



FCC / ISED Test Report

For

GRIP Hybrid Panel

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FCC ID: CFS8DL-GRIPH

IC ID: 573F-GRIPH

Report Completion Date: 2018-06-29

Prepared by and for:
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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 6dB bandwidth data; Added data to support simultaneous operation	2018-06-29

Report Authorization

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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 Bluetooth portion of the EUT.

The Bluetooth LE circuitry contains a single, dedicated, integral PCB antenna with a gain of 6dBi.

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). 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	99% Occupied Bandwidth	PASS
2	6 dB Emission Bandwidth	PASS
3	Maximum Conducted Output Power	PASS
4	Maximum Power Spectral Density	PASS
5	Out of Band Emissions	PASS
6	Radiated Emissions (Intentional)	PASS
7	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	05/11/2018	22.6	37.2	1014	P

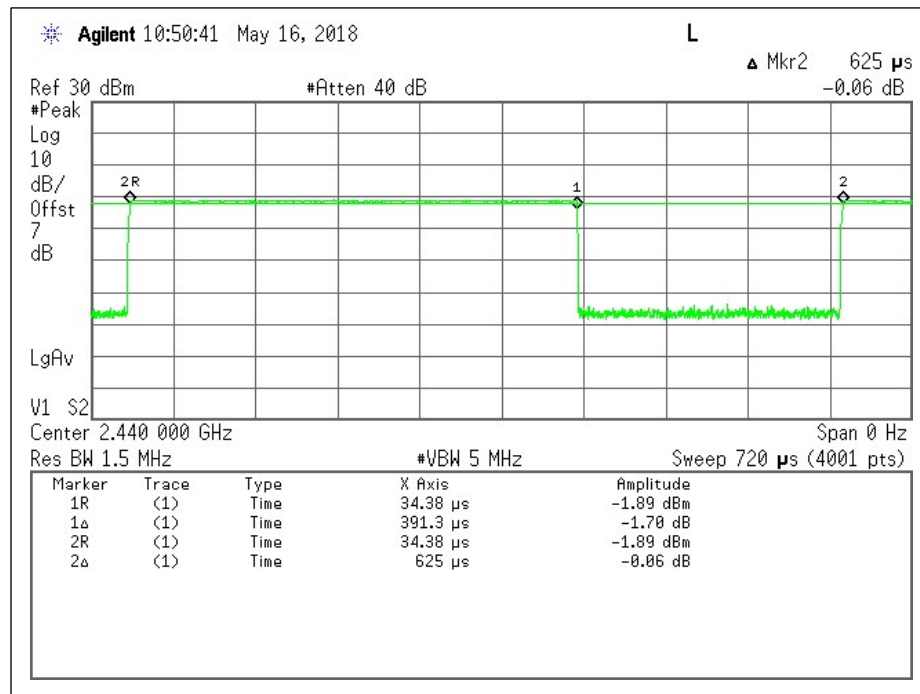
Equipment List

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 (%)	Correction Factor [10log(1/D)]
391.3	625	0.626	62.6	2.03

Duty Cycle Plot



6dB Emission Bandwidth (DTS 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 6 dB relative to the maximum level measured in the fundamental emission. Refer to KDB 558074 D01 DTS Meas Guidance v04.

Test Criteria

Reference	Limit
CFR 47 Subpart C 15.247 (a)(2) RSS-247 Section 5.2 (a)	$\geq 500\text{kHz}$

Test Information

Tester	Test Location	Date	Temperature (°C)	Humidity (%RH)	Pressure (mbar)	Results (P/F)
MA	RF Lab	06/26/2018	22.6	37.2	1014	P

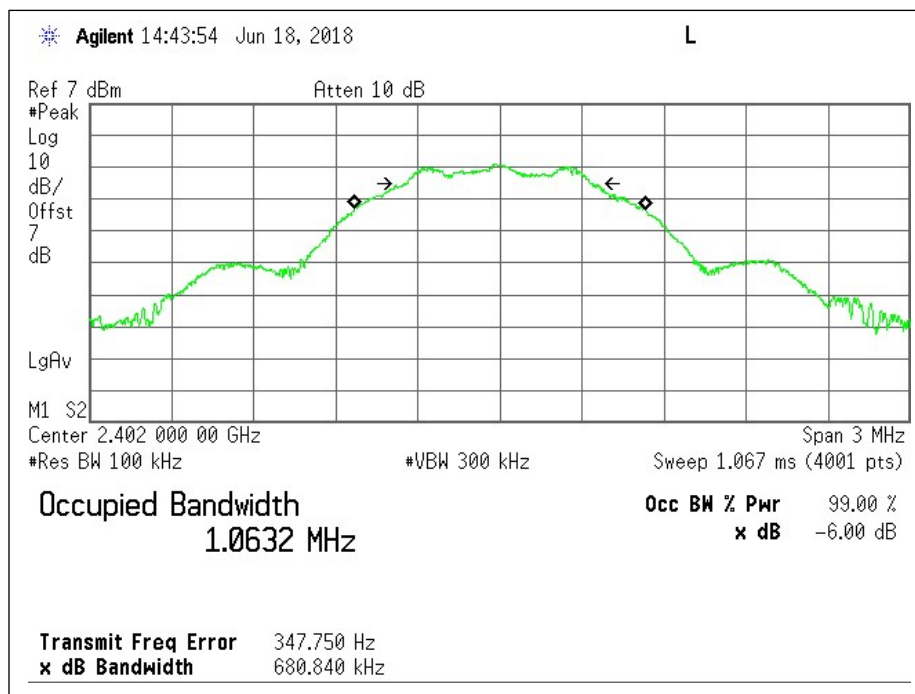
Equipment List

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	11533	A070144	Extech Instruments	SD700	08/21/17	08/21/20

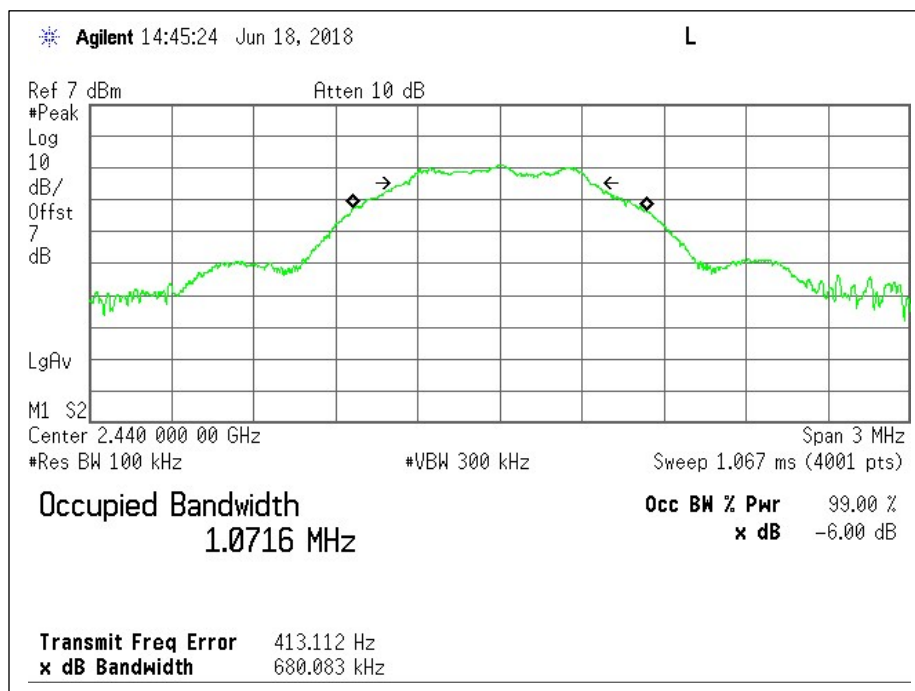
Test Results

Channel	Frequency (GHz)	6dB Bandwidth (in kHz)
Low	2.402	680.840
Mid	2.440	680.083
High	2.480	702.828

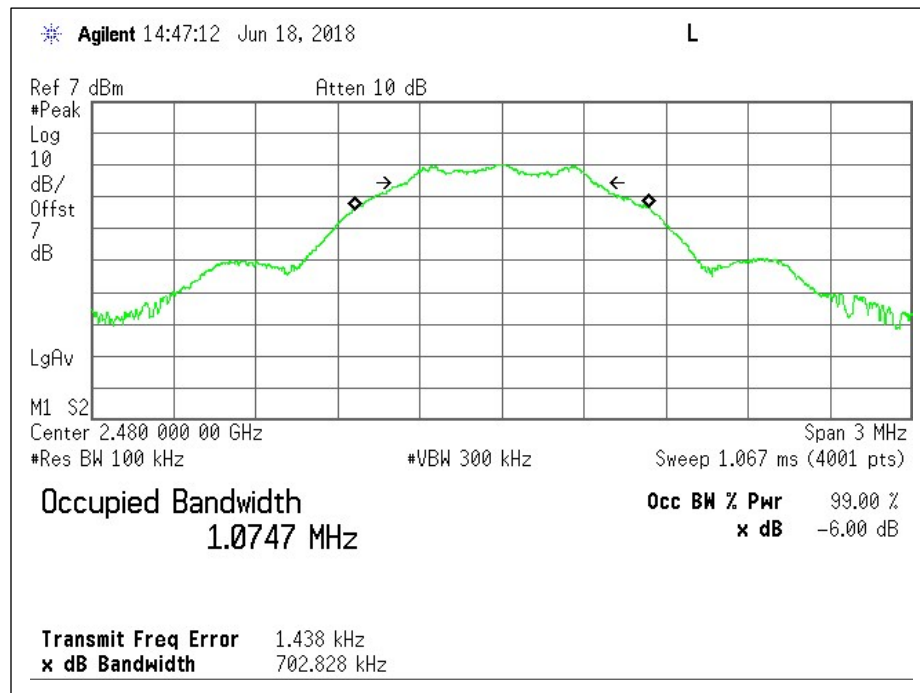
6dB Bandwidth



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	05/11/2018	22.6	37.2	1014	P

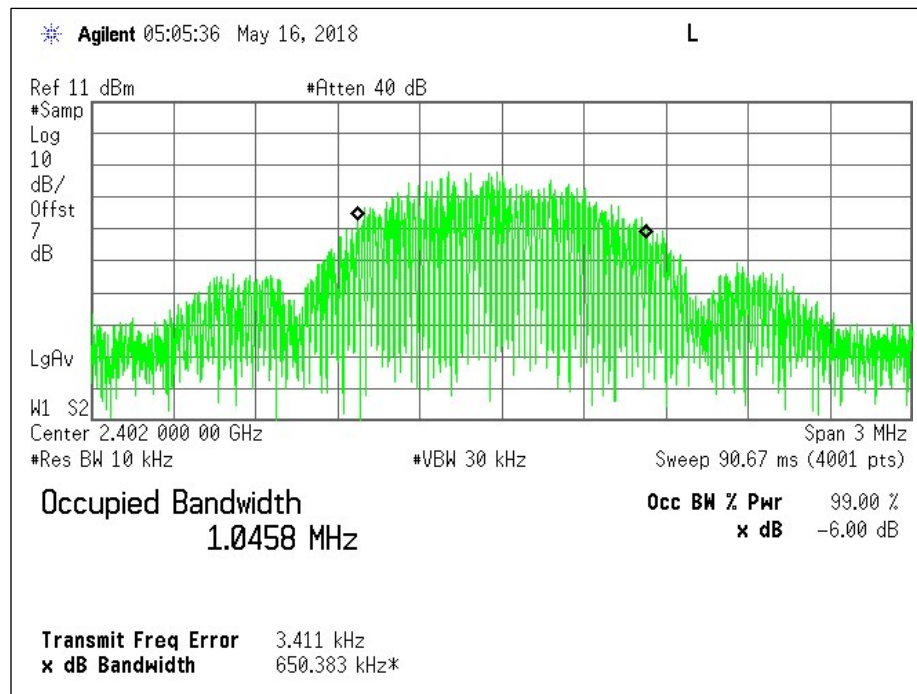
Equipment List

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	11533	A070144	Extech Instruments	SD700	08/21/17	08/21/20

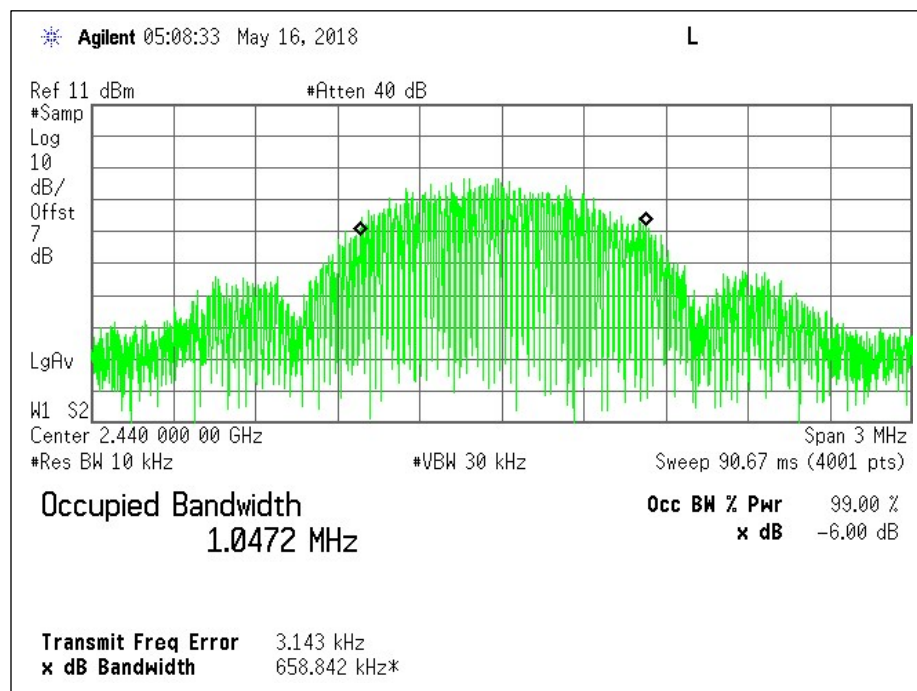
Test Results

Channel	Frequency (GHz)	99% Bandwidth (in MHz)
Low	2.402	1.0458
Mid	2.440	1.0472
High	2.480	1.0485

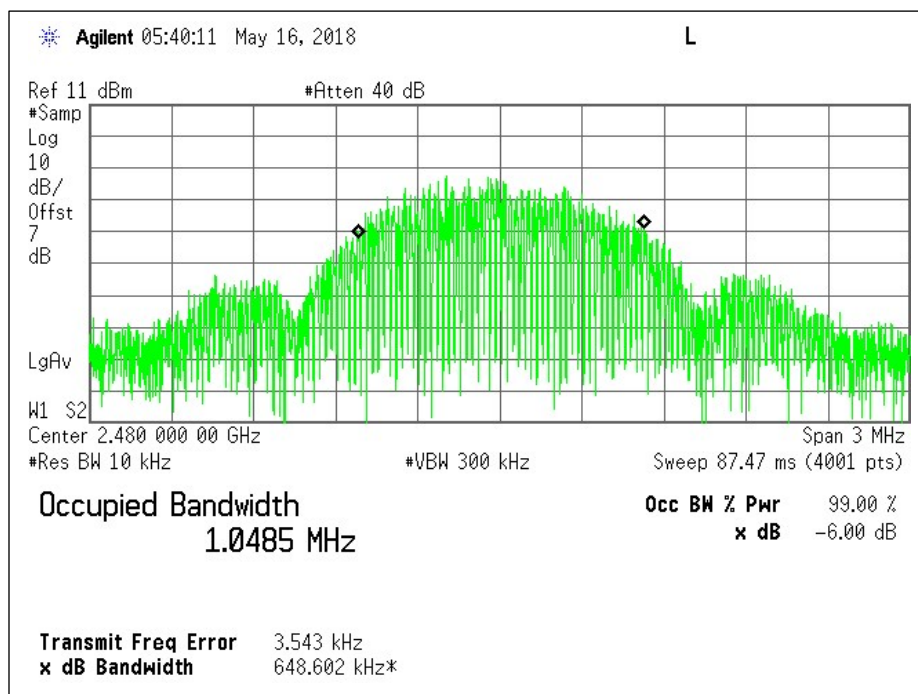
99% Occupied Bandwidth



Low Channel - Plot



Mid Channel - Plot



High Channel – Plot

Maximum Conducted Output Power

Test Description

For systems using digital modulation in the 902-928MHz, 2400-2483,5MHz and 5725-5850MHz bands, the conducted output power limit (specified below) is based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Maximum peak conducted output power was the method employed to determine fundamental emission output power.

Method RWB $\geq$ DTS Bandwidth per C63.10 and KDB 558074 was utilized for this test program.

Test Criteria

Reference	Limit
CFR 47 Subpart C 15.247 (b)(3) RSS-247 Section 5.4 (d)	1W (30dBm)

Test Information

Tester	Test Location	Date	Temperature (°C)	Humidity (%RH)	Pressure (mbar)	Results (P/F)
CL	RF Lab	05/11/218	22.6	37.2	1014	P

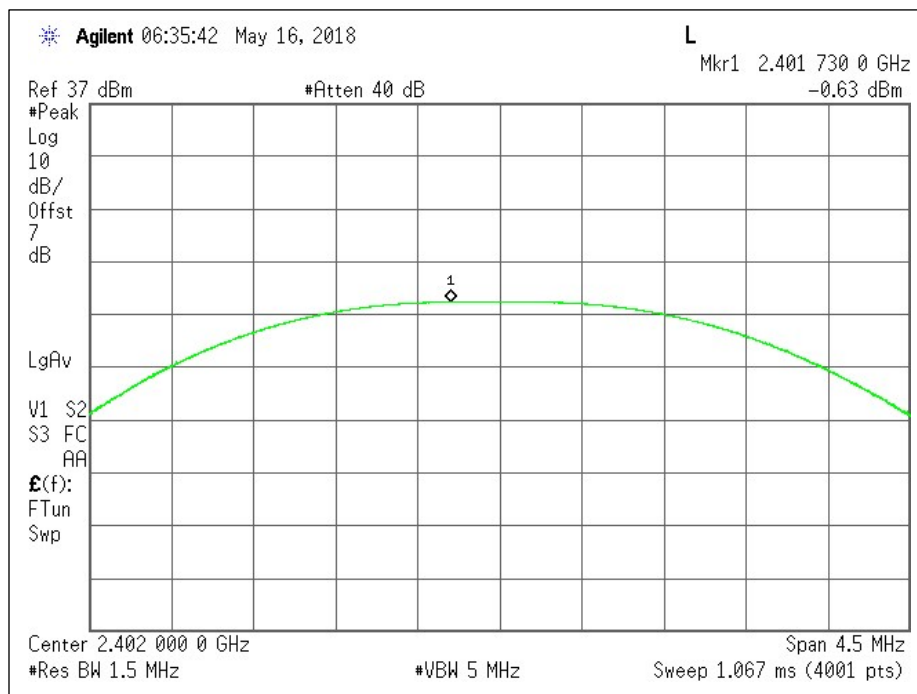
Equipment List

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	11533	A070144	Extech Instruments	SD700	08/21/17	08/21/20

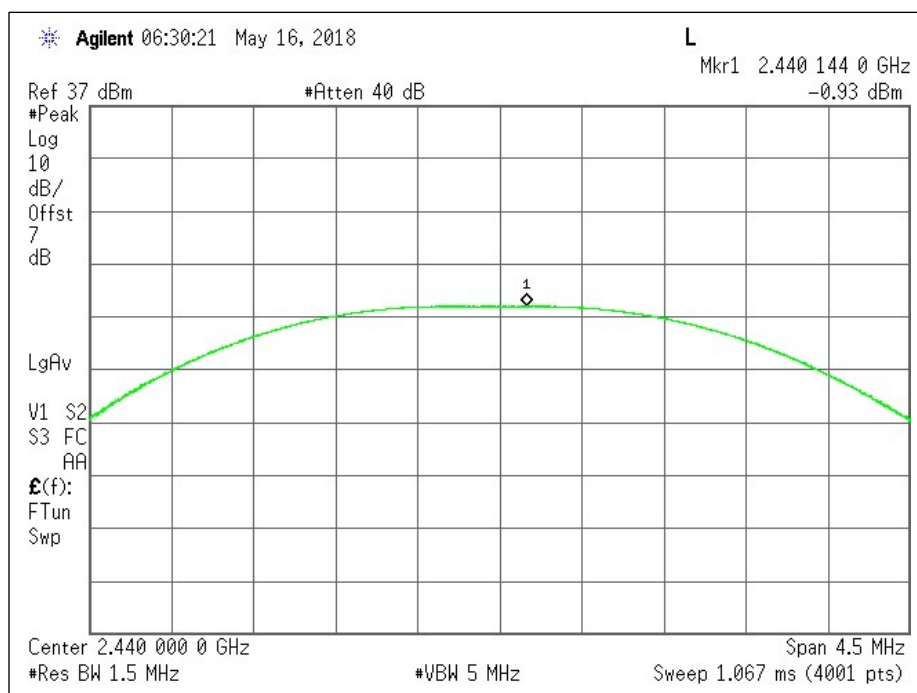
Test Results

Channel	Frequency (GHz)	Tx Channel BW Power (dBm)
Low	2.402	-0.63
Mid	2.440	-0.93
High	2.480	-1.21

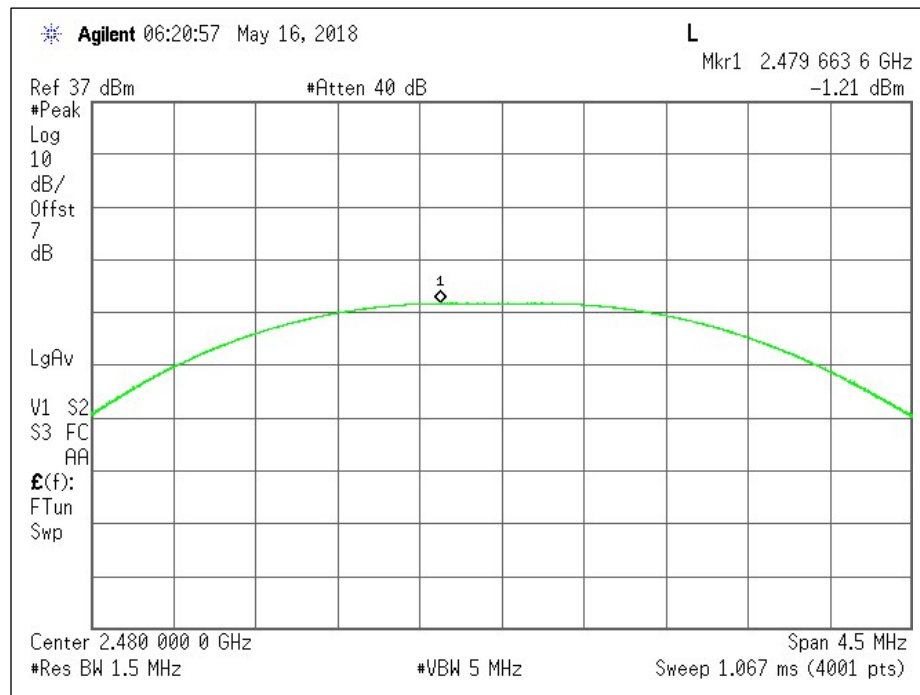
Output Power



Low Channel - Plot



Mid Channel - Plot



High Channel – Plot

Maximum Power Spectral Density

Test Description

The DTS rules specify a conducted PSD limit within the *DTS bandwidth* during any time interval of continuous transmission. Such specifications require that the same method as used to determine the conducted output power shall also be used to determine the power spectral density. Therefore, if maximum peak conducted output power was measured to demonstrate compliance to the output power limit, then the peak PSD procedure below (Method PKPSD) shall be used. If maximum conducted output power was measured to demonstrate compliance to the output power limit, then one of the average PSD procedures shall be used.

Since maximum conducted (peak) output power was the method employed to determine fundamental emission output power, then the peak power spectral density method was utilized.

Method PKPSD-1 per C63.10 and KDB 558074 was utilized for this test program.

Test Criteria

Reference	Limit
CFR 47 Subpart C 15.247 (e) RSS-247 Section 5.2 (b)	< 8 dBm in any 3 kHz Band

Test Information

Tester	Test Location	Date	Temperature (°C)	Humidity (%RH)	Pressure (mbar)	Results (P/F)
CL	RF Lab	05/11/2018	22.6	37.2	1014	P

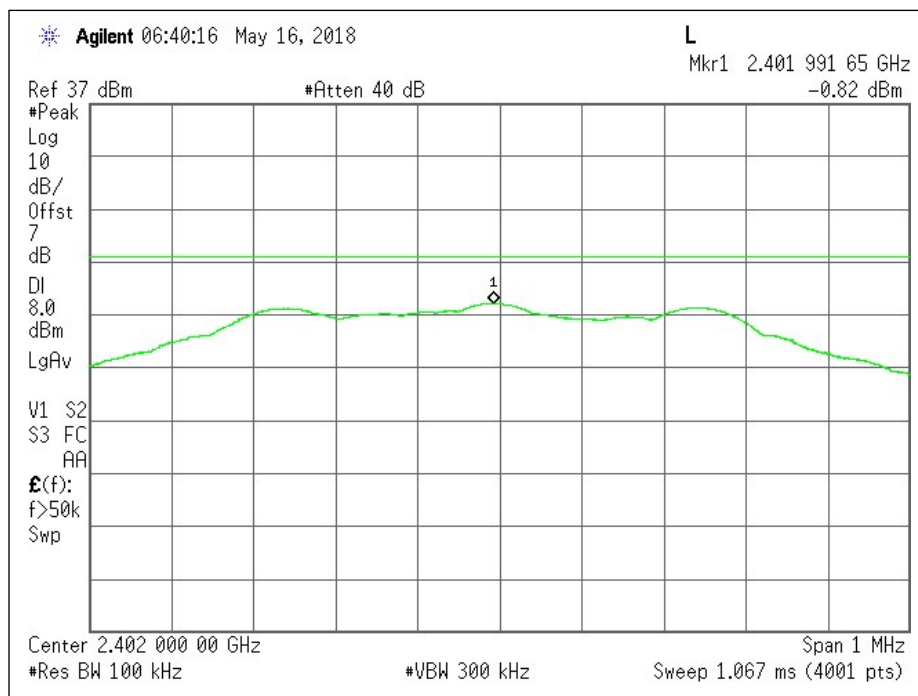
Equipment List

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	11533	A070144	Extech Instruments	SD700	08/21/17	08/21/20

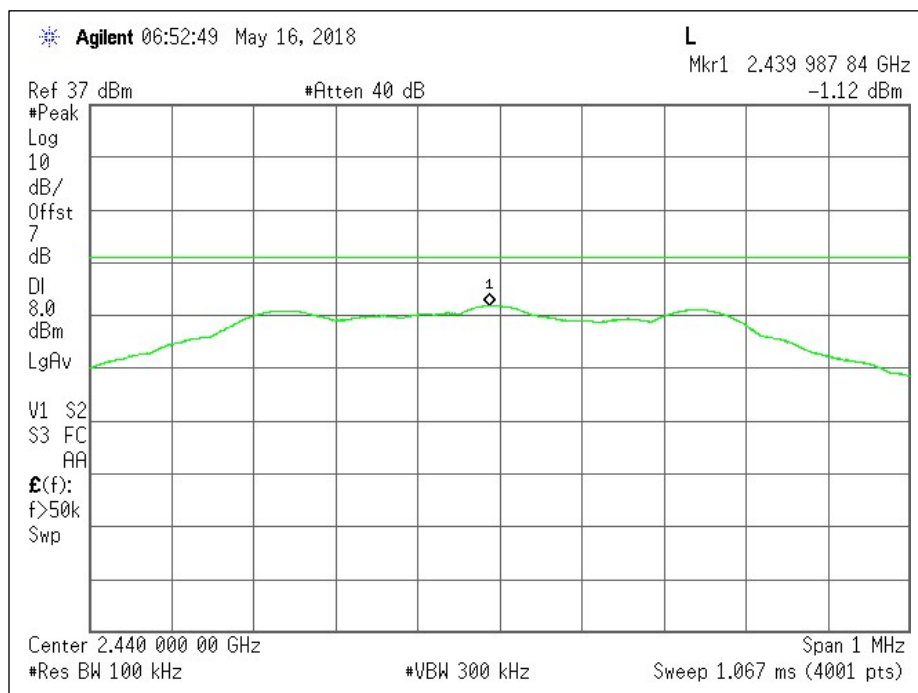
Test Results

Channel	Frequency (GHz)	Max PSD (dBm)
Low	2.402	-0.82
Mid	2.440	-1.12
High	2.480	-1.41

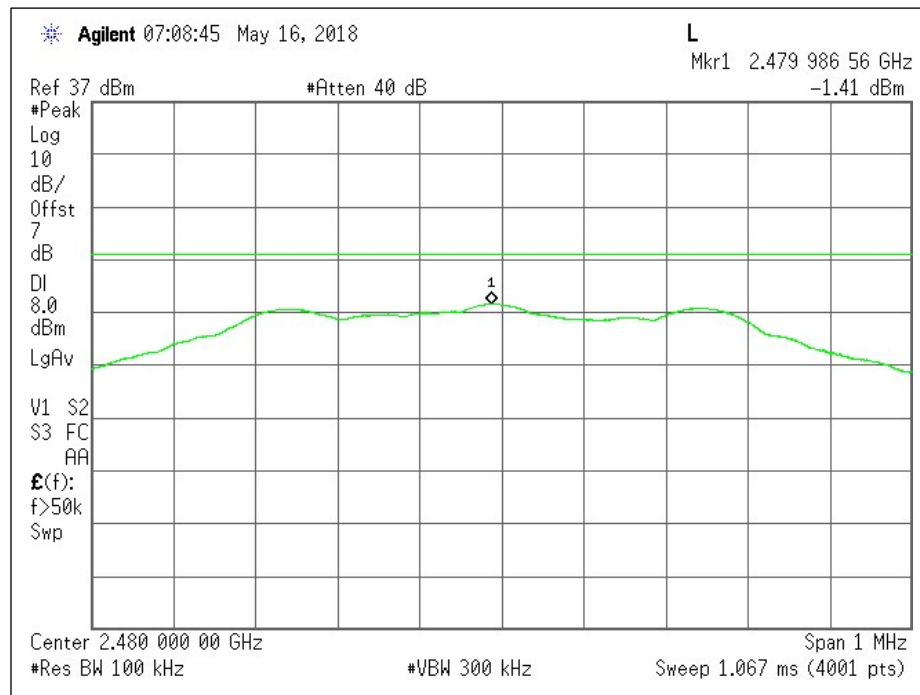
PSD



Low Channel - Plot



Mid Channel - Plot



High Channel – Plot

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 or 30dB Below the Fundamental

Test Information

Tester	Test Location	Date	Temperature (°C)	Humidity (%RH)	Pressure (mbar)	Results (P/F)
CL	RF Lab	05/11/2018	22.6	37.2	1014	P

Equipment List

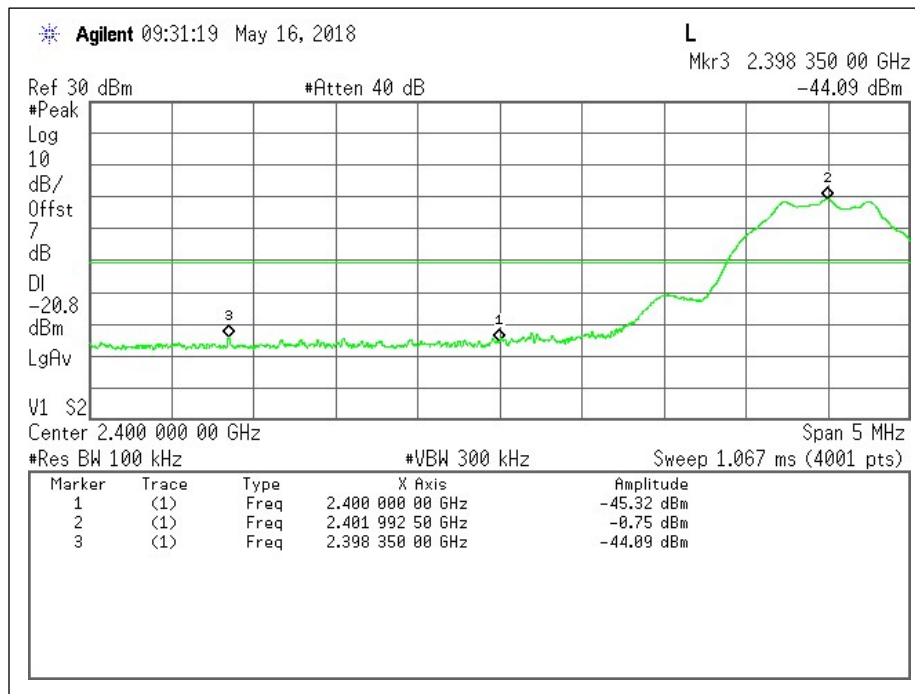
Instrument Type	ID #	Serial #	Manufacturer	Model	Cal Date	Cal Due Date
Spectrum Analyzer	11549	MY46187211	Agilent	E4440A	06/06/17	06/06/19
Environmental Meter	11533	A070144	Extech Instruments	SD700	08/21/17	08/21/20

Test Results

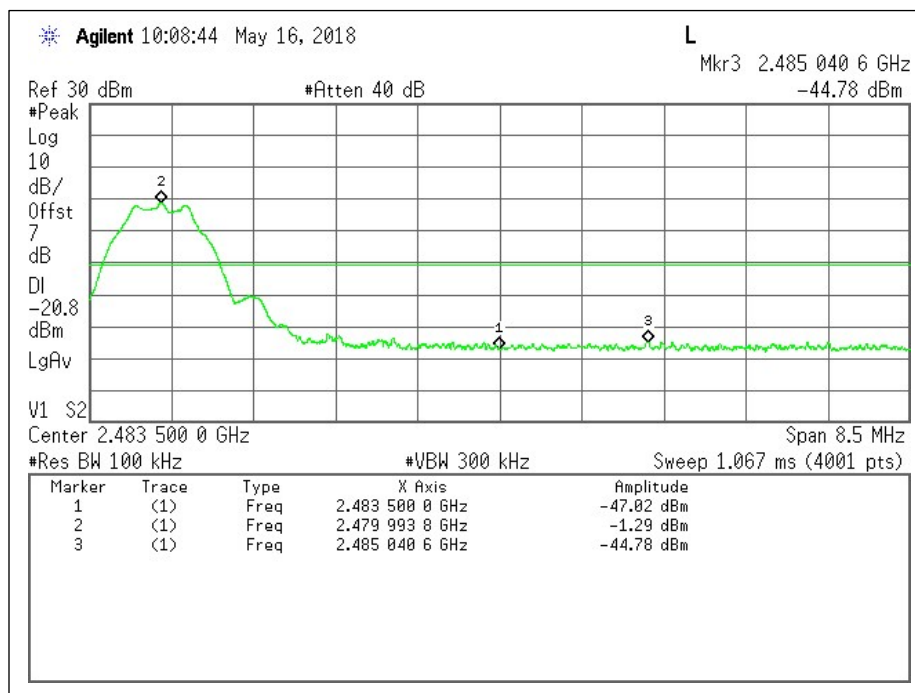
Authorized Band Edge				
Channel	Frequency (GHz)	Delta from Peak to Bandedge (dB)	Limit (dB)	Margin (dB)
Low	2.402	44.57	20	-24.57
High	2.480	45.73	20	-25.73

Conducted Spurious		
Channel	Frequency (GHz)	Highest Spurious Emission from -20dB down point (dB)
Low	2.402	-37.54
Mid	2.440	-37.21
High	2.480	-37.5

Band Edge

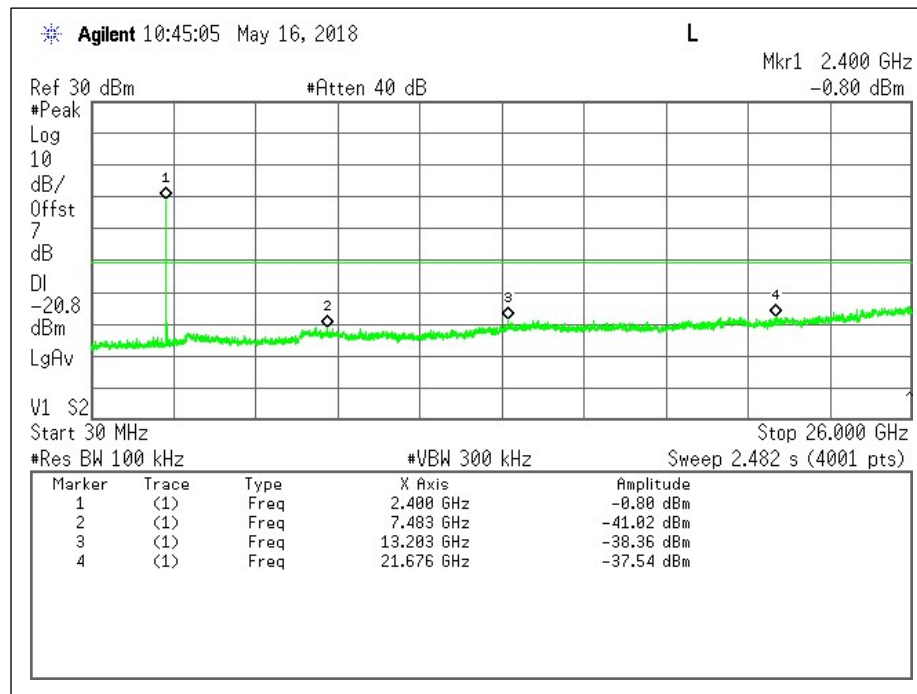


Low Channel - Plot

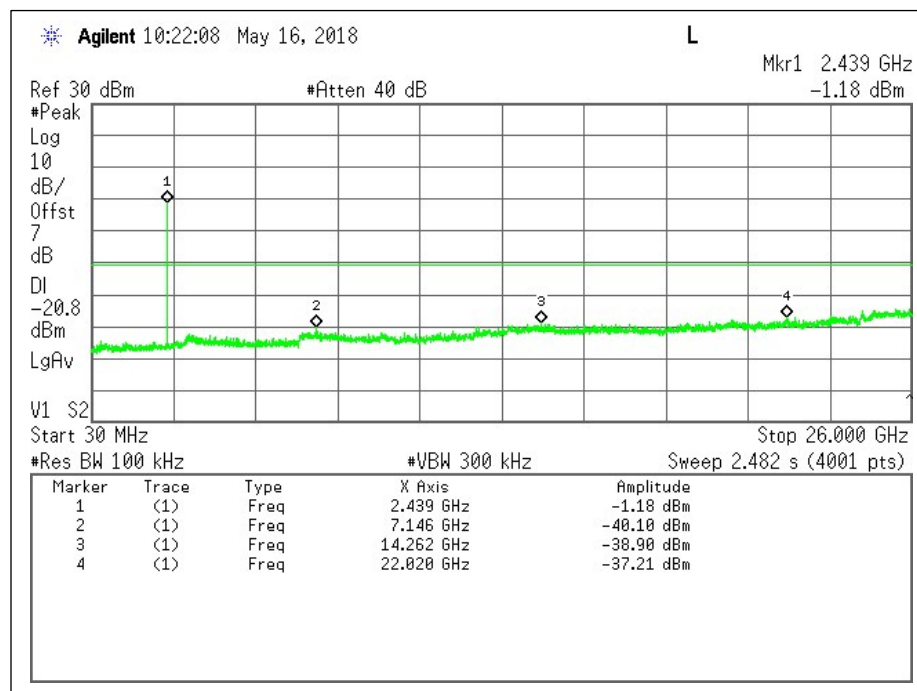


High Channel - Plot

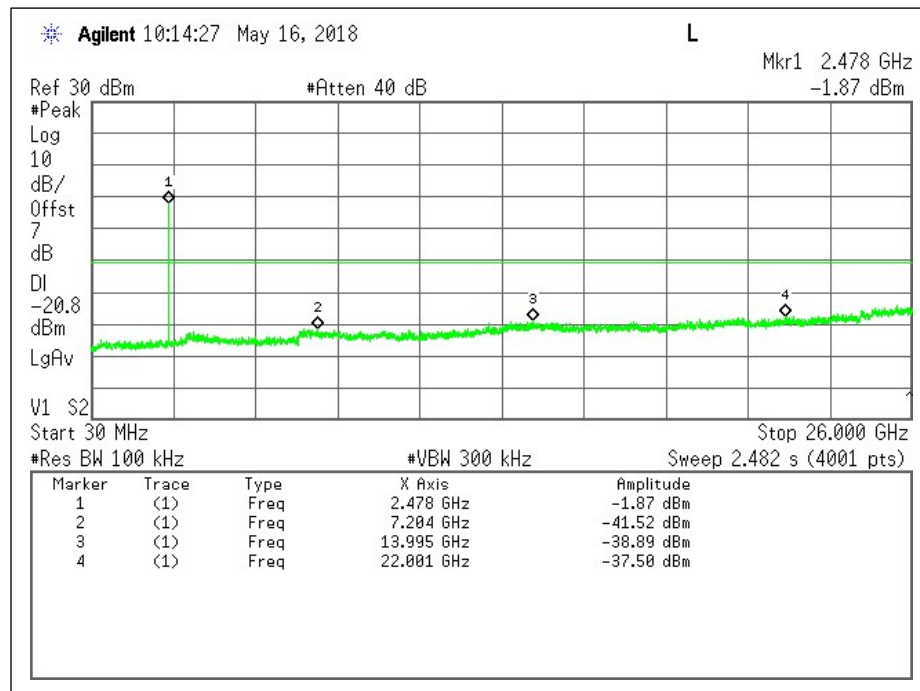
Conducted Spurious



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 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	05/17/18-05/23/18	28.3	54	1002	P

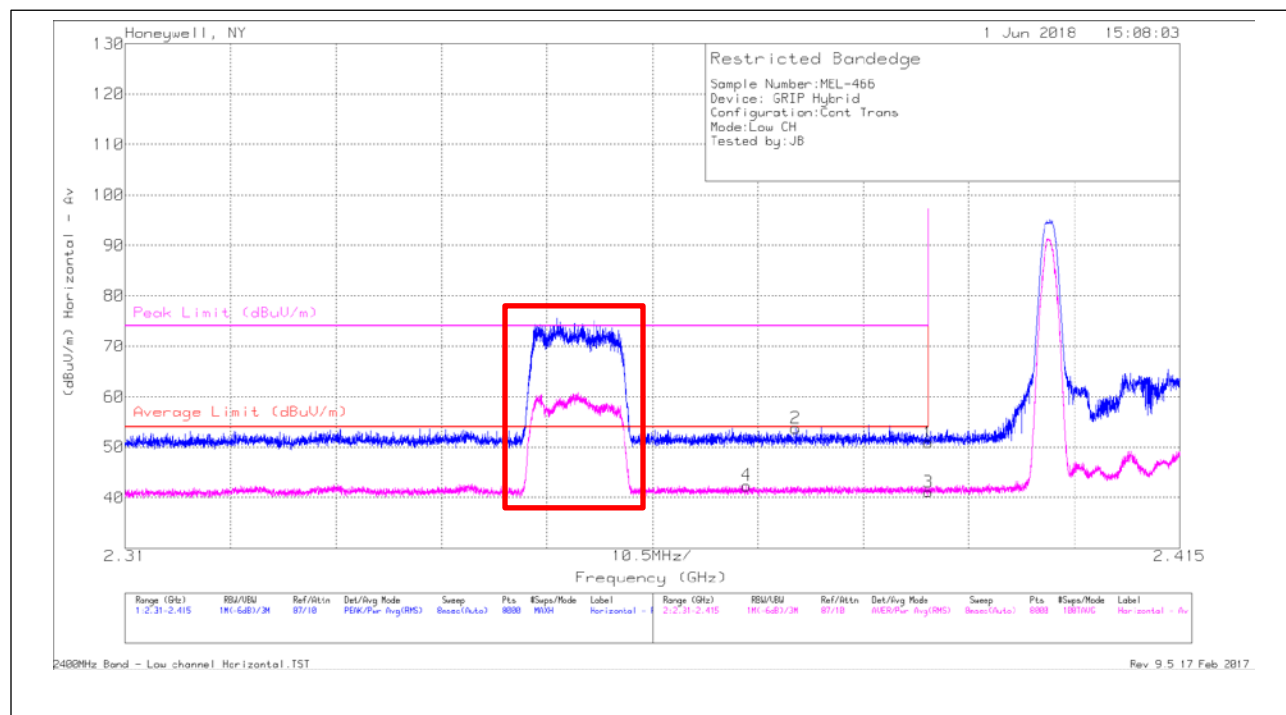
NOTE: Below 30MHz, pretesting showed that no emissions as a product of the EUT were detected within 20dB of the regulatory limit. Worse-case plot/data reported from 30MHz - 1GHz. Prescans performed in an anechoic chamber, final measurements performed on an OATS.

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
Horn Antenna (18-40GHz)	11472	151	EMCO	EM-6963	02/14/18	02/14/19
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
Preamp (18-40GHz)	11541	160911	Amplical	AMP18G40-35	N/A	N/A
Band Reject Filter	11553	G041	Micro-tronics	BRM50702-01	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
Horn Antenna (18-40GHz)	11472	151	EMCO	EM-6963	02/14/18	02/14/19
Preamp (1-18GHz)	11539	160362	Amplical	AMP1G18-35	N/A	N/A
Preamp (18-40GHz)	11541	160911	Amplical	AMP18G40-35	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

Restricted Band Edge



Low Channel Horizontal - Plot

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF [dB/m]	SWBOX3 [dB]	SMA7 [dB]	SMA5 [dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	16.59	Pk	28.5	.7	2.6	2.5	-	50.89	74	-23.11	150	360	H
2	* 2.377	19.64	Pk	28.4	.7	2.6	2.5	-	53.84	74	-20.16	150	360	H
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF [dB/m]	SWBOX3 [dB]	SMA7 [dB]	SMA5 [dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	* 2.39	6.8	RMS	28.5	.7	2.6	2.5	2.03	43.13	54	-10.87	150	360	H
4	* 2.372	8.34	RMS	28.3	.7	2.6	2.5	2.03	44.47	54	-9.53	150	360	H

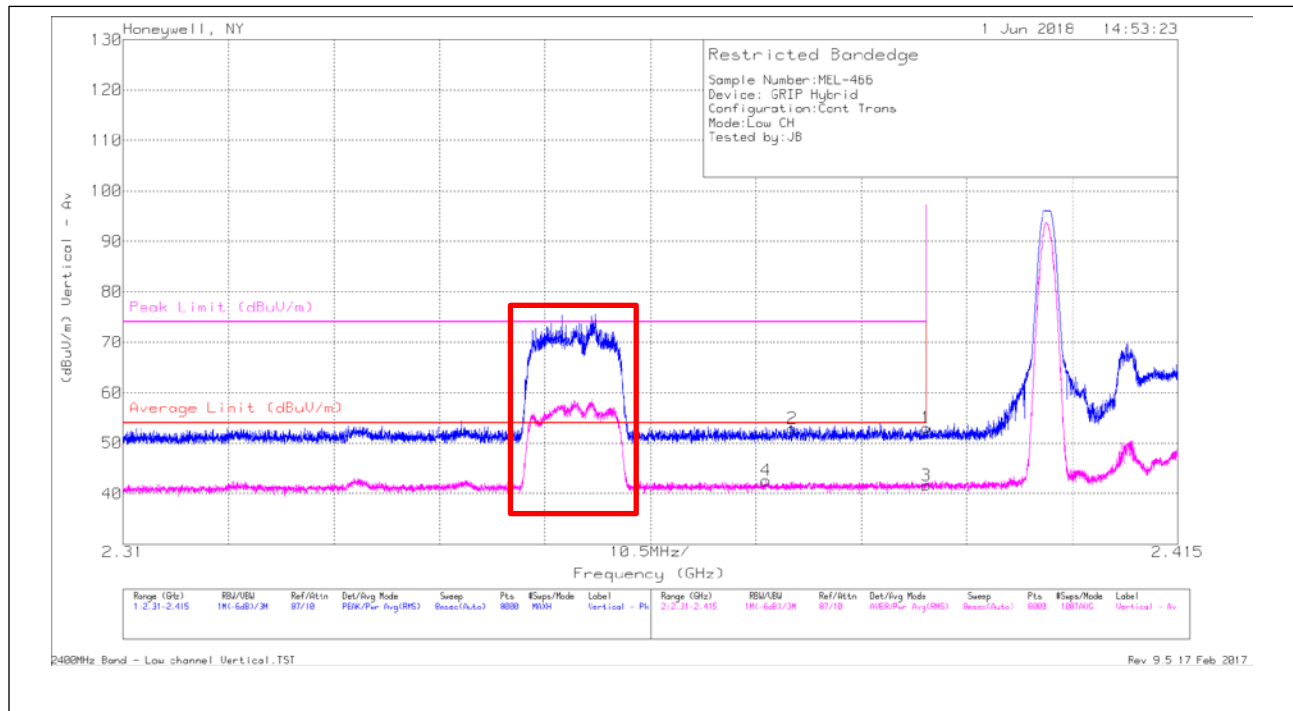
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

NOTE: Emissions highlighted in the plot above is OATS ambient and not a product of the transmitter.

Low Channel Horizontal - Data



Low Channel Vertical - Plot

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF [dB/m]	SWBOX3 [dB]	SMA7 [dB]	SMA5 [dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	18.75	Pk	28.5	.7	2.6	2.5	-	53.05	74	-20.95	273	295	V
2	* 2.377	18.7	Pk	28.4	.7	2.6	2.5	-	52.9	74	-21.1	273	295	V
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF [dB/m]	SWBOX3 [dB]	SMA7 [dB]	SMA5 [dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	* 2.39	7.37	RMS	28.5	.7	2.6	2.5	2.03	43.7	54	-10.3	273	295	V
4	* 2.374	8.39	RMS	28.4	.7	2.6	2.5	2.03	44.62	54	-9.38	273	295	V

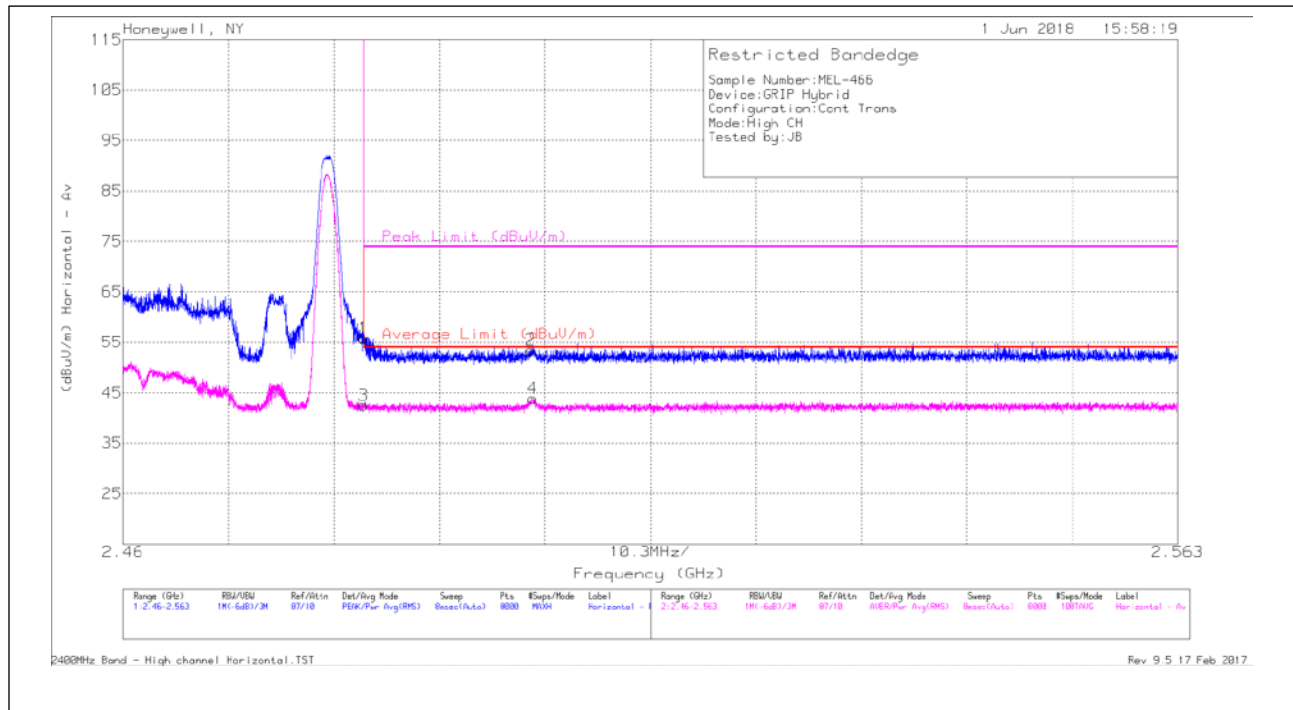
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

NOTE: Emissions highlighted in the plot above is OATS ambient and not a product of the transmitter.

Low Channel Vertical - Data



High Channel Horizontal - Plot

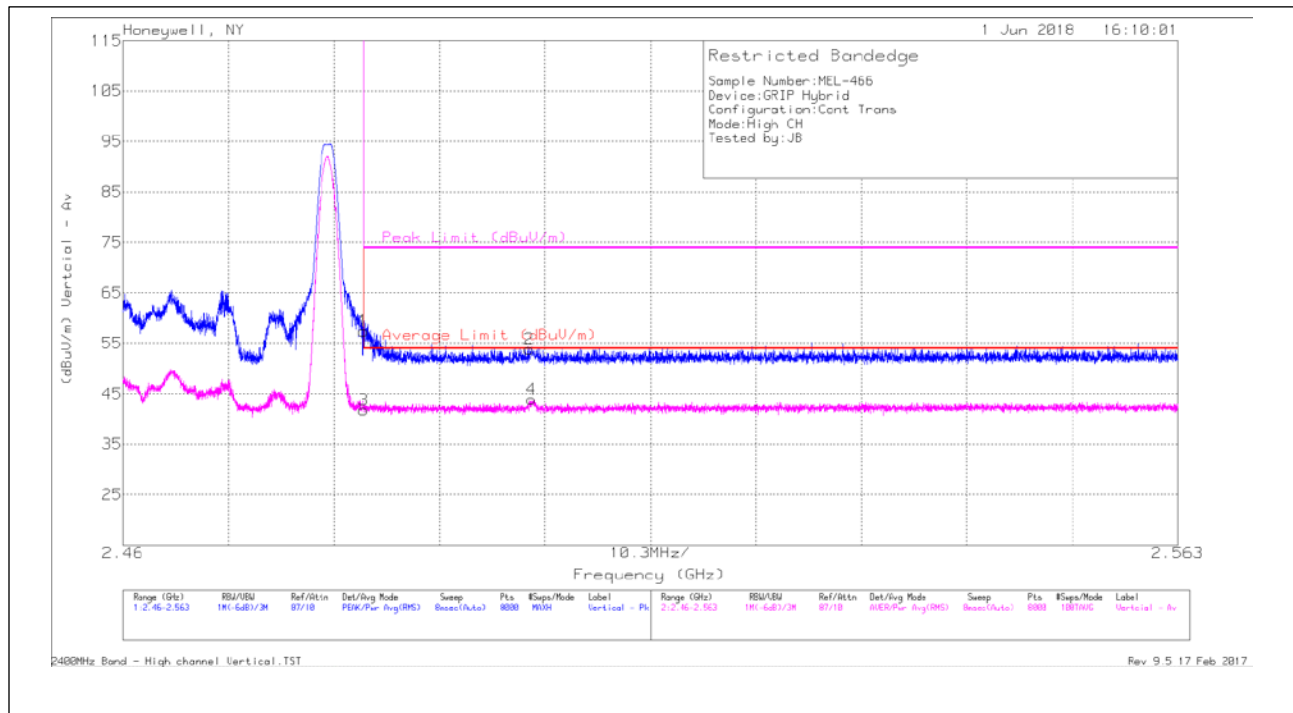
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF [dB/m]	SWBOX3 [dB]	SMA7 [dB]	SMA5 [dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	21.2	Pk	28.7	.7	2.6	2.6	-	55.8	74	-18.2	44	336	H
2	* 2.5	18.81	Pk	28.7	.7	2.7	2.6	-	53.51	74	-20.49	44	336	H
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF [dB/m]	SWBOX3 [dB]	SMA7 [dB]	SMA5 [dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	* 2.484	7.93	RMS	28.7	.7	2.6	2.6	2.03	44.56	54	-9.44	44	336	H
4	2.5	9.19	RMS	28.7	.7	2.7	2.6	2.03	45.92	54	-8.08	44	336	H

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

Pk - Peak detector

RMS - RMS detection

High Channel Horizontal - Data



High Channel Vertical - Plot

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF [dB/m]	SWBOX3 [dB]	SMA7 [dB]	SMA5 [dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	22.84	Pk	28.7	.7	2.6	2.6	-	57.44	74	-16.56	275	258	V
2	* 2.5	19.1	Pk	28.7	.7	2.7	2.6	-	53.8	74	-20.2	275	258	V
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF [dB/m]	SWBOX3 [dB]	SMA7 [dB]	SMA5 [dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	* 2.484	7.15	RMS	28.7	.7	2.6	2.6	2.03	43.78	54	-10.22	275	258	V
4	* 2.5	9.17	RMS	28.7	.7	2.7	2.6	2.03	45.9	54	-8.1	275	258	V

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

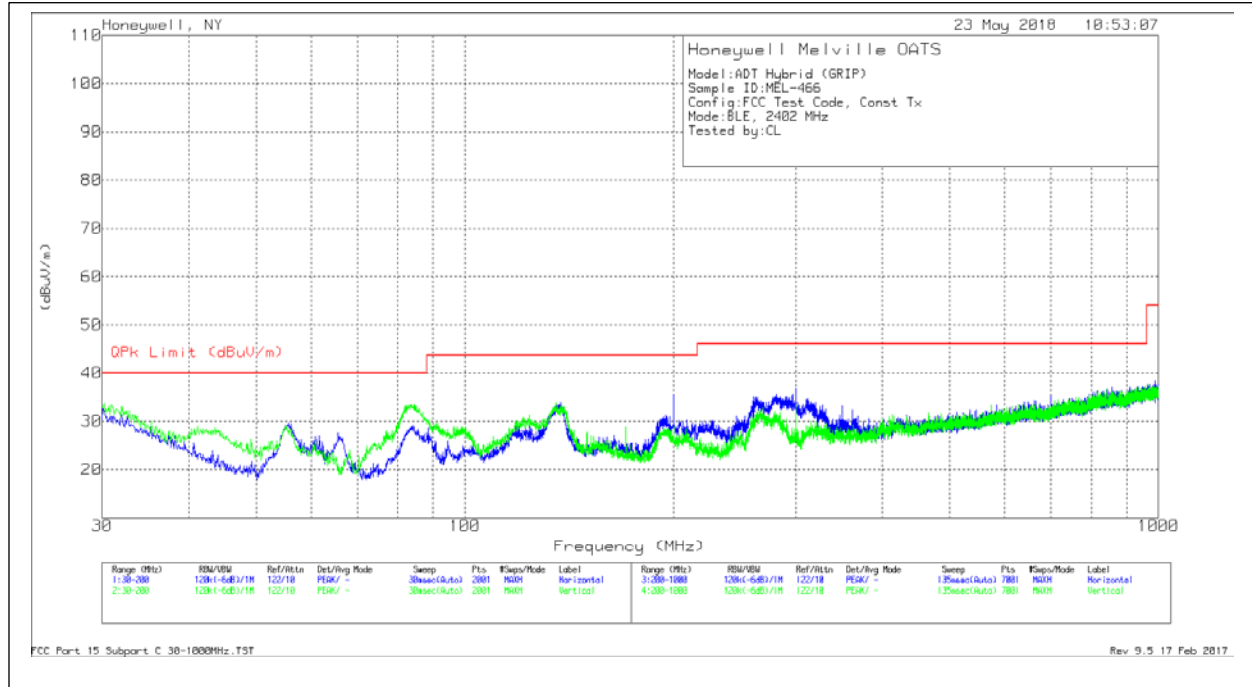
Pk - Peak detector

RMS - RMS detection

High Channel Vertical - Data

Spurious Emissions

Below 1GHz (Worse-case)



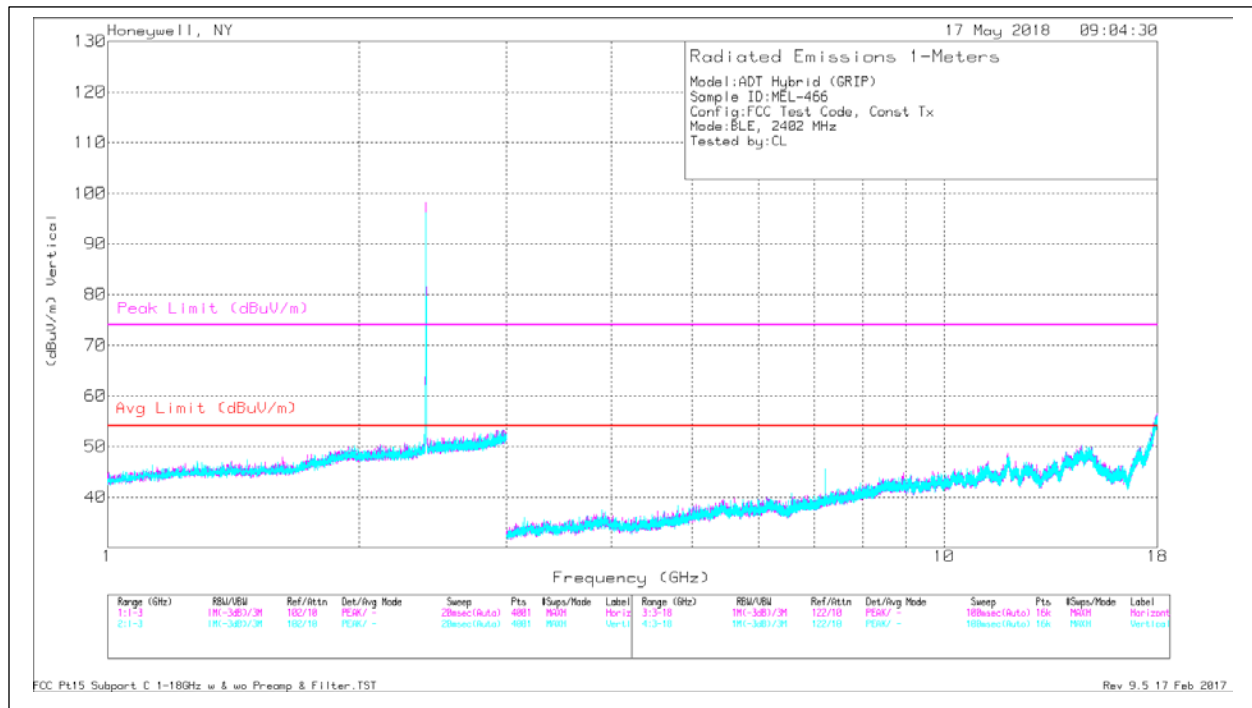
Low Channel - Plot

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
30.3812	11.09	Qp	24.6	.9	36.59	40	-3.41	222	164	H
199.8006	23.83	Qp	16.6	2.4	42.83	43.52	-.69	339	366	H
30.4287	11.06	Qp	24.5	.9	36.46	40	-3.54	107	227	V
84.0067	13.8	Qp	11.8	1.4	27	40	-13	300	192	V
299.2505	5.05	Qp	18	3.1	26.15	46.02	-19.87	220	144	H
299.6509	6.4	Qp	18	3.2	27.6	46.02	-18.42	352	179	V

Qp - Quasi-Peak detector

Low Channel - Data

1-18GHz



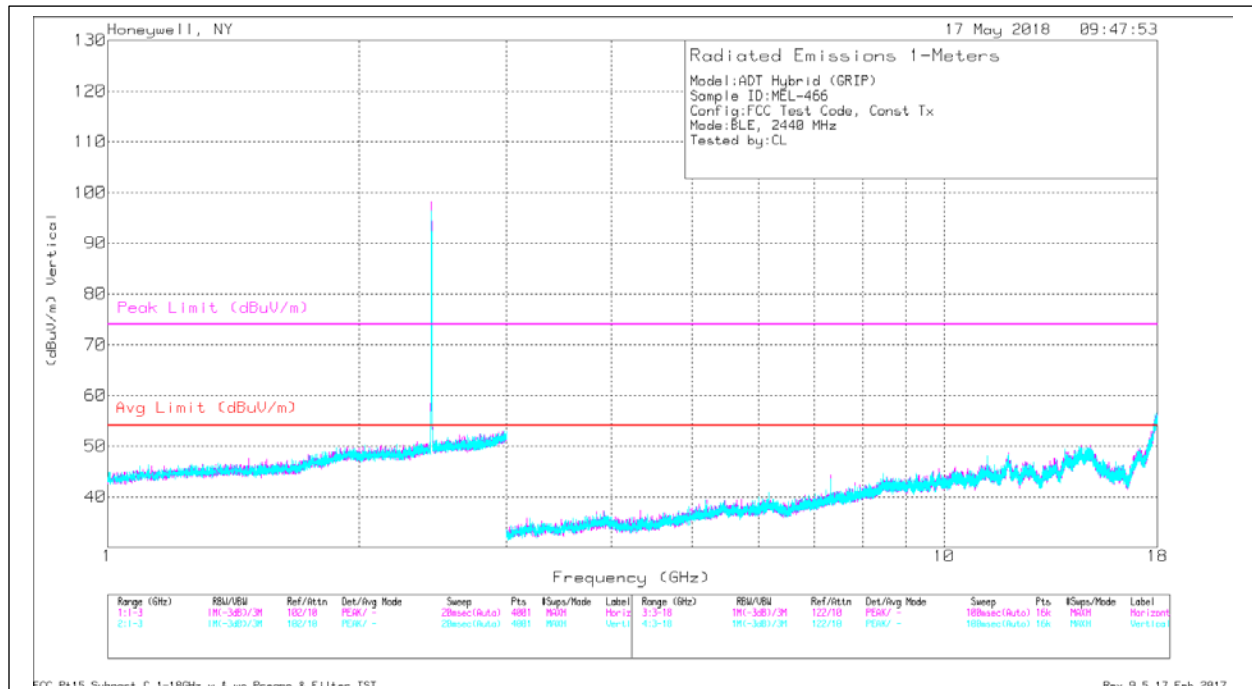
Low Channel - Plot

Frequency (GHz)	Meter Reading (dBuV)	Det	AF [dB/m]	SWBOX2 [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
2.965	46.33	PK2	30.1	-42.3	2.9	2.8	-	39.83	-	-	74	-34.17	18	237	H
2.963	34.43	MAv1	30	-42.3	2.9	2.8	2.03	29.86	54	-24.14	-	-	18	237	H
7.208	37.13	PK2	36.2	-39.5	4.6	4.5	-	42.93	-	-	74	-31.07	16	134	H
7.211	24.97	MAv1	36.2	-39.5	4.7	4.5	2.03	32.9	54	-21.1	-	-	16	134	H
14.821	37.76	PK2	42.1	-36.9	6.7	6.5	-	56.16	-	-	74	-17.84	274	298	H
14.82	26.4	MAv1	42.1	-36.9	6.7	6.5	2.03	46.83	54	-7.17	-	-	274	298	H
2.999	41.88	PK2	30.3	-42.5	2.9	2.8	-	35.38	-	-	74	-38.62	42	191	V
3.001	23.71	MAv1	30.3	-42.5	2.9	2.8	2.03	19.24	54	-34.76	-	-	42	191	V
7.205	36.58	PK2	36.2	-39.5	4.6	4.5	-	42.38	-	-	74	-31.62	253	171	V
7.212	24.92	MAv1	36.2	-39.5	4.7	4.5	2.03	32.85	54	-21.15	-	-	253	171	V
14.908	39.35	PK2	41.8	-36.9	6.9	6.5	-	57.65	-	-	74	-16.35	123	356	V
14.908	28.23	MAv1	41.8	-36.9	6.9	6.5	2.03	48.56	54	-5.44	-	-	123	356	V

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

Low Channel - Data



Mid Channel - Plot

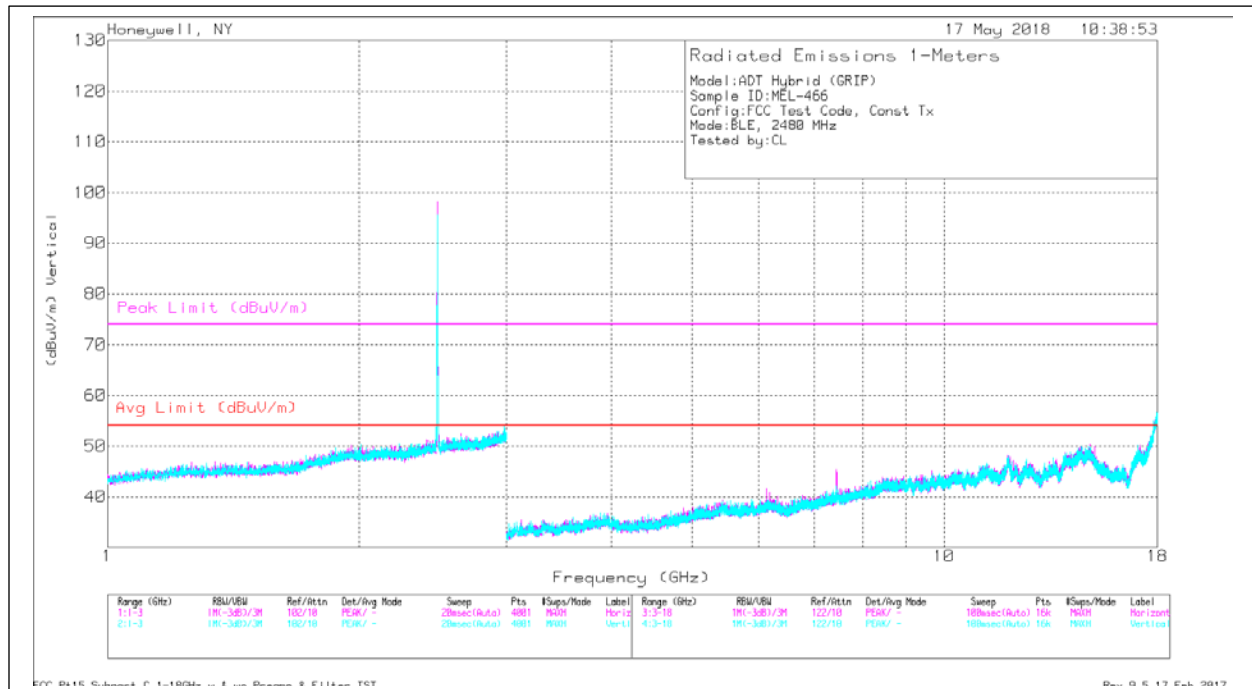
Frequency (GHz)	Meter Reading (dBuV)	Det	AF [dB/m]	SWBOX2 [dB]	SMA7 [dB]	SMA5 [dB]	DC Corr [dB]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2.991	45.96	PK2	30.2	-42.5	2.9	2.8	-	39.36	-	-	74	-34.64	359	234	H
2.992	25.08	MAv1	30.2	-42.5	2.9	2.8	2.03	20.51	54	-33.49	-	-	359	234	H
* 7.316	40.78	PK2	36.6	-39.6	4.6	4.5	-	46.88	-	-	74	-27.12	15	143	H
* 7.322	28.9	MAv1	36.6	-39.7	4.6	4.5	2.03	36.93	54	-17.07	-	-	15	143	H
14.851	39.12	PK2	42	-36.9	6.8	6.5	-	57.52	-	-	74	-16.48	85	375	H
14.851	26.52	MAv1	42	-36.9	6.8	6.5	2.03	46.95	54	-7.05	-	-	85	375	H
2.995	46.61	PK2	30.3	-42.5	2.9	2.8	-	40.11	-	-	74	-33.89	240	123	V
3.003	34.04	MAv1	30.3	-42.5	2.9	2.8	2.03	29.57	54	-24.43	-	-	240	123	V
* 7.319	40.17	PK2	36.6	-39.7	4.6	4.5	-	46.17	-	-	74	-27.83	282	109	V
* 7.322	29.08	MAv1	36.6	-39.7	4.6	4.5	2.03	37.11	54	-16.89	-	-	282	109	V
14.575	39.38	PK2	42.5	-36.9	6.9	6.4	-	58.28	-	-	74	-15.72	183	308	V
14.583	27.55	MAv1	42.5	-36.9	6.9	6.4	2.03	48.48	54	-5.52	-	-	183	308	V

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

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

Mid Channel - Data



High Channel - Plot

Frequency (GHz)	Meter Reading (dBuV)	Det	AF [dB/m]	SWBOX2 [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
2.983	45.56	PK2	30.2	-42.4	2.9	2.8	-	39.06	-	-	74	-34.94	98	252	H
2.988	24.97	MAv1	30.2	-42.4	2.9	2.8	2.03	20.5	54	-33.5	-	-	98	252	H
* 7.439	38.93	PK2	36.7	-39.7	4.7	4.6	-	45.23	-	-	74	-28.77	210	186	H
* 7.445	24.42	MAv1	36.7	-39.7	4.7	4.6	2.03	32.75	54	-21.25	-	-	210	186	H
14.981	39.78	PK2	41.4	-36.9	7	6.5	-	57.78	-	-	74	-16.22	136	351	H
14.981	28.47	MAv1	41.4	-36.9	7	6.5	2.03	48.5	54	-5.5	-	-	136	351	H
2.973	45.98	PK2	30.1	-42.3	2.9	2.8	-	39.48	-	-	74	-34.52	321	280	V
2.982	25.16	MAv1	30.2	-42.4	2.9	2.8	2.03	20.69	54	-33.31	-	-	321	280	V
* 7.442	39.05	PK2	36.7	-39.7	4.7	4.6	-	45.35	-	-	74	-28.65	158	243	V
* 7.443	24.21	MAv1	36.7	-39.7	4.7	4.6	2.03	32.54	54	-21.46	-	-	158	243	V
14.598	39.59	PK2	42.5	-36.9	6.9	6.4	-	58.49	-	-	74	-15.51	190	141	V
14.595	27.65	MAv1	42.5	-36.9	6.9	6.4	2.03	48.58	54	-5.42	-	-	190	141	V

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

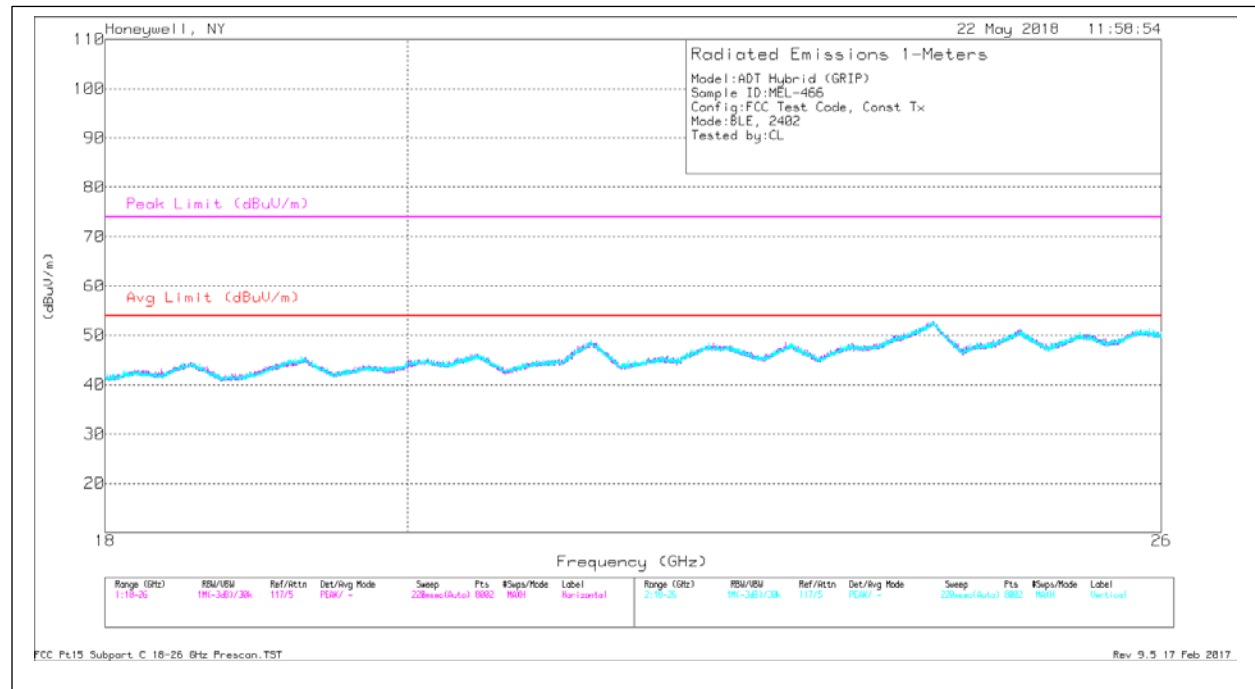
PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

High Channel – Data

18-26GHz

Note: No emissions detected above the system noise floor



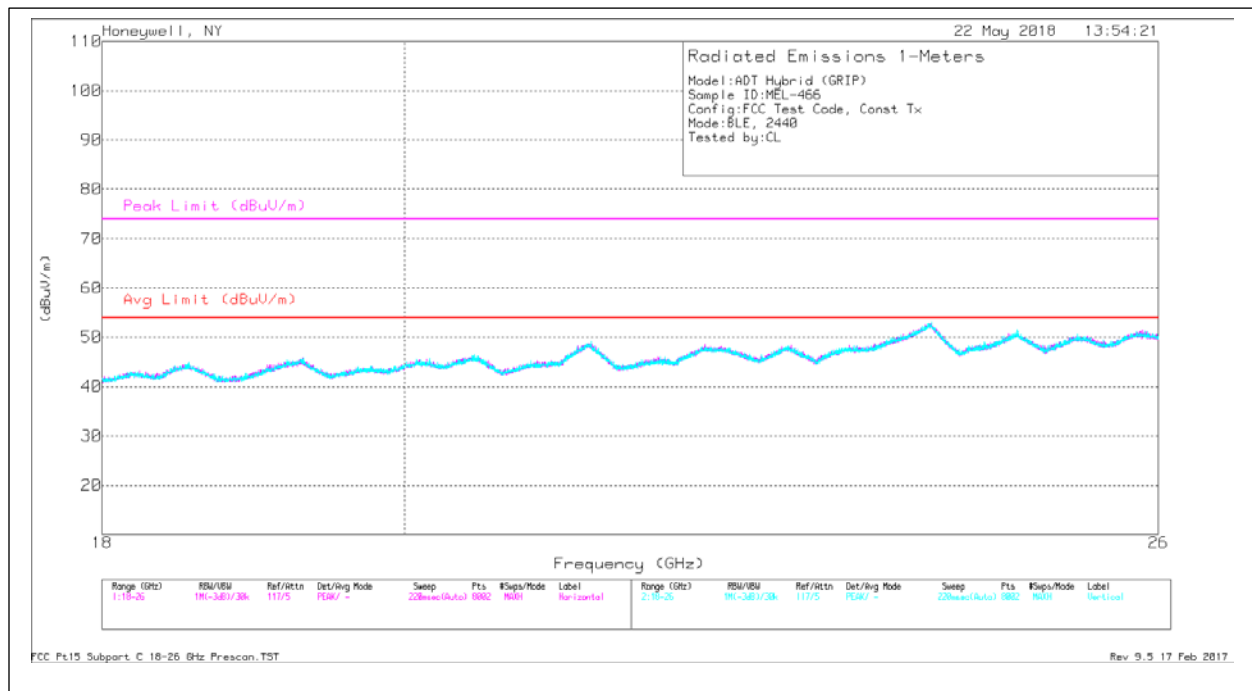
Low Channel – Plot

Frequency (GHz)	Meter Reading (dBuV)	Det	Horn ACF [dB/m]	SMA 8 [dB]	18-26G Preamp [dB]	Distance Corr Factor [dB]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 19.302	37.92	Pk	44.3	7.2	-34.3	-9.5	45.62	54	-8.38	74	-28.38	0-360	100	H
* 21.313	37.55	Pk	44.9	7.7	-32	-9.5	48.65	54	-5.35	74	-25.35	0-360	100	H
24.014	38.31	Pk	46.3	8.2	-30.4	-9.5	52.91	54	-1.09	74	-21.09	0-360	100	H
* 19.269	38.22	Pk	44.3	7.2	-34.5	-9.5	45.72	54	-8.28	74	-28.28	0-360	100	H
* 21.319	37.84	Pk	44.9	7.7	-31.9	-9.5	49.04	54	-4.96	74	-24.96	0-360	100	H
24.008	38.11	Pk	46.3	8.2	-30.4	-9.5	52.71	54	-1.29	74	-21.29	0-360	100	H

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

Pk - Peak detector

Low Channel - Data



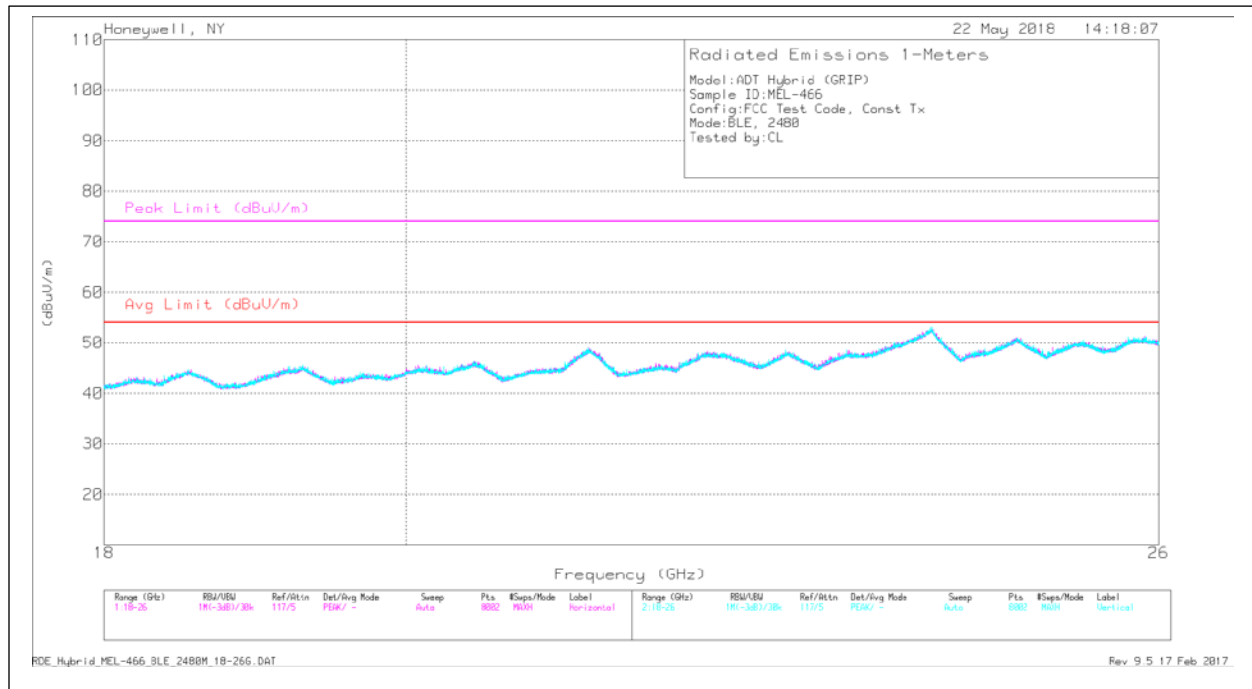
Mid Channel – Plot

Frequency (GHz)	Meter Reading (dBuV)	Det	Horn ACF [dB/m]	SMA 8 [dB]	18-26G Preamp [dB]	Distance Corr Factor [dB]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 19.278	37.84	Pk	44.3	7.2	-34.4	-9.5	45.44	54	-8.56	74	-28.56	0-360	100	H
* 21.324	37.68	Pk	44.9	7.7	-32	-9.5	48.78	54	-5.22	74	-25.22	0-360	100	H
24.021	38.08	Pk	46.3	8.2	-30.3	-9.5	52.78	54	-1.22	74	-21.22	0-360	100	H
* 19.305	38.13	Pk	44.3	7.2	-34.3	-9.5	45.83	54	-8.17	74	-28.17	0-360	100	H
* 21.341	38.55	Pk	44.9	7.7	-32.4	-9.5	49.25	54	-4.75	74	-24.75	0-360	100	H
24.027	38.38	Pk	46.3	8.2	-30.4	-9.5	52.98	54	-1.02	74	-21.02	0-360	100	H

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

Pk - Peak detector

Mid Channel - Data



High Channel - Plot

Frequency (GHz)	Meter Reading (dBuV)	Det	Horn ACF [dB/m]	SMA 8 [dB]	18-26G Preamp [dB]	Distance Corr Factor [dB]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 19.276	37.76	Pk	44.3	7.2	-34.5	-9.5	45.26	54	-8.74	74	-28.74	0-360	100	H
* 21.314	37.92	Pk	44.9	7.7	-32	-9.5	49.02	54	-4.98	74	-24.98	0-360	100	H
24.033	38.29	Pk	46.3	8.2	-30.6	-9.5	52.69	54	-1.31	74	-21.31	0-360	100	H
* 19.287	37.88	Pk	44.3	7.2	-34.3	-9.5	45.58	54	-8.42	74	-28.42	0-360	100	H
* 21.319	37.44	Pk	44.9	7.7	-31.9	-9.5	48.64	54	-5.36	74	-25.36	0-360	100	H
24.01	38.58	Pk	46.3	8.2	-30.4	-9.5	53.18	54	-8.2	74	-20.82	0-360	100	H

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

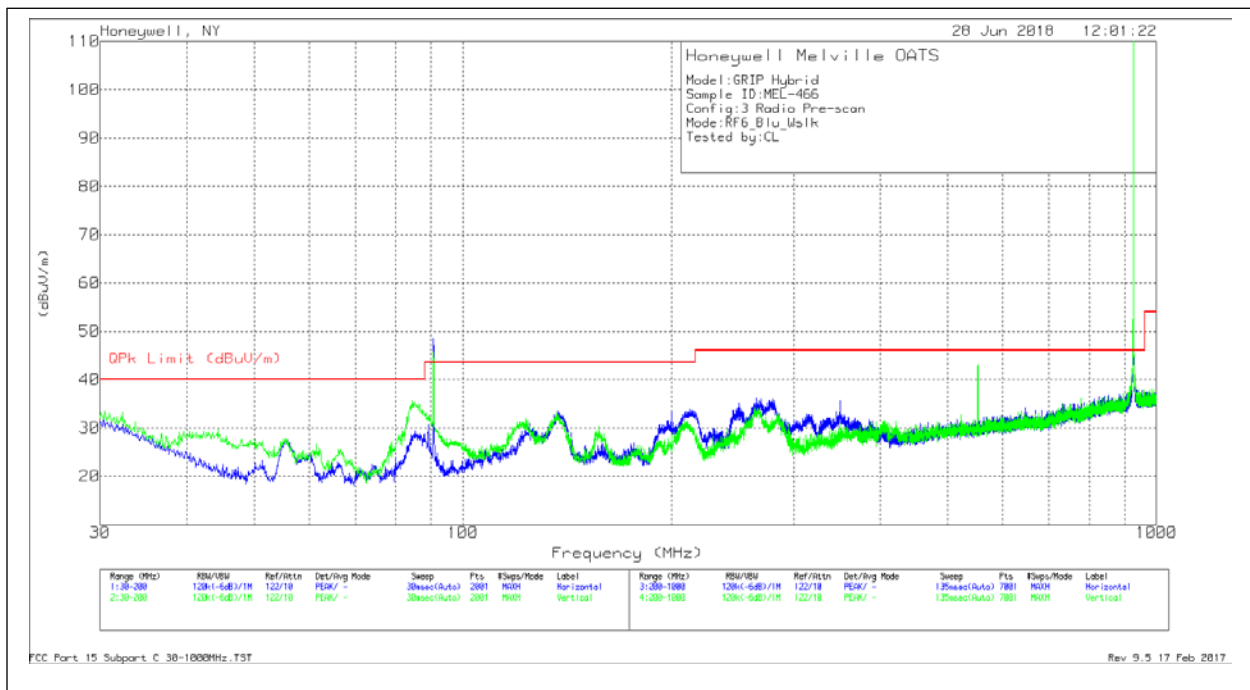
Pk - Peak detector

High Channel – Data

Simultaneous Transmission

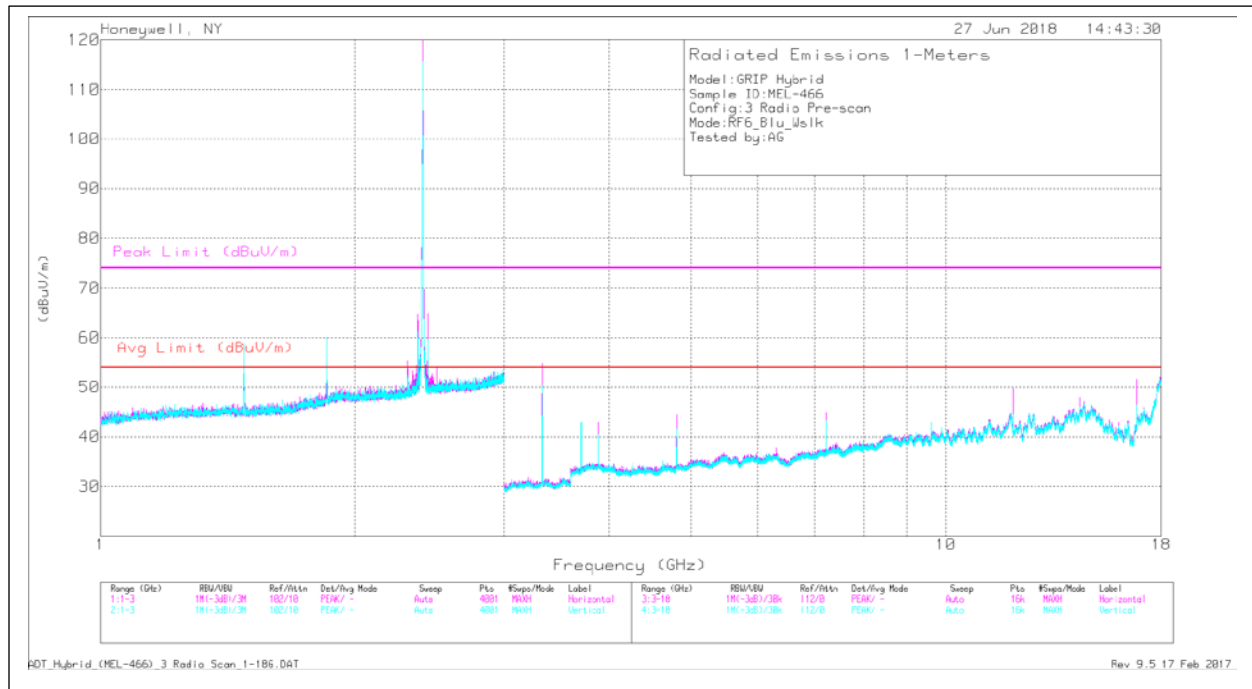
Configuration (Worse-case):

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

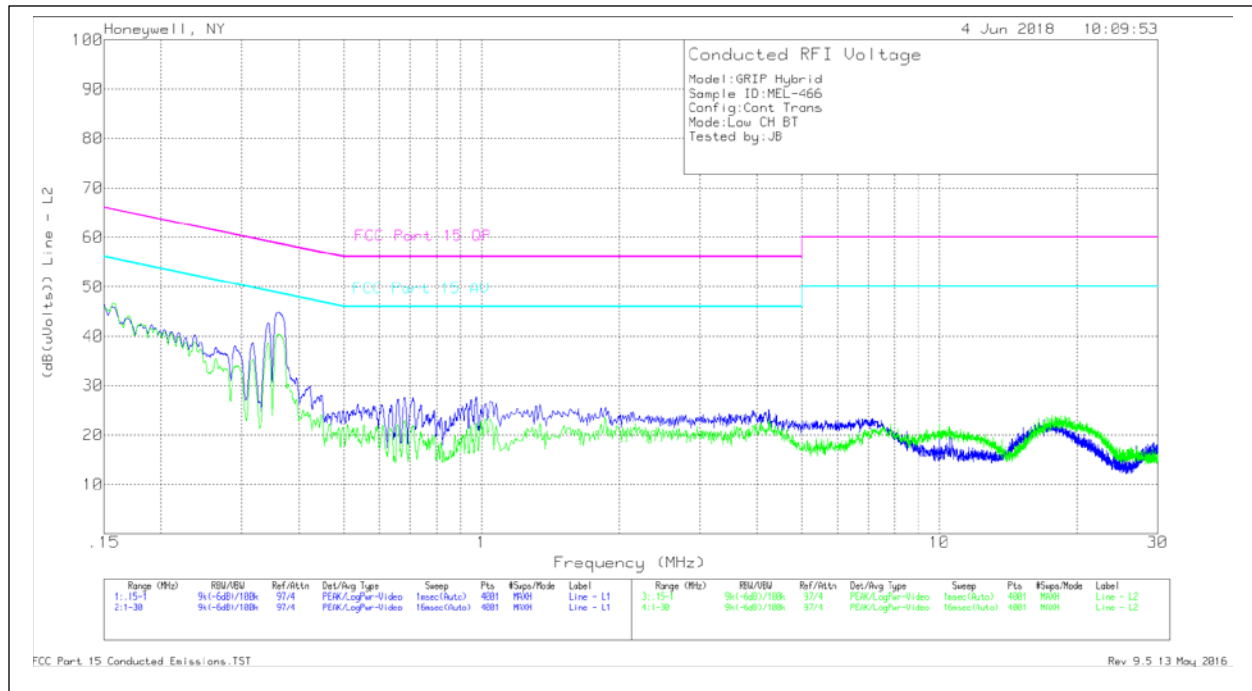
Test Information

Tester	Test Location	Date	Temperature (°C)	Humidity (%RH)	Pressure (mbar)	Results (P/F)
JB	RF Lab	06/04/2018	22.6	8.8	1014	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	A078144	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)
.36108	34.82	Pk	10	0	44.82	58.7	-13.88	48.7	-3.88
.34191	32.42	Pk	10.1	0	42.52	59.16	-16.64	49.16	-6.64
.15021	35.7	Pk	10.6	0	46.3	65.99	-19.69	55.99	-9.69
.18067	31.85	Pk	10.4	.1	42.35	64.45	-22.1	54.45	-12.1
.31625	28.54	Pk	10.1	0	38.64	59.8	-21.16	49.8	-11.16
.65705	17.45	Pk	9.9	0	27.35	56	-28.65	46	-18.65

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)
.36279	30.07	Pk	10.1	.1	40.27	58.66	-18.39	48.66	-8.39
.34245	28.41	Pk	10.1	0	38.51	59.14	-20.63	49.14	-10.63
.31678	25.24	Pk	10.1	0	35.34	59.79	-24.45	49.79	-14.45
.15682	36.13	Pk	10.6	0	46.73	65.63	-18.9	55.63	-8.9
.16938	33.52	Pk	10.5	0	44.02	64.99	-20.97	54.99	-10.97
.68133	12.94	Pk	10	0	22.94	56	-33.06	46	-23.06

Pk - Peak detector

Conducted Emissions – Data

END OF REPORT