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HOKLAS 005 TEST

TEST REPORT

Report No.: 14061542HKG-001

ECO-LOGIC PRODUCTS LIMITED

Application
For
Certification
(Original Grant)
(FCC ID: 2ACY7-EMW770)
(IC: 12321A-EMW770)

Transceiver

Prepared and Checked by:

Wong Kwok Yeung, Kenneth
Lead Engineer

Approved by:

Chan Chi Hung, Terry
Supervisor
Date: September 03, 2014

GENERAL INFORMATION

Grantee:	ECO-LOGIC PRODUCTS LIMITED
Grantee Address:	Unit 2113-2115, 21/F., Landmark North, 39 Lung Sum Avenue, Sheung Shui, N.T., Hong Kong.
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Tel:	3484 9184
Fax:	N/A
e-mail:	tim@elp.hk
Manufacturer:	DONGGUAN ECO-LOGIC TECHNOLOGY LIMITED
Manufacturer Address:	Dichong Second Industrial Zone, Gaolong Road, Gaobu Town, Dongguan City, Guangdong Province, China
Brand Name:	ELP
Model:	EMW770
Type of EUT:	Transceiver
Description of EUT:	Smart Switch
Serial Number:	N/A
FCC ID / IC:	2ACY7-EMW770 / 12321A-EMW770
Date of Sample Submitted:	June 30, 2014
Date of Test:	June 30, 2014 to August 29, 2014
Report No.:	14061542HKG-001
Report Date:	September 03, 2014
Environmental Conditions:	Temperature: +10 to 40°C Humidity: 10 to 90%

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SUMMARY OF TEST RESULT

TEST SPECIFICATION	REFERENCE	RESULTS
Transmitter Power Line Conducted Emissions	15.207 / RSS-Gen 7.2.4	Pass
Transmitter Field Strength and Bandedge Requirement	15.249 / RSS-210 A2.9	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 Bluetooth Smart Switch. The EUT is using direct sequence spread spectrum for Bluetooth module. The Bluetooth can support Bluetooth 4.0 BLE only. The Bluetooth portion operates in frequency range from 2402MHz to 2480MHz. The EUT is powered by AC Mains (120VAC 15A 1800W max).

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

Radiated emission measurements was 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 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.

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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 AC Mains 120VAC, max 15A 1800W.

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

The EUT exercise program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use.

2.3 Special Accessories

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

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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. 9 x Light Bulb 120V 200W (Provided by Intertek)
2. iPhone 5, Model: MD297, FCC: BCG-E2599A (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/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

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3.2 Radiated Emission Configuration Photograph

The worst case in radiated emission was found at 301.460 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 11.1 dB

3.4 Conducted Emission Configuration Photograph

The worst case in line-conducted emission was found at 487.5 kHz

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 18.68 dB compared with average limit

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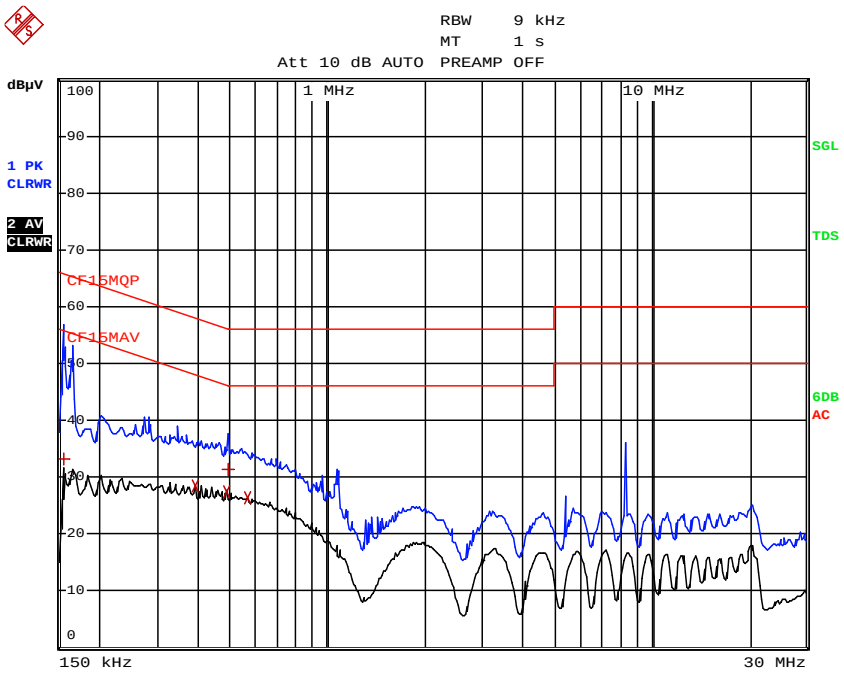

EDIT PEAK LIST (Final Measurement Results)

Trace1:	CF15MQP				
Trace2:	CF15MAV				
Trace3:	---				
TRACE		FREQUENCY	LEVEL dBµV		DELTA LIMIT dB
1	Quasi Peak	154.5 kHz	33.20	N	-32.55
2	CISPR Average	388.5 kHz	28.55	L1	-19.54
2	CISPR Average	487.5 kHz	27.52	N	-18.68
1	Quasi Peak	492 kHz	31.38	N	-24.75
2	CISPR Average	568.5 kHz	26.41	L1	-19.58

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Applicant: Eco-logic Products Limited
Model: EMW770
Worst-Case Operating Mode: Transmitting

Date of Test: August 29, 2014

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	93.6	33	29.4	90.0	48.4	41.6	94.0	-52.4
V	***4804.000***	***48.1***	***33***	***34.9***	***50.0***	***48.4***	***1.6***	***54.0***	***-52.4***
V	7206.000	44.5	33	37.9	49.4	48.4	1.0	54.0	-53.0
V	9608.000	44.4	33	40.4	51.8	48.4	3.4	54.0	-50.6
V	***12010.000***	***47.0***	***33***	***40.5***	***54.5***	***48.4***	***6.1***	***54.0***	***-47.9***
V	14412.000	50.5	33	40.0	57.5	48.4	9.1	54.0	-44.9

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	2402.000	93.6	33	29.4	90.0	114.0	-24.0
V	***4804.000***	***48.1***	***33***	***34.9***	***50.0***	***74.0***	***-24.0***
V	7206.000	44.5	33	37.9	49.4	74.0	-24.6
V	9608.000	44.4	33	40.4	51.8	74.0	-22.2
V	***12010.000***	***47.0***	***33***	***40.5***	***54.5***	***74.0***	***-19.5***
V	14412.000	50.5	33	40.0	57.5	74.0	-16.5

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.

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Model: EMW770
Worst-Case Operating Mode: Transmitting

Date of Test: August 29, 2014

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	2440.000	94.3	33	29.4	90.7	48.4	42.3	94.0	-51.7
V	***4880.000***	***48.4***	***33***	***34.9***	***50.3***	***48.4***	***1.9***	***54.0***	***-52.1***
V	***7320.000***	***44.8***	***33***	***37.9***	***49.7***	***48.4***	***1.3***	***54.0***	***-52.7***
V	9760.000	44.3	33	40.4	51.7	48.4	3.3	54.0	-50.7
V	***12200.000***	***47.3***	***33***	***40.5***	***54.8***	***48.4***	***6.4***	***54.0***	***-47.6***
V	14640.000	52.4	33	38.4	57.8	48.4	9.4	54.0	-44.6

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)
V	2440.000	94.3	33	29.4	90.7	114.0	-23.3
V	***4880.000***	***48.4***	***33***	***34.9***	***50.3***	***74.0***	***-23.7***
V	***7320.000***	***44.8***	***33***	***37.9***	***49.7***	***74.0***	***-24.3***
V	9760.000	44.3	33	40.4	51.7	74.0	-22.3
V	***12200.000***	***47.3***	***33***	***40.5***	***54.8***	***74.0***	***-19.2***
V	14640.000	52.4	33	38.4	57.8	74.0	-16.2

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.

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Applicant: Eco-logic Products Limited
Model: EMW770
Worst-Case Operating Mode: Transmitting

Date of Test: August 29, 2014

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	94.6	33	29.4	91.0	48.4	42.6	94.0	-51.4
V	***4960.000***	***48.9***	***33***	***34.9***	***50.8***	***48.4***	***2.4***	***54.0***	***-51.6***
V	***7440.000***	***44.7***	***33***	***37.9***	***49.6***	***48.4***	***1.2***	***54.0***	***-52.8***
V	9920.000	44.4	33	40.4	51.8	48.4	3.4	54.0	-50.6
V	***12400.000***	***47.1***	***33***	***40.5***	***54.6***	***48.4***	***6.2***	***54.0***	***-47.8***
V	14880.000	51.9	33	38.4	57.3	48.4	8.9	54.0	-45.1

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	2480.000	94.6	33	29.4	91.0	114.0	-23.0
V	***4960.000***	***48.9***	***33***	***34.9***	***50.8***	***74.0***	***-23.2***
V	***7440.000***	***44.7***	***33***	***37.9***	***49.6***	***74.0***	***-24.4***
V	9920.000	44.4	33	40.4	51.8	74.0	-22.2
V	***12400.000***	***47.1***	***33***	***40.5***	***54.6***	***74.0***	***-19.4***
V	14880.000	51.9	33	38.4	57.3	74.0	-16.7

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.

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Applicant: ECO-LOGIC PRODUCTS LIMITED Date of Test: August 29, 2014
Model: EMW770
Worst-Case Operating Mode: Transmitting

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	40.280	33.6	16	10.0	27.6	40.0	-12.4
V	72.612	32.0	16	7.0	23.0	40.0	-17.0
H	101.654	29.6	16	13.0	26.6	43.5	-16.9
H	***127.220***	***26.5***	***16***	***14.0***	***24.5***	***43.5***	***-19.0***
H	174.430	27.2	16	19.0	30.2	43.5	-13.3
H	***240.824***	***26.6***	***16***	***19.0***	***29.6***	***46.0***	***-16.4***
H	301.460	28.9	16	22.0	34.9	46.0	-11.1
H	446.050	22.3	16	26.0	32.3	46.0	-13.7

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 / RSS-210 Section 2.2.

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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 and Canada.

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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 (for Section 15.249)

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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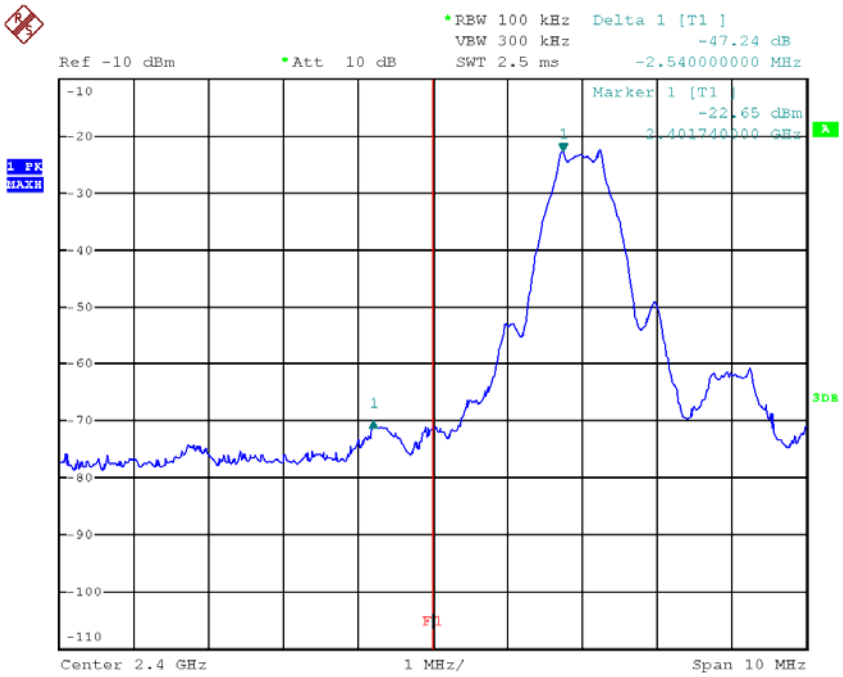

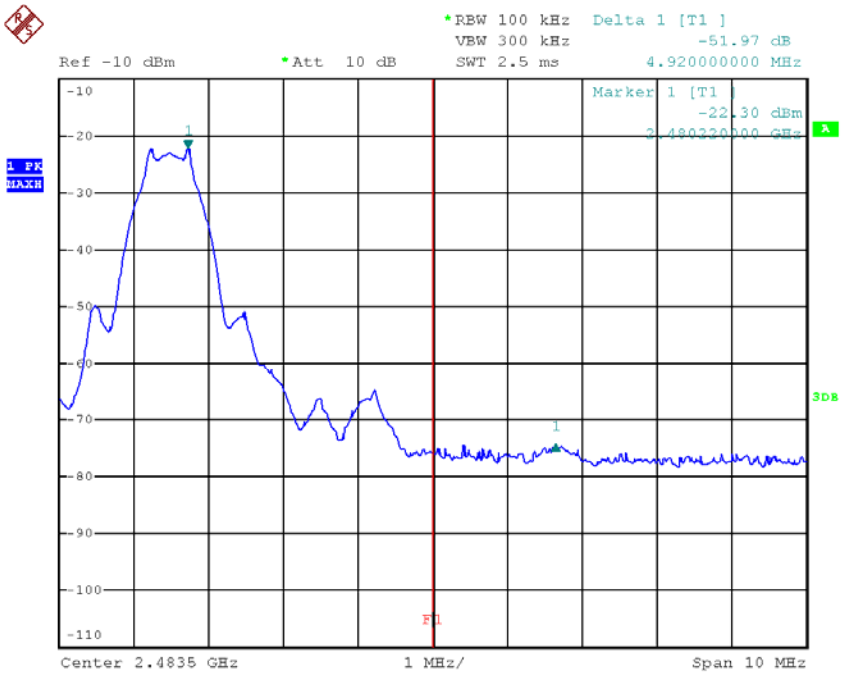

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Peak Measurement

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

=90.0 dBµV/m – 47.24 dB
=42.8 dBµV/m

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

=41.6 dBµV/m – 47.24 dB
=-5.6 dBµV/m

Upper bandedge

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

=91.0 dBµV/m – 51.97 dB
=39.0 dBµV/m

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

=42.6 dBµV/m – 51.97 dB
=-9.4 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 0.38ms for a digital "1" bit which illustrated on technical specification, with a resolution bandwidth (3dB) of 3MHz, so the pulse desensitivity factor is 0dB.

8.3 Calculation of Average Factor

The duty cycle is simply the on-time divided by the period:

The duration of one cycle = 100 ms

Effective period of the cycle = 0.38ms

DC = 0.38/100 = 0.0038

Therefore, the averaging factor is found by 20log 0.0038 = -48.4dB.

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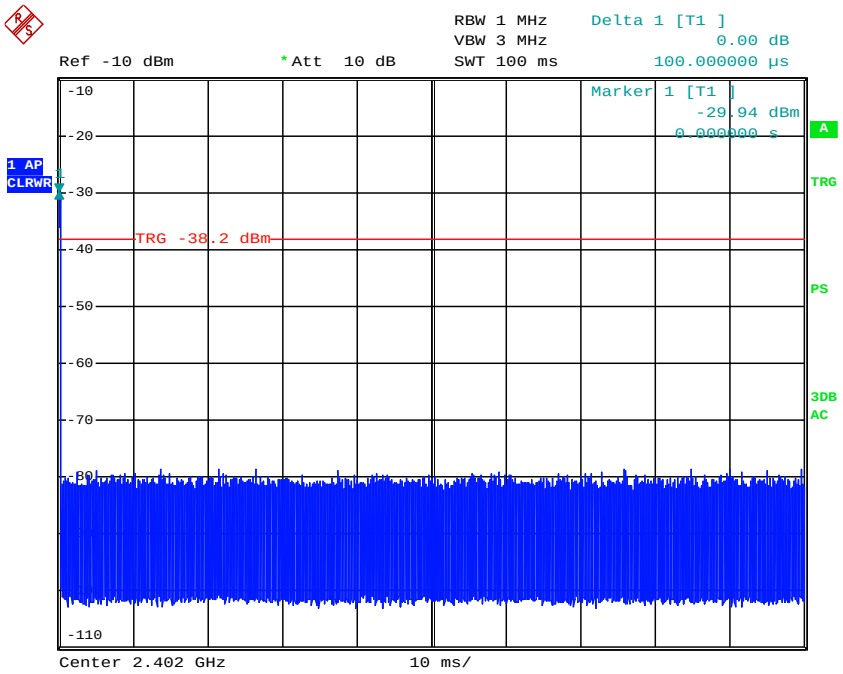

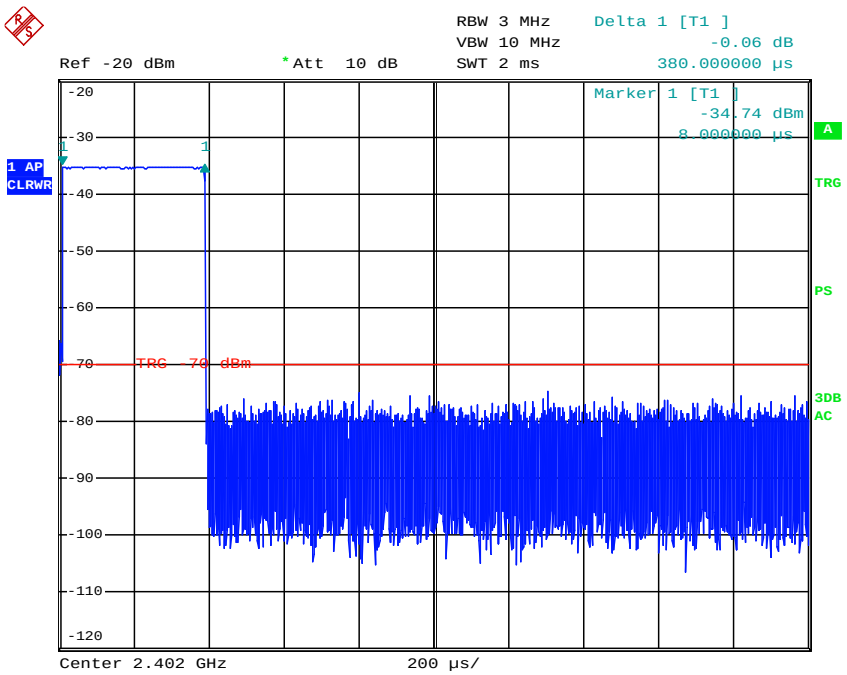

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8.4 Emissions Test Procedures

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 3 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.

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9.0 **Equipment List**

1) Radiated Emissions Test

Equipment	EMI Test Receiver	Double Ridged Guide Antenna	Spectrum Analyzer (9kHz to 13GHz)
Registration No.	EW-2666	EW-1015	EW-2839
Manufacturer	R&S	EMCO	R&S
Model No.	ESCI7	3115	EZURENTALS
Calibration Date	Jun. 20, 2013	Mar. 05, 2013	May 14, 2014
Calibration Due Date	Sep. 20, 2014	Sep. 05, 2014	May 14, 2015

Equipment	Log Periodic Antenna	Biconical Antenna	Broad-Band Horn Antenna
Registration No.	EW-0572	EW-0571	EW-1679
Manufacturer	EMCO	EMCO	SCHWARZBECK
Model No.	3146	3104C	BBHA9170
Calibration Date	Jun. 26, 2013	Nov. 01, 2013	Jun. 05, 2014
Calibration Due Date	Dec. 26, 2014	May 01, 2015	Jun. 05, 2015

2) Bandedge 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

3) 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

END OF TEST REPORT

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