



Test Report Prepared By:

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

FCC ID: 2ALEPT0007805

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Prepared for:

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REVISION RECORD

ISSUE	DATE	AUTHOR	REVISIONS
DRAFT 1	2022-03-08	I. Akram	Initial draft submitted for review.
Release1	2022-03-29	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. Breeze-V 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:			Breeze-V
Frequency Range		nge	903 – 914.2 MHz
	Type of Modu	lation	LoRa 500KHz DTS
DIE	Frequency Ra	nge	2400 – 2483.5 MHz
DLC	Type of Modu	lation	2402 – 2480 MHz
LoRa		LoRa	Ignion (Fractus Antennas S.L), RUN mXTENDTM (NN02-224) Peak Gain = 2.1 dBi, Chip Antenna
Associated An	tennas	BLE	Pulse Engineering, W3008, Gain=1.1 dBi, Chip Antenna
Model# / Serial#			T0007806 / 2210K0004
Variant Name / Model#			Breeze / T0007838, Vivid+ / T0007848
Power supply	/:		Battery Powered

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

This Breeze-V model contains all of the equipment options in this family of products. This model represents model number Breeze (T0007838) and Vivid+ (T0007848). This model was chosen as a worst-case condition for emission testing. Both T0007806/2210K0004 and T0007806/2210K0003 (Crystal/TCXO) tested for emission profile and found no difference in emission.

Detail differences between the models are given in Breeze-V 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. 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	Breeze-V	none	see § 2.1	Compliant
2.2	6dB Bandwidth	15.247(a)	Breeze-V	none	see § 2.2	Compliant
2.3	Max Output Power	15.247(d)	Breeze-V	none	see § 2.3	Compliant
2.4	Power Spectral Density	15.247(e)	Breeze-V	none	see § 2.4	Compliant
2.5	Band Edge	15.247(d)	Breeze-V	none	see § 2.5	Compliant
2.6	Conducted Spurious Emission (Non-Restricted Band)	15.247(d)	Breeze-V	none	see § 2.6	Compliant
2.7	EUT Position	ANSI C63.4	Breeze-V	none	see § 2.7	assed
2.8	Radiated Spurious Emission (Restricted Band)	15.205, 15.209 15.247(d)	Breeze-V	none	see § 2.8	Compliant
2.9	RF Exposure	15.247(i)	Breeze-V	none	see § 2.9	Compliant

Refer to the test data for applicable test conditions.

2.1 AC Power Line Conducted Emissions: Transmit Mode N/A

Test Lab: Electronics Test Centre, Airdrie

EUT: Breeze-V Standard: FCC Part 15.207 Basic Standard: ANSI C63.10: 2013

EUT status: N/A

Comments: EUT is internal Battery Powered. No Direct or indirect Connection to AC main.

2.2 6dB Bandwidth

Test Lab: Electronics Test Centre, Airdrie

Test Personnel: Imran Akram

Date: 2022-03-08 (20.7°C,14.2% RH)

EUT: Breeze-V

Standard: FCC PART 15.247

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	2021-06-18	2022-06-18
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	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]	6 dB BW [kHz]	Limit BW [KHz]
	Low	903	643.5	
LoRa 500 KHz	Mid	907.8	648.6	≥ 500
	High	914.2	648.2	

Screen Captures from the spectrum analyzer: Low Channel



Keysight Spectrum Analyzer - Occupied BV	N N	, , , , , , , , , ,			-		X
X RF 50 Ω AC x dB -6.00 dB	#IFGain:Low #Atte	SENSE:INT Pr Freq: 907.800000 MHz Free Run Avg Ho n: 40 dB	ALIGN AUTO	05:30:07 AM Radio Std: Radio Devi	Mar08, 2022 None	Trac	e/Detector
10 dB/div Ref 40.40 dBr	n						
30.4 20.4						c	Clear Write
10.4 0.400							Averoge
-9.60			harden	- Calon Marca		_	Average
-49.6							Max Hold
Center 907.800 MHz #Res BW 100 kHz		∜VBW 300 kHz		Span 2. Swe	.000 MHz ep 1 ms		Min Hold
Occupied Bandwidt	h	Total Power	21.8	dBm		_	_
7	12.57 kHz						Detector Peak▶
Transmit Freq Error	-12.468 kHz 648 6 kHz	% of OBW Pov x dB	ver 99 -6	.00 % 00 dB		Auto	Man
	040.0 KHZ						
MSG			STATUS	3			

Screen Captures from the spectrum analyzer: MID Channel

Screen Captures from the spectrum analyzer: High Channel

March Align Autor Align Autor Bit Sign 2: Align Autor Trace/Detector Center Freq 914.200000 MHz Image: Free Run Avg Hold:>60/0 Radio Std: None Radio Std: None 10 dB/div Ref 40.40 dBm Image: Free Run Avg Hold:>60/0 Radio Device: BTS Clear Write 10 dB/div Ref 40.40 dBm Image: Run Avg Hold:>60/0 Radio Device: BTS Clear Write 10 dB/div Ref 40.40 dBm Image: Run Avg Hold:>60/0 Radio Device: BTS Clear Write 10 dB/div Ref 40.40 dBm Image: Run Image: Run Avg Hold:>60/0 Radio Device: BTS 10 dB/div Ref 40.40 dBm Image: Run Image: Run Image: Run Image: Run Image: Run 10 dB/div Ref 40.40 dBm Image: Run Image: Run Image: Run Image: Run Image: Run 10 dB/div Ref 40.40 dBm Image: Run	Keysight Spectrum Analyz	zer - Occupied BW							ə 💌
Center Freq 914.200000 MHz Radio Std: None #FGain:Low #FGain:Low Avg Hold:>50/0 Radio Std: None Ra	LXI RF	50 Ω AC		SENSE:INT	ALIGN AUTO	05:38:59 AM	1 Mar 08, 2022	Trace/Dete	etor
Ing. rree kin Avginoid. source Radio Device: BTS 10 dB/d/v Ref 40.40 dBm Log 10 dB/d/v Ref 40.40 dBm Clear Write Average Max Hold Max Hold Max Hold Max Hold Min Hold Occupied Bandwidth Transmit Freq Error -6.485 kHz % of OBW Power 99.00 % x dB Bandwidth 648.2 kHz x dB -6.00 dB Max	Center Freq 914	.200000 MHz	Cente	r Freq: 914.200000 N	Hz	Radio Std:	None		CLOI
10 dB/div Ref 40.40 dBm 20 d		#IEG	aind ow #Atter	n:40 dB	g Hold:>50/50	Radio Devi	ce: BTS		
10 dB/div Ref 40.40 dBm Clear Write Clear Write Clear Write Average Max Hold Center 914.200 MHz #Res BW 100 kHz Transmit Freq Error x dB Bandwidth 648.2 kHz x dB Composition Clear Write Clear Write Clear Write Clear Write Average Max Hold Detector Peak Auto Man Man Composition Clear Write Average Max Hold Max Hold M		#1FG	ain:Low #7	1. 40 0.0		Rudio Berr	Ce. Dito		
10 dB/div Ref 40.40 dBm 204 204 204 204 204 204 204 204									
Log 304 204 204 204 204 204 204 204 2	10 dB/div Ref	40.40 dBm							
30.4 20.4	Log								
20.4 Image: Content of the second secon	30.4							Clean	
10.4 Average 39.6 Average 39.6 Max Hold 49.6 Max Hold Center 914.200 MHz #VBW 300 kHz Span 2.000 MHz #Res BW 100 kHz #VBW 300 kHz Sweep 1 ms Occupied Bandwidth Total Power 21.6 dBm Transmit Freq Error -6.485 kHz % of OBW Power 99.00 % x dB Bandwidth 648.2 kHz x dB -6.00 dB	20.4							Clear	Write
10.4 Average 19.6 Average 19.7 Max Hold 10.7 KHz #VBW 300 kHz Span 2.000 MHz Sweep 1 ms Min Hold Occupied Bandwidth Total Power 21.6 dBm Detector Peak ▶ Auto Man Man VB Bandwidth 648.2 kHz x dB 40.0 Auto Man Man									
3400 Average 950 Average 195 Max Hold 295 Span 2.000 MHz 950 Span 2.000 MHz #Res BW 100 kHz #VBW 300 kHz Span 2.000 MHz Max Hold Occupied Bandwidth Total Power 21.6 dBm 701.70 kHz % of OBW Power 99.00 % x dB Bandwidth 648.2 kHz x dB -6.00 dB	10.4								
Average Average Max Hold Max Hold Center 914.200 MHz #Res BW 100 kHz #Res BW 100 kHz Transmit Freq Error x dB Bandwidth 648.2 kHz x dB Center 914.200 MHz #VBW 300 kHz Span 2.000 MHz Span 2.000 MHz Span 2.000 MHz Sweep 1 ms Min Hold Detector Peak Auto Max Max Hold Max Hold	3.400								
19.6 19.6 19.6 10.0	-9.60							Av	erage
136 236 236 236 336 336 496 Span 2.000 MHz Center 914.200 MHz #VBW 300 kHz Span 2.000 MHz Max Hold Min Hold Min Hold Occupied Bandwidth Total Power 21.6 dBm 701.70 kHz Detector Transmit Freq Error -6.485 kHz % of OBW Power 99.00 % x dB Bandwidth 648.2 kHz x dB -6.00 dB Man					- North				
236 336	-19.6	and the second s				4.			-
336 Max Hold 436 Span 2.000 MHz Center 914.200 MHz #VBW 300 kHz Span 2.000 MHz Min Hold Occupied Bandwidth Total Power 21.6 dBm Detector Peak▶ Transmit Freq Error -6.485 kHz % of OBW Power 99.00 % x dB Bandwidth 648.2 kHz x dB 0 -6.00 dB Total	-29.6	~~				Mr. Som	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		
496 Imax nord Center 914.200 MHz #VBW 300 kHz Span 2.000 MHz #Res BW 100 kHz #VBW 300 kHz Sweep 1 ms Occupied Bandwidth Total Power 21.6 dBm Transmit Freq Error -6.485 kHz % of OBW Power 99.00 % x dB Bandwidth 648.2 kHz x dB -6.00 dB	-39.6		<u>مساوماً ا</u>					Max	Held
436 Center 914.200 MHz Span 2.000 MHz #Res BW 100 kHz #VBW 300 kHz Span 2.000 MHz Min Hold Total Power 21.6 dBm Occupied Bandwidth Total Power 21.6 dBm Transmit Freq Error -6.485 kHz % of OBW Power 99.00 % x dB Bandwidth 648.2 kHz x dB -6.00 dB								Wa	CHOIG
Center 914.200 MHz #VBW 300 kHz Span 2.000 MHz #Res BW 100 kHz #VBW 300 kHz Sweep 1 ms Occupied Bandwidth Total Power 21.6 dBm 701.70 kHz Detector Transmit Freq Error -6.485 kHz % of OBW Power 99.00 % x dB Bandwidth 648.2 kHz x dB -6.00 dB	-49.6							_	_
Center 914.200 MHZ Span 2.000 MHZ #Res BW 100 kHz #VBW 300 kHz Sweep 1 ms Occupied Bandwidth Total Power 21.6 dBm 701.70 kHz Detector Transmit Freq Error -6.485 kHz % of OBW Power 99.00 % x dB Bandwidth 648.2 kHz x dB -6.00 dB Man	Contor 014 200 M					Chap 2			
#Res BW 100 KH2 #VBW 300 KH2 Sweep This Occupied Bandwidth Total Power 21.6 dBm 701.70 kHz Detector Transmit Freq Error -6.485 kHz % of OBW Power 99.00 % x dB Bandwidth 648.2 kHz x dB -6.00 dB	#Boo BW 100 kH			N/BM 200 KHz		Sparrz.	on 1 mo		
Occupied Bandwidth Total Power 21.6 dBm 701.70 kHz Detector Transmit Freq Error -6.485 kHz % of OBW Power 99.00 % x dB Bandwidth 648.2 kHz x dB -6.00 dB	#Res BW 100 KH	Z	#	VEW JUUKHZ		Swe	ep 1 ms	Mir	1 Hold
Occupied Bandwidth Total Power 21.6 dBm 701.70 kHz Detector Transmit Freq Error -6.485 kHz % of OBW Power 99.00 % x dB Bandwidth 648.2 kHz x dB -6.00 dB				Total Dawa		d Day			
Transmit Freq Error -6.485 kHz % of OBW Power 99.00 % x dB Bandwidth 648.2 kHz x dB -6.00 dB	Occupied B	andwidth		Total Powe	r 21.0	dBm			
Transmit Freq Error -6.485 kHz % of OBW Power 99.00 % x dB Bandwidth 648.2 kHz x dB -6.00 dB		701	70 kHz					De	tector
Transmit Freq Error -6.485 kHz % of OBW Power 99.00 % Auto Man x dB Bandwidth 648.2 kHz x dB -6.00 dB Image: Comparison of the second seco		101.						20	Peak▶
x dB Bandwidth 648.2 kHz x dB -6.00 dB	Transmit Free	Error	-6 485 kHz	% of OBW	Power 99	00 %		Auto	Man
x dB Bandwidth 648.2 kHz x dB -6.00 dB			-0.400 MILE						
	x dB Bandwid	lth	648.2 kHz	x dB	-6.	00 dB			
MSG STATUS	MSG				STATU	s			

2.2.6 Channel Occupied Bandwidth Data: BLE

Mode of operation	Channel	Freq. [MHz]	6 dB BW [kHz]	Limit BW [KHz]
	Low	2402	669.9	
BLE	Mid	2440	668.4	≥ 500
	High	2480	669.4	

Screen Captures from the spectrum analyzer: Low Channel

Keysight Spectrum Analyzer - Occupied BW	1				
N RF 50 Ω AC Spap 3 0000 MHz	Center	Freg: 2.402000000 GHz	ALIGN AUTO	07:48:03 AM Mar 08, 2022 adio Std: None	Trace/Detector
	Trig: F	ree Run Avg Hold	d:>50/50	adia Daviasi RTS	
	#IFGain:Low #Atten	. 10 08	ĸ	adio Device: BTS	
10 dB/div Ref 20.40 dBm					
10.4					Clear Write
J.400					Clear write
-9.60					
-19.6			\leftarrow		
-29.6					Average
-39.6					
-49.6					
-59.6					Max Hold
-69.6					
Contor 2 402000 CHz				Spop 2 000 MHz	
#Res BW 100 kHz	#\	/BW 300 kHz		Sweep 1 ms	Min Hold
					Min Hold
Occupied Bandwidt	h	Total Power	6.63 d	Bm	
1.0	0697 MHz				Detector
				o 0/	Peak►
I ransmit Freq Error	14.664 KHZ	% of OBW Pow	er 99.0	0 %	Auto <u>Man</u>
x dB Bandwidth	669.9 kHz	x dB	-6.00	dB	
MSG			STATUS		

screen (Japtures	from the sp	ectrum ana	iyzer: wiii	D Channe	<u> </u>	
Keysight Spect	trum Analyzer - Occupi	ed BW					
<mark>w</mark> x dB -6.00	RF 50 Ω A	AC	SENSE:INT Center Freq: 2.44000	ALIGN A	AUTO 08:20:21 A Radio Std	M Mar 08, 2022 None	Meas Setup
		#IFGain:Low	#Atten: 10 dB	Avg Hold.>50/5	Radio Dev	ice: BTS	Avg/Hold Num
10 dB/div	Ref Offset 20 Ref 19.00 (.6 dB IBm					50 <u>On</u> Off
9.00 -1.00							Avg Mode Exp Repeat
-11.0							
-31.0	and the second s					and the second	
-51.0							% of OBW Power 99.00 %
Center 2.4 #Res BW	40000 GHz 100 kHz		#VBW 300 k	Hz	Span 3 Swe	.000 MHz ep 1 ms	PowerRef
Occup	ied Bandw	idth	Total P	ower	6.61 dBm		Total Power
Transm	it Freq Error	1.0540 MH 10.207 ki	IZ Hz % of OE	3W Power	99.00 %		x dB -6.00 dB
x dB Ba	ndwidth	668.4 k	Hz x dB		-6.00 dB		More 1 of 2
				i.	CTATUS		
Mod					514105		

Screen Captures from the spectrum analyzer: MID Channel

Screen Captures from the spectrum analyzer: High Channel

X RF 50 Ω AC SENSE:INT ALIGN AUTO 08:36:05 AM Mar 08, 2022	Trace/Detector
Center Freq 2.480000000 GHz Center Freq: 2.48000000 GHz Radio Std: None	The comb of control
#FGain:Low #Atten: 6 dB Radio Device: BTS	
10 dB/div Ref 19.00 dBm	
am	
	Clear Write
-21.0	
	Average
-61.0	Max Hold
-71.0	
Center 2.480000 GHz Span 3.000 MHz	
#Res BW 100 kHz #VBW 300 kHz Sweep 1 ms	Min Hold
Occupied Bandwidth Total Power 8.05 dBm	
1 0478 MHz	Detector
	Peak▶
Transmit Freq Error 7.574 kHz % of OBW Power 99.00 %	to <u>Man</u>
y dB Bandwidth 660.4 kHz y dB -6.00 dB	
MSG	

EUT: Breeze-V

2.3 Max Average Output Power

Test Lab: Electronics Test Centre, Airdrie

Test Personnel: : Imran Akram

Standard: FCC PART 15.247 Basic Standard: ANSI C63.10: 2013 FCC OET KDB 558074

Date: 2022-03-08 (20.7°C,14.2% RH)

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 Power 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	2021-06-18	2022-06-18
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	e 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

Mode of Operation	Channel	Freq. [MHz]	Out Put Power (dBm)	Out Put Power Limit (dBm
	Low	903	13.94	30
LoRa 500 KHz	Mid	907.8	14.03	30
	High	914.2	14.11	30

Screen Captures from the spectrum analyzer Low Channel







Screen Captures from the spectrum analyzer: High Channel

Keysight Spectrum Analyzer - Channel Pow	rer							
LX RF 50 Ω AC		SENSE:INT	ALI	IGN AUTO	05:42:35 A	M Mar 08, 2022	Me	as Setun
Integration BW 701.70 kH	Z	Center Freq: 914.200	000 MHz	500/500	Radio Std	None	inc	as octup
	#IEGain:Low	#Atten: 40 dB	Avginola.24	500/500	Radio Dev	ice: BTS	Ava	Hold Num
	an duniedw							500
							<u>On</u>	Off
10 dB/div Ref 20.00 dBn	<u>1</u>							
Log								
10.0								AvgMode
0.00		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		_			Exp	Repeat
-10.0				\rightarrow				
-20.0				1				
				1				Integ BW
-30.0				~~~				701.70 kHz
-40.0				\	\sim			
-50.0						~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		
-60.0								
-70.0								
-10.0								
Center 914.2000 MHz					Span 1	.053 MHz		
Res BW 10 kHz		VBW 100 kH	Iz		Sweep	12.6 ms		
Channel Bower		Douvor	Spectrol	Dana				
Channel Power		Power	Spectral	Dens	lly			
								ast Tuning
14.11 dBm	/ 701.7 kHz	_(44.35 c	lBm	/Hz		Auto	Man
							71010	
								More
								1 of 2
							_	
MSG				STATUS				

Mode of Operation	Channel	Freq. [MHz]	AV Output Power (dBm)	Duty Cycle Factor (dB)	Corrected AV output Power (dBm)	Out Put Power Limit (dBm
	Low	2402	-1.89	1.78	-0.11	30
BLE	Mid	2440	-2.09	1.79	-0.29	30
	High	2480	-2.03	1.79	-0.24	30

2.3.6 Max Average Output Power Data: BLE

BLE transmitting duty cycle < 98%. Method AVGSA-2 uses trace averaging across ON and OFF times of the EUT transmissions, followed by duty cycle correction is used. The procedure for this method is as follows:

Output Power Method AVGSA-2 For BLE			
Measure the duty of	cycle D of the transmitter output signal		
Span	≥ 1.5 times the OBW		
RBW	$1 - 5$ % of the OBW, ≤ 1 MHz		
VBW	≥ 3 x RBW		
Number of Points in sweep	\geq [2 x Span / RBW]. (This gives bin-to-bin spacing \leq RBW / 2, so that narrowband signals are not lost between frequency bins.)		
Sweep time	Auto		
Detector	RMS (Power Averaging)		
Sweep trigger	Free Run		
Trace Average	≥ 100 traces in power Averaging (RMS)		
Power measured	Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function with band limits set equal to the OBW band edges. If the instrument does not have a band power function, then sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.		
Duty Cycle Correction Factor	Add [10 log (1 / D)], where D is the duty cycle, to the measured power to compute the average power during the actual transmission times (because the measurement represents an average over both the ON and OFF times of the transmission). For example, add [10 log (1/0.25)] = 6 dB if the duty cycle is 25%.		

Duty Cycle (D) for Low Channel:



On Time = 417.6 µs

Time Period = 628.8 µs

Duty Cycle (D) = ON Time / Time Period = $[(417.6 \ \mu s / 628.8 \ \mu s)] \times 100 = 66.41\%$ Duty Cycle Correction Factor = 10 log (1 / D) = 10log (1/0.6641) = 1.78 dB



Screen Captures from the spectrum analyzer Low Channel

Duty Cycle (D) for MID Channel:



On Time = 412.8 µs

Time Period = $624.0 \ \mu s$

Duty Cycle (D) = ON Time / Time Period = $[(412.8 \ \mu s / 624.0 \ \mu s)] \times 100 = 66.15\%$ Duty Cycle Correction Factor = 10 log (1 / D) = 10log (1/0.6615) = 1.79 dB



Screen Captures from the spectrum analyzer MID Channel

Duty Cycle (D) for High Channel:



On Time = 412.8 µs

Time Period = $624.0 \ \mu s$

Duty Cycle (D) = ON Time / Time Period = $[(412.8 \ \mu s / 624.0 \ \mu s)] \times 100 = 66.15\%$ Duty Cycle Correction Factor = 10 log (1 / D) = 10log (1/0.6615) = 1.79 dB



Screen Captures from the spectrum analyzer High Channel

2.4 **Power Spectral Density**

Test Lab: Electronics Test Centre, Airdrie

Test Personnel: : Imran Akram

EUT: Breeze-V Standard: FCC PART 15.247 Basic Standard: ANSI C63.10: 2013

Date: 2022-03-08 (20.7°C,14.2% RH)

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.

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).				

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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
EMI receiver	Agilent	N9038A (FW A.25.05)	6130	2021-06-18	2022-06-18
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	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. [MHz]	PSD (dBm)	PSD Limit (dBm
LoRa 500 KHz	Low	903	-6.130	8
	Mid	907.8	-4.249	8
	High	914.2	-5.942	8

Keysight Spectrum Analyzer - Swept SA 05:03:34 AM Mar 08, 2022 IGN AUTO Peak Search Avg Type: RMS Avg|Hold:>500/500 TRACE 1 2 3 4 5 6 TYPE A WWWW DET A NNNN Marker 1 902.754700000 MHz Trig: Free Run #Atten: 40 dB PNO: Wide C Next Peak Mkr1 902.754 70 MHz -6.130 dBm Ref Offset 20.4 dB Ref 19.40 dBm 10 dB/div Log Next Pk Right ۵ Next Pk Left Marker Delta Center 903.0000 MHz #Res BW 3.0 kHz Span 1.100 MHz Sweep 149.9 ms (2001 pts) #VBW 10 kHz* Mkr→CF FUNCTION FUNCTION WIDTH FUNCTION VALUE 1 f 902.754 70 MHz -6.130 dBm Mkr→RefLvl 1 5 6 8 More 1 of 2 10 STATUS

Screen Capture from Spectrum Analyzer: Low Channel

Screen Capture from Spectrum Analyzer: MID Channel

Comparison Comparison <th>Keysight Spectrum Analyzer - Swept SA</th> <th></th> <th></th> <th></th> <th></th>	Keysight Spectrum Analyzer - Swept SA				
Ref Offset 20.4 dB Mkr1 907.750 50 MHz Next Peak 9.40 -4.249 dBm -4.249 dBm Next Pk Right 106 -4.249 dBm -4.249 dBm Next Pk Left 106 -4.249 dBm -4.249 dBm Next Pk Left 107 -4.249 dBm -4.249 dBm -4.249 dBm 11 -4.249 dBm -4.249 dBm -4.249 dBm 12 -4.249 dBm -4.249 dBm -4.249 dBm 11 -4.249	Marker 1 907.750500000 Γ	SENSE:II PNO: Wide Trig: Free Ru JEGain: Jow #Atten: 40 dB	ALIGN AUTO Avg Type: RMS Avg Hold:>500/500	05:33:07 AM Mar 08, 2022 TRACE 1 2 3 4 5 6 TYPE A WWWW DET A NNNNN	Peak Search
0.60 1	Ref Offset 20.4 dB		Mkr1 9	07.750 50 MHz -4.249 dBm	NextPeak
-10.6 -0.6	9.40 -0.60	<u>1</u>			Next Pk Right
40.8 40.8 40.4	-10.6				Next Pk Left
-70.6 Center 907.8000 MHz Span 1.100 MHz #Res BW 3.0 kHz #VBW 10 kHz* Sweep 149.9 ms (2001 pts) MkR MODE TRC SCL X Y POTO F TRC SCL X POTO F TRC SC	-40.6 -50.6 -60.6			When when a ward when a war	Marker Delta
MKR MODE TO KIL Control 1 N 1 f 907.750 50 MHz -4.249 dBm 2 3 - - - 4 - - - - 5 - - - - 6 - - - - 9 - - - - 10 - - - - 10 - - - - 10 - - - - 10 - - - - 10 - - - -	-70.6 Center 907.8000 MHz #Res BW 3.0 kHz	#VBW 10 kHz*	Sween 1	Span 1.100 MHz	Mkr→CF
2 3 4 5 6 7 6 6 6 6 6 6 6 6 6 6 6 6 7 6 7 6 7 6 7 7 6 7 </th <th>MKR MODE TRC SCL X 1 N 1 f 907.75</th> <th>50 50 MHz -4.249 dBm</th> <th>FUNCTION FUNCTION WIDTH</th> <th>FUNCTION VALUE</th> <th></th>	MKR MODE TRC SCL X 1 N 1 f 907.75	50 50 MHz -4.249 dBm	FUNCTION FUNCTION WIDTH	FUNCTION VALUE	
7 8 10 <td< td=""><th>2 3 4 5</th><td></td><td></td><td>E</td><td>Mkr→RefLvl</td></td<>	2 3 4 5			E	Mkr→RefLvl
11	7 8 9 10				More 1 of 2
	11	m	STATUS	• •	



Screen Capture from Spectrum Analyzer: High Channel

2.4.6 Average PSD Data BLE

BLE duty cycle is \leq 98%. The following procedure is applicable when the EUT cannot be configured to transmit continuously (i.e.,D < 98%), when sweep triggering/signal gating cannot be used to measure only when the EUT is transmitting at its maximum power control level, and when the transmission duty cycle is constant (i.e., duty cycle variations are less than ±2%):

Outpu	Output Power Method AVGPSD-2 For BLE									
Measure the duty cycle (D)	of the transmitter output signal.									
Set instrument center freque	ency to DTS channel center frequency.									
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									
Trace Average	Minimum 100 traces in power Averaging (RMS)									
PSD measured	Use the peak marker function to determine the maximum amplitude level.									
Duty Cycle Factor	Add [10 log (1 / D)], where D is the duty cycle measured in step a), to the measured PSD to compute the average PSD during the actual transmission time.									
If measured value exceeds requirement specified by regulatory agency, 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)										

Mode of operation	Channel	Freq. [MHz]	PSD (dBm)	Duty Cycle Factor (dB)	Corrected PSD (dBm)	PSD Limit (dBm
BLE	Low	2402	-19.302	1.78	-17.522	8
	Mid	2440	-20.169	1.79	-18.379	8
	High	2480	-19.754	1.79	-17.964	8



Screen Capture from Spectrum Analyzer: Low Channel

Screen Capture from Spectrum Analyzer: MID Channel



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Screen Capture from Spectrum Analyzer: High Channel

2.5 Band Edge Attenuation

Test Lab: Electronics Test Centre, Airdrie

Test Personnel: Imran Akram

EUT: Breeze-V

Standard: FCC PART 15.247

Basic Standard: ANSI C63.10: 2013

Date: 2022-03-08 (20.7°C,14.2% 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 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 #	Cal. Date	Cal. Due	
EMI receiver	Agilent	N9038A (FW A.25.05)	6130	2021-06-18	2022-06-18	
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 LoRa DTS

Worse Case Data

Mode of operation	Channel	Attenuation at Band Edge	Attenuation Limit at Band Edge		
	903	43.981dBc	30 dBc		
	914.2	46.069dBc	30 dBc		

Screen Capture from the spectrum analyzer: Lower Band Edge

🔤 Keysight Sp	ectrum Analyzer - Sw	ept SA								
<mark>w</mark> Marker 3	RF PRESEL 50 Ω	AC 50 MHz		SENS	E:INT	Avg Type Avg Hold	ALIGN AUTO : Log-Pwr :>500/500	04:55:48 A TRAC TY	M Mar 08, 2022 E 1 2 3 4 5 6 E M WWWW	Peak Search
10 dB/div	Ref Offset 20 Ref 39 40 (I.4 dB	Gain:Low	#Atten: 40	dB		ΔMk	□ r3 1.05 43	3 2 MHz .981 dB	Next Peak
29.4								♦ ^{3,}	∆4	Next Pk Right
9.40									DL1 -16.06 dBm	Next Pk Left
-20.6			n Anglen anglen	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	┈╳₄	ann				Marker Delta
Start 900 #Res BW	.000 MHz 100 kHz		#VBW	300 kHz	5000		Sweep 1.	Stop 903 .067 ms (.448 MHz 2001 pts)	Mkr→CF
MKR MODE 1 N 2 N 3 Δ4 4 F 5 5	f f f f f f	× 903.000 900.418 1.053 901.950	0 MHz 9 MHz 2 MHz (Δ) 0 MHz	14.071 dBr -28.976 dBr 43.981 dI -29.915 dBr	n B n			FUNCTI		Mkr→RefLvl
6 7 8 9 10										More 1 of 2
				m			1	1	• ·	
MSG							STATUS			

Screen Capture from the spectrum analyzer: Upper Band Edge

🔤 Keysight	t Spectru	ım A	nalyzer - Swe	pt SA										
<mark>(X)</mark> Marker	RF	PRES	EL 50 Ω		,		SENSE:INT	Т		ALIGN AUTO	05:50:40 A	M Mar 08, 2022	Trace	/Detector
				P IF	NO: Fast Gain:Low	Trig: F #Atten:	ree Run 40 dB		Avg Hold	d:>500/500	TY D		N Sele	ect Trace
10 dB/di	v	tef (Offset 20. 39.40 d	4 dB IBm						ΔMł	r3 -13.8 46	77 MHz .069 dE		1
29.4	3∆4												c	lear Write
9.40														
-10.6												DL1 -15.89 dBm	Trac	e Average
-30.6	ľ,	~~~~		-ph-manutana	¥۳۴۹	na-sanalana-san	ىسى المراجو مى ريان مى ال	Marine, wyalisi	haara ahaan ahaan ahaa		har and the second s			Max Hold
-50.6														Max Hold
Start 9′ #Res B	13.65 W 10	i0)0	VIHz (Hz		#VI	BW 300 kH	z			Sweep 1	Stop 930 I.600 ms (.000 MHz 2001 pts;		Min Hold
MKR MODE	TRC	SCL		X 013.05	2 MH -	Y 13.060	dRm	FUNCT	ION FU	INCTION WIDTH	FUNCTI	ON VALUE		
2 N	1	f	(4)	928.00	0 MHz	-31.239	dBm						Vi	wBlank
4 F	1	f	(Δ)	-13.87 928.05	0 MHZ	<u>46.06</u> -32.093	dBm							Trace On
5												=	_	
7														
9														More
10														1 of 3
•						m						4		
MSG										STATU	s			

2.5.6 Band Edge Data BLE

Worse Case Data

Mode of operation	Channel	Attenuation at Band Edge	Attenuation Limit at Band Edge		
	2402	56.024dBc	30 dBc		
DLE	2480	53.611dBc	30 dBc		

Screen Capture from the spectrum analyzer: Lower Band Edge

🔤 Keysight Sp	ectrum Analyzer	- Swept SA								
LXI	RF PRESEL 5	50 Ω AC		SENS	E:INT	A	LIGN AUTO	08:02:46 AM Mar 08,	2022	Trace/Detector
Marker 2	Δ 5.6698	309076 M	Hz	Trig: Free	Run A	valHold:	>300/300	TYPE MWW	4 56 ₩₩₩	
			IFGain:Low	Atten: 10	B			DET P N N	NNN	Select Trace
							^	Mkr2 5 67 M	L 17	
	Ref Offse	20.6 dB						56 /02	dB	1
10 dB/div	Ref 19.4	U aBm						00.402		
9.40									A2	
									23	Clear Write
-0.60										
-10.6										
-20.6								í		
-30.6								DL1 -31.0	ββBm	Trace Average
-30.0										Ű
-40.6										
-50.6									-{	
-60.6	بالينادر بالرديية ويعرونها	مروده طراق مراجا وسيار الشريروالل			سيب سار ورو		والبر فللها والرواحية والوار العراقي	han and Arg	/س	Max Hold
70.6										
-70.0										
Start 2 30	1000 GHz			^				Stop 2 40613 0	Hz	
#Res BW	100 kHz		#VB\	N 300 kHz		S	weep 1	0.27 ms (2001)	ots)	Min Hold
									-	
MKR MODE T	RC SCL	X 2.40		Y 0.020 dB	FUNCTION	N FUNC	CTION WIDTH	FUNCTION VALUE	Â	
2 A3 ⁴	f (Δ)	2.40	5.67 MHz (Δ)) 56.402 d	B					
3 F	f	2.39	5 38 GHz	-56.375 dB	n					View Blank
4									-	Trace On
6									-	
7										
8									- 11	More
10										1 of 3
11									~	
				m					F.	
MSG							STATU	5		

Screen Capture from the spectrum analyzer: Upper Band Edge

	ht Spectrum Ana	lyzer - Swe	pt SA								
L <mark>XI</mark>	RF PRESE	L 50 Ω	AC		_	SENSE:I	NT	ALIGN AUTO	08:48:58	AM Mar 08, 2022	Trace/Detector
Marke	r 2 -2.39	99054	24 MH	Z PNO: Eas	t 🕞 Tri	ig: Free Ru	n Av	g Type: Log-Pwr g Hold:>200/200	T		
				IFGain:Lo	w Ai	ten: 10 dB			C	DET P NNNNN	Select Trace
	Ref ()	ffset 20 i	6 dB					ΔN	lkr2 -2.4	400 MHz	1
10 dB/d	liv Ref	19.40 d	Bm						53	3.611 dB	
9.40		13									Clear Write
-0.60	اين ا										
-10.6	-/										
-20.6											
-30.6	کم	₩								DL1 -30.23 dBm	Trace Average
-40.6		-{									
-50.6 📈	<i>/</i> *	- Voc. 1	V								
-60.6		~>	∿3∽⊶	and show	minaly		สำรรณของสีขอสีขอสีขอสีของสีของ	en and the second		an and a state of the state of	Max Hold
-70.6											
Start 2	2.47788 G	Hz							Stop 2.5	0000 GHz	
#Res E	3W 100 ki	z		#	/BW 300) kHz		Sweep 2	2.133 ms	(2001 pts)	Min Hold
MKR MOD	DE TRC SCL		Х			Y	FUNCTION	FUNCTION WIDTH	FUNCT	ION VALUE	
1 N 2 A3		()	<u>2.479</u> -2	<u>981 GHz</u> 400 MHz	-0. (A) 5	707 dBm 3.611 dB					
3 F	1 f		2.482	415 GHz	-53.	711 dBm					View Blank
4										E	Trace On
6											
8											More
9											1 of 3
11										-	
•						III				•	
MSG								STATU	JS		

2.6 Conducted Spurious Emissions (Non-Restricted Band)

Test Lab: Electronics Test Centre, Airdrie

Test Personnel: Imran Akram

Standard: FCC PART 15.247

EUT: Breeze-V

Date: 2022-03-08 (20.7°C,14.2% 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	2021-06-18	2022-06-18
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	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

			Low Cha	annel			
		Keysight Spectrum Analyzer - Cha RF 50 Ω Integration BW 695.4	AC S AC Center Tria: Fr	ENSE:INT ALIGN AUTO Freq: 903.000000 MHz se Run AvgiHold:>500/500	D4:52:41 AM Mar08, 2022 Radio Std: None	Meas Setup	
			#IFGain:Low #Atten:	40 dB	Radio Device: BTS A	vg/Hold Num 500 Off	
		10 dB/div Ref 20.00	0 dBm			Avg Mode	
		-10.0			Exp	Repeat	
		-20.0				Integ BW 695.41 kHz	
		-40.0	у [.]		mmmmm		
		-60.0					
		Center 903.0000 MHz Res BW 10 kHz	VE	W 100 kHz	Span 1.043 MHz Sweep 12.47 ms		
		Channel Power		Power Spectral Dens	ity	PhNeiss Ont	
		13.94 dE	3m / 695.4 kHz	-44.49 dBm	/Hz Auto	Fast Tuning Man	
						More	
						1 of 2	
Keysight Sp	ectrum Analyzer	- Spurious Emissions		STATUS			
Start I in	RF !	50 Ջ <u>A</u> DC	SENSE Center Freq	INT ALI	GN AUTO 05:10:04 Radio St	AM Mar 08, 2022 d: None	Range Table
		IFGain:L	ow Trig: Free R #Atten: 40 c	un Avg Hold:>5 IB	0/50 Radio De	evice: BTS	Range
	Ref Of	fset 20.4 dB			902	2.89 MHz	1 <u>On</u> Off
10 dB/div	Ref 4	0.00 dBm			8.84	430 aBm	
30.0							Start Freq
10.0						∮ ¹	30.000 KH2
0.00							Stop Freq
-10.0							1.000000000 GHz
-30.0							Dee DW
-40.0							100.00 kHz
-50.0							Auto <u>Man</u>
Start 30	kHz				3	top 1 GHz	Video BW
Spur	Range	Frequency	Amplitude	Limit	Δ Limit		Auto <u>Man</u>
1	1	902.9 MHz	14.01 dBm	-16.06 dBm	30.07 dB	<u>^</u>	
2	1	847.3 MHz	-30.72 dBm -30.92 dBm	-16.06 dBm	-14.66 dB		Gaussian
4	1	760.9 MHz	-31.01 dBm	-16.06 dBm	-14.95 dB		
5	1 1	540.2 MHz 662.4 MHz	-31.12 dBm -31.36 dBm	-16.06 dBm -16.06 dBm	-15.06 dB -15.30 dB		More
7	1	463.3 MHz	-31.43 dBm	-16.06 dBm	-15.37 dB	-	1 of 3
MSG					STATUS 🚺 DC C	oupled	
Keysight Sp	ectrum Analyzer	- Spurious Emissions					- 2 ×
Marker 1	2.7092	SHZ	Center Free Trig: Free R	:INT ALI : 903.000000 MHz	GN AUTO 05:08:44 Radio St	AM Mar 08, 2022 d: None	Range Table
PASS		IFGain:L	_ow#Atten: 40 c	IB	Radio De	evice: BTS	Range
	Ref Off	set 21.4 dB			2.7 -30.1	'092 GHz 251 dBm	<u>On</u> Off
Log							Start Erog
21.0							1.000000000 GHz
11.0							
-9.00							Stop Freq
-19.0		1					10.000000000 GHz
-29.0						~~~	Res BW
-49.0							100.00 kHz Auto <u>Man</u>
Start 1 G	Hz				Sí	op 10 GHz	
							300.00 kHz
Spur	Range	Frequency	Amplitude	Limit	Δ Limit		Auto <u>Man</u>
1	2 2	5.131 GHz 5.282 GHz	-25.04 dBm -25.26 dBm	-16.06 dBm -16.06 dBm	-8.983 dB -9.205 dB	Â	Filter Type
3	2	3.670 GHz	-25.27 dBm	-16.06 dBm	-9.208 dB	Е.	Gaussian
4	2	5.230 GHz 6.074 GHz	-25.52 dBm -25.55 dBm	-16.06 dBm	-9.464 dB		
1 C C C C C C C C C C C C C C C C C C C		CONTRACTOR OF A DESCRIPTION	THE REPORT OF THE PARTY OF THE		STOT ND		More
6	2	6.787 GHz	-25.66 dBm	-16.06 dBm	-9.601 dB		1 of 3
6 7	2	6.787 GHz 6.903 GHz	-25.66 dBm -25.73 dBm	-16.06 dBm -16.06 dBm	-9.601 dB -9.671 dB	+	1 of 3

MID Channel



🔤 Ke	ysight Sp	ectrum Analyzer	r - Spurious Emis	sions									
L <mark>XI</mark>		RF	50 Ω 🚹 DC			SEI	NSE:INT		ALIGN AUTO	05:37:01 4	M Mar 08, 2022	Pa	nga Tabla
Ref	Offse	et 20.40 (dB			Center Fr	req: 907.800	000 MHz		Radio Std	: None	Na	inge i able
				IEGain!Lo	, , ,	#Atten: 4	od B	Avginoia	:>00/00	Radio Dev	vice: BTS		Range
				II Gain.EC						0.07			1
		Ref Of	fset 20.4 dB							907	.84 MHZ	On	Off
10 d	B/div	Ref 4	0.00 dBm							9.23	44 dBm		
Log													
30.0													Start Freq
20.0											A 1		30.000 kHz
10.0													
0.00													
10.0													Stop Freq
-10.0												1.00	0000000 GHz
-20.0												-	
-30.0													
-40.0											4		Res BW
50.0												Auto	Man
-50.0												Auto	man
Sta	rt 30	kHz								SI	op 1 GHz		
													Video BW
												Auto	300.00 KHZ
5	spur	Range	Freque	ncy	Am	plitude		Limit		∆ Limit		Auto	Inidii
		1	907.8 M	HZ	13.0	6 dBm	_	15.97 dB	m 20	9.93 dB	~		
	,	1	005 3 M	U 7	-30	53 dBm	_	15 07 dB	m _1	4 56 dB		F	ilter Type
		4	005 0 M	112	-00.			45.07 40	- 4	474 40			Gaussian
)	1	880.2 W	ΠZ	-30.		-	15.97 UBI	-	4.74 00	=	_	
4		1	876.6 M	HZ	-30.	90 dBm	-	15.97 dBi	m -1	4.93 dB			
5	5	1	358.2 M	Hz	-31.	37 dBm	-	15.97 dBi	m -1	5.40 dB			More
6	;	1	833.9 M	Hz	-31.	53 dBm	-	15.97 dBi	m -1	5.56 dB			1 of 3
7		1	528.1 M	Hz	-31.	59 dBm	-	15.97 dBi	m -1	5.62 dB	-		1010
MSG									STATU	is 🚺 DC Co	upled		
	1.1.0					_	_	_			-	_	
Ke	ysight spe	ectrum Analyzer	- opurious Emise	ions								_	

50 Ω AC SHZ IFGain:	Center Fro Trig: Free Low #Atten: 40	eq: 907.800000 MHz Run Avg Hc	ALIGN AUTO	05:36:02 A	4 Mar 08, 2022 None	Ra	nge Table
SHZ IFGain:	Trig: Free #Atten: 40	eq: 907.800000 MHz Run Avg Ho	d:>50/50	Radio Std:	None		
IFGain:	Low #Atten: 40		10.~0000				
) dB		Radio Dev	ice: BTS		Rang
eat 21 4 dB				2.72	36 GHz	On	
1.00 dBm				-30.3	97 dBm		
							Start Fre
						1.00	000000 GI
							Stop Fre
						10.00	0000000 GI
1						_	_
-							Dec D
							100.00 k
						Auto	M
				Sto	p 10 GHz		Video B
						Auto	300.00 kl
Frequency	Amplitude	Limit	ά Δ	Limit		Auto	<u>IVI</u>
3.650 GHz	-25.89 dBm	-15.97 d	Bm -9.9	922 dB	^		
5.991 GHz	-25.98 dBm	-15.97 d	Bm -10	.01 dB		F	ilter Type
6.892 GHz	-26.03 dBm	-15.97 d	Bm -10	.06 dB	=		Gaussian
6.803 GHz	-26.10 dBm	-15.97 d	Bm -10).13 dB			
5.948 GHz	-26.16 dBm	-15.97 d	Bm -10	.19 dB			Mo
6.631 GHz	-26.16 dBm	-15.97 d	Bm -10	.19 dB			1 01
3.622 GHz	-26.18 dBm	-15.97 d	Bm -10	.21 dB	-	_	
	Frequency 3.650 GHz 5.991 GHz 6.892 GHz 6.892 GHz 5.948 GHz 6.631 GHz 3.622 GHz	Frequency Amplitude 3.650 GHz -25.89 dBm 5.991 GHz -25.98 dBm 6.892 GHz -26.03 dBm 6.892 GHz -26.10 dBm 5.948 GHz -26.16 dBm 3.622 GHz -26.18 dBm	Frequency Amplitude Limit 3.650 GHz -25.89 dBm -15.97 d 5.991 GHz -25.98 dBm -15.97 d 6.892 GHz -26.10 dBm -15.97 d 5.948 GHz -26.10 dBm -15.97 d 5.631 GHz -26.16 dBm -15.97 d 3.622 GHz -26.16 dBm -15.97 d	Frequency Amplitude Limit Δ 3.650 GHz -25.89 dBm -15.97 dBm -0. 5.991 GHz -25.98 dBm -15.97 dBm -10. 6.892 GHz -26.10 dBm -15.97 dBm -10. 5.948 GHz -26.16 dBm -15.97 dBm -10. 5.632 GHz -26.16 dBm -15.97 dBm -10. 5.948 GHz -26.16 dBm -15.97 dBm -10. 3.622 GHz -26.18 dBm -15.97 dBm -10.	Frequency Amplitude Limit Δ Limit 3.650 GHz -25.99 dBm -15.97 dBm -9.922 dB 5.991 GHz -25.99 dBm -15.97 dBm -10.01 dB 6.892 GHz -26.03 dBm -15.97 dBm -10.11 dB 5.948 GHz -26.16 dBm -15.97 dBm -10.19 dB 6.631 GHz -26.16 dBm -15.97 dBm -10.19 dB 6.362 GHz -26.16 dBm -15.97 dBm -10.19 dB 6.31 GHz -26.18 dBm -15.97 dBm -10.19 dB	Image: state	Image: Second

	nign Chann	iei			
📕 Keysight Spectrum Analyzer - Channel Power					- 6 -
Integration BW 701.70 kHz	SENSE:INT Center Freq: 914.200000 MH:	ALIGN AUTO	05:42:35 AM Mar 08, 2022 Radio Std: None	М	eas Setup
ais	Gain:Low #Atten: 40 dB	lold:>500/500	Radio Device: BTS	Av	g/Hold Num
10 dB/dlv Ref 20.00 dBm				011	011
10.0 0.00				Exp	Avg Mode Repeat
-10.0					
-20.0		<u> </u>			Integ BW
-0.0		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	m		TOT.TO MIL
1-60.0					
-70.0 Center 914 2000 MHz			Spap 1 053 MHz		
Res BW 10 kHz	VBW 100 kHz		Sweep 12.6 ms		
Channel Power	Power Spe	ctral Densi	v		
14.11 dBm / 7	о1.7 kHz -44.3	5 dBm	Hz	F Auto	hNoise Opt Fast Tuning ► <u>Man</u>
					More
				_	1012

High Channel

		100		07.47	200		
Keyright Sp	actrum Analyzer	- Spurious Emissions		- Paral			
LXI	RF 5	50 Ω 🛕 DC	SENSE	INT AI	LIGN AUTO 05:54:0)6 AM Mar 08, 2022	Den ne Tekle
Start Lin	nit -15.89	dBm	Center Freq	: 921.825000 MHz	Radio S	Std: None	Range Table
		IFGain:	Low #Atten: 40 d	B Avginoid.>	Radio [Device: BTS	Range
					91	4.29 MHz	1
10 dB/div	Ref 4	3et 20.4 dB 0.00 dBm			8.	7221 dBm	<u>on</u> of
Log							
30.0							Start Freq
20.0						1	30.000 kHz
10.0							
0.00							Stop Fred
-10.0						['	1 00000000 GHz
-20.0							1.000000000000
-30.0							
-40.0							Res BW
-50.0							Auto Man
Start 30	kHz					Stop 1 GHz	Video BW 300.00 kHz
Spur	Range	Frequency	Amplitude	l imit	Λ I imit		Auto <u>Man</u>
	A		13 01 dBm	-15-90 dB-		A	
2	1	914.3 MHZ	-30.43 dBm	-15.89 dBm	-14 54 dE		Filter Type
3	1	771.0 MHz	-30.64 dBm	-15.89 dBm	-14.34 dE		Gaussian
4	1	954.2 MHz	-31.06 dBm	-15.89 dBm	-15 17 dE	=	
5	1	438 5 MHz	-31 10 dBm	-15.89 dBm	-15 21 dE		
6	1	943.7 MHz	-31.22 dBm	-15.89 dBm	-15.33 dE		More
7	1	37.03 MHz	-31.30 dBm	-15.89 dBm	-15.41 dE		1 of 3
MSG					STATUS 🚺 DC (Coupled	
Keysight Sp	and an all services						
and the second sec	ectrum Analyzer	 Spurious Emissions 					
LXI	RF 5	- Spurious Emissions 50 Ω AC	SENSE	INT A	LIGN AUTO 05:53:	11 AM Mar 08, 2022	Papa Table
Marker 1	RF 5	- Spurious Emissions 50 Ω AC SHZ	Center Freq Trig: Free R	:INT A : 921.825000 MHz un AvglHold:>	LIGN AUTO 05:53: Radio	11 AM Mar 08, 2022 Std: None	Range Table
Marker 1 PASS	RF 5	- Spurious Emissions 50 Ω AC SHZ IFGain:	Center Freq Trig: Free R #Atten: 40 d	:INT A : 921.825000 MHz un Avg Hold:> B	LIGN AUTO 05:53: Radio •50/50 Radio	11 AM Mar 08, 2022 Std: None Device: BTS	Range Table
Marker 1 PASS	RF 5	- Spurious Emissions 50 Ω AC EHZ IFGain:	Center Freq Trig: Free R How #Atten: 40 d	:INT A : 921.825000 MHz un Avg Hold:> B	LIGN AUTO 05:53: Radio 1 -50/50 Radio 1 2.	11 AM Mar 08, 2022 Std: None Device: BTS 7430 GHz	Range Table
Marker 1 PASS 10 dB/div	RF 5 2.7430 C Ref Off Ref 4	- Spurious Emissions 10 Q AC EHZ IFGain: Set 21.4 dB 1.00 dBm	Sense Center Freq Trig: Free R #Atten: 40 d	:INT A : 921.825000 MHz un Avg Hold:> B	LIGN AUTO 05:53: -50/50 Radio 2. -2. -30	11 AM Mar 08, 2022 Std: None Device: BTS 7430 GHz .558 dBm	Range Table Range 2 On Off
Marker 1 PASS	Ref Off Ref 4	- Spurious Emissions 50 Q AC EHZ IFGain: Set 21.4 dB 1.00 dBm	Center Freq Trig: Free R Low #Atten: 40 d	:INT A : 921.825000 MHz un Avg Hold:> B	LIGN AUTO 05:53: -50/50 Radio 2. -30	11 AM Mar08, 2022 Std: None Device: BTS 7430 GHz .558 dBm	Range Table Range 2 <u>On</u> Off
Marker 1 PASS	Ref Off Ref 4	- Spurious Emissions io Ω AC EHZ IFGain: Set 21.4 dB 1.00 dBm	Center Freq Trig: Free R Low #Atten: 40 d	:INT A : 921.825000 MHz un Avg Hold:> B	LIGN AUTO 05:53 -50/50 Radio Radio 2. -30	11 AM Mar08, 2022 Std: None Device: BTS 7430 GHz .558 dBm	Range Table Range 2 On Off Start Freq
Marker 1 PASS	Ref Off Ref 4	- Spurious Emissions IO Ω AC SHZ IFGain: Set 21.4 dB 1.00 dBm	Center Freq Trig: Free R Low #Atten: 40 d	::NT] A : 921.825000 MHz un Avg Hold:> B	LIGN AUTO 05:53 -50/50 Radio Radio 2. -30	11 AM Mar 08, 2022 Std: None Device: BTS 7430 GHz .558 dBm	Range Table Range 2 <u>On</u> Off Start Freq 1.00000000 GHz
Marker 1 PASS 10 dB/div Log 21.0 11.0	Ref Off Ref 4	- Spurious Emissions i0 Ω AC SHZ IFGain: Set 21.4 dB 1.00 dBm	Center Freq Trig: Free R HAtten: 40 d	:INT] A 921.825000 MHz un Avg Hold:> B	LIGN AUTO 05:53: 50/50 Radio 2: -50/50	11 AM Mar 08, 2022 Std: None Device: BTS 7430 GHz .558 dBm	Range Table Range 2 0n Off Start Freq 1.00000000 GHz
Marker 1 PASS 10 dB/div Log 21.0 11.0 1.0	Ref Off Ref 4	- Spurious Emissions 50 Q AC 5HZ IFGain: *set 21.4 dB 1.00 dBm	Center Freq Trig: Free R Low #Atten: 40 d	:INT A : 921.825000 MHz un Avg Hold:> B	LIGN AUTO 05:53: 550/50 Radio Radio 2. -30	11 AM Mar 08, 2022 Std: None Device: BTS 7430 GHz .558 dBm	Range Table Range Table 2 0n Off Start Freq 1.00000000 GHz Stop Fren
Marker 1 PASS 10 dB/div Log 31.0 21.0 11.0 1.00	Ref Off Ref 4	Spuriouz Emissions SHZ IFGain: Set 21 4 dB 1.00 dBm	Low #Atten: 40 d	:INT] A : 921.825000 MHz un Avg Hold:> B	LIGN AUTO 05:53: Radio 60/50 Radio 2. -30	11 AM Mar 08, 2022 Std: None Device: BTS 7430 GHz .558 dBm	Cange Table Range Table Qn Start Freq 1.00000000 GHz Stop Freq 10.00000000 GHz
Marker 1 PASS 10 dB/div Log 31.0 21.0 11.0 1.00 -9.00 -19.0	Ref Off Ref 4	Spuriouz Emissions SHZ IFGain: set21.4 dB 1.00 dBm	Low Sense	: 921.825000 MHz un Avg Hold:> B	LIGN AUTO 05:53: 50/50 Radio Radio 2, -30	11 AM Mar08, 2022 Std: None Device: BTS 7430 GHz .558 dBm	Range Table Range 2 0n Off Start Freq 1.00000000 GHz 10.00000000 GHz
Marker 1 PASS 210 dB/div 210 11.0 1.00 .9.00 .9.00 .9.00 .9.00	Ref off Ref 4	Spuriouz Emissions SHZ IFGain: set21.4 dB 1.00 dBm	Low Sense	:INT A 921.825000 MHz un Avg Hold:> B	LIGN AUTO 05:53: 50/50 Radio Radio 2. -30	11 AM Mar08, 2022 Std: None Device: BTS 7430 GHz .558 dBm	Range Table Range Table Range 2 0n Off Start Freq 1.00000000 GHz 10.00000000 GHz
Marker 1 PASS 10 dB/div Log 310 21.0 11.0 9.00 -19.0 -29.0 -39.0	RF 12 RF 12 RF 12 Ref 0f Ref 0f	Spuriouz Emissions 90 q. AC SHZ IFGain: set 21.4 dB 1.00 dBm	Low Sense	:INT] A 921.825000 MHz un Avg Hold:> B	LIGN AUTO 05:53: 50/50 Radio Radio 2. -30	11 AM Mar 08, 2022 Std: None Device: BTS 7430 GHz .558 dBm	Start Freq 1.000000000 GHz Stop Freq 10.00000000 GHz
Image: New York Image: New	Re 10 Re 12 Re 10 Ref 0 Ref 0	Spuriouz Emissions SH2 IFGain: set 21.4 dB I.00 dBm	Low SENSE	:INT A 921.825000 MHz un Avg Hold:2 B	LIGN AUTO 05:53: 50/50 Radio Radio 2. -30	11 AM Mar 08, 2022 Std: None Device: BTS 7430 GHz .558 dBm	Range Table Range Table 2 0n Off Start Freq 1.00000000 GHz 3top Freq 10.00000000 GHz 4.000 KHz Auto Man
Off Off <td>Ref Off Ref 4</td> <td>Spuriouz Emissions SH2 IFGain: set21.4 dB 1.00 dBm</td> <td>Low Sense</td> <td>: 921.825000 MHz un Avg Hold:> B</td> <td>LIGN AUTO 05:53: 60/50 Radio 7-30 Radio</td> <td>11 AM Mar06, 2022 Std: None Device: BTS 7430 GHz .558 dBm</td> <td>Start Freq 1.00000000 GHz Stop Freq 10.00000000 GHz Res BW 100.00 KHz Auto</td>	Ref Off Ref 4	Spuriouz Emissions SH2 IFGain: set21.4 dB 1.00 dBm	Low Sense	: 921.825000 MHz un Avg Hold:> B	LIGN AUTO 05:53: 60/50 Radio 7-30 Radio	11 AM Mar06, 2022 Std: None Device: BTS 7430 GHz .558 dBm	Start Freq 1.00000000 GHz Stop Freq 10.00000000 GHz Res BW 100.00 KHz Auto
0 Marker 1 PASS 0 dB/dlv 0 dB/dlv 0 10 dB/dlv 0 21.0 110 0 11.0 23.0 0 -19.0	Ref Off Ref 4	Spuriouz Emissions SH2 IFGain: set21.4 dB 1.00 dBm	Low Sense Center Freq #Atten: 40 d	: 921.825000 MHz un Avg Hold:> B	LIGN AUTO 05:53: 50/50 Radio 2. -30	11 AM Mar06, 2022 Std: None Device: BTS 7430 GHz .558 dBm	Range Table Range Table Range 2 On Off Start Freq 1.00000000 GHz 10.00000000 GHz 10.000 KHz Auto Man Video Man
0 0 Marker 1 PASS 0 dB/dlv 10 dB/dlv 21.0 110 11.0 220 -39.0	Ref Off Ref 4	Spuriouz Emissions SH2 IFGain: set21.4 dB 1.00 dBm	Low Atten: 40 d	INTI A 21.825000 MHz un Avg Hold:> B	LIGN AUTO 05:53: 50/50 Radio 2. -30 -30 -30 -30 -30 -30 -30 -30	11 AM Mar 06, 2022 Std: None Device: BTS 7430 GHz .558 dBm	Range Table Range Zable Qn Start Freq 1.000000000 GHz Stop Freq 10.00000000 GHz Res BW 100.000 KHz Auto Video BW 300.00 KHz Auto
Organization Operation	Ref off Ref 4	Spuriouz Emissions SHZ IFGain: set21.4 dB 1.00 dBm	Low Center Freq #Atten: 40 d	IIITI A 921.825000 MHz un Avg Hold:> B Limit	LIGN AUTO 05:53: 50/50 Radio 2. -30 -30 -30 -30 -30 -30 -30 -30	11 AM Mar 06, 2022 Std: None Device: BTS 7430 GHz .558 dBm	Range Table Range Table Range 2 On Off Start Freq 1.000000000 GHz Stop Freq 10.00000000 GHz Note BW 100.00 kHz Auto Man Video BW 300.00 kHz
Image: Constraint of the second sec	R 12 R 12 R 12 R 13 R 13	Frequency 6.026 GHz	Amplitude -25.41 dBm	EINT A 921.825000 MHz un Avg Hold:	LIGN AUTO 05:53: 50/50 Radio 2. -30 -30 -30 -30 -30 -30 -30 -30	11 AM Mar 06, 2022 Std: None Device: BTS 7430 GHz .558 dBm Stop 10 GHz	Range Table Range Table 2 0n Off Start Freq 1.00000000 GHz 10.00000000 GHz 10.00000000 GHz 10.00000000 GHz 10.00000000 GHz 10.0000000 GHz 10.00000000 GHz 10.0000000 GHz 10.00000000 GHz 10.00000000 GHz 10.00000000 GHz 10.00000000 GHz 10.00000000 GHz 10.000000000 GHz 10.00000000 GHz 10.0000000 GHz 10.0000000 GHz 10.0000000 GHz 10.0000000 GHZ 10.00000000 GHZ 10.0000000 GHZ 10.00000000 GHZ 10.00000000 GHZ 10.00000000 GHZ 10.00000000 GHZ 10.00000000 GHZ 10.000000000 GHZ 10.00000000 GHZ 10.00000000 GHZ 10.000000000 GHZ 10.000000000 GHZ 10.00000000000000 GHZ 10.00000000000000000000000000000000000
Image: Constraint of the second sec	Ref Off Ref 4 Ref	Spuriouz Emissions SHZ IFGain: set21.4 dB 1.00 dBm ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	Amplitude -25.51 dBm -25.51 dBm -25.51 dBm	EINT A 921.825000 MHz un Avg Hold:- B Limit -15.89 dBm -15.89 dBm	LIGN AUTO 05:53: 50/50 Radio 2. -30 -30 -30 -30 -30 -30 -30 -30	11 AM Mar 08, 2022 Std: None Device: BTS 7430 GHz .558 dBm Stop 10 GHz	Range Table Range Table 2 On Start Freq 1.00000000 GHz 3 Stop Freq 10.00000000 GHz Res BW 100.00 KHz Auto Man Video BW 300.00 KHz Auto Man
Offer Overlap Overlap <thoverlap< th=""> <thoverlap< th=""> <thove< td=""><td>Ref 000 Ref 1 Ref 4 Ref 4 Ref 4 Ref 4 Ref 4 Ref 4 Ref 4 Ref 2 2 2 2</td><td>Frequency 6.026 GHz 5.217 GHz 1.00 dBm</td><td>Amplitude -25.41 GBm -25.50 dBm -25.60 dBm -25.60 dBm</td><td>EINT A 921.825000 MHz un Avg Hold:- B Limit -15.89 dBm -15.89 dBm -15.89 dBm</td><td>LIGN AUTO 05:53: 50/50 Radio 70/50 Radio 2. -30 -30 2. -30 -30 -30 -30 -30 -30 -30 -30</td><td>11 AM Mar 08, 2022 Std: None Device: BTS 7430 GHz .558 dBm</td><td>Range Table Range 2 0n Off Start Freq 1.00000000 GHz 300,000 GHz 10.000 KHz Auto Man Video BW 300,00 KHz Auto Man</td></thove<></thoverlap<></thoverlap<>	Ref 000 Ref 1 Ref 4 Ref 4 Ref 4 Ref 4 Ref 4 Ref 4 Ref 4 Ref 2 2 2 2	Frequency 6.026 GHz 5.217 GHz 1.00 dBm	Amplitude -25.41 GBm -25.50 dBm -25.60 dBm -25.60 dBm	EINT A 921.825000 MHz un Avg Hold:- B Limit -15.89 dBm -15.89 dBm -15.89 dBm	LIGN AUTO 05:53: 50/50 Radio 70/50 Radio 2. -30 -30 2. -30 -30 -30 -30 -30 -30 -30 -30	11 AM Mar 08, 2022 Std: None Device: BTS 7430 GHz .558 dBm	Range Table Range 2 0n Off Start Freq 1.00000000 GHz 300,000 GHz 10.000 KHz Auto Man Video BW 300,00 KHz Auto Man
Marker 1 PASS 0 dB/dlv Log 31.0 21.0 110 1.00 9.00 -19.0 -19.0 -19.0 -19.0 -19.0 -19.0 Start 1 G Spur 1 2 3 4 2 3 4 5 5 5 5 5 5 5 5 5 5 5 5 5	Ref Off Ref 4	Spurdue Emissions SPU = 20 ← AC SH2 IFGain: set 21.4 dB 1.00 dBm 0 dBm	Amplitude -25.41 dBm -25.67 dBm -25.67 dBm	Limit -15.89 dBm -15.89 dBm -15.89 dBm -15.89 dBm -15.89 dBm	LIGN AUTO 05:53: Fadio 50/50 Radio Radio 2. -30 -30 -30 -30 -30 -30 -30 -30	11 AM Mar 06, 2022 Std: None Device: BTS 7430 GHz .558 dBm	Range Table Range 2 0n Off Start Freq 1.00000000 GHz Stop Freq 10.00000000 GHz 100.00 KHz Auto Man Video BW 300.00 KHz Auto Man
Office Operating O	Ref off Ref 4	Spuriouz Emissions SPU 2 IFGain: Set 21.4 dB 1.00 dBm 1.00 dB	Amplitude -25.41 dBm -25.61 dBm	Limit Limit -15.89 dBm -15.89 dBm -15.89 dBm -15.89 dBm -15.89 dBm -15.89 dBm -15.89 dBm	LIGN AUTO (05:53: 50/50 Radio 2. -30 -30 -30 -30 -30 -30 -30 -30	11 AM Mar 06, 2022 Std: None Device: BTS 7430 GHz .558 dBm	Range Table Range Table 2 0n 0ff Start Freq 1.00000000 GHz 10.0000000 GHz 10.000 KHz Auto Man Video BW 300.00 KHz Auto Man Filter Type Gaussian More
Image: Constraint of the second sec	Ref Off Ref 1 Ref 4 Ref 4 Ref 4 Ref 4 Ref 4 Ref 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Spurduz Emissions Spurduz Emissions Sugar 20 Set 21.4 dB I.00 dBm I	Amplitude -25.41 dBm -25.51 dBm -25.60 dBm -25.75 dBm -25.76 dBm -25.76 dBm	Limit -15.89 dBm -15.89 dBm -15.89 dBm -15.89 dBm -15.89 dBm -15.89 dBm -15.89 dBm -15.89 dBm -15.89 dBm	LIGN AUTO 05:53: 50/50 Radio 2. -30 -30 -30 -30 -30 -30 -30 -30	11 AM Mar 06, 2022 Std: None Device: BTS 7430 GHz .558 dBm	Range Table Range Table Range 2 0n Off Start Freq 1.00000000 GHz Stop Freq 10.00000000 GHz Res BW 100.00 KHz Auto Man Video BW 300.00 kHz Auto Man Filter Type Gaussian More 1 of 3
Image: Constraint of the second sec	Range 2 Range 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Spurduez Emissions SPU = 200 AC IFGain: set 21.4 dB 1.00 dBm 1.00 dBm	Amplitude -25.41 dBm -25.51 dBm -25.60 dBm -25.75 dBm -25.75 dBm -25.75 dBm	Limit -15.89 dBm -15.89 dBm -15.89 dBm -15.89 dBm -15.89 dBm -15.89 dBm	LIGN AUTO 05:53: Fadio 50/50 Radio 2. 30 30 	11 AM Mar 08, 2022 Std: None Device: BTS 7430 GHz .558 dBm	Range Table Range Table 2 0n Off Start Freq 1.00000000 GHz 300,000 KHz Auto Man Video BW 300,00 KHz Auto Man Filter Type Gaussian More 1 of 3
Sector Sector<	Ref Off Ref 4 Ref 4 Ref 4 Ref 4 Ref 4 Ref 4 Ref 4 Ref 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Spuriouz Emissions 90 AC SH2 IFGain: set 21.4 dB .00 dBm J.00 dBm .00 dBm Set 21.4 dB .00 dBm Sold Carl .012 GHz Sold Carl .013 GHz Sold Carl .015 GHz Sold Carl .015 GHz	Amplitude -25.41 dBm -25.51 dBm -25.67 dBm -25.77 dBm -25.77 dBm -25.76 dBm -25.70 dBm	Limit -15.89 dBm -15.89 dBm -15.89 dBm -15.89 dBm -15.89 dBm -15.89 dBm -15.89 dBm -15.89 dBm	LIGN AUTO 05:33: Fadio 05:33: Fadio 22, -30 24, -30 -30 -30 -30 -30 -30 -30 -30	11 AM Mar 06, 2022 Std: None Device: BTS 7430 GHz 558 dBm	Range Table Range 2 0n Off Start Freq 1.00000000 GHz Stop Freq 10.00000000 GHz 10.000 KHz Auto Man Video BW 300.00 KHz Auto Man Filter Type Gaussian More 1 of 3

MSG

2.6.6 Conducted Emissions Data: BLE Low Channel

🔤 Keysight S	pectrum Analyzer	- Spurious Emissions							🔤 Keysight S	pectrum Analyzer	- Spurious Emissions				- J 🔀
<mark>w</mark> Marker	RF 1823 84	50 Ω <u>Λ</u> DC	Cent	SENSE:INT er Freg: 2.353066967	GHz	0 08:04:28 A Radio Std	M Mar 08, 2022 : None	Range Table	<mark>W</mark> Marker [•]	RF 2 9 6071 (50 Ω AC	SENSE:INT Center Freg: 2.3	53066967 GHz	AUTO 08:12:15 AM Mar 08, 2022 Radio Std: None	Range Table
PASS	02010-11	IFGain	n:Low Trig: #Atte	Free Run Av en: 10 dB	g Hold:>50/50	Radio Dev	rice: BTS	Range			IFGain	:Low Trig: Free Run #Atten: 10 dB	Avg Hold:>50/8	50 Radio Device: BTS	Range
10 dB/div	Ref Of Ref 2	fset 20.6 dB 0.00 dBm				823. -69.1	84 MHz 76 dBm	1 <u>On</u> Off	10 dB/div	Ref Of Ref 2	fset 22 dB 1.40 dBm			9.6071 GHz -54.460 dBm	2 <u>On</u> Off
Log 10.0								Start Freq 30.000 kHz	Log 11.4 1.40						Start Freq 1.00000000 GHz
-20.0								Stop Freq 1.000000000 GHz	-8.60 -18.6 -28.6						Stop Freq 18.00000000 GHz
-50.0 -60.0						1		Res BW 100.00 kHz Auto <u>Man</u>	-48.6 -58.6 -68.6			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~			Res BW 100.00 kHz Auto <u>Man</u>
Start 30	kHz					St	op 1 GHz	Video BW 300.00 kHz	Start 1	GHz				Stop 18 GHz	Video BW 300.00 kHz
Spur	Range	Frequency	Amplitu	de L	imit	∆ Limit		Auto <u>Man</u>	Spur	Range	Frequency	Amplitude	Limit	∆ Limit	Auto <u>Man</u>
1 2 3	1 1 1	823.8 MHz 793.8 MHz 932.6 MHz	-60.00 de -61.29 de -61.67 de	<mark>8m -31.0</mark> 8m -31.0 8m -31.0	0 dBm • 0 dBm • 0 dBm •	-29.00 dB -30.29 dB -30.67 dB	т. Ш	Filter Type Gaussian	1 2 3	2 2 2	<mark>2.402 GHz</mark> 16.44 GHz 16.81 GHz	-2.013 dBm -49.84 dBm -51.15 dBm	-31.00 dBm -31.00 dBm -31.00 dBm	28.99 dB -18.84 dB -20.15 dB ∎	Filter Type Gaussian
4 5 6	1 1 1	843.0 MHz 910.0 MHz 865.6 MHz	-61.77 de -61.80 de -62.07 de	3m -31.0 3m -31.0 3m -31.0	0 dBm - 0 dBm - 0 dBm -	-30.77 dB -30.80 dB -31.07 dB		More 1 of 3	4 5 6	2 2 2	17.35 GHz 16.61 GHz 17.00 GHz	-51.53 dBm -51.56 dBm -51.88 dBm	-31.00 dBm -31.00 dBm -31.00 dBm	-20.53 dB -20.56 dB -20.88 dB	More 1 of 3
MSG	1	794.6 MHz	-62.08 di	-31.0	STA				MSG	2	16.72 GHZ	-51.96 dBm	-31.00 dBm	STATUS	

-		_					
🔤 Keysight Sj	pectrum Analyzer	- Spurious Emissions					🗗 💌
LXI	RF	50 Ω AC	SEN	VSE:INT	ALIGN AUTO	08:17:06 AM Mar 08, 2022	Range Table
Points 2	20001		Center Fr	req: 2.353066967 GHz	Ri Ri	adio Std: None	Range Table
PASS		IEGain	How #Atten: 1	0 dB	R:200/00	adio Device: BTS	Range
		II Guil	LOW			05 000 011	3
	Ref Of	fset 22 dB				25.906 GHZ	On Off
10 dB/div	Ref 2	1.40 dBm				-48.876 dBm	
Log							
11.4							Start Freq
1.40							18.00000000 GHz
-8.60							
-18.6							
10.0							Stop Freq
-28.6							26.00000000 GHz
-38.6						1	
-48.6							
58.6		~~~~~		$\sim \sim \sim$			Res BW
							100.00 KHz
-68.6							Auto <u>Mari</u>
Start 19	CH2					Stop 26 CHz	
Start To	GHZ					3top 20 GH2	Video BW
							300.00 kHz
Spur	Range	Frequency	Amplitude	Limit	ΔLi	imit	Auto <u>Man</u>
4	2	25.01.047	-44.10 dBm	-21 00 dE	m _12.1		
	2	23.91 GHZ	-44.19 UBIII	-31.00 dE	-13.1	9 UD	Filter Type
	3	24.82 GHZ	-44.89 06/11	-31.00 dE	-13.8	9 0 5	Gaussian
3	3	25.72 GHz	-45.00 dBm	-31.00 dE	m -14.0	0 dB ⊨	oudoblarr
4	3	25.73 GHz	-45.17 dBm	-31.00 dE	m -14.1	7 dB	
5	3	25.34 GHz	-45.24 dBm	-31.00 dE	-14.2	4 dB	More
6	3	25.99 GHz	-45.26 dBm	-31.00 dE	-14.2	6 dB	1 of 3
7	3	25.97 GHz	-45.39 dBm	-31.00 dE	m -14.3	9 dB	1013
						*	
MSG					STATUS		

MID Channel

Keysight	Spectrum Analyzer	- Spurious Emissions					Keysight !	Spectrum Analyzer	r - Spurious Emissions				
💴 Start Li	RF	50 Ω <u>∧</u> DC dBm	Center Freq: 2.44	ALIGN AUTO	08:25:30 AM Mar 08, 2022 Radio Std: None	Range Table	<mark>w</mark> Ava/Ho	RF Id Numbe	50 Ω AC	SENSE: Center Freq:	INT ALIGN 2.440000000 GHz	AUTO 08:32:11 AM Mar 08, 2022 Radio Std: None	Range Table
PASS		IFGain:L	ow #Atten: 6 dB	Avg Hold:>50/50	Radio Device: BTS	Range	1119,110		IFGain:	Low Trig: Free Ru #Atten: 6 dB	In Avg Hold:>20/2	20 Radio Device: BTS	Range
10 dB/div	Ref Of Ref 2	fset 20.6 dB 1.40 dBm			678.68 MHz -73.280 dBm	0n Off	10 dB/div	Ref Of Ref 2	fset 22 dB 2.80 dBm			2.4399 GHz -3.5127 dBm	2 <u>On</u> Off
11.4						Start Freq 30.000 kHz	12.8 2.80	1					Start Freq 1.000000000 GHz
-18.6 -28.6 -38.6						Stop Freq 1.000000000 GHz	-17.2 -27.2 -37.2						Stop Freq 18.000000000 GHz
-48.6 -58.6 -68.6				▲1		Res BW 100.00 kHz Auto <u>Man</u>	-47.2 -57.2 -67.2						Res BW 100.00 kHz Auto <u>Man</u>
Start 3) kHz				Stop 1 GHz	Video BW 300.00 kHz	Start 1	GHz				Stop 18 GHz	Video BW 300.00 kHz
Spur	Range	Frequency	Amplitude	Limit	∆ Limit	Auto <u>Man</u>	Spur	Range	Frequency	Amplitude	Limit	∆ Limit	Auto <u>Man</u>
1 2 3 4	1 1 1 1	678.7 MHz 782.9 MHz 872.3 MHz 942.3 MHz	-64.54 dBm -64.97 dBm -65.49 dBm -65.70 dBm	-32.00 dBm - -32.00 dBm - -32.00 dBm - -32.00 dBm -	32.54 dB △ 32.97 dB 33.49 dB ≡ 33.70 dB	Filter Type Gaussian	1 2 3 4	2 2 2 2	2.440 GHz 9.759 GHz 17.44 GHz 15.73 GHz	-1.552 dBm -51.03 dBm -54.64 dBm -54.93 dBm	-32.00 dBm -32.00 dBm -32.00 dBm -32.00 dBm	30.45 dB ▲ -19.03 dB -22.64 dB -22.93 dB ■	Filter Type Gaussian
5 6 7	1 1 1	916.2 MHz 860.9 MHz 929.1 MHz	-65.76 dBm -65.81 dBm -65.95 dBm	-32.00 dBm - -32.00 dBm - -32.00 dBm -	33.76 dB 33.81 dB 33.95 dB	More 1 of 3	5 6 7	2 2 2	16.13 GHz 16.74 GHz 16.92 GHz	-55.23 dBm -55.60 dBm -55.67 dBm	-32.00 dBm -32.00 dBm -32.00 dBm	-23.23 dB -23.60 dB -23.67 dB	More 1 of 3
MSG				STAT	rus 🔔 DC Coupled		MSG					STATUS	

🔤 Keysight Sp	ectrum Analyzer	- Spurious Emissions					
(X) Start Lin	RF 5	SOΩ AC	Center Fr	ISE:INT eg: 2.440000000 GHz	ALIGN AUTO 08:34:21 Radio St	AM Mar 08, 2022	Range Table
PASS	III -52.00	IFGain:	Low Trig: Free #Atten: 6	Run Avg Hold: dB	>20/20 Radio De	vice: BTS	Range
10 dB/div	Ref Off Ref 2	set 22 dB 2.80 dBm			25. -53.	830 GHz 500 dBm	3 <u>On Off</u>
12.8 2.80							Start Freq 18.000000000 GHz
-17.2 -27.2 -37.2							Stop Freq 26.00000000 GHz
-47.2 -57.2 -67.2				<u> </u>			Res BW 100.00 kHz Auto <u>Man</u>
Start 18	GHz				St	op 26 GHz	Video BW 300.00 kHz
Spur	Range	Frequency	Amplitude	Limit	Δ Limit		Auto <u>Man</u>
1	3	25.83 GHz	-48.49 dBm	-32.00 dBn	n -16.49 dB	<u>^</u>	
2	3	25.84 GHz	-48.68 dBm	-32.00 dBn	n -16.68 dB		Filter Type
3	3	25.92 GHz	-48.73 dBm	-32.00 dBn	n -16.73 dB	=	Gaussian
4	3	25.98 GHz	-48.75 dBm	-32.00 dBn	n -16.75 dB		
5	3	25.88 GHz	-48.75 dBm	-32.00 dBn	n -16.75 dB		More
6	3	25.71 GHz	-48.81 dBm	-32.00 dBn	n -16.81 dB		1 of 3
7	3	25.96 GHz	-49.14 dBm	-32.00 dBn	n -17.14 dB	-	
MSG					STATUS		

High Channel

Keysight S	pectrum Analyzer	- Spurious Emissions								🔤 Keysi	ight Spect	trum Analyzer - S	Spurious Emissions								- d 🔀
<mark>(,X)</mark>	RF 1	50 Ω 🛕 DC		SENSE:INT	A	LIGN AUTO	08:51:41 AM Mar 08,	2022	Range Table	LXI		RF 50	Ω AC		SEN	ISE:INT	ALI	GN AUTO	08:53:12 AM	Mar 08, 2022	Range Table
Start LI	nit -30.00	dBm		Trig: Free Run	AvalHold:>	20/20	Radio Std: None	- 8		Start	Limi	i -30.00 d	IBm	_	Trig: Free	eq: 2.480000 Run	AvalHold:>2	0/20 R	adio Std: i	None	
PASS		IFGa	iin:Low ื	#Atten: 10 dB			Radio Device: BTS	s	Range				IFG	Gain:Low 📩	#Atten: 1) dB		R	adio Devic	e: BTS	Range
10 dB/div	Ref Of Ref 2	fset 20.6 dB 2.80 dBm					748.58 M -70.109 dE	Hz Bm	1 <u>On</u> Off	10 dB/	/div	Ref Offs Ref 24.	et 22 dB .20 dBm						2.479 -2.426	99 GHz 60 dBm	2 <u>On</u> Off
12.8 2.80									Start Freq 30.000 kHz	Log 14.2 - 4.20 -		♦ ¹									Start Freq 1.000000000 GHz
-17.2 -27.2 -37.2									Stop Freq 1.000000000 GHz	-15.8 -25.8 -35.8											Stop Freq 18.000000000 GHz
-47.2 -57.2 -67.2						1			Res BW 100.00 kHz Auto <u>Man</u>	-45.8 -55.8 -65.8					~~~	J		~			Res BW 100.00 kHz Auto <u>Man</u>
Start 30	kHz						Stop 1 G	Hz	Video BW 300.00 kHz	Start	1 GH	z							Stop	18 GHz	Video BW 300.00 kHz
Spur	Range	Frequency	Am	nplitude	Limit	Δ	Limit	/	Auto <u>Man</u>	Sp	our	Range	Frequency	An An	nplitude		Limit	ΔL	imit		Auto <u>Man</u>
1	1	748 6 MHz	-59	92 dBm	-30.00 dBm	-20	92 dB	A .		1		2	2.480 GHz	-1.0	96 dBm	-3	0.00 dBm	28.90) dB	~	
2	1	749.0 MHz	-60	53 dBm	-30.00 dBm	-30	53 dB		Filter Type	2		2	16.47 GHz	-51	.21 dBm	-3	0.00 dBm	-21.2	1 dB		Filter Type
3	1	977.1 MHz	-61	47 dBm	-30.00 dBm	-31	.47 dB	-	Gaussian	3		2	15.59 GHz	-51	.35 dBm	-3	0.00 dBm	-21.3	5 dB	=	Gaussian
4	1	383.0 MHz	-61	52 dBm	-30 00 dBm	-31	52 dB			4		2	16.29 GHz	-51	.82 dBm	-3	0.00 dBm	-21.8	2 dB		
5	1	851.8 MHz	-61	74 dBm	-30.00 dBm	-31	74 dB			5		2	16.57 GHz	-51	.87 dBm	-3	0.00 dBm	-21.8	7 dB		
6	1	831.0 MHz	-61	76 dBm	-30.00 dBm	-31	.76 dB		More	6		2	16.80 GHz	-52	.03 dBm	-3	0.00 dBm	-22.0	3 dB		More
7	1	261.1 MHz	-61	85 dBm	-30.00 dBm	-31	.85 dB		1 of 3	7		2	17.92 GHz	-52	.03 dBm	-3	0.00 dBm	-22.0	3 dB		1 of 3
																				÷.	
MSG						STATUS	L DC Coupled			MSG								STATUS			

ш К	eysight Sp	ectrum Analyzer	- Spurious Emissions						[- 6
L <mark>XI</mark>	200	RF 5	50 Ω AC	SEI	VSE:INT	ALIGN AUTO	08:54:52 A	M Mar 08, 2022	Ran	ige Table
DAI	ige s			Trig: Free	e Run Avg Hol	d:>20/20				_
PA,			IFGain	:Low #Atten: 1	0 dB		Radio Dev	ice: BTS		Range
		Ref Of	set 22 dB				25.9	07 GHz	On	Off
10 c	B/div	Ref 2	4.20 dBm				-48.9	/1 dBm		
14.2										Start From
4.20									18 000	000000 GHz
-5.80									10.000	00000000112
15.00										
25.0										Stop Freq
-25.0									26.000	000000 GHz
-35.8								1		
-45.8								\sim		Res BW
-55.8										100.00 kHz
-65.8									Auto	Man
Sta	rt 18	GHz	I		^		Sto	p 26 GHz		
										300.00 kHz
				A second little and a	1.1		1.114		Auto	Man
	spur	Range	Frequency	Amplitude	Limit		Limit			
		3	25.91 GHz	-43.67 dBm	-32.00 di	3m -1'	1.67 dB	<u></u>	Fi	ilter Type
	2	3	25.86 GHz	-44.55 dBm	-32.00 dE	3m -12	2.55 dB			Gaussian
	3	3	25.93 GHz	-44.66 dBm	-32.00 dE	3m -12	2.66 dB	Ξ.		Gaussian
		3	25.80 GHz	-44.69 dBm	-32.00 d	sm -12	2.69 dB			
		3	25.75 GHz	-44./1 dBm	-32.00 d	sm -12	2.71 dB			More
)	3	25.27 GHZ	-45.05 dBm	-32.00 de	sm -1;	3.05 dB			1 of 3
ΓĽ		3	25.92 GHZ	-45.37 dBm	-32.00 di	sm -1.	3.37 dB	-		
MSG						STATUS	5			

2.7 EUT Positioning Assessment

Test Lab: Electronics Test Centre, Airdrie	EUT: Breeze-V
Test Personnel: Imran Akram	Standard: FCC PART 15.247
Date: 2022-02-28 (19.7° C,14.1 % RH)	Basic Standard: ANSI C63.4-2014
Comments : Z-Axis 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.

2.8 Radiated Spurious Emissions within restricted band

2022-03-01 (19.8° C,16.0 % RH)						
Date: 2022-02-28 (20.7° C,11.13 % RH)						
Braden Van Hee	Basic Standard: ANSI C63.10-2013					
Test Personnel: Imran Akram /Janet Mijares	Standard: FCC PART 15.247/15.209					
Test Lab: Electronics Test Centre, Airdrie	EUT: Breeze-V					

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 <mark>**</mark>	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 <mark>**</mark>	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 ****	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				
US only ** Canada 108 – 138 MHz *** Canada 960 – 1427 MHz *** Canada only								

Restricted Bands of Operation:

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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	2021-06-18	2022-06-18
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)	EMCO	3115	19357	2020-09-29	2022-09-29
STD Horn (18 – 26 GHz)	QuinStar Technology, Inc.	QWH-KPRS00	6163	2020-09-30	2022-09-30
Humidity/Temp Logger	Extech Ins. Corp.	42270	5892	2021-04-06	2022-04-06
Pre-Amplifier (30 – 1400 MHz)	HP	8447D	9291	2021-05-11	2022-05-11
Low Noise Amplifier (1 – 18 GHz)	MITEQ	JS43-01001800-21-5P	4354	2021-05-11	2022-05-11
Low Noise Amplifier (18 – 26 GHz)	MITEQ	JS44-01002650-33-3P	6163	2021-05-11	2022-05-11
RE Cable below 1GHz	Insulated Wire Inc.	KPS-1501A-3600- KPA-01102006	4419	2021-05-11	2022-05-11
Re Cable Above 1 GHz	A.H. System Inc.	SAC-26G-8.23	6187	2021-05-11	2022-05-11
0.9GHz Notch Filter	Microtronics	BRM20784	6947	2021-05-11	2022-05-11
2.4GHz Notch Filter	Microtronics	BRM50702	6953	2021-05-11	2022-05-11

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 903.0 MHz

The EUT met the requirements without modification.

2.8.5 Radiated Emissions Data: LoRa DTS

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 low band channel 903 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 [dB]	Corrected Reading [dBµv/m]	FCC 15.209 Limit [dBµv/m]	Delta [dB]	Azimuth [Deg]	Height [cm]	Polarization
1	*5417.1	32.04	AV	33.9	-30.9	35.04	54	-18.96	220	391	Horizontal
1	*5417.1	43.82	PK	33.9	-30.9	46.82	74	-27.18	220	391	Horizontal
2	*5418.9	30.8	AV	33.9	-30.9	33.8	54	-20.2	297	382	Vertical
2	*5418.9	43.43	PK	33.9	-30.9	46.43	74	27.57	297	382	Vertical

Spurious Emission

* Restricted Band



Plot of Radiated Emissions: Measuring Antenna Parallel

















2.8.6 Radiated Emissions Data: BLE

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 low band channel 2402 MHz was selected as the worst-case condition for detailed examination.
- In Transmit mode, the EUT was assessed up to 26 GHz.

Negative values for Delta indicate compliance.

Freq. Marker	Freq. [GHz]	Raw reading [dBµv]	Det	Antenna Factor [dB/m]	Pre amp Gain [dB]	DC Correctior Factor [dB]	Corrected Reading [dBµv/m]	FCC 15.209 Limit [dBµv/m]	Delta [dB]	Azimuth [Deg]	Height [cm]	Polarization
1	*4.804	41.11	AV	32.8	-32.0	1.79	43.58	54	-10.42	91	122	Horizontal
1	*4.804	50.46	PK	32.8	-32.0	1.79	53.05	74	-20.95	91	122	Horizontal
2	*7.2067	43.64	PK	35.8	-28.0	1.79	53.23	74	-20.77	89	114	Horizontal
2	7.2067	31.68	AV	35.8	-28.0	1.79	41.27	54	-12.73	89	114	Horizontal
3	*12.01	26.9	AV	39.2	-24.2	1.79	43.69	54	-10.31	247	105	Horizontal
3	*12.01	38.6	PK	39.2	-24.2	1.79	55.39	74	-18.61	247	105	Horizontal
4	*4.8034	53.34	PK	32.8	-32.0	1.79	55.93	74	-18.07	256	107	Vertical
4	*4.8034	43.88	AV	32.8	-32.0	1.79	46.47	54	-7.53	256	107	Vertical
5	*7.2052	46.11	PK	35.8	-28.0	1.79	55.7	74	-18.3	134	116	Vertical
5	*7.2052	33.95	AV	35.8	-28.0	1.79	43.54	54	-10.46	134	116	Vertical

Spurious Emission

Freq. Marker	Freq. [GHz]	Raw reading [dBµv]	Det	Antenna Factor [dB/m]	Pre amp Gain [dB]	DC Correction Factor [dB]	Corrected Reading [dBµv/m]	FCC 15.209 Limit [dBµv/m]	Delta [dB]	Azimuth [Deg]	Height [cm]	Polarization
6	*12.01	41.87	PK	39.1	-24.2	1.79	58.56	74	-15.44	272	104	Vertical
6	*12.01	29.49	AV	39.1	-24.2	1.79	46.18	54	-7.82	272	104	Vertical
7	*17.89	29.58	PK	46.2	-17.2	1.79	60.37	74	-13.63	197	105	Vertical
7	*17.89	15.66	AV	46.2	-17.2	1.79	46.45	54	-7.55	197	105	Vertical
1	23.89	19.27	Av	35.4	-17.2	1.79	39.26	54	-14.74	170	105	Horizontal
2	24.11	20.22	Av	35.6	-17.5	1.79	40.11	54	-13.89	36	120	Horizontal
3	24.65	21.08	Av	35.7	-17.5	1.79	41.07	54	-12.93	164	151	Horizontal
4	24.77	21.9	Av	35.7	-17.7	1.79	41.69	54	-12.31	350	160	Horizontal
5	25.34	21.08	Av	35.9	-17.7	1.79	41.07	54	-12.93	309	140	Horizontal
6	25.76	20.67	Av	36.1	-18	1.79	40.56	54	-13.44	77	174	Horizontal
7	25.92	21.21	Av	36.2	-17.5	1.79	41.7	54	-12.3	82	110	Horizontal
8	26.33	20.5	Av	36.4	-17.1	1.79	41.59	54	-12.41	13	139	Horizontal
9	24.59	20.23	Av	35.6	-17.4	1.79	40.22	54	-13.78	160	156	Vertical
10	24.79	21.63	Av	35.7	-17.8	1.79	41.32	54	-12.68	73	154	Vertical
11	25.30	21.74	Av	35.9	-17.5	1.79	41.93	54	-12.07	259	146	Vertical
12	25.94	20.84	Av	36.2	-17.6	1.79	41.23	54	-12.77	34	106	Vertical
13	26.46	21.59	Av	36.5	-16.8	1.79	43.08	54	-10.92	284	137	Vertical

* Restricted Band





Plot of Radiated Emissions: Measuring Antenna Perpendicular















Plot of Radiated Emissions: Horizontal polarization





Plot of Radiated Emissions: Horizontal/Vertical polarization Average analysis

 Radiated Emissions Tektelic BLE Low EUT 1 CS06 Project#t29e22a153
FCC Part 15.209 Jm PK
FCC Part 15.209 3m AVG

2.9 RF Exposure

Test Lab: Electronics Test Centre, Airdrie Test Personnel:	EUT: Breeze-V 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 Breeze-V 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 Breeze-V was placed at the center of the test chamber turntable on top of an 80cm high polystyrene foam table below 1GHz and at 1.5m high polystyrene foam table above 1 GHz. The EUT was grounded according to Tektelic Communication Inc. specifications.

3.3 Power Supply

All EUT power was supplied by an internal Battery.

Appendix A – Test Setup Block Diagram



End of Document