

TEST REPORT

Report No.: 22041064HKG-001

KALI AUDIO INC.

Application For Certification
(Original Grant)

FCC ID: 2ATSD-BTBOXKA
IC: 25195-BTBOXKA

Transceiver

Prepared and Checked by:

Approved by:

Signed on File
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Date: July 08, 2022

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TEST REPORT

GENERAL INFORMATION

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Manufacturer:	Dongguan Kwan Hong Electronics Co., Ltd.
Manufacturer Address:	No.5, Shichangxiang, Chang'an Town, Dongguan City, Guangdong Province, China.
Brand Name:	KALI AUDIO
Model / HVIN:	MVBT
PMN:	Bluetooth Input Module
Type of EUT:	Transceiver
Description of EUT:	Bluetooth Input Module
FCC ID / IC:	2ATSD-BTBOXKA / 25195-BTBOXKA
Date of Sample Submitted:	May 30, 2022
Date of Test:	May 30, 2022 to June 10, 2022
Report No.:	22041064HKG-001
Report Date:	July 08, 2022
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 / RSS-210 Issue 10 Certification.

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-Gen 8.9	
Radiated Emission in Restricted Bands	15.205 / RSS-Gen 8.10	Pass

For all technical data, which 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, 2020 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 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) MVBT is Bluetooth Input Module. The EUT is powered by 5VDC.

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 and IC No. 2042H, CABID is “HKAP01”.

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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 EUT was powered by a 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

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.

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

Provided by Intertek:

(1) AC/DC Adaptor Model: PS050I1000 (input 100-240VAC 50/60Hz 0.5A; output 5V 1A 5W)
Provided by Applicant

(2) 4 X audio cable of 2m long with termination
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 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 2480.000 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 1.8 dB

3.4 Conducted Emission Configuration Photograph

The worst case in line-conducted emission was found at 0.344 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 18.6 dB

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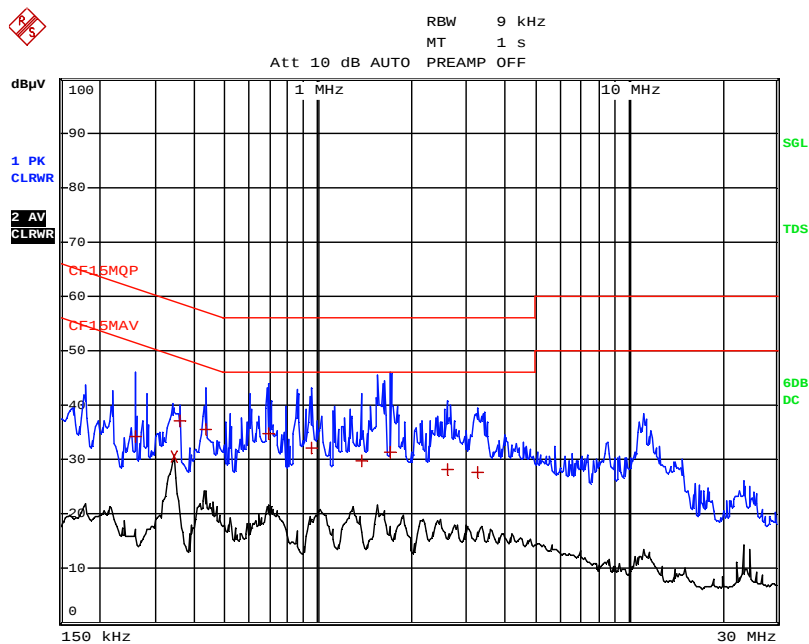
CONDUCTED EMISSION

Model/HVIN: MVBT

Date of Test: June 06, 2022

Worst-Case Operating Mode: Bluetooth Operating

EDIT PEAK LIST (Final Measurement Results)				
Trace1:	CF15MQP			
Trace2:	CF15MAV			
Trace3:	---			
TRACE	FREQUENCY	LEVEL dBμV	DELTA	LIMIT dB
1 Quasi Peak	258 kHz	34.25 L1	-27.23	
2 CISPR Average	343.5 kHz	30.49 L1	-18.62	
1 Quasi Peak	357 kHz	37.04 N	-21.75	
1 Quasi Peak	433.5 kHz	35.67 L1	-21.51	
1 Quasi Peak	694.5 kHz	34.66 L1	-21.33	
1 Quasi Peak	955.5 kHz	32.16 L1	-23.83	
1 Quasi Peak	1.3785 MHz	29.91 N	-26.08	
1 Quasi Peak	1.7115 MHz	31.29 L1	-24.70	
1 Quasi Peak	2.6205 MHz	28.32 N	-27.67	
1 Quasi Peak	3.255 MHz	27.75 L1	-28.24	



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

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RADIATED EMISSIONS

Model/HVIN: MVBT

Date of Test: June 06, 2022

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 (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	93.8	33	29.4	90.2	94.0	-3.8
V	4804.000	31.3	33	34.9	33.2	54.0	-20.8
V	7206.000	27.3	33	37.9	32.2	54.0	-21.8
V	9608.000	25.4	33	40.4	32.8	54.0	-21.2
H	12010.000	27.3	33	40.5	34.8	54.0	-19.2
H	14412.000	31.4	33	40.0	38.4	54.0	-15.6

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	103.8	33	29.4	100.2	114.0	-13.8
V	4804.000	44.3	33	34.9	46.2	74.0	-27.8
V	7206.000	41.5	33	37.9	46.4	74.0	-27.6
V	9608.000	48.8	33	40.4	56.2	74.0	-17.8
H	12010.000	41.0	33	40.5	48.5	74.0	-25.5
H	14412.000	44.2	33	40.0	51.2	74.0	-22.8

- 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 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 ± 5.3 dB at a level of confidence of 95%.

TEST REPORT

Model/HVIN: MVBT

Date of Test: June 06, 2022

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 (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Average (dBμV/m)	Average Limit at 3m (dBμV/m)	Margin (dB)
V	2440.000	94.8	33	29.4	91.2	94.0	-2.8
V	4880.000	33.3	33	34.9	35.2	54.0	-18.8
V	7320.000	27.7	33	37.9	32.6	54.0	-21.4
V	9760.000	26.1	33	40.4	33.5	54.0	-20.5
H	12200.000	28.0	33	40.5	35.5	54.0	-18.5
H	14640.000	33.0	33	38.4	38.4	54.0	-15.6

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	2440.000	101.0	33	29.4	101.0	114.0	-13.0
V	4880.000	46.2	33	34.9	46.2	74.0	-27.8
V	7320.000	46.4	33	37.9	46.4	74.0	-27.6
V	9760.000	56.5	33	40.4	56.5	74.0	-17.5
H	12200.000	48.5	33	40.5	48.5	74.0	-25.5
H	14640.000	51.1	33	38.4	51.1	74.0	-22.9

- 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 ± 5.3 dB at a level of confidence of 95%.

TEST REPORT

Model/HVIN: MVBT

Date of Test: June 06, 2022

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 (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Average (dBμV/m)	Average Limit at 3m (dBμV/m)	Margin (dB)
V	2480.000	95.0	33	29.4	91.4	94.0	-2.6
V	4960.000	32.3	33	34.9	34.2	54.0	-19.8
V	7440.000	28.6	33	37.9	33.5	54.0	-20.5
V	9920.000	35.0	33	40.4	42.4	54.0	-11.6
H	12400.000	27.1	33	40.5	34.6	54.0	-19.4
H	14880.000	33.2	33	38.4	38.6	54.0	-15.4

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)
V	2480.000	104.8	33	29.4	101.2	114.0	-12.8
V	4960.000	44.3	33	34.9	46.2	74.0	-27.8
V	7440.000	41.6	33	37.9	46.5	74.0	-27.5
V	9920.000	49.4	33	40.4	56.8	74.0	-17.2
H	12400.000	41.0	33	40.5	48.5	74.0	-25.5
H	14880.000	46.2	33	38.4	51.6	74.0	-22.4

- 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 ± 5.3 dB at a level of confidence of 95%.

TEST REPORT

Model/HVIN: MVBT

Date of Test: June 06, 2022

Worst-Case Operating Mode: Transmitting (Bluetooth 4.0 BLE)

Table 4
Pursuant to FCC Part 15 Section 15.249 / RSS-210 B10.0 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	94.4	33	29.4	90.8	94.0	-3.2
V	4804.000	32.4	33	34.9	34.3	54.0	-19.7
V	7206.000	27.6	33	37.9	32.5	54.0	-21.5
V	9608.000	25.2	33	40.4	32.6	54.0	-21.4
H	12010.000	28.1	33	40.5	35.6	54.0	-18.4
H	14412.000	31.2	33	40.0	38.2	54.0	-15.8

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	105.1	33	29.4	101.5	114.0	-12.5
V	4804.000	44.6	33	34.9	46.5	74.0	-27.5
V	7206.000	41.7	33	37.9	46.6	74.0	-27.4
V	9608.000	50.2	33	40.4	57.6	74.0	-16.4
H	12010.000	40.9	33	40.5	48.4	74.0	-25.6
H	14412.000	44.1	33	40.0	51.1	74.0	-22.9

- 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 ± 5.3 dB at a level of confidence of 95%.

TEST REPORT

Model/HVIN: MVBT

Date of Test: June 06, 2022

Worst-Case Operating Mode: Transmitting (Bluetooth 4.0 BLE)

Table 5
Pursuant to FCC Part 15 Section 15.249 / RSS-210 B10.0 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)
V	2440.000	94.7	33	29.4	91.1	94.0	-2.9
V	4880.000	32.7	33	34.9	34.6	54.0	-19.4
V	7320.000	27.3	33	37.9	32.2	54.0	-21.8
V	9760.000	24.9	33	40.4	32.3	54.0	-21.7
H	12200.000	27.7	33	40.5	35.2	54.0	-18.8
H	14640.000	33.4	33	38.4	38.8	54.0	-15.2

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	2440.000	105.6	33	29.4	102.0	114.0	-12.0
V	4880.000	44.5	33	34.9	46.4	74.0	-27.6
V	7320.000	41.2	33	37.9	46.1	74.0	-27.9
V	9760.000	49.9	33	40.4	57.3	74.0	-16.7
H	12200.000	40.7	33	40.5	48.2	74.0	-25.8
H	14640.000	45.6	33	38.4	51.0	74.0	-23.0

- 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 ± 5.3 dB at a level of confidence of 95%.

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Model/HVIN: MVBT

Date of Test: June 06, 2022

Worst-Case Operating Mode: Transmitting (Bluetooth 4.0 BLE)

Table 6
Pursuant to FCC Part 15 Section 15.249 / RSS-210 B10.0 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)
V	2480.000	95.8	33	29.4	92.2	94.0	-1.8
V	4960.000	32.2	33	34.9	34.1	54.0	-19.9
V	7440.000	27.9	33	37.9	32.8	54.0	-21.2
V	9920.000	35.2	33	40.4	42.6	54.0	-11.4
H	12400.000	27.9	33	40.5	35.4	54.0	-18.6
H	14880.000	32.7	33	38.4	38.1	54.0	-15.9

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	2480.000	105.8	33	29.4	102.2	114.0	-11.8
V	4960.000	45.0	33	34.9	46.9	74.0	-27.1
V	7440.000	41.4	33	37.9	46.3	74.0	-27.7
V	9920.000	50.1	33	40.4	57.5	74.0	-16.5
H	12400.000	41.2	33	40.5	48.7	74.0	-25.3
H	14880.000	46.2	33	38.4	51.6	74.0	-22.4

- 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 ± 5.3 dB at a level of confidence of 95%.

TEST REPORT

Model/HVIN: MVBT

Date of Test: June 06, 2022

Worst-Case Operating Mode: Bluetooth Operating

Table 7
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	32.868	32.8	16	10.0	26.8	40.0	-13.2
V	38.246	30.2	16	10.0	24.2	40.0	-15.8
V	68.986	40.8	16	8.0	32.8	40.0	-7.2
V	144.284	38.8	16	14.0	36.8	43.5	-6.7
V	212.025	27.2	16	17.0	28.2	43.5	-15.3
H	420.202	25.2	16	25.0	34.2	46.0	-11.8

- 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 ± 5.3 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 & IC 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.

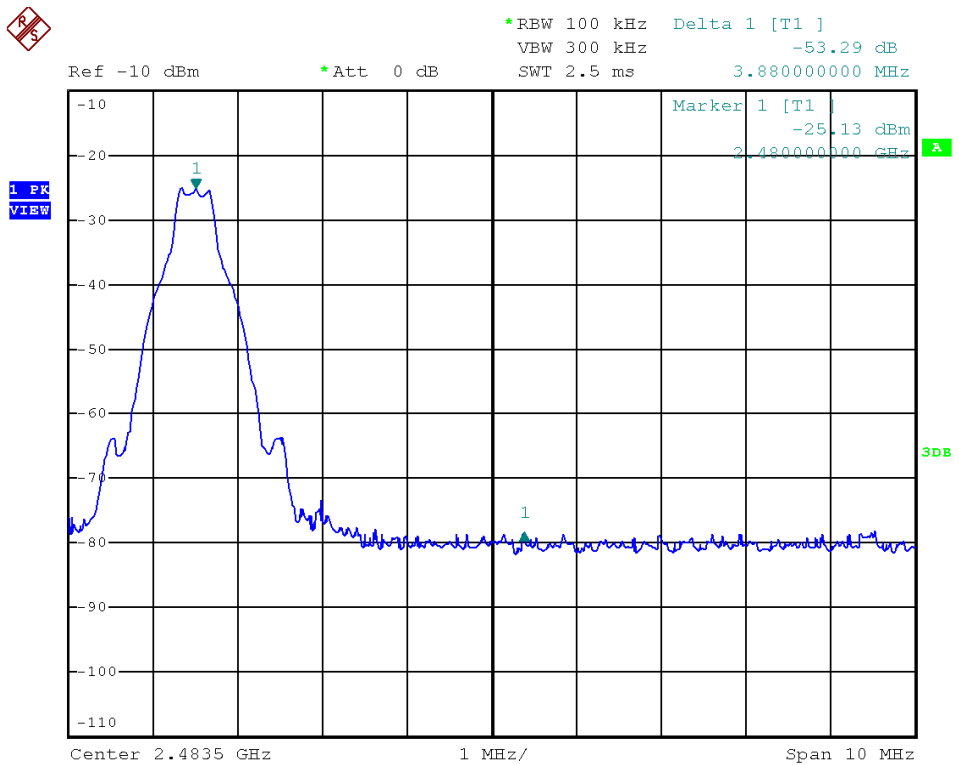
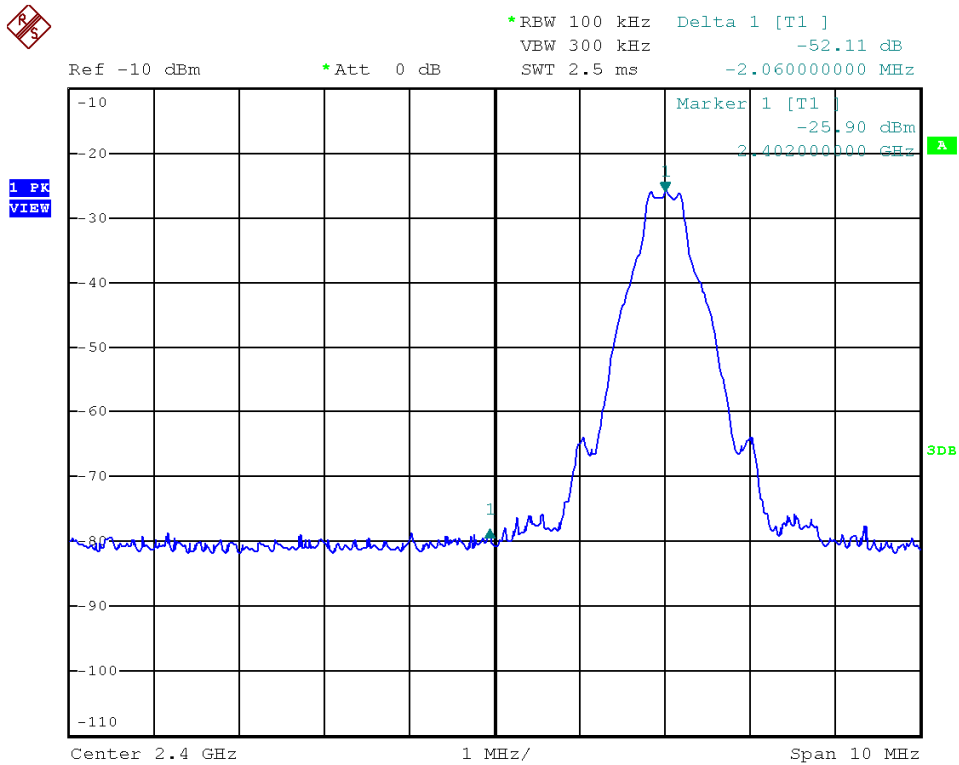
8.1 Radiated Emission on the Bandedge

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 (Bluetooth 3.0)



TEST REPORT

PEAK MEASUREMENT (Bluetooth 3.0)

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

$$\begin{aligned} &= 100.2 \text{ dB}\mu\text{V/m} - 52.1 \text{ dB} \\ &= 48.1 \text{ dB}\mu\text{V/m} \end{aligned}$$

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

$$\begin{aligned} &= 90.2 \text{ dB}\mu\text{V/m} - 52.1 \text{ dB} \\ &= 38.1 \text{ dB}\mu\text{V/m} \end{aligned}$$

Upper bandedge

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

$$\begin{aligned} &= 101.2 \text{ dB}\mu\text{V/m} - 53.3 \text{ dB} \\ &= 47.9 \text{ dB}\mu\text{V/m} \end{aligned}$$

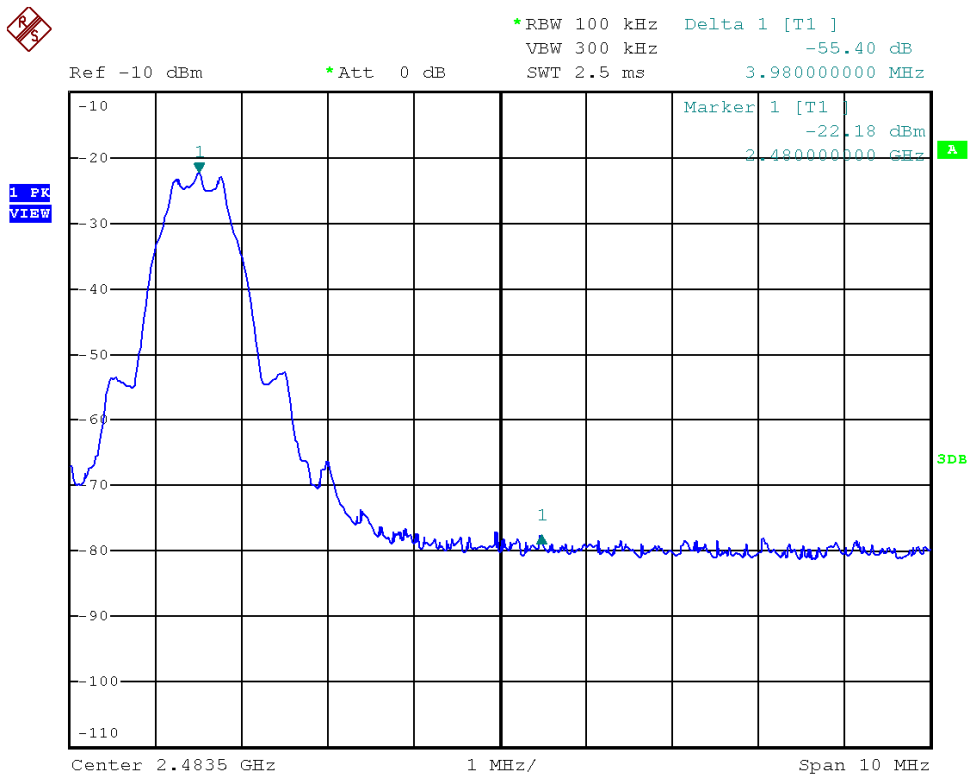
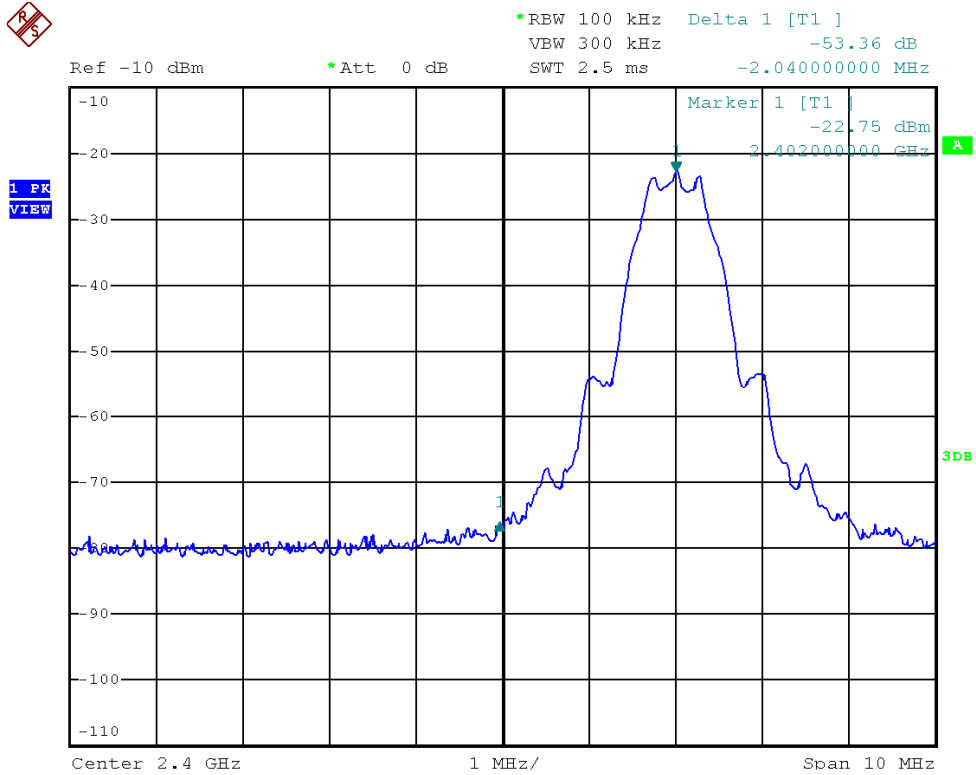
Average Resultant field strength = Fundamental emissions (average value) – delta from the plot

$$\begin{aligned} &= 91.4 \text{ dB}\mu\text{V/m} - 53.3 \text{ dB} \\ &= 38.1 \text{ dB}\mu\text{V/m} \end{aligned}$$

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

PEAK MEASUREMENT (Bluetooth 4.0 BLE)



TEST REPORT

PEAK MEASUREMENT (Bluetooth 4.0 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

=101.5 dB μ V/m – 53.4 dB
=48.1 dB μ V/m

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

=90.8 dB μ V/m – 53.4 dB
=37.4 dB μ V/m

Upper bandedge

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

=102.2 dB μ V/m – 55.4 dB
=46.8 dB μ V/m

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

=92.2 dB μ V/m – 55.4 dB
=36.8 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 (T_{eff}) is approximately $625\mu s$ 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 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.

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).

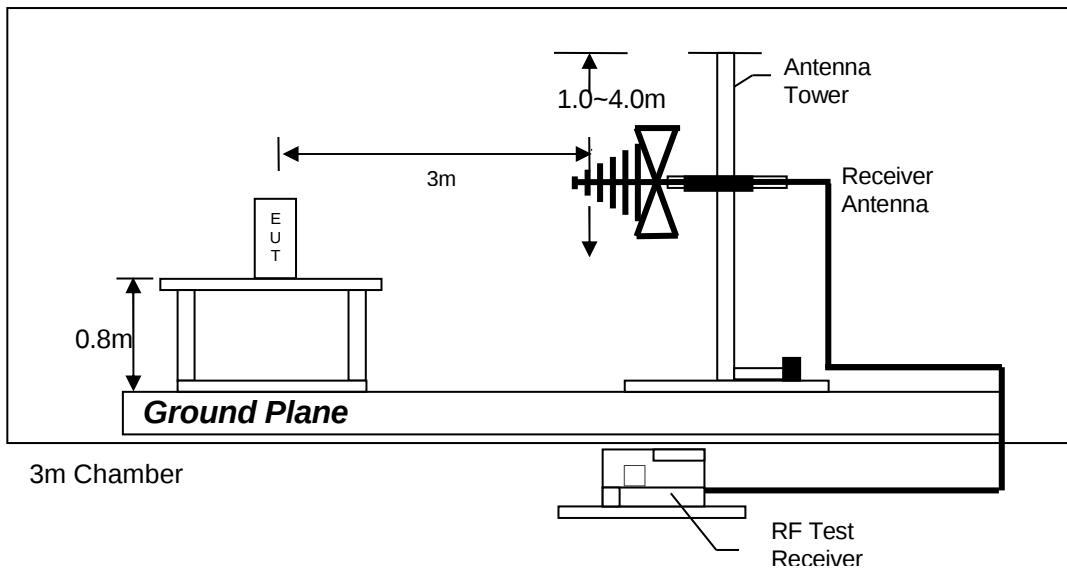
The IF bandwidth used for measurement of radiated signal strength was 100 kHz or greater when frequency is below 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application Note 150-2. A discussion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

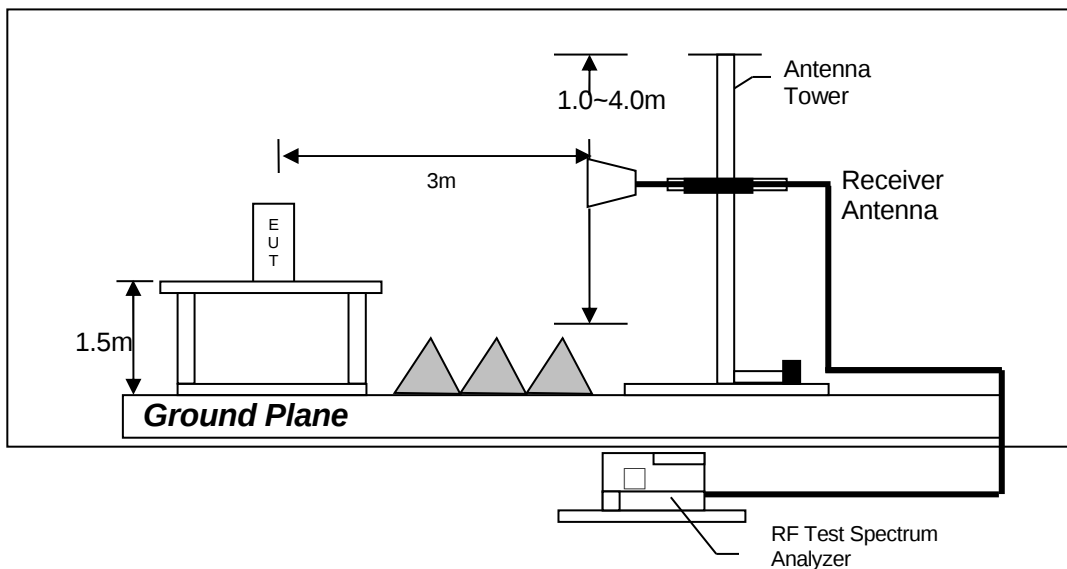
TEST REPORT

8.3.1 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

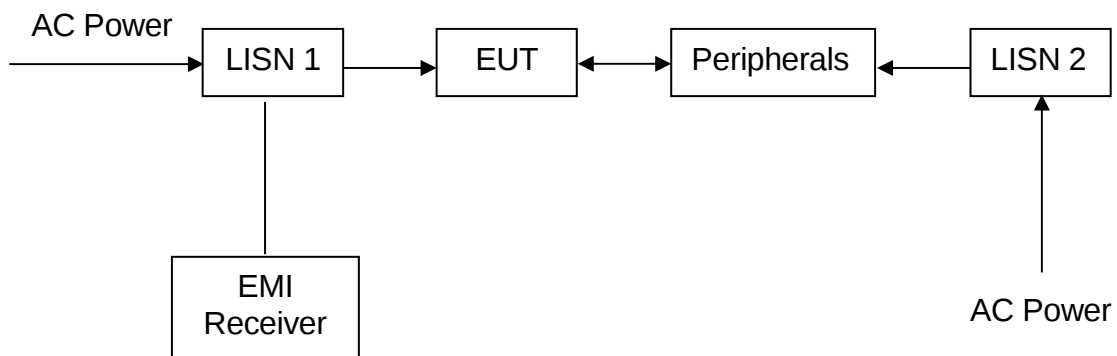
TEST REPORT

8.3.2 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.

8.3.3 Conducted Emission Test Setup



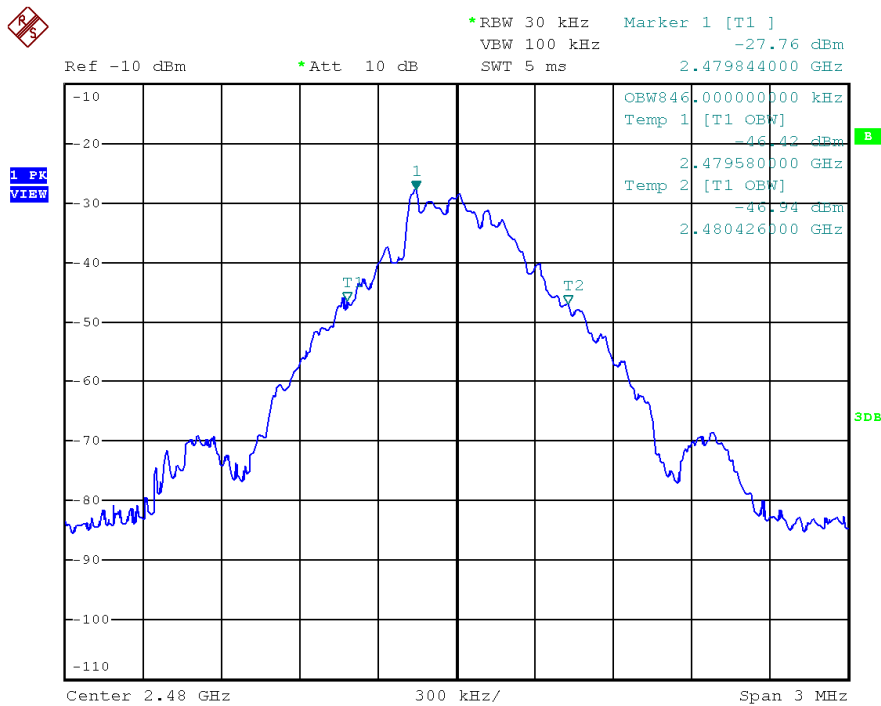
TEST REPORT

8.4 Occupied Bandwidth

Occupied Bandwidth Results: (Bluetooth 3.0)

Bluetooth (MHz)	Occupied Bandwidth (kHz)
Low Channel: 2402	846
Middle Channel: 2440	846
High Channel: 2480	846

The worst case is shown as below



TEST REPORT

Occupied Bandwidth Results: (Bluetooth 4.0 BLE)

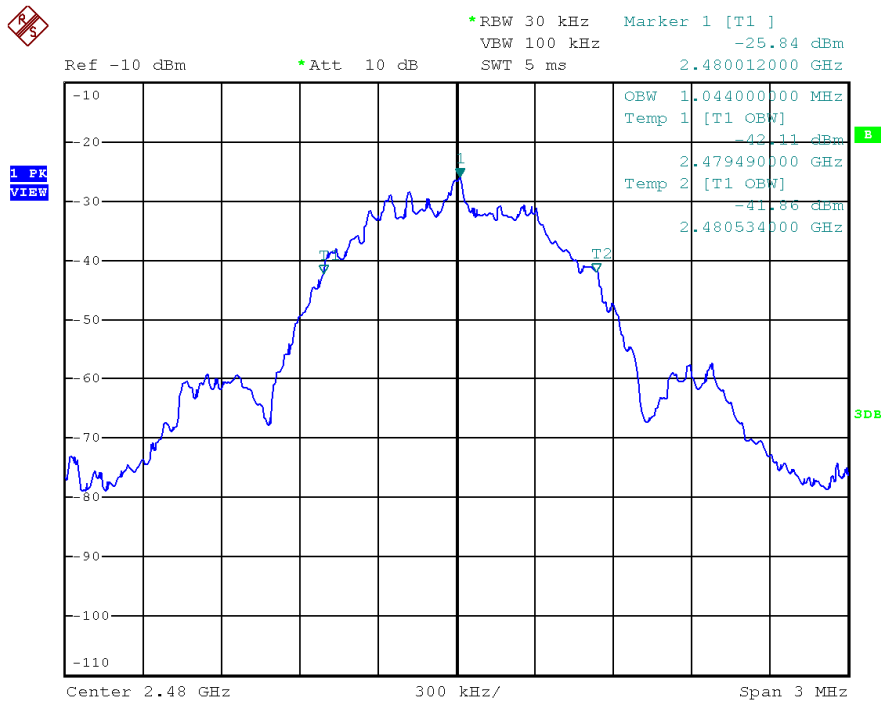
Bluetooth (MHz)	Occupied Bandwidth (kHz)
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Low Channel: 2402	1044
-------------------	------

Middle Channel: 2442	1044
----------------------	------

High Channel: 2480	1044
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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

Radiated Emissions Test

Equipment	EMI Test Receiver	Spectrum Analyzer	Biconical Antenna (20MHz to 200MHz)
Registration No.	EW-3481	EW-2466	EW-2512
Manufacturer	ROHDESCHWARZ	ROHDESCHWARZ	EMCO
Model No.	ESR7	FSP30	3104C
Calibration Date	December 21, 2021	November 18, 2019	June 03, 2020
Calibration Due Date	December 21, 2022	August 18, 2022	December 03, 2022

Equipment	Log Periodic Antenna	Double Ridged Guide Antenna	RF Cable 14m (1GHz to 26.5GHz)
Registration No.	EW-3243	EW-1133	EW-2781
Manufacturer	EMCO	EMCO	GREATBILLION
Model No.	3148B	3115	SMA m/SHF5MPU /SMA m ra14m,26G
Calibration Date	June 30, 2021	June 03, 2021	November 24, 2020
Calibration Due Date	December 30, 2022	November 26, 2022	November 24, 2022

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	N(m)-RG142-BNC(m) L=14M
Calibration Date	November 25, 2019	November 16, 2019	November 14, 2019
Calibration Due Date	June 25, 2022	September 16, 2022	August 14, 2022

Equipment	Pyramidal Horn Antenna	Active Loop H-field (9kHz to 30MHz)
Registration No.	EW-0905	EW-3302
Manufacturer	EMCO	EMCO
Model No.	3160-09	6502
Calibration Date	July 23, 2019	December 13, 2021
Calibration Due Date	June 23, 2022	June 13, 2023

TEST REPORT

Conducted Emissions Test

Equipment	RF Cable 240cm (RG142) (9kHz to 30MHz)	Artificial Mains Network	EMI Test Receiver
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	November 10, 2020	September 11, 2021	December 21, 2021
Calibration Due Date	August 10, 2022	September 11, 2022	December 21, 2022

Bandedge Measurement

Equipment	Spectrum Analyzer	5m RF Cable (40GHz)
Registration No.	EW-2466	EW-2701
Manufacturer	ROHDESCHWARZ	RADIALL
Model No.	FSP30	Sma m-m 5m 40G
Calibration Date	November 18, 2019	November 24, 2020
Calibration Due Date	August 18, 2022	November 24, 2022

TEST REPORT

Control Software for Radiated Emission

Software Information

Software Name	EMC32
Manufacturer	ROHDESCHWARZ
Software version	10.50.40 & 10.40.10

END OF TEST REPORT