# Test Report

Curtis-Straus LLC, *a wholly owned subsidiary of BV CPS*

| | |
|---|---|
| Report No | EK0676-1 |
| Client | Keurig Inc. |
| Address | 55 Walkers Brook Drive<br>Reading, MA 01867 |
| Phone | 781-205-7221 |
| Items tested | RFID Coffee Brewer |
| FCC ID | YMSK5E3U8R7I4G410 |
| FRN | 0019667195 |
| Equipment Type | Part 15.247 Digital Transmission Systems |
| Equipment Code | DTS |
| FCC/IC Rule Parts | 47 CFR 15.247 |
| Test Dates | May 17, 2010 & June 15, 2010 |
| Results | As detailed within this report |
| Prepared by | Matthew Burman – Test Engineer |
| Authorized by | Mairaj Hussain – EMC Supervisor |
| Issue Date | June 29, 2010 |
| Conditions of Issue | This Test Report is issued subject to the conditions stated in the '*Conditions of Testing*' section on page 29 of this report. |

## *Contents*



Form Final Report REV 7-20-07 (DW)

## *Summary*

This test report supports an application for certification of a transmitter operating pursuant to 47 CFR 15.247. The product is the Coffee Brewer equipped with RFID radio. It is a transmitter that operates in the range 902-928MHz.

We found that the product met the above requirements with modification (see *Modifications Required for Compliance* section on page 6). Ranganarayan Narasimhan from Keurig Inc. was present during the testing. The test sample was received in good condition.

## *Test Methodology*

Radiated emission and AC Line conducted testing was performed according to the procedures specified in ANSI C63.10 (2009) and C63.4 (2009). Radiated Emissions were maximized by rotating the device around its axes as well as varying the test antenna's height and polarity. The device antenna cannot be maximized separately.

Radiated emissions about the digital circuitry within the coffee brewer were not tested due to exemption. Section 15.103(d), a digital device utilized exclusively as an appliance.

Conducted emission at the antenna port was performed, as required by rule section.

The EUT receives backscattered RFID information at the same time that it transmits the data, it does not contain a dedicated receive mode.

The EUT operating voltage is 120Vac 60Hz.
Low operating channel frequency = 910MHz
Mid operating channel frequency = 915MHz
High operating channel frequency = 922MHz

The following bandwidths were used during radiated spurious and line conducted emissions.

| Frequency | RBW | VBW |
|---|---|---|
| 0.15-30MHz | 9kHz | 30kHz |
| 30-1000MHz | 120kHz | 1MHz |
| 1-25GHz | 1MHz | 3MHz |

Release Control Record

| Issue No. | Reason for change | Date Issued |
|---|---|---|
| 1 | Original Release | July 21, 2010 |

## *Product Tested - Configuration Documentation*

**EUT Configuration**

**Work Order:** K0676
**Company:** Keurig Inc.
**Company Address:** 55 Walkers Brook Drive
Reading, MA 01867
**Contact:** Ranganarayan Narasimhan
**Person Present:** Alexander Rojas

| | MN | PN | SN |
|---|---|---|---|
| **EUT:** | B80V | --- | Sample 1 |

**EUT Description:** RFID Coffee Brewer
**EUT Tx Frequency:** 902-928MHz

| *Support Equipment:* | MN | SN |
|---|---|---|
| none | --- | --- |

***EUT Ports:***

| Port Label | Port Type | No. of ports | No. Populated | Cable Type | Shielded | Ferrites | Length | Max Length | Unpopulated Reason |
|---|---|---|---|---|---|---|---|---|---|
| AC mains | AC | 1 | 1 | 3-wire AC | no | none | 1.5m | 1.5m | |

***Software / Operating Mode Description:***

EUT cotinues to transmit data at 902-928MHz.

## *Statement of Conformity*

The RFID Coffee Brewer has been found to conform to the following parts of 47 CFR and as detailed below:

| Part 15 | Comments |
|---|---|
| 15.15(b) | There are no controls accessible to the user that varies the output power. |
| 15.19 | The label is shown in the label exhibit. |
| 15.21 | Information to the user is shown in the instruction manual exhibit. |
| 15.27 | Modification was required for compliance, see modifications required for compliance section. |
| 15.31 | The EUT was tested in accordance with the measurement standards in this section. |
| 15.33 | Frequency range was investigated according to this section, unless noted in specific rule section under which the equipment operates. |
| 15.35 | The EUT emissions were measured using the measurement detector and bandwidth specified in this section, unless noted in specific rule section under which the equipment operates. |
| 15.203 | The antenna for this device is hardwired to the PCB. |
| 15.205<br>15.209 | The fundamental is not in a Restricted band and the spurious and harmonic emissions in the Restricted bands comply with the general emission limits of 15.209. |
| 15.207 | EUT meets the AC Line conducted emissions requirements of 15.207. |
| 15.247 | The unit complies with the requirements of 15.247 |

## *Modifications Required for Compliance*

To pass spurious emissions, aluminum foil tape had to be added inside the chassis, as noted in the pictures. Also the fundamental power level was reduced by 3dB. Prior to this modification the product was failing.

**Spurious Emissions Table**

**Date:** 04-Jun-10 **Company:** Keurig Inc. **Work Order:** K0676
**Engineer:** Matthew Burman **EUT Desc:** Model B80V Brewer Radio **EUT Operating Voltage/Frequency:** 120Vac 60Hz
**Temp:** 24.8°C **Humidity:** 44% **Pressure:** 1006mBar
**Frequency Range:** 1-6GHz **Measurement Distance:** 3 m
**Notes:** RBW = 1MHz Duty Cycle Correction Factor 20dB
VBW = 3MHz

| Antenna Polarization (H / V) | Frequency (MHz) | Peak Reading (dBµV) | Average Reading (dBµV) | Preamp Factor (dB) | Antenna Factor (dB/m) | Cable Factor (dB) | Filter Factor (dB) | Duty Cycle Correction Factor (dB) | Adjusted Peak Reading (dBµV/m) | Adjusted Avg Reading (dBµV/m) | FCC Class B High Frequency - Peak Limit (dBµV/m) | Margin (dB) | Result (Pass/Fail) | FCC Class B High Frequency - Average Limit (dBµV/m) | Margin (dB) | Result (Pass/Fail) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| v | 2718.0 | 64.57 | 64.6 | 22.4 | 29.2 | 3.1 | 0.6 | 20.0 | 75.1 | 55.1 | 74.0 | 1.1 | --- | 54.0 | 1.1 | --- |
| v with foil | 2718.0 | 60.4 | 60.4 | 22.4 | 29.2 | 3.1 | 0.6 | 20.0 | 70.9 | 50.9 | 74.0 | -3.1 | --- | 54.0 | -3.1 | --- |
| h with foil | 2718.0 | 64.26 | 64.3 | 22.4 | 29.2 | 3.1 | 0.6 | 20.0 | 74.8 | 54.8 | 74.0 | 0.8 | --- | 54.0 | 0.8 | --- |
| v | 3624.0 | 65.33 | 65.3 | 21.6 | 31.9 | 3.0 | 0.4 | 20.0 | 79.1 | 59.1 | 74.0 | 5.1 | --- | 54.0 | 5.1 | --- |
| h with foil | 3624.0 | 62.33 | 62.3 | 21.6 | 31.9 | 3.0 | 0.4 | 20.0 | 76.1 | 56.1 | 74.0 | 2.1 | --- | 54.0 | 2.1 | --- |
| h with foil | 3623.875 | 62.1 | 62.1 | 21.6 | 31.9 | 3.0 | 0.4 | 20.0 | 75.8 | 55.8 | 74.0 | 1.8 | | 54.0 | 1.8 | |
| v | 4530.0 | 57.37 | 57.4 | 20.8 | 32.8 | 3.5 | 0.4 | 20.0 | 73.3 | 53.3 | 74.0 | -0.7 | --- | 54.0 | -0.7 | --- |
| h with foil | 4530.0 | 55.77 | 55.8 | 20.8 | 32.8 | 3.5 | 0.4 | 20.0 | 71.7 | 51.7 | 74.0 | -2.3 | --- | 54.0 | -2.3 | --- |
| h with foil | 5436.0 | 49.59 | 49.6 | 20.5 | 34.8 | 4.4 | 0.5 | 20.0 | 68.8 | 48.8 | 74.0 | -5.2 | --- | 54.0 | -5.2 | --- |
| v with foil | 5436.0 | 47.92 | 47.9 | 20.5 | 34.8 | 4.4 | 0.5 | 20.0 | 67.1 | 47.1 | 74.0 | -6.9 | --- | 54.0 | -6.9 | --- |

***Table Result:*** --- by --- dB ***Worst Freq:*** --- MHz

**Test Site:** EMI Chamber 2 **Cable 1:** Asset #1506 **Cable 2:** Asset #1508 **High Pass Filter:** Asset #1310
**Analyzer:** Gold **Preamp:** Brown **Antenna:** Black Horn **Preselector:** ---

## *Test Results*

# *Bandwidth*

### LIMIT

*The minimum 6 dB bandwidth shall be at least 500 kHz.* [15.247(a) (2)]

### MEASUREMENTS / RESULTS

Measured 6dB bandwidth =

### Data Table

**Bandwidth**

**Date:** 08-Jul-10 **Company:** Keurig **Work Order:** K0676
**Engineer:** Matthew Burman **EUT Desc:** RFID Brewer **EUT Operating Voltage/Frequency:** 120Vac 60Hz
**Temp:** 26°C **Humidity:** 25% **Pressure:** 1013mBar
**Frequency Range:** 902-928MHz **Measurement Distance:** Conductive
**Notes:** 6dB bandwidth
RBW = 100kHz, VBW = 300kHz

| Antenna Polarization (H / V) | Frequency (MHz) | 6dB Bandwidth (MHz) | | | | | --- Limit (dBµV/m) | --- Margin (dB) | --- Result (Pass/Fail) | FCC 15.247 (a)(2) Limit (MHz) | FCC 15.247 (a)(2) Margin (MHz) | FCC 15.247 (a)(2) Result (Pass/Fail) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| low channel | 910.0 | 5.8120 | | | | | | | | 0.5 | 5.3 | Pass |
| mid channel | 915.0 | 4.5900 | | | | | | | | 0.5 | 4.1 | Pass |
| high channel | 920.0 | 6.1450 | | | | | | | | 0.5 | 5.6 | Pass |

***Table Result:*** Pass

**Test Site:** EMC4 **Cable 1:** EMIR-HIGH-21
**Analyzer:** Asset #1491 **Filter:** PE7019-20

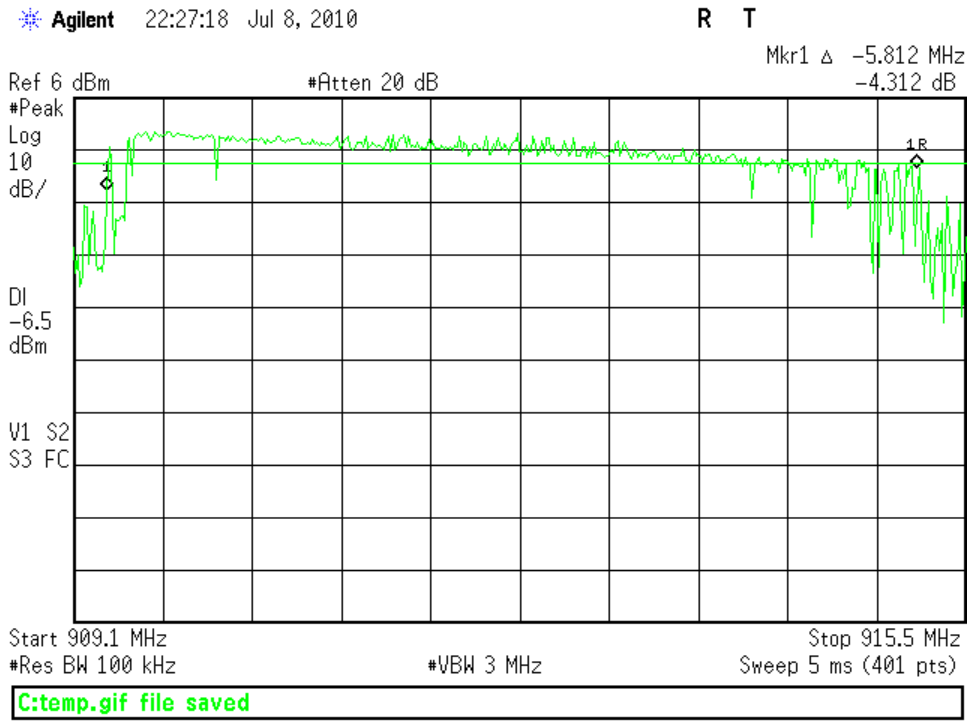
Rev: 7-Jul-2010

| Spectrum Analyzers / Receivers /Preselectors | Range | MN | Mfr | SN | Asset | Cat | Calibration Due |
|---|---|---|---|---|---|---|---|
| Rental SA #5 | 9kHz-26.5 GHz | E4407B | Agilent | MY44220066 | 1491 | I | 11-Feb-2011 |

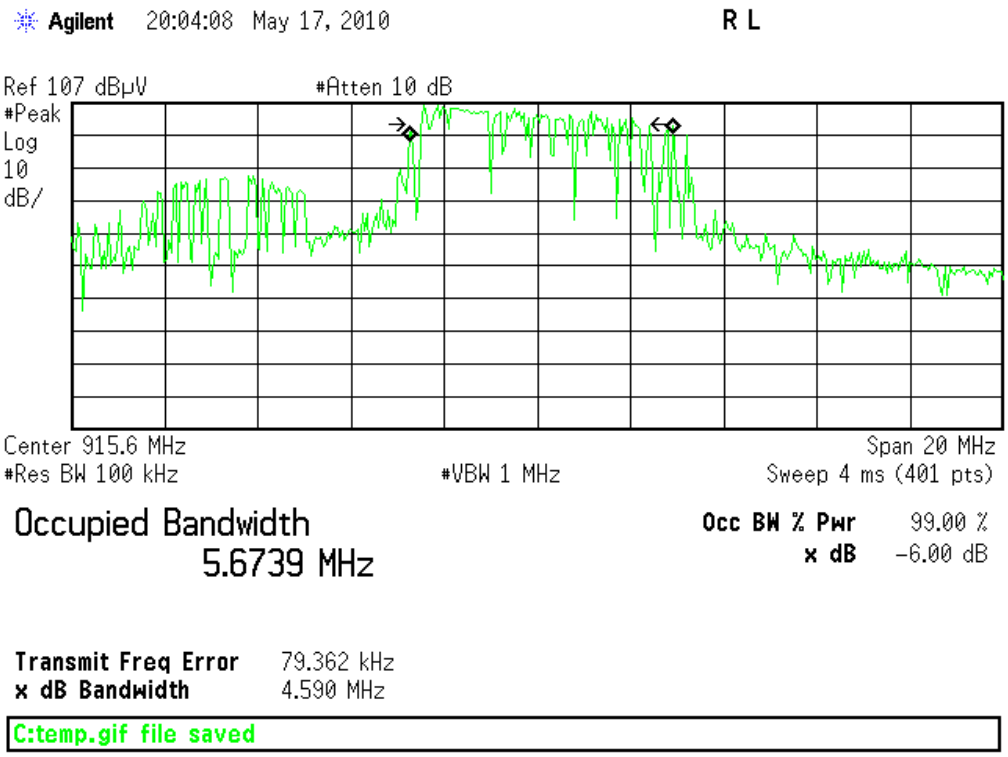
| Preamps /Couplers Attenuators / Filters | Range | MN | Mfr | SN | Asset | Cat | Calibration Due |
|---|---|---|---|---|---|---|---|
| HF 20dB 50W Attenuator | 0.009-18 GHz | PE 7019-20 | Pasternack | 1 | 791 | II | 8-May-2011 |

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.

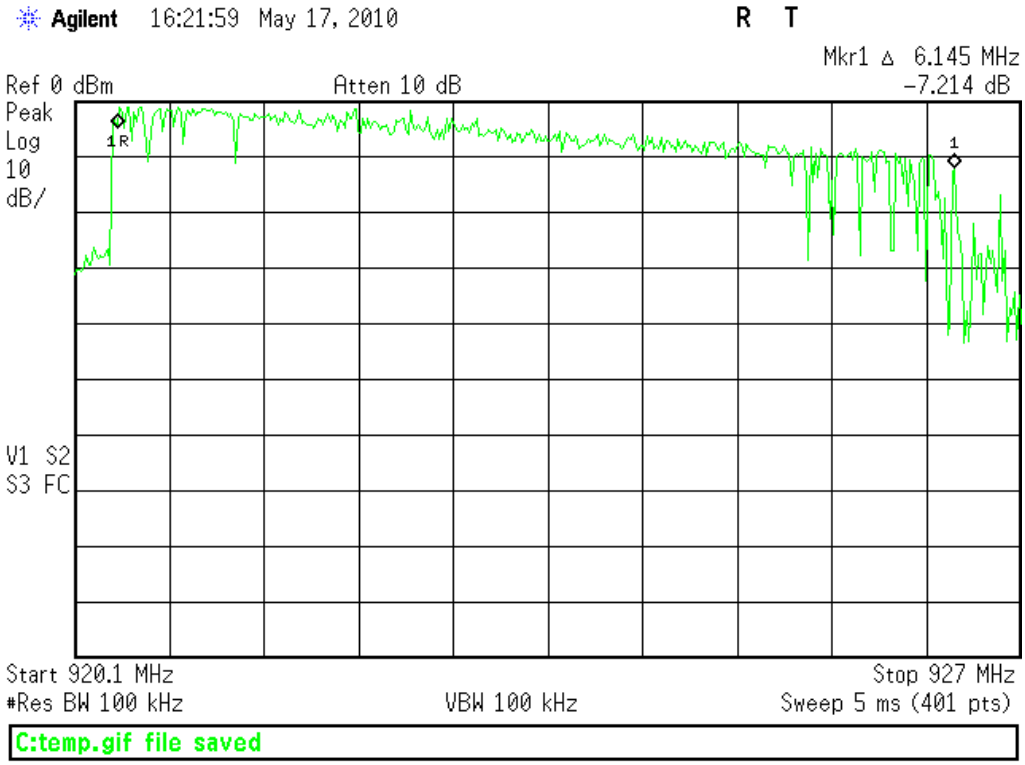
**PLOT**
**Low Channel**




**Mid Channel**



## High Channel



# *Peak Power*

## LIMIT

Conducted Output Power
1 Watt
[15.247(b) (3)]

## MEASUREMENTS / RESULTS

## DATA TABLE

**Peak Output Power**

**Date:** 08-Jul-10 **Company:** Keurig **Work Order:** K0676
**Engineer:** Matthew Burman, TT **EUT Desc:** RFID Brewer **EUT Operating Voltage/Frequency:** 120Vac 60Hz
**Temp:** 24.8°C **Humidity:** 44% **Pressure:** 1014mBar
**Frequency Range:** 902-928MHz **Measurement Distance:** Conductive
**Notes:** POP Option 2, Method #3
RBW = 1MHz, VBW = 3MHz
**1 Watt = 30dBm**

| Antenna Polarization (H / V) | Frequency (MHz) | Reading (dBm) | Filter Factor (dB) | | Cable Factor (dB) | Adjusted Reading (dBm) | --- Limit (dBµV/m) | --- Margin (dB) | --- Result (Pass/Fail) | FCC 15.247 (b)(3) Limit (dBm) | FCC 15.247 (b)(3) Margin (dB) | FCC 15.247 (b)(3) Result (Pass/Fail) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| low channel | 910.01 | 7.7 | 19.4 | | 1.1 | 28.2 | | | | 30.0 | -1.8 | Pass |
| mid channel | 913.2 | 3.1 | 19.4 | --- | 1.1 | 23.6 | --- | --- | --- | 30.0 | -6.4 | Pass |
| high channel | 922.3 | 4.3 | 19.4 | --- | 1.1 | 24.8 | --- | --- | --- | 30.0 | -5.2 | Pass |

***Table Result:*** Pass by -1.8 dB ***Worst Freq:*** 910.01 MHz

**Test Site:** EMC4 **Cable 1:** EMIR-HIGH-21
**Analyzer:** Asset #1491 **Attenuator:** PE7019-20

Rev: 7-Jul-2010

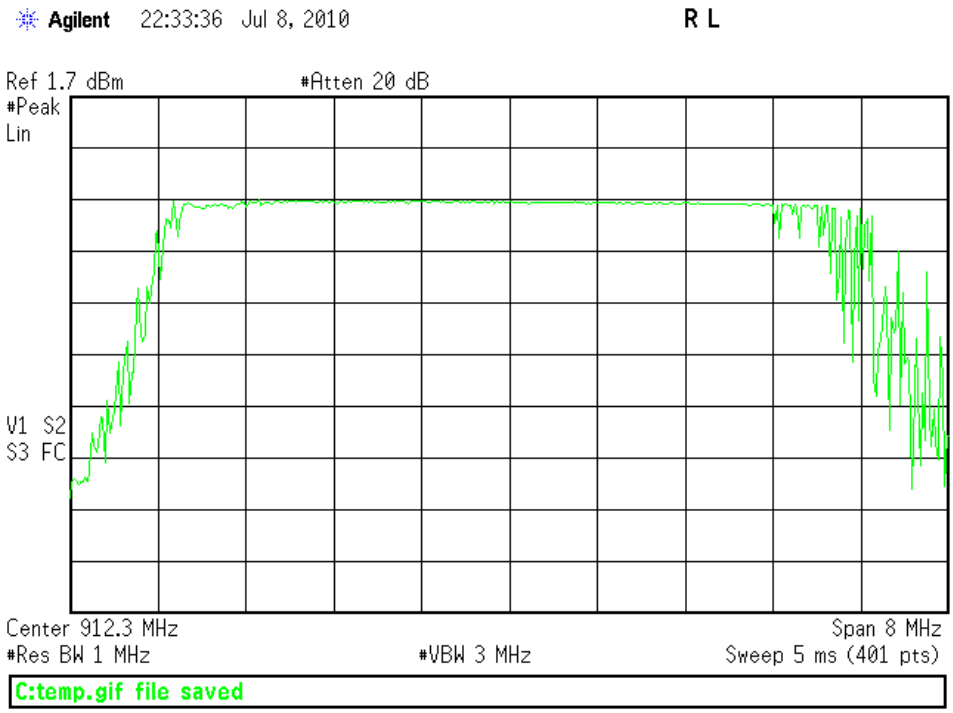
| Spectrum Analyzers / Receivers /Preselectors | Range | MN | Mfr | SN | Asset | Cat | Calibration Due |
|---|---|---|---|---|---|---|---|
| Rental SA #5 | 9kHz-26.5 GHz | E4407B | Agilent | MY44220066 | 1491 | I | 11-Feb-2011 |

| Preamps /Couplers Attenuators / Filters | Range | MN | Mfr | SN | Asset | Cat | Calibration Due |
|---|---|---|---|---|---|---|---|
| HF 20dB 50W Attenuator | 0.009-18 GHz | PE 7019-20 | Pasternack | 1 | 791 | II | 8-May-2011 |

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.

## PLOTS

### Sample Plot



# *Band Edge Measurements*

## LIMITS

*In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that...the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval,…the attenuation required under this paragraph shall be 30dB..*
[15.247(d)]

## MEASUREMENTS / RESULTS

Rev: 7-Jul-2010

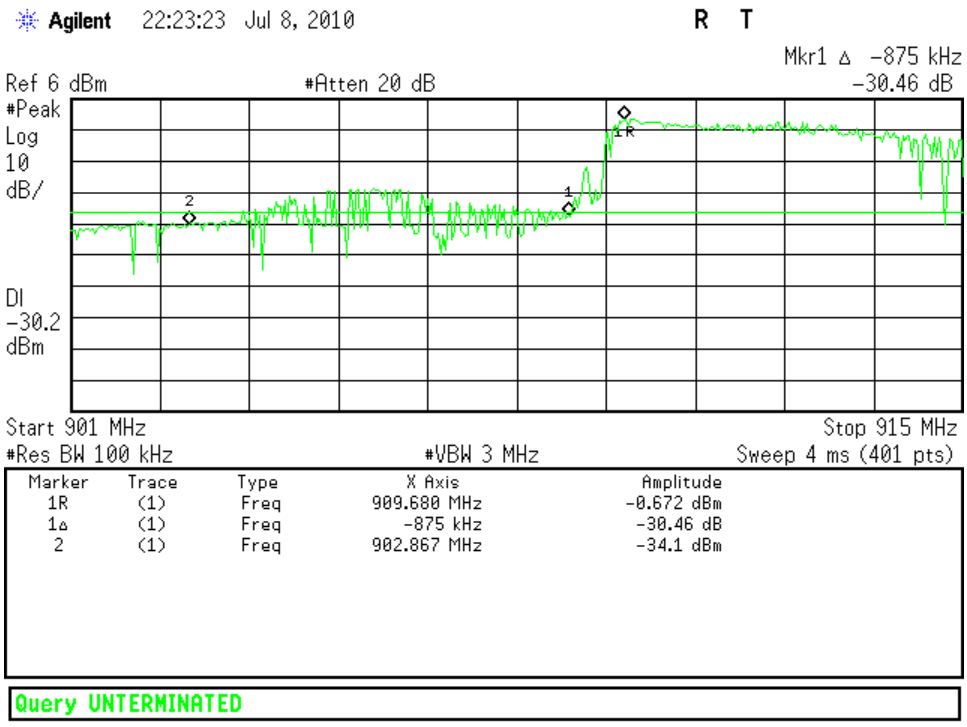
| Spectrum Analyzers / Receivers /Preselectors | Range | MN | Mfr | SN | Asset | Cat | Calibration Due |
|---|---|---|---|---|---|---|---|
| Rental SA #5 | 9kHz-26.5 GHz | E4407B | Agilent | MY44220066 | 1491 | I | 11-Feb-2011 |

| Preamps /Couplers Attenuators / Filters | Range | MN | Mfr | SN | Asset | Cat | Calibration Due |
|---|---|---|---|---|---|---|---|
| HF 20dB 50W Attenuator | 0.009-18 GHz | PE 7019-20 | Pasternack | 1 | 791 | II | 8-May-2011 |

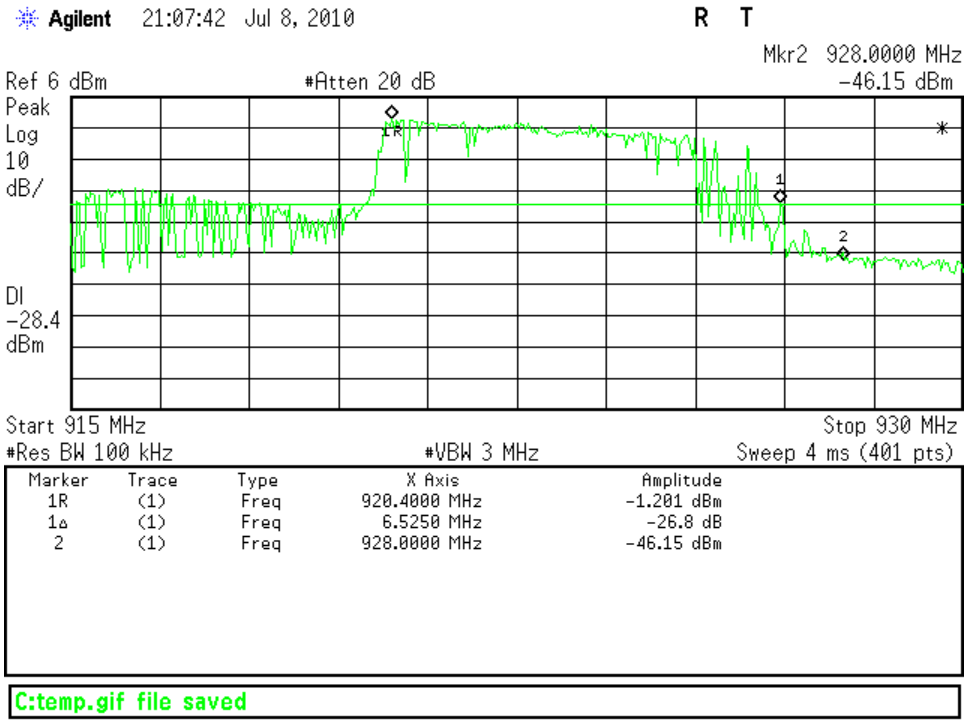
All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.

## PLOTS

### Low Channel



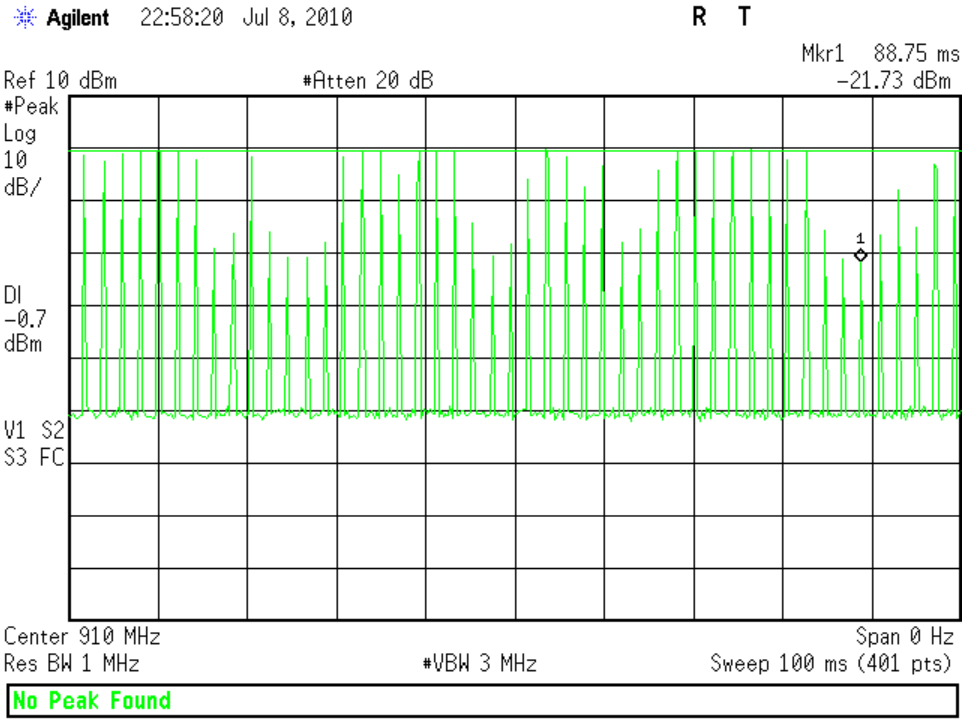
## High Channel



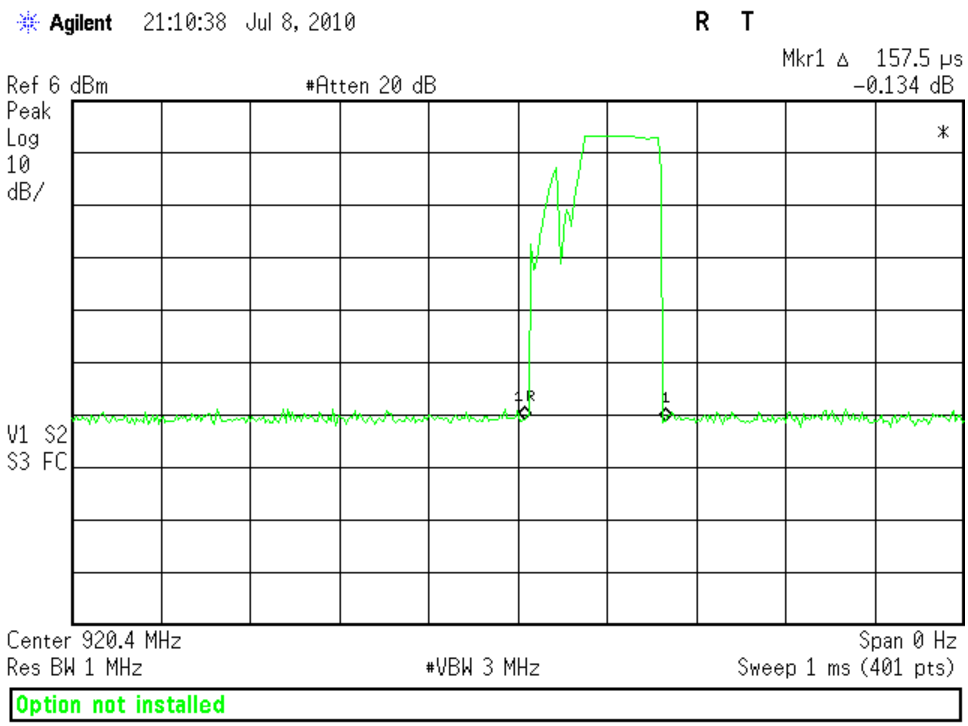
# *Duty Cycle Correction Calculation*

## MEASUREMENTS / CALCULATIONS

## PLOTS




**100ms window**




Duration of a single transmitting pulse

Each transmission lasts for 157.5µs, which is 0.1575ms

In 100ms, 47 transmissions occur.

0.1575 x 47 = 7.4205ms

DCCF = 20 x log (7.4205/100)

DCCF = -22.61dB

A maximum duty cycle correction factor of 20dB was applied to average readings.

Rev: 7-Jul-2010

| Spectrum Analyzers / Receivers /Preselectors | Range | MN | Mfr | SN | Asset | Cat | Calibration Due |
|---|---|---|---|---|---|---|---|
| Rental SA #5 | 9kHz-26.5 GHz | E4407B | Agilent | MY44220066 | 1491 | I | 11-Feb-2011 |
| **Preamps /Couplers Attenuators / Filters** | **Range** | **MN** | **Mfr** | **SN** | **Asset** | **Cat** | **Calibration Due** |
| HF 20dB 50W Attenuator | 0.009-18 GHz | PE 7019-20 | Pasternack | 1 | 791 | II | 8-May-2011 |

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.

# *Radiated Spurious Emissions*

## LIMITS

*Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).*
[15.247(d)]

## MEASUREMENTS / RESULTS

**Spurious Emissions**

**Date:** 17-May-10 **Company:** Keurig **Work Order:** K0676
**Engineer:** Arik Zwirner **EUT Desc:** Radio for brewer **EUT Operating Voltage/Frequency:** 120V/60Hz
**Temp:** 26°C **Humidity:** 21% **Pressure:** 1012mBar
**Frequency Range:** 30-1000MHz **Measurement Distance:** 3 m
**Notes:** 902-928MHz exempted as transmitter band quasi peak readings
RBW = 120kHz VBW = 300kHz

| Antenna Polarization (H / V) | Frequency (MHz) | Reading (dBµV) | Preamp Factor (dB) | Antenna Factor (dB/m) | Cable Factor (dB) | Adjusted Reading (dBµV/m) | CISPR Class B Limit (dBµV/m) | CISPR Class B Margin (dB) | CISPR Class B Result (Pass/Fail) | FCC Class B Limit (dBµV/m) | FCC Class B Margin (dB) | FCC Class B Result (Pass/Fail) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| V | 80.2 | 40.9 | 22.6 | 8.2 | 0.5 | 27.0 | 40.5 | -13.5 | Pass | 40.0 | -13.0 | Pass |
| V | 90.4 | 46.3 | 22.6 | 8.0 | 0.6 | 32.3 | 40.5 | -8.2 | Pass | 43.5 | -11.2 | Pass |
| V | 94.2 | 38.1 | 22.6 | 8.6 | 0.6 | 24.7 | 40.5 | -15.8 | Pass | 43.5 | -18.8 | Pass |
| V | 155.0 | 37.8 | 22.6 | 12.8 | 0.7 | 28.7 | 40.5 | -11.8 | Pass | 43.5 | -14.8 | Pass |
| V | 189.8 | 29.6 | 22.6 | 11.8 | 0.7 | 19.5 | 40.5 | -21.0 | Pass | 43.5 | -24.0 | Pass |
| V | 206.0 | 29.1 | 22.6 | 11.7 | 0.8 | 19.0 | 40.5 | -21.5 | Pass | 43.5 | -24.5 | Pass |
| V | 930.0 | 28.5 | 22.0 | 23.1 | 1.9 | 31.5 | 47.5 | -16.0 | Pass | 46.0 | -14.5 | Pass |

***Table Result:*** Pass by -8.2 dB ***Worst Freq:*** 90.4 MHz

**Test Site:** EMI Chamber 2 **Cable 1:** Asset #1508 **Cable 2:** Asset #1506 **Cable 3:** ---
**Analyzer:** Asset #1327 **Preamp:** Blue **Antenna:** Red-Black **Preselector:** ---

Rev: 17-May-2010

| Spectrum Analyzers / Receivers /Preselectors | Range | MN | Mfr | SN | Asset | Cat | Calibration Due |
|---|---|---|---|---|---|---|---|
| SA EMI Chamber (1327) | 9kHz-13.2 GHz | E4405B | Agilent | MY45103416 | 1327 | I | 11-Mar-2011 |
| **Radiated Emissions Sites** | **FCC Code** | **IC Code** | **VCCI Code** | | | **Cat** | **Calibration Due** |
| EMI Chamber 2 | 719150 | 2762A-7 | R-3033, G-107 | | | I | 15-Feb-2011 |
| **Preamps /Couplers Attenuators / Filters** | **Range** | **MN** | **Mfr** | **SN** | **Asset** | **Cat** | **Calibration Due** |
| Blue | 0.009-2000MHz | ZFL-1000-LN | CS | N/A | 759 | II | 6-Apr-2011 |
| **Antennas** | **Range** | **MN** | **Mfr** | **SN** | **Asset** | **Cat** | **Calibration Due** |
| Red-Black Bilog | 30-2000MHz | JB1 | Sunol | A091604-2 | 1106 | I | 28-Oct-2010 |
| **Meteorological Meters** | | **MN** | **Mfr** | **SN** | **Asset** | **Cat** | **Calibration Due** |
| Temp./Humidity/Atm. Pressure Gauge | | 7400 Perception II | Davis | N/A | 965 | I | 6-Apr-2011 |
| CHAMBER2 Thermohygrometer | | 35519-044 | Control Company | 72457639 | 1347 | II | 18-Aug-2011 |

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.

**Radiated Emissions Table**

**Date:** 17-Jun-10 **Company:** Keurig **Work Order:** K0676
**Engineer:** Evan Gould **EUT Desc:** RFID Brewer **EUT Operating Voltage/Frequency:** 120V / 60Hz
**Temp:** 26°C **Humidity:** 32% **Pressure:** 1002mBar
**Frequency Range:** 1-10GHz **Measurement Distance:** 3 m
**Notes:** EUT has final form of shielding modification installed. See pictures.

| Antenna Polarization (H / V) | Frequency (MHz) | Peak Reading (dBµV) | Preamp Factor (dB) | Antenna Factor (dB/m) | Cable Factor (dB) | Adjusted Peak Reading (dBµV/m) | Duty Cycle Correction Factor (dB) | Adjusted Avg Reading (dBµV/m) | FCC Class B High Frequency - Peak Limit (dBµV/m) | Peak Margin (dB) | Peak Result (Pass/Fail) | FCC Class B High Frequency - Average Limit (dBµV/m) | Average Margin (dB) | Average Result (Pass/Fail) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| H | 2747.4 | 63.4 | 22.0 | 28.9 | 3.2 | 73.5 | 20.0 | 53.5 | 74.0 | -0.5 | Pass | 54.0 | -0.5 | Pass |
| H | 3654.9 | 58.6 | 20.8 | 31.8 | 3.5 | 73.1 | 20.0 | 53.1 | 74.0 | -0.9 | Pass | 54.0 | -0.9 | Pass |

***Table Result:*** Pass by -0.5 dB ***Worst Freq:*** 2747.4 MHz

**Test Site:** EMI Chamber 1 **Cable 1:** Asset #1505 **Cable 2:** Asset #1507 **Cable 3:** ---
**Analyzer:** Asset #1327 **Preamp:** Asset #1517 **Antenna:** Orange Horn **Preselector:** ---

**Spurious Emissions**

**Date:** 15-Jun-10 **Company:** Keurig **Work Order:** K0676
**Engineer:** Matthew Burman **EUT Desc:** RFID Brewer **EUT Operating Voltage/Frequency:** 120Vac 60Hz
**Temp:** 22.2°C **Humidity:** 41% **Pressure:** 1014mBar
**Frequency Range:** 1-7GHz **Measurement Distance:** 3 m
**Notes:** Harmonics 15.247(d)
Fundamental at 915MHz

| Antenna Polarization (H / V) | Frequency (MHz) | Peak Reading (dBµV) | Preamp Factor (dB) | Antenna Factor (dB/m) | Filter Factor (dB) | Cable Factor (dB) | Adjusted Peak Reading (dBµV/m) | Duty Cycle Correction Factor (dB) | Adjusted Avg Reading (dBµV/m) | FCC Class B High Frequency - Peak Limit (dBµV/m) | Margin (dB) | Result (Pass/Fail) | FCC Class B High Frequency - Average Limit (dBµV/m) | Margin (dB) | Result (Pass/Fail) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| h | 4529.85 | 50.3 | 19.9 | 32.5 | 0.4 | 2.2 | 65.5 | 20.0 | 45.5 | 74.0 | -8.5 | Pass | 54.0 | -8.5 | Pass |
| h | 5441.45 | 49.3 | 19.6 | 34.2 | 0.6 | 2.3 | 66.8 | 20.0 | 46.8 | 74.0 | -7.2 | Pass | 54.0 | -7.2 | Pass |

***Table Result:*** Pass by -0.2 dB ***Worst Freq:*** 2748.25 MHz

**Test Site:** 1DCC-OATS-3M-I **Cable 1:** EMIR-HIGH-21 **High Pass Filter:** Asset #1310
**Analyzer:** Rental SA#1 **Preamp:** Asset #1517 **Antenna:** Yellow Horn

**Spurious Emissions**

**Date:** 15-Jun-10 **Company:** Keurig **Work Order:** K0676
**Engineer:** Matthew Burman **EUT Desc:** RFID Brewer **EUT Operating Voltage/Frequency:** 120Vac 60Hz
**Temp:** 22.2°C **Humidity:** 41% **Pressure:** 1014mBar
**Frequency Range:** 7-10GHz **Measurement Distance:** 1m
**Notes:** Harmonics **15.247(d)**
Fundamental at 915MHz

| Antenna Polarization (H / V) | Frequency (MHz) | Peak Reading (dBµV) | Preamp Factor (dB) | Antenna Factor (dB/m) | Filter Factor (dB) | Cable Factor (dB) | Adjusted Peak Reading (dBµV/m) | Duty Cycle Correction Factor (dB) | Adjusted Avg Reading (dBµV/m) | FCC Class B High Frequency - Peak Limit (dBµV/m) | Margin (dB) | Result (Pass/Fail) | FCC Class B High Frequency - Average Limit (dBµV/m) | Margin (dB) | Result (Pass/Fail) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| h | 7253.1 | 44.11 | 19.4 | 37.2 | 0.5 | 2.9 | 65.3 | 20.0 | 45.3 | 83.5 | -18.2 | Pass | 63.5 | -18.2 | Pass |
| h | 8159.75 | 41.2 | 19.4 | 38.4 | 0.8 | 3.2 | 64.2 | 20.0 | 44.2 | 83.5 | -19.3 | Pass | 63.5 | -19.3 | Pass |
| h | 9062.3 | 37.0 | 18.8 | 38.9 | 0.9 | 3.2 | 61.2 | 20.0 | 41.2 | 83.5 | -22.3 | Pass | 63.5 | -22.3 | Pass |

***Table Result:*** Pass by -9.4 dB ***Worst Freq:*** 7253.1 MHz

**Test Site:** 1DCC-OATS-3M-I **Cable 1:** EMIR-HIGH-21 **High Pass Filter:** Asset #0817
**Analyzer:** Rental SA#1 **Preamp:** Asset #1517 **Antenna:** Yellow Horn

Rev: 17-May-2010

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Spectrum Analyzers / Receivers /Preselectors** | **Range** | **MN** | **Mfr** | **SN** | **Asset** | **Cat** | **Calibration Due** |
| Rental SA #1 (Brown) | 9kHz-26.5GHz | E4407B | Agilent | SG44210511 | 1510 | I | 25-Mar-2011 |
| **Radiated Emissions Sites** | **FCC Code** | **IC Code** | **VCCI Code** | | | **Cat** | **Calibration Due** |
| 1DCC-OATS-3M-I | 719150 | 2762A-8 | R-3109 | | | II | 7-Jul-2011 |
| **Preamps /Couplers Attenuators / Filters** | **Range** | **MN** | **Mfr** | **SN** | **Asset** | **Cat** | **Calibration Due** |
| 1517 HF Preamp | 1-18GHz | CS | CS | N/A | 1517 | II | 29-May-2010 |
| **Antennas** | **Range** | **MN** | **Mfr** | **SN** | **Asset** | **Cat** | **Calibration Due** |
| Yellow Horn | 1-18GHz | 3115 | EMCO | 9608-4898 | 37 | I | 27-May-2011 |
| **Meteorological Meters** | | **MN** | **Mfr** | **SN** | **Asset** | **Cat** | **Calibration Due** |
| Temp./Humidity/Atm. Pressure Gauge | | 7400 Perception II | Davis | N/A | 965 | I | 6-Apr-2011 |
| 1DCC-OATS-3M-I Thermohygrometer | | 35519-044 | Control Company | 72457635 | 1334 | II | 18-Aug-2011 |

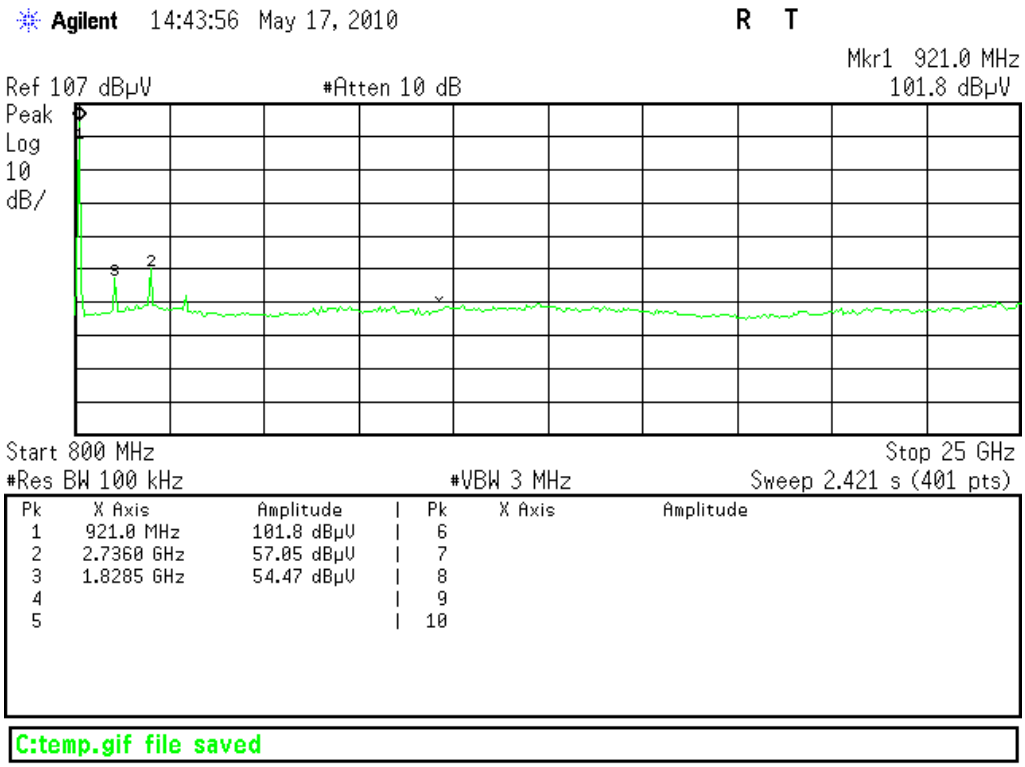
All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.

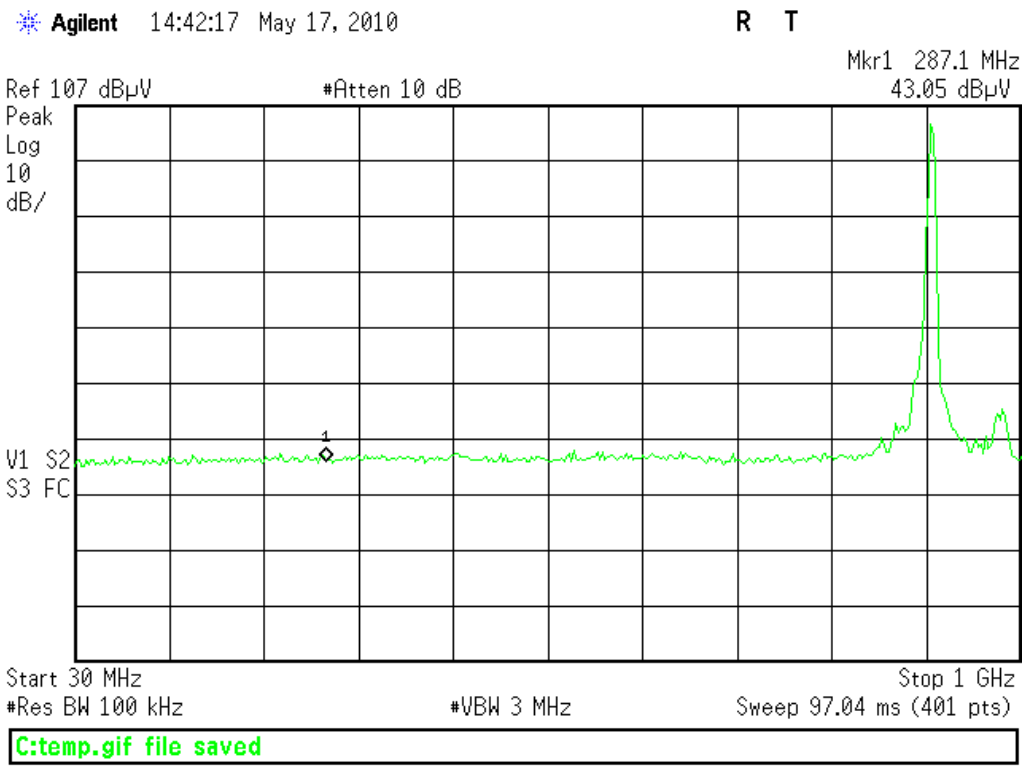
## *Conducted Spurious Emissions*

**LIMITS**

*In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth that contains the highest level of desired power…*
[15.247(d)]

**MEASUREMENTS / RESULTS**






Rev: 17-May-2010

| Spectrum Analyzers / Receivers /Preselectors | Range | MN | Mfr | SN | Asset | Cat | Calibration Due |
|---|---|---|---|---|---|---|---|
| Rental SA #1 (Brown) | 9kHz-26.5GHz | E4407B | Agilent | SG44210511 | 1510 | I | 25-Mar-2011 |
| **Radiated Emissions Sites** | **FCC Code** | **IC Code** | **VCCI Code** | | | **Cat** | **Calibration Due** |
| 1DCC-OATS-3M-I | 719150 | 2762A-8 | R-3109 | | | II | 7-Jul-2011 |
| **Preamps /Couplers Attenuators / Filters** | **Range** | **MN** | **Mfr** | **SN** | **Asset** | **Cat** | **Calibration Due** |
| HF 20dB 50W Attenuator | 0.009-18 GHz | PE 7019-20 | Pasternack | 1 | 791 | II | 8-May-2011 |

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.

# *Power Spectral Density*

## LIMIT

*…the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.* [15.247(e)]

## MEASUREMENTS / RESULTS

Data Tables

**Power Spectral Density**

**Date:** 08-Jul-10 **Company:** Keurig **Work Order:** K0676
**Engineer:** Matthew Burman, TT **EUT Desc:** RFID Brewer **EUT Operating Voltage/Frequency:** 120Vac 60Hz
**Temp:** 24.8°C **Humidity:** 46% **Pressure:** 1014mBar
**Frequency Range:** 902-928MHz **Measurement Distance:** Conductive
**Notes:** PSD Option 2

| Antenna Polarization (H / V) | Frequency (MHz) | Reading (dBm) | Filter Factor (dB) | | Cable Factor (dB) | Adjusted Reading (dBm) | --- Limit (dBµV/m) | --- Margin (dB) | --- Result (Pass/Fail) | FCC 15.247 (e) Limit (dBm) | FCC 15.247 (e) Margin (dB) | FCC 15.247 (e) Result (Pass/Fail) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| low channel | 910.0 | -32.8 | 19.4 | --- | 1.1 | -12.3 | | | | 8.0 | -20.3 | Pass |
| mid channel | 913.4 | -12.7 | 19.4 | --- | 1.1 | 7.8 | --- | --- | --- | 8.0 | -0.2 | Pass |
| high channel | 920.62275 | -13.5 | 19.4 | --- | 1.1 | 7.0 | --- | --- | --- | 8.0 | -1.0 | Pass |

***Table Result:*** Pass by -0.2 dB ***Worst Freq:*** 913.4 MHz

**Test Site:** EMC4 **Cable 1:** EMIR-HIGH-21
**Analyzer:** Asset #1492 **Attenuator:** PE7019-20

Rev: 7-Jul-2010

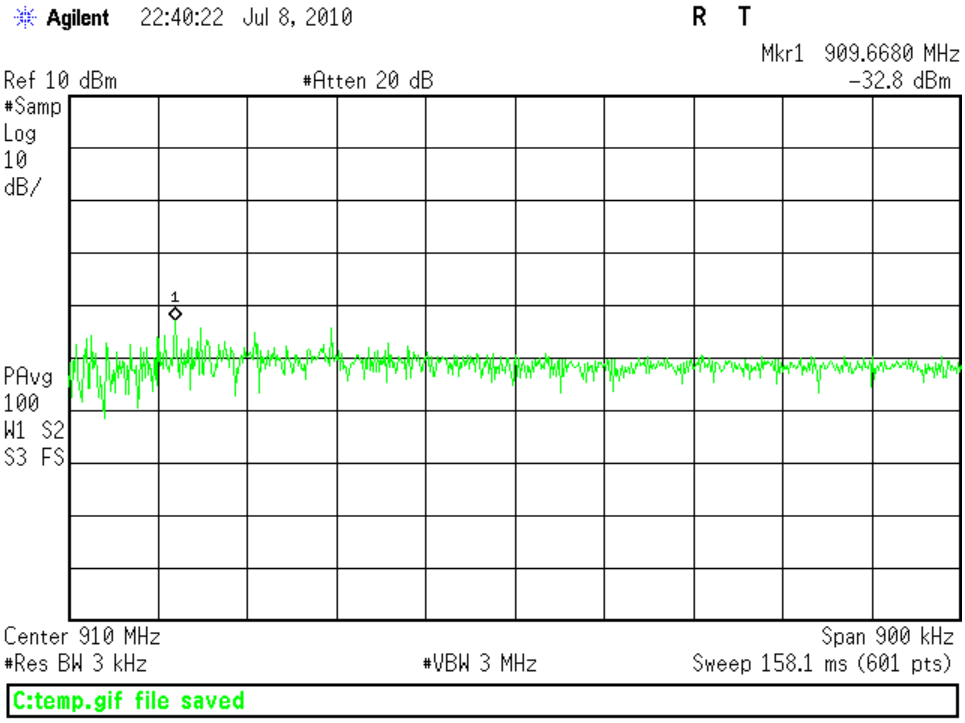
| Spectrum Analyzers / Receivers /Preselectors | Range | MN | Mfr | SN | Asset | Cat | Calibration Due |
|---|---|---|---|---|---|---|---|
| Rental SA #5 | 9kHz-26.5 GHz | E4407B | Agilent | MY44220066 | 1491 | I | 11-Feb-2011 |

| Preamps /Couplers Attenuators / Filters | Range | MN | Mfr | SN | Asset | Cat | Calibration Due |
|---|---|---|---|---|---|---|---|
| HF 20dB 50W Attenuator | 0.009-18 GHz | PE 7019-20 | Pasternack | 1 | 791 | II | 8-May-2011 |

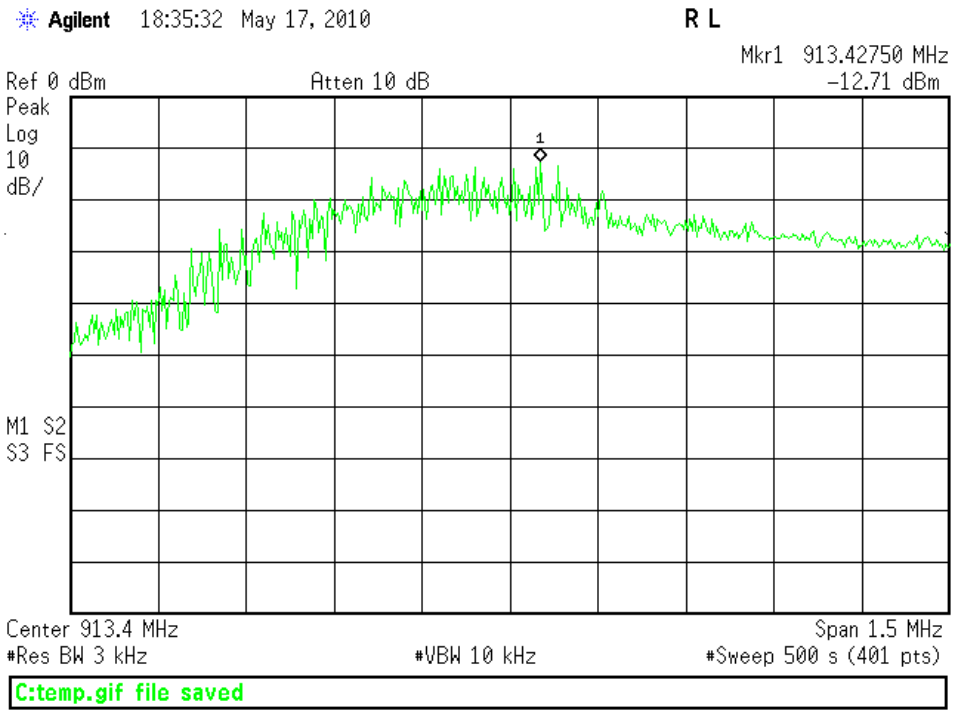
All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.

## PLOTS

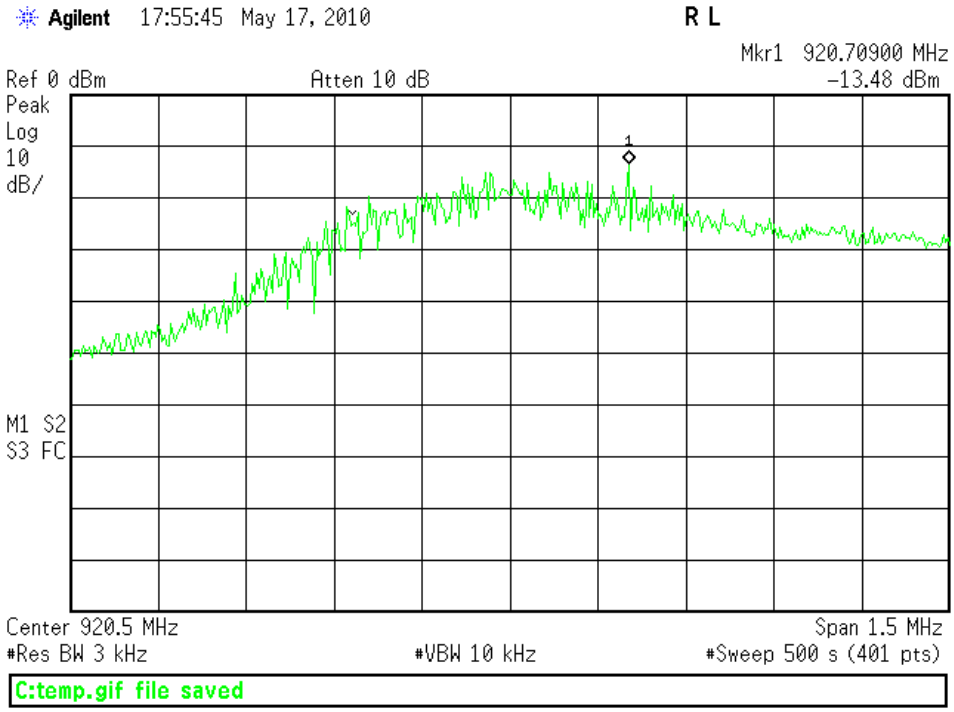
### Low Channel




### Mid Channel



## High Channel



# *AC Line Conducted Emissions*

## LIMITS

| Frequency of emission (MHz) | Quasi-peak limit (dBµV) | Average limit (dBµV) |
|---|---|---|
| 0.15-0.5 | 66 to 56* | 56 to 46* |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |

*Decreases with the logarithm of the frequency.

[47 CFR 15.207(a)]

## MEASUREMENTS / RESULTS

**AC Mains Conducted Emissions**

**Date:** 18-May-10 **Company:** Keurig Inc. **Work Order:** K0676
**Engineer:** Matthew Burman **EUT Desc:** RFID Coffee Brewer **Test Site:** CEMI02
**Temp:** 22.3°C **Humidity:** 23% **Pressure:** 1001mBar
**Notes:** Noise Floor
**Measurement Device:** Asset #1494 LISN **EUT Operating Voltage/Frequency:** 120Vac 60Hz
**Range:** 0.15-30MHz **Spectrum Analyzer:** Blue

| | Q.P. Readings | | Ave. Readings | | Impedance Factor | FCC/CISPR B | | FCC/CISPR B | | Overall |
|---|---|---|---|---|---|---|---|---|---|---|
| Frequency | QP1 | QP2 | AV1 | AV2 | | qp Limit | qp Margin | AVE Limit | AVE Margin | Result |
| (MHz) | (dBµV) | (dBµV) | (dBµV) | (dBµV) | (dB) | (dBµV) | dB | (dBµV) | dB | (Pass/Fail) |
| 0.15 | 13.5 | 14.8 | 13.5 | 14.8 | 20.1 | 66.0 | -31.1 | 56.0 | -21.1 | Pass |
| 1.00 | 9.7 | 10.5 | 9.7 | 10.5 | 20.1 | 56.0 | -25.4 | 46.0 | -15.4 | Pass |
| 5.00 | 6.1 | 6.8 | 6.1 | 6.8 | 20.1 | 56.0 | -29.1 | 46.0 | -19.1 | Pass |
| 10.00 | 4.2 | 4.7 | 4.2 | 4.7 | 20.1 | 60.0 | -35.3 | 50.0 | -25.2 | Pass |
| 15.00 | 3.6 | 2.3 | 3.6 | 2.3 | 20.2 | 60.0 | -36.3 | 50.0 | -26.2 | Pass |
| 20.00 | 2.7 | 5.1 | 2.7 | 5.1 | 20.3 | 60.0 | -34.6 | 50.0 | -24.6 | Pass |

***Table Result:*** Pass by -15.40 dB ***Worst Freq:*** 1.00 MHz

Rev: 18-May-2010

| LISNs/Measurement Probes | Range | MN | Mfr | SN | Asset | Cat | Calibration Due |
|---|---|---|---|---|---|---|---|
| 230VAC LISN Asset 1494 | 10kHz-50MHz | 9252-50-R-24-BNC | Solar | 84715 | 1494 | I | 13-Apr-2011 |

| Spectrum Analyzers / Receivers /Preselectors | Range | MN | Mfr | SN | Asset | Cat | Calibration Due |
|---|---|---|---|---|---|---|---|
| Blue | 9kHz-1.8GHz | 8591E | Agilent | 3223A00227 | 70 | I | 13-Jun-2010 |

| Conducted Test Sites (Mains / Telco) | FCC Code | VCCI Code | Cat | Calibration Due |
|---|---|---|---|---|
| CEMI 2 | 719150 | C-3361, T-1576 | III | NA |

| Meteorological Meters | MN | Mfr | SN | Asset | Cat | Calibration Due |
|---|---|---|---|---|---|---|
| Temp./Humidity/Atm. Pressure Gauge | 7400 Perception II | Davis | N/A | 965 | I | 6-Apr-2011 |
| CEMI2 Thermohygrometer | 35519-044 | Control Company | 72436083 | 1336 | II | 18-Aug-2011 |

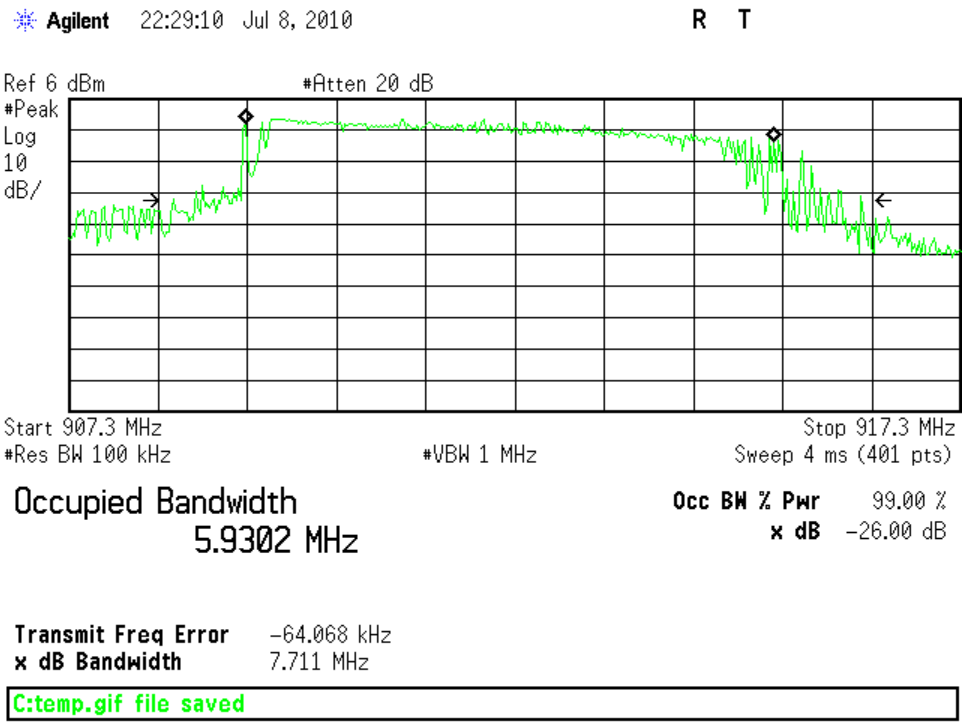
All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.

# *Occupied Bandwidth*

## REQUIREMENT

*When an occupied bandwidth is no specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured.* [RSS-GEN 4.6.1]

Low Channel

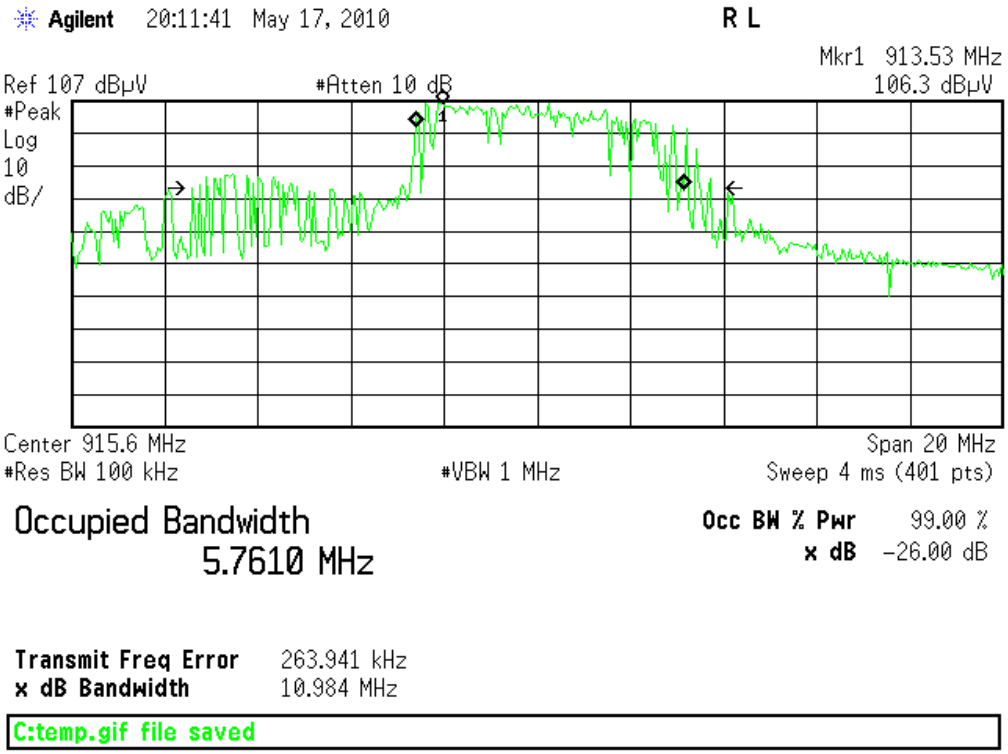



Rev: 7-Jul-2010

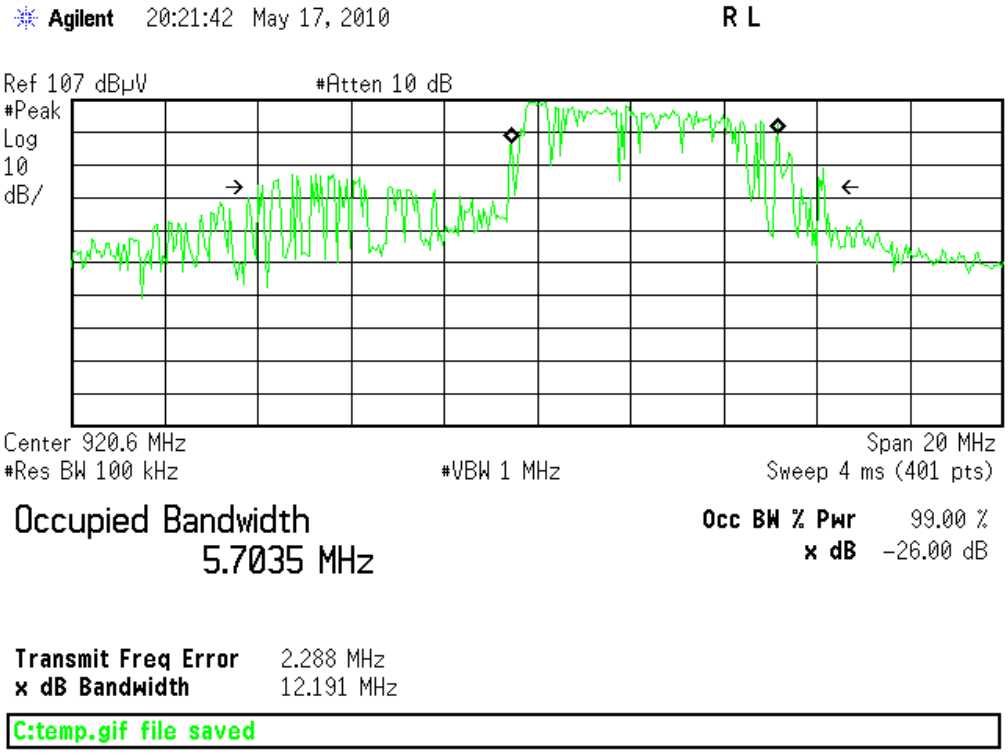
| Spectrum Analyzers / Receivers /Preselectors | Range | MN | Mfr | SN | Asset | Cat | Calibration Due |
|---|---|---|---|---|---|---|---|
| Rental SA #5 | 9kHz-26.5 GHz | E4407B | Agilent | MY44220066 | 1491 | I | 11-Feb-2011 |
| **Preamps /Couplers Attenuators / Filters** | **Range** | **MN** | **Mfr** | **SN** | **Asset** | **Cat** | **Calibration Due** |
| HF 20dB 50W Attenuator | 0.009-18 GHz | PE 7019-20 | Pasternack | 1 | 791 | II | 8-May-2011 |

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.

Mid Channel




High Channel



## *Measurement Uncertainty*

The listed uncertainties are the worst case uncertainty for the entire range of measurement. Please note that the uncertainty values are provided for informational purposes only and are not used in determining the PASS/FAIL results.

| Measurement | Expanded Uncertainty k=2 | Maximum allowable uncertainty |
|---|---|---|
| Radiated Emissions (30-1000MHz)<br>NIST<br>CISPR | <br>5.6dB<br>4.6dB | <br>N/A<br>5.2dB (Ucispr) |
| Radiated Emissions (1-26.5GHz) | 4.6dB | N/A |
| Radiated Emissions (above 26.5GHz) | 4.9dB | N/A |
| Magnetic Radiated Emissions | 5.6dB | N/A |
| Conducted Emissions<br>NIST<br>CISPR | <br>3.9dB<br>3.6dB | <br>N/A<br>3.6dB (Ucispr) |
| Telco Conducted Emissions (Current) | 2.9dB | N/A |
| Telco Conducted Emissions (Voltage) | 4.4dB | N/A |
| Electrostatic Discharge | 11.5% | N/A |
| Radiated RF Immunity (Uniform Field) | 1.6dB | N/A |
| Electrical Fast Transients | 23.1% | N/A |
| Surge | 23.1% | N/A |
| Conducted RF Immunity | 3dB | N/A |
| Magnetic Immunity | 12.8% | N/A |
| Dips and Interrupts | 2.3V | N/A |
| Harmonics | 3.5% | N/A |
| Flicker | 3.5% | N/A |
| Radio frequency (@ 2.4GHz) | $3.23 \times 10^{-8}$ | $1 \times 10^{-7}$ |
| RF power, conducted | 0.40dB | 0.75dB |
| Maximum frequency deviation:<br>• Within 300Hz and 6kHz of audio frequency / Within 6kHz and 25kHz of audio frequency | <br>3.4%<br>0.3dB | <br>5%<br>3dB |
| Adjacent channel power | 1.9dB | 3dB |
| Conducted spurious emission of transmitter, valid up to 12.75GHz | 2.39dB | 3dB |
| Conducted emission of receivers | 1.3dB | 3dB |
| Radiated emission of transmitter, valid up to 26.5GHz | 3.9dB | 6dB |
| Radiated emission of transmitter, valid up to 80GHz | 3.3dB | 6dB |
| Radiated emission of receiver, valid up to 26.5GHz | 3.9dB | 6dB |
| Radiated emission of receiver, valid up to 80GHz | 3.3dB | 6dB |
| Humidity | 2.37% | 5% |
| Temperature | 0.7°C | 1.0°C |
| Time | 4.1% | 10% |
| RF Power Density, Conducted | 0.4dB | 3dB |
| DC and low frequency voltages | 1.3% | 3% |
| Voltage (AC, <10kHz) | 1.3% | 2% |
| Voltage (DC) | 0.62% | 1% |
| The above reflects a 95% confidence level | | |

### *Product Documentation*

The following documentation has been provided by the client for inclusion in this report.

## *Conditions Of Testing*

**[Bureau Veritas Consumer Products Services, Inc., a Massachusetts corporation]**, and/or its affiliates (collectively, the "Company") will conduct, at the request of the Submitter ("**Client**"), the tests specified on the submitted Test Request Form or equivalent in accordance with, and subject to, the following terms and conditions (collectively, "**Conditions**"):

1. All orders for tests are subject to acceptance by the Company, and no order will constitute a binding commitment of the Company unless and until such order is accepted by it, as evidenced by the issuance of a written report ("**Test Report**") by the Company. The Test Report is issued solely by the Company, is intended for the exclusive use of Client and shall not be published, used for advertising purposes, copied or replicated for distribution to any other person or entity or otherwise publicly disclosed without the prior written consent of the Company. By submitting a request for services to the Company, Client consents to the disclosure to accreditation bodies of those records of Client relevant to the accreditation body's assessment of the Company's competence and compliance with relevant accreditation criteria. The Company shall not be liable for any loss or damage whatsoever resulting from the failure of the Company to provide its services within any time period for completion estimated by the Company. If Client anticipates using the Test Report in any legal proceeding, arbitration, dispute resolution forum or other proceeding, it shall so notify the Company prior to submitting the Test Report in such proceeding. The Company has no obligation to provide a fact or expert witness at such proceeding unless the Company agrees in advance to do so for a separate and additional fee.
2. The Test Report will set forth the findings of the Company solely with respect to the test samples identified therein. Unless specifically and expressly indicated in the Test Report, the results set forth in such Test Report are not intended to be indicative or representative of the quality or characteristics of the lot from which a test sample is taken, and Client shall not rely upon the Test Report as being so indicative or representative of the lot or of the tested product in general. The Test Report will reflect the findings of the Company at the time of testing only, and the Company shall have no obligation to update the Test Report after its issuance. The Test Report will set forth the results of the tests performed by the Company based upon the written information provided to the Company. The Test Report will be based solely on the samples and written information submitted to the Company by Client, and the Company shall not be obligated to conduct any independent investigation or inquiry with respect thereto.
3. The Company may, in its sole discretion, destroy samples which have been furnished to the Company for testing and which have not been destroyed in the course of testing. The Company may delegate the performance of all or a portion of the services contemplated hereunder to an affiliate, agent or subcontractor of the Company, and Client consents to such delegation.
4. These Conditions and the Test Report represent the entire understanding of the parties hereto with respect to the subject matter hereof and of the Test Report, and no modification, variance or extrapolation with respect thereto shall be permitted without the prior written consent of the Company.
5. The names, service marks, trademarks and copyrights of the Company and its affiliates, including the names "**BUREAU VERITAS**," "**BUREAU VERITAS CONSUMER PRODUCTS SERVICES**," "**BVCPS**", "**MTL**", "**ACTS**", "**MTL-ACTS**" and **CURTIS-STRAUS** (collectively, the "**Marks**") are and shall remain the sole property of the Company or its affiliates and shall not be used by Client except solely to the extent that Client obtains the prior written approval of the Company and then only in the manner prescribed by the Company. Client shall not contest the validity of the Marks or take any action that might impair the value or goodwill associated with the Marks or the image or reputation of the Company or its affiliates.
6. Payment in full shall be due 30 days after the date of invoice. Interest shall be due on overdue amounts from the due date until paid at an interest rate of 1.5% per month or, if less, the maximum rate permitted by law. The Company reserves the right, at any time and from time to time, to revoke any credit extended to Client. Client shall reimburse the Company for any costs it incurs in collecting past due amounts, including court costs and fees and expenses of attorneys and collection agencies. The Test Report may not be used or relied upon by Client if and for so long as Client fails to pay when due any invoice issued by the Company or any affiliate of it to Client or any affiliate or subsidiary of Client together with interest and penalties, if any, accrued thereon.
7. The Company disclaims any and all responsibility or liability arising out of or in connection with e-mail transmissions of such information.
8. Client understands and agrees that the Company is neither an insurer nor a guarantor, that the Company does not take the place of Client or any designer, manufacturer, agent, buyer, distributor or transportation or shipping company, and that the Company disclaims all liability in such capacities. Client further understands that if it seeks assurance against loss or damage, it should obtain appropriate insurance.
9. Client agrees that the Company, by providing the services, does not take the place of Client nor any third party, nor does the Company release them from any of their obligations, nor does the Company otherwise assume, abridge, abrogate or undertake to discharge any duty of any third party to Client or any duty of Client or any third party to any other third party, and Client will not release any third party from its obligations and duties with respect to the tested goods.
10. Client shall, on a timely basis, (a) provide adequate instructions to the Company in order to enable the Company to perform properly its services, (b) provide, or cause Client's suppliers and contractors to provide, the Company with all documents necessary to enable the Company to perform its services, (c) furnish the Company with all relevant information regarding Client's intended use and purposes of the tested goods, (d) advise the Company of essential dates and deadlines relevant to the tested goods and (e) fully exercise all rights and remedies available to Client against third parties in respect of the tested goods.
11. The Company shall undertake due care and ordinary skill in the performance of its services to Client, and the Company shall accept responsibility only were such skill has not been exercised and, even in such event, only to the extent of the limitation of liability set forth herein.
12. If Client desires to assert a claim arising from or relating to (i) the performance, purported performance or non-performance of any services by the Company or (ii) the sale, resale, manufacture, distribution or use of any tested goods, it must submit that claim to the Company in a writing that sets forth with particularity the basis for such claim within 60 days from discovery of the potential claim and not more than six months after the date of issuance of the Test Report to Client. Client waives any and all such claims including, without limitation, claims that the Test Report is inaccurate, incomplete or misleading or that additional or different testing is required, unless and then only to the extent that Client submits a written claim to the Company within both such time periods.

13. CLIENT SHALL, EXCEPT TO THE EXTENT OF COMPANY'S LIABILITY TO CLIENT HEREUNDER (WHICH IN NO EVENT SHALL EXCEED THE LIMITATION OF LIABILITY HEREIN), HOLD HARMLESS AND INDEMNIFY THE COMPANY, ITS AFFILIATES AND THEIR RESPECTIVE DIRECTORS, OFFICERS, EMPLOYEES, AGENTS AND SUBCONTRACTORS AGAINST ALL ACTUAL OR ALLEGED THIRD PARTY CLAIMS FOR LOSS, DAMAGE OR EXPENSE OF WHATSOEVER NATURE AND HOWSOEVER ARISING FROM OR RELATING TO (i) THE PERFORMANCE, PURPORTED PERFORMANCE OR NON-PERFORMANCE OF ANY SERVICES BY THE COMPANY OR (ii) THE SALE, RESALE, MANUFACTURE, DISTRIBUTION OR USE OF ANY TESTED GOODS.

14. EXCEPT AS MAY OTHERWISE BE EXPRESSLY AGREED TO IN WRITING BY THE COMPANY AND NOTWITHSTANDING ANY PROVISION TO THE CONTRARY CONTAINED HEREIN OR IN ANY TEST REPORT, NO WARRANTY OR GUARANTEE, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE, IS MADE.

15. (A) IN NO EVENT WHATSOEVER SHALL THE COMPANY BE LIABLE FOR ANY CONSEQUENTIAL, SPECIAL, INCIDENTAL, EXEMPLARY OR PUNITIVE DAMAGES IN CONNECTION WITH, RELATING TO OR ARISING OUT OF THE TEST REPORT OR THE SERVICES PROVIDED BY THE COMPANY HEREUNDER, INCLUDING WITHOUT LIMITATION LOSS OF OR DAMAGE TO PROPERTY; LOSS OF INCOME, PROFIT OR USE; OR ANY CLAIMS OR DEMANDS MADE AGAINST CLIENT OR ANY OTHER PERSON BY ANY THIRD PARTY IN CONNECTION WITH, RELATING TO OR ARISING OUT OF THE SERVICES PROVIDED BY THE COMPANY HEREUNDER.

(B)NOTWITHSTANDING ANY PROVISION TO THE CONTRARY CONTAINED HEREIN, AND IN RECOGNITION OF THE RELATIVE RISKS AND BENEFITS TO CLIENT AND THE COMPANY ASSOCIATED WITH THE TESTING SERVICES CONTEMPLATED HEREBY, THE RISKS HAVE BEEN ALLOCATED SUCH THAT UNDER NO CIRCUMSTANCES WHATSOEVER SHALL THE LIABILITY OF THE COMPANY TO CLIENT OR ANY THIRD PARTY IN RESPECT OF ANY CLAIM FOR LOSS, DAMAGE OR EXPENSE, OF WHATSOEVER NATURE OR MAGNITUDE, AND HOWSOEVER ARISING, EXCEED AN AMOUNT EQUAL TO FIVE (5) TIMES THE AMOUNT OF THE FEES PAID TO THE COMPANY FOR THE SPECIFIC SERVICES WHICH GAVE RISE TO SUCH CLAIM OR U.S.$10,000, WHICHEVER IS THE LESSER AMOUNT.

16. The Company shall not be liable for any loss or damage resulting from any delay or failure in performance of its obligations hereunder resulting directly or indirectly from any event of force majeure or any event outside the control of the Company. If any such event occurs, the Company may immediately cancel or suspend its performance hereunder without incurring any liability whatsoever to Client.

17. Company's services, including these Conditions, shall be governed by, and construed in accordance with, the local laws of the country where the Company performs the tests or, in the case of tests performed in the United States of America, the laws of Massachusetts without regard to conflicts of laws principles. If any aspect(s) of these Conditions is found to be illegal or unenforceable, the validity, legality and enforceability of all remaining aspects of these Conditions shall not in any way be affected or impaired thereby. Any proceeding related to the subject matter hereof shall be brought, if at all, in the courts of the country where the Company performs the tests or, in the case of tests performed in the United States of America, in the courts of Massachusetts. Client waives the right to interpose any counterclaim or setoffs of any nature in any litigation arising hereunder.

Rev.160009121(2)_#684340 v13CS