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EMC Test Report

Application for FCC Grant of Equipment Authorization
Canada Certification
Class III Permissive Change/Reassessment

FCC Part 15, Subpart E

Model: APIN0103

FCC ID:	Q9DAPIN0103
APPLICANT:	Aruba Networks 1344 Crossman Ave Sunnyvale, CA 94089
TEST SITE(S):	National Technical Systems - Silicon Valley 41039 Boyce Road. Fremont, CA. 94538-2435
IC SITE REGISTRATION #:	2845B-7
REPORT DATE:	May 9, 2016
FINAL TEST DATES:	March 7 and 8, 2016
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PROGRAM MGR / TECHNICAL REVIEWER:	QUALITY ASSURANCE DELEGATE / FINAL REPORT PREPARER:
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A2LA ACCREDITED
Testing Cert #0214.26

REVISION HISTORY

Rev#	Date	Comments	Modified By
-	May 9, 2016	First release	

TABLE OF CONTENTS

SCOPE

An electromagnetic emissions test has been performed on the Aruba Networks model APIN0103, pursuant to the following rules:

FCC Part 15, Subpart E requirements for UNII Devices

Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in the following reference standards and as outlined in National Technical Systems - Silicon Valley test procedures:

FCC General UNII Test Procedures KDB789033

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant Industry Canada performance and procedural standards.

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

OBJECTIVE

The primary objective of the manufacturer is compliance with the regulations outlined in the previous section.

Prior to marketing in the USA, all unlicensed transmitters and transceivers require certification. Receive-only devices operating between 30 MHz and 960 MHz are subject to either certification or a manufacturer's declaration of conformity, with all other receive-only devices exempt from the technical requirements.

Certification is a procedure where the manufacturer submits test data and technical information to a certification body and receives a certificate or grant of equipment authorization upon successful completion of the certification body's review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units, which are subsequently manufactured.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

STATEMENT OF COMPLIANCE

The tested sample of Aruba Networks model APIN0103 complied with the requirements of the following regulations:

FCC Part 15, Subpart E requirements for UNII Devices

Maintenance of compliance is the responsibility of the manufacturer. Any modifications to the product should be assessed to determine their potential impact on the compliance status of the device with respect to the standards detailed in this test report.

The test results recorded herein are based on a single type test of Aruba Networks model APIN0103 and therefore apply only to the tested sample. The sample was selected and prepared by Rob Hastings of Aruba Networks.

DEVIATIONS FROM THE STANDARDS

No deviations were made from the published requirements listed in the scope of this report.

TEST RESULTS SUMMARY

UNII / LELAN DEVICES

OPERATION IN THE 5.725 – 5.85 GHZ BAND

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.407(e)	RSS-247 6.2.4 (1)	6dB Bandwidth	Unchanged from original filing		
15.407(a) (3)	RSS-210 A9.2(2)	Output Power (multipoint systems)	a: 22.5dBm (178.3 mW) n20: 21.6dBm (145.0 mW) n40: 20.9dBm (123.6 mW) (Max eirp: 0.480W)	30 dBm (1 W) EIRP <= 4W	Complies
15.407(a) (3)	RSS-247 6.2.3 (1)	Power Spectral Density	a: 12.1dBm/MHz n20: 10.8dBm/MHz n40: 7.2dBm/MHz	30 dBm / 500 kHz	Complies
15.407(b) (4) / 15.209	RSS-247 6.2.4 (2)	Spurious Emissions	78.0 dBµV/m @ 5724.9 MHz (-0.3 dB)	Refer to the limits section (p20) for restricted bands, all others -17 dBm/MHz EIRP bandedge and -27 dBm/MHz EIRP	Complies

REQUIREMENTS FOR ALL U-NII/LELAN BANDS

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result
15.407	RSS-247 6.1	Modulation	Unchanged from original filing		
15.31 (m)	RSS-247 6.4 (1) RSS-Gen 6.8	Channel Selection	Emissions tested at outermost and middle channels in each band	Device was tested on the top, bottom and center channels in each band	N/A
15.407 (c)	RSS-247 6.4 (2)	Operation in the absence of information to transmit	Unchanged from original filing		
15.407 (g)		Frequency Stability			
15.407 (h1)	RSS-247 6.2.2 (1) 6.2.3 (1)	Transmit Power Control			
15.407 (h2)	RSS-247 6.3	Dynamic frequency Selection (device with radar detection)	Refer to separate test report	Threshold -62dBm (-64dBm if eirp > 200mW) Channel Availability Check > 60s Channel closing transmission time < 260ms Channel move time < 10s Non occupancy period > 30minutes	Complies

GENERAL REQUIREMENTS APPLICABLE TO ALL BANDS

FCC Rule Part	RSS Rule part	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.203	-	RF Connector	Unchanged from original filing		
15.407 (b) (6)	RSS-Gen Table 3	AC Conducted Emissions	34.2dBµV @ 0.36MHz. (-14.6dB)	Refer to page 19	Complies
15.247 (i) 15.407 (f)	RSS 102	RF Exposure Requirements	Original filing MPE exhibit represents worse case.		

MEASUREMENT UNCERTAINTIES

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level and were calculated in accordance with UKAS document LAB 34.

Measurement Type	Measurement Unit	Frequency Range	Expanded Uncertainty
RF power, conducted (power meter)	dBm	25 to 7000 MHz	± 0.52 dB
RF power, conducted (Spectrum analyzer)	dBm	25 to 7000 MHz	± 0.7 dB
Conducted emission of transmitter	dBm	25 to 26500 MHz	± 0.7 dB
Conducted emission of receiver	dBm	25 to 26500 MHz	± 0.7 dB
Radiated emission (substitution method)	dBm	25 to 26500 MHz	± 2.5 dB
Radiated emission (field strength)	dBµV/m	25 to 1000 MHz	± 3.6 dB
		1000 to 40000 MHz	± 6.0 dB
Conducted Emissions (AC Power)	dBµV	0.15 to 30 MHz	± 2.4 dB

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Aruba Networks model APIN0103 is an IEEE 802.11 abgn 2x2 access point.

The sample was received on March 7, 2016 and tested on March 7 and 8, 2016. The EUT consisted of the following component(s):

Company	Model	Description	Serial Number	FCC ID
Aruba Network	APIN0103	Access Point	CU0006604	4675A-APIN0103
Aruba Network	APIN0103	Access Point	CU0005990	4675A-APIN0103
CUIINC	6A-301DB12	AC/DC Power Supply	-	-

OTHER EUT DETAILS

Supports 20/40MHz bandwidths
2x2 only, CDD only

ANTENNA SYSTEM

Integral antenna, 3.9dBi for 2.4GHz, 4.1dBi for 5.15-5.35GHz band, 4.3dBi for 5.475-5.850GHz band

ENCLOSURE

The EUT enclosure is primarily constructed of plastic. It measures approximately 15 x 15 x 4cm high.

MODIFICATIONS

No modifications were made to the EUT during the time the product was at NTS Silicon Valley.

SUPPORT EQUIPMENT

No local support equipment was used during testing.

The following equipment was used as remote support equipment for emissions testing:

Company	Model	Description	Serial Number	FCC ID
Dell	E5440	Laptop	GMPNP12	-

EUT INTERFACE PORTS

The I/O cabling configuration during testing was as follows:

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
ENET	Laptop	UTP	Unshielded	10
Console	Laptop	Serial	Shielded	10

EUT OPERATION

During testing, the EUT was configured for continuous transmission on the noted channel. The data rate with the highest output power was used for each mode.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken at the test sites listed below. Pursuant to section 2.948 of the FCC's Rules and section 3.3 of RSP-100, construction, calibration, and equipment data has been filed with the Commission and with industry Canada.

Site	Designation / Registration Numbers		Location
	FCC	Canada	
Chamber 7	US0027	2845B-7	41039 Boyce Road Fremont, CA 94538-2435

ANSI C63.4 recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement. The test site(s) contain separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent requirements of ANSI C63.4.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing is performed in conformance with ANSI C63.10. Measurements are made with the EUT connected to the public power network through a nominal, standardized RF impedance, which is provided by a line impedance stabilization network, known as a LISN. A LISN is inserted in series with each current-carrying conductor in the EUT power cord.

RADIATED EMISSIONS CONSIDERATIONS

The FCC has determined that radiation measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an open field environment or in a semi-anechoic chamber. The test sites are maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4 guidelines and meet the Normalized Site Attenuation (NSA) requirements of ANSI C63.4.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1-1 is used for emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 2000 MHz. These receivers allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the CISPR detector used during measurements. If the repetition frequency of the signal being measured is below 20Hz, peak measurements are made in lieu of Quasi-Peak measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. Average measurements above 1000MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz, unless the signal is pulsed in which case the average (or video) bandwidth of the measuring instrument is reduced to onset of pulse desensitization and then increased.

INSTRUMENT CONTROL COMPUTER

Software is used to view and convert receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate. A personal computer is used to record all measurements made with the receivers. The software used for radiated and conducted emissions measurements is NTS EMI Test Software (rev 2.10)

LINE IMPEDANCE STABILIZATION NETWORK (LISN)

Line conducted measurements utilize a fifty microhenry Line Impedance Stabilization Network as the monitoring point. The LISN used also contains a 250 uH CISPR adapter. This network provides for calibrated radio frequency noise measurements by the design of the internal low pass and high pass filters on the EUT and measurement ports, respectively.

FILTERS/ATTENUATORS

External filters and precision attenuators are often connected between the receiving antenna or LISN and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

ANTENNAS

A loop antenna is used below 30 MHz. For the measurement range 30 MHz to 1000 MHz either a combination of a biconical antenna and a log periodic or a bi-log antenna is used. Above 1000 MHz, horn antennas are used. The antenna calibration factors to convert the received voltage to an electric field strength are included with appropriate cable loss and amplifier gain factors to determine an overall site factor, which is then programmed into the test receivers or incorporated into the test software.

ANTENNA MAST AND EQUIPMENT TURNTABLE

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height. Measurements below 30 MHz are made with the loop antenna at a fixed height of 1m above the ground plane.

ANSI C63.10 specifies that the test height above ground for table mounted devices shall be 80 centimeters. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor as specified in ANSI C63.4. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

INSTRUMENT CALIBRATION

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An exhibit of this report contains the list of test equipment used and calibration information.

TEST PROCEDURES

EUT AND CABLE PLACEMENT

The regulations require that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.10, and the worst-case orientation is used for final measurements.

CONDUCTED EMISSIONS

Conducted emissions are measured at the plug end of the power cord supplied with the EUT. Excess power cord length is wrapped in a bundle between 30 and 40 centimeters in length near the center of the cord. Preliminary measurements are made to determine the highest amplitude emission relative to the specification limit for all the modes of operation. Placement of system components and varying of cable positions are performed in each mode. A final peak mode scan is then performed in the position and mode for which the highest emission was noted on all current carrying conductors of the power cord.

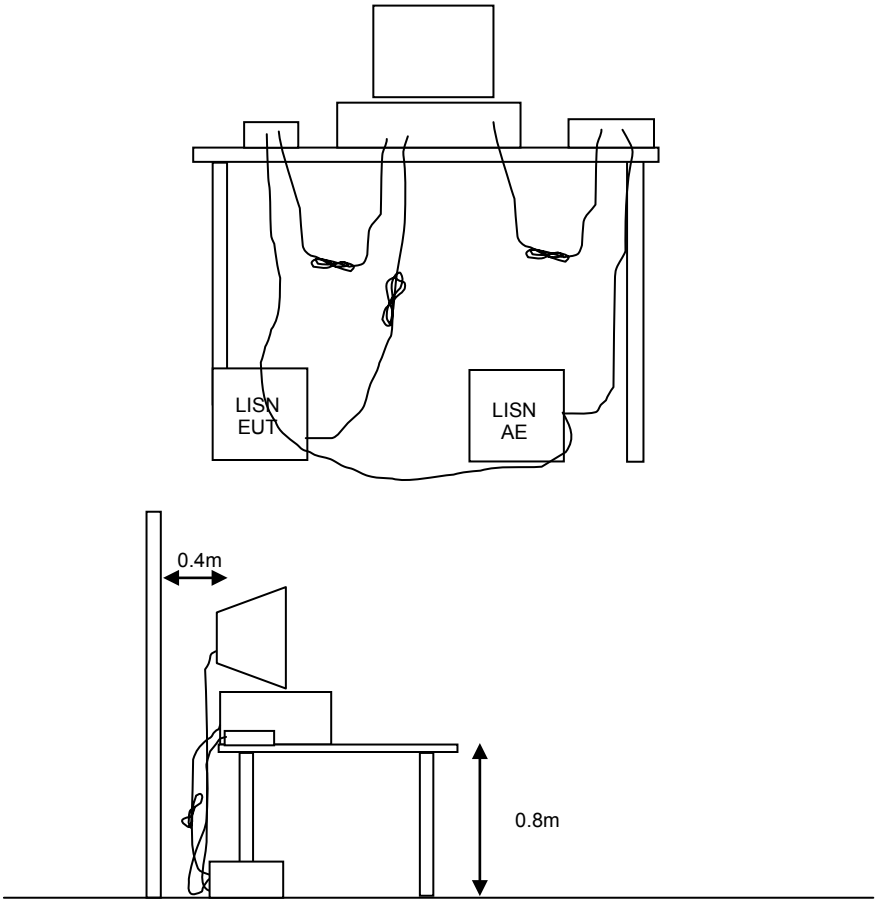


Figure 1 Typical Conducted Emissions Test Configuration

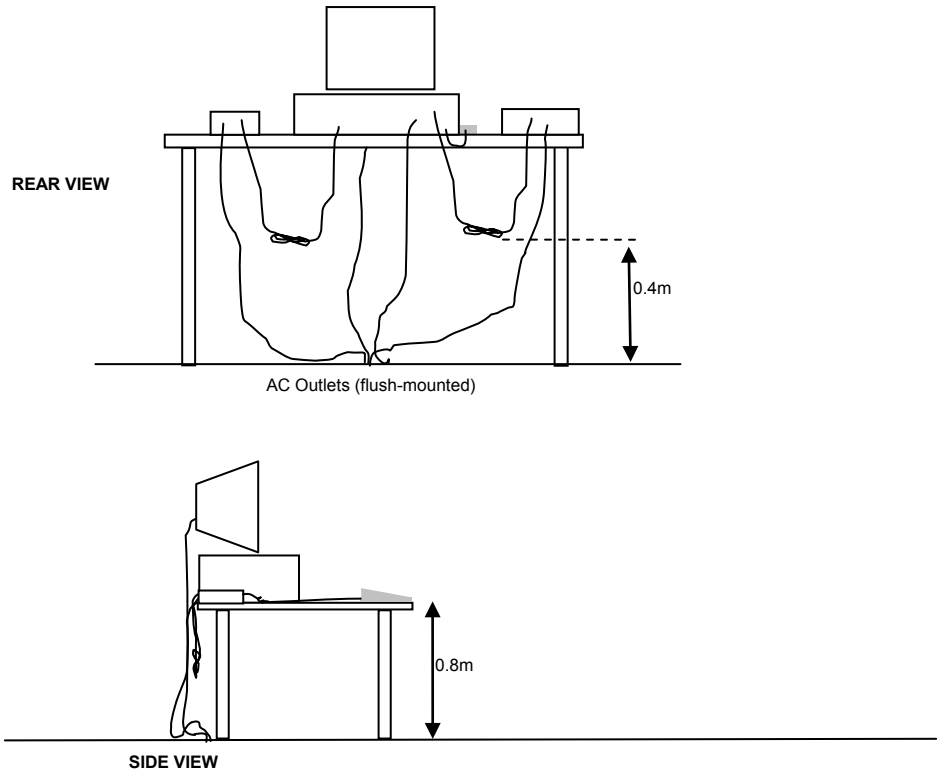
RADIATED EMISSIONS

A preliminary scan of the radiated emissions is performed in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed, one scan for each antenna polarization (horizontal and vertical; loop parallel and perpendicular to the EUT). During the preliminary scans, the EUT is rotated through 360˚, the antenna height is varied (for measurements above 30 MHz) and cable positions are varied to determine the highest emission relative to the limit. Preliminary scans may be performed in a fully anechoic chamber for the purposes of identifying the frequencies of the highest emissions from the EUT.

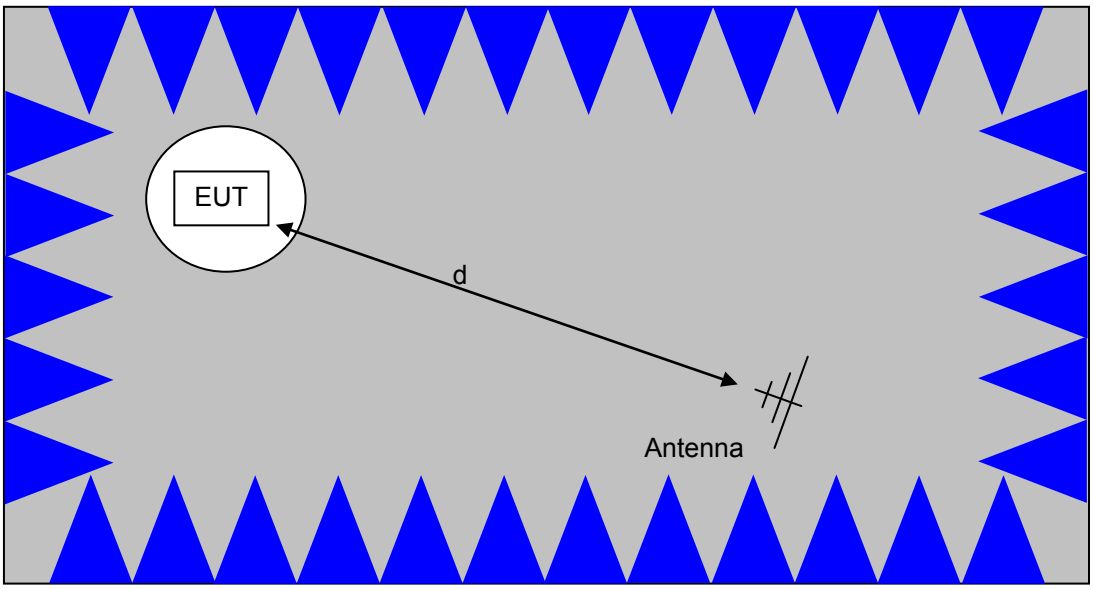
A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth, which results in the highest emission is then maintained while varying the antenna height from one to four meters (for measurements above 30 MHz, measurements below 30 MHz are made with the loop antenna at a fixed height of 1m). The result is the identification of the highest amplitude for each of the highest peaks. Each recorded level is corrected in the receiver using appropriate factors for cables, connectors, antennas, and preamplifier gain.

When testing above 18 GHz, the receive antenna is located at 1meter from the EUT and the antenna height is restricted to a maximum of 2.5 meters.

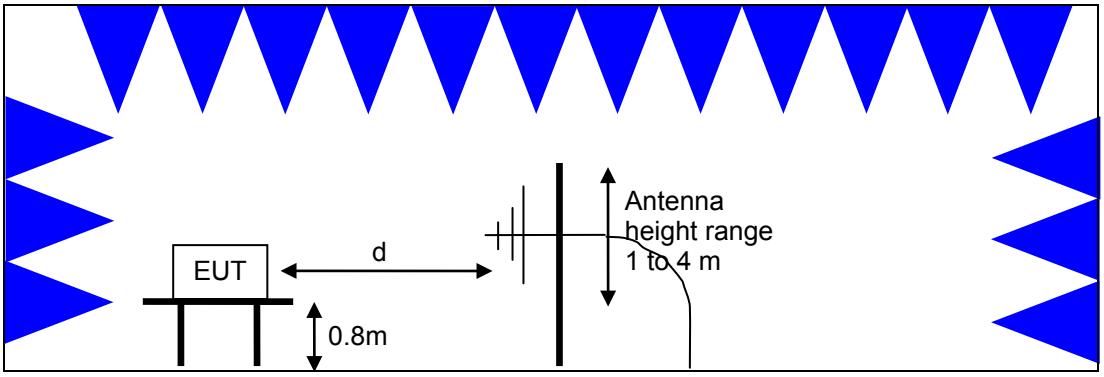


Typical Test Configuration for Radiated Field Strength Measurements



The anechoic materials on the walls and ceiling ensure compliance with the normalized site attenuation requirements of CISPR 16 / CISPR 22 / ANSI C63.4 for an alternate test site at the measurement distances used.

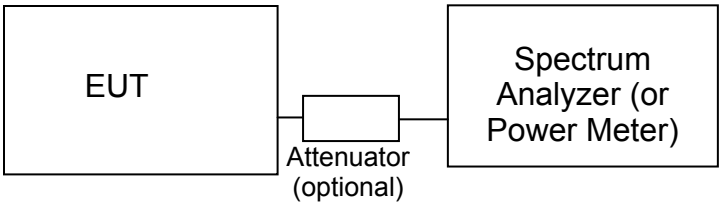
Floor-standing equipment is placed on the floor with insulating supports between the unit and the ground plane.



Test Configuration for Radiated Field Strength Measurements
Semi-Anechoic Chamber, Plan and Side Views

CONDUCTED EMISSIONS FROM ANTENNA PORT

Direct measurements of power, bandwidth and power spectral density are performed, where possible, with the antenna port of the EUT connected to either the power meter or spectrum analyzer via a suitable attenuator and/or filter. These are used to ensure that the front end of the measurement instrument is not overloaded by the fundamental transmission.



Test Configuration for Antenna Port Measurements

Measurement bandwidths (video and resolution) are set in accordance with the relevant standards and NTS Silicon Valley's test procedures for the type of radio being tested. When power measurements are made using a resolution bandwidth less than the signal bandwidth the power is calculated by summing the power across the signal bandwidth using either the analyzer channel power function or by capturing the trace data and calculating the power using software. In both cases the summed power is corrected to account for the equivalent noise bandwidth (ENBW) of the resolution bandwidth used.

If power averaging is used (typically for certain digital modulation techniques), the EUT is configured to transmit continuously. Power averaging is performed using either the built-in function of the analyzer or, if the analyzer does not feature power averaging, using external software. In both cases the average power is calculated over a number of sweeps (typically 100). When the EUT cannot be configured to continuously transmit then either the analyzer is configured to perform a gated sweep to ensure that the power is averaged over periods that the device is transmitting or power averaging is disabled and a max-hold feature is used.

If a power meter is used to make output power measurements the sensor head type (peak or average) is stated in the test data table.

BANDWIDTH MEASUREMENTS

The 6dB, 20dB, 26dB and/or 99% signal bandwidth are measured using the bandwidths recommended by ANSI C63.10 and RSS GEN.

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

The limits for conducted emissions are given in units of microvolts, and the limits for radiated emissions are given in units of microvolts per meter at a specified test distance. Data is measured in the logarithmic form of decibels relative to one microvolt, or dB microvolts (dBuV). For radiated emissions, the measured data is converted to the field strength at the antenna in dB microvolts per meter (dBuV/m). The results are then converted to the linear forms of uV and uV/m for comparison to published specifications.

For reference, converting the specification limits from linear to decibel form is accomplished by taking the base ten logarithm, then multiplying by 20. These limits in both linear and logarithmic form are as follows:

CONDUCTED EMISSIONS SPECIFICATION LIMITS: FCC 15.207; FCC 15.107(a), RSS GEN

The table below shows the limits for the emissions on the AC power line from an intentional radiator and a receiver.

Frequency (MHz)	Average Limit (dBuV)	Quasi Peak Limit (dBuV)
0.150 to 0.500	Linear decrease on logarithmic frequency axis between 56.0 and 46.0	Linear decrease on logarithmic frequency axis between 66.0 and 56.0
0.500 to 5.000	46.0	56.0
5.000 to 30.000	50.0	60.0

GENERAL TRANSMITTER RADIATED EMISSIONS SPECIFICATION LIMITS

The table below shows the limits for the spurious emissions from transmitters that fall in restricted bands[1].

Frequency Range (MHz)	Limit (uV/m)	Limit (dBuV/m @ 3m)
0.009-0.490	$2400/F_{KHz}$ @ 300m	$67.6-20*\log_{10}(F_{KHz})$ @ 300m
0.490-1.705	$24000/F_{KHz}$ @ 30m	$87.6-20*\log_{10}(F_{KHz})$ @ 30m
1.705 to 30	30 @ 30m	29.5 @ 30m
30 to 88	100 @ 3m	40 @ 3m
88 to 216	150 @ 3m	43.5 @ 3m
216 to 960	200 @ 3m	46.0 @ 3m
Above 960	500 @ 3m	54.0 @ 3m

RECEIVER RADIATED SPURIOUS EMISSIONS SPECIFICATION LIMITS

The table below shows the limits for the spurious emissions from receivers as detailed in FCC Part 15.109 and RSS GEN Table 2. Note that receivers operating outside of the frequency range 30 MHz – 960 MHz are exempt from the requirements of 15.109 and receivers that are not stand-alone are exempt from the ISED Canada requirements per RSS-GEN.

Frequency Range (MHz)	Limit (uV/m @ 3m)	Limit (dBuV/m @ 3m)
30 to 88	100	40
88 to 216	150	43.5
216 to 960	200	46.0
Above 960	500	54.0

[1] The restricted bands are detailed in FCC 15.205 and RSS-Gen Table 6

FCC 15.407 (a) OUTPUT POWER LIMITS

The table below shows the limits for output power and output power density. For the 5250-5350 and 5470-5725 MHz bands, where the signal bandwidth is less than 20 MHz the maximum output power is reduced to the power spectral density limit plus 10 times the log of the bandwidth (in MHz).

Operating Frequency (MHz)	Output Power	Power Spectral Density
5150 – 5250	1Watt (30 dBm)	17 dBm/MHz
5250 – 5350 and 5470-5725	250 mW (24 dBm)	11 dBm/MHz
5725 – 5825	1 Watt (30 dBm)	30 dBm/500kHz

For system using antennas with gains exceeding 6dBi, the output power and power spectral density limits are reduced by 1dB for every dB the antenna gain exceeds 6dBi.

SPURIOUS EMISSIONS LIMITS –UNII and LELAN DEVICES

The spurious emissions limits for signals below 1GHz are the FCC/RSS-Gen general limits. For emissions above 1GHz, signals in restricted bands are subject to the FCC/RSS-Gen general limits. All other signals have a limit of –27dBm/MHz, which is field strength of 68.3dBuV/m/MHz at a distance of 3m. For devices operating in the 5725-5850 MHz bands under the LELAN/UNII rules, the limit within 10MHz of the allocated band is increased to –17dBm/MHz.

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

Receiver readings are compared directly to the conducted emissions specification limit (decibel form) as follows:

$$R_r - S = M$$

where:
R_r = Receiver Reading in dBuV
S = Specification Limit in dBuV
M = Margin to Specification in +/- dB

SAMPLE CALCULATIONS - RADIATED EMISSIONS

Receiver readings are compared directly to the specification limit (decibel form). The receiver internally corrects for cable loss, preamplifier gain, and antenna factor. The calculations are in the reverse direction of the actual signal flow, thus cable loss is added and the amplifier gain is subtracted. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

A distance factor, when used for electric field measurements above 30MHz, is calculated by using the following formula:

$$F_d = 20*LOG_{10} (D_m/D_s)$$

where:
F_d = Distance Factor in dB
D_m = Measurement Distance in meters
D_s = Specification Distance in meters

For electric field measurements below 30MHz the extrapolation factor is either determined by making measurements at multiple distances or a theoretical value is calculated using the formula:

$$F_d = 40*LOG_{10} (D_m/D_s)$$

Measurement Distance is the distance at which the measurements were taken and Specification Distance is the distance at which the specification limits are based. The antenna factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

The margin of a given emission peak relative to the limit is calculated as follows:

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:
R_r = Receiver Reading in dBuV/m
F_d = Distance Factor in dB
R_c = Corrected Reading in dBuV/m
L_s = Specification Limit in dBuV/m
M = Margin in dB Relative to Spec

SAMPLE CALCULATIONS - FIELD STRENGTH TO EIRP CONVERSION

Where the radiated electric field strength is expressed in terms of the equivalent isotropic radiated power (eirp), or where a field strength measurement of output power is made in lieu of a direct measurement, the following formula is used to convert between eirp and field strength at a distance of d (meters) from the equipment under test:

$$E = \frac{1000000 \sqrt{30 P}}{d} \quad \text{microvolts per meter}$$

where P is the eirp (Watts)

For a measurement at 3m the conversion from a logarithmic value for field strength (dBuV/m) to an eirp power (dBm) is -95.3dB.

Appendix A Test Equipment Calibration Data

Radiated Emissions, 1000 - 40,000 MHz, 07-Mar-16

Manufacturer	Description	Model	Asset #	Calibrated	Cal Due
EMCO	Antenna, Horn, 1-18GHz	3115	868	6/26/2014	6/26/2016
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	870	1/21/2016	1/21/2017
HP / Miteq	SA40 Head (Red)	TTA1840-45-5P-HG-S	1145	7/17/2015	7/17/2016
Hewlett Packard	Spectrum Analyzer (SA40) Red 30 Hz -40 GHz	8564E (84125C)	1148	10/17/2015	10/17/2016
Micro-Tronics	Band Reject Filter, 5725-5875 MHz	BRC50705-02	1682	7/8/2015	7/8/2016
Hewlett Packard	High Pass filter, 8.2 GHz (Purple System)	P/N 84300-80039	1767	11/3/2015	11/3/2016
A. H. Systems	Purple System Horn, 18-40GHz	SAS-574, p/n: 2581	2160	8/28/2014	8/28/2017

Conducted Emissions - AC Power Ports, 08-Mar-16

Manufacturer	Description	Model	Asset #	Calibrated	Cal Due
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1538	12/19/2015	12/19/2016
Rohde & Schwarz	Pulse Limiter	ESH3 Z2	1594	5/14/2015	5/14/2016
Com-Power	9KHz-30MHz, 50uH, 15Aac, 10Adc, max CISPR 15	LI-215A	2671	6/26/2015	6/26/2016

Radio Antenna Port (Power and Spurious Emissions), 08-Mar-16

Manufacturer	Description	Model	Asset #	Calibrated	Cal Due
Agilent Technologies	PSA, Spectrum Analyzer, (installed options, 111, 115, 123, 1DS, B7J, HYX,	E4446A	2139	6/22/2015	6/22/2016

Appendix B Test Data

T101080 Pages 26 – 57

Client:	Aruba Networks	Job Number:	JD100928
Product	APIN0103 (FCC ID: Q9DAPIN0103)	T-Log Number:	T101080
System Configuration:	-	Project Manager:	Christine Krebill
Contact:	Rob Hastings	Project Coordinator:	-
Emissions Standard(s):	FCC 15.407	Class:	B
Immunity Standard(s):	-	Environment:	-

EMC Test Data

For The

Aruba Networks

Product

APIN0103 (FCC ID: Q9DAPIN0103)

Date of Last Test: 3/8/2016

Client:	Aruba Networks	Job Number:	JD100928
Model:	APIN0103 (FCC ID: Q9DAPIN0103)	T-Log Number:	T101080
		Project Manager:	Christine Krebill
Contact:	Rob Hastings	Project Coordinator:	-
Standard:	FCC 15.407	Class:	N/A

Power vs. Data Rate

In normal operating modes the card uses power settings stored on EEPROM to set the output power. For a given nominal output power the actual transmit power normally is reduced as the data rate increases, therefore testing was performed at the data rate in the mode with highest power to determine compliance with the requirements.
The following power measurements were made using a GATED average power meter and with the device configured in a continuous transmit mode on Chain 1 at the various data rates in each mode to verify the highest power mode:

Sample Notes

Sample S/N: CU0005990
Driver:

Duty Cycle

Date of Test: 3/7/2016
Test Engineer: Mehran Birgani
Test Location: Lab 3

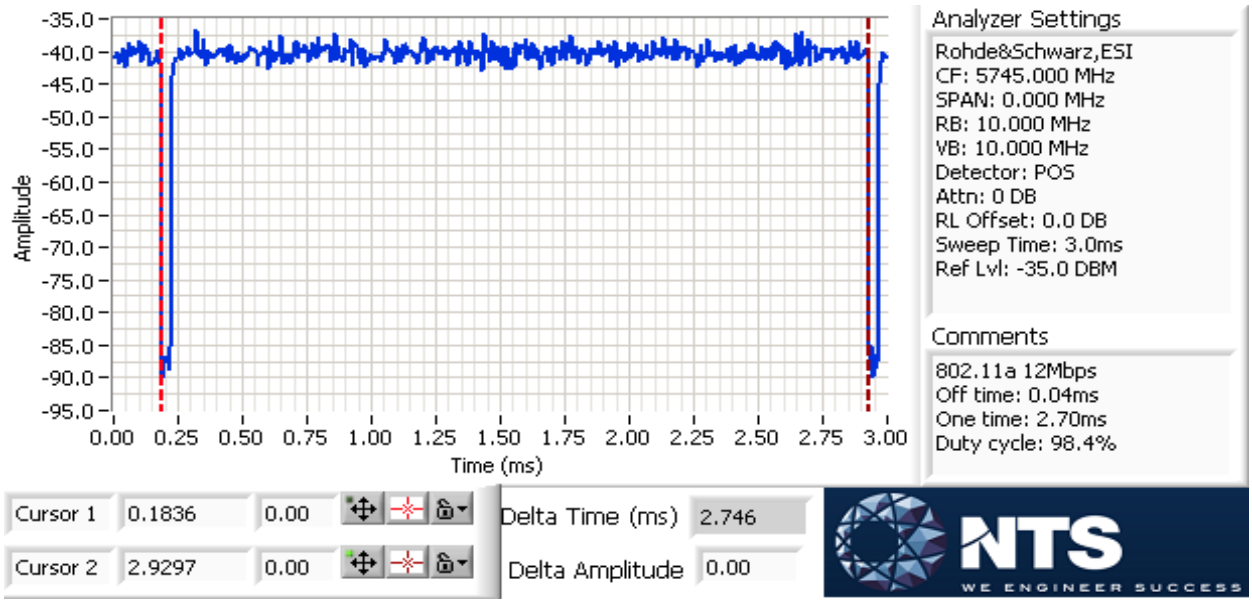
Duty cycle measurements performed on the worse case data rate for power.

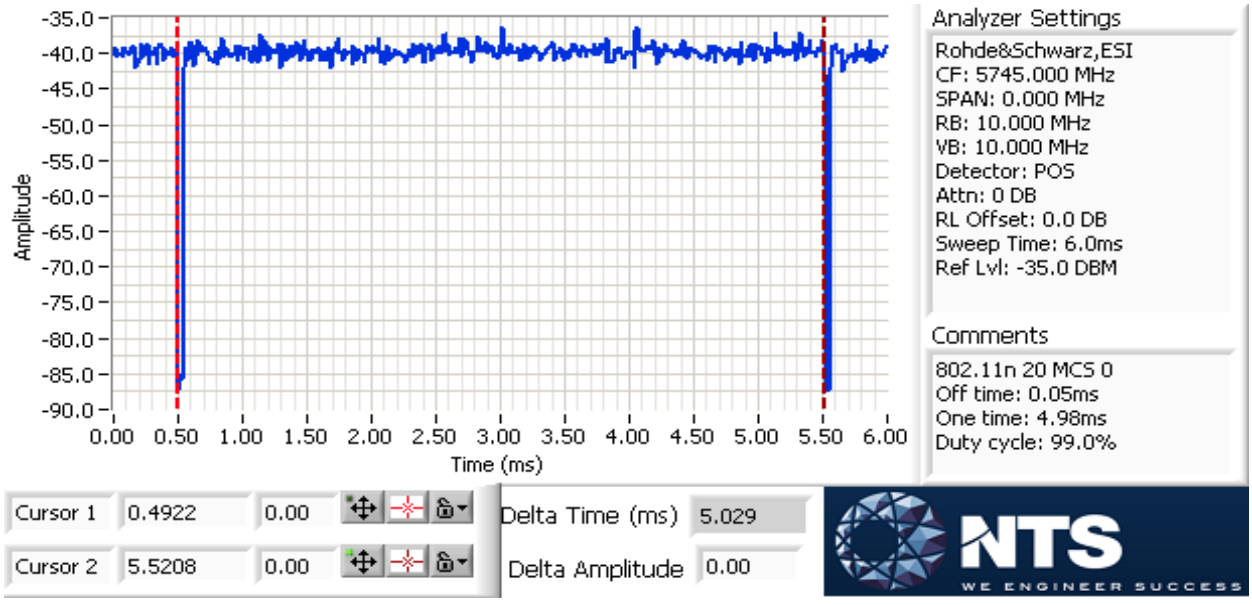
Notes: Measurements taken with maximum RBW/VBW settings allowed.

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
11a	12 MBps	98.4%	Yes	2.70	0	0	10
n20	MCS 0	99.0%	Yes	4.98	0	0	10
n40	MCS 0	98.8%	Yes	2.41	0	0	10

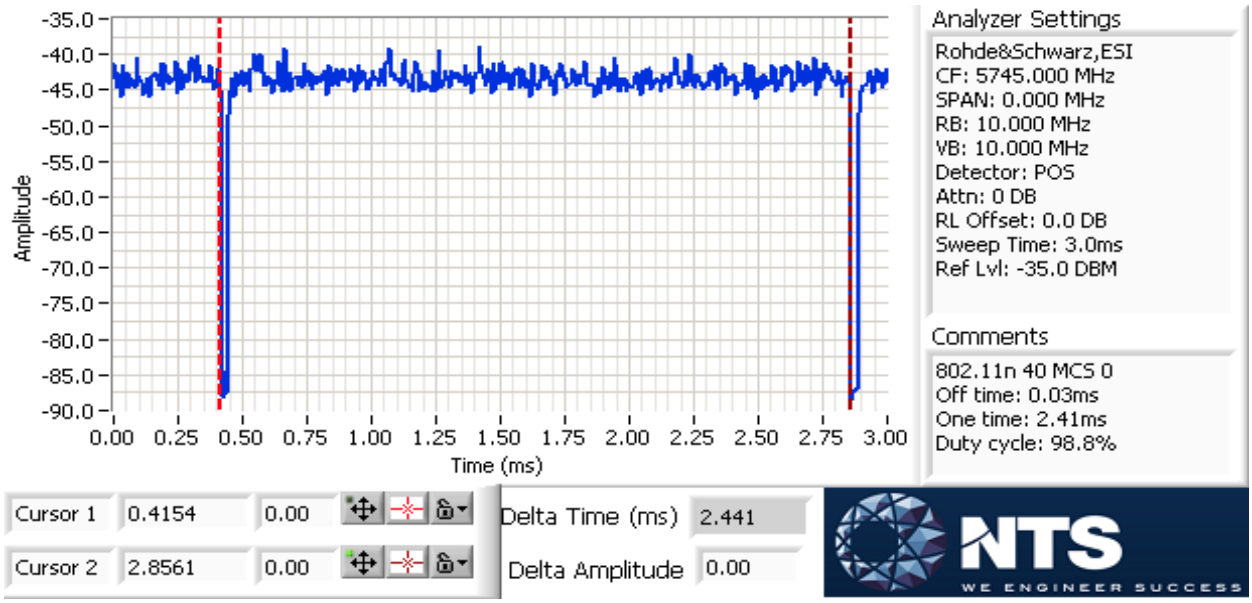
* Correction factor when using RMS/Power averaging - 10*log(1/x)
** Correction factor when using linear voltage average - 20*log(1/x)
T = Minimum transmission duration

Client:	Aruba Networks	Job Number:	JD100928
Model:	APIN0103 (FCC ID: Q9DAPIN0103)	T-Log Number:	T101080
		Project Manager:	Christine Krebill
Contact:	Rob Hastings	Project Coordinator:	-
Standard:	FCC 15.407	Class:	N/A





Client:	Aruba Networks	Job Number:	JD100928
Model:	APIN0103 (FCC ID: Q9DAPIN0103)	T-Log Number:	T101080
		Project Manager:	Christine Krebill
Contact:	Rob Hastings	Project Coordinator:	-
Standard:	FCC 15.407	Class:	N/A



Client:	Aruba Networks	Job Number:	JD100928
Model:	APIN0103 (FCC ID: Q9DAPIN0103)	T-Log Number:	T101080
		Project Manager:	Christine Krebill
Contact:	Rob Hastings	Project Coordinator:	-
Standard:	FCC 15.407	Class:	N/A

Date of Test: 3/7/2016
Test Engineer: Mehran Birgani
Test Location: Lab 3

Data Rate

Mode	Data Rate	Power (dBm)	Power setting
802.11a	6	19.5	20.0
	9	19.6	
	12	**19.7**	
	18	19.4	
	24	19.6	
	36	19.4	
	48	19.4	
	54	19.4	
802.11n 20MHz	6.5	**19.5**	20.0
	13	19.4	
	19.5	19.4	
	26	19.3	
	39	19.5	
	52	19.4	
	58.5	19.3	
	65	19.3	
802.11n/ac 40MHz	13.5	**19.3**	20.0
	27	19.3	
	40.5	19.2	
	54	19.2	
	81	19.2	
	108	19.0	
	121.5	19.1	
	135	19.0	

Note : Power setting - the software power setting used during testing, included for reference only.

Client:	Aruba Networks	Job Number:	JD100928
Model:	APIN0103 (FCC ID: Q9DAPIN0103)	T-Log Number:	T101080
		Project Manager:	Christine Krebill
Contact:	Rob Hastings	Project Coordinator:	-
Standard:	FCC 15.407	Class:	N/A

RSS-247 and FCC 15.407 (UNII) Radiated Spurious Emissions

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing.
For radiated emissions testing the measurement antenna was located 3 meters from the EUT, unless otherwise noted.

Ambient Conditions:

Temperature:	21.8 °C
Rel. Humidity:	35 %

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Aruba Networks	Job Number:	JD100928
Model:	APIN0103 (FCC ID: Q9DAPIN0103)	T-Log Number:	T101080
		Project Manager:	Christine Krebill
Contact:	Rob Hastings	Project Coordinator:	-
Standard:	FCC 15.407	Class:	N/A

Summary of Results

Run #	Mode	Channel	Target Setting	Final Setting	Test Performed	Limit	Result / Margin
20MHz Bandwith Modes							
1	a	149 - 5745MHz	18	19	Band Edge 5715 MHz	15E	62.6 dBµV/m @ 5715.0 MHz (-5.7 dB)
					Band Edge 5715 - 5725 MHz		78.0 dBµV/m @ 5724.9 MHz (-0.3 dB)
		165 - 5825MHz	18	23	Band Edge 5850 MHz		76.1 dBµV/m @ 5850.8 MHz (-2.2 dB)
					Band Edge 5860 MHz		65.8 dBµV/m @ 5860.3 MHz (-2.5 dB)
20MHz Bandwith Modes (continued)							
2	HT20	149 - 5745MHz	18	17	Band Edge 5715 MHz	15E	60.8 dBµV/m @ 5712.5 MHz (-7.5 dB)
					Band Edge 5715 - 5725 MHz		77.6 dBµV/m @ 5725.0 MHz (-0.7 dB)
		165 - 5825MHz	18	21	Band Edge 5850 MHz		73.6 dBµV/m @ 5850.8 MHz (-4.7 dB)
					Band Edge 5860 MHz		66.9 dBµV/m @ 5862.6 MHz (-1.4 dB)
40MHz Bandwith Modes							
3	HT40	151 - 5755MHz	18	15	Band Edge 5715 MHz	15E	67.8 dBµV/m @ 5711.2 MHz (-0.5 dB)
					Band Edge 5715 - 5725 MHz		74.0 dBµV/m @ 5723.2 MHz (-4.3 dB)
		159 - 5795MHz	18	21	Band Edge 5850 MHz		72.2 dBµV/m @ 5854.3 MHz (-6.1 dB)
					Band Edge 5860 MHz		66.7 dBµV/m @ 5860.9 MHz (-1.6 dB)

Client:	Aruba Networks	Job Number:	JD100928
Model:	APIN0103 (FCC ID: Q9DAPIN0103)	T-Log Number:	T101080
		Project Manager:	Christine Krebill
Contact:	Rob Hastings	Project Coordinator:	-
Standard:	FCC 15.407	Class:	N/A

Procedure Comments:

Measurements performed in accordance with FCC KDB 789033
Peak measurements performed with: RBW=1MHz, VBW=3MHz, peak detector, max hold, auto sweep time
Unless otherwise stated/noted, emission has duty cycle ≥ 98% and was measured using RBW=1MHz, VBW=10Hz, peak detector, linear average mode, auto sweep time, max hold 50 traces. (method VB of KDB 789033)

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
11a	12 MBps	98.4%	Yes	2.70	0	0	10
n20	MCS 0	99.0%	Yes	4.98	0	0	10
n40	MCS 0	98.8%	Yes	2.41	0	0	10

Sample Notes

Sample S/N: CU0006604
Driver: -
Antenna: Internal

Measurement Specific Notes:

Note 1:	For emissions outside of the restricted bands the limit is -27dBm/MHz eirp (68.3dBuV/m). The measurement method required is a peak measurement (RB=1MHz, VB≥3MHz, peak detector). Per KDB 789033 2) c) (i), compliance can be demonstrated by meeting the average and peak limits of 15.209, as an alternative.
Note 3:	Emission has constant duty cycle < 98%, average measurement performed: RBW=1MHz, VBW>1/T but not less than 10Hz, peak detector, linear averaging, auto sweep,max hold 50*1/DC traces (method VB of KDB 789033)
Note 5:	Plots of the average and peak bandedge do not account for any duty cycle correction. Refer to the tabular results for final measurements.

Client:	Aruba Networks	Job Number:	JD100928
Model:	APIN0103 (FCC ID: Q9DAPIN0103)	T-Log Number:	T101080
		Project Manager:	Christine Krebill
Contact:	Rob Hastings	Project Coordinator:	-
Standard:	FCC 15.407	Class:	N/A

Run #1: Radiated Bandedge Measurements, 5725-5850 MHz

Date of Test: 03/07/16
Test Engineer: Rafael Varelas
Test Location: FT Chamber #7

Config. Used: 1
Config Change: None
EUT Voltage: 120V/60Hz

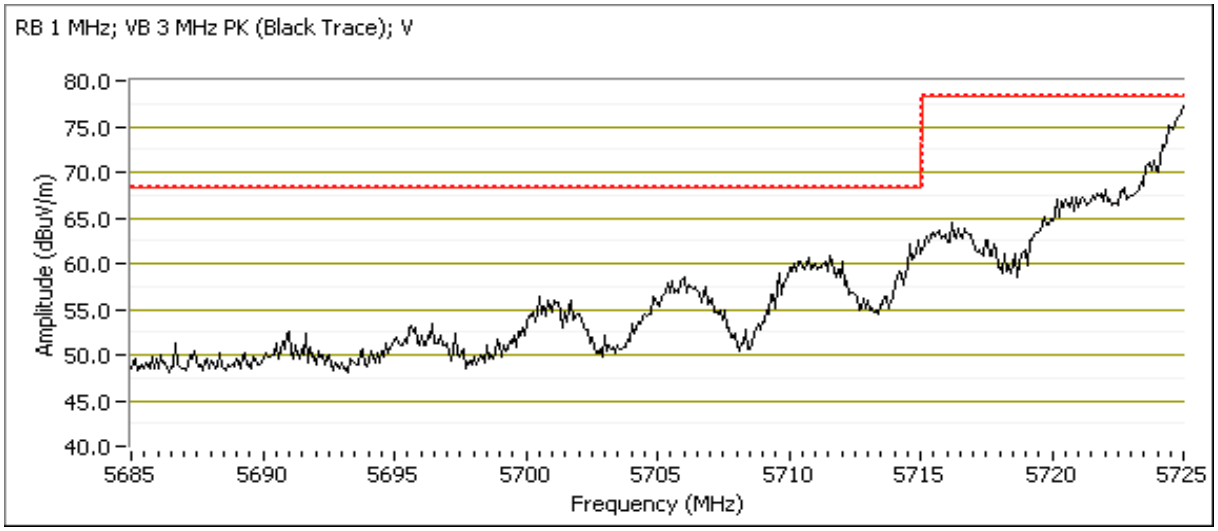
Channel: 149 - 5745 MHz
Tx Chain: 2Tx
Mode: a
Data Rate: 12 MBps

5715 MHz Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5715.000	62.6	V	68.3	-5.7	PK	146	2.0	POS; RB 1 MHz; VB: 3 MHz
5714.460	53.1	H	68.3	-15.2	PK	104	1.3	POS; RB 1 MHz; VB: 3 MHz

5715-5725 MHz Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	15.E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5724.920	78.0	V	78.3	-0.3	PK	146	2.0	POS; RB 1 MHz; VB: 3 MHz
5724.880	69.7	H	78.3	-8.6	PK	104	1.3	POS; RB 1 MHz; VB: 3 MHz



Client:	Aruba Networks	Job Number:	JD100928
Model:	APIN0103 (FCC ID: Q9DAPIN0103)	T-Log Number:	T101080
		Project Manager:	Christine Krebill
Contact:	Rob Hastings	Project Coordinator:	-
Standard:	FCC 15.407	Class:	N/A

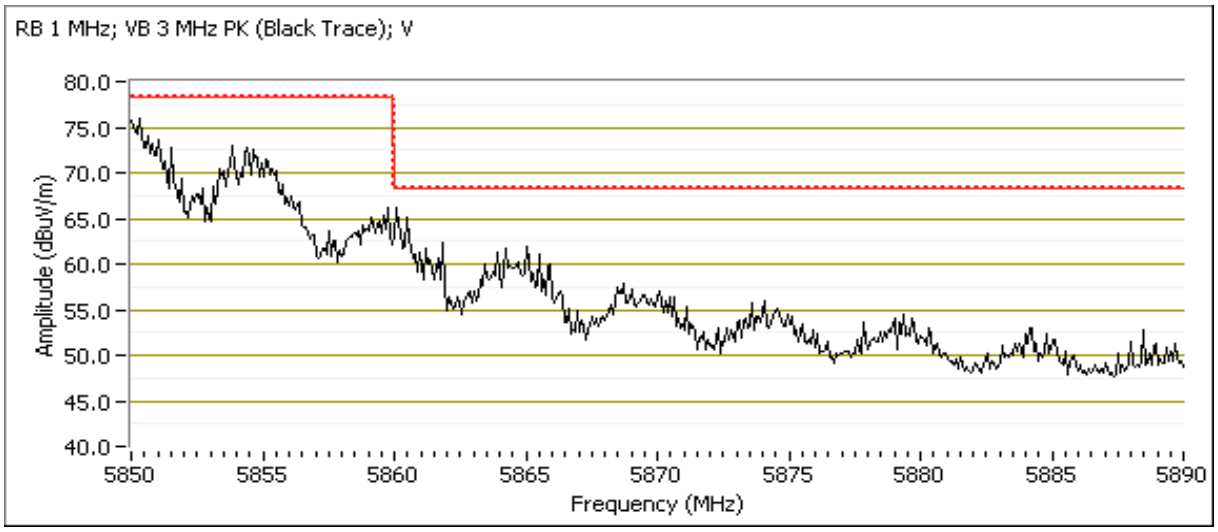
Channel: 165 - 5825 MHz
Tx Chain: 2Tx
Mode: a
Data Rate: 12 MBps

5850 MHz Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5850.760	76.1	V	78.3	-2.2	PK	8	2.6	POS; RB 1 MHz; VB: 3 MHz
5855.010	69.6	H	78.3	-8.7	PK	176	2.2	POS; RB 1 MHz; VB: 3 MHz

5860 MHz Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	15.E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5860.300	65.8	V	68.3	-2.5	PK	8	2.6	POS; RB 1 MHz; VB: 3 MHz
5860.120	61.1	H	68.3	-7.2	PK	176	2.2	POS; RB 1 MHz; VB: 3 MHz



Client:	Aruba Networks	Job Number:	JD100928
Model:	APIN0103 (FCC ID: Q9DAPIN0103)	T-Log Number:	T101080
		Project Manager:	Christine Krebill
Contact:	Rob Hastings	Project Coordinator:	-
Standard:	FCC 15.407	Class:	N/A

Run #2: Radiated Bandedge Measurements, 5725-5850 MHz

Date of Test: 03/07/16 Config. Used: 1

Test Engineer: Rafael Varelas Config Change: None

Test Location: FT Chamber #7 EUT Voltage: 120V/60Hz

Channel: 149 - 5745 MHz

Tx Chain: 2Tx

Mode: HT20

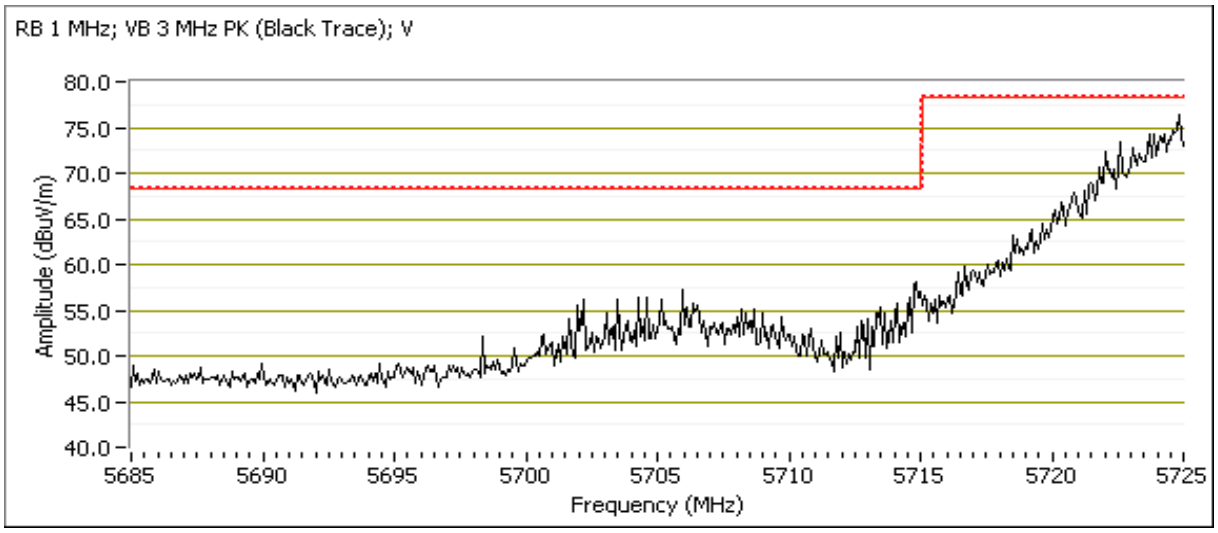
Data Rate: MCS 0

5715 MHz Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5712.480	60.8	V	68.3	-7.5	PK	320	2.5	POS; RB 1 MHz; VB: 3 MHz
5713.920	56.1	H	68.3	-12.2	PK	42	2.2	POS; RB 1 MHz; VB: 3 MHz

5715-5725 MHz Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	15.E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5724.960	77.6	V	78.3	-0.7	PK	0	2.3	POS; RB 1 MHz; VB: 3 MHz
5722.600	68.6	H	78.3	-9.7	PK	91	1.5	POS; RB 1 MHz; VB: 3 MHz



Client:	Aruba Networks	Job Number:	JD100928
Model:	APIN0103 (FCC ID: Q9DAPIN0103)	T-Log Number:	T101080
		Project Manager:	Christine Krebill
Contact:	Rob Hastings	Project Coordinator:	-
Standard:	FCC 15.407	Class:	N/A

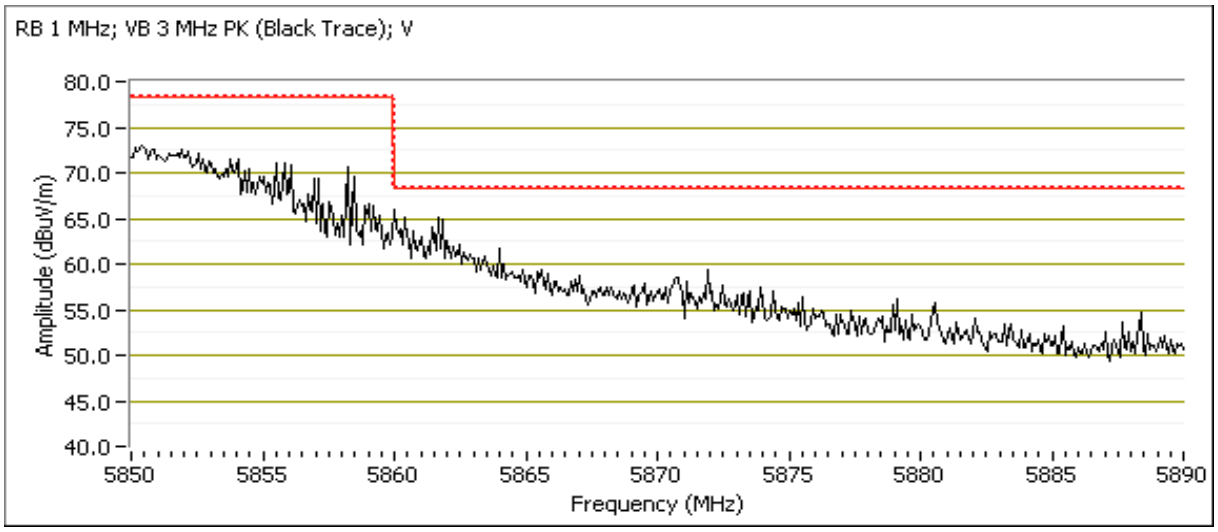
Channel: 165 - 5825 MHz
Tx Chain: 2Tx
Mode: HT20
Data Rate: MCS 0

5850 MHz Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5850.800	73.6	V	78.3	-4.7	PK	238	2.0	POS; RB 1 MHz; VB: 3 MHz
5850.600	61.5	H	78.3	-16.8	PK	106	1.6	POS; RB 1 MHz; VB: 3 MHz

5860 MHz Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	15.E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5862.580	66.9	V	68.3	-1.4	PK	197	2.2	POS; RB 1 MHz; VB: 3 MHz
5862.400	53.6	H	68.3	-14.7	PK	106	1.6	POS; RB 1 MHz; VB: 3 MHz



Client:	Aruba Networks	Job Number:	JD100928
Model:	APIN0103 (FCC ID: Q9DAPIN0103)	T-Log Number:	T101080
		Project Manager:	Christine Krebill
Contact:	Rob Hastings	Project Coordinator:	-
Standard:	FCC 15.407	Class:	N/A

Run #3: Radiated Bandedge Measurements, 5725-5850 MHz

Date of Test: 03/07/16
Test Engineer: Rafael Varelas
Test Location: FT Chamber #7

Config. Used: 1
Config Change: None
EUT Voltage: 120V/60Hz

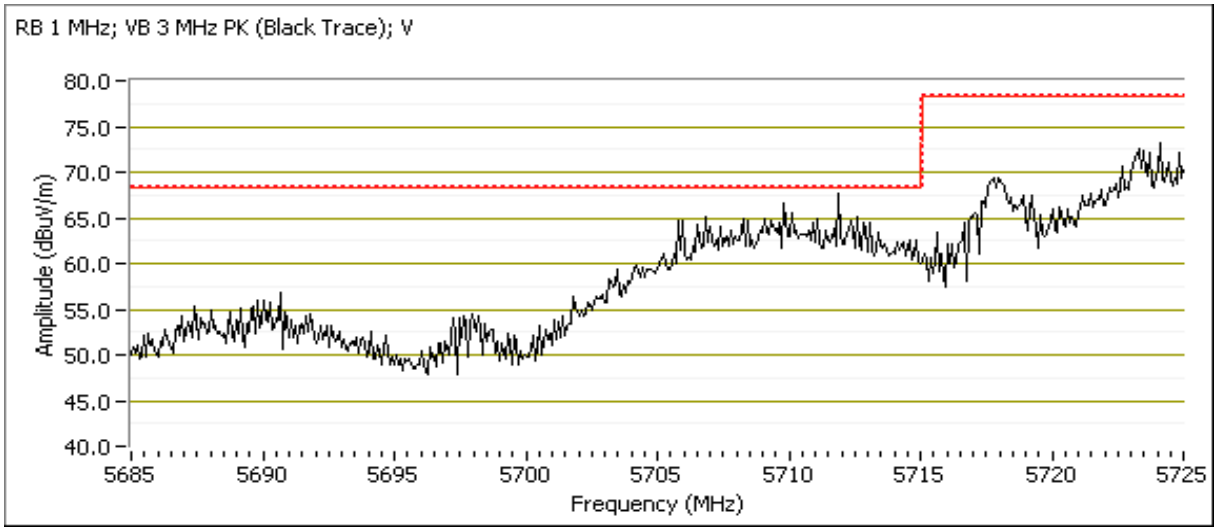
Channel: 151 - 5755 MHz
Tx Chain: 2Tx
Mode: HT40
Data Rate: MCS 0

5715 MHz Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5711.220	67.8	V	68.3	-0.5	PK	360	2.3	POS; RB 1 MHz; VB: 3 MHz
5712.050	66.3	H	68.3	-2.0	PK	180	1.9	POS; RB 1 MHz; VB: 3 MHz

5715-5725 MHz Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	15.E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5723.200	74.0	V	78.3	-4.3	PK	146	1.8	POS; RB 1 MHz; VB: 3 MHz
5719.110	67.8	H	78.3	-10.5	PK	180	1.9	POS; RB 1 MHz; VB: 3 MHz



Client:	Aruba Networks	Job Number:	JD100928
Model:	APIN0103 (FCC ID: Q9DAPIN0103)	T-Log Number:	T101080
		Project Manager:	Christine Krebill
Contact:	Rob Hastings	Project Coordinator:	-
Standard:	FCC 15.407	Class:	N/A

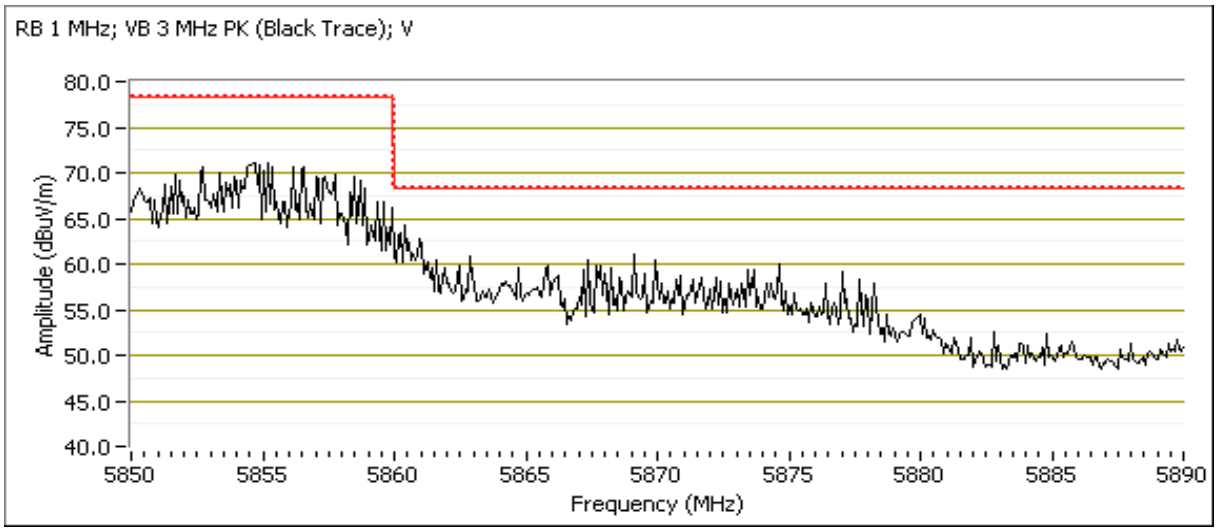
Channel: 159 - 5795 MHz
Tx Chain: 2Tx
Mode: HT40
Data Rate: MCS 0

5850 MHz Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5854.250	72.2	V	78.3	-6.1	PK	5	2.5	POS; RB 1 MHz; VB: 3 MHz
5851.800	62.9	H	78.3	-15.4	PK	54	2.8	POS; RB 1 MHz; VB: 3 MHz

5860 MHz Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	15.E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5860.940	66.7	V	68.3	-1.6	PK	5	2.5	POS; RB 1 MHz; VB: 3 MHz
5860.600	62.0	H	68.3	-6.3	PK	54	2.8	POS; RB 1 MHz; VB: 3 MHz



Client:	Aruba Networks	Job Number:	JD100928
Model:	APIN0103 (FCC ID: Q9DAPIN0103)	T-Log Number:	T101080
		Project Manager:	Christine Krebill
Contact:	Rob Hastings	Project Coordinator:	-
Standard:	FCC 15.407	Class:	N/A

RSS-247 and FCC 15.407 (UNII) Radiated Spurious Emissions

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing.
For radiated emissions testing the measurement antenna was located 3 meters from the EUT, unless otherwise noted.

Ambient Conditions:

Temperature: 21.8 °C
Rel. Humidity: 35 %

Summary of Results

Run #	Mode	Channel	Target Setting	Final Setting	Test Performed	Limit	Result / Margin
Scans on "center" channel in all OFDM modes to determine the worst case mode.							
1	a	157 - 5785MHz	18	23	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	47.7 dBµV/m @ 1720.1 MHz (-6.3 dB)
	n20	157 - 5785MHz	18	23	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	48.0 dBµV/m @ 5400.0 MHz (-6.0 dB)
	n40	151 - 5755MHz	18	23	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	48.7 dBµV/m @ 5399.9 MHz (-5.3 dB)
High channel for worse case mode							
2	n40	159 - 5795MHz	18	23	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	50.0 dBµV/m @ 5439.9 MHz (-4.0 dB)

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Aruba Networks	Job Number:	JD100928
Model:	APIN0103 (FCC ID: Q9DAPIN0103)	T-Log Number:	T101080
		Project Manager:	Christine Krebill
Contact:	Rob Hastings	Project Coordinator:	-
Standard:	FCC 15.407	Class:	N/A

Procedure Comments:

Measurements performed in accordance with FCC KDB 789033
Peak measurements performed with: RBW=1MHz, VBW=3MHz, peak detector, max hold, auto sweep time
Unless otherwise stated/noted, emission has duty cycle ≥ 98% and was measured using RBW=1MHz, VBW=10Hz, peak detector, linear average mode, auto sweep time, max hold 50 traces. (method VB of KDB 789033)

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
11a	12 MBps	98.4%	Yes	2.70	0	0	10
n20	MCS 0	99.0%	Yes	4.98	0	0	10
n40	MCS 0	98.8%	Yes	2.41	0	0	10

Sample Notes

Sample S/N: CU0006604
Driver: -
Antenna: Internal

Measurement Specific Notes:

Note 1:	For emissions outside of the restricted bands the limit is -27dBm/MHz eirp (68.3dBuV/m). The measurement method required is a peak measurement (RB=1MHz, VB≥3MHz, peak detector). Per KDB 789033 2) c) (i), compliance can be demonstrated by meeting the average and peak limits of 15.209, as an alternative.
Note 3:	Emission has constant duty cycle < 98%, average measurement performed: RBW=1MHz, VBW>1/T but not less than 10Hz, peak detector, linear averaging, auto sweep,max hold 50*1/DC traces (method VB of KDB 789033)

Notes:

Original testing showed no radio related emissions below 1GHz.

Client:	Aruba Networks	Job Number:	JD100928
Model:	APIN0103 (FCC ID: Q9DAPIN0103)	T-Log Number:	T101080
		Project Manager:	Christine Krebill
Contact:	Rob Hastings	Project Coordinator:	-
Standard:	FCC 15.407	Class:	N/A

Run #1, Radiated Spurious Emissions, 1,000 - 40,000 MHz. Operation in the 5725-5850 MHz Band

Date of Test: 03/07/16 Config. Used: 1

Test Engineer: Rafael Varelas Config Change: None

Test Location: FT Chamber #7 EUT Voltage: 120V/60Hz

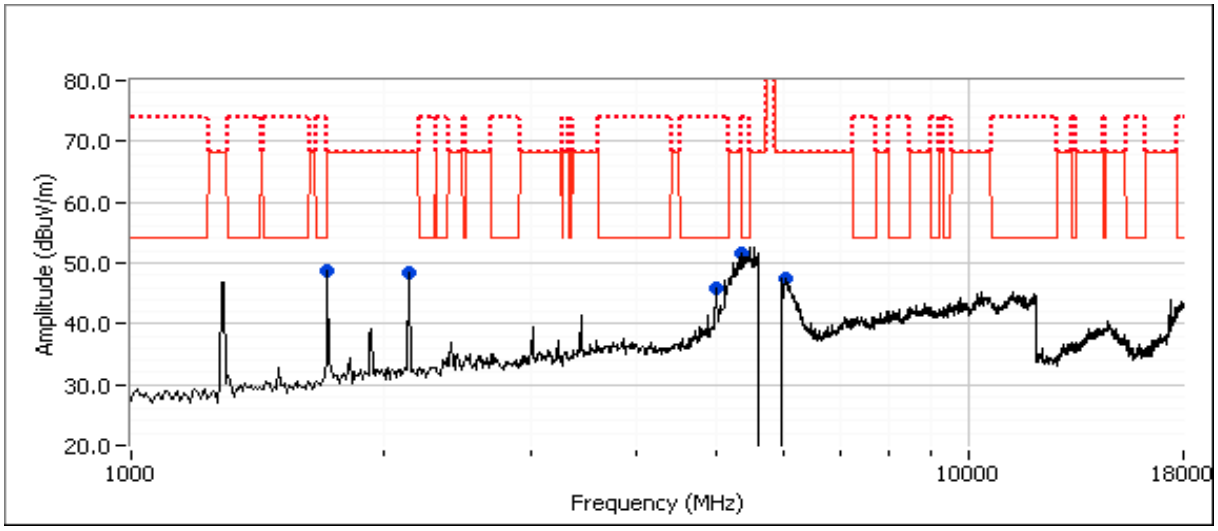
Run #1a: Center Channel

Channel: 157 Mode: a

Tx Chain: 2Tx Data Rate: 12 MBps

Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
1720.080	47.7	V	54.0	-6.3	AVG	261	1.3	RB 1 MHz;VB 10 Hz;Peak
1720.110	50.7	V	74.0	-23.3	PK	261	1.3	RB 1 MHz;VB 3 MHz;Peak
2150.160	49.9	V	68.3	-18.4	PK	104	2.0	RB 1 MHz;VB 3 MHz;Peak
5359.770	45.8	V	54.0	-8.2	AVG	176	1.0	RB 1 MHz;VB 10 Hz;Peak
5358.150	57.8	V	74.0	-16.2	PK	176	1.0	RB 1 MHz;VB 3 MHz;Peak
6023.530	55.1	V	68.3	-13.2	PK	184	2.4	RB 1 MHz;VB 3 MHz;Peak
4999.890	38.5	V	54.0	-15.5	AVG	168	2.0	RB 1 MHz;VB 10 Hz;Peak
4998.130	54.7	V	74.0	-19.3	PK	168	2.0	RB 1 MHz;VB 3 MHz;Peak

Note:	Scans made between 18 - 40 GHz with the measurement antenna moved around the card and its antennas 20-50cm from the device indicated there were no significant emissions in this frequency range
Note 1:	For emissions in restricted bands, the limit of 15.209 was used which requires average and peak measurements.
Note 2:	For emissions outside of the restricted bands the limit is -27dBm/MHz eirp (68.3dBuV/m). The measurement method required is a peak measurement (RB=1MHz, VB≥3MHz, peak detector).



Client:	Aruba Networks	Job Number:	JD100928
Model:	APIN0103 (FCC ID: Q9DAPIN0103)	T-Log Number:	T101080
		Project Manager:	Christine Krebill
Contact:	Rob Hastings	Project Coordinator:	-
Standard:	FCC 15.407	Class:	N/A

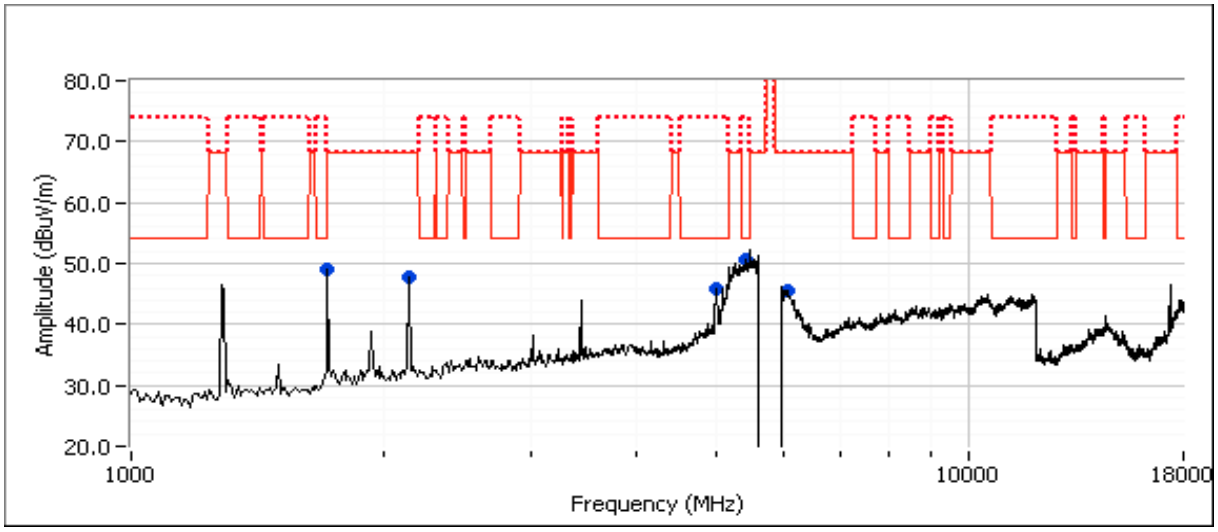
Run #1b: Center Channel

Channel: 157 Mode: 11n20

Tx Chain: 2Tx Data Rate: MCS 0

Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5400.030	48.0	V	54.0	-6.0	AVG	180	2.4	RB 1 MHz;VB 10 Hz;Peak
5400.010	58.4	V	74.0	-15.6	PK	180	2.4	RB 1 MHz;VB 3 MHz;Peak
6083.860	55.2	V	68.3	-13.1	PK	193	2.5	RB 1 MHz;VB 3 MHz;Peak
4999.550	37.8	V	54.0	-16.2	AVG	175	2.2	RB 1 MHz;VB 10 Hz;Peak
4999.750	53.8	V	74.0	-20.2	PK	175	2.2	RB 1 MHz;VB 3 MHz;Peak
1720.050	47.9	V	54.0	-6.1	AVG	82	1.9	RB 1 MHz;VB 10 Hz;Peak
1720.170	50.5	V	74.0	-23.5	PK	82	1.9	RB 1 MHz;VB 3 MHz;Peak
2150.180	46.2	V	68.3	-22.1	AVG	83	1.9	RB 1 MHz;VB 10 Hz;Peak
2150.030	49.7	V	68.3	-18.6	PK	83	1.9	RB 1 MHz;VB 3 MHz;Peak

Note:	Scans made between 18 - 40 GHz with the measurement antenna moved around the card and its antennas 20-50cm from the device indicated there were no significant emissions in this frequency range
Note 1:	For emissions in restricted bands, the limit of 15.209 was used which requires average and peak measurements.
Note 2:	For emissions outside of the restricted bands the limit is -27dBm/MHz eirp (68.3dBuV/m). The measurement method required is a peak measurement (RB=1MHz, VB≥3MHz, peak detector).



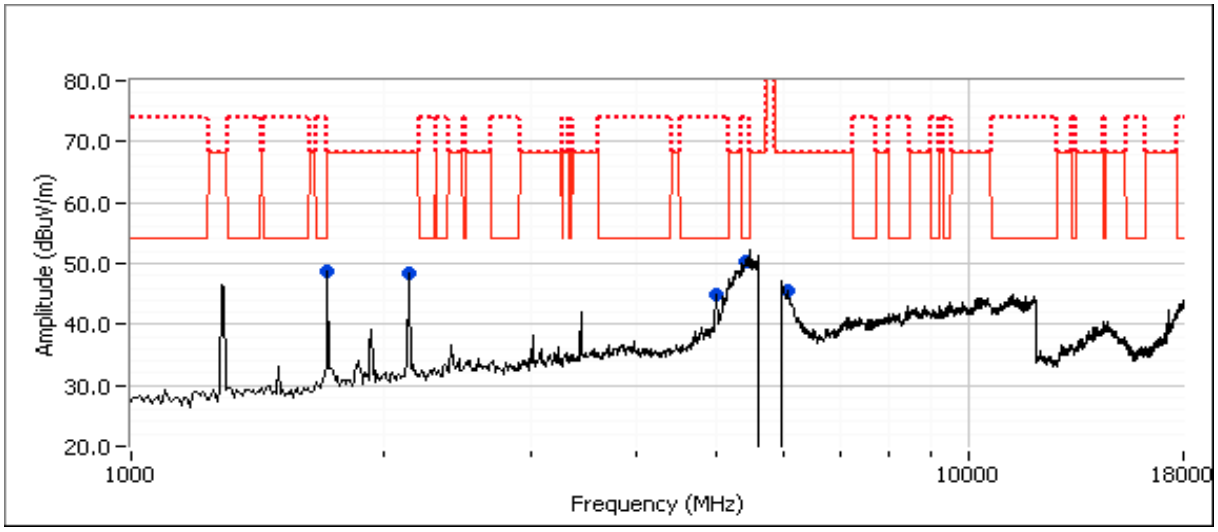
Client:	Aruba Networks	Job Number:	JD100928
Model:	APIN0103 (FCC ID: Q9DAPIN0103)	T-Log Number:	T101080
		Project Manager:	Christine Krebill
Contact:	Rob Hastings	Project Coordinator:	-
Standard:	FCC 15.407	Class:	N/A

Run #1c: Center Channel

Channel: 151 Mode: 11n40
Tx Chain: 2Tx Data Rate: MCS 0

Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5399.930	48.7	V	54.0	-5.3	AVG	192	2.0	RB 1 MHz;VB 10 Hz;Peak
5400.090	60.4	V	74.0	-13.6	PK	192	2.0	RB 1 MHz;VB 3 MHz;Peak
2150.110	49.7	V	68.3	-18.6	PK	86	1.9	RB 1 MHz;VB 3 MHz;Peak
1720.100	47.8	V	54.0	-6.2	AVG	82	1.9	RB 1 MHz;VB 10 Hz;Peak
1719.970	50.6	V	74.0	-23.4	PK	82	1.9	RB 1 MHz;VB 3 MHz;Peak
4997.270	38.8	V	54.0	-15.2	AVG	206	2.2	RB 1 MHz;VB 10 Hz;Peak
4999.160	55.2	V	74.0	-18.8	PK	206	2.2	RB 1 MHz;VB 3 MHz;Peak
6032.560	55.2	V	68.3	-13.1	PK	203	2.4	RB 1 MHz;VB 3 MHz;Peak

Note:	Scans made between 18 - 40 GHz with the measurement antenna moved around the card and its antennas 20-50cm from the device indicated there were no significant emissions in this frequency range
Note 1:	For emissions in restricted bands, the limit of 15.209 was used which requires average and peak measurements.
Note 2:	For emissions outside of the restricted bands the limit is -27dBm/MHz eirp (68.3dBuV/m). The measurement method required is a peak measurement (RB=1MHz, VB≥3MHz, peak detector).



Client:	Aruba Networks	Job Number:	JD100928
Model:	APIN0103 (FCC ID: Q9DAPIN0103)	T-Log Number:	T101080
		Project Manager:	Christine Krebill
Contact:	Rob Hastings	Project Coordinator:	-
Standard:	FCC 15.407	Class:	N/A

Run #2: Radiated Spurious Emissions, 1,000 - 40000 MHz. Operating Mode: Worse case from Run #1

Date of Test: 03/07/16 Config. Used: 1

Test Engineer: Rafael Varelas Config Change: None

Test Location: FT Chamber #7 EUT Voltage: 120V/60Hz

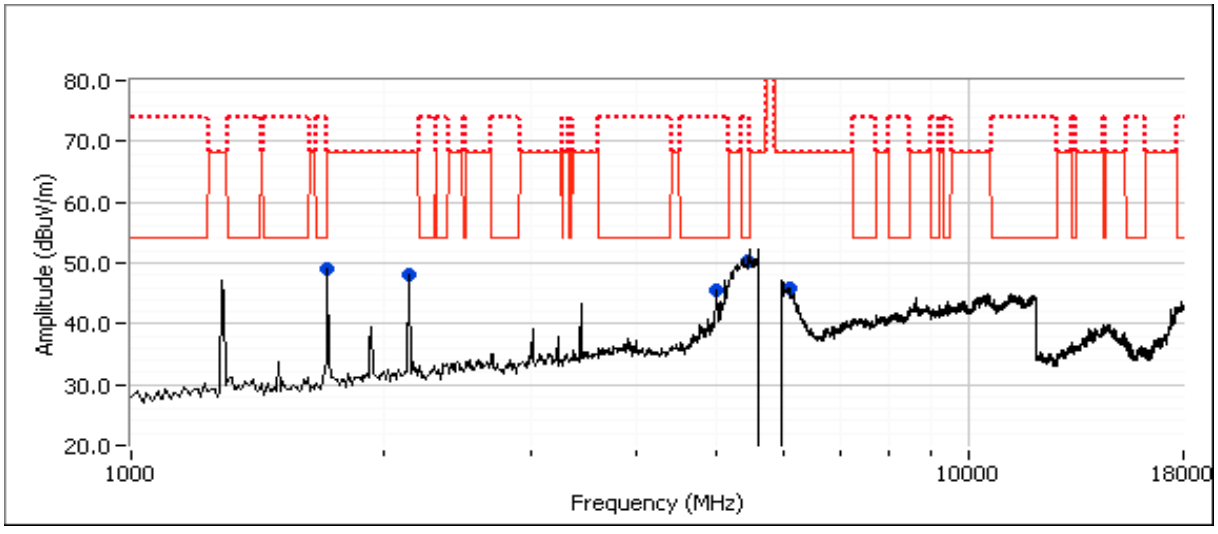
Run #2a: High Channel

Channel: 5795 Mode: 11n40

Tx Chain: 2x2 Data Rate: MCS 0

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5439.910	50.0	V	54.0	-4.0	AVG	188	1.9	RB 1 MHz;VB 10 Hz;Peak
5440.150	60.1	V	74.0	-13.9	PK	188	1.9	RB 1 MHz;VB 3 MHz;Peak
1720.120	48.3	V	54.0	-5.7	AVG	256	1.3	RB 1 MHz;VB 10 Hz;Peak
1720.110	50.8	V	74.0	-23.2	PK	256	1.3	RB 1 MHz;VB 3 MHz;Peak
6072.880	54.2	V	68.3	-14.1	PK	239	2.0	RB 1 MHz;VB 3 MHz;Peak
4999.760	38.8	V	54.0	-15.2	AVG	183	1.9	RB 1 MHz;VB 10 Hz;Peak
4999.040	55.1	V	74.0	-18.9	PK	183	1.9	RB 1 MHz;VB 3 MHz;Peak
2149.990	51.5	V	68.3	-16.8	PK	72	1.9	RB 1 MHz;VB 3 MHz;Peak

Note:	Scans made between 18 - 40 GHz with the measurement antenna moved around the card and its antennas 20-50cm from the device indicated there were no significant emissions in this frequency range



Client:	Aruba Networks	Job Number:	JD100928
Model:	APIN0103 (FCC ID: Q9DAPIN0103)	T-Log Number:	T101080
		Project Manager:	Christine Krebill
Contact:	Rob Hastings	Project Coordinator:	-
Standard:	FCC 15.407	Class:	N/A

RSS-247 (LELAN) and FCC 15.407(UNII)
Antenna Port Measurements
Power, PSD, Bandwidth and Spurious Emissions

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

General Test Configuration

When measuring the conducted emissions from the EUT's antenna port, the antenna port of the EUT was connected to the spectrum analyzer or power meter via a suitable attenuator to prevent overloading the measurement system. All measurements are corrected to allow for the external attenuators and cables used.

Ambient Conditions:

Temperature: 18-19 °C
Rel. Humidity: 35-40 %

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Sample Notes

Sample S/N: CU0005990
Driver: -

Client:	Aruba Networks	Job Number:	JD100928
Model:	APIN0103 (FCC ID: Q9DAPIN0103)	T-Log Number:	T101080
		Project Manager:	Christine Krebill
Contact:	Rob Hastings	Project Coordinator:	-
Standard:	FCC 15.407	Class:	N/A

Summary of Results

Run #	Test Performed	Limit	Pass / Fail	Result / Margin
1	Power, 5725 - 5850MHz	15.407(a) (3)	Pass	a: 22.5dBm (178.3 mW) n20: 21.6dBm (145.0 mW) n40: 20.9dBm (123.6 mW)
1	PSD, 5725 - 5850MHz	15.407(a) (3)	Pass	a: 12.1dBm/MHz n20: 10.8dBm/MHz n40: 7.2dBm/MHz
1	99% Bandwidth	RSS-GEN (Information only)	N/A	a: 18.4 MHz n20: 19.0 MHz n40: 36.5 MHz

Procedure Comments:

Measurements performed in accordance with FCC KDB 789033 D01

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
11a	12 MBps	98.4%	Yes	2.70	0	0	10
n20	MCS 0	99.0%	Yes	4.98	0	0	10
n40	MCS 0	98.8%	Yes	2.41	0	0	10

Client:	Aruba Networks	Job Number:	JD100928
Model:	APIN0103 (FCC ID: Q9DAPIN0103)	T-Log Number:	T101080
		Project Manager:	Christine Krebill
Contact:	Rob Hastings	Project Coordinator:	-
Standard:	FCC 15.407	Class:	N/A

Run #1: Bandwidth, Output Power and Power Spectral Density - MIMO Systems

Date of Test: 03/08/16 Config. Used: 1
Test Engineer: Mehran Birgani Config Change: None
Test Location: Lab 4 EUT Voltage: 120V/60Hz

Note 1:	Duty Cycle ≥ 98%. Output power measured using a spectrum analyzer (see plots below). RB=1MHz, VB=3 MHz, Span >OBW, # of points in sweep ≥ 2*span/RBW, auto sweep, RMS detector, power averaging on (transmitted signal was continuous, duty cycle ≥ 98%) and power integration over the OBW (method SA-1 of ANSI C63.10).
Note 2:	Measured using the same analyzer settings used for output power.
Note 3:	99% Bandwidth measured in accordance with C63.10 - RB between 1-5 % of OBW and VB ≥ 3*RB, Span between 1.5 and 5 times OBW.
Note 4:	For MIMO systems the total output power and total PSD are calculated from the sum of the powers of the individual chains (in linear terms). The antenna gain used to determine the EIRP and limits for PSD/Output power depends on the operating mode of the MIMO device. If the signals on the non-coherent between the transmit chains then the gain used to determine the limits is the highest gain of the individual chains and the EIRP is the sum of the products of gain and power on each chain. If the signals are coherent then the effective antenna gain is the sum (in linear terms) of the gains for each chain and the EIRP is the product of the effective gain and total power.

Antenna Gain Information

Freq	Antenna Gain (dBi) / Chain				BF	MultiChain Legacy	CDD	Sectorized / Xpol	Dir G (PWR)	Dir G (PSD)
	1	2	3	4						
5150-5250	4.1	4.1			No	Yes	Yes	No	4.10	7.1
5250-5350	4.1	4.1			No	Yes	Yes	No	4.10	7.1
5470-5725	4.3	4.3			No	Yes	Yes	No	4.30	7.3
5725-5825	4.3	4.3			No	Yes	Yes	No	4.30	7.3

For devices that support CDD modes

Min # of spatial streams: 1
Max # of spatial streams: 2

Notes:	BF = beamforming mode supported, Multichain Legacy = 802.11 legacy data rates supported for multichain transmissions, CDD = Cyclic Delay Diversity (or Cyclic Shift Diversity) modes supported, Sectorized / Xpol = antennas are sectorized or cross polarized.
Notes:	Dir G (PWR) = total gain (Gant + Array Gain) for power calculations; GA (PSD) = total gain for PSD calculations based on FCC KDB 662911. Depending on the modes supported, the Array Gain value for power could be different from the PSD value.
Notes:	Array gain for power/psd calculated per KDB 662911 D01.

Client:	Aruba Networks	Job Number:	JD100928
Model:	APIN0103 (FCC ID: Q9DAPIN0103)	T-Log Number:	T101080
		Project Manager:	Christine Krebill
Contact:	Rob Hastings	Project Coordinator:	-
Standard:	FCC 15.407	Class:	N/A

MIMO Device - 5725-5850 MHz Band - FCC/IC

Mode: 11a — Max EIRP (mW): 479.9

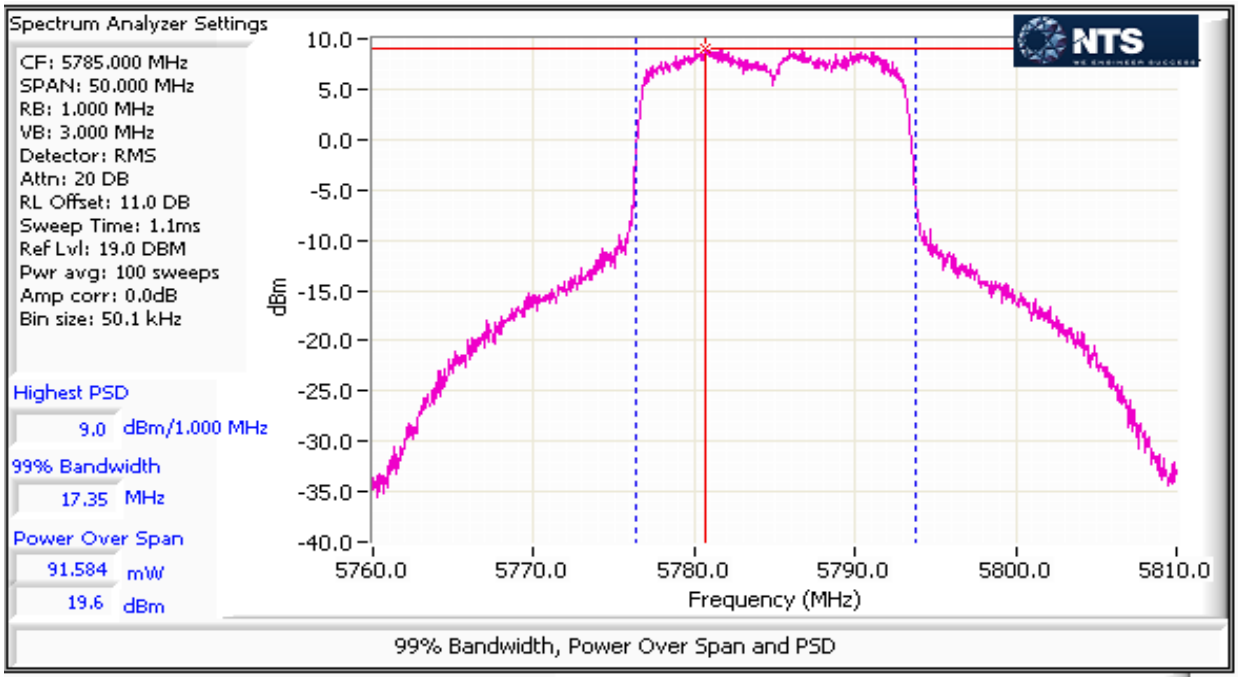
Frequency (MHz)	Chain	Software Setting	99% BW (MHz)	Duty Cycle %	Power dBm	Total Power[1] mW	Total Power[1] dBm	Limit dBm	Max Power (W)	Result
5745	1	19	16.9	98.4	16.4	84.4	19.3	30.0	0.178	Pass
	3									
	4									
	2				16.1					
5785	1	23	17.8	98.4	19.4	178.3	22.5	30.0		Pass
	3									
	4									
	2				19.6					
5825	1	23	18.4	98.4	19.5	178.3	22.5	30.0		Pass
	3									
	4									
	2				19.5					

MIMO Device 5725-5850 MHz PSD - FCC/IC

Mode: 11a

Frequency (MHz)	Chain	Software Setting	99% BW (MHz)	Duty Cycle %	PSD dBm/MHz	Total PSD[1] mW/MHz	Total PSD[1] dBm/MHz	FCC Limit dBm/500kHz	IC Limit dBm/500kHz	Result
5745	1	19		98.4	6.0	7.7	8.9	28.7	28.7	Pass
	3									
	4									
	2				5.7					
5785	1	23		98.4	9.0	15.9	12.0	28.7	28.7	Pass
	3									
	4									
	2				9.0					
5825	1	23		98.4	9.0	16.3	12.1	28.7	28.7	Pass
	3									
	4									
	2				9.2					

Client:	Aruba Networks	Job Number:	JD100928
Model:	APIN0103 (FCC ID: Q9DAPIN0103)	T-Log Number:	T101080
		Project Manager:	Christine Krebill
Contact:	Rob Hastings	Project Coordinator:	-
Standard:	FCC 15.407	Class:	N/A



Client:	Aruba Networks	Job Number:	JD100928
Model:	APIN0103 (FCC ID: Q9DAPIN0103)	T-Log Number:	T101080
		Project Manager:	Christine Krebill
Contact:	Rob Hastings	Project Coordinator:	-
Standard:	FCC 15.407	Class:	N/A

MIMO Device - 5725-5850 MHz Band - FCC/IC

Mode: n20 Max EIRP (mW): 390.3

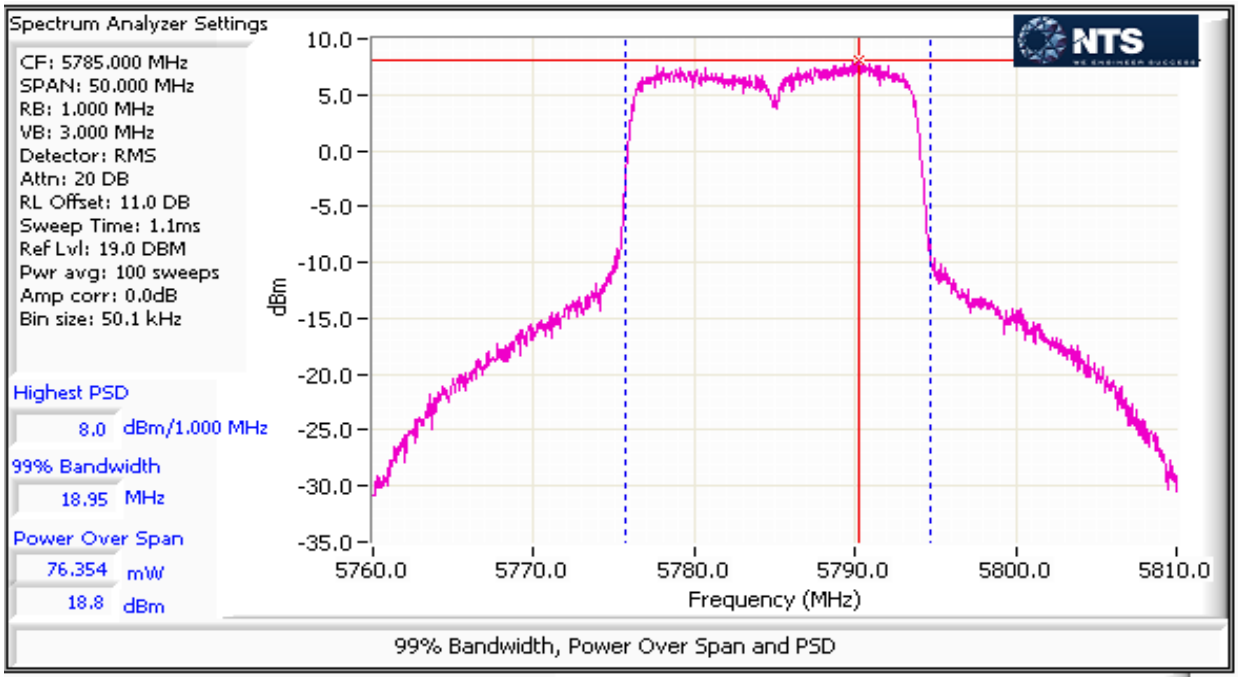
Frequency (MHz)	Chain	Software Setting	99% BW (MHz)	Duty Cycle %	Power dBm	Total Power[1] mW	Total Power[1] dBm	FCC Limit dBm	Max Power (W)	Result
5745	1	17	18.0	99.0	15.1	59.3	17.7	30.0	0.145	Pass
	3									
	4									
	2				14.3					
5785	1	23	19.0	99.0	18.8	145.0	21.6	30.0		Pass
	3									
	4									
	2				18.4					
5825	1	21	18.2	99.0	17.6	112.5	20.5	30.0		Pass
	3									
	4									
	2				17.4					

MIMO Device 5725-5850 MHz PSD - FCC/IC

Mode: n20

Frequency (MHz)	Chain	Software Setting	99% BW (MHz)	Duty Cycle %	PSD dBm/MHz	Total PSD[1] mW/MHz	Total PSD[1] dBm/MHz	FCC Limit dBm/MHz	IC Limit dBm/MHz	Result
5745	1	17		99.0	4.4	4.9	6.9	28.7	28.7	Pass
	3									
	4									
	2				3.4					
5785	1	23		99.0	8.0	12.1	10.8	28.7	28.7	Pass
	3									
	4									
	2				7.6					
5825	1	21		99.0	7.0	9.7	9.9	28.7	28.7	Pass
	3									
	4									
	2				6.7					

Client:	Aruba Networks	Job Number:	JD100928
Model:	APIN0103 (FCC ID: Q9DAPIN0103)	T-Log Number:	T101080
		Project Manager:	Christine Krebill
Contact:	Rob Hastings	Project Coordinator:	-
Standard:	FCC 15.407	Class:	N/A



Client:	Aruba Networks	Job Number:	JD100928
Model:	APIN0103 (FCC ID: Q9DAPIN0103)	T-Log Number:	T101080
		Project Manager:	Christine Krebill
Contact:	Rob Hastings	Project Coordinator:	-
Standard:	FCC 15.407	Class:	N/A

MIMO Device - 5725-5850 MHz Band - FCC/IC

Mode: n40 Max EIRP (mW): 332.7

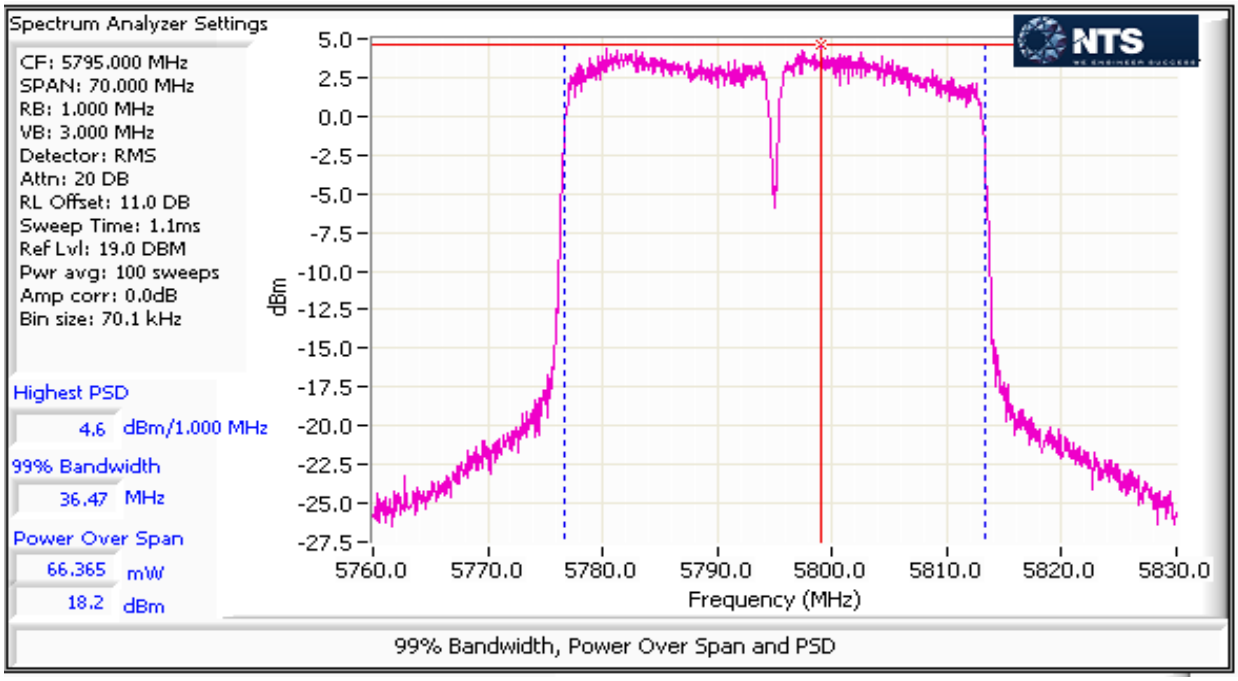
Frequency (MHz)	Chain	Software Setting	99% BW (MHz)	Duty Cycle %	Power dBm	Total Power[1] mW	Total Power[1] dBm	FCC Limit dBm	Max Power (W)	Result
5755	1	15	36.3	98.8	12.3	34.4	15.4	30.0	0.124	Pass
	3									
	4									
	2				12.4					
5795	1	21	36.5	98.8	17.6	123.6	20.9	30.0		Pass
	3									
	4									
	2				18.2					

MIMO Device 5725-5850 MHz PSD - FCC/IC

Mode: n40

Frequency (MHz)	Chain	Software Setting	99% BW (MHz)	Duty Cycle %	PSD dBm/MHz	Total PSD[1] mW/MHz	Total PSD[1] dBm/MHz	FCC Limit dBm/MHz	IC Limit dBm/MHz	Result
5755	1	15		98.8	-1.5	1.5	1.8	28.7	28.7	Pass
	3									
	4									
	2				-1.0					
5795	1	21		98.8	3.8	5.3	7.2	28.7	28.7	Pass
	3									
	4									
	2				4.6					

Client:	Aruba Networks	Job Number:	JD100928
Model:	APIN0103 (FCC ID: Q9DAPIN0103)	T-Log Number:	T101080
		Project Manager:	Christine Krebill
Contact:	Rob Hastings	Project Coordinator:	-
Standard:	FCC 15.407	Class:	N/A



Client:	Aruba Networks	Job Number:	JD100928
Model:	APIN0103 (FCC ID: Q9DAPIN0103)	T-Log Number:	T101080
		Project Manager:	Christine Krebill
Contact:	Rob Hastings	Project Coordinator:	-
Standard:	FCC 15.407	Class:	B

Conducted Emissions

(NTS Silicon Valley, Fremont Facility, Semi-Anechoic Chamber)

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 3/8/2016
Test Engineer: M. Birgani
Test Location: Fremont Chamber #7
Config. Used: 1
Config Change: -
EUT Voltage: 120V/60Hz

General Test Configuration

The EUT was located on a table inside the semi-anechoic chamber, 40 cm from a vertical coupling plane and 80cm from the LISN. Any cables running to remote support equipment where routed through metal conduit and when possible passed through a ferrite clamp upon exiting the chamber.

Ambient Conditions:

Temperature: 17-19 °C
Rel. Humidity: 30-35 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power,120V/60Hz	Class B	Pass	34.2dBµV @ 0.36MHz (-14.6dB)

Modifications Made During Testing

No modifications were made to the EUT during testing

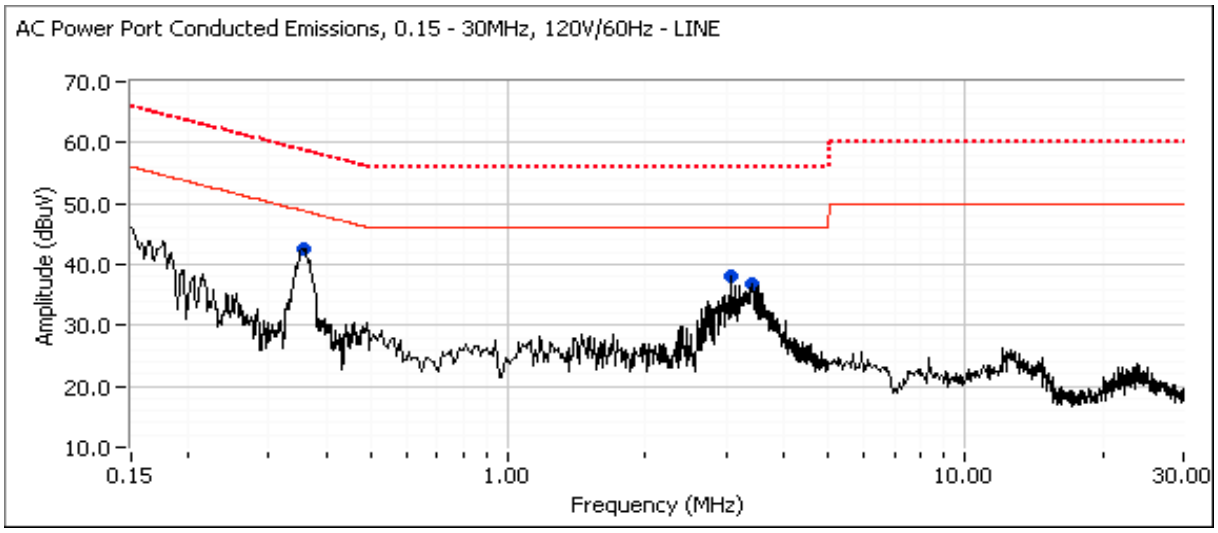
Deviations From The Standard

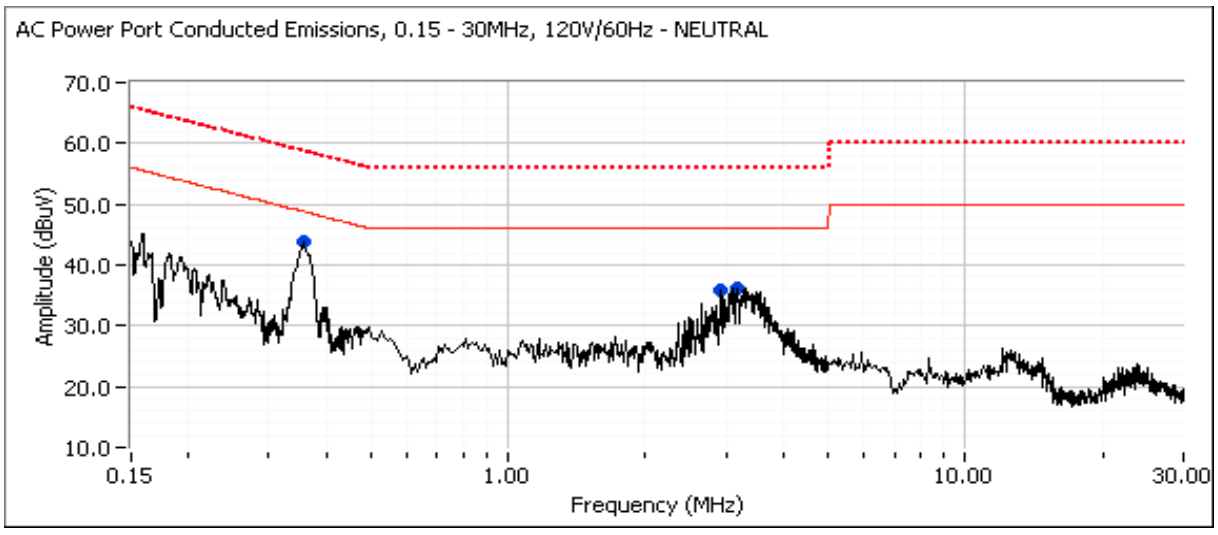
No deviations were made from the requirements of the standard.

Note: The unit was transmitting at 5745MHz at its maximum power setting.

Client:	Aruba Networks	Job Number:	JD100928
Model:	APIN0103 (FCC ID: Q9DAPIN0103)	T-Log Number:	T101080
		Project Manager:	Christine Krebill
Contact:	Rob Hastings	Project Coordinator:	-
Standard:	FCC 15.407	Class:	B

Run #1: AC Power Port Conducted Emissions, 0.15 - 30MHz, 120V/60Hz





Client:	Aruba Networks	Job Number:	JD100928
Model:	APIN0103 (FCC ID: Q9DAPIN0103)	T-Log Number:	T101080
		Project Manager:	Christine Krebill
Contact:	Rob Hastings	Project Coordinator:	-
Standard:	FCC 15.407	Class:	B

Run #1: AC Power Port Conducted Emissions, 0.15 - 30MHz, 120V/60Hz

Preliminary peak readings captured during pre-scan (peak readings vs. average limit)

Frequency	Level	AC	Class B		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
0.356	43.7	Neutral	48.8	-5.1	Peak	
0.357	42.5	Line	48.8	-6.3	Peak	
3.101	38.1	Line	46.0	-7.9	Peak	
3.447	36.7	Line	46.0	-9.3	Peak	
3.159	36.3	Neutral	46.0	-9.7	Peak	
2.905	36.0	Neutral	46.0	-10.0	Peak	

Final quasi-peak and average readings

Frequency	Level	AC	Class B		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
0.356	34.2	Neutral	48.8	-14.6	AVG	AVG (0.10s)
0.357	33.0	Line	48.8	-15.8	AVG	AVG (0.10s)
0.356	42.2	Neutral	58.8	-16.6	QP	QP (1.00s)
0.357	41.3	Line	58.8	-17.5	QP	QP (1.00s)
3.447	30.4	Line	56.0	-25.6	QP	QP (1.00s)
3.159	29.0	Neutral	56.0	-27.0	QP	QP (1.00s)
3.101	28.7	Line	56.0	-27.3	QP	QP (1.00s)
3.447	18.3	Line	46.0	-27.7	AVG	AVG (0.10s)
3.159	16.9	Neutral	46.0	-29.1	AVG	AVG (0.10s)
2.905	26.7	Neutral	56.0	-29.3	QP	QP (1.00s)
3.101	16.5	Line	46.0	-29.5	AVG	AVG (0.10s)
2.905	13.9	Neutral	46.0	-32.1	AVG	AVG (0.10s)

End of Report

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