# MEASUREMENT REPORT

## FCC PART 15C / RSS-247 WLAN 802.11b/g/n

| | |
|---|---|
| **FCC ID:** | HD5-CT40L0N |
| **IC:** | 1693B-CT40L0N |
| **APPLICANT:** | Honeywell International Inc<br>Honeywell Safety and Productivity Solutions |
| **Application Type:** | Certification |
| **Product:** | DOLPHIN CT40 |
| **Model No.:** | CT40-L0N |
| **Brand Name:** | Honeywell |
| **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 D01v04 |
| **Test Date:** | April 18 ~ June 14, 2018 |

Reviewed By : Jame Yuan
( Jame Yuan )

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 KDB 558074 D01v04. Test results reported herein relate only to the item(s) tested.

# Revision History

| Report No. | Version | Description | Issue Date | Note |
|---|---|---|---|---|
| 1804RSU010-U1 | Rev. 01 | Initial report | 06-15-2018 | Valid |
| | | | | |

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## §2.1033 General Information

| | |
|---|---|
| **Applicant:** | Honeywell International Inc<br>Honeywell Safety and Productivity Solutions |
| **Applicant Address:** | 9680 Old Bailes Road, Fort Mill, SC 29707 United States |
| **Manufacturer:** | Honeywell International Inc<br>Honeywell Safety and Productivity Solutions |
| **Manufacturer Address:** | 9680 Old Bailes Road, Fort Mill, SC 29707 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 |
| **MRT FCC Registration No.:** | 893164 |
| **MRT 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 Section 2.948 of the FCC Rules.**
- **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 and Radio testing for FCC, Industry Canada, EU and TELEC Rules.**

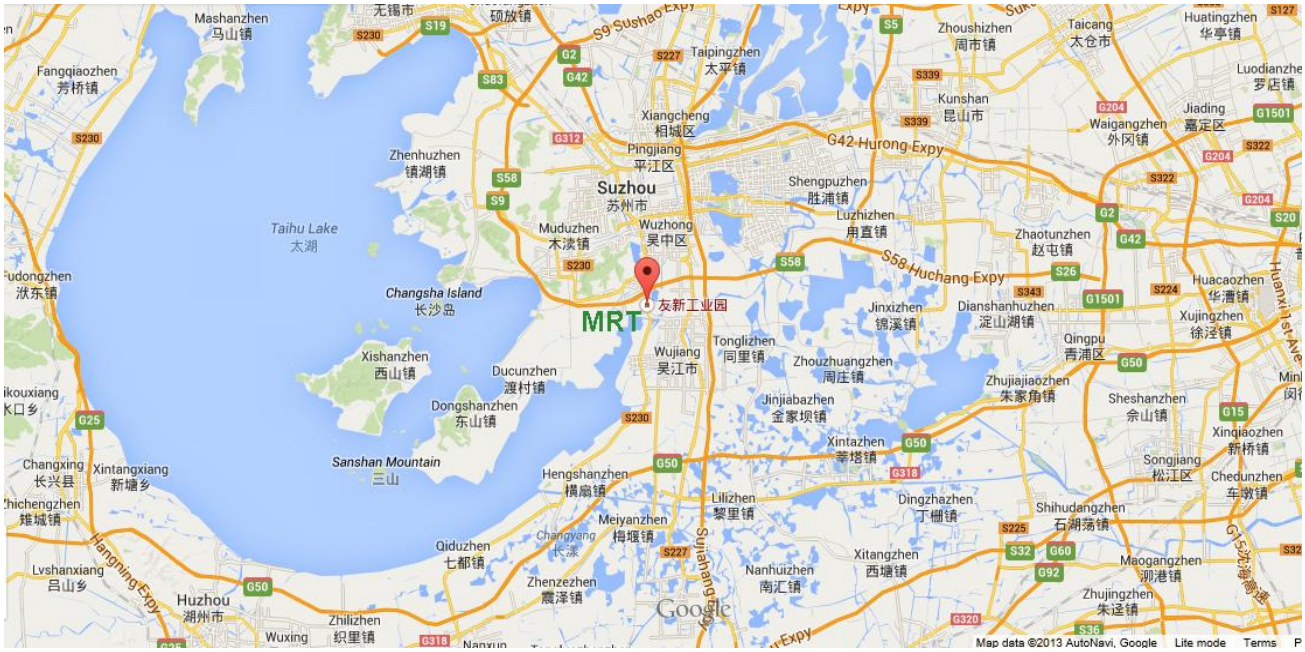
# 1. INTRODUCTION

## 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 detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4-2009 on September 30, 2013.



# 2. PRODUCT INFORMATION

## 2.1. Equipment Description

| | |
|---|---|
| Product Name: | DOLPHIN CT40 |
| Model No.: | CT40-L0N |
| Brand Name: | Honeywell |
| Hardware Version: | 1.0 |
| Software Version: | OS.01.008 |
| Wi-Fi Specification: | 802.11a/b/g/n/ac |
| Bluetooth Version: | v5.0 dual mode |
| **Accessories** | |
| USB Adapter: | Model No.: ADS-12B-06 05010E<br>Input Power: 100 - 240V ~ 50/60Hz, Max. 0.3A<br>Output Power: 5VDC 2.0A |
| Snap-on Adapter: | Model No.: CT40-SN |
| Battery: | Model No.: CT50-BTSC<br>Capacitance: 15.5Wh, 4090mAh<br>Rated Voltage: 3.8V<br>Limit Charge Voltage: 4.36V |

## 2.2. Product Specification Subjective to this Report

| | |
|---|---|
| Frequency Range: | 802.11b/g/n-HT20: 2412 ~ 2462MHz |
| Channel Number: | 802.11b/g/n-HT20: 11 |
| 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 72.2Mbps |
| Maximum Peak Output Power: | 802.11b: 18.25dBm<br>802.11g: 22.07dBm<br>802.11n-HT20: 21.26dBm |
| Antenna Type: | FPC Antenna |
| Antenna Gain: | 2.20dBi for 2.4GHz Band,<br>3.39dBi for 5GHz Band |

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

## 2.3. Working Frequencies for 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 | -- | -- |

## 2.4. Test Mode

| | |
|---|---|
| Test Mode | Mode 1: Transmit by 802.11b |
| | Mode 2: Transmit by 802.11g |
| | Mode 3: Transmit by 802.11n-HT20 |

## 2.5. Description of Test Software

The test utility software used during testing was “QRCT”, and the version was 3.0.268.0.

Power Parameter Value

| Test Mode | Test Channel No. | Test Frequency (MHz) | Power Parameter Value |
|---|---|---|---|
| 802.11b | 01 | 2412 | 13.0 |
| | 06 | 2437 | 13.5 |
| | 11 | 2462 | 12.5 |
| 802.11g | 01 | 2412 | 12.5 |
| | 06 | 2437 | 12.5 |
| | 11 | 2462 | 12.5 |
| 802.11n-HT20 | 01 | 2412 | 11.5 |
| | 06 | 2437 | 11.5 |
| | 11 | 2462 | 11.5 |

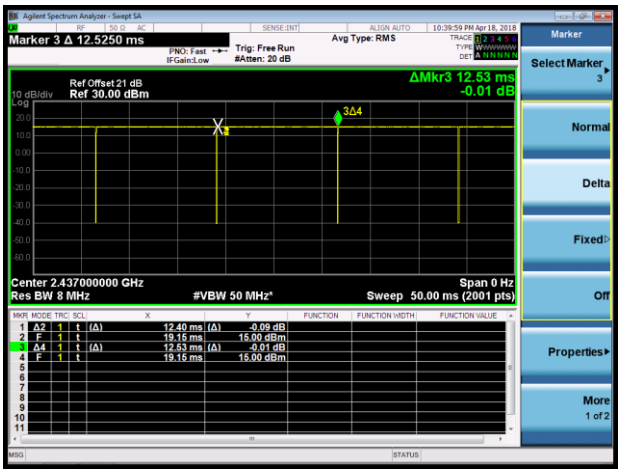
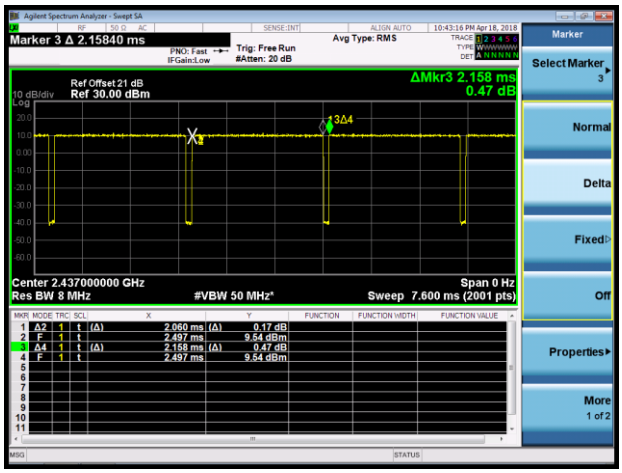
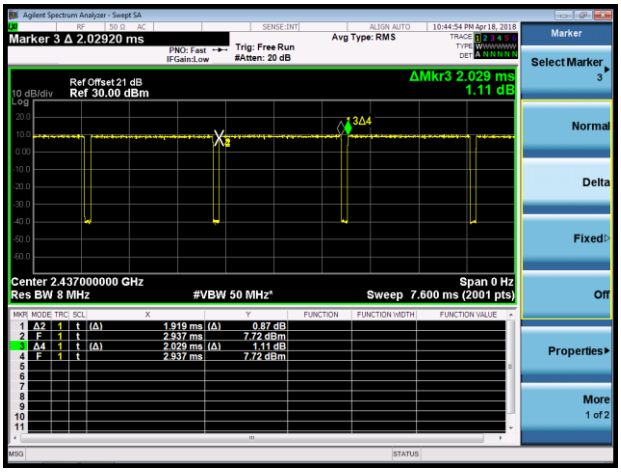
## 2.6. Device Capabilities

This device contains the following capabilities:

2.4GHz WLAN (DTS), 5GHz WLAN (UNII) and Bluetooth (v5.0 dual mode), NFC

**Note:** 2.4GHz WLAN (DTS) operation is possible in 20MHz 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. 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 | 98.96% |
| 802.11g | 95.46% |
| 802.11n-HT20 | 94.58% |

| Duty Cycle (T = Transmission Duration) | |
|---|---|
| 802.11b (T = 12.40ms) | 802.11g (T = 2.060ms) |
|  |  |
| 802.11n-HT20 (T = 1.919ms) | |
|  | |

## 2.7. Test Configuration

The **DOLPHIN CT40** was tested per the guidance of KDB 558074 D01v04. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

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

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

## 2.9. 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 D01v04 were used in the measurement of the **DOLPHIN CT40.**

**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 which 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, which 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 **DOLPHIN CT40** is **permanently attached.**
- There are no provisions for connection to an external antenna.

**Conclusion:**

The **DOLPHIN CT40** 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 | ESR7 | MRTSUE06001 | 1 year | 2018/08/18 |
| Two-Line V-Network | R&S | ENV 216 | MRTSUE06002 | 1 year | 2018/06/21 |
| Two-Line V-Network | R&S | ENV 216 | MRTSUE06003 | 1 year | 2018/06/21 |
| Thermohygrometer | Testo | 608-H1 | MRTSUE06404 | 1 year | 2018/08/14 |

Radiated Emissions - AC1

| Instrument | Manufacturer | Type No. | Asset No. | Cali. Interval | Cali. Due Date |
|---|---|---|---|---|---|
| MXE EMI Receiver | Agilent | N9038A | MRTSUE06125 | 1 year | 2018/08/18 |
| Microwave System Amplifier | Agilent | 83017A | MRTSUE06076 | 1 year | 2018/11/17 |
| Loop Antenna | Schwarzbeck | FMZB 1519 | MRTSUE06025 | 1 year | 2018/11/20 |
| Bilog Period Antenna | Schwarzbeck | VULB 9168 | MRTSUE06172 | 1 year | 2018/11/18 |
| Broad Band Horn Antenna | Schwarzbeck | BBHA9120D | MRTSUE06023 | 1 year | 2018/10/21 |
| Broad Band Horn Antenna | Schwarzbeck | BBHA 9170 | MRTSUE06024 | 1 year | 2018/12/14 |
| Broadband Coaxial Preamplifier | Schwarzbeck | BBV 9718 | MRTSUE06176 | 1 year | 2018/11/17 |
| Thermohygrometer | Testo | 608-H1 | MRTSUE06403 | 1 year | 2018/08/14 |
| Anechoic Chamber | TDK | Chamber-AC1 | MRTSUE06212 | 1 year | 2018/05/02 |
| | | | | 1 year | 2019/05/02 |

Conducted Test Equipment - TR3

| Instrument | Manufacturer | Type No. | Asset No. | Cali. Interval | Cali. Due Date |
|---|---|---|---|---|---|
| Power Meter | Agilent | U2021XA | MRTSUE06030 | 1 year | 2018/12/06 |
| Programmable Temperature & Humidity Chamber | BAOYT | BYH-1500L | MRTSUE06051 | 1 year | 2018/12/06 |
| Spectrum Analyzer | Agilent | N9020A | MRTSUE06106 | 1 year | 2018/04/20 |
| | | | | 1 year | 2019/04/20 |
| Thermohygrometer | Testo | 608-H1 | MRTSUE06401 | 1 year | 2018/08/14 |

| **Software** | **Version** | **Function** |
|---|---|---|
| EMI Software | V3 | 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:** **DOLPHIN CT40**

**FCC ID:** **HD5-CT40L0N**

| FCC Part Section(s) | RSS 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(d)] | Output Power | ≤ 1Watt & EIRP ≤ 4Watt | | 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 | ≥ 20dBc(Peak) | | 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.

## 7.2. 6dB Bandwidth Measurement

### 7.2.1.Test Limit

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

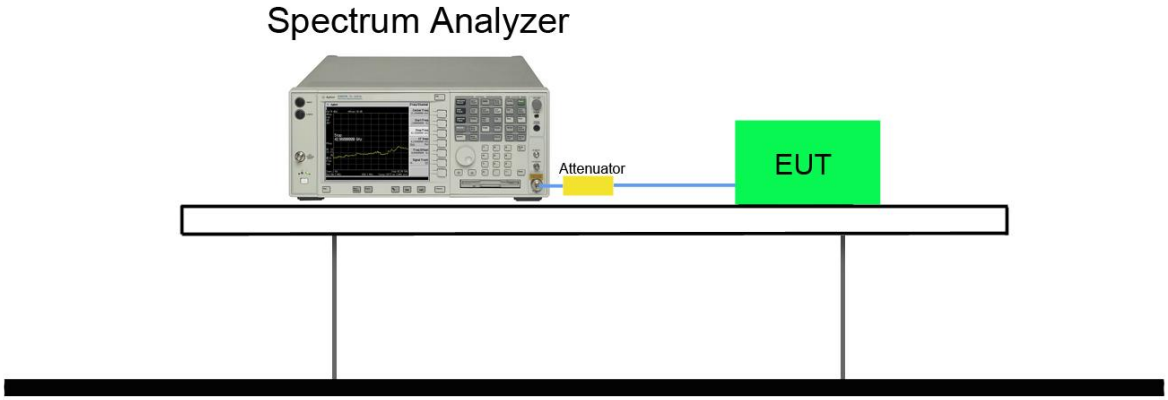
### 7.2.2.Test Procedure used

KDB 558074 D01v04 - Section 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

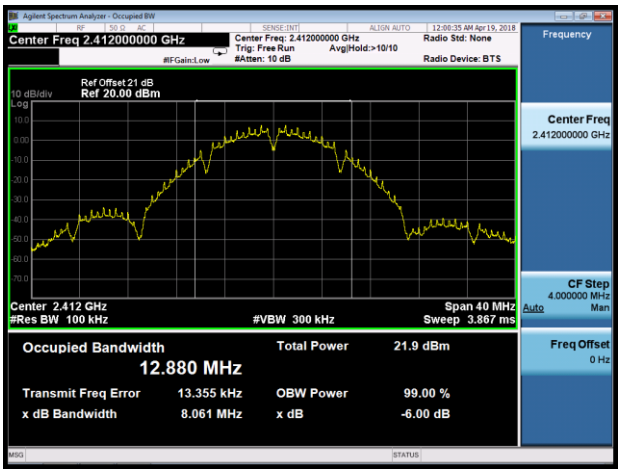
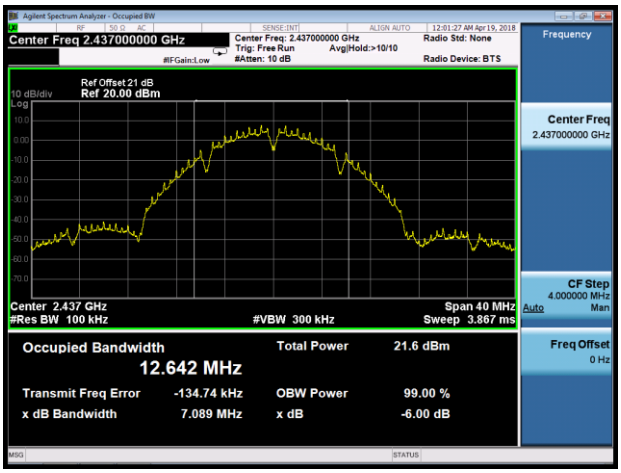
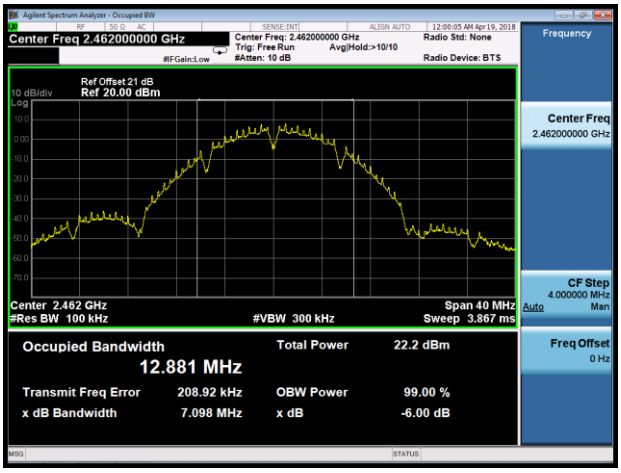
### 7.2.4.Test Setup

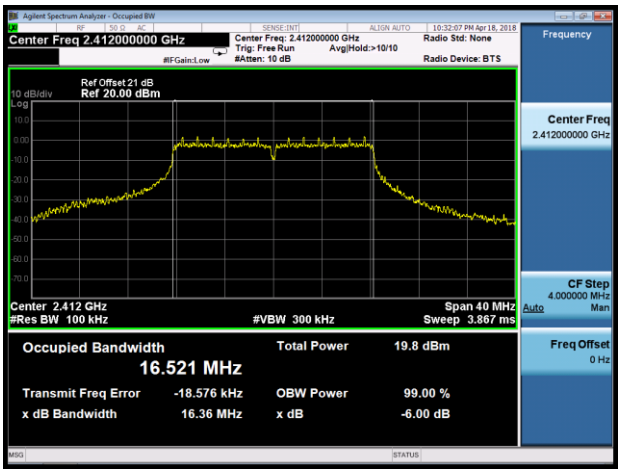
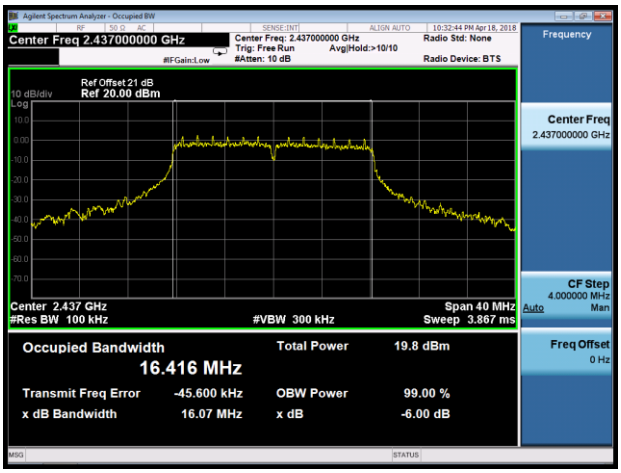
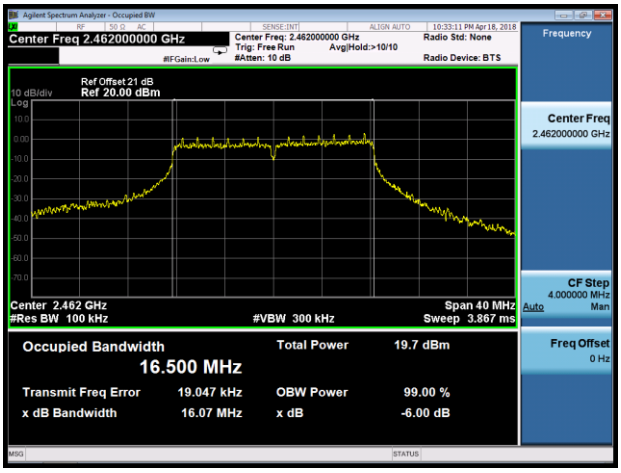


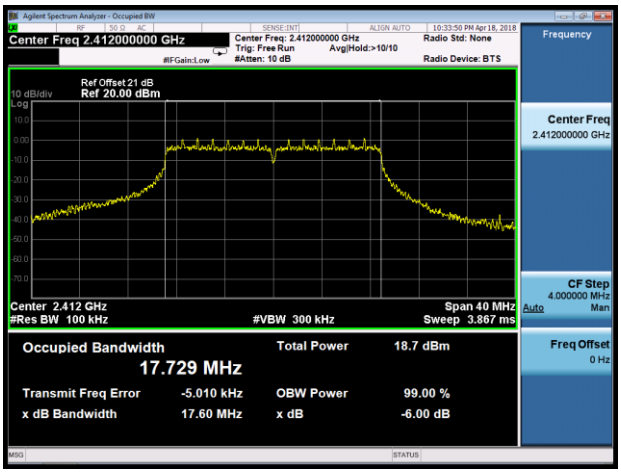
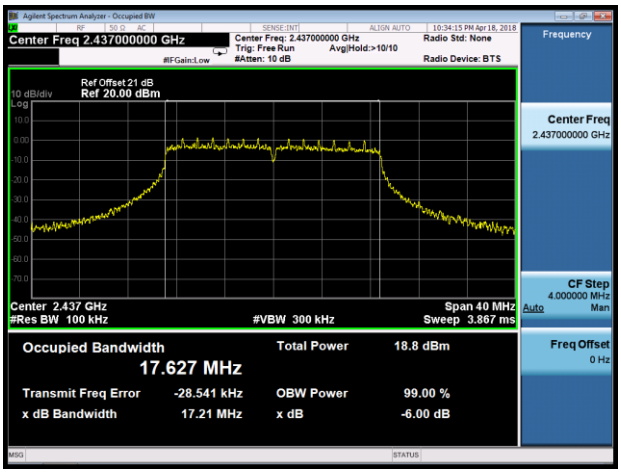
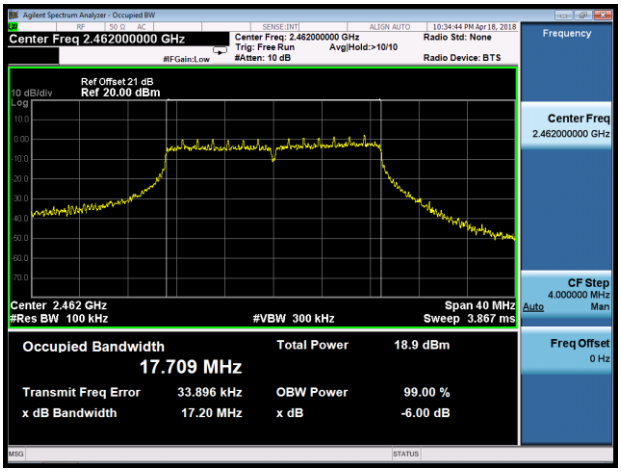
### 7.2.5.Test Result

| Product | DOLPHIN CT40 | Temperature | 25°C |
|---|---|---|---|
| Test Engineer | Cat Hu | Relative Humidity | 52% |
| Test Site | TR3 | Test Date | 2018/04/19 |

| Test Mode | Data Rate / MCS | Channel No. | Frequency (MHz) | 6dB Bandwidth (MHz) | Limit (MHz) | 99% Bandwidth (MHz) | Result |
|---|---|---|---|---|---|---|---|
| 802.11b | 1Mbps | 01 | 2412 | 8.06 | ≥ 0.5 | 12.88 | Pass |
| 802.11b | 1Mbps | 06 | 2437 | 7.09 | ≥ 0.5 | 12.64 | Pass |
| 802.11b | 1Mbps | 11 | 2462 | 7.10 | ≥ 0.5 | 12.88 | Pass |
| 802.11g | 6Mbps | 01 | 2412 | 16.36 | ≥ 0.5 | 16.52 | Pass |
| 802.11g | 6Mbps | 06 | 2437 | 16.07 | ≥ 0.5 | 16.42 | Pass |
| 802.11g | 6Mbps | 11 | 2462 | 16.07 | ≥ 0.5 | 16.50 | Pass |
| 802.11n-HT20 | MCS0 | 01 | 2412 | 17.60 | ≥ 0.5 | 17.73 | Pass |
| 802.11n-HT20 | MCS0 | 06 | 2437 | 17.21 | ≥ 0.5 | 17.63 | Pass |
| 802.11n-HT20 | MCS0 | 11 | 2462 | 17.20 | ≥ 0.5 | 17.71 | Pass |

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

| 802.11g 6dB Bandwidth | |
|---|---|
| **Channel 01 (2412MHz)** | **Channel 06 (2437MHz)** |
|  |  |
| **Channel 11 (2462MHz)** | |
|  | |

| 802.11n-HT20 6dB Bandwidth | |
|---|---|
| **Channel 01 (2412MHz)** | **Channel 06 (2437MHz)** |
|  |  |
| **Channel 11 (2462MHz)** | |
|  | |

## 7.3. Output Power Measurement

### 7.3.1.Test Limit

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

### 7.3.2.Test Procedure Used

KDB 558074 D01v04 - Section 9.1.3 PKPM1 Peak-reading power meter method

KDB 558074 D01v04 - Section 9.2.3.2 Method AVGPM-G

### 7.3.3.Test Setting

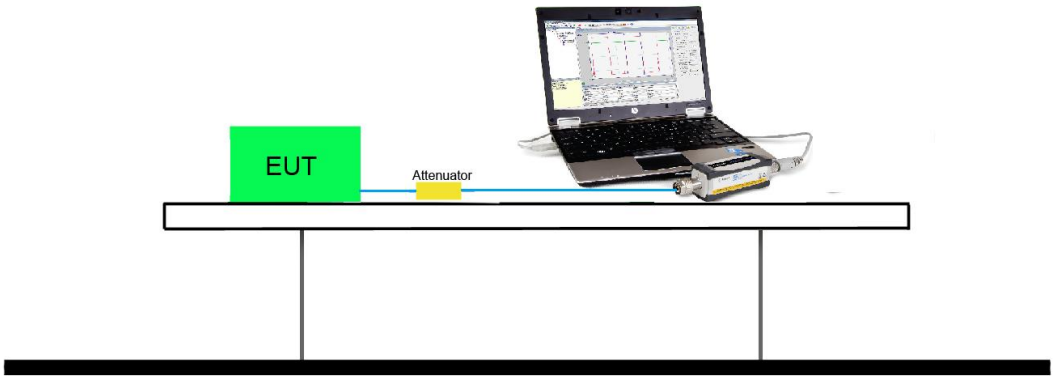
**Method PKPM1 (Peak Power Measurement)**

Peak power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The pulse sensor employs a VBW = 50MHz so this method was only used for signals whose DTS bandwidth was less than or equal to 50MHz.

**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.

| Test Mode | Bandwidth (MHz) | Channel No. | Frequency (MHz) | Data Rate / MCS | Average Power (dBm) |
|---|---|---|---|---|---|
| 802.11b | 20 | 6 | 2437 | 1Mbps | 14.22 |
| | | | | 5.5Mbps | 14.04 |
| | | | | 11Mbps | 13.86 |
| 802.11g | 20 | 6 | 2437 | 6Mbps | 13.15 |
| | | | | 24Mbps | 13.07 |
| | | | | 54Mbps | 12.83 |
| 802.11n | 20 | 6 | 2437 | MCS0 | 12.23 |
| | | | | MCS3 | 12.07 |
| | | | | MCS7 | 11.86 |

| Product | DOLPHIN CT40 | Temperature | 25°C |
|---|---|---|---|
| Test Engineer | Cat Hu | Relative Humidity | 52% |
| Test Site | TR3 | Test Date | 2018/04/18 |

**Test Result of Peak Output Power**

| Test Mode | Data Rate / MCS | Channel No. | Freq. (MHz) | Peak Power (dBm) | Limit (dBm) | E.I.R.P (dBm) | E.I.R.P Limit (dBm) | Result |
|---|---|---|---|---|---|---|---|---|
| 11b | 1Mbps | 01 | 2412 | 18.12 | ≤ 30.00 | 20.32 | ≤ 36.00 | Pass |
| 11b | 1Mbps | 06 | 2437 | 17.74 | ≤ 30.00 | 19.94 | ≤ 36.00 | Pass |
| 11b | 1Mbps | 11 | 2462 | 18.25 | ≤ 30.00 | 20.45 | ≤ 36.00 | Pass |
| 11g | 6Mbps | 01 | 2412 | 22.07 | ≤ 30.00 | 24.27 | ≤ 36.00 | Pass |
| 11g | 6Mbps | 06 | 2437 | 21.47 | ≤ 30.00 | 23.67 | ≤ 36.00 | Pass |
| 11g | 6Mbps | 11 | 2462 | 22.01 | ≤ 30.00 | 24.21 | ≤ 36.00 | Pass |
| 11n-HT20 | MCS0 | 01 | 2412 | 20.25 | ≤ 30.00 | 22.45 | ≤ 36.00 | Pass |
| 11n-HT20 | MCS0 | 06 | 2437 | 20.31 | ≤ 30.00 | 22.51 | ≤ 36.00 | Pass |
| 11n-HT20 | MCS0 | 11 | 2462 | 21.26 | ≤ 30.00 | 23.46 | ≤ 36.00 | Pass |

**Test Result of Average Output Power (Reporting Only)**

| Test Mode | Data Rate / MCS | Channel No. | Freq. (MHz) | Average Power (dBm) | Limit (dBm) | E.I.R.P (dBm) | E.I.R.P Limit (dBm) | Result |
|---|---|---|---|---|---|---|---|---|
| 11b | 1Mbps | 01 | 2412 | 13.53 | ≤ 30.00 | 15.73 | ≤ 36.00 | Pass |
| 11b | 1Mbps | 06 | 2437 | 14.22 | ≤ 30.00 | 16.42 | ≤ 36.00 | Pass |
| 11b | 1Mbps | 11 | 2462 | 13.16 | ≤ 30.00 | 15.36 | ≤ 36.00 | Pass |
| 11g | 6Mbps | 01 | 2412 | 13.06 | ≤ 30.00 | 15.26 | ≤ 36.00 | Pass |
| 11g | 6Mbps | 06 | 2437 | 13.15 | ≤ 30.00 | 15.35 | ≤ 36.00 | Pass |
| 11g | 6Mbps | 11 | 2462 | 13.13 | ≤ 30.00 | 15.33 | ≤ 36.00 | Pass |
| 11n-HT20 | MCS0 | 01 | 2412 | 12.15 | ≤ 30.00 | 14.35 | ≤ 36.00 | Pass |
| 11n-HT20 | MCS0 | 06 | 2437 | 12.23 | ≤ 30.00 | 14.43 | ≤ 36.00 | Pass |
| 11n-HT20 | MCS0 | 11 | 2462 | 12.19 | ≤ 30.00 | 14.39 | ≤ 36.00 | Pass |

## 7.4. Power Spectral Density Measurement

### 7.4.1.Test Limit

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

The same method of determining the conducted output power shall be used to determine the power spectral density.

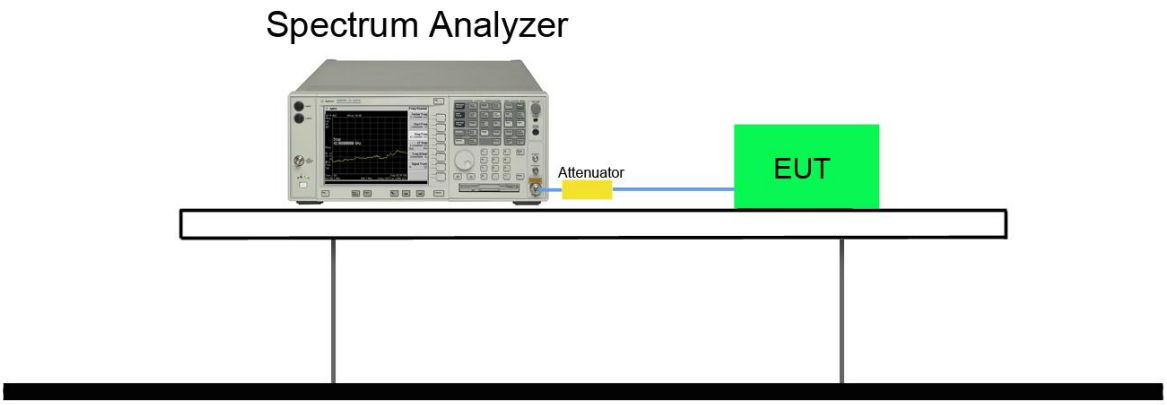
### 7.4.2.Test Procedure Used

KDB 558074 D01v04 - Section 10.2 Method PKPSD

### 7.4.3.Test Setting

1. Analyzer was set to the center frequency of the DTS channel under investigation
2. Span = 1.5 times the DTS channel bandwidth
3. RBW = 3kHz
4. VBW = 10kHz
5. Detector = peak
6. Sweep time = auto couple
7. Trace mode = max hold
8. Trace was allowed to stabilize

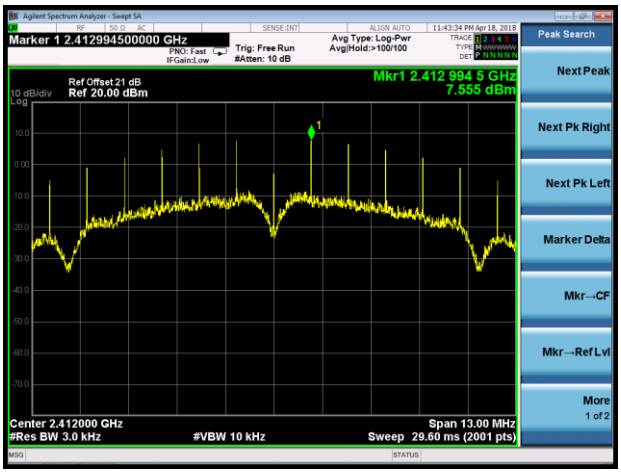
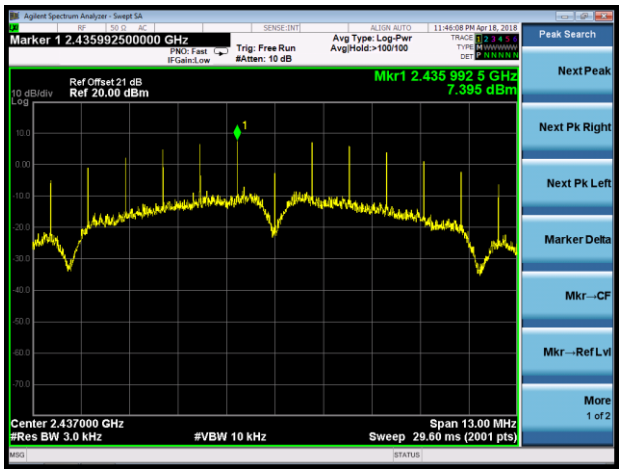
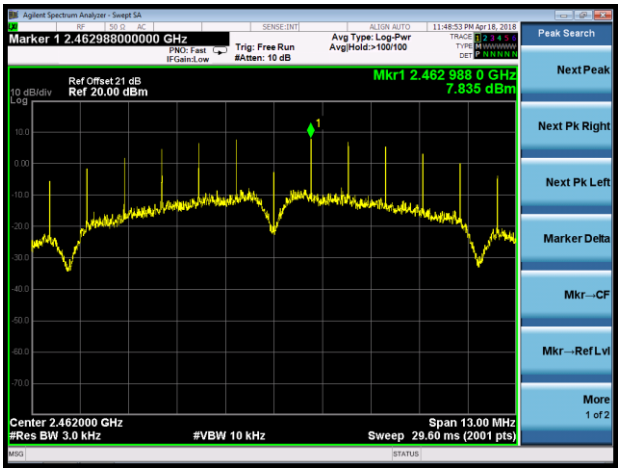
### 7.4.4.Test Setup

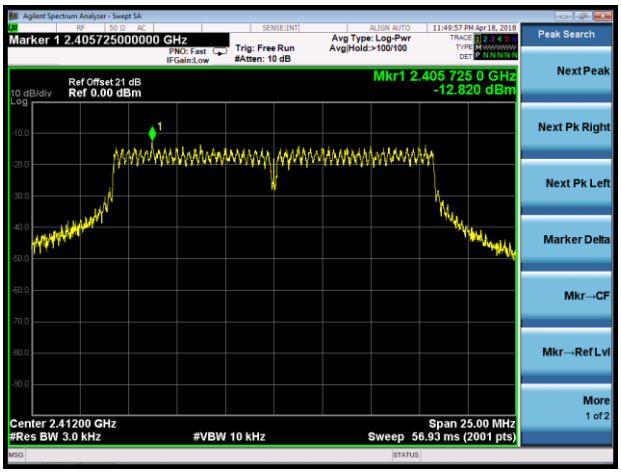
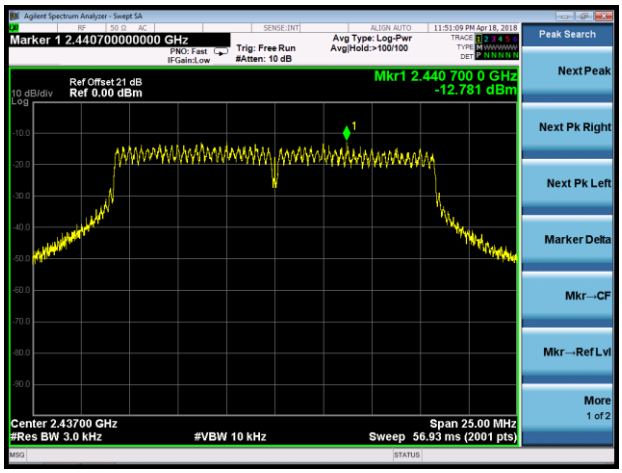
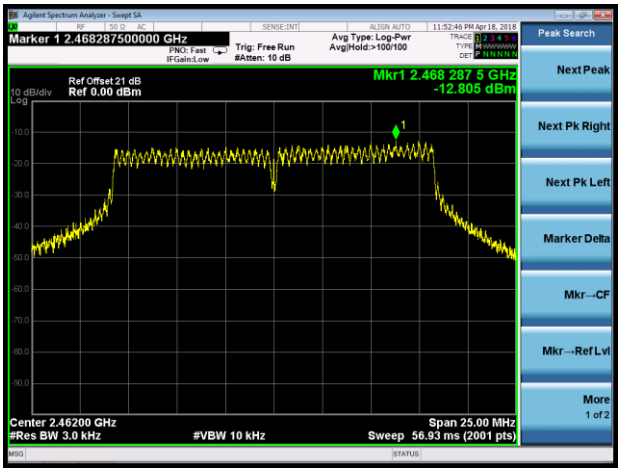


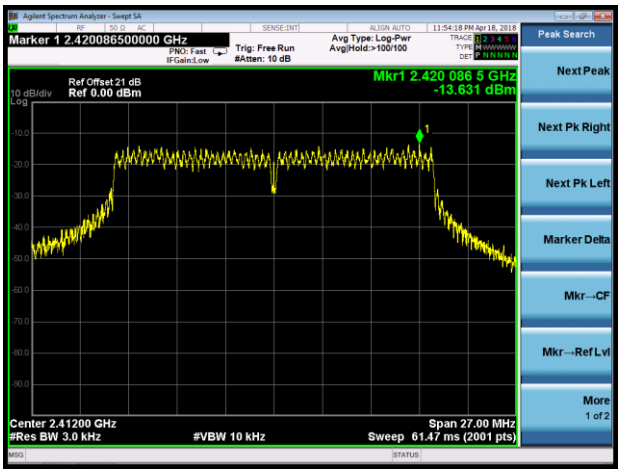
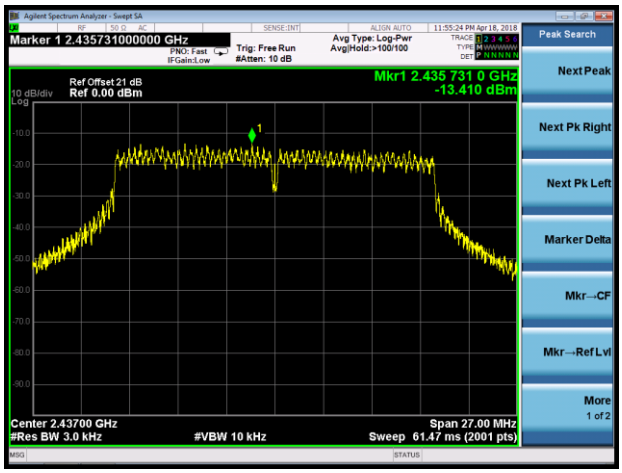
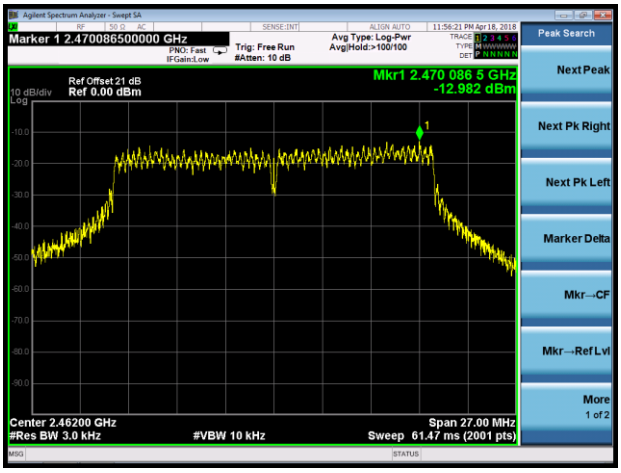
### 7.4.5.Test Result

| Product | DOLPHIN CT40 | Temperature | 25°C |
|---|---|---|---|
| Test Engineer | Cat Hu | Relative Humidity | 52% |
| Test Site | TR3 | Test Date | 2018/04/18 |

| Test Mode | Data Rate / MCS | Channel No. | Freq. (MHz) | PK PSD (dBm / 3kHz) | Limit (dBm / 3kHz) | Result |
|---|---|---|---|---|---|---|
| 11b | 1Mbps | 01 | 2412 | 7.56 | ≤ 8.00 | Pass |
| 11b | 1Mbps | 06 | 2437 | 7.40 | ≤ 8.00 | Pass |
| 11b | 1Mbps | 11 | 2462 | 7.84 | ≤ 8.00 | Pass |
| 11g | 6Mbps | 01 | 2412 | -12.82 | ≤ 8.00 | Pass |
| 11g | 6Mbps | 06 | 2437 | -12.78 | ≤ 8.00 | Pass |
| 11g | 6Mbps | 11 | 2462 | -12.81 | ≤ 8.00 | Pass |
| 11n-HT20 | MCS0 | 01 | 2412 | -13.63 | ≤ 8.00 | Pass |
| 11n-HT20 | MCS0 | 06 | 2437 | -13.41 | ≤ 8.00 | Pass |
| 11n-HT20 | MCS0 | 11 | 2462 | -12.98 | ≤ 8.00 | Pass |

| 802.11b PK PSD | |
|---|---|
| **Channel 01 (2412MHz)** | **Channel 06 (2437MHz)** |
|  |  |
| **Channel 11 (2462MHz)** | |
|  | |

| 802.11g AVGPSD - PK PSD | |
|---|---|
| **Channel 01 (2412MHz)** | **Channel 06 (2437MHz)** |
|  |  |
| **Channel 11 (2462MHz)** | |
|  | |

| 802.11n-HT20 - PK PSD | |
|---|---|
| **Channel 01 (2412MHz)** | **Channel 06 (2437MHz)** |
|  |  |
| **Channel 11 (2462MHz)** | |
|  | |

## 7.5. Conducted Band Edge and Out-of-Band Emissions

### 7.5.1.Test Limit

The limit for out-of-band spurious emissions at the band edge is 20dB below the fundamental emission level, as determined from the in-band power measurement of the DTS channel performed in a 100 kHz bandwidth per the PSD procedure.

### 7.5.2.Test Procedure Used

KDB 558074 D01v04 - Section 11.2 & Section 11.3

### 7.5.3.Test Settitng

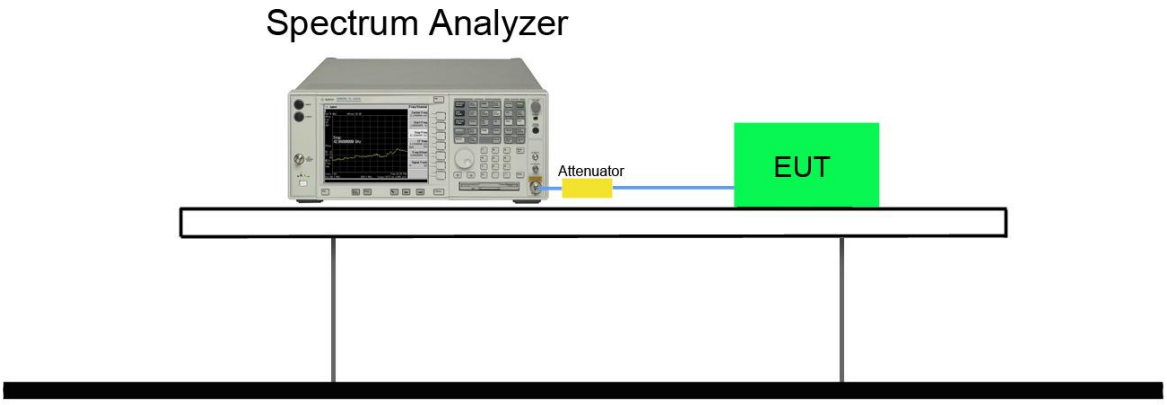
**Reference level measurement**

1. Set instrument center frequency to DTS channel center frequency
2. Set the span to ≥ 1.5 times the DTS bandwidth
3. Set the RBW = 100 kHz
4. Set the VBW ≥ 3 x RBW
5. Detector = peak
6. Sweep time = auto couple
7. Trace mode = max hold
8. Allow trace to fully stabilize

**Emission level measurement**

1. Set the center frequency and span to encompass frequency range to be measured
2. RBW = 100kHz
3. VBW = 300kHz
4. Detector = Peak
5. Trace mode = max hold
6. Sweep time = auto couple
7. The trace was allowed to stabilize

### 7.5.4.Test Setup



### 7.5.5.Test Result

| Product | DOLPHIN CT40 | Temperature | 25°C |
|---|---|---|---|
| Test Engineer | Hunk Li | Relative Humidity | 52% |
| Test Site | TR3 | Test Date | 2018/04/19 |

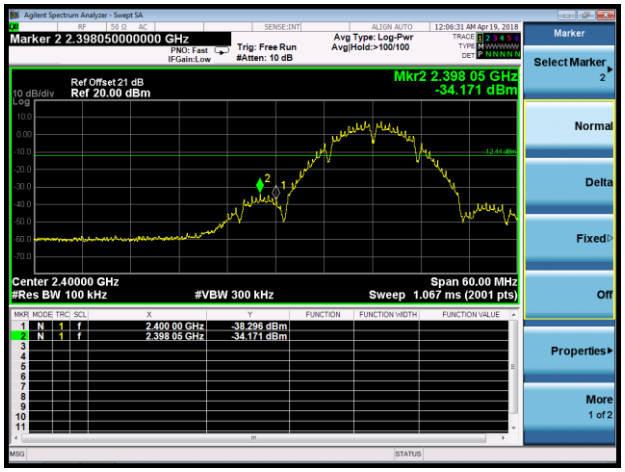
| Test Mode | Data Rate / MCS | Channel No. | Frequency (MHz) | Limit | Result |
|---|---|---|---|---|---|
| 802.11b | 1Mbps | 01 | 2412 | 20dBc | Pass |
| 802.11b | 1Mbps | 06 | 2437 | 20dBc | Pass |
| 802.11b | 1Mbps | 11 | 2462 | 20dBc | Pass |
| 802.11g | 6Mbps | 01 | 2412 | 20dBc | Pass |
| 802.11g | 6Mbps | 06 | 2437 | 20dBc | Pass |
| 802.11g | 6Mbps | 11 | 2462 | 20dBc | Pass |
| 802.11n-HT20 | MCS0 | 01 | 2412 | 20dBc | Pass |
| 802.11n-HT20 | MCS0 | 06 | 2437 | 20dBc | Pass |
| 802.11n-HT20 | MCS0 | 11 | 2462 | 20dBc | Pass |

## 802.11b Out-of-Band Emissions

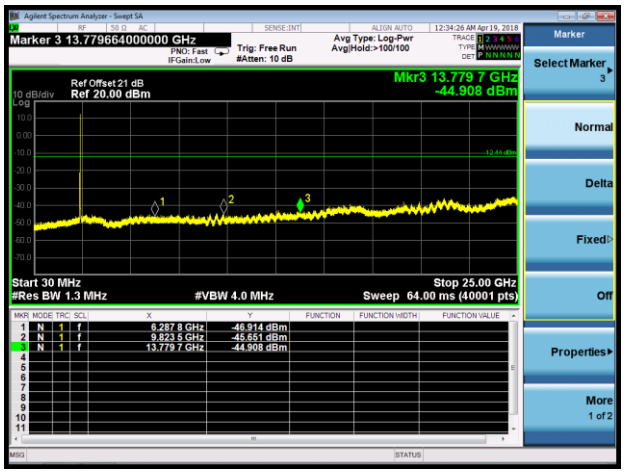
### Channel 01 (2412MHz)

#### 100kHz PSD Reference Level


#### Low Band Edge




#### Spurious Emission

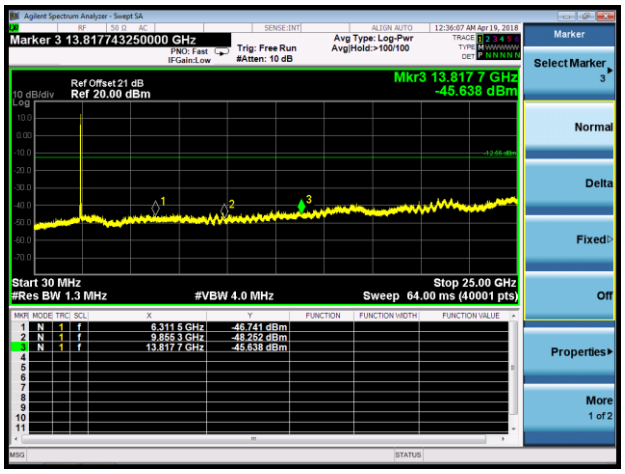



Note: The Value of the Display Line is -12.44dBm

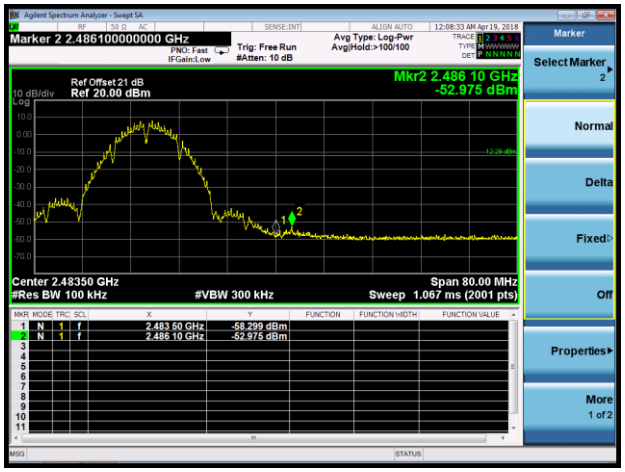
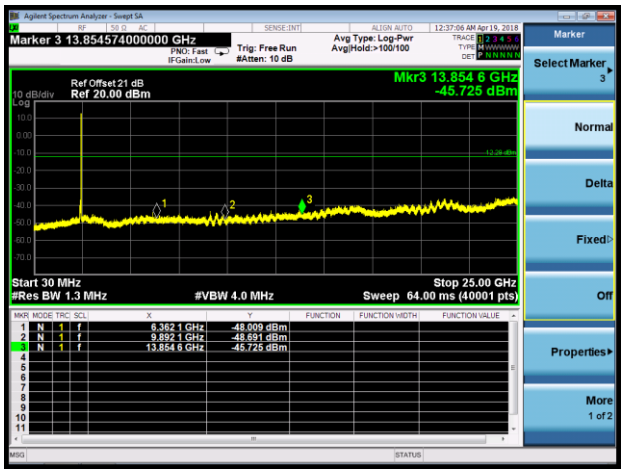
### Channel 06 (2437MHz)

#### 100kHz PSD Reference Level


#### Spurious Emission



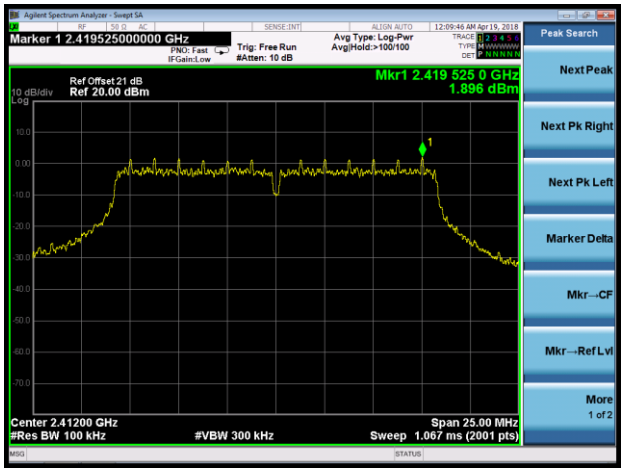

Note: The Value of the Display Line is -12.55dBm

| 802.11b Out-of-Band Emissions | |
|---|---|
| Channel 11 (2462MHz) | |
| 100kHz PSD Reference Level | High Band Edge |
|  |  |
| Spurious Emission | |
|  | Note: The Value of the Display Line is -12.29dBm |

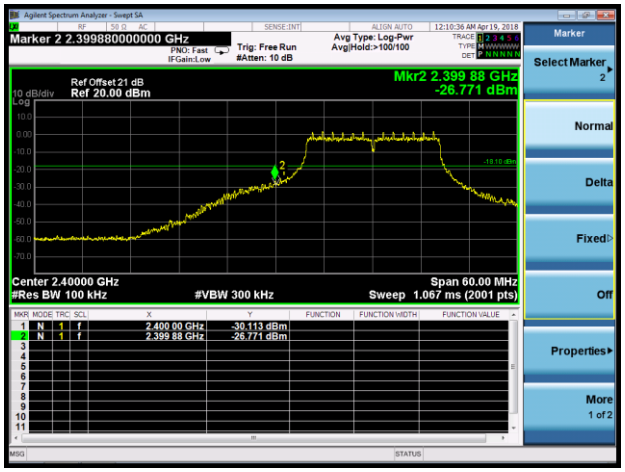
## 802.11g Out-of-Band Emissions

### Channel 01 (2412MHz)

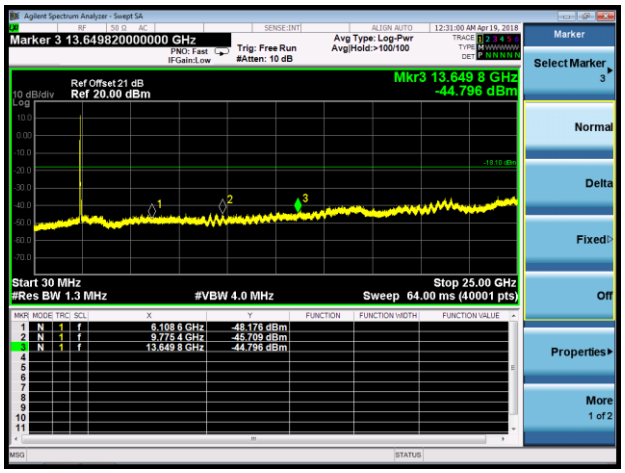
#### 100kHz PSD Reference Level




#### Low Band Edge



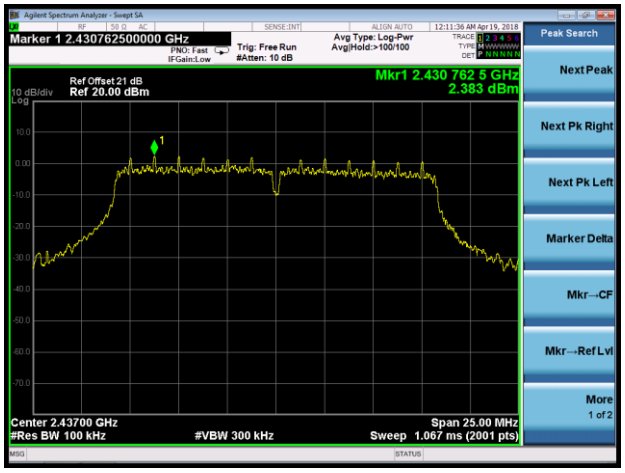

#### Spurious Emission



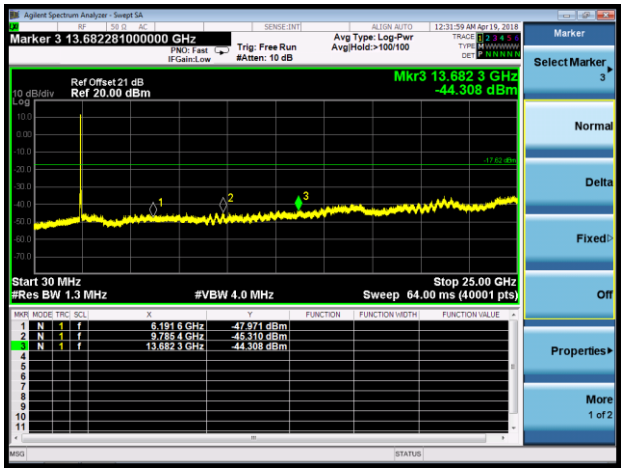

Note: The Value of the Display Line is -18.10dBm

### Channel 06 (2437MHz)

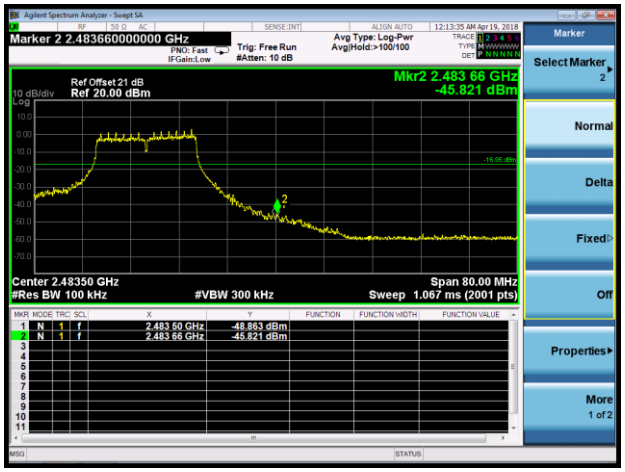
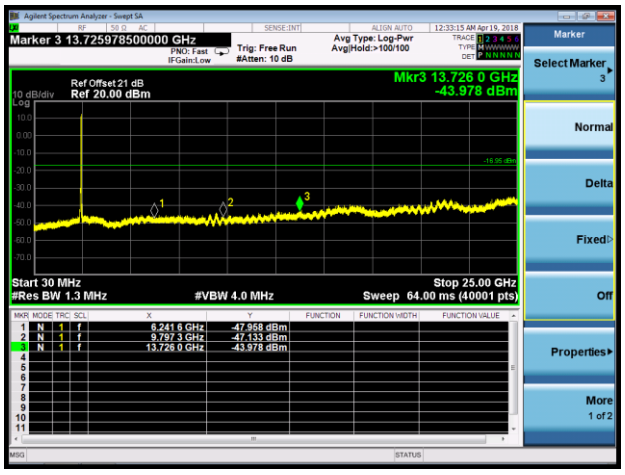
#### 100kHz PSD Reference Level




#### Spurious Emission




Note: The Value of the Display Line is -17.62dBm

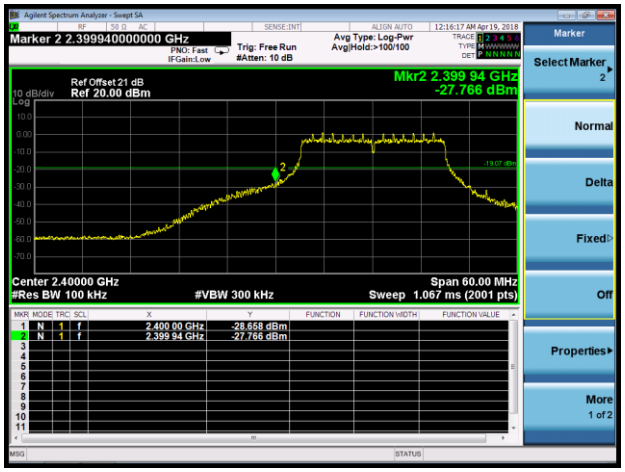
| 802.11g Out-of-Band Emissions | |
|---|---|
| Channel 11 (2462MHz) | |
| 100kHz PSD Reference Level | High Band Edge |
|  |  |
| Spurious Emission | |
|  | Note: The Value of the Display Line is -16.95dBm |

## 802.11n-HT20 Out-of-Band Emissions

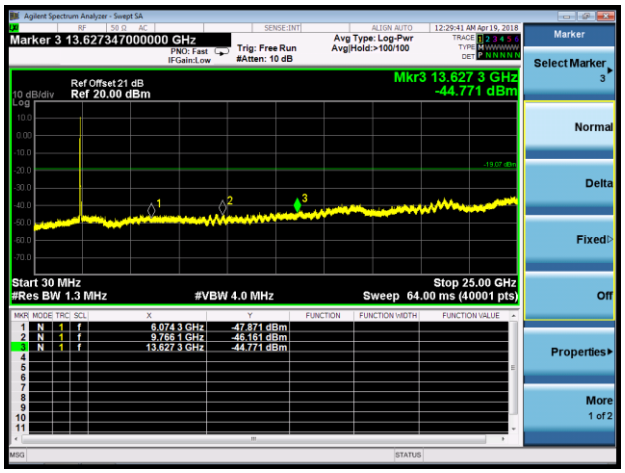
### Channel 01 (2412MHz)

#### 100kHz PSD Reference Level


#### Low Band Edge




#### Spurious Emission

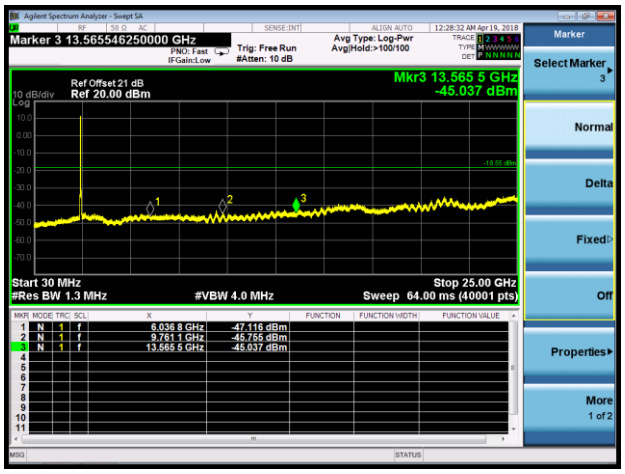



Note: The Value of the Display Line is -19.07dBm

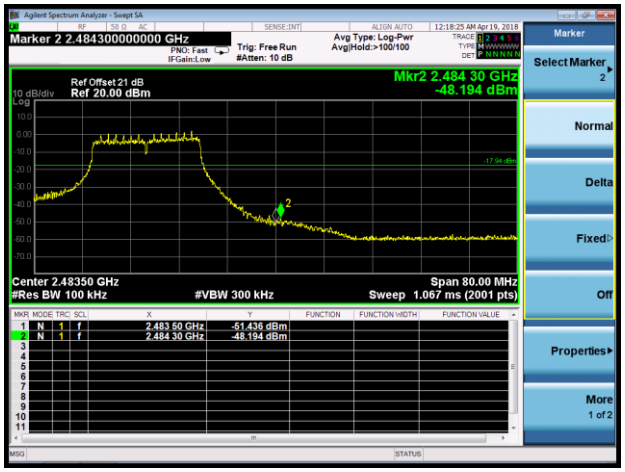
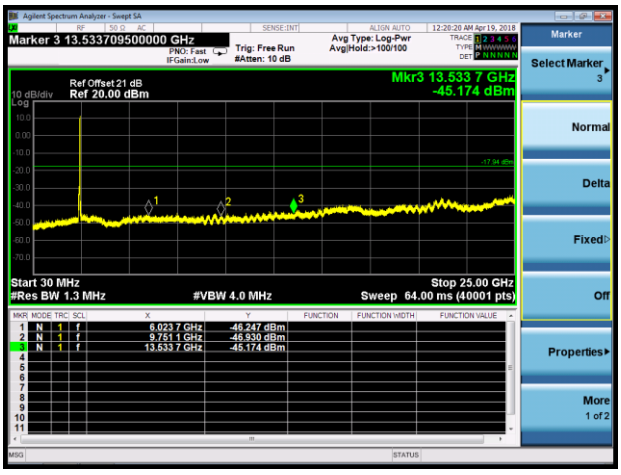
### Channel 06 (2437MHz)

#### 100kHz PSD Reference Level


#### Spurious Emission




Note: The Value of the Display Line is -18.55dBm

| 802.11n-HT20 Out-of-Band Emissions | |
|---|---|
| Channel 11 (2462MHz) | |
| 100kHz PSD Reference Level | High Band Edge |
|  |  |
| Spurious Emission | |
|  | Note: The Value of the Display Line is -17.94dBm |

## 7.6. Radiated Spurious Emission Measurement

### 7.6.1.Test Limit

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table per Section 15.209.

| FCC Part 15 Subpart C Paragraph 15.209 | | |
|---|---|---|
| Frequency [MHz] | Field Strength [uV/m] | Measured Distance [Meters] |
| 0.009 - 0.490 | 2400/F (kHz) | 300 |
| 0.490 - 1.705 | 24000/F (kHz) | 30 |
| 1.705 - 30 | 30 | 30 |
| 30 - 88 | 100 | 3 |
| 88 - 216 | 150 | 3 |
| 216 - 960 | 200 | 3 |
| Above 960 | 500 | 3 |

### 7.6.2.Test Procedure Used

ANSI C63.10 Section 6.3 (General Requirements)

ANSI C63.10 Section 6.4 (Standard test method below 30MHz)

ANSI C63.10 Section 6.5 (Standard test method above 30MHz to 1GHz)

ANSI C63.10 Section 6.6 (Standard test method above 1GHz)

### 7.6.3.Test Setting

**Table 1 - RBW as a function of frequency**

| Frequency | RBW |
|---|---|
| 9 ~ 150 kHz | 200 ~ 300 Hz |
| 0.15 ~ 30 MHz | 9 ~ 10 kHz |
| 30 ~ 1000 MHz | 100 ~ 120 kHz |

**Quasi-Peak Measurements below 1GHz**

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. Span was set greater than 1MHz
3. RBW = as specified in Table 1
4. Detector = CISPR quasi-peak
5. Sweep time = auto couple
6. Trace was allowed to stabilize

**Peak Measurements above 1GHz**

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

**Average Measurements above 1GHz (Method VB)**

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW; If the EUT is configured to transmit with duty cycle ≥ 98%, set VBW = 10 Hz.

If the EUT duty cycle is < 98%, set VBW ≥ 1/T. T is the minimum transmission duration.

4. Detector = Peak
5. Sweep time = auto
6. Trace mode = max hold
7. Trace was allowed to stabilize