

Panasonic Avionics Corp.

TEST REPORT FOR

W-LAN Module
Model: J3FYY0000061

Tested to The Following Standards:

FCC Part 15 Subpart E Section

15.407
(UNII 5.15 – 5.25GHz)

Report No.: 101836-3

Date of issue: April 9, 2019



Test Certificate # 803.02

This test report bears the accreditation symbol indicating that the testing performed herein meets the test and reporting requirements of ISO/IEC 17025 under the applicable scope of testing for CKC Laboratories, Inc.

We strive to create long-term, trust based relationships by providing sound, adaptive, customer first testing services. We embrace each of our customers' unique EMC challenges, not as an interruption to set processes, but rather as the reason we are in business.

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ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

Panasonic Avionics Corp.
26200 Enterprise Way
Lake Forest CA 92630

Representative: David O'Reilly
Customer Reference Number: 1626754

DATE OF EQUIPMENT RECEIPT:**DATE(S) OF TESTING:****REPORT PREPARED BY:**

Darcy Thompson
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 101836

March 21, 2019

March 21, 22 and 29, 2019

Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the equipment provided by the client, tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.

A handwritten signature in black ink, reading "Steve Behm", is positioned above a horizontal line.

Steve Behm
Director of Quality Assurance & Engineering Services
CKC Laboratories, Inc.

Test Facility Information



Our laboratories are configured to effectively test a wide variety of product types. CKC utilizes first class test equipment, anechoic chambers, data acquisition and information services to create accurate, repeatable and affordable test results.

TEST LOCATION(S):
CKC Laboratories, Inc.
110 Olinda Place
Brea, CA 92823

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.03.12

Site Registration & Accreditation Information

Location	*NIST CB #	FCC	JAPAN
Brea A, CA	US0060	US1025	A-0147

*CKC's list of NIST designated countries can be found at: <https://standards.gov/cabs/designations.html>

SUMMARY OF RESULTS

Standard / Specification: FCC Part 15 Subpart E - 15.407 (NII)

Test Procedure	Description	Modifications	Results
15.215	Occupied Bandwidth	NA	NP
15.407(a)(1)	Output Power	NA	NP
15.407(a)(1)	Power Spectral Density	NA	NP
15.407(a)(1)(iii)	EIRP at >30° Elevation	NA	NP
15.407(g)	Frequency Stability	NA	NP
15.407(b) / (b)(1)	Radiated Emissions & Band Edge	NA	Pass
15.207	AC Conducted Emissions	NA	NP

NA = Not Applicable

NP = CKC Laboratories was not contracted to perform tests.

ISO/IEC 17025 Decision Rule

The declaration of pass or fail herein is based upon assessment to the specification(s) listed above, including where applicable, assessment of measurement uncertainties. For performance related tests, equipment was monitored for specified criteria identified in that section of testing.

Modifications During Testing

This list is a summary of the modifications made to the equipment during testing.

Summary of Conditions

No modifications were made during testing.

Modifications listed above must be incorporated into all production units.

Conditions During Testing

This list is a summary of the conditions noted to the equipment during testing.

Summary of Conditions

None

EQUIPMENT UNDER TEST (EUT)

During testing, numerous configurations may have been utilized. The configurations listed below support compliance to the standard(s) listed in the Summary of Results section.

Configuration 1

Equipment Tested:

Device	Manufacturer	Model #	S/N
W-LAN Module	Panasonic Avionics Corp.	J3FYY0000061	NA

Support Equipment:

Device	Manufacturer	Model #	S/N
Tablet	Panasonic Avionics Corp.	RD-NA1108-02U1.2	RD11781
Cradle Int. Passenger Control Unit	Panasonic Avionics Corp.	RD-NA1103-01	U026022
Premium Seat Electronics Box	Panasonic Avionics Corp.	RD-FA3221-01	E646066
Laptop	Dell	Precision M2400	9303528493
Power Supply	GW Instek	PSP-405	EF171595
Power Supply	Dell	DA65NM130	NA

General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Radio Module
Type of Wideband System:	802.11a
Operating Frequency Range:	5180, 5200, 5220, 5240MHz
Modulation Type(s):	OFDM
Maximum Duty Cycle:	99%
Number of TX Chains:	2
Antenna Type(s) and Gain:	2x2 MIMO, 2.21dBi
Beamforming Type:	N/A
Antenna Connection Type:	External Connector
Nominal Input Voltage:	3.3Vdc
Firmware / Software used for Test:	DutApiClass, ver.1.0.9.05

FCC Part 15 Subpart E

15.407(b) / (b)(1) Radiated Emissions & Band Edge

Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92821 • 714 993 6112
 Customer: **Panasonic Avionics Corp.**
 Specification: **15.407(b) / 15.209 Radiated Spurious Emissions**
 Work Order #: **101836** Date: 3/22/2019
 Test Type: **Maximized Emissions** Time: 08:36:48
 Tested By: Don Nguyen Sequence#: 3
 Software: EMITest 5.03.12

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

The EUT is a radio module installed inside a host (tablet) which is placed on a Styrofoam platform. The EUT is programmed to transmit continuously at 99% duty cycle at 5180, 5200, and 5240MHz. Radio module has two antennas active at the same time. The tablet is running on fully charged battery.

The EUT is rotated in three orthogonal axes. Data represent the worst-case orientation.

Modulation: OFDM

Data Rate: 6Mbps

Mode: 802.11a

Operating frequency: 5180, 5200, 5220, 5240MHz

Firmware power setting: 8dBm

Radio Module: Limited modular approved module

PCII to add new antenna 2x2 MIMO, 2.21dBi gain.

Scanned frequency: 9kHz-1000MHz

9 kHz -150 kHz;RBW=200 Hz,VBW=600 Hz;

150 kHz-30 MHz;RBW=9 kHz,VBW=27 kHz;

30 MHz-1000 MHz;RBW=120 kHz,VBW=360 kHz,

Temperature: 24.2°C

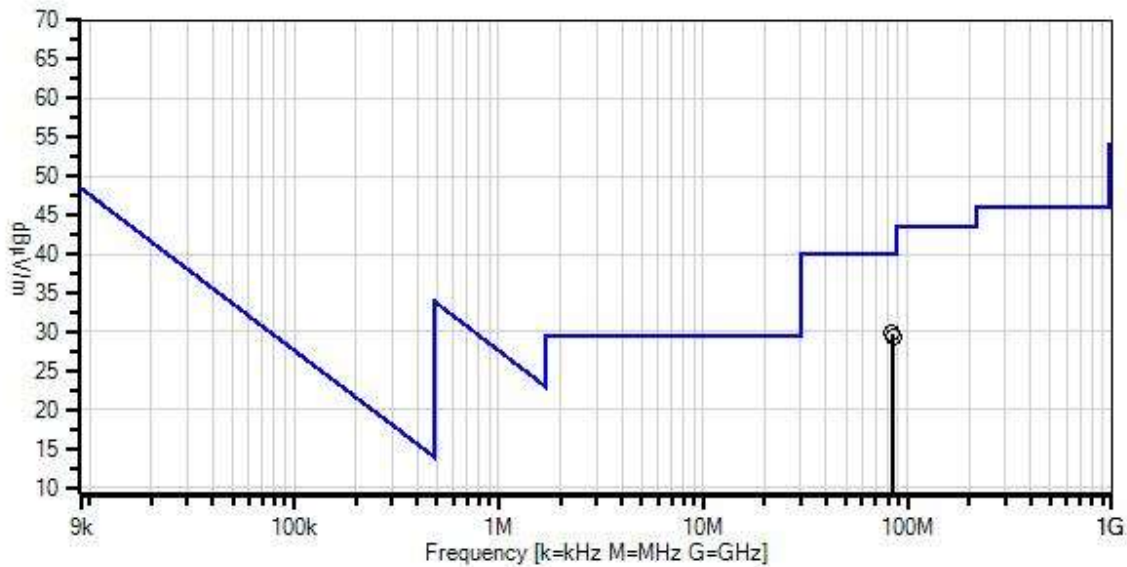
Relative Humidity: 36%

Site A

Test Method: ANSI C63.10 (2013)

KDB 789033 D02, December 14, 2017

Panasonic Avionics Corp. WO#: 101836 Sequence#: 3 Date: 3/22/2019
15.407(b) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Horiz



— Readings
× QP Readings
▼ Ambient
○ Peak Readings
* Average Readings
Software Version: 5.03.12

1 - 15.407(b) / 15.209 Radiated Spurious Emissions

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN00314	Loop Antenna	6502	5/13/2018	5/13/2020
T1	AN00309	Preamplifier	8447D	2/19/2018	2/19/2020
T2	AN01995	Biconilog Antenna	CBL6111C	4/23/2018	4/23/2020
T3	ANP05275	Attenuator	1W	4/5/2018	4/5/2020
T4	ANP05050	Cable	RG223/U	12/24/2018	12/24/2020
T5	ANP05198	Cable-Amplitude +15C to +45C (dB)	8268	12/4/2018	12/4/2020
	AN02869	Spectrum Analyzer	E4440A	8/10/2018	8/10/2019

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBμV	dB	dB	dB	dB	Table	dBμV/m	dBμV/m	dB	Ant
1	84.226M	42.0	-28.1 +1.6	+8.2	+6.0	+0.1	+0.0	29.8	40.0	-10.2	Horiz
2	85.332M	41.3	-28.1 +1.7	+8.3	+6.0	+0.1	+0.0	29.3	40.0	-10.7	Horiz



Test Location: CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92821 • 714 993 6112
 Customer: **Panasonic Avionics Corp.**
 Specification: **15.407(b)(1) / 15.209 Radiated Spurious Emissions - Client Devices**
 Work Order #: **101836** Date: 3/29/2019
 Test Type: **Maximized Emissions** Time: 16:31:12
 Tested By: Don Nguyen Sequence#: 2
 Software: EMITest 5.03.12

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

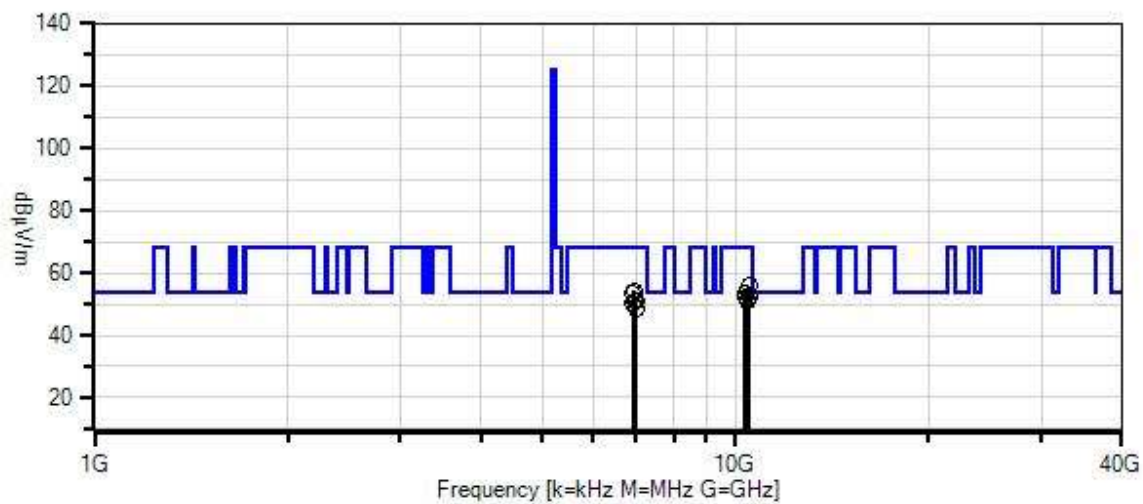
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

<p>The EUT is a radio module installed inside a host (tablet) which is placed on a Styrofoam platform. The EUT is programmed to transmit continuously at 99% duty cycle at 5180, 5200, and 5240MHz. Radio module has two antennas active at the same time. The tablet is running on fully charged battery.</p> <p>The EUT is rotated in three orthogonal axes. Data represent the worst-case orientation.</p> <p>Modulation: OFDM Data Rate: 6Mbps Mode: 802.11a Operating frequency: 5180, 5200, 5220, 5240MHz Firmware power setting: 8dBm Radio Module: Limited modular approved module PCII to add new antenna 2x2 MIMO, 2.21dBi gain.</p> <p>Scanned frequency: 1-40GHz 1-40GHz, RBW=1MHz, VBW=3MHz</p> <p>Temperature: 22.3°C Relative Humidity: 52.3%</p> <p>Site A</p> <p>Test Method: ANSI C63.10 (2013) KDB 789033 D02, December 14, 2017</p>
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Panasonic Avionics Corp. WO#: 101836 Sequence#: 2 Date: 3/29/2019
 15.407(b)(1) / 15.209 Radiated Spurious Emissions - Client Devices Test Distance: 3 Meters Vert



- Readings
 - Peak Readings
 - × QP Readings
 - * Average Readings
 - ▼ Ambient
- Software Version: 5.03.12
 1 - 15.407(b)(1) / 15.209 Radiated Spurious Emissions - Client Devices

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN00786	Preamp	83017A	5/12/2018	5/12/2020
T2	AN00849	Horn Antenna	3115	3/14/2018	3/14/2020
T3	ANP07139	Cable	ANDL1-PNMNM-48	3/4/2019	3/4/2021
T4	ANP07247	Cable	32022-29094K-29094K-24TC	7/5/2018	7/5/2020
T5	AN02869	Spectrum Analyzer	E4440A	8/10/2018	8/10/2019
	AN03367	Horn Antenna-ANSI C63.5 Calibration	62-GH-62-25.	8/24/2017	8/24/2019
	AN01413	Horn Antenna-ANSI C63.5 (dB/m)	84125-80008	10/17/2018	10/17/2020
	ANP07246	Cable	32022-29094K-29094K-24TC	7/5/2018	7/5/2020
	AN03158A	Horn Antenna	GH-28-25	3/30/2017	3/30/2019
	AN02672	Spectrum Analyzer	E4446A	3/13/2019	3/13/2021

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq MHz	Rdng dB μ V	T1 T5 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dB μ V/m	Spec dB μ V/m	Margin dB	Polar Ant
1	10473.500M	45.3	-36.0 +0.0	+38.6	+7.5	+0.6	+0.0	56.0	68.2	-12.2	Horiz
2	6933.250M	51.1	-37.4 +0.0	+34.7	+5.8	+0.2	+0.0	54.4	68.2	-13.8	Horiz
3	10359.580M	42.9	-35.8 +0.0	+38.5	+7.5	+0.7	+0.0	53.8	68.2	-14.4	Horiz
4	6906.580M	50.1	-37.4 +0.0	+34.6	+5.8	+0.2	+0.0	53.3	68.2	-14.9	Horiz
5	10478.700M	41.7	-36.0 +0.0	+38.6	+7.5	+0.6	+0.0	52.4	68.2	-15.8	Vert
6	10358.920M	41.3	-35.8 +0.0	+38.5	+7.5	+0.7	+0.0	52.2	68.2	-16.0	Vert
7	10400.420M	40.9	-35.9 +0.0	+38.7	+7.5	+0.6	+0.0	51.8	68.2	-16.4	Horiz
8	6986.750M	48.0	-37.4 +0.0	+34.7	+5.8	+0.2	+0.0	51.3	68.2	-16.9	Horiz
9	10400.250M	40.1	-35.9 +0.0	+38.7	+7.5	+0.6	+0.0	51.0	68.2	-17.2	Vert
10	6933.250M	47.5	-37.4 +0.0	+34.7	+5.8	+0.2	+0.0	50.8	68.2	-17.4	Vert
11	6906.580M	47.0	-37.4 +0.0	+34.6	+5.8	+0.2	+0.0	50.2	68.2	-18.0	Vert
12	6986.670M	45.4	-37.4 +0.0	+34.7	+5.8	+0.2	+0.0	48.7	68.2	-19.5	Vert

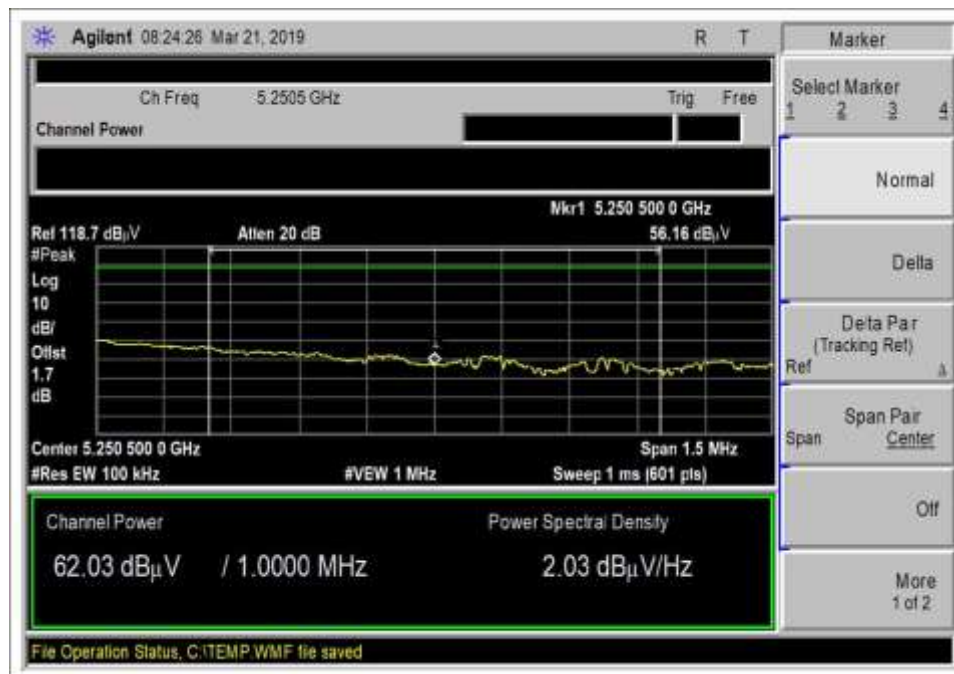
Band Edge

Band Edge Summary

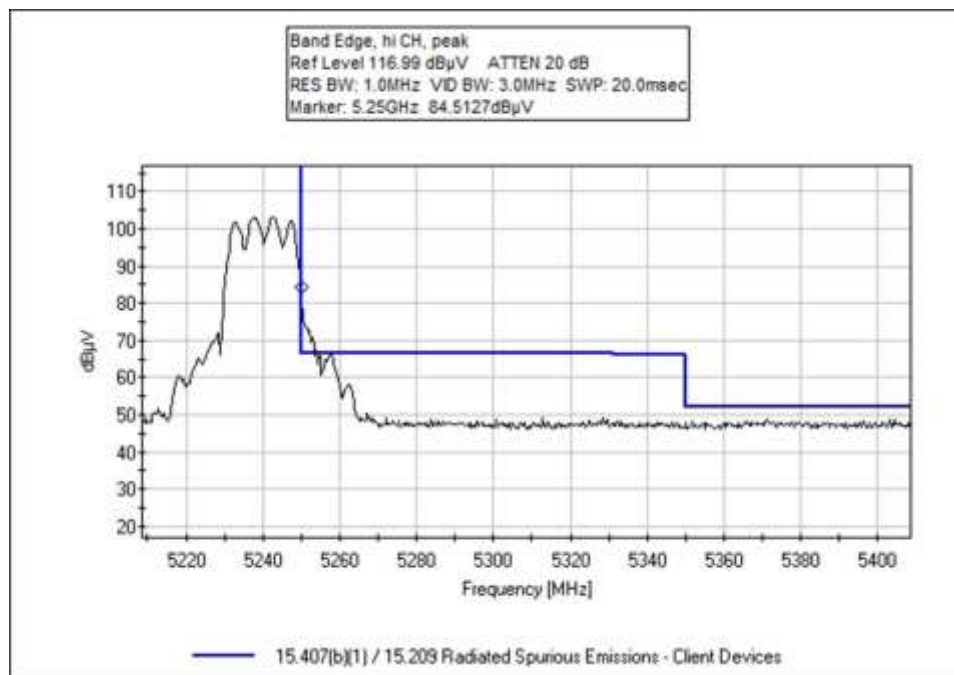
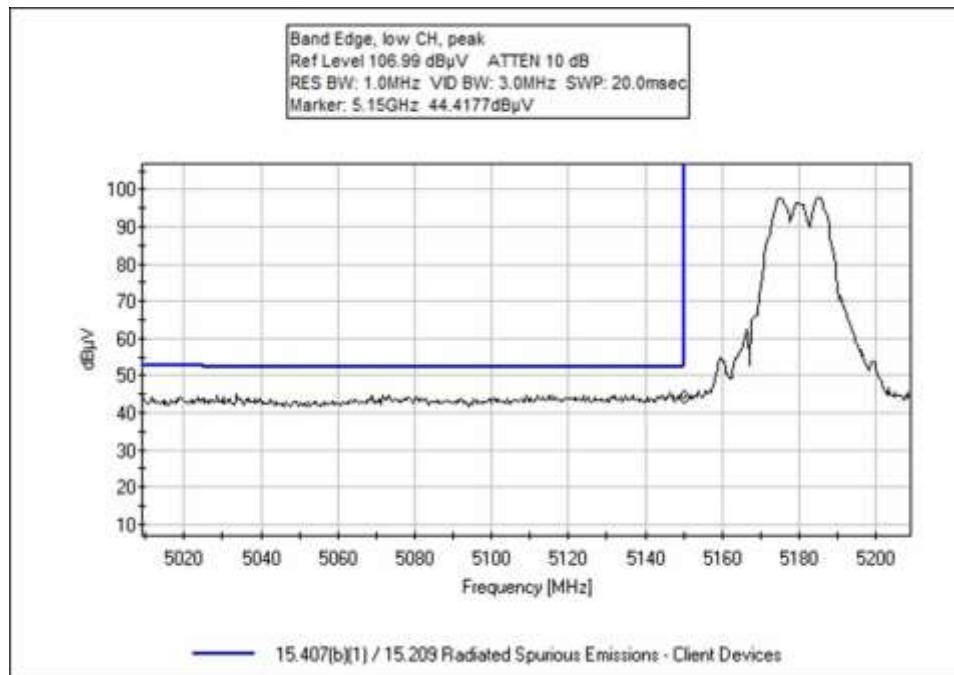
Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
5150	OFDM	External	45.9	< 54.0	Pass
5250	OFDM	External	62.0*	< 68.2	Pass

*Integration method

Band Edge Plots



High Channel Integration



Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92821 • 714 993 6112
 Customer: **Panasonic Avionics Corp.**
 Specification: **15.407(b)(1) / 15.209 Radiated Spurious Emissions - Client Devices**
 Work Order #: **101836** Date: 3/21/2019
 Test Type: **Maximized Emissions** Time: 09:25:41
 Tested By: Don Nguyen Sequence#: 1
 Software: EMITest 5.03.12

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

The EUT is a radio module installed inside a host (tablet) which is placed on a Styrofoam platform. The EUT is programmed to transmit continuously at 99% duty cycle. Radio module has two antennas active at the same time. The tablet is running on fully charged battery.

The EUT is rotated in three orthogonal axes. Data represent the worst-case orientation.

Modulation: OFDM

Mode: 802.11a

Operating frequency: 5180, 5200, 5220, 5240MHz

Firmware power setting: 8dBm

Radio Module: Limited modular approved module

PCII to add new antenna 2x2 MIMO, 2.21dBi gain.

Scanned frequency: 5150-5250 MHz

RBW=1MHz, VBW=3MHz

Temperature: 22.3°C

Relative Humidity: 52.3%

Site A

Test Method: ANSI C63.10 (2013)

KDB 789033 D02, December 14, 2017

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN00786	Preamp	83017A	5/12/2018	5/12/2020
T2	AN00849	Horn Antenna	3115	3/14/2018	3/14/2020
T3	ANP07139	Cable	ANDL1-PNMNM-48	3/4/2019	3/4/2021
T4	ANP07247	Cable	32022-29094K-29094K-24TC	7/5/2018	7/5/2020
T5	AN02869	Spectrum Analyzer	E4440A	8/10/2018	8/10/2019

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dB μ V	dB	dB	dB	dB	Table	dB μ V/m	dB μ V/m	dB	Ant
1	5250.001M	60.3	-37.5 +0.0	+33.9	+5.0	+0.3	+0.0	62.0	68.2	-6.2	Horiz
									integration method		
2	5150.000M	44.4	-37.5 +0.0	+33.8	+4.9	+0.3	+0.0	45.9	54.0	-8.1	Horiz

Test Setup Photo(s)

Below 1GHz



Above 1GHz





X Axis



Y Axis



Z Axis

SUPPLEMENTAL INFORMATION

Measurement Uncertainty

Uncertainty Value	Parameter
4.73 dB	Radiated Emissions
3.34 dB	Mains Conducted Emissions
3.30 dB	Disturbance Power

Uncertainties reported are worst case for all CKC Laboratories' sites and represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of $k=2$. Compliance is deemed to occur provided measurements are below the specified limits.

Emissions Test Details

TESTING PARAMETERS

Unless otherwise indicated, the following configuration parameters are used for equipment setup: The cables were routed consistent with the typical application by varying the configuration of the test sample. Interface cables were connected to the available ports of the test unit. The effect of varying the position of the cables was investigated to find the configuration that produced maximum emissions. Cables were of the type and length specified in the individual requirements. The length of cable that produced maximum emissions was selected.

The equipment under test (EUT) was set up in a manner that represented its normal use, as shown in the setup photographs. Any special conditions required for the EUT to operate normally are identified in the comments that accompany the emissions tables.

The emissions data was taken with a spectrum analyzer or receiver. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in the table below. The corrected data was then compared to the applicable emission limits. Preliminary and final measurements were taken in order to ensure that all emissions from the EUT were found and maximized.

CORRECTION FACTORS

The basic spectrum analyzer reading was converted using correction factors as shown in the highest emissions readings in the tables. For radiated emissions in $\text{dB}\mu\text{V}/\text{m}$, the spectrum analyzer reading in $\text{dB}\mu\text{V}$ was corrected by using the following formula. This reading was then compared to the applicable specification limit. Individual measurements were compared with the displayed limit value in the margin column. The margin was calculated based on subtracting the limit value from the corrected measurement value; a positive margin represents a measurement exceeding the limit, while a negative margin represents a measurement less than the limit.

SAMPLE CALCULATIONS		
	Meter reading	($\text{dB}\mu\text{V}$)
+	Antenna Factor	(dB/m)
+	Cable Loss	(dB)
-	Distance Correction	(dB)
-	Preamplifier Gain	(dB)
=	Corrected Reading	($\text{dB}\mu\text{V}/\text{m}$)

TEST INSTRUMENTATION AND ANALYZER SETTINGS

The test instrumentation and equipment listed were used to collect the emissions data. A spectrum analyzer or receiver was used for all measurements. Unless otherwise specified, the following table shows the measuring equipment bandwidth settings that were used in designated frequency bands. For testing emissions, an appropriate reference level and a vertical scale size of 10 dB per division were used.

MEASURING EQUIPMENT BANDWIDTH SETTINGS PER FREQUENCY RANGE			
TEST	BEGINNING FREQUENCY	ENDING FREQUENCY	BANDWIDTH SETTING
CONDUCTED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	9 kHz	150 kHz	200 Hz
RADIATED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	30 MHz	1000 MHz	120 kHz
RADIATED EMISSIONS	1000 MHz	>1 GHz	1 MHz

SPECTRUM ANALYZER/RECEIVER DETECTOR FUNCTIONS

The notes that accompany the measurements contained in the emissions tables indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "positive peak" detector mode. Whenever a "quasi-peak" or "average" reading was recorded, the measurement was annotated with a "QP" or an "Ave" on the appropriate rows of the data sheets. In cases where quasi-peak or average limits were employed and data exists for multiple measurement types for the same frequency then the peak measurement was retained in the report for reference, however the numbering for the affected row was removed and an arrow or caret ("^") was placed in the far left-hand column indicating that the row above takes precedence for comparison to the limit. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data.

Peak

In this mode, the spectrum analyzer or receiver recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature called "peak hold," the measurement device had the ability to measure intermittent or low duty cycle transient emission peak levels. In this mode the measuring device made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

Quasi-Peak

Quasi-peak measurements were taken using the quasi-peak detector when the true peak values exceeded or were within 2 dB of a quasi-peak specification limit. Additional QP measurements may have been taken at the discretion of the operator.

Average

Average measurements were taken using the average detector when the true peak values exceeded or were within 2 dB of an average specification limit. Additional average measurements may have been taken at the discretion of the operator. If the specification or test procedure requires trace averaging, then the averaging was performed using 100 samples or as required by the specification. All other average measurements are performed using video bandwidth averaging. To make these measurements, the test engineer reduces the video bandwidth on the measuring device until the modulation of the signal is filtered out. At this point, the measuring device is set into the linear mode and the scan time is reduced.