



FCC / ISED & Test Report

For:
iRhythm Technologies

Model Name:
A102A5001

Product Description:
Zio AT Gateway

Applied Rules and Standards:
47 CFR Parts 27

FCC ID: 2AFBP-AT18G

IC ID: -----

REPORT #: EMC_IRHYT_011_FCC_27
DATE: 2018-04-24



A2LA Accredited

IC recognized #
3462B-1

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1 Assessment

The following device as further described in section 3 of this report was evaluated against the applicable criteria specified in the Code of Federal Regulations Title 47 parts 27.

No deficiencies were ascertained.

| Company Name | Product Description | Model # |
|----------------------|---------------------|-----------|
| iRhythm Technologies | Zio AT Gateway | A102A5001 |

Responsible for Testing Laboratory:

| 2018-04-24 | Compliance | James Donnellan (Lab Manager - EMC) | |
|------------|------------|--|-----------|
| Date | Section | Name | Signature |

Responsible for the Report:

| 2018-04-24 | Compliance | Kevin Wang (Senior EMC Engineer) | |
|------------|------------|-------------------------------------|-----------|
| Date | Section | Name | Signature |

The test results of this test report relate exclusively to the test item specified in Section 3.
CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM Inc. USA.

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the EMC Test Report

| | |
|-----------------------------|------------------------|
| Company Name: | CETECOM Inc. |
| Department: | Compliance |
| Street Address: | 411 Dixon Landing Road |
| City/Zip Code | Milpitas, CA 95035 |
| Country | USA |
| Telephone: | +1 (408) 586 6200 |
| Fax: | +1 (408) 586 6299 |
| Lab Manager-EMC: | James Donnellan |
| Responsible Project Leader: | Kevin Wang |

2.2 Identification of the Client

| | |
|-------------------|---------------------------|
| Applicant's Name: | iRhythm Technologies |
| Street Address: | 650 Townsend St. #500 |
| City/Zip Code | San Francisco, CA 94103 |
| Country | United States |
| Contact Person: | Chase Hathaway |
| Phone No. | 415-757-3086 |
| e-mail: | chathaway@irhythmtech.com |

2.3 Identification of the Manufacturer

| | |
|------------------------|----------------------|
| Manufacturer's Name: | iRhythm Technologies |
| Manufacturers Address: | 11085 Knott Ave B |
| City/Zip Code | Cypress, CA 90630 |
| Country | United States |

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3 Equipment Under Test (EUT)

3.1 EUT Specifications

| | |
|---|--|
| Model No | A102A5001 |
| HW Version | Hardware PCBA PN: A102A6002 Gateway Assembly PN: A102A5001 |
| SW Version | Application Processor Firmware Version: 180321 Gateway CC2640R2F Production 2.1.2.3 Bluetooth Processor Firmware Version: 180321 Gateway EFM32GG290 Manufacturing 2.1.1.3 Release |
| FCC-ID | 2AFBP-AT18G |
| IC-ID: | ----- |
| HVIN: | ----- |
| PMN: | ----- |
| Product Description | Zio AT Gateway, The Gateway device transfers cardiac monitoring data to/from a Bluetooth radio to/from a LTE Cat M1 radio, powered by a single LiPo battery for up to 14 days. |
| Transceiver Technology / Type(s) of Modulation | u-Blox Model: SARA-R410M-02B FCC ID: XPY2AGQN4NNN FDD LTE 13: QPSK |
| Frequency Range | FDD LTE 13: 777-787 MHz |
| Max. declared antenna gain | Taoglas PA.26A - LTE chip antenna; peak gain: 1.13dBi. |
| Power Supply/ Rated Operating Voltage Range | Dedicated Battery Pack Vmin: 2.75 VDC/ Vnom: 3.6 VDC / Vmax: 4.2 VDC |
| Operating Temperature Range | 0 °C ~ 40 °C |
| Sample Revision | <input type="checkbox"/> Prototype <input type="checkbox"/> Production <input checked="" type="checkbox"/> Pre-Production |

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3.2 EUT Sample details

| EUT # | Serial Number | HW Version | SW Version | Comments |
|-------|--------------------|---|--|---------------------|
| 1 | KETA RPS 180058 | Hardware PCBA PN: A102A6002 Gateway Assembly PN: A102A5001 | Application Processor Firmware Version: 180321 Gateway CC2640R2F Production 2.1.2.3 Bluetooth Processor Firmware Version: 180321 Gateway EFM32GG290 Manufacturing 2.1.1.3 Release | Radiated Testing |

3.3 Accessory Equipment (AE) details

| AE # | Type | Model | Manufacturer | Serial Number |
|------|--------------|--------------------------|--------------------|---------------|
| 1 | 3.6V Battery | NCA103450-PC-1 Rev. C | House of Batteries | B622190812 |

3.4 Test Sample Configuration

| Set-up # | EUT / AE used for set-up | Comments |
|----------|--------------------------|--|
| 1 | EUT#1 | The EUT was configured to LTE Band 13 CAT M1 low and high channel with Bluetooth LE 5.0 with 2Mbps on the low channel. |

4 Subject of Investigation

The objective of the measurements done by CETECOM Inc. was to evaluate the compliance of the EUT against the relevant requirements specified in the Code of Federal Regulations Title 47 part 27.

4.1 Dates of Testing:

03/26/2018 - 03/30/2018

4.2 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus, with 95% confidence interval (in dB delta to result), based on a coverage factor k=1.

Radiated measurement

| | |
|--------------------|---------------------------------|
| 9 kHz to 30MHz | ±2.5 dB (Magnetic Loop Antenna) |
| 30 MHz to 1000 MHz | ±2.0 dB (Biconilog Antenna) |
| 1 GHz to 40 GHz | ±2.3 dB (Horn Antenna) |

Conducted measurement

| | |
|-------------------|----------------|
| 150 kHz to 30 MHz | ±0.7 dB (LISN) |
|-------------------|----------------|

| | |
|--------------------------|---------|
| RF conducted measurement | ±0.5 dB |
|--------------------------|---------|

4.3 Environmental Conditions during Testing:

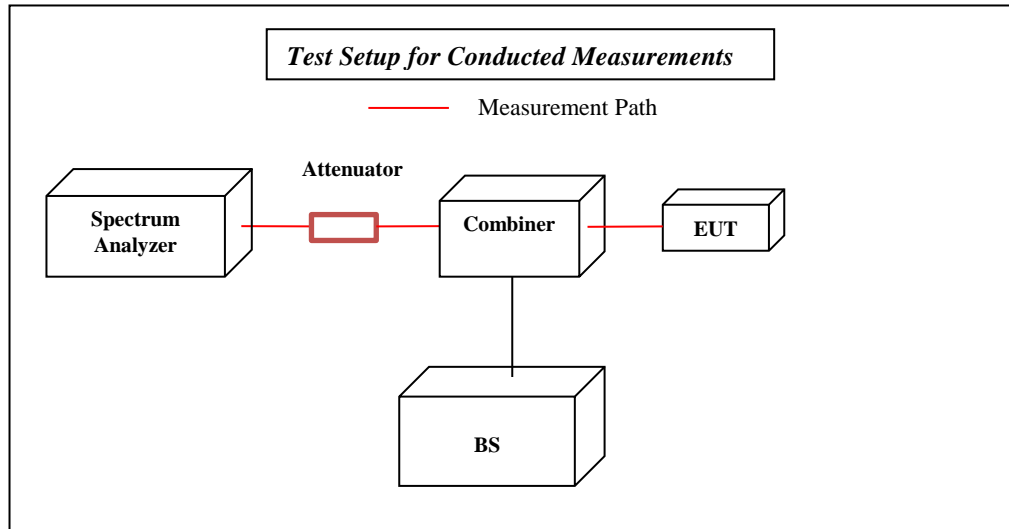
The following environmental conditions were maintained during the course of testing:

- Ambient Temperature: 20-25°C
- Relative humidity: 40-60%

Deviating test conditions are indicated at individual test description where applicable.

5 Measurement Procedures

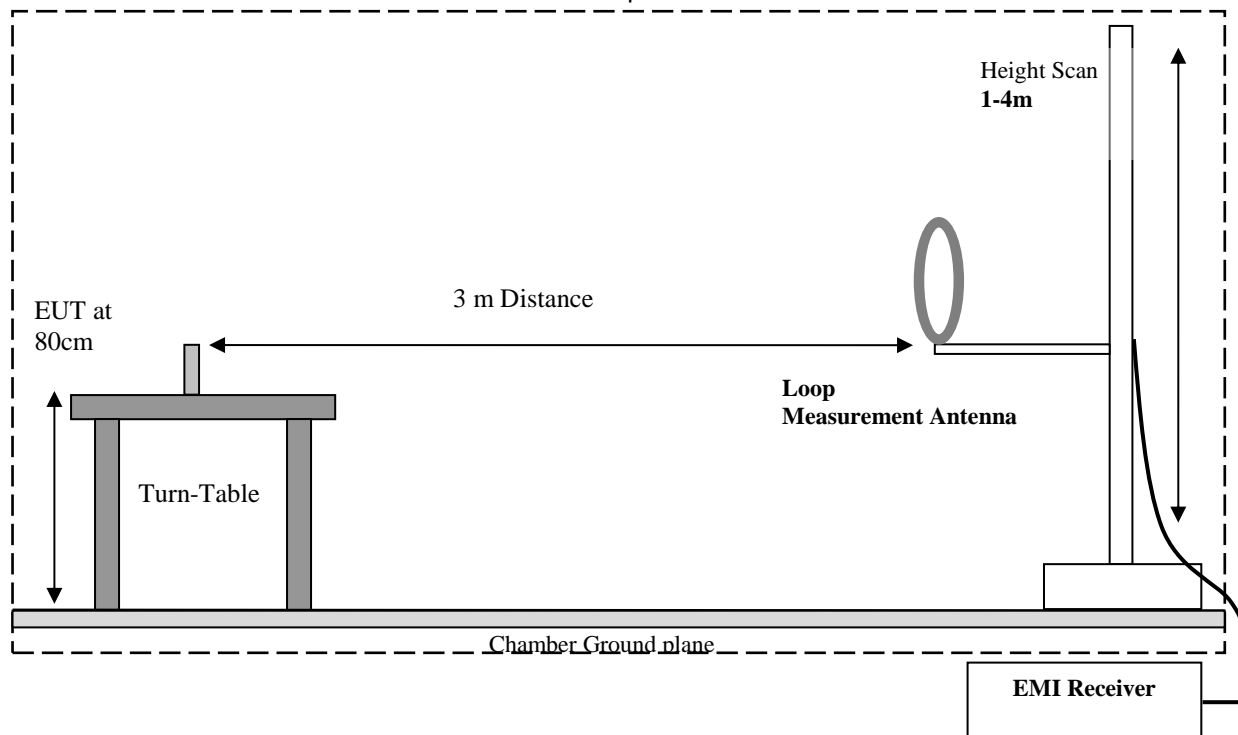
Testing is performed according to the guidelines provided in FCC publication (KDB) 971168 D01 v02r02 – “Measurement Guidance for Certification of Licensed Digital Transmitters” and according to relevant parts of ANSI/TIA-603-D-2010 as detailed below.



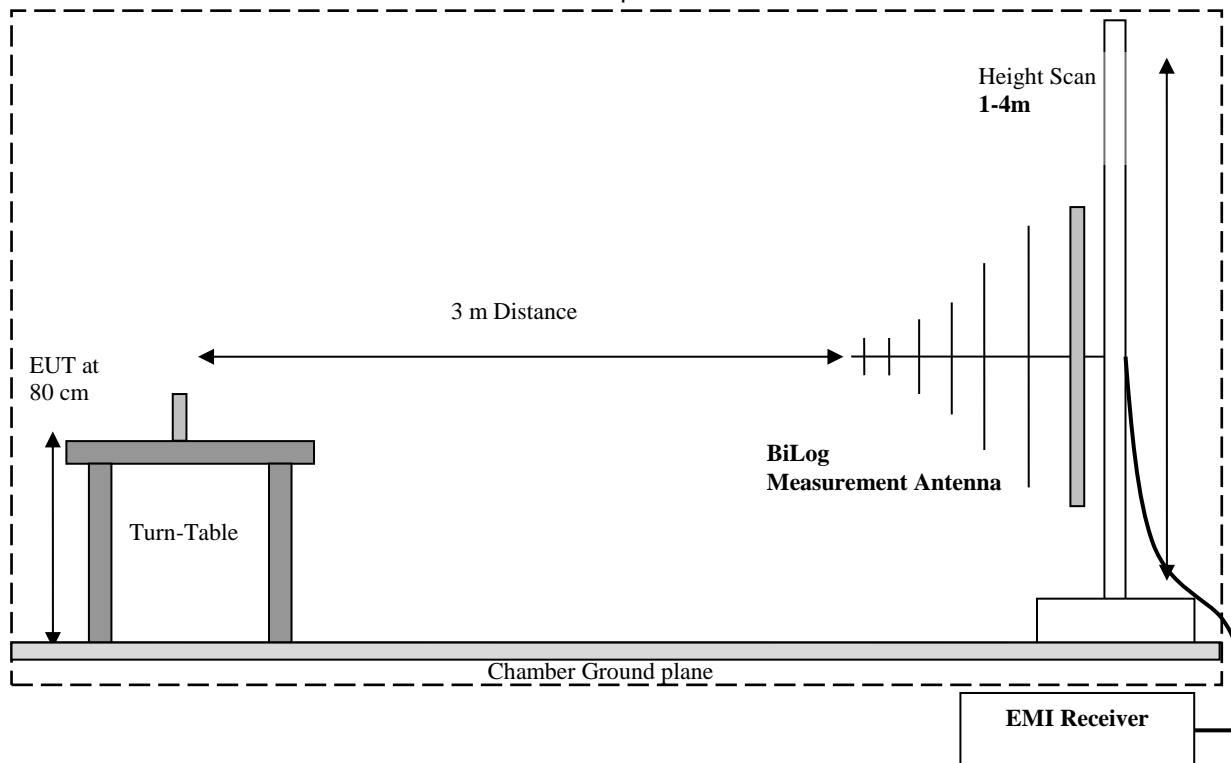
5.1 Radiated Measurement

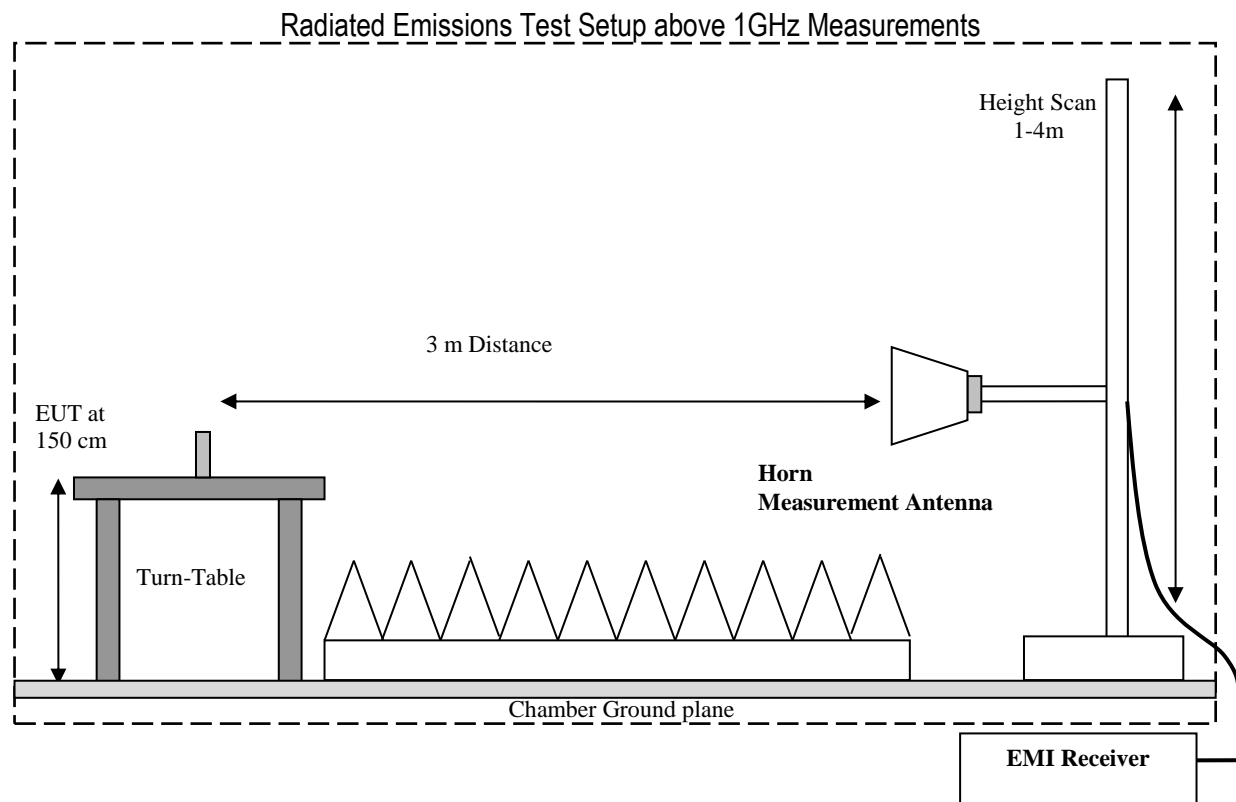
- The exploratory measurement is accomplished by running a matrix of 16 sweeps over the required frequency range with R&S Test-SW EMC32 for 4 positions of the turntable, two orthogonal positions of the EUT and both antenna polarizations. This procedure exceeds the requirement of the above standards to cover the 3 orthogonal axis of the EUT. A max peak detector is utilized during the exploratory measurement. The Test-SW creates an overall maximum trace for all 12 sweeps and saves the settings for each point of this trace. The maximum trace is part of the test report.
- The 10 highest emissions are selected with an automatic algorithm of EMC32 searching for peaks in the noise floor and ensuring that broadband signals are not selected multiple times.
- The maxima are then put through the final measurement and again maximized in a 90deg range of the turntable, fine search in frequency domain and height scan between 1m and 4m.
- The above procedure is repeated for all possible ways of power supply to EUT and for all supported modulations.
- In case there are no emissions above noise floor level only the maximum trace is reported as described above.
- The results are split up into up to 4 frequency ranges due to antenna bandwidth restrictions. A magnetic loop is used from 9 kHz to 30 MHz, a Biconilog antenna is used from 30 MHz to 1 GHz, and two different horn antennas are used to cover frequencies up to 40 GHz.

Radiated Emissions Test Setup below 30MHz Measurements



Radiated Emissions Test Setup 30MHz-1GHz Measurements





5.2 Sample Calculations for Field Strength Measurements

Field Strength is calculated from the Spectrum Analyzer/ Receiver readings, taking into account the following parameters:

- Measured reading in dB μ V
- Cable Loss between the receiving antenna and SA in dB and
- Antenna Factor in dB/m

All radiated measurement plots in this report are taken from a test SW that calculates the Field Strength based on the following equation:

$$FS \text{ (dB}\mu\text{V/m)} = \text{Measured Value on SA (dB}\mu\text{V)} - \text{Cable Loss (dB)} + \text{Antenna Factor (dB/m)}$$

Example:

| Frequency (MHz) | Measured SA (dB μ V) | Cable Loss (dB) | Antenna Factor Correction (dB) | Field Strength Result (dB μ V/m) |
|-----------------|--------------------------|-----------------|--------------------------------|--------------------------------------|
| 1000 | 80.5 | 3.5 | 14 | 98.0 |

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6 Measurement Results Summary

6.1 FCC 27 / RSS-139

| Test Specification | Test Case | Temperature and Voltage Conditions | Mode | Pass | Fail | NA | NP | Result |
|--------------------|------------------------------|------------------------------------|-------------|--------------------------|--------------------------|--------------------------|--------------------------|----------|
| §2.1046; §27.50 | RF Output Power | Nominal | LTE Band 13 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | ■ | Note 2 |
| §2.1055; §27.54 | Frequency Stability | Extreme Temperature and Voltage | LTE Band 13 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | ■ | Note 2 |
| §2.1049; §27.53 | Occupied Bandwidth | Nominal | LTE Band 13 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | ■ | Note 2 |
| §2.1051; §27.53 | Band Edge Compliance | Nominal | LTE Band 13 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | ■ | Note 2 |
| §2.1051; §27.53 | Conducted Spurious Emissions | Nominal | LTE Band 13 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | ■ | Note 2 |
| §2.1053; §27.53 | Radiated Spurious Emissions | Nominal | LTE Band 13 | ■ | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Complies |

Note 1: NA= Not Applicable; NP= Not Performed.

Note 2: Data leveraged from modular approval, FCC ID: XPY2AGQN4NNN.

7 Test Result Data

7.1 Radiated Spurious Emissions

7.1.1 Measurement utilizing KDB 971168 D01 Power Meas License Digital Systems v02r02, and according to ANSI/TIA-603-D-2010

Spectrum Analyzer Settings for FCC 22

| | | | |
|----------------------|---------------|--------------|--------------|
| Frequency Range | 30MHz – 1 GHz | 1 – 1.58 GHz | 1.58 – 9 GHz |
| Resolution Bandwidth | 100 kHz | 1 MHz | 1 MHz |
| Video Bandwidth | 100 kHz | 1 MHz | 1 MHz |
| Detector | Peak | Peak | Peak |
| Trace Mode | Max Hold | Max Hold | Max Hold |
| Sweep Time | Auto | Auto | Auto |

Spectrum Analyzer Settings for FCC 24

| | | | | |
|----------------------|---------------|-------------|--------------|---------------|
| Frequency Range | 30MHz – 1 GHz | 1 – 2.7 GHz | 2.7 – 18 GHz | 18 – 19.1 GHz |
| Resolution Bandwidth | 100 kHz | 1 MHz | 1 MHz | 1 MHz |
| Video Bandwidth | 100 kHz | 1 MHz | 1 MHz | 1 MHz |
| Detector | Peak | Peak | Peak | Peak |
| Trace Mode | Max Hold | Max Hold | Max Hold | Max Hold |
| Sweep Time | Auto | Auto | Auto | Auto |

7.1.2 Limits:

7.1.2.1 FCC Part 22.917 (a); FCC Part 24.238 (a); FCC Part 27.53 (h)

Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

7.1.2.2 RSS-132 Part 5.5; RSS-133 Part 6.5; RSS-139 Part 6.6 Transmitter Unwanted Emissions

Mobile and base station equipment shall comply with the limits in (i) and (ii) below.

i. In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p$ (watts).

ii. After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p$ (watts). If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz is required.

Note: The limit calculation result is a constant of -13 dBm.

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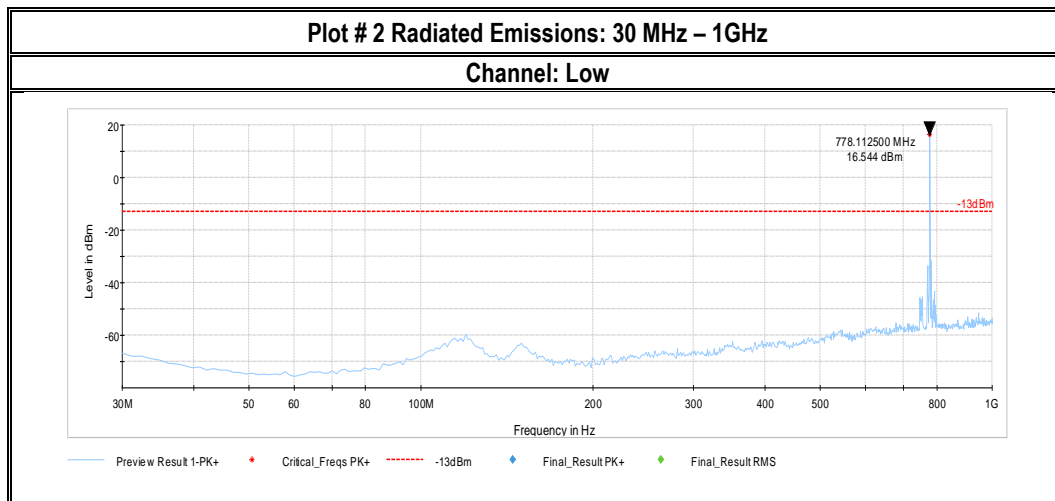
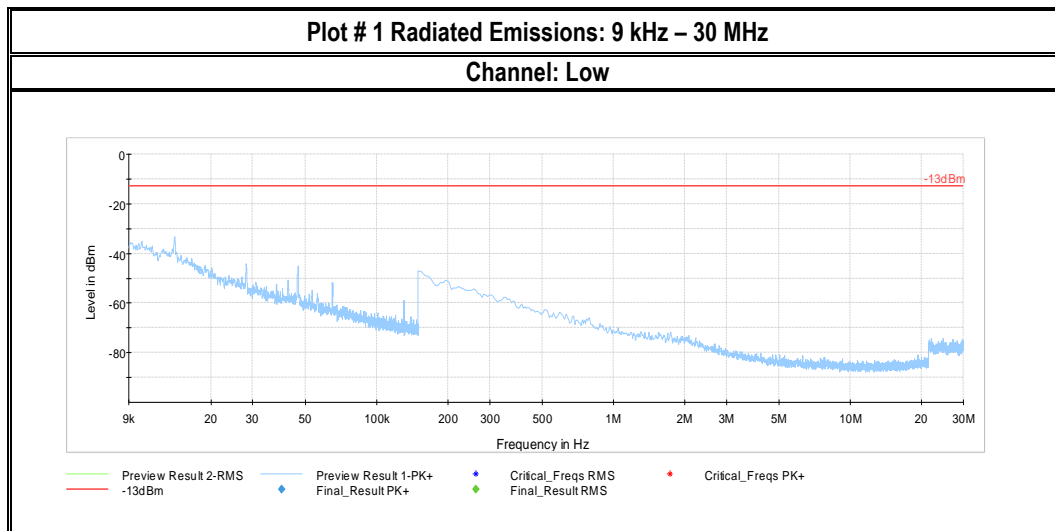
7.1.3 Test conditions and setup:

| Ambient Temperature (C) | EUT Set-Up # | EUT operating mode | Power Input |
|-------------------------|--------------|------------------------|----------------|
| 22 | 1 | LTE Band 13 + BTLE 5.0 | 3.6VDC Battery |

7.1.4 Measurement result:

| Plot # | Channel | EUT operating mode | Scan Frequency | Limit (dBm) | Result |
|--------|---------|--------------------|-----------------|-------------|--------|
| 1-5 | Low | LTE Band 13 | 9 kHz – 26 GHz | -13 | Pass |
| 6-8 | High | LTE Band 13 | 30 MHz – 18 GHz | -13 | Pass |

7.1.5 Measurement Plots:



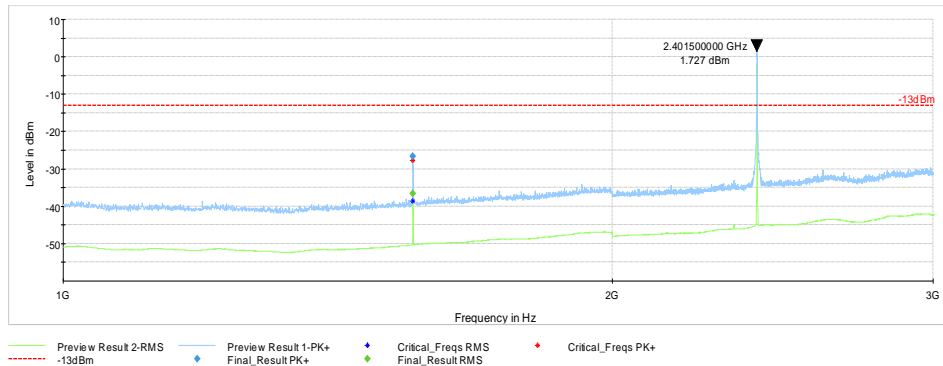
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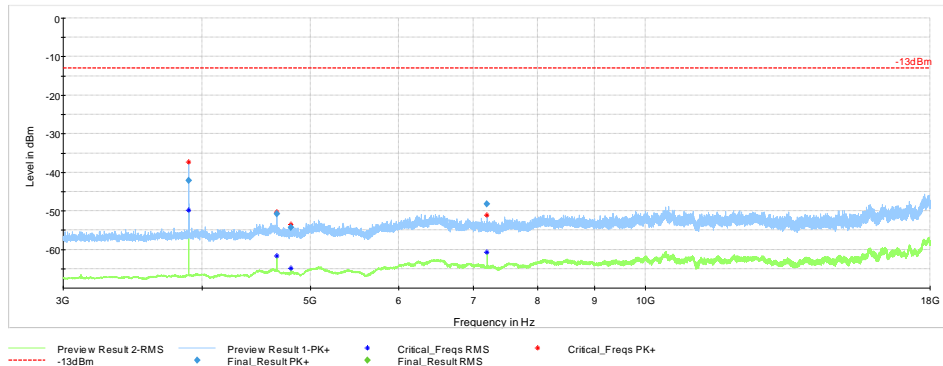
Plot # 3 Radiated Emissions: 1-3 GHz

Channel: Low



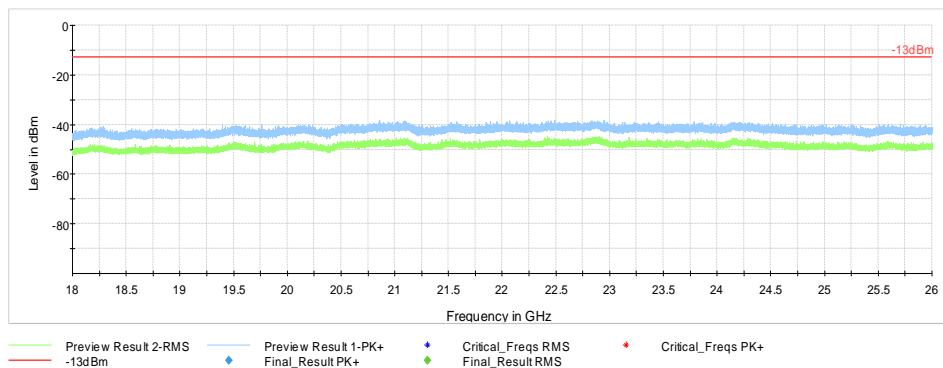
Plot # 4 Radiated Emissions: 3-18 GHz

Channel: Low



Plot # 5 Radiated Emissions: 18-26 GHz

Channel: Low



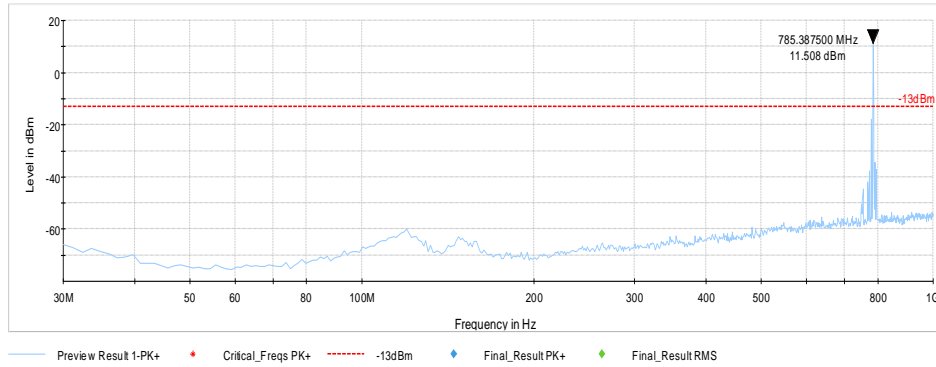
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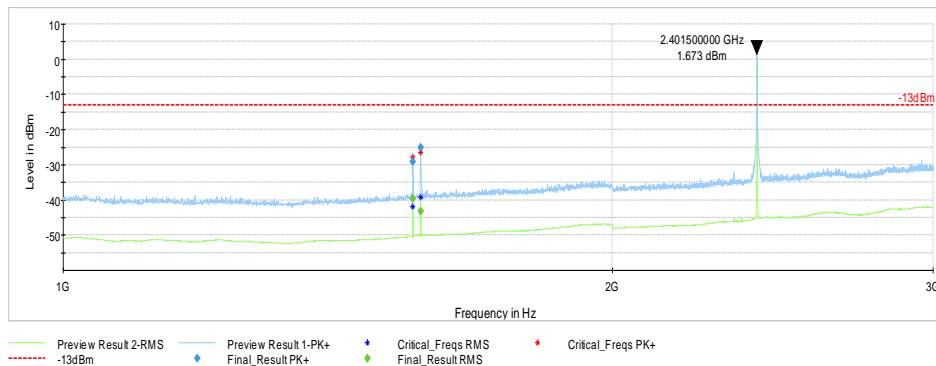
Plot # 6 Radiated Emissions: 30 MHz – 1GHz

Channel: High



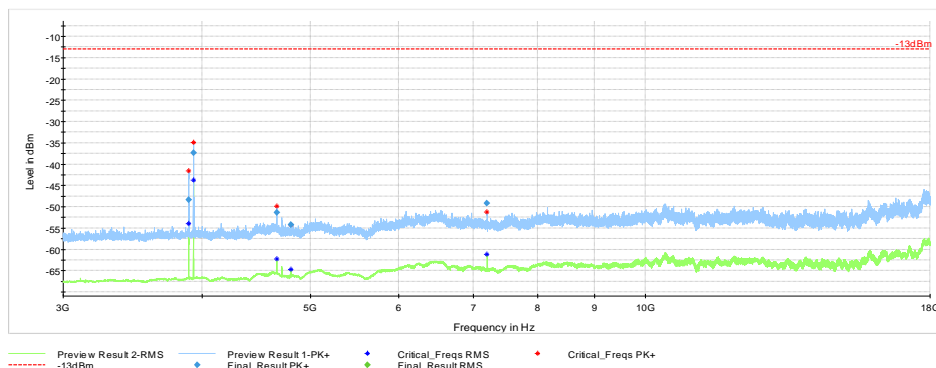
Plot # 7 Radiated Emissions: 1-3 GHz

Channel: High



Plot # 8 Radiated Emissions: 3-18 GHz

Channel: High



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8 Test setup photos

Setup photos are included in supporting file name: "EMC_IRHYT_011_FCC_27_Setup_photos.pdf"

9 Test Equipment And Ancillaries Used For Testing

| Item Name | Equipment Type | Manufacturer | Model | Serial # | Calibration Cycle | Last Calibration Date |
|----------------------------|------------------------|-----------------|---------|----------|-------------------|-----------------------|
| Antenna Loop Passive | Loop Antenna | ETS Lindgren | 6507 | 161344 | 3 Year | 10/26/2017 |
| Antenna Biconilog 3142E | Biconlog Antenna | EMCO | 3142E | 166067 | 3 Year | 06/27/2017 |
| Antenna Horn 3115 SN 35111 | Horn Antenna | EMCO | 3115 | 35111 | 3 Year | 07/24/2015 |
| Antenna Horn 3116 | Horn Antenna | ETS Lindgren | 3116 | 70497 | 3 Year | 10/31/2017 |
| Horn Antenna 3117-PA | Horn Antenna | ETS Lindgren | 3117-PA | 215984 | 3 Year | 01/26/2018 |
| ESU40 | EMI Test Receiver | Rohde & Schwarz | ESU40 | 100251 | 3 Year | 01/31/2018 |
| Thermometer Humidity TM320 | Thermometer Humidity | Dickson | TM320 | 5280063 | 1 Year | 11/02/2017 |
| CMW500 | Base Station Simulator | R&S | CMW500 | 127068 | 2 Year | 07/01/2017 |
| FSU | Spectrum Analyzer | R&S | FSU | 200256 | 2 Year | 07/04/2017 |
| Antenna Loop Passive | Loop Antenna | ETS Lindgren | 6507 | 161344 | 3 Year | 10/26/2017 |
| Antenna Biconilog 3142E | Biconlog Antenna | EMCO | 3142E | 166067 | 3 Year | 06/27/2017 |

Equipment used meets the measurement uncertainty requirements as required per applicable standards for 95% confidence levels.

Calibration due dates, unless defined specifically, falls on the last day of the month. Items indicated "N/A" for cal status either do not specifically require calibration or is internally characterized before use.

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10 Revision History

| Date | Report Name | Changes to report | Report prepared by |
|------------|----------------------|-------------------|--------------------|
| 2018-04-17 | EMC_IRHYT_011_FCC_27 | Initial Version | Kevin Wang |
| | | | |