

TEST REPORT

Report No.: 21030026HKG-001

MGA Entertainment (HK) Limited

Application For Certification
(Original Grant)

FCC ID: LU9657573

Transceiver

Prepared and Checked by:

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Date: March 09, 2021

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TEST REPORT

GENERAL INFORMATION

Grantee:	MGA Entertainment (HK) Limited
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Manufacturer:	MGA Entertainment (HK) Limited
Manufacturer Address:	Suite 301, 3/F., Chinachem Golden Plaza, No.77 Mody Road, Tsim Sha Tsui East, Kowloon, Hong Kong.
Brand Name:	Tobi 2 Smartwatch-Red
Model:	657573
Type of EUT:	Transceiver
Description of EUT:	Tobi 2 Smartwatch-Red
Serial Number:	N/A
FCC ID:	LU9657573
Date of Sample Submitted:	March 01, 2021
Date of Test:	March 01, 2021 to March 04, 2021
Report No.:	21030026HKG-001
Report Date:	March 09, 2021
Environmental Conditions:	Temperature: +10 to 40°C Humidity: 10 to 90%
Conclusion:	Test was conducted by client submitted sample. The submitted sample as received complied with the 47 CFR Part 15 Certification.

TEST REPORT

SUMMARY OF TEST RESULT

Test Specification	Reference	Results
Transmitter Power Line Conducted Emissions	15.207	Pass
Radiated Emission	15.249, 15.209	Pass
Radiated Emission on the Bandedge		
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, 2019 Edition

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 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 portable 2.4GHz BLE Transceiver (Watch Unit) for a Bluetooth Watch. The sample supplied operated on 40 channels, normally at 2402 - 2480MHz. The channels are separated with 2MHz spacing.

The Equipment Under Test (EUT), is a portable 2.4GHz BR/EDR Transceiver (Watch Unit) for a Bluetooth Watch. The sample supplied operated on 79 channels, normally at 2402 - 2480MHz. The channels are separated with 1MHz spacing.

The EUT is powered by 1 x 3.7V Rechargeable battery. After switching on the EUT, the watch will provide recording and gaming functions based on the virtual buttons pressed on the watch.

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 C63.10 (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 SAR, China. 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 C63.10 (2013).

The device was powered by DC 3.7V (1 x 3.7V Rechargeable Battery).

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 unit was operated standalone and placed in the center of the turntable.

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

Decision Rule for compliance: For FCC/IC standard, the measured value must be within the limits of applicable standard without accounting for the measurement uncertainty. For EN/IEC/HKTA/HKTC standard, conformity rules will be used as per standard directly excepted EN/IEC 61000-3-2, EN/IEC 61000-3-3, HKTA1004, HKCA1008, HKTA1019, HKTA1020, HKTA1041 and HKTA1044. For these excepted or not mentioned standards, Cl 4.2.2 of ILAC-G8:09/2019 decision rules will be reference and guard band will be equal to our measurement uncertainty with 95% confidence level (k=2). In case, the measured value is within guard band region, undetermined decision will be used.

2.5 Support Equipment List and Description

N/A.

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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 dB μ V/m

RA = Receiver Amplitude (including preamplifier) in dB μ 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 dB μ V/m

RR = RA - AG - AV in dB μ V

LF = CF + AF in dB

Assume a receiver reading of 52.0 dB μ 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 27 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

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

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

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

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

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

$$FS = RR + LF$$

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

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

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

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

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3.2 Radiated Emission Configuration Photograph

The worst case in radiated emission was found at 17360 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 8.0 dB

3.4 Conducted Emission Configuration Photograph

The worst case in line-conducted emission was found at 163.5 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 10.37 dB

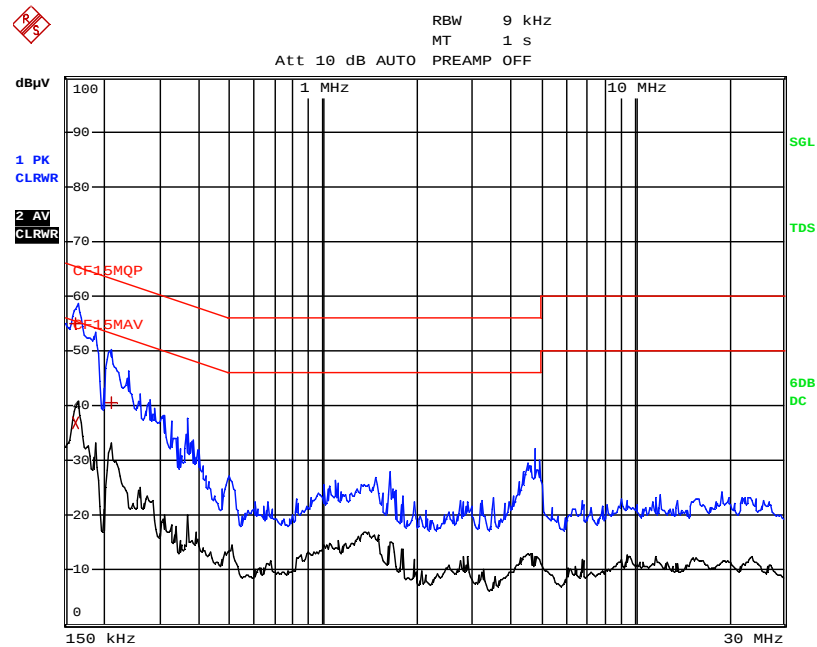
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CONDUCTED EMISSION

Model: 657573

Date of Test: March 04, 2021

Worst-Case Operating Mode: Charging



EDIT PEAK LIST (Final Measurement Results)				
Trace1:	CF15MQP			
Trace2:	CF15MAV			
Trace3:	---			
TRACE	FREQUENCY	LEVEL dBμV		DELTA LIMIT dB
1 Quasi Peak	163.5 kHz	54.91	L1	-10.37
2 CISPR Average	163.5 kHz	36.98	N	-18.30
1 Quasi Peak	213 kHz	40.59	N	-22.49

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

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RADIATED EMISSIONS

Model: 657573

Date of Test: March 04, 2021

Worst-Case Operating Mode: Transmitting (Bluetooth BLE)

Table 1
Pursuant to FCC Part 15 Section 15.249 Requirement

Lowest Channel

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Average (dBμV/m)	Average Limit at 3m (dBμV/m)	Margin (dB)
H	2402.000	87.1	33	29.4	83.5	94.0	-10.5
V	4804.000	35.9	33	34.9	37.8	54.0	-16.2
V	7206.000	26.9	33	37.9	31.8	54.0	-22.2
V	9608.000	27.2	33	40.4	34.6	54.0	-19.4
H	12010.000	29.8	33	40.5	37.3	54.0	-16.7
H	14412.000	34.0	33	40.0	41.0	54.0	-13.0
H	16814.000	39.7	33	37.6	44.3	54.0	-9.7

Polarization	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	102.9	33	29.4	99.3	114.0	-14.7
V	4804.000	47.6	33	34.9	49.5	74.0	-24.5
V	7206.000	40.3	33	37.9	45.2	74.0	-28.8
V	9608.000	40.4	33	40.4	47.8	74.0	-26.2
H	12010.000	43.5	33	40.5	51.0	74.0	-23.0
H	14412.000	47.2	33	40.0	54.2	74.0	-19.8
H	16814.000	52.9	33	37.6	57.5	74.0	-16.5

- NOTES:
1. Peak Detector Data unless otherwise stated.
 2. Average detector is applied according to ANSI C63.10.
 3. All measurements were made at 3 meters.
 4. Negative sign in the column shows value below limit.
 5. Horn antenna is used for the emission over 1000MHz.
 6. Emission (the row indicated by **bold italic**) within the restricted band meets the requirement of FCC Part 15 Section 15.205.
 7. Measurement Uncertainty is ±5.3dB at a level of confidence of 95%.

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Model: 657573

Date of Test: March 04, 2021

Worst-Case Operating Mode: Transmitting (Bluetooth BLE)

Table 2
Pursuant to FCC Part 15 Section 15.249 Requirement

Middle Channel

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Average (dBμV/m)	Average Limit at 3m (dBμV/m)	Margin (dB)
H	2440.000	86.3	33	29.4	82.7	94.0	-11.3
V	4880.000	34.5	33	34.9	36.4	54.0	-17.6
H	7320.000	27.8	33	37.9	32.7	54.0	-21.3
V	9760.000	26.6	33	40.4	34.0	54.0	-20.0
H	12200.000	29.4	33	40.5	36.9	54.0	-17.1
V	14640.000	36.3	33	38.4	41.7	54.0	-12.3
V	17080.000	39.3	33	37.6	43.9	54.0	-10.1

Polarization	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	2440.000	101.1	33	29.4	97.5	114.0	-16.5
V	4880.000	46.4	33	34.9	48.3	74.0	-25.7
H	7320.000	40.9	33	37.9	45.8	74.0	-28.2
V	9760.000	40.3	33	40.4	47.7	74.0	-26.3
H	12200.000	43.3	33	40.5	50.8	74.0	-23.2
V	14640.000	50.0	33	38.4	55.4	74.0	-18.6
V	17080.000	52.5	33	37.6	57.1	74.0	-16.9

- NOTES:
1. Peak Detector Data unless otherwise stated.
 2. Average detector is applied according to ANSI C63.10.
 3. All measurements were made at 3 meters.
 4. Negative sign in the column shows value below limit.
 5. Horn antenna is used for the emission over 1000MHz.
 6. Emission (the row indicated by **bold italic**) within the restricted band meets the requirement of FCC Part 15 Section 15.205.
 7. Measurement Uncertainty is ± 5.3 dB at a level of confidence of 95%.

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Model: 657573

Date of Test: March 04, 2021

Worst-Case Operating Mode: Transmitting (Bluetooth BLE)

Table 3
Pursuant to FCC Part 15 Section 15.249 Requirement

Highest Channel

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Average (dBμV/m)	Average Limit at 3m (dBμV/m)	Margin (dB)
H	2480.000	86.8	33	29.4	83.2	94.0	-10.8
V	4960.000	28.0	33	34.9	29.9	54.0	-24.1
V	7440.000	28.2	33	37.9	33.1	54.0	-20.9
H	9920.000	29.6	33	40.4	37.0	54.0	-17.0
H	12400.000	29.6	33	40.5	37.1	54.0	-16.9
V	14880.000	35.3	33	38.4	40.7	54.0	-13.3
V	17360.000	41.4	33	37.6	46.0	54.0	-8.0

Polarization	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	102.5	33	29.4	98.9	114.0	-15.1
V	4960.000	42.1	33	34.9	44.0	74.0	-30.0
V	7440.000	41.4	33	37.9	46.3	74.0	-27.7
H	9920.000	42.5	33	40.4	49.9	74.0	-24.1
H	12400.000	43.2	33	40.5	50.7	74.0	-23.3
V	14880.000	48.5	33	38.4	53.9	74.0	-20.1
V	17360.000	54.8	33	37.6	59.4	74.0	-14.6

- NOTES:
1. Peak Detector Data unless otherwise stated.
 2. Average detector is applied according to ANSI C63.10.
 3. All measurements were made at 3 meters.
 4. Negative sign in the column shows value below limit.
 5. Horn antenna is used for the emission over 1000MHz.
 6. Emission (the row indicated by **bold italic**) within the restricted band meets the requirement of FCC Part 15 Section 15.205.
 7. Measurement Uncertainty is ± 5.3 dB at a level of confidence of 95%.

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Model: 657573

Date of Test: March 04, 2021

Worst-Case Operating Mode: Transmitting (Bluetooth BR/EDR)

Table 4
Pursuant to FCC Part 15 Section 15.249 Requirement

Lowest Channel

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Average (dBμV/m)	Average Limit at 3m (dBμV/m)	Margin (dB)
V	2402.000	83.3	33	29.4	79.7	94.0	-14.3
V	4804.000	28.6	33	34.9	30.5	54.0	-23.5
H	7206.000	27.1	33	37.9	32.0	54.0	-22.0
H	9609.000	26.7	33	40.4	34.1	54.0	-19.9
V	12012.000	29.8	33	40.5	37.3	54.0	-16.7
H	14417.000	34.3	33	40.0	41.3	54.0	-12.7
H	16815.000	39.8	33	37.6	44.4	54.0	-9.6

Polarization	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	100.1	33	29.4	96.5	114.0	-17.5
V	4804.000	44.1	33	34.9	46.0	74.0	-28.0
H	7206.000	40.8	33	37.9	45.7	74.0	-28.3
H	9609.000	39.8	33	40.4	47.2	74.0	-26.8
V	12012.000	43.1	33	40.5	50.6	74.0	-23.4
H	14417.000	47.6	33	40.0	54.6	74.0	-19.4
H	16815.000	52.9	33	37.6	57.5	74.0	-16.5

- NOTES:
1. Peak Detector Data unless otherwise stated.
 2. Average detector is applied according to ANSI C63.10.
 3. All measurements were made at 3 meters.
 4. Negative sign in the column shows value below limit.
 5. Loop antenna is used for the emissions below 30MHz.
 5. Horn antenna is used for the emission over 1000MHz.
 6. Emission (the row indicated by **bold italic**) within the restricted band meets the requirement of FCC Part 15 Section 15.205.
 7. Measurement Uncertainty is ±5.3dB at a level of confidence of 95%.

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Model: 657573

Date of Test: March 04, 2021

Worst-Case Operating Mode: Transmitting (Bluetooth BR/EDR)

Table 5
Pursuant to FCC Part 15 Section 15.249 Requirement

Middle Channel

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Average (dBμV/m)	Average Limit at 3m (dBμV/m)	Margin (dB)
H	2440.000	81.8	33	29.4	78.2	94.0	-15.8
V	4882.000	27.3	33	34.9	29.2	54.0	-24.8
V	7324.000	27.8	33	37.9	32.7	54.0	-21.3
H	9760.000	26.3	33	40.4	33.7	54.0	-20.3
V	12202.000	29.3	33	40.5	36.8	54.0	-17.2
H	14640.000	36.2	33	38.4	41.6	54.0	-12.4
H	17081.000	39.4	33	37.6	44.0	54.0	-10.0

Polarization	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	2440.000	98.6	33	29.4	95.0	114.0	-19.0
V	4882.000	41.3	33	34.9	43.2	74.0	-30.8
V	7324.000	41.0	33	37.9	45.9	74.0	-28.1
H	9760.000	39.5	33	40.4	46.9	74.0	-27.1
V	12202.000	43.1	33	40.5	50.6	74.0	-23.4
H	14640.000	49.5	33	38.4	54.9	74.0	-19.1
H	17081.000	52.6	33	37.6	57.2	74.0	-16.8

- NOTES:
1. Peak Detector Data unless otherwise stated.
 2. Average detector is applied according to ANSI C63.10.
 3. All measurements were made at 3 meters.
 4. Negative sign in the column shows value below limit.
 5. Horn antenna is used for the emission over 1000MHz.
 6. Emission (the row indicated by **bold italic**) within the restricted band meets the requirement of FCC Part 15 Section 15.205.
 7. Measurement Uncertainty is ± 5.3 dB at a level of confidence of 95%.

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Model: 657573

Date of Test: March 04, 2021

Worst-Case Operating Mode: Transmitting (Bluetooth BR/EDR)

Table 6
Pursuant to FCC Part 15 Section 15.249 Requirement

Highest Channel

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Average (dBμV/m)	Average Limit at 3m (dBμV/m)	Margin (dB)
H	2480.000	83.5	33	29.4	79.9	94.0	-14.1
V	4960.000	28.8	33	34.9	30.7	54.0	-23.3
V	7440.000	27.8	33	37.9	32.7	54.0	-21.3
H	9920.000	27.8	33	40.4	35.2	54.0	-18.8
V	12400.000	29.7	33	40.5	37.2	54.0	-16.8
H	14879.000	35.2	33	38.4	40.6	54.0	-13.4
H	17359.000	41.0	33	37.6	45.6	54.0	-8.4

Polarization	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	100.3	33	29.4	96.7	114.0	-17.3
V	4960.000	43.6	33	34.9	45.5	74.0	-28.5
V	7440.000	41.3	33	37.9	46.2	74.0	-27.8
H	9920.000	41.5	33	40.4	48.9	74.0	-25.1
V	12400.000	43.4	33	40.5	50.9	74.0	-23.1
H	14879.000	48.8	33	38.4	54.2	74.0	-19.8
H	17359.000	55.4	33	37.6	60.0	74.0	-14.0

- NOTES:
1. Peak Detector Data unless otherwise stated.
 2. Average detector is applied according to ANSI C63.10.
 3. All measurements were made at 3 meters.
 4. Negative sign in the column shows value below limit.
 5. Horn antenna is used for the emission over 1000MHz.
 6. Emission (the row indicated by **bold italic**) within the restricted band meets the requirement of FCC Part 15 Section 15.205.
 7. Measurement Uncertainty is ±5.3dB at a level of confidence of 95%.

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Model: 657573

Date of Test: March 04, 2021

Worst-Case Operating Mode: Charging

Table 6
Pursuant to FCC Part 15 Section 15.209 Requirement

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBμV/m)	Limit at 3m (dBμV/m)	Margin (dB)
V	73.506	25.8	16	6.0	15.8	40.0	-24.2
H	215.978	20.5	16	17.0	21.5	43.5	-22.0
H	252.053	19.9	16	20.0	23.9	46.0	-22.1
H	293.491	17.2	16	22.0	23.2	46.0	-22.8
H	699.822	19.1	16	30.0	33.1	46.0	-13.0
V	852.044	18.8	16	31.0	33.8	46.0	-12.2

- NOTES:
1. Peak Detector Data unless otherwise stated.
 2. Average detector is applied according to ANSI C63.10.
 3. All measurements were made at 3 meters.
 4. Negative sign in the column shows value below limit.
 5. Horn antenna is used for the emission over 1000MHz.
 6. Emission (the row indicated by **bold italic**) within the restricted band meets the requirement of FCC Part 15 Section 15.205.
 7. Measurement Uncertainty is ± 5.3 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.

TEST REPORT

8.0 MISCELLANEOUS INFORMATION

The miscellaneous information includes details of the test procedure and measured bandwidth.

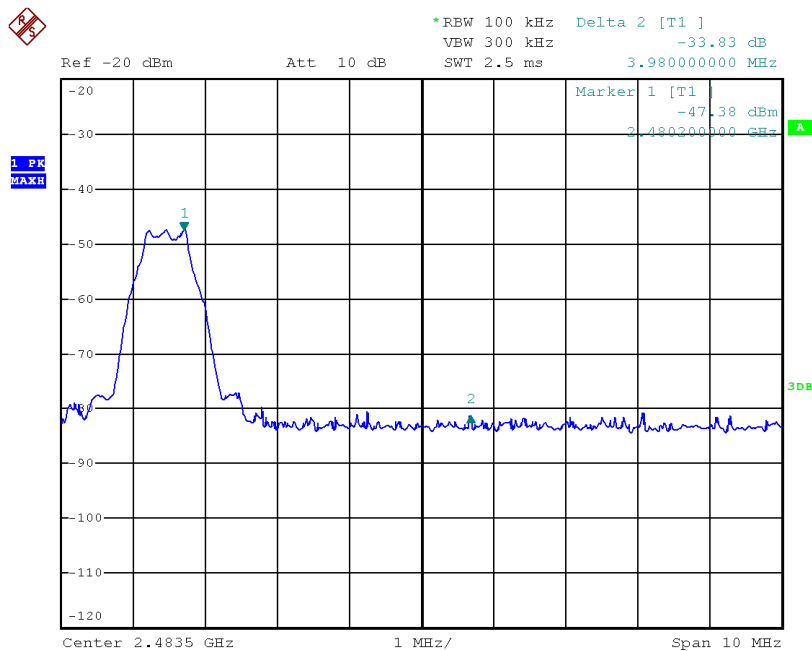
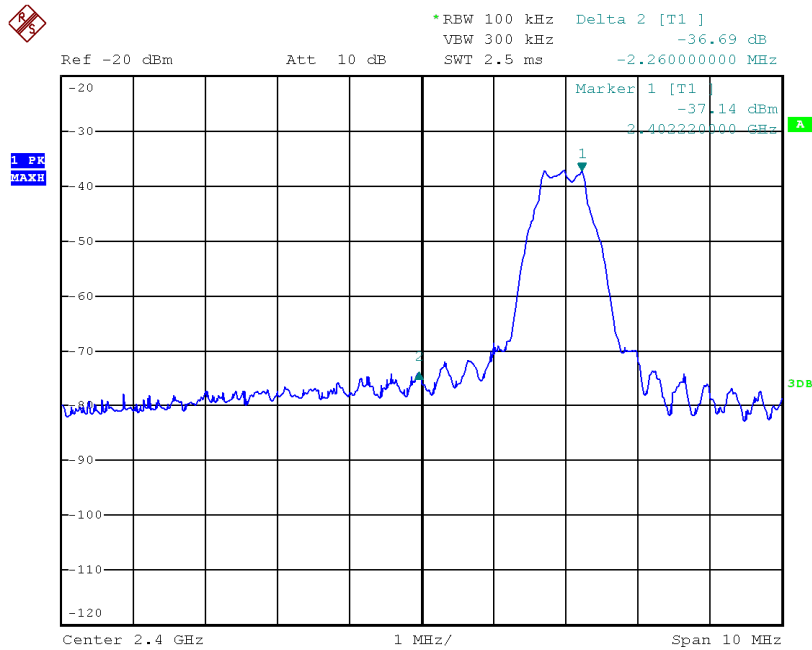
8.1 Radiated Emission on the Bandedge

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

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

$$=99.3 \text{ dB}\mu\text{V/m} - 36.7 \text{ dB}$$

$$=62.6 \text{ dB}\mu\text{V/m}$$

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

$$=83.5 \text{ dB}\mu\text{V/m} - 36.7 \text{ dB}$$

$$=46.8 \text{ dB}\mu\text{V/m}$$

Upper bandedge

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

$$=98.9 \text{ dB}\mu\text{V/m} - 33.8 \text{ dB}$$

$$=65.1 \text{ dB}\mu\text{V/m}$$

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

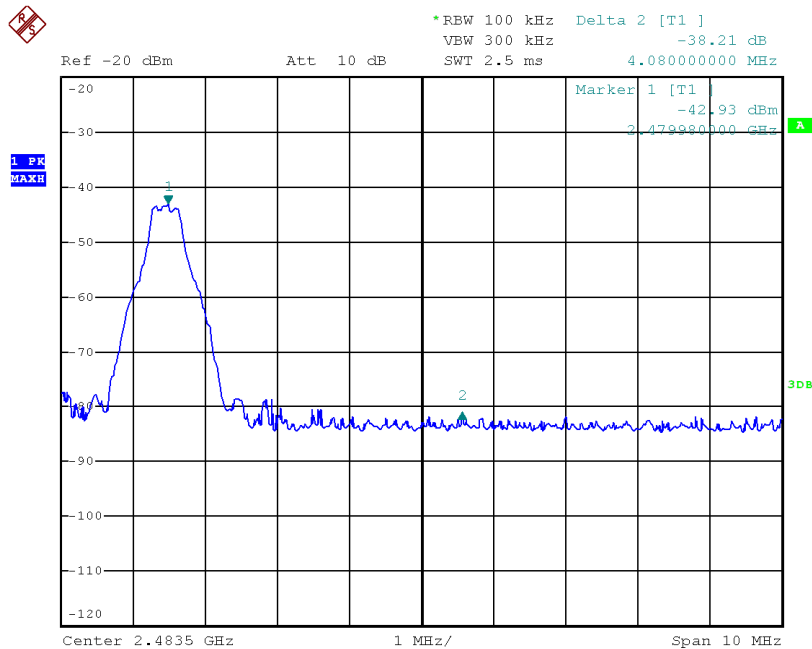
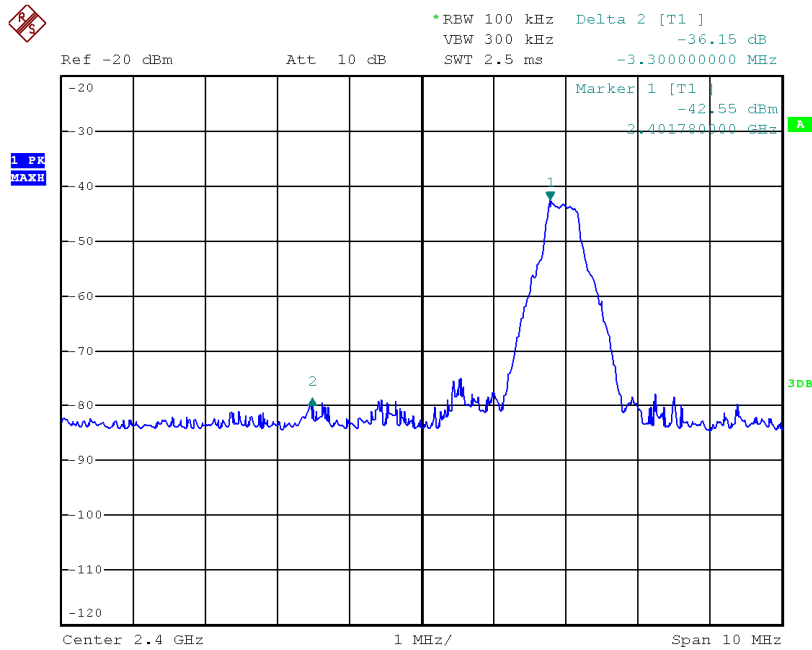
$$=83.2 \text{ dB}\mu\text{V/m} - 33.8 \text{ dB}$$

$$=49.4 \text{ dB}\mu\text{V/m}$$

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

TEST REPORT

PEAK MEASUREMENT



TEST REPORT

PEAK MEASUREMENT

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

$$\begin{aligned} &= 96.5 \text{ dB}\mu\text{V/m} - 36.2 \text{ dB} \\ &= 60.3 \text{ dB}\mu\text{V/m} \end{aligned}$$

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

$$\begin{aligned} &= 79.7 \text{ dB}\mu\text{V/m} - 36.2 \text{ dB} \\ &= 43.5 \text{ dB}\mu\text{V/m} \end{aligned}$$

Upper bandedge

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

$$\begin{aligned} &= 96.7 \text{ dB}\mu\text{V/m} - 38.2 \text{ dB} \\ &= 58.5 \text{ dB}\mu\text{V/m} \end{aligned}$$

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

$$\begin{aligned} &= 79.9 \text{ dB}\mu\text{V/m} - 38.2 \text{ dB} \\ &= 41.7 \text{ dB}\mu\text{V/m} \end{aligned}$$

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

TEST REPORT

8.2 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

8.2 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).

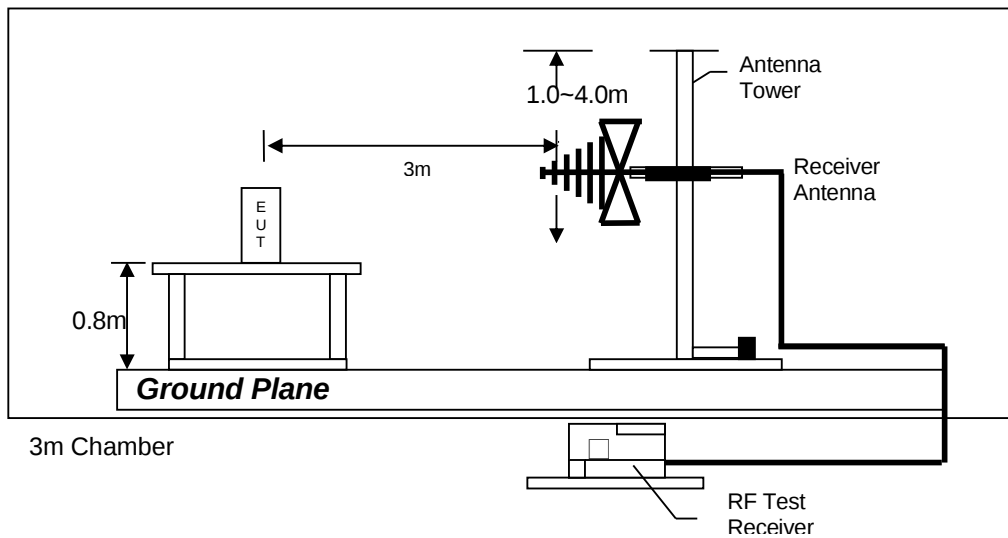
The IF bandwidth used for measurement of radiated signal strength was 100 kHz or greater when frequency is below 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application Note 150-2. A discussion 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.

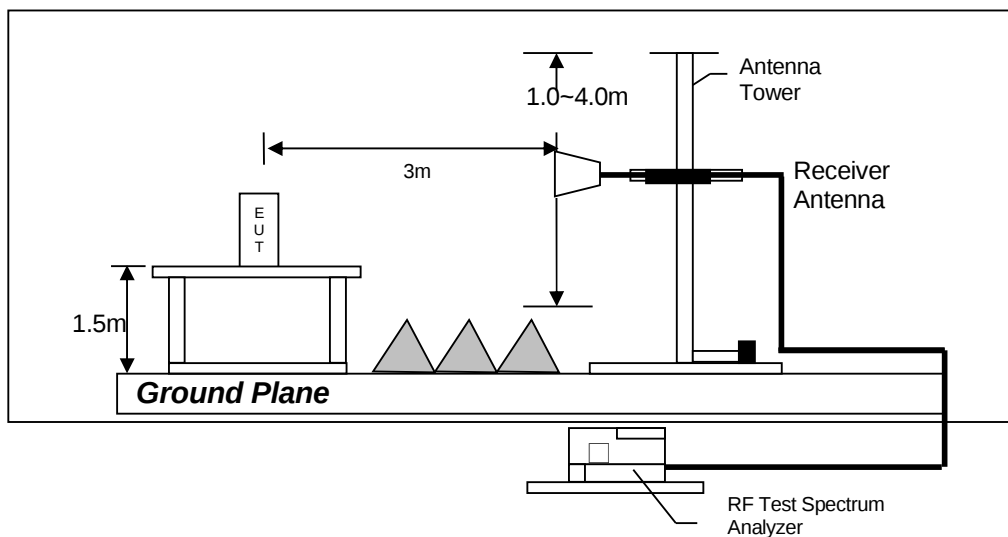
TEST REPORT

8.2.1 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

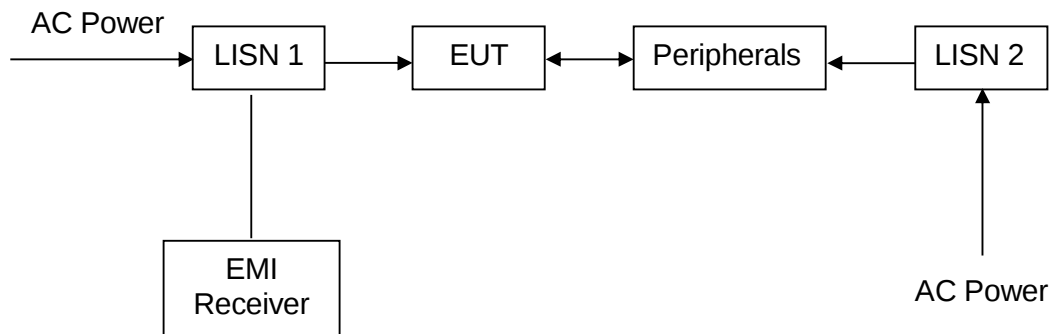
TEST REPORT

8.2.2 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.

8.2.3 Conducted Emission Test Setup



TEST REPORT

9.0 EQUIPMENT LIST

1) Radiated Emissions Test

Equipment	EMI Test Receiver (9kHz to 3GHz)	Spectrum Analyzer	Biconical Antenna
Registration No.	EW-2251	EW-2253	EW-3241
Manufacturer	ROHDESCHWARZ	ROHDESCHWARZ	EMCO
Model No.	ESCI	FSP40	3110C
Calibration Date	April 09, 2020	November 18, 2019	October 16, 2020
Calibration Due Date	April 09, 2021	March 18, 2021	October 16, 2021

Equipment	Log Periodic Antenna	Double Ridged Guide Antenna	RF Cable 14m (1GHz to 26.5GHz)
Registration No.	EW-0447	EW-1015	EW-3151
Manufacturer	EMCO	EMCO	GREATBILLION
Model No.	3146	3115	SMA m/SHF5MPU /SMA m ra14m,26G
Calibration Date	September 25, 2019	May 16, 2019	April 04, 2020
Calibration Due Date	March 25, 2021	March 16, 2021	April 04, 2021

Equipment	RF Preamplifier (9kHz to 6000MHz)	2.4GHz Notch Filter	14m Double Shield RF Cable (20MHz To 6GHz)
Registration No.	EW-3006b	EW-3435	EW-2074
Manufacturer	SCHWARZBECK	MICROWAVE	RADIALL
Model No.	BBV9718	N0324413	nm / RG142 / sma 14m
Calibration Date	November 25, 2019	November 16, 2019	August 29, 2020
Calibration Due Date	March 25, 2021	March 16, 2021	August 29, 2021

Equipment	Pyramidal Horn Antenna
Registration No.	EW-0905
Manufacturer	EMCO
Model No.	3160-09
Calibration Date	July 23, 2019
Calibration Due Date	March 23, 2021

2) Conducted Emissions Test

Equipment	EMI Test Receiver	Artificial Mains Network	RF Cable 80cm (RG142) (9kHz to 30MHz)
Registration No.	EW-3095	EW-2874	EW-2074
Manufacturer	ROHDESCHWARZ	ROHDESCHWARZ	RADIALL
Model No.	SCI	ENV-216	N(m)-RG142-BNC(m) L= 14M
Calibration Date	March 26, 2019	July 05, 2019	March 27, 2019
Calibration Due Date	March 26, 2021	July 05, 2021	March 27, 2021

TEST REPORT

3) Bandedge Measurement

Equipment	Spectrum Analyzer
Registration No.	EW-2253
Manufacturer	ROHDESCHWARZ
Model No.	FSP40
Calibration Date	November 18, 2019
Calibration Due Date	March 18, 2021

END OF TEST REPORT