



Test Report Prepared By:

Electronics Test Centre 27 East Lake Hill Airdrie, Alberta Canada T4A 2K3

sales@etc-mpbtech.com http://www.etc-mpb.com

Telephone: 1-403-912-0037

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EMC testing of the Tektelic Communication Inc. Kona Micro Gateway in accordance with FCC Part 15.247, and ANSI C63.10: 2013 as referenced by FCC OET KDB 558074 D01 15.247 Measurement Guidance v05r02.

FCC ID: 2ALEPT0007871

Test Personnel: Imran Akram, Janet Mijares, Branden Van Hee

Prepared for:

Tektelic Communication Inc.

7657 10th Street NE Calgary, Alberta Canada T2E 8X2

Telephone: 1-403-338-6910

Imran Akram <u>iakram@etc-mpbtech.com</u> EMC Technologist Electronics Test Centre (Airdrie)

Marc Rousseau marc.rousseau@mpbc.ca QA Manager Electronics Test Centre (Airdrie)

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Test Sample: Kona Micro Gateway FCC ID:2ALEPT0007871

REVISION RECORD

ISSUE	DATE	AUTHOR	REVISIONS
DRAFT 1	2021-12-20	I. Akram	Initial draft submitted for review.
DRAFT 1	2021-12-23	I. Akram	Sign Off

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1.0 INTRODUCTION

1.1 Scope

The purpose of this report is to present the results of compliance testing performed in accordance with FCC Part 15.247 and ANSI C63.10-2013 to gain FCC Certification Authorization for Low-Power License-Exempt transmitters. All test procedures, limits, criteria, and results described in this report apply only to the Tektelic Communication Inc. Kona Micro Gateway test sample, referred to herein as the EUT (Equipment Under Test).

This report does not imply product endorsement by the Electronics Test Centre, A2LA, nor any Canadian Government agency.

1.2 Applicant

This test report has been prepared for Tektelic Communication Inc., located in Calgary, Alberta, Canada.

1.3 Test Sample Description

Product Name	e:		*Kona Micro Gateway	
	Frequency Range		902.3 – 927.7 MHz	
	Type of Modulation		LoRa 125KHz DTS	
Lora Radio	Associated Antennas	LoRa	SUZHOU WUTONG COMMUNICATION CO.,LTD 860M Antenna, Omni directional, Gain 0.4 dBi	
		3G/4G	Antenova, PCB antenna CU9013-ANT1 Gain(peak) 0.51dBi	
Firmware HA	L version ID #		4.0.5-r2	
Model# / Serial#			T0004855 / 2139A0001	
Power supply	/:		(100 – 240)AC/DC Adaptor (12VDC@1A)	

As provided to ETC (Airdrie) by Tektelic Communication Inc.:

*This product is a Kona Micro Gateway is a LoRa base station. It may incorporate a 3G/4G backhaul module, FCC ID N7NEM7355.

This model contains all of the equipment options in this family of products. This model represents model number T0004855, T0005204, T0006271 and T0006342. This model was chosen as a worst-case condition for emission testing.

Detail differences between the models are given in Kona Micro Gateway family exhibit.

1.4 General Test Conditions

The EUT was set up and exercised using the configurations, modes of operation and arrangements defined in this report only. All inputs and outputs to and from other equipment associated with the EUT were adequately simulated.

Where relevant, the EUT was only tested using the monitoring methods and test criteria defined in this report.

The environmental conditions are recorded during each test, and are reported in the relevant sections of this document.

1.5 Reference Standards

Standards	Description
FCC, title 47 CFR § 15.247	Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.
FCC, title 47 CFR § 15.207	General Requirements for Compliance of Radio Apparatus
FCC, title 47 CFR § 15.209	Intentional radiator, conducted emission limits
ANSI C63.10-2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
ANSI C63.10-2014	American National Standard for Methods of Measurement of Radio – Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 KHz to 40 GHz
558074 D01 15.247 Meas Guidance v05r02	Guidance For Compliance Measurements On Digital Transmission System, Frequency Hopping Spread Spectrum System, And Hybrid System Devices Operating Under Section 15.247 Of The FCC Rules

1.6 Test Methodology

Test methods are specified in the Basic Standard as referenced and/or modified by the Product Standard in the part of Section 2 of this report associated with each particular test case.

1.6.1 Variations in Test Methodology

Any variance in methodology or deviation from the reference Standard is documented in the part of Section 2 of this report associated with each particular Test Case.

1.6.2 Test Sample Verification, Configuration & Modifications

EUT setup, configuration, protocols for operation and monitoring of EUT functions, and any modifications performed in order to meet the requirements, are detailed in each Test Case of Section 2 of this report.

1.6.3 Uncertainty of Measurement:

The factors contributing to measurement uncertainty are identified and calculated in accordance with CISPR 16-4-2: 2011.

This uncertainty estimate represents an expended uncertainty expressed at approximately 95% confidence using a coverage factor of k = 2.

Test Method	Uncertainty
Radiated Emissions Level (9 KHz – 1 GHz)	±5.8 dB
Radiated Emissions Level (1 GHz – 18 GHz)	±4.9 dB
Radiated Emissions Level (18 GHz – 26.5 GHz)	±5.0 dB
Conducted Emissions Level (150 KHz – 30 MHz)	±3.0 dB
Uncertainty Conducted Power level	±0.5 dB
Uncertainty Conducted Spurious emission level	±0.6 dB
Uncertainty for Bandwidth test	±1.5 %

2.0 TEST CONCLUSION

STATEMENT OF COMPLIANCE

The customer equipment referred to in this report was found to comply with the requirements, as summarized below.

The EUT was subjected to the following tests. Compliance status is reported as **Compliant** or **Non-compliant**. **N/A** indicates the test was Not Applicable to the EUT.

The measurement uncertainty is not accounted for determination of the statement of compliance. The statement of compliance is based only on the measurement value recorded.

Note: Maintenance of compliance is the responsibility of the Manufacturer. Any modifications to the product should be assessed to determine their potential impact on the compliance status of the EUT with respect to the standards detailed in this test report.

The following table summarizes the tests performed in terms of the specification, class or performance criterion applied, and the EUT modification state.

Test Case	Test Type	Specification	Test Sample	Mod.	Config.	Result
2.1	AC Conducted Emissions	15.207	Kona Micro Gateway	none	see § 2.1	Compliant
2.2	Occupied Bandwidth	15.247(a)(1) 15.247(2)(2)	Kona Micro Gateway	none	see § 2.2	Compliant
2.3	Max Output average Power Conducted	15.247(b)	Kona Micro Gateway	none	see § 2.3	Compliant
2.4	Power Spectral Density	15.247(e) 15.247(f)	Kona Micro Gateway	none	see § 2.4	Compliant
2.5	Band Edge	15.247(d)	Kona Micro Gateway	none	see § 2.5	Compliant
2.6	Conducted Spurious Emission (Non-Restricted Band Operation)	15.247(d)	Kona Micro Gateway	none	see § 2.6	Compliant
2.7	Minimum channel separation	15.247(a)(1)	Kona Micro Gateway	none	see § 2.7	Compliant
2.8	Average time of Occupancy for hybrid System	15.247(f)	Kona Micro Gateway	none	see § 2.8	Compliant
2.9	EUT Position	ANSI C63.4	Kona Micro Gateway	-	see § 2.9	assed
2.10	Radiated Spurious Emission (Restricted Band Operation)	15.205, 15.209 15.247(d)	Kona Micro Gateway	none	see § 2.10	Compliant
2.11	RF Exposure	15.247(i)	Kona Micro Gateway	none	see § 2.11	Compliant

Refer to the test data for applicable test conditions.

2.1 AC Power Line Conducted Emissions: Transmit Mode

Test Lab: Electronics Test Centre, Airdrie

Test Personnel: Janet Mijares

EUT: Kona Micro Gateway Standard: FCC Part 15.207 Basic Standard: ANSI C63.10: 2013

Date: 2021-11-01(19.0 C,15.9 % RH)

EUT status: Compliant

Specification: Part15-207

Frequency (MHz)	Quasi-Peak Limit (dBµV)	Average Limit (dBµV)			
0.15 – 0.5	66 – 56	56 – 46			
0.5 – 5	56	46			
5 – 30 60 50					
Criteria: The conducted emissions produced by a device shall not exceed the limits as specified.					

2.1.1 Test Guidance: ANSI C63.4-2014, Clause 7.3.1

Before any testing is performed, the Ambient (measurement noise floor) is recorded, and a QC check is performed to show that the system is functioning correctly.

Testing starts with a scan, performed under software control. After this is complete, the list of frequencies of interest is generated. These frequencies are then investigated for quasi-peak and average amplitude, as applicable. Emissions measured with a QP detector that fall below the Average limit are deemed to meet both requirements.

2.1.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

2.1.3 Test Equipment

Testing was performed with the following equipment:

Equipment	Manufacturer	Model #	Asset #	Cal. Date (yyyy-mm-dd)	Cal. Due (yyyy-mm- dd)
EMC Software	UL	Ver. 9.5	ETC-SW- EMC 2.1	N/A	N/A
EMI receiver	Keysight Technologies Inc.	N9038A (FW A.25.05)	6130	2021-06-18	2022-06-18
LISN	Com-Power	LI-215A	6180	2020-06-30	2022-06-30
Temp/RH logger	Extech	42270	5892	2021-04-06	2022-04-06

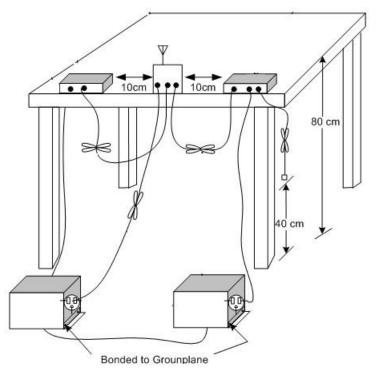
2.1.4 Test Sample Verification, Configuration & Modifications

The EUT was set to selected channels with test-specific software. The output was modulated as in normal operation. Configuration in Tx mode. GSM/LoRa radios are transmitting simultaneously.

The EUT was powered via an AC to DC Adaptor; manufacturer is Shenzhen Click Technology Co., LTD Model#CPS012D120100U.

The EUT met the requirements without modification.

Test setup diagram:



2.1.6 Conducted Emissions Data:

The EUT was evaluated in all transmit mode. No mode of transmission showed emission worst then another. The plots are from the DSS mode using mid-channel.

Freq. Marker	Freq. (MHz)	Raw reading (dBµv)	Det.	LISN Factor (dB/m)	Cable Loss (dB)	Corrected Reading (dBµV)	FCC 15.207 Limit (dBµV)	Delta (dB)	L/N
1	0.206	30.94	AV	0	.1	31.04	53.35	-22.31	L
2	0.414	32.86	AV	0	.2	33.06	47.57	-14.51	L
3	7.83	22.34	AV	0	.5	22.84	50	-27.16	L
4	16.23	35.56	AV	0	.9	36.46	50	-13.54	L
5	18.24	32.33	AV	0	.9	33.23	50	-16.77	L
1	0.181	23.72	AV	.1	.1	23.92	54.45	-30.53	N
2	0.388	29.8	AV	0	.2	30	48.09	-18.09	N
3	7.98	23.6	AV	0	.5	24.1	50	-25.9	N
4	16.23	35.45	AV	0	.9	36.35	50	-13.65	N
5	26.61	22.91	AV	.1	1.2	24.21	50	-25.79	N

Av = Average Detector

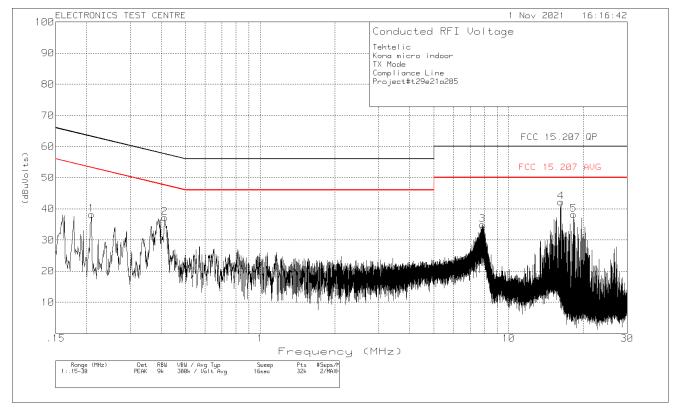
Raw Reading in dB μ V + LISN Factor in dB + Gain/Loss Factor in dB = Corrected Value db μ V.

Negative values for Delta indicate compliance.

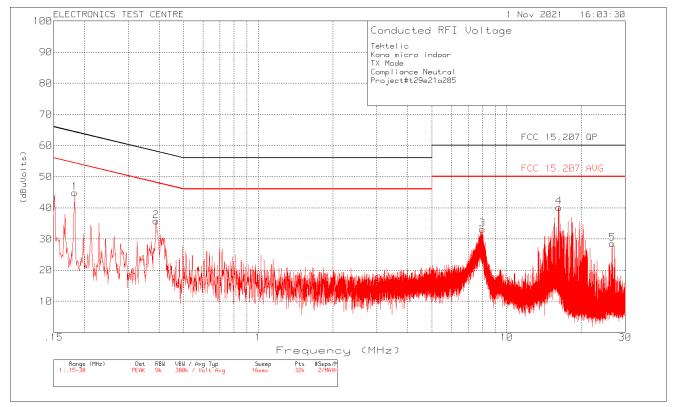
The Ground Bond was measured and found to be 1.25 m Ω .

Test Sample: Kona Micro Gateway FCC ID:2ALEPT0007871

Plot of Conducted Emissions: Line



Plot of Conducted Emissions: Neutral



2.2 Channel Occupied Bandwidth

Test Lab: Electronics Test Centre, Airdrie	EUT: Kona Micro Gateway
Test Personnel: Imran Akram	Standard: FCC PART 15.247
Date: 2021-12-16/20 (19.6°C,7.4 % RH)	Basic Standard: ANSI C63.10-2013 FCC OET KDB 558074

EUT status: Compliant

Specification: FCC Part 15.247 (a, 2), FCC 15.215 (c)

Criteria: There is no requirement for this type of hybrid system to comply with the 500 kHz minimum bandwidth normally associated with a DTS transmission.

2.2.1 Test Guidance: ANSI C63.10-2013, Clause 6.9.2 & 6.9.3/ FCC OET KDB 558074

This measurement is performed at low, mid and high frequencies, with modulation.

The RF output of EUT with an antenna connector is fed to the input of the spectrum analyzer through appropriate attenuation. The loss from the cable and the attenuator were added on the analyzer as gain offset setting there by allowing direct measurements, without the need for any further corrections.

Use the following spectrum analyzer setting:				
Span	Between two time and five times the channel center frequency OBW			
RBW	1% to 5% of the OBW			
VBW	Approximately three times of RBW			
Sweep	Auto Couple			
Detector Function	Peak			
Trace Max Hold				
Allow the trace to stabilize. The automated 99% BW function of the spectrum analyzer is engaged, 20dB bandwidth is measured with the X dB function.				

2.2.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

2.2.3 Test Equipment

Testing was performed with the following equipment:

Equipment	Manufacturer	Model #	Asset #	Cal. Date	Cal. Due
EXA Signal Analyzer	Agilent	N9010A FW A.14.16	6678	2021-07-22	2022-07-22
Temp/Humidity	Extech	42270	5892	2021-04-05	2022-04-15
Attenuator	Mini-Circuits®	BWS102W263	6932	Cal. before	e each use
Coaxial Cables (RF)	Huber+Suhner	Enviroflex 400	-	Cal. before	each use

2.2.4 Test Sample Verification, Configuration & Modifications

The EUT was set to transmit continuously on a selected channel with test-specific software. The output was modulated as in normal operation. The EUT met the requirements without modification.

Test setup diagrams for Occupied Bandwidth testing:

Conducted:

FLIT	Attenuator	Spectrum Analyzer
EUT	Attenuator	Spectrum Analyzer

2.2.5 Channel Occupied Bandwidth Data:

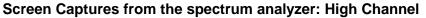
Mode of operation	Channel	Freq. [MHz]	20 dB OBW [kHz]	99% OBW [KHz]
	Low	902.3	139.5	126.32
LoRa 125KHz	Mid	914.9	139.5	126.30
	High	927.7	139.3	126.3

Screen Captures from the spectrum analyzer: Low Channel

Agilent Spectrum Analyzer - Occupied BW (X) RF 50 Q DC Ref Value 49.80 dBm		SENSE:INT SOURCE OFF Iter Freq: 902.300000 MHz I: Free Run Avg Ho	ALIGN AUTO	02:09:18 PM Radio Std:	1Dec 16, 2021 None	Trace/Detector
#1		en: 40 dB		Radio Devi	ce: BTS	
10 dB/div Ref 49.80 dBm	ń					
39.8 29.8 19.8						Clear Writ
9.80 -0.20 -10.2						Averag
-20.2					~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	Max Hol
Center 902.3 MHz #Res BW 3 kHz		#VBW 30 kHz			300 kHz 30.8 ms	Min Ho
Occupied Bandwidth		Total Power	35.8	dBm		
120	6.32 kHz					Detecto
Transmit Freq Error	1.102 kHz	OBW Power	99	.00 %		Auto <u>Ma</u>
x dB Bandwidth	139.5 kHz	x dB	-20.0	00 dB		
MSG			K STATUS			

Screen Captures from the spectrum analyzer: MID Channel

Agilent Spectrum Analyzer - Occupied BW						
KF 50Ω DC			DFF ALIGN AUTO		MDec 16, 2021	Trace/Detector
Center Freq 914.900000 MH		iter Freq: 914.900000 : Free Run	vg Hold:>10/10	Radio Sto	: None	
#		en:40 dB	- 31	Radio De	vice: BTS	
10 dB/div Ref 49.80 dBm						
Log						
39.8						
29.8						Clear Write
19.8	J					
9.80	/					
						Averag
-0.20						Average
-10.2						
-20.2					m	
-30.2						Max Hole
-40.2						maxinon
Center 914.9 MHz					n 300 kHz	
#Res BW 3 kHz		#VBW 30 kHz		Sweet	o 30.8 ms	Min Hole
		Total Pow	or 97	.0 dBm		
Occupied Bandwidth		TOTALFOW	51	.o ubiii		
12	6.30 kHz					Detecto
	4 007 1.11			0.00 0/		Peak
Transmit Freq Error	1.087 kHz	OBW Pow	er 9	99.00 %		Auto <u>Mar</u>
x dB Bandwidth	139.5 kHz	x dB	-20).00 dB		
			D or a			
MSG			I STAT	US		



gilent Spectrum Analyzer - Occupied BW ଅନ୍ୟ ଅନ୍ୟ 50 ହ ଅଟ		SENSE:INT SOURCE OFF	ALIGN AUTO	05:46:38 PM Dec 20, 2021	
Marker 1 Hz	#IFGain:Low	Center Freq: 927.700000 MHz	d:>10/10	Radio Std: None Radio Device: BTS	Trace/Detecto
0 dB/div Ref 50.40 dBm					
30.4					Clear Wr
100					Avera
60 9.6 9.6					MaxHe
enter 927.7 MHz Res BW 3 kHz		VBW 30 kHz		Span 300 kHz Sweep 30.8 ms	Min He
Occupied Bandwidth	26.30 kH	Total Power Z	38.0) dBm	Detec
Transmit Freq Error x dB Bandwidth	1.079 kł 139.3 kł			9.00 % 00 dB	Auto <u>N</u>
x up Bangwigin	139.3 KF	72 X UB	-20.	00 UB	
G				3	

2.3 Max Average Output Power

Test Lab:	Electronics	Test	Centre,	Airdrie
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Test Personnel: : Imran Akram

EUT: Kona Micro Gateway

Standard: FCC PART 15.247

Date: 2021-12-16/20 (19.6°C,7.4 % RH)

Basic Standard: ANSI C63.10: 2013 FCC OET KDB 558074

EUT status: Compliant

Specification: FCC Part 15.247

Criteria For systems using digital modulation / hybrid in the 902-928 MHz bands: 1 Watt.

2.3.1 Test Guidance: ANSI C63.10-2013, Clause 11.9.2.2.2 Clause 7.8.5 / FCC OET KDB 558074

This measurement is performed at low, mid and high frequencies, with modulation.

The RF output of EUT with an antenna connector is fed to the input of the spectrum analyzer through appropriate attenuation. The loss from the cable and the attenuator were added on the analyzer as gain offset setting there by allowing direct measurements, without the need for any further corrections.

2.3.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

2.3.3 Test Equipment

Testing was performed with the following equipment:

Equipment	Manufacturer	Model #	Asset #	Cal. Date	Cal. Due
EXA Signal Analyzer	Agilent	N9010A FW A.14.16	6678	2021-07-22	2022-07-22
Temp/Humidity	Extech	42270	5892	2021-04-05	2022-04-15
Attenuator	Mini-Circuits®	BWS102W263	6932	Cal. before	e each use
Coaxial Cables (RF)	Huber+Suhner	Enviroflex 400	-	Cal. before	each use

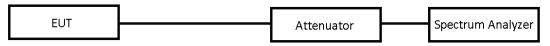
2.3.4 Test Sample Verification, Configuration & Modifications

The EUT was set to a selected channel with test-specific software. The output was modulated as in normal operation.

The EUT met the requirements without modification.

Test setup diagrams for Peak Power testing:

Conducted:



2.3.5 Max Output Power Data

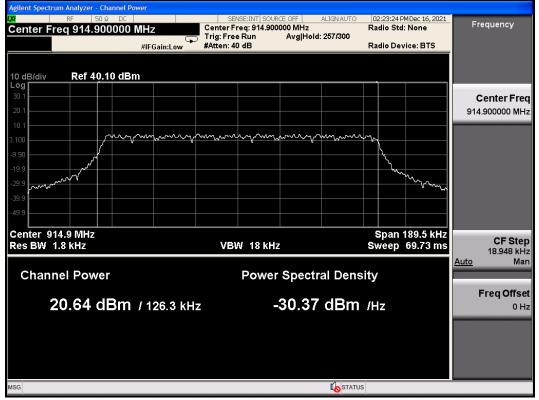
Mode of Operation	Channel	Freq. [MHz]	Out Put Power (dBm)	Out Put Power Limit (dBm
	Low	902.3	19.51	30
LoRa 500 KHz	Mid	914.9	20.64	30
	High	927.7	21.55	30

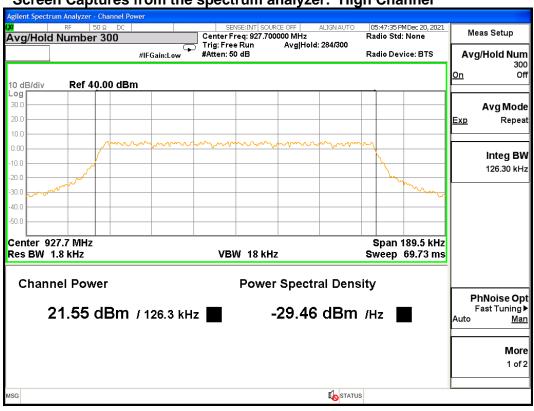
Output Power Method AVGSA-1 For DTS		
Span	≥ 1.5 times the OBW	
RBW	$1 - 5$ % of the OBW, ≤ 1 MHz	
VBW	≥ 3 x RBW	
Number of Points in sweep	≥ 2 x Span / RBW	
Sweep time	Auto Couple	
Detector	RMS (Power Averaging)	
Sweep trigger	Free Run (Duty Cycle ≥98%)	
Trace Average	Minimum 100 traces in power Averaging (RMS)	
Power measured	Integrated the spectrum across the OBW of the signal using the S/A band power measurement function, with band limit set equal to the OBW band edge.	

Screen Captures from the spectrum analyzer Low Channel

Agilent Spectrum Analyzer - Channel Power			
	SENSE:INT SOURCE OFF ALIG	GN AUTO 02:10:24 PM Dec 16, 2021 Radio Std: None	Trace/Detector
Integration BW 126.32 kHz	Trig: Free Run Avg Hold:>30		
#IFGain:Low	#Atten: 40 dB	Radio Device: BTS	
10 dB/div Ref 40.10 dBm			
Log			
30.1			Clear Write
20.1			Ciedi Wille
10.1			
3.100	mon when we we have the second	mm	
-9.90			Average
-19.9			
- A A			
www.		- www	
-39.9			Max Hold
-49.9			
Center 902.3 MHz		Span 189.5 kHz	
Res BW 1.8 kHz	VBW 18 kHz	Sweep 69.73 ms	
			Min Hold
Channel Power	Dower Spectrol	Density	
	Power Spectral	Density	
			Detector Average ►
19.51 dBm / 126.3 кна	-31.51 d	Bm /Hz	Auto Man
MSG		STATUS	







Screen Captures from the spectrum analyzer: High Channel

2.4 Power Spectral Density

Test Lab: Electronics Test Centre, Airdrie

Test Personnel: : Imran Akram

EUT: Kona Micro Gateway Standard: FCC PART 15.247 Basic Standard: ANSI C63.10: 2013

Date: 2021-12-16/20 (19.6°C,7.4 % RH)

EUT status: Compliant

Specification: FCC Part 15.247(f)

Criteria The power spectral density conducted from the intentional radiator to the antenna due to the digital modulation operation of the hybrid system, with the frequency hopping operation turned off, shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

2.4.1 Test Guidance: ANSI C63.10-2013, Clause 11.10.3 / FCC OET KDB 558074

This measurement is performed at low, mid and high frequencies, in continuous transmission, with modulation.

The RF output of EUT with an antenna connector is fed to the input of the spectrum analyzer through appropriate attenuation. The loss from the cable and the attenuator were added on the analyzer as gain offset setting there by allowing direct measurements, without the need for any further corrections.

Use the following Spectrum Analyzer settings		
Span	At least 1.5 times the OBW of channel center Frequency	
RBW	3 KHz	
VBW	≥ 3 x VBW	
Sweep	Auto Couple	
Detector Function	Power averaging (RMS) or Sample detector (when RMS not available.	
Trace	Employ trace average (rms) mode over a minimum of 100 traces.	
Ensure that the number of measurement points in the sweep \geq [2 x span / RBW]. Allow the trace to stabilize. Use the peak marker function to determine the maximum amplitude level.		

2.4.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

2.4.3 Test Equipment

Testing was performed with this equipment:

Equipment	Manufacturer	Model # Asset #		Cal. Date	Cal. Due	
EXA Signal Analyzer	Agilent	N9010A FW A.14.16	6678	2021-07-22	2022-07-22	
Temp/Humidity	Extech	42270	5892	2021-04-05	2022-04-15	
Attenuator	Mini-Circuits®	BWS102W263	6932	Cal. before each use		
Coaxial Cables (RF)	Huber+Suhner	Enviroflex 400	-	Cal. before each use		

2.4.4 Test Sample Verification, Configuration & Modifications

The EUT was set to transmit continuously on a selected channel with test-specific software. The output was modulated as in normal operation. The EUT met the requirements without modification.

Test setup diagrams for Peak Power Spectral Density testing: Conducted:

EUT	Attenuator	 	Spectrum Analyzer
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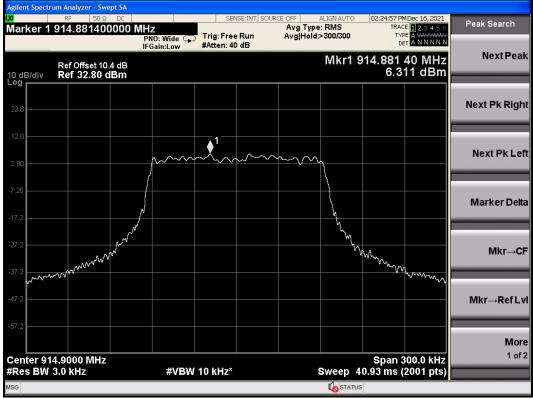
2.4.5 Average PSD Data

Mode of operation	Channel	Freq. [MHz]	PSD (dBm)	PSD Limit (dBm
	Low	902.3	5.663	8
LoRa 125 KHz	Mid	914.9	6.311	8
	High	927.5	7.557	8

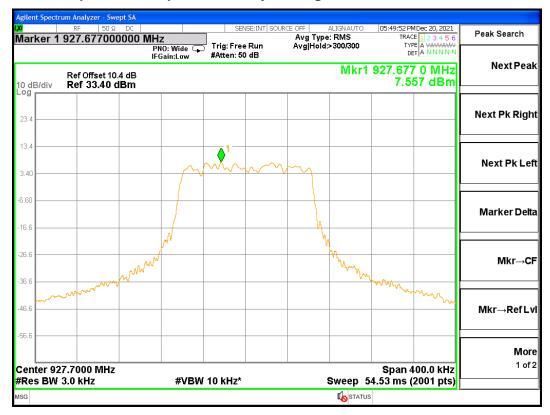
Screen Capture from Spectrum Analyzer: Low Channel

Agilent Spectrum Analyzer - Swept SA			ALIGN AUTO 9e: RMS d:>300/300	02:11:57 PMDec 16, 2021 TRACE 1 2 3 4 5 6 TYPE A WWWWW DET A NNNNN	Peak Search
Ref Offset 10.4 dB 10 dB/div Ref 32.80 dBm			Mkr1 9	02.282 45 MHz 5.663 dBm	Next Peal
22.8					Next Pk Righ
2.80		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~			Next Pk Let
7.20					Marker Delt
27.2 37.2			N N N	M	Mkr→C
47.2					Mkr→RefL
57.2 Center 902.3000 MHz				Span 300.0 kHz	Mor 1 of
Res BW 3.0 kHz	#VBW 10 kHz*		Sweep 40).93 ms (2001 pts)	

Screen Capture from Spectrum Analyzer: MID Channel



Screen Capture from Spectrum Analyzer: High Channel



2.5 Band Edge Attenuation

Test Lab: Electronics Test Centre, Airdrie

Test Personnel: Imran Akram

EUT: Kona Micro Gateway Standard: FCC PART 15.247 Basic Standard: ANSI C63.10: 2013

Date:2021-12-16/20 (19.6°C,7.4 % RH)

EUT status: Compliant

Specification: FCC Part 15.247(d)

Criteria: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.209(a) (see §15.205(c)).

2.5.1 Test Guidance: ANSI C63.10-2013 Clause 6.10.4 & 7.8.6, 6.10.6 / FCC OET KDB 558074

This measurement is performed at the low and high frequencies, with modulation.

The RF output of EUT with an antenna connector is fed to the input of the spectrum analyzer through appropriate attenuation. The loss from the cable and the attenuator were added on the analyzer as gain offset setting there by allowing direct measurements, without the need for any further corrections.

Use the following s	Use the following spectrum analyzer settings:						
Span	Wide enough to capture the peak level of the emission operating on the						
	channel closest to the band edge, as well as any modulation products that						
	fall outside of the authorized band of operation.						
Attenuation	Auto (at least 10 dB preferred).						
RBW	100 kHz						
VBW	300 kHz						
Sweep	Coupled						
Detector function	peak						
Trace	max hold						
Allow the trace to s	stabilize. Set the marker on the emission at the band edge, or on the highest						
modulation product outside of the band, if this level is greater than that at the band edge.							
Enable the marke	er-delta function, and then use the marker-to-peak function to move the						
marker to the peak	c of the in-band emission.						

2.5.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

2.5.3 Test Equipment

Testing was performed with the following equipment:

Equipment	Manufacturer	Ianufacturer Model # Asset #		Cal. Date	Cal. Due	
EXA Signal Analyzer	Agilent	N9010A FW A.14.16	6678	2021-07-22	2022-07-22	
Temp/Humidity	Extech	42270	5892	2021-04-05	2022-04-15	
Attenuator	Mini-Circuits®	BWS102W263	6932	Cal. before each use		
Coaxial Cables (RF)	Huber+Suhner	Enviroflex 400	-	Cal. before each use		

2.5.4 Test Sample Verification, Configuration & Modifications

The EUT was set to transmit continuously on a selected channel with test-specific software. The output was modulated as in normal operation. The EUT met the requirements without modification.

Test setup diagrams for Band Edge Attenuation testing:

Conducted:

EUT	Attenuator	Spectrum Analyzer

2.5.5 Band Edge Data

Worse Case Data

Mode of operation	Channel	Attenuation at Band Edge	Attenuation Limit at Band Edge		
Lora 125KHz	902.3	38.504 dBc	30 dBc		
(Non-Hopping)	927.7	39.368 dBc	30 dBc		
Lora 125KHz	902.3	38.881 dBc	30 dBc		
(Hopping)	927.7	37.006 dBc	30 dBc		

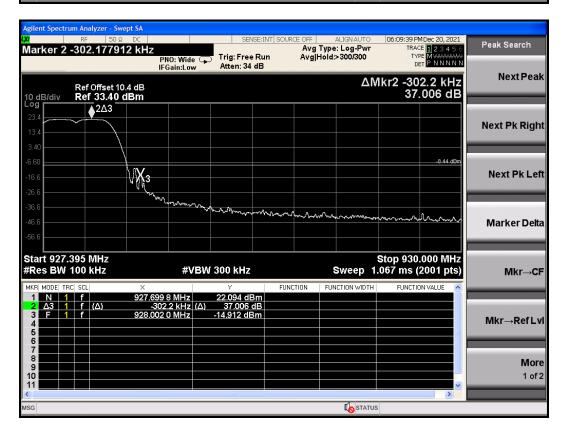
Screen Capture from the spectrum analyzer: Lower Band Edge (Non-Hopping)

Agilent Spect	rum Analyzer -	Swept SA							
I,XI		iOΩ DC		SENSE	INT SOURCE OFF	ALIGN AUTO		Dec 16, 2021	Trace/Detector
Marker 2	307.4750	000 kHz		Trig: Free R		Type: Log-Pwr Hold:>300/300	TRACI	1 23456	TheerBeteetor
			PNO: Wide C	Ing. nee ∩ #Atten: 40 d		11010.2000000	DE	E MWWWWW T P N N N N N	O al a st Tara a
			II Galli.2000		-				Select Trace
	Ref Offset	10.4 dB				Δ	Mkr2 30		1
10 dB/div	Ref 32.8	0 dBm					38.	504 dB	
Log								▲2∆3	
22.8									
12.8							\vdash	$ \rightarrow $	Clear Write
2.80									
2.00									
-7.20								-10.49 dBm	
-17.2							V.		Trace Average
07.0							X3		
-27.2									
-37.2	0	A	www.www.						
-47.2									Max Hold
-57.2									maxmora
-57.2									
Start 900							Stop 902.		
#Res BW			#)/P	W 300 kHz		Swoon 1	310p 902. 1.067 ms (2		Mire Hallel
#Res DW	TUU KHZ		#VD			Sweep	.007 ms (2	too r pisj	Min Hold
MKR MODE T	RC SCL	Х		Y	FUNCTION	FUNCTION WIDTH	FUNCTIO	N VALUE	
1 N ′	f		05 5 MHz	20.157 dBn					
2 <u>∆3</u> ′ 3 F ′			307.5 kHz (∆ 98 0 MHz	 <u>38.504 dE</u> -18.347 dBm 					View Blank
4		301.3		-10.347 0011					Trace On
5									Trace On
6									
8									
9									More
10									1 of 3
11								×	
<u> </u>									
MSG							S		

Screen Capture from the spectrum analyzer: Upper Band Edge (Non-Hopping)

	0 (-				
								Swept SA	Analyzer - S	Spectrum	gilent
-	4Dec 20, 2021 [05:51:18 Pf	ALIGN AUTO	CE OFF	ISE:INT SOU	SEM		DΩ DC	RF 50		u i
Trace/Detecto	E 1 2 3 4 5 6	TRAC	: Log-Pwr					000 kHz	312.8000	(er 2 -3	lark
	PEMWWWWW TPNNNNN	TYI	>300/300	Avg Hol		🚽 Trig: Free	PNO: Wide 🕞				
Select Trac		Di) dB	#Atten: 50	IFGain:Low				
	2.8 kHz	kr2 -31									
	368 dB	20							Ref Offset		
	300 UB							0 dBm	Ref 33.40	3/div	0 dE
										<u>2∆3</u>	
C lass 											3.4
Clear Wr										$ \rightarrow $	3.4
									<u>\</u>		.40
	-8.44 dBm								1		60
Trace Avera									3		
Trace Avera											5.6 ·
									~		6.6
	wanne war	man	mon	man	amon an	manna	some man	. Martin Martin			
											5.6
Max Ho									_		6.6
											- 1
											6.6
											ļ
	.000 MHz									t 927.7	
Min Ho	2001 pts)	.067 ms (Sweep 1.			/ 300 kHz	#VBV)0 kHz	s BW 1	Res
		ELNIOTIC	-						001 I		723 IN
	IN VALUE	FUNCTI	ICTION WIDTH	TION FI		00 400 dl		×		IODE TRC	
						22.129 dE 39.368	06 9 MHz 312.8 kHz (Δ)		f f (Δ)	N 1 ∆3 1	
View Blan						-17.240 dE	186 MHz		f (Δ)	F 1	
Trace O								020.0	•		4
Trace O											5
											6
	1										7
M											8 9
10											9
	~										1
ч											G
			No STATUS								9

Agilent Spect	rum Analyzer - Sv								
Marker 2	RF 50 S 295.30609	2 kHz				g Type: Log-Pwr	TRA	MDec 20, 2021	Peak Search
10 dB/div	Ref Offset 1 Ref 33.40	IF 0.4 dB	NO: Wide G Gain:Low	Trig: Free R Atten: 34 df		Hold:>300/300 A	Mkr2 29	5.3 kHz 8.881 dB	NextPeak
23.4 13.4	Rei 33.40								Next Pk Right
3.40 -6.60 -16.6 -26.6							Xs	-10.49 dBm	Next Pk Left
-36.6 -46.6	amenakan anaka	mmm.	manhaham		mathamhr	when	μv.		Marker Delta
Start 900 #Res BW		×	#VBV	V 300 kHz	FUNCTION	Sweep '	1.067 ms	2.503 MHz (2001 pts)	Mkr→CF
1 N 2 2 <u>A</u> 3 7 3 F 7 4 5	1 f 1 f (Δ) 1 f	902.300	5.3 kHz (Δ)	19.911 dBm	1				Mkr→RefLvl
6 7 8 9 10 11									More 1 of 2
< MSG				III		I STATU	IS		



2.6 Conducted Spurious Emissions (Non- Restricted Band)

Test Lab: Electronics Test Centre, Airdrie

Test Personnel: Imran Akram

Standard: FCC PART 15.247 Basic Standard: ANSI C63.4-2014

FCC OET KDB 558470 v04 DTS

EUT: Kona Micro Gateway

Date: 2021-12-16 / 20 (19.6°C,7.4 % RH)

EUT status: Compliant

Specification: FCC Part 15.247(d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

2.6.1 Test Guidance: ANSI C63.10-2013, Clause 6.7, 7.8.8 / 558074 D01 15.247 Measurement Guidance v05r02

This measurement is performed at the low, mid and high frequencies, with modulation. The RF output of EUT with an antenna connector is fed to the input of the spectrum analyzer through appropriate attenuation. The loss from the cable and the attenuator were added on the analyzer as gain offset setting there by allowing direct measurements, without the need for any further corrections.

Use the following spectrum analyzer settings:						
Span	Set the center frequency and span to encompass frequency range to be measured.					
RBW	100 kHz					
VBW	300 kHz					
Sweep	Auto Coupled					
Detector function	peak					
Trace	max hold					

Allow the trace to stabilize. Use the peak marker function to determine the maximum amplitude level. Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) is attenuated by at least the minimum requirements specified in

2.6.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

2.6.3 Test Equipment

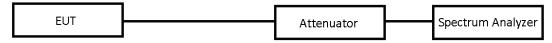
Testing was performed with the following equipment:

Equipment	Manufacturer	Model #	Asset #	Cal. Date	Cal. Due
EXA Signal Analyzer	Agilent	N9010A FW A.14.16	6678	2021-07-22	2022-07-22
Temp/Humidity	Extech	42270	5892	2021-04-05	2022-04-15
Attenuator	Mini-Circuits®	BWS102W263	6932	Cal. before each use	
Coaxial Cables (RF)	Huber+Suhner	Enviroflex 400	-	Cal. before each use	

2.6.4 Test Sample Verification, Configuration & Modifications

The EUT was set to a selected channel with test-specific software. The output was modulated as in normal operation. The EUT met the requirements without modification.

Test setup diagram for Conducted Spurious Emissions testing:



2.6.5 Conducted Emissions Data:

Low Channel

ntegration		20107		Sain:Low G	Trig: Fre #Atten: 4	req: 902.30 e Run 0 dB	Avg Hold	I>300/300	Radio De	vice: BTS	
10 dB/div	Ref 4	0.10	1Bm								
20.1 20.1											Clear Writ
9.90 19.9		m	~~~~	~^~~	a^-av	~~~~	~~~~~		n f		Averag
29.9 39.9 49.9										Sealer and	Max Hol
Center 902 Res BW 1.3					VB	N 18 KH	z			189.5 kHz 69.73 ms	Min Hol
Channe	el Pow	/er				Powe	r Specti	ral Dens	ity	,	Detecto
19	9.51	dB	n / 1	26.3 kH	z		31.51	dBm	/Hz		Average Auto Ma

		MSG		STATUS			
gilent Spect	rum Analyzer	- Spurious Emissions					
larker 1		50 Q DC		IT SOURCE OFF ALIGN 001.225000 MHz	AUTO 02:19:59 F Radio Std	MDec 16, 2021	Range Table
	112	IFGain:	Trig: Free Run				Bong
		IFGain:	Low #Atten: 40 dB		Radio Dev	/ice: B15	Rang
0.1011	Ref Of	fset 10.4 dB					<u>On</u> C
0 dB/div .og	Ref 4	1.00 dBm					
31.0							Start Fre
21.0							30.000 kł
11.0							
1.00							Stop Fre
9.00							1.000000000 Gi
19.0							
29.0							Res B
39.0							100.00 kł
19.0						- Lucian de la composición de la composicinde la composición de la composición de la composición de la	Auto Ma
Start 30	kHz				St	op 1 GHz	
							Video B 300.00 kH
Spur	Range	Fraguancy	Amplitude	Limit	Δ Limit		Auto <u>Ma</u>
spur 1		Frequency 902.3 MHz	Amplitude 19.70 dBm	-10.49 dBm	30.19 dB	~	
2	<mark>2</mark> 2	973.0 MHz	-41.98 dBm	-10.49 dBm	-31.49 dB		Filter Type
3	2	900.7 MHz	-42.33 dBm	-10.49 dBm	-31.84 dB	-	Gaussian
4	2 2	988.3 MHz	-42.41 dBm	-10.49 dBm	-31.92 dB	-	
		901.5 MHz	-42.59 dBm	-10.49 dBm	-32.10 dB		
5			-12 91 dBm				
6	2	890.8 MHz	-42.81 dBm -42.88 dBm	-10.49 dBm	-32.32 dB -32.39 dB		Moi
			-42.81 dBm -42.88 dBm -42.97 dBm		-32.32 dB -32.39 dB -32.48 dB	~	
6 7 8	2 2	890.8 MHz 968.1 MHz	-42.88 dBm	-10.49 dBm -10.49 dBm -10.49 dBm	-32.39 dB -32.48 dB	×	Moi 1 of
6 7 8	2 2 2	890.8 MHz 968.1 MHz 722.5 MHz	-42.88 dBm	-10.49 dBm -10.49 dBm -10.49 dBm	-32.39 dB	×	
6 7 8	2 2 2	890.8 MHz 968.1 MHz 722.5 MHz	-42.88 dBm -42.97 dBm	-10.49 dBm -10.49 dBm -10.49 dBm	-32.39 dB -32.48 dB	WDer 16 2021	1 of
6 7 8	2 2 2 rum Analyzer - RF 5	890.8 MHz 968.1 MHz 722.5 MHz	-42.88 dBm -42.97 dBm	-10.49 dBm -10.49 dBm -10.49 dBm	-32.39 dB -32.48 dB	MDec 16, 2021 I: None	
6 7 8 sg	2 2 2 rum Analyzer - RF 5	890.8 MHz 968.1 MHz 722.5 MHz	-42.88 dBm -42.97 dBm Sense:IN Center Freq: S Trig: Free Rut	-10.49 dBm -10.49 dBm -10.49 dBm	-32.39 dB -32.48 dB	: None	1 of
6 7 8 gilent Spectr larker 1	2 2 2 rum Analyzer - RF (Hz	890.8 MHz 968.1 MHz 722.5 MHz Spurious Emissions 80.9 DC	-42.88 dBm -42.97 dBm Sense:IN Center Freq: S Trig: Free Rut	-10.49 dBm -10.49 dBm -10.49 dBm	-32.39 dB -32.48 dB status AUTO 02:17:44 F Radio Std	: None	1 of Range Table Rang
6 7 8 gilent Spectr larker 1 ASS 0 dB/div	2 2 2 rum Analyzer - RF (Hz	890.8 MHz 968.1 MHz 722.5 MHz Spurious Emissions 80.9 DC	-42.88 dBm -42.97 dBm Sense:IN Center Freq: S Trig: Free Rut	-10.49 dBm -10.49 dBm -10.49 dBm	-32.39 dB -32.48 dB status AUTO 02:17:44 F Radio Std	: None	1 of Range Table Rang
6 7 8 gilent Spectr larker 1 ASS 0 dB/div og	2 2 2 rum Analyzer - RF (Hz	890.8 MHz 968.1 MHz 722.5 MHz Spurious Emissions 80 & DC	-42.88 dBm -42.97 dBm Sense:IN Center Freq: S Trig: Free Rut	-10.49 dBm -10.49 dBm -10.49 dBm	-32.39 dB -32.48 dB status AUTO 02:17:44 F Radio Std	: None	1 of Range Table Rang On C
6 7 8 gilent Spectr larker 1 ASS	2 2 2 rum Analyzer - RF (Hz	890.8 MHz 968.1 MHz 722.5 MHz Spurious Emissions 80.9 DC	-42.88 dBm -42.97 dBm Sense:IN Center Freq: S Trig: Free Rut	-10.49 dBm -10.49 dBm -10.49 dBm	-32.39 dB -32.48 dB status AUTO 02:17:44 F Radio Std	: None	1 of Range Table Rang On C Start Fre
6 7 8 gilent Spectr larker 1 ASS 0 dB/div og	2 2 2 rum Analyzer - RF (Hz	890.8 MHz 968.1 MHz 722.5 MHz Spurious Emissions 80.9 DC	-42.88 dBm -42.97 dBm Sense:IN Center Freq: S Trig: Free Rut	-10.49 dBm -10.49 dBm -10.49 dBm	-32.39 dB -32.48 dB status AUTO 02:17:44 F Radio Std	: None	1 of Range Table Rang On C Start Fre
6 7 8 sa ilent Spectr larker 1 ASS 0 dB/div og 31.6	2 2 2 rum Analyzer - RF (Hz	890.8 MHz 968.1 MHz 722.5 MHz Spurious Emissions 80.9 DC	-42.88 dBm -42.97 dBm Sense:IN Center Freq: S Trig: Free Rut	-10.49 dBm -10.49 dBm -10.49 dBm	-32.39 dB -32.48 dB status AUTO 02:17:44 F Radio Std	: None	1 of Range Table Rang On C Start Fre
6 7 8 sc gilent Spectr larker 1 ASS 0 dB/div og 31.6 11.6	2 2 2 rum Analyzer - RF (Hz	890.8 MHz 968.1 MHz 722.5 MHz Spurious Emissions 80.9 DC	-42.88 dBm -42.97 dBm Sense:IN Center Freq: S Trig: Free Rut	-10.49 dBm -10.49 dBm -10.49 dBm	-32.39 dB -32.48 dB status AUTO 02:17:44 F Radio Std	: None	1 of Range Table Rang
6 7 8 gitent Spectr ASS 0 dB/div 0 dB/div 21.6 11.6 1.60	2 2 2 rum Analyzer - RF (Hz	890.8 MHz 968.1 MHz 722.5 MHz Spurious Emissions 80.9 DC	-42.88 dBm -42.97 dBm Sense:IN Center Freq: S Trig: Free Rut	-10.49 dBm -10.49 dBm -10.49 dBm	-32.39 dB -32.48 dB status AUTO 02:17:44 F Radio Std	: None	1 of Range Table Rang On C Start Fre 1.00000000 Gł
6 7 8 glent Spectr ASS 0 dB/div 0 dB/div 16 11.6 1.6 1.6 1.6 1.6 1.6 1.6 1.6 1.6	2 2 2 rum Analyzer - RF (Hz	890.8 MHz 968.1 MHz 722.5 MHz Spurious Emissions 80.9 DC	-42.88 dBm -42.97 dBm Sense:IN Center Freq: S Trig: Free Rut	-10.49 dBm -10.49 dBm -10.49 dBm	-32.39 dB -32.48 dB status AUTO 02:17:44 F Radio Std	: None	1 of Range Table Rang On c Start Fre 1.00000000 GH
6 7 8 gilent Spectr larker 1 ASS 0 dB/div 0 dB/d	2 2 2 rum Analyzer - RF (Hz	890.8 MHz 968.1 MHz 722.5 MHz Spurious Emissions 80.9 DC	-42.88 dBm -42.97 dBm Sense:IN Center Freq: S Trig: Free Rut	-10.49 dBm -10.49 dBm -10.49 dBm	-32.39 dB -32.48 dB status AUTO 02:17:44 F Radio Std	: None	1 of Range Table Rang On C Start Fre 1.000000000 GH 10.00000000 GH Res B
6 7 8 gilent Spectr larker 1 ASS 0 dB/div 9 9 11.6 11.6 1.60 11.6 1.60 1.60 1.60 1.60	2 2 2 rum Analyzer - RF (Hz	890.8 MHz 968.1 MHz 722.5 MHz Spurious Emissions 80.9 DC	-42.88 dBm -42.97 dBm Sense: In Center Freq: S Trig: Free Rut	-10.49 dBm -10.49 dBm -10.49 dBm	-32.39 dB -32.48 dB status AUTO 02:17:44 F Radio Std	: None	1 of Range Table Rang On C Start Frr 1.000000000 Gl Stop Frr 10.00000000 Gl Res B 100.00 kl
6 7 8 gilent Spectr larker 1 ASS 0 dB/div 9 9 11.6 11.6 1.60 11.6 1.60 1.60 1.60 1.60	2 2 2 rum Analyzer - RF (Hz	890.8 MHz 968.1 MHz 722.5 MHz Spurious Emissions 80.9 DC	-42.88 dBm -42.97 dBm Sense: In Center Freq: S Trig: Free Rut	-10.49 dBm -10.49 dBm -10.49 dBm	-32.39 dB -32.48 dB status AUTO 02:17:44 F Radio Std	: None	1 of Range Table Rang On C Start Frr 1.000000000 Gl Stop Frr 10.00000000 Gl Res B 100.00 kl
678 3ilent Spectr larker 1 ASS 0 dB/div 0 g 0 dB/div 0 dB/d	2 2 2 Hz Ref Of Ref 4	890.8 MHz 968.1 MHz 722.5 MHz Spurious Emissions 80.9 DC	-42.88 dBm -42.97 dBm Sense: In Center Freq: S Trig: Free Rut	-10.49 dBm -10.49 dBm -10.49 dBm	-32.99 dB -32.48 dB ystatus Auto (02:17:44 F Radio Std Radio Std	: None	Auto Market Start
6 7 8 gitent Spectr ASS 0 dB/div 0 dB/div 21.6 11.6 1.60	2 2 2 Hz Ref Of Ref 4	890.8 MHz 968.1 MHz 722.5 MHz Spurious Emissions 80.9 DC	-42.88 dBm -42.97 dBm Sense: In Center Freq: S Trig: Free Rut	-10.49 dBm -10.49 dBm -10.49 dBm	-32.99 dB -32.48 dB ystatus Auto (02:17:44 F Radio Std Radio Std	: None vice: BTS	1 of Range Table Rang On C Start Fr 1.00000000 GI Stop Fr 10.00000000 GI Res B Auto M Auto M
678 38 310 Spectro 10 ASS 0 0B/div 0 0B/d	2 2 3 Horn Analyzer Ref Of Ref 4 Hz	890.8 MHz 968.1 MHz 722.5 MHz Spurious Emissions 89.9 DC IFGain:1 5set 11 dB 1.60 dBm	-42.88 dBm -42.97 dBm Sense: In Center Freq: S Trig: Free Rut	-10.49 dBm -10.49 dBm -10.49 dBm	-32.99 dB -32.48 dB ystatus Auto (02:17:44 F Radio Std Radio Std	: None vice: BTS	1 of Range Table Rang On C Start Frr 1.000000000 GI Stop Frr 10.0000 KI Res B Auto M Video B
6 7 8 sitent Spectra larker 1 ASS 0 dB/div 0 dB/div	2 2 2 Hz Ref of Ref 4	890.8 MHz 968.1 MHz 722.5 MHz Spurious Emissions 80.9 DC	-42.88 dBm -42.97 dBm Center Freq: 3 Center Freq: 3 Trig: Free Run #Atten: 40 dB	-10.49 dBm -10.49 dBm -10.49 dBm -10.49 dBm	-32.39 dB -32.48 dB STATUS AUTO 02:17:44F Radio Std Radio Dev Sto	: None vice: BTS	1 of Range Table Rang On C Start Fr 1.00000000 GI Stop Fr 10.00000000 GI Res B Auto M Auto M
6 7 8 31001 Spectre arker 1 ASS 0 dB/div 0 dB/div	2 2 2 Ref Of Ref Of Ref 4 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	890.8 MHz 968.1 MHz 722.5 MHz Spurious Emissions 09.0 C IFGain: IFGain: Set 11 dB 1.60 dBm	-42.88 dBm -42.97 dBm Center Freq 5 Trig: Free Rur #Atten: 40 dB	-10.49 dBm -10.49 dBm -10.49 dBm -10.49 dBm -10.49 dBm -10.49 dBm -10.49 dBm	-32.39 dB -32.48 dB 3574705 AUTO 102:17:44 R Radio Std Radio Std Radio Std Std Std A Limit -21.83 dB -21.87 dB	: None vice: BTS	1 oi Range Table Rang On c Start Fro 1.00000000 Gi Stop Fro 10.000 ki Auto M Video B Auto M
6 7 8 silent Spectr larker 1 ASS 0 dB/div 0 g 0 dB/div 0 g 1 6 1 6 0 dB/div 0 g 1 6 1 6 1 6 1 6 1 6 1 6 1 6 1 6	2 2 2 	890.8 MHz 968.1 MHz 722.5 MHz Spurious Emissions So C IFGeind Set 11 dB 1.60 dBm Frequency 3.783 GHz 3.825 GHz 3.825 GHz	-42.88 dBm -42.97 dBm Center Free Q Canter Free Q #Atten: 40 dB Amplitude -32.32 dBm -32.36 dBm -32.92 dBm	-10.49 dBm -10.49 dBm -10.49 dBm -10.49 dBm -10.49 dBm -10.49 dBm -10.49 dBm -10.49 dBm	-32.39 dB -32.48 dB -32.48 dB -32.48 dB -32.48 dB -32.48 dB Radio Std Radio Det Radio Det Sto Sto -21.83 dB -21.87 dB -22.43 dB	: None vice: BTS	Auto Miller Type
6 7 8 sitent Spectr larker 1 ASS 0 dB/div og 0 dB/div 0 dB/	2 2 2 Hz Ref of Ref 4 Hz :Hz :Hz :Hz 1 1 1 1	890.8 MHz 968.1 MHz 722.5 MHz Spurious Emissions 90 DC IFGaind fset 11 dB 1.60 dBm Set 12 dBm	-42.88 dBm -42.97 dBm Center Preq: Trig: Free Rur #Atten: 40 dB	-10.49 dBm -10.49 dBm -10.49 dBm -10.49 dBm -10.49 dBm -10.49 dBm -10.49 dBm -10.49 dBm -10.49 dBm	-32.39 dB -32.48 dB -32.48 dB -32.48 dB -32.48 dB -32.48 dB Radio Std Radio De Radio Std Radio De Std -21.83 dB -21.87 dB -22.43 dB -22.43 dB	: None vice: BTS	1 of Range Table Rang On C Start Fr 1.00000000 GI Stop Fr 10.00000000 GI Res B Auto M Auto M
678 38 30 30 30 31 40 31 40 31 40 31 40 31 40 5 5 5 5 5 5 5 5 5 5 5 5 5	2 2 2 Ref Of Ref 0 Ref 0 Ref 4 	890.8 MHz 968.1 MHz 722.5 MHz Spurious Emissions 892 DC IFGeint: 5set 11 dB 1.60 dBm Frequency 3.783 GHz 3.825 GHz 3.863 GHz 3.861 GHz	-42.88 dBm -42.97 dBm Center Freq 5 Trig: Free Rur #Atten: 40 dB	-10.49 dBm -10.49 dBm -10.49 dBm -10.49 dBm -10.49 dBm -10.49 dBm -10.49 dBm -10.49 dBm -10.49 dBm	-32.39 dB -32.48 dB -32.48 dB -32.48 dB -32.48 dB -32.48 dB -21.74 dB -22.43 dB -22.43 dB -22.43 dB -22.43 dB	: None vice: BTS	Auto Miles Start S
6 7 8 Silent Spectr larker 1 ASS 0 dB/div og 0 dB/div 0 dB/	2 2 2 Hz Ref of Ref 4 Hz :Hz :Hz :Hz 1 1 1 1	890.8 MHz 968.1 MHz 722.5 MHz Spurious Enricstons 00 0 C I IFGaint Set 11 dB 1.60 dBm Frequency 3.783 GHz 3.825 GHz 3.863 GHz 3.863 GHz 3.911 GHz 3.765 GHz	-42.88 dBm -42.97 dBm Center Preq: 3 Center Preq: 3 Trig: Free Rur #Atten: 40 dB	-10.49 dBm -10.49 dBm -10.49 dBm -10.49 dBm -10.49 dBm -10.49 dBm -10.49 dBm -10.49 dBm -10.49 dBm -10.49 dBm	-32.39 dB -32.48 dB -32.48 dB -32.48 dB -32.48 dB -32.48 dB -32.74 dB -22.43 dB -22.91 dB -22.91 dB -22.95 dB	: None vice: BTS	Auto Mo Gaussian Auto Mo Caussian Con Caussian Con Caussian Con Caussian Con Caussia
6 7 8 ellent Spectr ASS 0 dB/div 0 9 0 16 1 6 2 1 6 4 0 4 4 0 5 5 6	2 2 2 	890.8 MHz 968.1 MHz 722.5 MHz Spurious Emissions So C IFGeind Set 11 dB 1.60 dBm Frequency 3.783 GHz 3.825 GHz 3.876 GHz 3.876 GHz 3.911 GHz 3.745 GHz	-42.88 dBm -42.97 dBm Canter Free Q Senter Free Q #Atten: 40 dB Amplitude -32.36 dBm -33.23 dBm -33.23 dBm -33.40 dBm	-10.49 dBm -10.49 dBm -10.49 dBm TI SOURCE CFF ALIEN 01.225000 MHz AvgHold>50/5	-32.39 dB -32.48 dB -32.48 dB -32.48 dB -32.48 dB -32.74 dB -22.43 dB -22.43 dB -22.43 dB -22.74 dB -22.43 dB -22.74 dB -22.96 dB -22.91 dB	: None vice: BTS	Auto Miller Type

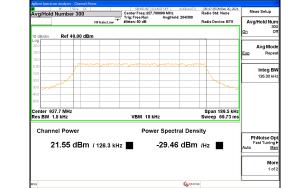
MID Channel

Center Freq 914.900000 MH	EGain:Low States and Avgl	z Radio St feld: 257/300	PMDec 16, 2021 Frequency cd: None Frequency	
10 dB/div Ref 40.10 dBm				
30.1			Center F 914.900000 I	
2010	an and the second s	an and a second a se		
49.9				
Center 914.9 MHz Res BW 1.8 kHz	VBW 18 kHz	Sweep	189.5 kHz 69.73 ms Auto	
Channel Power 20.64 dBm /		ctral Density 37 dBm /Hz	FreqOff	fset D Hz
490		G STATUS		-

dilent Spect Marker 1	RF 5	Spurious Emissions 50 Ω DC		q: 914.900000 MHz	Radio S	9 PMDec 16, 2021 itd: None	Ra	nge Table
		IFGain:				evice: BTS		Range
10 dB/div		set 10.4 dB 1.00 dBm					<u>On</u>	Of
21.0								Start Free 30.000 kH
1.00 9.00							1.00	Stop Fre 0000000 GH
29.0 39.0 49.0							Auto	Res BV 100.00 kH <u>Ma</u>
tart 30	kHz					Stop 1 GHz		Video B
Spur	Range	Frequency	Amplitude	Limit	Δ Limit		Auto	Ma
1 2	2 2 2	914.9 MHz 914.3 MHz	20.58 dBm -39.95 dBm	-9.360 dBr -9.360 dBr	n -30.59 dB		F	ilter Type
3 4 5	2 2	930.7 MHz 970.6 MHz 953.4 MHz	-41.66 dBm -41.88 dBm -42.22 dBm	-9.360 dBr -9.360 dBr -9.360 dBr	n -32.52 dB	3		Gaussian
6 7 8	2 2 2	891.5 MHz 914.0 MHz 913.7 MHz	-42.25 dBm -42.32 dBm -42.34 dBm	-9.360 dBr -9.360 dBr -9.360 dBr	n -32.96 dB			Mor 1 of
G					STATUS			

larker 1	RF 5	- <mark>Spurious E</mark> missions 50 Ω DC	Cente	SENSE:INT SOURCE OF r Freq: 914.900000 f ree Run Av		Radio Sto	MDec 16, 2021 I: None	Rai	nge Table
PASS		IFGa	ain:Low 🔭 #Atten	:40 dB		Radio De	vice: BTS		Rang
I0 dB/div		fset 11 dB 1.60 dBm						<u>On</u>	C
- og 31.6 21.6 11.6								1.00	Start Fre 0000000 GH
1.60 3.40 18.4								10.00	Stop Fre 0000000 Gi
28.4 38.4 48.4								Auto	Res B 100.00 k <u>M</u>
Start 1 G	Hz			<u> </u>		Sto	op 10 GHz		Video E 300.00 k
Spur	Range	Frequency	Amplitud	e L	.imit	∆ Limit		Auto	N
1 2	1	3.795 GHz 3.763 GHz	-32.03 dB -32.34 dB		60 dBm 60 dBm	-22.67 dB -22.98 dB	^	F	ilter Typ
3	1	3.685 GHz	-33.65 dBi		50 dBm	-24.29 dB			Gaussia
4	1	4.906 GHz	-33.96 dB		60 dBm	-24.60 dB	-		outeens
5	1	4.454 GHz	-34.04 dB	m -9.36	60 dBm	-24.68dB			
6	1	3.848 GHz	-34.05 dB		60 dBm	-24.69 dB			M
7 8	1 1	3.882 GHz 3.810 GHz	-34.10 dBi -34.15 dBi		60 dBm 60 dBm	-24.74dB -24.79dB	~		1 0
SG						STATUS			

High Channel



BF D D D SPREINT ISORE CFI AUXIATO D SSUE MITE Radio Strit None		rum Analyzer						
Spur Range Frequency Anglinide>101 Range	LXI	RF	50 Ω DC					Banga Tabla
If Galactore # After: 34 dB Radio Device: BTS Radio Device: BTS 10 ddiddr. Ref 40.40 dB 927.69 MHz 0 30 ddiddr. Ref 40.40 dB 927.69 MHz 0 31 ddiddr. Stort 7Feq 0 0 0 31 ddiddr. Stort 70 MHz 21.26 dBm -4.40 dBm -2.27 dB 31 ddiddr. 959.7 MHz 21.26 dBm -9.440 dBm -2.27 dB 31 ddiddr. 959.7 MHz -4.12.60 dBm -9.440 dBm -2.27 dB 31 ddiddr. 959.7 MHz -4.12.60 dBm -9.440 dBm -3.27 dB 31 ddiddr. 4.12 dB dBm -9.440 dBm -3.27 dB -4.400 dBm 31 ddiddr. 4.12 dB dBm -9.440 dBm -4.428 dB -4.428 dB -4.428 dB 6 ddiddr. 9.90 MHz -51.25 dBm -9.440 dBm -4.440 dBm -4.440 dBm -4.440 dBm -4.400 dBm -4.20 dBd -4.20 dBd -4.20	Avg/Hole	d Numbe	r 10	Tria: Erec F			: None	Range Table
Spir Range Frequency Amplitude Limit Auto 10 3000 3000 3000			IFGain:		iB	Radio De	vice: BTS	Range
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Start Frequency Amplitude Limit Allow Start Frequency Start Frequency Start Start Frequency Start Start Frequency Start Start Frequency Start	40 10/10	Ref Of	fset 10.4 dB					<u>On</u> Off
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20 0 30.000 kHz 30 0 40.00 kHz 30 0 41.00 kHz 30 0 41.00 kHz 30 0 41.00 kHz 30 0 41.00 kHz 30 0 92.00 kHz 30 0 41.00 kHz 30 0 92.00 kHz 31 0 92.00 kHz 32 0 51.25 dBm 32 0 90.00 kHz 32 0 51.25 dBm 32 0 10.00 kHz 32 0 10.00 kHz 32 0 10.00 kHz 32 0 10							1	Start Fred
10 4 1	20.4							
1 1	10.4							
303 304 305 305 306 3								
1000000000 GHz 100000000 GHz 1100000000 GHz 11100000000 GHz 111100000000 GHz 111100000000 GHz 111100000000 GHz 111100000000 GHz 111100000000 GHz 111100000000 GHz 1111000 GHz 111100000000 GHz 11110000000 GHz<								Stop Freq
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33 34 35 36 <td< td=""><td>-19.6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>	-19.6							
Start 30 kHz Stop 1 GHz Start 1 992.0 MHz 44.56 dBm Start 1 GHz Stop 10 GHz Start 1 GHz Stop 10 GHz Start 1 GHz Stop 10 GHz Start 1 GHz Amplitude Start 1 GHz Stop 10 GHz Start 1 GHz Stop 10 GHz <td>-29.6</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>+</td> <td></td>	-29.6						+	
Auto Man Start 30 kHz Stop 1 GHz Spur Range Frequency Amplitude Limit Δ Limit 1 992.7.7 MHz 21.28 dBm 8.440 dBm 29.72 dB 1 3 1 992.7 MHz 44.56 dBm 8.440 dBm 36.12 dB 6 3 1 992.7 MHz -47.43 dBm 8.440 dBm -38.99 dB 6 1 80.99 MHz -51.25 dBm -8.440 dBm -47.81 dB 6 1 6.1 a 80.04 MHz -53.33 dBm -8.440 dBm -44.89 dB 10'' 6 10'' 6 10'' 6 10'' 6 10'' 6 10'' 6 10'' 6 10'' 6 10'' 6 10''' 6 10'''' 6 10''''''''''''''''''''''''''''''''''''	-39.6						<u> </u>	
Start 30 kHz Stop 1 GHz Start 30 kHz Stop 1 GHz Spur Range Frequency Amplitude Limit Δ Limit 1 992.7 MHz 21.26 dBm -8.440 dBm -97.72 dB - 3 1 992.0 MHz -44.56 dBm -8.440 dBm -37.61 dB - 3 1 992.0 MHz -44.56 dBm -8.440 dBm -37.61 dB - 5 1 899.9 MHz -45.3 dBm -8.440 dBm -44.93 dB - - 6 1 80.0 MHz -53.33 dBm -8.440 dBm -44.99 dB -	-49.6							
Spur Range Frequency Amplitude Limit Δ Limit <thδ limit<="" th=""> <thδ limit<="" th=""> Δ L</thδ></thδ>	and the second se							
Spur Range Frequency Amplitude Limit A Limit 1 1 927.7 MHz 21.28 dBm -8.440 dBm 29.72 dB 3 1 992.0 MHz -46.05 dBm -8.440 dBm -37.61 dB - 4 1 995.7 MHz -47.33 dBm -8.440 dBm -37.61 dB - 5 1 899.9 MHz -51.25 dBm -8.440 dBm -42.81 dB - 6 1 840.0 MHz -53.13 dBm -8.440 dBm -44.99 dB - 8 1 800.0 MHz -53.33 dBm -8.440 dBm -44.99 dB - 9 1 7 7.755.4 MHz -53.43 dBm -44.09 dB - 9 1 7.774.3 GBm -8.440 dBm -42.99 dB - 1 6 1 7.774.3 GBm -42.056 dBm - - 9 1 0 - - - - - - - - - - - <td>Start 30</td> <td>kHz</td> <td></td> <td></td> <td></td> <td>S</td> <td>top 1 GHz</td> <td>Video BW</td>	Start 30	kHz				S	top 1 GHz	Video BW
Spur Range Frequency Amplitude Limit A Limit 1 1 992.0 MHz -44.56 dBm -8.440 dBm -37.61 dB 3 1 992.0 MHz -46.05 dBm -8.440 dBm -37.61 dB 5 1 899.9 MHz -51.25 dBm -8.440 dBm -42.81 dB 6 1 899.9 MHz -53.33 dBm -8.440 dBm -44.89 dB 0 7 1 735.4 MHz -53.33 dBm -8.440 dBm -44.89 dB 0 8 1 800.0 MHz -53.33 dBm -8.440 dBm -44.89 dB 0 8 1 800.0 MHz -53.43 dBm -8.440 dBm -44.89 dB 0 90 1 d73 1 d73 -55.43 dBm -8.440 dBm -42.85 dBm 0 0 91 1 d3 -55.43 dBm -44.00 dBm -42.656 dBm 0								
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5 1 899.9 MHz -51.25 dBm -8.440 dBm -42.81 dB More 6 1 840.4 MHz -53.13 dBm -8.440 dBm -44.70 dB -44.89 dB 1 1 of 3 7 1 75.54 MHz -53.33 dBm -8.440 dBm -44.70 dB -44.89 dB 1 1 of 3 8 1 800.0 MHz -53.33 dBm -8.440 dBm -44.99 dB 1 1 of 3 Sectorm Analyzer - Spurious Emissions Center Freq: 928.850000 MHz Addio St: None Radio St: None Stift 1 dB Stift 1 dB 3.7743 GHz	4							Gaussian
7 1 735.4 MHz -53.33 dBm -8.440 dBm -44.99 dB 1								
7 1 735.4 MHz -53.33 dBm -8.440 dBm -44.99 dB 1	6	1	840.4 MHz	-53.14 dBm	-8.440 dBm	-44.70 dB		More
B 1 800.0 MHz -53.43 dBm -8.440 dBm -44.99 dB Image: Start		1	735.4 MHz					
Ref Orfset 11 dB Construct Emissions Construct Construction Construction Emissions Avg/Hold Number 10 Radio Std: None Radio Std: None PASS Construction Construction Radio Std: None Radio Device: BTS Start 11 dB S.7743 SGB (BBM) Construction Ref Offset 11 dB S.7743 GHZ Start 1 GHZ Stop 10 CHz Start 1 GHZ Stop 10 CHz Video BW Video BW Start 1 GHZ Stop 10 CHz Stop 10 CHz Video BW Stop 10 CHz Video BW Stop 10 CHz Stop 10 CHz Stop 10 CHz Stop 10 CHz Video BW Stop 10 CHz Stop 10 CHz Stop 10 CHz Stop 10 CHz Stop 10 CHz S	8	1	800.0 MHz	-53.43 dBm	-8.440 dBm	-44.99 dB	*	
Ref Orfset 11 dB Construct Emissions Construct Construction Construction Emissions Avg/Hold Number 10 Radio Std: None Radio Std: None PASS Construction Construction Radio Std: None Radio Device: BTS Start 11 dB S.7743 SGB (BBM) Construction Ref Offset 11 dB S.7743 GHZ Start 1 GHZ Stop 10 CHz Start 1 GHZ Stop 10 CHz Video BW Video BW Start 1 GHZ Stop 10 CHz Stop 10 CHz Video BW Stop 10 CHz Video BW Stop 10 CHz Stop 10 CHz Stop 10 CHz Stop 10 CHz Video BW Stop 10 CHz Stop 10 CHz Stop 10 CHz Stop 10 CHz Stop 10 CHz S						4		
BF S09 C Septem Freq: 928.85000 MHz AUR9/MUTO Inspection Radio Std: None Avg/Hold Number 10 IFGaintLow Iffgi: Freq: 828.85000 MHz Avg/Hold>10/10 Radio Std: None Radio Std: None Aug/With Ref 41.00 dBm -42.656 dBm -42.656 dBm -42.656 dBm 1 10 dS/div Ref 41.00 dBm -42.656 dBm 1 0 100 Image Frequency Amplitude Image Frequency Image Frequency Image Frequency Image Frequency Image Frequency Amplitude Limit Auto Mage File 11 1 3.774 GHz -55.55 dBm -50.00 dBm -5.555 dB -55.55 dB -55.55 dB -55.55 dB -55.55 dB -55.00 dBm -56.40 dBm	MSG					STATUS		
Avg/Hold Number 10 Center Free 328.850000 MHz Radio Std: None Radio Std: None 2ASS IFGainLow Life Free Run Avg/Hold>1010 Radio Device: BTS 10 Edd/v Ref Offset 11 dB 3.7743 GHz 0 0 10 Bef offset 11 dB 3.7743 GHz 0 0 0 10 Bef offset 11 dB 3.7743 GHz 0 0 0 10 Bef offset 11 dB 3.7743 GHz 0 0 0 100 Bef offset 11 dB 3.7743 GHz 0 0 0 100 Bef offset 11 dB 3.7743 GHz 0 0 0 100 Bef offset 11 dB 3.7743 GHz 0 0 0 0 100 Bef offset 11 dB 3.7743 GHz 0 </th <th>Agilent Spect</th> <th>rum Analyzer -</th> <th>Sourious Emissions</th> <th></th> <th></th> <th></th> <th></th> <th></th>	Agilent Spect	rum Analyzer -	Sourious Emissions					
Spin Range Frequency Amplitude Limit Autom Autom Res But 10 discov discov <t< td=""><td>X</td><td></td><td>spurious cillissions</td><td></td><td></td><td></td><td></td><td></td></t<>	X		spurious cillissions					
Start 1 GHz Stor Range Frequency Amplitude Limit A Limit 1 1 3.774 GHz 42.656 dBm -42.656 dBm -42.656 dBm 10 dB/dly 1 1 1 1 1 1 1 1 0	A	RF 5	i0Ω DC	SENSE	NT SOURCE OFF ALI			Range Table
No dB/div Ref 41.00 dBm -42.656 dBm 10 dB/div -42.656 dBm 11 d -42.656 dBm 10 dB/div -42.656 dBm 11 d -42.656 dBm 10 dB/div -42.656 dBm 30 dV -42.656 dBm 10 dV -42.656 dBm		RF S Number	0 Ω DC 10	Trig: Free F	q:928.850000 MHz Run Avg Hold:>10	Radio Sto 0/10	l: None	
10 dB/d/w Ref 41.00 dBm -42.656 dBm 310 -42.656 dBm Start Freq 110	Avg/Holo PASS	RF S Number	0 Ω DC 10	Trig: Free F	q:928.850000 MHz Run Avg Hold:>10	Radio Sto 0/10 Radio De	l: None vice: BTS	
310 310 Start Freq 1.00000000 GHz 310 310 Start Freq 1.00000000 GHz 310 310 Start Freq 1.00000000 GHz 310 310 310 Start Freq 1.00000000 GHz 310 310 310 310 310 310 310 310			οΩ DC 10 IFGain:L	Trig: Free F	q:928.850000 MHz Run Avg Hold:>10	0/10 Radio Sto Radio De 3.7	l: None vice: BTS 743 GHz	Range
210 100000000 GHz 110 100000000 GHz 100 100000000 GHz 100000000 GHz 10000000 GHz 10000000 GHz 10000000 GHz 10000000 GHz 10000000 GHz 10000000 GHz 100000000 GHz 100000000 GHz 10000000 GHz 100000000 GHz 100000000 GHz 1100 GHz 55.11 dBm 110 GHz -55.55 dBm 110 GHz -56.75 dBm 10 GHz -56.75 dBm 10 GHz -56.75 dBm 10 GHz	PASS	Ref Off	10 DC 10 IFGain:L set 11 dB	Trig: Free F	q:928.850000 MHz Run Avg Hold:>10	0/10 Radio Sto Radio De 3.7	l: None vice: BTS 743 GHz	Range
110 100 1	10 dB/div	Ref Off	10 DC 10 IFGain:L set 11 dB	Trig: Free F	q:928.850000 MHz Run Avg Hold:>10	0/10 Radio Sto Radio De 3.7	l: None vice: BTS 743 GHz	Range 1 <u>On Off</u>
100 1	PASS 10 dB/div Log 31.0	Ref Off	10 DC 10 IFGain:L set 11 dB	Trig: Free F	q:928.850000 MHz Run Avg Hold:>10	0/10 Radio Sto Radio De 3.7	l: None vice: BTS 743 GHz	Range 1 <u>On Off</u> Start Freq
Start 1 GHz Stop Frequency Amplitude Limit Δ Limit 1 1 3.774 GHz -41.55 dBm -8.440 dBm -33.11 dB 2 3 2.101 GHz -55.55 dBm -50.00 dBm -5.555 dB 3 2.101 GHz -55.55 dBm -50.00 dBm -6.150 dB -6.150 dB 5 3 2.101 GHz -56.75 dBm -50.00 dBm -6.150 dB 5 3 2.100 GHz -56.75 dBm -50.00 dBm -6.179 dB	PASS 10 dB/div Log 31.0	Ref Off	10 DC 10 IFGain:L set 11 dB	Trig: Free F	q:928.850000 MHz Run Avg Hold:>10	0/10 Radio Sto Radio De 3.7	l: None vice: BTS 743 GHz	Range 1 <u>On Off</u> Start Freq
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19 0 1 10.00000000 GHz 20 0 1 1 1 20 0 1 1 1 30 0 1 1 1 30 0 1 1 1 30 0 1 1 1 Start 1 GHz Stop 10 GHz 41.55 dBm -8.440 dBm -33.11 dB 1 1 3.774 GHz -41.55 dBm -8.440 dBm -33.11 dB 2 3 2.101 GHz -55.15 dBm -50.00 dBm -5.155 dB 3 3.101 GHz -55.55 dBm -50.00 dBm -5.150 dB 4 3 2.101 GHz -56.40 dBm -50.00 dBm -6.403 dB 5 3 2.100 GHz -56.75 dBm -50.00 dBm -6.749 dB 6 3 2.100 GHz -56.75 dBm -50.00 dBm -6.749 dB	PASS 10 dB/div Log 31.0 21.0 11.0	Ref Off	10 DC 10 IFGain:L set 11 dB	Trig: Free F	q:928.850000 MHz Run Avg Hold:>10	0/10 Radio Sto Radio De 3.7	l: None vice: BTS 743 GHz	Range 1 <u>On</u> Off Start Freq 1.000000000 GHz
230 1	PASS 10 dB/div Log 31.0 21.0 11.0 1.00	Ref Off	10 DC 10 IFGain:L set 11 dB	Trig: Free F	q:928.850000 MHz Run Avg Hold:>10	0/10 Radio Sto Radio De 3.7	l: None vice: BTS 743 GHz	Range 1 <u>On Off</u> Start Freq 1.00000000 GHz Stop Freq
Start 1 GHz Stop 10 GHz Man 51 1 1 3.774 GHz 4.155 dBm -3.11 dBm -3.3.11 dB 1 1 3.774 GHz -41.55 dBm -8.440 dBm -33.11 dB 2 3 2.101 GHz -55.55 dBm -50.00 dBm -5.55 dB 3 3.2101 GHz -55.55 dBm -50.00 dBm -5.150 dB 4 3 2.101 GHz -56.40 dBm -50.00 dBm -6.150 dB 5 3 2.100 GHz -56.75 dBm -50.00 dBm -6.749 dB	PASS 10 dB/div 0 g 31.0 21.0 11.0 1.00 -9.00	Ref Off	10 DC 10 IFGain:L set 11 dB	Trig: Free F	q:928.850000 MHz Run Avg Hold:>10	0/10 Radio Sto Radio De 3.7	l: None vice: BTS 743 GHz	Range 1 <u>On Off</u> Start Freq 1.00000000 GHz Stop Freq
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Start 1 GHz Stop 10 GHz Video BW 300.00 kHz Spur Range Frequency Amplitude Limit A Limit 1 1 3.774 GHz -41.55 dBm -8.440 dBm -33.11 dB 2 3 2.101 GHz -55.11 dBm -50.00 dBm -5.105 dB 3 3 2.101 GHz -56.15 dBm -50.00 dBm -6.103 dB 5 3 2.101 GHz -56.40 dBm -50.00 dBm -6.749 dB 6 3 2.100 GHz -56.75 dBm -50.00 dBm -6.749 dB	PASS 10 dB/div Log 31.0 21.0 11.0 -9.00 -19.0 -29.0	Ref Off	00 DC FGaint Set 11 dB .00 dBm	Trig: Free F	q:928.850000 MHz Run Avg Hold:>10	0/10 Radio Sto Radio De 3.7	l: None vice: BTS 743 GHz	Range 1 <u>On</u> Off Start Freq 1.00000000 GHz 10.00000000 GHz Res BW
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Spur Range Frequency Amplitude Limit Δ Limit 1 1 3.774 GHz -41.55 dBm -8.440 dBm -33.11 dB 2 3 2.101 GHz -55.11 dBm -60.00 dBm -51.55 dB 3 3.2101 GHz -55.55 dBm -50.00 dBm -6.150 dB 4 3 2.101 GHz -56.40 dBm -50.00 dBm -6.150 dB 5 3 2.100 GHz -56.75 dBm -50.00 dBm -6.749 dB	PASS 10 dB/div Log 31.0 21.0 11.0 -9.00 -19.0 -29.0 -39.0	Ref Off	00 DC FGaint Set 11 dB .00 dBm	Trig: Free F	q:928.850000 MHz Run Avg Hold:>10	0/10 Radio Sto Radio De 3.7	l: None vice: BTS 743 GHz	Range <u>On</u> 0rr Start Freq 1.000000000 GHz Stop Freq 10.00000000 GHz Res BW 100.00 kHz
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2 3 2.101 GHz -55.11 dBm -50.00 dBm -5.105 dB Filter Type 3 3 2.101 GHz -55.55 dBm -50.00 dBm -5.555 dB Gaussian 4 3 2.101 GHz -56.15 dBm -50.00 dBm -6.150 dB -56.40 dB -50.00 dBm -6.403 dB 5 3 2.100 GHz -56.75 dBm -50.00 dBm -6.749 dB More	PASS 10 dB/div Log 31.0 21.0 11.0 -9.00 -19.0 -29.0 -39.0 -49.0 Start 1 G	Ref Off Ref 4	I O DC IFGain: IFGain: Set 11 dB I O dBm	Trig: Free F #Atten: 34 d	is 923.85000 MH2 Lun Avg Hold>11 B	Radio Sto Radio De 3.7 -42.6	i: None vice: BTS 743 GHz 56 dBm	Range <u>On</u> 0ff Start Freq 1.000000000 GHz Stop Freq 10.00000000 GHz Res BW 100.00 kHz Auto Man Video BW 300.00 kHz
3 3 2.101 GHz -55.55 dBm -50.00 dBm -5.555 dB 4 3 2.101 GHz -56.15 dBm -50.00 dBm -61.50 dB 5 3 2.101 GHz -56.40 dBm -50.00 dBm -6.403 dB 6 3 2.100 GHz -56.75 dBm -50.00 dBm -6.749 dB More	PASS 10 dB/div Log 31.0 21.0 11.0 -9.00 -19.0 -29.0 -33.0 -43.0 Start 1 G Spur	Ref Off Ref 4	ID IFGain:	Trig: Free F #Atten: 34 d	I: 923.850000 MH2 Lun Avg Hold>11 B	Radio Sto Radio De 3.7' -42.6	i: None vice: BTS 743 GHz 56 dBm	Range <u>On</u> 0ff Start Freq 1.000000000 GHz Stop Freq 10.00000000 GHz Res BW 100.00 kHz Auto Man Video BW 300.00 kHz
4 3 2.101 GHz -56.15 dBm -50.00 dBm -6.150 dB 5 3 2.101 GHz -56.40 dBm -50.00 dBm -6.403 dB 6 3 2.100 GHz -56.75 dBm -50.00 dBm -6.749 dB More	PASS 10 dB/div Log 31.0 21.0 11.0 -19.0 -29.0 -39.0 -39.0 -39.0 -39.0 -39.0 -39.0 -49.0 Start 1 G Spur 1	Ref Off Ref 4	requency 3.774 GHz	Amplifude -41.55 dBm	Limit -8.440 dBm	Radio Sto Radio De 3.7. -42.6	i: None vice: BTS 743 GHz 56 dBm	Range 1 <u>On</u> Off Start Freq 1.000000000 GHz Stop Freq 10.00000000 GHz 10.000000000 GHz Wideo BW Auto Man Video BW 300.00 kHz Auto Man
5 3 2.101 GHz -56.40 dBm -50.00 dBm -6.403 dB 6 3 2.100 GHz -56.75 dBm -50.00 dBm -6.749 dB More 1 of 3	PASS 10 dB/div Log 31.0 21.0 11.0 -29.0 -39.0 -39.0 Start 1 G Spur 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 2 2 2 2 2 2 2 2 2 2 2 2	Ref Off Ref 4: Hz Range 1 3	00 0 0C IFGain: IFGain: set 11 dB 1.00 dBm Frequency 3.774 GHz 2.101 GHz	Amplitude -55.11 dBm	1: 928.55000 MH2 tun Avg Hold>11 B Limit -8.440 dBm -30.00 dBm	Radio Sto Radio De 3,7' -42,6 	i: None vice: BTS 743 GHz 56 dBm	Range <u>On</u> Off Start Freq 1.000000000 GHz 1.00000000000 GHz Stop Freq 10.0000000000 GHz Man Auto Man Video BW 300.00 kHz Auto Man Filter Type Filter Type
6 3 2.100 GHz -56.75 dBm -50.00 dBm -6.749 dB More	PASS 10 dB/div Log 31.0 21.0 11.0 -29.0 -29.0 -29.0 -29.0 -29.0 -29.0 Start 1 G Spur 1 2 3 3 3 2 -2 -2 -2 -2 -2 -2 -2 -2 -2	Ref Off Ref 4	00 0 00 00 0FGaint IFGaint Set 11 dB 1.00 dBm Frequency 3.774 GHz 2.101 GHz 2.101 GHz	Amplitude -55.55 dBm	1: 923-85000 MH2 Ivan Avg Hold>11 B Limit -8,440 dBm -50.00 dBm -50.00 dBm	Radio Str. Radio De 3.7' -42.6 Δ Limit -33.11 dB -5.105 dB	i: None vice: BTS 743 GHz 56 dBm	Range <u>On</u> Off Start Freq 1.000000000 GHz 1.00000000000 GHz Stop Freq 10.0000000000 GHz Man Auto Man Video BW 300.00 kHz Auto Man Filter Type Filter Type
1 of 3	PASS 10 dB/div Log 31.0 21.0 11.0 -19.0 -29.0 -39.0 -49.0 Start 1 G Spur 1 2 3 4	Ref Off Ref 4 Hz Range 1 3 3 3	00 0 00 00 00 00 00 00 00 00 00 00 00 0	Amplitude -55.11 dBm -56.15 dBm	Imit -50.000 dBm -50.00 dBm -50.00 dBm	Radio Str. Radio De 3.7. -42.6 Δ Limit -33.11 dB -5.105 dB -5.555 dB -6.150 dB	i: None vice: BTS 743 GHz 56 dBm	Range <u>On</u> Off Start Freq 1.000000000 GHz 1.00000000000 GHz Stop Freq 10.0000000000 GHz Man Auto Man Video BW 300.00 kHz Auto Man Filter Type Filter Type
	PASS 10 dB/div Log 31.0 21.0 11.0 -29.0 -39.0 -39.0 Start 1 G Spur 1 2 3 4 5	Ref Off Ref 4: Hz Range 1 3 3 3 3 3	00 PC 10 IFGaint iset11 dB .00 dBm 0 dBm .11 5.00 dBm .11 1 .11 2.00 dBm .11 1 .11 <tr tr=""> 1 .11</tr>	Amplitude -41.55 dBm -55.11 dBm -56.40 dBm	:: 923.65000 MH2 Lun Avg Hold>10 B Limit -50.00 dBm -50.00 dBm -50.00 dBm	Radio 5tt Radio 0e 3.7' -42.6 	i: None vice: BTS 743 GHz 56 dBm	Range 1 0n 0ff Start Freq 1.000000000 GHz Stop Freq 10.00000000 GHz No.00 KHz Auto Man Video BW 300.00 kHz Auto Man Filter Type Gaussian
ISC STATUS	PASS 10 dB/div Log 31.0 21.0 11.0 -29.0 -39.0 -39.0 Start 1 G Spur 1 2 3 4 5	Ref Off Ref 4: Hz Range 1 3 3 3 3 3	00 PC 10 IFGaint iset11 dB .00 dBm 0 dBm .11 5.00 dBm .11 1 .11 2.00 dBm .11 1 .11 <tr tr=""> 1 .11</tr>	Amplitude -41.55 dBm -55.11 dBm -56.40 dBm	:: 923.65000 MH2 Lun Avg Hold>10 B Limit -50.00 dBm -50.00 dBm -50.00 dBm	Radio 5tt Radio 0e 3.7' -42.6 	i: None vice: BTS 743 GHz 56 dBm	Range 1 0n 0rff Start Freq 1.000000000 GHz Stop Freq 10.00000000 GHz 100.00 KHz Auto Man Video BW 300.00 kHz Auto Man Filter Type Gaussian
	PASS 10 dB/div Log 31.0 21.0 11.0 -29.0 -39.0 -39.0 Start 1 G Spur 1 2 3 4 5	Ref Off Ref 4: Hz Range 1 3 3 3 3 3	00 PC 10 IFGaint iset11 dB .00 dBm 0 dBm .11 5.00 dBm .11 1 .11 2.00 dBm .11 1 .11 <tr tr=""> 1 .11</tr>	Amplitude -41.55 dBm -55.11 dBm -56.40 dBm	:: 923.65000 MH2 Lun Avg Hold>10 B Limit -50.00 dBm -50.00 dBm -50.00 dBm	Radio 5tt Radio 0e 3.7' -42.6 	i: None vice: BTS 743 GHz 56 dBm	Range 1 0n 0rff Start Freq 1.000000000 GHz Stop Freq 10.00000000 GHz 100.00 KHz Auto Man Video BW 300.00 kHz Auto Man Filter Type Gaussian
	PASS 10 dB/div Log 31.0 21.0 11.0 -29.0 -39.0 -39.0 Start 1 G Spur 1 2 3 4 5	Ref Off Ref 4: Hz Range 1 3 3 3 3 3	00 PC 10 IFGaint iset11 dB .00 dBm 0 dBm .11 5.00 dBm .11 1 .11 2.00 dBm .11 1 .11 <tr tr=""> 1 .11</tr>	Amplitude -41.55 dBm -55.11 dBm -56.40 dBm	:: 923.65000 MH2 Lun Avg Hold>10 B Limit -50.00 dBm -50.00 dBm -50.00 dBm	Radio 5tt Radio 0e 3.7' -42.6 	i: None vice: BTS 743 GHz 56 dBm	Range 1 0n 0rff Start Freq 1.000000000 GHz Stop Freq 10.00000000 GHz 100.00 KHz Auto Man Video BW 300.00 kHz Auto Man Filter Type Gaussian

2.7 Channel Separation (Hybrid Mode)

Test Lab: Electronics Test Centre, Airdrie

Test Personnel: Imran Akram

Date: 2021-12-20 (19.1°C,8.0 % RH)

EUT: Kona Micro Gateway Standard: FCC Part 15.247

Basic Standard: ANSI C63.10: 2013

EUT status: Compliant

Specification: FCC Part 15.247(a, 1)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

2.7.1 Test Guidance: ANSI 63.10 Clause 7.8.2 / 558074 D01 15.247 Measurement Guidance v05r02

This measurement is performed with the EUT transmitter frequency hopping function active.

The RF output of EUT with an antenna connector is fed to the input of the spectrum analyzer through appropriate attenuation. The loss from the cable and the attenuator were added on the analyzer as gain offset setting there by allowing direct measurements, without the need for any further corrections.

The spectrum analyzer is set for a frequency span wide enough to capture at least two adjacent channels. The RBW is set to at least 1% of the span. The Peak detector is used, with the trace set to Max Hold. Channel Separation is displayed with the Marker Delta function.

2.7.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

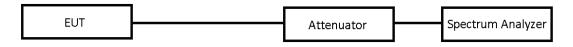
2.7.3 Test Equipment

Testing was performed with the following equipment:

Equipment	Manufacturer	Model #	Asset #	Cal. Date	Cal. Due
EXA Signal Analyzer	Agilent	N9010A FW A.14.16	6678	2021-07-22	2022-07-22
Temp/Humidity	Extech	42270	5892	2021-04-05	2022-04-15
Attenuator	Mini-Circuits®	BWS102W263	6932	Cal. before each use	
Coaxial Cables (RF)	Huber+Suhner	Enviroflex 400	-	Cal. before each use	

2.7.4 Test Sample Verification, Configuration & Modifications

EUT configuration for Channel Separation testing:



2.7.5 Channel Separation Data:

Compliant: The channel separation measured for this device is 200 kHz.

Screen Captures from the spectrum analyzer: Hybrid 125 KHz

ent Spectrum Analyzer - Swept SA RF 50 Ω DC	CENICE-I	NT SOURCE OFF ALIGN AUT	TO 05:35:20 PM Dec 20, 2021	
rker 1 Δ 200.001000 kHz PNO:	: Wide in:Low #Atten: 50 dB	Avg Type: Log-Pv n Avg Hold:>100/100	Wr TRACE 1 2 3 4 5 6	
Ref Offset 10.4 dB dB/div Ref 33.40 dBm			∆Mkr1 200 kHz 0.459 dB	
				Marker Coun
			h h Mhrai	Cou Marke ^{On}
art 926.000 MHz es BW 10 kHz	#VBW 300 kHz	Sweep	Stop 928.000 MHz 18.47 ms (1001 pts)	
MODE TEC SCL X Δ2 1 f (Δ) 200 F 1 f 926.300 M	kHz (Δ) 0.459 dB MHz 26.908 dBm	FUNCTION FUNCTION WI	OTH FUNCTION VALUE	All Markers
				Mc 2 c

2.8 Time of Occupancy (Hybrid Mode)

EUT: Kona Micro Gateway
Standard: FCC PART 15.247
Basic Standard: ANSI C63.10: 20013

EUT status: Compliant

Specification: FCC Part 15.247 (f)

The frequency hopping operation of the hybrid system, with the direct sequence or digital modulation operation turned-off, shall have an average time of occupancy on any frequency not to exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4

2.8.1 Test Guidance: ANSI 63.10 Clause 7.8.4 / 558074 D01 15.247 Measurement Guidance v05r02

This measurement is performed with the EUT frequency hopping function active.

The RF output of EUT with an antenna connector is fed to the input of the spectrum analyzer through appropriate attenuation. The loss from the cable and the attenuator were added on the analyzer as gain offset setting there by allowing direct measurements, without the need for any further corrections.

The spectrum analyzer is set for Peak detection over a 0 Hz frequency span (time domain) centered on a hopping channel. The RBW shall be \leq Channel spacing and where possible RBW should be set >> 1/T, where T is the expected dwell time per channel. VBW \geq RBW. The sweep time is adjusted to clearly capture one transmission. The Dwell time is measured with the Marker Delta function.

Another sweep is set to capture enough transmission events to calculate the number of events within the specified period of time. The Peak detector is used, with the trace set to Max Hold.

2.8.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

2.8.3 Test Equipment

Equipment	Manufacturer	Model #	Asset #	Cal. Date	Cal. Due	
EXA Signal Analyzer	Agilent	N9010A FW A.14.16	6678	2021-07-22	2022-07-22	
Temp/Humidity	Extech	42270	5892	2021-04-05	2022-04-15	
Attenuator	Mini-Circuits®	BWS102W263	6932	Cal. before each use		
Coaxial Cables (RF)	Huber+Suhner	Enviroflex 400	-	Cal. before each use		

Testing was performed with the following equipment:

2.8.4 Test Sample Verification, Configuration & Modifications

The EUT was operating in normal mode. The EUT met the requirements without modification.

EUT configuration for Dwell Time testing:

EUT	Attenuator	<u> </u>	Spectrum Analyzer
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Test Sample: Kona Micro Gateway FCC ID:2ALEPT0007871

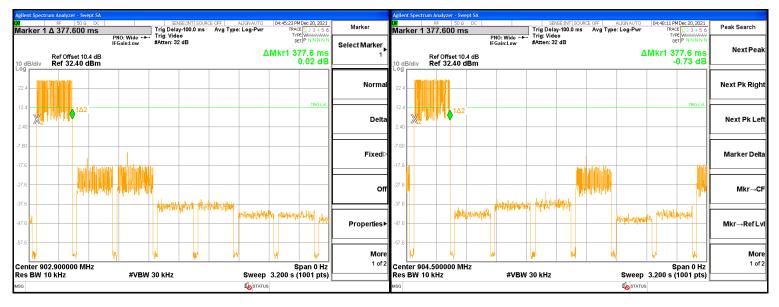
2.8.5 Dwell Time Data:

Measured Dwell time = 370.6 msKona Micro Gateway has 16 bands and each band have 8 channels. Window of measurement is equal to number of hopping channels multiple by $400\text{ms} = 0.4 \times 8 = 3.2 \text{ Sec}$ Number of events in 3.2 Sec = 1Margin = 400 - 370.6 = 29.4 ms

Screen Capture from the spectrum analyzer: sweep Time in 3.2 Sec

Band-1 (902.3 – 903.7 MHz)

Band-2 (903.9 – 905.3 MHz)



Band-3 (905.5 - 906.9 MHz)

Band-4 (907.1 - 908.5 MHz)

Agilent S	Spectr	um Anal																			Agiler	nt Sp	ectrum Anal																	
<mark>w</mark> Marke	er 1	RF 377.			DC				Trig D	elav-1	INT SC 00.0 m		OFF Avg Typ	ALIGI De: Lo	g-Pwr	04:50		Dec 20, 202: 1 2 3 4 5 W M M N N N		Peak Search	wµ Mar	rker	r 1 377.0	50 s 600 m						SEN Delay c:Vide	SE:INT :	SOURCE ms	OFF Avg Ty	ALIG pe: Lo	g-Pwr	04:	TRAC	MDec 20, 2	45.6	Peak Search
10 dB/c	div	Ref (Ref				PN IFG	10: Wide Gain:Low	,,	#Atter	n: 32 di	в				Δ	Mkr	1 37	7.6 m 0.14 dE	s	NextPeak	10 di Log		Ref C	Offset 1 32.40	0.4 d dBr	i IB	PNO: W FGain:l	ide 🔸		ten: 32						∆Mk	r1 3	77.6 r 0.05 (ms	Next Peak
22.4																				Next Pk Right	22.4																			Next Pk Righ
12.4	×2	inin,	, ≬ ¹	∆2														TRIG LVI	<u> </u>	Next Pk Left	12.4 2.40	×	(1 11)/1	1∆	2													TRIG	<u></u>	Next Pk Lef
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Cente				мн	Iz	Ņ	#\/	BW	<mark>м</mark> 30 кн		'n			M	ween	3 200	Sp Sp Sp Sp Sp Sp Sp Sp Sp Sp Sp Sp Sp S	pan 0 Hz 001 pts	z	More 1 of 2			907.700 V 10 kHz		IHz		N .	≠vbw	30 1	/U-7	4	n l		,	woor	N		pan 0		More 1 of 2
KES D MSG	794 I	υ κ Π2	£				#V	044	30 KH	12					STATUS		u ə (I	oo i pis	"		MSG		¥ 10 KH2					74044	30 1	NHZ					STATI		0051	,1001 h	JUS)	

Test Sample: Kona Micro Gateway FCC ID:2ALEPT0007871

Band-5 (908.7 - 910.1 MHz)

Band-6 (910.3 - 911.7 MHz)



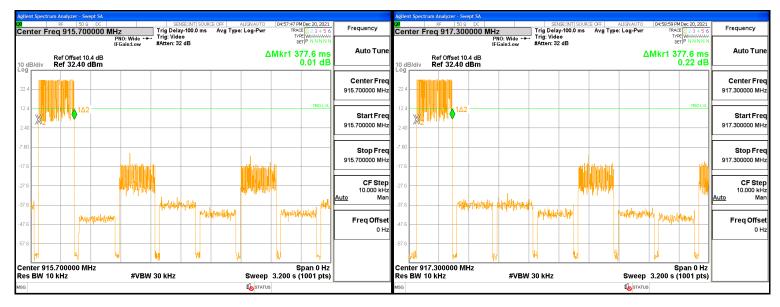
Band-7 (911.9 - 913.3 MHz)

Band-8 (913.5 - 914.9 MHz)

Agilent Sp																									Agile	ent Sp	pectrur	m Analy																					
<mark>w</mark> Marke		RF 877.60			DC						lav-1			Avg			AUTO P W	04	4:56:07 TR/ T	PMDec ACE 1 YPE W DET P	20,20	5 6	Peak Sear	ch	Cer	ntei	r Fre	RF 991	50 4.10		00 M	IHz	O: Wide] Trig	a Dela	av-100		RCE OFF			NAUTO 9 g-Pw i)4:57:01 Ti	PMDec	20,20 2345 NNN	21	Freq	uency
10 dB/di		Ref Off				IFG	o: wic ain:Lo	ie 🔸 w	#A	tten:	32 dE	8					4	7WI	kr1 3		6 n	ns	Next	Peak	10 d Loa	B/di		Ref Of Ref 3			dB	IFG	o: Wide ain:Lov	e -	#At	ten: 3	2 dB						ΔМ		377.	.6 m 11 d	s	A	uto Tun
22.4																					TRIG	_	Next Pk I	Right	22.4	4			n -																	TRIG L			nter Fre 00000 M⊦
2.40	(III		1Δ	.2																	1805		Next Pi	Left	12.4	8	(1		14	2																			Start Fre 00000 M⊢
-7.60											in."						fi talat						Marker	Delta	-7.60 -17.6															ldaði			dikit						Stop Fre 00000 M⊦
-27.6			M	lowali	la mi	4	un lu	depert				V				i							Mkr	→CF	-27.6								-	hann	4			h	P					e hile	AN ING		4	uto	CF Ste 10.000 k⊢ Ma
-47.6								. 1.4					pengha	Alture	474				Milli	Windy	14	 	Mkr→R	efLvl	-47.6	5 <mark> </mark>			hy	hun	olombayi					rahan	attal			_					• ptr.			Fr	reqOffso 0⊦
-57.6			Ņ			V			M			Ŋ			y.			W			ŋ			More	-57.6	ų						M			ų			W		4	1					W			
Center Res BV			00 1	/IHZ			#	vвw	/ 30	kHz						Sv	veep	3.2		Spa (100								.1000 kHz	100	/IHZ			#V	/BW	30 H	kHz					s	wee	р3.	200 :		n 0 H 01 pt			
MSG																ų,	STATUS	s							MSG																Ľ	STAT	US						

Band-9 (915.1 - 916.5 MHz)

Band-10 (916.7 - 918.1 MHz)



FCC Part 15.247

Band-11 (918.3 - 919.7 MHz)

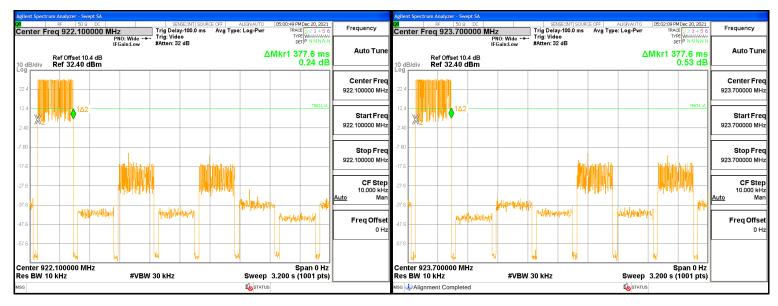
Band-12 (919.9 - 921.3 MHz)

Agilent Spectrum Analyzer - Swept SA			Agilent Spectrum Analyzer - Swept SA
	OFF ALIGNAUTO 04:59:39 PMDec 20, 2021 Avg Type: Log-Pwr TRACE 1 2 3 4 5 6 TYPE WWWWWWWWW DET P N N N N	Frequency	DM FF S0 @ SENSE:MT SOURCE CFF ALISNAUTO DESCOMPTION C20, 2021. Center Freq 920.500000 MHz Trig: Delay 1000 ms Avg Type: Log-Pwr TRe42, 123.45.5 Frequent PRO: Wide → Frequence: 32 dB Trig: Video Frequence: 32 dB Frequence: 32 dB Frequence: 32 dB
PHO: Wide → Trig: Video ING sin:Low #Atten: 32 dB 10 dB/div Ref 32.40 dBm	ΔMkr1 377.6 ms 0.14 dB	Auto Tune	
22.4	TRIGLYL	Center Freq 918.900000 MHz	2 22.4 9 920.50000
12.4 μ 1.42 2.40		Start Freq 918.900000 MHz	stari
-7.60		Stop Freq 918.900000 MHz	
27 6	1 1	CF Step 10.000 kHz <u>Auto</u> Man	
-47.6	prolonomista delevitedas	Freq Offset 0 Hz	
-57.6	m W W		
Center 918.900000 MHz Res BW 10 kHz #VBW 30 kHz	Span 0 Hz Sweep 3.200 s (1001 pts)		Center 920.500000 MHz Span 0 Hz Res BW 10 kHz #VBW 30 kHz Sweep 3.200 s (1001 pts)
MSG	K STATUS		MSG Contraction

Test Sample: Kona Micro Gateway FCC ID:2ALEPT0007871

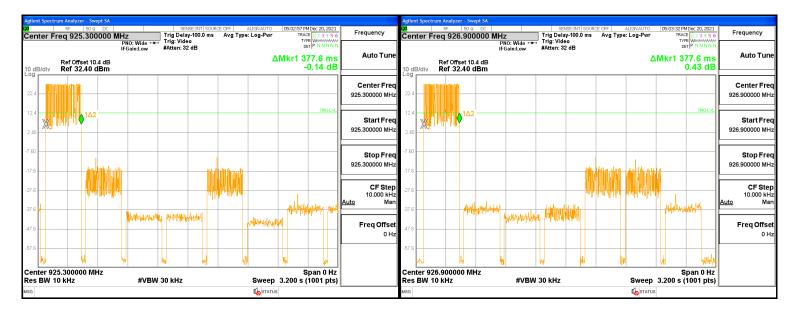
Band-13 (921.5 - 922.9 MHz)

Band-14 (923.1 - 924.5 MHz)



Band-15 (924.7 – 926.1 MHz)

Band-16 (926.3 - 927.7 MHz)



2.9 EUT Positioning Assessment

Test Lab: Electronics Test Centre, Airdrie	EUT: Kona Micro Gateway
Test Personnel: Imran Akram/Janet	Standard: FCC PART 15.247
Date: 2021-10-29 (19.6° C,21.10 % RH)	Basic Standard: ANSI C63.4-2014

Comments: Unit real life installation is ether wall mount or Table Top. Both positions were assed. Table top position found worse.

Specification: ANSI C63.4-2014, Clause 6.3.2.1

Portable, small, lightweight, or modular devices that may be handheld, worn on the body, or placed on a table during operation shall be positioned on a non-conducting platform, the top of which is 80 cm above the reference ground plane. The preferred area occupied by the EUT arrangement is 1 m by 1.5 m, but it may be larger or smaller to accommodate various sized EUTs (see Figure 6, Figure 7, and Figure 9). For testing purposes, ceiling- and wall-mounted devices also shall be positioned on a tabletop (see also 6.3.4 and 6.3.5). In making any tests involving handheld, body-worn, or ceiling-mounted equipment, it is essential to recognize that the measured levels may be dependent on the orientation (attitude) of the three orthogonal axes of the EUT. Thus, exploratory tests as specified in 8.3.1 shall be carried out for various axes orientations to determine the attitude having maximum or near-maximum emission level.

Refer to Test Setup photo exhibit.

2.10 Radiated Spurious Emissions / Co-Location (Restricted Band)

EUT: Kona Micro Gateway
Standard: FCC PART 15.247/15.209
Basic Standard: ANSI C63.10-2013

EUT status: Compliant

Specification: FCC PART 15.247(d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

MHz	MHz MHz		MHz MHz		GHz	GHz	
0.0900000 –	8.2910000 -	16.804250 -	162.01250 -	1660.0000 –	3.6000000 -	14.470000 –	
0.1100000	8.2940000	16.804750	167.17000	1710.0000	4.4000000	14.500000	
0.4950000 -	8.3620000 -	25.500000 -	167.72000 -	1718.8000 –	4.5000000 –	15.350000 –	
0.5050000	8.3660000	25.670000	173.20000 -	1722.2000	5.1500000	16.200000	
2.1735000 -	8.3762500 -	37.500000 -	240.00000 -	2200.0000 –	5.3500000 –	17.700000 –	
2.1905000	8.3867500	38.250000	285.00000	2300.0000	5.4600000	21.400000	
4.1250000 -	8.4142500 -	73.000000 -	322.00000 -	2310.0000 –	7.2500000 –	22.010000 –	
4.1280000	8.4147500	74.600000	335.40000	2390.0000	7.7500000	23.120000	
4.1772500 -	12.290000 -	74.800000 -	399.90000 -	2483.5000 –	8.0250000 -	23.600000 –	
4.1777500	12.293000	75.200000	410.00000	2500.0000	8.5000000	24.000000	
4.2072500 -	12.519750 -	108.00000 -	608.00000 -	2655.0000 -	9.0000000 -	31.200000 –	
4.2077500	12.520250	121.94000 **	614.00000	2900.0000	9.2000000	31.800000	
5.6770000 -	12.576750 -	123.00000 -	960.00000 –	32600000 –	9.3000000 -	36.430000 -	
5.6830000	12.577250	138.00000 **	1240.0000 ***	3267.0000	9.5000000	36.500000	
6.2150000 -	13.360000 -	149.90000 -	1300.0000 –	3332.0000 –	10.600000 –	Above	
6.2180000	13.410000	150.05000	1427.0000 <mark>***</mark>	3339.0000	12.700000	38.600000	
6.2677500 -	16.420000 -	156.52475-	1435.0000 –	3345.8000 –	13.250000 –		
6.2682500	16.423000	156.52525	1626.5000	3358.0000	13.400000		
6.3117500 - 6.3122500	16.694750 - 16.695250	156.70000 - 156.90000	1645.5000 – 1646.5000	3500.0000 – 3600.0000			

Restricted Bands of Operation:

US only

** Canada 108 – 138 MHz

*** Canada 960 – 1427 MHz

Canada only

2.8.1 Test Guidance: ANSI C63.10-2013, Clause 13.4.2

From 9 kHz to 150 kHz (resolution bandwidth of 200 Hz) and from 150 kHz to 30 MHz (resolution bandwidth 9 kHz) measurements are performed with a loop antenna (as per KDB 460108).

From 30 MHz to 1000 MHz, measurements are performed with a broadband biconilog antenna and a resolution bandwidth of 120 kHz.

Above 1000 MHz, measurements are performed with a DRG Horn antenna or a Standard Gain horn, and a resolution bandwidth of 1 MHz. The EUT is raised to 150 cm above the ground plane, and the area between the EUT and the antenna mast is covered with RF absorbent material.

The scan is performed at discreet increments of turntable azimuth and antenna height, which are selected in accordance with the applicable standard in order to assure capture of frequencies of interest. Optimization is performed based on the scan data.

Frequencies having peak emissions within 10dB of the limits are optimized. The EUT is rotated in azimuth over 360 degrees and the direction of maximum emission is noted.

Antenna height is varied from 1 - 4 meters at this azimuth to obtain the maximum emission. Then the maximum level is measured with the appropriate detector and recorded. Up to 1 GHz, measurements are performed with a Quasi-Peak detector. Above 1 GHz, measurements are recorded with Peak and/or Average detectors, as applicable.

2.8.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

2.8.3 Test Equipment

Testing was performed with the following equipment:

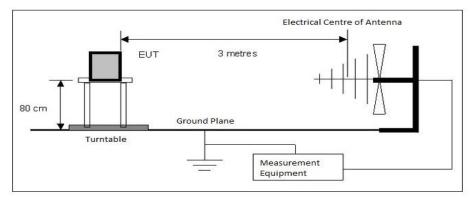
Equipment	Manufacturer	Model #	Asset #	Cal. Date (yyyy-mm-dd)	Cal. Due (yyyy-mm-dd)	
EMC Software	UL	Ver. 9.5	ETC-SW-EMC 2.1	N	I/A	
EMI receiver	Agilent	N9038A (FW A.25.05)	6130	2021-06-18	2022-06-8	
Loop Antenna	EMCO	6502	10868	2021-05-11	2023-05-11	
Biconilog Antenna	AR	JB1	6905	2021-10-29	2023-10-21	
DRG Horn	EMCO	3115	19357	2020-09-29	2022-09-29	
Humidity/Temp Logger	Extech Ins. Corp.	42270	5892	2021-04-06	2022-04-06	
Low Noise Amplifier (1 – 18 GHz)	MITEQ	JS43-01001800- 21-5P	4354	2021-02-03	2022-02-03	
Pre-Amplifier (30 – 1400 MHz)	HP	8447D	9291	2021-02-03	2022-02-03	
RE Cable below 1GHz	Insulated Wire Inc.	KPS-1501A- 3600-KPA- 01102006	4419	2021-02-03	2022-02-03	
Re Cable Above 1 GHz	A.H. System Inc.	SAC-26G-8.23	6187	2021-02-03	2022-02-03	
High Pass Filter	K&L	4DH21	-	2021-02-03	2022-02-03	

2.8.4 Test Sample Verification, Configuration & Modifications

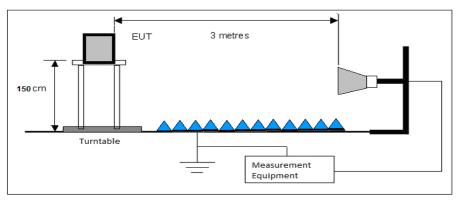
The EUT was set to a selected channel with test-specific software. The output was modulated as in normal operation. Both radios transmitting simultaneously, pre-approved GSM module is transmitting at 784 MHz and LoRa radio transmitting at MID Channel 914.9 MHz.

The EUT met the requirements without modification.

Test setup diagram for Radiated Spurious Emissions testing (below 1GHz):



Test setup diagram for Radiated Spurious Emissions testing (above 1GHz):



2.8.5 Radiated Emissions Data:

The emissions data are presented in tabular form, showing turntable azimuth, antenna height and polarization, the uncorrected spectrum analyzer reading, the correction factors applied, the net result, the value of the limit at the frequency investigated, and the Delta between the result and the limit.

Meter Reading in $dB\mu V$ + Antenna Factor in dB/m + Gain/Loss Factor in dB = Corrected Field Strength in $db\mu V/m$.

Delta = Field Strength – Limit

Notes:

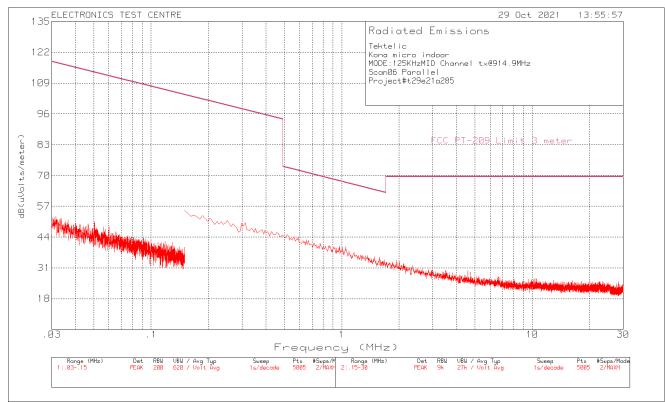
- When a preamp is used, the resulting gain is compensated, producing a negative value for the Cable Loss.
- Measurements reported are the result of adjusting the turntable azimuth and antenna height to obtain the maximum EUT emission. This may produce a different reading than the plot trace. The plot is a Peak Hold function obtained at discreet increments of height and azimuth, while the reported measurement is obtained with the appropriate Quasi Peak or Average detector after the height and azimuth have been adjusted for maximum emission.
- Preliminary scans were performed for all channels in Transmit modes. The MID band channel 914.9 MHz was selected as the worst-case condition for detailed examination.
- In Transmit mode, the EUT was assessed up to 10.0 GHz.

Freq. Marker	Freq. [MHz]	Raw reading [dBµv]	Det	Antenna Factor [dB/m]	Pre amp Gain/Cable Loss [dB]	Corrected Reading [dBµv/m]	FCC 15.247 Limit [dBµv/m]	Delta [dB]	Azimuth [Deg]	Height [cm]	Polarization
1	*1.0462	44.38	PK	24.3	-19.4	49.28	74	-24.72	211	143	Vertical
1	*1.0462	36.86	AV	24.3	-19.4	41.76	54	-12.24	211	143	Vertical
1	7.3194	41.2	PK	36.3	-27.6	49.9	74	-24.1	59	340	Vertical
1	7.3194	33.03	AV	36.3	-27.6	41.73	54	-12.27	59	340	Vertical

Negative values for Delta indicate compliance.

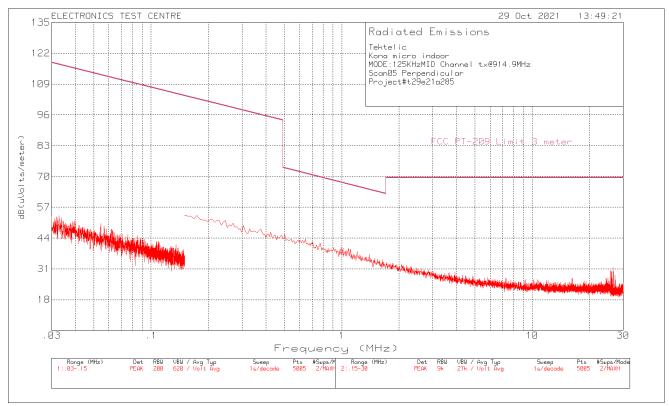
Spurious Emission

* Restricted Band

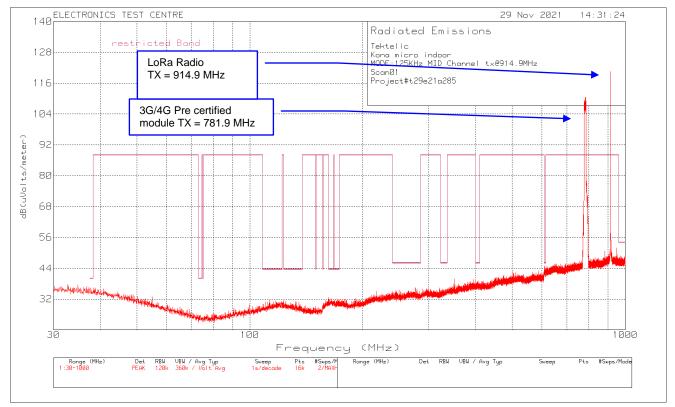


Plot of Radiated Emissions: Measuring Antenna Parallel

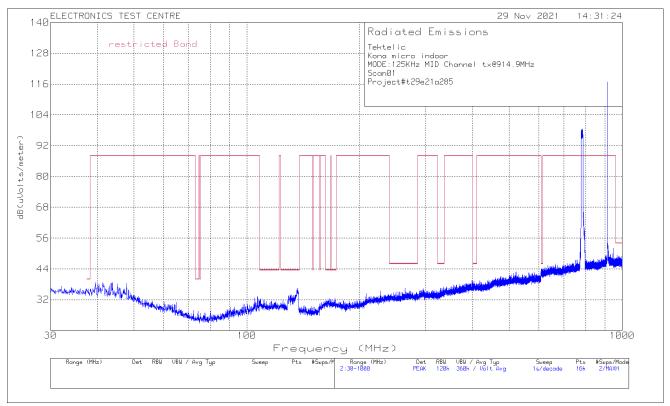
Plot of Radiated Emissions: Measuring Antenna Perpendicular



Plot of Radiated Emissions: Horizontal polarization

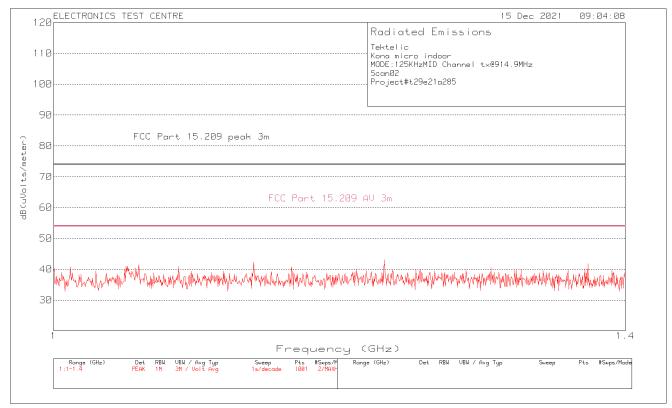


Plot of Radiated Emissions: Vertical polarization



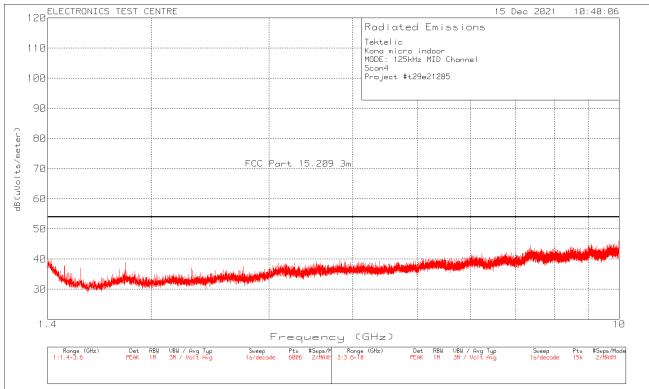
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Plot of Radiated Emissions: Horizontal polarization



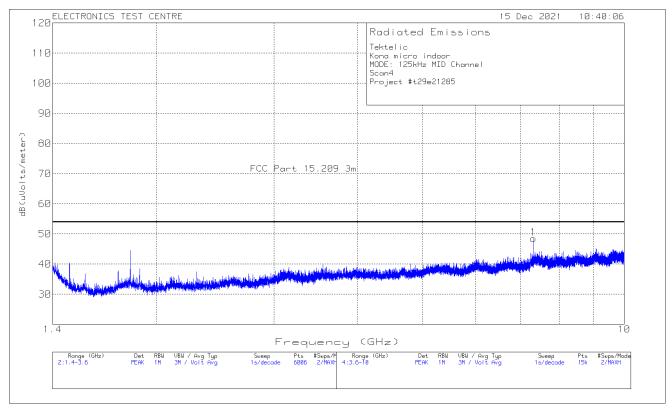
Plot of Radiated Emissions: Vertical polarization





Plot of Radiated Emissions: Horizontal polarization

Plot of Radiated Emissions: Vertical polarization



2.11 RF Exposure

Test Lab: Electronics Test Centre, Airdrie Test Personnel: Date:	EUT: Kona Micro Gateway Standard: FCC PART 15.247				
EUT status: Compliant					

Compliant: RF exposure assessment to be provided in a separate Exhibit.

3.0 TEST FACILITY

3.1 Location

The Kona Micro Gateway was tested at the Electronics Test Centre laboratory located in Airdrie, Alberta, Canada. The Radio Frequency Anechoic Chamber (RFAC), identified as Chamber 1, has a usable working space measuring 10.6 m long x 7.3 m wide x 6.5 m high.

Measurements taken at this site are accepted by Industry Canada as evidence of conformity per registration file # 2046A. This site is also listed with the FCC under Registration Number CA2046.

The floor, walls and ceiling consist of annealed steel panels. The walls and ceiling are covered with ferrite tile, augmented by RF absorbant foam material on the end wall nearest the turntable, and on the adjacent walls and the ceiling. The chamber floor supports a 15 cm high internal floor, constructed of annealed steel panels, that forms the ground plane, and is bonded to the chamber walls.

The 3-m diameter turntable is flush-mounted with the floor. A sub-floor cable-way is provided to route cables between the turntable pit and EUT support equipment located in the Control Room. Cables reach the EUT through an opening in the centre of the turntable.

Test instrumentation and EUT support equipment is located in the Control Room, consisting of two shielded vestibules joined together at the side of the main room. Cables are routed through bulkhead panels between the rooms and the test chamber as required. Power feeds are routed into the main room and vestibules through line filters providing at least 100 dB of attenuation between 10 kHz and 10 GHz.

Either floor mounted or table-top equipment can be tested at this facility.

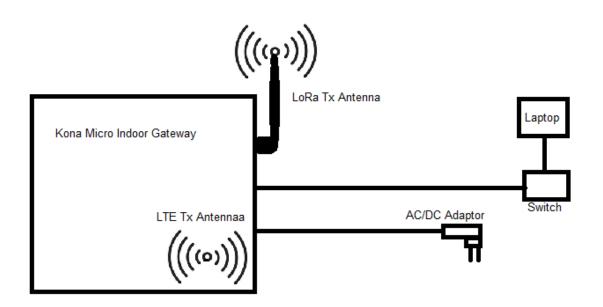
3.2 Grounding Plan

The Kona Micro Gateway was placed at the center of the test chamber turntable on top of a polystyrene foam table. The EUT was grounded according to Tektelic Communication Inc. specifications.

3.3 Power Supply

All EUT power was supplied by an AC/DC adaptor.

Appendix A – Test Setup Block Diagram



End of Document