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HOKLAS 005 TEST

TEST REPORT

Report No.: 14030606HKG-001

Modern Electronics Factory Ltd.

Application
For
Certification
(Original Grant)
(FCC ID: SSMMEF221BT)

Transceiver

Prepared and Checked by:

Wong Cheuk Ho, Herbert
Lead Engineer

Approved by:

Chan Chi Hung, Terry
Supervisor
Date: May 19, 2014

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GENERAL INFORMATION

Grantee:	Modern Electronics Factory Ltd.
Grantee Address:	Flat C, 10/F., Phase 4, Kwun Tong Industrial Centre, 472-478 Kwun Tong Road, Kwun Tong, Kowloon, Hong Kong.
Contact Person:	Ho Kwok Wing
Tel:	(852) 2344-3968
Fax:	(852) 2344-3088
e-mail:	kwho@modernelect.com
Manufacturer:	Keng Fu Jia Electronics (ShenZhen) Co., Ltd.
Manufacturer Address:	175 Huasheng Road, Langkou Community, Dalang Street, Bao'an District, ShenZhen, China.
Brand Name:	MET / SYLVANIA / CURTIS / PROSCAN
Model:	MET221BT / SRCD682BT / RCD682BT / PRCD682BT
Type of EUT:	Transceiver
Description of EUT:	Bluetooth CD Player w/PLL Radio
Serial Number:	N/A
FCC ID:	SSMMEF221BT
Date of Sample Submitted:	March 14, 2014
Date of Test:	March 14, 2014 to April 22, 2014
Report No.:	14030606HKG-001
Report Date:	May 19, 2014
Environmental Conditions:	Temperature: +10 to 40°C Humidity: 10 to 90%

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HOKLAS 005 TEST

SUMMARY OF TEST RESULT

TEST SPECIFICATION	REFERENCE	RESULTS
Transmitter Power Line Conducted Emissions	15.207	Pass
Radiated Emission Radiated Emission on the Bandedge	15.249	Pass
Radiated Emission in Restricted Bands	15.205	Pass

The equipment under test is found to be complying with the following standards:
FCC Part 15, October 1, 2012 Edition

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 2.4GHz Bluetooth speaker with AM/FM radio and CD player. The EUT can accept line in analog audio source. The Bluetooth portion is operating between 2402MHz and 2480MHz (79 channels with 1MHz channel spacing, adaptive frequency hopping). The EUT is powered by 12VDC (8 x 1.5V "D" batteries) or 120VAC. When the EUT is switched ON in Bluetooth mode, the display will show "BT" and flashing. The corresponding Bluetooth device would be searched and connected to the EUT before playing audio. After pairing, the "BT" will stay lit.

The Model: SRCD682BT, RCD682BT and PRCD682BT are the same as the Model: MET221BT in hardware aspect except different color, cosmetic details, brand name and model number. The difference in model number serves as marketing strategy.

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 an Open Area Test Site. Preliminary scans were performed in the Open Area Test Site 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 open area test site and conducted measurement facility used to collect the radiated data is located at Garment Centre, 576 Castle Peak Road, Kowloon, Hong Kong. This test facility and site measurement data have been placed on file with the FCC.

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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 120VAC or new 12VDC (8 x 1.5V "D" batteries).

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.

2.5 Support Equipment List and Description

1. 5.0 ohm resistance (Provided by Intertek)
2. 1m audio cable (Provided by Intertek)
3. Sony Walkman (Provided by Intertek) (EW-1738)
4. 0.75m USB cable (Provided by Intertek)

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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
AF = 7.4 dB
CF = 1.6 dB
AG = 29.0 dB
AV = 5.0 dB
RR = 18.0 dBµV
LF = 9.0 dB
FS = RR + LF
FS = 18 + 9 = 27 dBµV/m

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

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3.2 Radiated Emission Configuration Photograph

The worst case in radiated emission was found at 135.780 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 7.2 dB

3.4 Conducted Emission Configuration Photograph

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 more than 20 dB

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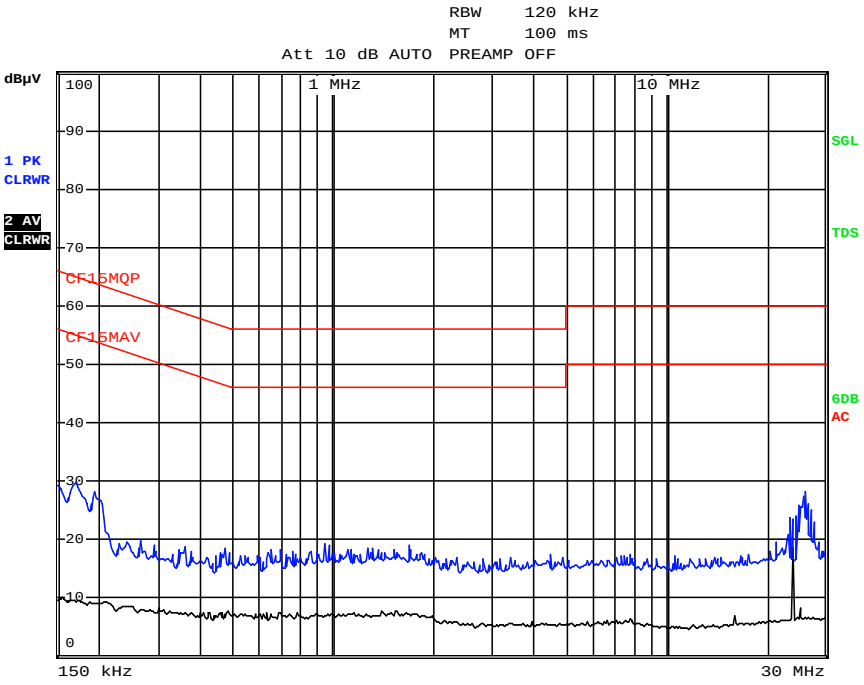

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HOKLAS 005 TEST

Applicant: Modern Electronics Factory Ltd. Date of Test: April 22, 2014
Model: MET221BT
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)
V	2402.000	100.9	33	29.4	97.3	24	73.3	94.0	-20.7
V	***4804.000***	***61.4***	***33***	***34.9***	***63.3***	***24***	***39.3***	***54.0***	***-14.7***
V	7206.000	61.9	33	37.9	66.8	24	42.8	54.0	-11.2
V	9608.000	45.8	33	40.4	53.2	24	29.2	54.0	-24.8
V	***12010.000***	***45.3***	***33***	***40.5***	***52.8***	***24***	***28.8***	***54.0***	***-25.2***
V	14412.000	44.9	33	40.0	51.9	24	27.9	54.0	-26.1

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)
V	2402.000	100.9	33	29.4	97.3	114.0	-16.7
V	***4804.000***	***61.4***	***33***	***34.9***	***63.3***	***74.0***	***-10.7***
V	7206.000	61.9	33	37.9	66.8	74.0	-7.2
V	9608.000	45.8	33	40.4	53.2	74.0	-20.8
V	***12010.000***	***45.3***	***33***	***40.5***	***52.8***	***74.0***	***-21.2***
V	14412.000	44.9	33	40.0	51.9	74.0	-22.1

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.

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Applicant: Modern Electronics Factory Ltd. Date of Test: April 22, 2014
Model: MET221BT
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)
V	2441.000	101.4	33	29.4	97.8	24	73.8	94.0	-20.2
V	***4882.000***	***60.5***	***33***	***34.9***	***62.4***	***24***	***38.4***	***54.0***	***-15.6***
V	***7323.000***	***60.0***	***33***	***37.9***	***64.9***	***24***	***40.9***	***54.0***	***-13.1***
V	9764.000	46.7	33	40.4	54.1	24	30.1	54.0	-23.9
V	***12205.000***	***45.4***	***33***	***40.5***	***52.9***	***24***	***28.9***	***54.0***	***-25.1***
V	14646.000	46.3	33	38.4	51.7	24	27.7	54.0	-26.3

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)
V	2441.000	101.4	33	29.4	97.8	114.0	-16.2
V	***4882.000***	***60.5***	***33***	***34.9***	***62.4***	***74.0***	***-11.6***
V	***7323.000***	***60.0***	***33***	***37.9***	***64.9***	***74.0***	***-9.1***
V	9764.000	46.7	33	40.4	54.1	74.0	-19.9
V	***12205.000***	***45.4***	***33***	***40.5***	***52.9***	***74.0***	***-21.1***
V	14646.000	46.3	33	38.4	51.7	74.0	-22.3

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.

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HOKLAS 005 TEST

Applicant: Modern Electronics Factory Ltd. Date of Test: April 22, 2014
Model: MET221BT
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)
V	2480.000	104.7	33	29.4	101.1	24	77.1	94.0	-16.9
V	***4960.000***	***61.7***	***33***	***34.9***	***63.6***	***24***	***39.6***	***54.0***	***-14.4***
V	***7440.000***	***60.5***	***33***	***37.9***	***65.4***	***24***	***41.4***	***54.0***	***-12.6***
V	9920.000	46.9	33	40.4	54.3	24	30.3	54.0	-23.7
V	***12400.000***	***45.4***	***33***	***40.5***	***52.9***	***24***	***28.9***	***54.0***	***-25.1***
V	14880.000	46.7	33	38.4	52.1	24	28.1	54.0	-25.9

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)
V	2480.000	104.7	33	29.4	101.1	114.0	-12.9
V	***4960.000***	***61.7***	***33***	***34.9***	***63.6***	***74.0***	***-10.4***
V	***7440.000***	***60.5***	***33***	***37.9***	***65.4***	***74.0***	***-8.6***
V	9920.000	46.9	33	40.4	54.3	74.0	-19.7
V	***12400.000***	***45.4***	***33***	***40.5***	***52.9***	***74.0***	***-21.1***
V	14880.000	46.7	33	38.4	52.1	74.0	-21.9

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.

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Applicant: Modern Electronics Factory Ltd. Date of Test: April 22, 2014
Model: MET221BT
Worst-Case Operating Mode: Bluetooth Playing

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)
V	49.220	31.2	16	11.0	26.2	40.0	-13.8
V	95.280	32.8	16	12.0	28.8	43.5	-14.7
V	***127.530***	***34.5***	***16***	***14.0***	***32.5***	***43.5***	***-11.0***
V	***135.780***	***38.0***	***16***	***14.0***	***36.0***	***43.5***	***-7.5***
V	143.680	36.7	16	14.0	34.7	43.5	-8.8
V	151.720	32.9	16	15.0	31.9	43.5	-11.6

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

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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.

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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 (calculation and timing diagram).

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, whichever is the lesser attenuation, which meet the requirement of part 15.249(d).

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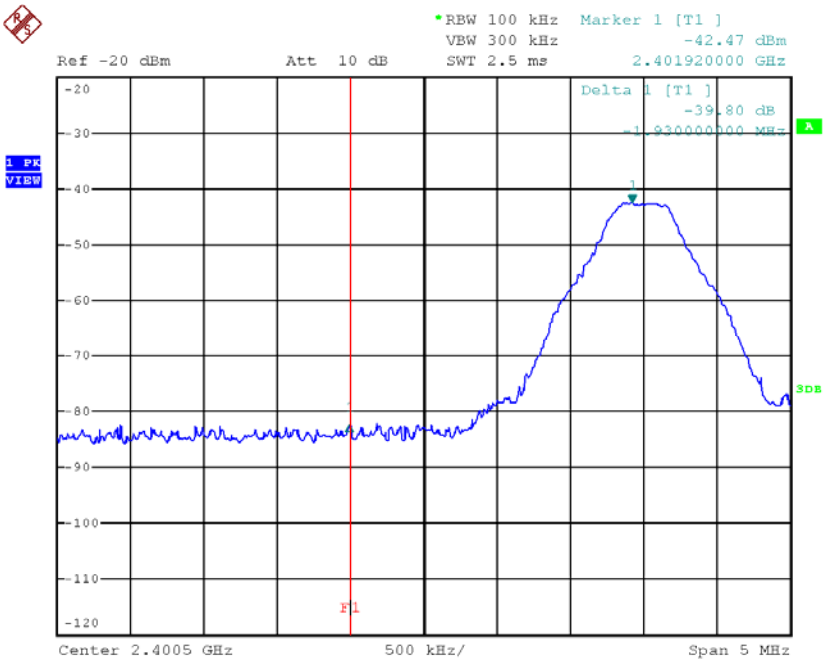

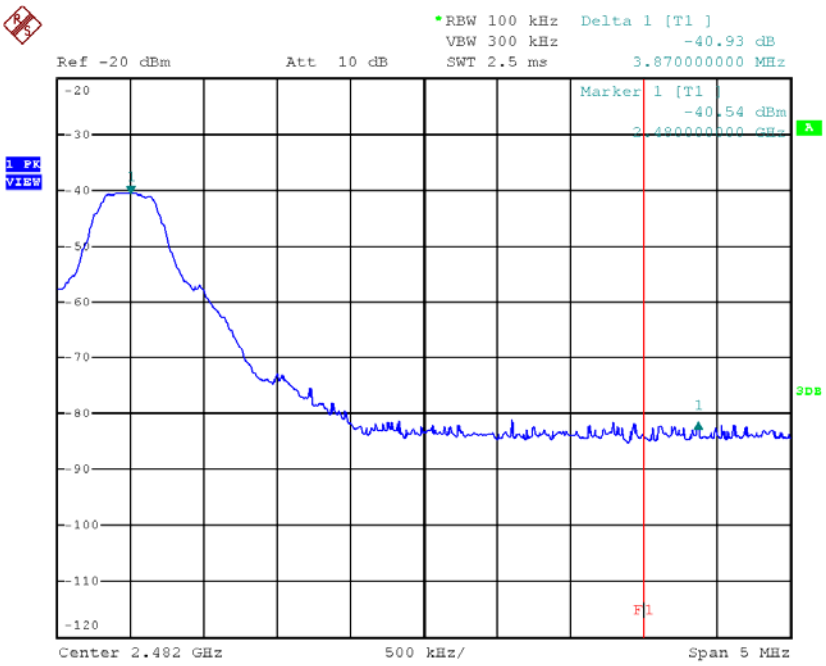

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Peak Measurement

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

=97.3 dBµV/m - 39.8 dB
=57.5 dBµV/m

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

=73.3 dBµV/m - 39.8 dB
=33.5 dBµV/m

Upper bandedge

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

=101.1 dBµV/m - 40.9 dB
=60.2 dBµV/m

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

=77.1 dBµV/m - 40.9 dB
=36.2 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).

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8.2 Discussion of Pulse Desensitization

Pulse desensitivity is not applicable for this device. The effective period (Teff) is approximately 625μs 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 2.0 / 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

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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.

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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.

9.0 **Confidentiality Request**

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

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10.0 **Equipment List**

1) Radiated Emissions Test

Equipment	EMI Test Receiver	Biconical Antenna	Log Periodic Antenna
Registration No.	EW-2666	EW-0571	EW-0446
Manufacturer	R&S	EMCO	EMCO
Model No.	ESCI7	3104C	3146
Calibration Date	Jun. 20, 2013	Nov. 01, 2013	Apr. 30, 2013
Calibration Due Date	Jun. 20, 2014	May 01, 2015	Oct. 30, 2014

Equipment	Spectrum Analyzer	Pyramidal Horn Antenna (18.0 - 26.5)GHz	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	Aug. 04, 2013	Jan. 28, 2014	Mar. 05, 2013
Calibration Due Date	Aug. 04, 2014	Jul. 28, 2015	Sep. 05, 2014

2) Conducted Emissions Test

Equipment	EMI Test Receiver	LISN
Registration No.	EW-2666	EW-2874
Manufacturer	R&S	R&S
Model No.	ESCI7	ENV-216
Calibration Date	Jun. 20, 2013	Oct. 17, 2013
Calibration Due Date	Jun. 20, 2014	Aug. 17, 2014

3) Bandedge Measurement

Equipment	Spectrum Analyzer
Registration No.	EW-2249
Manufacturer	R&S
Model No.	FSP30
Calibration Date	Oct. 28, 2013
Calibration Due Date	Oct. 28, 2014

END OF TEST REPORT

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