MRT Technology2Suzhou) Co., Ltd
Phone: +86-512-66308358
Fax: +86-512-66308368
Web: www.mrt-cert.com

Report No.: 1608RSU01101
Report Version: V01
Issue Date: 08-31-2016

MEASUREMENT REPORT
FCC PART 15.247 802.11b/g/n

FCC ID:	TK4WLM200NX
APPLICANT:	Compex Systems Pte Ltd
Application Type:	Certification
Product:	WIRELESS-N NETWORK MINI PCI ADAPTER
Model No.:	WLM200NX
Brand Name:	COMPEX
FCC Classification:	Digital Transmission System (DTS)
FCC Rule Part(s):	Part 15.247
Test Procedure(s):	ANSI C63.10-2013, KDB 558074 D01v03r05
	KDB 662911 D01v02r01
Test Date:	August 16 ~ 30, 2016

Reviewed By Manager : Robin Wu
(Robin Wu)

Approved By CEO : Marlin Chen
(Marlin Chen)

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 D01v03r05. Test results reported herein relate only to the item(s) tested.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date	Note
1608RSU01101	Rev. 01	Initial report	08-31-2016	Valid

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§2.1033 General Information

Applicant:	Compex Systems Pte Ltd
Applicant Address:	No:9 Harrison Road, Harrison Industrial Building, #05-01, Singapore 369651
Manufacturer:	Compex Systems Pte Ltd
Manufacturer Address:	No:9 Harrison Road, Harrison Industrial Building, #05-01, Singapore 369651
Test Site:	MRT Technology (Suzhou) Co., Ltd
Test Site Address:	D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China
MRT Registration No.:	809388
FCC Rule Part(s):	Part 15.247
FCC ID:	TK4WLM200NX
Test Device Serial No.:	N/A ☐ Production ☒ Pre-Production ☐ Engineering
FCC Classification:	Digital Transmission System (DTS)

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. 809388) 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-4179, G-814, C-4664, T-2206) 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.**

ilac-MRA A2LA American Association for Laboratory Accreditation

Accredited Laboratory

A2LA has accredited

MRT TECHNOLOGY (SUZHOU) CO., LTD.

Suzhou, China

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009*).

Presented this 17th day of June 2014.

President & CEO
For the Accreditation Council
Certificate Number 3628.01
Valid to August 31, 2016

For the term to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

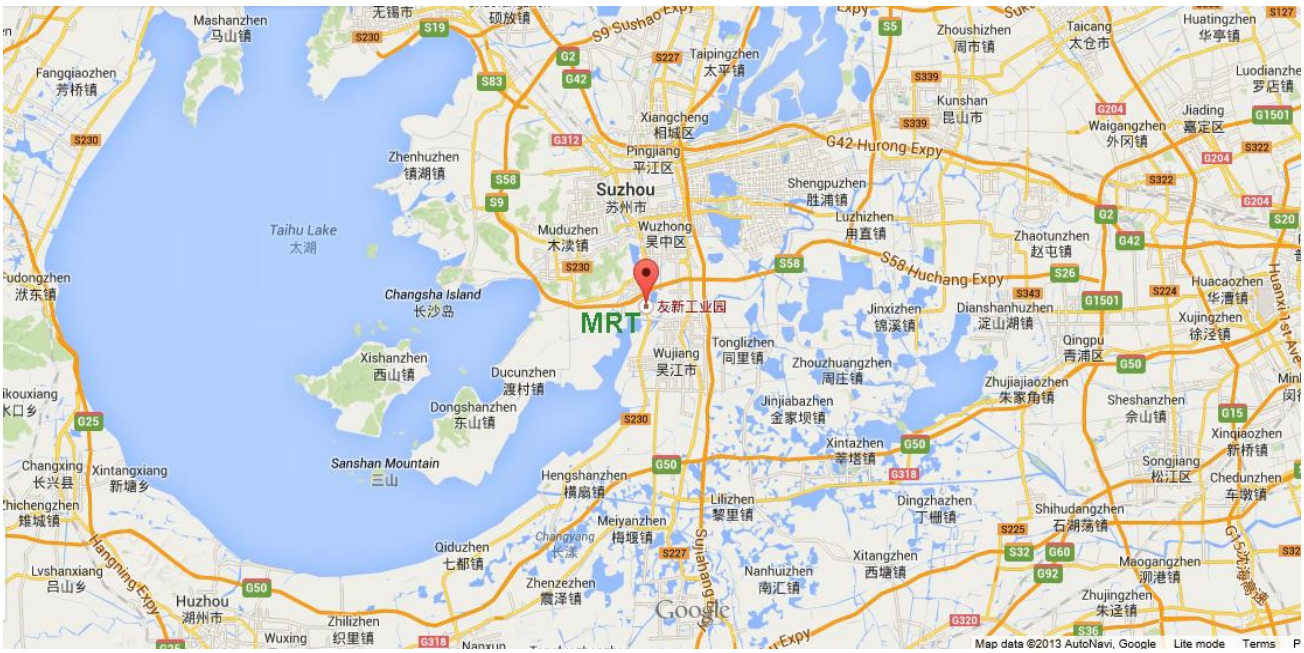
1. INTRODUCTION

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, Youxin Industrial Park, 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	WIRELESS-N NETWORK MINI PCI ADAPTER
Model No.	WLM200NX
Brand Name	COMPEX
WLAN Specification	
Frequency Range	**2.4GHz:** 802.11b/g/n-HT20: 2412 ~ 2462 MHz 802.11n-HT40: 2422 ~ 2452 MHz **5GHz:** 802.11a/n-HT20: 5745~5825MHz 802.11n-HT40: 5755~5795MHz
Type of Modulation	802.11b: DSSS 802.11g/a/n: OFDM

2.2. Operation Frequency / Channel List

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	N/A	N/A	N/A	N/A

2.3. Description of Available Antennas

Antenna Type	Frequency Band (GHz)	Manufacturer	Tx Paths	Max Peak Gain (dBi)	Directional Gain (dBi)	
					For Power	For PSD
Dipole Antenna	2.4	Compex Systems Pte Ltd	2	2	2	5.01
	5		2	2	2	5.01
PCB Antenna	2.4	Taoglas Antenna Solutions	2	3	3	6.01
	5		2	5	5	8.01

Note:

The EUT supports Cyclic Delay Diversity (CDD) mode, and CDD signals are correlated.

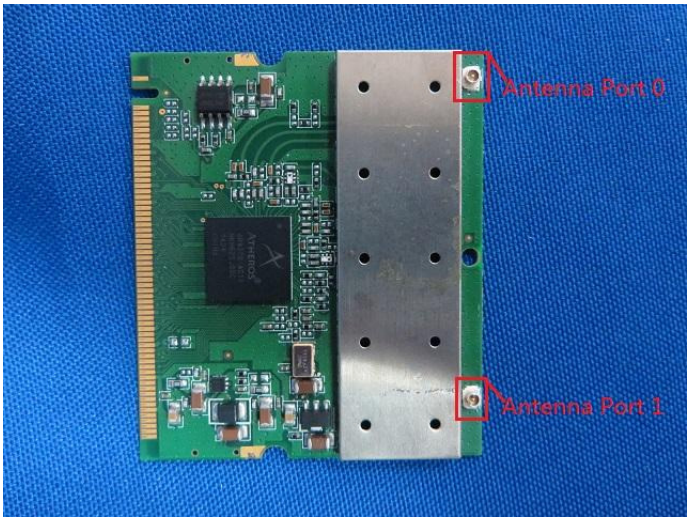
For CDD transmissions, directional gain is calculated as follows, N_{ANT} = 2, N_{SS} = 1.

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;
2. If antenna gains are not equal, the user may use either of the following methods to calculate directional gain, provided that each transmit antenna is driven by only one spatial stream:
   - 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;
   - $$DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$$

     $g_{j,k} = 10^{G_k/20}$ if the kth antenna is being fed by spatial stream j, or zero if it is not;

     G_k is the gain in dBi of the kth antenna.

2.4. Description of Antenna RF Port

Antenna RF Port


2.5. Test Mode

Test Mode	Mode 1: Transmit by 802.11b
	Mode 2: Transmit by 802.11g
	Mode 3: Transmit by 802.11n-HT20
	Mode 4: Transmit by 802.11n-HT40

2.6. Test Software

The test utility software used during testing was “ART”, and the version was “v09 b27”.

2.7. Device Capabilities

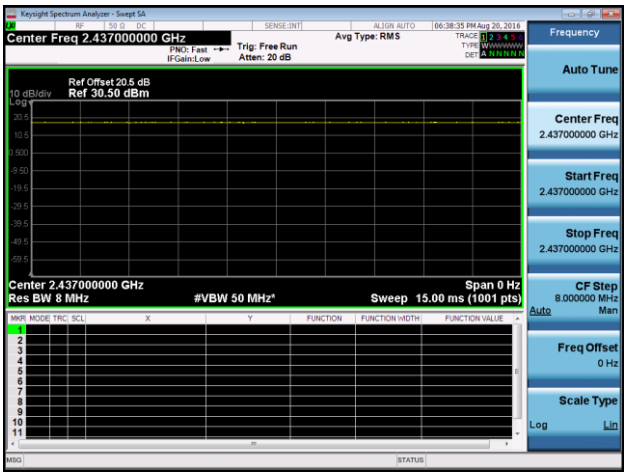
This device contains the following capabilities:

2.4GHz WLAN (DTS) & 5.8GHz WLAN (NII)

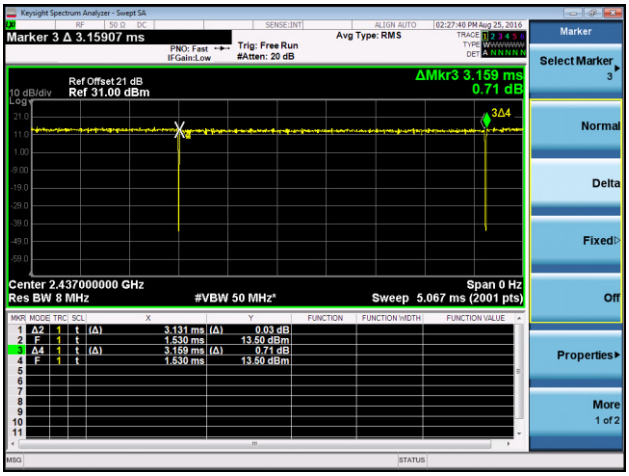
Note: 2.4GHz WLAN (DTS) operation is possible in 20MHz, and 40MHz channel bandwidths. The maximum achievable duty cycle was determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8MHz, VBW = 50MHz. The RBW and VBW were both greater than 50/T, where T is the minimum 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	100%
802.11g	99.1%
802.11n-HT20	97.5%
802.11n-HT40	96.4%

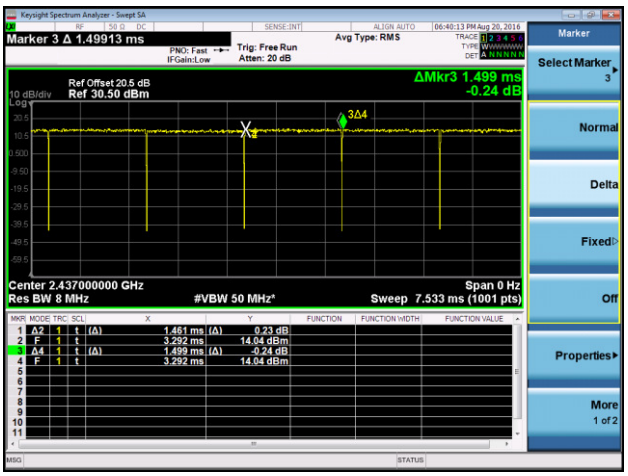
802.11b - Duty Cycle



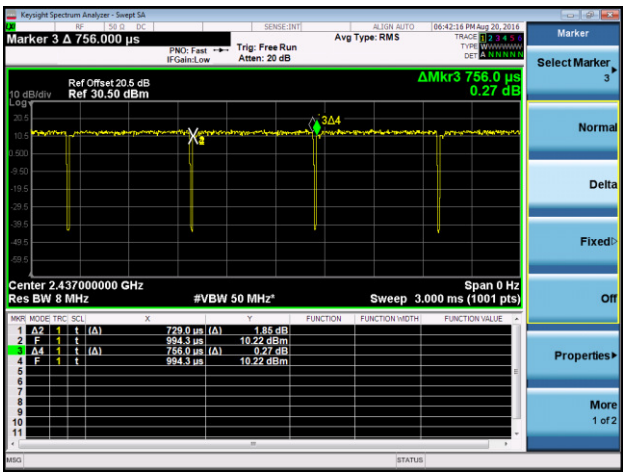
802.11g - Duty Cycle



802.11n-HT20 - Duty Cycle



802.11n-HT40 - Duty Cycle



2.8. Test Configuration

The **WIRELESS-N NETWORK MINI PCI ADAPTER** was tested per the guidance of KDB 558074 D01v03r05. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

2.9. EMI Suppression Device(s)/Modifications

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

2.10. 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.

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 D01v03r05 were used in the measurement of the **WIRELESS-N NETWORK MINI PCI ADAPTER.**

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.

Line conducted emissions test results are shown in Section 7.8.

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 1-25GHz 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 **Wireless-A/B/G/N Network Mini PCIe Adapter** uses a unique connector.

Antenna Type	Antenna Connector Type
Dipole Antenna	IPEX connector
PCB Antenna	IPEX connector

Conclusion:

The **WIRELESS-N NETWORK MINI PCI ADAPTER FCC ID: TK4WLM200NX** unit complies with the requirement of §15.203.

5. TEST EQUIPMENT CALIBRATION DATE

Conducted Emissions - SR2

Instrument	Manufacturer	Type No.	Serial No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR7	101209	1 year	2016/11/03
Two-Line V-Network	R&S	ENV216	101683	1 year	2016/11/03
Two-Line V-Network	R&S	ENV216	101684	1 year	2016/11/03
Temperature/Humidity Meter	Yuhuaze	HTC-2	N/A	1 year	2016/12/20
Shielding Anechoic Chamber	Mikebang	Chamber-SR2	N/A	1 year	2017/05/10

Radiated Emission – AC2

Instrument	Manufacturer	Type No.	Serial No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Agilent	N9020A	MRTSUE06106	1 year	2017/05/08
Microwave System Amplifier	Agilent	83017A	MY52090106	1 year	2017/03/29
Loop Antenna	Schwarzbeck	FMZB1519	1519-041	1 year	2016/12/14
Bilog Period Antenna	Schwarzbeck	VULB 9162	9162-047	1 year	2016/11/07
Horn Antenna	Schwarzbeck	BBHA9120D	9120D-1167	1 year	2016/11/07
Broadband Horn Antenna	Schwarzbeck	BBHA9170	BBHA9170549	1 year	2017/01/04
Temperature/Humidity Meter	Yuhuaze	HTC-2	N/A	1 year	2016/12/20
Anechoic Chamber	TDK	Chamber-AC2	N/A	1 year	2017/05/10

Conducted Test Equipment - TR3

Instrument	Manufacturer	Type No.	Serial No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Agilent	N9020A	MY52090106	1 year	2017/05/08
USB Wideband Power Sensor	Boonton	55006	8911	1 year	2017/05/08
Temperature/Humidity Meter	Yuhuaze	HTC-2	N/A	1 year	2016/12/20

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)): 150kHz~30MHz: 3.46dB
Radiated Emission Measurement - AC2
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 9kHz ~ 1GHz: 4.18dB 1GHz ~ 25GHz: 4.76dB

7. TEST RESULT

7.1. Summary

Company Name: **Compex Systems Pte Ltd**
FCC ID: **TK4WLM200NX**
FCC Classification: **Digital Transmission System (DTS)**
Data Rate(s) Tested: **1Mbps ~ 11Mbps (b); 6Mbps ~ 54Mbps (g); 13/14.4Mbps ~ 65.0/72.2Mbps (n-HT20); 27/30Mbps ~ 270/300Mbps (n-HT40);**

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.247(a)(2)	6dB Bandwidth	≥ 500kHz	Conducted	Pass	Section 7.2
15.247(b)(3)	Output Power	≤ 30dBm		Pass	Section 7.3
15.247(e)	Power Spectral Density	≤ 8dBm/3kHz		Pass	Section 7.4
15.247(d)	Band Edge / Out-of-Band Emissions	≥ 20dBc		Pass	Section 7.5
15.205 15.209	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	AC Conducted Emissions 150kHz - 30MHz	< FCC 15.207 limits	Line Conducted	Pass	Section 7.8

Notes:

1) 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.
2) 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.
3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables and attenuators.

7.2. 6dB Bandwidth Measurement

7.2.1. Test Limit

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

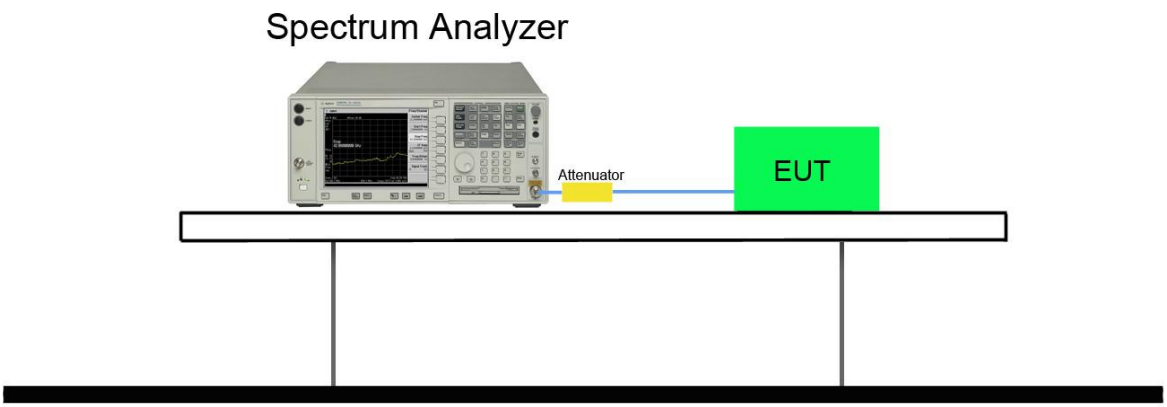
7.2.2. Test Procedure used

KDB 558074 D01v03r05 – 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



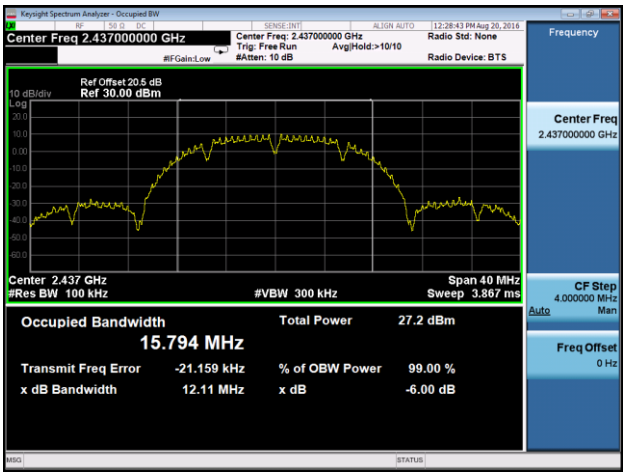
7.2.5. Test Result

Test Mode	Data Rate (Mbps)	Channel No.	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
Ant 0						
802.11b	1	01	2412	15.8	≥0.5	Pass
802.11b	1	06	2437	15.8	≥0.5	Pass
802.11b	1	11	2462	15.8	≥0.5	Pass
802.11g	6	01	2412	16.6	≥0.5	Pass
802.11g	6	06	2437	16.6	≥0.5	Pass
802.11g	6	11	2462	16.6	≥0.5	Pass
Ant 1						
802.11b	1	01	2412	15.8	≥0.5	Pass
802.11b	1	06	2437	15.8	≥0.5	Pass
802.11b	1	11	2462	15.8	≥0.5	Pass
802.11g	6	01	2412	16.7	≥0.5	Pass
802.11g	6	06	2437	16.7	≥0.5	Pass
802.11g	6	11	2462	16.7	≥0.5	Pass
Ant 0 / Ant 0 + 1						
802.11n-HT20	1	01	2412	17.8	≥0.5	Pass
802.11n-HT20	1	06	2437	17.8	≥0.5	Pass
802.11n-HT20	1	11	2462	17.8	≥0.5	Pass
802.11n-HT40	6	01	2412	36.2	≥0.5	Pass
802.11n-HT40	6	06	2437	36.3	≥0.5	Pass
802.11n-HT40	6	11	2462	36.2	≥0.5	Pass
Ant 1 / Ant 0 + 1						
802.11n-HT20	1	01	2412	17.8	≥0.5	Pass
802.11n-HT20	1	06	2437	17.8	≥0.5	Pass
802.11n-HT20	1	11	2462	17.8	≥0.5	Pass
802.11n-HT40	6	01	2412	36.2	≥0.5	Pass
802.11n-HT40	6	06	2437	36.3	≥0.5	Pass
802.11n-HT40	6	11	2462	36.2	≥0.5	Pass

802.11b 6dB Bandwidth - Ant 0

Channel 01 (2412MHz)

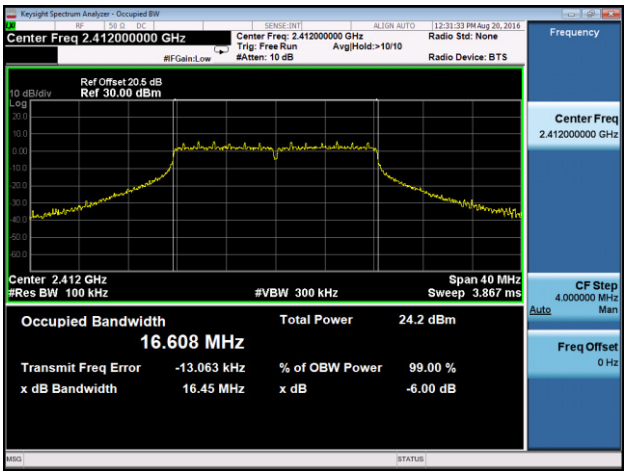
Channel 06 (2437MHz)



Channel 11 (2462MHz)

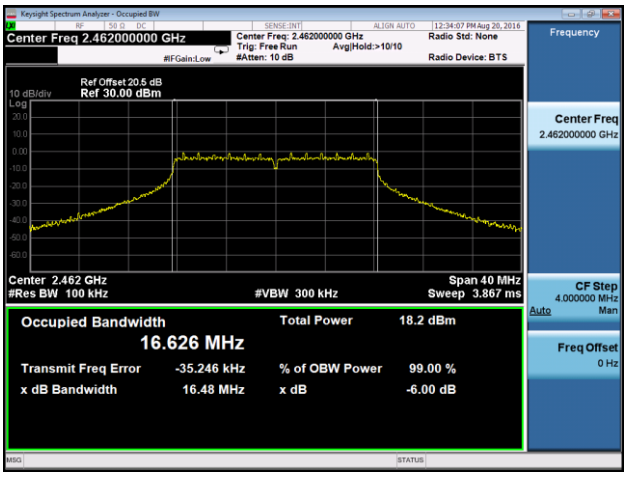
802.11g 6dB Bandwidth - Ant 0

Channel 01 (2412MHz)



Channel 06 (2437MHz)

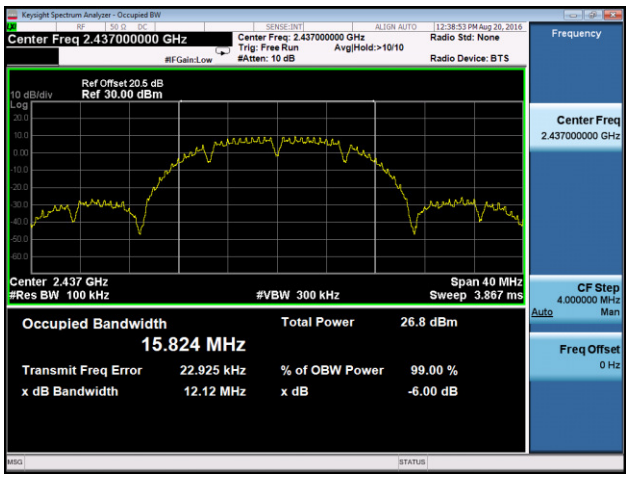
Channel 11 (2462MHz)



802.11b 6dB Bandwidth - Ant 1

Channel 01 (2412MHz)

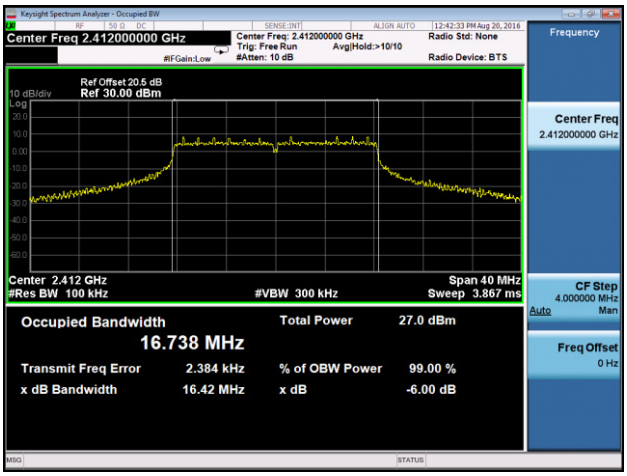
Channel 06 (2437MHz)



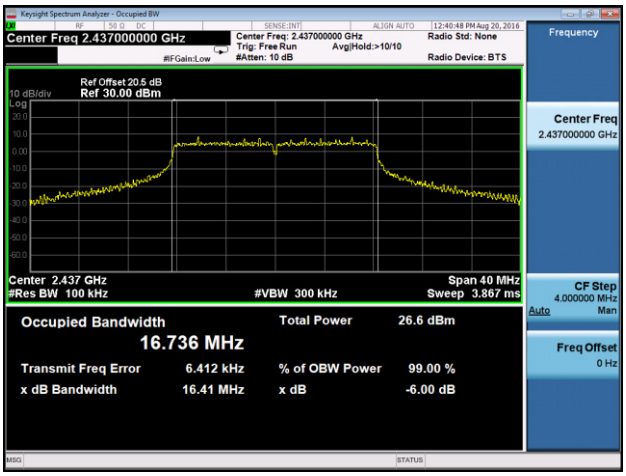
Channel 11 (2462MHz)

802.11g 6dB Bandwidth - Ant 1

Channel 01 (2412MHz)



Channel 06 (2437MHz)

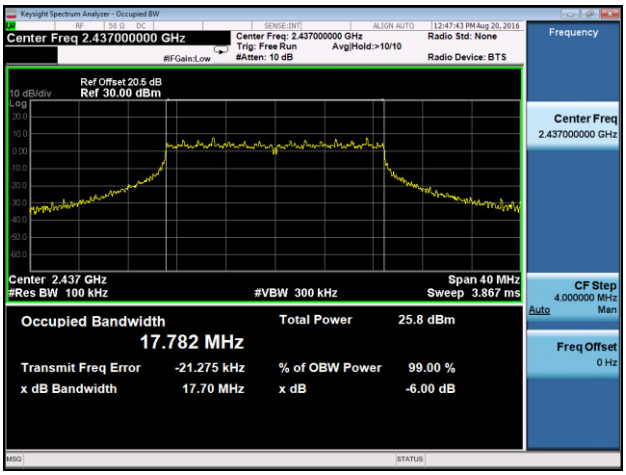


Channel 11 (2462MHz)

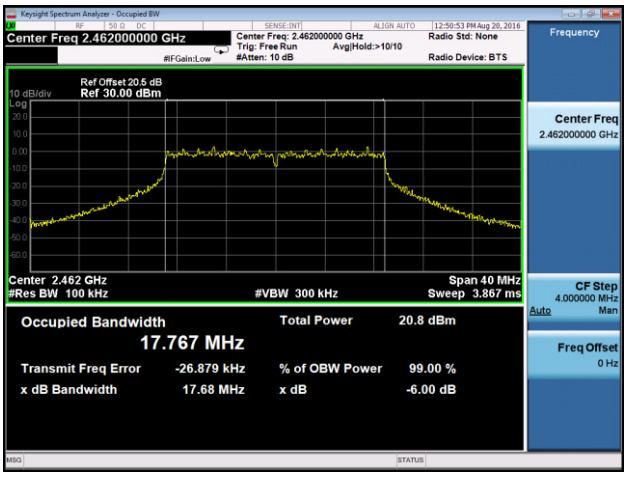
802.11n-HT20 6dB Bandwidth - Ant 0 / Ant 0 + 1

Channel 01 (2412MHz)

Channel 06 (2437MHz)

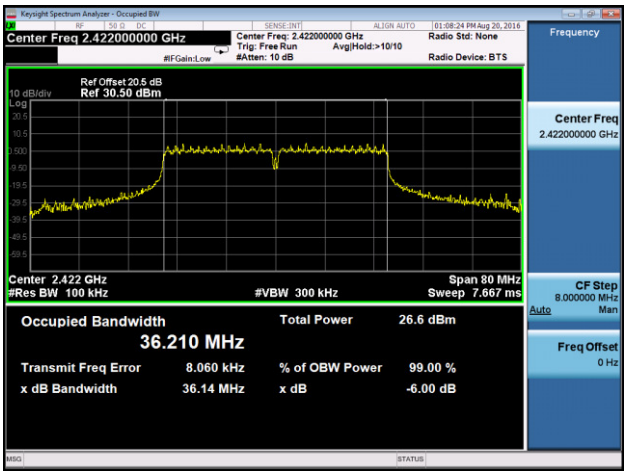


Channel 11 (2462MHz)

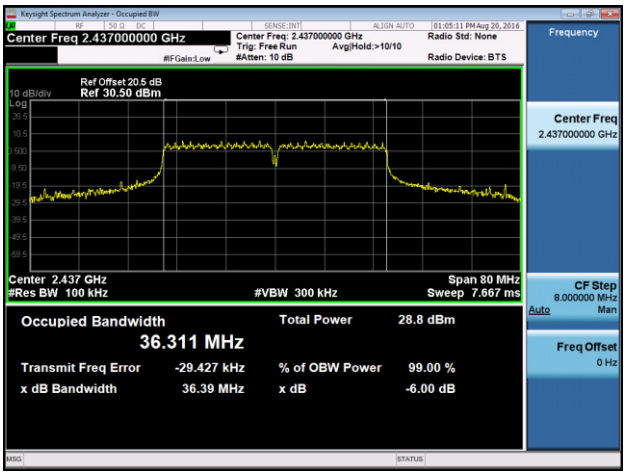


802.11n-HT40 6dB Bandwidth - Ant 0 / Ant 0 + 1

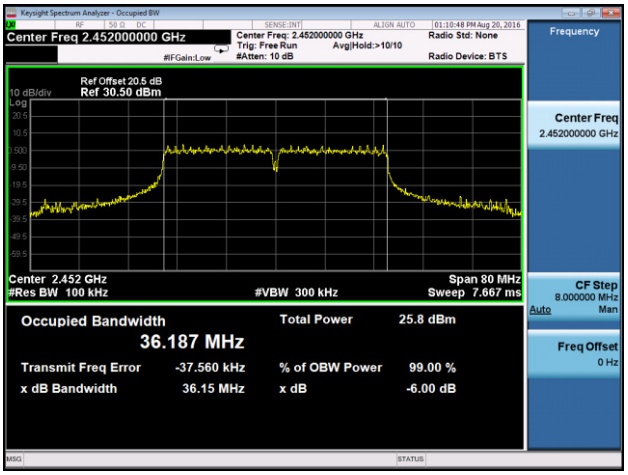
Channel 03 (2422MHz)



Channel 06 (2437MHz)

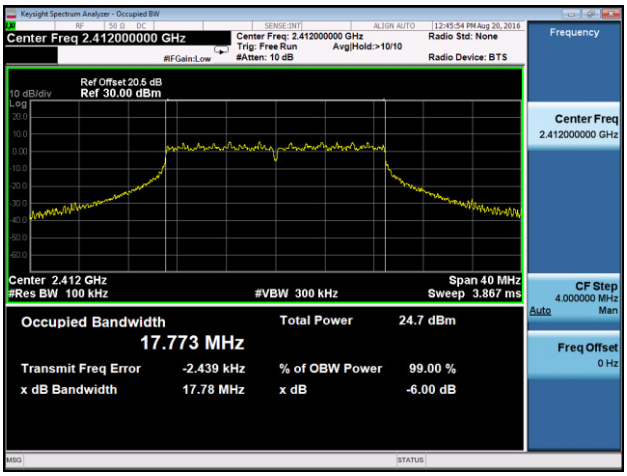


Channel 09 (2452MHz)

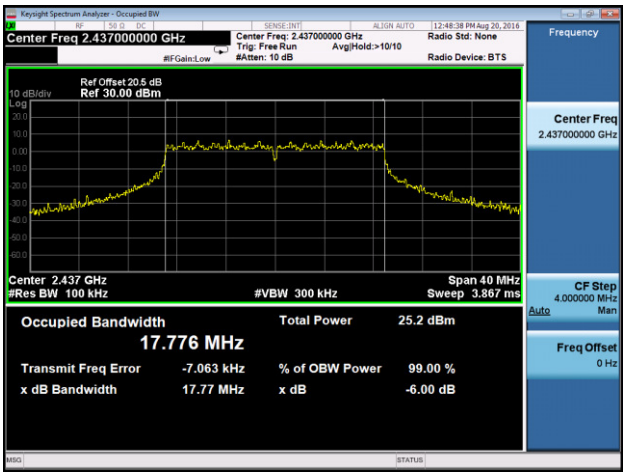


802.11n-HT20 6dB Bandwidth - Ant 1 / Ant 0 + 1

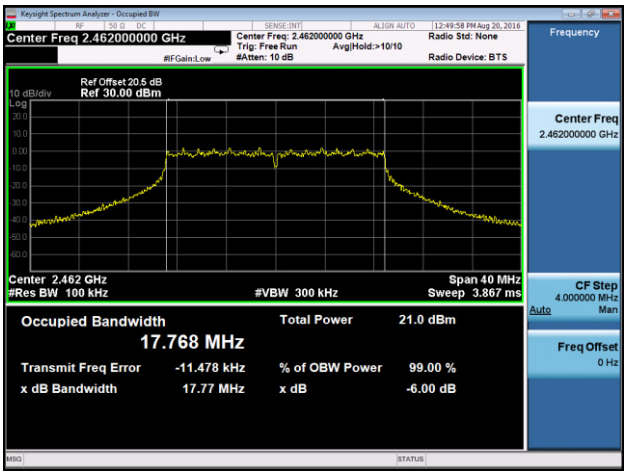
Channel 01 (2412MHz)



Channel 06 (2437MHz)

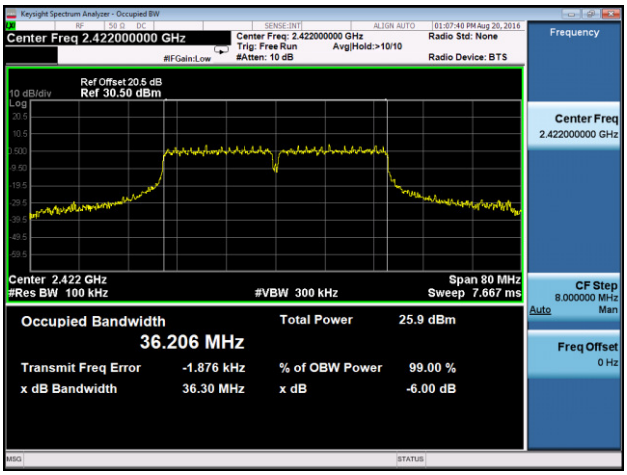


Channel 11 (2462MHz)

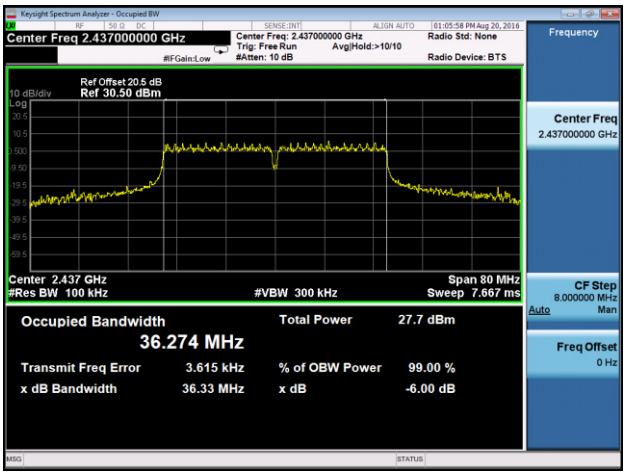


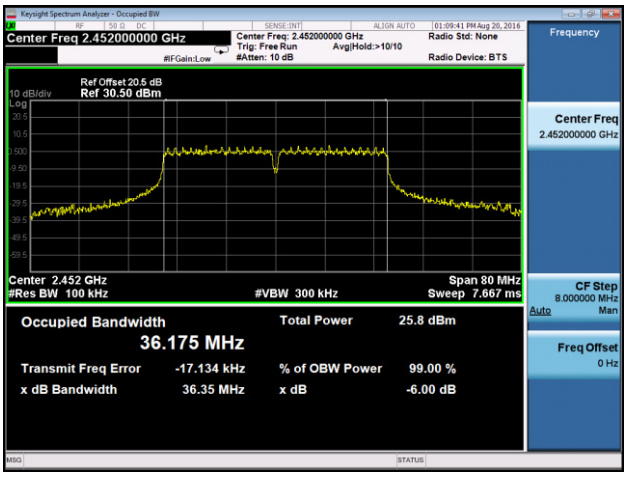
802.11n-HT40 6dB Bandwidth - Ant 1 / Ant 0 + 1

Channel 03 (2422MHz)



Channel 06 (2437MHz)



Channel 09 (2452MHz)	
	

7.3. Output Power Measurement

7.3.1. Test Limit

The maximum output power shall be less 1 Watt (30dBm).

7.3.2. Test Procedure Used

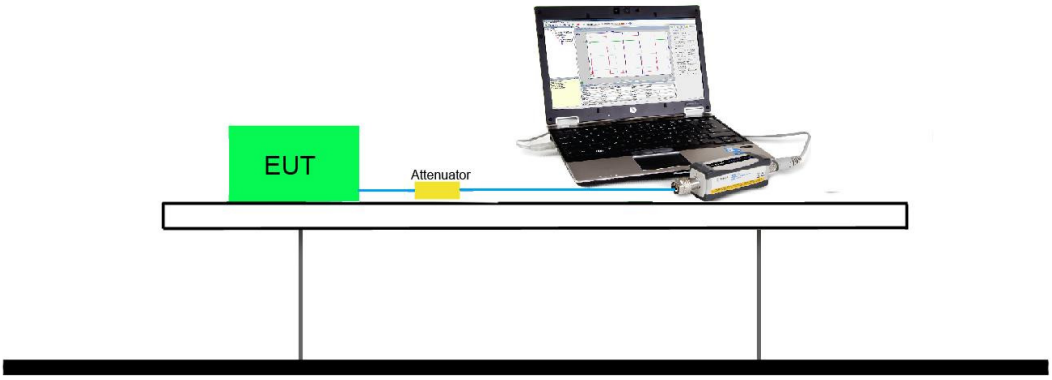
KDB 558074 D01v03r05 - Section 9.1.2 PKPM1 Peak Power Method (for signals with BW ≤ 50MHz)

7.3.3. Test Setting

Method PKPM1 (Peak Power Measurement of Signals with DTS BW ≤ 50MHz)

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.

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 (yellow marker) for final test of each channel.

N_{TX}	Data Rate (Mbps)	
	802.11b	802.11g
1	1	6
1	2	9
1	5.5	12
1	11	18
1	--	24
1	--	36
1	--	48
1	--	54

N_{Tx}	MCS Index for 802.11n	Data Rate (Mbps)			
		20MHz Bandwidth		40MHz Bandwidth	
		800ns GI	400ns GI	800ns GI	400ns GI
2	8	13.0	14.4	27.0	30.0
2	9	26.0	28.9	54.0	60.0
2	10	39.0	43.3	81.0	90.0
2	11	52.0	57.8	108.0	120.0
2	12	78.0	86.7	162.0	180.0
2	13	104.0	115.6	216.0	240.0
2	14	117.0	130.0	243.0	270.0
2	15	130.0	144.0	270.0	300.0

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

Output power at various data rates:

Test Mode	Bandwidth (MHz)	Channel No.	Frequency (MHz)	Data Rate (Mbps)	Average Power (dBm)
Ant 0					
802.11b	20	6	2437	1	21.74
				5.5	20.89
				11	20.11
802.11g	20	6	2437	6	21.69
				24	20.85
				54	20.33
Ant 0 / Ant 0 + 1					
802.11n	20	6	2437	13	20.74
				14.4	20.13
				52	19.69
				57.8	19.11
				130	18.67
				144	18.25
802.11n	40	6	2437	27	20.28
				30	19.78
				108	19.32
				120	18.87
				270	18.35
				300	17.92

Test Result of Peak Output Power

Test Mode	Data Rate (Mbps)	Channel No.	Freq. (MHz)	Ant 0 Peak Power (dBm)	Ant 0 Peak Power (dBm)	Total Peak Power (dBm)	Limit (dBm)	Result
1Tx - Ant 0								
802.11b	1	1	2412	22.59	--	22.59	≤30	Pass
802.11b	1	6	2437	24.39	--	24.39	≤30	Pass
802.11b	1	11	2462	18.18	--	18.18	≤30	Pass
802.11g	6	1	2412	26.87	--	26.87	≤30	Pass
802.11g	6	6	2437	27.43	--	27.43	≤30	Pass
802.11g	6	11	2462	22.08	--	22.08	≤30	Pass
1Tx - Ant 1								
802.11b	1	1	2412	--	24.68	24.68	≤30	Pass
802.11b	1	6	2437	--	24.27	24.27	≤30	Pass
802.11b	1	11	2462	--	24.65	24.65	≤30	Pass
802.11g	6	1	2412	--	26.97	26.97	≤30	Pass
802.11g	6	6	2437	--	27.10	27.10	≤30	Pass
802.11g	6	11	2462	--	26.98	26.98	≤30	Pass
2Tx - Ant 0 + 1								
802.11n-HT20	13	1	2412	26.08	25.59	28.85	≤30	Pass
802.11n-HT20	13	6	2437	27.33	25.85	29.66	≤30	Pass
802.11n-HT20	13	11	2462	24.89	25.12	28.02	≤30	Pass
802.11n-HT40	27	3	2422	26.95	26.62	29.80	≤30	Pass
802.11n-HT40	27	6	2437	27.16	25.84	29.56	≤30	Pass
802.11n-HT40	27	9	2452	26.41	26.18	29.31	≤30	Pass

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

7.3.6. Test Result of Average Output Power (Reporting Only)

Test Mode	Data Rate (Mbps)	Channel No.	Freq. (MHz)	Ant 0 Average Power (dBm)	Ant 1 Average Power (dBm)	Total Average Power (dBm)	Limit (dBm)	Result
1Tx - Ant 0								
802.11b	1	1	2412	19.64	--	19.64	≤30	Pass
802.11b	1	6	2437	21.74	--	21.74	≤30	Pass
802.11b	1	11	2462	15.28	--	15.28	≤30	Pass
802.11g	6	1	2412	18.74	--	18.74	≤30	Pass
802.11g	6	6	2437	21.69	--	21.69	≤30	Pass
802.11g	6	11	2462	13.50	--	13.50	≤30	Pass
1Tx - Ant 1								
802.11b	1	1	2412	--	21.84	21.84	≤30	Pass
802.11b	1	6	2437	--	21.63	21.63	≤30	Pass
802.11b	1	11	2462	--	21.70	21.70	≤30	Pass
802.11g	6	1	2412	--	20.91	20.91	≤30	Pass
802.11g	6	6	2437	--	21.76	21.76	≤30	Pass
802.11g	6	11	2462	--	20.25	20.25	≤30	Pass
2Tx - Ant 0 + 1								
802.11n-HT20	13	1	2412	16.92	17.19	20.07	≤30	Pass
802.11n-HT20	13	6	2437	20.74	20.61	23.69	≤30	Pass
802.11n-HT20	13	11	2462	15.30	14.85	18.09	≤30	Pass
802.11n-HT40	27	3	2422	19.96	19.73	22.86	≤30	Pass
802.11n-HT40	27	6	2437	20.28	20.22	23.26	≤30	Pass
802.11n-HT40	27	9	2452	19.72	20.03	22.89	≤30	Pass

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

7.4. Power Spectral Density Measurement

7.4.1. Test Limit

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

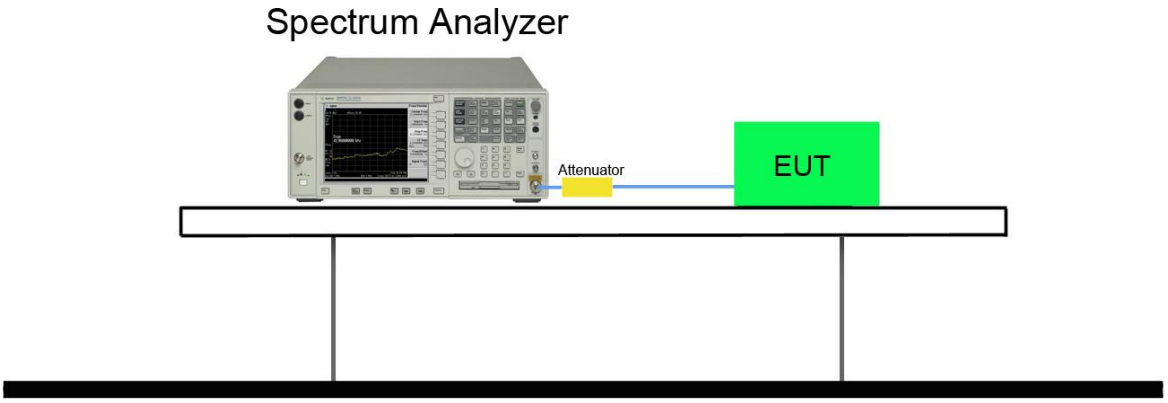
7.4.2. Test Procedure Used

KDB 558074 D01v03r05 - 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

Test Mode	Data Rate (Mbps)	Channel No.	Freq. (MHz)	Ant 0 PSD (dBm / 3kHz)	Ant 1 PSD (dBm / 3kHz)	Total PSD (dBm / 3kHz)	Limit (dBm / 3kHz)	Result
1Tx - Ant 0								
802.11b	1	1	2412	-6.8	---	-6.8	≤8.0	Pass
802.11b	1	6	2437	-4.1	---	-4.1	≤8.0	Pass
802.11b	1	11	2462	-7.4	---	-7.4	≤8.0	Pass
802.11g	6	1	2412	-7.9	---	-7.9	≤8.0	Pass
802.11g	6	6	2437	-3.4	---	-3.4	≤8.0	Pass
802.11g	6	11	2462	-14.2	---	-14.2	≤8.0	Pass
1Tx – Ant 1								
802.11b	1	1	2412	---	-4.4	-4.4	≤8.0	Pass
802.11b	1	6	2437	---	-4.2	-4.2	≤8.0	Pass
802.11b	1	11	2462	---	-4.9	-4.9	≤8.0	Pass
802.11g	6	1	2412	---	-4.0	-4.0	≤8.0	Pass
802.11g	6	6	2437	---	-6.0	-6.0	≤8.0	Pass
802.11g	6	11	2462	---	-5.2	-5.2	≤8.0	Pass
2Tx - Ant 0 + 1								
802.11n-HT20	1	1	2412	-8.8	-9.5	-6.1	≤7.99	Pass
802.11n-HT20	1	6	2437	-4.0	-7.7	-2.5	≤7.99	Pass
802.11n-HT20	1	11	2462	-12.2	-12.1	-9.1	≤7.99	Pass
802.11n-HT40	6	1	2412	-6.6	-10.5	-5.1	≤7.99	Pass
802.11n-HT40	6	6	2437	-6.7	-8.2	-4.4	≤7.99	Pass
802.11n-HT40	6	11	2462	-5.4	-9.2	-3.9	≤7.99	Pass

Note: Total PSD (dBm/3kHz) = $10*\log\{10^{(\text{Ant 0 PSD }/10)}+10^{(\text{Ant 1 PSD }/10)}\}$ (dBm/3kHz).

802.11b Peak PSD - Ant 0

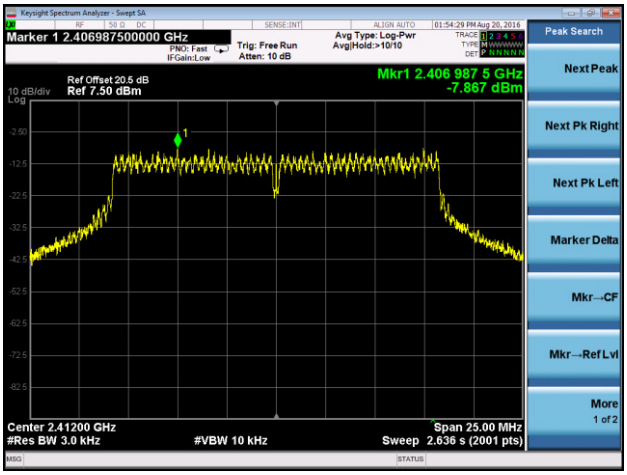
Channel 01 (2412MHz)

Channel 06 (2437MHz)

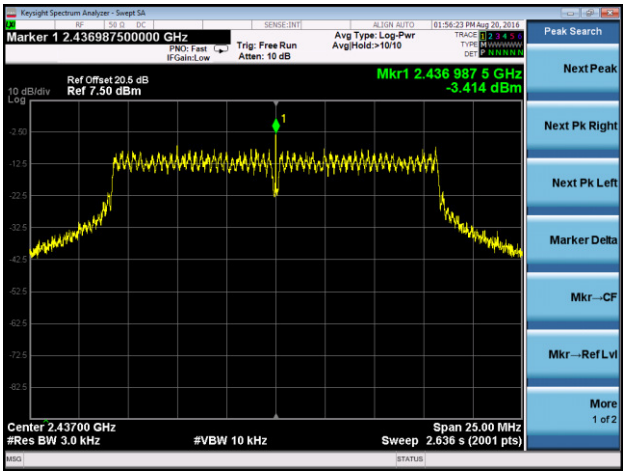
Channel 11 (2462MHz)

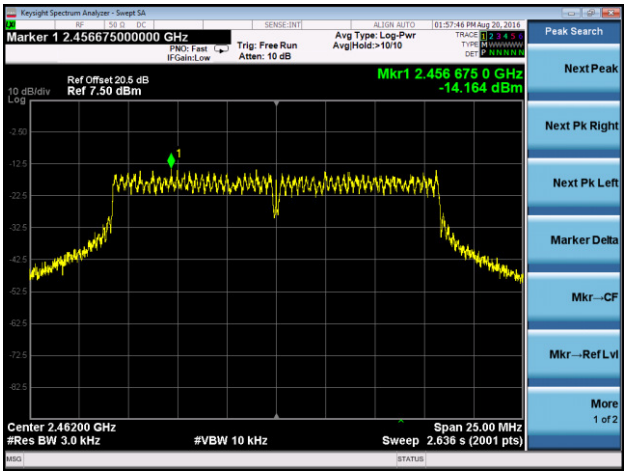
802.11g Peak PSD - Ant 0

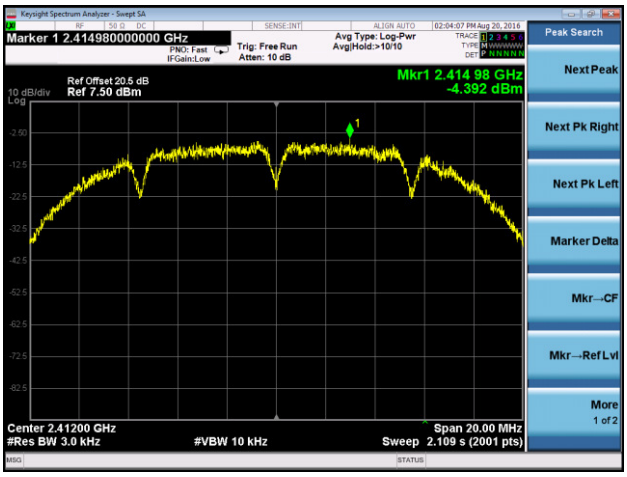
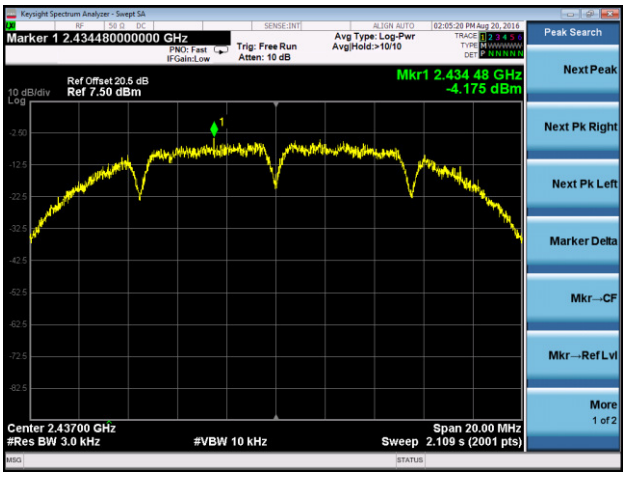
Channel 01 (2412MHz)



Channel 06 (2437MHz)



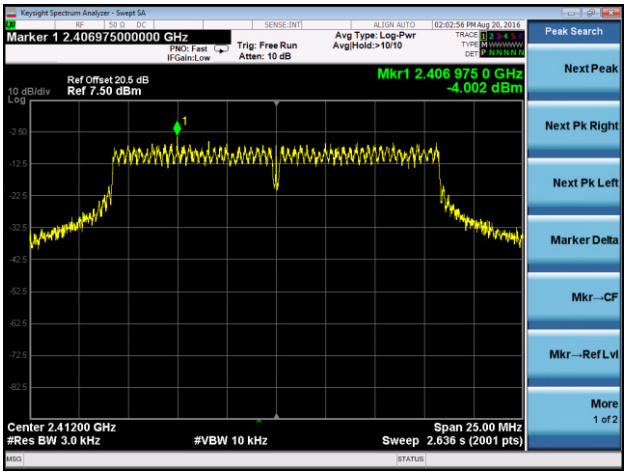
Channel 11 (2462MHz)	
	

802.11b Peak PSD - Ant 1	
Channel 01 (2412MHz)	Channel 06 (2437MHz)
	

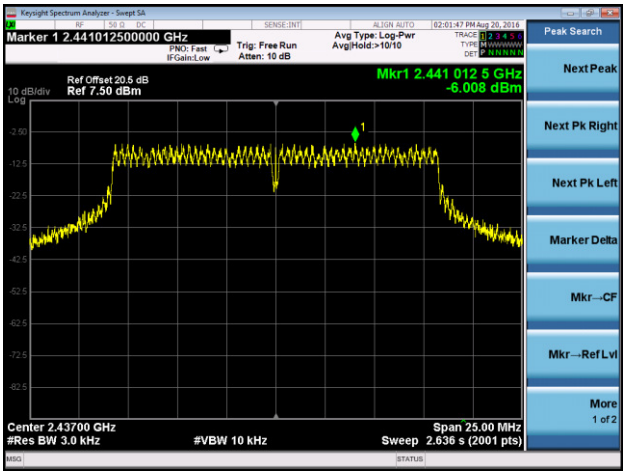
Channel 11 (2462MHz)	

802.11g Peak PSD - Ant 1

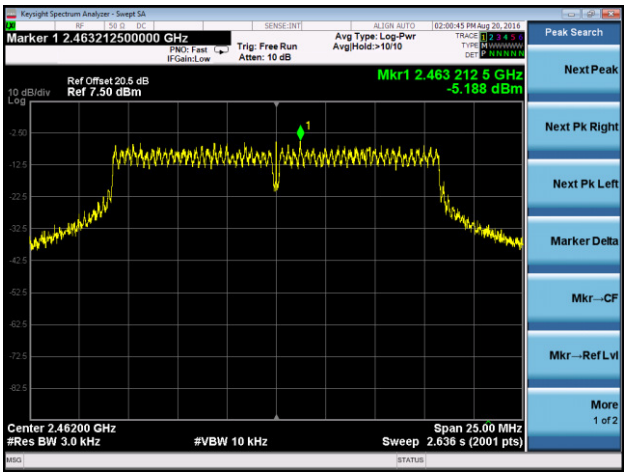
Channel 01 (2412MHz)



Channel 06 (2437MHz)

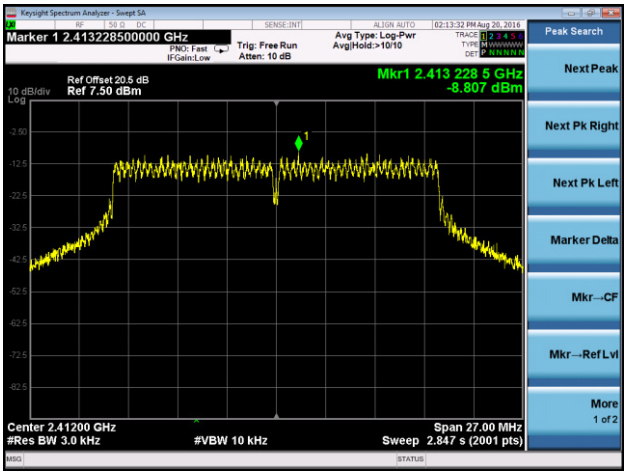


Channel 11 (2462MHz)

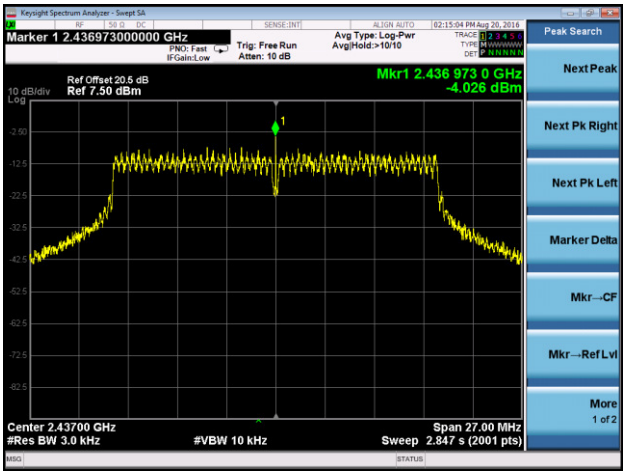


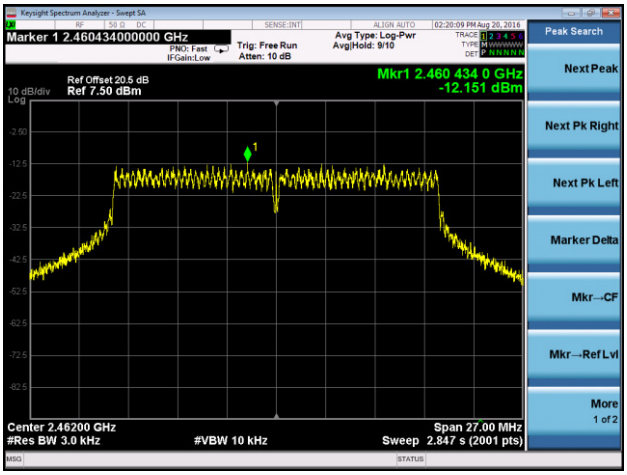
802.11n-HT20 Peak PSD - Ant 0 / Ant 0 + 1

Channel 01 (2412MHz)

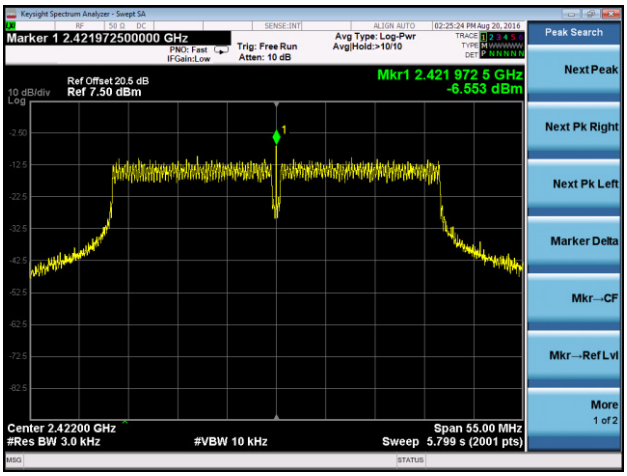
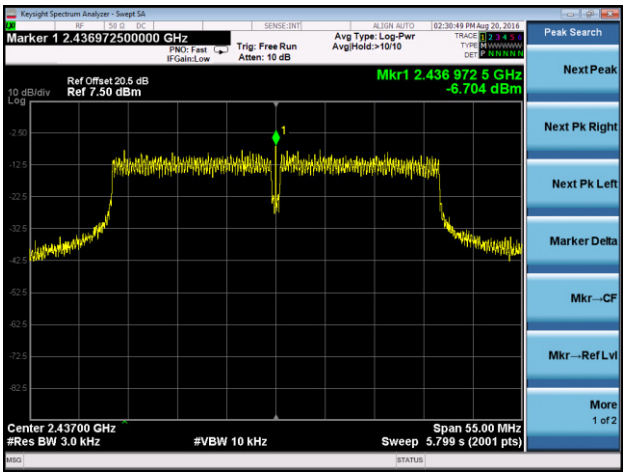


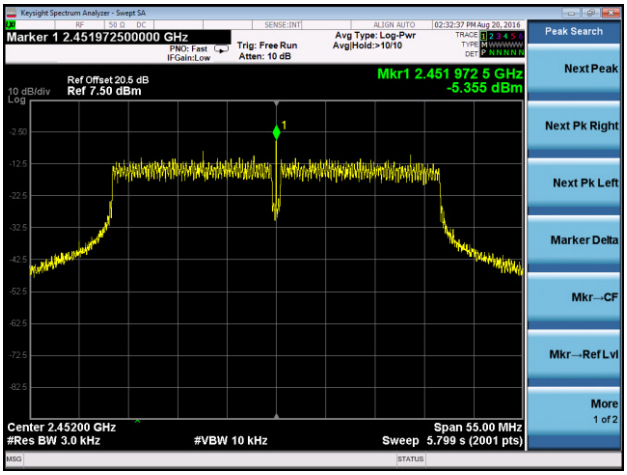
Channel 06 (2437MHz)



Channel 11 (2462MHz)	
	

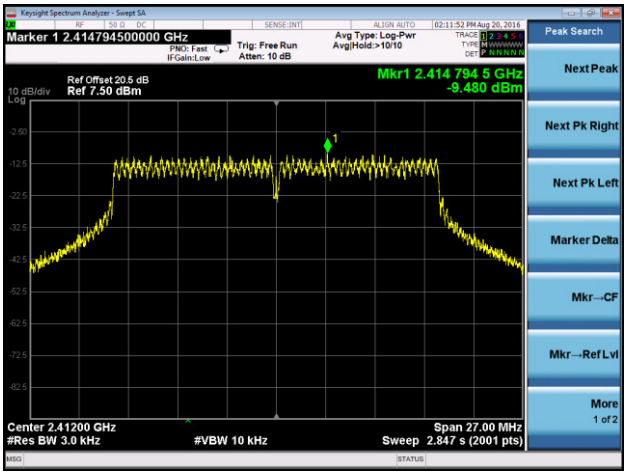
802.11n-HT40 Peak PSD - Ant 0 / Ant 0 + 1

Channel 03 (2422MHz)	Channel 06 (2437MHz)
	

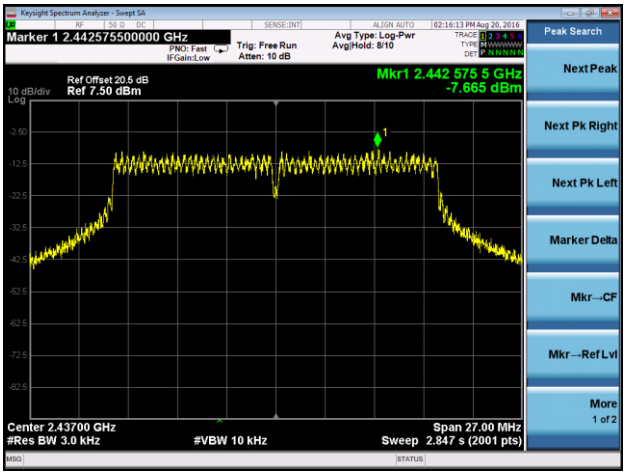
Channel 09 (2452MHz)	
	

802.11n-HT20 Peak PSD - Ant 1 / Ant 0 + 1

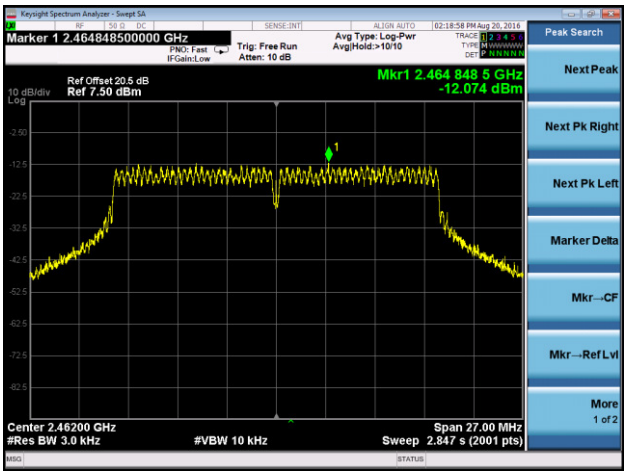
Channel 01 (2412MHz)



Channel 06 (2437MHz)

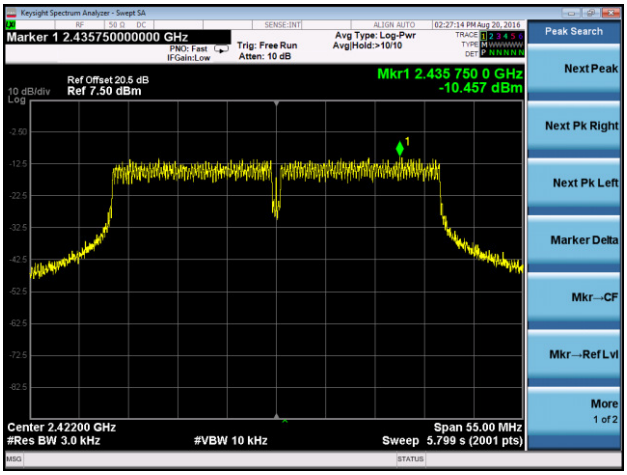


Channel 11 (2462MHz)

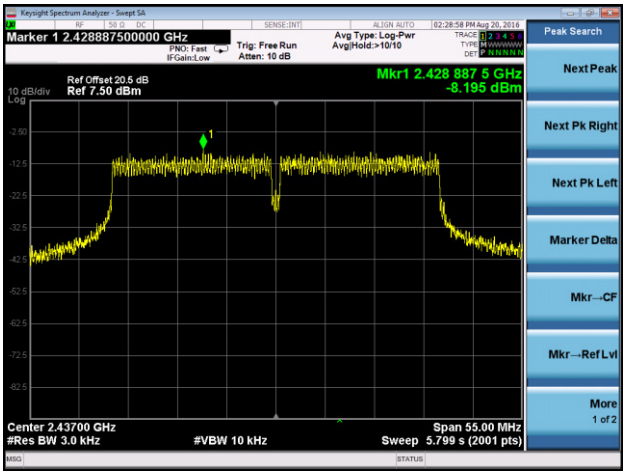


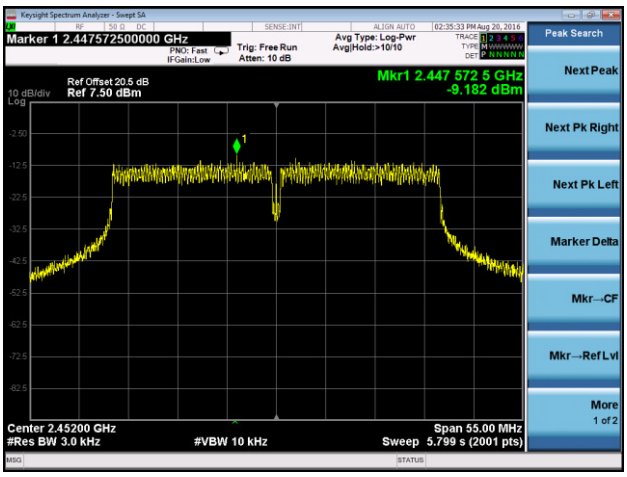
802.11n-HT40 Peak PSD - Ant 1 / Ant 0 + 1

Channel 03 (2422MHz)



Channel 06 (2437MHz)



Channel 09 (2452MHz)	
	

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 D01v03r05 - Section 11.2 & Section 11.3

7.5.3. Test Settitng

1. Reference level measurement

(a) Set instrument center frequency to DTS channel center frequency

(b) Set the span to ≥ 1.5 times the DTS bandwidth

(c) Set the RBW = 100 kHz

(d) Set the VBW ≥ 3 x RBW

(e) Detector = peak

(f) Sweep time = auto couple

(g) Trace mode = max hold

(h) Allow trace to fully stabilize

2. Emission level measurement

(a) Set the center frequency and span to encompass frequency range to be measured

(b) RBW = 100kHz

(c) VBW = 300kHz

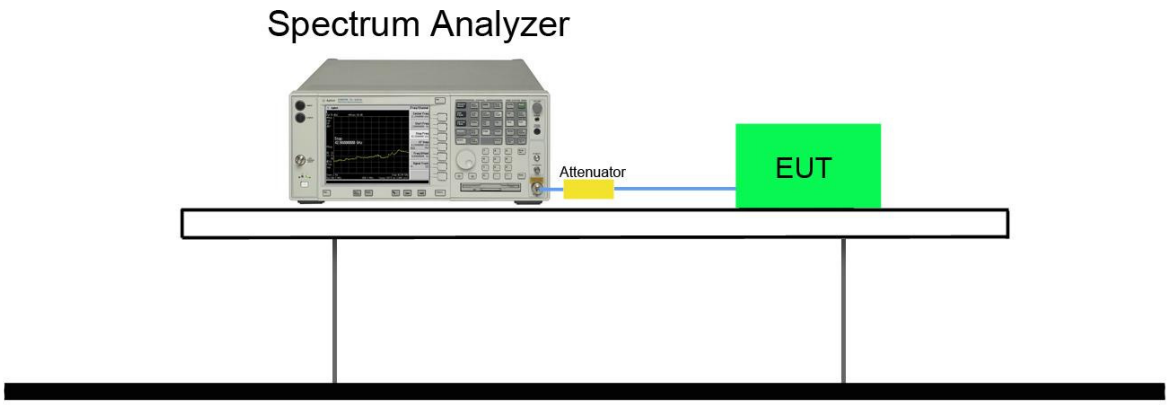
(d) Detector = Peak

(e) Trace mode = max hold

(f) Sweep time = auto couple

(g) The trace was allowed to stabilize

7.5.4. Test Setup

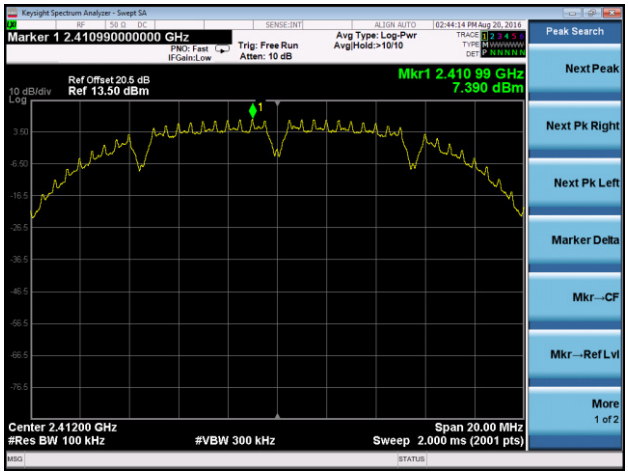
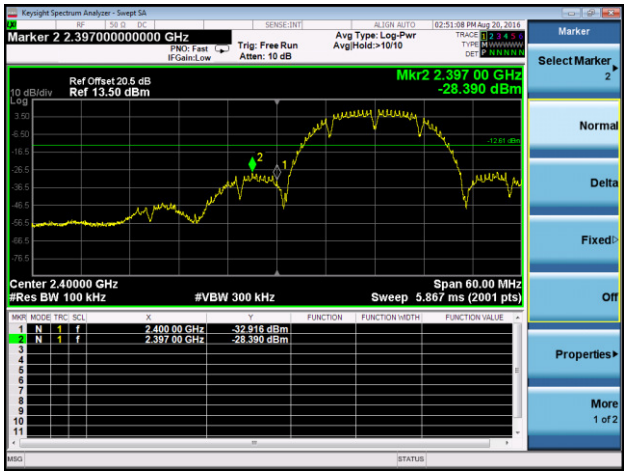


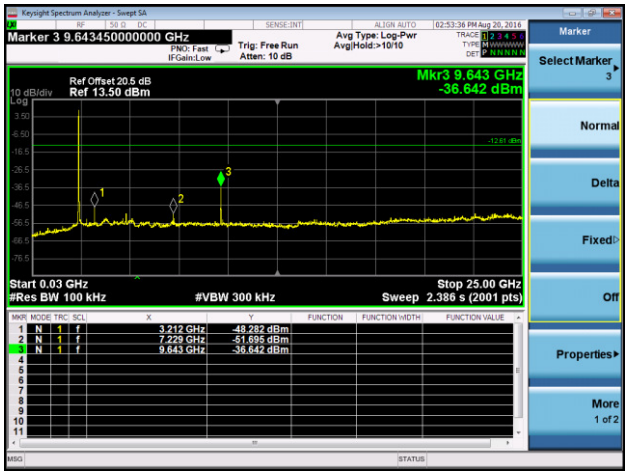
7.5.5. Test Result

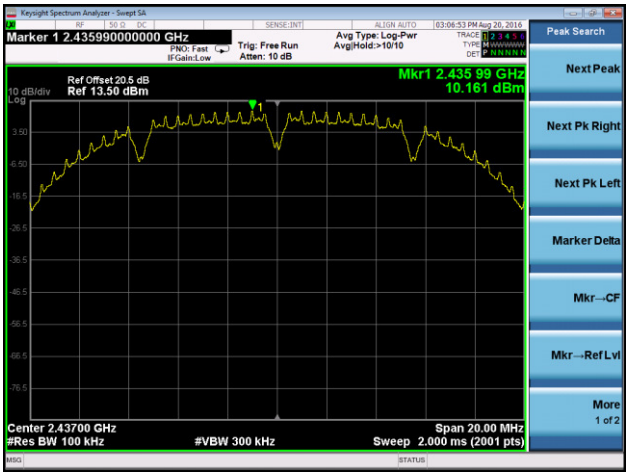
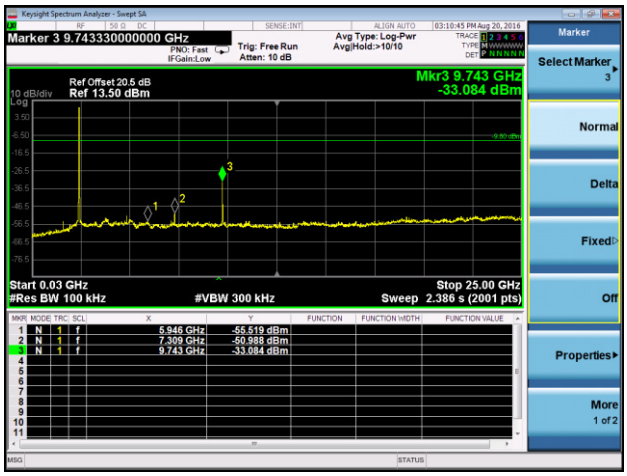
Test Mode	Data Rate (Mbps)	Channel No.	Frequency (MHz)	Limit	Result
Ant 0					
802.11b	1	01	2412	20dBc	Pass
802.11b	1	06	2437	20dBc	Pass
802.11b	1	11	2462	20dBc	Pass
802.11g	6	01	2412	20dBc	Pass
802.11g	6	06	2437	20dBc	Pass
802.11g	6	11	2462	20dBc	Pass
Ant 1					
802.11b	1	01	2412	20dBc	Pass
802.11b	1	06	2437	20dBc	Pass
802.11b	1	11	2462	20dBc	Pass
802.11g	6	01	2422	20dBc	Pass
802.11g	6	06	2437	20dBc	Pass
802.11g	6	11	2452	20dBc	Pass
Ant 0 / Ant 0 + 1					
802.11n-HT20	1	01	2412	20dBc	Pass
802.11n-HT20	1	06	2437	20dBc	Pass
802.11n-HT20	1	11	2462	20dBc	Pass
802.11n-HT40	6	01	2422	20dBc	Pass
802.11n-HT40	6	06	2437	20dBc	Pass
802.11n-HT40	6	11	2452	20dBc	Pass
Ant 1 / Ant 0 + 1					
802.11n-HT20	13	01	2412	20dBc	Pass
802.11n-HT20	13	06	2437	20dBc	Pass
802.11n-HT20	13	11	2462	20dBc	Pass
802.11n-HT40	27	01	2422	20dBc	Pass
802.11n-HT40	27	06	2437	20dBc	Pass
802.11n-HT40	27	11	2452	20dBc	Pass

802.11b Out-of-Band Emissions - Ant 0

Channel 01 (2412MHz)

100kHz PSD Reference Level	Low Band Edge
	

Spurious Emission	
	

Channel 06 (2437MHz)

100kHz PSD Reference Level	Spurious Emission