# TEST REPORT

**Date: 2014-06-30**
**Report No.: 60.870.14.014.02F**

| | |
|---|---|
| **Applicant:** | Binatone Electronics International Ltd. |
| | Floor 23A, 9 Des Voeux Road West, Sheung Wan, Hong Kong |

**Description of Samples:**

| | |
|---|---|
| Model name: | Digital Video Baby Monitor (Baby Unit) |
| Brand name: | motorola |
| Model no.: | MBP854HDBU, FCOUS85-W, FOCUS85-S, FOCUS85-B, SCOUT85, BLINK85-W, BLINK85-S, BLINK85-B |
| FCCID: | VLJ-FOCUS85 |

**Date Samples Received:** 2014-06-01

**Date Tested:** 2014-06-02 to 2014-06-30

**Investigation Requested:** FCC Part 15 Subpart C, Section 15.247

**Conclusions:** The submitted product <u>COMPLIED</u> with the requirements of Federal Communications Commission [FCC] Rules and Regulations Part 15. The tests were performed in accordance with the standards described above and on Section 2.2 in this Test Report.

**Remarks:** ---

Checked by:                                Approved by:-

| | |
|---|---|
| Ray Cheung | Jeff Pong |
| Project Engineer | Manager |
| Wireless & Telecom Department | Wireless & Telecom Department |

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## 1.0    General Details

### 1.1    Test Laboratory

Attestation of Global Compliance SZ Co Ltd.
2/F, Building 2,No.1-No.4,Chaxi Sanwei, Technical
Industrial Park, Gushu, Xixiang, Shenzhen, China.
Registration Number: 259865

Tested by:

John Zhi

### 1.2    Applicant Details

**Applicant**

**Binatone Electronics International Ltd.**
Floor 23A, 9 Des Voeux Road West, Sheung Wan, Hong
Kong

**Manufacturer**

**VTech (Dongguan) Telecommunication Limited**
VTech Science Park, Xia Ling Bei Management Zone,
Liaobu, Dongguan, Guangdong, China

### 1.3 Equipment Under Test [EUT]

**Description of EUT**

| | |
|---|---|
| Product Description: | Digital Video Baby Monitor (Baby Unit) |
| Model No.: | MBP854HDBU |
| Multi-listing Model: | FOCUS85-W, FOCUS85-S, FOCUS85-B, SCOUT85, BLINK85-W, BLINK85-S, BLINK85-B |
| Brand Name: | motorola |
| FCCID: | VLJ-FOCUS85 |
| Rating: | DC5.0V, 1500mA powered by AC/DC power adaptor |
| Operated Frequency: | 2402 – 2479 MHz |
| No. of Operated Channel: | 23 |
| Accessories and Auxiliary Equipments: | AC/DC Switching Adaptor |
| Antenna Type: | Integral |
| Manufacture of Antenna: | CVISION HK LTD |
| Antenna Gain: | 0 dBi |
| Antenna Model: | N/A |

**General Operation of EUT**

The Equipment Under Test (EUT) is a Camera of Wireless Monitoring System, which include of a FHSS Module and a 802.11b/g/n module.

As per Client Declaration, MBP854HDBU & all multi-list models (multi-list model listed on above) have the same technical construction including Software design, RF module, PCB layout, Circuit design, all electrical construction and basic mechanical construction. Only the outlook color and system grouping are different between the models, so we use MBP854HDBU as a representative model to perform all testing.

FHSS Operation Principle:

This module is controlled by microchip to generate Pseudorandom Frequency Hopping Sequence, this module support 23 hopping channels. Refer to section 4.5 of this report to have more detail of Pseudorandom Hopping Algorithm.

### 1.4 Related Submittal(s) Grants

This is a signal application subjected to Certificate Authorization.

### 2.0    Technical Details

### 2.1    Investigations Requested

Perform ElectroMagnetic Interference measurement in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15:2012 and ANSI C63.4: 2009

### 2.2    Test Standards and Results Summary Tables

| Test Condition | Test Requirement | Test Result | |
|---|---|---|---|
| | | Pass | N/A |
| Number of Frequency Hopping | Section 15.247 ( a1 ) | ☒ | ☐ |
| 20dB Bandwidth Measurement | Section 15.247 ( a1 ) | ☒ | ☐ |
| Hopping Channel Carrier Frequency Separation | Section 15.247 ( a1 ) | ☒ | ☐ |
| Average Time of Occupancy | Section 15.247 ( a1 ) | ☒ | ☐ |
| Pseudorandom Hopping Algorithm | Section 15.247 ( a1 ) | ☒ | ☐ |
| Band Edge Measurement | Section 15.247 | ☒ | ☐ |
| Maximum Output Power | Section 15.247 ( b1 ) | ☒ | ☐ |
| Out of Band Emission | Section 15.247 ( d ) | ☒ | ☐ |
| Radiated Emission in Restricted Band | Section 15.247 ( d ) | ☒ | ☐ |
| Conducted Emission on AC Mains | Section 15.207 | ☒ | ☐ |
| Antenna Requirement | Section 15.203 | ☒ See note 1 | ☐ |

Note 1 : The EUT uses a permanently attached antenna, which in accordance to Section 15.203, is considered sufficient to comply with the provisions of this section.

Remark:  N/A - Not Applicable

## 3.0 Test Methodology

### 3.1 Radiated Emission

The sample was placed 0.8m above the ground plane on a standard emission test site *. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.

### 3.2 Field Strength Calculation

The field strength at 3 m was established by adding the meter reading of the spectrum analyzer to the factors associated with antenna correction factor, cable loss, preamplifiers and filter attenuation.

The equation is expressed as follow:

FS = R + System Factor
System Factor = AF + CF + FA – PA

Where FS = Net Field Strength in dBuV/m at 3 meters.
    R = Reading of Spectrum Analyzer / Test Receiver in dBuV.
    AF = Antenna Factor in dB.
    CF = Cable Attenuation Factor in dB.
    FA = Filter Attenuation Factor in dB.
    PA = Preamplifier Factor in dB.

FA and PA are only be used for the measuring frequency above 1 GHz.

### 3.3 Conducted Emissions

The test was performed in accordance with ANSI C63.4: 2009, with the following: initial measurements were performed in peak and average detection modes on the live line of personal computer, any emissions recorded within 30dB of the relevant limit lines were re-measured using quasi-peak and average detection on the live and neutral lines with the worst case recorded in the table of results.

## 4.0 Test Results

### 4.1 Number of Hopping Frequency

| | |
|---|---|
| Test Requirement: | FCC part 15 section 15.247 (a1)(iii) |
| Test Date: | 2014-06-15 |
| Mode of Operation: | Transmitting mode. |
| Detector Function: | Max Hold |

**Result: PASS**

**Measured Result :**

Operating Channel Frequency in sequence (MHz):

| Channels list | | |
|---|---|---|
| CH1=2402MHz | CH2=2404MHz | CH3=2406MHz |
| CH4=2408MHz | CH5=2410MHz | CH6=2415MHz |
| CH7=2420MHz | CH8=2425MHz | CH9=2430MHz |
| CH10=2435MHz | CH11=2440MHz | CH12=2445MHz |
| CH13=2450MHz | CH14=2455MHz | CH15=2460MHz |
| CH16=2465MHz | CH17=2467MHz | CH18=2469MHz |
| CH19=2471MHz | CH20=2473MHz | CH21=2475MHz |
| CH22=2477MHz | CH23=2479MHz | |

**Limit for Number of Hopping Channel [ Section 15.247 (a1)(iii) ]**

At least 15 non-overlapping channels of each sequence for 2400-2483.5MHz.

**Result data graph shows the number of operation channels:**
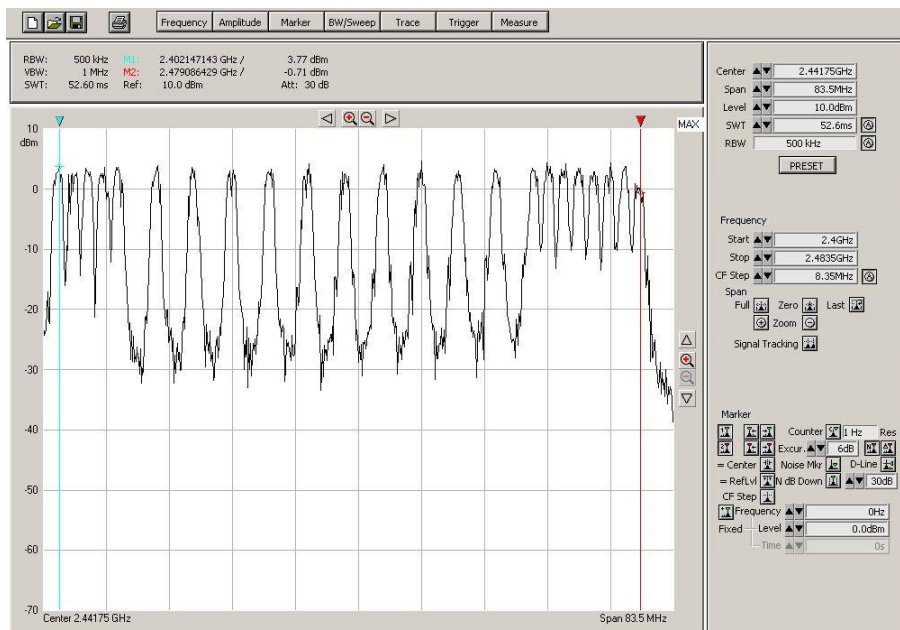
### 4.2 20dB Bandwidth Measurement

| | |
|---|---|
| Test Requirement: | FCC part 15 section 15.247 (a1) |
| Test Date: | 2014-06-15 |
| Mode of Operation: | Transmitting mode. |
| Detector Function: | Max Hold |

**Test Setup:**

The bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. Once the reference level is established, the equipment is conditioned with typical modulating signal to produce the worst-case (i.e. the widest) bandwidth.

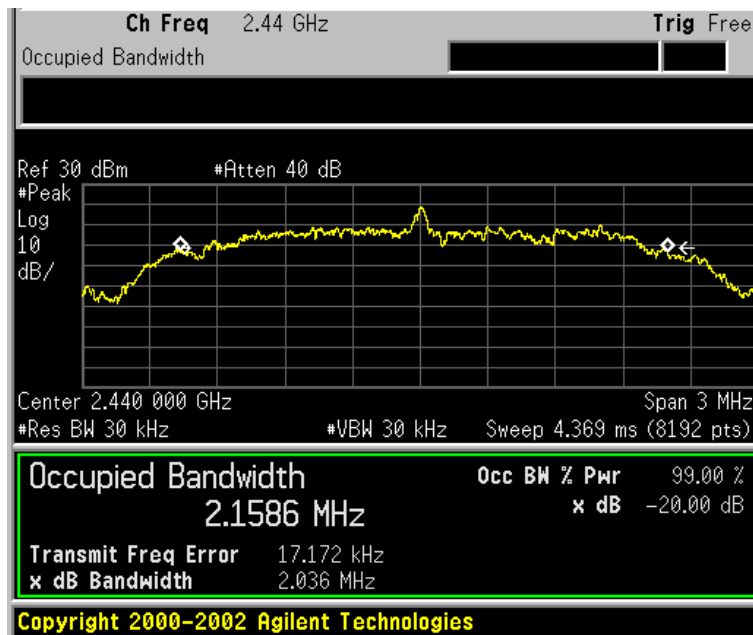| Channel | Measured frequency (MHz) | 20dB Bandwidth (MHz) |
|---|---|---|
| Lowest | 2402 | 2.069 |
| Middle | 2440 | 2.036 |
| Highest | 2479 | 2.066 |

This result is used for checking the hopping channel carrier frequencies separation.

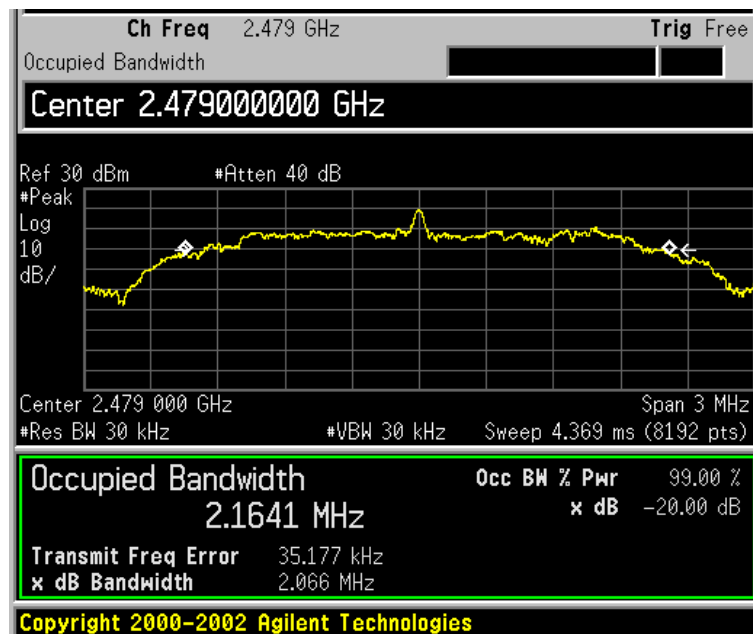**Result data graph shows 20 dB bandwidth, CF = 2402MHz, BW = 2.069MHz**
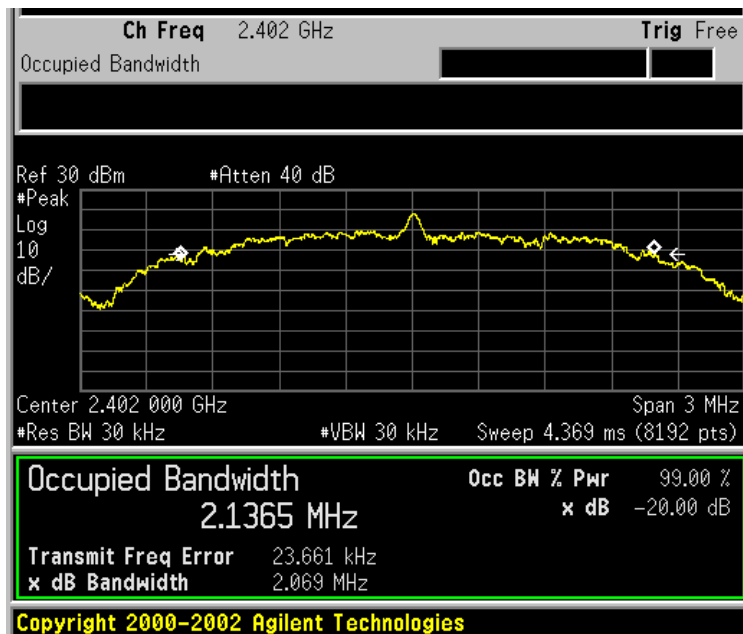
**Result data graph shows 20 dB bandwidth, CF = 2440MHz, BW = 2.036MHz**



**Result data graph shows 20 dB bandwidth, CF = 2479MHz, BW = 2.066MHz**

### 4.3 Hopping Channel Carrier Frequency Separation

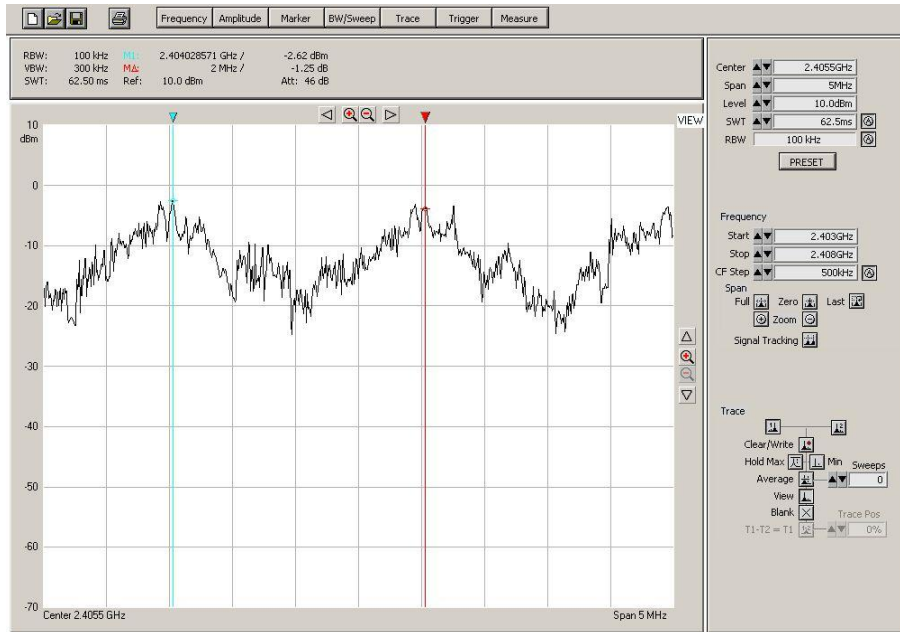| | |
|---|---|
| Test Requirement: | FCC part 15 section 15.247 (a1) |
| Test Date: | 2014-06-15 |
| Mode of Operation: | Transmitting mode. |
| Detector Function: | Max Hold |

**Result: PASS**

**Measured Result :**

Refer to the delta marker, the worst frequency separation between two adjacent channels is 2 MHz, therefore, the requirement of channel separated by a minimum of 25kHz of the hopping channel is applied.

**Limits for Hopping Channel Separation  [ Section 15.247 (a1) ]:**

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5MHz band may have hopping channel carrier frequencies that are separated by 25KHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater.

**Result data graph shows the channel separation:**

**4.4     Average Time of Channel Occupancy**

Test Requirement:                    FCC part 15 section 15.247 (a1)(iii)
Test Date:                               2014-06-15
Mode of Operation:                  Transmitting mode.
Detector Function:                    Zero span, Sweep time 1s

**Result : PASS**

**Measured Result :**

Each transmission only 23 channels will be used.

Observe time = 23 channels × 0.4s = 9.2s

There are 3 pulses within 311.2ms

And one set of pulses = 150.4us

Therefore, the average channel occupancy times (ms)

 = 150.4us x 3 x (9.2s/311.2ms)

So, total transmitting time is 0.013s. (<0.4s).

**Limits for Average Time of Occupancy [ Section 15.247 (a1)(iii) ]:**

The average time of occupancy on any channel shall not be greater than 0.4 second within a period of 0.4 seconds multiplied by the number of hopping channels employed.

**Result data graph shows total 23 channels are used.**
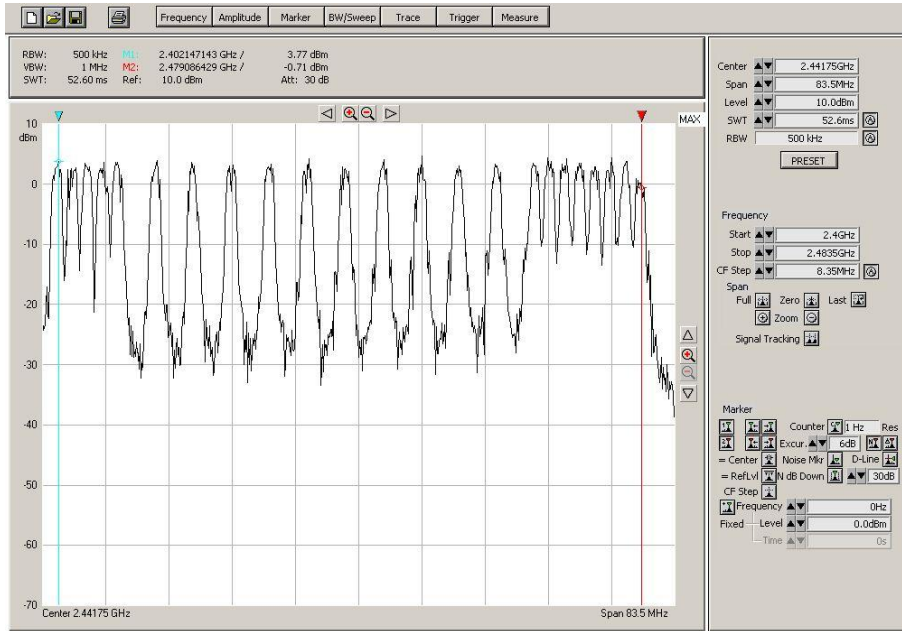


**Result data graph shows total 3 pulses with 311.2ms.**
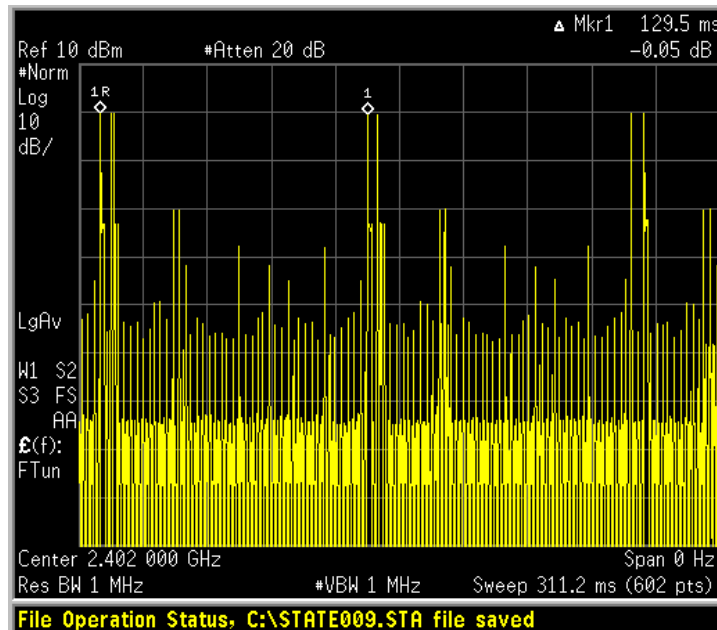
**Result data graph zooms into detail, one pulse period is 150.4us.**

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3/F, West Wing, Phase 2, 10 Science Park West Avenue, Shatin, Hong Kong

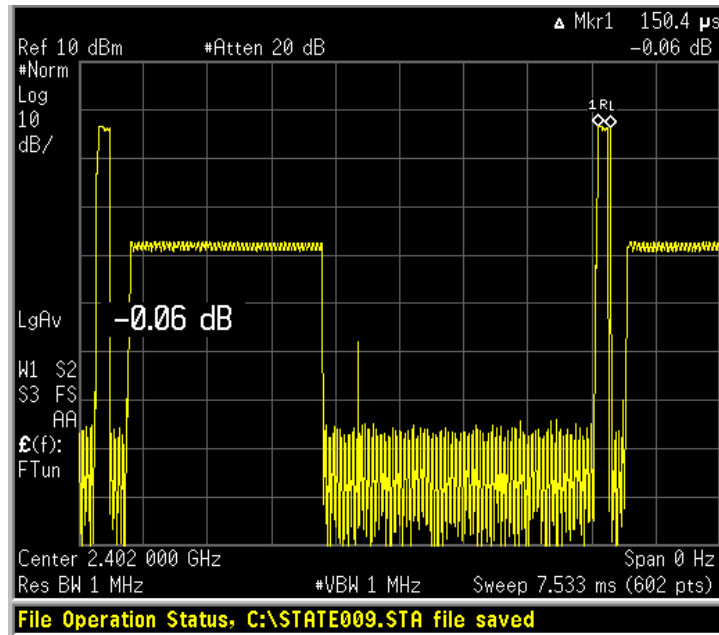### 4.5 Pseudorandom Hopping Algorithm

**Pseudorandom Frequency Hopping**

MBP854HDBU uses FHSS technology the frequency range of the system is operating from 2402MHz to 2479MHz. There are totally 23 channels with 2MHz (the worst) channel separation. A single data frame is transmitted on each frequency location before skipping to the next hopping frequency in the list.

| Channels list | | |
|---|---|---|
| CH1=2402MHz | CH2=2404MHz | CH3=2406MHz |
| CH4=2408MHz | CH5=2410MHz | CH6=2415MHz |
| CH7=2420MHz | CH8=2425MHz | CH9=2430MHz |
| CH10=2435MHz | CH11=2440MHz | CH12=2445MHz |
| CH13=2450MHz | CH14=2455MHz | CH15=2460MHz |
| CH16=2465MHz | CH17=2467MHz | CH18=2469MHz |
| CH19=2471MHz | CH20=2473MHz | CH21=2475MHz |
| CH22=2477MHz | CH23=2479MHz | |

**Requirement for Pseudorandom Hopping Algorithm [ Section 15.247 (a1) ]:**

The channel frequencies shall be selected from a pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on average by the transmitter.

## 4.6    Band Edge Measurement

| | |
|---|---|
| Test Requirement: | FCC part 15 section 15.247 |
| Test Date: | 2014-06-15 |
| Mode of Operation: | Transmitting mode. |
| Detector Function: | Max Hold |

**Result: PASS**

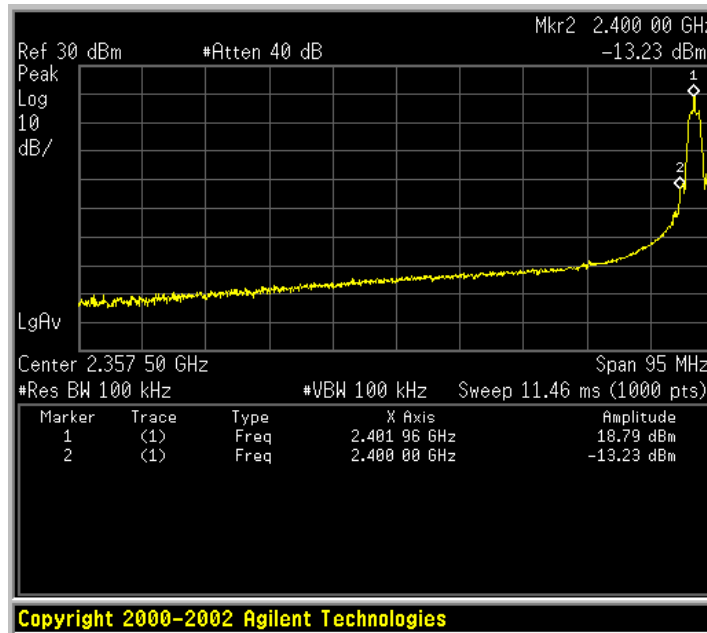**Measured Result :**

Refer to the figure, it shows the frequency of lower band edge and upper band edge separately.

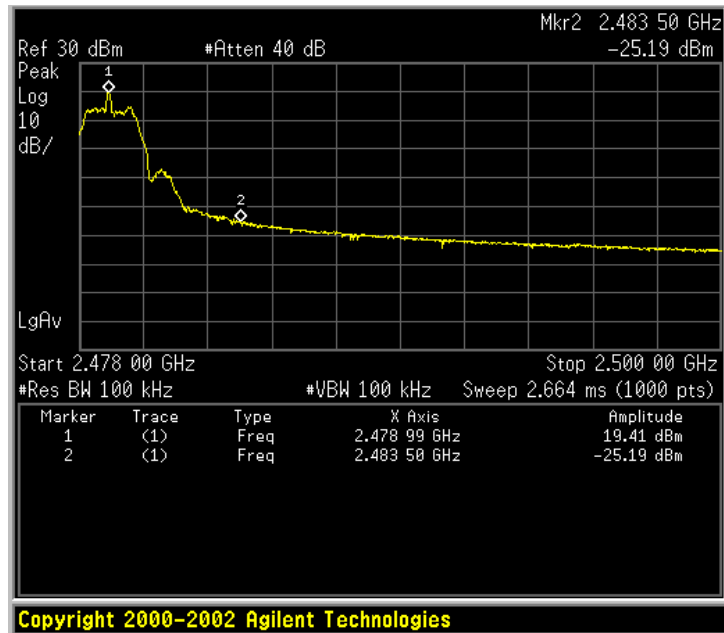**Limits of Band Edge for Carrier Frequencies Operated within the Bands [ Section 15.247 ]:**

The carrier frequencies should operate within 2400-2483.5MHz.

**Result data graph shows the frequency of lowest channel.**

**Result data graph shows the frequency of highest channel.**

**4.7 Maximum Output Power**

| | |
|---|---|
| Test Requirement: | FCC part 15 section 15.247 (a1) |
| Test Method: | ANSI C63.4:2009 |
| Test Date: | 2014-06-15 |
| Mode of Operation: | Transmitting mode. |
| Detector Function: | Peak |
| Measurement BW: | RBW 1MHz ; VBW 1MHz |

**Test Setup:**



**Result : PASS**

| Frequency (MHz) | Peak Output Power | | Limit | |
|---|---|---|---|---|
| | (dBm) | (W) | (dBm) | (W) |
| Lowest Channel : 2402 | 18.81 | 0.076 | 21 | 0.125 |
| Middle Channel : 2440 | 19.05 | 0.080 | 21 | 0.125 |
| Highest Channel : 2479 | 19.13 | 0.082 | 21 | 0.125 |

**Limits for Maximum Output Power [ Section 15.247 (a1)(iii) ]:**

For frequency hopping systems employing at least 75 hopping channels: 1 Watt
For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 Watts

**Result data graph shows the frequency of lowest channel**



**Result data graph shows the frequency of middle channel**

**Result data graph shows the frequency of highest channel**

**TÜV SÜD Hong Kong Ltd.**
3/F, West Wing, Phase 2, 10 Science Park West Avenue, Shatin, Hong Kong
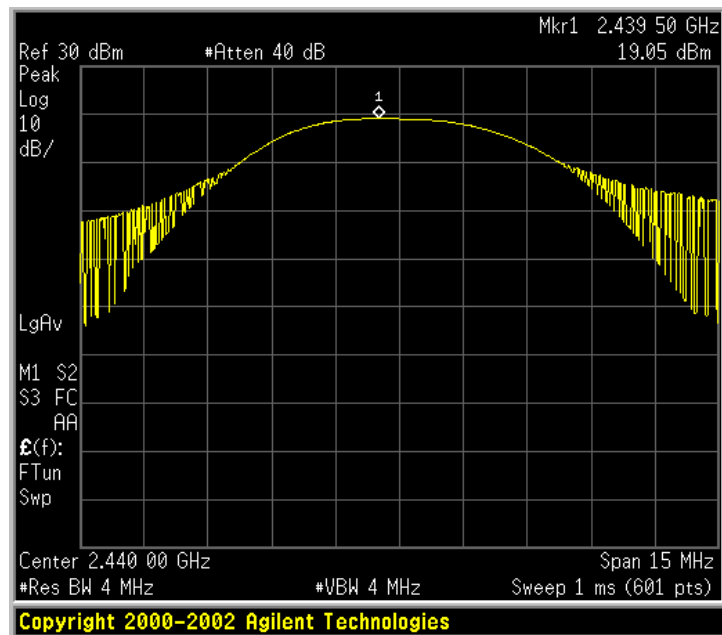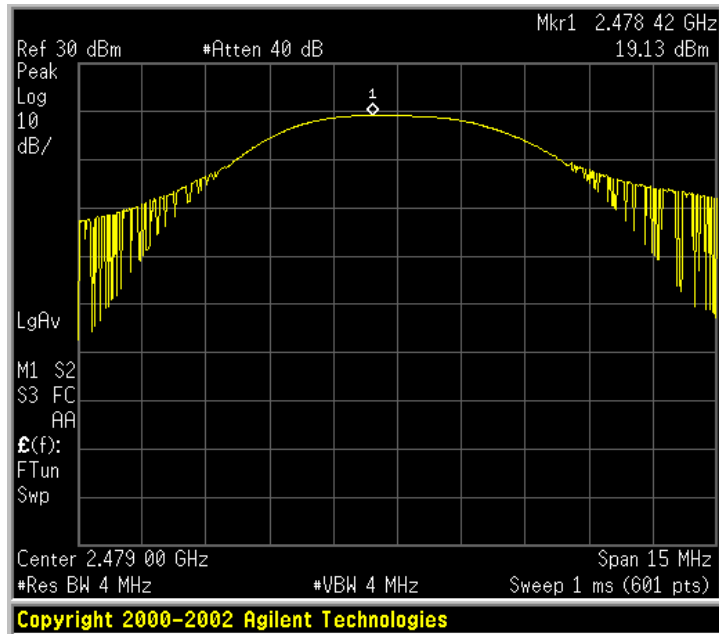
**4.8     Out of Band Emissions and Emissions in Restricted Bands**

Test Requirement:              FCC part 15 section 15.247 (d )
Test Method:                   ANSI C63.4:2009
Test Date:                     2014-06-15
Mode of Operation:             Transmitting mode.
Detector Function:             Peak
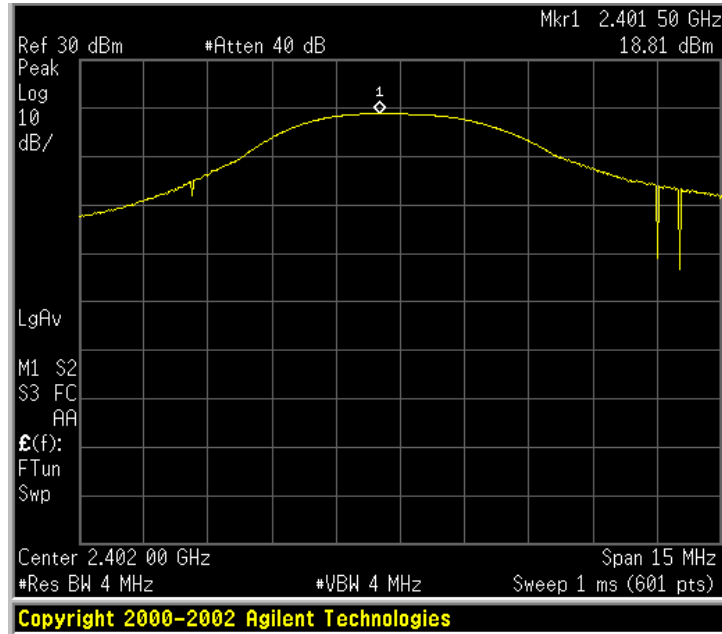Measurement BW:                RBW 100KHz ; VBW 300KHz

**Test Setup:**
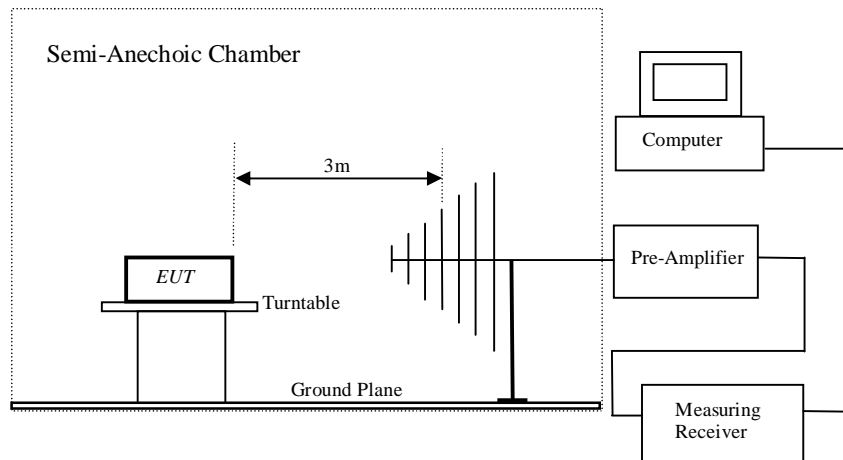
**Result : PASS**

**Out of Frequency Band Emissions:**

For out of band emissions that are close to or exceed 20dB attenuation requirement, and emission falls into restricted band, radiated emission was performed in order to show compliance with the general radiated emission requirement.

**Result Summary:**

Refer to the emission data graph, result shows that the significant emissions detected are with more than 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power.

**Limits for Out of Frequency Band Emission [ Section 15.247 (d) ]:**

In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power. Attenuation below the general limits specified in Section 15.209(a) is not required.

**Limit for Radiated Emission Falling in Restricted Bands [ Section 15.209 ]:**

| Frequency (MHz) | Field Strength [μV/m] | Field Strength [dBμV/m] |
|---|---|---|
| 30-88 | 100 | 40.0 |
| 88-216 | 150 | 43.5 |
| 216-960 | 200 | 46.0 |
| Above 960 | 500 | 54.0 |

Radiated emissions, which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209.

The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.

**Result : PASS**

**All Emission and Emissions Fall into Restricted Band were recorded as below:**

| | Emissions Frequency | E-Field Polarity | Reading | System Factor | Field strength at 3m | Limit | Delta to Limit |
|---|---|---|---|---|---|---|---|
| | **MHz** | | **dBuV/m** | **dB** | **dBuV/m** | **dBuV/m** | **dBuV/m** |
| **Lowest Channel** | | | | | | | |
| PK | 4800.00 | V | 47.50 | 8.50 | 56.00 | 74.00 | -18.00 |
| PK | 4800.00 | H | 50.20 | 8.50 | 58.70 | 74.00 | -15.30 |
| | | | | | | | |
| **Middle Channel** | | | | | | | |
| PK | 4875.00 | V | 46.80 | 8.80 | 55.60 | 74.00 | -18.40 |
| PK | 4875.00 | H | 49.40 | 8.80 | 58.20 | 74.00 | -15.80 |
| | | | | | | | |
| **Highest Channel** | | | | | | | |
| PK | 4962.50 | V | 50.80 | 9.10 | 59.90 | 74.00 | -14.10 |
| PK | 4962.50 | H | 54.80 | 9.10 | 63.90 | 74.00 | -10.10 |
| | | | | | | | |
| **Spurious Emissions** | | | | | | | |
| QP | 39.70 | V | 8.00 | 20.20 | 27.40 | 40.00 | -12.60 |
| QP | 262.80 | V | 21.50 | 13.90 | 29.70 | 46.00 | -16.30 |
| QP | 359.80 | V | 15.80 | 17.40 | 26.30 | 46.00 | -19.70 |
| QP | 408.12 | V | 15.40 | 18.70 | 36.90 | 46.00 | -9.10 |
| QP | 431.58 | V | 11.00 | 19.30 | 31.00 | 46.00 | -15.00 |
| QP | 450.98 | V | 9.50 | 20.10 | 29.90 | 46.00 | -16.10 |
| QP | 37.76 | H | 6.40 | 21.20 | 25.90 | 40.00 | -14.10 |
| QP | 191.02 | H | 18.10 | 12.80 | 29.00 | 43.50 | -14.50 |
| QP | 245.34 | H | 17.40 | 13.40 | 27.00 | 46.00 | -19.00 |
| QP | 288.02 | H | 21.20 | 15.60 | 36.80 | 46.00 | -9.20 |
| QP | 456.80 | H | 13.30 | 20.00 | 35.70 | 46.00 | -10.30 |
| QP | 947.62 | H | 10.70 | 28.70 | 33.70 | 46.00 | -12.30 |

**Radiated Emissions**

Refer to Figures shows the worst case channel's emission data graph from 30MHz-26GHz.

**Result Summary:**

1) Communication mode: All other emissions are more than 20dB below FCC part 15.209 limit.

2) No further spurious emissions found between 30 MHz and lowest internal used/generated frequency and from   30MHz to 1GHz.

**Remarks:**

1. " * " Radiated emissions which fall in the restricted bands as defined in Section 15.205(a).

2. Emission level with more than 20dB below the FCC required limit is not mentioned in table.

3. Delta to Limit = Field strength (dBμV/m) – Limit (dBμV/m).

4. Calculated measurement uncertainty: 9kHz -30MHz:   1.8dB.
                                        30MHz -1GHz:   5.2dB.
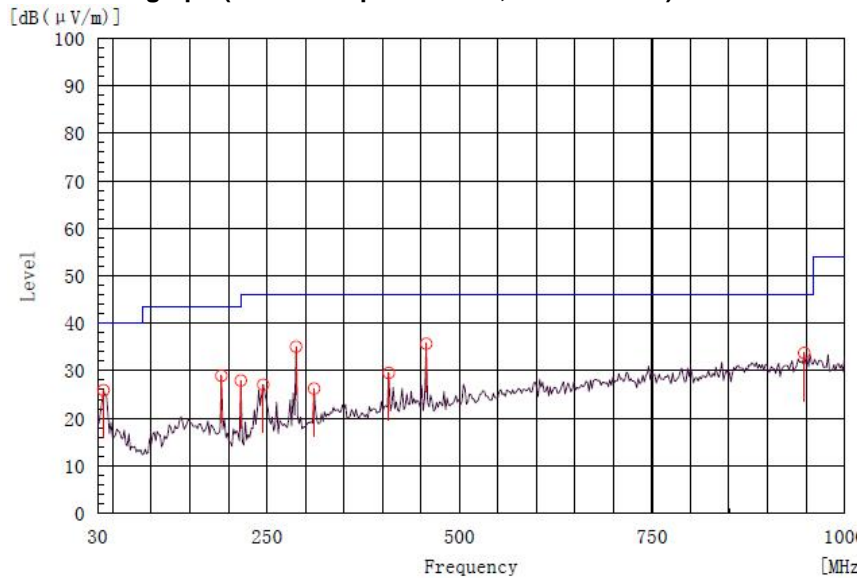                                        1GHz -18GHz:   5.1dB.

**Radiated emission data graph (Vertical polarization, 30MHz-1GHz)**
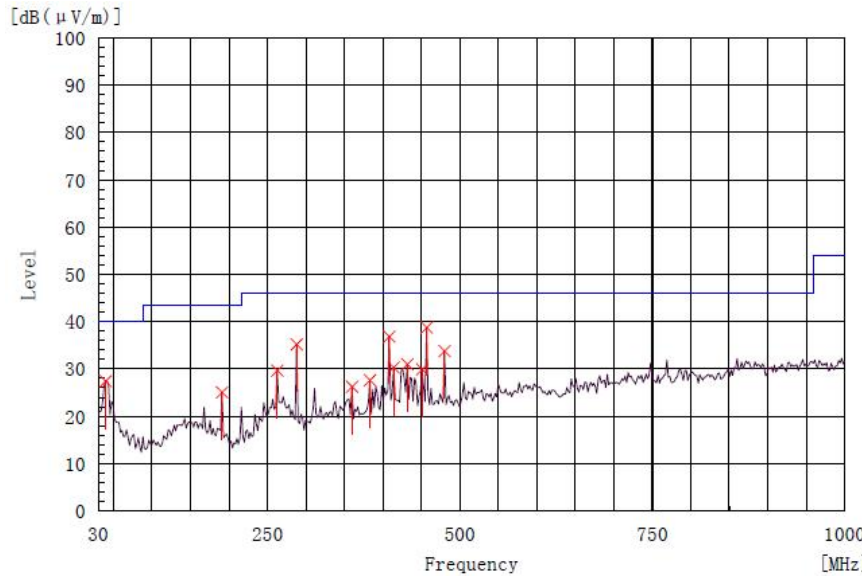


**Remark: Only background noise was measured from 1GHz-26GHz excluding the operation frequency relational.**

**Radiated emission data graph (Horizontal polarization, 30MHz-1GHz)**



**Remark: Only background noise was measured from 1GHz-26GHz excluding the operation frequency relational.**

### 4.9 Conducted Emissions (0.15MHz to 30MHz)

Test Requirement:                FCC part 15 Section 15.207 Class B
Test Method:                       ANSI C63.4:2009
Test Date:                           2014-06-15
Mode of Operation:            -Transmitting mode
Detector Function:             CISPR Quasi Peak
Measurement BW:           100 kHz
Worst Case Channel:         1

**Test Setup:**
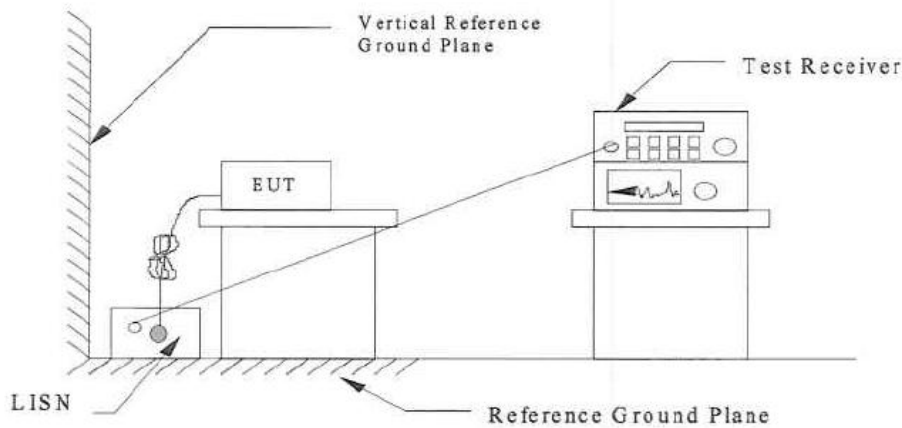


**Results:  PASS**

**- Refer Figures and tables for the result.**

**Limits for Conducted Emission [ Section 15.207]:**

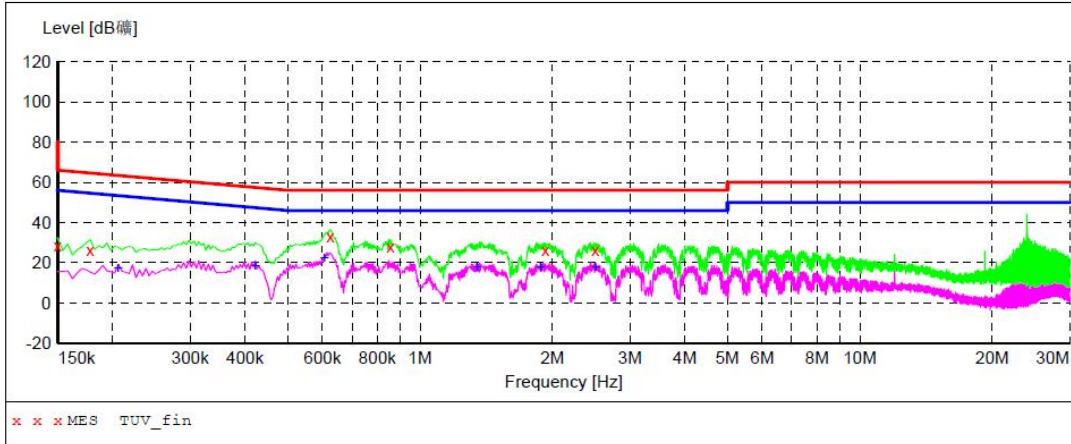| Frequency Range [MHz] | Quasi-Peak Limit [dBµV] | Average Limit [dBµV] |
|---|---|---|
| 0.15-0.5 | 66 to 56* | 56 to 46* |
| 0.5-5.0 | 56 | 46 |
| 5.0-30.0 | 60 | 50 |

* Decreases with the logarithm of the frequency.

Remarks:
Calculated measurement uncertainty: ±2.8dB
The result shown the worst case of the connection.

**Result data graph shows the conducted emission (Live).**



Refer to the following table for the result details:

| Conducted Emission | | | | | |
|---|---|---|---|---|---|
| Frequency (MHz) | Detector (QP/AV) | Phase | Result (dBµV) | Limit (dBµV) | Margin |
| 0.178 | QP | L | 26.20 | 65.00 | -38.80 |
| 0.626 | QP | L | 33.00 | 56.00 | -23.00 |
| 0.858 | QP | L | 28.10 | 56.00 | -27.90 |
| 1.930 | QP | L | 26.20 | 56.00 | -29.80 |
| 2.506 | QP | L | 26.10 | 56.00 | -29.90 |

**Result data graph shows the conducted emission (Neutral).**
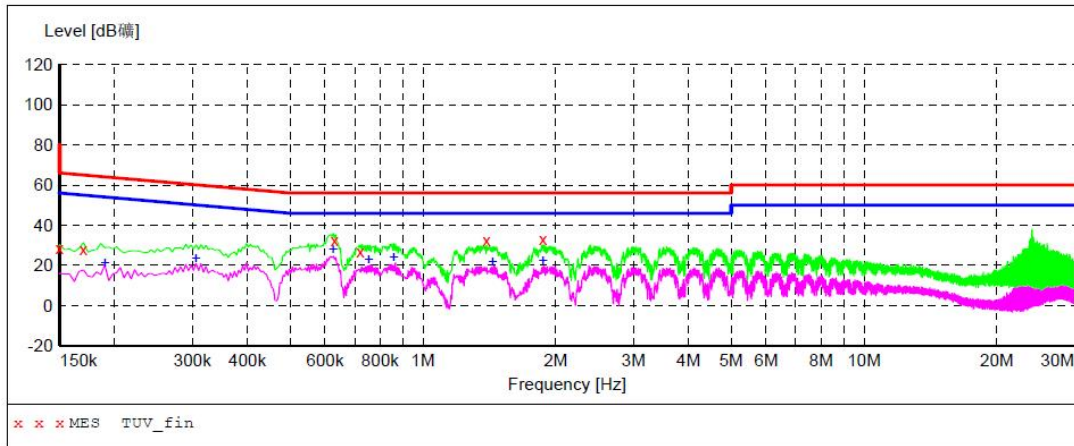


Refer to the following table for the result details:

| Conducted Emission | | | | | |
|---|---|---|---|---|---|
| Frequency (MHz) | Detector (QP/AV) | Phase | Result (dBμV) | Limit (dBμV) | Margin |
| 0.170 | QP | N | 28.20 | 65.00 | -36.80 |
| 0.630 | QP | N | 32.40 | 56.00 | -23.60 |
| 0.722 | QP | N | 26.60 | 56.00 | -29.40 |
| 1.394 | QP | N | 32.50 | 56.00 | -23.50 |
| 1.874 | QP | N | 33.10 | 56.00 | -22.90 |

**5.0     List of Measurement Equipment**

### Radiated Emission and Bandwidth Emissions

| Manufacturer | Description | Model no. | Serial no. | CAL due |
|---|---|---|---|---|
| N/A | 3m Semi- Anechoic Chamber | 9.0(L)*6.0(W)* 6.0(H) | N/A | Jul. 16 2014 |
| Agilent | Spectrum Analyzer | E4440A | US41421290 | Jul. 16 2014 |
| R&S | EMI Test Receiver | ESCI | 100694 | Jul. 16 2014 |
| A.H. | Wideband Antenna | SAS-521-4 | 26 | Jul. 16 2014 |
| EMCO | Antenna | 3142C | 60447 | Jul. 16 2014 |
| EM | Horn Antenna | EM-AH-10180 | 67 | Jul. 16 2014 |
| EM | Power Amplifier | EM30180 | 0607030 | Jul. 16 2014 |
| MF | Position Controller | MF-7802 | MF780208138 | N/A |

### Conducted Emissions

| Manufacturer | Description | Model no. | Serial no. | CAL due |
|---|---|---|---|---|
| N/A | Shielding Room | 7.(L)x4(W)x3(H) | N/A | Jul. 16 2014 |
| R&S | EMI Test Receiver | ESCI | 100694 | Jul. 16 2014 |
| R&S | LISN | ESH3-Z5 | 8389791009 | Jul. 16 2014 |

N/A   Not Applicable or Not Available