PCTEST Engineering Laboratory, Inc.

6660-B Dobbin Road · Columbia, MD 21045 · U.S.A.
TEL (410) 290-6652 · FAX (410) 290-6654
http://www.pctestlab.com

CERTIFICATE OF COMPLIANCE
FCC Part 15.231 Certification

OHSUNG ELECTRONICS CO., LTD.
#181 Dong Dan-Dong
Gu-Mi Kyung Buk, Korea
Attention: D.J. Jung, Manager

Dates of Tests: July 10, 2003
Test Report S/N: TX.230627312.OZ5
Test Site: PCTEST Lab, MD U.S.A.

FCC ID	**OZ5145TR**
APPLICANT	**OHSUNG ELECTRONICS CO., LTD.**

FCC Rule Part(s):	**§ 15.231 Subpart C – Intentional Radiator**
Classification:	**Remote Control Transmitter (DSC)**
EUT Type:	**RF Transmitter Remote Control**
Tx Frequency:	**417.5 – 418.5 MHz**
Trade Name:	***LG***
Model No.:	***6711R7N145A***

This device has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified is ANSI C63.4-1992.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

PCTEST certifies that no party to this application has been denied the FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. 862.

Alfred Cirwithian
Vice President Engineering

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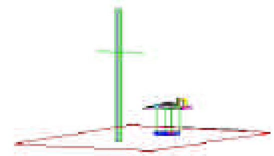
MEASUREMENT REPORT



Scope - Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission.

Company Name:	**OHSUNG ELECTRONICS CO., LTD.**
Address:	**#181 Dong Dan-Dong**
	Gu-Mi Kyung Buk, Korea
Attention:	**D.J. Jung, Manager**

- FCC ID: **OZ5145TR**
- Model: ***6711R7N145A***
- Trade Name: ***LG***
- EUT Type: RF Transmitter Remote Control
- Application Type: Transmitter Certification
- Tx Frequency: 417.5 – 418.5 MHz
- FCC Rule Part(s): § 15.231 Subpart C – Intentional Radiator
- Dates of Tests: July 10, 2003
- Place of Tests: PCTEST Lab, Columbia, MD U.S.A.
- Test Report S/N: TX. 230627312.OZ5

1.1 INTRODUCTION

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz (ANSI C63.4-1992) was used in determining radiated and conducted emissions emanating from **OHSUNG (Model: *6711R7N145A*) RF Transmitter Remote Control FCC ID: OZ5145TR.**

These measurement tests were conducted at ***PCTEST Engineering Laboratory, Inc.*** facility in New Concept Business Park, Guilford Industrial Park, Columbia, Maryland. The site address is 6660-B Dobbin Road, Columbia, MD 21045. The test site is one of the highest points in the Columbia area with an elevation of 390 feet above mean sea level. The site coordinates are 39° 11'15" N latitude and 76° 49'38" W longitude. The facility is 1.5 miles North of the FCC laboratory, and the ambient signal and ambient signal strength are approximately equal to those of the FCC laboratory. There are no FM or TV transmitters within 15 miles of the site. 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.

1.2 PCTEST Location

The map at right shows the location of the PCTEST Lab, its proximity to the FCC Lab, the Columbia vicinity area, the Baltimore-Washington International (BWI) airport, and the city of Baltimore, and the Washington, D.C. area. (see Figure1).

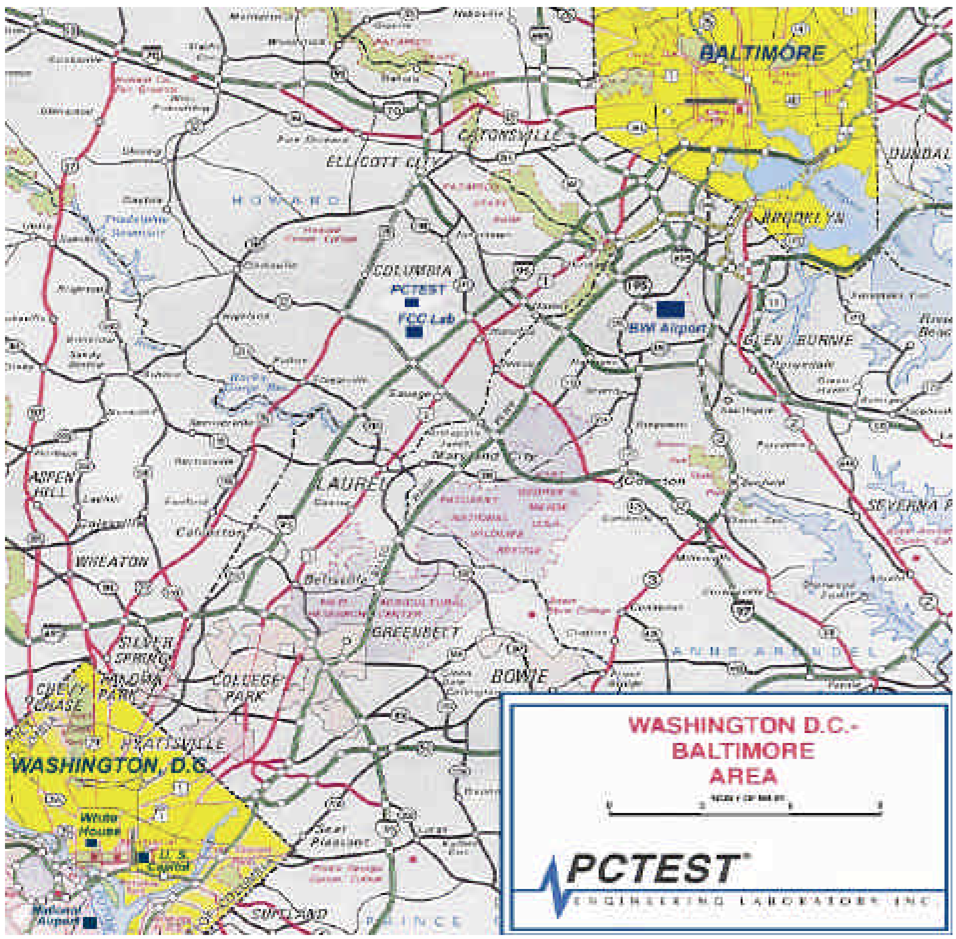


Figure 1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area.

2.1 Product Information

2.2 Equipment Description

The Equipment Under Test (EUT) is the **OHSUNG (Model: 6711R7N145A) RF Transmitter Remote Control FCC ID: OZ5145TR.**

* **Tx Frequency:**	**417.5 – 418.5 MHz**
* **Oscillator(s):**	**418 MHz**
* **Antenna:**	**Built-in internal looped antenna on-board**
* **Power Supply:**	**(2) AA Batteries**

2.3 EMI Suppression Device(s)

EMI suppression device(s) added and/or modifications made during testing.

- None

3.1 Description of Tests

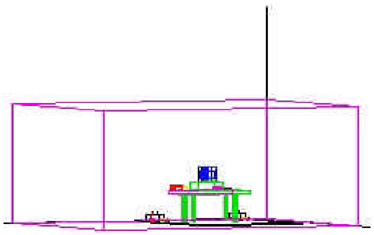


Figure 2. Shielded Enclosure Line-Conducted Test Facility

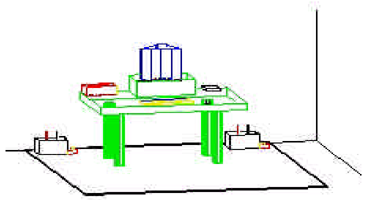


Figure 3. Line Conducted Emission Test Set-Up

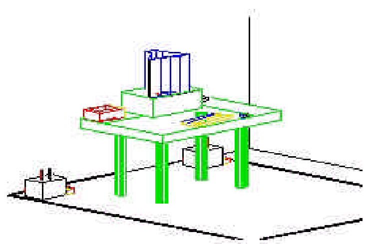


Figure 4. Wooden Table & Bonded LISNs

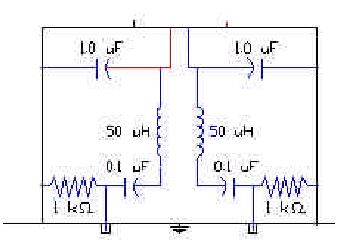


Figure 5. LISN Schematic Diagram

3.2 Conducted Emissions (n/a - powered by batteries)

The line-conducted facility is located inside a 16'x20'x10' shielded enclosure. It is manufactured by Ray Proof Series 81 (see Figure 2). The shielding effectiveness of the shielded room is in accordance with MIL-Std-285 or NSA 65-6. A 1m. x 1.5m. wooden table 80cm. high is placed 40cm. away from the vertical wall and 1.5m away from the side wall of the shielded room (see Figure 3). Solar Electronics and EMCO Model 3725/2 (10kHz-30MHz) 50Ω/50µH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room (see Figure 4). The EUT is powered from the Solar LISN and the support equipment is powered from the EMCO LISN. Power to the LISNs are filtered by a high-current high-insertion loss Ray Proof power line filters (100dB 14kHz-10GHz). The purpose of the filter is to attenuate ambient signal interference and this filter is also bonded to the shielded enclosure. All electrical cables are shielded by braided tinned copper zipper tubing with inner diameter of 1/2". If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply lines will be connected to the Solar LISN. LISN schematic diagram is shown in Figure 5. All interconnecting cables more than 1 meter were shortened by non-inductive bundling (serpentine fashion) to a 1-meter length. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the spectrum analyzer to determine the frequency producing the maximum EME from the EUT. The spectrum was scanned from 450kHz to 30MHz with 20 msec. sweep time. The frequency producing the maximum level was reexamined using EMI/ Field Intensity Meter and Quasi-Peak adapter. The detector function was set to CISPR quasi-peak mode. The bandwidth of the receiver was set to 10 kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each EME emission. Each emission was maximized by: switching power lines; varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and/or support equipment, and powering the monitor from the floor mounted outlet box and the computer aux AC outlet, if applicable; whichever determined the worst-case emission. Photographs of the worst-case emission can be seen in Appendix C. Each EME reported was calibrated using the HP8640B signal generator.

3.1 Description of Tests (continued)

3.3 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 configuration, clock speed, mode of operation or video resolution, turntable azimuth with respect to the antenna were noted for each frequency found. The spectrum was scanned from 30 to 200 MHz using biconical antenna and from 200 to 1000 MHz using log-spiral antenna. Above 1 GHz, linearly polarized double ridge horn antennas were used.

Final measurements were made outdoors at 3-meter test range using Roberts™ Dipole antennas or horn antenna (see Figure 6). The test equipment was placed on a wooden and plastic bench situated on a 1.5 x 2 meter area adjacent to the measurement area (see Figure 7). 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 using 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 100kHz or 1 MHz 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-meter high non-metallic 1 x 1.5 meter table (see Figure 8). The EUT, support equipment, and interconnecting cables were re-arranged and manipulated to maximize each EME emission. The turntable containing the system was rotated; the antenna height was varied 1 to 4 meters and stopped at the azimuth or height producing the maximum emission. Each emission was maximized by: varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and/or support equipment; powering the monitor from the floor mounted outlet box and the computer aux AC outlet if applicable, and changing the polarity of the antenna; whichever determined the worst-case emission. Photographs of the worst-case emission can be seen in Attachment H. Each EME reported was calibrated using the HP8640B signal generator. The Theoretical Normalized Site Attenuation Curves for both horizontal and vertical polarization are shown in Figure 9 according to ANSI C63.4.

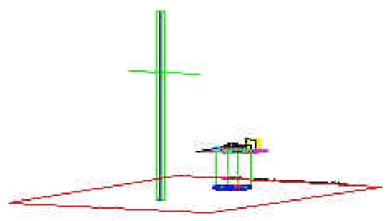


Figure 5. 3-Meter Test Site

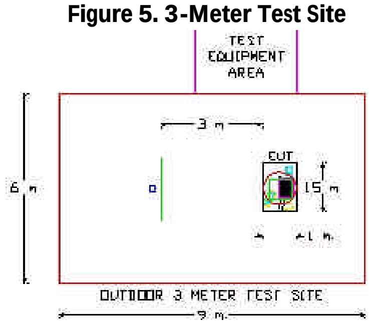


Figure 6. Dimensions of Outdoor Test Site

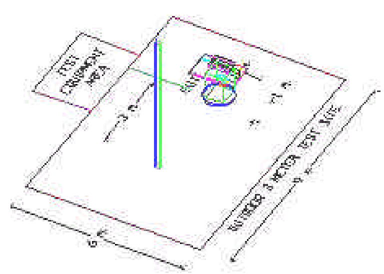


Figure 7. Turntable and System Setup

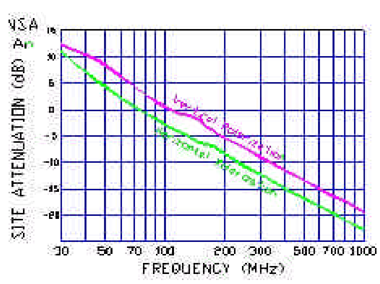


Figure 8. Normalized Site Attenuation Curves (H&V)

4.1 §15.203 Antenna Requirement

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the applicant can be used with the device. The use of permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with this requirement.

CONCLUSION

The OHSUNG RF Transmitter Remote Control complies with the requirement of §15.203 with a built-in looped antenna permanently attached to the transmitter.

5.1 Occupied Bandwidth Measurement

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70MHz and below 900MHz. The bandwidth is determined at the points 20 dB down from the modulated carrier.

418 MHz x 0.0025 = 1.045 MHz

A sample transmitter output was fed into the R&S Spectrum Analyzer and was plotted.

Span:	3.0 MHz
Vertical Scale:	5.0 dB/div
Center Frequency:	418.0 MHz

The bandwidth at 20 dB is **375 kHz**, which is within the allowable limit of **1045 kHz** at 418.0 MHz.

6.1 Frequency Measurements (Spurious)

Operating Frequencies: <u>418 MHz</u>
Distance of Measurements: <u>3 meters</u>

FREQ. (MHz)	**Level*** (dBm)	**AFCL**** (dB)	**POL** (H/V)	**Height** (m)	**Azimuth** (° angle)	**F/S** (µV/m)	**Margin***** (dB)
80.0	- 87.00	7.50	V	2.5	20	23.76	- 12.5
120.0	- 85.00	11.50	H	2.4	30	47.37	- 10.0
420.0	- 95.18	24.18	H	1.6	190	63.15	- 10.0
630.4	- 99.08	28.68	V	1.5	180	67.66	- 9.4
660.0	- 101.60	29.20	V	1.3	120	53.75	- 11.4
842.1	- 102.07	31.88	V	1.2	210	69.23	- 9.2

Table 1. Radiated Measurements at 3-meters.

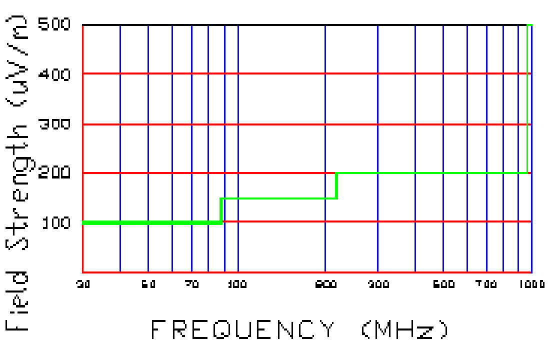


Figure 9. Spurious Radiated Limits at 3 meters

NOTES:

1. All channels were investigated and the worst-case is reported.
2. The EUT was tested with new batteries.
3. Radiated Limits are shown in Figure 10.
4. The EUT is manipulated through typical positions, polarity and length during the tests.

6.2 Frequency Measurements (Fundamental/ Harmonics)

Operating Frequencies: 418 MHz
Distance of Measurements: 3 meters

FREQ. (MHz)	Level (dBm)	AFCL (dB)	POL (H/V)	(dBmV/m) (PEAK)	F/S (Peak)	Avg. (dBuV/M)	MARGIN (dB)
418	- 50.3	24.1	V	80.8	10939.6	71.5	- 8.8
836	- 79.3	31.8	V	59.5	944.1	50.2	- 3.8
1254	- 95.0	31.2	V	43.2	144.5	33.9	- 20.1
1672	- 102.1	34.5	V	39.4	93.3	30.1	- 23.9
2090	- 104.0	36.7	V	39.7	96.6	30.4	- 23.6

Table 2. Radiated Measurements at 3-meters.

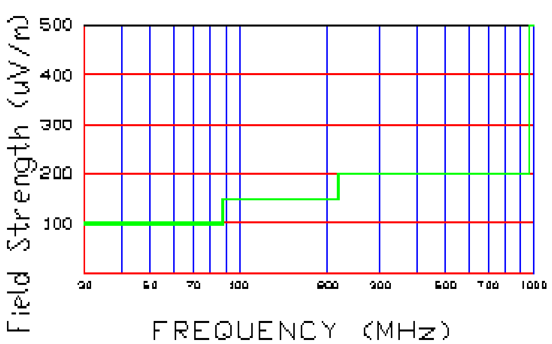


Figure 10. Spurious Radiated Limits at 3 meters

NOTES:
1. All channels were investigated and the worst-case is reported.
2. The EUT is supplied with nominal AC voltage or/and new/fully-recharged batteries.
3. Radiated Limits per §15.231:

Fund. Freq. (MHz)	F/S (mV/m)	F/S Spurious (mV/m)
40.66 ~ 40.70	2250	225
70 ~ 130	1250	125
130 ~ 174	1250 ~ 3750	125 ~ 375
174 ~ 260	3750	375
260 ~ 470	3750 ~ 12500	375 ~ 1250
470 & above	12500	1250

4. The peak emissions are not more than 20dB above the average limit.
5. The EUT is manipulated through typical positions, polarity and length during the tests.

8.1 Plot(s) of Emissions

See Attachment D

9.1 Sample Calculations

$$dB\mu V = 20 \log_{10} (\mu V/m)$$

$$dB\mu V = dBm + 107$$

9.2 Example 1:

Calculation of Limit @ 418.0 MHz per Section 15.231

260 MHz — Limit = 3750µV/m @ 3m

470 MHz — Limit = 12500µV/m @ 3m

$$\frac{12500 - 3750}{470 - 260} = \frac{8750}{210}$$

$$\frac{(418 - 260)(8750)}{(210)} = 6583\ \mu V/m$$

6583 + 3750 = 10333 µV/m Limit @ 418.0 MHz or 80.3 dBuV/m

9.3 Example 2:

Calculation of Duty Cycle per Section 15.35(e)

# of Code Groups per 100ms = 1

# of Wide Pulses = 2 @ 9.0 ms each

# of Narrow Pulses = 31 @ .525 ms each

Maximum duty cycle = (9.0 ms x 2 pulse) + (.525 ms x 31 pulses) = 34.3 %

10.1 Accuracy of Measurement

10.2 Measurement Uncertainty Calculations:

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and NIS 81 (1994).

Contribution (Line Conducted)	Probability Distribution	Uncertainty (± dB)	
		9kHz-150MHz	150-30MHz
Receiver specification	Rectangular	1.5	1.5
LISN coupling specification	Rectangular	1.5	1.5
Cable and input attenuator calibration	Normal (k=2)	0.3	0.5
Mismatch: Receiver VRC Γ_1 = 0.03 LISN VRC Γ_R = 0.8 (9kHz) 0.2 (30MHz) Uncertainty limits 20Log(1 ± Γ_1 Γ_R)	U-Shaped	0.2	0.35
System repeatability	Std. deviation	0.2	0.05
Repeatability of EUT		-	-
Combined standard uncertainty	Normal	1.26	1.30
Expanded uncertainty	Normal (k=2)	2.5	2.6

Calculations for 150kHz to 30MHz:

$$u_c(y) = \sqrt{\sum_{i=1}^{m} u_i^2(y)} = \pm\sqrt{\frac{1.5^2 + 1.5^2}{3} + \left(\frac{0.5}{2}\right)^2 + 0.35} = \pm 1.298\text{dB}$$

$U = 2U_c(y) = \pm 2.6\text{dB}$

Contribution (Radiated Emissions)	Probability Distribution	Uncertainties (± dB)	
		3 m	10 m
Ambient Signals		-	-
Antenna factor calibration	Normal (k=2)	± 1.0	± 1.0
Cable loss calibration	Normal (k=2)	± 0.5	± 0.5
Receiver specification	Rectangular	± 1.5	±1.5
Antenna directivity	Rectangular	+ 0.5 / - 0	+ 0.5
Antenna factor variation with height	Rectangular	± 2.0	± 0.5
Antenna phase centre variation	Rectangular	0.0	± 0.2
Antenna factor frequency interpolation	Rectangular	±. 0.25	± 0.25
Measurement distance variation	Rectangular	± 0.6	± 0.4
Site imperfections	Rectangular	± 2.0	± 2.0
Mismatch: Receiver VRC Γ_1 = 0.2 Antenna VRC Γ_R = 0.67 (Bi) 0.3 (Lp) Uncertainty limits 20Log(1 ± Γ_1 Γ_R)	U-Shaped	+ 1.1 - 1.25	± 0.5
System repeatability	Std. Deviation	± 0.5	± 0.5
Repeatability of EUT		-	-
Combined standard uncertainty	Normal	+ 2.19 / - 2.21	+ 1.74 / - 1.72
Expanded uncertainty U	Normal (k=2)	+ 4.38 / - 4.42	+ 3.48 / - 3.44

Calculations for 3m biconical antenna. Coverage factor of k=2 will ensure that the level of confidence will be approximately 95%, therefore:
$U = 2u_c(y) = 2 \times \pm 2.19 = \pm 4.38\text{dB}$

11.1 Test Equipment

Type	Model	Cal. Due Date	S/N
Microwave Spectrum Analyzer	HP 8566B (100Hz-22GHz)	12/05/03	3638A08713
Microwave Spectrum Analyzer	HP 8566B (100Hz-22GHz)	04/17/04	2542A11898
Spectrum Analyzer/Tracking Gen.	HP 8591A (9kHz-1.8GHz)	06/02/4	3144A02458
Spectrum Analyzer	HP 8591A (9kHz-1.8GHz)	10/15/03	3108A02053
Spectrum Analyzer	HP 8594A (9kHz-2.9GHz)	11/02/03	3051A00187
Signal Generator*	HP 8640B (500Hz-1GHz)	06/02/04	2232A19558
Signal Generator*	HP 8640B (500Hz-1GHz)	06/02/04	1851A09816
Signal Generator*	Rohde & Schwarz (0.1-1000MHz)	09/11/03	894215/012
Ailtech/Eaton Receiver	NM 37/57A-SL (30-1000MHz)	04/12/04	0792-03271
Ailtech/Eaton Receiver	NM 37/57A (30-1000MHz)	03/11/04	0805-03334
Ailtech/Eaton Receiver	NM 17/27A (0.1-32MHz)	09/17/03	08-03241
Quasi-Peak Adapter	HP 85650A	08/09/03	2043A00301
Ailtech/Eaton Adapter	CCA-7 CISPR/ANSI QP Adapter	03/11/04	0194-04082
RG58 Coax Test Cable	No. 167		n/a
Harmonic/Flicker Test System	HP 6841A (IEC 555-2/3)		3531A00115
Broadband Amplifier (2)	HP 8447D		1145A00470, 1937A03348
Broadband Amplifier	HP 8447F		2443A03784
Transient Limiter	HP 11947A (9kHz-200MHz)		2820A00300
Horn Antenna	EMCO Model 3115 (1-18GHz)		9704-5182
Horn Antenna	EMCO Model 3115 (1-18GHz)		9205-3874
Horn Antenna	EMCO Model 3116 (18-40GHz)		9203-2178
Biconical Antenna (4)	Eaton 94455/Eaton 94455-1/Singer 94455-1/Compliance Design		1295, 1332, 0355
Log-Spiral Antenna (3)	Ailtech/Eaton 93490-1		0608, 1103, 1104
Roberts Dipoles	Compliance Design (1 set) A100		5118
Ailtech Dipoles	DM-105A (1 set)		33448-111
EMCO LISN (2)	3816/2		1077, 1079
EMCO LISN	3725/2		2009
Microwave Preamplifier 40dB Gain	HP 83017A (0.5-26.5GHz)		3123A00181
Microwave Cables	MicroCoax (1.0-26.5GHz)		
Ailtech/Eaton Receiver	NM37/57A-SL		0792-03271
Spectrum Analyzer	HP 8591A		3034A01395
Modulation Analyzer	HP 8901A		2432A03467
NTSC Pattern Generator	Leader 408		0377433
Noise Figure Meter	HP 8970B		3106A02189
Noise Figure Meter	Ailtech 7510		TE31700
Noise Generator	Ailtech 7010		1473
Microwave Survey Meter	Holaday Model 1501 (2.450GHz)		80931
Digital Thermometer	Extech Instruments 421305		426966
Attenuator	HP 8495A (0-70dB) DC-4GHz		
Bi-Directional Coax Coupler	Narda 3020A (50-1000MHz)		
Shielded Screen Room	RF Lindgren Model 26-2/2-0		6710 (PCT270)
Shielded Semi-Anechoic Chamber	Ray Proof Model S81		R2437 (PCT278)
Environmental Chamber	Associated Systems Model 1025 (Temperature/Humidity)		PCT285

* Calibration traceable to the National Institute of Standards and Technology (NIST).

12.1 Conclusion

The data collected shows that the **OHSUNG (Model: 6711R7N145A)** ***RF Transmitter Remote Control*** **FCC ID: OZ5145TR** complies with §15.231 Subpart C of the FCC Rules.