ELECTRONICS TEST CENTRE
MPB TECHNOLOGIES INC.

ACCREDITED
TESTING CERT#2750.01

Test Report Prepared By:

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

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

Telephone: 1-403-912-0037

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EMC testing of the Tektelic Communication Inc. Pearl Fixed Gateway

in accordance with FCC Part 15.247, ANSI C63.4: 2014 and ANSI C63.10: 2013

as referenced by FCC OET KDB 558074 D01 DTS Measurement Guidance v04 and DA-00-0705A1 FHSS Filing and Measurement Guidance.

FCC ID: 2ALEPT0004438

Test Personnel: Imran Akram/ Henry Cookeygam

Prepared for: Tektelic Communication Inc.

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

Telephone: 1-403-338-6900

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

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

REVISION RECORD

ISSUE	DATE	AUTHOR	REVISIONS
DRAFT 1	2017-06-20	I. Akram	Initial draft submitted for review.
DRAFT 2	2017-08-12	I. Akram	Add conducted emission, and additional operating frequencies.
Release 1	2017-09-15	M. Rousseau	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 as specified in Tektelic Communication Inc. Test Plan. All test procedures, limits, criteria, and results described in this report apply only to the Tektelic Communication Inc. Pearl Fixed Gateway test sample, referred to herein as the EUT (Equipment Under Test).

This report does not imply product endorsement by the Electronics Test Centre, SCC, NAVLP, 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

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

Product Name:	Pearl Fixed Gateway
EUT Frequency Range	903.65 – 915.725, 927.5 MHz - DTS 912.31 – 927.0125 MHz – LoRa 125KHz FHSS 902.5 – 927.35 MHz –FSK
Type of Modulation	LoRa 500KHz DTS / LoRa 125KHz FHSS / FSK FHSS
Gateway model#/Serial#	T0004438 / 1716K0003
TTU info model#/serial#	T0004372 / 1708K0001
Associated Antennas/ Gain	L-COM, HG908U-PRO (8dBi), type: omni L-COM, HG906U-PRO (6dBi) , type: omni
Power:	12 VDC Nominal

The Pearl Fixed Gateway is a wireless LoRa gateway device with external antenna.

1.4 General Test Conditions and Assumptions

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 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 KDB 558074 v04 and FCC DA 00-705.

1.5.1 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.

1.5.2 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.

1.5.3 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.

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.

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	Pearl Fixed Gateway	none	see § 2.1	**Compliant**
2.2	Occupied Bandwidth	15.247(a)	Pearl Fixed Gateway	none	see § 2.2	**Compliant**
2.3	Peak Output	15.247(d)	Pearl Fixed Gateway	none	see § 2.3	**Compliant**
2.4	PSD	15.247(e)	Pearl Fixed Gateway	none	see § 2.4	**Compliant**
2.5	Band Edge	15.247(d)	Pearl Fixed Gateway	none	see § 2.5	**Compliant**
2.6	Conducted Spurious	15.247(d)	Pearl Fixed Gateway	none	see § 2.6	**Compliant**
2.7	Minimum Channel Separation	15.247(a)(1)	Pearl Fixed Gateway	none	see § 2.6	**Compliant**
2.8	Random hopping Sequence	15.247(a)(1)	Pearl Fixed Gateway	none	see § 2.6	**Compliant**
2.9	Equal Usage of Channel Frequencies	15.247(a)(1)	Pearl Fixed Gateway	none	see § 2.6	**Compliant**
2.10	EUT Position	ANSI C63.4	Pearl Fixed Gateway	-	-	N/A
2.11	Radiated Spurious	15.205, 15.209 15.247(d)	Pearl Fixed Gateway	none	see § 2.8	**Compliant**
2.12	RF Exposure	15.247(i)	Pearl Fixed Gateway	none	see § 2.9	**Compliant**

Refer to the test data for applicable test conditions.

2.1 AC Power Line Conducted Emissions: Transmit Mode

Test Lab: Electronics Test Centre, Airdrie	**EUT: Pearl Fixed Gateway**
Test Personnel: I. Akram, M. Rousseau	**Standard: FCC Part 15.207**
Date: July 31/Aug 1, 2017, T=22.5C, RH=40%	**Basic Standard: ANSI C63.4-2014**

EUT status: COMPLIANT

Specification:

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

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

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

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

2.1.2 Deviations From The Standard:

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

2.1.3 Uncertainty of Measurement:

The factors contributing to uncertainty of measurement are identified and calculated in accordance with UKAS (United Kingdom Accreditation Service) document “Lab 34, The Expression of Uncertainty in EMC Testing, Aug 2002.” As based on the “ISO Guide to the Expression of Uncertainty in Measurement, 1995.”

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

Test Method	Frequency	Uncertainty
Conducted Emissions Level	150 KHz – 30 MHz	±2.7 dB

2.1.4 Test Equipment

Testing was performed with the following equipment:

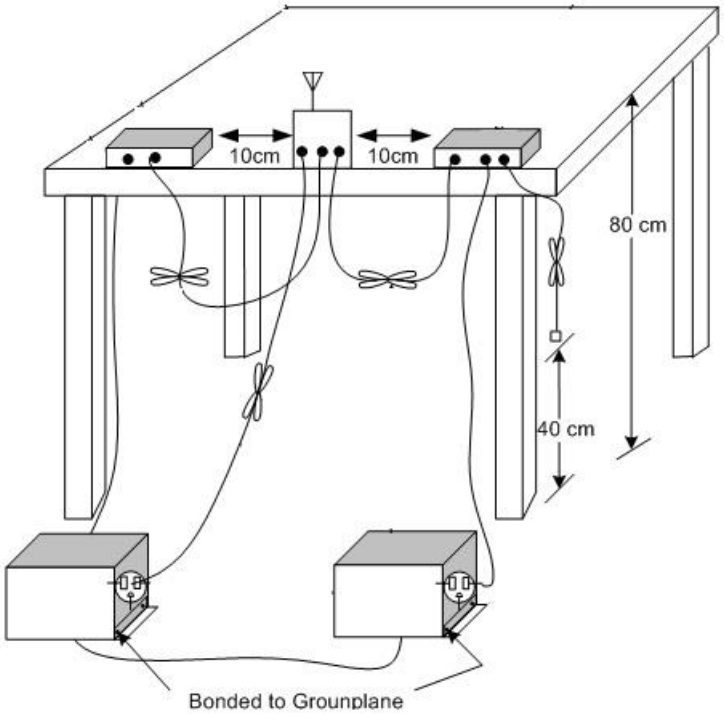
Equipment	Manufacturer	Model #	Asset #	Calibration Date	Calibration Due
EMC Software	UL	Ver. 9.5	ETC-SW-EMC 2.1	N/A	N/A
EMI receiver	Agilent	N9038A	6130	2017-06-20	2018-06-20
LISN	Com-Power	LI-215A	6180	2017-03-24	2018-03-24
Temp/RH logger	Extech	42270	5892	2017-04-06	2018-04-06

2.1.5 Test Sample Verification, Configuration & Modifications

The EUT was power through a power supply manufacture by Kikusui PAB 18-3.

The EUT met the requirements without modification.

Test setup diagram:

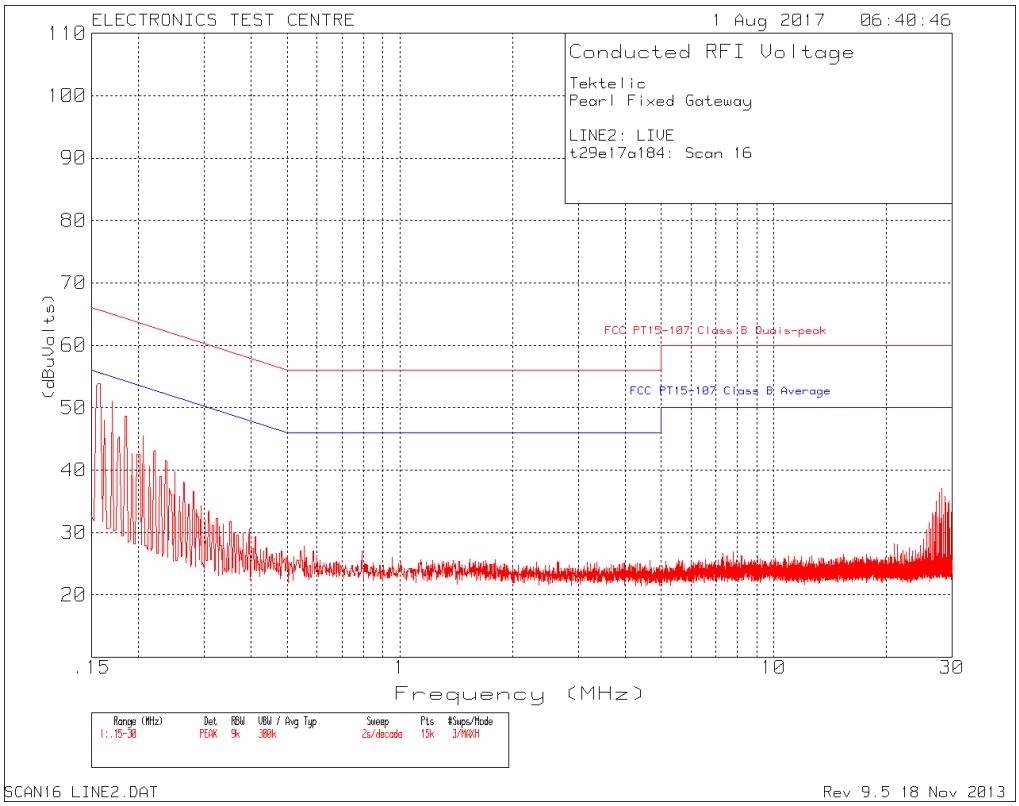


2.1.6 Conducted Emissions Data:

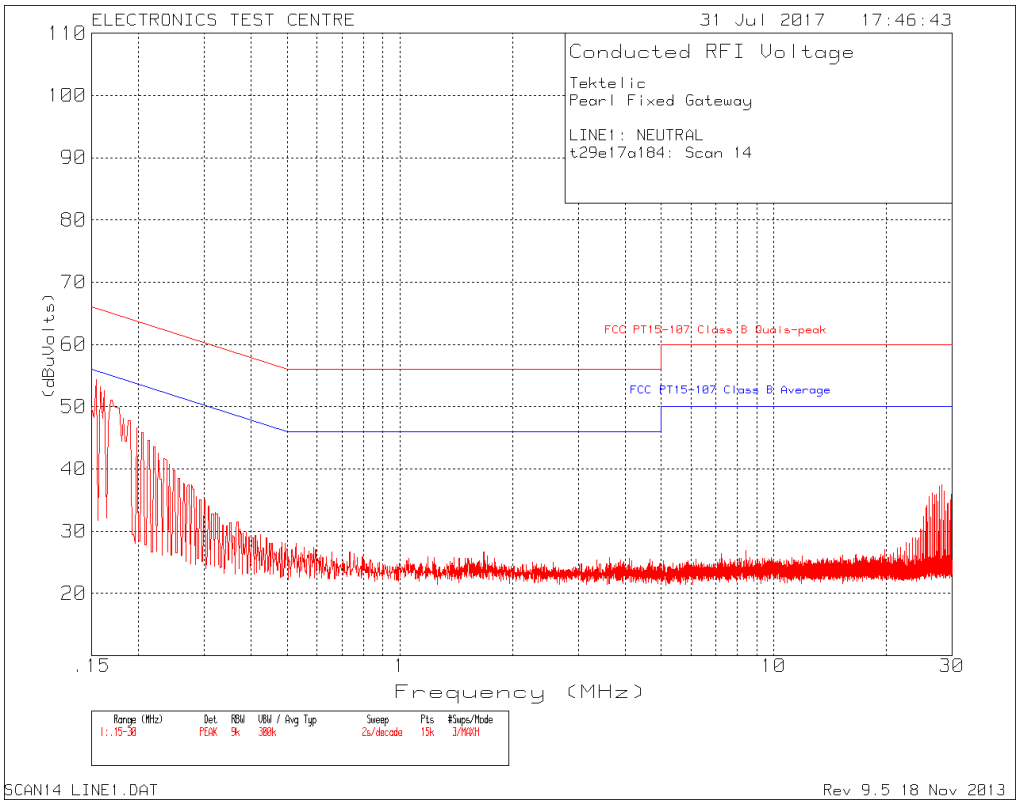
The EUT was evaluated in all transmit mode. No mode of transmission showed emission worst then another. The plots are from the LoRa 500 kHz DTS mode using mid-channel.

There were no emissions equal or above the applicable limit.

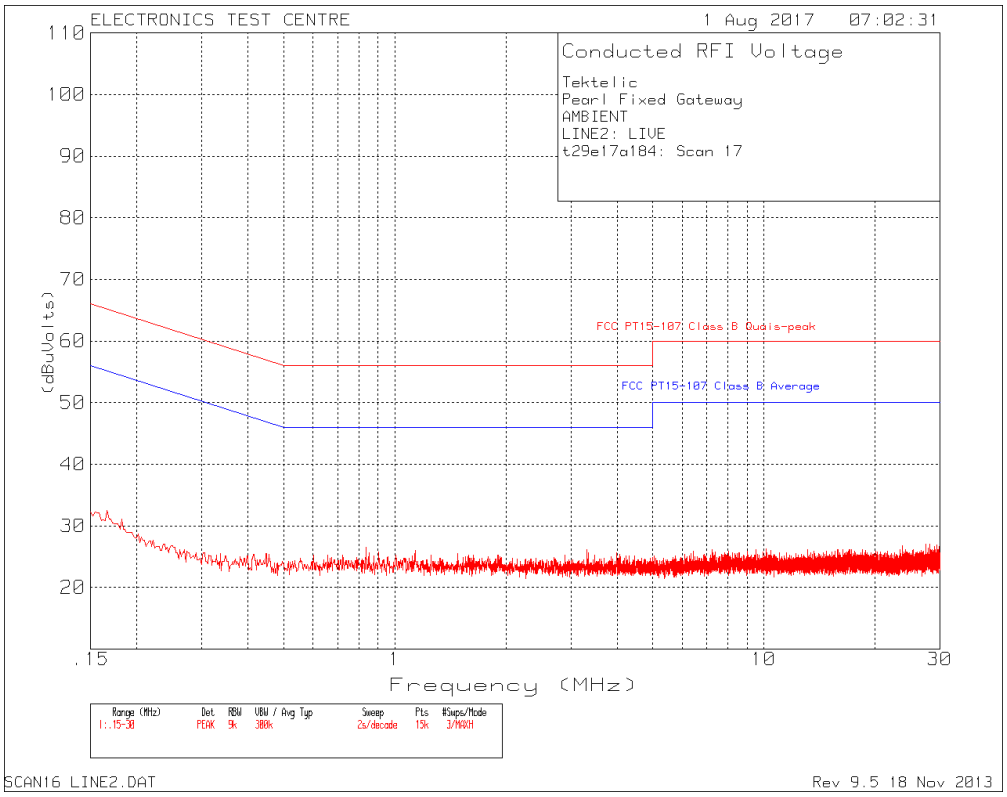
Plot of Conducted Emissions: Line



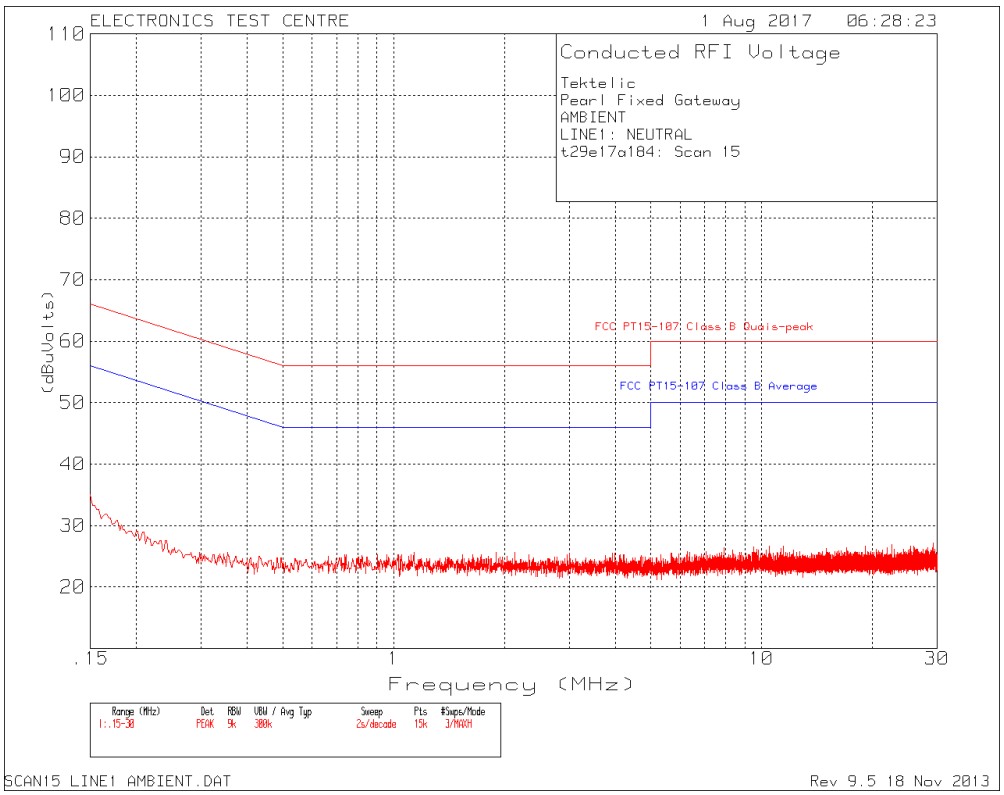
Plot of Conducted Emissions: Neutral



Plot of Test Ambient: (measurement noise floor): Line



Plot of Test Ambient: (measurement noise floor): Neutral



2.2 Channel Occupied Bandwidth

Test Lab: Electronics Test Centre, Airdrie	**EUT: Pearl Fixed Gateway**
Test Personnel: Imran Akram	**Standard: FCC PART 15.247**
Date: June 1/5/27, 2017 August 10, 2017 (23.6° C,34.5% RH), (20.2° C,46.6% RH)	**Basic Standard: ANSI C63.10-2013 FCC OET KDB 558074**

EUT status: Compliant

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

Criteria: Systems using digital modulation techniques may operate in the 902-928 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.
20 dB and 99% Bandwidth for FHSS.

2.2.1 Test Guidance: ANSI C63.10-2013, Clause 6.9.2 & 6.9.3/ FCC OET KDB 558074 Section 8 Option 2 / FCC DA-00-0705A1

This measurement is performed at low, mid and high frequencies.
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 ≥ (2 * OBW), ≤ (5 * OBW), selected to clearly display the channel. The RBW is set to 100 kHz. The VBW is set to ≥ (3 * RBW). The Peak detector is used, with the trace set to Max Hold.
For LoRa 125 KHz FHSS and FSK Span approximately 2 to 3 time of 20 dB BW, the RBW is set in the range ≥1% of the 20 dB BW and VBW ≥ 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:

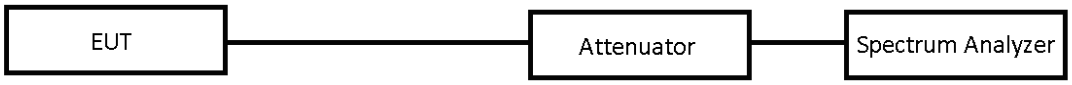
Equipment	Manufacturer	Model #	Asset #	Calibration Date	Calibration Due
EMI receiver	Agilent	N9038A	6130	2016-06-23	2017-06-23
EMI receiver	Agilent	N9038A	6130	2017-06-20	2018-06-20
Signal Analyzer	Agilent	N9010A	6678	2017-05-11	2018-05-11
Temp/Humidity	Extech	42270	5892	2017-04-06	2018-04-06
Attenuator	JFW	50FH-020-10	-	Monitored	
DC Blocker	MCL	BLK-89-S+	-	Monitored	

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 500 kHz DTS Mode

Channel	Freq. [MHz]	6 dB OBW [kHz]	99% OBW [KHz]	Limit 6 dB OBW
Low	903.65	597.2	664.34	≥ 500 KHz
Mid	909.95	597.1	661.06	≥ 500 KHz
High	915.725	600.0	661.90	≥ 500 KHz
High	927.5	608.3	660.06	≥ 500 KHz

LoRa 125 kHz FHSS Mode

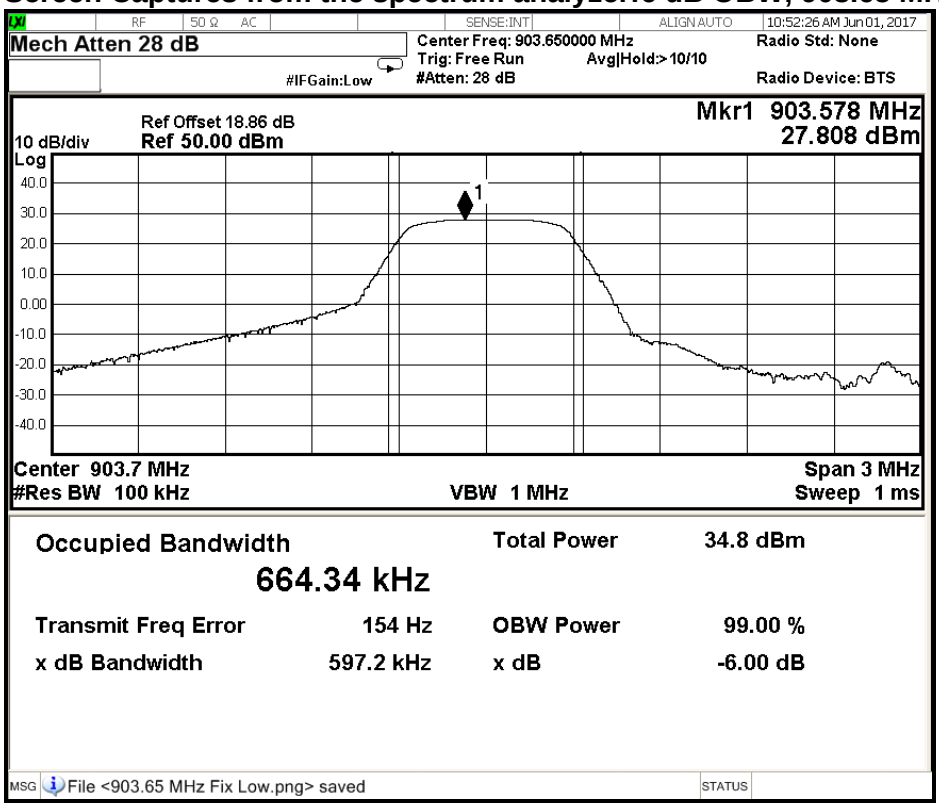
Channel	Freq. [MHz]	20 dB OBW [kHz]	99% OBW [KHz]
Low	912.310	160.6	132.94
Mid	919.5112	158.4	132.80
High	927.0125	159.3	133.06

FSK Mode

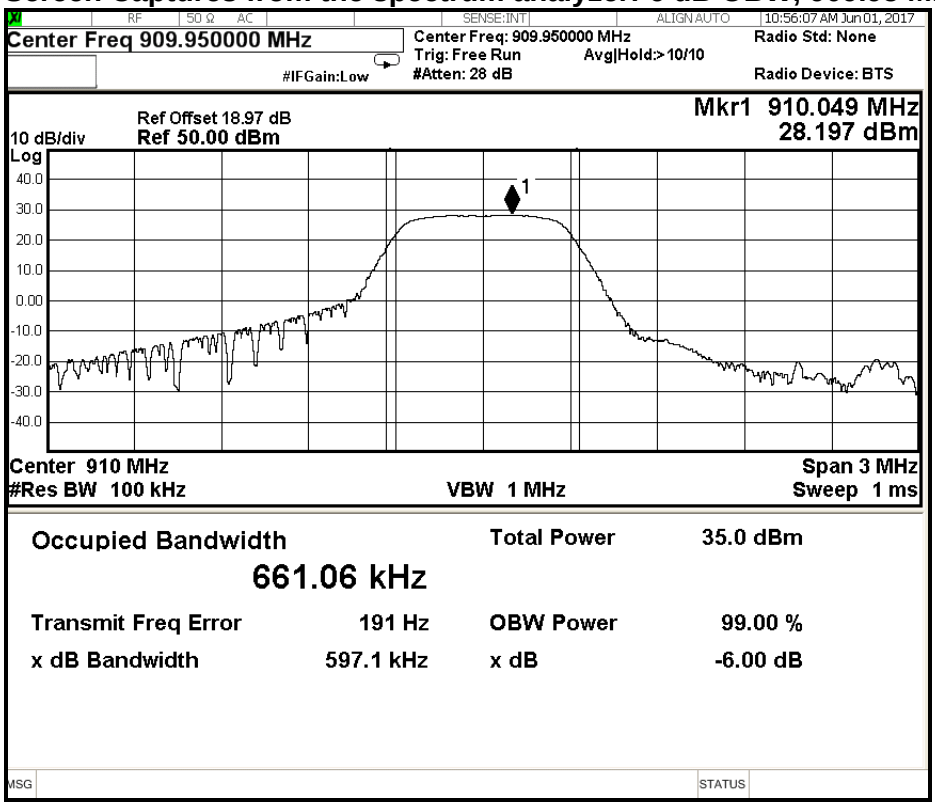
Data Rate	Channel	Freq. [MHz]	20 dB OBW [kHz]	99% OBW [KHz]
9.6 KHZ	Low	902.5	22.52	22.327
	Mid	915	22.01	22.508
	High	927	22.27	22.325
28.8 KHz	Low	902.5	63.32	61.405
	Mid	915	63.64	61.891
	High	927	59.53	59.280

LoRa 500 KHz DTS Mode

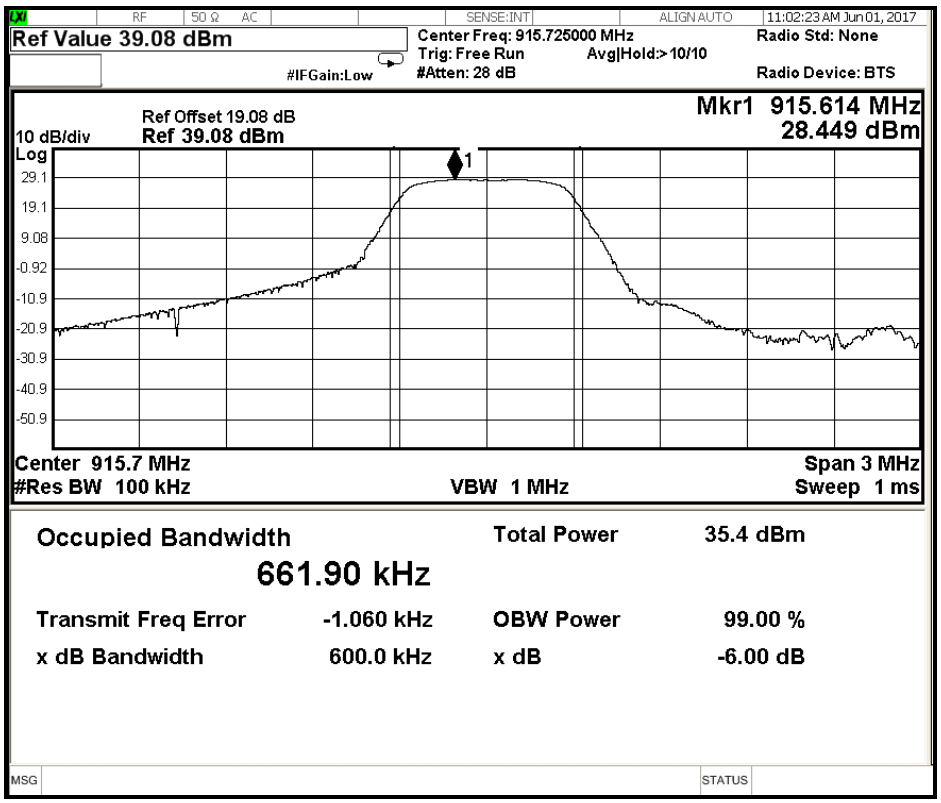
Screen Captures from the spectrum analyzer:6 dB OBW, 903.65 MHz



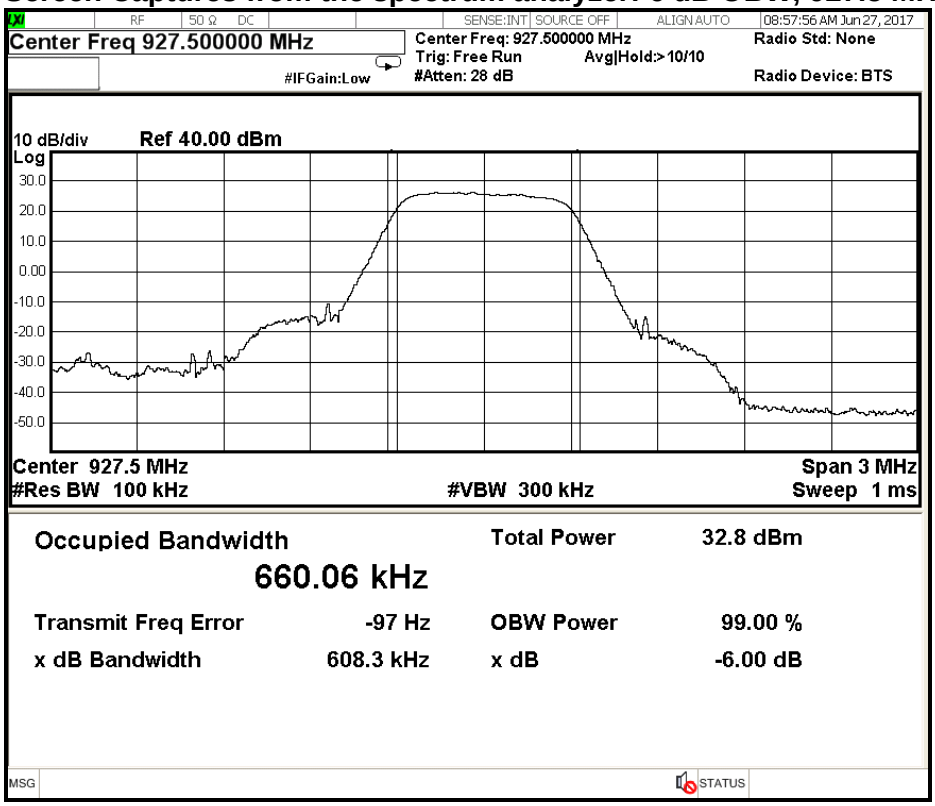
Screen Captures from the spectrum analyzer: 6 dB OBW, 909.95 MHz



Screen Captures: 6 dB OBW, 915.725 MHz

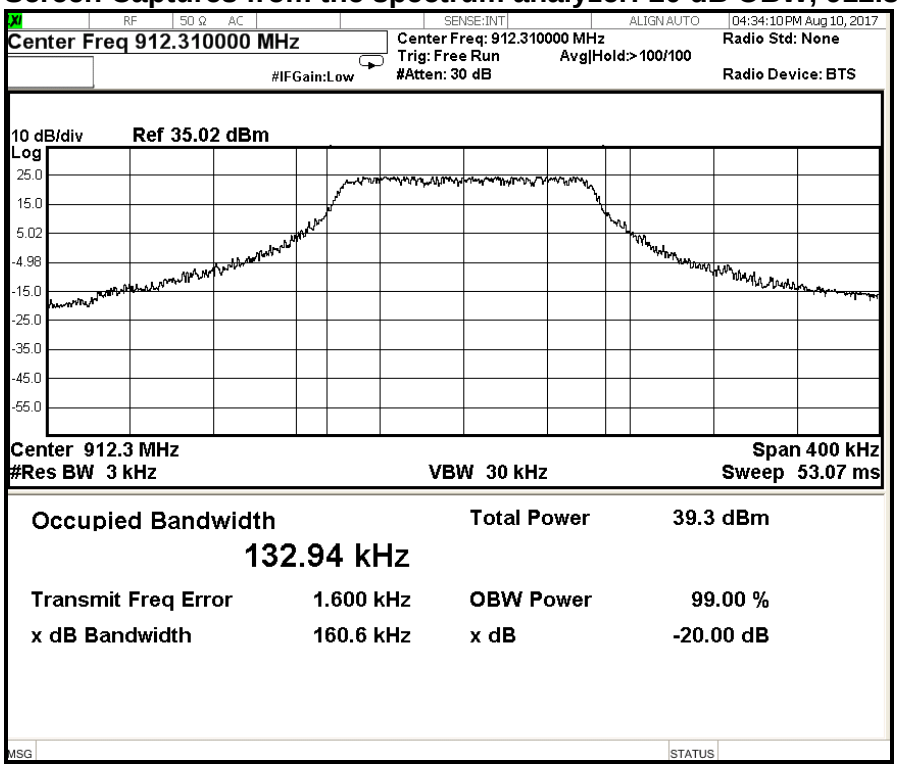


Screen Captures from the spectrum analyzer: 6 dB OBW, 927.5 MHz

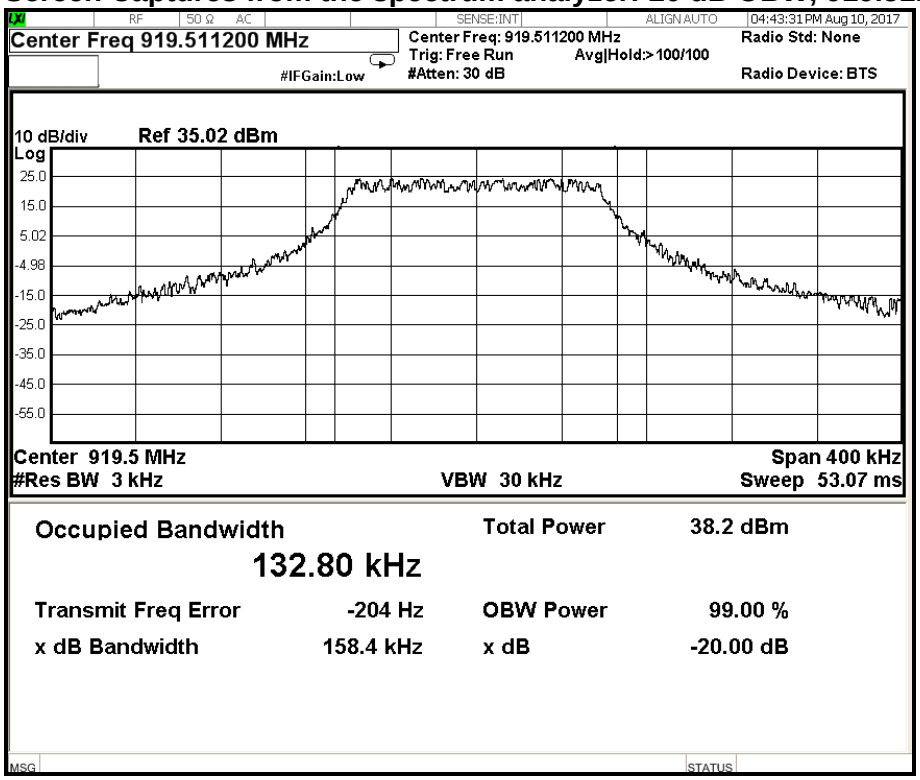


LoRa 125 KHz FHSS Mode

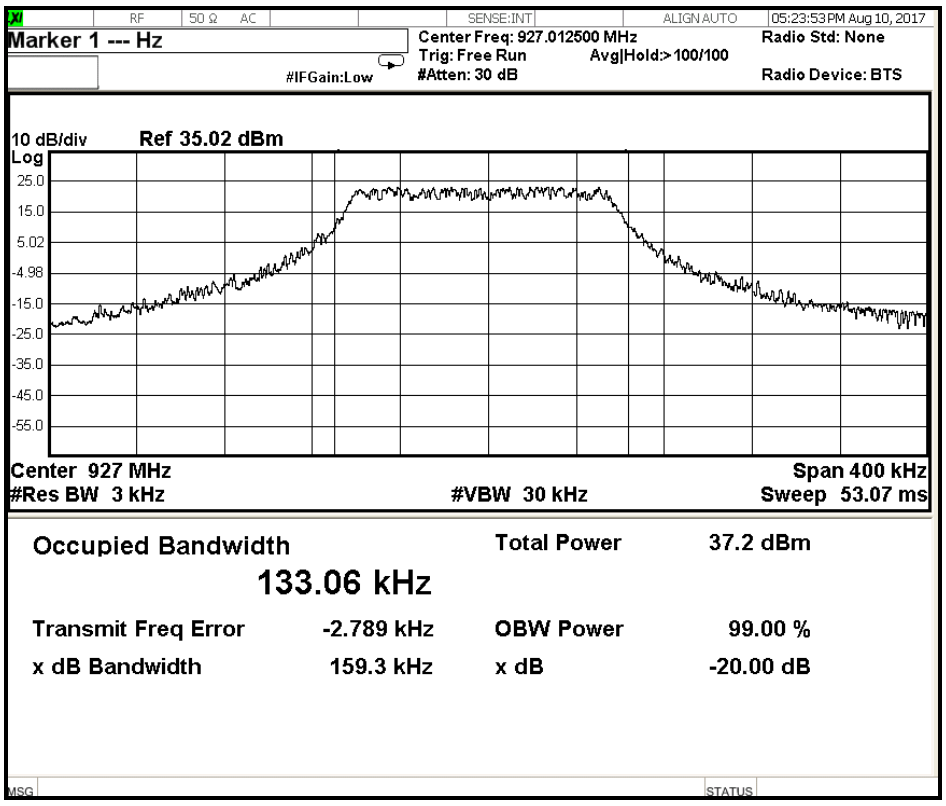
Screen Captures from the spectrum analyzer: 20 dB OBW, 912.31 MHz



Screen Captures from the spectrum analyzer: 20 dB OBW, 919.5112 MHz

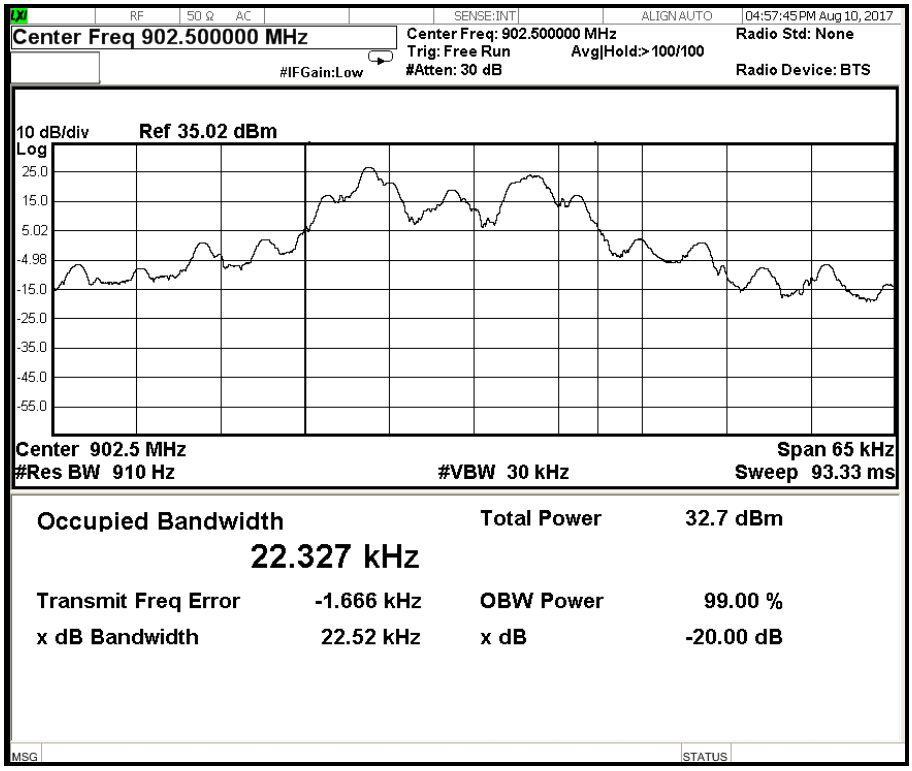


Screen Captures from the spectrum analyzer: 20 dB OBW, 927.0125 MHz

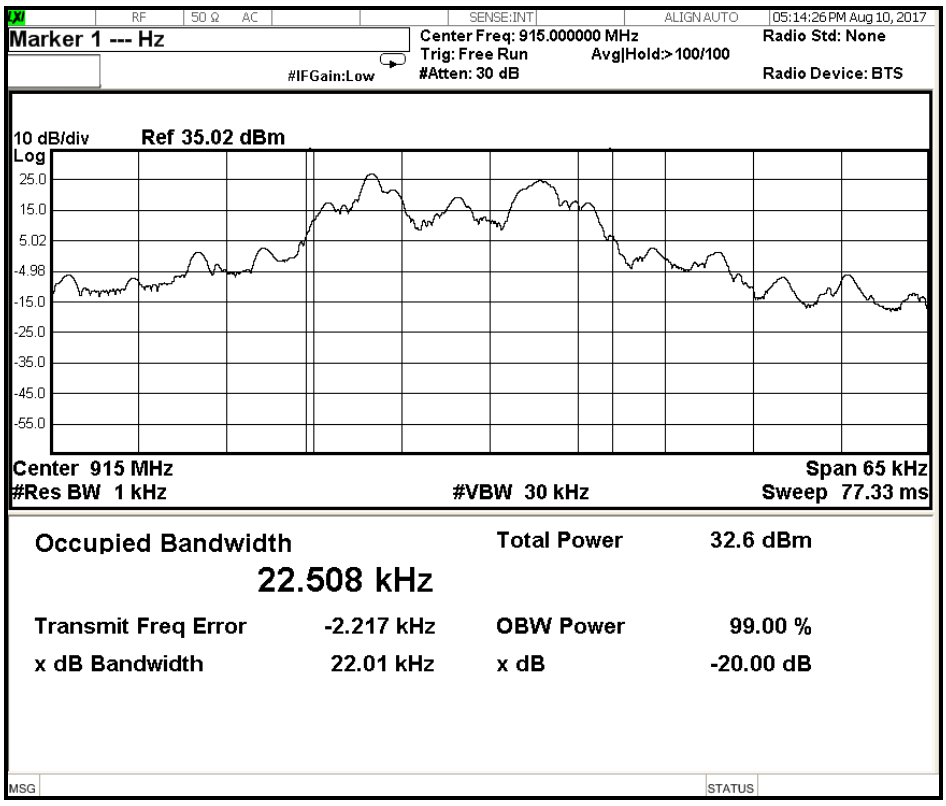


FSK (9.6 KHz) Mode

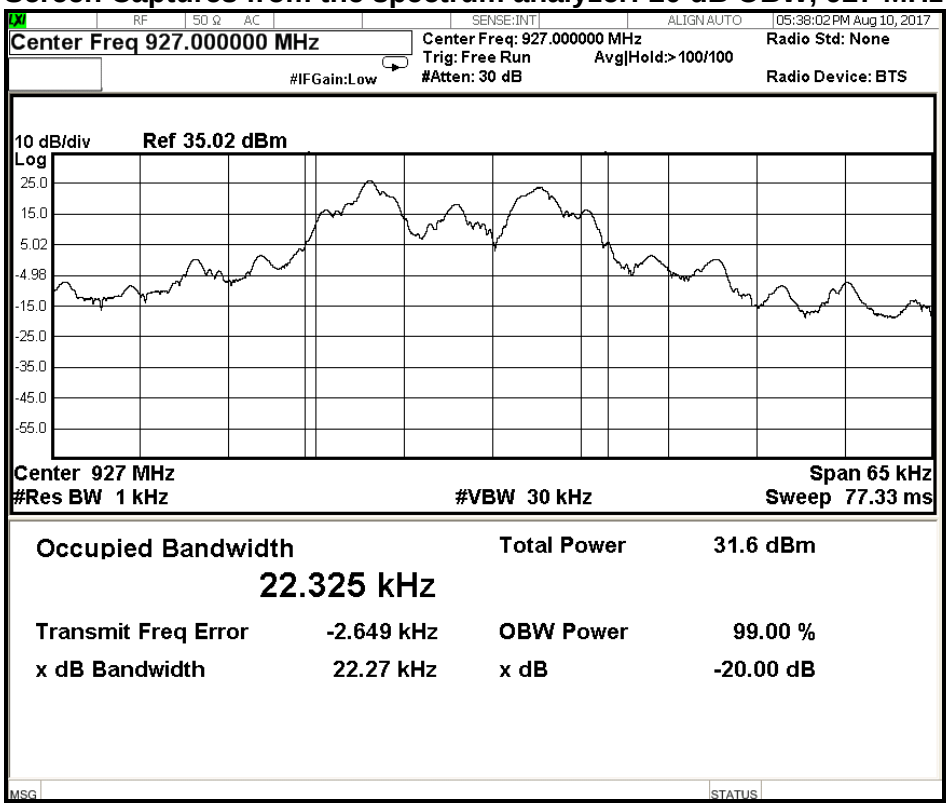
Screen Captures from the spectrum analyzer: 20 dB OBW, 902.5 MHz



Screen Captures from the spectrum analyzer: 20 dB OBW, 915 MHz

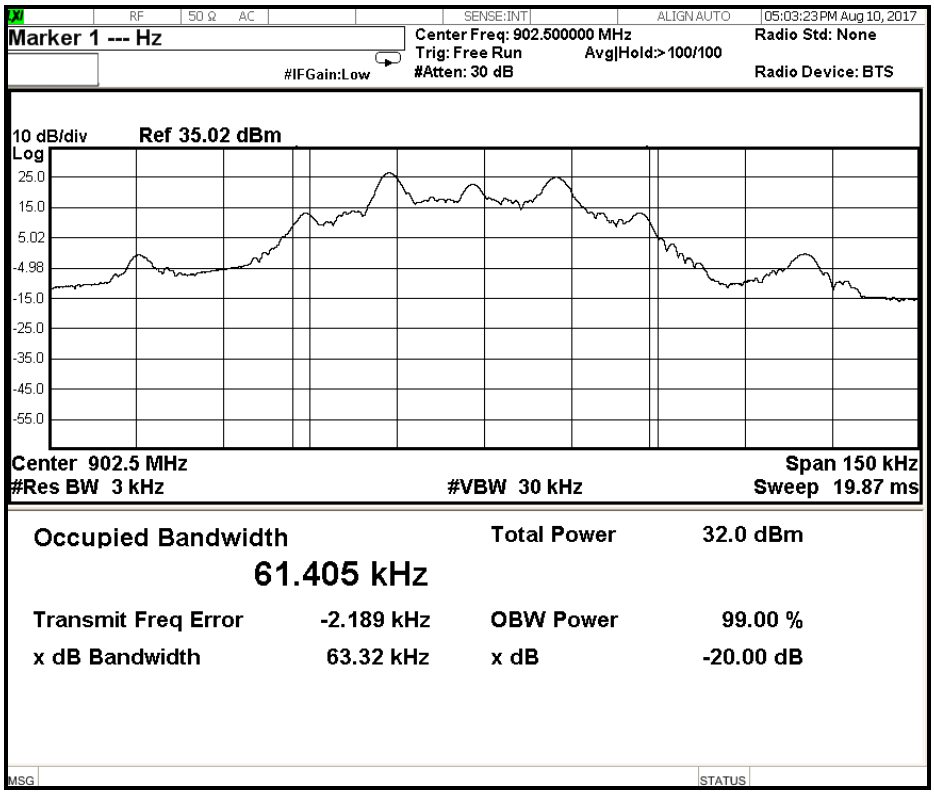


Screen Captures from the spectrum analyzer: 20 dB OBW, 927 MHz

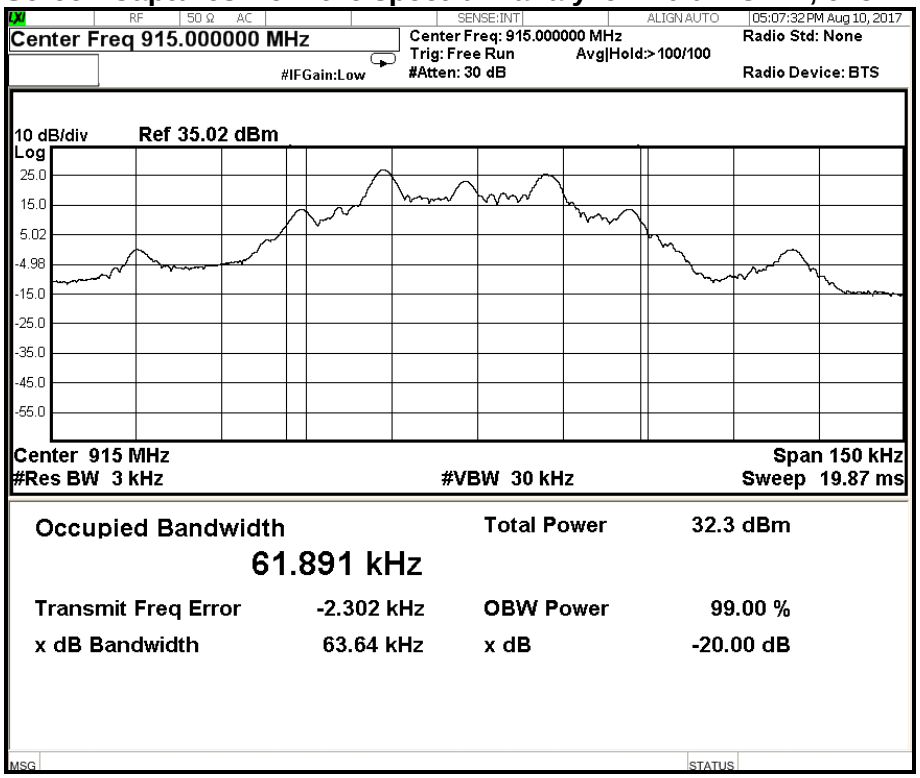


FSK (28.8 KHz) Mode

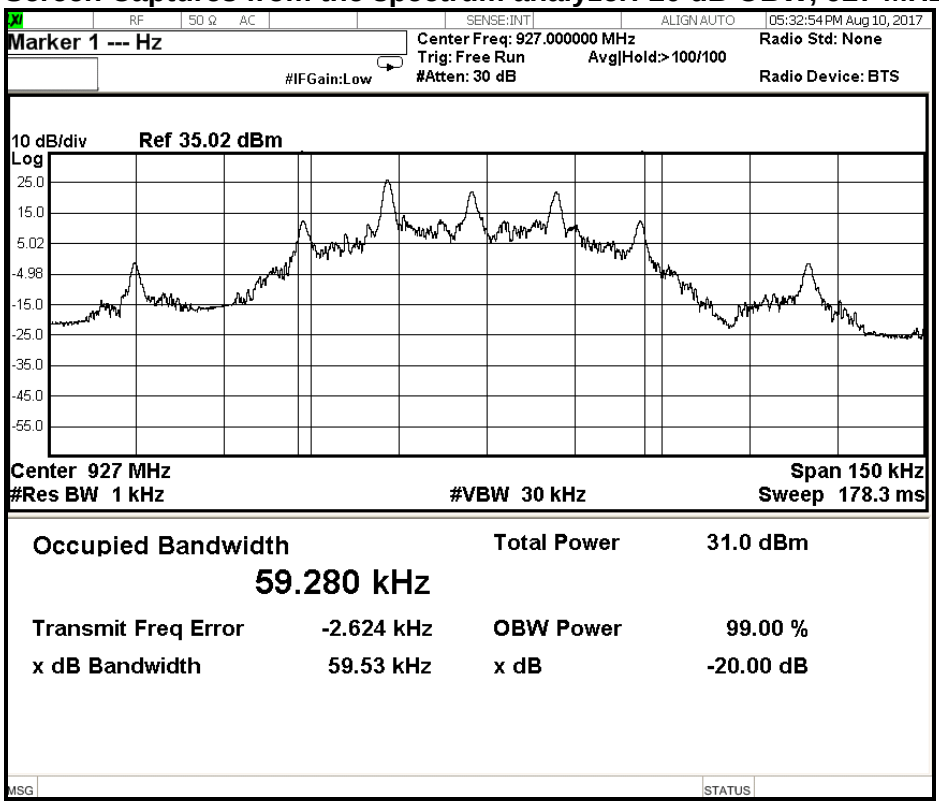
Screen Captures from the spectrum analyzer: 20 dB OBW, 902.5 MHz



Screen Captures from the spectrum analyzer: 20 dB OBW, 915 MHz



Screen Captures from the spectrum analyzer: 20 dB OBW, 927 MHz



2.3 Output Power

Test Lab: Electronics Test Centre, Airdrie	**EUT: Pearl Fixed Gateway**
Test Personnel: Imran Akram	**Standard: FCC PART 15.247**
Date: June 5&28, 2017 August 10, 2017 (23.6° C,34.5% RH), (20.2° C,46.6% RH)	**Basic Standard: ANSI C63.10: 2013 FCC OET KDB 558074**

EUT status: Compliant

Specification: FCC Part 15.247(b 2,3)

Criteria	(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. (2) For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels

2.3.1 Test Guidance: ANSI C63.10-2013, Clause 11.9.1.1 / FCC OET KDB 558074 Section 9.2.2.4 / FCC DA 00-705

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, with out the need for any further corrections.

Measurement procedure used was FCC KDB 558074 D01 V03r05 AVGSA-1 section 9.2.2.2 for DTS and ANSI 63.10 Section 7.8.5 / FCC DA 00-705 was used for 125 KHz FHSS and 125 KHz FSK FHSS.

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:

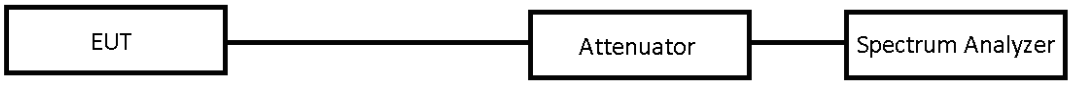
Equipment	Manufacturer	Model #	Asset #	Calibration Date	Calibration Due
EMI receiver	Agilent	N9038A	6130	2016-06-23	2017-06-23
EMI receiver	Agilent	N9038A	6130	2017-06-20	2018-06-20
Signal Analyzer	Agilent	N9010A	6678	2017-05-11	2018-05-11
Temp/Humidity	Extech	42270	5892	2017-04-06	2018-04-06
Attenuator	JFW	50FH-020-10		Monitored	
DC Blocker	MCL	BLK-89-S+		Monitored	

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 Peak Output Power Data

LoRa 500 KHz DTS Mode

Channel	Freq. [MHz]	Out Put Power (dBm)	Out Put Power Limit (dBm)	Margin (dB)
Low	903.65	26.79	30	3.21
Mid	909.95	27.04	30	2.96
High	915.725	27.15	30	2.85
High	927.5	24.86	30	5.14

LoRa 125 KHz FHSS Mode

Channel	Freq. [MHz]	Out Put Power (dBm)	Out Put Power Limit (dBm)	Margin (dB)
Low	912.31	27.450	30	2.55
Mid	919.5112	27.317	30	2.683
High	927.0125	26.071	30	3.929

FSK Mode

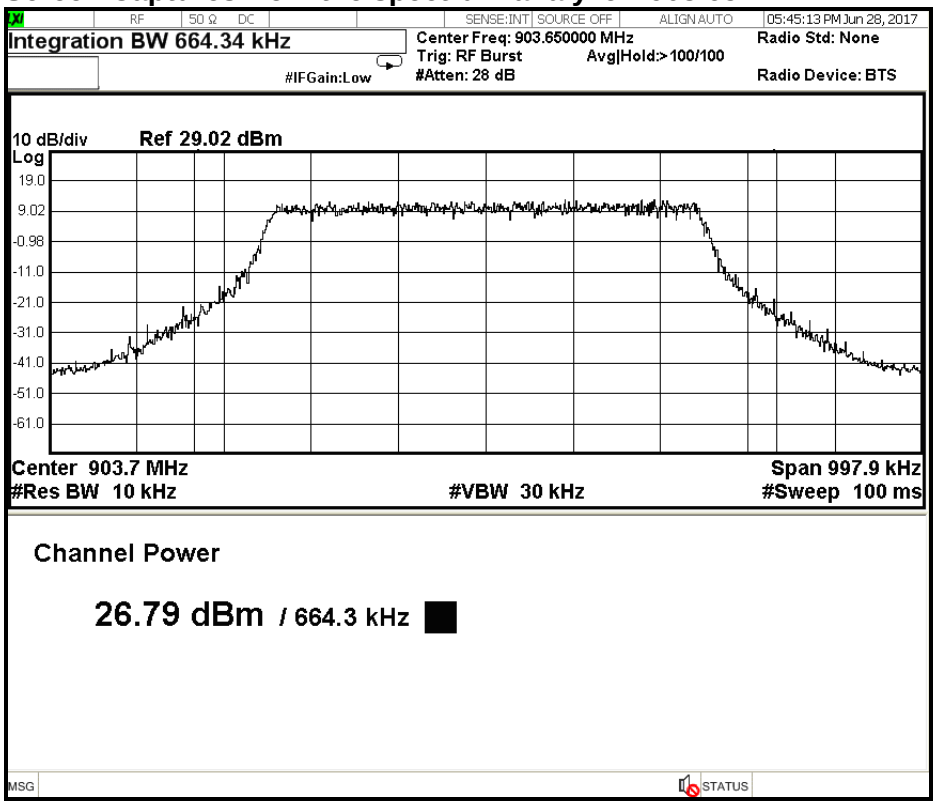
Mode	Channel	Freq. [MHz]	Out Put Power (dBm)	Out Put Power Limit (dBm)	Margin (dB)
9.6 KHz	Low	902.5	26.919	30	3.081
	Mid	915	27.377	30	2.623
	High	927	26.259	30	3.741
28.8 KHz	Low	902.5	26.775	30	3.225
	Mid	915	27.339	30	2.661
	High	927	26.220	30	3.78

Output Power Method AVGSA-1 For DTS	
Span	≥ 1.5 times the OBW
RBW	1 – 5 % of the OBW, ≤ 1 MHz
VBW	≥ 3 x RBW
Number of Points in sweep	≥ 2 x Span / RBW
Sweep time	Auto
Detector	RMS (Power Averaging)
Sweep trigger	Set to full power pulses
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.

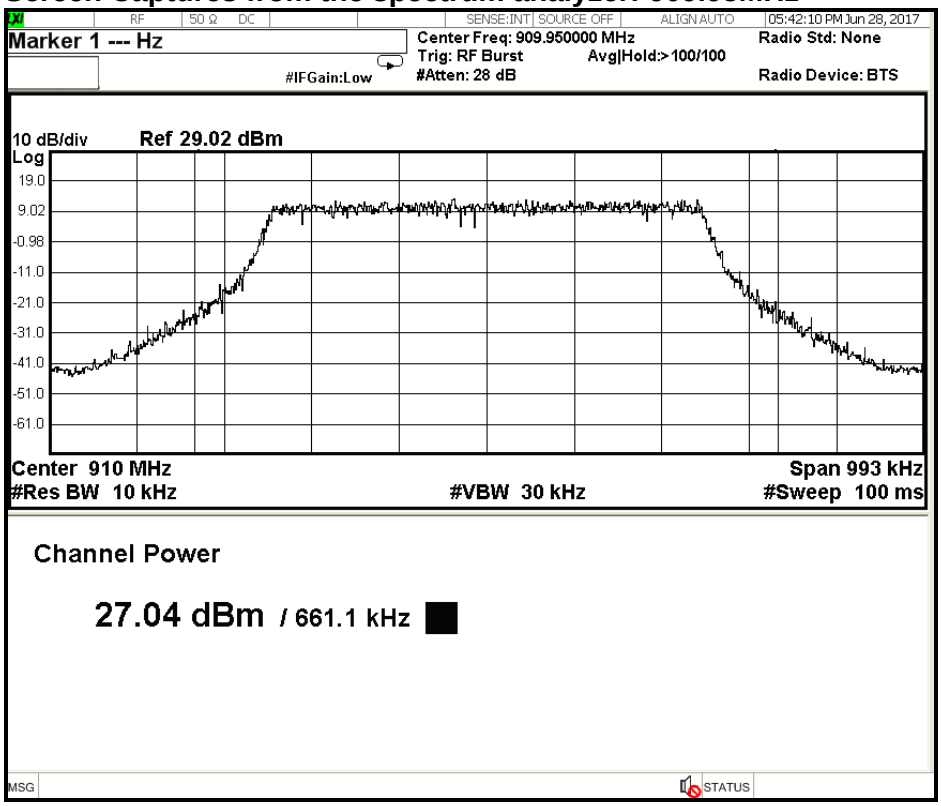
Output Power Method For FHSS	
Span	Approximately 5 times the 20 dB BW
RBW	> 20 dB bandwidth
VBW	≥ RBW
Sweep time	Auto
Detector	Peak
Trace	Max Hold Allowed Trace to stabilize Marker was set to peak of the emission Indicated level was the peak output power

LoRa 500 KHz DTS Mode

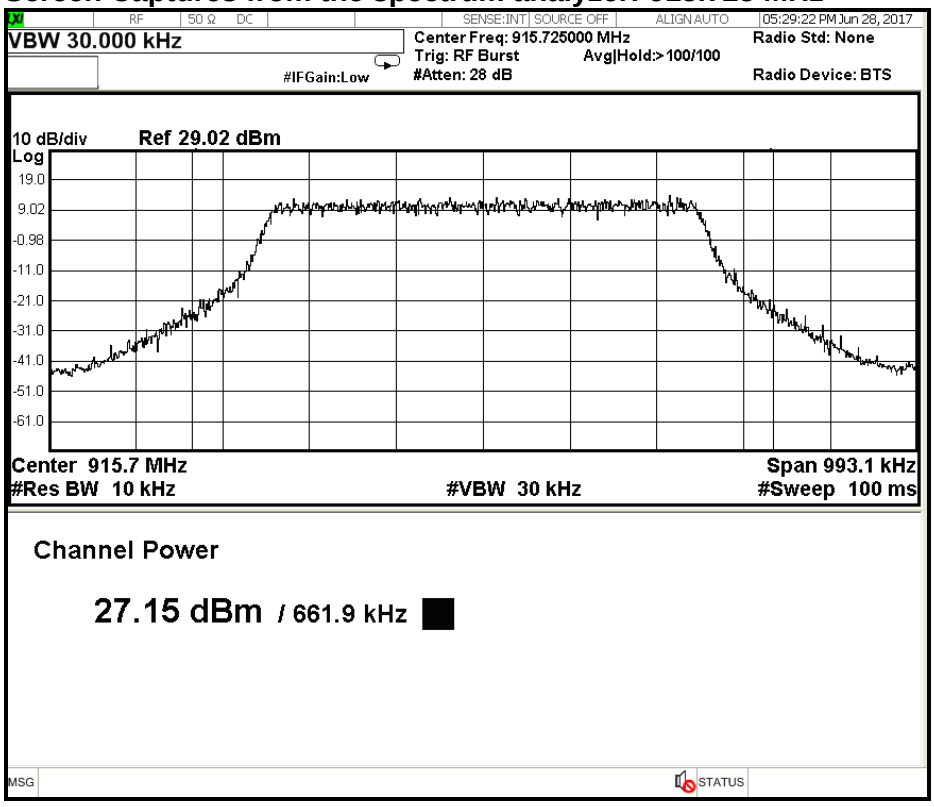
Screen Captures from the spectrum analyzer: 903.65MHz



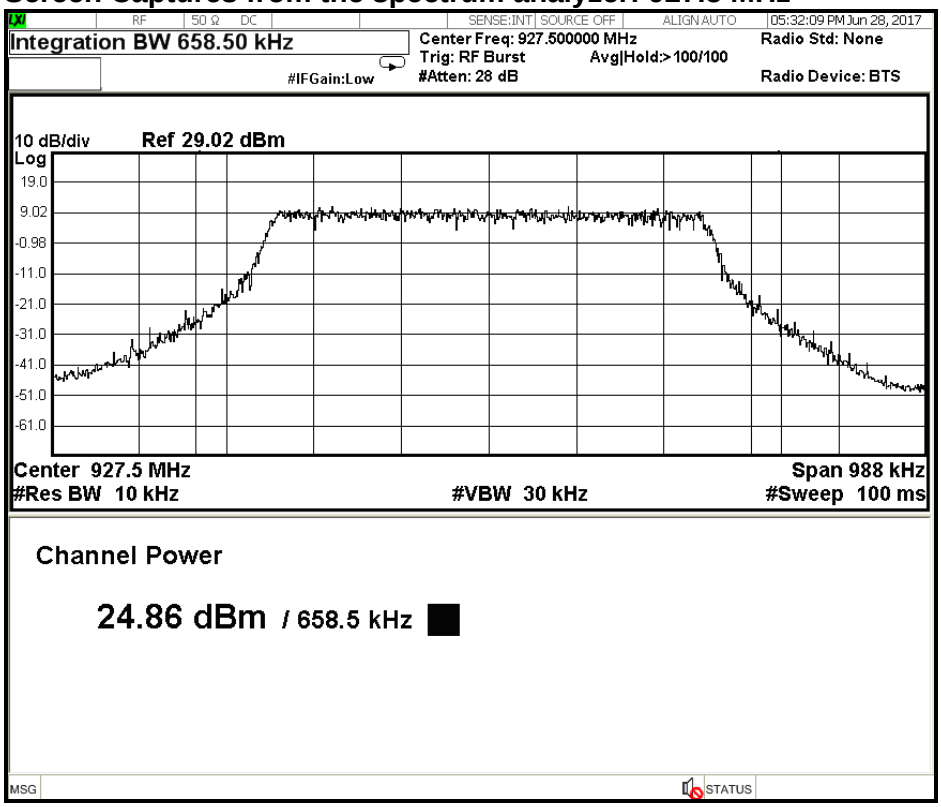
Screen Captures from the spectrum analyzer: 909.95MHz



Screen Captures from the spectrum analyzer: 915.725 MHz

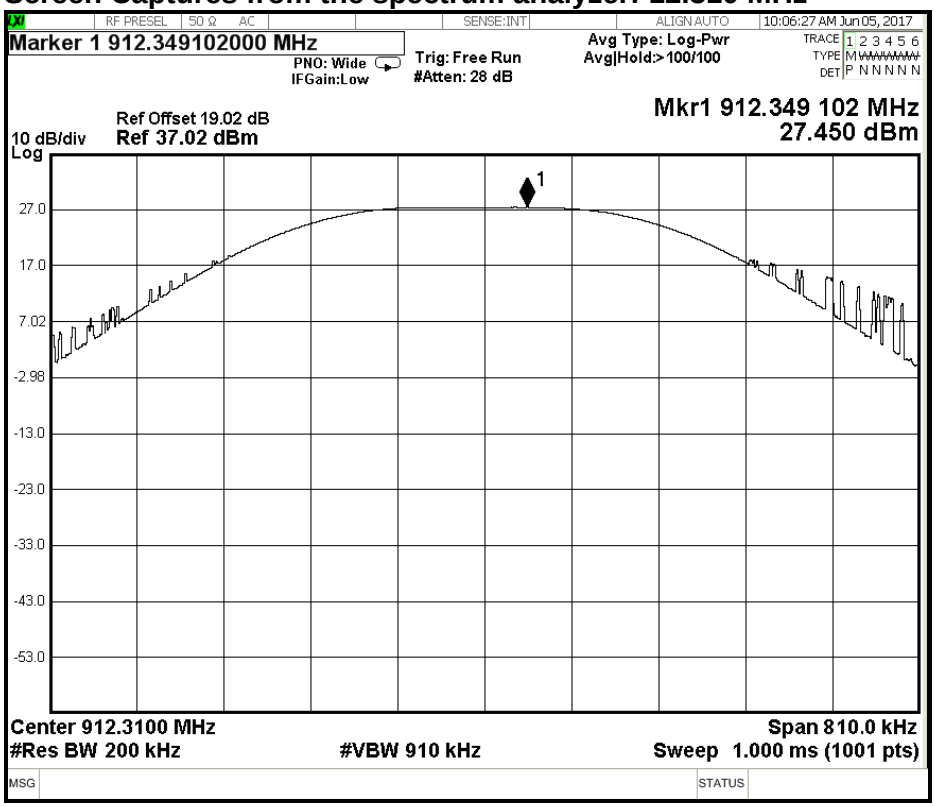


Screen Captures from the spectrum analyzer: 927.5 MHz

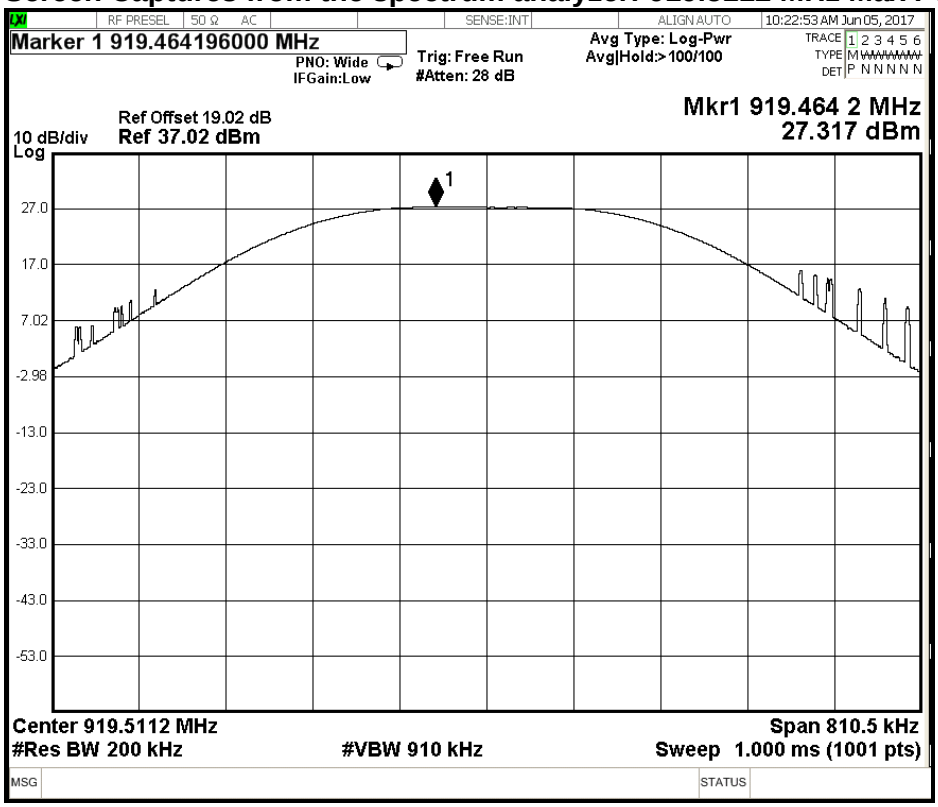


LoRa 125 KHz FHSS Mode

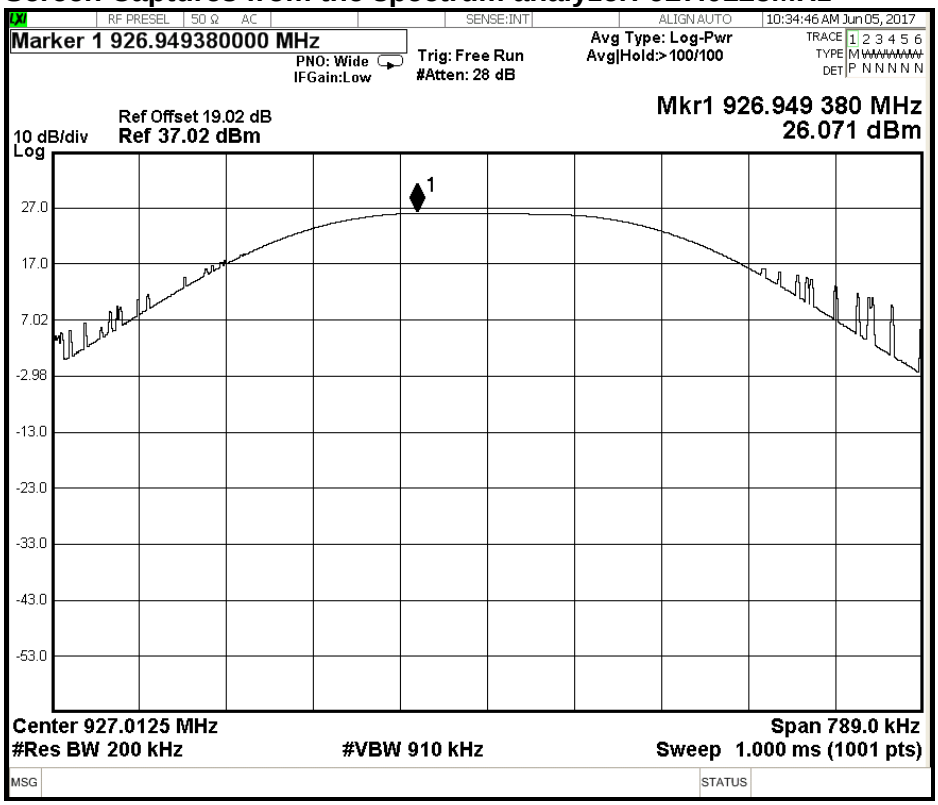
Screen Captures from the spectrum analyzer: 12.310 MHz



Screen Captures from the spectrum analyzer: 919.5112 MHz Max Power

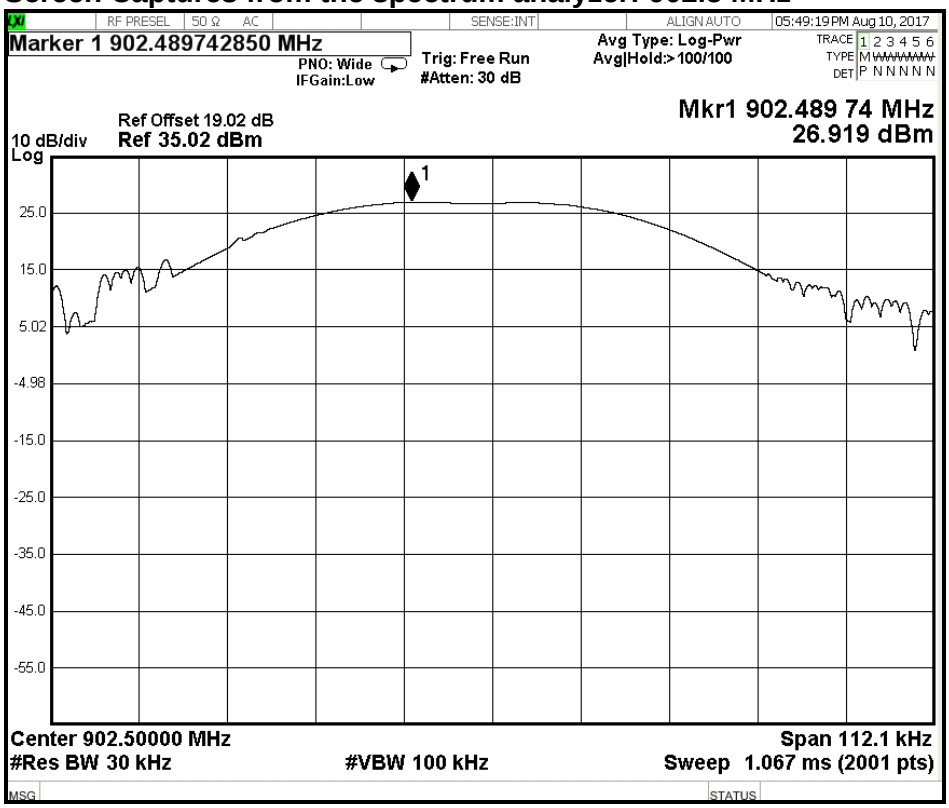


Screen Captures from the spectrum analyzer: 927.0125MHz

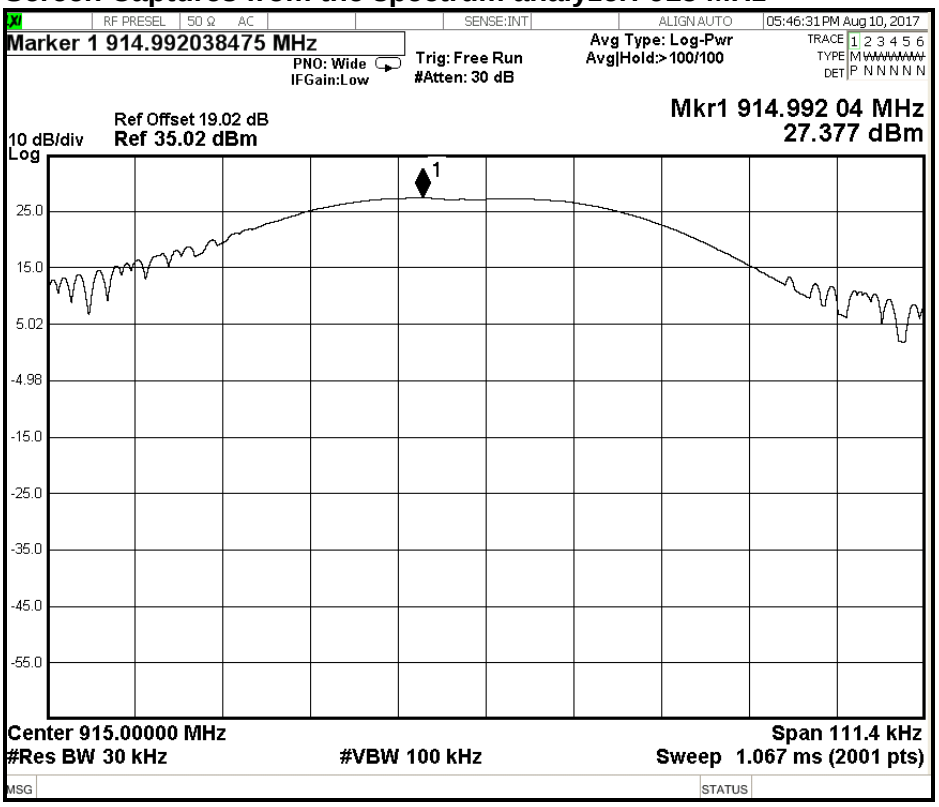


FSK (9.6 KHz) Mode

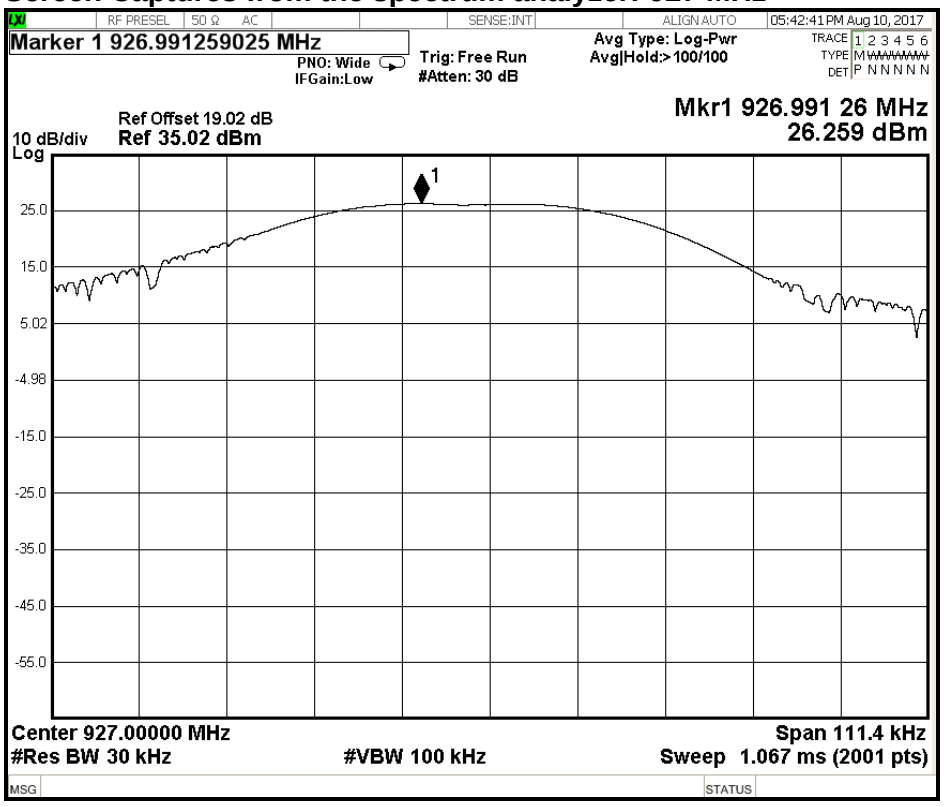
Screen Captures from the spectrum analyzer: 902.5 MHz



Screen Captures from the spectrum analyzer: 915 MHz

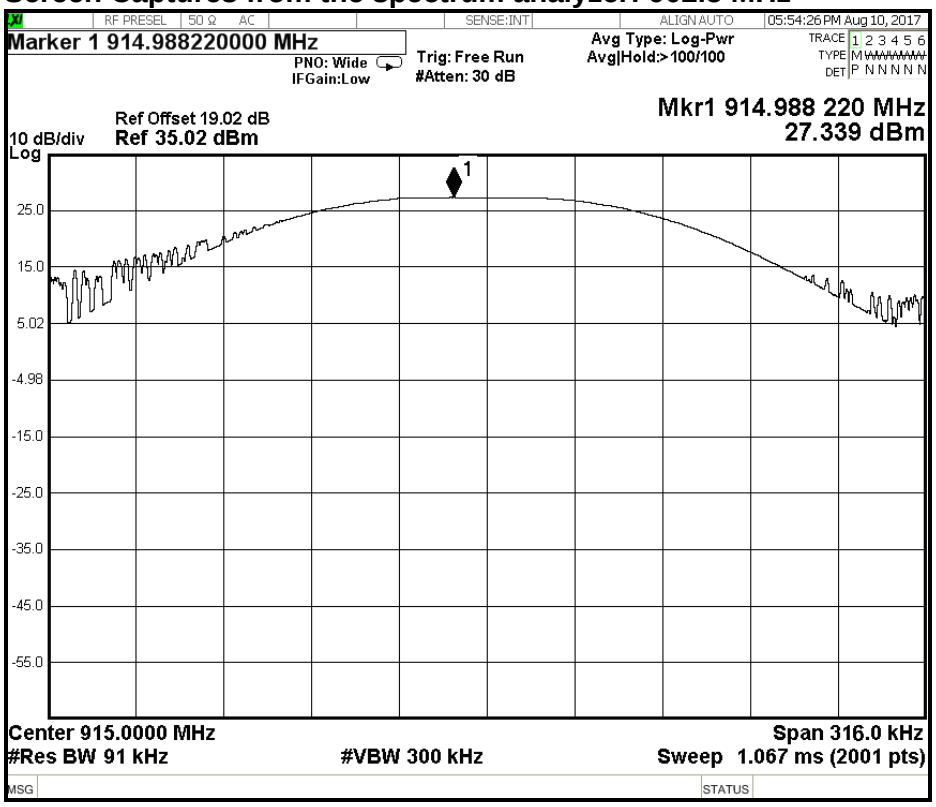


Screen Captures from the spectrum analyzer: 927 MHz

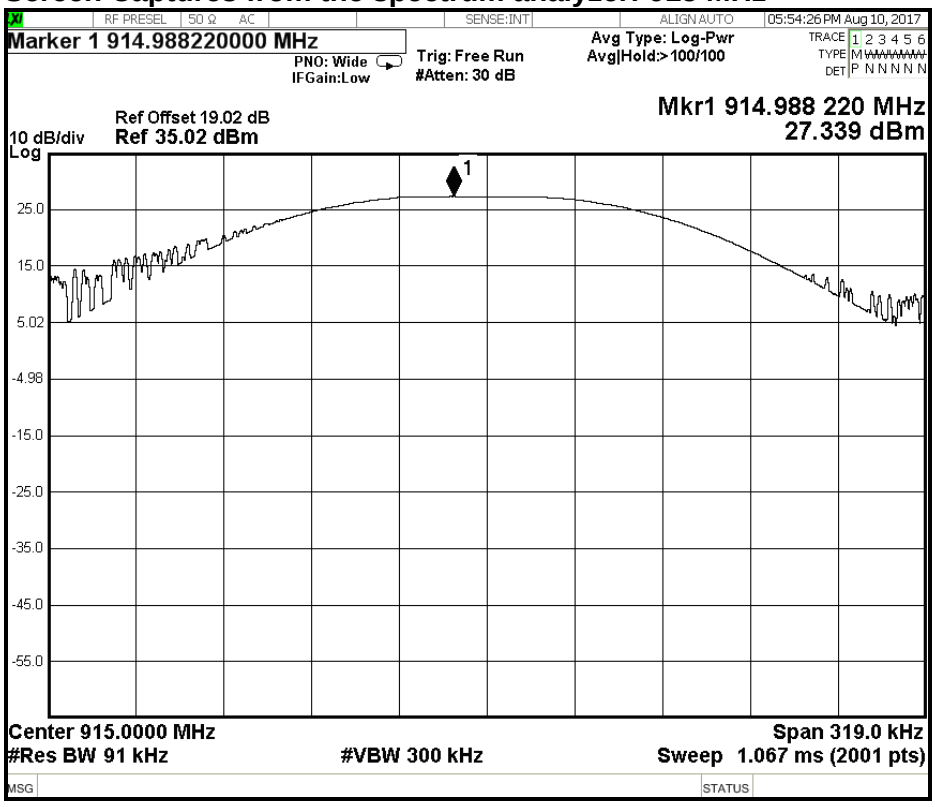


FSK (28.8 KHz) Mode

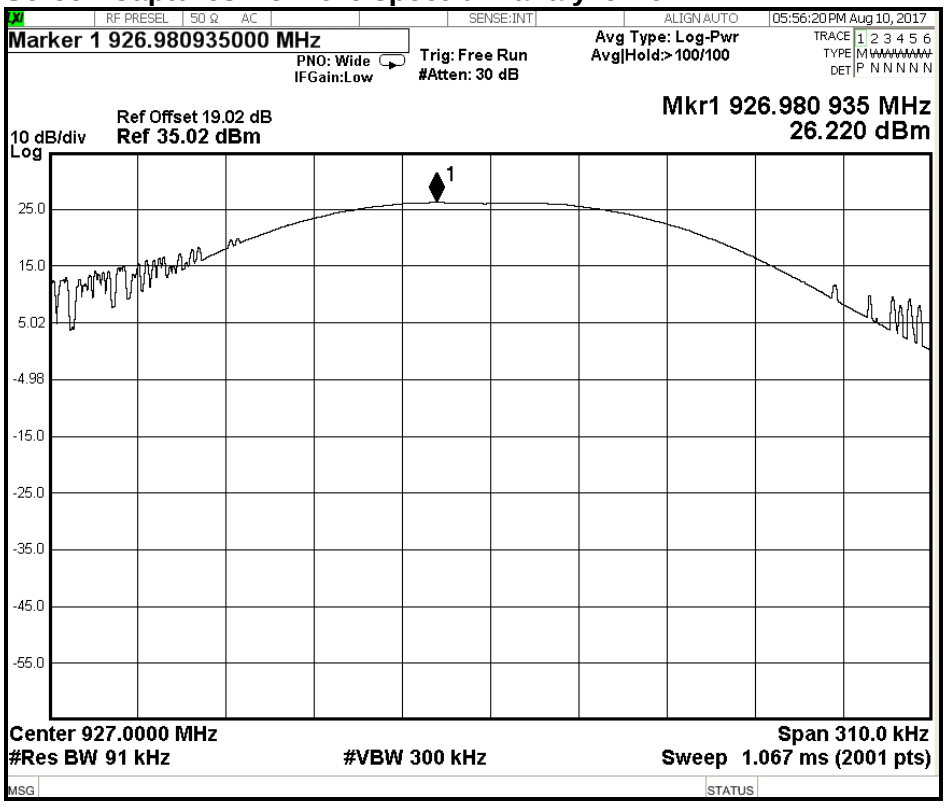
Screen Captures from the spectrum analyzer: 902.5 MHz



Screen Captures from the spectrum analyzer: 915 MHz



Screen Captures from the spectrum analyzer: 927 MHz



2.4 Power Spectral Density

Test Lab: Electronics Test Centre, Airdrie	**EUT: Pearl Fixed Gateway**
Test Personnel: Imran Akram	**Standard: FCC PART 15.247**
Date: June 28, 2017(23.6° C,34.5% RH)	**Basic Standard: ANSI C63.10: 2013**

EUT status: Compliant

Specification: FCC Part 15.247(e)

Criteria	For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

2.4.1 Test Guidance: ANSI C63.10-2013, Clause 11.10.2 / FCC OET KDB 558074 10.5

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, with out the need for any further corrections.

The spectrum analyzer is set for a frequency span of (1.5*(6dB BW)) centered on a channel. The RBW is set to 3 kHz and VBW is set to 10 kHz. The RMS average detector is used, with the trace set to average Hold. The marker is placed on the highest peak of the resulting trace.

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:

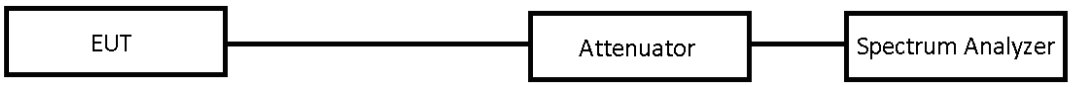
Equipment	Manufacturer	Model #	Asset #	Calibration Date	Calibration Due
Signal Analyzer	Agilent	N9010A	6678	2017-05-11	2018-05-11
Temp/Humidity	Extech	42270	5892	2017-04-06	2018-04-06
Attenuator	JFW	50FH-020-10		Monitored	
DC Blocker	MCL	BLK-89-S+		Monitored	

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:



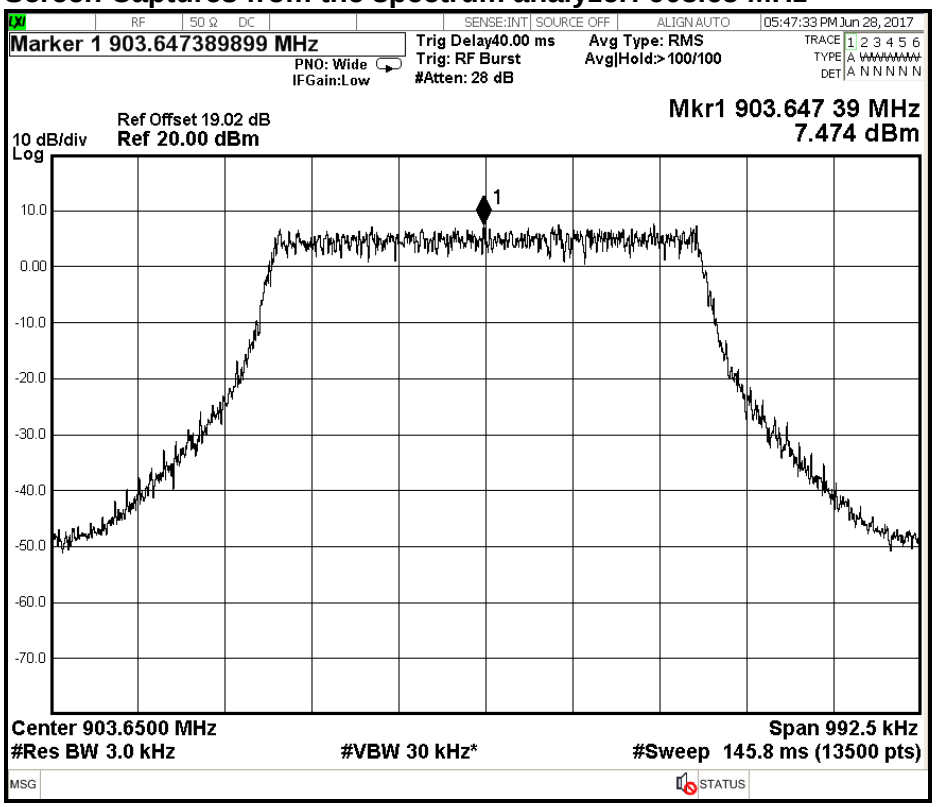
2.4.5 Peak PSD Data

LoRa 500 KHZ DTS Mode

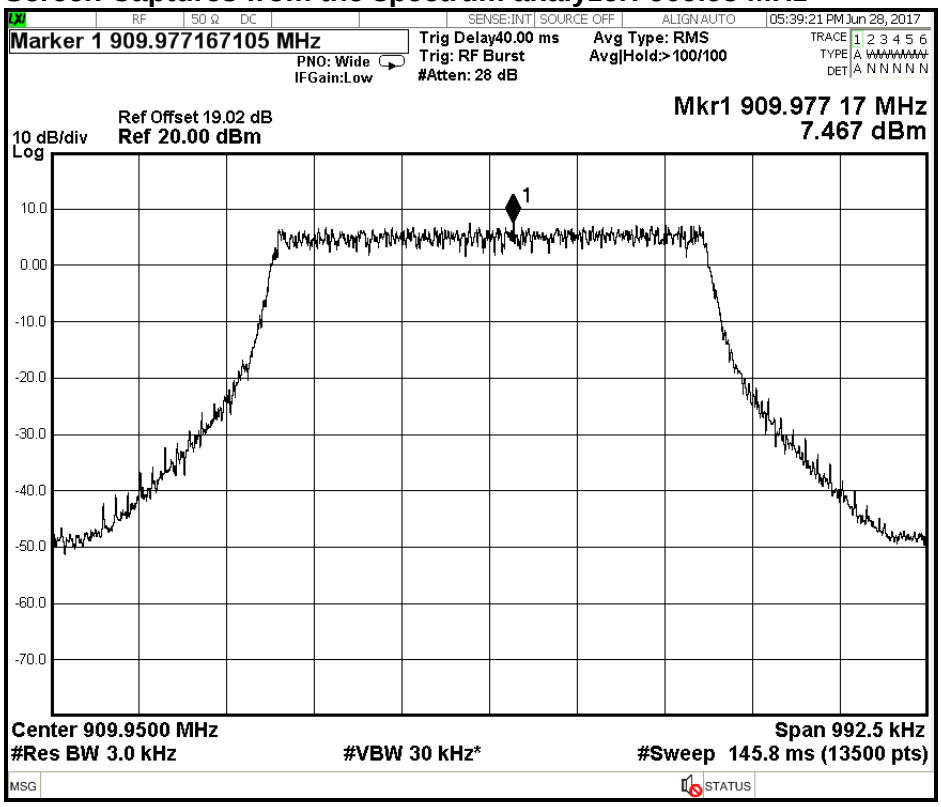
Channel	Freq. [MHz]	PSD (dBm)	PSD Limit (dBm	Margin (dB)
Low	903.65	7.474	8	0.526
Mid	909.95	7.467	8	0.533
High	915.725	7.110	8	0.89
High	927.5	5.201	8	2.799

LoRa 500KHz DTS:

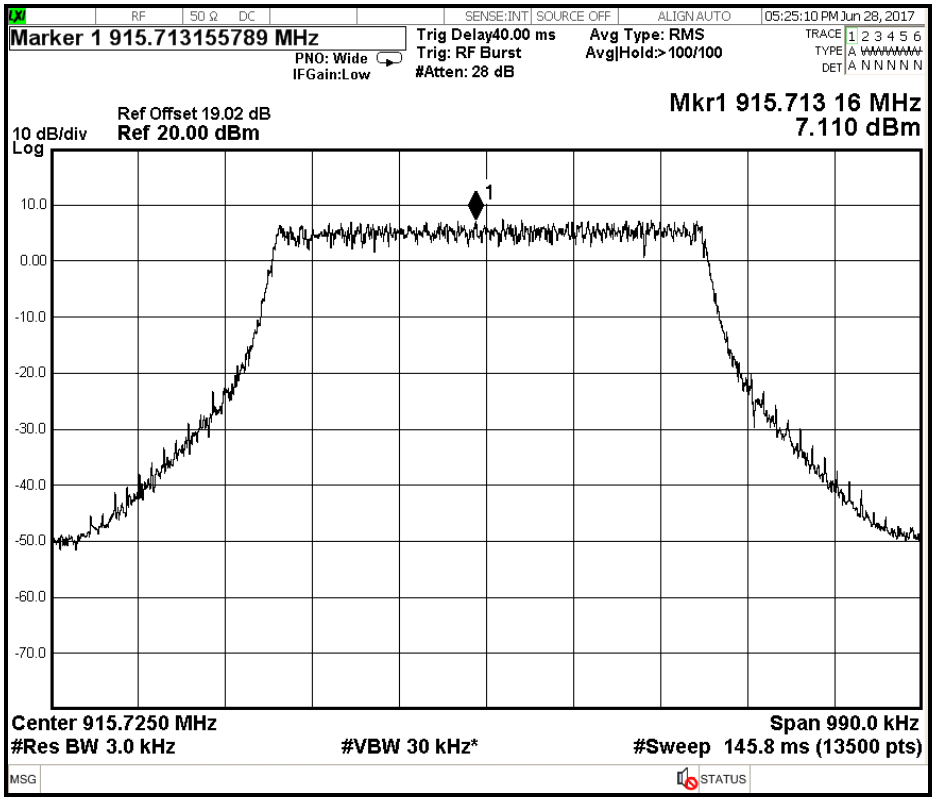
Screen Captures from the spectrum analyzer: 903.65 MHz



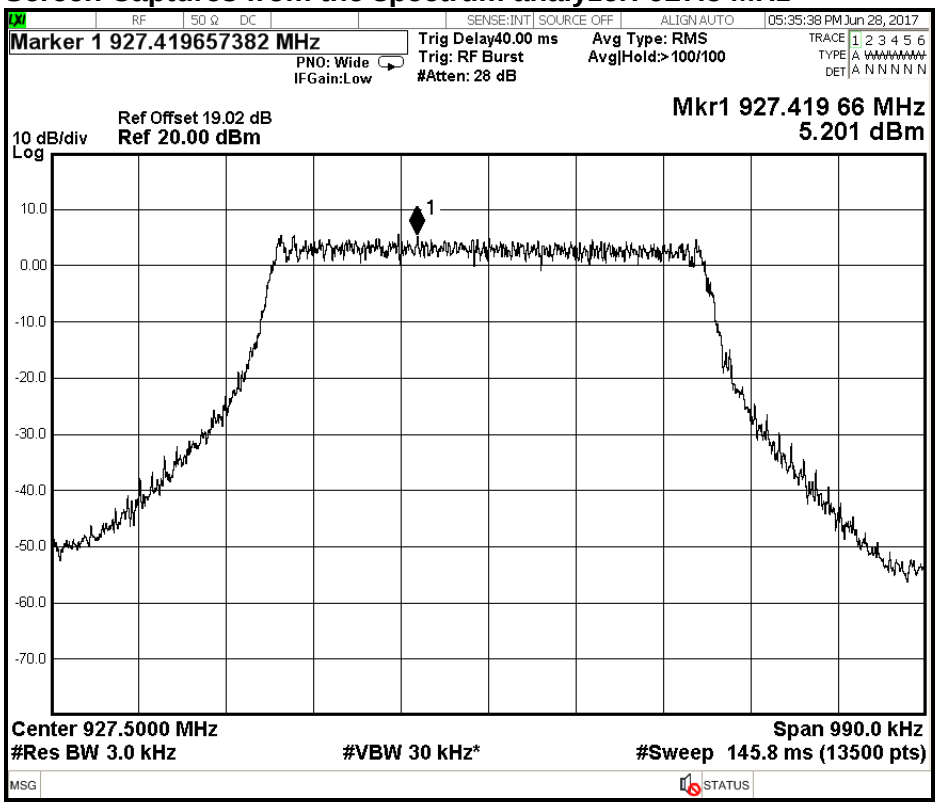
Screen Captures from the spectrum analyzer: 909.95 MHz



Screen Captures from the spectrum analyzer: 915.725 MHz



Screen Captures from the spectrum analyzer: 927.5 MHz



2.5 Band Edge Attenuation

Test Lab: Electronics Test Centre, Airdrie	**EUT: Pearl Fixed Gateway**
Test Personnel: Imran Akram	**Standard: FCC PART 15.247**
Date: June 2,5&27, 2017 August 10, 2017, Sept 15, 2017 (23.6° C,34.5% RH), (20.2° C,46.6% RH)	**Basic Standard: ANSI C63.10: 2013**

EUT status: Compliant

Specification: FCC Part 15.247(d)

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

2.5.1 Test Guidance: ANSI C63.10-2013 Clause 11.13.2 /FCC OET KDB 558074 / FCC DA 00-705

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, with out 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 ≥ 100 kHz. The VBW is set to ≥ (RBW * 3). The Peak detector is used, with the trace set to Max Hold.

The attenuation is measured with the Marker Delta function.

For the LoRa 125 KHz FHSS mode / FSK mode, the measurements were carried out in accordance with ANSI 63.10 Section 6.10 / FCC DA 00-705. The spectrum analyzer is set for a frequency span wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation. The RBW is 1% of the span and VBW is set to ≥ RBW. 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 #	Calibration Date	Calibration Due
EMI receiver	Agilent	N9038A	6130	2016-06-23	2017-06-23
EMI receiver	Agilent	N9038A	6130	2017-06-20	2018-06-20
Signal Analyzer	Agilent	N9010A	6678	2017-05-11	2018-05-11
Temp/Humidity	Extech	42270	5892	2017-04-06	2018-04-06
Attenuator	JFW	50FH-020-10		Monitored	
DC Blocker	MCL	BLK-89-S+		Monitored	

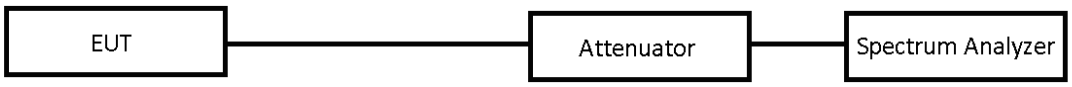
2.5.4 Test Sample Verification, Configuration & Modifications

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

The EUT met the requirements without modification.

Test setup diagrams for Band Edge Attenuation testing:

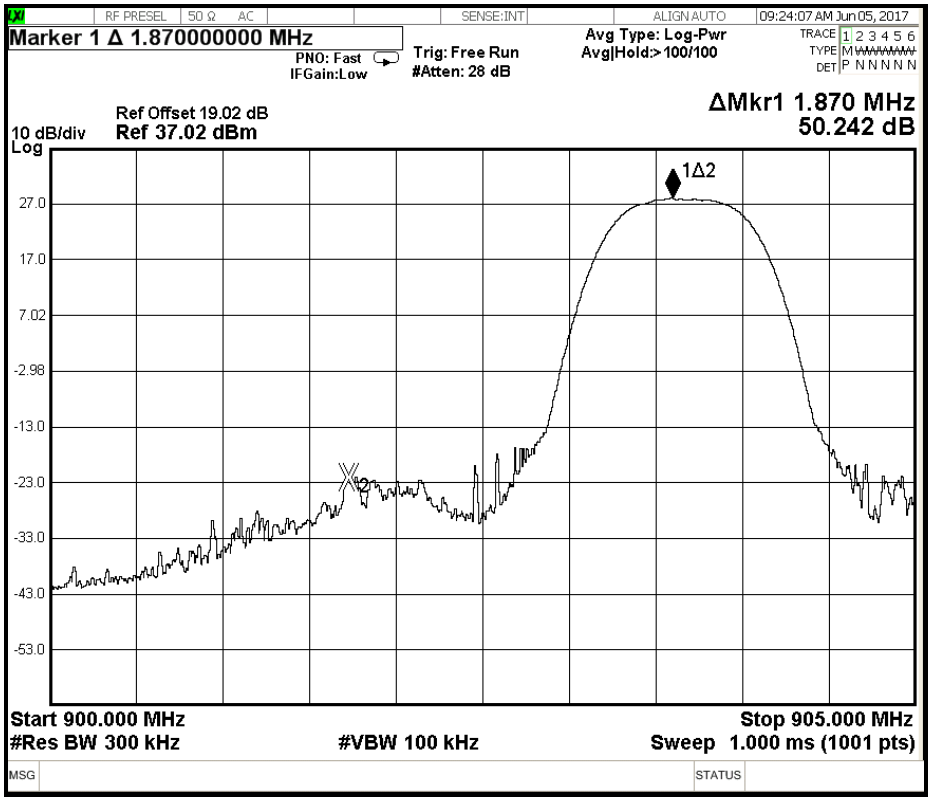
Conducted:



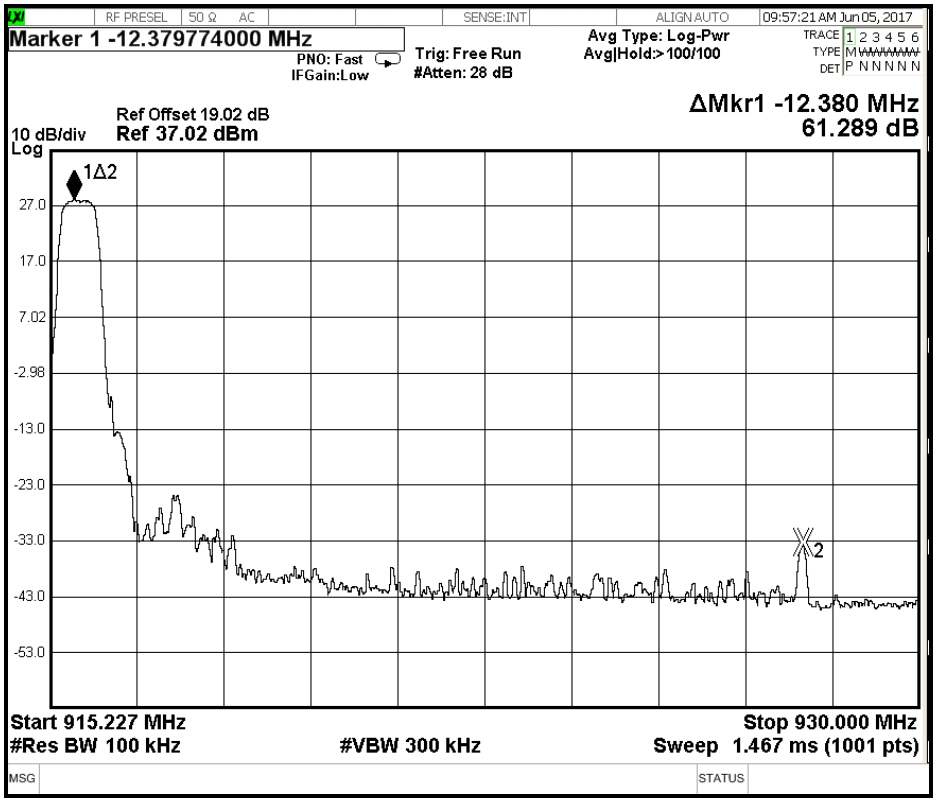
2.5.5 Band Edge Data

Modulation	Channel	Attenuation at Band Edge	Attenuation Limit at Band Edge
LoRa 500KHz DTS	903.65 MHz	50.242 dBc	20 dBc
	915.725 MHz	61.289 dBc	20 dBc
	927.5	44.803 dBc	20 dBc
LoRa 125KHz Non - Hopping	912.310 MHz	67.542 dBc	20 dBc
	927.0125 MHz	56.850 dBc	20 dBc
LoRa 125KHz (Hopping)	912.310 MHz	54.129 dBc	20 dBc
	927.0125 MHz	52.685 dBc	20 dBc
FSK 9.6 KHz (Non -Hopping)	902.5 MHz	31.777 dBc	20 dBc
	927.35 MHz	52.509 dBc	20 dBc
FSK 28.8 KHz (Non -Hopping)	902.5 MHz	27.505 dBc	20 dBc
	927 MHz	58.407 dBc	20 dBc
FSK 9.6 KHz (Hopping)	902.5 MHz	50.684 dBc	20 dBc
	927.35 MHz	58.288 dBc	20 dBc
FSK 28.8 KHz (Hopping)	902.5 MHz	50.656 dBc	20 dBc
	927 MHz	62.095 dBc	20 dBc

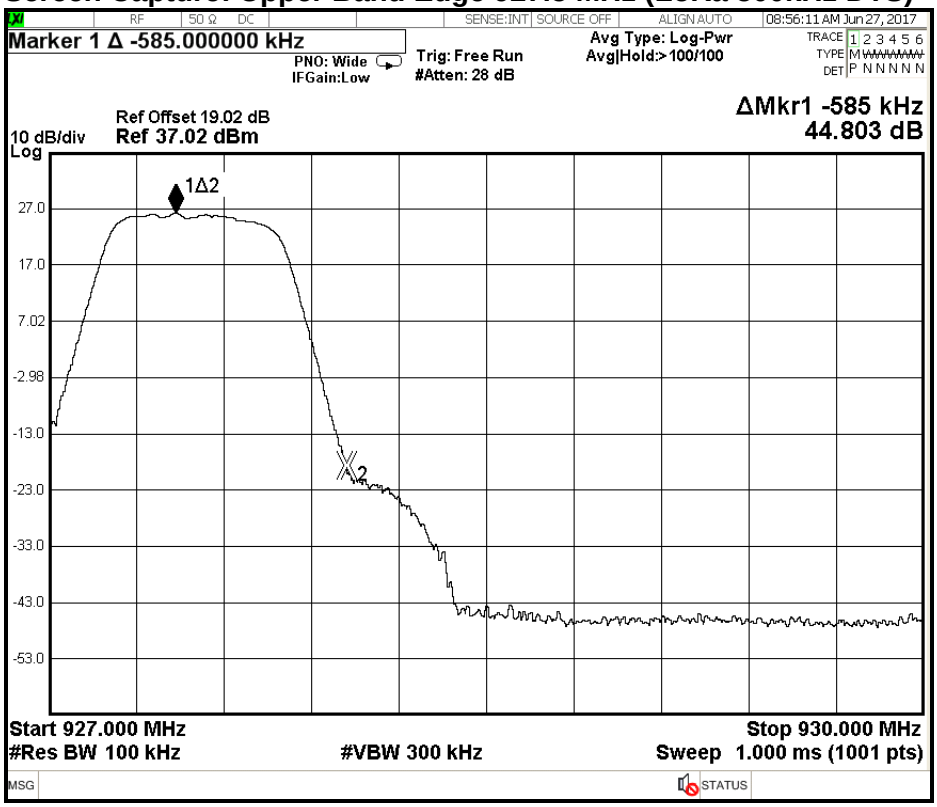
Screen Capture: Lower Band Edge (LoRa 500kHz DTS)



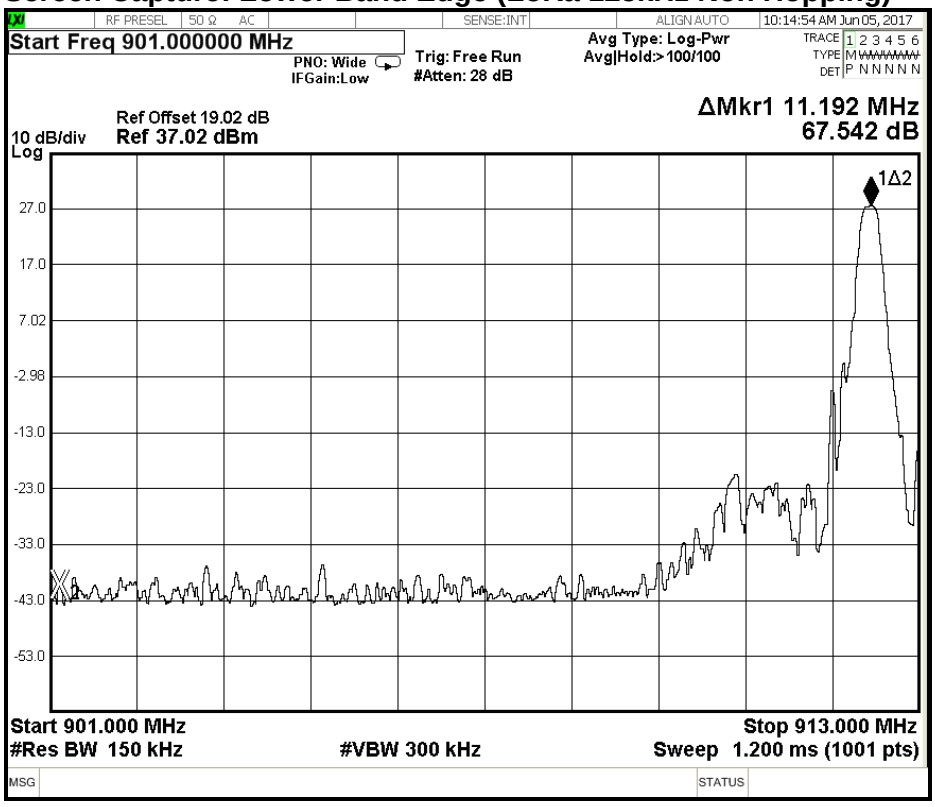
Screen Capture: Upper Band Edge 915.725 MHz (LoRa 500kHz DTS)



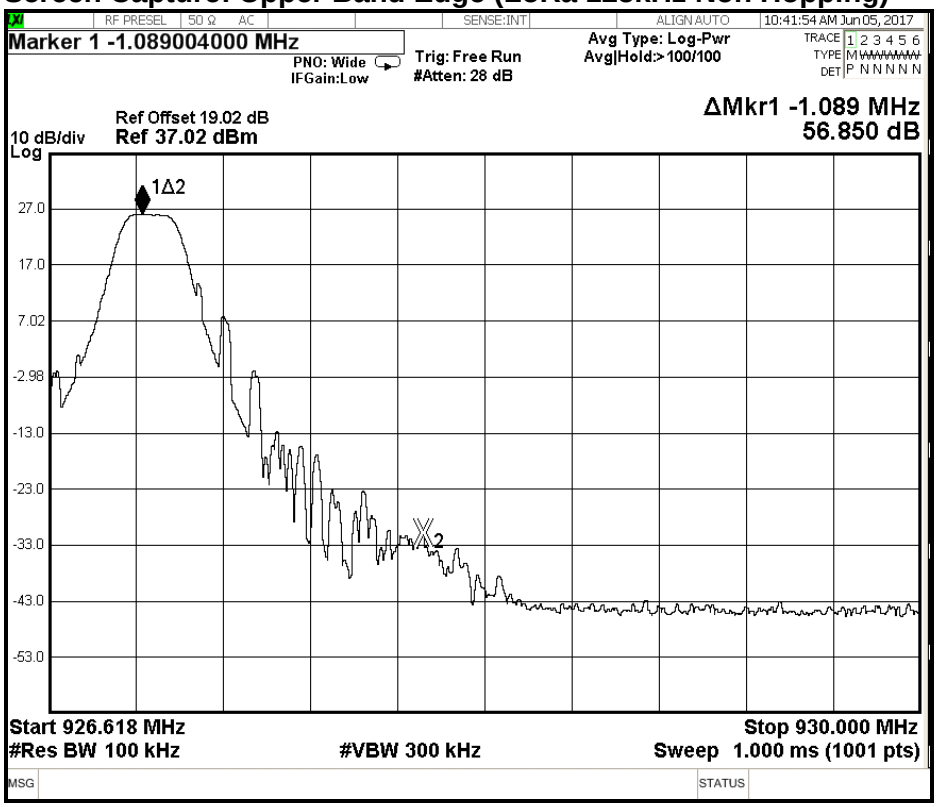
Screen Capture: Upper Band Edge 927.5 MHz (LoRa 500kHz DTS)



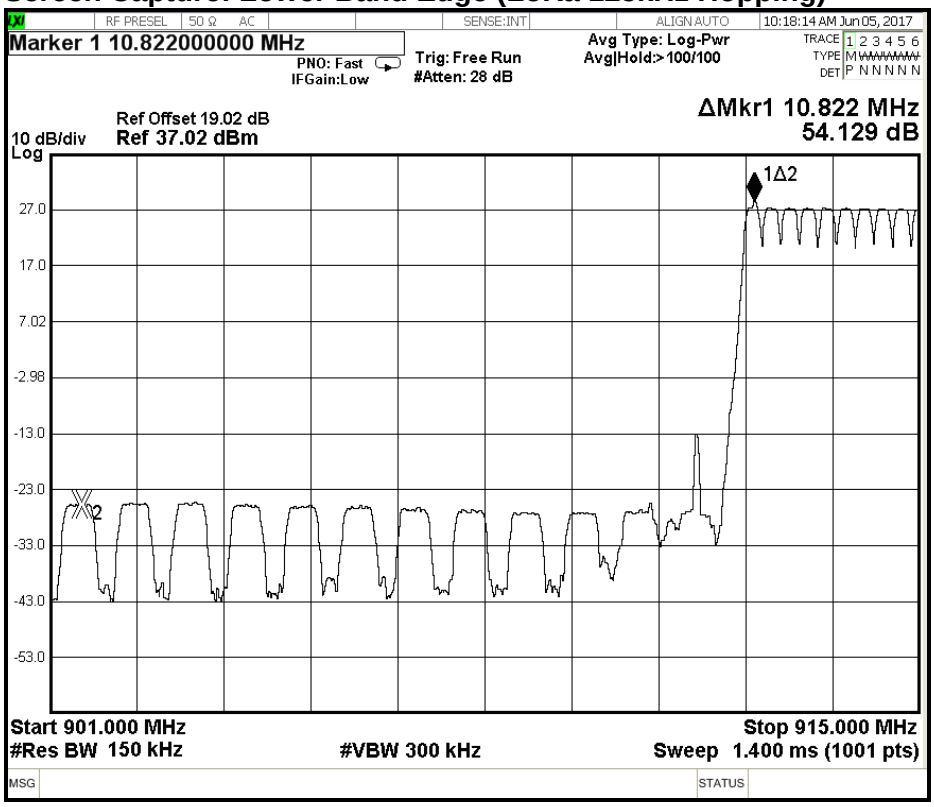
Screen Capture: Lower Band Edge (LoRa 125kHz Non Hopping)



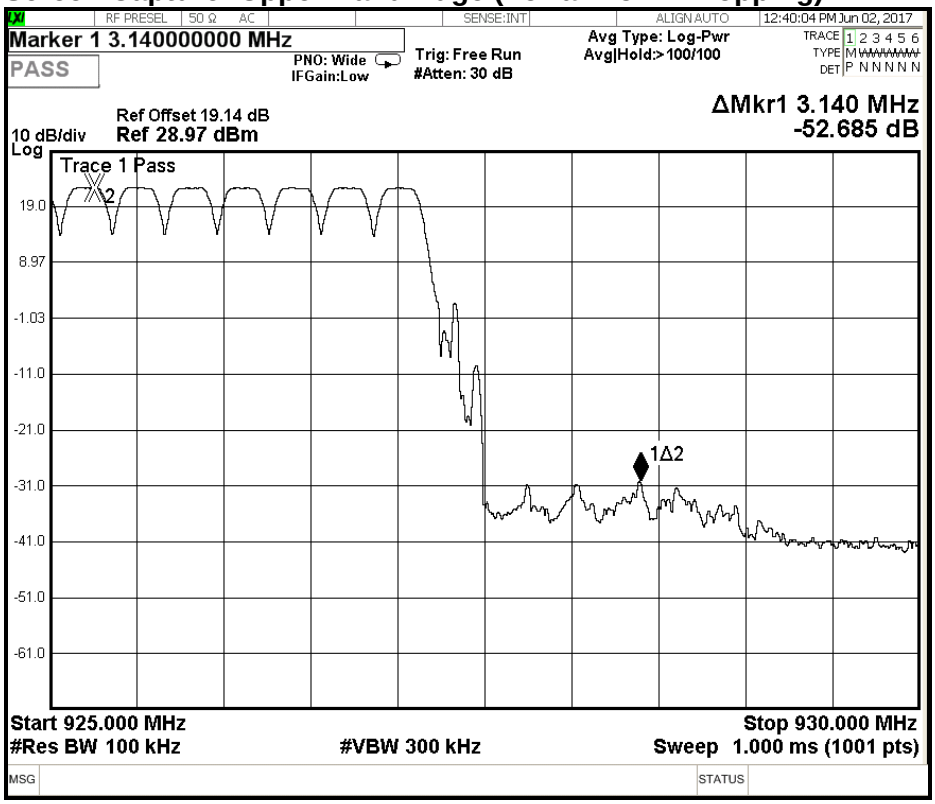
Screen Capture: Upper Band Edge (LoRa 125kHz Non Hopping)



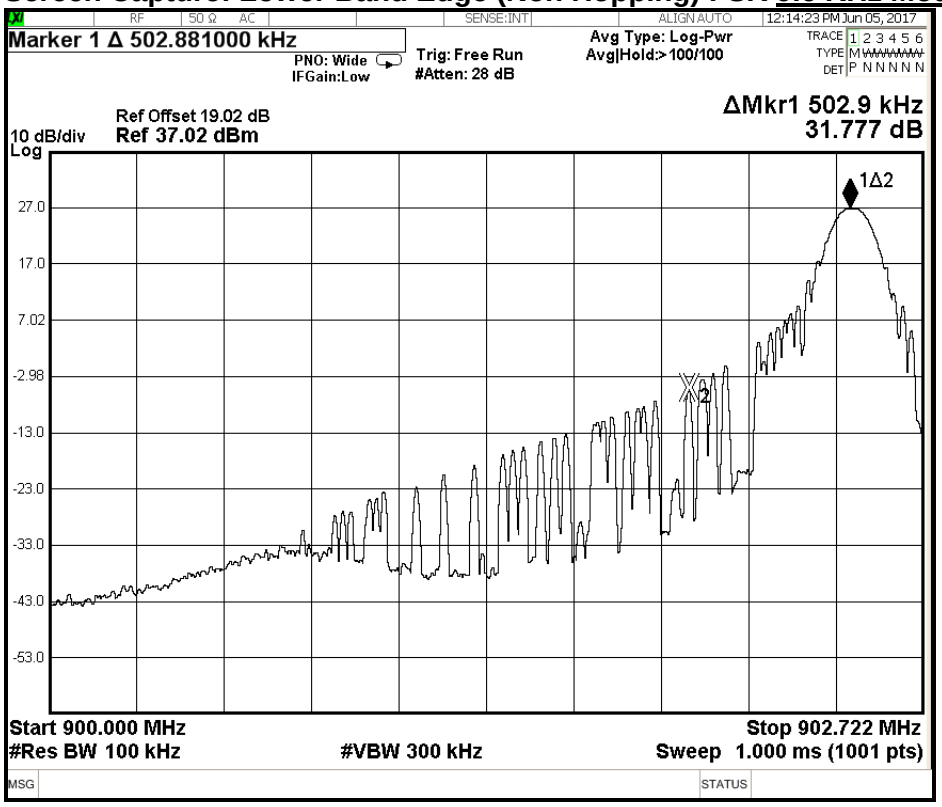
Screen Capture: Lower Band Edge (LoRa 125kHz Hopping)



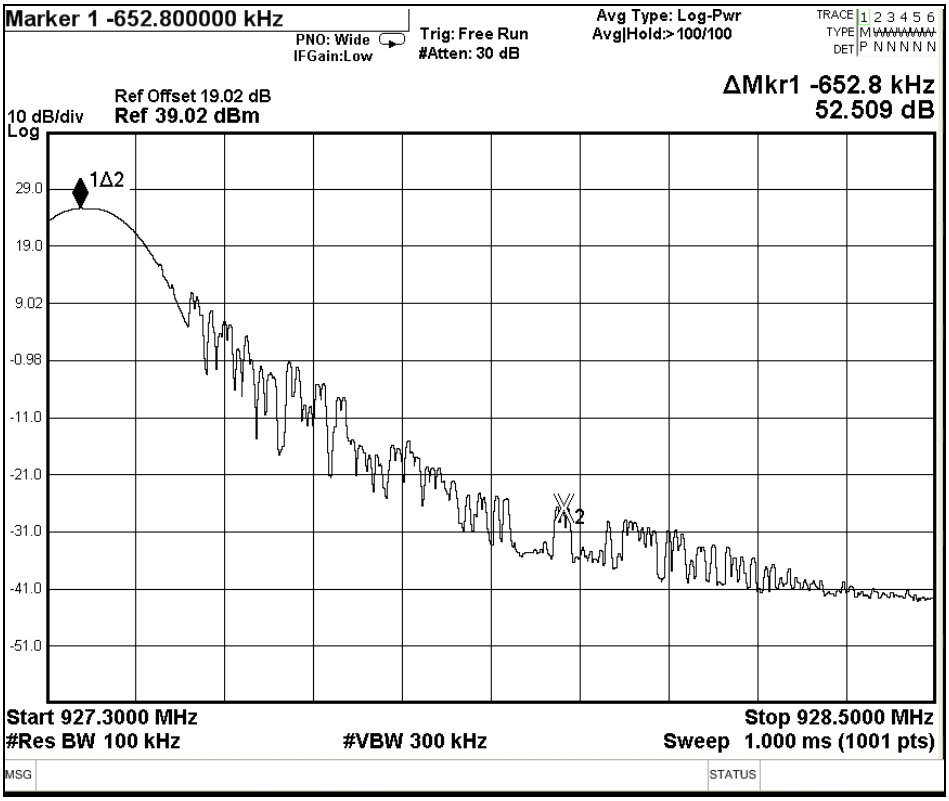
Screen Capture: Upper Band Edge (LoRa 125kHz Hopping)



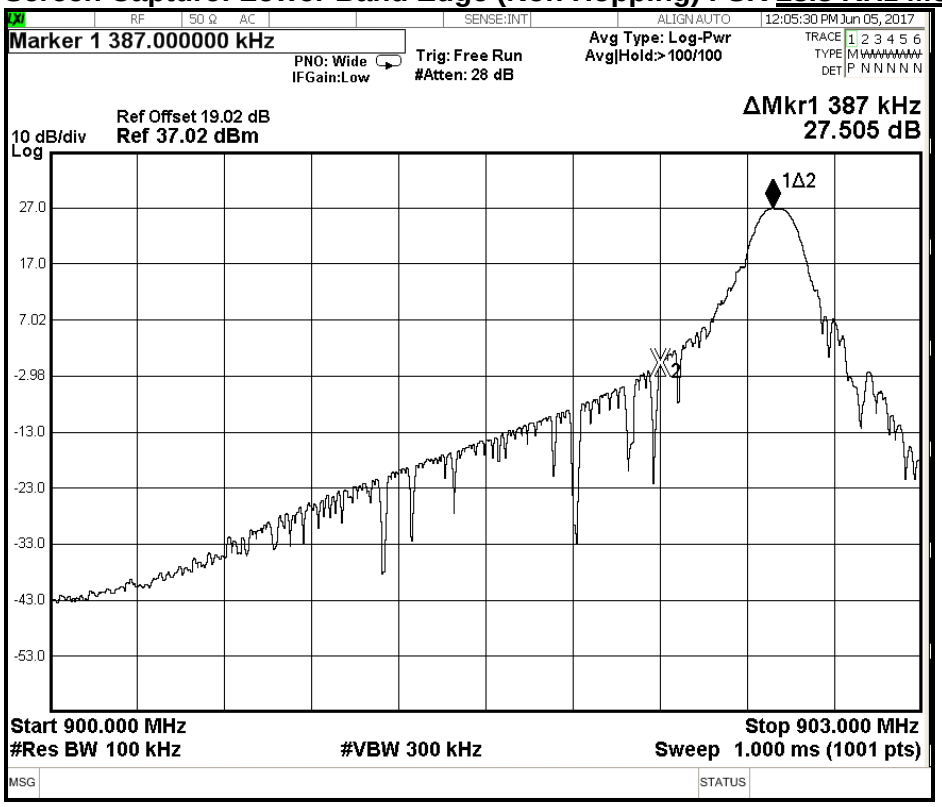
Screen Capture: Lower Band Edge (Non Hopping) FSK 9.6 KHz Mode



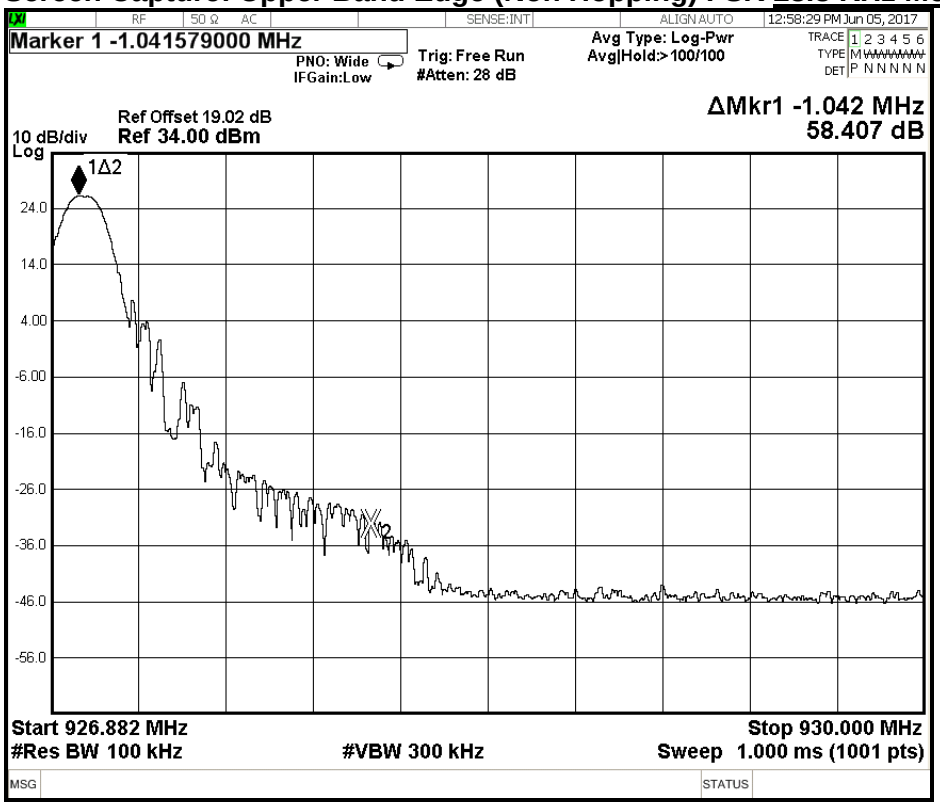
Screen Capture: Upper Band Edge (Non Hopping) FSK 9.6 KHz Mode



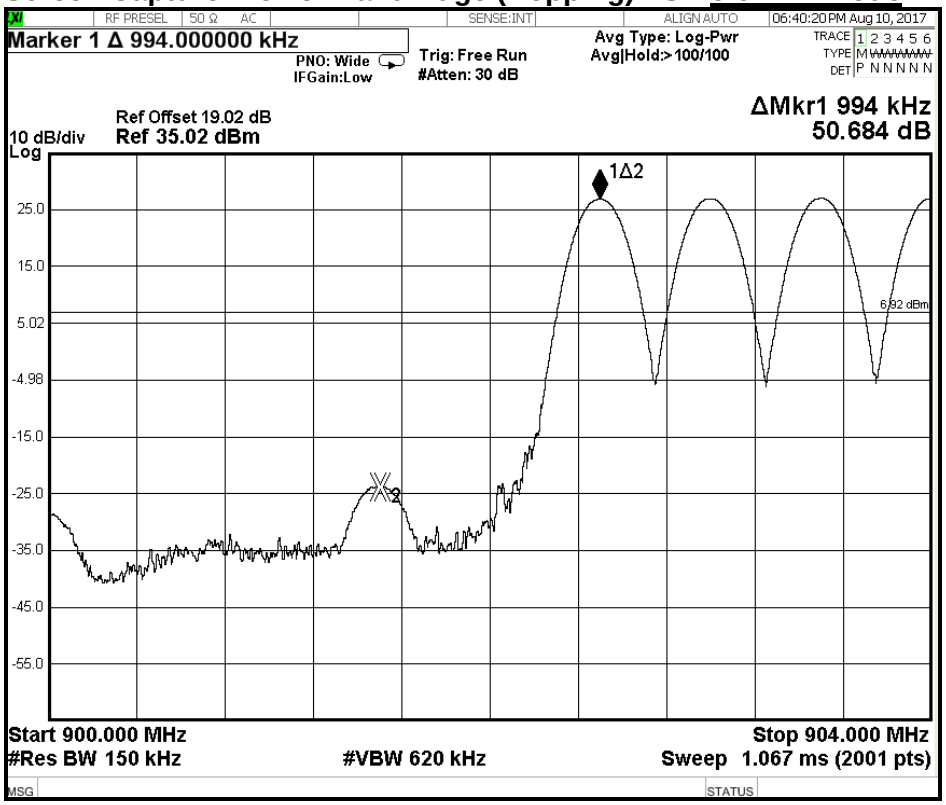
Screen Capture: Lower Band Edge (Non Hopping) FSK 28.8 KHz Mode



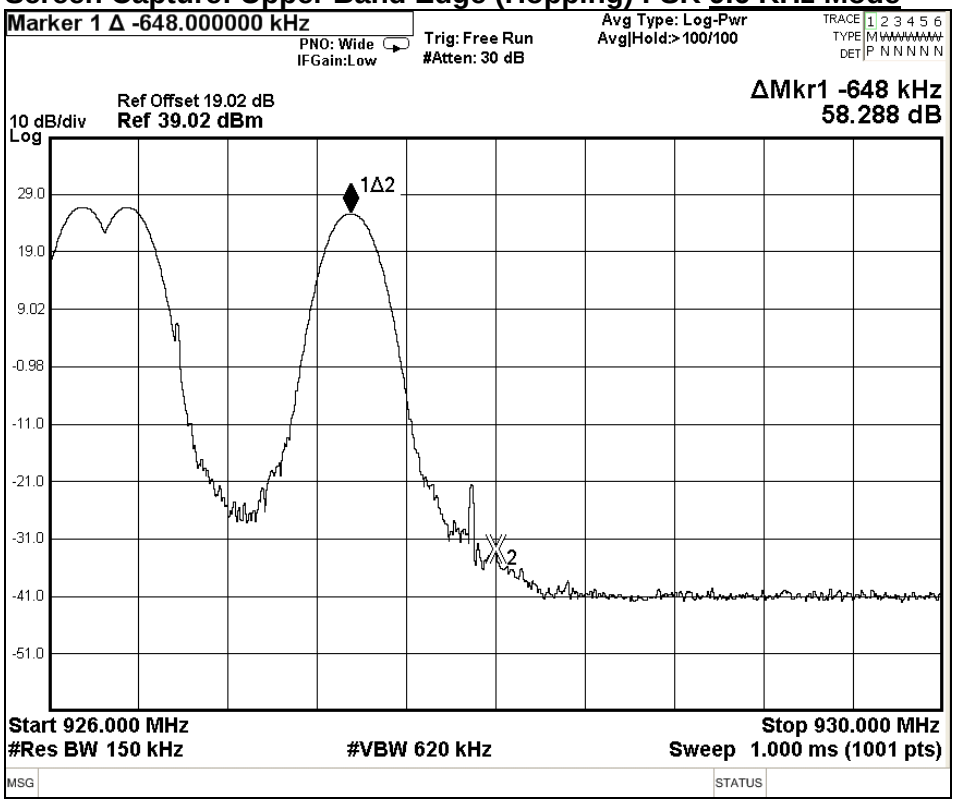
Screen Capture: Upper Band Edge (Non Hopping) FSK 28.8 KHz Mode



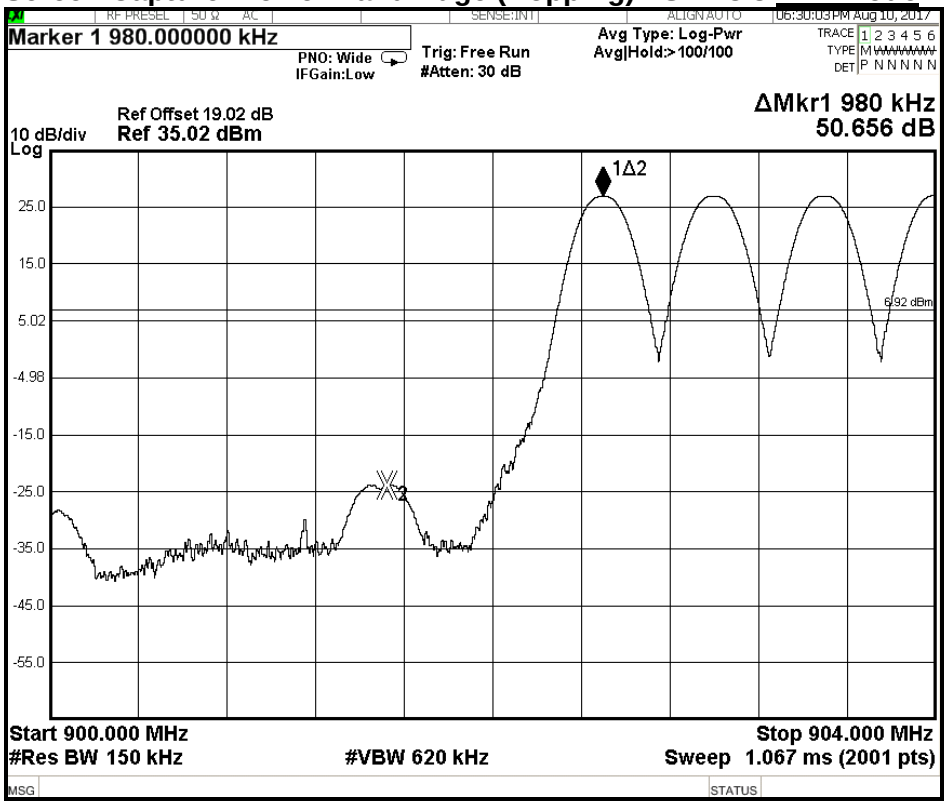
Screen Capture: Lower Band Edge (Hopping) FSK 9.6 KHz Mode



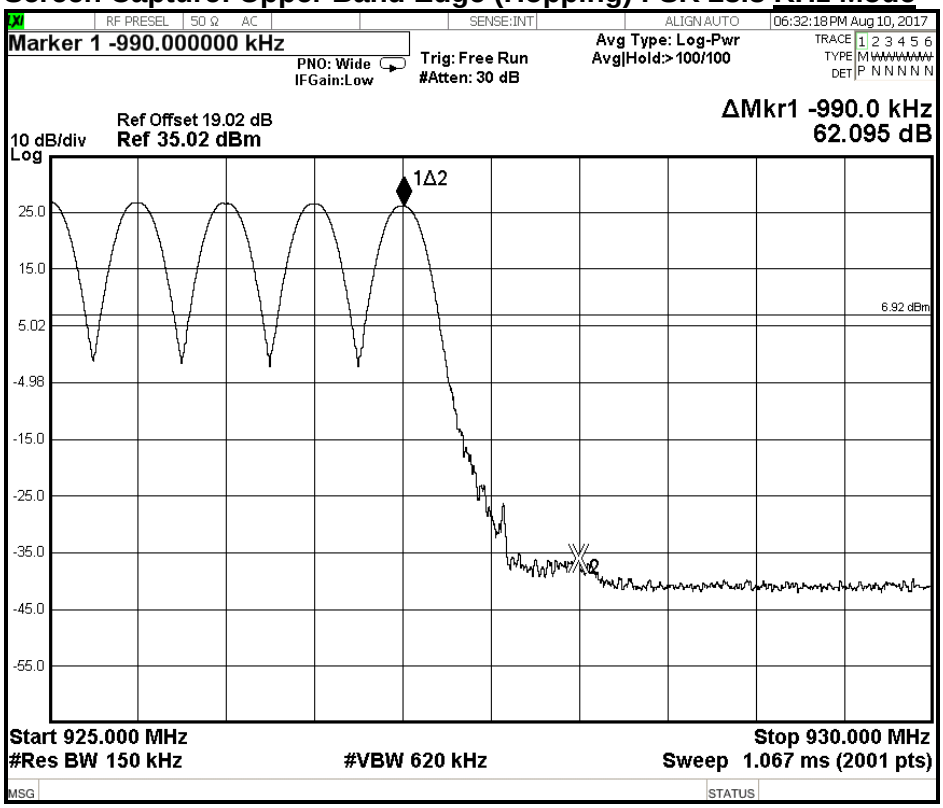
Screen Capture: Upper Band Edge (Hopping) FSK 9.6 KHz Mode



Screen Capture: Lower Band Edge (Hopping) FSK 28.8 KHz Mode



Screen Capture: Upper Band Edge (Hopping) FSK 28.8 KHz Mode



2.6 Conducted Spurious Emissions

Test Lab: Electronics Test Centre, Airdrie	**EUT: Pearl Fixed Gateway**
Test Personnel: Imran Akram	**Standard: FCC PART 15.247**
Date: June 5, 2017(23.6° C,34.5% 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 / FC DA 00-705

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, with out 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

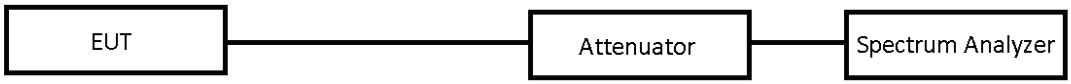
Testing was performed with the following equipment:

Equipment	Manufacturer	Model #	Asset #	Calibration Date	Calibration Due
EMI receiver	Agilent	N9038A	6130	2016-06-23	2017-06-23
Temp/Humidity	Extech	42270	5892	2017-04-06	2018-04-06
Attenuator	JFW	50FH-020-10		Monitored	
DC Blocker	MCL	BLK-89-S+		Monitored	

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.

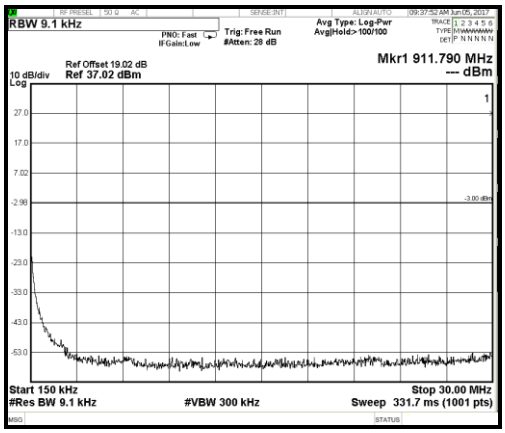
Test setup diagram for Conducted Spurious Emissions testing:

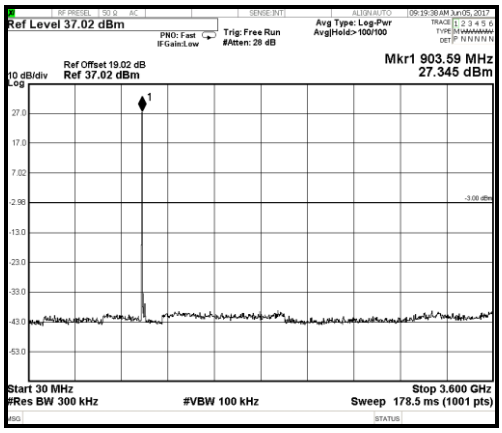


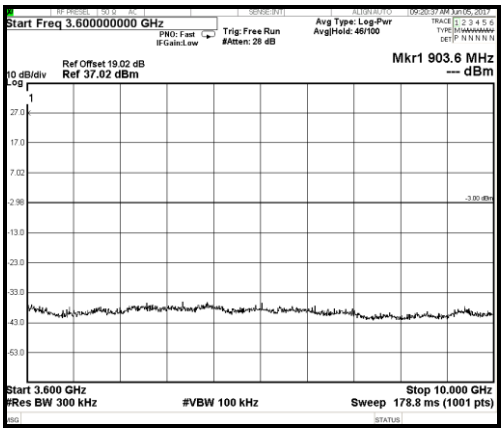
2.6.5 Conducted Emissions Data:

LoRa 500 kHz DTS Mode

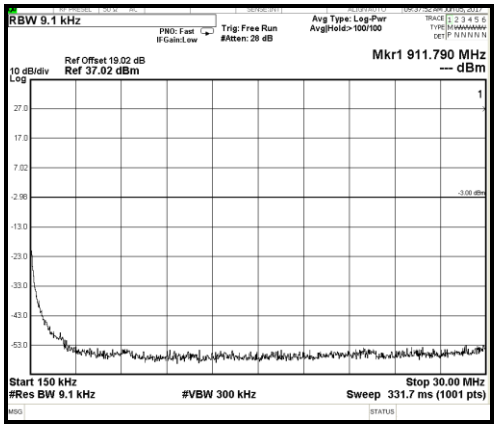
Low Channel

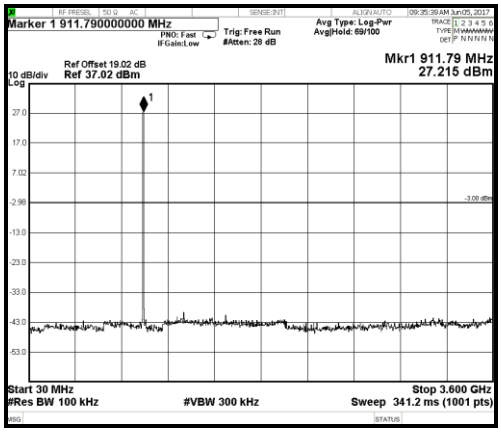


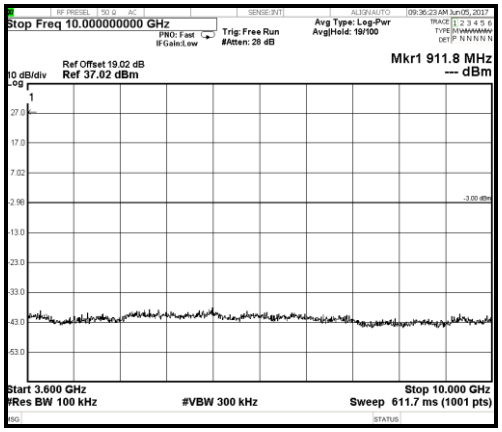




MID Channel

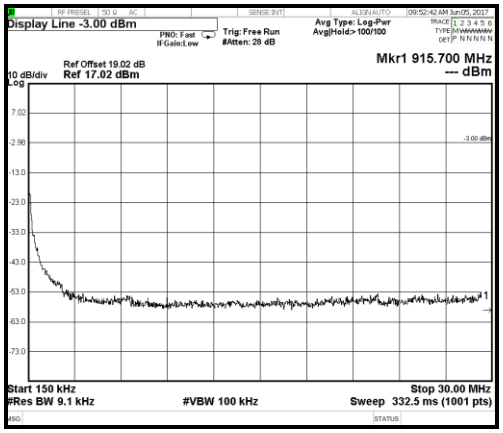


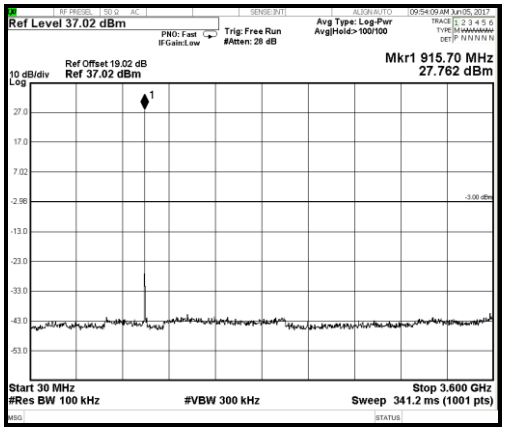


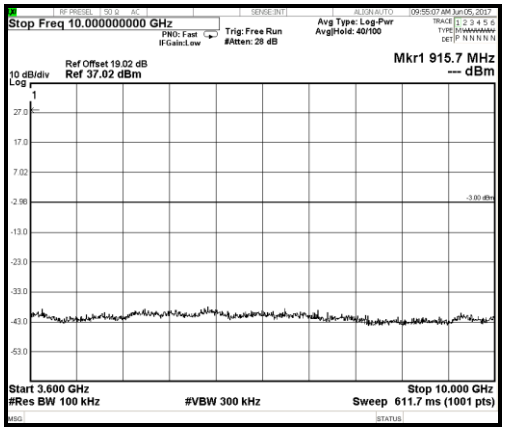


Plot of Conducted Emissions:

High Channel

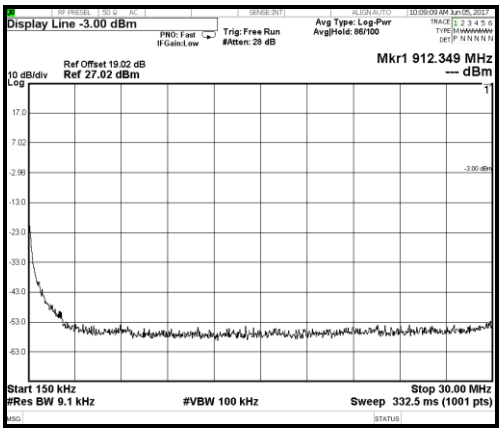


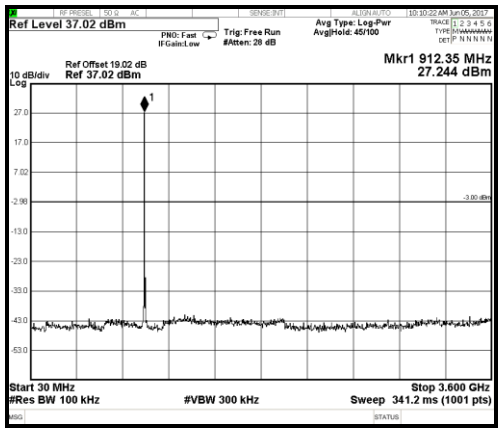


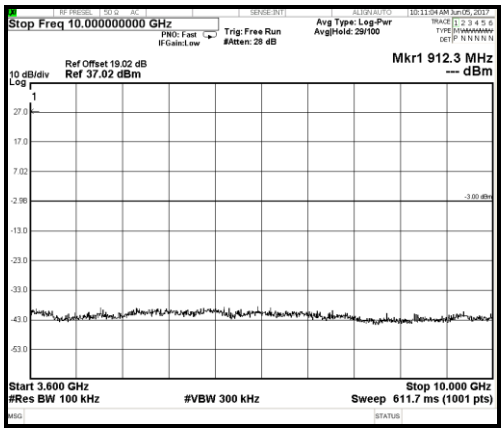


Plot of Conducted Emissions: LoRa 125 kHz Mode

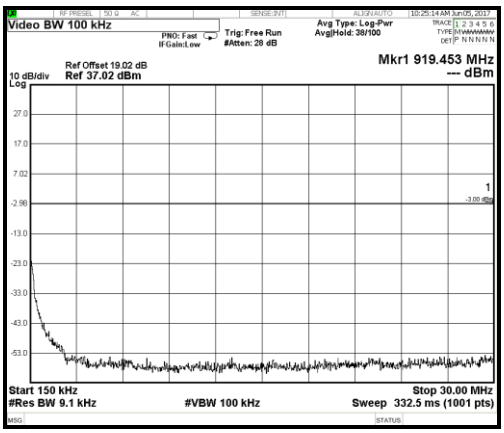
Low Channel

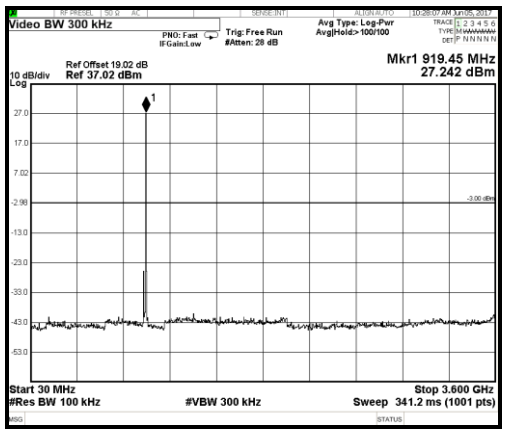


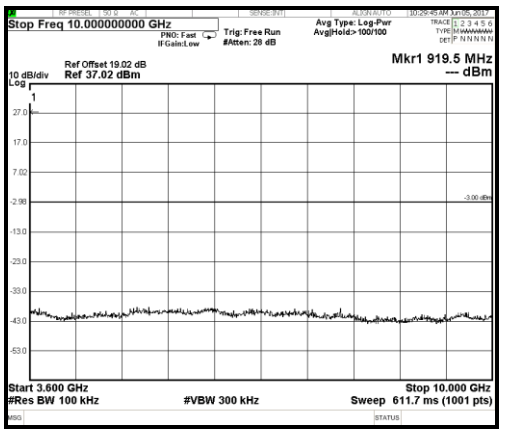




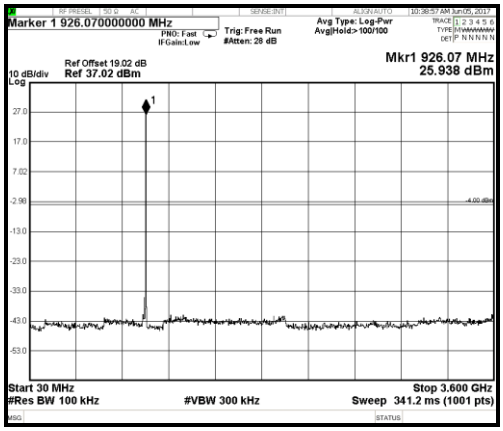
MID Channel

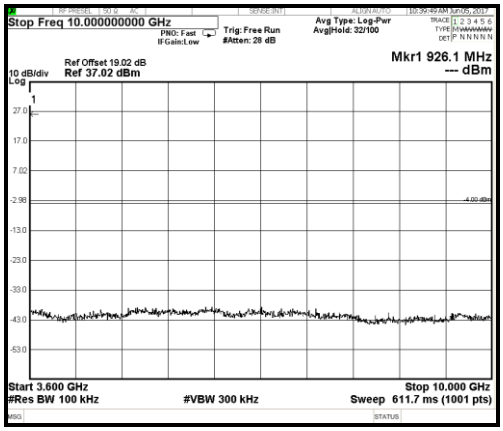






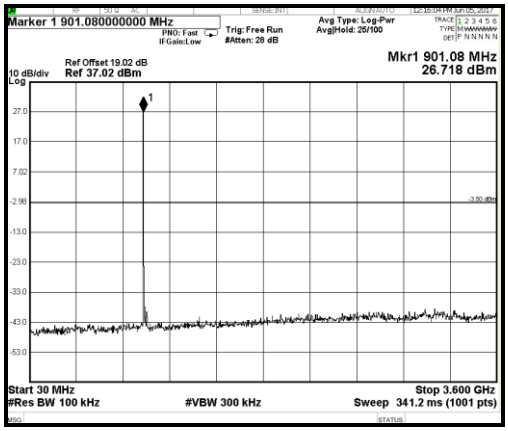
High Channel

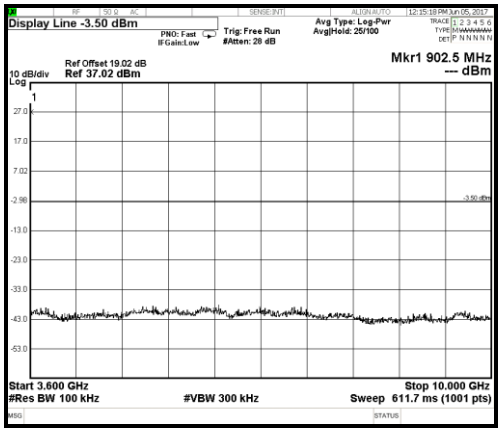




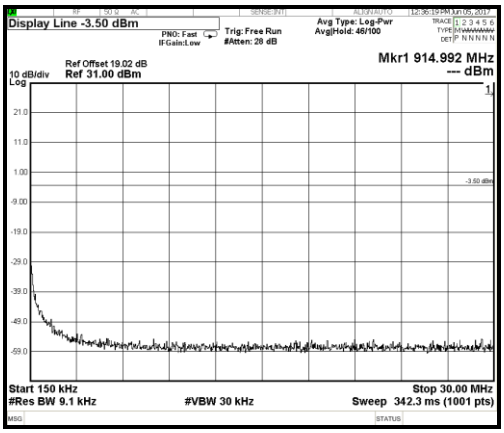
Plot of Conducted Emissions: FSK (9.6 kHz Rate)

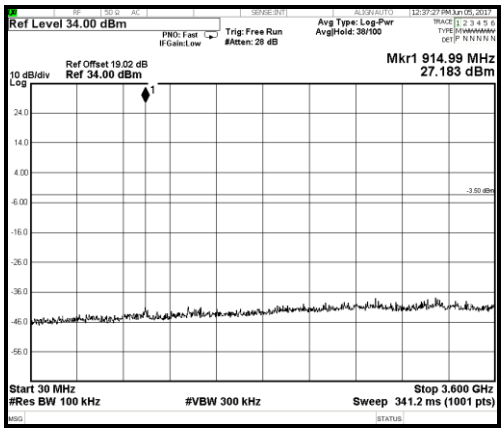
Low Channel

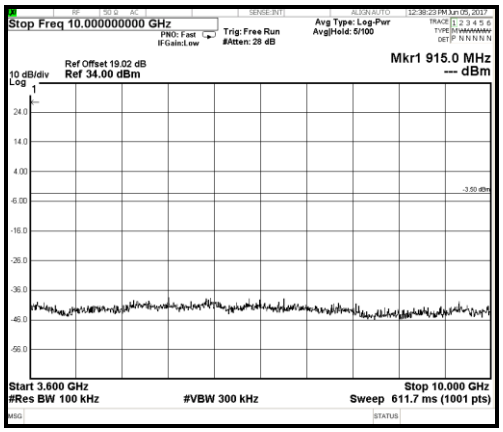




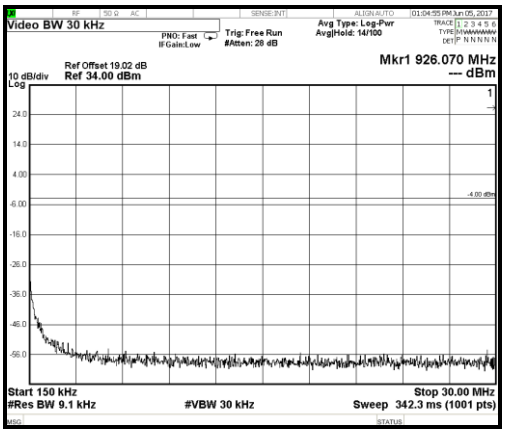
MID Channel

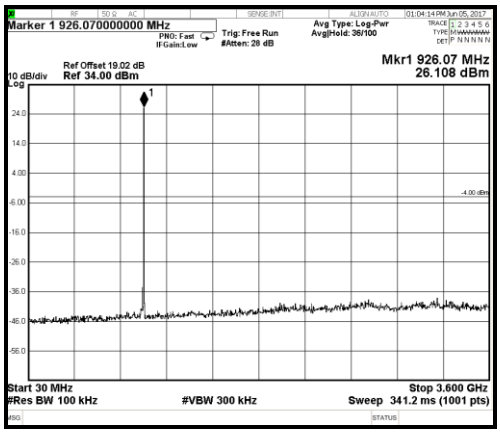


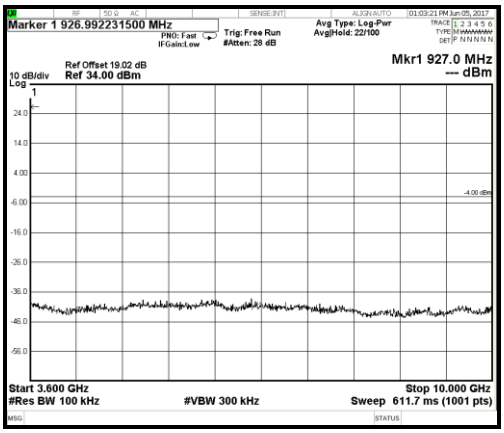




High Channel

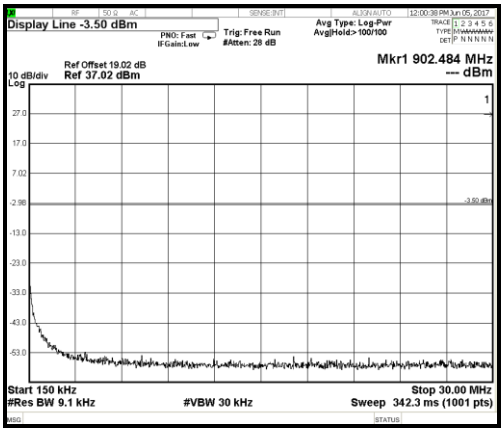


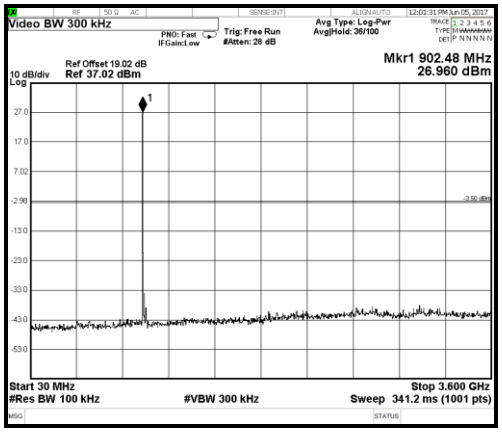


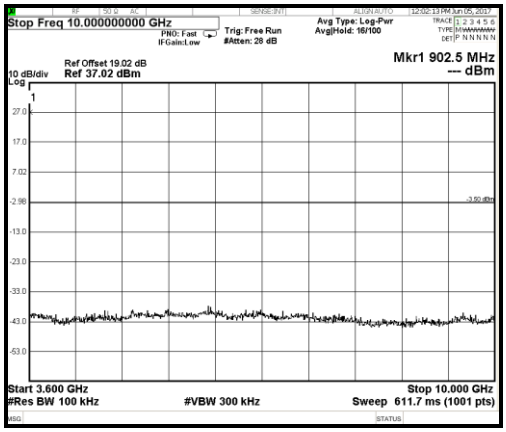


Plot of Conducted Emissions: FSK (28.8 kHz Rate)

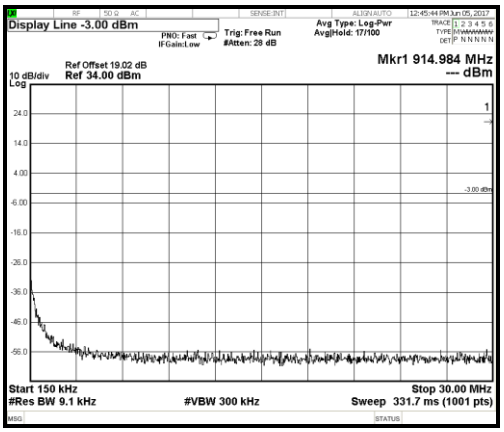
Low Channel

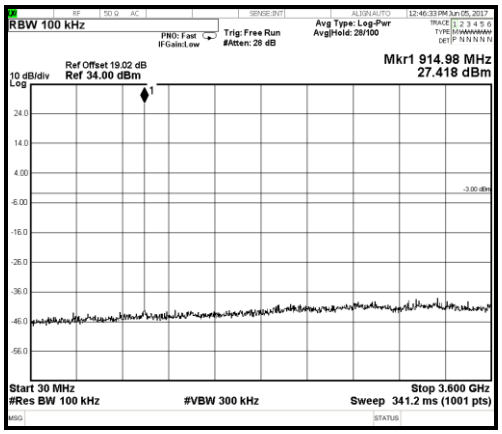


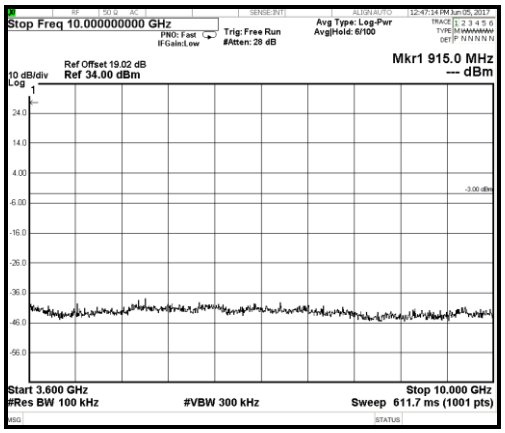




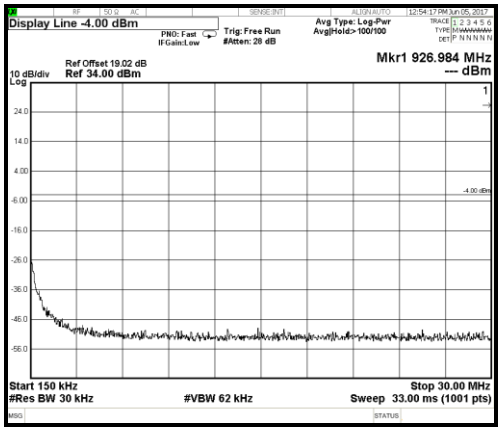
MID Channel

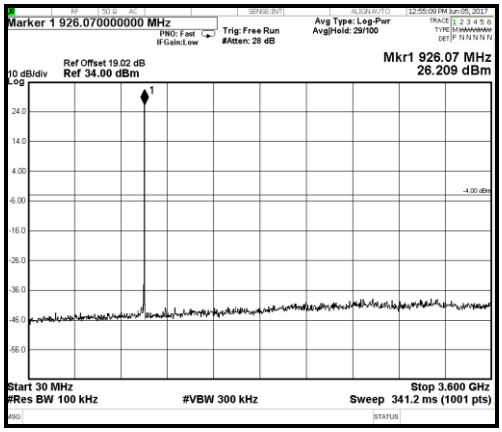


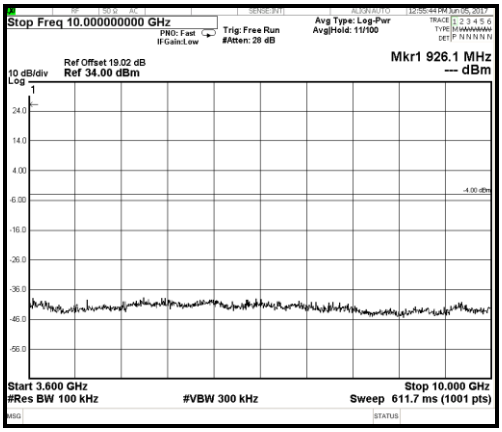




High Channel







2.7 Channel Separation

Test Lab: Electronics Test Centre, Airdrie	**EUT: Pearl Fixed Gateway**
Test Personnel: Imran Akram	**Standard: FCC Part 15.247**
Date: June 5, 2017(23.6° C,34.5% RH)	**Basic Standard: ANSI C63.10: 2013**

EUT status: Compliant

Specification: FCC Part 15.247(a, 1)

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

2.7.1 Test Guidance: ANSI 63.10 Clause 7.8.2/FCC DA-00-0705A1

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

The RF output of EUT with an antenna connector is fed to the input of the spectrum analyzer through appropriate attenuation. The loss from the cable and the attenuator were added on the analyzer as gain offset setting there by allowing direct measurements, with out the need for any further corrections.

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

2.7.2 Deviations From The Standard:

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

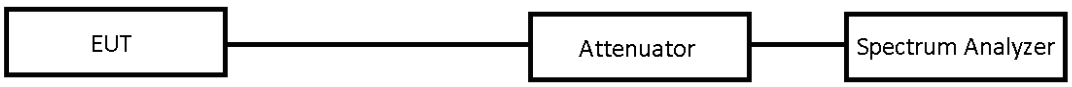
2.7.3 Test Equipment

Testing was performed with the following equipment:

Equipment	Manufacturer	Model #	Asset #	Calibration Date	Calibration Due
EMI receiver	Agilent	N9038A	6130	2016-06-23	2017-06-23
Temp/Humidity	Extech	42270	5892	2017-04-06	2018-04-06
Attenuator	JFW	50FH-020-10		Monitored	
DC Blocker	MCL	BLK-89-S+		Monitored	

2.7.4 Test Sample Verification, Configuration & Modifications

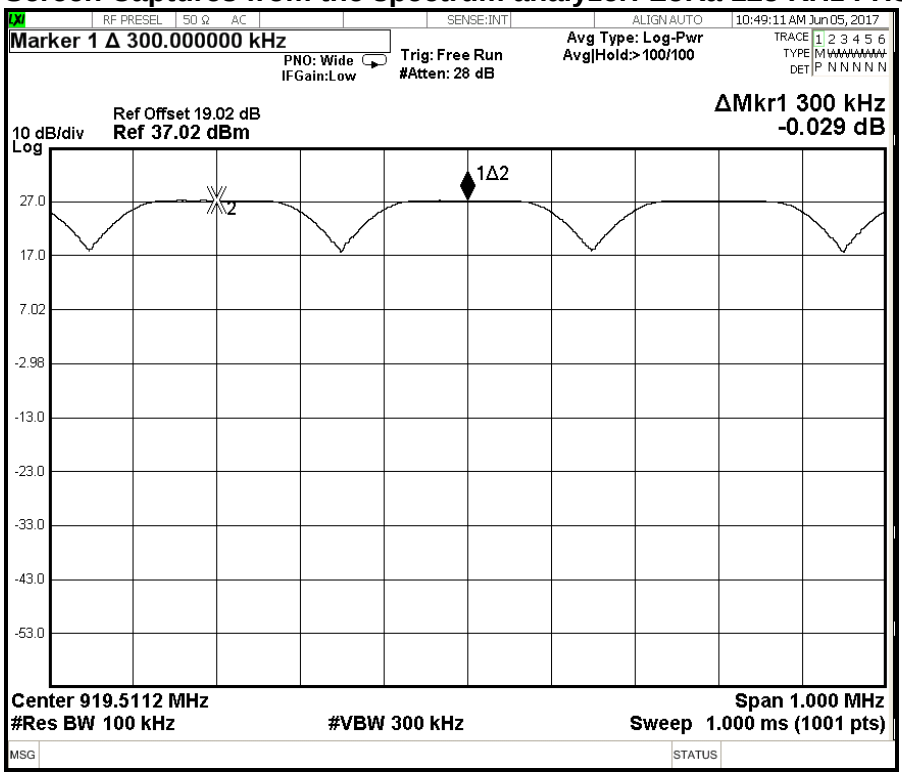
EUT configuration for Channel Separation testing:



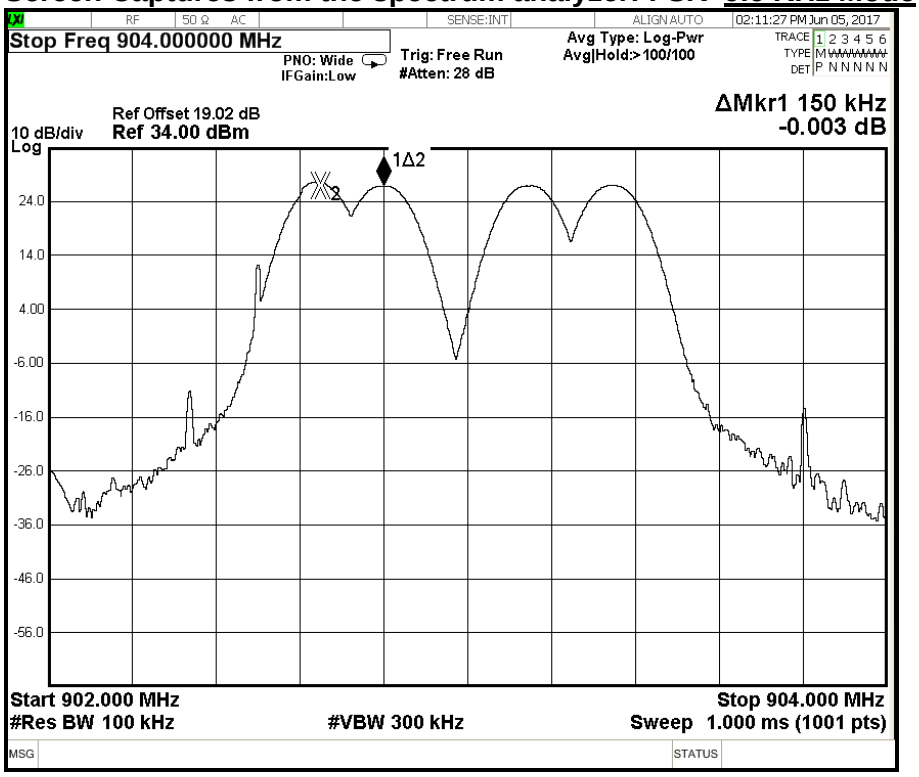
2.7.5 Channel Separation Data:

Compliant: The channel separation measured for this device ≥25 KHz.

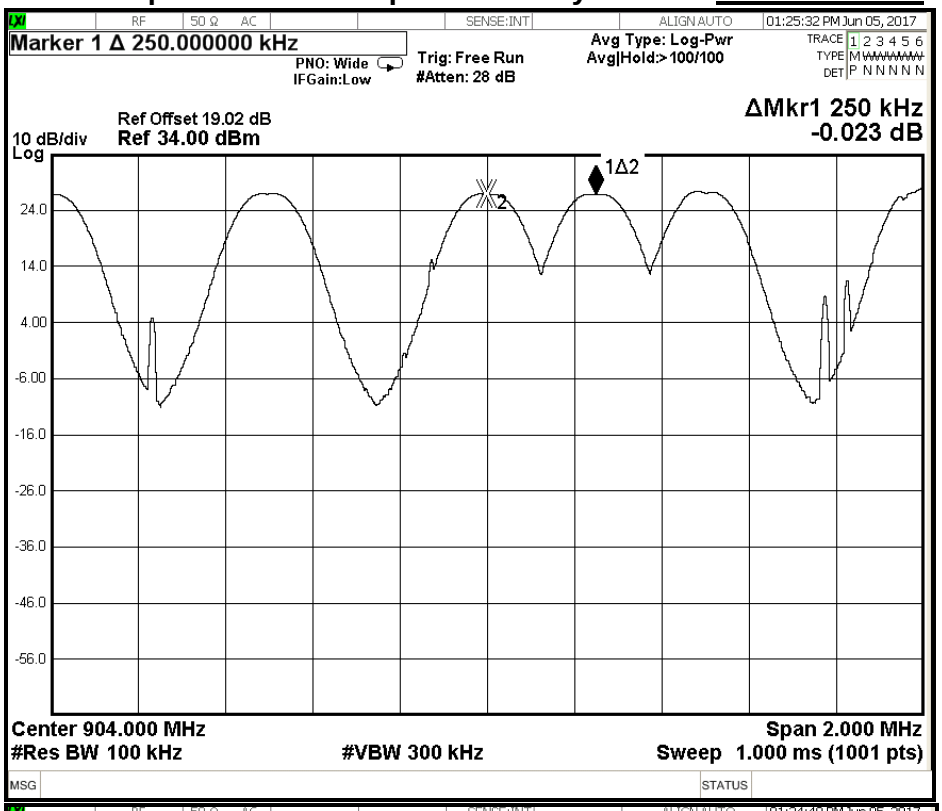
Screen Captures from the spectrum analyzer: LoRa 125 KHz FHSS

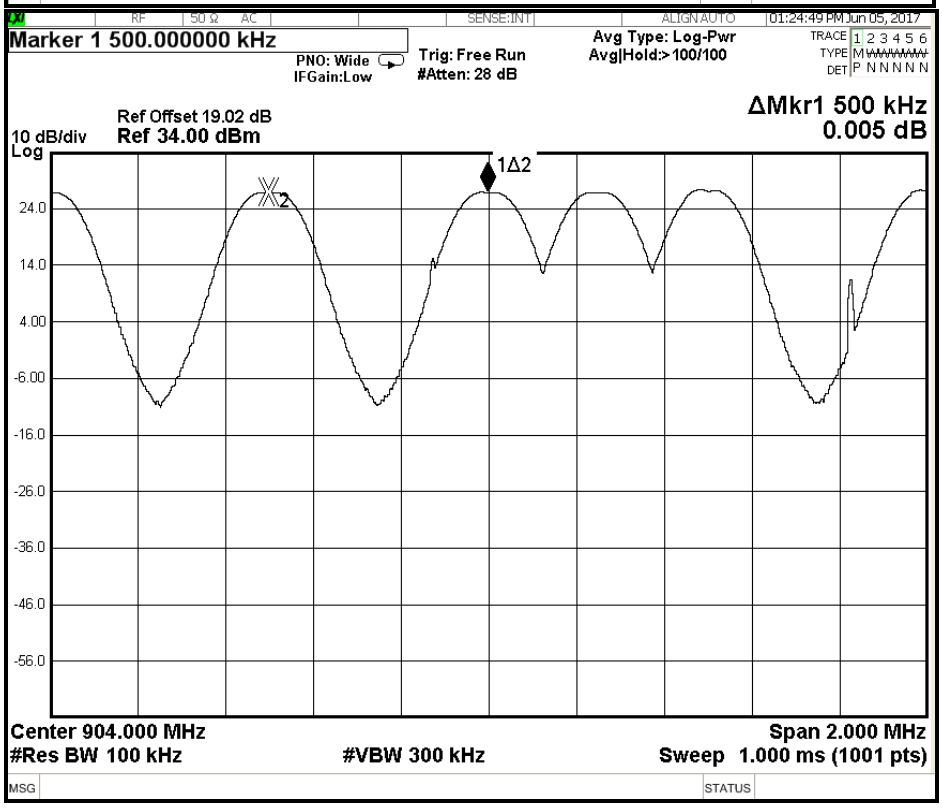


Screen Captures from the spectrum analyzer: FSK 9.6 KHz Mode



Screen Captures from the spectrum analyzer: FSK 28.8 KHz Mode





2.8 Number of Hopping Channels

Test Lab: Electronics Test Centre, Airdrie	**EUT: Pearl Fixed Gateway**
Test Personnel: Imran Akram	**Standard: FCC Part 15.247**
Date: August 11, 2011(23.6° C,34.5% RH)	**Basic Standard: ANSI C63.10: 2013**
	Number of Channels: 50

EUT status: Compliant

Specification: FCC Part 15.247(a,1,i)

For frequency hopping systems operating in the 902-928 MHz band, if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.

2.8.1 Test Guidance: ANSI 63.10 Clause 7.8.3 / FCC DA-00-0705A1

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

The RF output of EUT with an antenna connector is fed to the input of the spectrum analyzer through appropriate attenuation. The loss from the cable and the attenuator were added on the analyzer as gain offset setting there by allowing direct measurements, with out the need for any further corrections.

The spectrum analyzer is set for a frequency span selected to clearly display the hopping channels. The RBW is set ≥ 1% of the span or to identify clearly the individual channels set the RBW to less than 30% of the channel spacing or 20dB BW, which ever is smaller. The Peak detector is used, with the trace set to Max Hold.

2.8.2 Deviations From The Standard:

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

2.8.3 Test Equipment

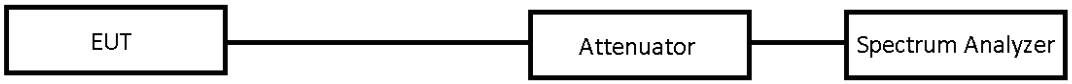
Testing was performed with the following equipment:

Equipment	Manufacturer	Model #	Asset #	Calibration Date	Calibration Due
EMI receiver	Agilent	N9038A	6130	2017-06-20	2018-06-20
Temp/Humidity	Extech	42270	5892	2017-04-06	2018-04-06
Attenuator	JFW	50FH-020-10	-	Monitored	
DC Blocker	MCL	BLK-89-S+	-	Monitored	

2.8.4 Test Sample Verification, Configuration & Modifications

The EUT was operating normally. The EUT met the requirements without modification.

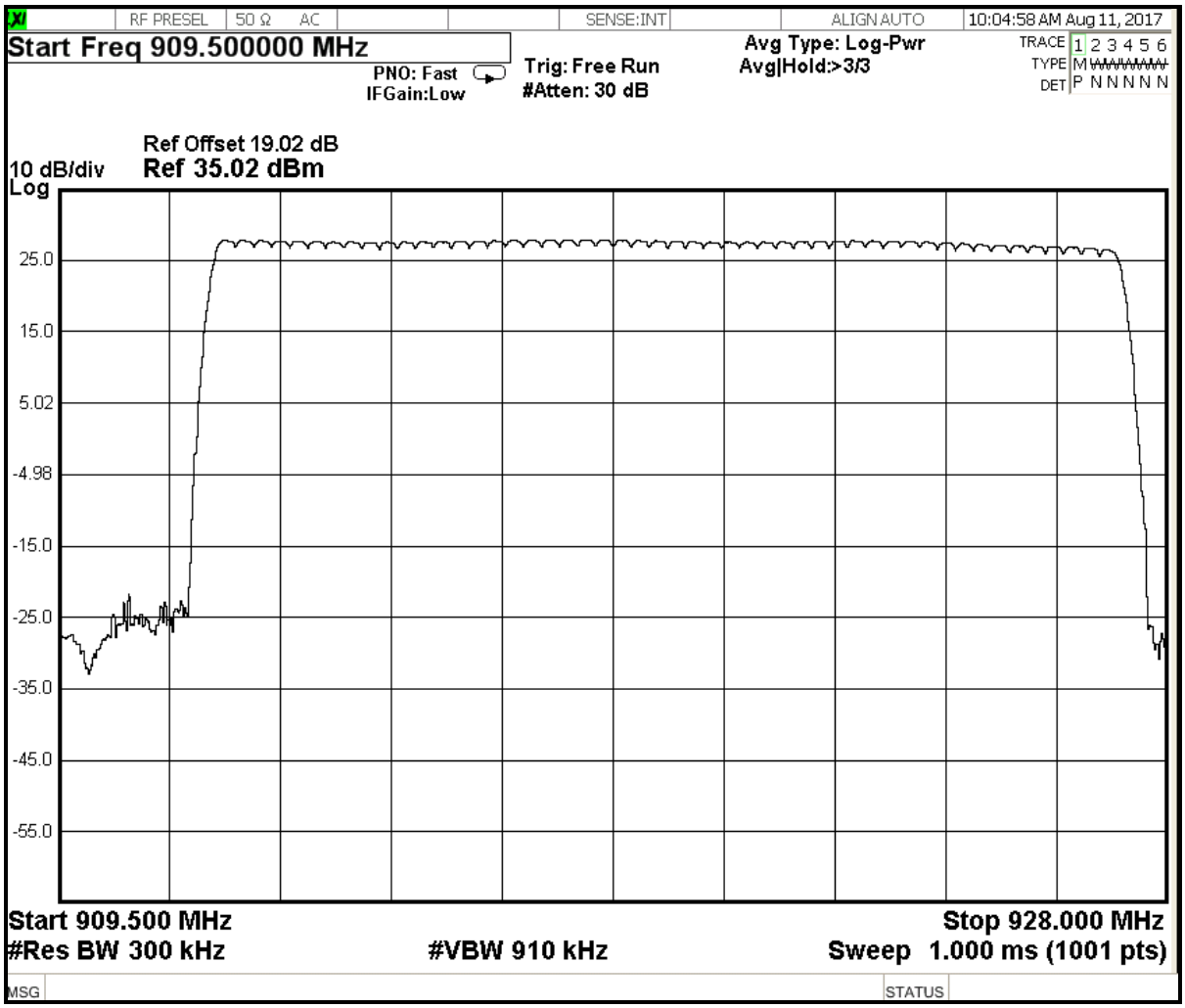
EUT configuration for Radiated Emissions testing:



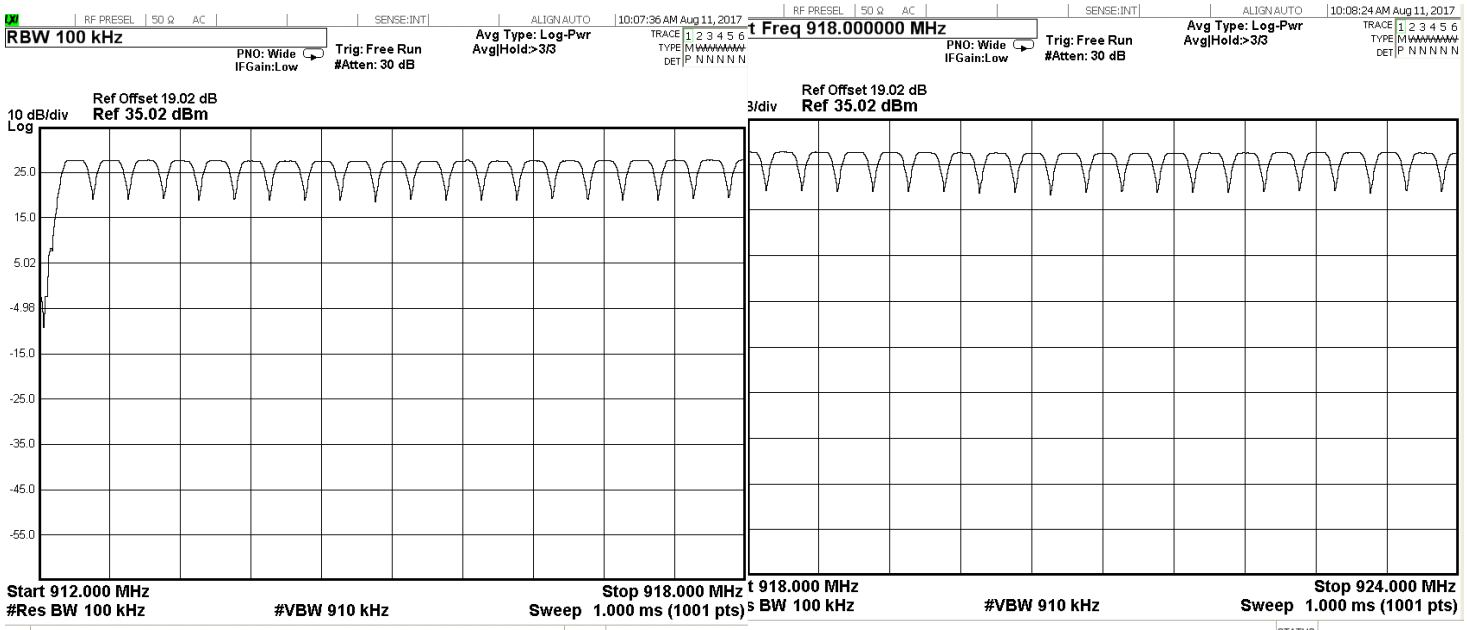
2.8.5 Hopping Channel Data:

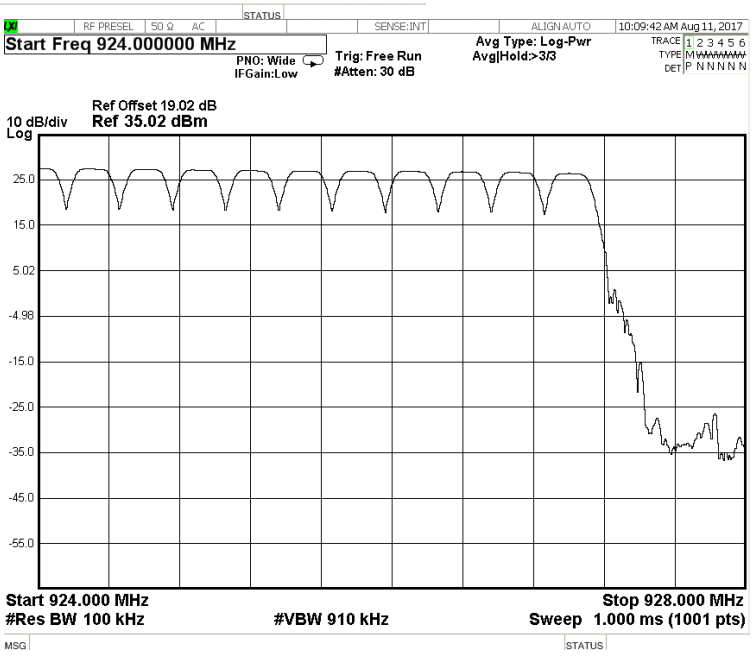
Compliant: There are 50 hopping channels

LoRa 125 KHz FHSS Mode

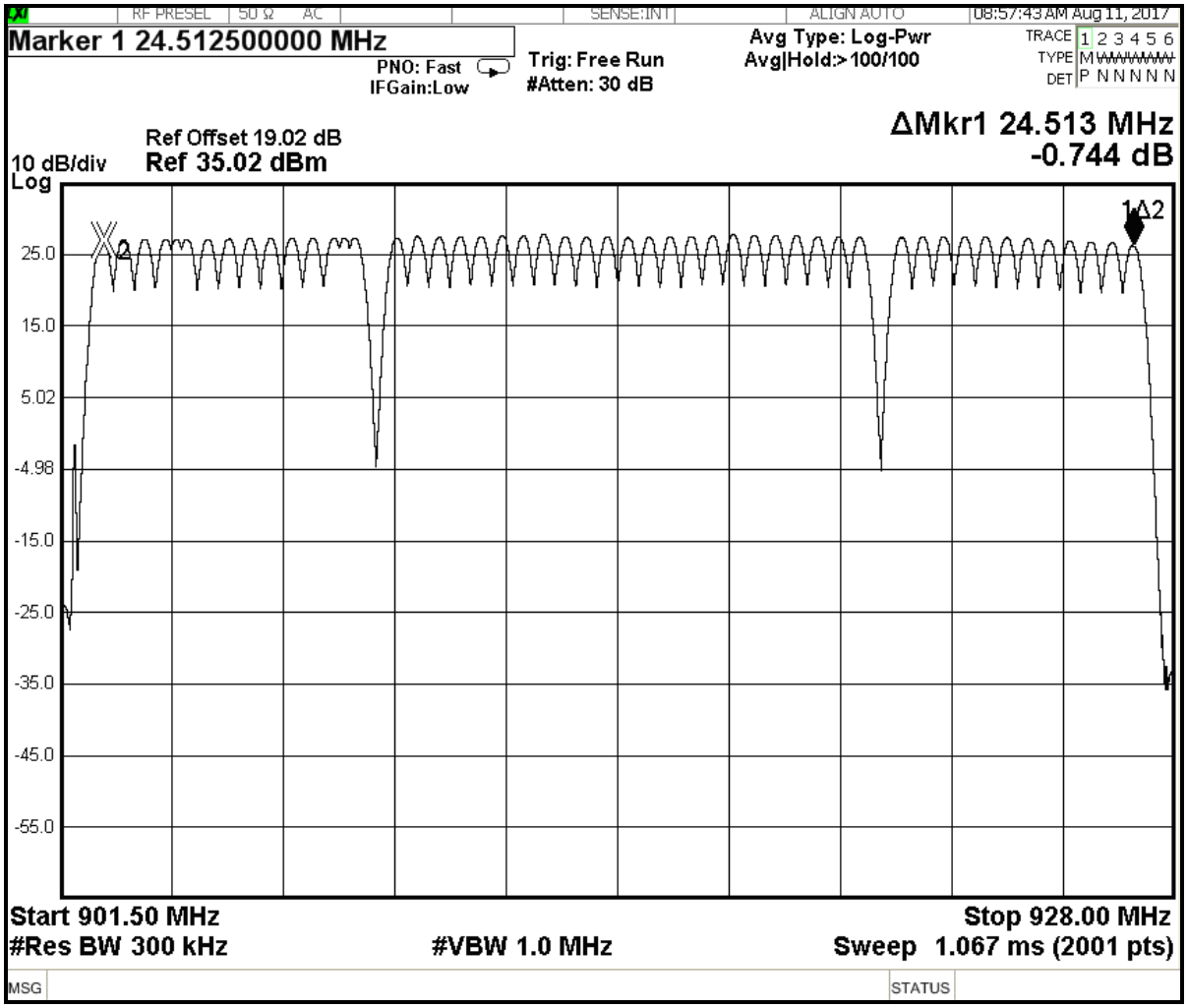


In Multiple Screens = LoRa 125KHz FHSS

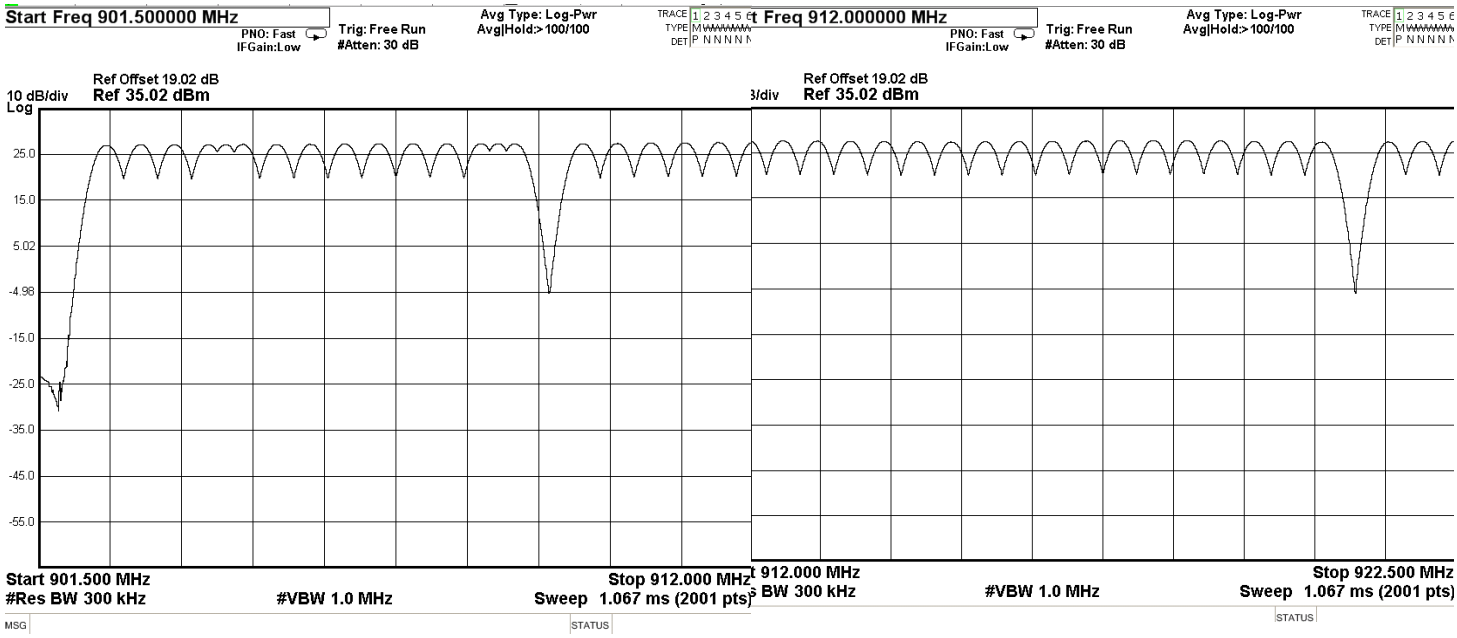


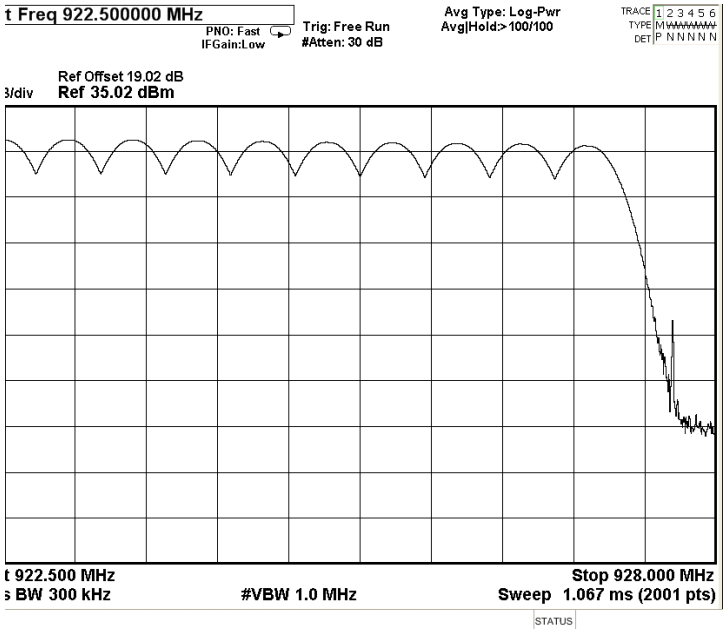


Screen Capture from the spectrum analyzer: 50 Channels FSK 28.8 KHz Mode

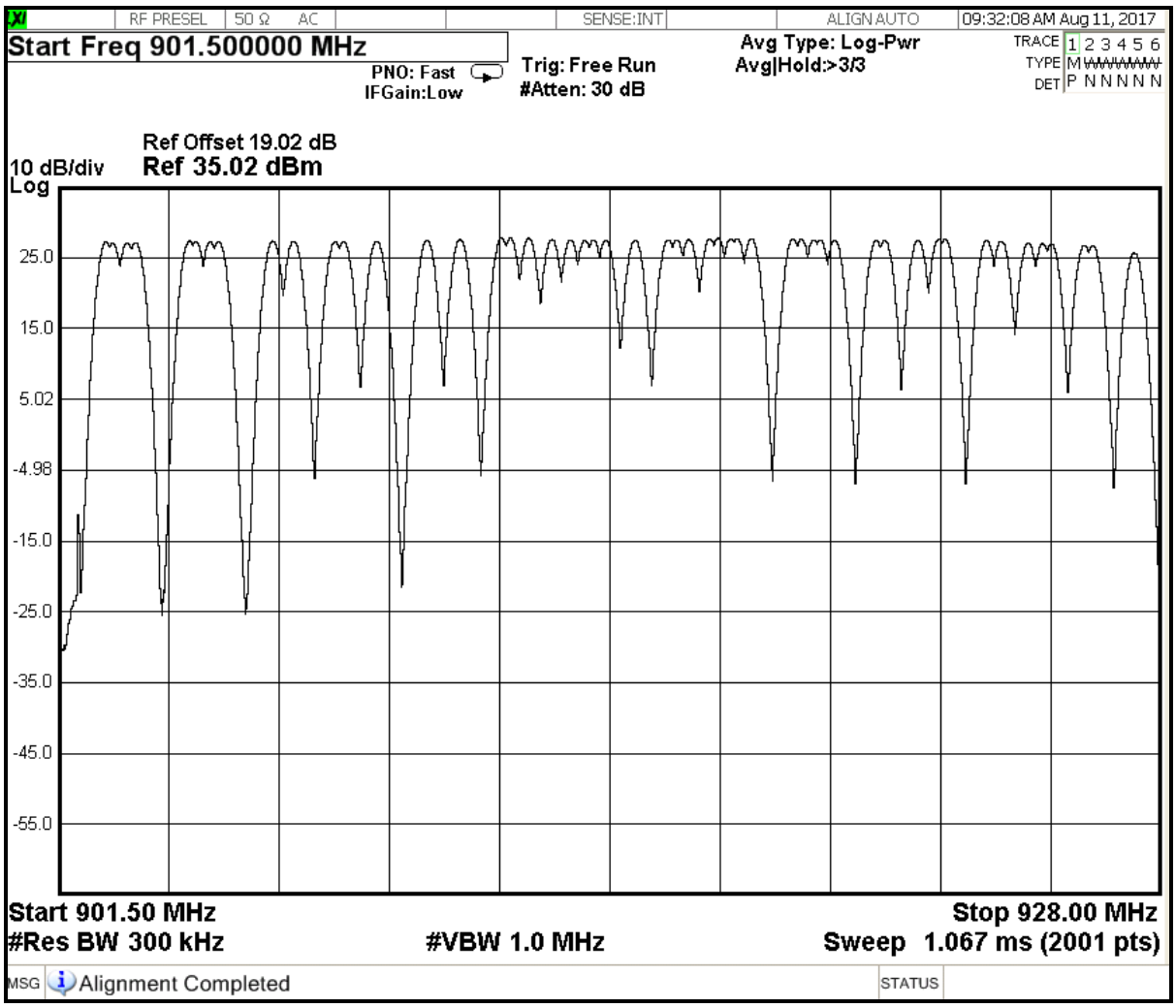


In Multiple Screens = FSK (28.8 KHz Mod)

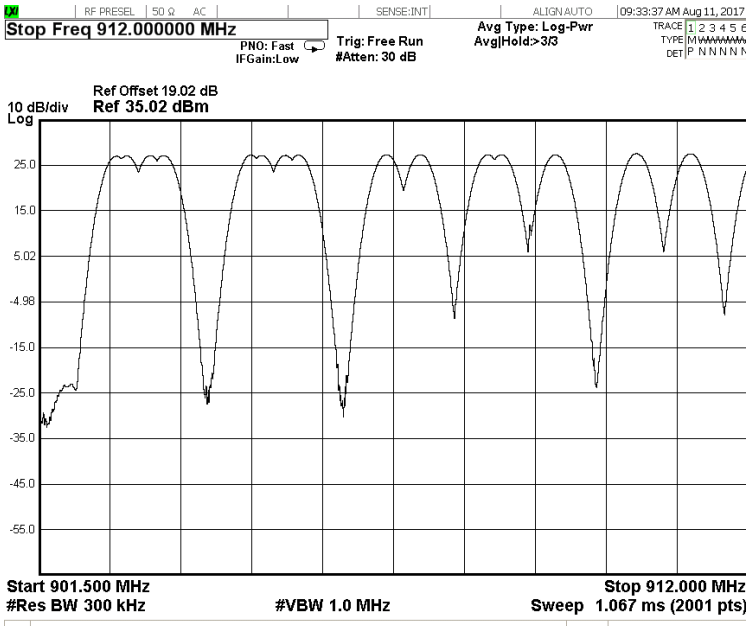


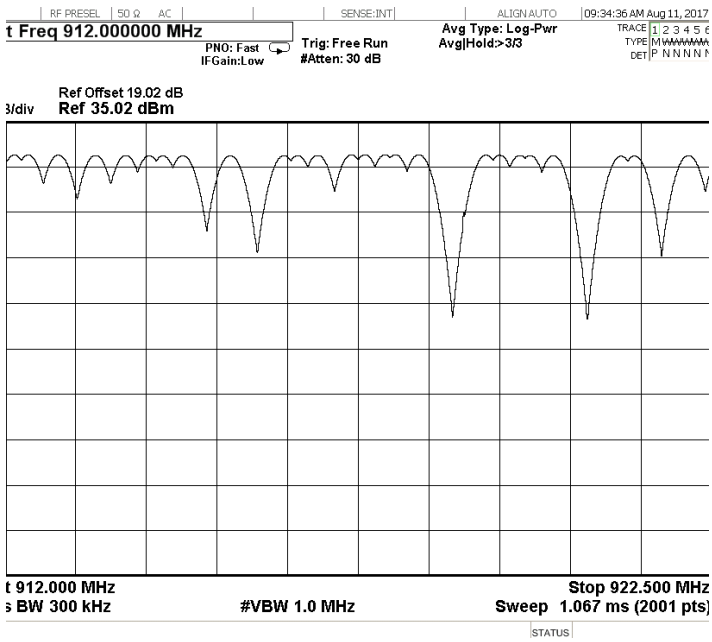


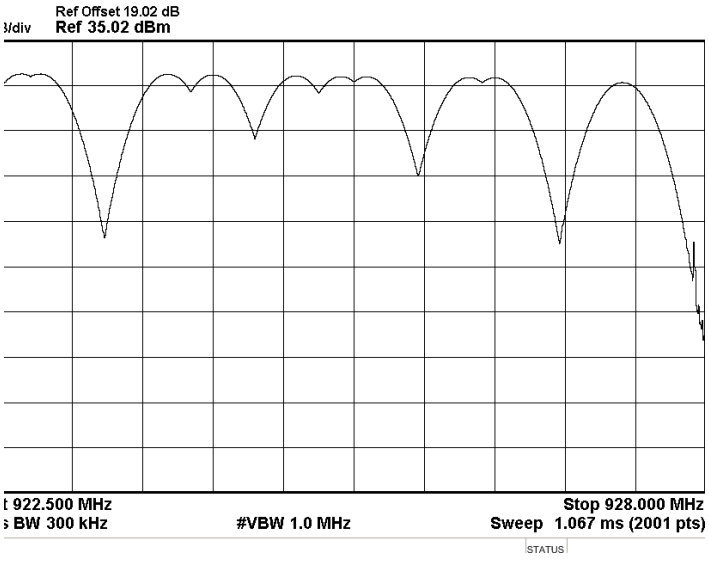
Screen Capture from the spectrum analyzer: FSK 9.6 kHz Mode



In Multiple Screens = FSK 9.6 kHz Mode







2.9 Time of Occupancy

Test Lab: Electronics Test Centre, Airdrie	**EUT: Pearl Fixed Gateway**
Test Personnel: Imran Akram	**Standard: FCC PART 15.247**
Date: June 5, 2017(23.6° C,34.5% RH)	**Basic Standard: ANSI C63.10: 20013**

EUT status: Compliant

Specification: FCC Part 15.247 (a, 1, i)

For frequency hopping systems operating in the 902-928 MHz band, if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.

2.9.1 Test Guidance: ANSI 63.10 Clause 7.8.4 / FCC DA-00-0705A1

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

The RF output of EUT with an antenna connector is fed to the input of the spectrum analyzer through appropriate attenuation. If the EUT antenna is integral to the device, an antenna is placed to capture the transmitted signals.

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

The sweep time is adjusted to clearly capture one transmission. The Dwell time is measured with the Marker Delta function.

Another sweep is set to capture enough transmission events to calculate the number of events within the specified period of time.

2.9.2 Deviations From The Standard:

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

2.9.3 Test Equipment

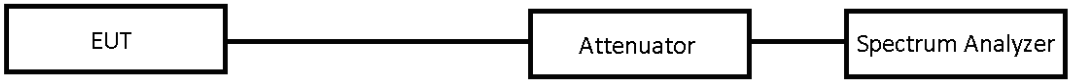
Testing was performed with the following equipment:

Equipment	Manufacturer	Model #	Asset #	Calibration Date	Calibration Due
EMI receiver	Agilent	N9038A	6130	2016-06-23	2017-06-23
Temp/Humidity	Extech	42270	5892	2017-04-06	2018-04-06
Attenuator	JFW	50FH-020-10		Monitored	
DC Blocker	MCL	BLK-89-S+		Monitored	

2.9.4 Test Sample Verification, Configuration & Modifications

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

EUT configuration for Dwell Time testing:



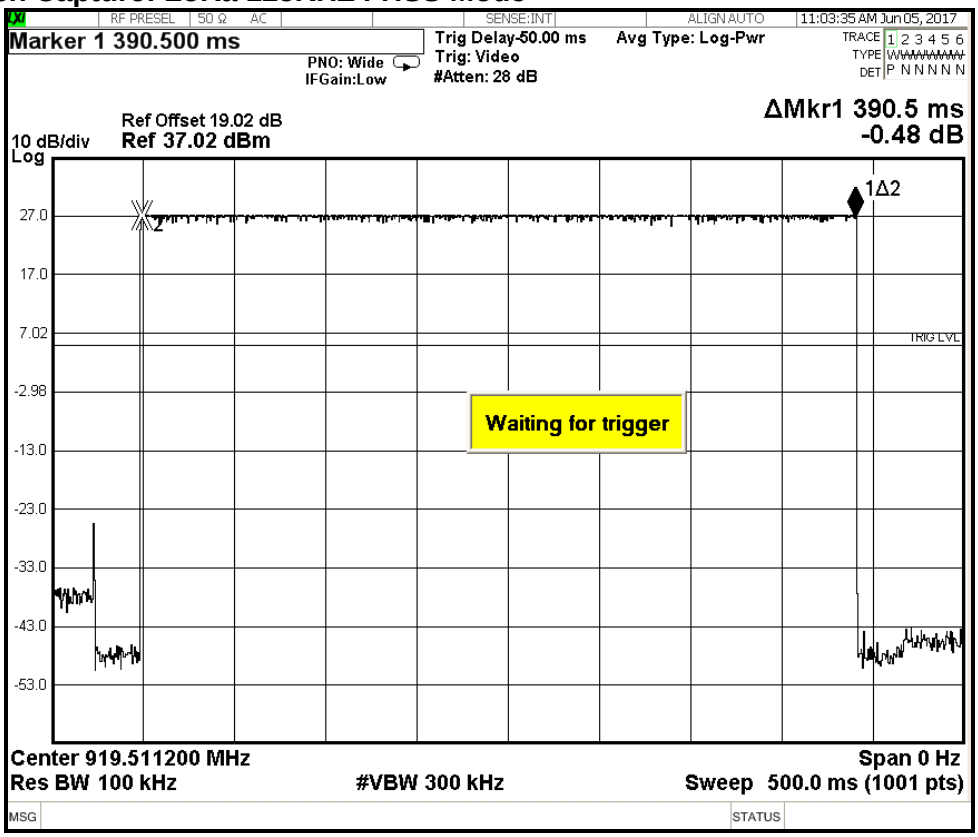
2.9.5 Dwell Time Data:

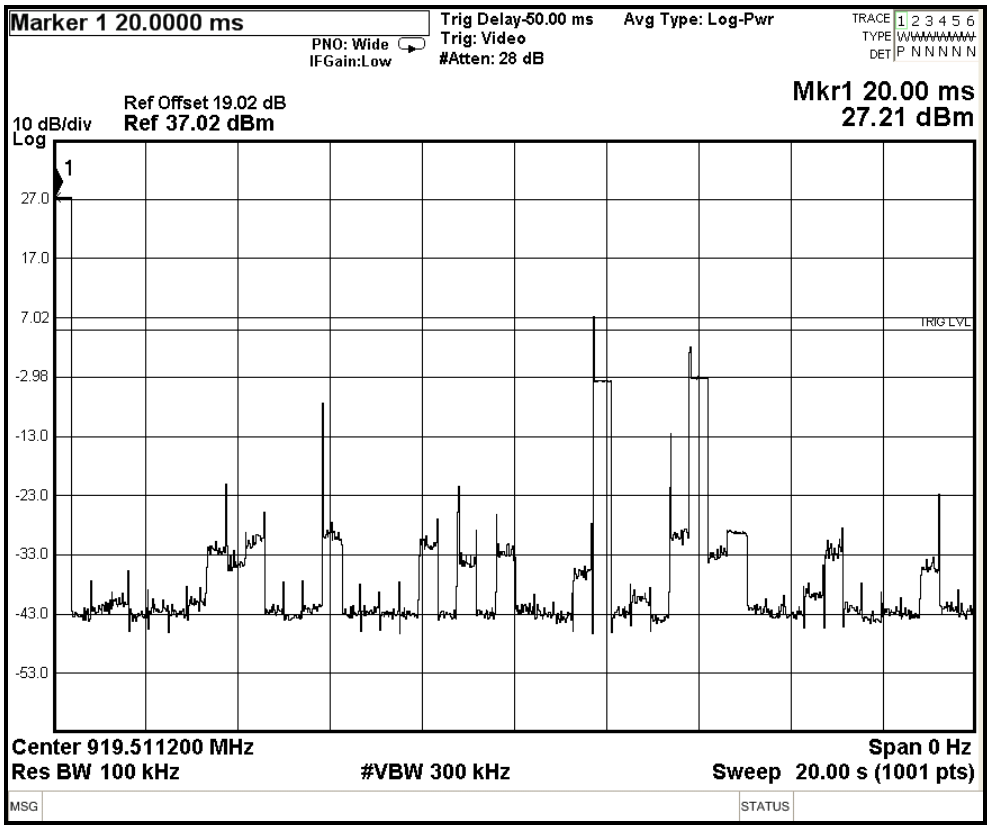
125 KHz FHSS Mode
Measured Dwell time = 390.5 ms
Number of events in 20 s = 1
Margin = 400ms – 390.5ms = **9.5 ms**

FSK 9.6 KHz
Measured Dwell time = 199 ms
Number of events in 20 s = 2
Margin = 400ms – 398ms = **2 ms**

FSK 28.8 KHz
Measured Dwell time = 66 ms
Number of events in 20 s = 4
Margin = 400ms – 264ms = **136 ms**

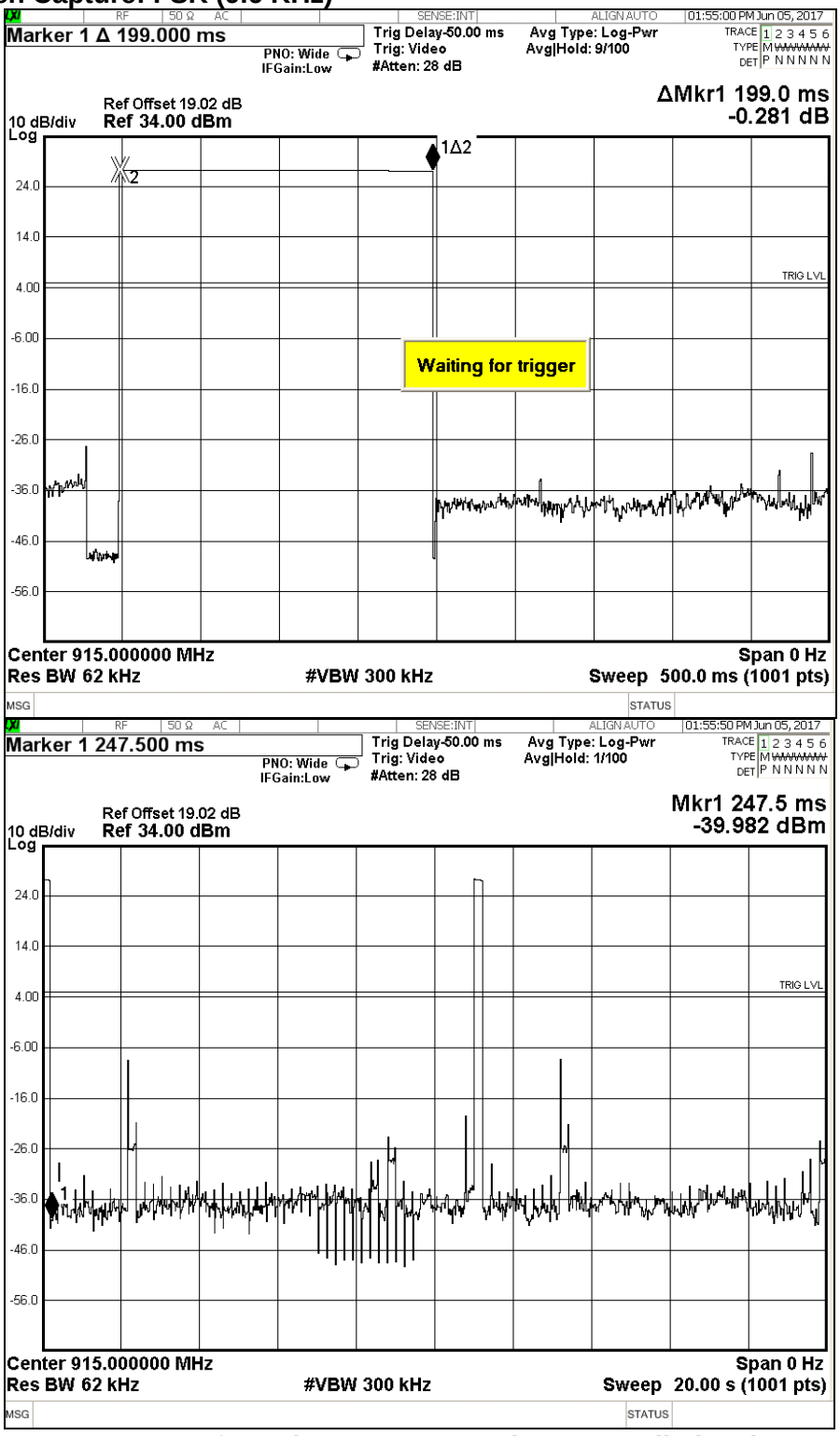
Screen Capture: LoRa 125KHZ FHSS Mode





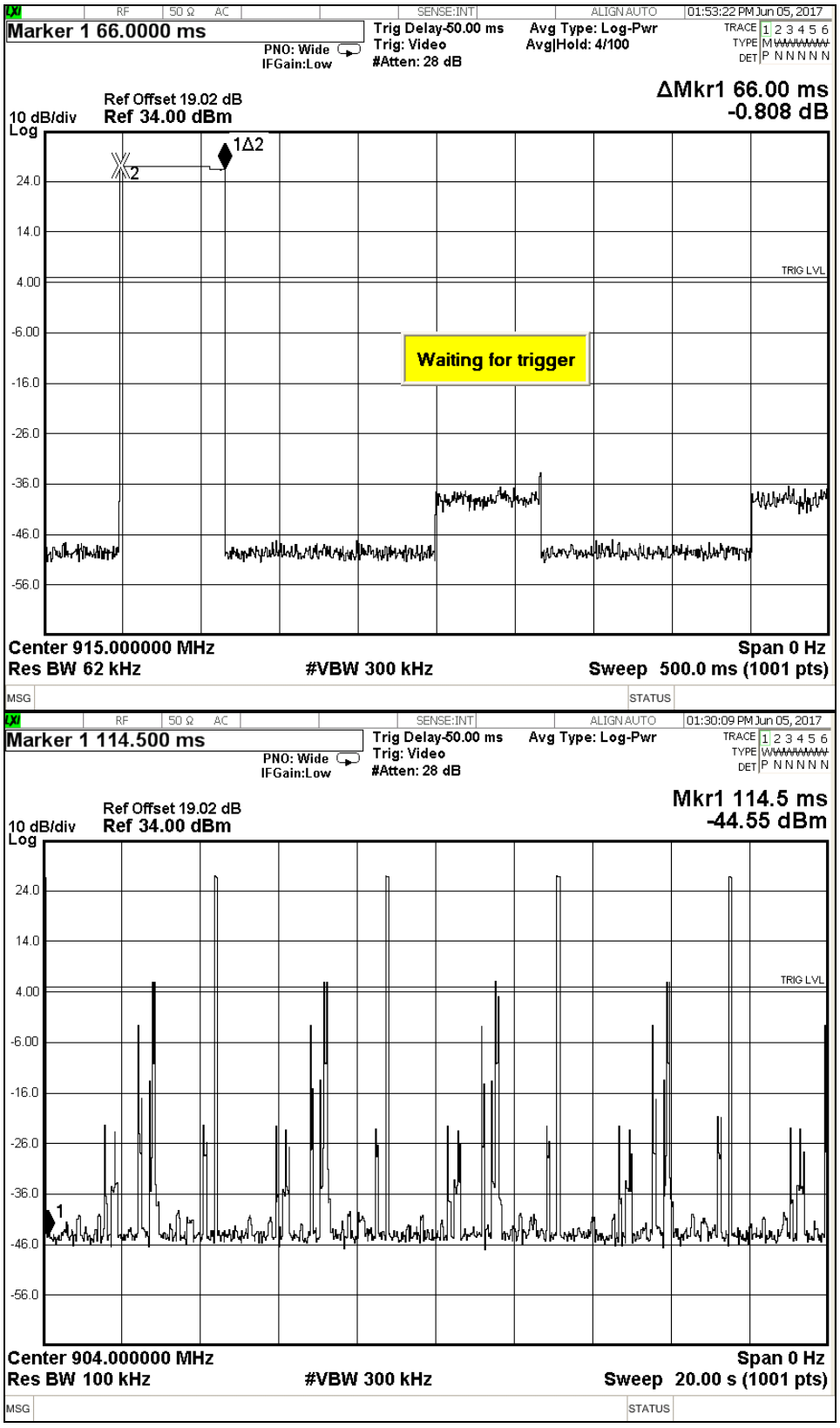
Screen Capture from the spectrum analyzer: Dwell time in 20 Sec

Screen Capture: FSK (9.6 KHz)



Screen Capture from the spectrum analyzer: Dwell Time in 20 Sec

Screen Capture: FSK (28.8 KHz)



Screen Capture from the spectrum analyzer: Dwell time in 20 Sec

2.10 EUT Positioning Assessment

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

EUT status: N/A

Comments: EUT is not a handheld or portable device. It installed in fix one orientation in its final installation.

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. For testing purposes, ceiling- and wall-mounted devices also shall be positioned on a tabletop. In making any tests involving handheld, body-worn, or ceiling-mounted equipment, it is essential to recognize that the measured levels may be dependent on the orientation (attitude) of the three orthogonal axes of the EUT. Thus, exploratory tests as specified in 8.3.1 shall be carried out for various axes orientations to determine the attitude having maximum or near-maximum emission level.

2.11 Radiated Spurious Emissions

Test Lab: Electronics Test Centre, Airdrie	**EUT: Pearl Fixed Gateway**
Test Personnel: Imran Akram/Henry Cookeygam	**Standard: FCC PART 15.247**
Date: 2017-06-05/06 (23.63° C,34.5 % RH)	**Basic Standard: ANSI C63.10-2013**

EUT status: Compliant

Specification: FCC PART 15.247(d)

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

Restricted Bands of Operation:

MHz	MHz	MHz	MHz	MHz	GHz	GHz
0.0900000 – 0.1100000	8.2910000 - 8.2940000	16.804250 - 16.804750	162.01250 - 167.17000 *	1660.0000 – 1710.0000	3.6000000 – 4.4000000	14.470000 – 14.500000
0.4950000 - 0.5050000 *	8.3620000 - 8.3660000	25.500000 - 25.670000	167.72000 - 173.20000 *	1718.8000 – 1722.2000	4.5000000 – 5.1500000	15.350000 – 16.200000
2.1735000 - 2.1905000	8.3762500 - 8.3867500	37.500000 - 38.250000	240.00000 – 285.00000	2200.0000 – 2300.0000	5.3500000 – 5.4600000	17.700000 – 21.400000
4.1250000 - 4.1280000	8.4142500 - 8.4147500	73.000000 - 74.600000	322.00000 - 335.40000	2310.0000 – 2390.0000	7.2500000 – 7.7500000	22.010000 – 23.120000
4.1772500 - 4.1777500	12.290000 - 12.293000	74.800000 - 75.200000	399.90000 – 410.00000	2483.5000 – 2500.0000 *	8.0250000 – 8.5000000	23.600000 – 24.000000
4.2072500 - 4.2077500	12.519750 - 12.520250	108.00000 - 121.94000 **	608.00000 – 614.00000	2655.0000 – 2900.0000	9.0000000 – 9.2000000	31.200000 – 31.800000
5.6770000 - 5.6830000	12.576750 - 12.577250	123.00000 - 138.00000 **	960.00000 – 1240.0000 ***	3260..0000 – 3267.0000	9.3000000 – 9.5000000	36.430000 – 36.500000
6.2150000 - 6.2180000	13.360000 - 13.410000	149.90000 - 150.05000 *	1300.0000 – 1427.0000 ***	3332.0000 – 3339.0000	10.600000 – 12.700000	Above 38.600000
6.2677500 - 6.2682500	16.420000 - 16.423000	156.52475-156.52525	1435.0000 – 1626.5000	3345.8000 – 3358.0000	13.250000 – 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

2.8.1 Test Guidance: ANSI C63.10-2013, Clause 13.5, Clause 6 / FCC DA00-705

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

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

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

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

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

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

2.8.2 Deviations From The Standard:

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

2.8.3 Uncertainty of Measurement:

The factors contributing to uncertainty of measurement are identified and calculated in accordance with UKAS (United Kingdom Accreditation Service) document “Lab 34, The Expression of Uncertainty in EMC Testing, Aug 2002.” as based on the “ISO Guide to the Expression of Uncertainty in Measurement, 1995.”

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

Test Method	Frequency	Uncertainty
Radiated Emissions Level	30 MHz – 1 GHz	±4.6 dB
Radiated Emissions Level	1 GHz – 26.5 GHz	±5.31 dB

2.8.4 Test Equipment

Testing was performed with the following equipment:

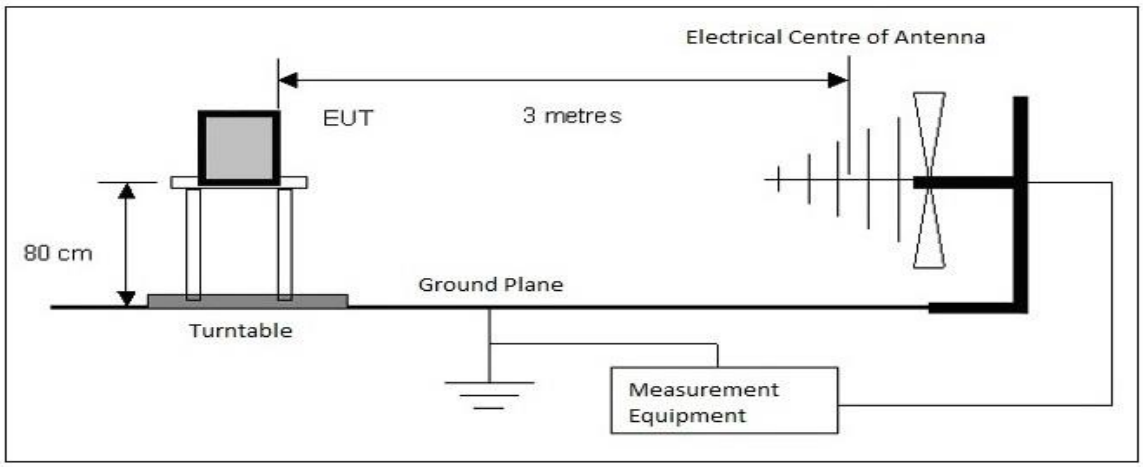
Equipment	Manufacturer	Model #	Asset #	Calibration Date	Calibration Due
EMC Software	UL	Ver. 9.5	ETC-SW-EMC 2.1	N/A	
EMI receiver	Agilent	N9038A	6130	2016-06-23	2017-06-23
Loop Antenna	EMCO	6502	10868	2017-03-29	2019-03-29
Biconilog Antenna	ARA	LPB-2520/A	4318	2016-05-18	2018-05-18
DRG Horn	EMCO	3115	19357	2016-08-24	2018-08-24
Humidity/Temp Logger	Extech Ins. Corp.	42270	5892	2017-04-06	2018-04-06
Low Noise Amplifier (1 – 18 GHz)	MITEQ	JS43-01001800-21-5P	4354	Monitored	

2.8.5 Test Sample Verification, Configuration & Modifications

The EUT was set to a selected channel with test-specific software. Non hopping 125 KHz LoRa FHSS MID channel was selected for Radiated Emission.

The EUT met the requirements without modification.

Test setup diagram for Radiated Spurious Emissions testing:



2.8.6 Radiated Emissions Data:

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

Meter Reading in dBμV + Antenna Factor in dB/m + Gain/Loss Factor in dB = Corrected Field Strength in dbμV/m.

Delta = Field Strength - Limit

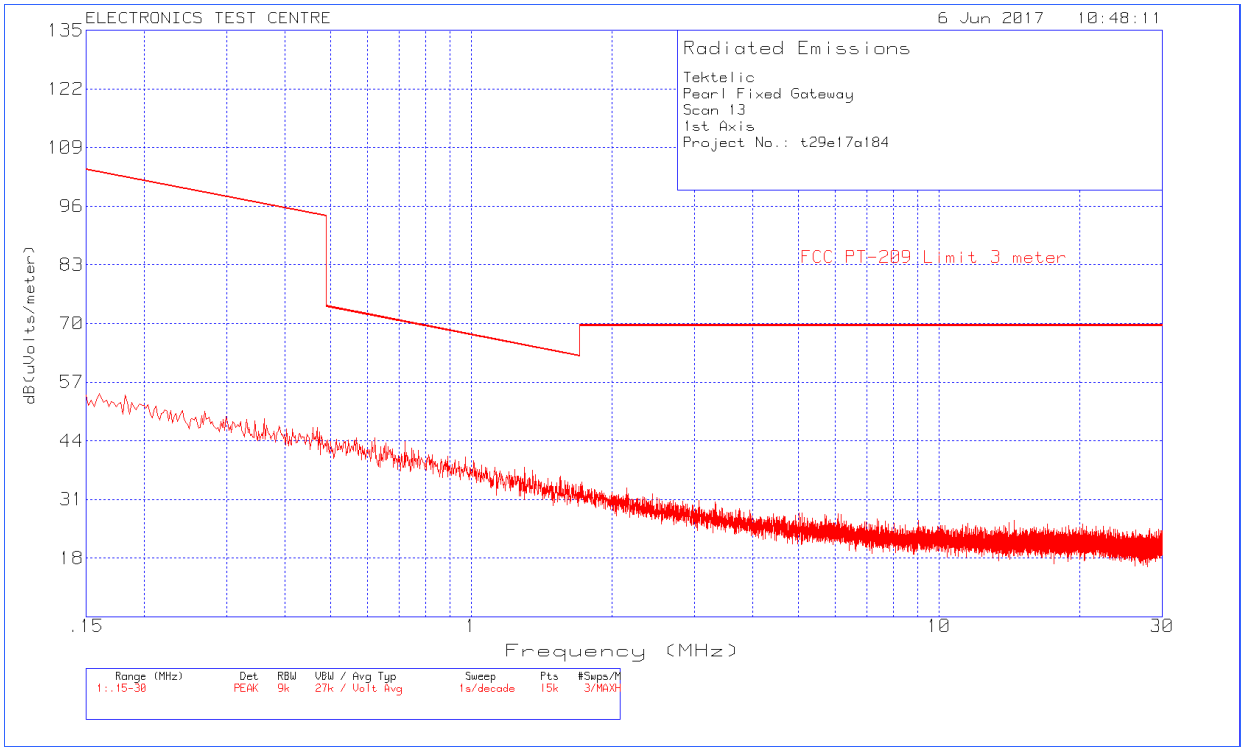
Notes:

- 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 midband channel 919.5112 MHz with125 KHz modulation was selected as the worst-case condition for detailed examination.
- In Transmit mode, the EUT was assessed up to 10.0 GHz.

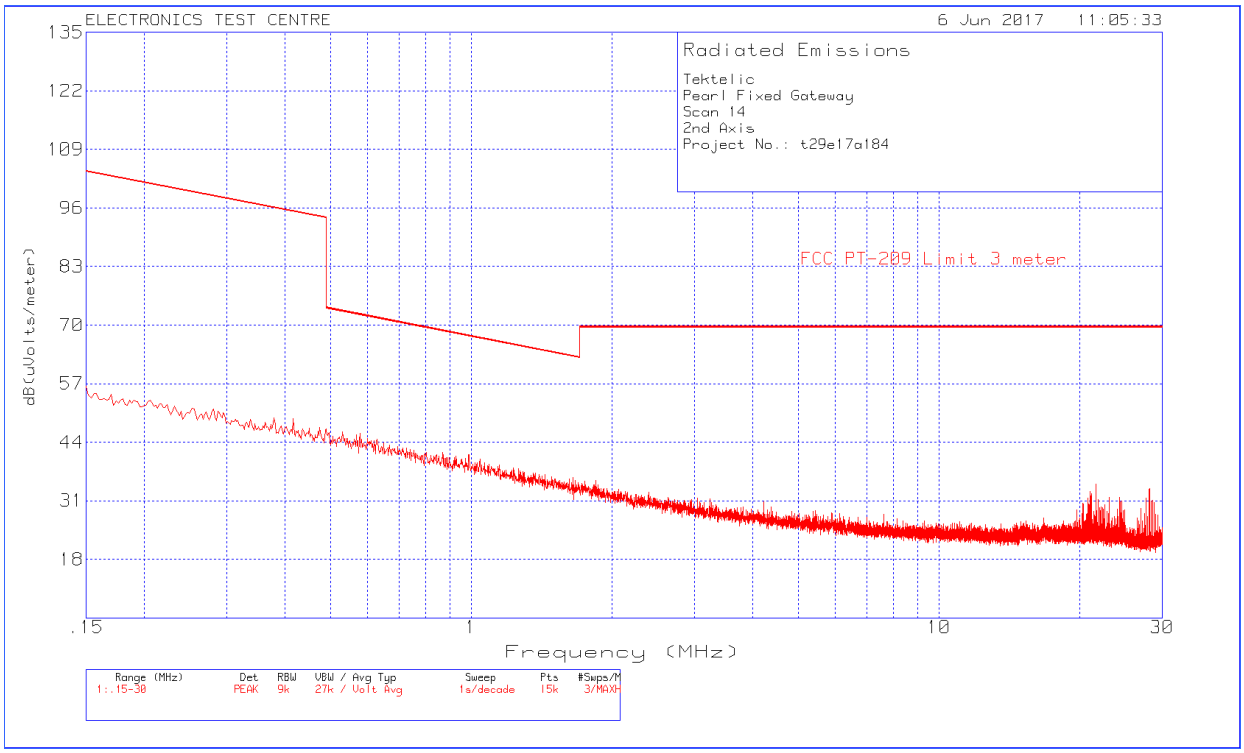
Negative values for Delta indicate compliance.

Freq. Marker	Freq. [MHz]	Raw reading [dBμv]	Det	Antenna Factor [dB/m]	Cable Loss [dB]	Corrected Reading [dBμv/m]	FCC 15.209 Limit [dBμv/m]	Delta [dB]	Azimuth [Deg]	Height [cm]	Polarization
1	768.0166	11.89	QP	24.4	5.8	42.09	46.02	-3.93	215	100	Horizontal
1	674.9911	14.5	QP	23.5	5.5	43.5	46.02	-2.52	41	118	Vertical
1	1485.0	55.49	PK	25.3	-35.1	45.69	53.98	-8.29	252	192	Horizontal
1	1485.0	52.74	Av	25.3	-35.1	42.94	53.98	-11.04	252	191	Horizontal
2	1485.0	57.41	PK	25.3	-35.1	47.61	53.98	-6.37	33	195	Horizontal
2	1485.0	54.52	Av	25.3	-35.1	44.72	53.98	-9.26	33	194	Horizontal

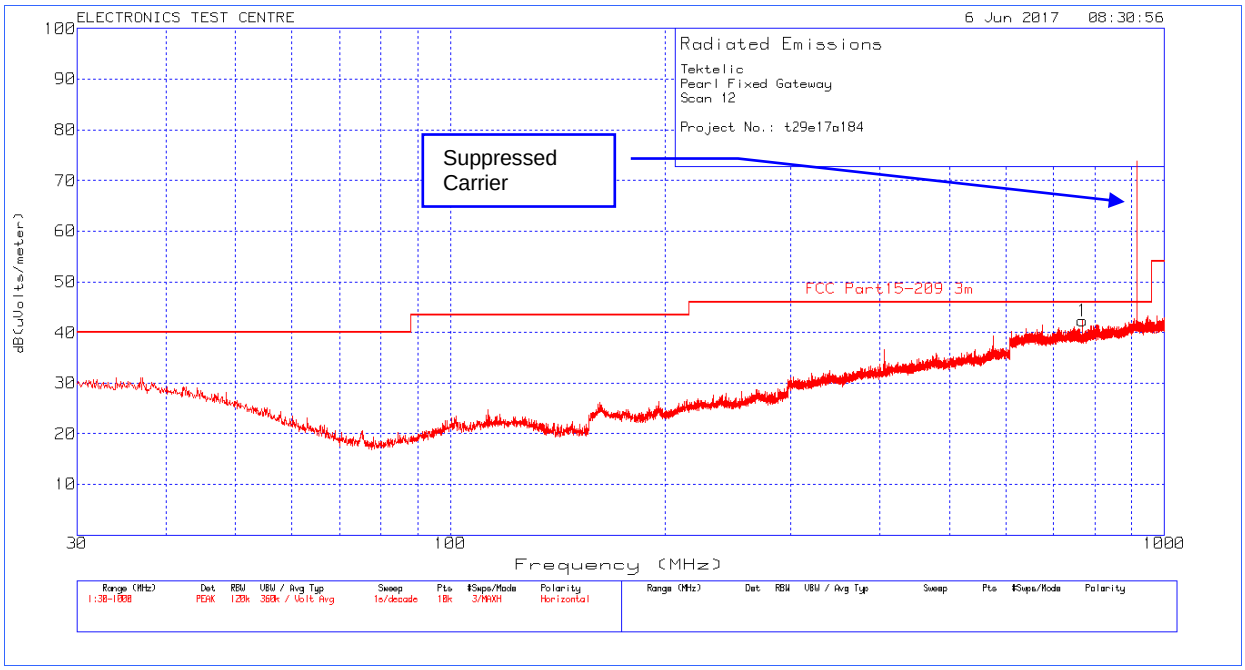
Plot of Radiated Emissions: Measuring Antenna 1st Orientation



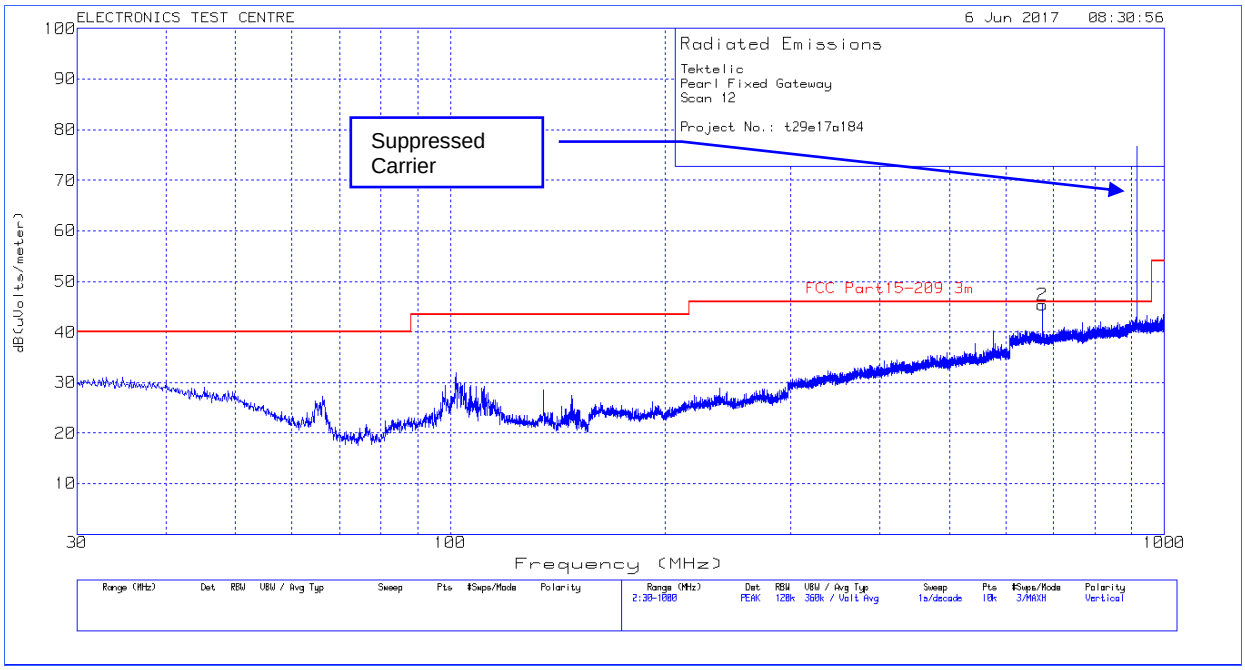
Plot of Radiated Emissions: Measuring Antenna 2nd Orientation



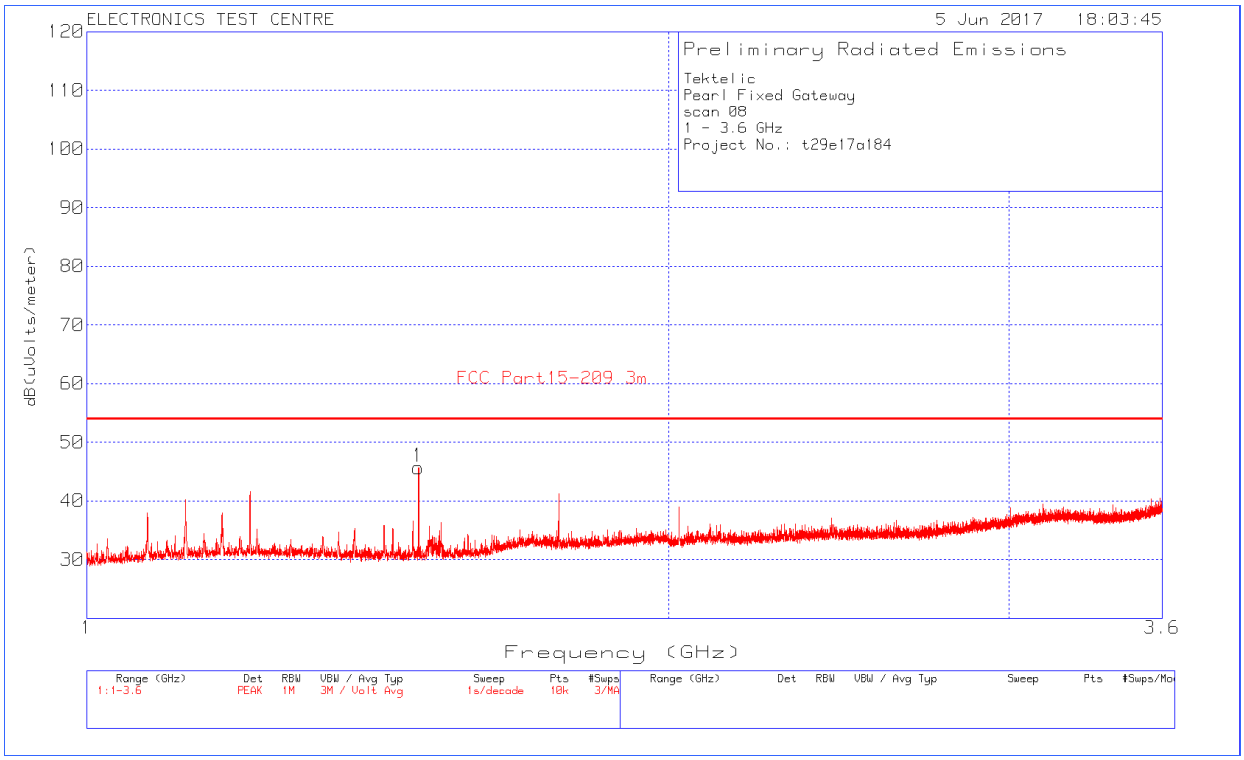
Plot of Radiated Emissions: Horizontal polarization



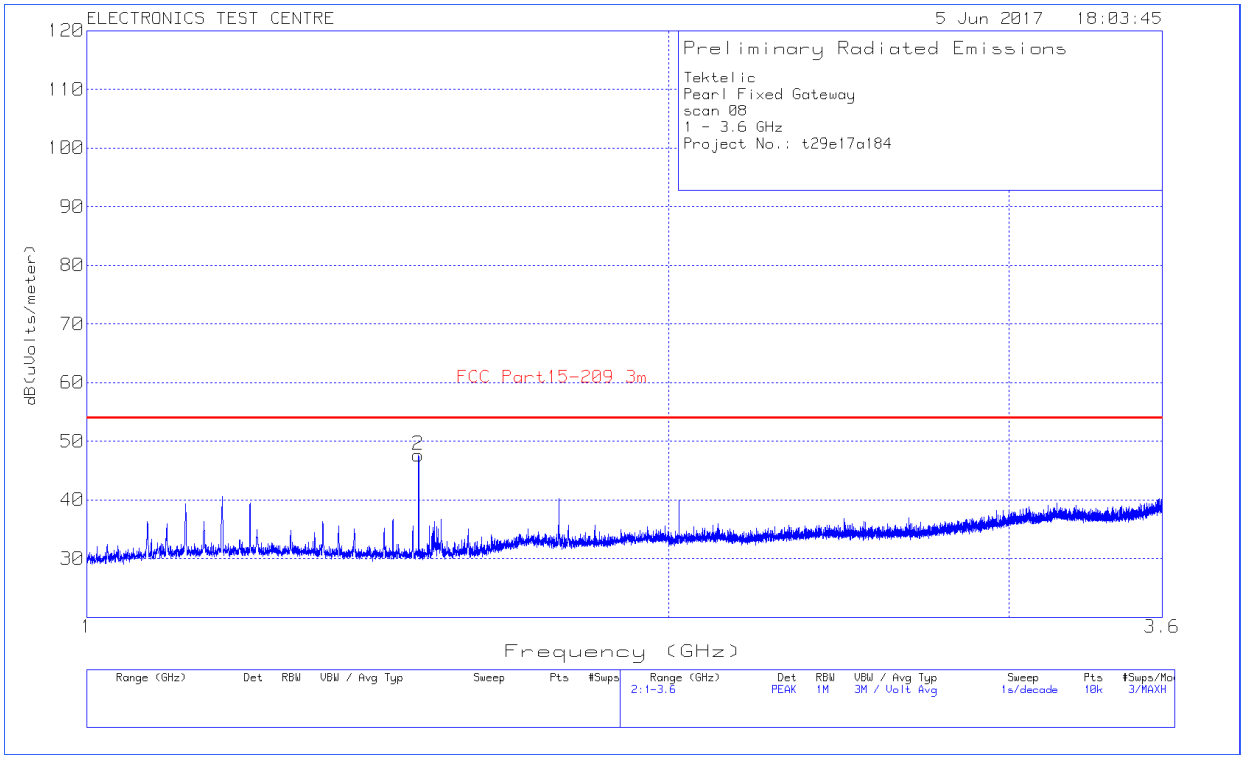
Plot of Radiated Emissions: Vertical polarization



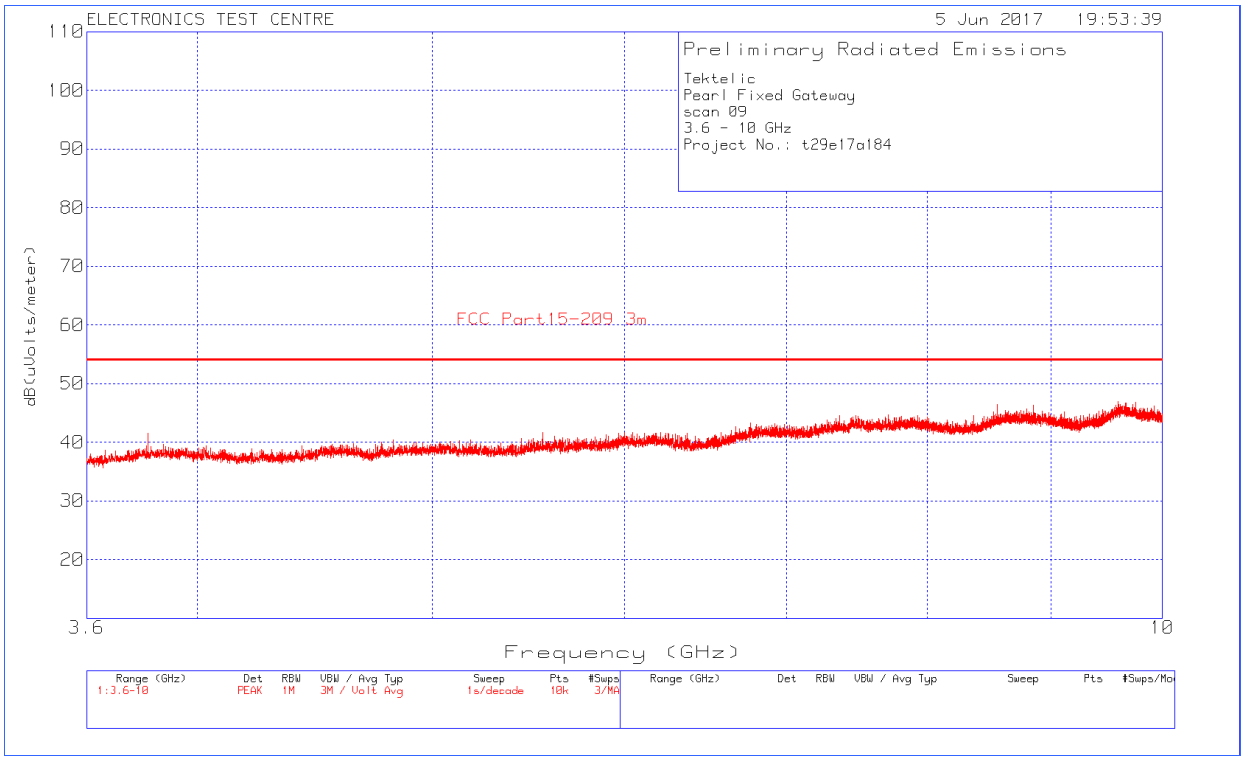
Plot of Radiated Emissions: Horizontal polarization



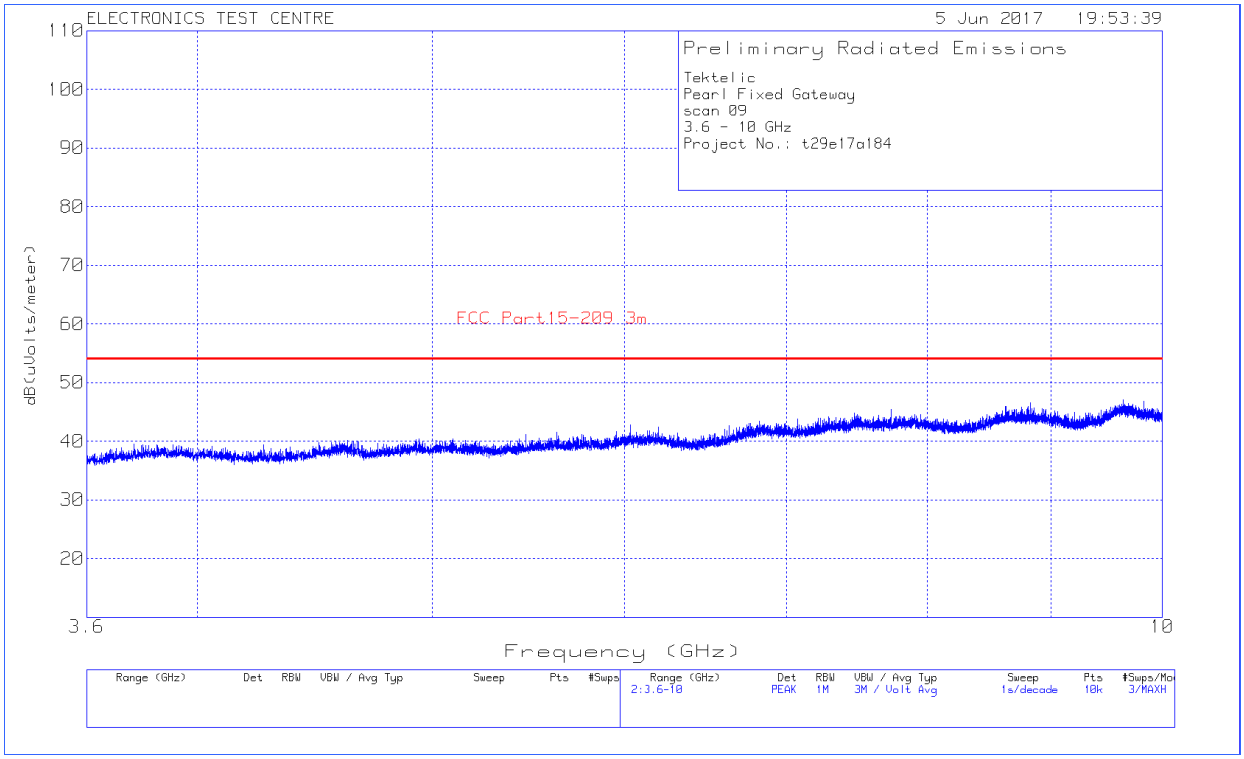
Plot of Radiated Emissions: Vertical polarization



Plot of Radiated Emissions: Horizontal polarization



Plot of Radiated Emissions: Vertical polarization



2.12 RF Exposure

Test Lab: Electronics Test Centre, Airdrie	**EUT: Pearl Fixed Gateway**
Test Personnel:	**Standard: FCC PART 15.247**
Date:	

EUT status: Compliant

Compliant: Environmental Assessment to be provided in a separate Exhibit.

3.0 TEST FACILITY

3.1 Location

The Pearl Fixed Gateway 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 Pearl Fixed Gateway was placed at the centre of the test chamber turntable on top of an 80-cm high polystyrene foam table. The EUT was grounded according to Tektelic Communication Inc. specifications.

3.3 Power Supply

All EUT power was supplied by an internal rechargeable battery. There is no EUT function while the battery is charging.

3.4 Emissions Profile

Ambient emission profiles were generated throughout the tests and are included in the test data.

End of Document