

TEST REPORT

Ref. Report No.

06-1341-014-01

Name and address of the applicant

Felio Electronics(M) Sdn. Bhd.
Lot 5, Jalan Gudang 16/9, Seksyen 16,
40200 Shan Alam, Selangoe D.E., Malaysia

Standard / Test regulation

FCC Part 15, Subpart C

Test result

Pass

Incoming date : May 03, 2006

Test date : May 15, 2006

Test item(s) ;

Security/Remote Control Transmitter
(Tire Pressure Monitoring System)

Model/type ref. ;

TPMS 315MHz

Manufacturer ;

Felio Electronics(M) Sdn. Bhd.

Additional information ;

-Required Authorization : Certification
-FCC ID. : QN5TPMS-TX
-Note : Test report(Certification) of
Receiver portion of this System is issued on
Ref. Report No.06-1341-014-02

Issue date : Jun 05, 2006

This test report only responds to the tested sample and shall not be reproduced except in full without written approval of the Korea Testing Laboratory.

Tested and reported by



Sung-Kyu Cho, Engineer

Reviewed by



Seok-Jin Kim , Telecommunication Team
Manager

KOREA TESTING LABORATORY

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I. GENERAL INFORMATION

1. Grantee's Name and Mailing Address : Felio Electronics(M) Sdn. Bhd.
Lot 5, Jalan Gudang 16/9, Seksyen 16,
40200 Shan Alam, Selangoe D.E., Malaysia
2. Manufacturer's Name and Mailing Address : Felio Electronics(M) Sdn. Bhd.
Lot 5, Jalan Gudang 16/9, Seksyen 16,
40200 Shan Alam, Selangoe D.E., Malaysia
3. Equipment Descriptions
- 3.1 Operating Frequency : 315 MHz
3.2 Type of Emission : Pulse Coded Signal
3.3 Power Supply : DC 3.0 V (Battery)
4. Rules and Regulations : FCC Part 15, Subpart C
5. Measuring Procedure : ANSI C63.4-2003
6. Place of Measurement : Absorber-lined Room (KTL)
7. Date of Measurement
- 7.1 Conducted Emission : Not Applicable
7.2 Radiated Emission : May 15, 2006

II. GENERAL REQUIREMENTS OF THE EUT

1. Labeling Requirement (Section 15.19)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interface, and (2) this device must accept any interference received, including interference that may cause undesired operation.

1.1 Location of Label : User's Guide Manual

1.2 How Applied : Printed

2. Information to User (Section 15.21)

The following or similar statements were provided in the manual for user instruction.

Please refer page 1 of the attached manual for details.

CAUTION : Any changes or modifications in construction of this device which are not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

3. Special Accessories (Section 15.27)

3.1 Were the special Accessories provided? [] yes, [x] no

3.2 If yes, details for the special accessories are as follows :

3.3 If yes, were the appropriate instructions provided on the first page of the text concerned with the installation of the device?

[] yes, [] no

3.4 Are these accessories provided of the type which can be readily obtained from multiple retail outlets ?

[] yes, [] no

And therefore does the manual specify what additional components or accessories are required to used in order to comply with the Rules?

[] yes, [] no

4. Compliant Conditions (Section 15.231)

4.1 Was the EUT used for continuous transmissions, voice or video, and the radio control of toys ?

[] yes, [☒] no

4.2 Was the EUT manually operated ?

[] yes, [☒] no

If yes, did the EUT employ a switch that would automatically deactivate the transmitter within not more than 5 seconds of being released ?

[] yes, [] no

4.3 Was the EUT automatically activated ?

[☒] yes, [] no

If yes, did the EUT cease transmission within 5 seconds after deactivation ?

[☒] yes, [] no

4.4 Was the EUT used for periodic transmissions at regular predetermined intervals ?

[] yes, [☒] no

III. RADIATED EMISSION MEASUREMENT (Section 15.231)

1. Test Procedure

1.1 Preliminary Testing for Reference

Preliminary testing was performed in a KTL absorber-lined room to determine the emission characteristics of the EUT. The EUT was placed on the wooden table which has dimensions of 0.8 meters in height, 1 meter in length and 1.5 meters in width. Receiving antenna (Biconi-Log antenna : 30 to 1000 MHz or Horn Antenna : 1 to 18 GHz) was placed at the distance of 1 meter from the EUT.

An attempt was made to maximize the emission level with the various configurations of the EUT. Emission levels from the EUT with various configurations were examined on a spectrum analyzer connected with a RF amplifier and graphed by a plotter.

1.2 Final Radiated Emission Test at an Absorber-Lined Room

The final measurement of radiated field strength was carried out in a KTL absorber-lined Room that was listed up at FCC according to the "Radiated Emissions Testing" procedure specified by ANSI C63.4.

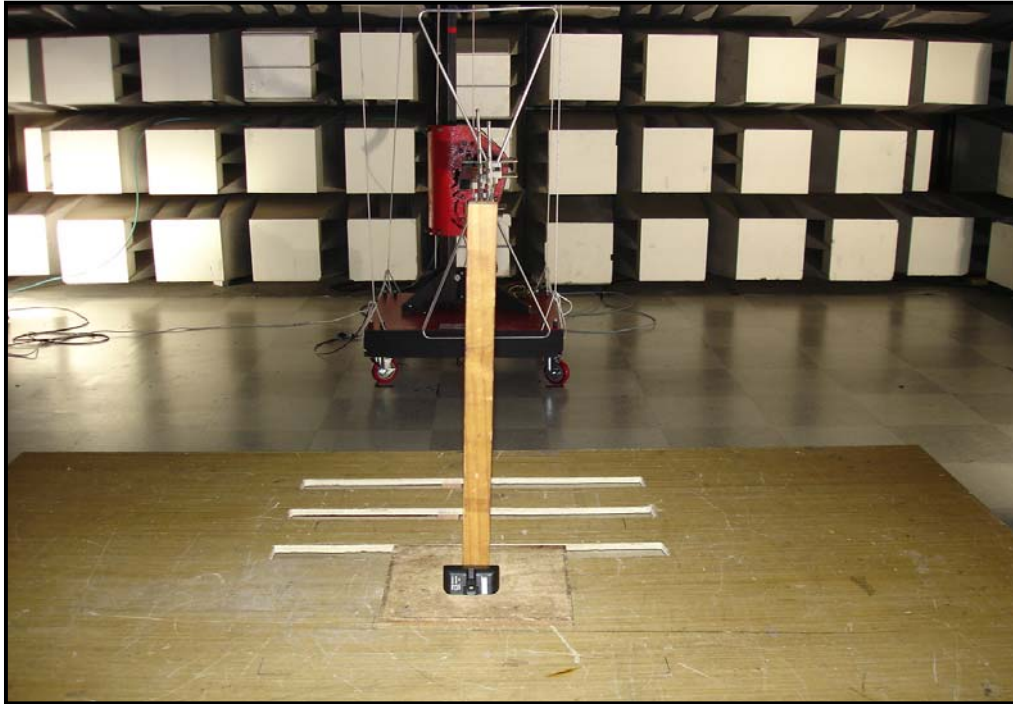
Based on the test results in preliminary test, measurement was made in same test set up and configuration with 3 orthogonal planes which produced maximum emission level. Receiving antenna was installed at 3-meter distance from the EUT, and was connected to an EMI receiver or spectrum analyzer with a RF amplifier.

Turntable was rotated through 360 degrees and receiving antenna height was varied from 1 to 4 meters above the ground plane with horizontal and vertical polarization to read maximum emission level.

If necessary, the radiated emission measurements could be performed at a closer distance than specified distance to ensure higher accuracy and their results were extrapolated to the specified distance using an inverse linear distance extrapolation factor(20dB/decade) as per Section 15.31(f).

The maximum emission level from the EUT occurred in such configuration as shown in the following photograph.

2. Photograph of the test configuration



3. Sample Calculation

The measured field strength was determined by averaging one complete pulse train including blanking interval because the pulse repetition time of the EUT(=27.375 ms) does not exceeds 0.1 seconds (15.35(c)). See graphs of page 12.

With the resolution bandwidth set at 100 kHz, the EUT produces a pulse spectrum on the spectrum analyzer because the bandwidth of the analyzer is greater than or equal to the PRF.

Therefore, as mentioned in HP Application Note 150-2 (page 11), the pulse desensitization(α_p) equals zero and the display amplitude is essentially a peak level.

The field strengths were calculated as follows ;

$$- E_{\text{peak}} (\text{dB}) = E_{\text{reading}} (\text{dB}) + \alpha_p + \text{Ant. Factor \& Cable Loss (dB)}$$

- To get the average voltage values in the one complete pulse train blanking intervals,

$$E_{\text{averg.}} (\mu\text{V}) = \frac{E_{\text{peak}} (\mu\text{V}) \times \text{Total pulse time of transmitter in the one complete pulse train (sec)}}{T_t (\text{sec})}$$

where,

$$\begin{aligned} \text{Pulse desensitization } (\alpha_p) &= 20\log(\tau_{\text{eff}} \times B \times K), \text{ HP AN150-2 (page 14)} \\ &= \frac{0}{0} \quad (\text{See 1.4}) \end{aligned}$$

$$\begin{aligned} \text{Total pulse time of transmitter} \\ \text{in the one complete pulse} \\ \text{train (maximum value)} &= \underline{9.375 \text{ msec}} \quad (\text{See the graph of page 12}) \end{aligned}$$

$$\begin{aligned} \text{One complete pulse train} \\ \text{time including blanking} \\ \text{interval } (T_t) &= \underline{27.375 \text{ msec}} \quad (\text{See the graph of page 12}) \end{aligned}$$

For example :

the average values at 315.0 MHz

Spectrum Analyzer measured values	:	<u>55.4</u>	dB μV
- Preamplifier	:	<u>0.0</u>	dB
+ Pulse Desensitization (α_p)	:	<u>0.0</u>	dB
+ Ant. Factor & Cable Loss	:	<u>15.8</u>	dB/m
<hr/>			
Voltage Peak Levels	:	<u>71.2</u>	dB $\mu\text{V/m}$
		(= <u>3630.8</u>)	$\mu\text{V/m}$

Voltage Average Levels

$$\begin{aligned} &= \frac{E_{\text{peak}} \times \text{Total pulse time of transmitter in the one complete pulse train}}{T_t} \\ &= \frac{3630.8 \mu\text{V/m} \times 9.375 \text{ msec}}{27.375 \text{ msec}} = \underline{1243.4 \mu\text{V/m}} = \underline{61.9 \text{ dB}\mu\text{V/m}} \end{aligned}$$

4. Measurement Data

- Resolution Bandwidth : - Peak (3 dB Bandwidth: 120 kHz for ranges below 1 GHz)
-Peak (3 dB Bandwidth : 1 MHz for ranges over 1 GHz)
- Measurement Distance: 3 Meter

Frequency (MHz)	* D.M.	* A.P.	Measured Value (dB μ V)	* A.F. + C.L. (dB/m)	* A.G. (dB)	* D.C.F. (dB)	Emission Level		Limit (dB μ V/m)	** Margin (dB)
							Peak (dB μ V/m)	Average (dB μ V/m)		
315.06	P	H	55.4	15.8	-	--	71.2	61.9	75.6	13.7
630.12	P	V	19.1	23.7	-	--	42.8	33.5	55.6	22.1
945.20	P	H	37.9	28.3	-30.0	--	36.2	26.9	55.6	28.7
--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--
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--	--	--	--	--	--	--	--	--	--	--
<p>Note</p> <p>The upper frequency range of this test was 5 GHz. The observed EMI Test Receiver's noise floor level with RF preamplifier was 30.0 dBμV for range below 1GHz and 35.0 dBμV for range above 1GHz. And all other emissions not reported on data were more than 30 dB below the permitted level.</p> <p>* D.M. : Detect Mode (P : Peak, Q : Quasi-Peak, A : Average) A.P. : Antenna Polarization (H : Horizontal, V : Vertical) A.F. : Antenna Factor C.L. : Cable Loss A.G. : Amplifier Gain D.C.F. : Distance Correction Factor < : Less than</p> <p>** Margin (dB) = Emission Level (dB) - Limit (dB)</p>										

Note ;

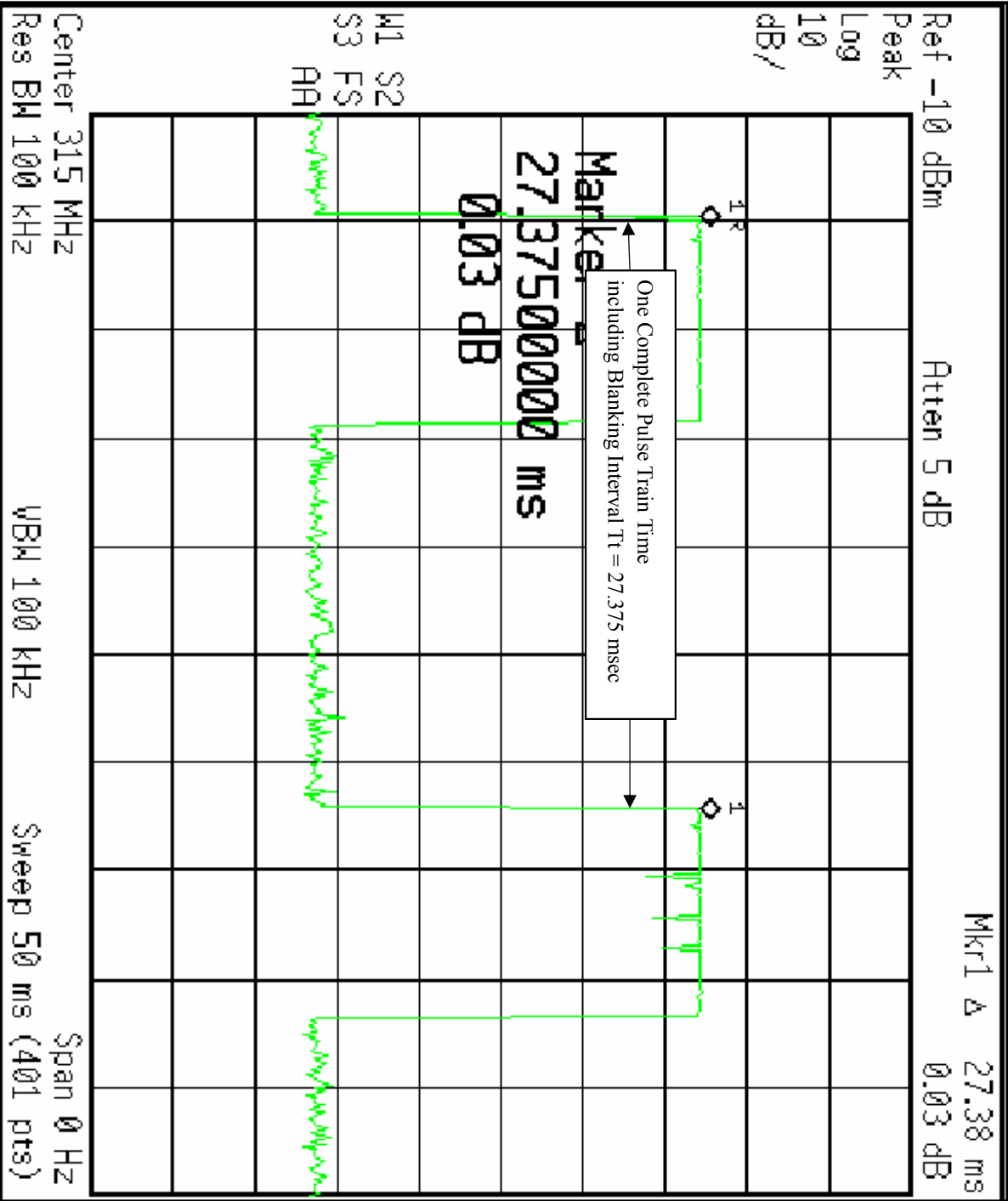
- (1) Fundamental emissions from the intentional radiators were not located within any of frequency bands described in section 15.205(a) listed below ;

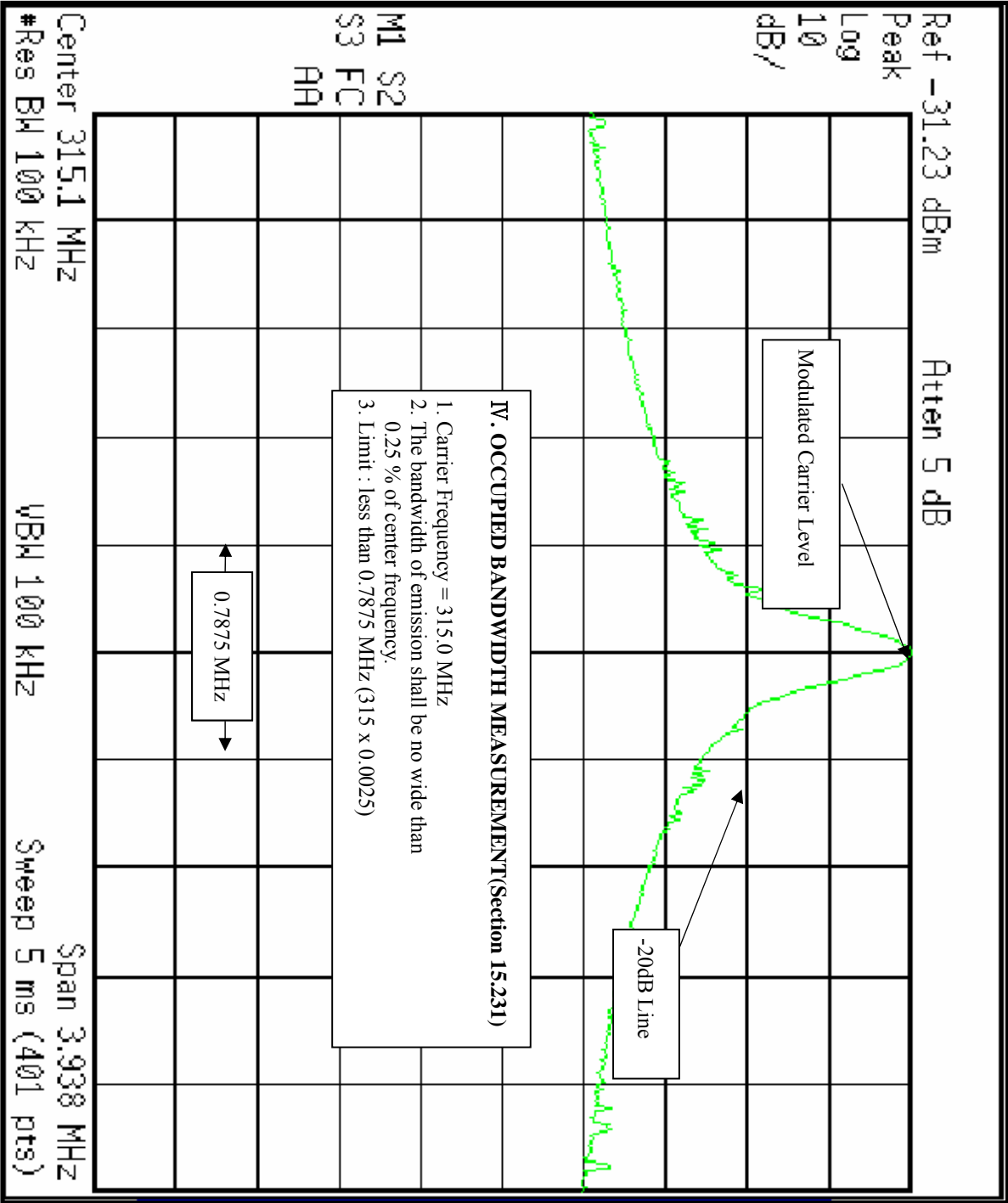
MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.25
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.1775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	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			

The field strength of emissions appearing within above frequency bands did not exceed the limits shown in section 15.209. At frequency equal to or less than 1000MHz, compliance with the limits section 15.209 was demonstrated using measurement employing a CISPR quasi-peak detector. Above 1000MHz, demonstrated based on the average value of the measured emissions.

- (2) If the intentional radiator was operated under the radiated emission limits of the general requirements of section 15.209, it's fundamental emissions were not located in the frequency bands 54-72MHz, 76-88MHz, 174-216MHz, 470-860MHz.
- (3) The level of any unwanted emissions from an intentional radiator did not exceed the level of the fundamental emission.
- (4) Radiated and spurious emissions were checked from 30MHz to 3GHz. And all other emissions not reported on data were more than 20 dB below the permitted level.

Reference Data : Pulse Train Time





V. TEST EQUIPMENT USED FOR MEASUREMENTS

<u>Equipment</u>	<u>Model No.</u>	<u>Manufacturer</u>	<u>Serial No.</u>	<u>Effective Cal. Duration</u>
[x] EMI Receiver (20 MHz-1 GHz)	ESVS30	R & S	830516/002	03/25/06-03/25/07
[x] EMI Receiver (20 Hz-7 GHz)	ESI	R & S	835571/004	10/14/05-10/14/06
[x] Spectrum Analyzer (9 kHz-26.5 GHz)	8563A	H. P.	3222A02069	03/16/06-03/16/07
[x] Spectrum Analyzer (3 Hz-50 GHz)	E4448A	Agilent	MY43360322	03/16/06-03/16/07
[x] Pre-Amplifier (0.1-3000 MHz, 30 dB)	8347A	H. P.	2834A00543	05/19/06-05/19/07
[x] Pre-Amplifier (1-26.5 GHz, 35 dB)	8449B	H. P.	3008A00302	06/14/05-06/14/06
[] Signal Generator (250 kHz-20 GHz)	E8257D	Agilent	MY44320379	12/27/05-12/27/06
[] LISN(50 Ω , 50 μ H) (10 kHz-100 MHz)	ESH3-Z5	R & S	826789/009	05/16/06-05/16/07
[] Plotter	7470A	H. P.	3104A21292	-
[] Tuned Dipole Ant. (30 MHz-300 MHz)	VHA 9103	Schwarzbeck	-	*
[] Tuned Dipole Ant. (300 MHz-1 GHz)	UHA 9105	Schwarzbeck	-	*
[x] BiConi-Log Ant. (30 MHz -1 GHz)	VULB9168	Schwarzbeck	9168-167	*
[x] Horn Ant. (1 GHz-18 GHz)	3115	EMCO	-	*
[] Horn Ant. (18 GHz-40 GHz)	3116	EMCO	-	*
[] Active Loop Ant. (9 kHz-30 MHz)	6502	EMCO	2532	*
[] DC Power Supply	6260B	H.P.	1145A04822	-
[] Shielded Room (5.0 m x 4.5 m)	-	SIN-MYUNG	-	-

* Each set of antennas has been calibrated to ensure correlation with ANSI C63.5 standard. The calibration of antennas is traceable to Korea Standard Research Institute(KSRI)