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FCC MEASUREMENT REPORT

FCC SUBPART C -INTENTIONAL RADIATOR CERTIFICATION
AND FCC PART 15 SUBPART B -UNINTENTIONAL RADIATORS
CLASS B DIGITAL DEVICE VERIFICATION

MEASUREMENT / TECHNICAL REPORT
TEST REPORT #: 99JAC004.FCC
Number of pages in Test Report : 15

On the
Model : HME-130R
Remote Car Alarm

FCC ID : OMYMHE-130R

For

Hanmaeum electronic co., Ltd.

399-1, Toegye-Dong, Chun Chon-City,
Kangwon-Do, Korea

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A. INTRODUCTION

STANDARD REFERENCES

Standards applied to the EUT:

(1) ANSI C63.4:1992, Methods of measurement of radio-noise emissions from low-voltage electrical and electronic equipment in the range of 9KHz to 40GHz.

(2) U.S. Code of Federal Regulations(CFR) Title 47, Part 15, Radio frequency devices, Subpart B Unintentional Radiators(October 1,1995).

(3) U.S Code of Federal Regulations(CFR) Title 47, Part 15, Radio frequency devices, Subpart C Intentional Radiators(October 1, 1995)

Standards utilized for measurement methods and / or equipment:

(4) CIRSPR Publication 16, Second Edition, (CISPR specification for radio interference measuring apparatus and measurement methods) IEC 1987.

A. INTRODUCTION (CONTINUED)

ELECTROMAGNETIC EMISSIONS

1) **CONDUCTED EMISSIONS**

The conducted electromagnetic emissions amplitudes were not measured on the Model HME-130R because the Equipment-Under-Test(EUT) is dc powered.

2) **RADIATED EMISSIONS**

The radiated electromagnetic emissions amplitudes were measured from the HANMAEUM ELECTRIC CO.,LTD. Model HME-130R Remote CAR Alarm at the JungAng EMC Ltd. Electromagnetic Measurements Laboratory on June 10, 1999 and June 28, 1999.
The test results confirm that the amplitudes of the radiated emissions from the Hanmaeum Electric Co.,Ltd. Model HME-130R Remote CAR Alarm tested in conjunction with other equipment(identified later in this report), are below the FCC Subpart B and Subpart C Limits.

TEST	CATEGORY	P.C.	PASS/FAIL
FCC			
Conducted Emission, Class B	15.107(a)(450kHz-30MHz)	-	N/A
Radiated Emissions, Class B	15.109(a)(30MHz-1000MHz)	-	Pass
Radiated Emissions	15.231(30MHz-1000MHz)	-	Pass
Microwave Radiated Emission	15.231(1MHz-4.5MHz)	-	Pass

" **P.C.**" = Performance Criteria
N/A = Not Applicable

B. EQUIPMENT-UNDER-TEST

The equipment-under-test(EUT) is the Hanmaeum Electric Co.,Ltd. Remote CAR Alarm Model HME-130R.

MODES OF OPERATION

The EUT was transmitting.
The EUT is the transmitter cease transmission within 5 seconds of the button release.

EMC MEASURES APPLIED TO EUT DESIGN

No additional measures were taken over those already incorporated in the product

DEVIATION CRITERIA

No deviation was required.

C. TEST PROCEDURE

1) **ELECTROMAGNETIC EMISSIONS**

The test procedures used for determining FCC Part 15 Subpart B -Unintentional Radiators Class B and FCC Part 15 Subpart C -Intentional Radiators compliance were in accordance with FCC Rules and Regulations, ANSI C63.4-1992 Methods of Measurement of Radio-Noise Emissions from Low-Voltage electrical and Electronic Equipment in the range of 9 KHz to 40 GHz.

All measurements were performed using the CISPR quasi-peak, peak or average detector functions of the receiver or spectrum analyzer. The bandwidth (6-dB) were as follows for the different detector functions and frequency ranges (deviations if necessary would be noted on the individual data sheets) :

FREQUENCY RANGE	QUASI-PEAK	PEAK	AVERAGE
10 kHz – 150 kHz	200 Hz	200 Hz	200 Hz
10 kHz – 30 MHz	9 kHz	10 kHz	10 kHz
30 MHz – 1,000 MHz	120 kHz	100 kHz	100 kHz
>1,000 MHz	N / A	1 MHz	1 MHz

Conducted Emissions Measurements:

The conducted emissions amplitudes were not measured on Model HME-130R because the EUT is dc powered.

Electric Field Radiated Emissions Measurements :

The radiated electromagnetic emissions were measured between 30 MHz and 1 GHz at the JungAng EMC Ltd Open Area Test Site at a three meter distance.
The radiated electromagnetic emissions were measured between 1 GHz and 4.5 GHz at the JungAng EMC Ltd Open Area Test Site at a three meters distance. The antennas were vertically and then horizontally polarized. The antenna height was varied between 1 and 4 meters.
The radiated-emissions amplitudes were measured at various azimuthal orientations in order to maximize amplitudes. Cables were oriented to maximize the field strength amplitudes.
Unless otherwise specified, broadband antennas were used. Standard broadband antennas used were selected from the following : Biconical 30 MHz - 300 MHz,

Log Periodic 0.3GHz - 1 GHz and Horn 1 GHz - 18 GHz. For measurement(up to 1 GHz), that were close to the limit, a tuned dipole antenna may be used.

D. TEST RESULTS

TEST	CATEGORY	P.C.	PASS/FAIL
FCC			
Conducted Emissions, Class B	15.107(a)(450 kHz – 30 MHz)	-	N/A
Radiated Emissions, Class B	15.109(a)(30 MHz – 1000 MHz)	-	Pass
Radiated Emissions	15.231 (30 MHz – 1000 MHz)	-	Pass
Microwave Radiated Emission	15.231 (1 MHz – 4.5 MHz)	-	Pass

" **P.C.**" = Performance Criteria
N/A = Not Applicable

- **ELECTROMAGNETIC EMISSIONS**

The worst-case data are tabulated in Tables D-I and D-II.

The electric field radiated emissions was tested June 12, 1999. The microwave emissions was tested June 23, 1999.

Figures D-1 and D-2 contain photographs of the radiated emissions and microwave emissions test set-ups.

The test results confirm that the radiated emissions amplitudes are below the FCC Subpart B and Subpart C Limits.

D. TEST RESULTS (Continued)

Emissions are measured at the specified distance and corrected for antenna factor (which converts dBuV to dBuV/m), cable losses, and gain of an external amplifier(if used.)

Test	Frequency: 36MHz		Polarization : Horizontal	
Meter Reading (dBuV)	Antenna Factor (dB)	Path Loss (dB)	Amplifier Gain (dB)	Field Strength (dBuV/m)
5	15.83	3.01	0	23.84

The calculations proceed as follows: Meter Reading(dBuV)+Antenna Factor(dB)+Path Loss(dB)-Amplifier Gain(dB) = Field Strength(dBuV/m).

When the emission level is less than 6 dB above the ambient noise floor, the antenna is moved closer to the EUT A 3-meter measurement level is compared with a 10-meter limit by extrapolating the limit to a 3-meter distance. One adds a factor of 10.5dB to the limit, which is derived from:

Correction Factor(dB) = 20 log(10m/3m) = 10.5dB

e.g., Limit@10m = 30dBuV/m@10
Limit@3m = 19.5dBuV/m@3m

Similarly, a 10-meter limit is extrapolated to a specified 30-meter limit by use of a correction factor of 20 log(10m/30m)= -9.5dB.

Microwave Radiated Emissions

Microwave emissions are normally measured in power rather-than field strength at the specified distance, and corrected by a factor of 107dB added to convert dBm to dBuV in a 50-measurement system, an antenna factor(which converts dBuV to dBuV/m), cable losses, and gain of an external amplifier(if used).

Test	Frequency: 1.3013GHz		Polarization : Horizontal	
Meter Reading (dBuV)	Antenna Factor (dB)	Path Loss (dB)	Amplifier Gain (dB)	Field Strength (dBuV/m)
17.34	26.20	7.5	0	51.04

The calculations proceed as for RF Radiated Emissions, except for the added conversion factor.

TABLE D-I. WORST-CASE ELECTRIC FIELD STRENGTH DATA

Frequency (MHz)	Amplitude Peak (dBuv/m)	FCC SUBPART B Q.P. Limit (dBuv/m)	Margin (dB) (Limit-Amplitude)	Polarization Vertical/ Horizontal	Comments
36.000	12.7	40.0	27.3	Vertical	4,5
155.000	14.4	43.4	29.0	Vertical	4,5
297.000	20.5	46.0	25.5	Vertical	4,5
36.000	12.7	40.0	27.3	Horizontal	4,5
155.000	14.4	43.4	29.0	Horizontal	4,5
297.000	20.7	46.0	25.5	Horizontal	4,5
Model HME-130R Remote CAR Alarm, SUBPART C LIMITS					
431.990	70.3	78.0	7.3	Vertical	1
863.955	44.4	55.6	11.2	Vertical	2
431.990	73.3	78.0	4.7	Horizontal	1
863.955	47.2	55.6	8.4	Horizontal	2

Comments:
1. Fundamental operation frequency.
2. Second harmonic of the fundamental frequency.
3. Third harmonic of the fundamental frequency.
4. Noise floor reading.
5. Amplitude was measured using the quasi-peak detector.

Notes:

All other radiated emissions amplitudes were at least 10dB below the FCC Subpart B and Subpart C Limits.
Emissions were scanned from 30MHz to 1000MHz with antennas in both the vertical and horizontal orientation.
The specified radiated emissions antenna reference distance was three meters.
Testing of the EUT was conducted at three meters. No additional signal was detected.

Amplitudes were measured using the peak detector. Reference detector specified in the limit is the CISPR quasi-peak detector.

FIGURE D-1. WORST-CASE RADIATED EMISSIONS TEST SETUP

TABLE D-II. WORST-CASE MICROWAVE FIELD STRENGTH DATA

Microwave Radiated Emissions, 1GHz to 4.5GHz

Frequency (MHz)	Amplitude Peak (dBuv/m)	FCC SUBPART B Q.P. Limit (dBuv/m)	Margin (dB) (Limit-Amplitude)	Polarization Vertical/ Horizontal	Comments
1295.96	43.6	55.6	12.0	Horizontal	
1727.96	39.5	55.6	16.1	Horizontal	
2159.95	40.1	55.6	15.5	Horizontal	
2591,94	43.5	55.6	12.1	Horizontal	
3023.93	44.6	55.6	11.0	Horizontal	
3455.92	46.5	55.6	9.1	Horizontal	
3887.91	47.8	55.6	7.8	Horizontal	
4319.90	49.1	55.6	6.5	Horizontal	

Comments:

1. Noise floor reading.

Notes:

All other radiated emissions amplitudes were at least 10dB below the FCC
Subpart B and Subpart C Limits.
Emissions were scanned from 1GHz to 4.5GHz with antennas in both the vertical and horizontal orientation.
The specified radiated emissions antenna reference distance was three meters.
Testing of the EUT was conducted at three meters.
No additional signal was detected.

Amplitudes were measured using the peak detector. Reference detector specified in the limit is the average detector.

FIGURE D-2. WORST-CASE MICROWAVE RADIATED EMISSIONS TEST SETUP

E. MEASUREMENT FACILITY AND INSTRUMENTATION

These measurement tests were conducted at **JungAng EMC LTD.**
The site address is 109-2, Yepyung-ri, Kumsa-myun, Youju-kun, Kyungki-do, Korea.
The area of **JungAng EMC LTD** test site is located in a mountain area
It is located in the valley surrounded by mountains in all directions where ambient radio signal conditions are quite and a favorable area to measure the radio frequency interference on open field test site for the computing and ISM devices manufactures.
The detailed description of the measurement facility was found to be in compliance with the requirements of §2.948 according to ANSI C63.4 on October 19, 1992.

Conducted Emissions

The conducted electromagnetic emissions amplitudes were not measured on the Model HME-130R because the Equipment-Under-Test(EUT) is dc powered.

Radiated Emissions

Preliminary measurements were made indoors at 1 meter using broadband antennas, broadband amplifier, and spectrum analyzer to determine the frequency producing the maximum EME.
Appropriate precaution was taken to ensure that all EME from the EUT were maximized and investigated.
The system configurations, turntable azimuth with respect to the antenna were noted for each frequency found.
The spectrum was scanned from 30 to 300MHz using biconical antenna and 300 to 1000MHz using log-spiral antenna.

Final measurements were made outdoors at 3 or 10 meter test range using dipole antenna.
The test equipment was placed on a wooden and plastic bench situated on a 1.5×2 meter area adjacent to measurement area.
Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition.
Each frequency found during pre-scan measurements was re-examined and investigated during EMI/Field Intensity Meter and Quasi-Peak Adapter.
The detector function was set to CISPR Quasi-Peak mode and the bandwidth of the receiver was set to 120KHz depending on the frequency or type of signal.

The half-wave dipole antenna was tuned to the frequency found during preliminary radiated measurements.
The EUT, support equipment and interconnecting cables were re-configured to the set-up producing The maximum emission for the frequency and were placed on top of a 0.8-metre high non-metallic 1×1.5 meter table.
The EUT, support equipment, and interconnecting cables were re-arranged and manipulated to maximize each EME emission.

E. MEASUREMENT FACILITY AND INSTRUMENTATION (continued)

The turntable containing the system was rotated, the antenna height was varied 1 to 4 meter and stopped at the azimuth or height producing the maximum emission. Each emission was maximized by :antenna height and polarity and azimuth EUT, if applicable, whichever determined the worst-case emission.

TABLE E-1. TET EQUIPMENT

The listing below denotes the test equipment utilized for the test(s)

Nomenclature	Manufactury Model Number	Serial Number	Calibration Date
Signal Analyzer (9kHz – 1.2GHz)	PMM PMM 9000	3100J70602	98 / 9 / 30
Spectrum Analyzer (9kHz – 2.6GHz)	ADVANTEST R3261C	61720002	99 / 01 / 19
Spectrum Analyzer (9kHz – 6.5GHz)	HP 8595E	2995E0898	99 / 05 / 19
Amplifier (0.1MHz-1.3GHz)	HP 8774D	2944A08872	99 / 04 / 21
Biconical Antenna	PMM BC01	0020J70501	98 / 08 / 10
Log Periodic Antenna	PMM LP01	0020J70501	98 / 08 / 10
Double-Ridged Horn Antenna	electro-metrics	2847	99 / 01 / 19
Dipole Antenna	SWALZBECK VHA9103	3608	98 / 06 / 29
Dipole Antenna	SWALZBECK UHA9105	4277	98 / 06 / 29
Loop Antenna	CHASE HLA6120	1116	98 / 06 / 29
Plotter	HP 7475A	7475A	N / A
Shield Room 4m x 3.5m x 2.4m	MYUNGJIN EMC 907-MJCO-12		
Turn Table	Dail EMC JAC-2		
Antenna Master	Dail EMC JAC-1		