41039 Boyce Road
Fremont, CA. 94538

510-578-3500 Phone
510-440-9525 Fax

EMC Test Report

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

Innovation, Science and Economic Development Canada
RSS-Gen Issue 5 / RSS-247 Issue 2
FCC Part 15, Subpart E

Models: APIN0534 and APIN0535

IC CERTIFICATION #:	4675A-APIN0534535
FCC ID:	Q9DAPIN0534535
APPLICANT:	Aruba, a Hewlett Packard Enterprise company 3333 Scott Blvd. Santa Clara, CA 95054
TEST SITE(S):	National Technical Systems 41039 Boyce Road. Fremont, CA. 94538-2435
IC SITE REGISTRATION #:	2845B-4 and 2845B-5
PROJECT NUMBER:	PR077654
REPORT DATE:	July 7, 2020
RE-ISSUED DATE:	July 24, 2020
FINAL TEST DATES:	October 3, 11, 12, 16, 19 and 25, 2018,
TOTAL NUMBER OF PAGES:	87

ACCREDITED
Testing Cert #0214.26

VALIDATING SIGNATORIES

PROGRAM MGR

David W. Bare
Chief Engineer

TECHNICAL REVIEWER:

David W. Bare
Chief Engineer

FINAL REPORT PREPARER:

David Guidotti
Senior Technical Writer

QUALITY ASSURANCE DELEGATE

Gary Izard
Quality Assurance Representative

REVISION HISTORY

Rev#	Date	Comments	Modified By
-	July 7, 2020	First release	
1	July 24, 2020	Corrected power on page 41	dwb

TABLE OF CONTENTS

SCOPE

An electromagnetic emissions test has been performed on the Aruba, a Hewlett Packard Enterprise company model APIN0534 and APIN0535, pursuant to the following rules:

RSS-GEN Issue 5 " General Requirements for Compliance of Radio Apparatus"
RSS 247 Issue 2 "Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSS) and Licence-Exempt Local Area Network (LE-LAN) Devices"
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 test procedures:

ANSI C63.10-2013
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.

National Technical Systems is accredited by the A2LA, certificate number 0214.26, to perform the test(s) listed in this report, except where noted otherwise.

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.

Prior to marketing in Canada, Class I transmitters, receivers and transceivers require certification. Class II devices are required to meet the appropriate technical requirements but are exempt from certification 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, a Hewlett Packard Enterprise company model APIN0534 and APIN0535 complied with the requirements of the following regulations:

RSS 247 Issue 2 "Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSS) and Licence-Exempt Local Area Network (LE-LAN) Devices"
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, a Hewlett Packard Enterprise company model APIN0534 and APIN0535 and therefore apply only to the tested sample. The sample was selected and prepared by Tian Wang-Mendez of Aruba, a Hewlett Packard Enterprise company.

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 5.15 – 5.25 GHZ BAND – ACCESS POINTS

FCC Rule Part		Description	Measured Value / Comments	Limit / Requirement	Result
15.407 (a) (1) (i) or (ii)		Output Power	ax80+80: 25.6 mW	30 dBm EIRP <= 4W	Complies
15.407 (a) (1) (i), (ii) or (iii)		Power Spectral Density	ax80+80: 0.5mW/MHz	17 dBm/MHz	Complies
15.407(b) (1) / 15.209		Spurious Emissions above 1GHz	53.4 dBµV/m @ 5148.6 MHz (-0.6 dB)	Refer to the limits section (p23) for restricted bands, all others -27 dBm/MHz EIRP	Complies

OPERATION IN THE 5.15 – 5.25 GHZ BAND

	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result
	RSS-247 6.2.1	Indoor operation only	Refer to user's manual	N/A	Complies
	RSS-247 6.2.1 (1)	99% Bandwidth	ax80+80: 154.34 MHz	N/A – limits output power if < 20MHz	N/A
	RSS-247 6.2.1 (1)	EIRP Output Power	ax80+80: 40.7 mW	23 dBm (200 mW)	Complies
	RSS-247 6.2.1 (1)	Power Spectral Density	ax80+80: 0.5 mW/MHz	10 dBm/MHz	Complies
	RSS-247 6.2.1 (2)	Spurious Emissions above 1GHz	53.4 dBµV/m @ 5148.6 MHz (-0.6 dB)	Refer to the limits section (p23) for restricted bands, all others -27 dBm/MHz EIRP 26 dBc in 5.25-5.35 GHz band	Complies

OPERATION IN THE 5.25 – 5.35 GHZ BAND

Note: The device is restricted to indoor use only, therefore the spectral density of spurious emissions in the 5.15 – 5.25 GHz band were limited to the power spectral limits for intentional signals detailed in FCC 15.407(b)(2) and RSS 247 6.2.2 (2) i) b

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.407(a) (2)		26dB Bandwidth		N/A – limits output power if < 20MHz	N/A
	RSS-247 6.2.2 (1)	99% Bandwidth	ax80+80: 154.34 MHz	N/A – limits EIRP if < 20MHz	N/A
15.407(a) (2)	RSS-247 6.2.1 (2)	Output Power	ax80+80: 22.8 mW	24 dBm (250 mW) EIRP <= 1W	Complies
15.407(a) (2)	RSS-247 6.2.2 (1)	Power Spectral Density	ax80+80: 0.5 mW/MHz	11 dBm/MHz	Complies
15.407(b) (2) / 15.209	RSS-247 6.2.2 (2)	Spurious Emissions above 1GHz	51.8 dBµV/m @ 5355.1 MHz (-2.2 dB)	Refer to the limits section (p23) for restricted bands, all others -27 dBm/MHz EIRP	Complies

OPERATION IN THE 5.47 – 5.725 GHZ BAND

FCC Rule Part		Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.407(a) (2)		26dB Bandwidth	> 20MHz for all modes	N/A – limits output power if < 20MHz	N/A
		99% Bandwidth	ax80+80: 154.24 MHz	N/A – limits EIRP if < 20MHz	N/A
15.407(a) (2)		Output Power	ax80+80: 91.2 mW	24 dBm (250 mW) EIRP <= 1W	Complies
15.407(a) (2)		Power Spectral Density	ax80+80: 1.9 mW/MHz	11 dBm/MHz	Complies
15.407(b) (3) / 15.209		Spurious Emissions above 1GHz	67.8 dBµV/m @ 5464.4 MHz (-0.5 dB)	Refer to the limits section (p23) for restricted bands, all others -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	System uses OFDM techniques	Digital modulation is required	Complies
15.407(b) (6) / 15.209	RSS-247 6.2.1 (2)	Spurious Emissions below 1GHz	No change from original filing	Refer to page 25	Complies
15.31 (m)	RSS-247 6.4 (1) RSS-Gen 6.9	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	No change from original filing	Device shall automatically discontinue operation in the absence of information to transmit	Complies
15.407 (g)		Frequency Stability	No change from original filing	Signal shall remain within the allocated band	Complies
15.407 (h1)	RSS-247 6.2.2 (1) 6.2.3 (1)	Transmit Power Control	No change from original filing	The U-NII device shall have the capability to operate with a mean EIRP value lower than 24dBm (250mW)	Complies
15.407 (h2)	RSS-247 6.3	Dynamic frequency Selection (device with radar detection)	Refer to separate test report, reference FR-077654.25-FCCDFS	Threshold -62dBm (-64dBm if eirp > 200mW) Channel Availability Check > 60s Channel closing transmission time < 260ms Channel move time < 10s Non occupancy period > 30minutes	Complies
	RSS-247 6.4 (5)	User manual information	No change from original filing	Warning regarding Tilt angle for EIRP compliance, Indoor use for 5150-5250 MHz band and Radar are primary user of some bands	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	No change from original filing	Unique or integral antenna required	Complies
15.407 (b) (6)	RSS-Gen Table 4	AC Conducted Emissions	No change from original filing	Refer to page 23	Complies
15.247 (i) 15.407 (f)	RSS 102	RF Exposure Requirements	Refer to MPE calculations in separate exhibit, RSS 102 declaration and User Manual statements.	Refer to OET 65, FCC Part 1 and RSS 102	Complies
-	RSS-Gen 6.8	User Manual	No change from original filing	Statement for products with detachable antenna	Complies
-	RSS-Gen 8.4	User Manual	No change from original filing	Statement for all products	Complies

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, a Hewlett Packard Enterprise company models APIN0534 and APIN0535 are enterprise grade Wi-Fi access points with two radios (one for 5 GHz bands and a second for 2.4 GHz bands). In addition, it incorporates a Bluetooth Low Energy (BLE) and ZigBee radio. Since the EUT could be placed in any position during operation, the EUT was treated as tabletop equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 48 Volts DC, 0.75 Amps or POE (57 Volts DC, 0.95Amps).

The samples were received on August 15, 2018 and tested on October 3, 11, 12, 16, 19 and 25, 2018, The following samples were used for testing:

Company	Model	Description	Serial Number	FCC ID
Aruba	APIN0534	Wi-Fi Access Point	CNG6K9V019	Q9DAPIN0534535
Aruba	APIN0535	Wi-Fi Access Point	CNG6K9W01F	
Aruba	APIN0534	Wi-Fi Access Point	CNG6K9V00M	
Aruba	APIN0535	Wi-Fi Access Point	CNG6K9W00R	
Aruba	APIN0535	Wi-Fi Access Point	CNG6K9V00C	

OTHER EUT DETAILS

The following EUT details should be noted:
Model APIN0534 uses external Wi-Fi antennas. Model APIN0535 uses internal Wi-Fi antennas. Both models use a separate internal BLE/ZigBee antenna.
Maximum antenna gains for internal antennas (details in test results):
2.4GHz: 3.5dBi max
5GHz: 5.4dBi max
BLE/ZigBee: 5.0 dBi (APIN0534), 3.1 dBi (APIN0535)

Maximum antenna gains for external antennas.

Antenna Model #	Description	2.4 Gain / 5G Gain
AP-ANT-1W	Whip/dipole antenna	3.8dBi/5.8dBi
AP-ANT-20	Whip/dipole antenna	2dBi/2dBi
AP-ANT-19	Whip/dipole antenna	3dBi/6dBi
AP-ANT-13B	Patch antenna	2.3dBi/4dBi
AP-ANT-40	Panel	4dBi/5dBi (4 element)
AP-ANT-45	Panel	5.5dBi/4.5dBi (4 element)
AP-ANT-48	Panel	8.5dBi/8.5dBi (4 element

The 802.11ax mode does not support partial RU configurations.

ENCLOSURE

The EUT enclosure measures approximately 24.5 by 24.5 by 5 centimeters. It is primarily constructed of aluminum and uncoated plastic.

MODIFICATIONS

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

SUPPORT EQUIPMENT

The following equipment was used as support equipment for testing:

Company	Model	Description	Serial Number	FCC ID
CUI Inc	ATS048T-A480	AC Adapter	-	-

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

Company	Model	Description	Serial Number	FCC ID
HP	840 G3	Laptop	5CG75124D0	-
Microsemi	PD-9001GR/AT/AC	POE adapter	None	-

EUT INTERFACE PORTS

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

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
DC Input	AC Adapter	two wire	Unshielded	1.2
Ethernet	POE Adatper	Cat 6	Unshielded	7.6
USB	Not connected	-	-	-
micro USB	Not connected	-	-	-
AC Adapter	Mains	Two wire	Unshileded	1.3
POE adapter	HP Laptop	Cat 6	Unshileded	1.5
POE adapter	Mains	Three wire	Unshileded	1.3

The micro USB and USB ports are for debug only.

EUT OPERATION

During testing, the EUT was was configured using the laptop to transmit continuously from all radios (2.4 GHz Wi-Fi, 5 GHz Wi-Fi and BLE/ZigBee) simultaneously on the selected channels and at the maximum power level. The BLE/ZigBee radio cannot transmit BLE and ZigBee simultaneously.

PROPOSED MODIFICATION DETAILS

GENERAL

This section details the modifications to the Aruba, a Hewlett Packard Enterprise company model APIN0534 and APIN0535 being proposed. All performance and construction deviations from the characteristics originally reported to the FCC are addressed

SOFTWARE

The operating software was modified to allow operation in 80+80 bandwidth 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 6.2 of RSS-GEN, NTS has been recognized as an accredited test laboratory by the Commission and Innovation, Science and Economic Development Canada. A description of the facilities employed for testing is maintained by NTS.

Site	Company / Registration Numbers		Location
	FCC	Canada	
Chamber 4	US1031	2845B (Wireless Test Lab #US0027)	41039 Boyce Road Fremont, CA 94538-2435
Chamber 5			

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. Results from testing performed in this chamber have been correlated with results from an open area test site. 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 for testing below 1 GHz and 1.5m for testing above 1 GHz. 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.

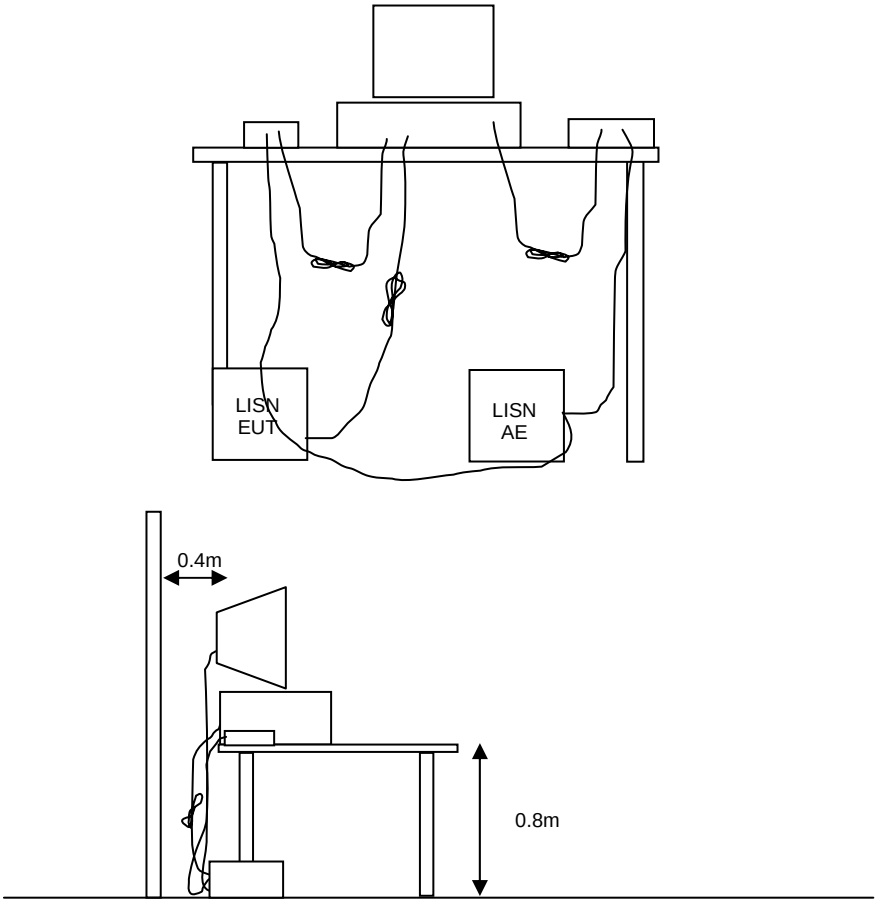


Figure 1 Typical Conducted Emissions Test Configuration

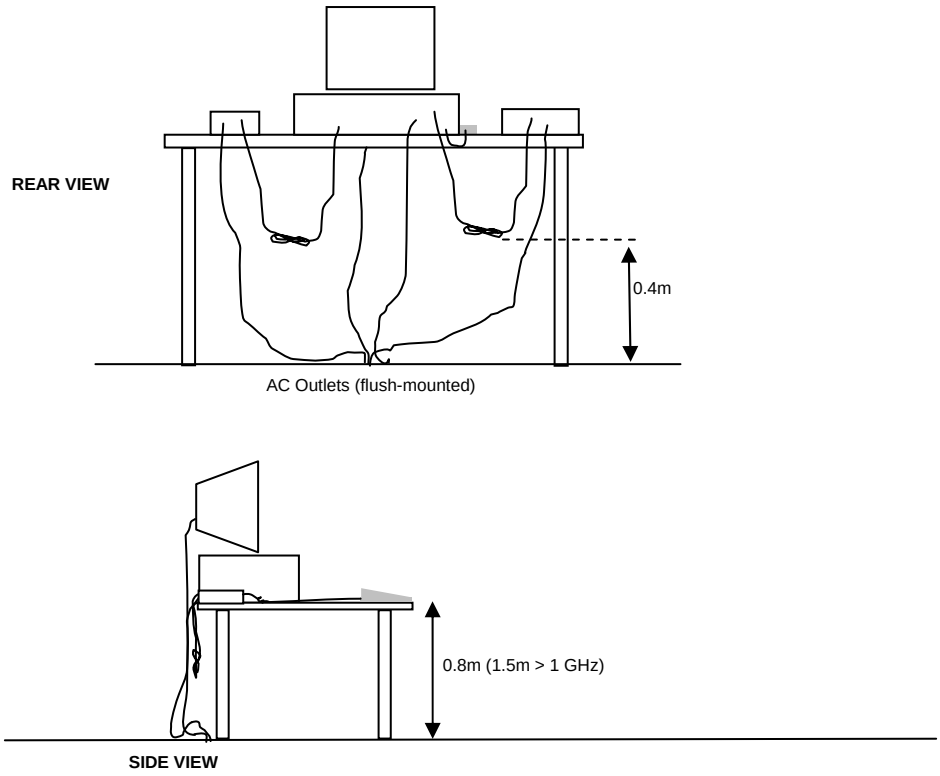
RADIATED EMISSIONS

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.

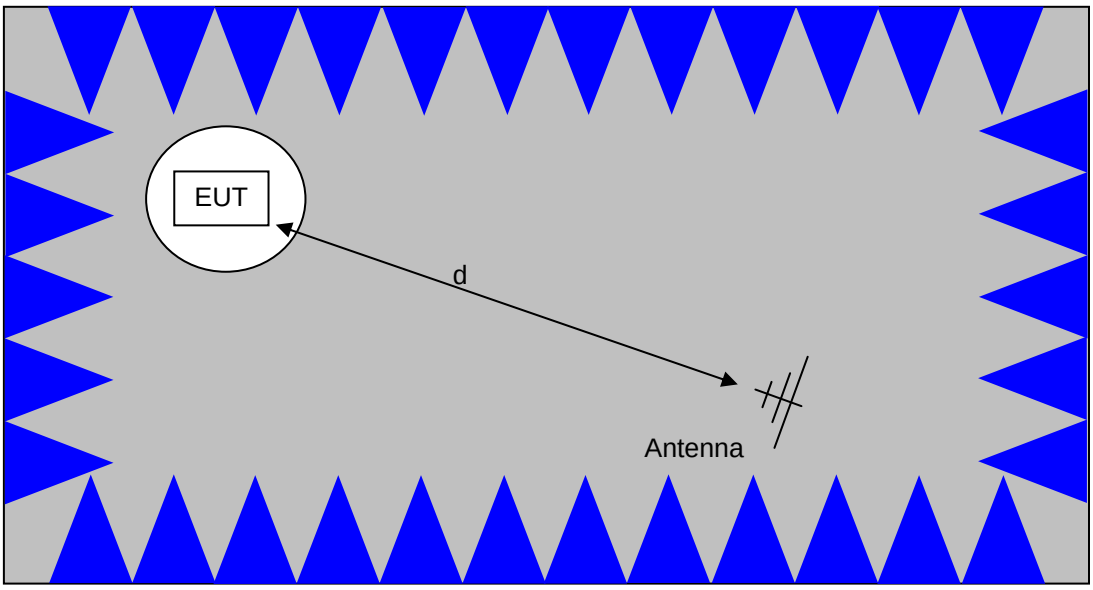
A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

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.

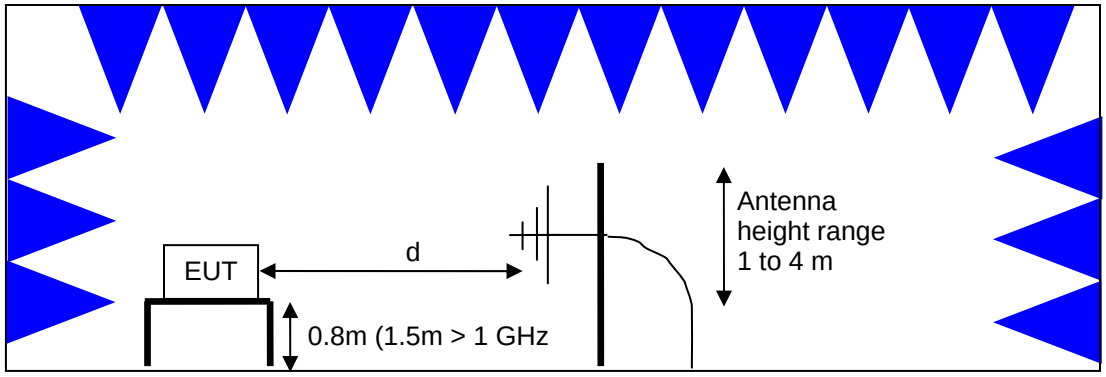


Typical Test Configuration for Radiated Field Strength Measurements



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.

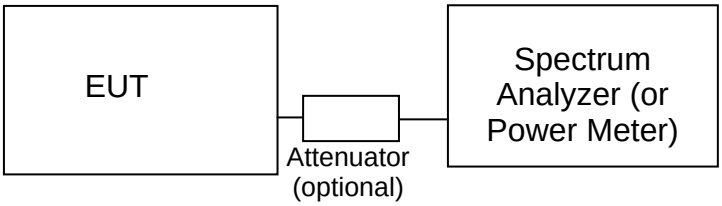
Floor-standing equipment is placed on the floor with insulating supports between the unit and the ground plane.



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; 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

[1] The restricted bands are detailed in FCC 15.205 and RSS-Gen Table 7

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
5725–5850	1 Watt (30 dBm)	30 dBm/500kHz
5925–6425 and 6525–6875	1Watt (30 dBm)	17 dBm/MHz
6425–6525 and 6875–7125	250 mW (24 dBm)	11 dBm/MHz

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. Fixed point-to-point applications using the 5725 – 5850 MHz band may use antennas of any gain without this limitation.

OUTPUT POWER LIMITS –LELAN DEVICES

The table below shows the limits for output power and output power density defined by RSS 247. 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	200mW (23 dBm) eirp	10 dBm/MHz eirp
5250 – 5350 and 5470 - 5725	250 mW (24 dBm)2 1W (30dBm) eirp	11 dBm/MHz
5725 – 5850	1 Watt (30 dBm) 4W eirp	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. Fixed point-to-point applications using the 5725 – 5850 MHz band may use antennas with any gain without this limitation.

[2] If EIRP exceeds 500mW the device must employ TPC

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 band under the LELAN/UNII rules, the limit within 5 MHz of the allocated band slopes from 27 dBm/MHz to 15.6 dBm/MHz, from 5 MHz to 25 MHz from the allocated band slopes from 15.6 dBm/MHz to 10 dBm/MHz, from 25 MHz to 75 MHz from the allocated band slopes from 10 dBm/MHz to -27 dBm/MHz and for more than 75 MHz from the allocated band is –27dBm/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

Manufacturer	Description	Model	Asset #	Calibrated	Cal Due
Radiated Emissions, Bandedge, 05-Oct-18					
EMCO	Antenna, Horn, 1-18 GHz	3115	1242	4/11/2017	4/19/2019
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB 7	1756	7/7/2018	7/7/2019
Radiated Emissions, Bandedge UNII , 12-Oct-18					
National Technical Systems	NTS EMI Software (rev 2.10)	N/A	0		N/A
EMCO	Antenna, Horn, 1-18 GHz	3115	1242	4/11/2017	4/19/2019
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB 7	1756	7/7/2018	7/7/2019
Radiated Emissions, 1000 - 40,000 MHz, 16-Oct-18					
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	9/5/2018	9/5/2019
EMCO	Antenna, Horn, 1-18 GHz (SA40-Red)	3115	1142	9/18/2018	9/18/2020
HP / Miteq	SA40 R Head HF preAmplifier, 18-40 GHz (w/1148)	TTA1840-45-5P-HG-S	1145	9/8/2018	9/8/2019
Hewlett Packard	Spectrum Analyzer (SA40) Red 30 Hz -40 GHz	8564E (84125C)	1148	9/27/2018	9/27/2019
EMCO	Antenna, Horn, 1-18 GHz	3115	1242	4/11/2017	4/19/2019
Hewlett Packard	High Pass filter, 8.2 GHz (Blu System)	P/N 84300-80039 (84125C)	1392	5/1/2018	5/1/2019
A. H. Systems	Spare System Horn, 18-40GHz	SAS-574, p/n: 2581	2162	8/4/2017	8/4/2019
Micro-Tronics	Band Reject Filter, 5150-5350 MHz	BRC50703-02	2239	8/17/2018	8/17/2019
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	2249	5/1/2018	5/1/2019
Radiated Emissions, 1000 - 40,000 MHz, 19-Oct-18					
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	9/5/2018	9/5/2019
HP / Miteq	SA40 R Head HF preAmplifier, 18-40 GHz (w/1148)	TTA1840-45-5P-HG-S	1145	9/8/2018	9/8/2019
Hewlett Packard	Spectrum Analyzer (SA40) Red 30 Hz -40 GHz	8564E (84125C)	1148	9/27/2018	9/27/2019
Hewlett Packard	High Pass filter, 8.2 GHz (Blu System)	P/N 84300-80039 (84125C)	1392	5/1/2018	5/1/2019
A. H. Systems	Spare System Horn, 18-40GHz	SAS-574, p/n: 2581	2162	8/4/2017	8/4/2019
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	2249	5/1/2018	5/1/2019
Micro-Tronics	Band Reject Filter, 5150-5350 MHz	BRC50703-02	2239	8/17/2018	8/17/2019
EMCO	Antenna, Horn, 1-18 GHz	3115	1242	4/11/2017	4/19/2019

Manufacturer	Description	Model	Asset #	Calibrated	Cal Due
Radiated Emissions, 1000 - 40,000 MHz, 25-Oct-18					
Micro-Tronics	Band Reject Filter, 5725-5875 MHz 12GHz	BRC50705-02	1728	3/23/2018	3/23/2019
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	9/5/2018	9/5/2019
HP / Miteq	SA40 R Head HF preAmplifier, 18-40 GHz (w/1148)	TTA1840-45-5P-HG-S	1145	9/8/2018	9/8/2019
Hewlett Packard	Spectrum Analyzer (SA40) Red 30 Hz -40 GHz	8564E (84125C)	1148	9/27/2018	9/27/2019
Hewlett Packard	High Pass filter, 8.2 GHz (Blu System)	P/N 84300-80039 (84125C)	1392	5/1/2018	5/1/2019
Micro-Tronics	Band Reject Filter, 5470-5725 MHz 12GHz	BRC50704-02	1681	3/23/2018	3/23/2019
A. H. Systems	Spare System Horn, 18-40GHz	SAS-574, p/n: 2581	2162	8/4/2017	8/4/2019
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	2249	5/1/2018	5/1/2019
EMCO	Antenna, Horn, 1-18 GHz	3115	1242	4/11/2017	4/19/2019

Appendix B Test Data

TL077654-RA-FCC Pages 31 – 86

Client:	Aruba, a Hewlett Packard Enterprise company	PR Number:	PR077654
Product	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
System Configuration:	-	Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Engineer:	David Bare
Emissions Standard(s):	FCC §15.247 & 15.407	Class:	
Immunity Standard(s):	-	Environment:	Radio

EMC Test Data

For The

Aruba, a Hewlett Packard Enterprise company

Product

APIN0534 and APIN0535

Date of Last Test: 6/20/2019

Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 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.

Summary of Results

Run #	Test Performed	Limit	Pass / Fail	Result / Margin
1	Power, 5150 - 5250MHz	15.407(a) (1), (2), (3) RSS-247 6.2	Pass	ax80+80: 25.6 mW
1	PSD, 5150 - 5250MHz	15.407(a) (1), (2), (3) RSS-247 6.2	Pass	ax80+80: 0.5 mW/MHz
1	99% Bandwidth	RSS-247 (Information only)	N/A	ax80+80: 154.34 MHz

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: 22.6 °C
Rel. Humidity: 38 %

Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A

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.

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)
11ax80+80	MCS0	95.3%	Yes	4.8	0.2	0.4	210
11ac80+80	MCS0	96.5%	Yes	5.4	0.2	0.3	184

Sample Notes

Sample S/N: CNG6K9V00M
Driver: P2 WNC 0.4.3a

Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A

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

Date of Test: 11/7/2018 Config. Used: 1
Test Engineer: Rafael Varelas / Roy Zheng Config Change: None
Test Location: FT Lab #4b EUT Voltage: POE & 120V/60Hz

Note 1:	Constant Duty Cycle < 98%. Output power measured using a spectrum analyzer (see plots below). RBW=1MHz, VB=3 MHz, Span > OBW, # of points in sweep ≥ 2*span/RBW, RMS sample detector, trace average 100 traces (at least 100 traces, increase the number to get true average), power averaging on and power integration over the OBW. Tthe measurements were adjusted by adding YY dB. This is based on 10log(1/x), where x is the duty cycle. (method SA-2 of ANSI C63.10)
Note 2:	Measured using the same analyzer settings used for output power.
Note 3:	For RSS-247 the limit for the 5150 - 5250 MHz band accounts for the antenna gain as the maximum eirp allowed is 10dBm/MHz. The limits are also corrected for instances where the highest measured value of the PSD exceeds the average PSD (calculated from the measured power divided by the measured 99% bandwidth) by more than 3dB by the amount that the measured value exceeds the average by more than 3dB.
Note 4:	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 5:	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								Dir G (PWR)	Dir G (PSD)
	1	2	3	4	5	6	7	8		
5150-5250	2.0	2.0	2.0	2.0					2.0	8.0

Higher gain antennas used for model APIN0534 and internal antennas of the APIN0535 use a corresponding lower power settings
Legacy modes operate on all chains
Power for BF mode is reduced by 6 dB so effective antenna gain does not change
CDD active for single stream modes

Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A

For devices that support CDD modes

Min # of spatial streams: 1

Max # of spatial streams: 4

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.
Notes:	For systems with Beamforming and CDD, choose one the following options: Option 1: Delays are optimized for beamforming, rather than being selected from cyclic delay table of 802.11; Array gains calculated based on beamforming criteria. Option 2: Antennas are paired for beamforming, and the pairs are configured to use the cyclic delay diversity of 802.11; the array gain associated with beamforming with 2 antennas (3dB), and the array gain associated with CDD with two antennas (3dB for PSD and 0 dB for power)

FCC UNII-1 Limits		Pwr	PSD
	Outdoor AP	30	17
X	Indoor AP	30	17
	Station (e.g. Client)	24	11
	Outdoor AP (>30° Elv.)	21	-

Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A

MIMO Device - 5150-5250 MHz and 5250-5350 MHz Bands - FCC

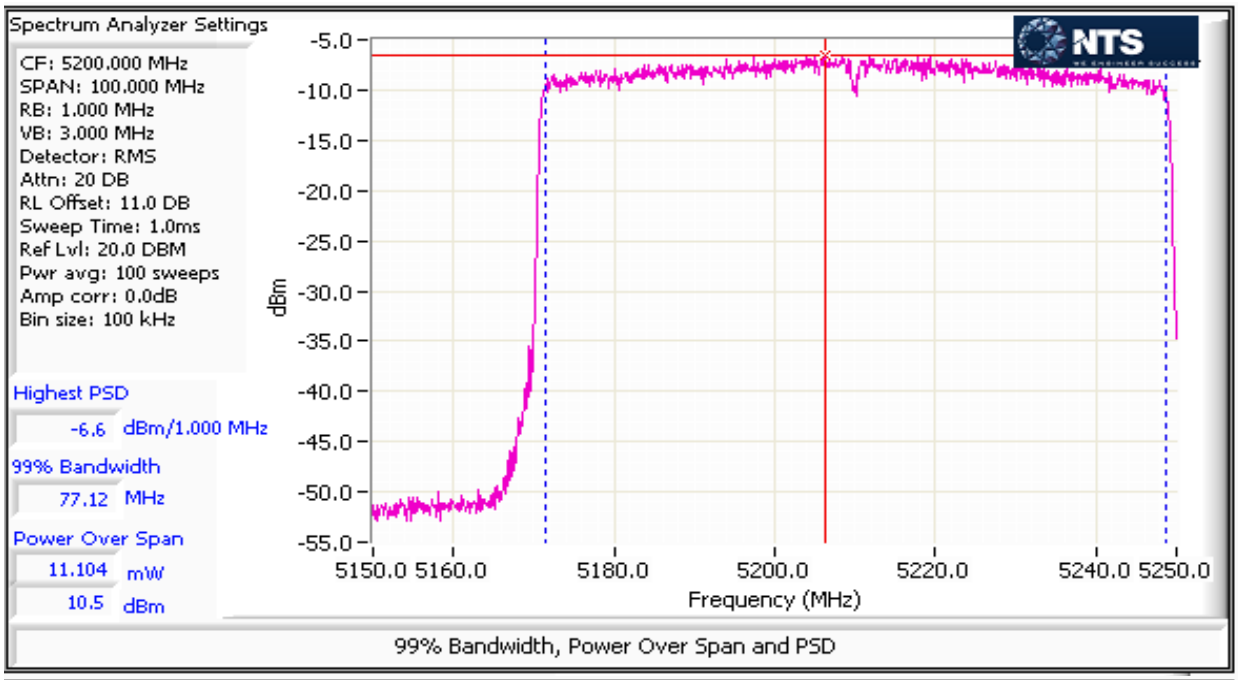
Mode: ax80 + 80 Max EIRP (mW): 40.6

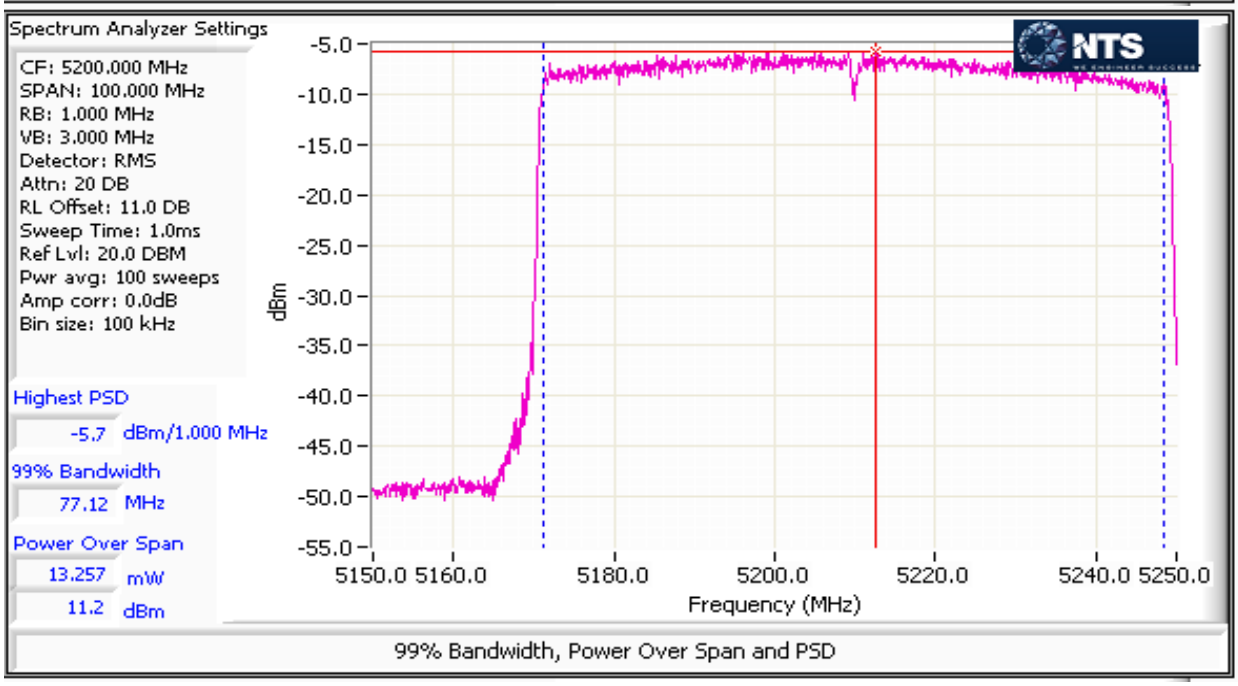
Frequency (MHz)	Chain	Software Setting		Duty Cycle %	Power dBm	Total Power[1] mW	Total Power[1] dBm	FCC Limit dBm	Max Power (W)	Result
5250	0	13		95.3	10.5	25.6	14.1	30.0	0.026	Pass
	1				11.2					
	2				-25.9					
	3				-25.0					

Portion within 5250-5350 MHz band (UNII-2A) Max EIRP (mW): 36.1

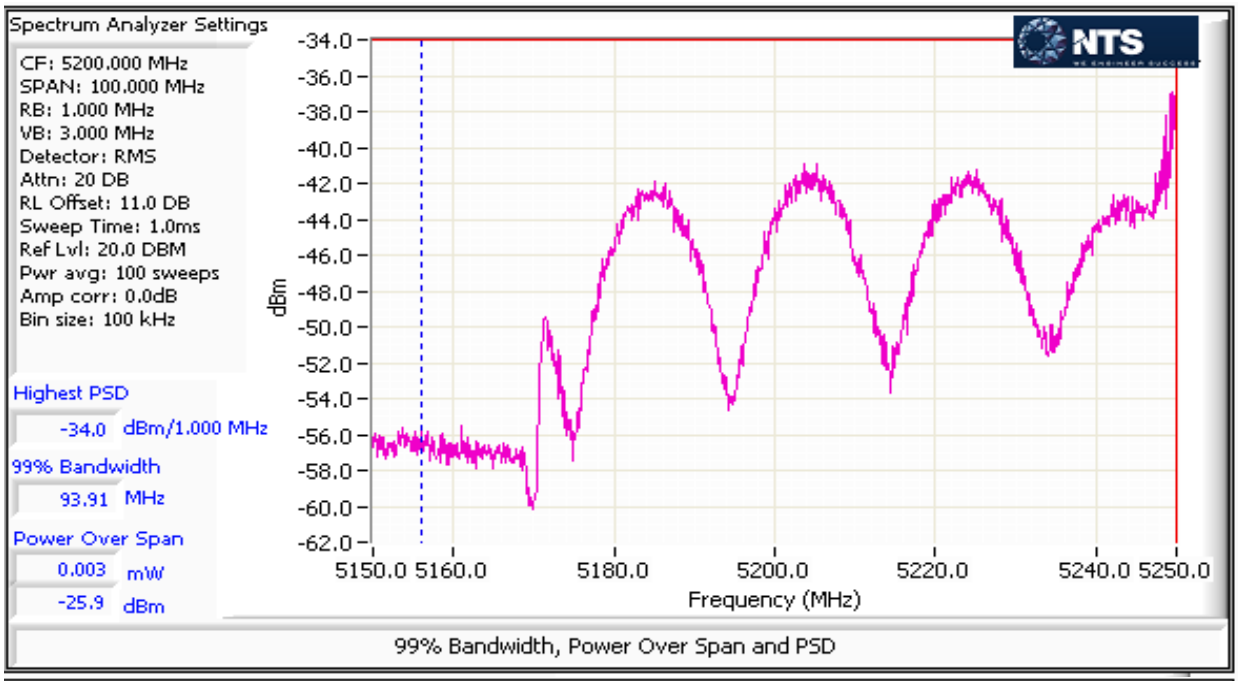
5250	0	13		95.3	-29.7	22.8	13.6	30.0	0.0228	Pass
	1				-20.7					
	2				10.6					
	3				10.1					

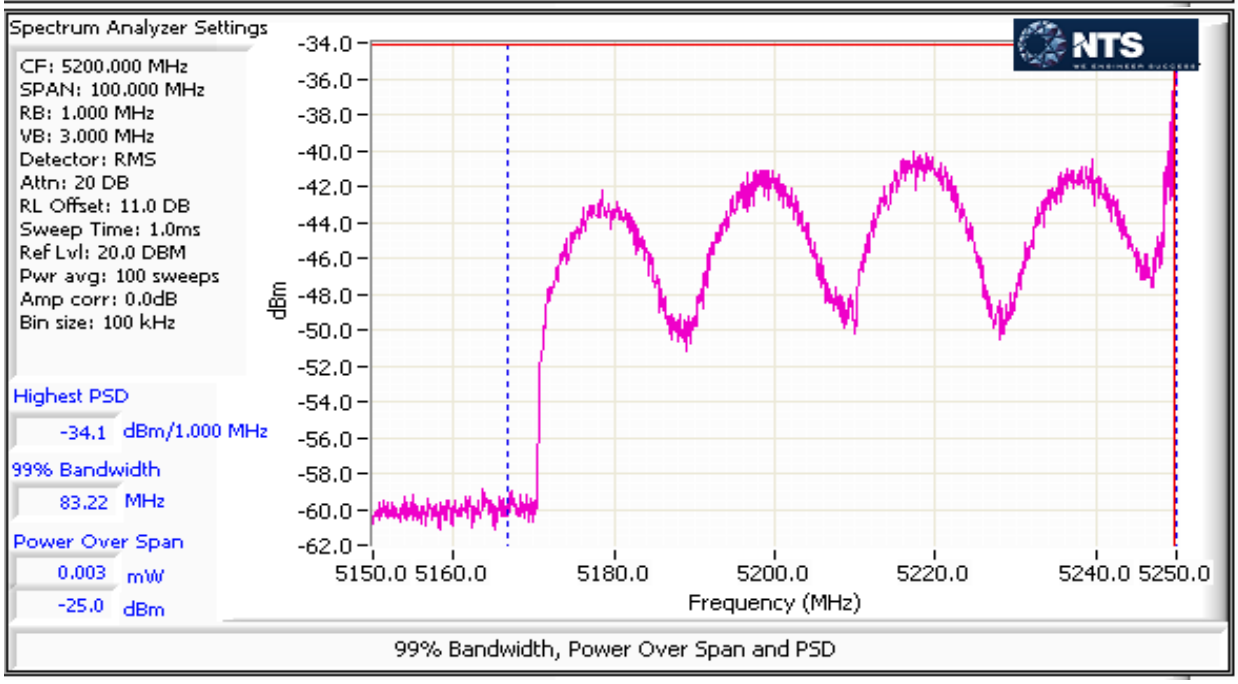
Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A



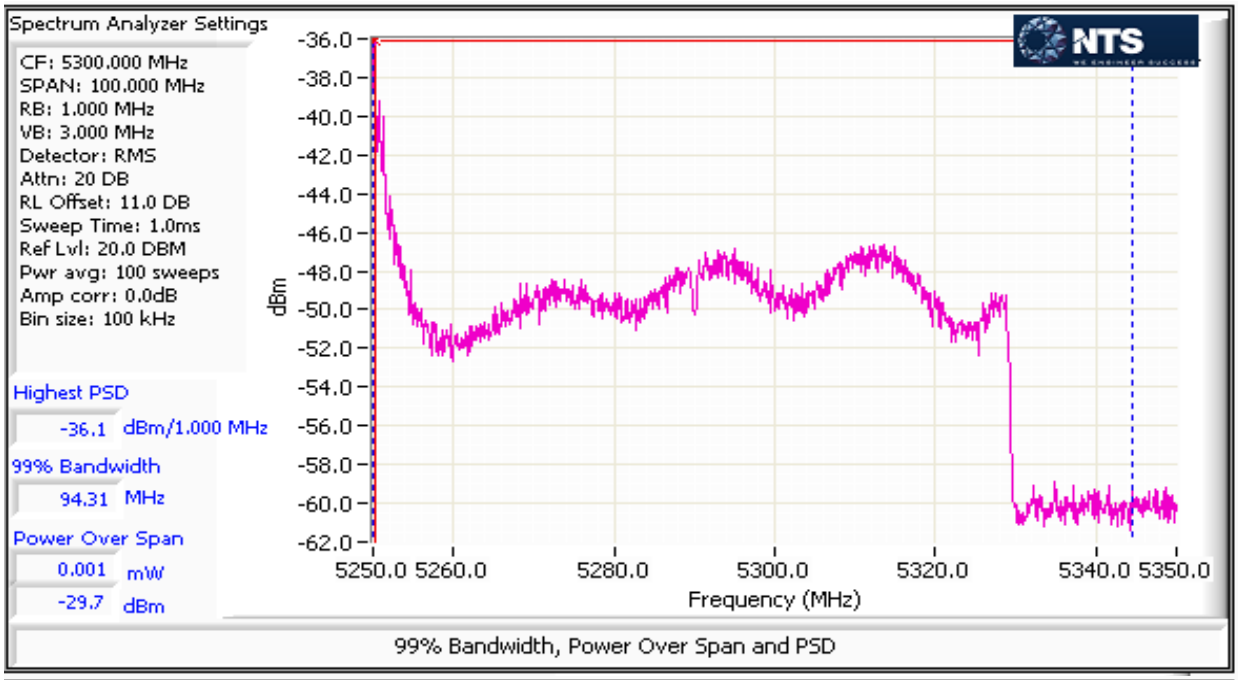


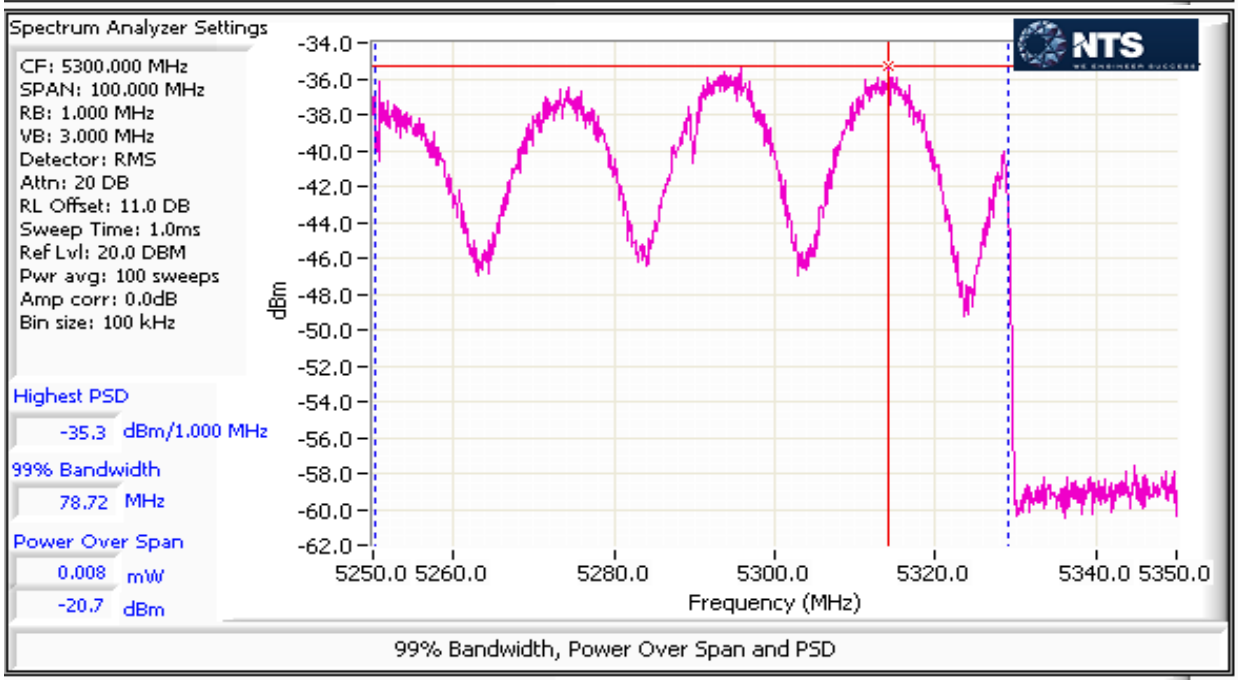
Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A



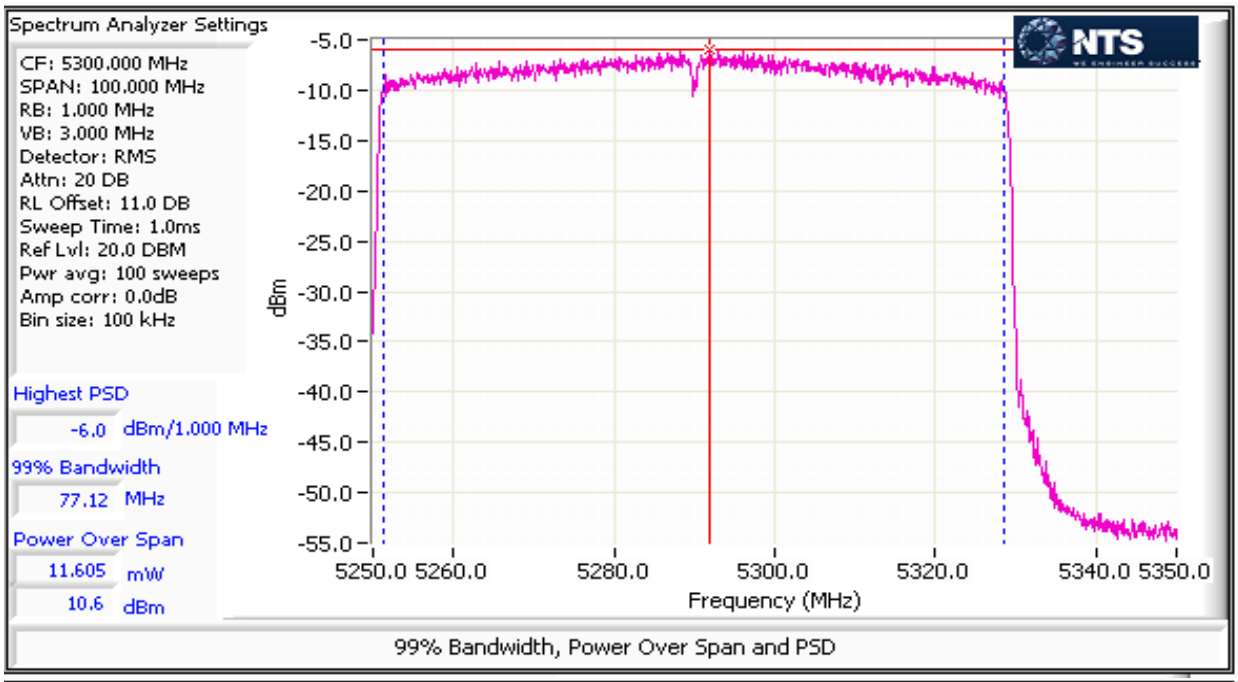


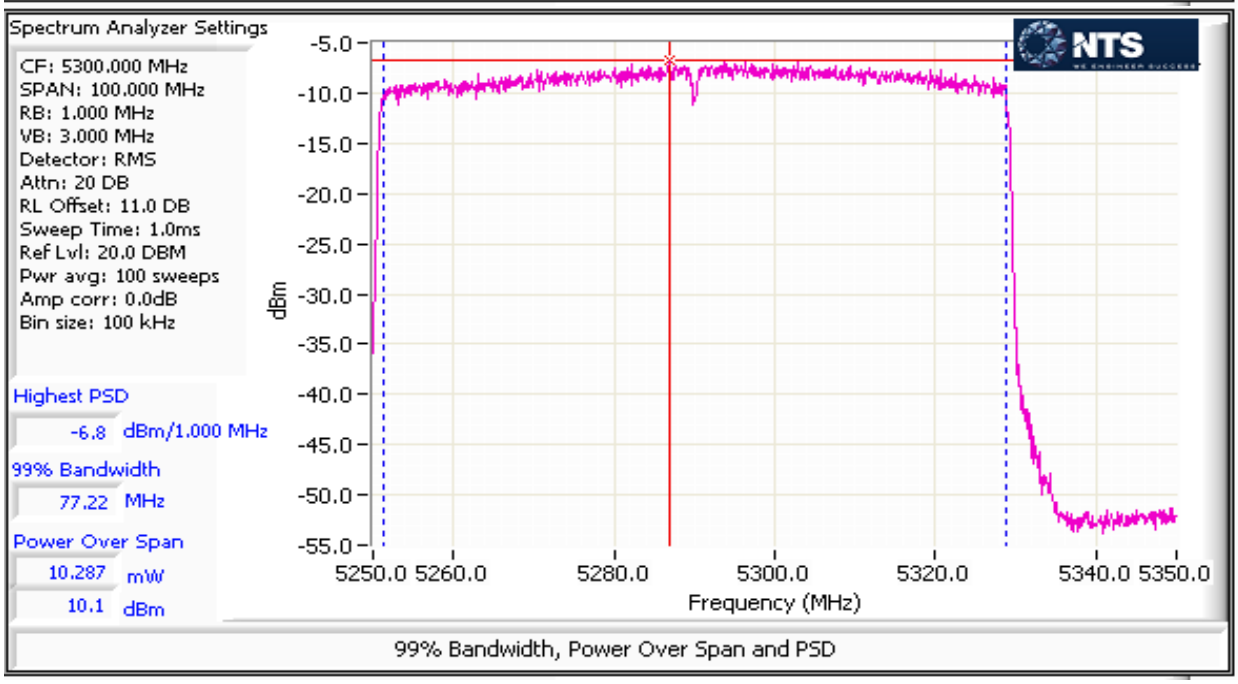
Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A





Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A





Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A

MIMO Device - 5150-5150 MHz Band - ISEDC

Mode: ax80 + 80 — Max EIRP (mW): 40.7

Frequency (MHz)	Chain	Software Setting	99% BW (MHz)	Duty Cycle %	Power[1] dBm	Total Power dBm	Total Power dBm (eirp)	IC limit dBm (eirp)	Max Power (W)	Result
5250	0	13	77.12	95.3	10.5	14.1	16.1	23.0	0.026	Pass
	1				11.2					
	2				-25.9					
	3				-25.0					

Portion within 5250-5350 MHz band (UNII-2A) — Max EIRP (mW): 36.3

5250	0	13	77.22	95.3	-29.7	13.6	15.6	30.0	0.023	Pass
	1				-20.7					
	2				10.6					
	3				10.1					

5150-5250 PSD - FCC

Mode: ax80 + 80

Frequency (MHz)	Chain	Software Setting		Duty Cycle %	PSD dBm/MHz	Total PSD[1] mW/MHz	Total PSD[1] dBm/MHz	FCC Limit dBm/MHz	Result
5250	0	13		95.3	-6.6	0.5	-3.0	15.0	Pass
	1				-5.7				
	2				-34.0				
	3				-34.1				

Portion within 5250-5350 MHz band (UNII-2A)

5250	0	13		95.3	-36.1	0.5	-3.0	30.0	Pass
	1				-35.3				
	2				-6.0				
	3				-6.8				

Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A

5150-5250 PSD - ISEDC
Mode: ax80 + 80

Frequency (MHz)	Chain	Software Setting		Duty Cycle %	PSD dBm/MHz	Total PSD[1] mW/MHz	Total PSD[1] dBm/MHz	IC Limit dBm/MHz	Result
5250	0	13		95.3	-6.6	0.5	-3.0	2.0	Pass
	1				-5.7				
	2				-34.0				
	3				-34.1				

Portion within 5250-5350 MHz band (UNII-2A)

5250	0	13		95.3	-36.1	0.5	-3.0	30.0	Pass
	1				-35.3				
	2				-6.0				
	3				-6.8				

5150-5250 PSD - FCC
Mode: ac80 + 80

ac80+80 mode tested to demonstrate PSD is same as for ax80+80 mode

Frequency (MHz)	Chain	Software Setting		Duty Cycle %	PSD dBm/MHz	Total PSD[1] mW/MHz	Total PSD[1] dBm/MHz	FCC Limit dBm/MHz	Result
5250	0	13		96.5	-6.4	0.5	-3.0	15.0	Pass
	1				-5.8				
	2				-35.7				
	3				-34.5				

Portion within 5250-5350 MHz band (UNII-2A)

5250	0	13		96.5	-36.1	0.5	-3.0	30.0	Pass
	1				-35.3				
	2				-5.9				
	3				-6.4				

Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A

5150-5250 PSD - ISEDC
Mode: ac80 + 80

Frequency (MHz)	Chain	Software Setting		Duty Cycle %	PSD dBm/MHz	Total PSD[1] mW/MHz	Total PSD[1] dBm/MHz	IC Limit dBm/MHz	Result
5250	0	13		96.5	-6.4	0.5	-3.0	2.0	Pass
	1				-5.8				
	2				-35.7				
	3				-34.5				

Portion within 5250-5350 MHz band (UNII-2A)

5250	0	13		96.5	-36.1	0.5	-3.0	30.0	0.0005	Pass
	1				-35.3					
	2				-5.9					
	3				-6.4					

Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 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.

Summary of Results

Run #	Test Performed	Limit	Pass / Fail	Result / Margin
1	Power, 5470 - 5725MHz	15.407(a) (1), (2), (3) RSS-247 6.2	Pass	ax80+80: 91.2 mW
1	PSD, 5470 - 5725MHz	15.407(a) (1), (2), (3) RSS-247 6.2	Pass	ax80+80: 1.9 mW/MHz
1	Max EIRP 5470 - 5725MHz	TPC required if EIRP≥ 500mW (27dBm). EIRP ≥ 200mW (23dBm) DFS threshold	Pass	EIRP = 23.3 dBm (213 mW)
1	26dB Bandwidth	15.407 (Information only)	-	> 20MHz for all modes

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.

Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A

Ambient Conditions:

Temperature: 22.6 °C
Rel. Humidity: 38 %

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.

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	MCS0	92.3%	Yes	1.4	0.3	0.7	698
11ax20	MCS0	95.6%	Yes	5.4	0.2	0.4	184
11ax40	MCS0	95.9%	Yes	5.4	0.2	0.4	184
11ax80	MCS0	94.9%	Yes	5.4	0.2	0.5	185
11ax80+80	MCS0	95.3%	Yes	4.8	0.2	0.4	210

Sample Notes

Sample S/N: CNG6K9V00M
Driver: P2 WNC 0.4.3a

Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A

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

Date of Test: 11/9/2018 Config. Used: 1

Test Engineer: Roy Zheng / R. Varelas Config Change: None

Test Location: FT Lab #4b EUT Voltage: POE & 120V/60Hz

Note 1:	Constant Duty Cycle < 98%. Output power measured using a spectrum analyzer (see plots below). RBW=1MHz, VB=3 MHz, Span > OBW, # of points in sweep ≥ 2*span/RBW, RMS sample detector, trace average 100 traces (at least 100 traces, increase the number to get true average), power averaging on and power integration over the OBW. Tthe measurements were adjusted by adding YY dB. This is based on 10log(1/x), where x is the duty cycle. (method SA-2 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								Dir G (PWR)	Dir G (PSD)
	1	2	3	4	5	6	7	8		
5470-5725	2.0	2.0	2.0	2.0					2.0	8.0

Higher gain antennas used for model APIN0534 and internal antennas of the APIN0535 use a corresponding lower power settings
Legacy modes operate on all chains
Power for BF mode is reduced by 6 dB so effective antenna gain does not change
CDD active for single stream modes

For devices that support CDD modes

Min # of spatial streams: 1

Max # of spatial streams: 4

Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A

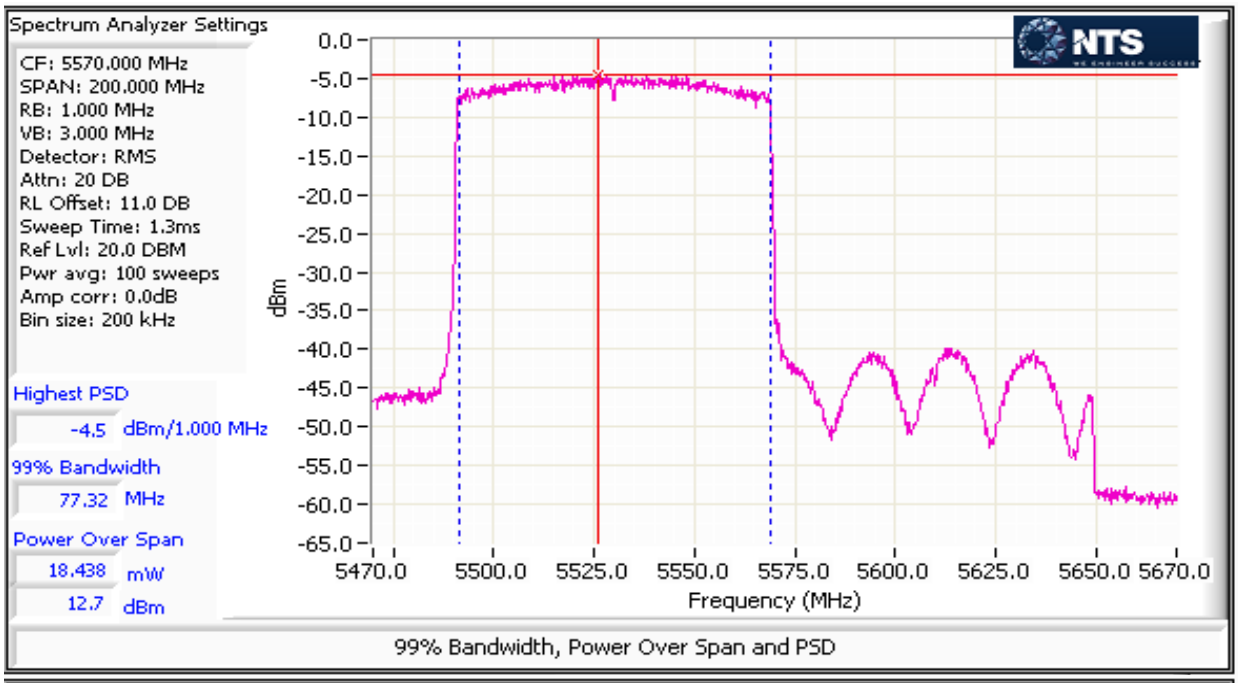
Notes:	BF = beamforming mode supported, Multichain Legacy = 802.11 legacy data rates supported for multichain transmissions, CDD = Cyclic Delay Diversity (or Cyclic Shift Diversity) modes supported, Sectorized / Xpol = antennas are sectorized or cross polarized.
Notes:	Dir G (PWR) = total gain (Gant + 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.
Notes:	For systems with Beamforming and CDD, choose one the following options: Option 1: Delays are optimized for beamforming, rather than being selected from cyclic delay table of 802.11; Array gains calculated based on beamforming criteria. Option 2: Antennas are paired for beamforming, and the pairs are configured to use the cyclic delay diversity of 802.11; the array gain associated with beamforming with 2 antennas (3dB), and the array gain associated with CDD with two antennas (3dB for PSD and 0 dB for power)
Notes:	Based on PSD results for 802.11n modes in the 5150-5250 Mhz band, only 802.11ax modes tested for 5725-5850 MHz.

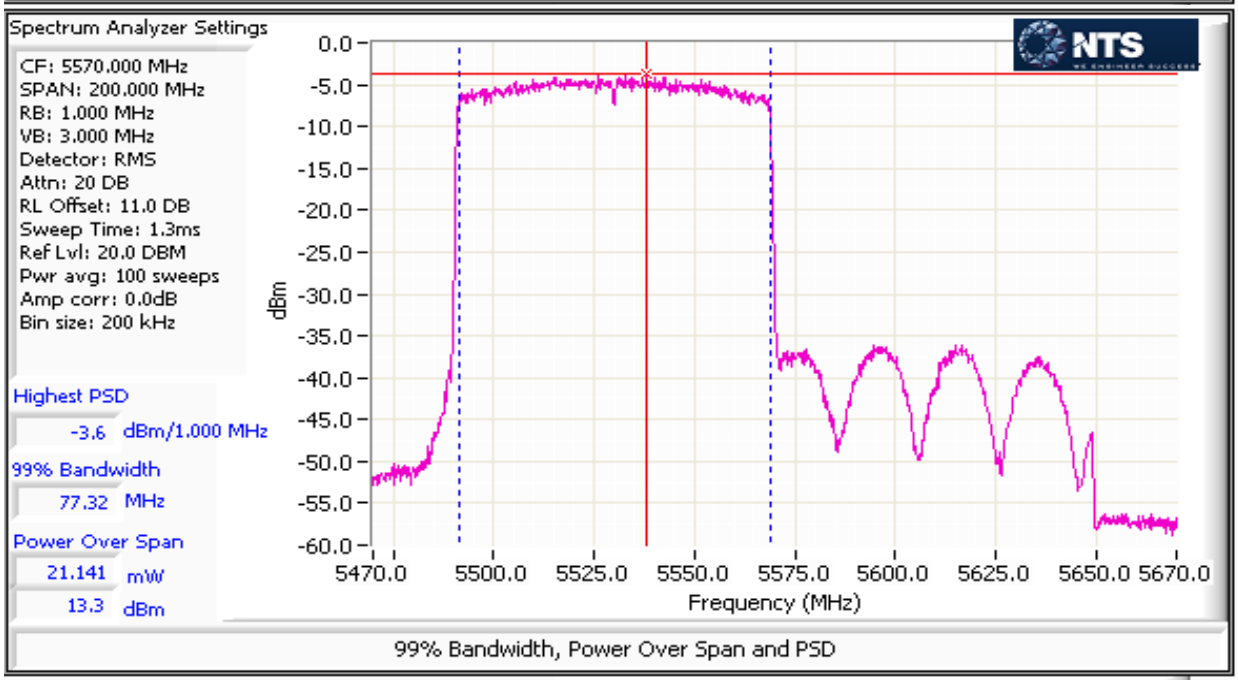
MIMO Device - 5470-5725 MHz Band - FCC Only

Mode: ax80+80 Max EIRP (mW): 144.5

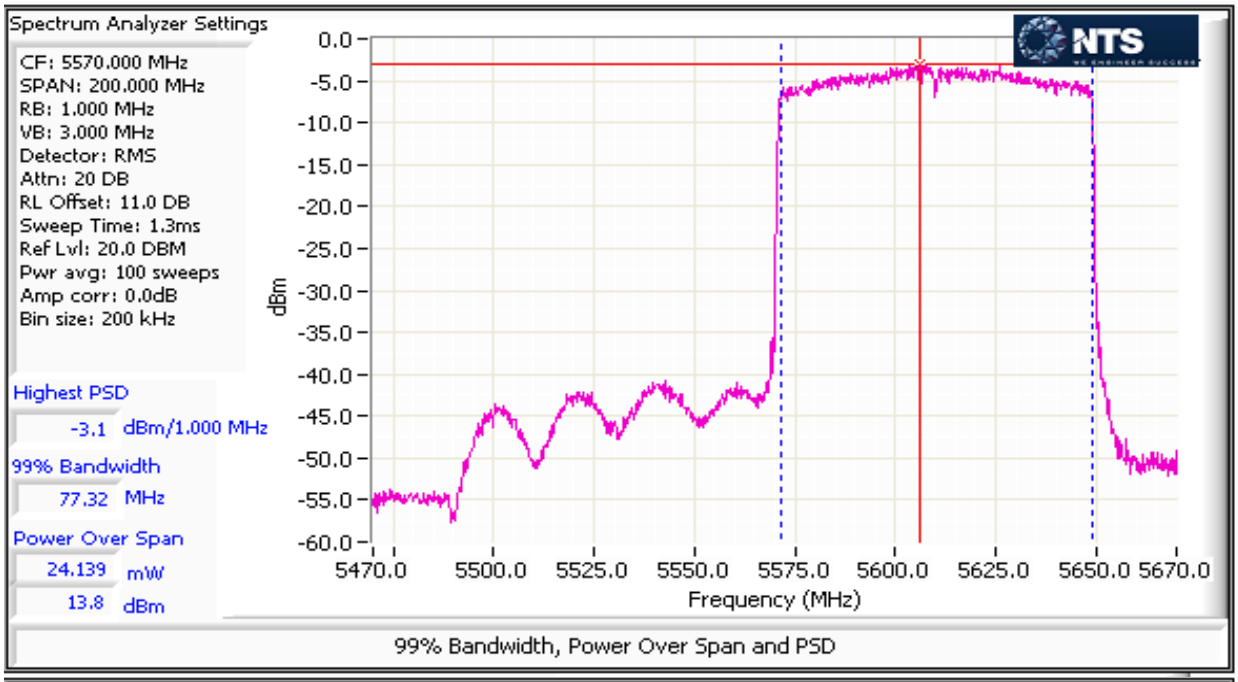
Frequency (MHz)	Chain	Software Setting	26dB BW (MHz)	Duty Cycle %	Power[1] dBm	Total Power mW	Total Power dBm	FCC Limit dBm	Max Power (W)	Result
5570	0	16	160.96	95.3	12.7	91.2	19.6	24.0	0.091	Pass
	1				13.3					
	2				13.8					
	3				13.6					

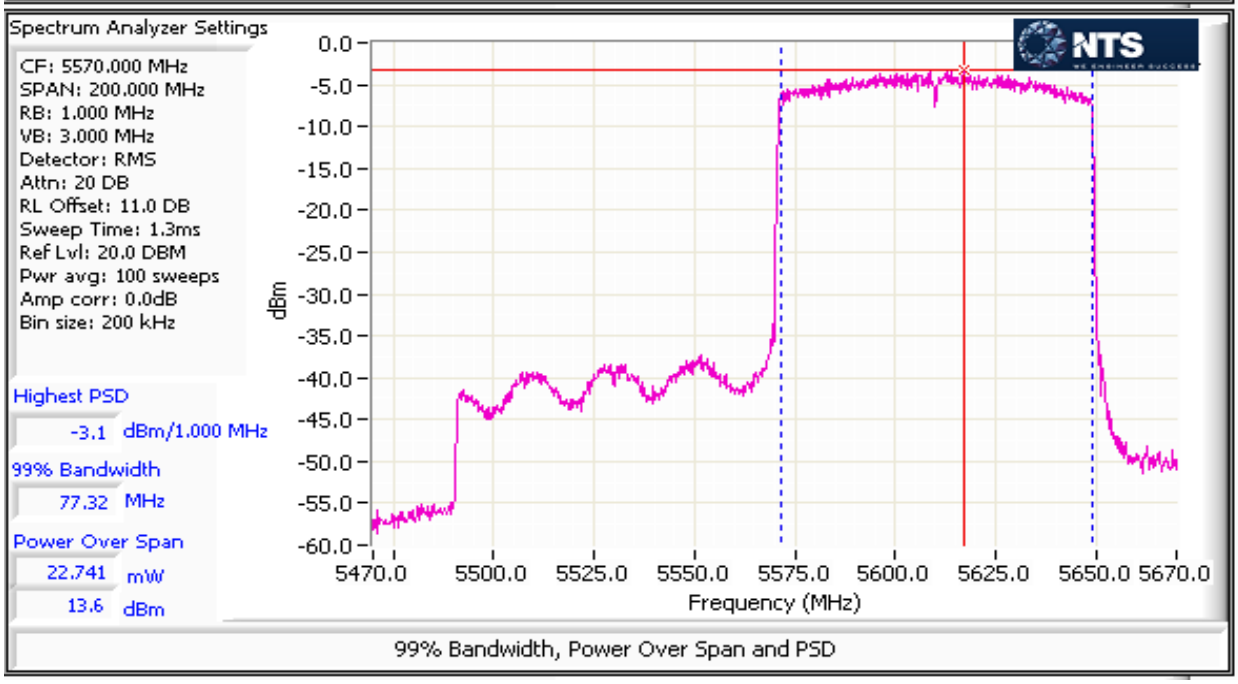
Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A





Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A





Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A

5470-5725 PSD - FCC Only
Mode: ax80+80

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		Result
5570	0	16		95.3	-4.5	1.9	2.8	9.0		Pass
	1				-3.6					
	2				-3.1					
	3				-3.1					

Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 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: 23.7 °C
Rel. Humidity: 39 %

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

BLE Sample SN: CNG6K9W00R and Zigbee Sample SN: CNG6K9W01F
Driver: P2 WNC 0.4.3a
Antenna: Integral 4x4 and BLE/ZigBee

Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A

Summary of Results

Run #	Mode	Channel	Target Setting	Final Setting	Test Performed	Limit	Result / Margin
80+80MHz Bandwith Modes							
17	ax80+80	50 - 5250MHz	17.5	13	Restricted Band Edge at 5150 MHz	15.209	52.4 dBµV/m @ 5130.0 MHz (-1.6 dB)
		50 - 5250MHz	17.5	13	Restricted Band Edge at 5350 MHz		47.0 dBµV/m @ 5350.3 MHz (-7.0 dB)
18		114 - 5570MHz	17.5	17	Restricted Band Edge at 5460 MHz		52.6 dBµV/m @ 5450.1 MHz (-1.4 dB)
		114 - 5570MHz	17.5	17	Band Edge 5460 - 5470 MHz	15E	67.8 dBµV/m @ 5464.4 MHz (-0.5 dB)

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	MCS0	92.3%	Yes	1.4	0.3	0.7	698
11ax20	MCS0	95.6%	Yes	5.4	0.2	0.4	184
11ax40	MCS0	95.9%	Yes	5.4	0.2	0.4	184
11ax80	MCS0	94.9%	Yes	5.4	0.2	0.5	185
11ac80+80	MCS0	96.5%	Yes	5.4	0.2	0.3	184

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, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A

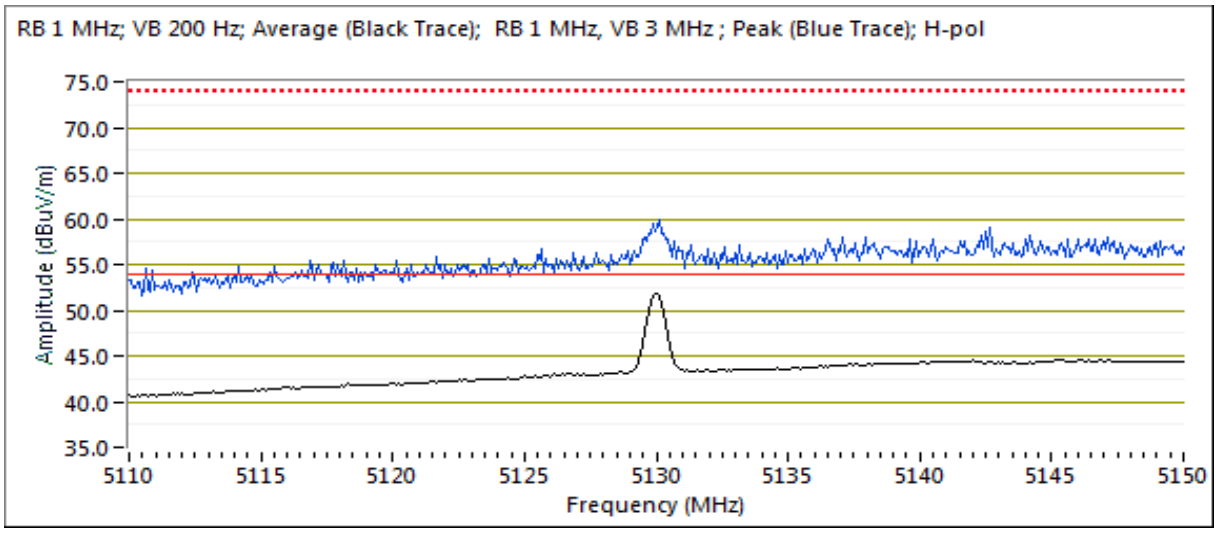
Run #17: Radiated Bandedge Measurements, 5150-5350MHz

Date of Test: 10/3/2018 Config. Used: 1
Test Engineer: Rafael Varelas Config Change: None
Test Location: Fremont Chamber #5 EUT Voltage: PoE & 120V/60Hz

Channel: 50 - 5250MHz at 13.0dBm Mode: BLE at 8 dBm
Tx Chain: 4Tx Mode: ax80+80 Ch.Freq.: 2440 MHz

5150 MHz Band Edge Signal Radiated Field Strength

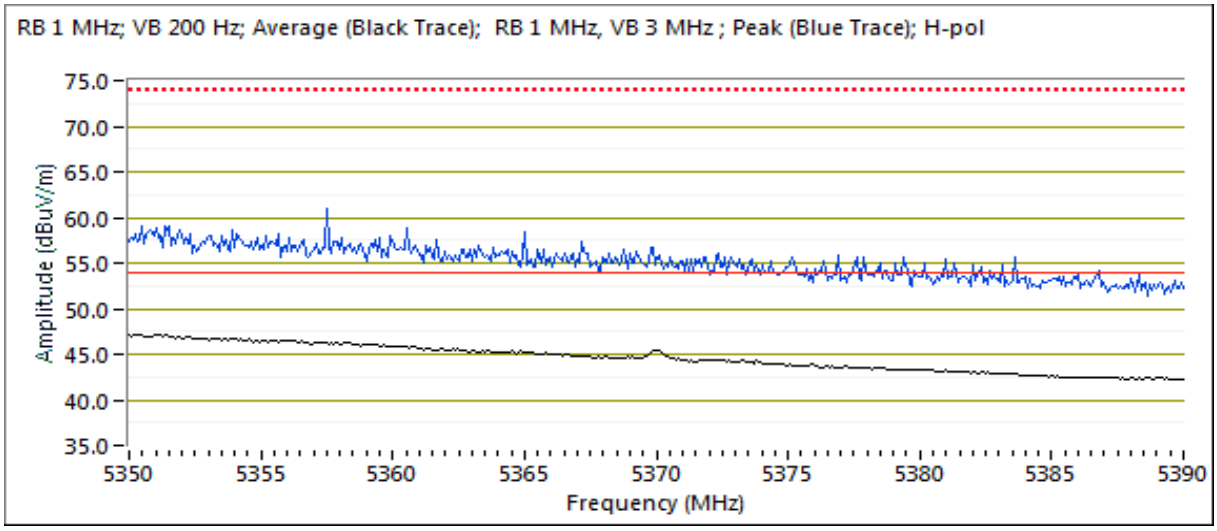
Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5129.960	52.4	H	54.0	-1.6	Avg	61	1.2	Note3,POS Vavg:100; RB 1 MHz; VB
5129.960	59.5	H	74.0	-14.5	PK	61	1.2	POS; RB 1 MHz; VB: 3 MHz



Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A

5350 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	
5350.320	47.0	H	54.0	-7.0	Avg	59	1.4	Note3,POS Vavg:100; RB 1 MHz; VB
5360.420	59.4	H	74.0	-14.6	PK	59	1.4	POS; RB 1 MHz; VB: 3 MHz
5369.950	44.8	V	54.0	-9.2	Avg	70	1.0	Note3,POS Vavg:100; RB 1 MHz; VB
5370.950	55.6	V	74.0	-18.4	PK	70	1.0	POS; RB 1 MHz; VB: 3 MHz



Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A

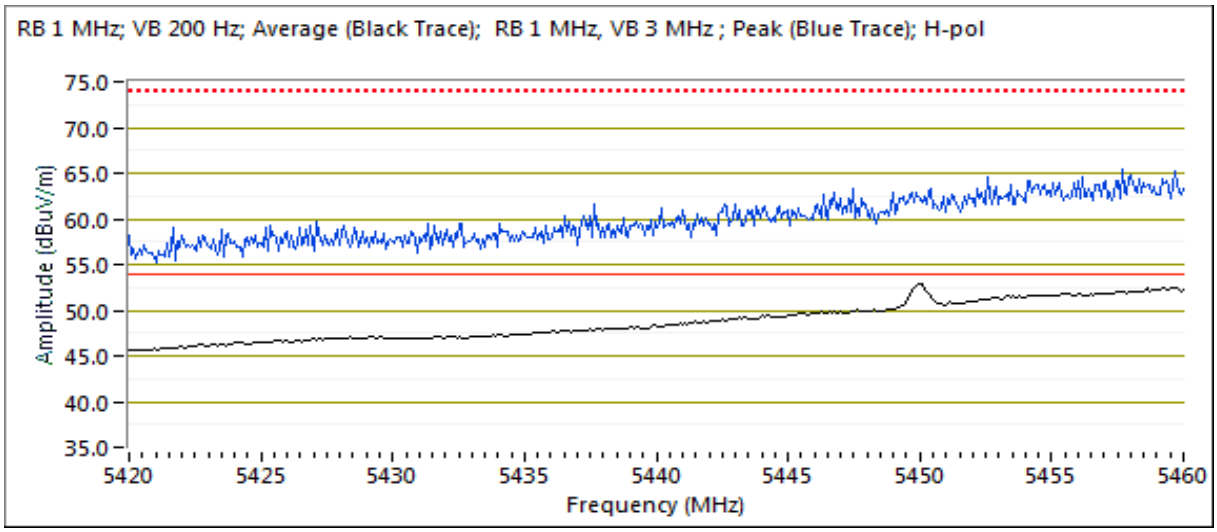
Run #18: Radiated Bandedge Measurements, 5470-5725MHz

Date of Test: 10/3/2018 Config. Used: 1
Test Engineer: Rafael Varelas Config Change: None
Test Location: Fremont Chamber #5 EUT Voltage: PoE & 120V/60Hz

Channel: 114 - 5570MHz Note: Channel 114 not used in Canada
Tx Chain: 4Tx
Mode: ax160

5460 MHz Band Edge Signal Radiated Field Strength

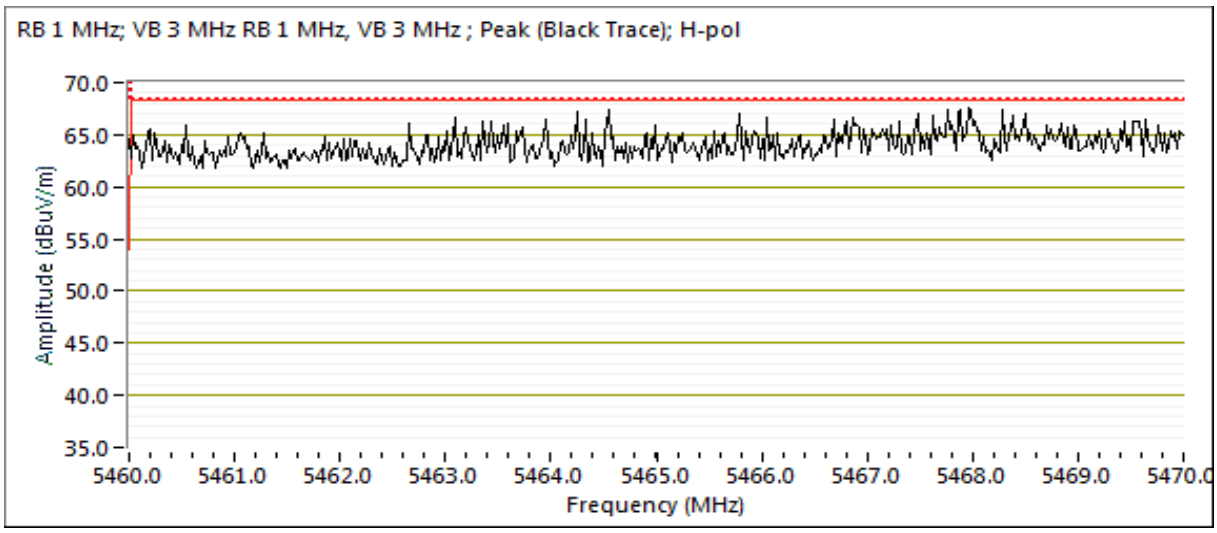
Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5450.050	52.6	H	54.0	-1.4	Avg	301	1.2	Note3,POS Vavg:100; RB 1 MHz; VB
5457.900	66.4	H	74.0	-7.6	PK	301	1.2	POS; RB 1 MHz; VB: 3 MHz



Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A

5470 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	
5464.430	67.8	H	68.3	-0.5	PK	301	1.2	POS; RB 1 MHz; VB: 3 MHz



Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 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: 24.5 °C
Rel. Humidity: 41 %

Summary of Results

Run #	Mode	Channel	Power Setting	Final Setting	Test Performed	Limit	Result / Margin
17	ax80+80	50 - 5250MHz	17.5	10.0	Restricted Band Edge at 5150 MHz	15.209	53.1 dBµV/m @ 5130.0 MHz (-0.9 dB)
		50 - 5250MHz	17.5	10.0	Restricted Band Edge at 5350 MHz		46.2 dBµV/m @ 5351.6 MHz (-7.8 dB)
18		114 - 5570MHz	17.5	14.0	Restricted Band Edge at 5460 MHz		51.4 dBµV/m @ 5450.1 MHz (-2.6 dB)
		114 - 5570MHz	17.5	14.0	Band Edge 5460 - 5470 MHz	15E	66.5 dBµV/m @ 5465.2 MHz (-1.8 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, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 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	6 MB/s	0.93	Yes	1.438	0.3	0.6	695
ax20	MCS0	0.96	Yes	5.444	0.2	0.4	184
11ax40	MCS0	0.96	Yes	5.444	0.2	0.4	184
11ax80	MCS0	0.95	Yes	5.408	0.2	0.5	185
11ax160	MCS0	0.96	Yes	5.444	0.2	0.3	184

Sample Notes

BLE Sample SN: CNG6K9V019 and Zigbee Sample SN: CNG6K9V00C
Driver: P2 WNC 0.4.3a
Antenna: AP-ANT-19 Wi-Fi and Integral BLE/ZigBee

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, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A

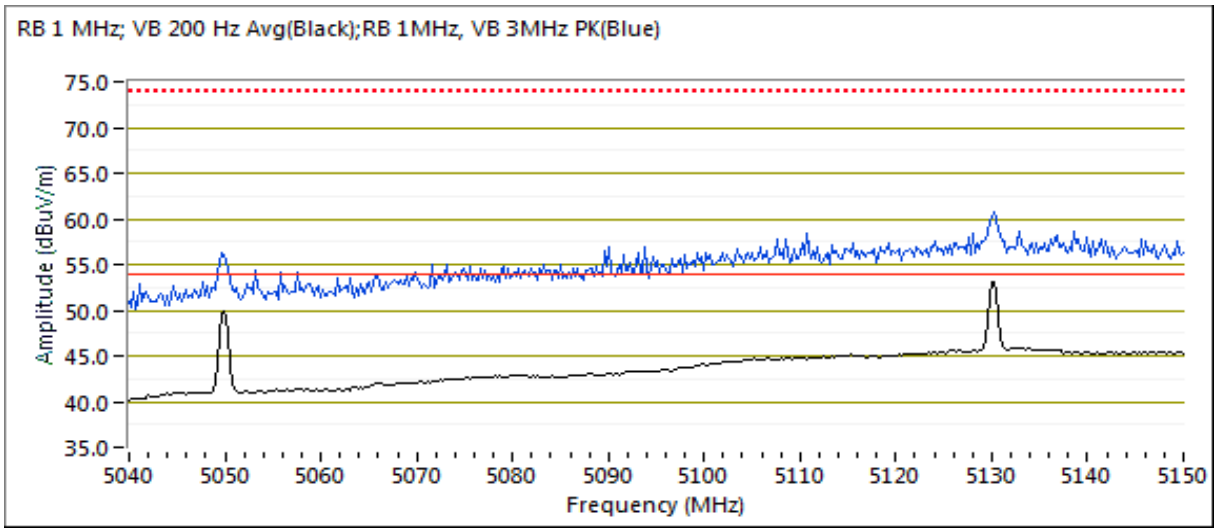
Run #17: Radiated Bandedge Measurements, 5150-5350MHz

Date of Test: 10/11/2018 Config. Used: 1
Test Engineer: Rafael Varelas Config Change: None
Test Location: Fremont Chamber #4 EUT Voltage: PoE & 120V/60Hz

Channel: 50 - 5250 MHz at 10.0dBm Mode: BLE at 8 dBm
Tx Chain: 4Tx Mode: ax80+80 Ch.Freq.: 2440 MHz

5150 MHz Band Edge Signal Radiated Field Strength

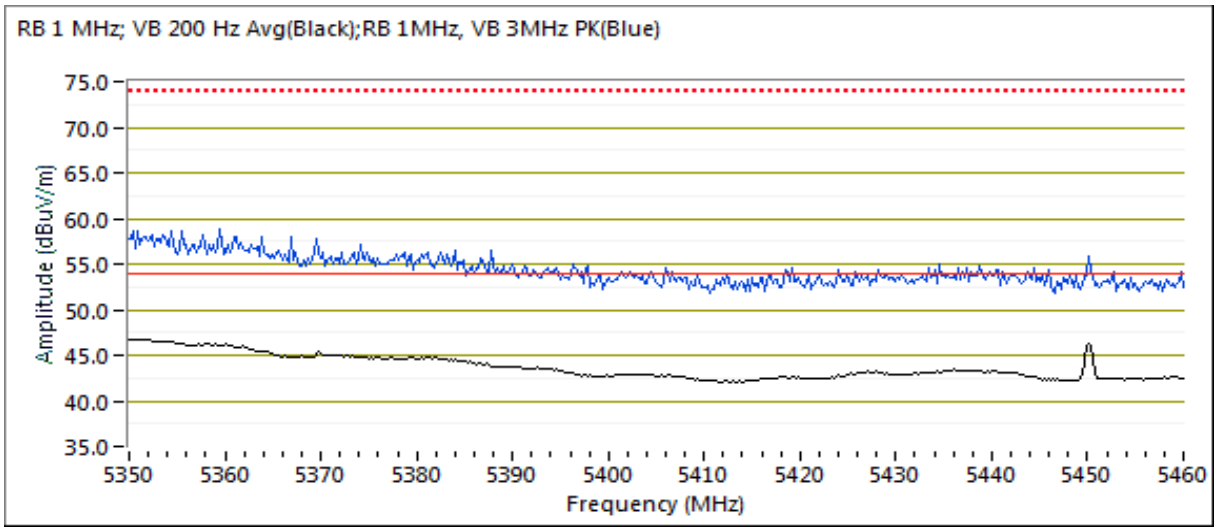
Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5130.030	53.1	V	54.0	-0.9	Avg	26	1.3	Note 3; RB 1 MHz; VB: 200 Hz
5129.590	61.6	V	74.0	-12.4	PK	26	1.3	POS; RB 1 MHz; VB: 3 MHz
5129.970	42.9	H	54.0	-11.1	Avg	71	1.3	Note 3; RB 1 MHz; VB: 200 Hz
5130.290	52.3	H	74.0	-21.7	PK	71	1.3	POS; RB 1 MHz; VB: 3 MHz



Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A

5350 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	
5351.600	46.2	V	54.0	-7.8	Avg	335	1.4	Note 3; RB 1 MHz; VB: 200 Hz
5350.380	58.8	V	74.0	-15.2	PK	335	1.4	POS; RB 1 MHz; VB: 3 MHz
5352.520	39.3	H	54.0	-14.7	Avg	254	1.7	Note 3; RB 1 MHz; VB: 200 Hz
5361.300	51.3	H	74.0	-22.7	PK	254	1.7	POS; RB 1 MHz; VB: 3 MHz

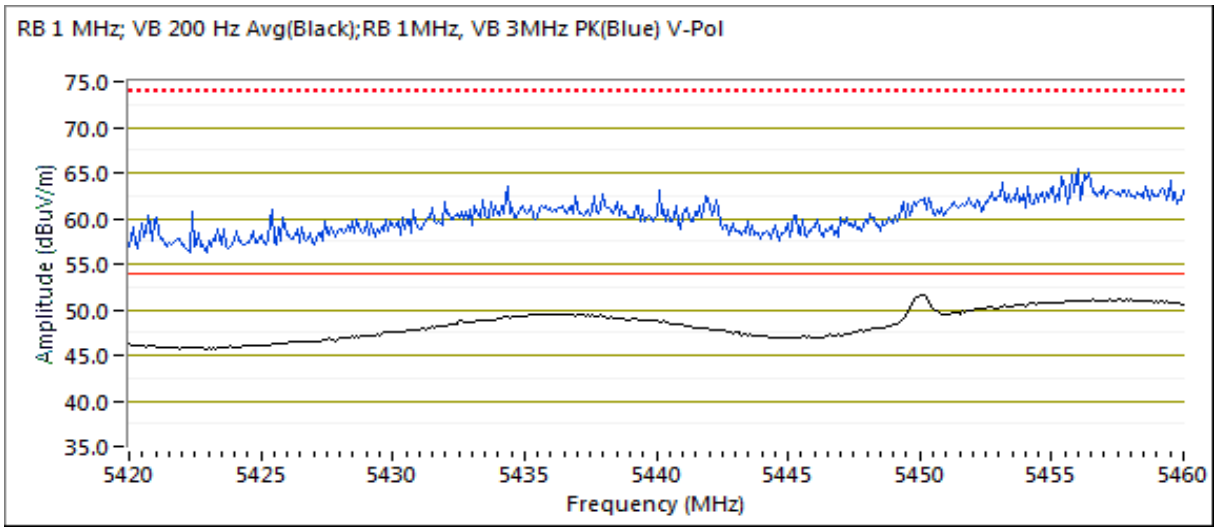


Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A

Run #18: Radiated Bandedge Measurements, 5470-5725MHz

Date of Test: 10/12/2018 Config. Used: 1
Test Engineer: Jude Semana Config Change: None
Test Location: Fremont Chamber #4 EUT Voltage: PoE & 120V/60Hz

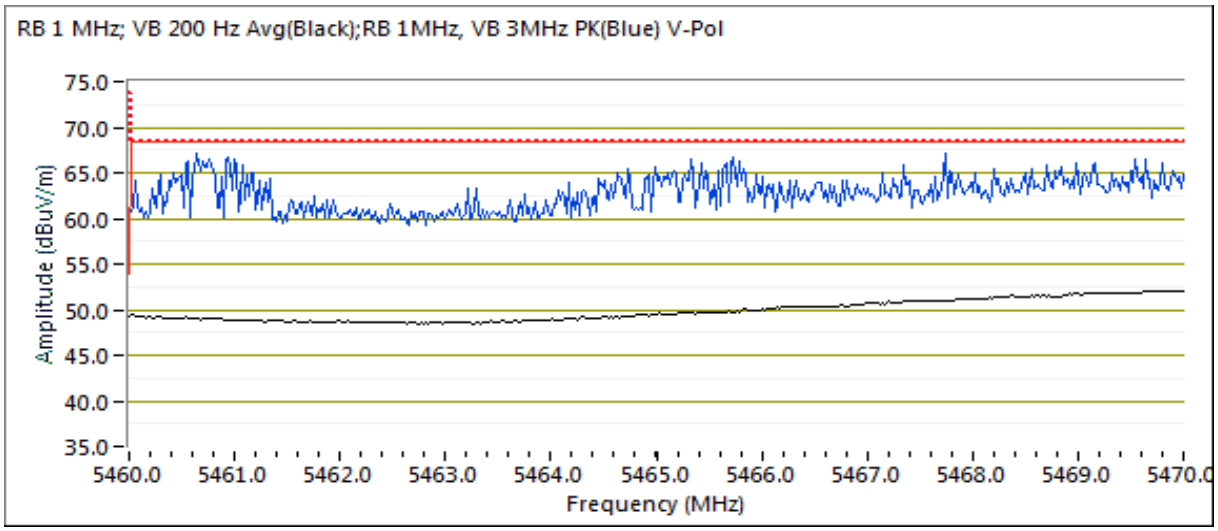
Channel: 114 - 5570MHz (5530+5610MHz) at 14dBm Note: Channel 114 not used in Canada
Tx Chain: 4Tx
Mode: ax80+80



5460 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	
5450.060	51.4	V	54.0	-2.6	Avg	332	1.5	Note 3; RB 1 MHz; VB: 200 Hz
5459.920	65.4	V	74.0	-8.6	PK	332	1.5	POS; RB 1 MHz; VB: 3 MHz
5459.840	40.9	H	54.0	-13.1	Avg	174	1.0	Note 3; RB 1 MHz; VB: 200 Hz
5457.920	52.8	H	74.0	-21.2	PK	174	1.0	POS; RB 1 MHz; VB: 3 MHz

Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A



5470 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	
5465.170	66.5	V	68.3	-1.8	PK	332	1.5	POS; RB 1 MHz; VB: 3 MHz
5467.680	53.9	H	68.3	-14.4	PK	174	1.0	POS; RB 1 MHz; VB: 3 MHz

Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 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: 24.1 °C
Rel. Humidity: 39 %

Summary of Results

Run #	Mode	Channel	Power Setting	Final Setting	Test Performed	Limit	Result / Margin
17	ax80+80	50 - 5250MHz	17.5	13.0	Restricted Band Edge at 5150 MHz	15.209	53.4 dBµV/m @ 5148.6 MHz (-0.6 dB)
		50 - 5250MHz	17.5	13.0	Restricted Band Edge at 5350 MHz		51.8 dBµV/m @ 5355.1 MHz (-2.2 dB)
18		114 - 5570MHz	17.5	16.0	Restricted Band Edge at 5460 MHz		53.6 dBµV/m @ 5458.3 MHz (-0.7 dB)
		114 - 5570MHz	17.5	16.0	Band Edge 5460 - 5470 MHz	15E	67.7 dBµV/m @ 5467.5 MHz (-0.6 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, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 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	6 MB/s	0.93	Yes	1.438	0.3	0.6	695
ax20	MCS0	0.96	Yes	5.444	0.2	0.4	184
11ax40	MCS0	0.96	Yes	5.444	0.2	0.4	184
11ax80	MCS0	0.95	Yes	5.408	0.2	0.5	185
11ax160	MCS0	0.96	Yes	5.444	0.2	0.3	184

Sample Notes

BLE Sample SN: CNG6K9V019 and Zigbee Sample SN: CNG6K9V00C
Driver: P2 WNC 0.4.3a
Antenna: AP-ANT-20 Wi-Fi and Integral BLE/ZigBee

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, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A

Run #17: Radiated Bandedge Measurements, 5150-5350MHz

Date of Test: 10/12/2018
Test Engineer: Rafael Varelas
Test Location: Fremont Chamber #4

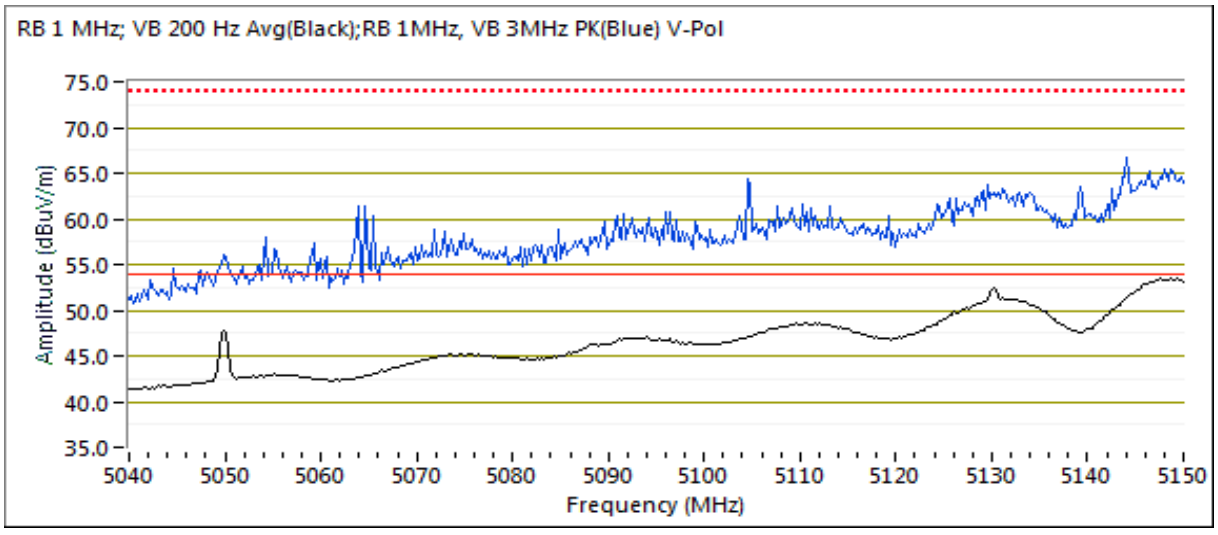
Config. Used: 1
Config Change: none
EUT Voltage: PoE & 120V/60Hz

Channel: 50 - 5250MHz
Tx Chain: 4Tx
Mode: ax160

Mode: BLE at 8 dBm
Ch.Freq.: 2440 MHz

5150 MHz Band Edge Signal Radiated Field Strength

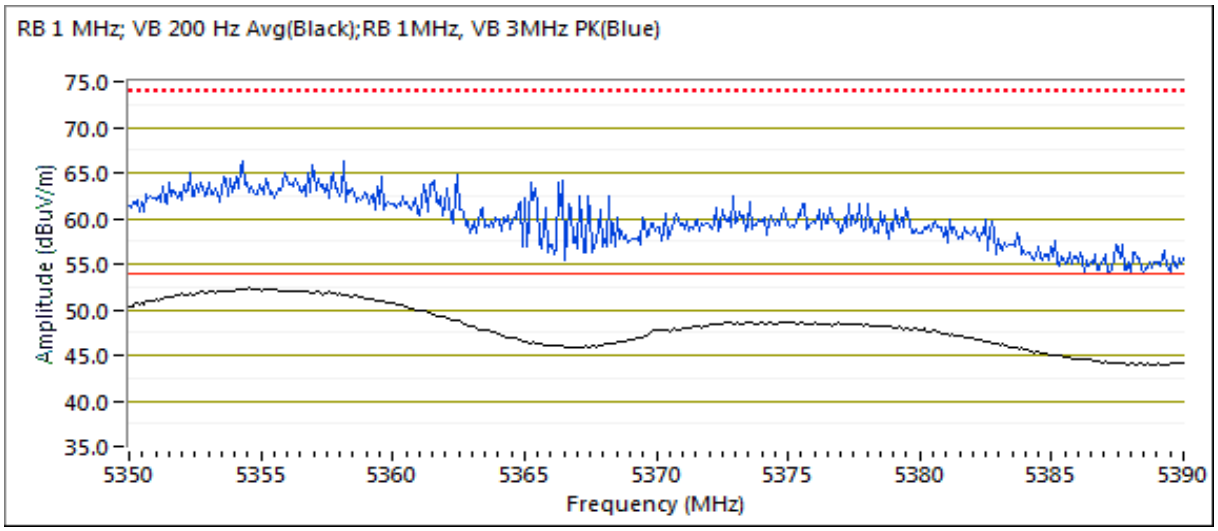
Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5148.620	53.4	V	54.0	-0.6	Avg	133	1.1	Note 3; RB 1 MHz; VB: 200 Hz
5147.780	67.2	V	74.0	-6.8	PK	133	1.1	POS; RB 1 MHz; VB: 3 MHz
5140.350	43.3	H	54.0	-10.7	Avg	227	1.0	Note 3; RB 1 MHz; VB: 200 Hz
5140.290	56.0	H	74.0	-18.0	PK	227	1.0	POS; RB 1 MHz; VB: 3 MHz



Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A

5350 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	
5355.130	51.8	V	54.0	-2.2	Avg	144	1.8	Note 3; RB 1 MHz; VB: 200 Hz
5357.580	65.7	V	74.0	-8.3	PK	144	1.8	POS; RB 1 MHz; VB: 3 MHz



Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A

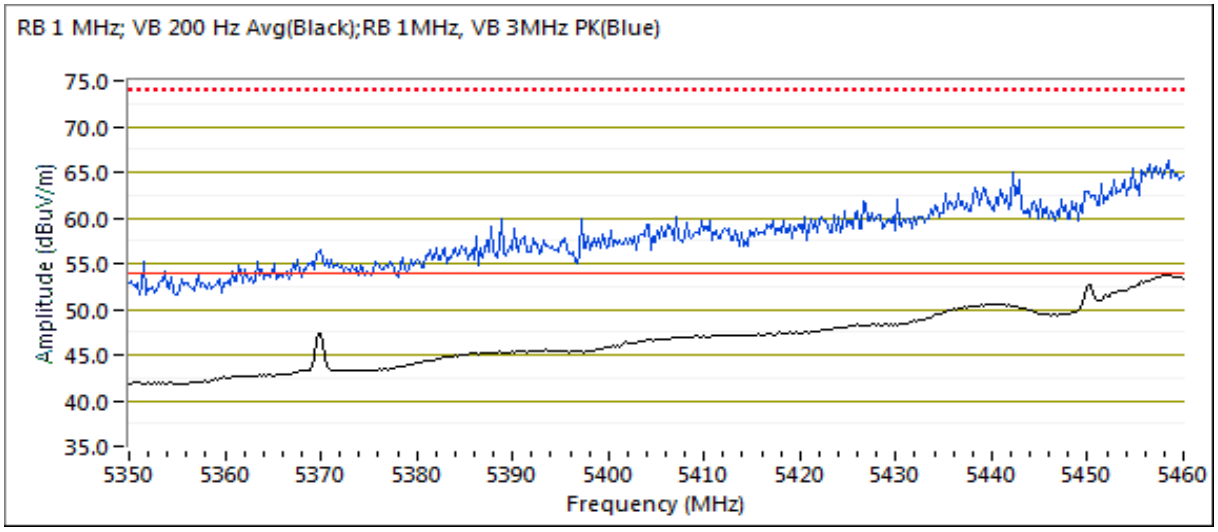
Run #18: Radiated Bandedge Measurements, 5470-5725MHz

Date of Test: 10/12/2018 Config. Used: 1
Test Engineer: Rafael Varelas Config Change: none
Test Location: Fremont Chamber #4 EUT Voltage: PoE & 120V/60Hz

Channel: 114 - 5570MHz Note: Channel 114 not used in Canada
Tx Chain: 4 Mode: BLE at 8 dBm
Mode: ax160 Ch.Freq.: 2440 MHz

5460 MHz Band Edge Signal Radiated Field Strength

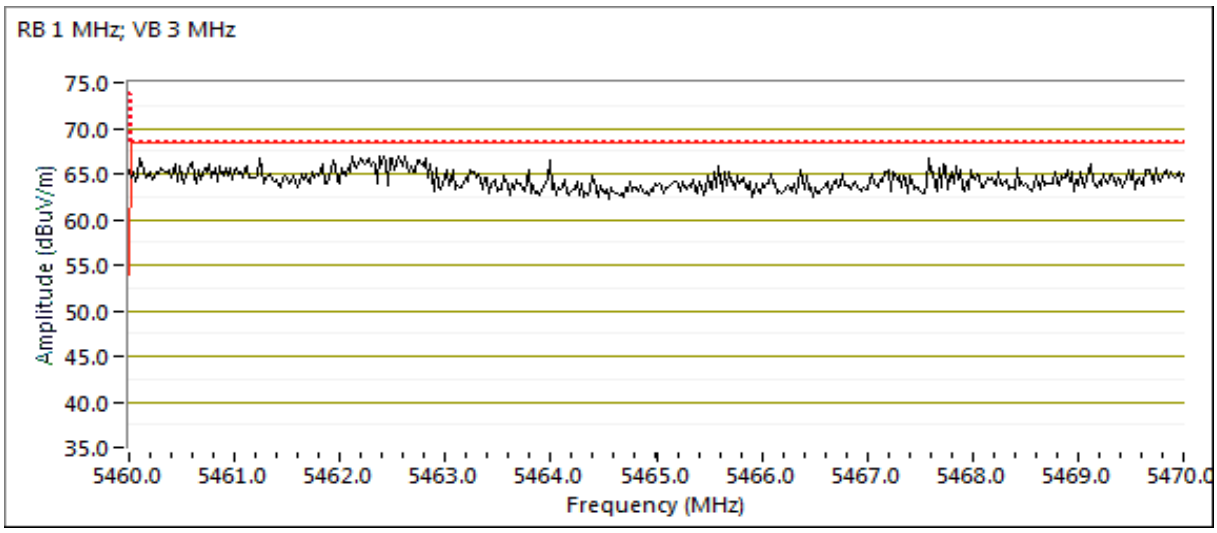
Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5458.320	53.6	V	54.0	-0.7	Avg	136	2.2	Note 3; RB 1 MHz; VB: 200 Hz
5458.760	67.8	V	74.0	-6.2	PK	136	2.2	POS; RB 1 MHz; VB: 3 MHz



Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A

5470 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	
5467.500	67.7	V	68.3	-0.6	PK	136	2.2	POS; RB 1 MHz; VB: 3 MHz



Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 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: 23.6 °C
Rel. Humidity: 40 %

Summary of Results

Run #	Mode	Channel	Target Setting	Final Setting	Test Performed	Limit	Result / Margin
17	ax80+80	50 - 5250MHz	17.5	16.5	Restricted Band Edge at 5150 MHz	15.209	52.0 dBµV/m @ 5050.0 MHz (-2.0 dB)
		50 - 5250MHz	17.5	16.5	Restricted Band Edge at 5350 MHz		48.2 dBµV/m @ 5350.6 MHz (-5.8 dB)
18		114 - 5570MHz	17.5	17.5	Restricted Band Edge at 5460 MHz		52.0 dBµV/m @ 5459.6 MHz (-2.0 dB)
		114 - 5570MHz	17.5	17.0	Band Edge 5460 - 5470 MHz	15E	67.2 dBµV/m @ 5466.9 MHz (-1.1 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.

Sample Notes

BLE Sample SN: CNG6K9V019 and Zigbee Sample SN: CNG6K9V00C
Driver: P2 WNC 0.4.3a
Antenna: AP-ANT-48 Wi-Fi and Integral BLE/ZigBee

Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 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

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
11a	MCS0	92.3%	Yes	1.4	0.3	0.7	698
11ax20	MCS0	95.6%	Yes	5.4	0.2	0.4	184
11ax40	MCS0	95.9%	Yes	5.4	0.2	0.4	184
11ax80	MCS0	94.9%	Yes	5.4	0.2	0.5	185
11ac80+80	MCS0	96.5%	Yes	5.4	0.2	0.3	184

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, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A

Run #17: Radiated Bandedge Measurements, 5150-5350MHz

Date of Test: 10/3/2018 Config. Used: 1

Test Engineer: M. Birgani Config Change: None

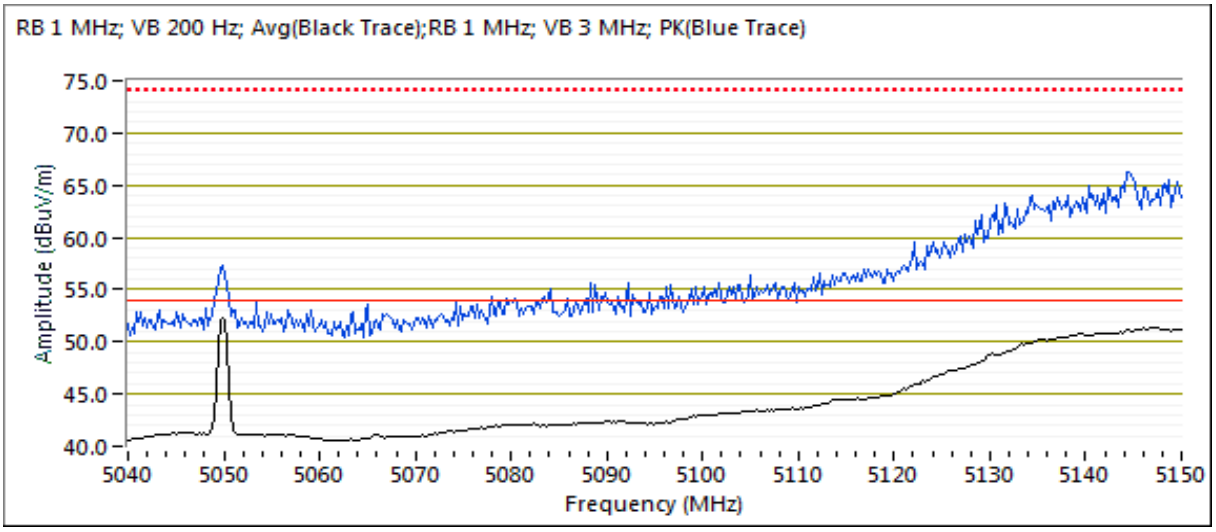
Test Location: Fremont Chamber #4 EUT Voltage: PoE & 120V/60Hz

Channel: 50 - 5250MHz at 16.5dBm Mode: BLE at 8 dBm

Tx Chain: 4Tx Mode: ax80+80 Ch.Freq.: 2440 MHz

5150 MHz Band Edge Signal Radiated Field Strength

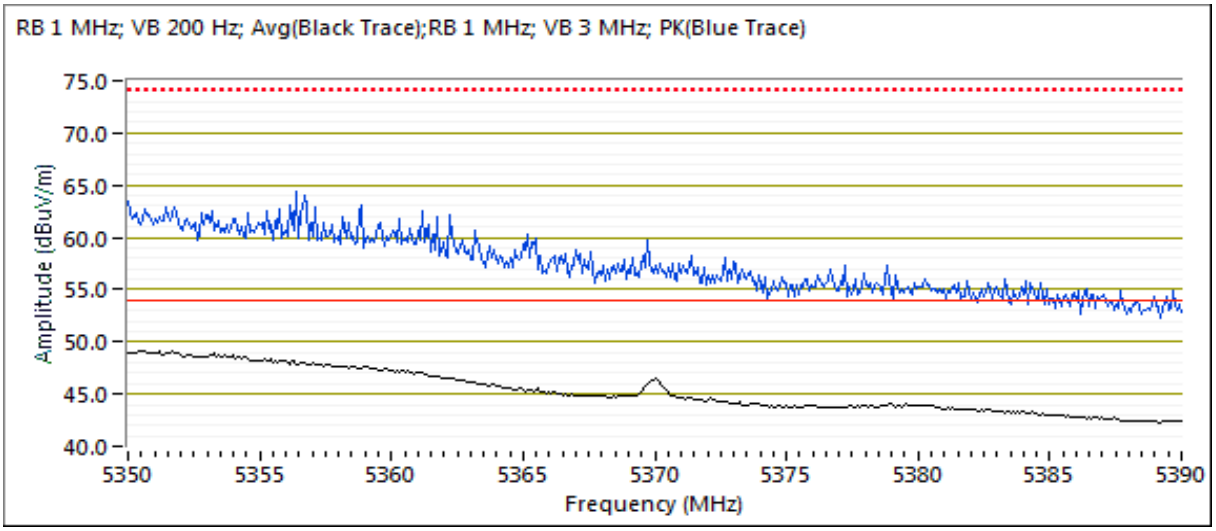
Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5050.010	52.0	H	54.0	-2.0	AVG	40	1.5	Note 3; RB 1 MHz; VB: 200 Hz
5144.990	66.8	H	74.0	-7.2	PK	40	1.5	RB 1 MHz; VB: 3 MHz



Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A

5350 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	
5350.600	48.2	H	54.0	-5.8	AVG	58	1.1	Note 3; RB 1 MHz; VB: 200 Hz
5351.000	64.4	H	74.0	-9.6	PK	58	1.1	RB 1 MHz; VB: 3 MHz



Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A

Run #18: Radiated Bandedge Measurements, 5470-5725MHz

Date of Test: 10/3/2018 Config. Used: 1

Test Engineer: M. Birgani Config Change: None

Test Location: Fremont Chamber #4 EUT Voltage: PoE & 120V/60Hz

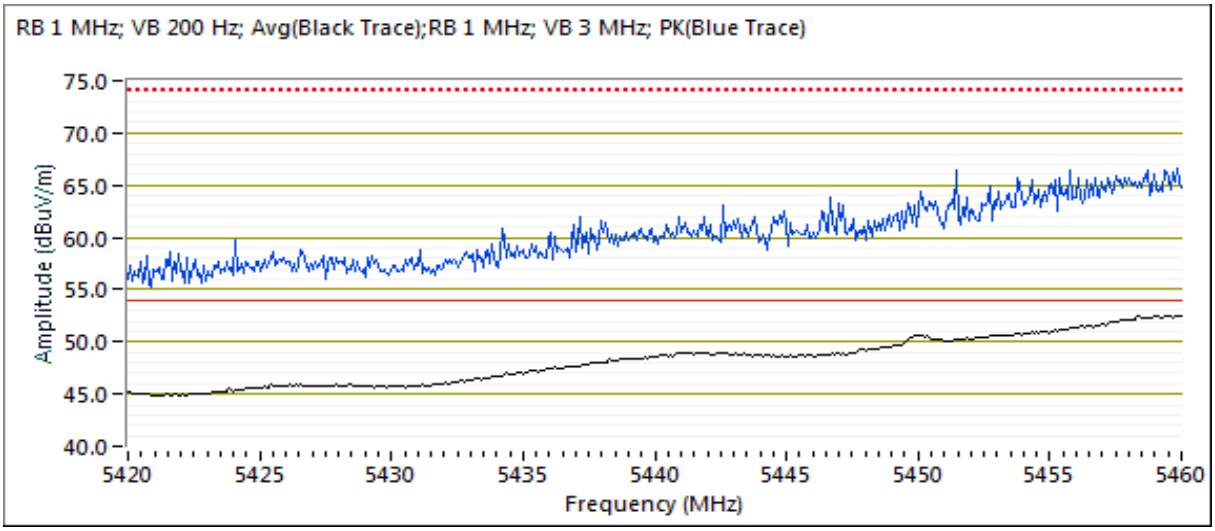
Note: Channel 114 not used in Canada

Channel: 114 - 5570MHz at 17.5dBm Mode: BLE at 8 dBm

Tx Chain: 4Tx Mode: ax80+80 Ch.Freq.: 2440 MHz

5460 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	
5459.610	52.0	H	54.0	-2.0	AVG	52	1.1	Note 3; RB 1 MHz; VB: 200 Hz
5455.730	66.9	H	74.0	-7.1	PK	52	1.1	RB 1 MHz; VB: 3 MHz



Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A

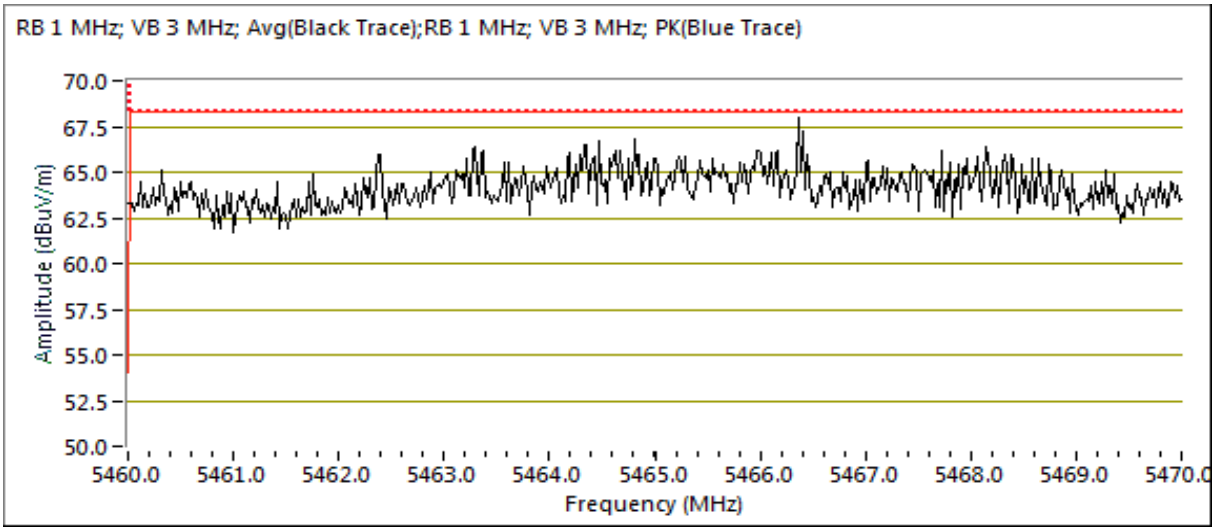
Note: Channel 114 not used in Canada

Channel: 114 - 5570MHz at 17.0dBm Mode: BLE at 8 dBm

Tx Chain: 4Tx Mode: ax80+80 Ch.Freq.: 2440 MHz

5470 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	
5466.850	67.2	H	68.3	-1.1	PK	52	1.1	POS; RB 1 MHz; VB: 3 MHz



Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A

RSS-247, FCC 15.247 and FCC 15.407 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: 20-24 °C
Rel. Humidity: 38-42 %

Summary of Results

Run #	Mode	Channel	Power Settings		Test Performed	Limit	Result / Margin
1	ax80+80 / b	6 & 50	20	20	Radiated Emissions, 1 - 40 GHz	FCC 15.209/ 15.247 / 15 E	46.7 dBµV/m @ 9747.97 MHz (-7.3 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, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 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)
ZigBee	250 kb/s	0.43	Yes	0.863	3.7	7.4	1159
BLE	1 Mb/s	0.72	Yes	0.586	1.4	2.9	1706
11b	1 Mb/s	0.78	Yes	0.669	1.1	2.1	1495
11a	MCS0	92.3%	Yes	1.4	0.3	0.7	698
11ax20	MCS0	95.6%	Yes	5.4	0.2	0.4	184
11ax40	MCS0	95.9%	Yes	5.4	0.2	0.4	184
11ax80	MCS0	94.9%	Yes	5.4	0.2	0.5	185
11ac80+80	MCS0	96.5%	Yes	5.4	0.2	0.3	184

Sample Notes

BLE Sample SN: CNG6K9W00R and Zigbee Sample SN: CNG6K9W01F
Driver: P2 WNC 0.4.4
Antenna: Integral. 4 antennas for 5 GHz radio and 4 antennas for 2.4 GHz radio (5GHz radio may also use 2 antennas but with 3 dB higher power and can operate in both lower and upper 5 GHz bands simutaneously). Tests performed with 4 antennas at the 2 antenna power levels. Tests performed with 4 antennas at the target power.

Measurement Specific Notes:

Note 1:	For emissions outside of the restricted bands the limit is -27dBm/MHz eirp (68.3dBuV/m) for emissions related to UNII operation. The measurement method required is a peak measurement (RB=1MHz, VB≥3MHz, peak detector).
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:	Digital device emission, class A limit extrapolated to 3m applied, peak reading vs peak or average limit.

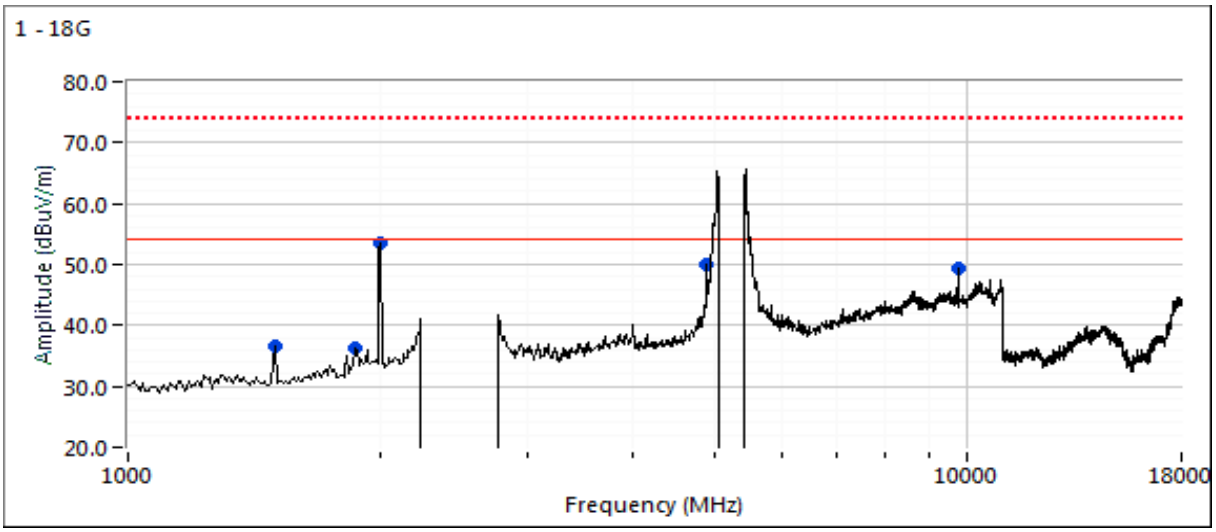
Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A

Run #1, Radiated Spurious Emissions, 1,000 - 40,000 MHz. Operation in the 5150-5350 MHz Band

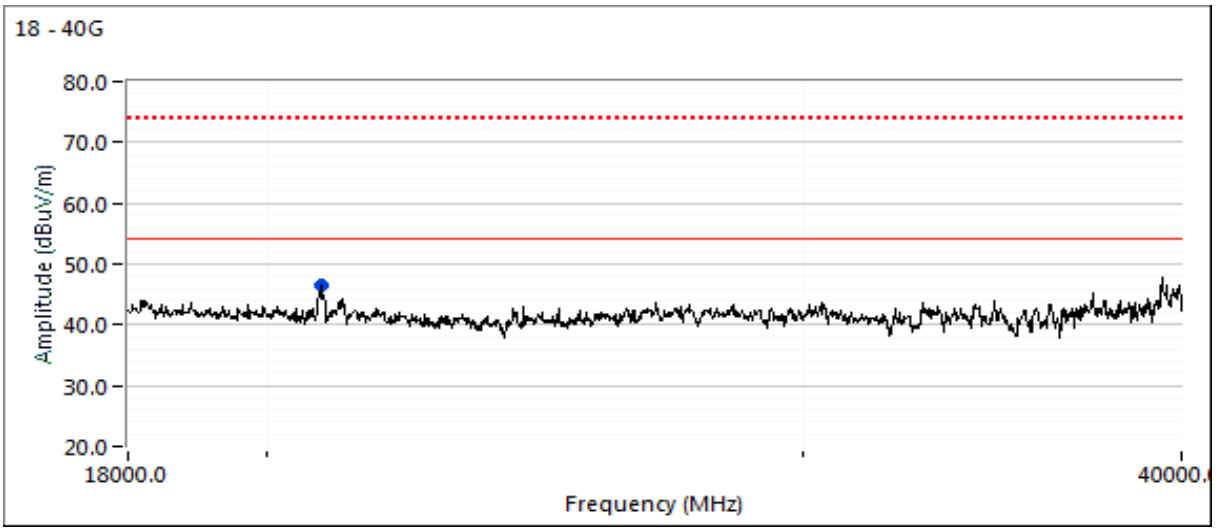
Date of Test: 10/25/2018 Config. Used: Internal
Test Engineer: Roy Zheng Config Change: none
Test Location: Chamber 5 EUT Voltage: PoE

Channel: 6 & 50 Wi-Fi Mode: ax80+80 / b
Tx Chain: 4 (5GHz), 4 (2.4 GHz) Data Rate: MCS0

Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
1500.000	36.7	V	60.0	-23.3	Peak	201	1.3	Note 5
1866.670	36.4	H	60.0	-23.6	Peak	196	1.0	Note 5
2000.000	53.4	V	60.0	-6.6	Peak	83	1.0	Note 5
4899.960	46.3	V	54.0	-7.7	VAVG	108	1.4	RB 1 MHz;VB 300 Hz;Note 3
4900.010	56.6	V	74.0	-17.4	PK	108	1.4	RB 1 MHz;VB 3 MHz;Peak
9747.970	46.7	V	54.0	-7.3	VAVG	175	1.2	RB 1 MHz;VB 300 Hz;Note 3
9748.180	55.5	V	74.0	-18.5	PK	175	1.2	RB 1 MHz;VB 3 MHz;Peak
20834.510	46.2	V	54.0	-7.8	VAVG	214	1.5	RB 1 MHz;VB 300 Hz;Note 3
20834.590	61.1	V	74.0	-12.9	PK	214	1.5	RB 1 MHz;VB 3 MHz;Peak



Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A



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) for emissions related to UNII operation. The measurement method required is a peak measurement (RB=1MHz, VB≥3MHz, peak detector).

Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A

RSS-247, FCC 15.247 and FCC 15.407 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: 23.4 °C
Rel. Humidity: 40 %

Summary of Results

Run #	Mode	Channel	Power Settings		Test Performed	Limit	Result / Margin
1	ax80+80 / b	6 & 50 Wi-Fi	20	20	Radiated Emissions, 1 - 40 GHz	FCC 15.209/ 15.247 / 15 E	53.3 dBµV/m @ 4890.0 MHz (-0.7 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, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 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)
ZigBee	250 kb/s	0.43	Yes	0.863	3.7	7.4	1159
BLE	1 Mb/s	0.72	Yes	0.586	1.4	2.9	1706
11b	1 Mb/s	0.78	Yes	0.669	1.1	2.1	1495
11a	MCS0	0.92	Yes	1.4	0.3	0.7	698
11ax20	MCS0	0.96	Yes	5.4	0.2	0.4	184
11ax40	MCS0	0.96	Yes	5.4	0.2	0.4	184
11ax80	MCS0	0.95	Yes	5.4	0.2	0.5	185
11ac80+80	MCS0	0.96	Yes	5.4	0.2	0.3	184

Sample Notes

BLE Sample SN: CNG6K9V019 and Zigbee Sample SN: CNG6K9V00C
Driver: P2 WNC 0.4.4
Antenna: AP-ANT-19 Wi-Fi, Integral BLE/ZigBee. 4 antennas for 5 GHz radio and 4 antennas for 2.4 GHz radio (5GHz radio may also use 2 antennas but with 3 dB higher power and can operate in both lower and upper 5 GHz bands simutaneously). Tests performed with 4 antennas at the 2 antenna power levels. Tests performed with 4 antennas at the target power.

Measurement Specific Notes:

Note 1:	For emissions outside of the restricted bands the limit is -27dBm/MHz eirp (68.3dBuV/m) for emissions related to UNII operation. The measurement method required is a peak measurement (RB=1MHz, VB≥3MHz, peak detector).
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:	Digital device emission, class A limit extrapolated to 3m applied, peak reading vs peak or average limit.

Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A

Run #1, Radiated Spurious Emissions, 1,000 - 40,000 MHz. Operation in the 5150-5350 MHz Band

Date of Test: 10/16/2018 0:00
Test Engineer: Roy Zheng / R. Varelas
Test Location: Chamber #5

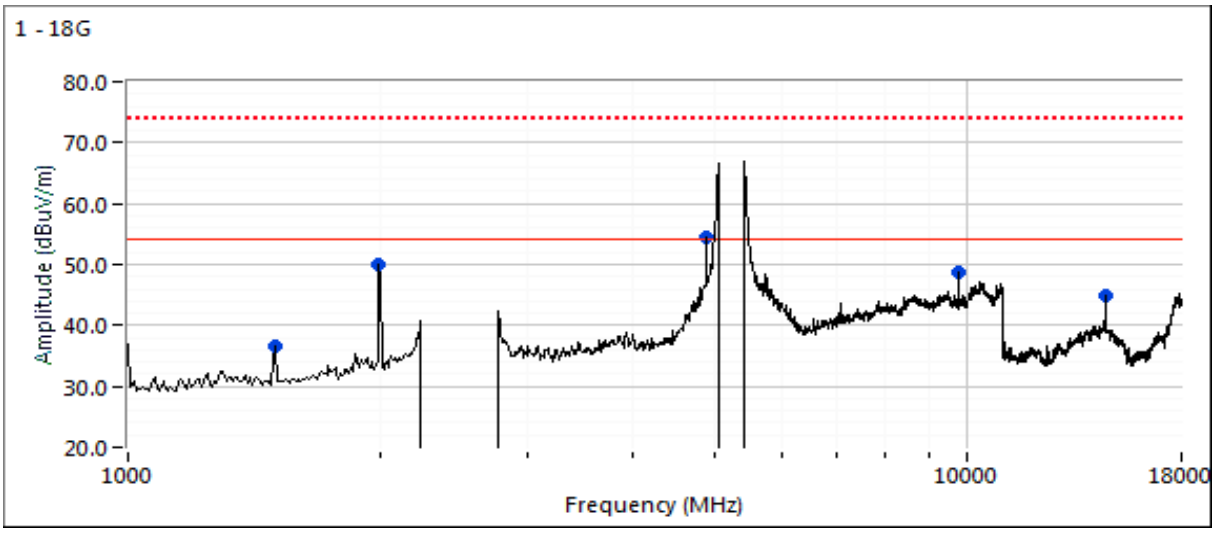
Config. Used: Ant 19
Config Change: none
EUT Voltage: PoE & 120V/60Hz

Run #1e: Center Channel

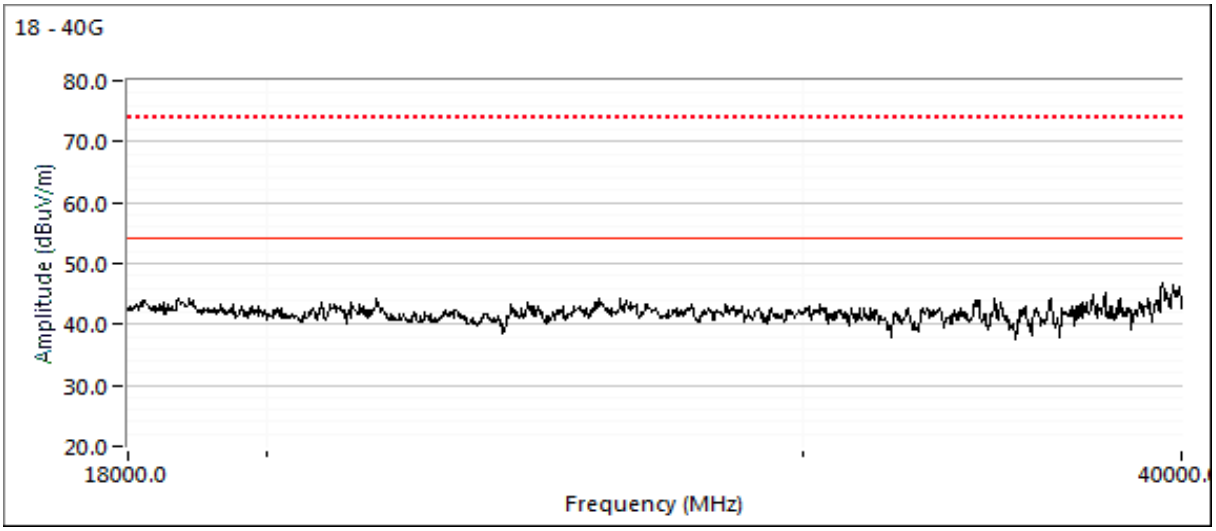
Channel: 6 & 50 Wi-Fi
Tx Chain: 4 (5GHz), 4 (2.4 GHz)

Mode: ax80+80 / g
Data Rate: MCS0

Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
1500.000	36.7	V	60.0	-23.3	Peak	35	0.9	Note 5
2000.000	50.0	V	60.0	-10.0	Peak	42	1.2	Note 5
7058.330	43.6	V	54.0	-10.4	Peak	174	1.3	
14628.330	44.8	V	54.0	-9.2	Peak	210	1.0	
4890.020	53.3	V	54.0	-0.7	VAVG	230	1.8	RB 1 MHz;VB 300 Hz;Note 3
4890.090	60.1	V	74.0	-13.9	PK	230	1.8	RB 1 MHz;VB 3 MHz;Peak
9747.910	44.9	V	54.0	-9.1	VAVG	201	1.8	RB 1 MHz;VB 300 Hz;Note 3
9747.710	54.8	V	74.0	-19.2	PK	201	1.8	RB 1 MHz;VB 3 MHz;Peak



Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A



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) for emissions related to UNII operation. The measurement method required is a peak measurement (RB=1MHz, VB≥3MHz, peak detector).

Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A

RSS-247, FCC 15.247 and FCC 15.407 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: 23-24 °C
Rel. Humidity: 37-39 %

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.

Summary of Results

Run #	Mode	Channel	Power Settings		Test Performed	Limit	Result / Margin
1	b ax80+80	6 50	20 20	16 20	Radiated Emissions, 1 - 40 GHz	FCC 15.209/ 15.247 / 15 E	42.4 dBµV/m @ 14621.8MHz (-11.6dB)

Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 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)
ZigBee	250 kb/s	42.7%	Yes	0.9	3.7	7.4	1159
BLE	1 Mb/s	72.0%	Yes	0.6	1.4	2.9	1706
11b	1 Mb/s	78.4%	Yes	0.7	1.1	2.1	1495
11a	MCS0	92.3%	Yes	1.4	0.3	0.7	698
11ax20	MCS0	95.6%	Yes	5.4	0.2	0.4	184
11ax40	MCS0	95.9%	Yes	5.4	0.2	0.4	184
11ax80	MCS0	94.9%	Yes	5.4	0.2	0.5	185
11ac80+80	MCS0	96.5%	Yes	5.4	0.2	0.3	184

Sample Notes

BLE Sample SN: CNG6K9V019 and Zigbee Sample SN: CNG6K9V00C
Driver: P2 WNC 0.4.3a
Antenna: AP-ANT-48 Wi-Fi, Integral BLE/ZigBee. 5GHz radio may also use 2 elements but with 3 dB higher power and can operate in both lower and upper 5 GHz bands simutaneously. Tests performed with at the 2 elements power levels. Tests performed with 4 antennas at the target power.

Measurement Specific Notes:

Note 1:	For emissions outside of the restricted bands the limit is -27dBm/MHz eirp (68.3dBuV/m) for emissions related to UNII operation. The measurement method required is a peak measurement (RB=1MHz, VB≥3MHz, peak detector).
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:	Digital device emission, class A limit extrapolated to 3m applied, peak reading vs peak or average limit.

Client:	Aruba, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A

Run #1, Radiated Spurious Emissions, 1,000 - 40,000 MHz. Operation in the 5150-5350 MHz Band

Date of Test: 10/19/18 Config. Used: Panel antenna
Test Engineer: Roy Zheng / R. Varelas Config Change: none
Test Location: Chamber #4 EUT Voltage: PoE & 120V/60Hz

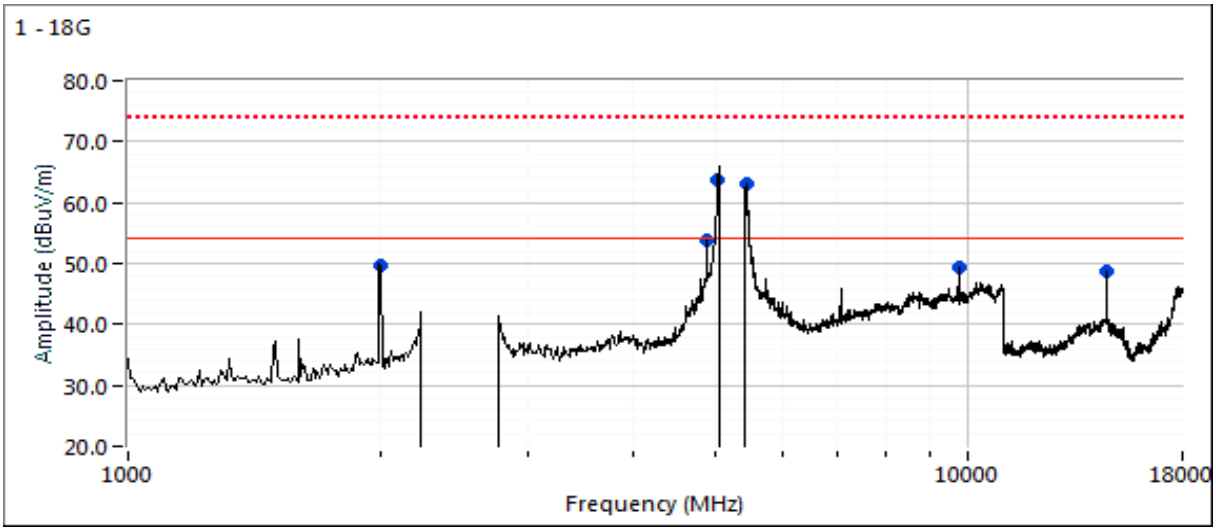
Run #1e: Center Channel

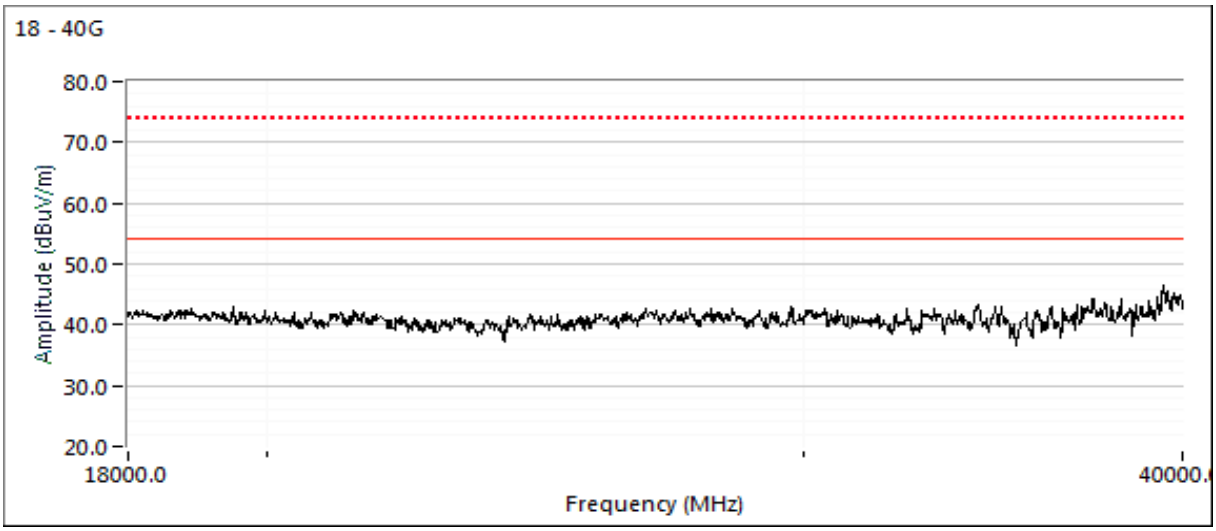
Channel: 6 & 50 Wi-Fi Mode: b & ac80+80
Tx Chain: 4 Data Rate: 1Mbps & MCS0

Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
14621.790	42.4	V	54.0	-11.6	VAVG	162	1.9	RB 1 MHz;VB 300 Hz;Note 3
14621.990	52.4	V	74.0	-21.6	PK	162	1.9	RB 1 MHz;VB 3 MHz;Peak
5050.000	53.0	H	-	-	PK	162	2.1	Done during BE measurment
5437.570	57.7	V	-	-	PK	169	1.1	Done during BE measurment

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, a Hewlett Packard Enterprise company	Job Number:	PR077654
Model:	APIN0534 and APIN0535	T-Log Number:	TL077654-RA-FCC
		Project Manager:	Christine Krebill
Contact:	Mark Hill	Project Coordinator:	David Bare
Standard:	FCC §15.247 & 15.407	Class:	N/A





End of Report

This page is intentionally blank and
marks the last page of this test report.