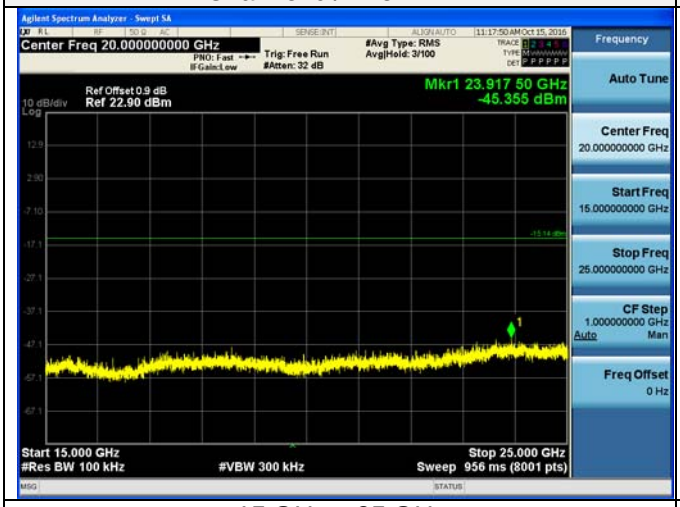
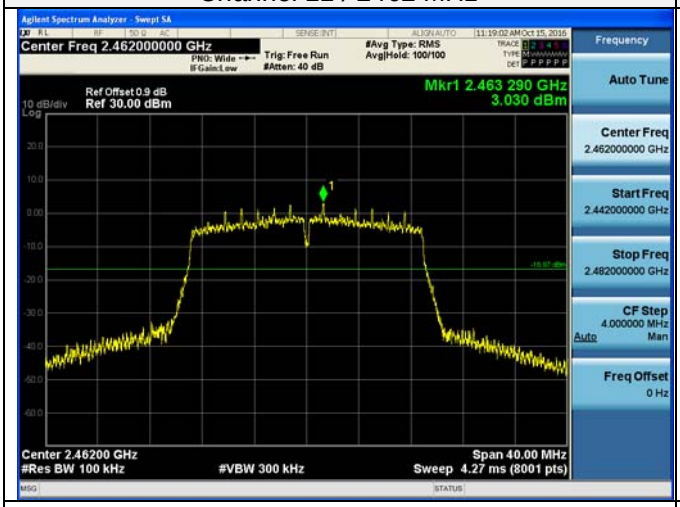
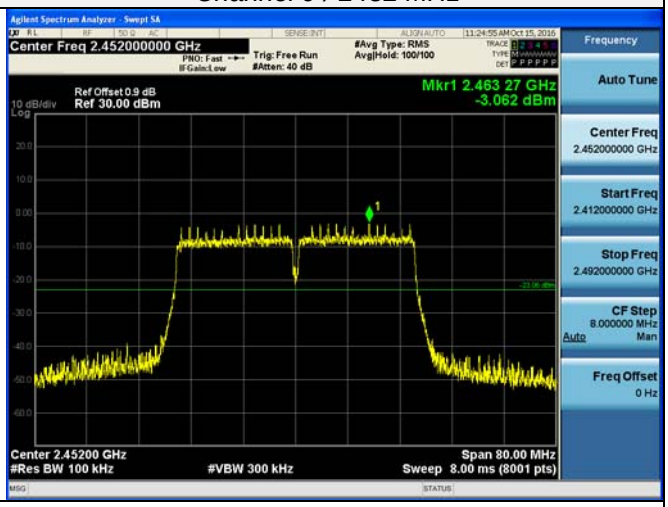
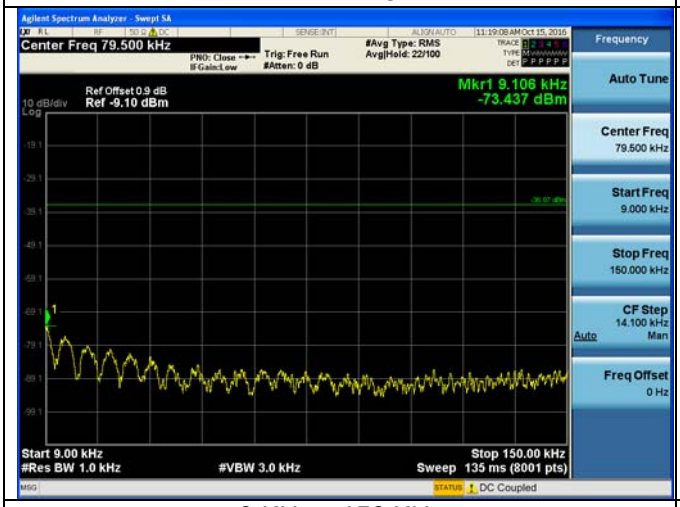
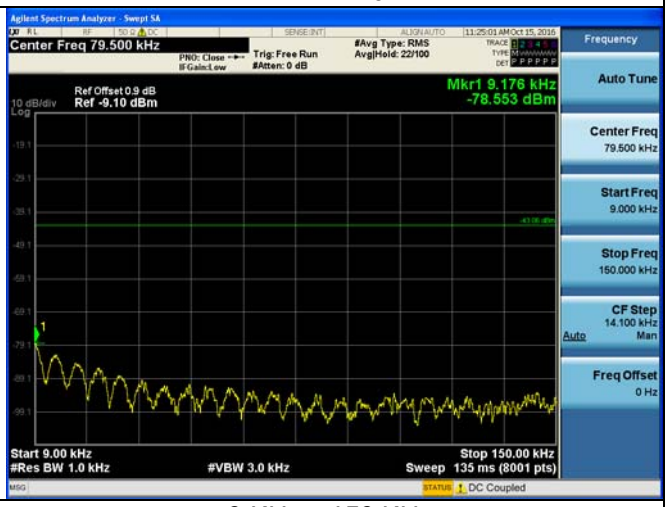
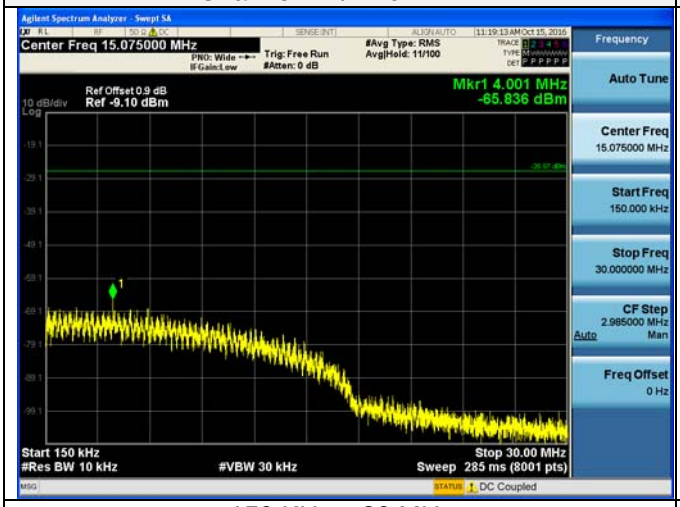
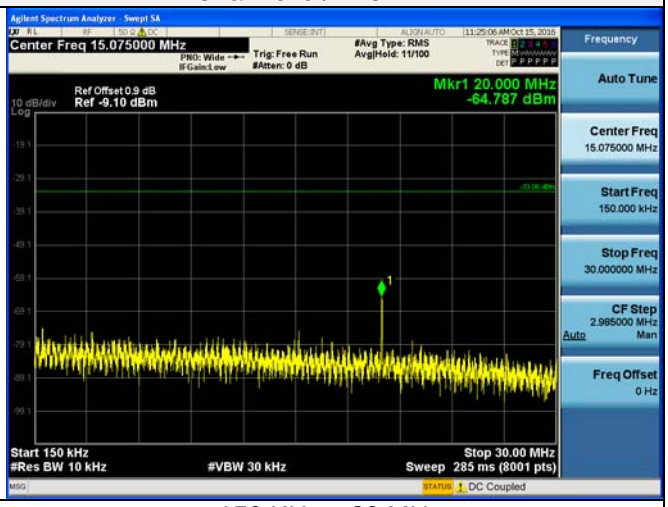
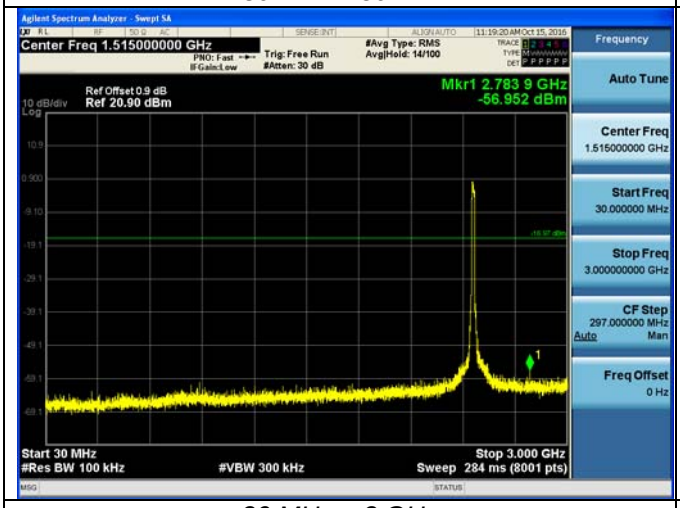
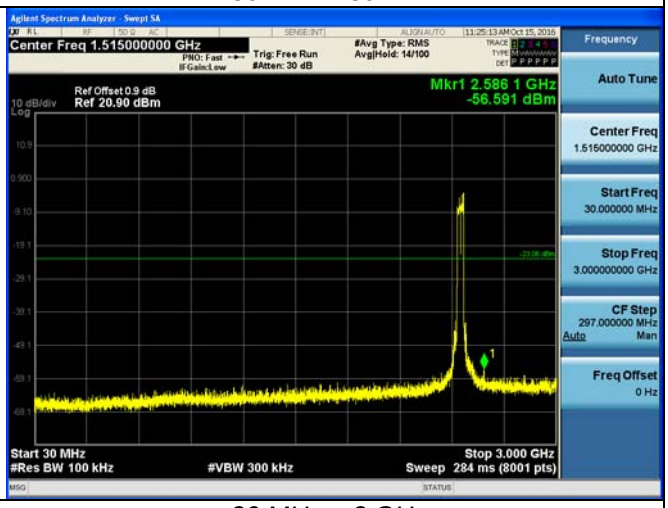
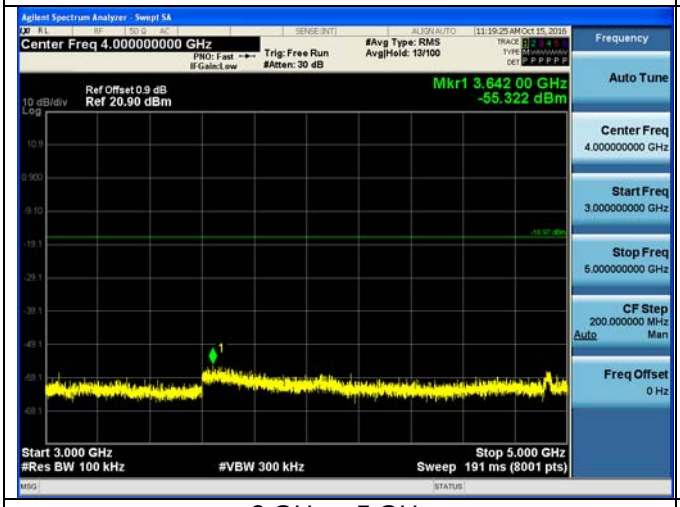
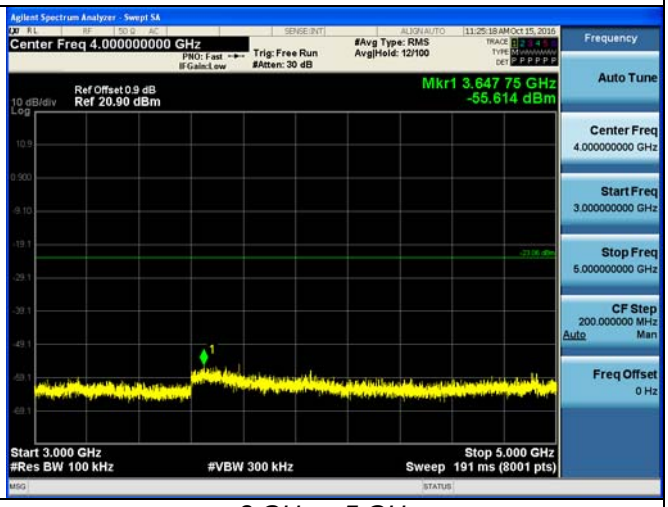
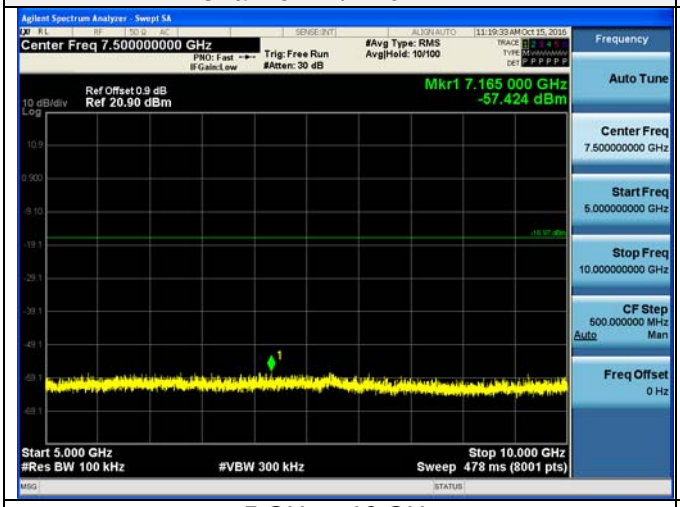
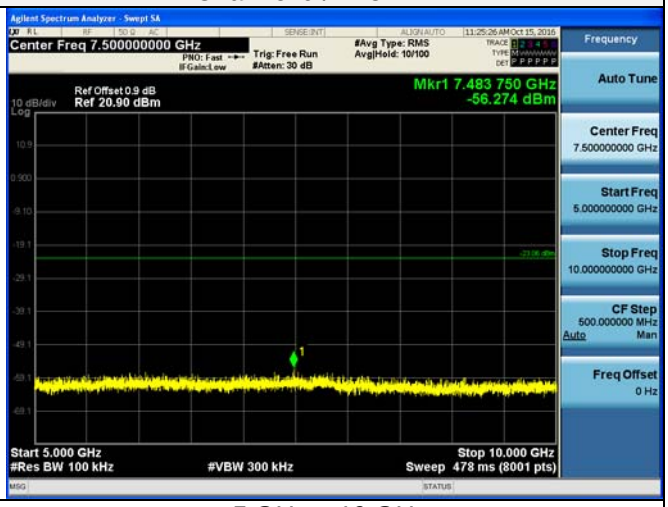
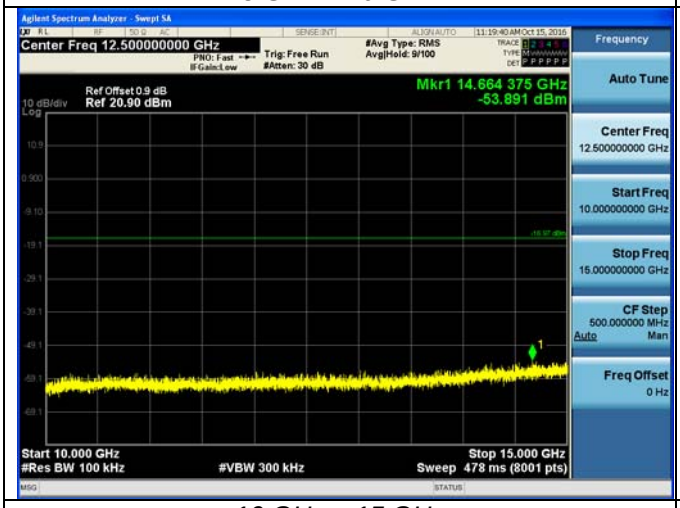
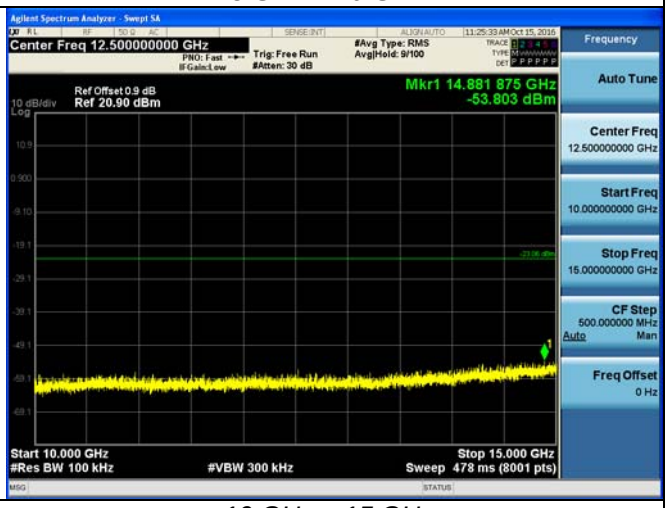
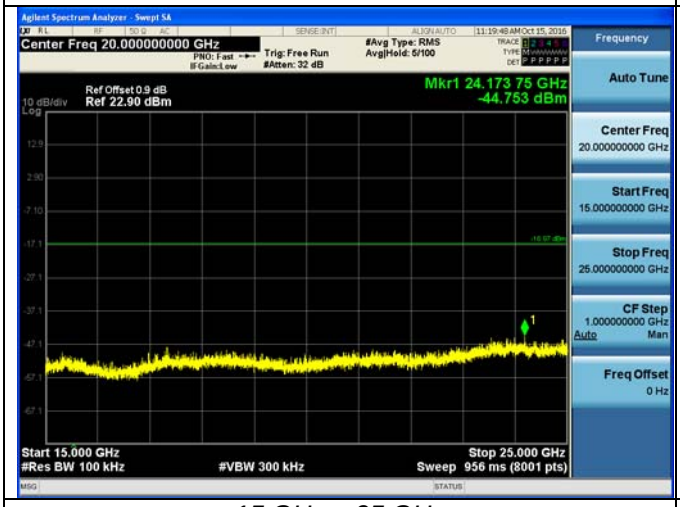
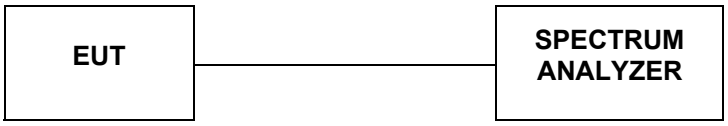
Band-edge Masurements for RF Conducted Emissions	
IEEE 802.11 n HT20	*IEEE 802.11 n HT40*
Channel 6 / 2437 MHz	*Channel 6 / 2437 MHz*
	
15 GHz – 25 GHz	*15 GHz – 25 GHz*
IEEE 802.11 n HT20	*IEEE 802.11 n HT40*
Channel 11 / 2462 MHz	*Channel 9 / 2452 MHz*
	
2442 MHz – 2482 MHz	*2412 MHz – 2492 MHz*
	
9 KHz – 150 KHz	*9 KHz – 150 KHz*

Band-edge Masurements for RF Conducted Emissions	
IEEE 802.11 n HT20	*IEEE 802.11 n HT40*
Channel 11 / 2462 MHz	*Channel 9 / 2452 MHz*
	
150 KHz – 30 MHz	*150 KHz – 30 MHz*
	
30 MHz – 3 GHz	*30 MHz – 3 GHz*
	
3 GHz – 5 GHz	*3 GHz – 5 GHz*

Band-edge Masurements for RF Conducted Emissions	
IEEE 802.11 n HT20	*IEEE 802.11 n HT40*
Channel 11 / 2462 MHz	*Channel 9 / 2452 MHz*
	
5 GHz – 10 GHz	*5 GHz – 10 GHz*
	
10 GHz – 15 GHz	*10 GHz – 15 GHz*
	
15 GHz – 25 GHz	*15 GHz – 25 GHz*

4.7 6dB Bandwidth

TEST CONFIGURATION



TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with RBW=100 KHz and VBW=300KHz.
The 6dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6dB.
According to KDB558074 D01 for one of the following procedures may be used to determine the modulated DTS device signal bandwidth.
1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

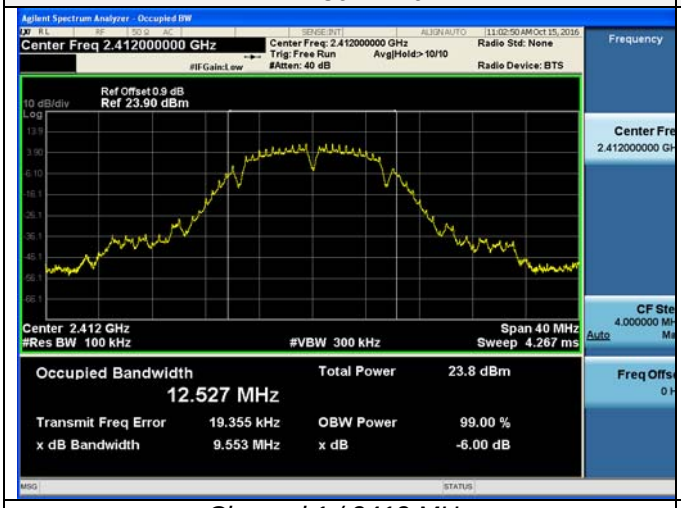
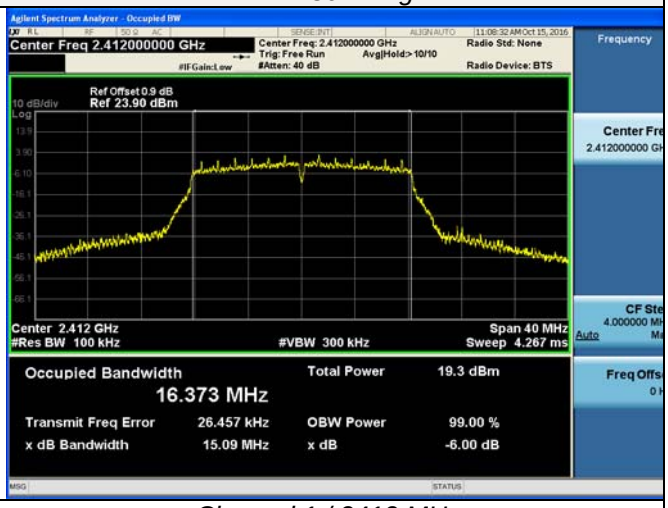
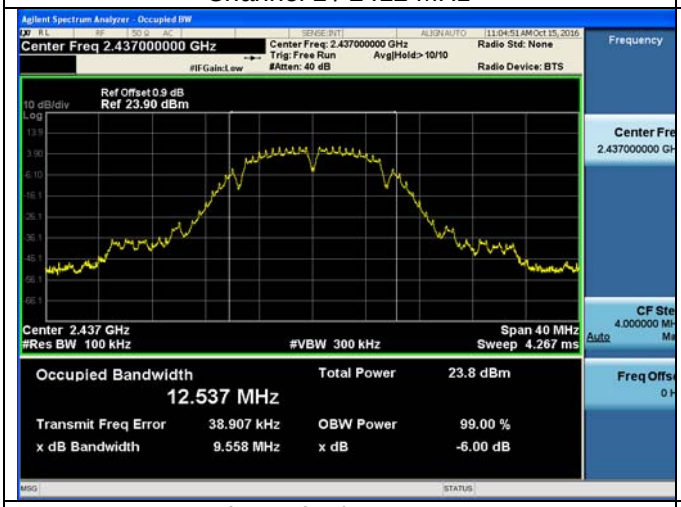
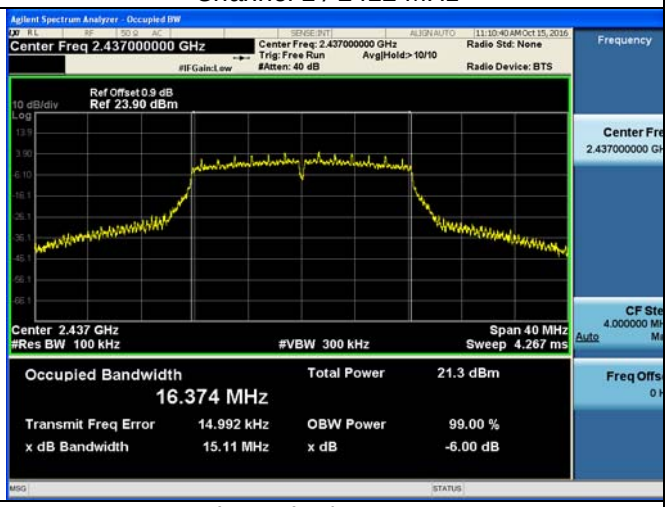
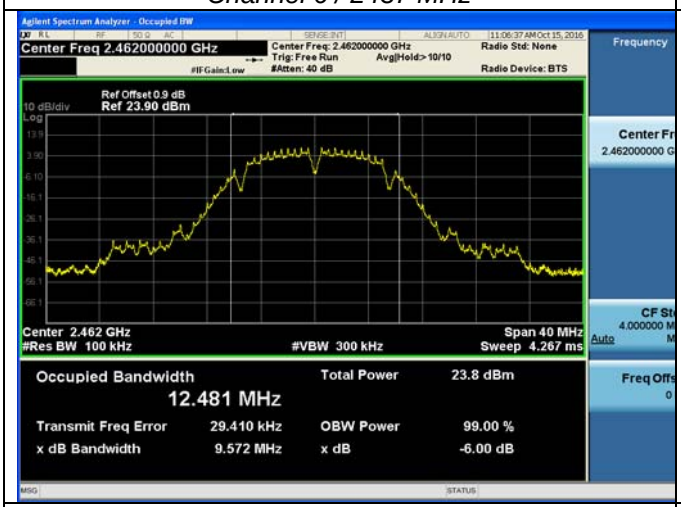
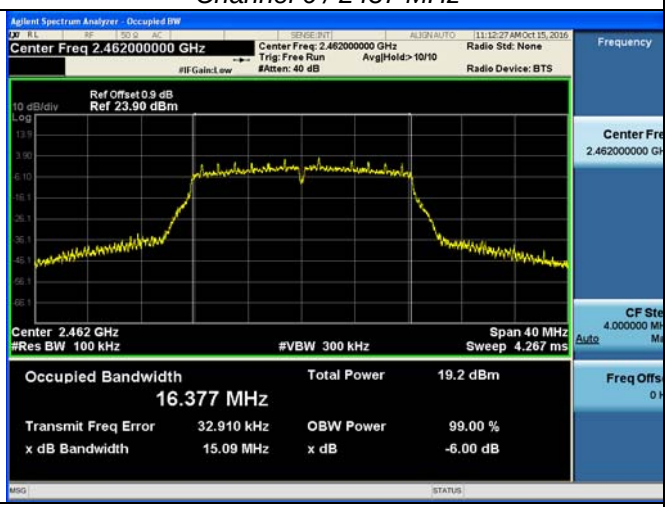
LIMIT

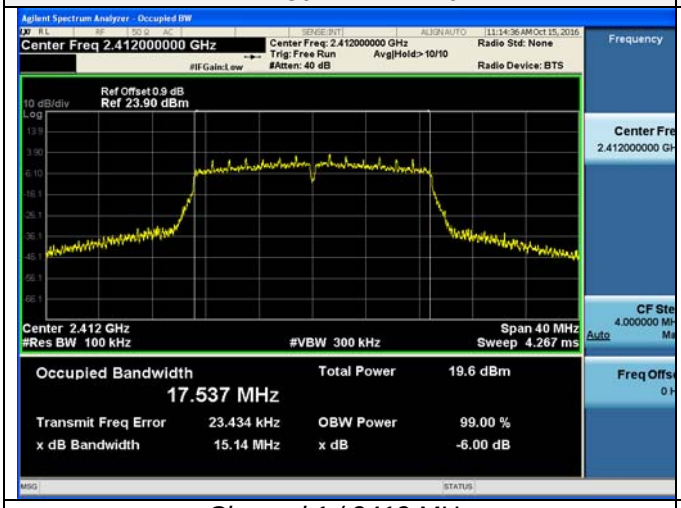
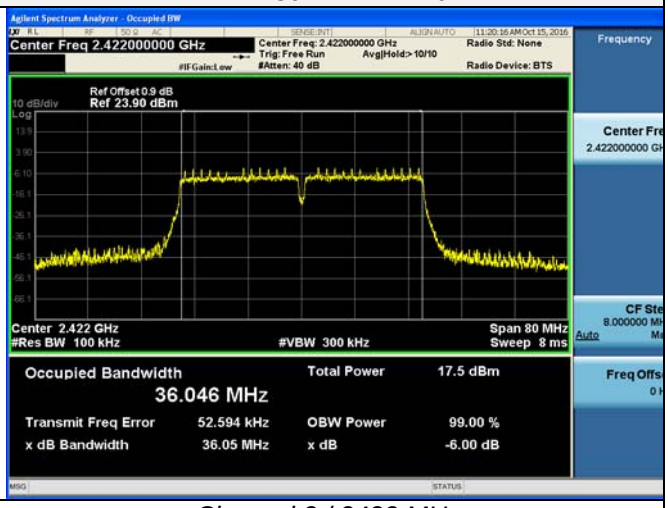
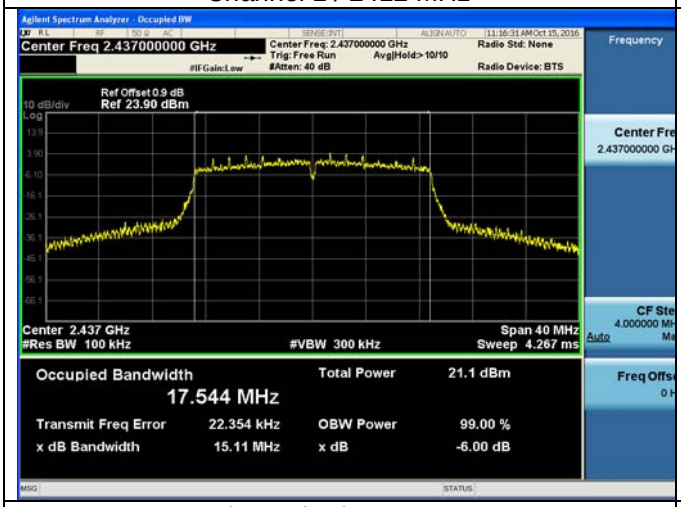
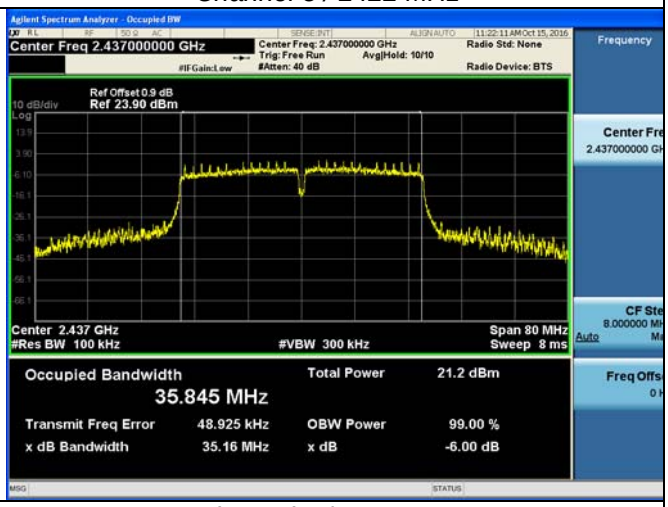
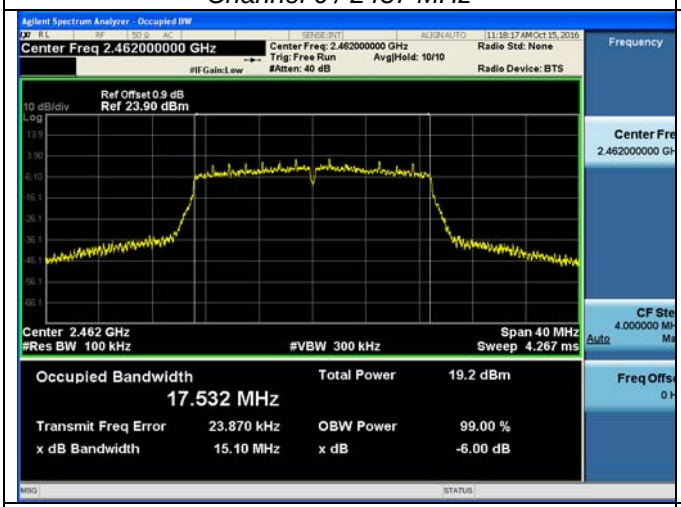
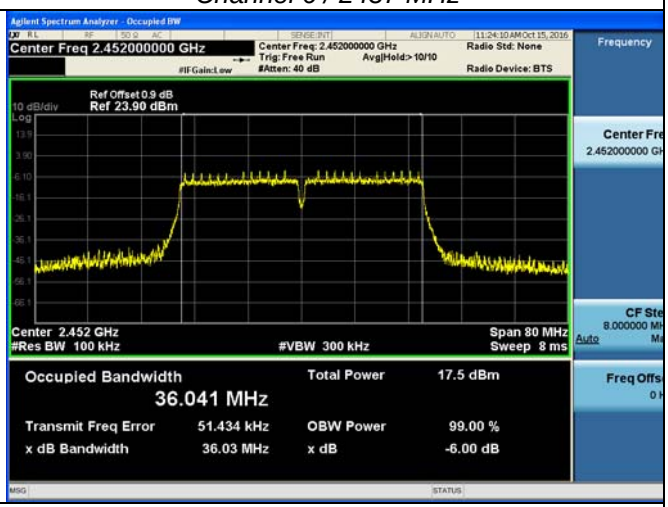
For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

TEST RESULTS

Test Mode	Channel	Frequency (MHz)	Measured 6 dB Bandwidth (MHz)	Limits (MHz)	Verdict
IEEE 802.11 b	1	2412	9.553	≥0.5000	PASS
	6	2437	9.558		
	11	2462	9.572		
IEEE 802.11 g	1	2412	15.09	≥0.5000	PASS
	6	2437	15.11		
	11	2462	15.09		
IEEE 802.11 n HT20	1	2412	15.14	≥0.5000	PASS
	6	2437	15.11		
	11	2462	15.10		
IEEE 802.11 n HT40	3	2422	36.05	≥0.5000	PASS
	6	2437	35.16		
	9	2452	36.03		

Remark:
1. *Measured output power at difference data rate for each mode and recorded worst case for each mode.*
2. *Test results including cable loss;*
3. *Worst case data at 1Mbps at IEEE 802.11 b; 6Mbps at IEEE 802.11 g; 6.5Mbps at IEEE 802.11 n HT20; 13.5Mbps at IEEE 802.11 n HT40;*
4. *please refer to following plots;*

6 dB Bandwidth	
IEEE 802.11 b	IEEE 802.11 g
	
Channel 1 / 2412 MHz	Channel 1 / 2412 MHz
	
Channel 6 / 2437 MHz	Channel 6 / 2437 MHz
	
Channel 11 / 2462 MHz	Channel 11 / 2462 MHz

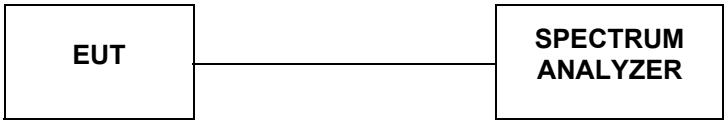
6 dB Bandwidth	
IEEE 802.11 n HT20	IEEE 802.11 n HT40
	
Channel 1 / 2412 MHz	Channel 3 / 2422 MHz
	
Channel 6 / 2437 MHz	Channel 6 / 2437 MHz
	
Channel 11 / 2462 MHz	Channel 9 / 2452 MHz

4.8 Band-edge Measurements for Radiated Emissions

TEST REQUIREMENT

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

TEST CONFIGURATION



TEST PROCEDURE

According to KDB 558074 D01 for Antenna-port conducted measurement. Antenna-port conducted measurements may also be used as an alternative to radiated measurements for demonstrating compliance in the restricted frequency bands. If conducted measurements are performed, then proper impedance matching must be ensured and an additional radiated test for cabinet/case spurious emissions is required.

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge, for Radiated emissions restricted band RBW=1MHz, VBW=3MHz for peak detector and RBW=1MHz, VBW=10Hz for Peak detector.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.
6. Measure the conducted output power (in dBm) using the detector specified by the appropriate regulatory agency (see 12.2.2, 12.2.3, and 12.2.4 for guidance regarding measurement procedures for determining quasi-peak, peak, and average conducted output power, respectively).
7. Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level (see 12.2.5 for guidance on determining the applicable antenna gain)
8. Add the appropriate maximum ground reflection factor to the EIRP level (6 dB for frequencies ≤ 30 MHz, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies > 1000 MHz).
9. For devices with multiple antenna-ports, measure the power of each individual chain and sum the EIRP of all chains in linear terms (e.g., Watts, mW).
10. Convert the resultant EIRP level to an equivalent electric field strength using the following relationship:
    $E = EIRP – 20\log D + 104.8$

where:
E = electric field strength in dBμV/m,
EIRP = equivalent isotropic radiated power in dBm
D = specified measurement distance in meters.

11. Since the out-of-band characteristics of the EUT transmit antenna will often be unknown, the use of a conservative antenna gain value is necessary. Thus, when determining the EIRP based on the measured conducted power, the upper bound on antenna gain for a device with a single RF output shall be selected as the maximum in-band gain of the antenna across all operating bands, or 2 dBi, whichever is greater. However, for devices that operate in multiple frequency bands while using the same transmit antenna, the highest gain of the antenna within the operating band nearest in frequency to the restricted band emission being measured may be used in lieu of the overall highest gain when the emission is at a frequency that is within 20 percent of the nearest band edge frequency, but in no case shall a value less than 2 dBi be used.
12. Compare the resultant electric field strength level to the applicable regulatory limit.
13. Perform radiated spurious emission test dures until all measured frequencies were complete.

LIMIT

Below -20dB of the highest emission level in operating band.
Radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)

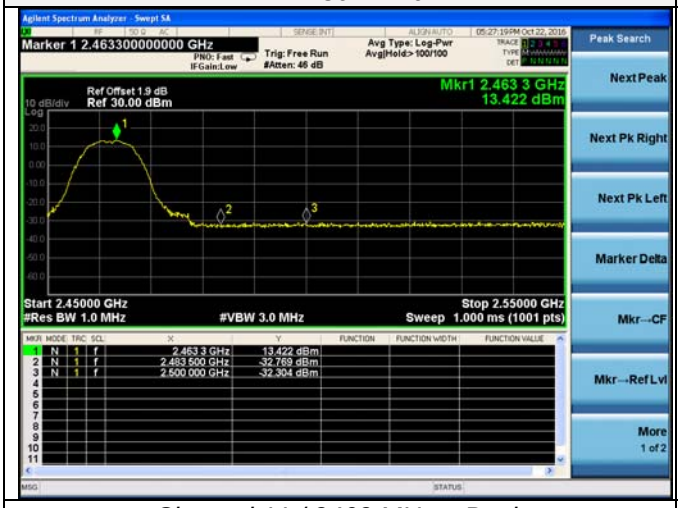
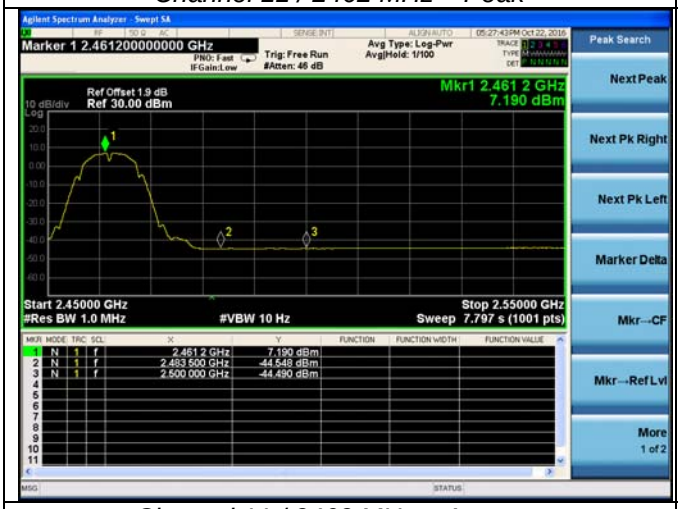
TEST RESULTS

IEEE 802.11 b							
Frequency (MHz)	**Conducted Power (dBm)**	**Antenna Gain (dBi)**	**Ground Reflection Factor (dB)**	**Covert Radiated E Level At 3m (dBuV/m)**	**Detector**	**Limit (dBuV/m)**	**Verdict**
2390.00	-31.611	2.00	0.00	65.647	Peak	74.00	PASS
2390.00	-44.760	2.00	0.00	52.498	AV	54.00	PASS
2413.18	10.966	2.00	0.00	108.224	Peak	---	PASS
2410.20	6.621	2.00	0.00	103.879	AV	---	PASS
2463.30	13.422	2.00	0.00	110.68	Peak	---	PASS
2461.20	7.190	2.00	0.00	104.448	AV	---	PASS
2483.50	-32.769	2.00	0.00	64.489	Peak	74.00	PASS
2484.80	-44.584	2.00	0.00	52.674	AV	54.00	PASS
IEEE 802.11 g							
Frequency (MHz)	**Conducted Power (dBm)**	**Antenna Gain (dBi)**	**Ground Reflection Factor (dB)**	**Covert Radiated E Level At 3m (dBuV/m)**	**Detector**	**Limit (dBuV/m)**	**Verdict**
2390.00	-29.283	2.00	0.00	67.975	Peak	74.00	PASS
2390.00	-43.577	2.00	0.00	53.681	AV	54.00	PASS
2413.56	10.712	2.00	0.00	107.97	Peak	---	PASS
2413.56	1.487	2.00	0.00	98.745	AV	---	PASS
2463.50	10.659	2.00	0.00	107.917	Peak	---	PASS
2463.10	1.140	2.00	0.00	98.398	AV	---	PASS
2483.500	-31.350	2.00	0.00	65.908	Peak	74.00	PASS
2483.500	-43.492	2.00	0.00	53.766	AV	54.00	PASS
IEEE 802.11 n HT20							
Frequency (MHz)	**Conducted Power (dBm)**	**Antenna Gain (dBi)**	**Ground Reflection Factor (dB)**	**Covert Radiated E Level At 3m (dBuV/m)**	**Detector**	**Limit (dBuV/m)**	**Verdict**
2390.000	-26.062	2.00	0.00	68.450	Peak	74.00	PASS
2390.000	-43.027	2.00	0.00	53.062	AV	54.00	PASS
2413.56	10.539	2.00	0.00	105.802	Peak	---	PASS
2413.44	0.436	2.00	0.00	95.952	AV	---	PASS
2463.60	10.610	2.00	0.00	105.133	Peak	---	PASS
2463.50	0.520	2.00	0.00	95.235	AV	---	PASS
2483.50	-31.474	2.00	0.00	71.588	Peak	74.00	PASS
2483.50	-43.205	2.00	0.00	51.303	AV	54.00	PASS
IEEE 802.11 n HT40							
Frequency (MHz)	**Conducted Power (dBm)**	**Antenna Gain (dBi)**	**Ground Reflection Factor (dB)**	**Covert Radiated E Level At 3m (dBuV/m)**	**Detector**	**Limit (dBuV/m)**	**Verdict**
2390.00	-28.707	2.00	0.00	68.551	Peak	74.00	PASS
2390.00	-43.856	2.00	0.00	53.402	AV	54.00	PASS
2424.66	7.205	2.00	0.00	104.463	Peak	---	PASS
2428.02	-6.744	2.00	0.00	90.514	AV	---	PASS
2457.36	6.787	2.00	0.00	104.045	Peak	---	PASS
2458.80	-2.963	2.00	0.00	94.295	AV	---	PASS
2483.50	-30.722	2.00	0.00	66.536	Peak	74.00	PASS
2483.50	-43.339	2.00	0.00	53.919	AV	54.00	PASS

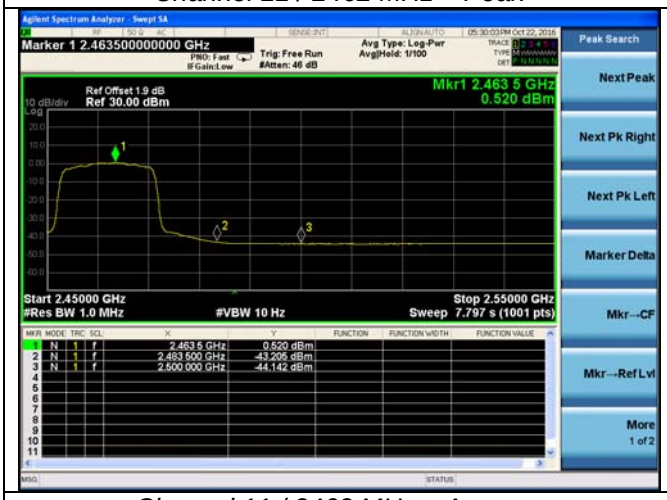
Remark:
1. *Measured output power at difference data rate for each mode and recorded worst case for each mode.*

2. *Test results including cable loss;*
3. *Worst case data at 1Mbps at IEEE 802.11 b; 6Mbps at IEEE 802.11 g; 6.5Mbps at IEEE 802.11 n HT20; 13.5Mbps at IEEE 802.11 n HT40;*
4. *"---" means that the fundamental frequency not for 15.209 limits requirement.*
5. *please refer to following plots;*

Band-edge Measurements for Radiated Emissions	
IEEE 802.11 b	*IEEE 802.11 g*
	
Channel 1 / 2412 MHz – Peak	*Channel 1 / 2412 MHz – Peak*
	
Channel 1 / 2412 MHz – Average	*Channel 1 / 2412 MHz – Average*

Band-edge Measurements for Radiated Emissions	
IEEE 802.11 b	IEEE 802.11 g
	
Channel 11 / 2462 MHz – Peak	Channel 11 / 2462 MHz – Peak
	
Channel 11 / 2462 MHz – Average	Channel 11 / 2462 MHz – Average

Band-edge Measurements for Radiated Emissions	
IEEE 802.11 n HT20	*IEEE 802.11 n HT40*
	
Channel 1 / 2412 MHz – Peak	*Chanenl 3 / 2422 MHz – Peak*
	
Channel 1 / 2412 MHz – Average	*Chanenl 3 / 2422 MHz – Average*

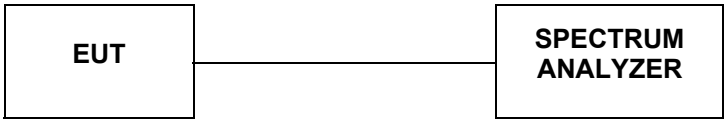
Band-edge Measurements for Radiated Emissions	
IEEE 802.11 n HT20	*IEEE 802.11 n HT40*
	
Channel 11 / 2462 MHz – Peak	*Channel 9 / 2452 MHz – Peak*
	
Channel 11 / 2462 MHz – Average	*Chanenl 9 / 2452 MHz – Average*

4.9 Band-edge Measurements for RF Conducted Emissions

LIMIT

1. Below -20dB of the highest emission level in operating band.
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

TEST CONFIGURATION



TEST PROCEDURE

According to KDB 558074 D01 for Antenna-port conducted measurement.

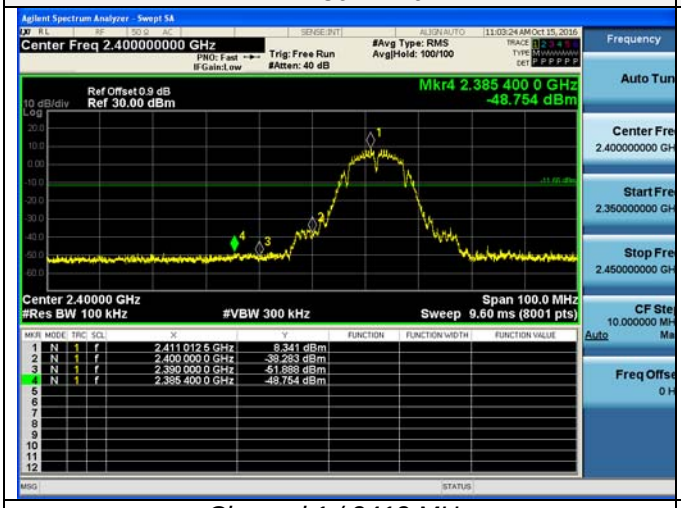
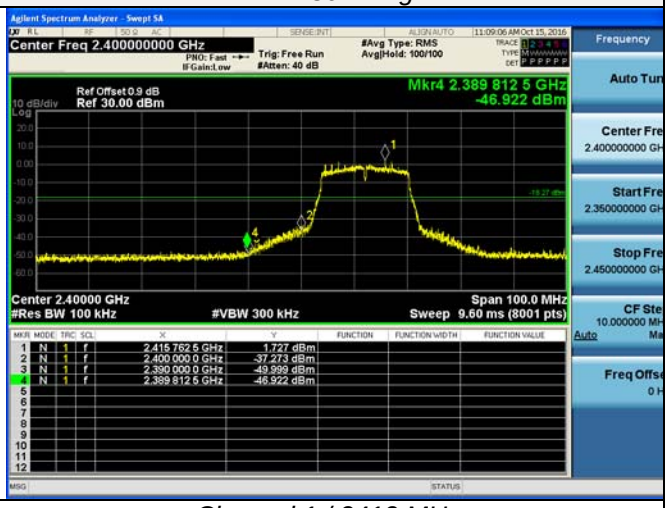
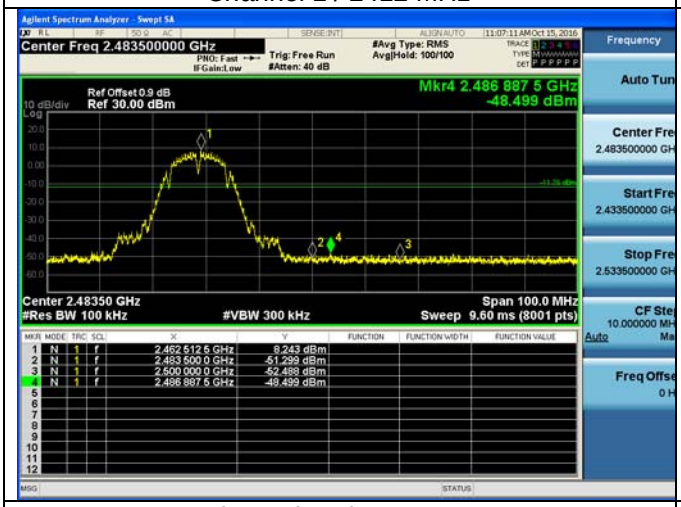
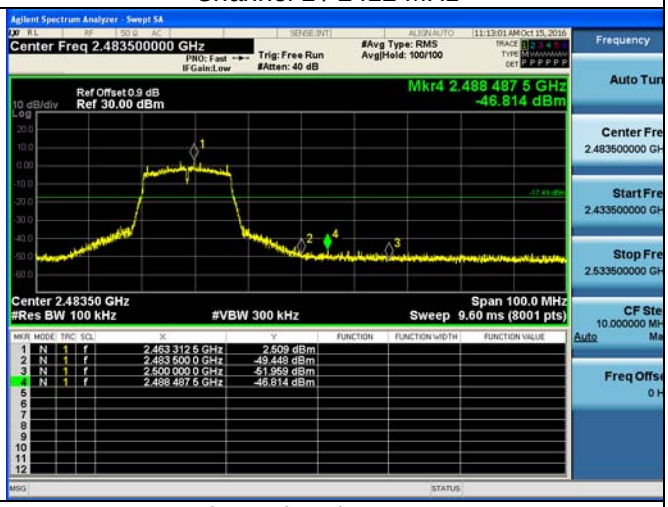
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge,
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.
6. Measure the conducted output power (in dBm) using the detector specified by the appropriate regulatory agency (see 12.2.2, 12.2.3, and 12.2.4 for guidance regarding measurement procedures for determining quasi-peak, peak, and average conducted output power, respectively).

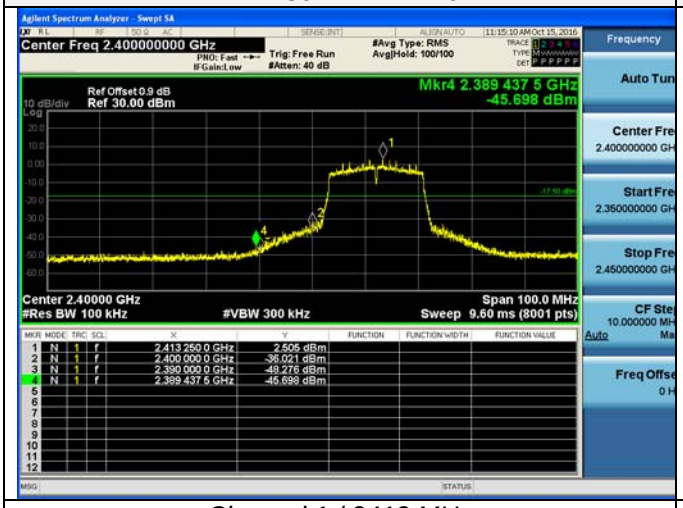
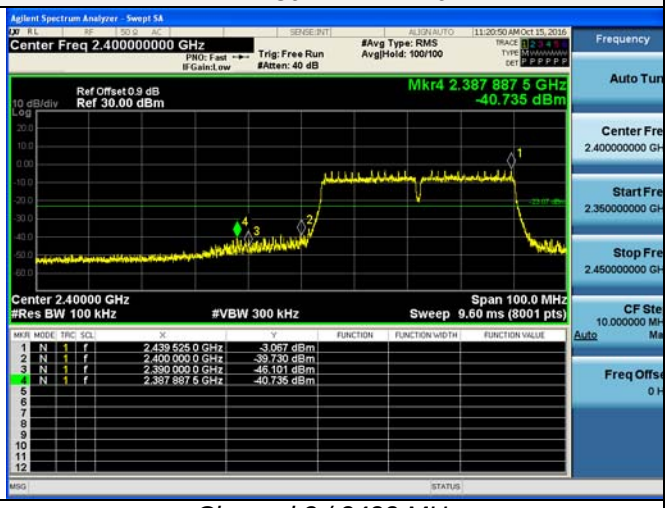
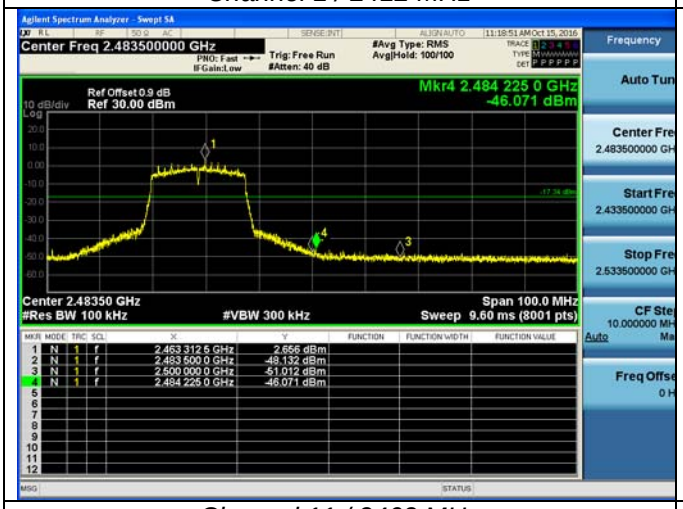
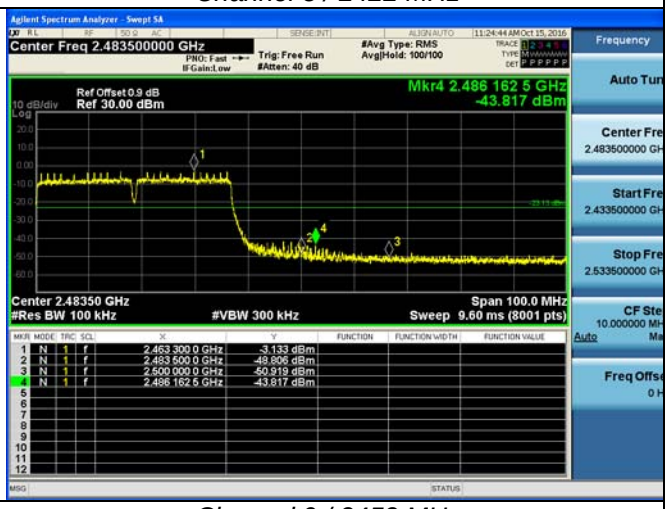
TEST RESULTS

Test Mode	Channel	Frequency (MHz)	Conductd Band-edge Emission (dBc)	Limits (dBc)	Verdict
IEEE 802.11 b	1	2412	<-20dBc	-20	PASS
	11	2462	<-20dBc	-20	
IEEE 802.11 g	1	2412	<-20dBc	-20	PASS
	11	2462	<-20dBc	-20	
IEEE 802.11 n HT20	1	2412	<-20dBc	-20	PASS
	11	2462	<-20dBc	-20	
IEEE 802.11 n HT40	3	2422	<-20dBc	-20	PASS
	9	2452	<-20dBc	-20	

Remark:

1. *Measured output power at difference data rate for each mode and recorded worst case for each mode.*
2. *Test results including cable loss;*
3. *Worst case data at 1Mbps at IEEE 802.11 b; 6Mbps at IEEE 802.11 g; 6.5Mbps at IEEE 802.11 n HT20; 13.5Mbps at IEEE 802.11 n HT40;*
4. *"---" means that the fundamental frequency not for 15.209 limits requirement.*
5. *please refer to following plots;*

Band-edge Measurements for RF Conducted Emissions	
IEEE 802.11 b	IEEE 802.11 g
	
Channel 1 / 2412 MHz	Channel 1 / 2412 MHz
	
Channel 11 / 2462 MHz	Channel 11 / 2462 MHz

Band-edge Measurements for RF Conducted Emissions	
IEEE 802.11 n HT20	IEEE 802.11 n HT40
	
Channel 1 / 2412 MHz	Channel 3 / 2422 MHz
	
Channel 11 / 2462 MHz	Channel 9 / 2452 MHz

4.10 Antenna Requirement

Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And according to FCC 47 CFR Section 15.247 (c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

Refer to statement below for compliance.

The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

Antenna Connected Construction

According to § 15.203 & RSS-Gen, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

Antenna Connector Construction

The directional gains of antenna used for transmitting is 0 dBi, and the antenna is an internal antenna connect to PCB board and no consideration of replacement. Please see EUT photo for details.
The WLAN and Bluetooth share same antenna.

Measurement

The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module.For normal WLAN devices, the DSSS mode is used.

Conducted power refer ANSI C63.10 :2013 Output power test procedure for DTS devices
Radiated power refer to ANSI C63.10 :2013 Radiated emissions tests.

Measurement parameters

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1MHz
Video bandwidth:	3MHz
Trace-Mode:	Max hold

Limits

FCC	IC
Antenna Gain	
6 dBi	

Results

T_{nom}	V_{nom}	Lowest Channel 2412 MHz	Middle Channel 2437 MHz	Highest Channel 2462 MHz
Conducted power [dBm] Measured with DSSS modulation		11.870	11.820	11.820
Radiated power [dBm] Measured with DSSS modulation		10.303	10.560	10.927
Gain [dBi] Calculated		-1.567	-1.260	-1.893
Measurement uncertainty		± 0.6 dB (cond.) / ± 2.56 dB (rad.)		

5 Test Setup Photos of the EUT

Please refer to separated files for Test Setup Photos of the EUT.

6 External Photos of the EUT

Please refer to separated files for External Photos of the EUT.

7 Internal Photos of the EUT

Please refer to separated files for Internal Photos of the EUT.

.....End of Report.....