

# ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

## INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

OF

**Product Name:** GLADIUS 5

**Brand Name:** ARBOR

**Marketing Name:** GLADIUS 5

**Model No.:** G551BA, G55XXXX (X=0~9, A~Z)

**Model Difference:** Please refer to page 7

**FCC ID:** 2ACHW-G55

**Report No.:** EH/2014/10020A-04

**Issue Date:** Aug. 21, 2014

**FCC Rule Part:** §15.225

**Prepared for:** ARBOR Technology Corp.  
10F., No.700, Zhongzheng Rd., Zhonghe Dist., New Taipei City, Taiwan

**Prepared by:** SGS Taiwan Ltd.  
Electronics & Communication Laboratory  
No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan 24803



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## VERIFICATION OF COMPLIANCE

**Applicant:** ARBOR Technology Corp.  
10F., No.700, Zhongzheng Rd., Zhonghe Dist., New Taipei City,  
Taiwan

**Product Name:** GLADIUS 5

**Brand Name:** ARBOR

**Marketing Name:** GLADIUS 5

**Model No.:** G551BA, G55XXXX (X=0~9, A~Z)

**Model Difference:** Please refer to page 7

**FCC ID:** 2ACHW-G55

**File Number:** EH/2014/10020A-04

**Date of test:** Jan. 29, 2014 ~ May. 09, 2014

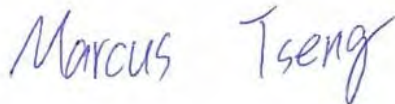
**Date of EUT Received:** Jan. 22, 2014

**We hereby certify that:**

The above equipment was tested by SGS Taiwan Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4:2009 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.225.

The test results of this report relate only to the tested sample identified in this report.

Test By:



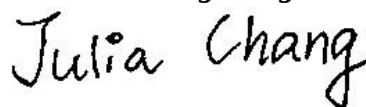
Date:

Aug. 21, 2014

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*Marcus Tseng / Engineer*

Prepared By:



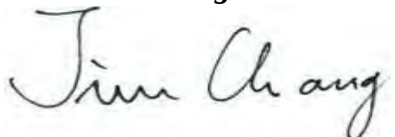
Date:

Aug. 21, 2014

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*Julia Chang / Clerk*

Approved By



Date:

Aug. 21, 2014

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*Jim Chang / Supervisor*

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## Version

| Version No. | Date          | Description                  |
|-------------|---------------|------------------------------|
| 00          | Aug. 21, 2014 | Initial creation of document |
|             |               |                              |
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## 1 GENERAL INFORMATION

### 1.1 Product Description

General:

|                    |                                                               |                                           |
|--------------------|---------------------------------------------------------------|-------------------------------------------|
| Product Name:      | GLADIUS 5                                                     |                                           |
| Brand Name:        | ARBOR                                                         |                                           |
| Marketing Name:    | GLADIUS 5                                                     |                                           |
| Model No.:         | G551BA, G55XXXX (X=0~9, A~Z)                                  |                                           |
| Model difference:  | Please refer to page 7                                        |                                           |
| Hardware Version:  | V02                                                           |                                           |
| Software Version:  | AMobile_G0550_V08                                             |                                           |
| Data Cable (USB):  | Model No.: YXT-64-MK5P-1M, Supplier: THIN STRIP OF SKY        |                                           |
| Simple Hands-Free: | Model No.: LTX-12654319-B003, Supplier: Sanmu                 |                                           |
| Power Supply:      | 3.7Vdc Rechargeable Li-ion Battery or 5Vdc from AC/DC Adapter |                                           |
|                    | Battery:                                                      | Model: G0550B01, Supplier: Japone         |
|                    | Adapter:                                                      | Model No.: BSYB050150U USB, Supplier: BSY |

NFC:

|                      |                    |
|----------------------|--------------------|
| Operating Frequency: | 13.56MHz           |
| Transmit Power:      | < 123dBuV/m at 3m. |
| Number of Channels:  | 1                  |
| Antenna Type:        | Loop Antenna       |
| Modulation Type:     | ASK, BPSK          |

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## Model Difference:

|                |                   |                                                                                         |                    |                                                      |
|----------------|-------------------|-----------------------------------------------------------------------------------------|--------------------|------------------------------------------------------|
| <b>G55XXXX</b> | <b>55</b>         | <b>X</b>                                                                                | <b>X</b>           | <b>XX</b>                                            |
| <b>Model</b>   | <b>Panel Size</b> | <b>Barcode Type</b>                                                                     | <b>Color</b>       | <b>Location</b>                                      |
| G              | 55: 5.5"          | 0:No Barcode Scanner<br>1:Honey 1D Scanner<br>2:Honey 2D Scanner<br>3:Marson 1D Scanner | B:Black<br>W:White | where X may be A-Z or blank<br>for marketing purpose |

This report complies with FCC regulatory radio rule with respect to RFID that operates on 13.56MHz.

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

This submittal(s) (test report) is intended for FCC ID: 2ACHW-G55 filing to comply with Section 15.225 of the FCC Part 15, Subpart C Rules.

## 1.3 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4:2009. Radiated testing was performed at an antenna to EUT distance 3 meters.

## 1.4 Test Facility

The measurement facilities used to collect the 3m Radiated Emission and AC power line conducted data are located on the address of SGS Taiwan Ltd. Electronics & Communication Laboratory No.134, Wu Kung Road, Wuku Industrial Zone, Taipei County, Taiwan which are constructed and calibrated to meet the FCC requirements in documents ANSI C63.4:2009. FCC Registration Number are: 990257, Canada Registration Number: 4620A-4.

The 10 m Open Area Test Sites located on the address of SGS Taiwan Ltd. Electronics & Communication Laboratory No.2, Keji 1st Rd., Guishan Township, Taoyuan County, Taiwan, which is constructed and calibrated to meet the CISPR 22/EN 55022 requirements. SGS Site No. 1(3 &10 meters) and FCC Registration Number: 455997.

## 1.5 Special Accessories

There is no special accessory used while test was conducted.

## 1.6 Equipment Modifications

There was no modification incorporated into the EUT.

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## 2 System Test Configuration

### 2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

### 2.2 EUT Exercise

An engineering test mode (software/firmware) that applicant provided was utilized to manipulate the EUT into transmit, selection of the test channel, and modulation scheme.

### 2.3 Test Procedure

#### 2.3.1 Conducted Emissions

The EUT is placed on a turn table which is 0.8 m above ground plane. According to the general criterion in Section 7.1 of ANSI C63.4:2009. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz, and the measurement procedure 7.3 in ANSI 63.4:2009 & 6.2.2 is followed to carry out the test. The CISPR Quasi-Peak and Average detector mode is employed according to §15.107

#### 2.3.2 Radiated Emissions

The EUT is placed on a turn table which is 0.8 m above ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna according to the requirements in Section 8 and 13 and of ANSI C63.4:2009.

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## 2.4 Limitation

### (1) Conducted Emission

According to section 15.207(a) and Conducted Emission Limits is as following.

| Frequency range<br>MHz                                                                                | Limits<br>dB (uV) |          |
|-------------------------------------------------------------------------------------------------------|-------------------|----------|
|                                                                                                       | Quasi-peak        | Average  |
| 0.15 to 0.50                                                                                          | 66 to 56          | 56 to 46 |
| 0.50 to 5                                                                                             | 56                | 46       |
| 5 to 30                                                                                               | 60                | 50       |
| Note                                                                                                  |                   |          |
| 1.The lower limit shall apply at the transition frequencies                                           |                   |          |
| 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz. |                   |          |

### (2) Radiated Emission

- The field strength of any emission within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.
- Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.
- Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.
- The field strength of any emissions appearing outside of the 13.110-14.010 MHz shall not exceed the general radiated emission limits in section 15.209 Table 5 and Table 6 (Intentional Radiators general limit).as below.

| Frequency<br>(MHz) | Field strength<br>$\mu\text{V/m}$ | Distance (m) | Field strength at 3m<br>$\text{dB}\mu\text{V/m}$ |
|--------------------|-----------------------------------|--------------|--------------------------------------------------|
| 1.705-30           | 30                                | 30           | 69.54                                            |
| 30-88              | 100                               | 3            | 40                                               |
| 88-216             | 150                               | 3            | 43.5                                             |
| 216-960            | 200                               | 3            | 46                                               |
| Above 960          | 500                               | 3            | 54                                               |

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- Remark:
1. Emission level in dBuV/m =  $20 \log (\mu\text{V/m})$
  2. Measurement was performed at an antenna to the closed point of EUT distance of meters.
  3. Distance extrapolation factor =  $40 \log (\text{required distance} / \text{test distance})$  (dB);
  4. The measurement was undertaken in closer distance at 3m, where extrapolation factor is offset to convert the limit of the measurement.  
Ex.  $20 * \log(30) + 40 * \log(30/3) = 69.54 \text{ dBuV/m}$
  5. Only spurious frequency is permitted to locate within the Restricted Bands specified in provision of § 15.205.
  6. The general radiated emission limits in § 15.209 apply for the spurious emission generate from UE, except for the fundamental emission where the respective section specifies otherwise.

### (3) Frequency Tolerance

The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

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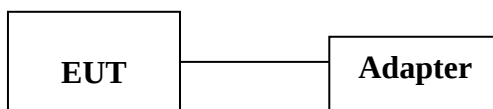
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## 2.5 Configuration of Tested System

**Fig. 2-1 Radiated Emission**



**Fig. 2-2 Conducted (Antenna Port) Configuration**



**Table 2-1 Equipment Used in Tested System**

| Item | Equipment | Mfr/Brand | Model/Type No. | Series No. | Data Cable | Power Cord |
|------|-----------|-----------|----------------|------------|------------|------------|
| 1.   | N/A       |           |                |            |            |            |

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Fig. 2-3 AC Power Line Conducted Emission

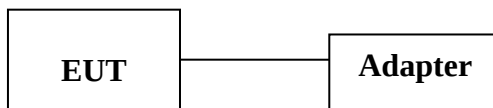


Table 2-2 Equipment Used in Tested System

| Item | Equipment | Mfr/Brand | Model/Type No. | Series No. | Data Cable | Power Cord |
|------|-----------|-----------|----------------|------------|------------|------------|
| 1.   | N/A       |           |                |            |            |            |

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### 3 Summary of Test Results

| FCC Rules                | Description Of Test                           | Result    |
|--------------------------|-----------------------------------------------|-----------|
| § 15.207                 | AC Power Line Conducted Emission              | Compliant |
| § 15.225 (a)-(d)         | Radiated Emission                             | Compliant |
| § 15.209                 | Radiated Emission Limits, general requirement | Compliant |
| § 15.225 (e)             | Frequency Stability                           | Compliant |
| § 2.1049<br>§ 15.215 (c) | 20 dB OCCUPIED BANDWIDTH                      | Compliant |
| § 15.203                 | Antenna Requirement                           | Compliant |

### 4 Description of test modes

The EUT stay in continuous transmitting mode. The frequency 13.56 MHz is the default channel to test, where it is the only manipulative channel as this application supports.

The field strength of spurious radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for Bluetooth Transmitter for channel Low, Mid and High the worst case H position was reported.

The data rate as the lowest supported is selected while tests are conducted.

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## 5 MEASUREMENT UNCERTAINTY

| Test Items                       | Uncertainty             |
|----------------------------------|-------------------------|
| AC Power Line Conducted Emission | +/- 2.586 dB            |
| Frequency Stability              | +/- 123.36 Hz           |
| 20 dB OCCUPIED BANDWIDTH         | +/- 123.36 Hz           |
| Temperature                      | +/- 0.8 °C              |
| Humidity                         | +/- 4.7 %               |
| DC / AC Power Source             | DC= +/- 1%, AC=+/- 0.2% |

Radiated Spurious Emission:

|                                                              |                            |
|--------------------------------------------------------------|----------------------------|
| Measurement uncertainty<br>(Polarization : <b>Vertical</b> ) | 30MHz - 180MHz: +/- 3.37dB |
|                                                              | 180MHz -417MHz: +/- 3.19dB |
|                                                              | 0.417GHz-1GHz: +/- 3.19dB  |

|                                                                |                            |
|----------------------------------------------------------------|----------------------------|
| Measurement uncertainty<br>(Polarization : <b>Horizontal</b> ) | 30MHz - 167MHz: +/- 4.22dB |
|                                                                | 167MHz -500MHz: +/- 3.44dB |
|                                                                | 0.5GHz-1GHz: +/- 3.39dB    |

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

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## 6 Conducted Emissions Test

### 6.1 Standard Applicable:

According to §15.207, frequency range within 150kHz to 30MHz shall not exceed the Limit table as below.

| Frequency range<br>MHz                                                                                                                                                       | Limits<br>dB(uV) |          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|----------|
|                                                                                                                                                                              | Quasi-peak       | Average  |
| 0.15 to 0.50                                                                                                                                                                 | 66 to 56         | 56 to 46 |
| 0.50 to 5                                                                                                                                                                    | 56               | 46       |
| 5 to 30                                                                                                                                                                      | 60               | 50       |
| Note<br>1.The lower limit shall apply at the transition frequencies<br>2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz. |                  |          |

### 6.2 Measurement Equipment Used:

| Conducted Emission Test Site |            |                         |                  |              |            |
|------------------------------|------------|-------------------------|------------------|--------------|------------|
| EQUIPMENT<br>TYPE            | MFR        | MODEL<br>NUMBER         | SERIAL<br>NUMBER | LAST<br>CAL. | CAL DUE.   |
| EMI Test Receiver            | R&S        | ESCI7                   | 100760           | 05/27/2013   | 05/26/2014 |
| LISN                         | Rolf-Heine | NNB-2/16Z               | 99012            | 03/26/2014   | 03/25/2015 |
| LISN                         | FCC        | FCC-LISN-50/250-25-2-01 | 04034            | 03/19/2014   | 03/18/2015 |
| Coaxial Cables               | N/A        | WK CE Cable             | N/A              | 11/26/2013   | 11/25/2014 |

### 6.3 EUT Setup:

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.4-2009.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

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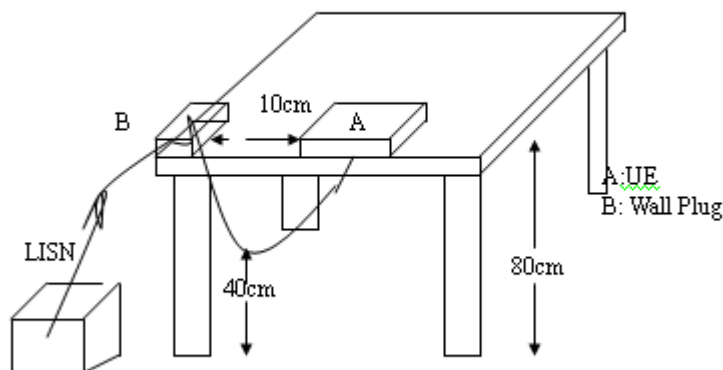
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#### 6.4 Test SET-UP (Block Diagram of Configuration)



#### 6.5 Measurement Procedure:

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

#### 6.6 Measurement Result:

Note: Refer to next page for measurement data and plots.

Note2: The \* reveals the worst-case results that closet to the limit

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## AC POWER LINE CONDUCTED EMISSION TEST DATA

|                 |                |           |      |            |               |
|-----------------|----------------|-----------|------|------------|---------------|
| Operation Mode: | Operation mode |           |      | Test Date: | May. 02, 2014 |
| Temperature:    | 26 °C          | Humidity: | 60 % | Test By:   | Nick          |

Site ConductionRoom

Phase: L1

Temperature: 26 °C

Limit: FCC Class B Conduction(QP)

Power: AC 120V/60Hz

Humidity: 60%

Mode: OperationMode

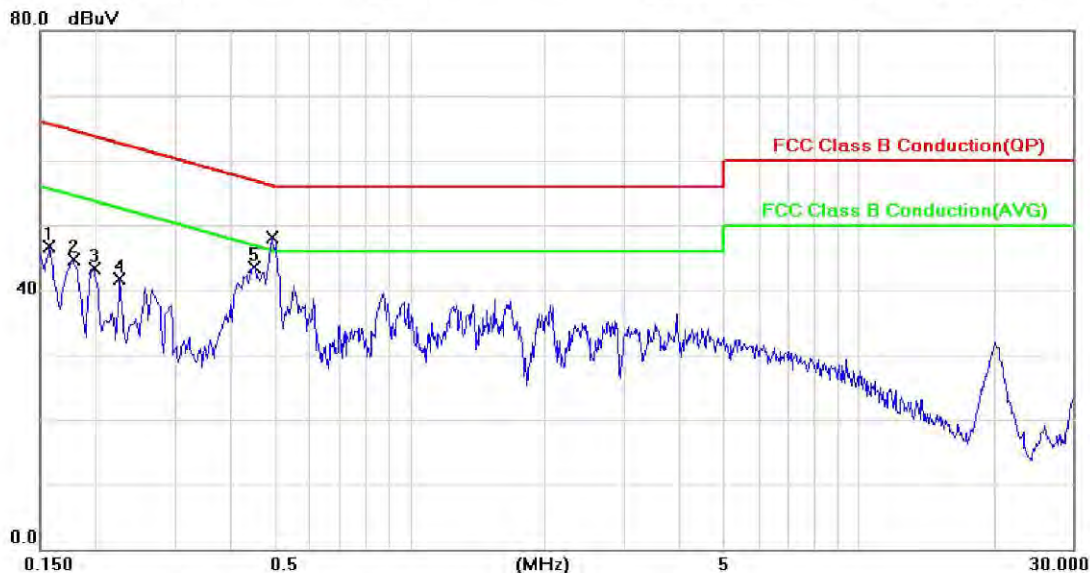
Note:

## ConductedEmission

Data: #4

Date: 2014/5/2

Time: 下午 05:12:20



| No. | Mk. | Freq.  | Reading Level | Correct Factor | Measurement | Limit | Over   | Detector | Comment |
|-----|-----|--------|---------------|----------------|-------------|-------|--------|----------|---------|
|     |     | MHz    | dBuV          | dB             | dBuV        | dBuV  | dB     |          |         |
| 1   |     | 0.1580 | 46.61         | 0.16           | 46.77       | 65.57 | -18.80 | peak     |         |
| 2   |     | 0.1780 | 44.50         | 0.16           | 44.66       | 64.58 | -19.92 | peak     |         |
| 3   |     | 0.1980 | 43.21         | 0.16           | 43.37       | 63.69 | -20.32 | peak     |         |
| 4   |     | 0.2260 | 41.49         | 0.16           | 41.65       | 62.60 | -20.95 | peak     |         |
| 5   |     | 0.4500 | 43.37         | 0.16           | 43.53       | 56.88 | -13.35 | peak     |         |
| 6 * |     | 0.4940 | 47.00         | 0.16           | 47.16       | 56.10 | -8.94  | QP       |         |
| 7   |     | 0.4940 | 37.00         | 0.16           | 37.16       | 46.10 | -8.94  | AVG      |         |

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Site: ConductionRoom

Phase: N

Temperature: 26 °C

Limit: FCC Class B Conduction(QP)

Power: AC 120V/60Hz

Humidity: 60%

Mode: OperationMode

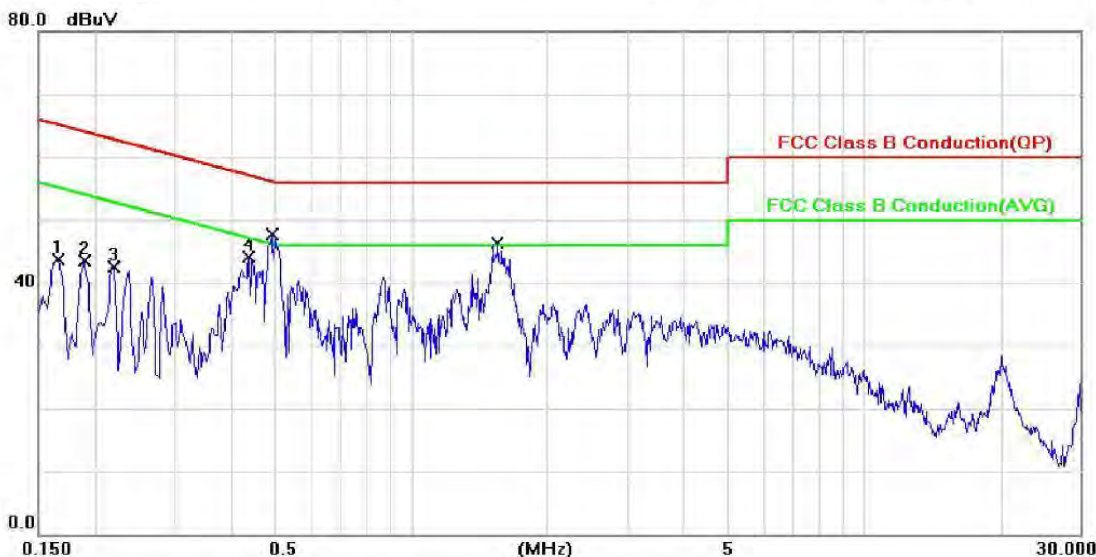
Note:

### Conducted Emission

Data: #3

Date: 2014/5/2

Time: 下午 05:05:35



| No. | Mk. | Freq.  | Reading Level | Correct Factor | Measurement | Limit | Over   |          |         |
|-----|-----|--------|---------------|----------------|-------------|-------|--------|----------|---------|
|     |     | MHz    | dBuV          | dB             | dBuV        | dBuV  | dB     | Detector | Comment |
| 1   |     | 0.1660 | 43.43         | 0.18           | 43.61       | 65.16 | -21.55 | peak     |         |
| 2   |     | 0.1900 | 43.33         | 0.19           | 43.52       | 64.04 | -20.52 | peak     |         |
| 3   |     | 0.2220 | 42.28         | 0.19           | 42.47       | 62.74 | -20.27 | peak     |         |
| 4   |     | 0.4380 | 43.90         | 0.19           | 44.09       | 57.10 | -13.01 | peak     |         |
| 5 * |     | 0.4940 | 46.10         | 0.19           | 46.29       | 56.10 | -9.81  | QP       |         |
| 6   |     | 0.4940 | 33.00         | 0.19           | 33.19       | 46.10 | -12.91 | AVG      |         |
| 7   |     | 1.5580 | 41.30         | 0.23           | 41.53       | 56.00 | -14.47 | QP       |         |
| 8   |     | 1.5580 | 29.50         | 0.23           | 29.73       | 46.00 | -16.27 | AVG      |         |

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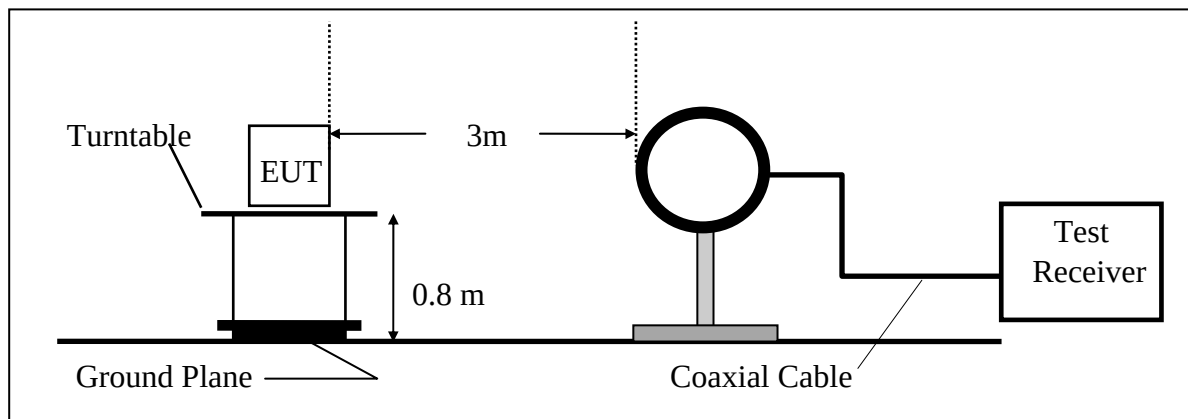
## 7 Radiated Emission Test

### 7.1 Measurement Procedure

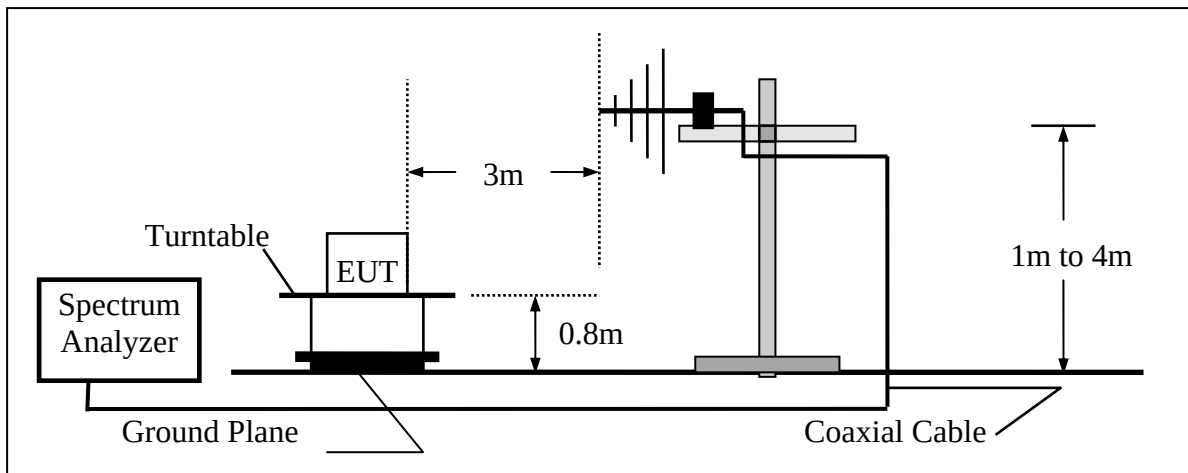
1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

### 7.2 Test SET-UP (Block Diagram of Configuration)

#### (A) Radiated Emission Test Set-Up, Frequency Below 30MHz



#### (B) Radiated Emission Test Set-Up, Frequency Below 1000MHz



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### 7.3 Measurement Equipment Used:

| 966 Chamber           |              |              |               |            |            |
|-----------------------|--------------|--------------|---------------|------------|------------|
| EQUIPMENT TYPE        | MFR          | MODEL NUMBER | SERIAL NUMBER | LAST CAL.  | CAL DUE.   |
| EMI Test Receiver     | R&S          | ESCI7        | 100760        | 05/27/2013 | 05/26/2014 |
| Spectrum Analyzer     | Agilent      | E4446A       | MY51100003    | 05/30/2013 | 05/29/2014 |
| EXA Spectrum Analyzer | Agilent      | N9010A       | MY50420195    | 01/20/2014 | 01/19/2015 |
| Bilog Antenna         | SCHWAZBECK   | VULB9168     | 378           | 01/02/2014 | 01/01/2015 |
| Loop Antenna          | ETS.LINDGREN | 6502         | 00148045      | 07/05/2013 | 07/04/2014 |
| Pre-Amplifier         | Agilent      | 8447D        | 2944A07676    | 01/03/2014 | 01/02/2015 |
| Turn Table            | HD           | DT420        | N/A           | N.C.R      | N.C.R      |
| Antenna Tower         | HD           | MA240-N      | 240/657       | N.C.R      | N.C.R      |
| Controller            | HD           | HD100        | N/A           | N.C.R      | N.C.R      |
| Low Loss Cable        | Huber Suhner | 966_Rx       | 9             | 01/03/2014 | 01/02/2015 |
| 3m Site NSA           | SGS          | 966 chamber  | N/A           | 07/15/2013 | 07/14/2014 |

### 7.4 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

|       |                        |                                            |
|-------|------------------------|--------------------------------------------|
| Where | FS = Field Strength    | CL = Cable Attenuation Factor (Cable Loss) |
|       | RA = Reading Amplitude | AG = Amplifier Gain                        |
|       | AF = Antenna Factor    |                                            |

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## 7.5 Field Strength of Fundamental Emission

### 7.5.1 Limit

Field strength of fundamental emissions limit:

The field strength of fundamental emissions shall not exceed 15848 micorvolts/meter at 30 meters. The Limit is converted to 123.90dBuV/m by offsetting the distance extrapolation factor as measurement distance is taken place at 3 meters.

$$\text{Distance extrapolation} = 40 * \log (30/3) = 40 \text{ dB}$$

$$\text{Limit is re-adjusted in terms of limit taken in 3m} = 20 * \log (15848 \text{ uV/m}) + 40 = 124.00\text{dBuV/m}$$

Note:

Actual FS(dB $\mu$ V/m) = Spectrum. Reading level(dB $\mu$ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB $\mu$ V/m) + Cable Loss(dB) – Pre\_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we’ve employed is peak detector.

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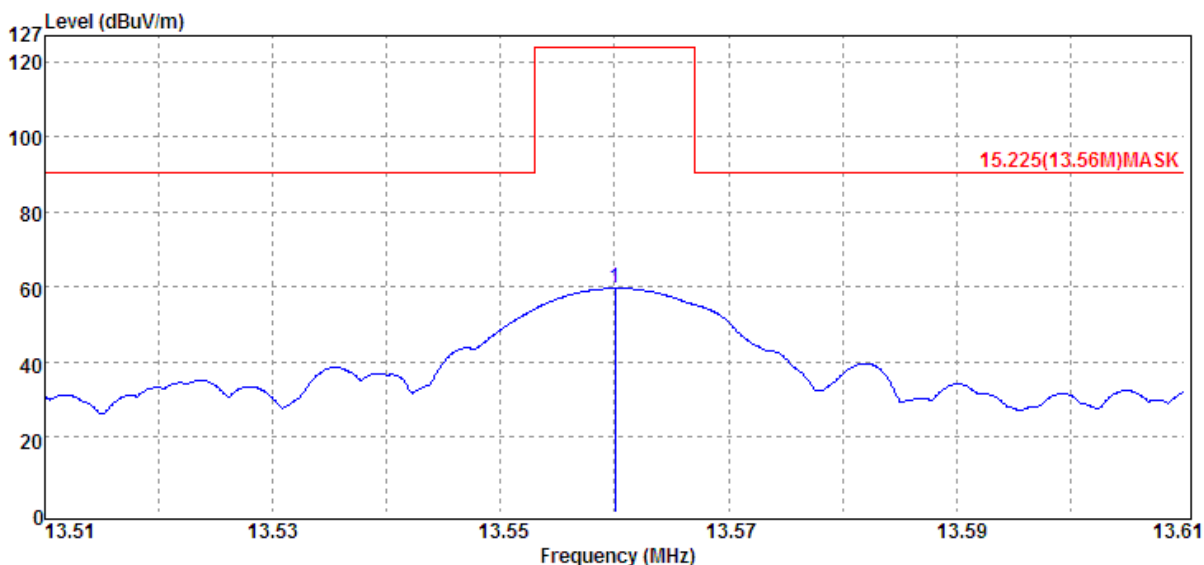
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|                       |            |                          |                  |
|-----------------------|------------|--------------------------|------------------|
| Operation Band        | :NFC       | Test Date                | :2014-05-03      |
| Fundamental Frequency | :13.56 MHz | Temp./Humi.              | :19.2 deg_C/58RH |
| Operation Mode        | :MAIN      | Engineer                 | :Curry           |
| EUT Pol.              | :H Plane   | Measurement Antenna Pol. | :VERTICAL        |

| Freq. | Note    | Detector | Spectrum      | Factor | Actual       | Limit        | Margin |
|-------|---------|----------|---------------|--------|--------------|--------------|--------|
|       |         | Mode     | Reading Level |        | FS           | @3m          |        |
| MHz   | F/H/E/S | PK/QP/AV | dB $\mu$ V    | dB     | dB $\mu$ V/m | dB $\mu$ V/m | dB     |
| 13.56 | F       | Peak     | 47.98         | 11.72  | 59.70        | 123.90       | -64.20 |



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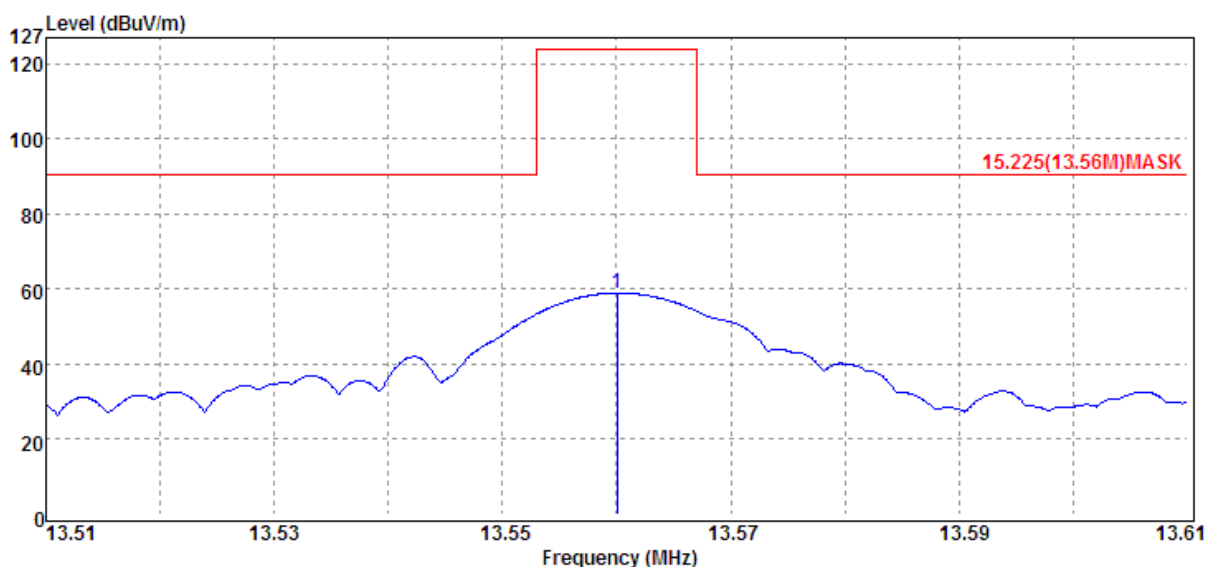
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|                       |            |                          |                  |
|-----------------------|------------|--------------------------|------------------|
| Operation Band        | :NFC       | Test Date                | :2014-05-03      |
| Fundamental Frequency | :13.56 MHz | Temp./Humi.              | :19.2 deg_C/58RH |
| Operation Mode        | :MAIN      | Engineer                 | :Curry           |
| EUT Pol.              | :H Plane   | Measurement Antenna Pol. | :HORIZONTAL      |

| Freq. | Note    | Detector | Spectrum      | Factor | Actual       | Limit        | Margin |
|-------|---------|----------|---------------|--------|--------------|--------------|--------|
| MHz   | F/H/E/S | Mode     | Reading Level | dB     | FS           | @3m          | dB     |
| MHz   | F/H/E/S | PK/QP/AV | dB $\mu$ V    | dB     | dB $\mu$ V/m | dB $\mu$ V/m | dB     |
| 13.56 | F       | Peak     | 47.26         | 11.72  | 58.98        | 123.90       | -64.92 |



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## 7.5.2 Radiated Mask

- (a) 15.848 millivolts/m (84 dB $\mu$ V/m) at 30 m, within the band 13.553-13.567 MHz.
- (b) 334 microvolts/m (50.5 dB $\mu$ V/m) at 30 m, within the bands 13.410-13.553 MHz and 13.567-13.710 MHz.
- (c) 106 microvolts/m (40.5 dB $\mu$ V/m) at 30 m, within the bands 13.110-13.410 MHz and 13.710-14.010 MHz.

Distance extrapolation =  $40 * \log(30/3) = 40$  dB

Limit is re-adjusted in terms of limit taken in 3m for the following frequency segment of the interest:

- a)  $20 * \log(15848 \mu\text{V/m}) + 40\text{dB} = 124.00\text{dB}\mu\text{V/m}$
- b)  $20 * \log(334 \mu\text{V/m}) + 40\text{dB} = 90.47\text{dB}\mu\text{V/m}$
- c)  $20 * \log(106 \mu\text{V/m}) + 40\text{dB} = 80.50\text{dB}\mu\text{V/m}$

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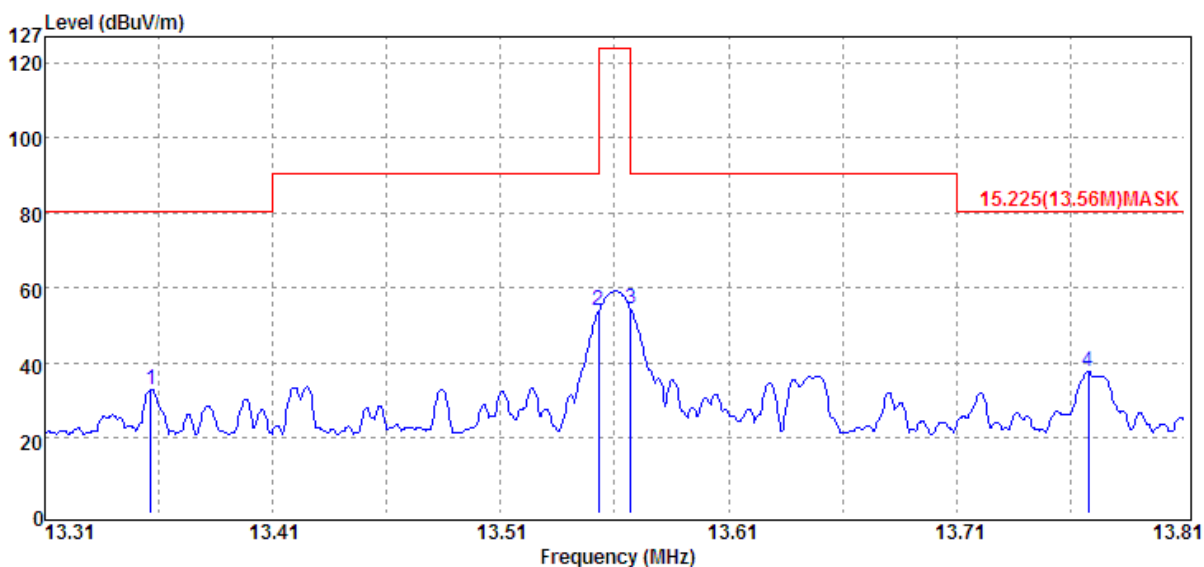
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|                       |            |                          |                  |
|-----------------------|------------|--------------------------|------------------|
| Operation Band        | :NFC       | Test Date                | :2014-05-03      |
| Fundamental Frequency | :13.56 MHz | Temp./Humi.              | :19.2 deg_C/58RH |
| Operation Mode        | :MASK      | Engineer                 | :Curry           |
| EUT Pol.              | :H Plane   | Measurement Antenna Pol. | :VERTICAL        |



| Freq. | Note    | Detector | Spectrum      | Factor | Actual | Limit  | Margin |
|-------|---------|----------|---------------|--------|--------|--------|--------|
|       |         | Mode     | Reading Level |        | FS     | @3m    |        |
| MHz   | F/H/E/S | PK/QP/AV | dBμV          | dB     | dBμV/m | dBμV/m | dB     |
| 13.36 | S       | Peak     | 21.34         | 11.74  | 33.08  | 80.50  | -47.42 |
| 13.55 | S       | Peak     | 42.21         | 11.72  | 53.93  | 90.47  | -36.54 |
| 13.57 | S       | Peak     | 42.98         | 11.72  | 54.70  | 90.47  | -35.77 |
| 13.77 | S       | Peak     | 26.26         | 11.70  | 37.96  | 80.50  | -42.54 |

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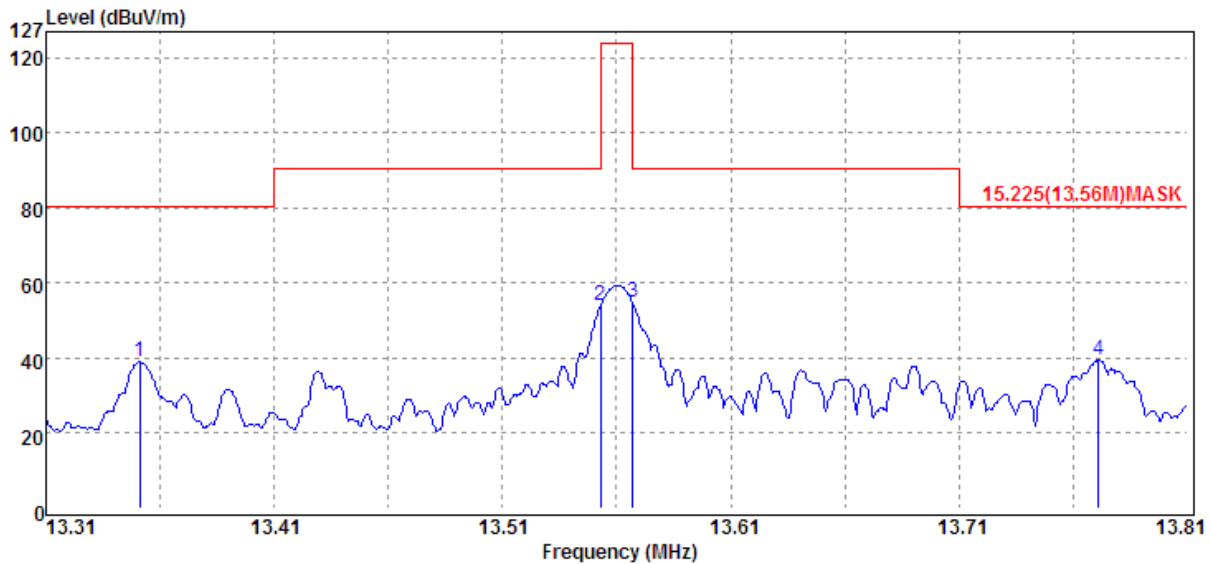
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|                       |            |                          |                  |
|-----------------------|------------|--------------------------|------------------|
| Operation Band        | :NFC       | Test Date                | :2014-05-03      |
| Fundamental Frequency | :13.56 MHz | Temp./Humi.              | :19.2 deg_C/58RH |
| Operation Mode        | :MASK      | Engineer                 | :Curry           |
| EUT Pol.              | :H Plane   | Measurement Antenna Pol. | :HORIZONTAL      |



| Freq. | Note    | Detector | Spectrum      | Factor | Actual       | Limit        | Margin |
|-------|---------|----------|---------------|--------|--------------|--------------|--------|
|       |         | Mode     | Reading Level |        | FS           | @3m          |        |
| MHz   | F/H/E/S | PK/QP/AV | dB $\mu$ V    | dB     | dB $\mu$ V/m | dB $\mu$ V/m | dB     |
| 13.35 | S       | Peak     | 27.22         | 11.74  | 38.96        | 80.50        | -41.54 |
| 13.55 | S       | Peak     | 42.39         | 11.72  | 54.11        | 90.47        | -36.36 |
| 13.57 | S       | Peak     | 43.16         | 11.72  | 54.88        | 90.47        | -35.59 |
| 13.77 | S       | Peak     | 27.79         | 11.70  | 39.49        | 80.50        | -41.01 |

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### 7.5.3 Radiated Emission –

Limit:

§ 15.225

(d) 30 microvolts/m (29.4 dB $\mu$ V/m) at 30 m, outside the band 13.110-14.010 MHz.

Limit is converted by adding the distance extrapolation factor as the measurement distance was taken place at 3m.

|                       |            |                          |                  |
|-----------------------|------------|--------------------------|------------------|
| Operation Band        | :NFC       | Test Date                | :2014-05-03      |
| Fundamental Frequency | :13.56 MHz | Temp./Humi.              | :19.2 deg_C/58RH |
| Operation Mode        | :TX        | Engineer                 | :Curry           |
| EUT Pol.              | :H Plane   | Measurement Antenna Pol. | :VERTICAL        |

| Freq. | Note    | Detector<br>Mode | Spectrum<br>Reading Level | Factor | Actual<br>FS | Limit<br>@3m | Margin |
|-------|---------|------------------|---------------------------|--------|--------------|--------------|--------|
| MHz   | F/H/E/S | PK/QP/AV         | dB $\mu$ V                | dB     | dB $\mu$ V/m | dB $\mu$ V/m | dB     |
| 10.72 | S       | Peak             | 11.79                     | 11.95  | 23.74        | 69.54        | -45.80 |
| 12.26 | S       | Peak             | 11.33                     | 11.81  | 23.14        | 69.54        | -46.40 |
| 15.68 | S       | Peak             | 11.31                     | 11.57  | 22.88        | 69.54        | -46.66 |
| 17.54 | S       | Peak             | 11.31                     | 11.46  | 22.77        | 69.54        | -46.77 |
| 20.64 | S       | Peak             | 11.87                     | 11.15  | 23.02        | 69.54        | -46.52 |
| 25.26 | S       | Peak             | 11.89                     | 9.96   | 21.85        | 69.54        | -47.69 |
| 27.12 | H       | Peak             | 32.18                     | 9.53   | 41.71        | 69.54        | -27.83 |

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|-----------------------|------------|--------------------------|------------------|
| Operation Band        | :NFC       | Test Date                | :2014-05-03      |
| Fundamental Frequency | :13.56 MHz | Temp./Humi.              | :19.2 deg_C/58RH |
| Operation Mode        | :TX        | Engineer                 | :Curry           |
| EUT Pol.              | :H Plane   | Measurement Antenna Pol. | :HORIZONTAL      |

| Freq. | Note    | Detector | Spectrum      | Factor | Actual       | Limit        | Margin |
|-------|---------|----------|---------------|--------|--------------|--------------|--------|
|       |         | Mode     | Reading Level |        | FS           | @3m          |        |
| MHz   | F/H/E/S | PK/QP/AV | dB $\mu$ V    | dB     | dB $\mu$ V/m | dB $\mu$ V/m | dB     |
| 10.62 | S       | Peak     | 11.86         | 11.95  | 23.81        | 69.54        | -45.73 |
| 12.10 | S       | Peak     | 10.57         | 11.83  | 22.40        | 69.54        | -47.14 |
| 16.16 | S       | Peak     | 10.86         | 11.55  | 22.41        | 69.54        | -47.13 |
| 17.98 | S       | Peak     | 10.13         | 11.44  | 21.57        | 69.54        | -47.97 |
| 20.74 | S       | Peak     | 10.26         | 11.13  | 21.39        | 69.54        | -48.15 |
| 24.12 | S       | Peak     | 11.39         | 10.23  | 21.62        | 69.54        | -47.92 |
| 27.12 | H       | Peak     | 9.41          | 9.53   | 18.94        | 69.54        | -50.60 |

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|-----------------------|------------|--------------------------|------------------|
| Operation Band        | :NFC       | Test Date                | :2014-05-03      |
| Fundamental Frequency | :13.56 MHz | Temp./Humi.              | :19.2 deg_C/58RH |
| Operation Mode        | :TX        | Engineer                 | :Curry           |
| EUT Pol.              | :H Plane   | Measurement Antenna Pol. | :VERTICAL        |

| Freq.  | Note    | Detector | Spectrum      | Factor | Actual       | Limit        | Margin |
|--------|---------|----------|---------------|--------|--------------|--------------|--------|
|        |         | Mode     | Reading Level |        | FS           | @3m          |        |
| MHz    | F/H/E/S | PK/QP/AV | dB $\mu$ V    | dB     | dB $\mu$ V/m | dB $\mu$ V/m | dB     |
| 40.68  | H       | ---      |               |        |              |              |        |
| 54.24  | H       | ---      |               |        |              |              |        |
| 67.80  | H       | ---      |               |        |              |              |        |
| 81.36  | H       | ---      |               |        |              |              |        |
| 94.92  | H       | ---      |               |        |              |              |        |
| 108.48 | H       | ---      |               |        |              |              |        |
| 122.04 | H       | ---      |               |        |              |              |        |
| 135.60 | H       | ---      |               |        |              |              |        |
| 30.97  | S       | Peak     | 32.54         | -14.03 | 18.51        | 40.00        | -21.49 |
| 143.49 | S       | Peak     | 28.09         | -13.02 | 15.07        | 43.50        | -28.43 |
| 316.15 | S       | Peak     | 27.99         | -10.99 | 17.00        | 46.00        | -29.00 |
| 343.31 | S       | Peak     | 28.46         | -10.43 | 18.03        | 46.00        | -27.97 |
| 358.83 | S       | Peak     | 27.94         | -10.04 | 17.90        | 46.00        | -28.10 |
| 766.23 | S       | Peak     | 28.01         | -2.79  | 25.22        | 46.00        | -20.78 |

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|-----------------------|------------|--------------------------|------------------|
| Operation Band        | :NFC       | Test Date                | :2014-05-03      |
| Fundamental Frequency | :13.56 MHz | Temp./Humi.              | :19.2 deg_C/58RH |
| Operation Mode        | :TX        | Engineer                 | :Curry           |
| EUT Pol.              | :H Plane   | Measurement Antenna Pol. | :HORIZONTAL      |

| Freq.  | Note    | Detector | Spectrum      | Factor | Actual       | Limit        | Margin |
|--------|---------|----------|---------------|--------|--------------|--------------|--------|
|        |         | Mode     | Reading Level |        | FS           | @3m          |        |
| MHz    | F/H/E/S | PK/QP/AV | dB $\mu$ V    | dB     | dB $\mu$ V/m | dB $\mu$ V/m | dB     |
| 40.68  | H       | ---      |               |        |              |              |        |
| 54.24  | H       | ---      |               |        |              |              |        |
| 67.80  | H       | ---      |               |        |              |              |        |
| 81.36  | H       | ---      |               |        |              |              |        |
| 94.92  | H       | ---      |               |        |              |              |        |
| 108.48 | H       | ---      |               |        |              |              |        |
| 122.04 | H       | ---      |               |        |              |              |        |
| 135.60 | H       | ---      |               |        |              |              |        |
| 161.92 | S       | Peak     | 26.95         | -12.69 | 14.26        | 43.50        | -29.24 |
| 273.47 | S       | Peak     | 28.39         | -11.81 | 16.58        | 46.00        | -29.42 |
| 385.02 | S       | Peak     | 27.59         | -9.47  | 18.12        | 46.00        | -27.88 |
| 587.75 | S       | Peak     | 27.68         | -5.13  | 22.55        | 46.00        | -23.45 |
| 679.90 | S       | Peak     | 27.53         | -3.67  | 23.86        | 46.00        | -22.14 |
| 798.24 | S       | Peak     | 27.17         | -2.33  | 24.84        | 46.00        | -21.16 |

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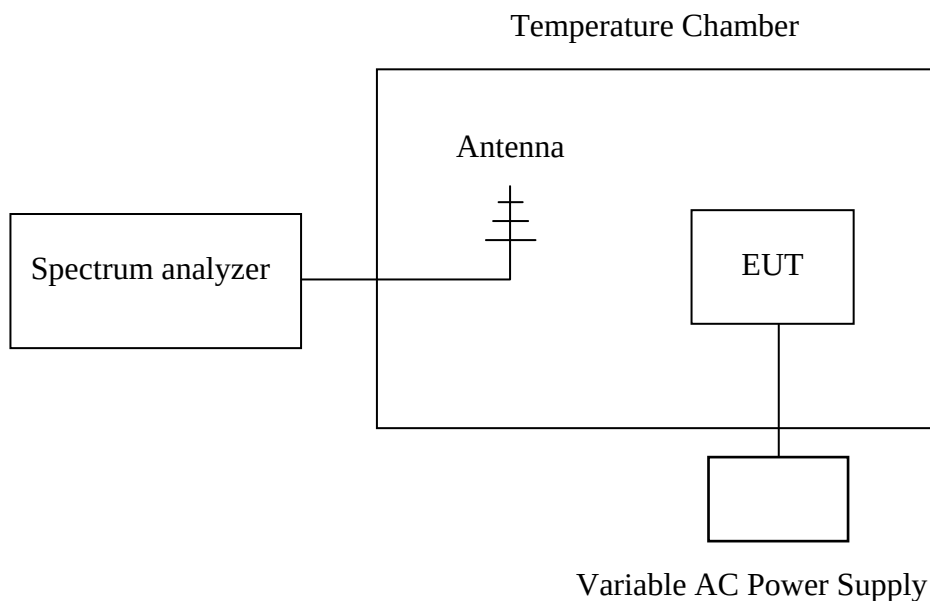
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## 8 Frequency Tolerance

### 8.1 Measurement Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set EUT as normal operation
3. Set SPA Center Frequency = fundamental frequency, RBW, VBW= 10kHz, Span =100kHz.
4. Set SPA Max hold. Mark peak.

### 8.2 Test SET-UP (Block Diagram of Configuration)



### 8.3 Measurement Equipment Used:

| Conducted Emission Test Site |          |              |               |            |            |
|------------------------------|----------|--------------|---------------|------------|------------|
| EQUIPMENT TYPE               | MFR      | MODEL NUMBER | SERIAL NUMBER | LAST CAL.  | CAL DUE.   |
| Spectrum Analyzer            | Agilent  | E4446A       | MY51100003    | 05/30/2013 | 05/29/2014 |
| Temperature Chamber          | TERCHY   | MHG-120LF    | 911009        | 05/07/2014 | 05/06/2015 |
| AC Power Supply              | APW-105N | 887592       | All Power     | N/A        | N/A        |

### 8.4 Measurement Results

Refer to attached data chart.

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## A. Temperature Variation

| Power Supply | Environment      | Frequency | Delta (Hz) | Limit (KHz) |
|--------------|------------------|-----------|------------|-------------|
| Vdc          | Temperature (°C) | (MHz)     |            |             |
| 3.7          | -20              | 13.560332 | -158.00    | +/- 1.356   |
| 3.7          | -10              | 13.560427 | -253.00    | +/- 1.356   |
| 3.7          | 0                | 13.560299 | -125.00    | +/- 1.356   |
| 3.7          | 10               | 13.560246 | -72.00     | +/- 1.356   |
| 3.7          | 20               | 13.560174 | 0.00       | +/- 1.356   |
| 3.7          | 30               | 13.560284 | -110.00    | +/- 1.356   |
| 3.7          | 40               | 13.560371 | -197.00    | +/- 1.356   |
| 3.7          | 50               | 13.560369 | -195.00    | +/- 1.356   |

## B. Supply Voltage Variation

| Power Supply | Environment      | Frequency | Delta (Hz) | Limit (KHz) |
|--------------|------------------|-----------|------------|-------------|
| Vdc          | Temperature (°C) | (MHz)     |            |             |
| 4.2          | 20               | 13.560177 | 7.00       | +/- 1.356   |
| 3.7          | 20               | 13.560184 | 0.00       | +/- 1.356   |
| 3.2          | 20               | 13.560168 | 16.00      | +/- 1.356   |

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## 9 20 dB OCCUPIED BANDWIDTH MEASUREMENT

### 9.1 Standard Applicable:

§2.1049 & §15.215 (c)

### 9.2 Limit:

None

### 9.3 Test Set-up

Refer to section 6.2 in this report

### 9.4 Measurement Procedure

20dB bandwidth

1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak mode.
2. 20dB Bandwidth the resolution bandwidth of 1 kHz and the video bandwidth of 3 kHz were used.
3. Measured the spectrum width with power higher than 20dB below carrier.

### 9.5 Measurement Equipment Used:

Refer to section 6.3 in this report

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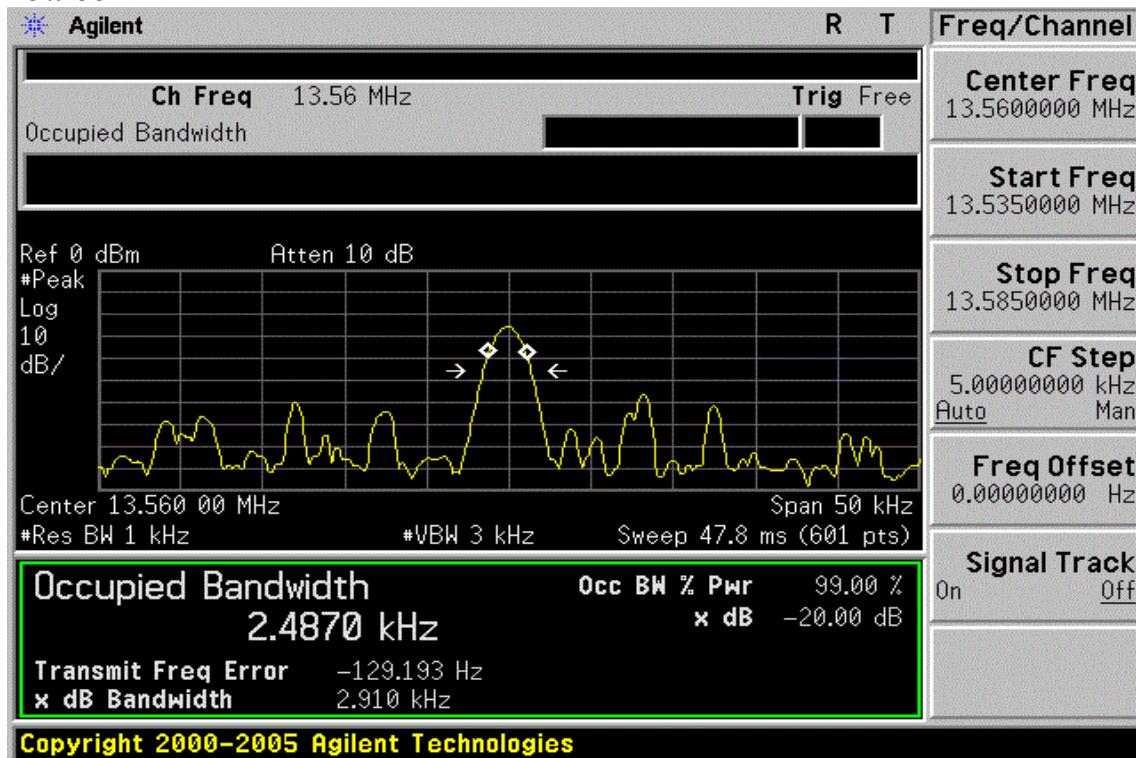
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## -20dB Bandwidth



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## 10 ANTENNA REQUIREMENT

### 10.1. Standard Applicable:

According to §15.203, Antenna requirement.

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. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on measurement or on data from the antenna manufacturer.

For transmitters of RF output power of 10 milliwatts or less, only the portion of the antenna gain that is in excess of 6 dBi (6 dB above isotropic gain) shall be added to the measured RF output power to demonstrate compliance with the radiated power limits specified in the applicable standard. For transmitters of output power greater than 10 milliwatts, the total antenna gain shall be added to the measured RF output power to demonstrate compliance to the specified radiated power limits.

### 10.2. Antenna Connected Construction:

The antenna connector is designed with unique type RF connector and no consideration of replacement. Please see EUT photo and antenna spec. for details.

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