TEST REPORT

Report Number: 103436674MPK-004
Project Numbers: G103436674, G103442604
April 05, 2018

Testing performed on the
Readers
Model: FAST-60-601-000001
FCC ID: 2APK7-9705082V1-0
IC: 23979-9705082V10

To

FCC Part 15 Subpart C (15.247)
Industry Canada RSS-247 Issue 2

For

Fastenal Company

Test Performed by:	Test Authorized by:
Intertek	Fastenal Company
1365 Adams Court	2001 Theurer Blvd
Menlo Park, CA 94025 USA	Winona, MN 55987 USA

Prepared by: _____ **Date:** April 05, 2018
Aaron Chang

Reviewed by: _____ **Date:** April 05, 2018
Krishna K Vemuri

Report No. 103436674MPK-004

Equipment Under Test:	Readers
Trade Name:	Fastenal Company
Model Number:	FAST-60-601-000001
Applicant:	Fastenal Company
Contact:	Lee Zenke
Address:	Fastenal Company 2001 Theurer Blvd Winona, MN 55987
Country	USA
Tel. Number:	(317) 429-4773
Email:	Lee.zenke@fastenal.com
Applicable Regulation:	FCC Part 15 Subpart C (15.247) Industry Canada RSS-247 Issue 2
Date of Test:	March 5-30 & April 4, 2018

We attest to the accuracy of this report:

Aaron Chang
Project Engineer

Krishna K Vemuri
Engineering Team Lead

TABLE OF CONTENTS

1.0 Introduction

This report is designed to show compliance of the 900 MHz transceiver with the requirements of FCC Part 15 Subpart C (15.247) and RSS-247. This test report covers only the FHSS radio.

1.1 Summary of Tests

TEST	Reference FCC	Reference Industry Canada	RESULTS
RF Output Power	15.247(b)	RSS-247, 5.4.2	Complies
20-dB Bandwidth	15.247(a)(1)	RSS-247, 5.1.1	Complies
Channel Separation	15.247(a)(1)	RSS-247, 5.1.2	Complies
Number of Hopping Channels	15.247(a)(1)	RSS-247, 5.14	Complies
Average Channel Occupancy Time	15.247(a)(1)	RSS-247, 5.14	Complies
Out-of-Band Antenna Conducted Emission	15.247(d)	RSS-247, 5.5	Complies
Transmitter Radiated Emissions	15.247(d), 15.209, 15.205	RSS-GEN	Complies
RF Exposure	15.247(i)	RSS-102	Complies
AC Conducted Emission	15.207	RSS-GEN	Complies*
Antenna Requirement	15.203	RSS-GEN	Complies (Internal Antenna)

*See report 103436674MPK-003 for 15.207 data.

2.0 General Description

2.1 Product Description

Fastenal Company supplied the following description of the EUT:

Device that takes an inventory of RFID tagged Bins and forwards this data to an in-range Controller via LoRa.

For more information, see user's manual provided by the manufacturer.

Information about the LoRa FHSS radio is presented below:

For more information, refer to the following product specification, declared by the manufacturer.

Information about the 900 MHz radio is presented below:

Applicant	Fastenal Company
Model No.	FAST-60-601-000001
FCC Identifier	2APK7-9705082V1-0
IC Identifier	23979-9705082V10
Type of Transmission	Frequency Hopping Spread Spectrum
Rated RF Output	12.05 dBm
Antenna(s) & Gain	Internal Antenna, Gain: 5.5 dBi
Frequency Range	902.7 – 927.2 MHz
Number of Channel(s)	50
Modulation Type	FSK
Applicant Name & Address	Fastenal Company 2001 Theurer Blvd Winona, MN 55987 USA

EUT receive date: March 05, 2018

EUT receive condition: The pre-production version of the EUT was received in good condition with no apparent damage. As declared by the Applicant, it is identical to the production units.

Test start date: March 5, 2018

Test completion date: April 04, 2018

The test results in this report pertain only to the item tested.

2.2 Related Submittal(s) Grants

None.

2.3 Test Methodology

Antenna conducted measurements were performed according to the procedure from ANSI C63.10:2013 for Frequency Hopping Spread Spectrum Systems

Radiated emissions measurements were performed according to the procedures in ANSI C63.10: 2013. Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the **"Data Sheet"** of this Application.

All other measurements were made in accordance with the procedures in part 2 of CFR 47.

Following is the channel test plan:

Channels in 900 MHz band			
Test Channel		Frequency, MHz	Tested
Low	1	902.7	√
Middle	25	915	√
High	50	927.2	√

2.4 Test Facility

The test site used to collect the radiated data is site 1 (10-m semi-anechoic chamber). This test facility and site measurement data have been fully placed on file with the FCC, IC and A2LA accredited.

3.0 System Test Configuration

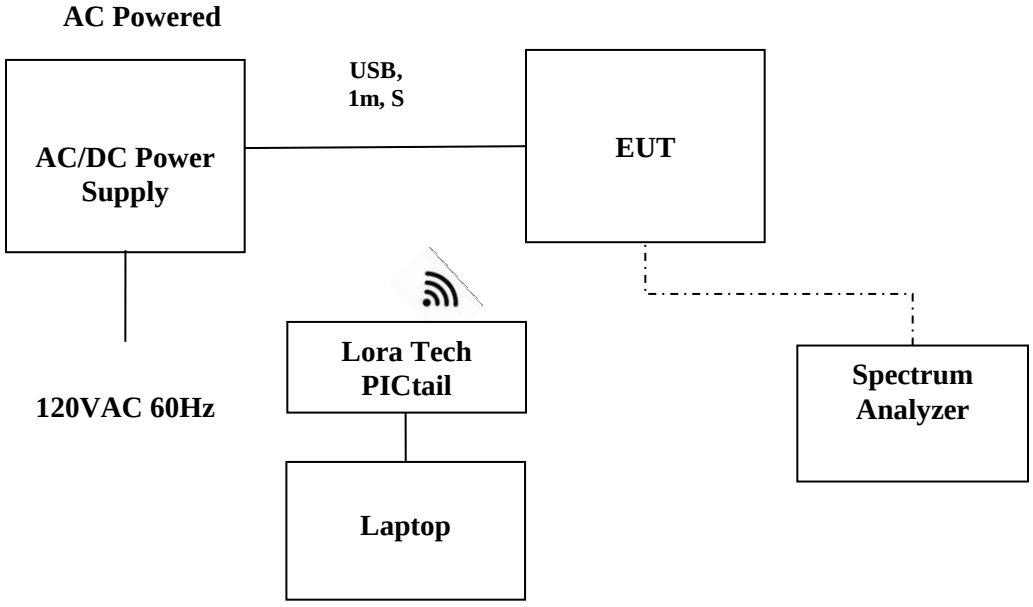
3.1 Support Equipment

Description	Manufacturer	Model Number
Laptop	HP	ProBook 430
LoRa Tech PICtail	MicroChip	MTI160581148

3.2 Block Diagram of Test Setup

Equipment Under Test			
Description	**Manufacturer**	**Model Number**	**Serial Number**
Reader	Fastenal Company	FAST-60-601-000001	Rd-0000014
AC/DC Power Supply	CUI Inc	SWI12-5-N	No markings

Antenna was removed and co-axial connector with a cable was installed for Conducted Measurements.



S = Shielded **U** = Unshielded	**F** = With Ferrite **m** = Length in Meters

3.3 Justification

For radiated emission measurements the EUT is placed on a non-conductive table. The EUT is attached to peripherals and they are connected and operational (as typical as possible). The EUT is wired to transmit full power. During testing, all cables are manipulated to produce worst-case emissions.

3.4 Mode of Operation During Test

During transmitter testing, the transmitter was setup to transmit continuously at maximum RF power on the low channel, middle channel, high channel and with hopping channels enabled.

3.5 Modifications Required for Compliance

Intertek installed no modifications during compliance testing in order to bring the product into compliance.

3.6 Additions, Deviations and Exclusions from Standards

No additions, deviations or exclusions from the standard were made.

4.0 Transmitter Emissions Measurement Results

4.1 20dB Bandwidth, and 99% Occupied Bandwidth
FCC Rule 15.247(a)(1)

4.1.1 Procedure

The Procedure described in the ANSI C63.10:2013 for Frequency Hopping Spread Spectrum Systems was used to determine the 20dB bandwidth.

- Span = Approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
- RBW = 1% of the 20 dB bandwidth
- VBW = 3 x RBW
- Sweep = Auto
- Detector function = Peak
- Trace = Max hold

The EUT should be transmitting at its maximum data rate. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

For 99% power bandwidth measurement, the bandwidth was determined by using the built-in 99% occupied bandwidth function of the spectrum analyzer.

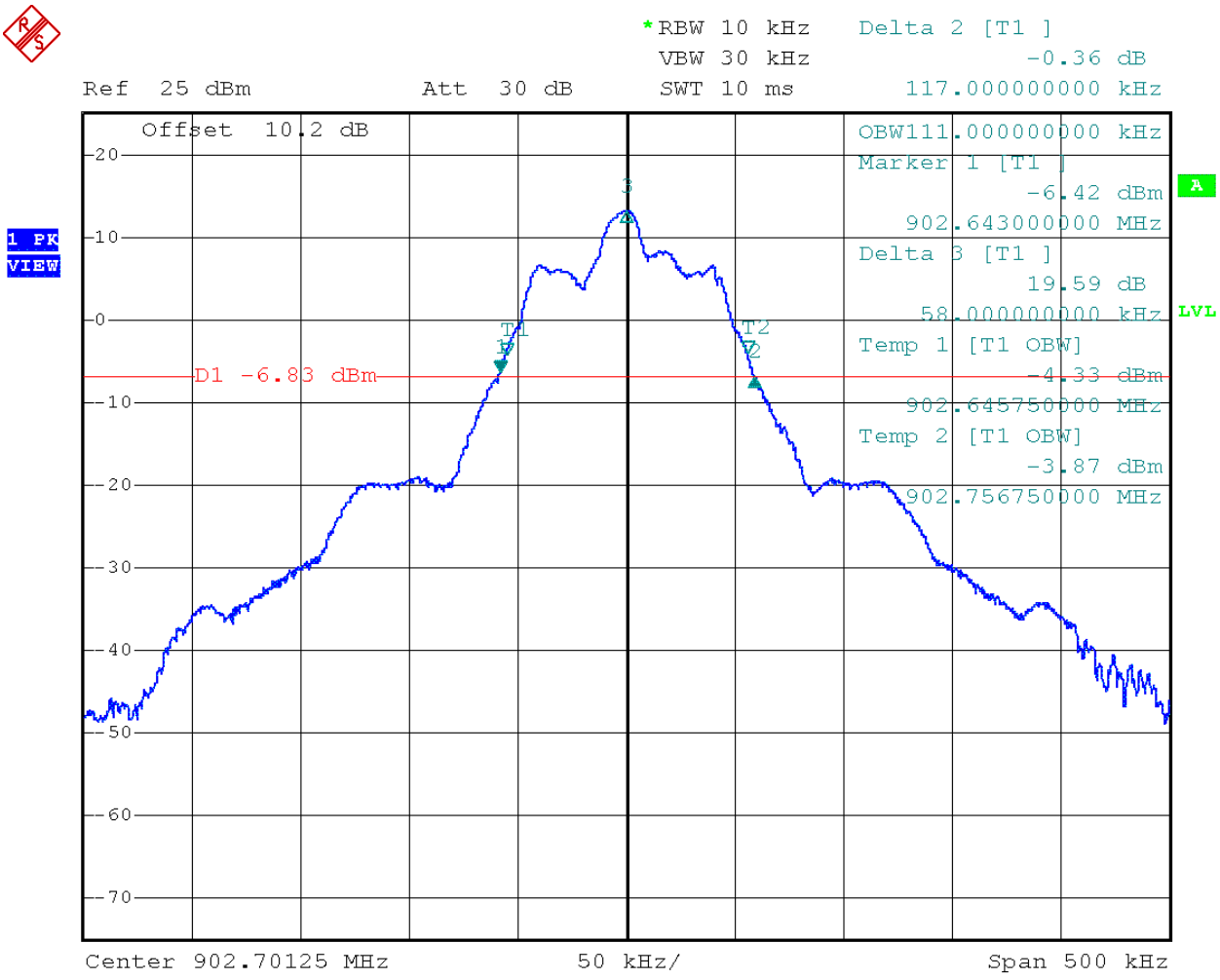
The antenna port of the EUT was connected to the input of a spectrum analyzer (SA). For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A Peak output reading was taken, a Display line was drawn for 20dB lower than Peak level. The 20dB bandwidth was determined from where the channel output spectrum intersected the display line.

Tested By:	Aaron Chang
Test Date:	March 21, 2018

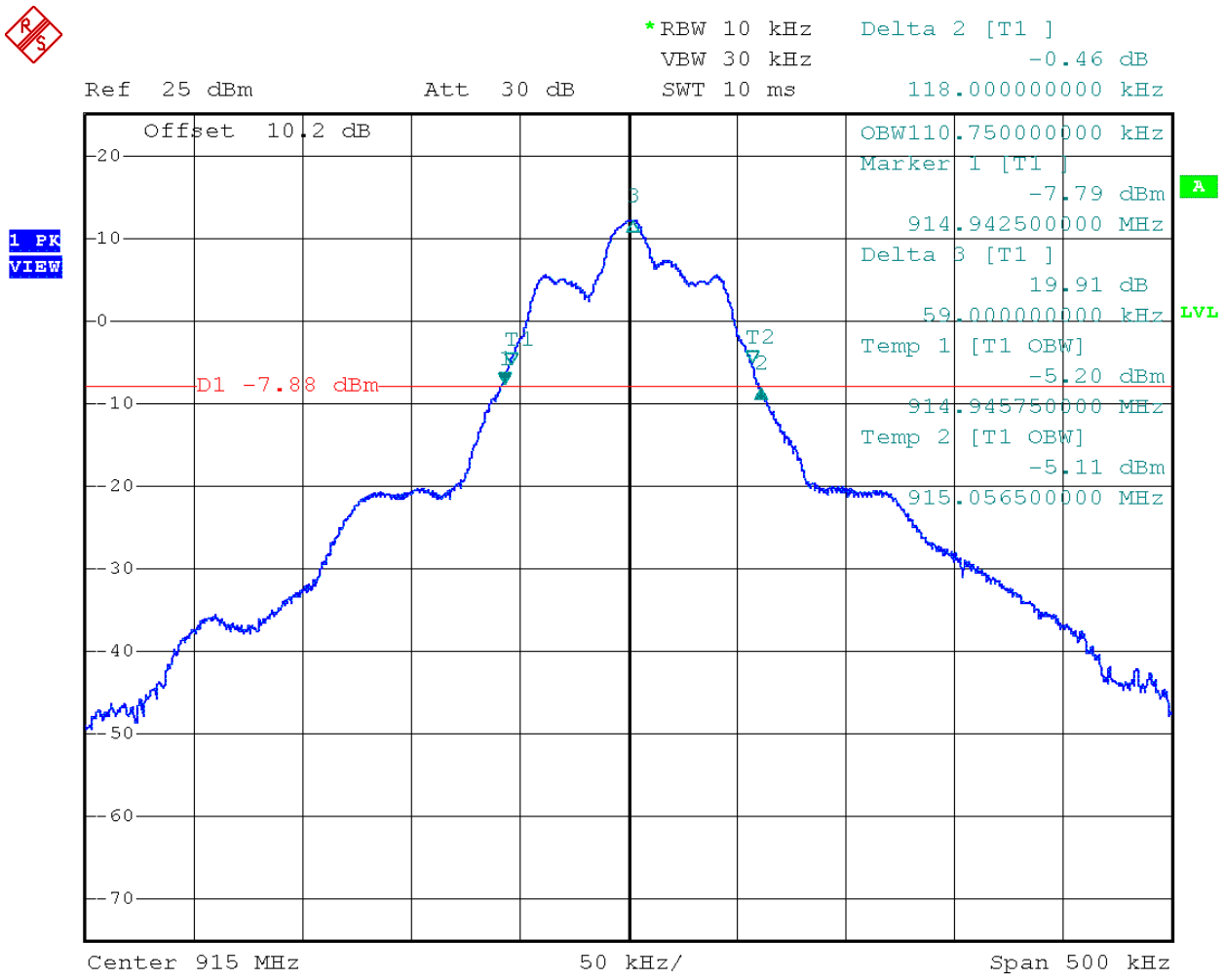
4.1.2 Test Result

Frequency MHz	20 dB FCC Bandwidth, MHz	99% Bandwidth, MHz	Plot #
902.7	0.117	0.111	1.1
915	0.118	0.111	1.2
927.2	0.118	0.111	1.3

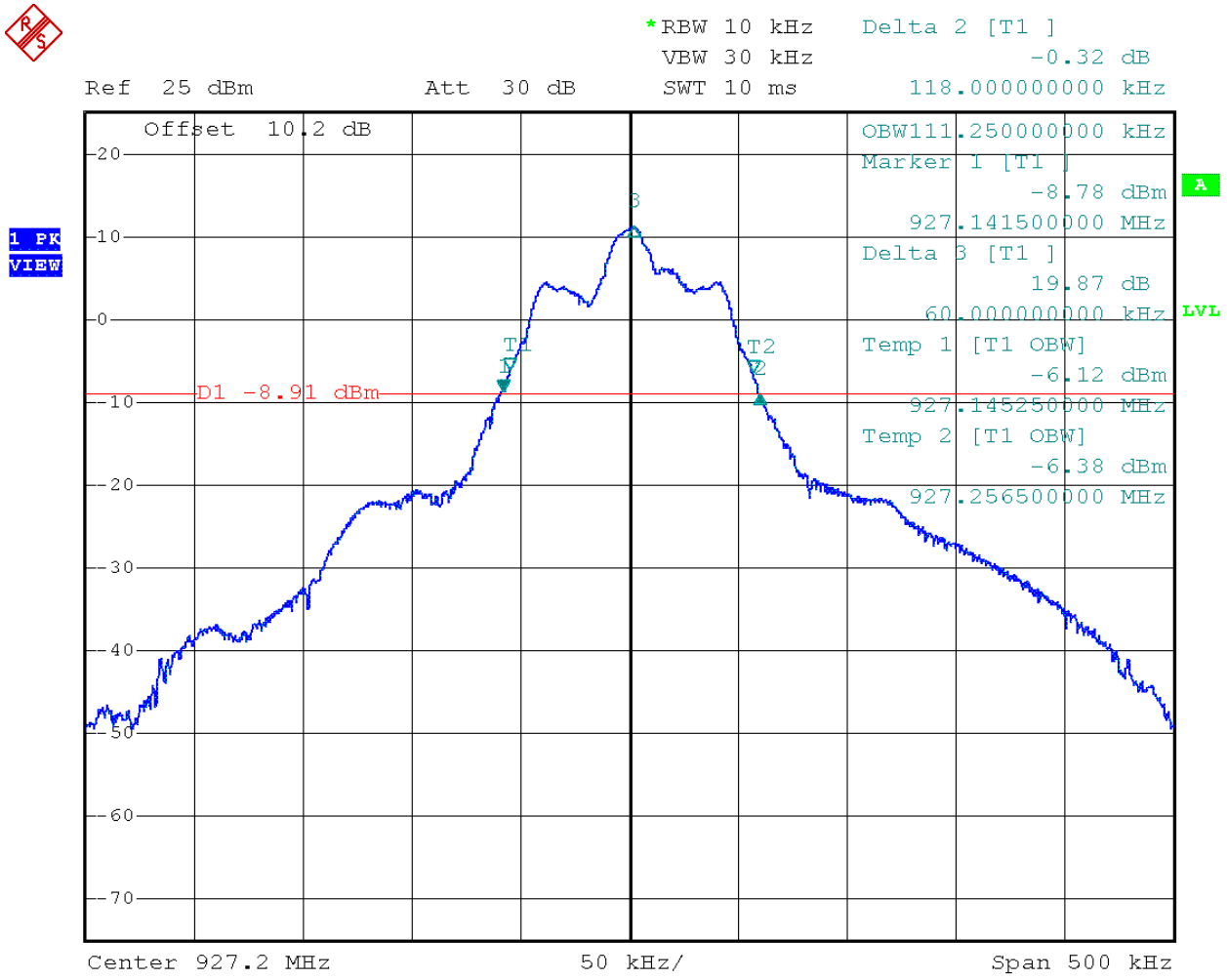
Plot 1. 1 – 20dB Bandwidth Low Channel



Plot 1. 2 – 20dB Bandwidth Middle Channel



Plot 1. 3 – 20dB Bandwidth High Channel



4.2 Conducted Output Power at Antenna Terminals
FCC Rule 15.247(b)(1)

4.2.1 Requirement

For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels

4.2.2 Procedure

The Procedure described in the ANSI C63.10:2013 for Frequency Hopping Spread Spectrum Systems was used to determine the RF Output Power.

- Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
- RBW > the 20 dB bandwidth of the emission being measured
- VBW = 3 x RBW
- Sweep = auto
- Detector function = peak
- Trace = max hold

Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power (see the NOTE above regarding external attenuation and cable loss). The limit is specified in one of the subparagraphs of this Section. Submit this plot.

The antenna port of the EUT was connected to the input of a spectrum analyzer. Power was read directly from the spectrum analyzer and cable loss correction was added to the reading to obtain the power at the antenna terminals.

Tested By:	Aaron Chang
Test Date:	March 26, 2018

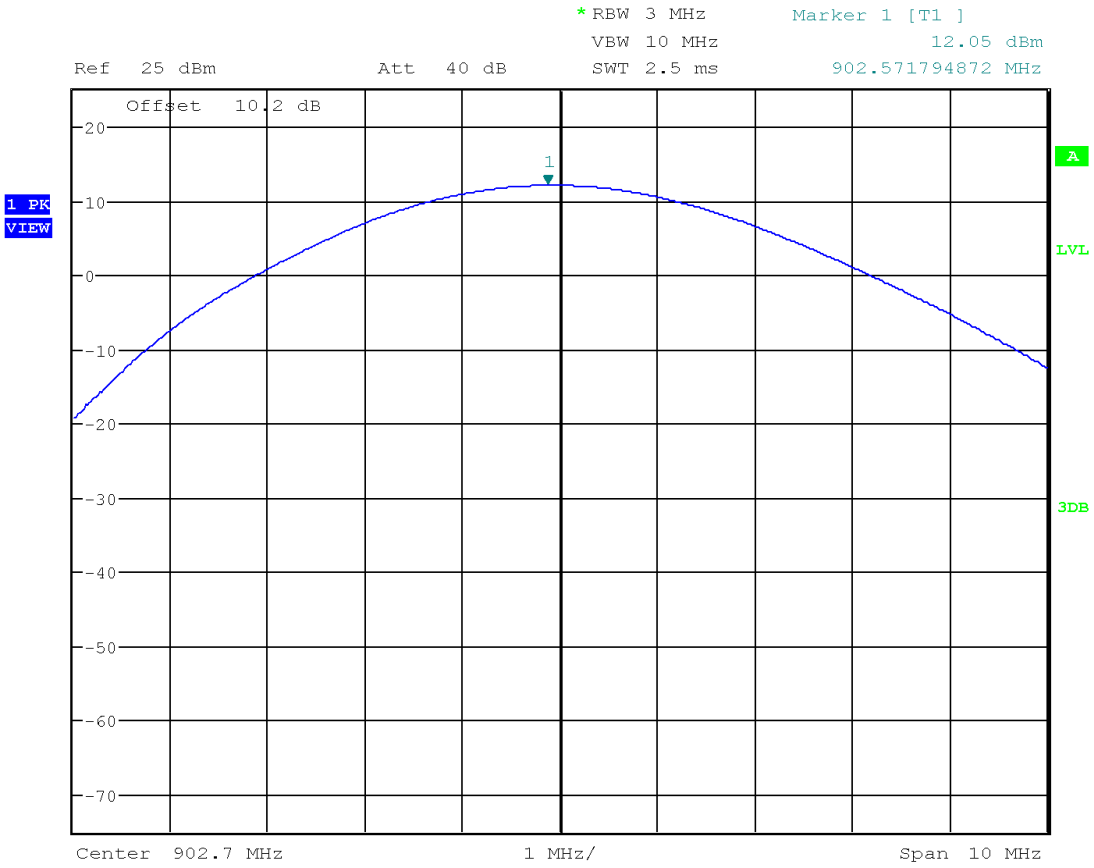
4.3.3 Test Result

Refer to the following plots for the test result:

Frequency MHz	Conducted Peak Power dBm	Conducted Peak Power mW	Plot #
902.7	12.05	16.03	2.1
915	11.03	12.68	2.2
927.2	10.03	10.07	2.3

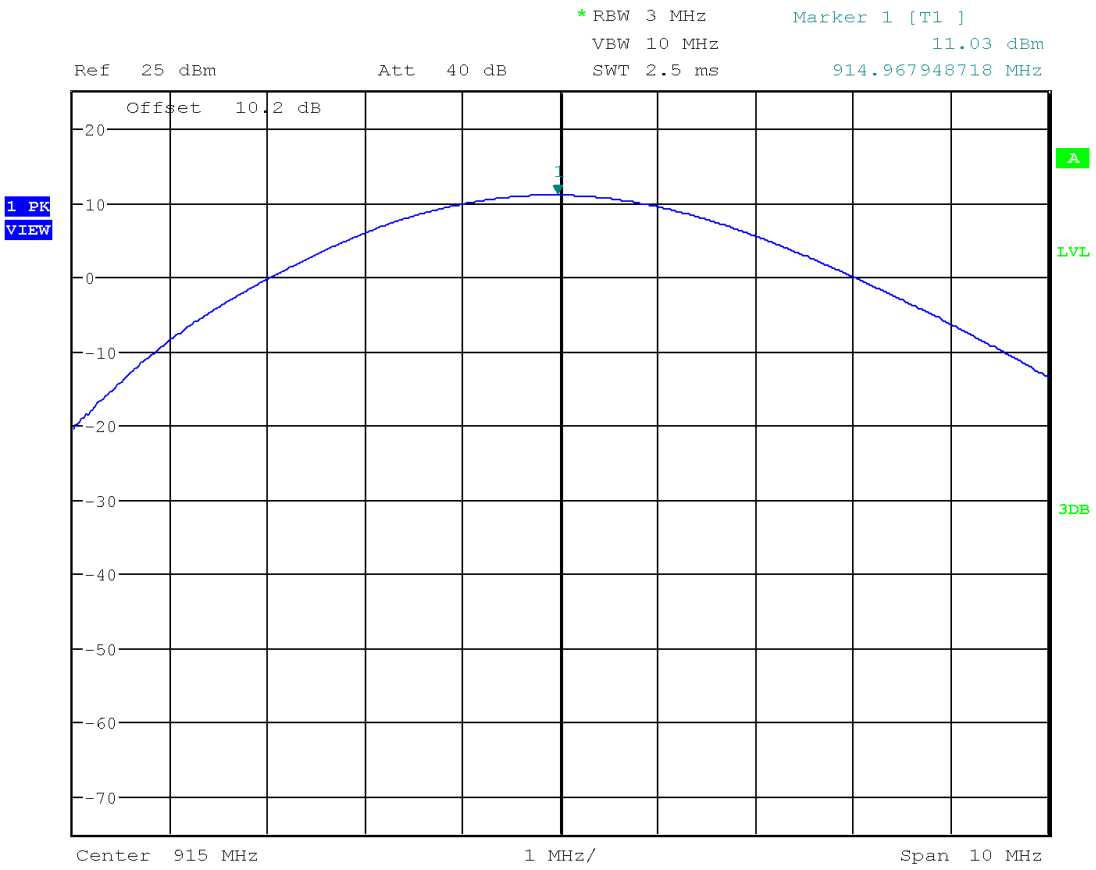
Results	Complies

Plot 2. 2 – Output Power Low Channel



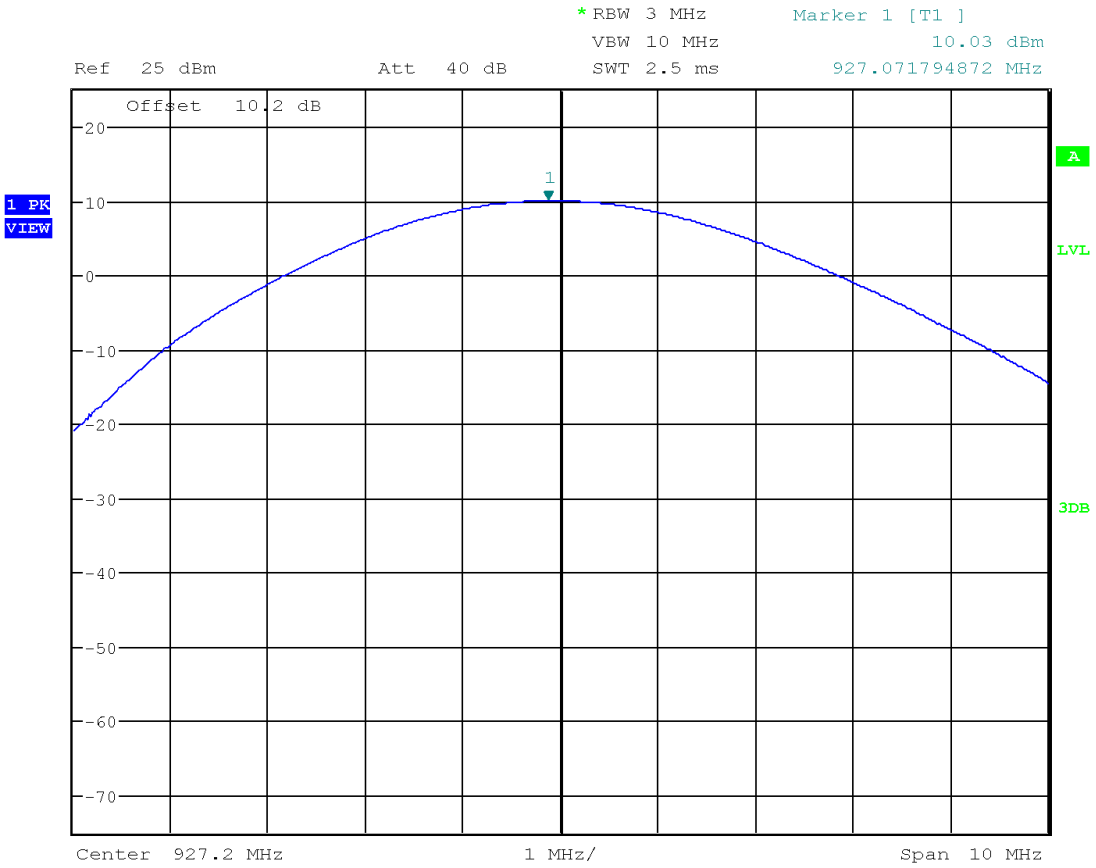
Date: 26.MAR.2018 06:58:24

Plot 2. 2 – Output Power Middle Channel



Date: 26.MAR.2018 06:59:36

Plot 2. 3 – Output Power High Channel



Date: 26.MAR.2018 07:00:45

4.3 Carrier Frequency Separation
FCC 15.247 (a)(1)

4.3.1 Requirement

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. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

4.3.2 Procedure

The Procedure described in the ANSI C63.10:2013 for Frequency Hopping Spread Spectrum Systems was used to determine the Carrier Frequency Separation.

- The EUT must have its hopping function enabled
- Span = wide enough to capture the peaks of two adjacent channels
- Resolution (or IF) Bandwidth (RBW) = 1% of the span
- Video (or Average) Bandwidth (VBW) = 3 x RBW
- Sweep = auto
- Detector function = peak
- Trace = max hold

Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

Tested By:	Aaron Chang
Test Date:	March 21, 2018

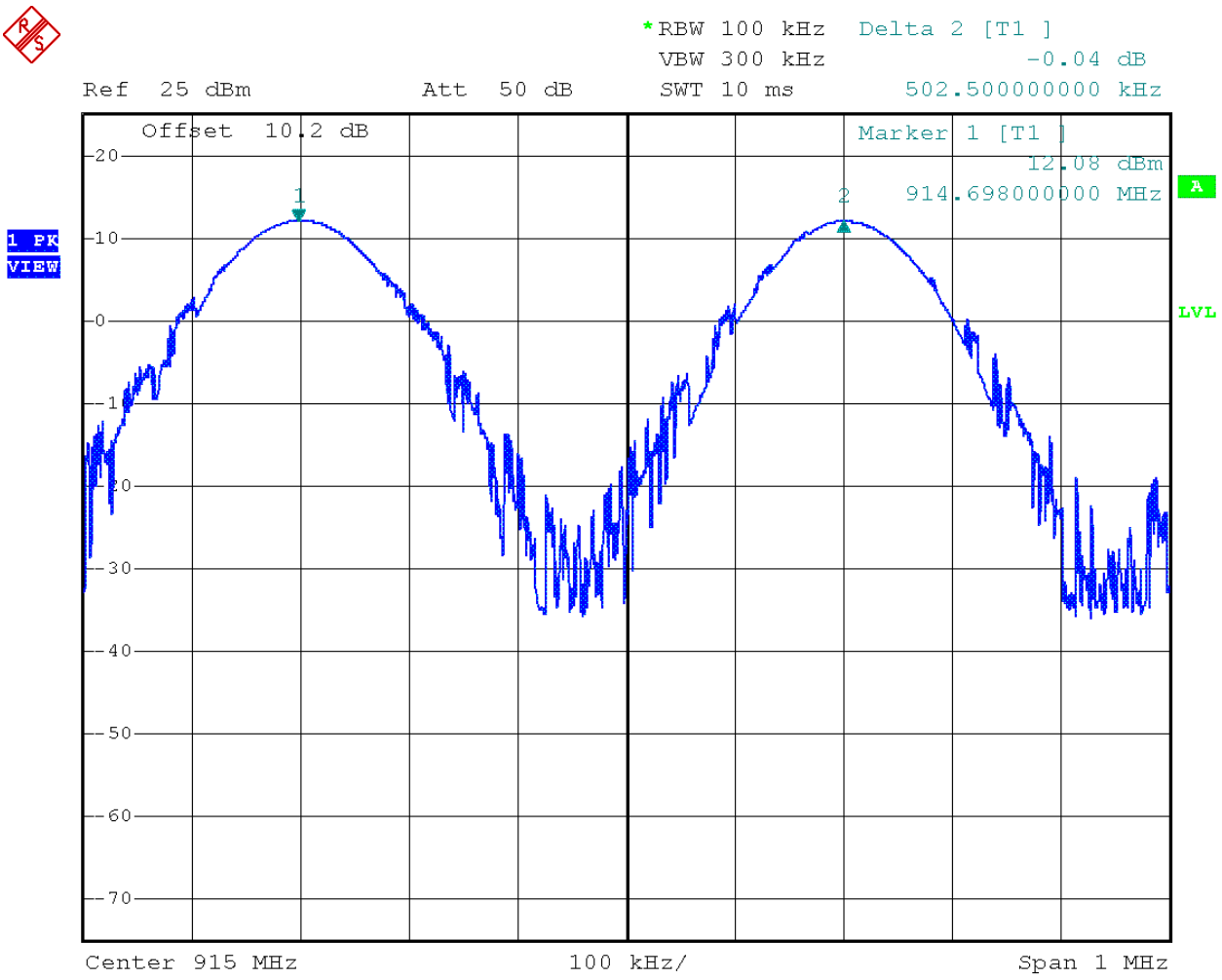
4.3.3 Test Result

The worst case 20dB Bandwidth is 118 kHz.

The minimum Carrier Frequency Separation is 118 kHz, therefore meets the minimum requirement. Please refer to spectrum analyzer plot 3.1 below for the test result.

Results	**Complies**

Plot 3.1– Channel Separation



Date: 21.MAR.2018 09:13:42

4.4 Number of Channels
FCC 15.247 (a)(1)(iii)

4.4.1 Requirement

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; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

4.4.2 Procedure

The Procedure described in the ANSI C63.10:2013 for Frequency Hopping Spread Spectrum Systems was used to determine the Number of Channels.

- The EUT must have its hopping function enabled.
- Span = the frequency band of operation
- RBW = 1% of the span
- VBW = 3 x RBW
- Sweep = auto
- Detector function = peak
- Trace = max hold

Allow the trace to stabilize. It may prove necessary to break the span up to sections, in order to clearly show all of the hopping frequencies.

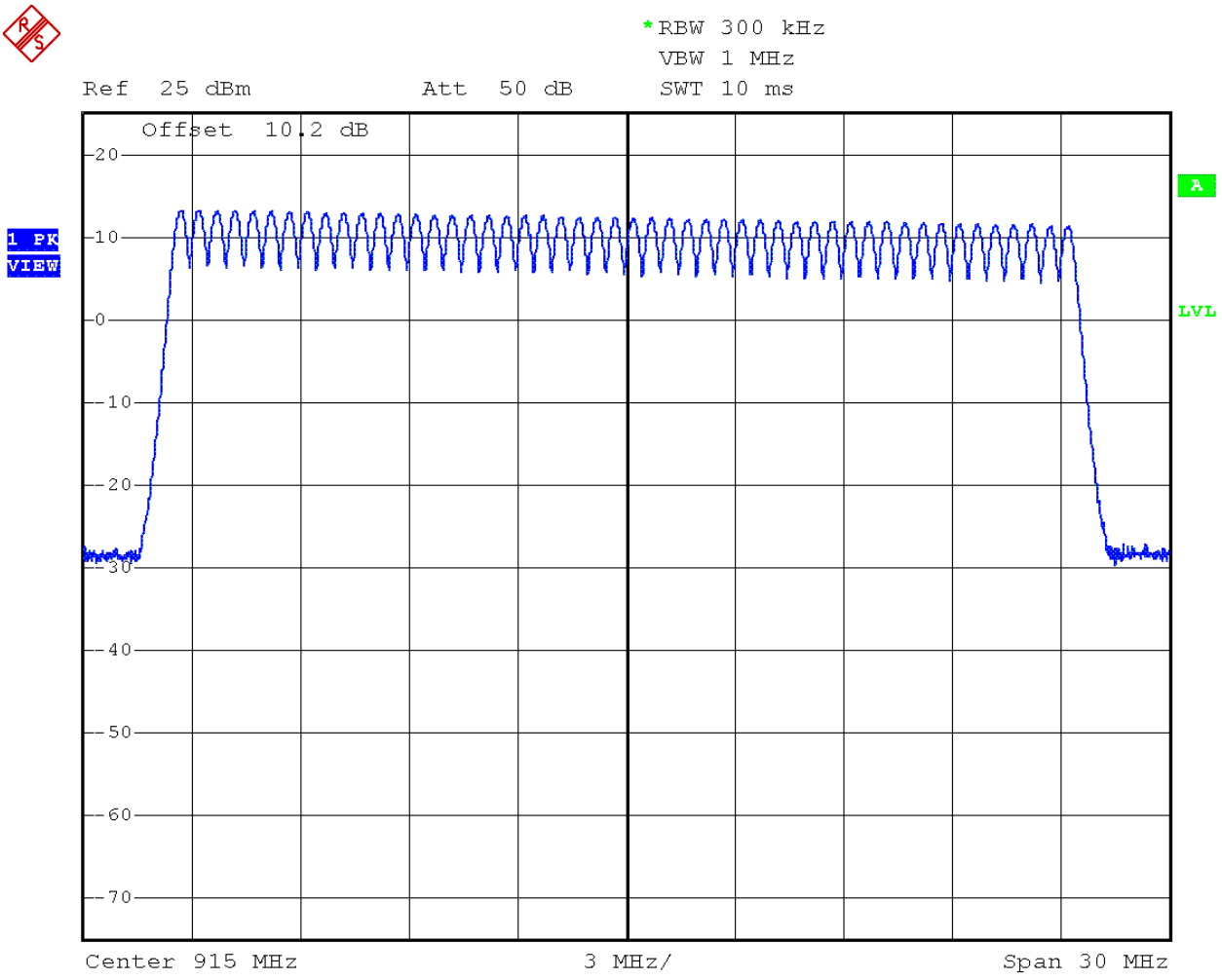
With the analyzer set to MAX HOLD, readings were taken once channels were filled in. The channel peaks were recorded and compared to the minimum number of channels required in the regulation.

Tested By:	Aaron Chang
Test Date:	March 26, 2018

4.4.3 Test Result

Results	50 Channels -Complies

Plot 4.1 - Number of hopping channels



4.5 Average Channel Occupancy Time
FCC 15.247(a)(1)

4.5.1 Requirement

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; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

4.5.2 Procedure

The Procedure described in the ANSI C63.10:2013 for Frequency Hopping Spread Spectrum Systems was used to determine the Average Channel Occupancy Time.

- The EUT must have its hopping function enabled.
- Span = zero span, centered on a hopping channel
- RBW = 1 MHz
- VBW = 3 x RBW
- Sweep = as necessary to capture the entire dwell time per hopping channel
- Detector function = peak
- Trace = max hold

If possible, use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. An oscilloscope may be used instead of a spectrum analyzer.

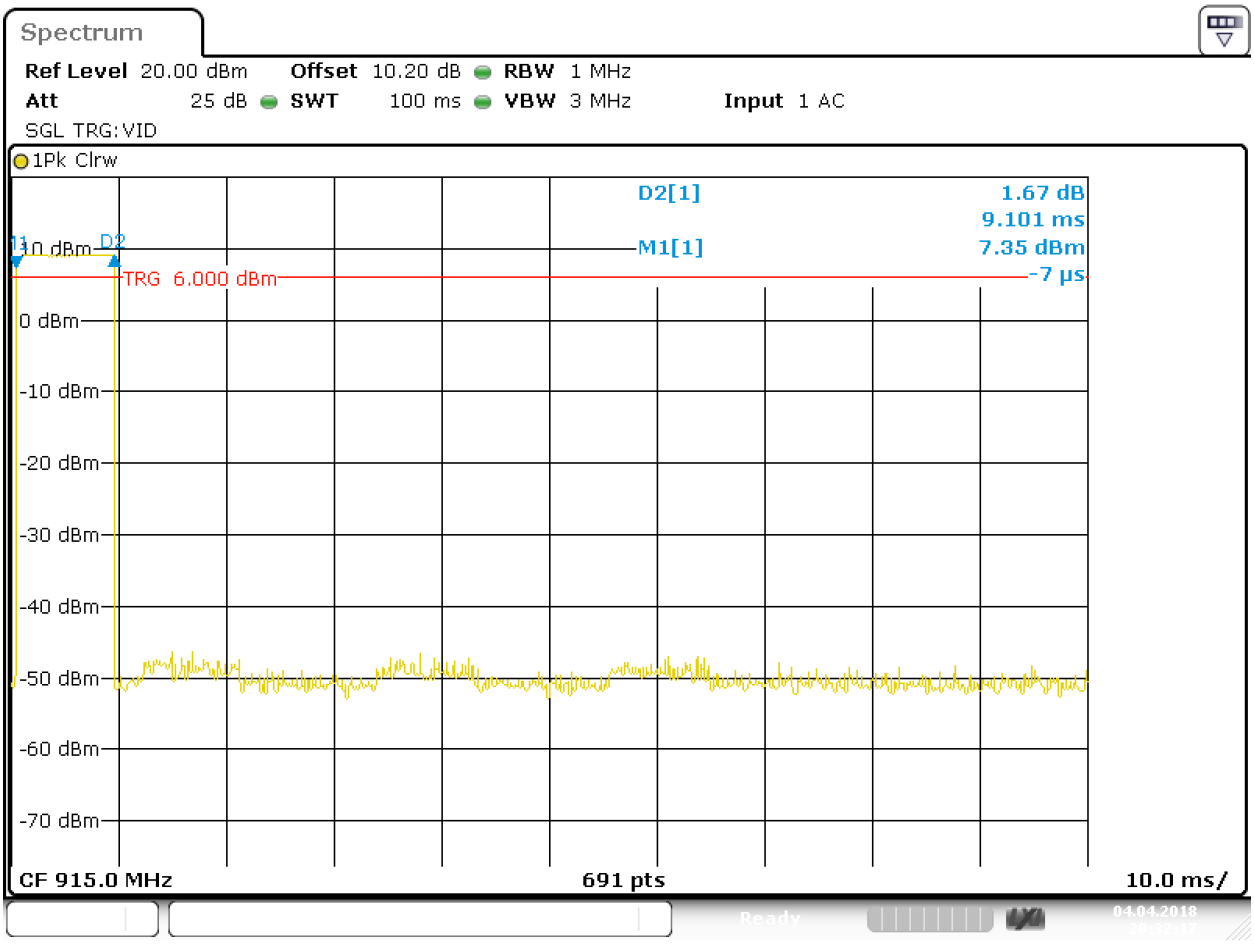
The spectrum analyzer center frequency was set to one of the known hopping channels, the SPAN was set to ZERO SPANS, and the TRIGGER was set to VIDEO. The time duration of the transmission so captured was measured with the MARKER DELTA function.

Tested By:	Aaron Chang
Test Date:	March 26, 2018

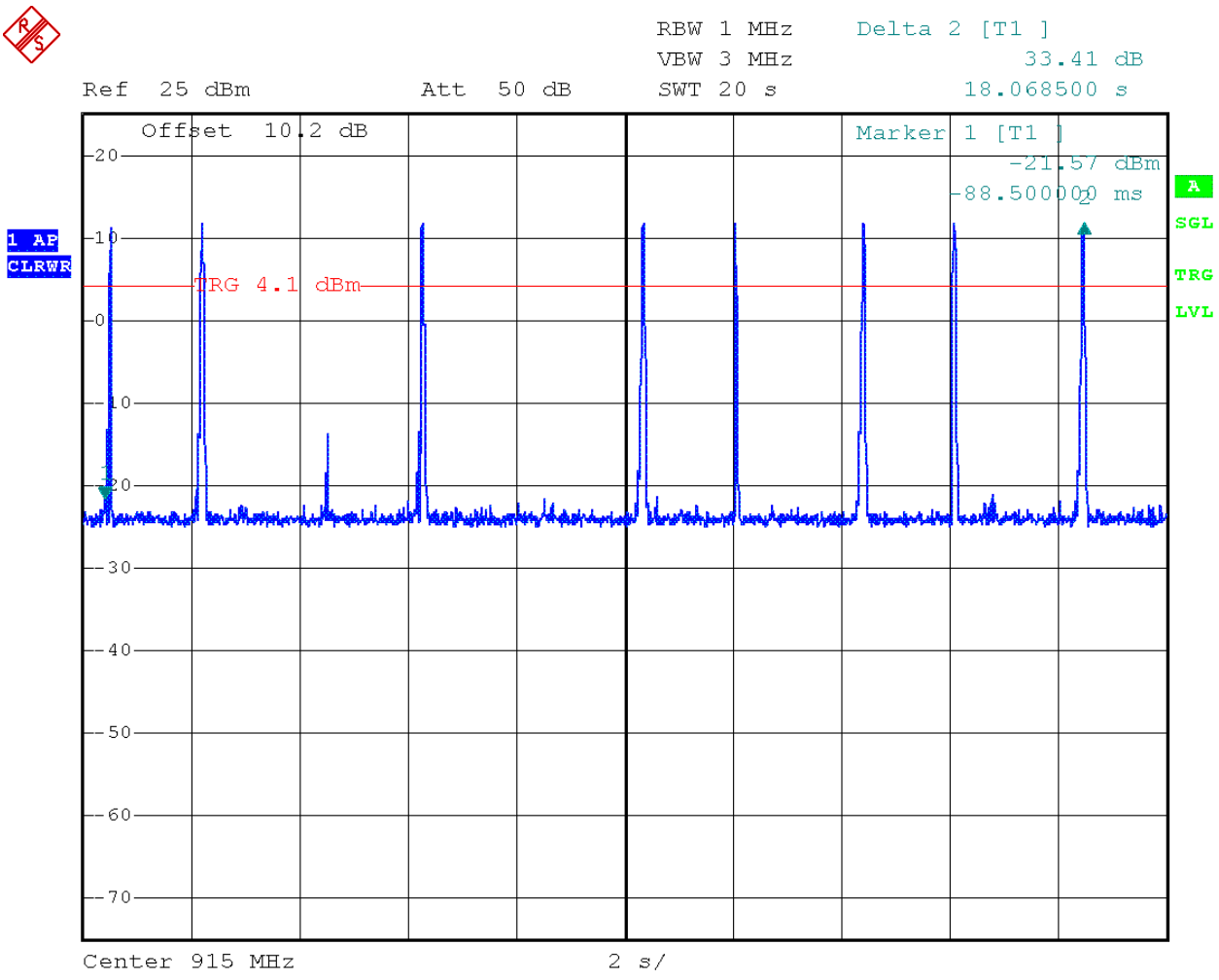
4.5.3 Test Results

Results	Complies

No. of Burst in 20 seconds	Burst On Time (ms)	Dwell Time (ms)	Dwell Time limit (ms)
8	9.1	72.8	400



Date: 4.APR.2018 20:32:17



Date: 21.MAR.2018 09:44:48

4.6 Out-of-Band Conducted Emissions
FCC 15.247(d)

4.6.1 Requirement

In any 100 kHz bandwidths outside the EUT pass-band, the RF power shall be at least 20dB (peak) or 30 dB (average) below that of the maximum in-band 100 kHz emissions.

4.6.2 Procedure

The Procedure described in the ANSI C63.10:2013 for Frequency Hopping Spread Spectrum Systems was used to determine the Out-of-Band Conducted Emissions.

- Span = wide enough to capture the peak level of the in-band emission and all spurious
- emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the
- 10th harmonic. Typically, several plots are required to cover this entire span.
- RBW = 100 kHz
- VBW = 3 x RBW
- Sweep = auto
- Detector function = peak
- Trace = max hold

Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded. The level displayed must comply with the limit specified in this Section.

A spectrum analyzer was connected to the antenna port of the transmitter. Analyzer Resolution Bandwidth was set to 100 kHz. For each channel investigated, the in-band and out-of-band emission measurements were performed. The out-of-band emissions were measured from 30 MHz to 26 GHz.

Tested By:	Aaron Chang
Test Date:	March 26, 2018

4.6.3 Test Result

Refer to the following plots and out-of-band conducted spurious emissions at the Band-Edge, Table 4.1 & 4.2 for the test results:

Table 4.1

Frequency MHz	Description	Plot #
902.7	Scan 30 MHz – 26 GHz	4.1
915	Scan 30 MHz – 26 GHz	4.2
927.2	Scan 30 MHz – 26 GHz	4.3

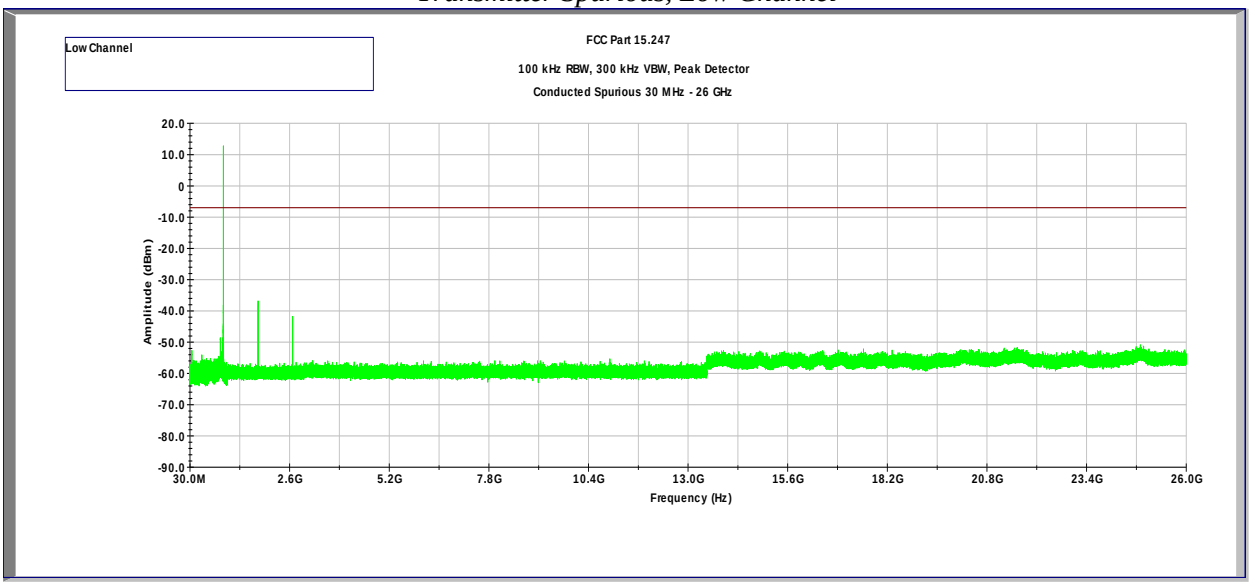
Out-of-Band Conducted Spurious Emissions at the Band-Edge:

Table 4.2

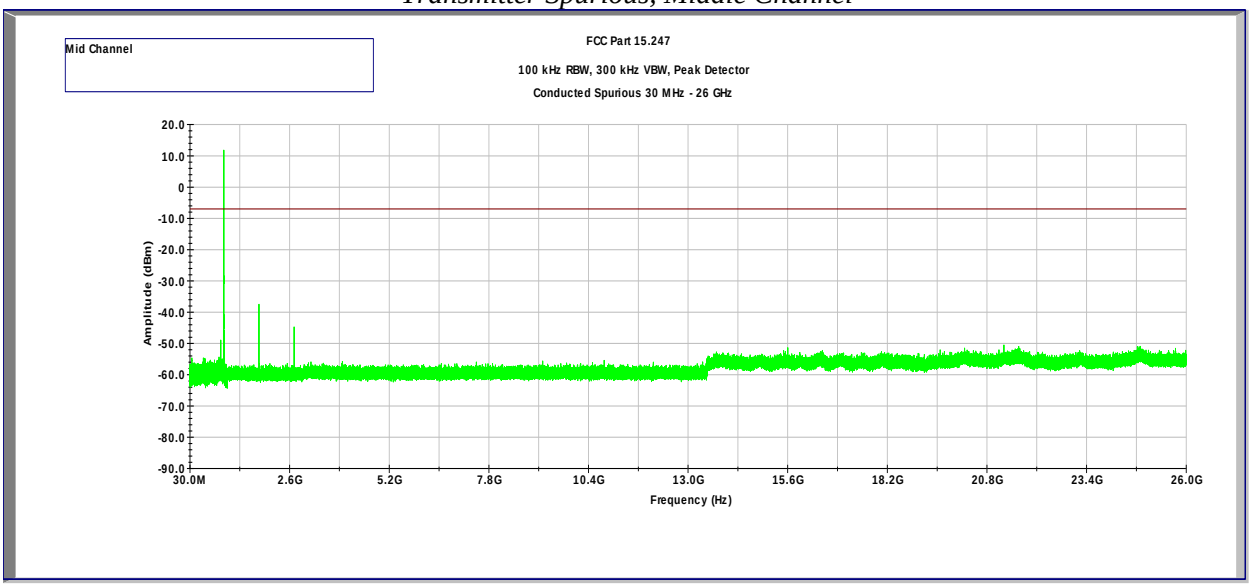
Channel	Frequency MHz	Out-band emissions margin to In-band emissions	Plot #
1	902.7	Complies	4.4
Hopping	Low Band Edge	Complies	4.5
50	927.2	Complies	4.6
Hopping	High Band Edge	Complies	4.7

Results	**Complies**

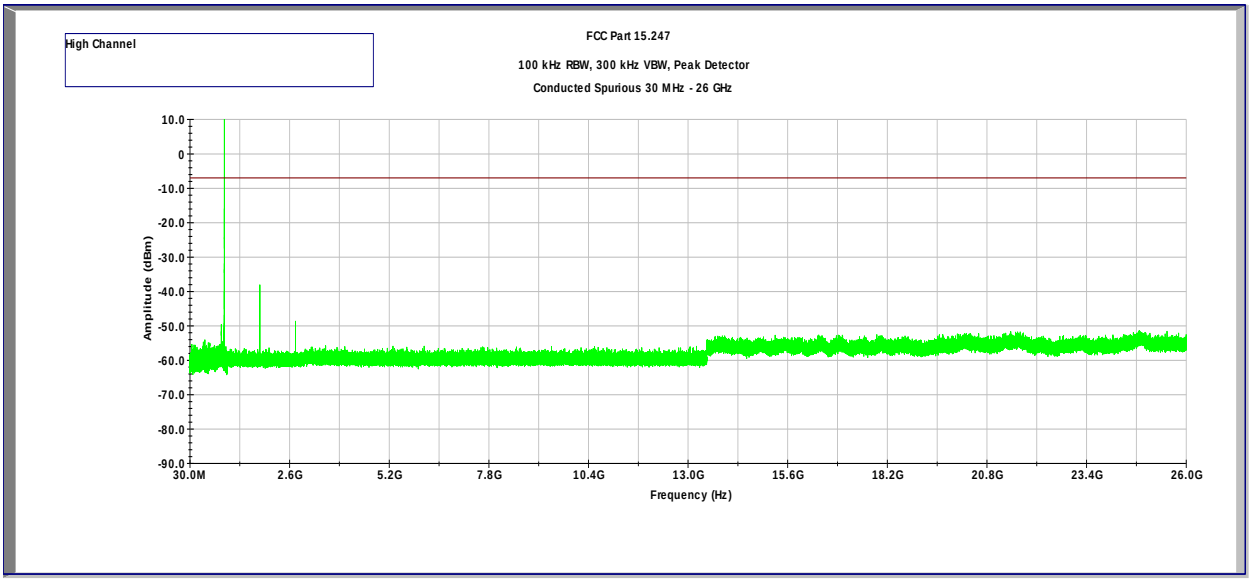
Plot 4.1
Transmitter Spurious, Low Channel



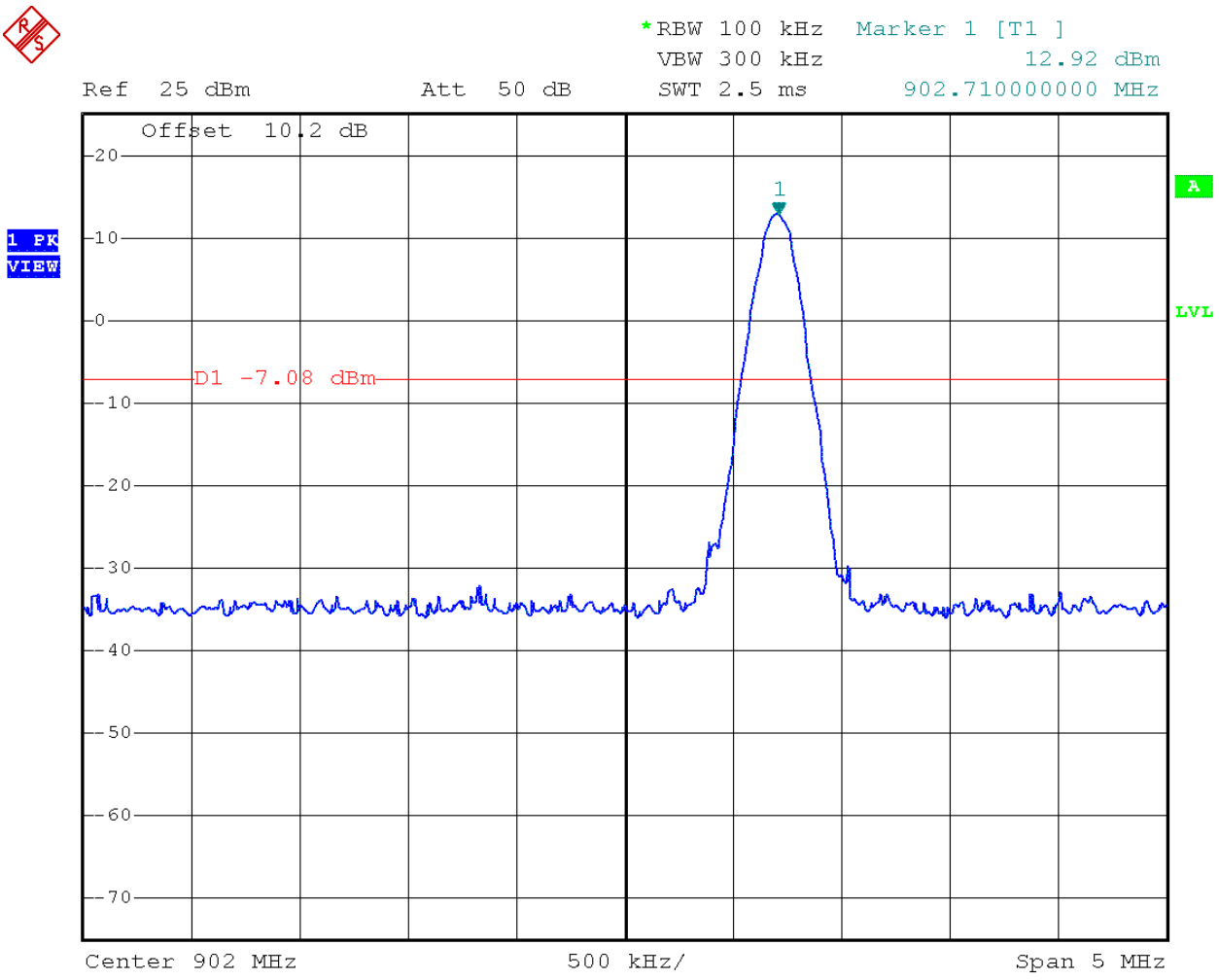
Plot 4.2
Transmitter Spurious, Middle Channel



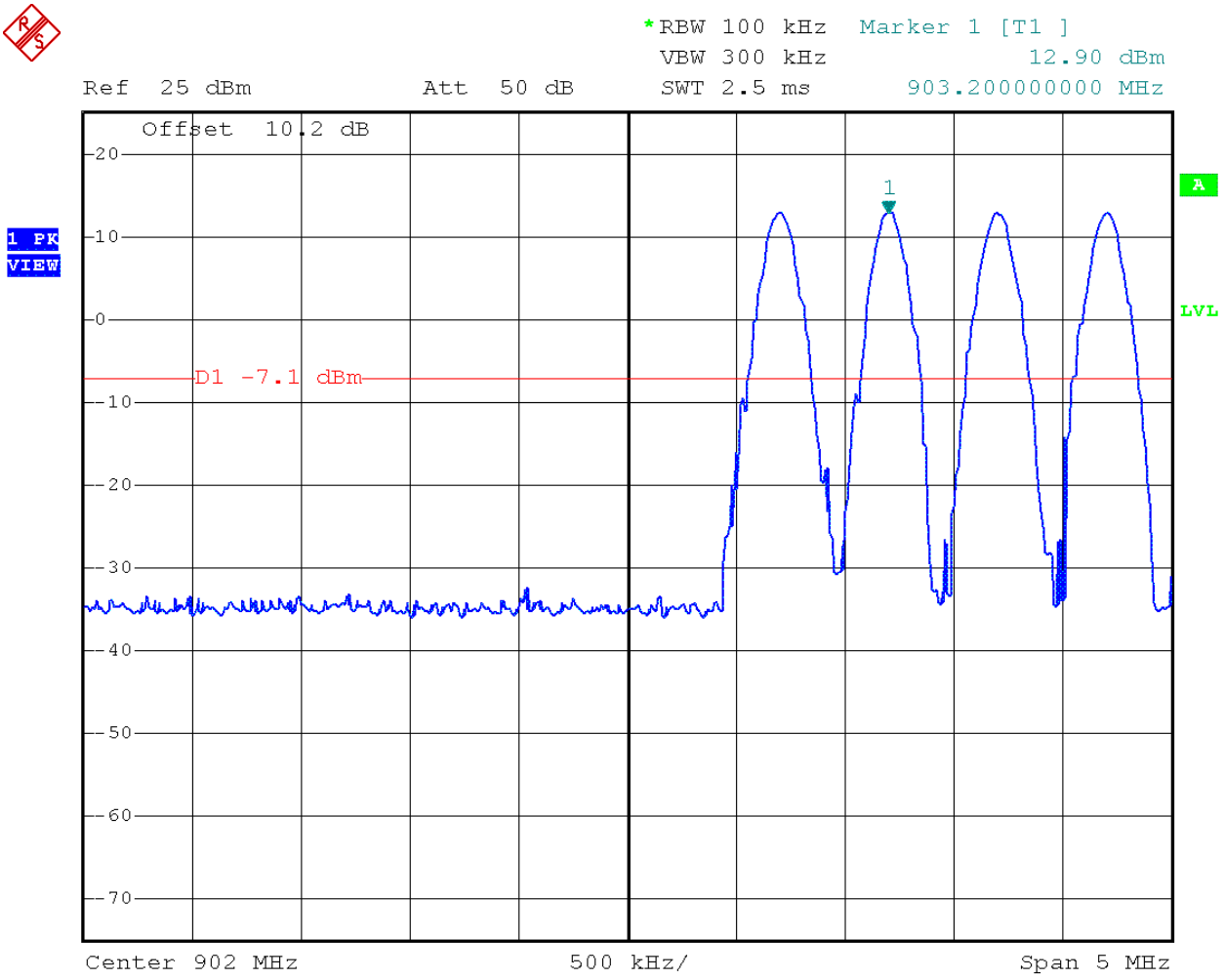
Plot 4.3
Transmitter Spurious, High Channel



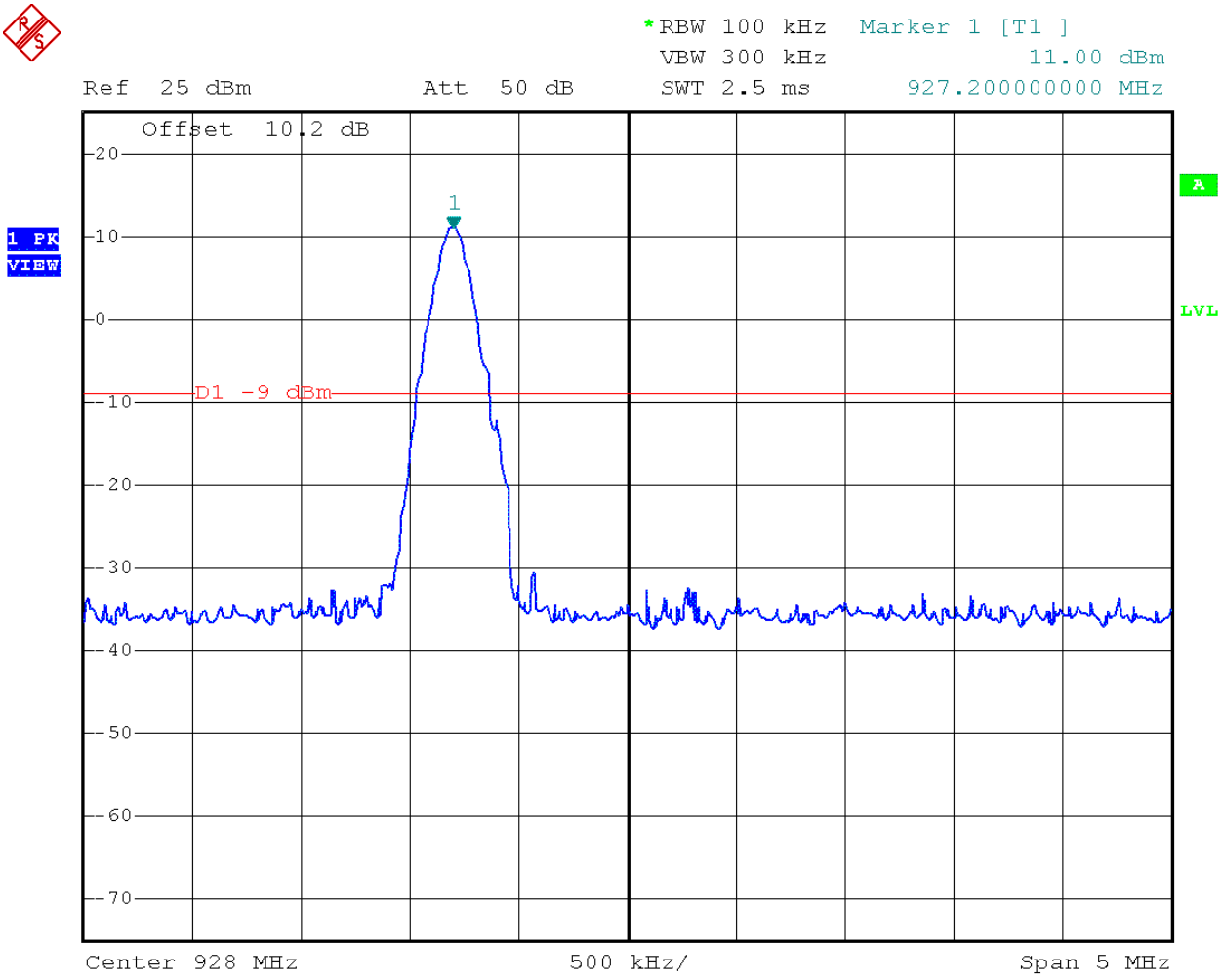
Plot 4.4
Conducted Band Edge, Low Channel



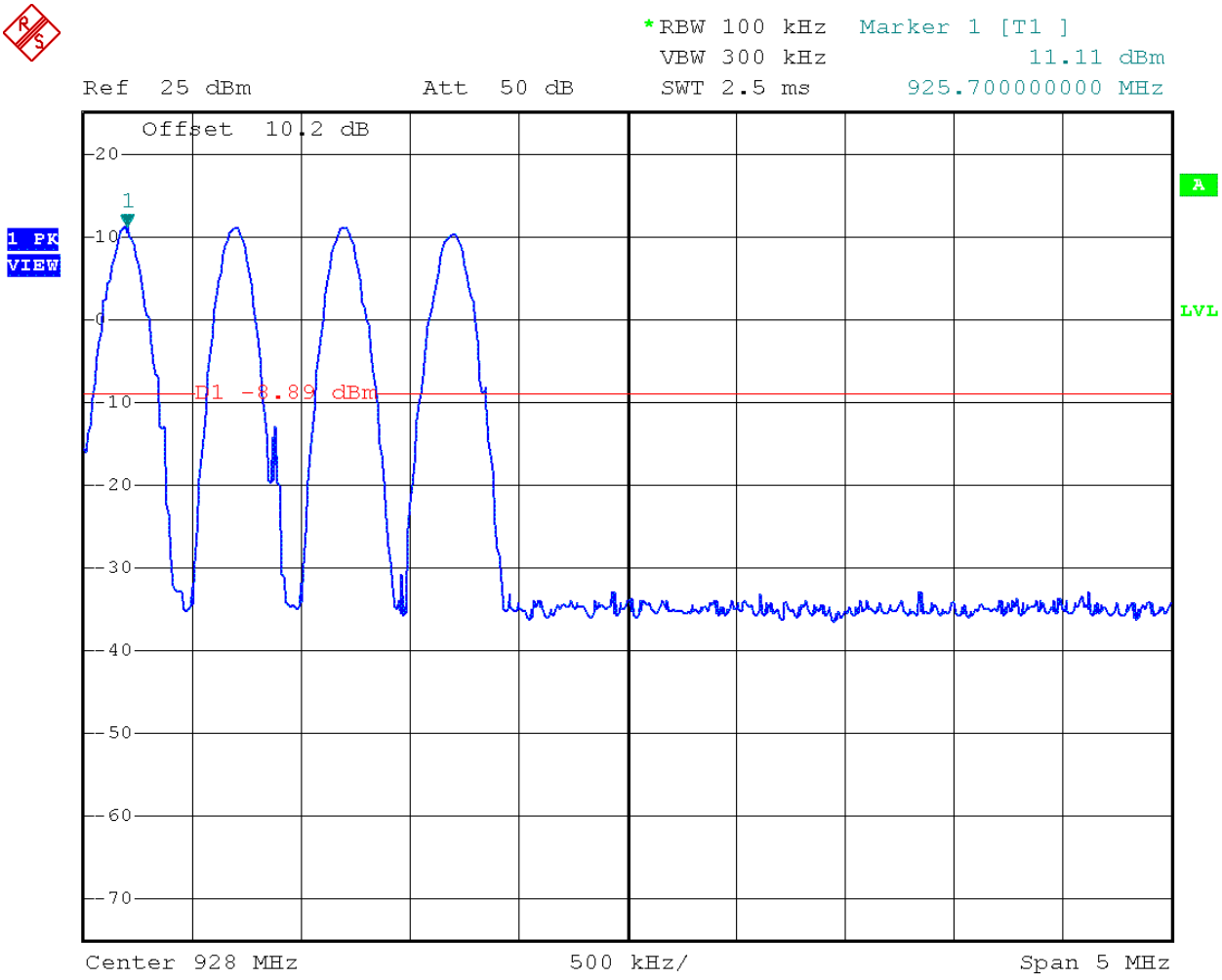
Plot 4.11
Conducted Band Edge (Hopping)



Plot 4.12
Conducted Band Edge, High Channel



Plot 4.13
Conducted Band Edge (Hopping)



4.7 Transmitter Radiated Emissions
FCC Rule 15.247(d), 15.209, 15.205

4.7.1 Requirement

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)).

For out of band radiated emissions (except for frequencies in restricted bands), in any 100 kHz bandwidths outside the EUT pass-band, the RF power shall be at least 20dB (peak) or 30 dB (average) below that of the maximum in-band 100 kHz emissions.

4.7.2 Procedure

Radiated emission measurements were performed from 30 MHz to 26,000 MHz. Spectrum Analyzer Resolution Bandwidth is 100 kHz or greater for frequencies 30 MHz to 1000 MHz, 1 MHz for frequencies above 1000 MHz.

The EUT is placed on a plastic turntable that is 80 cm in height. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). During testing, all cables were manipulated to produce worst-case emissions. The signal is maximized through rotation. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Radiated emissions are taken at 3 meters

All measurements were made with a Peak Detector and compared to QP limits for 30MHz – 1GHz and Average or Peak limits for 1GHz – 26GHz where applicable.

Data is included of the worst-case configuration (the configuration which resulted in the highest emission levels).

EUT was tested with Internal Antenna.

4.7.3 Field Strength Calculation

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF – AG; if measurement is performed at a distance other than specified in the rule, a Distance Correction Factor (DCF) shall be added.

Where FS = Field Strength in dB(μV/m)
RA = Receiver Amplitude (including preamplifier) in dB(μV); AF = Antenna Factor in dB(1/m)
CF = Cable Attenuation Factor in dB; AG = Amplifier Gain in dB

Assume a receiver reading of 52.0 dB(μV) is obtained. The antennas factor of 7.4 dB(1/m) and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving field strength of 32 dB(μV/m). This value in dB(μV/m) was converted to its corresponding level in μV/m.
RA = 52.0 dB(μV)
AF = 7.4 dB(1/m)
CF = 1.6 dB
AG = 29.0 dB
FS = 52.0+7.4+1.6-29.0 = 32 dB(μV/m).
Level in μV/m = Common Antilogarithm [(32 dBμV/m)/20] = 39.8 μV/m.

4.7.4 Test Results

The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

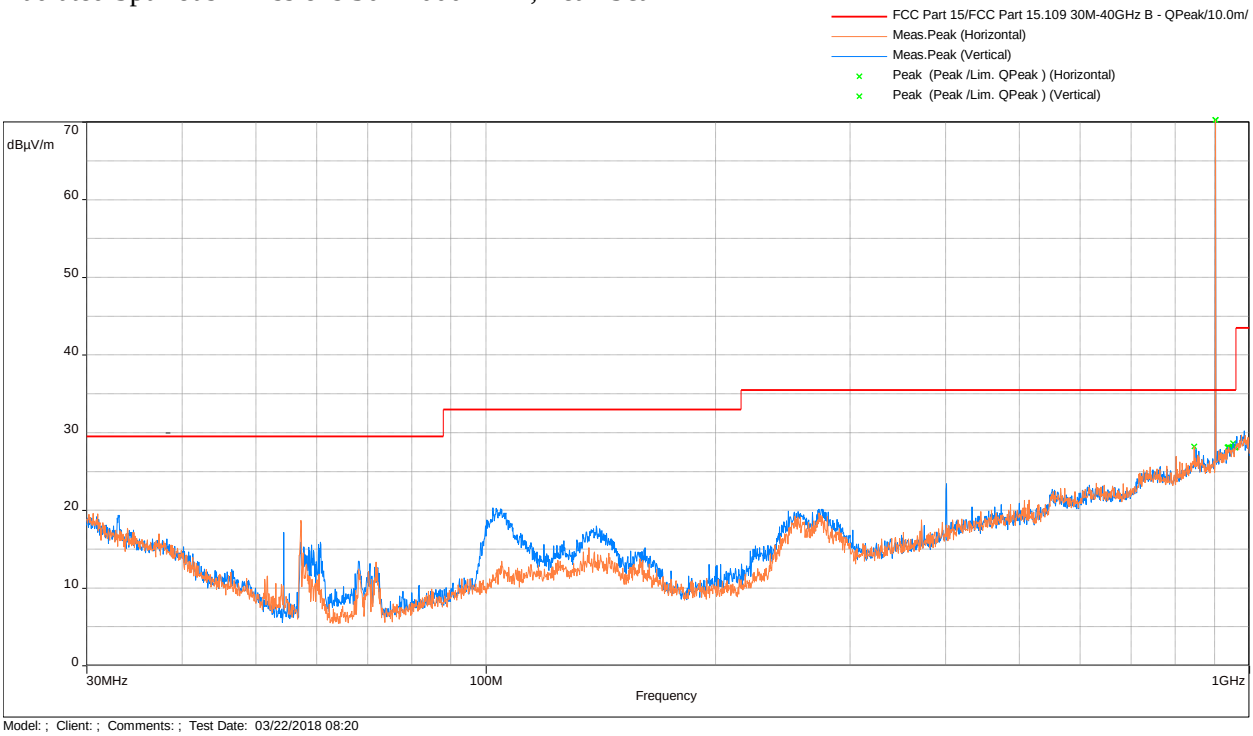
Radiated emission measurements were performed up to 26GHz. No other emissions were detected above the noise floor which is at least 10 dB below the limit.

All radiated measurements were conducted with the AC adapter. The worst case data was reported.

Tested By:	Aaron Chang
Test Date:	March 5 - 30, 2018

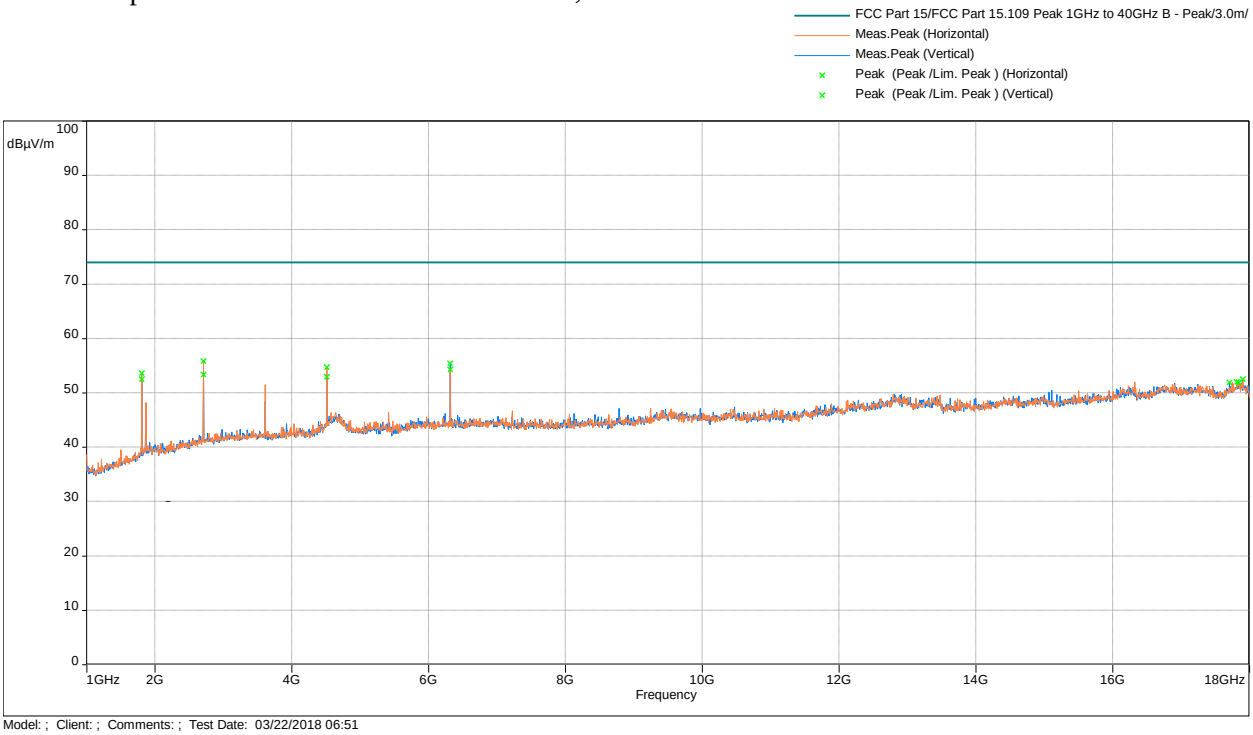
4.7.4 Test Results: 15.209 Out-of-Band Radiated Spurious Emissions, 902.7MHz

Radiated Spurious Emissions 30 - 1000 MHz, Peak Scan



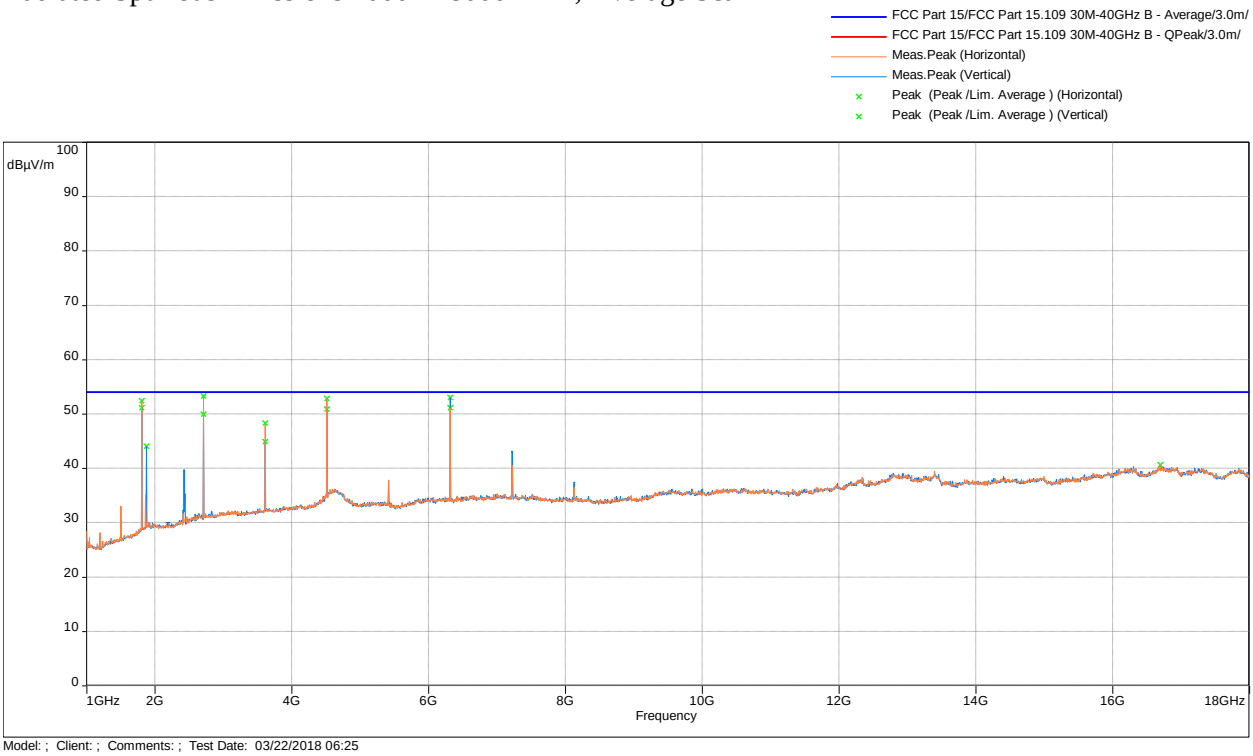
Model: ; Client: ; Comments: ; Test Date: 03/22/2018 08:20

Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan



Model: ; Client: ; Comments: ; Test Date: 03/22/2018 06:51

Radiated Spurious Emissions 1000 - 18000 MHz, Average Scan



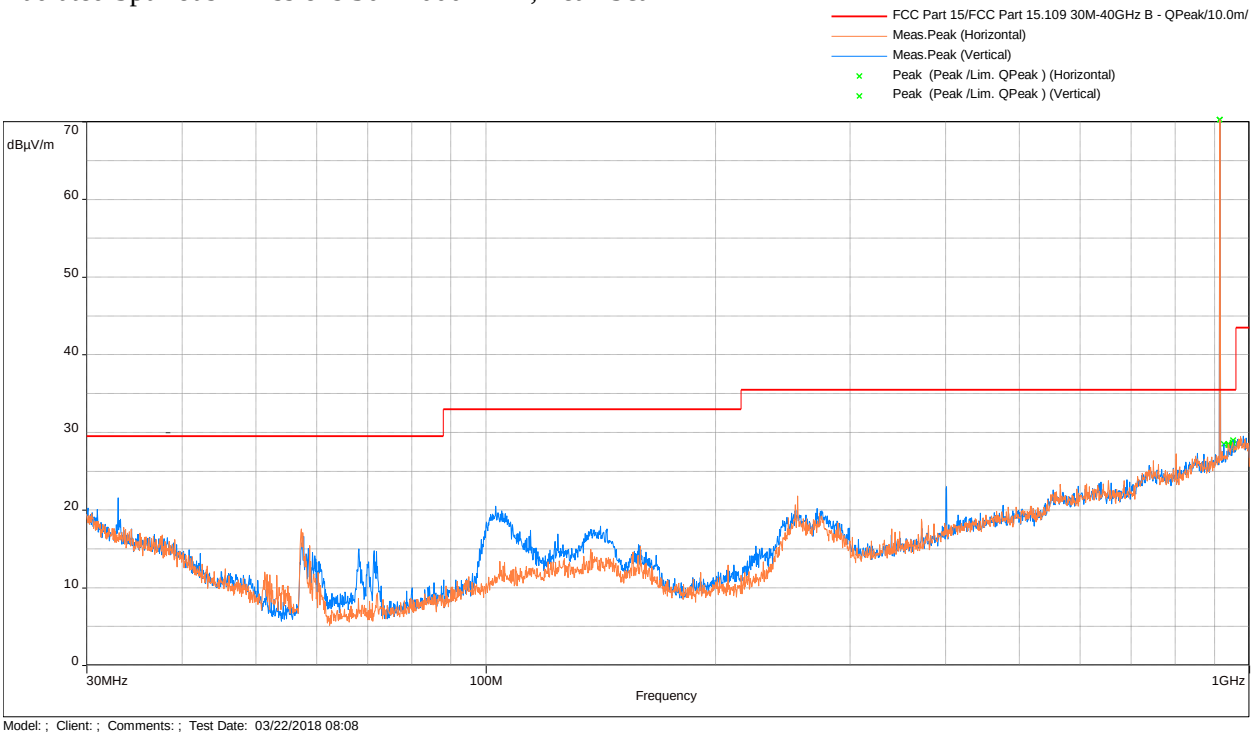
Model: ; Client: ; Comments: ; Test Date: 03/22/2018 06:25

Frequency (MHz)	Avg (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (m)	Angle (°)	Polarity	Correction (dB)
1805.233	52.43	54	-1.57	3.98	311.75	Horizontal	-15.19
1805.233	51.08	54	-2.92	2.49	207	Vertical	-15.19
2707.933	53.24	54	-0.76	2.48	289.25	Horizontal	-12.18
2707.933	49.89	54	-4.11	2.49	46.75	Vertical	-12.18
3610.633	48.31	54	-5.69	2.48	266.25	Horizontal	-9.79
3610.633	44.91	54	-9.09	2.49	1	Vertical	-9.79
4513.333	52.82	54	-1.18	3.98	334.5	Horizontal	-6.05
4513.333	50.88	54	-3.12	2.49	298.5	Vertical	-6.05
6318.733	52.99	54	-1.01	2.49	298.5	Vertical	-3.97
6318.733	51.16	54	-2.84	2.48	334.75	Horizontal	-3.97

Results	**Complies**

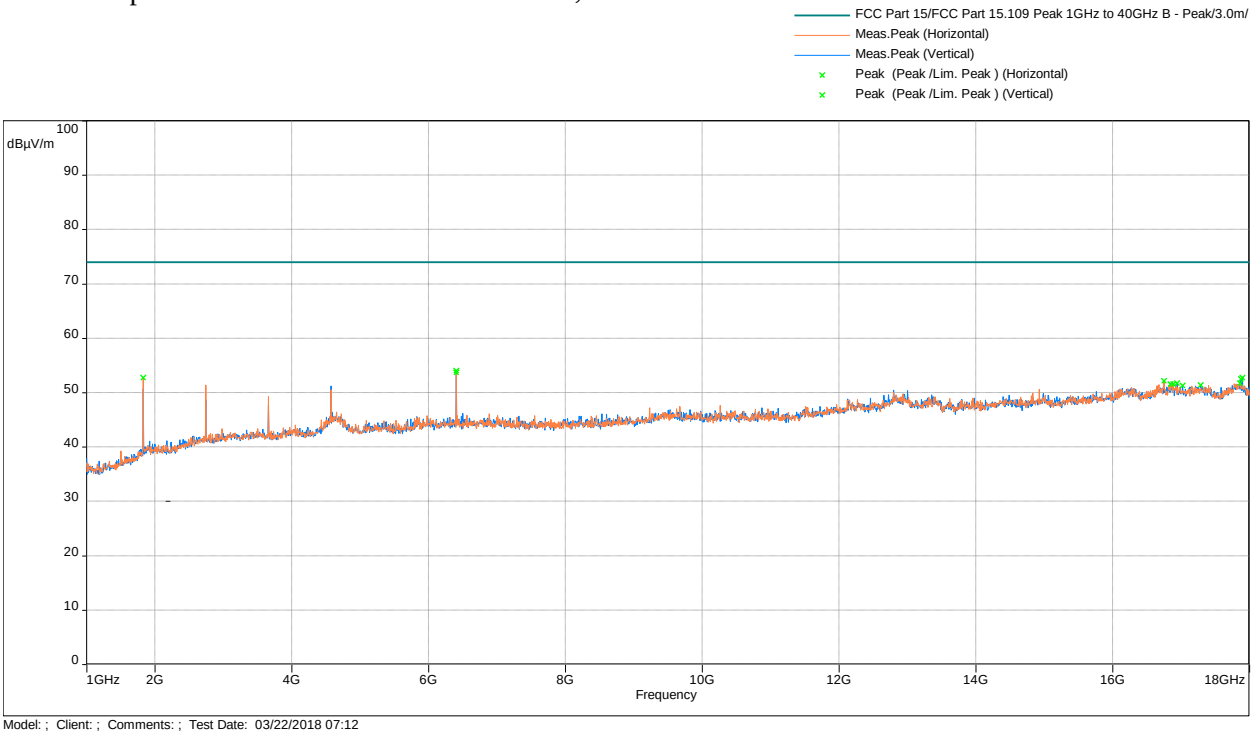
Test Results: 15.209 Out-of-Band Radiated Spurious Emissions, 915 MHz

Radiated Spurious Emissions 30 - 1000 MHz, Peak Scan



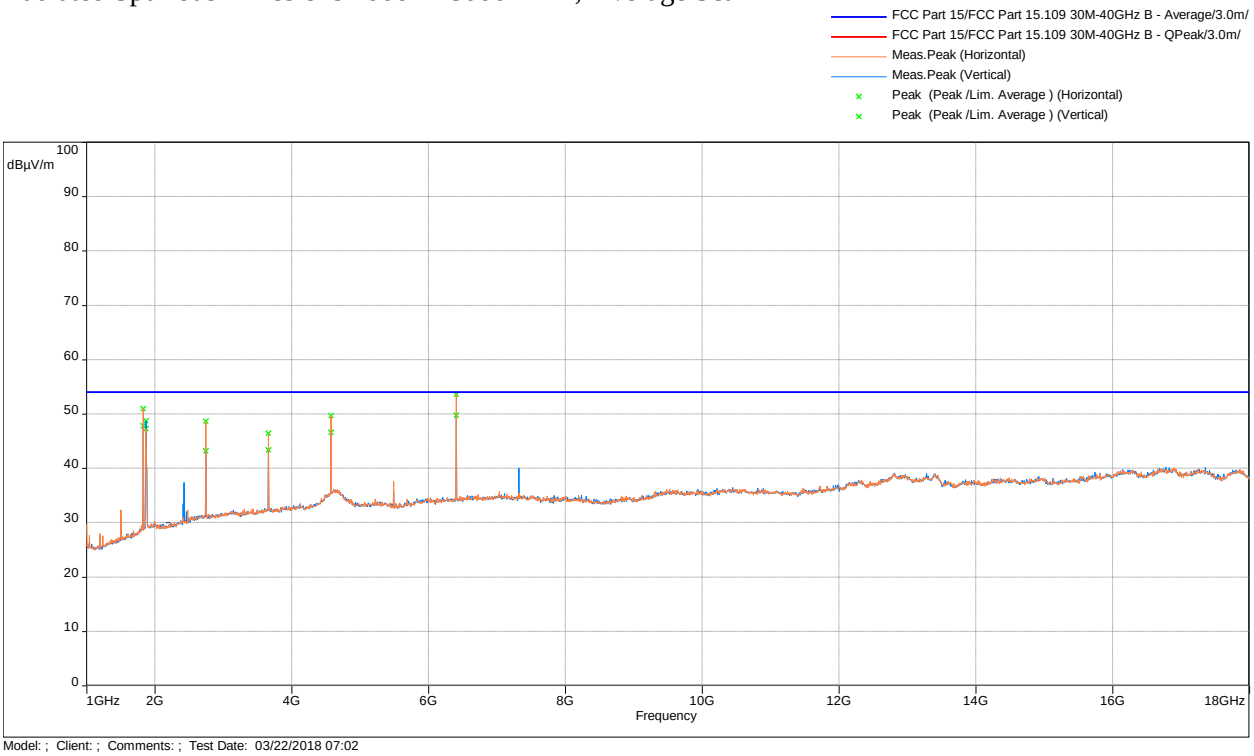
Model: ; Client: ; Comments: ; Test Date: 03/22/2018 08:08

Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan



Model: ; Client: ; Comments: ; Test Date: 03/22/2018 07:12

Radiated Spurious Emissions 1000 - 18000 MHz, Average Scan



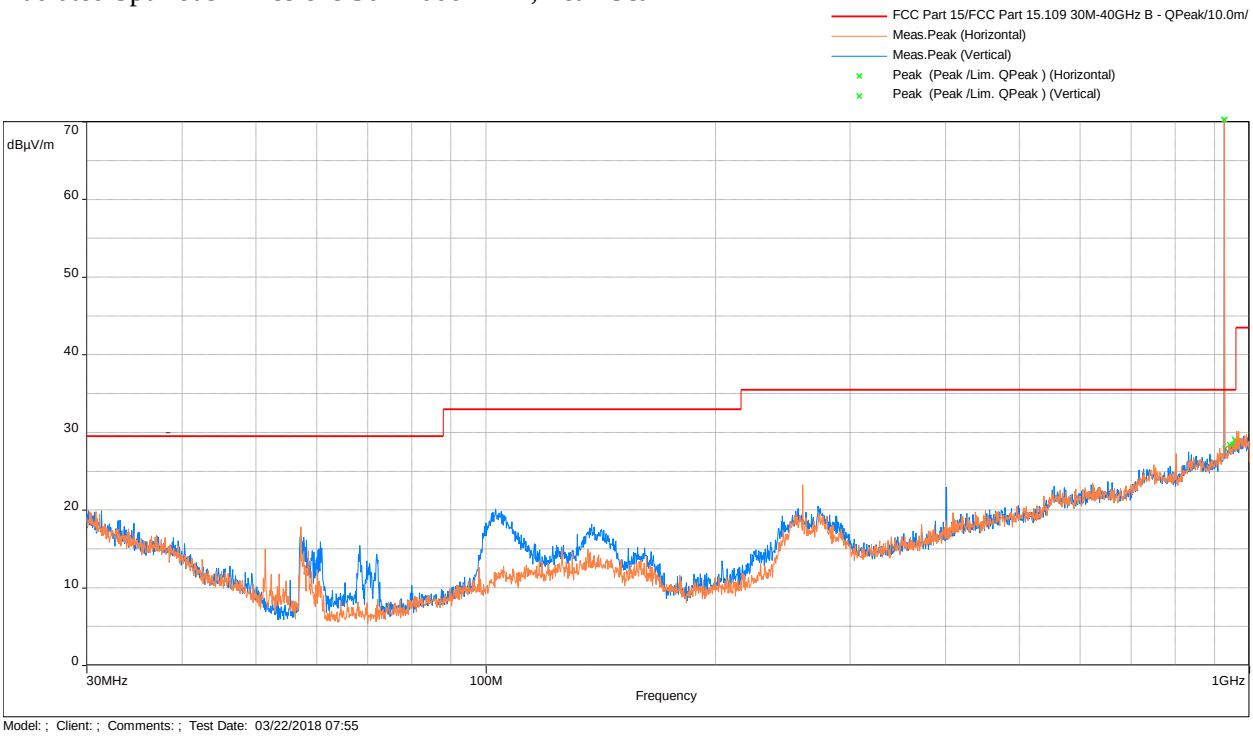
Model: ; Client: ; Comments: ; Test Date: 03/22/2018 07:02

Frequency (MHz)	Avg (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (m)	Angle (°)	Polarity	Correction (dB)
1829.6	50.93	54	-3.07	3.99	269.25	Horizontal	-15.08
1829.6	47.8	54	-6.2	2.51	185	Vertical	-15.08
2744.767	48.64	54	-5.36	2.52	288.5	Horizontal	-11.94
2744.767	43.2	54	-10.8	2.51	48	Vertical	-11.94
3659.933	46.41	54	-7.59	3.99	0.75	Horizontal	-9.58
3659.933	43.33	54	-10.67	2.51	320.5	Vertical	-9.58
4575.1	49.64	54	-4.36	3.99	269.25	Horizontal	-5.41
4575.1	46.62	54	-7.38	2.51	359.75	Vertical	-5.41
6404.867	53.61	54	-0.39	2.52	359.5	Horizontal	-4.06
6404.867	49.77	54	-4.23	1.01	320.75	Vertical	-4.06

Results	**Complies**

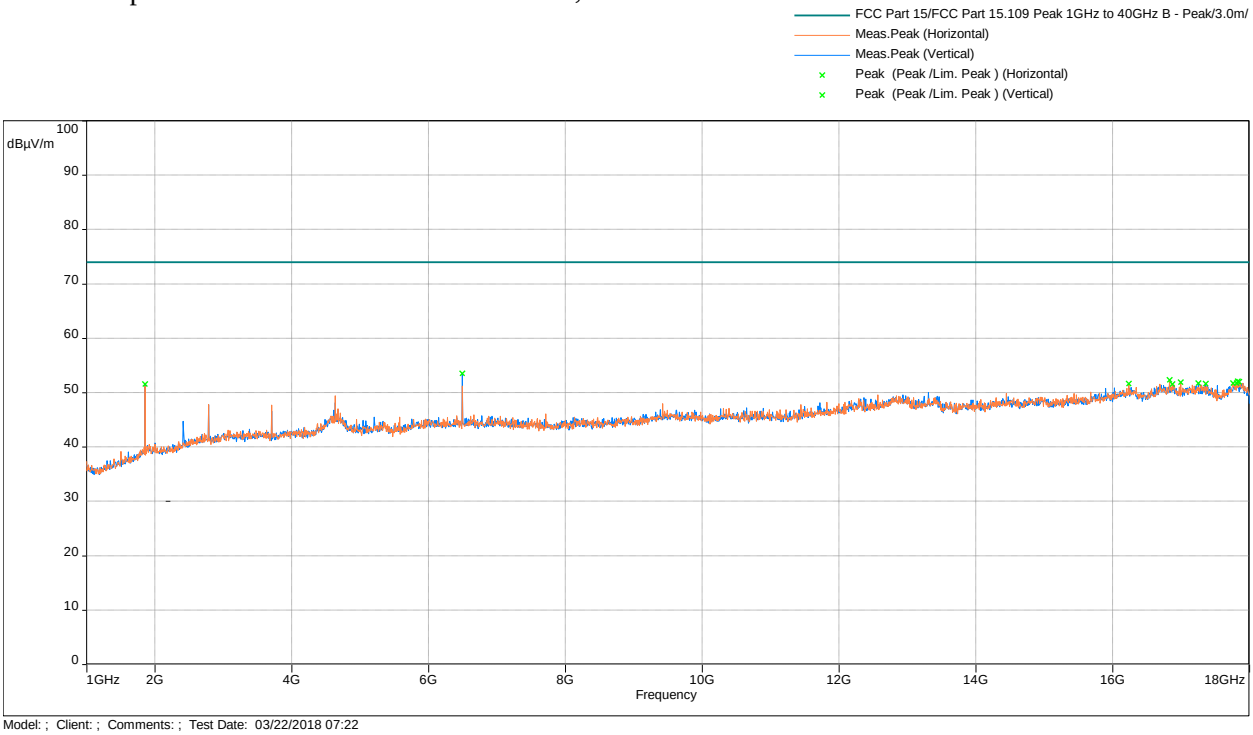
Test Results: 15.209 Out-of-Band Radiated Spurious Emissions, 927.2 MHz

Radiated Spurious Emissions 30 - 1000 MHz, Peak Scan



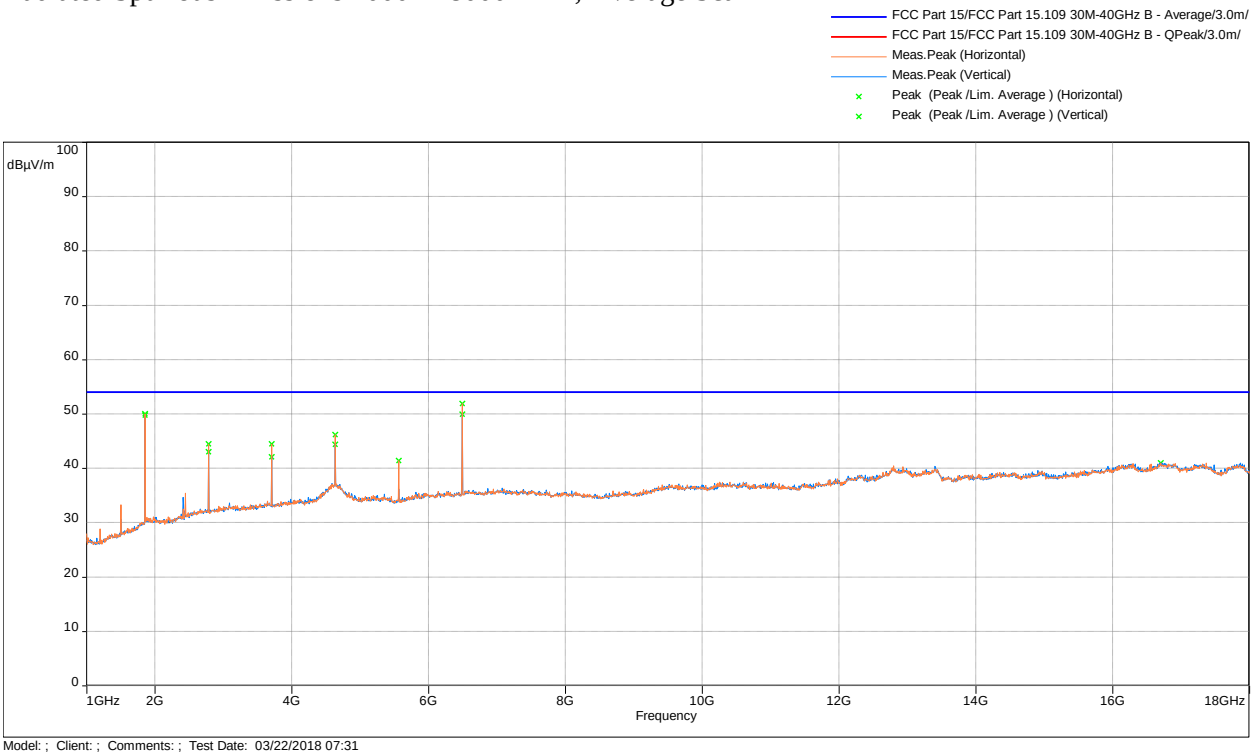
Model: ; Client: ; Comments: ; Test Date: 03/22/2018 07:55

Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan



Model: ; Client: ; Comments: ; Test Date: 03/22/2018 07:22

Radiated Spurious Emissions 1000 - 18000 MHz, Average Scan



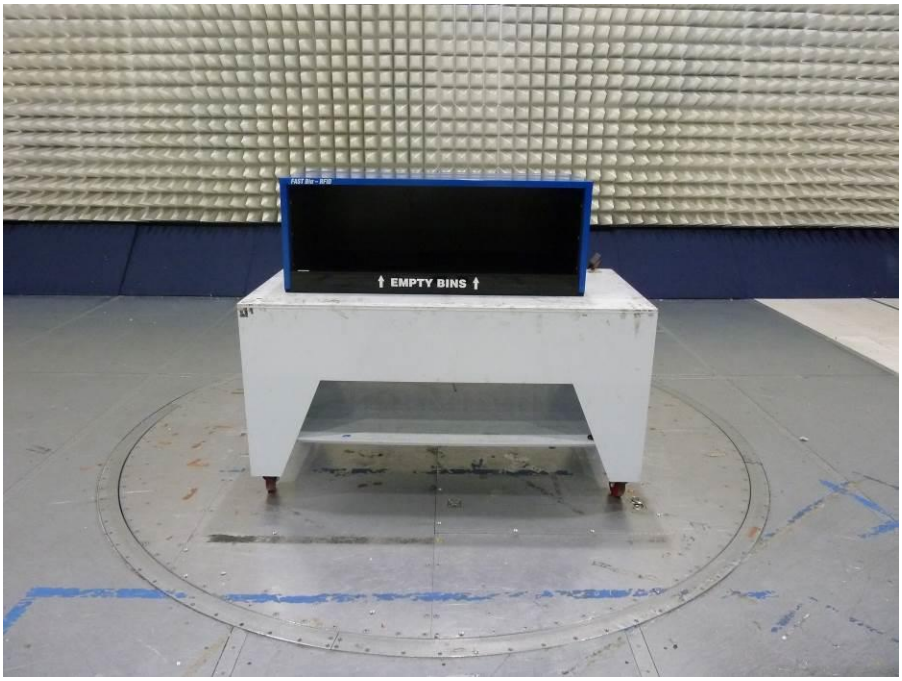
Model: ; Client: ; Comments: ; Test Date: 03/22/2018 07:31

Frequency (MHz)	Avg (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (m)	Angle (°)	Polarity	Correction (dB)
1853.967	50	54	-4	1.01	359	Horizontal	-14.92
2781.6	44.5	54	-9.5	2.48	266.25	Horizontal	-11.9
3708.667	44.5	54	-9.5	1.01	359.5	Horizontal	-9.39
4635.733	46.14	54	-7.86	2.48	243.75	Horizontal	-5.06
6490.433	51.92	54	-2.08	2.48	0	Horizontal	-3.87
1853.967	49.71	54	-4.29	2.52	0	Vertical	-14.92
2781.6	43.03	54	-10.97	1.02	129.75	Vertical	-11.9
3708.667	42.03	54	-11.97	3.99	312	Vertical	-9.39
4635.733	44.4	54	-9.6	2.52	359.75	Vertical	-5.06
6490.433	49.91	54	-4.09	1.02	359.75	Vertical	-3.87

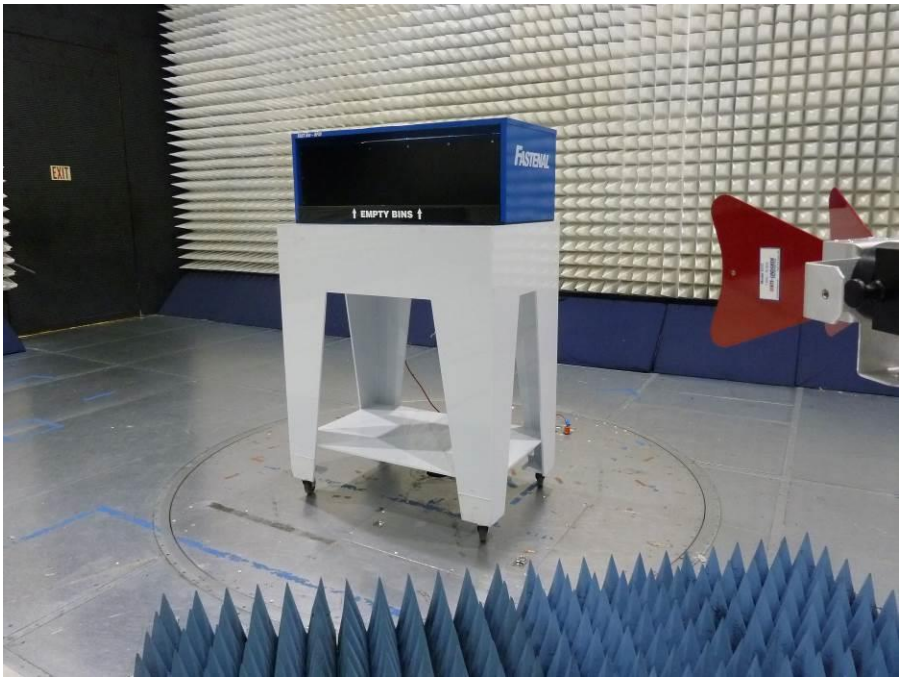
Results	**Complies**

4.7.5 Test Setup Photographs

The following photographs show the testing configurations used.



4.7.5 Test Setup Photographs (Continued)



5.0 List of Test Equipment

Measurement equipment used for emission compliance testing utilized the equipment on the following list:

Equipment	Manufacturer	Model/Type	Asset #	Cal Int	Cal Due
Spectrum Analyzer	Rohde and Schwarz	FSU	ITS 00913	12	01/24/19
Spectrum Analyzer	Rohde and Schwarz	ESR	ITS 01607	12	10/09/18
Active Horn Antenna	ETS-Lindgren	3117-PA	ITS 01636	12	01/11/19
EMI Receiver	Rohde and Schwarz	ESU	ITS 00961	12	07/10/18
BI-Log Antenna	Teseq	CBL 6111D	ITS 01058	12	08/11/18
Pre-Amplifier	Sonoma Instrument	310	ITS 00942	12	01/26/19
RF Cable	TRU Corporation	TRU CORE 300	ITS 01462	12	08/19/18
RF Cable	TRU Corporation	TRU CORE 300	ITS 01465	12	08/19/18
RF Cable	TRU Corporation	TRU CORE 300	ITS 01470	12	08/19/18
Attenuator	Narda	FSCM99899	ITS 01583	12	08/31/18
RF Cable	Megaphase	EMC1-K1K1-236	ITS 01538	12	06/13/18
LISN	COM-POWER	LIN-120A	ITS 01612	12	02/05/19

No Calibration required

Software used for emission compliance testing utilized the following:

Name	Manufacturer	Version	Template/Profile
Tile	Quantum Change	3.4.K.22	Conducted Restricted Band Edge_Avg Conducted Restricted Band Edge_Peak Conducted Restricted Band_1-26GHz Conducted Restricted Band_30M-1GHz Conducted Spurious_30M-26GHz
BAT-EMC	Nexio	3.16.0.64	Fastenal G103406457 3-12-2018.bpp
RS Commander	Rohde Schwarz	1.6.4	Not Applicable (Screen grabber)

6.0 Document History

Revision/ Job Number	Writer Initials	Reviewers Initials	Date	Change
1.0 / G103436674	AC	KV	April 05, 2018	Original document