2/F., Garment Centre,
576 Castle Peak Road, Kowloon,
Hong Kong SAR, China.

Telephone: (852) 2173 8888
Facsimile: (852) 2785 5487
www.intertek.com

TEST REPORT

Report No.: 23091090HKG-002

Warmup PLC

Application For Certification
(Original Grant)

FCC ID: 2AHBW6IENAS3

IC: 21121-6IENAS3

Transceiver

This report contains the data of BLE portion only

Prepared and Checked by:	**Approved by:**
Signed on File Leung Chun Ning, Peter Assistant Engineer	Digitally signed by Herbert Wong Location: Intertek Testing Services Hong Kong Limited Wong Cheuk Ho, Herbert Assistant Supervisor Date: November 30, 2023

TEST REPORT

GENERAL INFORMATION

Grantee:	Warmup PLC
Grantee Address:	704 Tudor Estate, Abbey Road, London, NW10 7UW, United Kingdom
Manufacturer:	Warmup PLC
Manufacturer Address:	704 Tudor Estate, Abbey Road, London, NW10 7UW, United Kingdom
FCC Specification Standard:	FCC Part 15, October 1, 2021 Edition
FCC ID:	2AHBW6IENAS3
FCC Model(s):	6IE-04-XX-YY-ZZ, 0804-0404-XX-YY
IC Specification Standard:	RSS-210 Issue 10 Amendment 1, April 2020 RSS-Gen Issue 5 Amendment 2, February 2021
IC:	21121-6IENAS3
HVIN:	6iE-04-CW-LC(S), 0804-0404-TB(S), 0804-0404-TW(S)
PMN:	6iE-04-CW-LC, 0804-0404-TB, 0804-0404-TW
Type of EUT:	Spread Spectrum Transmitter
Description of EUT:	Programmable WIFI Thermostat with GFCI
Sample Receipt Date:	November 20, 2023
Date of Test:	November 20, 2023 to November 28, 2023
Report Date:	November 30, 2023
Environmental Conditions:	Temperature: +10 to 40°C Relative Humidity: 10 to 90%
Conclusion:	Test was conducted by client submitted sample. The submitted sample as received complied with the 47 CFR Part 15 / RSS-210 Issue 10 Amendment 1 Certification. This report contains the data of BLE portion only

TEST REPORT

SUMMARY OF TEST RESULT

Test Items	FCC Part 15 Section	RSS-210 / RSS-Gen#	Results
Transmitter Power Line Conducted Emissions	15.207	8.8#	Complied
Radiated Emission	15.249, 15.209	B.10 / 8.9#	Complied
Radiated Emission on the Bandedge			Complied
Radiated Emission in Restricted Bands	15.205	8.10#	Complied

For all technical data can be referred to Annex B – Report cover sheet.
For electronic filing, the Annex B – Report cover sheet is saved with filename: Annex B.pdf.

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

FCC Part 15, October 1, 2021 Edition
RSS-210 Issue 10 Amendment 1, April 2020
RSS-Gen Issue 5 Amendment 2, February 2021

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 20dB 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

TEST REPORT

1.0 GENERAL DESCRIPTION

1.1 Product Description

The Equipment Under Test (EUT) is a Wi-Fi and BLE enabled thermostat designed to provide timed regulation of electric underfloor heating systems. The EUT is powered by 110-240VAC.

For Wi-Fi portion, the Equipment Under Test (EUT) operates at frequency range of 2412MHz to 2462MHz with 11 channels and 2422MHz to 2452MHz with 9 channels. For BLE Portion, it operates at frequency range of 2402.000 MHz to 2480.000 MHz with 40 channels, the channels are separated with 2MHz spacing.

The antenna(s) used in the EUT is integral, and the test sample is a prototype.
Peak Antenna Gain: 3.37 dBi

For FCC, all the models in the series 6iE-04-XX-YY-ZZ and 0804-0404-XX-YY are declared to be identical in hardware aspect and RF circuitry parameter. The series 6iE-04-XX-YY-ZZ means: where -04 means GFCI, XX means Lens/Housing Color, YY means decorative band colour, and ZZ means packaging version. The difference in model number serves as marketing strategy as declared by client. The series 0804-0404-XX-YY means: where XX means Lens/Housing Color and YY means packaging version. The difference in model number serves as marketing strategy as declared by client.

For IC: the models 6iE-04-CW-LC(S), 0804-0404-TB(S) are the same as the model 0804-0404-TW(S) in hardware aspect. The difference in model number serves as marketing strategy as declared by client.

The representative model 0804-0404-TW(S) was selected to test.

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 (BLE Portion).

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 and IC No. 2042H, CABID is "HKAP01".

TEST REPORT

2.0 SYSTEM TEST CONFIGURATION

2.1 Justification

For radiated emissions testing, the equipment under test (EUT) was setup to transmit / receive continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, all cables (if any) were manipulated to produce worst case emissions.

The EUT was powered by 120VAC during test.

For the measurements, the EUT was attached to a plastic stand if necessary and placed on the wooden turntable at 0.8m height from the ground plane for emission testing at or below 1GHz and 1.5m for emission measurements above 1GHz. If the base unit attached to peripherals, they were connected and operational (as typical as possible). Else, the base was wired to transmit full power with modulation.

The signal was maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization were varied during the search for maximum signal level. The antenna height was varied from 1 to 4 meters. Radiated emissions were taken at three meters unless the signal level was too low for measurement at that distance. If necessary, a pre-amplifier was used and/or the test was conducted at a closer distance.

For any intentional radiator powered by AC power line, measurements of the radiated signal level of the fundamental frequency component of the emission was performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage.

Radiated emission measurement for transmitter were performed 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 to 40 GHz, whichever is lower.

TEST REPORT

2.1 Justification (Cont'd)

Detector function for radiated emissions was in peak mode. Average readings, when required, were 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 section 4.8.3.

Determination of pulse desensitization was made according to Hewlett Packard Application Note 150-2, Spectrum Analysis... Pulsed RF. The effective period (Teff) was referred to Exhibit 4.8.3. With the resolution bandwidth 1MHz and spectrum analyzer IF bandwidth 3dB, the pulse desensitization factor was 0dB.

For AC power 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 0.4 meter 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.

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

All relevant operation modes have been tested, and the worst-case data is included in this report.

Different data rates have been tested. Worst case is reported only.

For simultaneous transmission, both Wi-Fi and BLE portions are also switched on when taking radiated emission for determining worst-case spurious emission.

2.2 EUT Exercising Software

The EUT exercise program (EspRFTestTool v2.8) used during radiated testing was designed to exercise the various system components in a manner similar to a typical use.

TEST REPORT

2.3 Details of EUT and Description of Accessories

Details of EUT:

The EUT is power by 120VAC

Description of Accessories:

N/A

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.

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.

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 dBµV/m
RA = Receiver Amplitude (including preamplifier) in dBµV
AF = Antenna Factor in dB
CF = Cable Attenuation 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 29.0 dB and average factor of 5.0 dB are subtracted, giving a field strength of 27.0 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 = 18.0 + 9.0 = 27.0 dBµV/m

RR = 18.0 dBµV
LF = 9.0 dB

Level in µV/m = Common Antilogarithm [(27.0 dBµV/m)/20] = 22.4 µV/m

TEST REPORT

3.2 Radiated Emission Configuration Photograph

The worst case in radiated emission was found at 2402.000 MHz

For electronic filing, the worst-case radiated emission configuration photographs are saved with filename: Setup 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 1.8 dB

3.4 Conducted Emission Configuration Photograph

The worst case in line-conducted emission was found at 0.5640 MHz

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

3.5 Conducted Emission Data

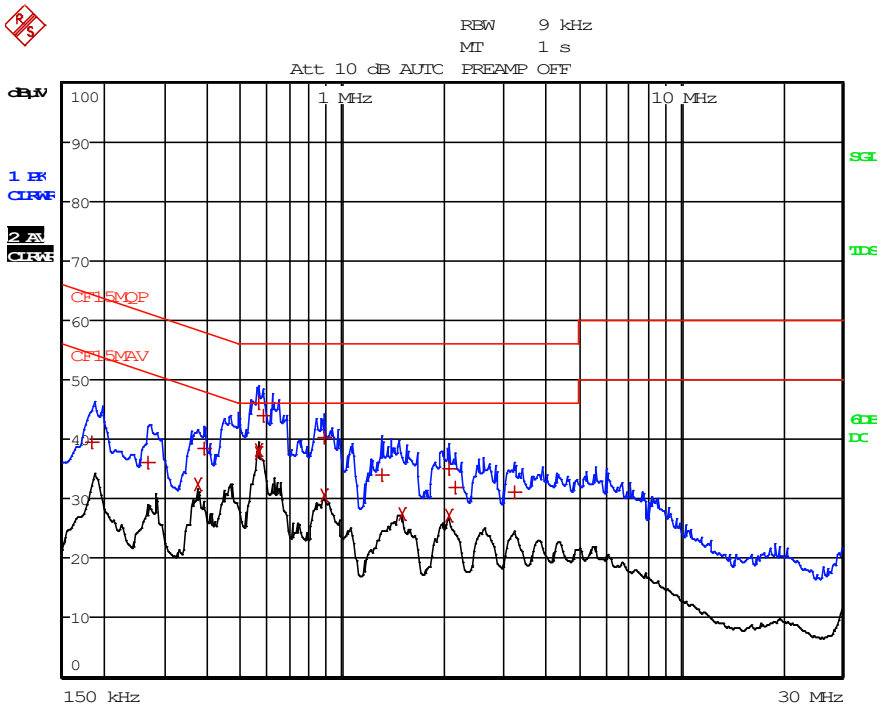
The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Judgment: Pass by 7.7 dB

TEST REPORT

CONDUCTED EMISSION

Model: 0804-0404-TW(S)
Date of Test: November 28, 2023
Worst-Case Operating Mode: Wi-Fi and BLE Operating



EDIT PEAK LIST (Final Measurement Results)

Trace1: CF15MQP
Trace2: CF15MAV
Trace3: ---

	TRACE	FREQUENCY	LEVEL dBµV		DELTA LIMIT dB
1	Quasi Peak	186 kHz	39.51	L1	-24.69
1	Quasi Peak	271.5 kHz	35.96	N	-25.10
2	CISPR Average	375 kHz	32.31	L1	-16.07
1	Quasi Peak	388.5 kHz	38.36	N	-19.73
1	Quasi Peak	564 kHz	46.06	N	-9.93
2	CISPR Average	564 kHz	38.28	L1	-7.71
2	CISPR Average	568.5 kHz	37.73	L1	-8.26
1	Quasi Peak	582 kHz	44.01	N	-11.98
1	Quasi Peak	883.5 kHz	40.29	N	-15.70
2	CISPR Average	883.5 kHz	30.44	L1	-15.55
1	Quasi Peak	1.3155 MHz	34.07	N	-21.92
2	CISPR Average	1.5045 MHz	27.46	N	-18.53
1	Quasi Peak	2.0625 MHz	35.08	N	-20.91
2	CISPR Average	2.0625 MHz	27.18	N	-18.81
1	Quasi Peak	2.1525 MHz	31.76	N	-24.23
1	Quasi Peak	3.2415 MHz	31.08	N	-24.91

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

TEST REPORT

RADIATED EMISSIONS

Model: 0804-0404-TW(S)
Date of Test: November 21, 2023
Worst-Case Operating Mode: Transmitting

Table 1

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

Lowest Channel

Polari-zation	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	95.8	33	29.4	92.2	94.0	-1.8
V	4804.000	26.5	33	34.9	28.4	54.0	-25.6
H	7206.000	27.3	33	37.9	32.2	54.0	-21.8
V	9608.000	27.9	33	40.4	35.3	54.0	-18.7
H	12010.000	30.0	33	40.5	37.5	54.0	-16.5
V	14412.000	34.6	33	40.0	41.6	54.0	-12.4

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
H	2402.000	102.8	33	29.4	99.2	114.0	-14.8
V	4804.000	39.8	33	34.9	41.7	74.0	-32.3
H	7206.000	40.7	33	37.9	45.6	74.0	-28.4
V	9608.000	41.0	33	40.4	48.4	74.0	-25.6
H	12010.000	43.2	33	40.5	50.7	74.0	-23.3
V	14412.000	47.9	33	40.0	54.9	74.0	-19.1

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 value in the margin column shows emission below limit.
5. Horn antenna is used for the emission over 1000MHz.
6. Emissions within the restricted band meets the requirement of FCC Part 15 Section 15.205 / RSS-Gen Section 8.10.
7. Measurement Uncertainty is ±5.3dB at a level of confidence of 95%.

TEST REPORT

RADIATED EMISSIONS

Model: 0804-0404-TW(S)
Date of Test: November 21, 2023
Worst-Case Operating Mode: Transmitting

Table 2

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

Middle Channel

Polari-zation	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	94.4	33	29.4	90.8	94.0	-3.2
V	4880.000	26.9	33	34.9	28.8	54.0	-25.2
V	7320.000	27.9	33	37.9	32.8	54.0	-21.2
V	9760.000	28.9	33	40.4	36.3	54.0	-17.7
V	12200.000	30.4	33	40.5	37.9	54.0	-16.1
H	14640.000	35.7	33	38.4	41.1	54.0	-12.9

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)
H	2440.000	101.1	33	29.4	97.5	114.0	-16.5
V	4880.000	40.0	33	34.9	41.9	74.0	-32.1
V	7320.000	41.6	33	37.9	46.5	74.0	-27.5
V	9760.000	42.1	33	40.4	49.5	74.0	-24.5
V	12200.000	44.0	33	40.5	51.5	74.0	-22.5
H	14640.000	49.7	33	38.4	55.1	74.0	-18.9

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 value in the margin column shows emission below limit.
5. Horn antenna is used for the emission over 1000MHz.
6. Emissions within the restricted band meets the requirement of FCC Part 15 Section 15.205 / RSS-Gen Section 8.10.
7. Measurement Uncertainty is ±5.3dB at a level of confidence of 95%.

TEST REPORT

RADIATED EMISSIONS

Model: 0804-0404-TW(S)
Date of Test: November 21, 2023
Worst-Case Operating Mode: Transmitting

Table 3

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

Highest Channel

Polari-zation	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	92.8	33	29.4	89.2	94.0	-4.8
H	4960.000	26.9	33	34.9	28.8	54.0	-25.2
V	7440.000	27.9	33	37.9	32.8	54.0	-21.2
H	9920.000	27.9	33	40.4	35.3	54.0	-18.7
H	12400.000	30.6	33	40.5	38.1	54.0	-15.9
V	14880.000	35.2	33	38.4	40.6	54.0	-13.4

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
H	2480.000	99.2	33	29.4	95.6	114.0	-18.4
H	4960.000	40.1	33	34.9	42.0	74.0	-32.0
V	7440.000	41.8	33	37.9	46.7	74.0	-27.3
H	9920.000	41.5	33	40.4	48.9	74.0	-25.1
H	12400.000	43.6	33	40.5	51.1	74.0	-22.9
V	14880.000	49.6	33	38.4	55.0	74.0	-19.0

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 value in the margin column shows emission below limit.
5. Horn antenna is used for the emission over 1000MHz.
6. Emissions within the restricted band meets the requirement of FCC Part 15 Section 15.205 / RSS-Gen Section 8.10.
7. Measurement Uncertainty is ±5.3dB at a level of confidence of 95%.

TEST REPORT

RADIATED EMISSIONS

Model: 0804-0404-TW(S)
Date of Test: November 23, 2023
Worst-Case Operating Mode: Wi-Fi and BLE Operating

Table 4

Pursuant to FCC Part 15 Section 15.209 / RSS-GEN 8.9 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	48.188	28.9	16	11.0	23.9	40.0	-16.1
V	60.555	26.1	16	10.0	20.1	40.0	-19.9
V	100.810	24.5	16	12.0	20.5	43.5	-23.0
V	165.194	18.7	16	17.0	19.7	43.5	-23.8
V	562.530	23.7	16	28.0	35.7	46.0	-10.3
H	885.661	18.4	16	32.0	34.4	46.0	-11.6

Notes:
1. Quasi-Peak Detector Data unless otherwise stated.
2. All measurements were made at 3 meters.
3. Negative value in the margin column shows emission below limit.
4. Horn antenna is used for the emission over 1000MHz.
5. Emissions within the restricted band meets the requirement of FCC Part 15 Section 15.205 / RSS-Gen Section 8.10.
6. Measurement Uncertainty is ±5.3dB 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).

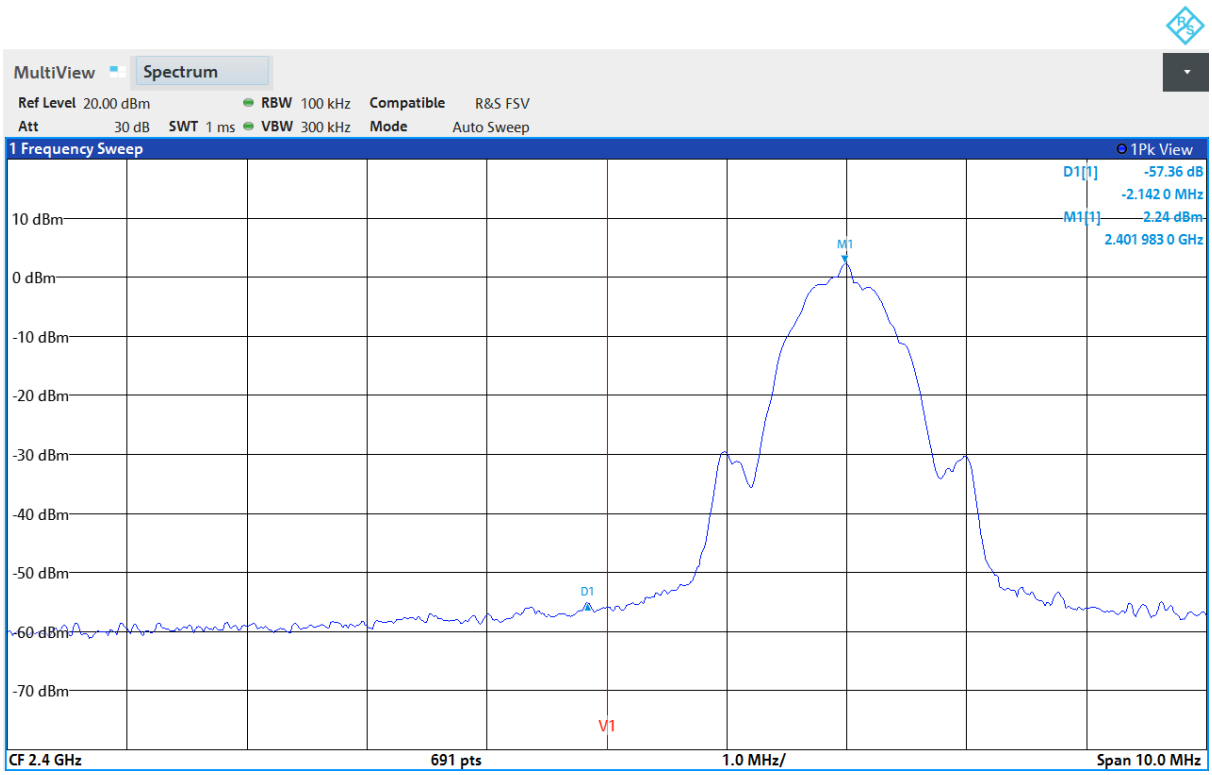
8.1 Radiated Emission on the Bandedge

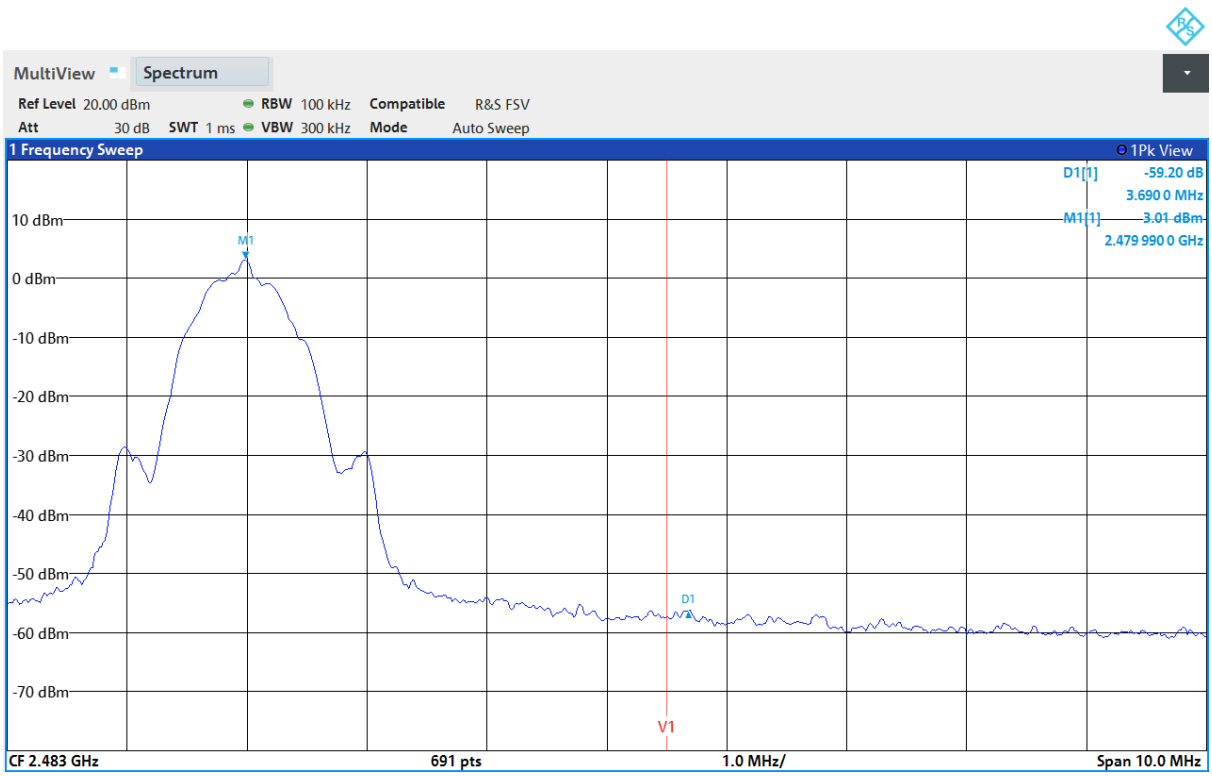
From the following plots, they show that the fundamental emissions are confined in the specified band (2400MHz to 2483.5MHz). In case of the fundamental emissions are within two standard bandwidths from the bandedge, the delta measurement technique is used for determining bandedge compliance. Standard 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-Gen 8.9, whichever is the lesser attenuation, which meet the requirement of Part 15.249(d) / RSS-210 B.10.

TEST REPORT

PEAK MEASUREMENT (BLE)





TEST REPORT

PEAK MEASUREMENT (BLE)

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

= 99.2 dBµV/m - 57.4 dB
= 41.8 dBµV/m

Average Resultant Field Strength = Fundamental Emissions (Average Value) – delta from the plot

= 92.2 dBµV/m - 57.4 dB
= 34.8 dBµV/m

Upper Bandedge

Peak Resultant Field Strength = Fundamental Emissions (Peak Value) – delta from the plot

= 95.6 dBµV/m - 59.2 dB
= 36.4 dBµV/m

Average Resultant Field Strength = Fundamental Emissions (Average Value) – delta from the plot

= 89.2 dBµV/m - 59.2 dB
= 30.0 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).

TEST REPORT

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 3MHz, so the pulse desensitivity factor is 0dB.

8.3 Calculation of Average Factor

Not Applicable

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.

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).

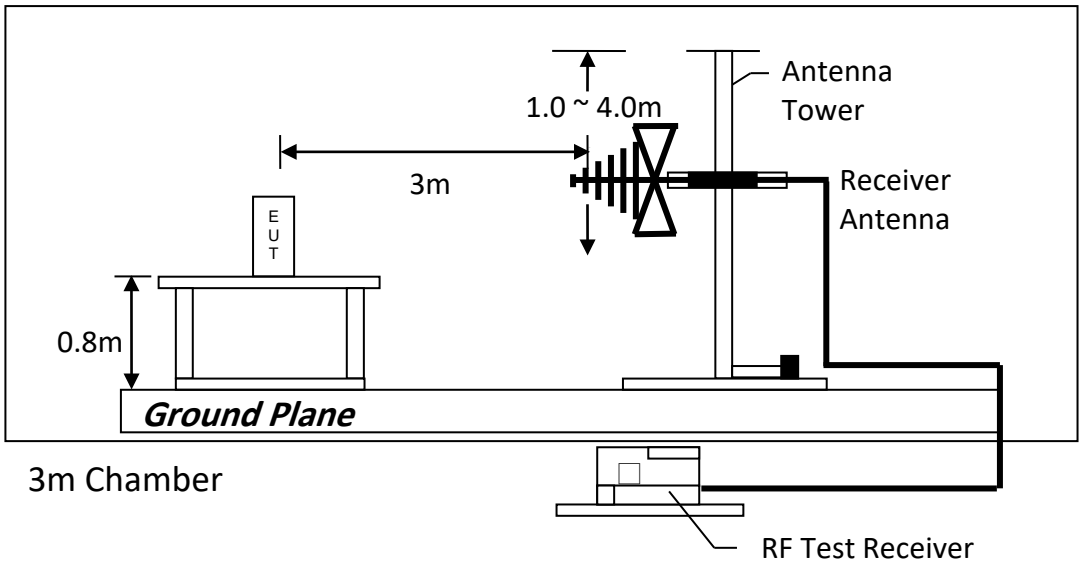
The IF bandwidth used for measurement of radiated signal strength was 100 kHz or greater when frequency is below 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application Note 150-2. A discussion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

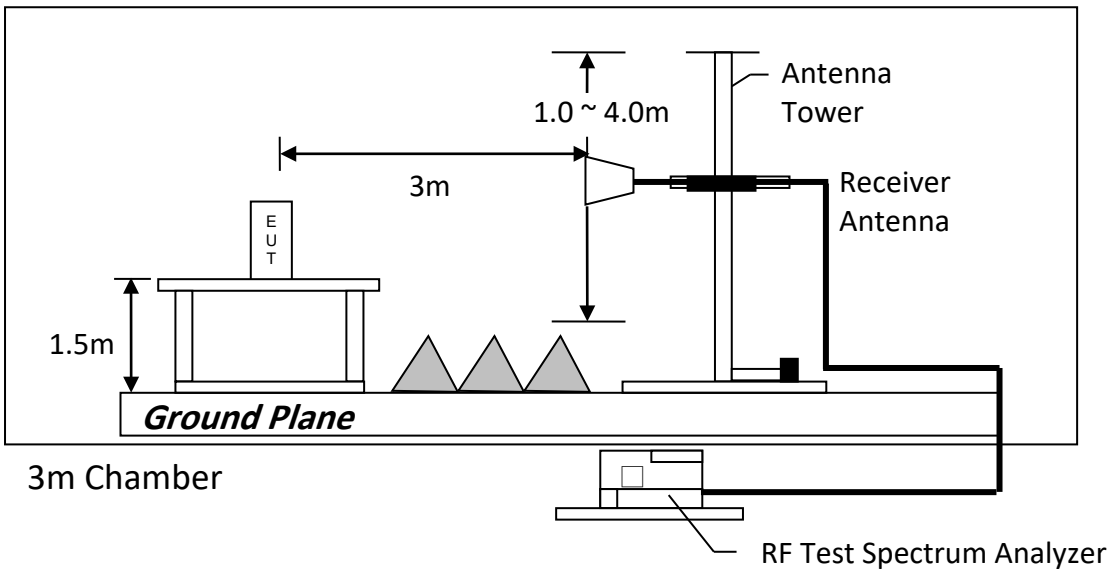
TEST REPORT

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

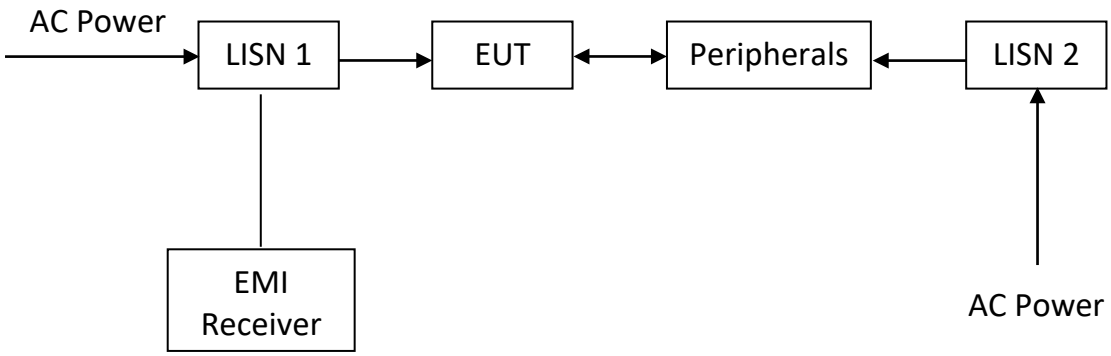
TEST REPORT

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



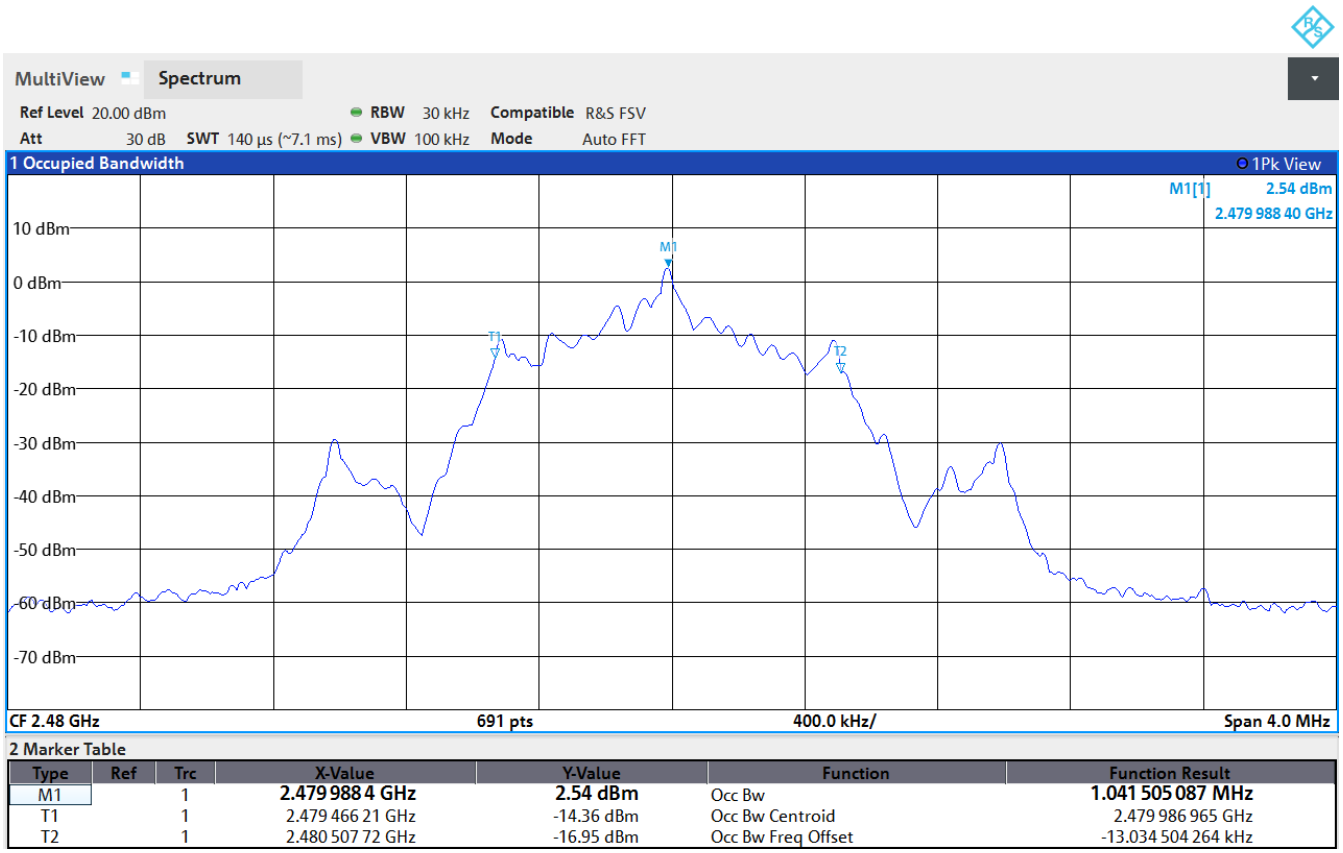
TEST REPORT

8.5 Occupied Bandwidth

Occupied Bandwidth Results: (BLE)

Bluetooth (MHz)	Occupied Bandwidth (kHz)
Low Channel: 2402	1036
Middle Channel: 2440	1036
High Channel: 2480	1042

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	Signal and Spectrum Analyzer (10Hz to 40GHz)	Biconical Antenna (30MHz to 300MHz)	EMI Test Receiver 7GHz
Registration No.	EW-3016	EW-3242	EW-3603
Manufacturer	ROHDESCHWARZ	EMCO	ROHDESCHWARZ
Model No.	FSV40	3110C	ESR7
Calibration Date	December 13, 2022	May 26, 2021	December 06, 2022
Calibration Due Date	December 13, 2023	February 26, 2024	December 06, 2023

Equipment	Log Periodic Antenna	Double Ridged Guide Antenna (1GHz - 18GHz)	Active Loop H-field (9kHz to 30MHz)
Registration No.	EW-3243	EW-0194	EW-3302
Manufacturer	EMCO	EMCO	EMCO
Model No.	3148B	3115	6502
Calibration Date	June 03, 2021	May 10, 2023	September 08, 2022
Calibration Due Date	December 30, 2023	November 10, 2024	December 08, 2023

Equipment	RF Preamplifier (9kHz to 6000MHz)	2.4GHz Notch Filter	14m Double Shield RF Cable (9kHz - 6GHz)
Registration No.	EW-3006b	EW-3435	EW-2376
Manufacturer	SCHWARZBECK	MICROWAVE	RADIALL
Model No.	BBV9718	N0324413	n m/br56/bnc m 14m
Calibration Date	February 15, 2022	June 16, 2022	January 26, 2022
Calibration Due Date	February 15, 2024	December 16, 2023	January 26, 2024

Equipment	RF Cable 14m (1GHz to 26.5GHz)	14m Double Shield RF Cable (20MHz to 6GHz)	Pyramidal Horn Antenna
Registration No.	EW-2781	EW-2074	EW-0905
Manufacturer	GREATBILLION	RADIALL	EMCO
Model No.	SMA m/SHF5MPU /SMA m ra14m,26G	N(m)-RG142-BNC(m) L=14M	3160-09
Calibration Date	December 12, 2022	December 10, 2021	July 20, 2021
Calibration Due Date	December 12, 2023	December 10, 2023	February 20, 2024

TEST REPORT

2) Conducted Emissions Test

Equipment	RF Cable 240cm (RG142) (9kHz to 30MHz)	Artificial Mains Network	EMI Test Receiver 7GHz
Registration No.	EW-2454	EW-2501	EW-3481
Manufacturer	RADIALL	ROHDESCHWARZ	ROHDESCHWARZ
Model No.	Bnc m st / 142 / bnc mra 240cm	ENV-216	ESR7
Calibration Date	June 13, 2023	September 11, 2021	December 21, 2021
Calibration Due Date	June 13, 2024	December 11, 2023	December 21, 2023

3) Bandedge Measurement

Equipment	Signal and Spectrum Analyzer	5m RF Cable (40GHz)
Registration No.	EW-3604	EW-2701
Manufacturer	ROHDESCHWARZ	RADIALL
Model No.	FSV3044	Sma m-m 5m 40G
Calibration Date	December 13, 2022	November 24, 2020
Calibration Due Date	December 13, 2023	February 24, 2024

4) OBW Measurement

Equipment	Signal and Spectrum Analyzer	5m RF Cable (40GHz)
Registration No.	EW-3604	EW-2701
Manufacturer	ROHDESCHWARZ	RADIALL
Model No.	FSV3044	Sma m-m 5m 40G
Calibration Date	December 13, 2022	November 24, 2020
Calibration Due Date	December 13, 2023	February 24, 2024

5) Control Software for Radiated Emission

Software Information	
Software Name	EMC32
Manufacturer	ROHDESCHWARZ
Software version	10.50.40

END OF TEST REPORT