



FCC / ISED Test Report

For

GRIP Hybrid Panel

Report #: 50346-A2

FCC ID: CFS8DL-GRIPH

IC ID: 573F-GRIPH

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	Added data (radiated & conducted) 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
20dB Emission Bandwidth.....	9
99% Occupied Bandwidth.....	12
Maximum Conducted Output Power.....	15
Number of Hopping Frequencies	18
Channel Separation	20
Dwell Time.....	25
Out-of-Band Emissions	27
Radiated Emissions (Intentional)	33
Conducted Emissions (Mains).....	43
END OF REPORT.....	45

Applicable Test Standards/Limits

Test Standards/Limits	Result	Dates Tested
ANSI C63.10: 2013	Compliant	05/07/2018 – 06/29/2018
RSS-247, Issue 2, Section 5	Compliant	05/07/2018 – 06/29/2018
RSS-GEN, Issue 4	Compliant	05/07/2018 – 06/29/2018
CFR 47 Pt 15 Subpart C, Section 15.207/209	Compliant	05/07/2018 – 06/29/2018
CFR 47 Pt 15 Subpart C, Section 15.247	Compliant	05/07/2018 – 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 GRIP Hybrid consists of a panel with hardwired device support. The panel has a main PCB board that contains components to support features (hardwired zones, hardwired keypads, etc.), interfaces to external devices/sensors (sensors, devices, and cameras) and communicators.

The device contains three on-board radios: RF6, Wiselink and Bluetooth. It also has provisions for pluggable Cellular and WiFi/Zwave modules. This filing is for the device without these optional add-on modules. These will be addressed in subsequent filings. The system is powered by a 13.5Vdc, 1.8A plug-in power supply, supported by a supervised 12V (Nominal) / 13.8V (Charge) voltage, 7AH backup battery.

This report will cover the Wiselink portion of the EUT.

It contains one (1) integral PCB antennas with a gain 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. Where required, the EUT was additional tested in hopping mode. The EUT has a typical installation orientation of vertical (i.e. wall-mounted). 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. All terminals (zones) were populated with typical cabling/terminating resistors. A Wired Touchpad was used to load the terminals it would normally be connected to.

Test Sample Identification

Sample ID Number	Sample Serial Number	Date Received
MEL-462	Non-serialized production unit	04/02/2018
MEL-466	Non-serialized production unit	04/18/2018
MEL-475	Non-serialized production unit	04/27/2018

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:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

[i.e.] 37 dBuV/m = 30 dBuV + 18.5 dB/m + 0.5 dB – 12 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

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//2018-05/08/2018	22.9	36.4	1014	P

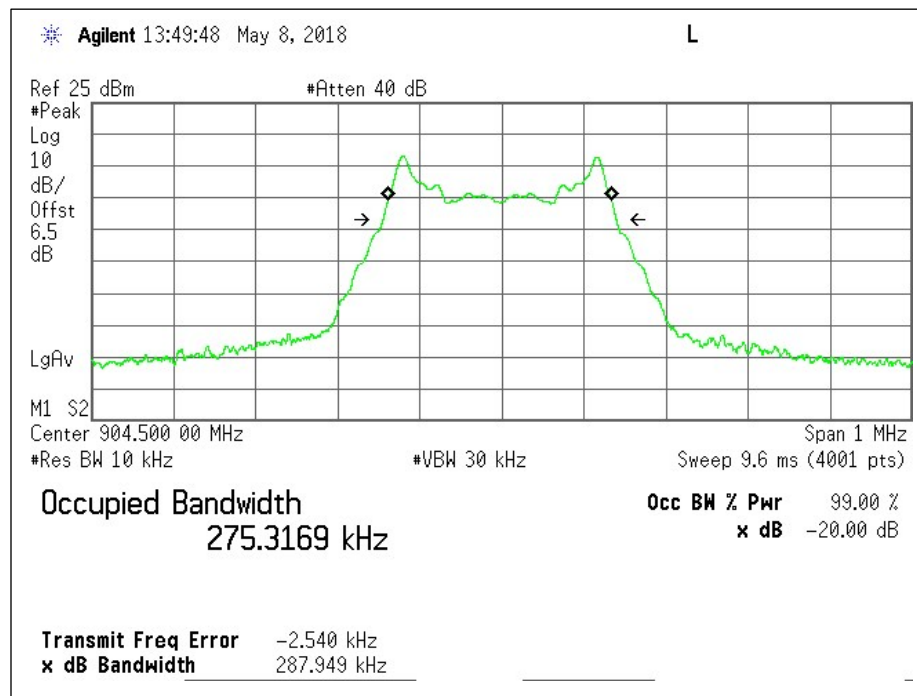
Equipment List

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

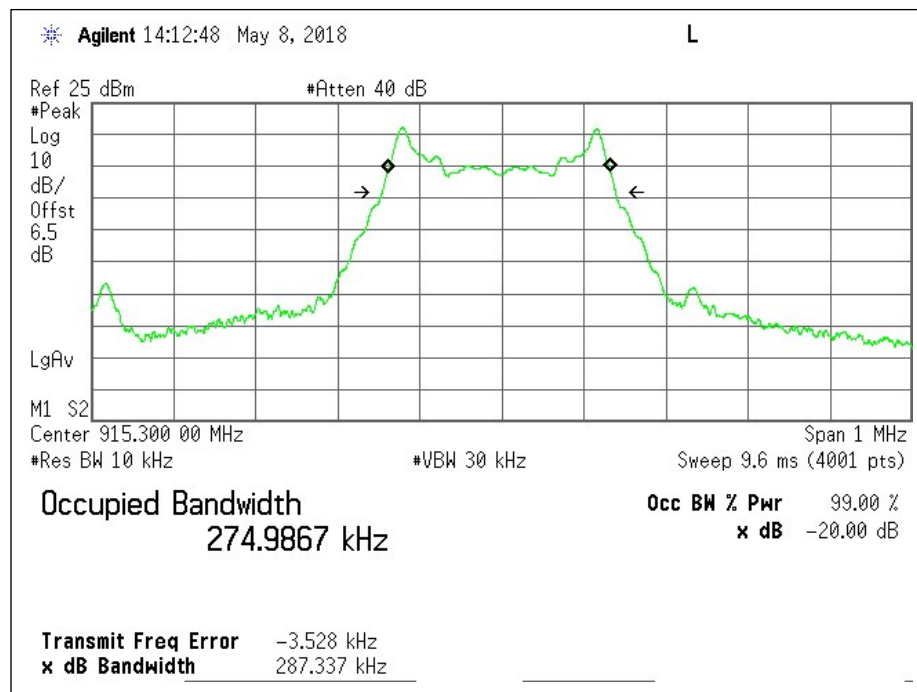
Test Results

Channel	Frequency (MHz)	20dB Bandwidth (kHz)
Low	904.5	287.9
Mid	915.3	287.3
High	926.1	287.7

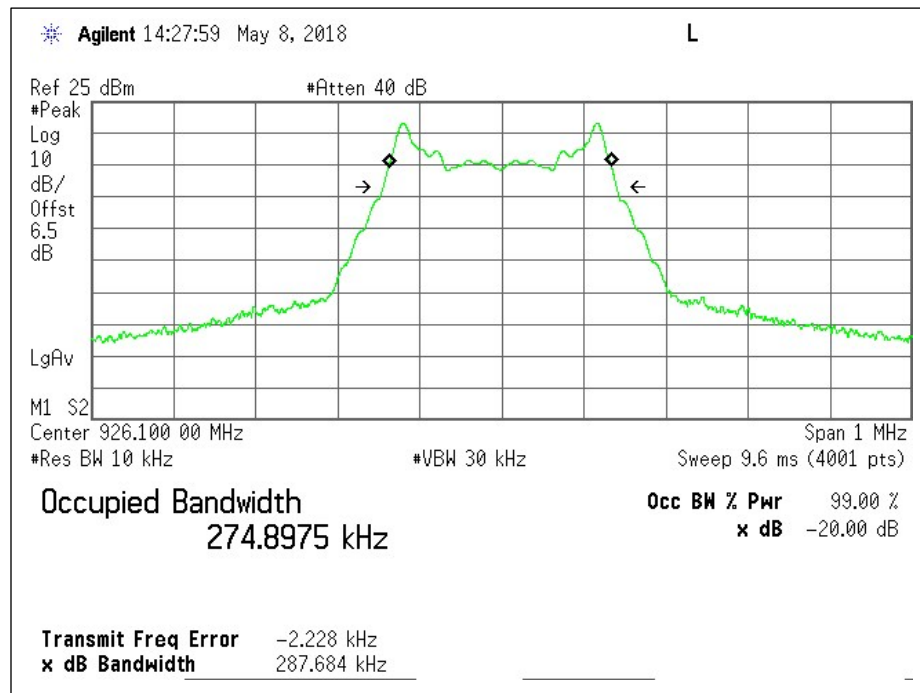
20dB Bandwidth



Low Channel - Plot



Mid 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

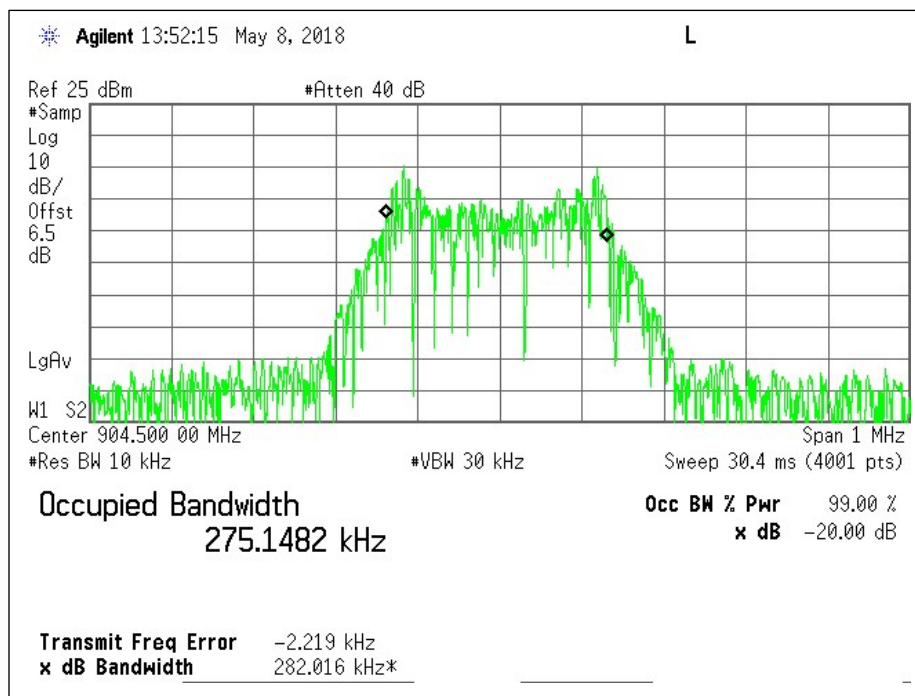
Equipment List

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

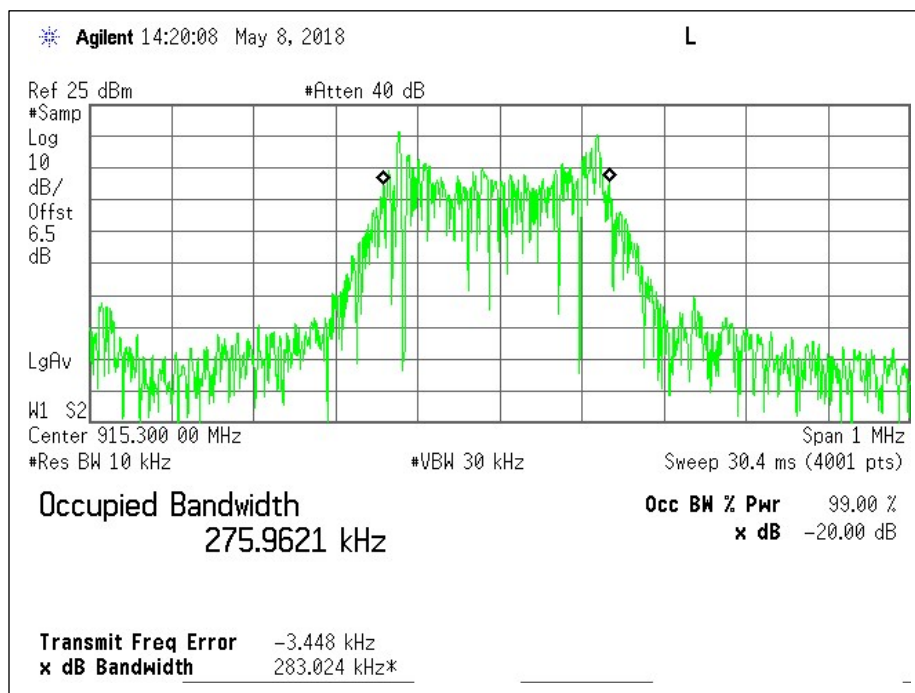
Test Results

Channel	Frequency (MHz)	99% Bandwidth (in kHz)
Low	904.5	275.1
Mid	915.3	276.0
High	926.1	275.2

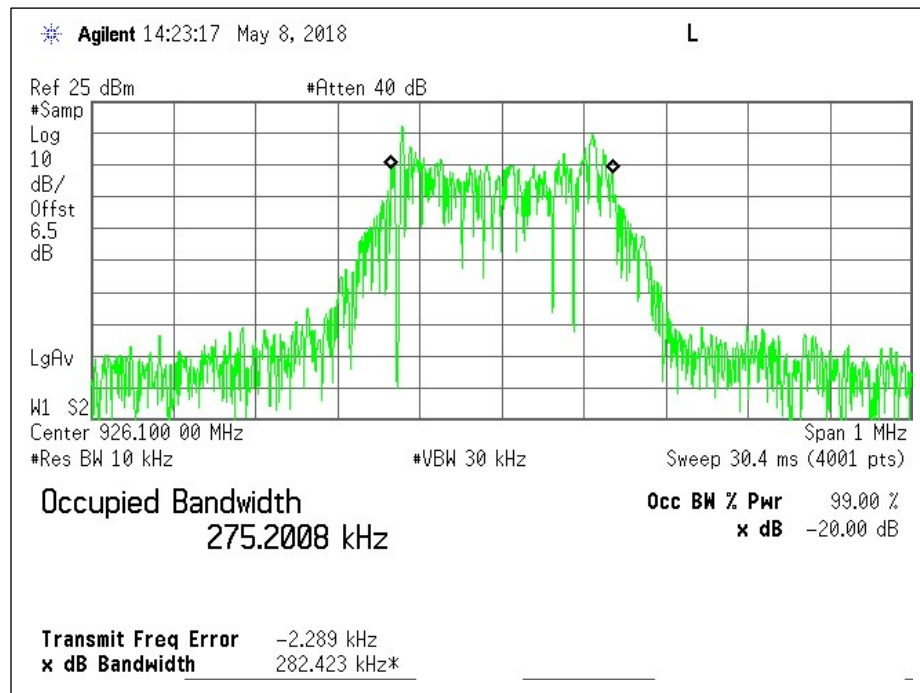
99% Occupied Bandwidth



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

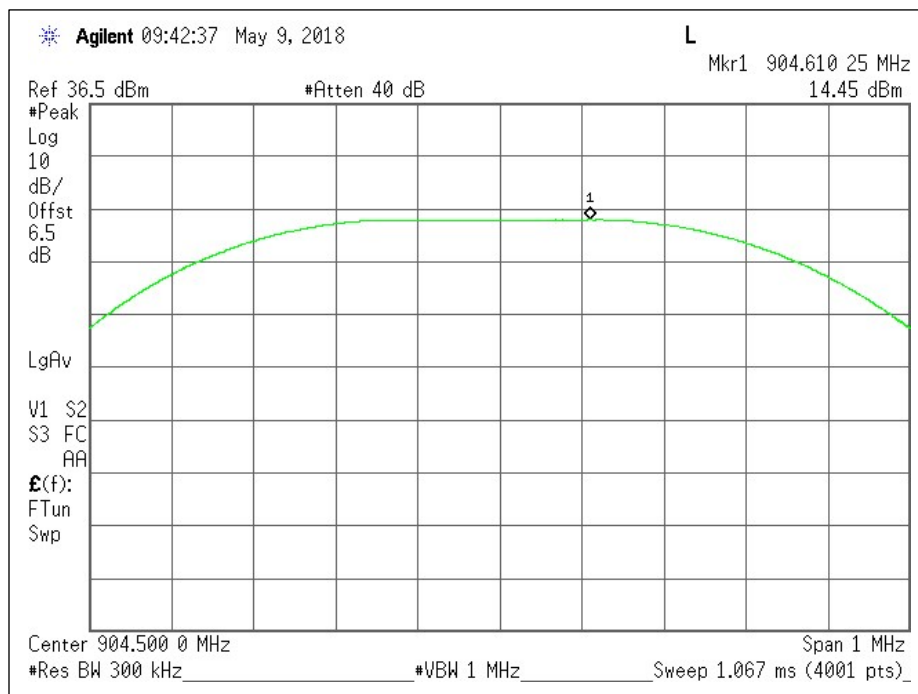
Equipment List

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

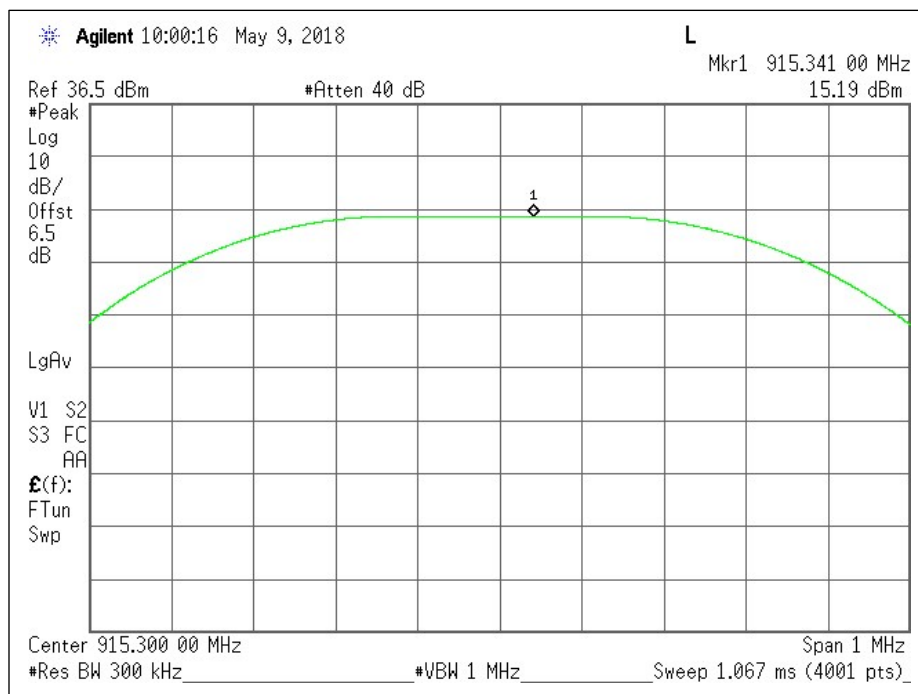
Test Results

Channel	Frequency (MHz)	Tx Channel Peak Power (dBm)	Tx Channel Peak Power (W)
Low	904.5	14.45	0.028
Mid	915.3	15.19	0.033
High	926.1	15.37	0.034

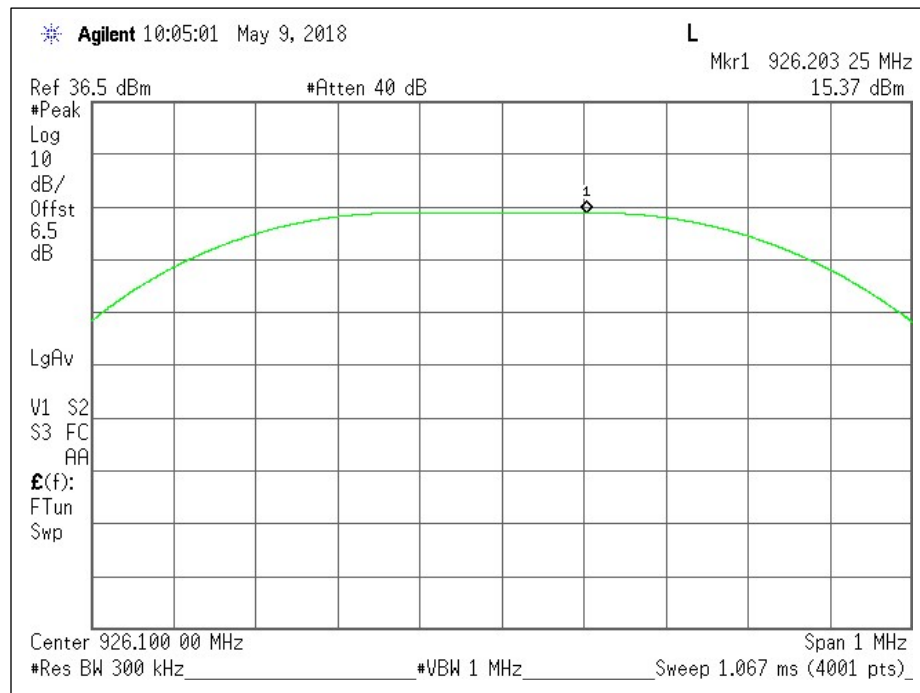
Output Power



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

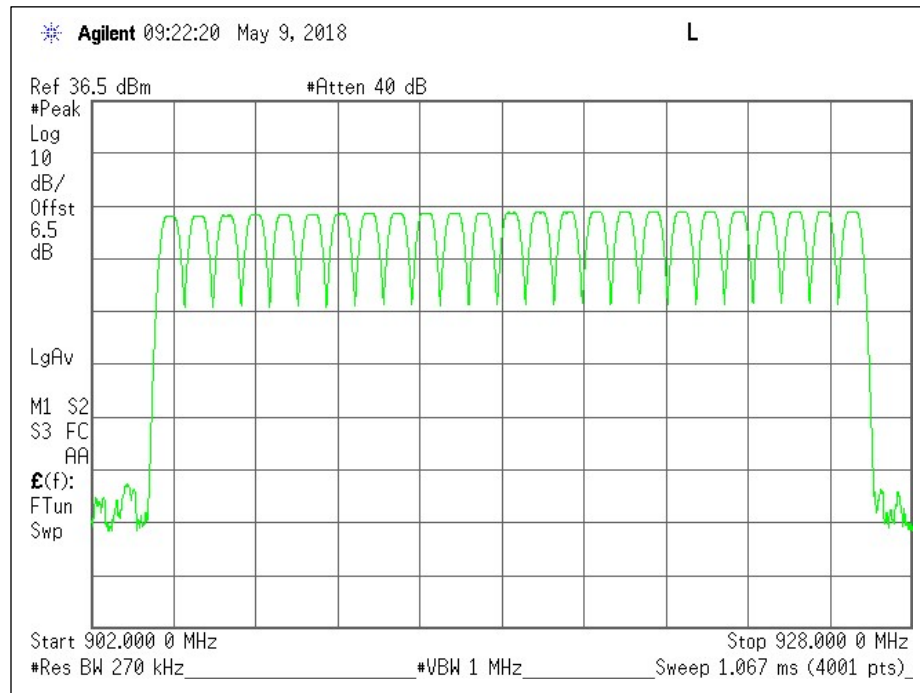
Equipment List

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

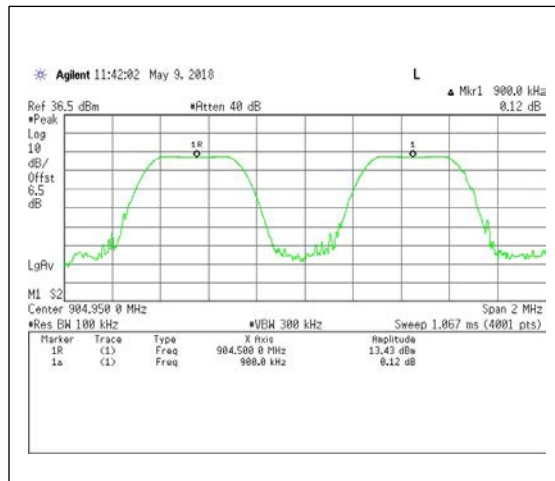
Equipment List

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

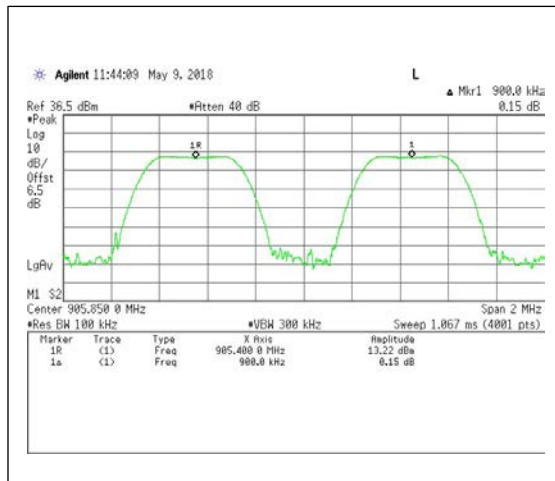
Test Results

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

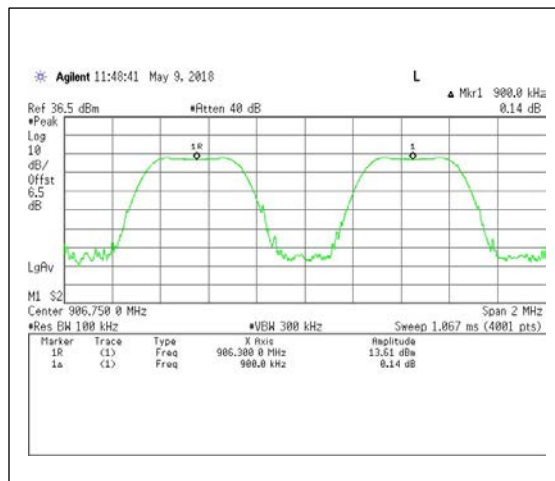
Channel Separation



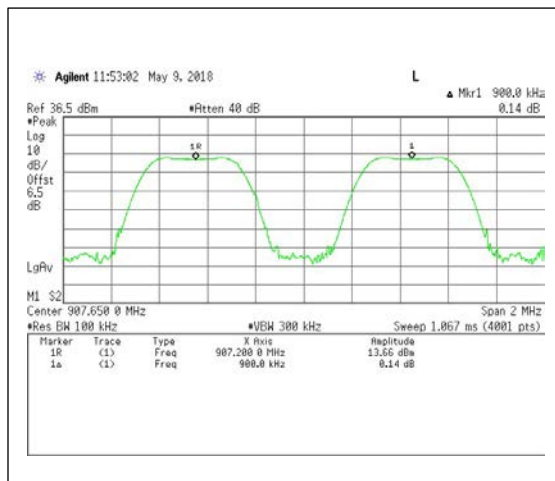
Channels 0-1



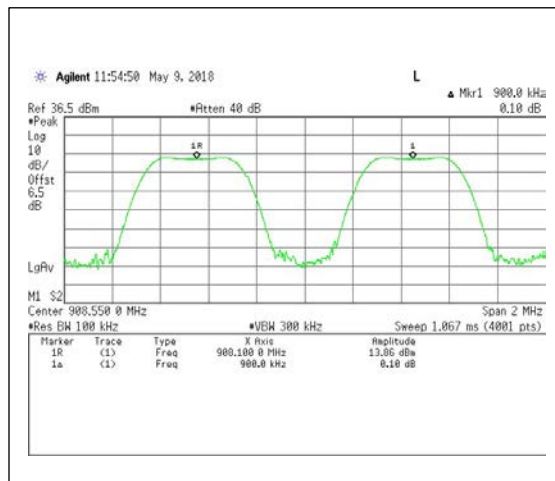
Channels 1-2



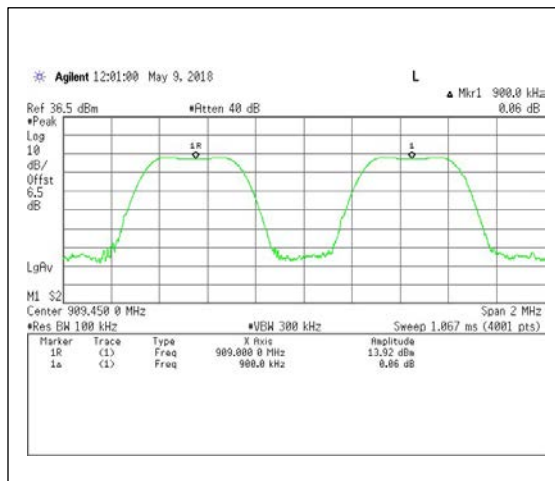
Channels 2-3



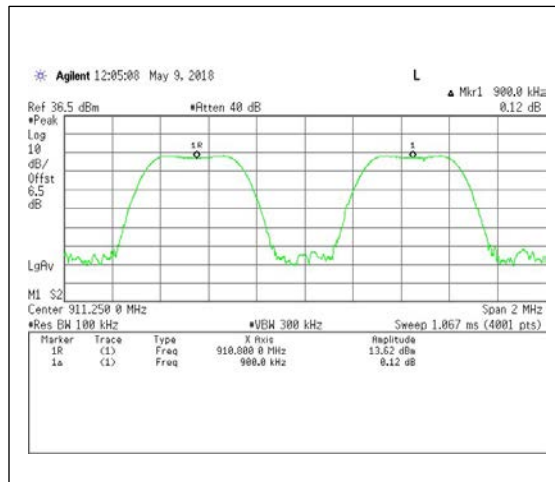
Channels 3-4



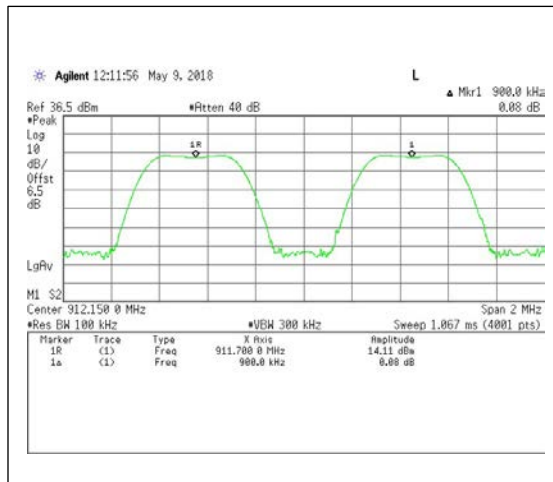
Channels 4-5



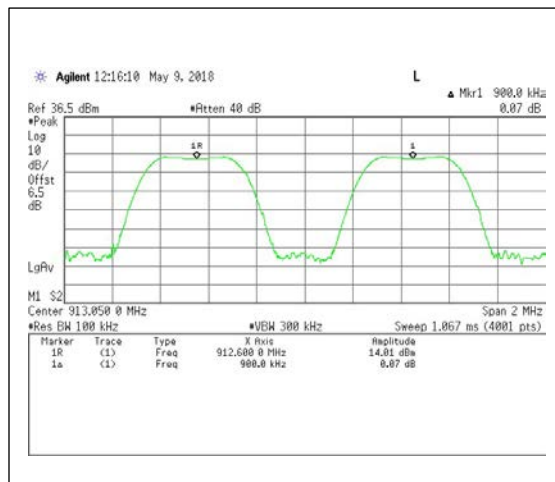
Channels 5-6



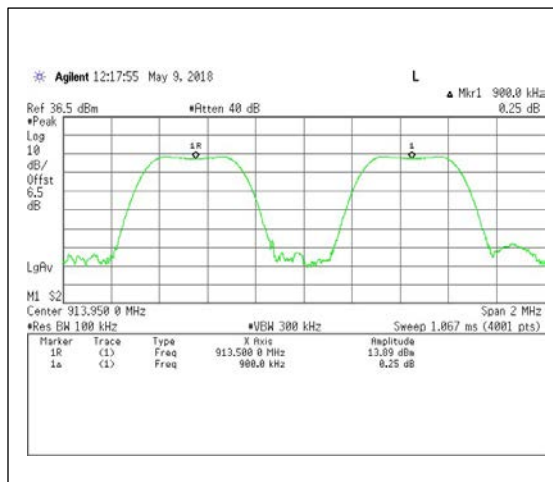
Channels 7-8



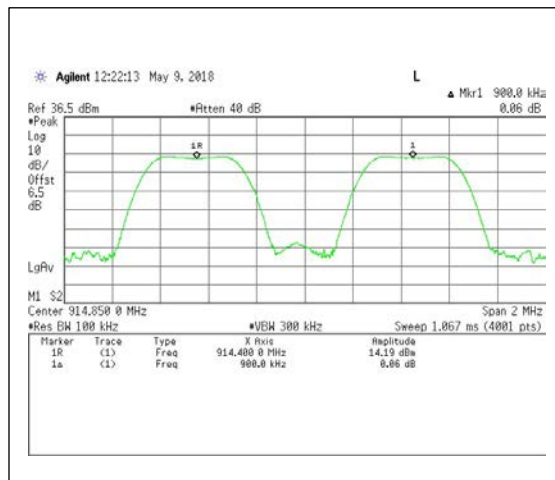
Channels 8-9



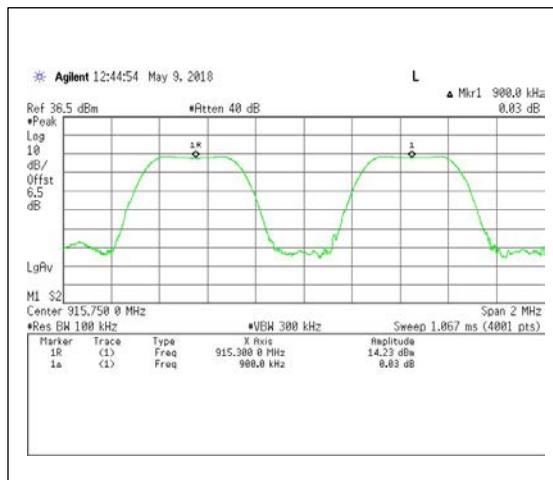
Channels 9-10



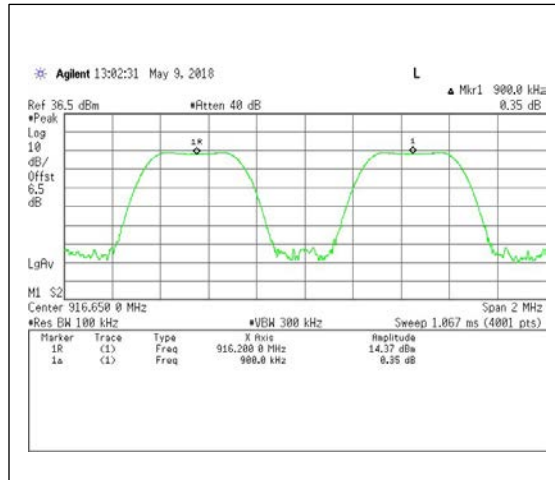
Channels 10-11



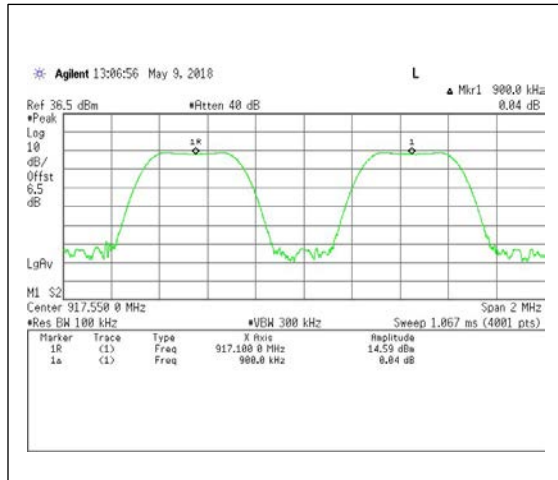
Channels 11-12



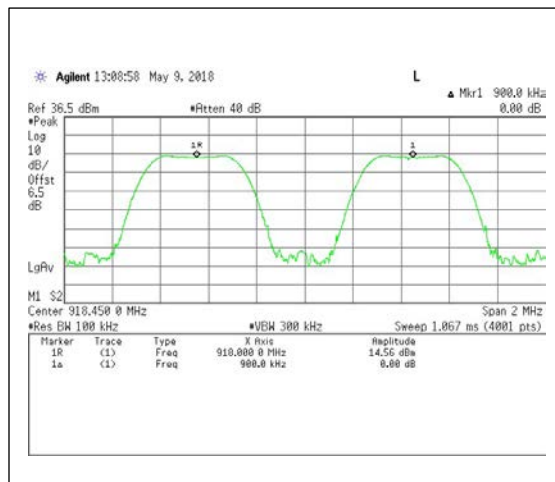
Channels 12-13



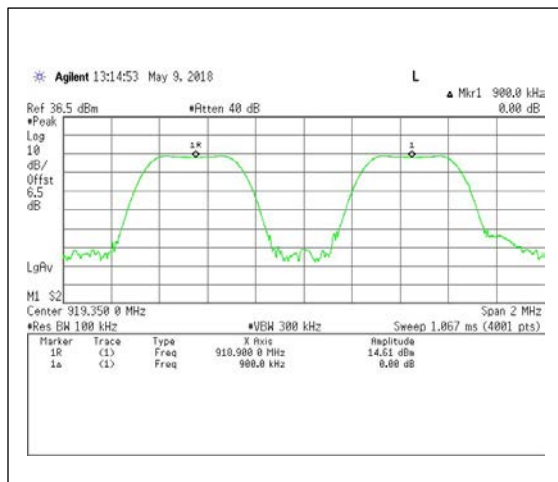
Channels 13-14



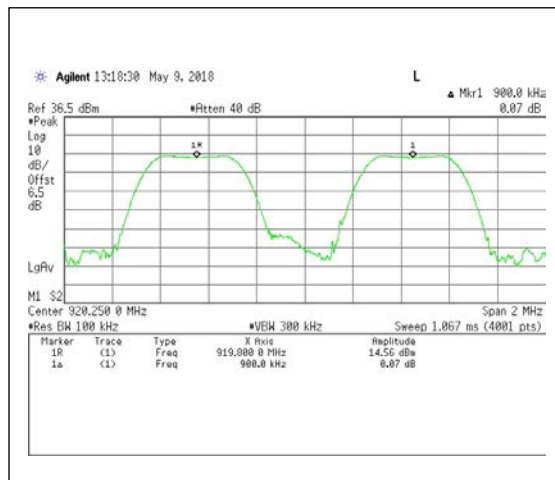
Channels 14-15



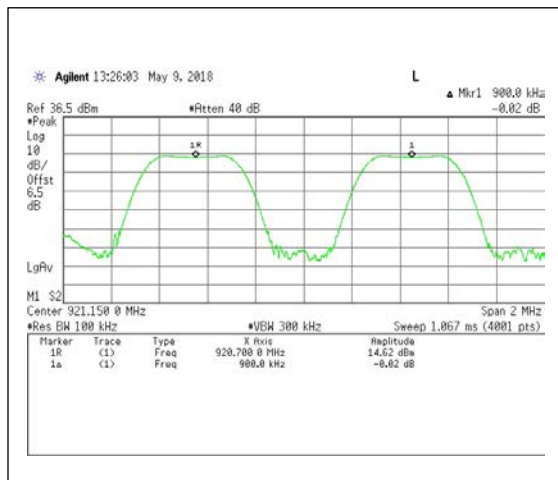
Channels 15-16



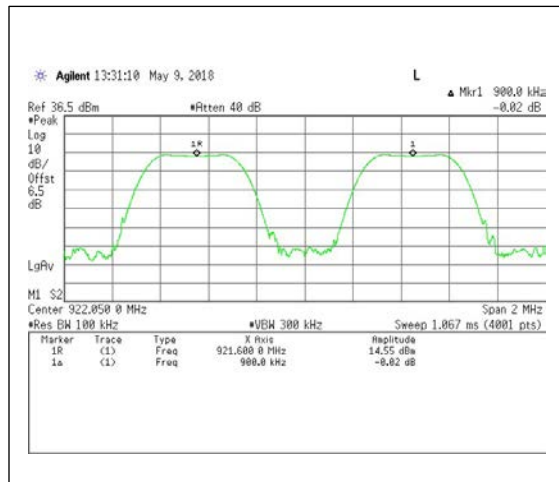
Channels 16-17



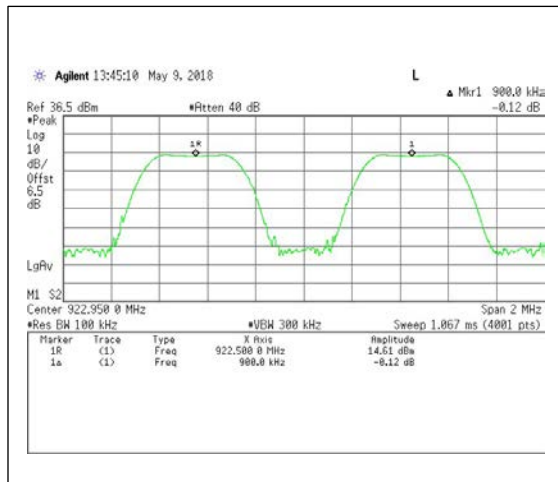
Channels 17-18



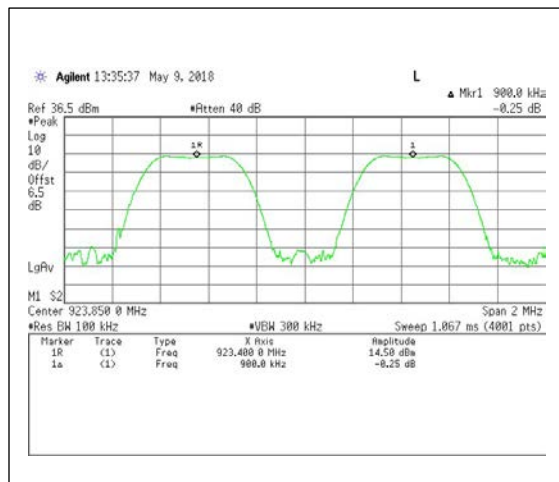
Channels 18-19



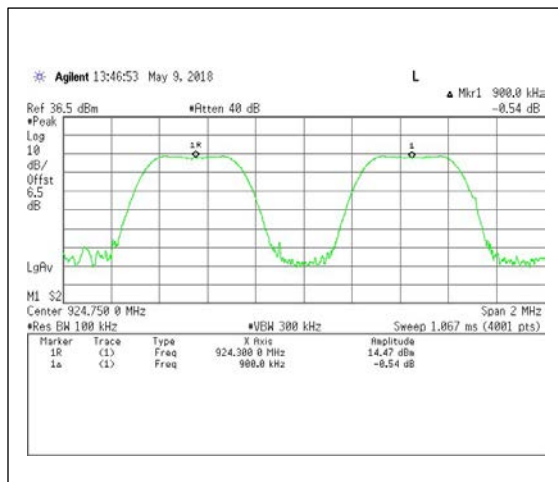
Channels 19-20



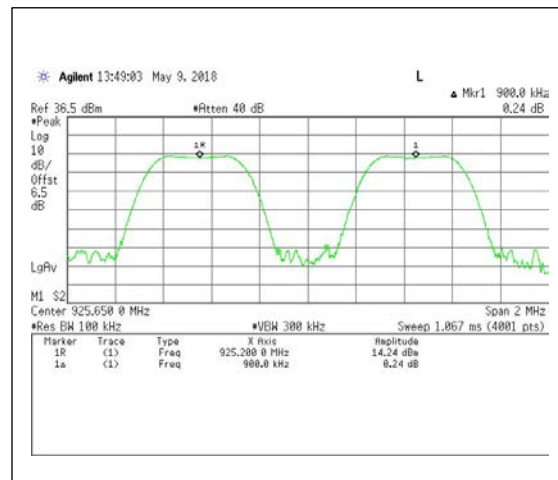
Channels 20-21



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

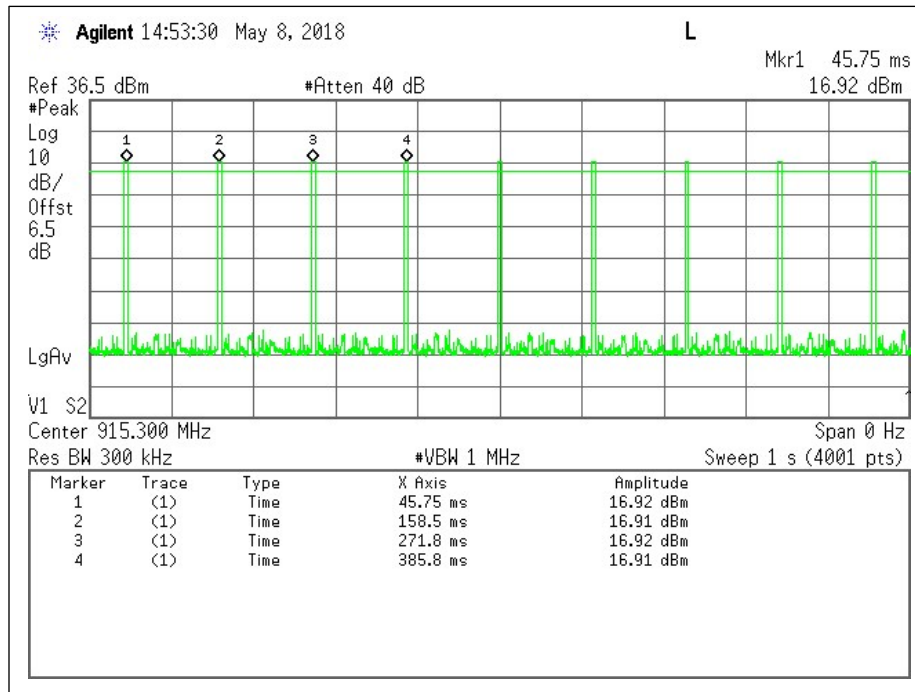
Equipment List

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

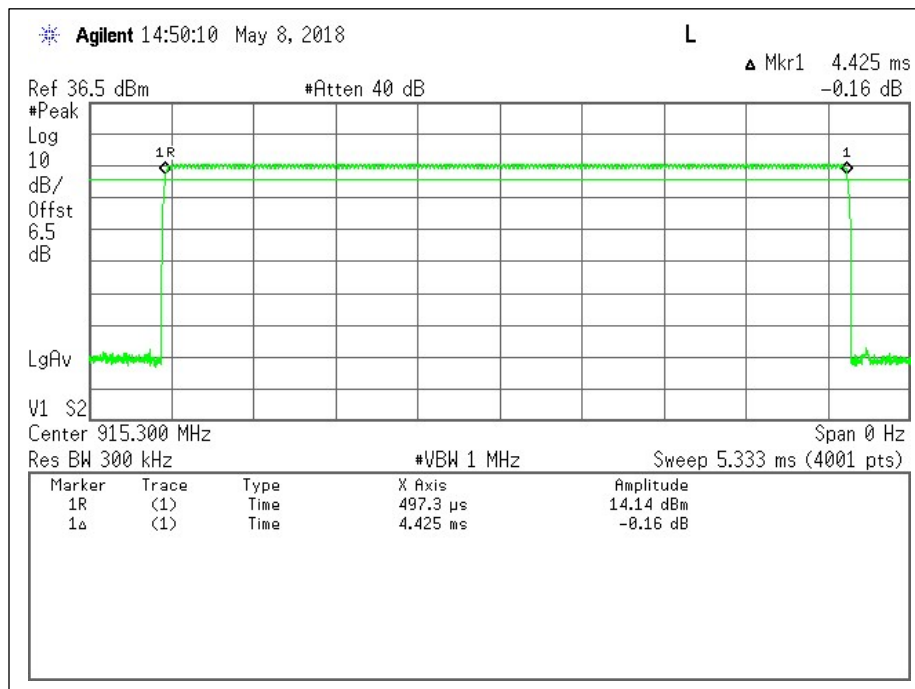
Test Results

Number of transmission in 10 seconds	Length of transmission time (msec)	Results (msec)	Limit (msec)
9 (times) * 10 = 90 times	4.425	398.3	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

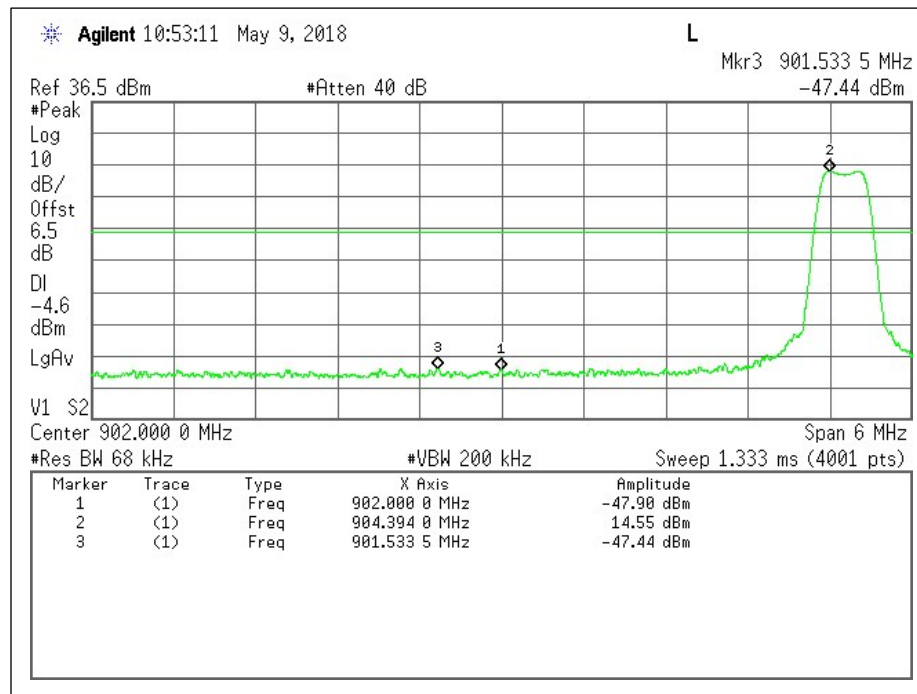
Instrument Type	ID #	Serial #	Manufacturer	Model	Cal Date	Cal Due Date
Spectrum Analyzer	11531	MY41000078	Agilent	E4440A	06/06/2017	06/06/2019
Environmental Meter	11533	A070144	Extech Instruments	SD700	08/21/2017	08/21/2020

Test Results

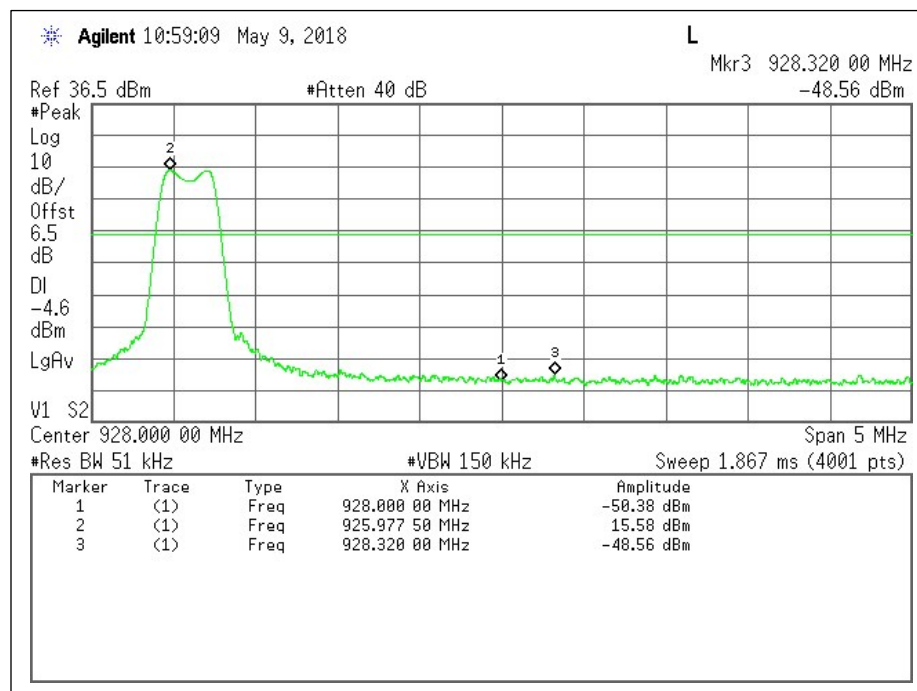
Authorized Band Edge				
Channel	Frequency (MHz)	Delta from Peak to Band edge (dB)	Limit (dB)	Margin (dB)
Low – Hopping OFF	904.5	62.45	20	-42.45
High – Hopping OFF	926.1	65.96	20	-45.96
Low – Hopping ON	904.5	62.67	20	-42.57
High – Hopping ON	926.1	65.31	20	-45.31

Conducted Spurious		
Channel	Frequency (MHz)	Highest Spurious Emission from 20dB down point (dB)
Low	904.5	-33.90
Mid	915.3	-33.89
High	926.1	-35.69

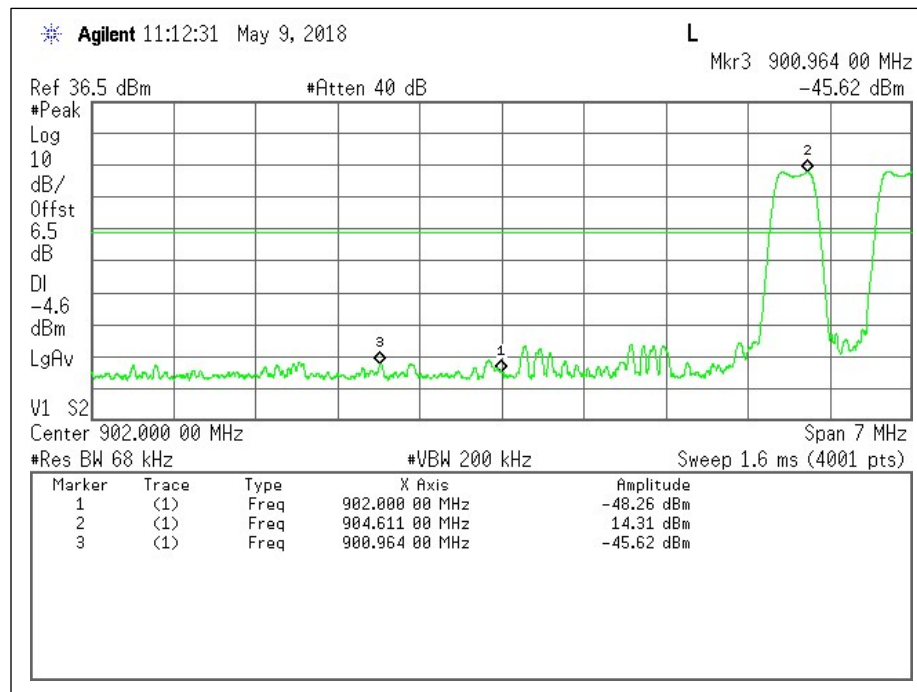
Band Edge



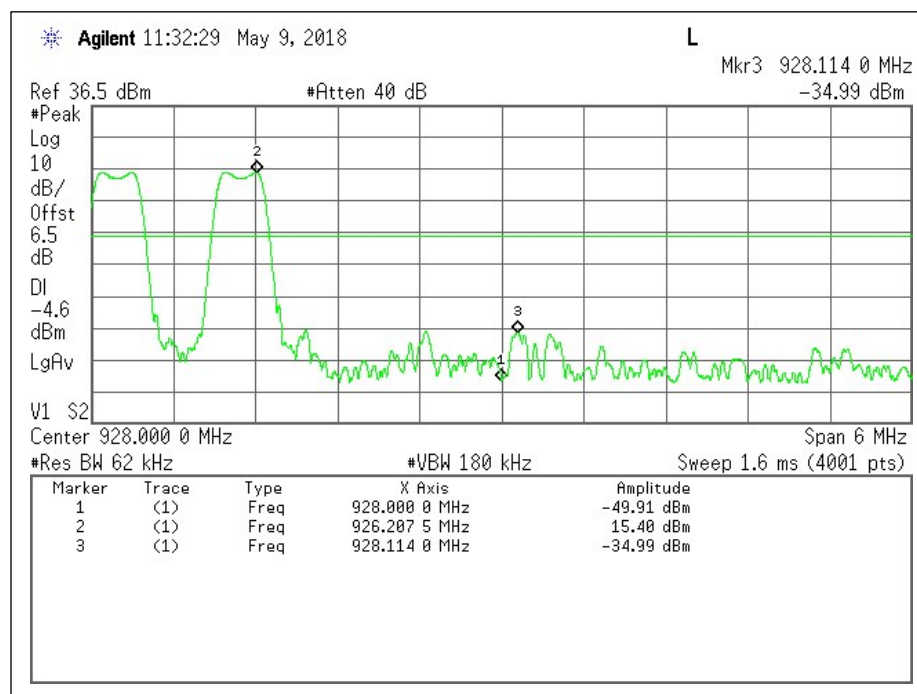
Low Channel, Hopping OFF - Plot



High Channel, Hopping OFF – Plot

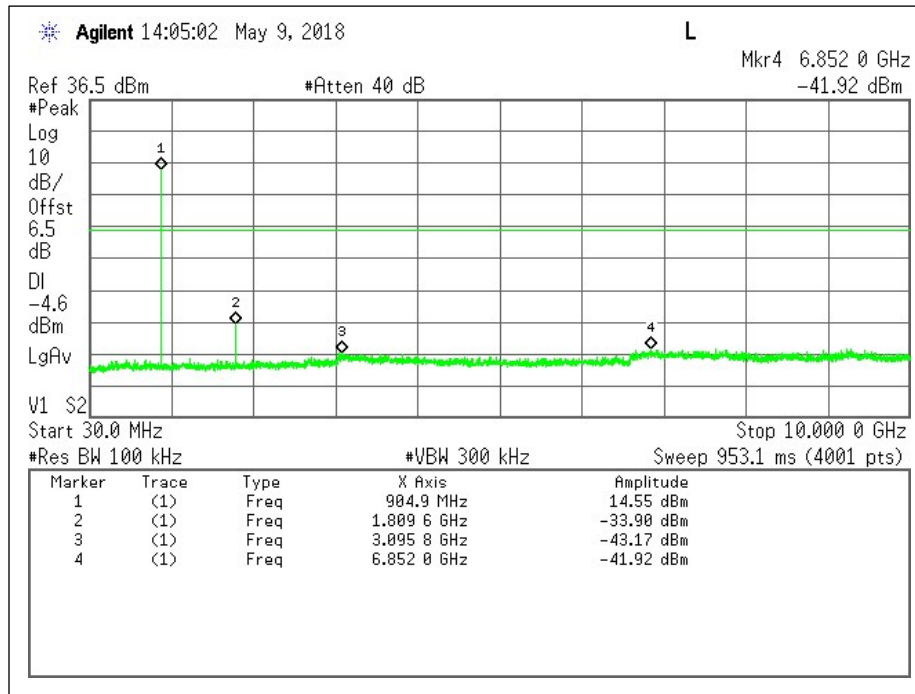


Low Channel, Hopping ON - Plot

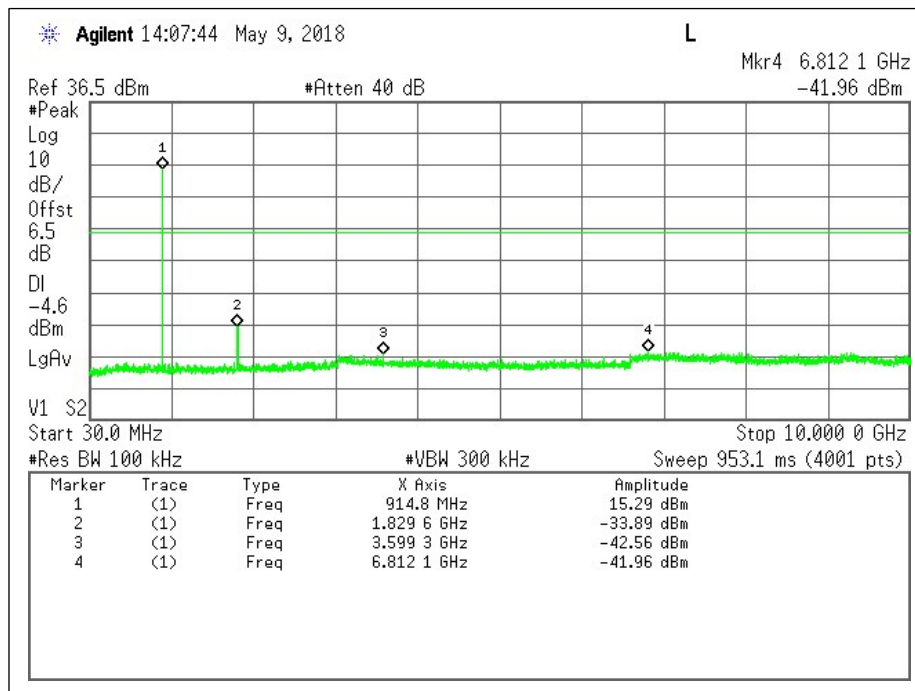


High Channel, Hopping ON - Plot

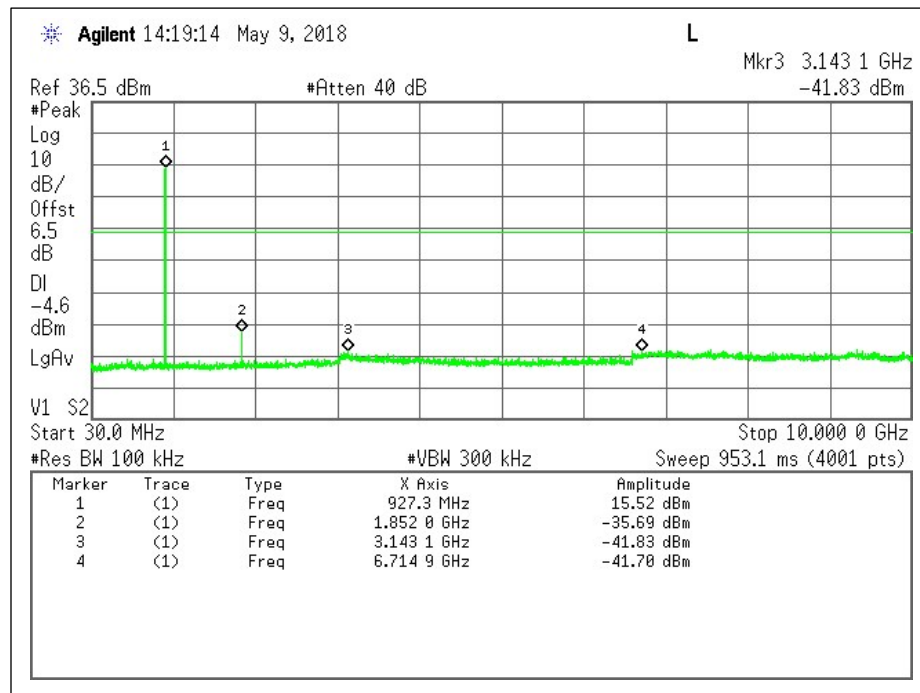
Conducted Spurious



Low Channel - Plot



Mid Channel - Plot



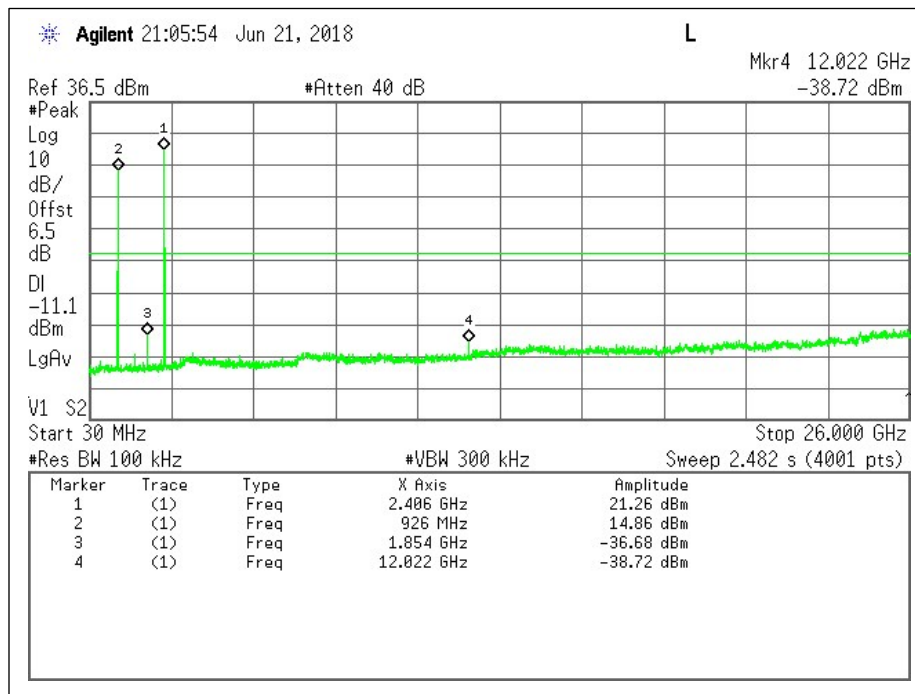
High Channel – Plot

Conducted Spurious – Simultaneous Transmission, Shared Antenna, with RF6 Radio

Configuration (Worse-case):

RF6 – Low Channel

Wiselink – High Channel



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 26 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 Chamber/OATS	05/07/18-05/23/18	28.3	54	1002	P

NOTE: Below 30MHz, pretesting showed that no emissions as a product of the EUT were detected within 20dB of the regulatory limit. Worse-case plot/data reported from 30MHz - 1GHz, per antenna. Prescans performed in an anechoic chamber, final measurements performed on an OATS.

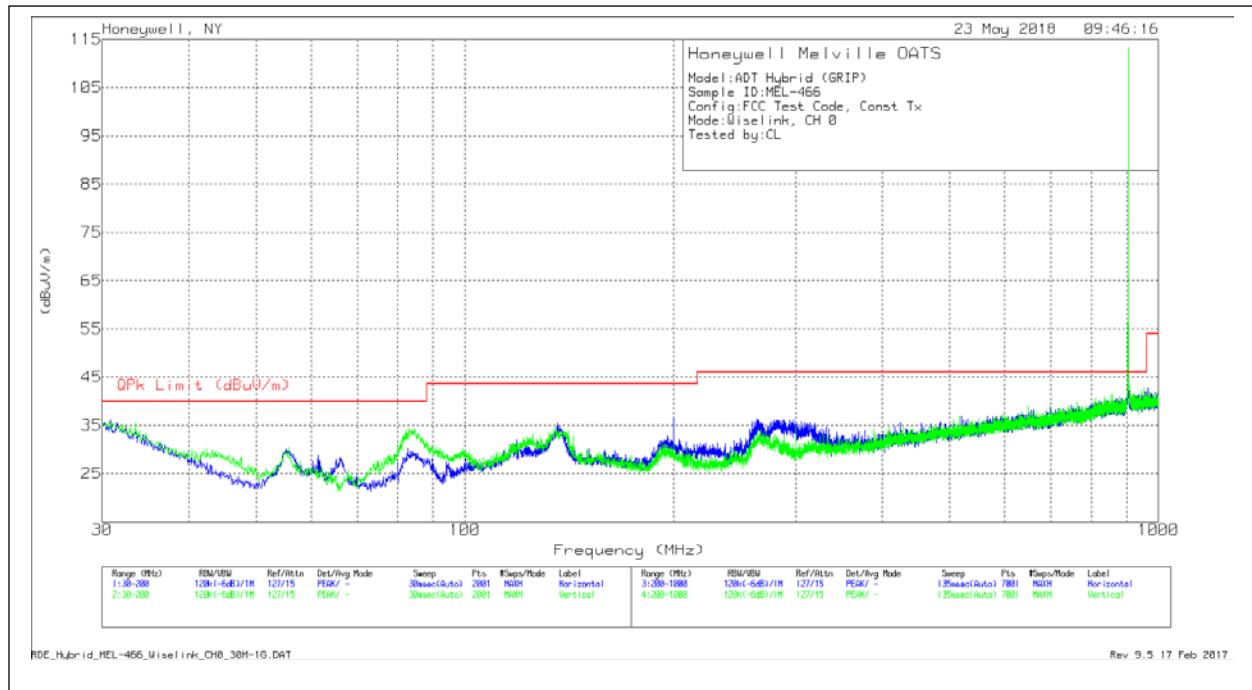
Equipment List

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 (1-18GHz)	11539	160362	Amplicial	AMP1G18-35	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



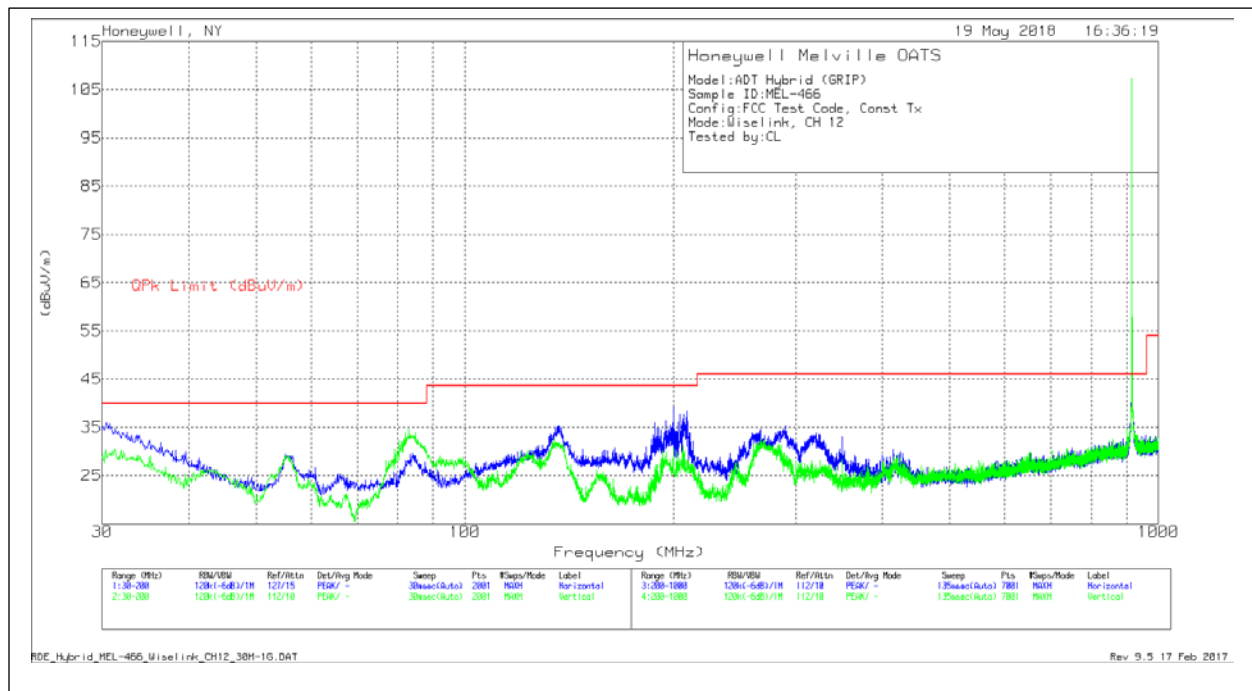
Low Channel - Plot

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
30.2589	11.03	Qp	24.7	.9	36.63	40	-3.37	222	247	H
199.8017	24.15	Qp	16.6	2.4	43.15	43.52	-.37	265	384	H
30.4661	11.1	Qp	24.5	.9	36.5	40	-3.5	214	262	V
83.2761	14.18	Qp	11.8	1.4	27.38	40	-12.62	287	143	V
* 134.9425	7.09	Qp	17.4	1.8	26.29	43.52	-17.23	22	324	V
* 264.7809	5.22	Qp	16.8	3.1	25.12	46.02	-20.9	51	135	H

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

Qp - Quasi-Peak detector

Low Channel - Data

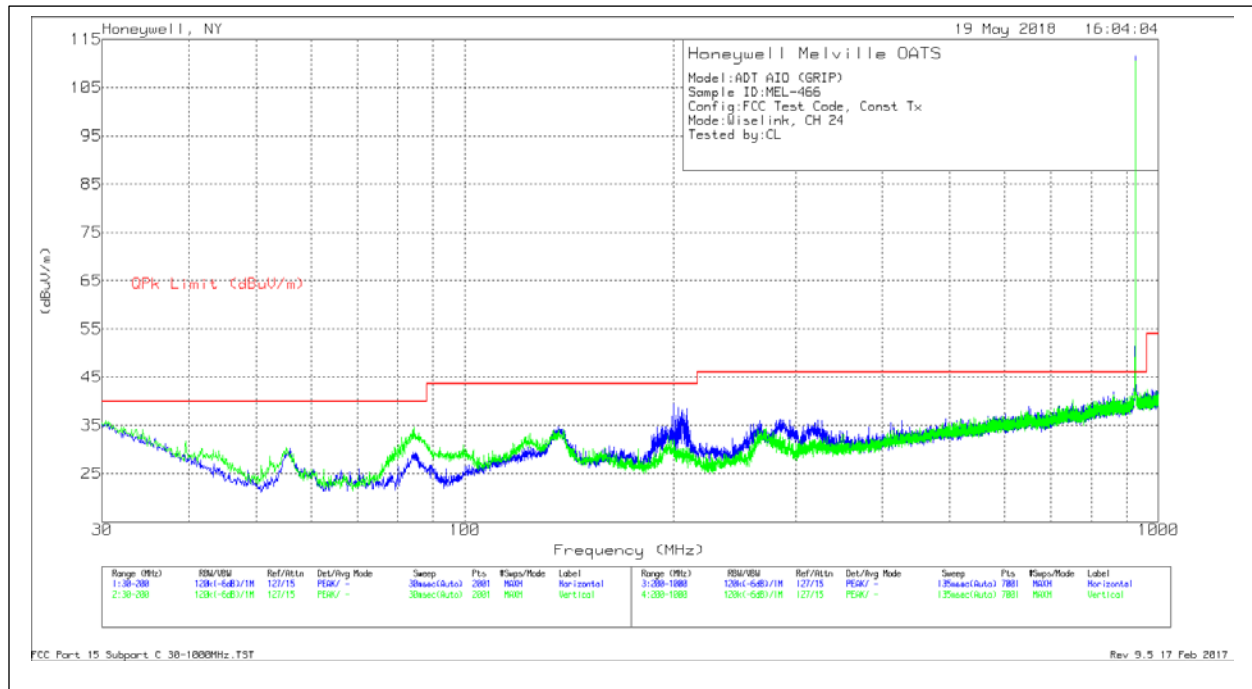


Mid Channel - Plot

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
30.3665	11.09	Qp	24.6	.9	36.59	40	-3.41	83	254	H
* 135.8031	5.73	Qp	17.3	1.9	24.93	43.52	-18.59	139	211	H
199.7708	24.18	Qp	16.6	2.4	43.18	43.52	-.34	360	367	H
55.797	18.41	Qp	12	1.1	31.51	40	-8.49	186	241	V
82.9124	15.91	Qp	11.7	1.4	29.01	40	-10.99	183	149	V
* 134.8517	14.6	Qp	17.4	1.8	33.8	43.52	-9.72	69	376	V

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

Mid Channel - Data



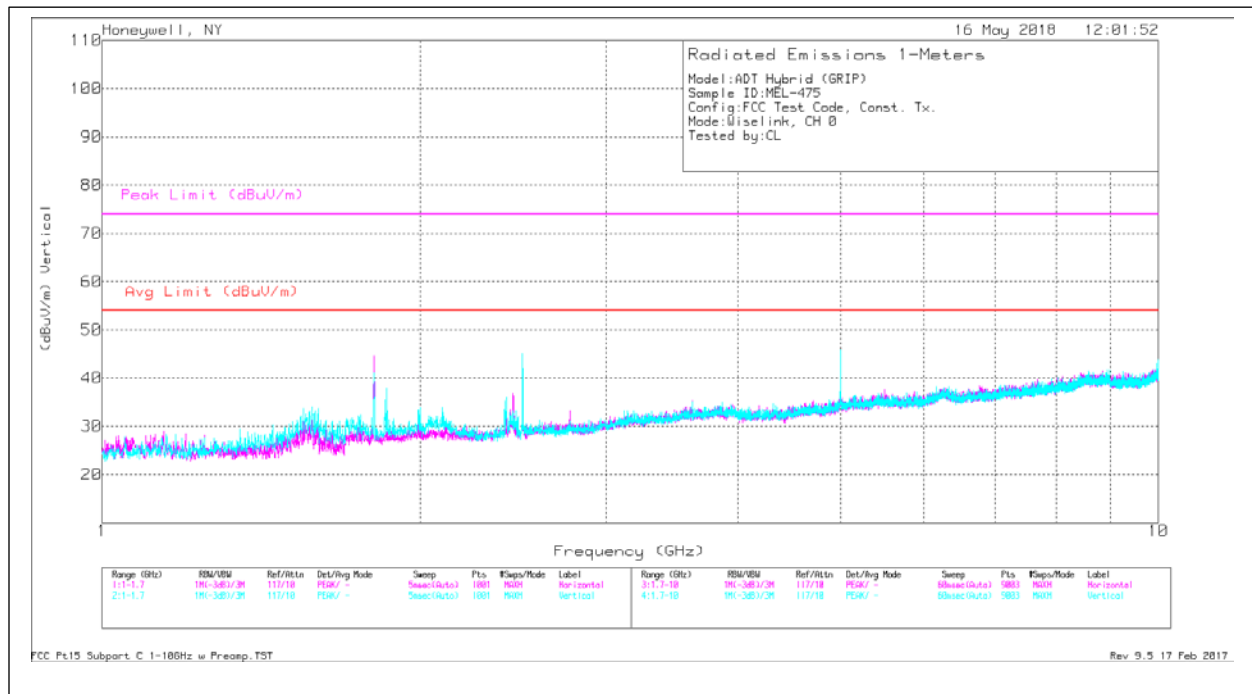
High Channel - Plot

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
30.3923	11.01	Qp	24.6	.9	36.51	40	-3.49	107	141	H
56.3768	16.99	Qp	12	1.1	30.09	40	-9.91	304	146	H
199.816	24.4	Qp	16.6	2.4	43.4	43.52	-.12	340	386	H
30.3971	11.11	Qp	24.6	.9	36.61	40	-3.39	96	222	V
55.5357	19.08	Qp	12	1.1	32.18	40	-7.82	257	204	V
85.2476	15.84	Qp	11.8	1.4	29.04	40	-10.96	298	175	V

Qp - Quasi-Peak detector

High Channel - Data

Above 1GHz



Low Channel – Plot

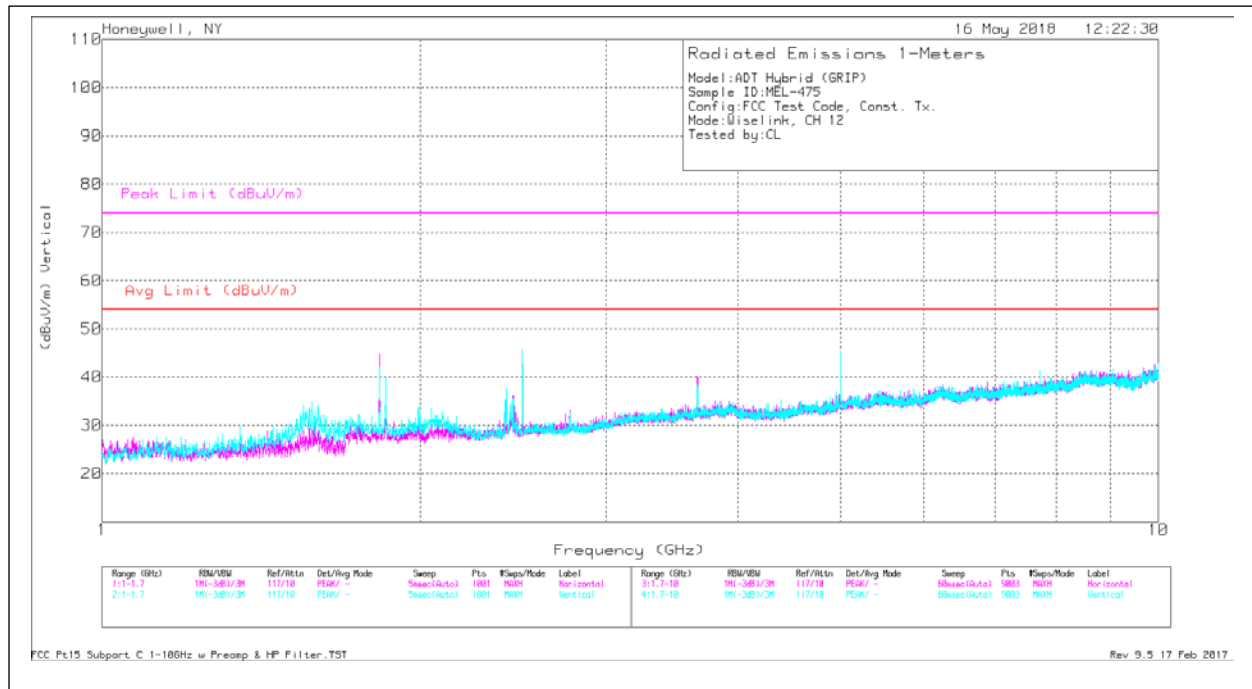
Frequency (GHz)	Meter Reading (dBuV)	Det	AF [dB/m]	SWBOX1 [dB]	SMA7 [dB]	SMA5 [dB]	HPF [dB]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1.809	52.06	PKFH	26.8	-42.4	2.3	2.2	.5	41.46	-	-	74	-32.54	61	115	H
1.809	49.08	VA1T	26.8	-42.4	2.3	2.2	.5	38.48	54	-15.52	-	-	61	115	H
2.5	61.21	PKFH	28.7	-43.3	2.7	2.6	.3	52.21	-	-	74	-21.79	182	102	H
2.5	60.13	VA1T	28.7	-43.3	2.7	2.6	.3	51.13	54	-2.87	-	-	182	102	H
* 4.999	46.62	PKFH	33.3	-41.1	3.8	3.7	.2	46.52	-	-	74	-27.48	299	109	H
* 5	40.77	VA1T	33.3	-41.1	3.8	3.7	.2	40.67	54	-13.33	-	-	299	109	H
1.809	50.82	PKFH	26.8	-42.4	2.3	2.2	.5	40.22	-	-	74	-33.78	176	117	V
1.809	45.78	VA1T	26.8	-42.4	2.3	2.2	.5	35.18	54	-18.82	-	-	176	117	V
2.5	60.21	PKFH	28.7	-43.3	2.7	2.6	.3	51.21	-	-	74	-22.79	174	123	V
2.5	59.34	VA1T	28.7	-43.3	2.7	2.6	.3	50.34	54	-3.66	-	-	174	123	V
* 5.001	47.66	PKFH	33.3	-41.1	3.8	3.7	.2	47.56	-	-	74	-26.44	158	208	V
* 5	42.08	VA1T	33.3	-41.1	3.8	3.7	.2	41.98	54	-12.02	-	-	158	208	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]	HPF [dB]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1.831	48.72	PKFH	27.1	-42.4	2.3	2.2	.5	38.42	-	-	74	-35.58	149	351	H
1.831	43.83	VA1T	27.1	-42.4	2.3	2.2	.5	33.53	54	-20.47	-	-	149	351	H
2.5	55.44	PKFH	28.7	-43.3	2.7	2.6	.3	46.44	-	-	74	-27.56	227	150	H
2.5	53.62	VA1T	28.7	-43.3	2.7	2.6	.3	44.62	54	-9.38	-	-	227	150	H
* 3.661	42.63	PKFH	32	-41.9	3.2	3.1	.3	39.33	-	-	74	-34.67	63	187	H
* 3.661	32.4	VA1T	32	-41.9	3.2	3.1	.3	29.1	54	-24.9	-	-	63	187	H
* 5	46.57	PKFH	33.3	-41.1	3.8	3.7	.2	46.47	-	-	74	-27.53	113	105	H
* 5	39.25	VA1T	33.3	-41.1	3.8	3.7	.2	39.15	54	-14.85	-	-	113	105	H
1.831	45.37	PKFH	27.1	-42.4	2.3	2.2	.5	35.07	-	-	74	-38.93	16	106	V
1.831	33.59	VA1T	27.1	-42.4	2.3	2.2	.5	23.29	54	-30.71	-	-	16	106	V
2.5	55.01	PKFH	28.7	-43.3	2.7	2.6	.3	46.01	-	-	74	-27.99	174	104	V
2.5	52.96	VA1T	28.7	-43.3	2.7	2.6	.3	43.96	54	-10.04	-	-	174	104	V
* 3.661	41.37	PKFH	32	-41.9	3.2	3.1	.3	38.07	-	-	74	-35.93	212	186	V
* 3.661	30.34	VA1T	32	-41.9	3.2	3.1	.3	27.04	54	-26.96	-	-	212	186	V
* 5	48.2	PKFH	33.3	-41.1	3.8	3.7	.2	48.1	-	-	74	-25.9	156	191	V
* 5	41.54	VA1T	33.3	-41.1	3.8	3.7	.2	41.44	54	-12.56	-	-	156	191	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



Frequency (GHz)	Meter Reading (dBuV)	Det	AF [dB/m]	SWBOX1 [dB]	SMA7 [dB]	SMA5 [dB]	HPF [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	56.47	PKFH	27.4	-42.4	2.3	2.2	.5	46.47	-	-	74	-27.53	10	371	H
1.854	33.24	VA1T	27.4	-42.4	2.3	2.2	.5	23.24	54	-30.76	-	-	10	371	H
2.5	55.95	PKFH	28.7	-43.3	2.7	2.6	.3	46.95	-	-	74	-27.05	226	126	H
2.5	54.18	VA1T	28.7	-43.3	2.7	2.6	.3	45.18	54	-8.82	-	-	226	126	H
* 5	47.72	PKFH	33.3	-41.1	3.8	3.7	.2	47.62	-	-	74	-26.38	297	105	H
* 5	41.45	VA1T	33.3	-41.1	3.8	3.7	.2	41.35	54	-12.65	-	-	297	105	H
1.851	45.07	PKFH	27.4	-42.4	2.3	2.2	.5	35.07	-	-	74	-38.93	320	265	V
1.852	31.7	VA1T	27.4	-42.4	2.3	2.2	.5	21.7	54	-32.3	-	-	320	265	V
2.5	51.34	PKFH	28.7	-43.3	2.7	2.6	.3	42.34	-	-	74	-31.66	140	302	V
2.5	48.2	VA1T	28.7	-43.3	2.7	2.6	.3	39.2	54	-14.8	-	-	140	302	V
* 5	48.22	PKFH	33.3	-41.1	3.8	3.7	.2	48.12	-	-	74	-25.88	264	231	V
* 5	41.09	VA1T	33.3	-41.1	3.8	3.7	.2	40.99	54	-13.01	-	-	264	231	V

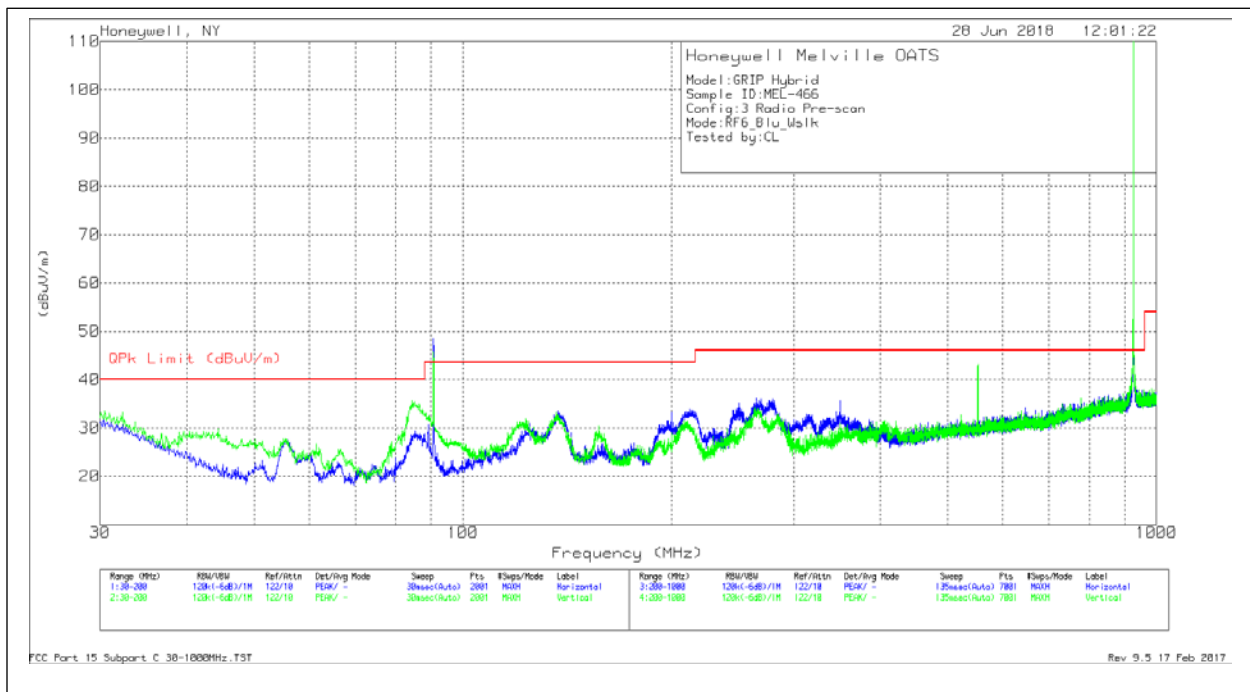
VA1T - FHSS: Linear Voltage Average VB=10Hz

High Channel – Data

Simultaneous Transmission

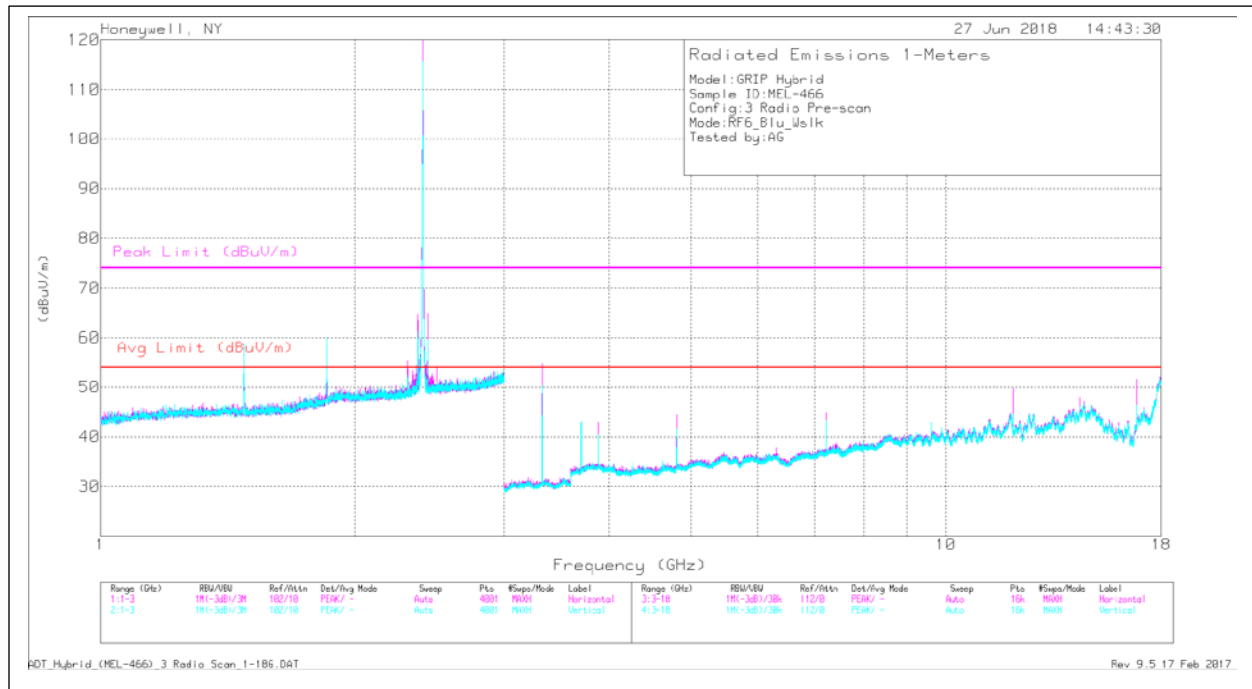
Configuration (Worse-case):

RF6 – Antenna 2, Low Channel
Wiselink – High Channel
Bluetooth (LE) – Low Channel



30-1000MHz – Plot

Note: No additional emissions generated by simultaneous transmission



1-18GHz – Plot

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
3.331	59.65	Pk	31.4	3	-40.6	-9.5	.9	20	64.85	74	-9.15	0-360	100	H
7.215	43.28	Pk	36.2	4.4	-39.6	-9.5	.1	20	54.88	74	-19.12	0-360	100	H
14.43	38.3	Pk	42.1	6.8	-40.7	-9.5	.9	20	57.9	74	-16.1	0-360	100	H
16.835	43.37	Pk	39.6	6.8	-39.6	-9.5	1	20	61.67	74	-12.33	0-360	100	H
3.331	55.07	Pk	31.4	3	-40.6	-9.5	.9	20	60.27	74	-13.73	0-360	100	V
7.214	41.82	Pk	36.2	4.4	-39.6	-9.5	.1	20	53.42	74	-20.58	0-360	100	V
14.592	36.02	Pk	42.5	6.6	-39.8	-9.5	.9	20	56.72	74	-17.28	0-360	100	V
16.835	38.14	Pk	39.6	6.8	-39.6	-9.5	1	20	56.44	74	-17.56	0-360	100	V

Frequency (GHz)	Meter Reading (dBuV)	Det	AF [dB/m]	SWBOX3 [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
* 1.479	22.87	PK2	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
* 3.7	22.18	PK2	32.2	1	3.3	3.2	61.88	-	-	74	-12.12	104	257	H
* 3.705	10.64	MAv1	32.2	1	3.3	3.2	50.34	54	-3.66	-	-	104	257	H
* 1.479	25.69	PK2	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
* 3.708	22.66	PK2	32.3	1	3.3	3.2	62.46	-	-	74	-11.54	82	160	V
* 3.705	10.43	MAv1	32.2	1	3.3	3.2	50.13	54	-3.87	-	-	82	160	V

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

Pk – Peak Detector

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

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 CFR 47 Subpart B, 15.107 ICES-003	0.15-0.5	66 to 56	56 to 46
	0.5-5	56	46
	5-30	60	50

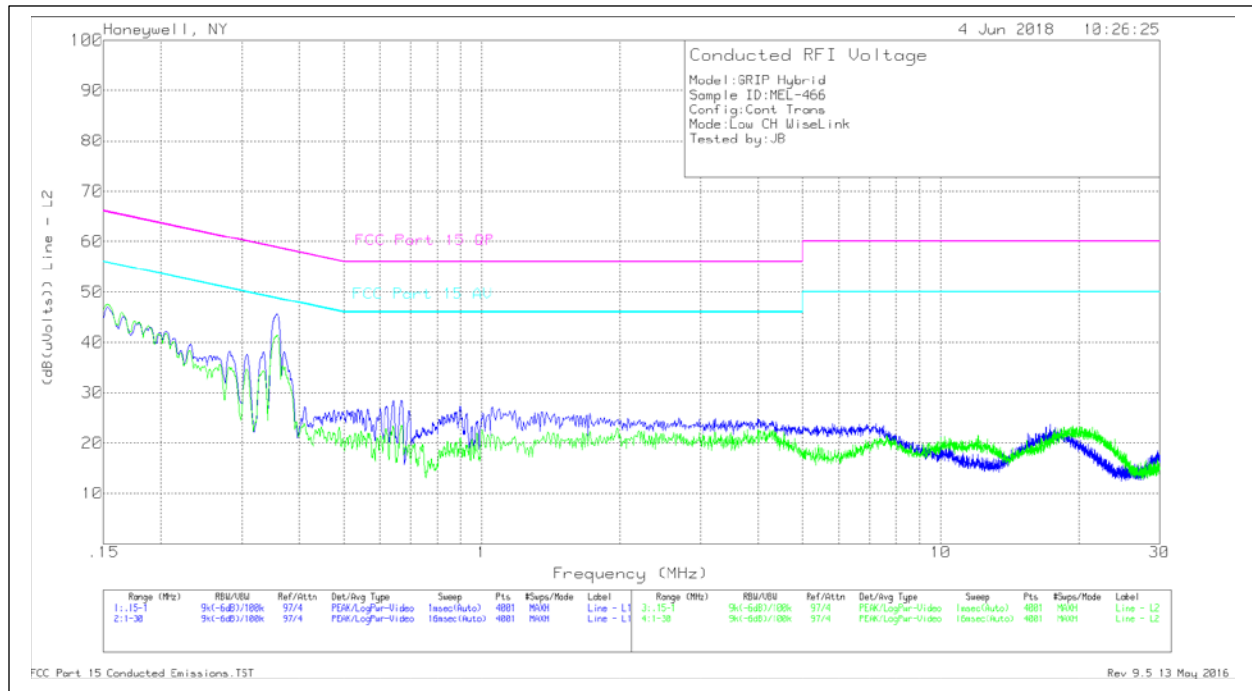
Test Information

Tester	Test Location	Date	Temperature (°C)	Humidity (%RH)	Pressure (mbar)	Results (P/F)
JB	RF Lab	06/04/18	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 (Worse-case)



Conducted Emissions Plot

Line - Hot									
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)
.35778	35.49	Pk	10	.1	45.59	58.78	-13.19	48.78	-3.19
.23201	29.29	Pk	10.2	.1	39.59	62.38	-22.79	52.38	-12.79
.67015	18.34	Pk	9.9	0	28.24	56	-27.76	46	-17.76
.89848	17.36	Pk	9.9	0	27.26	56	-28.74	46	-18.74
17.3125	13.28	Pk	10.2	.3	23.78	60	-36.22	50	-26.22
3.233	14.92	Pk	9.9	.1	24.92	56	-31.08	46	-21.08
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)
.35778	31.11	Pk	10.1	.1	41.31	58.78	-17.47	48.78	-7.47
.15298	36.91	Pk	10.6	0	47.51	65.84	-18.33	55.84	-8.33
.66812	13.54	Pk	10	0	23.54	56	-32.46	46	-22.46
1	11.94	Pk	10	0	21.94	56	-34.06	46	-24.06
21.416	12.39	Pk	10.5	.3	23.19	60	-36.81	50	-26.81
11.933	10.49	Pk	10.1	.2	20.79	60	-39.21	50	-29.21

Pk - Peak detector

Conducted Emissions Data

END OF REPORT