

Test Report for Unlicensed Low Power Transmitter

FCC Applicable Rule Parts: 15.205, 15.231

Applicant: FP Wireless LLC
105 Serra Way, PMB#356
Milpitas, CA 95035

FCC ID: UOGLRT01

Test date(s): 18 March 2009

Testing performed by: Compliance Certification Services
47173 Benicia Street
Fremont CA 94538

Description of device:

The FP Wireless LRT transmitter is a low power transmitter operating at 433.92 MHz, and will be used as part of a secure wireless gate entry system. The other parts of the system are FP Wireless receiver model WRR-42, authorized by Declaration of Conformity, and 915 MHz "illuminator" RF module model 9XTEND, certified separately by the manufacturer Maxstream. The RF module will be sold with one of the approved antenna types for the module.

TEST REQUIREMENTS

The referenced device is subject to certification under Part 2 of FCC Rules. The specific emissions limits and test requirements are found in Part 15 of FCC Rules. In addition to the device specific requirements listed in 15.231 (re-printed below), the following Part 15 requirements are universal to all unlicensed transmitters and would also apply:

- 15.19 Labeling requirements
- 15.20 Accessories
- 15.21 Information to user
- 15.31 Measurement standards
- 15.33 Frequency range of measurements
- 15.35 Measurement detector functions and bandwidths
- 15.203 Antenna requirement
- 15.204 External radio frequency power amplifiers and antenna modifications.
- 15.205 Restricted bands of operation.
- 15.209 Radiated emission limits, general requirements.
- 15.231 Periodic operation in the band 40.66 - 40.70 MHz and above 70 MHz.

MEASUREMENT PROCEDURES

All testing was performed in accordance with ANSI C63.4: 2003, using methodologies and instrumentation described therein.

REVISION INFORMATION AND ATTESTATION OF RESULTS

Report No: 09PRO004

REV No.	Description	Revised By:	Date
-	Original Issue	T. Cokenias	3/21/2009
1.0	Correct typo, duty cycle calc.	T. Cokenias	4/17/2009

FCC ID: UOGLRT01 meets all FCC requirements for a device of this type.

THOMAS N. COKENIAS

17 April 2009

A handwritten signature in blue ink, appearing to read "T. N. Cokenias", is written over a light yellow rectangular background.

EMC and Radio Regulatory Consultant
Agent for FP Wireless LLC.

15.205 Restricted bands of operation.

Only spurious emissions are permitted in any of the frequency bands listed below: The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209.

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
10.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	
13.36 - 13.41			

15.209 Radiated emission limits, general requirements.

Except as provided elsewhere in this paragraph the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength uV/m	Measurement distance, m
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.

15.231 Periodic operation in the band 40.66 - 40.70 MHz and above 70 MHz.

(a) The provisions of this Section are restricted to periodic operation within the band 40.66 - 40.70 MHz and above 70 MHz. Except as shown in paragraph (e) of this Section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, voice, video and the radio control of toys are not permitted. Data is permitted to be sent with a control signal. The following conditions shall be met to comply with the provisions for this periodic operation:

(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

(3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.

(4) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition.

(5) Transmission of set-up information for security systems may exceed the transmission duration limits in paragraphs (a)(1) and (a)(2) of this section, provided such transmission are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.

(b) In addition to the provisions of Section 15.205, the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (microvolts/meter)	Field Strength of Spurious Emissions (microvolts/meter)
40.66 - 40.70	2,250	225
70 - 130	1,250	125
130 - 174	1,250 to 3,750 **	125 to 375 **
174 - 260	3,750	375
260 - 470	3,750 to 12,500 **	375 to 1,250 **
Above 470	12,500	1,250

** linear interpolations

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, $\mu\text{V/m}$ at 3 meters = $56.81818(F) - 6136.3636$; for the band 260-470 MHz, $\mu\text{V/m}$ at 3 meters = $41.6667(F) - 7083.3333$. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]

(1) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.

(2) Intentional radiators operating under the provisions of this Section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table

may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in Section 15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of Section 15.205 shall be demonstrated using the measurement instrumentation specified in that section.

(3) The limits on the field strength of the spurious emissions in the above table are based

on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in Section 15.209, whichever limit permits a higher field strength.

(c) The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

TEST EQUIPMENT LIST

Equipment	Manufacturer	Model	Asset/Serial No.	Cal Due
Spectrum Analyzer	Agilent	E4446A	T146	01/06/10
Pre-amplifier 1-26 GHz	HP	8449B	T145	01/06/10
Pre-amplifier 30-1000 MHz	Sonoma	Sonoma	T173	12/16/09
Bilog antenna 30-1000 MHz	Sunol Systems	JB1	T130	09/08/09
Horn antenna 1-18 GHz	ETS	3115	T60	4/22/09

Transmitter Deactivation Time Test Requirement: 15.231(a) 2

(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

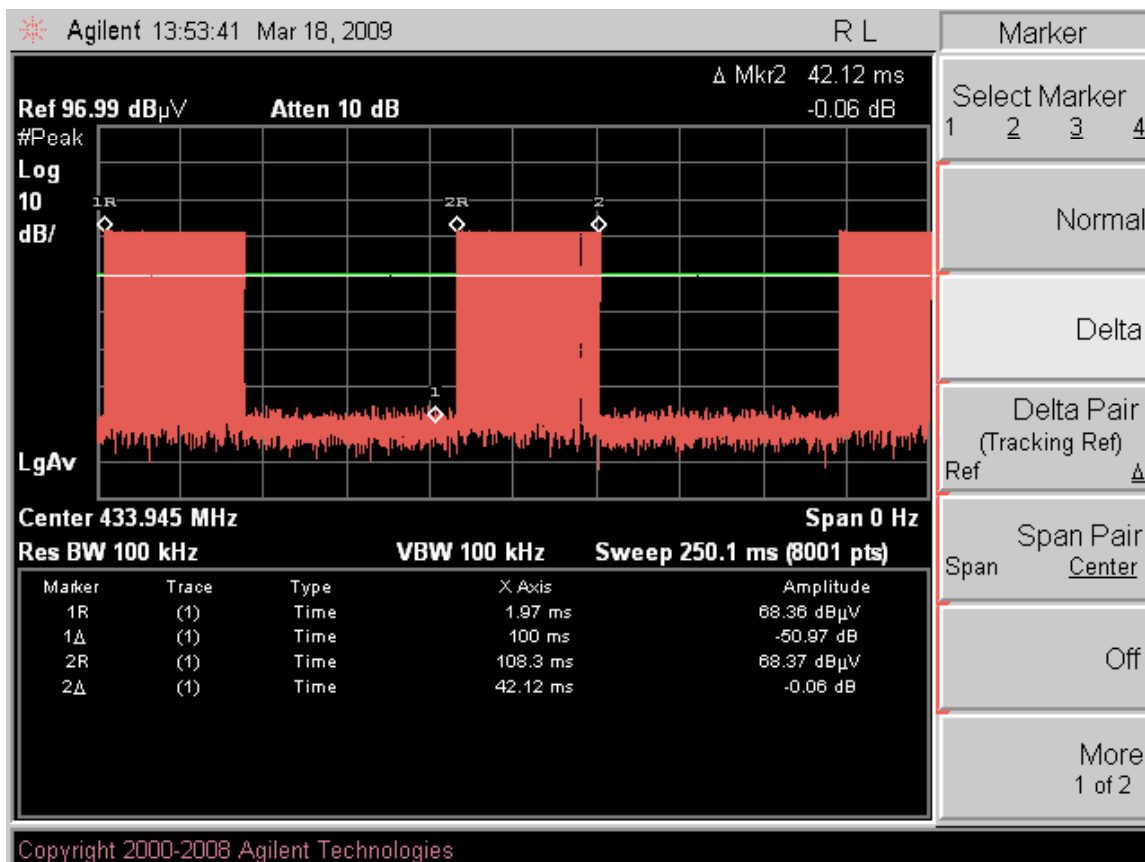
Test Procedure

The EUT was placed on the test table 3m from the antenna. The 915 MHz interrogator was set to produce continuous interrogations.

Test Results

After interrogation, the transmitter sends a signal approximately 42msec long in a 100msec time frame, then immediately ceases transmission until the next interrogation.

433.92 MHz TX Output (915 MHz continuous interrogations)



Radiated Emissions

Test Requirement: 15.231(b)

(b) In addition to the provisions of Section 15.205, the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (microvolts/meter)	Field Strength of Spurious Emissions (microvolts/meter)
40.66 - 40.70	2,250	225
70 - 130	1,250	125
130 - 174	1,250 to 3,750 **	125 to 375 **
174 - 260	3,750	375
260 - 470	3,750 to 12,500 **	375 to 1,250 **
Above 470	12,500	1,250

** linear interpolations

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, $\mu\text{V/m}$ at 3 meters = $56.81818(F) - 6136.3636$; for the band 260-470 MHz, $\mu\text{V/m}$ at 3 meters = $41.6667(F) - 7083.3333$. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]

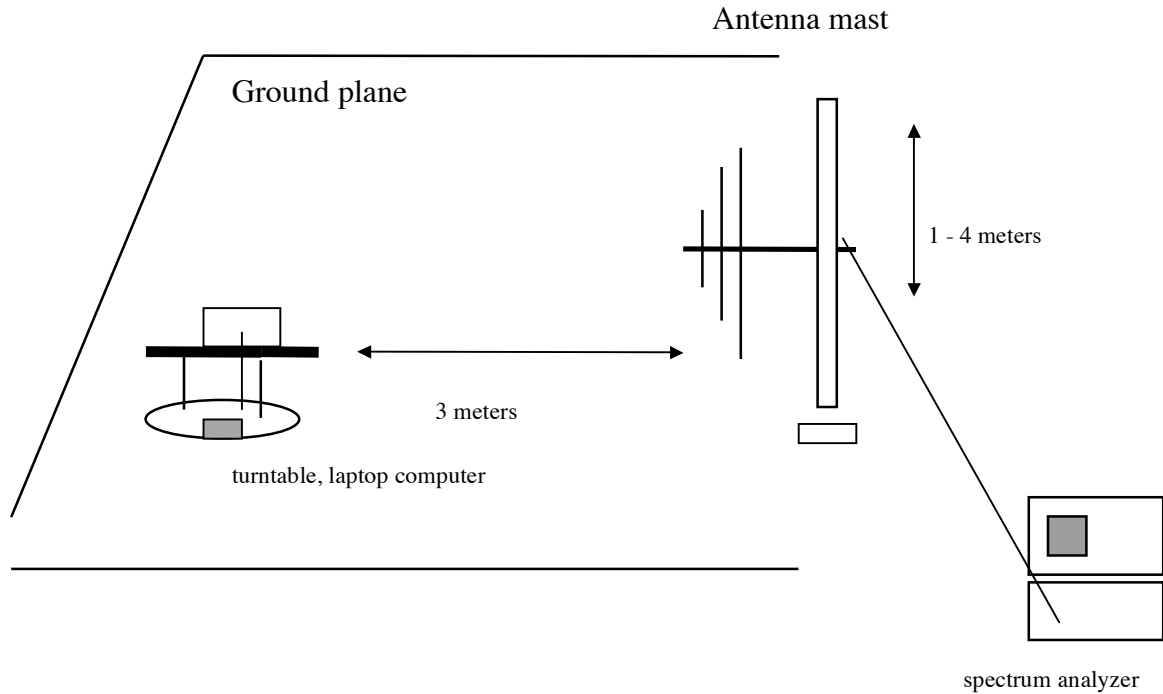
- (1) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.
- (2) Intentional radiators operating under the provisions of this Section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in Section 15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of Section 15.205 shall be demonstrated using the measurement instrumentation specified in that section.
- (3) The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in Section 15.209, whichever limit permits a higher field strength.

Test Procedures

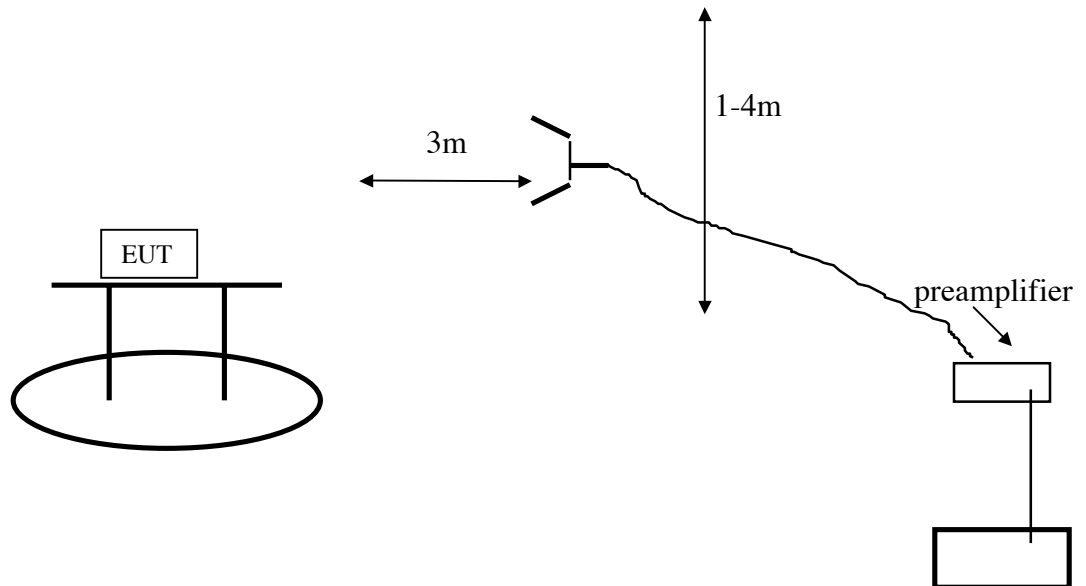
The EUT was set to produce continuous transmissions, by shorting two jumpers provided for continuous operation in test mode. The EUT was placed on an 80cm high table mounted on a turntable on an open air test site. At the fundamental frequency emission from the EUT, the turntable was rotated 360 degrees and the antenna raised and lowered in both horizontal and vertical polarities, in order to maximize the received emissions. This measurement was repeated for each of three EUT orientations: X-plane, Y-plane, and Z-plane. The worst-case orientation (highest emission) was X-plane.

Testing was performed from the lowest frequency generated by the EUT to the 10th harmonic of the fundamental. Spurious and harmonic emissions tests were performed with the EUT oriented in the X-plane.

Radiated Test Set-up, 30 - 1000 MHz



Radiated Test Set-up, 1-5 GHz



Duty Cycle Calculation

In any 100msec period, the maximum burst ON time is 42 msec.

Short pulse: 83.33 usec

Long pulse: 588.7 usec

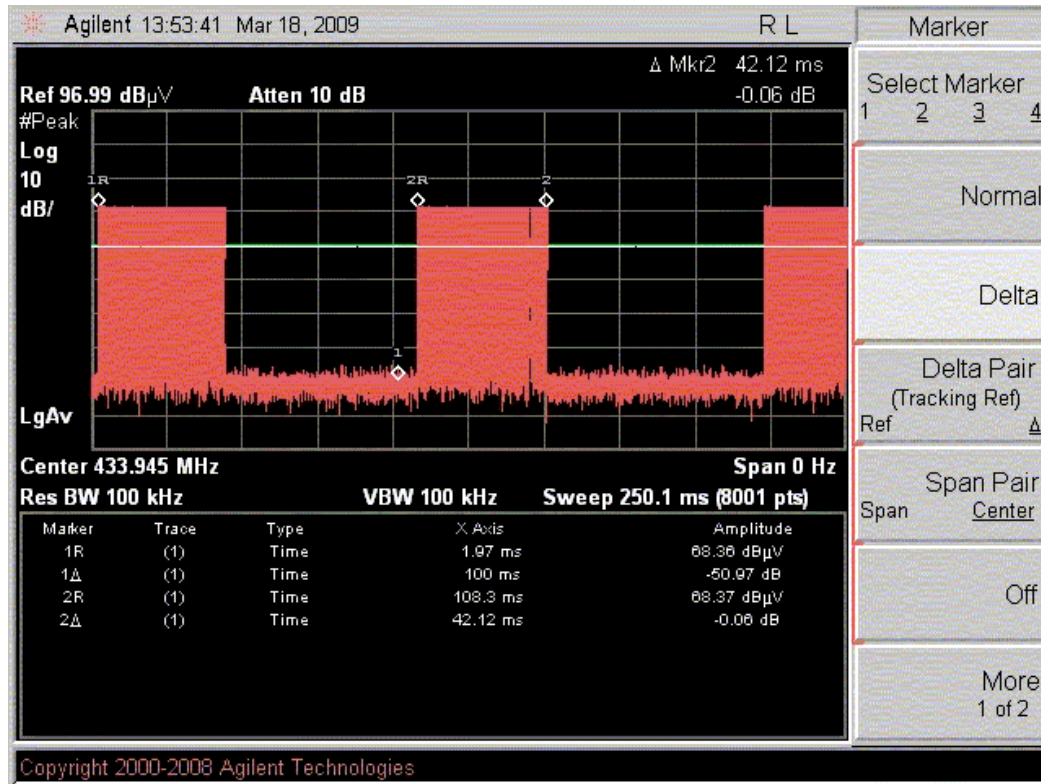
Number of short pulses in 12.8 msec: $29 \times (42/12.8) = 95$ pulses

Number of long pulses in 12.8 msec: $11 \times (42/12.8) = 36$ pulses

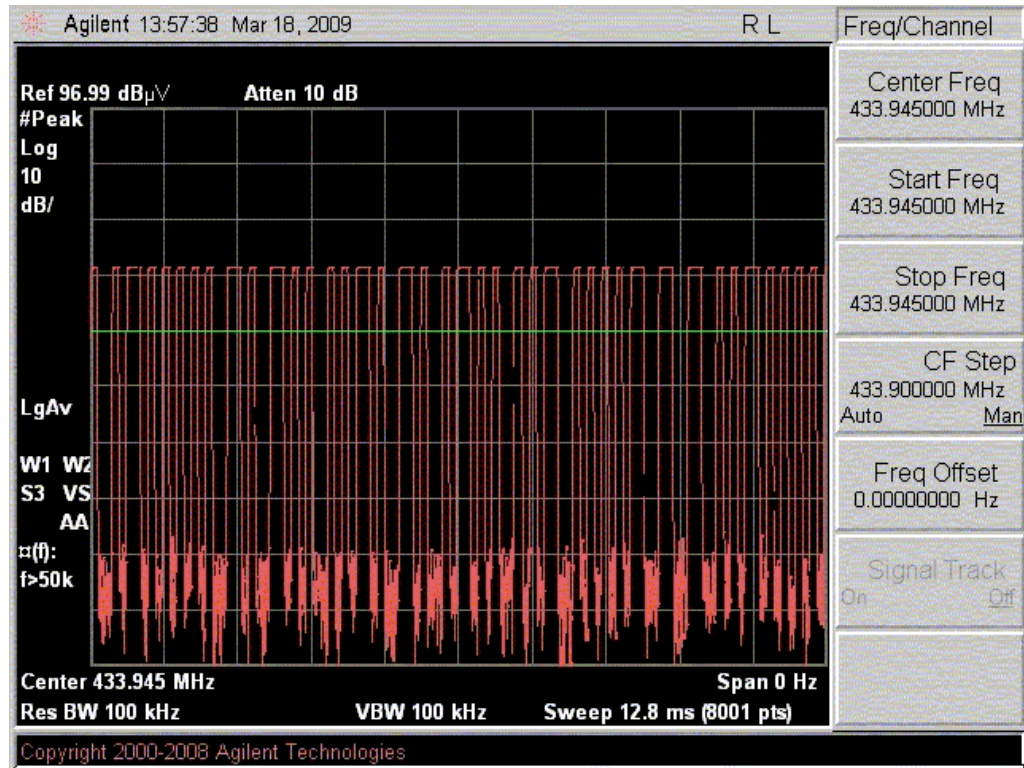
Total duty cycle correction = $20\log(((95 \times 0.0833) + (36 \times 588.7))/100) = -10.72$ dB

Note: It was not possible to distinguish individual pulses in the 42 msec burst plot, a shorter plot of 12.8 msec was required to do this.

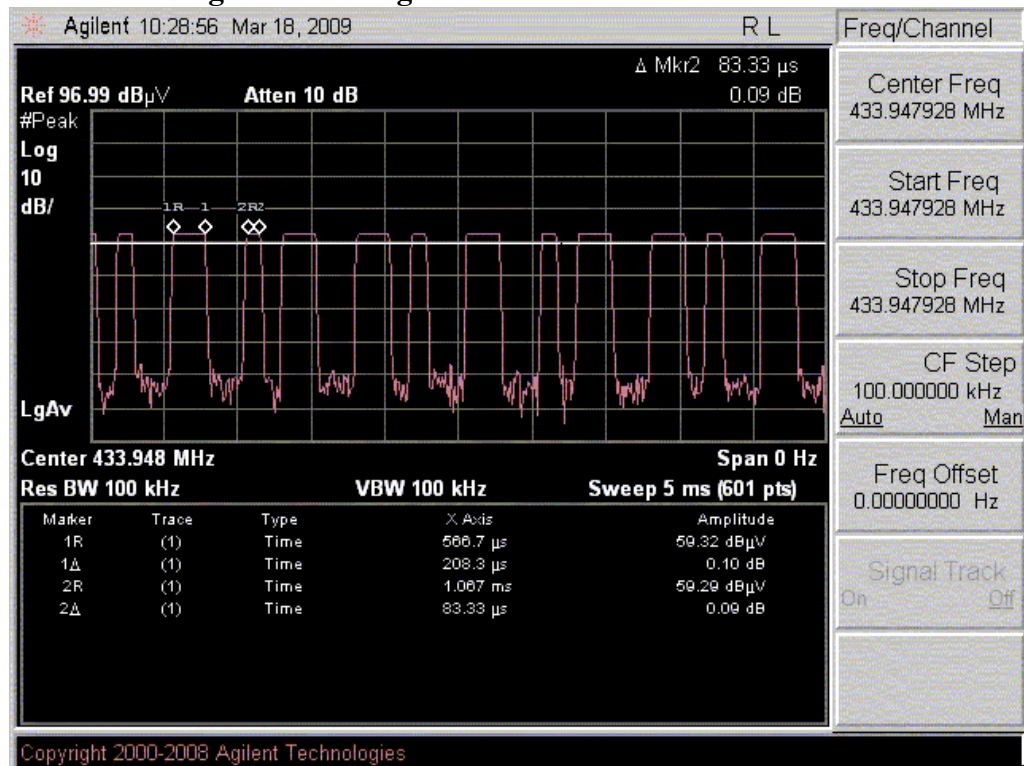
42 msec Bursts



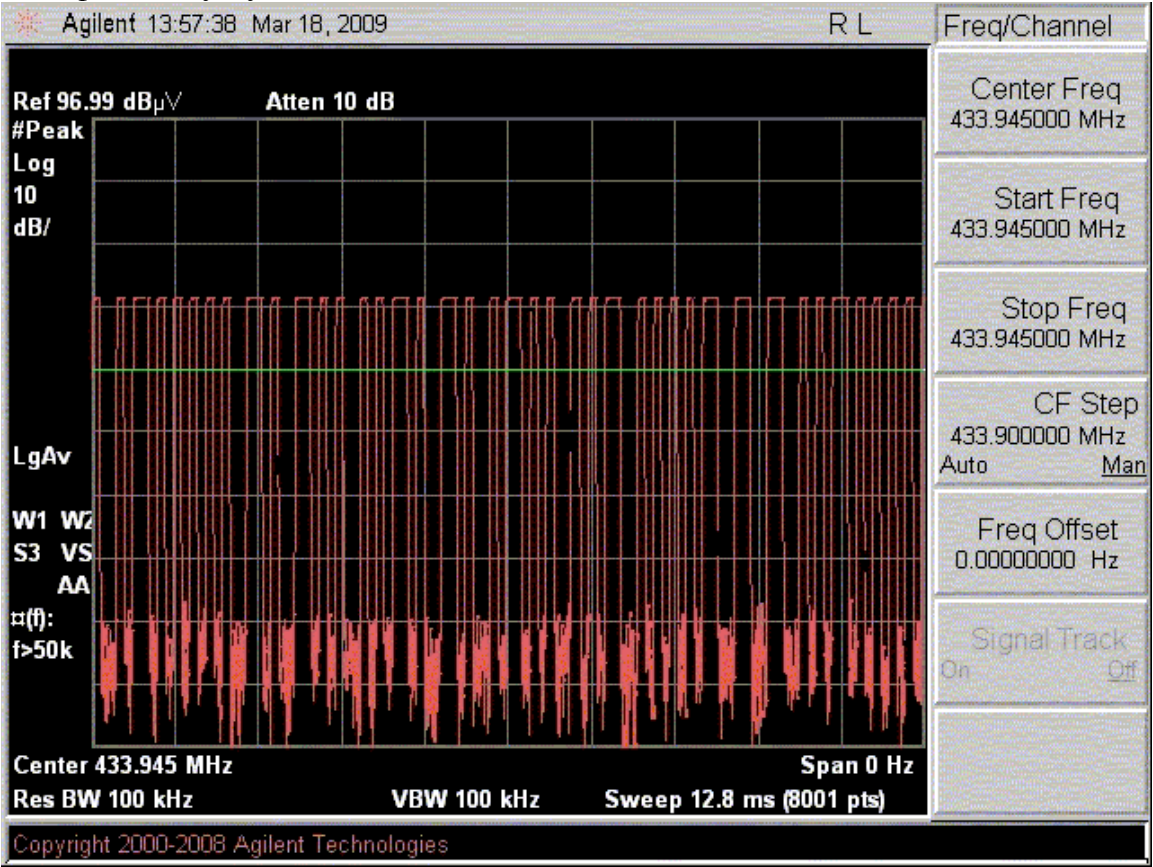
Number of Pulses in 12.8 msec



Short and Long Pulse Timing



Short pulse Duty Cycle



Test Results

EUT meets radiated emissions limits. Refer to spread sheets below.

Radiated Emissions to 10th Harmonic (433.92 MHz)

High Frequency Measurement																
Compliance Certification Services, Fremont 5m Chamber																
Company: FP Wireless Project: 09U12409 Date: 03/18/09 Test Engineer: Doug Anderson Configuration: Stand Alone Mode: Continuous Tx																
Test Equipment:																
Horn 1-18GHz T60; S/N: 2238 @3m <small>Hi Frequency Cables</small>				Pre-amplifier 1-26GHz T34 HP 8449B				Pre-amplifier 26-40GHz				Horn > 18GHz				
3' cable 22807700 3' cable 22807700				12' cable 22807600 12' cable 22807600				20' cable 22807500 20' cable 22807500				HPF		Reject Filter		
<small> Peak Measurements RBW=VBW=1MHz (>1GHz) & 100kHz (<1GHz) Average Measurements RBW=1MHz (>1GHz) & 100kHz (<1GHz) ; VBW=10Hz </small>																
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filtr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)	
Fundamental X-Position																
0.434	3.0	67.7	60.6	15.6	1.9	0.0	0.0	0.0	85.1	78.1	100.8	80.8	-15.7	-2.7	H	
0.434	3.0	46.6	39.2	15.6	1.9	0.0	0.0	0.0	64.1	56.7	100.8	80.8	-36.7	-24.1	V	
Fundamental Y-Position																
0.434	3.0	57.7	50.7	15.6	1.9	0.0	0.0	0.0	75.2	68.2	100.8	80.8	-25.6	-12.7	H	
0.434	3.0	64.6	57.5	15.6	1.9	0.0	0.0	0.0	82.0	74.9	100.8	80.8	-18.8	-5.9	V	
Fundamental Z-Position																
0.434	3.0	59.5	52.5	15.6	1.9	0.0	0.0	0.0	77.0	69.9	100.8	80.8	-23.8	-10.9	H	
0.434	3.0	64.8	57.8	15.6	1.9	0.0	0.0	0.0	82.3	75.3	100.8	80.8	-18.5	-5.5	V	
2nd Harmonic X-Position																
0.868	3.0	42.4	35.1	21.3	2.6	-28.0	0.0	0.0	38.3	31.1	80.8	60.8	-42.5	-29.8	H	
0.868	3.0	33.3	30.5	21.3	2.6	-28.0	0.0	0.0	29.2	26.4	80.8	60.8	-51.6	-34.4	V	
3rd Harmonic and Higher X-Position																
1.302	3.0	57.6	41.9	25.5	2.7	-37.8	0.0	0.0	48.0	32.2	74	54	-26.0	-21.8	H	
1.736	3.0	54.8	40.0	26.9	3.2	-37.2	0.0	0.0	47.7	32.9	74	54	-26.3	-21.1	H	
2.170	3.0	58.0	41.4	27.9	3.6	-36.6	0.0	0.0	52.9	36.3	74	54	-21.1	-17.7	H	
2.604	3.0	47.6	33.8	28.6	4.0	-36.2	0.0	0.0	44.1	30.2	74	54	-29.9	-23.8	H	
3.038	3.0	53.0	37.8	29.8	4.4	-35.9	0.0	0.0	51.3	36.0	74	54	-22.7	-18.0	H	
3.472	3.0	48.8	35.2	30.8	4.7	-35.5	0.0	0.0	48.9	35.3	74	54	-25.1	-18.7	H	
3.905	3.0	43.2	29.8	31.8	5.1	-35.1	0.0	0.0	45.1	31.6	74	54	-28.9	-22.4	H	
3rd Harmonic and Higher Y-Position																
1.302	3.0	57.5	41.9	25.5	2.7	-37.8	0.0	0.0	47.8	32.2	74	54	-26.2	-21.8	V	
1.736	3.0	55.2	40.4	26.9	3.2	-37.2	0.0	0.0	48.1	33.2	74	54	-25.9	-20.8	V	
2.170	3.0	63.5	44.2	27.9	3.6	-36.6	0.0	0.0	58.4	39.1	74	54	-15.6	-14.9	V	
2.604	3.0	49.0	35.0	28.6	4.0	-36.2	0.0	0.0	45.4	31.4	74	54	-28.6	-22.6	V	
3.038	3.0	51.5	36.9	29.8	4.4	-35.9	0.0	0.0	49.8	35.2	74	54	-24.2	-18.8	V	
3.472	3.0	46.0	33.0	30.8	4.7	-35.5	0.0	0.0	46.1	33.0	74	54	-27.9	-21.0	V	
3.905	3.0	45.6	32.2	31.8	5.1	-35.1	0.0	0.0	47.4	34.0	74	54	-26.6	-20.0	V	
4.339	3.0	41.3	27.5	32.3	5.4	-34.9	0.0	0.0	44.1	30.3	74	54	-29.9	-23.7	V	
Rev. 11.10.08																
f	Measurement Frequency					Amp	Preamp Gain					Avg Lim	Average Field Strength Limit			
Dist	Distance to Antenna					D Corr	Distance Correct to 3 meters					Pk Lim	Peak Field Strength Limit			
Read	Analyzer Reading					Avg	Average Field Strength @ 3 m					Avg Mar	Margin vs. Average Limit			
AF	Antenna Factor					Peak	Calculated Peak Field Strength					Pk Mar	Margin vs. Peak Limit			
CL	Cable Loss					HPF	High Pass Filter									

Occupied Bandwidth Requirement: 15.231(c)

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

Test procedure

The Occupied Bandwidth measurement function was activated. The RES BW was set to 100kHz, VID BW to 300 kHz.

Test Results

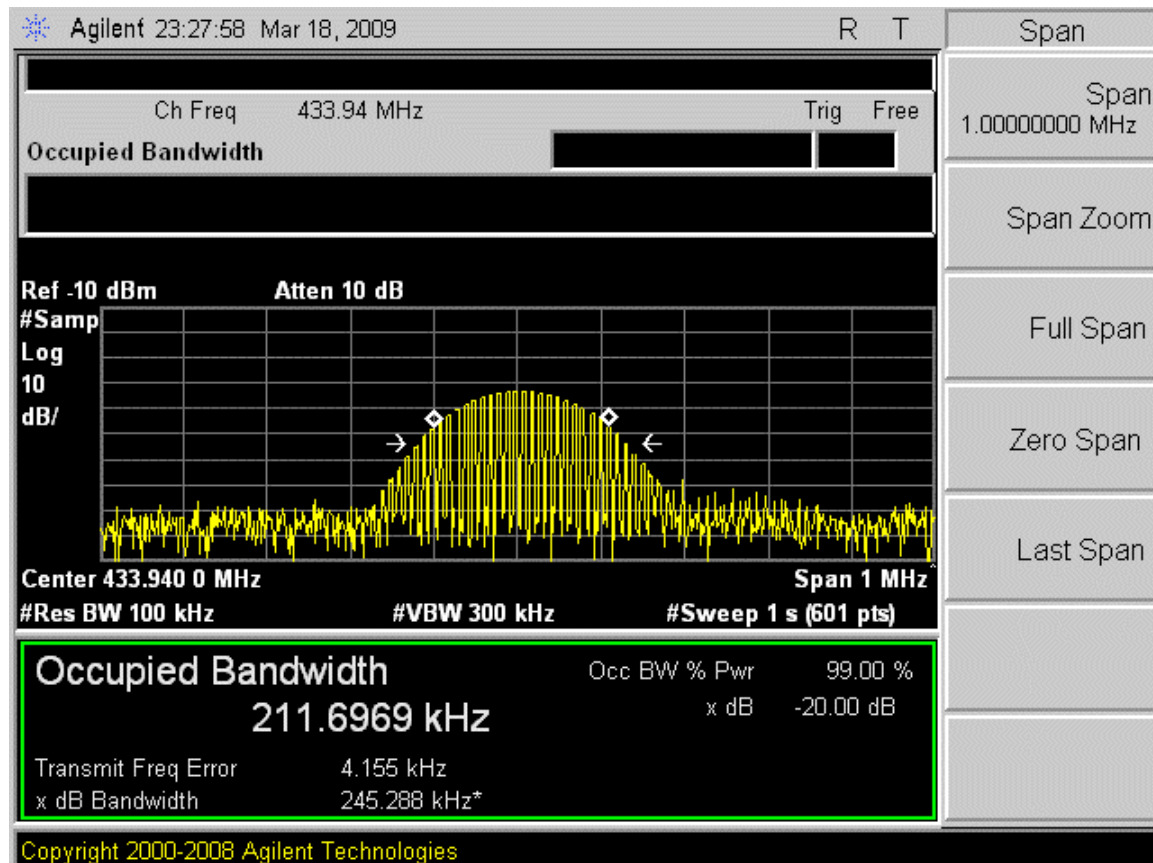
Test results were plotted for 99% bandwidth and -20 dBc bandwidth.

Maximum -20c bandwidth measured: 245.288 kHz

Maximum allowed: $0.25\% \times 433.92\text{MHz} = 1.085\text{ MHz}$

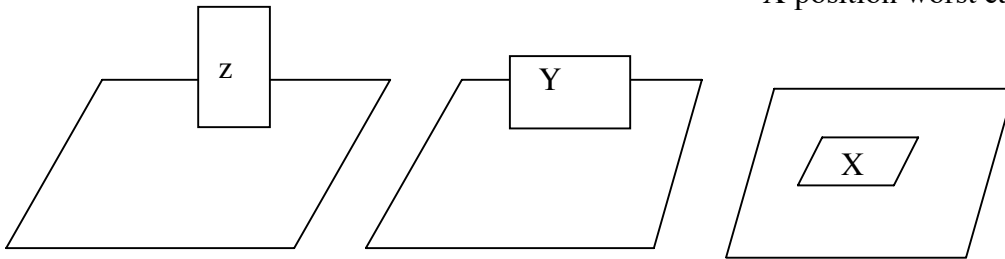
The worst-case occupied bandwidth is well below the maximum allowed by the Rules

Emission Bandwidth Plot



Radiated Test Set-Up Photographs

X position worst case



X-position Back

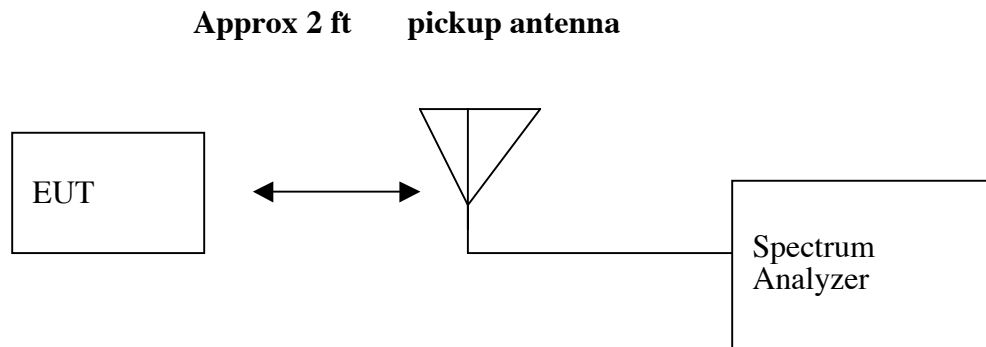


X-Position Front



Occupied Bandwidth Test

(Photo not available)



END OF REPORT