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

ETC Report #: t29e17a147-1 Release 2 Date: March 29, 2017

EMC testing of the Tektelic Communications Inc. Kona Macro 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 v03r05

FCC ID: 2ALEPT0004279

Test Personnel: David Raynes

Prepared for: Tektelic Communications Inc.

7657 10 St NE
Calgary, Alberta
Canada
T2E 8X2

Telephone: 1-403-338-6900

David Raynes
draynes@etc-mpbtech.com
EMC Technologist
Electronics Test Centre (Airdrie)

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

REVISION RECORD

ISSUE	DATE	AUTHOR	REVISIONS
DRAFT 1	March 23, 2017	D. Raynes	Initial draft submitted for review.
Release 1	March 24, 2017	M. Rousseau, D. Raynes	Sign off
Release 2	March 29, 2017	D. Raynes, M. Rousseau	Amended KDB reference, change equipment product code

TABLE OF CONTENTS

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 Communications Inc Test Plan. All test procedures, limits, criteria, and results described in this report apply only to the Tektelic Communications Inc. Kona Macro 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 Communications Inc, located in Calgary, Alberta, Canada.

1.3 Test Sample Description

As provided to ETC (Airdrie) by Tektelic Communications Inc:

Product Name:	Kona Macro Gateway
Model #	T0004250 B with SFP Optical module added.
Serial #	1705K0003
Power:	48 VDC
Antenna used	Cell port: BMHO69027002NF 2dBi LoRa port: HG908U-PRO 8dBi

This product is a wireless LoRa gateway device with external antennas. It may incorporate a 3G/4G WiLAN backhaul module, FCC ID N7NEM7355.

Antenna datasheet are provided in Annex A.

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, and ANSI C63.10-2013 as referenced in FCC KDB 558074 v03r05.

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

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	Kona Macro Gateway			**N/A**
2.2	Maximum O/P	15.247(d)	Kona Macro Gateway	SFP Optical card added.	see § 2.2	**Compliant**
2.3	PSD	15.247(e)	Kona Macro Gateway	SFP Optical card added.	see § 2.3	**Compliant**
2.4	Channel Bandwidth	15.247(a)(2)	Kona Macro Gateway	SFP Optical card added.	see § 2.4	**Compliant**
2.5	Band Edge	15.247(d)	Kona Macro Gateway	SFP Optical card added.	see § 2.5	**Compliant**
2.6	Conducted Spurious	15.247(d)	Kona Macro Gateway	SFP Optical card added.	see § 2.6	**Compliant**
2.7	EUT Position	ANSI C63.4	Kona Macro Gateway			**N/A**
2.8	Radiated Spurious	15.205, 15.209 15.247(d)	Kona Macro Gateway	SFP Optical card added.	see § 2.8	**Compliant**
2.9	RF Exposure	15.247(i)	Kona Macro Gateway	SFP Optical card added.	see § 2.9	**Compliant**

The SFP Optical card was added to the Model T0004250 in order to create the worst-case condition for emissions.

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: Kona Macro Gateway**
Test Personnel:	**Standard: FCC Part 15.207**
Date:	**Basic Standard: ANSI C63.4: 2014**

EUT status: Not Applicable

The EUT is DC-powered, from a source provided by the end-user. There is no connection to the AC mains.

2.2 Maximum Conducted Average Output Power

Test Lab: Electronics Test Centre, Airdrie	**EUT: Kona Macro Gateway**
Test Personnel: David Raynes	**Standard: FCC PART 15.247**
Date: 2017-02-21 (19.5° C, 21.7% RH)	**Basic Standard: ANSI C63.10: 2013**

EUT status: Compliant

Specification: FCC Part 15.247(b)(3) & (4)

(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the *maximum conducted output power* is the highest total transmit power occurring in any mode.

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

2.2.1 Test Guidance: FCC KDB 558074 D01, Clause 9.2.2.2

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 spectrum analyzer is set for a frequency span ≥ (1.5*OBW) centered on a channel. The RBW is set to 1 – 5% (OBW) and VBW is set ≥ (3*RBW). The RMS (power averaging) detector is used, with the trace set to Average 100. After the trace has processed 100 sweeps, the power is read from the analyzer display.

The reported power value is compensated for cable loss and attenuation.

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
Attenuator	Fairview Microwave	SA18N5WA-10		Monitored	
Attenuator	Weinschel Engineering	1 (20 dB)	AT6731	Monitored	
Temp/Humidity	Extech	42270	5892	2016-04-07	2017-04-07

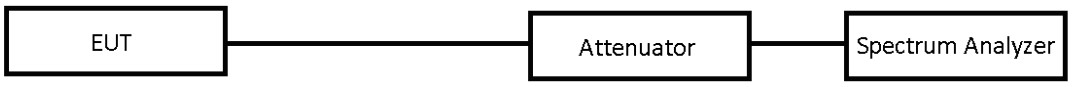
2.2.4 Test Sample Verification, Configuration & Modifications

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

Testing was performed in 1-Carrier mode and in 2-Carrier mode.

The EUT met the requirements without modification.

Test setup diagram for Maximum Conducted Average Output Power testing:



2.2.5 Output Power Data

Measurements were performed via connection to the antenna ports, with attenuation between the EUT and the spectrum analyzer.

NOTE: 2 dB of attenuation is specified in the User Manual to compensate for the 8 dBi Gain of the LoRa antennas.

Antenna 0: 1 Carrier

Frequency (MHz)	SA Peak (dBm)	Cable loss & Attenuation (dB)	Corrected Reading (dBm)	RF Output (Watts)	Limit (Watts)	**Margin** (Output - limit)
923.3	-1.40	29.95	28.55	0.72	1	**-0.28**
923.9	-1.59	29.95	28.36	0.69	1	**-0.31**
924.5	-1.78	29.95	28.17	0.66	1	**-0.34**
925.1	-1.99	29.95	27.96	0.79	1	**-0.21**

Antenna 0: 2 Carriers

Frequency (MHz)	SA Peak (dBm)	Cable loss & Attenuation (dB)	Corrected Reading (dBm)	RF Output (Watts)	Limit (Watts)	**Margin** (Output - limit)
923.3 + 923.9	-0.17	29.95	29.78	0.95	1	**-0.05**
923.9 + 924.5	-0.12	29.95	29.83	0.96	1	**-0.04**
924.5 + 925.1	-0.05	29.95	29.90	0.98	1	**-0.02**

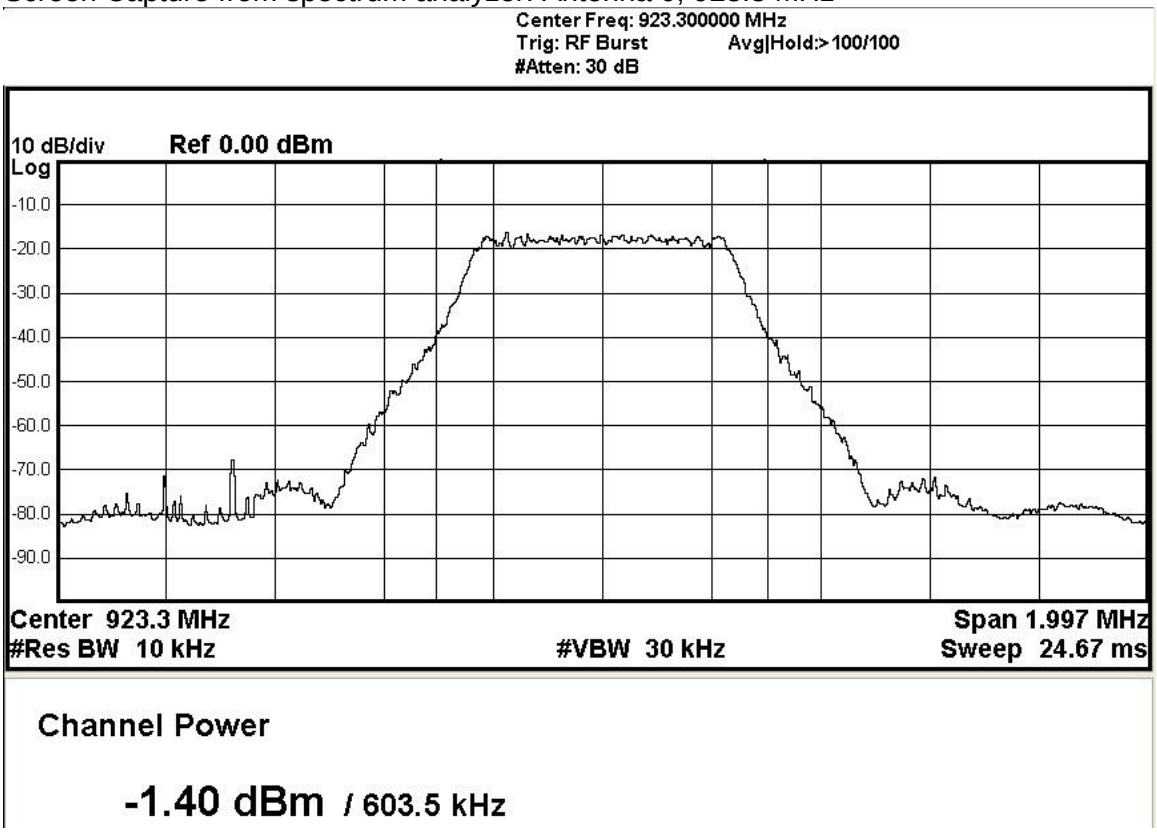
Antenna 1: 1 Carrier

Frequency (MHz)	SA Peak (dBm)	Cable loss & Attenuation (dB)	Corrected Reading (dBm)	RF Output (Watts)	Limit (Watts)	**Margin** (Output - limit)
925.7	-1.32	29.94	28.62	0.74	1	**-0.26**
926.3	-1.04	29.94	28.90	0.79	1	**-0.21**
926.9	-1.05	29.94	28.89	0.77	1	**-0.23**
927.5	-1.05	29.94	28.89	0.77	1	**-0.23**

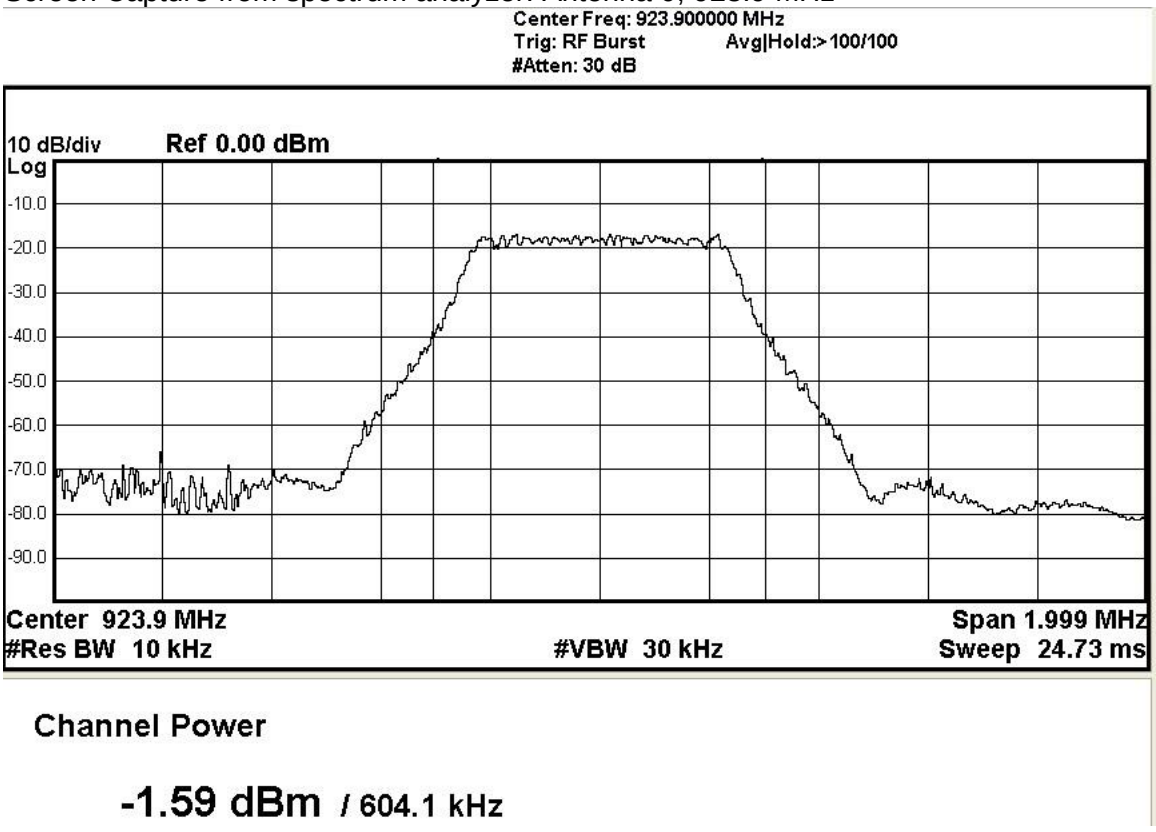
Antenna 1: 2 Carriers

Frequency (MHz)	SA Peak (dBm)	Cable loss & Attenuation (dB)	Corrected Reading (dBm)	RF Output (Watts)	Limit (Watts)	**Margin** (Output - limit)
925.7 + 926.3	-0.33	29.94	29.61	0.91	1	**-0.09**
926.3 + 926.9	-0.31	29.94	29.63	0.92	1	**-0.08**
926.9 + 927.5	-0.30	29.94	29.64	0.92	1	**-0.08**

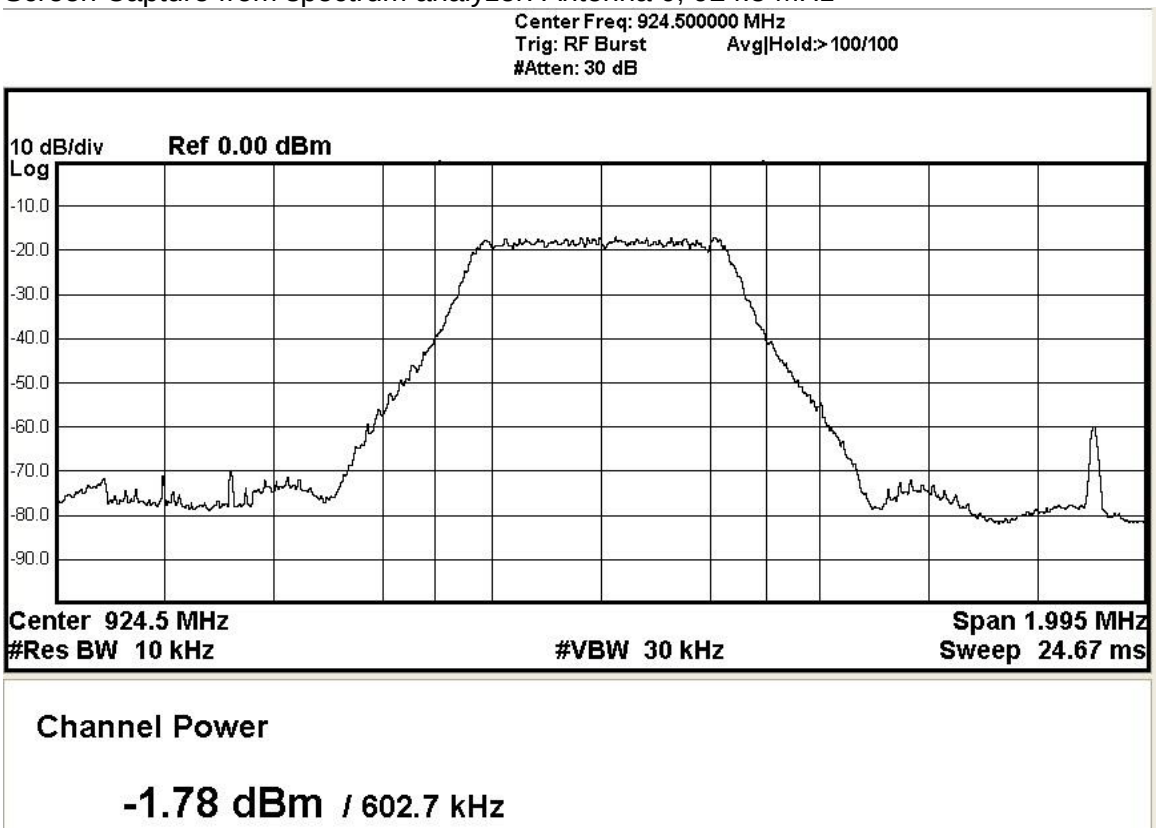
Screen Capture from spectrum analyzer: Antenna 0, 923.3 MHz



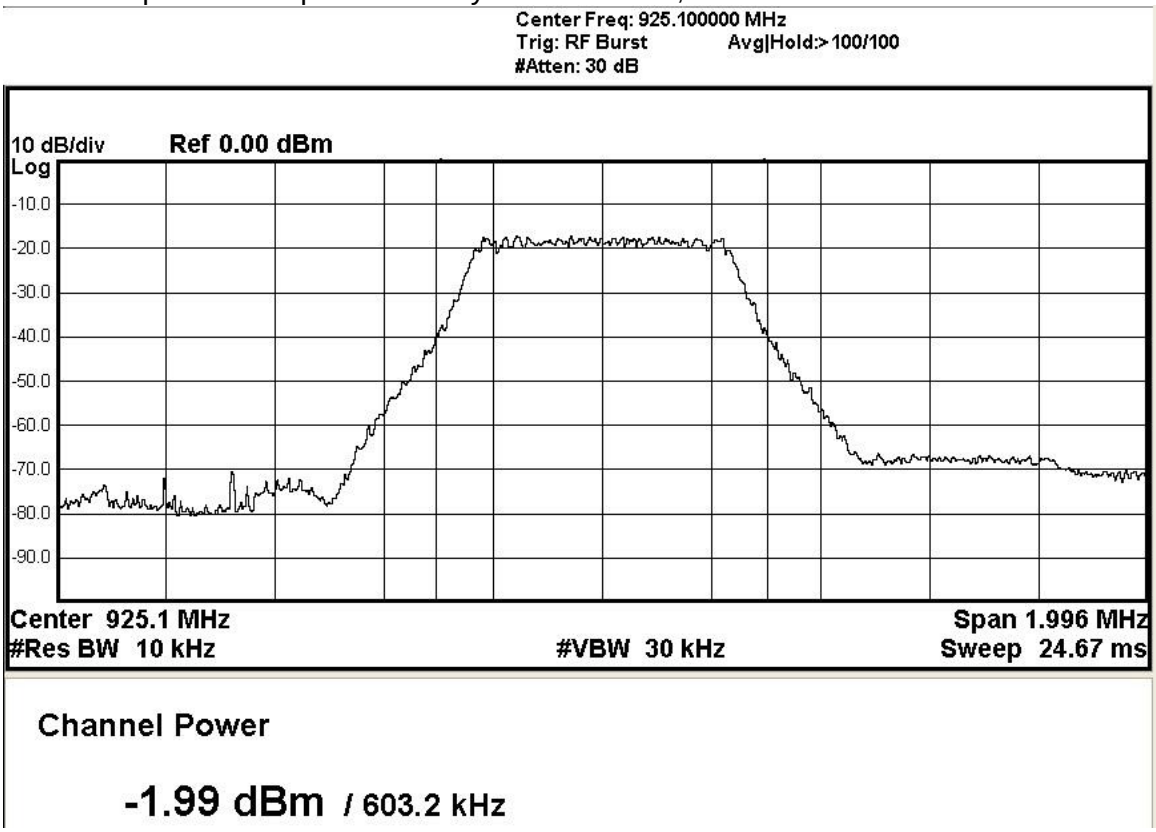
Screen Capture from spectrum analyzer: Antenna 0, 923.9 MHz



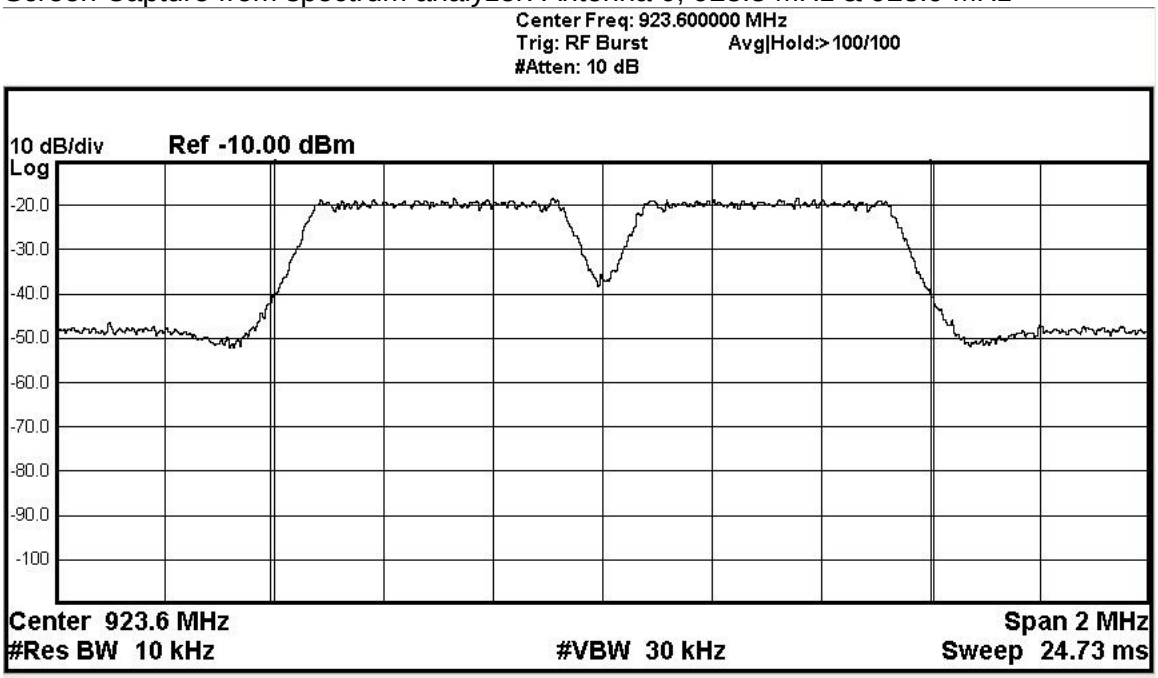
Screen Capture from spectrum analyzer: Antenna 0, 924.5 MHz



Screen Capture from spectrum analyzer: Antenna 0, 925.1 MHz



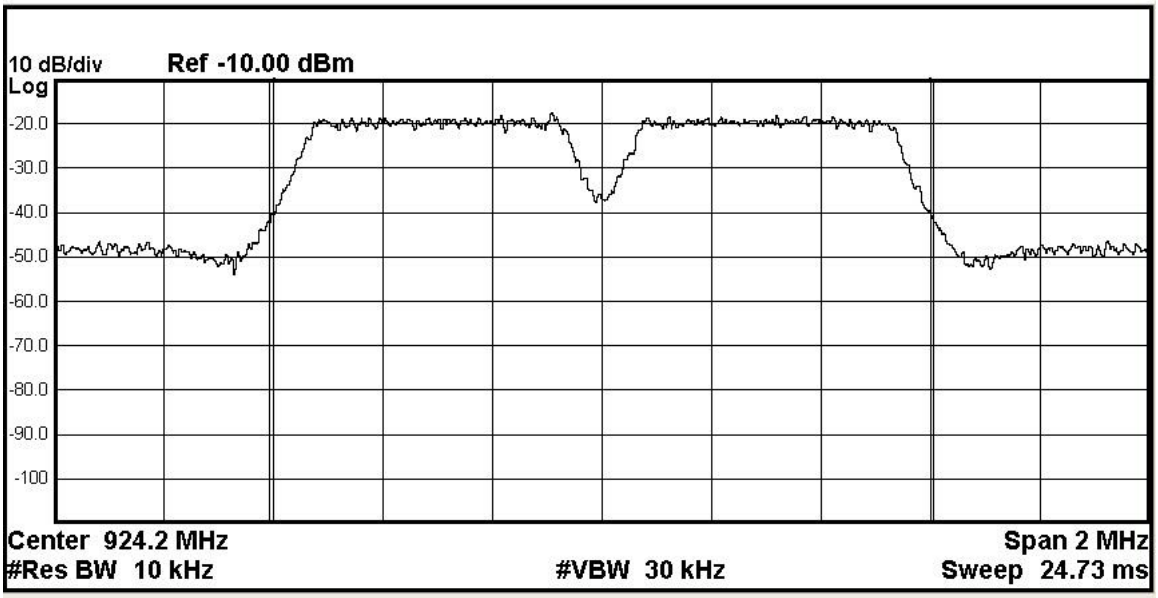
Screen Capture from spectrum analyzer: Antenna 0, 923.3 MHz & 923.9 MHz



Channel Power

-0.17 dBm / 1.21 MHz

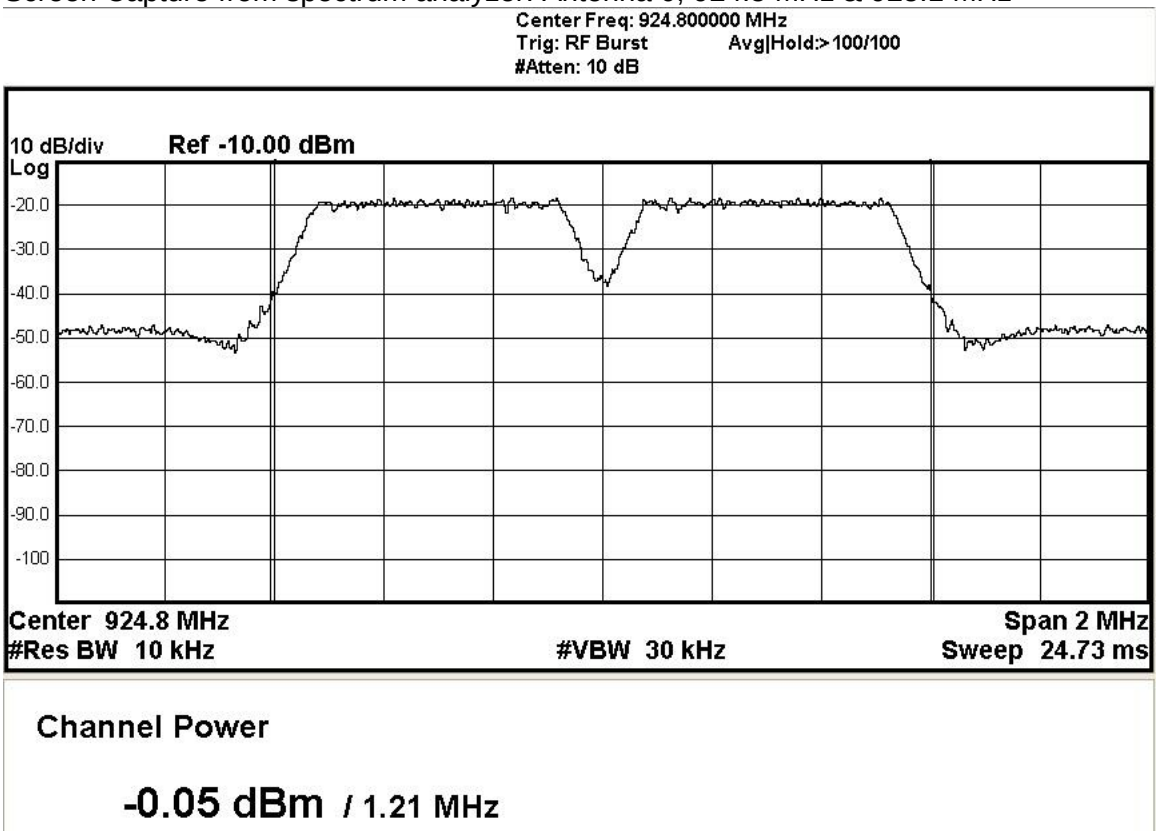
Screen Capture from spectrum analyzer: Antenna 0, 923.9 MHz & 924.5 MHz



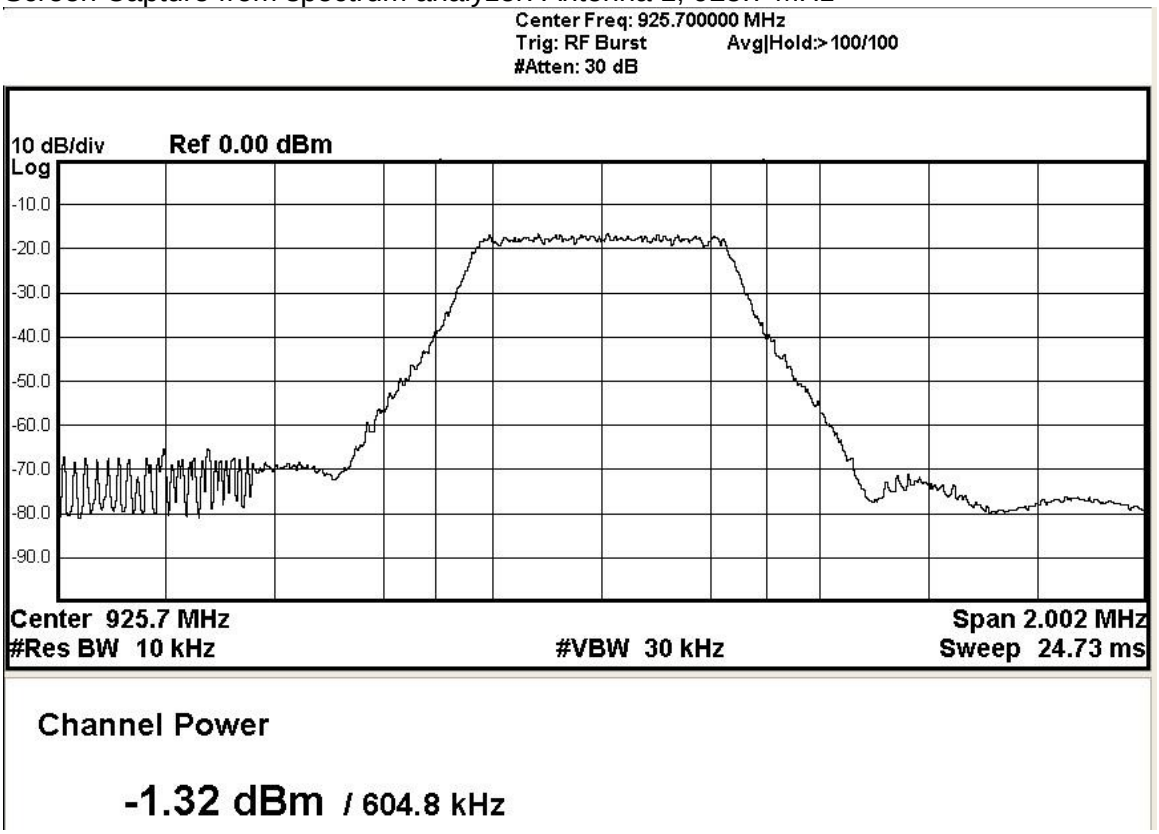
Channel Power

-0.12 dBm / 1.21 MHz

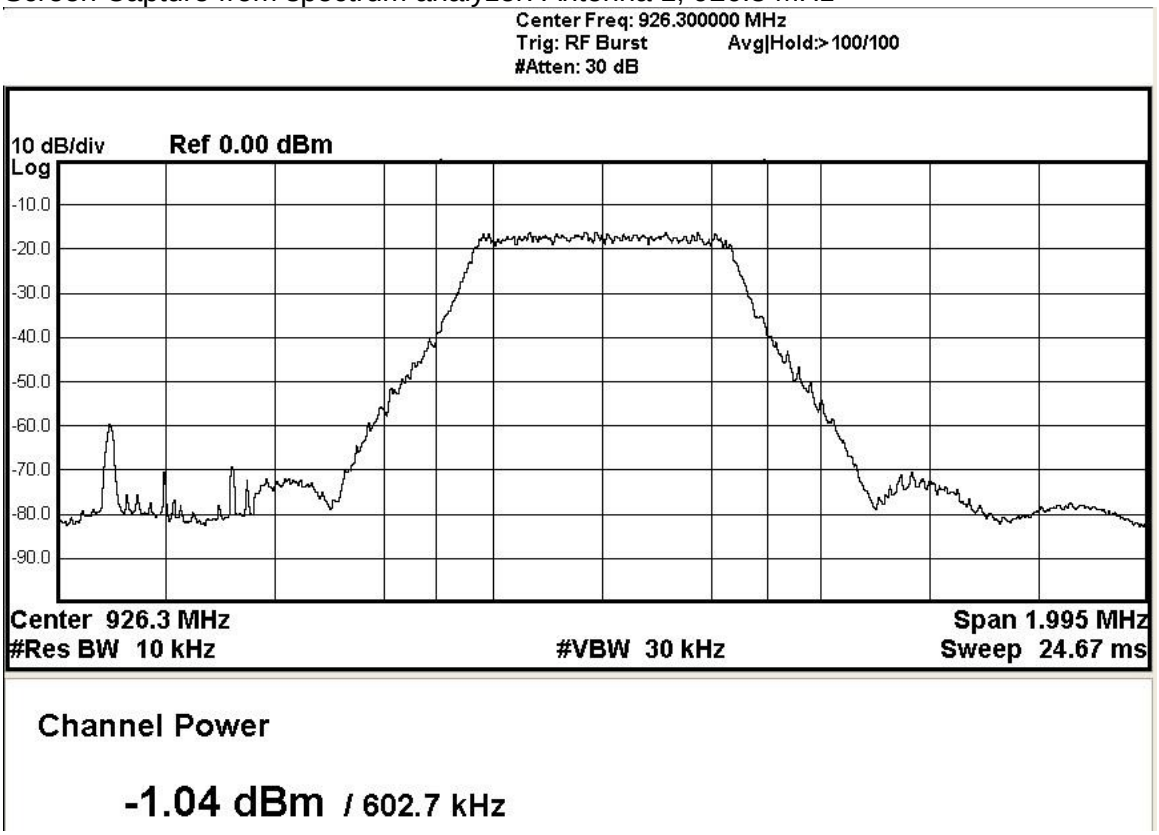
Screen Capture from spectrum analyzer: Antenna 0, 924.5 MHz & 925.1 MHz



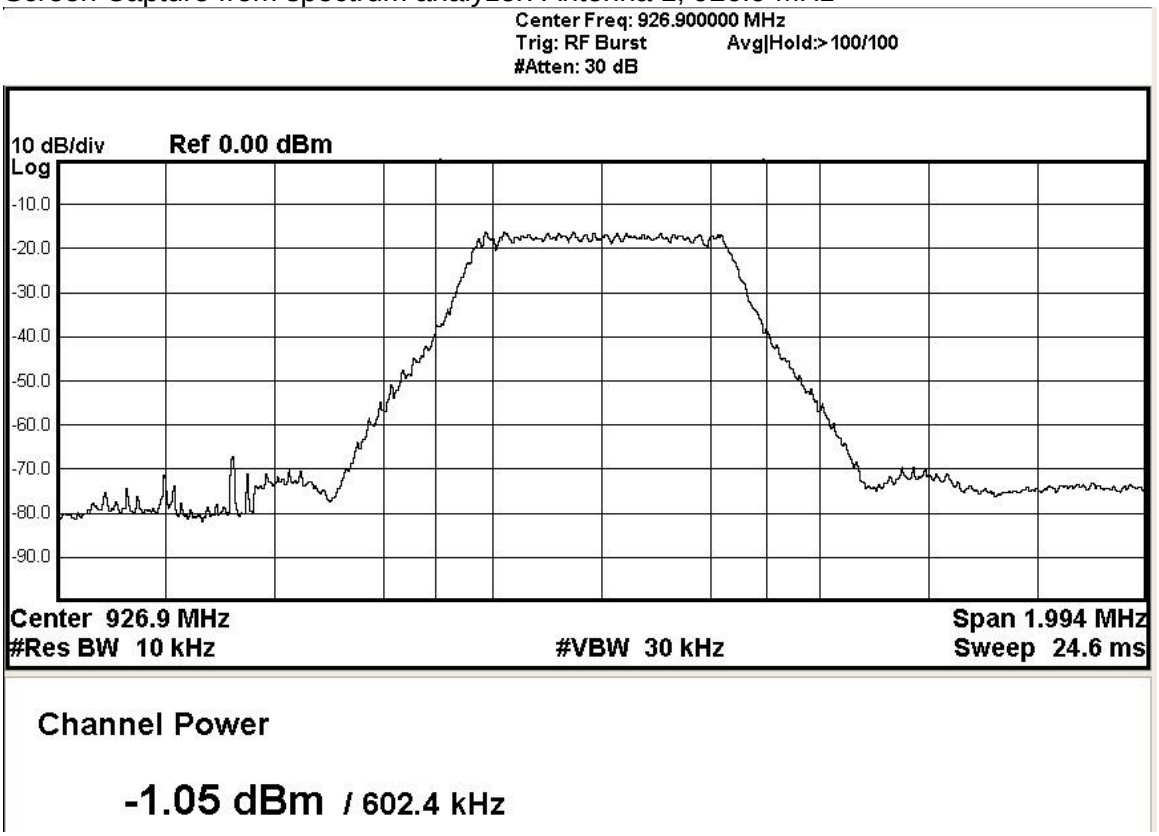
Screen Capture from spectrum analyzer: Antenna 1, 925.7 MHz



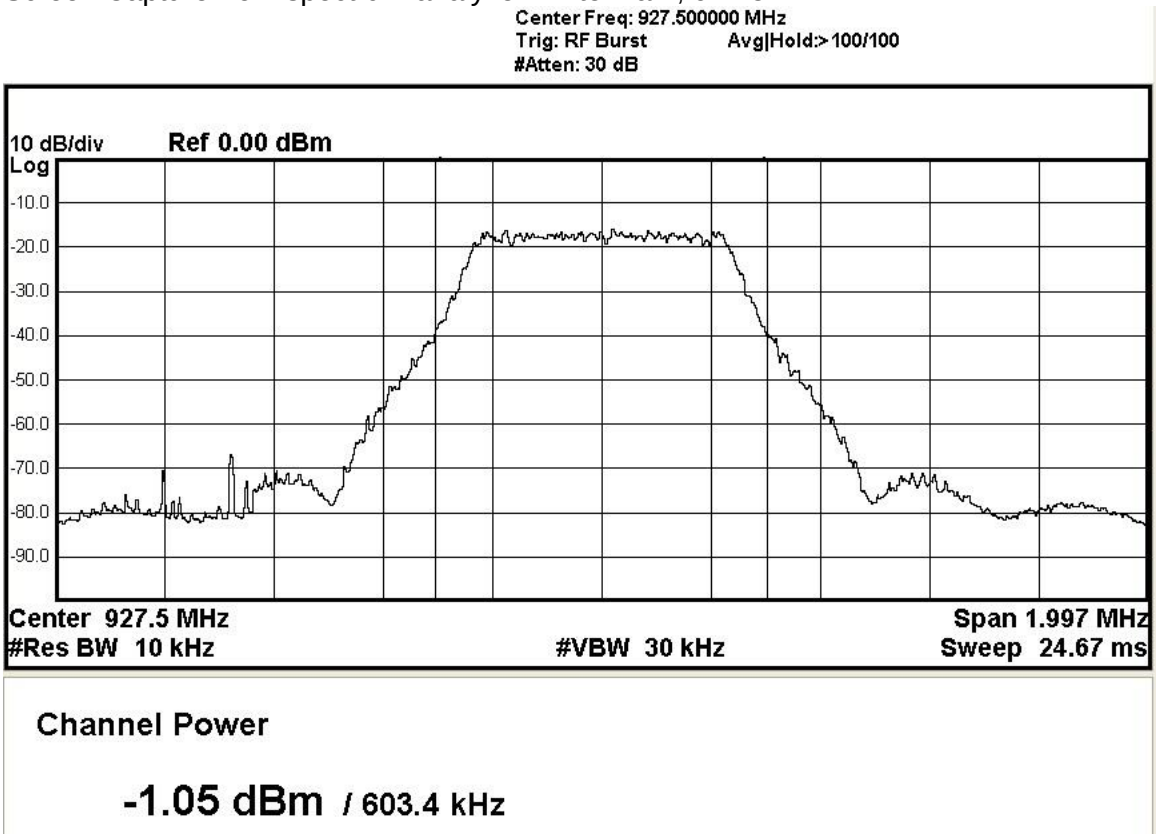
Screen Capture from spectrum analyzer: Antenna 1, 926.3 MHz



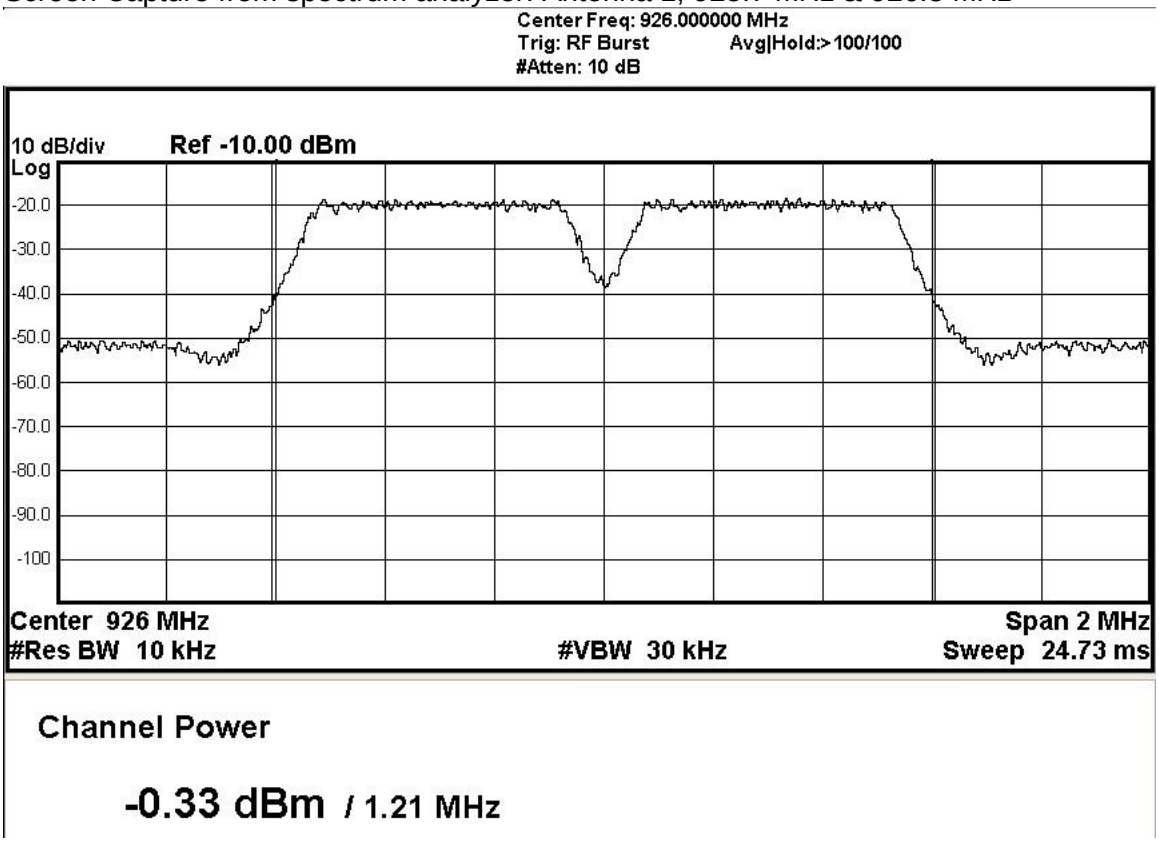
Screen Capture from spectrum analyzer: Antenna 1, 926.9 MHz



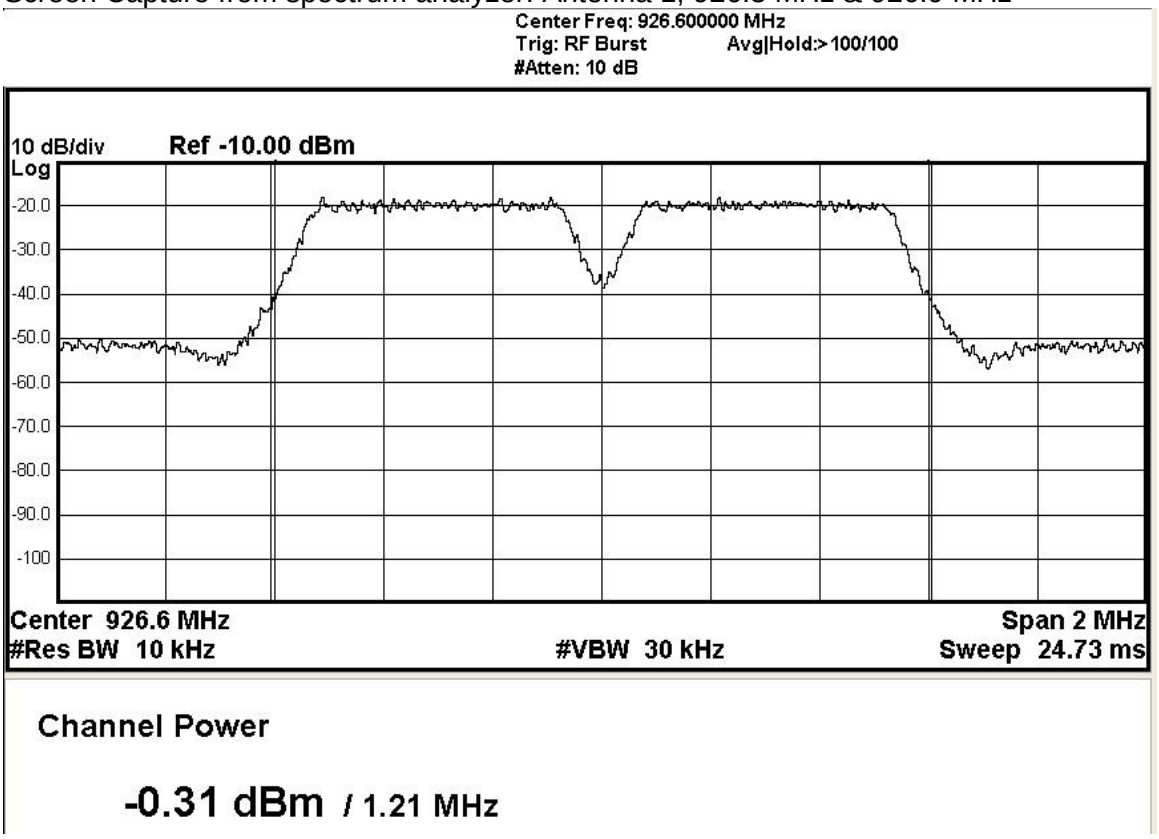
Screen Capture from spectrum analyzer: Antenna 1, 927.5 MHz



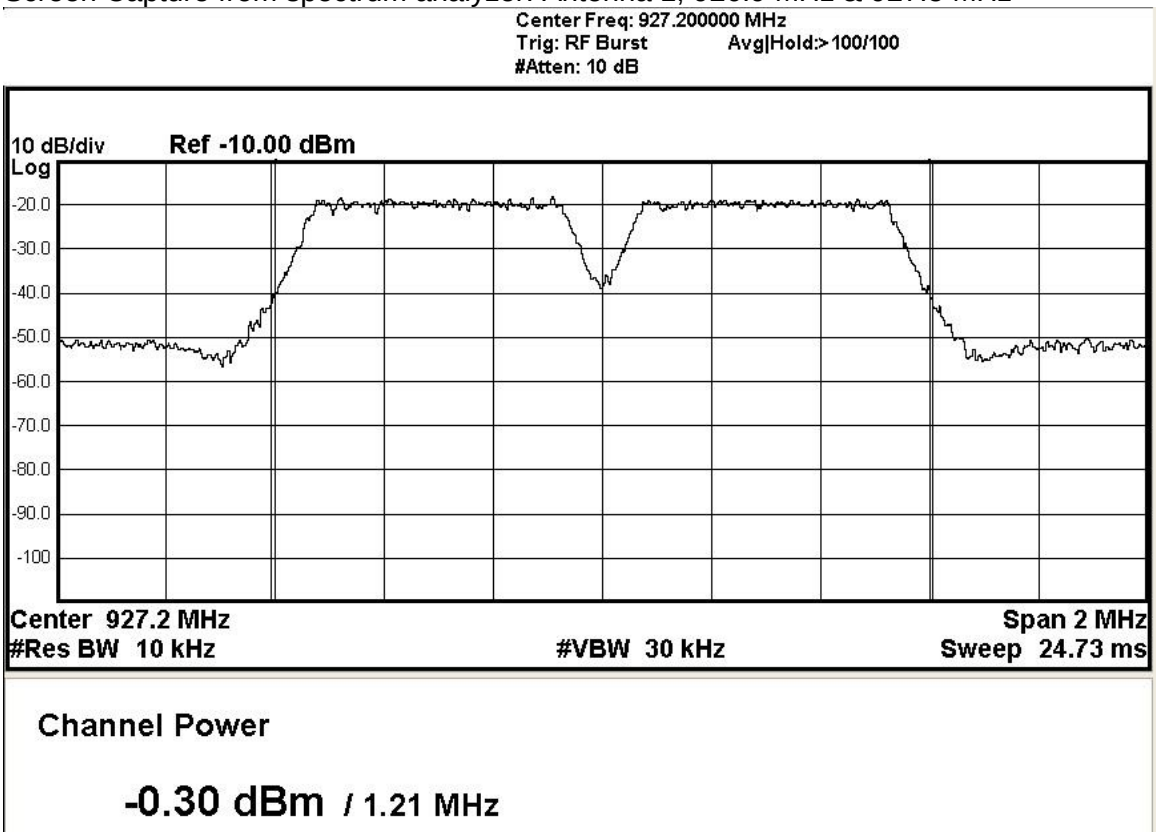
Screen Capture from spectrum analyzer: Antenna 1, 925.7 MHz & 926.3 MHz



Screen Capture from spectrum analyzer: Antenna 1, 926.3 MHz & 926.9 MHz



Screen Capture from spectrum analyzer: Antenna 1, 926.9 MHz & 927.5 MHz



2.3 Power Spectral Density

Test Lab: Electronics Test Centre, Airdrie	**EUT: Kona Macro Gateway**
Test Personnel: David Raynes	**Standard: FCC PART 15.247**
Date: 2017-02-17 (23.6° C, 16.4% RH) **Date: 2017-02-22 (18.2° C, 24.4% RH)**	**Basic Standard: ANSI C63.10: 2013**

EUT status: Compliant

Specification: FCC Part 15.247(e)

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.

2.3.1 Test Guidance: FCC KDB 558074 D01, Clause 10.3

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 spectrum analyzer is set for a frequency span ≥ (1.5*OBW) centered on a channel. The RBW is set to 3 kHz and VBW is set ≥ (3*RBW). The RMS (power averaging) detector is used, with the trace set to Average 100. After the trace has processed 100 sweeps, the marker is placed on the highest peak of the resulting trace.

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

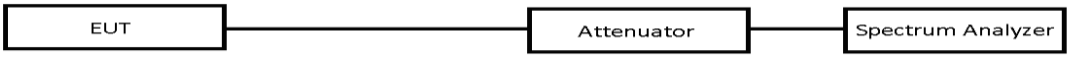
Testing was performed with the following equipment:

Equipment	Manufacturer	Model #	Asset #	Calibration Date	Calibration Due
EMI receiver	Agilent	N9038A	6130	2016-06-23	2017-06-23
Attenuator	Fairview Microwave	SA18N5WA-10		Monitored	
Attenuator	Weinschel Engineering	1 (20 dB)	AT6731	Monitored	
Temp/Humidity	Extech	42270	5892	2016-04-07	2017-04-07

2.3.4 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 diagram for Peak Power Spectral Density testing:



2.3.5 PSD Data

Measurements were performed via connection to the antenna ports, with attenuation between the EUT and the spectrum analyzer.

Antenna 0: 1 Carrier

Frequency (MHz)	SA Peak (dBm)	Attenuation & Cable Loss (dB)	Corrected Reading (dBm)	Limit (dBm)	**Margin (dB)** (PSD – Limit)
923.3	-22.13	29.95	7.82	8	**-0.18**
923.9	-22.53	29.95	7.42	8	**-0.58**
924.5	-22.36	29.95	7.59	8	**-0.41**
925.1	-22.37	29.95	7.58	8	**-0.42**

Antenna 1: 1 Carrier

Frequency (MHz)	SA Peak (dBm)	Cable Loss (dB)	Corrected Reading (dBm)	Limit (dBm)	**Margin (dB)** (PSD – Limit)
925.7	-22.26	29.94	7.68	8	**-0.32**
926.3	-22.15	29.94	7.79	8	**-0.21**
926.9	-22.32	29.94	7.62	8	**-0.38**
927.5	-22.16	29.94	7.78	8	**-0.22**

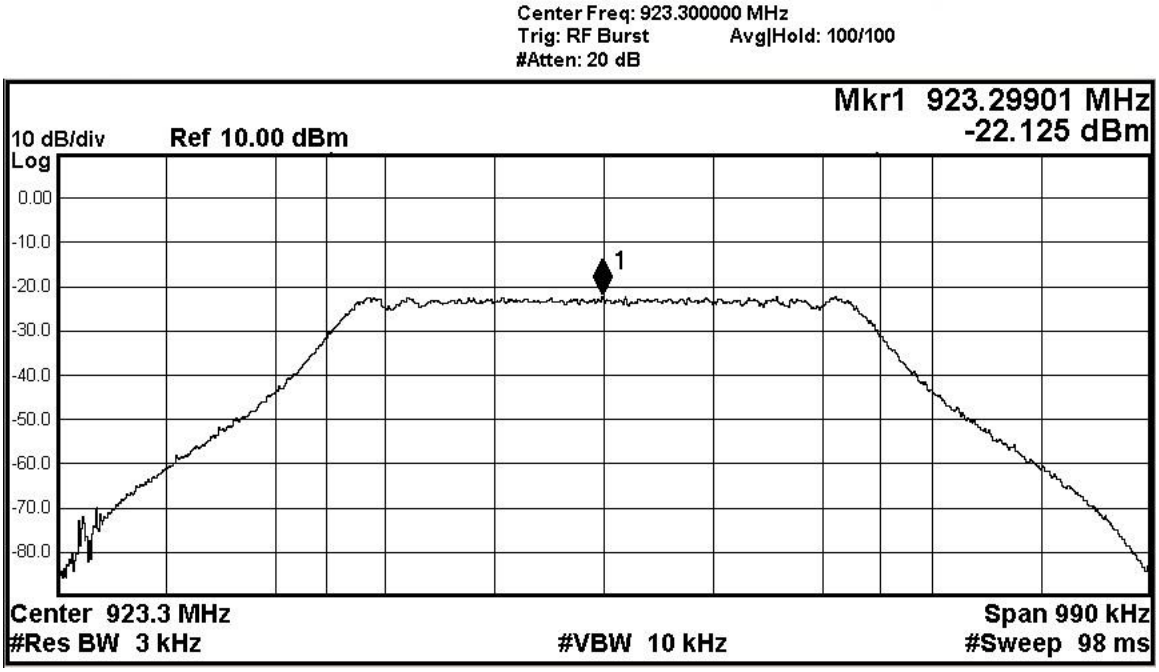
Antenna 0: 2 Carriers

Frequency (MHz)	SA Peak (dBm)	Cable Loss (dB)	Corrected Reading (dBm)	Limit (dBm)	**Margin (dB)** (PSD – Limit)
923.3	-22.23	29.95	7.72	8	**-0.28**
923.9	-22.51	29.95	7.44	8	**-0.56**
924.5	-23.16	29.95	6.79	8	**-1.21**
925.1	-22.47	29.95	7.48	8	**-0.52**

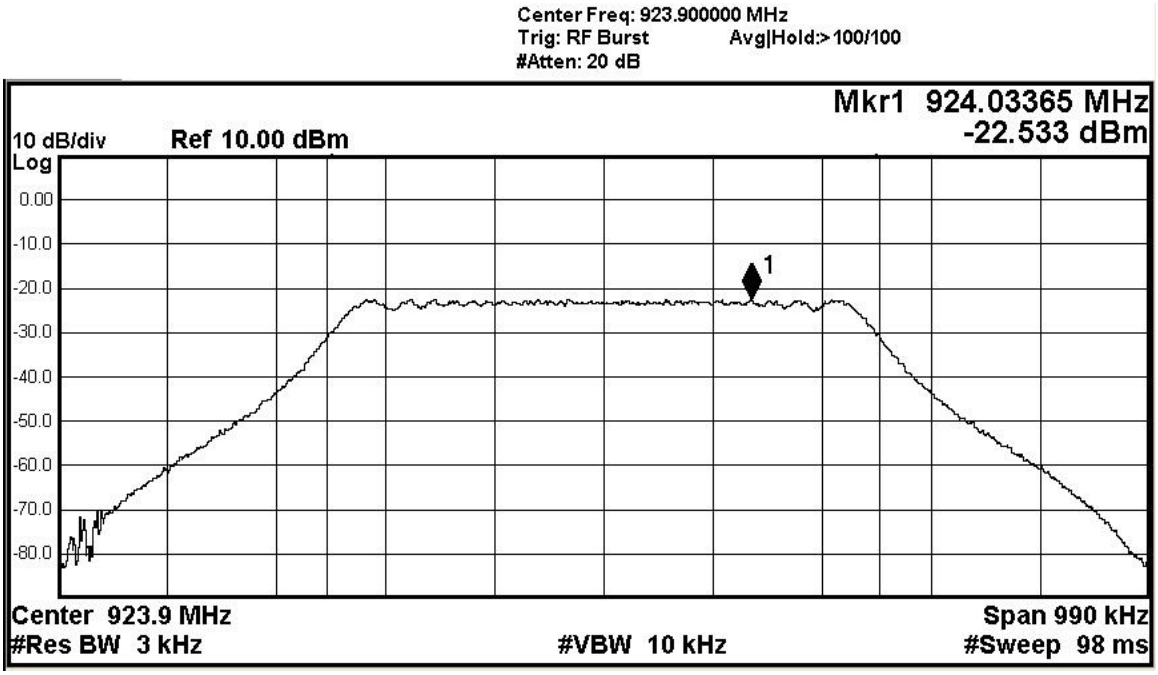
Antenna 1: 2 Carriers

Frequency (MHz)	SA Peak (dBm)	Cable Loss (dB)	Corrected Reading (dBm)	Limit (dBm)	**Margin (dB)** (PSD – Limit)
925.7	-23.09	29.94	6.85	8	**-1.15**
926.3	-22.88	29.94	7.06	8	**-0.94**
926.9	-22.62	29.94	7.32	8	**-0.68**
927.5	-22.97	29.94	6.97	8	**-1.03**

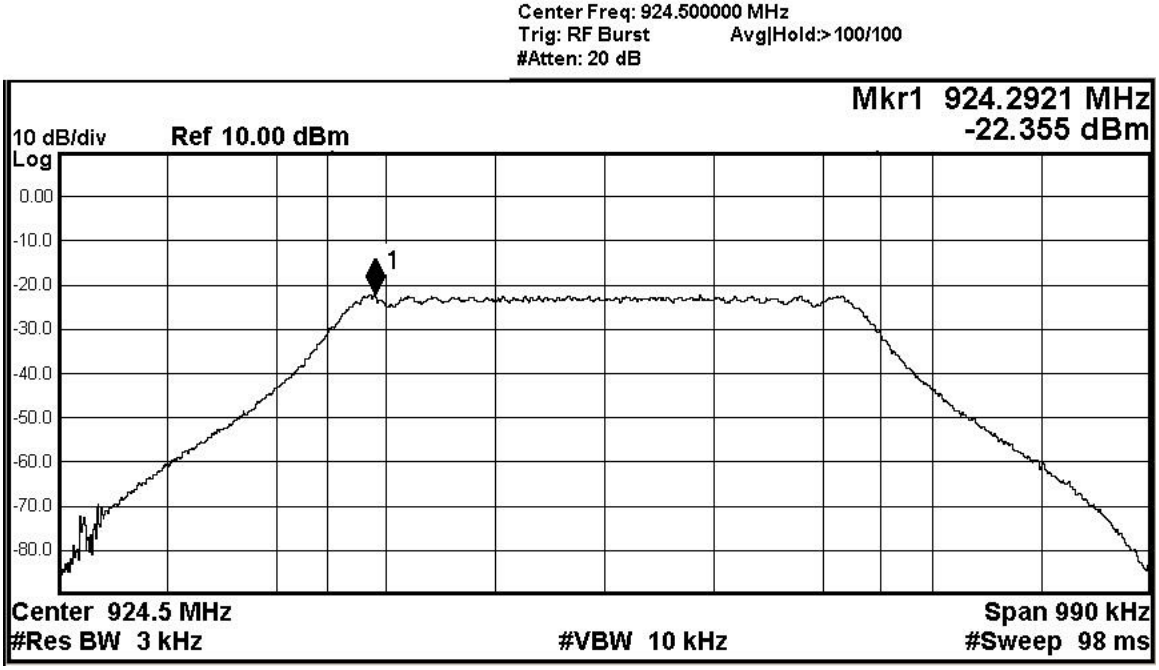
Screen Capture from spectrum analyzer: Antenna 0, 1 Carrier, 923.3 MHz



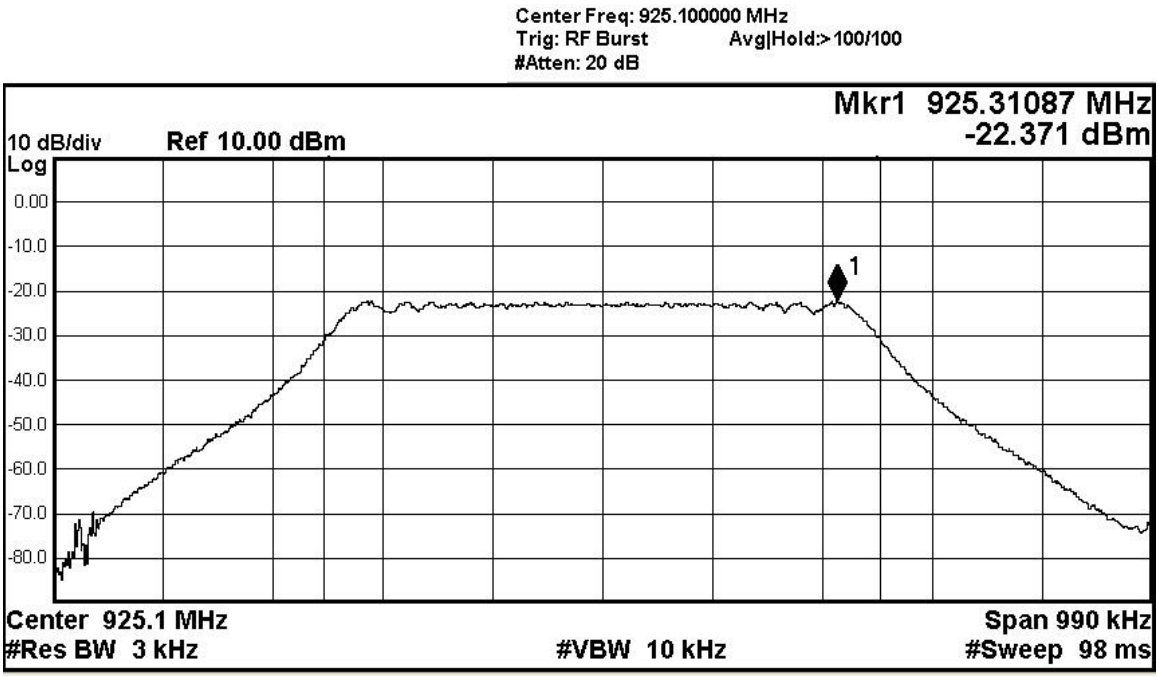
Screen Capture from spectrum analyzer: Antenna 0, 1 Carrier, 923.9 MHz



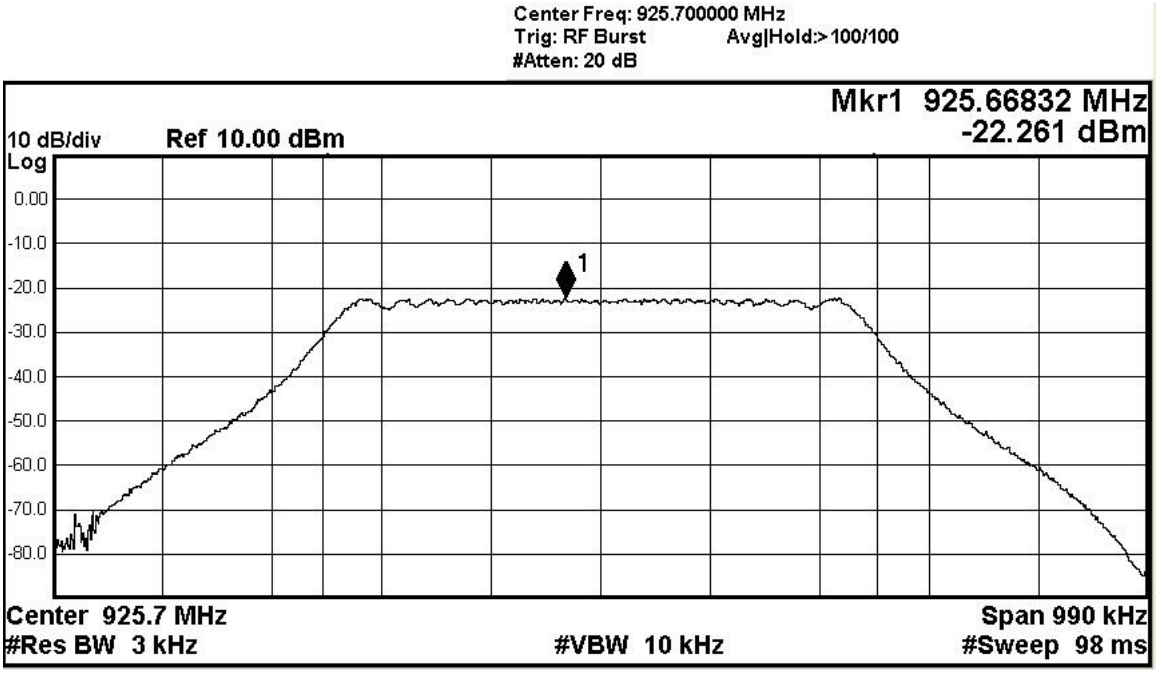
Screen Capture from spectrum analyzer: Antenna 0, 1 Carrier, 924.5 MHz



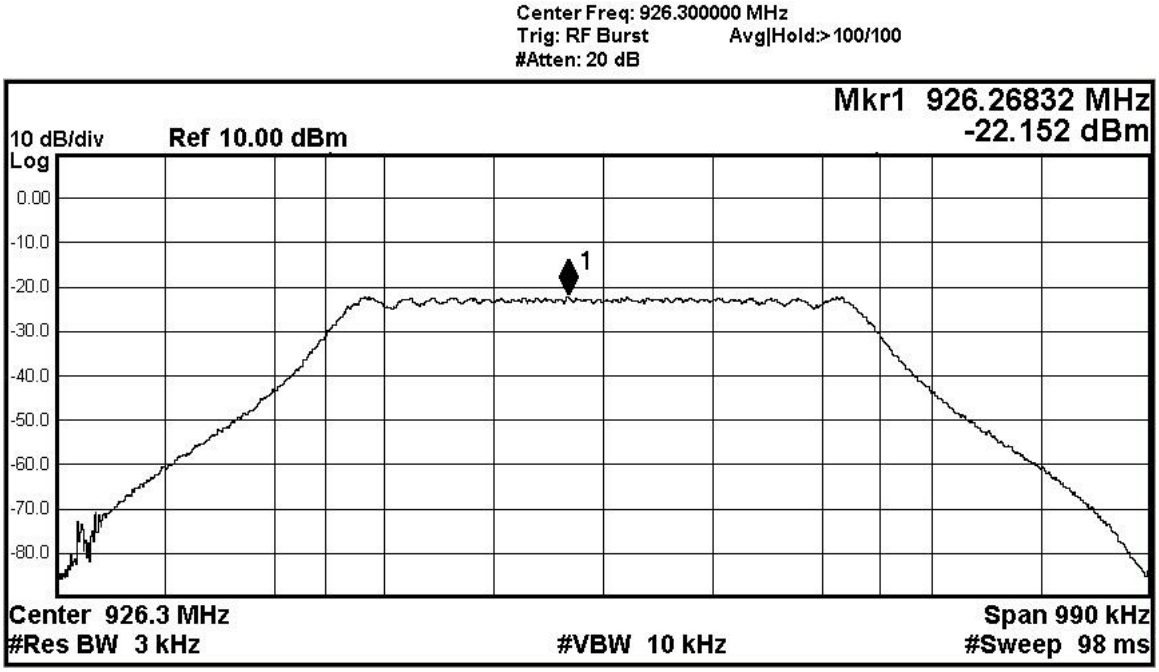
Screen Capture from spectrum analyzer: Antenna 0, 1 Carrier, 925.1 MHz



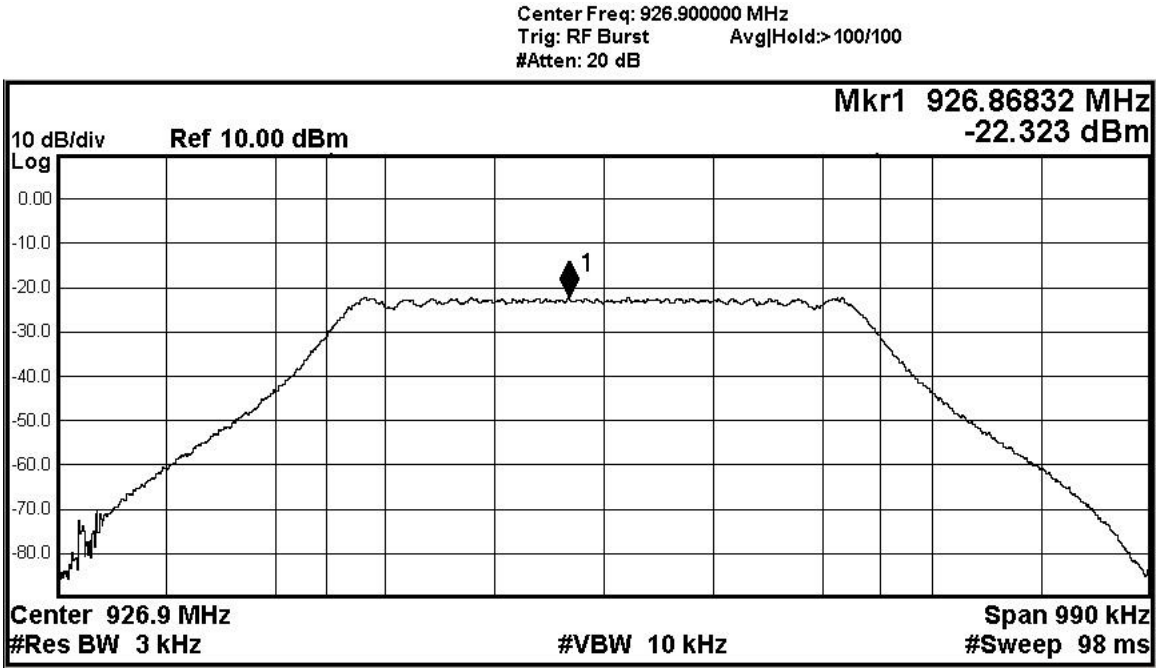
Screen Capture from spectrum analyzer: Antenna 1, 1 Carrier, 925.7 MHz



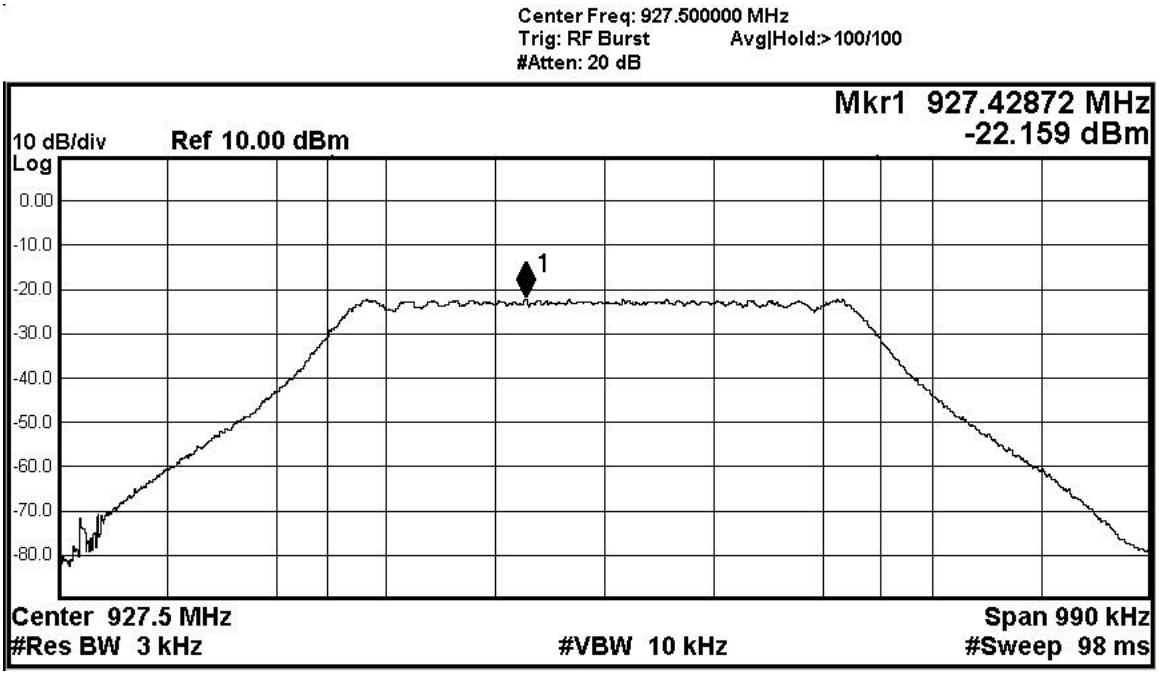
Screen Capture from spectrum analyzer: Antenna 1, 1 Carrier, 926.3 MHz



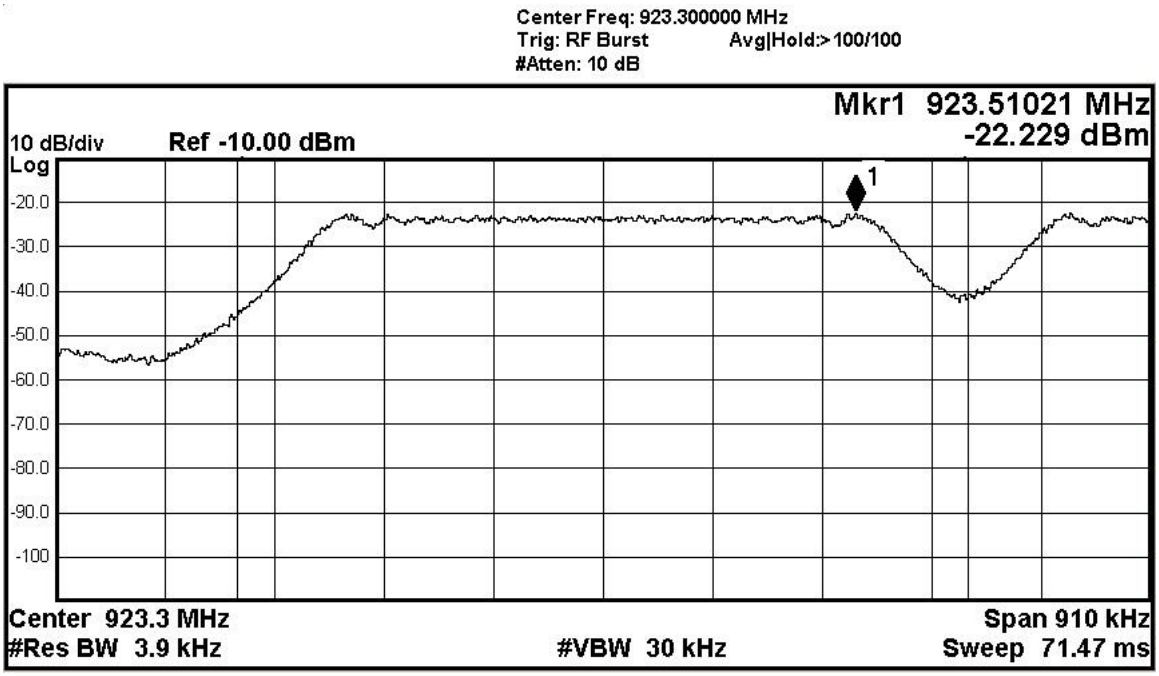
Screen Capture from spectrum analyzer: Antenna 1, 1 Carrier, 926.9 MHz



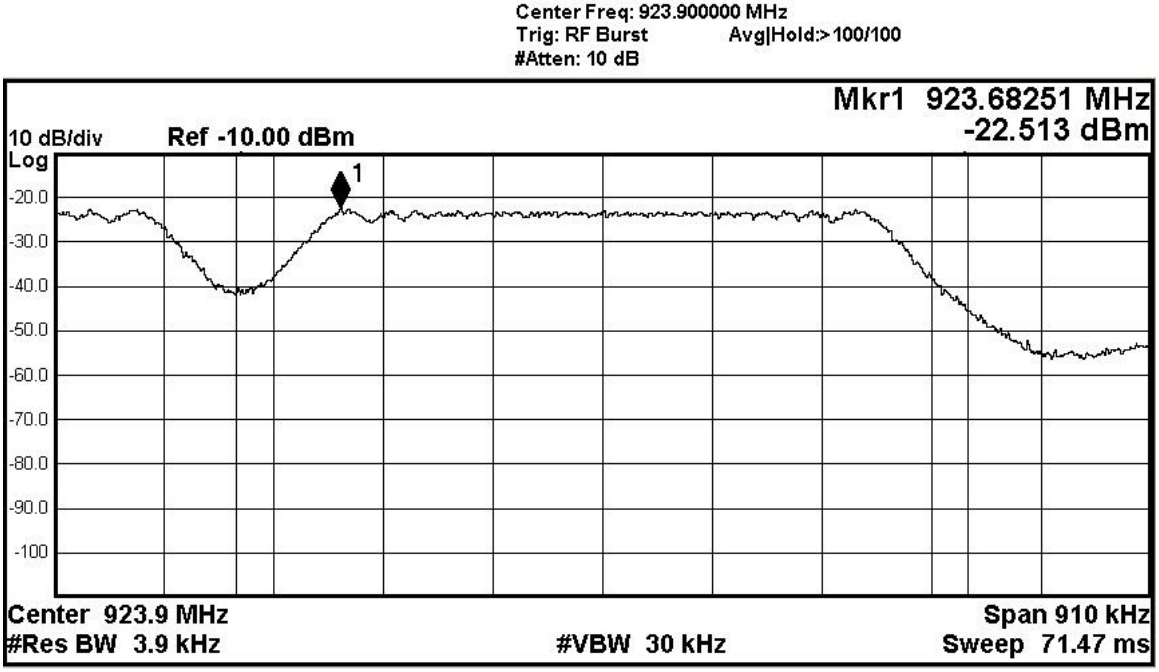
Screen Capture from spectrum analyzer: Antenna 1, 1 Carrier, 927.5 MHz



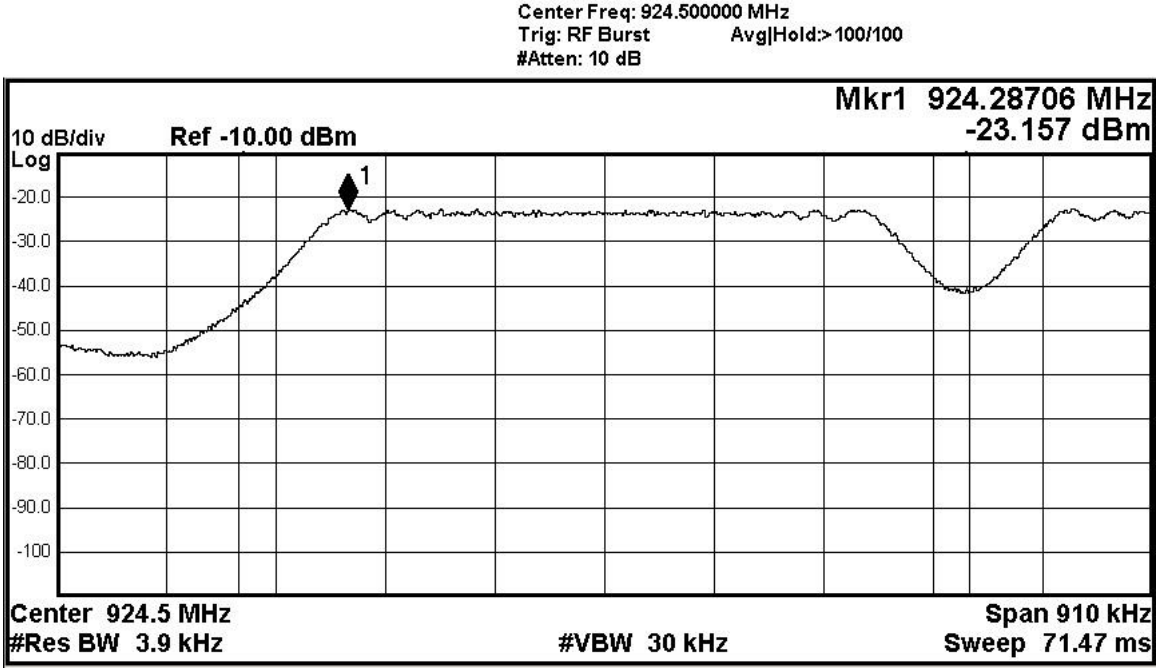
Screen Capture from spectrum analyzer: Antenna 0, 2 Carrier, 923.3 MHz



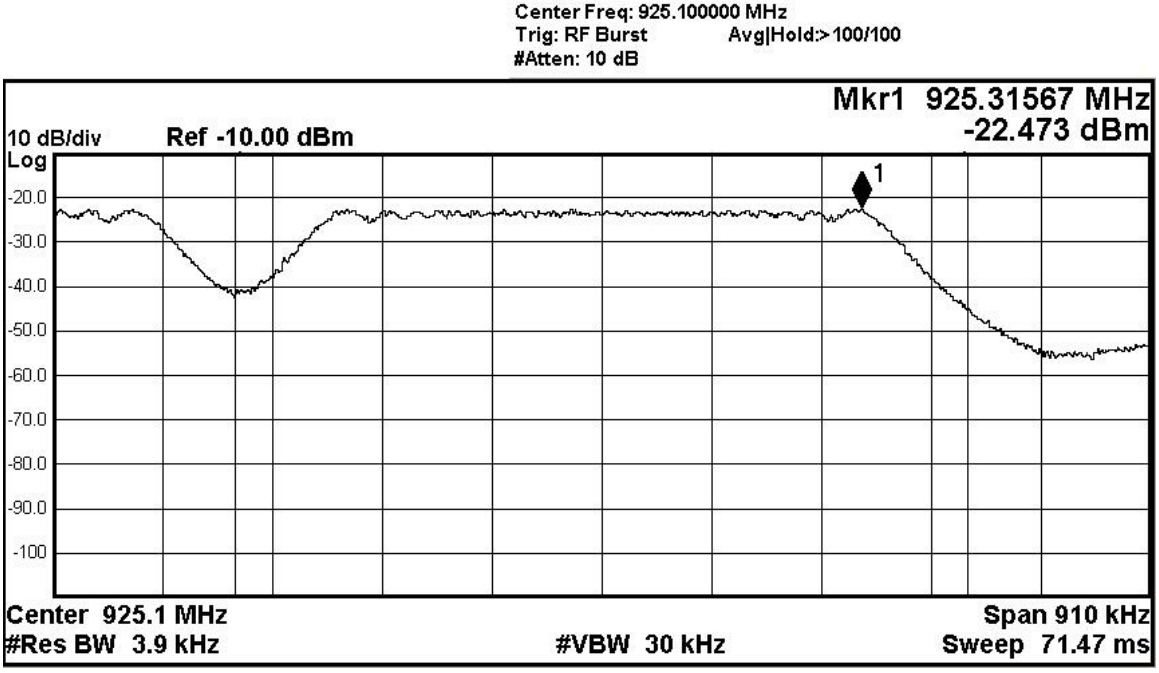
Screen Capture from spectrum analyzer: Antenna 0, 2 Carrier, 923.9 MHz



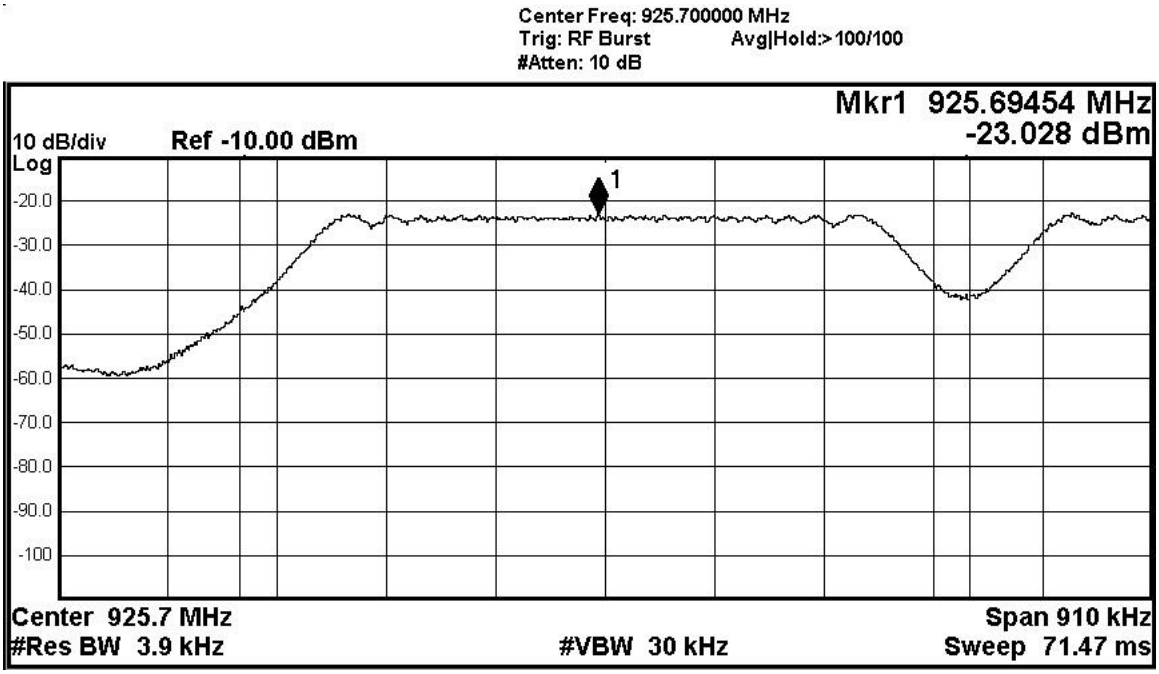
Screen Capture from spectrum analyzer: Antenna 0, 2 Carrier, 924.5 MHz



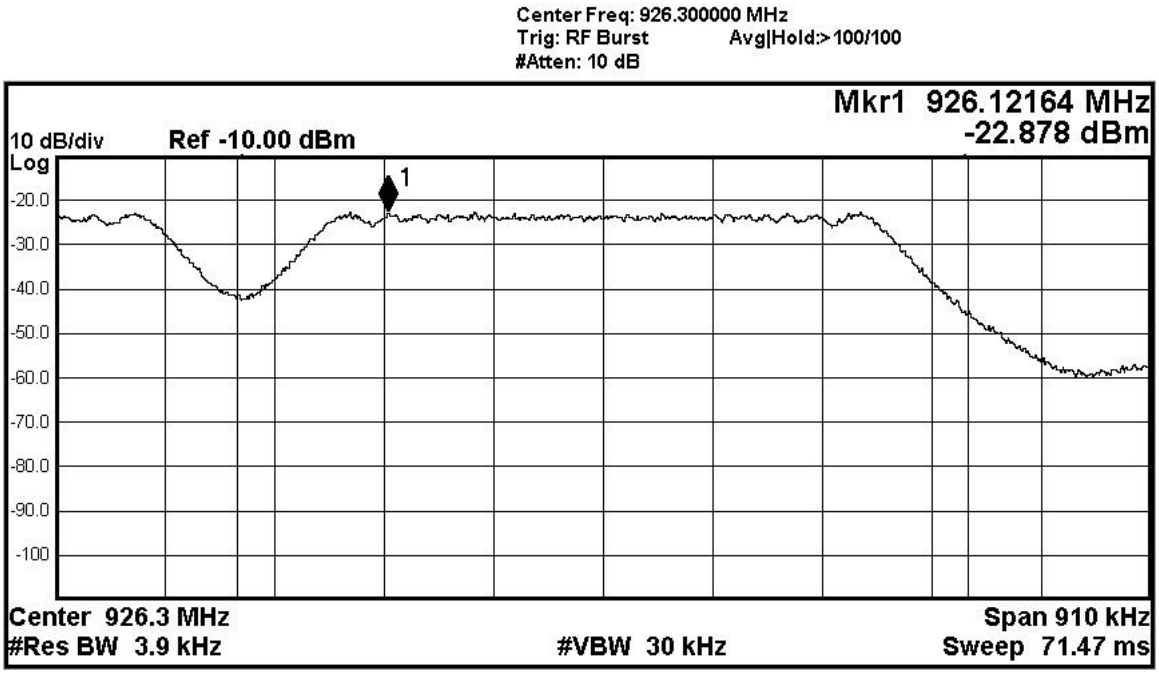
Screen Capture from spectrum analyzer: Antenna 0, 2 Carrier, 925.1 MHz



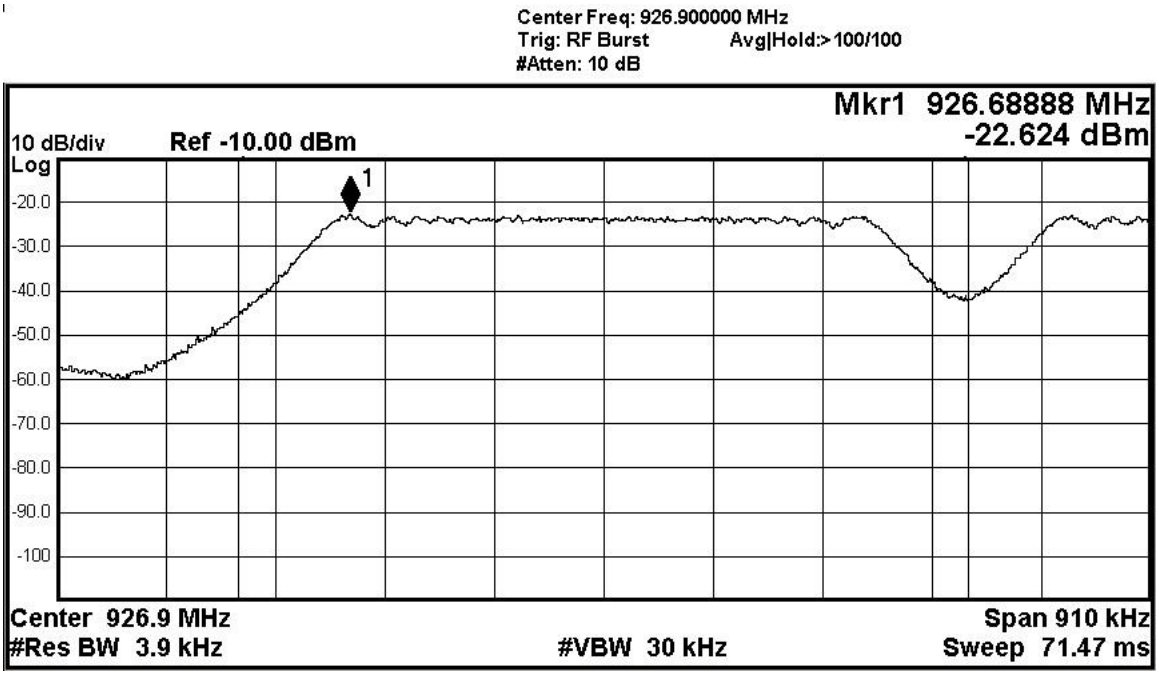
Screen Capture from spectrum analyzer: Antenna 1, 2 Carrier, 925.7 MHz



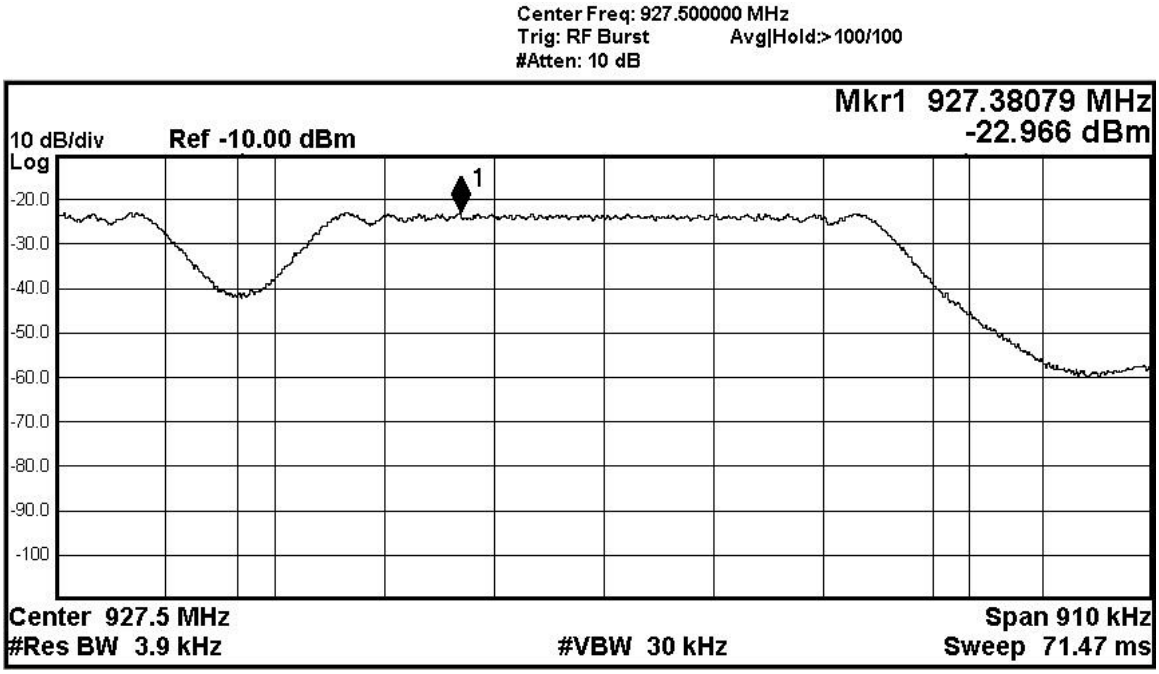
Screen Capture from spectrum analyzer: Antenna 1, 2 Carrier, 926.3 MHz



Screen Capture from spectrum analyzer: Antenna 1, 2 Carrier, 926.9 MHz



Screen Capture from spectrum analyzer: Antenna 1, 2 Carrier, 927.5 MHz



2.4 Channel Occupied Bandwidth

Test Lab: Electronics Test Centre, Airdrie	**EUT: Kona Macro Gateway**
Test Personnel: David Raynes	**Standard: FCC PART 15.247**
Date: 2017-02-21 (19.5° C, 21.7% RH)	**Basic Standard: ANSI C63.10-2013**

EUT status: Compliant

Specification: FCC Part 15.247(a)(2)

Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

2.4.1 Test Guidance: FCC KDB 558074 D01, Clause 8.2

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 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.

The automated 99% BW function of the spectrum analyzer is engaged, and the 6 dB OBW is measured with the x dB function.

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

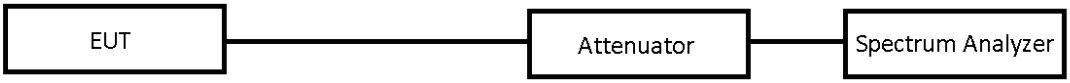
Testing was performed with the following equipment:

Equipment	Manufacturer	Model #	Asset #	Calibration Date	Calibration Due
EMI receiver	Agilent	N9038A	6130	2016-06-23	2017-06-23
Attenuator	Fairview Microwave	SA18N5WA-10		Monitored	
Attenuator	Weinschel Engineering	1 (20 dB)	AT6731	Monitored	
Temp/Humidity	Extech	42270	5892	2016-04-07	2017-04-07

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 diagram for Occupied Bandwidth testing:

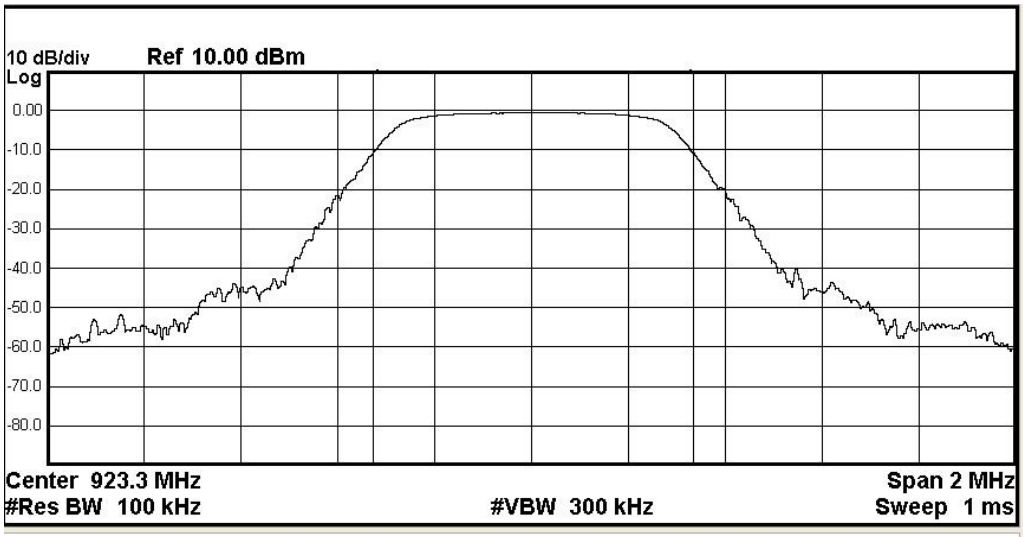


2.4.5 Channel Occupied Bandwidth Data:

Freq. (MHz)	6 dB OBW (kHz)	99% OBW (kHz)
923.3	603.5	660.67
923.9	604.1	657.11
924.5	602.7	658.08
925.1	603.2	656.90
925.7	604.8	657.29
926.3	602.7	657.41
926.9	602.4	658.01
927.5	603.4	656.86

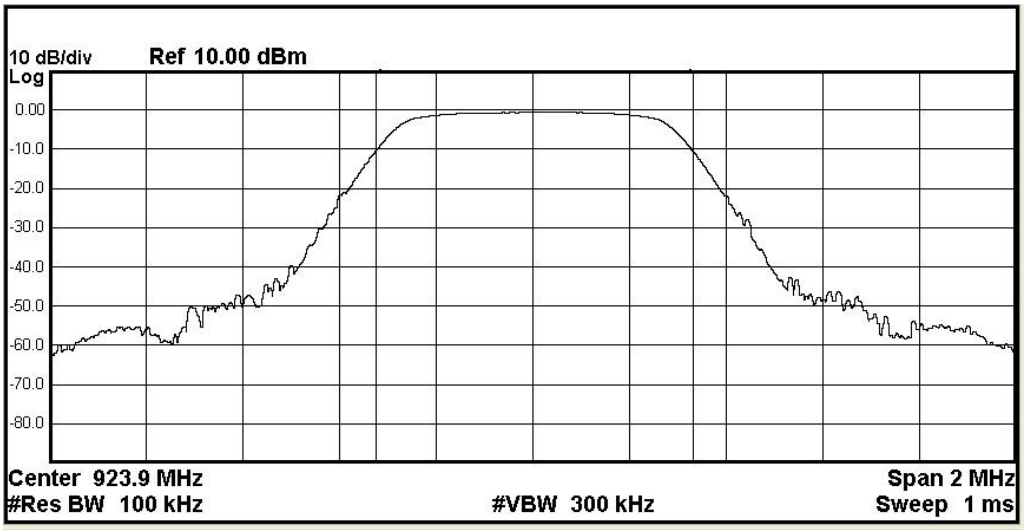
Screen Captures from the spectrum analyzer:

6 dB OBW, 923.3 MHz:



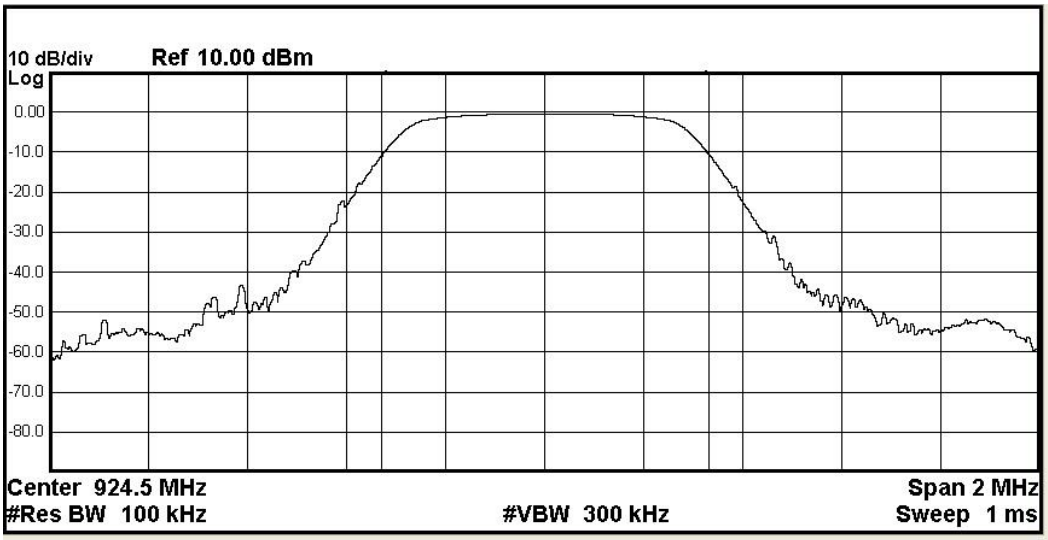
Occupied Bandwidth		Total Power	6.36 dBm
660.67 kHz			
Transmit Freq Error	4.104 kHz	OBW Power	99.00 %
x dB Bandwidth	603.5 kHz	x dB	-6.00 dB

6 dB OBW, 923.9 MHz:



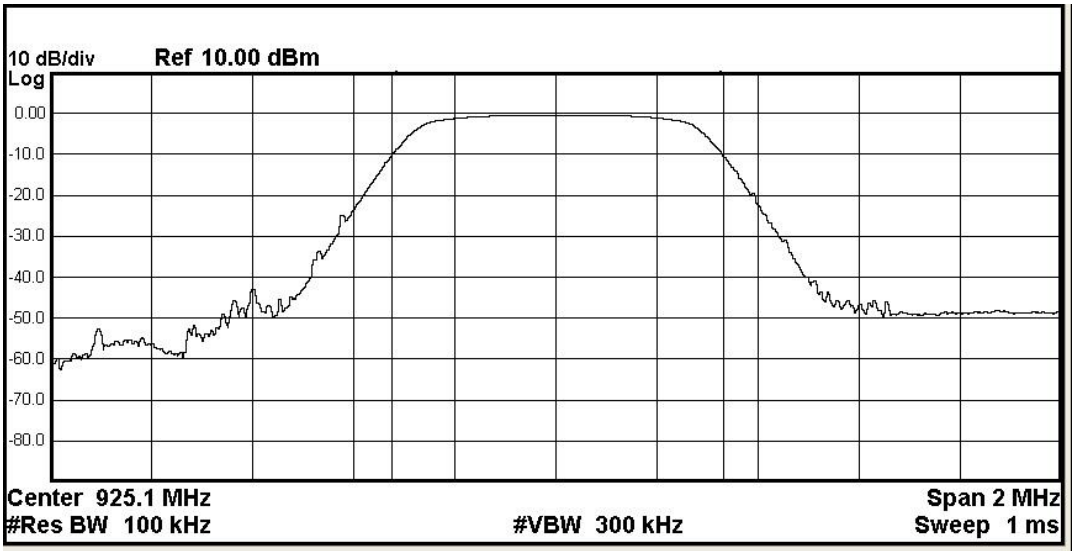
Occupied Bandwidth		Total Power	6.34 dBm
657.11 kHz			
Transmit Freq Error	3.806 kHz	OBW Power	99.00 %
x dB Bandwidth	604.1 kHz	x dB	-6.00 dB

6 dB OBW, 924.5 MHz:



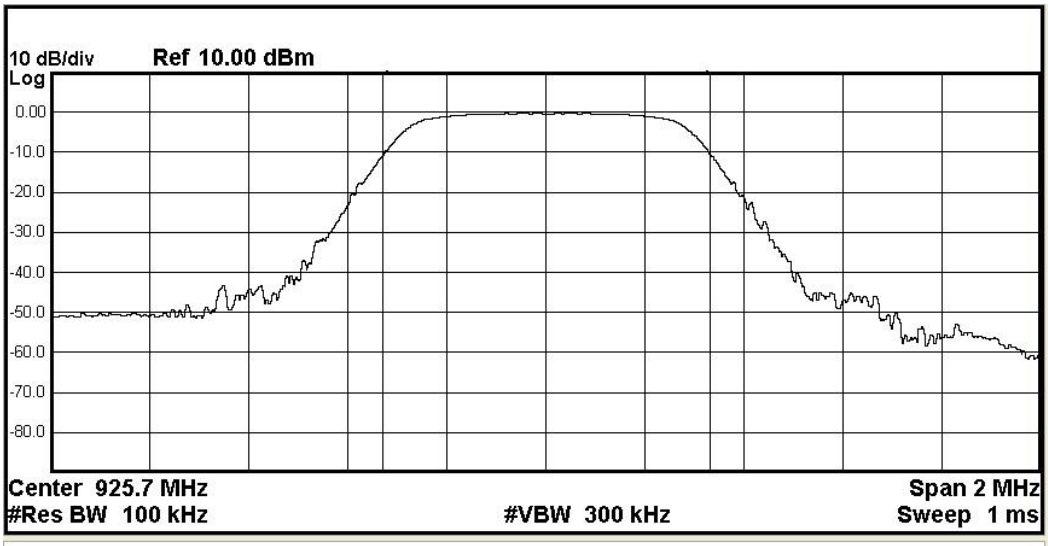
Occupied Bandwidth		Total Power	6.43 dBm
658.08 kHz			
Transmit Freq Error	3.073 kHz	OBW Power	99.00 %
x dB Bandwidth	602.7 kHz	x dB	-6.00 dB

6 dB OBW, 925.1 MHz:



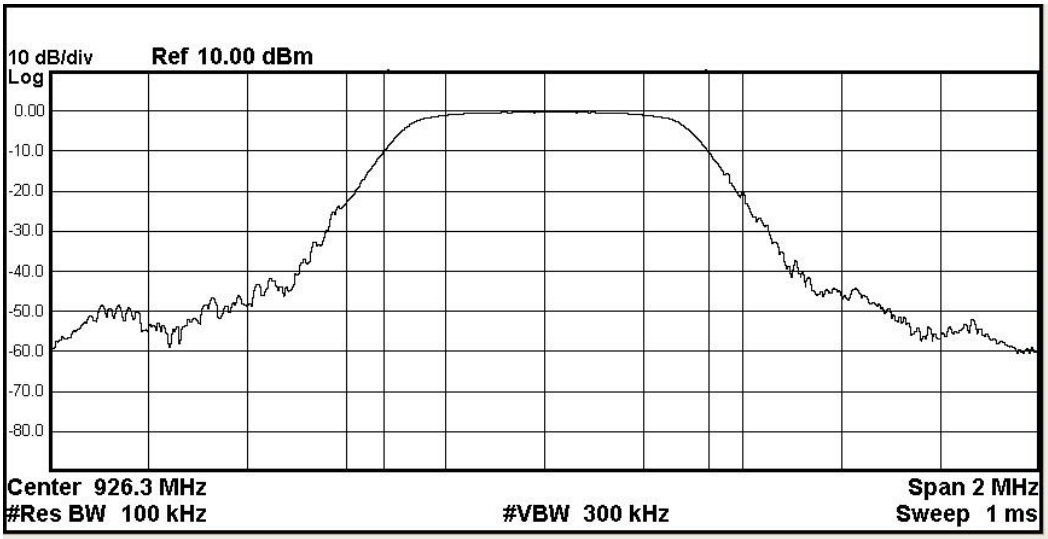
Occupied Bandwidth		Total Power	6.49 dBm
656.90 kHz			
Transmit Freq Error	4.173 kHz	OBW Power	99.00 %
x dB Bandwidth	603.2 kHz	x dB	-6.00 dB

6 dB OBW, 925.7 MHz:



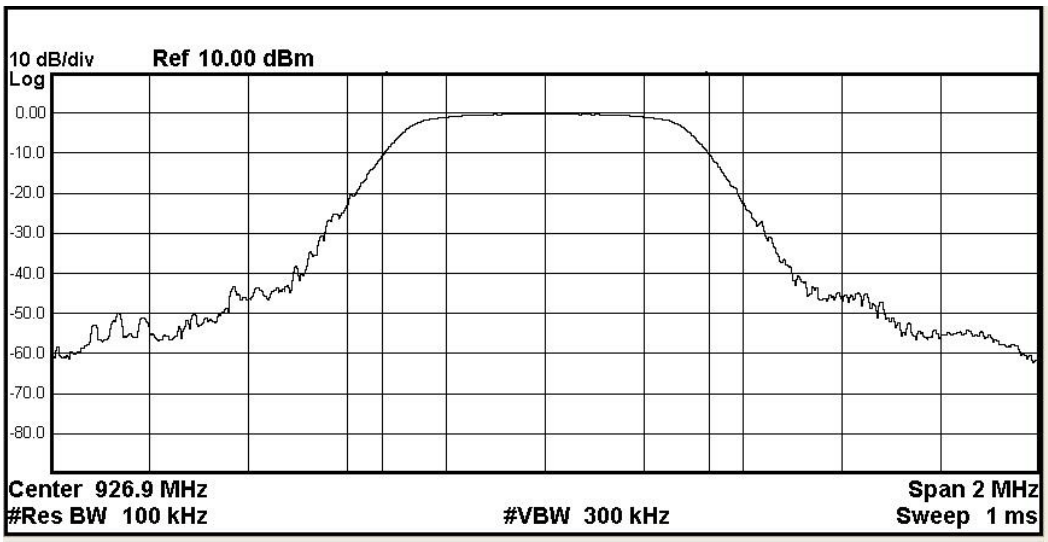
Occupied Bandwidth		Total Power	6.63 dBm
657.29 kHz			
Transmit Freq Error	3.391 kHz	OBW Power	99.00 %
x dB Bandwidth	604.8 kHz	x dB	-6.00 dB

6 dB OBW, 926.3 MHz:



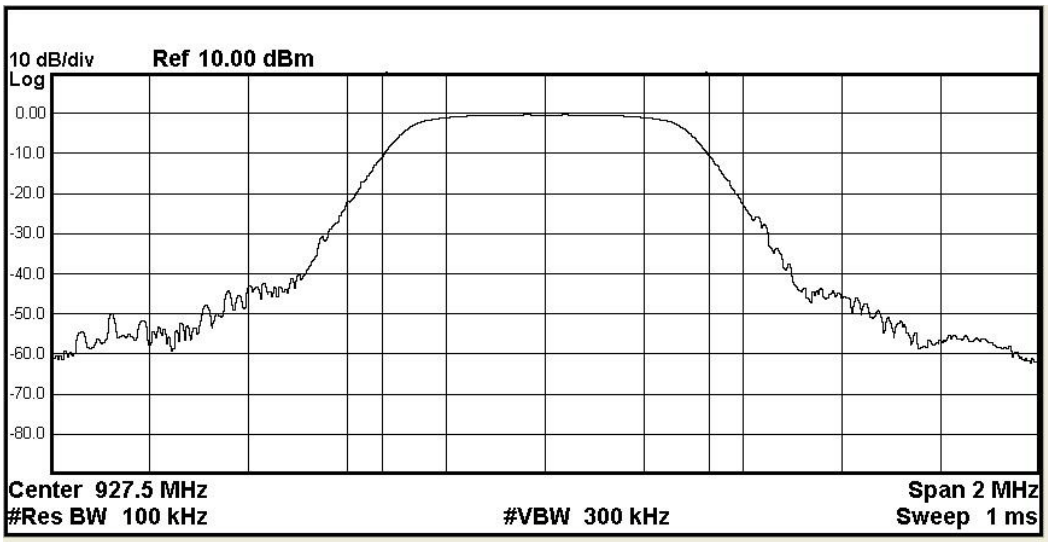
Occupied Bandwidth		Total Power	6.64 dBm
657.41 kHz			
Transmit Freq Error	3.676 kHz	OBW Power	99.00 %
x dB Bandwidth	602.7 kHz	x dB	-6.00 dB

6 dB OBW, 926.9 MHz:



Occupied Bandwidth		Total Power	6.65 dBm
658.01 kHz			
Transmit Freq Error	2.741 kHz	OBW Power	99.00 %
x dB Bandwidth	602.4 kHz	x dB	-6.00 dB

6 dB OBW, 2480 MHz:



Occupied Bandwidth		Total Power	6.60 dBm
656.86 kHz			
Transmit Freq Error	2.354 kHz	OBW Power	99.00 %
x dB Bandwidth	603.4 kHz	x dB	-6.00 dB

2.5 Band Edge Attenuation

Test Lab: Electronics Test Centre, Airdrie	**EUT: Kona Macro Gateway**
Test Personnel: David Raynes	**Standard: FCC PART 15.247**
Date: 2017-02-17 (23.6° C, 16.4% RH)	**Basic Standard: ANSI C63.10: 2013**
Date: 2017-02-22 (18.2° C, 24.4% RH)	

EUT status: Compliant

Specification: FCC Part 15.247(d)

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

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 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.

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:

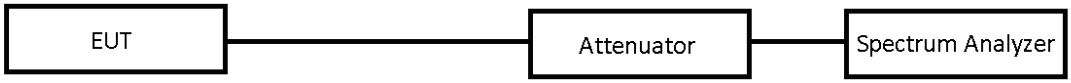
Equipment	Manufacturer	Model #	Asset #	Calibration Date	Calibration Due
EMI receiver	Agilent	N9038A	6130	2016-06-23	2017-06-23
Attenuator	Fairview Microwave	SA18N5WA-10		Monitored	
Attenuator	Weinschel Engineering	1 (20 dB)	AT6731	Monitored	
Temp/Humidity	Extech	42270	5892	2016-04-07	2017-04-07

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 diagram for Band Edge Attenuation testing:

Conducted:

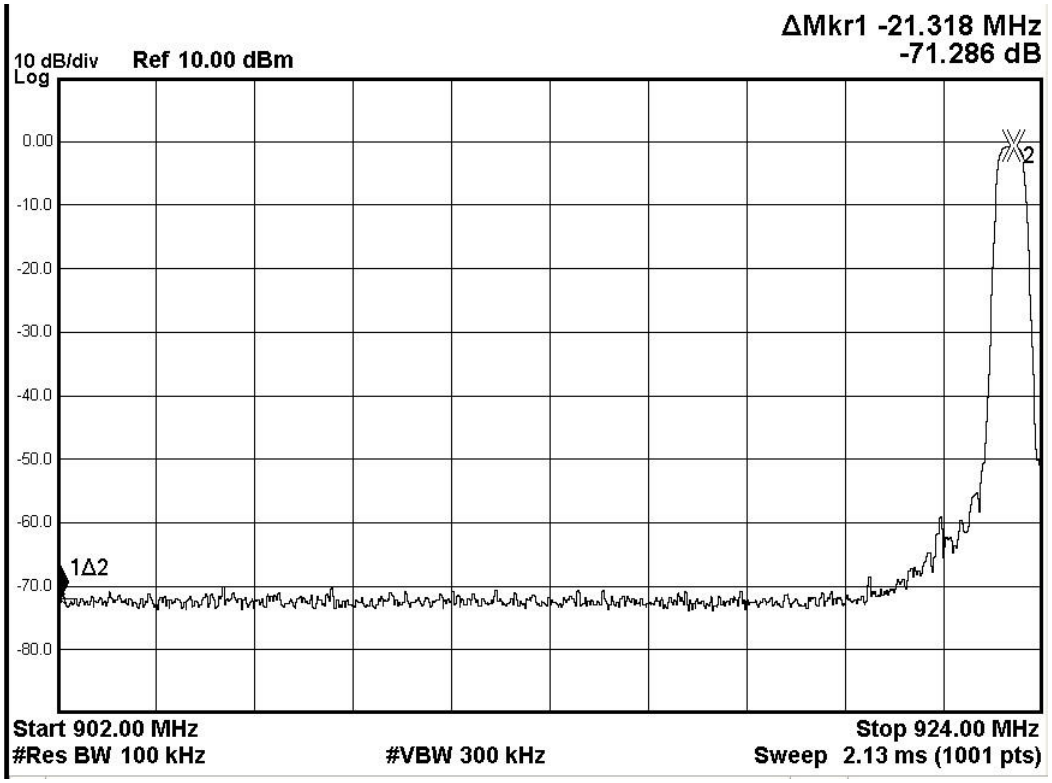


2.5.5 Band Edge Data

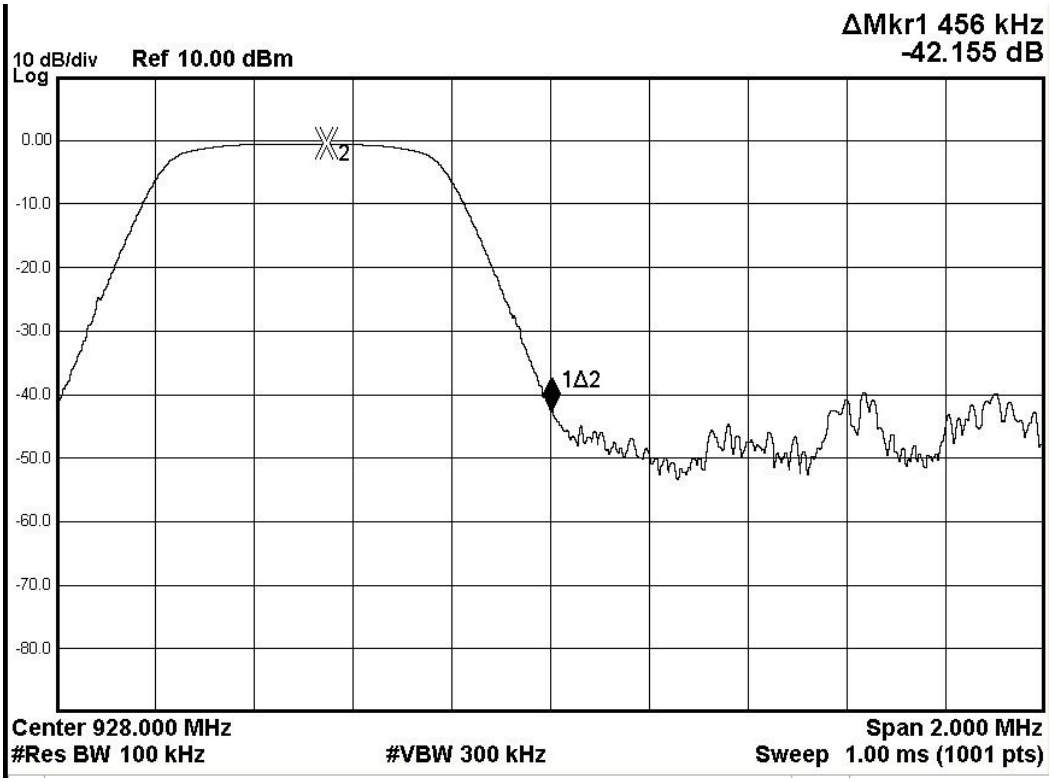
Worst-Case Data:

Channel Frequency	Attenuation at Band Edge
923.3 MHz	71.29 dB
925.1 MHz & 925.7 MHz	30.37 dB

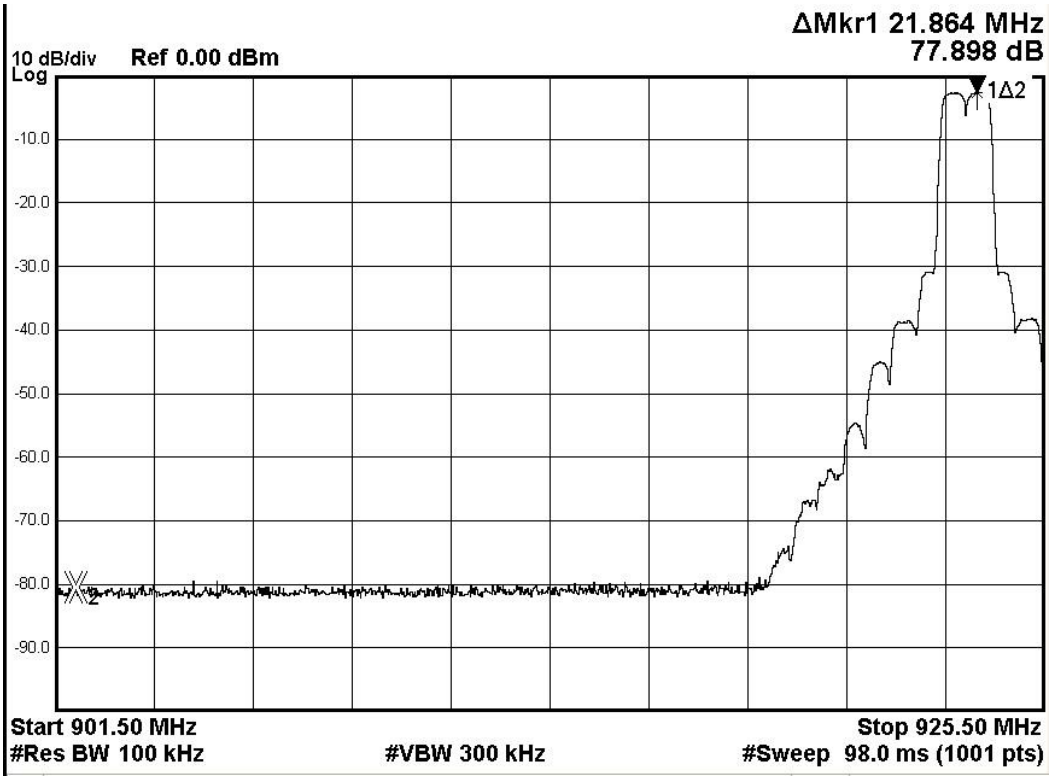
Screen Capture from the spectrum analyzer: Lower Band Edge, 1 carrier



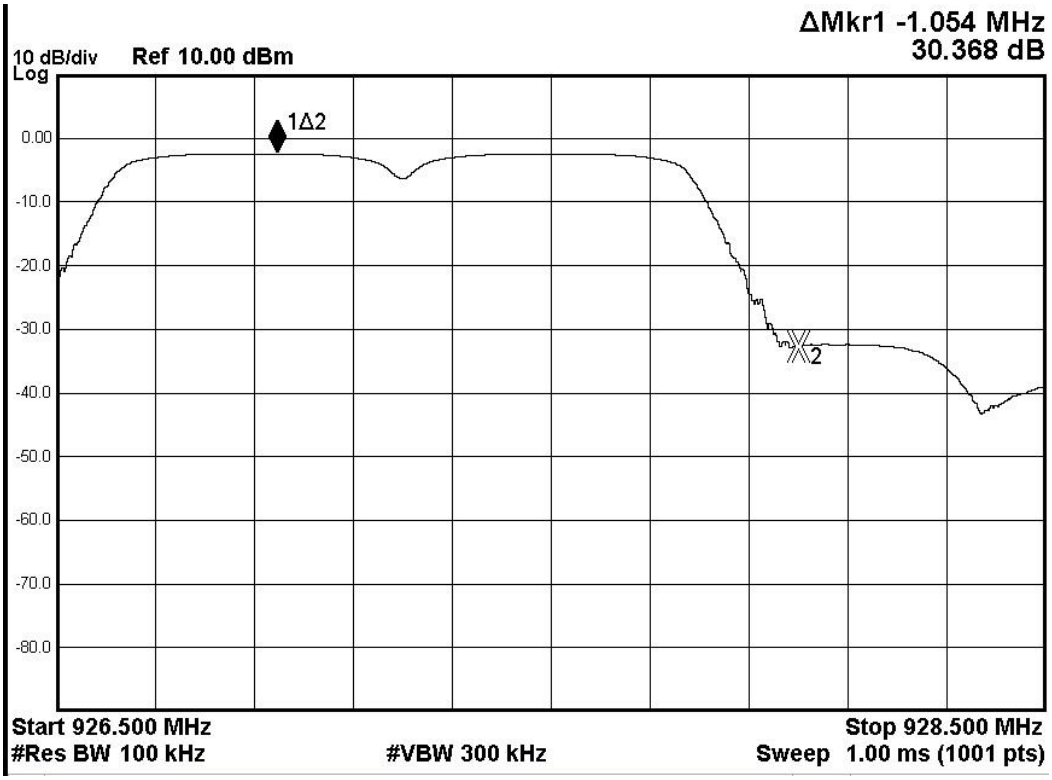
Screen Capture from the spectrum analyzer: Upper Band Edge, 1 carrier



Screen Capture from the spectrum analyzer: Lower Band Edge, 2 carriers



Screen Capture from the spectrum analyzer: Upper Band Edge, 2 carriers



2.6 Conducted Spurious Emissions

Test Lab: Electronics Test Centre, Airdrie	**EUT: Kona Macro Gateway**
Test Personnel: David Raynes	**Standard: FCC PART 15.247**
Date: 2017-02-21 (19.5° C, 21.7% RH)	**Basic Standard: ANSI C63.4-2014**

EUT status: Compliant

Specification: FCC Part 15.247(d)

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

2.6.1 Test Guidance: ANSI C63.10-2013, Clause 6.7

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

The RF output of EUT with an antenna connector is fed to the input of the spectrum analyzer through appropriate attenuation.

The 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.

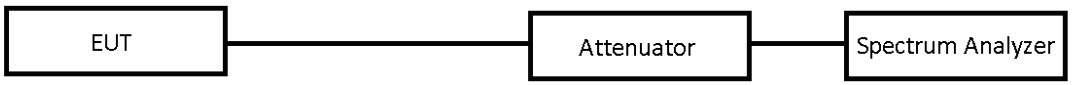
Testing was performed with the following equipment:

Equipment	Manufacturer	Model #	Asset #	Calibration Date	Calibration Due
EMI receiver	Agilent	N9038A	6130	2016-06-23	2017-06-23
Attenuator	Fairview Microwave	SA18N5WA-10		Monitored	
Attenuator	Weinschel Engineering	1 (20 dB)	AT6731	Monitored	
Temp/Humidity	Extech	42270	5892	2016-04-07	2017-04-07

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:

The emissions data are presented in tabular form, showing 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 dBm + Gain/Loss Factor in dB = Corrected Power in dBm.

Delta = Measured Value - Limit

Negative values for Delta indicate compliance.

1 Carrier:

Ant0: 923.3 MHz (Cable Loss + Attenuation = 29.95 dB).

Ant1: 926.9 MHz (Cable Loss + Attenuation = 29.94 dB):

There were no reportable emissions.

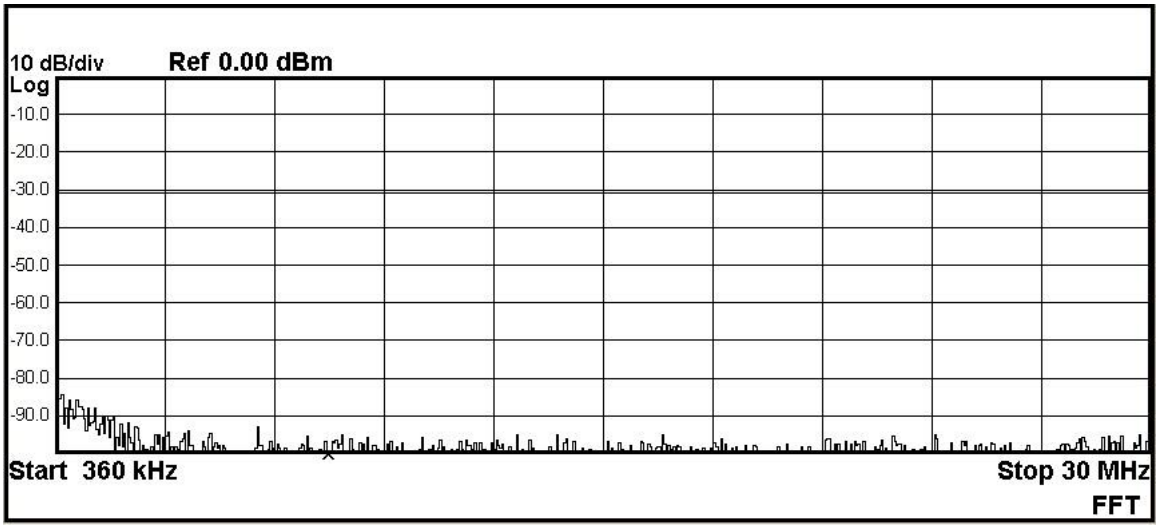
2 Carriers:

Ant0: 923.3 MHz & 925.1 MHz (Cable Loss + Attenuation = 29.95 dB).

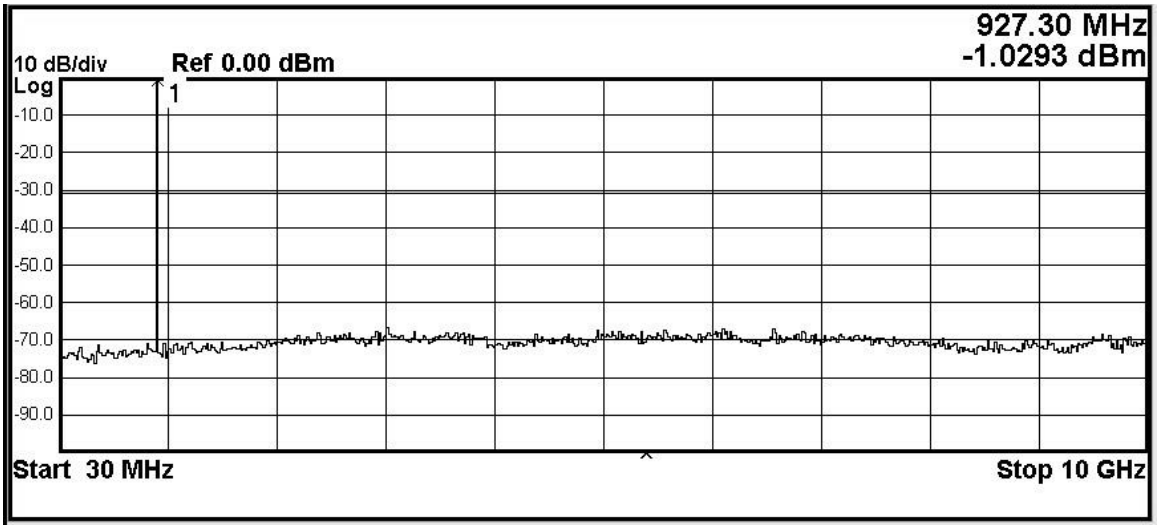
Ant1: 926.9 MHz & 927.5 MHz (Cable Loss + Attenuation = 29.94 dB):

There were no reportable emissions.

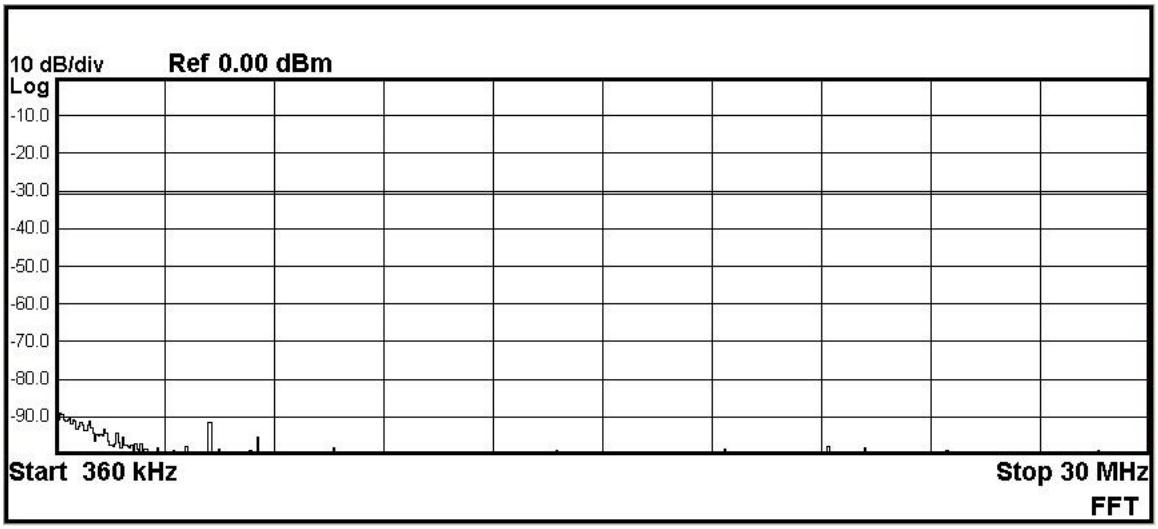
Conducted Emissions: 1 Carrier, Ant0:



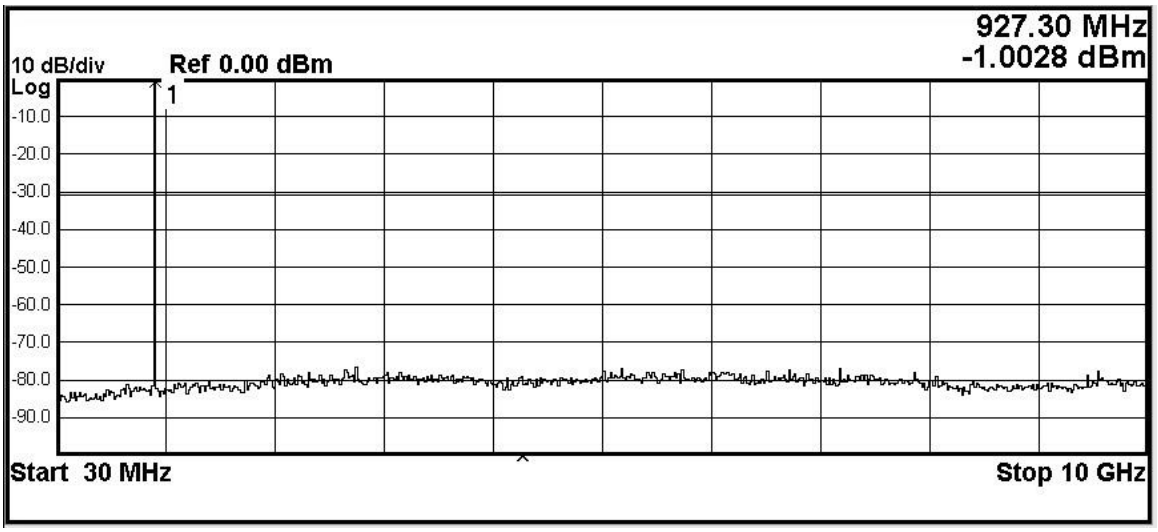
Conducted Emissions: 1 Carrier, Ant0:



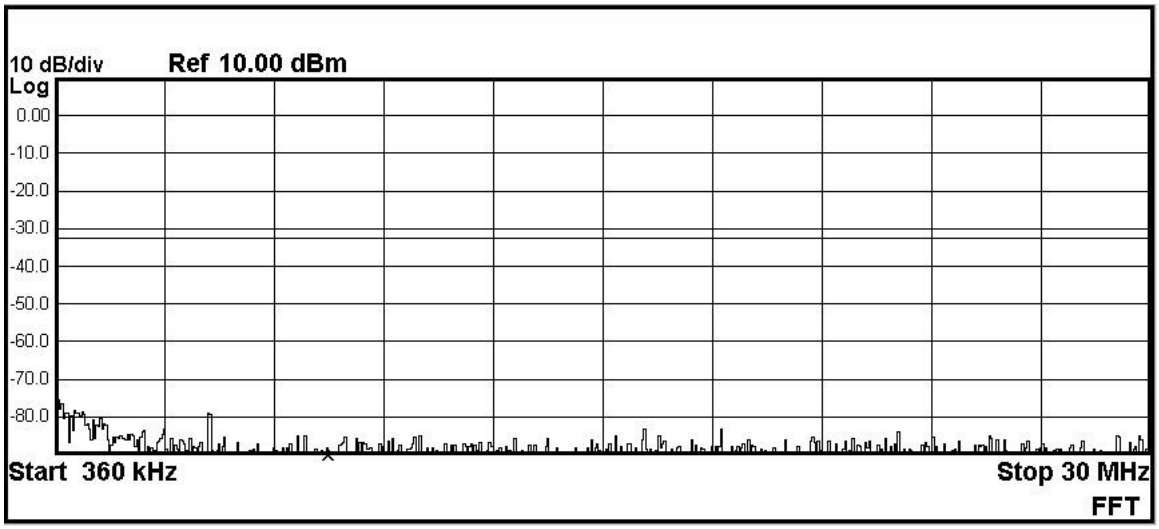
Conducted Emissions: 1 Carrier, Ant1:



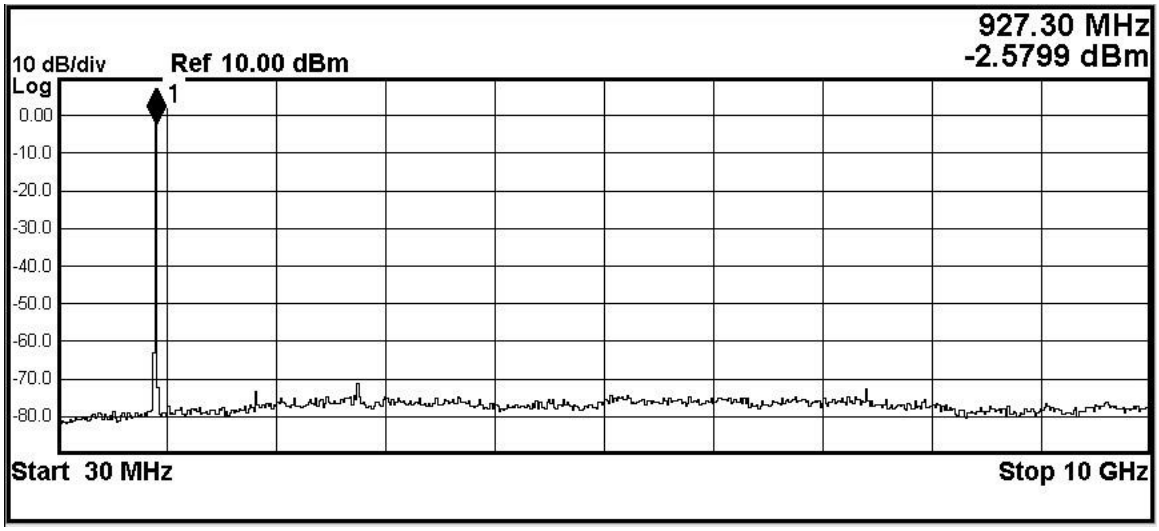
Conducted Emissions: 1 Carrier, Ant1:



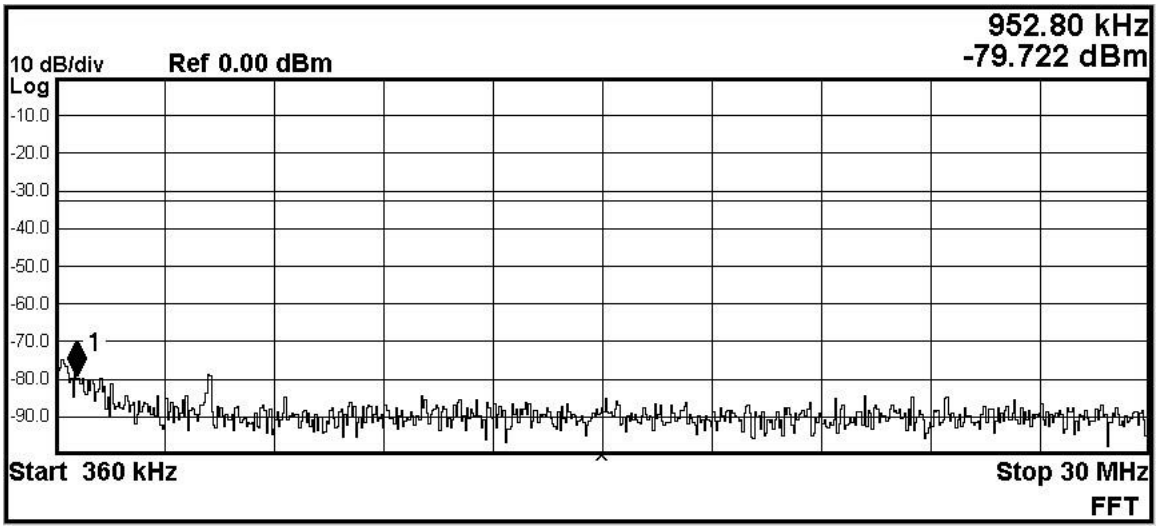
Conducted Emissions: 2 Carriers, Ant0:



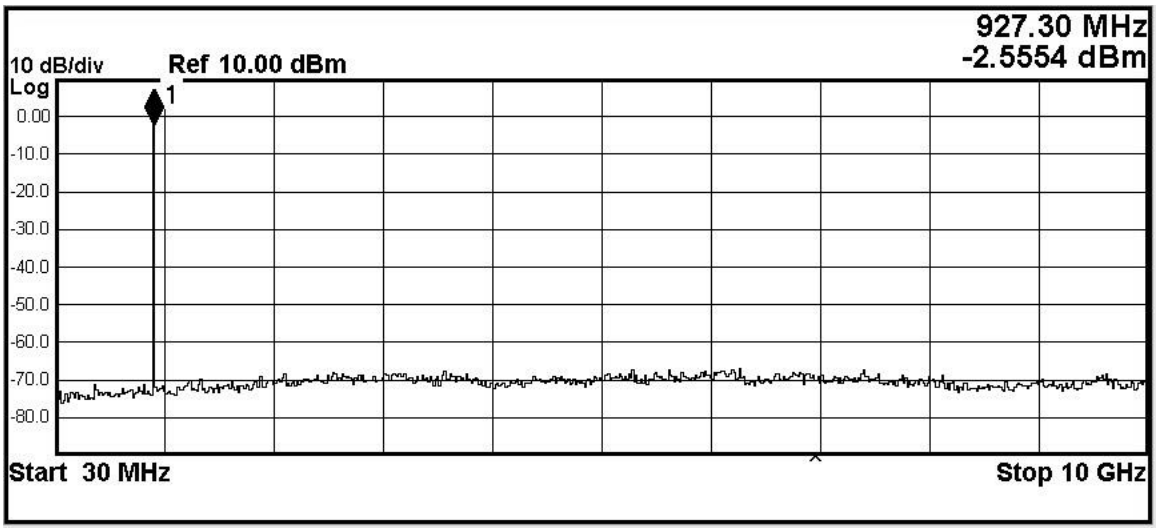
Conducted Emissions: 2 Carriers, Ant0:



Conducted Emissions: 2 Carriers, Ant1:



Conducted Emissions: 2 Carriers, Ant1:



2.7 EUT Positioning Assessment

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

EUT status: Not Applicable

The EUT is specified for fixed installation.

For details, refer to the installation instructions in the User Manual.

2.8 Radiated Spurious Emissions

Test Lab: Electronics Test Centre, Airdrie	**EUT: Kona Macro Gateway**
Test Personnel: David Raynes	**Standard: FCC PART 15.247**
Date: 2017-02-23 (18.5° C, 20.5% RH) **Date: 2017-02-24 (20.1° C, 18.9% RH)** **Date: 2017-02-27 (17.9° C, 14.7% RH)** **Date: 2017-03-02 (17.9° C, 14.5% 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 13.4.2

From 9kHz 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.

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	2015-04-10	2017-04-10
Biconilog Antenna	ARA	LPB-2520/A	4318	2016-05-18	2018-05-18
Filter	K&L	D5TNF-800/1000-1.1-N/N-GRI	S/N 1	Monitored	
DRG Horn	EMCO	3115	19357	2016-08-24	2018-08-24
Low Noise Amplifier (1 – 18 GHz)	MITEQ	JS43-01001800-21-5P	4354	Monitored	
Temp/Humidity	Extech	42270	5892	2016-04-07	2017-04-07

2.8.5 Test Sample Verification, Configuration & Modifications

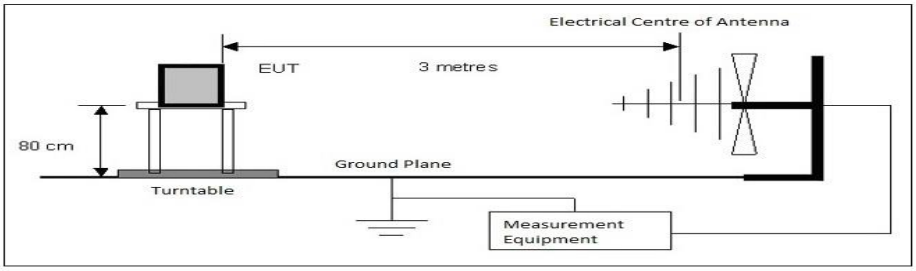
The EUT was set to selected channels with test-specific software. The output was modulated as in normal operation. Configuration for 2-Carrier operation on ANT0 port at 924.5 MHz & 925.1 MHz, and 1-carrier operation on ANT1 port at 925.7 MHz was selected as the worst-case for detailed examination. This selection was based on the absence of harmonic emissions with any of the Tx channels selected, and the opportunity to use a single band-reject filter to block the carrier fundamentals while making measurements between 1 GHz and 1.3 GHz. The 3G/4G backhaul was operating in LTE mode (Tx @ 777-787MHz). The emissions measured in this section of the report are either unintentional emissions (as reported separately in Test Report # t29e17a146-1), or points selected to demonstrate noise floor margin.

The 3G/4G backhaul output was connected to a PCTEL BMHO69027002NF omnidirectional antenna rated at 2 dBi Gain. Both LoRa outputs were connected to L-com HG908U-PRO omnidirectional antennas, rated at 8 dBi Gain. For 1-carrier operation, the reduced output power compensates for the extra antenna gain. For 2-carrier operation, the total output is at the permitted maximum, so 2 dB of attenuation was applied to reduce the effective antenna gain to 6 dBi.

The LoRa antennas were mounted 1.9 m above the ground plane, on masts 1.5 m apart. The 3G/4G antenna was mounted on one of the masts, 1.2 m above the ground plane.

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.
- The EUT was assessed up to 10 GHz. To prevent LNA saturation, a band-reject filter was used to block frequencies between 924 MHz and 926 MHz.
- Pursuant to Part 15.31(o), emissions that are more than 20 dB below the applicable limit are not reported.

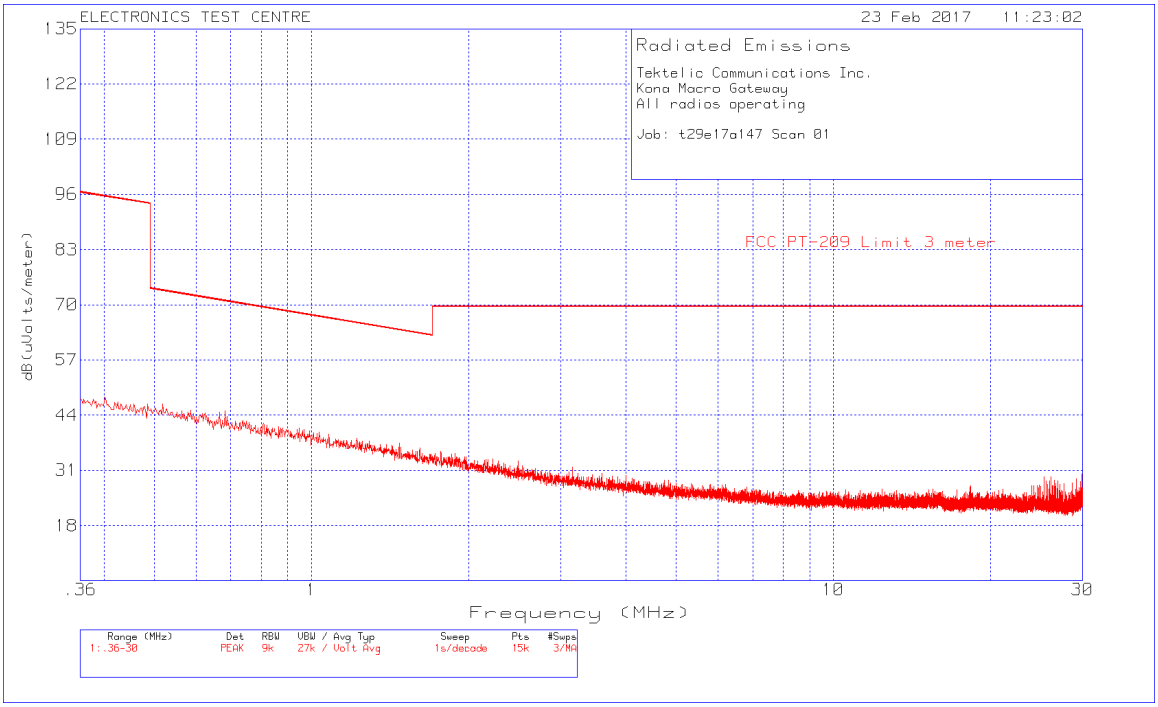
Negative values for Delta indicate compliance.

Transmit Mode, ANT0 port at 924.5 MHz & 925.1 MHz, and ANT1 port at 925.7 MHz:

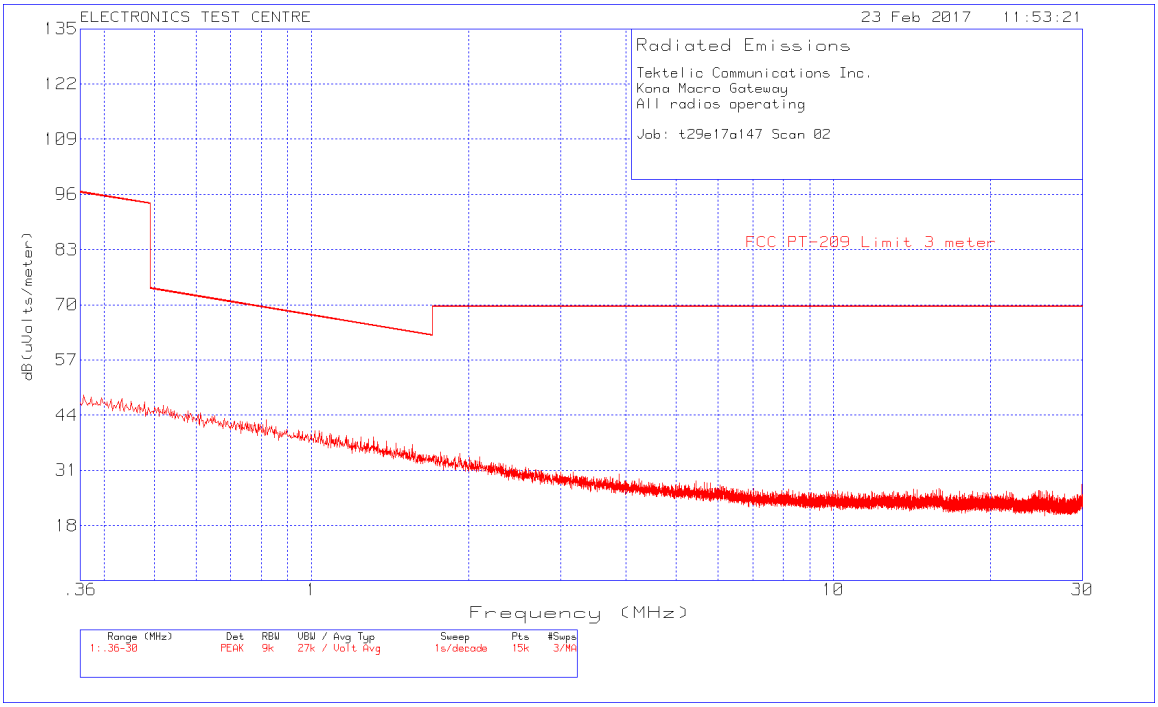
Freq. Marker	Freq. [MHz]	Raw reading [dBµv]	Det	Antenna Factor [dB/m]	Cable Loss [dB]	Corrected Reading [dBµv/m]	FCC 15.209 Limit [dBµv/m]	Delta [dB]	Azimuth [Deg]	Height [cm]	Polarization
1	31.4298	32.31	QP	21.7	-25.1	28.91	40.00	**-11.09**	304	102	Vertical
1	134.9892*	30.20	QP	13.7	-6.9	37.00	43.52	**-6.52**	329	245	Horizontal
2	404.9993*	36.67	QP	19.9	-18.3	38.27	46.02	**-7.75**	173	145	Horizontal
3	647.9672	24.72	QP	23.7	-16.8	31.62	46.02	**-14.40**	54	101	Horizontal
4	674.9679	31.36	QP	23.5	-16.5	38.36	46.02	**-7.66**	13	167	Horizontal
1	102.6362	26.19	QP	13.3	-3.5	35.99	43.52	**-7.53**	12	114	Vertical
2	109.1876*	25.21	QP	14.4	-4.3	35.31	43.52	**-8.21**	278	284	Vertical
3	125.0079*	28.79	QP	15.0	-6.0	37.79	43.52	**-5.73**	325	105	Vertical
4	135.0102*	33.97	QP	13.7	-6.9	40.77	43.52	**-2.75**	359	210	Vertical
5	139.4493	29.10	QP	13.0	-7.1	35.00	43.52	**-8.52**	143	255	Vertical
6	174.9768	28.87	QP	13.8	-8.3	34.37	43.52	**-9.15**	170	263	Vertical
7	404.996*	35.87	QP	19.9	-18.3	37.47	46.02	**-8.55**	163	100	Vertical
8	674.9875	32.50	QP	23.5	-16.5	39.50	46.02	**-6.52**	299	102	Vertical
1	1237.8*	26.09	Av	25.1	-16.0	35.19	53.98	**-18.79**	64	321	Horizontal
2	1238.1*	26.10	Av	25.1	-16.0	35.20	53.98	**-18.78**	69	186	Vertical
1	1301.6*	25.58	Av	25.3	-15.4	38.48	53.98	**-15.50**	20	284	Horizontal
2	2440.2	28.80	Av	28.7	-24.1	33.40	53.98	**-20.58**	309	176	Horizontal
3	2433.8	26.98	Av	28.7	-24.1	31.58	53.98	**-22.40**	269	148	Vertical
4	2458.2	27.09	Av	28.7	-24.3	31.40	53.98	**-22.58**	182	178	Vertical
4	2458.2	56.12	Pk	28.7	-24.3	60.52	73.98	**-13.46**	182	178	Vertical
1	8474.1*	21.44	Av	37.3	-23.2	35.54	53.98	**-18.44**	22	200	Horizontal
2	8626.9	21.60	Av	37.3	-23.4	35.50	53.98	**-18.48**	78	126	Horizontal
3	9546.2	18.58	Av	37.7	-26.5	29.78	53.98	**-24.20**	3	210	Horizontal
4	9915.8	19.46	Av	38.1	-23.6	33.96	53.98	**-20.02**	88	228	Horizontal
5	8171.1*	20.58	Av	36.7	-23.7	33.58	53.98	**-20.40**	212	107	Vertical
6	8525.4	21.50	Av	37.3	-23.1	35.70	53.98	**-18.28**	110	103	Vertical
7	9918.1	19.42	Av	38.1	-23.5	34.02	53.98	**-19.96**	194	102	Vertical

*** Restricted Band**

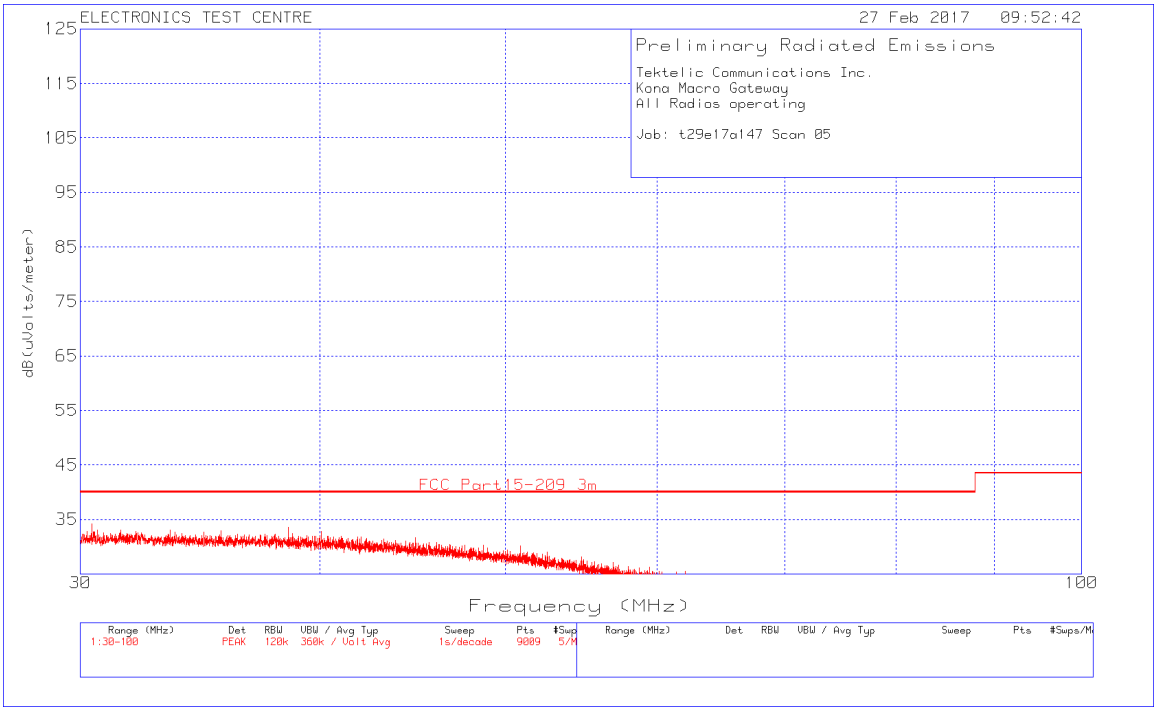
Plot of Radiated Emissions: Measuring Antenna 1st Orientation



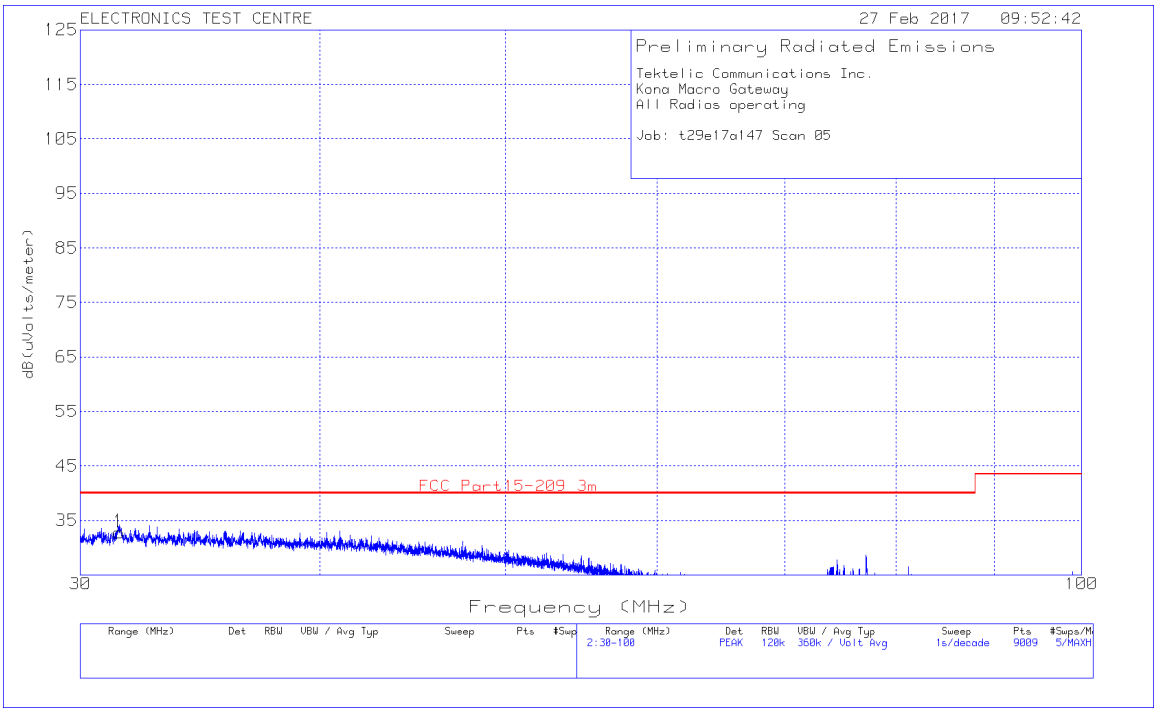
Plot of Radiated Emissions: Measuring Antenna 2nd Orientation



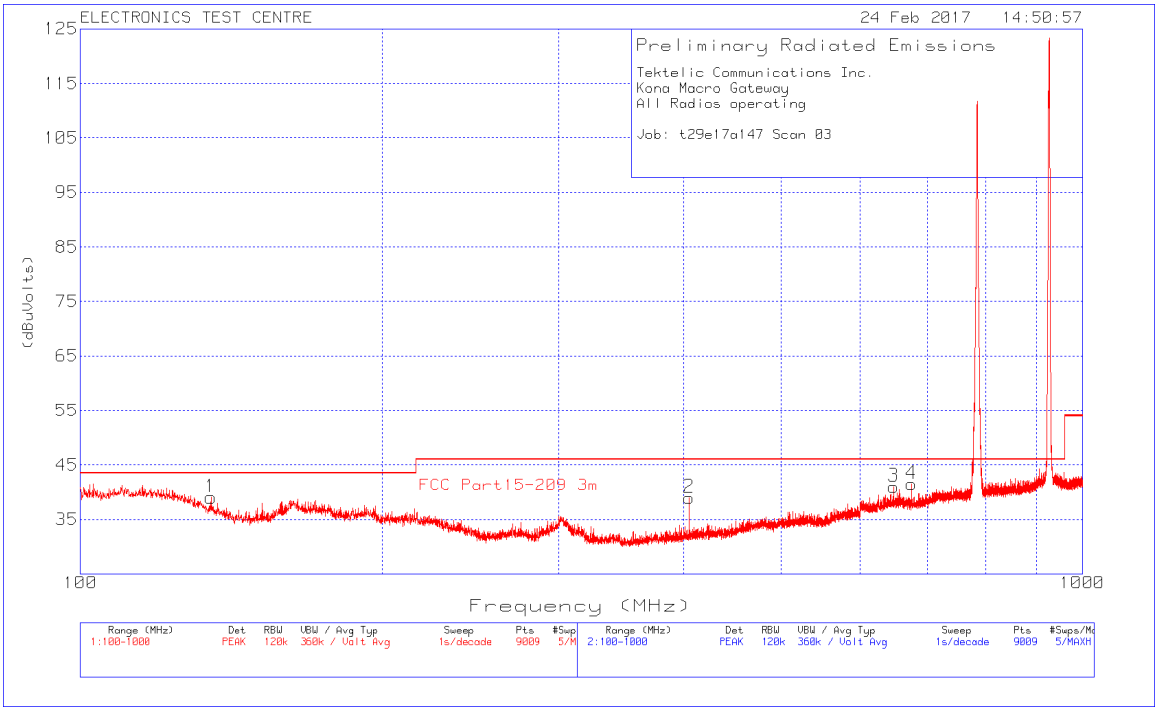
Plot of Radiated Emissions: Horizontal polarization



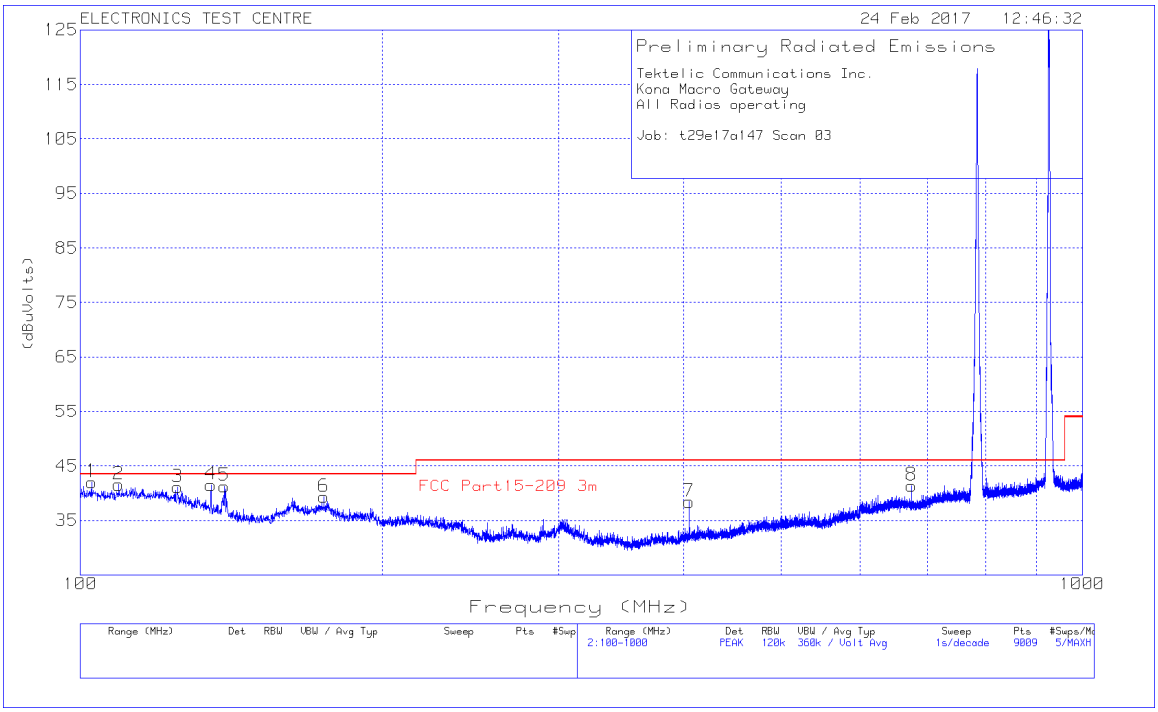
Plot of Radiated Emissions: Vertical polarization



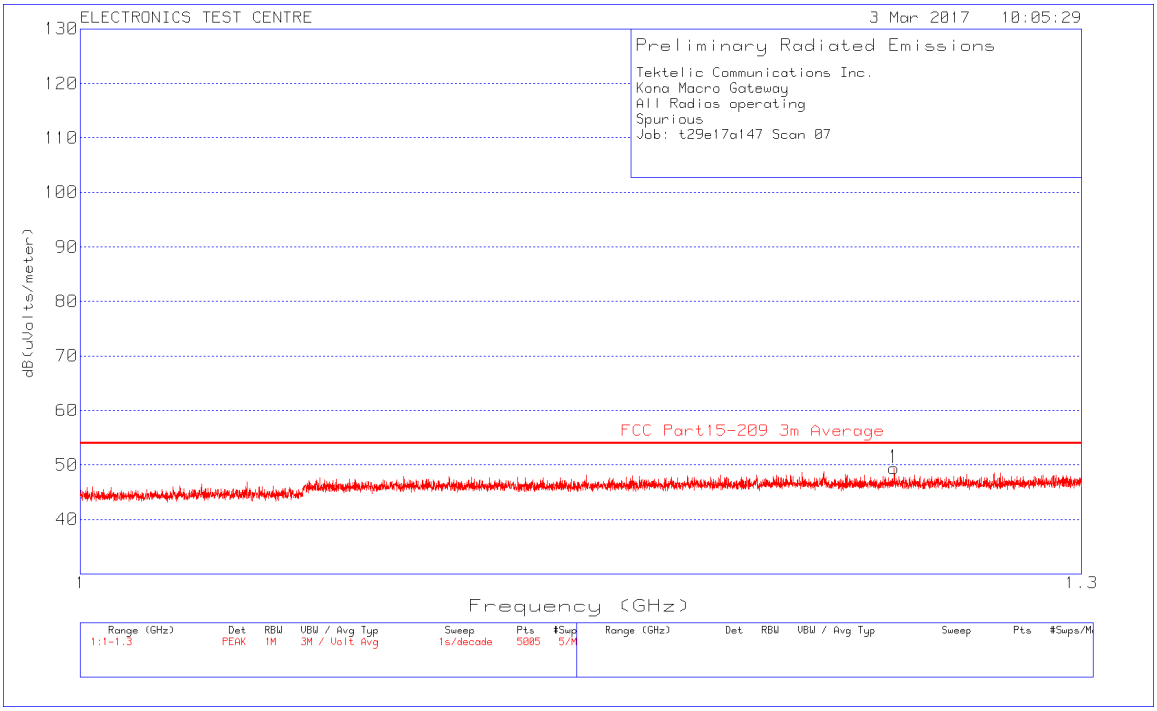
Plot of Radiated Emissions: Horizontal polarization



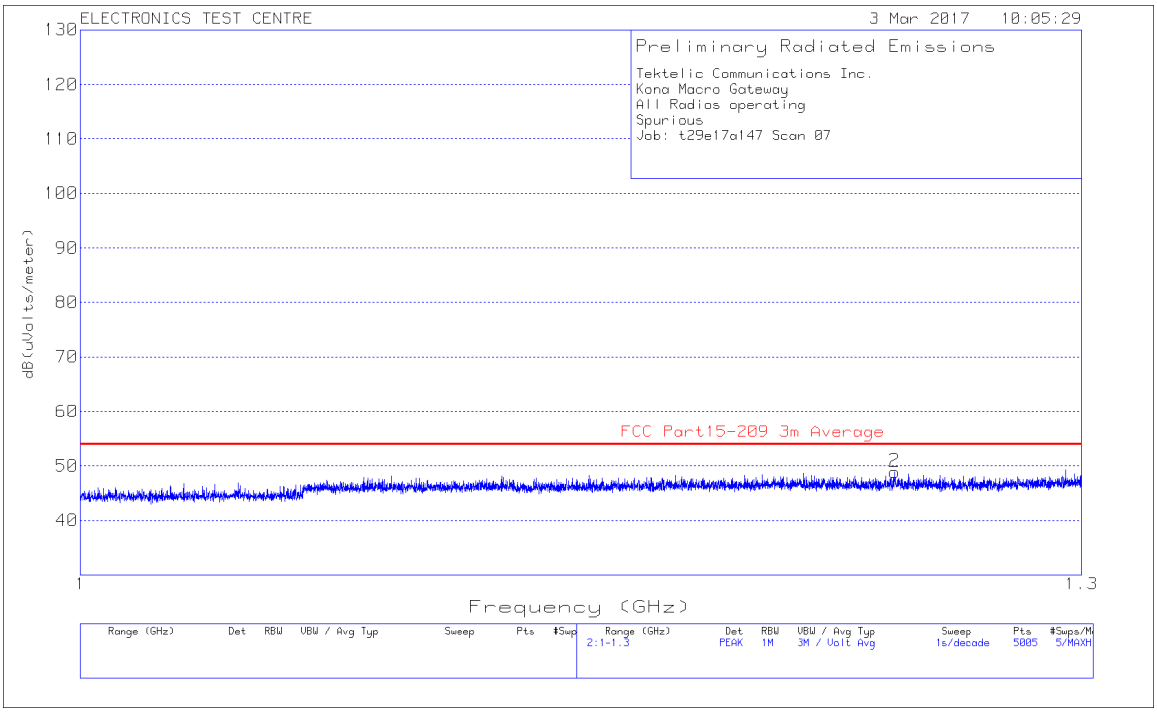
Plot of Radiated Emissions: Vertical polarization



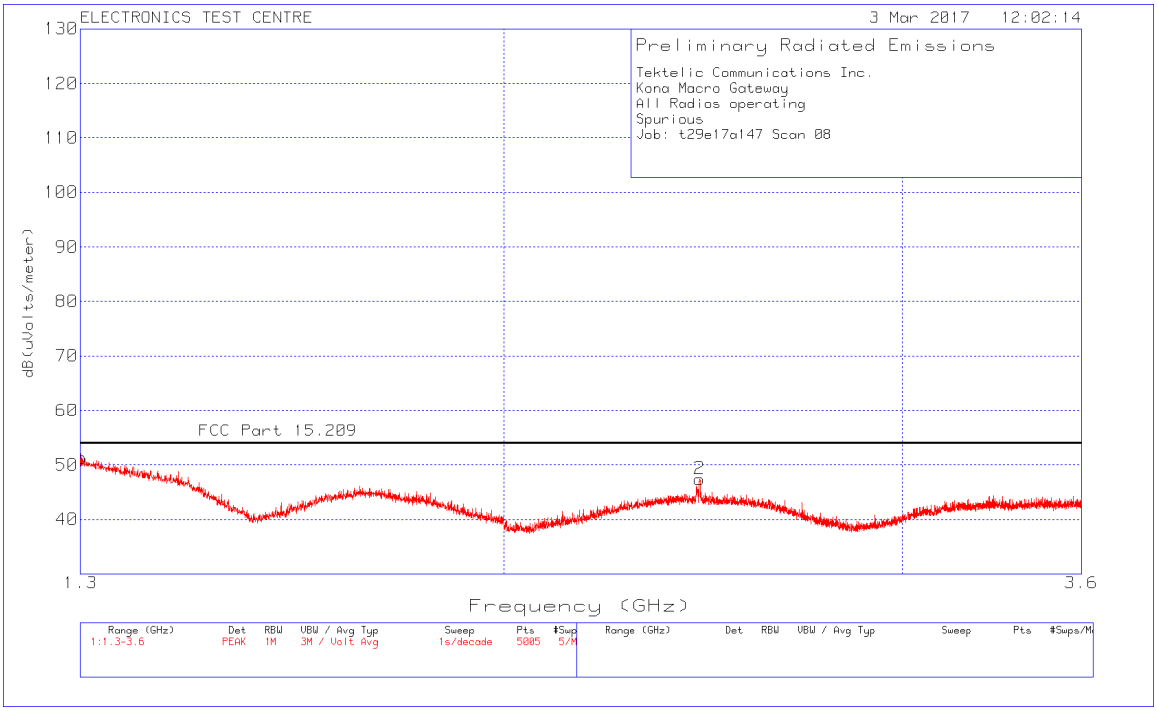
Plot of Radiated Emissions: Horizontal polarization



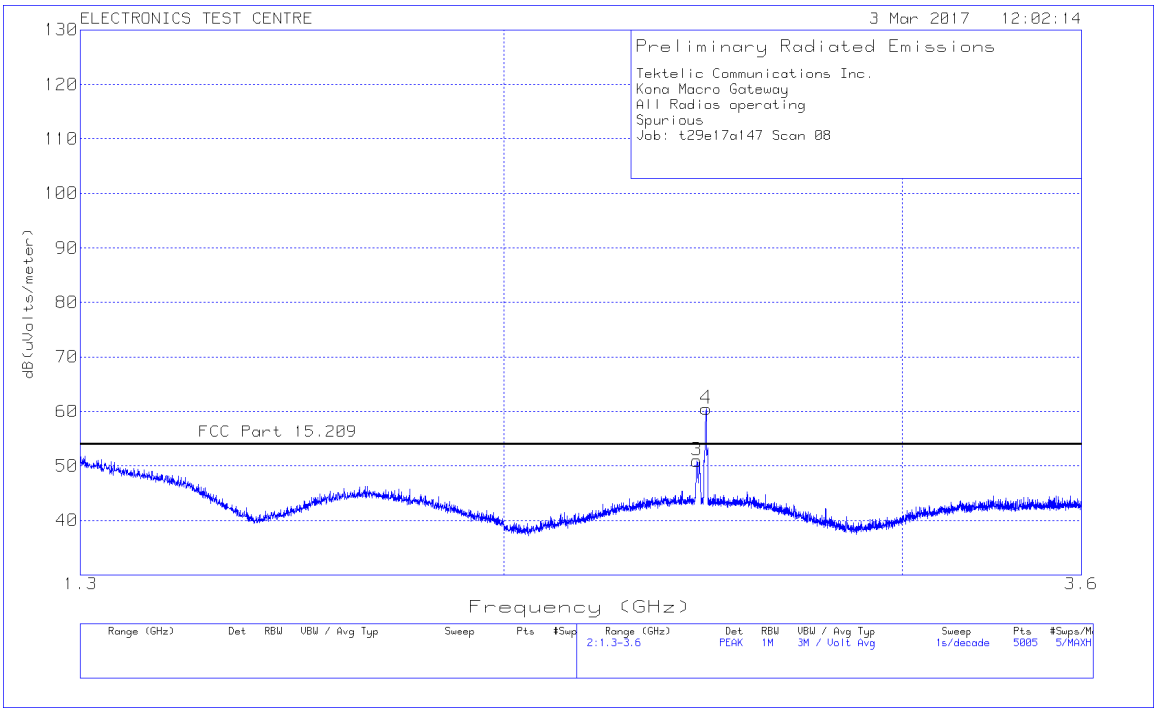
Plot of Radiated Emissions: Vertical polarization



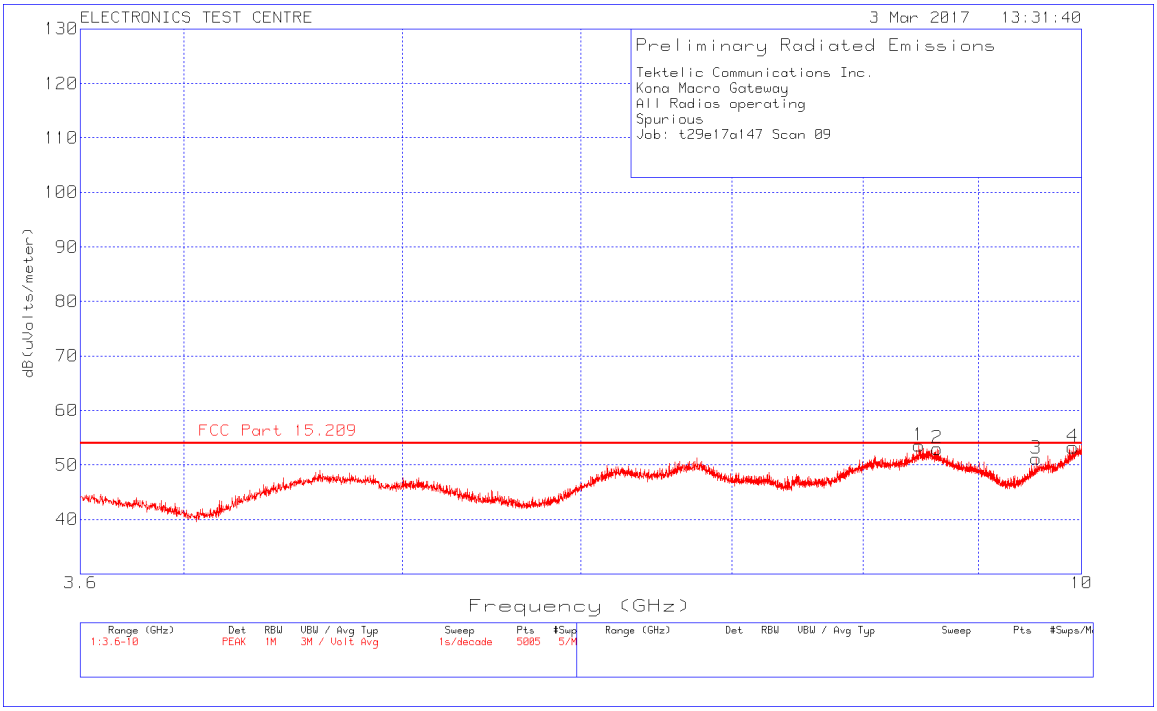
Plot of Radiated Emissions: Horizontal polarization



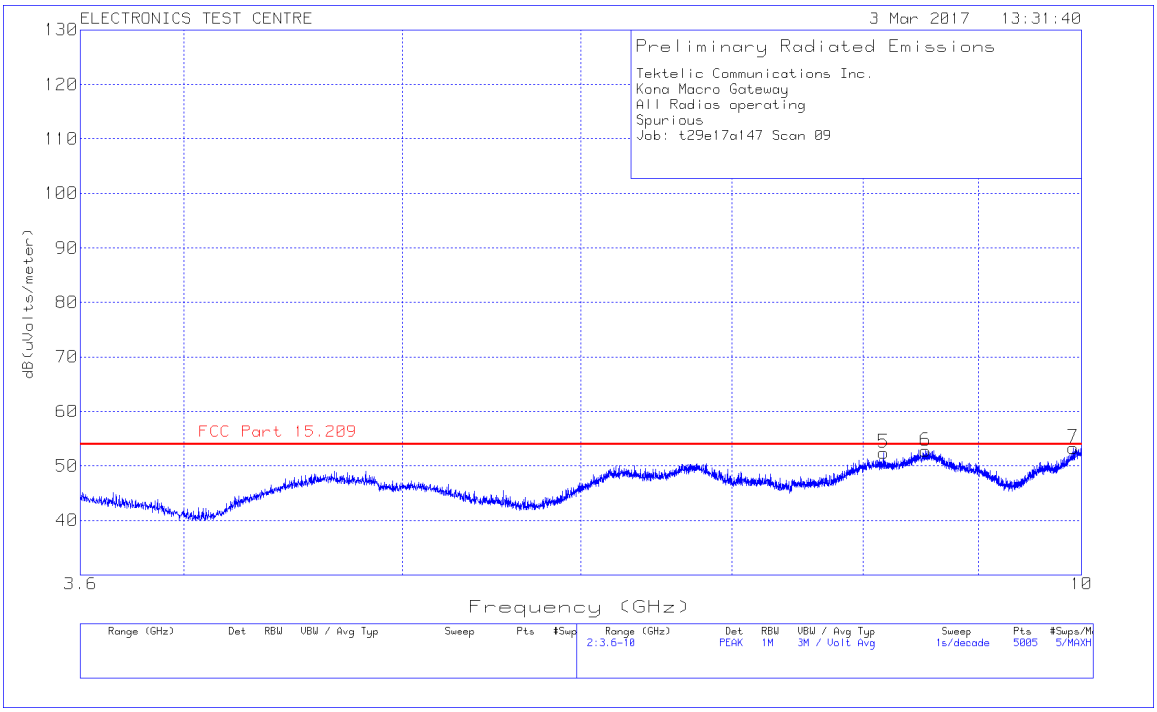
Plot of Radiated Emissions: Vertical polarization



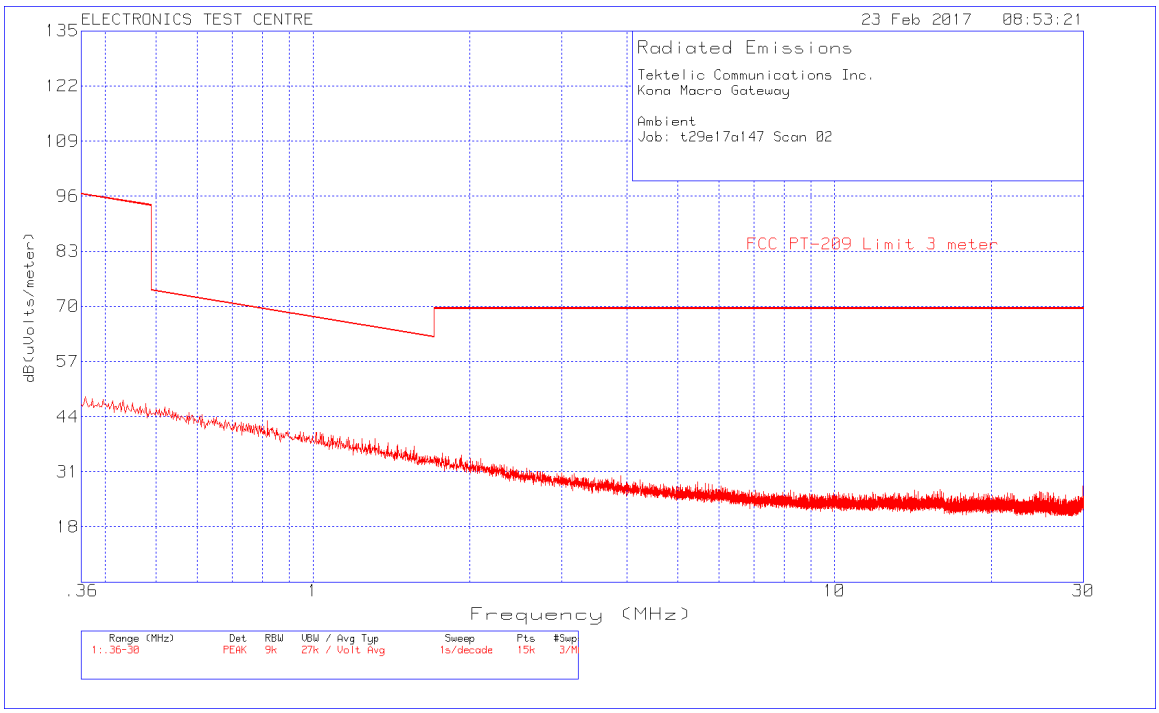
Plot of Radiated Emissions: Horizontal polarization



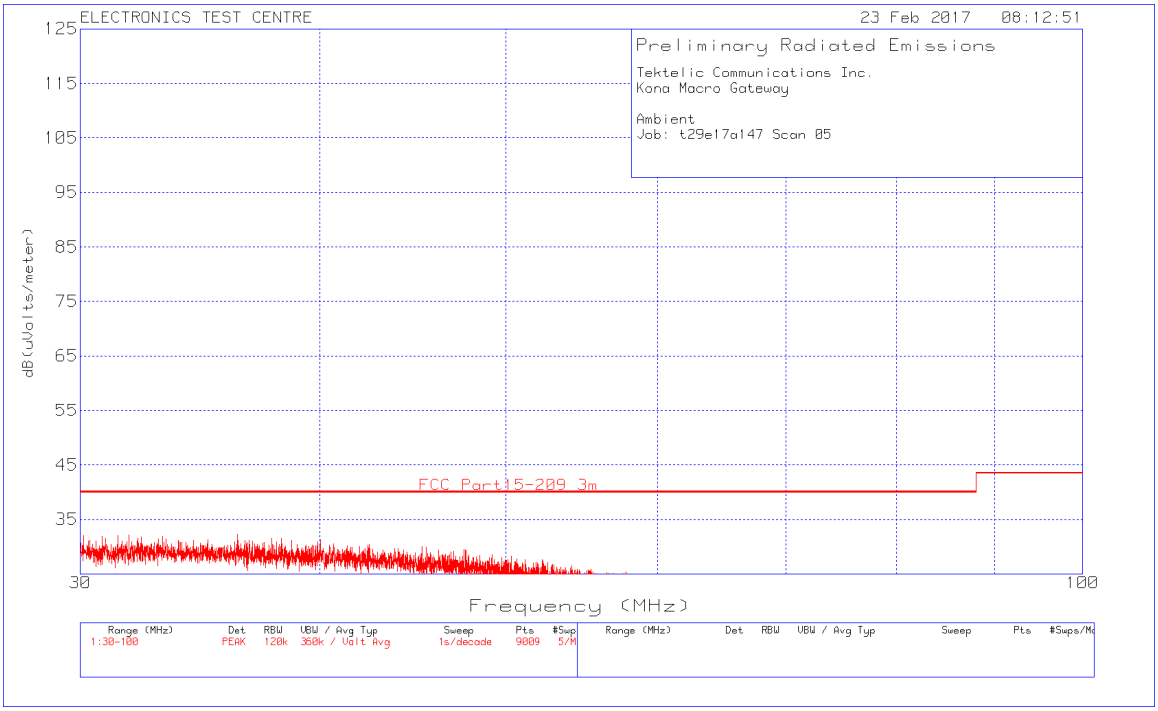
Plot of Radiated Emissions: Vertical polarization



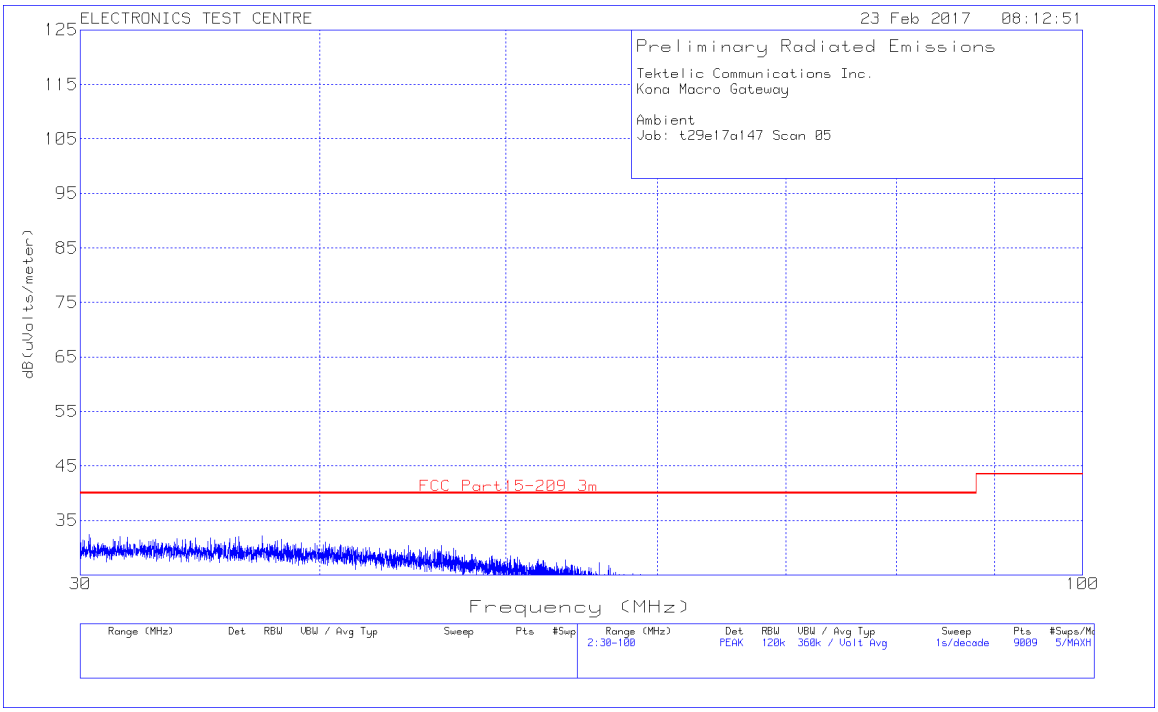
Plot of Test Chamber Ambient: (measurement noise floor):



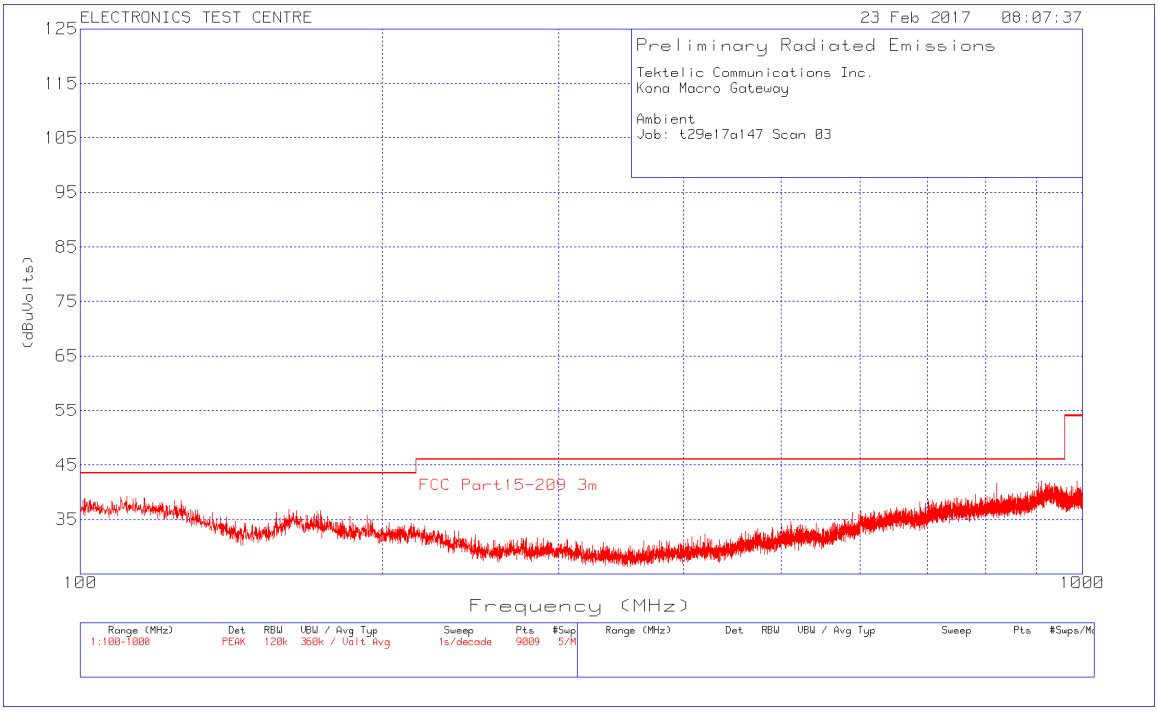
Plot of Test Chamber Ambient: (measurement noise floor):



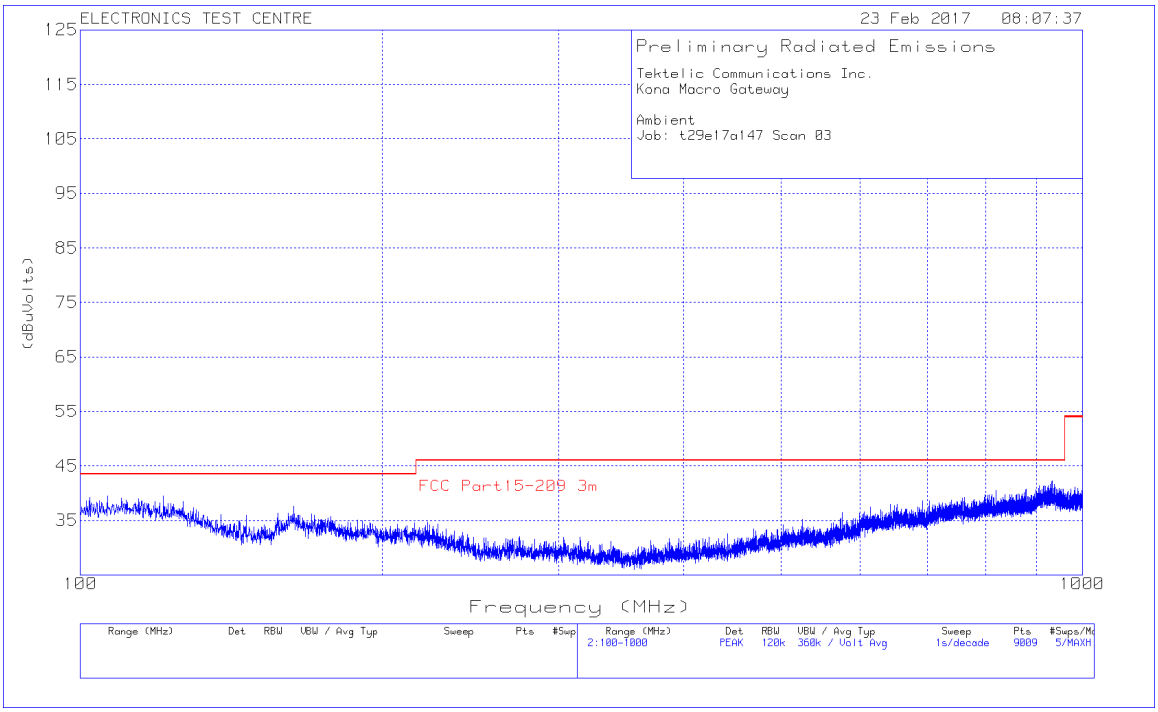
Plot of Test Chamber Ambient: (measurement noise floor):



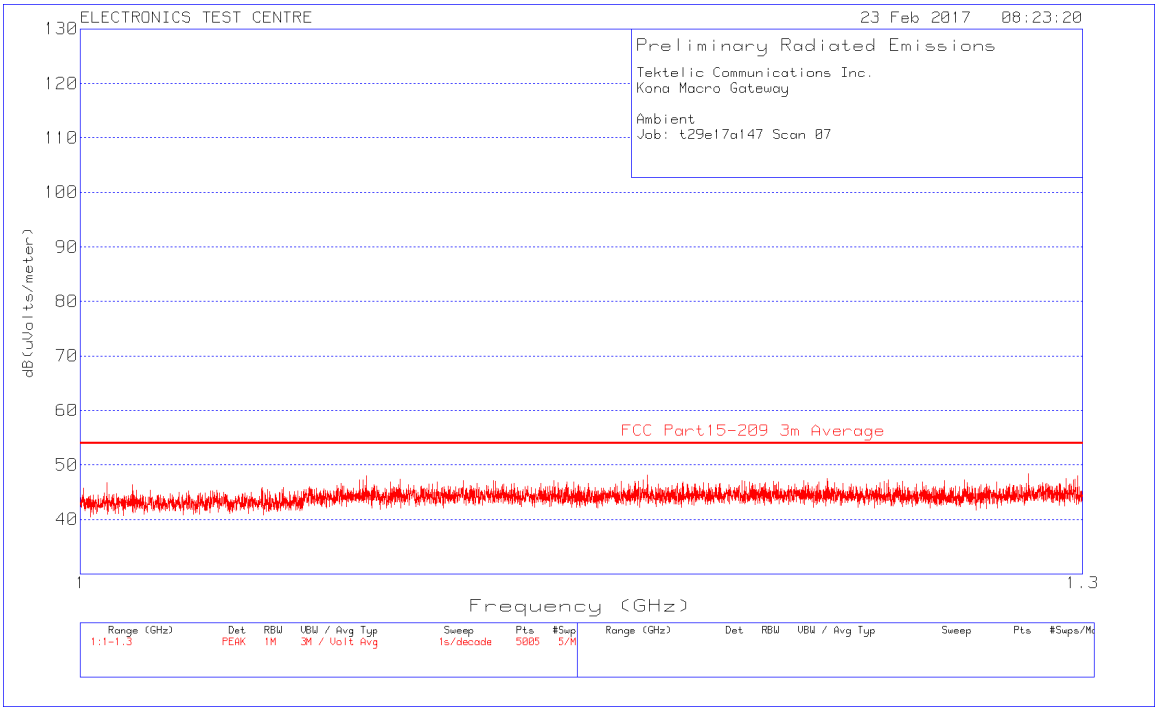
Plot of Test Chamber Ambient: (measurement noise floor):



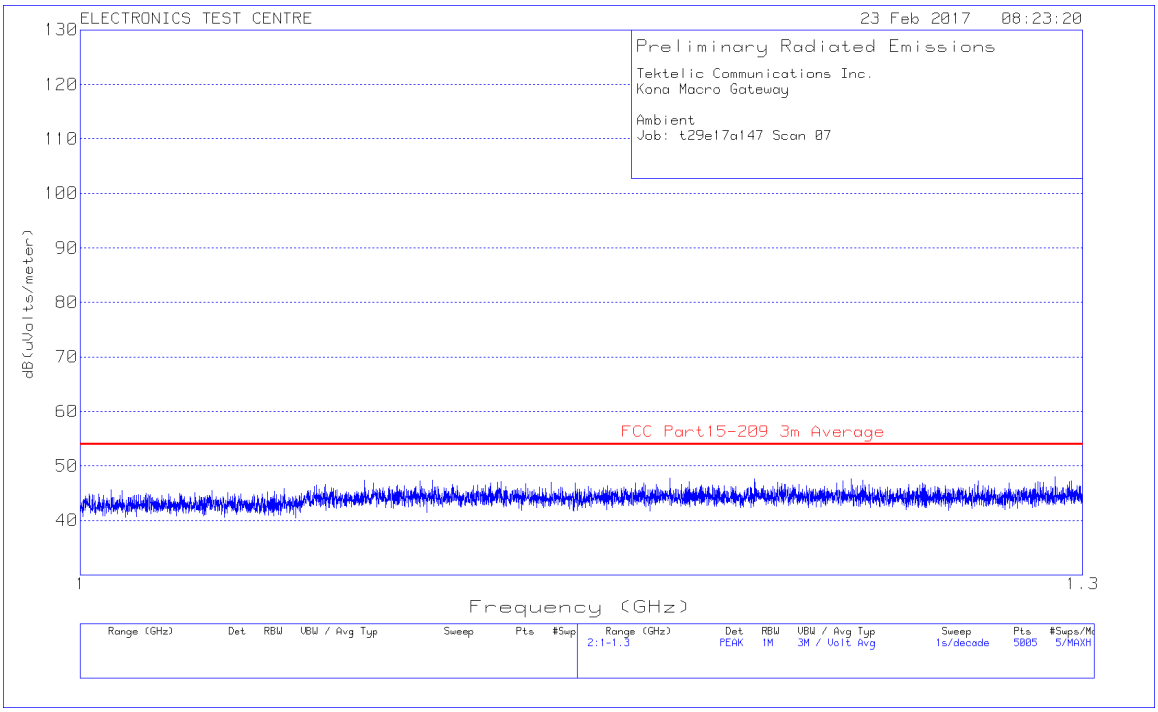
Plot of Test Chamber Ambient: (measurement noise floor):



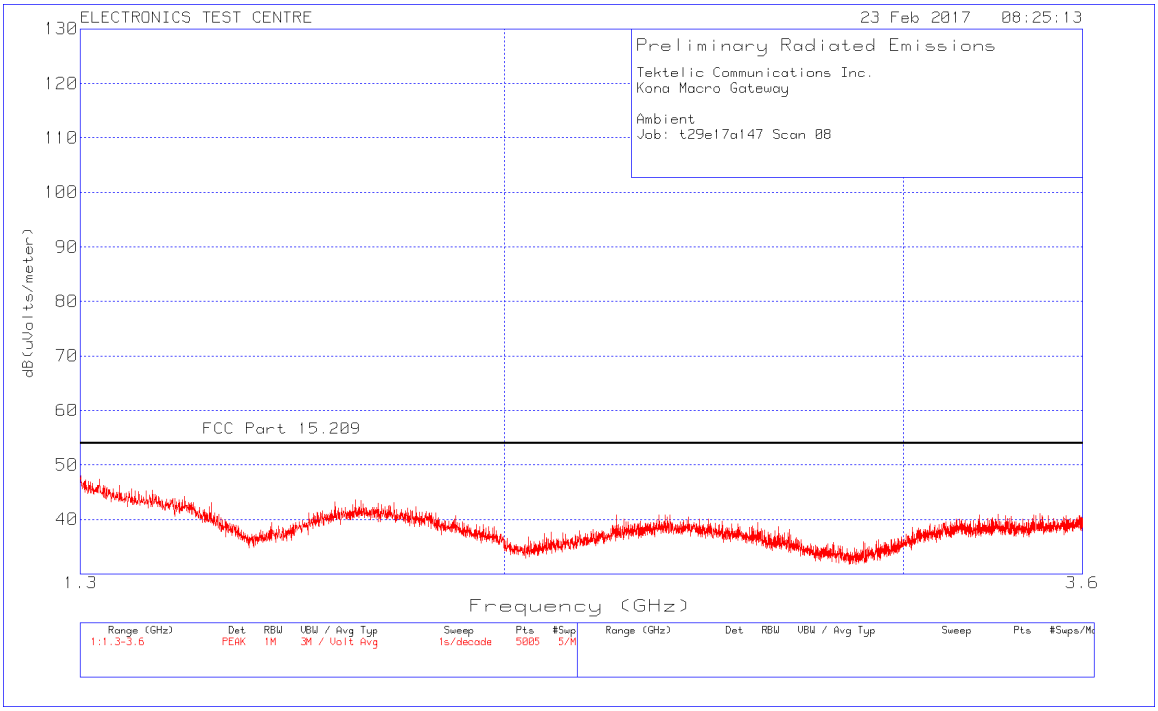
Plot of Test Chamber Ambient: (measurement noise floor):



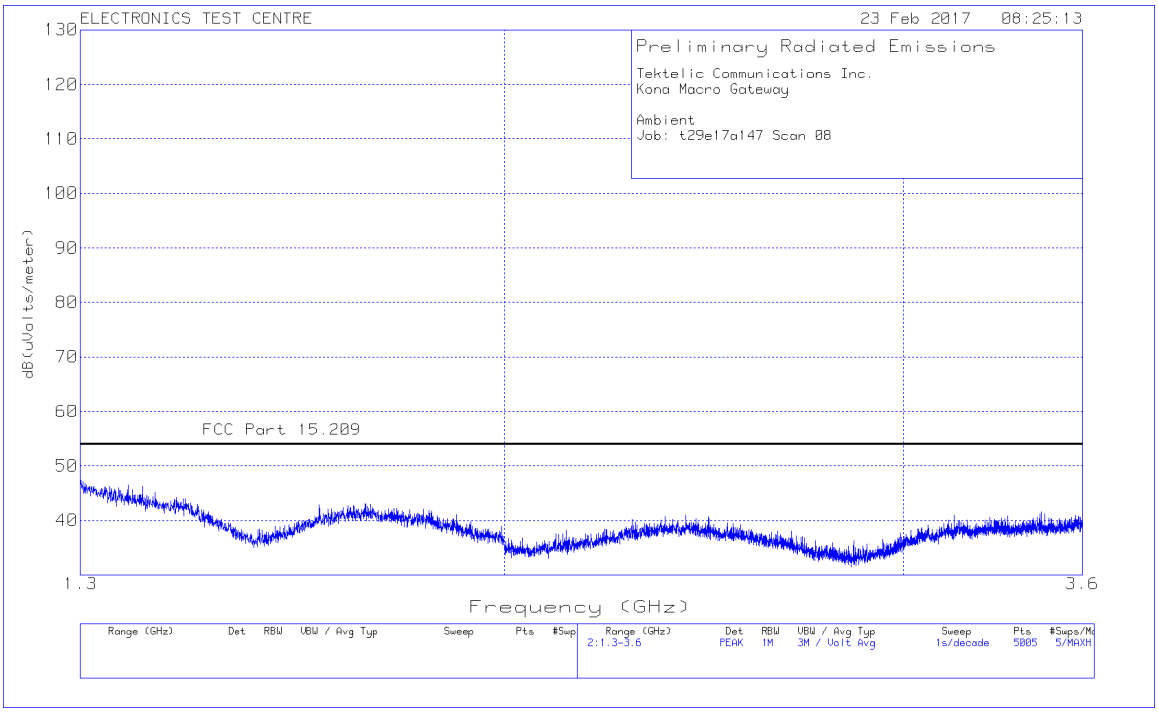
Plot of Test Chamber Ambient: (measurement noise floor):



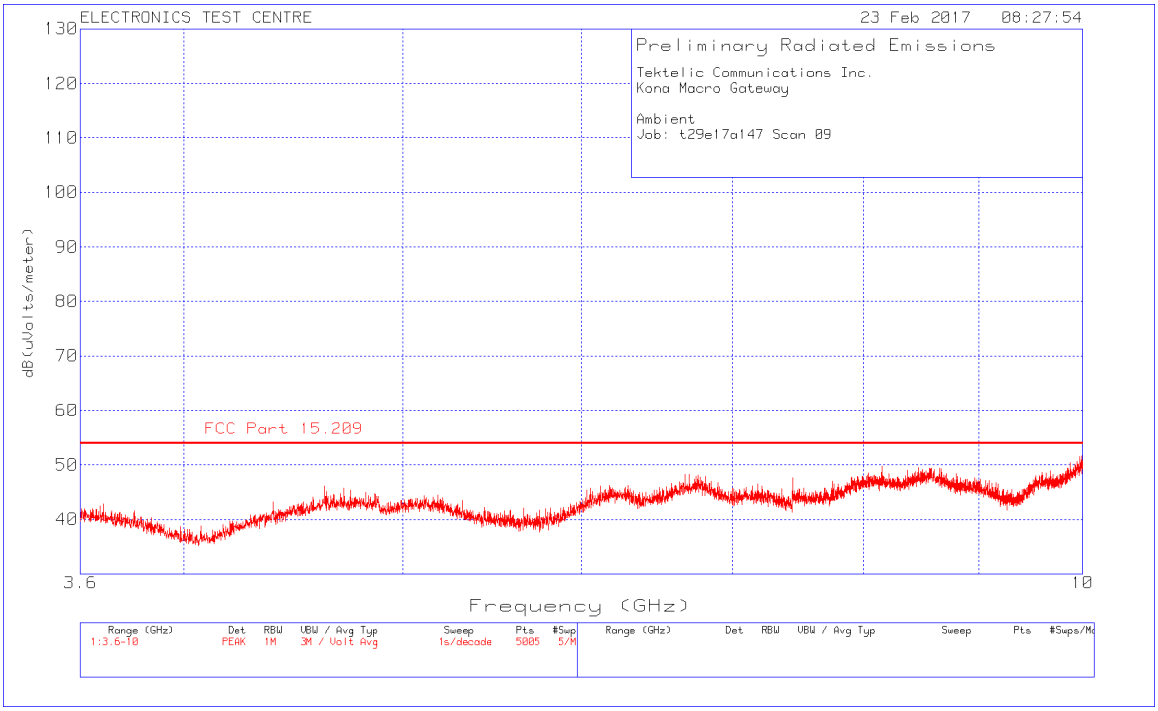
Plot of Test Chamber Ambient: (measurement noise floor):



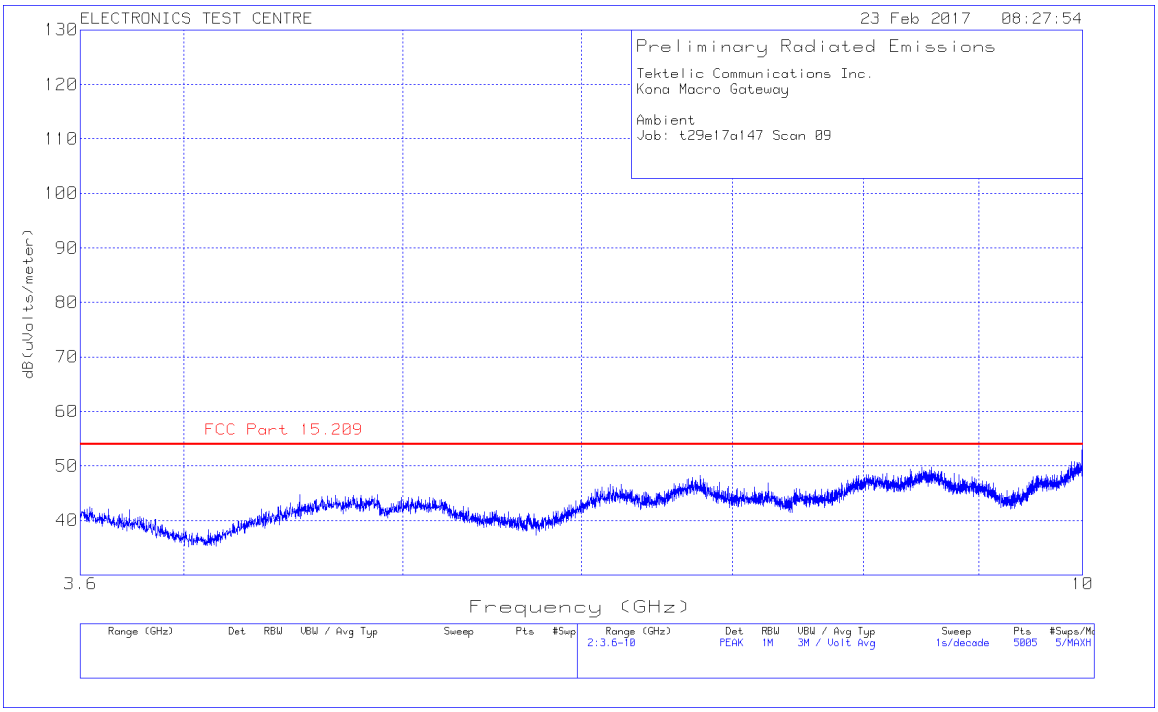
Plot of Test Chamber Ambient: (measurement noise floor):



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



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



2.9 RF Exposure

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

EUT status: Compliant

Compliant: Environmental Assessment provided in a separate Exhibit.

3.0 TEST FACILITY

3.1 Location

The Kona Macro 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 Kona Macro Gateway was placed at the centre of the test chamber turntable on a wooden mast. The antennas were mounted on metal masts 1.5 m apart. The EUT was grounded according to Tektelic Communications Inc specifications.

3.3 Power Supply

All EUT power was supplied by a filtered 48 VDC source.

3.4 Emissions Profile

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

Appendix A – Antenna datasheets

L-com Global Connectivity www.L-com.com

HyperLink Wireless 900 MHz 8 dBi Professional High Performance Omni Antenna
Model: HG908U-PRO

Applications

- 900 MHz ISM band
- 900 MHz wireless video
- Point to multi-point and Non Line Of Sight (NLOS) applications
- GSM, SCADA applications
- 900 MHz cellular band

Features

- Rugged industrial grade design
- Lightweight fiberglass radome
- All weather operation
- Integral N-Female connector
- Includes heavy duty steel mast mounting brackets

RoHS Compliant

Description

The HyperLink HG908U-PRO is a high performance Omni-directional antenna designed for the 900 MHz ISM band. It is ideally suited for multipoint, Non Line of Sight (NLOS) and mobile applications where high gain and wide coverage is desired. Typical applications include 900MHz Wireless LAN, SCADA, Wireless Video Links and 900MHz Cellular band applications.

This antenna features an integral N-Female type connector that mounts through the wall of an equipment enclosure. Included with the HG908U-PRO is a dual u-bolt mast mounting kit. Consisting of a heavy-duty steel bracket and a pair of U-bolts, this kit allows installation on masts up to 2.0" in diameter.

This antenna's construction features a rugged 1.58" diameter white fiberglass radome for durability, aesthetics and long service life. It is designed for all weather operation.

Specifications

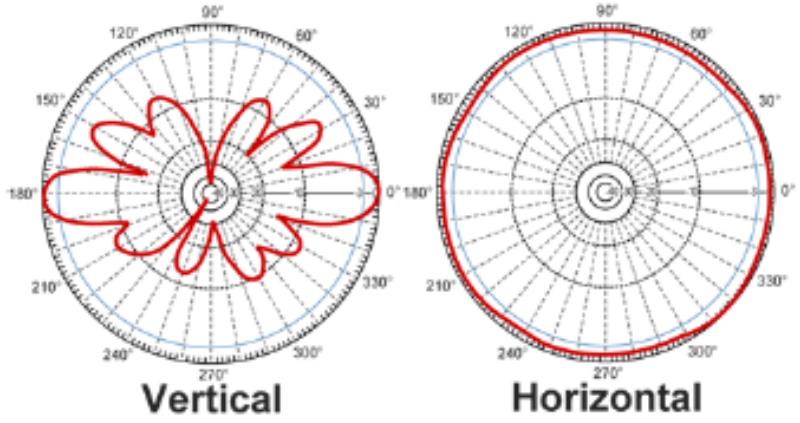
Electrical Specifications

Frequency	900 – 928 MHz
Gain	8 dBi
Impedance	50 Ohm
Horizontal Beam Width	360°
Vertical Beam Width	12°
Polarization	Vertical
VSWR	< 1.5
Max. Input Power	100 Watt
Lightning Protection	DC Ground

Mechanical Specifications

Connector	N-Female
Weight (Including Bracket)	3.75 lbs. (1.7 kg)
Length	63 in. (1.6m)
Radome Diameter	1.5 in. (38mm)
Mast Mounting Dia.	1.2 to 2 in. (31.7 to 50.8 mm)
Operating Temperature	-40° C to 60° C (-40° F to 140° F)
Max. Wind Velocity	210km/h (130mph)
RoHS Compliant	Yes

RF Antenna Patterns



INFRASTRUCTURE ANTENNAS

Omnidirectional Antenna - 4G LTE Vented

BMHO69027002NF

PCTEL®

VenU® 4G LTE/Cellular & Wi-Fi Omnidirectional Antenna

The VenU BMHO69027002 is a high performance omnidirectional antenna designed for outdoor base station applications. It supports high capacity data throughput for 4G LTE Cellular, 3G and Wi-Fi wireless networks in a compact housing. The antenna can be direct mounted via a built-in N Female bulkhead termination that allows direct mounting to the radio equipment.

Features

- Rugged, UV-resistant, low-profile housing for outdoor applications
- Innovative vented design with aerated cap and base drain system
- N Female bulkhead for direct radio mount access

BMHO69027002NF

BAM1009 mount

STANDARD CONFIGURATION

Model	Connector	Mount
BMHO69027002NF	N Female bulkhead	BAM-1009 base station aluminum mount kit for masts up to 2.4 inches in diameter (sold separately)

ELECTRICAL SPECIFICATIONS - RF ANTENNA

Frequency Range	Gain	Azimuth Half Power Beamwidth	Elevation Half Power Beamwidth
690-960 MHz / 1700-2700 MHz	2 dBi / 2 dBi	360° / 360°	45° / 35°

ELECTRICAL SPECIFICATIONS - RF ANTENNA, continued

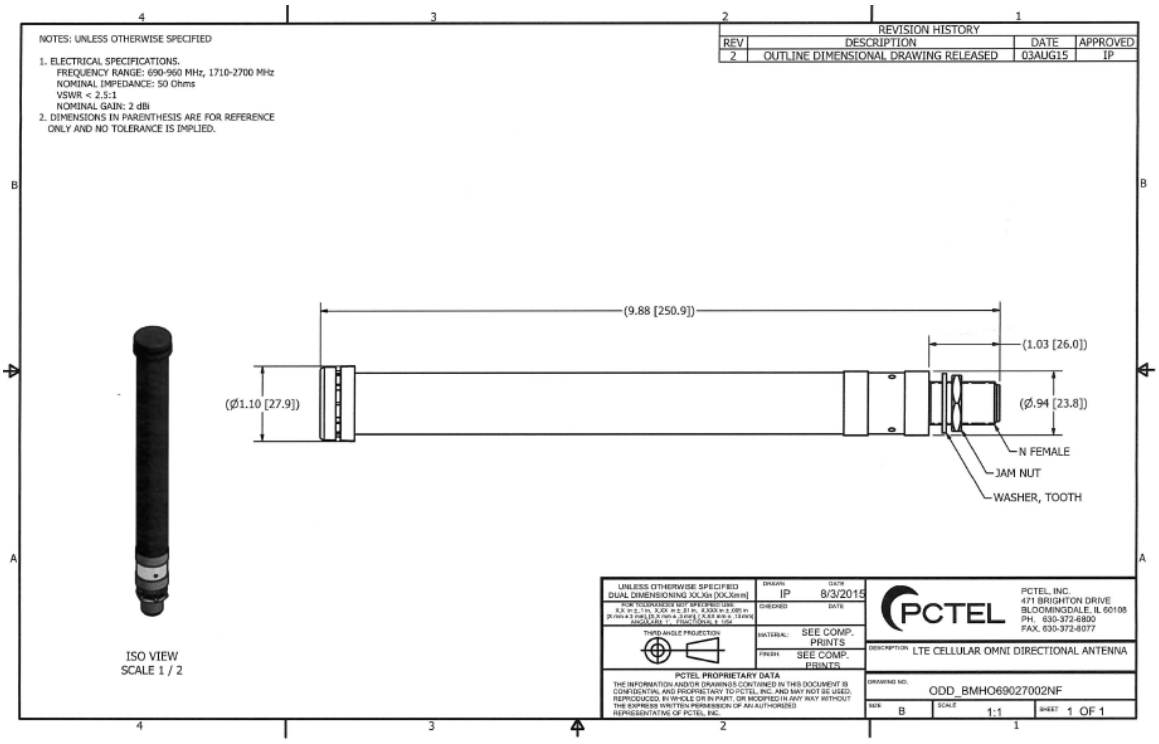
Average Power	Polarization	Nominal Impedance
25 watts max.	Vertical, linear	50 ohms

MECHANICAL & ENVIRONMENTAL SPECIFICATIONS

Dimensions	Weight	Housing Material
9 H x .94 OD in (22.86 x 2.38 cm)	0.30 lbs (0.14 kg)	Black UV-Stable ASA

MECHANICAL & ENVIRONMENTAL SPECIFICATIONS, continued

Rated Wind	Temperature Range	Lateral Thrust @ Rated Wind	Bending Moment @ Rated Wind
125 mph	-40°C to +85°C	3.1 lbs	1.1 ft-lbs


NOTES: UNLESS OTHERWISE SPECIFIED
1. ELECTRICAL SPECIFICATIONS.
FREQUENCY RANGE: 690-960 MHz, 1710-2700 MHz
NOMINAL IMPEDANCE: 50 Ohms
VSWR < 2.5:1
NOMINAL GAIN: 2 dBi
2. DIMENSIONS IN PARENTHESIS ARE FOR REFERENCE ONLY AND NO TOLERANCE IS IMPLIED.
REVISION HISTORY
REV DESCRIPTION DATE APPROVED
2 OUTLINE DIMENSIONAL DRAWING RELEASED 03AUG15 IP
(9.88 [250.9])
(1.03 [26.0])
(Ø1.10 [27.9])
(Ø.94 [23.8])
N FEMALE
JAM NUT
WASHER, TOOTH
ISO VIEW
SCALE 1 / 2
UNLESS OTHERWISE SPECIFIED
DUAL DIMENSIONING XX.Xin [XX.Xmm]
THIRD ANGLE PROJECTION
DRAWN IP 8/3/2015
CHECKED
MATERIAL: SEE COMP. PRINTS
FINISH: SEE COMP. PRINTS
PCTEL PROPRIETARY DATA
THE INFORMATION AND/OR DRAWINGS CONTAINED IN THIS DOCUMENT IS CONFIDENTIAL AND PROPRIETARY TO PCTEL, INC. AND MAY NOT BE USED, REPRODUCED, IN WHOLE OR IN PART, OR MODIFIED IN ANY WAY WITHOUT THE EXPRESS WRITTEN PERMISSION OF AN AUTHORIZED REPRESENTATIVE OF PCTEL INC.
PCTEL
PCTEL, INC.
471 BRIGHTON DRIVE
BLOOMINGDALE, IL 60108
PH. 630-372-6800
FAX. 630-372-6877
DESCRIPTION: LTE CELLULAR OMNI DIRECTIONAL ANTENNA
DRAWING NO. ODD_BMHO69027002NF
SIZE B SCALE 1:1 SHEET 1 OF 1

End of Document