# MEASUREMENT REPORT

## FCC PART 15.247 / RSS-247 WLAN 802.11b/g/n

| | |
|---|---|
| **FCC ID:** | 2AI9TOAW-AP1201 |
| **APPLICANT:** | ALE USA Inc. |
| **Application Type:** | Certification |
| **Product:** | OmniAccess Stellar |
| **Model No.:** | OAW-AP1201 |
| **Brand Name:** | Alcatel-Lucent Enterprise |
| **FCC Classification:** | Digital Transmission System (DTS) |
| **FCC Rule Part(s):** | Part 15 Subpart C (Section 15.247) |
| **IC Rule(s):** | RSS-247 Issue 2, RSS-GEN Issue 5 |
| **Test Procedure(s):** | ANSI C63.10-2013, KDB 558074 D01v05<br>KDB 662911 D01v02r01 |
| **Test Date:** | September 06 ~ October 20, 2018 |

Reviewed By: Sunny Sun
( Sunny Sun )

Approved By: Robin Wu
( Robin Wu )

ACCREDITED
TESTING LABORATORY
CERTIFICATE #3628.01

The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013. Test results reported herein relate only to the item(s) tested.

# Revision History

| Report No. | Version | Description | Issue Date | Note |
|---|---|---|---|---|
| 1810RSU015-U1 | Rev. 01 | Initial Report | 10-31-2018 | Valid |
| | | | | |

Note: This report is supplemented to MRT Original “1808RSU025-U1” Report updating applicant, product name and model number.

# CONTENTS

## §2.1033 General Information

| | |
|---|---|
| **Applicant:** | ALE USA Inc. |
| **Applicant Address:** | 26801 West Agoura Road, Calabasas, CA 91301, United States. |
| **Manufacturer:** | ALE USA Inc. |
| **Manufacturer Address:** | 26801 West Agoura Road, Calabasas, CA 91301, United States. |
| **Test Site:** | MRT Technology (Suzhou) Co., Ltd |
| **Test Site Address:** | D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China |
| **FCC Registration No.:** | 893164 |
| **IC Registration No.:** | 11384A-1 |
| **Test Device Serial No.:** | N/A ☐ Production ☒ Pre-Production ☐ Engineering |

### Test Facility / Accreditations

**Measurements were performed at MRT Laboratory located in Tian'edang Rd., Suzhou, China.**

- **MRT facility is a FCC registered (MRT Reg. No. 893164) test facility with the site description report on file and has met all the requirements specified in ANSI C63.4-2014.**
- **MRT facility is an IC registered (MRT Reg. No. 11384A-1) test laboratory with the site description on file at Industry Canada.**
- **MRT facility is a VCCI registered (R-20025, G-20034, C-20020, T-20020) test laboratory with the site description on file at VCCI Council.**
- **MRT Lab is accredited to ISO 17025 by the American Association for Laboratory Accreditation (A2LA) under the American Association for Laboratory Accreditation Program (A2LA Cert. No. 3628.01) in EMC, Telecommunications, Radio and SAR testing.**

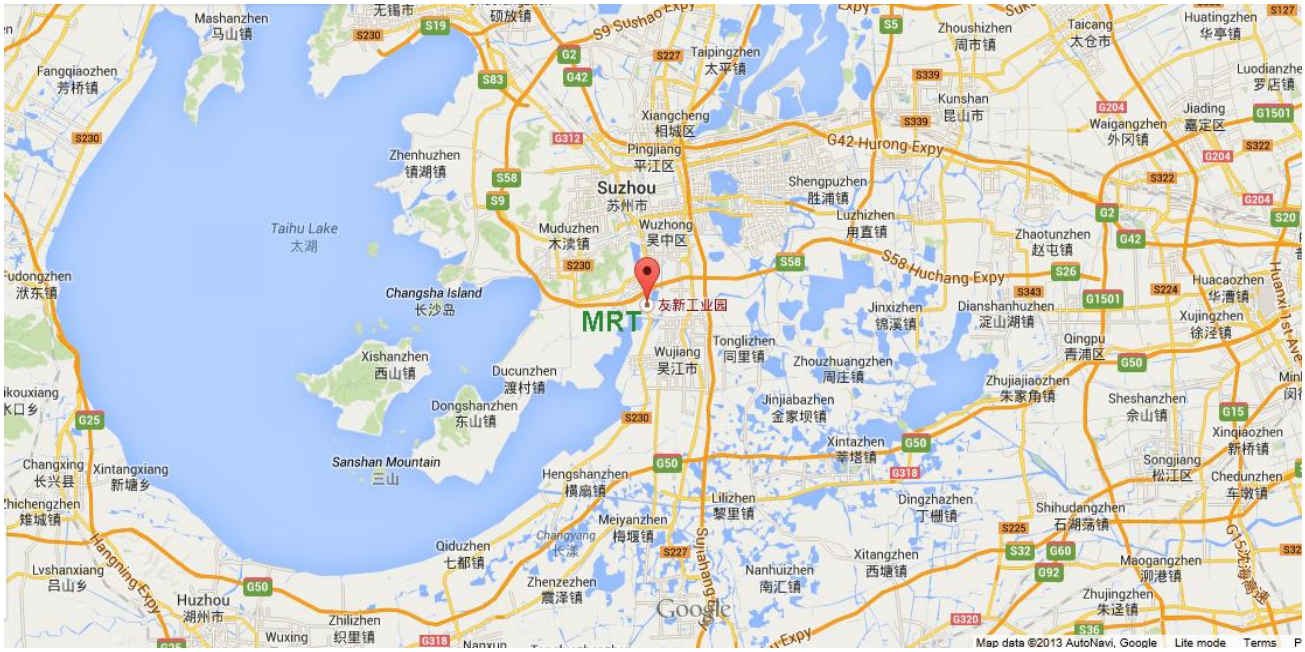
# 1. INTRODUCTION

## 1.1. Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Industry Canada Certification and Engineering Bureau.

## 1.2. MRT Test Location

The map below shows the location of the MRT LABORATORY, its proximity to the Taihu Lake. These measurement tests were conducted at the MRT Technology (Suzhou) Co., Ltd. Facility located at D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China. The measurement facility compliant with the test site requirements specified in ANSI C63.4-2014.



# 2. PRODUCT INFORMATION

## 2.1. Feature of Equipment under Test

| | |
|---|---|
| Product Name: | OmniAccess Stellar |
| Model No.: | OAW-AP1201 |
| Brand Name: | Alcatel-Lucent Enterprise |
| Wi-Fi Specification | 802.11a/b/g/n/ac |
| Bluetooth Specification: | v5.0 |
| Operating Temperature: | 0 ~ 45 °C |
| Power Type: | POE input or AC adapter input |
| Operating Environment: | Indoor Use |
| **Accessories** | |
| Adapter 1# | Model No.: ADP-30HR B<br>Input Power: 100 - 240V ~ 50/60Hz, 1.0A<br>Output Power: 48VDC/0.66A |
| Adapter 2# | Model No.: PD-9001 GR/AT/AC<br>Input Power: 100 - 240V ~ 50/60Hz, 0.67A<br>Output Power: 55VDC/0.6A |

## 2.2. Product Specification Subjective to this Report

| | |
|---|---|
| Frequency Range | 802.11b/g/n-HT20: 2412 ~ 2462 MHz<br>802.11n-HT40: 2422 ~ 2452 MHz |
| Channel Number: | 802.11b/g/n-HT20: 11<br>802.11n-HT40: 7 |
| Type of Modulation | 802.11b: DSSS<br>802.11g/n: OFDM |
| Data Rate: | 802.11b: 1/2/5.5/11Mbps<br>802.11g: 6/9/12/18/24/36/48/54Mbps<br>802.11n: up to 300Mbps |

Note: For other features of this EUT, test report will be issued separately.

## 2.3. Working Frequencies to this report

802.11b/g/n-HT20

| Channel | Frequency | Channel | Frequency | Channel | Frequency |
|---|---|---|---|---|---|
| 01 | 2412 MHz | 02 | 2417 MHz | 03 | 2422 MHz |
| 04 | 2427 MHz | 05 | 2432 MHz | 06 | 2437 MHz |
| 07 | 2442 MHz | 08 | 2447 MHz | 09 | 2452 MHz |
| 10 | 2457 MHz | 11 | 2462 MHz | -- | -- |

802.11n-HT40

| Channel | Frequency | Channel | Frequency | Channel | Frequency |
|---|---|---|---|---|---|
| 03 | 2422 MHz | 04 | 2427 MHz | 05 | 2432 MHz |
| 06 | 2437 MHz | 07 | 2442 MHz | 08 | 2447 MHz |
| 09 | 2452 MHz | -- | -- | -- | -- |

## 2.4. Description of Available Antennas

| Antenna Type | Frequency Band (GHz) | Tx Paths | Per Chain Max Antenna Gain (dBi) | | Beam-Forming Directional Gain (dBi) | CDD Directional Gain(dBi) | |
|---|---|---|---|---|---|---|---|
| | | | Ant 0 | Ant 1 | | For Power | For PSD |
| Wi-Fi Internal Antenna | | | | | | | |
| PCB | 2412 ~ 2462 | 2 | 4.70 | 3.70 | 7.22 | 4.70 | 7.71 |
| | 5150 ~ 5250 | 2 | 3.80 | 3.00 | 6.42 | 3.80 | 6.81 |
| | 5250 ~ 5350 | 2 | 3.80 | 3.00 | 6.42 | 3.80 | 6.81 |
| | 5470 ~ 5725 | 2 | 4.60 | 3.80 | 7.22 | 4.60 | 7.61 |
| | 5725 ~ 5850 | 2 | 4.60 | 3.00 | 6.85 | 4.60 | 7.61 |
| Bluetooth Internal Antenna | | | | | | | |
| PCB | 2402 ~ 2480 | 1 | 3.70 | | -- | | |

Note:

1. The EUT supports SISO technology for 802.11b mode only.
2. The EUT supports Cyclic Delay Diversity (CDD) mode, and CDD signals are correlated.
   For CDD transmissions, directional gain is calculated as follows, $N_{ANT}$ = 2, $N_{SS}$ = 1.
   If all antennas have the same gain, $G_{ANT}$, Directional gain = $G_{ANT}$ + Array Gain, where Array Gain is as follows.
   - For power spectral density (PSD) measurements on all devices,

   Array Gain = 10 log ($N_{ANT}$/ $N_{SS}$) dB = 3.01;
   - For power measurements on IEEE 802.11 devices,

   Array Gain = 0 dB for $N_{ANT}$ ≤ 4;
   If antenna gains are not equal, Directional gain may be calculated by using the formulas applicable to equal gain antennas with $G_{ANT}$ set equal to the gain of the antenna having the highest gain.
3. The EUT also supports Beam Forming mode, and the Beam Forming support 802.11n/ac, not include 802.11a/b/g. The directional gain = $10*\log[(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2/N_{ANT}]$dBi.

## 2.5. Description of Antenna RF Port

| Antenna RF Port | | | | |
|---|---|---|---|---|
| -- | 2.4GHz RF Port | | 5GHz RF Port | |
| Software Control Port | Ant 0 | Ant 1 | Ant 0 | Ant 1 |


## 2.6. Test Mode

| | |
|---|---|
| Test Mode | Mode 1: Transmit by 802.11b (1Mbps) |
| | Mode 2: Transmit by 802.11g (6Mbps) |
| | Mode 3: Transmit by 802.11n-HT20 (MCS0) |
| | Mode 4: Transmit by 802.11n-HT40 (MCS0) |

| 2.4GHz Test Mode | SISO | Ant 0 + 1 | |
|---|---|---|---|
| | | CDD | Beam-Forming |
| 802.11b | √ | × | × |
| 802.11g | × | √ | × |
| 802.11n-HT20 | × | √ | √ |
| 802.11n-HT40 | × | √ | √ |

## 2.7. Test Software

The test utility software used during testing was “QRCT”, and the version was “3.0.211.0”.

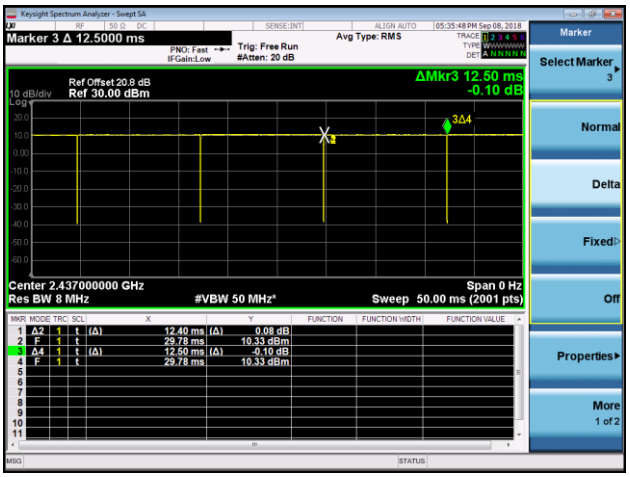
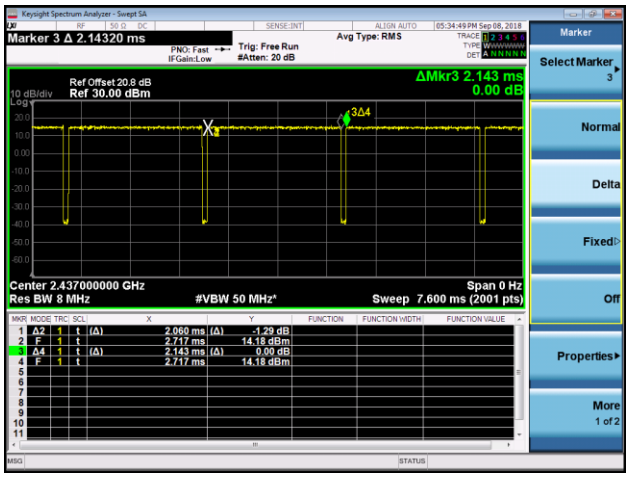
## 2.8. Device Capabilities

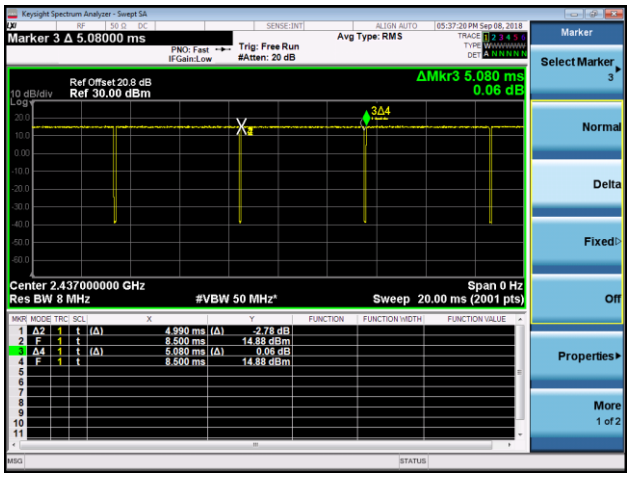
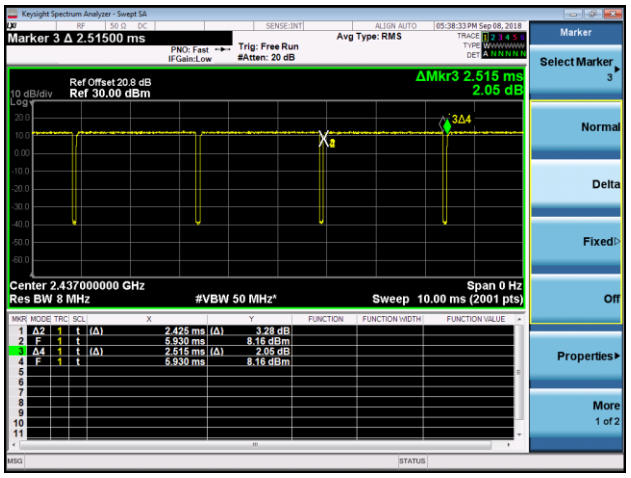
This device contains the following capabilities:

2.4GHz WLAN (DTS), 5GHzWLAN (NII), Bluetooth (v5.0)

**Note:** 2.4GHz WLAN (DTS) operation is possible in 20MHz, and 40MHz channel bandwidths. The maximum achievable duty cycles for all modes were determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8MHz, VBW = 50MHz, and detector = peak. The RBW and VBW were both greater than 50/T, where T is the minimum transmission duration, and the number of sweep points across T was greater than 100. The duty cycles are as follows:

| Test Mode | Duty Cycle |
|---|---|
| 802.11b | 99.20% |
| 802.11g | 96.12% |
| 802.11n-HT20 | 98.23% |
| 802.11n-HT40 | 96.42% |

| 802.11b (T = 12.40 ms) | 802.11g (T = 2.060 ms) |
|---|---|
|  |  |

| 802.11n-HT20 (T = 4.990 ms) | 802.11n-HT40 (T = 2.425 ms) |
|---|---|
|  |  |



## 2.9. Test Configuration

The **OmniAccess Stellar** was tested per the guidance of KDB 558074 D01v05. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

## 2.10. EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

## 2.11. Labeling Requirements

Per 2.1074 & 15.19; Docket 95-19

The label shall be permanently affixed at a conspicuous location on the device; instruction manual or pamphlet supplied to the user and be readily visible to the purchaser at the time of purchase. However, when the device is so small wherein placement of the label with specified statement is not practical, only the FCC ID must be displayed on the device per Section 15.19(a)(5). Please see attachment for FCC ID label and label location.

RSP-100 Issue 11 Section 3

The manufacturer, importer or distributor shall meet the labelling requirements set out in this section for every unit:

(i) prior to marketing in Canada, for products manufactured in Canada

(ii) prior to importation into Canada, for imported products

For information regarding the e-labelling option, see Notice 2014-DRS1003. The label for the certified product represents the manufacturer's or importer's compliance with Innovation, Science and Economic Development Canada's (ISED) regulatory requirements.

Please see attachment for IC label and label location.

# 3. DESCRIPTION of TEST

## 3.1. Evaluation Procedure

The measurement procedures described in the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.10-2013), and the guidance provided in KDB 558074 D01v05 were used in the measurement.

**Deviation from measurement procedure…….....None**

## 3.2. AC Line Conducted Emissions

The line-conducted facility is located inside an 8'x4'x4' shielded enclosure. A 1m x 2m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50uH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference ground-plane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the receiver and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The receiver was scanned from 150kHz to 30MHz. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 9kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was also maximized by varying: power lines, the mode of operation or data exchange speed, or support equipment whichever determined the worst-case emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions are used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

An extension cord was used to connect to a single LISN which powered by EUT. The extension cord was calibrated with LISN, the impedance and insertion loss are compliance with the requirements as stated in ANSI C63.10-2013.

## 3.3. Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. A MF Model 210SS turntable is used for radiated measurement. It is a continuously rotatable, remote controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm high PVC support structure is placed on top of the turntable.
For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up for frequencies below 1GHz was placed on top of the 0.8 meter high, 1 x 1.5 meter table; and test set-up for frequencies 1-40GHz was placed on top of the 1.5 meter high, 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, if applicable, turntable azimuth, and receive antenna height was noted for each frequency found.
Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions. According to 3dB Beam-Width of horn antenna, the horn antenna should be always directed to the EUT when rising height.

# 4. ANTENNA REQUIREMENTS

**Excerpt from §15.203 of the FCC Rules/Regulations:**

"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section."

- The antenna of the **OmniAccess Stellar** is **permanently attached.**
- There are no provisions for connection to an external antenna.

**Conclusion:**

The unit complies with the requirement of §15.203.

# 5. TEST EQUIPMENT CALIBRATION DATE

Conducted Emissions - SR2

| Instrument | Manufacturer | Type No. | Asset No. | Cali. Interval | Cali. Due Date |
|---|---|---|---|---|---|
| EMI Test Receiver | R&S | ESR3 | MRTSUE06185 | 1 year | 2019/04/25 |
| Two-Line V-Network | R&S | ENV216 | MRTSUE06002 | 1 year | 2019/06/21 |
| Two-Line V-Network | R&S | ENV216 | MRTSUE06003 | 1 year | 2019/06/21 |
| Thermohygrometer | Testo | 608-H1 | MRTSUE06404 | 1 year | 2019/08/14 |
| Shielding Anechoic Chamber | Mikebang | Chamber-TR3 | MRTSUE06215 | 1 year | 2019/05/10 |

Transmitter Spurious Emissions - AC1

| Instrument | Manufacturer | Type No. | Asset No. | Cali. Interval | Cal. Due Date |
|---|---|---|---|---|---|
| PXA Signal Analyzer | Keysight | 9030B | MRTSUE06395 | 1 year | 2019/09/13 |
| Microwave System Amplifier | Agilent | 83017A | MRTSUE06076 | 1 year | 2018/11/17 |
| Bilog Period Antenna | Schwarzbeck | VULB 9168 | MRTSUE06172 | 1 year | 2018/11/18 |
| Broad Band Horn Antenna | Schwarzbeck | BBHA9120D | MRTSUE06023 | 1 year | 2019/10/21 |
| Broad Band Horn Antenna | Schwarzbeck | BBHA 9170 | MRTSUE06024 | 1 year | 2018/12/14 |
| Thermohygrometer | Testo | 608-H1 | MRTSUE06403 | 1 year | 2019/08/14 |
| Anechoic Chamber | TDK | Chamber-AC1 | MRTSUE06212 | 1 year | 2019/05/10 |

Conducted Test Equipment - TR3

| Instrument | Manufacturer | Type No. | Asset No. | Cali. Interval | Cali. Due Date |
|---|---|---|---|---|---|
| Spectrum Analyzer | Agilent | N9020A | MRTSUE06106 | 1 year | 2019/04/25 |
| EXA Signal Analyzer | Keysight | N9010B | MRTSUE06457 | 1 year | 2019/07/18 |
| Power Meter | Agilent | U2021XA | MRTSUE06030 | 1 year | 2018/12/06 |
| Thermohygrometer | Testo | 608-H1 | MRTSUE06401 | 1 year | 2019/08/14 |

| Software | Version | Function |
|---|---|---|
| e3 | V8.3.5 | EMI Test Software |

# 6. MEASUREMENT UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k = 2.

| |
|---|
| AC Conducted Emission Measurement - SR2 |
| Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)):<br>150kHz~30MHz: 3.46dB |
| Radiated Emission Measurement - AC1 |
| Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)):<br>9kHz ~ 1GHz: 4.18dB<br>1GHz ~ 25GHz: 4.76dB |
| Spurious Emissions, Conducted - TR3 |
| Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)):<br>0.78dB |
| Output Power - TR3 |
| Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)):<br>1.13dB |
| Power Spectrum Density - TR3 |
| Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)):<br>1.15dB |
| Occupied Bandwidth - TR3 |
| Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)):<br>0.28% |

# 7. TEST RESULT

## 7.1. Summary

**Product Name:** **ALE USA Inc.**

**FCC ID:** **2AI9TOAW-AP1201**

| FCC Section(s) | IC Section(s) | Test Description | Test Limit | Test Condition | Test Result | Reference |
|---|---|---|---|---|---|---|
| 15.247(a)(2) | RSS-247 [5.2] | 6dB Bandwidth | ≥ 500kHz | Conducted | Pass | Section 7.2 |
| 15.247(b)(3) | RSS-247 [5.4(4)] | Output Power | ≤ 30dBm | | Pass | Section 7.3 |
| 15.247(e) | RSS-247 [5.2] | Power Spectral Density | ≤ 8dBm/3kHz | | Pass | Section 7.4 |
| 15.247(d) | RSS-247 [5.5] | Band Edge / Out-of-Band Emissions | ≤ 30dBc(Average) | | Pass | Section 7.5 |
| 15.205 15.209 | RSS-247 [5.5] | General Field Strength Limits (Restricted Bands and Radiated Emission Limits) | Emissions in restricted bands must meet the radiated limits detailed in 15.209 | Radiated | Pass | Section 7.6 & 7.7 |
| 15.207 | RSS-Gen [8.8] | AC Conducted Emissions 150kHz - 30MHz | < FCC 15.207 limits | Line Conducted | Pass | Section 7.8 |

**Notes:**

1) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
2) All modes of operation and data rates were investigated. For radiated emission test, every axis (X, Y, Z) was also verified. The test results shown in the following sections represent the worst case emissions.
3) Test Items “6dB Bandwidth” & “Band Edge / Out-of-Band Emissions” have been assessed MIMO transmission, and showed the worst test data in this report.

## 7.2. 6dB Bandwidth Measurement

### 7.2.1.Test Limit

The minimum 6dB bandwidth shall be at least 500 kHz.

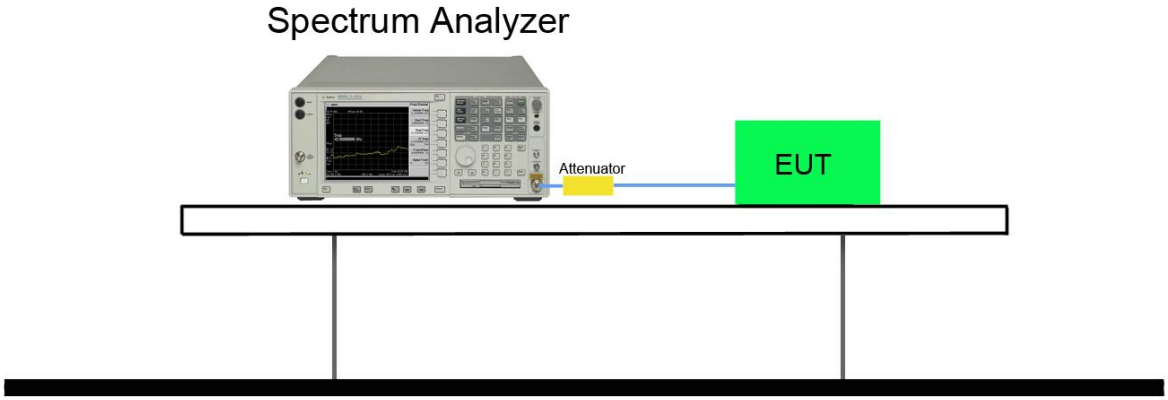
### 7.2.2.Test Procedure used

ANSI C63.10-2013 - Section 11.8.2 Option 2

### 7.2.3.Test Setting

1. The Spectrum's automatic bandwidth measurement capability was used to perform the 6dB bandwidth measurement. The "X" dB bandwidth parameter was set to X = 6. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. Set RBW = 100 kHz
3. VBW ≥ 3 × RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. Allow the trace was allowed to stabilize

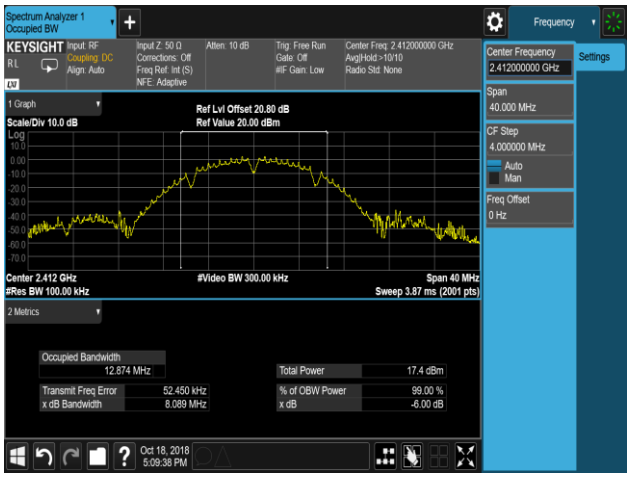
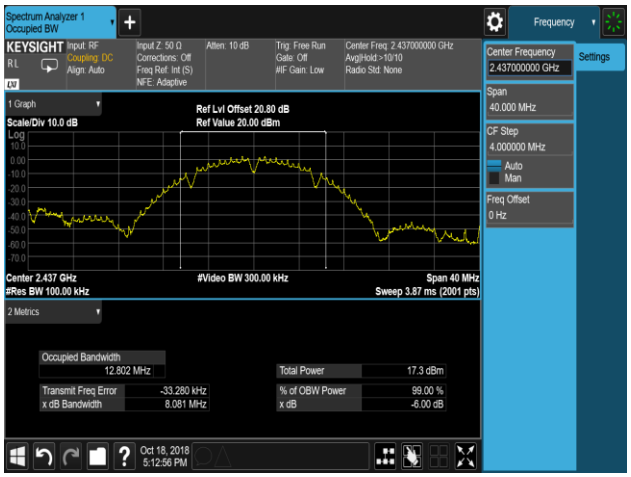
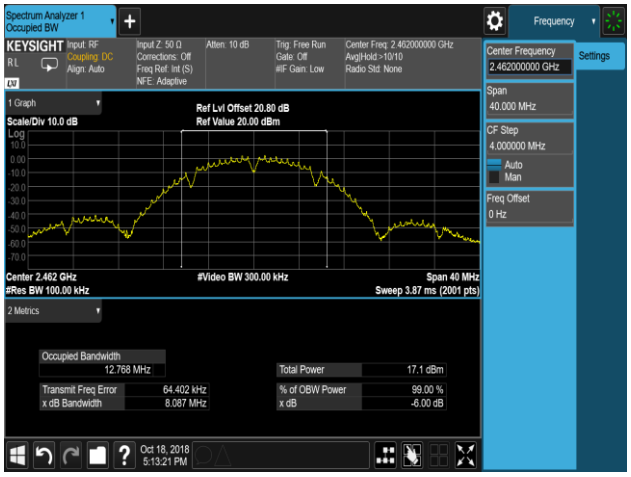
### 7.2.4.Test Setup

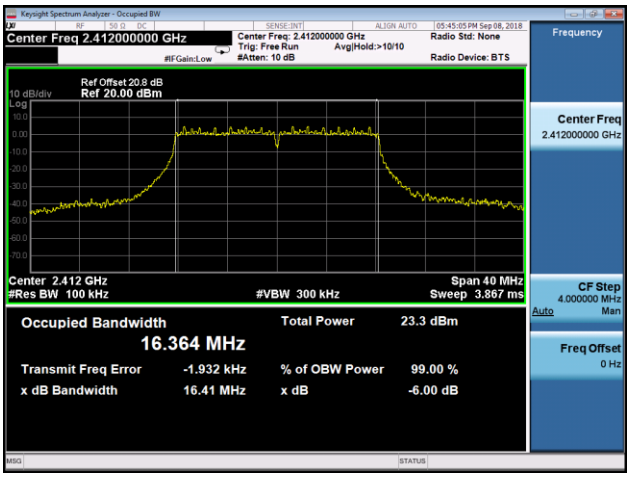
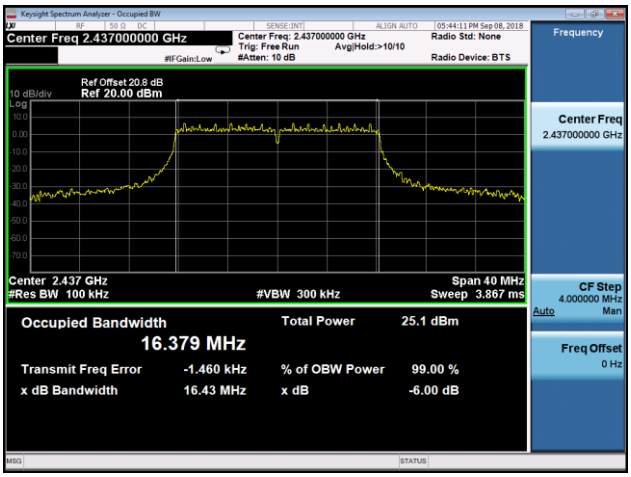
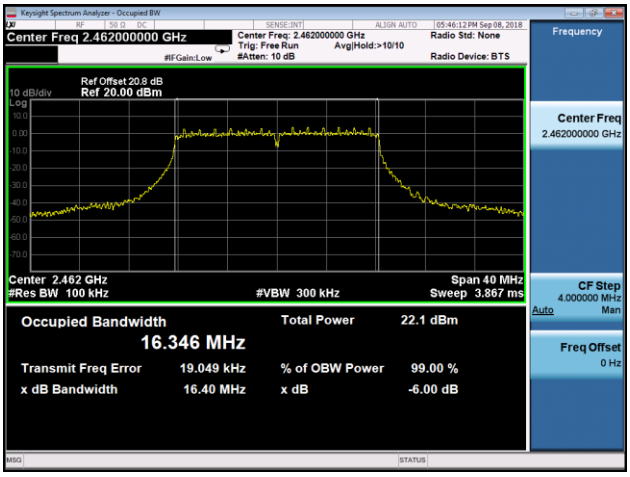


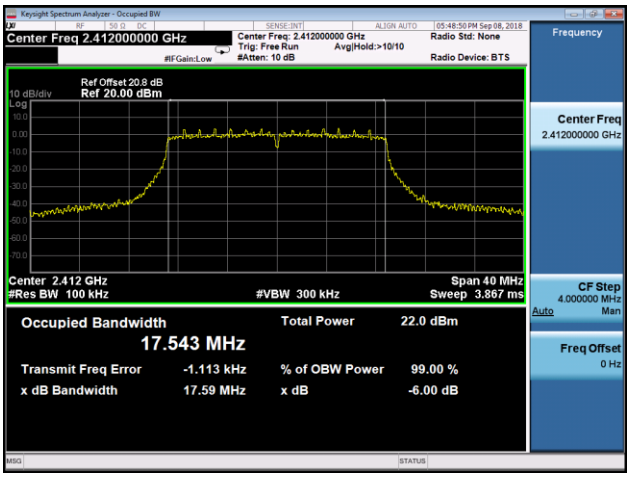
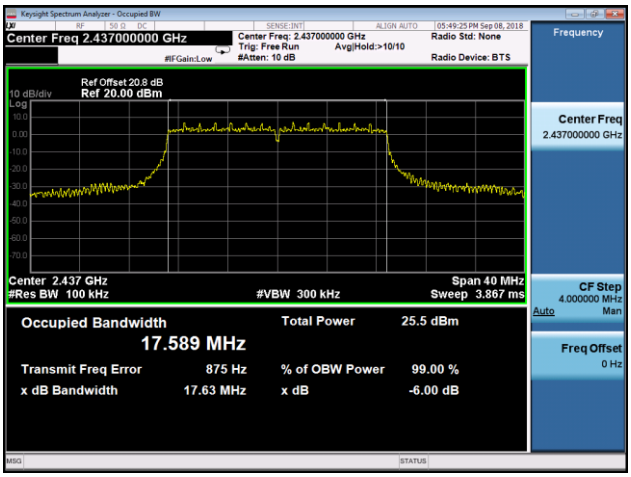
### 7.2.5.Test Result

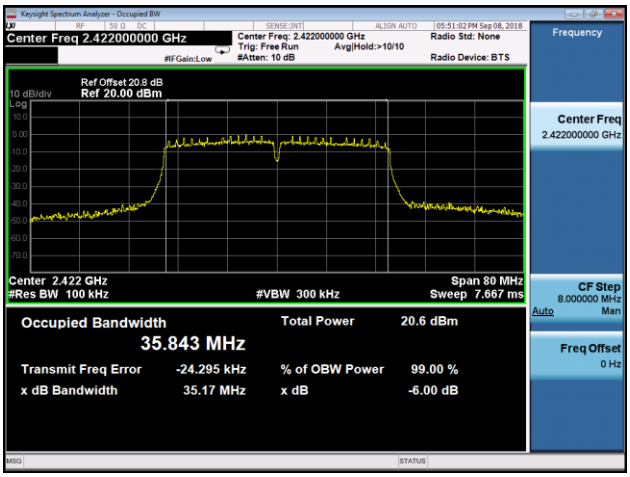
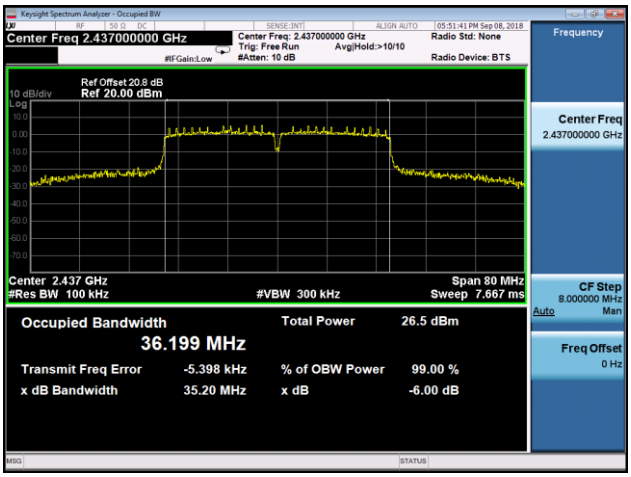
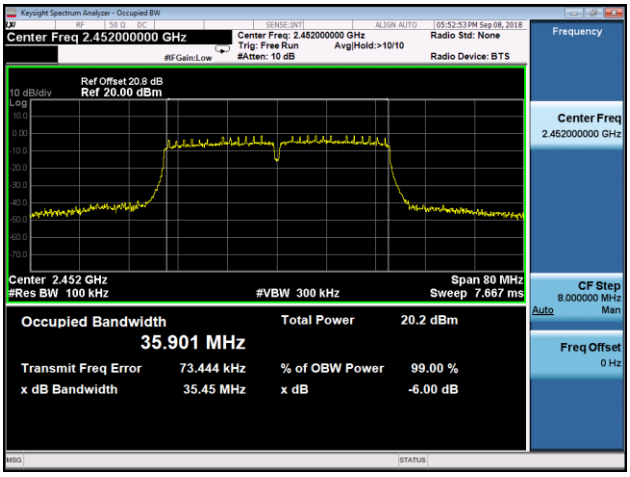
| Product | OmniAccess Stellar | Temperature | 23°C |
|---|---|---|---|
| Test Engineer | Flag Yang | Relative Humidity | 54% |
| Test Site | TR3 | Test Date | 2018/09/08 |

| Test Mode | Data Rate/ MCS | Channel No. | Frequency (MHz) | 6dB Bandwidth (MHz) | Limit (MHz) | Result |
|---|---|---|---|---|---|---|
| Ant 0 | | | | | | |
| 802.11b | 1Mbps | 01 | 2412 | 8.09 | ≥ 0.5 | Pass |
| 802.11b | 1Mbps | 06 | 2437 | 8.08 | ≥ 0.5 | Pass |
| 802.11b | 1Mbps | 11 | 2462 | 8.09 | ≥ 0.5 | Pass |
| Ant 0 / Ant 0 + 1 | | | | | | |
| 802.11g | 6Mbps | 01 | 2412 | 16.41 | ≥ 0.5 | Pass |
| 802.11g | 6Mbps | 06 | 2437 | 16.43 | ≥ 0.5 | Pass |
| 802.11g | 6Mbps | 11 | 2462 | 16.40 | ≥ 0.5 | Pass |
| 802.11n-HT20 | MCS0 | 01 | 2412 | 17.59 | ≥ 0.5 | Pass |
| 802.11n-HT20 | MCS0 | 06 | 2437 | 17.63 | ≥ 0.5 | Pass |
| 802.11n-HT20 | MCS0 | 11 | 2462 | 17.59 | ≥ 0.5 | Pass |
| 802.11n-HT40 | MCS0 | 03 | 2422 | 35.17 | ≥ 0.5 | Pass |
| 802.11n-HT40 | MCS0 | 06 | 2437 | 35.20 | ≥ 0.5 | Pass |
| 802.11n-HT40 | MCS0 | 09 | 2452 | 35.45 | ≥ 0.5 | Pass |

| 802.11b 6dB Bandwidth - Ant 0 | |
|---|---|
| Channel 01 (2412MHz) | Channel 06 (2437MHz) |
|  |  |
| Channel 11 (2462MHz) | |
|  | |

| 802.11g 6dB Bandwidth - Ant 0 / Ant 0 + 1 | |
|---|---|
| Channel 01 (2412MHz) | Channel 06 (2437MHz) |
|  |  |
| Channel 11 (2462MHz) | |
|  | |

| 802.11n-HT20 6dB Bandwidth - Ant 0 / Ant 0 + 1 | |
|---|---|
| Channel 01 (2412MHz) | Channel 06 (2437MHz) |
|  |  |
| Channel 11 (2462MHz) | |
|  | |

| 802.11n-HT40 6dB Bandwidth - Ant 0 / Ant 0 + 1 | |
|---|---|
| Channel 03 (2422MHz) | Channel 06 (2437MHz) |
|  |  |
| Channel 09 (2452MHz) | |
|  | |

## 7.3. Output Power Measurement

### 7.3.1.Test Limit

The maximum out power shall be less 1 Watt (30dBm) and the E.I.R.P shall not exceed 4 Watt (36dBm).

The conducted output power limit specified in paragraph FCC Part 15.247(b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs FCC Part 15.247(b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### 7.3.2.Test Procedure Used

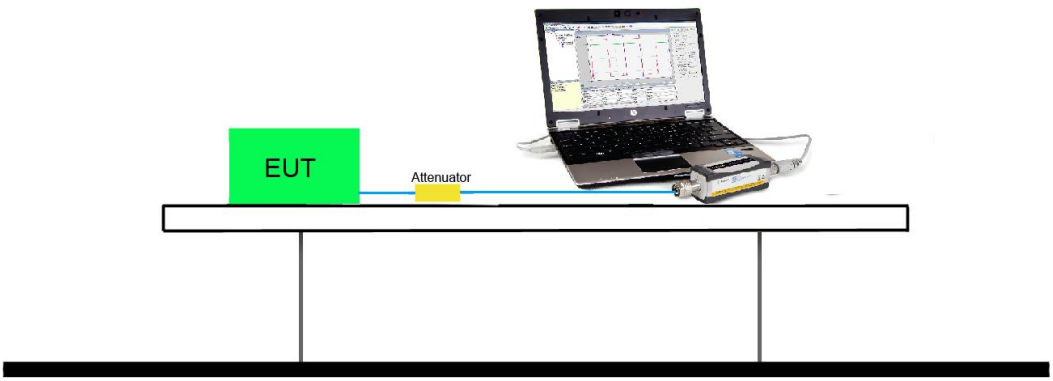
ANSI C63.10-2013 - Section 11.9.2.3

### 7.3.3.Test Setting

**Method AVGPM-G (Measurement using a gated RF average-reading power meter)**

Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since this measurement is made only during the ON time of the transmitter, no duty cycle correction is required.

### 7.3.4.Test Setup



### 7.3.5.Test Result of Output Power

Power output test was verified over all data rates of each mode shown as below, and then choose the maximum power output (gray marker) for final test of each channel.

Output power at various data rates for Ant 0 / Ant 0+1 port:

| Test Mode | Bandwidth (MHz) | Channel No. | Frequency (MHz) | Data Rate/ MCS | Average Power (dBm) |
|---|---|---|---|---|---|
| 802.11b | 20 | 6 | 2437 | 1Mbps | 17.59 |
| | | | | 5.5Mbps | 17.13 |
| | | | | 11Mbps | 16.61 |
| 802.11g | 20 | 6 | 2437 | 6Mbps | 18.44 |
| | | | | 24Mbps | 17.95 |
| | | | | 54Mbps | 17.40 |
| 802.11n | 20 | 6 | 2437 | MCS0 | 18.54 |
| | | | | MCS3 | 18.03 |
| | | | | MCS7 | 17.60 |
| 802.11n | 40 | 6 | 2437 | MCS0 | 19.31 |
| | | | | MCS3 | 18.88 |
| | | | | MCS7 | 18.25 |

| Product | OmniAccess Stellar | Temperature | 23°C |
|---|---|---|---|
| Test Engineer | Flag Yang | Relative Humidity | 54% |
| Test Site | TR3 | Test Date | 2018/09/07 |

| Test Mode | Data Rate/ MCS | Channel No. | Freq. (MHz) | Ant 0 Average Power (dBm) | Ant 1 Average Power (dBm) | Total Average Power (dBm) | Limit (dBm) | EIRP Average Power (dBm) | E.I.R.P Limit (dBm) | Result |
|---|---|---|---|---|---|---|---|---|---|---|
| Ant 0 / Ant 1 (SISO Mode) | | | | | | | | | | |
| 11b | 1Mbps | 01 | 2412 | 17.62 | 17.38 | -- | ≤ 30.00 | 22.32 | ≤ 36.00 | Pass |
| 11b | 1Mbps | 06 | 2437 | 17.59 | 16.85 | -- | ≤ 30.00 | 22.29 | ≤ 36.00 | Pass |
| 11b | 1Mbps | 11 | 2462 | 17.64 | 16.30 | -- | ≤ 30.00 | 22.34 | ≤ 36.00 | Pass |
| Ant 0 + 1 (CDD Mode) | | | | | | | | | | |
| 11g | 6Mbps | 01 | 2412 | 16.11 | 16.65 | 19.40 | ≤ 30.00 | 24.10 | ≤ 36.00 | Pass |
| 11g | 6Mbps | 06 | 2437 | 18.44 | 18.82 | 21.64 | ≤ 30.00 | 26.34 | ≤ 36.00 | Pass |
| 11g | 6Mbps | 11 | 2462 | 14.40 | 15.84 | 18.19 | ≤ 30.00 | 22.89 | ≤ 36.00 | Pass |
| 11n-HT20 | MCS0 | 01 | 2412 | 15.10 | 15.72 | 18.43 | ≤ 30.00 | 23.13 | ≤ 36.00 | Pass |
| 11n-HT20 | MCS0 | 06 | 2437 | 18.54 | 19.70 | 22.17 | ≤ 30.00 | 26.87 | ≤ 36.00 | Pass |
| 11n-HT20 | MCS0 | 11 | 2462 | 15.03 | 15.75 | 18.42 | ≤ 30.00 | 23.12 | ≤ 36.00 | Pass |
| 11n-HT40 | MCS0 | 03 | 2422 | 13.69 | 14.05 | 16.88 | ≤ 30.00 | 21.58 | ≤ 36.00 | Pass |
| 11n-HT40 | MCS0 | 06 | 2437 | 19.31 | 19.93 | 22.64 | ≤ 30.00 | 27.34 | ≤ 36.00 | Pass |
| 11n-HT40 | MCS0 | 09 | 2452 | 12.54 | 13.59 | 16.11 | ≤ 30.00 | 20.81 | ≤ 36.00 | Pass |
| Ant 0 + 1 (Beam-Forming Mode) | | | | | | | | | | |
| 11n-HT20 | MCS0 | 01 | 2412 | 14.05 | 14.37 | 17.22 | ≤ 28.78 | 24.44 | ≤ 36.00 | Pass |
| 11n-HT20 | MCS0 | 06 | 2437 | 16.56 | 16.83 | 19.71 | ≤ 28.78 | 26.93 | ≤ 36.00 | Pass |
| 11n-HT20 | MCS0 | 11 | 2462 | 16.07 | 16.35 | 19.22 | ≤ 28.78 | 26.44 | ≤ 36.00 | Pass |
| 11n-HT40 | MCS0 | 03 | 2422 | 16.18 | 16.32 | 19.26 | ≤ 28.78 | 26.48 | ≤ 36.00 | Pass |
| 11n-HT40 | MCS0 | 06 | 2437 | 17.76 | 17.89 | 20.84 | ≤ 28.78 | 28.06 | ≤ 36.00 | Pass |
| 11n-HT40 | MCS0 | 09 | 2452 | 17.58 | 17.90 | 20.75 | ≤ 28.78 | 27.97 | ≤ 36.00 | Pass |

Note 1: For 11b, EIRP Average Power (dBm) = Max { (Ant 0 Average Power + Ant 0 Gain) : (Ant 1 Average Power + Ant 1 Gain) } (dBm).

Note 2: Total Average Power (dBm) = $10*\log\{10^{(\text{Ant 0 Average Power }/10)} + 10^{(\text{Ant 1 Average Power }/10)}\}$ (dBm).

Note 3: For CDD Mode, EIRP Average Power (dBm) = Total Average Power (dBm) + CDD Directional Gain (dBi).

For Beam-Forming Mode, EIRP Average Power (dBm) = Total Average Power (dBm) + Beam-Forming Directional Gain (dBi).

## 7.4. Power Spectral Density Measurement

### 7.4.1.Test Limit

The maximum permissible power spectral density is 8dBm in any 3 kHz band.

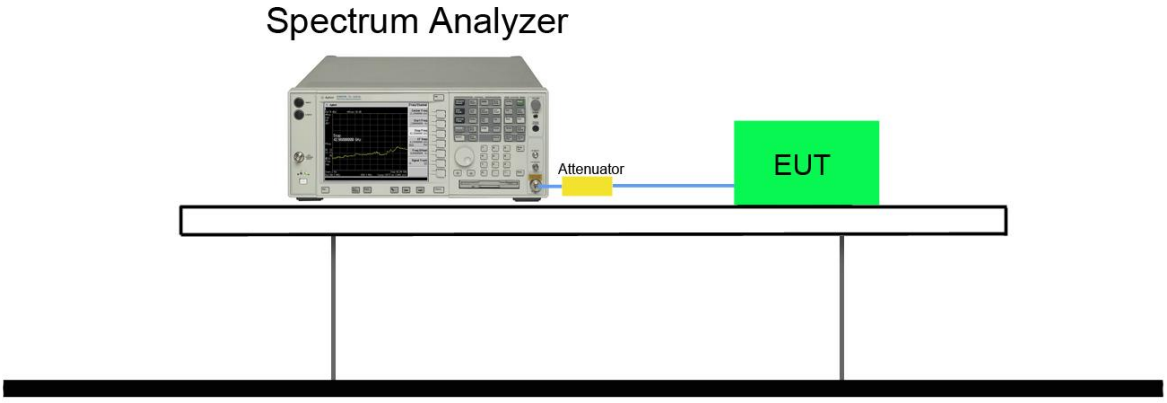
### 7.4.2.Test Procedure Used

ANSI C63.10 Section 11.10.6

### 7.4.3.Test Setting

1. Measure the duty cycle (x) of the transmitter output signal
2. Set instrument center frequency to DTS channel center frequency.
3. Set span to at least 1.5 times the OBW.
4. RBW = 10kHz
5. VBW = 30kHz
6. Detector = RMS
7. Ensure that the number of measurement points in the sweep ≥ 2 x span/RBW.
8. Sweep time = auto couple
9. Don’t use sweep triggering. Allow sweep to “free run”.
10. Employ trace averaging (RMS) mode over a minimum of 100 traces.
11. Use the peak marker function to determine the maximum amplitude level.
12. Add 10 log (1/x), where x is the duty cycle measured in step (a, to the measured PSD to compute the average PSD during the actual transmission time.
13. Add Constant Factor = 10*log(3kHz / 10kHz) = -5.23

### 7.4.4.Test Setup



### 7.4.5.Test Result

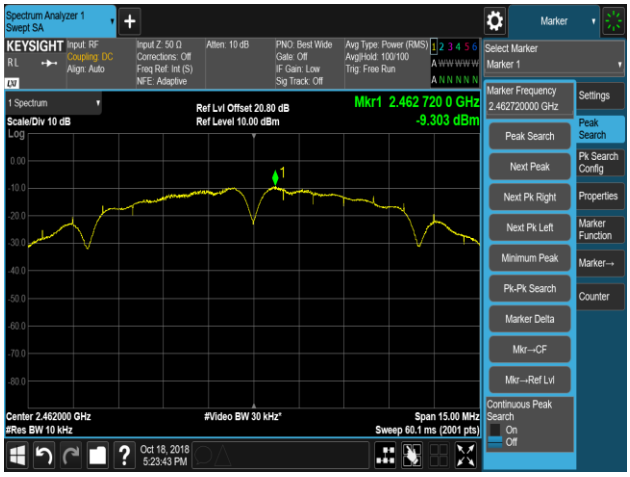
| Product | OmniAccess Stellar | Temperature | 23°C |
|---|---|---|---|
| Test Engineer | Flag Yang | Relative Humidity | 54% |
| Test Site | TR3 | Test Date | 2018/09/08 |

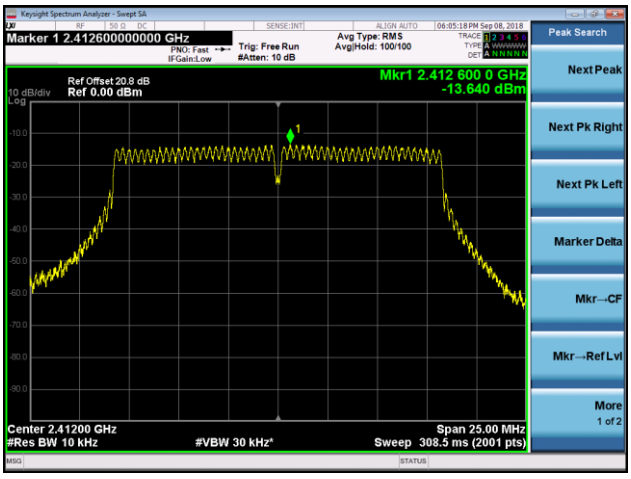
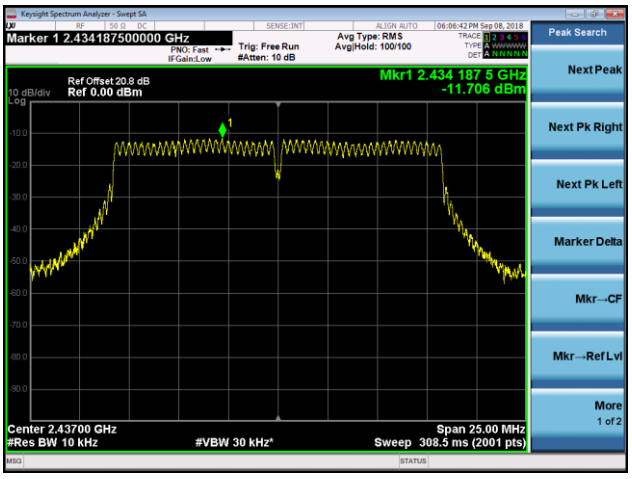
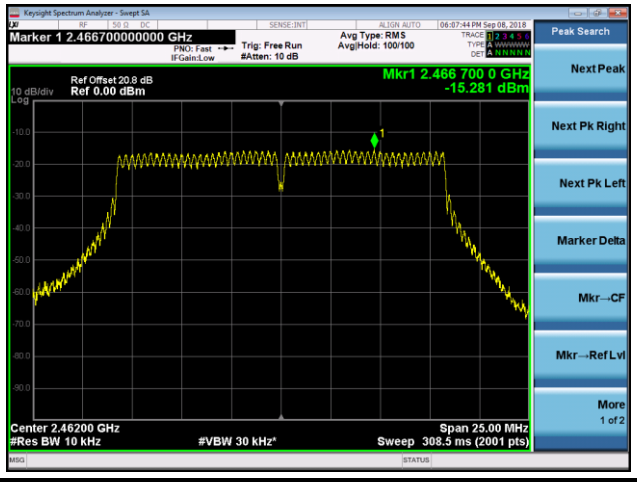
| Test Mode | Data Rate/ MCS | Channel No. | Freq. (MHz) | Ant 0 AVGPSD (dBm / 10kHz) | Ant 1 AVGPSD (dBm / 10kHz) | Duty Cycle (%) | Constant Factor | Total AVGPSD (dBm / 3kHz) | Limit (dBm / 3kHz) | Result |
|---|---|---|---|---|---|---|---|---|---|---|
| Ant 0 / Ant 1 (SISO Mode) | | | | | | | | | | |
| 11b | 1Mbps | 01 | 2412 | -9.78 | -8.56 | 99.20 | -5.23 | -13.79 | ≤ 8.00 | Pass |
| 11b | 1Mbps | 06 | 2437 | -9.75 | -9.19 | 99.20 | -5.23 | -14.42 | ≤ 8.00 | Pass |
| 11b | 1Mbps | 11 | 2462 | -9.30 | -9.30 | 99.20 | -5.23 | -14.53 | ≤ 8.00 | Pass |
| Ant 0 + 1 (CDD Mode) | | | | | | | | | | |
| 11g | 6Mbps | 01 | 2412 | -13.64 | -12.74 | 96.12 | -5.23 | -15.21 | ≤ 6.29 | Pass |
| 11g | 6Mbps | 06 | 2437 | -11.71 | -11.13 | 96.12 | -5.23 | -13.46 | ≤ 6.29 | Pass |
| 11g | 6Mbps | 11 | 2462 | -15.28 | -14.50 | 96.12 | -5.23 | -16.92 | ≤ 6.29 | Pass |
| 11n-HT20 | MCS0 | 01 | 2412 | -14.17 | -13.54 | 98.23 | -5.23 | -16.06 | ≤ 6.29 | Pass |
| 11n-HT20 | MCS0 | 06 | 2437 | -10.67 | -9.93 | 98.23 | -5.23 | -12.50 | ≤ 6.29 | Pass |
| 11n-HT20 | MCS0 | 11 | 2462 | -14.51 | -13.21 | 98.23 | -5.23 | -16.03 | ≤ 6.29 | Pass |
| 11n-HT40 | MCS0 | 03 | 2422 | -19.08 | -18.79 | 96.42 | -5.23 | -20.99 | ≤ 6.29 | Pass |
| 11n-HT40 | MCS0 | 06 | 2437 | -13.41 | -13.22 | 96.42 | -5.23 | -15.37 | ≤ 6.29 | Pass |
| 11n-HT40 | MCS0 | 09 | 2452 | -19.95 | -19.12 | 96.42 | -5.23 | -21.58 | ≤ 6.29 | Pass |
| Ant 0 + 1 (Beam-Forming Mode) | | | | | | | | | | |
| 11n-HT20 | MCS0 | 01 | 2412 | -13.50 | -12.80 | 98.23 | -5.23 | -15.36 | ≤ 6.78 | Pass |
| 11n-HT20 | MCS0 | 06 | 2437 | -11.14 | -10.86 | 98.23 | -5.23 | -13.22 | ≤ 6.78 | Pass |
| 11n-HT20 | MCS0 | 11 | 2462 | -11.11 | -11.63 | 98.23 | -5.23 | -13.58 | ≤ 6.78 | Pass |
| 11n-HT40 | MCS0 | 03 | 2422 | -13.90 | -14.55 | 96.42 | -5.23 | -16.27 | ≤ 6.78 | Pass |
| 11n-HT40 | MCS0 | 06 | 2437 | -12.96 | -12.94 | 96.42 | -5.23 | -15.01 | ≤ 6.78 | Pass |
| 11n-HT40 | MCS0 | 09 | 2452 | -12.97 | -12.72 | 96.42 | -5.23 | -14.90 | ≤ 6.78 | Pass |

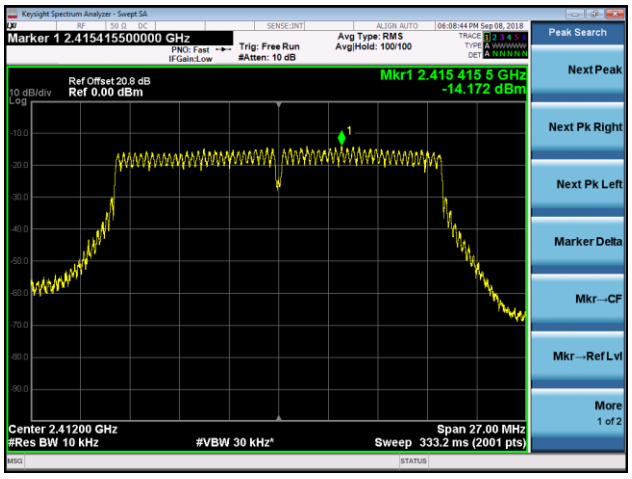
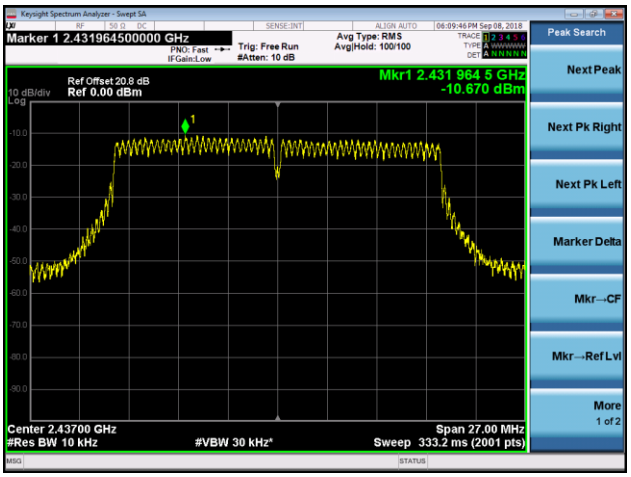
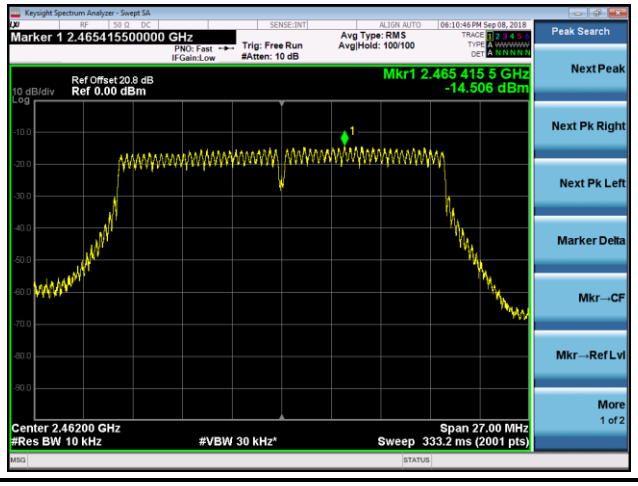
Note 1: When EUT duty cycle ≥ 98%, Total AVGPSD = 10*log $\{10^{(\text{Ant 0 AVGPSD}/10)} + 10^{(\text{Ant 1 AVGPSD}/10)}\}$ + Constant Factor.

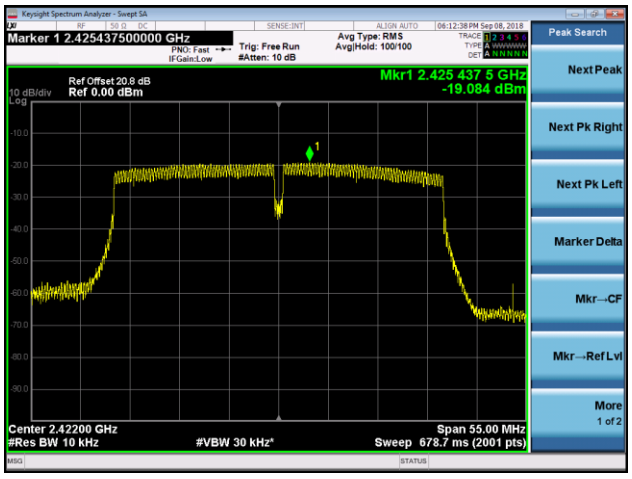
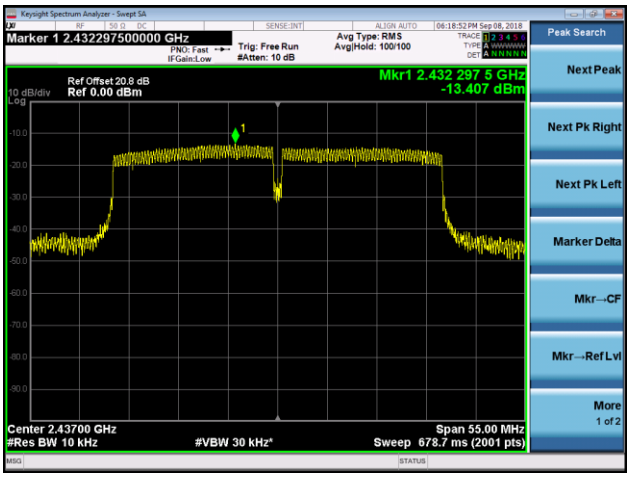
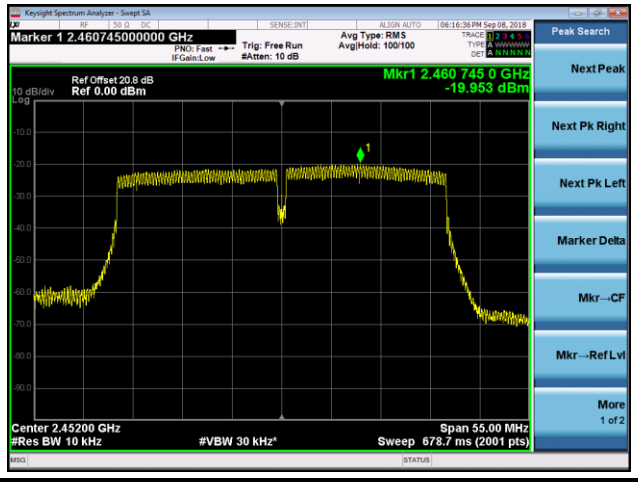
Note 2: When EUT duty cycle < 98%, Total AVGPSD = 10*log $\{10^{(\text{Ant 0 AVGPSD}/10)} + 10^{(\text{Ant 1 AVGPSD}/10)}\}$ + 10*log (1/duty cycle) + Constant Factor.

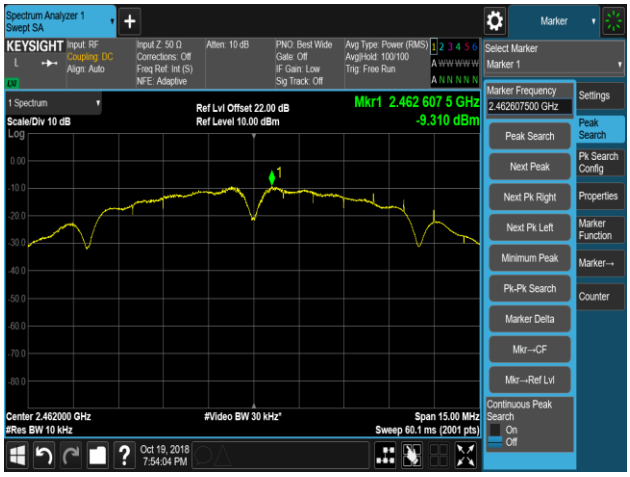
Note 3: For 11b, Total AVGPSD (dBm / 3kHz) = Max { Ant 0 AVGPSD (dBm / 10kHz) : Ant 1 AVGPSD (dBm / 10kHz)} + Constant Factor.

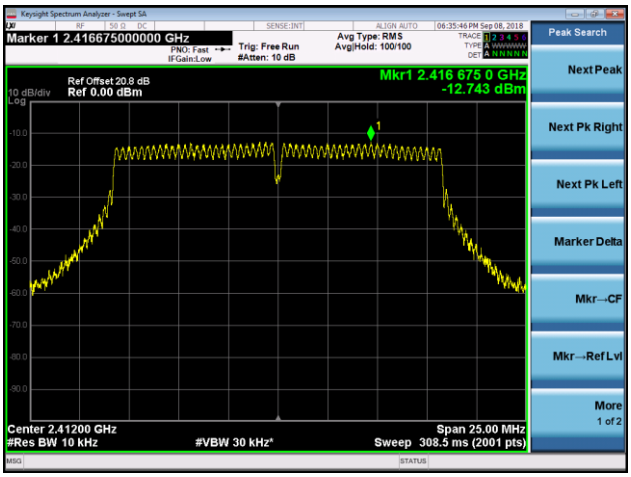
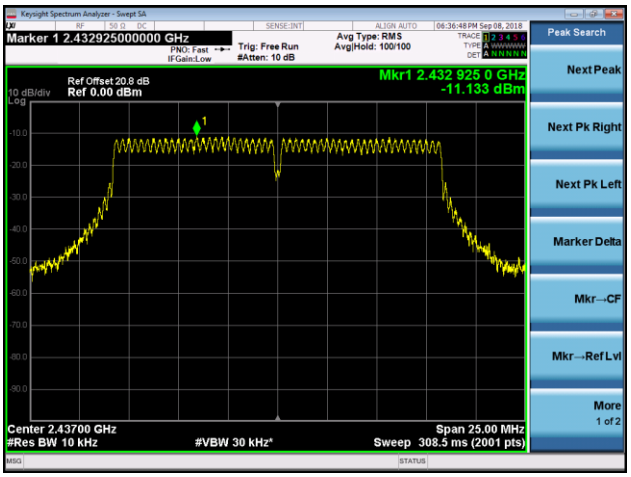
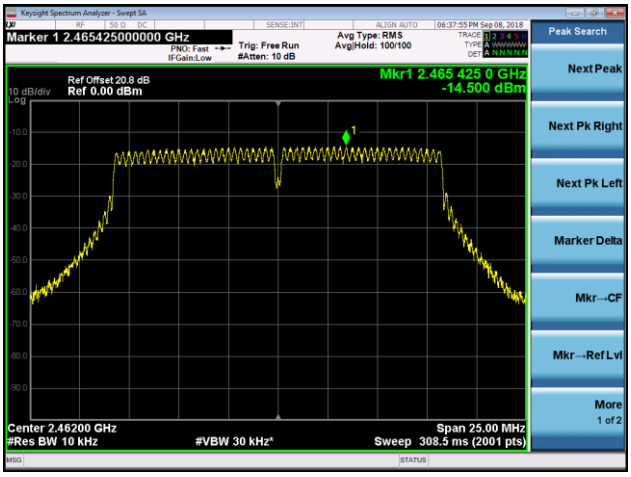
| 802.11b PSD - Ant 0 (SISO Mode) | |
|---|---|
| Channel 01 (2412MHz) | Channel 06 (2437MHz) |
|  |  |
| Channel 11 (2462MHz) | |
|  | |

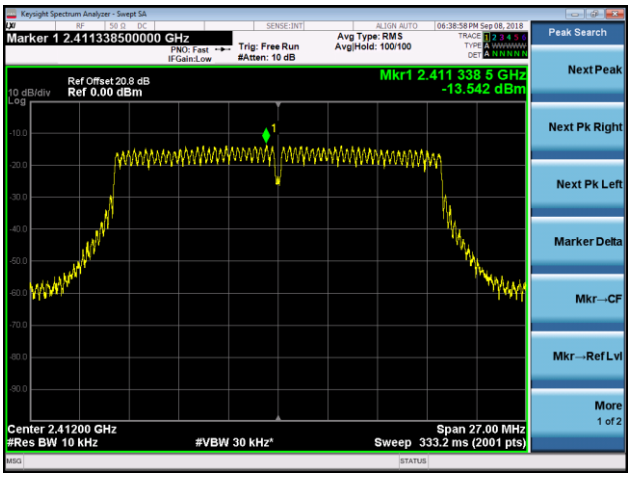
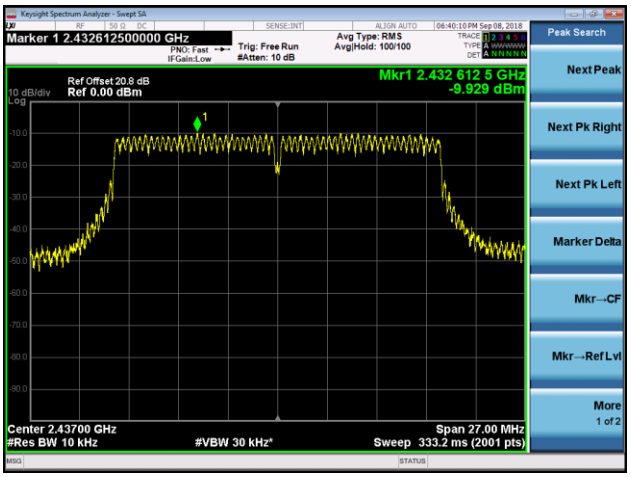
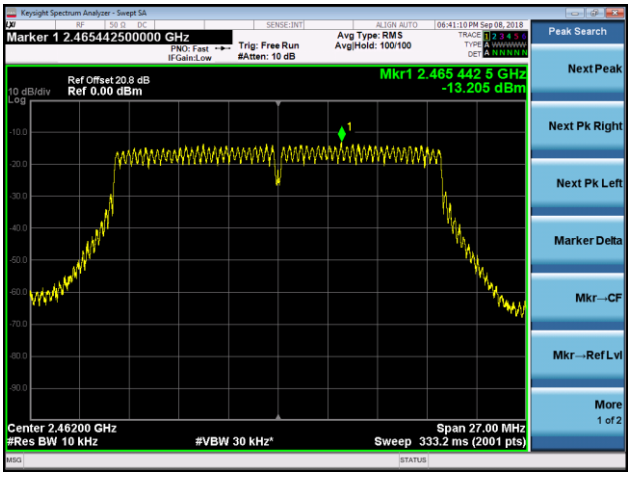
| 802.11g PSD - Ant 0 / Ant 0 + 1 (CDD Mode) | |
|---|---|
| Channel 01 (2412MHz) | Channel 06 (2437MHz) |
|  |  |
| Channel 11 (2462MHz) | |
|  | |

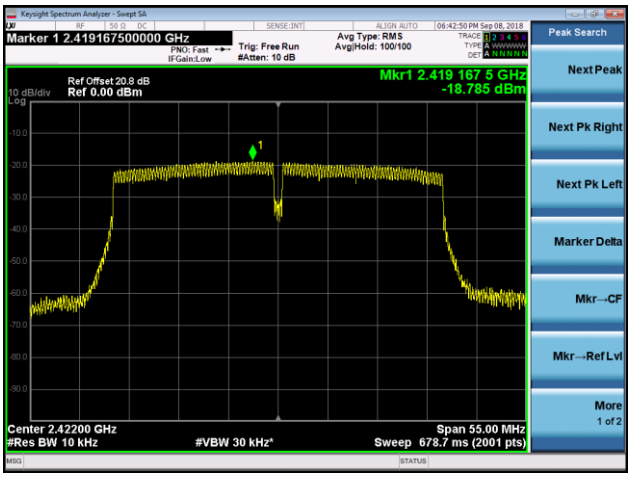
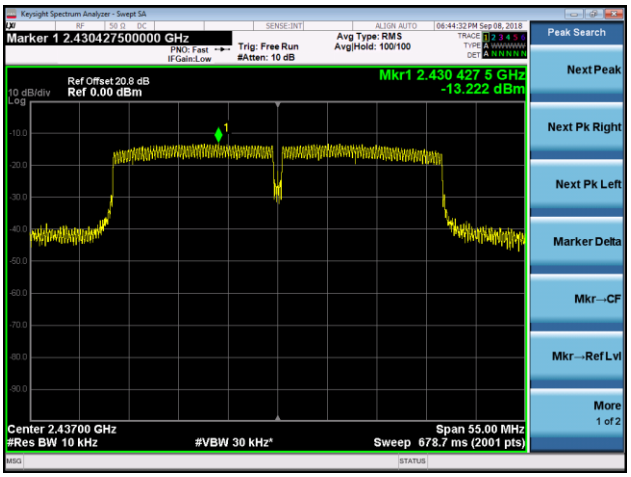
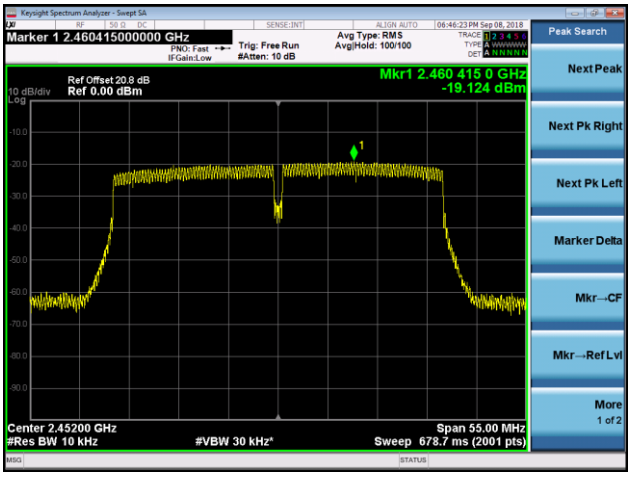
| 802.11n-HT20 PSD - Ant 0 / Ant 0 + 1 (CDD Mode) | |
|---|---|
| Channel 01 (2412MHz) | Channel 06 (2437MHz) |
|  |  |
| Channel 11 (2462MHz) | |
|  | |

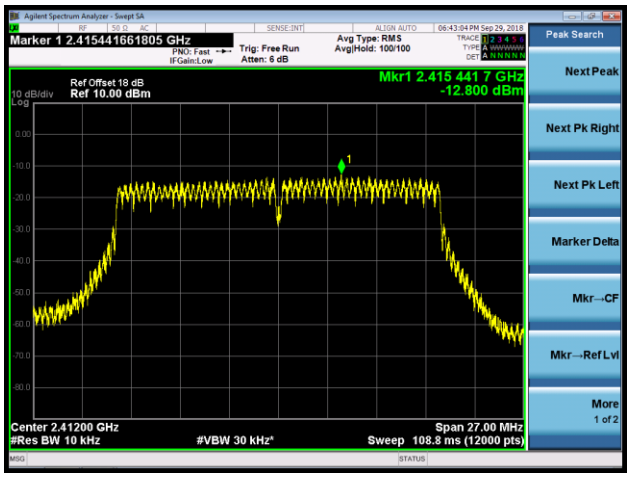
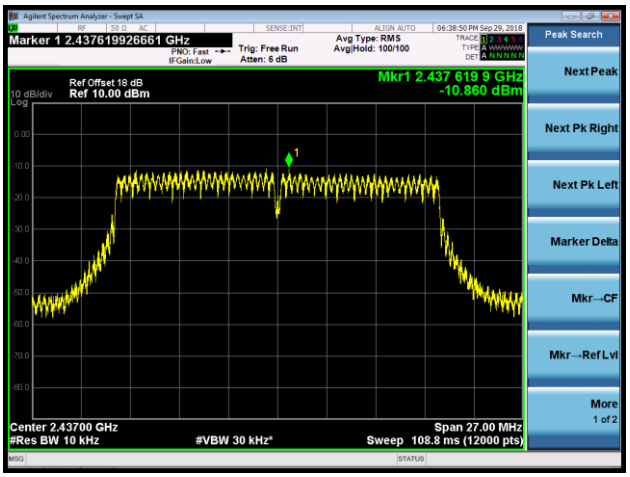
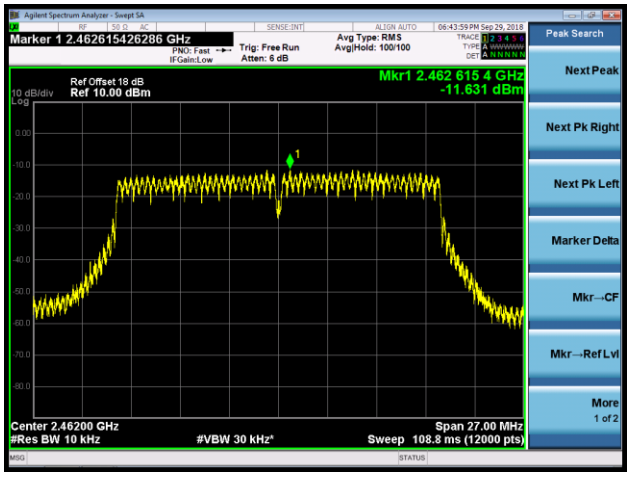
| 802.11n-HT40 PSD - Ant 0 / Ant 0 + 1 (CDD Mode) | |
|---|---|
| Channel 03 (2422MHz) | Channel 06 (2437MHz) |
|  |  |
| Channel 09 (2452MHz) | |
|  | |

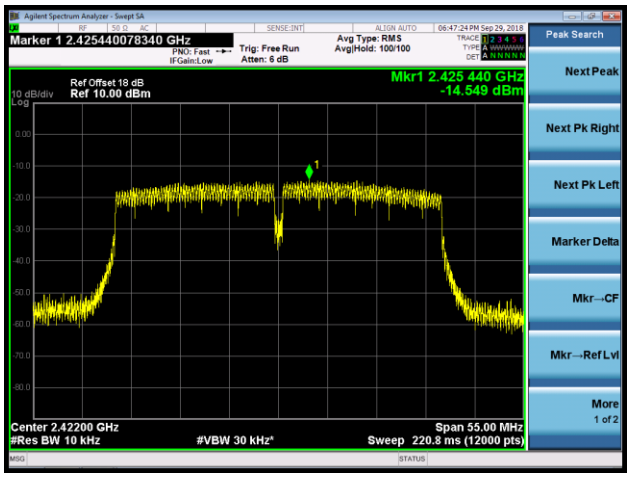
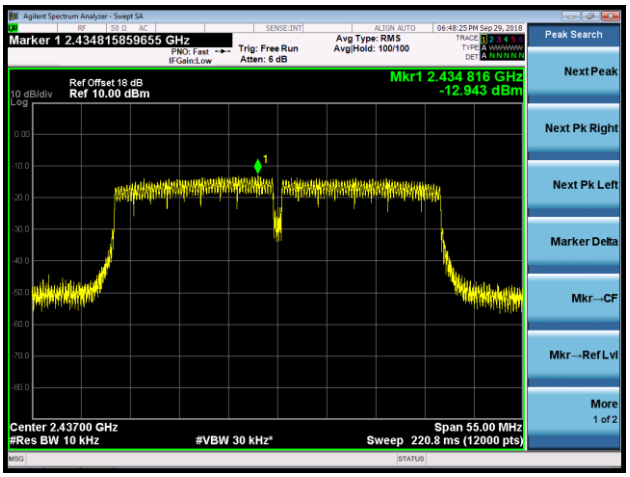
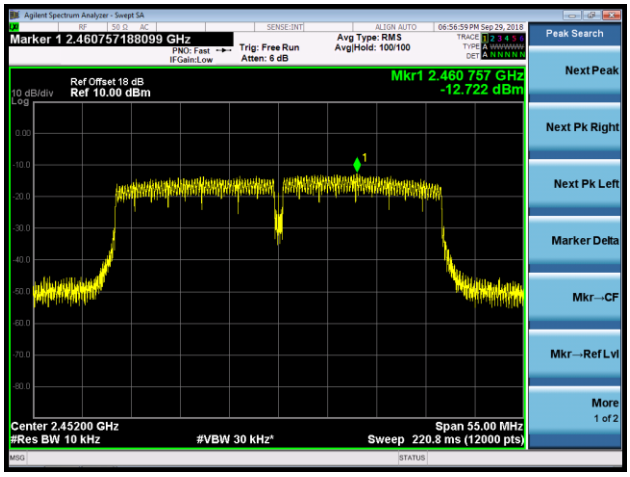
| 802.11b PSD - Ant 1 (SISO Mode) | |
|---|---|
| Channel 01 (2412MHz) | Channel 06 (2437MHz) |
|  |  |
| Channel 11 (2462MHz) | |
|  | |

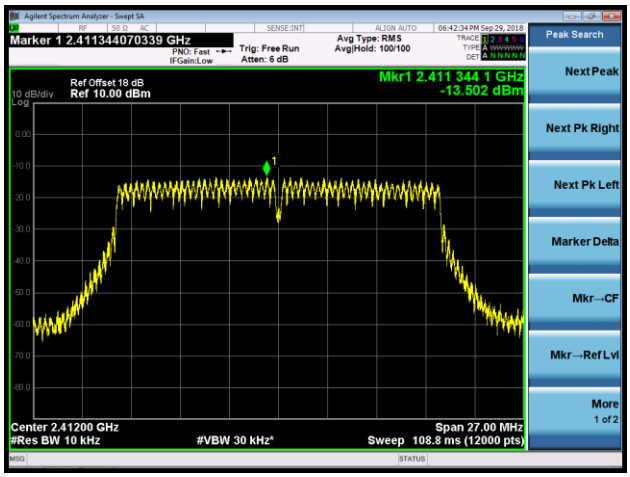
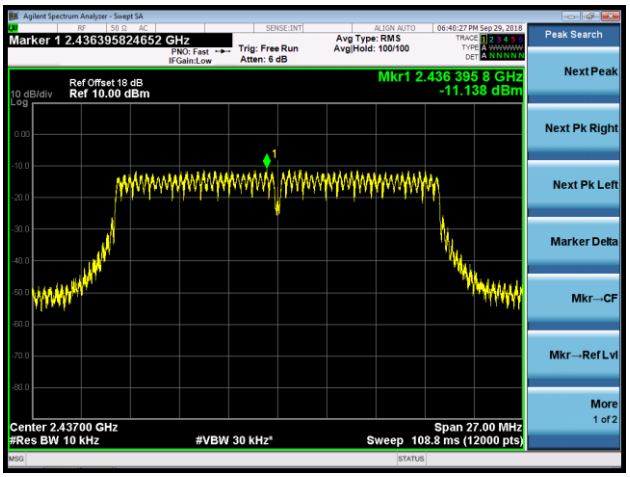
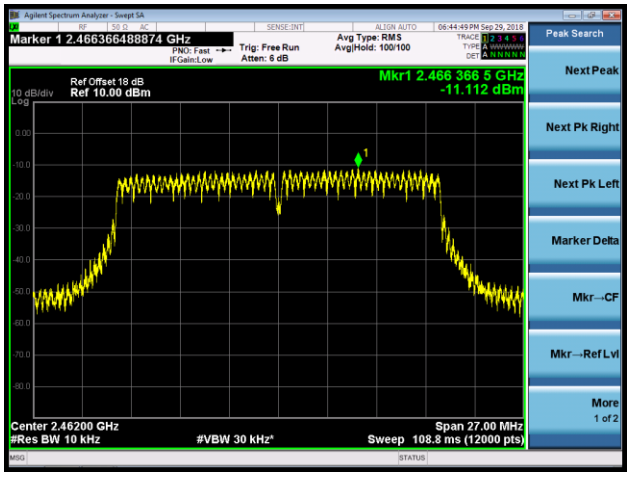
| 802.11g PSD - Ant 1 / Ant 0 + 1 (CDD Mode) | |
|---|---|
| Channel 01 (2412MHz) | Channel 06 (2437MHz) |
|  |  |
| Channel 11 (2462MHz) | |
|  | |

| 802.11n-HT20 PSD - Ant 1 / Ant 0 + 1 (CDD Mode) | |
|---|---|
| Channel 01 (2412MHz) | Channel 06 (2437MHz) |
|  |  |
| Channel 11 (2462MHz) | |
|  | |

| 802.11n-HT40 PSD - Ant 1 / Ant 0 + 1 (CDD Mode) | |
|---|---|
| Channel 03 (2422MHz) | Channel 06 (2437MHz) |
|  |  |
| Channel 09 (2452MHz) | |
|  | |

| 802.11n-HT20 AVGPSD - Ant 0 / Ant 0 + 1 (Beam-Forming Mode) | |
|---|---|
| Channel 01 (2412MHz) | Channel 06 (2437MHz) |
|  |  |
| Channel 11 (2462MHz) | |
|  | |

| 802.11n-HT40 AVGPSD - Ant 0 / Ant 0 + 1 (Beam-Forming Mode) | |
|---|---|
| Channel 03 (2422MHz) | Channel 06 (2437MHz) |
|  |  |
| Channel 09 (2452MHz) | |
|  | |

| 802.11n-HT20 AVGPSD - Ant 1 / Ant 0 + 1 (Beam-Forming Mode) | |
|---|---|
| Channel 01 (2412MHz) | Channel 06 (2437MHz) |
|  |  |
| Channel 11 (2462MHz) | |
|  | |