

TEST REPORT**Report No.: 17121176HKG-002**

Conair Corporation

Application For Certification
(Original Grant)**FCC ID: DJT WCR450**
IC: 670A-WCR450C

Transceiver

PREPARED AND CHECKED BY:**APPROVED BY:**

Signed On File

Wong Cheuk Ho, Herbert
Lead EngineerWong Kwok Yeung, Kenneth
Senior Lead Engineer
Date: February 05, 2018

TEST REPORT**GENERAL INFORMATION**

FCC Grantee:	Conair Corporation
FCC Grantee Address:	1 Cummings Point Road, Stamford, CT 06902, USA
FCC Contact Person:	Stephen Pizzolato
IC Grantee:	CONAIR CONSUMER PRODUCTS ULC
IC Grantee Address:	100 CONAIR PARKWAY WOODBRIDGE ON L4H 0L2 Canada
IC Contact Person:	Kami Bosland
Manufacturer:	Dongguan Ko Shing Electronics Co., Ltd.
Manufacturer Address:	Changxie Road, Si Ma Village, Changping Town, Dongguan, Guangdong 523570 China.
Brand Name:	Conair
FCC Model:	WCR450
IC Model / HVIN:	WCR450C / WCR450C
IC PMN:	WCR450C
Additional Model:	N/A
Type of EUT:	Transceiver
Description of EUT:	Bluetooth Alarm Clock
Serial Number:	N/A
FCC ID / IC:	DJT WCR450 / 670A-WCR450C
Date of Sample Submitted:	December 28, 2017
Date of Test:	December 28, 2017 to February 04, 2018
Report No.:	17121176HKG-002
Report Date:	February 05, 2018
Environmental Conditions:	Temperature: +10 to 40°C Humidity: 10 to 90%

TEST REPORT**SUMMARY OF TEST RESULT**

Test Specification	Reference	Results
Transmitter Power Line Conducted Emissions	15.207 / RSS-Gen 8.8	Pass
Radiated Emission	15.249, 15.209 /	Pass
Radiated Emission on the Bandedge	RSS-210 B.10, RSS-210 4.4	
Radiated Emission in Restricted Bands	15.205 / RSS-210 4.1	Pass

The equipment under test is found to be complying with the following standards:

FCC Part 15, October 1, 2016 Edition

RSS-210 Issue 9, August 2016

RSS-Gen Issue 4, November 2014

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.
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 expected variations in temperature and supply voltage were considered.

TEST REPORT**TABLE OF CONTENTS**

1.0 GENERAL DESCRIPTION	5
1.1 Product Description	5
1.2 Related Submittal(s) Grants	5
1.3 Test Methodology	5
1.4 Test Facility	5
2.0 SYSTEM TEST CONFIGURATION	6
2.1 Justification	6
2.2 EUT Exercising Software	6
2.3 Special Accessories	6
2.4 Measurement Uncertainty	6
2.5 Support Equipment List and Description	6
3.0 EMISSION RESULTS	7
3.1 Field Strength Calculation	7
3.2 Radiated Emission Configuration Photograph	8
3.3 Radiated Emission Data	8
3.4 Conducted Emission Configuration Photograph	8
3.5 Conducted Emission Data	8
4.0 EQUIPMENT PHOTOGRAPHS	15
5.0 PRODUCT LABELLING	15
6.0 TECHNICAL SPECIFICATIONS	15
7.0 INSTRUCTION MANUAL	15
8.0 MISCELLANEOUS INFORMATION	16
8.1 Radiated Emission on the Bandedge	16
8.2 Discussion of Pulse Desensitization	19
8.3 Calculation of Average Factor	19
8.4 Emissions Test Procedures	20
8.5 Occupied Bandwidth	24
9.0 CONFIDENTIALITY REQUEST	25
10.0 EQUIPMENT LIST	25

TEST REPORT**1.0 GENERAL DESCRIPTION****1.1 Product Description**

The Equipment Under Test (EUT) is a Bluetooth Alarm Clock which equips with 2.4GHz Bluetooth audio playback feature. The EUT operates at frequency range of 2402MHz to 2480MHz. There are total 79 channels with 1MHz channel spacing. The EUT can play wireless audio signal when paired with a Bluetooth devices. The audio signal is then amplified and driving internal loudspeakers. The applicant declared that Bluetooth 4.0 BLE is not used in the product. The two USB ports are for charging external devices only. The EUT is powered by 120VAC only. A CR2032 (3V Lithium) and 2X size “AAA” batteries are for internal memory backup of Alarm Clock portion.

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 transmitter.

1.3 Test Methodology

Both AC mains line-conducted and radiated emission measurements were performed according to the procedures in ANSI C63.10 (2013). All radiated measurements were performed in an 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 No. 2042V-1.

TEST REPORT**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 C63.10 (2013).

The device was powered by 120VAC.

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 (if any) used during radiated 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.

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. 2.08Ω Resistive Load with USB cable of 0.6m Long
2. Power Cable of 1.2m long Terminated with 10Ω Resistive Load
(Provided by Intertek)

TEST REPORT**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 $\text{dB}\mu\text{V}/\text{m}$

RA = Receiver Amplitude (including preamplifier) in $\text{dB}\mu\text{V}$

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 $\text{dB}\mu\text{V}/\text{m}$

RR = RA - AG - AV in $\text{dB}\mu\text{V}$

LF = CF + AF in dB

Assume a receiver reading of 52.0 $\text{dB}\mu\text{V}$ 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 $\text{dB}\mu\text{V}/\text{m}$. This value in $\text{dB}\mu\text{V}/\text{m}$ was converted to its corresponding level in $\mu\text{V}/\text{m}$.

$$RA = 52.0 \text{ dB}\mu\text{V}/\text{m}$$

$$AF = 7.4 \text{ dB}$$

$$RR = 18.0 \text{ dB}\mu\text{V}$$

$$CF = 1.6 \text{ dB}$$

$$LF = 9.0 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$AV = 5.0 \text{ dB}$$

$$FS = RR + LF$$

$$FS = 18 + 9 = 27 \text{ dB}\mu\text{V}/\text{m}$$

$$\text{Level in } \mu\text{V}/\text{m} = \text{Common Antilogarithm } [(27 \text{ dB}\mu\text{V}/\text{m})/20] = 22.4 \mu\text{V}/\text{m}$$

TEST REPORT**3.2 Radiated Emission Configuration Photograph**

The worst case in radiated emission was found at 31.385 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 4.5 dB

3.4 Conducted Emission Configuration Photograph

The worst case in line-conducted emission was found at 0.654 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 0.9 dB

TEST REPORT

CONDUCTED EMISSION

FCC Model: WCR450 / IC Model: WCR450C

Date of Test: February 04, 2018

Worst-Case Operating Mode: USB Charging + Bluetooth Audio Playing + Clock

EDIT PEAK LIST (Final Measurement Results)					
Trace1:	CF15MQP	Trace2:	CF15MAV	Trace3:	---
TRACE	FREQUENCY	LEVEL dB μ V	DELTA	LIMIT dB	
1	Quasi Peak 154.5 kHz	48.42 L1	-	-17.32	
2	CISPR Average 154.5 kHz	38.07 L1	-	-17.68	
2	CISPR Average 231 kHz	37.41 L1	-	-15.00	
1	Quasi Peak 235.5 kHz	45.02 N	-	-17.22	
2	CISPR Average 388.5 kHz	42.73 L1	-	-5.35	
1	Quasi Peak 393 kHz	44.98 L1	-	-13.01	
1	Quasi Peak 483 kHz	40.12 L1	-	-16.16	
2	CISPR Average 541.5 kHz	38.72 N	-	-7.27	
2	CISPR Average 654 kHz	45.12 L1	-	-0.87	
1	Quasi Peak 658.5 kHz	48.60 N	-	-7.39	
1	Quasi Peak 897 kHz	42.15 N	-	-13.84	
2	CISPR Average 919.5 kHz	35.31 L1	-	-10.68	
1	Quasi Peak 1.158 MHz	44.08 L1	-	-11.91	
2	CISPR Average 1.158 MHz	34.72 L1	-	-11.27	
1	Quasi Peak 1.968 MHz	41.80 N	-	-14.19	
2	CISPR Average 1.968 MHz	35.09 L1	-	-10.90	
1	Quasi Peak 2.6205 MHz	38.21 N	-	-17.79	
2	CISPR Average 2.9355 MHz	31.81 N	-	-14.18	
1	Quasi Peak 3.2775 MHz	36.23 L1	-	-19.76	
2	CISPR Average 3.2775 MHz	31.80 N	-	-14.19	

EDIT PEAK LIST (Final Measurement Results)					
Trace1:	CF15MQP	Trace2:	CF15MAV	Trace3:	---
TRACE	FREQUENCY	LEVEL dB μ V	DELTA	LIMIT dB	
1	Quasi Peak 4.587 MHz	34.16 L1	-	-21.83	
2	CISPR Average 4.587 MHz	29.04 N	-	-16.95	
1	Quasi Peak 5.8965 MHz	31.14 L1	-	-28.85	
2	CISPR Average 5.8965 MHz	25.64 L1	-	-24.35	
1	Quasi Peak 14.406 MHz	28.59 L1	-	-31.40	
2	CISPR Average 14.406 MHz	24.29 N	-	-25.70	
1	Quasi Peak 20.949 MHz	41.65 L1	-	-18.35	
2	CISPR Average 20.949 MHz	33.89 N	-	-16.10	
2	CISPR Average 22.254 MHz	30.96 N	-	-19.03	
1	Quasi Peak 22.2585 MHz	36.90 N	-	-23.09	

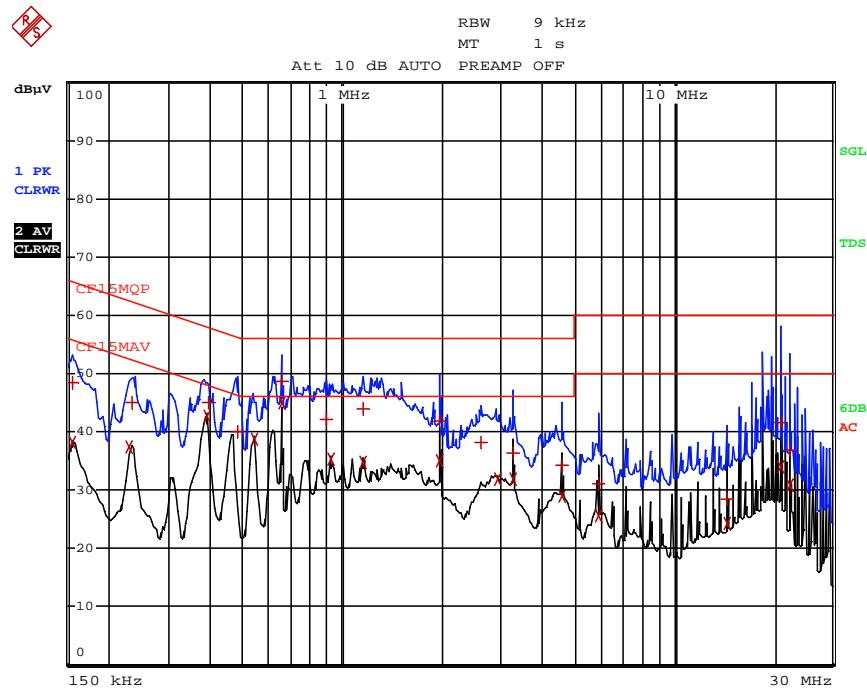
 Note: Measurement Uncertainty is ± 4.2 dB at a level of confidence of 95%.

TEST REPORT

FCC Model: WCR450 / IC Model: WCR450C

Date of Test: February 04, 2018

Worst-Case Operating Mode: USB Charging + Bluetooth Audio Playing + Clock

Note: Measurement Uncertainty is ± 4.2 dB at a level of confidence of 95%.

TEST REPORT

RADIATED EMISSIONS

FCC Model: WCR450 / IC Model: WCR450C

Date of Test: February 04, 2018

Worst-Case Operating Mode: Transmitting (Bluetooth 3.0)

Table 1
Pursuant to FCC Part 15 Section 15.249 / RSS-210 B10.0 Requirement

Lowest Channel

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dB μ V/m)	Average Factor (dB)	Calculated at 3m (dB μ V/m)	Average Limit at 3m (dB μ V/m)	Margin (dB)
H	2402.000	95.8	33	29.4	92.2	24	68.2	94.0	-25.8
H	4804.000	50.1	33	34.9	52.0	24	28.0	54.0	-26.0
H	7206.000	41.1	33	37.9	46.0	24	22.0	54.0	-32.0
H	9608.000	39.4	33	40.4	46.8	24	22.8	54.0	-31.2
H	12010.000	46.1	33	40.5	53.6	24	29.6	54.0	-24.4
H	14412.000	46.6	33	40.0	53.6	24	29.6	54.0	-24.4

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dB μ V/m)	Peak Limit at 3m (dB μ V/m)	Margin (dB)
H	2402.000	95.8	33	29.4	92.2	114.0	-21.8
H	4804.000	50.1	33	34.9	52.0	74.0	-22.0
H	7206.000	41.1	33	37.9	46.0	74.0	-28.0
H	9608.000	39.4	33	40.4	46.8	74.0	-27.2
H	12010.000	46.1	33	40.5	53.6	74.0	-20.4
H	14412.000	46.6	33	40.0	53.6	74.0	-20.4

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. 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 4.1.
6. Measurement Uncertainty is ± 5.3 dB at a level of confidence of 95%.

TEST REPORT

FCC Model: WCR450 / IC Model: WCR450C

Date of Test: February 04, 2018

Worst-Case Operating Mode: Transmitting (Bluetooth 3.0)

Table 2
Pursuant to FCC Part 15 Section 15.249 / RSS-210 B10.0 Requirement

Middle Channel

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dB μ V/m)	Average Factor (dB)	Calculated at 3m (dB μ V/m)	Average Limit at 3m (dB μ V/m)	Margin (dB)
H	2442.000	96.0	33	29.4	92.4	24	68.4	94.0	-25.6
H	4884.000	50.3	33	34.9	52.2	24	28.2	54.0	-25.8
H	7326.000	40.7	33	37.9	45.6	24	21.6	54.0	-32.4
H	9768.000	39.2	33	40.4	46.6	24	22.6	54.0	-31.4
H	12210.000	45.9	33	40.5	53.4	24	29.4	54.0	-24.6
H	14652.000	47.8	33	38.4	53.2	24	29.2	54.0	-24.8

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dB μ V/m)	Peak Limit at 3m (dB μ V/m)	Margin (dB)
H	2442.000	96.0	33	29.4	92.4	114.0	-21.6
H	4884.000	50.3	33	34.9	52.2	74.0	-21.8
H	7326.000	40.7	33	37.9	45.6	74.0	-28.4
H	9768.000	39.2	33	40.4	46.6	74.0	-27.4
H	12210.000	45.9	33	40.5	53.4	74.0	-20.6
H	14652.000	47.8	33	38.4	53.2	74.0	-20.8

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 4.1.
6. Measurement Uncertainty is ± 5.3 dB at a level of confidence of 95%.

TEST REPORT

FCC Model: WCR450 / IC Model: WCR450C

Date of Test: February 04, 2018

Worst-Case Operating Mode: Transmitting (Bluetooth 3.0)

Table 3
Pursuant to FCC Part 15 Section 15.249 / RSS-210 B10.0 Requirement

Highest Channel

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dB μ V/m)	Average Factor (dB)	Calculated at 3m (dB μ V/m)	Average Limit at 3m (dB μ V/m)	Margin (dB)
H	2480.000	96.2	33	29.4	92.6	24	68.6	94.0	-25.4
H	4960.000	50.7	33	34.9	52.6	24	28.6	54.0	-25.4
H	7440.000	41.5	33	37.9	46.4	24	22.4	54.0	-31.6
H	9920.000	39.5	33	40.4	46.9	24	22.9	54.0	-31.1
H	12400.000	46.3	33	40.5	53.8	24	29.8	54.0	-24.2
H	14880.000	48.4	33	38.4	53.8	24	29.8	54.0	-24.2

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dB μ V/m)	Peak Limit at 3m (dB μ V/m)	Margin (dB)
H	2480.000	96.2	33	29.4	92.6	114.0	-21.4
H	4960.000	50.7	33	34.9	52.6	74.0	-21.4
H	7440.000	41.5	33	37.9	46.4	74.0	-27.6
H	9920.000	39.5	33	40.4	46.9	74.0	-27.1
H	12400.000	46.3	33	40.5	53.8	74.0	-20.2
H	14880.000	48.4	33	38.4	53.8	74.0	-20.2

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 4.1.
6. Measurement Uncertainty is ± 5.3 dB at a level of confidence of 95%.

TEST REPORT

FCC Model: WCR450 / IC Model: WCR450C

Date of Test: February 04, 2018

Worst-Case Operating Mode: USB Charging + Bluetooth Audio Playing + Clock

Table 4
Pursuant to FCC Part 15 Section 15.209 / RSS-210 4.4 Requirement

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-amp (dB)	Antenna Factor (dB)	Net at 3m (dB μ V/m)	Limit at 3m (dB μ V/m)	Margin (dB)
V	31.385	41.5	16	10.0	35.5	40.0	-4.5
V	32.632	38.6	16	10.0	32.6	40.0	-7.4
V	38.868	38.6	16	10.0	32.6	40.0	-7.4
V	52.725	32.9	16	11.0	27.9	40.0	-12.1
H	84.250	39.0	16	8.0	31.0	40.0	-9.0
H	85.497	40.6	16	8.0	32.6	40.0	-7.4
H	86.745	40.5	16	8.0	32.5	40.0	-7.5
H	87.992	39.4	16	9.0	32.4	40.0	-7.6
V	120.902	33.9	16	14.0	31.9	43.5	-11.6
V	150.418	33.0	16	14.0	31.0	43.5	-12.5
V	178.964	27.1	16	20.0	31.1	43.5	-12.4
H	266.056	28.7	16	21.0	33.7	46.0	-12.3
H	665.765	21.8	16	29.0	34.8	46.0	-11.2

NOTES:

1. Quasi-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 4.1.
6. Measurement Uncertainty is $\pm 5.3\text{dB}$ at a level of confidence of 95%.

TEST REPORT

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.

TEST REPORT**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).

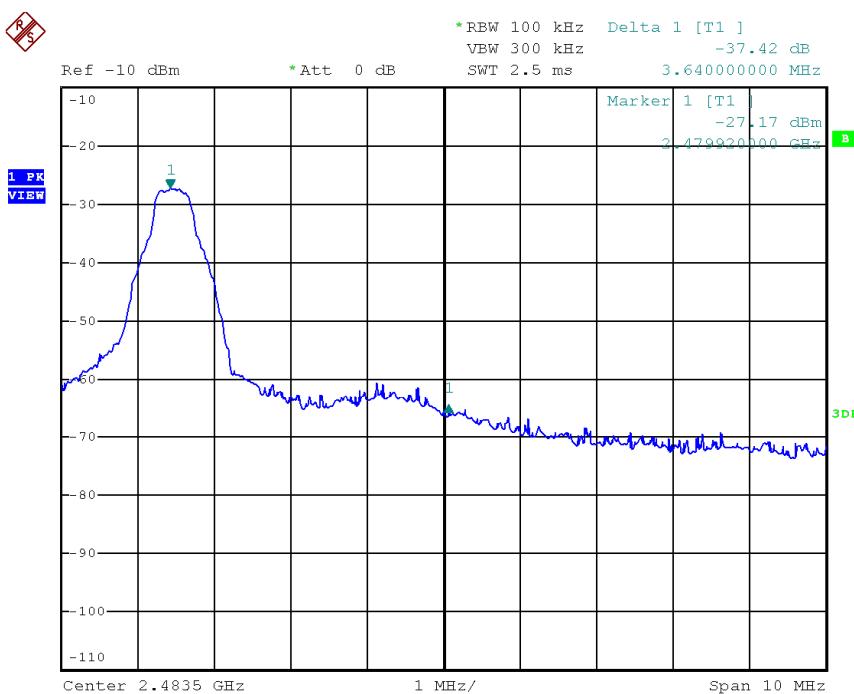
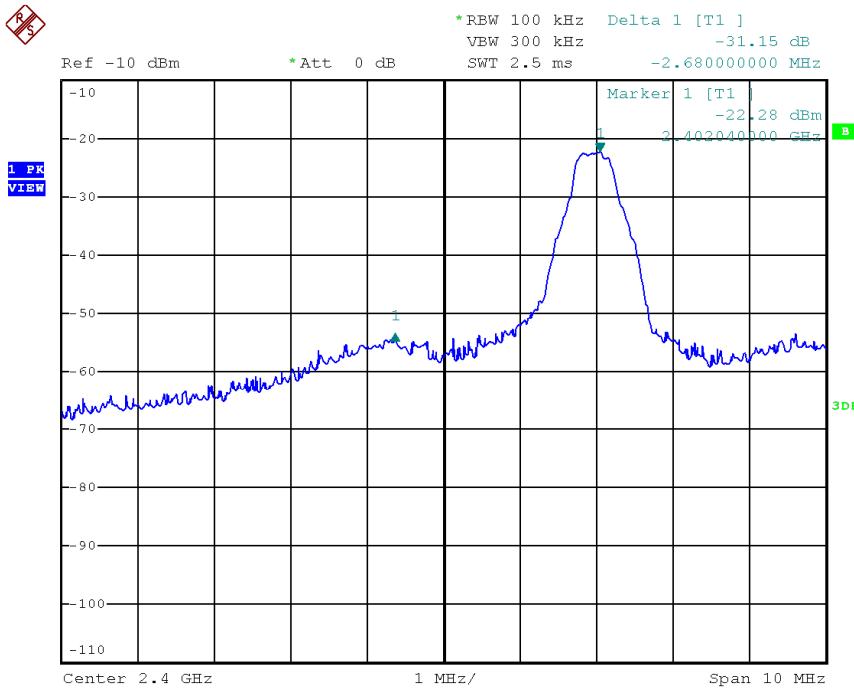
8.1 Radiated Emission on the Bandedge

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 C63.10 (2013) 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 4.4, whichever is the lesser attenuation, which meet the requirement of part 15.249(d) / RSS-210 B.10.

TEST REPORT

Peak Measurement



TEST REPORT**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

=92.2 dB μ V/m - 31.2 dB

=61.0 dB μ V/m

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

=68.2 dB μ V/m - 31.2 dB

=37.0 dB μ V/m

Upper bandedge

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

=92.6 dB μ V/m - 37.4 dB

=55.2 dB μ V/m

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

=68.6 dB μ V/m - 37.4 dB

=31.2 dB μ V/m

The resultant field strength meets the general radiated emission limit in Section 15.209 / RSS-210 4.4, which does not exceed 74 dB μ V/m (Peak Limit) and 54 dB μ V/m (Average Limit).

TEST REPORT**8.2 Discussion of Pulse Desensitization**

Pulse desensitivity is not applicable for this device. The effective period (Teff) is approximately 625 μ s 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

Based on the Bluetooth Specification Version 3.0 + EDR, the transmitter ON time for each timeslot of Bluetooth is 625 μ s. DH5 has the maximum duty cycle, which consists of 5 continuous Tx slots and 1 Rx slot. Therefore one hopset take $(5+1) \times 625\mu\text{s} = 3.75\text{ms}$. For one period for a pseudo-random hopping through at least 20 RF channels in adaptive mode (worse case), it take: $20 \times 3.75\text{ms} = 75\text{ms}$.

The dwell time for DH5 is $5 \times 625\mu\text{s} = 3.125\text{ms}$.

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

$$\begin{aligned}\text{Duty Cycle (DC)} &= \text{Maximum On time in 100ms/100ms} \\ &= 3.125\text{ms} \times 2/100\text{ms} \\ &= 0.0625\end{aligned}$$

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

TEST REPORT**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 0.8m in height above the ground plane for emission measurement at or below 1GHz and 1.5m in height above the ground plane for emission measurement above 1GHz. 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.

TEST REPORT**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.

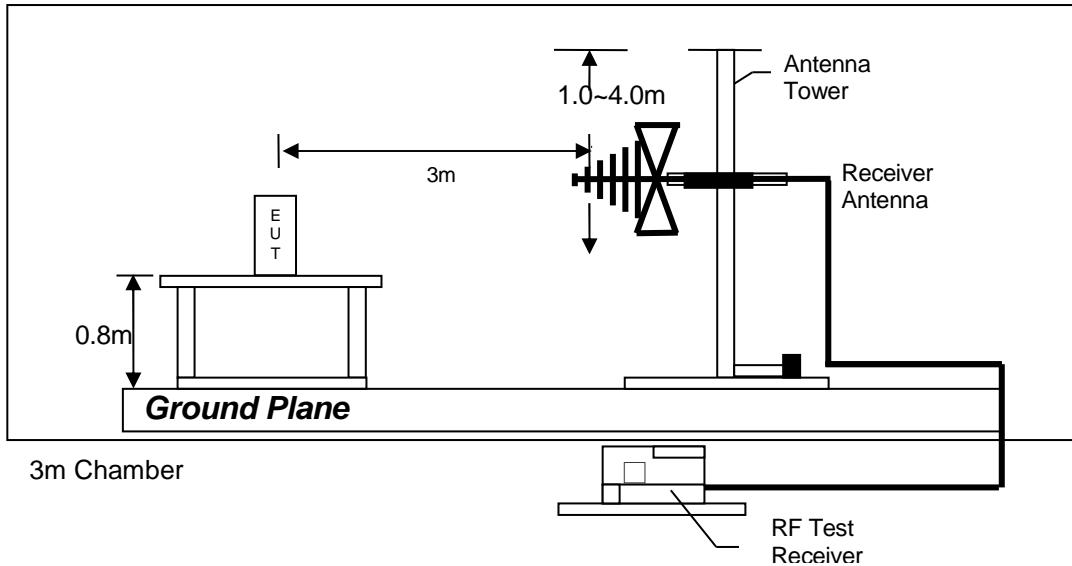
Conducted measurements were made as described in ANSI C63.10 (2013).

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.

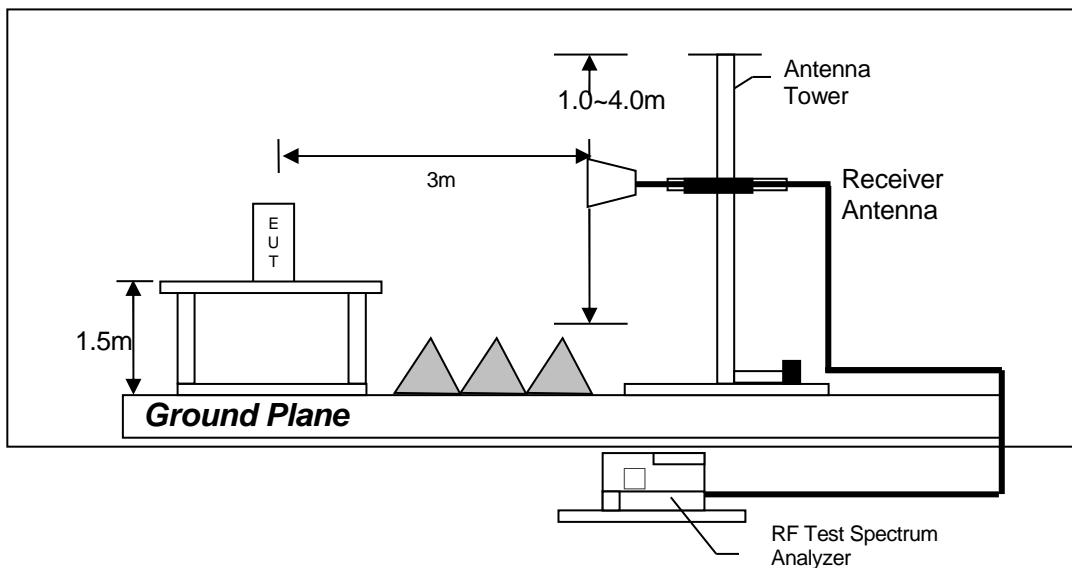
Transmitter measurements are normally conducted at a measurement distance of three meters. However, to assure low enough noise floor in the forbidden bands and above 1 GHz, signals are acquired at a distance of one meter or less. All measurements are extrapolated to three meters using inverse scaling,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

TEST REPORT**8.4.1 Radiated Emission Test Setup**

The figure below shows the test setup, which is utilized to make these measurements.



Test setup of radiated emissions up to 1GHz

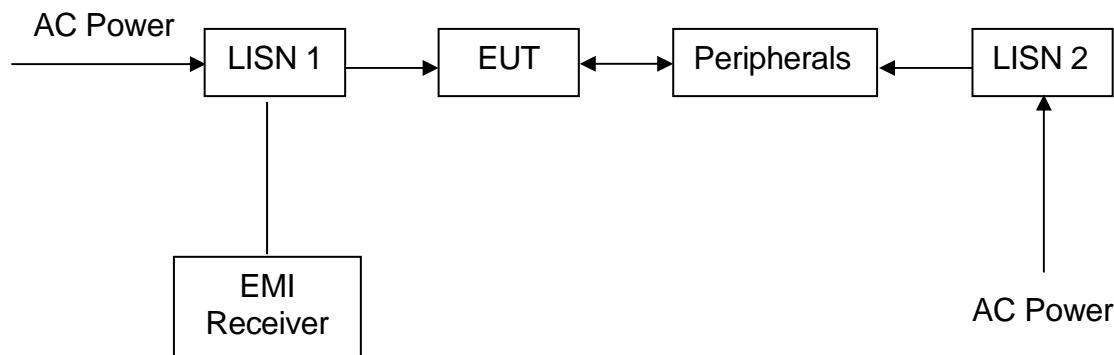


Test setup of radiated emissions above 1GHz

TEST REPORT**8.4.2 Conducted Emission Test Procedures**

For tabletop equipment, the EUT along with its peripherals were placed on a 1.0m(W)×1.5m(L) and 0.8m in height wooden table. For floor-standing equipment, the EUT and all cables were insulated, if required, from the ground plane by up to 12 mm of insulating material. The EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane. The EUT was connected to power mains through a line impedance stabilization network (LISN), which provided 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room. The excess power cable between the EUT and the LISN was bundled.

All connecting cables of EUT and peripherals were moved to find the maximum emission.

8.4.3 Conducted Emission Test Setup

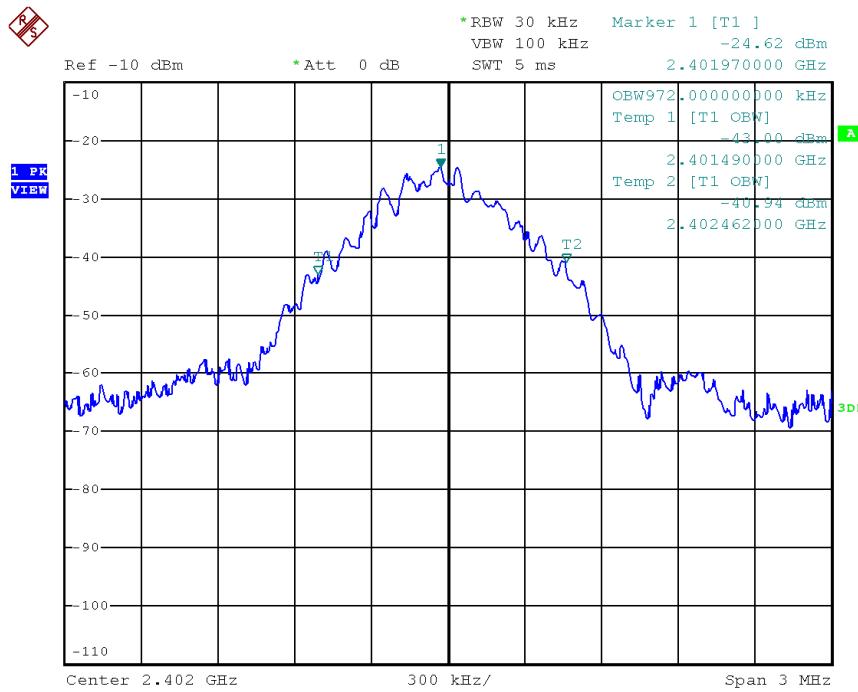
TEST REPORT

8.5 Occupied Bandwidth

Occupied Bandwidth Results:

Bluetooth (MHz)	Occupied Bandwidth (kHz)
Low Channel: 2402	972
Middle Channel: 2442	960
High Channel: 2480	972

The worst case is shown as below



TEST REPORT

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-2500	EW-3242	EW-1042
Manufacturer	ROHDE SCHWARZ	EMCO	EMCO
Model No.	ESCI	3110C	3148
Calibration Date	Oct. 13, 2017	Aug. 17, 2016	Jun. 19, 2017
Calibration Due Date	Oct. 13, 2018	Feb. 17, 2018	Dec. 19, 2018
EQUIPMENT	SPECTRUM ANALYZER	Pyramidal Horn Antenna	DOUBLE RIDGED GUIDE ANTENNA
Registration No.	EW-2253	EW-0905	EW-1015
Manufacturer	ROHDE SCHWARZ	EMCO	EMCO
Model No.	FSP40	3160-09	3115
Calibration Date	Jul. 24, 2017	Aug. 18, 2017	Nov. 17, 2017
Calibration Due Date	Jul. 24, 2018	Feb. 18, 2019	May. 17, 2019
Equipment	Active Loop H-field (9kHz to 30MHz)	RF Cable 9kHz to 1000MHz	RF Cable 14m (1GHz to 26.5GHz)
Registration No.	EW-3326	EW-3170	EW-2781
Manufacturer	EMCO	N/A	GREATBILLION
Model No.	6502	9kHz to 1000MHz	SMA m/SHF5MPU /SMA m ra14m,26G
Calibration Date	Sep. 27, 2017	Mar. 20, 2017	Sep. 25, 2017
Calibration Due Date	Mar. 27, 2019	Mar. 20, 2018	Sep. 25, 2018
Equipment	RF PRE-AMPLIFIER 3 PCS (9KHZ TO 40GHZ)	Notch Filter (cutoff frequency 2.4GHz to 2.5GHz)	
Registration No.	EW-3006	EW-2213	
Manufacturer	SCHWARZBECK	MICROTRONICS	
Model No.	BBV 9718	BRM50701-02	
Calibration Date	Mar. 23, 2017	May. 26, 2017	
Calibration Due Date	Mar. 23, 2018	May. 26, 2018	

TEST REPORT

2) Conducted Emissions Test

Equipment	EMI Test Receiver	RF Cable 9kHz to 1000MHz	Artificial Mains Network
Registration No.	EW-2500	EW-3170	EW-0192
Manufacturer	ROHDE SCHWARZ	N/A	ROHDE SCHWARZ
Model No.	ESCI	9kHz to 1000MHz	ESH3-Z5
Calibration Date	Oct. 13, 2017	Mar. 20, 2017	Oct. 27, 2017
Calibration Due Date	Oct. 13, 2018	Mar. 20, 2018	Aug. 25, 2018

3) Bandedge/Bandwidth Measurement

EQUIPMENT	RF Cable (up to 40GHz) SPECTRUM ANALYZER 1.5m length	
Registration No.	EW-3104	EW-2253
Manufacturer	N/A	ROHDE SCHWARZ
Model No.	SMA-M to SMA-M	FSP40
Calibration Date	Feb. 28, 2017	Jul. 24, 2017
Calibration Due Date	Feb. 28, 2018	Jul. 24, 2018

END OF TEST REPORT