.00	-13	-62.33	-49.33	Pass
			0	1	1000.00 – 1850.0	-13	-50.42	-37.42	Pass
			0	25	1000.00 – 1850.0	-13	-50.51	-37.51	Pass
			0						
			0						
			0	1	1910.00 – 26000.0	-13	-44.88	-31.88	Pass
			0	25	1910.00 – 26000.0	-13	-44.61	-31.61	Pass



Title: Kumu Networks Inc Relay 2.0
To: FCC Part 24E, 27C & IC RSS 130, RSS 133
Serial #: KUMU06-U2 Rev A

Channel #	Test Frequency (MHz)	Bandwidth (MHz)	RB (Starting)	RB #	Frequency Range (MHz)	Limit dBm	Amplitude dBm	Margin dB	Pass/Fail
19175	1907.5	5	0	1	30.00 – 1000.00	-13	-62.21	-49.21	Pass
			0	25	30.00 – 1000.00	-13	-62.23	-49.23	Pass
			0	1	1000.00 – 1850.0	-13	-48.10	-35.1	Pass
			0	25	1000.00 – 1850.0	-13	-48.26	-35.26	Pass
			0	1	1910.00 – 26000.0	-13	5.97*		
			0	25	1910.00 – 26000.0	-13	6.13*		
			0	1	1909.00 - 1911.00	-13	-17.38	-4.38	Pass
			0	25	1909.00 - 1911.00	-13	-25.57	-12.57	Pass

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

*Due to the extended frequency sweep (1,910.00 – 26,000.00 MHz) further investigation was required to comply with the band-edge limit at 1910 MHz. The unit was found to comply with the band-edge requirements.



Title: Kumu Networks Inc Relay 2.0
To: FCC Part 24E, 27C & IC RSS 130, RSS 133
Serial #: KUMU06-U2 Rev A

Equipment Configuration for Out Of Band Emissions

Band:	2	Duty Cycle (%):	99.00
Modulation:	QPSK	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48	Tested By:	SB
Engineering Test Notes:	None		

Channel #	Test Frequency (MHz)	Bandwidth (MHz)	RB (Starting)	RB #	Frequency Range (MHz)	Limit dBm	Amplitude dBm	Margin dB	Pass/Fail
18650	1855	10	0	1	30.00 – 1000.00	-13	-61.46	-48.46	Pass
			0	25	30.00 – 1000.00	-13	-61.26	-48.26	Pass
			0	1	1000.00 – 1850.0	-13	21.49*		
			0	25	1000.00 – 1850.0	-13	7.66*		
			0	1	1849.00 - 18510.00	-13	-14.19	-14.19	Pass
			0	25	1849.00 - 18510.00	-13	-27.01	-27.01	Pass
			0	1	1910.00 – 26000.0	-13	-44.74	-31.74	Pass
			0	25	1910.00 – 26000.0	-13	-44.72	-31.72	Pass

*Due to the extended frequency sweep (1,000.00 – 1,850.00 MHz) further investigation was required to comply with the band-edge limit at 1850 MHz. The unit was found to comply with the band-edge requirements.

Channel #	Test Frequency (MHz)	Bandwidth (MHz)	RB (Starting)	RB #	Frequency Range (MHz)	Limit dBm	Amplitude dBm	Margin dB	Pass/Fail
18900	1880	10	0	1	30.00 – 1000.00	-13	-61.41	-48.41	Pass
			0	25	30.00 – 1000.00	-13	-61.32	-48.32	Pass
			0	1	1000.00 – 1850.0	-13	-49.23	-36.23	Pass
			0	25	1000.00 – 1850.0	-13	-48.97	-35.97	Pass
			0						
			0						
			0	1	1910.00 – 26000.0	-13	-44.76	-31.76	Pass
			0	25	1910.00 – 26000.0	-13	-32.12	-19.12	Pass



Title: Kumu Networks Inc Relay 2.0
To: FCC Part 24E, 27C & IC RSS 130, RSS 133
Serial #: KUMU06-U2 Rev A

Equipment Configuration for Out Of Band Emissions			
Band:	2	Duty Cycle (%):	99.00
Modulation:	QPSK	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48	Tested By:	SB
Engineering Test Notes:	None		

Channel #	Test Frequency (MHz)	Bandwidth (MHz)	RB (Starting)	RB #	Frequency Range (MHz)	Limit dBm	Amplitude dBm	Margin dB	Pass/Fail
19150	1905	10	0	1	30.00 – 1000.00	-13	-61.27	-48.27	Pass
			0	25	30.00 – 1000.00	-13	-61.55	-48.55	Pass
			0	1	1000.00 – 1850.0	-13	-47.96	-34.96	Pass
			0	25	1000.00 – 1850.0	-13	-48.31	-35.31	Pass
			0	1	1910.00 – 26000.0	-13	7.49*		
			0	25	1910.00 – 26000.0	-13	6.73*		
			0	1	1909.00 - 1911.00	-13	-14.81	-1.81	Pass
			0	25	1909.00 - 1911.00	-13	-23.09	-10.09	Pass

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

*Due to the extended frequency sweep (1,910.00 – 26,000.00 MHz) further investigation was required to comply with the band-edge limit at 1910 MHz. The unit was found to comply with the band-edge requirements.



Title: Kumu Networks Inc Relay 2.0
To: FCC Part 24E, 27C & IC RSS 130, RSS 133
Serial #: KUMU06-U2 Rev A

Equipment Configuration for Out Of Band Emissions

Band:	2	Duty Cycle (%):	99.00
Modulation:	QPSK	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48	Tested By:	SB
Engineering Test Notes:	None		

Channel #	Test Frequency (MHz)	Bandwidth (MHz)	RB (Starting)	RB #	Frequency Range (MHz)	Limit dBm	Amplitude dBm	Margin dB	Pass/Fail
18675	1857.5	15	0	1	30.00 – 1000.00	-13	-61.34	-48.34	Pass
			0	25	30.00 – 1000.00	-13	-61.35	-48.35	Pass
			0	1	1000.00 – 1850.0	-13	19.65*		
			0	25	1000.00 – 1850.0	-13	2.93*		
			0	1	1849.00 - 18510.00	-13	-20.28	-20.28	Pass
			0	25	1849.00 - 18510.00	-13	-26.39	-26.39	Pass
			0	1	1910.00 – 26000.0	-13	-44.88	-31.88	Pass
			0	25	1910.00 – 26000.0	-13	-44.91	-31.91	Pass

*Due to the extended frequency sweep (1,000.00 – 1,850.00 MHz) further investigation was required to comply with the band-edge limit at 1850 MHz. The unit was found to comply with the band-edge requirements.

Channel #	Test Frequency (MHz)	Bandwidth (MHz)	RB (Starting)	RB #	Frequency Range (MHz)	Limit dBm	Amplitude dBm	Margin dB	Pass/Fail
18900	1880	15	0	1	30.00 – 1000.00	-13	-61.11	-48.11	Pass
			0	25	30.00 – 1000.00	-13	-61.53	-48.53	Pass
			0	1	1000.00 – 1850.0	-13	-46.91	-33.91	Pass
			0	25	1000.00 – 1850.0	-13	-40.96	-27.96	Pass
			0						
			0	1	1910.00 – 26000.0	-13	-45.04	-32.04	Pass
			0	25	1910.00 – 26000.0	-13	-29.45	-16.45	Pass



Title: Kumu Networks Inc Relay 2.0
To: FCC Part 24E, 27C & IC RSS 130, RSS 133
Serial #: KUMU06-U2 Rev A

Channel #	Test Frequency (MHz)	Bandwidth (MHz)	RB (Starting)	RB #	Frequency Range (MHz)	Limit dBm	Amplitude dBm	Margin dB	Pass/Fail
19125	1902.5	15	0	1	30.00 – 1000.00	-13	-61.51	-48.51	Pass
			0	25	30.00 – 1000.00	-13	-61.87	-48.87	Pass
			0	1	1000.00 – 1850.0	-13	-49.75	-36.75	Pass
			0	25	1000.00 – 1850.0	-13	-47.76	-34.76	Pass
			0	1	1910.00 – 26000.0	-13	8.01*		
			0	25	1910.00 – 26000.0	-13	7.16*		
			0	1	1909.00 - 1911.00	-13	-19.71	-6.71	Pass
			0	25	1909.00 - 1911.00	-13	-23.87	-10.87	Pass

Traceability to Industry Recognized Test Methodologies

Work Instruction: WI-03 MEASURING RF SPECTRUM MASK

Measurement Uncertainty: ± 2.81 dB

*Due to the extended frequency sweep (1,910.00 – 26,000.00 MHz) further investigation was required to comply with the band-edge limit at 1910 MHz. The unit was found to comply with the band-edge requirements.



Title: Kumu Networks Inc Relay 2.0
To: FCC Part 24E, 27C & IC RSS 130, RSS 133
Serial #: KUMU06-U2 Rev A

Equipment Configuration for Out Of Band Emissions

Band:	2	Duty Cycle (%):	99.00
Modulation:	QPSK	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48	Tested By:	SB
Engineering Test Notes:	None		

Channel #	Test Frequency (MHz)	Bandwidth (MHz)	RB (Starting)	RB #	Frequency Range (MHz)	Limit dBm	Amplitude dBm	Margin dB	Pass/Fail
18700	1860	20	0	1	30.00 – 1000.00	-13	-61.88	-48.88	Pass
			0	25	30.00 – 1000.00	-13	-61.87	-48.87	Pass
			0	1	1000.00 – 1850.0	-13	16.36*		
			0	25	1000.00 – 1850.0	-13	-2.68*		
			0	1	1849.00 - 18510.00	-13	-26.13	-26.13	Pass
			0	25	1849.00 - 18510.00	-13	-28.35	-28.35	Pass
			0	1	1910.00 – 26000.0	-13	-44.98	-31.98	Pass
			0	25	1910.00 – 26000.0	-13	-43.28	-30.28	Pass

*Due to the extended frequency sweep (1,000.00 – 1,850.00 MHz) further investigation was required to comply with the band-edge limit at 1850 MHz. The unit was found to comply with the band-edge requirements.

Channel #	Test Frequency (MHz)	Bandwidth (MHz)	RB (Starting)	RB #	Frequency Range (MHz)	Limit dBm	Amplitude dBm	Margin dB	Pass/Fail
18900	1880	20	0	1	30.00 – 1000.00	-13	-62.12	-49.12	Pass
			0	25	30.00 – 1000.00	-13	-61.87	-48.87	Pass
			0	1	1000.00 – 1850.0	-13	-44.66	-31.66	Pass
			0	25	1000.00 – 1850.0	-13	-37.50	-24.50	Pass
			0						
			0						
			0	1	1910.00 – 26000.0	-13	-42.89	-29.89	Pass
			0	25	1910.00 – 26000.0	-13	-28.09	-15.09	Pass

Channel #	Test Frequency (MHz)	Bandwidth (MHz)	RB (Starting)	RB #	Frequency Range (MHz)	Limit dBm	Amplitude dBm	Margin dB	Pass/Fail
19100	1900	20	0	1	30.00 – 1000.00	-13	-62.05	-49.05	Pass
			0	25	30.00 – 1000.00	-13	-62.11	-49.11	Pass
			0	1	1000.00 – 1850.0	-13	-49.57	-36.57	Pass
			0	25	1000.00 – 1850.0	-13	-45.30	-32.3	Pass
			0	1	1910.00 – 26000.0	-13	7.26*		
			0	25	1910.00 – 26000.0	-13	7.40*		
			0	1	1909.00 - 1911.00	-13	-25.39	-12.39	Pass
			0	25	1909.00 - 1911.00	-13	-26.70	-13.7	Pass

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

*Due to the extended frequency sweep (1,910.00 – 26,000.00 MHz) further investigation was required to comply with the band-edge limit at 1910 MHz. The unit was found to comply with the band-edge requirements.

Band 12: Out of Band Emissions

Equipment Configuration for Out Of Band Emissions

Band:	12	Duty Cycle (%):	99.00
Modulation:	QPSK	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48	Tested By:	JRK
Engineering Test Notes:	None		

Channel #	Test Frequency (MHz)	Bandwidth (MHz)	RB (Starting)	RB #	Frequency Range (MHz)	RCVR BW (KHz)	Limit dBm	Amplitude dBm	Margin dB	Pass/Fail
23035	701.5	5	0	1	30.0 - 698.0	100k	-13	-33.50	-20.50	Pass
			0	25	30.0 - 698.0	100k	-13	-41.50	-28.50	Pass
			0	1	698.0 - 699.0	10k	-13	-19.62	-6.62	Pass
			0	25	698.0 - 699.0	10k	-13	-32.89	-19.89	Pass
			0	1	704.0 - 705.0	10k	-13	-53.02	-40.02	Pass
			0	25	704.0 - 705.0	10k	-13	-31.25	-18.25	Pass
			0	1	705.0 - 1000.0	100k	-13	-45.44	-32.44	Pass
			0	25	705.0 - 1000.0	100k	-13	-38.74	-25.74	Pass
			0	1	1000.00 - 26000.0	100k	-13	-38.66	-25.66	Pass
			0	25	1000.00 - 26000.0	100k	-13	-42.51	-29.51	Pass

Channel #	Test Frequency (MHz)	Bandwidth (MHz)	RB (Starting)	RB #	Frequency Range (MHz)	RCVR BW (KHz)	Limit dBm	Amplitude dBm	Margin dB	Pass/Fail
23095	707.5	5	0	1	30.0 - 704.0	100k	-13	-31.87	-18.87	Pass
			0	25	30.0 - 704.0	100k	-13	-35.50	-22.50	Pass
			0	1	704.0 - 705.0	10k	-13	-19.04	-6.04	Pass
			0	25	704.0 - 705.0	10k	-13	-31.61	-18.61	Pass
			0	1	710.0 - 711.0	10k	-13	-53.28	-40.28	Pass
			0	25	710.0 - 711.0	10k	-13	-31.07	-18.07	Pass
			0	1	711.0 - 1000.0	100k	-13	-46.30	-33.30	Pass
			0	25	711.0 - 1000.0	100k	-13	-33.43	-20.43	Pass
			0	1	1000.00 - 26000.0	100k	-13	-36.77	-23.77	Pass
			0	25	1000.00 - 26000.0	100k	-13	-40.85	-27.85	Pass



Title: Kumu Networks Inc Relay 2.0
To: FCC Part 24E, 27C & IC RSS 130, RSS 133
Serial #: KUMU06-U2 Rev A

Channel #	Test Frequency (MHz)	Bandwidth (MHz)	RB (Starting)	RB #	Frequency Range (MHz)	RCVR BW (KHz)	Limit dBm	Amplitude dBm	Margin dB	Pass/Fail
23155	713.5	5	0	1	30.0 - 710.0	100k	-13	-32.76	-19.76	Pass
			0	25	30.0 - 710.0	100k	-13	-35.36	-22.36	Pass
			0	1	710.0 - 711.0	10k	-13	-19.31	-6.31	Pass
			0	25	710.0 - 711.0	10k	-13	-31.85	-18.85	Pass
			0	1	716.0 - 717.0	10k	-13	-54.98	-41.98	Pass
			0	25	716.0 - 717.0	10k	-13	-31.96	-18.96	Pass
			0	1	717.0 - 1000.0	100k	-13	-49.51	-36.51	Pass
			0	25	717.0 - 1000.0	100k	-13	-51.33	-38.33	Pass
			0	1	1000.00 - 26000.0	100k	-13	-37.86	-24.86	Pass
			0	25	1000.00 - 26000.0	100k	-13	-39.78	-26.78	Pass

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB



Title: Kumu Networks Inc Relay 2.0
To: FCC Part 24E, 27C & IC RSS 130, RSS 133
Serial #: KUMU06-U2 Rev A

Channel #	Test Frequency (MHz)	Bandwidth (MHz)	RB (Starting)	RB #	Frequency Range (MHz)	RCVR BW (KHz)	Limit dBm	Amplitude dBm	Margin dB	Pass/Fail
23060	704.0	10	0	1	30.0 - 698.0	100k	-13	-39.8	-26.8	Pass
			0	25	30.0 - 698.0	100k	-13	-42.55	-29.55	Pass
			0	1	698.0 - 699.0	10k	-13	-26.48	-13.48	Pass
			0	25	698.0 - 699.0	10k	-13	-41.97	-28.97	Pass
			0	1	709.0 - 710.0	10k	-13	-51.05	-38.05	Pass
			0	25	709.0 - 710.0	10k	-13	-39.29	-26.29	Pass
			0	1	710.0 - 1000.0	100k	-13	-46.1	-33.1	Pass
			0	25	710.0 - 1000.0	100k	-13	-34.52	-21.52	Pass
			0	1	1000.00 - 26000.0	100k	-13	-37.77	-24.77	Pass
			0	25	1000.00 - 26000.0	100k	-13	-42.79	-29.79	Pass

Channel #	Test Frequency (MHz)	Bandwidth (MHz)	RB (Starting)	RB #	Frequency Range (MHz)	RCVR BW (KHz)	Limit dBm	Amplitude dBm	Margin dB	Pass/Fail
23095	707.5	10	0	1	30.0 - 701.5	100k	-13	-40.14	-27.14	Pass
			0	25	30.0 - 701.5	100k	-13	-38.58	-25.58	Pass
			0	1	701.5 - 702.5	10k	-13	-25.78	-12.78	Pass
			0	25	701.5 - 702.5	10k	-13	-40.18	-27.18	Pass
			0	1	712.5 - 713.5	10k	-13	-51.17	-38.17	Pass
			0	25	712.5 - 713.5	10k	-13	-39.91	-26.91	Pass
			0	1	713.5 - 1000.0	100k	-13	-46.13	-33.13	Pass
			0	25	713.5 - 1000.0	100k	-13	-35.93	-22.93	Pass
			0	1	1000.00 - 26000.0	100k	-13	-38.39	-25.39	Pass
			0	25	1000.00 - 26000.0	100k	-13	-43.22	-30.22	Pass



Title: Kumu Networks Inc Relay 2.0
To: FCC Part 24E, 27C & IC RSS 130, RSS 133
Serial #: KUMU06-U2 Rev A

Channel #	Test Frequency (MHz)	Bandwidth (MHz)	RB (Starting)	RB #	Frequency Range (MHz)	RCVR BW (KHz)	Limit dBm	Amplitude dBm	Margin dB	Pass/Fail
23130	711.0	10	0	1	30.0 - 705.0	100k	-13	-39.4	-26.4	Pass
			0	25	30.0 - 705.0	100k	-13	-38.04	-25.04	Pass
			0	1	705.0 - 706.0	10k	-13	-25.94	-12.94	Pass
			0	25	705.0 - 706.0	10k	-13	-40.11	-27.11	Pass
			0	1	716.0 - 717.0	10k	-13	-52.86	-39.86	Pass
			0	25	716.0 - 717.0	10k	-13	-40.8	-27.8	Pass
			0	1	717.0 - 1000.0	100k	-13	-47.26	-34.26	Pass
			0	25	717.0 - 1000.0	100k	-13	-37.9	-24.9	Pass
			0	1	1000.00 - 26000.0	100k	-13	-36.56	-23.56	Pass
			0	25	1000.00 - 26000.0	100k	-13	-42.07	-29.07	Pass

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Band 13: Out of Band Emissions

Equipment Configuration for Out Of Band Emissions

Band:	13	Duty Cycle (%):	99.00
Modulation:	QPSK	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48	Tested By:	JRK
Engineering Test Notes:	None		

Channel #	Test Frequency (MHz)	Bandwidth (MHz)	RB (Starting)	RB #	Frequency Range (MHz)	RCVR BW (KHz)	Limit dBm	Amplitude dBm	Margin dB	Pass/Fail
23205	779.5	5	0	1	30.0 - 776.0	100k	-13	-31.17	-18.17	Pass
			0	25	30.0 - 776.0	100k	-13	-40.82	-27.82	Pass
			0	1	776.0 - 777.0	10k	-13	-19.94	-6.94	Pass
			0	25	776.0 - 777.0	10k	-13	-34.13	-21.13	Pass
			0	1	782.0 - 783.0	10k	-13	-53.51	-40.51	Pass
			0	25	782.0 - 783.0	10k	-13	-31.99	-18.99	Pass
			0	1	783.0 - 1000.0	100k	-13	-47.57	-34.57	Pass
			0	25	783.0 - 1000.0	100k	-13	-38.54	-25.54	Pass
			0	1	1000.00 - 26000.0	100k	-13	-26.78	-13.78	Pass
			0	25	1000.00 - 26000.0	100k	-13	-31.44	-18.44	Pass

Channel #	Test Frequency (MHz)	Bandwidth (MHz)	RB (Starting)	RB #	Frequency Range (MHz)	RCVR BW (KHz)	Limit dBm	Amplitude dBm	Margin dB	Pass/Fail
23230	782	5	0	1	30.0 - 778.5	100k	-13	-36.53	-23.53	Pass
			0	25	30.0 - 778.5	100k	-13	-36.53	-23.53	Pass
			0	1	778.5 - 779.5	10k	-13	-21.13	-8.13	Pass
			0	25	778.5 - 779.5	10k	-13	-33.59	-20.59	Pass
			0	1	784.5 - 785.5	10k	-13	-55.75	-42.75	Pass
			0	25	784.5 - 785.5	10k	-13	-33.77	-20.77	Pass
			0	1	785.5 - 1000.0	100k	-13	-50.20	-37.20	Pass
			0	25	785.5 - 1000.0	100k	-13	-32.26	-19.26	Pass
			0	1	1000.00 - 26000.0	100k	-13	-28.78	-15.78	Pass
			0	25	1000.00 - 26000.0	100k	-13	-31.41	-18.41	Pass

Channel #	Test Frequency (MHz)	Bandwidth (MHz)	RB (Starting)	RB #	Frequency Range (MHz)	RCVR BW (KHz)	Limit dBm	Amplitude dBm	Margin dB	Pass/Fail
23255	784.5	5	0	1	30.0 - 781.0	100k	-13	-32.05	-19.05	Pass
			0	25	30.0 - 781.0	100k	-13	-32.05	-19.05	Pass
			0	1	781.0 - 782.0	10k	-13	-20.15	-7.15	Pass
			0	25	781.0 - 782.0	10k	-13	-32.35	-19.35	Pass
			0	1	787.0 - 788.0	10k	-13	-56.18	-43.18	Pass
			0	25	787.0 - 788.0	10k	-13	-33.48	-20.48	Pass
			0	1	788.0 - 1000.0	100k	-13	-51.34	-38.34	Pass
			0	25	788.0 - 1000.0	100k	-13	-37.39	-24.39	Pass
			0	1	1000.00 - 26000.0	100k	-13	-26.77	-13.77	Pass
			0	25	1000.00 - 26000.0	100k	-13	-31.95	-18.95	Pass

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Channel #	Test Frequency (MHz)	Bandwidth (MHz)	RB (Starting)	RB #	Frequency Range (MHz)	RCVR BW (KHz)	Limit dBm	Amplitude dBm	Margin dB	Pass/Fail
23230	782.0	10	0	1	30.0 – 776.0	100k	-13	-40.97	-27.97	Pass
			0	25	30.0 – 776.0	100k	-13	-44.27	-31.27	Pass
			0	1	776.0 – 777.0	10k	-13	-27.15	-14.15	Pass
			0	25	776.0 – 777.0	10k	-13	-43.28	-30.28	Pass
			0	1	787.0 – 788.0	10k	-13	-50.94	-37.94	Pass
			0	25	787.0 – 788.0	10k	-13	-41.48	-28.48	Pass
			0	1	788.0 – 1000.0	100k	-13	-48.65	-35.65	Pass
			0	25	788.0 – 1000.0	100k	-13	-48.65	-35.65	Pass
			0	1	1000.00 – 26000.0	100k	-13	-25.61	-12.61	Pass
			0	25	1000.00 – 26000.0	100k	-13	-32.83	-19.83	Pass

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB



Title: Kumu Networks Inc Relay 2.0
To: FCC Part 24E, 27C & IC RSS 130, RSS 133
Serial #: KUMU06-U2 Rev A

Band 17: Out of Band Emissions

Equipment Configuration for Out Of Band Emissions

Band:	17	Duty Cycle (%):	99.00
Modulation:	QPSK	Antenna Gain (dBi):	Not Applicable
Temperature (°C):	+20.0	Beam Forming Gain (Y)(dB):	Not Applicable
Voltage (Vdc):	-48	Tested By:	JRK
Engineering Test Notes:	None		

Channel #	Test Frequency (MHz)	Bandwidth (MHz)	RB (Starting)	RB #	Frequency Range (MHz)	RCVR BW (KHz)	Limit dBm	Amplitude dBm	Margin dB	Pass/Fail
23755	706.5	5	0	1	30.0 - 703.0	100k	-13	-32.63	-19.63	Pass
			0	25	30.0 - 703.0	100k	-13	-35.23	-22.23	Pass
			0	1	703.0 - 704.0	10k	-13	-20.24	-7.24	Pass
			0	25	703.0 - 704.0	10k	-13	-31.66	-18.66	Pass
			0	1	709.0 - 710.0	10k	-13	-53.62	-40.62	Pass
			0	25	709.0 - 710.0	10k	-13	-31.70	-18.70	Pass
			0	1	710.0 - 1000.0	100k	-13	-47.38	-34.38	Pass
			0	25	710.0 - 1000.0	100k	-13	-33.24	-20.24	Pass
			0	1	1000.00 - 26000.0	100k	-13	-47.79	-34.79	Pass
			0	25	1000.00 - 26000.0	100k	-13	-52.72	-39.72	Pass

Channel #	Test Frequency (MHz)	Bandwidth (MHz)	RB (Starting)	RB #	Frequency Range (MHz)	RCVR BW (KHz)	Limit dBm	Amplitude dBm	Margin dB	Pass/Fail
23790	710.0	5	0	1	30.0 - 706.5	100k	-13	-30.64	-17.64	Pass
			0	25	30.0 - 706.5	100k	-13	-37.85	-24.85	Pass
			0	1	706.5 - 707.5	10k	-13	-19.81	-6.81	Pass
			0	25	706.5 - 707.5	10k	-13	-33.21	-20.21	Pass
			0	1	712.5 - 713.5	10k	-13	-53.38	-40.38	Pass
			0	25	712.5 - 713.5	10k	-13	-32.24	-19.24	Pass
			0	1	713.5 - 1000.0	100k	-13	-48.11	-35.11	Pass
			0	25	713.5 - 1000.0	100k	-13	-41.13	-28.13	Pass
			0	1	1000.00 - 26000.0	100k	-13	-48.57	-35.57	Pass
			0	25	1000.00 - 26000.0	100k	-13	-52.83	-39.83	Pass



Title: Kumu Networks Inc Relay 2.0
To: FCC Part 24E, 27C & IC RSS 130, RSS 133
Serial #: KUMU06-U2 Rev A

Channel #	Test Frequency (MHz)	Bandwidth (MHz)	RB (Starting)	RB #	Frequency Range (MHz)	RCVR BW (KHz)	Limit dBm	Amplitude dBm	Margin dB	Pass/Fail
23825	713.5	5	0	1	30.0 - 710.0	100k	-13	-33.92	-20.92	Pass
			0	25	30.0 - 710.0	100k	-13	-35.33	-22.33	Pass
			0	1	710.0 - 711.0	10k	-13	-20.04	-7.04	Pass
			0	25	710.0 - 711.0	10k	-13	-32.05	-19.05	Pass
			0	1	716.0 - 717.0	10k	-13	-56.03	-43.03	Pass
			0	25	716.0 - 717.0	10k	-13	-33.05	-20.05	Pass
			0	1	717.0 - 1000.0	100k	-13	-51.41	-38.41	Pass
			0	25	717.0 - 1000.0	100k	-13	-37.15	-24.15	Pass
			0	1	1000.00 - 26000.0	100k	-13	-50.97	-37.97	Pass
			0	25	1000.00 - 26000.0	100k	-13	-51.58	-38.58	Pass

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB



Title: Kumu Networks Inc Relay 2.0
To: FCC Part 24E, 27C & IC RSS 130, RSS 133
Serial #: KUMU06-U2 Rev A

Channel #	Test Frequency (MHz)	Bandwidth (MHz)	RB (Starting)	RB #	Frequency Range (MHz)	RCVR BW (KHz)	Limit dBm	Amplitude dBm	Margin dB	Pass/Fail
23780	709.0	10	0	1	30.0 - 703.0	100k	-13	-38.36	-25.36	Pass
			0	25	30.0 - 703.0	100k	-13	-38.22	-25.22	Pass
			0	1	703.0 - 704.0	10k	-13	-26.32	-13.32	Pass
			0	25	703.0 - 704.0	10k	-13	-41.17	-28.17	Pass
			0	1	714.0 - 715.0	10k	-13	-51.94	-38.94	Pass
			0	25	714.0 - 715.0	10k	-13	-41.29	-28.29	Pass
			0	1	715.0 - 1000.0	100k	-13	-47.03	-34.03	Pass
			0	25	715.0 - 1000.0	100k	-13	-40.38	-27.38	Pass
			0	1	1000.00 - 26000.0	100k	-13	-47.29	-34.29	Pass
			0	25	1000.00 - 26000.0	100k	-13	-54.03	-41.03	Pass

Channel #	Test Frequency (MHz)	Bandwidth (MHz)	RB (Starting)	RB #	Frequency Range (MHz)	RCVR BW (KHz)	Limit dBm	Amplitude dBm	Margin dB	Pass/Fail
23790	710.0	10	0	1	30.0 - 704.0	100k	-13	-36.84	-23.84	Pass
			0	25	30.0 - 704.0	100k	-13	-38.47	-25.47	Pass
			0	1	704.0 - 705.0	10k	-13	-25.98	-12.98	Pass
			0	25	704.0 - 705.0	10k	-13	-41.3	-28.3	Pass
			0	1	715.0 - 716.0	10k	-13	-52.48	-39.48	Pass
			0	25	715.0 - 716.0	10k	-13	-41.87	-28.87	Pass
			0	1	716.0 - 1000.0	100k	-13	-47.82	-34.82	Pass
			0	25	716.0 - 1000.0	100k	-13	-41.28	-28.28	Pass
			0	1	1000.00 - 26000.0	100k	-13	-47.57	-34.57	Pass
			0	25	1000.00 - 26000.0	100k	-13	-54.24	-41.24	Pass

Channel #	Test Frequency (MHz)	Bandwidth (MHz)	RB (Starting)	RB #	Frequency Range (MHz)	RCVR BW (KHz)	Limit dBm	Amplitude dBm	Margin dB	Pass/Fail
23800	711.0	10	0	1	30.0 - 705.0	100k	-13	-39.84	-26.84	Pass
			0	25	30.0 - 705.0	100k	-13	-39.24	-26.24	Pass
			0	1	705.0 - 706.0	10k	-13	-26.48	-13.48	Pass
			0	25	705.0 - 706.0	10k	-13	-41.26	-28.26	Pass
			0	1	716.0 - 717.0	10k	-13	-53.1	-40.1	Pass
			0	25	716.0 - 717.0	10k	-13	-42.25	-29.25	Pass
			0	1	717.0 - 1000.0	100k	-13	-48.54	-35.54	Pass
			0	25	717.0 - 1000.0	100k	-13	-40.66	-27.66	Pass
			0	1	1000.00 - 26000.0	100k	-13	-48.42	-35.42	Pass
			0	25	1000.00 - 26000.0	100k	-13	-53.87	-40.87	Pass

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

9.6. Radiated Transmitter Emissions

Conducted Test Conditions for Out of Band Emissions			
Standard:	FCC Part 24E, 27C IC RSS-130, RSS-133	Ambient Temp. (°C):	20.0 - 24.5
Test Heading:	Out of Band Emissions	Rel. Humidity (%):	32 - 45
Standard Section(s):	FCC 24E: 24.238 a & b FCC 27C: 27.53c & g RSS-130:4.7.1 RSS-133: 6.5	Pressure (mBars):	999 - 1001
Reference Document(s):	See Normative References		

Test Procedure for Out of Band Emissions
 With reference to the test configuration identified in Section 8.1 Conducted Test Setup the EUT was set to transmit on the appropriate center frequency of the selected frequency band and bandwidth. Out of Band emissions was tested under QPSK.

Testing was performed under ambient conditions.

Limits Out of Band Emissions

Band 2:
FCC 24E: §24.238 Emission limitations for Broadband PCS equipment.
 (c) *Out of band emissions.* The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

RSS-133: 6.5 (i) In the 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p$ (watts). 2 GHz Personal Communications Services RSS-133 4

(ii) After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p$ (watts). If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.

(d) *Measurement procedure.* Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

Band 12,13,17:
FCC 27C: §27.53 Emission limits for Miscellaneous Wireless Communications Services.
 (c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:
 (2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log (P)$ dB;

(g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log (P)$ dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

RSS-130: 4.7.1 The unwanted emissions in any 100 kHz bandwidth on any frequency outside the low frequency edge and the high frequency edge of each frequency block range(s), shall be attenuated below the transmitter power, P (dBW), by at least $43 + 10 \log_{10} p$ (watts), dB. However, in the 100 kHz band immediately outside of the equipment's frequency block range, a resolution bandwidth of 30 kHz may be employed.

Band 2: Radiated Transmitter Emissions

FCC 24E: §24.238 Emission limitations for Broadband PCS equipment.

(a) *Out of band emissions.* The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

Band 2 1852.50 MHz 1 RB

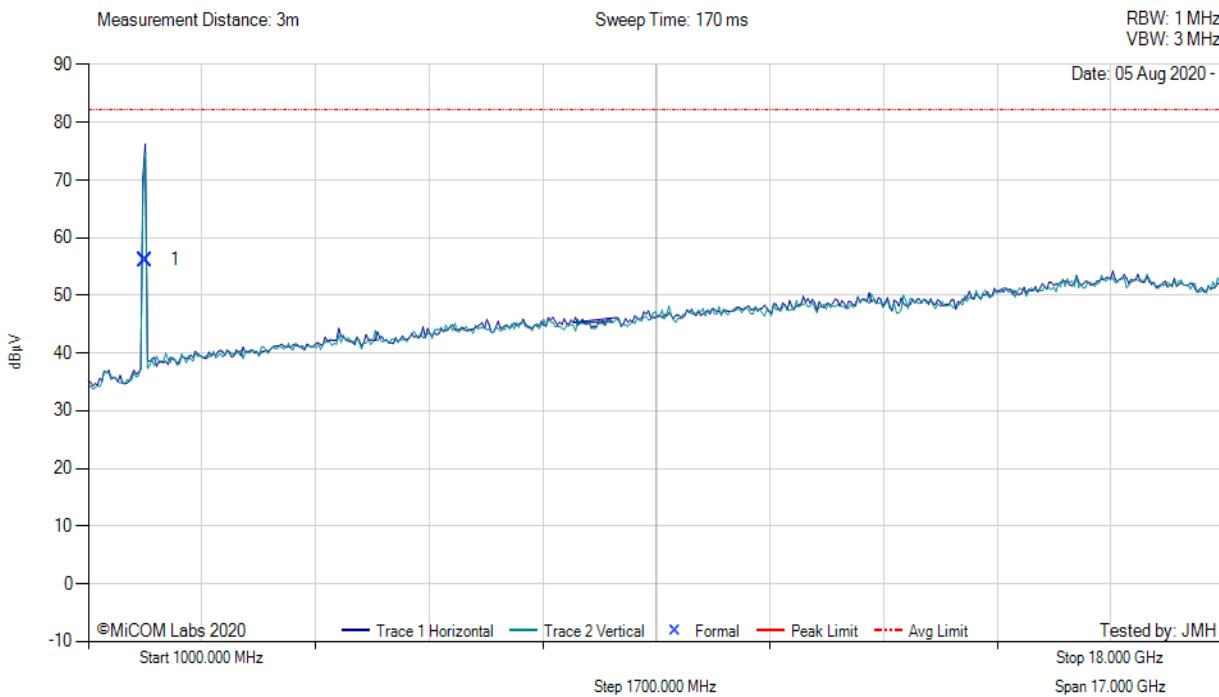
Equipment Configuration for Restricted Band Spurious Emissions

Antenna:	Not Applicable	Variant:	5 MHz
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	1852.50	Data Rate:	1 RB
Power Setting:	Max	Tested By:	JMH

Test Measurement Results



Test Freq: 1852.50 MHz, Power Setting: Max, Duty Cycle (%): 99



1000.00 - 18000.00 MHz													
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB/m	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail	
1	1850.41	68.42	1.77	-14.06	56.13	Fundamental	Horizontal	100	0	--	--		

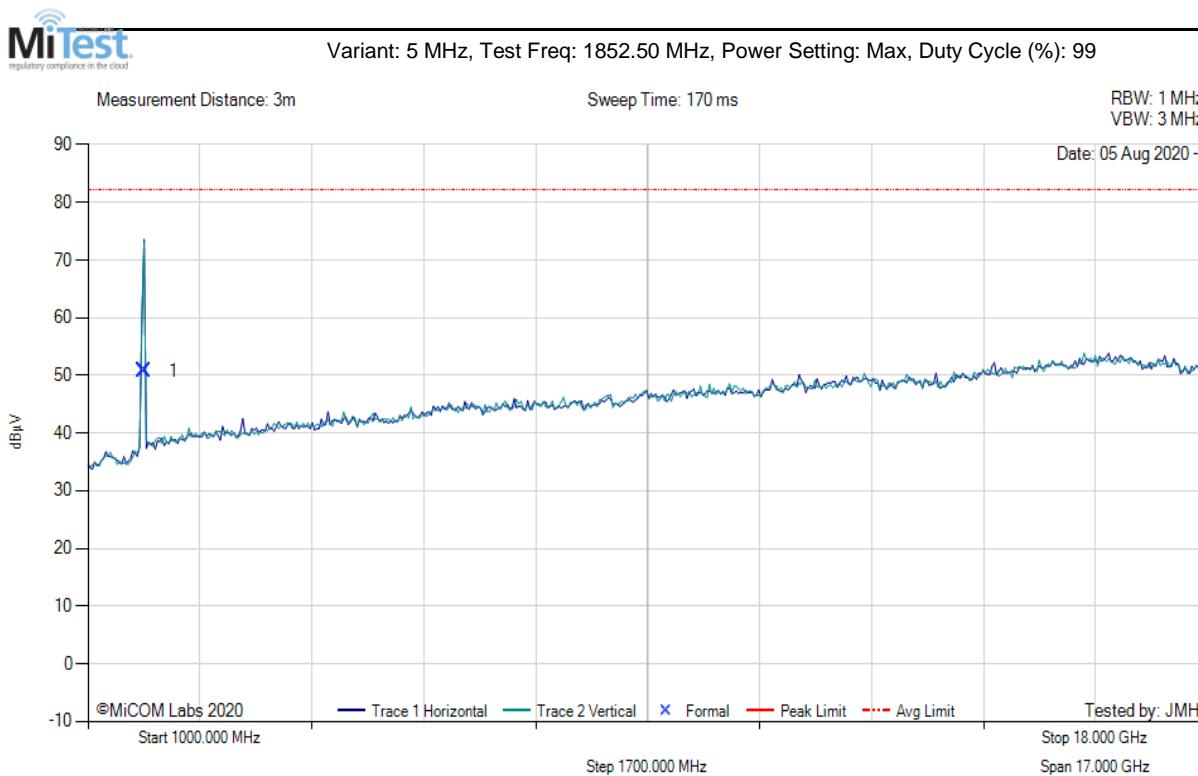
Test Notes: EUT powered by -48VDC, connected to Call box outside chamber. 1 RB

Band 2 1852.50 MHz Full RB

Equipment Configuration for Restricted Band Spurious Emissions

Antenna:	Not Applicable	Variant:	5 MHz
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	1852.50	Data Rate:	Full RB
Power Setting:	Max	Tested By:	JMH

Test Measurement Results



1000.00 - 18000.00 MHz													
Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB/m	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail	
1	1852.50	63.09	1.77	-14.07	50.79	Fundamental	Horizontal	100	0	--	--		

Test Notes: EUT powered by -48VDC, connected to Call box outside chamber. Full RB

Band 2 1880.00 MHz Full RB

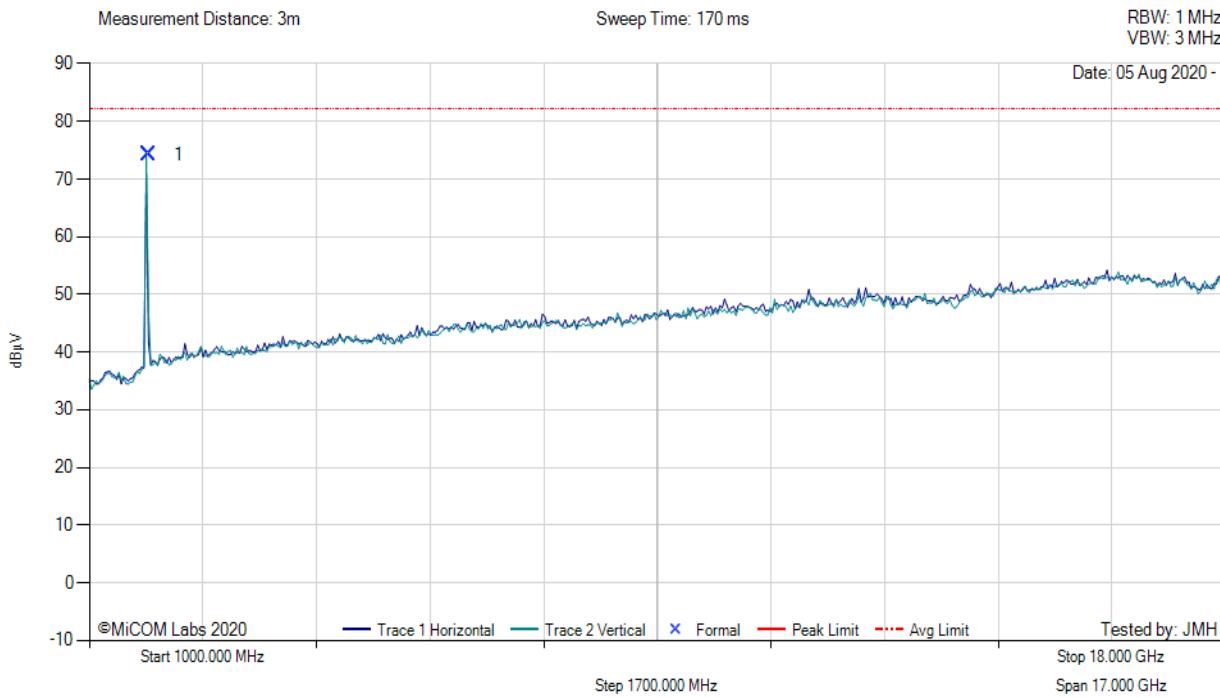
Equipment Configuration for Restricted Band Spurious Emissions

Antenna:	Not Applicable	Variant:	5 MHz
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	1880.00	Data Rate:	Full RB
Power Setting:	Max	Tested By:	JMH

Test Measurement Results



Test Freq: 1880.00 MHz, Power Setting: Max, Duty Cycle (%): 99



1000.00 - 18000.00 MHz												
Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB/m	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail
1	1881.93	86.34	1.80	-13.95	74.19	Fundamental	Vertical	151	354	--	--	

Test Notes: EUT powered by -48VDC, connected to Call box outside chamber. Full RB

Band 2 1880.00 MHz 1 RB

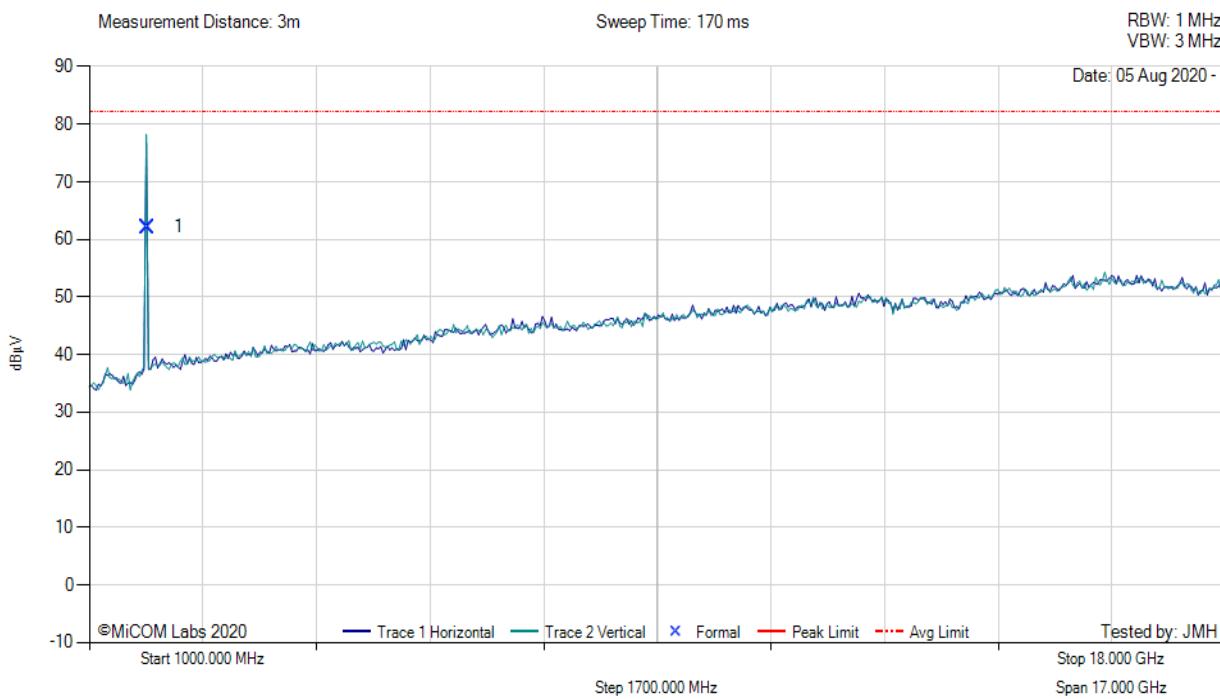
Equipment Configuration for Restricted Band Spurious Emissions

Antenna:	Not Applicable	Variant:	5 MHz
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	1880.00	Data Rate:	1 RB
Power Setting:	Max	Tested By:	JMH

Test Measurement Results



Test Freq: 1880.00 MHz, Power Setting: Max, Duty Cycle (%): 99



1000.00 - 18000.00 MHz													
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB/m	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail	
1	1880.19	74.27	1.80	-13.96	62.11	Fundamental	Vertical	100	192	--	--		

Test Notes: EUT powered by -48VDC, connected to Call box outside chamber. 1 RB

Band 2 1907.50 MHz Full RB

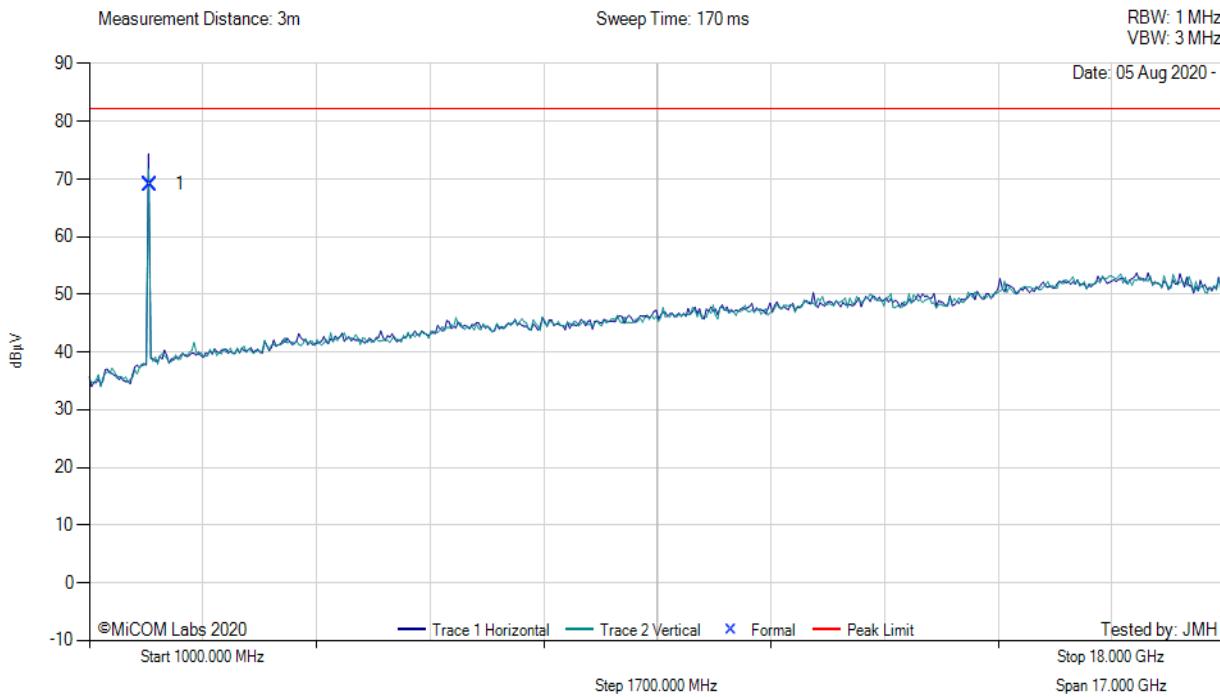
Equipment Configuration for Radiated Spurious Emissions (Class A)

Antenna:	Not Applicable	Variant:	5 MHz
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	1907.50	Data Rate:	Full RB
Power Setting:	Max	Tested By:	JMH

Test Measurement Results



Test Freq: 1885.00 MHz, Power Setting: Max, Duty Cycle (%): 99



1000.00 - 18000.00 MHz												
Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
1	1907.55	81.10	1.79	-13.84	69.05	Fundamental	Horizontal	101	172	--	--	

Test Notes: EUT powered by -48VDC, connected to Call box outside chamber, Full Resource Blocks

Band 2 1907.50 MHz 1 RB

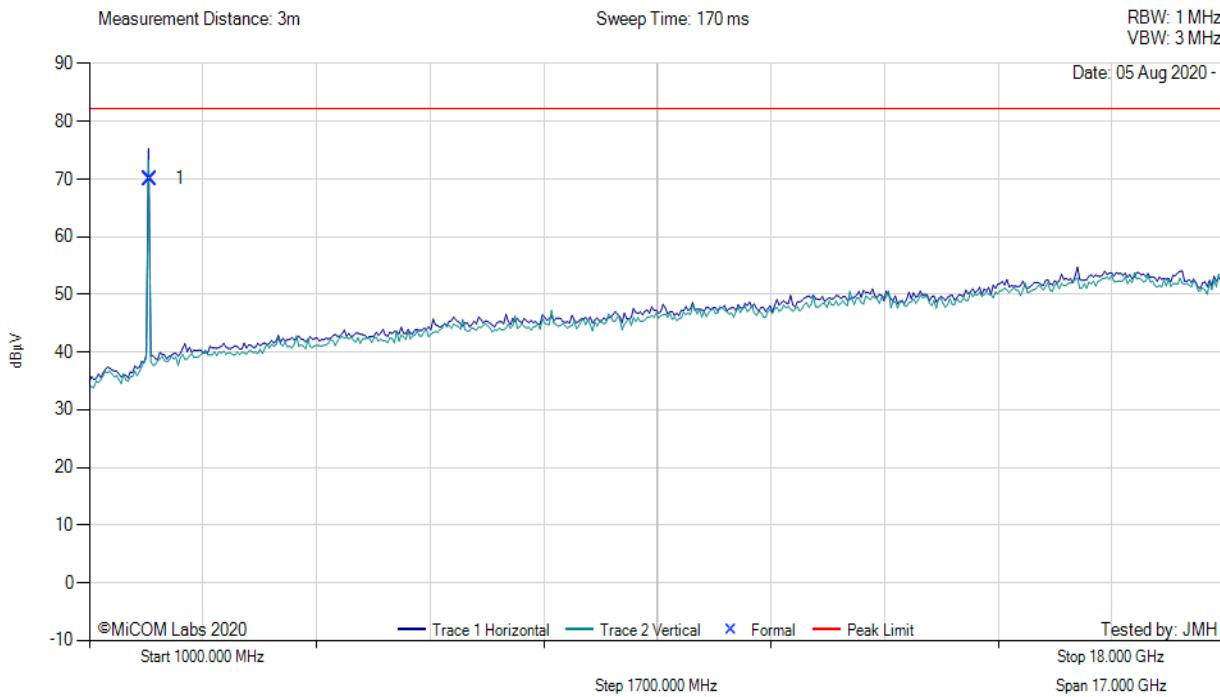
Equipment Configuration for Radiated Spurious Emissions (Class A)

Antenna:	Not Applicable	Variant:	5 MHz
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	1907.50	Data Rate:	1 RB
Power Setting:	Max	Tested By:	JMH

Test Measurement Results



Test Freq: 1907.50 MHz, Power Setting: Max, Duty Cycle (%): 99



1000.00 - 18000.00 MHz												
Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB/m	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail
1	1905.35	82.11	1.78	-13.85	70.04	Fundamental	Horizontal	200	172	--	--	

Test Notes: EUT powered by -48VDC, connected to Call box outside chamber. 1 RB

Band 12: Radiated Transmitter Emissions

FCC 27.53g: Emission limits for Miscellaneous Wireless equipment.

(g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log (P)$ dB.

30- 1000 MHz Emissions

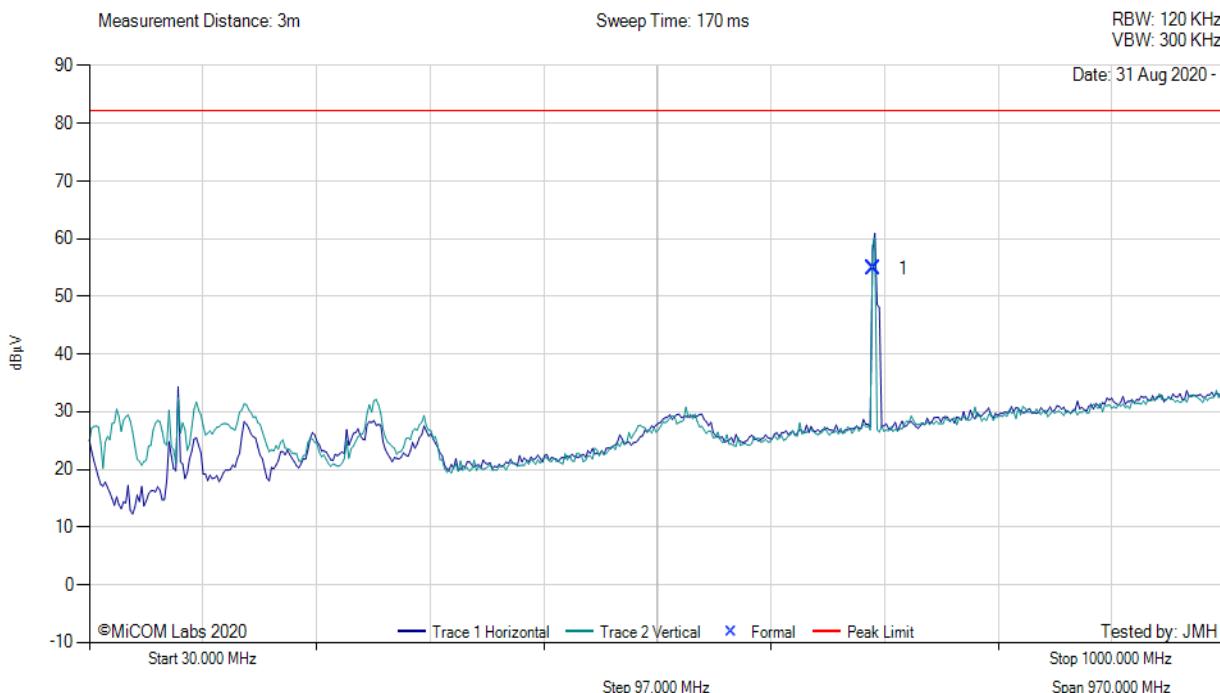
Band 12 701.5 MHz 1 RB

Equipment Configuration for Restricted Band Spurious Emissions

Antenna:	Not Applicable	Variant:	LTE Band 13
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	784.50	Data Rate:	1 RB
Power Setting:	Max	Tested By:	JMH



Variant: LTE Band 12, Test Freq: 701.50 MHz, Power Setting: Max, Duty Cycle (%): 99



30.00 - 1000.00 MHz												
Num	Frequency MHz	Raw dBµV	Cable Loss dB	AF dB/m	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	699.30	55.93	6.20	-7.30	54.83	Fundamental	Horizontal	100	0	--	--	

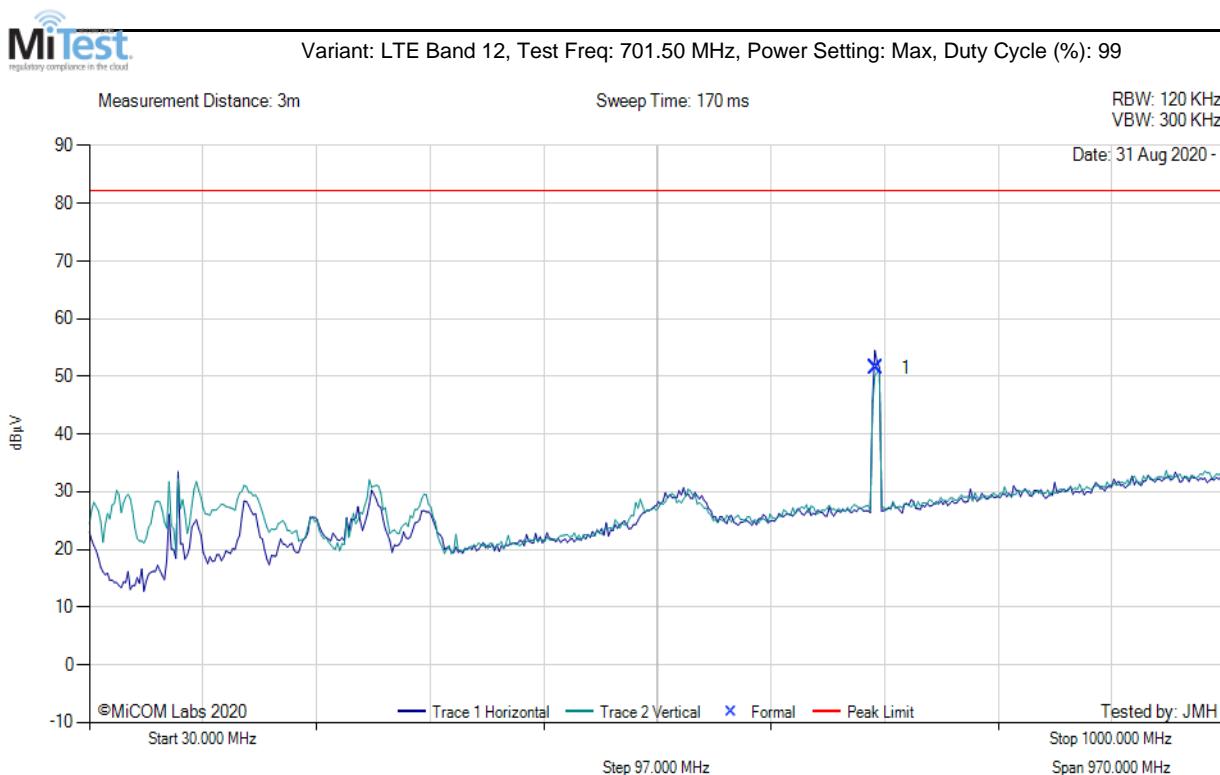
Test Notes: EUT powered by -48VDC DC. Connected to callbox outside chamber. UL 701.5 1 RB

Band 12 701.5 MHz Full RB

Equipment Configuration for Radiated Spurious Emissions

Antenna:	Not Applicable	Variant:	LTE Band 12
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	701.50	Data Rate:	Full RB
Power Setting:	Max	Tested By:	JMH

Test Measurement Results



30.00 - 1000.00 MHz												
Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB/m	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail
1	701.91	52.52	6.20	-7.23	51.49	Fundamental	Horizontal	100	296	--	--	

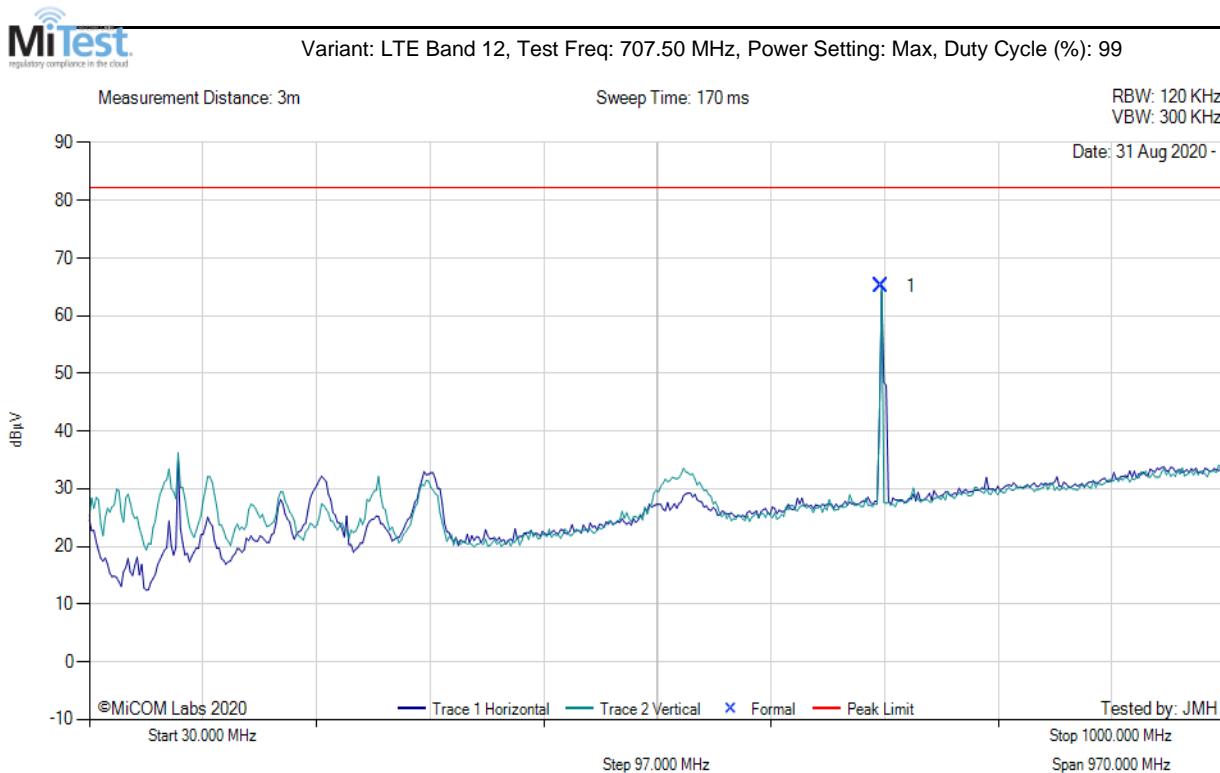
Test Notes: EUT powered by -48VDC DC. Connected to callbox outside chamber. UL 701.5 Full RB

Band 12 707.5 MHz 1 RB

Equipment Configuration for Radiated Spurious Emissions

Antenna:	Not Applicable	Variant:	LTE Band 12
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	707.50	Data Rate:	1 RB
Power Setting:	Max	Tested By:	JMH

Test Measurement Results



30.00 - 1000.00 MHz													
Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB/m	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail	
1	705.54	66.24	6.22	-7.25	65.21	Fundamental	Vertical	100	0	--	--		

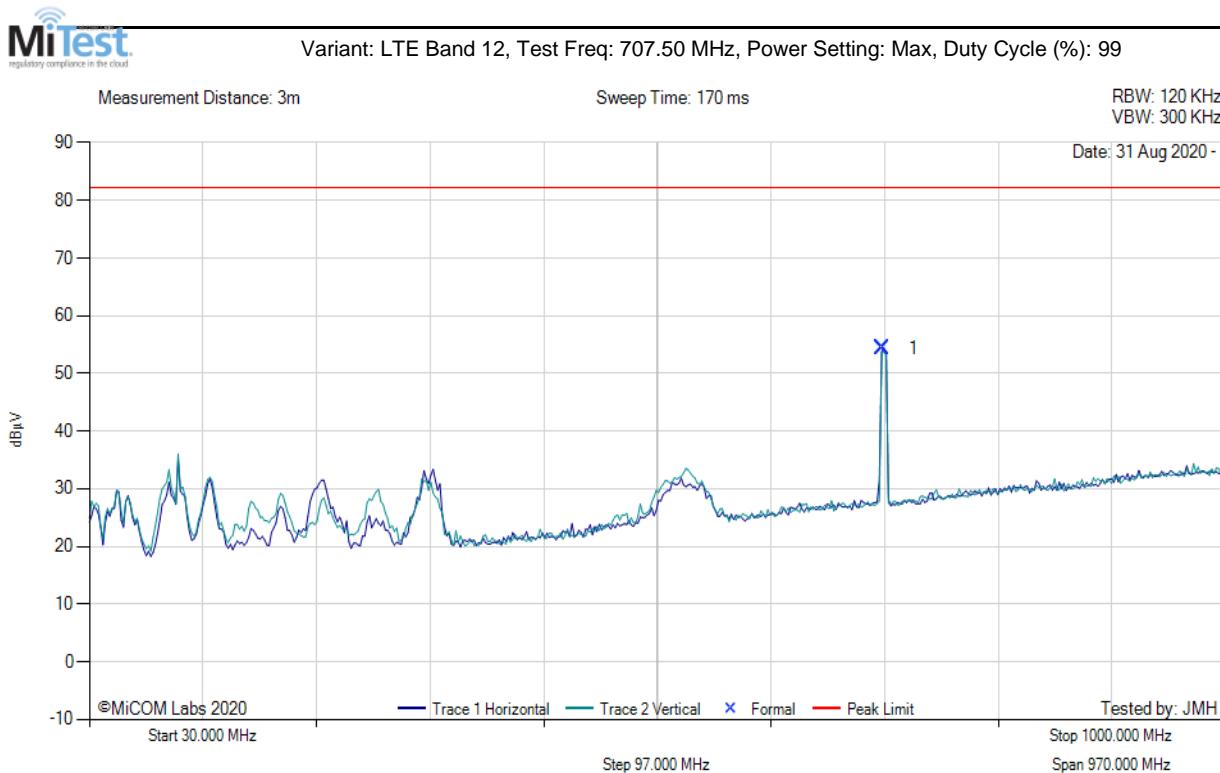
Test Notes: EUT powered by -48VDC DC. Connected to callbox outside chamber. UL 701.5 1 RB

Band 12 707.5 MHz Full RB

Equipment Configuration for Radiated Spurious Emissions

Antenna:	Not Applicable	Variant:	LTE Band 12
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	707.50	Data Rate:	Full RB
Power Setting:	Max	Tested By:	JMH

Test Measurement Results



30.00 - 1000.00 MHz													
Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB/m	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail	
1	707.58	55.27	6.22	-7.16	54.33	Fundamental	Horizontal	100	171	--	--		

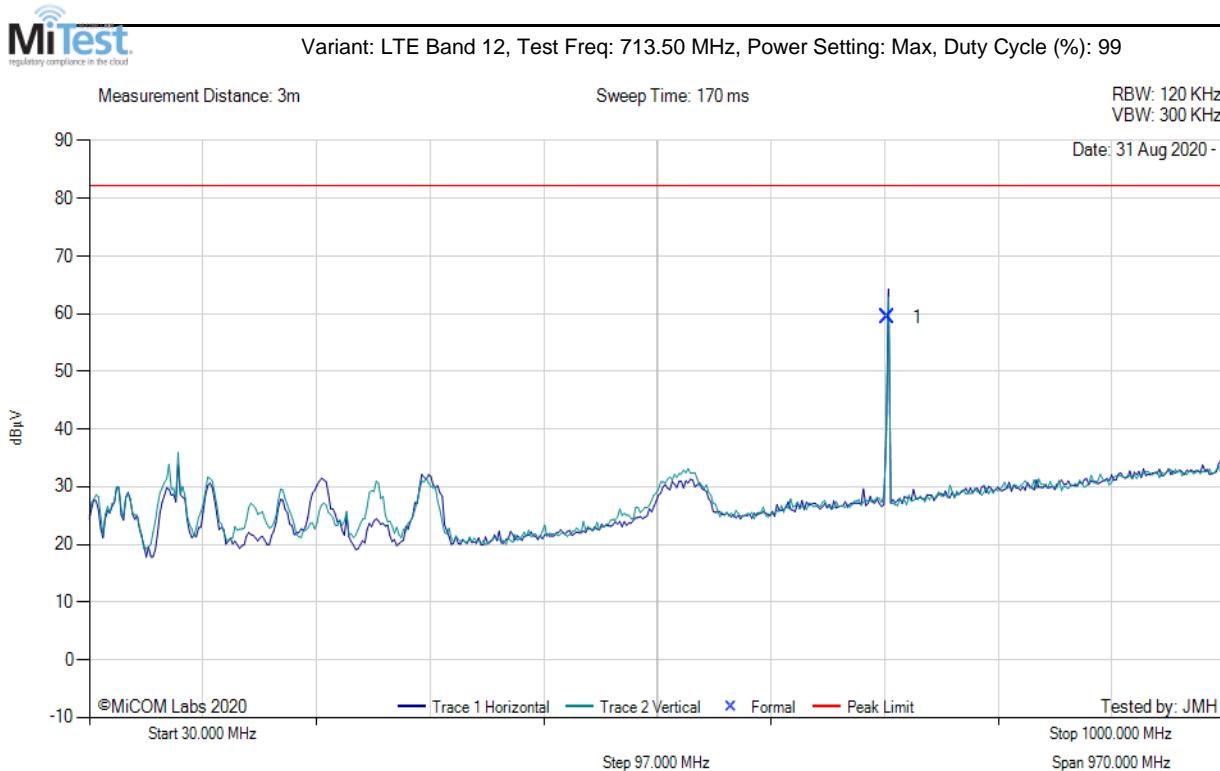
Test Notes: EUT powered by -48VDC DC. Connected to callbox outside chamber. UL 701.5 Full RB

Band 12 713.5 MHz 1 RB

Equipment Configuration for Radiated Spurious Emissions

Antenna:	Not Applicable	Variant:	LTE Band 12
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	713.50	Data Rate:	1 RB
Power Setting:	Max	Tested By:	JMH

Test Measurement Results



30.00 - 1000.00 MHz												
Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB/m	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail
1	711.41	60.23	6.23	-7.14	59.33	Fundamental	Horizontal	201	0	--	--	

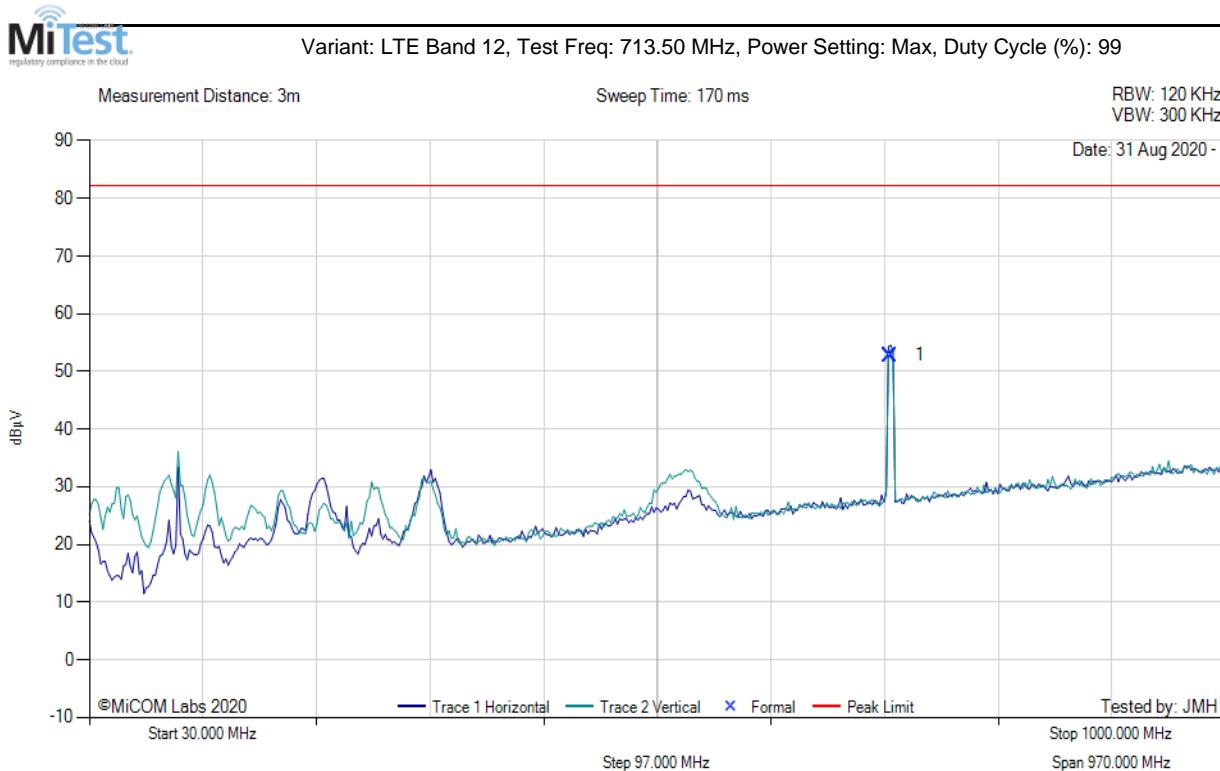
Test Notes: EUT powered by -48VDC DC. Connected to callbox outside chamber. UL 713.5.1 RBB

Band 12 713.5 MHz Full RB

Equipment Configuration for Radiated Spurious Emissions

Antenna:	Not Applicable	Variant:	LTE Band 12
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	713.50	Data Rate:	Full RB
Power Setting:	Max	Tested By:	JMH

Test Measurement Results



30.00 - 1000.00 MHz													
Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB/m	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail	
1	713.31	53.61	6.23	-7.03	52.81	Fundamental	Horizontal	100	0	--	--		

Test Notes: EUT powered by -48VDC DC. Connected to callbox outside chamber. UL 713.5 Full RB

1-8 GHz Emissions

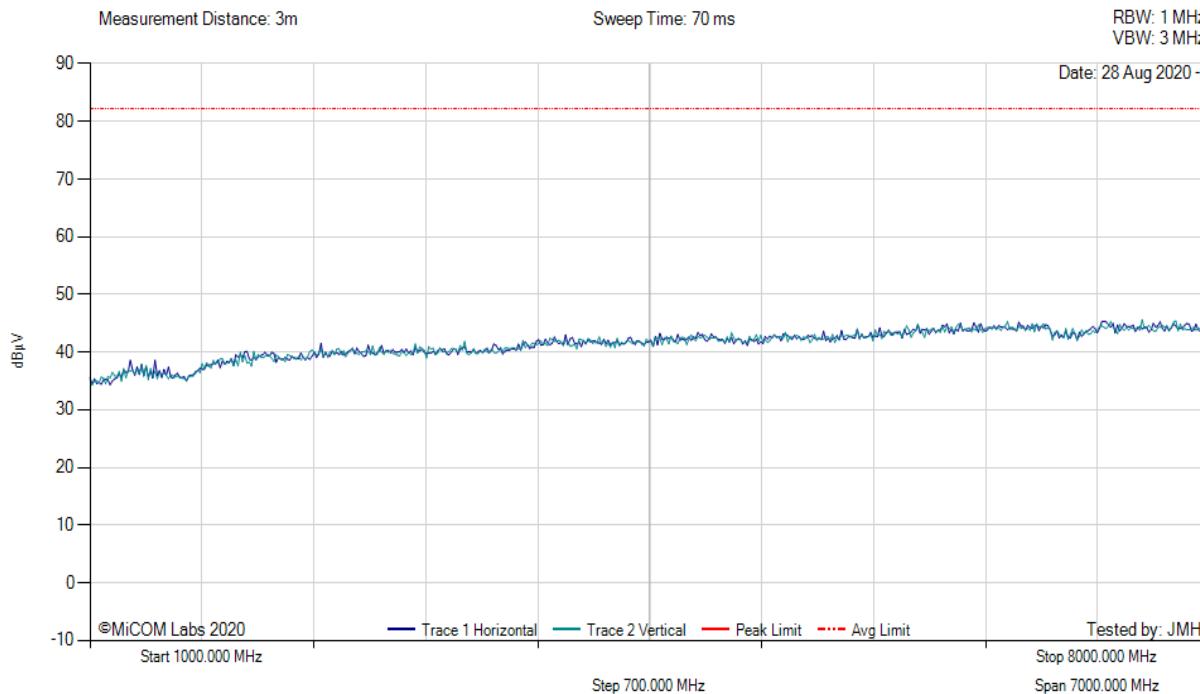
Band 12 701.5 MHz 1 RB

Equipment Configuration for Restricted Band Spurious Emissions

Antenna:	Not Applicable	Variant:	Band 12 LTE
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	701.50	Data Rate:	1 RB
Power Setting:	Max	Tested By:	JMH



Variant: Band 12 LTE, Test Freq: 701.50 MHz, Power Setting: Max, Duty Cycle (%): 99



There are no emissions found within 6dB of the limit line.

Test Notes: EUT powered by -48VDC DC. Connected to callbox outside chamber. UL 701.5 MHz 1 RB

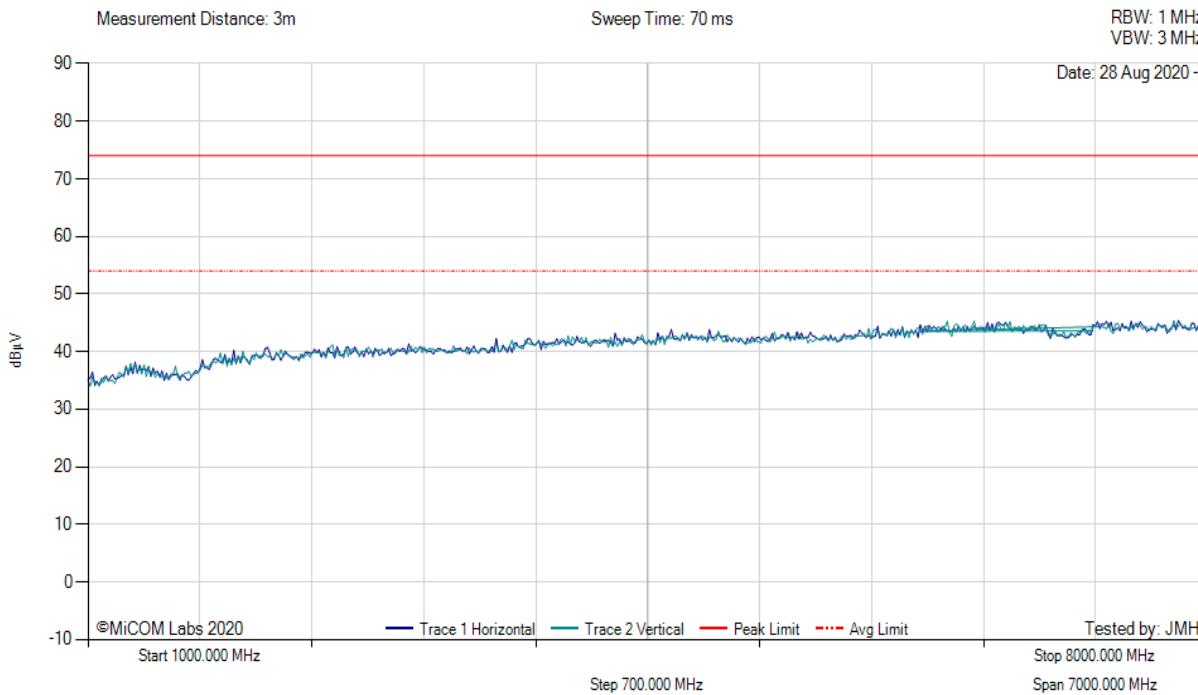
Band 12 701.5 MHz Full RB

Equipment Configuration for Restricted Band Spurious Emissions

Antenna:	Not Applicable	Variant:	Band 12 LTE
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	701.50	Data Rate:	Full RB
Power Setting:	Max	Tested By:	JMH



Variant: Band 12 LTE, Test Freq: 701.50 MHz, Power Setting: Max, Duty Cycle (%): 99



There are no emissions found within 6dB of the limit line.

Test Notes: EUT powered by -48VDC DC. Connected to callbox outside chamber. UL 701.5 MHz Full RB

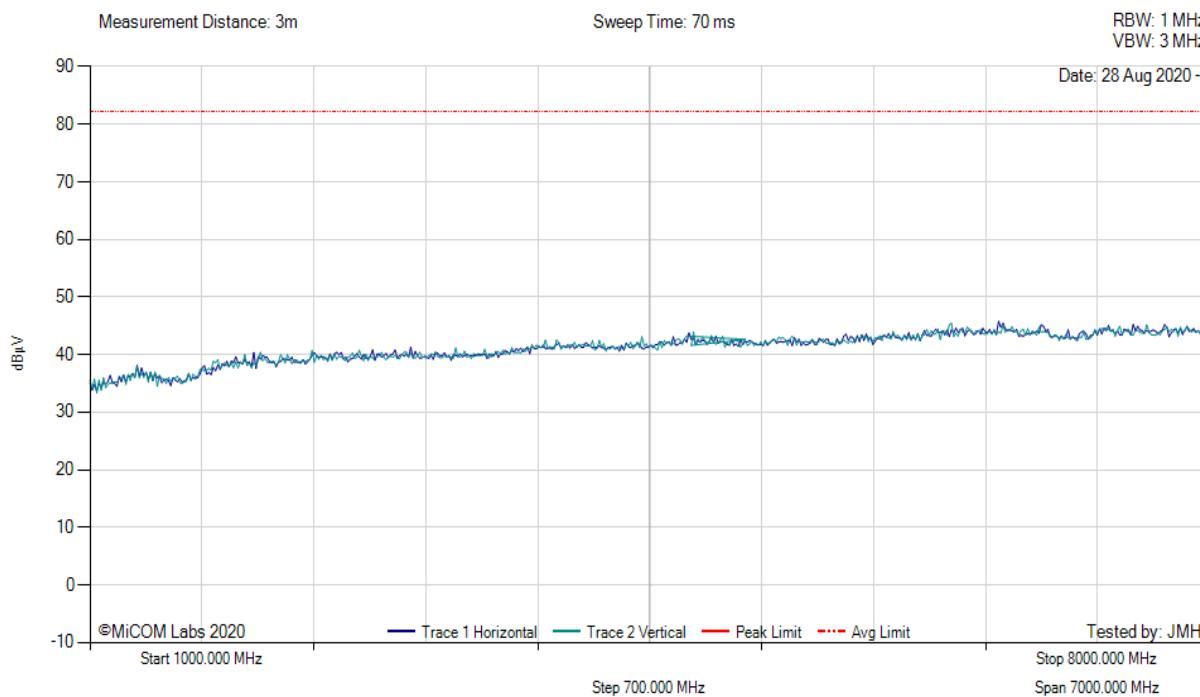
Band 12 707.5 MHz 1 RB

Equipment Configuration for Restricted Band Spurious Emissions

Antenna:	Not Applicable	Variant:	Band 12 LTE
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	707.50	Data Rate:	1 RB
Power Setting:	Max	Tested By:	JMH



Variant: Band 12 LTE, Test Freq: 707.50 MHz, Power Setting: Max, Duty Cycle (%): 99



There are no emissions found within 6dB of the limit line.

Test Notes: EUT powered by -48VDC DC. Connected to callbox outside chamber. UL 707.5 MHz 1 RB

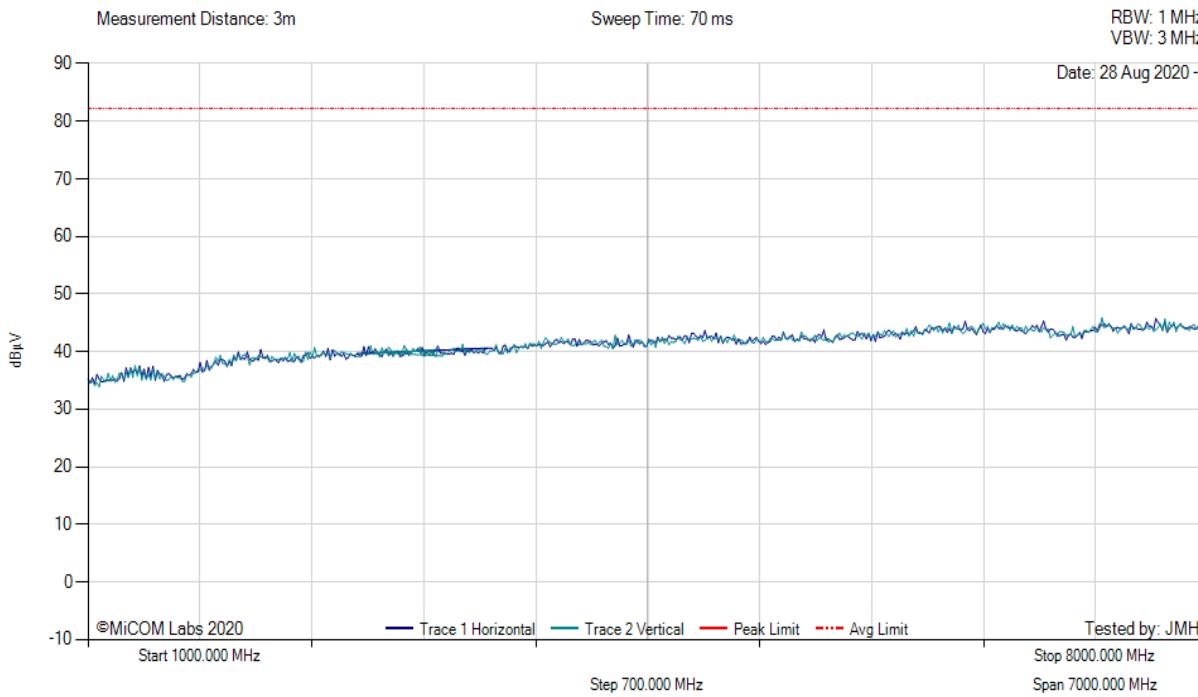
Band 12 707.5 MHz Full RB

Equipment Configuration for Restricted Band Spurious Emissions

Antenna:	Not Applicable	Variant:	Band 12 LTE
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	707.50	Data Rate:	Full RB
Power Setting:	Max	Tested By:	JMH



Variant: Band 12 LTE, Test Freq: 707.50 MHz, Power Setting: Max, Duty Cycle (%): 99



There are no emissions found within 6dB of the limit line.

Test Notes: EUT powered by -48VDC DC. Connected to callbox outside chamber. UL 707.5 MHz Full RB

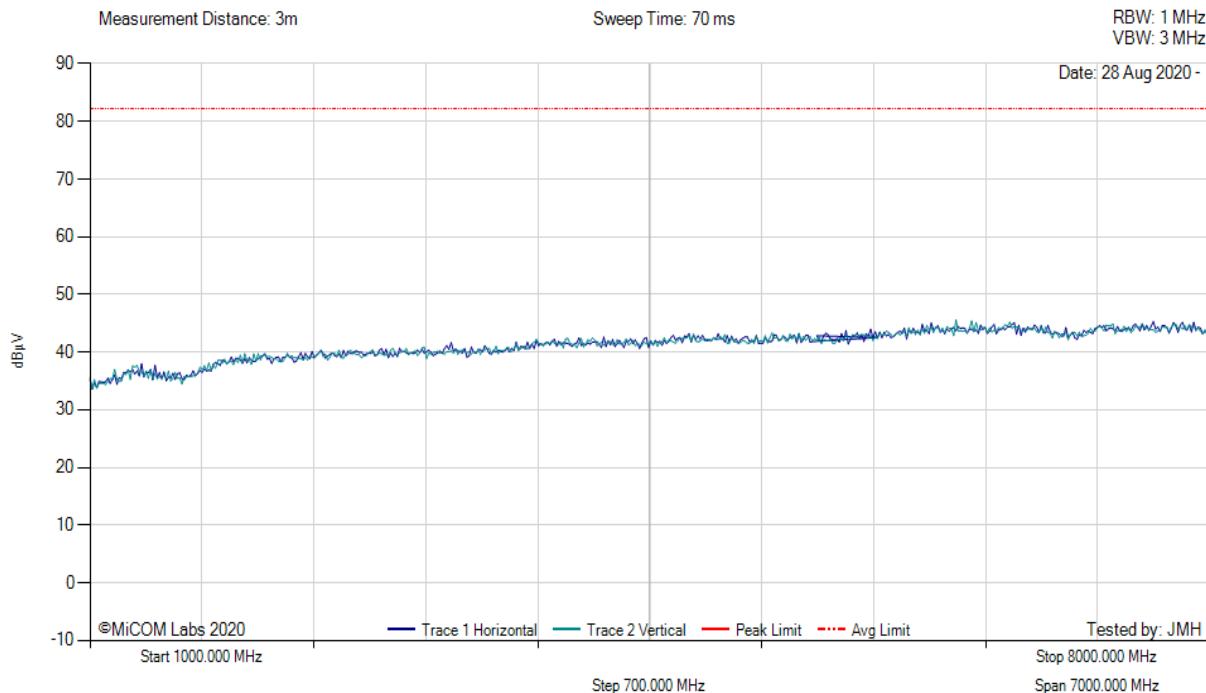
Band 12 713.5 MHz 1 RB

Equipment Configuration for Restricted Band Spurious Emissions

Antenna:	Not Applicable	Variant:	Band 12 LTE
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	713.50	Data Rate:	1RB
Power Setting:	Max	Tested By:	JMH



Variant: Band 12 LTE, Test Freq: 713.50 MHz, Power Setting: Max, Duty Cycle (%): 99



There are no emissions found within 6dB of the limit line.

Test Notes: EUT powered by -48VDC DC. Connected to callbox outside chamber. UL 713.5 MHz 1 RB

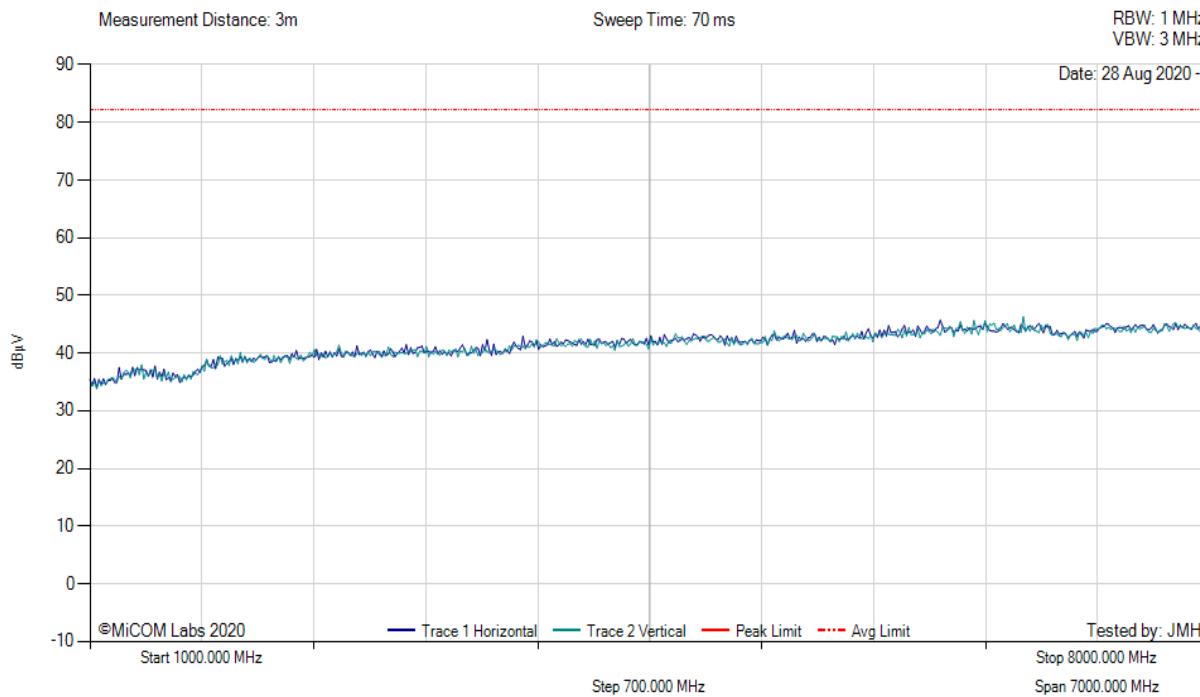
Band 12 713.5 MHz Full RB

Equipment Configuration for Restricted Band Spurious Emissions

Antenna:	Not Applicable	Variant:	Band 12 LTE
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	713.50	Data Rate:	Full RB
Power Setting:	Max	Tested By:	JMH



Variant: Band 12 LTE, Test Freq: 713.50 MHz, Power Setting: Max, Duty Cycle (%): 99



There are no emissions found within 6dB of the limit line.

Test Notes: EUT powered by -48VDC DC. Connected to callbox outside chamber. UL 713.5 MHz Full RB

Band 13: Radiated Transmitter Emissions

FCC 27.53c: Emission limits for Miscellaneous Wireless equipment.

(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log (P)$ dB;.

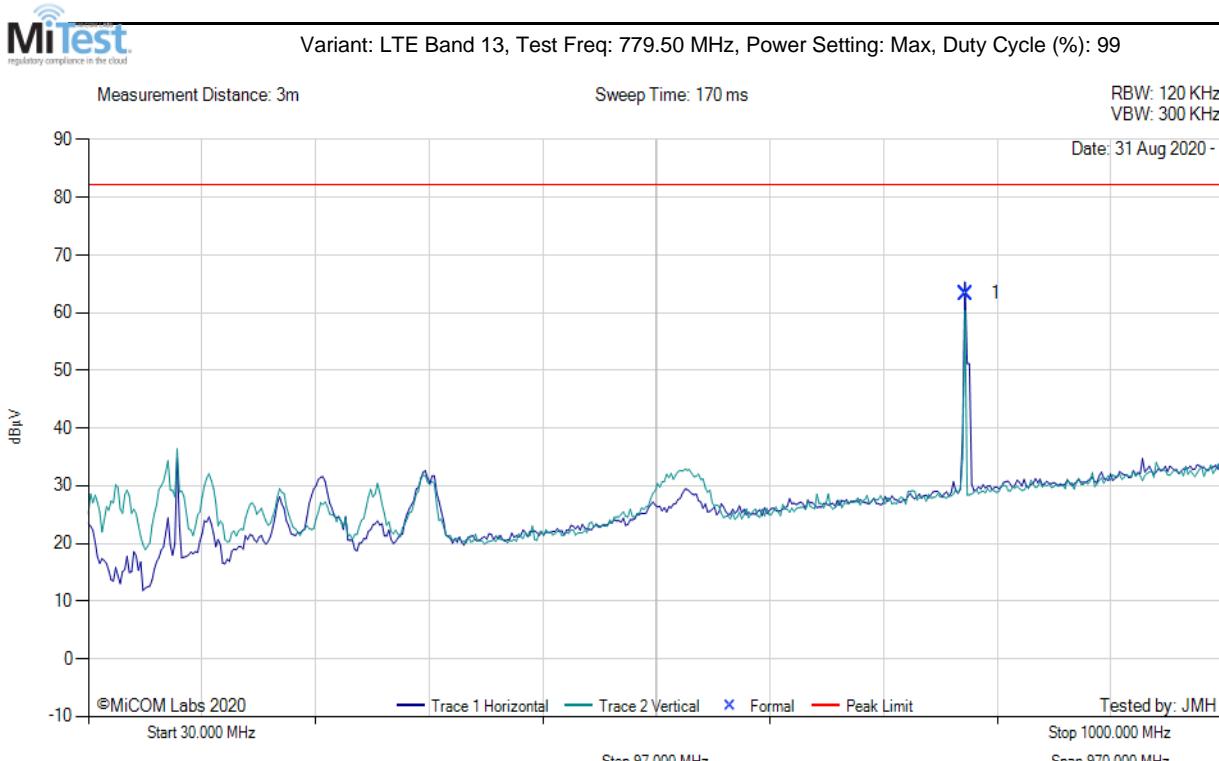
30- 1000 MHz Emissions

Band 13 779.5 MHz 1 RB

Equipment Configuration for Radiated Spurious Emissions

Antenna:	Not Applicable	Variant:	LTE Band 13
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	779.50	Data Rate:	1 RB
Power Setting:	Max	Tested By:	JMH

Test Measurement Results



30.00 - 1000.00 MHz												
Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB/m	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail
1	779.34	63.09	6.42	-6.19	63.32	Fundamental	Horizontal	200	116	--	--	

Test Notes: EUT powered by -48VDC DC. Connected to callbox outside chamber. UL 779.5.1 RBs

Issue Date: 14th September 2020

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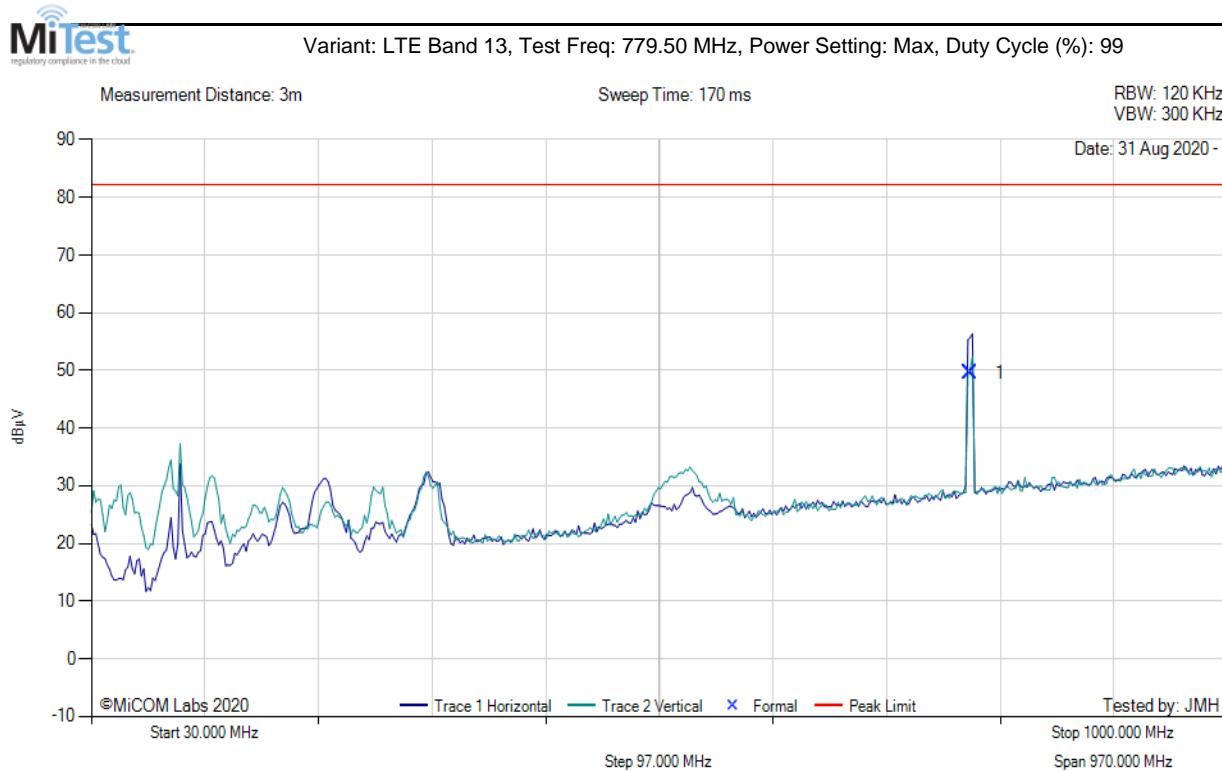
MiCOM Labs, 575 Boulder Court, Pleasanton, California 94566 USA, Phone: +1 (925) 462 0304, Fax: +1 (925) 462 0306, www.micomlabs.com

Band 13 779.5 MHz Full RB

Equipment Configuration for Radiated Spurious Emissions

Antenna:	Not Applicable	Variant:	LTE Band 13
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	779.50	Data Rate:	Full RB
Power Setting:	Max	Tested By:	JMH

Test Measurement Results



30.00 - 1000.00 MHz												
Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB/m	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail
1	779.82	49.21	6.43	-6.09	49.55	Fundamental	Horizontal	100	209	--	--	

Test Notes: EUT powered by -48VDC DC. Connected to callbox outside chamber. UL 779.5 Full RB

Issue Date: 14th September 2020

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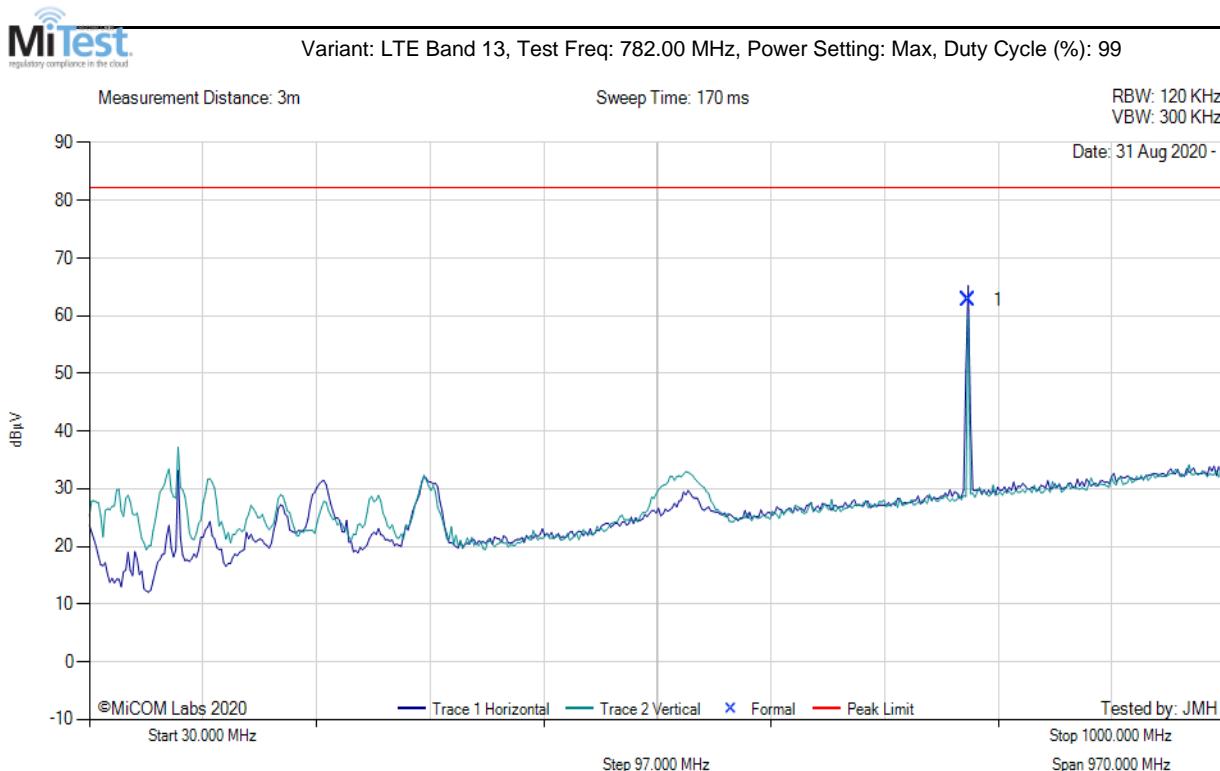
MiCOM Labs, 575 Boulder Court, Pleasanton, California 94566 USA, Phone: +1 (925) 462 0304, Fax: +1 (925) 462 0306, www.micomlabs.com

Band 13 782 MHz 1 RB

Equipment Configuration for Radiated Spurious Emissions

Antenna:	Not Applicable	Variant:	LTE Band 13
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	782.00	Data Rate:	1 RB
Power Setting:	Max	Tested By:	JMH

Test Measurement Results



30.00 - 1000.00 MHz													
Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB/m	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail	
1	779.91	62.41	6.43	-6.09	62.75	Fundamental	Horizontal	200	50	--	--		

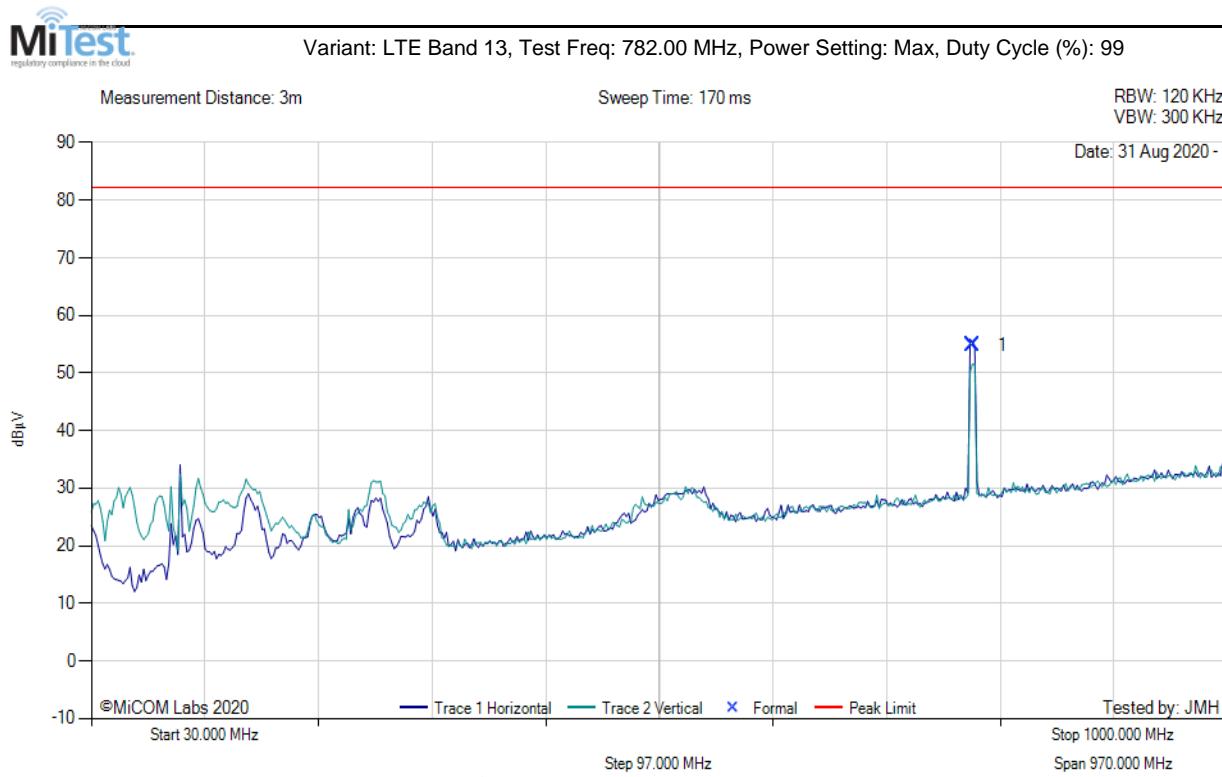
Test Notes: EUT powered by -48VDC DC. Connected to callbox outside chamber. UL 782.0 1 RB

Band 13 782 MHz Full RB

Equipment Configuration for Radiated Spurious Emissions

Antenna:	Not Applicable	Variant:	LTE Band 13
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	782.00	Data Rate:	Full RB
Power Setting:	Max	Tested By:	JMH

Test Measurement Results



30.00 - 1000.00 MHz												
Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB/m	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail
1	782.04	54.48	6.44	-6.02	54.90	Fundamental	Horizontal	100	84	--	--	

Test Notes: EUT powered by -48VDC DC. Connected to callbox outside chamber. UL 782.0 Full RB

Band 13 784.5 MHz 1 RB

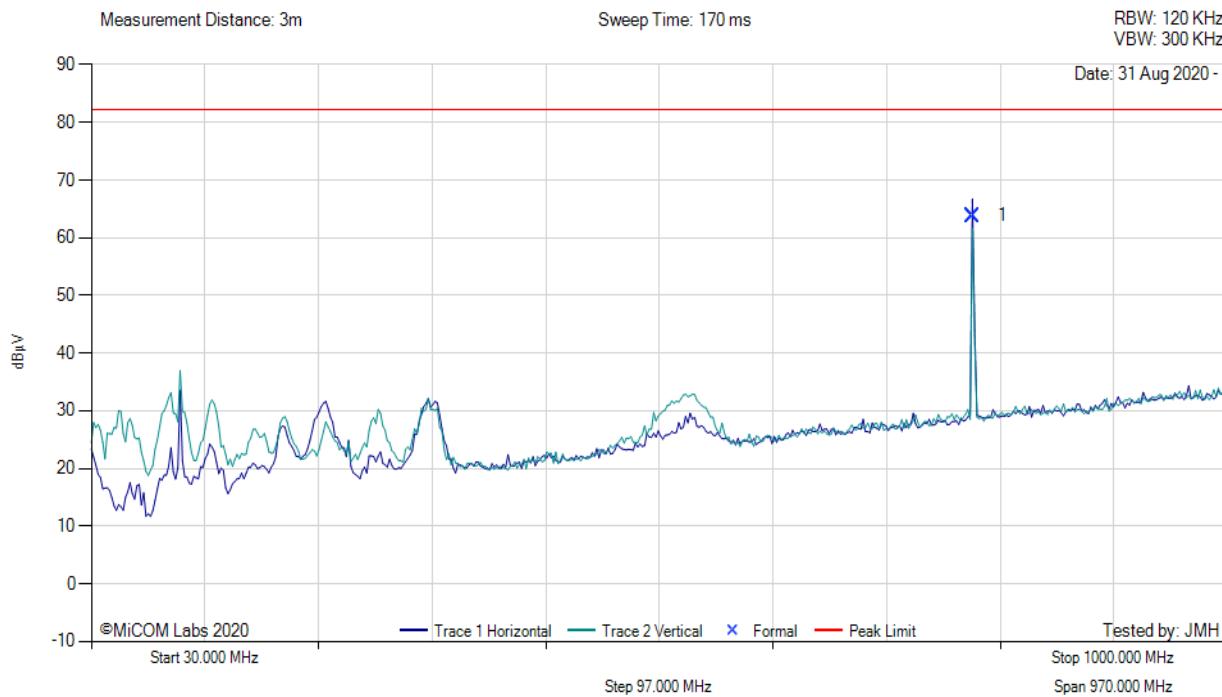
Equipment Configuration for Radiated Spurious Emissions

Antenna:	Not Applicable	Variant:	LTE Band 13
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	784.50	Data Rate:	1 RB
Power Setting:	Max	Tested By:	JMH

Test Measurement Results



Variant: LTE Band 13, Test Freq: 784.50 MHz, Power Setting: Max, Duty Cycle (%): 99



30.00 - 1000.00 MHz													
Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB/m	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail	
1	782.34	63.35	6.44	-6.02	63.78	Fundamental	Horizontal	200	58	--	--		

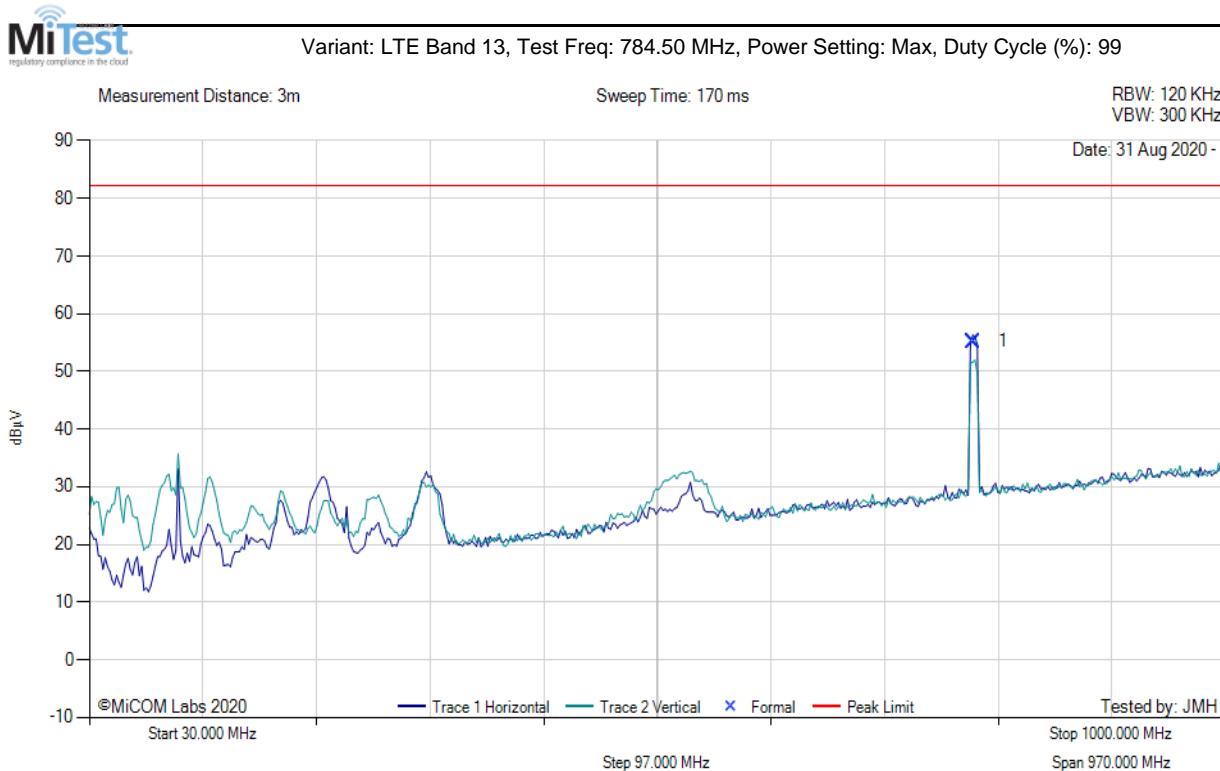
Test Notes: EUT powered by -48VDC DC. Connected to callbox outside chamber. UL 784.5 1 RB

Band 13 784.5 MHz Full RB

Equipment Configuration for Radiated Spurious Emissions

Antenna:	Not Applicable	Variant:	LTE Band 13
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	784.50	Data Rate:	Full RB
Power Setting:	Max	Tested By:	JMH

Test Measurement Results



30.00 - 1000.00 MHz												
Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB/m	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail
1	784.37	54.83	6.44	-6.04	55.23	Fundamental	Horizontal	200	52	--	--	

Test Notes: EUT powered by -48VDC DC. Connected to callbox outside chamber. UL 784.5 Full RB

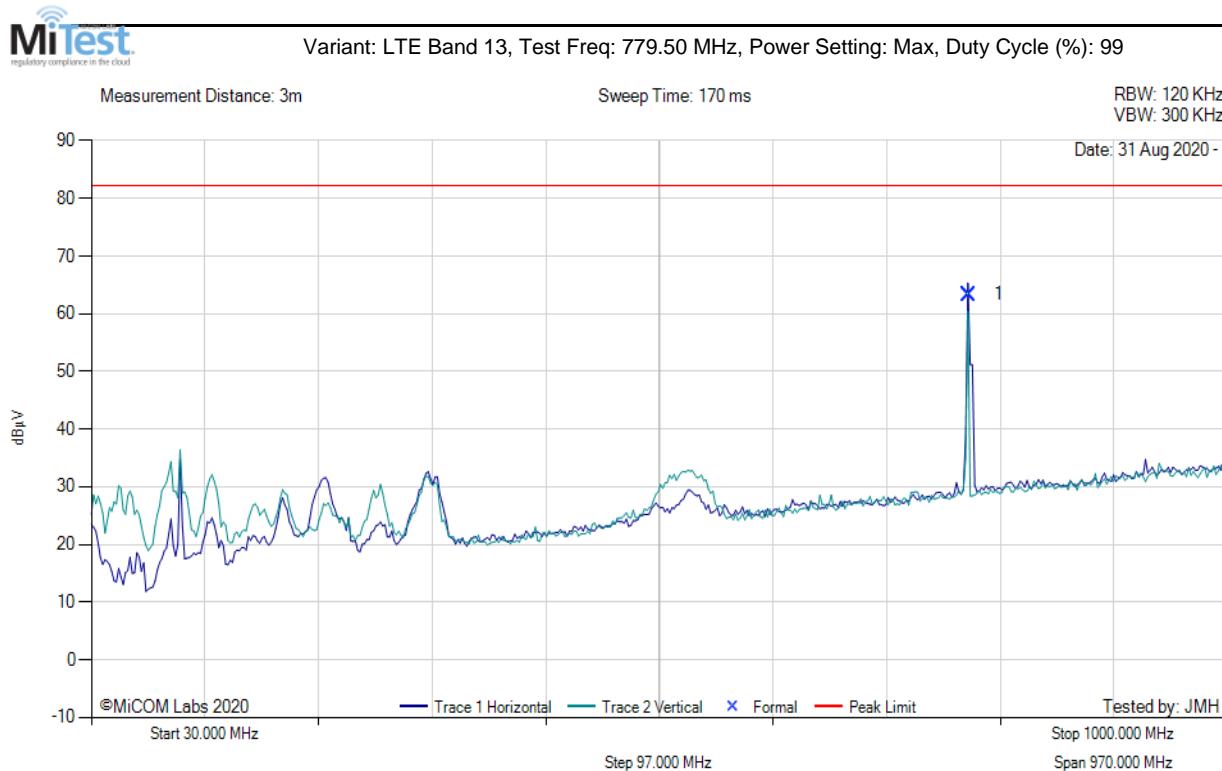
1-8 GHz Emissions

Band 13 779.5 MHz 1 RB

Equipment Configuration for Radiated Spurious Emissions

Antenna:	Not Applicable	Variant:	LTE Band 13
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	779.50	Data Rate:	MHz 1 RB
Power Setting:	Max	Tested By:	JMH

Test Measurement Results



30.00 - 1000.00 MHz												
Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB/m	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail
1	779.34	63.09	6.42	-6.19	63.32	Fundamental	Horizontal	200	116	--	--	



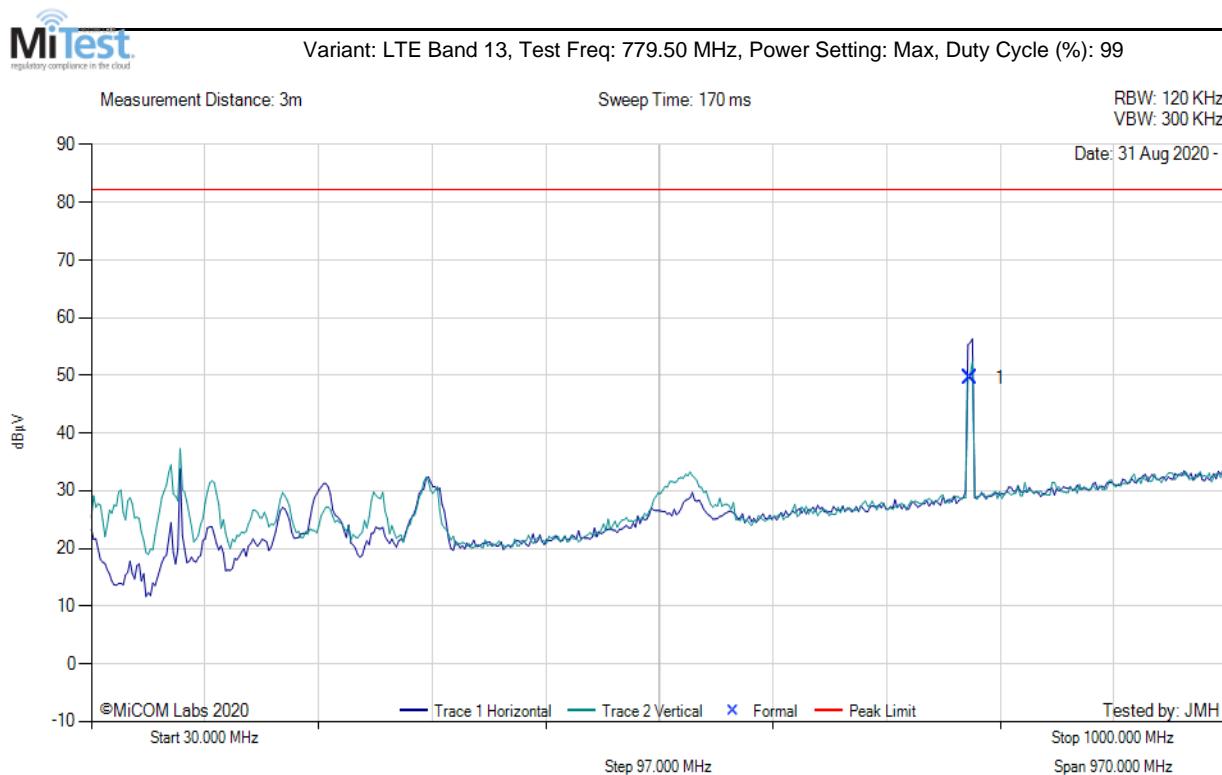
Title: Kumu Networks Inc Relay 2.0
To: FCC Part 24E, 27C & IC RSS 130, RSS 133
Serial #: KUMU06-U2 Rev A

Band 13 779.5 MHz Full RB

Equipment Configuration for Radiated Spurious Emissions

Antenna:	Not Applicable	Variant:	LTE Band 13
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	779.50	Data Rate:	MHz Full RB
Power Setting:	Max	Tested By:	JMH

Test Measurement Results



30.00 - 1000.00 MHz												
Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB/m	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail
1	779.82	49.21	6.43	-6.09	49.55	Fundamental	Horizontal	100	209	--	--	

Test Notes: EUT powered by -48VDC DC. Connected to callbox outside chamber. UL 779.5 MHz Full RB

Issue Date: 14th September 2020

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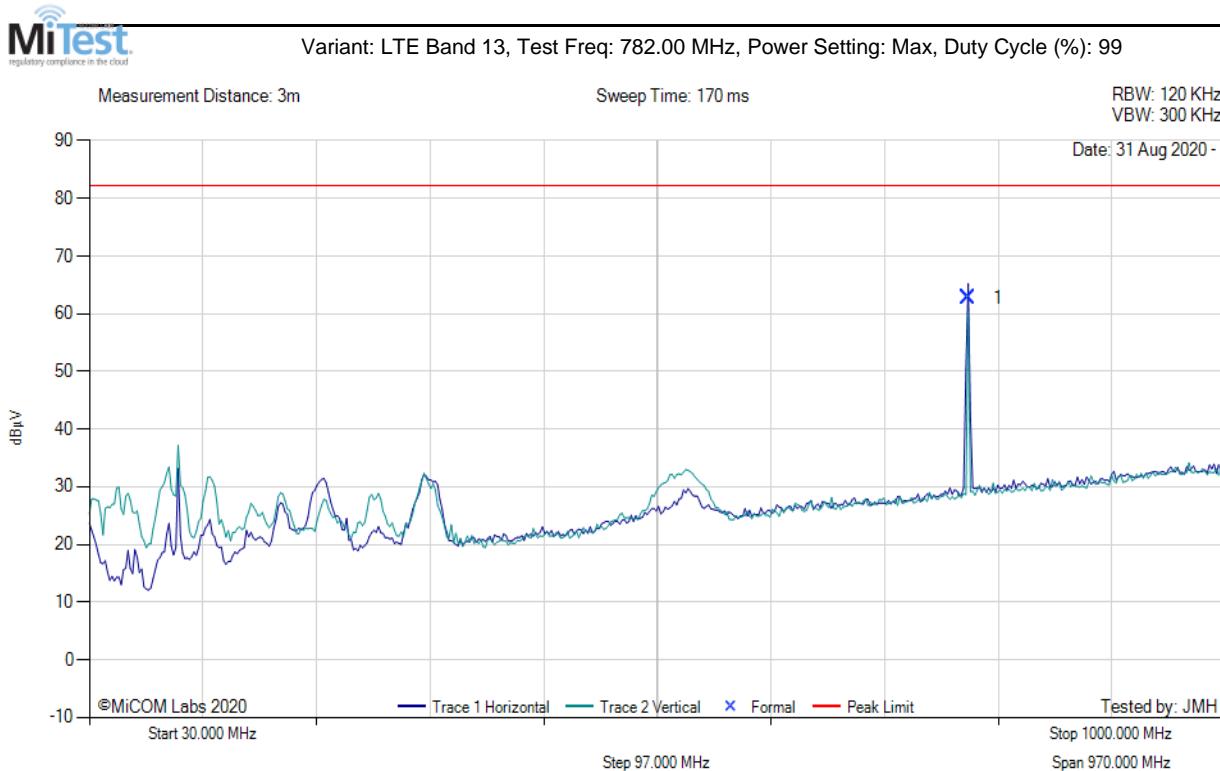
MiCOM Labs, 575 Boulder Court, Pleasanton, California 94566 USA, Phone: +1 (925) 462 0304, Fax: +1 (925) 462 0306, www.micomlabs.com

Band 13 782 MHz 1 RB

Equipment Configuration for Radiated Spurious Emissions

Antenna:	Not Applicable	Variant:	LTE Band 13
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	782.00	Data Rate:	MHz 1 RB
Power Setting:	Max	Tested By:	JMH

Test Measurement Results



30.00 - 1000.00 MHz												
Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB/m	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail
1	779.91	62.41	6.43	-6.09	62.75	Fundamental	Horizontal	200	50	--	--	

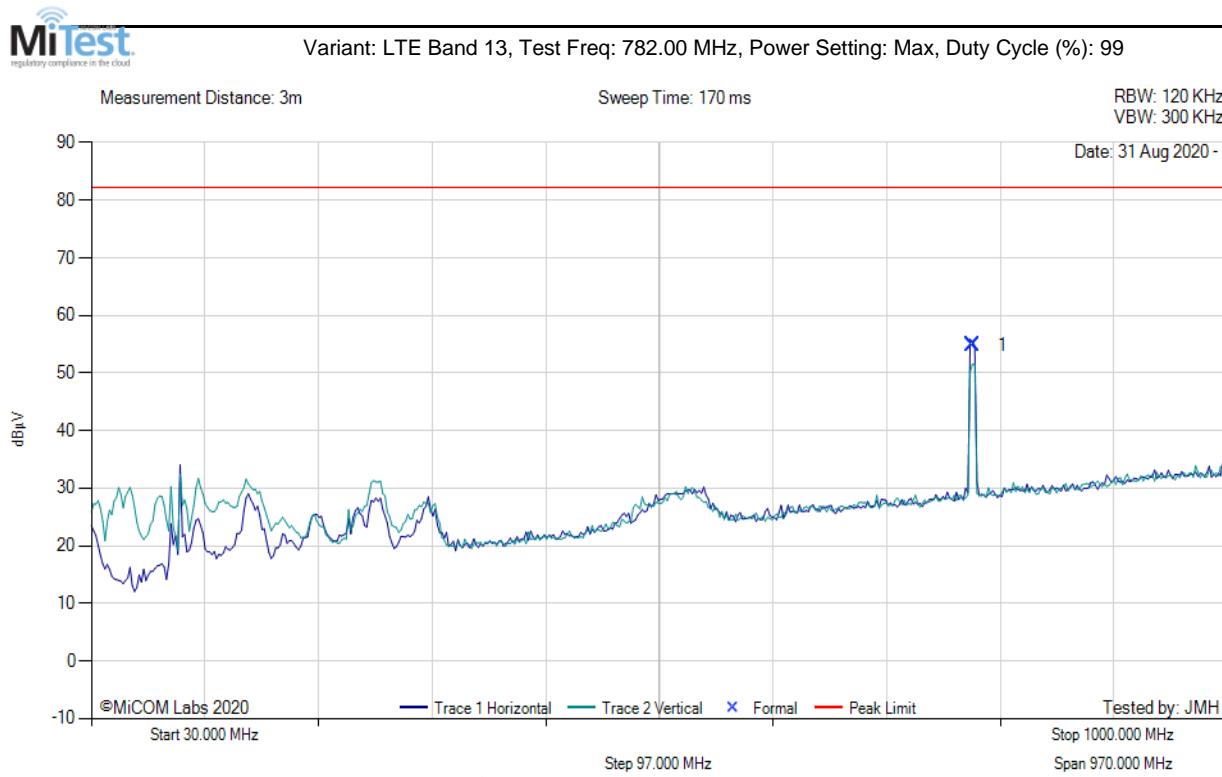
Test Notes: EUT powered by -48VDC DC. Connected to callbox outside chamber. UL 782.0 MHz 1 RB

Band 13 782 MHz Full RB

Equipment Configuration for Radiated Spurious Emissions

Antenna:	Not Applicable	Variant:	LTE Band 13
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	782.00	Data Rate:	MHz Full RB
Power Setting:	Max	Tested By:	JMH

Test Measurement Results



30.00 - 1000.00 MHz												
Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB/m	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail
1	782.04	54.48	6.44	-6.02	54.90	Fundamental	Horizontal	100	84	--	--	

Test Notes: EUT powered by -48VDC DC. Connected to callbox outside chamber. UL 782.0 MHz Full RB

Band 13 784.5 MHz 1 RB

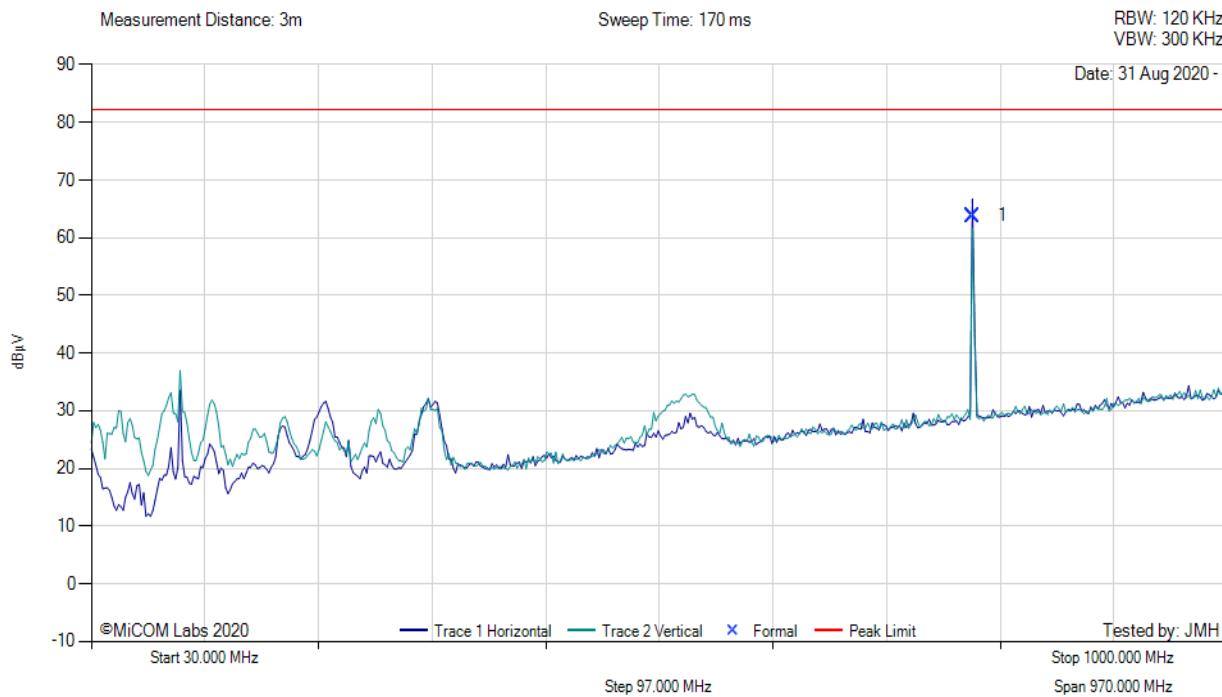
Equipment Configuration for Radiated Spurious Emissions

Antenna:	Not Applicable	Variant:	LTE Band 13
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	784.50	Data Rate:	MHz 1 RB
Power Setting:	Max	Tested By:	JMH

Test Measurement Results



Variant: LTE Band 13, Test Freq: 784.50 MHz, Power Setting: Max, Duty Cycle (%): 99



30.00 - 1000.00 MHz

Num	Frequency MHz	Raw dBμV	Cable Loss dB	AF dB/m	Level dBμV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBμV/m	Margin dB	Pass /Fail
1	782.34	63.35	6.44	-6.02	63.78	Fundamental	Horizontal	200	58	--	--	

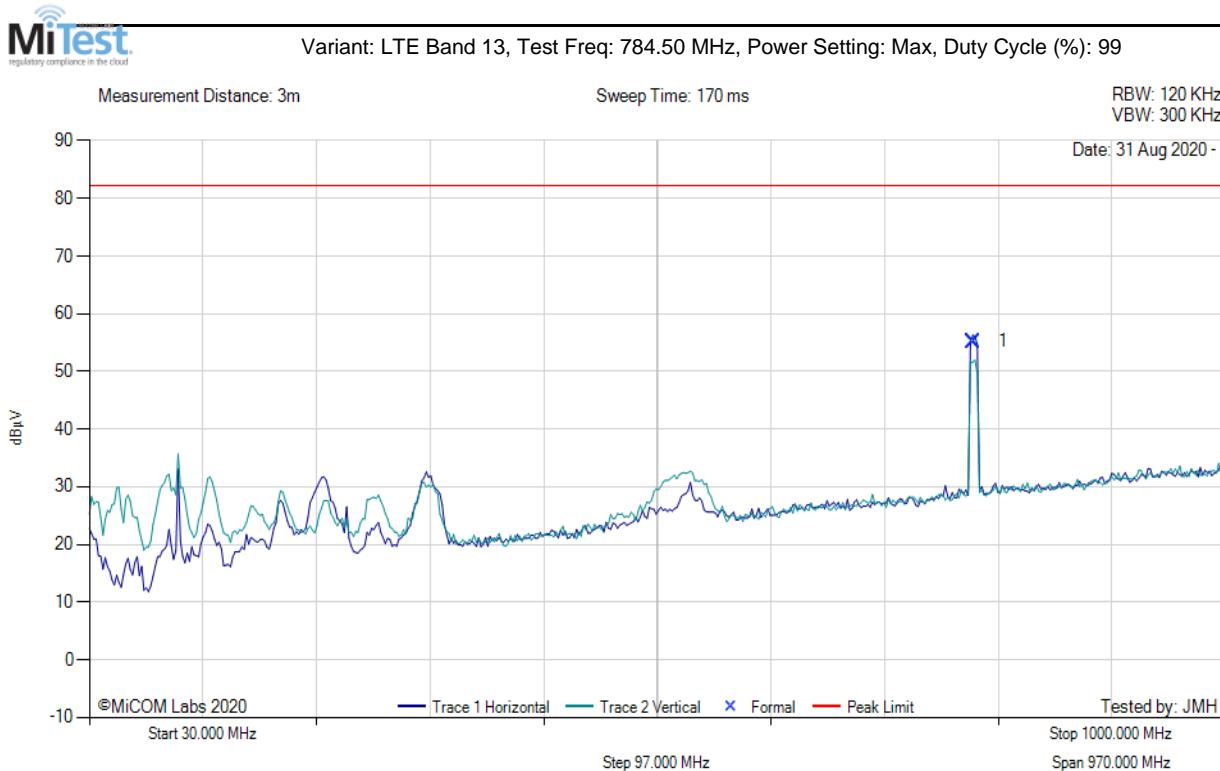
Test Notes: EUT powered by -48VDC DC. Connected to callbox outside chamber. UL 784.5 MHz 1 RB

Band 13 784.5 MHz Full RB

Equipment Configuration for Radiated Spurious Emissions

Antenna:	Not Applicable	Variant:	LTE Band 13
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	784.50	Data Rate:	MHz Full RB
Power Setting:	Max	Tested By:	JMH

Test Measurement Results



30.00 - 1000.00 MHz												
Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB/m	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail
1	784.37	54.83	6.44	-6.04	55.23	Fundamental	Horizontal	200	52	--	--	

Test Notes: EUT powered by -48VDC DC. Connected to callbox outside chamber. UL 784.5 MHz Full RB

Band 17: Radiated Transmitter Emissions

FCC 27.53g: Emission limits for Miscellaneous Wireless equipment.

(g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log (P)$ dB.

30- 1000 MHz Emissions

Band 17 706.5 MHz 1 RB

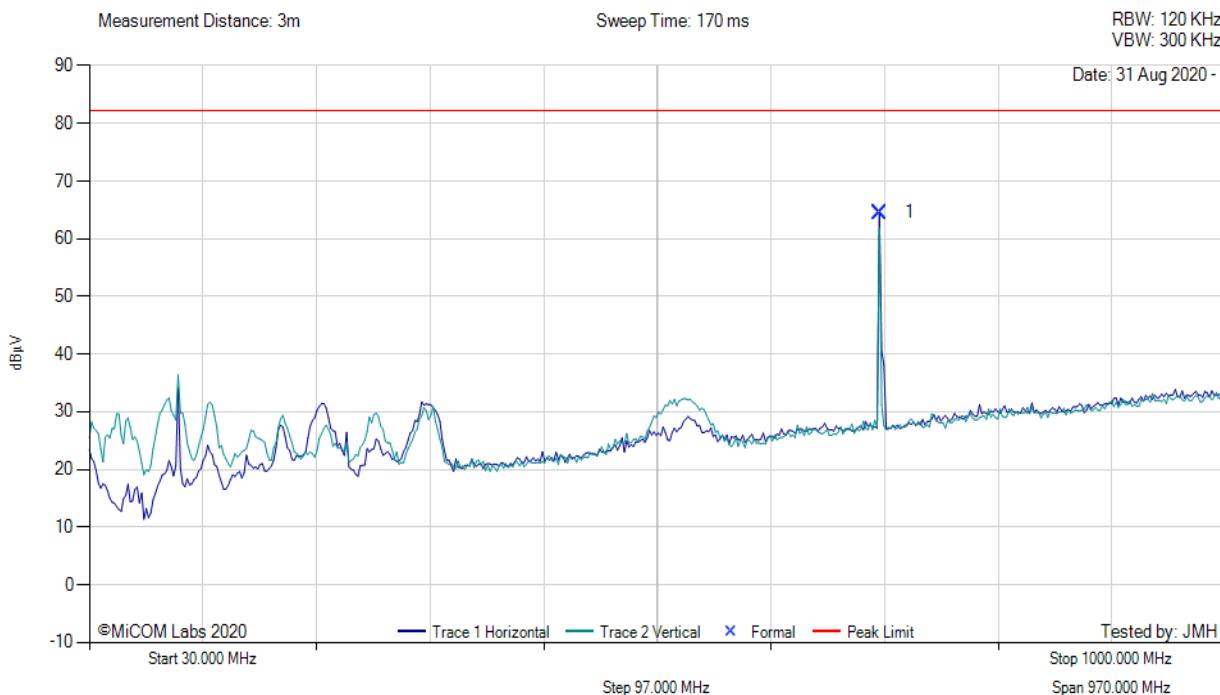
Equipment Configuration for Radiated Spurious Emissions

Antenna:	Not Applicable	Variant:	LTE Band 17
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	706.50	Data Rate:	1 RB
Power Setting:	Max	Tested By:	JMH

Test Measurement Results



Variant: LTE Band 17, Test Freq: 706.50 MHz, Power Setting: Max, Duty Cycle (%): 99



30.00 - 1000.00 MHz												
Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB/m	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail
1	704.43	65.60	6.21	-7.24	64.57	Fundamental	Horizontal	200	74	--	--	

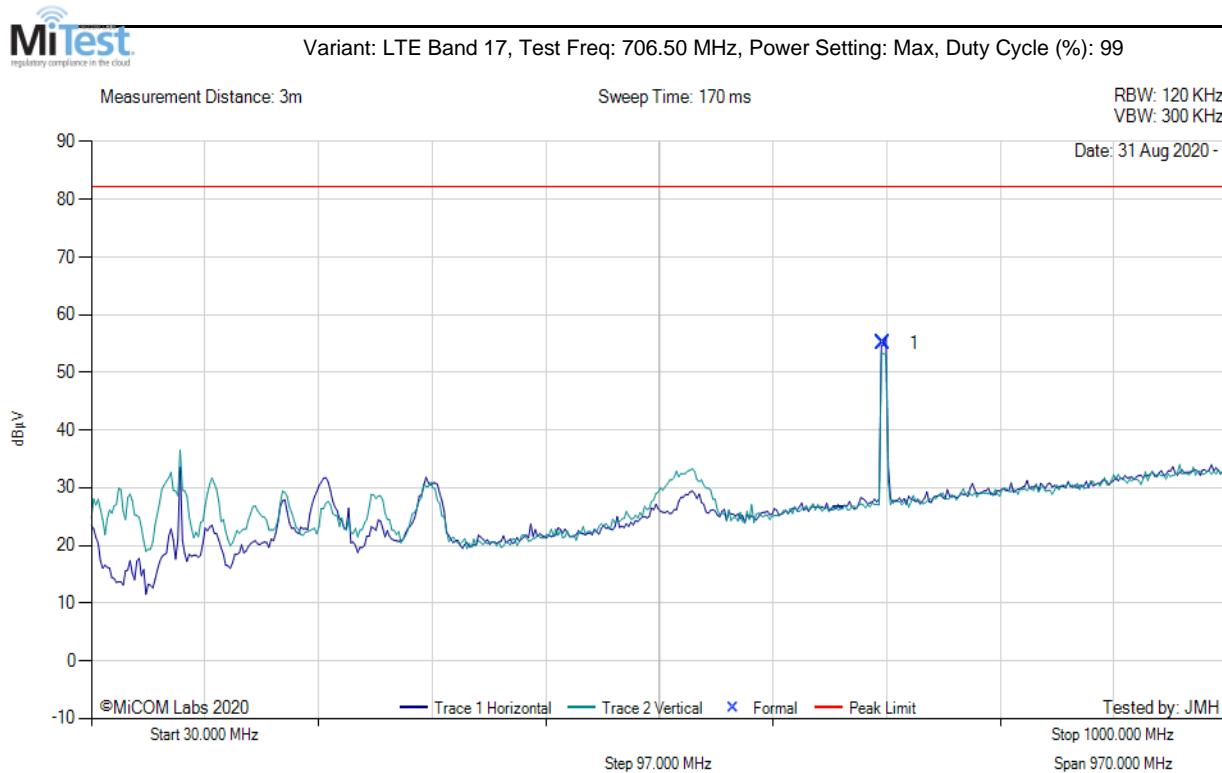
Test Notes: EUT powered by -48VDC DC. Connected to callbox outside chamber. UL 706.5 1 RB

Band 17 706.5 MHz Full RB

Equipment Configuration for Radiated Spurious Emissions

Antenna:	Not Applicable	Variant:	LTE Band 17
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	706.50	Data Rate:	Full RB
Power Setting:	Max	Tested By:	JMH

Test Measurement Results



30.00 - 1000.00 MHz												
Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB/m	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail
1	706.41	56.04	6.22	-7.25	55.01	Fundamental	Horizontal	100	191	--	--	

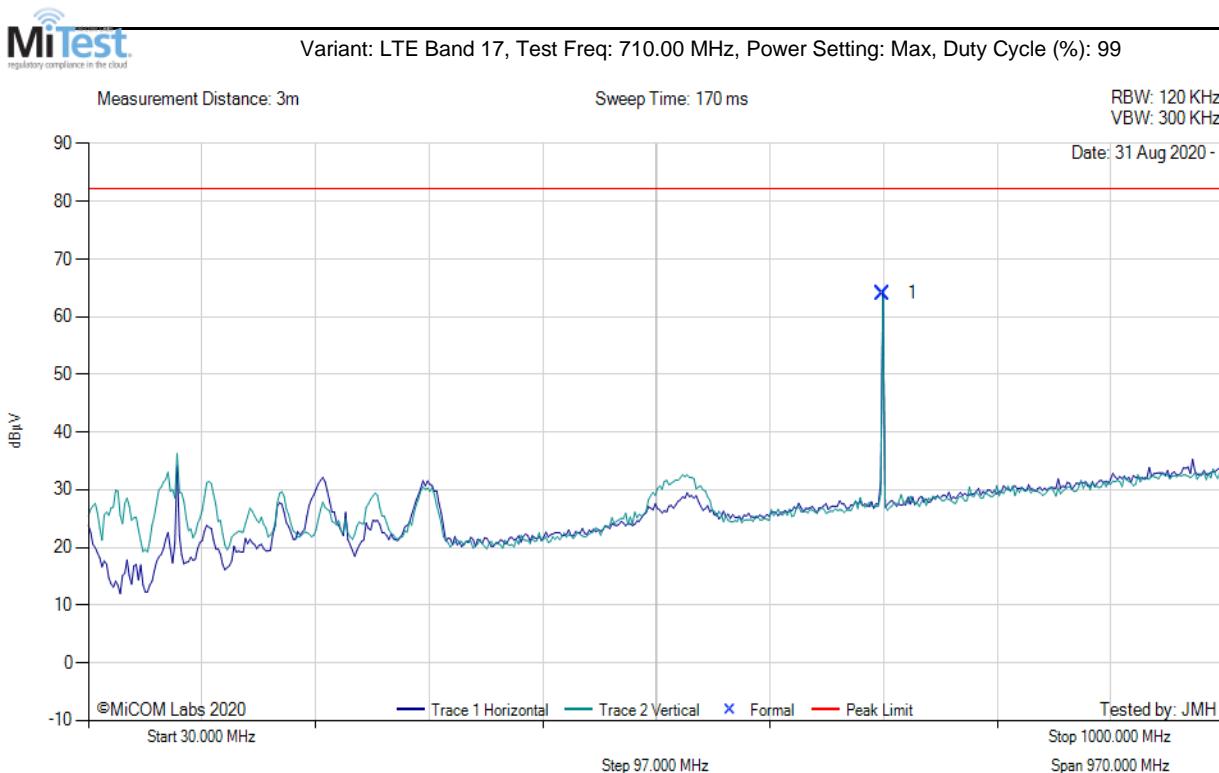
Test Notes: EUT powered by -48VDC DC. Connected to callbox outside chamber. UL 706.5 Full RB

Band 17 710 MHz 1 RB

Equipment Configuration for Radiated Spurious Emissions

Antenna:	Not Applicable	Variant:	LTE Band 17
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	710.00	Data Rate:	1 RB
Power Setting:	Max	Tested By:	JMH

Test Measurement Results



30.00 - 1000.00 MHz												
Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB/m	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail
1	707.92	64.99	6.22	-7.16	64.05	Fundamental	Horizontal	100	173	--	--	

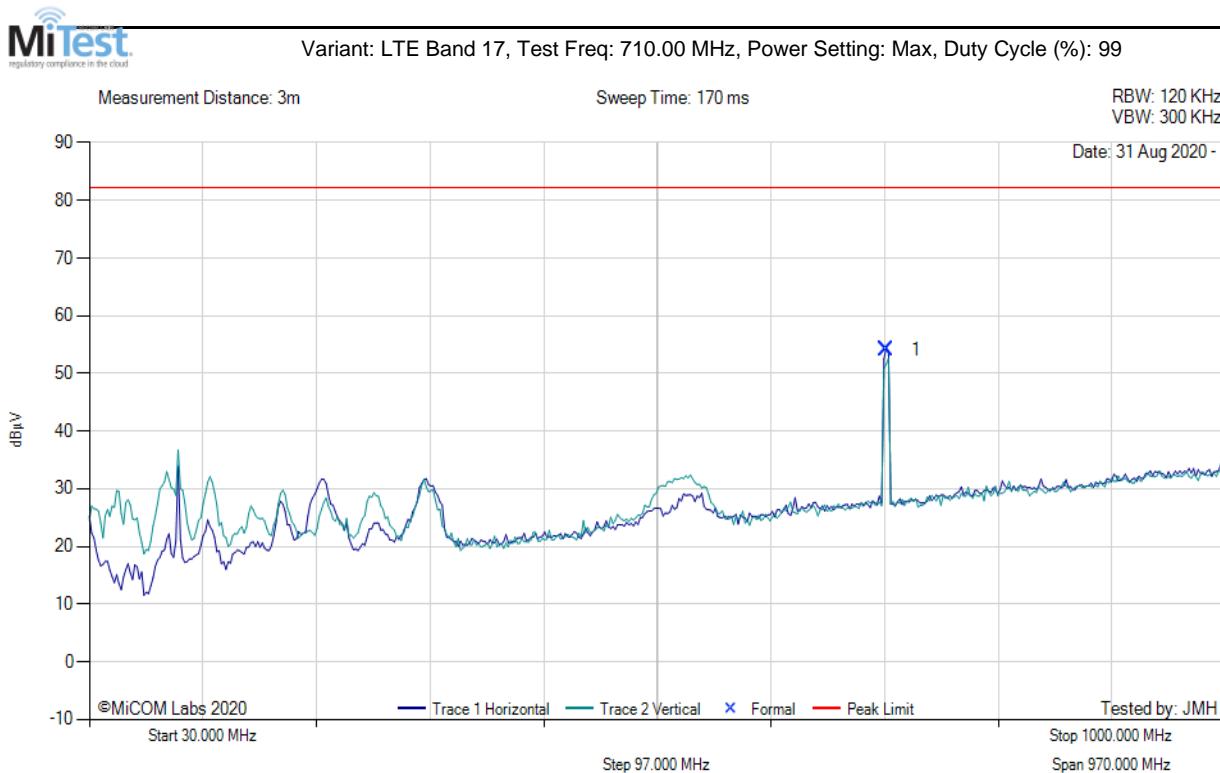
Test Notes: EUT powered by -48VDC DC. Connected to callbox outside chamber. UL 710.0 1 RBs

Band 17 710 MHz Full RB

Equipment Configuration for Radiated Spurious Emissions

Antenna:	Not Applicable	Variant:	LTE Band 17
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	710.00	Data Rate:	Full RB
Power Setting:	Max	Tested By:	JMH

Test Measurement Results



30.00 - 1000.00 MHz												
Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB/m	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail
1	709.89	55.06	6.23	-7.15	54.14	Fundamental	Horizontal	200	30	--	--	

Test Notes: EUT powered by -48VDC DC. Connected to callbox outside chamber. UL 710.0 Full RB

Band 17 713.5 MHz 1 RB

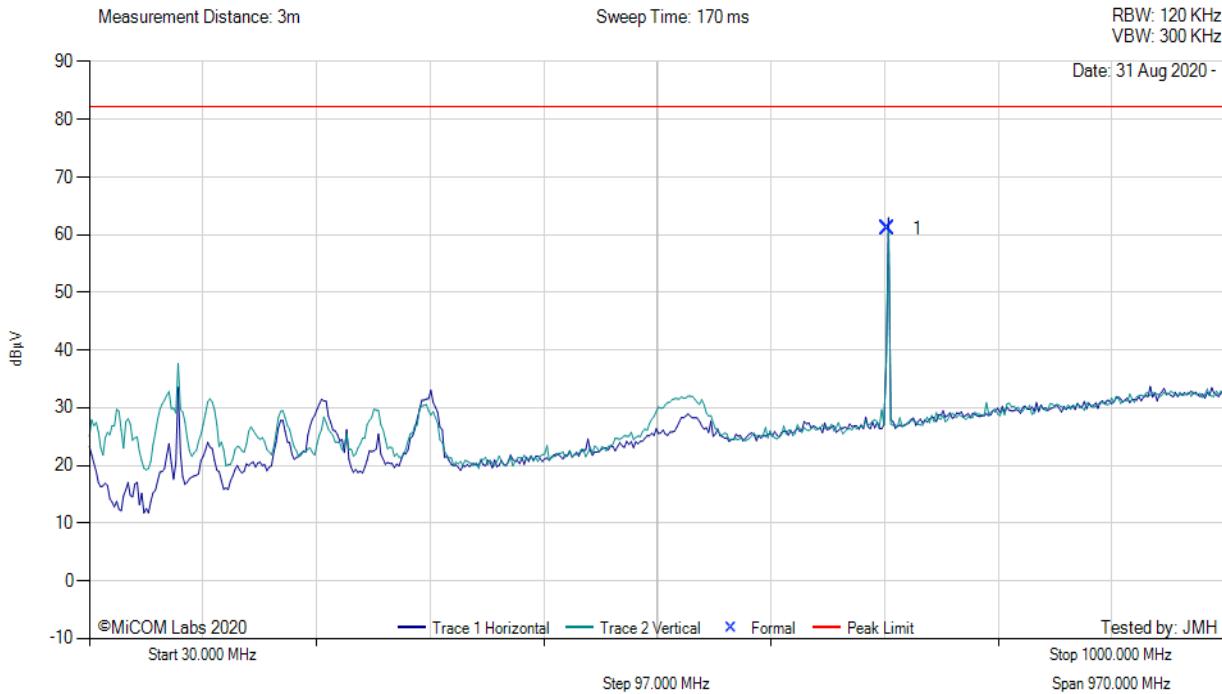
Equipment Configuration for Radiated Spurious Emissions

Antenna:	Not Applicable	Variant:	LTE Band 17
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	713.50	Data Rate:	1 RB
Power Setting:	Max	Tested By:	JMH

Test Measurement Results



Variant: LTE Band 17, Test Freq: 713.50 MHz, Power Setting: Max, Duty Cycle (%): 99



30.00 - 1000.00 MHz													
Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB/m	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail	
1	711.46	62.04	6.23	-7.14	61.13	Fundamental	Horizontal	200	134	--	--		

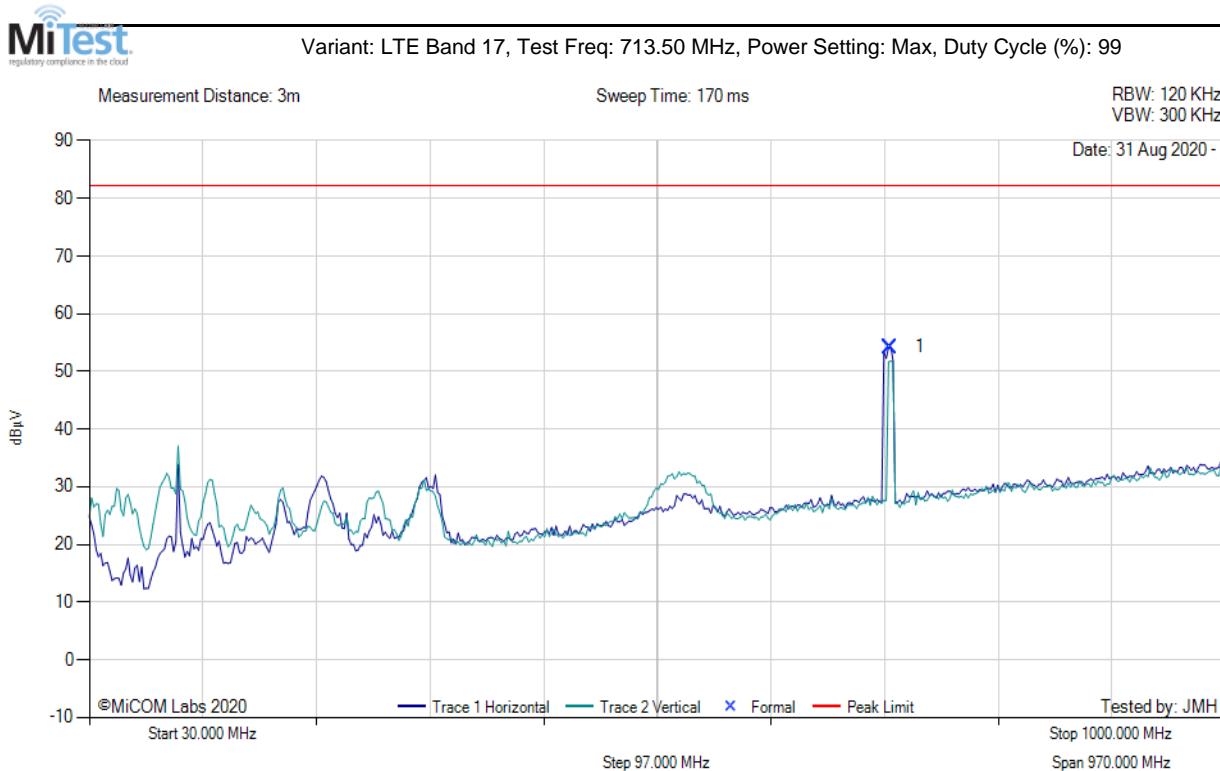
Test Notes: EUT powered by -48VDC DC. Connected to callbox outside chamber. UL 713.5 1 RB

Band 17 713.5 MHz Full RB

Equipment Configuration for Radiated Spurious Emissions

Antenna:	Not Applicable	Variant:	LTE Band 17
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	713.50	Data Rate:	Full RB
Power Setting:	Max	Tested By:	JMH

Test Measurement Results



30.00 - 1000.00 MHz												
Num	Frequency MHz	Raw dB μ V	Cable Loss dB	AF dB/m	Level dB μ V/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB μ V/m	Margin dB	Pass /Fail
1	713.59	55.02	6.24	-7.00	54.26	Fundamental	Horizontal	200	168	--	--	

Test Notes: EUT powered by -48VDC DC. Connected to callbox outside chamber. UL 713.5 Full RB

1-8 GHz Emissions

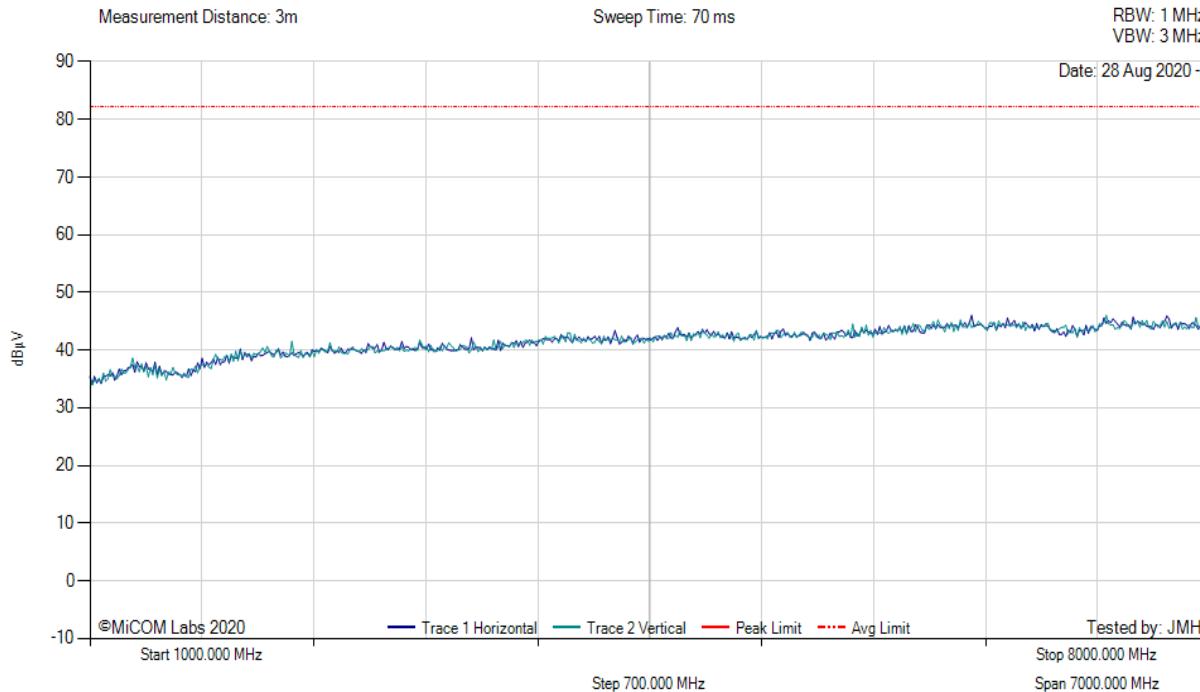
Band 17 706.5 MHz 1 RB

Equipment Configuration for Restricted Band Spurious Emissions

Antenna:	Not Applicable	Variant:	Band 17 LTE
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	706.50	Data Rate:	1 RB
Power Setting:	Max	Tested By:	JMH



Variant: Band 17 LTE, Test Freq: 706.50 MHz, Power Setting: Max, Duty Cycle (%): 99



There are no emissions found within 6dB of the limit line.

Test Notes: EUT powered by -48VDC DC. Connectex to callbox outside chamber. UL 706.5 MHz 1 RB

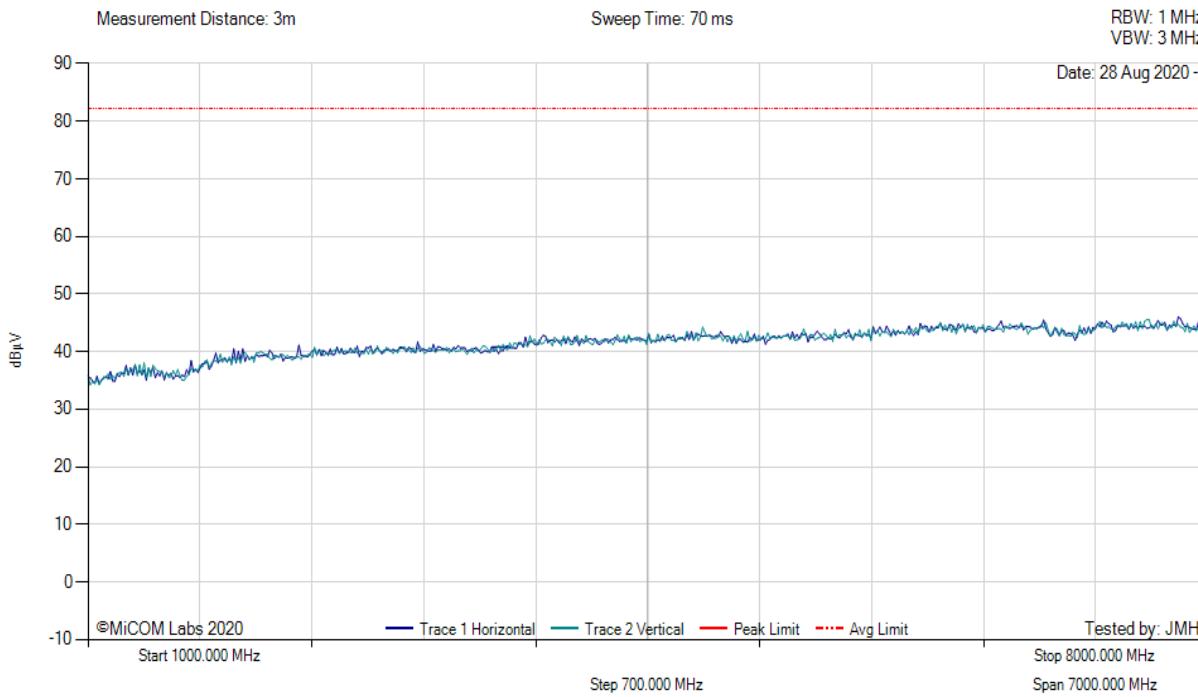
Band 17 706.5 MHz Full RB

Equipment Configuration for Restricted Band Spurious Emissions

Antenna:	Not Applicable	Variant:	Band 17 LTE
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	706.50	Data Rate:	Full RB
Power Setting:	Max	Tested By:	JMH



Variant: Band 17 LTE, Test Freq: 706.50 MHz, Power Setting: Max, Duty Cycle (%): 99



There are no emissions found within 6dB of the limit line.

Test Notes: EUT powered by -48VDC DC. Connected to callbox outside chamber. UL 706.5 MHz Full RB

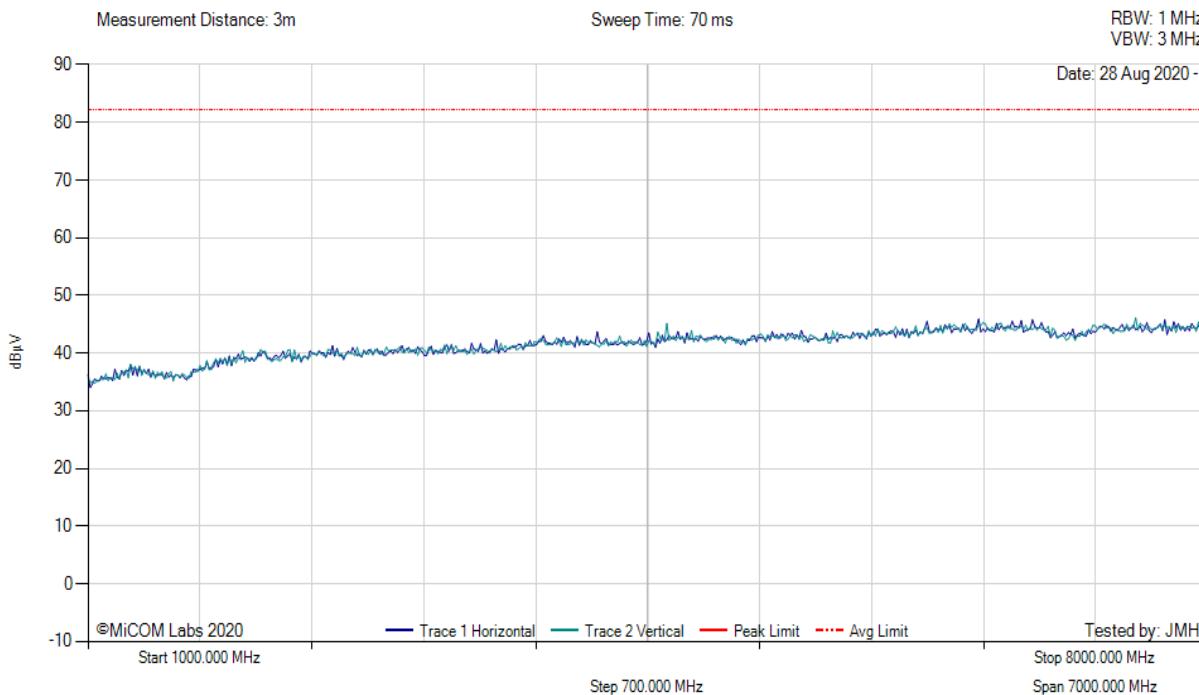
Band 17 710 MHz 1 RB

Equipment Configuration for Restricted Band Spurious Emissions

Antenna:	Not Applicable	Variant:	Band 17 LTE
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	710.00	Data Rate:	1 RB
Power Setting:	Max	Tested By:	JMH



Variant: Band 17 LTE, Test Freq: 710.00 MHz, Power Setting: Max, Duty Cycle (%): 99



There are no emissions found within 6dB of the limit line.

Test Notes: EUT powered by -48VDC DC. Connected to callbox outside chamber. UL 710 MHz 1 RB

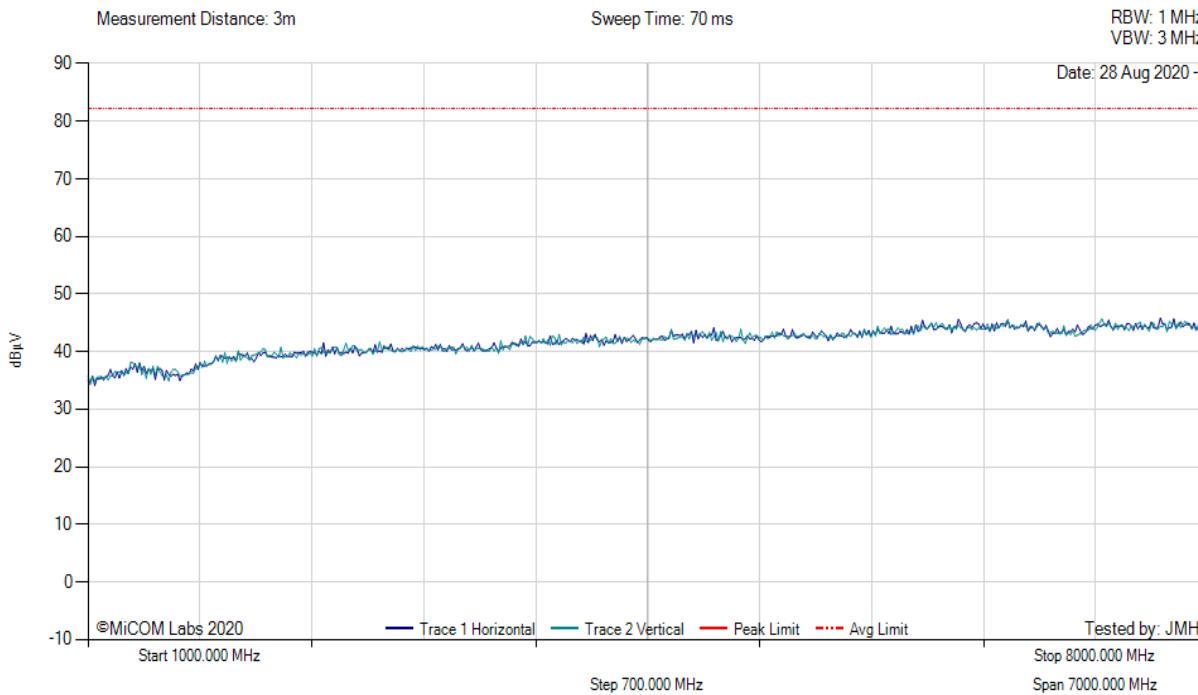
Band 17 710 MHz Full RB

Equipment Configuration for Restricted Band Spurious Emissions

Antenna:	Not Applicable	Variant:	Band 17 LTE
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	710.00	Data Rate:	Full RB
Power Setting:	Max	Tested By:	JMH



Variant: Band 17 LTE, Test Freq: 710.00 MHz, Power Setting: Max, Duty Cycle (%): 99



There are no emissions found within 6dB of the limit line.

Test Notes: EUT powered by -48VDC DC. Connected to callbox outside chamber. UL 710 MHz Full RB

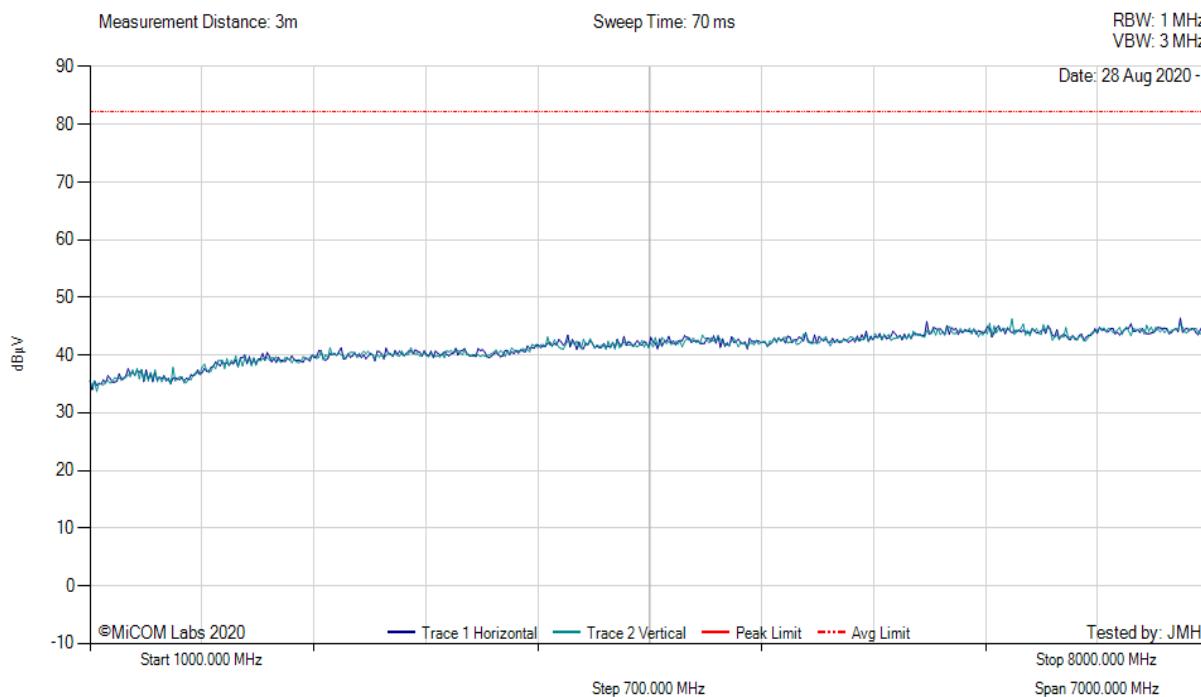
Band 17 713.5 MHz 1 RB

Equipment Configuration for Restricted Band Spurious Emissions

Antenna:	Not Applicable	Variant:	Band 17 LTE
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	713.50	Data Rate:	1 RB
Power Setting:	Max	Tested By:	JMH



Variant: Band 17 LTE, Test Freq: 713.50 MHz, Power Setting: Max, Duty Cycle (%): 99



There are no emissions found within 6dB of the limit line.

Test Notes: EUT powered by -48VDC DC. Connected to callbox outside chamber. UL 713.5 MHz 1 RB

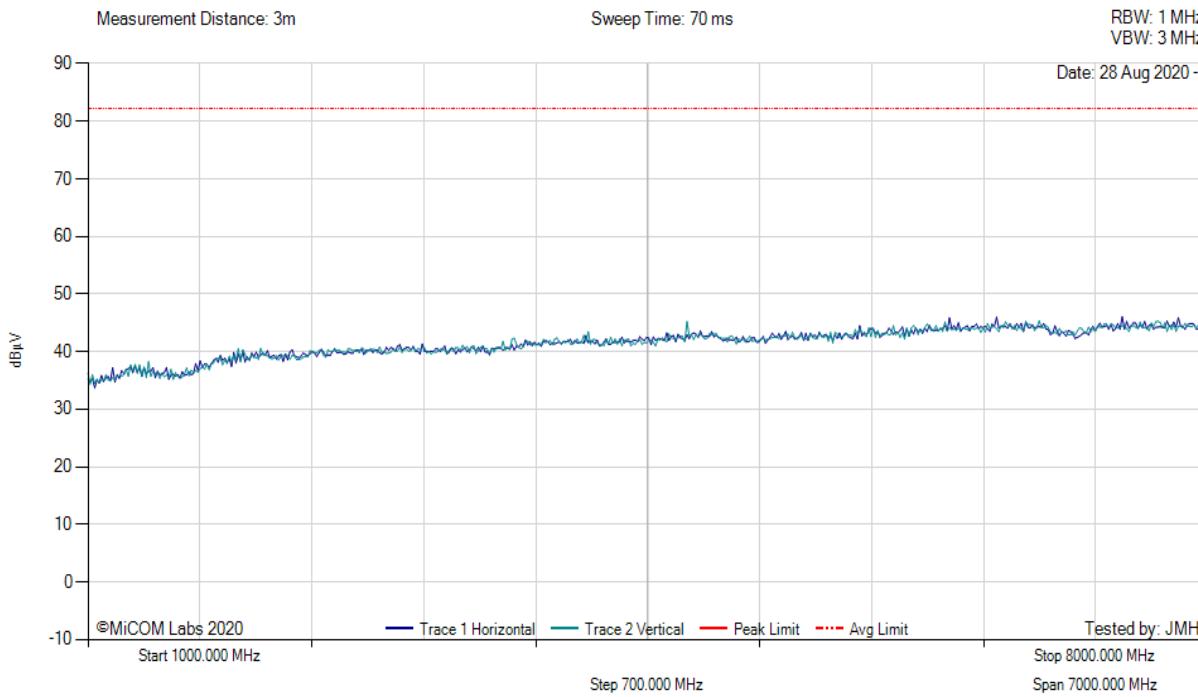
Band 17 713.5 MHz Full RB

Equipment Configuration for Restricted Band Spurious Emissions

Antenna:	Not Applicable	Variant:	Band 17 LTE
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	713.50	Data Rate:	Full RB
Power Setting:	Max	Tested By:	JMH



Variant: Band 17 LTE, Test Freq: 713.50 MHz, Power Setting: Max, Duty Cycle (%): 99



There are no emissions found within 6dB of the limit line.

Test Notes: EUT powered by -48VDC DC. Connected to callbox outside chamber. UL 713.5 MHz Full RB

9.7. Radiated Receiver Emissions

Conducted Test Conditions for Receiver Spurious Emissions						
Standard:	IC RSS-133	Ambient Temp. (°C):	20.0 - 24.5			
Test Heading:	Frequency Stability	Rel. Humidity (%):	32 - 45			
Standard Section(s):	RSS-133: 6.6	Pressure (mBars):	999 - 1001			
Reference Document(s):	See Normative References					
Test Procedure for Receiver Spurious Emissions With reference to the test configuration identified in Section 8.1 Conducted Test Setup the EUT was set to transmit on the appropriate center frequency of the selected frequency band and bandwidth. Out of Band emissions was tested under QPSK. Testing was performed under ambient conditions.						
Limits Receiver Spurious Emissions RSS-133: Receiver spurious emissions shall comply with the limits specified in RSS-Gen.						

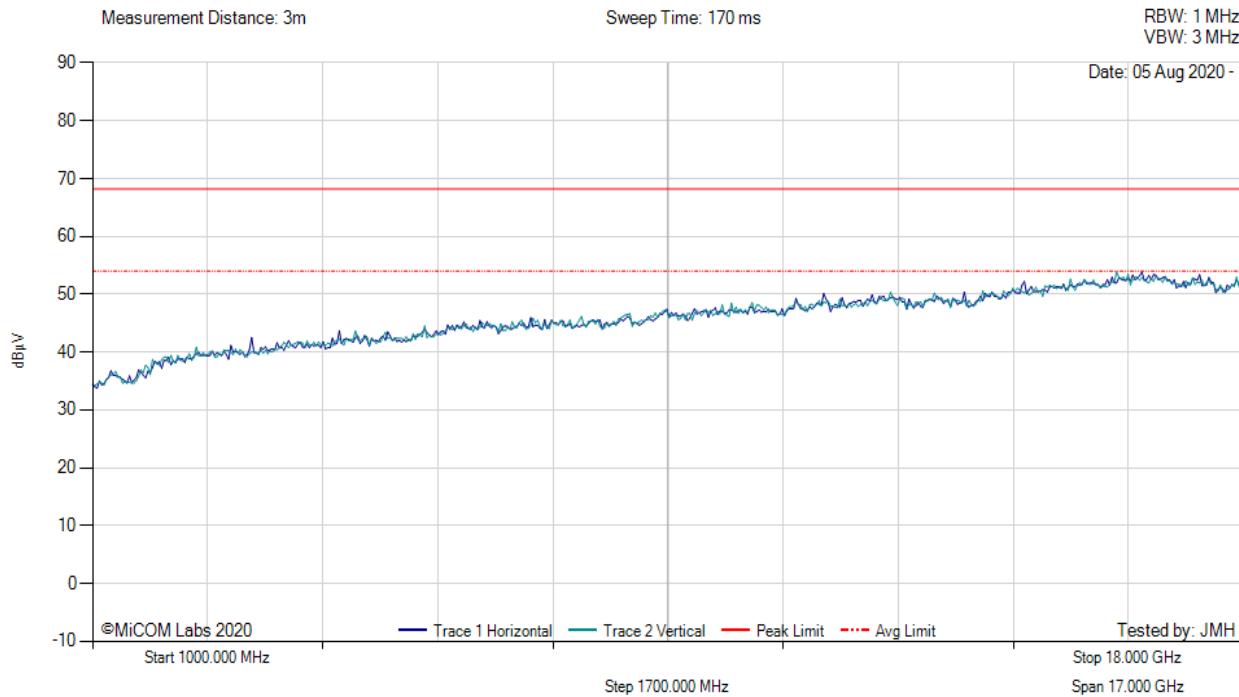
Equipment Configuration for Restricted Band Spurious Emissions

Antenna:	Not Applicable	Variant:	5 MHz
Antenna Gain (dBi):	Not Applicable	Modulation:	QPSK
Beam Forming Gain (Y):	Not Applicable	Duty Cycle (%):	99
Channel Frequency (MHz):	1852.50	Data Rate:	Full RB
Power Setting:	Max	Tested By:	JMH

Test Measurement Results



Test Freq: 1852.50 MHz, Power Setting: Max, Duty Cycle (%): 99



There are no emissions found within 6dB of the limit line.

Test Notes: EUT powered by -48VDC, connected to Call box outside chamber. Full RB