



FCC 47 CFR PART 15 SUBPART C

TEST REPORT

FOR

GROUND BASED UNIT

MODEL NUMBER: RRH

FCC ID: 2AJN8-GS1

REPORT NUMBER: R12422568-E1

ISSUE DATE: 2018-08-24

**Prepared for
HARRIS CORPORATION
2400 PALM BAY ROAD NE
PALM BAY, FLORIDA 32905, USA**

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Revision History

Ver.	Issue Date	Revisions	Revised By
1	2018-08-03	Initial Issue	Brian T. Kiewra
2	2018-08-24	Added power confirmation statement to Section 5.2.	Brian T. Kiewra

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Harris Corporation
2400 Palm Bay Road NE
Palm Bay, Florida 32905, USA

EUT DESCRIPTION: Ground Based Unit

MODEL: RRH

SERIAL NUMBER: Non-serialized

DATE TESTED: 2018-07-26

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Compliant

UL LLC tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL LLC 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.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC 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, or any agency of the U.S. Government.

Approved & Released
For UL LLC By:



Jeffrey Moser
Operations Leader
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Prepared By:



Brian T. Kiewra
Project Engineer
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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013, KDB558074 D01 v04, KDB662911D01 v02r01.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 12 Laboratory Dr., Research Triangle Park, NC 27709, USA and 2800 Perimeter Park Drive, Suite B, Morrisville, NC 27560.

12 Laboratory Dr., RTP, NC 27709
<input type="checkbox"/> Chamber A
<input type="checkbox"/> Chamber C
2800 Perimeter Park Dr., Suite B, Morrisville, NC 27560
<input type="checkbox"/> Chamber NORTH
<input checked="" type="checkbox"/> Chamber SOUTH

UL LLC is accredited by NVLAP, Laboratory Code 200246-0. The full scope of accreditation can be viewed at <https://www.nist.gov/nvlap>.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY	REQUIRED BY STANDARD
Occupied Channel Bandwidth	2.00%	±5 %
RF output power, conducted	1.3 dB	±1,5 dB
Power Spectral Density, conducted	2.47 dB	±3 dB
Unwanted Emissions, conducted	2.94 dB	±3 dB
All emissions, radiated	5.36 dB	±6 dB
Temperature	2.26 °C	±3 °C
Supply voltages	2.40%	±3 %
Time	3.39%	±5 %

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a ground-based 2.4 GHz transceiver intended to communicate with airborne stations.

5.2. MAXIMUM OUTPUT POWER

Output power not measured in this report. This report covers radiated spot checks due to manufacturing location change of the antenna ports. The antenna port connections were moved from the rear of the enclosure to the side of the enclosure. No changes to PCBs were made to accommodate this change. Only the connector locations and the cable routing from the PCB to the connectors was changed.

Refer to R11150849-E1V3 for power data. Power was confirmed to be within the expected manufacturing tolerances of the original granted power prior to performing any tests.

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The Ground Station antenna consists of eight columns of elements with individual feeds forming a phased array antenna system. The system has a maximum gain of 28.98 dBi. By applying different phases and amplitudes to the inputs, a beam may be steered in azimuth over a 30 degree range. Control channel information is sent over a 30 degree wide beam.

5.4. SOFTWARE AND FIRMWARE

The software/firmware is as follows:

Version: 0.0.3
Revision: 6002
Build ID: 203
Package ID: 2

5.5. WORST-CASE CONFIGURATION AND MODE

EUT was tested in same orientation as original testing. These radiated spot checks are to ensure that the unit is still in compliance due to manufacturing change of antenna connector location. Antenna ports were moved from rear of device to the bottom.

Bandedge was performed on high channel in the 9MHz mode since it is closer to the bandedge, and no variation was found when compared to the original data. Spurious spot checks were determined by comparing high channel in each bandwidth to the original data, the only disparity was an additional spur in the 540kHz BW mode. Therefore low, mid, and high channels were tested for the 540kHz mode. While only high channel performed in the 9MHz BW mode.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Power Supply	Newmar	D/C 1639	N/A	NA

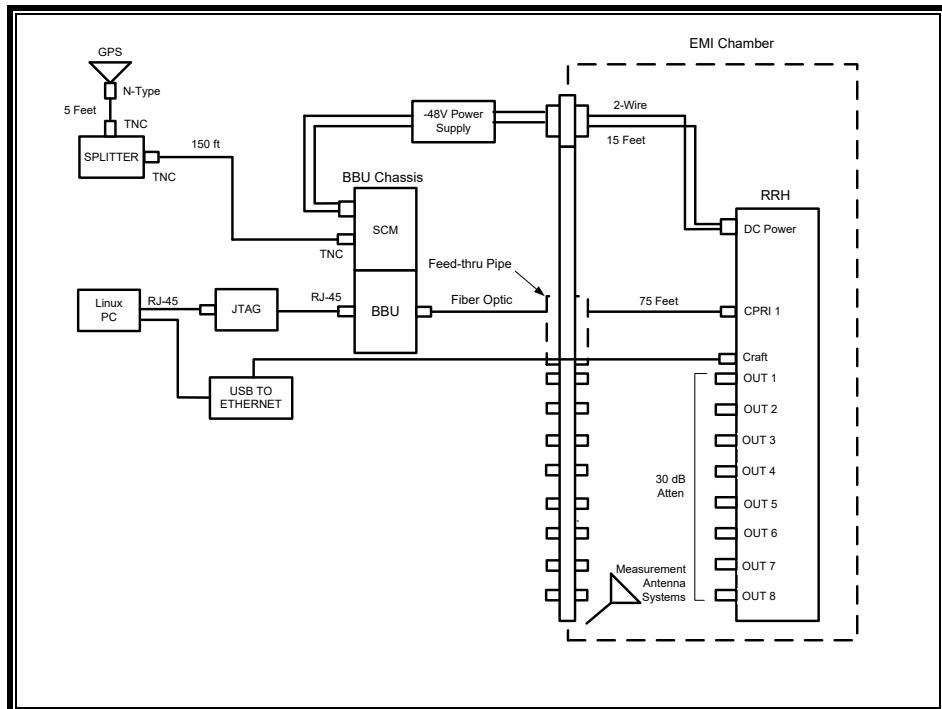
I/O CABLES

I/O Cable List						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	DC	1	-	-	4.5	None
2	CPRI	1	Fiber	Fiber	23	None
3	ENET	1	RJ45	CAT5e	7.5	None
4	Craft	1	RJ45	CAT5e	7.5	None
5	Antenna Port	8	SMA	Coax	4.5	None

TEST SETUP

EUT installed as a standalone device.

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Note: All test performed within equipment calibration intervals. Unless test date occurred between calibration intervals, in which case both calibrations intervals were included.

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville - South Chamber)

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
1-18 GHz					
AT0069	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2018-04-30	2019-04-30
Gain-Loss Chains					
S-SAC03	Gain-loss string: 1-18GHz	Various	Various	2018-03-20	2019-03-20
Receiver & Software					
SA0026	Spectrum Analyzer	Agilent	N9030A	2018-03-20	2019-03-20
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
Additional Equipment used					
s/n 161024887	Environmental Meter	Fisher Scientific	15-077-963	2016-12-23	2018-12-23

7. MEASUREMENT METHODS

Out-of-band emissions in non-restricted bands: KDB 558074 D01 v04, Section 11.0.

Out-of-band emissions in restricted bands: KDB 558074 D01 v04, Section 12.1.

General Radiated Emissions: ANSI C63.10:2013 Sections 6.3 – 6.6

8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
0.009-0.490	2400/F(kHz) @ 300 m	-
0.490-1.705	24000/F(kHz) @ 30 m	-
1.705 - 30	30 @ 30m	-
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for below 1GHz measurements and 1.5 m above the ground plane for above 1GHz 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 for the 30-1000 MHz range, 9 kHz for peak detection measurements or 9 kHz for quasi-peak detection measurements for the 0.15-30 MHz range and 200 Hz for peak detection measurements or 200 Hz for quasi-peak detection measurements for the 9 to 150 kHz range. Peak detection is used unless otherwise noted as quasi-peak.

For peak measurements above 1 GHz, the resolution bandwidth is set to 1 MHz and the video bandwidth is set to 3 MHz. For average measurements above 1GHz, the resolution bandwidth and video bandwidth are set as described in ANSI C63.10:2013 for the applicable measurement. The particular averaging method used for this test program was RMS averaging.

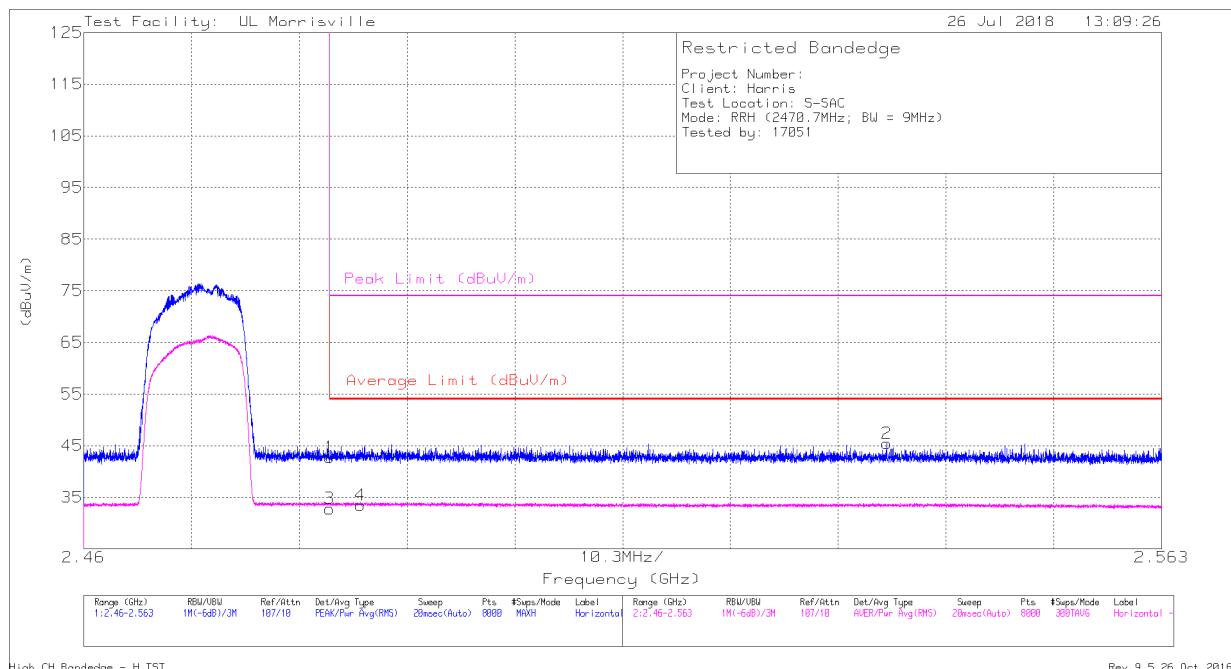
The spectrum from 1 to 18 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band. For 9kHz to 1000 MHz and 18 to 26 GHz investigation, the worst-case channel was selected.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. 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.

8.2. TRANSMITTER ABOVE 1 GHz

8.2.1. TX ABOVE 1 GHz – 9MHz BW

AUTHORIZED BANDEDGE (2470.7MHz, HORIZONTAL)



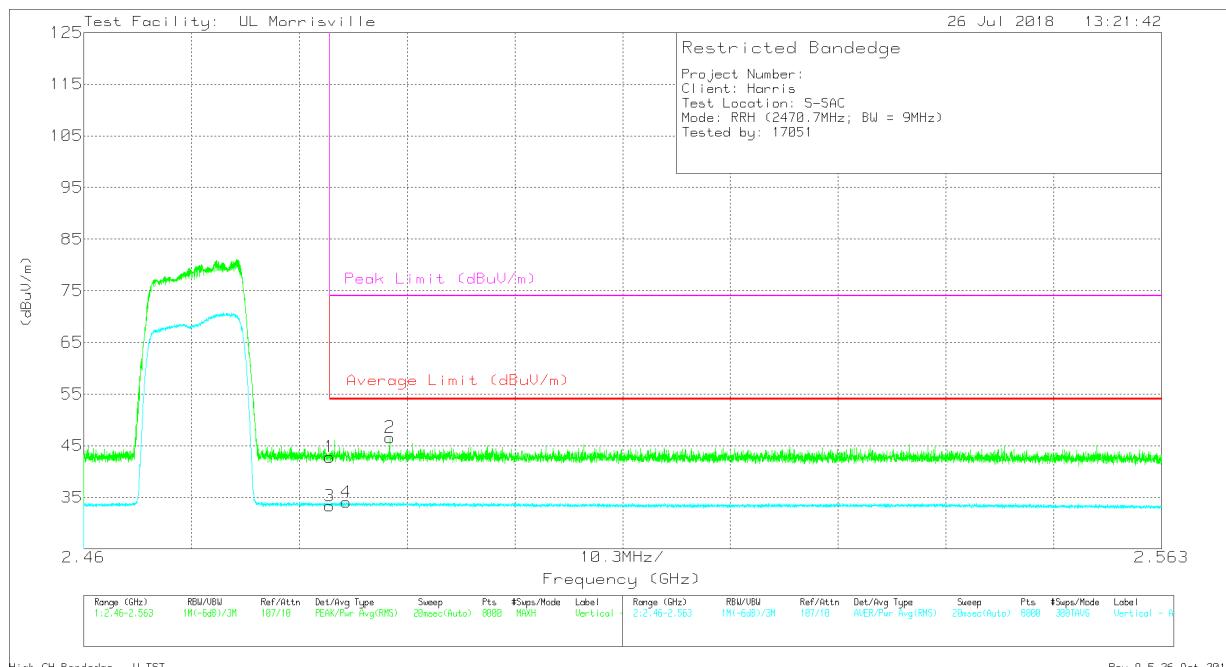
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0069 AF (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	34.94	Pk	32.4	-24.6	0	42.74	-	-	74	-31.26	277	132	H
3	* 2.484	25	RMS	32.4	-24.6	.68	33.48	54	-20.52	-	-	277	132	H
4	* 2.486	25.66	RMS	32.4	-24.6	.68	34.14	54	-19.86	-	-	277	132	H
2	2.537	37.93	Pk	32.4	-24.9	0	45.43	-	-	74	-28.57	277	132	H

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

Pk - Peak detector

RMS - RMS detection

AUTHORIZED BANDEDGE (2470.7MHz, VERTICAL)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0069 AF (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	35.02	Pk	32.4	-24.6	0	42.82	-	-	74	-31.18	219	115	V
3	* 2.484	24.87	RMS	32.4	-24.6	.68	33.35	54	-20.65	-	-	219	115	V
4	* 2.485	25.59	RMS	32.4	-24.6	.68	34.07	54	-19.93	-	-	219	115	V
2	* 2.489	38.86	Pk	32.4	-24.7	0	46.56	-	-	74	-27.44	219	115	V

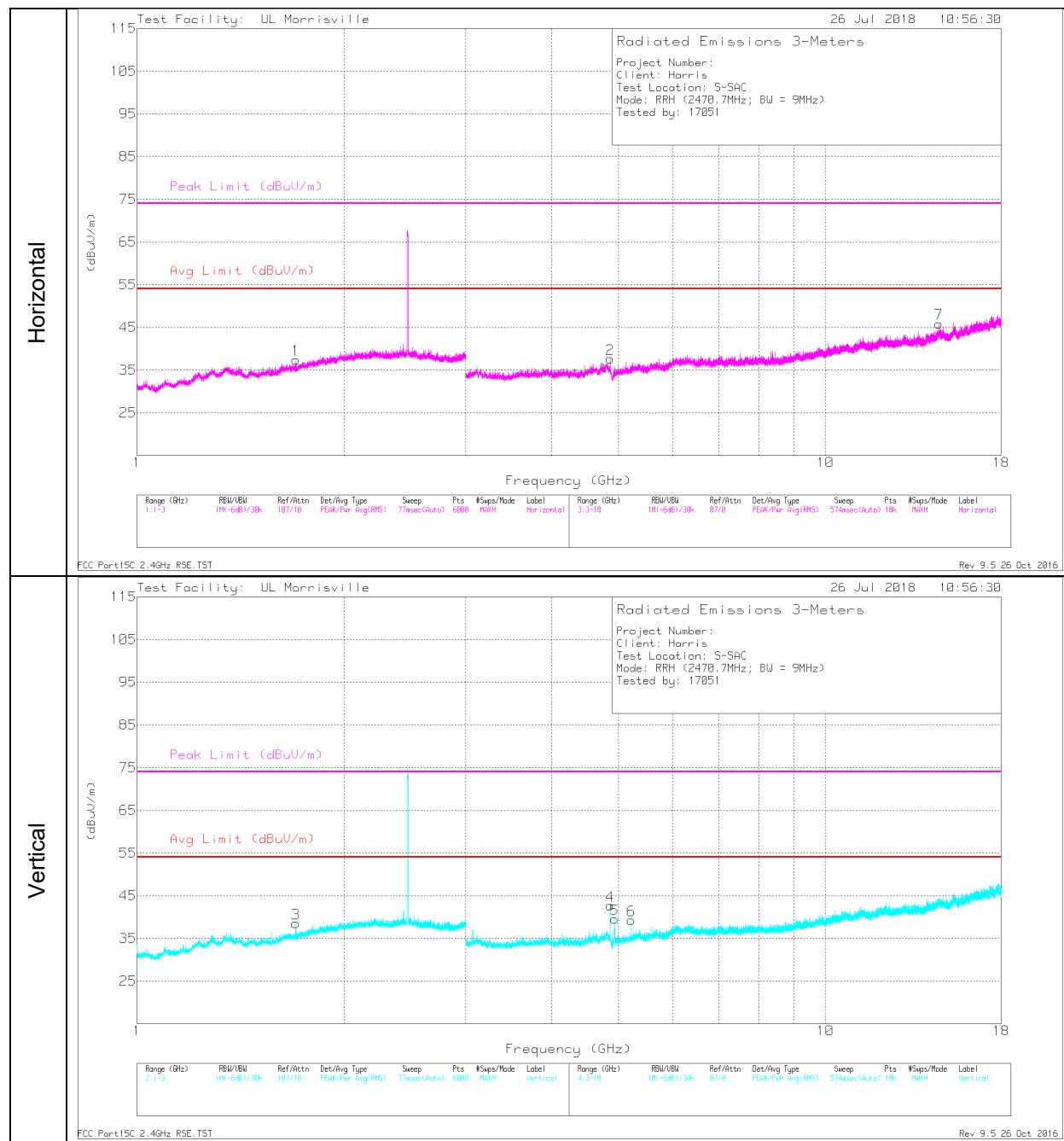
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS

HIGH CHANNEL (2470.7 MHz)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0069 AF (dB/m)	Amp/Cbl/Fltr/Pad (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	* 1.7	37.49	PK2	28.8	-22.2	0	44.09	-	-	74	-29.91	217	162	H
	* 1.7	28.03	MAv1	28.7	-22.2	.68	35.21	54	-18.79	-	-	217	162	H
3	* 1.7	37.86	PK2	28.7	-22.2	0	44.36	-	-	74	-29.64	204	102	V
	* 1.7	28.01	MAv1	28.7	-22.2	.68	35.19	54	-18.81	-	-	204	102	V
2	* 4.866	41.1	PK2	34	-30.9	0	44.2	-	-	74	-29.8	218	101	H
	* 4.866	32.48	MAv1	34	-30.9	.68	36.26	54	-17.74	-	-	218	101	H
4	* 4.866	44.72	PK2	34	-30.9	0	47.82	-	-	74	-26.18	21	107	V
	* 4.866	39.35	MAv1	34	-30.9	.68	43.13	54	-10.87	-	-	21	107	V
5	* 4.942	46.39	PK2	34	-31.1	0	49.29	-	-	74	-24.71	232	101	V
	* 4.941	34.63	MAv1	34	-31	.68	38.31	54	-15.69	-	-	232	101	V
6	5.222	35.82	Pk	34.2	-30.7	0	39.32	-	-	-	-	0-360	101	V
7	14.604	28.37	Pk	39.6	-22.1	0	45.87	-	-	-	-	0-360	199	H

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

Pk - Peak detector

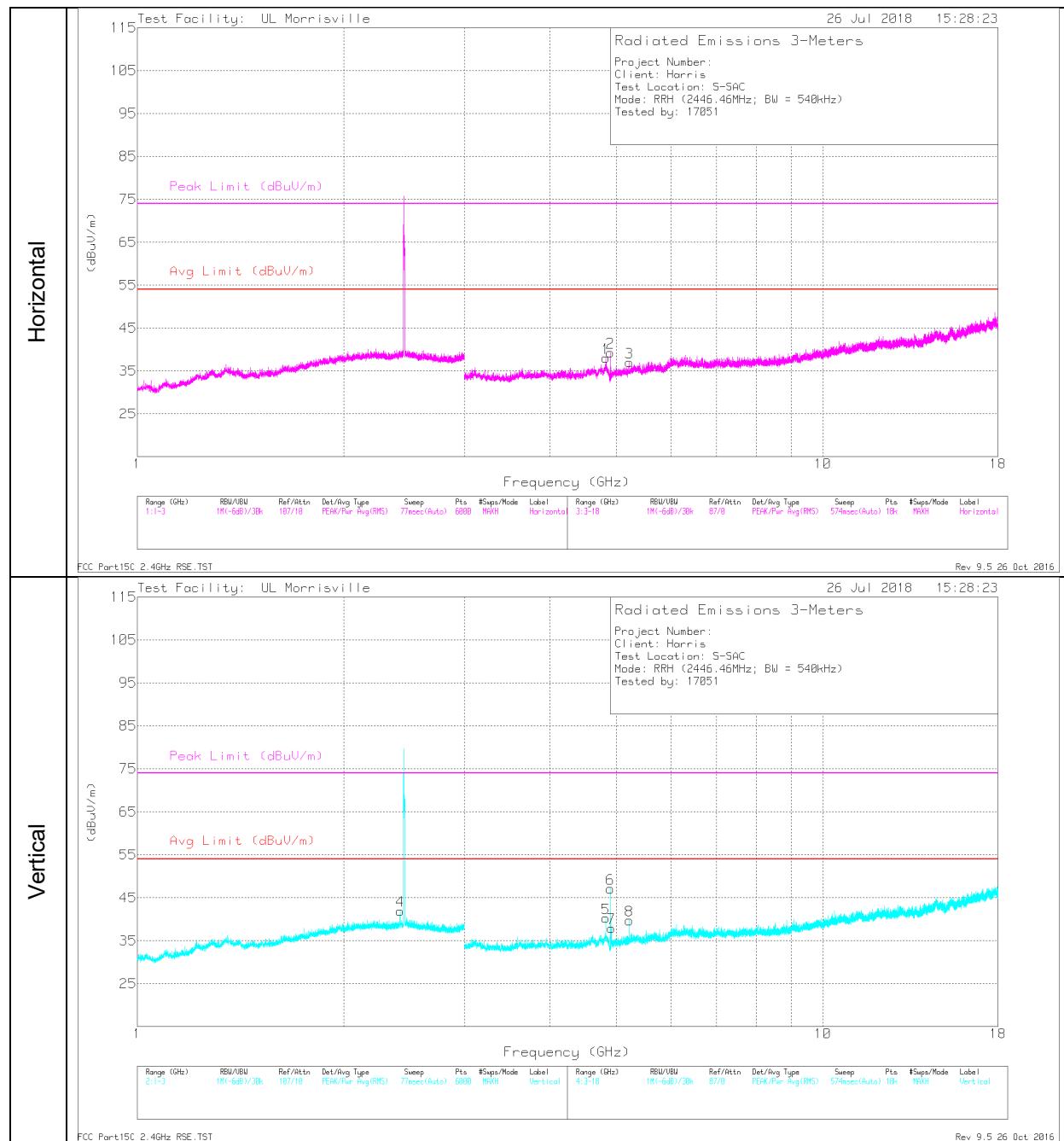
PK2 - Maximum Peak

MAv1 - Maximum RMS Average

8.2.2. TX ABOVE 1 GHz – 540kHz BW

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL (2446.46MHz)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0069 AF (dB/m)	Amp/Cbl/Fltr/Pad (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	* 4.826	41.4	PK2	34	-31	0	44.4	-	-	74	-29.6	255	104	H
	* 4.826	31.98	MAv1	34	-31	.75	35.73	54	-18.27	-	-	255	104	H
2	* 4.901	42.61	PK2	34	-30.9	0	45.71	-	-	74	-28.29	231	101	H
	* 4.901	35.86	MAv1	34	-30.9	.75	39.71	54	-14.29	-	-	231	101	H
5	* 4.826	43.73	PK2	34	-31	0	46.73	-	-	74	-27.27	199	101	V
	* 4.826	35.89	MAv1	34	-31	.75	39.64	54	-14.36	-	-	199	101	V
6	* 4.901	48.99	PK2	34	-30.9	0	52.09	-	-	74	-21.91	212	102	V
	* 4.901	45.08	MAv1	34	-30.9	.75	48.93	54	-5.07	-	-	212	102	V
7	* 4.915	42.38	PK2	34	-31	0	45.38	-	-	74	-28.62	79	101	V
	* 4.915	31.49	MAv1	34	-31	.75	35.24	54	-18.76	-	-	79	101	V
4	2.42	34.06	Pk	32.1	-24.2	0	41.96	-	-	-	-	0-360	199	V
3	5.223	33.52	Pk	34.2	-30.7	0	37.02	-	-	-	-	0-360	199	H
8	5.223	36.23	Pk	34.2	-30.7	0	39.73	-	-	-	-	0-360	199	V

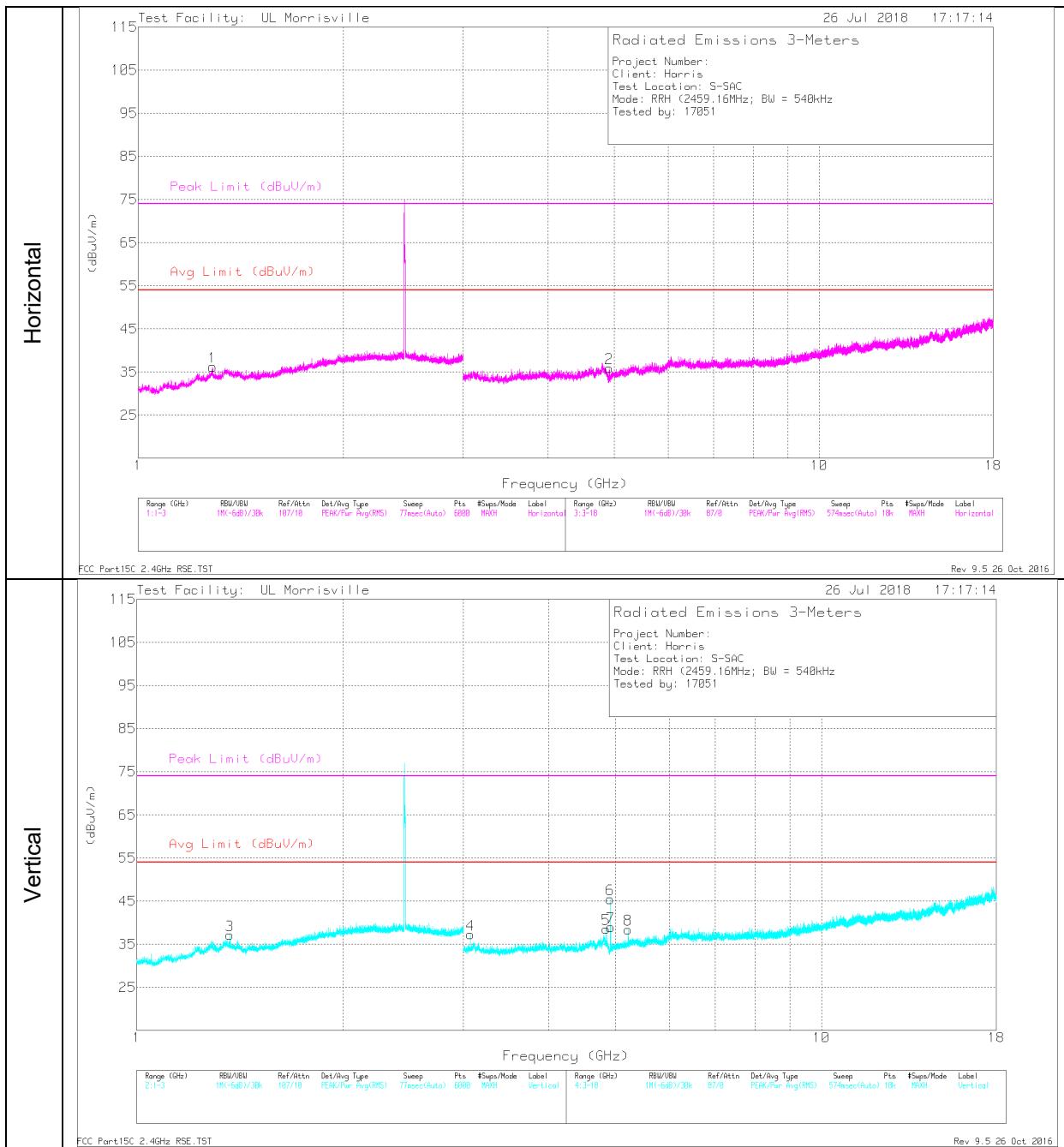
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

PK2 - Maximum Peak

MAv1 - Maximum RMS Average

MID CHANNEL (2459.16 MHz)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0069 AF (dB/m)	Amp/Cbl/Fltr/Pad (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	* 1.286	35.84	PK2	29.1	-23.3	0	41.64	-	-	74	-32.36	93	177	H
	* 1.286	23.77	MAv1	29.1	-23.3	.75	30.32	54	-23.68	-	-	93	177	H
3	* 1.368	35.19	PK2	29.4	-22.9	0	41.69	-	-	74	-32.31	73	117	V
	* 1.368	23.24	MAv1	29.4	-22.9	.75	30.49	54	-23.51	-	-	73	117	V
2	* 4.918	45.96	PK2	34	-31	0	48.96	-	-	74	-25.04	177	101	H
	* 4.918	30.28	MAv1	34	-31	.75	34.03	54	-19.97	-	-	177	101	H
5	* 4.846	43.09	PK2	34	-30.8	0	46.29	-	-	74	-27.71	234	138	V
	* 4.846	35.59	MAv1	34	-30.8	.75	39.54	54	-14.46	-	-	234	138	V
6	* 4.918	55.64	PK2	34	-31	0	58.64	-	-	74	-15.36	212	101	V
	* 4.918	39.37	MAv1	34	-31	.75	43.12	54	-10.88	-	-	212	101	V
7	* 4.927	43.23	PK2	34	-31	0	46.23	-	-	74	-27.77	348	102	V
	* 4.926	36.37	MAv1	34	-31	.75	40.12	54	-13.88	-	-	348	102	V
4	3.072	37.16	Pk	33.3	-33.2	0	37.26	-	-	-	-	0-360	101	V
8	5.223	34.95	Pk	34.2	-30.7	0	38.45	-	-	-	-	0-360	199	V

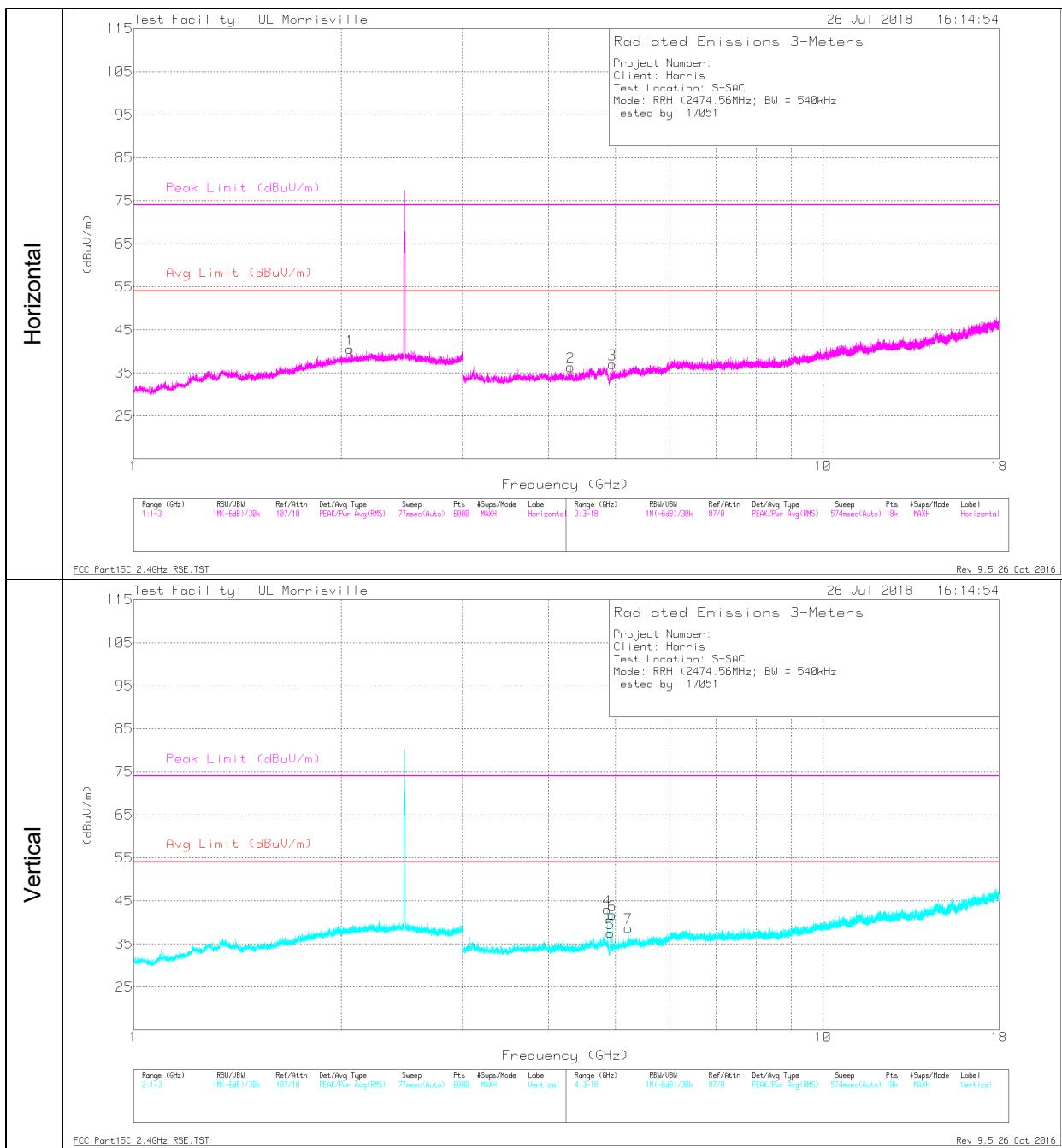
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

PK2 - Maximum Peak

MAv1 - Maximum RMS Average

HIGH CHANNEL (2474.56 MHz)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0069 AF (dB/m)	Amp/Cbl/Fltr/Pad (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	* 4.308	40.05	PK2	33.4	-31.8	0	41.65	-	-	74	-32.35	144	100	H
	* 4.308	27.7	MAv1	33.4	-31.8	.75	30.05	54	-23.95	-	-	144	100	H
3	* 4.949	46.22	PK2	34	-31.1	0	49.12	-	-	74	-24.88	181	101	H
	* 4.949	30.03	MAv1	34	-31.1	.75	33.68	54	-20.32	-	-	181	101	H
4	* 4.866	44.77	PK2	34	-30.9	0	47.87	-	-	74	-26.13	22	100	V
	* 4.866	39.7	MAv1	34	-30.9	.75	43.55	54	-10.45	-	-	22	100	V
5	* 4.915	42.87	PK2	34	-31	0	45.87	-	-	74	-28.13	80	101	V
	* 4.915	32.52	MAv1	34	-31	.75	36.27	54	-17.73	-	-	80	101	V
6	* 4.949	49.99	PK2	34	-31.1	0	52.89	-	-	74	-21.11	234	102	V
	* 4.949	33.67	MAv1	34	-31.1	.75	37.32	54	-16.68	-	-	234	102	V
1	2.06	32.31	Pk	31.1	-22.9	0	40.51	-	-	-	-	0-360	199	H
7	5.222	35.22	Pk	34.2	-30.7	0	38.72	-	-	-	-	0-360	101	V

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

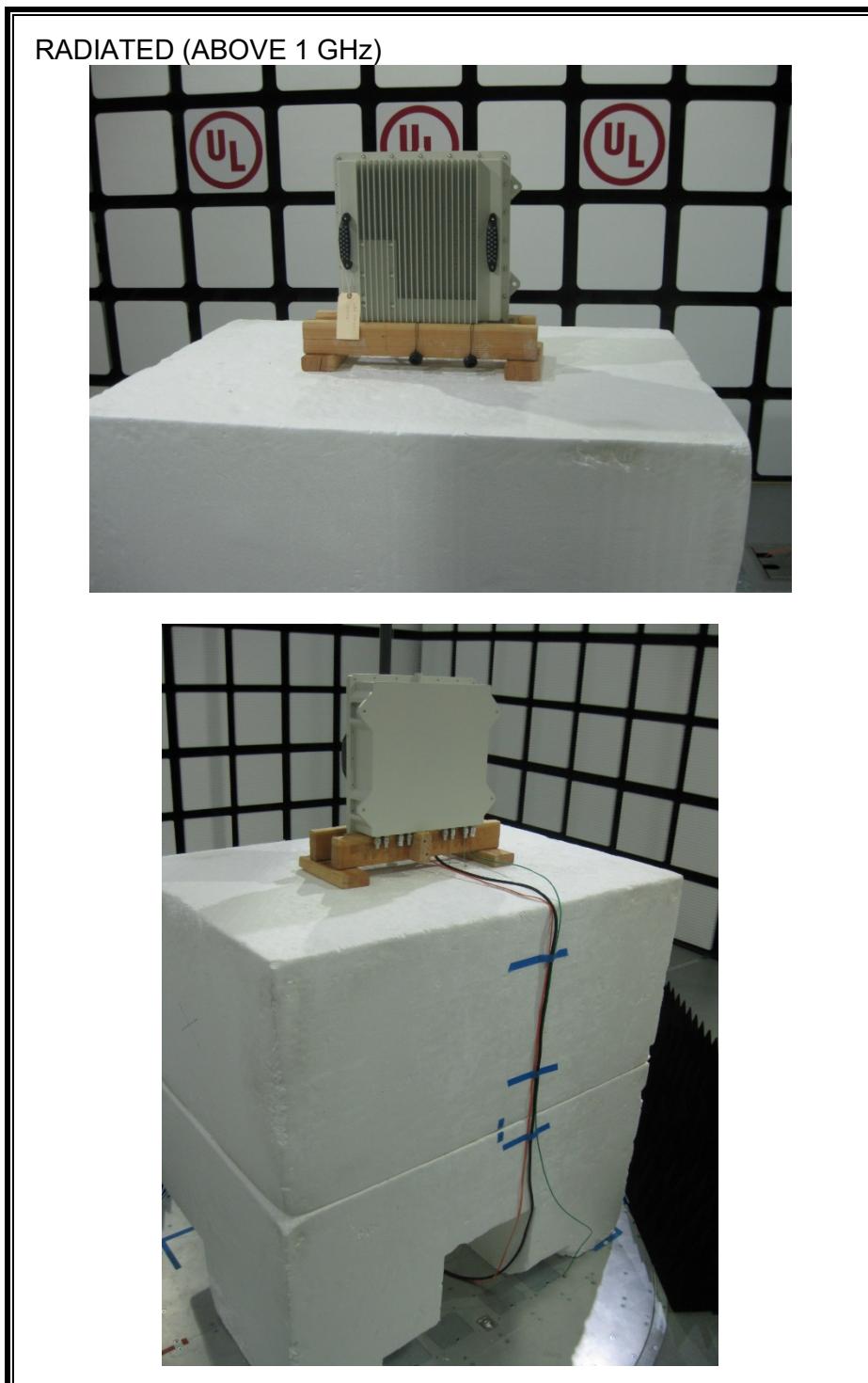
Pk - Peak detector

PK2 - Maximum Peak

MAv1 - Maximum RMS Average

9. SETUP PHOTOS

RADIATED RF MEASUREMENT SETUP (ABOVE 1 GHz)



END OF REPORT