

TEST REPORT

Ref. Report No.

99-341-053-1

This test report only responds to the tested sample and shall not be reproduced except

Name and address of the applicant

Radio Plus Co., Ltd.
174, Nae-Dong, Ohjung-Ku, Puchon-City,
Kyungki-Do, Korea 421-160

Standard / Test regulation

FCC Part 15, Subpart C

Test result

Pass

Incoming date : October 29, 1999

Test item(s) ;

Security/Remote Control Transmitter
(Car Alarm)

Model/type ref. ;

RCM-3000

Manufacturer ;

Radio Plus Co., Ltd.

Additional information ;

-Required Authorization : Certification
-FCC ID. : OT2RCM-3000T

Test date : November 2 ~ November 17, 1999

Issue date : December 7, 1999

in full without written approval of the the Korea Testing Laboratory.

Tested and reported by

Reviewed by

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**KOREA TESTING
LABORATORY**

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. GENERAL INFORMATION

1. Grantee Name and : Radio Plus Co., Ltd.
Mailing Address 174, Nae-Dong, Ohjung-Ku, Puchon-City
Kyungki-Do, Korea 421-160

2. Manufacturer's Name and : Radio Plus Co., Ltd.
Mailing Address 174, Nae-Dong, Ohjung-Ku, Puchon-City
Kyungki-Do, Korea 421-160

3. Equipment Descriptions

3.1 Operating Frequency : 434.79MHz
3.2 Type of Emission : FM Pulse Code Signal
3.3 Power Supply : DC 12.0V (Car Battery)
3.4 Additional Information ;

- Oscillator used : Crystal(48.31MHz) X 9 = 434.79MHz
- Frequency Multiplier used : 2SC3585

4. Rules and Regulations : FCC Part 15, Subpart C

5. Measuring Procedure : ANSI C63.4-1992

6. Place of Measurement : Absorber-lined room(3-Meter) of KAITECH

7. Date of Measurement

6.1 Conducted Emission : Not Applicable
6.2 Radiated Emission : November 17, 1999

. GENERAL REQUIREMENTS OF THE EUT

1. Labelling 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 interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

1.1 Location on Enclosure : Manual for Installation and Operating Instruction1.2 How Applied : Printing

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 device?
[] yes, [] no3.4 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, such as voice or video, and data transmission ?

☐ 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

5. Modification of the Equipment Under Test

☒ Any modifications were not made to the EUT during the testing since the test results were found of be complied with the FCC Rules with the EUT in the as received condition.

☐ Modification(s) was(were) made to the EUT in order to make it meet FCC Rules since it had shown non-compliance for some test items in the course of our testing.

- Status of non-compliance :

- Details of Modifications :

. INPUT POWER MEASUREMENT (Section 15.31)

INPUT POWER
419.25 mW

Note : 1. Input Power : $P_{Ove} = (P_p \times D)_{pulse} + P_D$

Where, P_p : Input Peak Power (= $V \times I_p$)

P_D : Input DC Power (= $V \times I_D$)

D : Duty Cycle (= $\tau_{eff} \times PRF$)

Measured Input Voltage (V) = 12.14 DCV

Measured Input Peak Current (I_p) = 28.30 mA

Measured Input Bias Current (I_D) = 25.11 mA

Measured An Effective Pulse Width (τ_{eff}) = 0.896 msec

Measured Pulse Repetition Frequency (PRF) = 372 Hz

2. Input current was measured using the current probe and the oscilloscope.

3. τ_{eff} and PRF were measured using the spectrum analyzer.

4. P_p = 12.14 DCV $\times$ 28.30 mA = 343.56 mW

P_D = 12.14 DCV $\times$ 25.11 mA = 304.84 mW

D = 0.896 msec $\times$ 372 Hz = 0.333

. 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(Biconical antenna : 30 to 300MHz, Log-periodic antenna : 200 to 1000MHz or Horn Antenna : 1 to 18GHz) was placed at the distance of 1 meter from the EUT.

The measurement was performed with main controller was connected. An attempt was made to maximize the emission level with the various configurations of the EUT. The position of the EUT was horizontally or vertically changed to find the worst case configuration.

Emissions level 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 a 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.

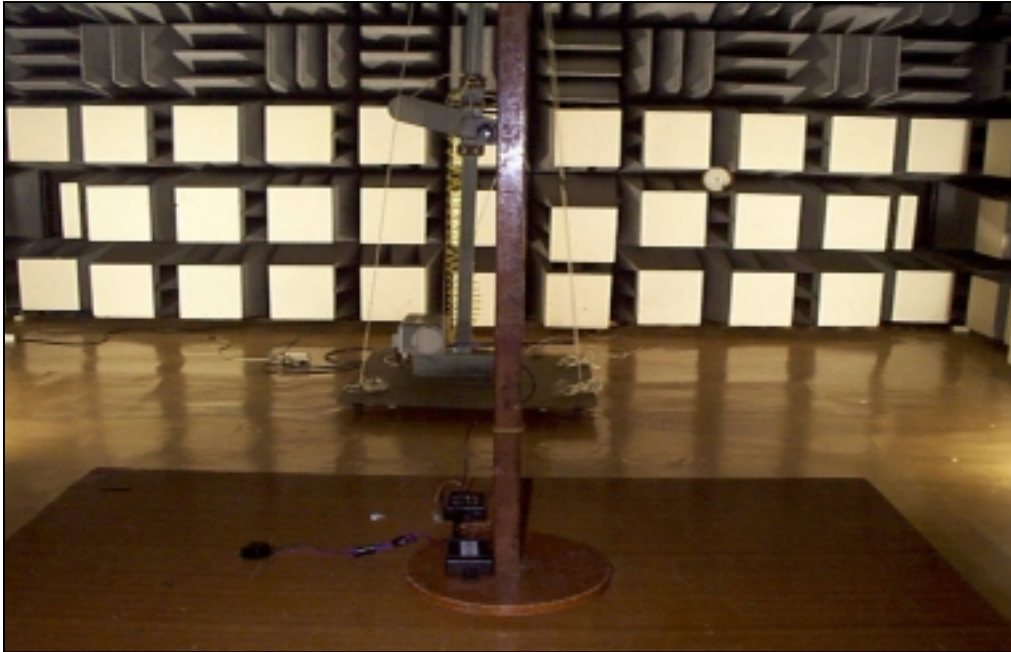
Based on the test results in preliminary test, measurement was made in same test set up and configuration which produced maximum emission level. Receiving antenna was installed at 3-meter distance from the EUT, and was connected to an EMI receiver or spectrum analyzer with a RF amplifier.

Turntable was rotated through 360 degrees and receiving antenna height was varied from 1 to 4 meters above the ground plane 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 in such configuration as shown in the following photograph.

2. Photograph for the worst case configuration



3. Sample Calculation

The measured field strength was determined by averaging over one complete pulse train including blanking interval because the pulse train time of the EUT (≈ 43.01 msec) did not exceed 0.1 seconds (15.35(c)). See graphs of page 13.

With the resolution bandwidth set at 100KHz, the EUT produces a pulse spectrum on the spectrum analyzer because the bandwidth of the analyzer is greater than or equal to the PRF (≈ 372 Hz).

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,

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

where,

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

$$\begin{aligned} \text{Total pulse time of transmitter} \\ \text{in the one complete pulse train} &= \underline{43.01 \text{ msec}} \text{ (See the graph of page 13)} \end{aligned}$$

$$\begin{aligned} \text{one complete pulse train} \\ \text{time including blanking interval } (T_t) &= \underline{43.01 \text{ msec}} \text{ (See graphs of page 13)} \end{aligned}$$

For example :

the average values at 434.79 MHz

$$\begin{aligned} \text{Spectrum Analyzer measured values} &: \underline{71.5} \text{ dB} \\ - \text{Preamplifier} &: \underline{30.0} \text{ dB} \\ + \text{Pulse Desensitization } (\alpha_p) &: \underline{0.0} \text{ dB} \\ + \text{Ant.Factor \& Cable Loss} &: \underline{25.3} \text{ dB} \end{aligned}$$

$$\begin{aligned} \text{Voltage Peak Levels} &: \underline{66.8} \text{ dB}\square/\text{m} \\ & (= \underline{2187.8} \square/\text{m}) \end{aligned}$$

Voltage Average Levels

$$\begin{aligned} &= \frac{E_{\text{peak}} \times \text{Total pulse time of transmitter in the one complete pulse train}}{T_t} \\ &= \frac{2187.8 \square \times 43.01 \text{ msec}}{43.01 \text{ msec}} = \underline{2187.8} \square/\text{m} \end{aligned}$$

4. Measurement Data

- Measurement Button : -
- Resolution Bandwidth : Peak (3dB Bandwidth : 100kHz for 1GHz below)
Peak (3dB Bandwidth : 1MHz for 1GHz over)
- Measurement Distance : 3 Meter

Frequency (MHz)	* D.M.	* A.P.	Measured Value (dB□)	* A.F. + C.L. (dB)	* A.G. (dB)	* D.C.F. (dB)	Emission Level		Limit (□/m)	** Margin (dB)
							Peak (□/m)	Average (□/m)		
434.79	P	H	71.5	25.3	-30.0	-	2187.8	2187.8	11032.9	-14.1
*** 869.58	P	H	40.6	34.2	-30.0	-9.5	58.2	58.2	1103.3	-25.6
*** 1304.37	P	H/V	**** <40.0	32.0	-35.0	-9.5	<23.7	<23.7	500.0	<-26.5
*** 1739.16	P	H/V	**** <40.0	35.0	-35.0	-9.5	<33.5	<33.5	1103.3	<-30.4
*** 2173.95	P	H/V	**** <40.0	37.8	-35.0	-9.5	<46.2	<46.2	1103.3	<-27.6
*** 2608.74	P	H/V	**** <40.0	40.2	-35.0	-9.5	<61.0	<61.0	1103.3	<-25.2
-	-	-	-	-	-	-	-	-	-	-

Note

- * 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

** Margin (dB) = Emission Level (dB) - Limit (dB)

*** In the case of these frequencies, the EUT was measured at 1.0m distance for sufficient sensitivity of measurement system.

**** < means less than. The observed spectrum analyzer noise floor level with RF preamplifier (Model No. : 8449B) was 40.0 dBuV.

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, its 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 allother emissions not reported on data were more than 20 dB below the permitted level.

5.Reference Data : Frequency Pulse Wide(τ_{eff}) and Pulse Repetition Frequency(PRF)

RADIOPLUS RCM-3000 CODE SUMMARY

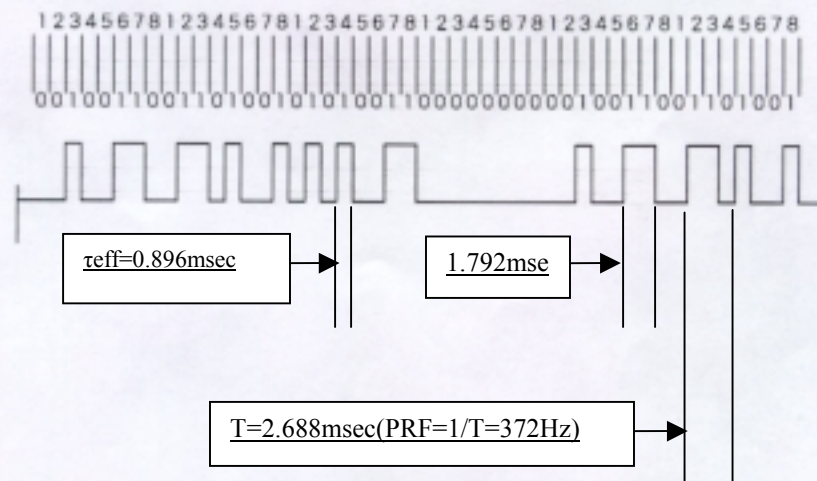
-. 1 BIT = 896us

-. 1 FRAME = 48 BIT (48 * 896us = 43ms)

-. CODE :

ID (16 BIT) , EVENT (16 BIT) , ID (16 BIT)

-. BIT STREAM :



Reference Data : Pulse Train Time

RADIOPLUS RCM-3000 CODE SUMMARY

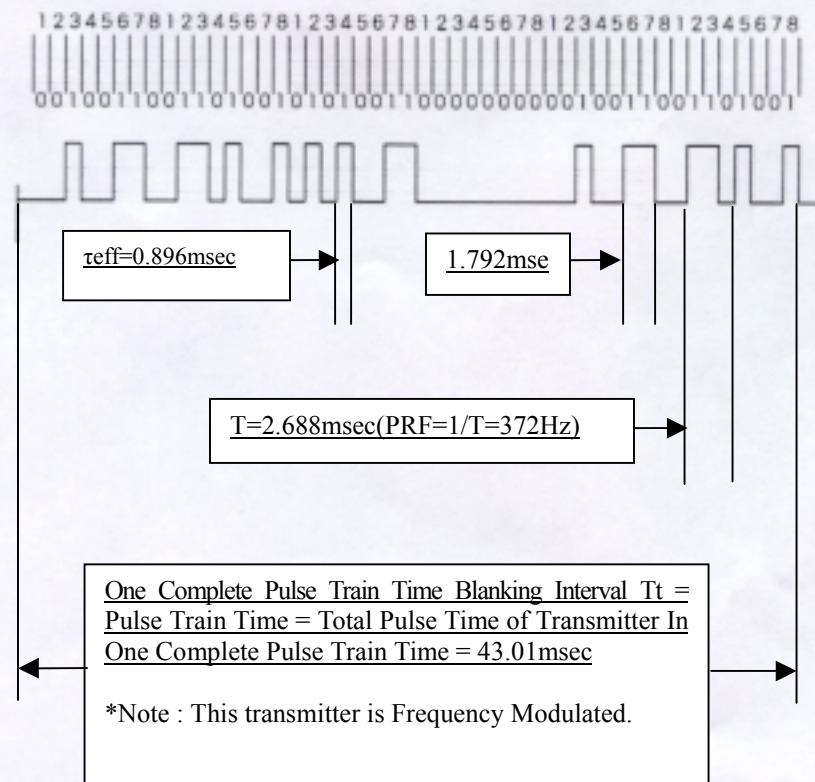
-. 1 BIT = 896us

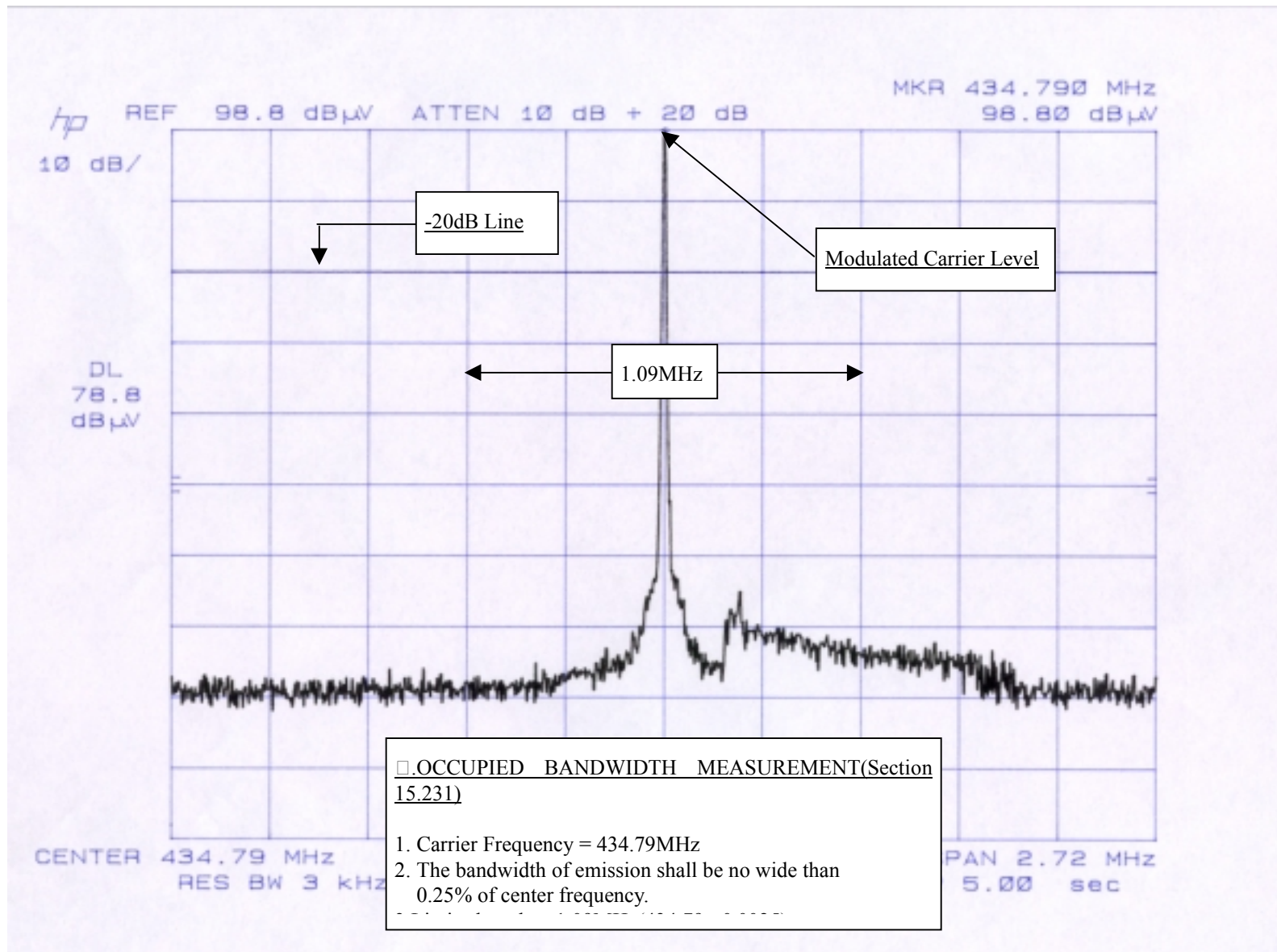
-. 1 FRAME = 48 BIT (48 * 896us = 43ms)

-. CODE :

ID (16 BIT) , EVENT (16 BIT) , ID (16 BIT)

-. BIT STREAM :





□. TEST EQUIPMENT USED FOR FCC COMPLIANCE TESTING

<u>Equipment</u>	<u>Model No.</u>	<u>Manufacturer</u>	<u>Serial No.</u>	<u>Effective Cal.</u>	<u>Duration</u>
[x] EMI Receiver (20MHz-1GHz)	ESVS30	R & S	830516/002	06/29/99-06/29/00	
[x] Spectrum Analyzer (9kHz-26.5GHz)	8563A	H. P.	3222A02069	02/10/99-02/10/00	
[x] Spectrum Analyzer (100Hz-22GHz)	8566B	H. P.	3014A07057	05/29/99-05/29/00	
[x] Quasi-Peak Adapter (10kHz-1GHz)	85650A	H. P.	3107A01511	05/29/99-05/29/00	
[x] RF-Preselector (20Hz-2GHz)	85685A	H. P.	3010A01181	05/29/99-05/29/00	
[] Test Receiver (9kHz-30MHz)	ESH3	R & S	860905/001	06/29/99-06/29/00	
[x] Pre-Amplifier (0.1-3000MHz, 30dB)	8347A	H. P.	2834A00543	05/29/99-05/29/00	
[x] Pre-Amplifier (1-26.5GHz, 35dB)	8449B	H. P.	3008A00302	06/29/99-06/29/00	
[] LISN(50 , 50 H) (10kHz-100MHz)	3825/2	EMCO	9010-1710	-	
[] LISN(50 , 50 H) (10kHz-100MHz)	3825/2	EMCO	9011-1720	-	
[x] Plotter	7470A	H. P.	3104A21292	-	
[x] Tuned Dipole Ant. (30MHz-300MHz)	VHA 9103	Schwarzbeck	-	-	*
[x] Tuned Dipole Ant. (300MHz-1GHz)	UHA 9105	Schwarzbeck	-	-	*
[x] Biconical Ant. (20MHz-200MHz)	BBA9106	Schwarzbeck	-	*	
[x] Log Periodic Ant. (200MHz-1GHz)	3146	EMCO	-	-	*
[x] Horn Ant. (1GHz-18GHz)	3115	EMCO	-	*	
[x] Oscilloscope	TDS540	Tektronix	B023930	11/11/98-11/11/99	
[x] Volt Meter	3438A	H.P.	1717A-00613	05/29/99-05/29/00	
[] DC Power Supply	6206B	H.P.	1145A04822	-	
[x] Shielded Room	(5.0m x 4.5m)	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).