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ETC Report #: t29e20a152-P-DTS_FCC Release 1

Report date: September 15, 2021

Test Dates: December 21, 22 and 23, 2020 January 15, 2021

EMC testing of the Tektelic Communication Inc. BLE Sensor GEN2 in accordance with FCC Part 15.247, ANSI C63.4: 2014 and ANSI C63.10: 2013 as referenced by FCC OET KDB 558074 D01 15.247 Measurement Guidance v05r02.

FCC ID: 2ALEPT0007796

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REVISION RECORD

ISSUE	DATE	AUTHOR	REVISIONS
DRAFT 1	2021-07-30	I. Akram	Initial draft submitted for review.
Release 1	2021-09-15	M. Rousseau 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, ANSI C63.4-2014 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. BLE Sensor GEN2 test sample, referred to herein as the EUT (Equipment Under Test).

The sample has been provided by the customer.

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 Nam	e:	BLE Sensor GEN2
	Frequency Band	902 – 928 MHz
	Type of Modulation	Chirp Spread Spectrum
	BW/Frequency Range	DTS 500kHz, 903 – 914.2 MHz
LoRa Radio	Associated Antenna	Mfr: Fractus Antennas S.L, p/n: NN02-224,
	ASSociated Antenna	omni-directional, Gain 2.8dBi
	Detachable/Non Detachable	Non-Detachable (internal to product) Compliant FCC15.203 requirements)
	Model# / Serial#	T0007378 / 2048A0224
	Frequency Band	2400 – 2483.5 MHz
	Type of Modulation	DTS
	BW/Frequency Range	2402 – 2480 MHz
BLE Radio	Associated Antenna	Mfr: Pulse Larsen Antennas, p/n: W3008,
	ASSociated Antenna	Omnidirectional, Gain: 1.1dBi
	Detachable/Non	Non-Detachable (internal to product) Compliant FCC15.203
	Detachable	requirements)
	Model# / Serial#	T0007128 / 2048A0049
Power supply	y:	Internal Battery

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

Note: All three channels / axis for worse selected variant were evaluated. Worse channel and axis were selected for detail analysis for radiated emission. Differences in variant are given in product family document.

1.4 Multiple Models with different form factors

The BLE Generation 2 product family portable device variants share the same PCB and have the same RF circuitry, antenna, and output power. The differences between the variants in the product family are strictly functional - the sensor transducers and batteries supported for each variant are dependent on the use case it will address.

The enclosures of all variant are made of the same plastic. The only difference is the size to accommodate the battery and battery type (AA cell, or C cell) it holds. During our initial analysis of the product variants, we performed worst case power emission on both enclosure types for both radios and all modulation on each channel and axis's. The result of our worst-case engineering measurement is shown below.

Enclosure	Mode	Frequency (MHz)	Field Strength (dBµV/m)
		903	104.16
	LoRa (DTS)	907.8	101.71
		914.2	102.12
AA	LoRa	902.33	102.49
Enclosure	(DSS)	908.7	102.96
Linciosure	(033)	914.9	101.79
	BLE	2402	89.0
		2438	91.0
		2480	81.0
	LoRa (DTS)	903	106.0
		907.8	108.0
		914.2	106.0
	LoRa	902.33	110.0
C Enclosure		908.7	108.0
	(DSS)	914.9	107.0
		2402	84.37
	BLE	2438	83.28
		2480	81.35

1.5 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.

In this report, the EUT is only tested for the DTS transmission. Test results regarding Hybrid 125 kHz transmission mode is provided in the separate report. The environmental conditions are recorded during each test and are reported in the relevant sections of this document.

1.6 Scope of Testing

Tests were performed in accordance with FCC Part 15.247, ANSI C63.4: 2014, ANSI C63.10: 2013 as referenced in FCC OET KDB 558074 D01 15.247 Measurement Guidance v05r02.

The EUT was also tested as an unintentional radiator, as reported separately.

1.6.1 Test Methodology

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

1.6.2 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.

1.6.3 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.

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

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.

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	
	Frequency Range = (903 – 914.2) MHz 500 KHz DTS Mode Max. Conducted Average Tx Power = 18.67dBm (0.074 Watt)						
2.1	AC Conducted Emissions (Tx)	15.207	BLE Sensor GEN2	none	see § 2.1	n/a	
2.2	Occupied Bandwidth	15.247(a)(1) 15.247(2)(2)	BLE Sensor GEN2	none	see § 2.2	Compliant	
2.3	Max Average Output Power Conducted	15.247(b)	BLE Sensor GEN2	none	see § 2.3	Compliant	
2.4	Power Spectral Density	15.247(e) 15.247(f)	BLE Sensor GEN2	none	see § 2.4	Compliant	
2.5	Band Edge	15.247(d)	BLE Sensor GEN2	none	see § 2.5	Compliant	
2.6	Conducted Spurious Emission in Non-Restricted Band	15.247(d)	BLE Sensor GEN2	none	see § 2.6	Compliant	
2.7	EUT Position	ANSI C63.4	BLE Sensor GEN2	none	see § 2.7	Assessed	
2.8	Radiated Spurious Emission in Restricted Band (Tx Mode)	15.205, 15.209 15.247(d)	BLE Sensor GEN2	none	see § 2.8	Compliant	
2.9	RF Exposure	15.247(i)	BLE Sensor GEN2	none	see § 2.9	Exempt	

Refer to the test data for applicable test conditions.

2.1 AC Power Line Conducted Emissions

Test Lab: Electronics Test Centre, Airdrie

Test Personnel:

EUT: BLE Sensor GEN2 Standard: FCC Part 15.207

Date:

Basic Standard: ANSI C63.10: 2013

EUT status: n/a

Comments: Comments: BLE Sensor GEN2 is battery powered and there is no direct connection to Main.

2.2 Channel Occupied Bandwidth (DTS Mode)

Test Lab: Electronics Test Centre, Airdrie	EUT: BLE Sensor GEN2			
Test Personnel: Imran Akram	Standard: FCC PART 15.247			
Date: 2020-12-23 (21.6°C,14 % RH) 2021-01-15 (21.0°C,17.8 % RH)	Basic Standard: ANSI C63.10-2013 KDB 558074 D01 15.247 Measurement Guidance v05r02			
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: FCC KDB 558074 D01 15.247 Measurement Guidance v05r02/ ANSI C63.10 clause 11.8

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

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

Use the following spectrum analyzer settings:				
Span	between two times and five times the channel center frequency OBW			
RBW	100 KHz			
VBW	Set the VBW \geq [3 x RBW].			
Sweep	Auto Couple			
Detector function	peak			
Trace mode max hold				
Allow the trace to stabilize. The automatic bandwidth measurement capability of an				
instrument employed using the X dB bandwidth mode with X set to 6 dB				

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 (yyyy-mm-dd)	Cal. Due (yyyy-mm-dd)
MXE EMI Receiver	Keysight Technologies Inc	N9038A FW A 22.08	6906	2019-10-29	2020-10-29
Temp/Humidity	Extech	42270	5892	2019-04-05	2020-04-05
Attenuator	FairView Microwave	SA18N5WA-10	6886	2020-02-01	2021-02-01
DC Blocker	MCL	BLK-89-S+	-	2020-02-01	2021-02-01
CE Cable (50cm length)	Huber+Suhner	Enviroflex 400	-	2020-02-01	2021-02-01

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 modified to provide the direct access to antenna port for conducted measurements.

For compliance purposes EUT met requirements without any modification

There is no Deviation and exclusions from test specifications.

Test setup diagrams for Occupied Bandwidth testing:

Conducted:

EUT	Attenuator		Spectrum Analyzer

2.2.5 Channel Occupied Bandwidth Data: (LoRa)

Channel	Freq. [MHz]	6 dB OBW [kHz]	99% OBW [KHz]	Limit 6 dB OBW
Low	903	629.9	671.94	≥ 500 KHz
Mid	907.8	629.2	671.14	≥ 500 KHz
High	914.2	634.1	677.19	≥ 500 KHz

Screen Captures from the spectrum analyzer: Low Channel (LoRA)

	trum Analyzer - Occupied BW									
Ref Offset	RF 50 Ω AC		Center Fre	SE:INT eq: 903.000	000 MHz	LIGN AUTO	Radio Sto	AM Dec 23, 2020 d: None	Trac	e/Detector
		#IFGain:Low	Trig: Free #Atten: 30		Avg Hol	ld:>100/100	Radio De	vice: BTS		
10 dB/div	Ref Offset 10.5 dE Ref 38.50 dBm									
28.5										
18.5									(Clear Write
8.50										
-1.50										
-11.5		~~~					- marine			Average
-21.5	and the second states						- man	man		
-31.5										
-41.5										Max Hold
-51.5										
Center 903 #Res BW			#VB	W 300 k	Hz			2.000 MHz eep 1 ms		Min Hold
Occup	ied Bandwidt	h		Total P	ower	26.	2 dBm			
	6	71.94 k	Hz							Detector Peak▶
Transm	nit Freq Error	13.419	kHz	% of O	3W Pov	ver 9	9.00 %		Auto	Man
x dB Ba	andwidth	629.9	kHz	x dB		-6	.00 dB			
MSG						STATU	IS			

Average

Max Hold

Min Hold

Detector Peak▶

Man

Auto

Span 2.000 MHz

26.2 dBm

99.00 %

-6.00 dB

STATUS

Sweep 1 ms

10.6 20.5 30.5 40.5

50.

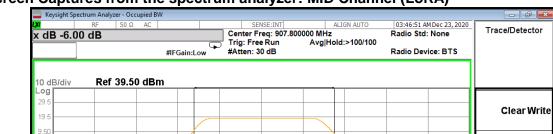
Center 907.800 MHz

Occupied Bandwidth

Transmit Freq Error

x dB Bandwidth

#Res BW 100 kHz



#VBW 300 kHz

x dB

Total Power

% of OBW Power

Screen Captures from the spectrum analyzer: MID Channel (LoRA)

Screen captures from the spectrum analyzer High Channel (LoRA)

671.14 kHz

13.480 kHz

629.2 kHz

Keysight Spectrum Analyzer - Occupied BW RF 50 Ω AC Center Freq 914.200000 M	IH7 Ce	SENSE:INT	ALIGN AUTO	04:10:46 AM Dec 23, 2020	Trace/Detecto
	Tr		Avg Hold:>100/100	Radio Device: BTS	
0 dB/div Ref 38.50 dBm					
og 28.5					Clear Wr
3.50					
1.5					Avera
1.5				man man man man	
1.5					Max Ho
enter 914.200 MHz				Cron 2 000 MHz	
Res BW 100 kHz		#VBW 300 kH	Z	Span 2.000 MHz Sweep 1 ms	Min Ho
Occupied Bandwidth	ı	Total Pov	wer 26.	3 dBm	
67	7.19 kHz				Detec Pea
Transmit Freq Error	9.026 kHz	% of OBV	V Power 9	9.00 %	Auto <u>N</u>
x dB Bandwidth	634.1 kHz	x dB	-6	.00 dB	
G			STATU	JS	

2.2.6 Channel Occupied Bandwidth Data: (BLE)

Channel	Freq. [MHz]	6 dB OBW [kHz]	99% OBW [MHz]	Limit 6 dB OBW
Low	2402	715.9	1.0487	≥ 500 KHz
Mid	2438	716.6	1.0669	≥ 500 KHz
High	2480	710.2	1.0524	≥ 500 KHz

Screen Captures from the spectrum analyzer: Low Channel (BLE)



Screen Captures from the spectrum analyzer: MID Channel (BLE)

Keysight Spectrum Analyzer - Occupied BW			
X RF 50 Ω AC		IGN AUTO 11:37:41 AM Jan 15, 2021 Radio Std: None	Trace/Detector
Ref Value 20.00 dBm	Center Freq: 2.438000000 GHz Trig: Free Run Avg Hold:>		
#IFGain:Lo		Radio Device: BTS	
		Mkr1 0 Hz	
10 dB/div Ref 20.00 dBm		dBm	
Log 1			
10.0			Clear Write
0.00			
-10.0			
-20.0			
-30.0			Average
-40.0		and a second sec	, in the second s
-50.0			
-60.0			Max Hold
-70.0			
Center 2.438000 GHz		Span 4.000 MHz	
#Res BW 100 kHz	#VBW 300 kHz	Sweep 1 ms	
	#•BH 000 MIL	encop i no	Min Hold
Occupied Bandwidth	Total Power	7.12 dBm	
1.0669	MU-7		Detector
1.0003			Detector Peak▶
Transmit Freq Error -54.7	57 kHz % of OBW Power	99.00 %	Auto <u>Man</u>
x dB Bandwidth 716	.6 kHz x dB	-6.00 dB	
MSG		STATUS	

Screen captures from the spectrum analyzer High Channel (BLE)

Keysight Spect	rum Analyzer - Occupied B RF 50 Ω AC	N	SENSE:INT ALIG	N AUTO 12:15:22 PM 3 15	2021
Ref Value	30.70 dBm		er Freq: 2.480000000 GHz	I2:15:22 PM Jan 15 Radio Std: None	Trace/Detector
			Free Run Avg Hold:>10 n: 12 dB	710 Radio Device: B1	s
10 dB/div	Ref 30.70 dBr	n		Mkr1 0 d	
20.7 10.7					Clear Write
-9.30 -19.3					Averag
-29.3 -39.3 -49.3 -59.3					
,	80000 GHz 100 kHz	#	≠VBW 300 kHz	Span 4.000 Sweep 1	
Occup	ied Bandwid		Total Power	7.05 dBm	
	1.	0524 MHz			Detecto Peak
Transm	it Freq Error	-57.220 kHz	% of OBW Power	99.00 %	Auto <u>Ma</u>
x dB Ba	ndwidth	710.2 kHz	x dB	-6.00 dB	
ISG				STATUS	

2.3 Maximum conducted (average) output power (DTS Mode)

Test Lab: Electronics Test Centre, Airdrie	EUT: BLE Sensor GEN2
Test Personnel: Imran Akram	Standard: FCC PART 15.247
Date: 2020-12-23 (21.6°C,14 % RH) 2021-01-15 (21.0°C,17.8 % RH)	Basic Standard: ANSI C63.10: 2013 KDB 558074 D01 15.247 Measurement Guidance v05r02

EUT status: Compliant

Specification: FCC Part 15.247(b, 3)

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

2.3.1 Test Guidance: FCC KDB 558074 D01 15.247 Measurement Guidance v05r02/ ANSI C63.10 Sub clause 11.9.2.2

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.

Outp	ut Power Method AVGSA-1
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 (If Duty Cycle ≥98%)
Trace Average	At least 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 (yyyy-mm-dd)	Cal. Due (yyyy-mm-dd)
MXE EMI Receiver	Keysight Technologies Inc	N9038A FW A 22.08	6906	2019-10-29	2020-10-29
Temp/Humidity	Extech	42270	5892	2019-04-05	2020-04-05
Attenuator	FairView Microwave	SA18N5WA-10	6886	2020-02-01	2021-02-01
DC Blocker	MCL	BLK-89-S+	-	2020-02-01	2021-02-01
CE Cable (50cm length)	Huber+Suhner	Enviroflex 400	-	2020-02-01	2021-02-01

2.3.4 Test Sample Verification, Configuration & Modifications

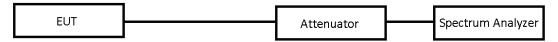
The EUT was set to a selected channel with test-specific software. The output was modulated as in normal operation.

The EUT modified to provide the direct access to antenna port for conducted measurements.

For compliance purposes EUT met requirements without any modification

Test setup diagrams for Peak Power testing:

Conducted:



2.3.5 Average Output Power Data (LoRa)

LoRa 500 KHz

Channel	Freq. [MHz]	Out Put Power (dBm)	Out Put Power Limit (dBm)	Margin (dB)
Low	903	18.59	30	11.41
Mid	907.8	18.64	30	11.36
High	914.2	18.67	30	11.33

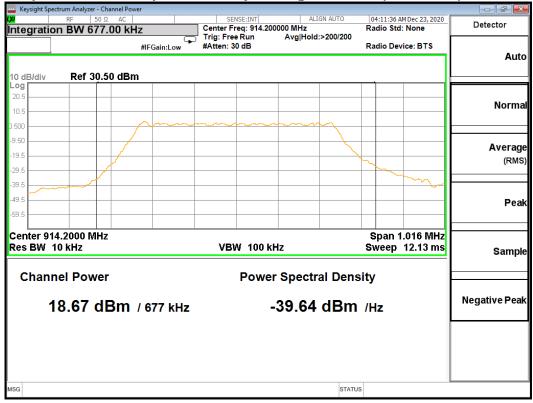
Screen Captures from the spectrum analyzer Low Channel (DTS Mode)



Screen Captures from the spectrum analyzer: MID Channel (DTS Mode)

Keysight Spect	trum Analyzer - (1				
tegration		Ω AC		Center Fre	g: 907.800		IGN AUTO		7 AM Dec 23, 2020 td: None	Detector
	gration BW 671.00 kHz #IFGain:Low			Trig: Free #Atten: 30		Avg Hold	i:>200/200	Radio D	Device: BTS	Au
0 dB/div og	Ref 30.	.50 dBm						_		
0.5										
).5										Norn
		\sim	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~				
50	_									Avera
.5	_									Avera (RM
.5										(
5		~							m	
.5										Pe
.5	_									
enter 907	7.8000 MH	7						Snar	1.007 MHz	
es BW 9.				VBW	91 kHz				p 14.53 ms	Sam
Chann	el Powe	er			Power	Spect	ral Dens	sity		
		_								Negative Pe
1	8.64 d	Bm / 67	71 kHz		-	39.63	dBm	/Hz		nogunter e
									P. Contraction of the second se	
							STATU	\$		

Screen Captures from the spectrum analyzer: High Channel (DTS Mode)



2.3.6 Average Output Power Data (BLE)

Channel	Freq. [MHz]	Out Put Power (dBm)	Out Put Power Limit (dBm)	Margin (dB)
Low	2402	0.79	30	29.21
Mid	2438	0.42	30	29.58
High	2480	0.38	30	29.62

Screen Captures from the spectrum analyzer Low Channel (BLE)



Screen Captures from the spectrum analyzer: MID Channel (BLE)

Keysight Spe Span 2.00	ctrum Analyzer - Chan RF 50 Ω	AC			: 2.438000000			11:44:10 A Radio Std	MJan 15, 2021 : None		Detector
		#IFGai		Trig: Free Ru #Atten: 40 dl		g Hold:>200/	/200	Radio Dev	rice: BTS		
10 dB/div	Ref 10.00	dBm					•				
-10.0										с	lear Writ
-20.0						~					
-40.0											Averaç
60.0											
70.0 80.0											Max Ho
Center 2.4 Res BW 1	138000 GHz 18 kHz			VBW	180 kHz				.000 MHz p 7.4 ms		Min Ho
Chanr	nel Power			Р	ower Sp	ectral D)ens	ity			
	0.42 dB	m / 1 M	۱Hz		-59	.58 dE	3m	/Hz		Auto	Detect Average M
SG							STATUS				

Screen Captures from the spectrum analyzer: High Channel (BLE)



2.4 Power Spectral Density (DTS Mode)

Test Lab: Electronics Test Centre, Airdrie	EUT: BLE Sensor GEN2
Test Personnel: Imran Akram	Standard: FCC PART 15.247
Date: 2020-12-23 (21.6°C,14 % RH) 2021-01-15 (21.0°C,17.8 % RH)	Basic Standard: ANSI C63.10: 2013 KDB 558074 D01 15.247 Measurement Guidance v05r02

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: FCC KDB 558074 D01 15.247 Measurement Guidance v05r02/ Sub clause 11.10 of ANSI C63.10

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

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

Use the following s	spectrum analyzer settings:
Span	At least 1.5 times the OBW.
RBW	3 KHz
VBW	Set the VBW \geq [3 × RBW].
Sweep	Auto Couple
Detector function	Power averaging (RMS) or sample detector (when RMS not available).
Trace mode	Employ trace averaging (RMS) mode over a minimum of 100 traces.
Allow the trace to amplitude level.	stabilize. Use the peak marker function to determine the maximum

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

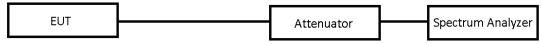
Testing was performed with this equipment:

Equipment	Manufacturer	Model # Asset		Cal. Date (yyyy-mm-dd)	Cal. Due (yyyy-mm-dd)
MXE EMI Receiver	Keysight Technologies Inc	N9038A FW A 22.08	6906	2019-10-29	2020-10-29
Temp/Humidity	Extech	42270	5892	2019-04-05	2020-04-05
Attenuator	FairViewSA18N5WA- 106886		6886	2020-02-01	2021-02-01
DC Blocker	MCL	BLK-89-S+	-	2020-02-01	2021-02-01
CE Cable (50cm length)	Huber+Suhner	Enviroflex 400	-	2020-02-01	2021-02-01

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 Peak PSD Data (LoRa DTS MODE)

500 KHZ Channels

Channel	Freq. [MHz]	PSD (dBm/3KHz)	PSD Limit (dBm/3KHz)
Low	903	-1.070	8
Mid	907.8	-1.370	8
High	914.2	-1.179	8

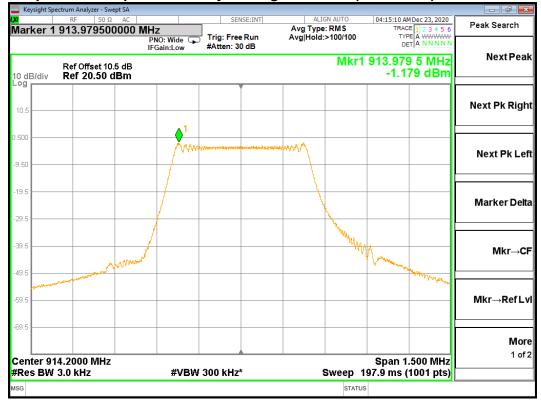
Screen Capture from Spectrum Analyzer: LOW Channel (DTS Mode)



Screen Capture from Spectrum Analyzer: MID Channel (DTS Mode)



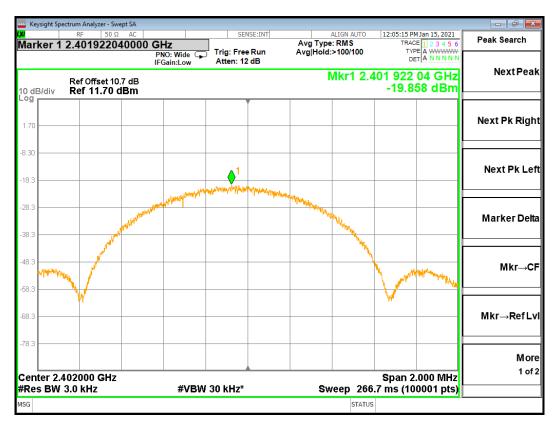
Screen Capture from Spectrum Analyzer: High Channel (DTS Mode)



2.4.6 Peak PSD Data (BLE DTS MODE)

Channel	Freq. [MHz]	PSD (dBm/3KHz)	PSD Limit (dBm/3KHz)
Low	2402	-19.858	8
Mid	2438	-20.743	8
High	2480	-20.614	8

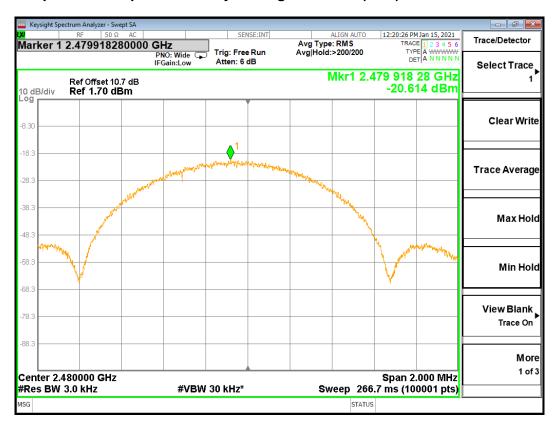
Screen Capture from Spectrum Analyzer: LOW Channel (BLE)



Screen Capture from Spectrum Analyzer: MID Channel (BLE)



Screen Capture from Spectrum Analyzer: High Channel (BLE)



2.5 Band Edge Attenuation (DTS Mode)

Test Lab: Electronics Test Centre, Airdrie	EUT: BLE Sensor GEN2
Test Personnel: Imran Akram	Standard: FCC PART 15.247
Date: 2020-12-23 (21.6°C,14 % RH) 2021-01-15 (21.0°C,17.8 % RH)	Basic Standard: ANSI C63.10: 2013 KDB 558074 D01 15.247 Measurement Guidance v05r02

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 11.11, 11.13.2 / FCC KDB 558074 D01 15.247 Measurement Guidance v05r02 Clause 8.7

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

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

Use the following s	spectrum analyzer settings:
Span	That encompasses both the peak of the fundamental emission and the
	band-edge emission under investigation.
RBW	1% of the total span
VBW	Set the VBW \geq [3 × RBW].
Sweep	Auto Couple
Detector function	Peak
Trace mode	Max Hold.
Allow the trace to	stabilize. Use the peak marker function to determine the maximum
amplitude level.	

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 (yyyy-mm-dd)	Cal. Due (yyyy-mm-dd)
MXE EMI Receiver	Keysight Technologies Inc	N9038A FW A 22.08	6906	2019-10-29	2020-10-29
Temp/Humidity	Extech	42270	5892	2019-04-05	2020-04-05
Attenuator	FairView Microwave	SA18N5WA-10	6886	2020-02-01	2021-02-01
DC Blocker	MCL	BLK-89-S+	-	2020-02-01	2021-02-01
CE Cable (50cm length)	Huber+Suhner	Enviroflex 400	-	2020-02-01	2021-02-01

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
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2.5.5 Band Edge Data (DTS MODE)

Modulation	Channel	Attenuation at Band Edge	Attenuation Limit at Band Edge
Lora 500KHz	903	47.995 dBc	30 dBc
Channels	914.2	68.679 dBc	30 dBc

Screen Capture from the spectrum analyzer: Lower Band Edge (DTS Mode)

🔤 Keysight Sp	ectrum Analyzer - Swept	t SA						
w Marker 1	RF PRESEL 50 Ω Δ 972.50000		SENSE	Avg Typ	IGN AUTO be: Log-Pwr d:>200/200	TRACI	Dec 23, 2020	Peak Search
10 dB/div	Ref Offset 10.5 Ref 30.50 dE		#Atten: 30 d			Mkr1 97:	2.5 kHz 995 dB	Next Peak
20.5 10.5					1Δ2			Next Pk Right
-9.50 -19.5 -29.5							DL1_11.42 dBm	Next Pk Left
-39.5 -49.5 -59.5								Marker Delta
	.000 MHz / 100 kHz RG SCL	Х	BW 300 kHz		Sweep 1.	Stop 903. .000 ms (1 FUNCTIO	1001 pts)	Mkr→CF
1 Δ2 2 F 3 4 5 6	1 f (Δ) 1 f	972.5 kHz(901.900 0 MHz	∆) 47.995 dE -29.251 dBm				E	Mkr→RefLv
7 8 9 10 11								More 1 of 2
MSG			m		STATUS	;	4	

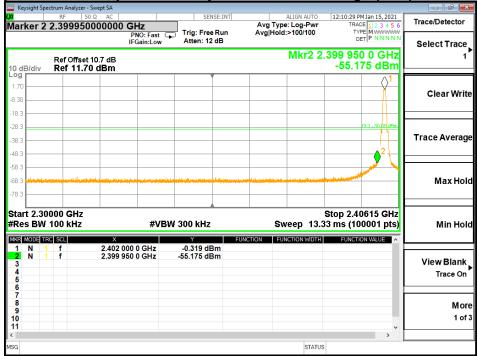
Screen Capture from the spectrum analyzer: Upper Band Edge (DTS Mode)

Avg Type: Log-Pwr TRACE 1 2 3 4 5 6	Trace/Detector
st Trig: Free Run Avg Hold:>100/100 TVPE MWWWWW w #Atten: 30 dB	Select Trace
ΔMkr1 -13.573 6 MHz 68.679 dB	1
	01
	Clear Write
DL1-1113.dBm	
	Trace Average
Mar war war war war war war war war war w	Max Hold
Stop 930.000 MHz VBW 300 kHz Sweep 1.533 ms (1001 pts)	Min Hold
Y FUNCTION FUNCTION WIDTH FUNCTION VALUE	
z (Δ) 68.679 dB z -49.846 dBm	View Blank
E	Trace On
	More 1 of 3
STATUS	

2.5.6 Band Edge Data (BLE DTS MODE)

Modulation	Channel	Attenuation at Band Edge	Attenuation Limit at Band Edge
BLE	2402	54.856 dBc	30 dBc
DLE	2480	57.866 dBc	30 dBc

Screen Capture from the spectrum analyzer: Lower Band Edge (BLE)



Screen Capture from the spectrum analyzer: Upper Band Edge (BLE)

							nalyzer - Sw		ght Spec	Key
Trace/Detector	12:26:39 PM Jan 15, 2021 TRACE 1 2 3 4 5 6 TYPE M WWWWW	ALIGN AUTO e: Log-Pwr		SENSE:INT		AC 00000 GH	50 Ω 35500	^{RF} 2.48	er 2 3	lark
Select Trac	DET P NNNN		Avg Hold	g: Free Run ten: 12 dB		PN0 IFG				
	l83 550 00 GHz -58.864 dBm	Mkr2 2.4					Offset 10 11.70		div	0 dE
								1	()	. og 1.70
Clear Wr								\mathcal{A}	~~~~	8.30
	DL 1 -30 00 dBm									18.3
Trace Avera	DL1 -30.00.dHm						\sim			28.3 38.3 -
					2		<u> </u>			48.3
		a tiday a sure of the	والمردية والمراجع والمراجع			Marile Market Street				58.3
Max Ho	and an all and a state of the second state of the second state of the second state of the second state of the s									58.3 ·
										78.3
Min Ho	top 2.490000 GHz 57 ms (100001 pts)		S) kHz	#VBW 300				2.479 BW 1	
	FUNCTION VALUE	NCTION WIDTH	INCTION FL			х			DDE TRO	
View Blan Trace O				998 dBm 864 dBm		2.480 000 00 2.483 550 00		f	N 1 N 1	2 3 4 5 6
Мс 1 с										7 8 9 10
	×									11
		STATUS								G

2.6 Conducted Spurious Emissions in non-restricted frequency bands (DTS Mode)

Test Personnel: Imran Akram

Date: 2020-12-23 (21.6°C,14 % RH) 2021-01-15 (21.0°C,17.8 % RH) Standard: FCC PART 15.247 Basic Standard: ANSI C63.4-2014 KDB 558074 D01 15.247 Measurement Guidance v05r02

EUT: BLE Sensor GEN2

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 11.11, FCC KDB 558074 D01 15.247 Measurement Guidance v05r02 Clause 8.5

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 \geq 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:

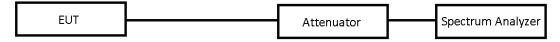
Equipment	Manufacturer	Model #	Asset #	Cal. Date (yyyy-mm-dd)	Cal. Due (yyyy-mm-dd)
MXE EMI Receiver	Keysight Technologies Inc	N9038A FW A 22.08	6906	2019-10-29	2020-10-29
Temp/Humidity	Extech	42270	5892	2019-04-05	2020-04-05
Attenuator	FairView Microwave	SA18N5WA-10	6886	2020-02-01	2021-02-01
DC Blocker	MCL	BLK-89-S+	-	2020-02-01	2021-02-01
CE Cable (50cm length)	Huber+Suhner	Enviroflex 400	-	2020-02-01	2021-02-01

2.6.4 Test Sample Verification, Configuration & Modifications

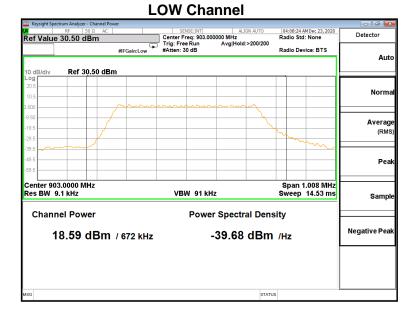
The EUT was set to a selected channel with test-specific software. The output was modulated as in normal operation. The EUT met the requirements without modification.

The EUT modified to provide the direct access to antenna port for conducted measurements

Test setup diagram for Conducted Spurious Emissions testing:



2.6.5 Conducted Suprious Emissions Data: LoRa



		it Spectrum Analyzer - Si					ight Spectrum Analyzer - Swept SA
SENSE:INT ALIGN AUTO 03:32:27 AM Dec 23, 2020 Avg Type: Log-Pwr TRACE 1 2 3 4 5 6		r 8 8.1274508	Sweep/Control	03:13:20 AM Dec 23, 2020 TRACE 1 2 3 4 5 6	Avg Type: Log-Pwr	SENSE:INT	RF PRESEL 50 Ω ▲ DC ts 4000
W #Atten: 30 dB DET P NNNN	PNO: Fast ++ IFGain:Low		Sweep Time	TYPE MWWWWW DET P NNNNN	-	Fast Trig: Free Run n:Low #Atten: 30 dB	
Mkr8 8.127 5 GHz -43.290 dBm		Ref Offset 1 v Ref 31.50	276 ms <u>Auto</u> Man	Mkr1 120 kHz -41.052 dBm			Ref Offset 10.5 dB div Ref 30.50 dBm
Nes			Sweep Setup ►				
CL1.10.42.886	3			DL111.42 oBn			
	4				No. 1. March 1997 - 199	in division in a contrain a constant series	
Stop 10.000 GHz /BW 300 kHz Sweep 953.6 ms (32000 pts) Y FUNCTION I FUNCTION WIDTH FUNCTION VALUE -	#VBW	0 MHz SW 100 kHz E TROISCU		Stop 30.00 MHz 75.9 ms (4000 pts)		#VBW 300 kHz	: 30 KHz BW 10 KHz ODE TRC SCL X
18,718 dBm -32,884 dBm -24,382 dBm -43,382 dBm -38,875 dBm -40,986 dBm	902.6 MHz 1.805 7 GHz 2.708 9 GHz 3.612 1 GHz 4.513 8 GHz 7.224 8 GHz	1 f 1 f 1 f 1 f 1 f 1 f	Gate [Off,∟0]	E			N 1 f 120
43.022 dBm 43.290 dBm	5.419 3 GHz 8.127 5 GHz	i f 1 f	Points 4000				
III STATUS			I	DC Coupled	STATUS	m	Points changed; all traces cleared

MID Channel

ntegratio		Ω AC		SENSE:INT Center Freq: 907.80		Radio St	AM Dec 23, 2020	Detector
			FGain:Low	Trig: Free Run #Atten: 30 dB	Avg Hold:>200		evice: BTS	Aut
0 dB/div	Ref 30	.50 dBm						
20.5								
10.5								Norm
500			~~~~~	<u> </u>				
.50		+				\rightarrow		Avera
9.5								(RM
9.5		/	-				ma	
9.5								
9.5								Pe
9.5								
enter 907		lz					1.007 MHz	
es BW 9	.1 kHz			VBW 91 kH	lz	Sweep	14.53 ms	Sam
Chann	el Powe	ər		Powe	r Spectral D	ensity		
aiiii					. opeolia b	y		
1	8.64 d	Bm /	671 kHz		-39.63 dE	3m /Hz		Negative Pe
							F	
						STATUS		

🔤 Keysight Sp	ectrum Analyzer - Swept SA						@ 	🔤 Key	/sight Spect	um Analyzer - Sw						
<mark>ø</mark> Marker 1	RF 50 Ω <u>A</u> DC 89.954989 kHz		SENSE	Avg Ty	IGN AUTO	03:53:52 AM Dec 23, 2020 TRACE 1 2 3 4 5 6	Peak Search	w Mar⊧	ker 4 4	RF 50 Ω	97991 GH		SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr Avg Hold: 10/10	03:59:40 AM Dec 23, 2020 TRACE 1 2 3 4 5 6	Peak Search
10 dB/div	Ref Offset 10.5 dB Ref 20.50 dBm	PNO: Fast G IFGain:Low	#Atten: 30 d		4.210/10	Mkr1 90 kHz	Next Peak	10 dE		Ref Offset 11 Ref 31.50 (IFG	O: Fast ↔ ain:Low	#Atten: 30 dB		TYPE N NNNN DET NNNNN r4 4.538 70 GHz -37.342 dBm	Next Peak
10.500						DL1 -11 37.dBm	Next Pk Right	21.5								Next Pk Right
-19.5 -29.5 -39.5						UL1-11-32.00h	Next Pk Left	-8.50 -18.5		0	2		A4		DL1 +10.37 dBm	Next Pk Left
-49.5	n) Hi kalanga katan tang kata tang kata ki kang kata ki ka	nark slade stad	general and the state of the state of the	atanti mana mana takina	giq-darldat piquanty	entionectoresesses sectores and the open-	Marker Delta	-38.5 -48.5 -58.5	and a product of the	Y						Marker Delta
Start 30 H #Res BW	10 kHz RC SCL X		W 300 kHz	FUNCTION FI	Sweep 2	Stop 30.00 MHz 75.9 ms (4000 pts) FUNCTIONVALUE	Mkr→CF	#Res	MODE TRC	00 kHz	×			Sweep 9	Stop 10.000 GHz 57.0 ms (99000 pts)	Mkr→CF
1 N 2 3 4 5	1 f	90 kHz	-43.799 dBm			E	Mkr→RefLvl	2	N 1	f f f	907.87 1.815 25 2.723 64 4.538 70	GHz GHz	19.767 dBm -33.930 dBm -24.514 dBm -37.342 dBm			Mkr→RefLv
7 8 9 10 11							More 1 of 2	7 8 9 10 11								More 1 of 2
MSG			m		STATUS	DC Coupled		K MSG						STAT	JS	

High Channel

Keysight Spectrum Analyzer - Channel Power			#_ _
rf 50 Ω AC ntegration BW 677.00 kHz	SENSE:INT ALIGN AUTO Center Freq: 914.200000 MHz	04:11:36 AM Dec 23, 2020 Radio Std: None	Detector
#F0	Gain:Low Trig: Free Run Avg Hold:>200/20 #Atten: 30 dB	00 Radio Device: BTS	Aut
0 dB/div Ref 30.50 dBm			Norm
9.5			Avera (RM
9.5			Pe
enter 914.2000 MHz es BW 10 kHz	VBW 100 kHz	Span 1.016 MHz Sweep 12.13 ms	Samı
Channel Power 18.67 dBm / 6	Power Spectral De 77 kHz -39.64 dBi		Negative Pe
3G	st	TATUS	

Keysight Spectrum Analyzer - Swept SA			wy Keysight Spectrum Analyzer - Swept SA	- # 💌
RF 50 2 ADC SENSE:INT ALION AUTO Average/Hold Number 10 PMC East (Trig: Free Run AvgType: Log-Pw	04:18:36 AM Dec 23, 2020	Meas Setup		Peak Search
PNO: Fast Trig: Free Run Avg Hold:>10/10 IFGain:Low #Atten: 30 dB	TYPE MWWWWW DET PNNNNN	Avg/Hold Num	IFGain:Low Atten: 30 dB DET P NNNNN	Next Peak
Ref Offset 10.5 dB 10 dB/div Ref 30.50 dBm	Mkr1 105 kHz -44.217 dBm	10	Ref Offset 11.5 dB Mkr4 7.312 10 GHz 10 dB/div Ref 31.50 dBm -38.674 dBm	INCAL P COR
		Avg Type Log-Pwr (Video) ► Auto Man		Next Pk Right
295	Di 111.13 dBm	Limits►		Next Pk Left
-39 5 1		N dB Points -3.01 dB On <u>Off</u>		Marker Delta
Start 30 kHz #Res BW 10 kHz #VBW 300 kHz Sweep MxR Mode tric sci x y Function wid	Stop 30.00 MHz 275.9 ms (4000 pts)	PhNoise Opt Fast Tuning ► Auto Man	Start 30 MHz Stop 10.000 GHz #Res BW 100 kHz #VBW 300 kHz Sweep 957.0 ms (99000 pts) Ime@imdolfpingisci x y Function Function wubbit Function wubbit	Mkr→CF
1 N 1 f 105 kHz -44.217 dBm 3 4 5 6 6	E	ADC Dither Medium ► Auto Man		Mkr→RefLvl
7 8 9 10 11		More 1 of 2	9	More 1 of 2
≮ [™ MSG STA	TUS J. DC Coupled		K W STATUS	

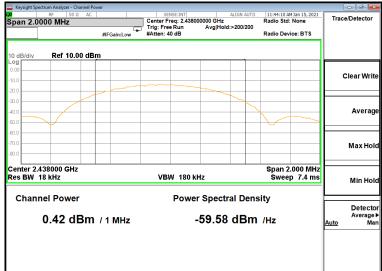
2.6.6 Conducted Spurious Emissions Data: BLE



		MBG					314103					
Keysight Spectrum Analyzer - Swept SA				-	🔤 Keysigl	ht Spectrum Ar	nalyzer - Swept SA					
ম⊧ <u>50 Ω ∆</u> চc arker 1 286.243500 kHz	Z PNO: Fast Trig: Free Run	ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>10/10	12:13:30 PM Jan 15, 2021 TRACE 1 2 3 4 5 6 TYPE M WWWWW	Peak Search	Marke	r 3 9.60	50 Ω AC 6752100000	0 GHz PNO: Fast	SENSE:INT	ALIGN AU Avg Type: Log-P Avg Hold:>10/10	Wr TRACE 1 2 3 4 5 6	Peak Search
	IFGain:Low Atten: 12 dB		DET P N N N N N	NextPeak				IFGain:Low	Atten: 12 dB		DET P NNNN	NextPe
Ref Offset 10.7 dB dB/div Ref 11.70 dBm		IVI)	kr1 286.24 kHz -64.234 dBm		10 dB/d	Ref C liv Ref	Offset 11.7 dB 12.70 dBm			IV	kr3 9.606 75 GHz -54.513 dBm	
.70				New Di Diebé	2.70		≬ ¹					Naut Die Die
.3				Next Pk Right	-7.30							Next Pk Rig
3			011-30.00 dBm		-17.3						DL1-23.00 dBm	
3				Next Pk Left	-37.3							Next Pk L
3					-47.3			\Diamond^2	3			
	and a sufficient state of the s	at we chards and we chard the weather and	and the second stand of the second state	Marker Delta	-67.3			Jul				Marker De
					-77.3							
art 30 kHz es BW 100 kHz	#VBW 300 kHz	Sween 666	Stop 30.00 MHz 7 ms (100001 pts)	Mkr→CF	Start 3 #Res F		(H7	#VBI	V 300 kHz	Sween	Stop 18.000 GHz 1.720 s (100001 pts)	Mkr-
MODE TRC SCL X	Y	FUNCTION FUNCTION WIDTH	FUNCTION VALUE		MKR MOD	DE TRC SCL	x		Y F	JNCTION FUNCTION W		
N 1 f	286.24 kHz -64.234 dBm				1 N 2 N 3 N	1 f	4.8	401 68 GHz 803 37 GHz 506 75 GHz	0.683 dBm -59.588 dBm -54.513 dBm		_	
			_	Mkr→RefLvl	4 5		5.0	500 7 5 GHZ	-04.013 UBIII			Mkr→Ref
					6 7							
				More 1 of 2	9 10							M 1
			×		11 <						×	
		STATUS	L DC Coupled		MSG					SI	ATUS	
		K 1110 1										

m Analyzer - Swept SA	
5.956560000000 GHz Avg Type: Log-Pwr	TRACE 1 2 3 4 5 6 TYPE M WWWWW
IFGain:Low Atten: 12 dB	.956 56 GHz Select Trace
	41.641 dBm
	Clear Writ
	Trace Average
	10 11 10 10 10 10 10 10 10 10 10 10 10 1
	Max Ho
GHz St	op 26.000 GHz
0 kHz #VBW 300 kHz Sweep 766.7 m	ns (100001 pts) Min Ho
X Y FUNCTION FUNCTION WIDTH f 25.956 56 GHz -41.641 dBm FUNCTION FUNCTION	FUNCTION VALUE
	View Blank Trace On
	Mo
	1 of
STATUS	

MID Channel

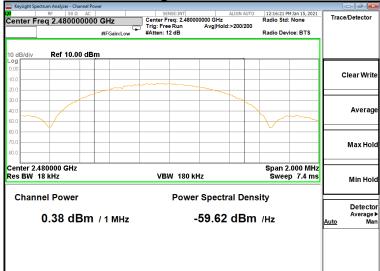


STATUS

weysight Spectrum Analyzer - Swept SA				- 9 💌	🔤 Ke	eysight Spectri	ım Analyzer - Sw									
₩ RF 50 Ω ▲ DC Marker 1 2.43798000000	0 GHz	SE:INT ALIGN AUT Avg Type: Log-Pv	Vr TRACE 1 2 3 4 5 6	Marker	wµ Disp	play Lin	e 1 -30.0	AC 0 dBm			SE:INT	Avg Type:	LIGN AUTO	11:58:33 AM Jan 1 TRACE 1 2	3456	Display
	PNO: Fast Trig: Free IFGain:Low Atten: 10	dB	DET P NNNN	SelectMarker				F	NO: Fast Gain:Low	Trig: Free Atten: 10		Avg Hold:		TYPE MW DET PN		Annotation►
10 dB/div Ref Offset 10.5 dB Ref 10.50 dBm		Mk	r1 2.437 980 GHz dBm	1			Ref Offset 11 Ref 11.70 (Mkr	3 9.752 85 -53.404 c		Annotation
-19.50				Normal	Log 1.70 -8.30 -18.3		^1 									Title►
-19.5			DL1 -30.00 dBm	Delta	-18.3 -28.3 -38.3 -48.3						▲ 3			DI 1.3		Graticule <u>On</u> Off
-59.5 -69.5 -79.5	and a second and a second second	man and the second s	Nellan provide the second of	Fixed⊳	-58.3 -68.3 -78.3										-	Display Line -30.00 dBm <u>On</u> Off
Start 30 kHz #Res BW 100 kHz	#VBW 300 kHz	Sweep	Stop 30.00 MHz 2.867 ms (1001 pts)		#Re	rt 30 MH es BW 10	0 kHz	×	#VBV	/ 300 kHz	PUNA		weep 1.	Stop 18.000 720 s (10000 FUNCTION VAL	l pts)	Display Lines ►
Image N 1 F 2 3 4 5 6	2.438 GHz dB			Properties▶		N 1 N 1	f f f	2.437	80 GHz 43 GHz 85 GHz	0.775 dB -59.701 dB -53.404 dB	m m		GHOWWIDTH	FUNCTION VAL		System Display▶ Settings
7 8 9 10 11				More 1 of 2	7 8 9 10 11										```	
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- 2 🖻							ctrum Analyzer -	Keysight Spec
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1	25.374 24 GHz -41.879 dBm	Mkr1					Ref Offset Ref 23.0	dB/div
								3 .0
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Trace Averag	DL1 -30.00 dDm							7.0
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				dallar or bood if		in a set of the set	an an ha thirte a fact the	7.0
Max Hol							**************************************	7.0
	Stop 26.000 GHz						00 011-	art 18.00
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) Min Hol	FUNCTION VALUE	UNCTION WIDTH	FUNCTION	Y .879 dBm	24 GHz -4	X 25.27/	f	GRIMODE TRO
View Blank	_			.679 UBIII	24 GHZ -4	20.374	-	2
Trace On								4
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High Channel



STATUS

Display Line 1-30.00 dBm (Foint.cw) Avg Type: Log-Pwr Trig: Free Run Bedint.cw Avg Type: Log-Pwr Avg/biol:>100 Trid: Free Run Bedint.cw Avg Type: Log-Pwr Avg/biol:>100 Trid: Free Run Bedint.cw Avg Type: Log-Pwr Trig: Free Run Bedint.cw Avg Type: Log-Pwr Avg/biol:>100 Trid: Free Run Bedint.cw Avg Type: Log-Pwr Avg/biol:>100 Mkr2 9:200	Keysight Spectrum Analyzer - Swept SA		u Keysight Spectrum Analyzer - Swept SA		
Ref Offset 107.dB Mkr1 280.85 kHz -64.472 dBm Annotation Ref offset 117.dB Mkr2 9.920 69 GHz -53.965 dBm Next Peak 10 dB(dv/ Ref 11.70 dBm 64.472 dBm 64.472 dBm 64.472 dBm 64.472 dBm 1 <td< td=""><td></td><td></td><td>Marker 2 9.920688000000 GHz</td><td>Avg Type: Log-Pwr</td><td>TRACE 1 2 3 4 5 6 Peak Search</td></td<>			Marker 2 9.920688000000 GHz	Avg Type: Log-Pwr	TRACE 1 2 3 4 5 6 Peak Search
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10 1	10 dB/div Ref 11.70 dBm	-64.472 dBm	10 dB/div Ref 12.70 dBm		-53.965 dBm
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#Res BW 100 kHz #VBW 300 kHz #VBW 300 kHz Sweep 6.667 ms (100001 pts) Display Lines #Res BW 100 kHz #VBW 300 kHz Sweep 1.720 s (100001 pts) Mkr—CF 1 1 f 280.85 kHz -64.472 dBm Function Motifier Function Moti		-30.00 dBn	-67.3		
I N 1 f 2.479 92 GHz 0.032 dBm 3 System Display + 4 -53.965 dBm -53.965 dBm 4 Settings 6 -64.472 dBm -64.472 dBm -64.472 dBm 5 Settings 6 -73.965 dBm -53.965 dBm -64.472 dBm 7 Settings 6 -73.965 dBm -64.472 dBm -64.472 dBm 7 Settings 7 -74.748 -74.748 -74.748 -74.748 8 Settings 7 -74.748 -74.748 -74.748 -74.748 -74.748 10 Settings 10 -74.748 -74.748 -74.748 -74.748 -74.748 -74.748 10 -74.748 -74.748 -74.748 -74.748 -74.748 -74.748 -74.748 -74.748 10 -74.748 -74.748 -74.748 -74.748 -74.748 -74.748 -74.748 -74.748 -74.748 -74.748 -74.748 -74.748 -74.748 -74.748 -74.748 -74.748 -74.748 -74.748 -74.748			#Res BW 100 kHz #VBW 30		
9 10 10f2		System Display	1 N 1 f 2.479 92 GHz 2 N 1 f 9.920 69 GHz -5	0.032 dBm	
	3 8 9 10 11	v	7 8 9 10 11		
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- 8 -							ectrum Analyze	(eysight Sp
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Select Trace	DET P NNNN		Avgi	Trig: Free Run Atten: 12 dB	PNO: Fast 🖵 IFGain:Low			
1	25.732 64 GHz -42.207 dBm	Mkr1				fset 22 dB 3.00 dBm		dB/div
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	and the second second second							0
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	Stop 26.000 GHz						000 GHz	
	.7 ms (100001 pts)			300 kHz	#VBW		100 kHz	
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1 of								
	×							
	3	STATUS						

2.7 EUT Positioning Assessment

Test Lab: Electronics Test Centre, Airdrie

Test Personnel: Janet Mijares

Date: 2020-12-21/22 (20.1°C,16.3% RH)

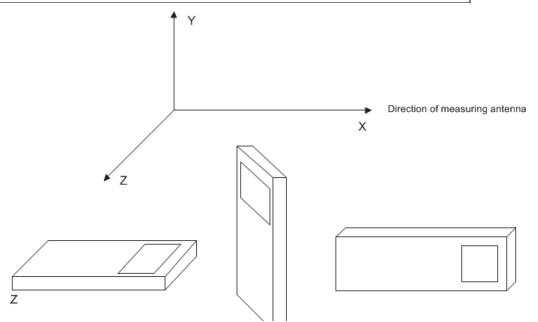
EUT: BLE Sensor GEN2 Standard: FCC PART 15.247 Basic Standard: ANSI C63.4-2014

X-Axis Found worse

Comments: EUT oriented in three axis's and X- axis found to be worse emission axis. .

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 in restricted frequency bands (TX Mode)

Test Lab: Electronics Test Centre, Airdrie

EUT: BLE Sensor GEN2

Test Personnel:, Imran Akram, Janeth Mijares

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

Date: 2020-12-22/23 (21.6°C,14 % RH)

EUT status: Compliant

Specification: FCC PART 15.247(d)

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

2.8.1 Test Guidance: ANSI C63.10-2013, Clause 11.12 / KDB 558074 D01 15.247 Measurement Guidance v05r02 Clause 8.6

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

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

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

2.8.2 Deviations From The Standard:

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

2.8.3 Test Equipment

Testing was performed with the following equipment:

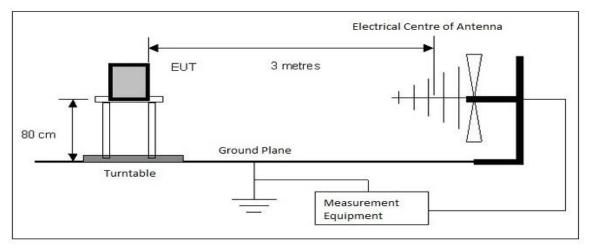
Equipment Manufacturer		Model # Asset #		Cal. Date (yyyy-mm-dd)	Cal. Due (yyyy-mm-dd)	
EMC Software	UL	Ver. 9.5	ETC-SW-EMC 2.1	N	/A	
EMI receiver	Agilent	N9038A (FW A.25.05)	6130	2019-05-10	2020-05-10	
Loop Antenna	EMCO	6502	10868	2019-04-11	2021-04-11	
Biconilog Antenna	ARA	LPB-2520/A	4318	2018-09-19	2020-09-19	
DRG Horn	EMCO	3115	19357	2018-09-12	2020-09-12	
Humidity/Temp Logger	Extech Ins. Corp.	42270	5892	2019-04-05	2020-04-05	
Low Noise Amplifier (1 – 18 GHz)	MITEQ	JS43-01001800- 21-5P	4354	2020-01-03	2021-01-03	
Pre-Amplifier (30 – 1300 MHz)	HP	8447D	9291	2020-01-03	2021-01-03	
RE Cable below 1GHz	Insulated Wire Inc.	KPS-1501A- 3600-KPA- 01102006	4419	2020-01-03	2021-01-03	
Re Cable Above 1 GHz	A.H. System Inc.	SAC-26G-8.23	6187	2020-01-03	2021-01-03	
Notch filter 2.45GHz	Micro-Tronix	BRM50702	s/n 088	2020-01-03	2021-01-03	
High Pass Filter	K&L	4DH21	-	2020-01-03	2021-01-03	

2.8.4 Test Sample Verification, Configuration & Modifications

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

The EUT met the requirements without modification.

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



Above 1GHz, the EUT is raised using a low permittivity material (polystyrene) to a height of 1.5m.

FCC Part 15.205 Restricted Bands of Operation:
--

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	*4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	*108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	*2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	*3600 - 4400	(²)
13.36 - 13.41	patriated band aball ba 0,400,0,510 ML		

¹ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz, ² Above 38.6

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in 15.209 shall be demonstrated based on the average value of the measured emissions.

Specification: FCC15.209 Radiated emission limits.

Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

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 $db_{\mu}V/m$.

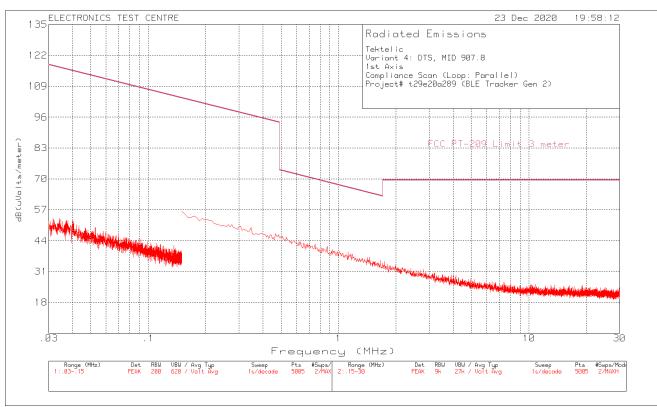
Delta = Field Strength - Limit

- **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 discrete increments of height and azimuth, while the reported measurement is obtained with the appropriate Quasi Peak or Average detector after the height and azimuth have been adjusted for maximum emission.
 - Preliminary scans were performed for all channels in Transmit modes. The MID band channel 907.8 MHz was selected as the worst-case condition for detailed examination.
 - In Transmit mode, the EUT was assessed up to 10.0 GHz.

	. <u>J</u>										r P
Freq.	Freg.	Raw reading		Antenna Factor	Pre amp Gain	Corrected Reading	FCC 15.209 Limit	Delta	Azimuth	Hoight	
Marker	[MHz]	(dBµv]	Det	[dB/m]	[dB]	[dBµv/m]	[dBµv/m]	[dB]	[Deg]	Height [cm]	Polarization
1	278.88	22.62	QP	17.4	-21.9	18.12	46.02	-27.9	18	103	Horizontal
-		-	-		_	-		-	-		
2	124.25	26.78	QP	18.1	-23.2	21.68	43.5	-21.82	90	105	Vertical
3	689.74	26.44	QP	24.1	-19.3	31.24	46.02	-17.78	290	115	Vertical
1	*2723.8	50.07	AV	29.7	-33.8	45.97	54	-8.03	41	322	Horizontal
1	*2723.8	56.16	PK	29.7	-33.8	52.06	74	-21.94	41	322	Horizontal
2	*2723.8	47.57	AV	29.7	-33.8	43.47	54	-10.53	77	321	Vertical
2	*2723.8	54.03	PK	29.7	-33.8	49.93	74	-24.07	77	321	Vertical
1	*5464.4	29.86	AV	34	-30.4	33.46	54	-20.54	189	232	Horizontal
1	*5446.4	41.5	PK	34	-30.4	45.1	74	-28.9	189	232	Horizontal
2	*7262.8	24.59	AV	36.3	-27.5	33.39	54	-20.61	320	296	Horizontal
2	*7262.8	37.26	PK	36.3	-27.5	46.06	74	-27.94	320	296	Horizontal
3	*8169.3	26.95	AV	36.7	-26.2	37.45	54	-16.55	11	207	Horizontal
3	*8169.3	40.54	PK	36.7	-26.2	51.04	74	-22.96	11	207	Horizontal
4	*9079.3	24.7	AV	37.5	-26.4	35.8	54	-18.2	45	143	Horizontal
4	*9079.3	37.84	PK	37.5	-26.4	48.94	74	-25.06	45	143	Horizontal
5	*5446.4	31.66	AV	34	-30.4	35.26	54	-18.74	143	238	Vertical
5	*5446.4	42.83	PK	34	-30.4	46.43	74	-27.57	143	238	Vertical
6	*7261.4	27.45	AV	36.3	-27.5	36.25	54	-17.75	206	111	Vertical
6	*7261.4	40.18	PK	36.3	-27.5	48.98	74	-25.02	206	111	Vertical
7	*8172.3	25.75	AV	36.7	-26.2	36.25	54	-17.75	318	156	Vertical
7	*8172.3	40.67	PK	36.7	-26.2	51.17	74	-22.83	318	156	Vertical
8	*9079.7	23.69	AV	37.5	-26.4	34.79	54	-19.21	306	154	Vertical
8	*9079.7	36.87	PK	37.5	-26.4	47.97	74	-26.03	306	154	Vertical

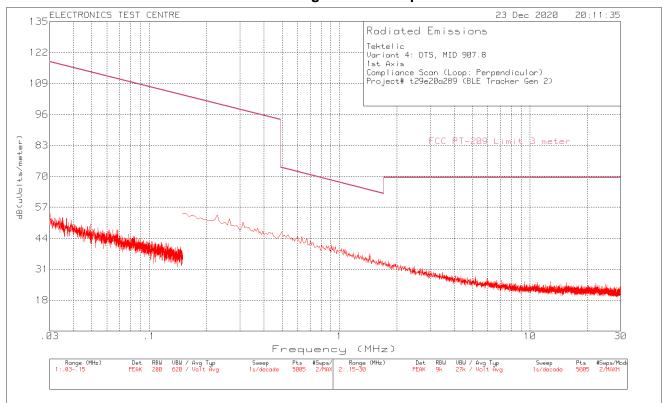
Negative values for Delta indicate compliance.

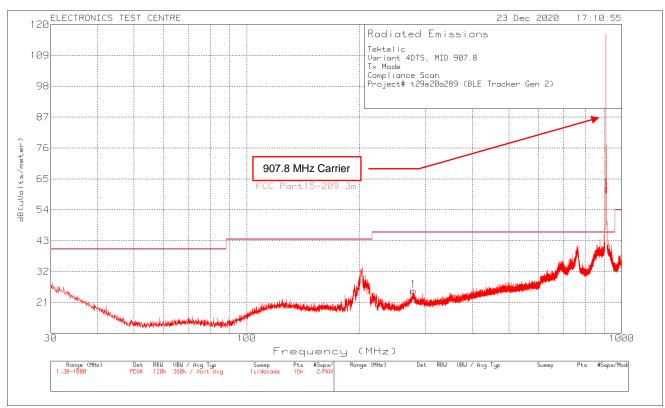
AV: Average Detector, PK: Peak Detector, * Restricted Band (RB) Non Restricted Band (NRB)



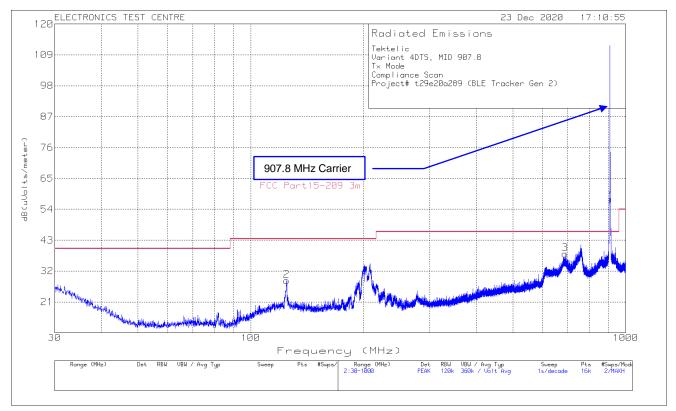
Plot of Radiated Emissions LoRa: Measuring Antenna Parallel







Plot of Radiated Emissions LoRa: Vertical polarization

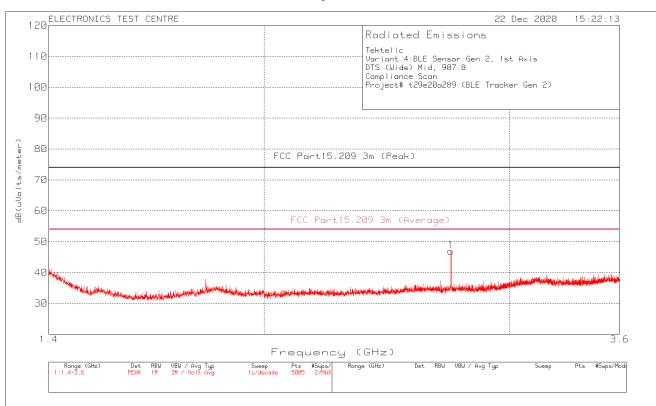


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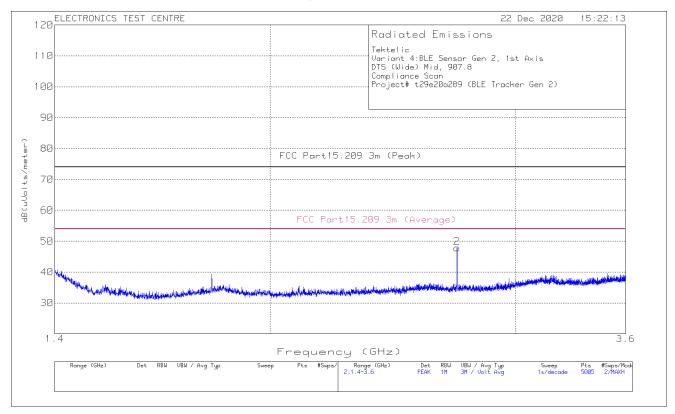
30 ELECTRONICS TEST CENTRE	22 Dec 2020 15:13:22
120	lst Axis Compliance Scan
88	
98	
80 FCC Part15-209 Peak 3m	
70	
68	FCC Part15-289 3m Average
58	
48	ensulatoruntentenariatika, etaisunkilleisirendukunteisiaikatus, asudasiaiki
Freque	ncy (GHz)
	iups/ Range (SHz) Det RBU UBU / Avg Typ Sweep Pts #Sups/Mod

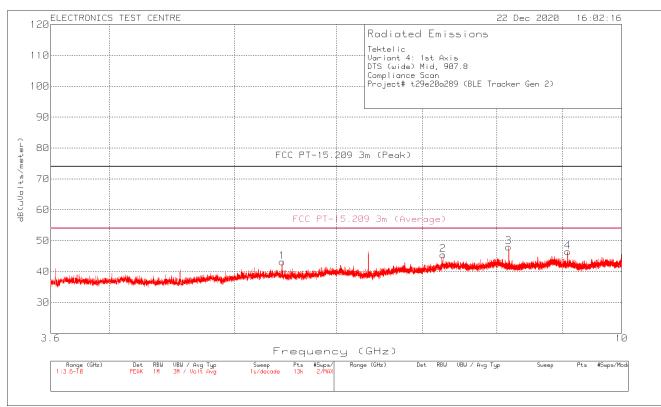
Plot of Radiated Emissions LoRa: Vertical polarization



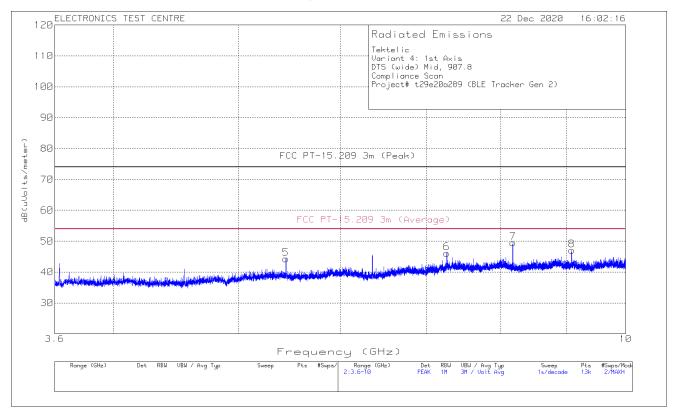


Plot of Radiated Emissions LoRa: Vertical polarization





Plot of Radiated Emissions LoRa: Vertical polarization



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 discrete increments of height and azimuth, while the reported measurement is obtained with the appropriate Quasi Peak or Average detector after the height and azimuth have been adjusted for maximum emission.
 - Preliminary scans were performed for all channels in Transmit modes. The MID band channel 2438 MHz was selected as the worst-case condition for detailed examination.
 - In Transmit mode, the EUT was assessed up to 26.5 GHz.

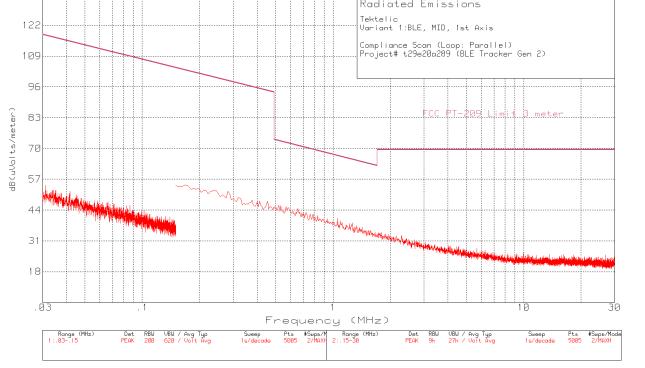
Freq. Marker	Freq. [GHz]	Raw reading [dBµv]	Det	Antenna Factor [dB/m]	Pre amp Gain [dB]	Corrected Reading [dBµv/m]	FCC 15.209 Limit [dBµv/m]	Delta [dB]	Azimuth [Deg]	Height [cm]	Polarization
1	*4.876	39.41	AV	33	-31.9	40.51	54	-13.49	202	121	Horizontal
1	*4.876	44.1	PK	33	-31.9	45.28	74	-28.74	202	121	Horizontal
4	*17.86	19.8	AV	46.2	-20	46	54	-8.0	39	103	Horizontal
4	*17.86	31.16	PK	46.2	-20	57.36	74	-16.64	39	103	Horizontal
2	*4.876	39.26	AV	33	-31.9	40.36	54	-13.64	132	107	Vertical
2	*4.876	43.76	PK	33	-31.9	44.86	74	-29.14	132	107	Vertical
3	*17.86	19.81	AV	46.2	-19.9	46.11	54	-7.89	17	102	Vertical
3	*17.86	31.59	PK	46.2	19.9	57.89	74	-16.11	17	102	Vertical

Negative values for Delta indicate compliance.

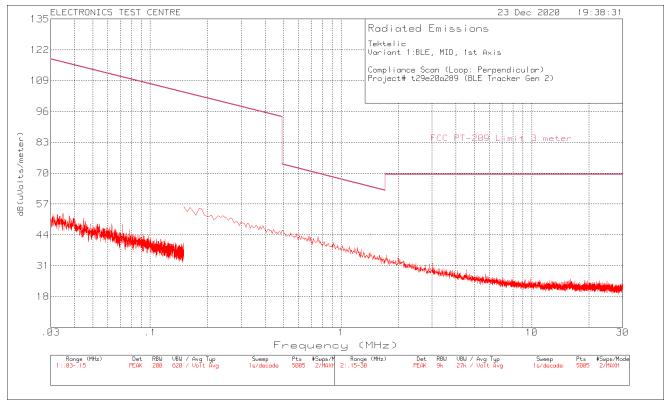
AV: Average Detector, PK: Peak Detector, * Restricted Band (RB) Non Restricted Band (NRB)

19:24:01

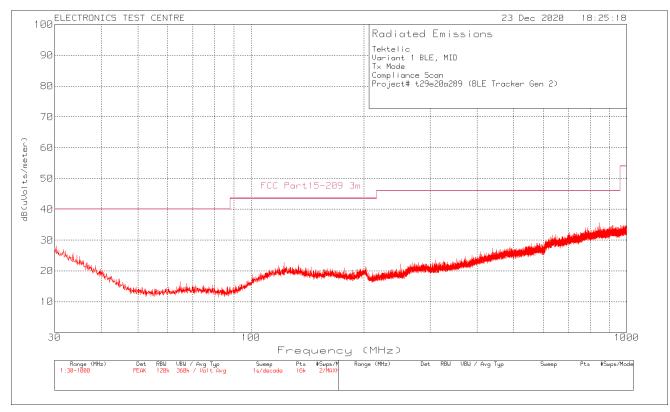
Plot of Radiated Emissions BLE: Measuring Antenna Parallel



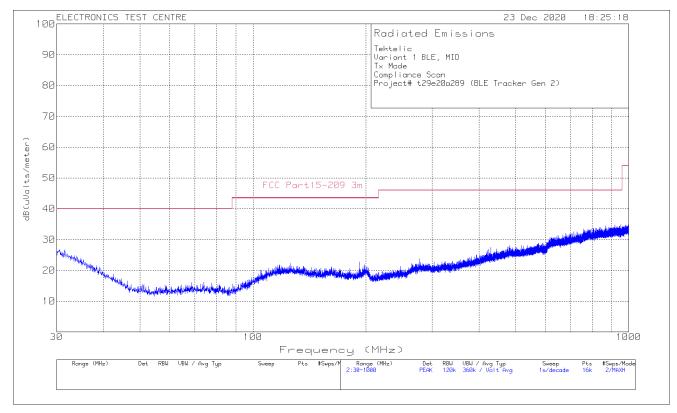
Plot of Radiated Emissions BLE: Measuring Antenna Perpendicular



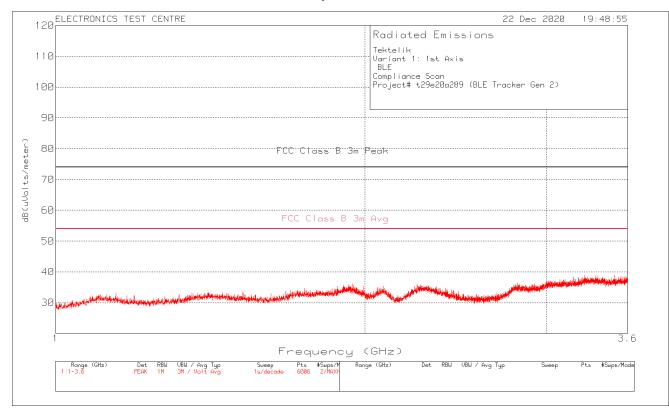
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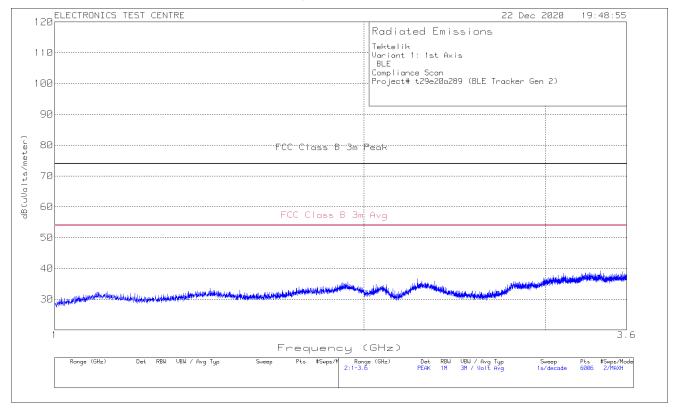
Plot of Radiated Emissions BLE: Vertical polarization

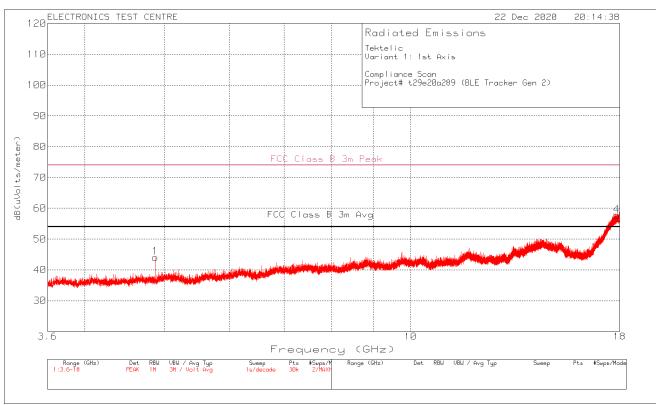


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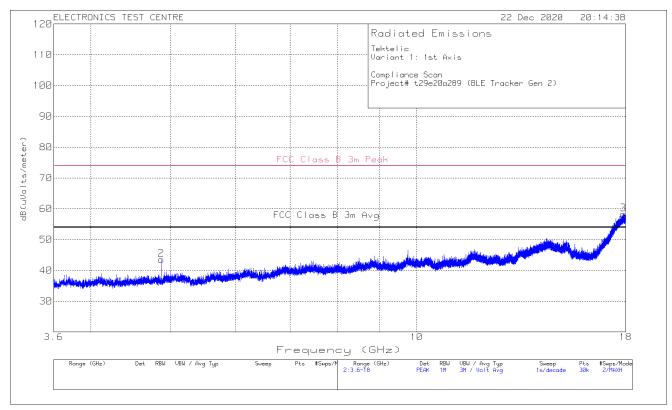


Plot of Radiated Emissions BLE: Vertical polarization



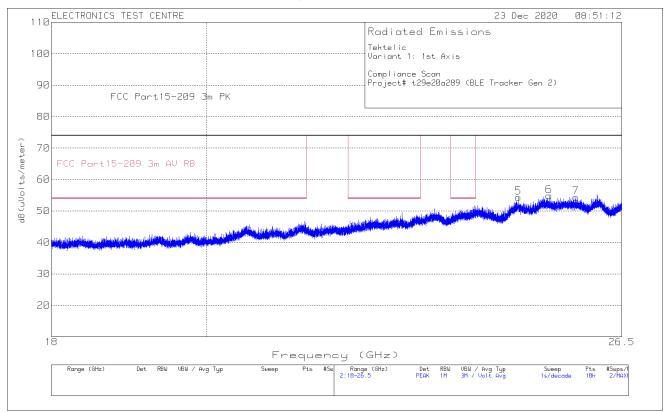


Plot of Radiated Emissions BLE: Vertical polarization



110	ELECTRONICS TEST CENTRE	23 Dec 2020 08:51:12
100		Radiated Emissions Tektelic Variant 1: 1st Axis
90	FCC Part15-209 3m PK	Compliance Scan Project# t29e20a289 (BLE Tracker Gen 2)
80		
70	FCC Part15-209 3m AV RB	
60		- 1
50		
40		NY 2012 AND
30		
20		
1	8 Frequency	
	Range (GHz) Det R6M UBM / Avg Typ Sweep Pts \$\$w 1:18-25.5 PEAK 1M 3M / Uoit Avg 1s/decade 18k 18	Range (GHz) Det RBW UBW / Avg Typ Sweep Pts #Swps/t

Plot of Radiated Emissions BLE: Vertical polarization



Test Personnel:

2.9 RF Exposure

Test Lab: Electronics Test Centre, Airdrie

Standard: FCC PART 15.247

EUT: BLE Sensor GEN2

Date:

EUT status: Exempt

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

3.0 TEST FACILITY

3.1 Location

The BLE Sensor GEN2 was tested for emissions 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.

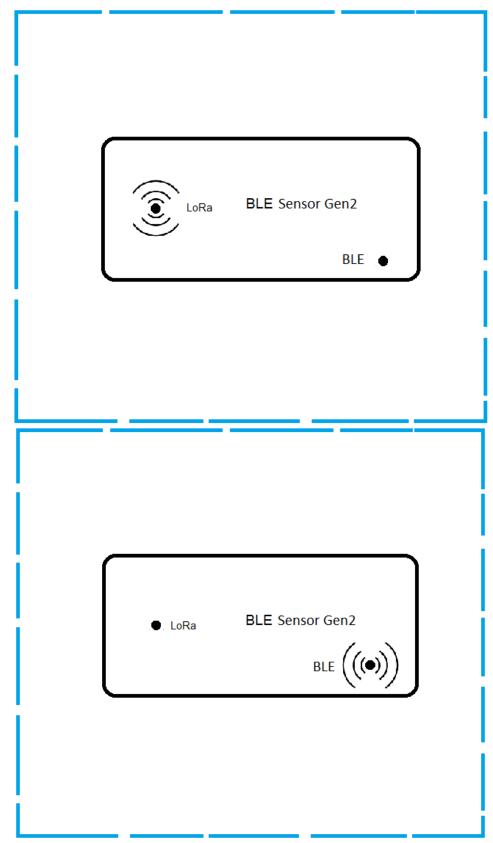
3.2 Grounding Plan

The BLE Sensor GEN2 was placed at the center of the test chamber turntable on top of polystyrene foam table. No provision is made within the BLE Sensor GEN2 for an earth ground connection.

3.3 Power Supply

All EUT power was supplied by a DC power supply (3.6 V).

Appendix A (Worse Emission test Setup Block Diagram)



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