TEST REPORT

Ref. Report No.
00-341-003-02

Name and address of the applicant

AM Equipment
P.O. BOX 790
402 E. HAZEL JEFFERSON, OR 97352
U.S.A.

Standard / Test regulation

FCC Part 15, Subpart C

Test result

Pass

Incoming date : January 21, 2000

Test date : March 28, 2000

Test item(s) ;

Security/Remote Control Transmitter
(RF Motor Control System)

Model/type ref. ;

MIDAS2

Manufacturer ;

SAM-M ELECTRON

Additional information ;

-Required Authorization : Certification
-FCC ID. : OYT-3201220

Issue date : April 14, 2000

Tested and reported by

Jeong-Min Kim , Senior Engineer

Reviewed by

Seok-Jin Kim , EMC Team Leader

KOREA TESTING LABORATORY

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. GENERAL INFORMATION

1. Grantee Name and Mailing Address	:	AM Equipment P. O. Box 790, 402 E. HAZEL JEFFERSON, OR 97352 U.S.A.
2. Manufacturer's Name and Mailing Address	:	SAM-M ELECTRON 239-12 Gasan-Dong, Kumchon-Gu, Seoul, Korea 152-023

3. Equipment Descriptions

3.1 Operating Frequency	:	314.95 MHz
3.2 Detect Method	:	Pulse Code Signal
3.3 Used Oscillator	:	314.95 MHz (Resonator)
3.4 Power Suppy	:	DC 6V (Battery)

4. Rules and Regulations	:	FCC Part 15, Subpart C
5. Measuring Procedure	:	ANSI C63.4-1992

6. Date of Measurement

6.1 Line Conducted	:	Not Applicable
6.2 Radiated Emission	:	March 28, 2000

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

1.1 Location of Label : Manual for Installation and Operating Instruction
1.2 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, [ ] 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, such as voice or video, and data transmission ?

[ ] yes, [x] no

4.2 Was the EUT manually operated ?

[x] 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 ?

[x] yes, [ ] no

4.3 Was the EUT automatically activated ?

[ ] yes, [x] 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, [x] no

. INPUT POWER MEASUREMENT (Section 15.31)

INPUT POWER
89.4 mW

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

Where, P_p : Input Peak Power (= V x I_p)

P_D : Input DC Power (= V x I_D)

D : Duty Cycle (= $|_{eff}$ x PRF)

Measured Input Voltage (V) = 6.25 DCV

Measured Input Peak Current (I_p) = 12.84 mA

Measured Input Bias Current (I_D) = 12.42 mA

Measured An Effective Pulse Width ($|_{eff}$) = 0.33 msec

Measured Pulse Repetition Frequency (PRF) = 446 Hz

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

3. $|_{eff}$ and PRF were measured using the spectrum analyzer.

4. P_p = 6.25 DCV · 12.84 mA = 80.25 mW

P_D = 6.25 DCV · 12.42 mA = 77.63 mW

D = 0.33 msec · 446 Hz = 0.147

. 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 three buttons respectively. 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.

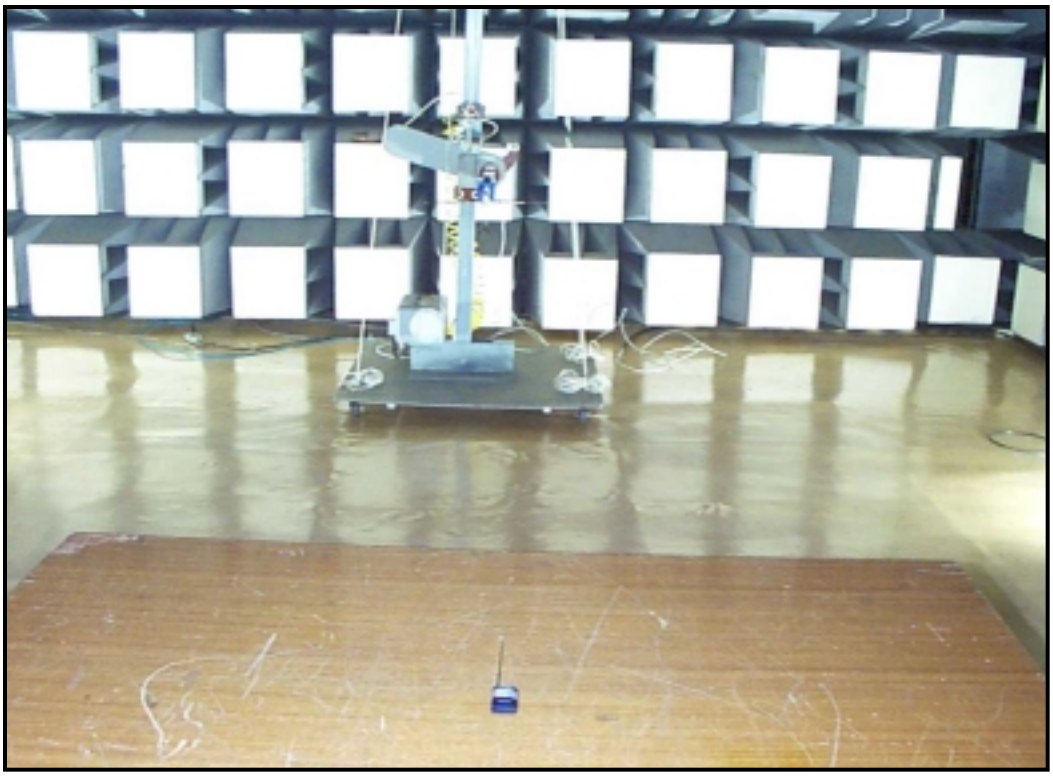
Based on the test results in preliminary test, measurement was made in same test set up and configuration which produced maximum emission level. Receiving antenna was installed at 3-meter distance from the EUT, and was connected to an EMI receiver or spectrum analyzer with a RF amplifier.

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 occurred when EUT was set to Button(•) 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 (=80.85 msec) did not exceed 0.1 seconds (15.35(c)). See graphs of page 13 .

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 (= 446 Hz).

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

The field strengths were calculated as follows ;

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

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

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

where,

Pulse desensitization ($\langle_p$) = 20log($|_{eff}$ x B x K), HP AN150-2 (page 14)
= 0 (See 1.4)

Total pulse time of transmitter in the one complete pulse train = 26.7 msec (See the graph of page 13)

One complete pulse train time including blanking interval (T_t) = 80.85 msec (See graphs of page 13)

For example :

the average values at 314.91 MHz

	Spectrum Analyzer measured values	: 71.2 dB
-	Preamplifier	: 30.0 dB
+	Pulse Desensitization ($\langle_p$)	: 0.0 dB
+	Ant.Factor & Cable Loss	: 21.8 dB
	Voltage Peak Levels	: 63.0 dB∂/μ
		(= 1412.5 ∂/μ)

Voltage Average Levels

$$= \frac{E_{peak} \cdot \text{Total pulse time of transmitter in the one complete pulse train}}{T_t}$$

$$= \frac{1412.0\ \partial/\mu \cdot 26.7 \text{ msec}}{80.85 \text{ msec}} = 466.5\ \partial/\mu$$

4. Measurement Data

- Measurement Button : 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)		
314.91	P	H	71.2	21.8	-30.0	-	1412.5	466.5	6037.9	-22.2
629.82	P	H/V	< 32.0	29.6	-30.0	-	< 38.0	< 12.5	603.8	<-33.6
944.73	P	H/V	< 32.0	35.2	-30.0	-	< 72.4	< 23.9	603.8	<-28.0
1259.64	P	H/V	< 32.0	31.9	-30.0	-	< 49.5	< 16.3	603.8	<-31.3
-	-	-	-	-	-	-	-	-	-	-

Note

The observed spectrum analyzer noise floor level with RF preamplifier was 32.0dB∂. And all other emissions not reported on data were more than 25dB below the permitted level.

* 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

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

Note ;

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

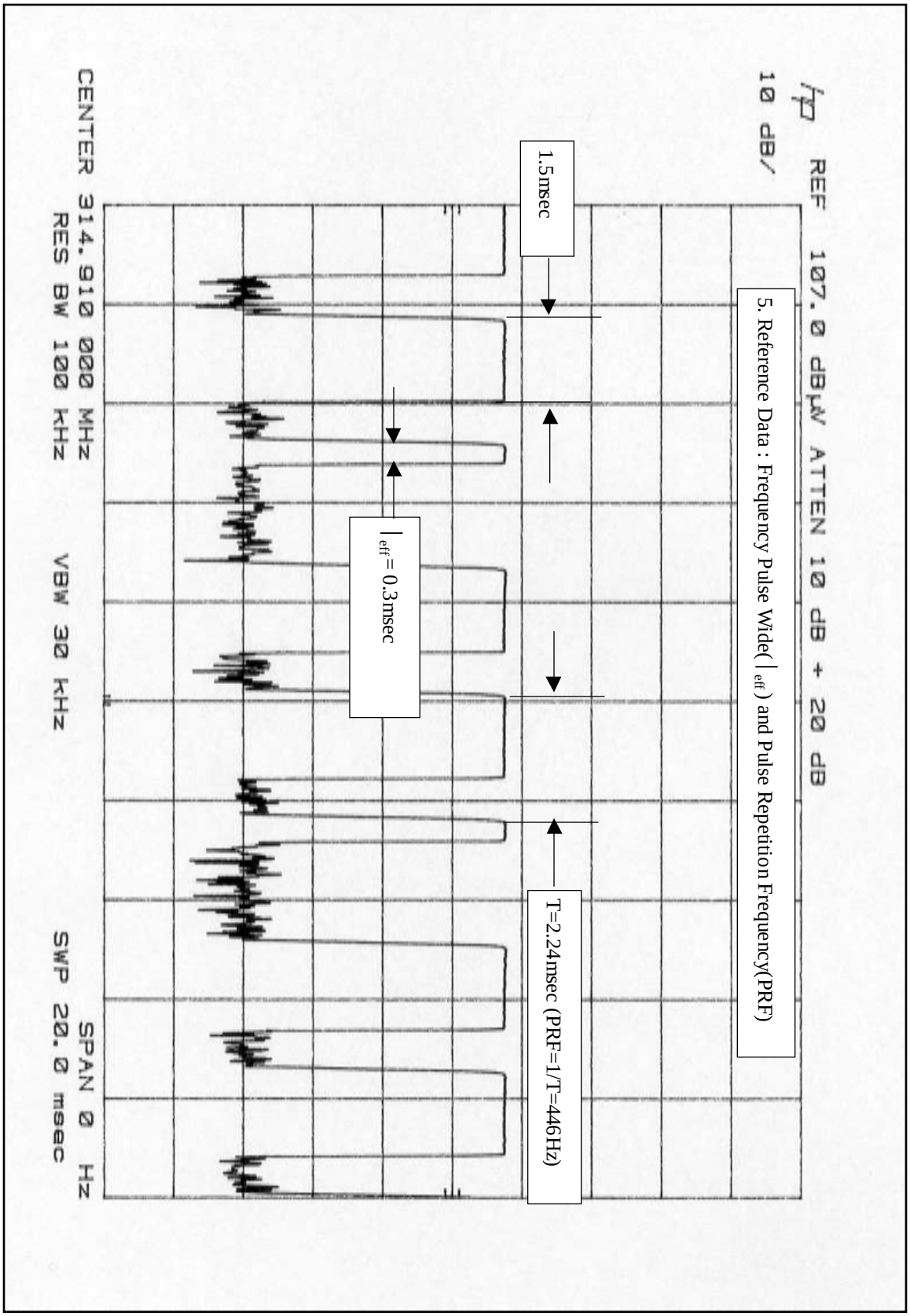
MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.25
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.1775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218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

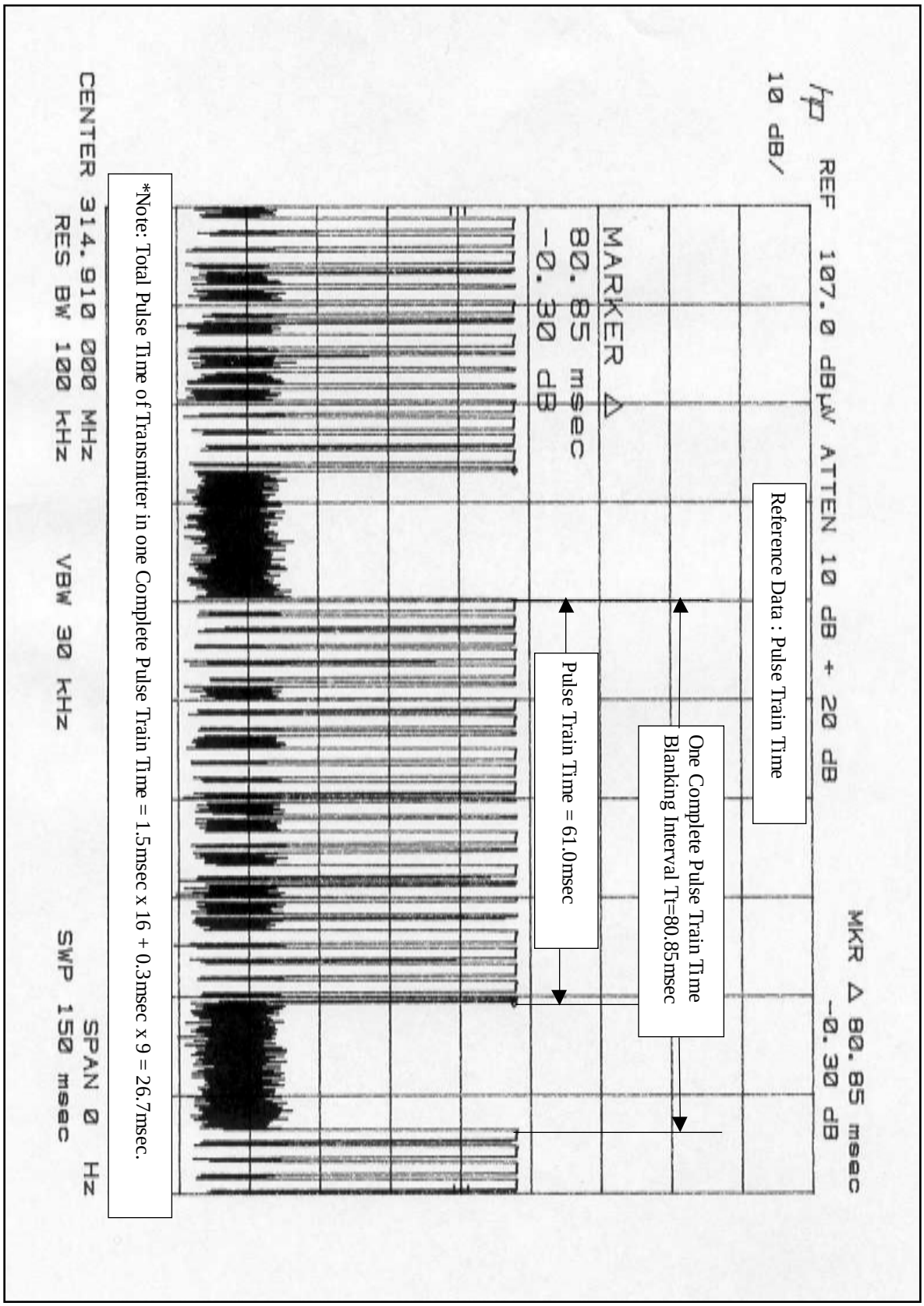
(2) If the intentional radiator was operated under the radiated emission limits of the general requirements of section 15.209, it's fundamental emissions were not located in the frequency bands 54-72MHz, 76-88MHz, 174-216MHz, 470-860MHz.

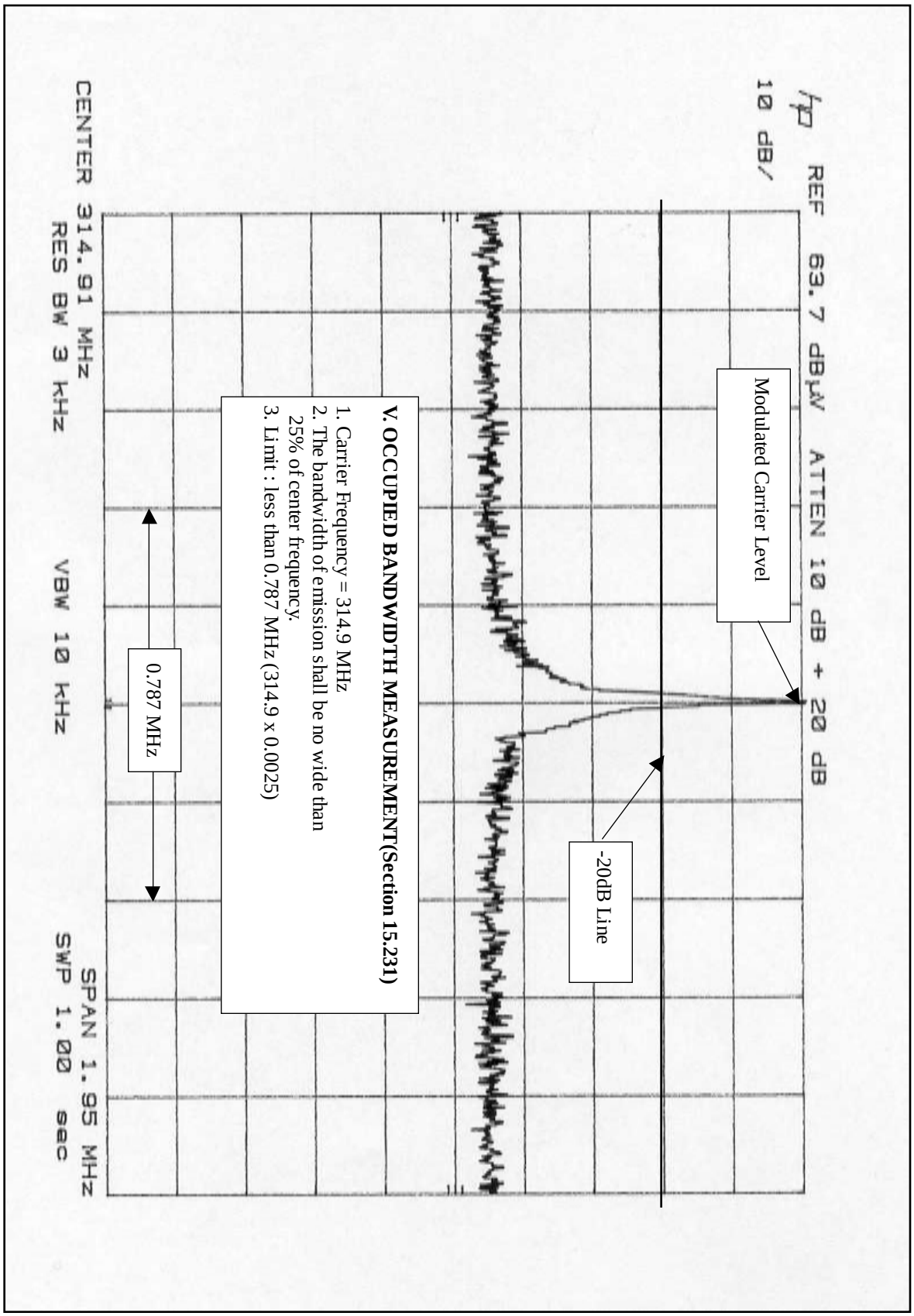
(3) The level of any unwanted emissions from an intentional radiator did not exceed the level of the fundamental emission.

(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.



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


REF 107.0 dBµV ATTEN 10 dB + 20 dB
MKR Δ 80.85 msec
-0.30 dB
10 dB/
MARKER Δ
80.85 msec
-0.30 dB
Reference Data : Pulse Train Time
One Complete Pulse Train Time
Blanking Interval Tt=80.85msec
Pulse Train Time = 61.0msec
CENTER 314.910 000 MHz
RES BW 100 kHz
VBW 30 kHz
SPAN 0 Hz
SWP 150 msec
*Note: Total Pulse Time of Transmitter in one Complete Pulse Train Time = 1.5msec x 16 + 0.3msec x 9 = 26.7msec.


REF 63.7 dBµV ATTEN 10 dB + 20 dB
10 dB/
Modulated Carrier Level
-20dB Line
CENTER 314.91 MHz
RES BW 3 kHz
VBW 10 kHz
SPAN 1.95 MHz
SWP 1.00 sec
0.787 MHz
V. OCCUPIED BANDWIDTH MEASUREMENT(Section 15.231)
1. Carrier Frequency = 314.9 MHz
2. The bandwidth of emission shall be no wide than 25% of center frequency.
3. Limit : less than 0.787 MHz (314.9 x 0.0025)

. TEST EQUIPMENT USED FOR MEASUREMENTS

Equipment	Model No.	Manufacturer	Serial No.	Effective Cal. Duration
[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	02/18/00-02/18/01
[ ] Spectrum Analyzer (100Hz-22GHz)	8566B	H. P.	3014A07057	05/29/99-05/29/00
[ ] Quasi-Peak Adapter (10kHz-1GHz)	85650A	H. P.	3107A01511	05/29/99-05/29/00
[ ] 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
[ ] LISN(50ohm , 50μH) (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. (30MHz-300MHz)	BBA 9106	Schwarzbeck	-	*
[x] Log Periodic Ant. (200MHz-1GHz)	3146	EMCO	-	*
[x] Horn Ant. (1GHz-18GHz)	3115	EMCO	-	*
[ ] DC Power Supply	6260B	H.P.	1145A04822	-
[ ] 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).