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TEST REPORT

Report Number: 18051454HKG-002

Application for Original Grant of 47 CFR Part 15 Certification

Single New of RSS-247 Issue 2 Equipment

This report contains the data of Bluetooth 4.0 BLE portion only.

FCC ID: Q2O-PULSE2I
IC: 152B-PULSE2I

Prepared and Checked by:	**Approved by:**
Signed On File Wong Cheuk Ho, Herbert Lead Engineer	Digitally signed by Kenneth Wong Location: Intertek Testing Services Hong Kong Ltd. Wong Kwok Yeung, Kenneth Senior Lead Engineer Date: October 26, 2018

TEST REPORT

GENERAL INFORMATION

Applicant Name:	Lenbrook Industries Ltd.
Applicant Address:	633 Granite Court Pickering ON L1W 3K1 Canada
FCC Specification Standard:	FCC Part 15, October 1, 2017 Edition
FCC ID:	Q2O-PULSE2I
FCC Model(s):	PULSE 2i
IC Specification Standard:	RSS-247 Issue 2, February 2017 RSS-Gen Issue 5, April 2018
IC:	152B-PULSE2I
PMN:	Premium Wireless Steaming Speaker
HVIN:	PULSE 2i
Type of EUT:	Spread Spectrum Transmitter
Description of EUT:	Premium Wireless Steaming Speaker
Serial Number:	N/A
Sample Receipt Date:	June 06, 2018
Date of Test:	June 06, 2018 to October 26, 2018
Report Date:	October 26, 2018
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-247 Issue 2 Certification.

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1.0 TEST RESULTS SUMMARY & STATEMENT OF COMPLIANCE

1.1 Summary of Test Results

Test Items	FCC Part 15 Section	RSS-247/ RSS-Gen# Section	Results	Details See Section
Antenna Requirement	15.203	7.1.2#	Pass	2.1
Max. Conducted Output Power (Peak)	15.247(b)(3)&(4)	5.4(4)	Pass	4.1
Min. 6dB RF Bandwidth	15.247(a)(2)	5.2(1)	Pass	4.2
Max. Power Density (average)	15.247(e)	5.2(2)	Pass	4.3
Out of Band Antenna Conducted Emission	15.247(d)	5.5	Pass	4.4
Radiated Emission in Restricted Bands and Spurious Emissions	15.247(d), 15.209 & 15.109	5.5	Pass	4.6
AC Power Line Conducted Emission	15.207 & 15.107	7.2.4#	N/A	4.7

Note: 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.

1.2 Statement of Compliance

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

FCC Part 15, October 1, 2016 Edition
RSS-247 Issue 2, February 2017
RSS-Gen Issue 5, April 2018

TEST REPORT

2.0 GENERAL DESCRIPTION

2.1 Product Description

The Equipment-Under-Test (EUT) PULSE 2i is a Premium Wireless Steaming Speaker. The EUT contains both WLAN (WiFi) and Bluetooth modules. The Bluetooth module has Bluetooth 4.0 BLE and Bluetooth 3.0 features. The EUT can accept analog audio signal, digital audio signal and wireless audio signal via Bluetooth devices. An iOS/Android apps Bluesound installed in Smartphone can act as the remote control of the EUT. The EUT has internal power amplifiers and loudspeaker. It is powered by 100-240VAC.The EUT is powered by 100-240VAC.

For the WLAN (WiFi) module:

For 2.400-2.4835GHz:
The Equipment Under Test (EUT) operates at frequency range of 2412MHz to 2462MHz with 11 channels.
For 802.11b mode, it operates at frequency range of 2412.000MHz to 2462.000MHz with 11 channels. It transmits via Direct-sequence spread spectrum (DSSS) modulation. Maximum bit rate can be up to 11Mbps.
For 802.11g mode, it operates at frequency range of 2412.000MHz to 2462.000MHz with 11 channels. It transmits via Orthogonal Frequency Division Multiplexing (OFDM) modulation. Maximum bit rate can be up to 54Mbps.
For 802.11n (with 20MHz bandwidth) mode, it operates at frequency range of 2412.000MHz to 2462.000MHz with 11 channels. It transmits via Orthogonal Frequency Division Multiplexing (OFDM) modulation. Maximum bit rate can support up to 65Mbps.
For 802.11n (with 40MHz bandwidth) mode, it operates at frequency range of 2422.000MHz to 2452.000MHz with 7 channels. It transmits via Orthogonal Frequency Division Multiplexing (OFDM) modulation. Maximum bit rate can support up to 65Mbps.

For 5.15-5.25GHz:

The Equipment Under Test (EUT) operates at frequency range of 5180MHz to 5240MHz with 4 channels.
For 802.11a mode, it operates at frequency range of 5180.00MHz to 5250.000MHz with 4 channels. It transmits via Orthogonal Frequency Division Multiplexing (OFDM) modulation. Maximum bit rate can be up to 54Mbps.
For 802.11n (with 20MHz bandwidth) mode, it operates at frequency range of 5180.00MHz to 5250.000MHz with 4 channels. It transmits via Orthogonal Frequency Division Multiplexing (OFDM) modulation. Maximum bit rate can support up to 65.0Mbps.
For 802.11n (with 40MHz bandwidth) mode, it operates at frequency range of 5190.00MHz to 5230.000MHz with 2 channels. It transmits via Orthogonal Frequency Division Multiplexing (OFDM) modulation. Maximum bit rate can support up to 135.0Mbps.
For 802.11ac (with 20MHz bandwidth) mode, it operates at frequency range of 5180.00MHz to 5250.000MHz with 4 channels. It transmits via Orthogonal Frequency Division Multiplexing (OFDM) modulation. Maximum bit rate can support up to 86.7Mbps.
For 802.11ac (with 40MHz bandwidth) mode, it operates at frequency range of 5190.00MHz to 5230.000MHz with 2 channels. It transmits via Orthogonal Frequency Division Multiplexing (OFDM) modulation. Maximum bit rate can support up to 180Mbps.
For 802.11ac (with 80MHz bandwidth) mode, it operates at frequency 5210MHz. It transmits via Orthogonal Frequency Division Multiplexing (OFDM) modulation. Maximum bit rate can support up to 390Mbps.

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For 5.725-5.850GHz:

The Equipment Under Test (EUT) operates at frequency range of 5745MHz to 5825MHz with 5 channels.
For 802.11a mode, it operates at frequency range of 5745.00MHz to 5825.000MHz with 5 channels. It transmits via Orthogonal Frequency Division Multiplexing (OFDM) modulation. Maximum bit rate can be up to 54Mbps.
For 802.11n (with 20MHz bandwidth) mode, it operates at frequency range of 5745MHz to 5825MHz with 5 channels. It transmits via Orthogonal Frequency Division Multiplexing (OFDM) modulation. Maximum bit rate can support up to 216.6Mbps.
For 802.11n (with 40MHz bandwidth) mode, it operates at frequency range of 5755.00MHz to 5795.000MHz with 2 channels. It transmits via Orthogonal Frequency Division Multiplexing (OFDM) modulation. Maximum bit rate can support up to 450Mbps.
For 802.11ac (with 20MHz bandwidth) mode, it operates at frequency range of 5745MHz to 5825MHz with 5 channels. It transmits via Orthogonal Frequency Division Multiplexing (OFDM) modulation. Maximum bit rate can support up to 260Mbps.
For 802.11ac (with 40MHz bandwidth) mode, it operates at frequency range of 5755.00MHz to 5795.000MHz with 2 channels. It transmits via Orthogonal Frequency Division Multiplexing (OFDM) modulation. Maximum bit rate can support up to 600Mbps.
For 802.11ac (with 80MHz bandwidth) mode, it operates at frequency 5775MHz. It transmits via Orthogonal Frequency Division Multiplexing (OFDM) modulation. Maximum bit rate can support up to 1300Mbps.

For the Bluetooth module:
For Bluetooth 4.0 BLE mode, it occupies a frequency range from 2402MHz to 2480MHz (40 channels with channel spacing of 2MHz). It transmits via GFSK modulation.

For Bluetooth 3.0 mode, it occupies a frequency range from 2402MHz to 2480MHz (79 channels with channel spacing of 1MHz). It transmits via GFSK modulation.

The antenna(s) used in the EUT is internal, integral.

The circuit description is saved with filename: descri.pdf.

This report contains the data of Bluetooth 4.0 BLE portion only.

2.2 Test Methodology

Both AC power line-conducted and radiated emission measurements were performed according to the procedures in ANSI C63.10 (2013). Preliminary radiated scans and all radiated measurements were performed in radiated emission test sites. All Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application. Antenna port conducted measurements were performed according to ANSI C63.10 (2013) and KDB Publication No.558074 D01 v04 (05-April-2017) All other measurements were made in accordance with the procedures in 47 CFR Part 2 and RSS-Gen Issue 5 (2018).

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2.3 Test Facility

The radiated emission test site and antenna port conducted measurement facility used to collect the radiated data and conductive data are at Workshop No. 3, G/F., World-Wide Industrial Centre, 43-47 Shan Mei Street, Fo Tan, Sha Tin, N.T., Hong Kong. This test facility and site measurement data have been fully placed on file with the FCC and Industry Canada No.: 2042V-1.

2.4 Related Submittal(s) Grants

This is a single application for certification of a transceiver (Bluetooth portion)

TEST REPORT

3.0 SYSTEM TEST CONFIGURATION

3.1 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.

For the measurements, the EUT was attached to a plastic stand if necessary and placed on the wooden turntable. If the base unit attached to peripherals, they were connected and operational (as typical as possible).

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.

Emission that are directly caused by digital circuits in the transmit path and transmitter portion were measured, and the limit are according to FCC Part 15 Section 15.209 / RSS-247 2.5. Digital circuitries used to control additional functions other than the operation of the transmitter are subject to FCC Part 15 Section 15.109 / RSS-247 Section 5.5 Limits.

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3.1 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 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.

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

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

All data rates were tested under normal mode of Bluetooth 4.0 BLE. Only the worst-case data is shown in the report for GFSK.

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

3.2 EUT Exercising Software

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

TEST REPORT

3.3 Details of EUT and Description of Accessories

Details of EUT:

(1) The EUT is powered by 120VAC

Description of Accessories:

1. Earphone with cable of 1.2m meter long
2. 4GB USB flash drive
   (Provided by Intertek)
3. LAN cable of 1.5m long with termination
4. Power Cable of 2m long
5. Analog In coaxial cable of 1.5m long with termination
   (Provided by Applicant)

3.4 Measurement Uncertainty

When determining of the test conclusion, the Measurement Uncertainty of test at a level of confidence of 95% has been considered. The values of the Measurement uncertainty for radiated emission test and RF conducted measurement test are ± 5.3dB and ±0.99dB respectively. The value of the Measurement uncertainty for conducted emission test is ±4.2dB.

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.

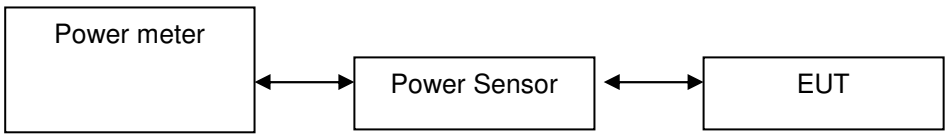
TEST REPORT

4.0 TEST RESULTS

4.1 Maximum Conducted (peak) Output Power at Antenna Terminals

RF Conduct Measurement Test Setup

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



The antenna port of the EUT was connected to the input of a spectrum analyzer.

☒ The antenna power of the EUT was connected to the input of a power meter. Power was read directly and cable loss correction was added to the reading to the obtain power at the EUT antenna terminals. The measurement procedure 9.1.2 was used.

☐ The EUT should be configured to transmit continuously (at a minimum duty cycle of 98%) at full power over the measurement duration. The measurement procedure AVG1 was used.

Antenna Gain = 2.0 dBi

Frequency (MHz)		Output in dBm	Output in mWatt
Low Channel:	2402	2.84	1.92
Middle Channel:	2440	5.19	3.30
High Channel:	2480	5.68	3.70

Cable loss : 0.5 dB External Attenuation : 0 dB

Cable loss, external attenuation: ☒ included in OFFSET function
☐ added to SA raw reading

Max. conducted (peak) output level = 5.68 dBm

Limits:
☒ 1W (30dBm) for antennas with gains of 6dBi or less

☐ ___W (___dBm) for antennas with gains more than 6dBi

TEST REPORT

4.2 Minimum 6dB RF Bandwidth

The antenna port of the EUT was connected to the input of a spectrum analyzer. The EBW measurement procedure was used. A PEAK output reading was taken, a DISPLAY line was drawn 6dB lower than PEAK level. The 6dB bandwidth was determined from where the channel output spectrum intersected the display line.

Frequency (MHz)		6dB Bandwidth (MHz)
Low Channel:	2402	0.708
Middle Channel:	2440	0.720
High Channel:	2480	0.720

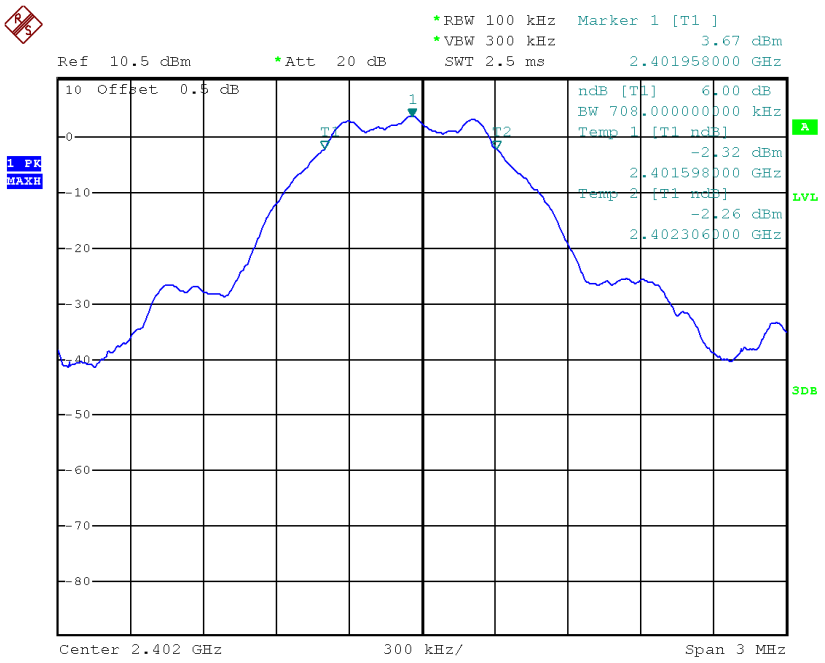
Limits
6 dB bandwidth shall be at least 500kHz

The plots of 6dB RF bandwidth are saved as below.

TEST REPORT

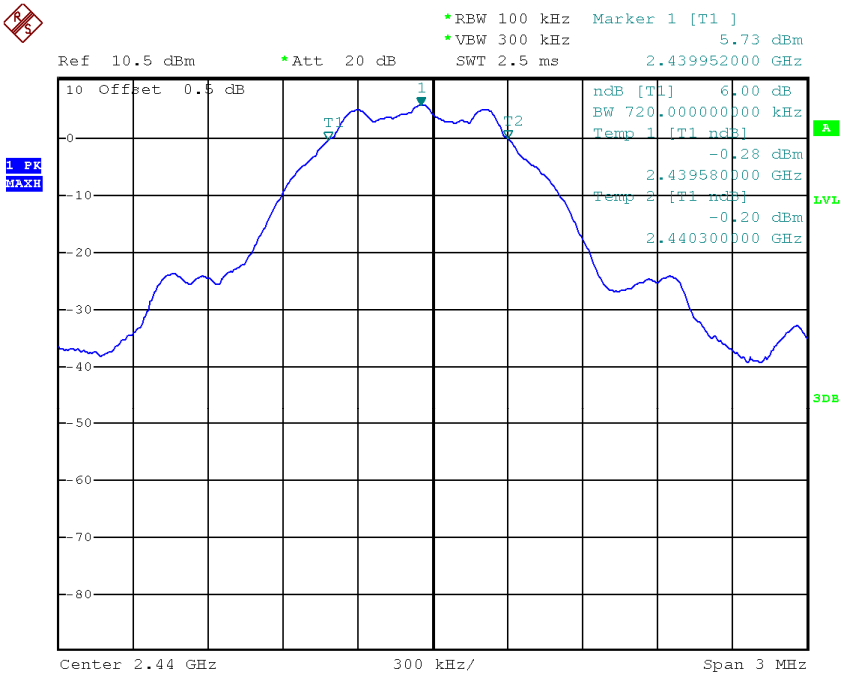
PLOTS OF 6dB RF BANDWIDTH

Lowest Channel



Date: 29.AUG.2018 09:39:03

Middle Channel

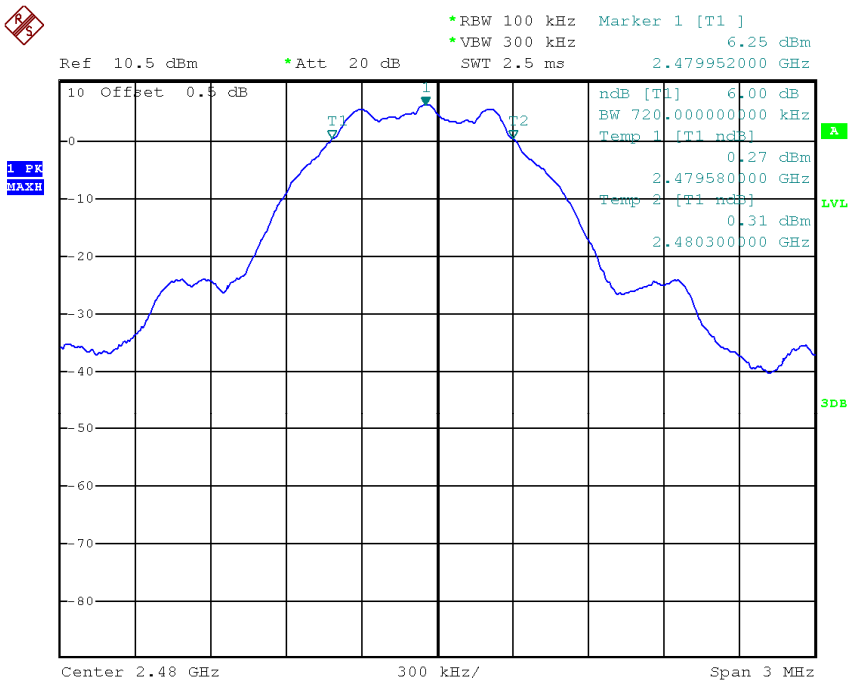


Date: 29.AUG.2018 09:52:44

TEST REPORT

PLOTS OF 6dB RF BANDWIDTH

Highest Channel



Date: 29.AUG.2018 09:58:53

TEST REPORT

4.3 Maximum Power Spectral Density

Antenna output of the EUT was coupled directly to spectrum analyzer. The measurement procedure 10.2 PKPSD was used. If an external attenuator and/or cable was used, these losses are compensated for using the OFFSET function of the analyser.

Frequency (MHz)		PSD in 100kHz (dBm)
Low Channel:	2402	3.62
Middle Channel:	2440	5.72
High Channel:	2480	6.22

Cable Loss: 0.5 dB

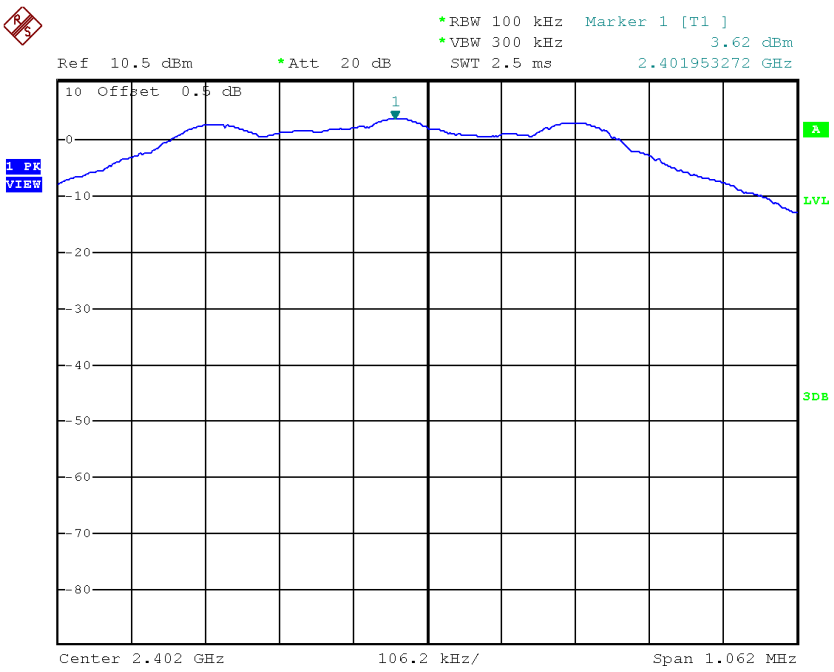
Limit:
8dBm

The plots of power spectral density are as below.

TEST REPORT

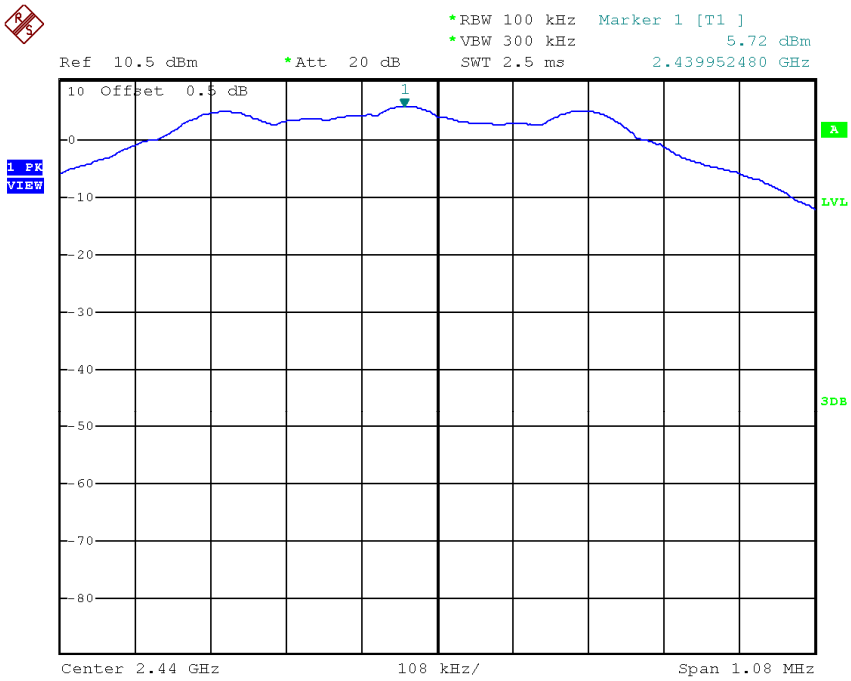
PLOTS OF POWER SPECTRAL DENSITY

Lowest channel



Date: 29.AUG.2018 09:41:55

Middle channel

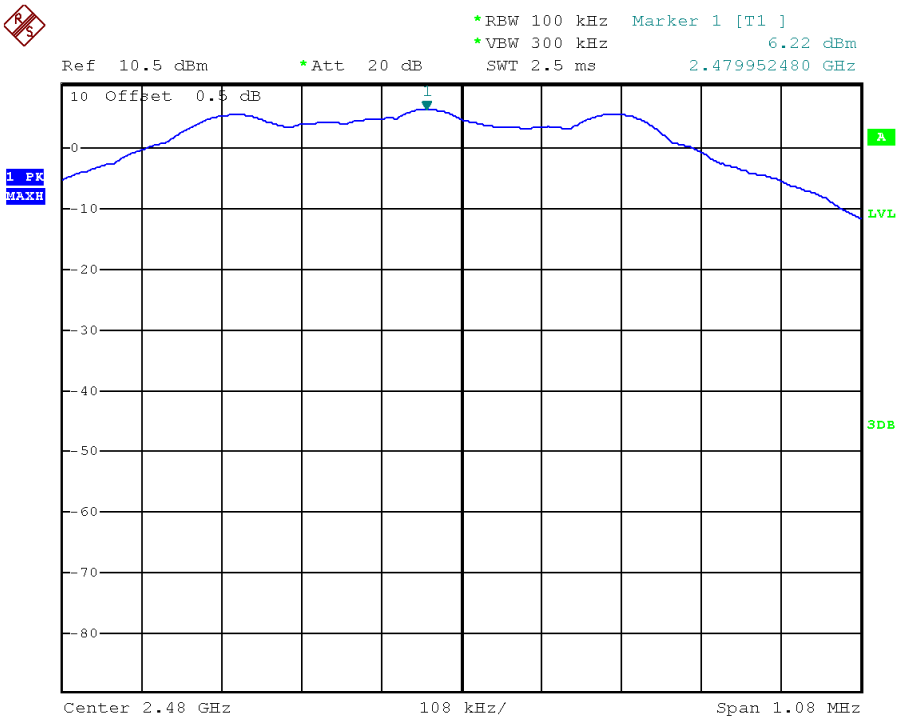


Date: 29.AUG.2018 09:54:07

TEST REPORT

PLOTS OF POWER SPECTRAL DENSITY

Highest channel



Date: 29.AUG.2018 10:04:32

TEST REPORT

4.4 Out of Band Conducted Emissions

For Bluetooth 4.0 BLE, the maximum conducted (peak) output power was used to demonstrate compliance as described in 9.1. Then the display line (in red) shown in the following plots denotes the limit at 20dB below maximum measured in-band peak PSD level in 100 KHz bandwidth for Bluetooth 4.0 BLE.

The measurement procedures under sections 11 of KDB558074 D01 v04 (05-April-2017) were used.

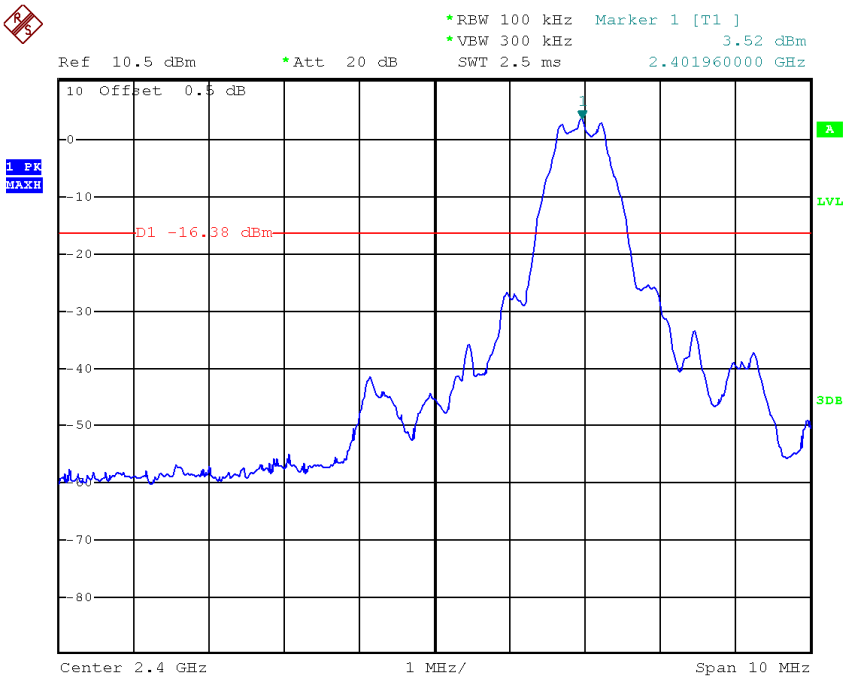
Furthermore, delta measurement technique for measuring bandedge emissions was incorporated in the test of the edge at 2483.5MHz.

Limits:
All spurious emission and up to the tenth harmonic was measured and they were found to be at least for Bluetooth 4.0 BLE below the maximum measured in-band peak PSD level.

TEST REPORT

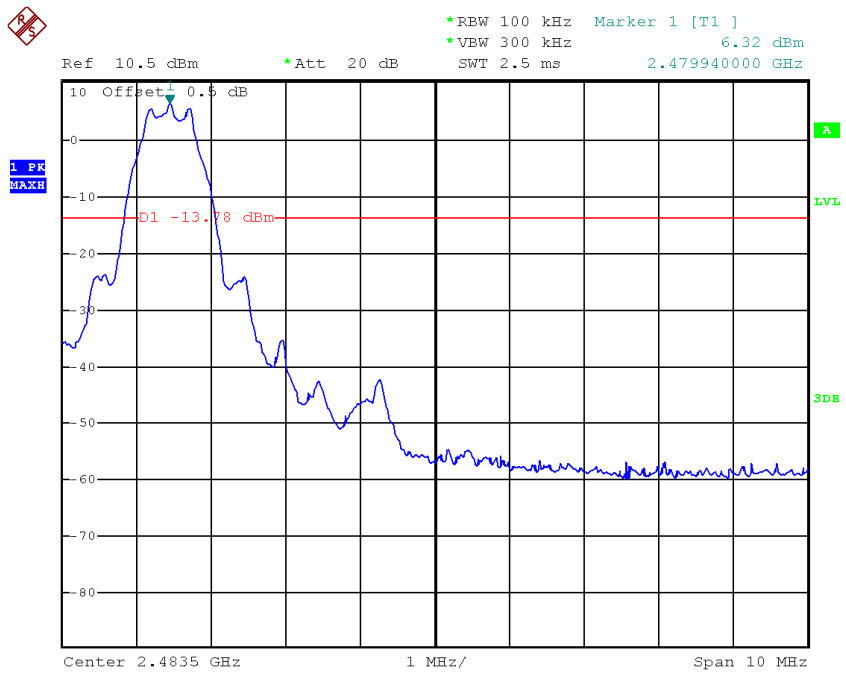
PLOTS OF OUT OF BAND CONDUCTED EMISSIONS

Lowest Channel, Bandedge



Date: 29.AUG.2018 12:07:35

Highest Channel, Bandedge

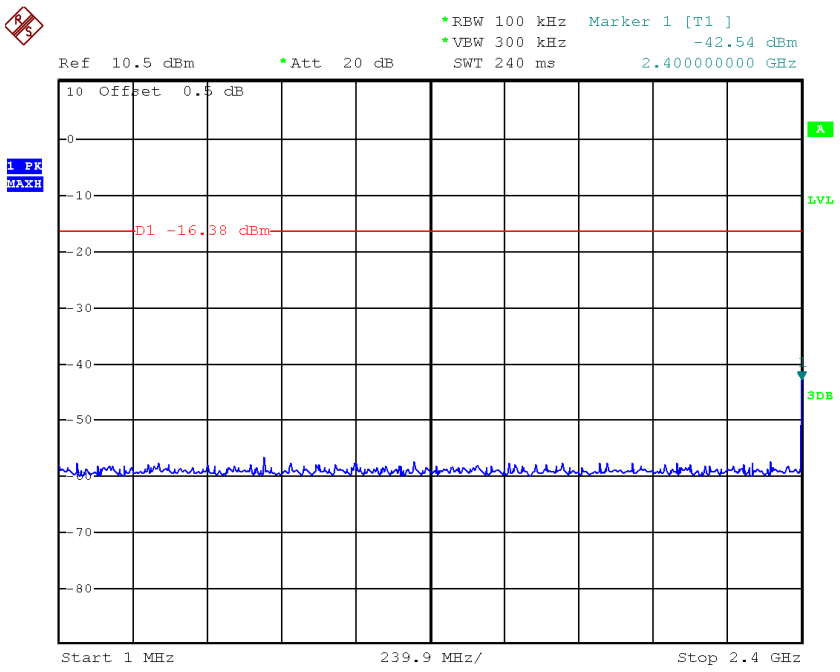


Date: 29.AUG.2018 15:05:59

TEST REPORT

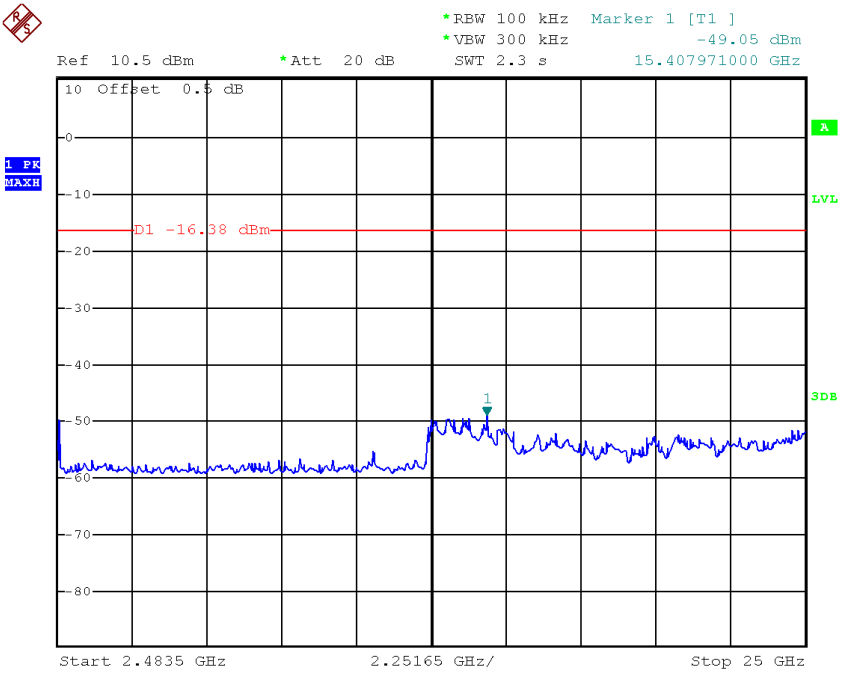
PLOTS OF OUT OF BAND CONDUCTED EMISSIONS

Lowest Channel, Plot A



Date: 29.AUG.2018 12:16:50

Lowest Channel, Plot B

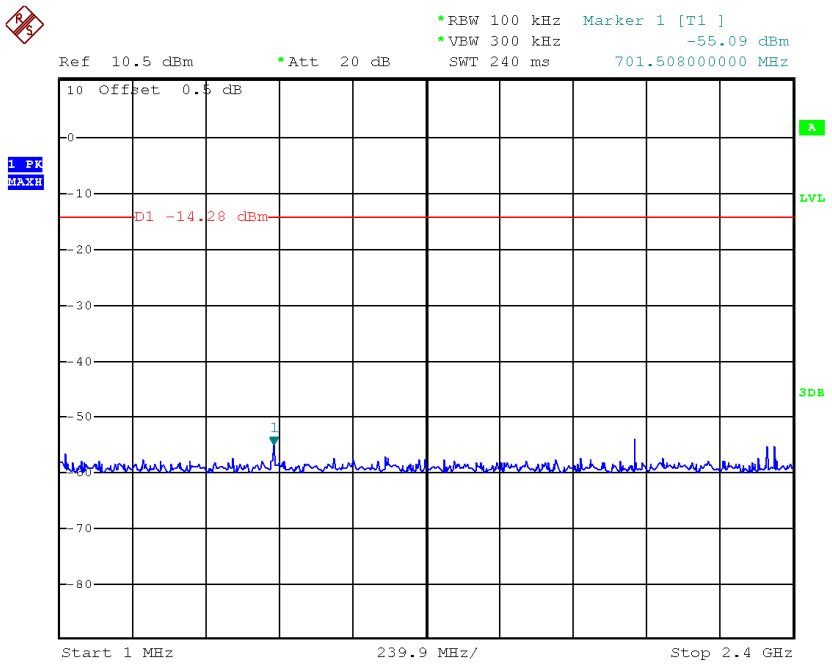


Date: 29.AUG.2018 12:18:08

TEST REPORT

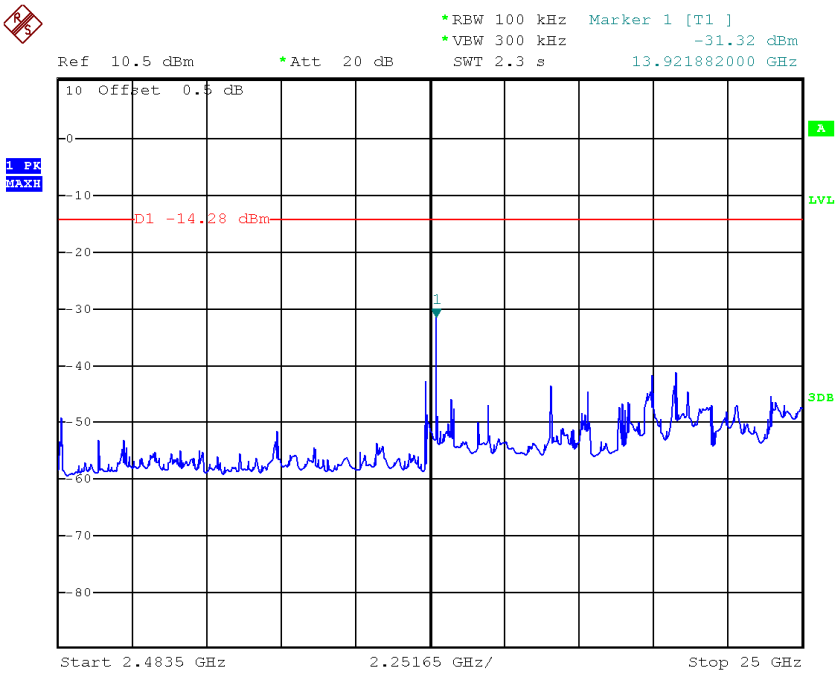
PLOTS OF OUT OF BAND CONDUCTED EMISSIONS

Middle Channel, Plot A



Date: 29.AUG.2018 09:55:39

Middle Channel, Plot B

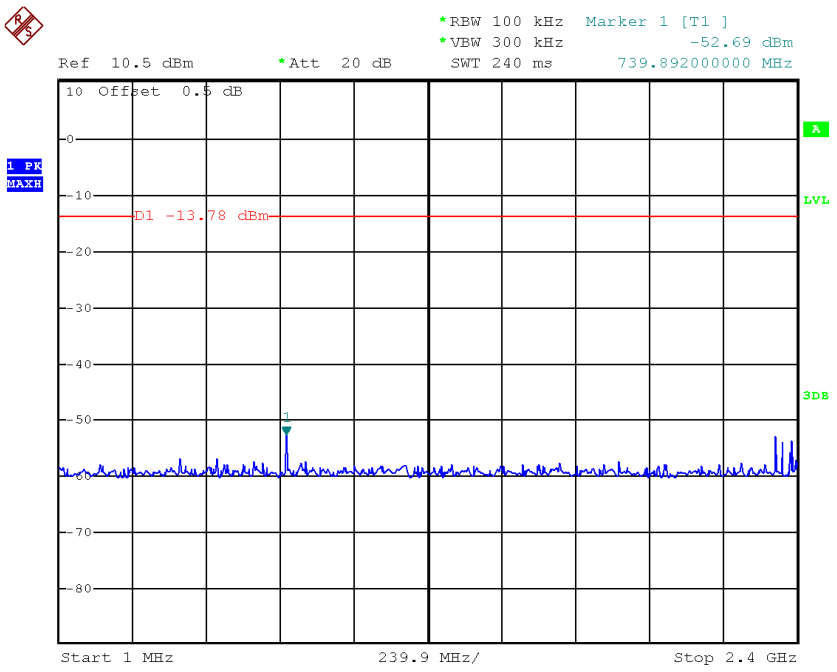


Date: 29.AUG.2018 09:56:48

TEST REPORT

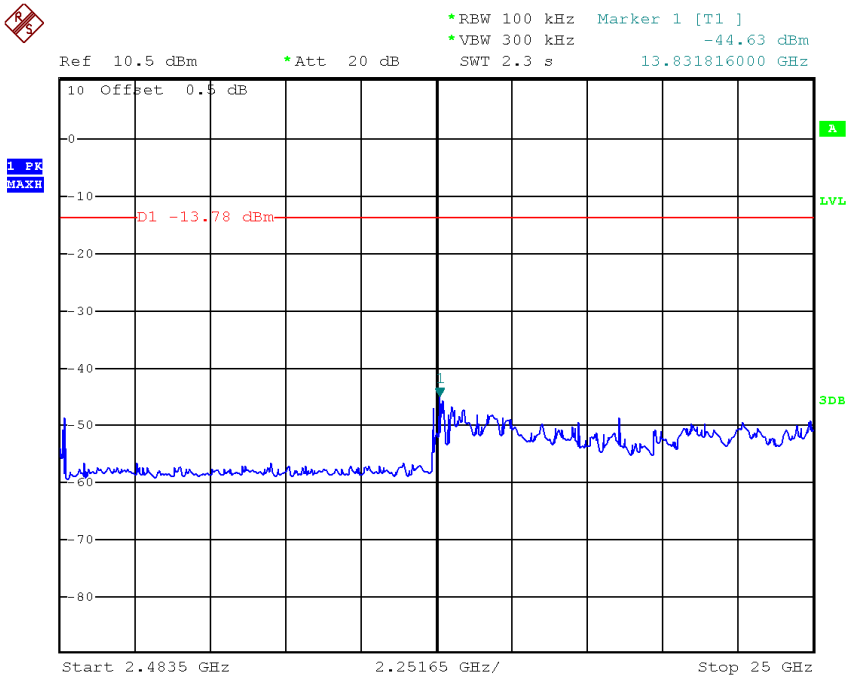
PLOTS OF OUT OF BAND CONDUCTED EMISSIONS

Highest Channel, Plot A



Date: 29.AUG.2018 10:05:42

Highest Channel, Plot B



Date: 29.AUG.2018 10:07:01

TEST REPORT

4.5 Field Strength Calculation

The field strength is calculated by adding the reading on the Spectrum Analyzer to the factors associated with preamplifiers (if any), antennas, cables, pulse desensitization and average factors (when specified limit is in average and measurements are made with peak detectors). A sample calculation is included below.

FS = RA + AF + CF - AG + PD + AV

Where FS = Field Strength in dBµV/m
RA = Receiver Amplitude (including preamplifier) in dBµV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB
PD = Pulse Desensitization in dB
AV = Average Factor in -dB

In the radiated emission table which follows, the reading shown on the data table may reflect the preamplifier gain. An example of the calculations, where the reading does not reflect the preamplifier gain, follows:

FS = RA + AF + CF - AG + PD + AV

Example
Assume a receiver reading of 62.0 dBµV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29.0 dB is subtracted. The pulse desensitization factor of the spectrum analyzer is 0.0 dB, and the resultant average factor is -10.0 dB. The net field strength for comparison to the appropriate emission limit is 32.0 dBµV/m. This value in dBµV/m is converted to its corresponding level in µV/m.

RA = 62.0 dBµV
AF = 7.4 dB
CF = 1.6 dB
AG = 29.0 dB
PD = 0.0 dB
AV = -10 dB

FS = 62.0 + 7.4 + 1.6 – 29.0 + 0.0 + (-10.0) = 32.0 dBµV/m

Level in µV/m = Common Antilogarithm [(32.0 dBµV/m)/20] = 39.8 µV/m

TEST REPORT

4.6 Transmitter Radiated Emissions in Restricted Bands and Spurious Emissions

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.

The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

4.6.1 Radiated Emission Configuration Photograph

Worst Case Restricted Band Radiated Emission
at

374.986 MHz

The worst case radiated emission configuration photographs are saved with filename: config photos.pdf

4.6.2 Radiated Emission Data

The data in tables 1-4 list the significant emission frequencies, the limit and the margin of compliance.

Judgement -

Passed by 0.2 dB margin

TEST REPORT

RADIATED EMISSION DATA

Mode: TX-Channel 00

Table 1

Polari-zation	Frequency (MHz)	Reading	Correction Factor	Net at 3m - Peak (dBµV/m)	Average Factor (dB)	Calculated at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
H	***2390.000***	***56.3***	***-3.5***	***52.8***	***0***	***52.8***	***54.0***	***-1.2***
H	***4804.000***	***44.3***	***6.5***	***50.8***	***0***	***50.8***	***54.0***	***-3.2***
H	***12010.000***	***32.5***	***20.1***	***52.6***	***0***	***52.6***	***54.0***	***-1.4***

Polari-zation	Frequency (MHz)	Reading	Correction Factor	Net at 3m - Peak (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
H	***2390.000***	***56.3***	***-3.5***	***52.8***	***74.0***	***-21.2***
H	***4804.000***	***44.3***	***6.5***	***50.8***	***74.0***	***-23.2***
H	***12010.000***	***32.5***	***20.1***	***52.6***	***74.0***	***-21.4***

NOTES:

1. Peak detector is used for the emission measurement.

2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.

3. Negative value in the margin column shows emission below limit.

4. Horn antenna is used for the emission over 1000MHz.

5. Emission (the row indicated by ***bold italic***) within the restricted band meets the requirement of FCC Part 15 Section 15.205 / RSS-Gen Section 8.10.

TEST REPORT

Mode: TX-Channel 19

Table 2

Polari-zation	Frequency (MHz)	Reading	Correction Factor	Net at 3m - Peak (dBµV/m)	Average Factor (dB)	Calculated at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
H	***4880.000***	***43.9***	***6.7***	***50.6***	***0***	***50.6***	***54.0***	***-3.4***
H	***7320.000***	***36.5***	***13.7***	***50.2***	***0***	***50.2***	***54.0***	***-3.8***
H	***12200.000***	***32.1***	***20.5***	***52.6***	***0***	***52.6***	***54.0***	***-1.4***

Polari-zation	Frequency (MHz)	Reading	Correction Factor	Net at 3m - Peak (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
H	***4880.000***	***43.9***	***6.7***	***50.6***	***74.0***	***-23.4***
H	***7320.000***	***36.5***	***13.7***	***50.2***	***74.0***	***-23.8***
H	***12200.000***	***32.1***	***20.5***	***52.6***	***74.0***	***-21.4***

NOTES:

1. Peak detector is used for the emission measurement.

2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.

3. Negative value in the margin column shows emission below limit.

4. Horn antenna is used for the emission over 1000MHz.

5. Emission (the row indicated by ***bold italic***) within the restricted band meets the requirement of FCC Part 15 Section 15.205 / RSS-Gen Section 8.10.

TEST REPORT

Mode: TX-Channel 39

Table 3

Polari-zation	Frequency (MHz)	Reading	Correction Factor	Net at 3m - Peak (dBµV/m)	Average Factor (dB)	Calculated at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
H	***2483.500***	***56.1***	***-3.5***	***52.6***	***0***	***52.6***	***54.0***	***-1.4***
H	***4960.000***	***44.0***	***6.8***	***50.8***	***0***	***50.8***	***54.0***	***-3.2***
H	***7440.000***	***36.7***	***13.8***	***50.5***	***0***	***50.5***	***54.0***	***-3.5***
H	***12400.000***	***31.6***	***20.8***	***52.4***	***0***	***52.4***	***54.0***	***-1.6***

Polari-zation	Frequency (MHz)	Reading	Correction Factor	Net at 3m - Peak (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
H	***2483.500***	***56.1***	***-3.5***	***52.6***	***74.0***	***-21.4***
H	***4960.000***	***44.0***	***6.8***	***50.8***	***74.0***	***-23.2***
H	***7440.000***	***36.7***	***13.8***	***50.5***	***74.0***	***-23.5***
H	***12400.000***	***31.6***	***20.8***	***52.4***	***74.0***	***-21.6***

NOTES:

1. Peak detector is used for the emission measurement.
2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
3. Negative value in the margin column shows emission below limit.
4. Horn antenna is used for the emission over 1000MHz.
5. Emission (the row indicated by ***bold italic***) within the restricted band meets the requirement of FCC Part 15 Section 15.205 / RSS-Gen Section 8.10.

TEST REPORT

Mode: WiFi + Bluetooth Audio Playing

Table 4

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-amp (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Limit at 3m (dBµV/m)	Margin (dB)
V	30.606	45.4	16	10.0	39.4	40.0	-0.6
V	31.394	44.4	16	10.0	38.4	40.0	-1.6
V	32.576	44.2	16	10.0	38.2	40.0	-1.8
V	43.822	44.8	16	10.0	38.8	40.0	-1.2
V	62.222	42.4	16	10.0	36.4	40.0	-3.6
V	77.196	45.5	16	6.0	35.5	40.0	-4.5
V	98.476	44.5	16	12.0	40.5	43.5	-3.0
V	101.872	41.2	16	13.0	38.2	43.5	-5.3
V	141.216	36.5	16	14.0	34.5	43.5	-9.0
V	203.175	33.6	16	16.0	33.6	43.5	-9.9
V	***225.758***	***36.2***	***16***	***18.0***	***38.2***	***46.0***	***-7.8***
V	***249.978***	***33.4***	***16***	***20.0***	***37.4***	***46.0***	***-8.6***
H	282.200	34.4	16	22.0	40.4	46.0	-5.6
H	304.784	33.4	16	22.0	39.4	46.0	-6.6
H	***324.972***	***32.4***	***16***	***24.0***	***40.4***	***46.0***	***-5.6***
H	***374.986***	***37.8***	***16***	***24.0***	***45.8***	***46.0***	***-0.2***
H	399.994	33.6	16	25.0	42.6	46.0	-3.4
H	499.995	32.2	16	26.0	42.2	46.0	-3.8
V	624.974	32.2	16	29.0	45.2	46.0	-0.8
V	750.044	27.2	16	30.0	41.2	46.0	-4.8
H	874.962	26.8	16	32.0	42.8	46.0	-3.2
H	999.970	27.0	16	33.0	44.0	54.0	-10.0

NOTES:
1. Quasi-Peak detector is used for the emission measurement.

2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.

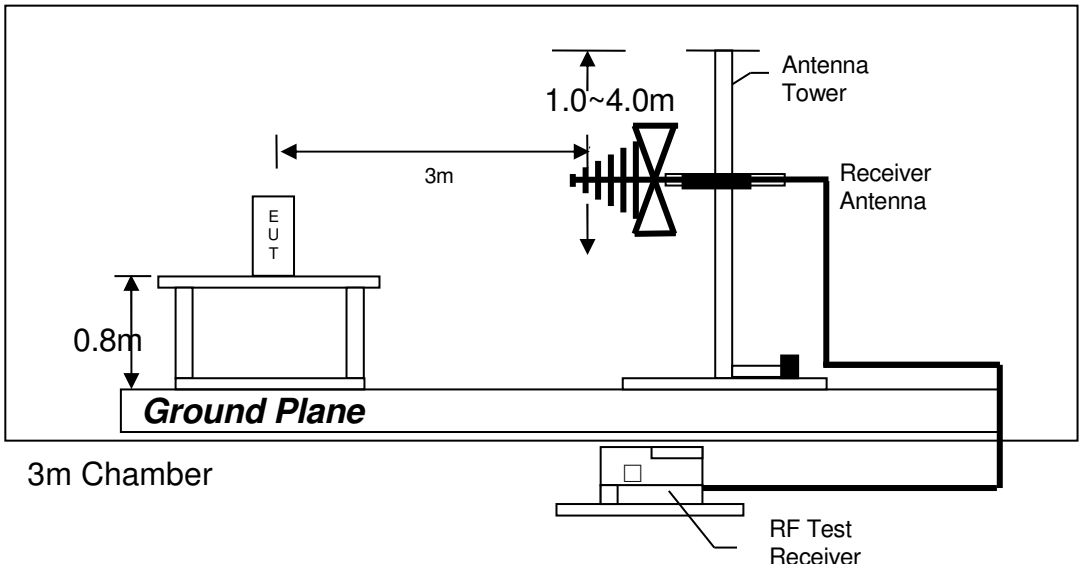
3. Negative value in the margin column shows emission below limit.

4. Emission (the row indicated by ***bold italic***) within the restricted band meets the requirement of FCC Part 15 Section 15.205 / RSS-Gen Section 8.10.

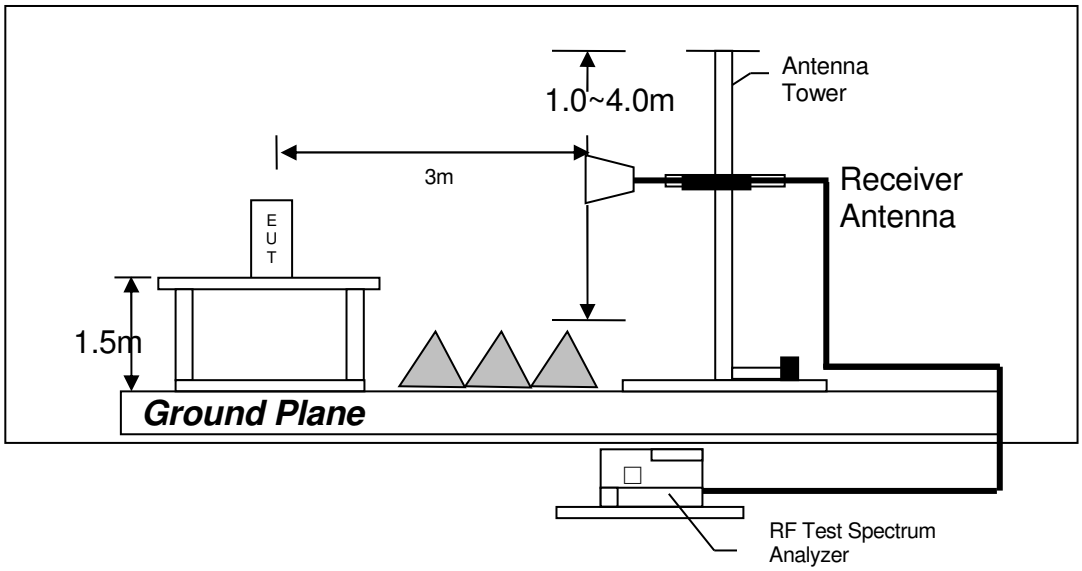
TEST REPORT

4.6.3 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

4.6.4 Transmitter Duty Cycle Calculation

Not applicable – No average factor is required.

TEST REPORT

4.7 AC Power Line Conducted Emission

☐ Not applicable – EUT is only powered by battery for operation.

☒ EUT connects to AC power line. Emission Data is listed in following pages.

☐ Base Unit connects to AC power line and has transmission. Handset connects to AC power line but has no transmission. Emission Data of Base Unit is listed in following pages.

4.7.1 AC Power Line Conducted Emission Configuration Photograph

Worst Case Line-Conducted Configuration
at

0.578 MHz

The worst case line conducted configuration photographs are attached in the Appendix and saved with filename: config photos.pdf

4.7.2 AC Power Line Conducted Emission Data

The plot(s) and data in the following pages list the significant emission frequencies, the limit and the margin of compliance.

Passed by 4.1 dB margin

TEST REPORT

AC POWER LINE CONDUCTED EMISSION

Worst Case: WiFi + Bluetooth Audio Playing

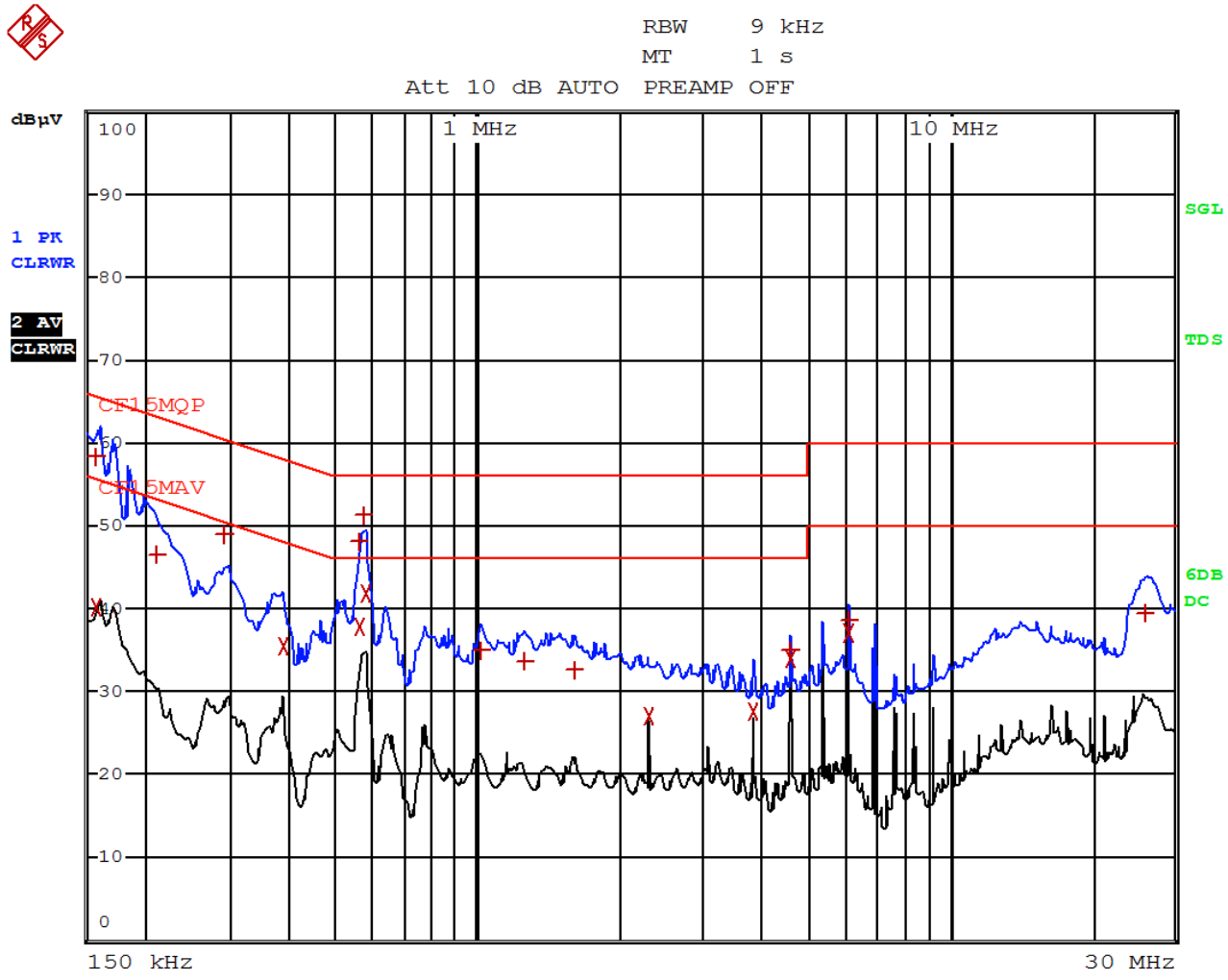
EDIT PEAK LIST (Final Measurement Results)

Trace1:	CF15MQP
Trace2:	CF15MAV
Trace3:	---

	TRACE	FREQUENCY	LEVEL dBµV		DELTA LIMIT dB
1	Quasi Peak	159 kHz	58.41	N	-7.10
2	CISPR Average	159 kHz	40.30	L1	-15.21
1	Quasi Peak	213 kHz	46.50	N	-16.58
1	Quasi Peak	294 kHz	48.99	N	-11.41
2	CISPR Average	384 kHz	35.67	N	-12.51
1	Quasi Peak	564 kHz	48.21	N	-7.78
2	CISPR Average	564 kHz	38.04	N	-7.95
1	Quasi Peak	573 kHz	51.40	N	-4.59
2	CISPR Average	577.5 kHz	41.86	N	-4.13
1	Quasi Peak	1.0185 MHz	35.13	N	-20.86
1	Quasi Peak	1.2525 MHz	33.62	N	-22.37
1	Quasi Peak	1.599 MHz	32.64	N	-23.35
2	CISPR Average	2.3055 MHz	27.07	L1	-18.93
2	CISPR Average	3.84 MHz	27.60	L1	-18.39
1	Quasi Peak	4.6095 MHz	35.04	L1	-20.95
2	CISPR Average	4.6095 MHz	33.96	L1	-12.03
1	Quasi Peak	6.144 MHz	38.60	L1	-21.40
2	CISPR Average	6.144 MHz	37.19	L1	-12.80
1	Quasi Peak	25.917 MHz	39.49	L1	-20.50

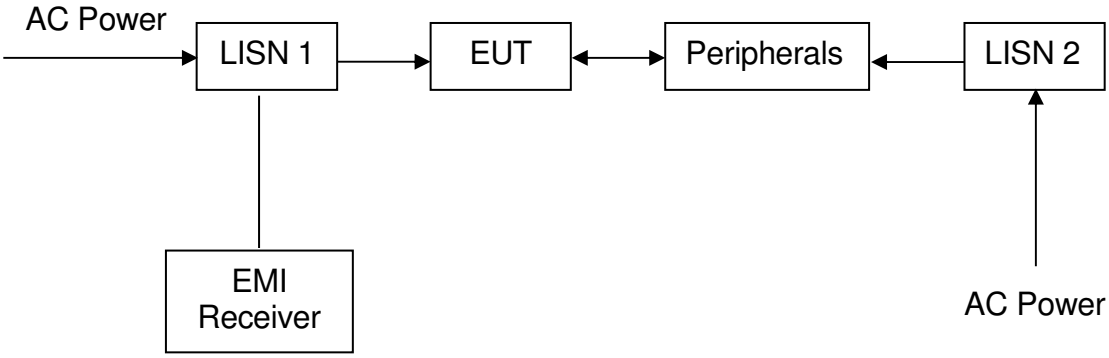
TEST REPORT

Worst Case: WiFi + Bluetooth Audio Playing



TEST REPORT

4.7.3 Conducted Emission Test Setup



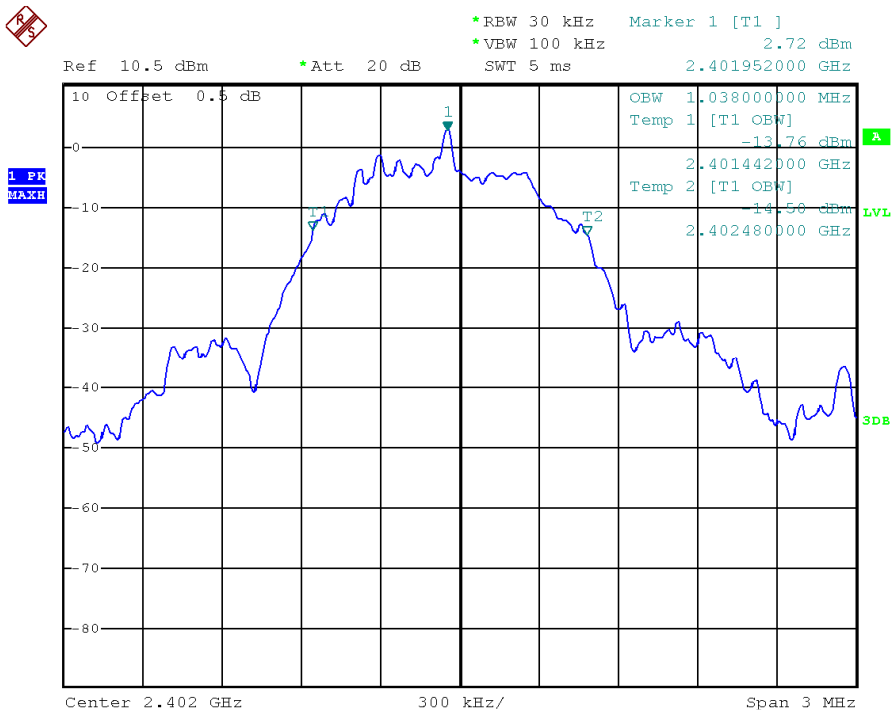
TEST REPORT

4.8 Occupied Bandwidth

Occupied Bandwidth Results:

Bluetooth (MHz)		Occupied Bandwidth (MHz)
Low Channel:	2402	1.038
Middle Channel:	2440	1.038
High Channel:	2480	1.032

The worst case is shown as below



TEST REPORT

5.0 EQUIPMENT LIST

1) Radiated Emissions Test

Equipment	EMI Test Receiver	Biconical Antenna	Log Periodic Antenna
Registration No.	EW-3156	EW-0954	EW-0447
Manufacturer	ROHDESCHWARZ	EMCO	EMCO
Model No.	ESR26	3104C	3146
Calibration Date	November 10, 2017	February 27, 2018	January 17, 2018
Calibration Due Date	November 10, 2018	August 27, 2019	July 17, 2019

Equipment	Active Loop H-field (9kHz to 30MHz)	12m Double Shield RF Cable (20MHz to 6GHz)	RF Cable (up to 40GHz)
Registration No.	EW-2313	EW-1852	EW-3155
Manufacturer	ELECTROMETRI	RADIALL	N/A
Model No.	EM-6876	N(m)-RG142 - N(m)	1-40 GHz
Calibration Date	March 08, 2018	January 19, 2018	January 29, 2018
Calibration Due Date	September 08, 2019	January 19, 2019	January 29, 2019

Equipment	Double Ridged Guide Antenna	Pyramidal Horn Antenna	Spectrum Analyzer
Registration No.	EW-1015	EW-0905	EW-3110
Manufacturer	EMCO	EMCO	R&S
Model No.	3115	3160-09	FSP30
Calibration Date	November 17, 2017	August 18, 2017	March 05, 2018
Calibration Due Date	May 17, 2019	February 18, 2019	March 05, 2019

Equipment	Notch Filter (cutoff frequency 2.4GHz to 2.5GHz)	Solid State Low Noise Preamplifier Assembly (1 - 18)GHz	RF Pre-amplifier (9kHz to 40GHz)
Registration No.	EW-2213	EW-3229	EW-3006
Manufacturer	MICROTRONICS	BONN ELEKTRO	SCHWARZBECK
Model No.	BRM50701-02	BLMA 0118-5G	BBV 9744
Calibration Date	May 24, 2018	January 30, 2018	April 26, 2018
Calibration Due Date	May 24, 2019	January 30, 2019	April 26, 2019

2) Conductive Measurement Test

Equipment	Spectrum Analyzer	RF Cable (up to 40GHz) 1.5m length	RF Power Meter with Power Sensor (N1921A)
Registration No.	EW-3110	EW-3104	EW-2270
Manufacturer	R&S	N/A	N/A
Model No.	FSP30	SMA-M to SMA-M	AGILENTTECH
Calibration Date	March 05, 2018	July 03, 2018	January 15, 2018
Calibration Due Date	March 05, 2019	July 03, 2019	January 15, 2019

TEST REPORT

3) Bandedge/Bandwidth Measurement

Equipment	RF Cable (up to 40GHz) 1.5m length	Spectrum Analyzer
Registration No.	EW-3104	EW-3110
Manufacturer	N/A	R&S
Model No.	SMA-M to SMA-M	FSP30
Calibration Date	July 03, 2018	March 05, 2018
Calibration Due Date	July 03, 2019	March 05, 2019

4) Conducted Emissions Test

Equipment	Artificial Mains Network	RF Cable 240cm (RG142)	EMI Test Receiver
Registration No.	EW-2501	EW-2454	EW-3156
Manufacturer	ROHDESCHWARZ	RADIALL	ROHDESCHWARZ
Model No.	ENV-216	bnc m st / 142 /bnc m ra 240cm	ESR26
Calibration Date	February 14, 2018	March 27, 2018	November 10, 2017
Calibration Due Date	February 14, 2019	March 27, 2019	November 10, 2018

END OF TEST REPORT