

# PCTEST Engineering Laboratory, Inc.

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## CERTIFICATE OF COMPLIANCE

LG Electronics Inc. – Cooking Appliance  
391-2, Ga Eum Jeong-Dong, Changwon,  
Gyeong Nam, 641-711, KOREA  
Attention: Mr. Bo-Hoon Kim, Engineer

Dates of Tests: March 17-18, 1999  
Test Report S/N: 18.990315169.BEJ  
Test Site: PCTEST Lab., MD U.S.A.

FCC ID

**BEJS181XF**

APPLICANT

**LG ELECTRONICS INC.**

|                  |                               |
|------------------|-------------------------------|
| Rule Part(s):    | FCC Part 18                   |
| Equipment Class: | 8CC (Part 18 Consumer Device) |
| EUT Type:        | Microwave Oven                |
| RF Frequency:    | 2.450 GHz                     |
| RF Power Output: | 1150 Watts                    |
| Magnetron(s):    | LG 2M246 or Toshiba 2M248J    |
| Trade Name(s):   | <b>GoldStar®</b>              |
| Model(s):        | <b>MS-184SJ</b>               |

This equipment 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 MP-5.

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. 853(a)*

  
Randy Ortanez  
President & Chief Engineer

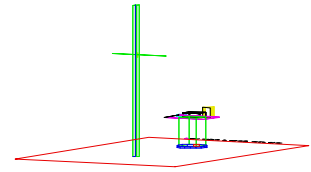
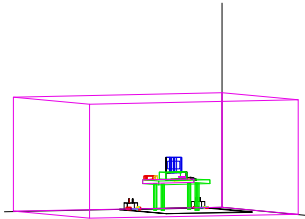


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## FCC Part 18 MEASUREMENT REPORT



*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.*

|                        |  |
|------------------------|--|
| <b>Manufacturer:</b>   | <b>LG ELECTRONICS INC. - Changwon Plant</b>                                    |
| <b>Address:</b>        | <b>391-2, Ga Eum Jeong-Dong, Changwon-City,<br/>Gyeong Nam, 641-110, KOREA</b> |
| <b>Contact Person:</b> | <b>Mr. Bo Hoon Kim - Senior Engineer<br/>Cooking Appliance OBU</b>             |
| <b>Importer:</b>       | <b>LG ELECTRONICS INC. (Chicago Office)</b>                                    |
| <b>Address:</b>        | <b>1000 Sylvan Avenue<br/>Englewood Cliffs, NJ 07632</b>                       |
| <b>Attention:</b>      | <b>Mr. K. S. Kim - General Manager</b>   |

- FCC ID: **BEJS181XF**
- Equipment Type: Microwave Oven
- Magnetron(s): LG 2M246 or Toshiba 2M248J
- RF Frequency: 2.450 GHz
- RF Power Output: 1150 Watt
- Trade Name(s): **GoldStar<sup>®</sup>**
- Model: **MS-184SJ**
- Power Cord: Unshielded
- Rule Part(s): FCC Part 18 - ISM Consumer Device
- Test Procedure: MP-5
- Dates of Tests: March 17-18, 1999
- Place of Tests: PCTEST Lab, Columbia, MD U.S.A.
- Test Report S/N: 18.990315169.BEJ

## Introduction

The measurement procedure described in MP-5 entitled "FCC Methods of Measurements of Radio Noise Emissions from Industrial, Scientific, and Medical Equipment" was used in determining frequency measurement, power output measurement, and field strength measurement emanating from **LG Electronics Inc. (GoldStar Model: MS-184S) Microwave Oven FCC ID: BEJS181XF**.

These measurement tests were conducted at *PCTEST Engineering Laboratory* 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.

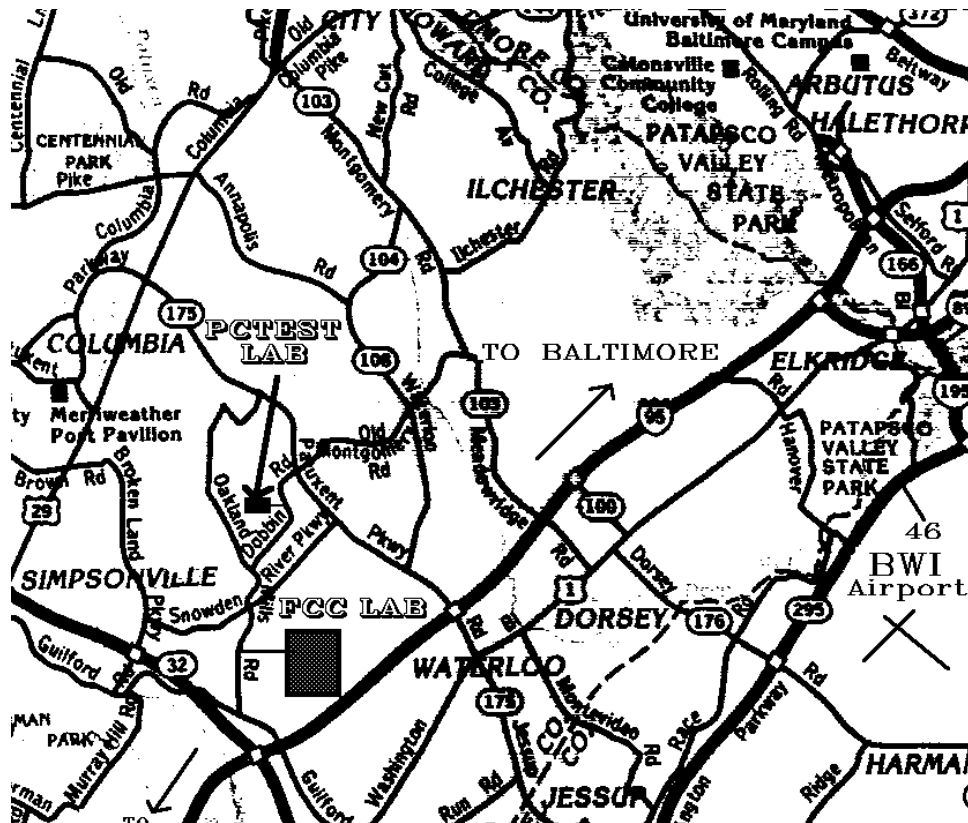


Fig. 1. The map above shows the Columbia vicinity area.  
The map also shows PCTest Lab, FCC Lab and BWI airport. (Scale 1"=2miles)

## Product Information

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### Equipment Description:

The Equipment Under Test (EUT) is the **LG Electronics Inc. (GoldStar Model: MS-184S)**  
**Microwave Oven FCC ID: BEJS181XF.**

Magnetron(s): LG 2M246 or Toshiba 2M248J

RF Frequency: 2.450 GHz

RF Power Output: 1150 Watt

Power Consumption: 1550 Watts

Power Supply: 120V AC, 13.6 A

Cavity Volume: 1.8 cu. ft. (approx.)

Mode Stirrer: Turntable

Power Cord: Unshielded

Outer Dimensions: 21 7/8 x 13 9/16 x 18 13/16 inches

EMI suppression device(s) added and/or modified during testing:

\* none

## Test Data (LG Magnetron Model: 2M246)

### A. Input Power

The input power was measured using a RMS wattmeter. A 275ml. water load in a polypropylene beaker is placed in the center of the oven. The 275ml. of water was chosen for its compatibility with UL procedure to determine input ratings. The oven was operated at full output power for 6 minutes. The reading was taken after 6 minutes at full power.

| Voltage<br>(VAC) | Current<br>(Amps) | Power Consumption<br>(Watts) | Manufacturers<br>Rating<br>(Amps) |
|------------------|-------------------|------------------------------|-----------------------------------|
| 111.1            | 14.18             | 1517                         | 13.6                              |

### B. Power Output

The calorimetric method was used in determining the maximum output power. The test method described in MP-5 and IEC Publication 705/1988. A 1000ml. of water in a beaker was placed in the center of the oven. The oven was operated at full power.

$$P(W) = \frac{4.187 \times Q \times \Delta T}{t}$$

[ ΔT = Temperature Rise in °C]  
 [Q = Quantity of Water in ml]  
 [ t = Operation Time in sec.]

Quantity of Water Q = 1000ml. = 1 liter  
 Starting Temp. = 20°C  
 Time = 120 sec.  
 Final Temp. = 50.4 °C

$$\text{Power (W)} = \frac{4.187 \times 1000 \times 30.4}{120}$$

$$\text{Power (W)} = \underline{1060.7} \text{ Watts}$$

## Test Data (Toshiba Magnetron Model: 2M248J)

### A. Input Power

The input power was measured using a RMS wattmeter. A 275ml. water load in a polypropylene beaker is placed in the center of the oven. The 275ml. of water was chosen for its compatibility with UL procedure to determine input ratings. The oven was operated at full output power for 6 minutes. The reading was taken after 6 minutes at full power.

| Voltage<br>(VAC) | Current<br>(Amps) | Power Consumption<br>(Watts) | Manufacturers<br>Rating<br>(Amps) |
|------------------|-------------------|------------------------------|-----------------------------------|
| 110.9            | 14.08             | 1511                         | 13.6                              |

### B. Power Output

The calorimetric method was used in determining the maximum output power. The test method described in MP-5 and IEC Publication 705/1988. A 1000ml. of water in a beaker was placed in the center of the oven. The oven was operated at full power.

$$P(W) = \frac{4.187 \times Q \times \Delta T}{t}$$

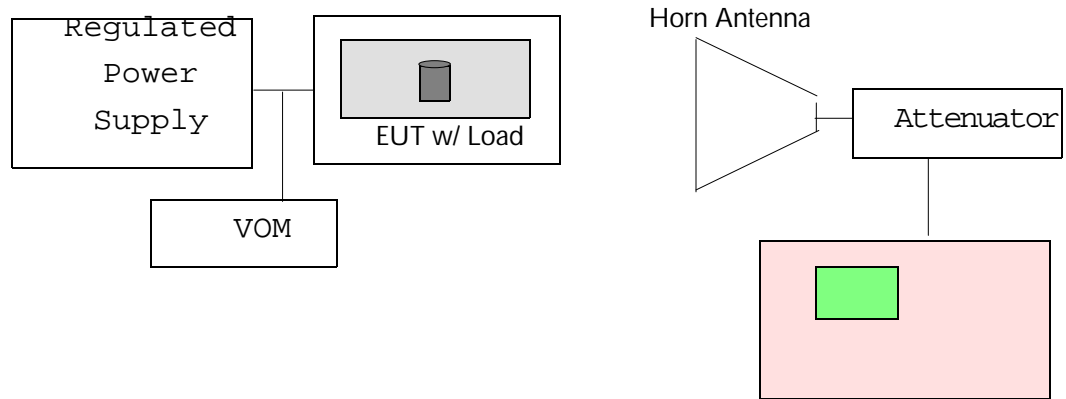
[ ΔT = Temperature Rise in °C]  
 [Q = Quantity of Water in ml]  
 [ t = Operation Time in sec.]

Quantity of Water Q = 1000ml. = 1 liter  
 Starting Temp. = 20°C  
 Time = 120 sec.  
 Final Temp. = 50.1 °C

$$\text{Power (W)} = \frac{4.187 \times 1000 \times 30.1}{120}$$

$$\text{Power (W)} = \underline{1050.2} \text{ Watts}$$

### C. Frequency Measurements (LG 2M246 Magnetron)



*(1) Frequency vs. Load variation test*

Initial Load 1000ml                  Final Load 200ml  
Fundamental Freq.                  2.450 GHz  
Limit 2.4GHz<2.5GHz

Minimum Frequency Observed:   2.403  GHz  
Maximum Frequency Observed:   2.484  GHz

**CONCLUSION:                  PASS**

*(2) Frequency vs. Line Voltage variation test*

Variation of line voltage from 80% (96Volts) to 125% (150Volts)  
Load 1000ml  
Fundamental Freq.                  2.450 GHz  
Limit 2.4GHz<2.5GHz

Minimum Frequency Observed:   2.405  GHz  
Maximum Frequency Observed:   2.477  GHz

**CONCLUSION:                  PASS**

## C. Frequency Measurements (Toshiba 2M248J Magnetron)

:  
:  
(1) *Frequency vs. Load variation test*

Initial Load 1000ml                  Final Load 200ml  
Fundamental Freq.                  2.450 GHz  
Limit 2.4GHz<2.5GHz

Minimum Frequency Observed: 2.420 GHz  
Maximum Frequency Observed: 2.493 GHz

**CONCLUSION:                  PASS**

(2) *Frequency vs. Line Voltage variation test*

Variation of line voltage from 80% (96Volts) to 125% (150Volts)  
Load 1000ml  
Fundamental Freq.                  2.450 GHz  
Limit 2.4GHz<2.5GHz

Minimum Frequency Observed: 2.408 GHz  
Maximum Frequency Observed: 2.496 GHz

**CONCLUSION:                  PASS**

## D. Power Density Safety Check

The power density was check to ensure that the power is not greater than 1.0mW/cm<sup>2</sup> at any location of the oven. The 1.0mW/cm<sup>2</sup> is in accordance with CDRH and UL 923 specifications.

*A microwave survey meter was placed on all sides, bottom, and top of the oven.  
No power greater than 0.10mW/cm<sup>2</sup> was observed and did not exceed the specified limits.*

**CONCLUSION:                  PASS**

## Test Data (LG Magnetron Model: 2M246)

### E. Radiated Emissions

Preliminary measurements were made inside an anechoic chamber at 1 meter to determine the emission characteristics of the EUT. The EUT is configured and operated in a manner which produces the maximum emission in a typical configuration. Final measurements were made outdoors at our 3-meter test site.

| FREQ.<br>(GHz) | AFCL<br>(dB) | Load<br>(ml) | Turntable<br>Location | Meter<br>Reading<br>(dBμV) | F/S<br>@ 3m.<br>(dBμV) | F/S<br>@ 3m.<br>(μV/m) | FCC<br>Limit<br>@ 300m<br>(μV/m) | F/S<br>@ 300m<br>(μV/m) |
|----------------|--------------|--------------|-----------------------|----------------------------|------------------------|------------------------|----------------------------------|-------------------------|
| 2.210          | 38.2         | 700          | Center                | 31.5                       | 69.7                   | 3054.9                 | 37.9                             | 30.6                    |
| 2.609          | 39.0         | 700          | Center                | 29.1                       | 68.1                   | 2541.0                 | 37.9                             | 25.4                    |
| 4.810          | 47.8         | 300          | Center                | 17.9                       | 65.7                   | 1927.5                 | 37.9                             | 19.3                    |
| 4.852          | 47.8         | 300          | Outside               | 20.1                       | 67.9                   | 2483.1                 | 37.9                             | 24.8                    |
| 4.931          | 47.8         | 700          | Center                | 19.5                       | 67.3                   | 2317.4                 | 37.9                             | 23.2                    |
| 4.978          | 47.8         | 700          | Outside               | 16.3                       | 64.1                   | 1603.3                 | 37.9                             | 16.0                    |
| 7.328          | 53.6         | 300          | Center                | 11.7                       | 65.3                   | 1840.8                 | 37.9                             | 18.4                    |
| 7.345          | 53.6         | 300          | Outside               | 14.8                       | 68.4                   | 2630.3                 | 37.9                             | 26.3                    |
| 7.357          | 53.6         | 700          | Center                | 14.6                       | 68.2                   | 2570.4                 | 37.9                             | 25.7                    |
| 7.380          | 53.6         | 700          | Outside               | 15.5                       | 69.1                   | 2851.0                 | 37.9                             | 28.5                    |
| 9.885          | 58.4         | 700          | Center                | 8.8                        | 67.2                   | 2290.9                 | 37.9                             | 22.9                    |

**NOTES:**

1. Measurements using Average detector (RBW=1MHz VBW=10Hz)
2. AFCL = Antenna Factor and Cable Loss
3. F/S = Field Strength
4. Limit per §18.305 =  $25^{\sqrt{\text{Power}}/500}$

## Test Data (Toshiba Magnetron Model: 2M248J)

### E. Radiated Emissions

Preliminary measurements were made inside an anechoic chamber at 1 meter to determine the emission characteristics of the EUT. The EUT is configured and operated in a manner which produces the maximum emission in a typical configuration. Final measurements were made outdoors at our 3-meter test site.

| FREQ.<br>(GHz) | AFCL<br>(dB) | Load<br>(ml) | Turntable<br>Location | Meter<br>Reading<br>(dBμV) | F/S<br>@ 3m.<br>(dBμV) | F/S<br>@ 3m.<br>(μV/m) | FCC<br>Limit<br>@ 300m<br>(μV/m) | F/S<br>@ 300m<br>(μV/m) |
|----------------|--------------|--------------|-----------------------|----------------------------|------------------------|------------------------|----------------------------------|-------------------------|
| 2.221          | 38.2         | 700          | Outside               | 26.6                       | 64.8                   | 1737.8                 | 37.9                             | 17.4                    |
| 2.630          | 39.0         | 700          | Outside               | 24.7                       | 63.7                   | 1531.1                 | 37.9                             | 15.3                    |
| 4.838          | 47.8         | 300          | Center                | 16.2                       | 64.0                   | 1584.9                 | 37.9                             | 15.9                    |
| 4.847          | 47.8         | 300          | Center                | 16.0                       | 63.8                   | 1548.8                 | 37.9                             | 15.5                    |
| 4.891          | 47.8         | 700          | Center                | 14.2                       | 62.0                   | 1258.9                 | 37.9                             | 12.6                    |
| 4.940          | 47.8         | 700          | Center                | 16.1                       | 63.9                   | 1566.8                 | 37.9                             | 15.7                    |
| 7.320          | 53.6         | 300          | Outside               | 8.8                        | 62.4                   | 1318.3                 | 37.9                             | 13.2                    |
| 7.360          | 53.6         | 300          | Center                | 9.1                        | 62.7                   | 1364.6                 | 37.9                             | 13.7                    |
| 7.373          | 53.6         | 700          | Outside               | 7.8                        | 61.4                   | 1174.9                 | 37.9                             | 11.8                    |
| 7.380          | 53.6         | 700          | Center                | 6.7                        | 60.3                   | 1035.1                 | 37.9                             | 10.4                    |
| 9.780          | 58.4         | 700          | Outside               | 1.7                        | 60.1                   | 1011.6                 | 37.9                             | 10.1                    |

**NOTES:**

1. Measurements using Average detector (RBW=1MHz VBW=10Hz)
2. AFCL = Antenna Factor and Cable Loss
3. F/S = Field Strength
4. Limit per §18.305 =  $25^{\sqrt{\text{Power}}/500}$

## Accuracy of Measurement

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

| Contribution<br>(Line Conducted)  | Probability Distribution | Uncertainty (+/- dB) |            |
|---|--------------------------|----------------------|------------|
|   |                          | 9kHz-150MHz          | 150-30 MHz |
| 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 $\Gamma_1=0.03$<br>LISN VRC $\Gamma_R=0.8$ (9 kHz) 0.2 (30 MHz)<br>Uncertainty limits $20\text{Log}(1 \pm \Gamma_1\Gamma_R)$ | 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 150 kHz to 30 MHz:

$$u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)} = \pm \sqrt{\frac{1.5^2 + 1.5^2}{3} + \frac{0.5^2}{2} + \frac{0.05^2}{2} + 0.35^2} = \pm 1.298 \text{ dB}$$

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

| Contribution<br>(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   |

## Test Equipment

| Type                             | Model  | Cal. Due Date | S/N                    |
|----------------------------------|--|---------------|------------------------|
| Microwave Spectrum Analyzer      | HP8566B (100Hz-22GHz)                                      | 08/15/99      | 3638A08713             |
| Microwave Spectrum Analyzer      | HP8566B (100Hz-22GHz)                                      | 04/17/99      | 2542A11898             |
| Spectrum Analyzer/Tracking Gen.  | HP8591A (100Hz-1.8GHz)                                     | 08/10/99      | 3144A02458             |
| Signal Generator*                | HP8640B (500Hz-1GHz)                                       | 08/09/99      | 2232A19558             |
| Signal Generator*                | HP8640B (500Hz-1GHz)                                       | 08/09/99      | 1851A09816             |
| Signal Generator*                | Rohde & Schwarz (0.1-1000MHz)                              | 09/11/99      | 894215/012             |
| Ailtech/Eaton Receiver           | NM37/57A-SL (30-1000MHz)                                   | 04/12/99      | 0792-03271             |
| Ailtech/Eaton Receiver           | NM37/57A (30-1000MHz)                                      | 03/11/00      | 0805-03334             |
| Ailtech/Eaton Receiver           | NM17/27A (0.1-32MHz)                                       | 09/17/99      | 0608-03241             |
| Quasi-Peak Adapter               | HP85650A   | 08/15/99      | 2043A00301             |
| Ailtech/Eaton Adapter            | CCA-7 CISPR/ANSI QP Adapter                                | 03/11/00      | 0194-04082             |
| RG58 Coax Test Cable             | No. 167  |               | n/a                    |
| Harmonic/Flicker Test System     | HP 6841A (IEC 555-2/3)                                     |               | 3531A00115             |
| Broadband Amplifier (2)          | HP8447D  |               | 1145A00470, 1937A03348 |
| Broadband Amplifier              | HP8447F  |               | 2443A03784             |
| Transient Limiter                | HP11947A (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)                                  |               |                        |
| Ailtech Dipoles                  | DM-105A (1 set)  |               | 33448-111              |
| EMCO LISN                        | 3816/2   |               | 1079                   |
| EMCO LISN                        | 3816/2   |               | 1077                   |
| EMCO LISN                        | 3725/2   |               | 2009                   |
| Microwave Preamplifier 40dB Gain | HP83017A (0.5-26.5GHz)                                     |               | 3123A00181             |
| Microwave Cables                 | MicroCoax (1.0-26.5GHz)                                    |               |                        |
| Ailtech/Eaton Receiver           | NM37/57A-SL  |               | 0792-03271             |
| Spectrum Analyzer                | HP8594A  |               | 3051A00187             |
| Spectrum Analyzer (2)            | HP8591A  |               | 3034A01395, 3108A02053 |
| Modulation Analyzer              | HP8901A  |               | 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           | Holiday 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).

## Recommendation/Conclusion

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The data collected shows that the **LG Electronics Inc. (GoldStar Model: MS-184SJ) Microwave Oven FCC ID: BEJS181XF** complies with Part 18 of the FCC Rules.