RHEIN TECH LABORATORIES, INC.

Engineering Solutions & Electromagnetic Compatibility Services

Intentional Radiated Emissions Test Report - FCC Part 15.247 & RSS-210

Test Lab:	Applicant:
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FCC ID:	CFS8DLRF6FOB	**Test Report Date**	March 31, 2015
IC:	573F-RF6FOB	**RTL Work Order Number**	2014228
Model #	RF6FOB	**RTL Quote Number**	QRTL14-069A
American National Standard Institute	ANSI C63.10-2009: American National Standard for Testing Unlicensed Wireless Devices		
FCC Rule Part(s)	FCC Rules Part 15.247: Operation within the bands 920-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz Direct Sequence System (10-01-14)		
IC Rule Part(s)	RSS-210 Issue 8: Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment RSS-Gen Issue 4: General Requirements for Compliance of Radio Apparatus		

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this test report. No modifications were made to the equipment during testing in order to achieve compliance with these standards. Furthermore, there was no deviation from, additions to, or exclusions from, the applicable parts of FCC Part 2, FCC Part 15, IC RSS-210, IC RSS-Gen, ANSI C63.4 and ANSI C63.10.

Signature:  Date: March 31, 2015

Typed/Printed Name: Desmond A. Fraser Position: President

This report may not be reproduced, except in full, without the written approval of Rhein Tech Laboratories and Honeywell International. The test results relate only to the item(s) tested.

These tests are accredited and meet the requirements of ISO/IEC 17025 as verified by ANAB. Refer to certificate and scope of accreditation AT-1445.

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1 General Information

1.1 Scope

Applicable Standards:

- FCC Rules Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz.
- RSS-210 Issue 8: Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment
- RSS-Gen Issue 3: General Requirements and Information for the Certification of Radio Apparatus

This test report addresses the intentional radiated emissions requirements per FCC 15.247, which are the harmonic/spurious radiated emissions occurring in the restricted bands per FCC 15.205 (against the FCC 15.209 limits).

1.2 Description of EUT

Equipment Under Test	RF6FOB
Power Supply	3V battery
Frequency Range	2405 – 2475 MHz
Antenna Connector Type	N/A
Antenna Types	Internal

1.3 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located at 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing.

1.4 Modifications

None.

2 Test Information

2.1 Description of Test Modes

In accordance with FCC 15.31(m), and because the EUT utilizes an operating band greater than 10 MHz, the following frequencies were tested:

Table 2-1: Frequencies Tested

Channel	Frequency
Low	2405
Mid	2445
High	2475

2.2 Exercising the EUT

The EUT was tested in all three orthogonal planes in order to determine worst-case emissions. The EUT was provided with software to continuously transmit during testing. The carrier was also checked to verify that information was being transmitted. There were no deviations from the test standard(s) and/or methods. The test results reported relate only to the item tested.

2.3 Test Result Summary

Table 2-2: Test Result Summary – FCC Part 15, Subpart C (Section 15.247), IC RSS-210/RSS-Gen

FCC Reference	IC Reference	C63.10 Procedure	Test	Pass/Fail or N/A
FCC 15.209	RSS-Gen 7.2.5	6.5, 6.6	Radiated Emissions	Pass

2.4 Related Submittal(s)/Grant(s)

This report is to support an application for certification under FCC ID: CFS8DLRF6FOB, IC: 573F-RF6FOB.

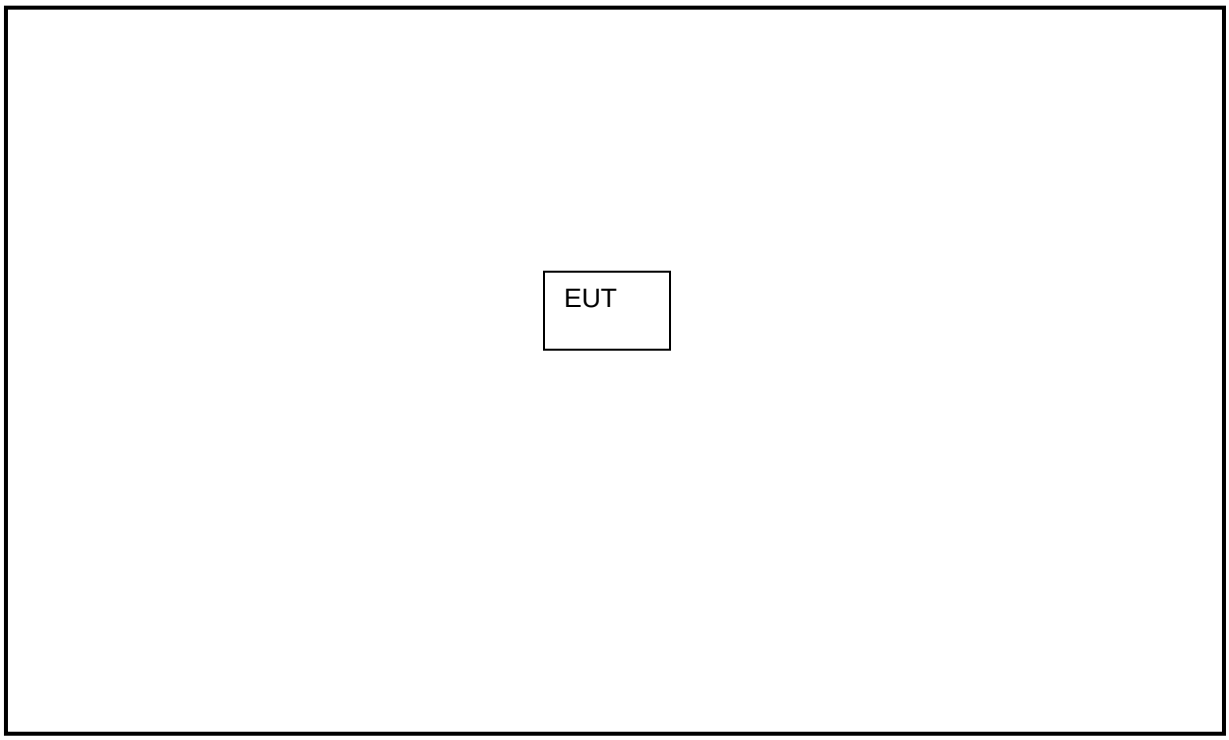
2.5 Test System Details

The test samples were received on March 12, 2015. The FCC identifiers for all applicable equipment, plus descriptions of all cables used in the tested system, are identified in the following tables.

Table 2-3: Equipment Under Test

Part	Manufacturer	Model #	Serial Number	FCC ID	RTL Bar Code
FOB	Honeywell International	RF6FOB	SARF6F0BV1	CFS8DLRF6FOB	21602

Figure 2-1: Configuration of Tested System



3 Radiated Emissions – FCC 15.209; IC RSS-210

3.1 Limits of Radiated Emissions Measurement

Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009-0.490	2400/f (kHz)	300
0.490-1.705	2400/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

As shown in 15.35(b), for frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any circumstances of modulation.

3.2 Radiated Emissions Measurement Test Procedure

Procedure: C63.10-2009 6.5, 6.6

Before final measurements of radiated emissions were made on the open-field three/ten meter range, the EUT was scanned indoors at one and three meter distances. This was done in order to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emissions measurements on the open-field range, at each frequency, in order to ensure that maximum emission amplitudes were attained.

Final radiated emissions measurements were made on the three/ten-meter, open-field test site. The EUT was placed on a nonconductive turntable 0.8 meters above the ground plane. The spectrum was examined from 9 kHz to the 10^{th} harmonic of the highest fundamental transmitter frequency (24.75 GHz).

At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations. For frequencies between 30 and 1000 MHz, the spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. For emissions above 1,000 MHz, emissions are measured using the average detector function with a minimum resolution bandwidth of 1 MHz. No video filter less than 10 times the resolution bandwidth was used. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

Table 3-1: Radiated Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901583	Agilent Technologies	EXA N9010	Spectrum Analyzer (10 Hz – 26.5 GHz)	MY51250846	4/16/15
900932	Rhein Tech Laboratories	8449B OPT H02	Amplifier (1 – 26.5 GHz)	3008A00505	9/5/15
900878	Rhein Tech Laboratories	AM3-1197-0005	3 meter antenna mast, polarizing	OATS1	N/A
900791	Chase	CBL6112	Antenna (30 MHz – 2 GHz)	2099	6/11/17
901218	EMCO	3160-09	Horn Antenna (18 - 26.5 GHz)	960281-003	4/20/15
900772	EMCO	3161-02	Horn Antenna (2 - 4 GHz)	9804-1044	4/20/15
900321	EMCO	3161-03	Horn Antenna (4 – 8.2 GHz)	9508-1020	4/20/15
900323	EMCO	3160-07	Horn Antenna (8.2 – 12.4 GHz)	9605-1054	4/20/15
900356	EMCO	3160-08	Horn Antenna (12.4 – 18 GHz)	9607-1044	4/20/15
901218	EMCO	3160-09	Horn Antenna (18 – 26.5 GHz)	960281-003	4/19/15

3.3 Radiated Emissions Test Results

3.3.1 Radiated Emissions Harmonics/Spurious

Table 3-2: 2405 MHz; Average Mode

Emission Frequency (MHz)	Analyzer Reading (dBuV) (1 MHz RBW, 10 Hz VBW)	Site Correction Factor (dB/m)	Corrected Average Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2405.000	62.7	26.0	88.7	Fundamental	

Table 3-3: 2445 MHz; Average Mode

Emission Frequency (MHz)	Analyzer Reading (dBuV) (1 MHz RBW, 10 Hz VBW)	Site Correction Factor (dB/m)	Corrected Average Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2445.000	62.9	26.1	89.0	Fundamental	

Table 3-4: 2475 MHz; Average Mode

Emission Frequency (MHz)	Analyzer Reading (dBuV) (1 MHz RBW, 10 Hz VBW)	Site Correction Factor (dB/m)	Corrected Average Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2475.00	64.9	26.2	91.1	Fundamental	

Table 3-5: 2405 MHz; Peak Mode

Emission Frequency (MHz)	Spectrum Analyzer Peak Level (1 MHz RBW/3 MHz VBW) (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2405.000	64.8	26.0	90.8	Fundamental	
4810.000	66.3	-0.1	66.2	74.0	-7.8
7215.000	52.0	2.7	54.7	74.0	-19.3
9620.000	27.3	10.3	37.6	74.0	-36.4
12025.000	23.5	10.0	33.5	74.0	-40.5
14430.000	22.8	15.7	38.5	74.0	-35.5
16835.000	31.9	18.0	49.9	74.0	-24.1

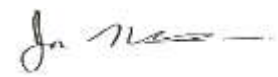
Table 3-6: 2445 MHz; Peak Mode

Emission Frequency (MHz)	Spectrum Analyzer Peak Level (1 MHz RBW/3 MHz VBW) (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2445.000	64.5	26.1	90.6	Fundamental	
4890.000	71.2	0.1	71.3	74.0	-2.7
7335.000	46.7	3.1	49.8	74.0	-24.2
9780.000	31.0	10.0	41.0	74.0	-33.0
12225.000	31.4	9.8	41.2	74.0	-32.8
14670.000	31.4	15.7	47.1	74.0	-26.9
17115.000	34.2	18.3	52.5	74.0	-21.5

Table 3-7: 2475 MHz; Peak Mode

Emission Frequency (MHz)	Spectrum Analyzer Peak Level (1 MHz RBW/3 MHz VBW) (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2475.00	66.1	26.2	92.3	Fundamental	
4950.00	70.3	0.1	70.4	74.0	-3.6
7425.00	48.3	2.6	50.9	74.0	-23.1
9900.00	30.3	9.0	39.3	74.0	-34.7
12375.00	29.4	10.3	39.7	74.0	-34.3
14850.00	29.9	15.8	45.7	74.0	-28.3
17325.00	33.6	18.4	52.0	74.0	-22.0

Test Personnel:

Jon Wilson		March 13, 2015
EMC Test Engineer	Signature	Date of Test

4 Compliance with the Band Edge – FCC 15.247(d); RSS-210 2.2

4.1 Band Edge Test Procedure

Peak (1 MHz RBW/3 MHz VBW) and average (1 MHz RBW/10 Hz VBW) corrected radiated measurements were taken within the restricted band to show compliance.

Table 4-1: Band Edge Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901583	Agilent Technologies	EXA N9010	Spectrum Analyzer (10 Hz – 26.5 GHz)	MY51250846	4/16/15

4.2 Restricted Band Edge Test Results

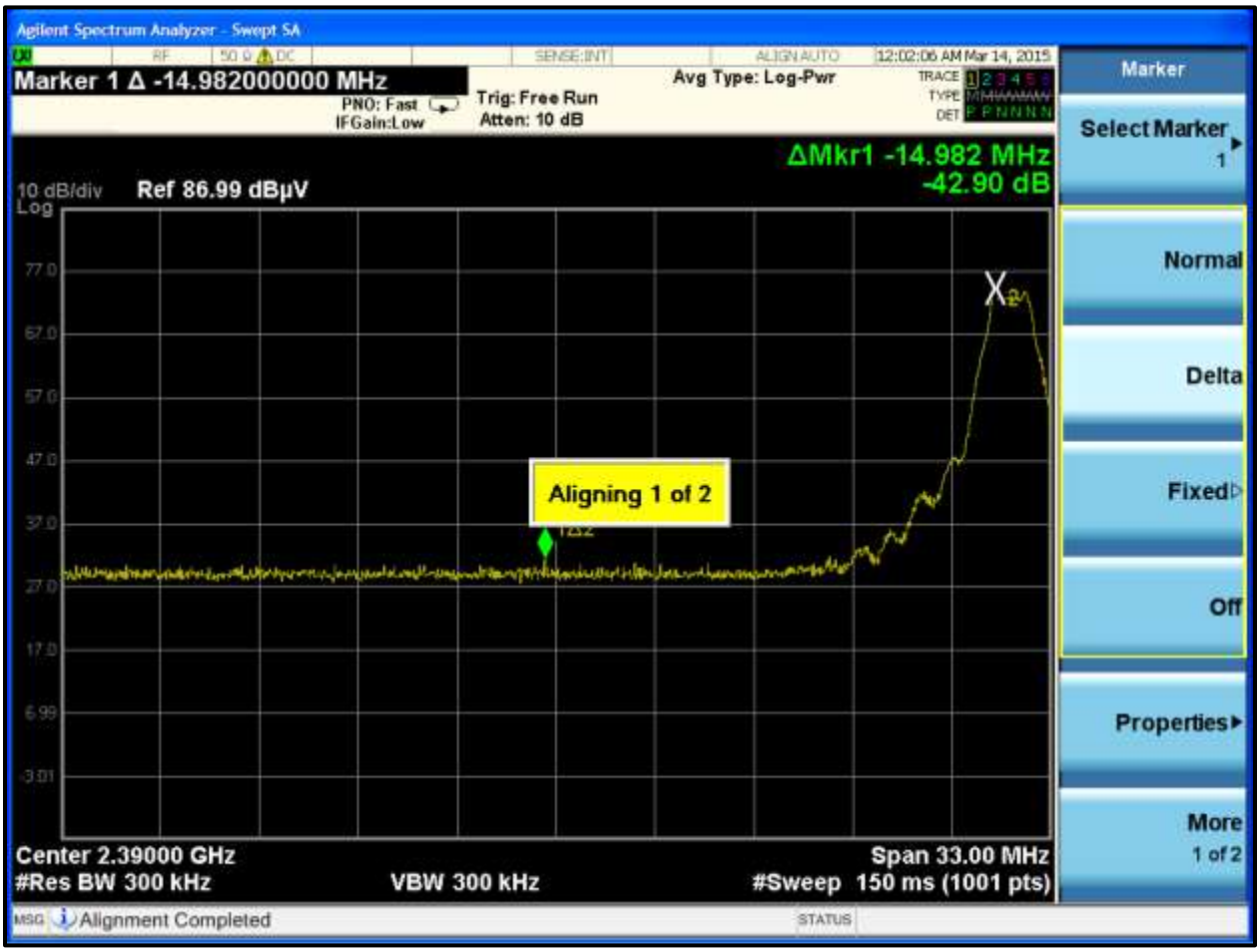
4.2.1 Lower Band Edge

88.7 dBuV/m is the average field strength measurement, from which the delta measurement of 42.9 dB is subtracted (reference Peak plot 4-1, note DET=P), resulting in a level 45.8 dB. This level has a margin of 8.2 dB below the limit of 54 dBuV/m.

Calculation: 88.7 dBuV/m – 42.9 dB – 54 dBuV/m = -8.2 dB
88.7 – 42.9 – 54 = -8.2

Peak Field Strength of Lower Band Edge (1 MHz RBW/3 MHz VBW) = 90.8 dBuV/m
Average Field Strength of Lower Band Edge (1 MHz RBW/10 Hz VBW) = 88.7 dBuV/m
Delta measurement = 42.9 dB

Plot 4-1: In Band Emissions - 2405 MHz



4.2.2 Upper Band Edge

91.1 dBuV/m is the average field strength measurement, from which the delta measurement of 49.0 dB is subtracted (reference Peak plot 4-2, note DET=P), resulting in a level 42.1 dB. This level has a margin of 11.9 dB below the limit of 54 dBuV/m.

Calculation: 91.1 dBuV/m – 49.0 dB – 54 dBuV/m = -11.9 dB

Peak Field Strength of Upper Band Edge (1 MHz RBW/1 MHz VBW) = 92.3 dBuV/m
Average Field Strength of Upper Band Edge (1 MHz RBW/10 Hz VBW) = 91.1 dBuV/m
Delta measurement = 49.0 dB

Plot 4-2: In Band Emissions – 2475 MHz

Test Personnel:

Jon Wilson		February 13, 2015
EMC Test Engineer	Signature	Date of Test

5 Conclusion

The data in this measurement report shows that the Honeywell International Model # RF6FOB, FCC ID: CFS8DLRF6FOB, IC: 573F-RF6FOB, complies with the applicable intentional radiated emissions requirements of Parts 2 and 15 of the FCC rules and regulations and Industry Canada RSS-Gen and RSS-210.

Appendix A: Test Photographs

Photograph 1: Radiated Testing – Front View

Photograph 2: Radiated Testing