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# TEST REPORT

## Report No.: 14100916HKG-001

## Imation Corp.

Application
For
Certification
(Original Grant)
**(FCC ID: PB4-TDKWR680)**
**(IC: 6900A-TDKWR680)**

Transceiver

Prepared and Checked by:

Signed On File
Wong Cheuk Ho, Herbert
Lead Engineer

Approved by:


Wong Kwok Yeung, Kenneth
Lead Engineer
Date: November 28, 2014

## GENERAL INFORMATION

| | |
|---|---|
| Grantee: | Imation Corp. |
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| Manufacturer: | Imation Corp. |
| Manufacturer Address: | 1 Imation Way,<br>Oakdale, Minnesota 55128-3414,<br>United States. |
| Brand Name: | TDK Life on Record |
| Model: | WR680 |
| Type of EUT: | Transceiver |
| Description of EUT: | Wireless Headphones |
| Serial Number: | N/A |
| FCC ID / IC: | PB4-TDKWR680 / 6900A-TDKWR680 |
| Date of Sample Submitted: | October 24, 2014 |
| Date of Test: | October 24, 2014 to November 11, 2014 |
| Report No.: | 14100916HKG-001 |
| Report Date: | November 28, 2014 |
| Environmental Conditions: | Temperature: +10 to 40°C<br>Humidity: 10 to 90% |

## SUMMARY OF TEST RESULT

| TEST SPECIFICATION | REFERENCE | RESULTS |
|---|---|---|
| Transmitter Power Line Conducted Emissions | 15.207 / RSS-Gen 7.2.4 | Pass |
| Radiated Emission<br>Radiated Emission on the Bandedge | 15.249 / RSS-210 A2.9 | Pass |
| Digital Device Radiated Emissions | 15.109 / RSS-210 2.5 | Pass |
| Radiated Emission in Restricted Bands | 15.205 / RSS-210 2.2 | Pass |

The equipment under test is found to be complying with the following standards:
FCC Part 15, October 1, 2012 Edition
RSS-210 Issue 8, December 2010
RSS-Gen Issue 3, December 2010

Note: 1. The EUT uses a permanently attached antenna which, in accordance to section 15.203, is considered sufficient to comply with the pervisions of this section.
2. Pursuant to FCC part 15 Section 15.215(c), the 20 dB bandwidth of the emission was contained within the frequency band designated (mentioned as above) which the EUT operated. The effects, if any, from frequency sweeping, frequency hopping, other modulation techniques and frequency stability over excepted variations in temperature and supply voltage were considered.

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## 1.0 General Description

### 1.1 Product Description

The Equipment Under Test (EUT) is a Wireless Headphones. It can accept analog input source (3.5mm phone jack aux-in) and wireless Bluetooth device. The Bluetooth module in the EUT is operating in the frequency range from 2402MHz to 2480MHz (79 channels with 1MHz channel spacing). The audio signal is fed to earphones. The EUT is powered by 3.6VDC internal rechargeable battery. The internal battery can be charged via USB port (5VDC). The USB port is for charging only without PC connectivity. The NFC tag is a passive device (for Bluetooth pairing) as declared by the applicant.

Antenna Type: Internal, Integral

For electronic filing, the brief circuit description is saved with filename: descri.pdf.

### 1.2 Related Submittal(s) Grants

This is a single application for certification of a transceiver.

### 1.3 Test Methodology

Both AC mains line-conducted and radiated emission measurements were performed according to the procedures in ANSI C63.4 (2009). All radiated measurements were performed in 3m Chamber. Preliminary scans were performed in the 3m Chamber only to determine worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the **"Justification Section"** of this Application.

### 1.4 Test Facility

The 3m Chamber and conducted measurement facility used to collect the radiated data is located at Workshop No. 3, G/F., World-Wide Industrial Centre, 43-47 Shan Mei Street, Fo Tan, Sha Tin, N.T., Hong Kong. This test facility and site measurement data have been placed on file with the FCC and IC.

## 2.0 System Test Configuration

### 2.1 Justification

The system was configured for testing in a typical fashion (as a customer would normally use it), and in the confines as outlined in ANSI C63.4 (2009).

The device was powered by 3.6VDC internal rechargeable battery.

For the AC line conducted emission test, the EUT along with its peripherals were placed on a 1.0m(W)x1.5m(L) and 0.8m in height wooden table and the EUT was adjusted to maintain a 0.4meter space from a vertical reference plane. The EUT was connected to power mains through a line impedance stabilization network (LISN), which provided 50ohm coupling impedance for measuring instrument. The LISN housing, measuring instrument case, reference ground plane, and vertical ground plane were bounded together. The excess power cable between the EUT and the LISN was bundled.

For maximizing emissions, the EUT was rotated through 360°, the antenna height was varied from 1 meter to 4 meters above the ground plane, and the antenna polarization was changed. This step by step procedure for maximizing emissions led to the data reported in Exhibit 3.0.

The rear of unit shall be flushed with the rear of the table.

The equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). The EUT was mounted to a plastic stand if necessary and placed on the wooden turntable, which enabled the engineer to maximize emissions through its placement in the three orthogonal axes.

2.2 EUT Exercising Software

There was no special software to exercise the device. Once the unit is powered up, it transmits the RF signal continuously.

2.3 Special Accessories

There are no special accessories necessary for compliance of this product.

2.4 Measurement Uncertainty

When determining of the test conclusion, the Measurement Uncertainty of test has been considered.

Uncertainty and Compliance - Unless the standard specifically states that measured values are to be extended by the measurement uncertainty in determining compliance, all compliance determinations are based on the actual measured value.

2.5 Support Equipment List and Description

1. HP Notebook Computer (Model: 430G1)
2. Portable Hard disk with USB cable of 0.4m long
   (Provided by Intertek)
3. USB cable of 1m long (for charging only)
4. Software: BlueTest3
   (Provided by Applicant)

## 3.0 **Emission Results**

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

### 3.1 Field Strength Calculation

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

FS = RA + AF + CF - AG - AV

where FS = Field Strength in dBµV/m
RA = Receiver Amplitude (including preamplifier) in dBµV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB
AV = Average Factor in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows:

FS = RR + LF

where FS = Field Strength in dBµV/m
RR = RA - AG - AV in dBµV
LF = CF + AF in dB

Assume a receiver reading of 52.0 dBµV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB are added. The amplifier gain of 29 dB and average factor of 5 dB are subtracted, giving a field strength of 32 dBµV/m. This value in dBµV/m was converted to its corresponding level in µV/m.

RA = 52.0 dBµV/m
AF = 7.4 dB
CF = 1.6 dB
AG = 29.0 dB
AV = 5.0 dB
FS = RR + LF
FS = 18 + 9 = 27 dBµV/m

RR = 18.0 dBµV
LF = 9.0 dB

Level in µV/m = Common Antilogarithm [(27 dBµV/m)/20] = 22.4 µV/m

3.2 Radiated Emission Configuration Photograph

The worst case in radiated emission was found at 4884.000 MHz

For electronic filing, the worst case radiated emission configuration photographs are saved with filename: radiated photos.pdf.

3.3 Radiated Emission Data

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Judgment: Passed by 4.2 dB

3.4 Conducted Emission Configuration Photograph

The worst case in line-conducted emission was found at 0.177 MHz

For electronic filing, the worst case line-conducted configuration photographs are saved with filename: conducted photo.pdf.

3.5 Conducted Emission Data

For electronic filing, the graph and data table of conducted emission is saved with filename: conducted.pdf.

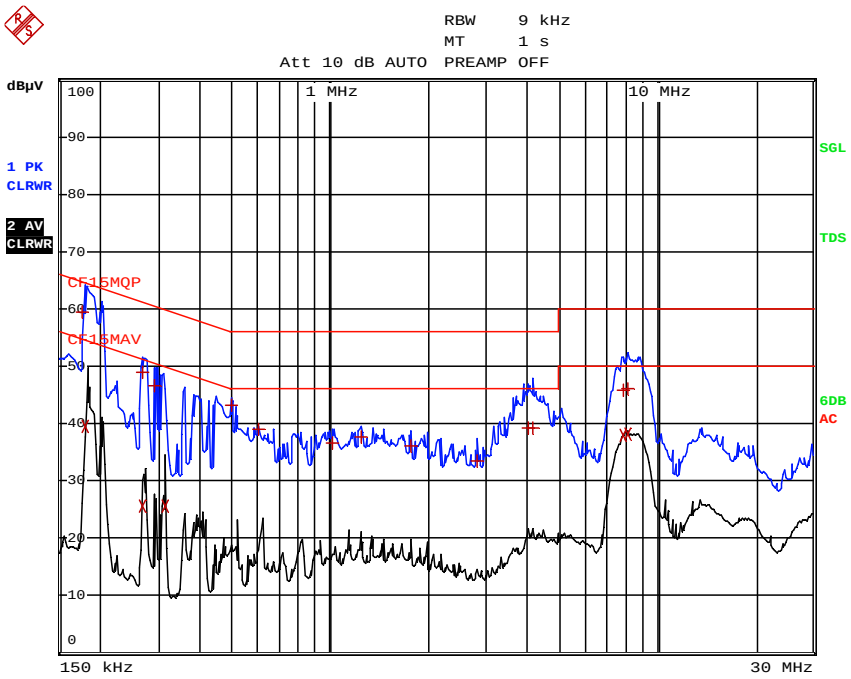
Judgment: Pass by 5.1 dB

Worst-Case Operating Mode: Transmitting (Bluetooth)

EDIT PEAK LIST (Final Measurement Results)

Trace1: CF15MQP
Trace2: CF15MAV
Trace3: ---

| TRACE | | FREQUENCY | LEVEL dBµV | | DELTA LIMIT dB |
|---|---|---|---|---|---|
| 1 | Quasi Peak | 177 kHz | 59.47 | N | -5.14 |
| 2 | CISPR Average | 181.5 kHz | 39.53 | N | -14.87 |
| 1 | Quasi Peak | 267 kHz | 49.01 | L1 | -12.19 |
| 2 | CISPR Average | 271.5 kHz | 25.64 | N | -25.42 |
| 1 | Quasi Peak | 294 kHz | 46.70 | L1 | -13.71 |
| 2 | CISPR Average | 312 kHz | 25.66 | N | -24.25 |
| 1 | Quasi Peak | 496.5 kHz | 43.22 | L1 | -12.83 |
| 1 | Quasi Peak | 600 kHz | 38.87 | N | -17.12 |
| 1 | Quasi Peak | 1.014 MHz | 36.51 | N | -19.48 |
| 1 | Quasi Peak | 1.248 MHz | 37.70 | L1 | -18.29 |
| 1 | Quasi Peak | 1.7745 MHz | 36.14 | N | -19.85 |
| 1 | Quasi Peak | 2.8095 MHz | 33.57 | N | -22.42 |
| 1 | Quasi Peak | 4.0245 MHz | 39.24 | N | -16.75 |
| 1 | Quasi Peak | 4.164 MHz | 39.19 | N | -16.80 |
| 2 | CISPR Average | 7.917 MHz | 37.94 | N | -12.05 |
| 1 | Quasi Peak | 7.9215 MHz | 45.88 | N | -14.12 |
| 1 | Quasi Peak | 8.1375 MHz | 45.97 | N | -14.02 |
| 2 | CISPR Average | 8.1825 MHz | 38.23 | N | -11.76 |



Applicant: Imation Corp. Date of Test: November 11, 2014
Model: WR680
Worst-Case Operating Mode: Transmitting (Bluetooth)

Table 1

**Radiated Emissions**
**Pursuant to FCC Part 15 Section 15.249 Requirement**

Lowest Channel

| Polari-zation | Frequency (MHz) | Reading (dBµV) | Pre-Amp Gain (dB) | Antenna Factor (dB) | Net at 3m - Peak (dBµV/m) | Average Factor (dB) | Calculated at 3m (dBµV/m) | Average Limit at 3m (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| H | 2402.000 | 102.4 | 33 | 29.4 | 98.8 | 24 | 74.8 | 94.0 | -19.2 |
| ***H*** | ***4804.000*** | ***67.7*** | ***33*** | ***34.9*** | ***69.6*** | ***24*** | ***45.6*** | ***54.0*** | ***-8.4*** |
| H | 7206.000 | 59.5 | 33 | 37.9 | 64.4 | 24 | 40.4 | 54.0 | -13.6 |
| H | 9608.000 | 48.0 | 33 | 40.4 | 55.4 | 24 | 31.4 | 54.0 | -22.6 |
| ***H*** | ***12010.000*** | ***51.1*** | ***33*** | ***40.5*** | ***58.6*** | ***24*** | ***34.6*** | ***54.0*** | ***-19.4*** |
| H | 14412.000 | 47.4 | 33 | 40.0 | 54.4 | 24 | 30.4 | 54.0 | -23.6 |

| Polari-zation | Frequency (MHz) | Reading (dBµV) | Pre-Amp Gain (dB) | Antenna Factor (dB) | Net at 3m - Peak (dBµV/m) | Peak Limit at 3m (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| H | 2402.000 | 102.4 | 33 | 29.4 | 98.8 | 114.0 | -15.2 |
| ***H*** | ***4804.000*** | ***67.7*** | ***33*** | ***34.9*** | ***69.6*** | ***74.0*** | ***-4.4*** |
| H | 7206.000 | 59.5 | 33 | 37.9 | 64.4 | 74.0 | -9.6 |
| H | 9608.000 | 48.0 | 33 | 40.4 | 55.4 | 74.0 | -18.6 |
| ***H*** | ***12010.000*** | ***51.1*** | ***33*** | ***40.5*** | ***58.6*** | ***74.0*** | ***-15.4*** |
| H | 14412.000 | 47.4 | 33 | 40.0 | 54.4 | 74.0 | -19.6 |

NOTES: 1. Peak Detector Data unless otherwise stated.

2. All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distances were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.

3. Negative sign in the column shows value below limit.

4. Horn antenna is used for the emission over 1000MHz.

5. Emission (the row indicated by ***bold italic***) within the restricted band meets the requirement of FCC Part 15 Section 15.205 / RSS-210 Section 2.2.

Applicant: Imation Corp. Date of Test: November 11, 2014
Model: WR680
Worst-Case Operating Mode: Transmitting (Bluetooth)

Table 2

**Radiated Emissions**
**Pursuant to FCC Part 15 Section 15.249 Requirement**

Middle Channel

| Polari-zation | Frequency (MHz) | Reading (dBµV) | Pre-Amp Gain (dB) | Antenna Factor (dB) | Net at 3m - Peak (dBµV/m) | Average Factor (dB) | Calculated at 3m (dBµV/m) | Average Limit at 3m (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| H | 2442.000 | 102.0 | 33 | 29.4 | 98.4 | 24 | 74.4 | 94.0 | -19.6 |
| ***H*** | ***4884.000*** | ***67.9*** | ***33*** | ***34.9*** | ***69.8*** | ***24*** | ***45.8*** | ***54.0*** | ***-8.2*** |
| ***H*** | ***7326.000*** | ***59.9*** | ***33*** | ***37.9*** | ***64.8*** | ***24*** | ***40.8*** | ***54.0*** | ***-13.2*** |
| H | 9768.000 | 48.0 | 33 | 40.4 | 55.4 | 24 | 31.4 | 54.0 | -22.6 |
| ***H*** | ***12210.000*** | ***49.1*** | ***33*** | ***40.5*** | ***56.6*** | ***24*** | ***32.6*** | ***54.0*** | ***-21.4*** |
| H | 14652.000 | 49.0 | 33 | 38.4 | 54.4 | 24 | 30.4 | 54.0 | -23.6 |

| Polari-zation | Frequency (MHz) | Reading (dBµV) | Pre-Amp Gain (dB) | Antenna Factor (dB) | Net at 3m - Peak (dBµV/m) | Peak Limit at 3m (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| H | 2442.000 | 102.0 | 33 | 29.4 | 98.4 | 114.0 | -15.6 |
| ***H*** | ***4884.000*** | ***67.9*** | ***33*** | ***34.9*** | ***69.8*** | ***74.0*** | ***-4.2*** |
| ***H*** | ***7326.000*** | ***59.9*** | ***33*** | ***37.9*** | ***64.8*** | ***74.0*** | ***-9.2*** |
| H | 9768.000 | 48.0 | 33 | 40.4 | 55.4 | 74.0 | -18.6 |
| ***H*** | ***12210.000*** | ***49.1*** | ***33*** | ***40.5*** | ***56.6*** | ***74.0*** | ***-17.4*** |
| H | 14652.000 | 49.0 | 33 | 38.4 | 54.4 | 74.0 | -19.6 |

NOTES: 1. Peak Detector Data unless otherwise stated.

2. All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distances were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.

3. Negative sign in the column shows value below limit.

4. Horn antenna is used for the emission over 1000MHz.

5. Emission (the row indicated by ***bold italic***) within the restricted band meets the requirement of FCC Part 15 Section 15.205 / RSS-210 Section 2.2.

Applicant: Imation Corp. Date of Test: November 11, 2014
Model: WR680
Worst-Case Operating Mode: Transmitting (Bluetooth)

Table 3

**Radiated Emissions**
**Pursuant to FCC Part 15 Section 15.249 Requirement**

Highest Channel

| Polari-zation | Frequency (MHz) | Reading (dBµV) | Pre-Amp Gain (dB) | Antenna Factor (dB) | Net at 3m - Peak (dBµV/m) | Average Factor (dB) | Calculated at 3m (dBµV/m) | Average Limit at 3m (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| H | 2480.000 | 101.6 | 33 | 29.4 | 98.0 | 24 | 74.0 | 94.0 | -20.0 |
| ***H*** | ***4960.000*** | ***67.5*** | ***33*** | ***34.9*** | ***69.4*** | ***24*** | ***45.4*** | ***54.0*** | ***-8.6*** |
| ***H*** | ***7440.000*** | ***59.5*** | ***33*** | ***37.9*** | ***64.4*** | ***24*** | ***40.4*** | ***54.0*** | ***-13.6*** |
| H | 9920.000 | 46.0 | 33 | 40.4 | 53.4 | 24 | 29.4 | 54.0 | -24.6 |
| ***H*** | ***12400.000*** | ***49.9*** | ***33*** | ***40.5*** | ***57.4*** | ***24*** | ***33.4*** | ***54.0*** | ***-20.6*** |
| H | 14880.000 | 49.0 | 33 | 38.4 | 54.4 | 24 | 30.4 | 54.0 | -23.6 |

| Polari-zation | Frequency (MHz) | Reading (dBµV) | Pre-Amp Gain (dB) | Antenna Factor (dB) | Net at 3m - Peak (dBµV/m) | Peak Limit at 3m (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| H | 2480.000 | 101.6 | 33 | 29.4 | 98.0 | 114.0 | -16.0 |
| ***H*** | ***4960.000*** | ***67.5*** | ***33*** | ***34.9*** | ***69.4*** | ***74.0*** | ***-4.6*** |
| ***H*** | ***7440.000*** | ***59.5*** | ***33*** | ***37.9*** | ***64.4*** | ***74.0*** | ***-9.6*** |
| H | 9920.000 | 46.0 | 33 | 40.4 | 53.4 | 74.0 | -20.6 |
| ***H*** | ***12400.000*** | ***49.9*** | ***33*** | ***40.5*** | ***57.4*** | ***74.0*** | ***-16.6*** |
| H | 14880.000 | 49.0 | 33 | 38.4 | 54.4 | 74.0 | -19.6 |

NOTES: 1. Peak Detector Data unless otherwise stated.

2. All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distances were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.

3. Negative sign in the column shows value below limit.

4. Horn antenna is used for the emission over 1000MHz.

5. Emission (the row indicated by ***bold italic***) within the restricted band meets the requirement of FCC Part 15 Section 15.205 / RSS-210 Section 2.2.

Applicant: Imation Corp. Date of Test: November 11, 2014
Model: WR680
Worst-Case Operating Mode: Bluetooth Sound Playing with Charging

Table 4

**Radiated Emissions**
**Pursuant to FCC Part 15 Section 15.209 Requirement**

| Polarization | Frequency (MHz) | Reading (dBµV) | Pre-amp (dB) | Antenna Factor (dB) | Net at 3m (dBµV/m) | Limit at 3m (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| H | 44.968 | 37.2 | 16 | 10.0 | 31.2 | 40.0 | -8.8 |
| H | 75.222 | 38.8 | 16 | 6.0 | 28.8 | 40.0 | -11.2 |
| H | 176.888 | 28.2 | 16 | 19.0 | 31.2 | 43.5 | -12.3 |
| H | 292.402 | 24.4 | 16 | 22.0 | 30.4 | 46.0 | -15.6 |
| H | 389.004 | 24.2 | 16 | 25.0 | 33.2 | 46.0 | -12.8 |
| H | 433.442 | 29.8 | 16 | 25.0 | 38.8 | 46.0 | -7.2 |
| H | 455.002 | 29.4 | 16 | 26.0 | 39.4 | 46.0 | -6.6 |
| H | 491.002 | 29.8 | 16 | 26.0 | 39.8 | 46.0 | -6.2 |
| H | 594.002 | 25.8 | 16 | 29.0 | 38.8 | 46.0 | -7.2 |
| H | 720.002 | 25.6 | 16 | 30.0 | 39.6 | 46.0 | -6.4 |

NOTES: 1. Peak Detector Data unless otherwise stated.

2. All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distances were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.

3. Negative sign in the column shows value below limit.

4. Emission (the row indicated by ***bold italic***) within the restricted band meets the requirement of FCC Part 15 Section 15.205.

## 4.0 Equipment Photographs

For electronic filing, the photographs are saved with filename: external photos.pdf and internal photos.pdf.

## 5.0 Product Labelling

For electronics filing, the FCC ID label artwork and the label location are saved with filename: label.pdf.

## 6.0 Technical Specifications

For electronic filing, the block diagram and schematic of the tested EUT are saved with filename: block.pdf and circuit.pdf respectively.

## 7.0 Instruction Manual

For electronic filing, a preliminary copy of the Instruction Manual is saved with filename: manual.pdf.

This manual will be provided to the end-user with each unit sold/leased in the United States and Canada.

## 8.0 **Miscellaneous Information**

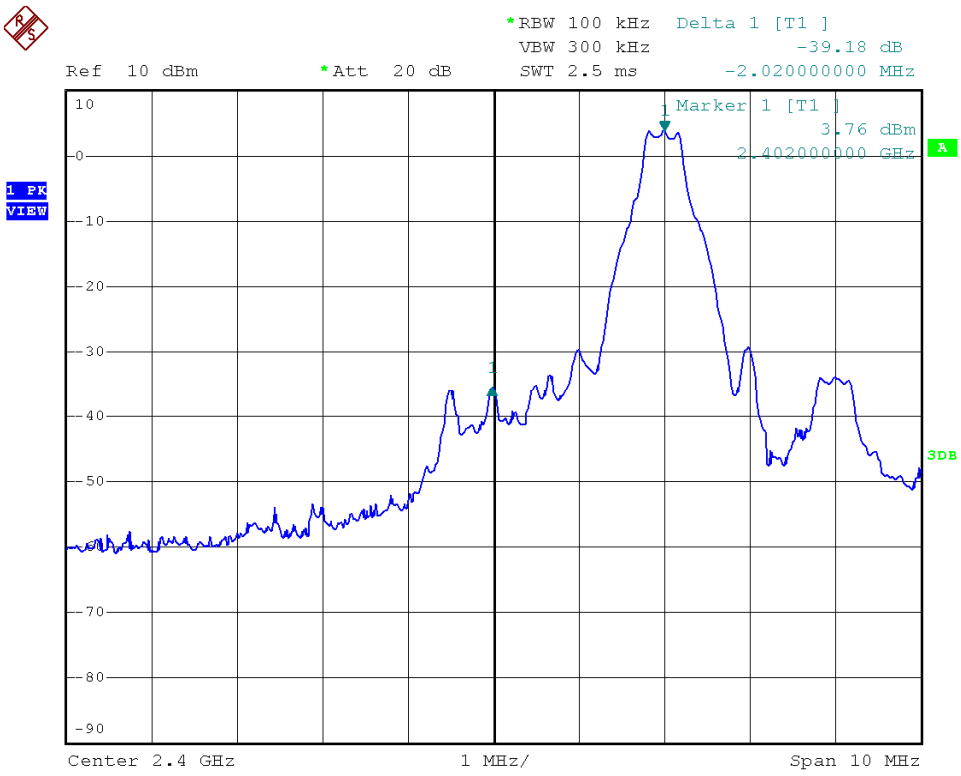
The miscellaneous information includes details of the test procedure and measured bandwidth / calculation of factor such as pulse desensitization and averaging factor.

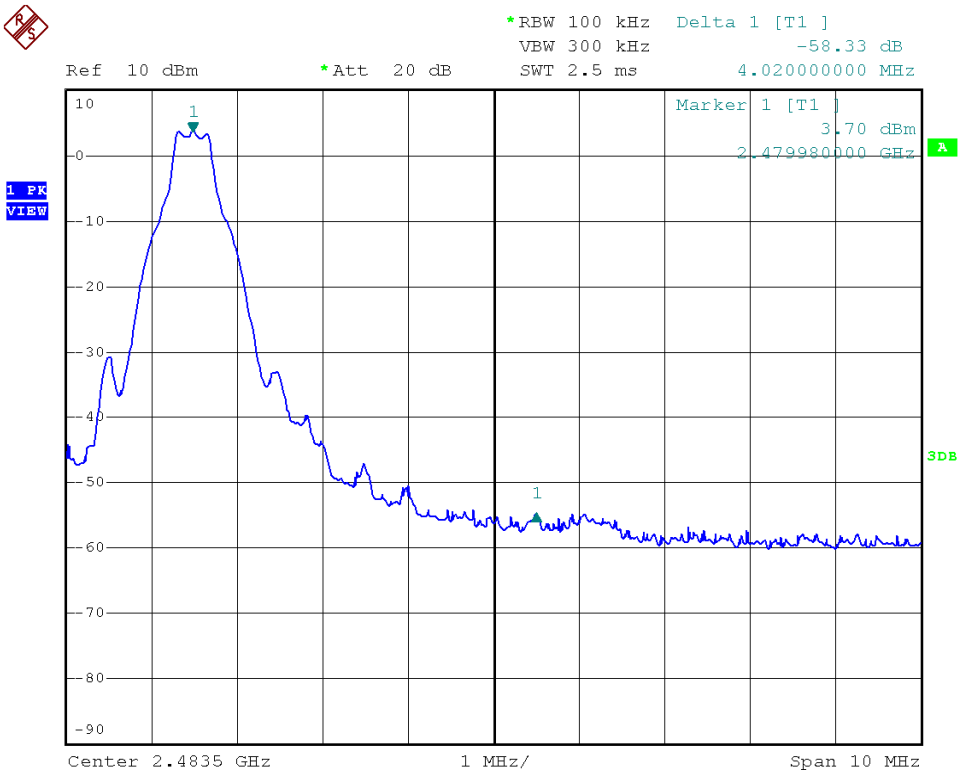
### 8.1 Radiated Emission on the Bandedge

From the following plots, they show that the fundamental emissions are confined in the specified band (2400MHz to 2483.5MHz). In case of the fundamental emissions are within two standard bandwidths from the bandedge, the delta measurement technique is used for determining bandedge compliance. Standard bandwidth is the bandwidth specified by ANSI C63.4 (2009) for frequency being measured.

Emissions radiated outside of the specified frequency bands, except harmonics, are attenuated by 50dB below the level of the fundamental or to the general radiated emissions limits in Section 15.209 / RSS-210 2.5, whichever is the lesser attenuation, which meet the requirement of part 15.249(d) / RSS-210 A2.9.

Peak Measurement (Bluetooth)



Peak Measurement (Bluetooth)

Bandedge compliance is determined by applying marker-delta method, i.e. (Bandedge Plot).

Lower bandedge

Peak Resultant field strength = Fundamental emissions (peak value) – delta from the plot

=98.8 dBµV/m - 39.2 dB
=59.6 dBµV/m

Average Resultant field strength = Fundamental emissions (average value) – delta from the plot

=74.8 dBµV/m - 39.2 dB
=35.6 dBµV/m

Upper bandedge

Peak Resultant field strength = Fundamental emissions (peak value) – delta from the plot

=98.0 dBµV/m - 58.3 dB
=39.7 dBµV/m

Average Resultant field strength = Fundamental emissions (average value) – delta from the plot

=74.0 dBµV/m - 58.3 dB
=15.7 dBµV/m

The resultant field strength meets the general radiated emission limit in Section 15.209, which does not exceed 74 dBµV/m (Peak Limit) and 54 dBµV/m (Average Limit).

8.2 Discussion of Pulse Desensitization

Pulse desensitivity is not applicable for this device. The effective period (Teff) is approximately 0.625ms for a digital “1” bit which illustrated on technical specification, with a resolution bandwidth (3dB) of 1MHz, so the pulse desensitivity factor is 0dB.

8.3 Calculation of Average Factor

Based on the Bluetooth Specification Version 2.1 + EDR, the transmitter ON time for each timeslot of Bluetooth is 625µs. DH5 has the maximum duty cycle, which consists of 5 continuous Tx slots and 1 Rx slot. Therefore one hopset take (5+1) x 625µs = 3.75ms. For one period for a pseudo-random hopping through at least 20 RF channels in adaptive mode (worse case), it take: 20 x 3.75ms = 75ms.

The dwell time for DH5 is 5 x 625µs = 3.125ms.

For the worst case calculation, there are two transmissions might occur in 100ms. Therefore,

Duty Cycle (DC) = Maximum On time in 100ms/100ms
= 3.125ms x 2/100ms
= 0.0625

Average Factor (AF) of Bluetooth in dB = $20 \log_{10} (0.0625)$
= -24 dB

8.4 Emissions Test Procedures

The following is a description of the test procedure used by Intertek Testing Services Hong Kong Ltd. in the measurements of transmitter operating under the Part 15, Subpart C rules.

The transmitting equipment under test (EUT) is placed on a wooden turntable which is four feet in diameter and approximately one meter in height above the ground plane. During the radiated emissions test, the turntable is rotated and any cables leaving the EUT are manipulated to find the configuration resulting in maximum emissions. The EUT is adjusted through all three orthogonal axis to obtain maximum emission levels. The antenna height and polarization are also varied during the testing to search for maximum signal levels. The height of the antenna is varied from one to four meters.

Detector function for radiated emissions is in peak mode. Average readings, when required, are taken by measuring the duty cycle of the equipment under test and subtracting the corresponding amount in dB from the measured peak readings. A detailed description for the calculation of the average factor can be found in Exhibit 8.3.

The frequency range scanned is from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or 40 GHz, whichever is lower. For line conducted emissions, the range scanned is 150 kHz to 30 MHz.

8.4 Emissions Test Procedures (cont'd)

The EUT is warmed up for 15 minutes prior to the test.

AC power to the unit is varied from 85% to 115% nominal and variation in the fundamental emission field strength is recorded. If battery powered, a new, fully charged battery is used.

Conducted measurements were made as described in ANSI C63.4 (2009).

The IF bandwidth used for measurement of radiated signal strength was 100 kHz or greater when frequency is below 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application Note 150-2. A discussion of whether pulse desensitivity is applicable to this unit is included in this report (See Exhibit 8.1). Above 1000 MHz, a resolution bandwidth of 1 MHz is used.

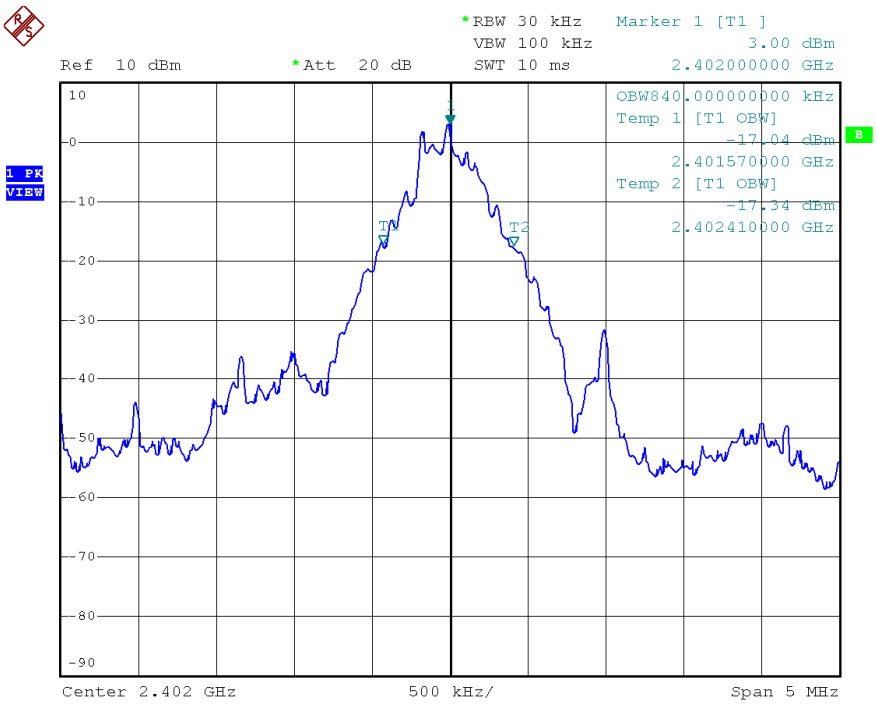
Transmitter measurements are normally conducted at a measurement distance of three meters. However, to assure low enough noise floor in the forbidden bands and above 1 GHz, signals are acquired at a distance of one meter or less. All measurements are extrapolated to three meters using inverse scaling, unless otherwise reported. Measurements taken at a closer distance are so marked.

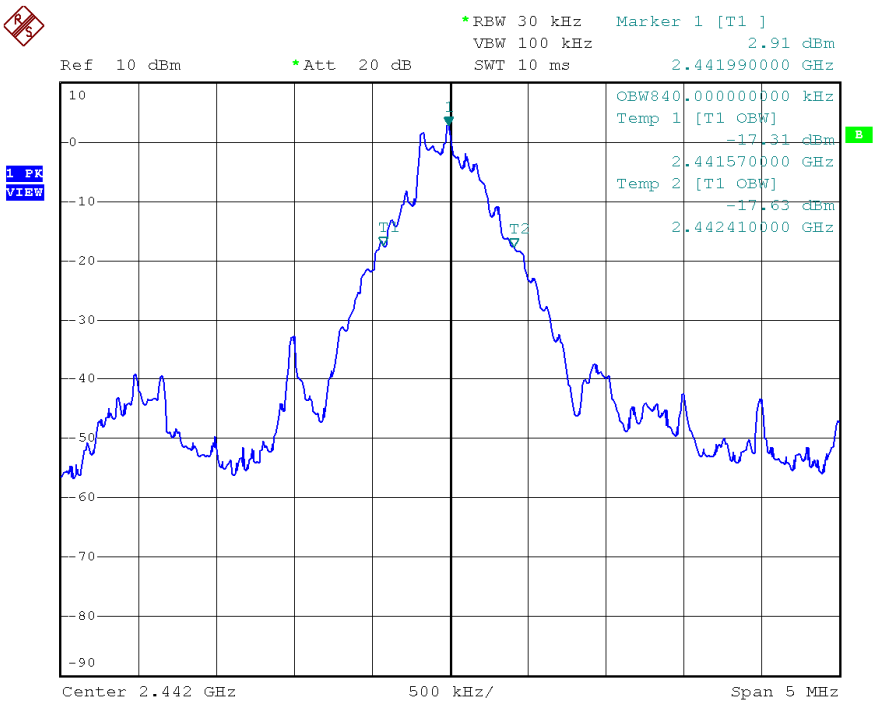
## 8.5 Occupied Bandwidth

Occupied Bandwidth Results: Bluetooth

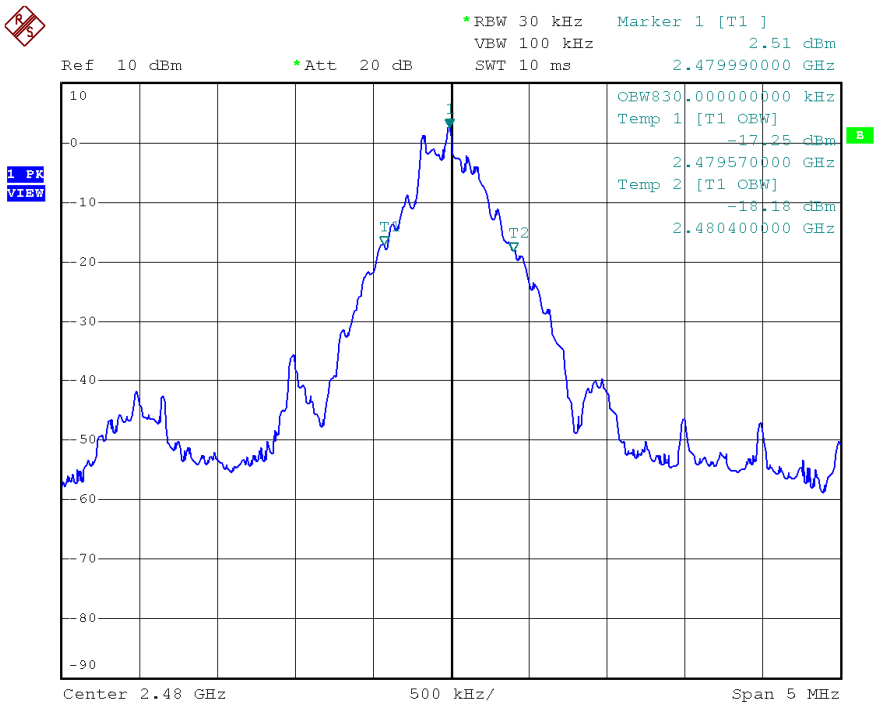
| Bluetooth | Occupied Bandwidth (kHz) |
|---|---|
| Low Channel: 2402 | 840 |
| Middle Channel: 2442 | 840 |
| High Channel: 2480 | 830 |

Bandwidth Measurement (Bluetooth)



Bandwidth Measurement (Bluetooth)



## 9.0 Confidentiality Request

For electronic filing, a preliminary copy of the confidentiality request is saved with filename: request.pdf.

## 10.0 Equipment List

1) Radiated Emissions Test

| Equipment | EMI Test Receiver | Biconical Antenna | Log Periodic Antenna |
|---|---|---|---|
| Registration No. | EW-2666 | EW-0571 | EW-0572 |
| Manufacturer | R&S | EMCO | EMCO |
| Model No. | ESCI7 | 3104C | 3146 |
| Calibration Date | Jun. 20, 2013 | Nov. 01, 2013 | Jun. 26, 2013 |
| Calibration Due Date | Dec. 20, 2014 | May 01, 2015 | Dec. 26, 2014 |

| Equipment | Spectrum Analyzer | Pyramidal Horn Antenna | Double Ridged Guide Antenna |
|---|---|---|---|
| Registration No. | EW-2466 | EW-0905 | EW-1015 |
| Manufacturer | R&S | EMCO | EMCO |
| Model No. | FSP30 | 3160-09 | 3115 |
| Calibration Date | Sep. 02, 2014 | Jan. 28, 2014 | Oct. 28, 2014 |
| Calibration Due Date | Sep. 02, 2015 | Jul. 28, 2015 | Apr. 28, 2016 |

2) Conducted Emissions Test

| Equipment | EMI Test Receiver | LISN |
|---|---|---|
| Registration No. | EW-2666 | EW-2501 |
| Manufacturer | R&S | R&S |
| Model No. | ESCI7 | ENV-216 |
| Calibration Date | Jun. 20, 2013 | Dec. 25, 2013 |
| Calibration Due Date | Dec. 20, 2014 | Nov. 30, 2014 |

3) Bandedge/Bandwidth Measurement

| Equipment | Spectrum Analyzer |
|---|---|
| Registration No. | EW-2329 |
| Manufacturer | R&S |
| Model No. | FSP3 |
| Calibration Date | Jun. 19, 2014 |
| Calibration Due Date | Jun. 19, 2015 |

END OF TEST REPORT