



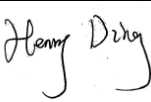
# FCC PART 15.407 TEST REPORT

For

**Airpul LLC**

6 Daye Rd, jinjiang, Chengdu, Sichuan, China 610016

**FCC ID: 2ACCYAC8231**

|                                                                                                                                                                                                                           |                                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| <b>Report Type:</b><br>Original Report                                                                                                                                                                                    | <b>Product Type:</b><br>Wireless HD Pro                                               |
| <b>Test Engineer:</b> Lynn Yi                                                                                                                                                                                             |  |
| <b>Report Number:</b> RSC140226003                                                                                                                                                                                        |                                                                                       |
| <b>Report Date:</b> 2014-05-04                                                                                                                                                                                            |                                                                                       |
| <b>Reviewed By:</b> Henry Ding                                                                                                                                                                                            |  |
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## GENERAL INFORMATION

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

The *Airpul LLC*'s product, model number: *AC8231 (FCC ID: 2ACCYAC8231)* or ("EUT") in this report is a *Wireless HD Pro*, which was measured approximately: 6.69in (L)\*4.25in (W)\*1.97in (H). Rated input voltage: DC 12 V from adapter. The operating frequency is 5150~5250MHz, 5725~5825MHz.

Adapter:  
Manufacturer: HON-KWANG  
Model: HK-HP-A12  
Input: AC 100-240V ~ 50/60Hz, 0.8A  
Output: DC 12V

*\*All measurement and test data in this report was gathered from final production sample, serial number: 14022601(Assigned by BACL, Chengdu). It may have deviation from any other sample.  
The EUT supplied by the applicant was received on 2014-02-26, and EUT complied with test requirement.*

### Objective

This type approval report is prepared on behalf of *Airpul LLC* in accordance with Part 2-Subpart J, Part 15-Subparts A, B and E of the Federal Communications Commission rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart E, section 15.203, 15.205, 15.207, 15.209 and 15.407 rules.

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

No related submittal(s).

### Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2003, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Chengdu).

### Test Facility

The test site used by BACL to collect test data is located in the 5040, HuiLongWan Plaza, No. 1, ShaWan Road, JinNiu District, ChengDu, China

Test site at BACL has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on July 31, 2009. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 560332. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

## SYSTEM TEST CONFIGURATION

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### Description of Test Configuration

The EUT was configured for testing in an engineering mode which was provided by the manufacturer.

The operating frequency range is 5150~5250 MHz and 5725~5825 MHz, the frequencies are 5190 MHz, 5230 MHz for 5150~5250 MHz band.

5755 MHz, 5795 MHz for 5725~5825 MHz band, which was provided by the manufacturer.

### EUT Exercise Software

The test was performed under “**AppCom\_3.0.3.16**” which was provided by the manufacturer.

### Equipment under Test (EUT) General Description

| Applicant  | Description     | Model Number | Serial Number |
|------------|-----------------|--------------|---------------|
| Airpul LLC | Wireless HD Pro | AC8231       | 14022601      |

### Support Equipment List and Details

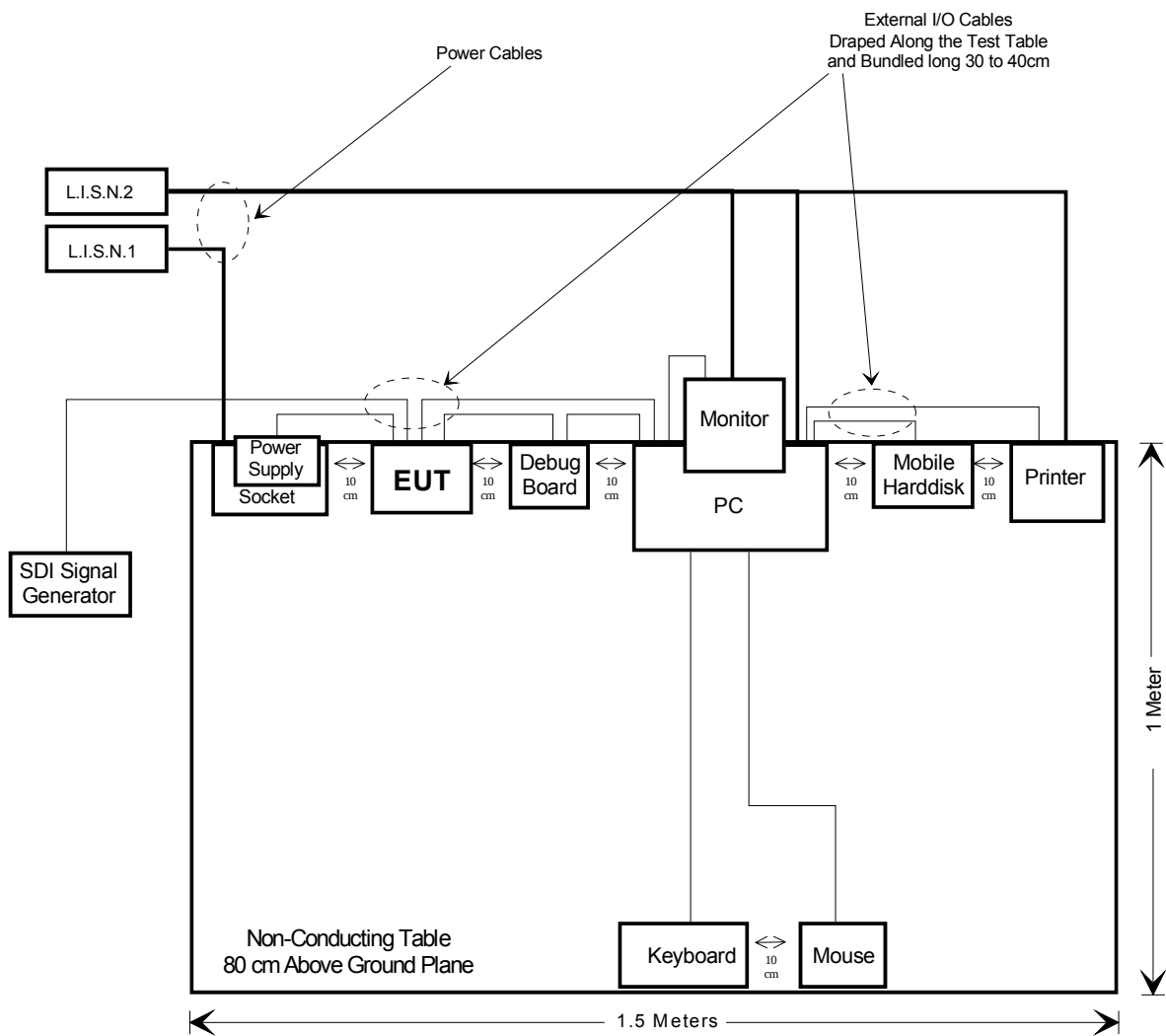
| Manufacturer | Description          | Model      | Serial Number |
|--------------|----------------------|------------|---------------|
| IBM          | PC                   | 8176       | 99Y7315       |
| DELL         | Monitor              | SK-8815    | 9161649       |
| IBM          | Keyboard             | KM-110X    | XBK133000993  |
| Logitech     | Mouse                | M-U0004    | 810-001808    |
| TOSHIBA      | Mobile Hard Disk     | V6700-A500 | 1297FH0YSRE8  |
| EPSON        | Printer              | B261A      | GXSK285854    |
| Dfine        | Debug Board          | None       | None          |
| HON-KWANG    | Power Supply         | HK-HP-A12  | None          |
| None         | SDI Signal Generator | None       | None          |

### External I/O Cable

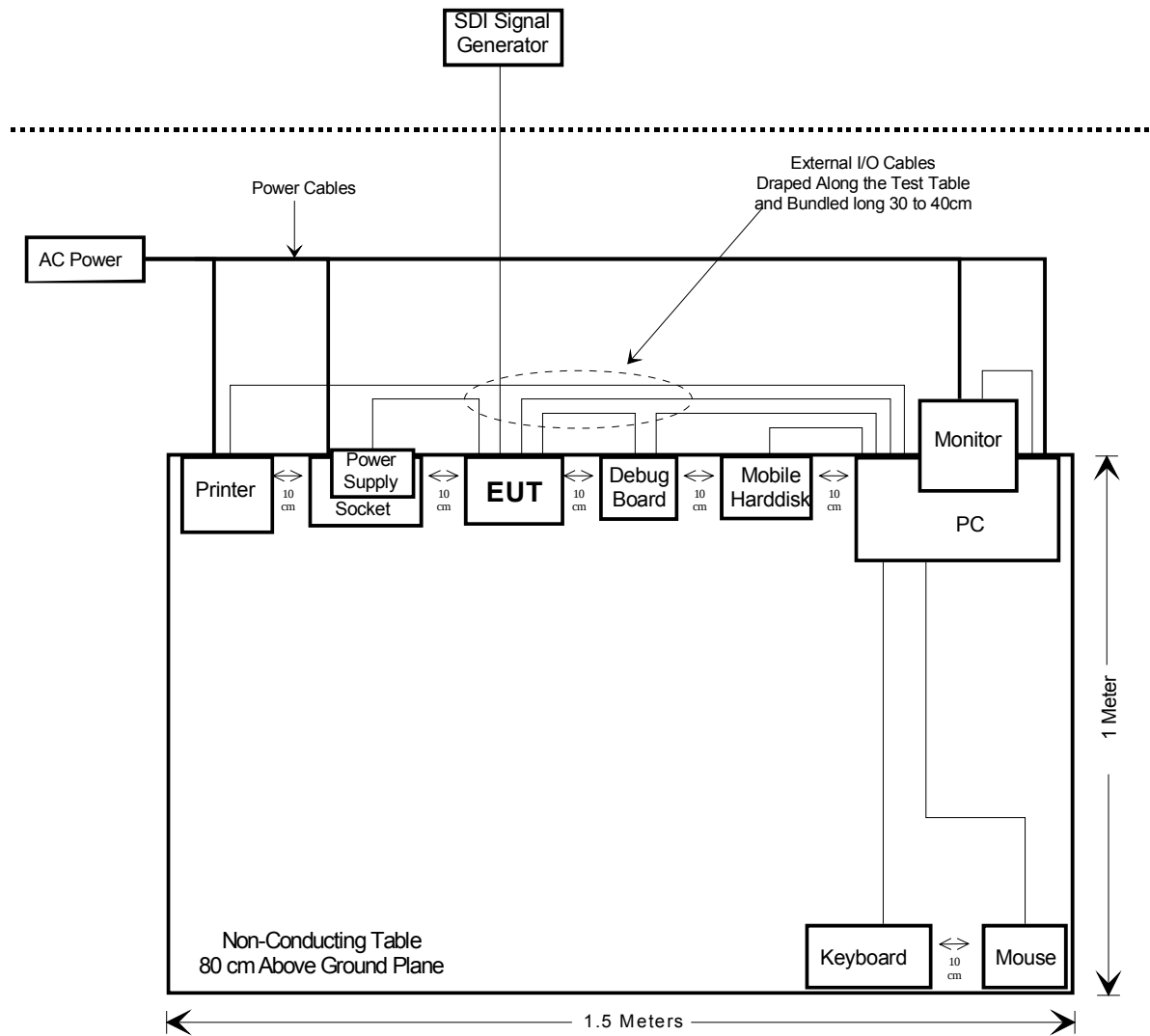
| Cable Description        | Length (m) | From | To                   |
|--------------------------|------------|------|----------------------|
| Shielding VGA Cable      | 1.5m       | PC   | Monitor              |
| Shielding USB Cable      | 1.0m       | PC   | EUT                  |
| Shielding RS232 Cable    | 1.5m       | PC   | Printer              |
| Shielding Mouse Cable    | 1.5m       | PC   | Mouse                |
| Shielding Keyboard Cable | 1.5m       | PC   | Keyboard             |
| Shielding USB Cable      | 0.5m       | PC   | Mobile Hard Disk     |
| Shielding BNC Cable      | 10m        | EUT  | SDI Signal Generator |
| Shielding RS232 Cable    | 1.5m       | PC   | Debug Board          |
| Unshielded RS232 Cable   | 0.15m      | EUT  | Debug Board          |

## Block Diagram of Test Setup

For Conducted Emissions:



For Undesirable Emission:



## SUMMARY OF TEST RESULTS

| FCC Rules                                     | Description of Test                    | Result      |
|-----------------------------------------------|----------------------------------------|-------------|
| FCC §15.407 (f) & §1.1310 & §2.1091           | Maximum Permissible Exposure           | Compliance  |
| §15.203                                       | Antenna Requirement                    | Compliance  |
| §15.407(e)                                    | Indoor operation only                  | Compliance* |
| §15.407(b)(6)& §15.207(a)                     | Conducted Emissions                    | Compliance  |
| §15.205& §15.209 & §15.407(b) (1),(4),(6),(7) | Undesirable Emission& Restricted Bands | Compliance  |
| §15.407(b) (1),(2),(3),(4)                    | Out of Band Emissions                  | Compliance  |
| §15.407(a) (1),(3)                            | 26 dB Bandwidth                        | Compliance  |
| §15.407(a)(1),(3)                             | Conducted Transmitter Output Power     | Compliance  |
| §15.407 (a)(1),(3),(5)                        | Power Spectral Density                 | Compliance  |
| §15.407(a)(6)                                 | Peak Excursion Ratio                   | Compliance  |

**Note**

Compliance\*: Refer to user's manual (within the 5.15–5.25 GHz band, this equipment will be restricted to indoor operation.)

## FCC §15.407(f) & §1.1310 & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

### Applicable Standard

According to subpart 15.407(f) and subpart §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

| (B) Limits for General Population/Uncontrolled Exposure |                               |                               |                                     |                          |
|---------------------------------------------------------|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| Frequency Range (MHz)                                   | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) | Power Density (mW/cm <sup>2</sup> ) | Averaging Time (minutes) |
| 0.3–1.34                                                | 614                           | 1.63                          | *(100)                              | 30                       |
| 1.34–30                                                 | 824/f                         | 2.19/f                        | *(180/f <sup>2</sup> )              | 30                       |
| 30–300                                                  | 27.5                          | 0.073                         | 0.2                                 | 30                       |
| 300–1500                                                | /                             | /                             | f/1500                              | 30                       |
| 1500–100,000                                            | /                             | /                             | 1.0                                 | 30                       |

f = frequency in MHz; \* = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

### Calculated Formulary:

Predication of MPE limit at a given distance

$S = PG/4\pi R^2$  = power density (in appropriate units, e.g. mW/cm<sup>2</sup>);

P = power input to the antenna (in appropriate units, e.g., mW);

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

### Calculated Data:

| Frequency (MHz) | Antenna Gain |           | Conducted Power |       | Evaluation Distance (cm) | Power Density (mW/cm <sup>2</sup> ) | MPE Limit (mW/cm <sup>2</sup> ) |
|-----------------|--------------|-----------|-----------------|-------|--------------------------|-------------------------------------|---------------------------------|
|                 | (dBi)        | (numeric) | (dBm)           | (mW)  |                          |                                     |                                 |
| 5190            | 5            | 3.16      | 14.81           | 30.29 | 20                       | 0.019                               | 1.0                             |
| 5230            | 5            | 3.16      | 14.19           | 26.24 | 20                       | 0.017                               | 1.0                             |
| 5755            | 5            | 3.16      | 18.59           | 72.21 | 20                       | 0.045                               | 1.0                             |
| 5795            | 5            | 3.16      | 18.70           | 74.13 | 20                       | 0.047                               | 1.0                             |

**Result:** The device meet FCC MPE at 20 cm distance

## **FCC §15.203 – ANTENNA REQUIREMENT**

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### **Applicable Standard**

According to § 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

And according to FCC 47 CFR section 15.407 (a)(1),if transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### **Antenna Connector Construction**

The EUT has two dipole antennas, which was used a unique type of connector to attach to the EUT, and complied with 15.203, the maximum gain is 5.0 dBi in 5150-5250MHz and 5725-5825MHz band, please refer to the external photos.

**Result:** Compliance.

## FCC §15.407 (b) (6) §15.207 (a) – CONDUCTED EMISSIONS

### Applicable Standard

FCC §15.207, §15.407(b) (6)

### Measurement Uncertainty

Compliance or non-compliance with a disturbance limit shall be determined in the following manner:

If  $U_{lab}$  is less than or equal to  $U_{cispr}$  of Table 1, then:

–compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;  
 –non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

If  $U_{lab}$  is greater than  $U_{cispr}$  of Table 1, then:

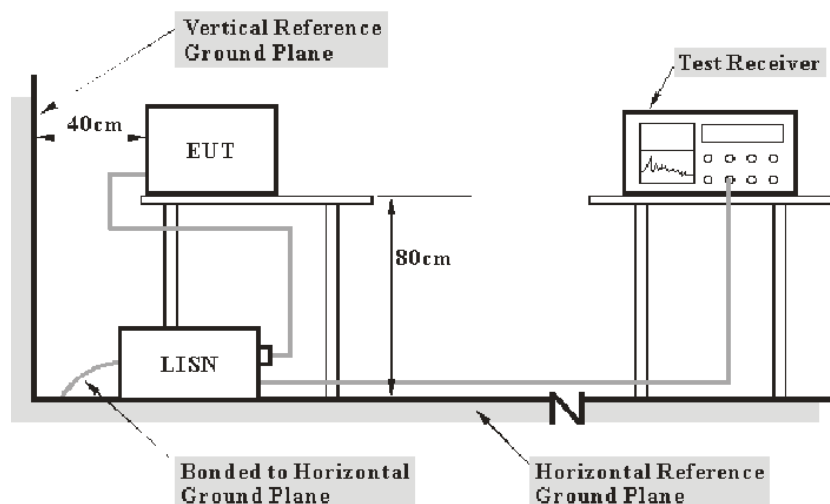
–compliance is deemed to occur if no measured disturbance level, increased by  $(U_{lab} - U_{cispr})$ , exceeds the disturbance limit;  
 –non-compliance is deemed to occur if any measured disturbance level, increased by  $(U_{lab} - U_{cispr})$ , exceeds the disturbance limit.

Based on CISPR 16-4-2: 2011, measurement uncertainty of conducted disturbance at mains port using AMN at Bay Area Compliance Laboratories Corp. (Chengdu) is 3.17 dB (150 kHz to 30 MHz).

Table 1 – Values of  $U_{cispr}$

| Measurement                                                       | $U_{cispr}$ |
|-------------------------------------------------------------------|-------------|
| Conducted disturbance at mains port using AMN (150 kHz to 30 MHz) | 3.4 dB      |

### EUT Setup



Note: 1. Support units were connected to second LISN.  
 2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.4-2003 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The spacing between the peripherals was 10 cm.

DC 12 V was used by EUT through 120 VAC/60 Hz adapter.

### EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

| Frequency Range  | IF B/W |
|------------------|--------|
| 150 kHz – 30 MHz | 9 kHz  |

### Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$$V_C = V_R + A_C + VDF$$

$$C_f = A_C + VDF$$

Herein,

$V_C$  (cord. Reading): corrected voltage amplitude

$V_R$ : reading voltage amplitude

$A_C$ : attenuation caused by cable loss

VDF: voltage division factor of AMN

$C_f$ : Correction Factor

The “**Margin**” column of the following data tables indicates the degree of compliance within 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:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

### Test Equipment List and Details

| Manufacturer    | Description       | Model  | Serial Number | Calibration Date | Calibration Due Date |
|-----------------|-------------------|--------|---------------|------------------|----------------------|
| Rohde & Schwarz | EMI Test Receiver | ESCI   | 100028        | 2013-08-22       | 2014-08-21           |
| Rohde & Schwarz | L.I.S.N.          | ENV216 | 3560.6550.06  | 2013-07-31       | 2014-07-30           |
| Rohde & Schwarz | L.I.S.N.          | ENV216 | 3560.6550.12  | 2014-02-08       | 2015-02-07           |

\* **Statement of Traceability:** BACL (Chengdu) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

## Test Procedure

During the conducted emission test, the adapter was connected to the LISN and the other support equipments were connected to the outlet of the second LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

## Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207, with the worst margin reading of:

**15.62 dB at 0.344 MHz in the Neutral** conducted mode

## Test Data

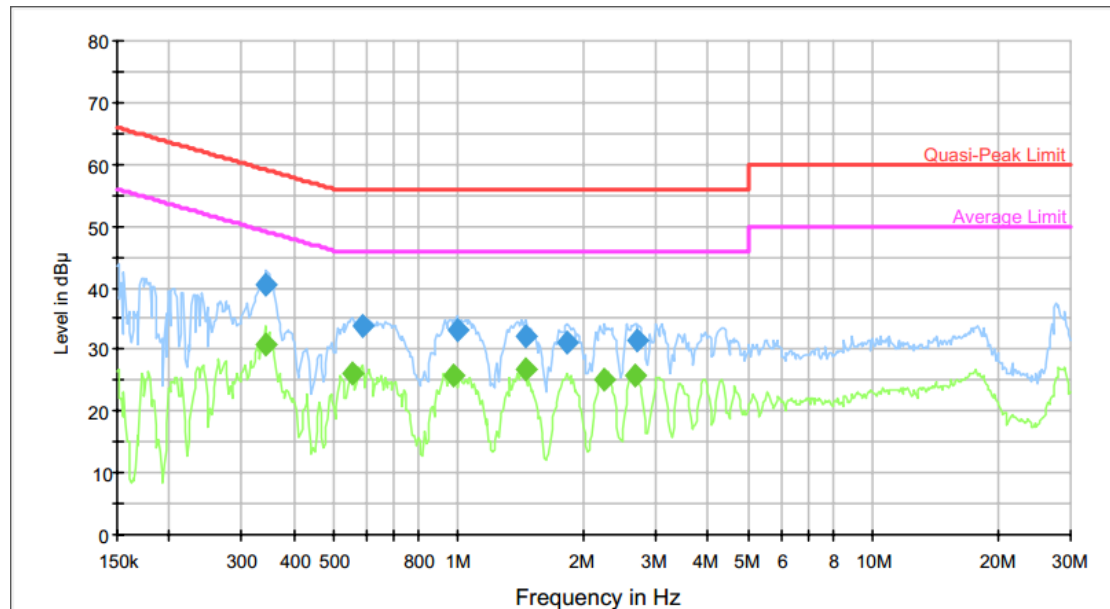
### Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 26 °C     |
| Relative Humidity: | 56 %      |
| ATM Pressure:      | 101.4 kPa |

*The testing was performed by Lynn Yi on 2014-04-30.*

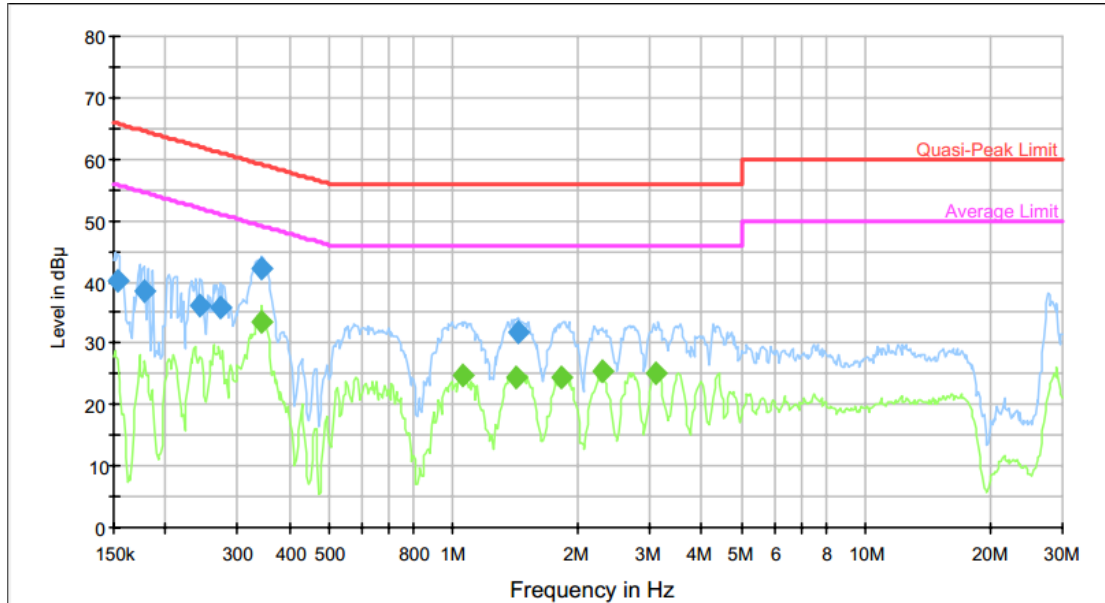
Test Mode: Transmitting

120 V, 60 Hz, Line:



| Conducted Emissions |                                  |                     |                         |                 |                |
|---------------------|----------------------------------|---------------------|-------------------------|-----------------|----------------|
| Frequency<br>(MHz)  | Corrected<br>Amplitude<br>(dBμV) | Detector<br>(QP/AV) | Phase<br>(Line/Neutral) | Limit<br>(dBμV) | Margin<br>(dB) |
| 0.344               | 40.50                            | QP                  | Line                    | 59.12           | 18.62          |
| 0.586               | 33.70                            | QP                  | Line                    | 56.00           | 22.30          |
| 0.991               | 33.00                            | QP                  | Line                    | 56.00           | 23.00          |
| 1.453               | 32.10                            | QP                  | Line                    | 56.00           | 23.90          |
| 1.831               | 31.30                            | QP                  | Line                    | 56.00           | 24.70          |
| 2.684               | 31.40                            | QP                  | Line                    | 56.00           | 24.60          |
| 0.341               | 30.80                            | AV                  | Line                    | 49.18           | 18.38          |
| 0.554               | 26.10                            | AV                  | Line                    | 46.00           | 19.90          |
| 0.976               | 25.70                            | AV                  | Line                    | 46.00           | 20.30          |
| 1.453               | 26.70                            | AV                  | Line                    | 46.00           | 19.30          |
| 2.253               | 25.20                            | AV                  | Line                    | 46.00           | 20.80          |
| 2.663               | 25.90                            | AV                  | Line                    | 46.00           | 20.10          |

**120V, 60 Hz, Neutral:**



| Conducted Emissions |                                  |                     |                         |                 |                |
|---------------------|----------------------------------|---------------------|-------------------------|-----------------|----------------|
| Frequency<br>(MHz)  | Corrected<br>Amplitude<br>(dBμV) | Detector<br>(QP/AV) | Phase<br>(Line/Neutral) | Limit<br>(dBμV) | Margin<br>(dB) |
| 0.154               | 40.20                            | QP                  | Neutral                 | 65.80           | 25.60          |
| 0.179               | 38.50                            | QP                  | Neutral                 | 64.54           | 26.04          |
| 0.244               | 36.10                            | QP                  | Neutral                 | 61.96           | 25.86          |
| 0.273               | 35.90                            | QP                  | Neutral                 | 61.04           | 25.14          |
| 0.344               | 42.20                            | QP                  | Neutral                 | 59.12           | 16.92          |
| 1.430               | 31.80                            | QP                  | Neutral                 | 56.00           | 24.20          |
| 0.344               | 33.50                            | AV                  | Neutral                 | 49.12           | 15.62          |
| 1.057               | 24.70                            | AV                  | Neutral                 | 46.00           | 21.30          |
| 1.419               | 24.60                            | AV                  | Neutral                 | 46.00           | 21.40          |
| 1.831               | 24.60                            | AV                  | Neutral                 | 46.00           | 21.40          |
| 2.289               | 25.60                            | AV                  | Neutral                 | 46.00           | 20.40          |
| 3.098               | 25.10                            | AV                  | Neutral                 | 46.00           | 20.90          |

## FCC §15.209, §15.205 & §15.407(b) (1) (4) (6) (7) – UNDESIRABLE EMISSION & RESTRICTED BANDS

### Applicable Standard

FCC §15.407 (b) (1), (4), (6), (7); §15.209; §15.205;

For transmitters operating in the 5.15–5.25 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz.

For transmitters operating in the 5.725–5.825 GHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an EIRP of –17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an EIRP of –27 dBm/MHz.

Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209.

According to KDB 789033 D01 General UNII Test Procedures v01, emission shall be computed as:

$E[\text{dBuV/m}] = \text{EIRP}[\text{dBm}] + 95.2$ , for  $d = 3$  meters.

### Measurement Uncertainty

Compliance or non-compliance with a disturbance limit shall be determined in the following manner:

If  $U_{\text{lab}}$  is less than or equal to  $U_{\text{cisp}}r$  of Table 1, then:

–compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;  
–non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

If  $U_{\text{lab}}$  is greater than  $U_{\text{cisp}}r$  of Table 1, then:

–compliance is deemed to occur if no measured disturbance level, increased by  $(U_{\text{lab}} - U_{\text{cisp}}r)$ , exceeds the disturbance limit;  
–non-compliance is deemed to occur if any measured disturbance level, increased by  $(U_{\text{lab}} - U_{\text{cisp}}r)$ , exceeds the disturbance limit.

Based on CISPR 16-4-2: 2011, measurement uncertainty of radiated emission at a distance of 3m at Bay Area Compliance Laboratories Corp. (Chengdu) is:

30M~200MHz:  $\pm 4.7$  dB ;

200M~1GHz:  $\pm 6.0$  dB ;

1G-6GHz:  $\pm 5.13$  dB;

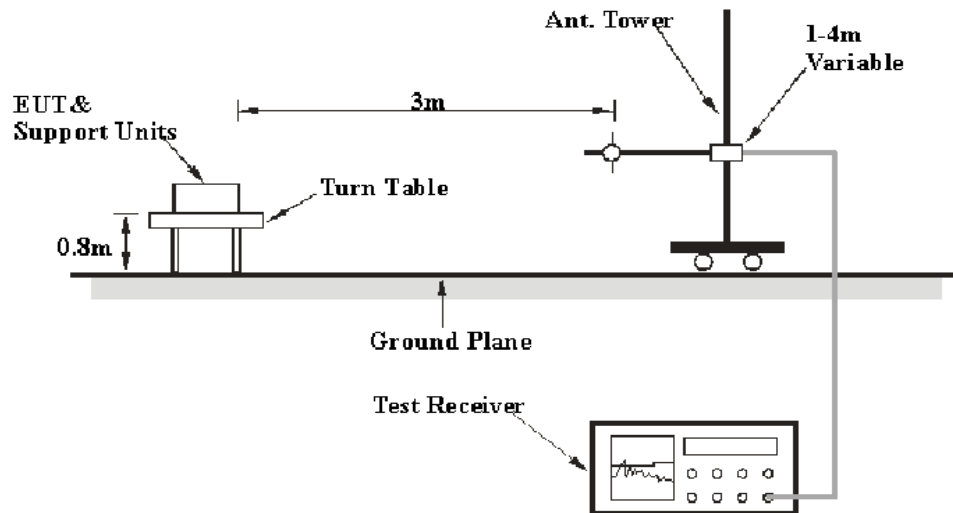
6G~40GHz:  $\pm 5.47$  dB;

Table 1 – Values of  $U_{\text{cisp}}r$

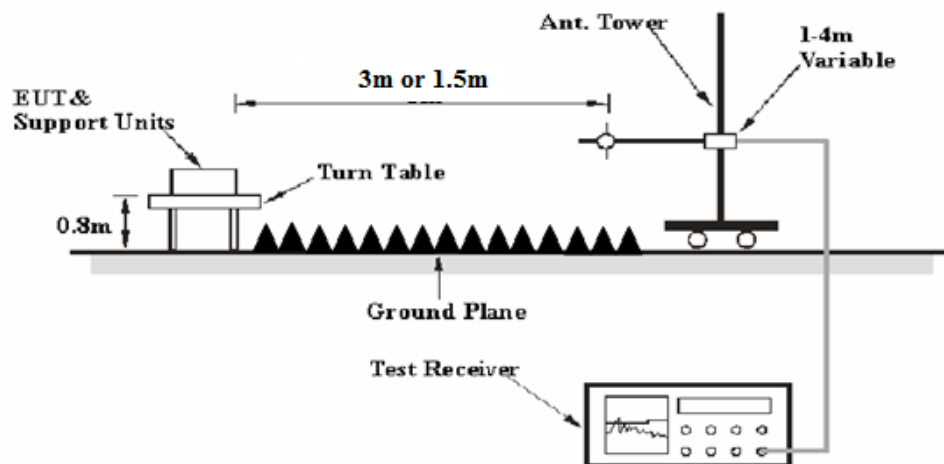
| Measurement                                                                                | $U_{\text{cisp}}r$ |
|--------------------------------------------------------------------------------------------|--------------------|
| Radiated disturbance (electric field strength at an OATS or in a SAC) (30 MHz to 1000 MHz) | 6.3 dB             |
| Radiated disturbance (electric field strength in a FAR) (1 GHz to 6 GHz)                   | 5.2 dB             |
| Radiated disturbance (electric field strength in a FAR) (6 GHz to 18 GHz)                  | 5.5 dB             |

## EUT Setup

### Below 1 GHz:



### Above 1 GHz:



The radiated emission tests were performed in the 3 meters chamber, using the setup accordance with the ANSI C63.4-2003. The specification used was the FCC 15.209 and FCC 15.407 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

DC 12 V was used by EUT through 120 VAC/60 Hz adapter.

## EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 40 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

| Frequency Range  | RBW     | Video B/W | IF B/W | Detector |
|------------------|---------|-----------|--------|----------|
| 30MHz – 1000 MHz | 120 kHz | 300 kHz   | 120kHz | QP       |
| Above 1 GHz      | 1MHz    | 3 MHz     | /      | PK       |
|                  | 1MHz    | 10 Hz     | /      | Ave.     |

## Test Procedure

During the radiated emission test, the adapter was connected to the first AC floor outlet and the other support equipments were connected to the second AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1GHz, peak and Average detection modes for frequencies above 1 GHz.

According to ANSI C63.4-2003, the above 1GHz test result shall be extrapolated to the specified distance using an extrapolation factor of 20dB/decade from 3m to 1.5m

Distance extrapolation factor =  $20 \log (3\text{m}/1.5\text{m})$  dB

Extrapolation result (dB $\mu$ V/m) = Corrected Amplitude (dB $\mu$ V/m) -6dB

## Test Equipment List and Details

| Manufacturer          | Description           | Model Number | Serial Number      | Calibration Date | Calibration Due Date |
|-----------------------|-----------------------|--------------|--------------------|------------------|----------------------|
| Agilent               | Amplifier             | 8447D        | 2944A10442         | 2013-07-23       | 2014-07-22           |
| Rohde & Schwarz       | EMI Test Receiver     | ESCI         | 100028             | 2013-08-22       | 2014-08-21           |
| Sunol Sciences        | Broadband Antenna     | JB3          | A101808            | 2014-04-10       | 2015-04-09           |
| Rohde & Schwarz       | Spectrum Analyzer     | FSL18        | 100180             | 2013-07-31       | 2014-07-30           |
| Rohde & Schwarz       | Spectrum Analyzer     | FSEM30       | 100018             | 2013-07-31       | 2014-07-30           |
| Rohde&Schwarz         | Spectrum Analyzer     | FSP38        | 100478             | 2013-06-16       | 2014-06-15           |
| EM TEST               | Horn Antenna          | 3115         | 003-6076           | 2014-04-09       | 2015-04-08           |
| Ducommun Technologies | Horn Antenna          | ARH-4223-02  | 1007726-01<br>1304 | 2013-06-16       | 2014-06-15           |
| Ducommun Technologies | Horn Antenna          | ARH-2823-02  | 1007726-01<br>1302 | 2013-06-16       | 2014-06-15           |
| HP                    | Amplifier             | 8449B        | 3008A00277         | 2013-07-31       | 2014-07-30           |
| EMCT                  | Semi-Anechoic Chamber | 966          | N/A                | 2013-03-13       | 2016-03-12           |

**\* Statement of Traceability:** BACL (Chengdu) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

## Corrected Amplitude & Margin Calculation

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

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Loss} + \text{Cable Loss} - \text{Amplifier Gain}$$

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 limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Extrapolation result}$$

## Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, Section 15.205, 15.209 and 15.407, with the worst margin reading of:

**2.71 dB at 47.49 MHz** in the **Vertical** polarization mode

## Test Data

### Environmental Conditions

|                           |           |
|---------------------------|-----------|
| <b>Temperature:</b>       | 25 °C     |
| <b>Relative Humidity:</b> | 54 %      |
| <b>ATM Pressure:</b>      | 101.1 kPa |

*The testing was performed by Lynn Yi on 2014-04-28.*

Test Mode: Transmitting

5150-5250 MHz:

| Frequency<br>(MHz)     | Receiver          |                        | Rx Antenna     |                | Cable<br>loss<br>(dB) | Amplifier<br>Gain<br>(dB) | Corrected<br>Amplitude<br>(dBμV/m) | Extrapolation<br>result<br>(dBμV/m) | Limit<br>(dBμV/m) | Margin<br>(dB) |
|------------------------|-------------------|------------------------|----------------|----------------|-----------------------|---------------------------|------------------------------------|-------------------------------------|-------------------|----------------|
|                        | Reading<br>(dBμV) | Detector<br>(PK/QP/AV) | Polar<br>(H/V) | Factor<br>(dB) |                       |                           |                                    |                                     |                   |                |
| Low Channel: 5190 MHz  |                   |                        |                |                |                       |                           |                                    |                                     |                   |                |
| 5190                   | 36.39             | AV                     | H              | 31.74          | 8.07                  | 0.00                      | 76.20                              | 70.20                               | N/A               | N/A            |
| 5190                   | 54.57             | PK                     | H              | 31.74          | 8.07                  | 0.00                      | 94.38                              | 88.38                               | N/A               | N/A            |
| 5190                   | 47.83             | AV                     | V              | 31.74          | 8.07                  | 0.00                      | 87.64                              | 81.64                               | N/A               | N/A            |
| 5190                   | 65.18             | PK                     | V              | 31.74          | 8.07                  | 0.00                      | 104.99                             | 98.99                               | N/A               | N/A            |
| 10380                  | 35.26             | PK                     | V              | 37.38          | 14.74                 | 24.12                     | 63.25                              | 57.25                               | 68.20             | 10.95          |
| 15570                  | 29.71             | PK                     | H              | 39.41          | 17.26                 | 22.18                     | 64.21                              | 58.21                               | 68.20             | 9.99           |
| 15570                  | 15.62             | AV                     | V              | 39.41          | 17.26                 | 22.18                     | 50.12                              | 44.12                               | 54.00             | 9.88           |
| 5150                   | 30.53             | PK                     | V              | 31.67          | 8.11                  | 0.00                      | 70.31                              | 64.31                               | 68.20             | *3.89          |
| 5150                   | 16.78             | AV                     | V              | 31.67          | 8.11                  | 0.00                      | 56.56                              | 50.56                               | 54.00             | *3.44          |
| 1559.296               | 51.36             | PK                     | V              | 24.19          | 4.51                  | 25.67                     | 54.40                              | 48.40                               | 68.20             | 19.80          |
| 1559.296               | 48.58             | AV                     | V              | 24.19          | 4.51                  | 25.67                     | 51.62                              | 45.62                               | 54.00             | 8.38           |
| 47.49                  | 54.59             | QP                     | V              | 10.13          | 0.43                  | 28.03                     | 37.12                              | 37.12                               | 40.00             | *2.88          |
| 370.18                 | 50.67             | QP                     | H              | 15.60          | 1.08                  | 28.07                     | 39.28                              | 39.28                               | 46.00             | 6.72           |
| High Channel: 5230 MHz |                   |                        |                |                |                       |                           |                                    |                                     |                   |                |
| 5230                   | 36.27             | AV                     | H              | 31.81          | 8.04                  | 0.00                      | 76.12                              | 70.12                               | N/A               | N/A            |
| 5230                   | 52.85             | PK                     | H              | 31.81          | 8.04                  | 0.00                      | 92.70                              | 86.70                               | N/A               | N/A            |
| 5230                   | 46.22             | AV                     | V              | 31.81          | 8.04                  | 0.00                      | 86.07                              | 80.07                               | N/A               | N/A            |
| 5230                   | 64.92             | PK                     | V              | 31.81          | 8.04                  | 0.00                      | 104.77                             | 98.77                               | N/A               | N/A            |
| 10460                  | 34.63             | PK                     | V              | 37.39          | 14.77                 | 24.10                     | 62.69                              | 56.69                               | 68.20             | 11.51          |
| 15690                  | 30.28             | PK                     | H              | 39.44          | 17.26                 | 22.23                     | 64.75                              | 58.75                               | 68.20             | 9.45           |
| 15690                  | 15.72             | AV                     | V              | 39.44          | 17.26                 | 22.23                     | 50.19                              | 44.19                               | 54.00             | 9.81           |
| 5350                   | 28.78             | PK                     | V              | 32.03          | 7.92                  | 0.00                      | 68.73                              | 62.73                               | 68.20             | 5.47           |
| 5350                   | 15.57             | AV                     | V              | 32.03          | 7.92                  | 0.00                      | 55.52                              | 49.52                               | 54.00             | *4.48          |
| 1559.296               | 51.91             | PK                     | V              | 24.19          | 4.51                  | 25.67                     | 54.95                              | 48.95                               | 68.20             | 19.25          |
| 1559.296               | 48.19             | AV                     | V              | 24.19          | 4.51                  | 25.67                     | 51.23                              | 45.23                               | 54.00             | 8.77           |
| 47.49                  | 54.76             | QP                     | V              | 10.13          | 0.43                  | 28.03                     | 37.29                              | 37.29                               | 40.00             | *2.71          |
| 370.18                 | 50.95             | QP                     | H              | 15.60          | 1.08                  | 28.07                     | 39.56                              | 39.56                               | 46.00             | 6.44           |

\*Within measurement uncertainty!

5725-5825 MHz:

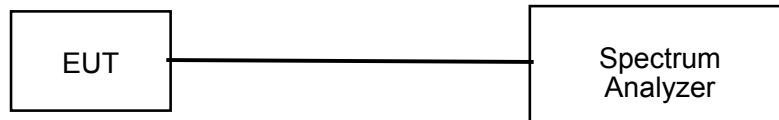
| Frequency              | Receiver       |                     | Rx Antenna  |             | Cable loss (dB) | Amplifier Gain (dB) | Corrected Amplitude (dBμV/m) | Extrapolation result (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|------------------------|----------------|---------------------|-------------|-------------|-----------------|---------------------|------------------------------|-------------------------------|----------------|-------------|
| (MHz)                  | Reading (dBμV) | Detector (PK/QP/AV) | Polar (H/V) | Factor (dB) |                 |                     |                              |                               |                |             |
| Low Channel: 5755 MHz  |                |                     |             |             |                 |                     |                              |                               |                |             |
| 5755                   | 39.16          | AV                  | H           | 32.61       | 8.45            | 0.00                | 80.22                        | 74.22                         | N/A            | N/A         |
| 5755                   | 57.65          | PK                  | H           | 32.61       | 8.45            | 0.00                | 98.71                        | 92.71                         | N/A            | N/A         |
| 5755                   | 51.85          | AV                  | V           | 32.61       | 8.45            | 0.00                | 92.91                        | 86.91                         | N/A            | N/A         |
| 5755                   | 68.96          | PK                  | V           | 32.61       | 8.45            | 0.00                | 110.02                       | 104.02                        | N/A            | N/A         |
| 11510                  | 36.23          | PK                  | V           | 37.38       | 14.74           | 24.12               | 64.22                        | 58.22                         | 68.20          | 9.98        |
| 17265                  | 29.43          | PK                  | H           | 43.12       | 17.89           | 22.42               | 68.03                        | 62.03                         | 68.20          | 6.17        |
| 17265                  | 15.64          | AV                  | V           | 43.12       | 17.89           | 22.42               | 54.24                        | 48.24                         | 54.00          | 5.76        |
| 5723                   | 29.84          | PK                  | V           | 32.57       | 8.36            | 0.00                | 70.77                        | 64.77                         | 78.20          | 13.43       |
| 5723                   | 15.51          | AV                  | V           | 32.57       | 8.36            | 0.00                | 56.44                        | 50.44                         | 54.00          | *3.56       |
| 1559.296               | 50.89          | PK                  | V           | 24.19       | 4.51            | 25.67               | 53.93                        | 47.93                         | 68.20          | 20.27       |
| 1559.296               | 48.47          | AV                  | V           | 24.19       | 4.51            | 25.67               | 51.51                        | 45.51                         | 54.00          | 8.49        |
| 49.28                  | 54.85          | QP                  | V           | 9.20        | 0.44            | 28.02               | 36.47                        | 36.47                         | 40.00          | *3.53       |
| 370.18                 | 50.87          | QP                  | H           | 15.60       | 1.08            | 28.07               | 39.48                        | 39.48                         | 46.00          | 6.52        |
| High Channel: 5795 MHz |                |                     |             |             |                 |                     |                              |                               |                |             |
| 5795                   | 40.36          | AV                  | H           | 32.65       | 8.56            | 0.00                | 81.57                        | 75.57                         | N/A            | N/A         |
| 5795                   | 58.23          | PK                  | H           | 32.65       | 8.56            | 0.00                | 99.44                        | 93.44                         | N/A            | N/A         |
| 5795                   | 51.18          | AV                  | V           | 32.65       | 8.56            | 0.00                | 92.39                        | 86.39                         | N/A            | N/A         |
| 5795                   | 68.72          | PK                  | V           | 32.65       | 8.56            | 0.00                | 109.93                       | 103.93                        | N/A            | N/A         |
| 11590                  | 36.85          | PK                  | V           | 37.39       | 14.77           | 24.10               | 64.91                        | 58.91                         | 68.20          | 9.29        |
| 17385                  | 29.23          | PK                  | H           | 43.67       | 17.69           | 22.42               | 68.17                        | 62.17                         | 68.20          | 6.03        |
| 17385                  | 15.51          | AV                  | V           | 43.67       | 17.69           | 22.42               | 54.45                        | 48.45                         | 54.00          | 5.55        |
| 5825                   | 28.52          | PK                  | V           | 32.69       | 8.64            | 0.00                | 69.85                        | 63.85                         | 78.20          | 14.36       |
| 5825                   | 15.17          | AV                  | V           | 32.69       | 8.64            | 0.00                | 56.50                        | 50.50                         | 54.00          | *3.51       |
| 1559.296               | 50.62          | PK                  | V           | 24.19       | 4.51            | 25.67               | 53.66                        | 47.66                         | 68.20          | 20.54       |
| 1559.296               | 48.06          | AV                  | V           | 24.19       | 4.51            | 25.67               | 51.10                        | 45.10                         | 54.00          | 8.90        |
| 46.58                  | 53.85          | QP                  | V           | 10.54       | 0.43            | 28.04               | 36.78                        | 36.78                         | 40.00          | *3.22       |
| 370.18                 | 50.79          | QP                  | H           | 15.60       | 1.08            | 28.07               | 39.40                        | 39.40                         | 46.00          | 6.60        |

\*Within measurement uncertainty!

## Conducted Spurious Emission at Antenna Port

### Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. The Resolution bandwidth is set to 1MHz, The Video bandwidth is set to  $\geq 1\text{MHz}$ , report the peak value out of the operating band. Offset the antenna gain and cable loss.
3. Repeat above procedures until all frequencies measured were complete.



### Test Data

#### Environmental Conditions

|                    |                       |
|--------------------|-----------------------|
| Temperature:       | 21 °C & 22 °C         |
| Relative Humidity: | 54 % & 55 %           |
| ATM Pressure:      | 101.4 kPa & 109.8 kPa |

The testing was performed by Lynn Yi on 2014-04-30 & 2014-05-03.

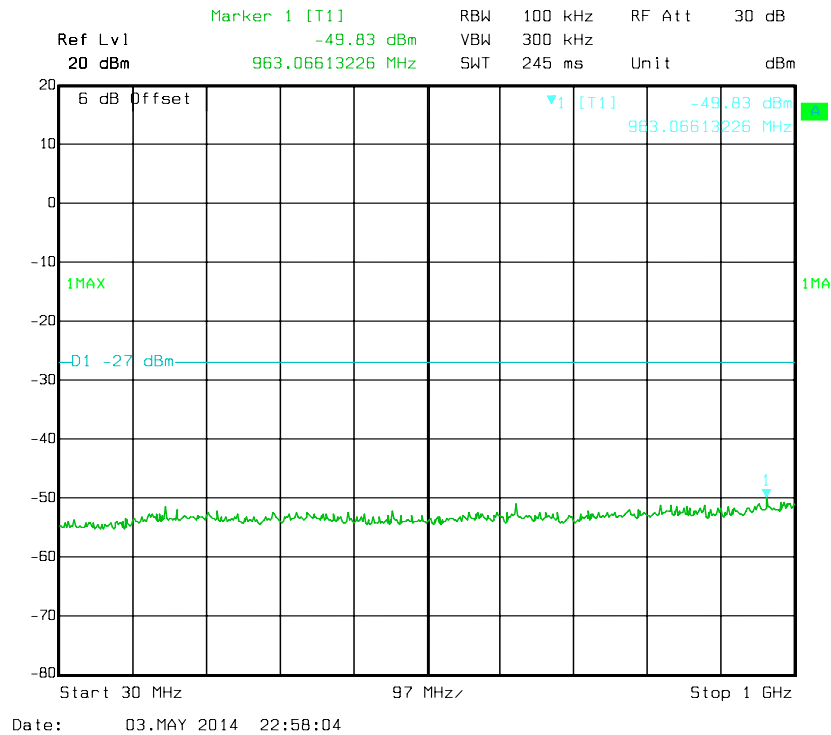
Please refer to the following table and plots.

| Frequency<br>(MHz) | Worst Reading Level<br>(dBm) |           |                     | Limit<br>(dBm) | Result |
|--------------------|------------------------------|-----------|---------------------|----------------|--------|
|                    | Antenna 1                    | Antenna 2 | Antenna 1+Antenna 2 |                |        |
| 5190               | -34.01                       | -34.58    | -31.28              | -27            | PASS   |
| 5230               | -34.51                       | -34.54    | -31.51              | -27            | PASS   |
| 5755               | -34.54                       | -34.04    | -31.27              | -27            | PASS   |
| 5795               | -34.65                       | -34.96    | -31.79              | -27            | PASS   |

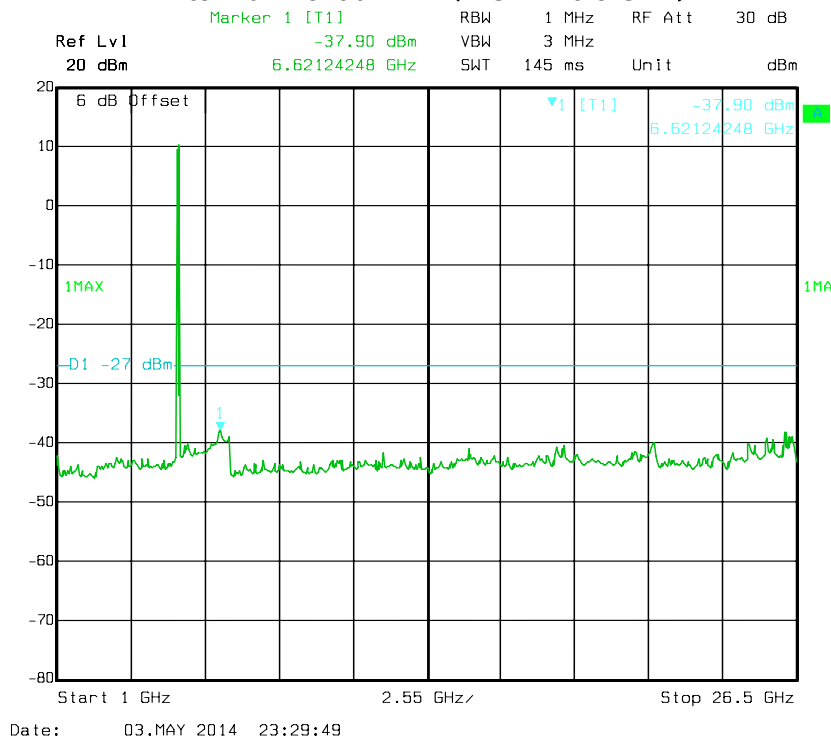
Note: the antenna gain was 5dBi, the cable loss was 1dB.

5150-5250 MHz:

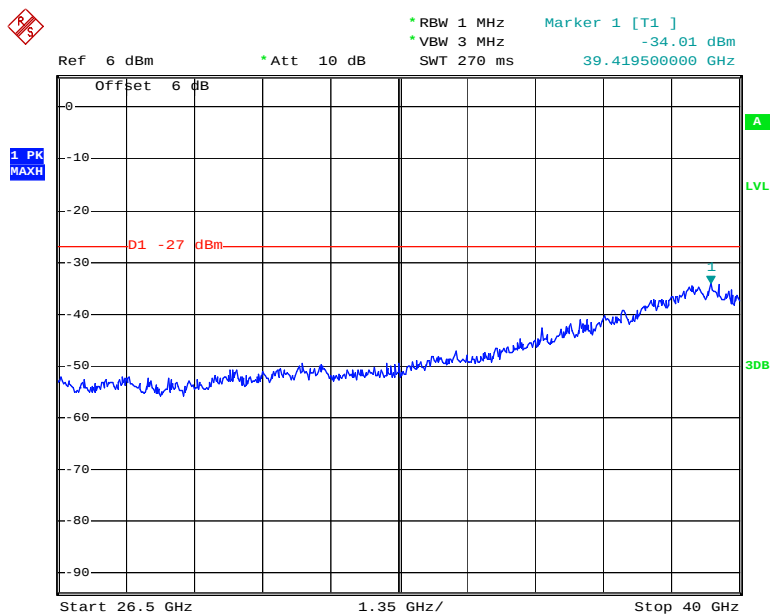
Antenna 1: 5190 MHz (30 MHz-1 GHz)



Antenna 1: 5190 MHz (1 GHz-26.5 GHz)

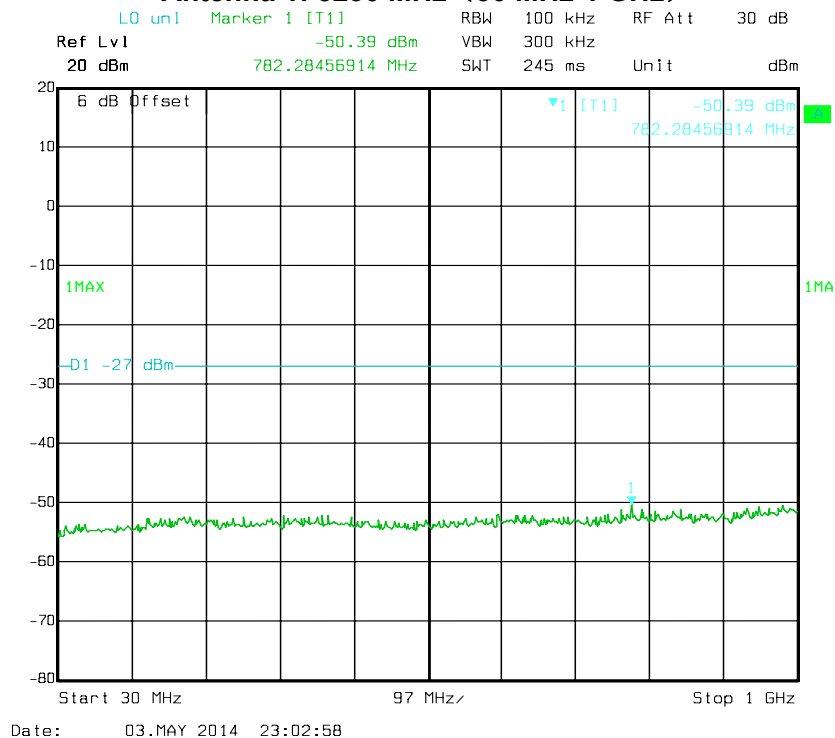


### Antenna 1: 5190 MHz (26.5 GHz-40 GHz)



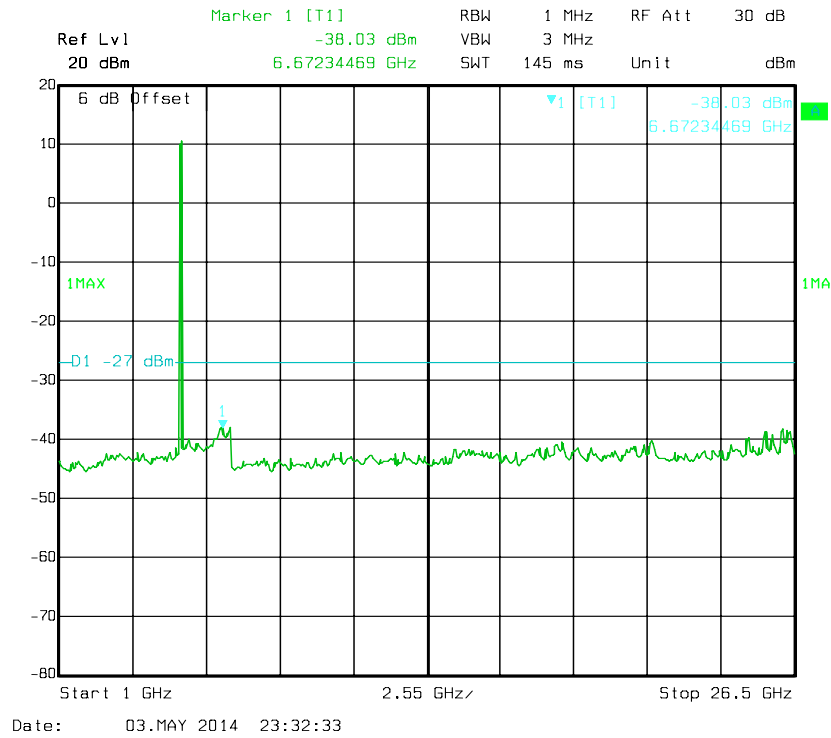
Date: 30.APR.2014 15:01:12

### Antenna 1: 5230 MHz (30 MHz-1 GHz)

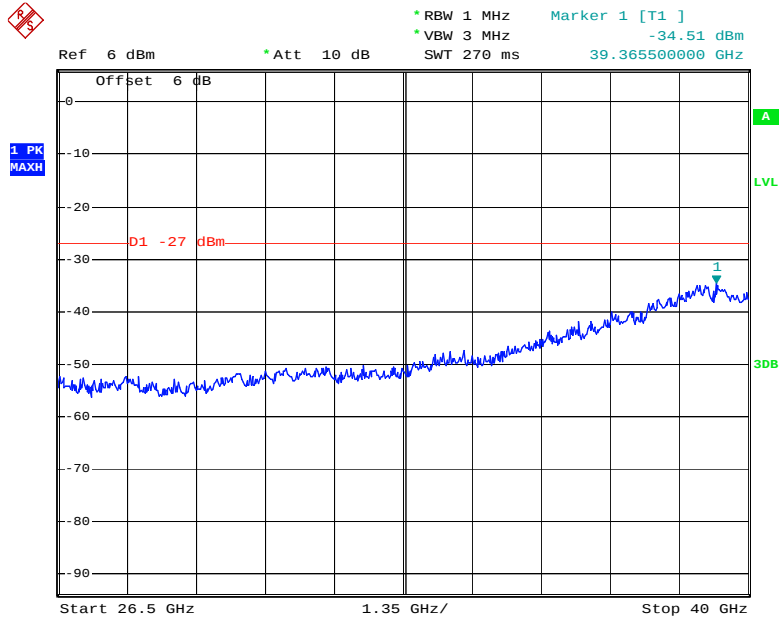


Date: 03.MAY 2014 23:02:58

**Antenna 1: 5230 MHz (1 GHz-26.5 GHz)**

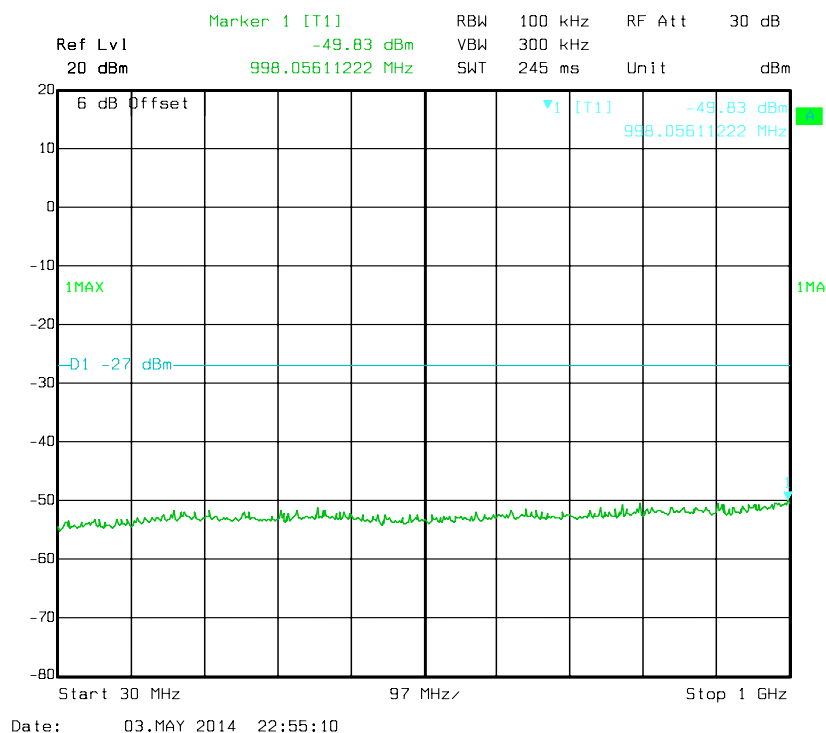


**Antenna 1: 5230 MHz (26.5 GHz-40 GHz)**

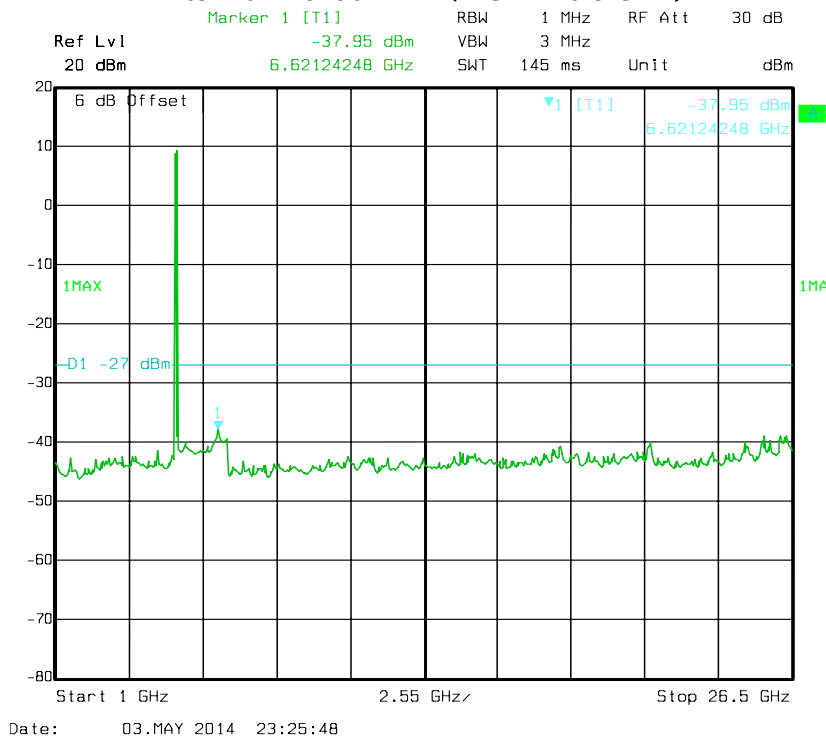


Date: 30.APR.2014 15:04:24

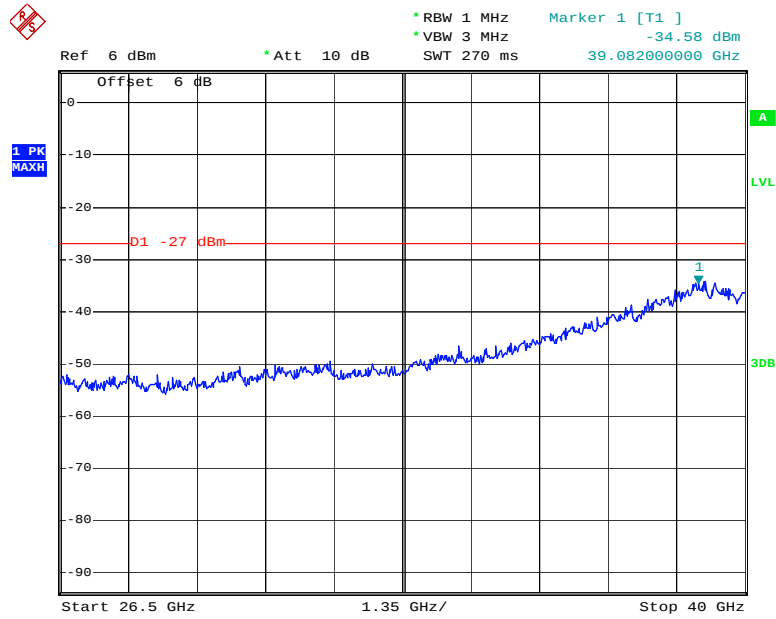
### Antenna 2: 5190 MHz (30MHz-1GHz)



### Antenna 2: 5190 MHz (1 GHz-26.5 GHz)

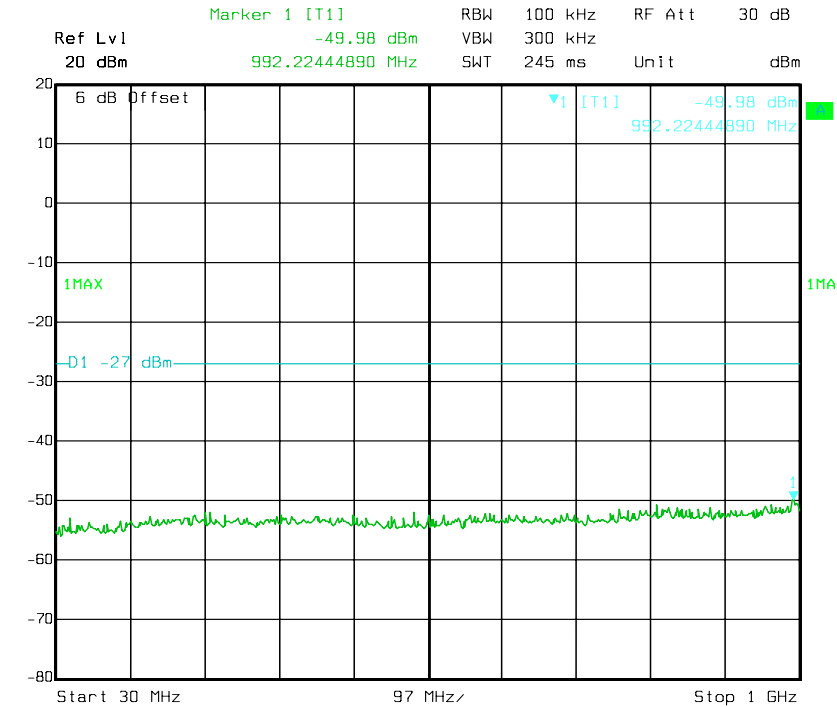


**Antenna 2: 5190 MHz (26.5 GHz-40 GHz)**



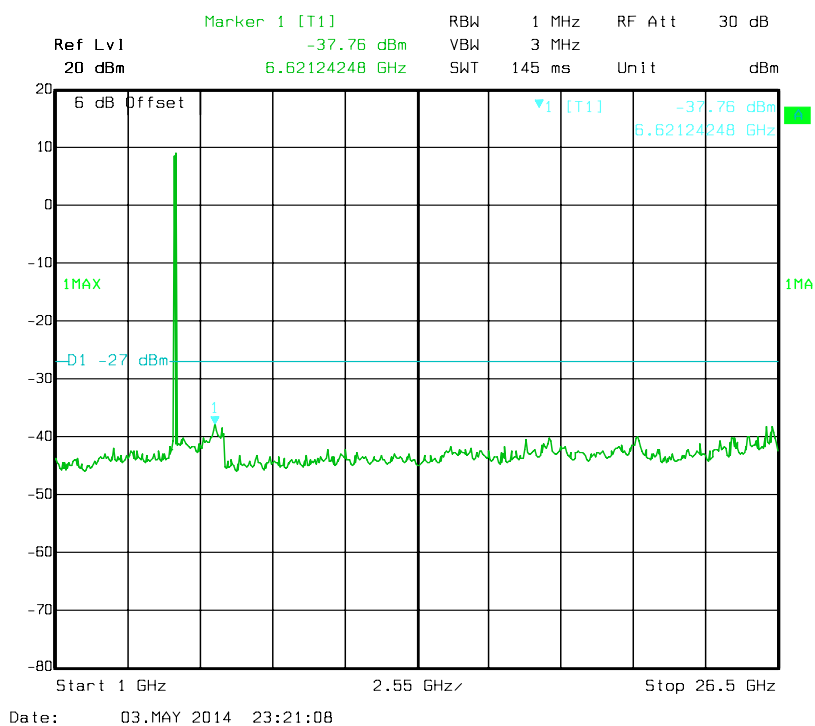
Date: 30.APR.2014 15:17:19

**Antenna 2: 5230 MHz (30 MHz-1 GHz)**

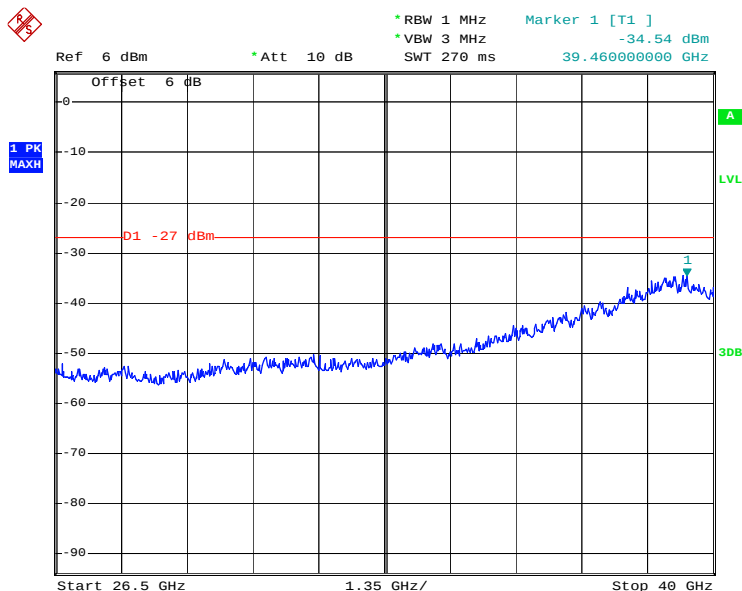


Date: 03.MAY 2014 23:08:41

### Antenna 2: 5230 MHz (1 GHz-26.5 GHz)



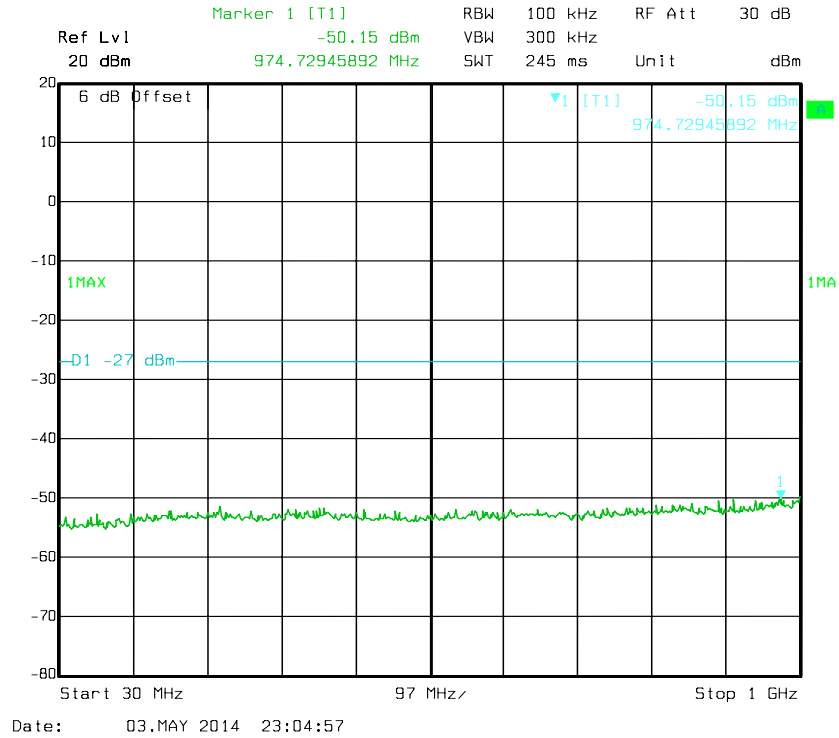
### Antenna 2: 5230 MHz (26.5 GHz-40 GHz)



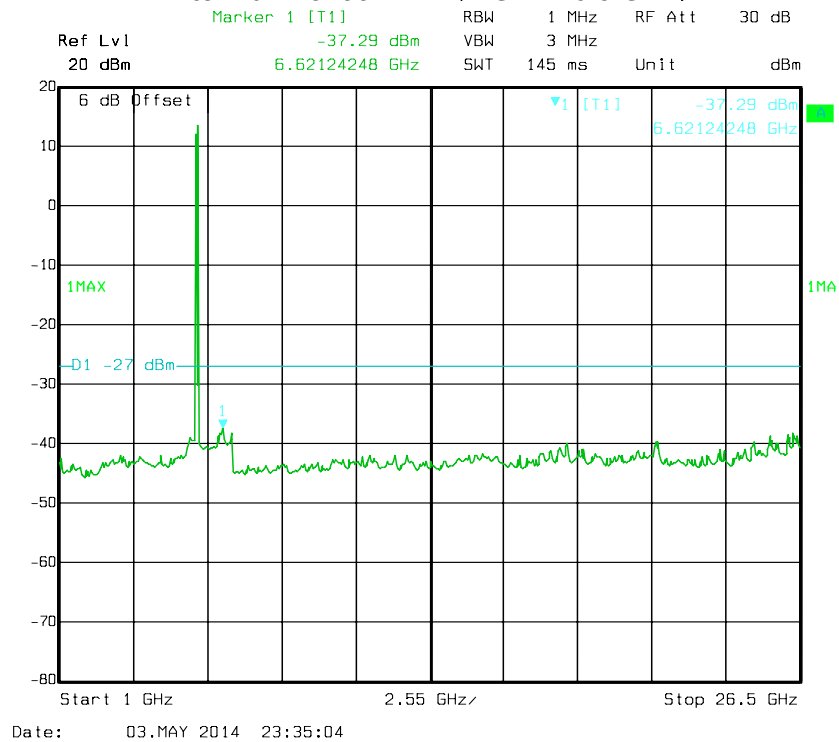
Date: 30.APR.2014 15:21:25

5725-5825 MHz:

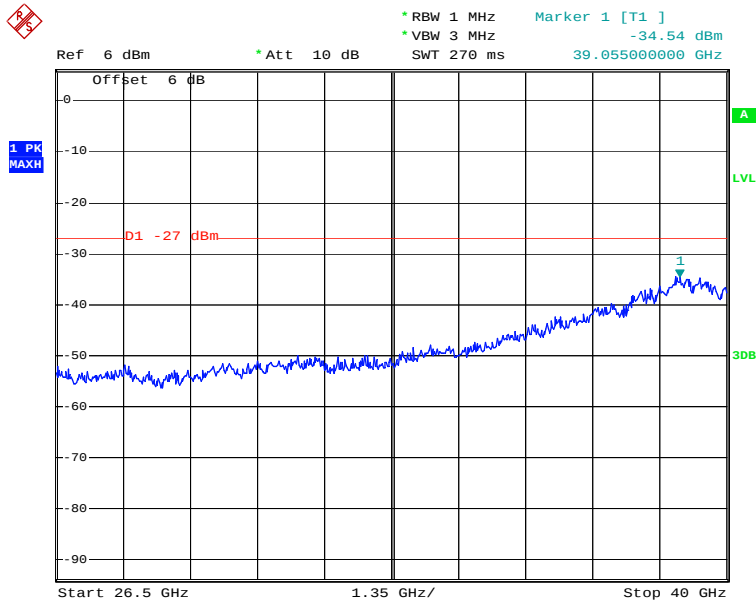
Antenna 1: 5755 MHz (30 MHz-1 GHz)



Antenna 1: 5755 MHz (1 GHz-26.5 GHz)

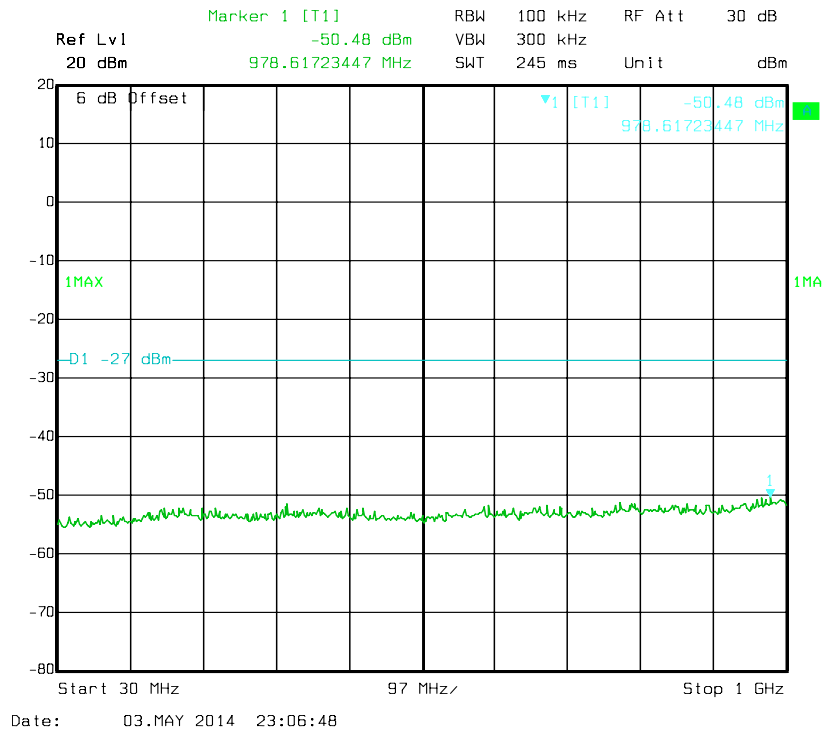


### Antenna 1: 5755 MHz (26.5 GHz-40 GHz)

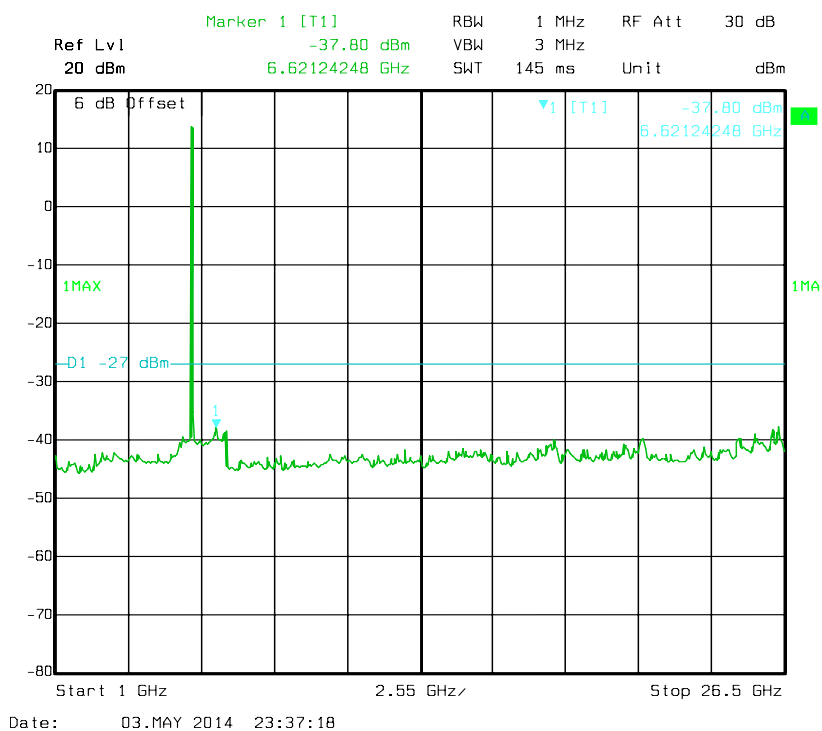


Date: 30.APR.2014 15:07:36

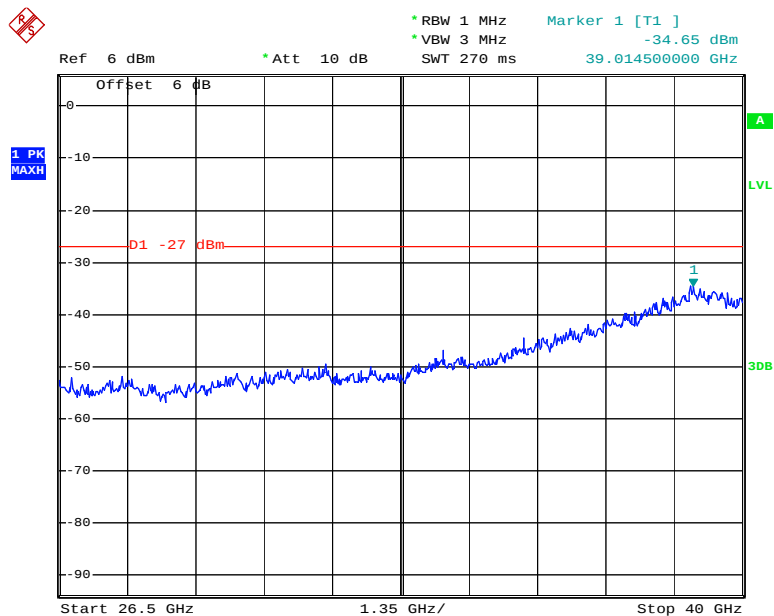
### Antenna 1: 5795 MHz (30 MHz-1 GHz)



### Antenna 1: 5795 MHz (1 GHz-26.5 GHz)

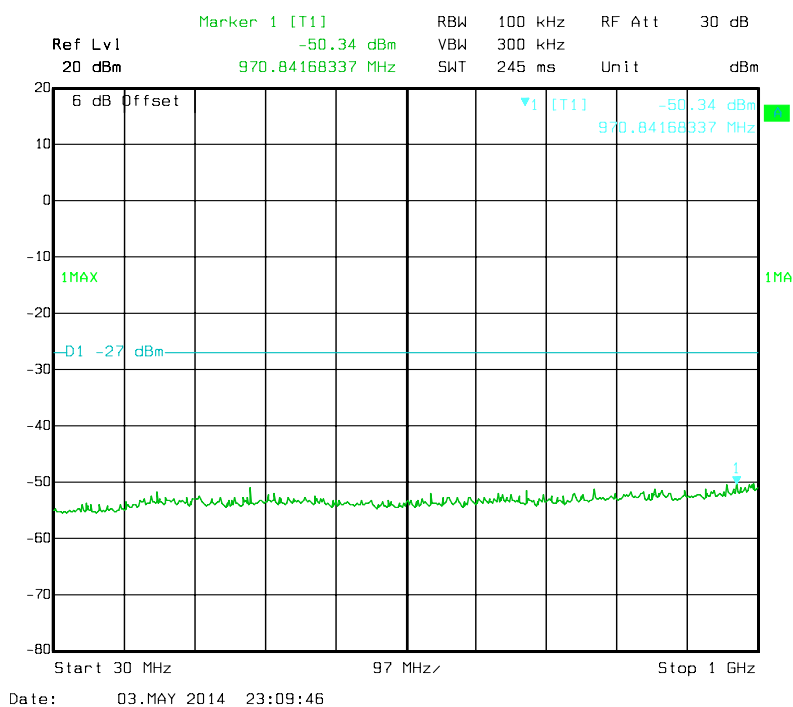


### Antenna 1: 5795 MHz (26.5 GHz-40 GHz)

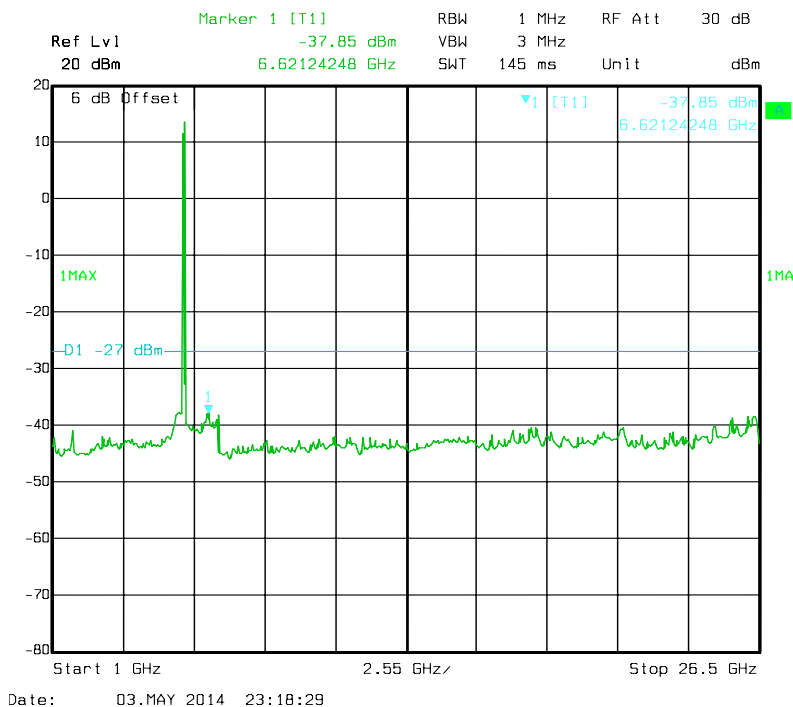


Date: 30.APR.2014 15:11:46

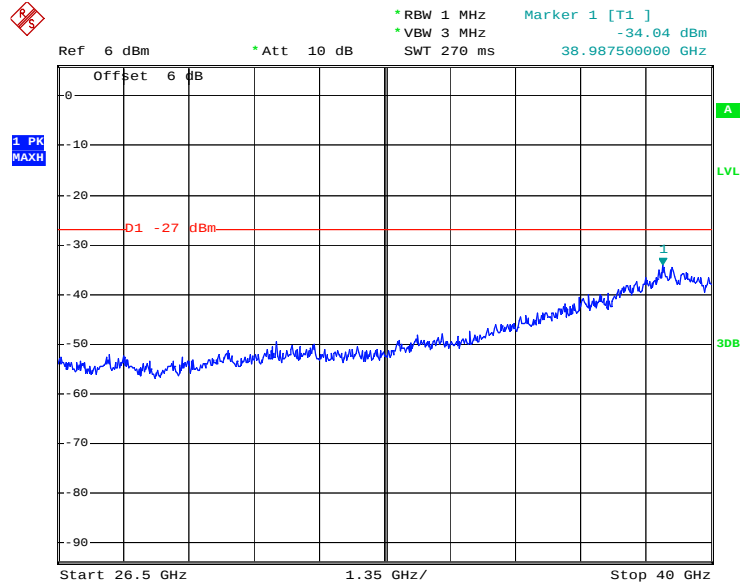
### Antenna 2: 5755 MHz (30 MHz-1 GHz)



### Antenna 2: 5755 MHz (1 GHz-26.5 GHz)

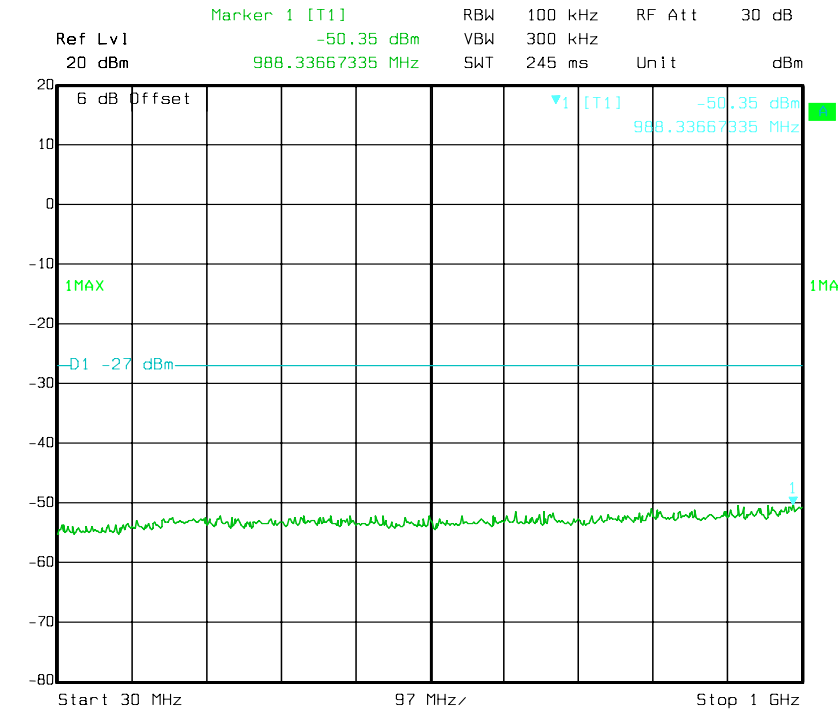


### Antenna 2: 5755 MHz (26.5 GHz-40 GHz)



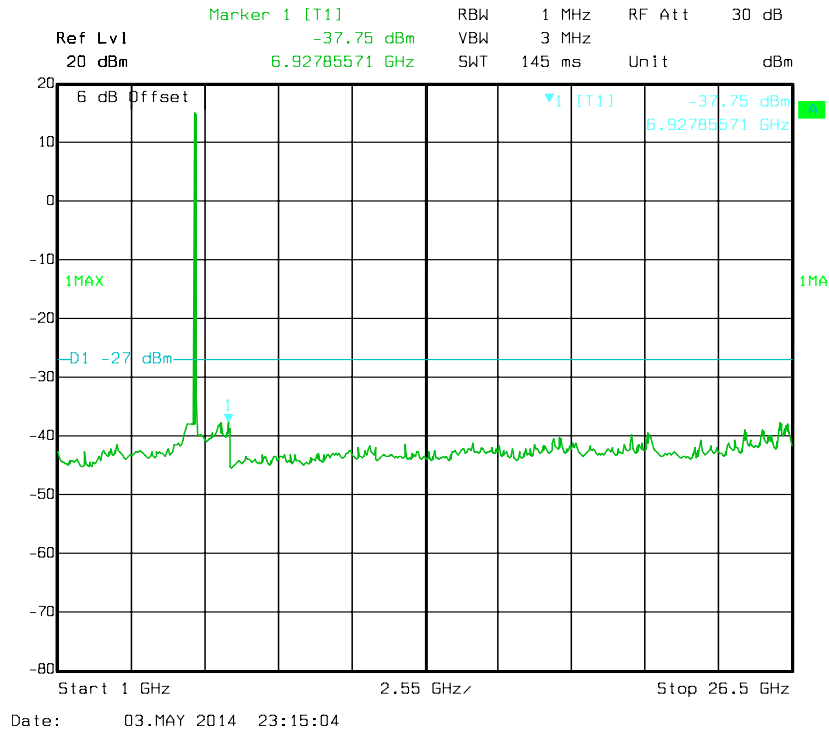
Date: 30.APR.2014 15:25:31

### Antenna 2: 5795 MHz (30 MHz-1 GHz)

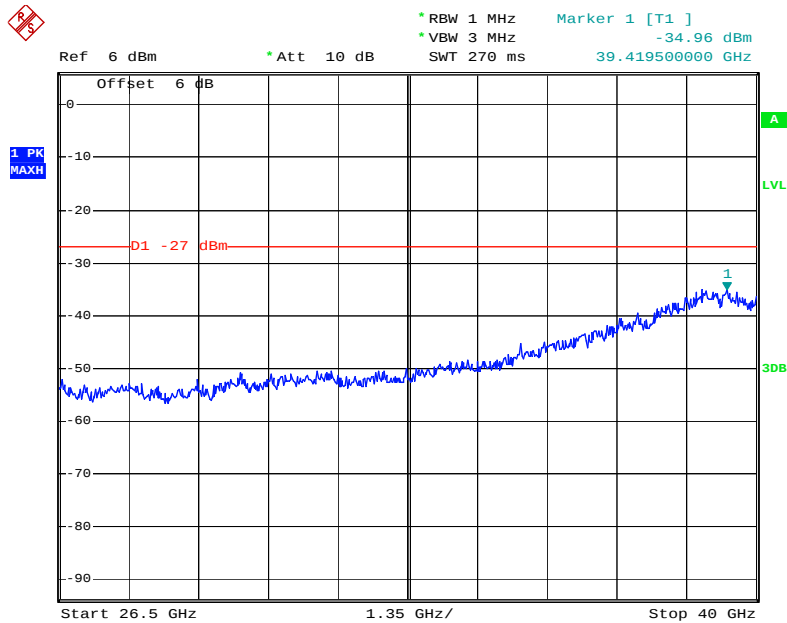


Date: 03.MAY 2014 23:11:00

### Antenna 2: 5795 MHz (1 GHz-26.5 GHz)



### Antenna 2: 5795 MHz (26.5 GHz-40 GHz)



Date: 30.APR.2014 15:29:37

## **FCC §15.407(b) (1) (2) (3) (4) – OUT OF BAND EMISSIONS**

### **Applicable Standard**

FCC §15.407 (b) (1), (2), (3), (4);

For transmitters operating in the 5.15–5.25 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz.

For transmitters operating in the 5.25–5.35 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz. Devices operating in the 5.25–5.35 GHz band that generate emissions in the 5.15–5.25 GHz band must meet all applicable technical requirements for operation in the 5.15–5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of –27 dBm/MHz in the 5.15–5.25 GHz band.

For transmitters operating in the 5.47–5.725 GHz band: all emissions outside of the 5.47–5.725 GHz band shall not exceed an EIRP of –27 dBm/MHz.

For transmitters operating in the 5.725–5.825 GHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an EIRP of –17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an EIRP of –27 dBm/MHz.

### **Test Procedure**

1. Check the calibration of the measuring instrument using either an internal calibration or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 1 MHz and VBW to 3MHz of spectrum analyzer.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

### **Test Equipment List and Details**

| Manufacturer    | Description       | Model  | Serial Number | Calibration Date | Calibration Due Date |
|-----------------|-------------------|--------|---------------|------------------|----------------------|
| Rohde & Schwarz | Spectrum Analyzer | FSEM30 | 100018        | 2013-07-31       | 2014-07-30           |

\* **Statement of Traceability:** BACL (Chengdu) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

## Test Data

### Environmental Conditions

|                           |                       |
|---------------------------|-----------------------|
| <b>Temperature:</b>       | 22 °C & 23 °C         |
| <b>Relative Humidity:</b> | 55 % & 56 %           |
| <b>ATM Pressure:</b>      | 109.8 kPa & 102.0 kPa |

*The testing was performed by Lynn Yi on 2014-05-03 & 2014-05-04.*

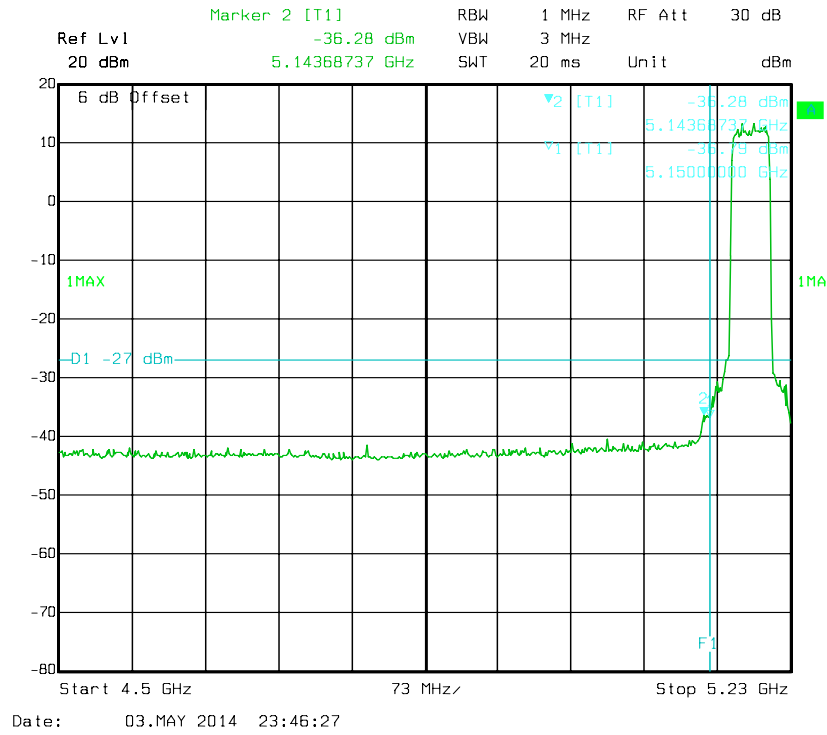
Test mode: transmitting

| Frequency band | Bandedge               | Worst Reading Level (dBm) |           |                     | Limit (dBm) | Result |
|----------------|------------------------|---------------------------|-----------|---------------------|-------------|--------|
|                |                        | Antenna 1                 | Antenna 2 | Antenna 1+Antenna 2 |             |        |
| 5150-5250MHz   | Left                   | -36.28                    | -38.53    | -34.25              | -27         | PASS   |
|                | Right                  | -39.71                    | -38.87    | -36.26              | -27         | PASS   |
| 5725-5825MHz   | Left (5715-5725 MHz)   | -29.66                    | -29.19    | -26.41              | -17         | PASS   |
|                | Left (Below 5715 MHz)  | -36.10                    | -33.25    | -31.43              | -27         | PASS   |
|                | Right (5825-5835 MHz)  | -29.58                    | -28.32    | -25.89              | -17         | PASS   |
|                | Right (Above 5835 MHz) | -35.09                    | -32.96    | -30.89              | -27         | PASS   |

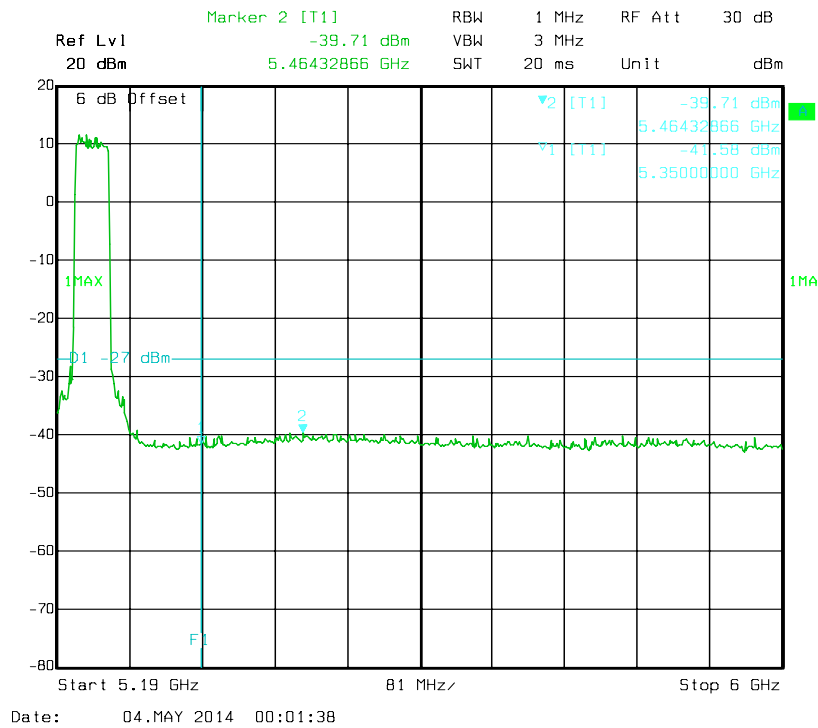
*Note: the antenna gain was 5dBi, the cable loss was 1dB.*

5150-5250 MHz:

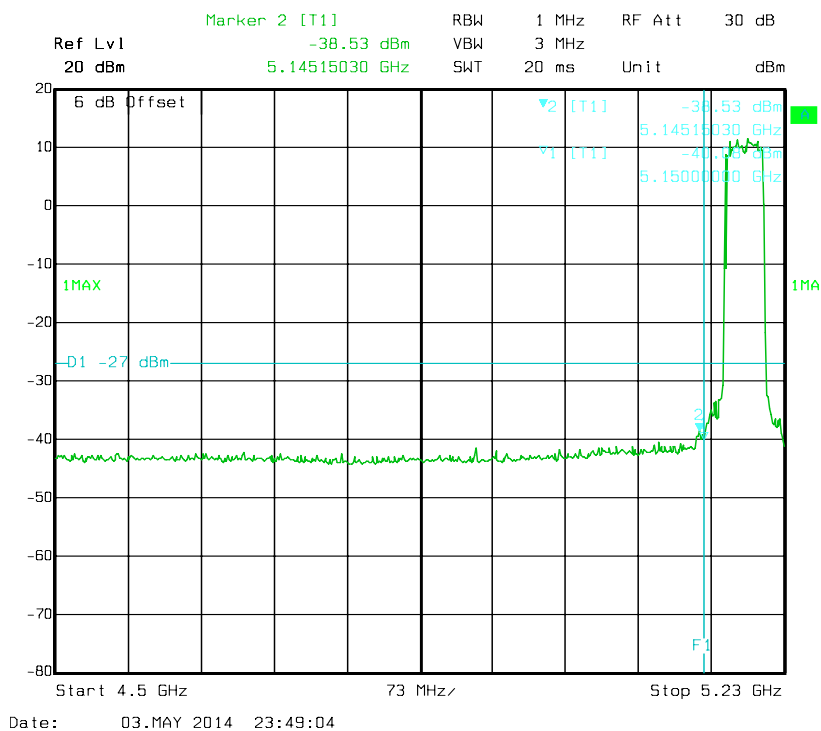
Antenna 1: Bandedge-5190 MHz



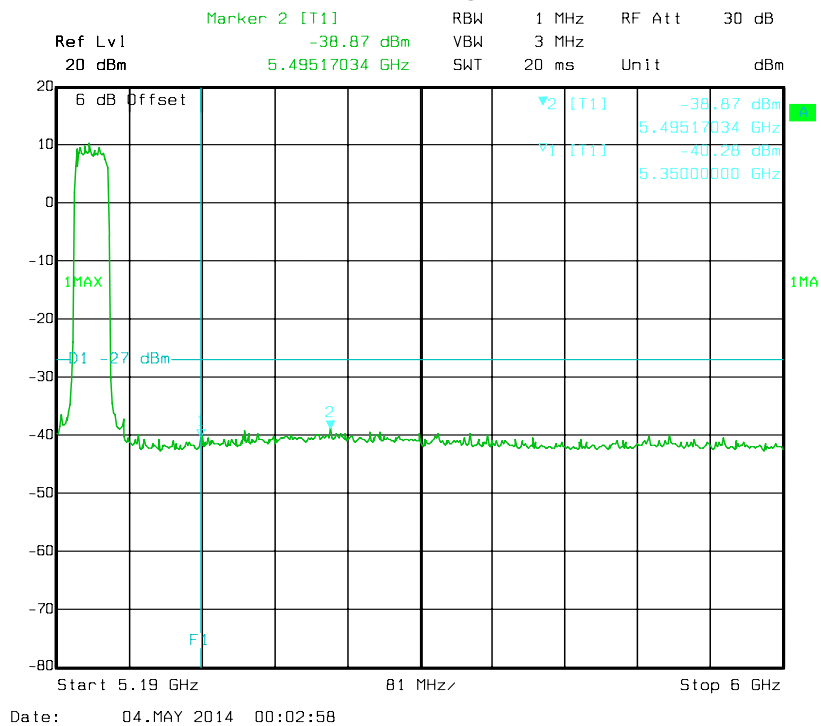
Antenna 1: Bandedge-5230 MHz



### Antenna 2: Bandedge-5190 MHz

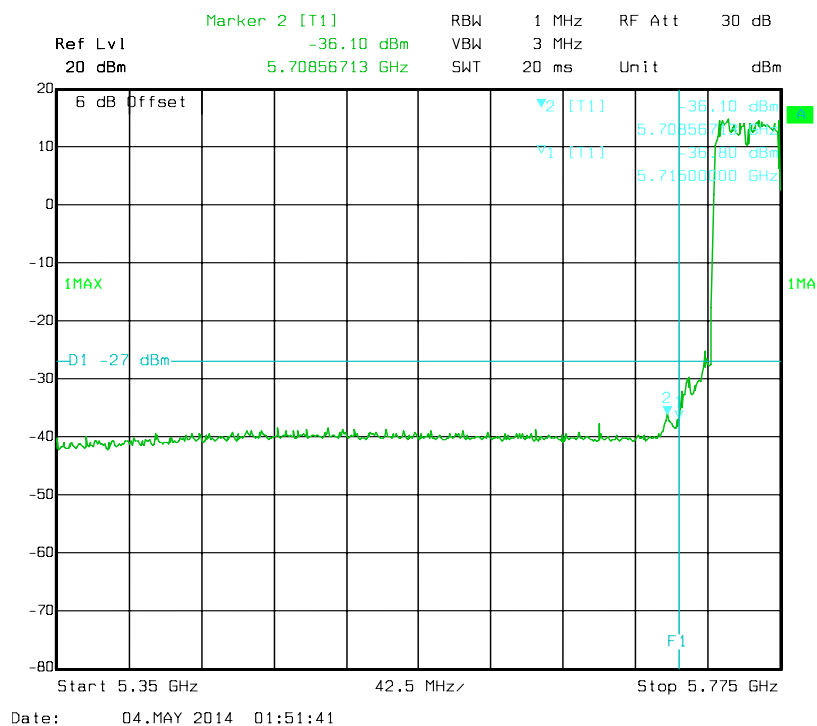
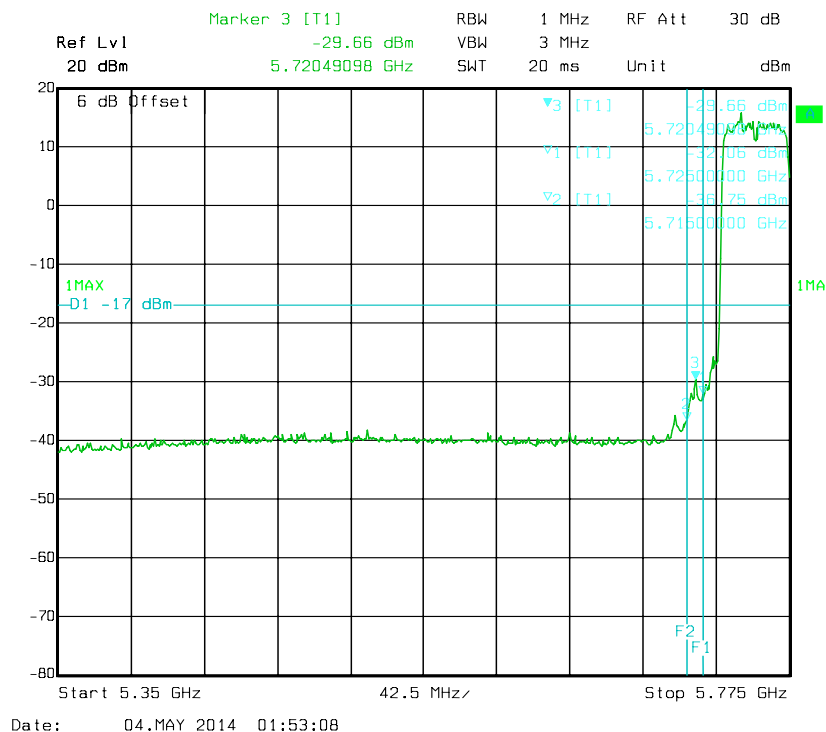


### Antenna 2: Bandedge-5230 MHz

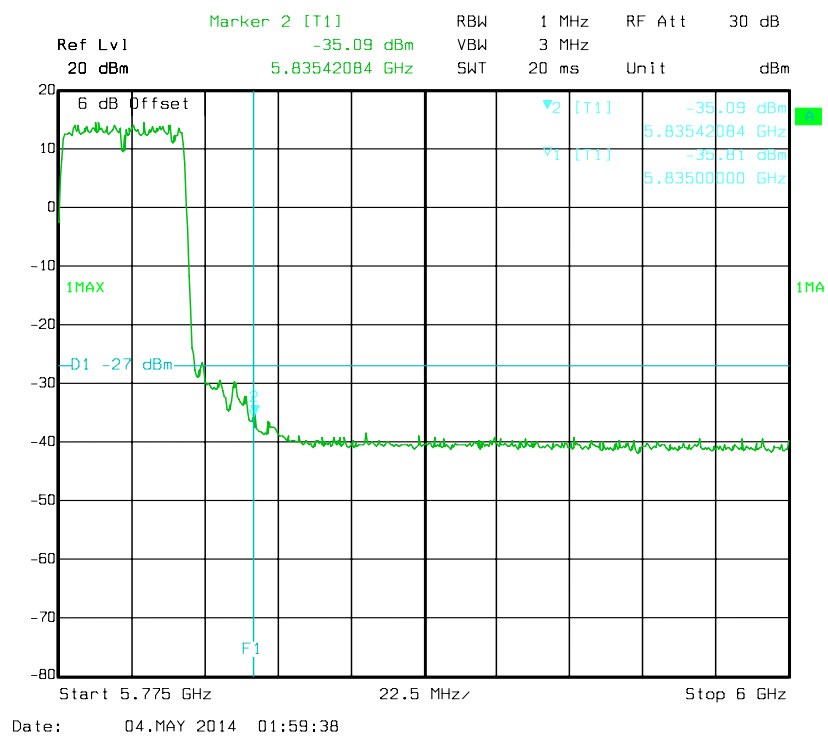
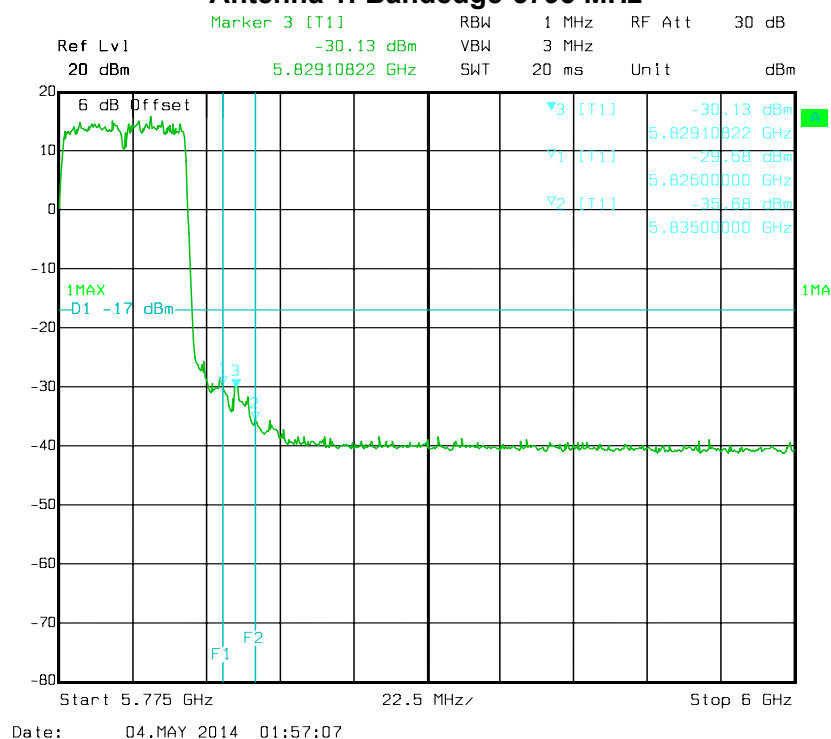


5725-5825 MHZ:

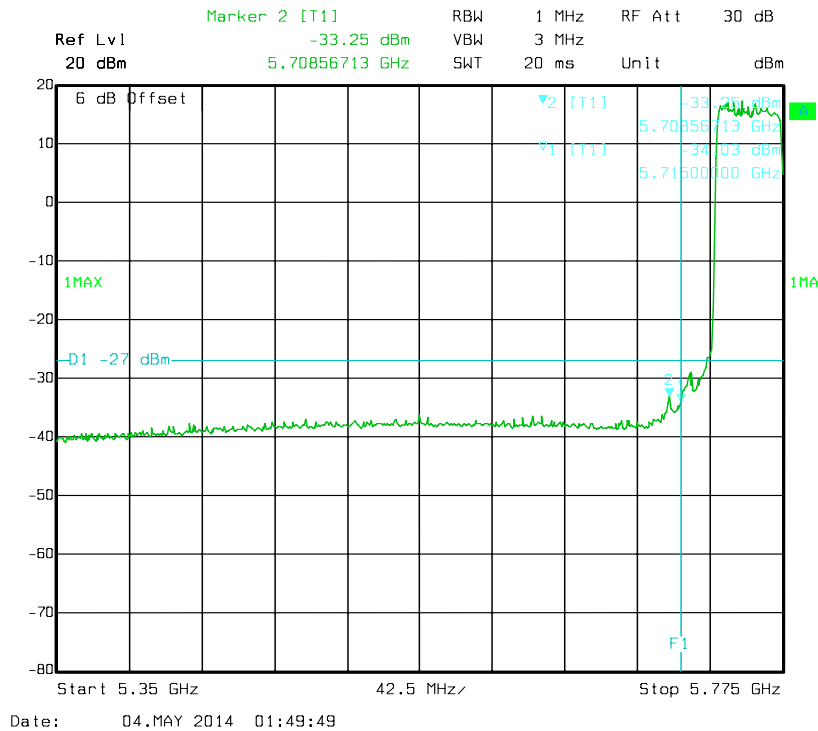
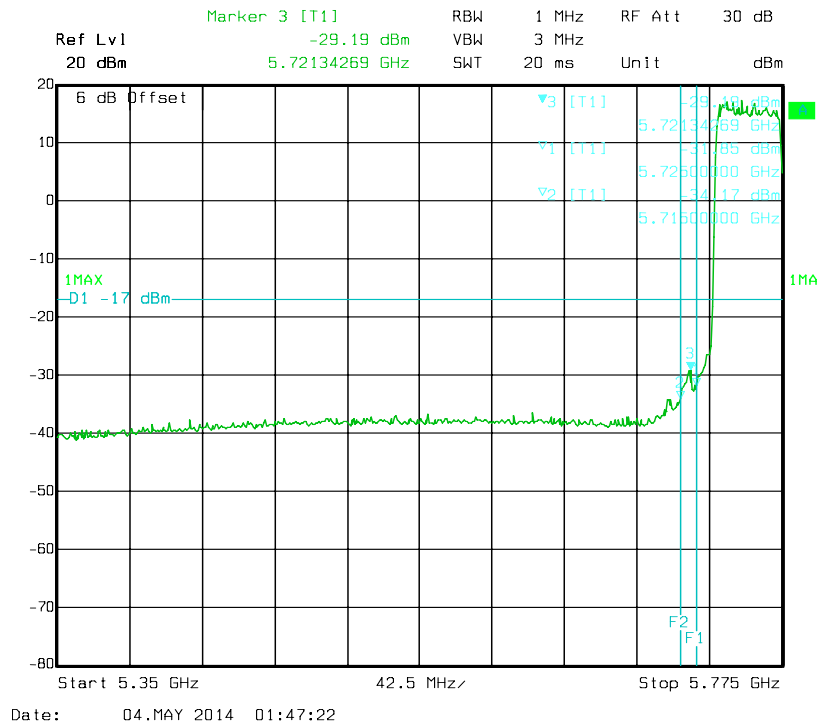
Antenna 1: Bandedge-5755 MHz



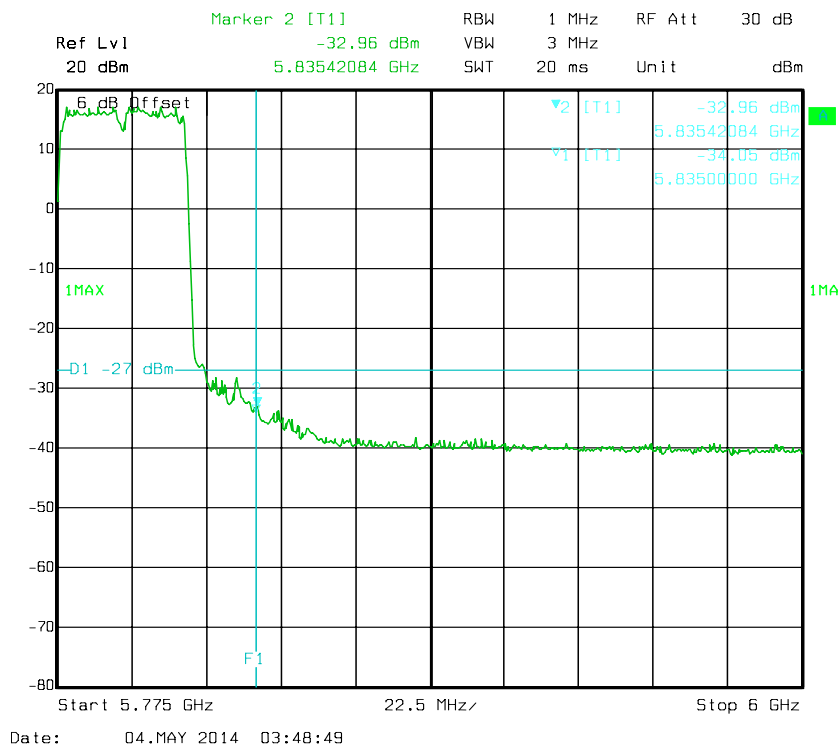
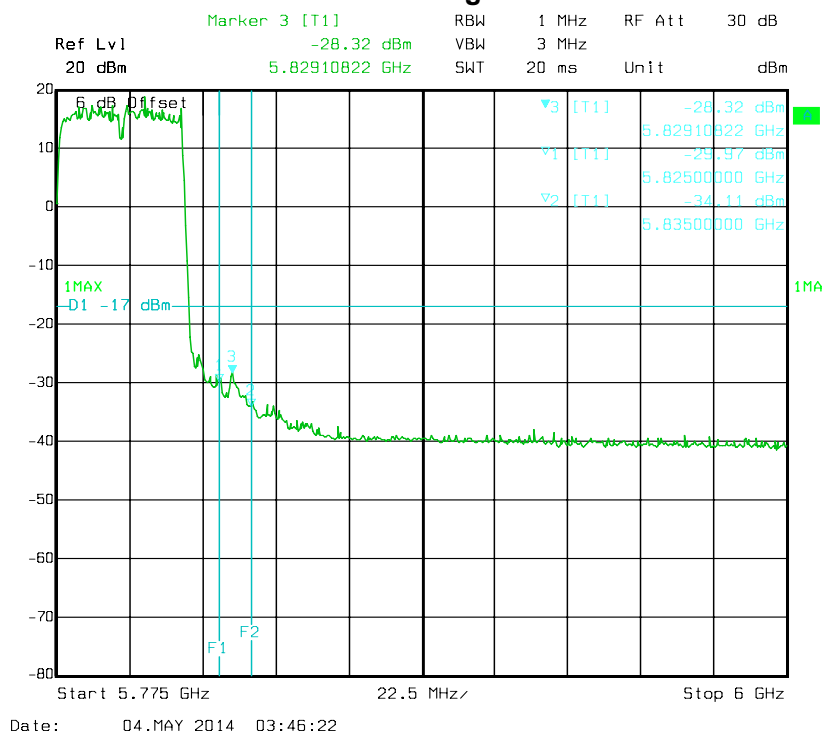
### Antenna 1: Bandedge-5795 MHz



### Antenna 2: Bandedge-5755 MHz



## Antenna 2: Bandedge-5795 MHz



## **FCC §15.407(a) (1) (3)– 26 dB OCCUPIED BANDWIDTH**

### **Applicable Standard**

For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

For the band 5.725–5.825 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 1 W or 17 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 17 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain up to 23 dBi without any corresponding reduction in the transmitter peak output power or peak power spectral density. For fixed, point-to-point U-NII transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in peak transmitter power and peak power spectral density for each 1 dB of antenna gain in excess of 23 dBi would be required. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

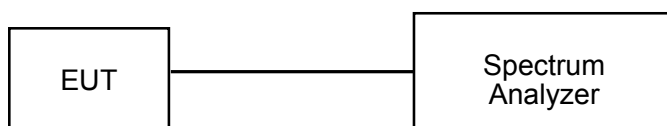
### **Test Equipment List and Details**

| <b>Manufacturer</b> | <b>Description</b> | <b>Model</b> | <b>Serial Number</b> | <b>Calibration Date</b> | <b>Calibration Due Date</b> |
|---------------------|--------------------|--------------|----------------------|-------------------------|-----------------------------|
| Rohde & Schwarz     | Spectrum Analyzer  | FSL18        | 100180               | 2013-07-31              | 2014-07-30                  |

\* **Statement of Traceability:** BACL (Chengdu) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

## Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Use a RBW = approximately 1% of the emission bandwidth. Set the VBW > RBW. Use a peak detector. Do not use the Max Hold function. Rather, use the view button to capture the emission. Measure maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat, measurement as needed until the RBW/EBW ratio is approximately 1%.
4. Repeat above procedures until all frequencies measured were complete.



## Test Data

### Environmental Conditions

|                           |                       |
|---------------------------|-----------------------|
| <b>Temperature:</b>       | 24°C & 25°C           |
| <b>Relative Humidity:</b> | 54 % & 55 %           |
| <b>ATM Pressure:</b>      | 101.9 kPa & 101.2 kPa |

The testing was performed by Lynn Yi on 2014-04-22 & 2014-04-23.

**Test Result:** Pass.

Please refer to the following tables and plots.

Test mode: Transmitting

### 5150-5250 MHz:

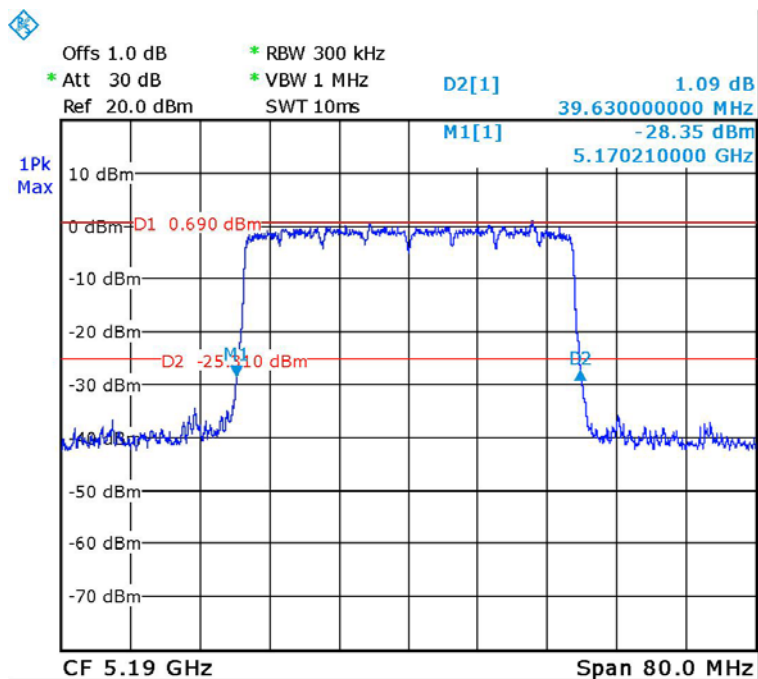
| Channel | Frequency (MHz) | 26dB Bandwidth (MHz) |           |
|---------|-----------------|----------------------|-----------|
|         |                 | Antenna 1            | Antenna 2 |
| Low     | 5190            | 39.630               | 39.281    |
| High    | 5230            | 39.361               | 39.260    |

### 5725-5825 MHz:

| Channel | Frequency (MHz) | 26dB Bandwidth (MHz) |           |
|---------|-----------------|----------------------|-----------|
|         |                 | Antenna 1            | Antenna 2 |
| Low     | 5755            | 39.261               | 39.465    |
| High    | 5795            | 39.221               | 39.441    |

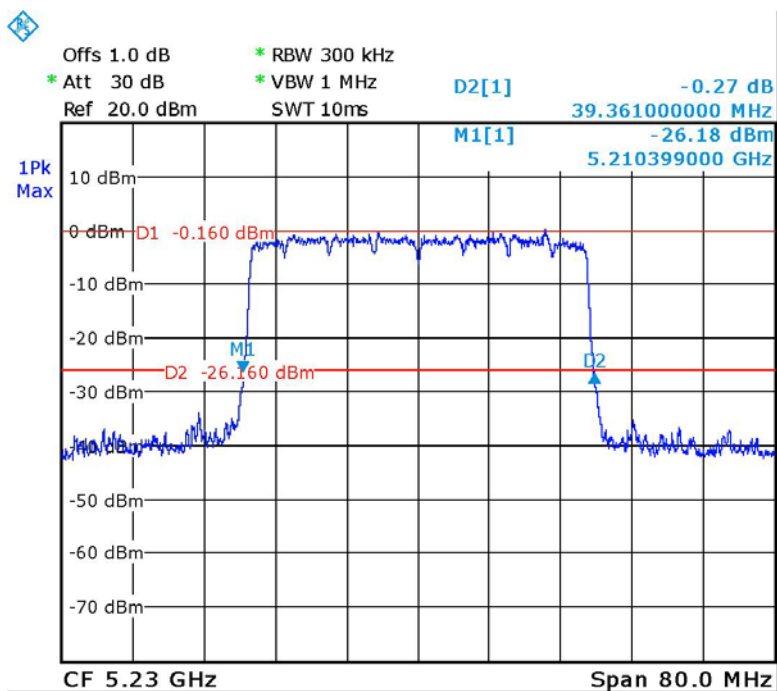
5150-5250 MHZ:

Antenna 1: 26 dB Bandwidth-5190 MHz



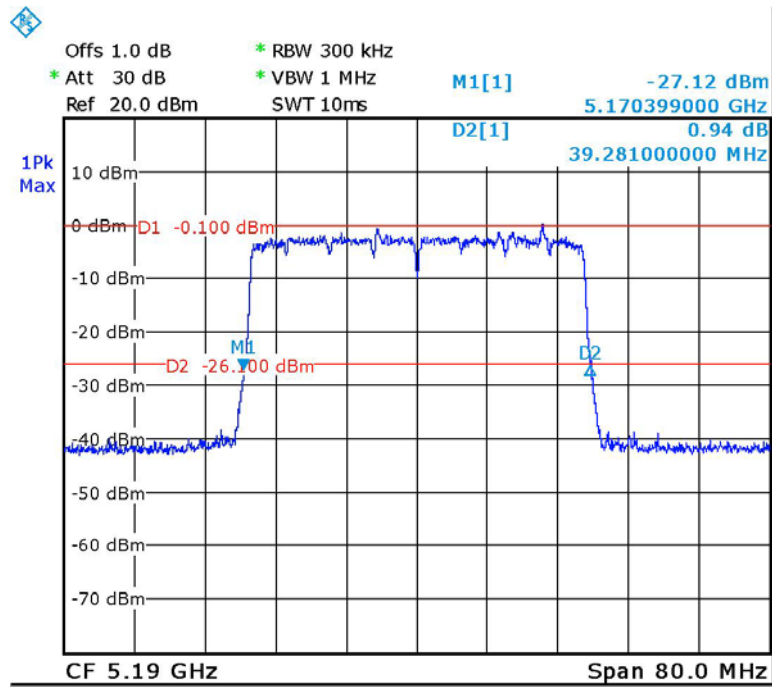
Date: 22.APR.2014 04:27:02

Antenna 1: 26 dB Bandwidth-5230 MHz



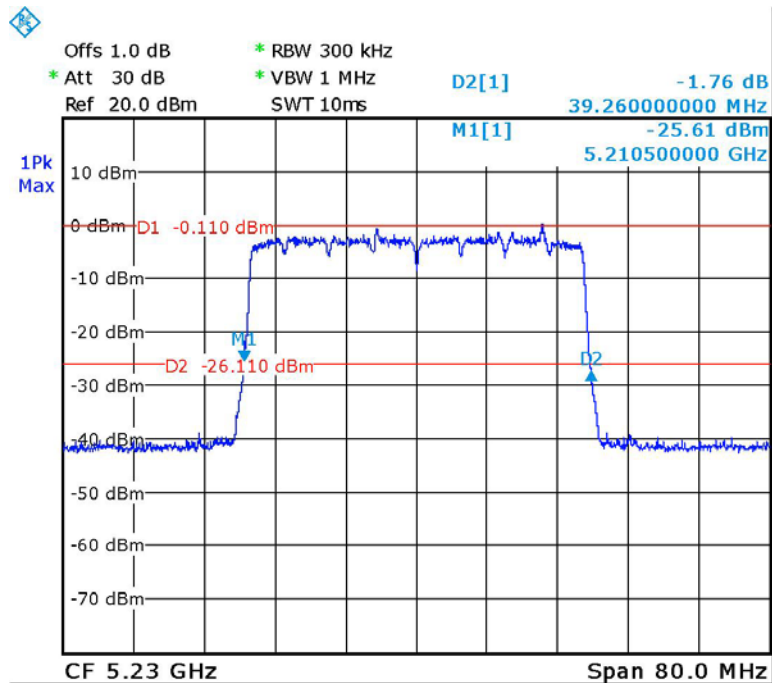
Date: 22.APR.2014 22:36:03

### Antenna 2: 26 dB Bandwidth-5190 MHz



Date: 22.APR.2014 05:04:24

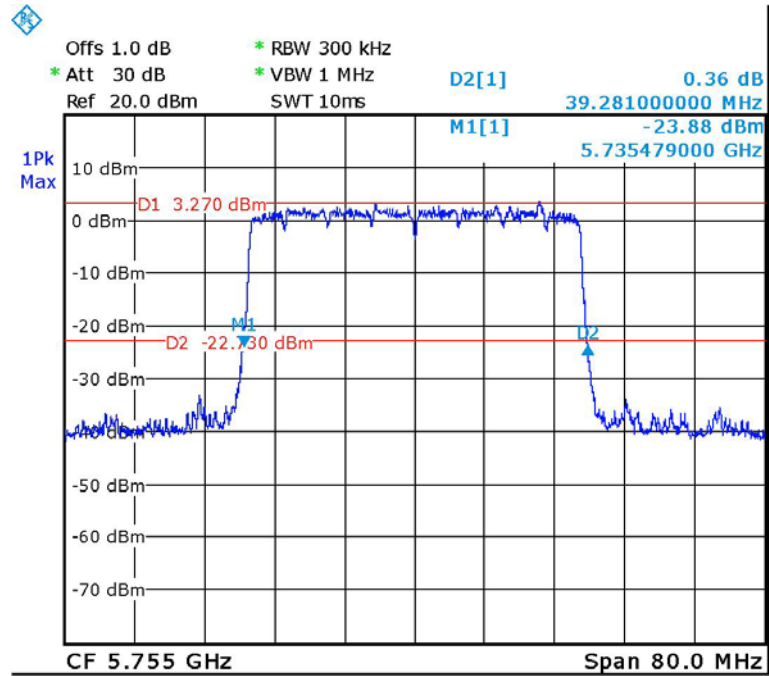
### Antenna 2: 26 dB Bandwidth-5230 MHz



Date: 22.APR.2014 05:13:00

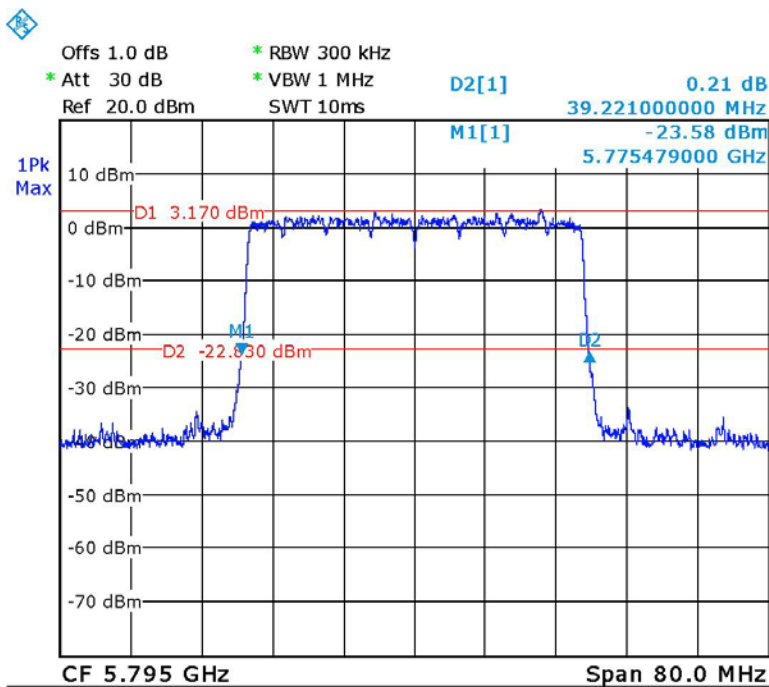
5725-5825 MHZ:

Antenna 1: 26 dB Bandwidth-5755 MHz



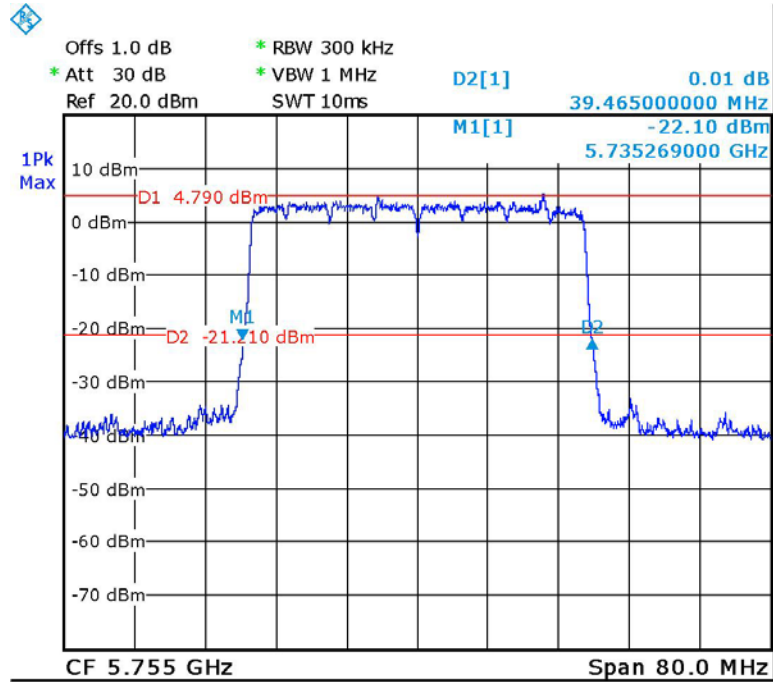
Date: 23.APR.2014 04:23:45

Antenna 1: 26 dB Bandwidth-5795 MHz



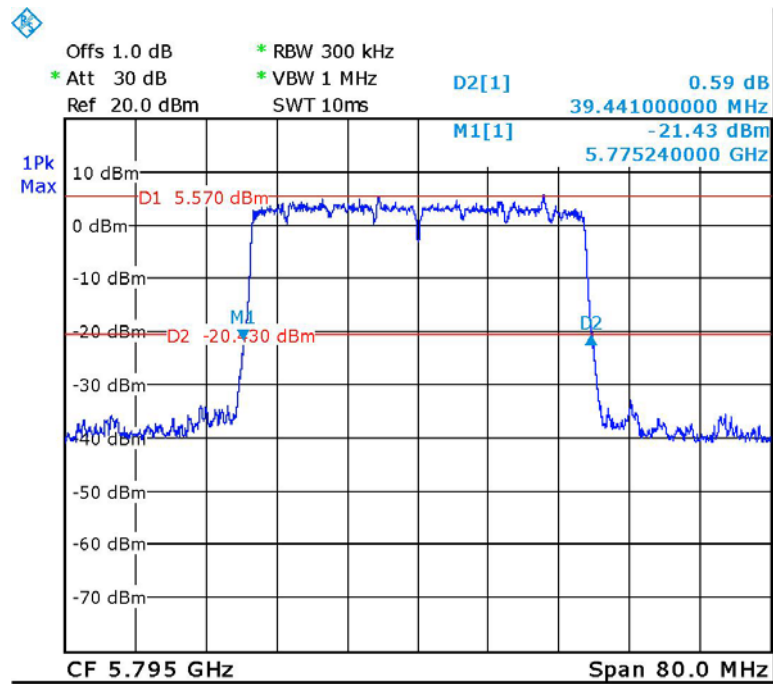
Date: 23.APR.2014 04:35:45

### Antenna 2: 26 dB Bandwidth-5755 MHz



Date: 23.APR.2014 01:45:47

### Antenna 2: 26 dB Bandwidth-5795 MHz



Date: 23.APR.2014 03:55:06

## **FCC §15.407(a) (1) (3)– CONDUCTED TRANSMITTER OUTPUT POWER**

### **Applicable Standard**

For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or  $4 \text{ dBm} + 10 \log B$ , where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

For the band 5.725–5.825 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 1 W or  $17 \text{ dBm} + 10 \log B$ , where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 17 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain up to 23 dBi without any corresponding reduction in the transmitter peak output power or peak power spectral density. For fixed, point-to-point U-NII transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in peak transmitter power and peak power spectral density for each 1 dB of antenna gain in excess of 23 dBi would be required. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

### **Test Equipment List and Details**

| <b>Manufacturer</b> | <b>Description</b> | <b>Model</b> | <b>Serial Number</b> | <b>Calibration Date</b> | <b>Calibration Due Date</b> |
|---------------------|--------------------|--------------|----------------------|-------------------------|-----------------------------|
| Rohde & Schwarz     | Spectrum Analyzer  | FSL18        | 100180               | 2013-07-31              | 2014-07-30                  |

\* **Statement of Traceability:** BACL (Chengdu) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

## Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set span to encompass the entire emission bandwidth (EBW) of the signal. Set RBW = 1 MHz. Set VBW  $\geq$  3 MHz. Use sample detector mode. Use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at full control power for entire sweep of every sweep. If the device transmits continuously, with no off intervals or reduced power intervals, the trigger may be set to "free run". Trace average 100 traces in power averaging mode. Compute power by integrating the spectrum across the 26 dB EBW of the signal. The integration can be performed using the spectrum analyzer's band power measurement function with band limits set equal to the EBW band edges or by summing power levels in each 1 MHz band in linear power terms. The 1 MHz band power levels to be summed can be obtained by averaging, in linear power terms, power levels in each frequency bin across the 1 MHz.
4. Repeat above procedures until all frequencies measured were complete.

## Test Data

### Environmental Conditions

|                           |                       |
|---------------------------|-----------------------|
| <b>Temperature:</b>       | 24°C & 25°C           |
| <b>Relative Humidity:</b> | 54 % & 55 %           |
| <b>ATM Pressure:</b>      | 101.9 kPa & 101.2 kPa |

The testing was performed by Lynn Yi on 2014-04-22 & 2014-04-23.

### 5150-5250 MHz:

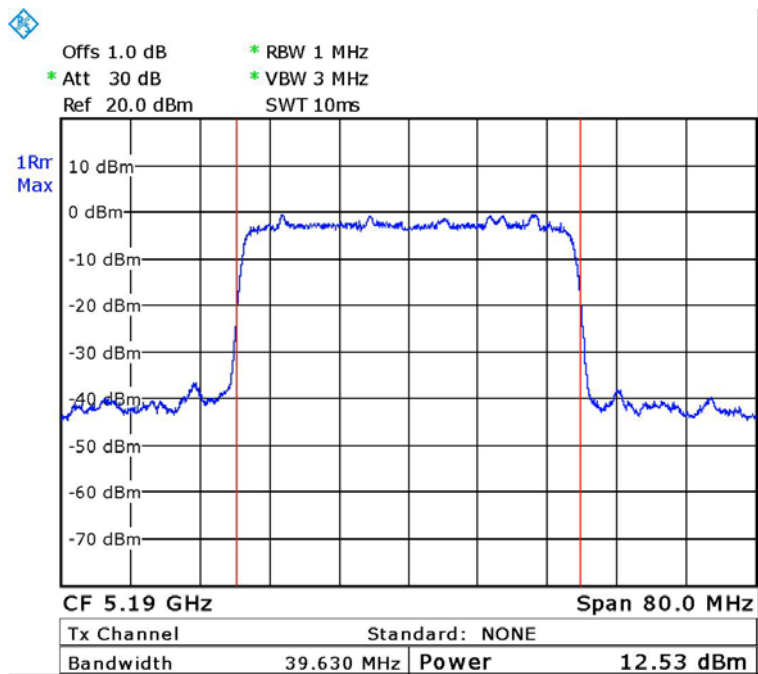
| Channel | Frequency (MHz) | Output Power (dBm) |           |                       | Limit (dBm) |
|---------|-----------------|--------------------|-----------|-----------------------|-------------|
|         |                 | Antenna 1          | Antenna 2 | Antenna 1 + Antenna 2 |             |
| Low     | 5190            | 12.53              | 10.93     | 14.81                 | 17          |
| High    | 5230            | 11.68              | 10.23     | 14.19                 | 17          |

### 5725-5825 MHz:

| Channel | Frequency (MHz) | Output Power (dBm) |           |                       | Limit (dBm) |
|---------|-----------------|--------------------|-----------|-----------------------|-------------|
|         |                 | Antenna 1          | Antenna 2 | Antenna 1 + Antenna 2 |             |
| Low     | 5755            | 14.86              | 16.19     | 18.59                 | 30          |
| High    | 5795            | 14.72              | 16.39     | 18.70                 | 30          |

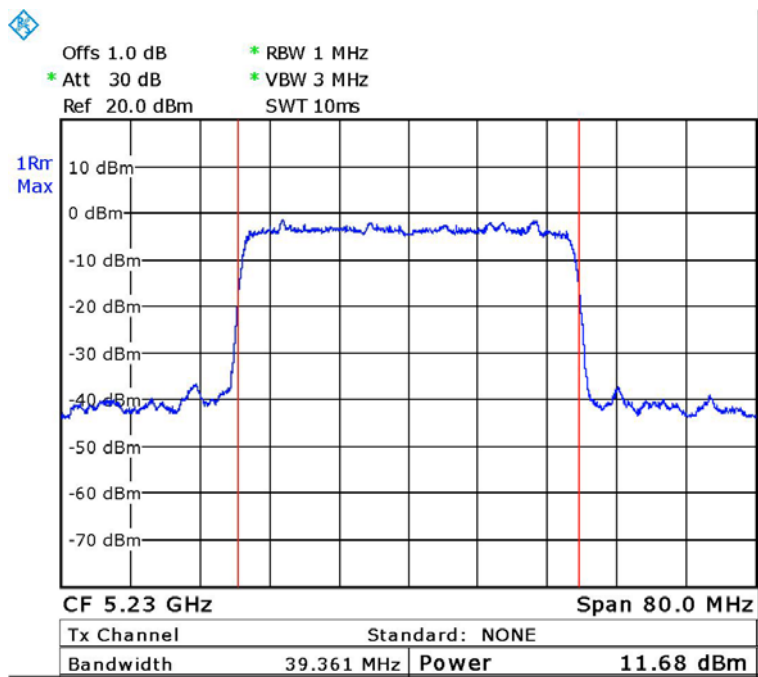
5150-5250 MHz:

Antenna 1: RF Output Power, Low Channel



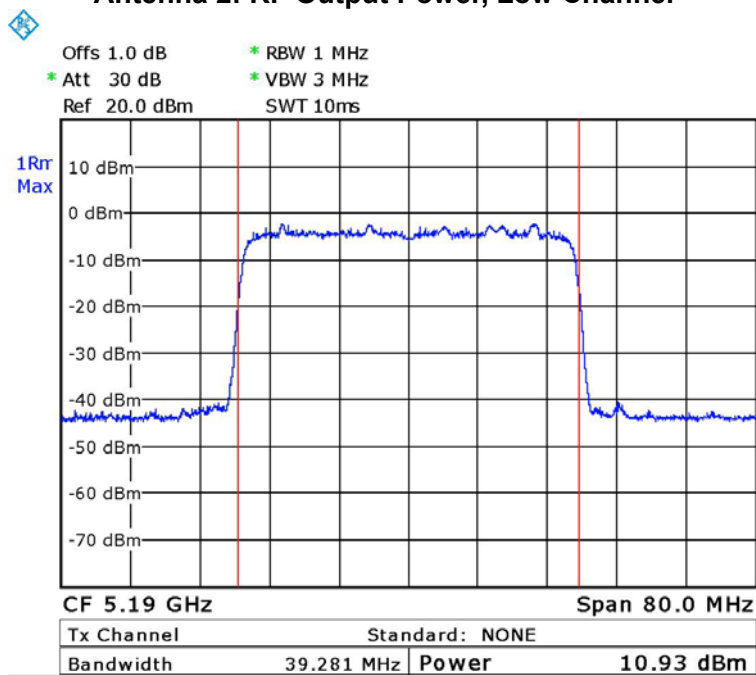
Date: 22.APR.2014 04:30:59

Antenna 1: RF Output Power, High Channel



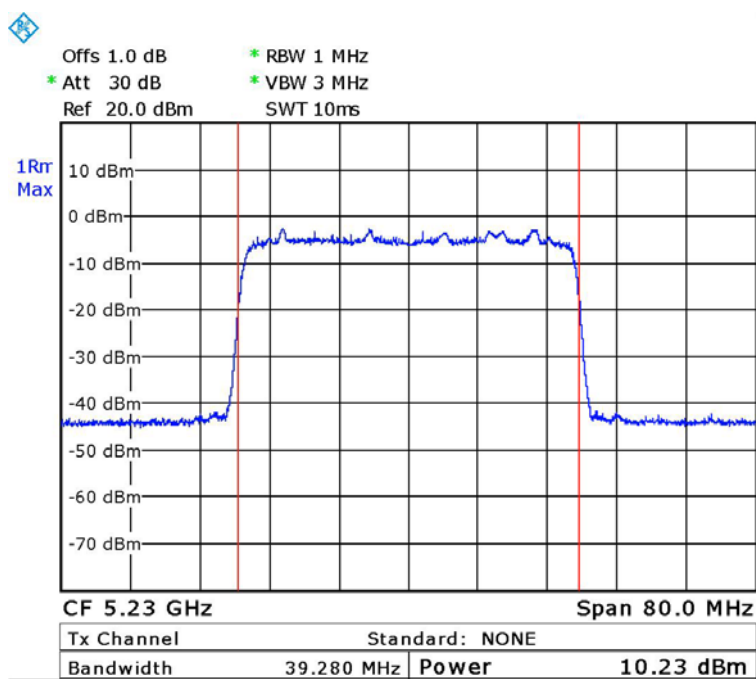
Date: 22.APR.2014 22:50:00

### Antenna 2: RF Output Power, Low Channel



Date: 22.APR.2014 04:57:32

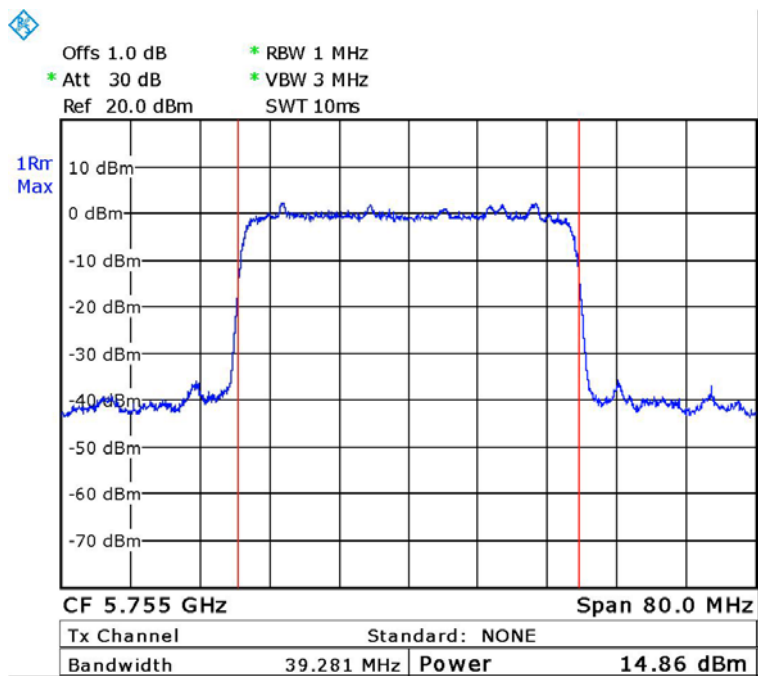
### Antenna 2: RF Output Power, High Channel



Date: 22.APR.2014 05:24:48

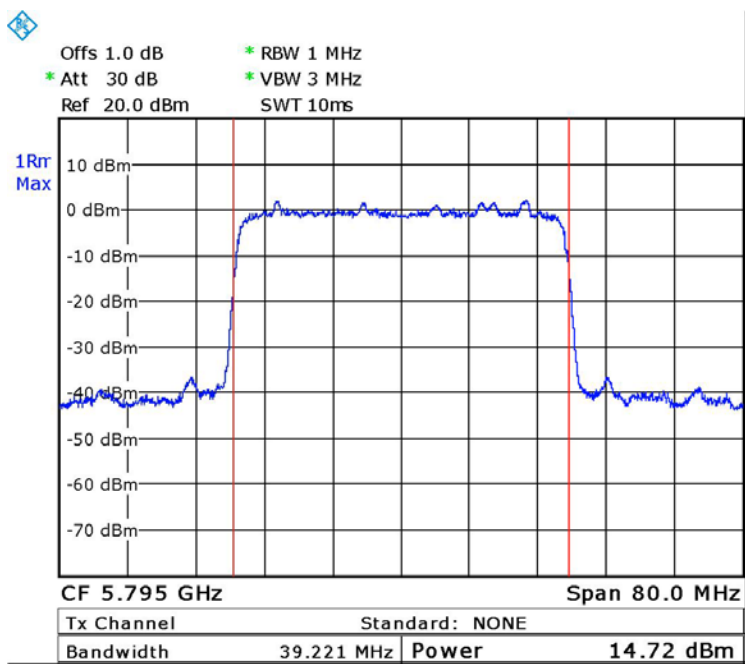
5725-5825 MHz:

Antenna 1: RF Output Power, Low Channel



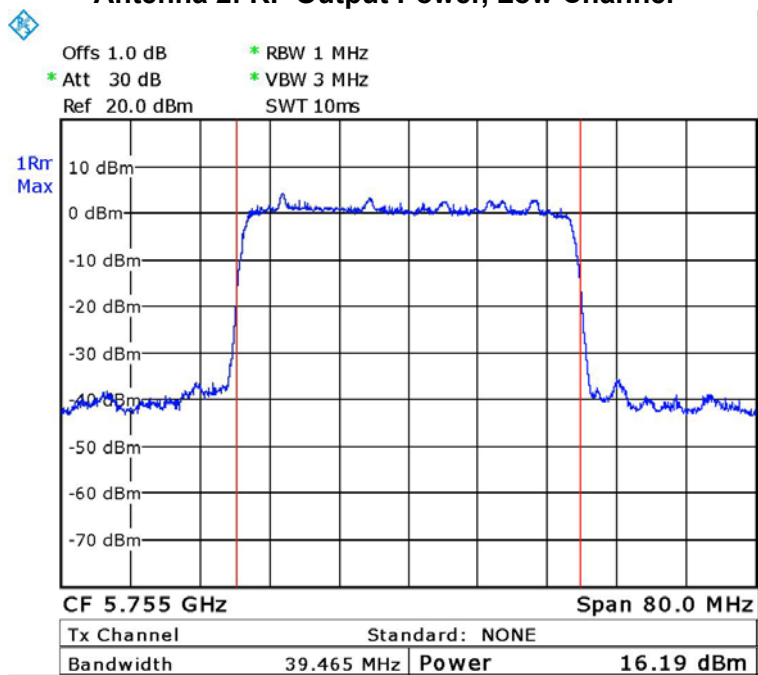
Date: 23.APR.2014 04:26:41

Antenna 1: RF Output Power, High Channel



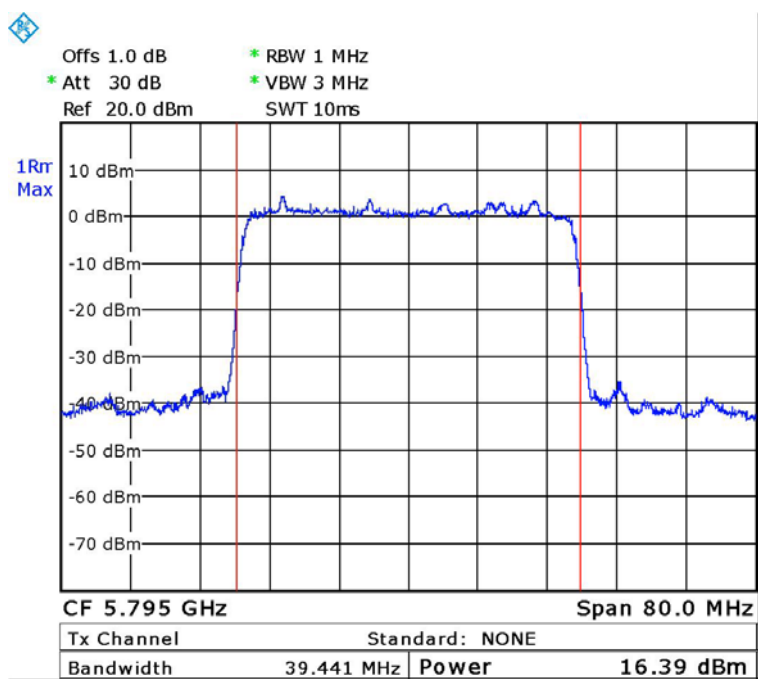
Date: 23.APR.2014 04:46:31

### Antenna 2: RF Output Power, Low Channel



Date: 23.APR.2014 05:01:34

### Antenna 2: RF Output Power, High Channel



Date: 23.APR.2014 05:08:48

## **FCC §15.407(a) (1) (3) (5) - POWER SPECTRAL DENSITY**

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### **Applicable Standard**

For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or  $4 \text{ dBm} + 10 \log B$ , where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

For the band 5.725–5.825 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 1 W or  $17 \text{ dBm} + 10 \log B$ , where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 17 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain up to 23 dBi without any corresponding reduction in the transmitter peak output power or peak power spectral density. For fixed, point-to-point U-NII transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in peak transmitter power and peak power spectral density for each 1 dB of antenna gain in excess of 23 dBi would be required. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple colocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

The peak power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A resolution bandwidth less than the measurement bandwidth can be used, provided that the measured power is integrated to show total power over the measurement bandwidth. If the resolution bandwidth is approximately equal to the measurement bandwidth, and much less than the emission bandwidth of the equipment under test, the measured results shall be corrected to account for any difference between the resolution bandwidth of the test instrument and its actual noise bandwidth.

### **Test Procedure**

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Use sample detector and power averaging (not video averaging) mode. Set RBW= 1 MHz, VBW > 1 MHz. The PPSD is the highest level found across the emission in any 1-MHz band after 100 sweeps of averaging. This method is permitted only if the transmission pulse or sequence of pulses remains at maximum transmits power throughout each of the 100 sweeps of averaging and that the interval between pulses is not included in any of the sweeps.
4. Repeat above procedures until all frequencies measured were complete.

## Test Equipment List and Details

| Manufacturer    | Description       | Model | Serial Number | Calibration Date | Calibration Due Date |
|-----------------|-------------------|-------|---------------|------------------|----------------------|
| Rohde & Schwarz | Spectrum Analyzer | FSL18 | 100180        | 2013-07-31       | 2014-07-30           |

\* **Statement of Traceability:** BACL (Chengdu) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

## Test Data

### Environmental Conditions

|                           |                       |
|---------------------------|-----------------------|
| <b>Temperature:</b>       | 24°C & 25°C           |
| <b>Relative Humidity:</b> | 54 % & 55 %           |
| <b>ATM Pressure:</b>      | 101.9 kPa & 101.2 kPa |

The testing was performed by Lynn Yi on 2014-04-22 & 2014-04-23.

Test Mode: Transmitting

**Test Result:** Pass

Test mode: Transmitting

### 5150-5250 MHz:

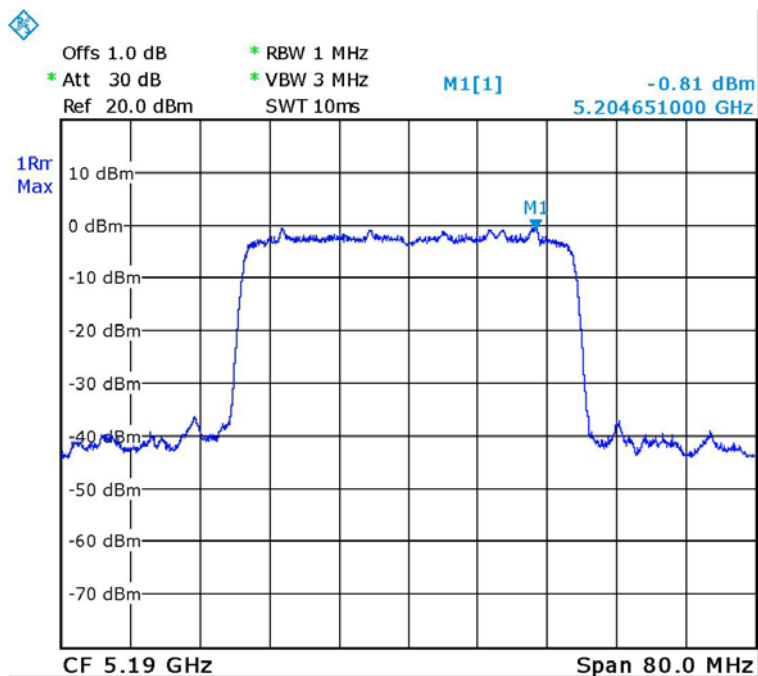
| Channel | Frequency (MHz) | Power Spectral Density (dBm/MHz) |           |                       | Limit (dBm) | Result |
|---------|-----------------|----------------------------------|-----------|-----------------------|-------------|--------|
|         |                 | Antenna 1                        | Antenna 2 | Antenna 1 + Antenna 2 |             |        |
| Low     | 5190            | -0.81                            | -2.20     | 1.56                  | 4           | Pass   |
| High    | 5230            | -1.85                            | -2.98     | 0.63                  | 4           | Pass   |

### 5725-5825 MHz:

| Channel | Frequency (MHz) | Power Spectral Density (dBm/MHz) |           |                       | Limit (dBm) | Result |
|---------|-----------------|----------------------------------|-----------|-----------------------|-------------|--------|
|         |                 | Antenna 1                        | Antenna 2 | Antenna 1 + Antenna 2 |             |        |
| Low     | 5755            | 1.84                             | 3.53      | 5.78                  | 17          | Pass   |
| High    | 5795            | 1.73                             | 3.82      | 5.91                  | 17          | Pass   |

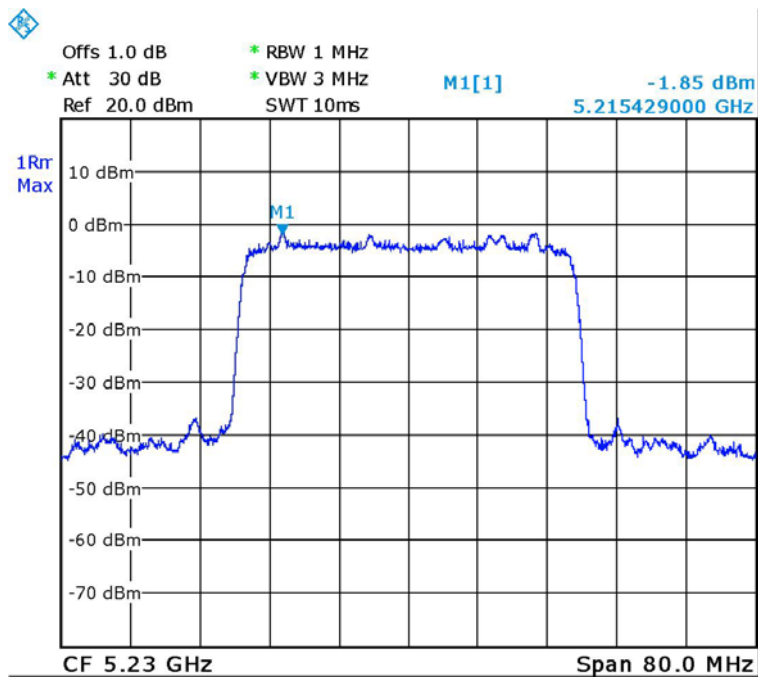
5150-5250 MHz:

Antenna 1: Power Spectral Density, Low Channel



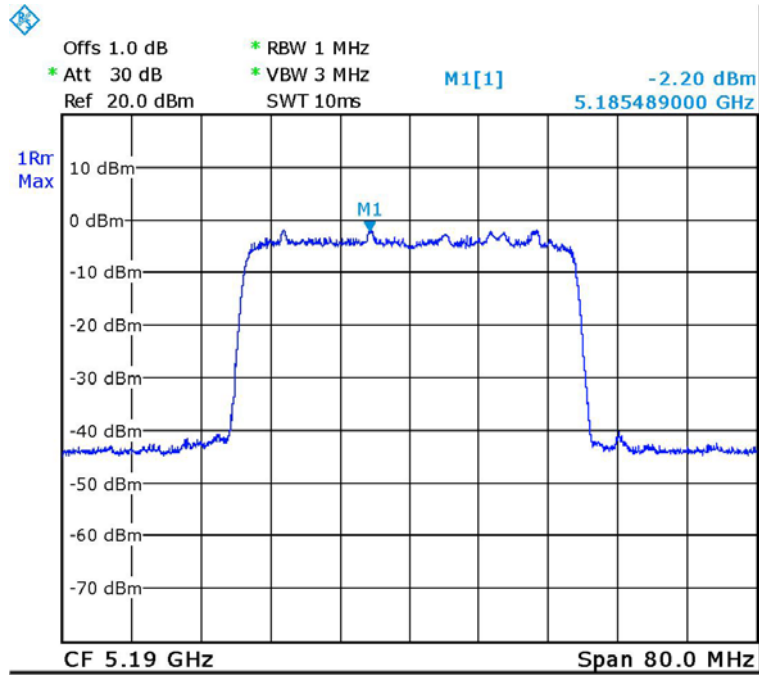
Date: 22.APR.2014 04:17:20

Antenna 1: Power Spectral Density, High Channel



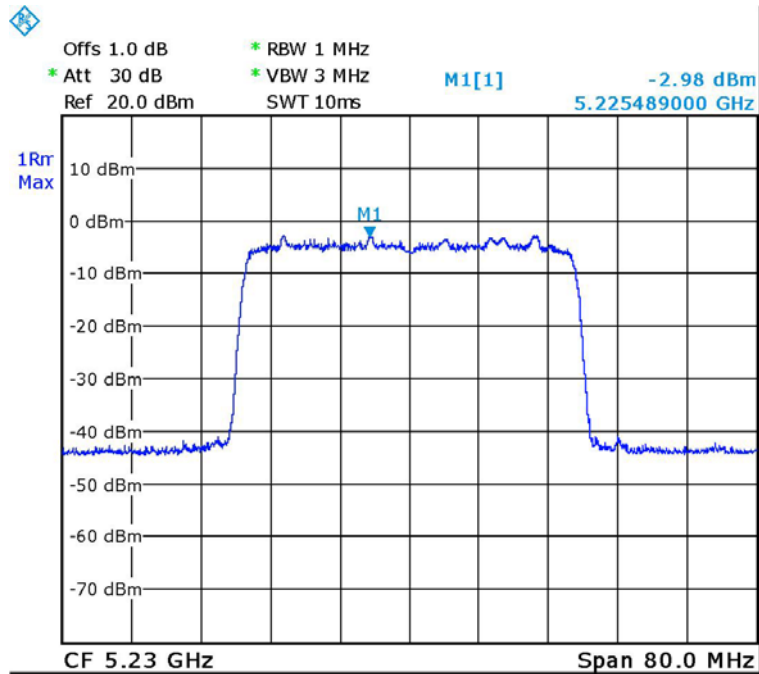
Date: 22.APR.2014 22:41:45

### Antenna 2: Power Spectral Density, Low Channel



Date: 22.APR.2014 04:45:00

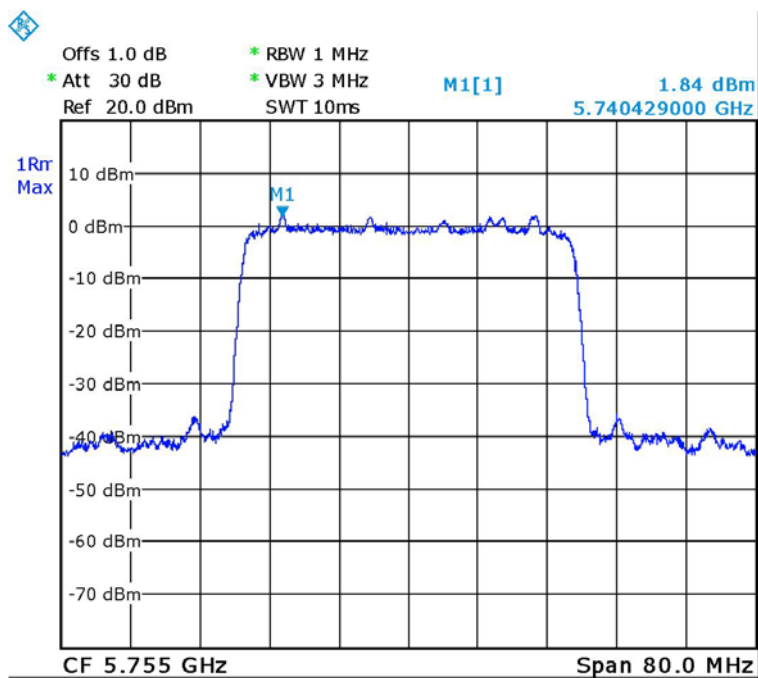
### Antenna 2: Power Spectral Density, High Channel



Date: 22.APR.2014 05:23:29

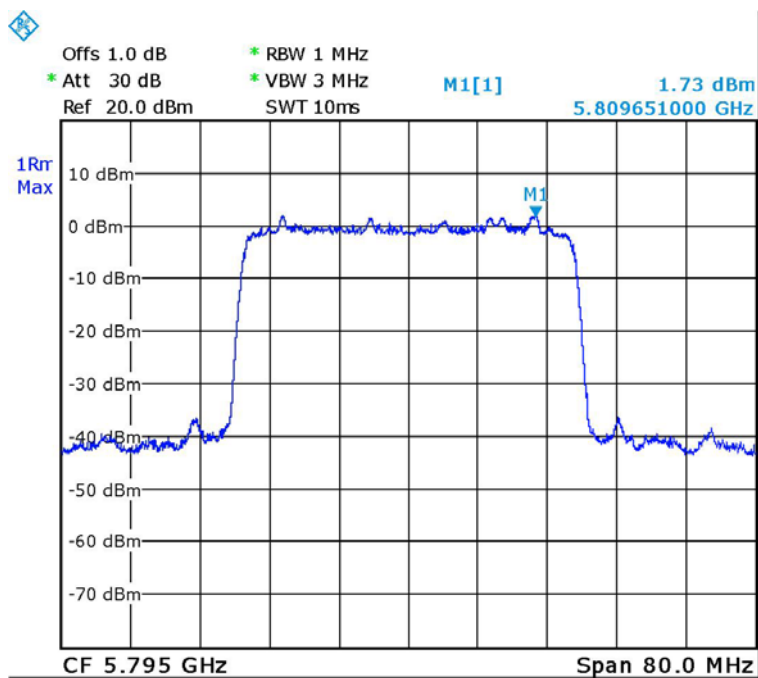
5725-5825 MHz:

### Antenna 1: Power Spectral Density, Low Channel



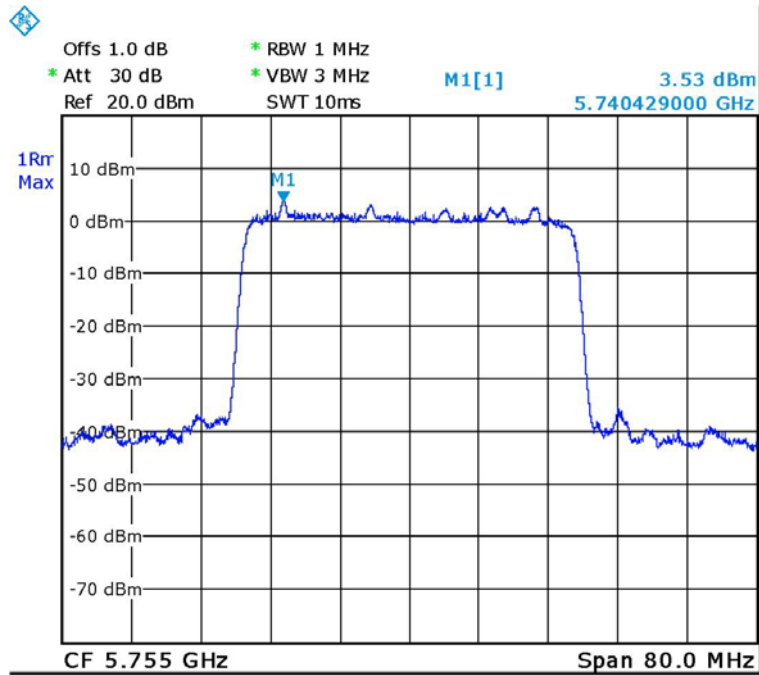
Date: 23.APR.2014 04:25:38

### Antenna 1: Power Spectral Density, High Channel



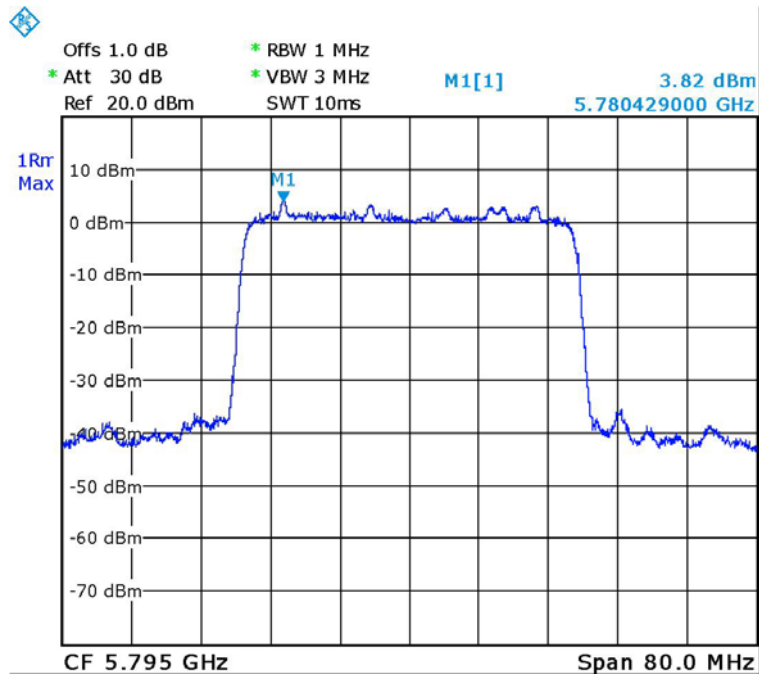
Date: 23.APR.2014 04:37:34

### Antenna 2: Power Spectral Density, Low Channel



Date: 23.APR.2014 04:55:35

### Antenna 2: Power Spectral Density, High Channel



Date: 23.APR.2014 03:57:18

## FCC §15.407(a) (6) – PEAK EXCURSION RATIO

### Applicable Standard

According to §15.407(a) (6), the ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

### Test Procedure

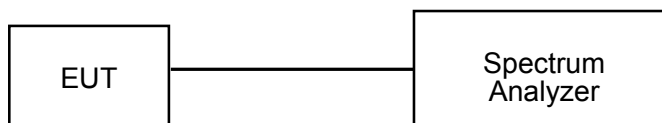
Set the spectrum analyzer span to view the entire emission bandwidth.  
The largest difference between the following two traces must be  $\leq 13$  dB for all frequencies across the emission bandwidth. Submit a plot.

#### 1st Trace:

- Set RBW = 1 MHz, VBW  $\geq 3$  MHz with peak detector and maxhold settings.

#### 2nd Trace:

- create the 2nd trace using the settings described in the section “FCC §15.407(a)(1)(2) – conducted transmitter output power”.



### Test Equipment List and Details

| Manufacturer    | Description       | Model | Serial Number | Calibration Date | Calibration Due Date |
|-----------------|-------------------|-------|---------------|------------------|----------------------|
| Rohde & Schwarz | Spectrum Analyzer | FSL18 | 100180        | 2013-07-31       | 2014-07-30           |

\* **Statement of Traceability:** BACL (Chengdu) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

### Test Data

#### Environmental Conditions

|                    |                       |
|--------------------|-----------------------|
| Temperature:       | 24°C & 25°C           |
| Relative Humidity: | 54 % & 55 %           |
| ATM Pressure:      | 101.9 kPa & 101.2 kPa |

*The testing was performed by Lynn Yi on 2014-04-22 & 2014-04-23.*

*Test Mode: Transmitting*

**5150-5250 MHz:**

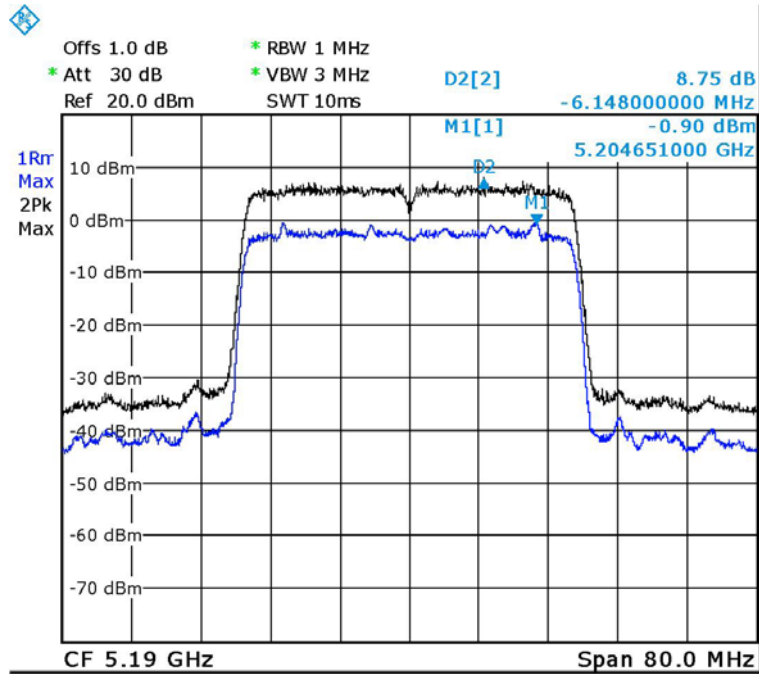
| Channel | Frequency (MHz) | Peak Excursion Ratio (dB) |           | Limit (dB) | Result |
|---------|-----------------|---------------------------|-----------|------------|--------|
|         |                 | Antenna 1                 | Antenna 2 |            |        |
| Low     | 5190            | 8.75                      | 8.16      | 13         | Pass   |
| High    | 5230            | 8.37                      | 8.18      | 13         | Pass   |

**5725-5825 MHz:**

| Channel | Frequency (MHz) | Peak Excursion Ratio (dB) |           | Limit (dB) | Result |
|---------|-----------------|---------------------------|-----------|------------|--------|
|         |                 | Antenna 1                 | Antenna 2 |            |        |
| Low     | 5755            | 7.61                      | 7.35      | 13         | Pass   |
| High    | 5795            | 7.50                      | 6.48      | 13         | Pass   |

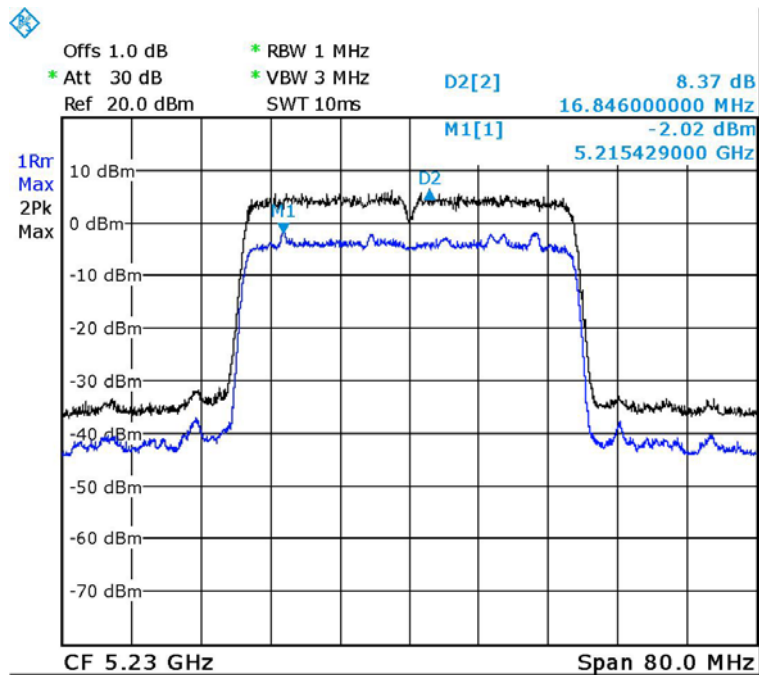
5150-5250 MHz:

Antenna 1: Peak Excursion, Low Channel



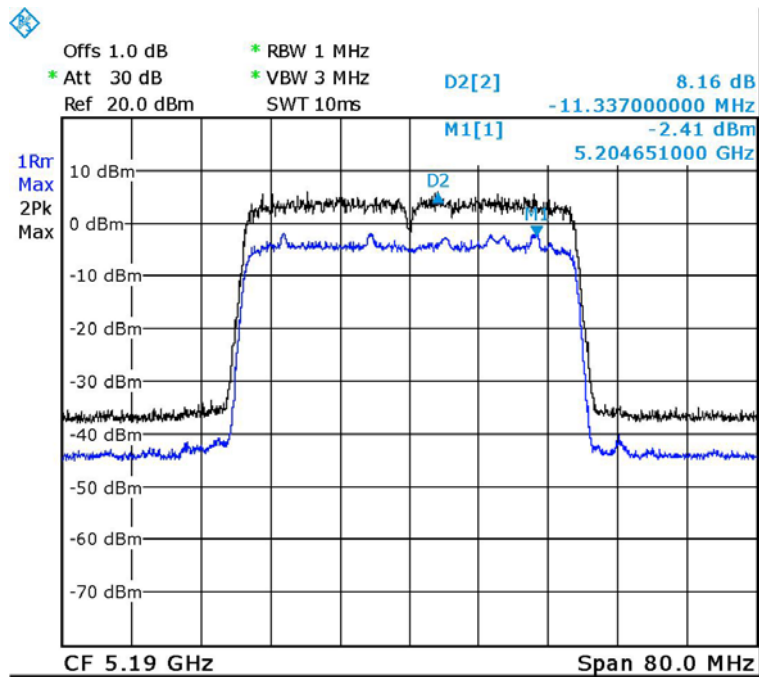
Date: 22.APR.2014 04:40:15

Antenna 1: Peak Excursion, High Channel



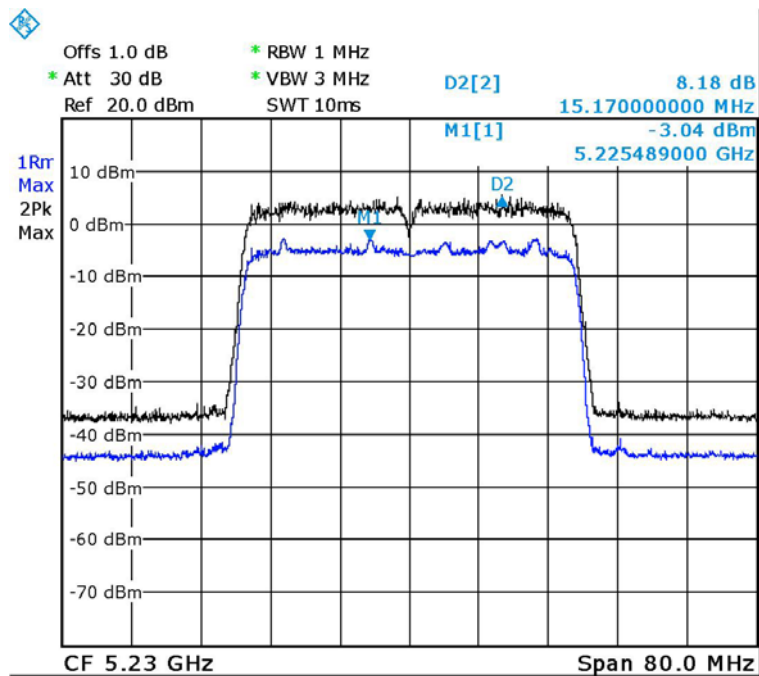
Date: 22.APR.2014 22:57:47

### Antenna 2: Peak Excursion, Low Channel



Date: 22.APR.2014 04:43:49

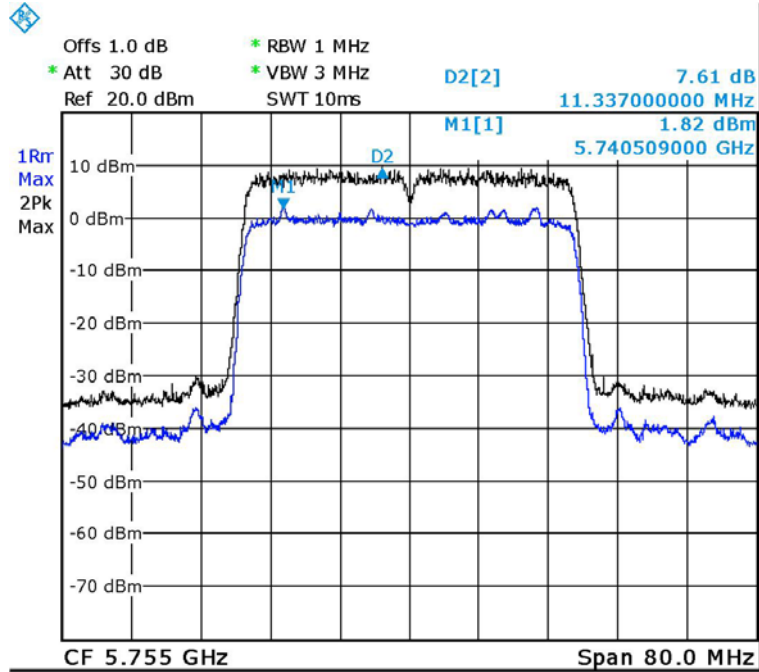
### Antenna 2: Peak Excursion, High Channel



Date: 22.APR.2014 05:26:30

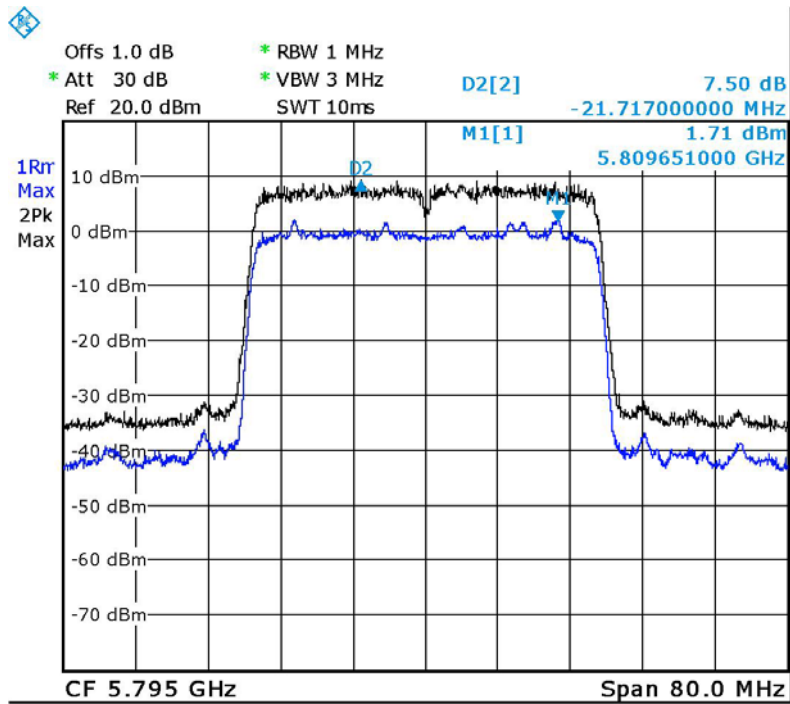
5725-5825 MHz:

Antenna 1: Peak Excursion, Low Channel



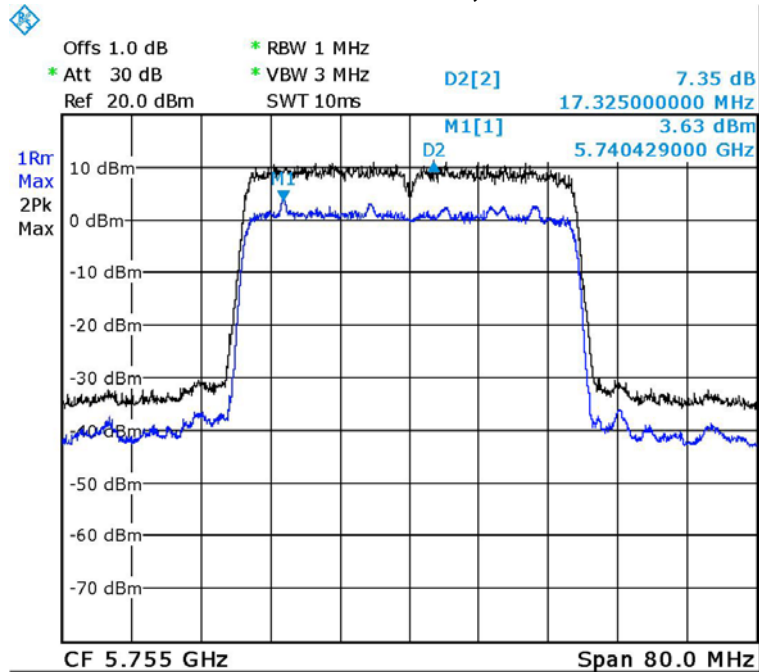
Date: 23.APR.2014 04:28:28

Antenna 1: Peak Excursion, High Channel



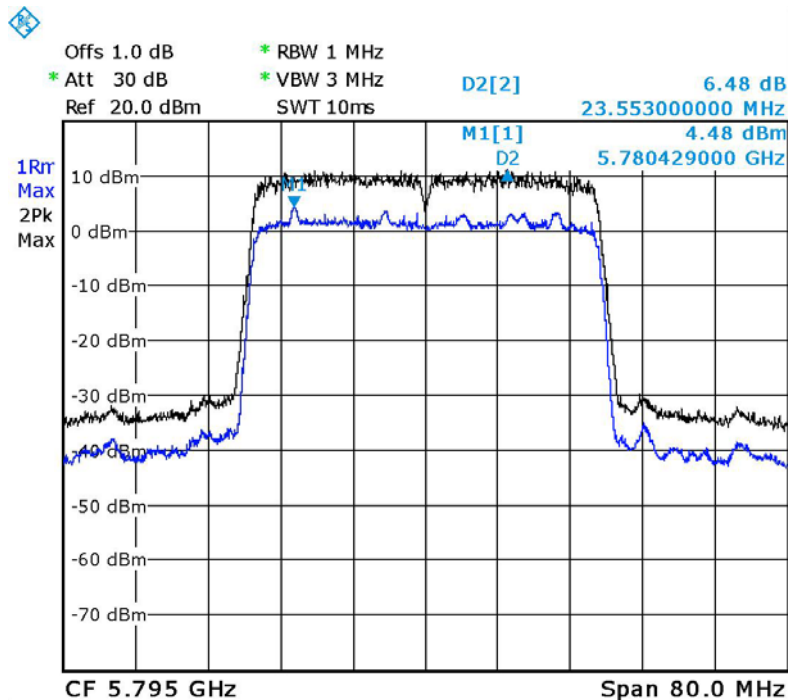
Date: 23.APR.2014 04:48:00

### Antenna 2: Peak Excursion, Low Channel



Date: 23.APR.2014 05:03:42

### Antenna 2: Peak Excursion, High Channel



Date: 23.APR.2014 05:05:14

\*\*\*\*\* END OF REPORT \*\*\*\*\*