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: 2018-05-03

A2LA Accredited

IC recognized # 3462B-1

***CETECOM* Inc.**
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CETECOM Inc. is a Delaware Corporation with Corporation number: 2905571

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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:

Date	Section	Name	Signature
2018-05-03	Compliance	James Donnellan (Lab Manager - EMC)	James Donnellan

Responsible for the Report:

Date	Section	Name	Signature
2018-05-03	Compliance	Kevin Wang (Senior EMC Engineer)	Kevin Wang Digitally signed by Kevin Wang DN: cn=Kevin Wang, o=CETECOM Inc., ou=EMC, email=Kevin.Wang@cetecom.com, c=US Date: 2018.05.03 14:28:50 -07'00'

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

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

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 Bluetooth version 4.0 and 5.0, Low Energy: GFSK
Frequency Range	FDD LTE 13: 777-787 MHz Bluetooth Low Energy: 2400-2483.5MHz
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 ºC ~ 40 ºC
Sample Revision	☐Prototype ☐Production ■ Pre-Production

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	LTE Band 13 CAT M1 was configured as 1 RB for Uplink with NB Position at Low or High. Bluetooth LE was configured as BLE 5.0 with 2 Mbps on the low channel which has the highest output power.

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:

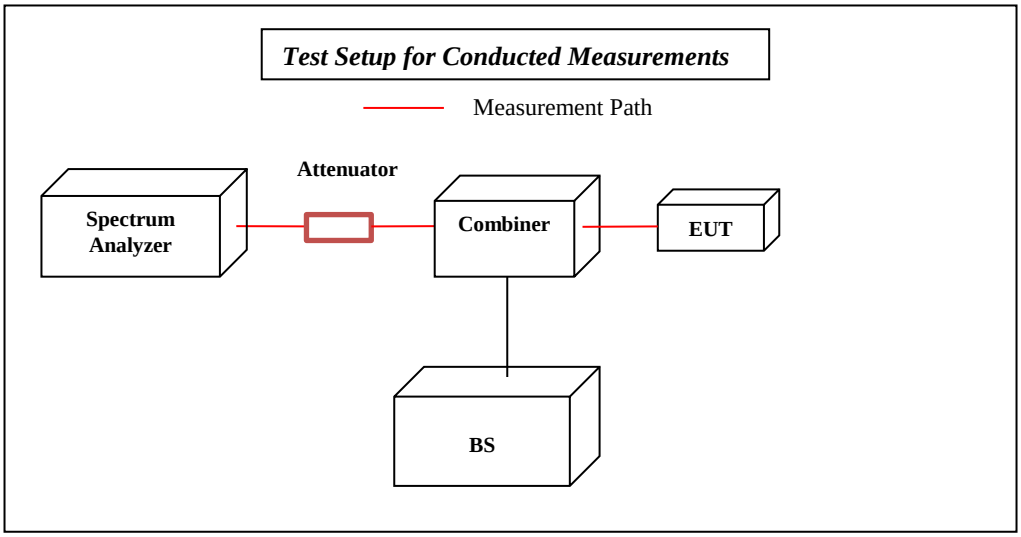
The following environmental conditions were maintained during the course of testing:

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

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

5 Measurement Procedures

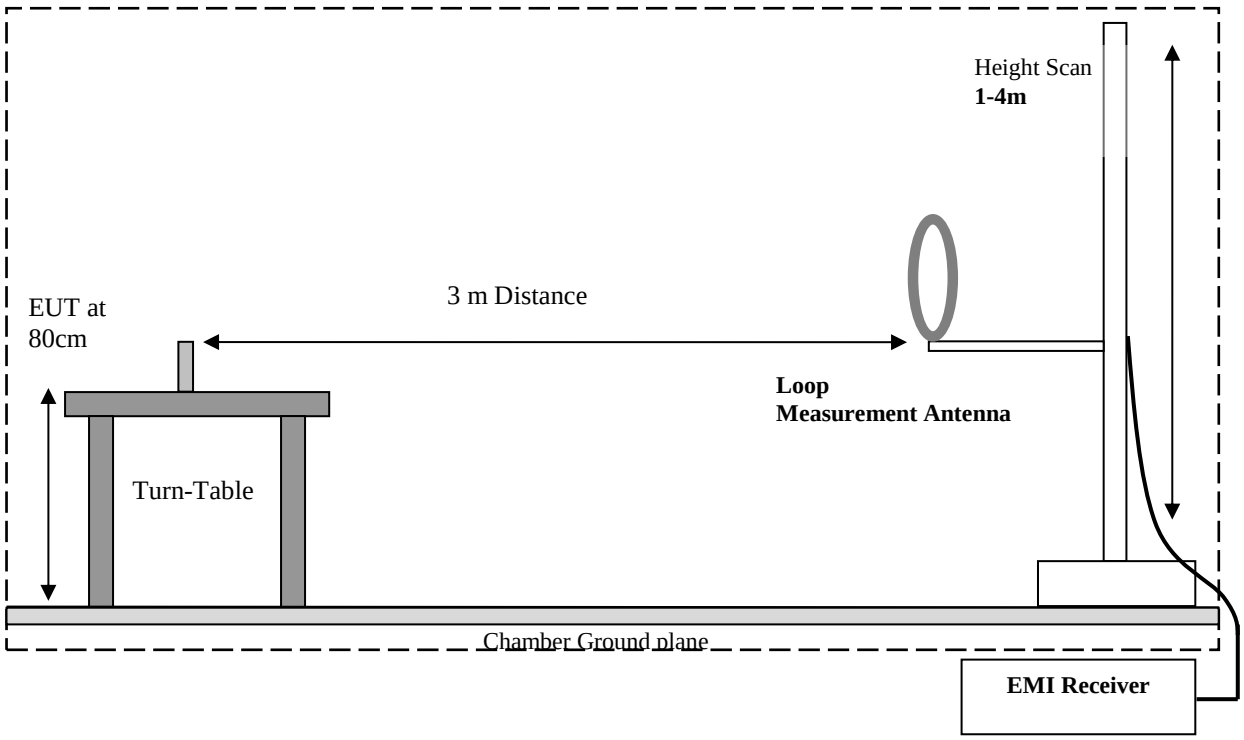
Testing is performed according to the guidelines provided in FCC publication (KDB) 971168 D01 v02r02 – "Measurement Guidance for Certification of Licensed Digital Transmitters" and according to relevant parts of ANSI/TIA-603-D-2010 as detailed below.



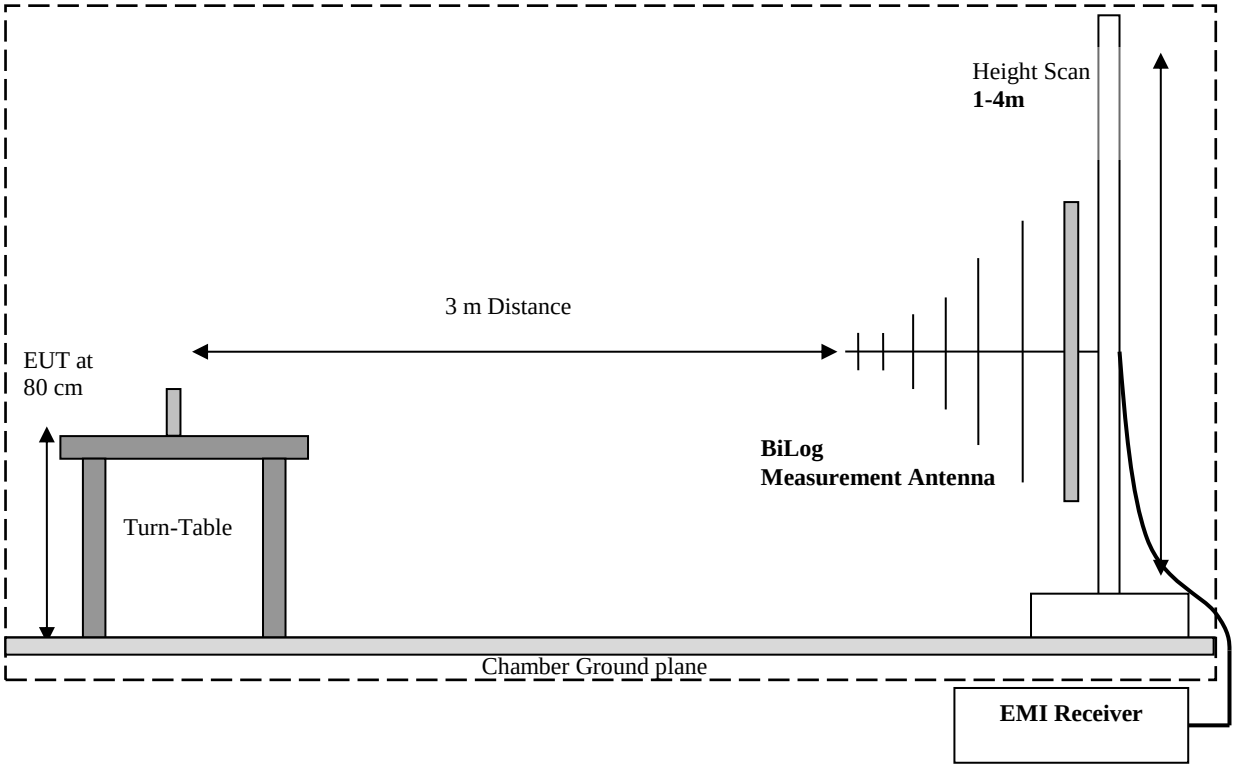
5.1 Radiated Measurement

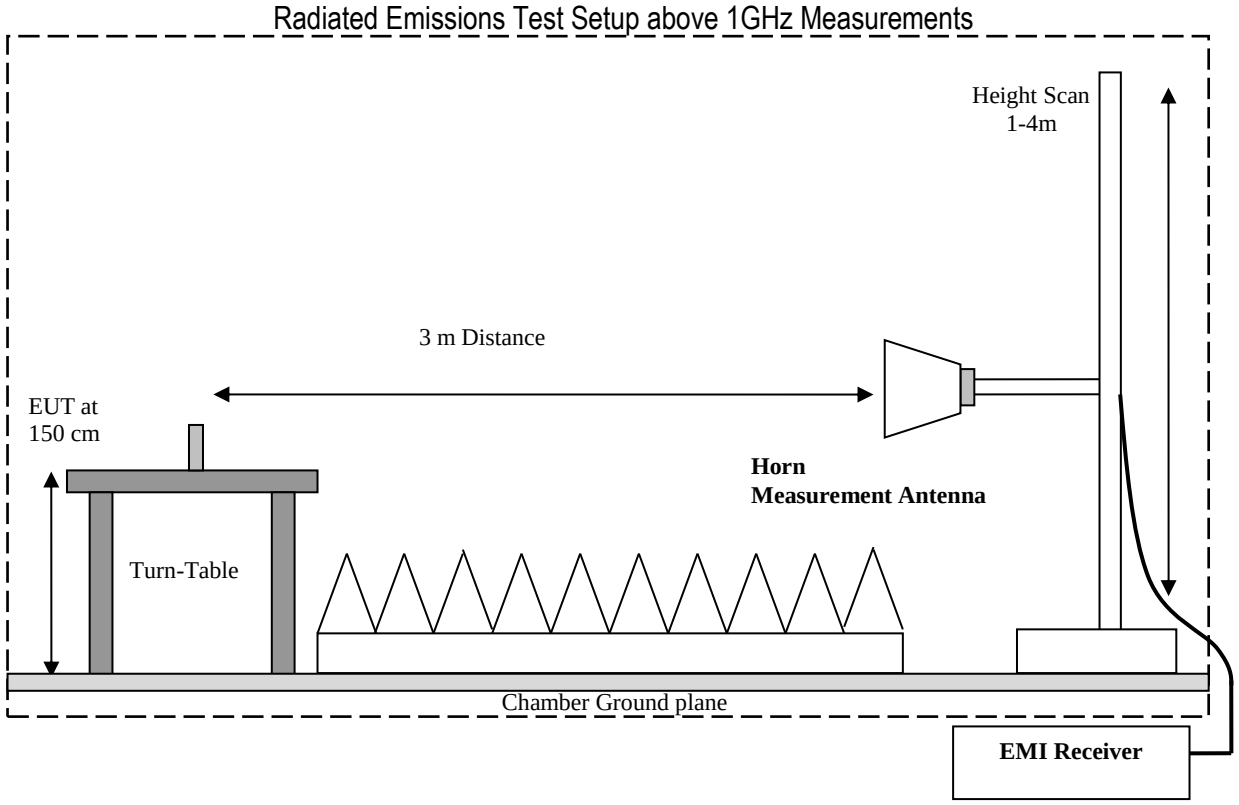
- The exploratory measurement is accomplished by running a matrix of 16 sweeps over the required frequency range with R&S Test-SW EMC32 for 4 positions of the turntable, two orthogonal positions of the EUT and both antenna polarizations. This procedure exceeds the requirement of the above standards to 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 dBµV
- 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 (dBµV/m) = Measured Value on SA (dBµV)- Cable Loss (dB)+ Antenna Factor (dB/m)

Example:

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

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	☐	☐	☐	■	Note 2
§2.1055; §27.54	Frequency Stability	Extreme Temperature and Voltage	LTE Band 13	☐	☐	☐	■	Note 2
§2.1049; §27.53	Occupied Bandwidth	Nominal	LTE Band 13	☐	☐	☐	■	Note 2
§2.1051; §27.53	Band Edge Compliance	Nominal	LTE Band 13	☐	☐	☐	■	Note 2
§2.1051; §27.53	Conducted Spurious Emissions	Nominal	LTE Band 13	☐	☐	☐	■	Note 2
§2.1053; §27.53	Radiated Spurious Emissions	Nominal	LTE Band 13	■	☐	☐	☐	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 C63.26-2015:

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 log10p (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 log10 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.

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

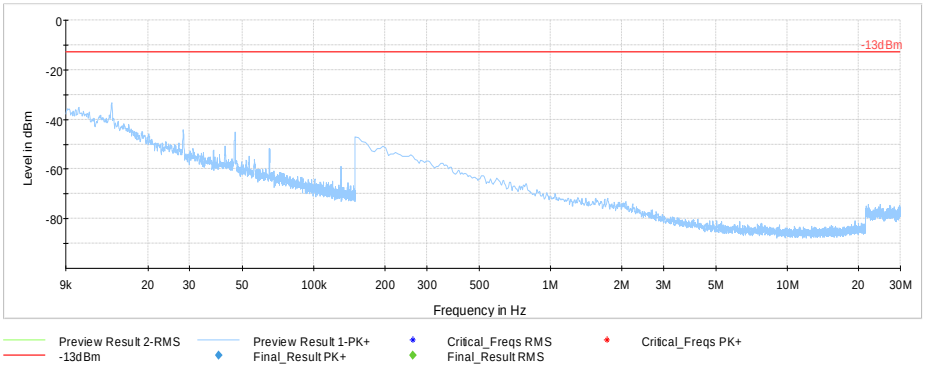
7.1.4 Measurement result:

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:

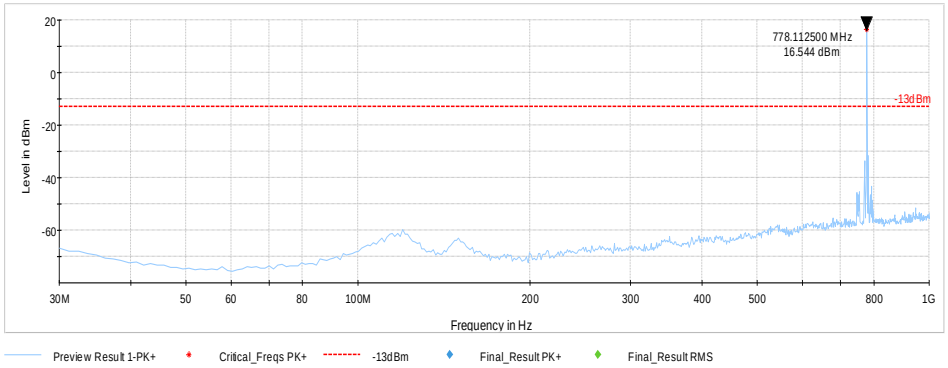
Plot # 1 Radiated Emissions: 9 kHz – 30 MHz

Channel: Low



Plot # 2 Radiated Emissions: 30 MHz – 1GHz

Channel: Low

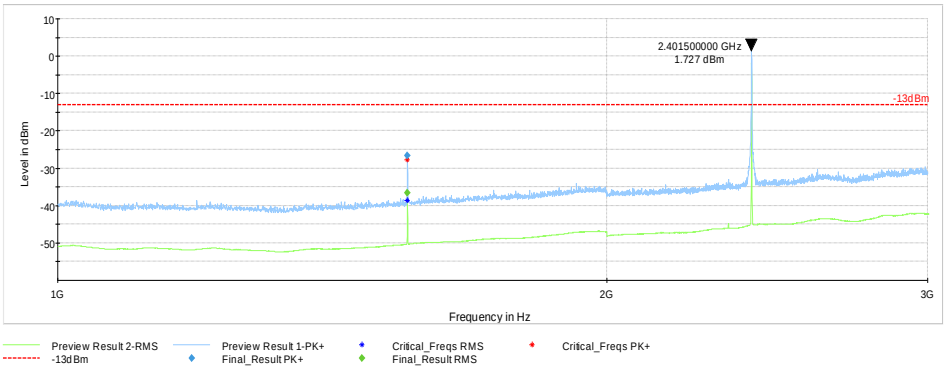


Plot # 3 Radiated Emissions: 1-3 GHz

Channel: Low

Final Result

Frequency (MHz)	MaxPeak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1555.5	---	-36.60	-13	-23.6	500.0	1000.000	155.0	V	26.0	-64.1
1555.5	-26.71	---	---	---	500.0	1000.000	190.0	V	45.0	-64.1

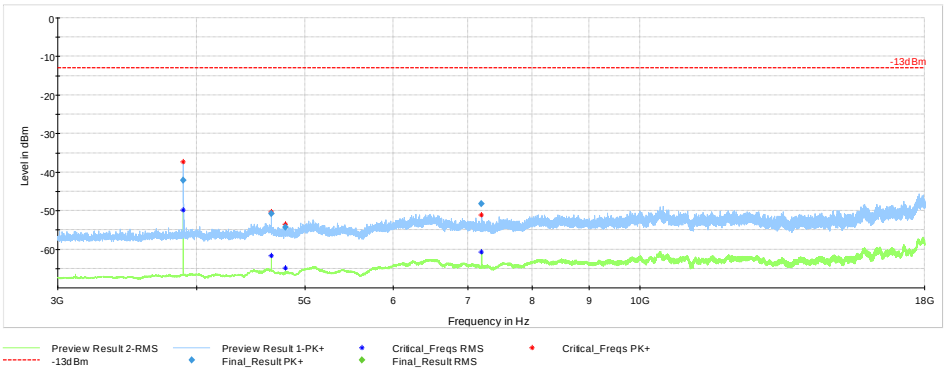


Plot # 4 Radiated Emissions: 3-18 GHz

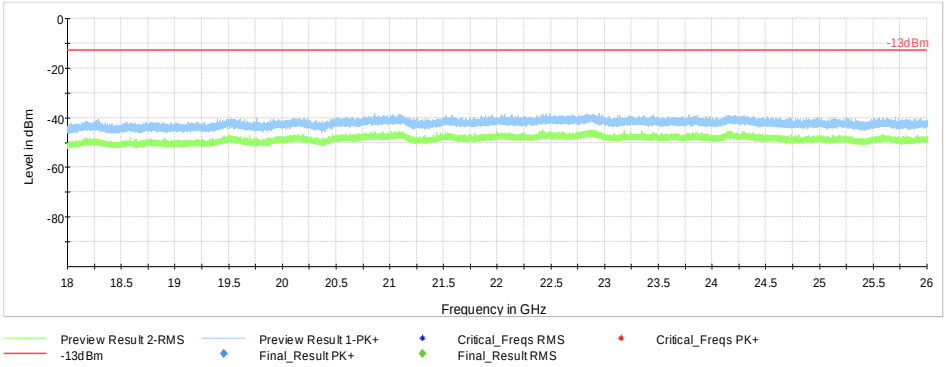
Channel: Low

Final Result

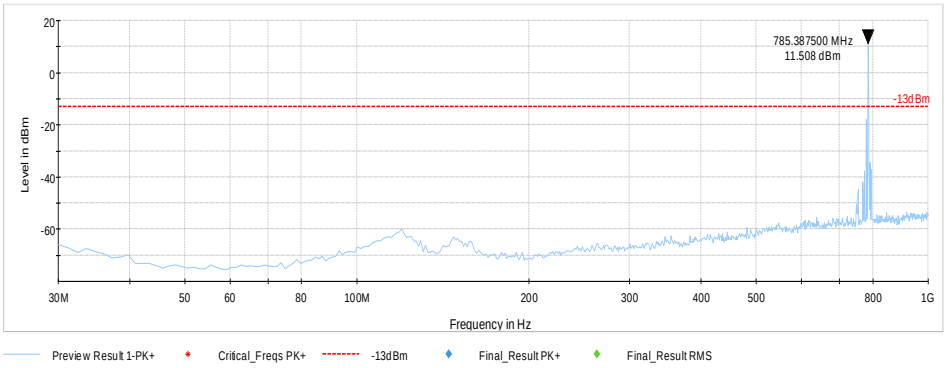
Frequency (MHz)	MaxPeak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3889.500000	-42.10	---	---	---	10.0	1000.000	180.0	H	126.0	-101.4
4666.000000	-50.81	---	---	---	10.0	1000.000	226.0	V	178.0	-99.9
4804.500000	-54.34	---	---	---	10.0	1000.000	174.0	V	315.0	-100.3
7205.000000	-48.24	---	---	---	10.0	1000.000	225.0	H	17.0	-95.7



Plot # 5 Radiated Emissions: 18-26 GHz
Channel: Low



Plot # 6 Radiated Emissions: 30 MHz – 1GHz
Channel: High

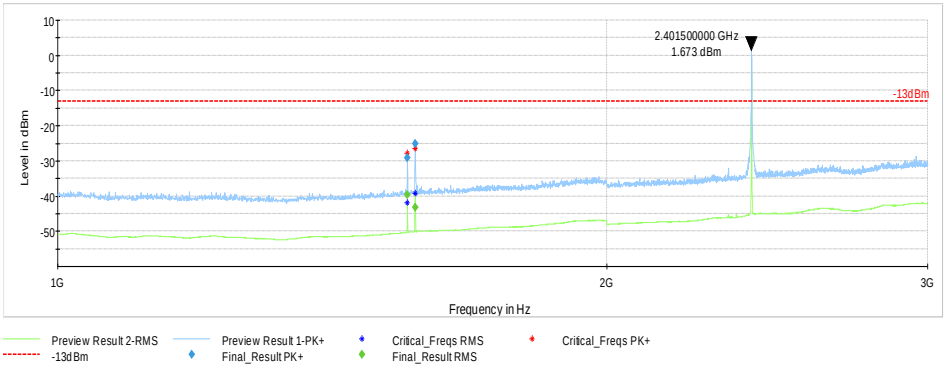


Plot # 7 Radiated Emissions: 1-3 GHz

Channel: High

Final Result

Frequency (MHz)	MaxPeak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1555.000000	---	-39.70	-13	-26.7	500.0	1000.000	155.0	V	33.0	-64.1
1555.000000	-29.12	---	---	---	500.0	1000.000	184.0	V	32.0	-64.1
1570.500000	---	-43.30	-13	-30.3	500.0	1000.000	172.0	V	45.0	-63.9
1570.500000	-25.04	---	---	---	500.0	1000.000	184.0	V	26.0	-63.9

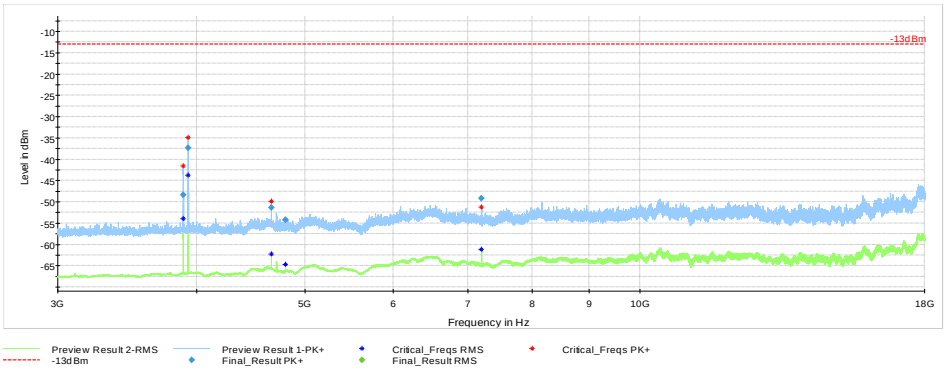


Plot # 8 Radiated Emissions: 3-18 GHz

Channel: High

Final Result

Frequency (MHz)	MaxPeak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3887.000000	-48.40	---	---	---	10.0	1000.000	227.0	H	191.0	-101.4
3927.000000	-37.28	---	---	---	10.0	1000.000	245.0	H	187.0	-101.3
4665.500000	-51.41	---	---	---	10.0	1000.000	173.0	V	155.0	-99.9
4804.000000	-54.22	---	---	---	10.0	1000.000	185.0	H	-5.0	-100.3
7205.000000	-49.16	---	---	---	10.0	1000.000	223.0	H	14.0	-95.7



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.

10 Revision History

Date	Report Name	Changes to report	Report prepared by
2018-05-03	EMC_IRHYT_011_FCC_27	Initial Version	Kevin Wang