# ELECTROMAGNETIC EMISSION COMPLIANCE REPORT FOR LOW-POWER, NON-LICENSED TRANSMITTER

| | |
|---|---|
| **Test Report No.** | **: E10NR-050** |
| **AGR No** | **: A10NA-048** |
| **Applicant** | **: Digifi Co., Ltd.** |
| **Address** | **: 3F, Anyang K-Center, #1591-9 Burim-dong, Dongan-gu, Anyang-si, Gyeonggi-do, Korea** |
| **Manufacturer** | **: Digifi Co., Ltd.** |
| **Address** | **: 3F, Anyang K-Center, #1591-9 Burim-dong, Dongan-gu, Anyang-si, Gyeonggi-do, Korea** |
| **Type of Equipment** | **: Dongle of Wireless Audio Set** |
| **FCC ID.** | **: V9F-OPERAS5T** |
| **Model Name** | **: Opera S5T** |
| **Multiple Model Name** | **: Opera S5T+, rWand, Focal High Definition Wireless iTransmitter, EID-1** |
| **Serial number** | **: None** |
| **Total page of Report** | **: 22 pages (including this page)** |
| **Date of Incoming** | **: November 08, 2010** |
| **Date of issue** | **: November 22, 2010** |

## SUMMARY

The equipment complies with the regulation; **FCC Part 15 Subpart C Section 15.249.**

This test report only contains the result of a single test of the sample supplied for the examination.

It is not a generally valid assessment of the features of the respective products of the mass-production.

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**Revision History**

| Issue Report No. | Issued Date | Revisions | Effect Section |
|---|---|---|---|
| E10NR-050 | November 22, 2010 | Initial Release | All |
| | | | |
| | | | |

 

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# 1. VERIFICATION OF COMPLIANCE

| | |
|---|---|
| APPLICANT | : Digifi Co., Ltd. |
| ADDRESS | : 3F, Anyang K-Center, #1591-9 Burim-dong, Dongan-gu, Anyang-si, Gyeonggi-do, Korea |
| CONTACT PERSON | : Mr. Harry, Park / Managing Director |
| TELEPHONE NO | : +82-31-446-2345 |
| FCC ID | : V9F-OPERAS5T |
| MODEL NAME | : Opera S5T |
| SERIAL NUMBER | : N/A |
| DATE | : November 22, 2010 |

| | |
|---|---|
| EQUIPMENT CLASS | **DXX – Low Power Communications Transmitter** |
| KIND OF EQUIPMENT | Dongle of Wireless Audio Set |
| THIS REPORT CONCERNS | Original Grant |
| MEASUREMENT PROCEDURES | ANSI C63.4: 2009 |
| TYPE OF EQUIPMENT TESTED | Pre-Production |
| KIND OF EQUIPMENT AUTHORIZATION REQUESTED | Certification |
| EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S) | FCC PART 15 SUBPART C Section 15.249 |
| MODIFICATIONS ON THE EQUIPMENT TO ACHIEVE COMPLIANCE | No |
| FINAL TEST WAS CONDUCTED ON | 3 m open area test site |

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

 

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# 2. TEST SUMMARY

## 2.1 Test items and results

| SECTION | TEST ITEMS | RESULTS |
|---|---|---|
| 15.249 (a) | Field Strength of Emission | Met the Limit / PASS |
| 15.249 (c) | Measurement distance | Met the Requirement / PASS |
| 15.249 (d) | Emissions Radiated Outside of the Specified Frequency Band | Met the Limit / PASS |
| 15.249 (e) | Radiated Emissions above 1 000 MHz | Met the Limit / PASS |
| 15.209 | Radiated Emission Limits, General Requirement | Met the Limit / PASS |
| 15.207 | Conducted Limits | N/A (See Note) |
| 15.203 | Antenna Requirement | Met the Requirement / PASS |

Note: This test is not performed because the EUT is operated by DC battery.

## 2.2 Additions, deviations, exclusions from standards

No additions, deviations or exclusions have been made from standard.

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

Original submittal only

## 2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in section 2.1.

## 2.5 Test Methodology

Radiated testing was performed according to the procedures in ANSI C63.4: 2009 at a distance of 3 m from EUT to the antenna.

## 2.6 Test Facility

The open area test site and conducted measurement facilities are located on at 307-51, Daessangryung-ri, Chowol-eup, Gwangju-si, Gyeonggi-do, 464-862, Korea. Description details of test facilities were submitted to the Commission on August 21, 2008. (Registration Number: 340658)



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# 3. GENERAL INFORMATION

## 3.1 Product Description

The Digifi Co., Ltd., Model: Opera S5T (referred to as the EUT in this report) is a Dongle of Wireless Audio Set that is used for iPod. Product specification information described herein was obtained from product data sheet or user's manual.

| | |
|---|---|
| DEVICE TYPE | Portable Device |
| OPERATING FREQUENCY | 2 403 MHz ~ 2 478 MHz |
| RATED RF OUTPUT POWER | 0 dBm |
| USED ANTENNA | Mfr.: AMOTECH / Model No.: ALA131C3 (Gain 0.75 dBi) |
| ANTENNA | Chip Antenna |
| CHANNEL | 16 Channels |
| MODULATION METHOD | MSK |
| Tx DATA SPEED | 2.37 Mb/s |
| USED RF CHIP | Kleer, KLR3012 |
| LIST OF EACH OSC. OR CRY. FREQ.(FREQ.>=1MHz) | 22.576 649 MHz |
| NUMBER OF LAYER | 4 Layers |
| POWER REQUIREMENT | DC 3.7 V from an iPod |

## 3.2 Model Differences

-. The following lists consist of the added model and their differences.

| Model Name | Differences | Tested |
|---|---|---|
| Opera S5T | Basic Model | ☑ |
| Opera S5T+, rWand,Focal High Definition Wireless iTransmitter, EID-1 | These models are identical to basic model except for the model designation only. | ☐ |

*Note: 1. Applicant consigns only basic model to test, therefore this test report just guarantees the units which have been tested.*

*2. The Applicant/manufacturer is responsible for the compliance of all variants.*

# 4. EUT MODIFICATIONS

-. None


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# 5. SYSTEM TEST CONFIGURATION

## 5.1 Justification

This device was configured for testing in a typical way as a normal customer is supposed to be used. During the test, the following components were installed inside of the EUT.

| DEVICE TYPE | MANUFACTURER | MODEL/PART NUMBER | FCC ID |
|---|---|---|---|
| Main Board | Digifi Co., Ltd. | N/A | N/A |

## 5.2 Peripheral equipment

Defined as equipment needed for correct operation of the EUT, but not considered as tested:

| Model | Manufacturer | FCC ID | Description | Connected to |
|---|---|---|---|---|
| Opera S5T | Digifi Co., Ltd. | V9F-OPERAS5T | Dongle of Wireless Audio Set (EUT) | Jig Board |
| N/A | N/A | N/A | Jig Board | EUT and Notebook PC |
| PP10L | Dell Computer | DoC | Notebook | - |
| MO56UOA | Dell Computer | DoC | Mouse | Notebook PC |
| DRP-305DN | Digital Elec. | N/A | DC Power Supply | EUT |

## 5.3 Mode of operation during the test

For the testing, software used to control the EUT for staying in continuous transmitting is programmed.

For final testing, the EUT was set at Low Channel (2 403 MHz), Middle Channel (2 438 MHz), and High Channel (2 478 MHz). To get a maximum emission levels from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes.

## 5.4 Configuration of Test System

**Line Conducted Test** **:** It is not need to test this requirement, because the EUT shall be operated by DC battery and charged from iPod device only.

**Radiated Emission Test** **:**Preliminary radiated emissions test were conducted using the procedure in ANSI C63.4: 2009 8.3.1.1 and 13.4.1 to determine the worse operating conditions. Final radiated emission tests were conducted at 3 m open area test site.

The turntable was rotated through 360 degrees and the EUT was tested by positioned three orthogonal planes to obtain the highest reading on the field strength meter. Once maximum reading was determined, the search antenna was raised and lowered in both vertical and horizontal polarization.



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### 5.5 Antenna Requirement

According to section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

**Antenna Construction:**

The antenna of the EUT is a chip antenna on the main board in the EUT, so no consideration of replacement by the user.

## 6. PRELIMINARY TEST

### 6.1 AC Power line Conducted Emissions Tests

During Preliminary Tests, the following operating mode was investigated

| Operation Mode | The Worse operating condition (Please check one only) |
|---|---|
| It is not need to test this requirement, because the power of the EUT is supplied from the battery of iPod. | |

### 6.2 General Radiated Emissions Tests

During Preliminary Tests, the following operating modes were investigated

| Operation Mode | The Worse operating condition (Please check one only) |
|---|---|
| TX Mode | X |


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# 7. RADIATED EMISSION TEST

## 7.1 Test set-up

The radiated emissions measurements were on the 3 m, open-field test site. The EUT and other support equipment were placed on a non-conductive turntable above the ground plane. The interconnecting cables from outside test site were inserted into ferrite clamps at the point where the cables reach the turntable.

The frequency spectrum from 30 MHz to 1 000 MHz was scanned and emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

Test set-up photos are included in appendix I.

## 7.2 Measurement uncertainty

Radiated emission electric field intensity, 30 MHz ~ 300 MHz : ± 4.43 dB

Radiated emission electric field intensity, 300 MHz ~ 1 000 MHz : ± 3.80 dB

Radiated emission electric field intensity, 1 000 MHz ~ 3 000 MHz: ± 4.4 dB

Measurement uncertainty is calculated in accordance with WECC 19-1990. The measurement uncertainty is given with a confidence of 95 % with the coverage factor, $k$ = 2.

## 7.3 Test equipment used

| | Model Number | Manufacturer | Description | Serial Number | Last Cal. (Interval) |
|---|---|---|---|---|---|
| ■ - | ESVD | Rohde & Schwarz | Test Receiver | 838453/018 | Nov. 20, 2009 (1Y) |
| ■ - | 8564E | HP | Spectrum Analyzer | 3650A00756 | Jun. 10, 2010 (1Y) |
| ■ - | 83051A | Agilent | Microwave System Preamplifer | 3950M00201 | Jun. 11, 2010 (1Y) |
| ■ - | MA240 | HD GmbH | Antenna Master | N/A | N/A |
| ■ - | HD100 | HD GmbH | Position Controller | N/A | N/A |
| ■ - | DS420S | HD GmbH | Turn Table | N/A | N/A |
| ■ - | VHA9103 | Schwarzbeck | Biconical Antenna | 91031852 | Mar. 30, 2010 (2Y) |
| ■ - | 9108-A(494) | Schwarzbeck | Log Periodic Antenna | 62281001 | Mar. 30, 2010 (2Y) |
| ■ - | BBHA9120D | Schwarzbeck | Horn Antenna | BBHA9120D294 | Jun. 17, 2009 (2Y) |

All test equipment used is calibrated on a regular basis.



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## 7.4 Final Result of Measurement

### 7.4.1 Field Strength of the Fundamental Frequency

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

Humidity Level : 52 % R.H. Temperature: 14 °C

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249(a)

Result : PASSED BY –7.06 dB at 2 478.00 MHz

EUT : Dongle of Wireless Audio Set Date: November 12, 2010

Operating Condition : TX mode

Distance : 3 m

| Channel | Radiated Emissions | | | Ant | Correction Factors | | Total | FCC Limit | |
|---|---|---|---|---|---|---|---|---|---|
| | Carrier Freq. (MHz) | Amplitude (dBμV) | Detect Mode | Pol. | Antenna (dB/m) | Cable (dB) | Amplitude (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
| Low | 2 403.00 | 61.50 | Peak | H | 27.09 | 5.00 | 93.59 | 113.98 | -20.39 |
| | | 52.00 | Average | H | | | 84.09 | 93.98 | -9.89 |
| | | 63.33 | Peak | V | | | 95.42 | 113.98 | -18.56 |
| | | 54.50 | Average | V | | | 86.59 | 93.98 | -7.39 |
| Middle | 2 438.00 | 61.83 | Peak | H | 27.18 | 5.06 | 94.07 | 113.98 | -19.91 |
| | | 52.67 | Average | H | | | 84.91 | 93.98 | -9.07 |
| | | 63.17 | Peak | V | | | 95.41 | 113.98 | -18.57 |
| | | 54.00 | Average | V | | | 86.24 | 93.98 | -7.74 |
| High | 2 478.00 | 62.17 | Peak | H | 27.29 | 5.13 | 94.59 | 113.98 | -19.39 |
| | | 53.00 | Average | H | | | 85.42 | 93.98 | -8.56 |
| | | 63.83 | Peak | V | | | 96.25 | 113.98 | -17.73 |
| | | 54.50 | Average | V | | | 86.92 | 93.98 | -7.06 |

*Remark: To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes, but the worst plane data were recorded in the report.

**Tested by: Ki-Hong, Nam / Senior Engineer**



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### 7.4.2 Emissions Conducted Outside of the Specified Frequency Bands

Humidity Level : 52 % R.H. Temperature: 14 °C

EUT : Dongle of Wireless Audio Set Date: November 12, 2010

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249(d)

Operating Condition : TX mode

| Channel | Frequency (MHz) | Amplitude (dBm) | dBc |
|---|---|---|---|
| Low | 2 403.00 | -9.90 | - |
| | 166.00 | -63.67 | -73.57 |
| | 9 620.00 | -54.17 | -64.07 |
| Middle | 2 438.00 | -9.80 | - |
| | 166.00 | -64.17 | -73.97 |
| | 9 780.00 | -52.17 | -61.97 |
| High | 2 478.00 | -9.50 | - |
| | 166.00 | -63.83 | -73.33 |
| | 9 940.00 | -48.50 | -58.00 |

Remark. Frequency was scanned up to 26.5 GHz and the data in the table is reference only.

**Tested by: Ki-Hong, Nam / Senior Engineer**



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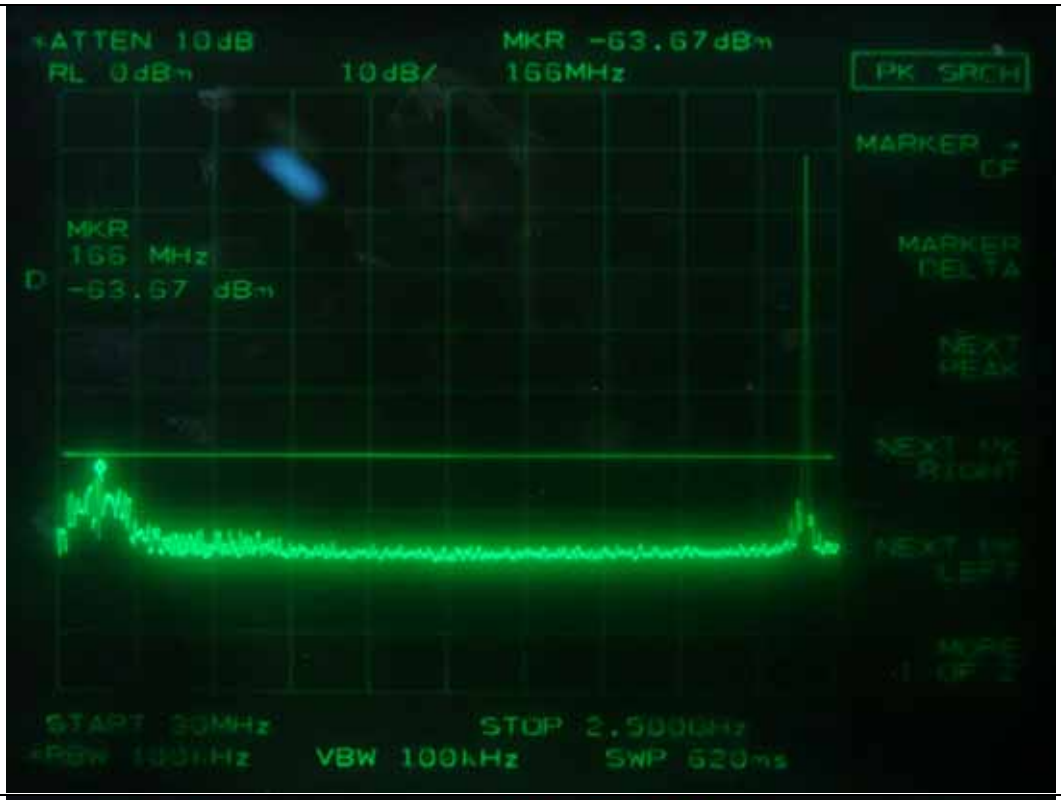
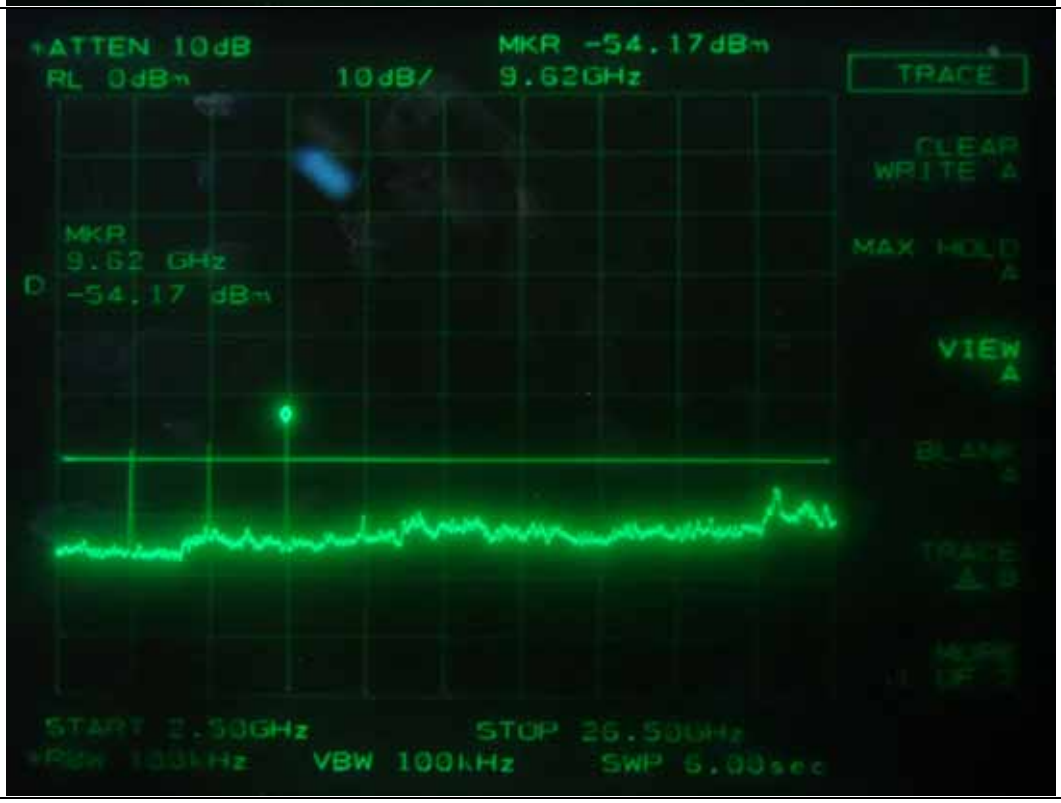
**Low Channel**



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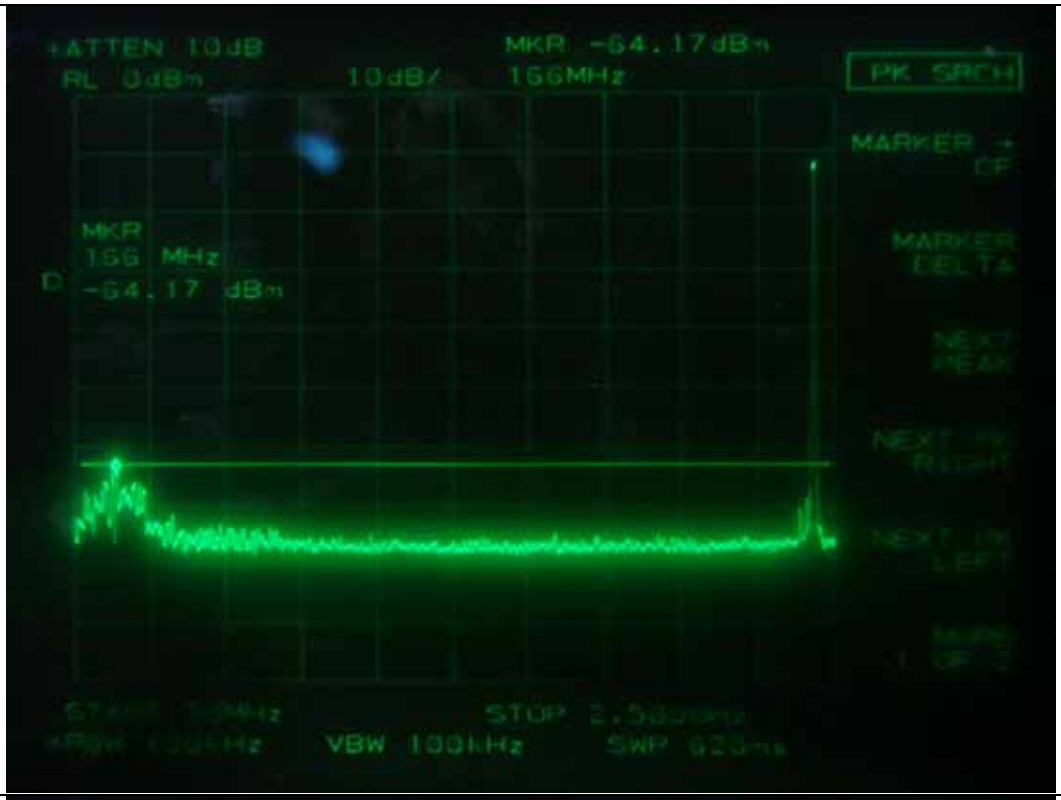
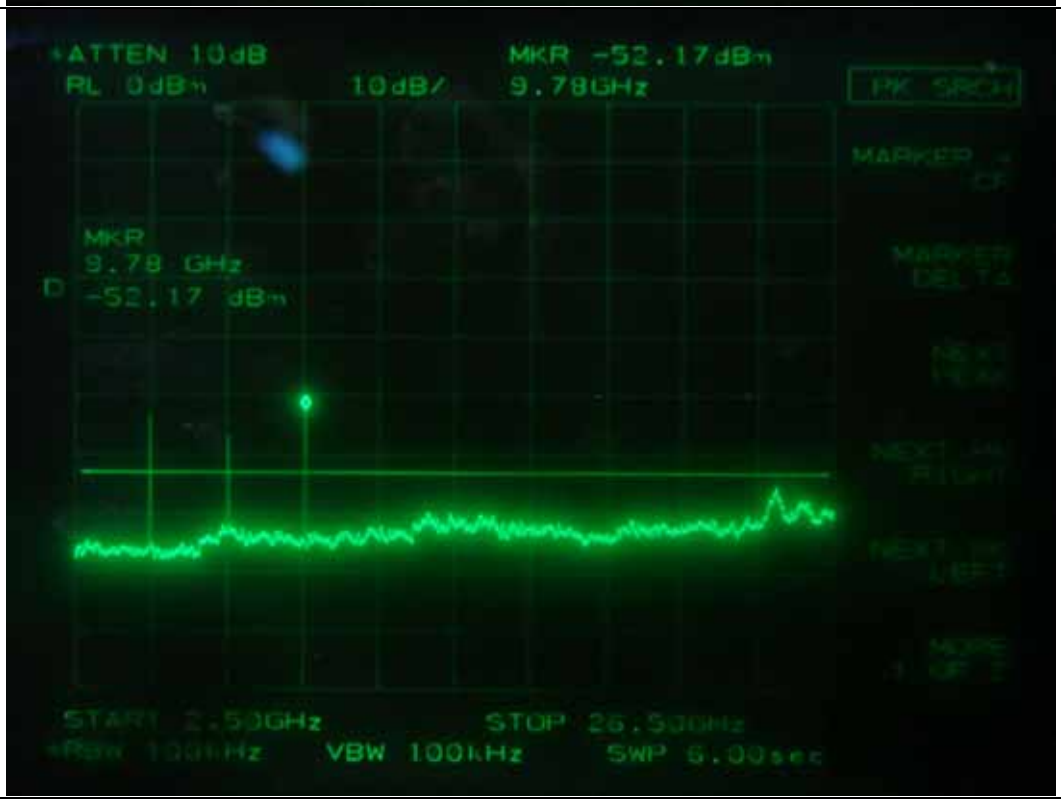
**Middle Channel**



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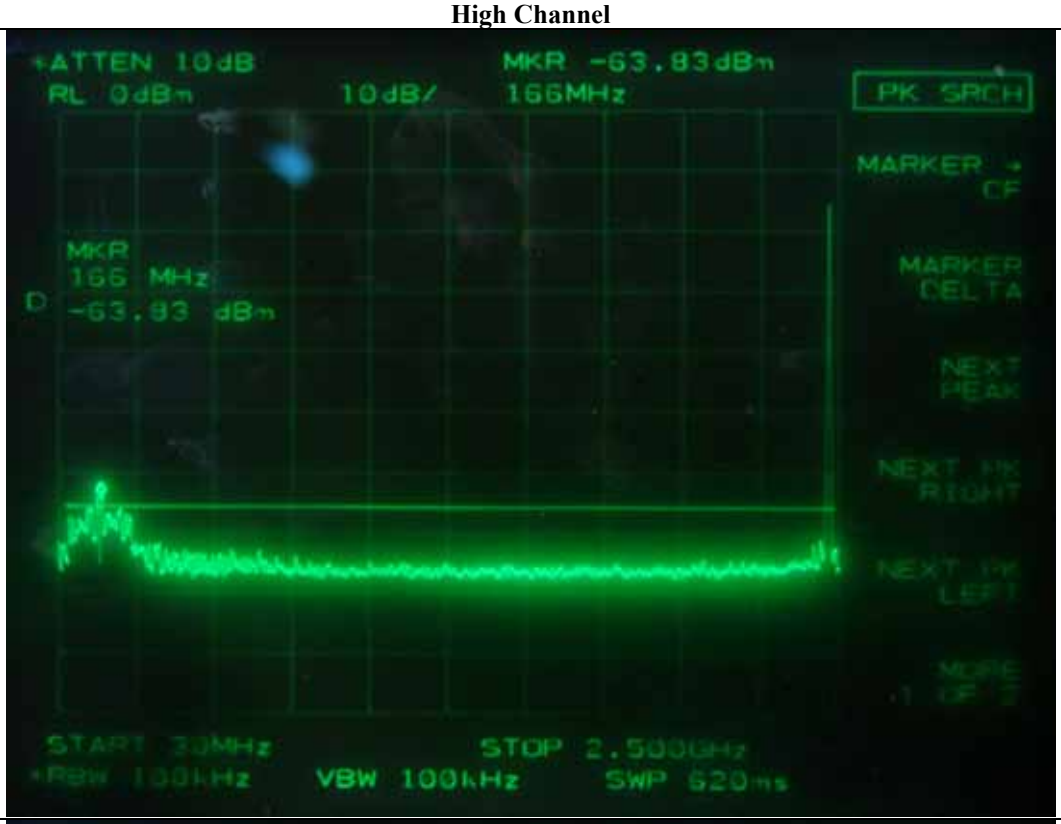
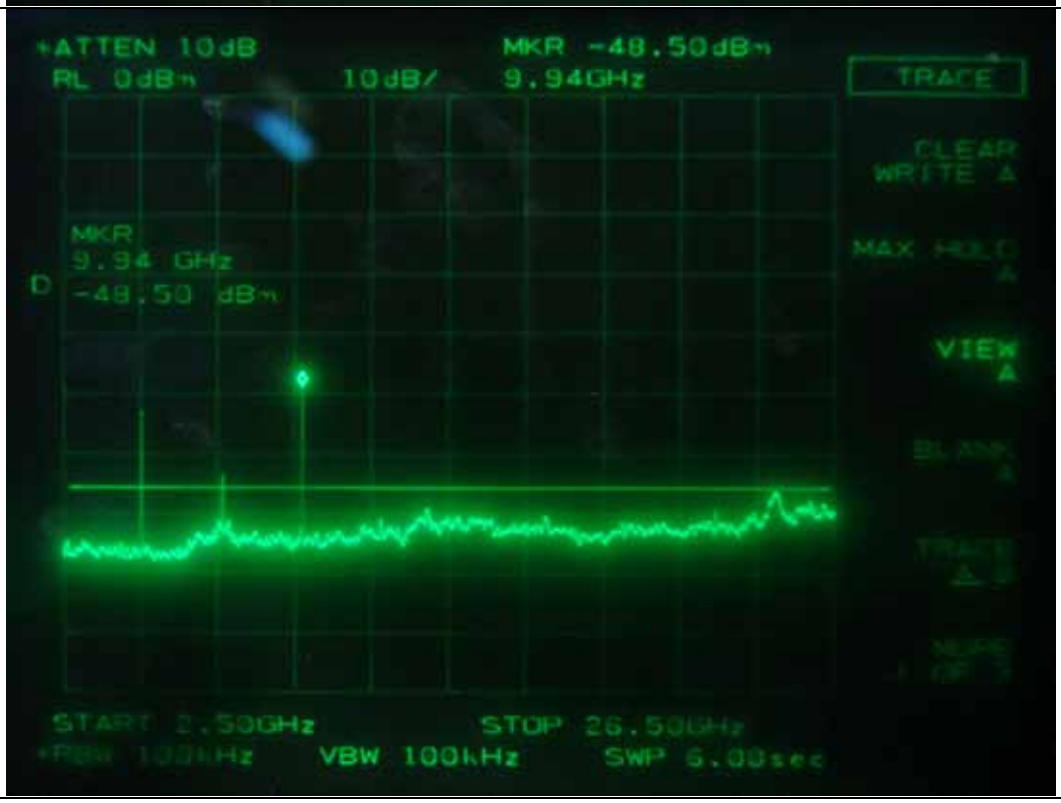
**High Channel**



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### 7.4.3 Emissions Radiated Outside of the Specified Frequency Bands

#### 7.4.3.1 Test Data for Spurious except for Harmonic above 1 000 MHz

Humidity Level : 52 % R.H. Temperature: 14 °C

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249(d)

Result : PASSED

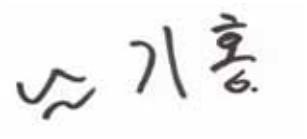
EUT : Dongle of Wireless Audio Set Date: November 12, 2010

Operating Condition : TX mode

Distance : 3 m

| Channel | Frequency (MHz) | Reading (dBμV) | Detector Mode | Ant. Pol. (H/V) | Ant. Factor | Cable Loss | Amp Gain | Total (dBμV/m) | Limits (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| Low | It was not observed any emissions from the EUT. | | | | | | | | | |
| Middle | | | | | | | | | | |
| High | | | | | | | | | | |

Tabulated test data for Restricted Band



**Tested by: Ki-Hong, Nam / Senior Engineer**

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**7.4.3.2 Test Data for Harmonic**

Humidity Level : 52 % R.H. Temperature: 14 °C
Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249(a)
Result : PASSED BY –10.54 dB at 4 956.00 MHz

EUT : Dongle of Wireless Audio Set Date: November 12, 2010
Operating Condition : TX mode
Distance : 3 m

| Channel | Frequency (MHz) | Reading (dBµV) | Detector Mode | Ant. Pol. (H/V) | Ant. Factor | Cable Loss | Amp Gain | Total (dBµV/m) | Limits (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| Low | 4 806.00* | 41.33 | Peak | H | 31.07 | 6.87 | 28.80 | 50.47 | 73.98 | -23.51 |
| | | 32.50 | Average | H | | | | 41.64 | 53.98 | -12.34 |
| | | 44.67 | Peak | V | | | | 53.81 | 73.98 | -20.17 |
| | | 33.83 | Average | V | | | | 42.97 | 53.98 | -11.01 |
| | Other frequencies were not found up to 26.5 GHz. | | | | | | | | | |
| Middle | 4 876.00* | 41.67 | Peak | H | 31.18 | 6.92 | 28.74 | 51.03 | 73.98 | -22.95 |
| | | 32.83 | Average | H | | | | 42.19 | 53.98 | -11.79 |
| | | 44.50 | Peak | V | | | | 53.86 | 73.98 | -20.12 |
| | | 33.33 | Average | V | | | | 42.69 | 53.98 | -11.29 |
| | Other frequencies were not found up to 26.5 GHz. | | | | | | | | | |
| High | 4 956.00* | 42.00 | Peak | H | 31.31 | 6.97 | 28.67 | 51.61 | 73.98 | -22.37 |
| | | 33.17 | Average | H | | | | 42.78 | 53.98 | -11.20 |
| | | 45.17 | Peak | V | | | | 54.78 | 73.98 | -19.20 |
| | | 33.83 | Average | V | | | | 43.44 | 53.98 | -10.54 |
| | Other frequencies were not found up to 26.5 GHz. | | | | | | | | | |

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical, “*” Frequency fall in restricted band

**Tested by: Ki-Hong, Nam / Senior Engineer**



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**7.4.3.3 Test Data for Spurious except for Harmonic**

Humidity Level : 52 % R.H. Temperature: 13 °C

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.209 (a)

Result : PASSED BY –9.24 dB at 67.50 MHz under low and high channel

EUT : Dongle of Wireless Audio Set Date: November 10, 2010

Frequency range : 30 MHz ~ 1 000 MHz

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)

| Frequency (MHz) | Reading (dBµV) | Ant. Pol. (H/V) | Ant. Height (m) | Angle (°) | Ant. Factor (dB/m) | Cable Loss | Emission Level (dBµV/m) | Limits (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| **Low Channel** | | | | | | | | | |
| 67.50 | 21.50 | V | 1.00 | 280.00 | 7.26 | 2.00 | 30.76 | 40.00 | -9.24 |
| 79.00 | 18.33 | V | 1.30 | 150.00 | 6.21 | 2.02 | 26.56 | 40.00 | -13.44 |
| 125.00 | 15.50 | V | 1.00 | 330.00 | 13.89 | 2.45 | 31.84 | 43.52 | -11.68 |
| 135.83 | 16.17 | V | 1.00 | 150.00 | 14.43 | 2.50 | 33.10 | 43.52 | -10.42 |
| 175.50 | 12.33 | V | 1.00 | 220.00 | 16.08 | 3.03 | 31.44 | 43.52 | -12.08 |
| 360.20 | 15.67 | H | 1.00 | 160.00 | 16.08 | 3.68 | 35.43 | 46.02 | -10.59 |
| **Middle Channel** | | | | | | | | | |
| 67.50 | 21.33 | V | 1.00 | 280.00 | 7.26 | 2.00 | 30.59 | 40.00 | -9.41 |
| 79.00 | 18.50 | V | 1.30 | 150.00 | 6.21 | 2.02 | 26.73 | 40.00 | -13.27 |
| 125.00 | 15.50 | V | 1.00 | 330.00 | 13.89 | 2.45 | 31.84 | 43.52 | -11.68 |
| 135.83 | 16.33 | V | 1.00 | 150.00 | 14.43 | 2.50 | 33.26 | 43.52 | -10.26 |
| 175.50 | 12.67 | V | 1.00 | 220.00 | 16.08 | 3.03 | 31.78 | 43.52 | -11.74 |
| 360.20 | 15.83 | H | 1.00 | 160.00 | 16.08 | 3.68 | 35.59 | 46.02 | -10.43 |
| **High Channel** | | | | | | | | | |
| 67.50 | 21.50 | V | 1.00 | 280.00 | 7.26 | 2.00 | 30.76 | 40.00 | -9.24 |
| 79.00 | 18.67 | V | 1.30 | 150.00 | 6.21 | 2.02 | 26.90 | 40.00 | -13.10 |
| 125.00 | 15.17 | V | 1.00 | 330.00 | 13.89 | 2.45 | 31.51 | 43.52 | -12.01 |
| 135.83 | 16.50 | V | 1.00 | 150.00 | 14.43 | 2.50 | 33.43 | 43.52 | -10.09 |
| 175.50 | 12.17 | V | 1.00 | 220.00 | 16.08 | 3.03 | 31.28 | 43.52 | -12.24 |
| 360.20 | 15.50 | H | 1.00 | 160.00 | 16.08 | 3.68 | 35.26 | 46.02 | -10.76 |

**Tested by: Ki-Hong, Nam / Senior Engineer**



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**7.4.3.4 Band Edge**

-. Test Date : November 12, 2010

-. Resolution bandwidth : 1 MHz for Peak and Average Mode

-. Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode

-. Frequency range : 1 GHz ~ 25 GHz

-. Measurement distance : 3 m

-. Operating Condition : Low / High Channel

-. Result : PASSED BY –31.90 dB at High Channel

| Frequency (MHz) | Reading (dBµV) | Detector Mode | Ant. Pol. (H/V) | Ant. Factor | Cable Loss | Amp Gain | Total (dBµV/m) | Limits (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| **Test Data for Low Channel** | | | | | | | | | |
| 2 390.00 | 31.45 | Peak | H | 27.05 | 3.13 | 28.98 | 32.65 | 74.00 | -41.35 |
| | 20.81 | Average | H | | | | 22.01 | 54.00 | -31.99 |
| | 32.03 | Peak | V | | | | 33.23 | 74.00 | -40.77 |
| | 20.33 | Average | V | | | | 21.53 | 54.00 | -32.47 |
| **Test Data for High Channel** | | | | | | | | | |
| 2 483.50 | 30.09 | Peak | H | 27.31 | 3.17 | 28.82 | 31.75 | 74.00 | -42.25 |
| | 20.40 | Average | H | | | | 22.06 | 54.00 | -31.94 |
| | 30.67 | Peak | V | | | | 32.33 | 74.00 | -41.67 |
| | 20.44 | Average | V | | | | 22.10 | 54.00 | -31.90 |

**Tested by: Ki-Hong, Nam / Senior Engineer**



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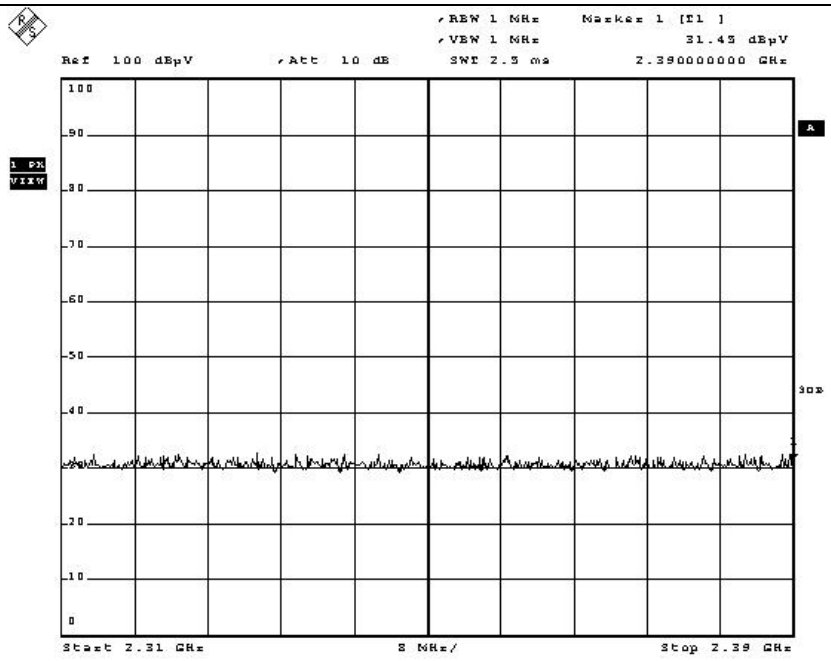
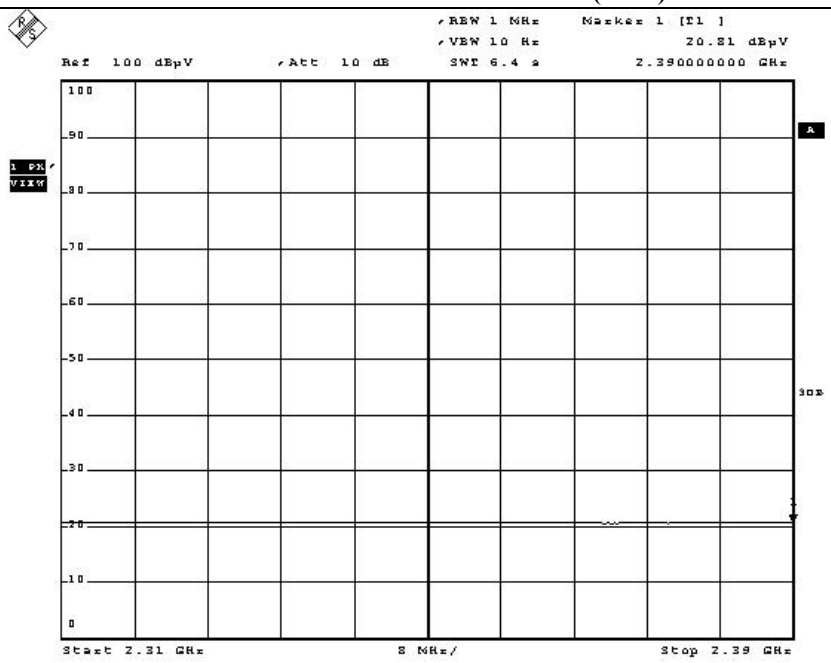
**Plotted Data for band edge**




**Low Channel – Horizontal (Peak)**




**Low Channel – Horizontal (Average)**

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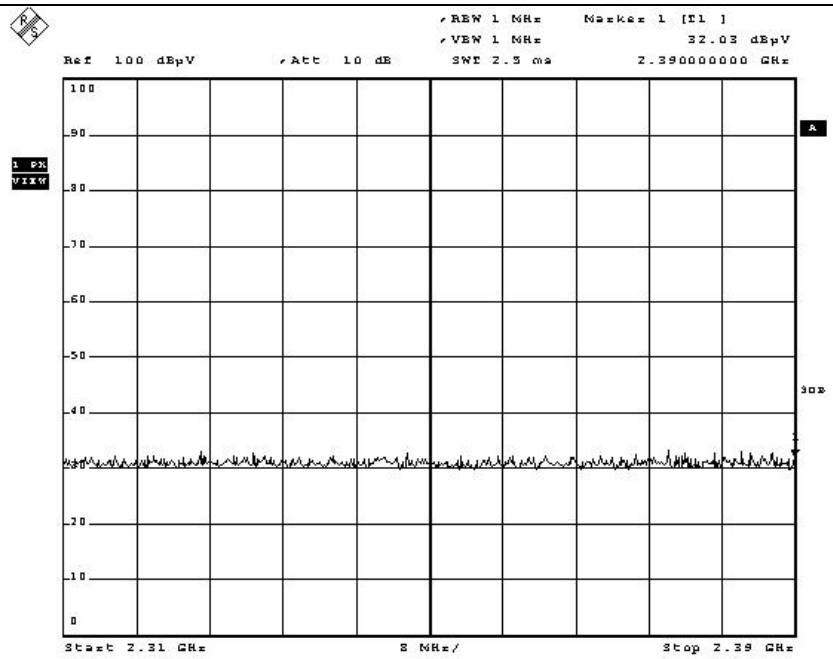
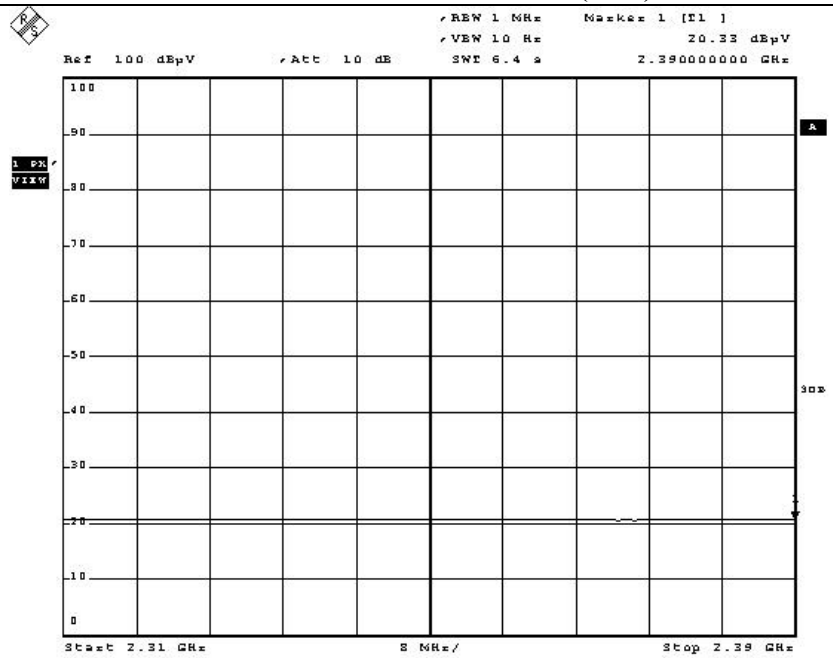



**Low Channel – Vertical (Peak)**




**Low Channel – Vertical (Average)**

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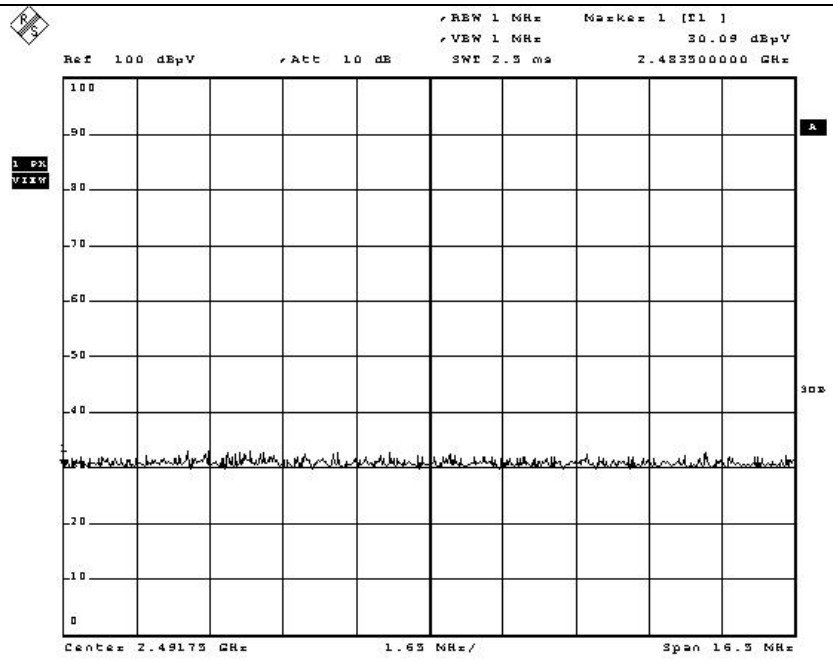
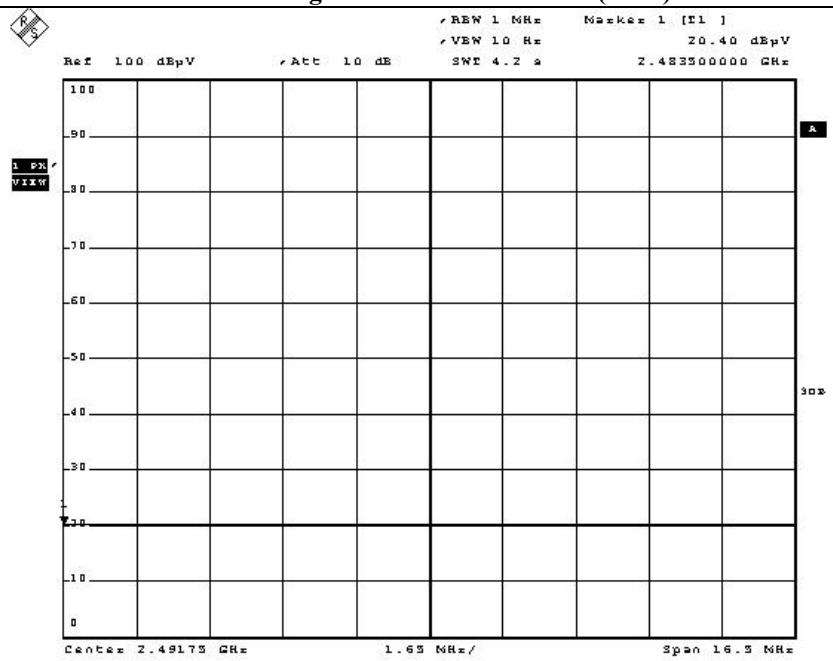



**High Channel – Horizontal (Peak)**




**High Channel – Horizontal (Average)**

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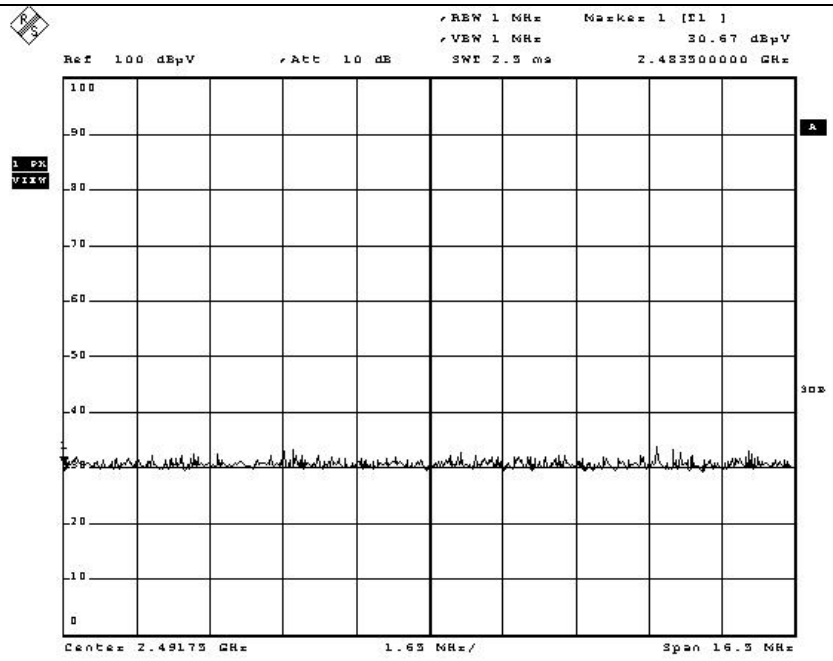
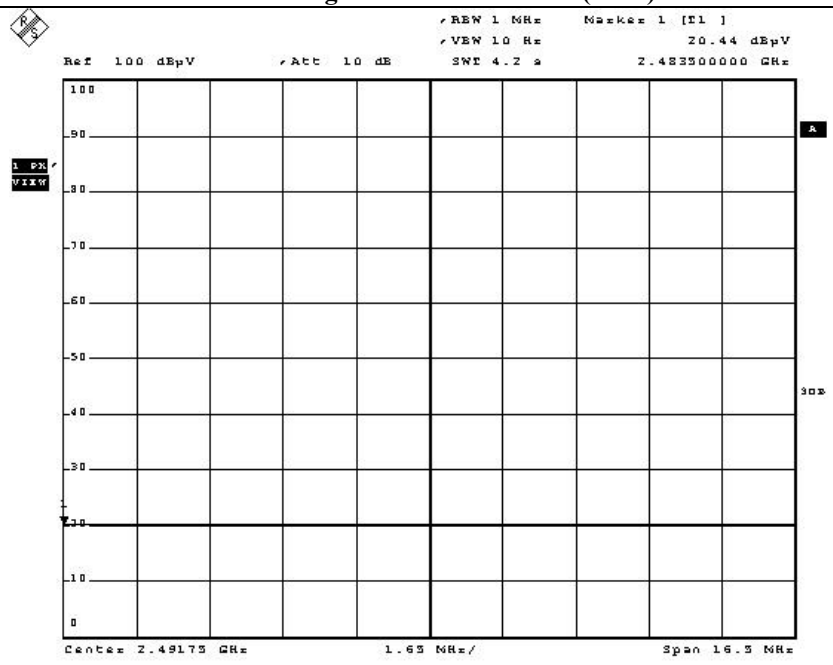



**High Channel – Vertical (Peak)**




**High Channel – Vertical (Average)**

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