



FCC / ISED Test Report

FOR
Juniper Systems, Inc.

Model Name
MS3

Product Description
Ultra-rugged handheld computer for field data collection.

FCC ID: VSFMS3
IC ID: 7980A-MS3

Applied Rules and Standards
47 CFR Part 15.247 (DSS)
RSS-247 Issue 2 (FHSs) & RSS-Gen Issue 5

REPORT #: EMC_JUNIP_026_19001_FCC_15.247_ISED_RFID_DSS

DATE: 4/23/2019



A2LA Accredited

IC recognized #
3462B-2

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1 Assessment

The following device as further described in section 3 of this report was evaluated for radiated spurious emissions for unlicensed radio according to criteria specified in FCC rules 15.247 of Title 47 of the Code of Federal Regulations and the relevant ISED Canada standard RSS-GEN and RSS-247.

No deviations were ascertained.

According to section 5 of this report, the overall result is PASS.

Company	Description	Model #
Juniper Systems, Inc.	Ultra-rugged handheld computer for field data collection.	MS3

Responsible for Testing Laboratory:

4/23/2019	Compliance	Cindy Li (Lab Manager)	
Date	Section	Name	Signature

Responsible for the Report:

4/23/2019	Compliance	Issa Ghanma (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:	Cindy Li
Responsible Project Leader:	Sangeetha Sivaraman

2.2 Identification of the Client

Applicant's Name:	Juniper Systems, Inc.
Street Address:	1132 W 1700 N
City/Zip Code	Logan, UT 84321
Country	USA

2.3 Identification of the Manufacturer

Manufacturer's Name:	Same as client.
Manufacturers Address:	
City/Zip Code	
Country	



3 Equipment Under Test (EUT)

3.1 EUT Specifications

Marketing name:	Mesa 3
Firmware Version Identification Number (FVIN):	MS3_SW_00
Hardware Version Identification Number (HVIN):	MS3
Product Marketing Name (PMN):	MS3
Frequency Range / number of channels:	<ol style="list-style-type: none"> 1. M6e-Nano: <ol style="list-style-type: none"> a. Center to center: 917.4 MHz – 927.2 MHz b. 50 Channels 2. M6e-Micro: <ol style="list-style-type: none"> a. Center to center: 917.5 MHz – 922.5 MHz b. 50 Channels
Type(s) of Modulation:	PR-ASK, PWM
Modes of Operation:	Hopping
Antenna Information as declared:	<ol style="list-style-type: none"> 1. M6e-Nano: Internal, Passive, Patch, 0.9 dBi at 922 MHz 2. M6e-Micro: Internal, Passive, Patch, 1.2 dBi at 920 MHz
Max. declared output Powers in modular grant:	<ol style="list-style-type: none"> 1. M6e-Nano: 0.512 Watts 2. M6e-Micro: 0.6887 Watts
Power Supply/ Rated Operating Voltage Range:	Battery: Low 6 VDC, Nominal 7.3 VDC, High 8.3 VDC Charger: Low 9.9 VDC, Nominal 12 VDC, High 15.6 VDC
Operating Temperature Range:	Low -20 °C, Nominal 20 °C, High 50 °C
Sample Revision:	<input type="checkbox"/> Prototype Unit; <input checked="" type="checkbox"/> Production Unit; <input type="checkbox"/> Pre-Production
EUT Dimensions [mm]:	137 x 215 x 35
Weight:	2 Lbs
EUT Diameter:	<input checked="" type="checkbox"/> < 60 cm <input type="checkbox"/> Other _____



RFID Module Information	
Module Name:	<ol style="list-style-type: none"> 1. M6e-Nano 2. M6e-Micro
FCC ID:	<ol style="list-style-type: none"> 1. M6e-Nano: <ol style="list-style-type: none"> a. Manufacturer FCC ID: QV5MERCURY6EN b. Juniper Systems FCC ID: VSF25589 2. M6e-Micro: <ol style="list-style-type: none"> a. Manufacturer FCC ID: QV5MERCURY6E-M b. Juniper Systems FCC ID: VSF26593
IC ID:	<ol style="list-style-type: none"> 1. M6e-Nano: <ol style="list-style-type: none"> a. Manufacturer IC ID: 5407A-MERCURY6EN b. Juniper Systems IC ID: 7980A-25589 2. M6e-Micro: <ol style="list-style-type: none"> a. Manufacturer IC ID: 5407A-MERCURY6EM b. Juniper Systems IC ID: 7980A-26593
Other Radios included in the device:	<ul style="list-style-type: none"> ❖ Cellular: <ul style="list-style-type: none"> • Sierra Wireless EM7455 • FCC ID: <ul style="list-style-type: none"> ○ Manufacturer: N7NEM7455 ○ Juniper Systems: VSF28015 • IC ID: <ul style="list-style-type: none"> ○ Manufacturer: 2417C-EM7455 ○ Juniper Systems: 7980A-28015 ❖ Bluetooth and WLAN (802.11): <ul style="list-style-type: none"> • Ampak Technology Inc. HS2B56 • Bluetooth 5.0 • 802.11a/b/g/n/ac 2x2 MIMO ❖ GPS: (M6e-Nano Only) <ul style="list-style-type: none"> • U-blox AG NEO-M8N

3.2 EUT Sample details

EUT #	Serial Number	HW Version	SW Version	Notes / Comments
1	MS3W-C17	MS3_00	MS3_SW_00	Radiated Emissions / Nano
2	MS3W-C09	MS3_00	MS3_SW_00	Radiated Emissions / Micro

3.3 Accessory Equipment (AE) details



AE #	Comments
1	SWITCHING POWER SUPPLY: <ul style="list-style-type: none"> • MODEL: PSAA30R-120 • Input: 100-240V ~ 0.8A 50-60Hz • Output: 12V == 2.5A

3.4 Test Sample Configuration

Set-up #	Combination of AE used for test set up	Comments
1	EUT#1	-
2	EUT#2	-
3	EUT#1 + AE#1	AC Conducted emissions
4	EUT#2 + AE#1	AC Conducted emissions

3.5 Mode of Operation details

Mode of Operation	Description of Operating modes	Additional Information
Op. 1	RFID PR-ASK	Pre-installed software programs were loaded on the EUT by the client, that will not be available to the end user, provides the ability to configure the radio to: <ul style="list-style-type: none"> • Continuous transmit modulated and CW • Select TX fixed channel. • Maximum duty cycle. • Maximum output power. For Radiated measurements: The internal antenna was connected.

3.6 Justification for Worst Case Mode of Operation

During the testing process the EUT was tested with transmitter sets on low and high channels, the highest duty cycle, maximum output power and worst case of modulations supported based on the maximum conducted output power in modular grant and reports.

For radiated measurements, all data in this report shows the worst case between horizontal and vertical antenna polarizations and for all orientations of the EUT.



4 Subject of Investigation

The objective of the measurements done by CETECOM Inc. was to assess the performance of the EUT according to the relevant requirements specified in FCC rules 15.247 of Title 47 of the Code of Federal Regulations and Radio Standard Specification RSS-247 Issue 2 and RSS-GEN Issue 5 of ISED Canada.

This test report is to support a request for new equipment authorization under the:

- FCC ID: VSFMS3
- IC ID: 7980A-MS3

Testing procedures are based on 558074 D01 DTS Meas Guidance v04 – “GUIDANCE FOR PERFORMING COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEMS (DTS) OPERATING UNDER SECTION 15.247” - April 5, 2017, by the Federal Communications Commission, Office of Engineering and Technology, Laboratory Division.



5 Measurement Results Summary

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	NA	NP	Result
§15.247(b) RSS-247 5.4(a)	Maximum Peak Conducted Output Power	-	-	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Note 1 Note 2
§15.247(d) §15.205 RSS-247 5.5 RSS-Gen 8.10	Band Edge Compliance	-	-	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Note 1 Note 2
§15.247(a) RSS-247 5.1(c)	Spectrum Bandwidth	-	-	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Note 1 Note 2
§15.247(a) RSS-247 5.1(c)	Carrier Frequency Separation	-	-	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Note 1 Note 2
§15.247(a) RSS-247 5.1(c)	Number of Hopping Channels	-	-	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Note 1 Note 2
§15.247(a) RSS-247 5.1(c)	Time of occupancy	-	-	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Note 1 Note 2
§15.247(d) §15.209 (a) RSS-Gen 6.13	TX Spurious emissions-Radiated	Nominal	PR-ASK	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Complies
§15.207(a) RSS-Gen 8.8	AC Conducted Emissions	Nominal	PR-ASK	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Complies

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

Note 2: Leveraged from module certification M6e-Nano FCC/IC ID: VSF25589 / 7980A-25589 and M6e-Micro FCC/IC ID: VSF26593 / 7980A-26593



6 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 30 MHz	± 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)
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RF conducted measurement ± 0.5 dB

According to TR 102 273 a multiplicative propagation of error is assumed for RF measurement systems. For this reason the RMS method is applied to dB values and not to linear values as appropriate for additive propagation of error. Also used: <http://physics.nist.gov/cuu/Uncertainty/typeb.html>. The above calculated uncertainties apply to direct application of the Substitution method. The Substitution method is always used when the EUT comes closer than 3 dB to the limit.

6.1 Environmental Conditions During Testing:

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

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

6.2 Dates of Testing:

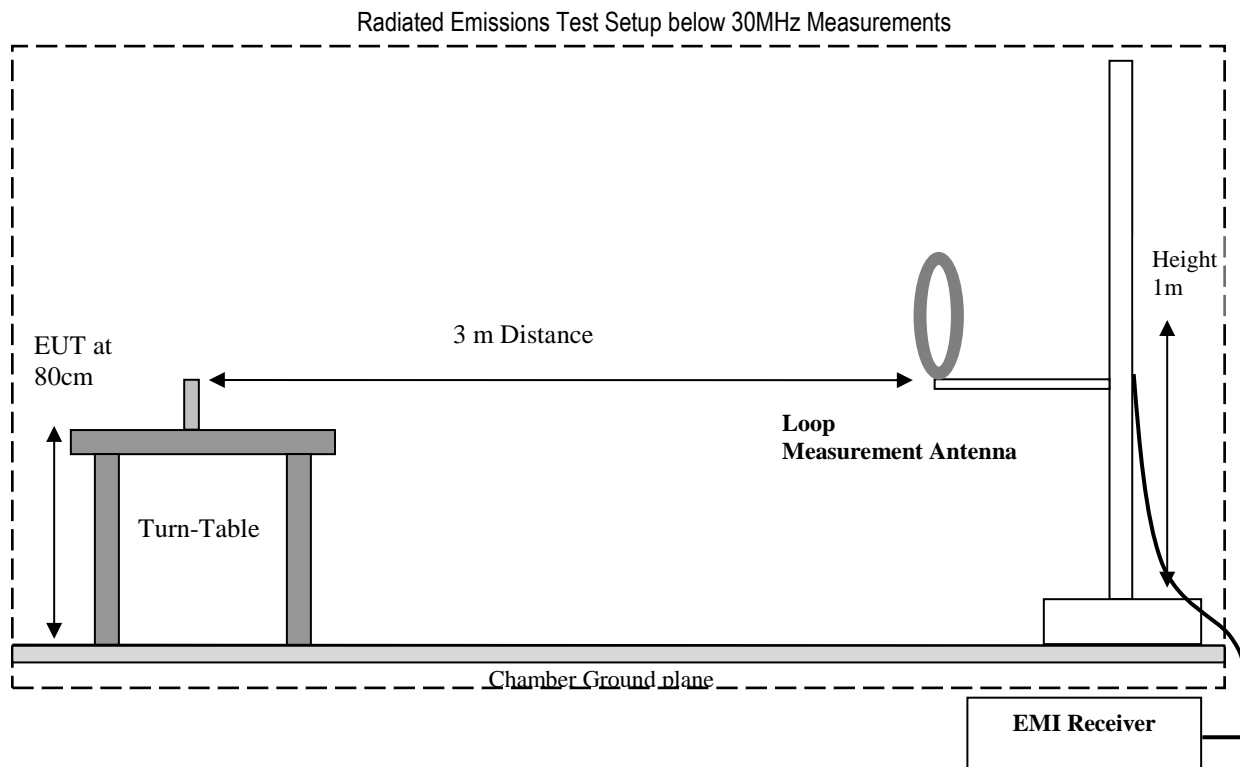
03/19/2019 – 03/25/2019

7 Measurement Procedures

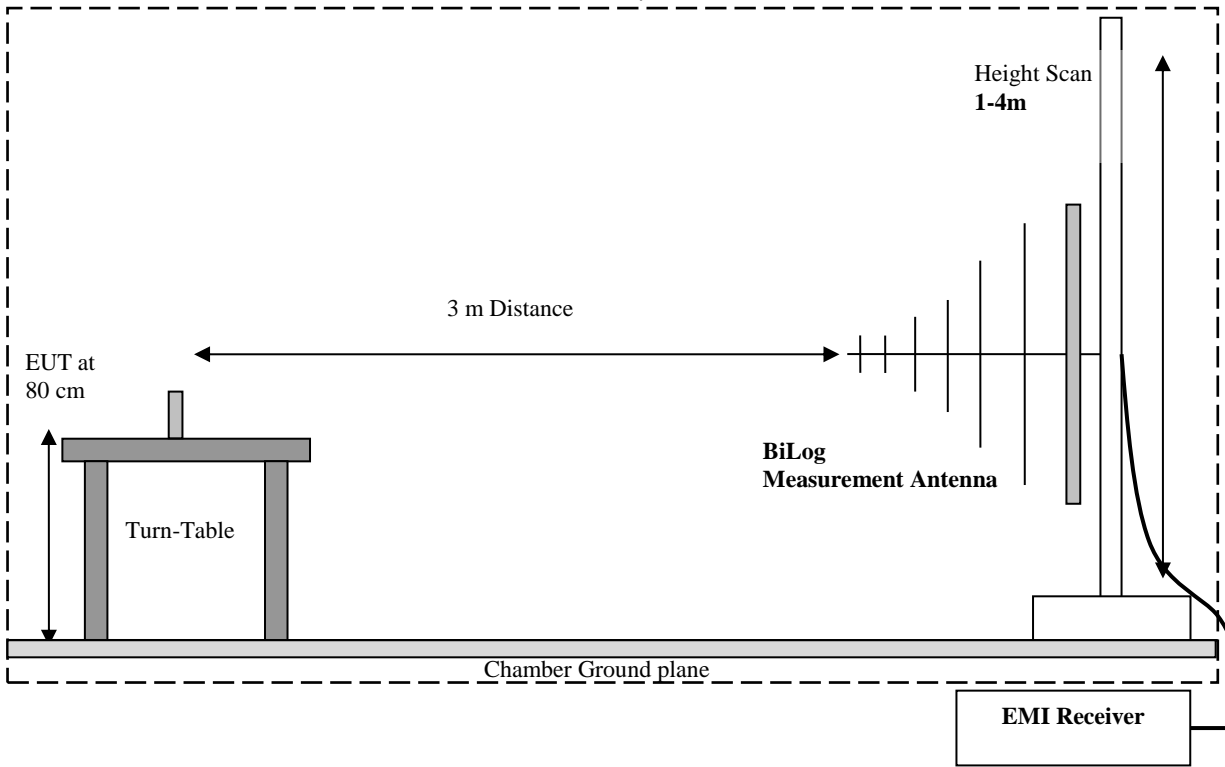
7.1 Radiated Measurement

The radiated measurement is performed according to ANSI C63.10 (2013)

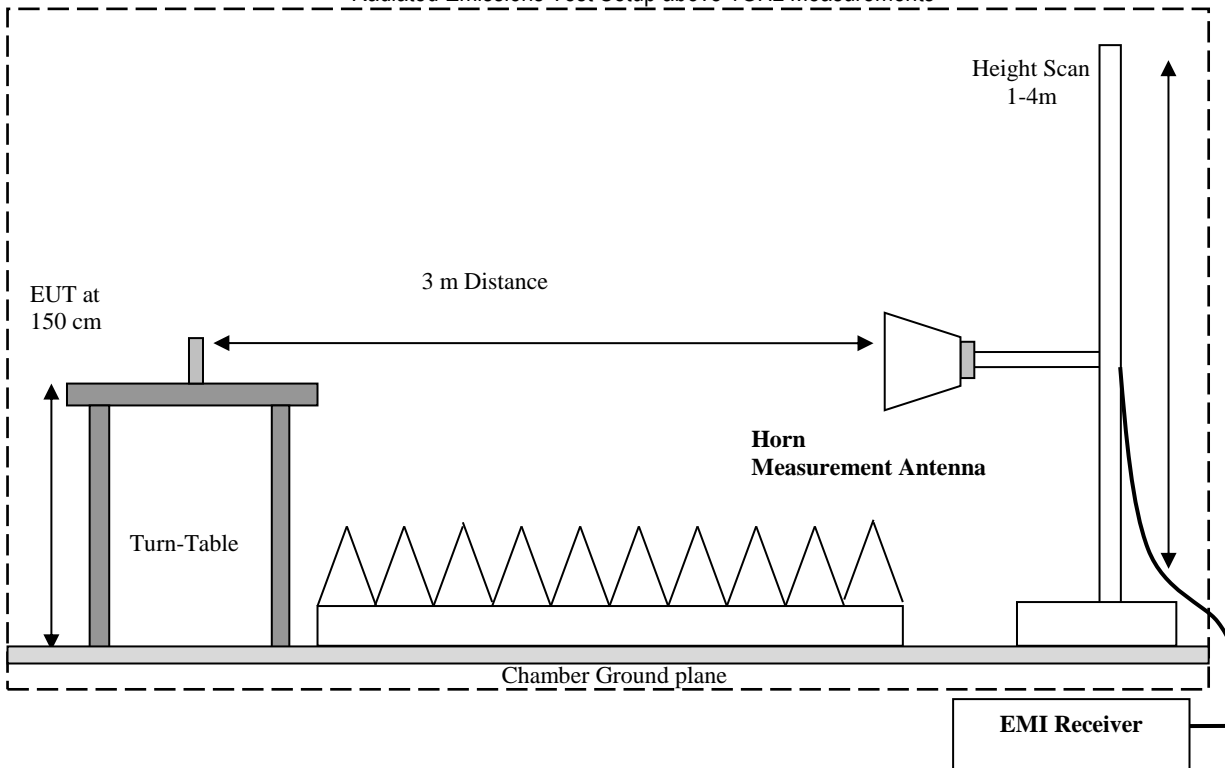
- The exploratory measurement is accomplished by running a matrix of 16 sweeps over the required frequency range with R&S Test-SW EMC32 for 360° continuous measurement of the turntable, two orthogonal positions of the EUT and both antenna polarizations. This procedure exceeds the requirement of the above 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 30MHz-1GHz Measurements



Radiated Emissions Test Setup above 1GHz Measurements





7.1.1 Sample Calculations for Field Strength Measurements

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

1. Measured reading in dBμV
2. Cable Loss between the receiving antenna and SA in dB and
3. 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 (dBμV)	Cable Loss (dB)	Antenna Factor Correction (dB)	Field Strength Result (dBμV/m)
1000	80.5	3.5	14	98.0



8 Test Result Data

8.1 Transmitter Spurious Emissions and Restricted Bands

8.1.1 Measurement according to ANSI C63.10

Analyzer Settings:

- Frequency = 9 KHz – 30 MHz
- RBW = 9 KHz
- Detector = Peak

- Frequency = 30 MHz – 1 GHz
- Detector = Peak / Quasi-Peak
- RBW = 120 KHz (<1 GHz)

- Frequency > 1 GHz
- Detector = Peak / Average
- RBW = 1MHz

Plots reported here represent the worst case emissions for horizontal and vertical antenna polarizations and for three orientations of the EUT. Unless mentioned otherwise, the emissions outside the limit lines in the plots are from the transmit signal.

8.1.2 Limits: FCC 15.247(d)/15.209(a) /RSS-Gen 6.13

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
10.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

- Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).
- PEAK LIMIT= 74dB μ V/m
- AVG. LIMIT= 54dB μ V/m
- Except as shown in CFR 47 Part 15.205 paragraph (d), only spurious emissions are permitted in any of the frequency bands listed below



Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

Radiated spurious emissions shall be measured for the transmit frequencies, transmit power, and data rate for the lowest, middle and highest channel in each frequency band of operation and for the highest gain antenna for each antenna type, and using the appropriate parameters and test requirements described in 5.4.

The highest (or worst-case) data rate shall be recorded for each measurement.

For testing at distance other than the specified in the standard, the limit conversion is calculated by using 40 dB/decade extrapolation as follow:

$$\text{Conversion factor (CF)} = 40 \log (D/d) = 40 \log (300 \text{ m} / 3 \text{ m}) = 80 \text{ dB}$$

8.1.3 Test conditions and setup:

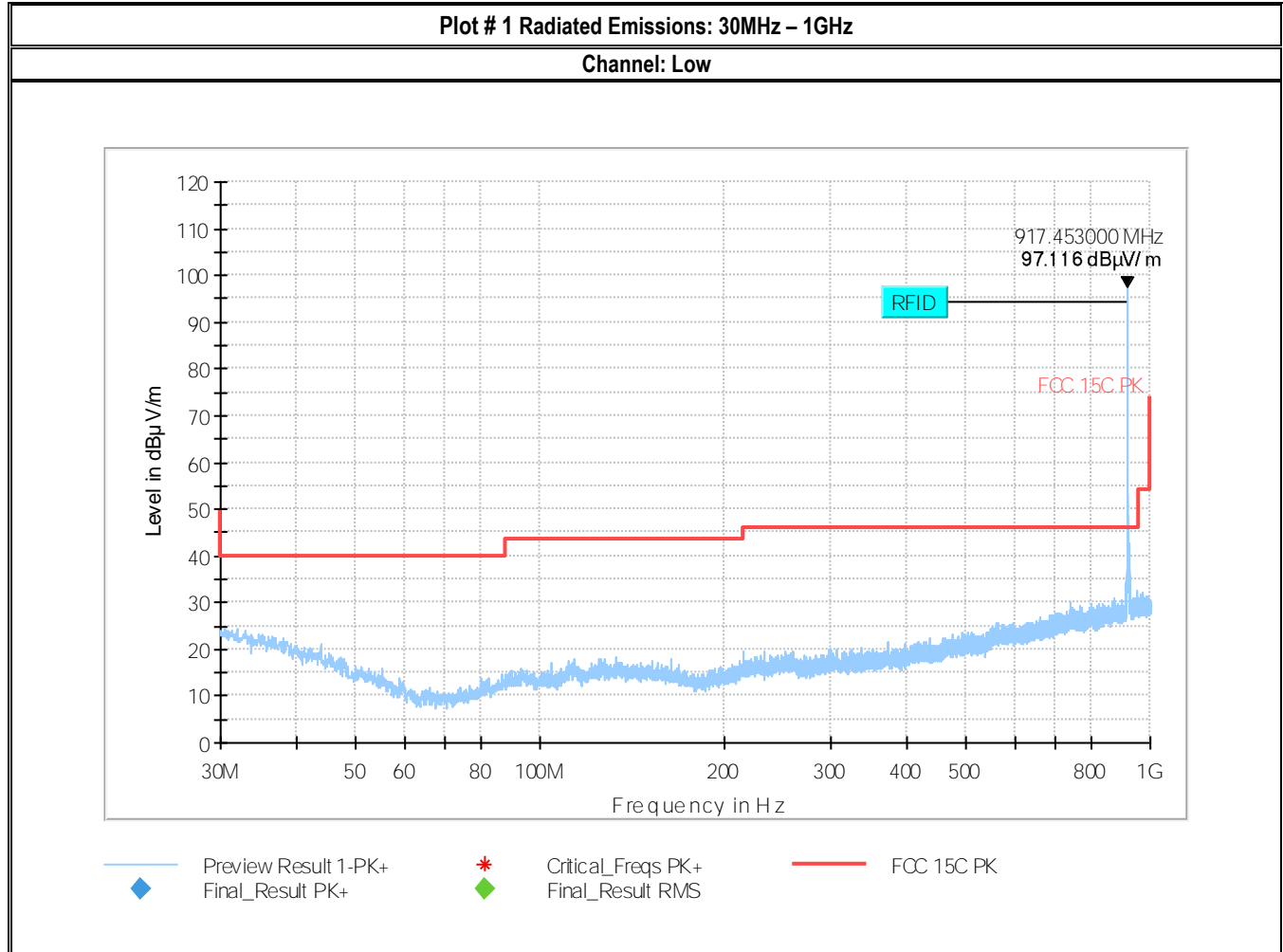
Ambient Temperature	EUT operating mode	Power Input
22° C	Op.1	7.3 VDC

8.1.4 Measurement result:

Plot #	EUT #	Channel #	Scan Frequency	Critical Frequency [MHz]	Emission level [dBµV/m]	Detector	Limit	Result
1 – 3	1	Low	30 MHz – 10 GHz	1834.943	43.51	RMS	See section 8.1.2	Pass
4	1	Mid	9 KHz – 30 MHz	3.44	37.31	Peak	See section 8.1.2	Pass
5 – 7	1	High	30 MHz – 10 GHz	566.14	35.41	Peak	See section 8.1.2	Pass
8 – 10	2	Low	30 MHz – 10 GHz	1835.069	47.13	RMS	See section 8.1.2	Pass
11	2	Mid	9 KHz – 30 MHz	1.23	33.06	Peak	See section 8.1.2	Pass
12 - 14	2	High	30 MHz – 10 GHz	1844.985	33.19	RMS	See section 8.1.2	Pass



8.1.5 Measurement Plots:



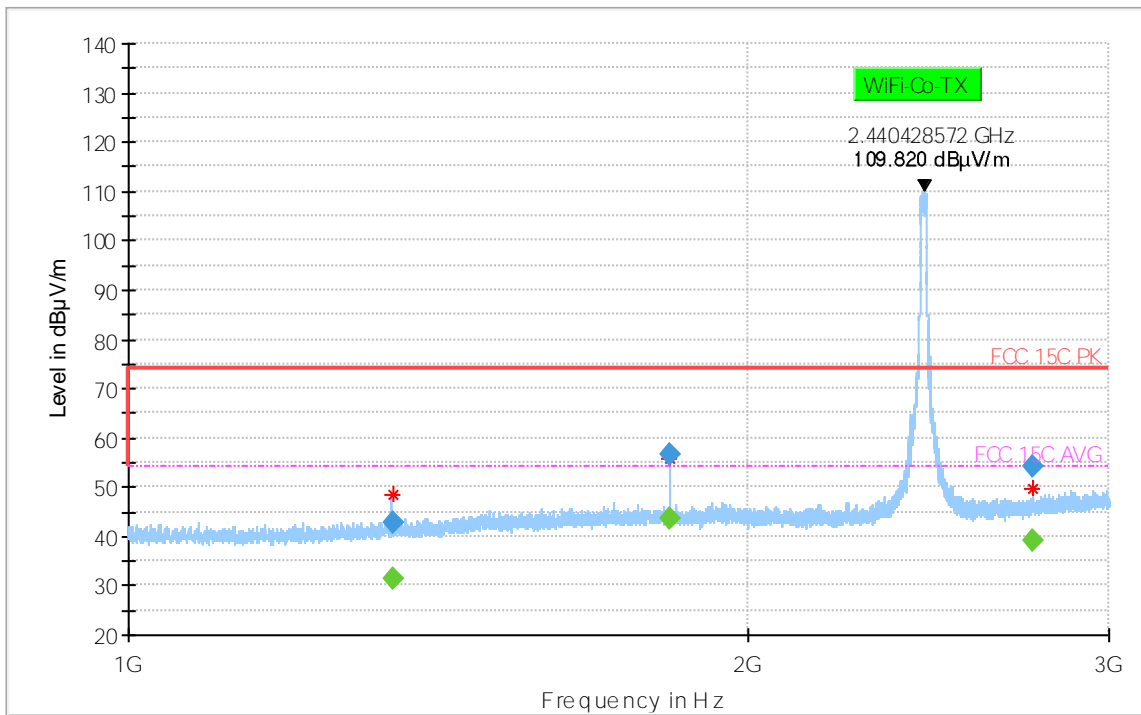


Plot # 2 Radiated Emissions: 1 – 3GHz

Channel: Low

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
1343.989	---	31.31	53.98	22.67	300.0	1000.0	242.0	V	33.0	6	9:05:55 PM - 3/20/2019
1343.989	42.75	---	74.00	31.25	300.0	1000.0	242.0	V	33.0	6	9:05:55 PM - 3/20/2019
1834.943	56.67	---	74.00	17.33	300.0	1000.0	217.0	H	202.0	8	9:12:22 PM - 3/20/2019
1834.943	---	43.51	53.98	10.47	300.0	1000.0	217.0	H	202.0	8	9:12:23 PM - 3/20/2019
2752.514	54.31	---	73.99	19.68	300.0	1000.0	107.0	V	106.0	10	9:09:05 PM - 3/20/2019
2752.514	---	38.92	53.98	15.06	300.0	1000.0	107.0	V	106.0	10	9:09:06 PM - 3/20/2019



— Preview Result 1-PK+ * Critical_Freqs PK+ — FCC 15C PK
- - - FCC 15C AVG ◆ Final_Result PK+ ◆ Final_Result RMS

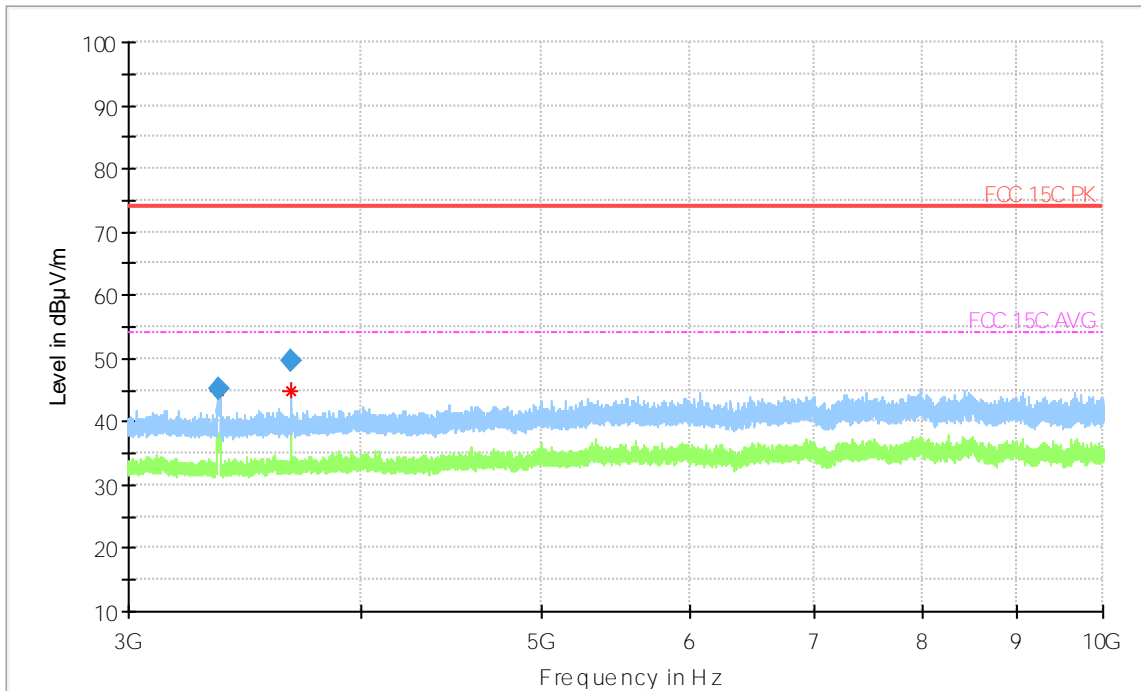


Plot # 3 Radiated Emissions: 3 – 18GHz

Channel: Low

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
3355.682	45.15	73.99	28.84	200.0	1000.0	120.0	V	96.0	-37	8:10:37 PM - 3/20/2019
3669.566	49.49	73.99	24.50	200.0	1000.0	100.0	V	192.0	-36	8:13:55 PM - 3/20/2019



- Preview Result 2-RMS
- Preview Result 1-PK+
- FCC 15C PK
- ◆ Final_Result PK+
- ◆ Final_Result RMS
- * Critical_Freqs RMS
- - - FCC 15C AVG

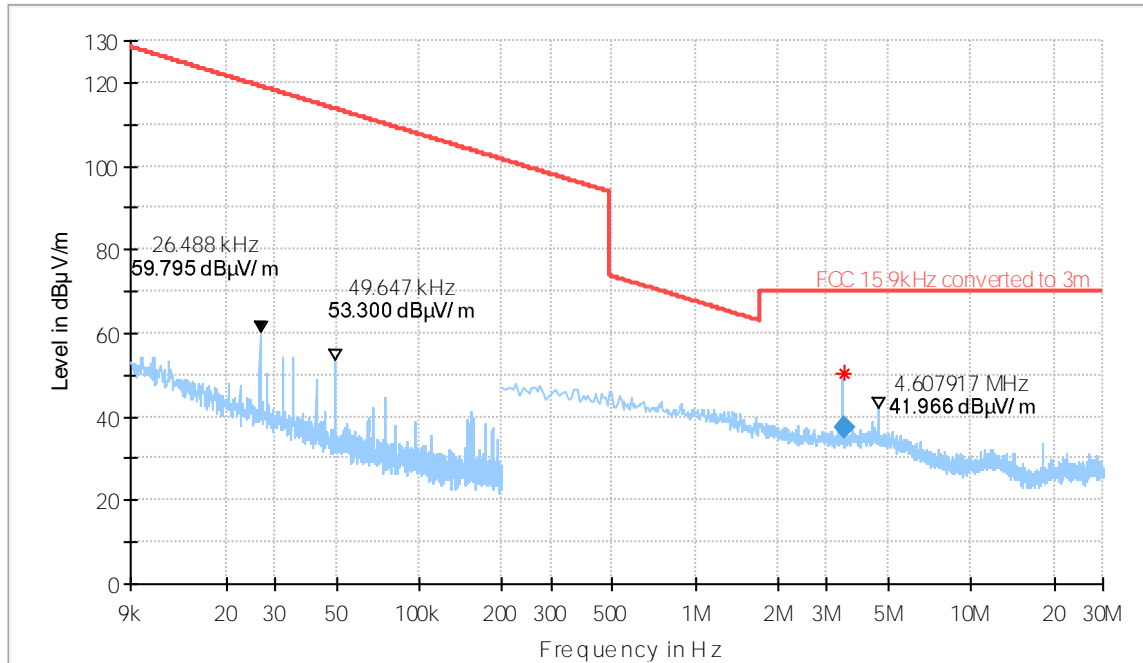


Plot # 4 Radiated Emissions: 9KHz – 30MHz

Channel: Mid

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
3.44	37.31	70.00	32.69	500.0	9.0	175.0	V	261.0	19	5:37:09 PM - 3/21/2019



- Preview Result 2-RMS
- * Critical_Freqs RMS
- FCC 15.9kHz converted to 3m
- ◆ Final_Result RMS
- Preview Result 1-PK+
- * Critical_Freqs PK+
- ◆ Final_Result PK+

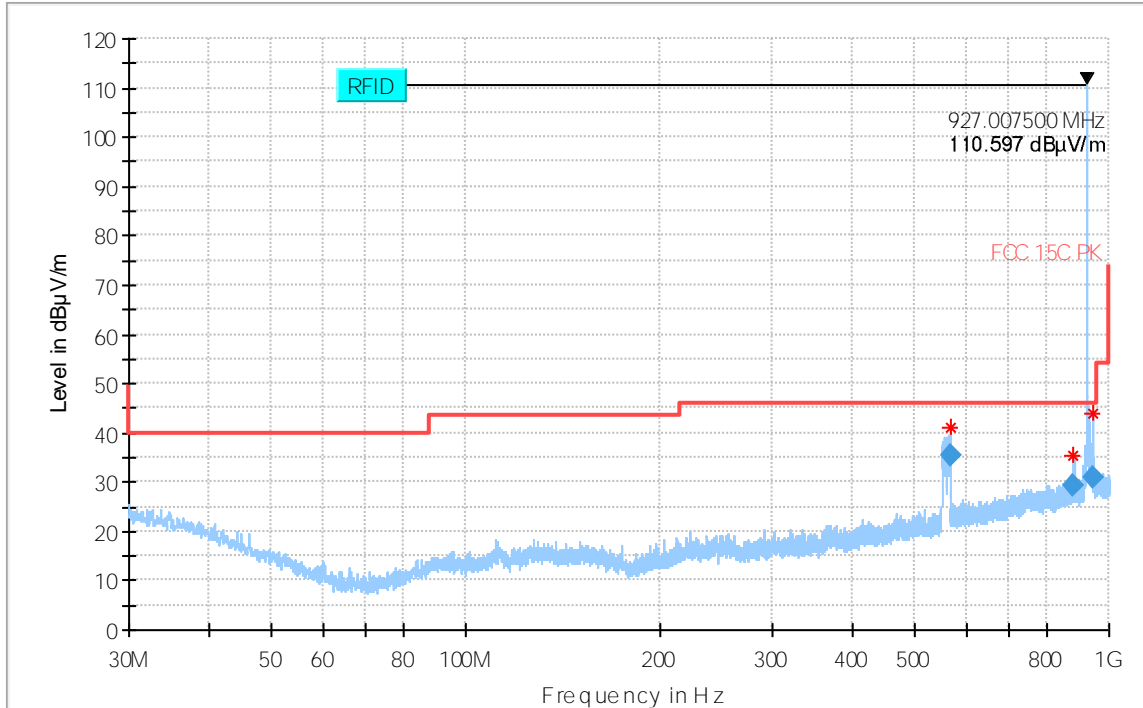


Plot # 5 Radiated Emissions: 30MHz – 1GHz

Channel: High

Final Result

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
566.14	35.41	46.00	10.59	100.0	100.0	100.0	V	-8.0	-10	4:42:27 PM - 3/21/2019
881.34	29.24	46.00	16.76	100.0	100.0	171.0	H	114.0	-6	4:45:18 PM - 3/21/2019
947.01	31.07	46.00	14.93	100.0	100.0	198.0	H	109.0	-5	4:47:58 PM - 3/21/2019



- ◆ Preview Result 1-PK+
- * Critical_Freqs PK+
- FCC 15C PK
- ◆ Final_Result PK+
- ◆ Final_Result RMS

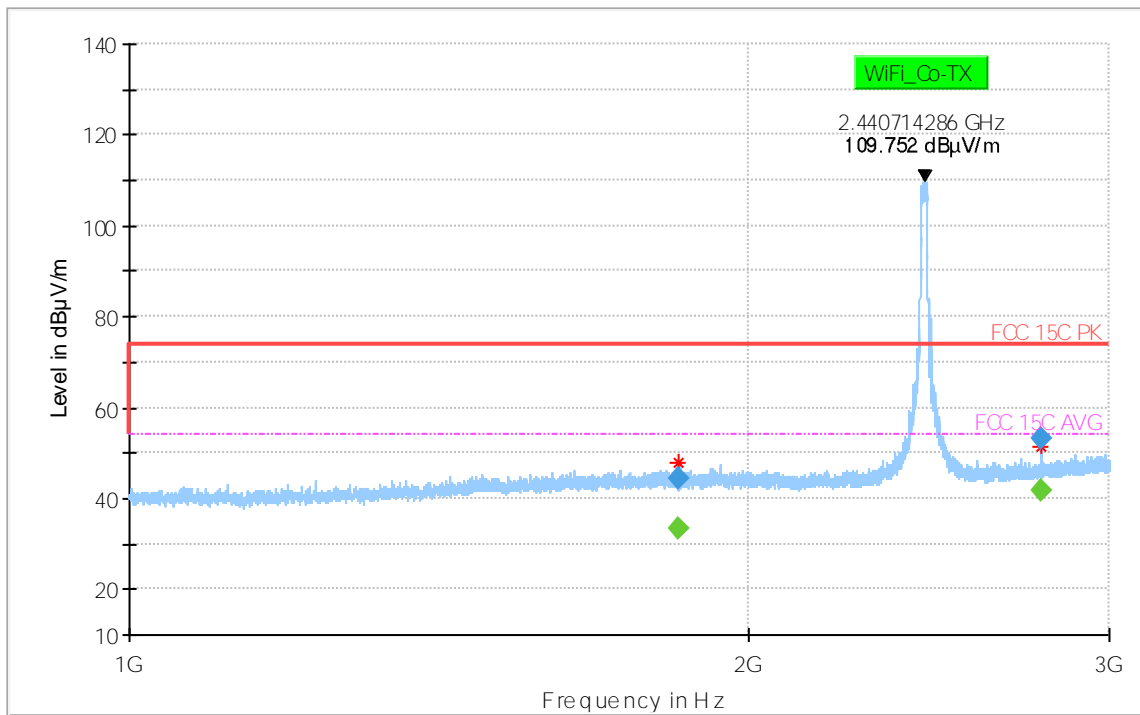


Plot # 6 Radiated Emissions: 1 – 3GHz

Channel: High

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
1850.183	44.24	---	74.00	29.76	300.0	1000.0	164.0	H	222.0	8	9:33:08 PM - 3/20/2019
1850.183	---	33.18	53.98	20.80	300.0	1000.0	164.0	H	222.0	8	9:33:08 PM - 3/20/2019
2781.076	53.24	---	73.99	20.75	300.0	1000.0	100.0	V	197.0	10	9:29:48 PM - 3/20/2019
2781.076	---	41.84	53.98	12.14	300.0	1000.0	100.0	V	197.0	10	9:29:49 PM - 3/20/2019



- Preview Result 1-PK+
- - - FCC 15C AVG
- * Critical_Freqs PK+
- ◆ Final_Result PK+
- FCC 15C PK
- ◆ Final_Result RMS

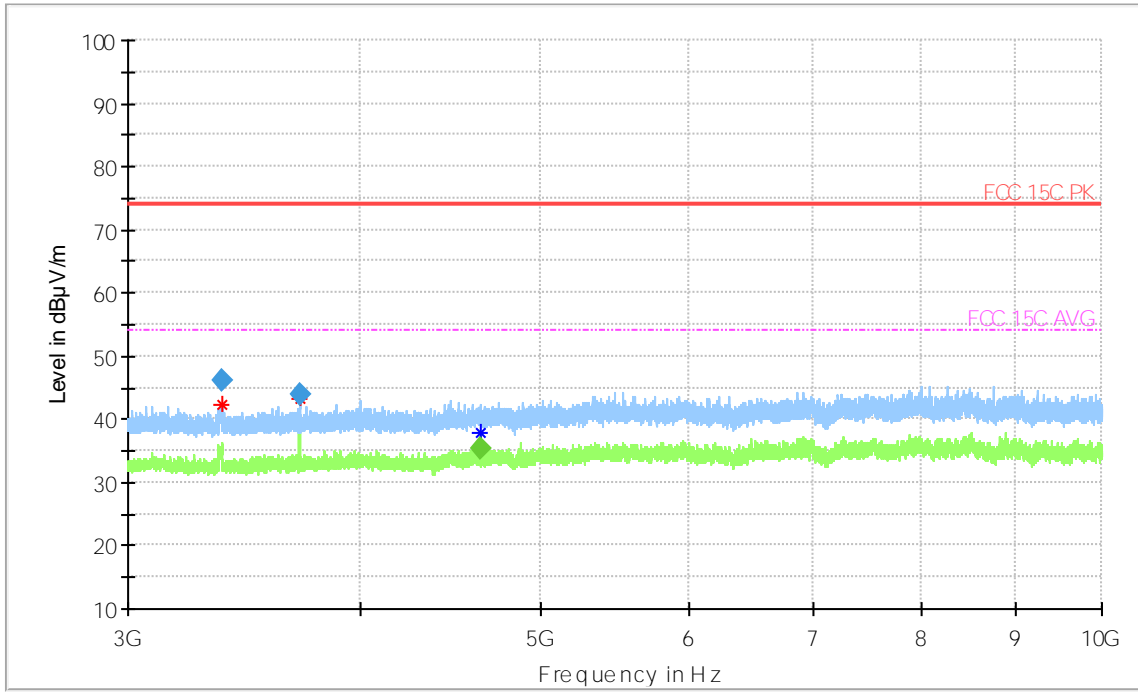


Plot # 7 Radiated Emissions: 3 – 10GHz

Channel: High

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
3371.252	46.22	---	73.99	27.77	200.0	1000.0	107.0	H	47.0	-37	8:36:04 PM - 3/20/2019
3707.865	44.04	---	73.99	29.95	200.0	1000.0	191.0	V	204.0	-35	8:39:28 PM - 3/20/2019
4635.076	---	35.41	53.98	18.57	200.0	1000.0	107.0	V	4.0	-34	8:42:52 PM - 3/20/2019

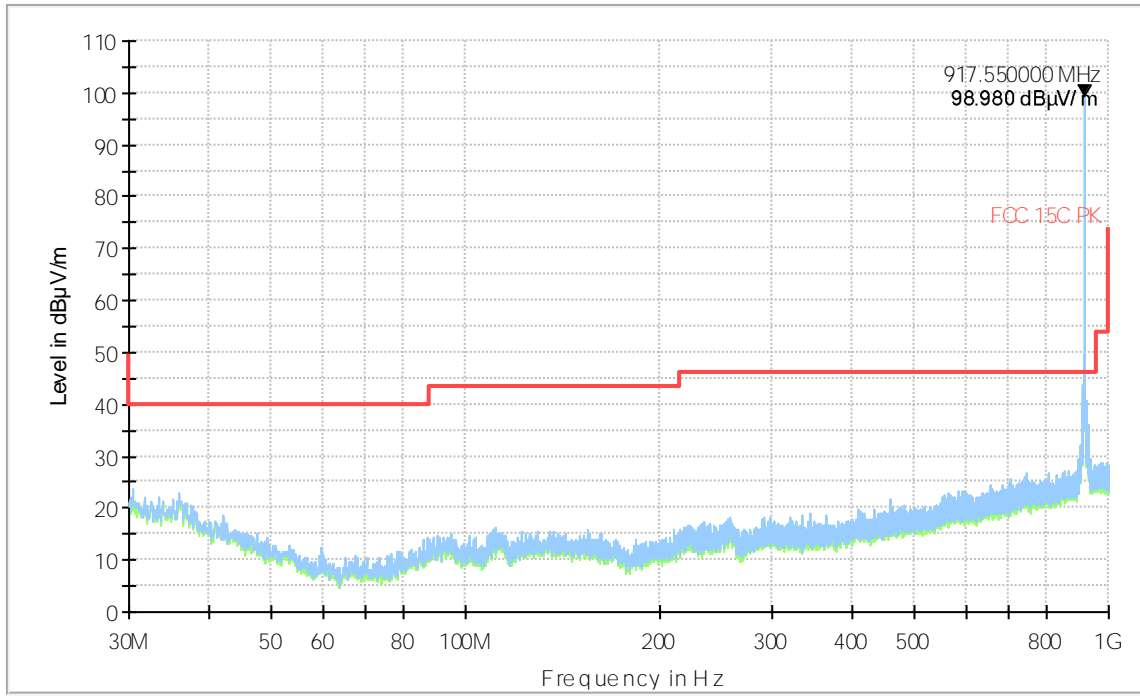


- Preview Result 2-RMS
- Preview Result 1-PK+
- FCC 15C PK
- - - FCC 15C AVG
- * Critical_Freqs PK+
- ◆ Final_Result PK+
- ◆ Final_Result RMS
- * Critical_Freqs RMS



Plot # 8 Radiated Emissions: 30MHz – 1GHz

Channel: Low



- Preview Result 2-RMS
- Preview Result 1-PK+
- Critical_Freqs RMS
- Critical_Freqs PK+
- FCC 15C PK
- Final_Result PK+
- Final_Result RMS

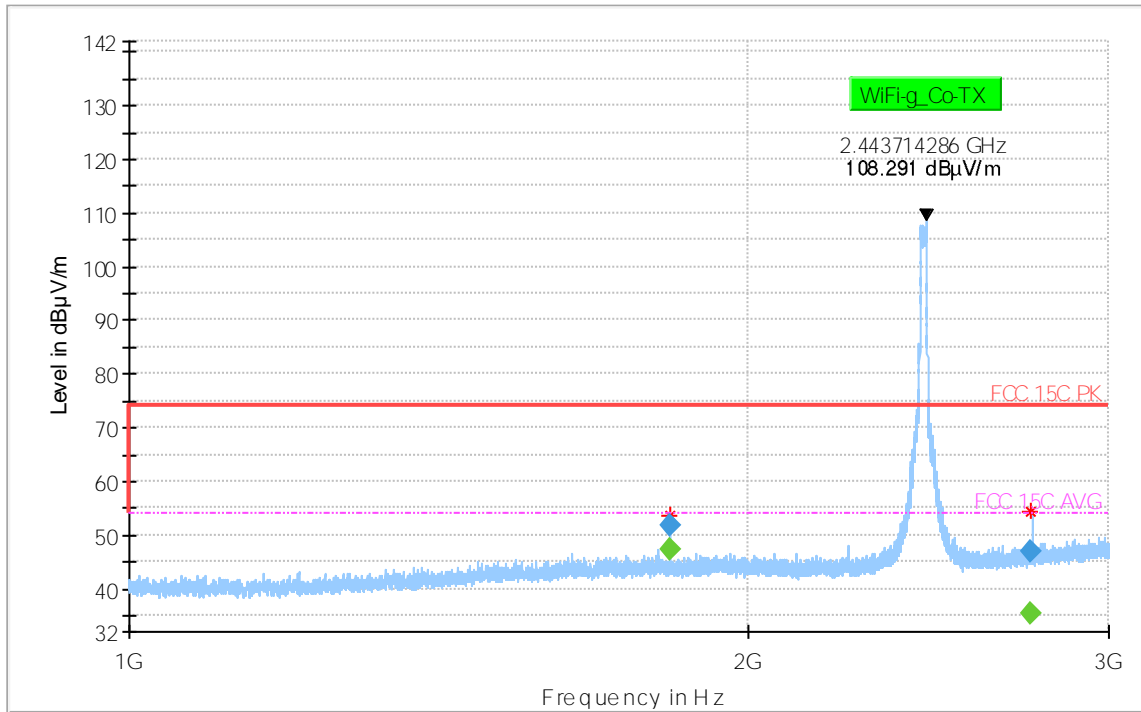


Plot # 9 Radiated Emissions: 1 – 3GHz

Channel: Low

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
1835.069	51.61	---	74.00	22.39	300.0	1000.0	144.0	V	347.0	8	3:55:50 PM - 3/20/2019
1835.069	---	47.13	53.98	6.85	300.0	1000.0	144.0	V	347.0	8	3:55:50 PM - 3/20/2019
2749.436	46.83	---	73.99	27.16	300.0	1000.0	204.0	V	84.0	10	3:52:51 PM - 3/20/2019
2749.436	---	35.29	53.98	18.69	300.0	1000.0	204.0	V	84.0	10	3:52:52 PM - 3/20/2019



- Preview Result 1-PK+
- FCC 15C AVG
- * Critical_Freqs PK+
- ◆ Final_Result PK+
- FCC 15C PK
- ◆ Final_Result RMS

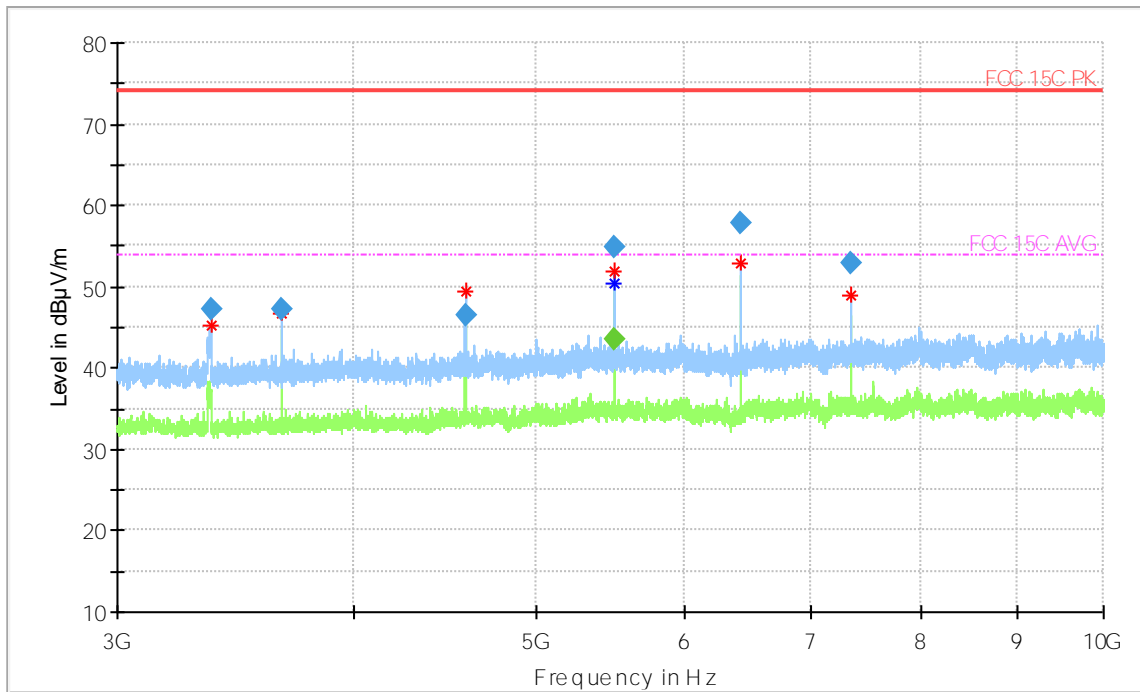


Plot # 10 Radiated Emissions: 3 – 18GHz

Channel: Low

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
3361.978	47.20	---	73.99	26.79	200.0	1000.0	249.0	H	215.0	-37	4:44:22 PM - 3/20/2019
3669.894	47.25	---	73.99	26.74	200.0	1000.0	227.0	V	290.0	-36	4:47:38 PM - 3/20/2019
4587.734	46.50	---	73.99	27.49	200.0	1000.0	148.0	V	302.0	-34	4:50:42 PM - 3/20/2019
5504.867	54.77	---	73.99	19.21	200.0	1000.0	261.0	V	306.0	-31	4:56:38 PM - 3/20/2019
5505.033	---	43.52	53.98	10.46	200.0	1000.0	222.0	V	308.0	-31	5:11:12 PM - 3/20/2019
6422.456	57.88	---	73.99	16.11	200.0	1000.0	245.0	V	298.0	-31	4:53:38 PM - 3/20/2019
7339.581	52.99	---	73.99	20.99	200.0	1000.0	107.0	V	314.0	-30	4:59:53 PM - 3/20/2019

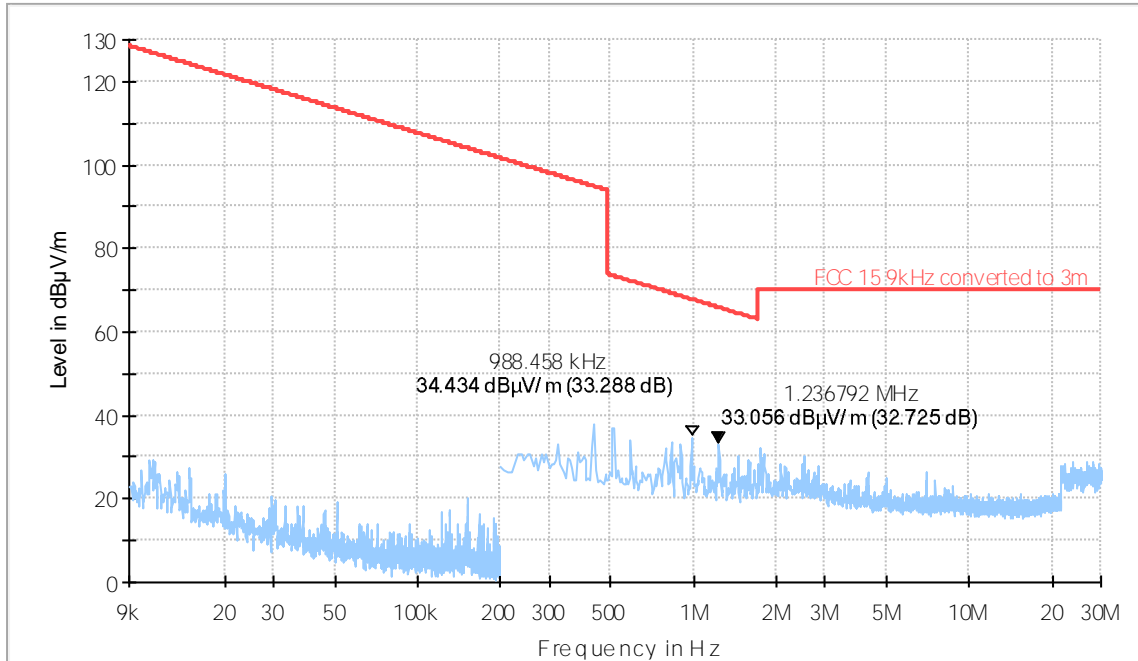


- Preview Result 2-RMS
- Preview Result 1-PK+
- * Critical_Freqs PK+
- FCC 15C PK
- ◆ Final_Result PK+
- ◆ Final_Result RMS
- * Critical_Freqs RMS
- - - FCC 15C AVG



Plot # 11 Radiated Emissions: 9KHz – 30MHz

Channel: Mid

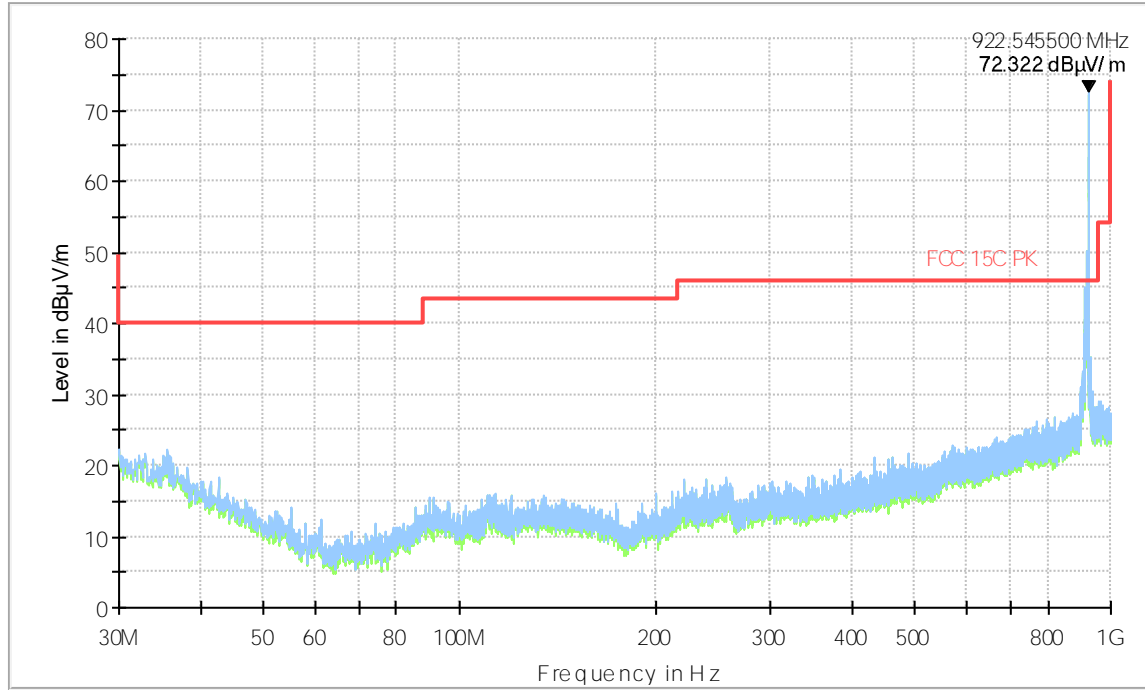


- Preview Result 2-RMS
- * Critical_Freqs RMS
- FCC 15.9kHz converted to 3m
- ◆ Final_Result RMS
- Preview Result 1-PK+
- * Critical_Freqs PK+
- ◆ Final_Result PK+



Plot # 12 Radiated Emissions: 30MHz – 1GHz

Channel: High



- Preview Result 2-RMS
- Critical_Freqs PK+
- Final_Result RMS
- Preview Result 1-PK+
- FCC 15C PK
- Critical_Freqs RMS
- Final_Result PK+

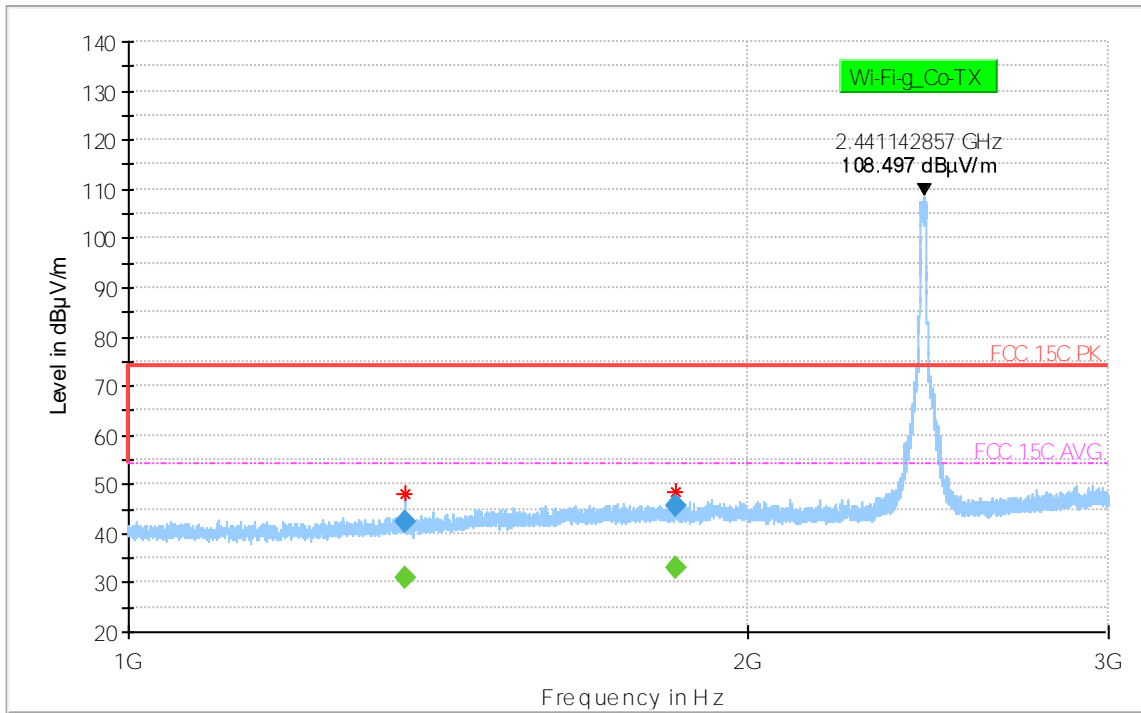


Plot # 13 Radiated Emissions: 1 – 3GHz

Channel: High

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
1364.632	---	30.99	53.98	22.99	300.0	1000.0	274.0	V	45.0	6	4:09:42 PM - 3/20/2019
1364.632	42.23	---	74.00	31.77	300.0	1000.0	274.0	V	45.0	6	4:09:42 PM - 3/20/2019
1844.985	---	33.19	53.98	20.79	300.0	1000.0	222.0	V	229.0	8	4:12:59 PM - 3/20/2019
1844.985	45.50	---	74.00	28.50	300.0	1000.0	222.0	V	229.0	8	4:12:59 PM - 3/20/2019



— Preview Result 1-PK+
 * Critical_Freqs PK+
 — FCC 15C PK
- - - FCC 15C AVG
 ◆ Final_Result PK+
 ◆ Final_Result RMS

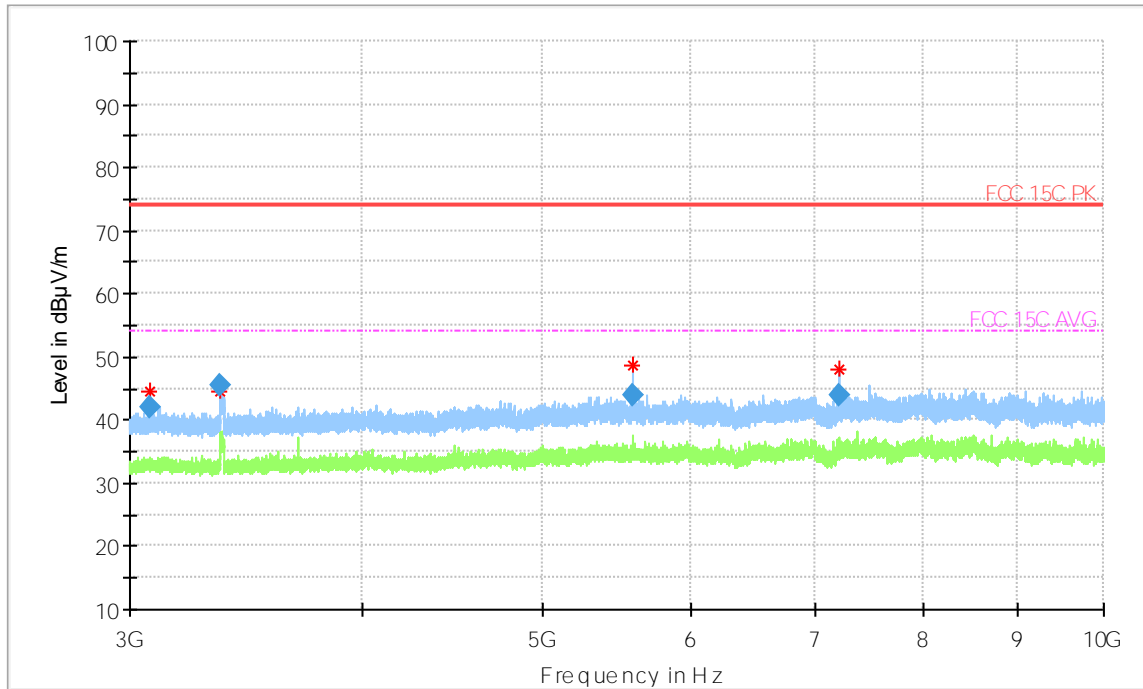


Plot # 14 Radiated Emissions: 3 – 10GHz

Channel: High

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
3077.526	41.87	73.99	32.13	200.0	1000.0	317.0	H	66.0	-37	5:31:32 PM - 3/20/2019
3352.261	45.64	73.99	28.35	200.0	1000.0	202.0	V	281.0	-37	5:41:03 PM - 3/20/2019
5586.895	43.77	73.99	30.22	200.0	1000.0	287.0	H	108.0	-31	5:34:47 PM - 3/20/2019
7207.713	44.02	73.99	29.96	200.0	1000.0	258.0	H	219.0	-30	5:37:41 PM - 3/20/2019



- Preview Result 2-RMS
- Preview Result 1-PK+
- * Critical_Freqs PK+
- FCC 15C PK
- - - FCC 15C AVG
- ◆ Final_Result PK+
- ◆ Final_Result RMS
- * Critical_Freqs RMS



8.2 AC Power Line Conducted Emissions

8.2.1 Measurement according to ANSI C63.4

Analyzer Settings:

- RBW = 9 KHz (CISPR Bandwidth)
- Detector: Peak / Average for Pre-scan
- Quasi-Peak/Average for Final Measurements

8.2.2 Limits: §15.207 & RSS-Gen 8.8

FCC §15.207(a) & RSS-Gen 8.8

- Except as shown in paragraphs (b) and (c) of this section of the CFR, for an intentional radiator 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 (1), as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between frequency ranges.

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

*Decreases with the logarithm of the frequency.

8.2.3 Test conditions and setup:

Ambient Temperature ©	Power line (L1, L2, L3, N)	Power Input
22° C	Line & Neutral	110V / 60Hz

8.2.4 Measurement Result:

Plot #	EUT Set-Up #:	EUT operating mode	Scan Frequency	Limit	Result
1	3	Op.1	150 kHz – 30 MHz	See section 8.2.2	Pass
2	4	Op.1	150 kHz – 30 MHz	See section 8.2.2	Pass



8.2.5 Measurement Plots:

Plot # 1

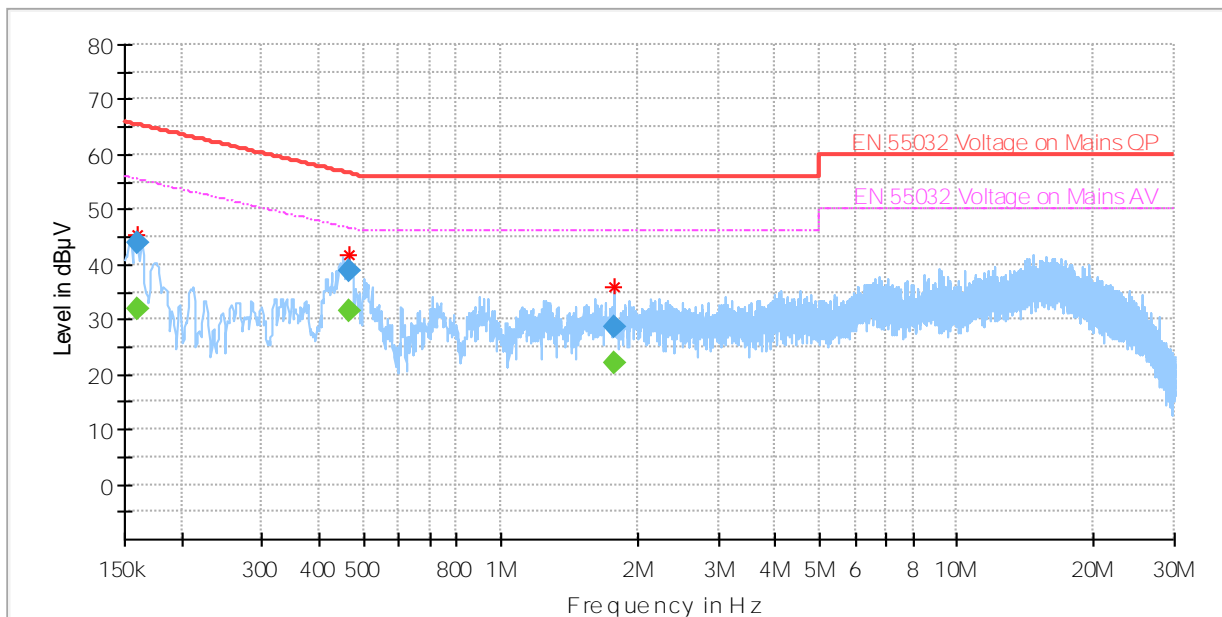
EUT Information

EUT Name: MS3
 Manufacturer: Juniper Systems
 Serial Number: MS3W-C14
 HVIN: MS2GR
 Comment: AE #1 See section 3.3 of this report

Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE	Corr. (dB)	Comment
0.159595	---	31.95	55.49	23.53	500.0	9.000	L1	GND	10.7	12:49:15 PM - 4/16/2019
0.159595	43.88	---	65.49	21.61	500.0	9.000	L1	GND	10.7	12:49:15 PM - 4/16/2019
0.464491	---	31.39	46.61	15.23	500.0	9.000	L1	GND	10.2	12:49:20 PM - 4/16/2019
0.464491	38.95	---	56.61	17.66	500.0	9.000	L1	GND	10.2	12:49:20 PM - 4/16/2019
1.770429	---	22.05	46.00	23.95	500.0	9.000	N	GND	10.3	12:49:42 PM - 4/16/2019
1.770429	28.56	---	56.00	27.44	500.0	9.000	N	GND	10.3	12:49:42 PM - 4/16/2019

Disclaimer: Any measurement data within 2dB from the limit line is conditional PASS/FAIL due to measurement uncertainty considerations.



- Preview Result 1-PK+
- EN 55032 Voltage on Mains QP
- EN 55032 Voltage on Mains AV
- ◆ Final_Result QPK
- * Critical_Freqs PK+
- ◆ Final_Result CAV



Plot # 2

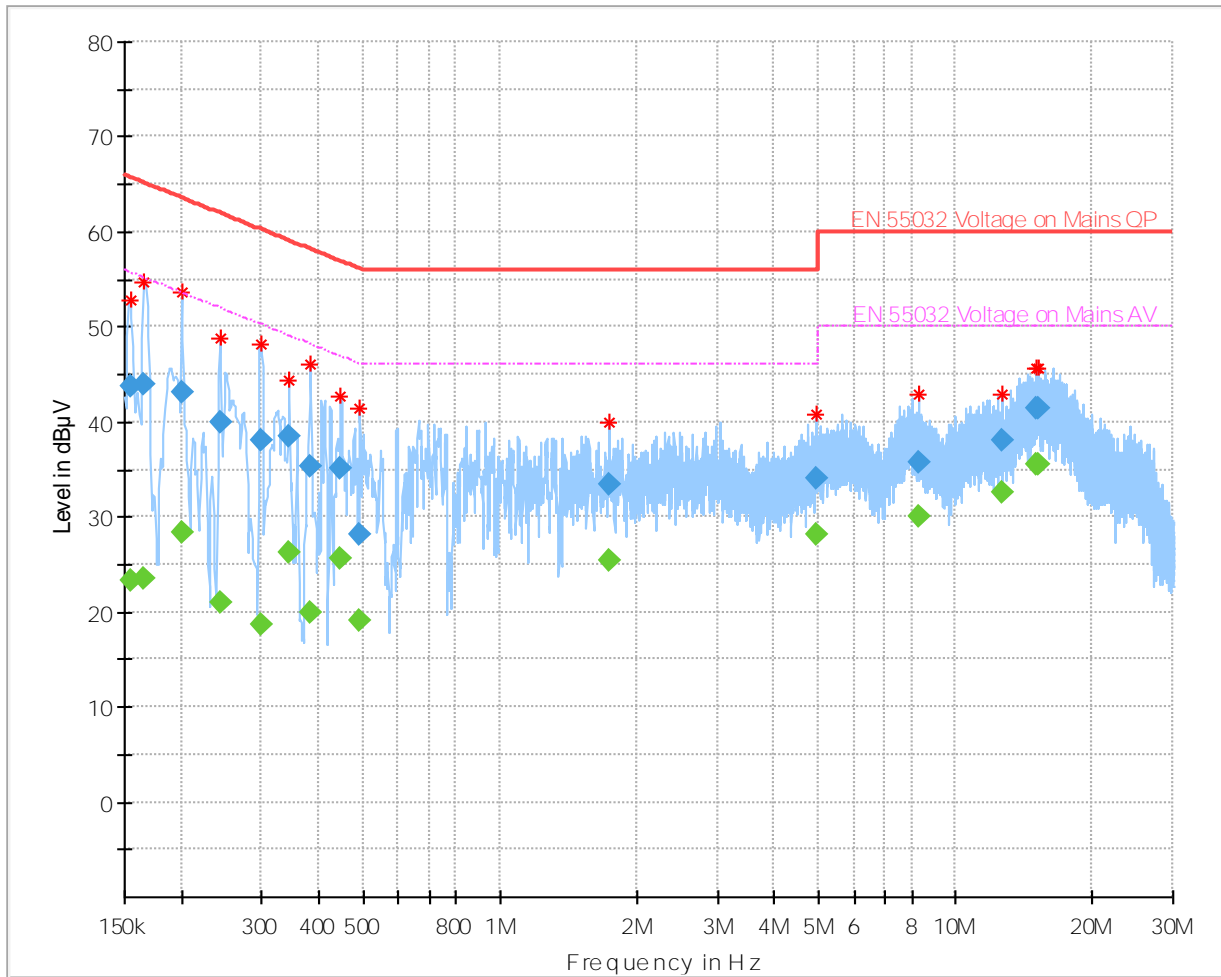
EUT Information

EUT Name: MS3
 Manufacturer: Juniper Systems
 Serial Number: MS3W-C09
 HVIN: MS2GR
 Comment: AE #1 See section 3.3 of this report

Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE	Corr. (dB)	Comment
0.154264	---	23.25	55.77	32.52	500.0	9.000	L1	GND	10.7	12:40:25 PM - 4/16/2019
0.154264	43.69	---	65.77	22.08	500.0	9.000	L1	GND	10.7	12:40:24 PM - 4/16/2019
0.165991	---	23.51	55.16	31.65	500.0	9.000	L1	GND	10.8	12:40:29 PM - 4/16/2019
0.165991	44.03	---	65.16	21.13	500.0	9.000	L1	GND	10.8	12:40:29 PM - 4/16/2019
0.200105	---	28.42	53.61	25.19	500.0	9.000	L1	GND	10.5	12:40:34 PM - 4/16/2019
0.200105	43.19	---	63.61	20.42	500.0	9.000	L1	GND	10.5	12:40:34 PM - 4/16/2019
0.242748	---	21.05	52.00	30.95	500.0	9.000	L1	GND	10.6	12:40:39 PM - 4/16/2019
0.242748	39.93	---	62.00	22.08	500.0	9.000	L1	GND	10.6	12:40:39 PM - 4/16/2019
0.298184	---	18.58	50.29	31.71	500.0	9.000	L1	GND	10.3	12:40:44 PM - 4/16/2019
0.298184	37.96	---	60.29	22.34	500.0	9.000	L1	GND	10.3	12:40:43 PM - 4/16/2019
0.345091	---	26.29	49.08	22.79	500.0	9.000	L1	GND	10.3	12:40:48 PM - 4/16/2019
0.345091	38.44	---	59.08	20.64	500.0	9.000	L1	GND	10.3	12:40:48 PM - 4/16/2019
0.384536	---	19.87	48.18	28.31	500.0	9.000	L1	GND	10.3	12:40:53 PM - 4/16/2019
0.384536	35.30	---	58.18	22.88	500.0	9.000	L1	GND	10.3	12:40:53 PM - 4/16/2019
0.447434	---	25.55	46.92	21.37	500.0	9.000	L1	GND	10.3	12:40:58 PM - 4/16/2019
0.447434	35.09	---	56.92	21.84	500.0	9.000	L1	GND	10.3	12:40:57 PM - 4/16/2019
0.492209	---	19.13	46.13	27.00	500.0	9.000	L1	GND	10.1	12:41:03 PM - 4/16/2019
0.492209	28.15	---	56.13	27.98	500.0	9.000	L1	GND	10.1	12:41:03 PM - 4/16/2019
1.732050	---	25.35	46.00	20.65	500.0	9.000	L1	GND	10.3	12:41:08 PM - 4/16/2019
1.732050	33.49	---	56.00	22.51	500.0	9.000	L1	GND	10.3	12:41:08 PM - 4/16/2019
4.956916	---	28.10	46.00	17.90	500.0	9.000	N	GND	10.2	12:41:29 PM - 4/16/2019
4.956916	34.11	---	56.00	21.89	500.0	9.000	N	GND	10.2	12:41:29 PM - 4/16/2019
8.285191	---	30.02	50.00	19.98	500.0	9.000	L1	GND	10.5	12:41:50 PM - 4/16/2019
8.285191	35.73	---	60.00	24.27	500.0	9.000	L1	GND	10.5	12:41:50 PM - 4/16/2019
12.692330	---	32.60	50.00	17.40	500.0	9.000	N	GND	10.6	12:42:12 PM - 4/16/2019
12.692330	38.08	---	60.00	21.92	500.0	9.000	N	GND	10.6	12:42:11 PM - 4/16/2019
15.053679	---	35.52	50.00	14.48	500.0	9.000	N	GND	10.8	12:42:16 PM - 4/16/2019
15.053679	41.43	---	60.00	18.57	500.0	9.000	N	GND	10.8	12:42:16 PM - 4/16/2019
15.151757	---	35.49	50.00	14.51	500.0	9.000	N	GND	10.8	12:42:21 PM - 4/16/2019
15.151757	41.40	---	60.00	18.60	500.0	9.000	N	GND	10.8	12:42:21 PM - 4/16/2019

Disclaimer: Any measurement data within 2dB from the limit line is conditional PASS/FAIL due to measurement uncertainty considerations.



- Preview Result 1-PK+
- EN 55032 Voltage on Mains OP
- Final_Result OPK
- Critical_Freqs PK+
- EN 55032 Voltage on Mains AV
- Final_Result CAV



9 Test setup photos

Setup photos are included in supporting file name: "EMC_JUNIP_026_19001_FCC_15.247_ISED_RFID_DSS_Setup_Photos.pdf"

10 Test Equipment And Ancillaries Used For Testing

Equipment Type	Manufacturer	Model	Serial #	Calibration Cycle	Last Calibration Date
PASSIVE LOOP	ETS.LINDGREN	6512	00164698	3 YEARS	08/08/2017
BILOG ANTENNA	TESEO	CBL 6141B	41106	3 YEARS	11/01/2017
HORN ANTENNA	ETS.LINDGREN	3115	00035114	3 YEARS	07/31/2017
HORN ANTENNA	ETS.LINDGREN	3117	0167061	3 YEARS	08/08/2017
HORN ANTENNA	ETS.LINDGREN	3116C	00166821	3 YEARS	09/24/2017
SIGNAL ANALYZER	R&S	FSV 40	101022	3 YEARS	07/05/2017
COMPACT DIGITAL BAROMETER	CONTROL COMPANY	35519-055	91119547	2 YEARS	06/20/2017
THRMOMETER HUMIDIY	DICKSON	TM320	16253639	3 YEARS	11/02/2017

Note: 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.

11 Revision History

Date	Report Name	Changes to report	Report prepared by
4/23/2019	EMC_JUNIP_026_19001_FCC_15.247_ISED_RFID_DSS	Draft Version	Issa Ghanma