Lab Code: 200167-0

# FCC PART 15.245
# INDUSTRY CANADA RSS-210, ISSUE 7, JUNE 2007

# MEASUREMENT AND TEST REPORT

For

## Takex America Inc.

3350 Montgomery Drive
Santa Clara, CA 95054, USA

**FCC ID: TO5MW-100**
**IC ID: 6160A-MW100**
**Model: MW-100A**

| **Report Type:** | **Product Type:** |
|---|---|
| Original Report | Microwave Sensor |

| | |
|---|---|
| **Test Engineer:** | James Ma |
| **Report Number:** | R0807085 |
| **Report Date:** | 2008-08-22 |
| **Reviewed By:** | Boni Baniqued<br>Sr. RF Engineer |
| **Prepared By:**<br>**(84)** | Bay Area Compliance Laboratories Corp.<br>1274 Anvilwood Ave<br>Sunnyvale, CA 94089, USA<br>Tel: (408) 732-9162,<br>Fax: (408) 732 9164 |

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# DOCUMENT REVISION HISTORY

| Revision Number | Report Number | Description of Revision | Date of Revision |
|---|---|---|---|
| 0 | R0807085 | Original Report | 2008-08-22 |

# 1 GENERAL INFORMATION

## 1.1 Product Description for Equipment under Test (EUT)

This BACL measurement and test report has been complied on behalf of *Takex America Inc.* and their product, model*: MW-100A* or the "EUT" as referred to in this report. The EUT consists of transmitter which sends 24.15 GHz of microwave and receiver which receives the beam. It will initiate an alarm signal when the receiver detects a drop in the beam reception level between the transmitter and receiver.

## 1.2 EUT Photo

*Additional photos in exhibit C*

## 1.3 EUT Mechanical Description

The EUT measures approximately 307.0mm L x 126mm W x 126mm H and weighs approximately 930g.

## 1.4 Objective

This type approval report is prepared on behalf of *Takex America Inc.* in accordance with Part 2, Subpart J, Part 15, Subparts A, B, and C.

## 1.5 Related Submittal(s)/Grant(s)

N/A

## 1.6 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.4-2003.

## 1.7 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the values range from $\pm$2.0 for Conducted Emissions tests and $\pm$4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL.

Detailed instrumentation measurement uncertainties can be found in BACL report QAP-018.

## 1.8 Test Facility

The semi-anechoic chambers used by BACL to collect radiated and conducted emissions measurement data is located in the building at it's facility in Sunnyvale, California, USA.

BACL's test sites have been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission and Voluntary Control Council for Interference has the reports on file and is listed under FCC registration number: 90464 and VCCI Registration No.: C-1298 and R-1234. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The current scope of accreditations can be found at http://ts.nist.gov/ts/htdocs/210/214/scopes/2001670.htm

# 2 SYSTEM TEST CONFIGURATION

## 2.1 Justification

The EUT was configured for testing according to ANSI C63.4-2003.

The EUT was tested in the normal (native) operating mode to represent *worst*-case results during the final qualification test.

## 2.2 Special Accessories

There were no special accessories were required, included, or intended for use with EUT during these tests.

## 2.3 Equipment Modifications

No modifications were made to the EUT.

## 2.4 Power Supply

| Manufacturer | Description | Model | Serial Number |
|---|---|---|---|
| BK Precision | DC Power Supply | 1740 | 26502000233 |

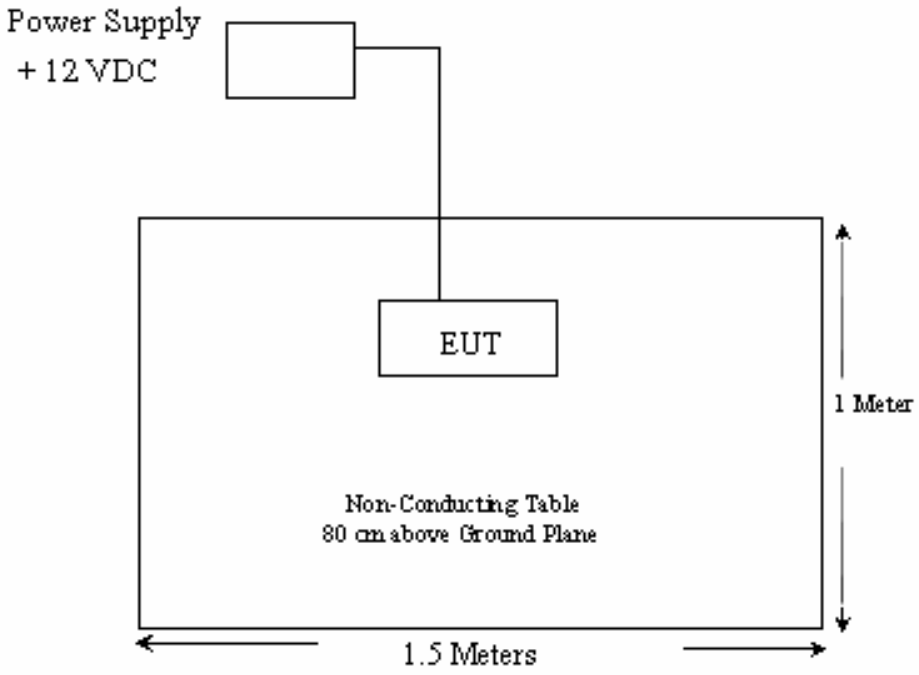
## 2.5 Interface Ports and Cabling

N/A

## 2.6 Local Support Equipment

N/A

## 2.7 Test Setup Block Diagram



# 3 SUMMARY OF TEST RESULTS FOR FCC PART 15C & IC RSS-210

| FCC Part15C& IC RSS-210/RSS-Gen Rules | Description of Tests | Results |
|---|---|---|
| FCC §15.207, IC RSS-Gen §7.2.2 | Conducted Emissions | N/A* |
| §15.245 (b), RSS-210 A7 | Field Strength of Fundamentals | Compliant |
| §15.245 (b)(1)(i), RSS-210 A7 | Field Strength of Harmonics | Compliant |
| §15.245 (b)(3), RSS-210 A7 | Radiated Emissions: Out of Band Emissions | Compliant |
| IC RSS-Gen 4.6.1 | 99% Bandwidth | Compliant |
| IC RSS-Gen 4.10 | Receiver spurious emissions | Compliant |

**Note:** * 12-30 VDC Power supply.

# 4 FCC 15.207, IC RSS-GEN §7.2.2 – CONDUCTED EMISSIONS

N/A

The power supply of EUT is 12 to 30 Vdc.

# 5 FCC 15.245 (b), § RSS-210 A7 – FIELD STRENGTH OF FUNDAMENTALS

## 5.1 Application Standards

FCC §15.245 Operation within the bands 902–928 MHz, 2435–2465 MHz, 5785–5815 MHz, 10500–10550 MHz, and 24075–24175 MHz.

(a) Operation under the provisions of this section is limited to intentional radiators used as field disturbance sensors, excluding perimeter protection systems.

(b) The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

| Fundamental Frequency (MHz) | Field strength of fundamental (millivolts/meter) | Field strength of harmonics (millivolts/meter) |
|---|---|---|
| 902–928 | 500 | 1.6 |
| 2435–2465 | 500 | 1.6 |
| 5785–5815 | 500 | 1.6 |
| 10500–10550 | 2500 | 25.0 |
| 24075–24175 | 2500 | 25.0 |

(1) Regardless of the limits shown in the above table, harmonic emissions in the restricted bands below 17.7 GHz, as specified in §15.205, shall not exceed the field strength limits shown in §15.209.

RSS-210 Annex 7 - Field Disturbance Sensors Operating in the Bands 902-928 MHz, 2435-2465 MHz, 5785-5815 MHz, 10.5-10.55 GHz and 24.075-24.175 GHz

This section provides standards for low-power devices classified as field disturbance sensors which operate under the following conditions. These do not include protection systems employing perimeter antennas.

The field strengths measured at 3 meters shall not exceed the following:

| Fundamental Frequencies (MHz) | Field Strength (millivolts/m) | |
|---|---|---|
| | Fundamental | Harmonics |
| 902-928 | 500(Note 1) | 1.6 |
| 2435-2465 | 500(Note 1) | 1.6 |
| 5785-5815 | 500(Note 1) | 1.6 |
| 10500-10550 | 2500(Note 2) | 25 |
| 24075-24175 | 2500(Note 2) | 25 |

**Note 1:** equivalent to 75 mW e.i.r.p.
**Note 2:** equivalent to1.9 W e.i.r.p.

**Notes:**

1. Additionally, harmonic emissions falling into a restricted band of Table 1 and below 17.7 GHz shall meet the limits of Table 2.

Those falling into restricted bands above 17.7 GHz shall not exceed the following field strength limits measured at a distance of 3 meters:

(i) 25 mV/m for the second and third harmonics of field disturbance sensors operating in the 24075-24175 MHz and for devices designed for use only within buildings or for intermittent use such as to open building doors;

(ii) 7.5 mV/m; for all other devices.

## 5.2 Test Setup

The radiated emissions tests were performed in the 3-meter semi-anechoic chamber test site, using the setup in accordance with ANSI C63.4-2003. The specification used was the FCC 15 Subpart C limits.

## 5.3 Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date |
|---|---|---|---|---|
| Agilent | Analyzer, Spectrum | E4446A | US44300386 | 2008-05-19 |
| Wise Wave | 18 – 26.5 GHz Antenna | ARH-4223-02 | 10555-02 | 2008-05-12 |
| Wise Wave | 18 – 26.5 GHz Antenna | ARH-4223-02 | 10555-01 | 2008-05-12 |
| HP | Amplifier, Pre, Microwave | 8449B | 3147A00400 | 2007-11-02 |
| HP | Generator, Signal | 83650B | 3614A00276 | 2008-05-28 |

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

## 5.4 Environmental Conditions

| | |
|---|---|
| **Temperature:** | 24 ° C |
| **Relative Humidity:** | 65 % |
| **ATM Pressure:** | 1020 mbar |

**The testing was performed by James Ma on 2008-07-18*

## 5.5 Test Procedure

Maximizing procedure was performed to ensure EUT compliance is with all installation combinations.

For frequency below 1 GHz, all data were recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dB of specification limits), and are distinguished with a "**QP**" in the data table.

For frequency above 1 GHz, all data were recorded in the peak detection mode. Average result was based on average detector mode or convert from peak mode with the duty cycle.

## 5.6 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corrected Amplitude = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit. The equation for margin calculation is as follows:

Margin = Corrected Amplitude - Limit

## 5.7 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.245 standard's radiated emissions limits and had the worst margin of:

**Unit 1: -26.70 dB @ 24170 MHz** in the **Horizontal** polarization at **Carrier Frequency**

**Unit 2: -26.70 dB @ 24110 MHz** in the **Horizontal** polarization at **Carrier Frequency**

The provisions in §15.35 for limiting peak emissions apply:

Please refer to the following tables for full test results

## 5.8 Radiated Emissions Test Result Data

Unit 1: Fundamental Frequency = 24. 17 GHz (Measured at 3 meter)

| Freq. (MHz) | Reading (dBuV) | Azimuth (Degrees) | Ant. Height (m) | Ant. Polar (H/ V) | Ant. Factor (dB/m) | Cable Loss (dB) | Pre-Amp. Gain (dB) | Duty Cycle Factor (dB) | Cord. Reading (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 24170.0 | 79.6 | 10 | 1.0 | V | 23.0 | 18.9 | 34.43 | - | 87.1 | 148 | -60.9 | Peak |
| 24170.0 | 100.2 | 340 | 1.1 | H | 23.0 | 18.9 | 34.43 | - | 107.7 | 148 | -40.3 | Peak |
| 24170.0 | 79.6 | 10 | 1.0 | V | 23.0 | 18.9 | 34.43 | -6.38 | 80.7 | 128 | -47.3 | Ave |
| 24170.0 | 100.2 | 340 | 1.1 | H | 23.0 | 18.9 | 34.43 | -6.38 | 101.3 | 128 | -26.7 | Ave |

**Notes:**

Pulse Width = 120 μs,
Total Pulse at 100 ms = 400 Pulses
Duty Cycle Factor = 20Log ((120 μs x 400) / (100 ms)) = - 6.38 dB
(Please refer to the duty cycle plots attached)
Average Reading is calculated based on the Peak reading + the Duty Cycle Correction factor

Unit 2: Fundamental Frequency = 24.11 GHz (Measured at 3 meter)

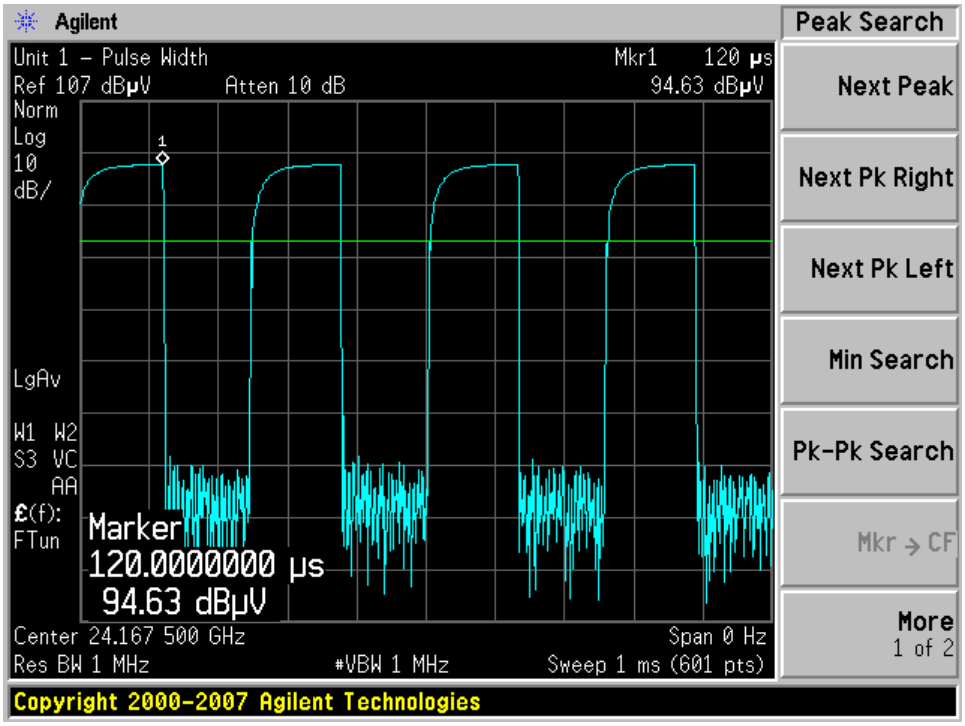
| Freq. (MHz) | Reading (dBuV) | Azimuth (Degrees) | Ant. Height (m) | Ant. Polar (H / V) | Ant. Factor (dB/m) | Cable Loss (dB) | Pre-Amp. Gain (dB) | Duty Cycle Factor (dB) | Cord. Reading (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 24110.0 | 82.1 | 10 | 1.0 | V | 23.0 | 18.9 | 34.43 | - | 89.6 | 148 | -58.4 | Peak |
| 24110.0 | 99.8 | 5 | 1.1 | H | 23.0 | 18.9 | 34.43 | - | 107.3 | 148 | -40.7 | Peak |
| 24110.0 | 82.1 | 10 | 1.0 | V | 23.0 | 18.9 | 34.43 | -6.02 | 83.6 | 128 | -44.4 | Ave |
| 24110.0 | 99.8 | 5 | 1.1 | H | 23.0 | 18.9 | 34.43 | -6.02 | 101.3 | 128 | -26.7 | Ave |

**Notes:**

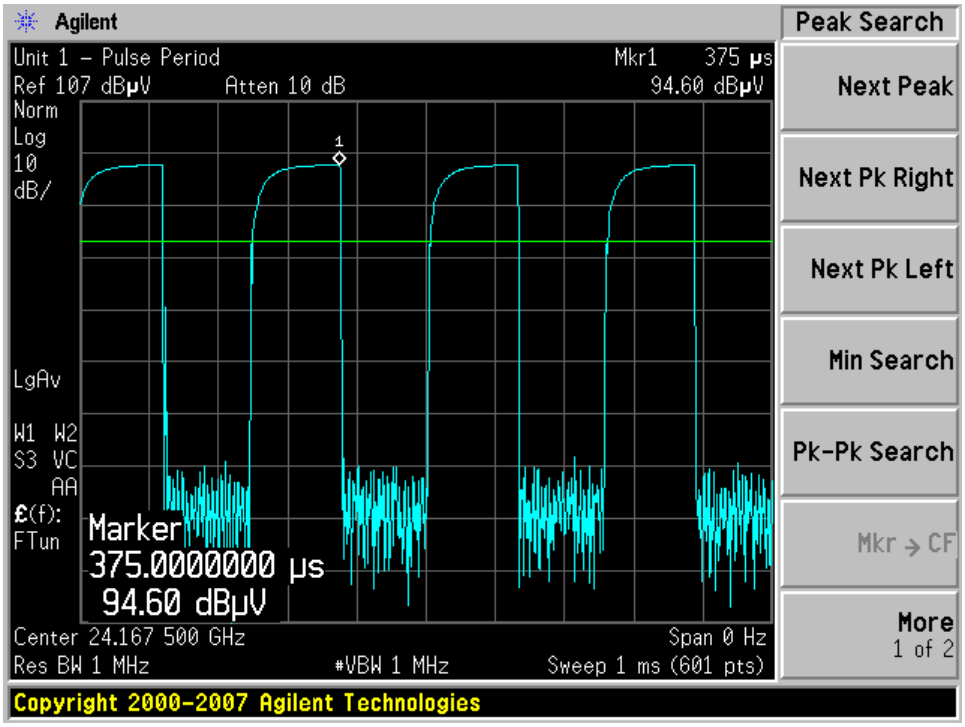
Pulse Width = 125 μs,
Total Pulse at 100 ms = 400 Pulses
Duty Cycle Factor = 20Log ((125 μs x 400) / (100 ms)) = - 6.02 dB
(Please refer to the duty cycle plots attached)
Average Reading is calculated based on the Peak reading + the Duty Cycle Correction factor

## Duty Cycle of Unit 1

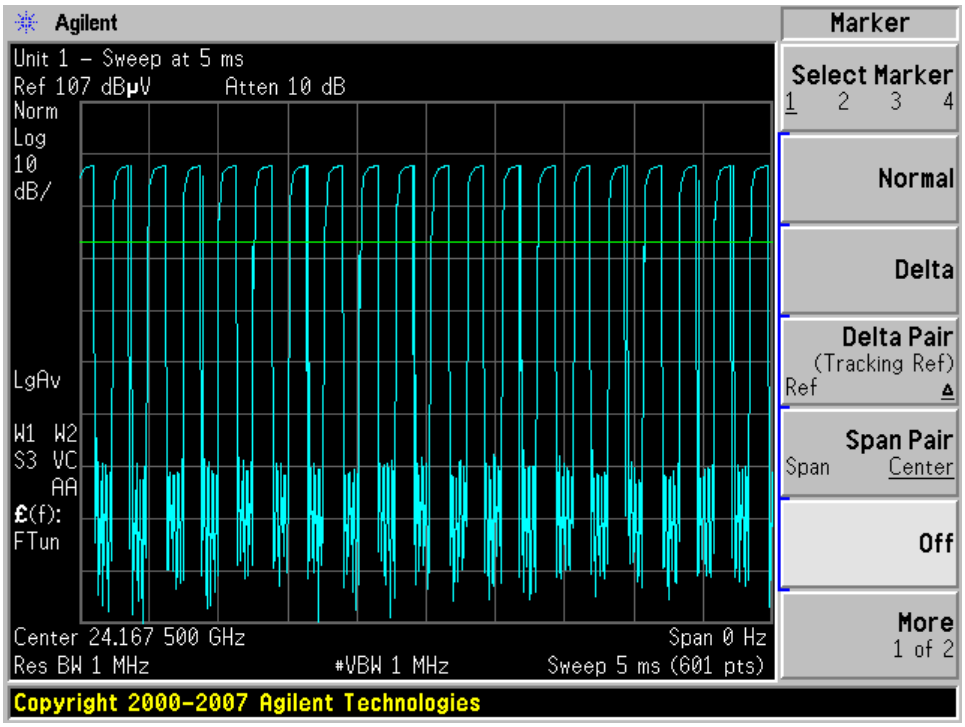
### Pulse Width




### Pulse Period

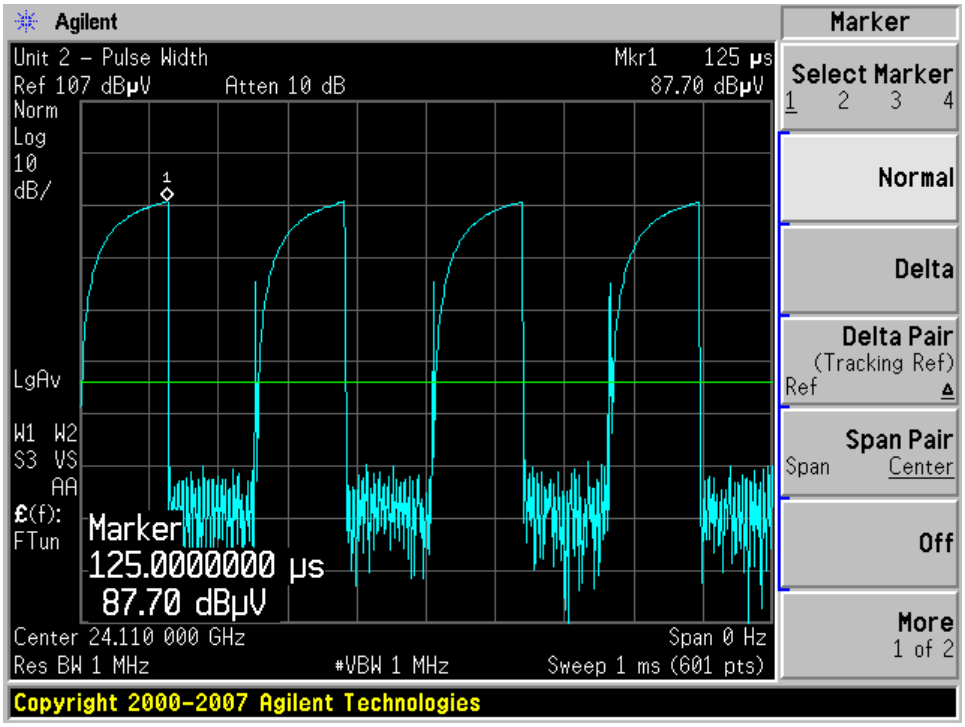


**Pulse Sweep at 5 ms**

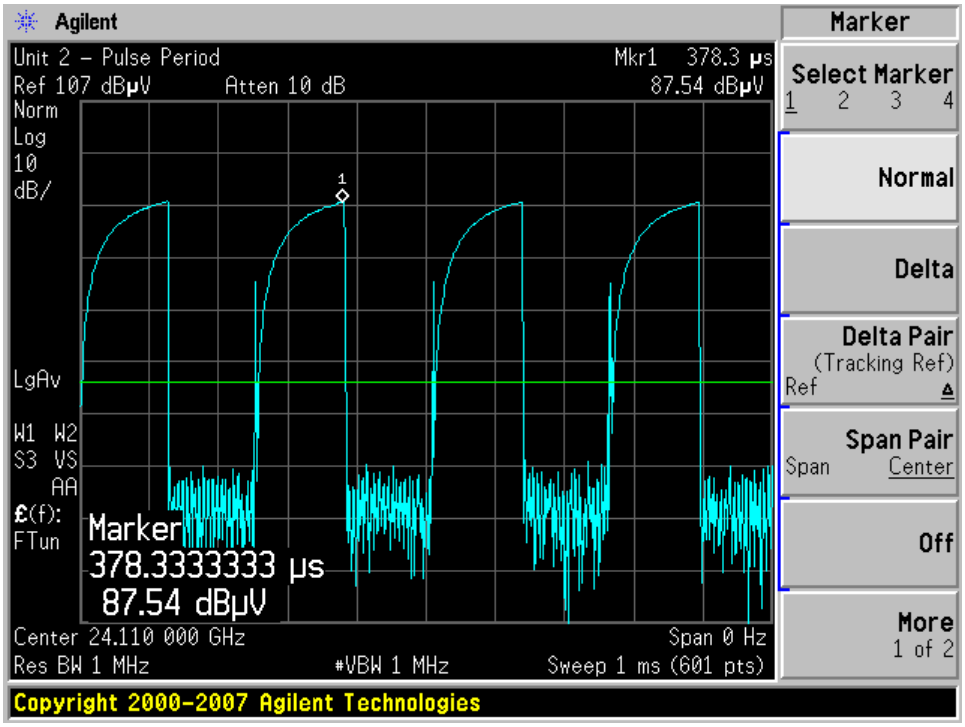



**Duty Cycle Unit 2**

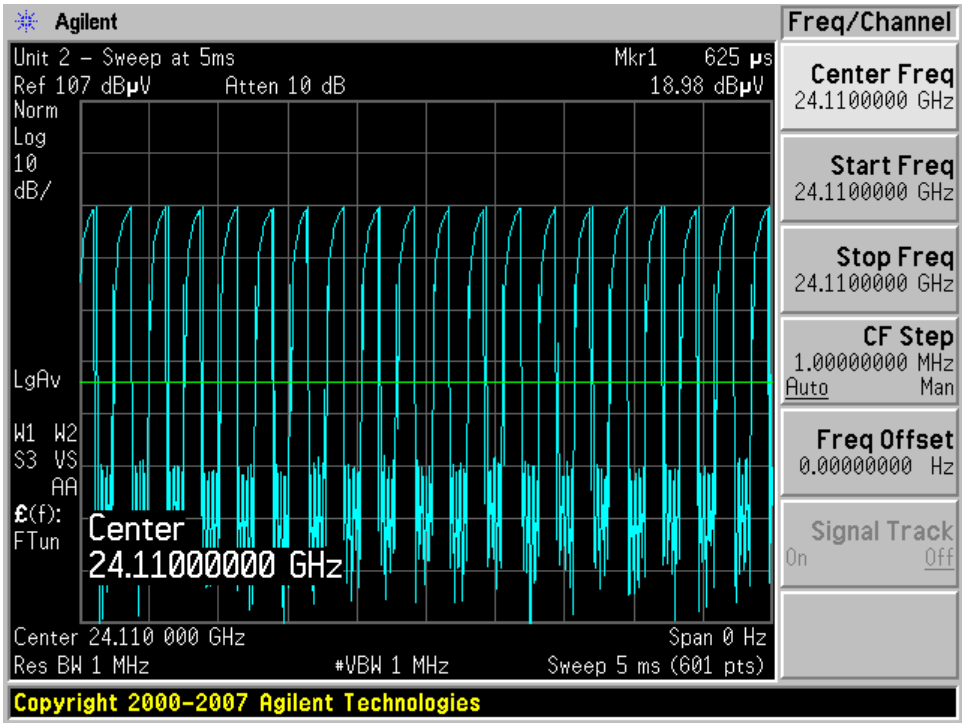
**Pulse Width**



**Pulse Period**




**Pulse Sweep at 5 ms**



# 6 FCC 15.245(b) & § RSS-210 A7 – FIELD STRENGTH OF HARMONICS & OUT OF BAND EMISSIONS

## 6.1 Application Standards

FCC § 15.245 Operation within the bands 902–928 MHz, 2435–2465 MHz, 5785–5815 MHz, 10500–10550 MHz, and 24075–24175 MHz.

(a) Operation under the provisions of this section is limited to intentional radiators used as field disturbance sensors, excluding perimeter protection systems.

(b) The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

| Fundamental frequency (MHz) | Field strength of fundamental (millivolts/meter) | Field strength of harmonics (millivolts/meter) |
|---|---|---|
| 902–928 | 500 | 1.6 |
| 2435–2465 | 500 | 1.6 |
| 5785–5815 | 500 | 1.6 |
| 10500–10550 | 2500 | 25.0 |
| 24075–24175 | 2500 | 25.0 |

(1) Regardless of the limits shown in the above table, harmonic emissions in the restricted bands below 17.7 GHz, as specified in §15.205, shall not exceed the field strength limits shown in §15.209.

As Per FCC §15.205 Restricted bands of operation

**(a)** Except as shown in 15.205 paragraphs (d), only spurious emissions are permitted in any of the frequency bands listed below:

| MHz | MHz | MHz | MHz | MHz | GHz | GHz |
|---|---|---|---|---|---|---|
| 0.090 – 0.110 | 8.291 – 8.294 | 16.69475 – 16.69525 | 156.7 – 156.9 | 1435 – 1626.5 | 3.332 – 3.339 | 10.6 – 12.7 |
| 0.495 – 0.505 | 8.362 – 8.366 | 25.5 – 25.67 | 162.0125 –167.17 | 1645.5 – 1646.5 | 3.3458 – 3.358 | 13.25 – 13.4 |
| 2.1735 – 2.1905 | 8.37625 – 8.38675 | 37.5 – 38.25 | 167.72 – 173.2 | 1660 – 1710 | 3.600 – 4.400 | 14.47 – 14.5 |
| 4.125 – 4.128 | 8.41425 – 8.41475 | 73 – 74.6 | 240 – 285 | 1718.8 – 1722.2 | 4.5 – 5.15 | 15.35 – 16.2 |
| 4.17725 – 4.17775 | 12.29 – 12.293 | 74.8 – 75.2 | 322 – 335.4 | 2200 – 2300 | 5.35 – 5.46 | 17.7 – 21.4 |
| 4.20725 – 4.20775 | 12.51975 – 12.52025 | 108 – 121.94 | 399.9 – 410 | 2310 – 2390 | 7.25 – 7.75 | 22.01 – 23.12 |
| 6.215 – 6.218 | 12.57675 – 12.57725 | 123 – 138 | 608 – 614 | 2483.5 – 2500 | 8.025 – 8.5 | 23.6 – 24.0 |
| 6.26775 – 6.26825 | 13.36 – 13.41 | 149.9 – 150.05 | 960 – 1240 | 2690 – 2900 | 9.0 – 9.2 | 31.2 – 31.8 |
| 6.31175 – 6.31225 | 16.42 – 16.423 | 156.52475 – 156.52525 | 1300 – 1427 | 3260 – 3267 | 9.3 – 9.5 | 36.43 – 36.5 |
| | | | | | | Above 38.6 |

**(b)** Except as provided in 15.205 paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

**(c)** Except as provided in paragraphs (d) and (e), regardless of the field strength limits specified elsewhere in this Subpart, the provisions of this Section apply to emissions from any intentional radiator.

As Per FCC §15.209 Radiated emission limits, general requirements.

**(a)** Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

| Frequency (MHz) | Field Strength (microvolts/meter) | Measurement Distance (meters) |
|---|---|---|
| 0.009 - 0.490 | 2400/F(kHz) | 300 |
| 0.490 - 1.705 | 24000/F(kHz) | 30 |
| 1.705 - 30.0 | 30 | 30 |
| 30 - 88 | 100 ** | 3 |
| 88 - 216 | 150 ** | 3 |
| 216 - 960 | 200 ** | 3 |
| Above 960 | 500 | 3 |

*** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.*

**(b)** In the emission table above, the tighter limit applies at the band edges.

As per RSS-210 Annex 7, This section provides standards for low-power devices classified as field disturbance sensors which operate under the following conditions. These do not include protection systems employing perimeter antennas.

The field strengths measured at 3 meter shall not exceed the following:

| Fundamental Frequencies (MHz) | Field Strength (millivolts/m) | |
|---|---|---|
| | Fundamental | Harmonics |
| 902-928 | 500(Note 1) | 1.6 |
| 2435-2465 | 500(Note 1) | 1.6 |
| 5785-5815 | 500(Note 1) | 1.6 |
| 10500-10550 | 2500(Note 2) | 25 |
| 24075-24175 | 2500(Note 2) | 25 |

**Note 1:** equivalent to 75 mW e.i.r.p. **Note 2:** equivalent to1.9 W e.i.r.p.

**Notes:**

1. Additionally, harmonic emissions falling into a restricted band of Table 1 and below 17.7 GHz shall meet the limits of Table 2.

Those falling into restricted bands above 17.7 GHz shall not exceed the following field strength limits measured at a distance of 3 metres:

(i) 25 mV/m for the second and third harmonics of field disturbance sensors operating in the 24075-24175 MHz and for devices designed for use only within buildings or for intermittent use such as to open building doors;

(ii) 7.5 mV/m; for all other devices.

## 6.2 Test Setup

The radiated emissions tests were performed in the 3-meter semi-anechoic chamber test site, using the setup in accordance with ANSI C63.4-2003. The specification used was the FCC 15 Subpart C limits.

## 6.3 Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date |
|---|---|---|---|---|
| HP | Amplifier, Pre | 8447D | 2944A10198 | 2007-12-19 |
| Sunol Science Corp. | Broadband Antenna | JB3 Antenna | A020106-3 | 2008-03-24 |
| HP | Pre, Amplifier (1 ~ 26.5 GHz) | 8449B | 3147A00400 | 2007-11-02 |
| A. R.A | Antenna, Horn, DRG | DRG-118/A | 1132 | 2007-06-18 ( 2 yrs) |
| OML | WR-19 Harmonic Mixer with Horn Antenna | ARH-1923-02 | 11648-01 | 2008-01-23 |
| OML | Diplexer for Agilent Spectrum Analyzer | DPL26 | N/A | N/A |
| HP | Generator, Signal | 83650B | 3614A00276 | 2008-05-28 |
| Agilent | Analyzer, Spectrum | E4446A | US44300386 | 2008-05-19 |

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

## 6.4 Environmental Conditions

| | |
|---|---|
| **Temperature:** | 24°C |
| **Relative Humidity:** | 65 % |
| **ATM Pressure:** | 1020 mbar |

**The testing was performed by James Ma on 2008-07-17 to 2008-07-21*

## 6.5 Test Procedure

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations.

For frequency below 1 GHz, all data were recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dB of specification limits), and are distinguished with a "**QP**" in the data table.

For frequency above 1 GHz, all data were recorded in the peak detection mode. Average result was based on average detector mode or convert from peak mode with the duty cycle.

## 6.6 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corrected Amplitude = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit. The equation for margin calculation is as follows:

Margin = Corrected Amplitude - Limit

## 6.7 Summary of Test Results

**Unit 1** (Fundamental Frequency = 24.17 GHz)

Worst case reading as follows measured at 3 meters:

**30 MHz to 1 GHz**: -9.63 dB at 100.34 MHz in the **Vertical** polarization

**1GHz – 17.70 GHz**: -1.36 dB at 17428.30 MHz in the **Vertical** polarization

**Band Edge:** -3.31 dB at 24175 MHz in the **Horizontal** polarization

**Harmonics**: -12.80 dB at 48340 MHz in the **Horizontal** polarization

**Unit 2** (Fundamental Frequency = 24.11 GHz)

Worst case reading as follows measured at 3 meters:

**30 MHz to 1 GHz**: -11.33 dB at 94.51 MHz in the **Vertical** polarization

**1GHz – 17.70 GHz**: -1.05 dB at 17345.82 MHz in the **Vertical** polarization

**Band Edge:** -1.35 dB at 24175 MHz in the **Horizontal** polarization

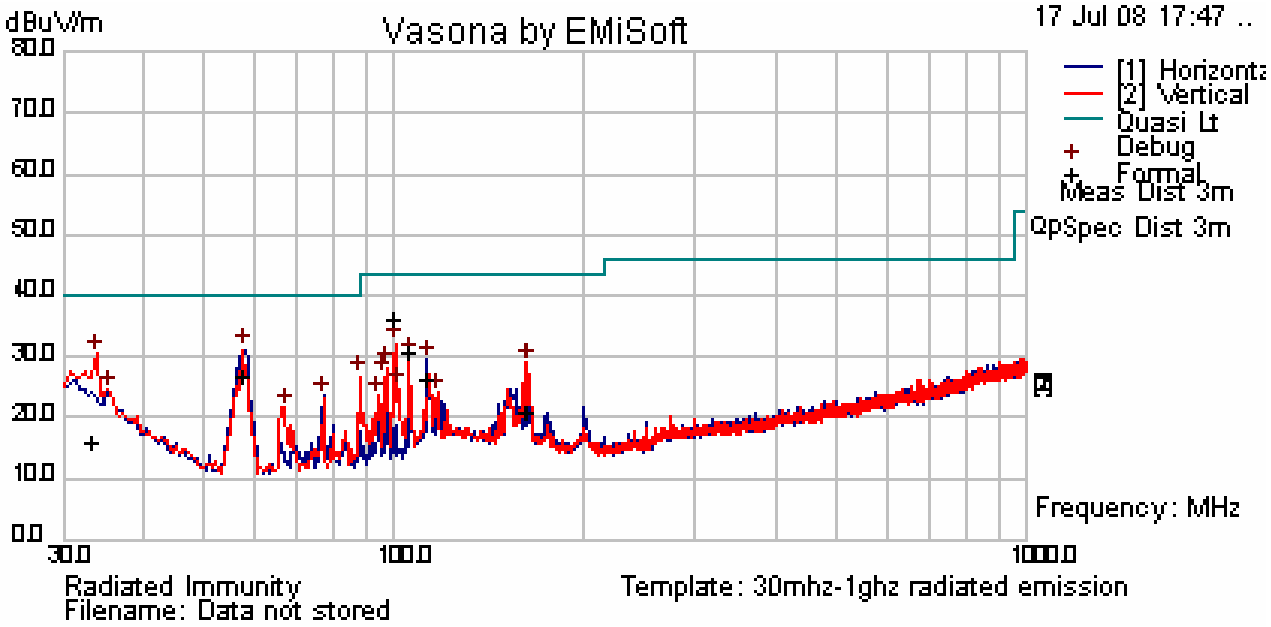
**Harmonics**: -12.90 dB at 48220 MHz in the **Vertical** polarization

Please refer to the following tables for full test results

## 6.8 Radiated Emission (30 MHz to 1 GHz)

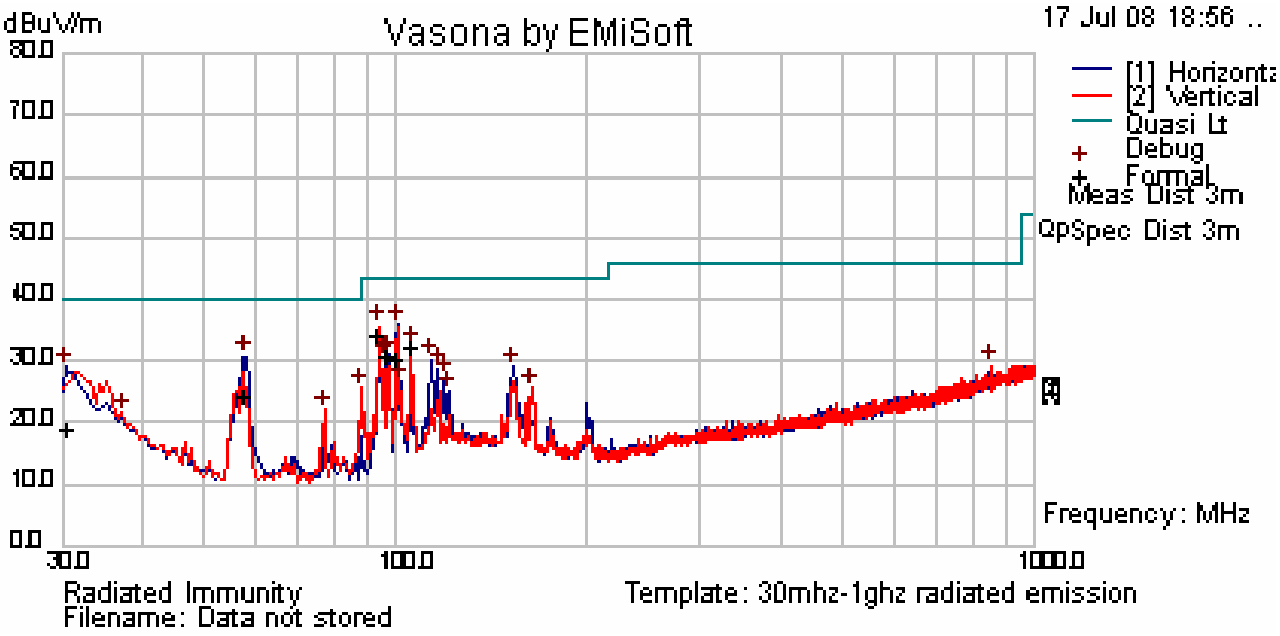
**Measured at 3 meter**

**Unit 1** (Fundamental Frequency = 24.17 GHz)




| Freq. (MHz) | Meter Reading (dBuV) | Detector (QP/AV) | Azimuth (Degree) | Ant. Height (cm) | Ant. Polar. (H/V) | Ant. Factor & Amp. Gain (dB) | Cable Loss (dB) | Cord. Amp. (dBµV/m) | FCC Part 15.245/15.209 RSS-210/RSS-Gen | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Limit (dBuV/m) | Margin (dB) |
| 100.34 | 40.77 | QP | 276 | 174 | V | -17.50 | 10.60 | 33.87 | 43.50 | -9.63 |
| 105.72 | 34.07 | QP | 16 | 240 | V | -16.03 | 10.60 | 28.64 | 43.50 | -14.86 |
| 58.19 | 34.93 | QP | 52 | 245 | H | -20.70 | 10.40 | 24.63 | 40.00 | -15.37 |
| 113.07 | 27.88 | QP | 326 | 119 | H | -14.64 | 10.60 | 23.83 | 43.50 | -19.67 |
| 162.59 | 22.92 | QP | 216 | 120 | V | -15.17 | 10.63 | 18.37 | 43.50 | -25.13 |
| 33.69 | 12.43 | QP | 79 | 227 | V | -9.15 | 10.34 | 13.62 | 40.00 | -26.38 |

**Unit 2** (Fundamental Frequency = 24.11 GHz)




| Freq. (MHz) | Meter Reading (dBuV) | Detector (QP/AV) | Azimuth (Degree) | Ant. Height (cm) | Ant. Polar. (H/V) | Ant. Factor & Amp. Gain (dB) | Cable Loss (dB) | Cord. Amp. (dBµV/m) | FCC Part 15.245/15.209 RSS-210/RSS-Gen | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Limit (dBuV/m) | Margin (dB) |
| 94.51 | 40.88 | QP | 247 | 103 | V | -19.31 | 10.60 | 32.17 | 43.50 | -11.33 |
| 105.75 | 35.45 | QP | 191 | 335 | V | -16.02 | 10.60 | 30.03 | 43.50 | -13.47 |
| 97.66 | 36.19 | QP | 126 | 175 | H | -18.34 | 10.60 | 28.45 | 43.50 | -15.05 |
| 100.37 | 34.90 | QP | 44 | 98 | H | -17.49 | 10.60 | 28.00 | 43.50 | -15.50 |
| 58.02 | 32.21 | QP | 344 | 103 | H | -20.72 | 10.40 | 21.89 | 40.00 | -18.11 |
| 30.55 | 12.99 | QP | 209 | 126 | H | -6.75 | 10.31 | 16.55 | 40.00 | -23.45 |

## 6.9 Radiated Emission (1 GHz to 17.70 GHz)

Measured at 3 meter

**Unit 1** (Fundamental Frequency = 24.17 GHz)

| Freq. (MHz) | Meter Reading (dBuV) | Detector (PK/AV) | Azimuth (Degree) | Ant. Height (cm) | Ant. Polar (H/V) | Ant. Factor & Amp. Gain (dB) | Cable Loss (dB) | Duty Cycle Factor (dB) | Cord. Reading (dBuV/m) | FCC Part15.245/ RSS-210 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Limit (dBuV/m) | Margin (dB) |
| 17428.3 | 35.21 | PK | 19 | 181 | V | 13.98 | 9.83 | 0.00 | 59.02 | 74 | -14.98 |
| 17428.3 | 35.21 | AV | 19 | 181 | V | 13.98 | 9.83 | - 6.38 | 52.64 | 54 | -1.36 |

**Unit 2 (**Fundamental Frequency = 24.11 GHz)

| Freq. (MHz) | Meter Reading (dBuV) | Detector (PK/AV) | Azimuth (Degree) | Ant. Height (cm) | Ant. Polar (H/V) | Ant. Factor & Amp. Gain (dB) | Cable Loss (dB) | Duty Cycle Factor (dB) | Cord. Reading (dBuV/m) | FCC Part15.245/ RSS-210 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Limit (dBuV/m) | Margin (dB) |
| 17345.82 | 35.92 | PK | 202 | 186 | V | 13.22 | 9.83 | 0 | 58.97 | 74 | -15.03 |
| 17345.82 | 35.92 | AV | 202 | 186 | V | 13.22 | 9.83 | - 6.02 | 52.95 | 54 | -1.05 |

**Notes:** Average Reading is calculated based on the Peak reading + the Duty Cycle Correction factor.

**Harmonics**

**Unit 1** (Fundamental Frequency = 24.17 GHz)

| Freq. (MHz) | Reading (dBuV) | Azimuth (degree) | Ant. Height (m) | Ant. Polar (H/V) | Ant. Factor (dB/m) | Conversion & Cable Loss (dB) | Distance Factor (dB) | Duty Cycle Factor (dB) | Cord. Reading (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 48340.0 | 14.6 | 0 | 1.0 | H | 23.0 | 53.5 | 9.54 | - 6.38 | 75.18 | 88 | -12.8 | Ave |
| 48340.0 | 9.8 | 0 | 1.0 | V | 23.0 | 53.5 | 9.54 | - 6.38 | 70.38 | 88 | -17.6 | Ave |
| 48340.0 | 14.6 | 0 | 1.0 | H | 23.0 | 53.5 | 9.54 | 0 | 81.56 | 108 | -26.4 | Peak |
| 48340.0 | 9.8 | 0 | 1.0 | V | 23.0 | 53.5 | 9.54 | 0 | 76.76 | 108 | -31.2 | Peak |

**Unit 2 (**Fundamental Frequency = 24.11 GHz)

| Freq. (MHz) | Reading (dBuV) | Azimuth (degree) | Ant. Height (m) | Ant. Polar (H/V) | Ant. Factor (dB/m) | Conversion & Cable Loss (dB) | Distance Factor (dB) | Duty Cycle Factor (dB) | Cord. Reading (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 48220.0 | 14.2 | 0 | 1.0 | V | 23.0 | 53.5 | 9.54 | - 6.02 | 75.1 | 88 | -12.9 | AV |
| 48220.0 | 10.1 | 0 | 1.0 | H | 23.0 | 53.5 | 9.54 | - 6.02 | 71.0 | 88 | -17.0 | AV |
| 48220.0 | 14.2 | 0 | 1.0 | V | 23.0 | 53.5 | 9.54 | 0 | 81.2 | 108 | -26.8 | PK |
| 48220.0 | 10.1 | 0 | 1.0 | H | 23.0 | 53.5 | 9.54 | 0 | 77.1 | 108 | -30.9 | PK |

**Notes:**
- Measured at 1 meter without Pre-Amplifier
- Third harmonic is very low.
- Average Reading is calculated based on the Peak reading + the Duty Cycle Correction factor

**Band Edge (24075 -24175 MHz)**

**Unit 1** (Fundamental Frequency = 24.17 GHz)

| Freq. (MHz) | Reading (dBuV) | Azimuth (Degree) | Ant. Height (Meter) | Ant. Polar (H/V) | Ant. Factor (dB) | Cable Loss (dB) | Pre-Amp. Gain (dB) | Duty Cycle Factor (dB) | Cord. Reading (dBuV/m) | FCC Part15.209/ IC RSS-210 | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Limit (dBuV/m) | Margin (dB) | |
| 24175.0 | 49.6 | 5 | 1.1 | H | 23.0 | 18.9 | 34.43 | - 6.38 | 50.69 | 54 | -3.31 | Ave |
| 24175.0 | 49.6 | 5 | 1.1 | H | 23.0 | 18.9 | 34.43 | 0 | 57.07 | 74 | -16.93 | Peak |
| 24175.0 | 49.2 | 10 | 1.0 | V | 23.0 | 18.9 | 34.43 | - 6.38 | 50.29 | 54 | -3.71 | Ave |
| 24175.0 | 49.2 | 10 | 1.0 | V | 23.0 | 18.9 | 34.43 | 0 | 56.67 | 74 | -17.33 | Peak |
| 24075.0 | 40.1 | 5 | 1.1 | H | 23.0 | 18.9 | 34.49 | - 6.38 | 41.13 | 54 | -12.87 | Ave |
| 24075.0 | 39.5 | 15 | 1.0 | V | 23.0 | 18.9 | 34.49 | - 6.38 | 40.53 | 54 | -13.47 | Ave |
| 24075.0 | 40.1 | 5 | 1.1 | H | 23.0 | 18.9 | 34.49 | 0 | 47.51 | 74 | -26.49 | Peak |
| 24075.0 | 39.5 | 15 | 1.0 | V | 23.0 | 18.9 | 34.49 | 0 | 46.91 | 74 | -27.09 | Peak |

**Unit 2 (**Fundamental Frequency = 24.11 GHz)

| Freq. (MHz) | Reading (dBuV) | Azimuth (Degree) | Ant. Height (Meter) | Ant. Polar (H/V) | Ant. Factor (dB) | Cable Loss (dB) | Pre-Amp. Gain (dB) | Duty Cycle Factor (dB) | Cord. Reading (dBuV/m) | FCC Part15.209/ IC RSS-210 | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Limit (dBuV/m) | Limit (dBuV/m) | |
| 24175 | 51.2 | 5 | 1.1 | H | 23 | 18.9 | 34.43 | -6.02 | 52.65 | 54 | -1.35 | Ave |
| 24175 | 51.2 | 5 | 1.1 | H | 23 | 18.9 | 34.43 | 0 | 58.67 | 74 | -15.33 | Peak |
| 24175 | 50.3 | 10 | 1 | V | 23 | 18.9 | 34.43 | -6.02 | 51.75 | 54 | -2.25 | Ave |
| 24175 | 50.3 | 10 | 1 | V | 23 | 18.9 | 34.43 | 0 | 57.77 | 74 | -16.23 | Peak |
| 24075 | 40.5 | 5 | 1.1 | H | 23 | 18.9 | 34.49 | -6.02 | 41.89 | 54 | -12.11 | Ave |
| 24075 | 40.2 | 15 | 1 | V | 23 | 18.9 | 34.49 | -6.02 | 41.59 | 54 | -12.41 | Ave |
| 24075 | 40.5 | 5 | 1.1 | H | 23 | 18.9 | 34.49 | 0 | 47.91 | 74 | -26.09 | Peak |
| 24075 | 40.2 | 15 | 1 | V | 23 | 18.9 | 34.49 | 0 | 47.61 | 74 | -26.39 | Peak |

**Note:** Average Reading is calculated based on the Peak reading + the Duty Cycle Correction factor.

# 7 RSS-Gen § 4.6.1 99% Occupied Bandwidth

## 7.1 Applicable Standard

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured.
The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used since a peak or, peak hold, may produce a wider bandwidth than actual.
The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded.
The span between the two recorded frequencies is the occupied bandwidth.

## 7.2 Equipment List

| Manufacturer | Description | Model | Serial Number | Calibration Date |
|---|---|---|---|---|
| Agilent | Spectrum analyzer | E4440A | US45303156 | 2008-05-31 |

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

## 7.3 Environmental Conditions

| | |
|---|---|
| **Temperature:** | 27 °C |
| **Relative Humidity:** | 40 % |
| **ATM Pressure:** | 102.0 kPa |

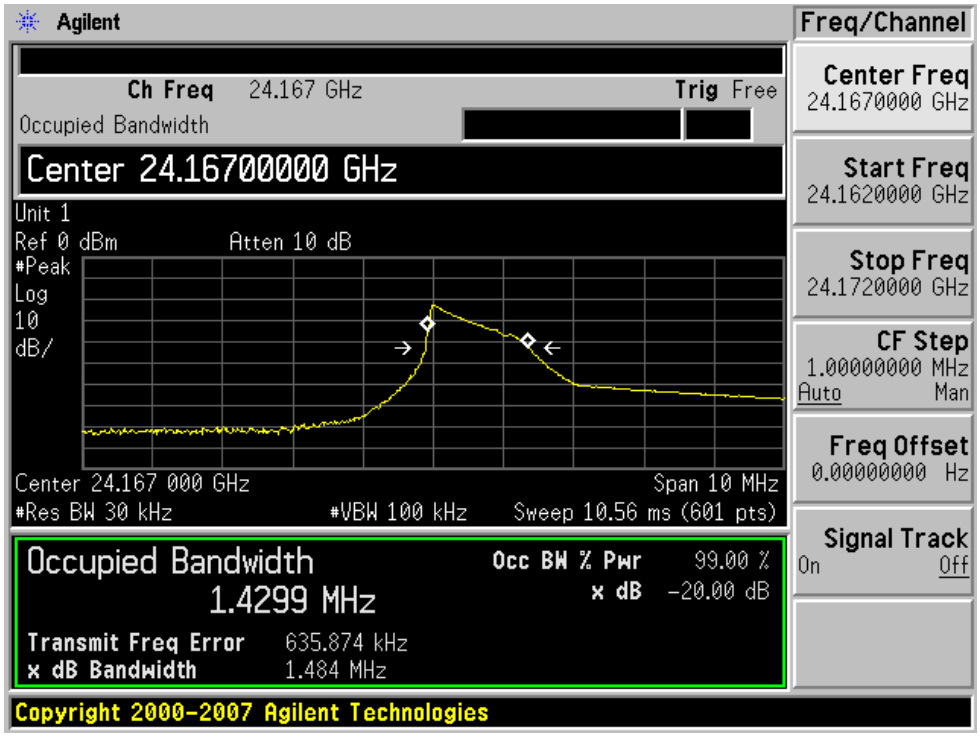
**The testing was performed by James Ma from 2008-07-22.*

## 7.4 Summary of Test Results

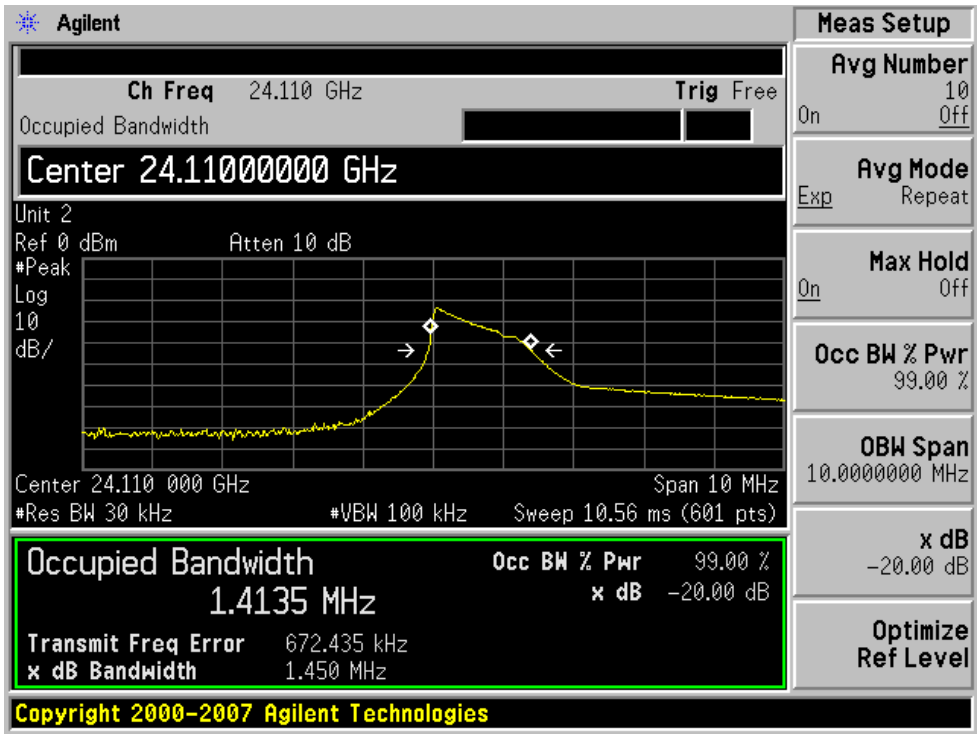
| Unit | Frequency (MHz) | 99% Occupied BW (MHz) |
|---|---|---|
| 1 | 24167 | 1.4299 |
| 2 | 24110 | 1.4135 |

Please refer to the following plots for detailed test results

**Unit 1** (Fundamental Frequency = 24.17 GHz)



**Unit 2 (**Fundamental Frequency = 24.11 GHz)



# 8 RSS-Gen § 4.10 Receiver Spurious Radiated Emissions

## 8.1 Test Setup

The radiated emissions tests were performed in the 3 meter chamber, using the setup in accordance with ANSI C63.4-2003.

## 8.2 Equipment Lists and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date |
|---|---|---|---|---|
| HP | Amplifier, Pre (.1~1300MHz) | 8447D | 2944A10198 | 2007-12-19 |
| Rohde & Schwarz | EMI Test Receiver | ESCI 1166.5950 K03 | 100337 | 2008-03-08 |
| Sunol Sciences | Broadband Antenna | JB1 | A03105-3 | 2008-03-25 |

**Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

## 8.3 Environmental Conditions

| | |
|---|---|
| **Temperature:** | 25 °C |
| **Relative Humidity:** | 58 % |
| **ATM Pressure:** | 101.5 kPa |

**The testing was performed by James Ma on 2008-08-22.*

## 8.4 Test Procedure

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations.

All data were recorded in the peak detection mode. Quasi-peak readings was performed only when an emissions was found to be marginal (within -4 dB of specification limits), and are distinguished with a "**QP**" in the data table.

## 8.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corrected Amplitude = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit. The equation for margin calculation is as follows:

Margin = Corrected Amplitude - Limit

## 8.6 Summary of Test Results

According to the test data,, the EUT complied with the with the RSS-210/Gen, with the closest margins from the limit listed below:

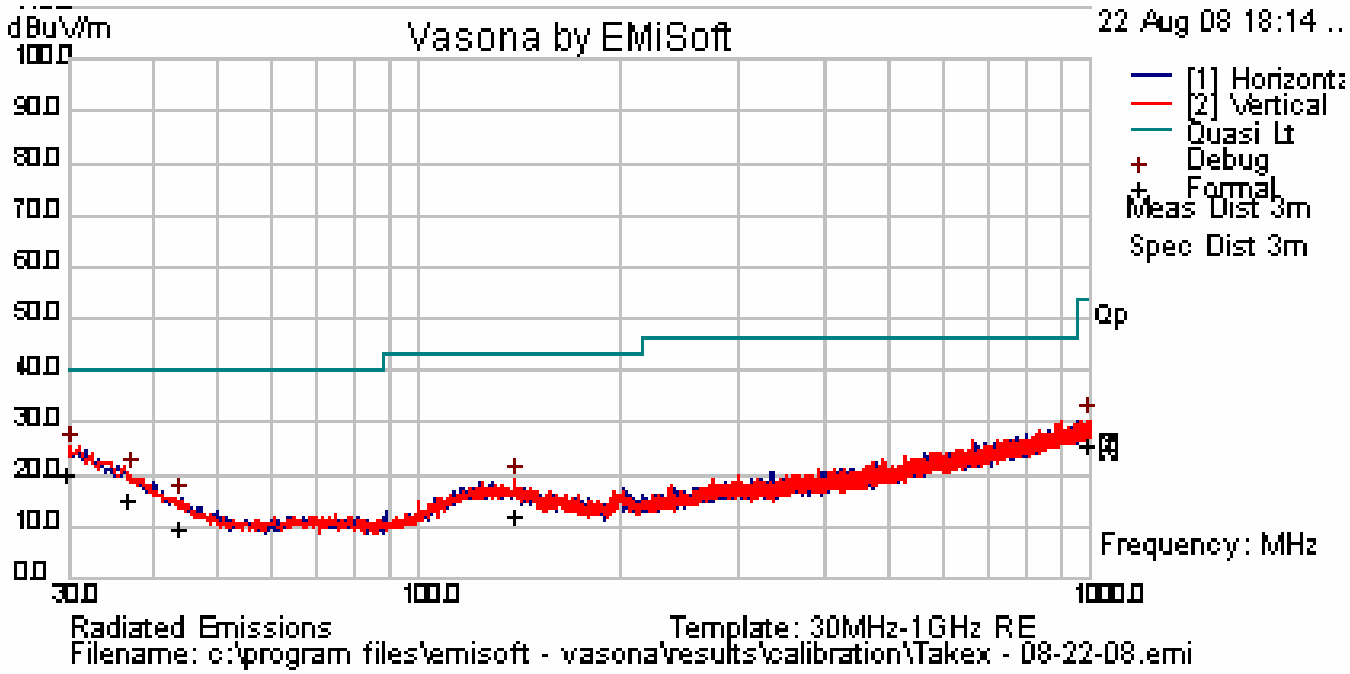
Unit 1: Fundamental Frequency = 24170 MHz

**-22.74dB** at **30.15 MHz** in the Vertical polarization

Unit 2: Fundamental Frequency = 24110 MHz

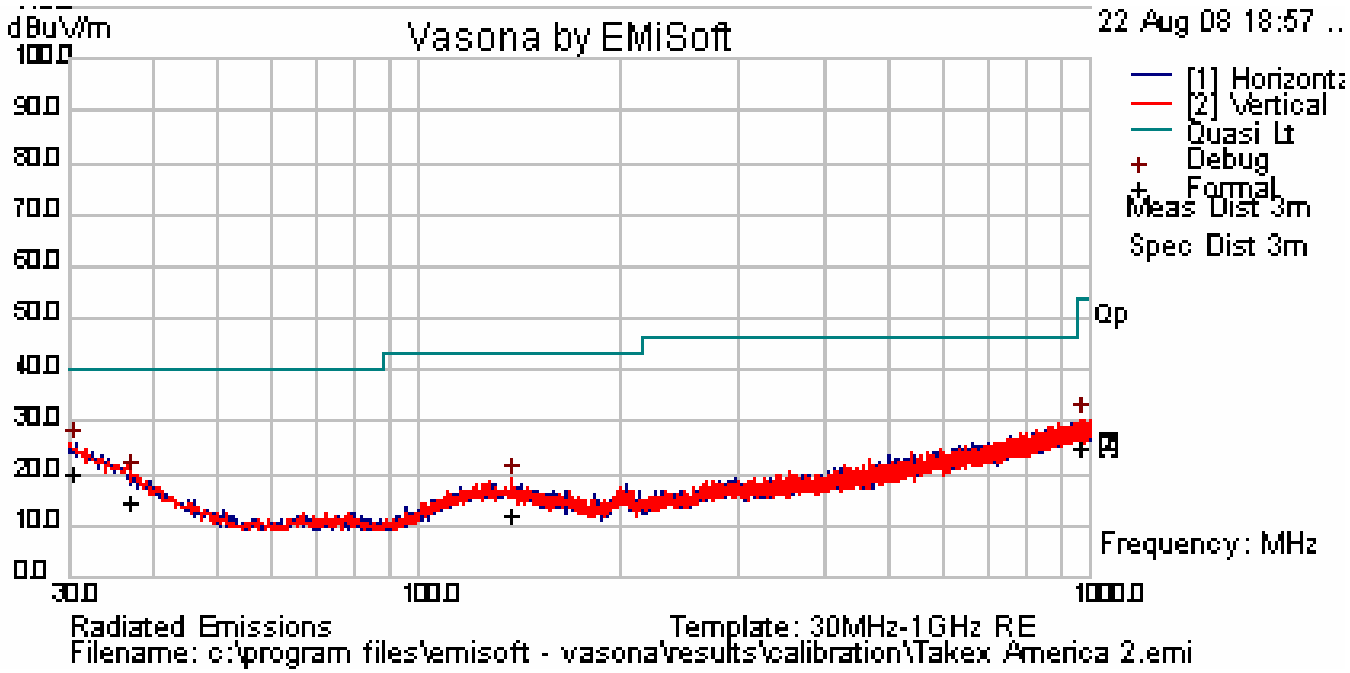
**-23.08dB** at **30.62 MHz** in the Horizontal polarization

Test Data and Plots for Unit 1




| Frequency (MHz) | Reading (dBuV) | Cable Loss (dB) | AF (dB) | Cord. (dBuV/m) | Detector | Ant. Pol | Ant. Height (cm) | Deg | Limit (dBuV/m) | Margin (dB) | Pass / Fail |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 30.15 | 14.84 | 10.42 | -8.00 | 17.26 | QP | V | 281 | 196 | 40.00 | -22.74 | Pass |
| 37.04 | 14.86 | 10.44 | -13.39 | 11.90 | QP | H | 117 | 90 | 40.00 | -28.10 | Pass |
| 994.82 | 15.68 | 12.21 | -5.37 | 22.52 | QP | H | 178 | 37 | 54.00 | -31.48 | Pass |
| 139.08 | 14.43 | 10.73 | -15.97 | 9.19 | QP | V | 367 | 207 | 43.50 | -34.31 | Pass |
| 44.22 | 14.68 | 10.46 | -18.56 | 6.58 | QP | H | 181 | 214 | 40.00 | -33.42 | Pass |

Test Data and Plots for Unit 2




| Frequency (MHz) | Reading (dBuV) | Cable Loss (dB) | AF (dB) | Cord. (dBuV/m) | Detector | Ant. Pol | Ant. Height (cm) | Deg | Limit (dBuV/m) | Margin (dB) | Pass / Fail |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 30.62 | 14.88 | 10.42 | -8.38 | 16.92 | QP | H | 152 | 242 | 40.00 | -23.08 | Pass |
| 37.33 | 14.85 | 10.44 | -13.60 | 11.69 | QP | V | 232 | 197 | 40.00 | -28.31 | Pass |
| 976.96 | 15.63 | 12.19 | -5.68 | 22.14 | QP | H | 256 | 149 | 54.00 | -31.86 | Pass |
| 137.51 | 14.37 | 10.71 | -15.88 | 9.20 | QP | V | 345 | 360 | 43.50 | -34.30 | Pass |