September 30, 1998

Rich Fabina, Engineer

Federal Communication Commission
Equipment Approval Services
7435 Oakland Mills Road
Columbia, Maryland 21046
(301) 725-1585 x 220 Fax: (301) 344 2050

Subject: 731 Confirmation Number EA91296; Correspondence ID : 3549

Mr. Fabina:

The additional information requested, (Correspondence ID: 3549), for the application requesting FCC ID: F9CC1R-1, and having Form Confirmation Number EA91296, should be contained within this document.

Should you require any further information concerning this application, please contact me anytime via any the following methods:

- Phone : (864) 843 – 5158 or 0303
- Fax : (864) 843 – 1812
- Email : montysimmons@prodigy.net

Best Regards,

William Monty Simmons
Certification Specialist
Compliance Test Laboratories, Inc.

ISSUE ONE : EMISSION TESTING

THE REQUEST

1. In accordance with Section 15.31(m) of the FCC Rules, since this transmitter operates over a frequency range of 10 MHz, provide test data with it operating on two channels, a high channel and a low channel. You provided test data on one channel, but I don't know if it's acceptable (See item 2 below).

2. The hopping for this transmitter must be stopped during radiated emissions testing to simplify the measurements. Please confirm that the hopping was stopped for the radiated emission measurements submitted on 915 MHz. If the hopping was not stopped, please remeasure radiated emissions with the hopping stopped on two channels as requested in item 1. If the hopping cannot be stopped, you will have to describe the hopping sequence, the channel dwell time and the radiated emission test procedures is sufficient detail to enable me to determine that you have maximized the emissions from this transmitter for the two channels that must be measured.

REPLY

- **The Hopping Transmitter was indeed configured to prevent hopping from frequency to frequency and forced to continually transmit at 915MHz.**

- **Additional test data at 918 MHz is supplied in Attachment A of this reply.**

ISSUE TWO : TRANSMITTER SCHEMATICS

THE REQUEST

3. Submit legible schematic diagrams of this transmitter. I have done everything that I can do to read them and they are simply unreadable as originally submitted.

REPLY

Three JPEG files were uploaded at the same time this text file was uploaded. These JPEG files contain images of the schematic diagrams you requested.

ISSUE THREE : TYPE OF TRANSMITTER

THE REQUEST

4. Confirm that this transmitter operates in accordance with Section 15.249 of the FCC Rules and does not operate as a spread spectrum transmitter in accordance with Section 15.247 of the Rules.

REPLY

- **The EUT described in the report for requested FCC ID F9CC1R-1 is indeed a hopping transmitter that operates in accordance with Section 15.249 of the FCC Rules.**

- **In addition, the manufacturer of the EUT indicates that the EUT shall be operated in accordance to Section 15.249.**

ISSUE FOUR : CONFIDENTIALLY REQUEST

THE REQUEST

5. Confidentiality of the block and schematic diagrams has been requested, but one other exhibit in the application was marked confidential by you. Please confirm that only the block and schematic diagrams require confidentiality.

THE REPLY

Confidentiality is requested only for the Block and Schematic diagrams.

Attachment A : Additional Emission Measurements

1 Microwave Radiated Emissions

1.1 Test Site Used

The microwave radiated electromagnetic emission amplitudes, between 900 MHz and 10 GHz, were acquired with the EUT setup on the CTL OATS. At frequencies where ambient noise levels prevented accurate data acquisition on the CTL OATS, the measurements were acquired in the three-meter semi-anechoic chamber.

1.2 Special Test Equipment Used

Special test equipment used to acquire the test data is given below. Please refer to the table in Section 6.3.2 for more detailed information.

- For frequencies between 1GHz and 18GHz, the Spectrum Technologies Horn Antenna was used.
- For frequencies above 1GHz, the HP 8449B preamplifier was used.

1.3 Test Procedure

The EUT was setup on a RF transparent table that rests on an EMCO turntable capable of rotating the EUT from 0 to 360 degrees. Cables were oriented to maximize the field strength amplitudes. The receiving antenna was set to fixed height of 1-meter during the test (line of sight). The test distance on the OATS and in the semi-anechoic chamber was three meters. Measurements were manually acquired via the following test procedure:

(1) To facilitate easier and more accurate data acquisition, modify the EUT so that it transmits continuously.

(2) Determine the fundamental frequency, and the first ten harmonics.

(3) Tune the receiver to the frequency of interest;
   (a) Setup measurement instrumentation in proper measurement mode;
   (b) Place the antenna in the horizontal position;
   (c) Rotate EUT and record the maximum emission level detected, antenna height, antenna polarization, and turntable angle;
   (d) Place the antenna in the vertical position and repeat step (c);
   (e) Return to step (3) and repeat for each harmonic of interest;
   (f) Create a report presenting the test results;

1.4 Calculations

The calculation process for intentional microwave radiated emissions is as indicated below.

The microwave emissions were measured in power (dBm) rather than field strength (dBuV). The dBm power reading for the EUT described is converted to dBuV by adding a conversion factor of 76.3 (in a 50-Σ measurement system).

- **Conversion Factor $V_{dB\mu V}$ to P_{dBm}**

(1) P_1 = reference power (watts); P_2 = measured power (watts);
(2) [by definition] Bel = B = $\text{Log}(P_2/P_1)$;
(3) [by definition] dB = 10 Log (P_2/P_1);
(4) [use $P = V^2/Z$ relationship] dB = 20 Log (V_2/V_1) + 10 Log(Z_1/Z_2);
(5) [where $Z_1 = Z_2$] dB = 20 Log (V_2/V_1);
(6) [reference = 1 Volt] dBV = 20 Log (V_2);

dBm = decibels above one mW

(7) [Using Equation (6) above] $V_{dB\mu V} = 90 + P_{dBm} + 10\ \text{Log}_{10}(Z)$;
(8) [For Z = 50-Σ] $V_{dB\mu V} = 107 + P_{dBm}$

- **Duty Cycle Correction**

Time Slot : 100ms
Message Duration : (96 data bits / message) (1/16384 sec / data bit) = 5.859 ms / message
Actual Transmit Time : (message duration) / 2 = 2.93 ms / message
Percent Duty Cycle : [(Transmit Time) / 100ms)] (100) = 2.93 %
(9) **Voltage Correction : 20 Log10 (Duty Cycle) = 30.7 dB**

- **Conversion Factor $V_{dB\mu V}$ to P_{dBm} After Compensating for Duty Cycle**

(10) [Using Equation (8) and Correction (9)] $V_{dB\mu V} = 76.3 + P_{dBm}$

- **FCC Limit Correction via 47 CFR 15.249**

(11) 47 CFR 15.249(a) Limit = 500 µV/m
[Convert to dBµV using equation (6)] dBµV = 20 Log_{10} (500) = 53.98
(12) 47 CFR 15.249(d) Peak Correction = + 20dB

(13) Corrected §15.429 FCC Limit = 73.98 or 74.0 dBµV

Equation (10) and Limit (13) given above are used to determine compliance as given below:

(1) Margin (dBuV/m) = Applicable Limit (dBuV) - Field Strength (dBuV/m)

(2) Field Strength (dBuV/m) = Meter Reading (dBm) + 76.3 + Loss (dB) - Gain (dB)
- Loss = Cable Loss (dB) + Antenna Factor (dB) + Attenuation (dB)
- Gain = Amplifier Gain (dB)

EXAMPLE CALCULATION

Frequency: 2.0 GHz
- Meter Reading = -47 (dBm)
- Cable Loss = 15 (dB)
- Antenna Factor = 16 (dB)
- Attenuation = 0 (dB) [no attenuator external to receiver]
- Amplifier Gain = 34.4 (dB) [preamplifier in signal path]
- Applicable Limit = 74 (dBuV/m)

Margin (dB) = 74 (dB) - [-47 (dBm) + 76.3 + 15 (dB) +16 (dB) - 34.4 (dB)] = 48.1 dB

1.4.1 Microwave Radiated Emissions Data

Test Date : September 23, 1998
Test Performed : Radiated Emissions
Limit Values : 47 CFR §15.249(a) - (d)
Test Distance : 3 Meters

EUT DESCRIPTION		ENVIRONMENTAL CONDITIONS	
(1)	Centron RMR Electricity Meter	Barometric Pressure	: 30.21 mmHg
(2)	EUT S/N: 14915930	Temperature	: 34 °C
(3)	Transmitting Mode : Continuous, Not Hopping	Relative Humidity	: 46 %

Fundamental Tx Frequency (F_0) = 915.00MHz

Harmonic	Frequency (MHz)	Reading (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Amp. Gain (dB)	Corrected Reading (dBuV/m	FCC Limit (dBuV/m)	Margin y Limit - CR (dB)	Antenna Polarity (H / V)
1(F_0)	918	61.4	23.1	7.2	0.0	91.68	94.0	2.32	V

Harmonics

Harmonic	Frequency (MHz)	Reading (dBm)	Conversion Factor (dBm to dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Amp. Gain (dB)	Corrected Reading (dBuV/m	FCC Limit (dBuV/m)	Margin (dB)	Antenna Polarity (H / V)
2(F_0)	1,836.18	- 39.9	76.3	29.0	11.5	34.4	42.5	74.0	31.5	V
3(F_0)	2,754.27	- 65.8	76.3	31.7	14.8	34.1	22.9	74.0	51.1	H
4(F_0)	3,672.36	- 61.5	76.3	33.2	17.3	34.3	31.0	74.0	43.0	V
5(F_0)	4,590.45	-70.3	76.3	34.2	19.0	34.4	24.8	74.0	49.2	V
6(F_0)	5,508.54	- 76.1	76.3	36.3	21.3	34.4	23.4	74.0	50.6	V
7(F_0)	6,405	----	----	38.0	26.9	----	----	74.0	----	----
8(F_0)	7,320	----	----	39.6	29.8	----	----	74.0	----	----
9(F_0)	8,235	----	----	39.6	32.2	----	----	74.0	----	----
10(F_0)	9,150	----	----	40.7	36.2	----	----	74.0	----	----
11(F_0)	10,065	----	----	----	----	----	----	74.0	----	----

- : 1(F_0) measurement made using the CISPR Quasi-Peak detection mode; BiLog Antenna
- : 2(F_0) through 5(F_0) measurement made using PEAK detection mode; Horn Antenna