

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

OF

Product Name: Tablet PC

Brand Name: hp

Model No.: HSTNN-Q93C

FCC ID: B94HNQ93CSPN

Report No.: E2/2015/30061

Issue Date: Apr. 30, 2015

FCC Rule Part: §15.225

Prepared for: Hewlett-Packard Company
1501 Page Mill Road, M/S1419, Palo Alto, CA
94304, United States

Prepared by: SGS Taiwan Ltd.
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VERIFICATION OF COMPLIANCE

Applicant: Hewlett-Packard Company
 1501 Page Mill Road, M/S1419, Palo Alto, CA, 94304, United States

Product Name: Tablet PC

Brand Name: hp

Model No.: HSTNN-Q93C

FCC ID: B94HNQ93CSPN

File Number: E2/2015/30061

Date of test: Mar. 16, 2015 ~ Apr. 13, 2015

Date of EUT Received: Mar. 16, 2015

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Electronics & Communication Laboratory. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10:2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits.

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

| | | | |
|---------------------|---|-------------|---------------|
| Test By: |  | Date | Apr. 30, 2015 |
| | <i>Jazz Huang / Asst. Supervisor</i> | | |
| Prepared By: |  | Date | Apr. 30, 2015 |
| | <i>Violetta Tang / Clerk</i> | | |
| Approved By: |  | Date | Apr. 30, 2015 |
| | <i>Jim Chang / Asst. Manager</i> | | |

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Revision History

| Report Number | Revision | Description | Issue Date |
|---------------|----------|------------------------------|---------------|
| E2/2015/30061 | Rev.00 | Initial creation of document | Apr. 30, 2015 |
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1 GENERAL INFORMATION

1.1 Product Description

General:

| | | |
|---|---|--|
| Product Name: | Tablet PC | |
| Brand Name: | hp | |
| Model No.: | HSTNN-Q93C | |
| Product SW/HW version | Win 8.1 / 1.0 | |
| Radio SW/HW version | 7.7.2.0 / 1.0 | |
| Power Supply: | 3.8Vdc form Rechargeable Li-ion Battery or 5.25V from AC/DC Adapter | |
| | Battery: | 1. Model No.: HSTNH-C408M-SD, Supplier: Dynapack |
| | | 2. Model No.: HSTNH-C408M-SS, Supplier: SDI (SQ) |
| | Adapter: | 1. Model No.: TPN-AA01, Supplier: AcBel |
| | | 2. Model No.: TPN-DA01, Supplier: Delta |
| 3. Model No.: TPN-LA01, Supplier: Lite-On | | |

NFC:

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

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1.2 Product Feature of Equipment Under Test

The equipment under Test (Hereafter Called: EUT) is Tablet PC supporting Wi-Fi 802.11abgn & ac, Bluetooth with NFC features, and below is details of information.

| Product Feature | |
|---------------------|---------------------|
| Product Name: | Tablet PC |
| Brand Name: | hp |
| Model No.: | HSTNN-Q93C |
| FCC ID | B94HNQ93CSPN |
| Wi-Fi Specification | 802.11a/b/g/n/ac |
| Bluetooth Version | V4.0 dual mode + HS |
| NFC Specification | NFC |

Note: The above EUT information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

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1.3 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.225

ANSI C63.10:2013

Note:

1. All test items have been performed and record as per the above standards.
2. The composite system is compliance with FCC Subpart B is authorized under the certification procedure.
3. The EUT was placed 1.5m height for frequency above 1GHz in accordance with ANSI C63.10:2013.

1.4 Test Facility

SGS Taiwan Ltd. Electronics & Communication Laboratory No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333. (TAF code 0513)

FCC Registration Numbers are: 628985

Canada Registration Number: 4620A-5

1.5 Special Accessories

There are no special accessories 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. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz. The CISPR Quasi-Peak and Average detector mode is employed according to §15.107. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

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.

2.4 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuation factor between EUT conducted port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly EUT RF output level.

Note:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Following shows an offset computation example with cable loss 1dB.

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2.5 Configuration of Tested System

Fig. 2-1 Radiated Emission & Conducted (Antenna Port) Configuration

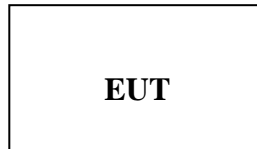


Table 2-1 Equipment Used in Tested System

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

Fig. 2-2 AC Power Line Conducted Emission

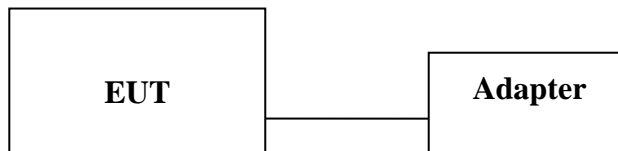


Table 2-2 Equipment Used in Tested System

| Item | Equipment | Mfr/Brand | Model/Type No. | Series No. | Data Cable | Power Cord |
|------|-------------------|-----------|----------------|------------|------------|------------|
| 1. | NFC Test Software | N/A | N/A | N/A | N/A | 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 §15.215 (c) | 20dB 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.

Note:

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

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5 MEASUREMENT UNCERTAINTY

| Test Items | Uncertainty |
|---|-----------------------------|
| AC Power Line Conducted Emission | +/- 2.586 dB |
| Peak Output Power | +/- 0.84 dB |
| 6dB Bandwidth | +/- 51.33 Hz |
| 100 KHz Bandwidth Of Frequency Band Edges | +/- 1.55 dB |
| Peak Power Density | +/- 1.3 dB |
| Temperature | +/- 0.65 °C |
| Humidity | +/- 4.6 % |
| DC / AC Power Source | DC= +/- 0.13%, AC= +/- 0.2% |

Radiated Spurious Emission:

| | |
|--|----------------------------|
| Measurement uncertainty (Polarization : Vertical) | 30MHz - 180MHz: +/- 3.37dB |
| | 180MHz -417MHz: +/- 3.19dB |
| | 0.417GHz-1GHz: +/- 3.19dB |
| | 1GHz - 18GHz: +/- 4.04dB |
| | 18GHz - 40GHz: +/- 4.04dB |

| | |
|--|----------------------------|
| Measurement uncertainty (Polarization : Horizontal) | 30MHz - 167MHz: +/- 4.22dB |
| | 167MHz -500MHz: +/- 3.44dB |
| | 0.5GHz-1GHz: +/- 3.39dB |
| | 1GHz - 18GHz: +/- 4.08dB |
| | 18GHz - 40GHz: +/- 4.08dB |

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 EMISSION TEST

6.1 Standard Applicable:

Frequency range within 150kHz to 30MHz shall not exceed the Limit table as below.

| Frequency range MHz | Limits 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.

6.2 Measurement Equipment Used:

| Conducted Emission Test Site | | | | | |
|------------------------------|--------------|-------------------|---------------|------------------|-----------------|
| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Date | Calibration Due |
| EMI Test Receiver | R&S | ESCI 3 | 101311 | 06/20/2014 | 06/19/2015 |
| Coaxial Cables | N/A | N30N30-1042-150cm | N/A | 01/06/2015 | 01/07/2016 |
| LISN | Schwarzbeck | NSLK 8127 | 8127-648 | 06/10/2014 | 06/09/2015 |
| LISN | Rolf-Heine | NNB-2/16Z | 99012 | 03/04/2015 | 03/03/2016 |
| Test Software | Farad | EZ-EMC | Ver. SGS-03A2 | N.C.R. | N.C.R. |

6.3 EUT Setup:

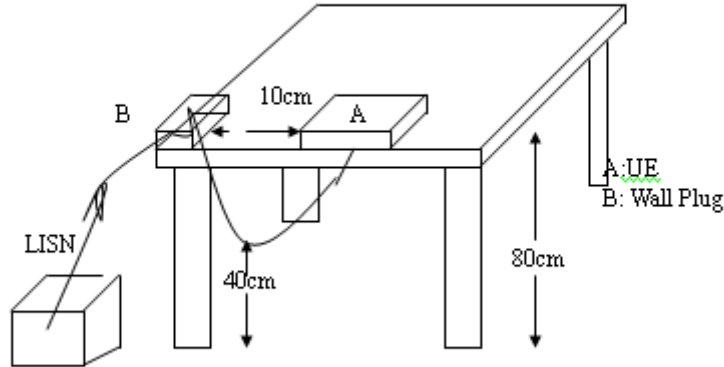
1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2013.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

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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 phases of power being supplied by given UE are completed

6.6 Measurement Result:

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

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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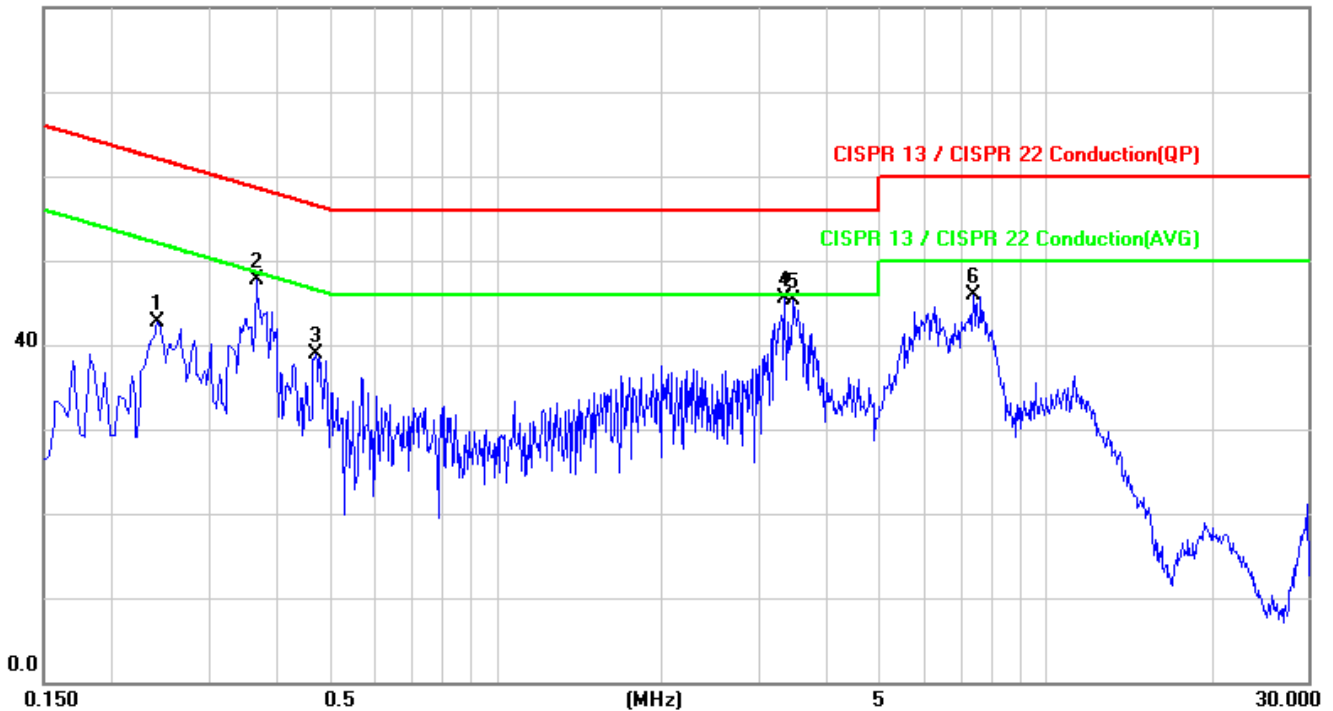
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AC POWER LINE CONDUCTED EMISSION TEST DATA

| | | | | | |
|--------------------|----------------|-----------|------|------------|---------------|
| Operation Mode: | Operation mode | | | Test Date: | Apr. 10, 2015 |
| Temperature: | 20 | Humidity: | 64 % | Test By: | Ashton |
| Adapter Model No.: | TPN-AA01 | | | | |

80.0 dBuV



| No. | Mk. | Freq. | Reading | Factor | Measurement | Limit | Over | Detector | Comment |
|-----|-----|--------|---------|--------|-------------|--------|--------|----------|---------|
| | | (MHz) | dBuV | (dB) | (dBuV) | (dBuV) | (dB) | | |
| 1 | | 0.2420 | 42.53 | 0.10 | 42.63 | 62.03 | -19.40 | peak | |
| 2 | | 0.3660 | 47.52 | 0.15 | 47.67 | 58.59 | -10.92 | peak | |
| 3 | | 0.4700 | 38.63 | 0.21 | 38.84 | 56.51 | -17.67 | peak | |
| 4 | * | 3.3620 | 44.84 | 0.60 | 45.44 | 56.00 | -10.56 | peak | |
| 5 | | 3.4740 | 44.75 | 0.60 | 45.35 | 56.00 | -10.65 | peak | |
| 6 | | 7.4020 | 45.27 | 0.65 | 45.92 | 60.00 | -14.08 | peak | |

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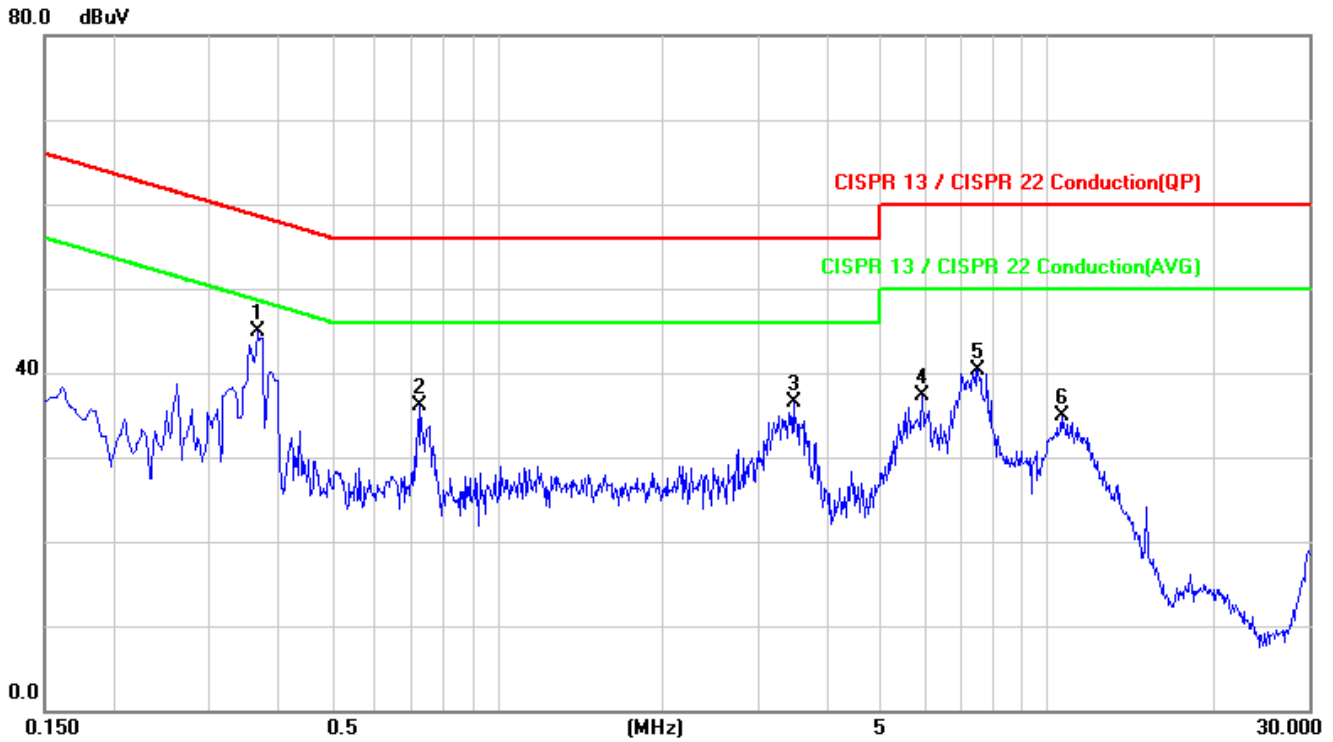
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| No. | Mk. | Freq. (MHz) | Reading dBuV | Factor (dB) | Measurement (dBuV) | Limit (dBuV) | Over (dB) | Detector | Comment |
|-----|-----|----------------|-----------------|----------------|-----------------------|-----------------|--------------|----------|---------|
| 1 | * | 0.3660 | 44.81 | 0.16 | 44.97 | 58.59 | -13.62 | peak | |
| 2 | | 0.7260 | 35.72 | 0.33 | 36.05 | 56.00 | -19.95 | peak | |
| 3 | | 3.4620 | 35.82 | 0.60 | 36.42 | 56.00 | -19.58 | peak | |
| 4 | | 5.9420 | 36.59 | 0.63 | 37.22 | 60.00 | -22.78 | peak | |
| 5 | | 7.5140 | 39.71 | 0.66 | 40.37 | 60.00 | -19.63 | peak | |
| 6 | | 10.6620 | 34.14 | 0.68 | 34.82 | 60.00 | -25.18 | peak | |

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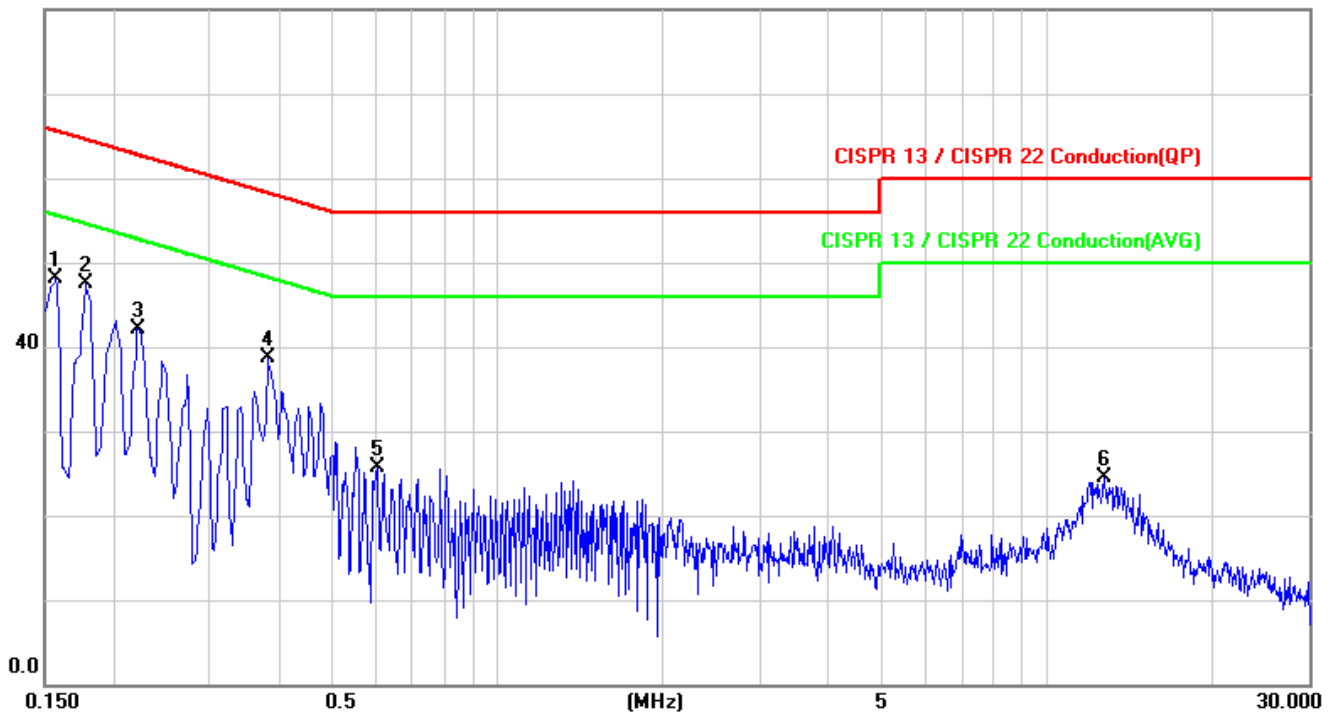
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AC POWER LINE CONDUCTED EMISSION TEST DATA

| | | | | | |
|--------------------|----------------|-----------|------|------------|---------------|
| Operation Mode: | Operation mode | | | Test Date: | Apr. 10, 2015 |
| Temperature: | 20 | Humidity: | 64 % | Test By: | Ashton |
| Adapter Model No.: | TPN-DA01 | | | | |

80.0 dBuV



| No. | Mk. | Freq. (MHz) | Reading (dBuV) | Factor (dB) | Measurement (dBuV) | Limit (dBuV) | Over (dB) | Detector | Comment |
|-----|-----|----------------|-------------------|----------------|-----------------------|-----------------|--------------|----------|---------|
| 1 | | 0.1580 | 48.00 | 0.09 | 48.09 | 65.57 | -17.48 | peak | |
| 2 | * | 0.1780 | 47.38 | 0.10 | 47.48 | 64.58 | -17.10 | peak | |
| 3 | | 0.2220 | 42.02 | 0.10 | 42.12 | 62.74 | -20.62 | peak | |
| 4 | | 0.3820 | 38.54 | 0.17 | 38.71 | 58.24 | -19.53 | peak | |
| 5 | | 0.6060 | 25.40 | 0.26 | 25.66 | 56.00 | -30.34 | peak | |
| 6 | | 12.7180 | 23.82 | 0.64 | 24.46 | 60.00 | -35.54 | peak | |

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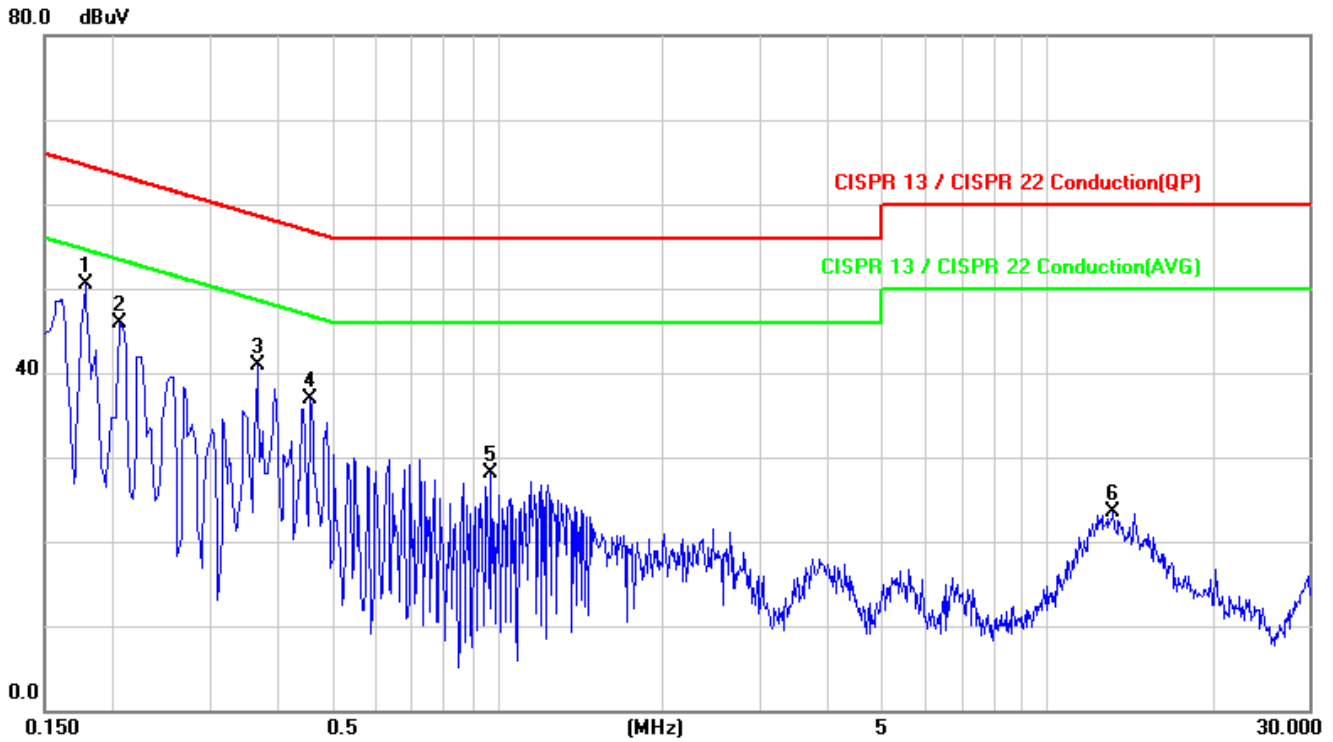
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| No. | Mk. | Freq. | Reading | Factor | Measurement | Limit | Over | Detector | Comment |
|-----|-----|---------|---------|--------|-------------|--------|--------|----------|---------|
| | | (MHz) | dBuV | (dB) | (dBuV) | (dBuV) | (dB) | | |
| 1 | * | 0.1780 | 50.39 | 0.10 | 50.49 | 64.58 | -14.09 | peak | |
| 2 | | 0.2060 | 45.87 | 0.09 | 45.96 | 63.37 | -17.41 | peak | |
| 3 | | 0.3660 | 40.72 | 0.16 | 40.88 | 58.59 | -17.71 | peak | |
| 4 | | 0.4580 | 36.77 | 0.21 | 36.98 | 56.73 | -19.75 | peak | |
| 5 | | 0.9780 | 27.75 | 0.42 | 28.17 | 56.00 | -27.83 | peak | |
| 6 | | 13.2140 | 22.81 | 0.64 | 23.45 | 60.00 | -36.55 | peak | |

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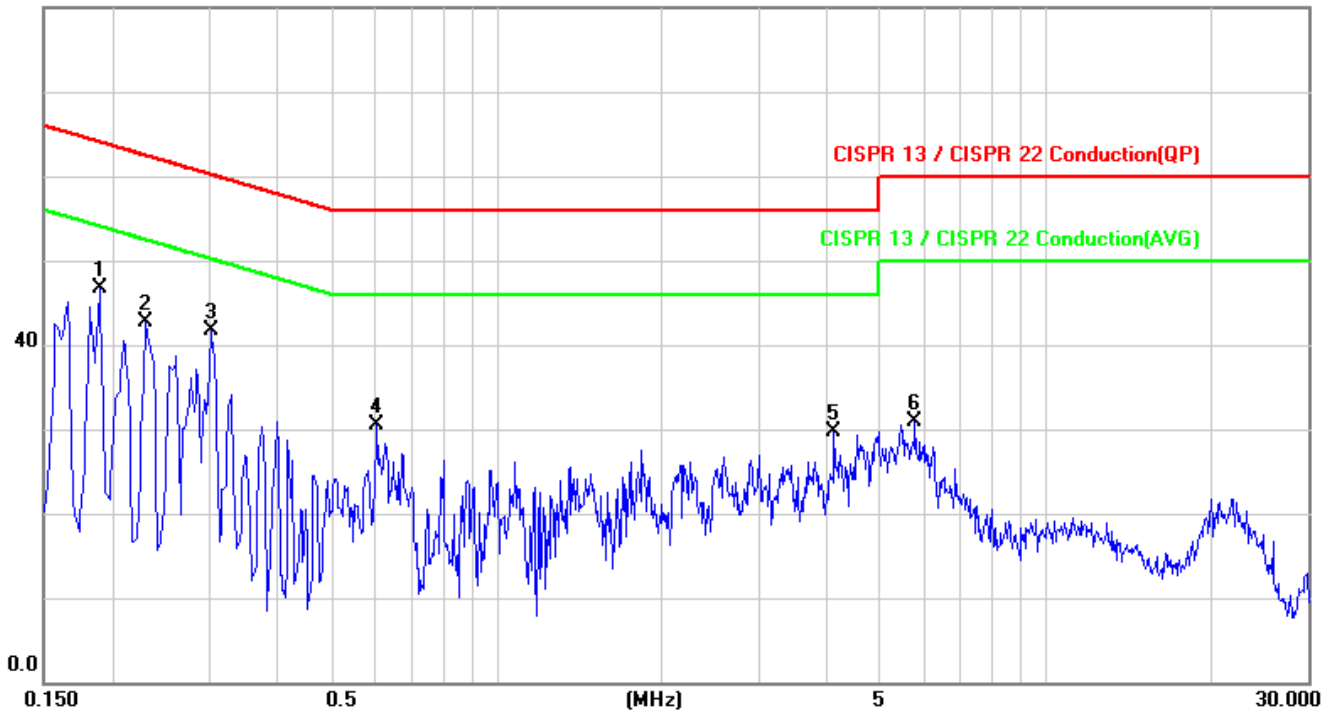
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AC POWER LINE CONDUCTED EMISSION TEST DATA

| | | | | | |
|--------------------|----------------|-----------|------|------------|---------------|
| Operation Mode: | Operation mode | | | Test Date: | Apr. 10, 2015 |
| Temperature: | 20 | Humidity: | 64 % | Test By: | Ashton |
| Adapter Model No.: | TPN-LA01 | | | | |

80.0 dBuV



| No. | Mk. | Freq. | Reading | Factor | Measurement | Limit | Over | Detector | Comment |
|-----|-----|--------|---------|--------|-------------|--------|--------|----------|---------|
| | | (MHz) | dBuV | (dB) | (dBuV) | (dBuV) | (dB) | | |
| 1 | * | 0.1900 | 46.71 | 0.09 | 46.80 | 64.04 | -17.24 | peak | |
| 2 | | 0.2300 | 42.63 | 0.10 | 42.73 | 62.45 | -19.72 | peak | |
| 3 | | 0.3020 | 41.61 | 0.13 | 41.74 | 60.19 | -18.45 | peak | |
| 4 | | 0.6060 | 30.31 | 0.26 | 30.57 | 56.00 | -25.43 | peak | |
| 5 | | 4.1140 | 29.09 | 0.61 | 29.70 | 56.00 | -26.30 | peak | |
| 6 | | 5.8020 | 30.32 | 0.62 | 30.94 | 60.00 | -29.06 | peak | |

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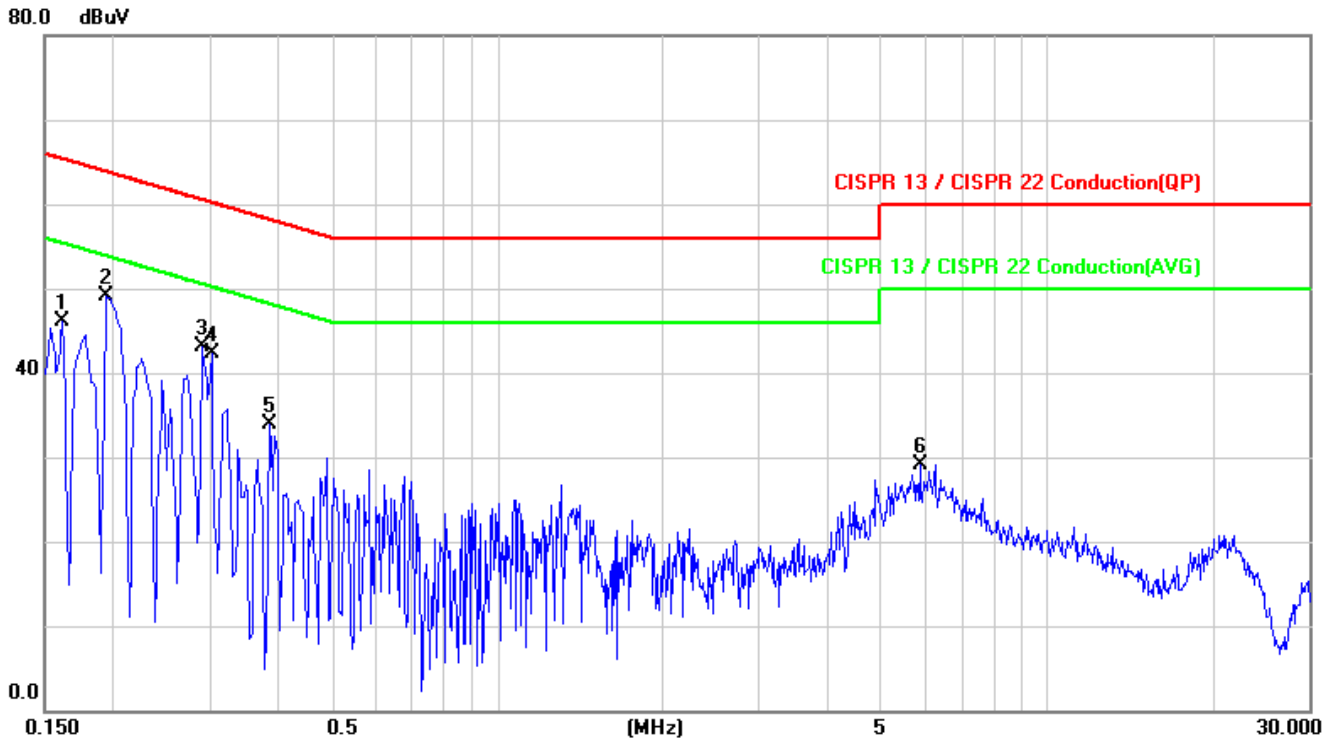
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| No. | Mk. | Freq. (MHz) | Reading dBuV | Factor (dB) | Measurement (dBuV) | Limit (dBuV) | Over (dB) | Detector | Comment |
|-----|-----|----------------|-----------------|----------------|-----------------------|-----------------|--------------|----------|---------|
| 1 | | 0.1620 | 46.02 | 0.09 | 46.11 | 65.36 | -19.25 | peak | |
| 2 | * | 0.1940 | 49.05 | 0.09 | 49.14 | 63.86 | -14.72 | peak | |
| 3 | | 0.2900 | 42.97 | 0.13 | 43.10 | 60.52 | -17.42 | peak | |
| 4 | | 0.3020 | 42.17 | 0.13 | 42.30 | 60.19 | -17.89 | peak | |
| 5 | | 0.3860 | 33.64 | 0.17 | 33.81 | 58.15 | -24.34 | peak | |
| 6 | | 5.8860 | 28.45 | 0.62 | 29.07 | 60.00 | -30.93 | peak | |

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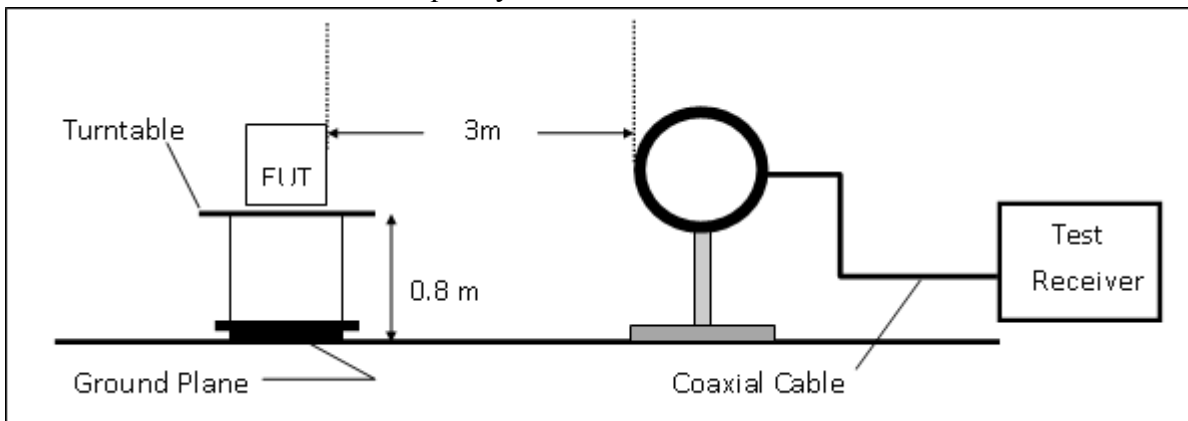
7 RADIATED EMISSION TEST

7.1 Measurement Procedure

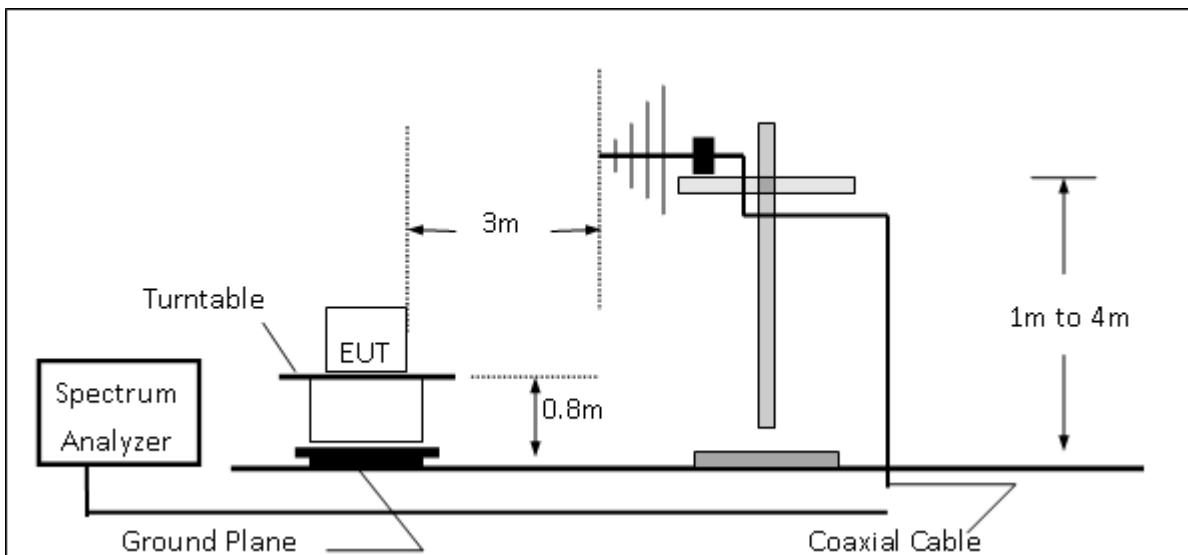
- 1 The EUT was placed on a turn table which is 0.8m above ground plane.
- 2 Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 3 And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

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 form 30MHz to 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 | ESU 40 | 100363 | 04/09/2015 | 04/08/2016 |
| Loop Antenna | ETS-Lindgren | 6502 | 00143303 | 12/09/2014 | 12/08/2015 |
| Broadband Antenna | TESEQ | CBL 6112D | 35240 | 12/05/2014 | 12/04/2015 |
| Pre Amplifier | EMC Instruments | EMC330 | 980096 | 12/19/2014 | 12/18/2015 |
| Coaxial Cable | Huber+Suhner | RG 214/U | 966Rx 9K-30M | 12/19/2014 | 12/18/2015 |
| Coaxial Cable | Huber+Suhner | RG 214/U SUCOFLEX 104 | 966Rx 30M-3G | 12/19/2014 | 12/18/2015 |
| Site NSA | SGS | 966 Chamber C | SAC-C | 03/04/2015 | 03/03/2016 |
| Site VSWR | SGS | 966 Chamber C | SAC-C | 03/04/2015 | 03/03/2016 |
| DC Power Supply | HOLA | DP-3003 | D7070035 | 05/31/2014 | 05/30/2015 |
| Controller | MF | MF-7802 | N/A | N.C.R. | N.C.R. |
| Antenna Master | MF | N/A | N/A | N.C.R. | N.C.R. |
| Turn Table | MF | N/A | N/A | N.C.R. | N.C.R. |
| Test Software | World-Pallas | Dr. E | V 3.0 Lite | N.C.R. | N.C.R. |

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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 | |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/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.

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 microrvolts/meter at 30 meters.

The Limit is converted to 124.00dBuV/m by offsetting the distance extrapolation factor as measurement distance is taken place at 3 meters.

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

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(dBμV/m) = Spectrum. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/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.

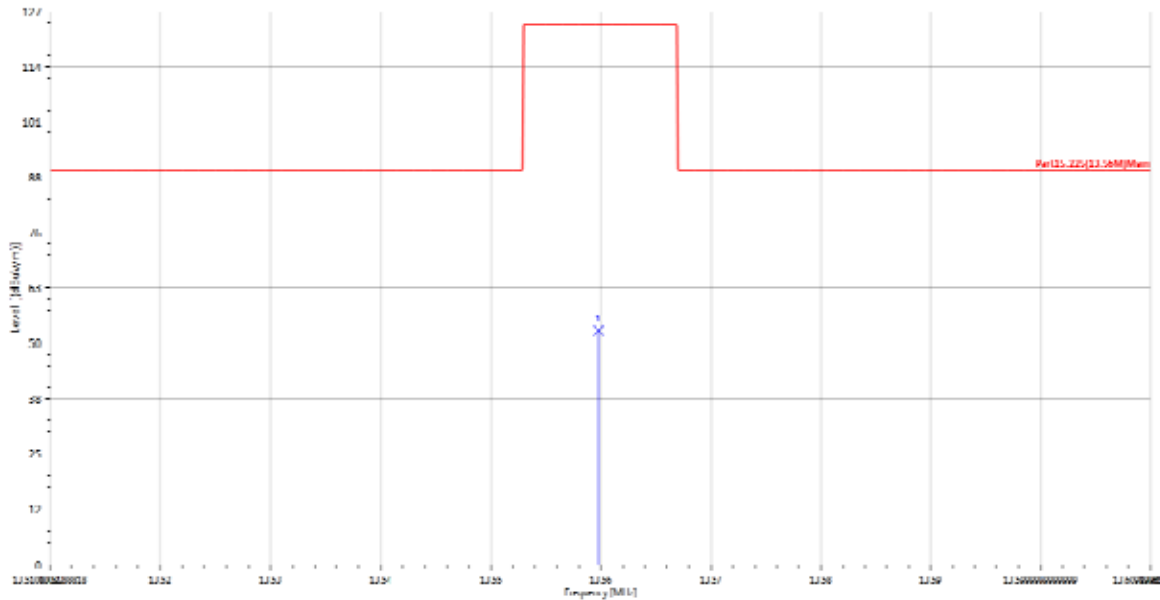
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| | | | |
|-----------------------|------------|--------------------------|--------------------|
| Operation Band | :NFC | Test Date | :2015-04-10 |
| Fundamental Frequency | :13.56 MHz | Temp./Humi. | :17.9 deg_C/ 51 RH |
| Operation Mode | :MAIN | Engineer | :Ashton |
| EUT Pol. | :H Plane | Measurement Antenna Pol. | :VERTICAL |

| Freq. | Detector | Note | Spectrum | Factor | Actual | Limit | Margin |
|-------|----------|---------|---------------|--------|--------|--------|--------|
| MHz | PK/QP/AV | F/H/E/S | Reading Level | dB | dBμV/m | dBμV/m | dB |
| 13.56 | Peak | F | 42.54 | 11.16 | 53.71 | 123.90 | -70.19 |



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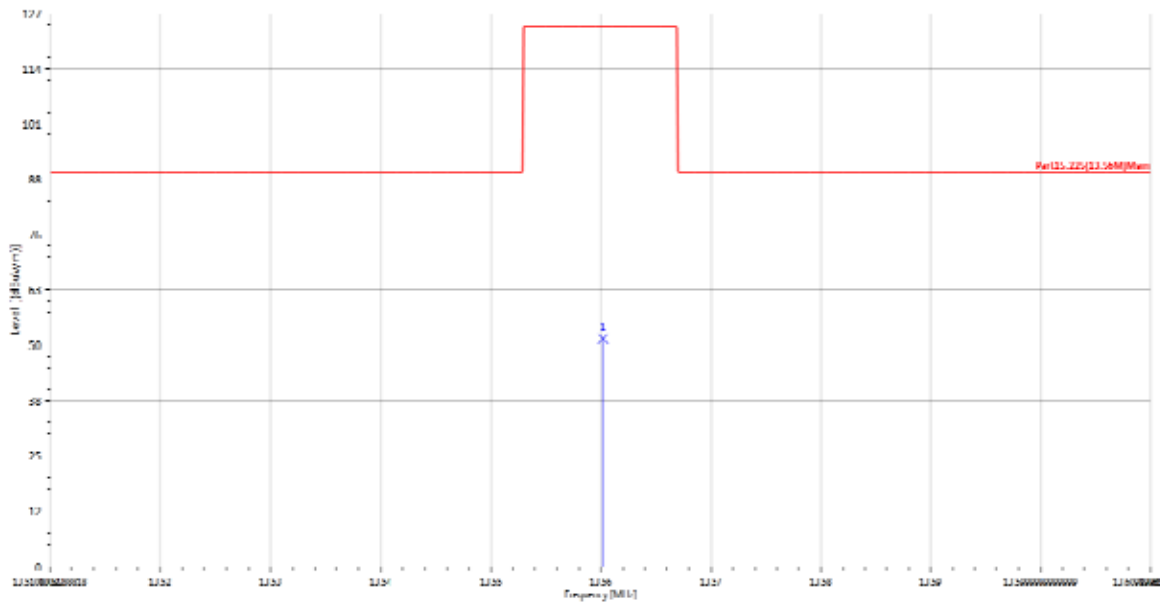
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| | | | |
|-----------------------|------------|--------------------------|--------------------|
| Operation Band | :NFC | Test Date | :2015-04-10 |
| Fundamental Frequency | :13.56 MHz | Temp./Humi. | :17.9 deg_C/ 51 RH |
| Operation Mode | :MAIN | Engineer | :Ashton |
| EUT Pol. | :H Plane | Measurement Antenna Pol. | :HORIZONTAL |

| Freq. MHz | Detector Mode | Note F/H/E/S | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|--------------|------------------|-----------------|-----------------------------------|--------------|------------------------|------------------------|--------------|
| 13.56 | Peak | F | 41.16 | 11.16 | 52.32 | 123.90 | -71.58 |



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7.5.2 Radiated Mask

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

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

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

1. $20 \cdot \log(15848 \mu\text{V/m}) + 40\text{dB} = 124.00\text{dBuV/m}$
2. $20 \cdot \log(334 \mu\text{V/m}) + 40\text{dB} = 90.47\text{dBuV/m}$
3. $20 \cdot \log(106 \mu\text{V/m}) + 40\text{dB} = 80.50\text{dBuV/m}$

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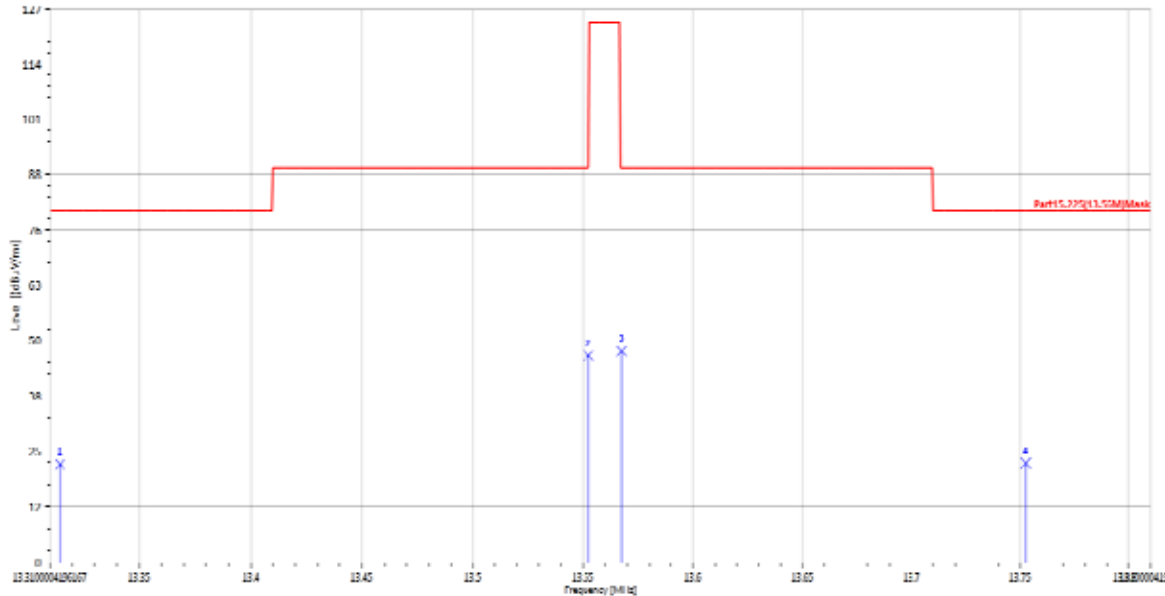
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| | | | |
|-----------------------|------------|--------------------------|--------------------|
| Operation Band | :NFC | Test Date | :2015-04-10 |
| Fundamental Frequency | :13.56 MHz | Temp./Humi. | :17.9 deg_C/ 51 RH |
| Operation Mode | :MASK | Engineer | :Ashton |
| EUT Pol. | :H Plane | Measurement Antenna Pol. | :VERTICAL |



| Freq. MHz | Detector Mode | Note F/H/E/S | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|--------------|------------------|-----------------|-----------------------------------|--------------|------------------------|------------------------|--------------|
| 13.31 | Peak | S | 11.21 | 11.17 | 22.38 | 80.50 | -58.12 |
| 13.55 | Peak | S | 36.23 | 11.17 | 47.40 | 90.47 | -43.07 |
| 13.57 | Peak | S | 37.25 | 11.16 | 48.41 | 90.47 | -42.06 |
| 13.75 | Peak | S | 11.48 | 11.15 | 22.63 | 80.50 | -57.87 |

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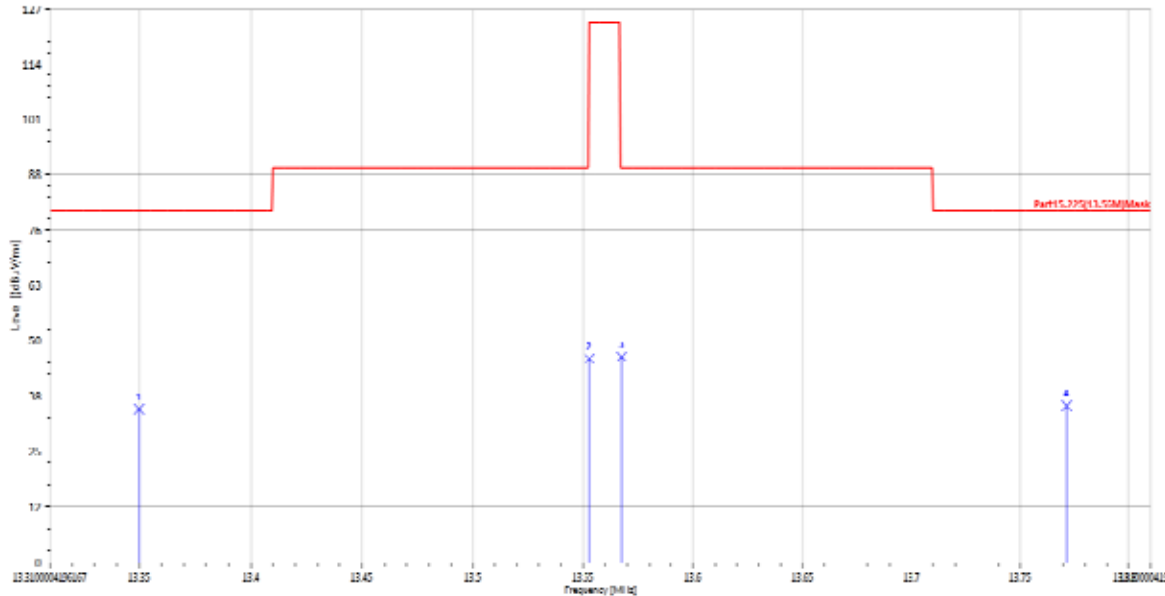
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| | | | |
|-----------------------|------------|--------------------------|--------------------|
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| Fundamental Frequency | :13.56 MHz | Temp./Humi. | :17.9 deg_C/ 51 RH |
| Operation Mode | :MASK | Engineer | :Ashton |
| EUT Pol. | :H Plane | Measurement Antenna Pol. | :HORIZONTAL |



| Freq. MHz | Detector Mode | Note F/H/E/S | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|--------------|------------------|-----------------|-----------------------------------|--------------|------------------------|------------------------|--------------|
| 13.35 | Peak | S | 23.92 | 11.18 | 35.10 | 80.50 | -45.40 |
| 13.55 | Peak | S | 35.43 | 11.17 | 46.60 | 90.47 | -43.87 |
| 13.57 | Peak | S | 35.85 | 11.16 | 47.01 | 90.47 | -43.46 |
| 13.77 | Peak | S | 24.64 | 11.15 | 35.79 | 80.50 | -44.71 |

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7.5.3 Radiated Emission –

Limit:

§ 15.225

(d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

a) $20 \cdot \log(30 \mu\text{V/m}) + 40\text{dB} = 69.54 \text{ dBuV/m}$

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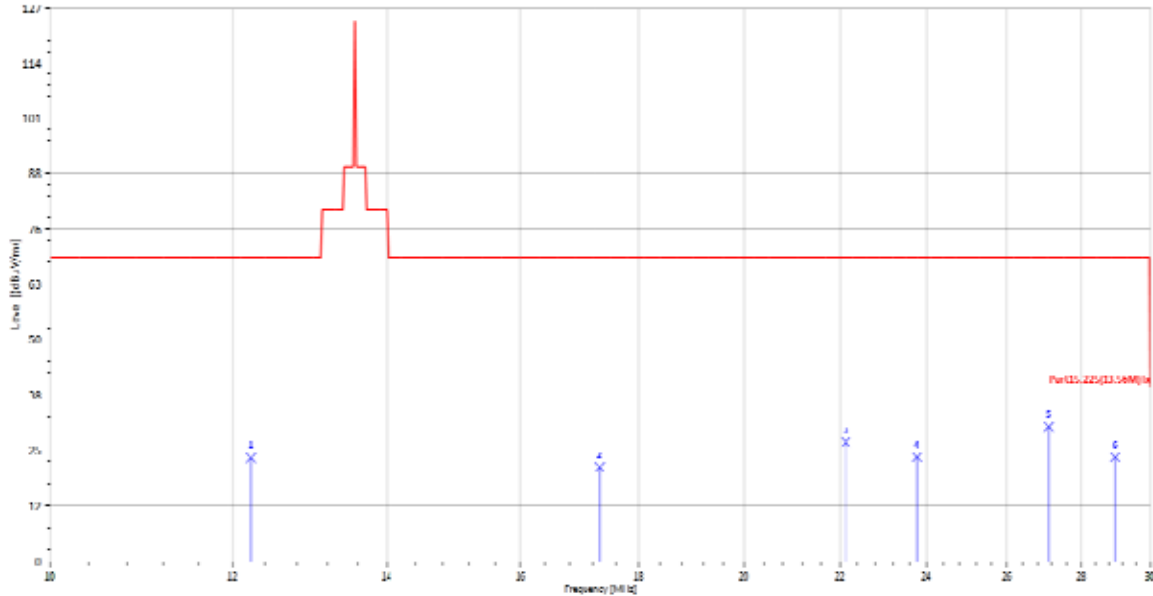
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| | | | |
|-----------------------|------------|--------------------------|--------------------|
| Operation Band | :NFC | Test Date | :2015-04-10 |
| Fundamental Frequency | :13.56 MHz | Temp./Humi. | :17.9 deg_C/ 51 RH |
| Operation Mode | :TX | Engineer | :Ashton |
| EUT Pol. | :H Plane | Measurement Antenna Pol. | :VERTICAL |



| Freq. MHz | Detector Mode | Note F/H/E/S | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|--------------|------------------|-----------------|-----------------------------------|--------------|------------------------|------------------------|--------------|
| 12.22 | Peak | S | 12.45 | 11.21 | 23.66 | 69.54 | -45.88 |
| 17.32 | Peak | S | 10.46 | 11.06 | 21.51 | 69.54 | -48.03 |
| 22.14 | Peak | S | 16.67 | 10.56 | 27.24 | 69.54 | -42.30 |
| 23.78 | Peak | S | 13.57 | 10.27 | 23.84 | 69.54 | -45.70 |
| 27.12 | Peak | S | 21.16 | 9.64 | 30.80 | 69.54 | -38.74 |
| 28.98 | Peak | S | 14.51 | 9.29 | 23.80 | 69.54 | -45.74 |

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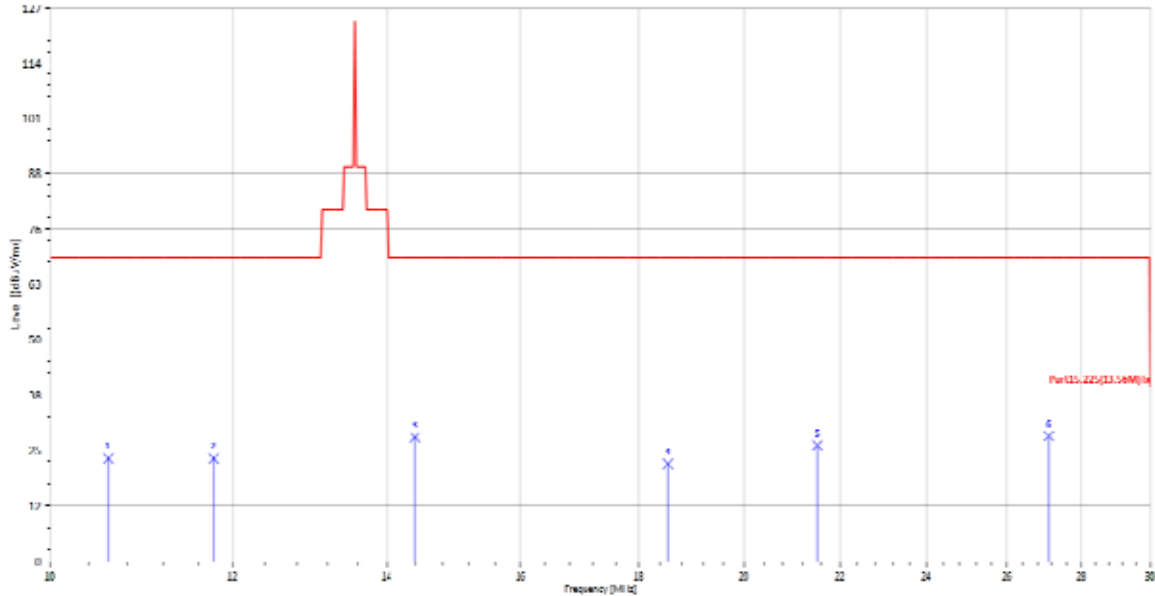
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|-----------------------|------------|--------------------------|--------------------|
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| Fundamental Frequency | :13.56 MHz | Temp./Humi. | :17.9 deg_C/ 51 RH |
| Operation Mode | :TX | Engineer | :Ashton |
| EUT Pol. | :H Plane | Measurement Antenna Pol. | :HORIZONTAL |



| Freq. MHz | Detector Mode | Note F/H/E/S | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|--------------|------------------|-----------------|-----------------------------------|--------------|------------------------|------------------------|--------------|
| 10.60 | Peak | S | 12.22 | 11.26 | 23.48 | 69.54 | -46.06 |
| 11.78 | Peak | S | 12.25 | 11.22 | 23.47 | 69.54 | -46.07 |
| 14.40 | Peak | S | 17.24 | 11.13 | 28.37 | 69.54 | -41.17 |
| 18.54 | Peak | S | 11.25 | 11.00 | 22.25 | 69.54 | -47.29 |
| 21.52 | Peak | S | 15.82 | 10.67 | 26.50 | 69.54 | -43.04 |
| 27.12 | Peak | S | 18.99 | 9.64 | 28.62 | 69.54 | -40.92 |

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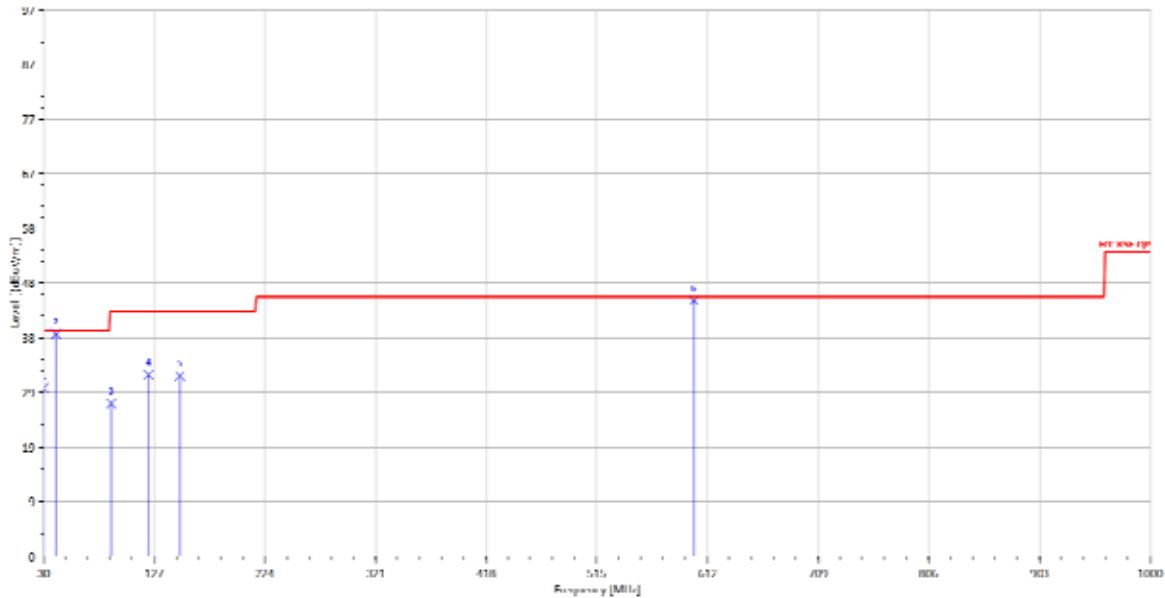
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|-----------------------|------------|--------------------------|--------------------|
| Operation Band | :NFC | Test Date | :2015-04-10 |
| Fundamental Frequency | :13.56 MHz | Temp./Humi. | :17.9 deg_C/ 51 RH |
| Operation Mode | :TX | Engineer | :Ashton |
| EUT Pol. | :H Plane | Measurement Antenna Pol. | :VERTICAL |



| Freq. MHz | Detector Mode | Note F/H/E/S | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|--------------|------------------|-----------------|-----------------------------------|--------------|------------------------|------------------------|--------------|
| 30.11 | QP | S | 42.99 | -13.17 | 29.82 | 40.00 | -10.18 |
| 40.69 | QP | S | 58.90 | -19.44 | 39.46 | 40.00 | -0.54 |
| 89.17 | Peak | S | 52.82 | -25.74 | 27.08 | 43.50 | -16.42 |
| 122.15 | Peak | S | 53.61 | -21.40 | 32.21 | 43.50 | -11.29 |
| 149.31 | Peak | S | 54.60 | -22.61 | 31.99 | 43.50 | -11.51 |
| 599.96 | QP | S | 57.81 | -12.46 | 45.35 | 46.00 | -0.65 |

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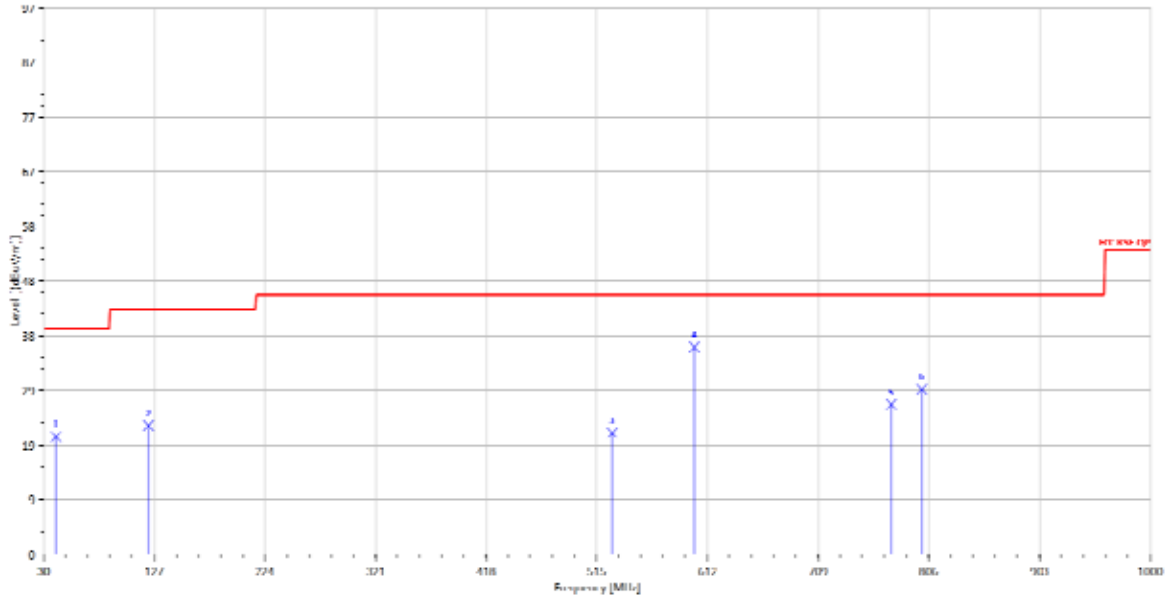
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| | | | |
|-----------------------|------------|--------------------------|--------------------|
| Operation Band | :NFC | Test Date | :2015-04-10 |
| Fundamental Frequency | :13.56 MHz | Temp./Humi. | :17.9 deg_C/ 51 RH |
| Operation Mode | :TX | Engineer | :Ashton |
| EUT Pol. | :H Plane | Measurement Antenna Pol. | :HORIZONTAL |



| Freq. MHz | Detector Mode | Note F/H/E/S | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|--------------|------------------|-----------------|-----------------------------------|--------------|------------------------|------------------------|--------------|
| 40.67 | Peak | S | 40.25 | -19.43 | 20.82 | 40.00 | -19.18 |
| 122.15 | Peak | S | 44.22 | -21.40 | 22.82 | 43.50 | -20.68 |
| 528.58 | Peak | S | 34.65 | -13.16 | 21.49 | 46.00 | -24.51 |
| 600.36 | Peak | S | 49.18 | -12.45 | 36.73 | 46.00 | -9.27 |
| 773.02 | Peak | S | 36.83 | -10.26 | 26.57 | 46.00 | -19.43 |
| 800.18 | Peak | S | 38.77 | -9.49 | 29.28 | 46.00 | -16.72 |

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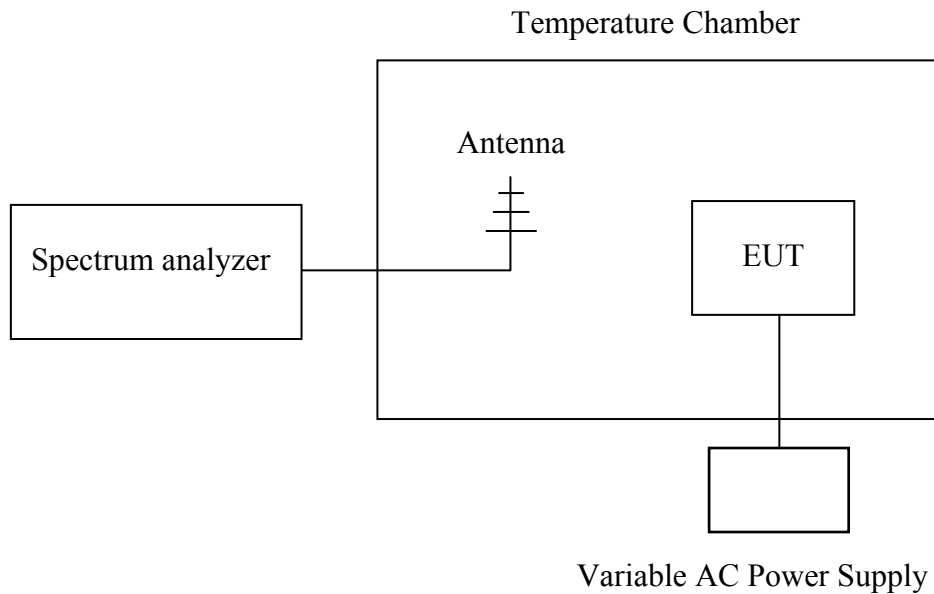
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8 Frequency Tolerance

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 | N9010A | MY53400256 | 10/15/2014 | 10/14/2015 |
| Coaxial Cable 30cm | WOKEN | 00100A1F1A195C | RF01 | 12/19/2014 | 12/18/2015 |
| DC Block | PASTERNAK | PE8210 | RF29 | 12/19/2014 | 12/18/2015 |
| Attenuator | WOKEN | 218FS-10 | RF23 | 12/19/2014 | 12/18/2015 |
| DC Power Supply | Agilent | E3640A | MY53140006 | 05/31/2014 | 05/30/2015 |
| Loop Antenna | ETS-Lindgren | 6502 | 00143303 | 12/09/2014 | 12/08/2015 |

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8.4 Measurement Results

A. Temperature Variation

| Power Supply | Environment | Frequency | Delta (Hz) | Limit (KHz) |
|--------------|-----------------|-----------|------------|-------------|
| Vdc | Temperature () | (MHz) | | |
| 3.8 | -20 | 13.560345 | 55.000 | ±1.356 |
| 3.8 | -10 | 13.560355 | 45.000 | ±1.356 |
| 3.8 | 0 | 13.560360 | 40.000 | ±1.356 |
| 3.8 | 10 | 13.560335 | 65.000 | ±1.356 |
| 3.8 | 20 | 13.560400 | 0.000 | ±1.356 |
| 3.8 | 30 | 13.560305 | 95.000 | ±1.356 |
| 3.8 | 40 | 13.560295 | 105.000 | ±1.356 |
| 3.8 | 50 | 13.560300 | 100.000 | ±1.356 |

B. Supply Voltage Variation

| Power Supply | Environment | Frequency | Delta (Hz) | Limit (KHz) |
|--------------|-----------------|-----------|------------|-------------|
| Vdc | Temperature () | (MHz) | | |
| 4.35 | 20 | 13.560350 | 50.000 | +/- 1.356 |
| 3.8 | 20 | 13.560400 | 0.000 | +/- 1.356 |
| 3.3 | 20 | 13.560380 | 20.000 | +/- 1.356 |

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9 20dB OCCUPIED BANDWIDTH MEASUREMENT

9.1 Limit:

None

9.3 Test Set-up

Refer to section 7.2 in this report

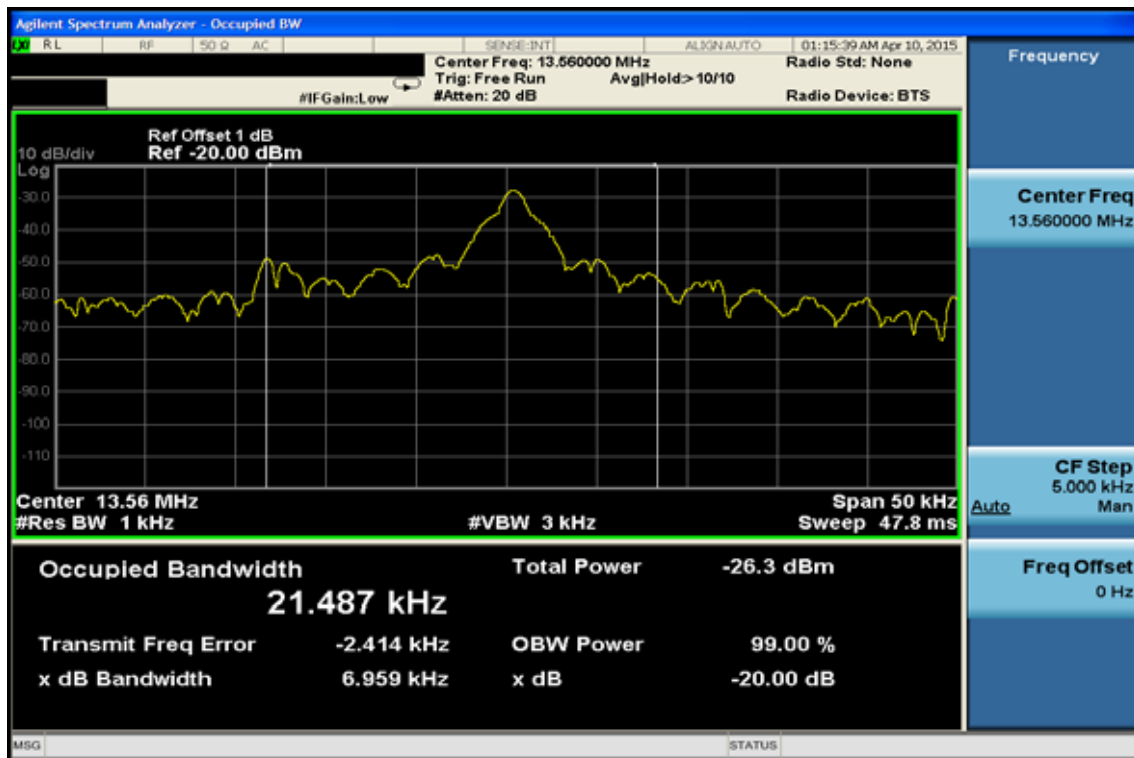
9.4 Measurement Procedure

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:

| Frequency (MHz) | 20dB Bandwidth(kHz) |
|-----------------|---------------------|
| 13.56 | 6.959 |

-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.

10.2 Antenna Connected Construction:

The antenna is designed with permanent attached and no consideration of replacement. Please see EUT photo and antenna spec. for details.

~ End of Report ~

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