Engineering and Testing for EMC and Safety Compliance

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FCC Part 15.247 Certification Application Report

Test Lab:	Applicant:
Rhein Tech Laboratories, Inc. Phone: 703-689-0368 360 Herndon Parkway Fax: 703-689-2056 Suite 1400 www.rheintech.com Herndon, VA 20170 E-Mail: ATCBINFO@rheintech.com	L3 Communications Phone: 434-316-5230 3750 Centerview Drive Chantilly, VA 20151 Contact: Andrew O'Neill

FCC ID:	XG8-TB100001	**Test Report Date:**	October 19, 2009
Platform:	N/A	**RTL Work Order Number:**	2009239
Model #:	FAP5010-001	**RTL Quote Number:**	QRTL09-318
American National Standard Institute:	ANSI C63.4-2003: Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz		
American National Standard Institute:	ANSI C63.10-2009: American National Standard for Testing Unlicensed Wireless Devices		
FCC Classification:	DTS – Part 15 Digital Transmission System		
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 (10-01-08) (Guidance per DA 00-705)		

Frequency Range (MHz)	Output Power (W)	Frequency Tolerance	Emission Designator
903.0 – 927.0	0.014	N/A	FXD

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, ANSI C63.4.

Signature: _____ Date: October 19, 2009

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

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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.

1.2 Description of EUT

Equipment Under Test	Fixed Tracking Beacon
Model #	FAP5010-001
Power Supply	Two “C” Alkaline Batteries
Modulation Type	2-FSK
Frequency Range	903.0 – 927.0 MHz
Antenna Connector Type	Reverse Polarity TNC (RP-TNC)
Antenna Types	External Omni 0 dBi

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 (ANSI C63.4 2003).

1.4 Related Submittal(s)/Grant(s)

This is an original application for certification for L3 Communications Model# FAP5010-001, a Fixed Tracking Beacon, FCC ID: XG8-TB100001.

1.5 Modifications

No modifications were required for compliance.

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	903.0
Mid	915.0
High	927.0

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)

FCC Reference	C63.10 Procedure	Test	Pass/Fail or N/A
FCC 15.207	6.2	AC Power Conducted Emissions	N/A
FCC 15.209	6.5, 6.6	Radiated Emissions	Pass
FCC 15.247(b)	6.10	Maximum Peak Power Output	Pass
FCC 15.247(d)	6.7	Antenna Conducted Spurious Emissions	Pass
FCC 15.247(d)	6.9.2	Band Edge	Pass
FCC 15.247(a)(2)	6.9.1	6 dB Bandwidth	Pass
FCC 15.247(e)	6.11	Power Spectral Density	Pass

2.4 Test System Details

The test samples were received on August 7 and October 16, 2009. 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
Tracking Beacon	Innovative Wireless Technologies	FAP5010-001	TB09290019	XG8-TB100001	19270
Serial Interface PCB	Innovative Wireless Technologies	BB1241P1	N/A	N/A	19269
Antenna	N/A	N/A	N/A	N/A	19271

2.5 Configuration of Tested System

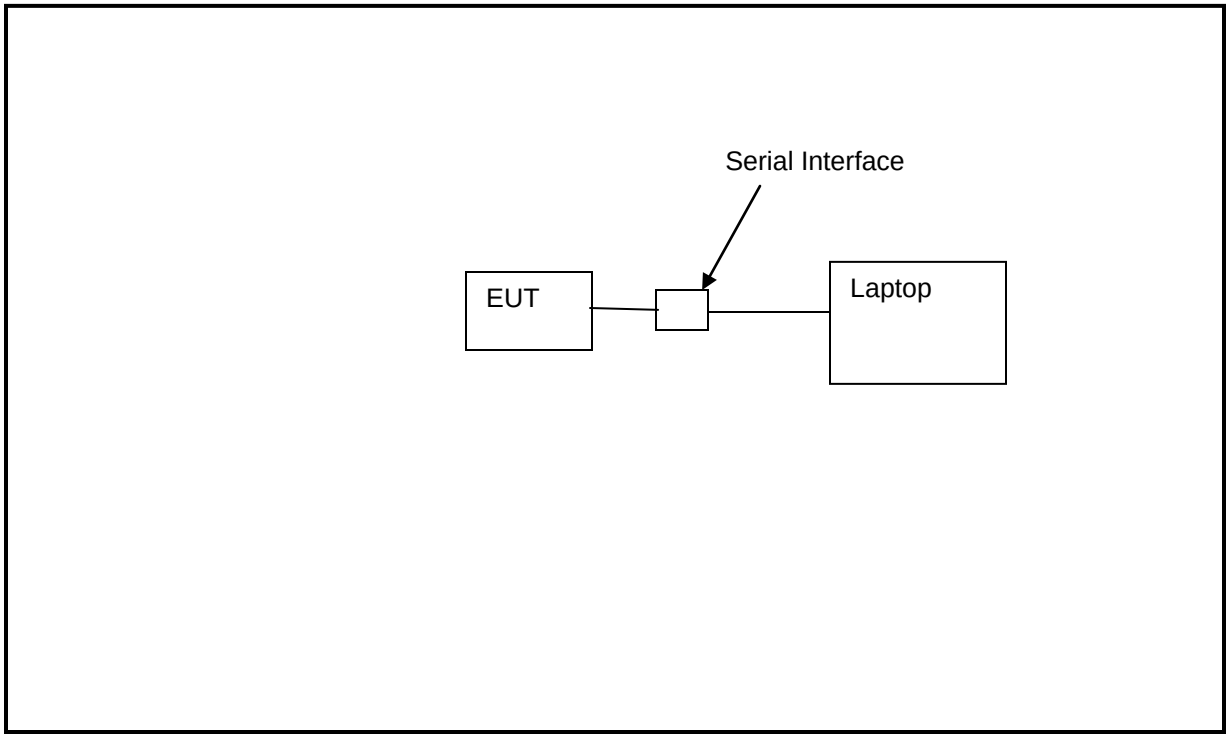


Figure 2-1: Configuration of System Under Test

3 Peak Output Power – FCC 15.247(b)(3)

3.1 Power Output Test Procedure

A conducted power measurement of the EUT was taken using an Agilent spectrum analyzer.

Procedure: C63.10-2009 6.10

Table 3-1: Power Output Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
95448	Agilent Technologies	E4448A	Spectrum Analyzer (3 Hz – 50 GHz)	MY46180621	5/29/11

3.2 Power Output Test Data

Table 3-2: Power Output Test Data

Frequency (MHz)	Peak Conducted Power (dBm)
903.0	11.5
915.0	11.3
927.0	11.1

Test Personnel:

Richard B. McMurray, P.E.	Richard B. McMurray	October 18, 2009
Test Engineer	Signature	Date Of Test

4 Band Edge Compliance of RF Conducted Emissions – FCC 15.247(d)

4.1 Band Edge Test Procedure

Procedure: C63.10-2009 6.9.2, 6.9.3

The EUT was connected to the spectrum analyzer through suitable attenuation. The span was set wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation. The spectrum analyzer was set to the following:

RBW > = 1% of the span
VBW > = RBW
Sweep = auto
Detector function = peak
Trace = max hold

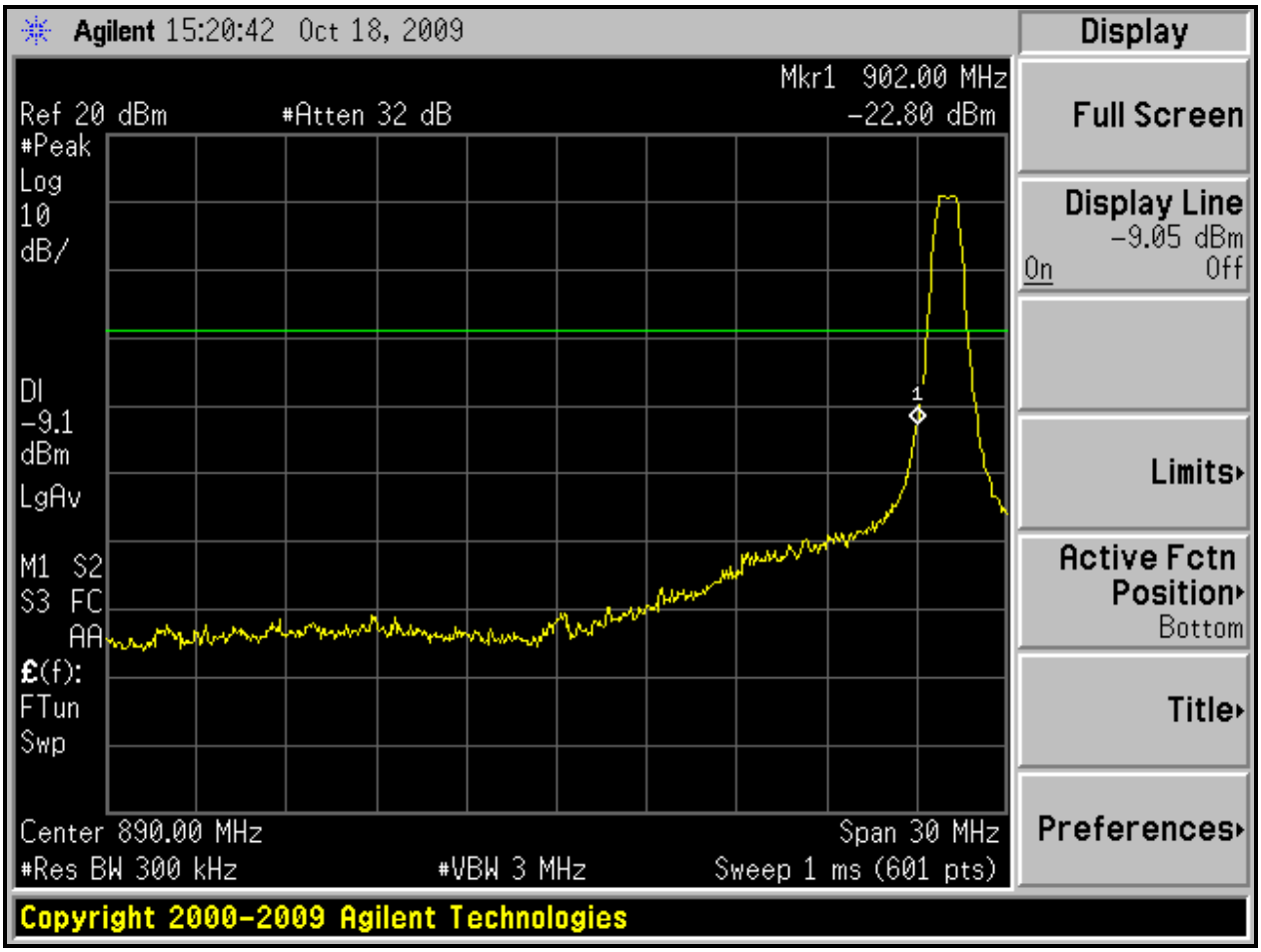
The trace was allowed to stabilize. The marker was set on the emission at the band edge. The marker-delta was used to show the delta between the maximum in-band emission and the emission at the band edge, and was compared to the 20 dBc requirement of 15.247(d) (when using peak emissions).

Table 4-1: Test Equipment

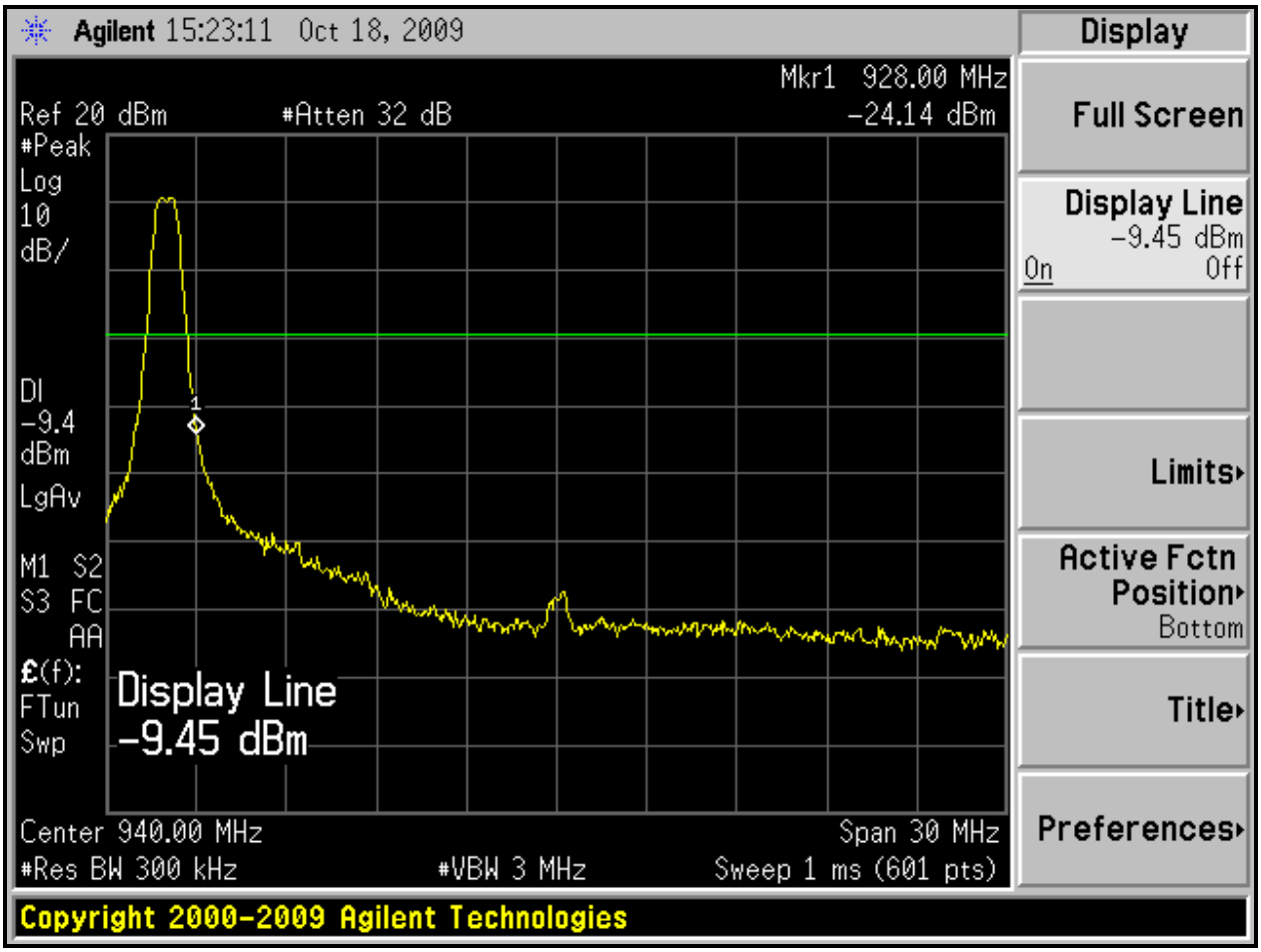
RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
95448	Agilent Technologies	E4448A	Spectrum Analyzer (3 Hz – 50 GHz)	MY46180621	5/29/11

4.2 Test Results

Plot 4-1: Lower Band Edge (902 MHz Band Edge, 903.0 MHz Carrier)



Plot 4-2: Upper Band Edge (928 MHz Band Edge, 927.0 MHz Carrier)



Test Personnel:

Richard B. McMurray, P.E.	Richard B. McMurray	October 18, 2009
Test Engineer	Signature	Date Of Test

5 Antenna Conducted Spurious Emissions – FCC 15.247(d)

5.1 Antenna Conducted Spurious Emissions Test Procedures

Procedure: C63.10-2009 6.7

Antenna spurious emissions per FCC 15.247(d) were measured from the EUT antenna port using a 50-ohm spectrum analyzer with the resolution bandwidth set at 100 kHz, and the video bandwidth set at 100 kHz. The modulated carrier was identified at the following frequencies: 903.0 MHz, 915 MHz and 927.0 MHz. The carrier to the 10th harmonic of the carrier frequency was investigated.

5.2 Antenna Conducted Spurious Emissions Test Results

All spurious emissions were greater than 20 dB below the limit (note that we are reporting power as peak). Per FCC 15.31(o), no data is being reported.

Table 5-1: Antenna Conducted Spurious Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
95448	Agilent Technologies	E4448A	Spectrum Analyzer (3 Hz – 50 GHz)	MY46180621	5/29/11

Test Personnel:

Richard B. McMurray, P.E.	Richard B. McMurray	October 18, 2009
Test Engineer	Signature	Date Of Test

6 6 dB Bandwidth – FCC 15.247(a)(2)

6.1 6 dB Bandwidth Test Procedure – Minimum 6 dB Bandwidth

Procedure: C63.10-2009 6.9

The minimum 6 dB bandwidths per FCC 15.247(a)(2) were measured using a 50-ohm spectrum analyzer with the resolution bandwidth set at 120 kHz, and the video bandwidth set at 360 kHz. The device was modulated. The minimum 6 dB bandwidths are presented below.

Table 6-1: 6 dB Bandwidth Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
95448	Agilent Technologies	E4448A	Spectrum Analyzer (3 Hz – 50 GHz)	MY46180621	5/29/11

6.2 6 dB Bandwidth Test Results

Table 6-2: 6 dB Bandwidth Test Data

Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass/Fail
903.0	0.54	0.5	Pass
915.0	0.53	0.5	Pass
927.0	0.54	0.5	Pass

Test Personnel:

Richard B. McMurray, P.E.	Richard B. McMurray	October 18, 2009
Test Engineer	Signature	Date Of Test

7 Power Spectral Density – FCC 15.247(e)

7.1 Power Spectral Density Test Procedure

Procedure: C63.10-2009 6.11.2

The power spectral density per FCC 15.247(d) was measured using a 50-ohm spectrum analyzer with the resolution bandwidth set at 3 kHz, the video bandwidth set at 10 kHz, and the sweep time set at 100 seconds. The spectral lines were resolved for the modulated carriers at 903.0, 915.0 and 927.0 MHz. These levels are below the +8 dBm limit. See the power spectral density table and plots.

Table 7-1: Power Spectral Density Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
95448	Agilent Technologies	E4448A	Spectrum Analyzer (3 Hz – 50 GHz)	MY46180621	5/29/11

7.2 Power Spectral Density Test Data

Table 7-2: Power Spectral Density Test Data

Frequency (MHz)	RF Power Level (dBm)	Maximum Limit +8 dBm	Pass/Fail
903.0	5.3	8	Pass
915.0	5.2	8	Pass
927.0	4.9	8	Pass

Test Personnel:

Richard B. McMurray, P.E.	Richard B. McMurray	October 18, 2009
Test Engineer	Signature	Date Of Test

8 Conducted Emissions Measurement Limits – FCC 15.207

8.1 Limits of Conducted Emissions Measurement

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66-56	56-46
0.5-5.0	56	46
5.0-30.0	60	50

8.2 Conducted Emissions Measurement Test Procedure

Procedure: C63.10-2009 6.2

The power line conducted emission measurements were performed in a Series 81 type shielded enclosure manufactured by Rayproof. The EUT was assembled on a wooden table 80 centimeters high. Power was fed to the EUT through a 50-ohm / 50 micro Henry Line Impedance Stabilization Network (EUT LISN). The EUT LISN was fed power through an A.C. filter box on the outside of the shielded enclosure. The filter box and EUT LISN housing are bonded to the ground plane of the shielded enclosure. A second LISN, the peripheral LISN, provides isolation for the EUT test peripherals. This peripheral LISN was also fed A.C. power. A metal power outlet box, which is bonded to the ground plane and electrically connected to the peripheral LISN, powers the EUT host peripherals.

The spectrum analyzer was connected to the A.C. line through an isolation transformer. The 50-ohm output of the EUT LISN was connected to the spectrum analyzer input. Conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or peak mode if applicable). The analyzer's 6 dB bandwidth was set to 9 kHz. No video filter less than 10 times the resolution bandwidth was used. Average measurements are performed in linear mode using a 10 kHz resolution bandwidth, a 1 Hz video bandwidth, and by increasing the sweep time in order to obtain a calibrated measurement. The emission spectrum was scanned from 150 kHz to 30 MHz. The highest emission amplitudes relative to the appropriate limit were measured and have been recorded in this report.

8.3 Conducted Line Emissions Test Data

N/A – EUT is battery operated.

9 Radiated Emissions – FCC 15.209

9.1 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.

9.2 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 (24.8 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 9-1: Radiated Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901365	MITEQ	JS4-00102600-41-5P	Amplifier, 0.1-26 GHz, 30dB gain	N/A	3/4/10
900878	Rhein Tech Labs	AM3-1197-0005	3 meter antenna mast, polarizing	Outdoor Range 1	Not Required
901516	Insulated Wire, Inc.	KPS-1503-2400-KPS	RF cable, 20'	NA	10/19/10
901517	Insulated Wire Inc.	KPS-1503-360-KPS	RF cable 36"	NA	10/19/10
901242	Rhein Tech Labs	WRT-000-0003	Wood rotating table	N/A	Not Required
900772	EMCO	3161-02	Horn Antenna (2 - 4 GHz)	9804-1044	6/14/10
900321	EMCO	3161-03	Horn Antennas (4 - 8,2GHz)	9508-1020	6/14/10
900323	EMCO	3160-7	Horn Antennas (8,2 - 12,4 GHz)	9605-1054	6/14/10
901215	Hewlett Packard	8596EM	Spectrum Analyzer (9 KHz - 12.8 GHz)	3826A00144	10/23/09

9.3 Radiated Emissions Test Results

9.3.1 Radiated Emissions Harmonics/Spurious

Table 9-2: Radiated Emissions Harmonics/Spurious TX Frequency – 903.0 MHz

Emission Frequency (MHz)	Peak Analyzer Reading (dBuV) (1 MHz RBW/VBW)	Average Analyzer Reading (dBuV) (1 MHz RBW/ 10 Hz VBW)	Site Correction Factor (dB/m)	Average Emission Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
1806.000	55.4	52.3	-0.6	51.7	88.4	-36.7
2709.000	59.4	54.2	-6.6	47.6	54.0	-6.4
3612.000	39.5	27.2	-5.0	22.2	54.0	-31.8
4515.000	34.6	22.3	1.3	23.6	54.0	-30.4
5418.000	39.3	26.8	3.6	30.4	54.0	-23.6
6321.000	35.5	22.0	4.2	26.2	88.4	-62.2
7224.000	40.7	28.5	5.6	34.1	88.4	-54.3
8127.000	38.7	25.5	6.4	31.9	54.0	-22.1
9030.000	40.1	25.3	12.2	37.5	54.0	-16.5

Table 9-3: Radiated Emissions Harmonics/Spurious TX Frequency – 915.0 MHz

Emission Frequency (MHz)	Peak Analyzer Reading (dBuV) (1 MHz RBW/VBW)	Average Analyzer Reading (dBuV) (1 MHz RBW/ 10 Hz VBW)	Site Correction Factor (dB/m)	Average Emission Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
1830.000	54.0	50.5	-0.4	50.1	89.9	-39.8
2745.000	59.5	54.4	-6.1	48.3	89.9	-41.6
3660.000	38.2	27.3	-5.1	22.2	54.0	-31.8
4575.000	37.6	24.8	1.7	26.5	54.0	-27.5
5490.000	43.7	31.2	3.8	35.0	89.9	-54.9
6405.000	37.7	25.2	4.1	29.3	89.9	-60.6
7320.000	39.3	27.0	5.3	32.3	54.0	-21.7
8235.000	38.4	25.0	11.6	36.6	54.0	-17.4
9150.000	38.9	25.7	12.3	38.0	54.0	-16.0

Table 9-4: Radiated Emissions Harmonics/Spurious TX Frequency – 927.0 MHz

Emission Frequency (MHz)	Peak Analyzer Reading (dBuV) (1 MHz RBW/VBW)	Average Analyzer Reading (dBuV) (1 MHz RBW/ 10 Hz VBW)	Site Correction Factor (dB/m)	Average Emission Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
1854.000	52.2	47.3	0.3	47.6	86.6	-39.0
2781.000	63.1	58.2	-6.3	51.9	54.0	-2.1
3708.000	38.7	27.2	-5.0	22.2	54.0	-31.8
4635.000	36.9	24.2	1.7	25.9	54.0	-28.1
5562.000	44.5	32.3	3.5	35.8	86.6	-50.8
6489.000	38.5	26.0	4.0	30.0	86.6	-56.6
7416.000	40.1	27.4	5.7	33.1	54.0	-20.9
8343.000	38.0	24.7	11.6	36.3	54.0	-17.7
9270.000	37.2	24.8	12.4	37.2	54.0	-16.8

Test Personnel:

Daniel W. Baltzell		October 19, 2009
EMC Test Engineer	Signature	Date Of Test

10 Conclusion

The data in this measurement report shows that the L3 Communications L3 Communications Model# FAP5010-001, a Fixed Tracking Beacon, FCC ID: XG8-TB100001, complies with all the applicable requirements of Parts 2 and 15 of the FCC Rules and Regulations.