

Date: 2000-12-19

TEST REPORT

Page 1 of 23

No.: HM103621

FCC PART 15 SUBPART C CERTIFICATION REPORT

FOR LOW POWER TRANSMITTER

TEST REPORT No.: HM103621

Equipment Under Test [EUT]:
Model Number:
Applicant:
FCC ID :

Wireless Thermometer
NU-601
Ewig Industrial Co., Ltd.
N9Z-NU-601

Date: 2000-12-19

TEST REPORT

Page 2 of 23

No.: HM103621

CONTENT:

Cover
Content
Conclusion

Page 1 of 23
Page 2-3 of 23
Page 4 of 23

1.0 General Details

1.1	Test Laboratory	Page 5 of 23
1.2	Applicant Details Applicant HKSTC Code Number for Applicant Manufacturer	Page 5 of 23
1.3	Equipment Under Test [EUT] Description of EUT operation	Page 6 of 23
1.4	Date of Order	Page 6 of 23
1.5	Submitted Sample	Page 6 of 23
1.6	Test Duration	Page 6 of 23
1.7	Country of Origin	Page 6 of 23
1.8	Additional Information of EUT	Page 7 of 23

2.0 Technical Details

2.1	Investigations Requested	Page 8 of 23
2.2	Test Standards and Results Summary	Page 8 of 23

3.0 Test Results

3.1	Emission	Page 9-14 of 23
3.2	Bandwidth Measurement	Page 15-16 of 23

Date: 2000-12-19

TEST REPORT

Page 3 of 23

No.: HM103621

Appendix A

List of Measurement Equipment

Page 17 of 23

Appendix B

Duty Cycle Correction During 100 msec

Page 18-19 of 23

Appendix C

Periodic Operation

Page 20-21 of 23

Appendix D

Photographs

Page 22-23 of 23

Date: 2000-12-19

TEST REPORT

Page 4 of 23

No.: HM103621

CONCLUSION

The submitted product was deemed to have COMPLIED with the requirements of Federal Communications Commission [FCC] Rules and Regulations Part 15. The tests were performed in accordance with the standards described above and on Section 2.2 in this Test Report.

Testing Engineer

Verify by

Patrick Wong
for Managing Director

Date: 2000-12-19

TEST REPORT

Page 5 of 23

No.: HM103621

1.0 General Details

1.1 Test Laboratory

The Hong Kong Standards and Testing Centre Ltd.
EMC Laboratory
10 Dai Wang Street, Taipo Industrial Estate
New Territories, Hong Kong

Telephone: 852 2666 1888
Fax: 852 2664 4353

1.2 Applicant Details **Applicant**

Ewig Industries Co., Ltd.
13/F., Houtex Ind'l Bldg., 16 Hung To Road,
Kwun Tong, Kowloon, Hong Kong

Telephone: 852 29516880
Fax: 852 23435799

HKSTC Code Number for Applicant

EWI001

Manufacturer

Ewig Industries Co., Ltd.
13/F., Houtex Ind'l Bldg., 16 Hung To Road,
Kwun Tong, Kowloon, Hong Kong

Telephone: 852 29516880
Fax: 852 23435799

No.: HM103621

1.3 Equipment Under Test [EUT]

Description of Sample

Product: Wireless Thermometer
Manufacturer: Ewig Industries Co., Ltd.
Brand Name: N/A
Model Number: NU-601
Input Voltage: 4.5Vd.c ("AAA" size battery x 3)
Additional Model Number: NU-701
Additional FCC ID: N9Z-NU-701

1.3.1 Description of EUT Operation

The Equipment Under Test (EUT) is an Ewig Industries Co., Ltd., 433.9MHz Wireless Thermometer. The transmitter is an automatic transmitter. The EUT is to transmit RF signal while temperature measurement is changed. The EUT is for data transmission, Modulation by Data Code. Tape is pulses modulation.

1.4 Date of Order

2000-11-11

1.5 Submitted Sample(s):

2 Samples per model

1.6 Test Duration

2000-11-29

1.7 Country of Origin

China

1.8 Additional Information of EUT

	Submitted	Not Available
User Manual	☒	☐
Part List	☒	☐
Circuit Diagram	☒	☐
Printed Circuit Board [PCB] Layout	☒	☐
Rating Label	☒	☐
Block diagram	☒	☐
FCC ID Label	☒	☐

Date: 2000-12-19

TEST REPORT

Page 8 of 23

No.: HM103621

2.0 Technical Details

2.1 Investigations Requested

Perform ElectroMagnetic Interference measurement in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15 and ANSI C63.4:1992 for FCC Certification.

2.2 Test Standards and Results Summary Tables

EMISSION Results Summary						
Test Condition	Test Requirement	Test Method	Class / Severity	Test Result		
				Pass	Failed	N/A
Field Strength of Fundamental Emissions & Spurious Emissions	FCC 47CFR 15.231e	ANSI C63.4:1992	N/A	☒	☐	☐
Radiated Emissions, 30MHz to 1GHz	FCC 47CFR 15.209	ANSI C63.4:1992	Class B	☒	☐	☐
Conducted Emissions on AC, 0.45MHz to 30MHz	FCC 47CFR 15.207	ANSI C63.4:1992	Class B	☐	☐	☒

Note: N/A - Not Applicable

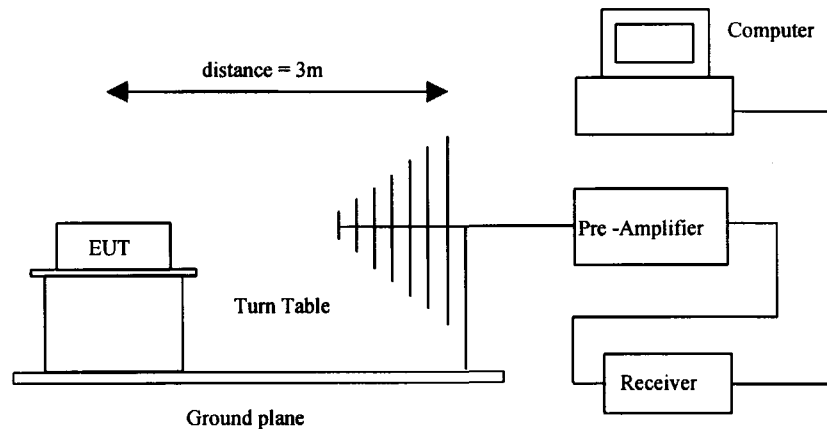
3.0 Test Results**3.1 Emission****3.1.1 Radiated Emissions**

Test Requirement:	FCC 47CFR 15.231e
Test Method:	ANSI C63.4:1992
Test Date:	2000-11-29
Mode of Operation:	On mode

Test Method:

The sample was placed 0.8m above the ground plane on the OATS *. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigate all operating modes, rotated about all 3 axis (X, Y & Z) to obtain worst position, manipulating interconnecting cables, rotating turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.

*: OATS [Open Area Test Site] located at HKSTC with a metal ground plane on filed with the FCC pursuant to section 2.948 of the FCC rules, with Registration Number: 90657.

Test Setup:

Limits for Field Strength of Fundamental Emissions [FCC 47CFR 15.231e]:

Frequency Range of Fundamental [MHz]	Field Strength of Fundamental Emissions [$\mu\text{V/m}$]	Field Strength of Spurious Emissions [$\mu\text{V/m}$]
40.66-40.70	1,000	100
70-130	500	50
130-174	500 to 1,500 *	50 to 150 *
174-260	1,500	150
260-470	1,500 to 5,000 *	150 to 500 *
Above 470	5,000	500

Where F is the frequency in MHz, the formula for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, $\mu\text{V/m}$ at meters= $22.72727(F)-2454.545$; for the band 260-470 MHz, $\mu\text{V/m}$ at 3 meters = $16.6667(F)-2833.3333$. The maximum permissible unwanted emission level is 20dB below the maximum fundamental level.

Results:

Field Strength of Fundamental Emissions						
Peak Value						
Frequency MHz	Level @3m dB μV	Correction Factor dB/m	Field Strength dB $\mu\text{V/m}$	Field Strength $\mu\text{V/m}$	Limit ** @3m $\mu\text{V/m}$	Antenna Polarity
433.9	65.3	22.2	87.5	23713.7	43983.5	Vertical

According to FCC 47CFR15.35, the limit on the radio frequency emissions as measured using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit for the frequency being investigated unless a different peak emission limit is otherwise specified in the rules.

Remarks:

*: Linear interpolations

Correction Factor included Antenna Factor and Cable Attenuation.

Calculated measurement uncertainty = 30MHz to 300MHz $\pm 3.7\text{dB}$
300MHz to 1GHz $+3.0\text{dB} / -2.7\text{dB}$

Date: 2000-12-19

TEST REPORT

Page 11 of 23

No.: HM103621

Results:

Field Strength of Fundamental Emissions Average Value *						
Frequency MHz	Level @3m dBμV	Correction Factor dB/m	Field Strength dBμV/m	Field Strength μV/m	Limit ** @3m μV/m	Antenna Polarity
433.9	49.0	22.2	71.2	412.1	4398.4	Vertical

Field Strength of Spurious Emissions Average Value *						
Frequency MHz	Level @3m dBμV	Correction Factor dB/m	Field Strength dBμV/m	Field Strength μV/m	Limit @3m μV/m	Antenna Polarity
867.8	<1.0	32.8	<33.8	<49.0	439.8	Vertical
+1301.7	<1.0	28.3	<29.3	<29.2	500.0	Vertical
1735.6	<1.0	32.1	<33.1	<45.2	439.8	Vertical
2169.5	<1.0	26.2	<27.2	<22.9	439.8	Vertical
2603.4	<1.0	28.0	<29.0	<28.2	439.8	Vertical
3037.3	<1.0	28.5	<29.5	<29.9	439.8	Vertical
3471.2	<1.0	30.6	<31.6	<38.0	439.8	Vertical
+3905.1	<1.0	32.0	<33.0	<44.7	500.0	Vertical
+4339.0	<1.0	33.0	<34.0	<56.2	500.0	Vertical

Remarks:

*: Adjusted by Duty Cycle = -16.3dB

**:
According to FCC C47CFR 15.231e,
FCC Limit for Average Measurement = $16.6667(433.9\text{MHz}) - 2833.3333 = 4398.35\mu\text{V/m}$

+: Denotes restricted band of operation.
Measurement were made using a peak detector. Any emission less than 1000 MHz and falling within the restricted bands of FCC Rules Part 15 Section 15.205 were not adjusted for averaging and the limit of FCC Rules Part 15 Section 15.209 were applied

Correction Factor included Antenna Factor and Cable Attenuation.

Calculated measurement uncertainty = 30MHz to 300MHz ±3.7dB
300MHz to 1GHz +3.0dB / -2.7dB

No.: HM103621

TEST REPORT

Page 12 of 23

Limited for Radiated Emissions [FCC 47 CFR 15.209 Class B]:

Frequency Range [MHz]	Quasi-Peak Limits [μV/m]
30-88	100
88-216	150
216-960	200
Above960	500

The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.

Results:

Radiated Emissions Quasi-Peak						
Frequency MHz	Level @3m dBμV	Correction Factor dB/m	Field Strength dBμV/m	Field Strength μV/m	Limit @3m μV/m	Antenna Polarity
NO EMISSION DETECTED WITHIN 20dB OF THE FCC LIMITS						

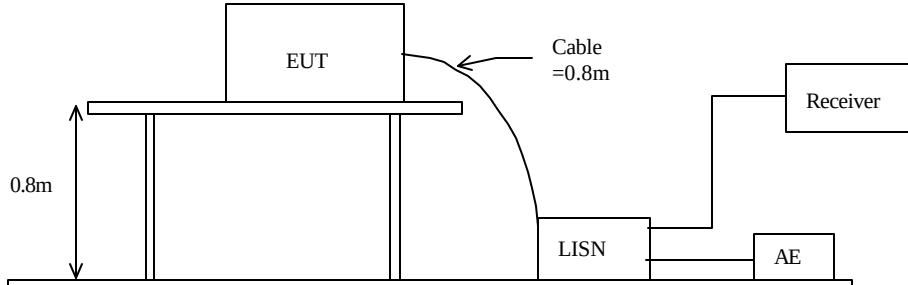
3.1.1 Conducted Emissions (0.45MHz to 30MHz)

Test Requirement:	FCC 47CFR 15.207
Test Method:	ANSI C63.4:1992
Test Date:	2000-11-29
Mode of Operation:	Not Applicable

Test Method:

The test was performed in accordance with ANSI C63.4:1992, with the following: an initial measurement was performed in peak and average detection mode on the live line. Any emissions recorded within 30dB of the relevant limit line were re-measured using quasi-peak and average detection on the live and neutral lines with the worst case recorded in the table of results.

Test Setup:



Date: 2000-12-19

TEST REPORT

Page 14 of 23

No.: HM103621

Limit for Conducted Emissions (FCC 47 CFR 15.207):

Frequency Range [MHz]	Quasi-Peak Limits [μV/m]
0.45-30	250

Limits for Conducted Emissions Test, please refer to limit lines (Quasi-Peak) in the following diagram labelled as (QP).

Results:

The EUT is operated by a single source of internal battery power [located in the battery compartment], therefore power line conducted emission was deemed unnecessary.

Remarks:

Calculated measurement uncertainty = $\pm 2.3\text{dB}$

3.2 20dB Bandwidth of Fundamental Emission

Test Requirement:	FCC 47 CFR 15.231
Test Method:	ANSI C63.4:1992 (Section 13.1.7)
Test Date:	2000-11-29
Mode of Operation:	On mode

Test Method:

The bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. Once the reference level is established, the equipment is conditioned with typical modulating signal to produce the worst-case (i.e. the widest) bandwidth.

Test Setup:

As Test Setup of clause 3.1.1 in this test report.

Date: 2000-12-19

TEST REPORT

Page 16 of 23

No.: HM103621

Limits for 20 dB Bandwidth of Fundamental Emission:

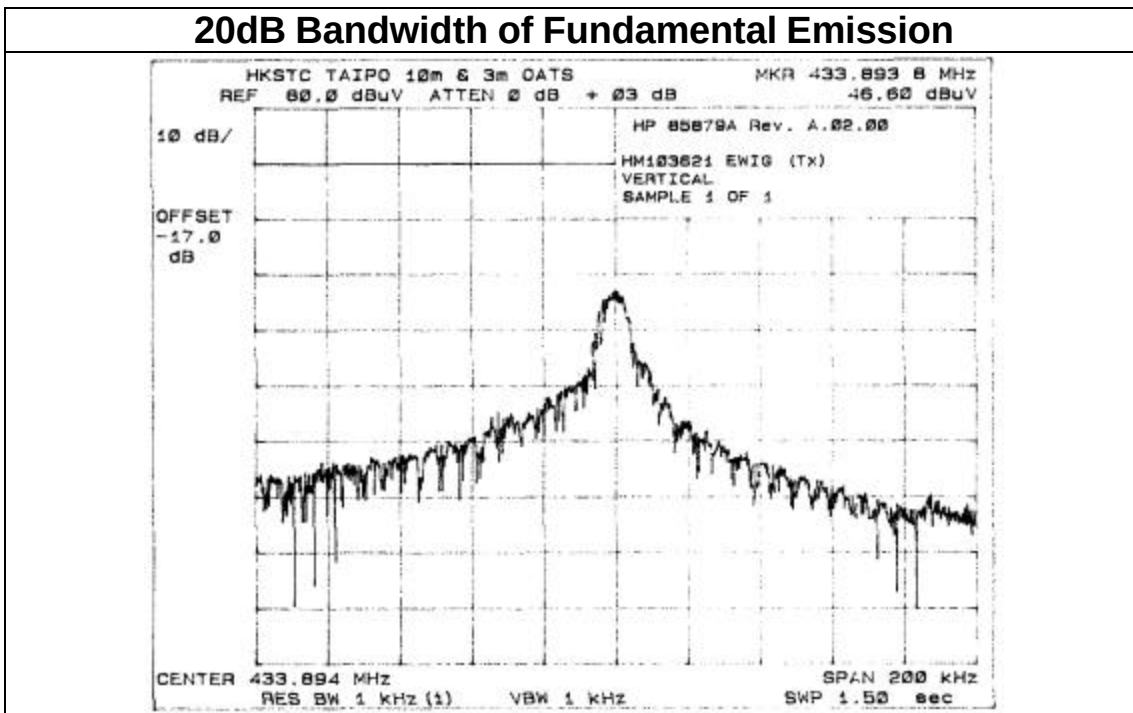
Frequency Range [MHz]	20dB Bandwidth [KHz]	FCC Limits * [KHz]
433.9	35.0	1084.75

Remarks:

*: FCC Limit for Bandwidth measurement = $(0.25\%)(\text{Center Frequency})$
= $(0.0025)(433.9)$
= 1084.75KHz

Results:

The following figure is the measured bandwidth of Fundamental Emission.



Date: 2000-12-19

TEST REPORT

Page 17 of 23

No.: HM103621

Appendix A

Test Equipment Audit

Radiated Emission

EQP NO.	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CAL.
EM007	SPECTRUM ANALYZER	HEWLETT PACKARD	HP85660B	3144A21192	18/07/00
EM008	SPECTRUM ANALYZER DISPLAY	HEWLETT PACKARD	HP85662A	3144A20514	18/07/00
EM009	QUASI PEAK ADAPTOR	HEWLETT PACKARD	HP85650A	3303A01702	18/07/00
EM010	RF PRESELECTOR	HEWLETT PACKARD	HP85685A	3221A01410	18/07/00
EM011	ATTENUATOR/SWITCH	HEWLETT PACKARD	HP11713A	2508A10595	18/07/00
EM012	PRE-AMPLIFIER	HEWLETT PACKARD	HP8449B	3008A00262	18/07/00
EM013	CONTROLLER (COMPUTER), COLOR MONITOR, KEYBOARD & MOUSE FLOPPY DRIVE	HEWLETT PACKARD HEWLETT PACKARD HEWLETT PACKARD	HP9000 HP A1097C HP9133L	6226A60314 3151J39517 2623A02468	CM
EM131	PORTABLE SPECTRUM ANALYSER	HEWLETT PACKARD	8595EM	3710A00155	10/07/00
EM017	ANTENNA	ARA INC.	LPB-2513/A	1069	17/02/00
EM020	HORN ANTENNA	EMCO	3115	4032	09/08/00
EM072	SIGNAL GENERATOR	HEWLETT PACKARD	8640B	1948A11892	30/03/98
EM083	HKSTC OPEN AREA TEST SITE	HKSTC	N/A	N/A	15/02/01
EM145	EMI TEST RECEIVER	R & S	ESCS 30	830245/021	31/05/00

Conducted Emission

EQP NO.	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CAL
EM078	VARIAC	SHANGHAI VOLTAGE	TDGC-3/0.5	N/A	CM
EM081	SMALL SCREENED ROOM	MIKO INST HK	N/A	N/A	10/09/00
EM002	LISN	EMCO	3825-2	9005-1657	27/07/99
EM119	LISN	R & S	ESH3-Z5	0831.5518.52	31/08/00
EM145	EMI TEST RECEIVER	R & S	ESCS 30	830245/021	31/05/00
EM120	EMI TEST RECEIVER	R&S	ESHS10	1004.0401.10	04/09/00
EM127	ISOLATION TRANSFORMER 220 TO 300	WING SUN	N/A	N/A	N/A
EM142	PLUSE LIMITER	R & S	ESH3Z2	357.8810.52	29/01/00

Remarks:

CM Corrective Maintenance
N/A Not Applicable or Not Available
TBD To Be Determined

No.: HM103621

Appendix B**Duty Cycle Correction During 100msec**

Each data sent a different series of characters, but each packet period (41msec) would not exceed a series of 25 long (250 μ sec) and short (200 μ sec) pulses. Assumed any combination of short or long pulses may be obtained due to encoding the worse case transmit duty cycle would be considered 25x250 μ per 41msec = 15.2% duty cycle.

Remarks:

Duty Cycle Correction = $20\text{Log}(0.152) = -16.3\text{dB}$

The following figures [Figure A to Figure C] showed the characteristics of the pulse train for one of these functions.

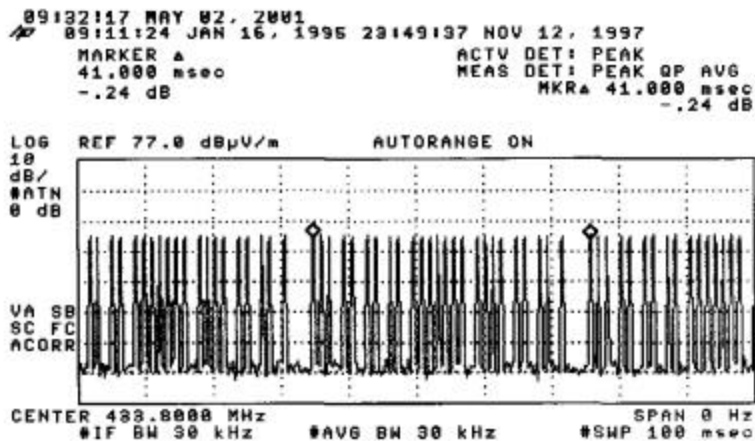
Figure A [Pulse Train]

Figure B [Long Pulse]

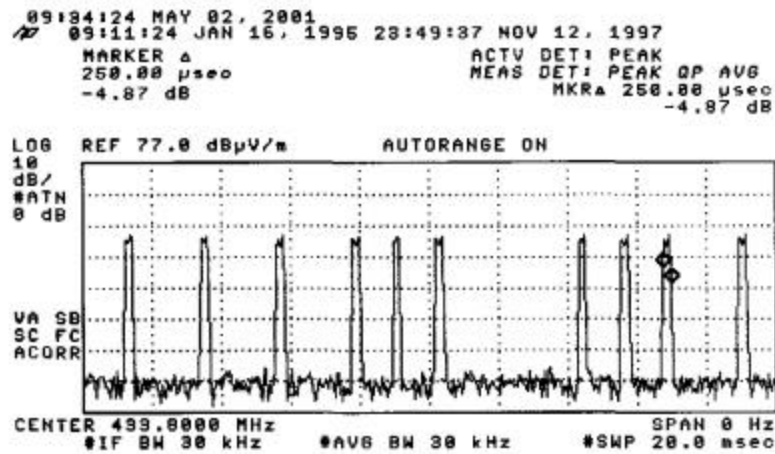
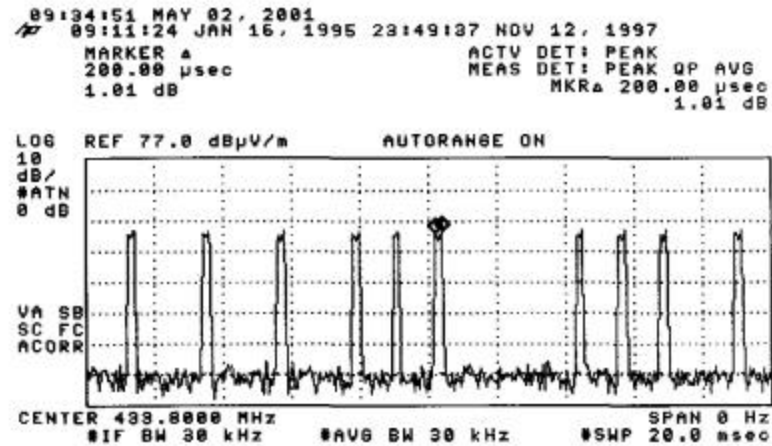


Figure C [Short Pulse]



No.: HM103621

Appendix C**Periodic Operation [FCC 47CFR 15.231e]**

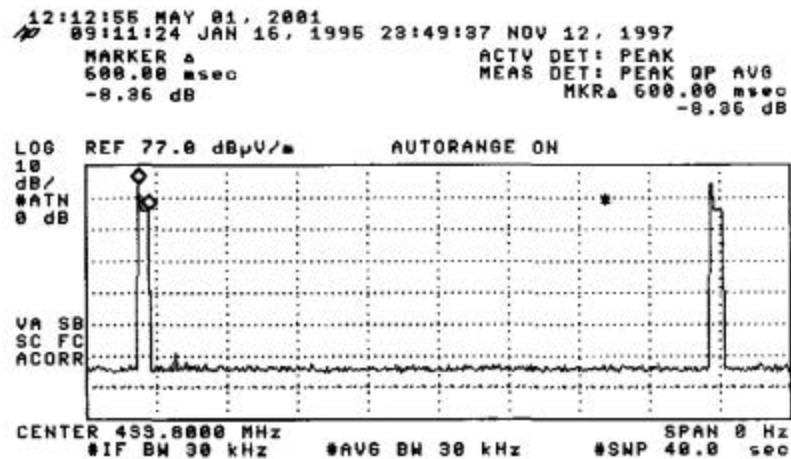
According to FCC 47CFR15.231e. The EUT shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

Results:

Since the EUT of each transmission is 600 msec, so the silent period must not less than 18 seconds (600msec x 30).

The following figures [Figure D to Figure E] showed the duration of each transmission and silent period.

Figure D [Each transmission]



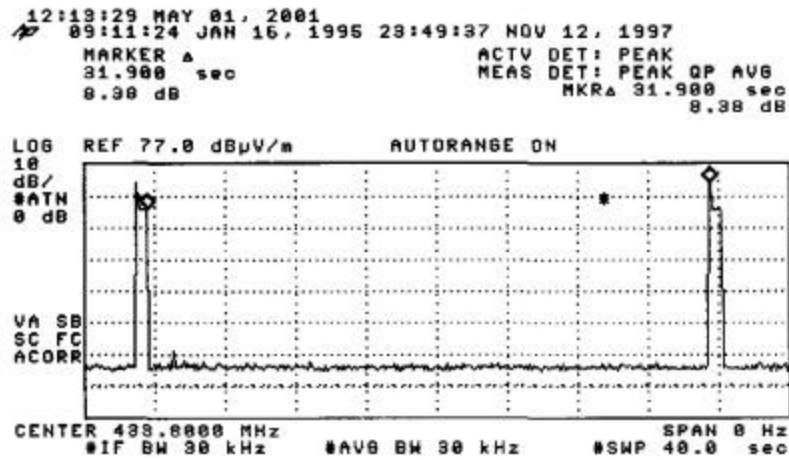
Date: 2000-12-19

TEST REPORT

Page 21 of 23

No.: HM103621

Periodic operation [FCC 47CFR15.231e]
Figure E [Silent Period]



Date: 2000-12-19

TEST REPORT

Page 22 of 23

No.: HM103621

Appendix D

Photographs of EUT

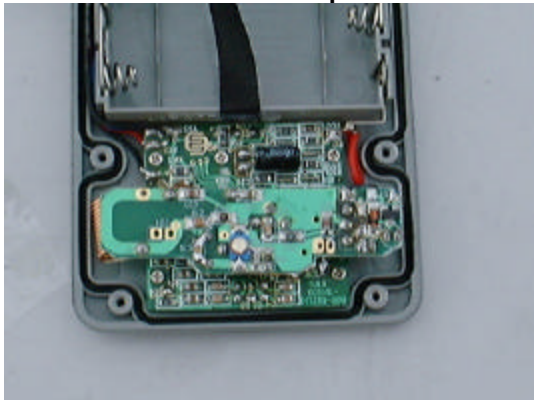
Front View of the product



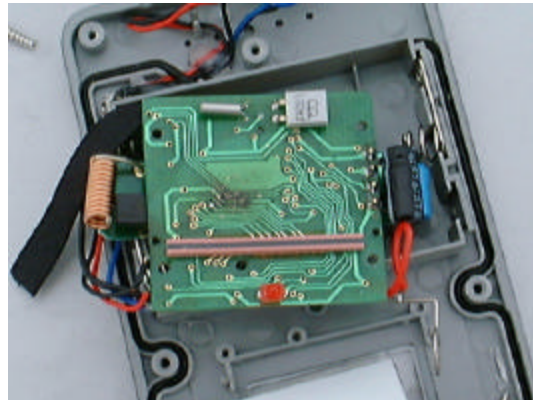
Rear View of the product



Inner Circuit Top View



Inner Circuit Bottom View



Date: 2000-12-19

TEST REPORT

Page 23 of 23

No.: HM103621

Photographs of EUT

Measurement of Radiated Emission Test Set Up



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