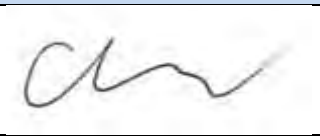
# RF TEST REPORT

SIEMIC
A Bureau Veritas Group Company

Report No.: FCC IC_SL17060501-ZBR-021_DSS_Rev2.0
Supersede Report No.:

| | | |
|---|---|---|
| Applicant | : | Zebra Technologies Corporation |
| Host Product Name | : | Mobile Thermal Printer |
| Host Model No. | : | ZQ310 and ZQ320 |
| Module Model No. | : | ZQ3BT |
| Test Standard | : | 47 CFR 15.247<br>RSS-247 Issue 1.0, May 2015 |
| Test Method | : | ANSI C63.10: 2013<br>RSS-Gen Issue 4, Nov 2014<br>FCC Public Notice DA 00-705 |
| FCC ID | : | I28-ZBRZQ3BT |
| IC ID | : | 3798B- ZBRZQ3BT |
| Dates of test | : | 07/22/2017 – 08/16/2017 |
| Issue Date | : | 08/18/2017 |
| Test Result | : | ☒ Pass ☐ Fail |
| Equipment complied with the specification [X]<br>Equipment did not comply with the specification [ ] | | |

| This Test Report is Issued Under the Authority of: | |
|---|---|
|  |  |
| Rachana Khanduri | Chen Ge |
| Test Engineer | Engineer Reviewer |

Issued By:
SIEMIC Laboratories
775 Montague Expressway, Milpitas, 95035 CA

ilac-MRA
ACCREDITED
TESTING CERT # 2742-01

# Laboratory Introduction

SIEMIC, headquartered in the heart of Silicon Valley, with superior facilities in US and Asia, is one of the leading independent testing and certification facilities providing customers with one-stop shop services for Compliance Testing and Global Certifications.


In addition to testing and certification, SIEMIC provides initial design reviews and compliance management throughout a project. Our extensive experience with China, Asia Pacific, North America, European, and International compliance requirements, assures the fastest, most cost effective way to attain regulatory compliance for the global markets.

## Accreditations for Conformity Assessment

| Country/Region | Accreditation Body | Scope |
| --- | --- | --- |
| USA | FCC, A2LA | EMC, RF/Wireless, Telecom |
| Canada | IC, A2LA, NIST | EMC, RF/Wireless, Telecom |
| Taiwan | BSMI, NCC, NIST | EMC, RF, Telecom, Safety |
| Hong Kong | OFTA, NIST | RF/Wireless, Telecom |
| Australia | NATA, NIST | EMC, RF, Telecom, Safety |
| Korea | KCC/RRA, NIST | EMI, EMS, RF, Telecom, Safety |
| Japan | VCCI, JATE, TELEC, RFT | EMI, RF/Wireless, Telecom |
| Mexico | NOM, COFETEL, Caniety | Safety, EMC, RF/Wireless, Telecom |
| Europe | A2LA, NIST | EMC, RF, Telecom, Safety |
| Israel | MOC, NIST | EMC, RF, Telecom, Safety |

## Accreditations for Product Certifications

| Country | Accreditation Body | Scope |
| --- | --- | --- |
| USA | FCC TCB, NIST | EMC, RF, Telecom |
| Canada | IC FCB, NIST | EMC, RF, Telecom |
| Singapore | iDA, NIST | EMC, RF, Telecom |
| EU | NB | EMC & R&TTE Directive |
| Japan | MIC (RCB 208) | RF, Telecom |
| Hong Kong | OFTA (US002) | RF, Telecom |

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# 1 Report Revision History

| Report No. | Report Version | Description | Issue Date |
| --- | --- | --- | --- |
| FCC IC_RF_SL17060501_ZBR-021_DSS | None | Original | 08/08/2017 |
| FCC IC_RF_SL17060501_ZBR-021_DSS_Rev1.0 | 1.0 | Update Radiated Emissions data | 08/16/2017 |
| FCC IC_RF_SL17060501_ZBR-021_DSS_Rev2.0 | 2.0 | Update Radiated Emissions data | 08/18/2017 |
| | | | |
| | | | |

# 2 Executive Summary

The purpose of this test program was to demonstrate compliance of following product

| | |
|---|---|
| Company: | Zebra Technologies Corporation |
| Host Product Name: | Mobile Thermal Printer |
| Host Model No.: | ZQ310 and ZQ320 |
| Module Model No. | ZBRZQ3BT |

against the current Stipulated Standards. The specified model product stated above has demonstrated compliance with the Stipulated Standard listed on 1st page.

# 3 Customer information

| | |
|---|---|
| Applicant Name | Zebra Technologies Corp. |
| Applicant Address | 3 Overlook Point, Lincolnshire, IL 60069 |
| Manufacturer Name | Zebra Technologies Corp. |
| Manufacturer Address | 3 Overlook Point, Lincolnshire, IL 60069 |

# 4 Test site information

| | |
|---|---|
| Lab performing tests | SIEMIC Laboratories |
| Lab Address | 775 Montague Expressway, Milpitas, CA 95035 |
| FCC Test Site No. | 881796 |
| IC Test Site No. | 4842D-2 |
| VCCI Test Site No. | A0133 |

# 5 Modification

| Index | Item | Description | Note |
|---|---|---|---|
| - | - | - | - |
| | | | |
| | | | |
| | | | |
| | | | |

# 6 EUT Information

## 6.1 EUT Description

| | |
| --- | --- |
| Host Product Name | Mobile Thermal Printer |
| Host Model No. | ZQ310 and ZQ320 |
| Module Model No. | ZQ3BT |
| Trade Name | Zebra |
| Serial No. | XXZFJ170700353 |
| Input Power | 100-240VAC_47/63Hz |
| Power Adapter Manu/Model | N/A |
| Power Adapter SN | N/A |
| Hardware version | N/A |
| Software version | N/A |
| Date of EUT received | 07/28/2017 |
| Equipment Class/ Category | FHSS |
| Port/Connectors | USB |
| Remark | NONE |

## 6.2 Spec for BT Radio

| Radio Type | Bluetooth (Ver4.0+EDR) |
| --- | --- |
| Operating Frequency | 2402MHz-2480MHz |
| Modulation | FHSS (BDR, EDR) |
| Channel Spacing | 1MHz (BDR, EDR) |
| Antenna Type | Chip |
| Antenna Gain | 1.69 dBi |
| Antenna Connector Type | - |

## 6.3 EUT test modes/configuration Description

| Mode | Note |
| --- | --- |
| Bluetooth | BDR (GFSK) |
| Bluetooth | EDR (8-DPSK) |

## 6.4 EUT Photos-External


EUT -Top View


EUT -Bottom View with battery


EUT -Bottom View without battery

EUT- Front View

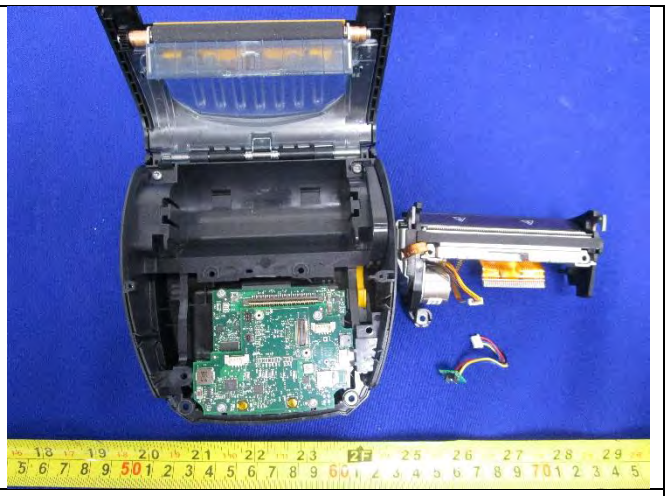
EUT - Rear View

EUT - Left Side View

| | |
|---|---|
|  |  |
| EUT – Right Side View | EUT - Battery View |

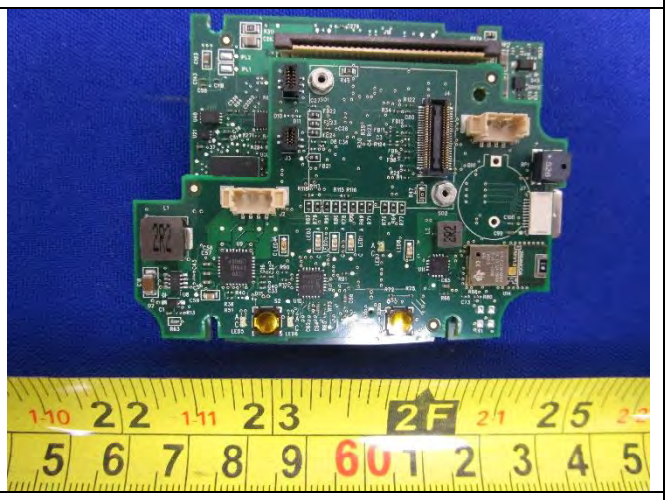
## 6.5 EUT Photos – Internal

PCBA Open Case View 1



PCBA Open Case View 2

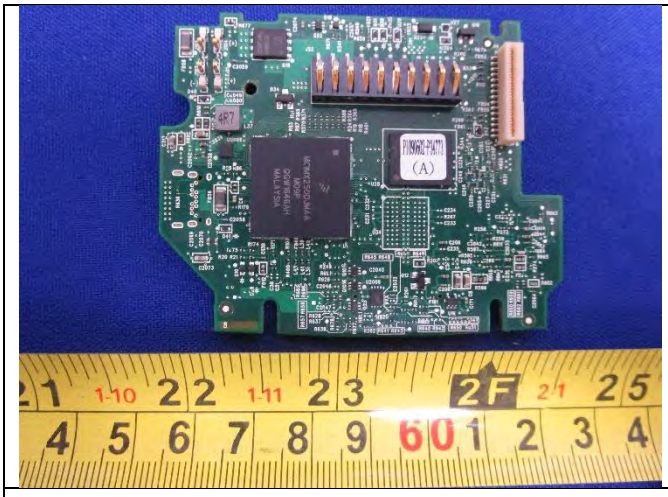
EUT PCBA Close-Up View



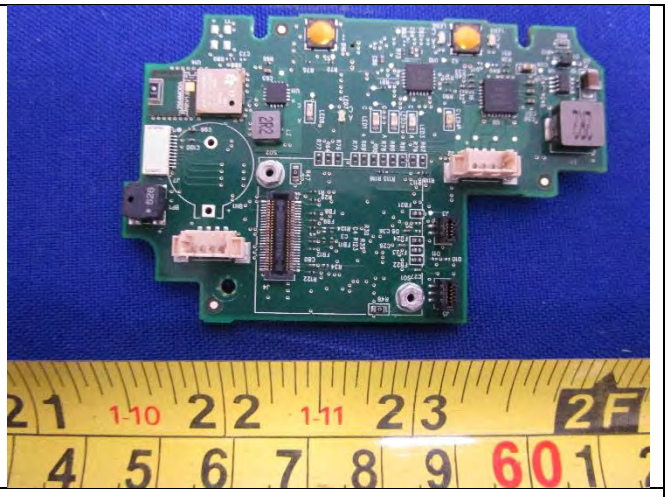
PCBA – Top View

PCBA A and B Top View

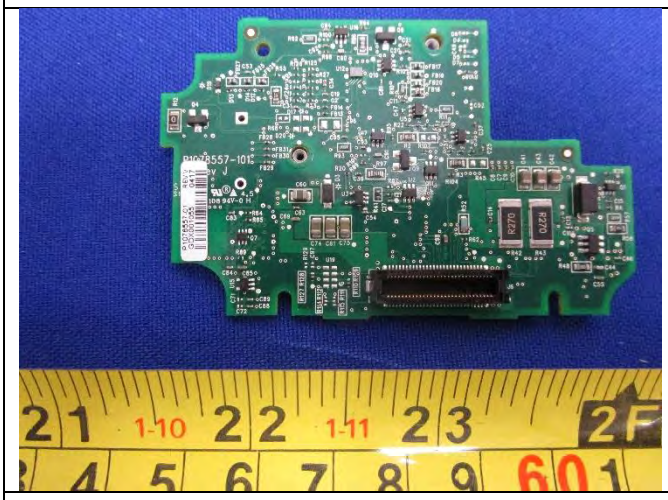
PCBA A- Top View



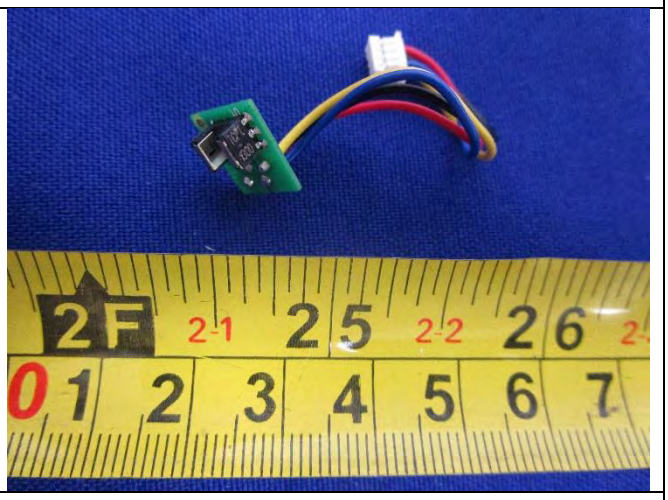
PCBA A – Bottom View



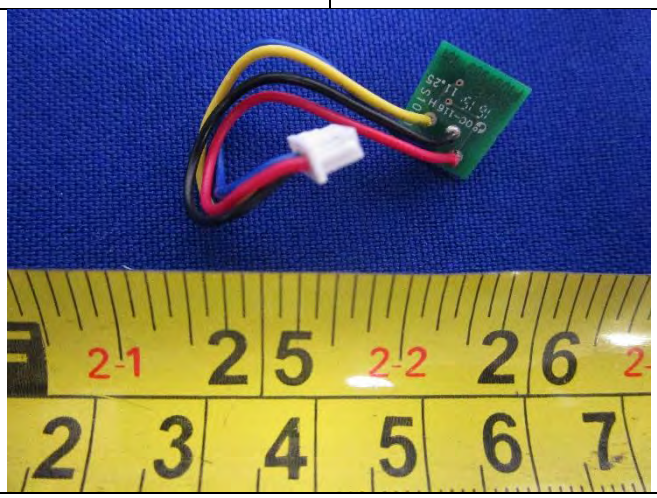
Main PCBA -Top View



Main PCBA– Bottom View

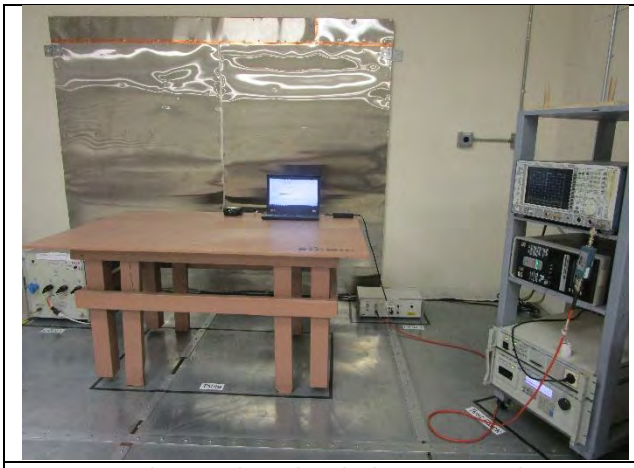


PCBA B – Top View

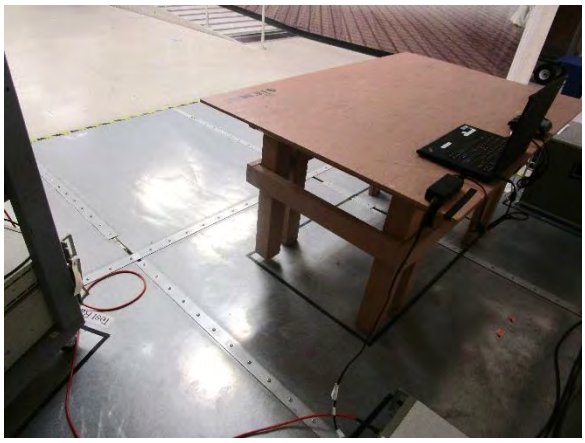


PCBA B – Bottom View

## 6.6 EUT Test Setup Photos

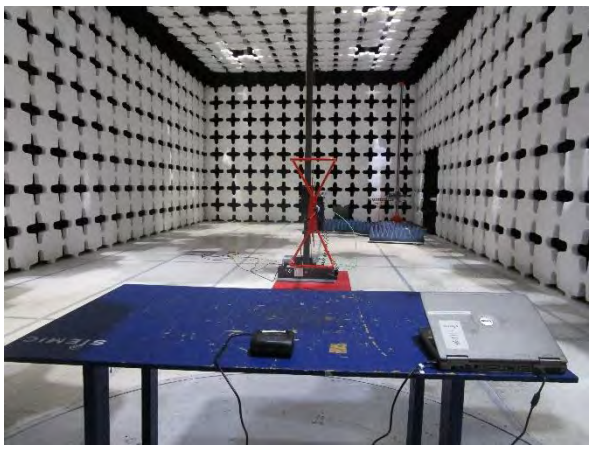


AC Line Conducted Emissions – Front View



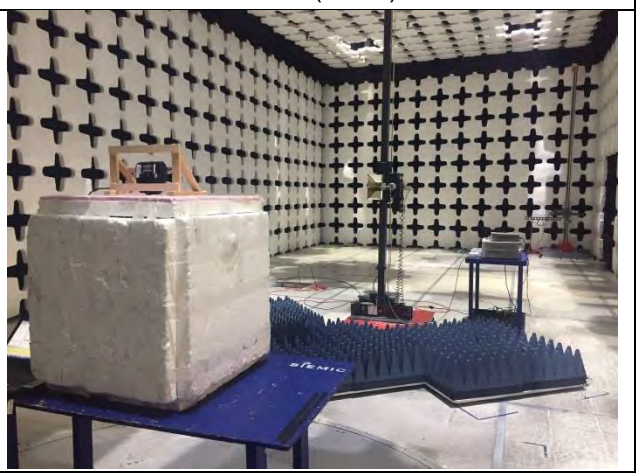
AC Line Conducted Emissions – Rear View

Radiated Emissions (<1GHz) – Front View



Radiated Emissions (<1GHz) – Rear View

Radiated Emissions (>1GHz) – Front View(EUT vertical)



Radiated Emissions (>1GHz) – Rear View(EUT vertical)

| | |
|---|---|
|  |  |
| Radiated Emissions (>1GHz) – Front View (EUT horizontal) | Radiated Emissions (>1GHz) – Rear View(EUT horizontal) |

# 7 Supporting Equipment/Software and cabling Description

## 7.1 Supporting Equipment

| Item | Supporting Equipment Description | Model | Serial Number | Manufacturer | Note |
| --- | --- | --- | --- | --- | --- |
| 1 | Laptop | ThinkPad T420s | N/A | Lenovo | - |
| | | | | | |
| | | | | | |

## 7.2 Cabling Description

| Name | Connection Start | | Connection Stop | | Length / shielding Info | | Note |
| --- | --- | --- | --- | --- | --- | --- | --- |
| | From | I/O Port | To | I/O Port | Length (m) | Shielding | |
| USB | EUT | I/O Port | Laptop | USB | 2 | Unshielded | - |
| | | | | | | | |

## 7.3 Test Software Description

| Test Item | Software | Description |
| --- | --- | --- |
| RF Testing | Zebra Toolbox | Set the EUT to transmit continuously in diferent test mode |
| | | |
| | | |

# 8 Test Summary

| Test Item | Test standard | | Test Method/Procedure | | Pass / Fail |
|---|---|---|---|---|---|
| Restricted Band of Operation | FCC | 15.205 | FCC | ANSI C63.10: 2013<br>Public Notice DA 00-705 | ☒ Pass<br>☐ N/A |
| | IC | RSS Gen 8.10 | | RSS Gen Issue 4: 2014 | |
| AC Conducted Emissions Voltage | FCC | 15.207(a) | FCC | ANSI C63.10: 2013 | ☒ Pass<br>☐ N/A |
| | IC | RSS Gen 8.8 | | RSS Gen Issue 4: 2014 | |

DSS Band Requirement

| Test Item | Test standard | | Test Method/Procedure | | Pass / Fail |
|---|---|---|---|---|---|
| Channel Separation | FCC | 15.247 (a)(1) | FCC | Public Notice DA 00-705 | ☒ Pass<br>☐ N/A |
| | IC | RSS247 (5.1.5) | IC | - | |
| 20dB Occupied Bandwidth | FCC | 15.247(a)(1) | FCC | Public Notice DA 00-705 | ☒ Pass<br>☐ N/A |
| | IC | RSS247 (5.1.2) | IC | - | |
| 99% Occupied Bandwidth | FCC | 15.247(a)(2) | FCC | | ☒ Pass<br>☐ N/A |
| | IC | RSS Gen 6.6 | IC | RSS Gen Issue 4: 2014 - | |
| Number of Hopping Channels | FCC | 15.247(a)(1) | FCC | Public Notice DA 00-705 | ☒ Pass<br>☐ N/A |
| | IC | RSS247 (5.1.5) | IC | - | |
| Band Edge and Radiated Spurious Emissions | FCC | 15.247(d) | FCC | Public Notice DA 00-705 | ☒ Pass<br>☐ N/A |
| | IC | RSS247(5.5) | IC | - | |
| Time of Occupancy | FCC | 15.247(a)(1) | FCC | Public Notice DA 00-705 | ☒ Pass<br>☐ N/A |
| | IC | RSS247 (5.1.5) | IC | - | |
| Output Power | FCC | 15.247(b) | FCC | Public Notice DA 00-705 | ☒ Pass<br>☐ N/A |
| | IC | RSS247 (5.4.2) | IC | - | |
| Receiver Spurious Emissions | FCC | 15.247(d) | FCC | - | ☐ Pass<br>☒ N/A |
| | IC | RSS Gen (7.1) | IC | RSS Gen (7.1) | |
| Antenna Gain > 6 dBi | FCC | 15.247(e) | FCC | Public Notice DA 00-705 | ☐ Pass<br>☒ N/A |
| | IC | RSS247 (5.4.6) | IC | - | |
| Power Spectral Density | FCC | 15.247(e) | FCC | Public Notice DA 00-705 | ☐ Pass<br>☒ N/A |
| | IC | RSS247 (5.2.2) | IC | - | |
| Hybrid System Requirement | FCC | 15.247(f) | FCC | Public Notice DA 00-705 | ☐ Pass<br>☒ N/A |
| | IC | RSS247 (5.3) | IC | - | |
| Hopping Capability | FCC | 15.247(g) | FCC | Public Notice DA 00-705 | ☒ Pass<br>☐ N/A |
| | IC | RSS247 (5.1.5) | IC | - | |
| RF Exposure requirement | FCC | 15.247(i) | FCC | Public Notice DA 00-705 | ☐ Pass<br>☒ N/A |
| | IC | RSS Gen(3.2) | IC | - | |
| Remark | 1. All measurement uncertainties are not taken into consideration for all presented test result.<br>2. The applicant shall ensure frequency stability by showing that an emission is maintained within the band of operation under all normal operating conditions as specified in the user's manual. | | | | |

# 9 Measurement Uncertainty

## 9.1 Conducted Emissions

The test is to measure the conducted emissions to the mains port of the EUT.

Some error sources that can contribute to the total uncertainty:

- Uncertainty of the receiver
- Uncertainty of the LISN
- Uncertainty of cables
- Uncertainty due to the mismatches
- Etc, see the below table for details

| Source of Uncertainty | Value (dB) | Probability Distribution | Division | Sensitivity Coefficient | Expanded Uncertainty |
|---|---|---|---|---|---|
| Receiver Reading | 0.12 | Rectangular | 1.732 | 1 | 0.069284 |
| Cable Insertion Loss | 0.21 | Normal | 2 | 1 | 0.105 |
| Filter Insertion Loss | 0.25 | Normal | 2 | 1 | 0.125 |
| LISN Insertion Loss | 0.40 | Normal | 2 | 1 | 0.20 |
| Receiver CW accuracy | 0.5 | Rectangular | 1.732 | 1 | 0.2886836 |
| Pulse Amplitude Response | 1.5 | Rectangular | 1.732 | 1 | 0.86605081 |
| PRF Response | 1.5 | Rectangular | 1.732 | 1 | 0.86605081 |
| Mismatch LISN - Receiver | 0.25 | U-Shape | 1.414 | 1 | 0.1768033 |
| LISN Impedance | 2.5 | Triangular | 2.449 | 1 | 1.0208248 |
| Combined Standard Uncertainty | | | | | 1.928133 |
| Expanded Uncertainty (K=2) | | | | | 3.856266 |

The total derived measurement uncertainty is +/- 3.86 dB.

## 9.2 Radiated Emissions (30MHz to 1GHz)

The test is to measure the radiated emissions of the EUT.

Some error sources that can contribute to the total uncertainty:

- Uncertainty of the receiver
- Uncertainty of the antenna
- Uncertainty of cables
- Uncertainty due to the mismatches
- NSA Calibration
- Etc., details see the below table

| Source of Uncertainty | Value (dB) | Probability Distribution | Division | Sensitivity Coefficient | Expanded Uncertainty |
|---|---|---|---|---|---|
| Receiver Reading | 0.12 | Rectangular | 1.732 | 1 | 0.069284 |
| Cable Insertion Loss | 0.21 | Normal | 2 | 1 | 0.105 |
| Filter Insertion Loss | 0.25 | Normal | 2 | 1 | 0.125 |
| Antenna Factor | 0.65 | Normal | 2 | 1 | 0.325 |
| Receiver CW accuracy | 0.5 | Rectangular | 1.732 | 1 | 0.2886836 |
| Pulse Amplitude Response | 1.5 | Rectangular | 1.732 | 1 | 0.86605081 |
| PRF Response | 1.5 | Rectangular | 1.732 | 1 | 0.86605081 |
| Mismatch Filter - Receiver | 0.25 | U-Shape | 1.414 | 1 | 0.1768033 |
| NSA Calibration | 4.0 | U-Shape | 1.414 | 1 | 2.8288543 |
| Combined Standard Uncertainty | | | | | 3.0059131 |
| Expanded Uncertainty (K=2) | | | | | 6.0118262 |

The total derived measurement uncertainty is +/- 6.00 dB.

## 9.3 Radiated Emissions (1GHz to 40GHz)

The test is to measure the radiated emissions of the EUT.

Some error sources that can contribute to the total uncertainty:
- Uncertainty of the receiver
- Uncertainty of the antenna
- Uncertainty of cables
- Uncertainty due to the mismatches
- VSWR Calibration
- Etc., details see the below table

| Source of Uncertainty | Value (dB) | Probability Distribution | Division | Sensitivity Coefficient | Expanded Uncertainty |
|---|---|---|---|---|---|
| Receiver Reading | 0.12 | Rectangular | 1.732 | 1 | 0.0692840 |
| Cable Insertion Loss | 0.21 | Normal | 2 | 1 | 0.1050000 |
| Filter Insertion Loss | 0.25 | Normal | 2 | 1 | 0.1250000 |
| Antenna Factor | 0.65 | Normal | 2 | 1 | 0.3250000 |
| Receiver CW accuracy | 0.5 | Rectangular | 1.732 | 1 | 0.2886836 |
| Pulse Amplitude Response | 1.5 | Rectangular | 1.732 | 1 | 0.8660508 |
| PRF Response | 1.5 | Rectangular | 1.732 | 1 | 0.8660508 |
| Mismatch Filter - Receiver | 0.25 | U-Shape | 1.414 | 1 | 0.1768033 |
| VSWR Calibration | 2.0 | U-Shape | 1.414 | 1 | 1.4144272 |
| Combined Standard Uncertainty | | | | | 4.2363 |
| Expanded Uncertainty (K=2) | | | | | 8.4726 |

The total derived measurement uncertainty is +/- 8.47 dB.

## 9.4 RF conducted measurement

The test is to measure the RF output power from the EUT.

Some error sources that can contribute to the total uncertainty:

- Uncertainty of the Reference Level Uncertainty
- Uncertainty of variable attenuators
- Uncertainty of cables
- Uncertainty due to the mismatches

| Source of Uncertainty | Value (dB) | Probability Distribution | Division | Sensitivity Coefficient | Expanded Uncertainty |
|---|---|---|---|---|---|
| Reference Level | 0.12 | Rectangular | 1.732 | 1 | 0.069284 |
| Cable Insertion Loss | 0.21 | Normal | 2 | 1 | 0.105 |
| Attenuator | 0.25 | Normal | 2 | 1 | 0.125 |
| Mismatch | 0.25 | U-Shape | 1.414 | 1 | 0.1768033 |
| Combined Standard Uncertainty | | | | | 0.476087 |
| Expanded Uncertainty (K=2) | | | | | 0.952174 |

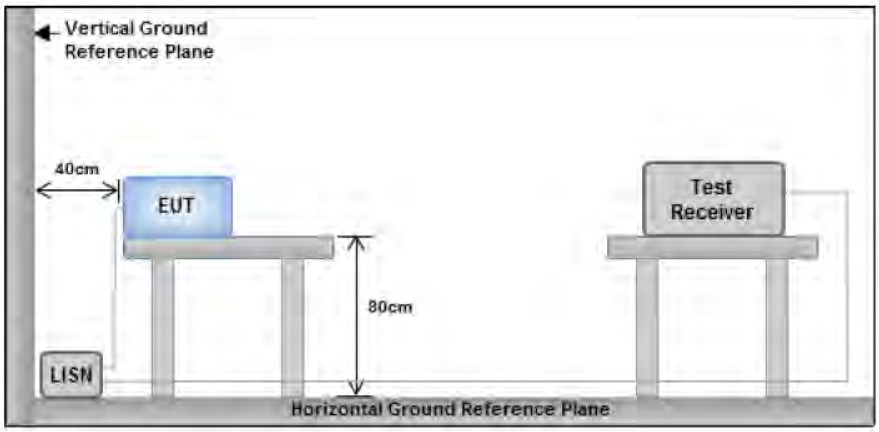
The total derived measurement uncertainty is +/- 0.95 dB.

# 10 Measurements, Examination and Derived Results

## 10.1 Conducted Emissions

Conducted Emission Limit

| Frequency ranges (MHz) | Limit (dBuV) | |
|---|---|---|
| | QP | Average |
| 0.15 ~ 0.5 | 66 – 56 | 56 – 46 |
| 0.5 ~ 5 | 56 | 46 |
| 5 ~ 30 | 60 | 50 |

| Spec | Item | Requirement | Applicable |
|---|---|---|---|
| 47CFR§15.207 | a) | For Low-power radio-frequency devices that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). The lower limit applies at the boundary between the frequency ranges. | ☒ |
| Test Setup |  Note: 1. Support units were connected to second LISN.<br>2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes | | |
| Procedure | - The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table, as shown in Annex B.<br>- The power supply for the EUT was fed through a 50Ω/50μH EUT LISN, connected to filtered mains.<br>- The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.<br>- All other supporting equipment was powered separately from another main supply. | | |
| Remark | EUT tested with AC 120V 60Hz | | |
| Result | ☒ Pass ☐ Fail | | |

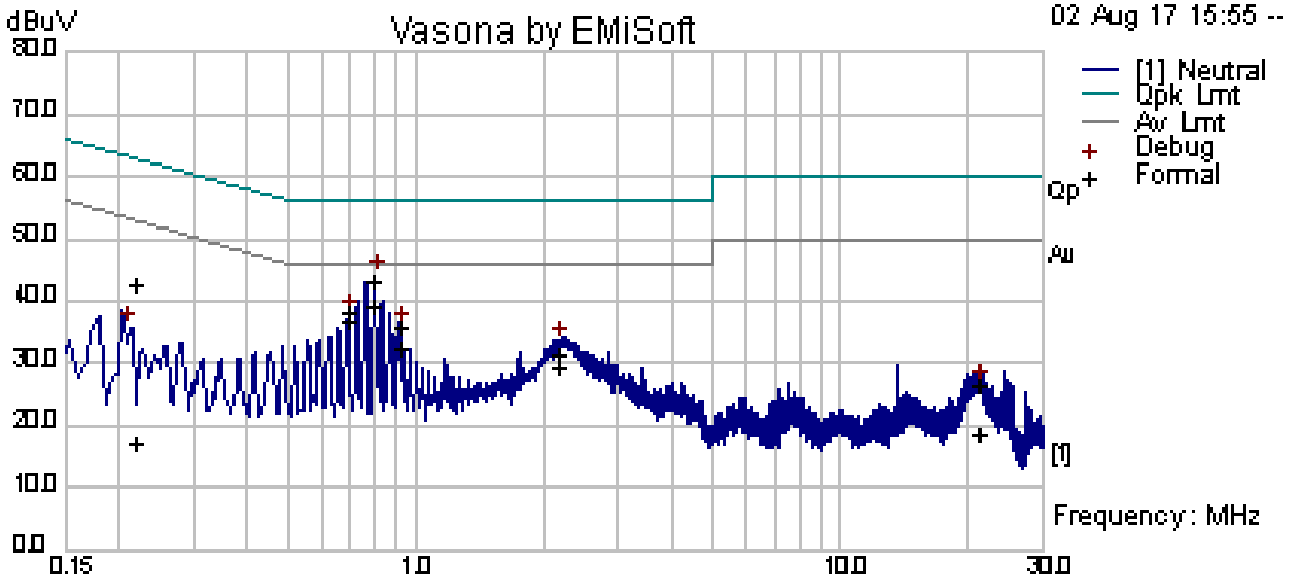
Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by *Rachana Khanduri* at *Conducted Emission Test Site*.

## Conducted Emission Test Results

| Test specification: | Conducted Emissions | | | |
|---|---|---|---|---|
| Environmental Conditions: | Temp(°C): | 21 | Result: | ☒ Pass ☐ Fail |
| | Humidity (%): | 45 | | |
| | Atmospheric(mbar): | 1021 | | |
| Mains Power: | 120VAC, 60Hz | | | |
| Tested by: | Rachana Khanduri | | | |
| Test Date: | 08/02/2017 | | | |
| Remarks | conducted @ Neutral | | | |

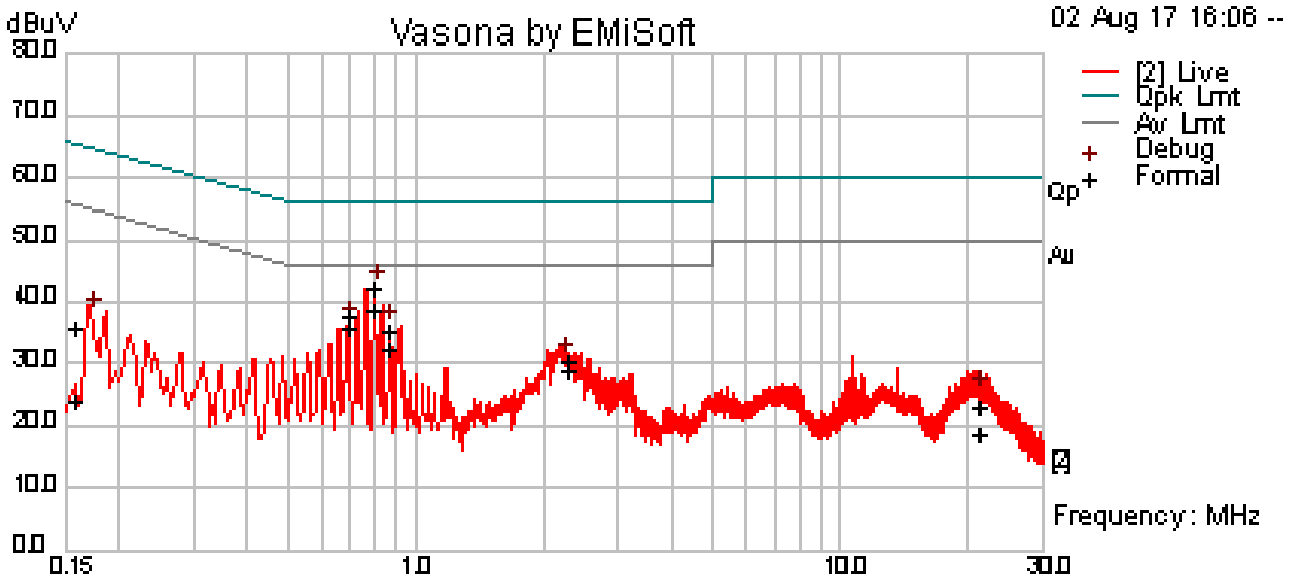



Neutral Plot at 120Vac, 60Hz

| Frequency (MHz) | Raw (dBuV) | Cable Loss (dB) | Factors (dB) | Level (dBuV) | Measurement Type | Line / Neutral | Limit (dBuV) | Margin (dB) | Pass /Fail |
|---|---|---|---|---|---|---|---|---|---|
| 0.80 | 32.50 | 10.01 | 0.55 | 43.06 | Quasi Peak | Neutral | 56.00 | -12.94 | Pass |
| 0.69 | 26.03 | 10.01 | 0.56 | 36.61 | Quasi Peak | Neutral | 56.00 | -19.39 | Pass |
| 0.92 | 25.49 | 10.01 | 0.53 | 36.04 | Quasi Peak | Neutral | 56.00 | -19.96 | Pass |
| 2.17 | 21.06 | 10.02 | 0.50 | 31.58 | Quasi Peak | Neutral | 56.00 | -24.42 | Pass |
| 0.22 | 31.29 | 10.00 | 1.15 | 42.44 | Quasi Peak | Neutral | 62.87 | -20.43 | Pass |
| 21.27 | 15.85 | 10.07 | 0.68 | 26.60 | Quasi Peak | Neutral | 60.00 | -33.40 | Pass |
| 0.80 | 28.76 | 10.01 | 0.55 | 39.32 | Average | Neutral | 46.00 | -6.68 | Pass |
| 0.69 | 27.66 | 10.01 | 0.56 | 38.23 | Average | Neutral | 46.00 | -7.77 | Pass |
| 0.92 | 21.70 | 10.01 | 0.53 | 32.24 | Average | Neutral | 46.00 | -13.76 | Pass |
| 2.17 | 18.71 | 10.02 | 0.50 | 29.23 | Average | Neutral | 46.00 | -16.77 | Pass |
| 0.22 | 5.83 | 10.00 | 1.15 | 16.98 | Average | Neutral | 52.87 | -35.89 | Pass |
| 21.27 | 8.03 | 10.07 | 0.68 | 18.79 | Average | Neutral | 50.00 | -31.21 | Pass |

## Conducted Emission Test Results

| Test specification: | Conducted Emissions | | | |
|---|---|---|---|---|
| Environmental Conditions: | Temp(°C): | 22 | Result: | ☒ Pass ☐ Fail |
| | Humidity (%): | 45 | | |
| | Atmospheric(mbar): | 1021 | | |
| Mains Power: | 120Vac, 60Hz | | | |
| Tested by: | Rachana Khanduri | | | |
| Test Date: | 08/02/2017 | | | |
| Remarks | conducted @ Live | | | |




Live Plot at 120Vac, 60Hz

| Frequency (MHz) | Raw (dBuV) | Cable Loss (dB) | Factors (dB) | Level (dBuV) | Measurement Type | Line / Neutral | Limit (dBuV) | Margin (dB) | Pass /Fail |
|---|---|---|---|---|---|---|---|---|---|
| 0.80 | 31.80 | 10.01 | 0.55 | 42.36 | Quasi Peak | Live | 56.00 | -13.64 | Pass |
| 0.69 | 25.47 | 10.01 | 0.56 | 36.04 | Quasi Peak | Live | 56.00 | -19.96 | Pass |
| 0.87 | 24.89 | 10.01 | 0.54 | 35.44 | Quasi Peak | Live | 56.00 | -20.56 | Pass |
| 2.27 | 18.44 | 10.02 | 0.50 | 28.96 | Quasi Peak | Live | 56.00 | -27.04 | Pass |
| 0.16 | 24.34 | 10.00 | 1.64 | 35.98 | Quasi Peak | Live | 65.57 | -29.59 | Pass |
| 21.09 | 12.36 | 10.07 | 0.68 | 23.11 | Quasi Peak | Live | 60.00 | -36.89 | Pass |
| 0.80 | 28.10 | 10.01 | 0.55 | 38.66 | Average | Live | 46.00 | -7.34 | Pass |
| 0.69 | 27.13 | 10.01 | 0.56 | 37.70 | Average | Live | 46.00 | -8.30 | Pass |
| 0.87 | 21.76 | 10.01 | 0.54 | 32.31 | Average | Live | 46.00 | -13.69 | Pass |
| 2.27 | 19.66 | 10.02 | 0.50 | 30.18 | Average | Live | 46.00 | -15.82 | Pass |
| 0.16 | 12.57 | 10.00 | 1.64 | 24.21 | Average | Live | 55.57 | -31.36 | Pass |
| 21.09 | 8.03 | 10.07 | 0.68 | 18.78 | Average | Live | 50.00 | -31.22 | Pass |

Note: The results above show only the worst case.

## 10.2 Channel Separation (Bluetooth BDR/EDR)

Requirement(s):

| Spec | Item | Requirement | Applicable |
|---|---|---|---|
| 47 CFR §15.247 (e)<br>RSS-247 (A2.6) | a) | Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater. | ☒ |

| | | | | |
|---|---|---|---|---|
| Test Setup |  | | | |
| Test Procedure | DA 00-705 Measurement Guidelines for Frequency Hopping Spread Spectrum Systems<br><br>Channel Separation procedure<br>- The EUT must have its hopping function enabled.<br>- Span = wide enough to capture the peaks of two adjacent channels<br>- Resolution (or IF) Bandwidth (RBW) ≥ 1% of the span<br>- Video (or Average) Bandwidth (VBW) ≥ RBW.<br>- Detector = Peak.<br>- Trace mode = max hold.<br>- Use the marker-delta function to determine the separation between the peaks of the adjacent channels. | | | |
| Test Date | 08/01/2017 | Environmental condition | Temperature<br>Relative Humidity<br>Atmospheric Pressure | 21ºC<br>46%<br>1019mbar |
| Remark | NONE | | | |
| Result | ☒ Pass ☐ Fail | | | |

Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by *Rachana Khanduri* at *RF Test Site*.

Configuration : Bluetooth Mode , BDR Mode

| Channel | Channel Frequency (MHz) | Channel Separation (MHz) | >2/3 20dB Bandwidth (MHz) | Pass/Fail |
|---|---|---|---|---|
| Low | 2402 | 1.000 | >585.73 | Pass |
| Mid | 2441 | 1.004 | >591.47 | Pass |
| High | 2480 | 1.002 | >623.53 | Pass |

Configuration : Bluetooth Mode , EDR Mode

| Channel | Channel Frequency (MHz) | Channel Separation (MHz) | >2/3 20dB Bandwidth (MHz) | Pass/Fail |
|---|---|---|---|---|
| Low | 2402 | 1.002 | >0.915 | Pass |
| Mid | 2441 | 1.002 | >0.903 | Pass |
| High | 2480 | 1.002 | >0.913 | Pass |

Note: The results of 20dB BW can be found in section 10.3.

## Channel Separation Test Plot (Bluetooth BDR/EDR)


Channel Separation-BDR 2402MHz


Channel Separation-EDR 2402MHz


Channel Separation-BDR 2441MHz

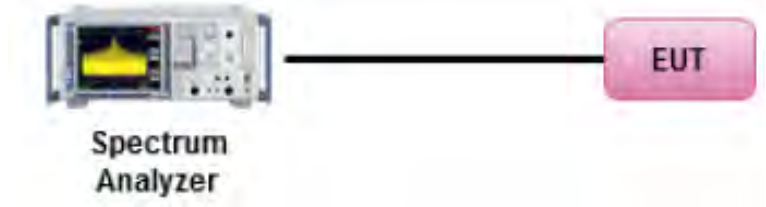

Channel Separation-EDR 2441MHz


Channel Separation-BDR 2480MHz


Channel Separation-EDR 2480MHz

## 10.3 20dB and 99% Occupied Bandwidth (Bluetooth BDR/EDR)

Requirement(s):

| Spec | Requirement | Applicable |
|---|---|---|
| 47 CFR §15.247 | Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 2/3 of 20 dB bandwidth of the hopping channel, whichever is greater. | ☒ |
| RSS Gen 4.6.1 | The transmitter shall be operated at its maximum carrier power measured under normal test conditions. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used given that a peak or peak hold may produce a wider bandwidth than actual. The trace data points are recovered and directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded. The span between the two recorded frequencies is the occupied bandwidth | ☒ |
| Test Setup |  | |
| Procedure | 20dB Emission bandwidth measurement procedure<br>- Set RBW ≥ 1% of 20dB Bandwidth<br>- Set the video bandwidth (VBW) ≥ RBW.<br>- Detector = Peak.<br>- Trace mode = max hold.<br>- Sweep = auto couple.<br>- Allow the trace to stabilize.<br>- Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.<br><br>99% bandwidth measurement procedure<br>1. EUT was set for low , mid, high channel with modulated mode and highest RF output power.<br>2. The spectrum analyzer was connected to the antenna terminal. | |

| Test Date | 08/01/2017 | Environmental condition | Temperature | 23oC |
|---|---|---|---|---|
| | | | Relative Humidity | 47% |
| | | | Atmospheric Pressure | 1019mbar |
| Remark | - | | | |
| Result | ☐ Pass ☐ Fail | | | |

Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by *Rachana Khanduri* at *RF Test Site*.

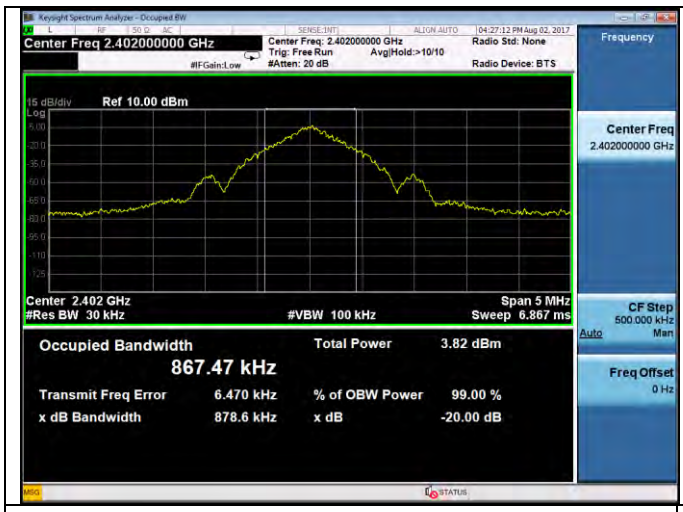
Configuration : Bluetooth mode , BDR Mode

| Channel | Channel Frequency (MHz) | OBW | | 2/3 20dB Bandwidth (KHz) |
| --- | --- | --- | --- | --- |
| | | 99% (KHz) | 20dB(KHz) | |
| Low | 2402 | 867.47 | 878.60 | 585.73 |
| Mid | 2441 | 867.30 | 887.20 | 591.47 |
| High | 2480 | 877.01 | 935.30 | 623.53 |

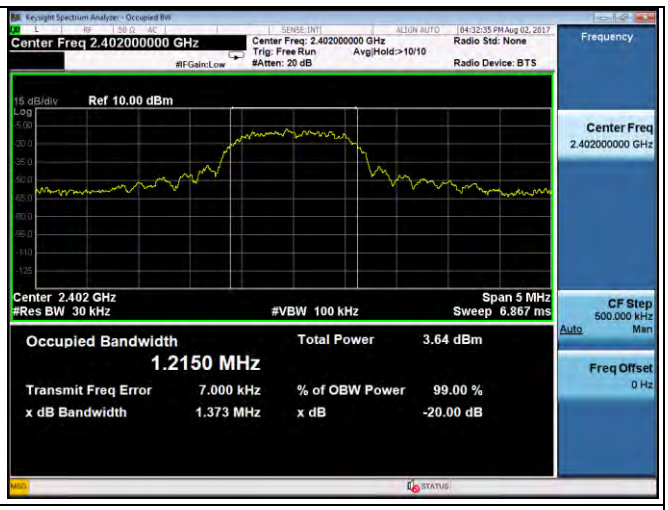
Configuration : Bluetooth mode , EDR mode

| Channel | Channel Frequency (MHz) | OBW | | 2/3 20dB Bandwidth (MHz) |
| --- | --- | --- | --- | --- |
| | | 99%(MHz) | 20dB(MHz) | |
| Low | 2402 | 1.23 | 1.373 | 0.915 |
| Mid | 2441 | 1.23 | 1.355 | 0.903 |
| High | 2480 | 1.22 | 1.369 | 0.913 |

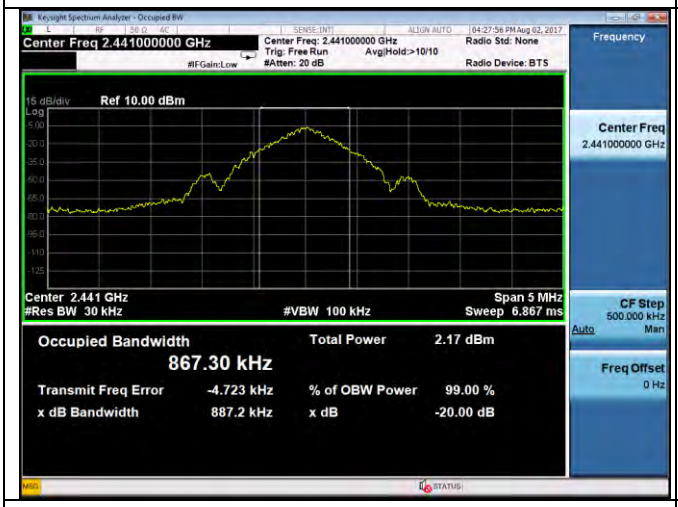
99% & 20dB Bandwidth Test Plots( Bluetooth BDR, EDR)



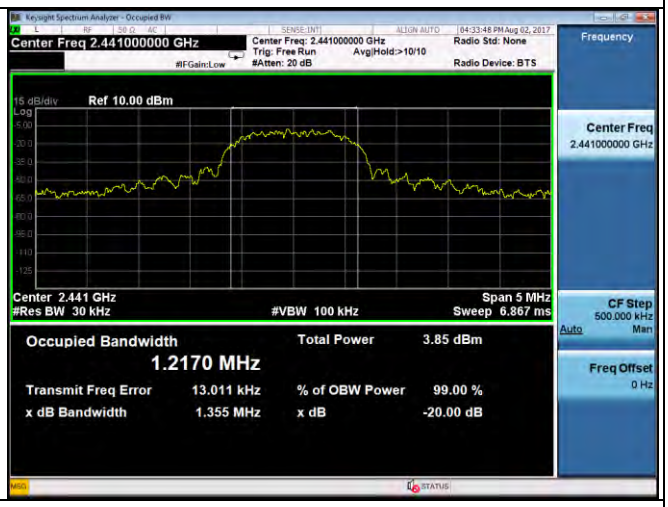

99% and 20dB BW –Bluetooth BDR 2402MHz



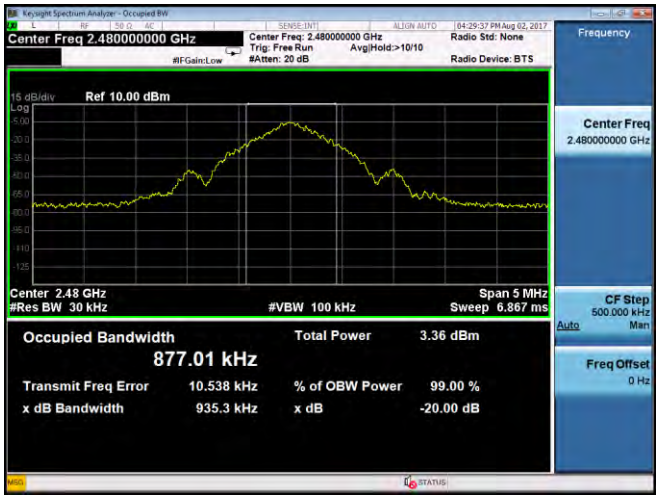

99% and 20dB BW –Bluetooth EDR 2402MHz



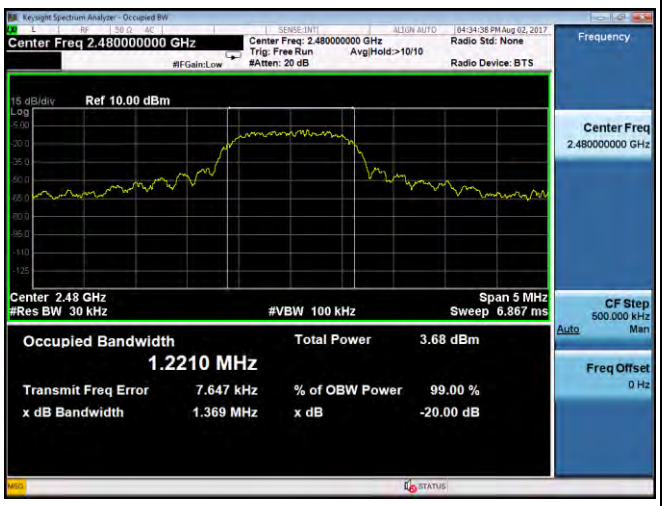

99% and 20dB BW –Bluetooth BDR 2441MHz




99% and 20dB BW –Bluetooth EDR 2441MHz




99% and 20dB BW –Bluetooth BDR 2480MHz

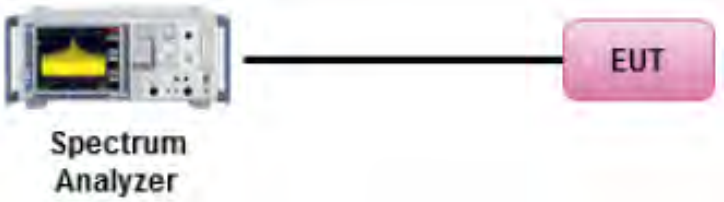



99% and 20dB BW –Bluetooth EDR 2480MHz

## 10.4 Number of Hopping Channel (Bluetooth BDR/EDR)

Requirement(s):

| Spec | Requirement | Applicable |
|---|---|---|
| 47 CFR §15.247<br>RSS247 (5.1.5) | For frequency hopping systems in the 2400-2483.5MHz band employing at least 75 hopping channels, and all frequency hopping systems in the 5725-5850MHz band: below 1 Watt (inclusive). | ☒ |

| | | | |
|---|---|---|---|
| Test Setup |  | | |
| Procedure | Number of hopping frequencies procedure<br>1. The EUT must have its hopping function enabled<br>2. Span = the frequency band of operation.<br>3. Resolution (or IF) Bandwidth (RBW) ≥ 1% of the span.<br>4. Video (or Average) Bandwidth (VBW) ≥ RBW.<br>5. Detector = peak.<br>6. Sweep time = auto couple.<br>7. Trace mode = max hold.<br>8. Allow trace to fully stabilize.<br>9. Save the plot | | |
| Test Date | 08/02/2017 | Environmental condition | Temperature 23oC<br>Relative Humidity 47%<br>Atmospheric Pressure 1019mbar |
| Remark | - | | |
| Result | ☒ Pass ☐ Fail | | |

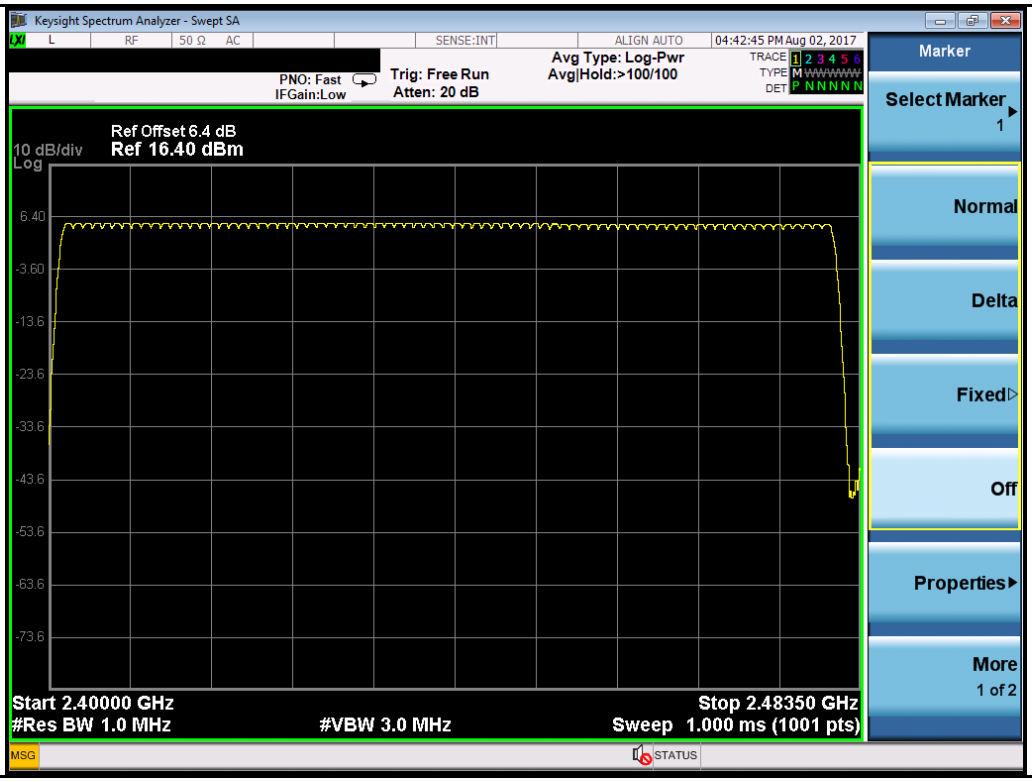
Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

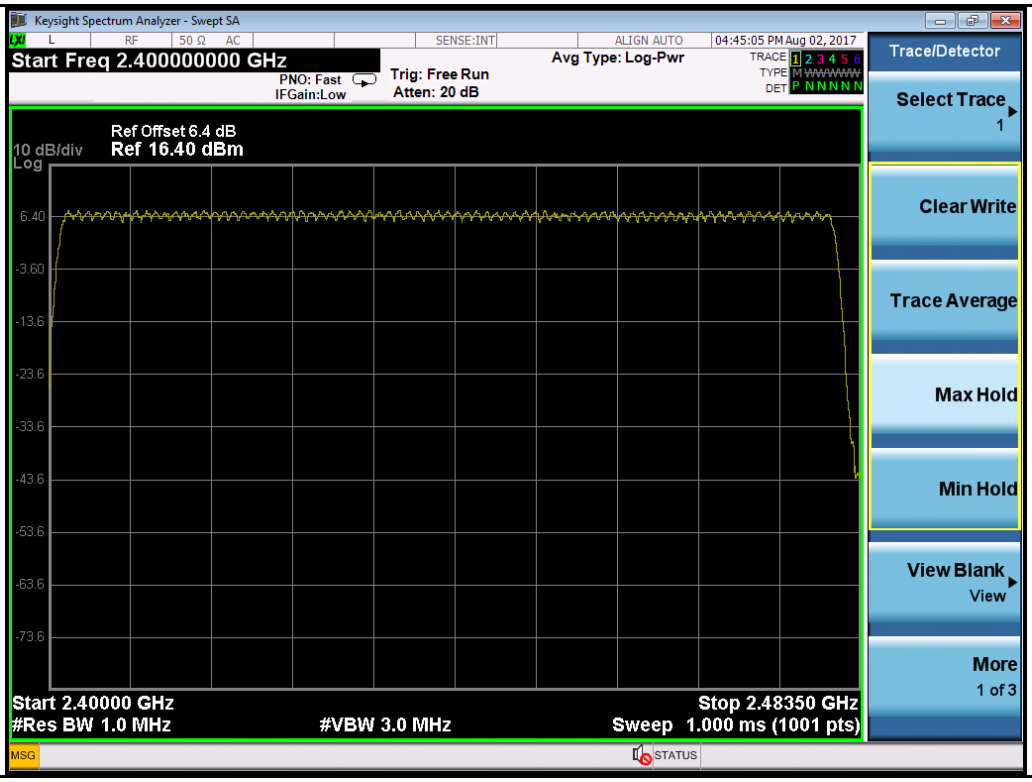
Test was done by *Rachana Khanduri* at *RF Test Site*.

| Channel Number | Limit | Pass/Fail |
|---|---|---|
| 79 | >75 | Pass |

Hopping Channel Test Plots( Bluetooth BDR, EDR)




BDR – 79 Channels

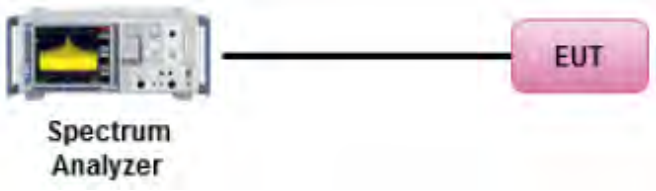



EDR – 79 Channels

## 10.5 Time of Occupancy (Bluetooth BDR/EDR)

Requirement(s):

| Spec | Requirement | Applicable |
|---|---|---|
| 47 CFR §15.247<br>RSS247 (5.1.5) | Frequency hopping systems in the 2400-2483.5MHz band shall use at least 15 non-overlapping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems which use fewer than 75 hopping frequencies may employ intelligent hopping techniques to avoid interference to other transmissions. | ☒ |

| | | | |
|---|---|---|---|
| Test Setup |  | | |
| Test Procedure | DA 00-705 Measurement Guidelines for Frequency Hopping Spread Spectrum Systems<br><br>Time of Occupancy Procedure<br>- The EUT must have its hopping function enabled.<br>- Span = zero span<br>- centered on a hopping channel<br>- RBW = 1 MHz; VBW ≥ RBW<br>- Sweep = as necessary to capture the entire dwell time per hopping channel.<br>- Detector = Peak.<br>- Trace mode = max hold.<br>- If possible, use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation. | | |
| Test Date | 08/02/2017 | Environmental condition | Temperature 21ºC<br>Relative Humidity 46%<br>Atmospheric Pressure 1019mbar |
| Remark | Dwell Time=Pulse time*(1600/6/79)*31.6s<br>DH5 is the worst case. | | |
| Result | ☒ Pass ☐ Fail | | |

Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by *Rachana Khanduri* at *RF Test Site*.

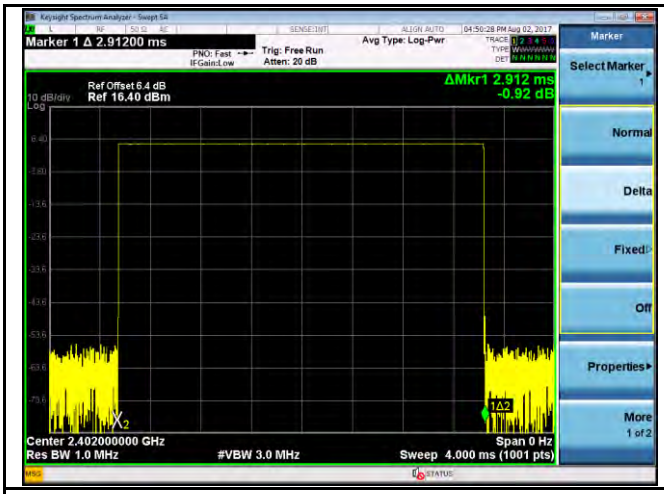
Bluetooth BDR Test Mode

| Channel | Channel Frequency (MHz) | On Time (mSec) | Dwell Time (Sec) | Limit (Sec) |
|---|---|---|---|---|
| Low | 2402 | 2.91 | 0.31 | 0.4 |
| Mid | 2441 | 2.91 | 0.31 | 0.4 |
| High | 2480 | 2.90 | 0.31 | 0.4 |

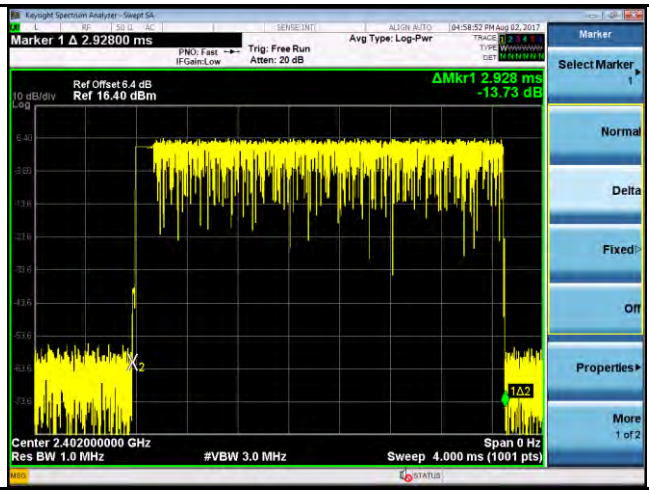
Bluetooth EDR Test Mode

| Channel | Channel Frequency (MHz) | On Time (mSec) | Dwell Time (Sec) | Limit (Sec) |
|---|---|---|---|---|
| Low | 2402 | 2.93 | 0.31 | 0.4 |
| Mid | 2441 | 2.93 | 0.31 | 0.4 |
| High | 2480 | 2.94 | 0.31 | 0.4 |

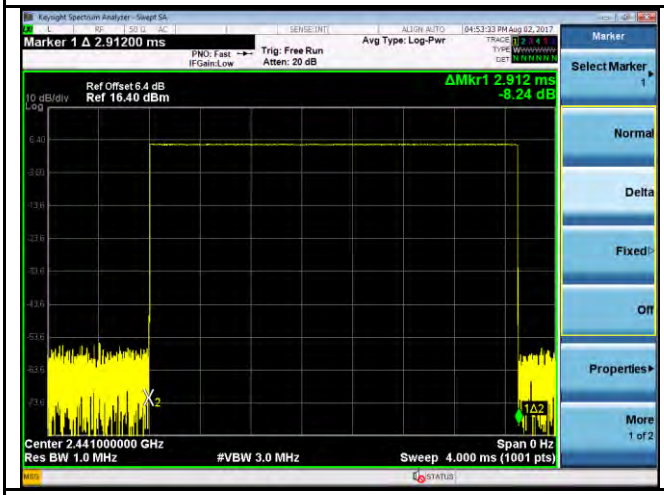
Time of Occupancy Test Plot (Bluetooth BDR/EDR)



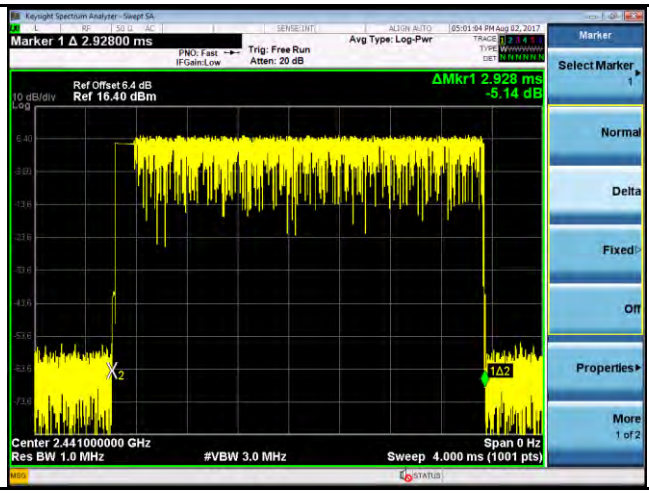

BDR Low Channel (On-Time)



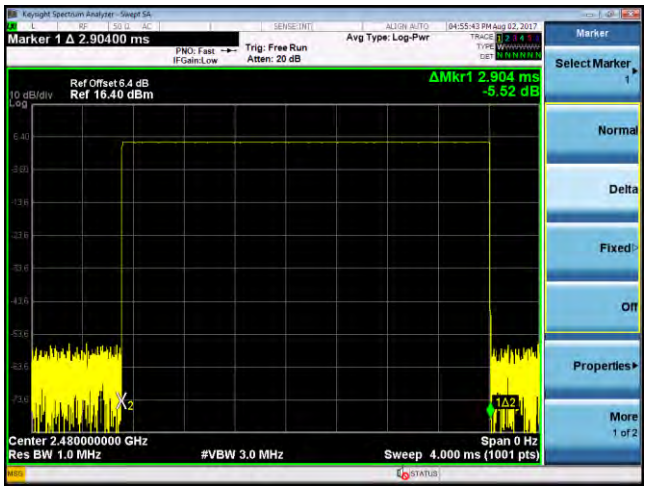

EDR Low Channel (On-Time)



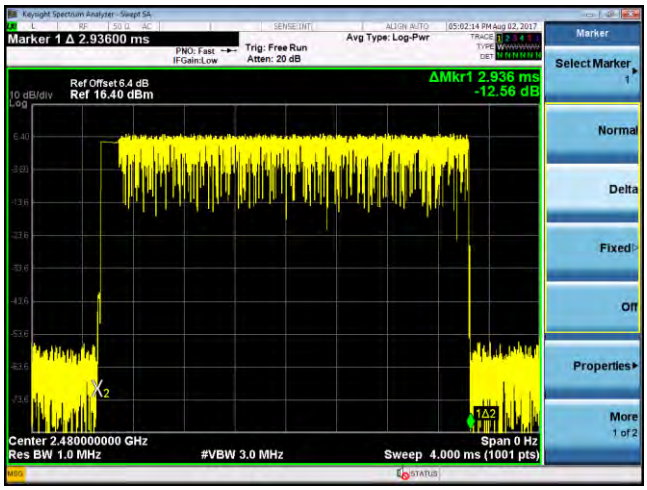

BDR Middle Channel (On-Time)




EDR Middle Channel (On-Time)




BDR High Channel (On-Time)

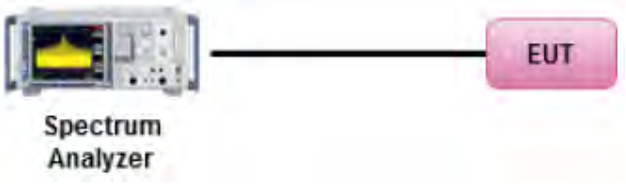



EDR High Channel (On-Time)

## 10.6 Peak Output Power (Bluetooth BDR/EDR)

Requirement(s):

| Spec | Item | Requirement | Applicable |
|---|---|---|---|
| § 15.247 | a) | For frequency hopping systems in the 2400-2483.5MHz band employing at least 75 hopping channels, and all frequency hopping systems in the 5725-5850MHz band: below 1 Watt (inclusive). | ☒ |
| | b) | Power reduction (antenna gain > 6dBi) | ☐ |
| § 15.247 | | Frequency hopping systems operated in 2400-2483.5MHz with output power not greater than 125mW, the intervals of hopping channel carrier frequencies shall not be less than 25kHz or two thirds of the 20dB bandwidth of the hopping channel, whichever is greater. | ☐ |

| | | | | |
|---|---|---|---|---|
| Test Setup |  | | | |
| Test Procedure | Maximum output power measurement procedure<br>- Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel.<br>- RBW > 20 dB bandwidth of the emission being measured;<br>- VBW ≥ RBW.<br>- Detector = peak.<br>- Sweep time = auto couple.<br>- Trace mode = max hold.<br>- Allow trace to fully stabilize.<br>- Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power. | | | |
| Test Date | 08/02/2017 | Environmental condition | Temperature<br>Relative Humidity<br>Atmospheric Pressure | 21ºC<br>46%<br>1019mbar |
| Remark | NONE | | | |
| Result | ☒ Pass ☐ Fail | | | |

Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes ☐ N/A

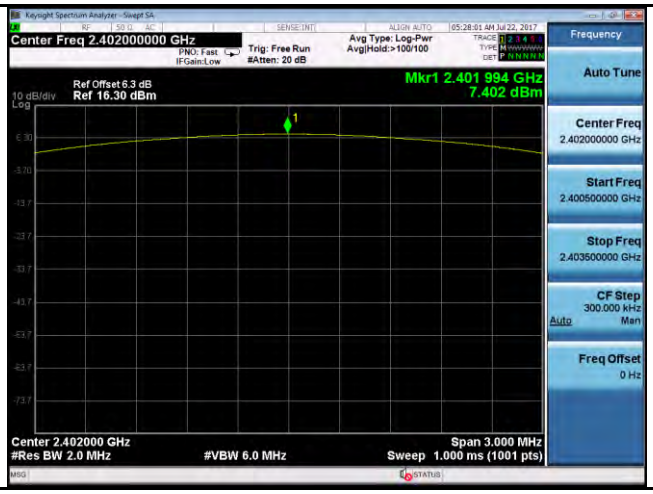
Test was done by *Rachana Khanduri* at *RF Test Site*.

Output Power measurement results

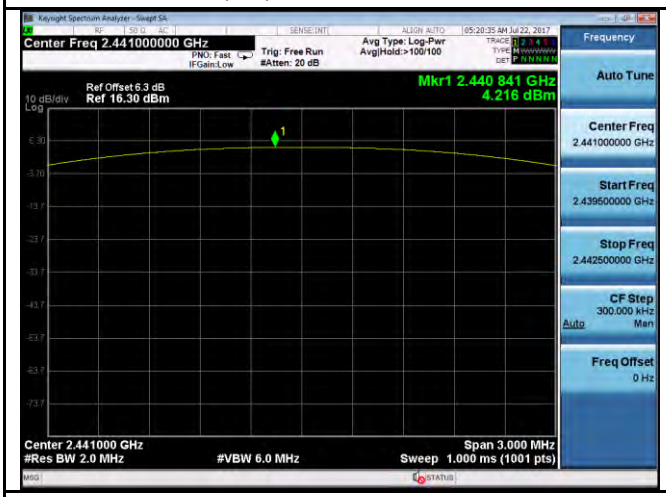
| Type | Freq (MHz) | Test mode | CH | Conducted Power (dBm) | Limit (dBm) | Result |
| --- | --- | --- | --- | --- | --- | --- |
| Output power | 2402 | Bluetooth BDR | Low | 4.27 | ≤30 | Pass |
| | 2441 | Bluetooth BDR | Mid | 4.22 | ≤30 | Pass |
| | 2480 | Bluetooth BDR | High | 4.18 | ≤30 | Pass |
| | 2402 | Bluetooth EDR | Low | 7.40 | ≤30 | Pass |
| | 2441 | Bluetooth EDR | Mid | 7.20 | ≤30 | Pass |
| | 2480 | Bluetooth EDR | High | 7.09 | ≤30 | Pass |

Peak Output Power Test Plot (Bluetooth BDR/EDR)


Output power - BDR 2402MHz



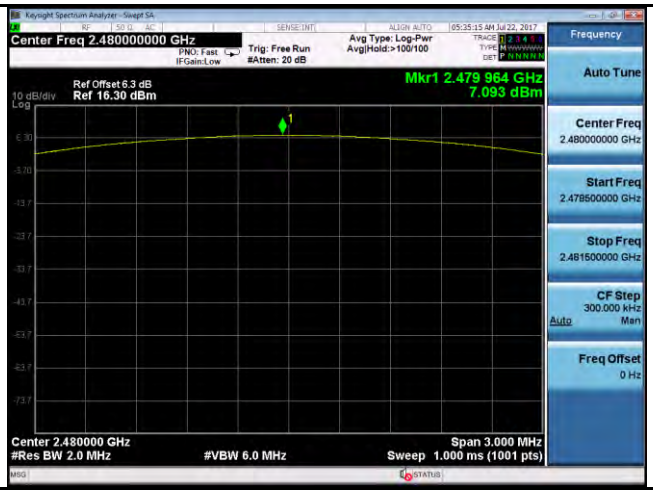

Output power - EDR 2402MHz




Output power - BDR 244MHz


Output power - EDR 2441MHz


Output power - BDR 2480MHz

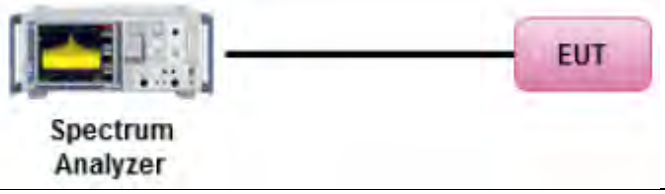



Output power - EDR 2480MHz

## 10.7 Band Edge (Bluetooth BDR/EDR)

Requirement(s):

| Spec | Item | Requirement | Applicable |
|---|---|---|---|
| § 15.247 | d) | For non-restricted band, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB or 30dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, determined by the measurement method on output power to be used. Attenuation below the general limits specified in § 15.209 (a) is not required<br>☒ 20 dB down ☐ 30 dB down | ☒ |

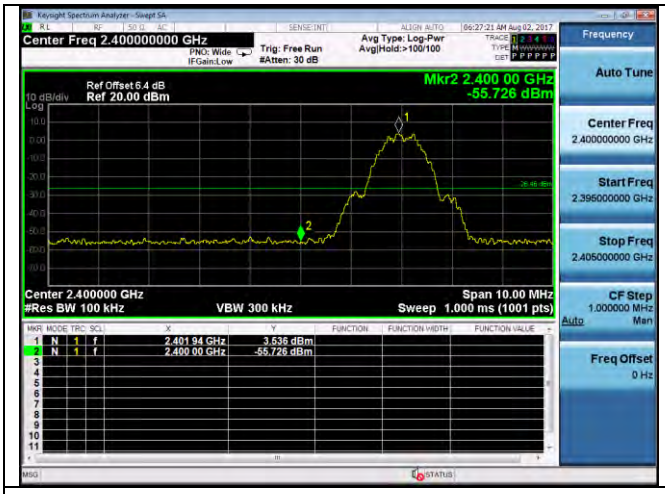
| | | | | |
|---|---|---|---|---|
| Test Setup |  | | | |
| Test Procedure | Band Edge measurement procedure<br>1. Set the EUT to maximum power setting and enable the EUT transmit continuously.<br>2. Band edge emissions must be at least 30 dB down from the highest emission level within the authorized band as a measured. The attenuation shall be be 30 dB instead of 20 dB when Peak conducted output power procedure is used.<br>3. Change modulation and channel bandwidth then repeat step 1 to 2.<br>4. Measured and record the results in the test report. | | | |
| Test Date | 08/02/2017 | Environmental condition | Temperature<br>Relative Humidity<br>Atmospheric Pressure | 22ºC<br>46%<br>1020mbar |
| Remark | N/A | | | |
| Result | ☒ Pass ☐ Fail | | | |

Test Data ☐ Yes ☒ N/A

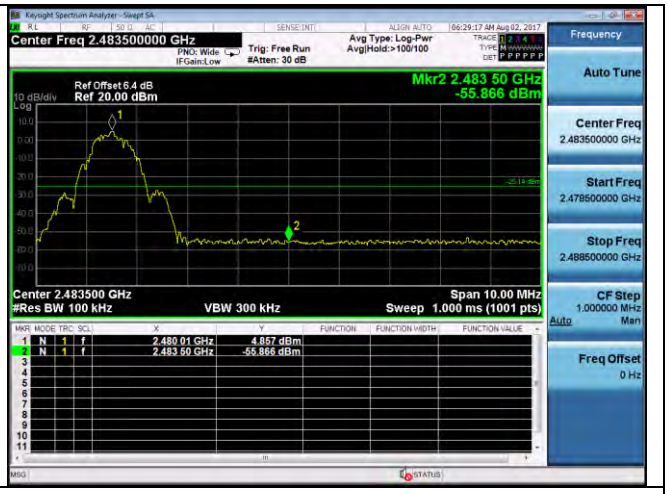
Test Plot ☒ Yes (See below) ☐ N/A

Test was done by *Rachana Khanduri* at *RF Test Site*.

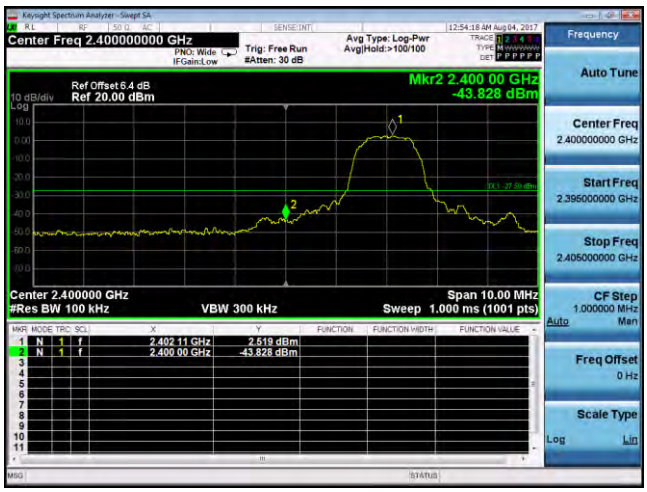
Band Edge Test Plots (Bluetooth)



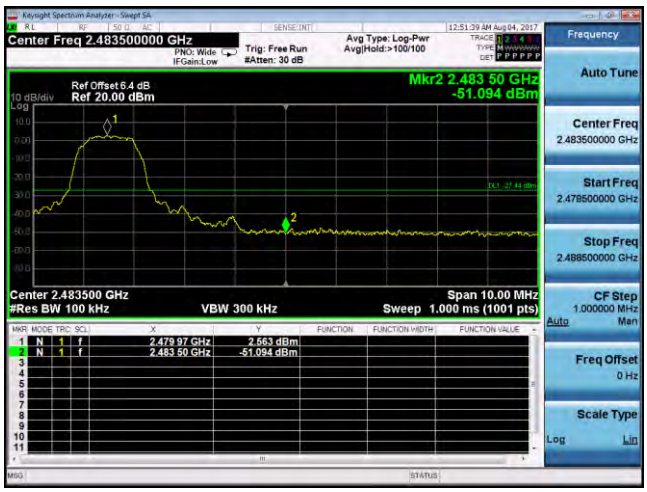

Band Edge -BDR 2402MHz




Band Edge -BDR 2480MHz

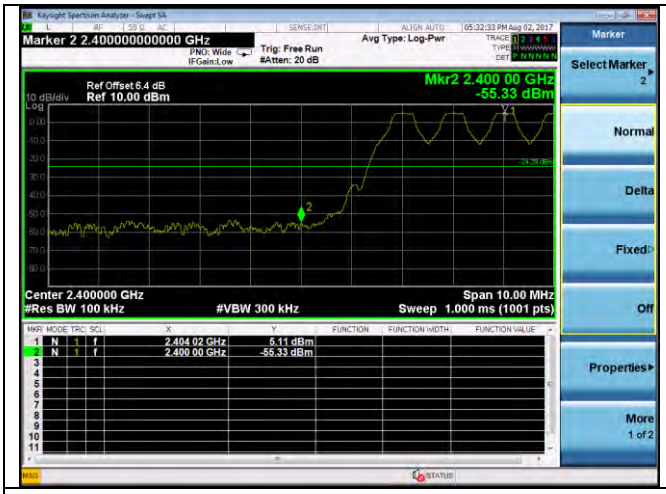



Band Edge -EDR 2402MHz

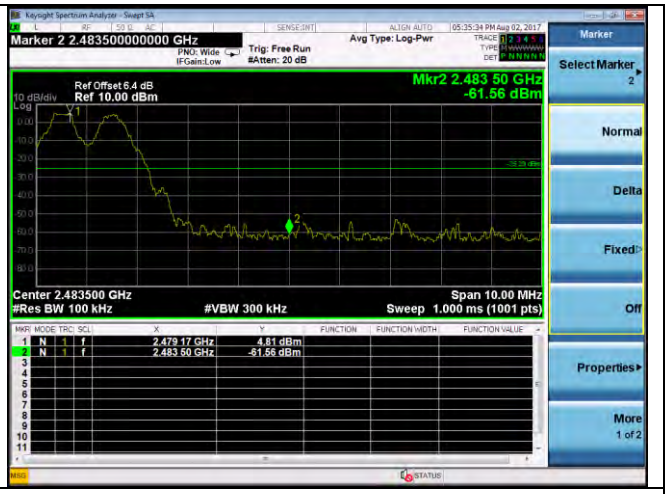



Band Edge -EDR 2480MHz

Band Edge Hopping Test Plots (Bluetooth)




Band Edge-Hopping-BDR 2402MHz



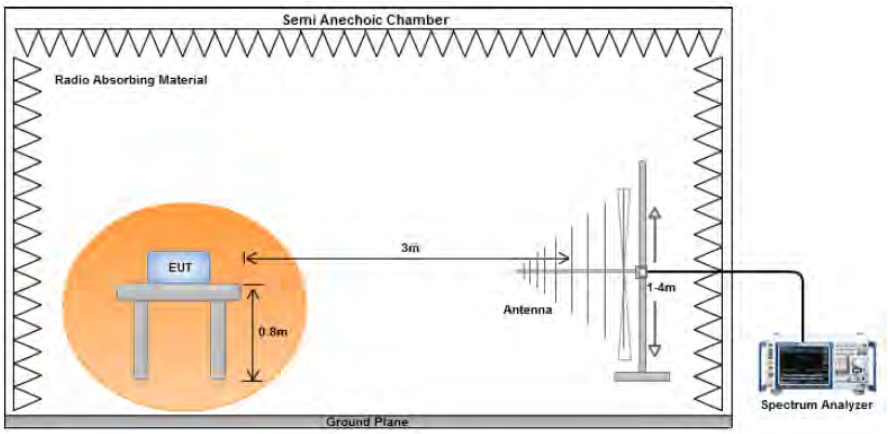

Band Edge- Hopping-BDR 2480MHz


Band Edge- Hopping-EDR 2402MHz


Band Edge- Hopping-EDR 2480MHz

## 10.8 Transmitter Radiated Spurious Emissions Below 1GHz

Requirement(s):

| Spec | Item | Requirement | Applicable |
|---|---|---|---|
| 47CFR§15.247(d), RSS247(5.5) | a) | Except higher limit as specified elsewhere in other section, the emissions from the low-power radio-frequency devices shall not exceed the field strength levels specified in the following table and the level of any unwanted emissions shall not exceed the level of the fundamental emission. The tighter limit applies at the band edges<br>Frequency range (MHz) / Field Strength (uV/m):<br>30 – 88 / 100<br>88 – 216 / 150<br>216 960 / 200<br>Above 960 / 500 | ☒ |
| Test Setup |  | | |
| Procedure | 1. The EUT was switched on and allowed to warm up to its normal operating condition.<br>2. The test was carried out at the selected frequency points obtained from the EUT characterisation. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:<br>a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.<br>b. The EUT was then rotated to the direction that gave the maximum emission.<br>c. Finally, the antenna height was adjusted to the height that gave the maximum emission.<br>3. A Quasi-peak measurement was then made for that frequency point.<br>4. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured. | | |
| Remark | The EUT was scanned up to 1GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case. | | |
| Result | ☒ Pass ☐ Fail | | |

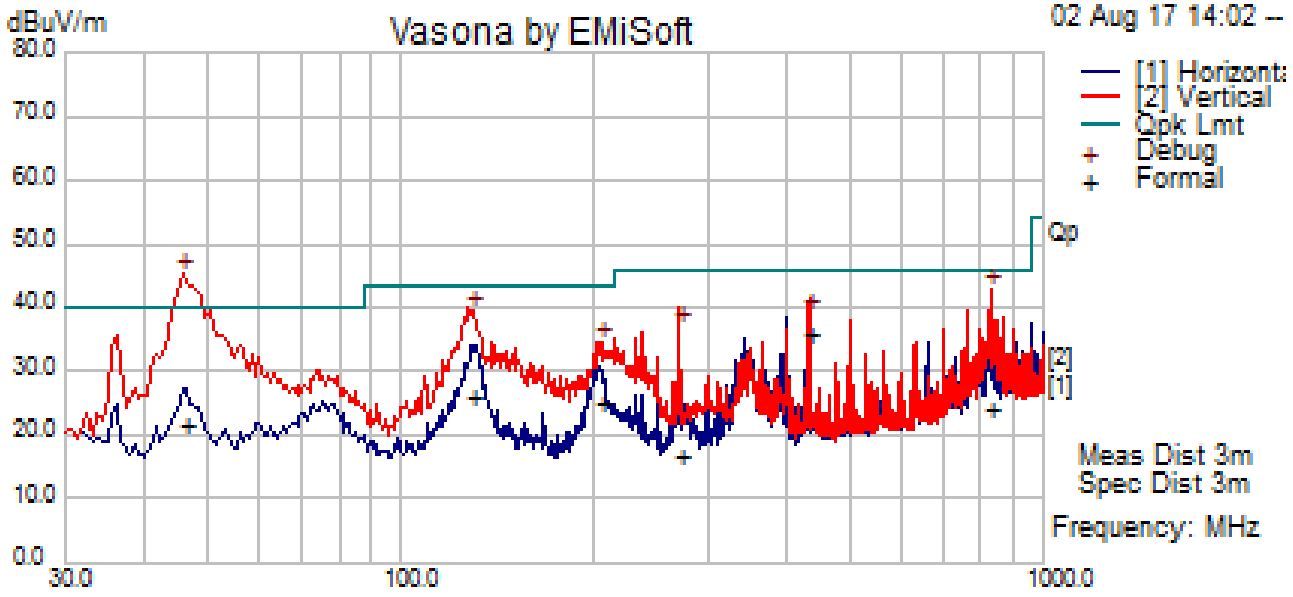
Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by *Rachana Khanduri* at *10m Chamber.*

## Radiated Emission Test Results (Below 1GHz)

| Test specification: | Radiated Spurious Emissions (30MHz – 1000MHz) | | | |
|---|---|---|---|---|
| Environmental Conditions: | Temp(°C): | 22 | Result : | ☒ Pass ☐ Fail |
| | Humidity (%): | 37 | | |
| | Atmospheric(mbar): | 1021 | | |
| Mains Power: | 120VAC, 60Hz | | | |
| Tested by: | Rachana Khanduri | | | |
| Test Date: | 08/02/2017 | | | |
| Remarks: | BDR 2441MHz | | | |

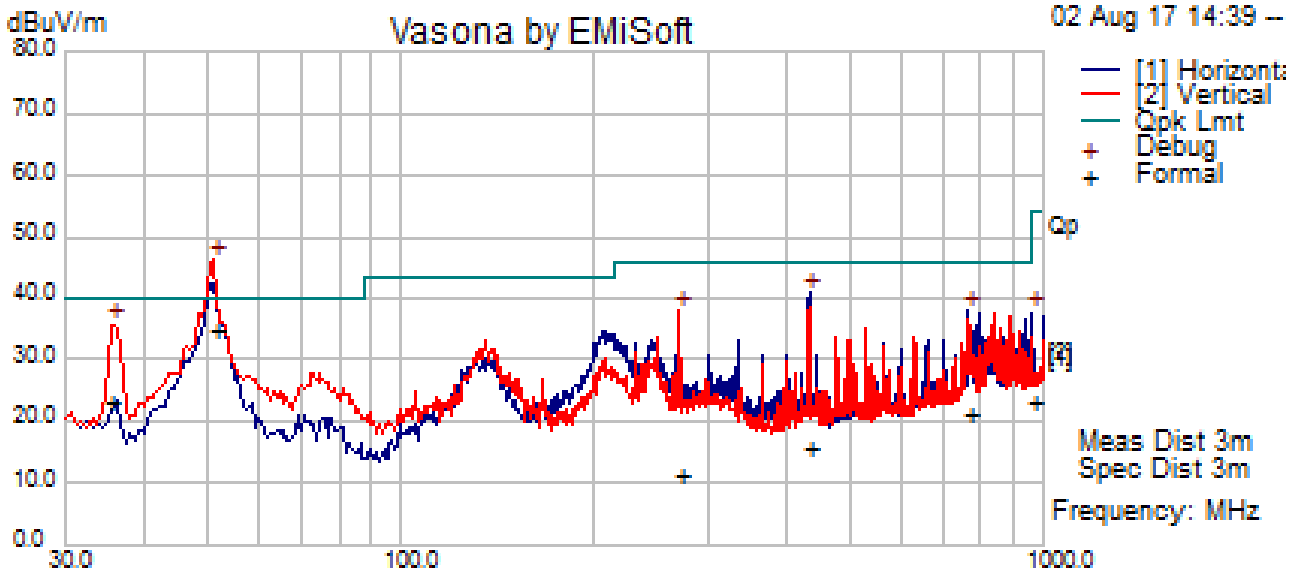



Quasi Max Measurement

| Frequency (MHz) | Raw (dBuV) | Cable Loss (dB) | AF (dB) | Level (dBuV/m) | Measurement Type | Pol (V/H) | Hgt (cm) | Azt (Deg) | Limit (dBuV/m) | Margin (dB) | Pass /Fail |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 45.976 | 35.42 | 11.54 | -25.60 | 21.36 | Quasi Max | H | 171 | 262 | 40 | -18.64 | Pass |
| 831.47 | 22.17 | 16.29 | -14.42 | 24.04 | Quasi Max | H | 129 | 152 | 46 | -21.96 | Pass |
| 128.769 | 36.39 | 12.29 | -22.87 | 25.80 | Quasi Max | H | 179 | 231 | 43.5 | -17.70 | Pass |
| 431.98 | 41.05 | 14.36 | -19.71 | 35.71 | Quasi Max | H | 214 | 269 | 46 | -10.29 | Pass |
| 205.00 | 36.44 | 12.88 | -24.16 | 25.16 | Quasi Max | H | 105 | 240 | 43.5 | -18.34 | Pass |
| 271.23 | 26.97 | 13.32 | -23.60 | 16.70 | Quasi Max | H | 147 | 208 | 46 | -29.30 | Pass |

Note: Both horizontal and vertical polarities were investigated. The results above show only the worst case.

| Test specification: | Radiated Spurious Emissions (30MHz – 1000MHz) | | | |
|---|---|---|---|---|
| Environmental Conditions: | Temp(°C): | 22 | Result : | ☒ Pass ☐ Fail |
| | Humidity (%): | 37 | | |
| | Atmospheric(mbar): | 1021 | | |
| Mains Power: | 120VAC, 60Hz | | | |
| Tested by: | Rachana Khanduri | | | |
| Test Date: | 08/02/2017 | | | |
| Remarks: | EDR 2441MHz | | | |

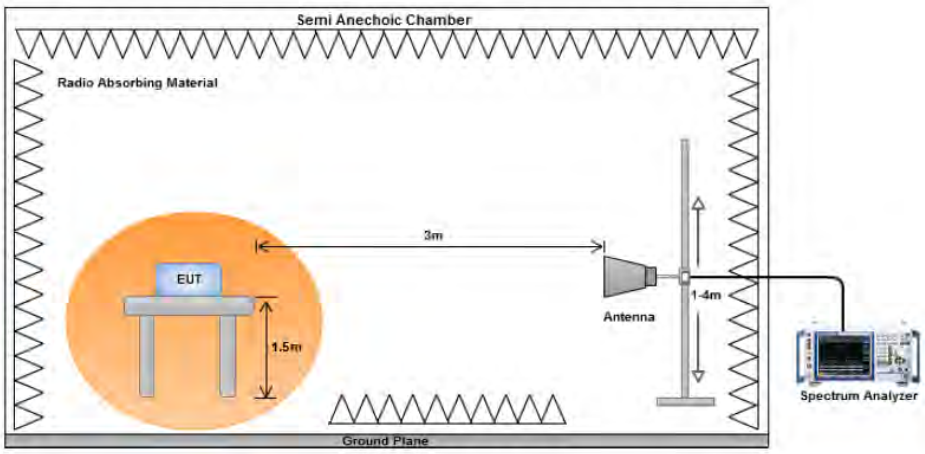



Quasi Max Measurement

| Frequency (MHz) | Raw (dBuV) | Cable Loss (dB) | AF (dB) | Level (dBuV/m) | Measurement Type | Pol (V/H) | Hgt (cm) | Azt (Deg) | Limit (dBuV/m) | Margin (dB) | Pass /Fail |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 51.13 | 50.43 | 11.59 | -27.25 | 34.77 | Quasi Max | V | 226 | 165 | 40 | -5.23 | Pass |
| 35.21 | 29.80 | 11.37 | -18.14 | 23.04 | Quasi Max | V | 177 | 201 | 40 | -16.96 | Pass |
| 433.34 | 20.95 | 14.36 | -19.69 | 15.62 | Quasi Max | H | 175 | 181 | 46 | -30.38 | Pass |
| 766.62 | 19.96 | 16.02 | -15.04 | 20.94 | Quasi Max | H | 106 | 243 | 46 | -25.06 | Pass |
| 271.42 | 21.64 | 13.33 | -23.59 | 11.37 | Quasi Max | V | 360 | 142 | 46 | -34.63 | Pass |
| 959.89 | 19.53 | 16.93 | -13.31 | 23.15 | Quasi Max | H | 376 | 76 | 46 | -22.86 | Pass |

## 10.9 Transmitter Radiated Spurious Emissions > 1GHz & Restricted band & non-restricted band emission

Requirement(s):

| Spec | Item | Requirement | Applicable |
|---|---|---|---|
| 47CFR§15.247(d), RSS247(5.5) | a) | For non-restricted band, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB or 30dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, determined by the measurement method on output power to be used. Attenuation below the general limits specified in § 15.209(a) is not required<br>☒ 20 dB down ☐ 30 dB down | ☒ |
| | b) | or restricted band, emission must also comply with the radiated emission limits specified in 15.209 | ☒ |
| Test Setup | |  | |
| Procedure | | 1. The EUT was switched on and allowed to warm up to its normal operating condition.<br>2. The test was carried out at the selected frequency points obtained from the EUT characterisation. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:<br>a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.<br>b. The EUT was then rotated to the direction that gave the maximum emission.<br>c. Finally, the antenna height was adjusted to the height that gave the maximum emission.<br>3. An average measurement was then made for that frequency point.<br>4. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured. | |
| Remark | | The EUT was scanned up to 26GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case. | |
| Result | | ☒ Pass ☐ Fail | |

Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☐ Yes (See below) ☒ N/A

Test was done by *Rachana Khanduri* at *3m Chamber.*

## Radiated Emission Test Results

### Bluetooth BDR – 2402MHz

| Frequency (MHz) | Raw (dBuV) | Cable Loss (dB) | AF (dB) | Level (dBuV/m) | Measurement Type | Pol (V/H) | Hgt (cm) | Azt (Deg) | Limit (dBuV/m) | Margin (dB) | Pass /Fail |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4804 | 45.28 | 5.47 | -2.03 | 48.73 | Peak Max | H | 138 | 107 | 74 | -25.28 | Pass |
| 1995 | 42.63 | 3.55 | -6.06 | 40.11 | Peak Max | V | 284 | 356 | 74 | -33.89 | Pass |
| 1328 | 51.7 | 3.01 | -9.22 | 45.49 | Peak Max | V | 159 | 146 | 74 | -28.51 | Pass |
| *13042 | 37.85 | 9.60 | 3.63 | 51.08 | Peak Max | V | 131 | 4 | 74 | -22.92 | Pass |
| 4804 | 37.33 | 5.47 | -2.03 | 40.77 | Average Max | H | 138 | 107 | 54 | -13.23 | Pass |
| 1995 | 30.53 | 3.55 | -6.06 | 28.01 | Average Max | V | 284 | 356 | 54 | -25.99 | Pass |
| 1328 | 32.21 | 3.01 | -9.22 | 26 | Average Max | V | 159 | 146 | 54 | -28 | Pass |
| *13042 | 26.48 | 9.60 | 3.63 | 39.70 | Average Max | V | 131 | 4 | 54 | -14.30 | Pass |

### Bluetooth BDR – 2441MHz

| Frequency (MHz) | Raw (dBuV) | Cable Loss (dB) | AF (dB) | Level (dBuV/m) | Measurement Type | Pol (V/H) | Hgt (cm) | Azt (Deg) | Limit (dBuV/m) | Margin (dB) | Pass /Fail |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4882 | 43.36 | 5.51 | -2.15 | 46.72 | Peak Max | H | 134 | 115 | 74 | -27.28 | Pass |
| 1869 | 43.52 | 3.45 | -6.69 | 40.28 | Peak Max | V | 356 | 231 | 74 | -33.72 | Pass |
| 1330 | 47.77 | 3.01 | -9.2 | 41.58 | Peak Max | H | 127 | 84 | 74 | -32.42 | Pass |
| *12166 | 39.79 | 9.27 | 2.46 | 51.51 | Peak Max | V | 229 | 66 | 74 | -22.49 | Pass |
| 4882 | 33.95 | 5.51 | -2.15 | 37.31 | Average Max | H | 134 | 115 | 54 | -16.69 | Pass |
| 1869 | 30.67 | 3.45 | -6.69 | 27.42 | Average Max | V | 356 | 231 | 54 | -26.58 | Pass |
| 1330 | 31.97 | 3.01 | -9.2 | 25.78 | Average Max | H | 127 | 84 | 54 | -28.22 | Pass |
| *12166 | 27.35 | 9.27 | 2.46 | 39.08 | Average Max | V | 229 | 66 | 54 | -14.93 | Pass |

### Bluetooth BDR – 2480MHz

| Frequency (MHz) | Raw (dBuV) | Cable Loss (dB) | AF (dB) | Level (dBuV/m) | Measurement Type | Pol (V/H) | Hgt (cm) | Azt (Deg) | Limit (dBuV/m) | Margin (dB) | Pass /Fail |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4960 | 44.15 | 5.56 | -2.17 | 47.54 | Peak Max | H | 122 | 96 | 74 | -26.46 | Pass |
| 1330 | 54.03 | 3.01 | -9.2 | 47.84 | Peak Max | H | 206 | 102 | 74 | -26.16 | Pass |
| 2266 | 43.51 | 3.78 | -6.12 | 41.17 | Peak Max | V | 262 | 181 | 74 | -32.83 | Pass |
| *16174 | 37.88 | 10.65 | 3.96 | 52.48 | Peak Max | V | 325 | 48 | 74 | -21.52 | Pass |
| 4960 | 36.63 | 5.56 | -2.17 | 40.02 | Average Max | H | 122 | 96 | 54 | -13.98 | Pass |
| 1330 | 32.73 | 3.01 | -9.2 | 26.54 | Average Max | H | 206 | 102 | 54 | -27.46 | Pass |
| 2266 | 31.13 | 3.78 | -6.12 | 28.79 | Average Max | V | 262 | 181 | 54 | -25.21 | Pass |
| *16174 | 25.97 | 10.65 | 3.96 | 40.58 | Average Max | V | 325 | 48 | 54 | -13.42 | Pass |

Bluetooth EDR – 2402MHz

| Frequency (MHz) | Raw (dBuV) | Cable Loss (dB) | AF (dB) | Level (dBuV/m) | Measurement Type | Pol (V/H) | Hgt (cm) | Azt (Deg) | Limit (dBuV/m) | Margin (dB) | Pass /Fail |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4804 | 40.93 | 5.47 | -2.03 | 44.37 | Peak Max | V | 137 | 76 | 74 | -29.63 | Pass |
| 1793 | 50.87 | 3.38 | -7.2 | 47.05 | Peak Max | V | 127 | 67 | 74 | -26.95 | Pass |
| 1328 | 53.27 | 3.01 | -9.22 | 47.06 | Peak Max | V | 163 | 143 | 74 | -26.94 | Pass |
| *16506 | 37.50 | 10.82 | 5.92 | 54.24 | Peak Max | V | 131 | 14 | 74 | -19.76 | Pass |
| 4804 | 28.87 | 5.47 | -2.03 | 32.31 | Average Max | V | 137 | 76 | 54 | -21.69 | Pass |
| 1793 | 30.25 | 3.38 | -7.2 | 26.43 | Average Max | V | 127 | 67 | 54 | -27.57 | Pass |
| 1328 | 33.87 | 3.01 | -9.22 | 27.66 | Average Max | V | 163 | 143 | 54 | -26.34 | Pass |
| *16506 | 25.73 | 10.82 | 5.92 | 42.47 | Average Max | V | 131 | 14 | 54 | -11.53 | Pass |

Bluetooth EDR – 2441MHz

| Frequency (MHz) | Raw (dBuV) | Cable Loss (dB) | AF (dB) | Level (dBuV/m) | Measurement Type | Pol (V/H) | Hgt (cm) | Azt (Deg) | Limit (dBuV/m) | Margin (dB) | Pass /Fail |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4882 | 46.66 | 5.51 | -2.15 | 50.02 | Peak Max | H | 205 | 255 | 74 | -23.98 | Pass |
| 1330 | 55.62 | 3.01 | -9.2 | 49.43 | Peak Max | H | 392 | 62 | 74 | -24.57 | Pass |
| 2011 | 41.58 | 3.56 | -6.02 | 39.11 | Peak Max | H | 257 | 324 | 74 | -34.89 | Pass |
| *14746 | 38.30 | 10.09 | 4.26 | 52.65 | Peak Max | V | 226 | 316 | 74 | -21.35 | Pass |
| 4882 | 37.95 | 5.51 | -2.15 | 41.31 | Average Max | H | 205 | 255 | 54 | -12.69 | Pass |
| 1330 | 30.81 | 3.01 | -9.2 | 24.62 | Average Max | H | 392 | 62 | 54 | -29.38 | Pass |
| 2011 | 29.97 | 3.56 | -6.02 | 27.51 | Average Max | H | 257 | 324 | 54 | -26.49 | Pass |
| *14746 | 25.84 | 10.09 | 4.26 | 40.19 | Average Max | V | 226 | 316 | 54 | -13.81 | Pass |

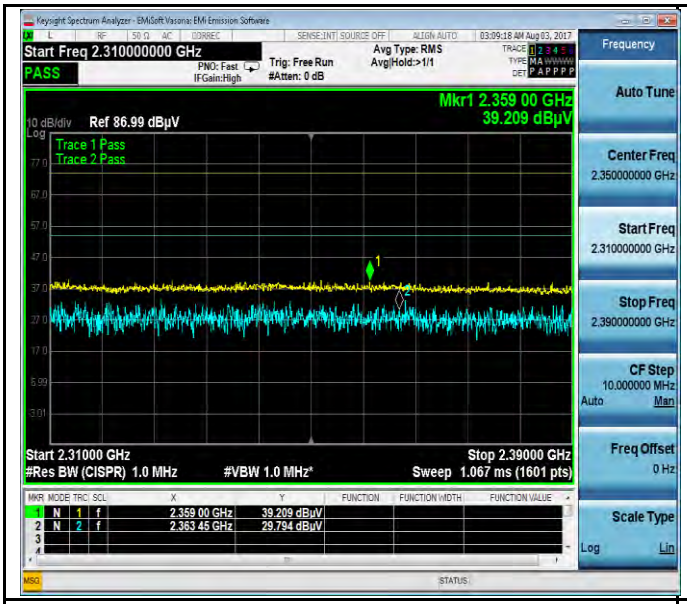
Bluetooth EDR – 2480MHz

| Frequency (MHz) | Raw (dBuV) | Cable Loss (dB) | AF (dB) | Level (dBuV/m) | Measurement Type | Pol (V/H) | Hgt (cm) | Azt (Deg) | Limit (dBuV/m) | Margin (dB) | Pass /Fail |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4960 | 50.57 | 5.56 | -2.17 | 53.96 | Peak Max | H | 105 | 89 | 74 | -20.04 | Pass |
| 1329 | 53.35 | 3.01 | -9.21 | 47.15 | Peak Max | V | 108 | 323 | 74 | -26.85 | Pass |
| 1107 | 43.45 | 2.86 | -11.23 | 35.09 | Peak Max | V | 336 | 261 | 74 | -38.92 | Pass |
| *14938 | 37.89 | 10.04 | 4.08 | 52.01 | Peak Max | V | 196 | 226 | 74 | -21.99 | Pass |
| 4960 | 43.83 | 5.56 | -2.17 | 47.21 | Average Max | H | 105 | 89 | 54 | -6.79 | Pass |
| 1329 | 31.39 | 3.01 | -9.21 | 25.19 | Average Max | V | 108 | 323 | 54 | -28.81 | Pass |
| 1107 | 31.16 | 2.86 | -11.23 | 22.8 | Average Max | V | 336 | 261 | 54 | -31.2 | Pass |
| *14938 | 25.86 | 10.04 | 4.08 | 39.98 | Average Max | V | 196 | 226 | 54 | -14.02 | Pass |

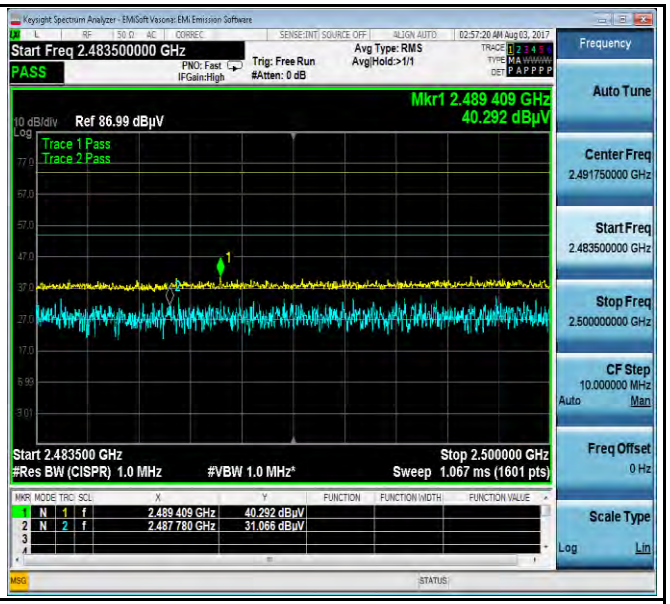
*EUT in horizontal orientation

Note: Both horizontal and vertical polarities were investigated. The results above show only the worst case.

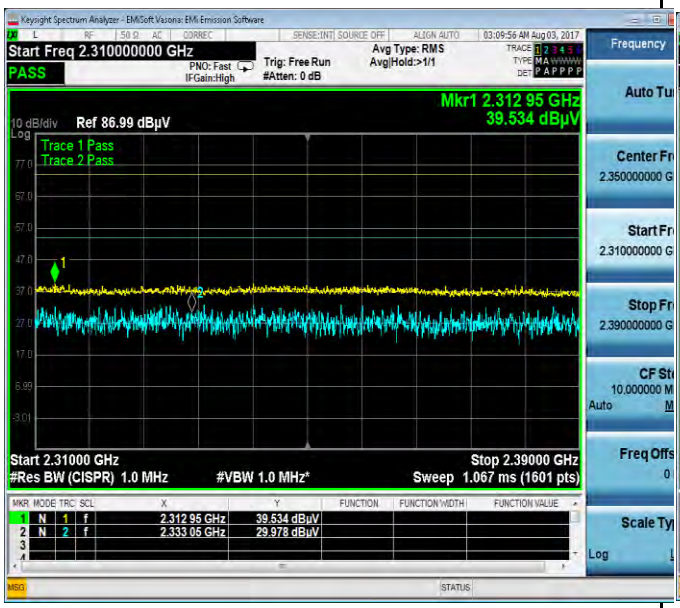
## Restricted Band Test plot (Bluetooth BDR/EDR)



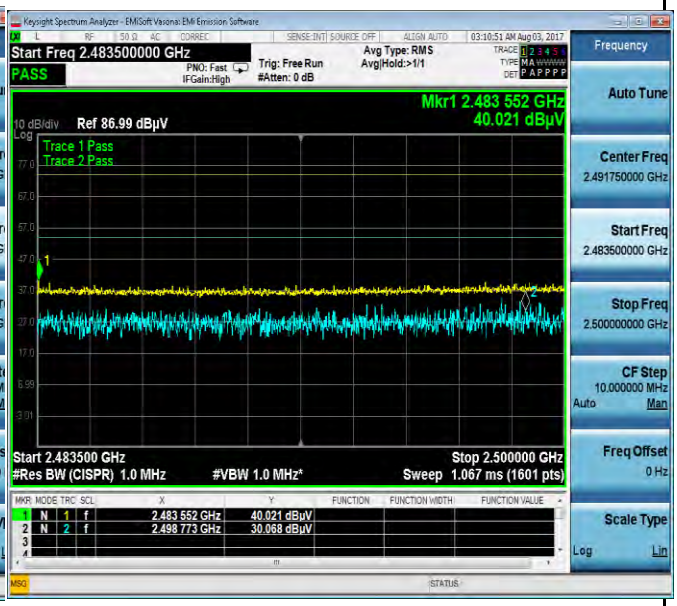

Restricted Band BDR 2402MHz




Restricted Band BDR 2480MHz




Restricted Band EDR 2402MHz




Restricted Band EDR 2480MHz

# Annex A. TEST INSTRUMENT

| Instrument | Model | Serial # | Cal Date | Cal Cycle | Cal Due | In use |
| --- | --- | --- | --- | --- | --- | --- |
| Conducted Emissions | | | | | | |
| R & S Receiver | ESIB 40 | 100179 | 04/21/2017 | 1 Year | 04/21/2018 | ☑ |
| CHASE LISN | MN2050B | 1018 | 08/16/2016 | 1 Year | 08/16/2017 | ☑ |
| Radiated Emissions | | | | | | |
| Keysight EXA 44GHz Spectrum Analyzer | N9010A | MY51440112 | 11/02/2016 | 1 Year | 11/02/2017 | ☑ |
| Bi-Log antenna (30MHz~2GHz) | JB1 | A030702 | 01/13/2017 | 1 Year | 01/13/2018 | ☑ |
| Horn Antenna (1GHz~26GHz) | 3115 | 100059 | 08/11/2016 | 1 Year | 08/11/2017 | ☑ |
| Pre-Amplifier (1-40GHz) | SAS-474 | 579 | 05/04/2017 | 1 Year | 05/04/2018 | ☑ |
| Preamplifier (100KHz-7GHz) | LPA-6-30 | 11140711 | 02/09/2017 | 1 Year | 02/09/2018 | ☑ |
| 3 Meters SAC | 3M | N/A | 09/09/2016 | 1 Year | 09/09/2017 | ☐ |
| 10 Meters SAC | 10M | N/A | 10/06/2016 | 1 Year | 10/06/2017 | ☑ |
| RF Conducted Measurement | | | | | | |
| Spectrum Analyzer | N9010A | 10SL0219 | 11/16/2016 | 1 Year | 11/16/2017 | ☑ |

# Annex B. SIEMIC Accreditation

| Accreditations | Document | Scope / Remark |
|---|---|---|
| ISO 17025 (A2LA) | | Please see the documents for the detailed scope |
| ISO Guide 65 (A2LA) | | Please see the documents for the detailed scope |
| TCB Designation | | A1, A2, A3, A4, B1, B2, B3, B4, C |
| FCC DoC Accreditation | | FCC Declaration of Conformity Accreditation |
| FCC Site Registration | | 3 meter site |
| FCC Site Registration | | 10 meter site |
| IC Site Registration | | 3 meter site |
| IC Site Registration | | 10 meter site |
| EU NB | | Radio & Telecommunications Terminal Equipment:<br>EN45001 – EN ISO/IEC 17025 |
| | | Electromagnetic Compatibility:<br>EN45001 – EN ISO/IEC 17025 |
| Singapore iDA<br>CB(Certification Body) | | Phase I, Phase II |
| Vietnam MIC<br>CAB Accreditation | | Please see the document for the detailed scope |
| Hong Kong OFCA | | (Phase II) OFCA Foreign Certification Body for Radio and Telecom |
| | | (Phase I) Conformity Assessment Body for Radio and Telecom |
| Industry Canada CAB | | Radio: Scope A – All Radio Standard Specification in Category I |
| | | Telecom: CS-03 Part I, II, V, VI, VII, VIII |

| | | |
|---|---|---|
| Japan Recognized Certification Body Designation | | Radio: A1. Terminal equipment for purpose of calling<br>Telecom: B1. Specified radio equipment specified in Article 38-2, Paragraph 1, Item 1 of the Radio Law |
| Korea CAB Accreditation | | EMI: KCC Notice 2008-39, RRL Notice 2008-3: CA Procedures for EMI<br>KN22: Test Method for EMI<br>EMS: KCC Notice 2008-38, RRL Notice 2008-4: CA Procedures for EMS<br>KN24, KN61000-4-2, -4-3, -4-4, -4-5, -4-6, -4-8, -4-11: Test Method for EMS |
| | | Radio: RRL Notice 2008-26, RRL Notice 2008-2, RRL Notice 2008-10, RRL Notice 2007-49, RRL Notice 2007-20, RRL Notice 2007-21, RRL Notice 2007-80, RRL Notice 2004-68 |
| | | Telecom: President Notice 20664, RRL Notice 2007-30, RRL Notice 2008-7 with attachments 1, 3, 5, 6; President Notice 20664, RRL Notice 2008-7 with attachment 4 |
| Taiwan NCC CAB Recognition | | LP0002, PSTN01, ADSL01, ID0002, IS6100, CNS14336, PLMN07, PLMN01, PLMN08 |
| Taiwan BSMI CAB Recognition | | CNS 13438 |
| Japan VCCI | | R-3083: Radiation 3 meter site<br>C-3421: Main Ports Conducted Interference Measurement<br>T-1597: Telecommunication Ports Conducted Interference Measurement |
| Australia CAB Recognition | | EMC: AS/NZS CISPR 11, AS/NZS CISPR 14.1, AS/NZS CISPR22, AS/NZS 61000.6.3, AS/NZS 61000.6.4 |
| | | Radio communications: AS/NZS 4281, AS/NZS 4268, AS/NZS 4280.1, AS/NZS 4280.2, AS/NZS 4295, AS/NZS 4582, AS/NZS 4583, AS/NZS 4769.1, AS/NZS 4769.2, AS/NZS 4770, AS/NZS 4771 |
| | | Telecommunications: AS/ACIF S002:05, AS/ACIF S003:06, AS/ACIF S004:06 AS/ACIF S006:01, AS/ACIF S016:01, AS/ACIF S031:01, AS/ACIF S038:01, AS/ACIF S040:01, AS/ACIF S041:05, AS/ACIF S043.2:06, AS/ACIF S60950.1 |
| Australia NATA Recognition | | AS/ACIF S002, AS/ACIF S003, AS/ACIF S004, AS/ACIF S006, AS/ACIF S016,AS/ACIF S031, AS/ACIF S038, AS/ACIF S040, AS/ACIF S041, AS/ACIF S043.2 |