

Honeywell

FCC / ISED Test Report

For

GRIP 7" AIO Panel

Report #: 50346-A2

FCC ID: CFS8DL-GRIPAIO7

IC ID: 573F-GRIPAIO7

Report Completion Date: 2018-06-29

Prepared by and for:

Honeywell International Inc.

2 Corporate Center Dr.

Suite 100 PO Box 9040

Melville, NY 11747



Testing

NVLAP Lab Code: 600110

Document Introduction

Honeywell tested the above equipment in accordance with the requirements set forth in the listed standards. All indications of Pass/Fail in the report are opinions expressed by Honeywell based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

This document is a record of the FCC/ISED Test Report for Honeywell products. It demonstrates the data required to be analyzed to certify a product according to the requirements of the FCC & ISED.

The results in the report reflect only the model of the items under test unless noted otherwise. This document may not be altered or revised in any way unless done so by Honeywell and all revisions are duly noted in the revisions section. Any alterations of this document not carried out by Honeywell will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Test Report Revision History				
Revision	Prepared By	Reviewed By	Revision Detail	Release Date
---	M. Antola	A. Roussin	Original Release	2018-06-21
A	M. Antola	A. Roussin	Updated configuration section & added duty cycle data; Added radiated data to support simultaneous operation conditions	2018-06-29

Report Authorization

Report Prepared By:



Michael Antola
Hardware Engineer II
HBT RF & EMC Design
Honeywell International Inc.

Reviewed & Approved By:



Andrew Roussin
Hardware Engineer II
HBT RF & EMC Design
Honeywell International Inc.

Contents

Applicable Test Standards/Limits.....	5
Deviations from Test Methods	5
Facilities and Accreditation	5
Test Item Description	5
Worse-Case Configuration & Mode.....	6
Calibration & Measurement Uncertainty.....	7
Opinions / Interpretations	7
Test Summary.....	8
On Time and Duty Cycle.....	9
20dB Emission Bandwidth.....	10
99% Occupied Bandwidth.....	13
Maximum Conducted Output Power.....	16
Number of Hopping Frequencies	19
Channel Separation	21
Dwell Time.....	26
Out-of-Band Emissions	28
Radiated Emissions (Intentional)	33
Conducted Emissions (Mains).....	44
END OF REPORT.....	46

Applicable Test Standards/Limits

Test Standards/Limits	Result	Dates Tested
ANSI C63.10: 2013	Compliant	05/04/2018 – 06/29/2018
RSS-247, Issue 2, Section 5	Compliant	05/04/2018 – 06/29/2018
RSS-GEN, Issue 4	Compliant	05/04/2018 – 06/29/2018
CFR 47 Pt 15 Subpart C, Section 15.207/209	Compliant	05/04/2018 – 06/29/2018
CFR 47 Pt 15 Subpart C, Section 15.247	Compliant	05/04/2018 – 06/29/2018

Deviations from Test Methods

#	Deviation Description
0	None

Facilities and Accreditation

The test site and measurement facility used to collect data are located at 2 Corporate Center Dr., Melville, NY 11747, USA. Honeywell International is accredited by NVLAP, Laboratory Code 600110-0. The full scope of accreditation can be viewed at the NVLAP website.

Test Item Description

The Global Residential Intrusion Platform (GRIP) 7” All-In-One (AIO) solution consists of a panel with a built-in touch screen display. The panel consists of a main PCB board that contains components (Display, camera, microphones, speaker) to support features such as video and audio, interfaces to external devices/sensors (sensors, devices, and cameras) and wireless communicators. The EUT is AC powered with a battery back-up.

There are three (3) on-board radios - Bluetooth (LE), RF6 and Wiselink. Plug-in modules can support WiFi, Z-Wave and cellular communications. This report will cover the Wiselink portion of the EUT.

The Wiselink circuitry contains a single integral PCB antenna with a gain of 4.7dBi.

Worse-Case Configuration & Mode

Radiated emissions was performed with the EUT set to transmit at the low/mid/high channels with the highest output power as worst-case scenario. The EUT has a typical installation orientation of vertical (i.e. wall-mounted or standing upright on desktop). Therefore, all final radiated test was performed with the EUT in the vertical orientation. See setup photos for details. The AC powered configuration proved to be the worse-case configuration and was tested as such.

Test Sample Identification

Sample ID Number	Sample Serial Number	Date Received
MEL-461	Non-serialized production unit	04/02/2018
MEL-473	Non-serialized production unit	04/19/2018

Calibration & Measurement Uncertainty

- Measuring Instrument Calibration – The measuring equipment utilized to perform the tests documented in this report have been calibrated in accordance with the manufacturer’s recommendations and is traceable to recognized national standards.
- Sample Calculation – Where relevant, the following sample calculation is provided:

$$\text{Field Strength (dBuV/m)} = \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} - \text{Preamp Gain (dB)}$$

[i.e.] $37 \text{ dBuV/m} = 30 \text{ dBuV} + 18.5 \text{ dB/m} + 0.5 \text{ dB} - 12 \text{ dB}$

- Uncertainty - Figures are valid to a confidence level of 95%.

Test	Standard Uncertainty
Radiated Emissions (30-200MHz Horizontal)	+/- 5.05 dB
Radiated Emissions (30-200MHz Vertical)	+/- 5.28 dB
Radiated Emissions (200-1000MHz Horizontal)	+/- 10.21 dB
Radiated Emissions (200-1000MHz Vertical)	+/- 10.36 dB
Radiated Emissions (Above 1GHz)	+/- 9.70 dB
Conducted Emissions (150KHz-30MHz)	+/- 4.36 dB

Opinions / Interpretations

None

Test Summary

All tests described below are required, unless otherwise noted. Notes should be described in detail in the "Additional notes" section.

#	Test Description	Status
1	20 dB Emission Bandwidth	PASS
2	99% Occupied Bandwidth	PASS
3	Maximum Conducted Output Power	PASS
4	Number of Hopping Frequencies	PASS
5	Channel Separation	PASS
6	Dwell Time	PASS
7	Out-of-Band Emissions	PASS
8	Radiated Emissions (Intentional)	PASS
9	Conducted Emissions (Mains)	PASS

On Time and Duty Cycle

Test Description

Refer to KDB 558074 Zero-Span Analyzer Method.

Test Criteria

Reference	Limit
KDB 558074, Section 6	None, for reporting only

Test Information

Tester	Test Location	Date	Temperature (°C)	Humidity (%RH)	Pressure (mbar)	Results (P/F)
CL	RF Lab	05/04//2018-05/07/2018	23	14.6	1010	P

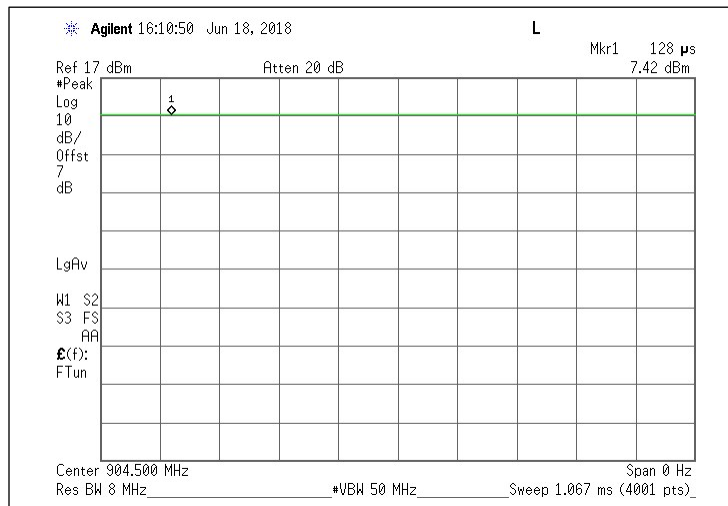
Equipment List

Instrument Type	ID #	Serial #	Manufacturer	Model	Cal Date	Cal Due Date
Spectrum Analyzer	11549	MY46187211	Agilent	E4440A	06/06/17	06/06/19
Environmental Meter	11548	A078188	Extech Instruments	SD700	04/24/17	04/24/18

Test Results

On Time (usec)	Period (usec)	Duty Cycle	Duty Cycle (%)
128	128	1	100

Duty Cycle Plot



20dB Emission Bandwidth

Test Description

Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.

Test Limit

Reference	Limit
CFR 47 Subpart C 15.247 (a)(1)(i) RSS-247 Section 5.4 (c)	<500kHz

Test Information

Tester	Test Location	Date	Temperature (°C)	Humidity (%RH)	Pressure (mbar)	Results (P/F)
CL	RF Lab	05/04//2018-05/07/2018	22.9	36.4	1014	P

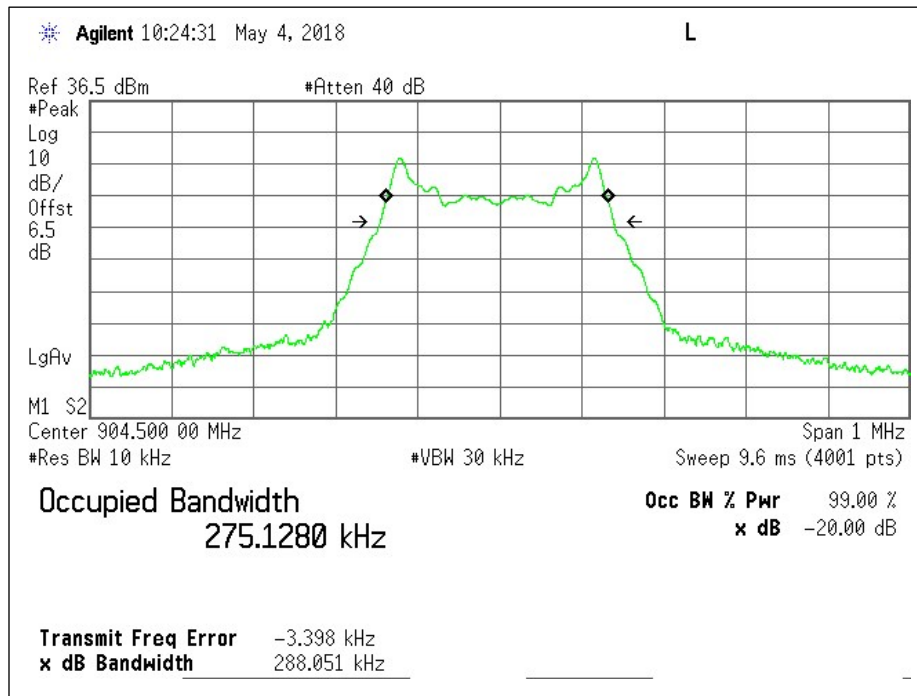
Equipment List

Instrument Type	ID #	Serial #	Manufacturer	Model	Cal Date	Cal Due Date
Spectrum Analyzer	11531	MY41000078	Agilent	E4440A	06/06/2017	06/06/2019
Environmental Meter	11533	A070144	Extech Instruments	SD700	08/21/2017	08/21/2020

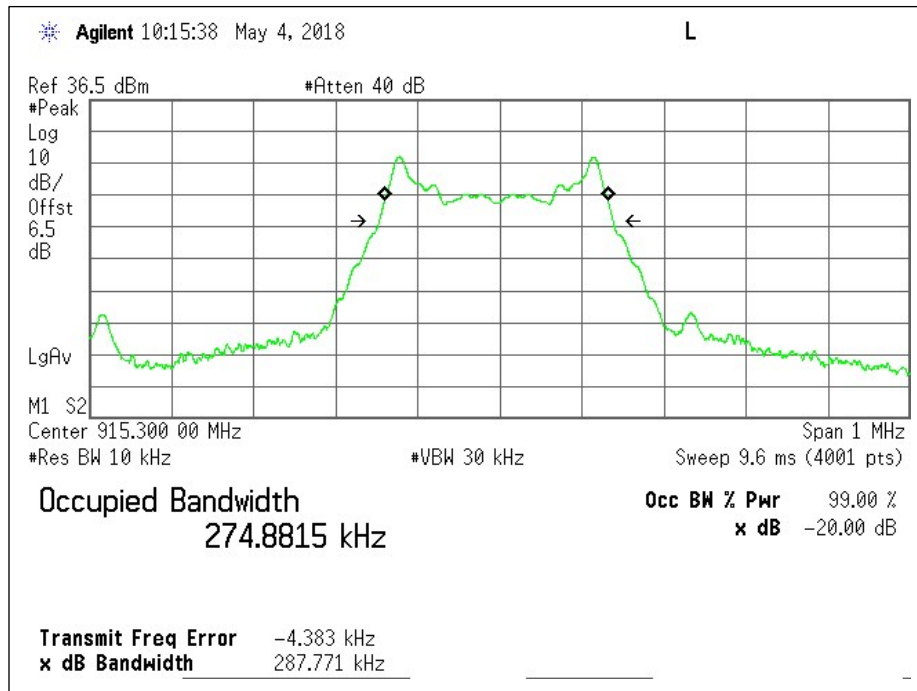
Test Results

Channel	Frequency (MHz)	20dB Bandwidth (kHz)
Low	904.5	288.05
Mid	915.3	287.77
High	926.1	287.67

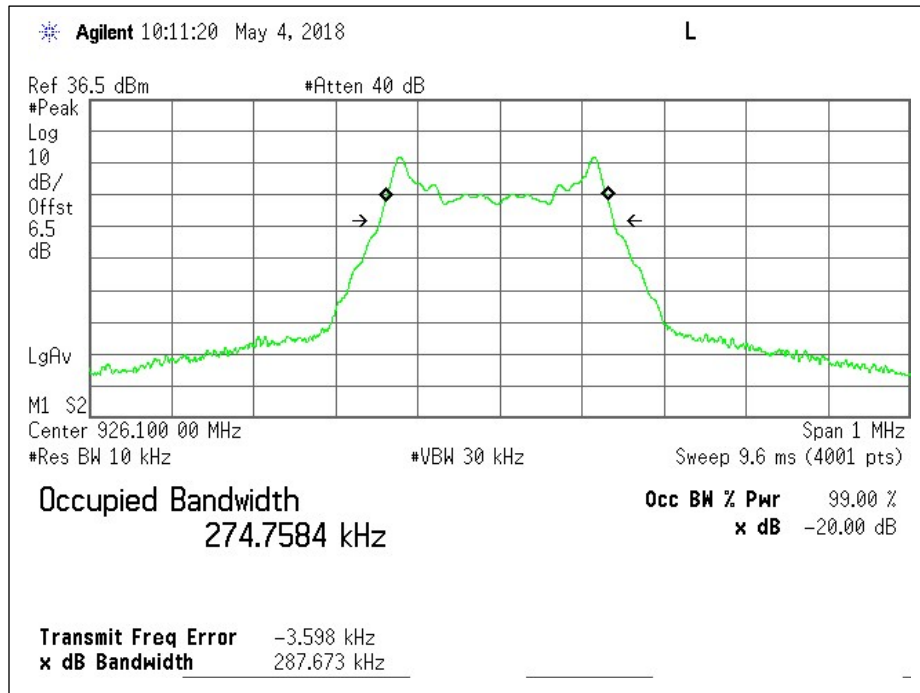
20dB Bandwidth



Low Channel - Plot



Mid Channel - Plot



High Channel - Plot

99% Occupied Bandwidth

Test Description

The emission bandwidth (x dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated x dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth.

When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

Test Criteria

Reference	Limit
RSS-GEN, Section 6.6	N/A

Test Information

Tester	Test Location	Date	Temperature (°C)	Humidity (%RH)	Pressure (mbar)	Results (P/F)
CL	RF Lab	05/04//2018-05/08/2018	22.9	36.4	1014	P

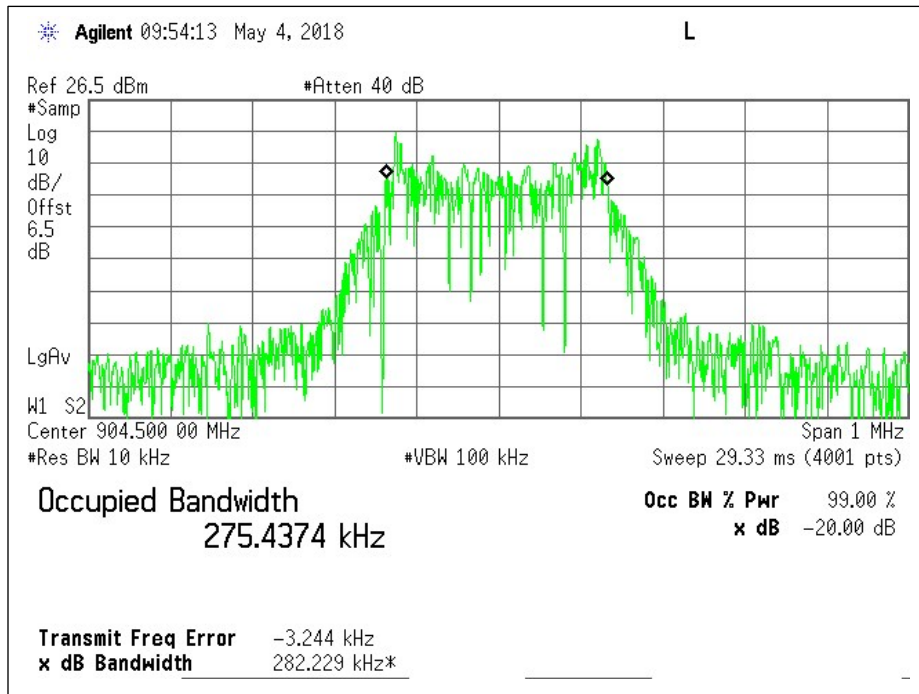
Equipment List

Instrument Type	ID #	Serial #	Manufacturer	Model	Cal Date	Cal Due Date
Spectrum Analyzer	11531	MY41000078	Agilent	E4440A	06/06/2017	06/06/2019
Environmental Meter	11533	A070144	Extech Instruments	SD700	08/21/2017	08/21/2020

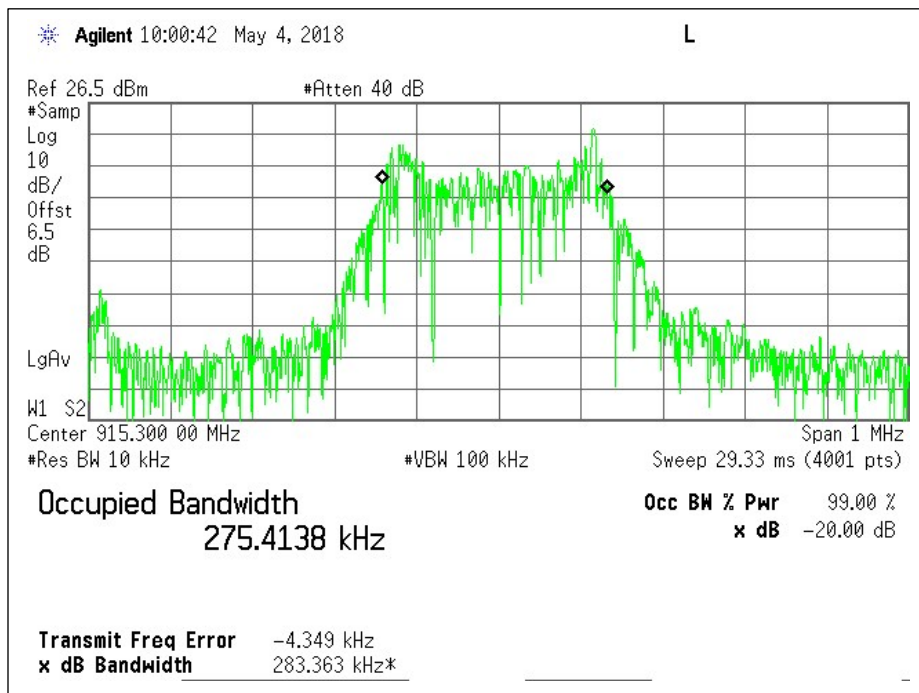
Test Results

Channel	Frequency (MHz)	99% Bandwidth (in kHz)
Low	904.5	275.44
Mid	915.3	275.41
High	926.1	274.63

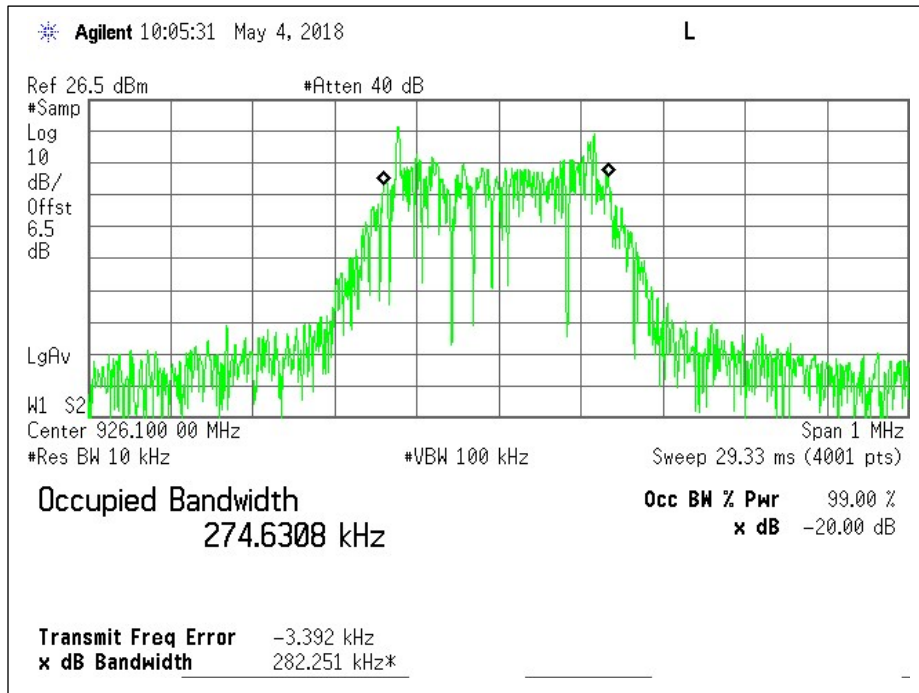
99% Occupied Bandwidth



Low Channel - Plot



Mid Channel - Plot



High Channel - Plot

Maximum Conducted Output Power

Test Description

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, as permitted under paragraph (a)(1)(i) of this section.

Test Criteria

Reference	Limit
CFR 47 Subpart C 15.247 (b)(2) RSS-247 Section 5.4 (a)	0.25W (24dBm)

Test Information

Tester	Test Location	Date	Temperature (°C)	Humidity (%RH)	Pressure (mbar)	Results (P/F)
CL	RF Lab	05/04//2018-05/08/2018	22.9	36.4	1014	P

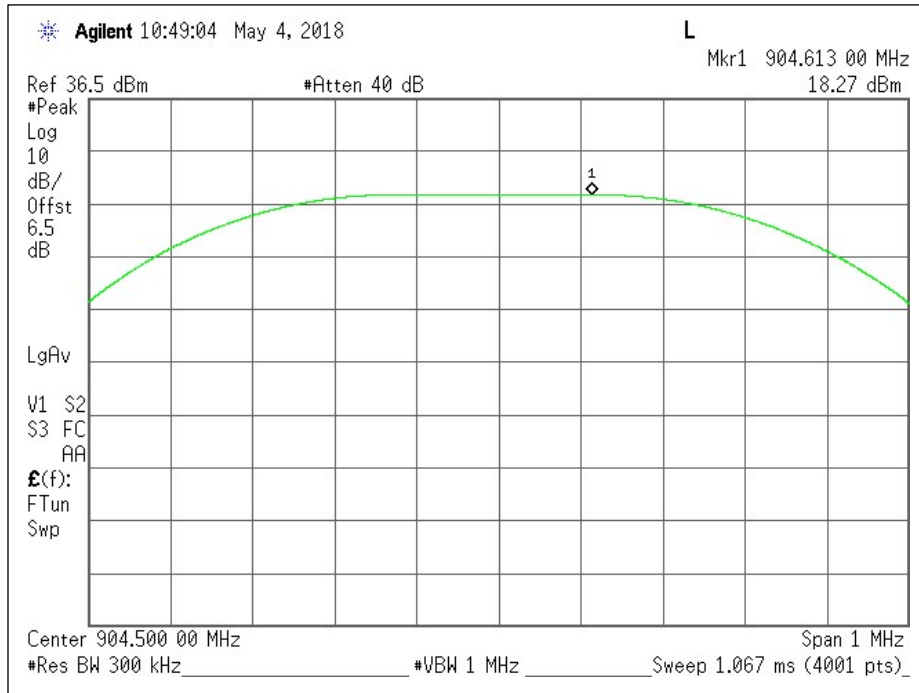
Equipment List

Instrument Type	ID #	Serial #	Manufacturer	Model	Cal Date	Cal Due Date
Spectrum Analyzer	11531	MY41000078	Agilent	E4440A	06/06/2017	06/06/2019
Environmental Meter	11533	A070144	Extech Instruments	SD700	08/21/2017	08/21/2020

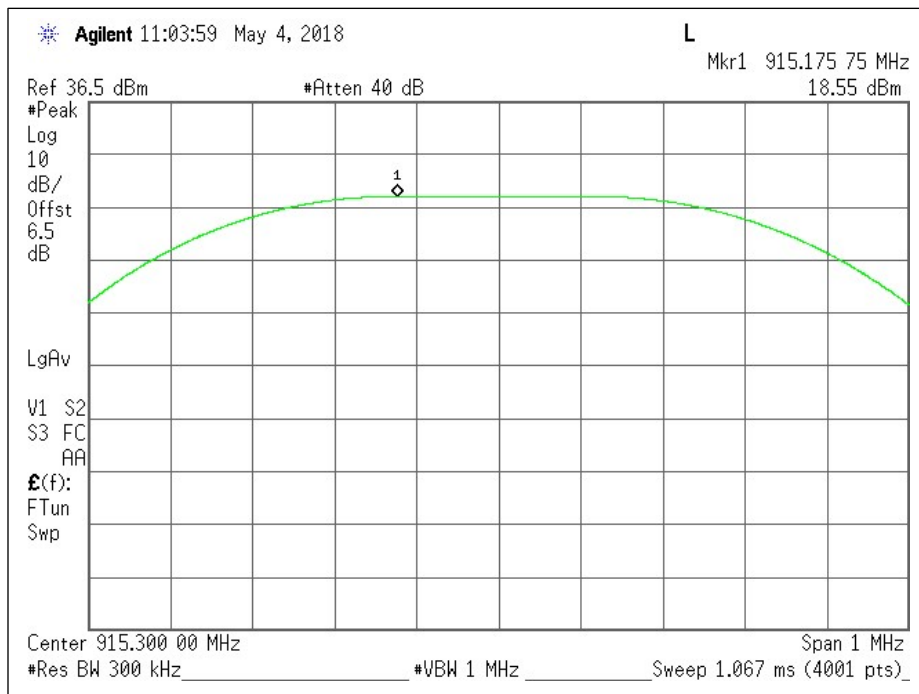
Test Results

Channel	Frequency (MHz)	Tx Channel Peak Power (dBm)	Tx Channel Peak Power (W)
Low	904.5	18.27	0.067
Mid	915.3	18.55	0.072
High	926.1	18.41	0.069

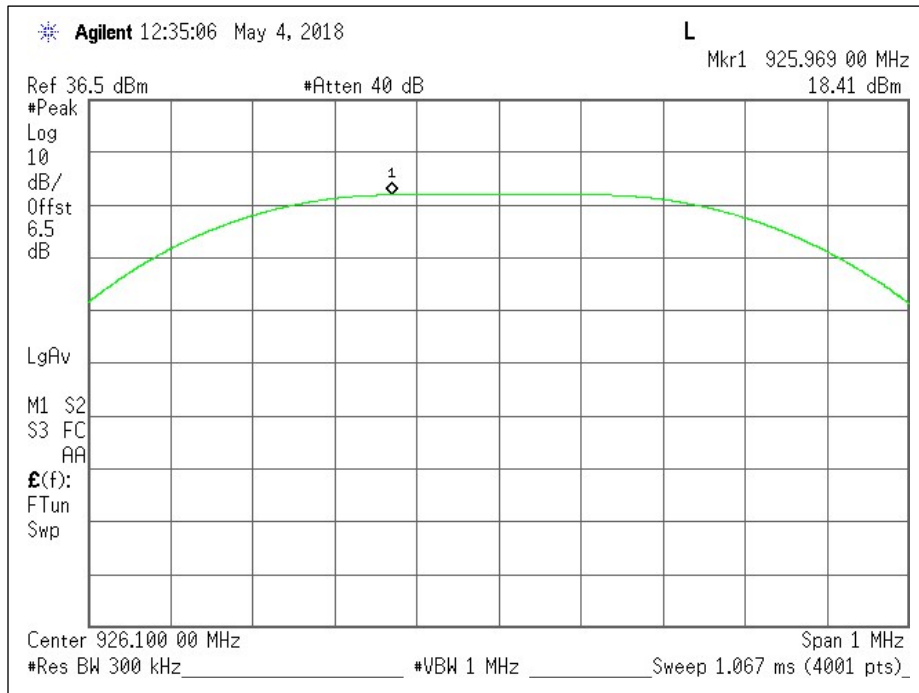
Output Power



Low Channel - Plot



Mid Channel - Plot



High Channel - Plot

Number of Hopping Frequencies

Test Description

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.

Test Criteria

Reference	Limit
CFR 47 Subpart C 15.247 (a)(1) RSS-247 Section 5.1 (c)	≥ 25 Hopping Frequencies

Test Information

Tester	Test Location	Date	Temperature (°C)	Humidity (%RH)	Pressure (mbar)	Results (P/F)
CL	RF Lab	05/04//2018-05/08/2018	22.9	36.4	1014	P

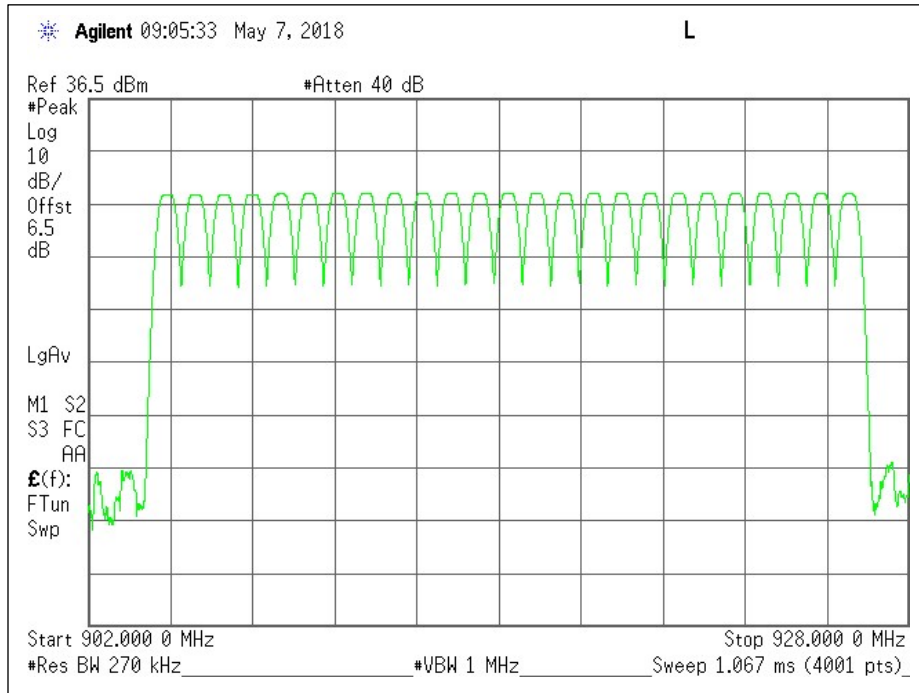
Equipment List

Instrument Type	ID #	Serial #	Manufacturer	Model	Cal Date	Cal Due Date
Spectrum Analyzer	11531	MY41000078	Agilent	E4440A	06/06/2017	06/06/2019
Environmental Meter	11533	A070144	Extech Instruments	SD700	08/21/2017	08/21/2020

Test Results

Number of Hopping Frequencies
25

Number of Hopping Frequencies



Number of Channels

Channel Separation

Test Description

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

Test Criteria

Reference	Limit
CFR 47 Subpart C 15.247 (a)(1) RSS-247 Section 5.1 (b)	>25kHz or the 20dB Bandwidth, whichever is greater

Test Information

Tester	Test Location	Date	Temperature (°C)	Humidity (%RH)	Pressure (mbar)	Results (P/F)
CL	RF Lab	05/04//2018-05/08/2018	22.9	36.4	1014	P

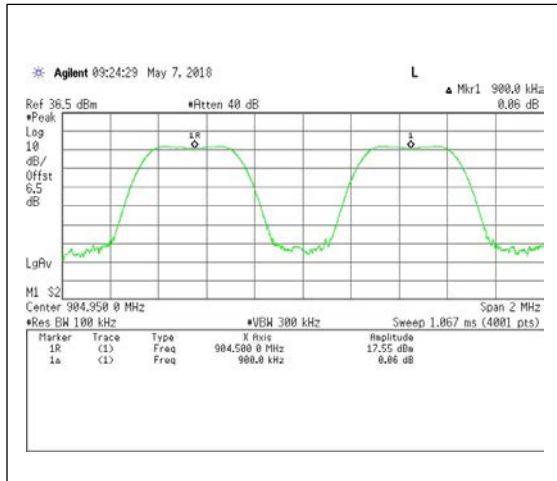
Equipment List

Instrument Type	ID #	Serial #	Manufacturer	Model	Cal Date	Cal Due Date
Spectrum Analyzer	11531	MY41000078	Agilent	E4440A	06/06/2017	06/06/2019
Environmental Meter	11533	A070144	Extech Instruments	SD700	08/21/2017	08/21/2020

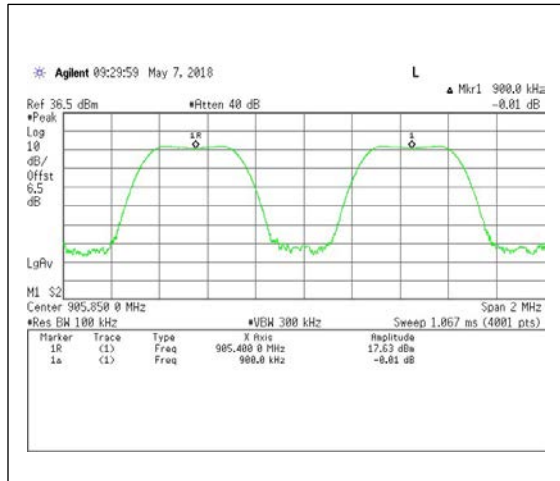
Test Results

Requirement is >25kHz or 20dB bandwidth	Channel Separation between each Channel
20dB bandwidth = 275kHz	900kHz

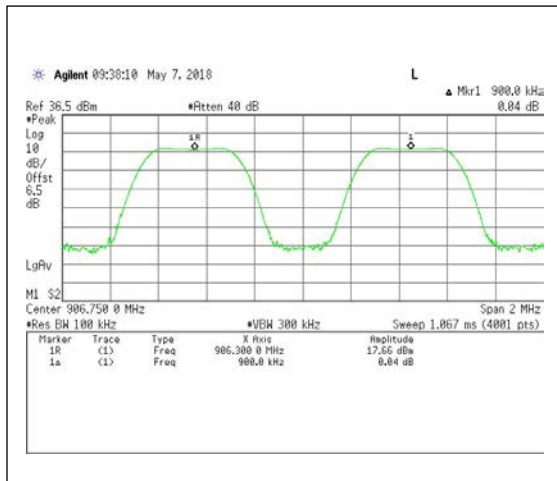
Channel Separation



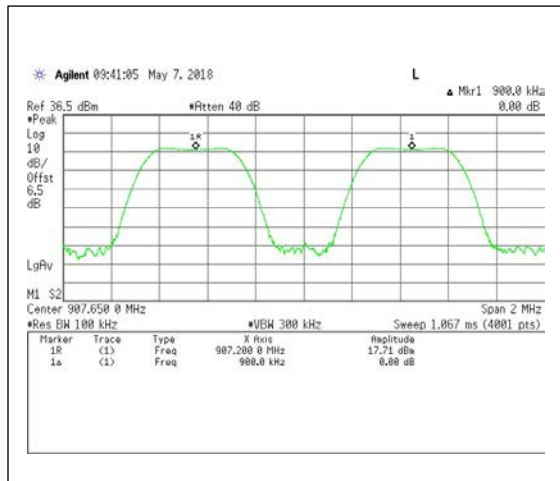
Channels 0-1



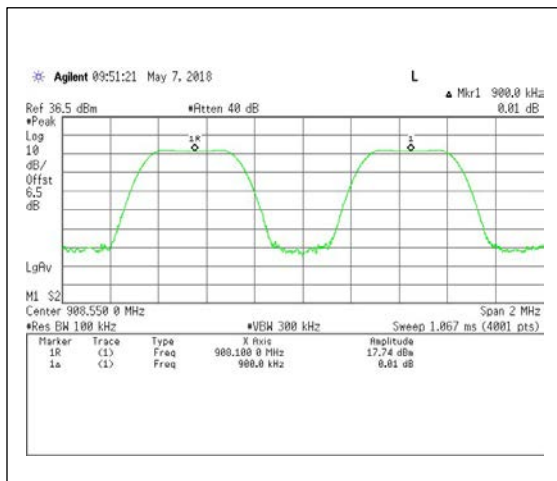
Channels 1-2



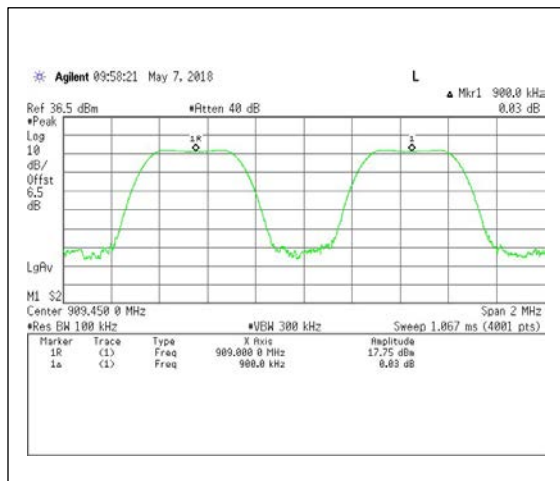
Channels 2-3



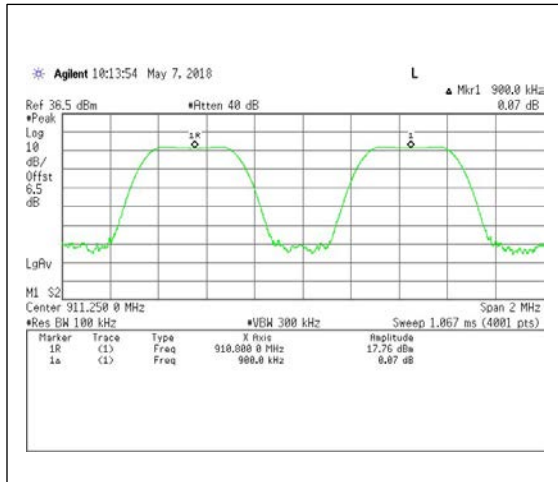
Channels 3-4



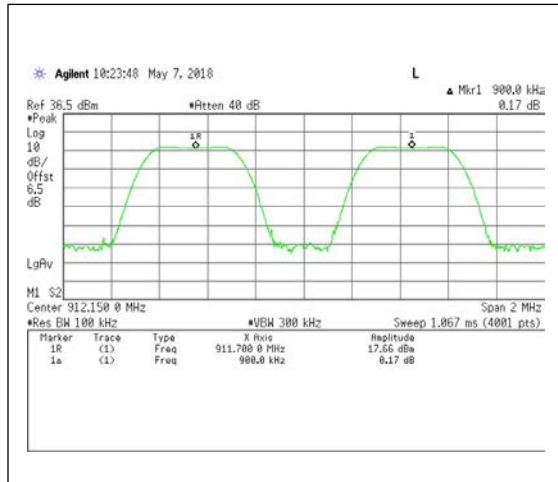
Channels 4-5



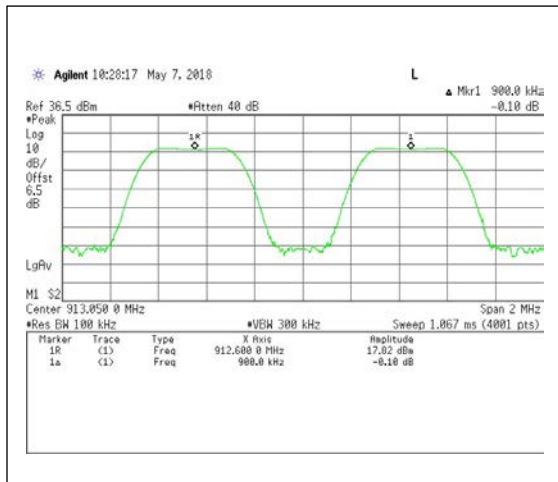
Channels 5-6



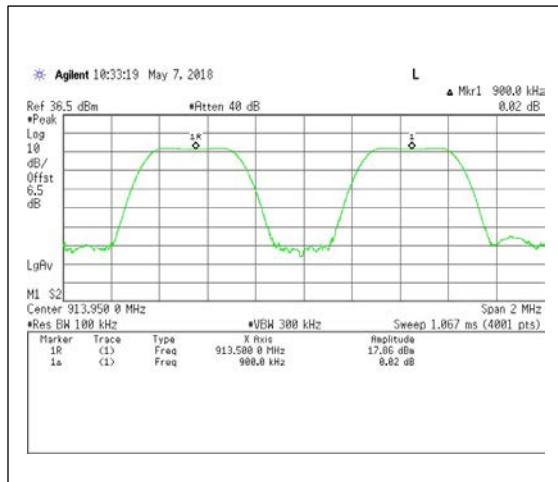
Channels 7-8



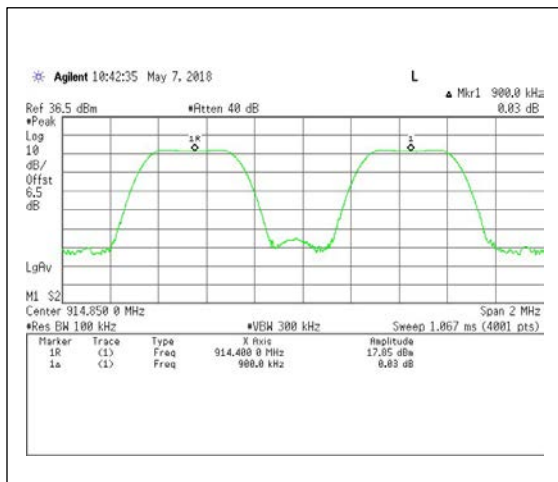
Channels 8-9



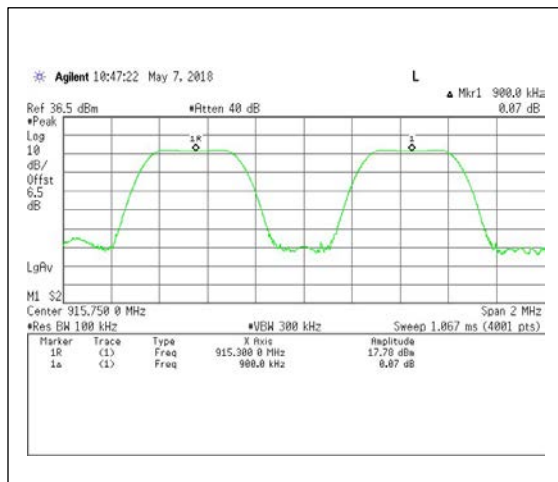
Channels 9-10



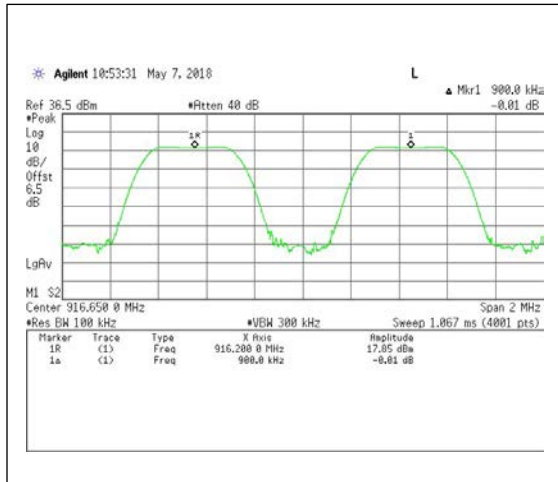
Channels 10-11



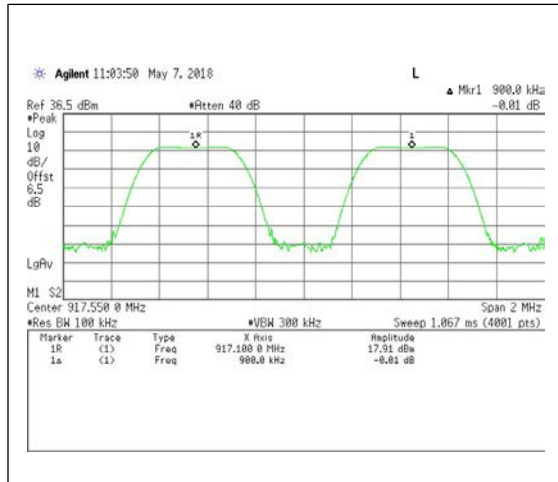
Channels 11-12



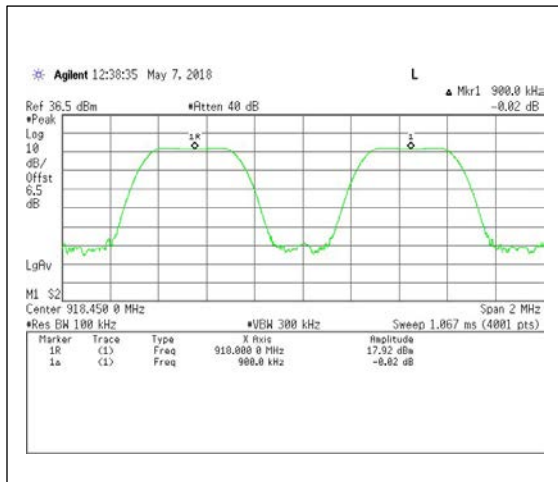
Channels 12-13



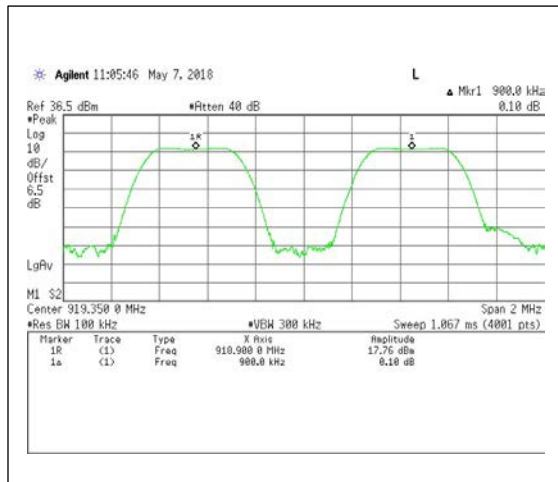
Channels 13-14



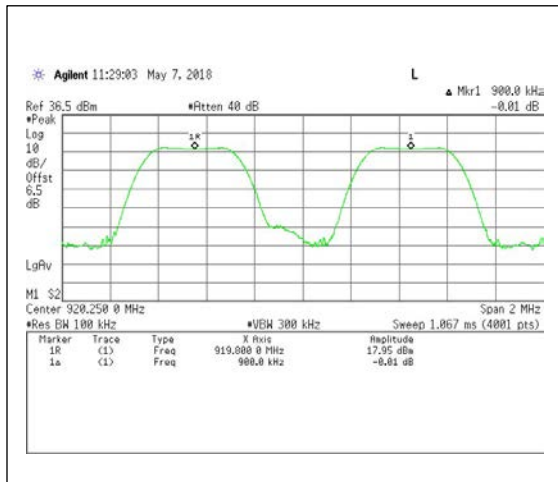
Channels 14-15



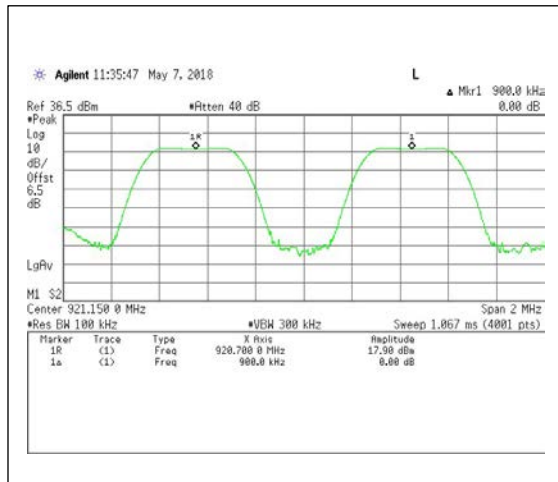
Channels 15-16



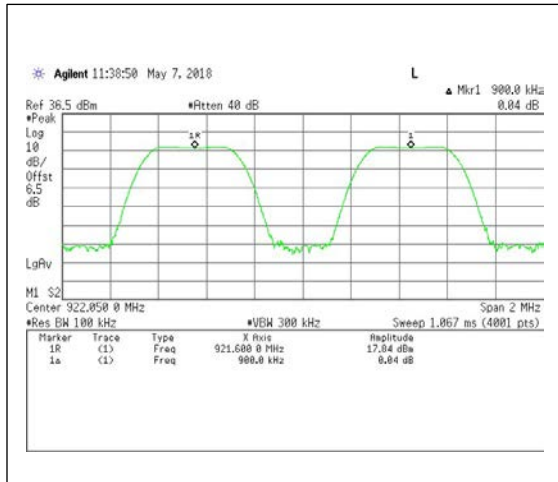
Channels 16-17



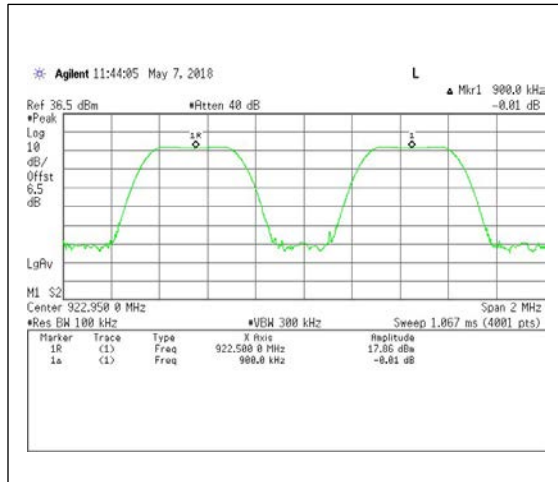
Channels 17-18



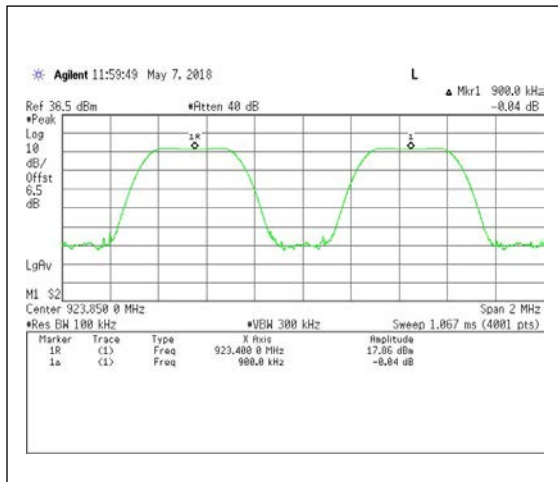
Channels 18-19



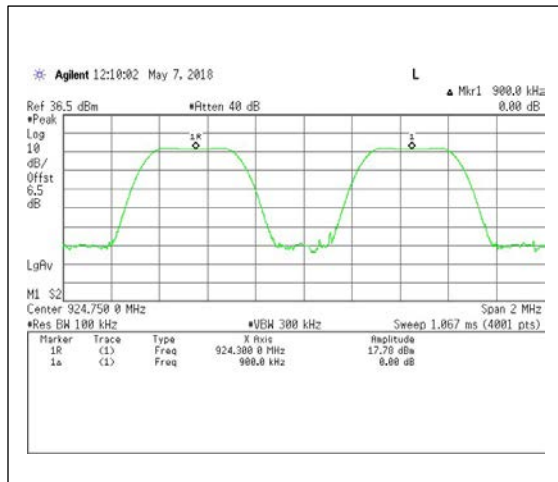
Channels 19-20



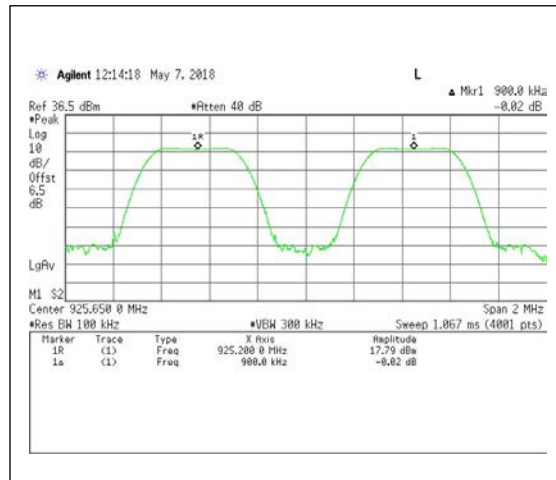
Channels 20-21



Channels 21-22



Channels 22-23



Channels 23-24

Dwell Time

Test Description

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.

Test Criteria

Reference	Limit
CFR 47 Subpart C 15.247 (a)(1) RSS-247 Section 5.1 (c/d)	< 0.4 seconds

Test Information

Tester	Test Location	Date	Temperature (°C)	Humidity (%RH)	Pressure (mbar)	Results (P/F)
CL	RF Lab	05/04//2018-05/08/2018	22.9	36.4	1014	P

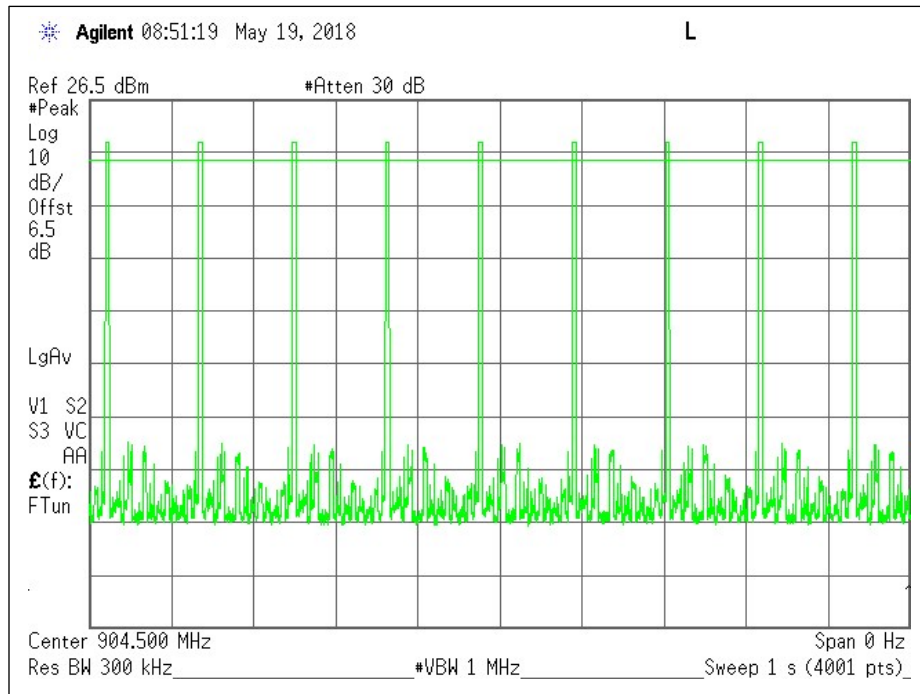
Equipment List

Instrument Type	ID #	Serial #	Manufacturer	Model	Cal Date	Cal Due Date
Spectrum Analyzer	11531	MY41000078	Agilent	E4440A	06/06/2017	06/06/2019
Environmental Meter	11533	A070144	Extech Instruments	SD700	08/21/2017	08/21/2020

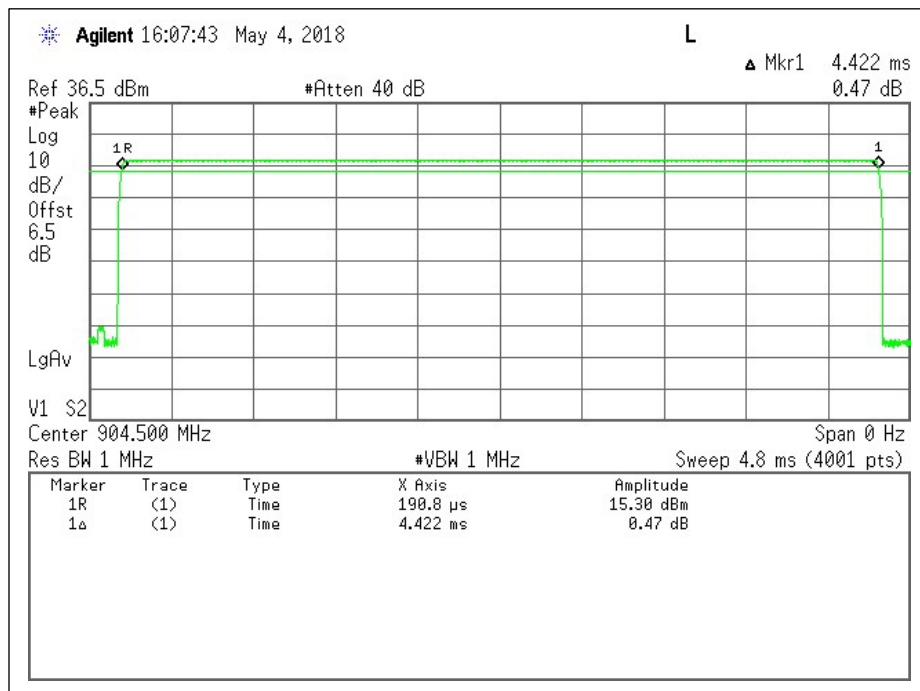
Test Results

Number of transmission in 10 seconds	Length of transmission time (msec)	Results (msec)	Limit (msec)
9 (times) * 10 = 90 times	4.422	397.8	400

Dwell Time



Number of Transmissions



Dwell Time per Channel

Out-of-Band Emissions

Test Description

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)

Test Criteria

Reference	Limit
CFR 47 Subpart C 15.247 (d) RSS-247, Section 5.5	20 dB Below the Fundamental

Test Information

Tester	Test Location	Date	Temperature (°C)	Humidity (%RH)	Pressure (mbar)	Results (P/F)
CL	RF Lab	05/04//2018-05/08/2018	22.9	36.4	1014	P

Equipment List

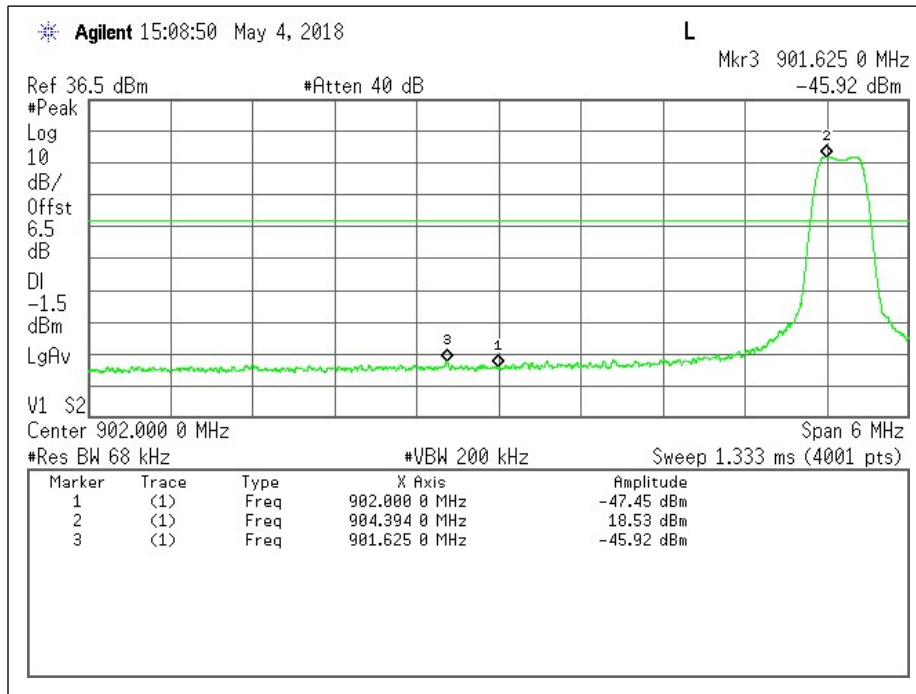
Instrument Type	ID #	Serial #	Manufacturer	Model	Cal Date	Cal Due Date
Spectrum Analyzer	11531	MY41000078	Agilent	E4440A	06/06/2017	06/06/2019
Environmental Meter	11533	A070144	Extech Instruments	SD700	08/21/2017	08/21/2020

Test Results

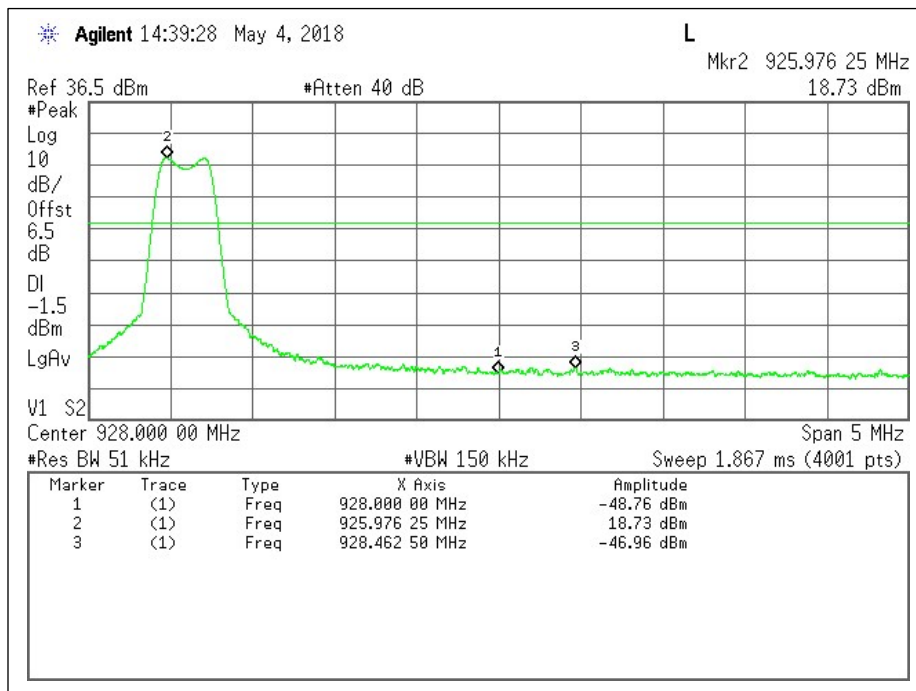
Authorized Band Edge				
Channel	Frequency (MHz)	Delta from Peak to Band edge (dB)	Limit (dB)	Margin (dB)
Low – Hopping OFF	904.5	65.98	20	-45.98
High – Hopping OFF	926.1	67.49	20	-47.49
Low – Hopping ON	904.5	63.78	20	-43.78
High – Hopping ON	926.1	68.75	20	-48.75

Conducted Spurious		
Channel	Frequency (MHz)	Highest Spurious Emission from 20dB down point (dB)
Low	904.5	-41.92
Mid	915.3	-41.72
High	926.1	-41.41

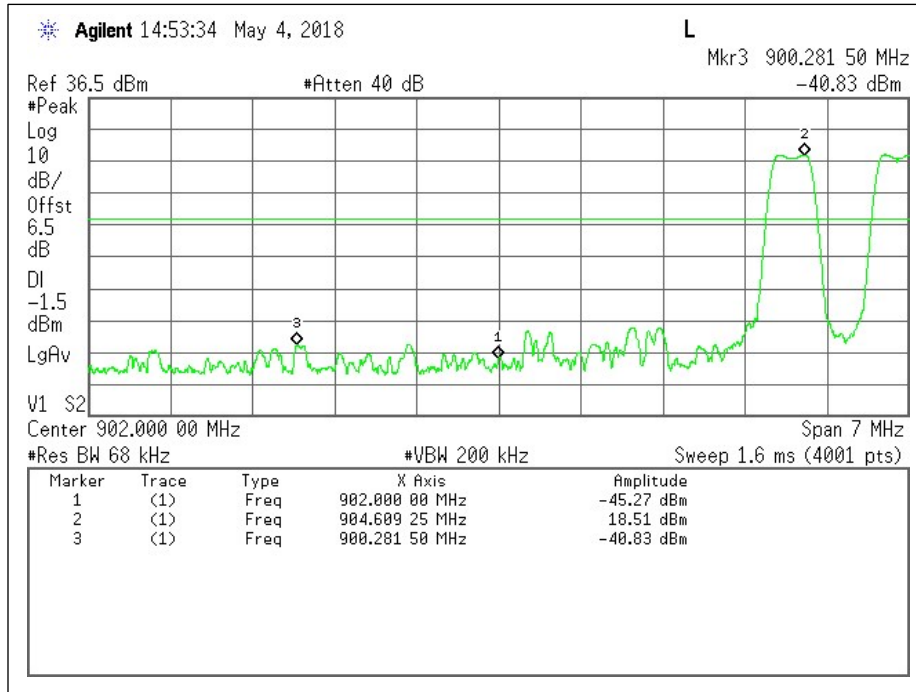
Band Edge



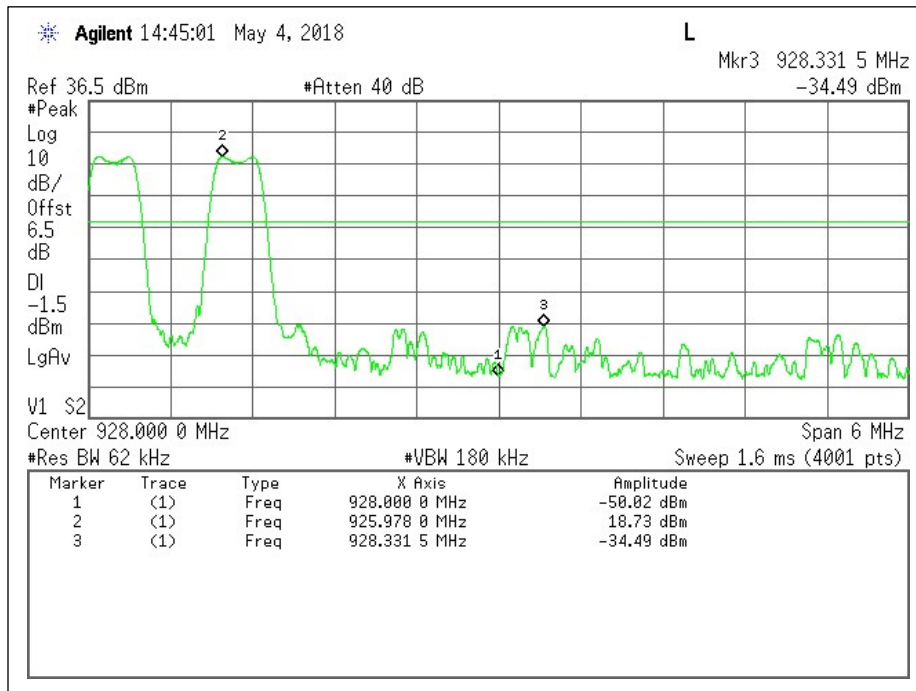
Low Channel, Hopping OFF - Plot



High Channel, Hopping OFF - Plot

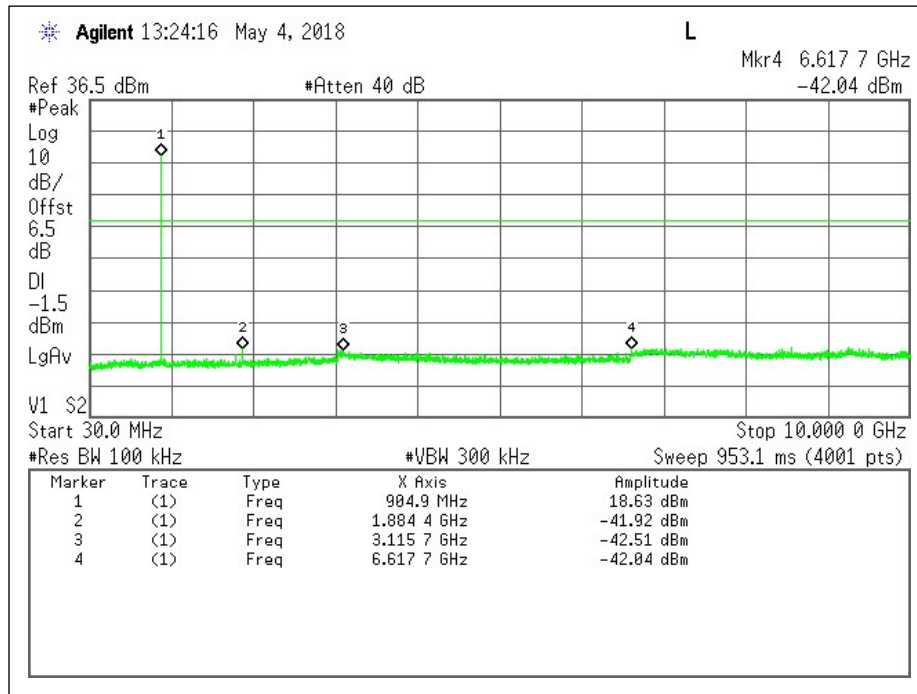


Low Channel, Hopping ON - Plot

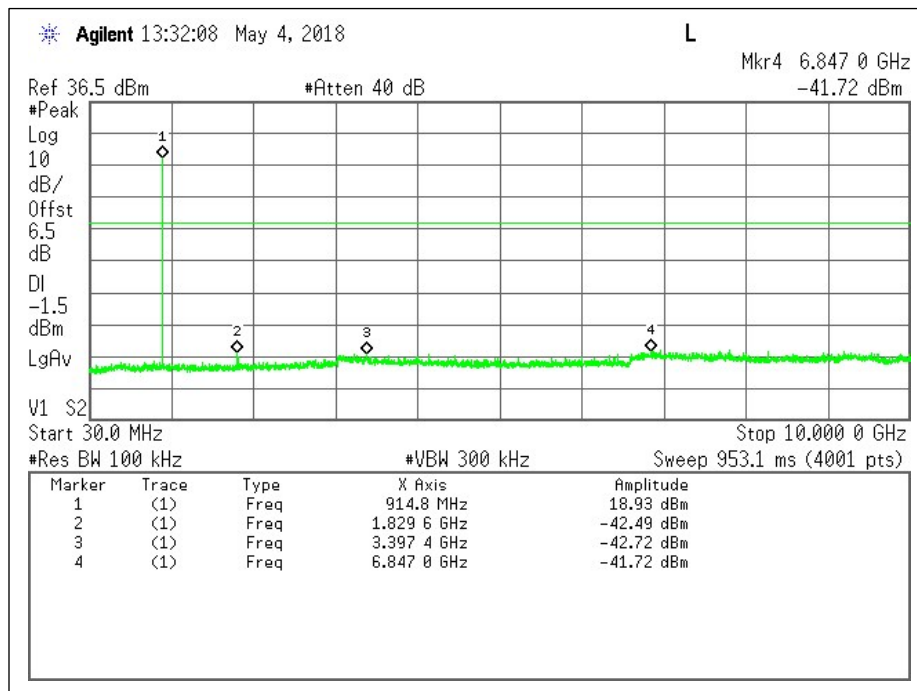


High Channel, Hopping ON - Plot

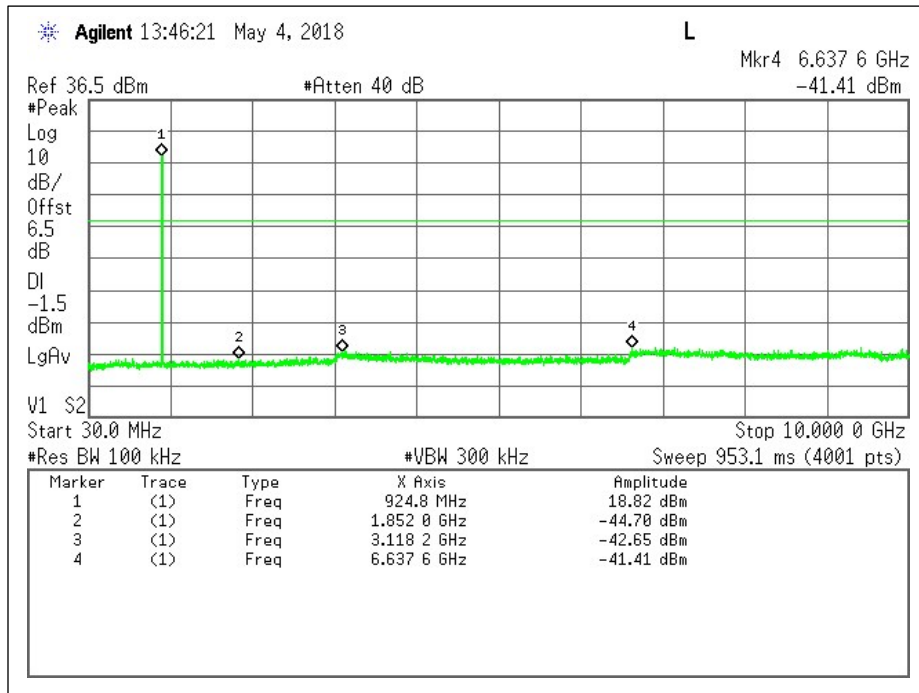
Conducted Spurious



Low Channel - Plot



Mid Channel - Plot



High Channel – Plot

Radiated Emissions (Intentional)

Test Description

Intentional Radiator Radiated Emissions are a test of the emissions, and harmonics on the EUT. The EUT is positioned to get the maximum emissions after a series of prescan measurements. The EUT is placed on a non-conducting table 80 cm above the ground plane for below 1 GHz measurements and 1.5 m above the ground plane for above 1 GHz measurements. The antenna to EUT distance is 3 meters. For measurements below 1 GHz the resolution bandwidth is set to 120 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak. For measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 1 MHz for peak measurements and as applicable for average measurements. The spectrum from 30 MHz to 10 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

Test Criteria

Reference	Limit		
	Frequency Range (MHz)	Field Strength Limit (uV/m)	Measurement distance (meters)
CFR 47 Subpart C, 15.205 CFR 47 Subpart C, 15.209 RSS-GEN	0.009-0.490	2400/F(kHz)	300
	0.490-1.705	24000/F(kHz)	30
	1.705-30.0	30	30
	30-88	100**	3
	88-216	150**	3
	216-960	200**	3
	Above 960	500	3

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241.

Test Information

Tester	Test Location	Date	Temperature (°C)	Humidity (%RH)	Pressure (mbar)	Results (P/F)
CL/JB	RF Lab/OATS	05/17/2018-05/24/2018	14.4	52	1001	P

NOTE: Below 30MHz, pretesting showed that no emissions as a product of the EUT were detected within 20dB of the regulatory limit. Prescans performed in an anechoic chamber, final measurements performed on an OATS.

Since Wiselink/RF6/Bluetooth radios can transmit simultaneously, additional spurious scans are provided with all radios on and transmitting in their worse-case state.

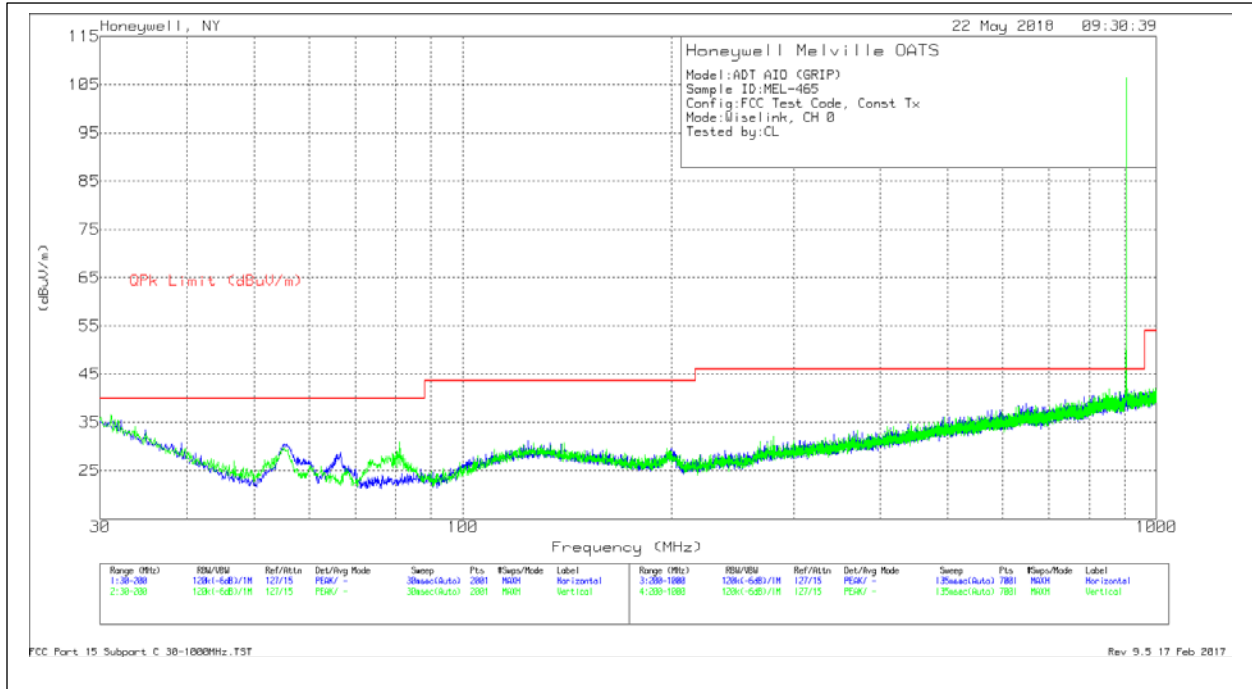
Equipment List

Instrument Type	ID #	Serial #	Manufacturer	Model	Cal Date	Cal Due Date
RF Chamber						
Spectrum Analyzer	11496	100303	Rohde & Schwarz	FSU26	04/11/18	04/11/19
Loop Antenna (9kHz-30MHz)	11535	121080	Com-Power	AL-130R	10/17/18	10/17/19
Bilog Antenna (30MHz-5GHz)	11311	A022406	Sunol	JB5	02/01/18	02/01/19
Horn Antenna (1-18GHz)	2319	2317	EMCO	3115	01/10/18	01/10/19
Preamp (10-4200MHz)	11537	1603006	Mini Circuits	TVA-11-422	N/A	N/A
Preamp (1-18GHz)	11557	18040034	Com-Power	PAM-118A	N/A	N/A
High Pass Filter	11552	G018	Micro-tronics	HPM50111-01	N/A	N/A
Measurement Software	11543	Version 9.5	UL	UL EMC	N/A	N/A
Environmental Meter	11533	A070144	Extech Instruments	SD700	08/21/17	08/21/20
OATS						
Spectrum Analyzer	11545	103125	Rohde & Schwarz	FSW26	02/21/18	02/21/19
Bilog Antenna (30MHz-6GHz)	11534	A012816	Sunol	JB6	03/27/18	03/27/19
Horn Antenna (1-18GHz)	2973	3127	EMCO	RGA-60	01/22/18	01/22/19
Preamp (800MHz-21GHz)	11538	233701631	Mini Circuits	ZVA-213-S+	N/A	N/A
High Pass Filter	11552	G018	Micro-tronics	HPM50111-01	N/A	N/A
Measurement Software	11543	Version 9.5	UL	UL EMC	N/A	N/A
Environmental Meter	11533	A070144	Extech Instruments	SD700	08/21/17	08/21/20

Test Results

Spurious Emissions

Below 1GHz

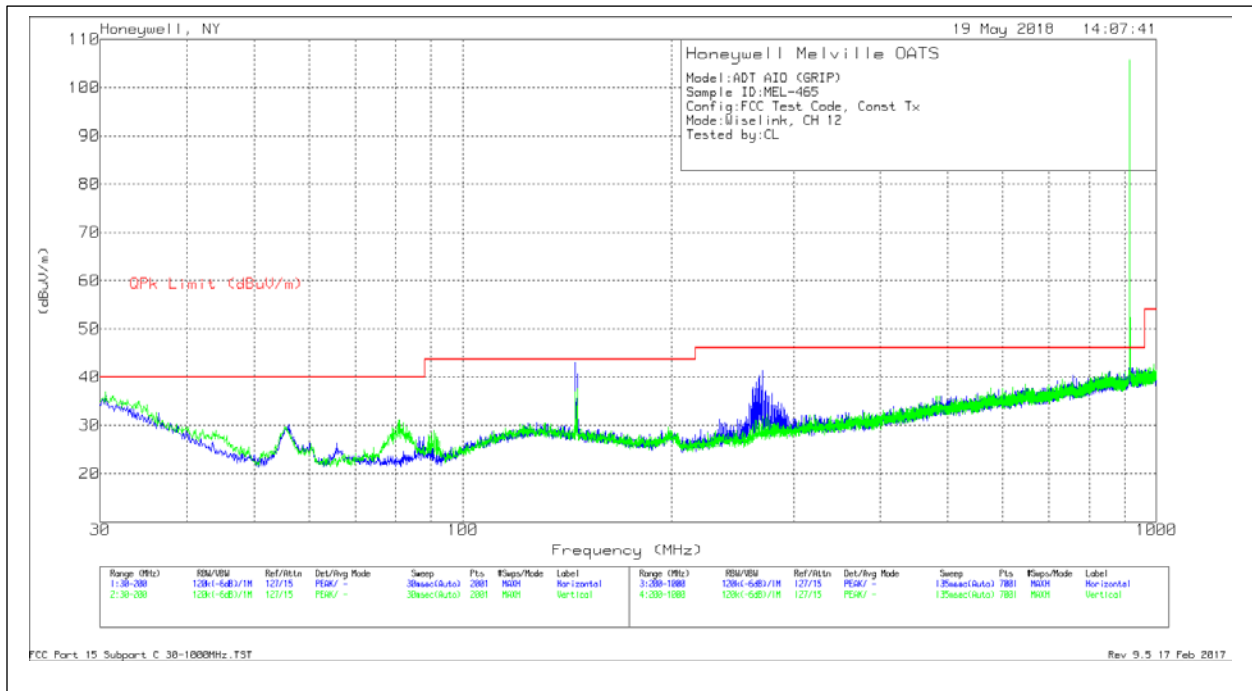


Low Channel - Plot

Frequency (MHz)	Meter Reading (dBuV)	Det	AF_JB6 [dB/m]	Cable 1 [dB]	Corrected Reading (dBuV/m)	QPK Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
31.0679	10.89	Qp	24.1	.9	35.89	40	-4.11	157	388	H
55.2281	15.64	Qp	12	1.1	28.74	40	-11.26	256	349	H
* 124.9085	5.5	Qp	17.6	1.7	24.8	43.52	-18.72	76	228	H
30.6387	11.32	Qp	24.4	.9	36.62	40	-3.38	159	360	V
* 123.9244	7.04	Qp	17.6	1.7	26.34	43.52	-17.18	161	102	V
55.1602	19.24	Qp	12	1.1	32.34	40	-7.66	212	145	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 Qp - Quasi-Peak detector

Low Channel - Data



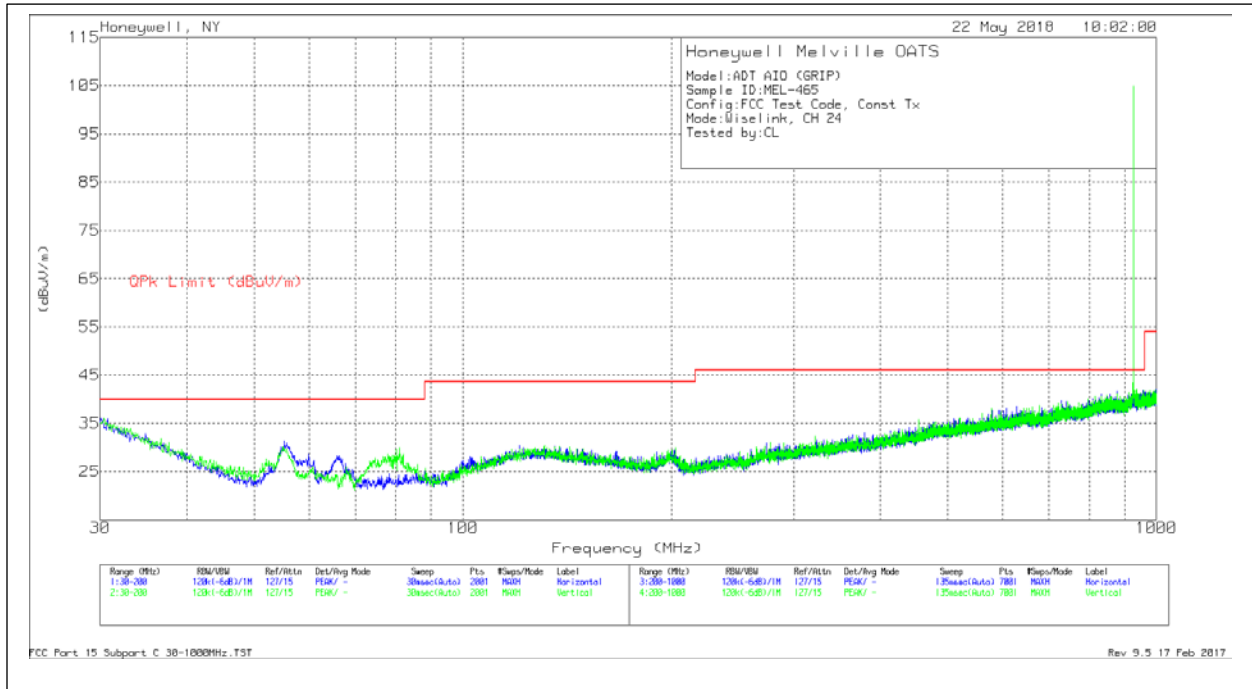
Mid Channel - Plot

Frequency (MHz)	Meter Reading (dBuV)	Det	AF_JB6 [dB/m]	Cable 1 [dB]	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
30.4012	11.14	Qp	24.6	.9	36.64	40	-3.36	243	194	H
145.5348	5.6	Qp	16.9	1.9	24.4	43.52	-19.12	97	284	H
32.0812	12.42	Qp	23.4	.9	36.72	40	-3.28	341	310	V
55.9136	18.7	Qp	12	1.1	31.8	40	-8.2	341	266	V
146.0469	9.28	Qp	16.9	2	28.18	43.52	-15.34	224	318	V
* 269.9965	4.58	Qp	17.4	3.1	25.08	46.02	-20.94	12	182	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Qp - Quasi-Peak detector

Mid Channel - Data



High Channel - Plot

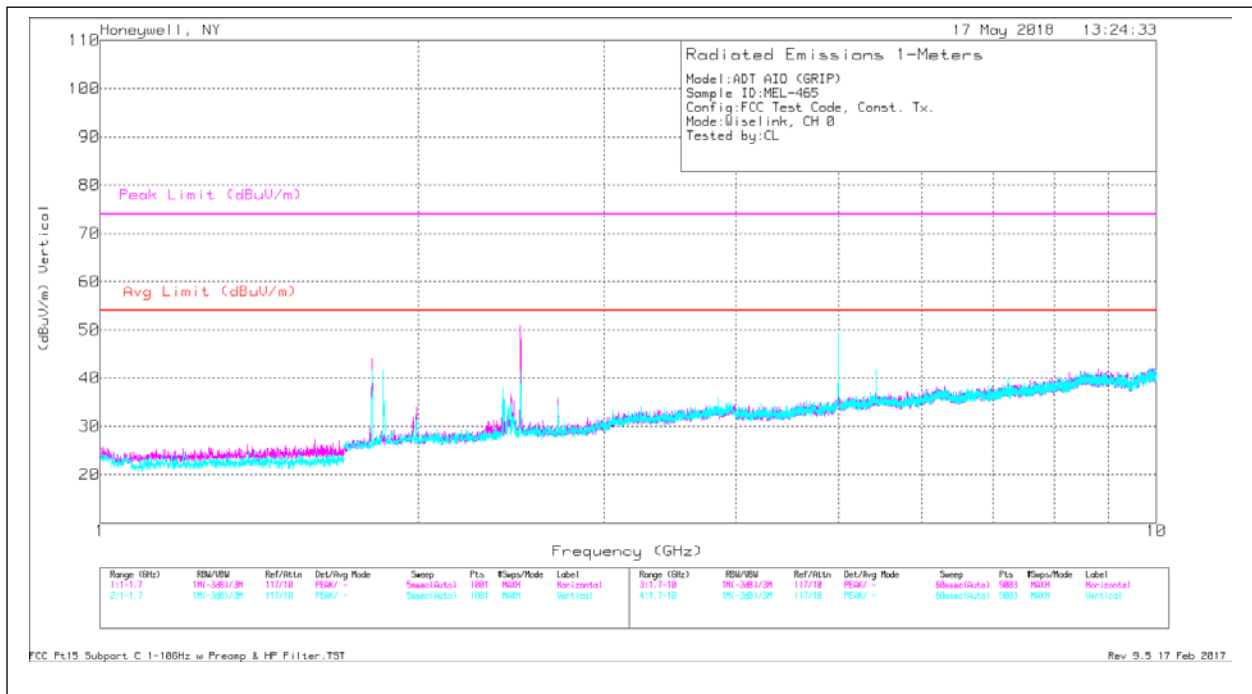
Frequency (MHz)	Meter Reading (dBuV)	Det	AF_JB6 [dB/m]	Cable 1 [dB]	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
30.5581	11.04	Qp	24.4	.9	36.34	40	-3.66	127	268	H
55.9225	15.44	Qp	12	1.1	28.54	40	-11.46	69	382	H
* 130.5362	5.54	Qp	17.5	1.8	24.84	43.52	-18.68	310	324	H
30.202	11.15	Qp	24.7	.9	36.75	40	-3.25	298	192	V
54.6589	20.4	Qp	12.1	1.1	33.6	40	-6.4	154	371	V
* 126.4578	8.61	Qp	17.6	1.8	28.01	43.52	-15.51	355	221	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Qp - Quasi-Peak detector

High Channel - Data

Above 1GHz



Low Channel – Plot

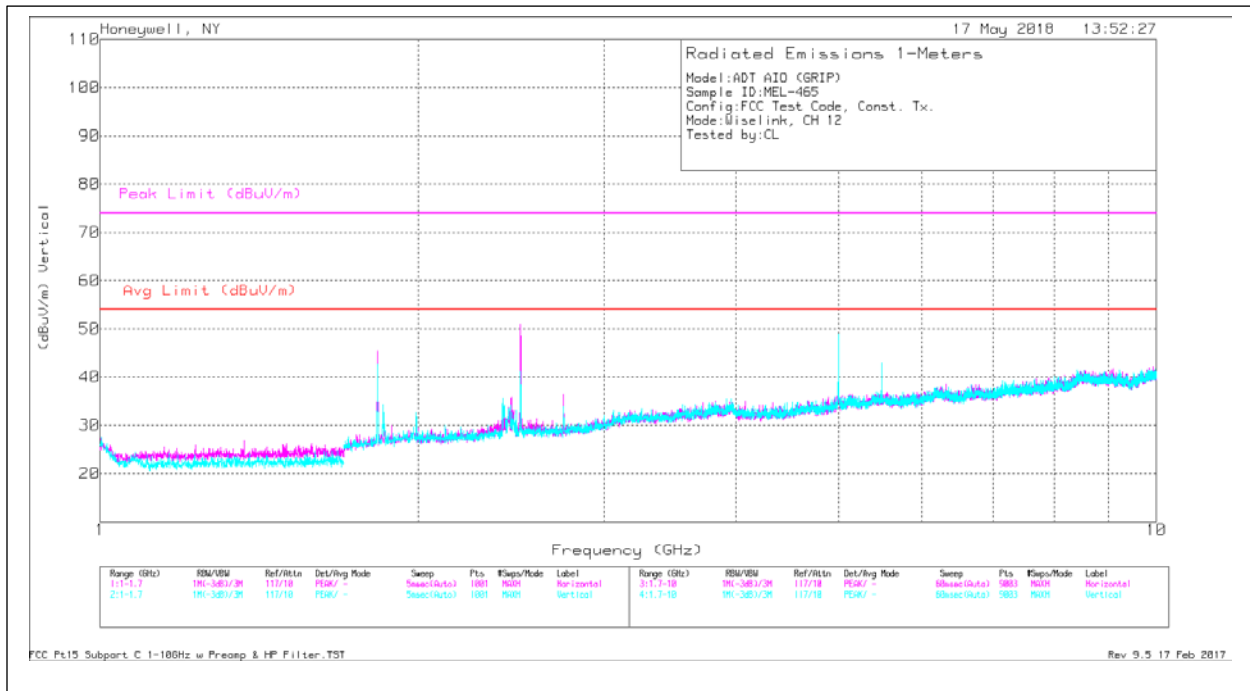
Frequency (GHz)	Meter Reading (dBuV)	Det	AF [dB/m]	SWBOX1 [dB]	SMA7 [dB]	SMA5 [dB]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1.813	51.19	PKFH	26.9	-42.4	2.3	2.2	40.19	-	-	74	-33.81	77	194	H
1.814	33.99	VA1T	26.9	-42.4	2.3	2.2	22.99	54	-31.01	-	-	77	194	H
* 2.485	60.96	PKFH	28.7	-43.3	2.6	2.6	51.56	-	-	74	-22.44	165	208	H
* 2.5	47.29	VA1T	28.7	-43.3	2.7	2.6	37.99	54	-16.01	-	-	165	208	H
* 5	49.05	PKFH	33.3	-41.1	3.8	3.7	48.75	-	-	74	-25.25	142	184	H
* 5	43.58	VA1T	33.3	-41.1	3.8	3.7	43.28	54	-10.72	-	-	142	184	H
1.814	54.94	PKFH	26.9	-42.4	2.3	2.2	43.94	-	-	74	-30.06	18	217	V
1.81	34.81	VA1T	26.8	-42.4	2.3	2.2	23.71	54	-30.29	-	-	18	217	V
* 2.489	58.63	PKFH	28.7	-43.3	2.6	2.6	49.23	-	-	74	-24.77	91	317	V
* 2.5	34.36	VA1T	28.7	-43.3	2.7	2.6	25.06	54	-28.94	-	-	91	317	V
* 5	52.89	PKFH	33.3	-41.1	3.8	3.7	52.59	-	-	74	-21.41	32	181	V
* 5	49.57	VA1T	33.3	-41.1	3.8	3.7	49.27	54	-4.73	-	-	32	181	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PKFH - FHSS: RB=100k/1MHz VB=3 x RB, Peak

VA1T - FHSS: Linear Voltage Average VB=10Hz

Low Channel - Data



Mid Channel – Plot

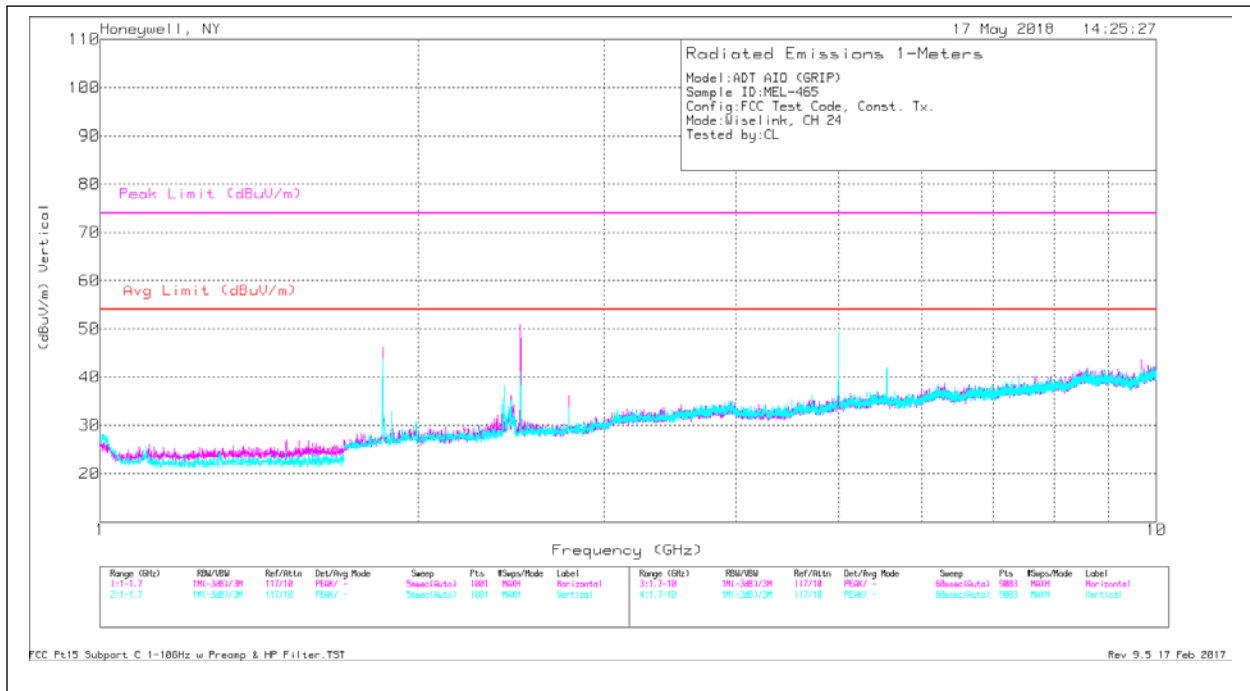
Frequency (GHz)	Meter Reading (dBuV)	Det	AF [dB/m]	SWBOX1 [dB]	SMA7 [dB]	SMA5 [dB]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1.827	58.57	PKFH	27.1	-42.4	2.3	2.2	47.77	-	-	74	-26.23	228	129	H
1.836	33.92	VA1T	27.2	-42.4	2.3	2.1	23.12	54	-30.88	-	-	228	129	H
* 2.5	49.59	PKFH	28.7	-43.3	2.7	2.6	40.29	-	-	74	-33.71	174	112	H
* 2.5	46.13	VA1T	28.7	-43.3	2.7	2.6	36.83	54	-17.17	-	-	174	112	H
* 5	49.89	PKFH	33.3	-41.1	3.8	3.7	49.59	-	-	74	-24.41	241	282	H
* 5	44.94	VA1T	33.3	-41.1	3.8	3.7	44.64	54	-9.36	-	-	241	282	H
1.831	62.17	PKFH	27.1	-42.4	2.3	2.2	51.37	-	-	74	-22.63	17	105	V
1.835	37.77	VA1T	27.2	-42.4	2.3	2.1	26.97	54	-27.03	-	-	17	105	V
* 5	50.51	PKFH	33.3	-41.1	3.8	3.7	50.21	-	-	74	-23.79	272	215	V
* 5	46.74	VA1T	33.3	-41.1	3.8	3.7	46.44	54	-7.56	-	-	272	215	V
* 2.489	50.02	PKFH	28.7	-43.3	2.6	2.6	40.62	-	-	74	-33.38	108	153	V
* 2.5	35.31	VA1T	28.7	-43.3	2.7	2.6	26.01	54	-27.99	-	-	108	153	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PKFH - FHSS: RB=100k/1MHz VB=3 x RB, Peak

VA1T - FHSS: Linear Voltage Average VB=10Hz

Mid Channel - Data



High Channel - Plot

Frequency (GHz)	Meter Reading (dBuV)	Det	AF [dB/m]	SWBOX1 [dB]	SMA7 [dB]	SMA5 [dB]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1.854	54.78	PKFH	27.4	-42.4	2.3	2.2	44.28	-	-	74	-29.72	89	344	H
1.85	31.77	VAIT	27.4	-42.4	2.3	2.2	21.27	54	-32.73	-	-	89	344	H
* 2.487	52.47	PKFH	28.7	-43.3	2.6	2.6	43.07	-	-	74	-30.93	161	127	H
* 2.5	46.35	VAIT	28.7	-43.3	2.7	2.6	37.05	54	-16.95	-	-	161	127	H
* 5	49.19	PKFH	33.3	-41.1	3.8	3.7	48.89	-	-	74	-25.11	240	256	H
* 5	44.54	VAIT	33.3	-41.1	3.8	3.7	44.24	54	-9.76	-	-	240	256	H
1.851	61.59	PKFH	27.4	-42.4	2.3	2.2	51.09	-	-	74	-22.91	232	265	V
1.849	40.89	VAIT	27.4	-42.4	2.3	2.2	30.39	54	-23.61	-	-	232	265	V
* 2.499	58.41	PKFH	28.7	-43.3	2.7	2.6	49.11	-	-	74	-24.89	82	259	V
* 2.5	34.37	VAIT	28.7	-43.3	2.7	2.6	25.07	54	-28.93	-	-	82	259	V
* 5	54.21	PKFH	33.3	-41.1	3.8	3.7	53.91	-	-	74	-20.09	42	203	V
* 5	51.15	VAIT	33.3	-41.1	3.8	3.7	50.85	54	-3.15	-	-	42	203	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PKFH - FHSS: RB=100k/1MHz VB=3 x RB, Peak

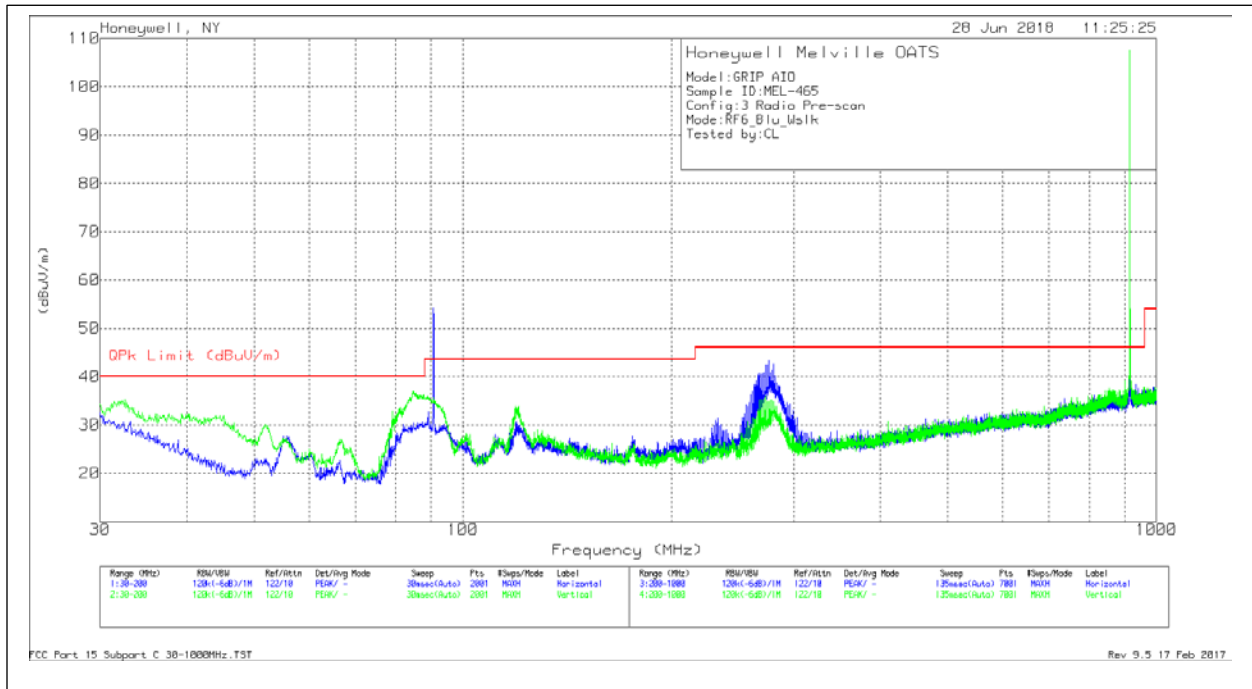
VAIT - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

High Channel – Data

Simultaneous Transmission

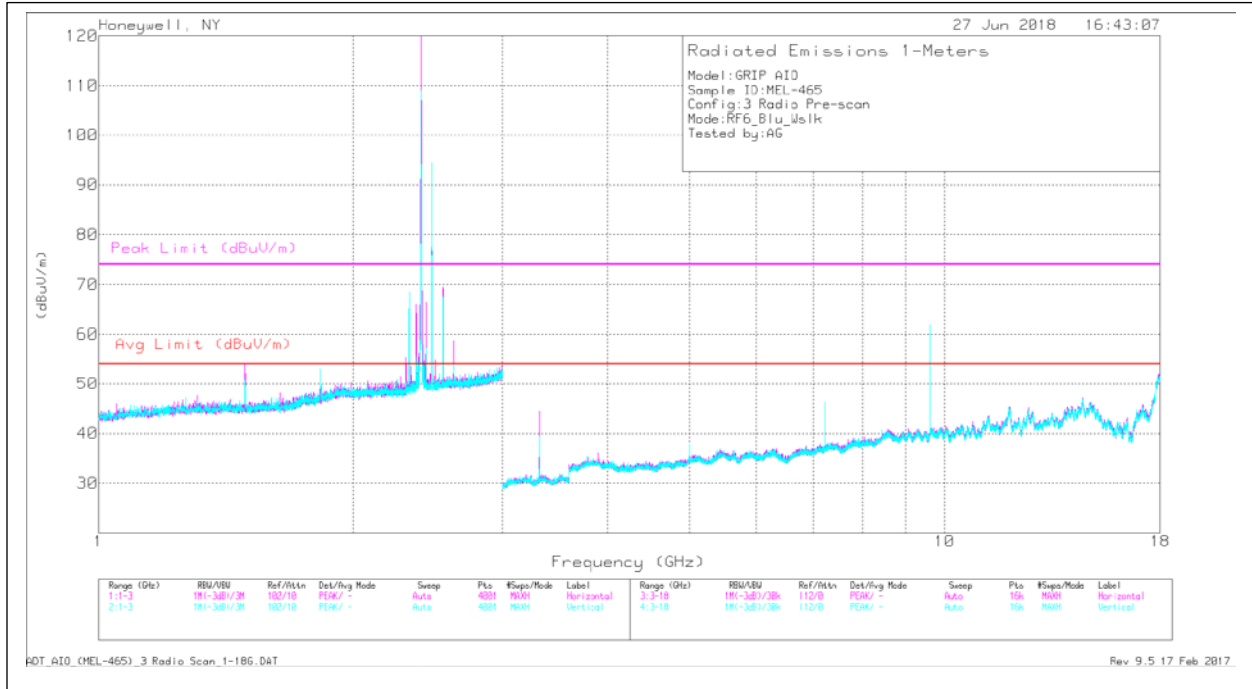
Configuration (Worse-case):

RF6 – Antenna 1, Low Channel
Wiselink – Low Channel
Bluetooth (LE) – High Channel



30-1000MHz – Plot

Note: No additional emissions generated by simultaneous transmission



1-18GHz – Plot

Frequency (GHz)	Meter Reading (dBuV)	Det	AF [dB/m]	SWBOX3 [dB]	SMA7 [dB]	SMA5 [dB]	DC Corr [dB]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.479	22.87	Pk	25.4	.6	2.1	1.9	-	52.87	-	-	74	-21.13	165	102	H
* 1.479	18.89	MAv1	25.4	.6	2.1	1.9	-	48.89	54	-5.11	-	-	165	102	H
* 2.33	32.3	Pk	28.1	.7	2.6	2.5	-	66.2	-	-	74	-7.8	226	204	H
* 2.33	27.36	Av	28.1	.7	2.6	2.5	-23.4	37.86	54	-16.14	-	-	226	204	H
* 1.479	25.69	Pk	25.4	.6	2.1	1.9	-	55.69	-	-	74	-18.31	358	181	V
* 1.479	19.68	MAv1	25.4	.6	2.1	1.9	-	49.68	54	-4.32	-	-	358	181	V
* 2.33	28.34	Pk	28.1	.7	2.6	2.5	-	62.24	-	-	74	-11.76	193	108	V
* 2.33	22.15	Av	28.1	.7	2.6	2.5	-23.4	32.65	54	-21.35	-	-	193	108	V

Frequency (GHz)	Meter Reading (dBuV)	Det	AF [dB/m]	SMA 8 [dB]	CP Preamp	Distance Corr Factor [dB]	2.4G Notch Filter	Pad [dB]	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2.555	47.56	Pk	28.9	2.5	-	-9.5	-	-	69.46	74	-4.54	0-360	100	H
2.631	36.62	Pk	29	2.5	-	-9.5	-	-	58.62	74	-15.38	0-360	100	H
1.831	32.76	Pk	27.1	2.1	-	-9.5	-	-	52.46	74	-21.54	0-360	100	V
3.32	49.43	Pk	31.4	3	-40.6	-9.5	.8	20	54.53	74	-19.47	0-360	100	H
7.215	43.08	Pk	36.2	4.4	-39.6	-9.5	.1	20	54.68	74	-19.32	0-360	100	H
9.619	56.21	Pk	38	5.2	-39.8	-9.5	.8	20	70.91	74	-3.09	0-360	100	H
14.573	35.82	Pk	42.5	6.6	-39.8	-9.5	1	20	56.62	74	-17.38	0-360	100	H
17.171	36.14	Pk	41.4	6.9	-39.7	-9.5	.4	20	55.64	74	-18.36	0-360	100	H
7.214	44.67	Pk	36.2	4.4	-39.6	-9.5	.1	20	56.27	74	-17.73	0-360	100	V
9.619	57.22	Pk	38	5.2	-39.8	-9.5	.8	20	71.92	74	-2.08	0-360	100	V
14.584	36.31	Pk	42.5	6.6	-39.7	-9.5	.9	20	57.11	74	-16.89	0-360	100	V
17.185	35.61	Pk	41.5	6.9	-39.8	-9.5	.4	20	55.11	74	-18.89	0-360	100	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak Detector

Av - KDB558074 Method: PK + DC Corr (Duty Cycle Correction Factor)

MAv1 - KDB558074 Option 1 Maximum RMS Average

Duty Cycle (RF6) = 6.75%, thus DC Corr = $20\log(0.0675) = -23.4\text{dB}$

2.33GHz was found to be a product of the RF6 transmitter, thus Average measurement was derived by applying a duty cycle correction factor to the Peak measurement.

1-18GHz – Data

Conducted Emissions (Mains)

Test Description

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10 / C63.4.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorder for both NEUTRAL and HOT lines.

Test Criteria

Reference	Limit (dBuV)		
	Frequency Range (MHz)	Quasi-Peak	Average
CFR 47 Subpart C, 15.207 RSS-GEN	0.15-0.5	66 to 56	56 to 46
CFR 47 Subpart B, 15.107 ICES-003	0.5-5	56	46
	5-30	60	50

Test Information

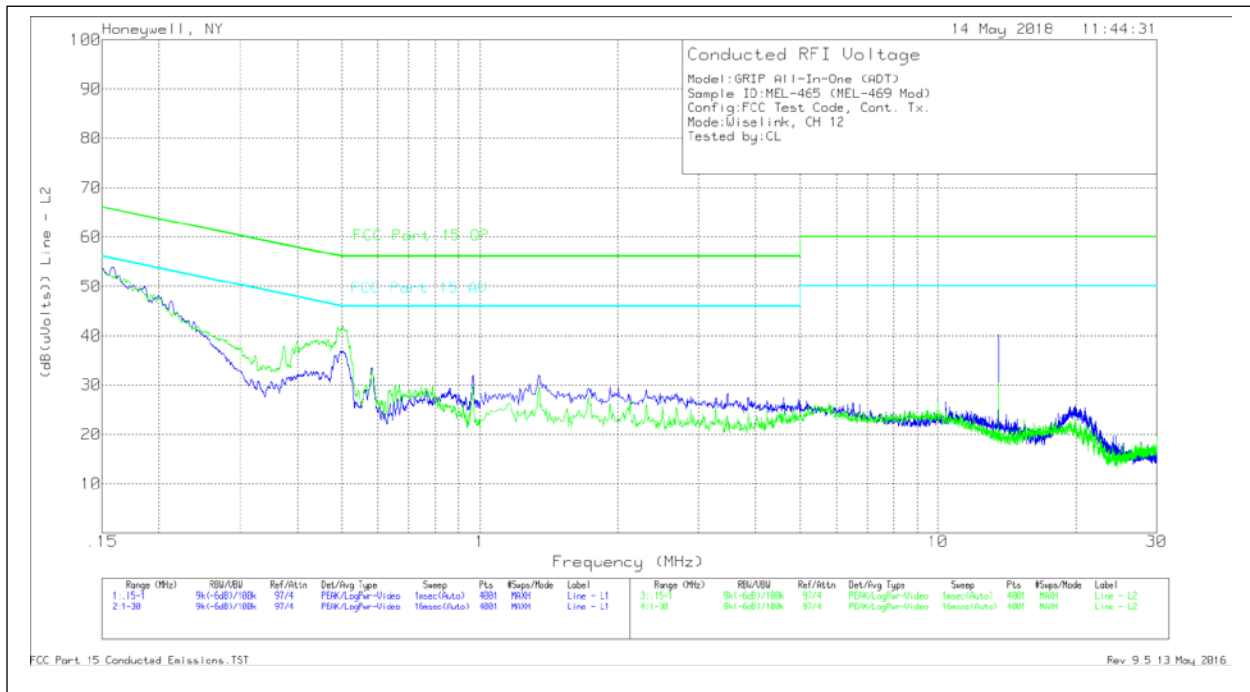
Tester	Test Location	Date	Temperature (°C)	Humidity (%RH)	Pressure (mbar)	Results (P/F)
CL	RF Lab	05/10/2018-05/14/2018	24	39.9	1013	P

Equipment List

Instrument Type	ID #	Serial #	Manufacturer	Model	Cal Date	Cal Due Date
Spectrum Analyzer	11556	MY49430802	Keysight	N9030A (PXA)	12/19/2017	12/19/2018
LISN	11527	241259	Com-Power	LIN-120A	01/10/2018	01/10/2019
Measurement Software	11543	Version 9.5	UL	UL EMC	N/A	N/A
Environmental Meter	11533	A070144	Extech Instruments	SD700	08/21/2017	08/21/2020

Test Results

Intentional Mode (Worse-case)



Mid Channel Plot

Line - L1									
Frequency (MHz)	Meter Reading (dBuV)	Det	Gain/Loss [dB] LISN1	CDE Cable #1	Corrected Reading (dB(uVolts))	FCC Part 15 QP	Margin (dB)	FCC Part 15 AV	Margin (dB)
.1582	43.24	Pk	10.6	0	53.84	65.56	-11.72	55.56	-1.72
.50134	26.88	Pk	10	0	36.88	56	-19.12	46	-9.12
.96611	22.09	Pk	9.9	0	31.99	56	-24.01	46	-14.01
1.34075	21.94	Pk	9.9	0	31.84	56	-24.16	46	-14.16
13.557	29.9	Pk	10.1	.2	40.2	60	-19.8	50	-9.8
19.91525	15.14	Pk	10.4	.3	25.84	60	-34.16	50	-24.16
Line - Neutral									
Frequency (MHz)	Meter Reading (dBuV)	Det	Gain/Loss [dB] LISN1	CDE Cable #1	Corrected Reading (dB(uVolts))	FCC Part 15 QP	Margin (dB)	FCC Part 15 AV	Margin (dB)
.15085	42.62	Pk	10.6	0	53.22	65.95	-12.73	55.95	-2.73
.50305	32.05	Pk	9.9	0	41.95	56	-14.05	46	-4.05
.96547	19.65	Pk	9.9	0	29.55	56	-26.45	46	-16.45
1.34075	19.61	Pk	9.9	0	29.51	56	-26.49	46	-16.49
9.99725	16.65	Pk	10	.2	26.85	60	-33.15	50	-23.15
13.557	20.16	Pk	10.1	.2	30.46	60	-29.54	50	-19.54

Pk - Peak detector

Mid Channel Data

END OF REPORT