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ETC Report #: t29e22a261-DTS Release1

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

FCC ID: 2ALEPT0008387

Test Dates: September 30 to October 20, 2022

Test Personnel: Imran Akram, Janet Mijares,

Prepared for:

Tektelic Communication Inc.

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Test Sample: Kona Mega Gateway FCC ID:2ALEPT0008387

REVISION RECORD

ISSUE	DATE	AUTHOR	REVISIONS
DRAFT 1	2022-10-11	I. Akram / J. Mijares	Initial draft submitted for review.
DRAFT 2	2022-10-19	J. Mijares	Removed modem 7430 results.
Release 1	2022-10-27	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 Mega 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:			Kona Mega Gateway
	Frequency Band		902 – 928 MHz
Lora Radio	Frequency Rang	ge	923.3 – 927.5 MHz
	Type of Modulation		LoRa 500KHz DTS
LoRa Associa	ated Antennas	1	Isotropic Model # WTTX-OMNI920-8-NJ, 8 dBi antenna
EUT		Model#	T0005010
EUT		Serial#	2239K0001
Pre-Certified	LTE Madam	Model#	EM7455
Pre-Certined		FCC ID#	N7NEM7455
Variant Model#			T0004978, T0004982, T0004988, T0004992, T0004996
			T0005000, T0005004, T0005006, T0005008, T0005010
Power supply	y:		DC Powered

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

This Kona Mega Gateway T0005010 model contains all of the equipment options in this family of products. This model was chosen as a worst-case condition for emission testing.

Detail differences between the models are given in Kona Mega Gateway family exhibit in Appendix A of this test report.

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 C63.4-2014	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. Separate test report is provided to customer for RX mode under SDOC.

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	Modifications	Config.	Result
2.1	AC Conducted Emissions (TX)	15.207	Kona Mega Gateway	none	see § 2.1	Compliant
2.2	6dB Bandwidth	15.247(a)	Kona Mega Gateway	none	see § 2.2	Compliant
2.3	Max Output Power	15.247(d)	Kona Mega Gateway	none	see § 2.3	Compliant
2.4	Power Spectral Density	15.247(e)	Kona Mega Gateway	none	see § 2.4	Compliant
2.5	Band Edge	15.247(d)	Kona Mega Gateway	none	see § 2.5	Compliant
2.6	Conducted Spurious Emission (Non-Restricted Band)	15.247(d)	Kona Mega Gateway	none	see § 2.6	Compliant
2.7	EUT Position	ANSI C63.4	Kona Mega Gateway	none	see § 2.7	N/A Fix Position
2.8	Radiated Spurious Emission (TX Mode) (Restricted Band)	15.205, 15.209 15.247(d)	Kona Mega Gateway	none	see § 2.8	Compliant
2.9	Radiated Emission (RX Mode)	15.109	Kona Mega Gateway	none	see § 2.9	Compliant
2.10	AC Conducted Emissions (RX)	15.107	Kona Mega Gateway	none	see § 2.10	Compliant
2.11	RF Exposure	15.247(i)	Kona Mega Gateway	none	see § 2.11	Compliant

Refer to the test data for applicable test conditions.

2.1 AC Power Line Conducted Emissions: Transmit Mode

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

EUT status: Compliant

Specification:

Frequency (MHz)	Quasi-Peak Limit (dBµV)	Average Limit (dBµV)		
0.15 – 0.5	66 to 56 *	56 to 46 *		
0.5 – 5	56	46		
5 – 30	60	50		
	1			

Criteria: The conducted emissions produced by a device shall not exceed the limits as specified.

Limits decrease linearly with the logarithm of the frequency

2.1.1 Test Guidance

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.

The EUT is powered through a 50μ H Line Impedance Stabilizing Network (LISN) which is placed 80cm away from the EUT. For tabletop equipment, a vertical ground plane is placed 40cm from the edge of the table. Lastly, the spectrum analyzer is connected to the LISN via armored cable run from the control room to the test chamber. Both the LISN and vertical ground plane are grounded to the reference ground plane on the chamber floor.

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:

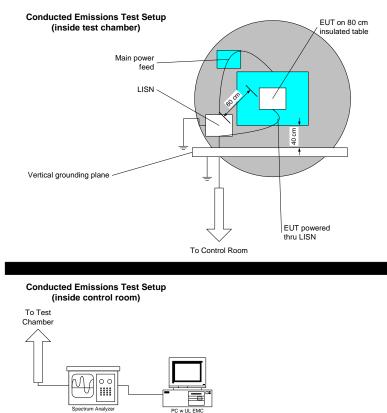
Equipment	Manufacturer	Model #	Asset #	Calibration Date	Calibration Due
EMC Software	UL	Ver. 9.5	ETC-SW-EMC 2.1	N	/Α
EMI receiver	Agilent	N9038A FW A.25.05	6130	2022-07-12	2023-07-12
LISN 150kHz to 30MHz	Com-Power	LI-215A	6180	2022-08-09	2024-08-09
T/H Data Logger	Extech Ins.	42270	5892	2022-04-07	2023-04-07

2.1.4 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. EUT has option of POE. EUT tested for conducted emission on AC side of POE adaptor model#PD-9501GO-ET/AC and serial#C19026674000302. Customer is not providing POE adaptor with EUT.

The EUT met the requirements without modification.

Diagram of setup for Conducted Emissions testing:



2.1.5 Conducted Emissions Data

The emissions data is presented in tabular form, showing the uncorrected spectrum analyzer reading, the correction factors applied, the net result, the value(s) of limit at the frequency measured, and the Delta between the result and the limit.

	-				_				
Freq. Marker	Freq. (MHz)	Raw reading (dBµv)	Det.	LISN Factor (dB/m)	Cable Loss (dB)	Corrected Reading (dBµV)	FCC 207 Limit (dBµV)	Delta (dB)	L/N
1	.51162	28.28	LnAv	0	9.8	38.08	46	-7.92	Line
2	2.95718	19.39	LnAv	0	9.9	29.29	46	-16.71	Line
3	4.84727	18.32	LnAv	0	10	28.32	46	-17.68	Line
4	13.48129	19.17	LnAv	0	10.4	29.57	50	-20.43	Line
1	.50043	28.63	LnAv	0	9.8	38.43	46	-7.57	Neutral
2	4.78016	24.3	LnAv	0	10	34.3	46	-11.7	Neutral
3	13.35826	20.28	LnAv	0	10.4	30.68	50	-19.32	Neutral

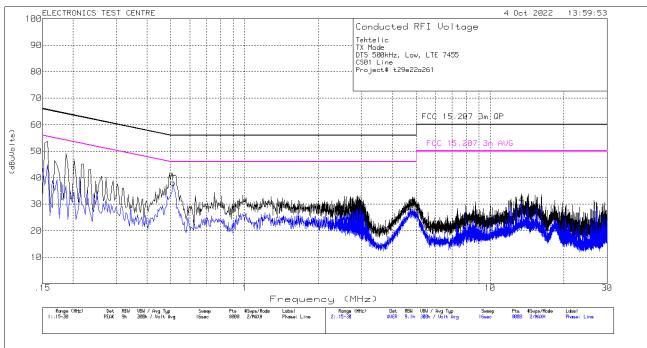
EUT with LTE EM7455

Meter Reading in dB_µV + LISN Factor in dB + Gain/Loss Factor in dB = Corrected Emission Strength in dB_µV.

Notes:

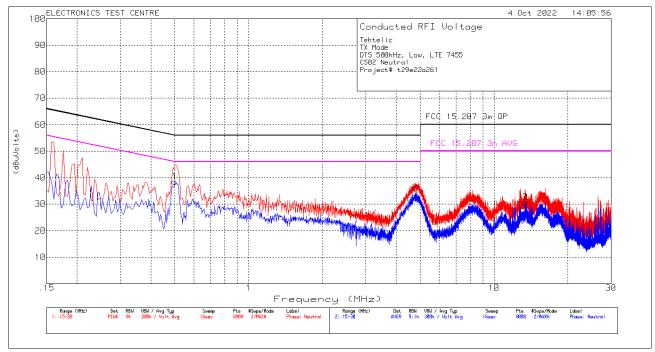
- When a preamp is used, the resulting gain is compensated, producing a negative value for the Cable Loss.
- LnAv = Linear Average detector

Negative values for Delta indicate compliance.



EUT with LTE EM7455 Plot of Conducted Emissions: LINE

Plot of Conducted Emissions: Neutral



2.2 6dB Bandwidth

Test Lab: Electronics Test Centre, Airdrie

Test Personnel: Imran Akram/ Janet Mijares

Data: 2022 10.06/07 (20.7°C 25.2% PH)

EUT: Kona Mega Gateway

Standard: FCC PART 15.247

Date: 2022-10-06/07 (20.7°C, 25.2%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: Systems using digital modulation techniques may operate in the 902-928 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

2.2.1 Test Guidance: ANSI C63.10-2013, Clause 11.8 / 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.

For DTS the spectrum analyzer is set for a frequency span \geq (2 * OBW), \leq (5 * OBW), selected to clearly display the channel. The RBW is set to 100 kHz. The VBW is set to \geq (3 * RBW). The Peak detector is used, with the trace set to Max Hold.

The automated 99% BW function of the spectrum analyzer is engaged, and the 6 dB OBW and/or 20 dB OBW 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:

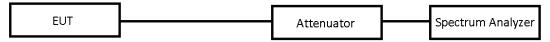
Equipment	Manufacturer	Model #	Asset #	Cal. Date	Cal. Due
EMI receiver	Agilent	N9038A (FW A.25.05)	6130	2022-07-12	2023-07-12
Temp/Humidity	Extech	42270	5892	2022-04-07	2023-04-07
Attenuator	Fairview Microwave	SA18N5WA-10	6886	Cal. before	e each use
Coaxial Cables (RF)	W.L. Gore	Pgr10R01036.0	-	Cal. before	e 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:



2.2.5 Channel Occupied Bandwidth Data: LoRa DTS

		_			
Mode of operation	Channel	Freq. [MHz]	Ant Port 0	Ant Port 1	Limit BW [kHz]
	Low	923.3	612.8	611.7	
LoRa 500 KHz	Mid	925.1	612.8	612	≥ 500
	High	927.5	611.6	611.2	

Antenna Port 0

Screen Captures from the spectrum analyzer: Low Channel

Keysight Spectrum Analyzer - Occupied BW - AP -ALIGN AUTO 02:05:35 AM Oct 06, 2022 Trace/Detector Center Freq: 923.300000 MHz Radio Std: None x dB -6.00 dB Avg|Hold:>10/10 Trig: Free Run #Atten: 30 dB Ð Radio Device: BTS #IEGain:Low Ref Offset 10.7 dB Ref 40.70 dBm 10 dB/div Log **Clear Write** Average Max Hold Center 923.300 MHz #Res BW 100 kHz Span 2.000 MHz Sweep 1 ms #VBW 300 kHz **Min Hold Total Power** 35.9 dBm **Occupied Bandwidth** 645.24 kHz Detector Peak) 895 Hz Man **Transmit Freq Error** % of OBW Power 99.00 % Auto x dB Bandwidth 612.8 kHz x dB -6.00 dB мsg 🧼 File <1.png> saved STATUS

Screen Captures from the spectrum analyzer: MID Channel

Keysight Spectrum Analyzer - Occupied B					
ΙΧΙ RF 50 Ω AC		SENSE:INT	ALIGN AUTO	02:45:16 AM Oct 06, 2022	Trace/Detector
Ref Value 50.20 dBm	Tries F	r Freq: 925.100000 MHz Free Run Avg Ho	old:>10/10	Radio Std: None	
		n: 40 dB		Radio Device: BTS	
Ref Offset 10.7 d 10 dB/div Ref 50.20 dBr					
40.2					Clear Write
30.2					Clear Write
20.2					
10.2	/	\	\		
3.200			1		Average
-9.80					
-19.8			Commenter	www.	
-29.8					Max Hold
-39.8					
Center 925.100 MHz				Span 2.000 MHz	
#Res BW 100 kHz	#	VBW 300 kHz		Sweep 1 ms	Min Hole
					Min Hold
Occupied Bandwidt	h	Total Power	35.6	dBm	
6	45.28 kHz				Detecto
0					Peak
Transmit Freq Error	949 Hz	% of OBW Pov	wer 99	.00 %	Auto <u>Mar</u>
x dB Bandwidth	612.8 kHz	x dB	-6	00 dB	
			-0.		
MSG			STATUS	3	

Keysight Spectrum Analyzer - Occupied				•	
LXI RF 50 Ω AC		SENSE:INT	ALIGN AUTO	02:59:43 AM Oct 06, 2022	
Center Freq 927.50000) MHz	Center Freq: 927.50		Radio Std: None	Trace/Detector
		Trig: Free Run	Avg Hold:>10/10		
	#IFGain:Low	#Atten: 40 dB		Radio Device: BTS	
10 dB/div Ref 50.20 dB	2m				
Log					
40.2					
30.2					Clear Write
20.2					
10.2			+ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$		
3.200	/				Average
					3
-9.80				man www.	
-19.8					
-29.8					Max Hold
-39.8					maxilora
30.0					
Center 927.500 MHz				Span 2.000 MHz	
#Res BW 100 kHz		#VBW 3001	kHz	Sweep 1 ms	Min Hold
					WIIT HOID
Occupied Bandwig	dth	Total F	ower 35.	8 dBm	
	644.86 kH	Z			Detector
	4.07011			0.00	Peak►
Transmit Freq Error	1.076 kl	Iz % of O	BW Power 9	9.00 %	Auto <u>Man</u>
x dB Bandwidth	611.6 ki	lz x dB	-6	.00 dB	
MSG			STAT	US	

Screen Captures from the spectrum analyzer: High Channel

Antenna Port 1

Screen Captures from the spectrum analyzer: Low Channel

Keysight Spectrum Analyzer - Occupied BV					
		SENSE:INT AL	LIGN AUTO 01:44:46 AM Radio Std:		Trace/Detector
	#IFGain:Low #Atten:	ree Run Avg Hold:> :40 dB	10/10 Radio Devid	e: BTS	
10 dB/div Ref 50.20 dBr	n				
40.2					
30.2					Clear Write
20.2					
10.2					
3.200	/_				Average
-9.80			h		
-19.8			and a second a second a second a second a second a second a	and the second second	
-29.8					Max Hold
-39.8					
Center 923.300 MHz			Span 2.0	000 MHz	
#Res BW 100 kHz	#\	/BW 300 kHz		ep 1ms	Min Hold
Occupied Bandwidt	'n	Total Power	35.9 dBm		
	 44.59 kHz				Detector
					Peak►
Transmit Freq Error	937 Hz	% of OBW Power	r 99.00 %		Auto <u>Man</u>
x dB Bandwidth	611.7 kHz	x dB	-6.00 dB		
			1 I		
MSG			STATUS		

	n Analyzer - Occ	unied BW									
IXI F	RF 50 Ω	AC		SENSE			ALIGN AUTO		M Oct 07, 2022	Tree	e/Detector
Ref Value 50	0.20 dBm				: 925.100000 MH un Avg		- 40/40	Radio Std	: None	Trac	elDelector
		#IFG	ain:Low	#Atten: 40 d	B Avg	noia.	>10/10	Radio Dev	ice: BTS		
10 dB/div Log	Ref 50.20) dBm	_							-	
40.2											
30.2										(Clear Write
				_						_	
20.2											
10.2			/			\uparrow					
3.200			/			+					Average
-9.80	A. Doo-	م					Lune .			_	
-19.8	and the second s	and a start of the						barrow	and a second second		
-29.8											
											Max Hold
-39.8										_	
Center 925.1	00 MHz							Snan 2	.000 MHz		
#Res BW 10				#VBW	300 kHz				ep 1 ms		
											Min Hold
Occupie	d Band	width		Т	otal Power		35.7	′ dBm		_	
			.78 k⊦	-							Detector
		044	./ 0 KF								Detector Peak►
Transmit	Freg Err	or	1.007 k	Hz %	of OBW P	owe	r 99	.00 %		Auto	Man
						00					
x dB Ban	dwidth		612.0 k	Hz X	dB		-6.	00 dB			
MSG							STATUS	5			
							0				

Screen Captures from the spectrum analyzer: MID Channel

Screen Captures from the spectrum analyzer: High Channel

Keysight Spectrum Analyzer - Occupied E	W		<u> </u>		
Center Freq 927.500000		SENSE:INT Freg: 927.500000 MHz		02:32:57 AM Oct 07, 2022 adio Std: None	Frequency
Center Treq 327.300000		ree Run Avg Hold			
	#IFGain:Low #Atten	: 40 dB	ĸ	adio Device: BTS	
10 dB/div Ref 50.20 dB	m				
40.2					Center Freq
30.2					927.500000 MHz
20.2					
10.2	/				
3.200	/	\	۲		
-9.80			1		
-19.8	and the second s		hourses	man man man man	
-29.8					
-39.8					
Center 927.500 MHz				Span 2.000 MHz	CF Step
#Res BW 100 kHz	#\	VBW 300 kHz		Sweep 1 ms	200.000 kHz
Occupied Bandwid	th	Total Power	35.7 d	Bm	<u>Auto</u> Man
	 644.37 kHz				
	944.37 КПZ				Freq Offset
Transmit Freq Error	1.159 kHz	% of OBW Pow	er 99.0	0 %	0 Hz
x dB Bandwidth	611.2 kHz	x dB	-6.00	dB	
MSG			STATUS		
			entroo		

2.3 Max Average Output Power

Test Lab: Electronics Test Centre, Airdrie	EUT: Kona Mega Gateway
Test Personnel: Imran Akram/ Janet Mijares	Standard: FCC PART 15.247
Date: 2022-10-06/07 (20.7°C, 25.2% RH)	Basic Standard: ANSI C63.10: 2013 FCC OET KDB 558074

EUT status: Compliant

Specification: FCC Part 15.247(b, 3)

Criteria (3) For systems using digital modulation in the 902-928 MHz bands: 1 Watt.

2.3.1 Test Guidance: ANSI C63.10-2013, Clause 11.9.2.2.2/ 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.

Output Powe	er Method AVGSA-1 For LoRa 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
Detector	RMS (Power Averaging)
Sweep trigger	Free Run (Duty Cycle ≥98%)
Trace Average	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.

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
EMI receiver	Agilent	N9038A (FW A.25.05)	6130	2022-07-12	2023-07-12
Temp/Humidity	Extech Ins.	42270	5892	2022-04-07	2023-04-07
Attenuator	Fairview Microwave	SA18N5WA-10	6886	Cal. before each use	
Coaxial Cables (RF)	W.L. Gore	Pgr10R01036.0	-	Cal. before each use	

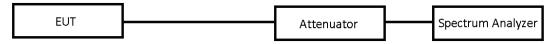
2.3.4 Test Sample Verification, Configuration & Modifications

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:

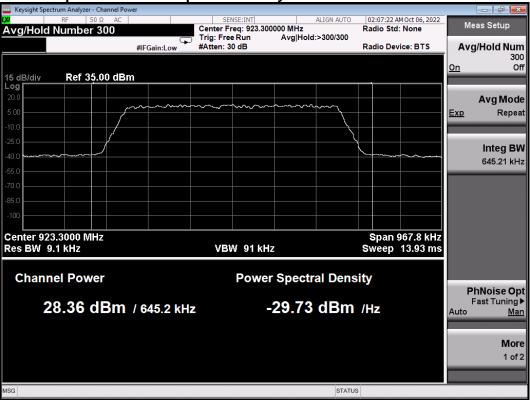


2.3.5 Max Average Output Power Data: LoRa DTS

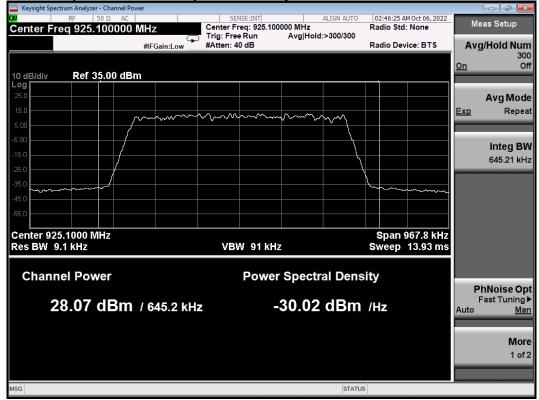
		Freq.	Antenna Port 0	Antenna Port 1	Out Put Power
Mode of Operation	Channel	[MHz]	Out Put Power (dBm)	Out Put Power (dBm)	Limit (dBm
	Low	923.3	28.36	28.37	30
LoRa 500 kHz	Mid	925.1	28.07	28.13	30
	High	927.5	28.39	28.15	30

Antenna Port 0

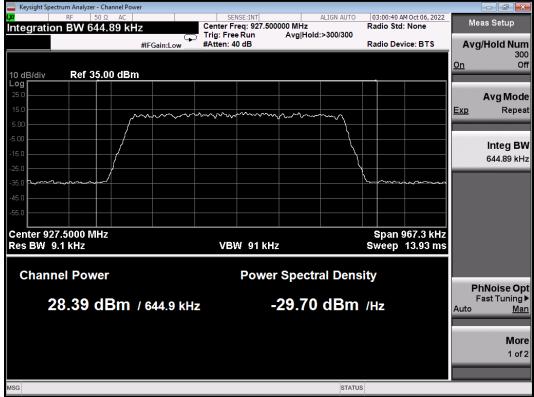
Screen Captures from the spectrum analyzer Low Channel



Screen Captures from the spectrum analyzer: MID Channel



Screen Captures from the spectrum analyzer: High Channel

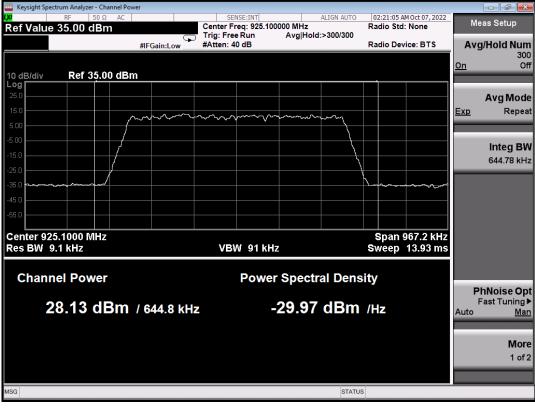


Antenna Port 1

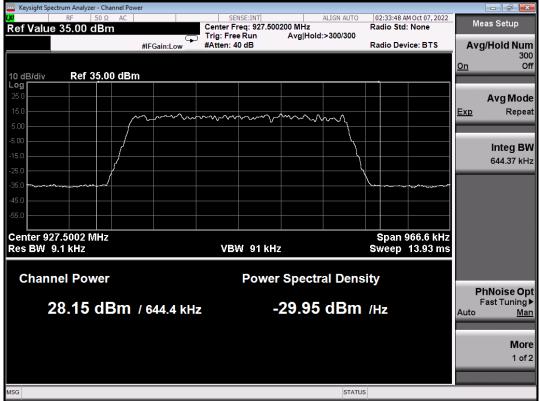
Screen Captures from the spectrum analyzer Low Channels

Every State Strate Analyzer - Channel Power								
ເ× so Ω AC Avg/Hold Number 300	С	SENSE:INT enter Freg: 923.3000		ALIGN AUTO	01:49:50 A Radio Std	M Oct 07, 2022	Me	as Setup
		rig: Free Run Atten: 40 dB	Avg Hold:	>300/300	Radio Dev	ice: BTS	Avg	/Hold Num
15 dB/div Ref 35.00 dBm							<u>On</u>	300 Off
20.0 5.00		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	^				Exp	Avg Mode Repeat
-25.0 -40.0 -55.0 -70.0 -85.0								Integ BW 644.63 kHz
-100 Center 923.3000 MHz Res BW 9.1 kHz		VBW 91 kHz				966.9 kHz 13.93 ms		
Channel Power		Power	Spectra	al Dens	ity			
28.37 dBm / 644.6 кHz -29.73 dBm /Hz					P F Auto	hNoise Opt Fast Tuning ► <u>Man</u>		
								More 1 of 2
мsg 🔱 File <1_0000.png> saved				STATUS				









2.4 Power Spectral Density

Test Lab: Electronics Test Centre, Airdrie	EUT: Kona Mega Gateway
Test Personnel: Imran Akram/ Janet Mijares	Standard: FCC PART 15.247
Date: 2022-10-06/07 (20.5°C,25.2% RH)	Basic Standard: ANSI C63.10: 2013

EUT status: Compliant

Specification: FCC Part 15.247(e)

Criteria For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna 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.

Me	Method AVGPSD-1 For DTS								
Span	≥ 1.5 times the OBW								
RBW	3 kHz ≤ RBW ≥ 100 kHz.								
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)								
PSD measured	Use the peak marker function to determine the maximum amplitude level.								
If the measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span to meet the minimum measurement point requirement as the RBW is reduced).									

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

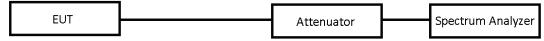
Testing was performed with this equipment:

Equipment	Manufacturer	Manufacturer Model # Asse		Cal. Date	Cal. Due
EMI receiver	Agilent	N9038A (FW A.25.05)	6130	2022-07-12	2023-07-12
Temp/Humidity	Extech Ins.	42270	5892	2022-04-07	2023-04-07
Attenuator	Fairview Microwave	SA18N5WA-10	6886	Cal. before	e each use
Coaxial Cables (RF)	W.L. Gore	Pgr10R01036.0	-	Cal. before	e 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:



2.4.5 Average PSD Data LoRa DTS

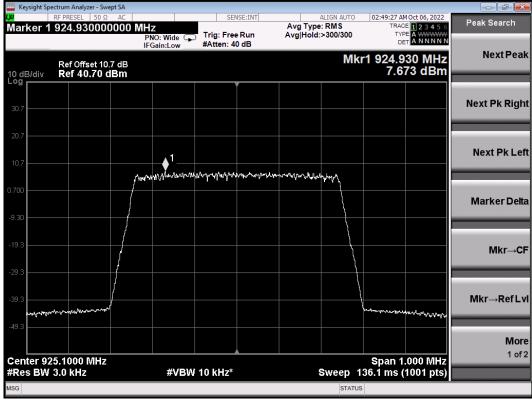
Mode of operation	Channel	Freq.	Antenna Port 0	Antenna Port 1	PSD Limit	
•		[MHz]	PSD (dBm)	PSD (dBm)	(dBm	
	Low	923.3	7.854	7.888	8	
LoRa 500 KHz	Mid	925.1	7.673	7.789	8	
	High	927.5	7.671	7.818	8	

Antenna Port 0

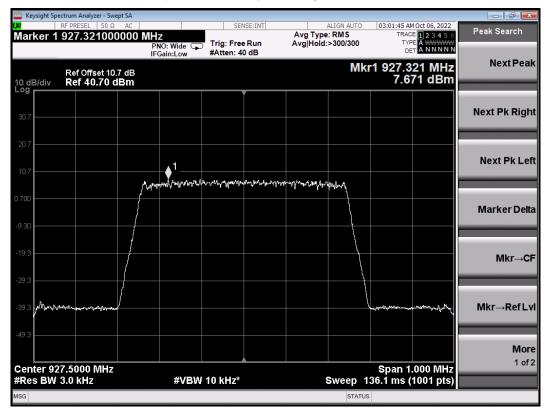
Screen Capture from Spectrum Analyzer: Low Channel

	m Analyzer - Swept SA								
	PRESEL 50 Ω AC		SEN	ISE:INT	Avg Type	ALIGN AUTO		E 1 2 3 4 5 6	Peak Search
Marker 1 92	23.234000000	PNO: Wide G	Trig: Free #Atten: 3		Avg Hold:		TYF	E A WWWWW T A NNNNN	
	tef Offset 10.7 dB tef 30.70 dBm					Mk	r1 923.2 7.8	34 MHz 54 dBm	Next Peak
20.7									Next Pk Right
0.700	}	partageneration	1 ปกระหาศักรรณ	and and a second of the second of the second s	nt million and	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~			Next Pk Left
-9.30									Marker Delta
-29.3									Mkr→CF
-39.3 -49.3	www.www.						mannessour	and the second second	Mkr→RefLvl
-59.3									More 1 of 2
Center 923.3 #Res BW 3.0		#VBW	10 kHz*				36.1 ms (.000 MHz 1001 pts)	1 012
MSG						STATUS	6		

Screen Capture from Spectrum Analyzer: MID Channel



Screen Capture from Spectrum Analyzer: High Channel

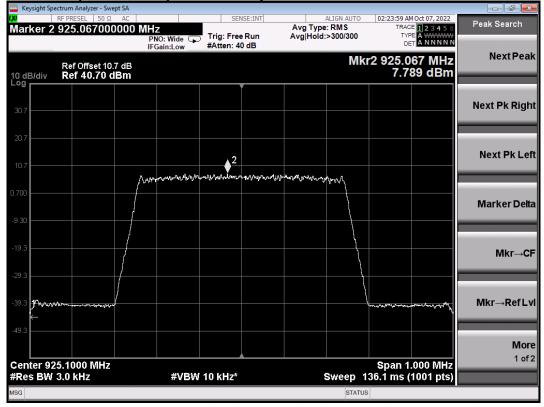


Antenna Port 1

Screen Capture from Spectrum Analyzer: Low Channel

									ctrum Analyzer - Swe	Keysight S
Peak Search	M Oct 07, 2022 DE 1 2 3 4 5 6	TRAC		Avg Type	NSE:INT	SE	17		RF PRESEL 50 Ω 923.331000	larker 1
		TY	>300/300	Avg Hold		Trig: Fre #Atten: 4	NO: Wide 🖵 Gain:Low	Р	020100100	narritor
NextPeal	31 MHz	1 923.3	Mk				Gameow		Ref Offset 10	
	88 dBm	7.8							Ref 30.70 c	0 dB/div
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Next Pk Righ										20.7
					1					
				www.	-	ala ala and	rapper referred on the sec	And		10.7
Next Pk Lei								/ ¥*		.700
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										9.30
Marker Delt			Į					{		
			ł					\$		19.3
								/		29.3
Mkr→C								1		
	manner	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~						/	v - m - w - v - w - m	39.3 7~~~
Min Defi										
Mkr→RefLv										49.3
										59.3
Mor										
1 of:	.000 MHz	Snan 1							3.3000 MHz	Center 0
	(1001 pts)	36.1 ms (Sweep 1			10 kHz*	#VBW			Res BW
			STATUS							ISG

Screen Capture from Spectrum Analyzer: MID Channel



Screen Capture from Spectrum Analyzer: High Channel

Keysight Spe	ectrum Analyzer - Swept SA								
Marker 2	RF PRESEL 50 Ω AC 927.553200000 AC) MHz		NSE:INT	Avg Type		TRAC	HOct 07, 2022	Peak Search
		PNO: Wide 🕞 IFGain:Low	Trig: Free #Atten: 4		Avg Hold:	>300/300	DE		
10 dB/div Log	Ref Offset 10.7 dB Ref 40.70 dBm					Mk	r2 927.5 7.8	53 MHz 18 dBm	Next Peak
30.7									Next Pk Right
20.7									_
10.7				♦ ²					Next Pk Left
0.700		phone have been and a second	ฟรูษฏีกระจะจะวันวัน _้ ระจะจ	n nanaranan	ጜኯጜኇኯኯኯ	Nu Pr late			
-9.30									Marker Delta
-19.3									
-29.3									Mkr→CF
-39.3 J MAAAA	manna					Ì	handrease	www.www.www.	Mkr→RefLvl
-49.3									
Contor A	7.5002 MHz						Enon 4		More 1 of 2
#Res BW		#VBW	10 kHz*			Sweep_1	span 1 36.1 m <u>s (</u>	.000 MHz 1001 pts)	
MSG						STATUS			

2.5 Band Edge Attenuation

Test Lab: Electronics Test Centre, Airdrie	EUT: Kona Mega Gateway			
Test Personnel: Imran Akram/ Janet Mijares	Standard: FCC PART 15.247			
Date: 2022-10-06/07 (20.5°C, 25.2% RH)	Basic Standard: ANSI C63.10: 2013			

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 11.13.2 & 6.10.4, 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.

The spectrum analyzer is set for a frequency span to show the band edge and the nearest channel. The RBW is set to \geq 100 kHz. The VBW is set to \geq (RBW * 3). The Peak detector is used, with the trace set to Max Hold.

The attenuation is measured with the Marker Delta function.

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 Model # Asset #		Asset #	Cal. Date	Cal. Due
EMI receiver	Agilent	N9038A (FW A.25.05)	6130	2022-07-12	2023-07-12
Temp/Humidity	Extech Ins.	42270	5892	2022-04-07	2023-04-07
Attenuator	Fairview Microwave	SA18N5WA-10	6886	Cal. before	e each use
Coaxial Cables (RF)	W.L. Gore	Pgr10R01036.0	-	Cal. before	each use

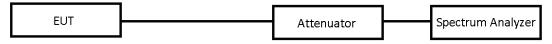
2.5.4 Test Sample Verification, Configuration & Modifications

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:



2.5.5 Band Edge Data LoRa DTS

Worse Case Data

Mode of		Antenna Port 0	Antenna Port 1	Attenuation	
operation	Channel	Attenuation at Band Edge	Attenuation at Band Edge	Limit at Band Edge	
Lora 500kHz	923.3	68.448dBc	69.002dBc	30 dBc	
	927.5	42.159dBc	41.946dBc	30 dBc	

Antenna Port 0

Screen Capture from the spectrum analyzer: Lower Band Edge

Keysight Spectrum Analyzer - Sv			,		<u> </u>	
play Line 1 -1.64		SEN	SE:INT Avg	ALIGN AUTO	02:19:29 AM Oct 06, 2022 TRACE 1 2 3 4 5 (Display
		Fast Trig: Free Low #Atten: 40	Run Avg	Hold:>300/300	DET P NNNN	
Ref Offset 1 dB/div Ref 40.70				ΔΜ	kr3 21.422 MHz 68.448 dB	
g 🗌 🗌					▲3∆4	
7						Titl
7					<u> </u>	
7						
) <u> </u>					DL1 1.64 dBm	Gratic
) 						On
					/ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	
· <u>^2</u>						Display
		- a - a - b - wearing	manna	makuman	ment h	Display L -1.64 d
<u> </u>						<u>On</u>
art 900.00 MHz					Stop 925.27 MHz	
es BW 100 kHz		#VBW 300 kHz		Sweep 2	.467 ms (1001 pts)	Display Line
MODE TRC SCL	х	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	
N 1 f	923.221 M 901.900 M		m			Syster
$\Delta 4$ 1 f (Δ)	21.422 M 901.900 M	Hz (Δ) 68.448 d	IB			Displa
	901.900 MI	HZ -39.501 UB			E	Setting
					-	
				STATU		
				STATUS		

Screen Capture from the spectrum analyzer: Upper Band Edge

							-					
- 6 -								pt SA	Analyzer - Swe	rum A	ght Spect	Keysi
Peak Search	1 Oct 06, 2022		ALIGN AUTO	A	NSE:IN	SE		AC	SEL 50 Ω			XI
	E 1 2 3 4 5 6 E M WWWW	TYP	pe: Log-Pwr d:>300/300		e Run	Trig: Fre	O: Wide G	340 kHz	64.925	<u>- 1</u>	er 3 /	lark
	PNNNN	DE				#Atten: 4	Gain:Low					
NextPeal	4.9 kHz	lkr3 -76	٨٨									
	159 dB	10 -70							Offset 10			
					-			Bm	f 40.70 o ∆4		div	l0 dBi ₋og ⊏
									∆4	$\langle \rangle^{3}_{+}$		30.7
Next Pk Righ												
												20.7
								\uparrow				10.7
	DL1 -1.61 dBm							_\).700
Next Pk Lef							2	$ \Delta $				-9.30
						the second s	~~~X4	l				-19.3 -
		~_~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~			han	and the second						
												-29.3
Marker Delta												-39.3
												-49.3
	000 MHz	Stop 930.									927.2	
Mkr→Cf	1001 pts)	.000 ms (Sweep 1			/ 300 kHz	#VBV		kHz	00	BW 1	#Res
	N VALUE	FUNCTIO	UNCTION WIDTH	UNCTION		Y		x		SCL	DDE TRC	MKR M
						28.766 dl		927.492		f	N 1	1
						<u>-13.932 dl</u> 42.159) MHz 9 kHz (Δ)	928.050	(Δ)	f	<u>v 1</u> 4 1	2 3 A
Mkr→RefLv					Bm	-13.353 di		928.265		f	- 1	
	E											5
												6
More												8
1 of 2												9
1012												10
	4					III				-		•
			STATUS									SG
					_					_	_	_

Antenna Port 1

Screen Capture from the spectrum analyzer: Lower Band Edge

Keysight Sp	pectrum Analyzer							
	RF PRESEL			SENS		ALIGN AUTO	02:15:52 AM Oct 07, 20	
rker 2	2 Δ 21.37	3670000		Trig: Free F		g Type: Log-Pwr Hold:>300/300	TRACE 1 2 3 4	5 0
			PNO: Fast IFGain:Low	#Atten: 40 d		11010.2300/300	DET P N N N	
			II Gain.Low					Next Pe
	Ref Offse	t 10.7 dB				ΔΜ	kr2 21.374 MI	1Z
dB/div	Ref 40.						69.002 d	IB
^{yg}							▲2∆3	
).7								
).7								Next Pk Rig
).7								
00							DL1 1.63 c	:IBm
30								Next Pk L
							N IN	
9.3								
9.3								
	V					Land and a state of the	B	Marker De
9.3 	-+Xymman	Canadian Section of the Section of t	∿⊷~►₩₩≈₽₩₽₩ ₩ ₩	Jan Andrew Strand Strand Strand Strand				warker De
9.3								
).00 MHz						Stop 925.27 M	Hz
Res BW	/ 100 kHz		#VE	3W 300 kHz		Sweep 2	.467 ms (1001 pi	ts) Mkr→0
	RC SCL	Х		Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	
	1 f	923	.331 MHz	28.992 dBr				
2 <u>A</u> 3 ·	1 f (Δ)		.374 MHz (/					
3 = -	1 f	901	.900 MHz	-39.894 dBn	n			Mkr→RefL
4								=
6								
7								
7								Mo
5 6 7 8 9								
7 								Мо 1 о
7 B				m				

Screen Capture from the spectrum analyzer: Upper Band Edge

					- 7 -
🕅 RF PRESEL 50 Ω AC Marker 3 Δ -775.888000 k	Hz	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	02:38:34 AM Oct 07, 2022 TRACE 1 2 3 4 5 6	Peak Search
	PNO: Wide	Frig: Free Run Atten: 40 dB	Avg Hold:>300/300	TYPE M WWWW DET P N N N N N	
	IFGall:Low *	Atten: 40 ub	A 1	Mkr3 -775.9 kHz	Next Peak
Ref Offset 10.7 dB 10 dB/div Ref 40.70 dBm				41.946 dB	
		Ţ			
30.7					Next Pk Right
20.7					Next P K Right
10.7					
0.700				DL1 -1.85 dBm	
-9.30	$\partial^2 - \chi$				Next Pk Left
-19.3	~~~X4~~	and the second s			
-29.3		the second second	man and the second		
-39.3					Marker Delta
-49.3					
Start 927.268 MHz #Res BW 100 kHz	#VBW 30	00 kHz	Sween 1	Stop 930.000 MHz 1.000 ms (1001 pts)	Mkr→CF
MKRI MODEI TRCI SCLI X	#*B**3		-		Miki — Ci
	497 5 MHz 2	Y FUN 8.672 dBm	ICTION FUNCTION WIDTH	FUNCTION VALUE	
	050 0 MHz -1 775.9 kHz (Δ)	5.831 dBm 41.946 dB			
4 F 1 f 928.		3.272 dBm			Mkr→RefLvl
5				E	
7					
9					More
10				-	1 of 2
		m			
MSG			STATU	IS	

2.6 Conducted Spurious Emissions (Non-Restricted Band)

Test Lab: Electronics Test Centre, Airdrie

Test Personnel: Imran Akram/ Janet Mijares

EUT: Kona Mega Gateway

Standard: FCC PART 15.247

Date: 2022-10-06/07 (20.5°C, 25.2% RH)

Basic Standard: ANSI C63.4-2014 FCC OET KDB 558470 v04 DTS

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

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.

The spectrum analyzer is stepped through the spectrum in frequency spans selected to ensure acceptable frequency resolution. The RBW is set to 100 kHz. The VBW is set to ≥ 300 kHz. The Peak detector is used, with the trace set to Max Hold.

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

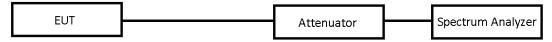
Testing was performed with the following equipment:

Equipment	Manufacturer	Model #	Asset #	Cal. Date	Cal. Due
EMI receiver	Agilent	N9038A (FW A.25.05)	6130	2022-07-12	2023-07-12
Temp/Humidity	Extech	42270	5892	2022-04-07	2023-04-07
Attenuator	Fairview Microwave	SA18N5WA-10	6886	Cal. before	e each use
Coaxial Cables (RF)	W.L. Gore	Pgr10R01036.0	-	Cal. before	e 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:



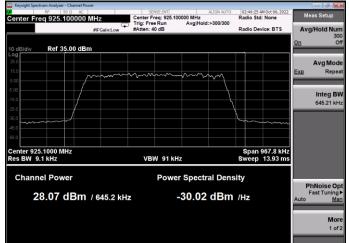
2.6.5 Conducted Emissions Data: LoRa DTS

Antenna Port 0

	Low	Chann	el		
Keysight Spectrum Analyzer - Channel P		SENSE:INT Center Freq: 923.30 Trig: Free Run #Atten: 30 dB	ALIGN AUTO 00000 MHz Avg Hold:>300/300	02:07:22 AM Oct 06, 2022 Radio Std: None Radio Device: BTS	Meas Setup Avg/Hold Nun 30
15 dB(div Ref 35.00 dE Log 20 5.00 4.00 4.00 4.00 4.00 4.00 4.00 4.0					On O Avg Mod Exp Reper Integ BV 645.21 kH
Center 923.3000 MHz Res BW 9.1 kHz Channel Power 28.36 dBm	/ 645.2 kH		^{iz} r Spectral Den -29.73 dBrr		
ASQ			STAT	nie	Mo 1 of

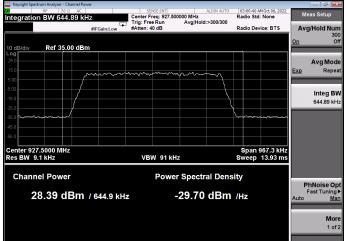
🛄 Keysi		alyzer - Spurious E	nissions							🔤 Keysight		r - Spurious Emissions							_	
1) Point	_R ⊧ s 19999	50 Ω Å DC			reg: 500.015000 MHz		02:35:05 AM Oct 06, 2022 Radio Std: None	F	Range Table	Nef Off	set 11.20	50 Ω AC		Center Fre	SE:INT eq: 500.0150	000 MHz	Radio	00 AM Oct 06, 2022 Std: None	Ra	nge Table
			IFGain:Low	Trig: Fre #Atten: 4			Radio Device: BTS		Range	PASS			n:Low 구	Trig: Free #Atten: 40		Avg Hold:>1		Device: BTS	-	Range
10 dB/		f Offset 10.7 ef 45.00 dE					923.29 MHz 22.948 dBm		1 Off	10 dB/div		ffset 11.2 dB I 5.50 dBm					6 -39	1066 GHz .830 dBm	<u>On</u>	Off
35.0 25.0							1		Detector 1 Peak	25.5									I	Detector 1 Peak
5.00 -5.00									Detector 2	5.50 -4.50 -14.5									I	Detector 2
-25.0 - -35.0 - -45.0 -		Accedited in the second second						Auto	Sweep Time 96.0 ms 2 Man	-24.5 -34.5 -44.5					● ¹				S <u>Auto</u>	Sweep Time 861 ms Man
Start	30 kHz						Stop 1 GHz		Points 19999	Start 1	GHz							Stop 10 GHz		Points 20001
Sp	ur Ran	ge Freq	iency	Amplitude	Limit	Δ	Limit	Auto	<u>o</u> Man	Spur	Range	Frequency	Am	plitude		Limit	∆ Limit		<u>Auto</u>	Man
1 2	1 1	<mark>923.3</mark> 926.5	MHz ·	28.75 dBm -40.18 dBm		-38.	<mark>9 dB</mark> 54 dB		IF Gain Low Gain▶	1 2	2 2	6.099 GHz 5.318 GHz	-36.0	<mark>36 dBm</mark> 03 dBm	-1	.640 dBm .640 dBm	-33.72 dl -34.39 dl	3		IF Gain Low Gain ▶
3	1	930.4 921.7		-40.58 dBm -40.74 dBm	-1.640 dBm -1.640 dBm		94 dB ₌ 10 dB	Auto	o <u>Man</u>	3	2 2	6.621 GHz 6.060 GHz		04 dBm 10 dBm		.640 dBm	-34.40 dl -34.46 dl		Auto	Man
45	1	921.7 450.8		-40.74 dBm -40.88 dBm	-1.640 dBm		24 dB	-		5	2	5.621 GHz		24 dBm		.640 dBm	-34.40 di -34.60 di			
6	1	12.13		-41.09 dBm	-1.640 dBm		45 dB		More 3 of 3	6	2	6.110 GHz		25 dBm		.640 dBm	-34.61 dl			More 3 of 3
7	1	503.1	MHz	-41.11 dBm	-1.640 dBm	-39.	47 dB 📮	_		7	2	3.647 GHz	-36.2	28 dBm	-1	.640 dBm	-34.64 di	3 .		
MSG						STATUS	L DC Coupled			MSG							STATUS			

MID Channel



🛄 Keysigi		zer - Spurious Emissions				- 6 -	Keysight Sp		- Spurious Emissions				
Start I	.imit -1.9	50 Ω <u>∧</u> DC 3 dBm		25.100000 MHz	Radio Std: None	Range Table	Start Lin	nit -1.93 c	50Ω AC dBm	Center Fre	q: 925.100000 MHz	N AUTO 02:51:27 AM Oct 06 Radio Std: None	Peak Search
		IFGair	:Low Trig: Free Run #Atten: 40 dB		Radio Device: BTS	Range	PASS		IFGain:L	.ow Trig: Free #Atten: 40		Radio Device: B	Novt Boak
10 dB/d		Offset 10.7 dB 45.50 dBm			925.09 MHz 23.982 dBm		10 dB/div		fset 11.2 dB 6.00 dBm			5.9959 C -39.545 d	HZ
25.5					∳ ¹	Abs Start Limit -1.93 dBm	26.0						Next Pk Right
-4.50						Abs Stop Limit -1.93 dBm <u>Auto</u> Man	6.00 -4.00						Next Pk Left
-24.5 -34.5 -44.5						Peak Excursion 6.00 dB	-24.0 -34.0 -44.0				↓ ¹		Marker Delta
Start		taa da mili ya da parikanina waxa da k	n on an diskiningin maninen inkini adipaken at	an ang sina	Stop 1 GHz	Pk Threshold	Start 1 C	GHz				Stop 10	GHz
Spi	r Rang	e Frequency	Amplitude	Limit	Δ Limit	-90.00 dBm	Spur	Range	Frequency	Amplitude	Limit	Δ Limit	
1 2	1 1	925.1 MHz 924.6 MHz	28.43 dBm -22.73 dBm	-1.930 dBm -1.930 dBm	30.36 dB^ -20.80 dB	Attenuation	1 2	2 2	7.419 GHz 5.210 GHz	-35.62 dBm -35.67 dBm	- <mark>1.930 dBm</mark> -1.930 dBm	-33.69 dB -33.74 dB	Â
3	1	896.5 MHz	-39.52 dBm	-1.930 dBm	-37.59 dB ≡	<u>Auto</u> Man	3	2	6.725 GHz	-35.91 dBm	-1.930 dBm	-33.98 dB	E
4 5	1	967.7 MHz 928.6 MHz	-40.29 dBm -40.54 dBm	-1.930 dBm -1.930 dBm	-38.36 dB -38.61 dB		4	2 2	6.105 GHz 6.139 GHz	-35.95 dBm -36.14 dBm	-1.930 dBm -1.930 dBm	-34.02 dB -34.21 dB	
6	1	712.3 MHz	-40.79 dBm	-1.930 dBm	-38.86 dB	More	5	2	6.139 GHZ 3.640 GHZ	-36.22 dBm	-1.930 dBm	-34.21 dB -34.29 dB	More
7	1	419.5 MHz	-41.27 dBm	-1.930 dBm	-39.34 dB	2 of 3	7	2	5.745 GHz	-36.30 dBm	-1.930 dBm	-34.37 dB	1 of 2
MSG					STATUS 1 DC Coupled		MSG					STATUS	

High Channel



🔤 Keysig			Spurious Emissions				- 8	Keysight		- Spurious Emissions				
<mark>W</mark> Start	Limit -		DΩ <u>A</u> DC Bm	SENSE:I Center Freq:	928.634061 MHz	Radio Std: None	Range Table	Start L	r⊧ mit -1.61 o	50Ω AC		928.634061 MHz	Radio Std: None	Range Table
			IFGain	:Low Trig: Free Ru #Atten: 40 dB		I0 Radio Device: BTS	Range	-		IFGain:	Low Trig: Free Ru #Atten: 40 dl		0 Radio Device: BTS	Range
10 dB/	div		set 10.7 dB i. 50 dB m			927.49 MHz 22.170 dBm		10 dB/div		fset 11.2 dB 6.00 dBm			5.0892 G -40.348 dE	Hz <u>on</u> off
25.5						1	Detector 1 Peak	26.0						Detector 1 Peak
5.50							Detector 2 Off	-4.00						Detector 2
-24.5 -34.5 -44.5	ge-organist the	ang series bags			an al fair ghi ta dhadha dha dha an ta		Sweep Tim 96.0 m <u>Auto</u> Ma	-34.0						Sweep Time 861 ms <u>Auto</u> Man
Start	30 kHz		and a constant of the second secon	an in a shi ta ta shi na a sha ta shi ta shi		Stop 1 GHz	1999		GHz				Stop 10 G	Hz Points 20001
Sp	ur R	ange	Frequency	Amplitude	Limit	Δ Limit	<u>Auto</u> Ma	Spur	Range	Frequency	Amplitude	Limit	Δ Limit	<u>Auto</u> Man
1 2	1 1		927.5 MHz 931.9 MHz	28.70 dBm -23.28 dBm	-1.610 dBm -1.610 dBm	30.31 dB -21.67 dB	IF Gain Low Gain	2	2 2	5.904 GHz 6.814 GHz	-34.69 dBm -34.69 dBm	- <mark>1.610 dBm</mark> -1.610 dBm	-33.08 dB -33.08 dB	ÎF Gain Low Gain ▶
3	1 1		928.0 MHz 923.0 MHz	-24.17 dBm -25.91 dBm	-1.610 dBm -1.610 dBm	-22.56 dB = -24.30 dB	Auto <u>Mar</u>	3 4	2 2	3.648 GHz 6.239 GHz	-35.47 dBm -35.70 dBm	-1.610 dBm -1.610 dBm	-33.86 dB -34.09 dB	auto <u>Man</u>
5 6 7	1		920.7 MHz 932.6 MHz 921.7 MHz	-26.63 dBm -26.96 dBm -30.02 dBm	-1.610 dBm -1.610 dBm -1.610 dBm	-25.02 dB -25.35 dB -28.41 dB	Mon 3 of 3	6	2 2 2	6.155 GHz 6.212 GHz 7.228 GHz	-36.14 dBm -36.28 dBm -36.30 dBm	-1.610 dBm -1.610 dBm -1.610 dBm	-34.53 dB -34.67 dB -34.69 dB	More 3 of 3
MSG						STATUS 1 DC Coupled		MSG					STATUS	*

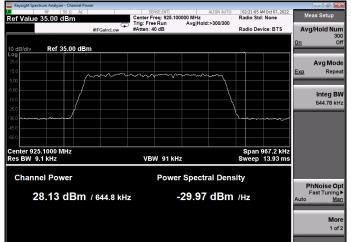
Antenna Port 1

Low Channel

Keysight Spect	trum Analyzer - Channel Pow RF 50 Ω AC	er	SENSE:INT		ALIGN AUTO	01:49:50 4	M Oct 07, 2022			
avg/Hold	Number 300		Center Freq: 923.30	0000 MHz		Radio Std		Mea	as Setup	
		#IFGain:Low	Trig: Free Run #Atten: 40 dB	Avg Hold:	>300/300	Radio Dev	vice: BTS	Avg/Hold		
								-	3	
5 dB/div	Ref 35.00 dBn	ı						<u>On</u>	_	
og 0.0								_		
	r		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	·	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~				AvgMo	
					1			Exp	Rep	
1.0										
5.0	mmm				,	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~			Integ E	
1.0									644.63	
5.0									_	
1.0										
5.0										
enter 923	3.3000 MHz					Span	966.9 kHz			
es BWI 9	.1 kHz		VBW 91 kH	z			13.93 ms			
Chann	el Power		Power	r Spectra	al Dens	ity				
									Noise	
2	8.37 dBm	/ 644.6 kHz	z -	29.73	dBm	/Hz		Auto	ast Tunin M	
									_	
									м	
									1	
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n DEile <	1_0000.png> saved				STATUS					
A1.110 <	-cooo.piig> saveu				anning					

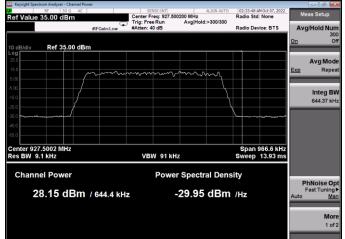
	it Spectrum A	Analyzer - Spuri	ous Emissions							📖 Keysight Spectrum Analyzer - Spurious Emissions 💦 👘 🖓 🚾										
LXI	RF					ALIGN AUTO	01:57:04 AM Oct			ange Table		^{R⊧}	50 Ω AC	SENSE	E:INT ALIGI	Radio Std:	10ct 07, 2022	Rang	e Table	
Points	19999			Center Fr Trig: Free	eq: 923.300000 MHz Run AvalHold:	- 40/40	Radio Std: Nor	ne	R	ange Table		rset 11.20	ØВ	Trig: Free R			None			
			IFGain:Lo			>10/10	Radio Device: I	втя		Range	PASS		IFGain	:Low #Atten: 40 c	B	Radio Devi	ce: BTS		Range	
10 dB/d		Ref Offset 1 Ref 45.50					923.24 24.553	MHz dBm	<u>On</u>	1 Off	10 dB/di		ffset 11.2 dB 6 .00 dBm				74 GHz 73 dBm		Off	
Log 35.5 25.5								1—		Detector 1	36.0 26.0							De	etector 1 Peak	
15.5 5.50 -4.50										Detector 2	6.00 -4.00							De	tector 2 Off	
-24.5 -34.5 -44.5	an a		regen werden die Lie Marken ein die sein werden auf gegen wie begenen gesche die	statu yang dan yang satu yang katantan Satu yang dan yang satu yang katantan			M		<u>Auto</u>	Sweep Time 96.0 ms Man	-24.0 -34.0 -44.0				 1			Swo Auto	eep Time 861 ms Man	
Start	30 kHz						Stop 7	1 GHz		Points 19999	Start 1	GHz		^		Sto	o 10 GHz		Points 20001	
Spi	r Rai	nge Fr	equency	Amplitude	Limit	Δ	Limit		<u>Auto</u>	Man	Spu	r Range	Frequency	Amplitude	Limit	∆ Limit		Auto	Man	
1	1	92	3.2 MHz	28.77 dBm	-1.630 dBn	n 30.	.40 dB	~			1	2	6.043 GHz	-35.59 dBm	-1.630 dBm	-33.96 dB	^			
2	1		9.4 MHz	-22.49 dBm	-1.630 dBn		.86 dB			IF Gain Low Gain ►	2	2	6.149 GHz	-35.67 dBm	-1.630 dBm	-34.04 dB			IF Gain _ow Gain ▶	
3	1		9.7 MHz	-22.76 dBm	-1.630 dBn		.13 dB	=	Auto	Man	3	2	6.025 GHz	-36.38 dBm	-1.630 dBm	-34.75 dB	=	Auto	Man	
4	1		2.8 MHz	-22.80 dBm	-1.630 dBn		.17 dB				4	2	3.642 GHz	-36.39 dBm	-1.630 dBm	-34.76 dB				
5	1		0.2 MHz	-24.52 dBm	-1.630 dBn		2.89 dB				5	2	6.171 GHz	-36.42 dBm	-1.630 dBm	-34.79 dB			Marro	
6	1		8.9 MHz	-25.21 dBm	-1.630 dBn		3.58 dB			More	6	2	5.839 GHz	-36.50 dBm	-1.630 dBm	-34.87 dB			More	
7	1		6.5 MHz	-25.74 dBm	-1.630 dBn		.11 dB	-		3 of 3	7	2	3.621 GHz	-36.52 dBm	-1.630 dBm	-34.89 dB	-		3 of 3	
MSG						STATUS	DC Coupled	d			MSG					STATUS				

MID Channel



Keysig	ht Spectrum A	inalyzer - Spi	urious Emissions					×	🔤 Keysight Sp		- Spurious Emissions					
L <mark>XI</mark>	.imit -1.			Center Freq: 92		AUTO 02:25:51 AM Oct 07, 202 Radio Std: None	2 Ra	ange Table	<mark>(X)</mark> Start Lin	nit -1.87 c	50 Ω AC	Center Free	:INT ALIGN	AUTO 02:27:36 AM Radio Std:	10ct 07, 2022	Range Table
Start	-imit -1.	87 aBr	u IFGai	Trig: Free Run	Avg Hold:>10/1		_	Range	PASS	iit - 1.07 C	IFGain:L	Trig: Free R	un Avg Hold:>10/1	0 Radio Devi	ce: BTS	Range
10 dB/		tef Offset tef 45.5				925.14 MH 22.556 dBn		1 Off	10 dB/div		set 11.2 dB 6.00 dBm				68 GHz)3 dBm	On Off
25.5						∮ ¹		Detector 1 Peak	26.0							Detector 1 Peak
5.50 -4.50								Detector 2	6.00 -4.00 -14.0							Detector 2
-24.5 -34.5 -44.5	19 No - 19 No. 1	9110-10-10-00-00					Auto	Sweep Time 96.0 ms Man	-24.0 -34.0 -44.0				• ¹		~	Sweep Time 861 ms <u>Auto</u> Man
Start	30 kHz					Stop 1 GH:	z	Points 19999	Start 1 C	GHz				Stop	o 10 GHz	Points 20001
Sp	ır Rar	nge F	requency	Amplitude	Limit	Δ Limit	Auto	Man	Spur	Range	Frequency	Amplitude	Limit	Δ Limit		<u>Auto</u> Man
1 2	1 1	<u>9</u>	25.1 MHz 25.6 MHz	28.50 dBm -23.39 dBm	-1.870 dBm -1.870 dBm	30.37 dB -21.52 dB		IF Gain Low Gain ▶	1 2	2 2	5.878 GHz 5.093 GHz	-34.29 dBm -34.97 dBm	-1.870 dBm -1.870 dBm	-32.42 dB -33.10 dB	<u>^</u>	IF Gain Low Gain ▶
3	1 1		21.2 MHz 29.9 MHz	-26.42 dBm -27.51 dBm	-1.870 dBm -1.870 dBm	-24.55 dB ≣ -25.64 dB	Auto	<u>Man</u>	3 4	2 2	5.154 GHz 5.169 GHz	-35.28 dBm -35.52 dBm	-1.870 dBm -1.870 dBm	-33.41 dB -33.65 dB	E	Auto <u>Man</u>
5 6 7	1	9	30.5 MHz 18.1 MHz 20.8 MHz	-28.26 dBm -29.39 dBm -29.42 dBm	-1.870 dBm -1.870 dBm -1.870 dBm	-26.39 dB -27.52 dB -27.55 dB		More 3 of 3	5 6 7	2 2 2	5.203 GHz 5.984 GHz 5.363 GHz	-35.67 dBm -35.74 dBm -35.94 dBm	-1.870 dBm -1.870 dBm -1.870 dBm	-33.80 dB -33.87 dB -34.07 dB		More З of 3
MSG			20.0 MITZ	-25.42 UBII		STATUS DC Coupled			MSG					STATUS	Ţ.	

High Channel



- Keysie	aht Spectrum	n Analyzer -	Spurious Emissions						Keys	sight Spectrum An	nalyzer - Spur	rious Emissions						
<mark>w</mark> Start	Limit -		Ω <u>A</u> DC Bm	Center Freq: 92 Trig: Free Run		Radio Std: None	Ra	ange Table		t Limit -1.8	50 Ω 85 dBn		Center Trig: F	Freq: 928.634000 MHz ree Run Avg Hold:>10	Radio St /10		Range	e Table
			IFGa	ain:Low #Atten: 40 dB		Radio Device: BTS	_	Range	PAS	S		IFGain:L	Low #Atten	40 dB	Radio De	evice: BTS		Range
10 dB/			et 10.7 dB .00 dBm			927.39 MHz 23.168 dBm		1 Off	10 dB		ef Offset ef 46.50					465 GHz 729 dBm	<u>On</u>	Off
26.0 16.0						1		Detector 1 Peak	Log 36.5 - 26.5 - 16.5 -								Det	tector 1 Peak
6.00 — -4.00 = -14.0 —								Detector 2	6.50 - -3.50 = -13.5 -								Det	tector 2 off
-24.0 — -34.0 — -44.0 —		angengang Pangangang					Auto	Sweep Time 96.0 ms Man	-23.5 -33.5 -43.5			1_					Swe Auto	e ep Time 861 ms Man
Start	30 kHz					Stop 1 GHz		Points 19999	Start	t 1 GHz			^		St	op 10 GHz		Points 20001
Sp	ur Ra	ange	Frequency	Amplitude	Limit	∆ Limit	Auto	Man	Sr	pur Ran	ae F	requency	Amplitude	e Limit	∆ Limit		Auto	Man
1 2	1 1		927.4 MHz 927.9 MHz	28.45 dBm -22.23 dBm	- <mark>1.850 dBm</mark> -1.850 dBm	30.30 dB -20.38 dB		IF Gain Low Gain ▶	1 2	2 2	5.	951 GHz 649 GHz	-35.60 dBr -35.75 dBr	n -1.850 dBm	-33.75 dB -33.90 dB	*	L	IF Gain .ow Gain ▶
3	1		926.9 MHz	-22.43 dBm	-1.850 dBm	-20.58 dB	Auto	Man	3	2	3.	613 GHz	-36.07 dBr	n -1.850 dBm	-34.22 dB	=	Auto	Man
4	1		929.9 MHz	-24.86 dBm	-1.850 dBm	-23.01 dB			4	2	5.	626 GHz	-36.12 dBr	n -1.850 dBm	-34.27 dB			
5	1		922.0 MHz	-26.06 dBm	-1.850 dBm	-24.21 dB		More	5	2		635 GHz	-36.16 dBr		-34.31 dB			More
6	1		921.3 MHz 924.1 MHz	-26.31 dBm -27.61 dBm	-1.850 dBm -1.850 dBm	-24.46 dB -25.76 dB		3 of 3	6	2 2		161 GHz 353 GHz	-36.18 dBr		-34.33 dB -34.34 dB			3 of 3
			924.T IVITIZ	-27.01 dBill		;				2	5.	393 GHZ	-36.19 dBr	n -1.850 dBm	-34.34 dB	*		
MSG					1	TATUS L DC Coupled			MSG						STATUS			

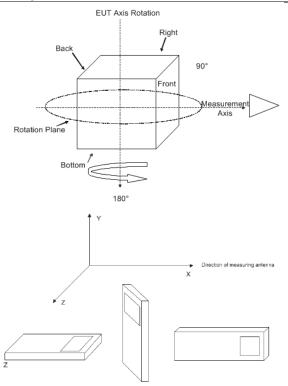
2.7 EUT Positioning Assessment

Test Lab: Electronics Test Centre, Airdrie	EUT: Kona Mega Gateway
Test Personnel:	Standard: FCC PART 15.247
Date:	Basic Standard: ANSI C63.4-2014

Comments: N/A, EUT used in fix position

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.



2.8 Radiated Spurious Emissions within restricted band

Test Lab: Electronics Test Centre, Airdrie

Test Personnel: Janet Mijares

Date: 2022-09-30 (20.6° C,38.1 % RH) 2022-10-03/04 (20.7° C,30.1 % RH) EUT: Kona Mega Gateway Standard: FCC PART 15.247/15.209/15.205 Basic Standard: ANSI C63.10-2013

EUT status: Compliant

Specification: FCC PART 15.247(d)

In any 100kHz 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)).

16.804250 - 16.804750 25.500000 - 25.670000 37.500000 - 38.250000 73.000000 - 74.600000 74.800000 - 75.200000	162.01250 - 167.17000 - 173.20000 - 240.00000 - 285.00000 - 322.00000 - 335.40000 - 399.90000 - 410.00000 -	1660.0000 - 1710.0000 1718.8000 - 1722.2000 2200.0000 - 2300.0000 2310.0000 - 2390.0000 2483.5000 - 2500.0000	3.6000000 - 4.4000000 - 5.1500000 - 5.3500000 - 5.4600000 - 7.2500000 - 7.7500000 - 8.0250000 - 8.5000000 -	14.470000 - 14.500000 - 15.350000 - 16.200000 - 21.400000 - 23.120000 - 23.600000 - 24.000000 -
25.670000 37.500000 - 38.250000 73.000000 - 74.600000 74.800000 - 75.200000	173.20000 - 240.00000 - 285.00000 - 335.40000 - 399.90000 - 410.00000 -	1722.2000 2200.0000 - 2300.0000 2310.0000 - 2390.0000 2483.5000 -	5.1500000 5.3500000 - 5.4600000 7.2500000 - 7.7500000 8.0250000 -	16.200000 17.700000 - 21.400000 22.010000 - 23.120000 23.600000 -
38.250000 73.000000 - 74.600000 74.800000 - 75.200000	285.00000 322.00000 - 335.40000 399.90000 - 410.00000	2300.0000 2310.0000 – 2390.0000 2483.5000 –	5.4600000 7.2500000 - 7.7500000 8.0250000 -	21.400000 22.010000 - 23.120000 23.600000 -
74.600000 74.800000 - 75.200000	335.40000 399.90000 - 410.00000	2390.0000 2483.5000 -	7.7500000 8.0250000 –	23.120000 23.600000 -
75.200000	410.00000			
400.00000				
108.00000 - 121.94000 **	608.00000 - 614.00000	2655.0000 - 2900.0000	9.0000000 - 9.2000000	31.200000 - 31.800000
123.00000 - 138.00000 **	960.00000 – 1240.0000 <mark>***</mark>	32600000 – 3267.0000	9.3000000 - 9.5000000	36.430000 - 36.500000
149.90000 - 150.05000	1300.0000 – 1427.0000 <mark>***</mark>	3332.0000 – 3339.0000	10.600000 – 12.700000	Above 38.600000
156.52475- 156.52525	1435.0000 – 1626.5000	3345.8000 – 3358.0000	13.250000 – 13.400000	
156.70000 - 156.90000	1645.5000 – 1646.5000	3500.0000 – 3600.0000		
	149.90000 - 150.05000 156.52475- 156.52525 156.70000 -	149.90000 - 1300.0000 - 150.05000 1427.0000 *** 156.52475- 1435.0000 - 156.52525 1626.5000 156.70000 - 1645.5000 -	149.90000 - 150.05000 1300.0000 - 1427.0000 3332.0000 - 3339.0000 156.52475- 156.52525 1435.0000 - 1626.5000 3345.8000 - 3358.0000 156.70000 - 1645.5000 - 3500.0000 - 3500.0000 -	149.90000 - 150.05000 1300.0000 - 1427.0000 3332.0000 - 3339.0000 10.600000 - 12.700000 156.52475- 156.52525 1435.0000 - 1626.5000 3345.8000 - 3358.0000 13.250000 - 13.400000 156.70000 - 1645.5000 - 3500.0000 -

Restricted Bands of Operation:

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.

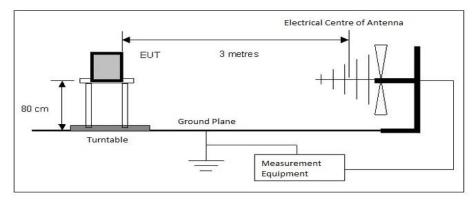
Above 1000 MHz, measurements are performed with a DRG Horn antenna or a Standard Gain horn, and a resolution bandwidth of 1 MHz. The EUT is raised to 150 cm above the ground plane, and the area between the EUT and the antenna mast is covered with RF absorbent material.

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.

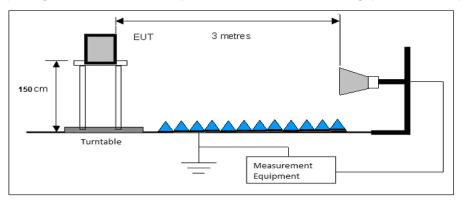
Frequencies having peak emissions within 10dB of the limits are optimized. The EUT is rotated in azimuth over 360 degrees and the direction of maximum emission is noted.

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.

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



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



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	/A
EMI receiver	Agilent	N9038A (FW A.25.05)	6130	2022-07-12	2023-07-12
Loop Antenna (9KHz – 30MHz)	EMCO	6502	10868	2021-05-11	2023-05-11
Biconilog Antenna (30 – 1000 MHz)	AR	JB1	6905	2021-10-29	2023-10-29
DRG Horn (1000 – 18000 MHz)	Tensor	4105	9588	2021-05-10	2023-05-10
Humidity/Temp Logger	Extech Ins. Corp.	42270	5892	2022-04-07	2023-04-07
Pre-Amplifier (30 – 1400 MHz)	HP	8447D	9291	*2022-05-11	2023-05-11
Low Noise Amplifier (1 – 18 GHz)	MITEQ	JS43-01001800-21- 5P	4354	*2022-05-11	2023-05-11
RE Cable below 1GHz	Insulated Wire Inc.	KPS-1501A-3600- KPA-01102006	4419	*2022-05-11	2023-05-11
Re Cable Above 1 GHz	A.H. System Inc.	SAC-26G-8.23	6187	*2022-05-11	2023-05-11
0.9GHz Notch Filter	Microtronics	BRM20784	6947	*2022-05-11	2023-05-11
1.4GHz HPF	K&L	4DH21-R1793/6000-0/0	6952	*2022-05-11	2023-05-11

* In house (Gain/loss) verification Performed.

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. LoRa radio transmitting at low Channel 923.3 MHz

The EUT met the requirements without modification.

2.8.5 Radiated Emissions Data: LoRa DTS with LTE EM7455 Modem

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 μ V + Antenna Factor in dB/m + Gain/Loss Factor in dB = Corrected Field Strength in db μ V/m.

Delta = Field Strength – Limit

Notes:

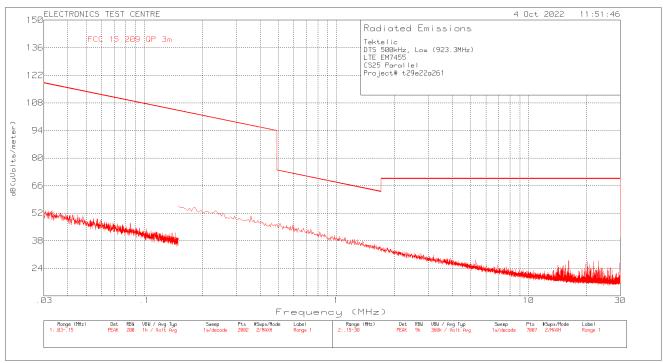
- When a preamp is used, the resulting gain is compensated, producing a negative value for the Cable Loss.
- Measurements reported are the result of adjusting the turntable azimuth and antenna height to obtain the maximum EUT emission. This may produce a different reading than the plot trace. The plot 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 low band channel 923.3 MHz was selected as the worst-case condition for detailed examination.
- In Transmit mode, the EUT was assessed up to 10.0 GHz.

Negative values for Delta indicate compliance.

Freq. Marker	Freq. [MHz]	Raw reading[dBµv]	Det	Antenna Factor [dB/m]	Pre amp Gain/Cable Loss [dB]	Corrected Reading [dBµv/m]	FCC 15.209 Limit [dBµv/m]	Delta [dB]	Azim uth [Deg]	Height [cm]	Polarization
1	23.13	27.54	QP	9.8	1.3	38.64	36.56	-30.92	0	100	Perpendicular
1	*38.07	34.41	QP	19	-24.5	28.91	40.1	-11.09	122	105	Vertical
2	*73.28	41.02	QP	12.1	-23.8	29.32	40.01	-10.68	352	107	Vertical
3	540.16	45.47	PK	22.4	-20.3	48.07	20dBc	82.98dBc	21	105	Vertical
1	1847.0	36.05	AV	27.1	-34.4	28.75	53.98	-25.23	320	319	Horizontal
1	1847.0	45.49	РК	27.1	-34.4	38.19	73.98	-35.79	320	319	Horizontal
2	1847.0	36.81	AV	27.1	-34.4	29.51	53.98	-24.47	3	126	Vertical
2	1847.0	45.23	PK	27.1	-34.4	37.93	73.98	-36.05	3	126	Vertical

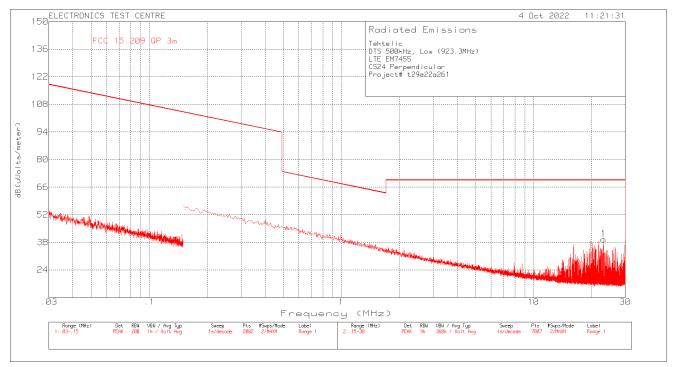
Spurious Emission

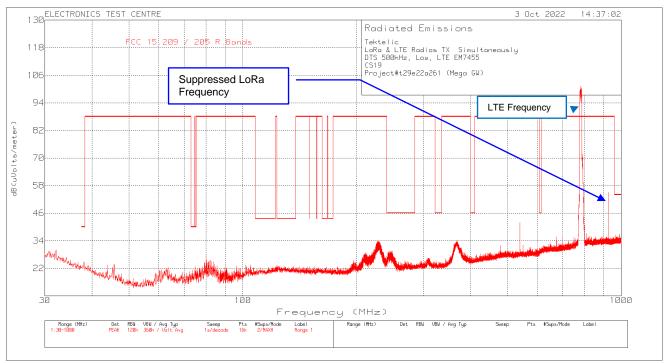
* Restricted Band

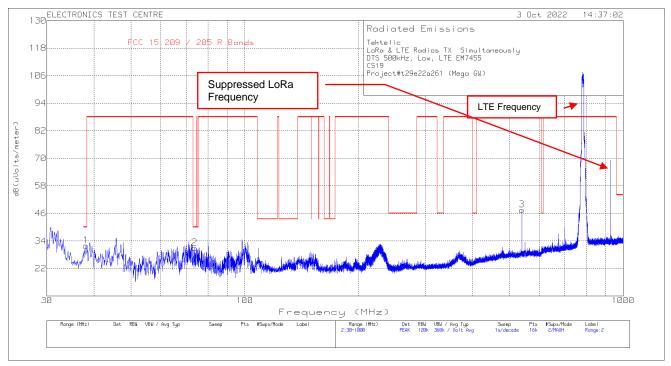


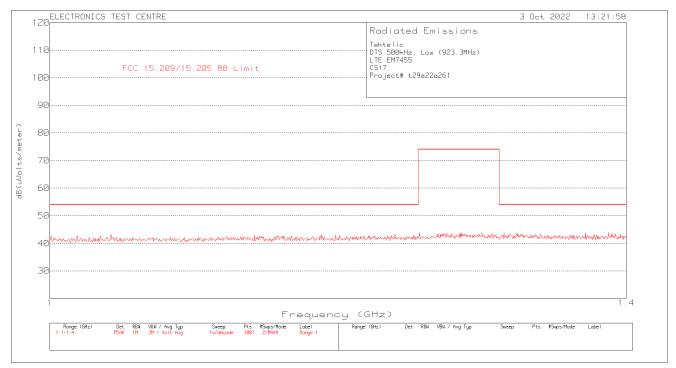
Plot of Radiated Emissions: Measuring Antenna Parallel

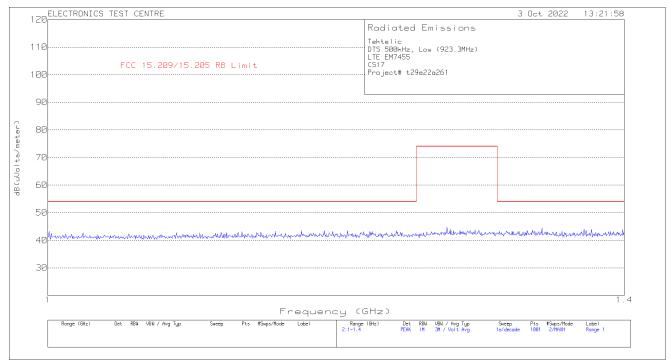
Plot of Radiated Emissions: Measuring Antenna Perpendicular

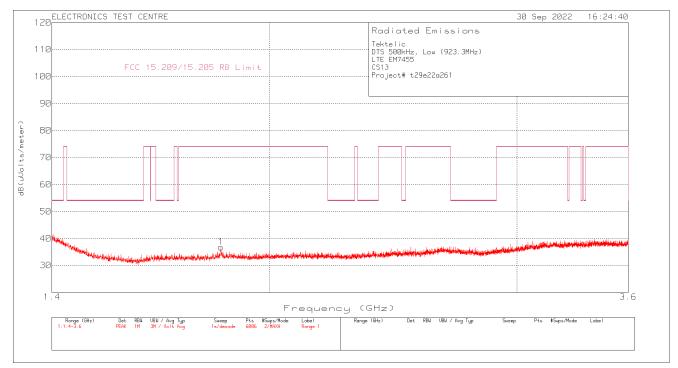


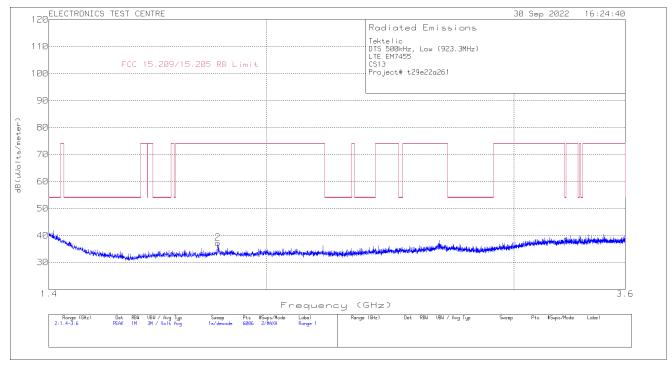




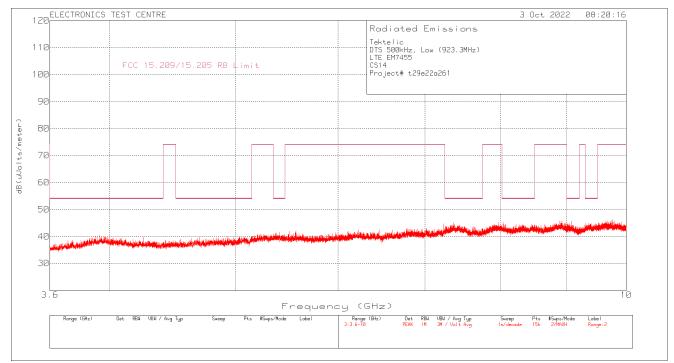


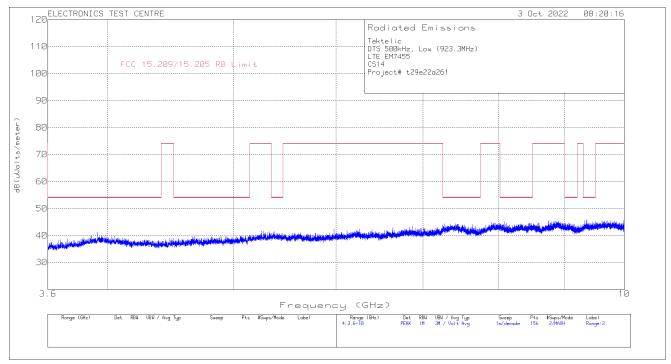












2.9 Radiated Emissions Receive Mode

Test Lab: Electronics Test Centre, Airdrie	EUT: Kona Mega Gateway
Test Personnel: Janet Mijares	Standard: FCC Part 15.109
Date:2022-10-03/20 (20.7°C,30.1% RH)	Basic Standard: ANSI C63.4: 2014
	Class: B

EUT status: Compliant

Frequency (MHz)	FCC Part 15.109 Class B Limit (3m)
30 – 88	40 (dBµV/m)
88 – 216	43.52 (dBµV/m)
216 – 960	46.02 (dBµV/m)
Above 960	53.98 (dBµV/m)

Criteria: The radiated emissions produced by a device, measured at a distance of 3 meters, shall not exceed the limits as specified.

2.9.1 Test Guidance:

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 scan is performed at discreet increments of turntable azimuth and stepped antenna height, with peak detector and Max Hold function 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.

After the pre-scan is completed, the frequencies of interest 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. This may produce a different reading than the pre scan trace. 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.

2.9.2 Deviations From The Standard:

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

2.9.3 Test Equipment

Testing was performed with the following equipment:

Equipment Manufacturer		Model #	Asset #	Calibration Date	Calibration Due	
EMC Software	EMC Software UL		ETC-SW-EMC 2.1	N/A		
EMI receiver	Agilent	N9038A (FW A.25.05)	6130	2022-07-12	2023-07-12	
Biconilog Antenna	SunAR RF Motion;	JB1	6905	2021-10-29	2023-10-29	
DRG Horn	Tensor	4105	9588	2021-05-10	2023-05-10	
T/H Logger	EXTECH Ins.	42270	5892	2022-04-07	2023-04-07	
Pre- Amp	HP	8447D	9291	*2022-05-11	2023-05-11	
Low Noise Amplifier	MITEQ	JS43-01001800- 21-5P	4354	*2022-05-11	2023-05-11	
RE Cable	Insulated Wire Inc.	KPS-1501A-3600- KPA-01102006	4419	*2022-05-11	2023-05-11	

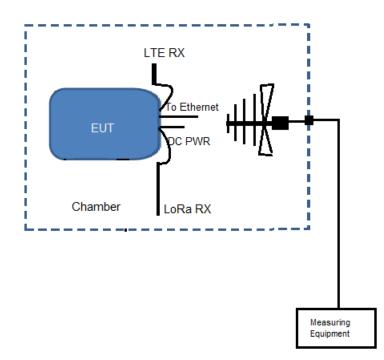
* In house (Gain/loss) verification Performed.

2.9.4 Test Sample Verification, Configuration & Modifications

To cover the unintentional radiated emission. The both radios were configured in receive mode. Unit was placed at the center of turntable in semi-anechoic chamber 80cm above the ground plane and at a distance of 3m from the test receive antenna.

The EUT met the requirements without modification.

EUT configuration for Radiated Emissions testing:



2.9.5 Radiated Emissions Data maximization: with LTE EM7455 Modem

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 μ V + Antenna Factor in dB/m + Gain/Loss Factor in dB = Corrected Field Strength in db μ V/m.

Delta = Field Strength – Limit

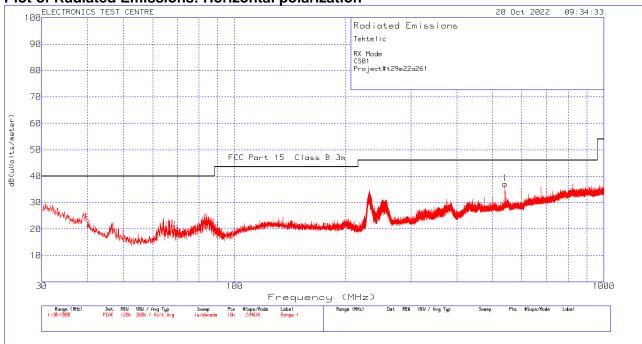
Notes:

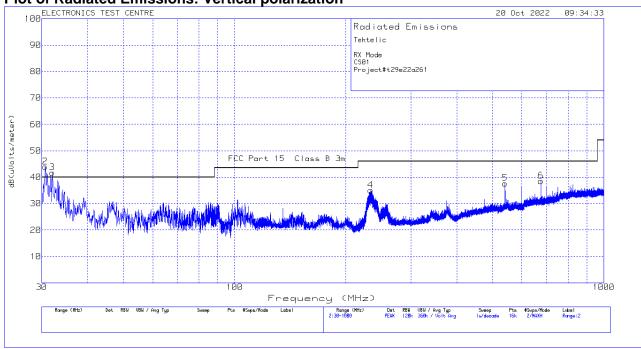
- When a preamp is used, the resulting gain is compensated, producing a negative value for the Cable Loss.
- Measurements reported are the result of adjusting the turntable azimuth and antenna height to obtain the maximum EUT emission. This may produce a different reading than the plot trace. The plot 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.
- In receive mode, the EUT was assessed up to 5.0 GHz.

Negative values for Delta indicate compliance.

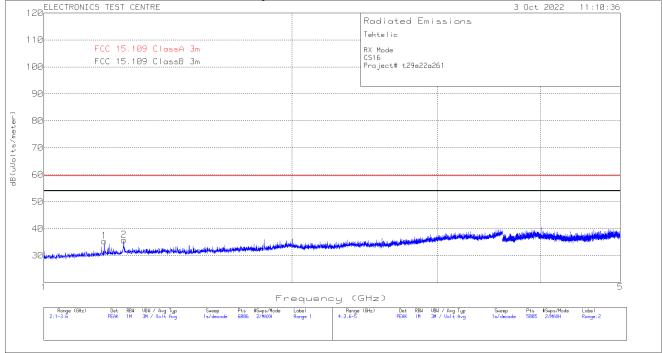
Freq. Marker	Freq. [MHz]	Raw reading [dBµv]	Det	Antenna Factor [dB/m]	Pre amp Gain [dB]	Corrected Reading [dBµv/m]	FCC 15.109 Class B Limit [dBµv/m]	Delta [dB]	Azimuth [Deg]	Height [cm]	Polarization
1	539.9901	32.93	QP	22.4	-20.3	35.03	46.03	-11	230	211	Horizontal
2	30.6822	38.45	QP	24.5	-24.7	38.25	40.01	-1.76	319	101	Vertical
3	32.0772	35.31	QP	23.5	-24.7	34.11	40.01	-5.9	278	106	Vertical
4	234.1495	38.98	QP	15.3	-22.2	32.08	46.03	-13.95	101	116	Vertical
5	540.0108	36.69	QP	22.4	-20.3	38.79	46.03	-7.24	169	213	Vertical
6	674.9997	32.71	QP	23.7	-19.4	37.01	46.03	-9.02	0	179	Vertical
1	1184.1	41.02	AV	24.5	-35.3	30.22	53.98	-23.76	248	109	Vertical
2	1250.0	35.56	AV	24.9	-35.2	25.26	53.98	-28.72	139	260	Vertical

Spurious Emission





120 ELECT	RONICS TEST CENTRE					3 Oct 20	22 11:10:36			
				Radiated Emissions						
110										
	FCC 15.109 ClassA 3			RX Mode	RX Mode					
100	FCC 15.109 ClassB 3	lm		CS16 Project# t29e22	a261					
90										
80										
70										
/0										
60										
50										
40					المراجع المستعمر المحمد الم	ومنابة أيتعاظ أخفته ولاءانه الالاطوريا				
		والاستغادة والمؤجلة أفار وتطرر لاستدر ولأسر أسترو وا	ويستبعده بمعالية المقالية فالمتالية والمتعامين ومعتمدته	بالمطامل مغالا لطافيه ومعرودة المراحد أحداده المعراف			in the state we will be an a state of the st			
30,,,,,,,,,,,,,,,,										
1							5			
		C D) 4C	Frequency			c n 40	s/Mode Label			
1:1-3.ē	e (GHz) Det RBU UBU / Avg Typ 5 PEAK 1M 3M / Volt Avg	Sweep Pts #Swps 1s/decode 6006 2/MA	WH Ronge 1 3	Range (GHz) Det RBU 3.6-5 PEAK IM	UBW / Avg Typ 3M / Volt Avg	Sweep Pts #Swp 1s/decade 5885 2/M	AXH Ronge:2			



2.10 AC Power Line Conducted Emissions Receive Mode

Test Lab: Electronics Test Centre, Airdrie	EUT: Kona Mega Gateway
Test Personnel: Janet Mijares	Standard: FCC 15.107
Date: 2022-10-04 (20.7°C, 30.1% RH)	Basic Standard: ANSI C63.4: 2014
	Class: B

EUT status: Compliant

Specification:

Frequency (MHz)	Quasi-Peak Limit (dBµV)	Average Limit (dBµV)
0.15 – 0.5	66 to 56 *	56 to 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.

Limits decrease linearly with the logarithm of the frequency

2.10.1 Test Guidance

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.

The EUT is powered through a 50 μ H Line Impedance Stabilizing Network (LISN) which is placed 80cm away from the EUT. For tabletop equipment, a vertical ground plane is placed 40cm from the edge of the table. Lastly, the spectrum analyzer is connected to the LISN via armored cable run from the control room to the test chamber. Both the LISN and vertical ground plane are grounded to the reference ground plane on the chamber floor.

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.

2.10.2 Deviations From The Standard

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

2.10.3 Test Equipment

Testing was performed with the following equipment:

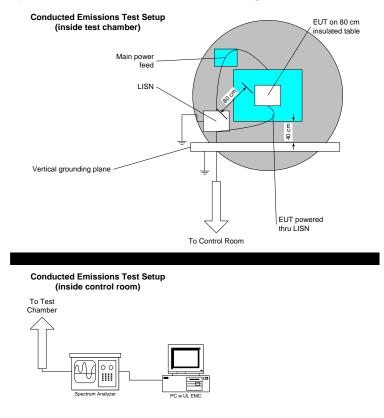
Equipment	Manufacturer	Model #	Asset #	Calibration Date	Calibration Due
EMC Software	UL	Ver. 9.5	ETC-SW-EMC 2.1	N/A	
EMI receiver	Agilent	N9038A FW A.25.05	6130	2022-07-12	2023-07-12
LISN 150kHz to 30MHz	Com-Power	LI-215A	6180	2022-08-09	2024-08-09
T/H Data Logger	Extech Ins.	42270	5892	2022-04-07	2023-04-07

2.10.4 Test Sample Verification, Configuration & Modifications

To cover the unintentional conducted emission. The both radios were configured in receive mode. EUT has option of POE. EUT tested for conducted emission on AC side of POE adaptor model#PD-9501GO-ET/AC and serial#C19026674000302. Customer is not providing POE adaptor with EUT.

The EUT met the requirements without modification.

Diagram of setup for Conducted Emissions testing:



2.10.5 Conducted Emissions Data

The emissions data is presented in tabular form, showing the uncorrected spectrum analyzer reading, the correction factors applied, the net result, the value(s) of limit at the frequency measured, and the Delta between the result and the limit.

Freq. Marker	Freq. (MHz)	Raw reading (dBµv)	Det.	LISN Factor (dB/m)	Cable Loss (dB)	Corrected Reading (dBµV)	FCC 107 Limit (dBµV)	Delta (dB)	L/N
1	.16118	36.73	LnAv	.1	9.8	46.63	55.4	-8.77	Line
2	.51162	27.86	LnAv	0	9.8	37.66	46	-8.34	Line
3	4.85472	18.46	LnAv	0	10	28.46	46	-17.54	Line
4	13.47756	18.03	LnAv	0	10.4	28.43	50	-21.57	Line
1	.16491	35.51	LnAv	.1	9.8	45.41	55.21	-9.8	Neutral
2	.50043	28.87	LnAv	0	9.8	38.67	46	-7.33	Neutral
3	4.8249	23.7	LnAv	0	10	33.7	46	-12.3	Neutral
4	13.41418	18.76	LnAv	0	10.4	29.16	50	-20.84	Neutral

EUT with LTE EM7455

Meter Reading in dB_µV + LISN Factor in dB + Gain/Loss Factor in dB = Corrected Emission Strength in dB_µV.

Notes:

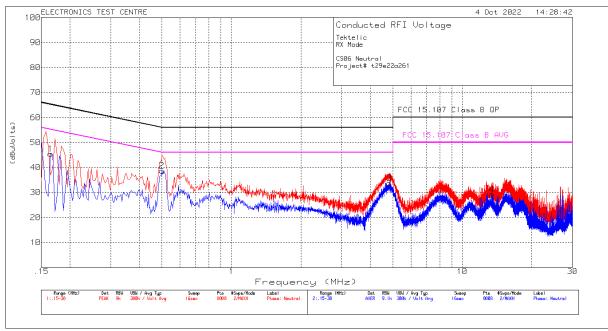
- When a preamp is used, the resulting gain is compensated, producing a negative value for the Cable Loss.
- LnAv = Linear Average detector

Negative values for Delta indicate compliance.

100 4 Oct 2022 14:25:06 Conducted RFI Voltage Tektelic RX Mode 90 CS05 Line Project# t29e22a261 80 70 FCC 15.107 Class B QP 60 (dBuUo I ts) B AUG 50 40 36 28 10 Frequency (MHz) Pts #Swps/Mode Label 8888 2/MAXH Phose:Line Range (NHz) 2:.15-38 Det RBW VBW / Avg Typ PEAK 9k 30Bk / Volt Avg Det RBN UBW / Avg Typ AUER 9.1k 380k / Ubit Avg Pts #Swps/Mode 2008 2/MAXH Ronge (MHz) 1:.15-30 Sweep Itisec Sweep 16eec Lobel Phase: Line

EUT with LTE EM7455 Plot of Conducted Emissions: LINE

Plot of Conducted Emissions: Neutral



2.11 RF Exposure

Test Lab: Electronics Test Centre, Airdrie

Test Personnel:

EUT: Kona Mega Gateway Standard: FCC PART 15.247

Date:

EUT status: Compliant

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

3.0 TEST FACILITY

3.1 Location

The Kona Mega 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 Mega Gateway was placed at the center of the test chamber turntable on top of an 80-cm high polystyrene foam table below 1GHz and at 1.5m high polystyrene foam table above 1 GHz in TX Mode. The EUT was grounded according to Tektelic Communication Inc. specifications. Enclosure is connected to ground.

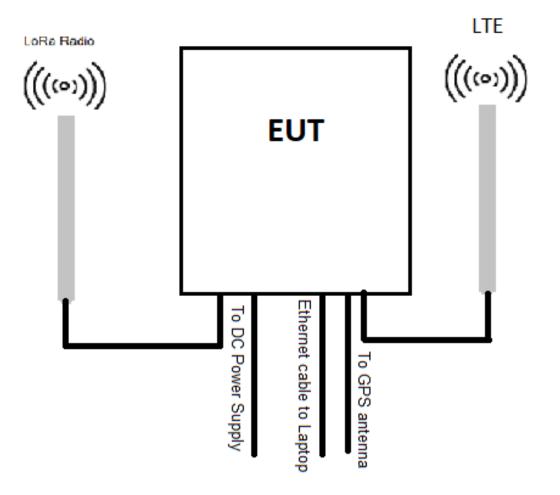
3.3 Power Supply

All EUT power was supplied by an external DC power supply.

Appendix A – EUT Family Information

Product Number	1X LoRa ANT	2X LoRa ANT	LTE Modem
T0004978	x		
T0004982		Х	
T0004988	х		
T0004992		Х	
T0004996	х		
T0005000		Х	
T0005004	х		
T0005006	х		х
T0005008		Х	
T0005010		Х	х

Appendix B – Test Setup Block Diagram



End of Document

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