



RF TEST REPORT

Applicant Huawei Technologies Co., Ltd.
FCC ID QISWE3200
Product 300Mbps WiFi Extender
Model WE3200
Report No. R1807H0075-R1
Issue Date August 17, 2018

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 15C (2018)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

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Summary of measurement results

Number	Summary of measurements of results	Clause in FCC rules	Verdict
1	Maximum conducted output power	15.247(b)(3)	PASS
2	6 dB bandwidth	15.247(a)(2)	PASS
3	Power spectral density	15.247(e)	PASS
4	Band Edge	15.247(d)	PASS
5	Spurious RF Conducted Emissions	15.247(d)	PASS
6	Unwanted Emissions	15.247(d),15.205,15.209	PASS
7	Conducted Emissions	15.207	PASS

Date of Testing: July 31, 2018~ August 16, 2018

1. Test Laboratory

1.1. Notes of the test report

This report shall not be reproduced in full or partial, without the written approval of **TA technology (shanghai) co., Ltd.** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein .Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above.

1.2. Test facility

CNAS (accreditation number: L2264)

TA Technology (Shanghai) Co., Ltd. has obtained the accreditation of China National Accreditation Service for Conformity Assessment (CNAS).

FCC (Designation number: CN1179, Test Firm Registration Number: 446626)

TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

IC (recognition number is 8510A)

TA Technology (Shanghai) Co., Ltd. has been listed by industry Canada to perform electromagnetic emission measurement.

VCCI (recognition number is C-4595, T-2154, R-4113, G-10766)

TA Technology (Shanghai) Co., Ltd. has been listed by industry Japan to perform electromagnetic emission measurement.

A2LA (Certificate Number: 3857.01)

TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.



1.3. Testing Location

Company: TA Technology (Shanghai) Co., Ltd.
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City: Shanghai
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E-mail: xukai@ta-shanghai.com

2. General Description of Equipment under Test

Client Information

Applicant	Huawei Technologies Co., Ltd.
Applicant address	Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.China.
Manufacturer	Huawei Technologies Co., Ltd.
Manufacturer address	Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.China.

General information

EUT Description	
Model	WE3200
SN	J4N8W18528000030
Hardware Version	AM1WE3200M
Software Version	8.0.1.5
Power Supply	External Power Supply
Antenna Type	Internal Antenna
Antenna Connector	A permanently attached antenna (meet with the standard FCC Part 15.203 requirement)
Antenna Gain	Antenna 1: 2.00 dBi Antenna 2: 2.00 dBi
additional beamforming gain	NA
Test Mode	802.11b, 802.11g, 802.11n(HT20/HT40);
Modulation Type	802.11b: DSSS; 802.11g/n(HT20/HT40): OFDM
Max. Conducted Power	22.07dBm
Operating Frequency Range(s)	802.11b/g/n(HT20): 2412 ~ 2462 MHz 802.11n(HT40): 2422 ~ 2452 MHz
Note: The information of the EUT is declared by the manufacturer.	

3. Applied Standards

According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

Test standards

- **FCC CFR47 Part 15C (2018) Radio Frequency Devices**
- **ANSI C63.10 (2013)**
- **KDB 558074 D01 DTS Meas Guidance v04**
- **KDB 662911 D01 Multiple Transmitter Output v02r01**

4. Test Configuration

Test Mode

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application.

The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in lie-down position (X axis) and the worst case was recorded.

In order to find the worst case condition, Pre-tests are needed at the presence of different data rate. Preliminary tests have been done on all the configuration for confirming worst case. Data rate below means worst-case rate of each test item.

The test software is used IPOP

Worst-case data rates are shown as following table.

Band	Data Rate
802.11b	1 Mbps
802.11g	6 Mbps
802.11n HT20	MCS0
802.11n HT40	MCS0

According to RF Output power results in chapter 5.1, MIMO was selected as the worst antenna for 802.11n HT20/ HT40. SISO Antenna 2 was selected as the worst SISO antenna.

The worst case Antenna mode for each of the following tests for Wi-Fi:

Test Cases	Antenna 1	Antenna 2	MIMO
Maximum conducted output power	O	O	802.11n HT20 802.11n HT40
6dB Bandwidth	--	802.11b/g	802.11n HT20 802.11n HT40
Band Edge	--	802.11b/g	802.11n HT20 802.11n HT40
Power Spectral Density	O	O	802.11n HT20 802.11n HT40
Spurious RF Conducted Emissions	--	802.11b/g	802.11n HT20 802.11n HT40
Unwanted Emissions	--	802.11b/g	802.11n HT20 802.11n HT40
Conducted Emission	--	802.11b/g	802.11n HT20 802.11n HT40
Note: "O": test all bands			

5. Test Case Results

5.1. Maximum conducted output power

Ambient condition

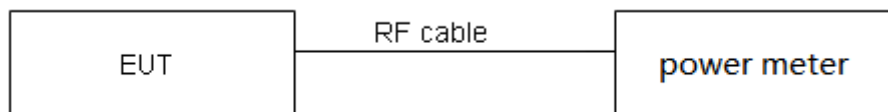
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Methods of Measurement

During the process of the testing, The EUT was connected to Average Power meter with a known loss. The EUT is max power transmission with proper modulation. The signal transmission is continuous.

The conducted Power is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically.

Test Setup



Limits

Rule Part 15.247 (b) (3) specifies that " For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz: 1 Watt."

Average Output Power	$\leq 1W$ (30dBm)
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Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 0.44$ dB.

Test Results

Single Antenna Power Index						
Packet Type	Antenna 1			Antenna 2		
	CH1	CH6	CH11	CH1	CH6	CH11
802.11b	52	52	52	50	52	52
802.11g	47	54	47	47	54	48
802.11n HT20	50	55	48	48	55	46
Packet Type	CH3	CH6	CH9	CH3	CH6	CH9
802.11n HT40	48	54	47	47	53	45

MIMO Power Index			
Packet Type	CH1	CH6	CH11
802.11n HT20	51	55	49
Packet Type	CH3	CH6	CH9
802.11n HT40	50	56	48

Band	T _{on} (ms)	T _(on+off) (ms)	Duty cycle	Duty cycle correction Factor(dB)
802.11b	1.00	1.00	1.00	NA
802.11g	1.00	1.00	1.00	NA
802.11n HT20	1.00	1.00	1.00	NA
802.11n HT40	1.00	1.00	1.00	NA

Note: when Duty cycle>0.98, Duty cycle correction Factor not required.

SISO Antenna 1

Network Standards	Carrier frequency (MHz)	Average Power Measured (dBm)	Average Power with duty factor (dBm)	Limit (dBm)	Conclusion
802.11b	2412	19.01	19.01	30	PASS
	2437	19.18	19.18	30	PASS
	2462	19.11	19.11	30	PASS
802.11g	2412	16.95	16.95	30	PASS
	2437	18.98	18.98	30	PASS
	2462	17.11	17.11	30	PASS
802.11n HT20	2412	17.12	17.12	30	PASS
	2437	19.09	19.09	30	PASS
	2462	16.37	16.37	30	PASS
802.11n HT40	2422	16.93	16.93	30	PASS
	2437	19.01	19.01	30	PASS
	2452	16.04	16.04	30	PASS

Note: Average Power with duty factor = Average Power Measured +Duty cycle correction factor

SISO Antenna 2

Network Standards	Carrier frequency (MHz)	Average Power Measured (dBm)	Average Power with duty factor (dBm)	Limit (dBm)	Conclusion
802.11b	2412	19.18	19.18	30	PASS
	2437	19.15	19.15	30	PASS
	2462	19.16	19.16	30	PASS
802.11g	2412	17.16	17.16	30	PASS
	2437	18.99	18.99	30	PASS
	2462	16.95	16.95	30	PASS
802.11n HT20	2412	17.28	17.28	30	PASS
	2437	19.22	19.22	30	PASS
	2462	15.92	15.92	30	PASS
802.11n HT40	2422	17.05	17.05	30	PASS
	2437	19.05	19.05	30	PASS
	2452	15.88	15.88	30	PASS

Note: Average Power with duty factor = Average Power Measured +Duty cycle correction factor

MIMO

Network Standards	Carrier frequency (MHz)	MIMO Antenna 1		MIMO Antenna 2		Total Power (dBm)	Limit (dBm)	Conclusion
		Average Power Measured (dBm)	Average Power with duty factor (dBm)	Average Power Measured (dBm)	Average Power with duty factor (dBm)			
802.11n HT20	2412	16.88	16.88	17.44	17.44	20.18	30	PASS
	2437	18.77	18.77	19.08	19.08	21.94	30	PASS
	2462	15.87	15.87	16.14	16.14	19.02	30	PASS
802.11n HT40	2422	16.71	16.71	17.09	17.09	19.91	30	PASS
	2437	18.93	18.93	19.19	19.19	22.07	30	PASS
	2452	15.76	15.76	16.20	16.20	19.00	30	PASS

Note: 1. Average Power with duty factor = Average Power Measured + Duty cycle correction factor
 2. For Total Power, according to KDB 662911 D01 Multiple Transmitter Output v02r01 1),
 The Total Power = $10 \log(10^{(Power\ antenna1\ in\ dBm/10)} + 10^{(Power\ antenna2\ in\ dBm/10)})$.
 3. The manufacturer declared the transmitter output signals is CDD mode. And $N_{SS}=2$. According to KDB 662911 D01 Multiple Transmitter Output v02r01 2)f)(i): If all antennas have the same gain, Directional gain = $G_{ANT} + \text{Array Gain}$,
 For power measurements on IEEE 802.11 devices,
 Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;
 Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT} ;
 Array Gain = $5 \log(N_{ANT}/N_{SS})$ dB or 3 dB, whichever is less, for 20-MHz channel widths with $N_{ANT} \geq 5$.
 So directional gain = $G_{ANT} + \text{Array Gain} = 2 + 0 = 2$ dB < 6 dBi. So the power limit is 30 dBm

5.2. 6dB Bandwidth

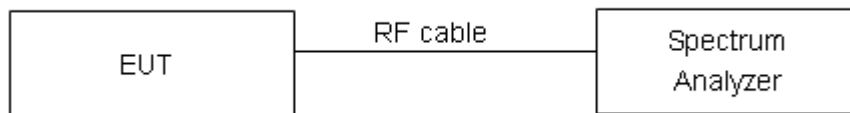
Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable. RBW is set to 100 kHz; VBW is set to 300 kHz on spectrum analyzer. Dector=Peak, Trace mode=max hold.

Test Setup



Limits

Rule Part 15.247 (a) (2) specifies that “Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.”

minimum 6 dB bandwidth	≥ 500 kHz
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Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 936$ Hz.

Test Results:

According to RF Output power results in chapter 5.1, MIMO was selected as the worst antenna for 802.11n HT20/ HT40. SISO Antenna 2 was selected as the worst SISO antenna.

SISO Antenna 2

Network Standards	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 6 dB bandwidth (MHz)	Limit (kHz)	Conclusion
802.11b	2412	14.748	10.060	500	PASS
	2437	14.997	10.100	500	PASS
	2462	14.812	9.620	500	PASS
802.11g	2412	16.384	16.420	500	PASS
	2437	16.541	16.460	500	PASS
	2462	16.411	16.480	500	PASS

MIMO Antenna 1

Network Standards	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 6 dB bandwidth (MHz)	Limit (kHz)	Conclusion
802.11n HT20	2412	17.556	17.61	500	PASS
	2437	17.591	17.63	500	PASS
	2462	17.511	17.62	500	PASS
802.11n HT40	2422	35.965	36.36	500	PASS
	2437	36.170	36.47	500	PASS
	2452	36.035	36.43	500	PASS

MIMO Antenna 2

Network Standards	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 6 dB bandwidth (MHz)	Limit (kHz)	Conclusion
802.11n HT20	2412	17.515	17.34	500	PASS
	2437	17.599	17.61	500	PASS
	2462	17.485	17.21	500	PASS
802.11n HT40	2422	36.061	36.37	500	PASS
	2437	36.253	36.44	500	PASS
	2452	35.901	35.93	500	PASS

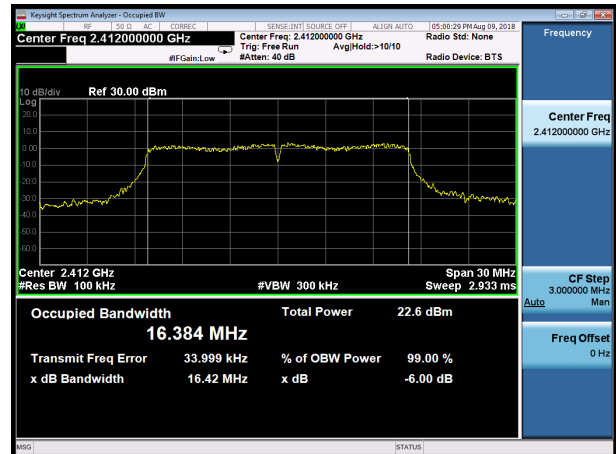


SISO Antenna 2

802.11b, Carrier frequency (MHz): 2412



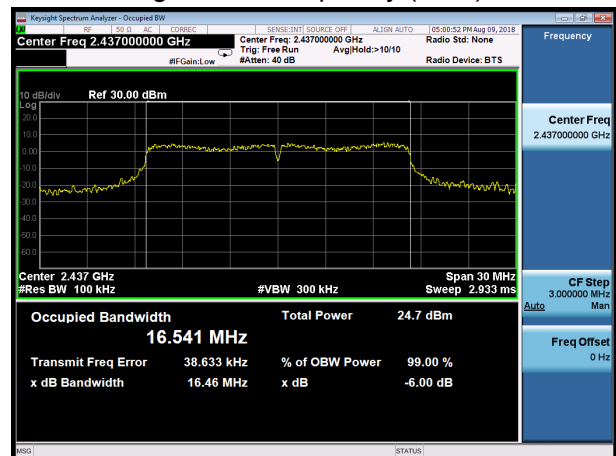
802.11g, Carrier frequency (MHz): 2412



802.11b, Carrier frequency (MHz): 2437



802.11g, Carrier frequency (MHz): 2437



802.11b, Carrier frequency (MHz): 2462



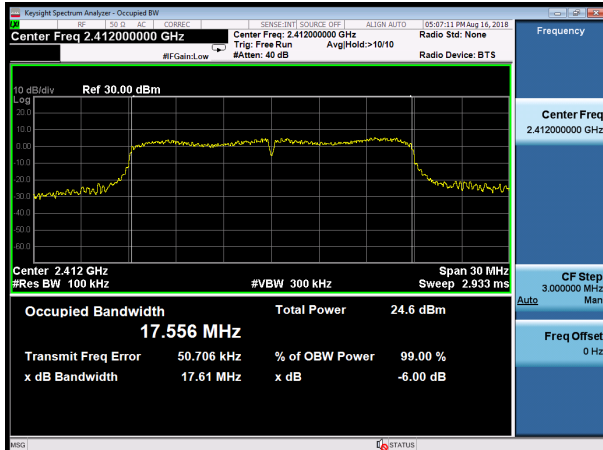
802.11g, Carrier frequency (MHz): 2462



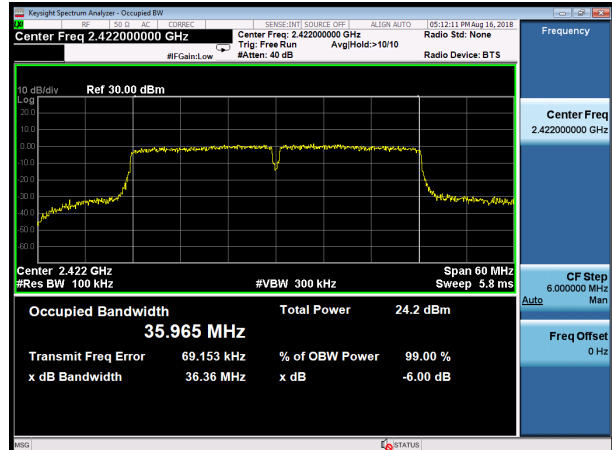


MIMO Antenna 1

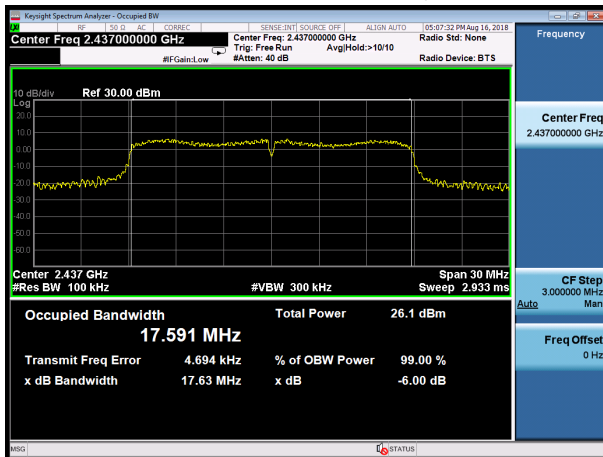
802.11n(HT20), Carrier frequency (MHz): 2412



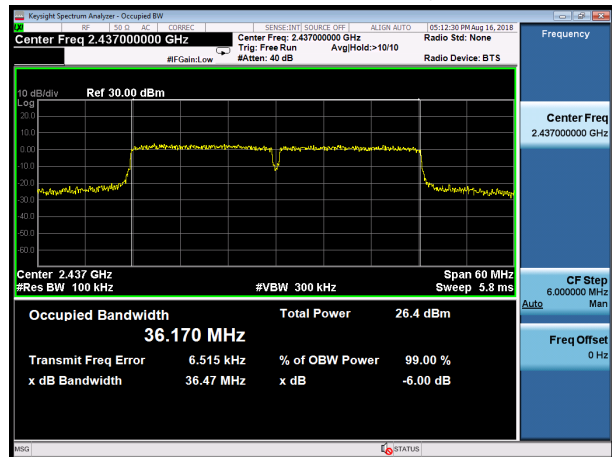
802.11n(HT40), Carrier frequency (MHz): 2422



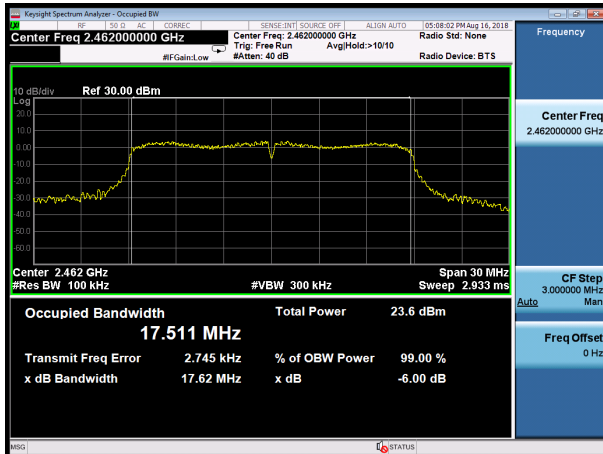
802.11n(HT20), Carrier frequency (MHz): 2437



802.11n(HT40), Carrier frequency (MHz): 2437



802.11n(HT20), Carrier frequency (MHz): 2462



802.11n(HT40), Carrier frequency (MHz): 2452



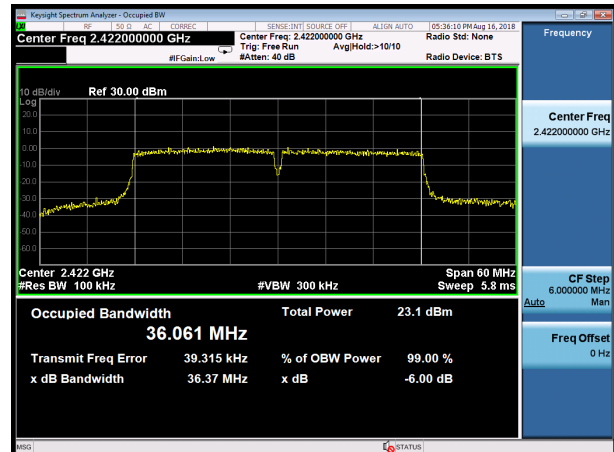


MIMO Antenna 2

802.11n(HT20), Carrier frequency (MHz): 2412



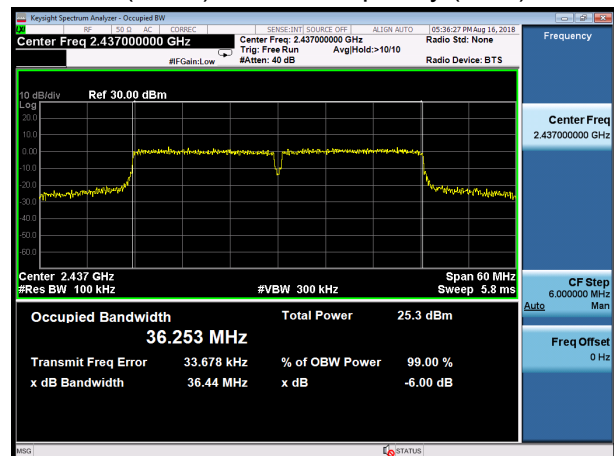
802.11n(HT40), Carrier frequency (MHz): 2422



802.11n(HT20), Carrier frequency (MHz): 2437



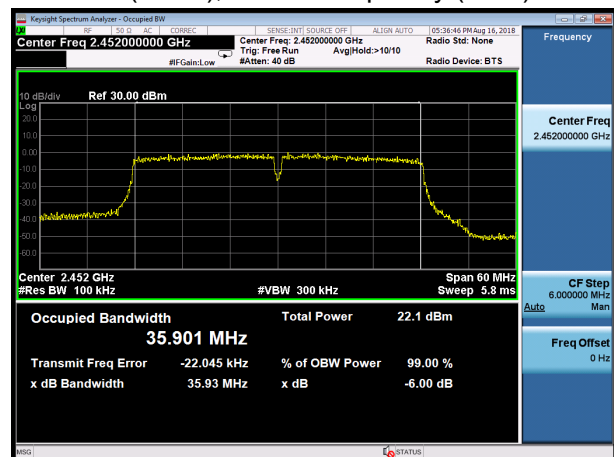
802.11n(HT40), Carrier frequency (MHz): 2437



802.11n(HT20), Carrier frequency (MHz): 2462



802.11n(HT40), Carrier frequency (MHz): 2452



5.3. Band Edge

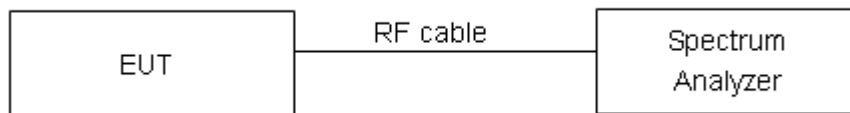
Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable the band edge of the lowest and highest channels were measured. The peak detector is used and RBW is set to 100 kHz and VBW is set to 300 kHz on spectrum analyzer. Spectrum analyzer plots are included on the following pages.

Test Setup



Limits

Rule Part 15.247(d) specifies that “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.”

Measurement Uncertainty

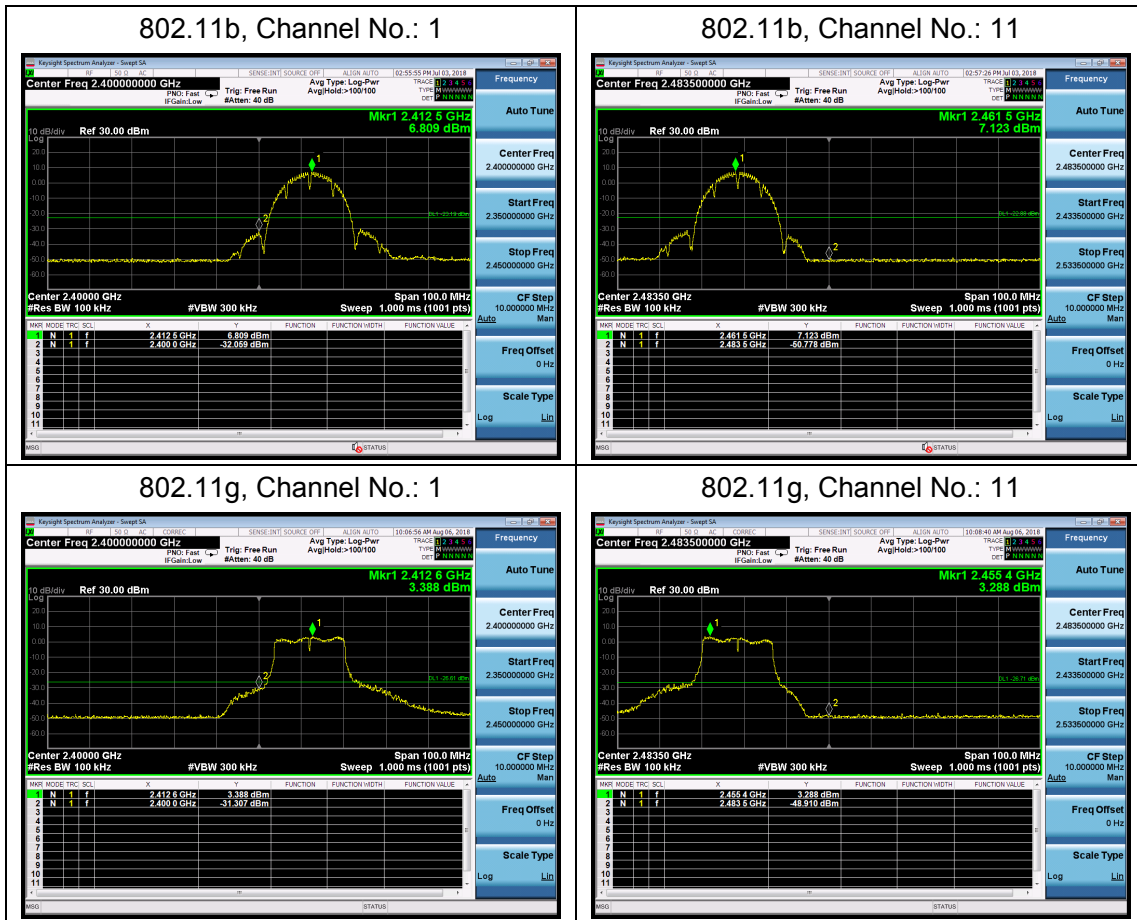
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 1.96$.

Frequency	Uncertainty
2GHz-3GHz	1.407 dB



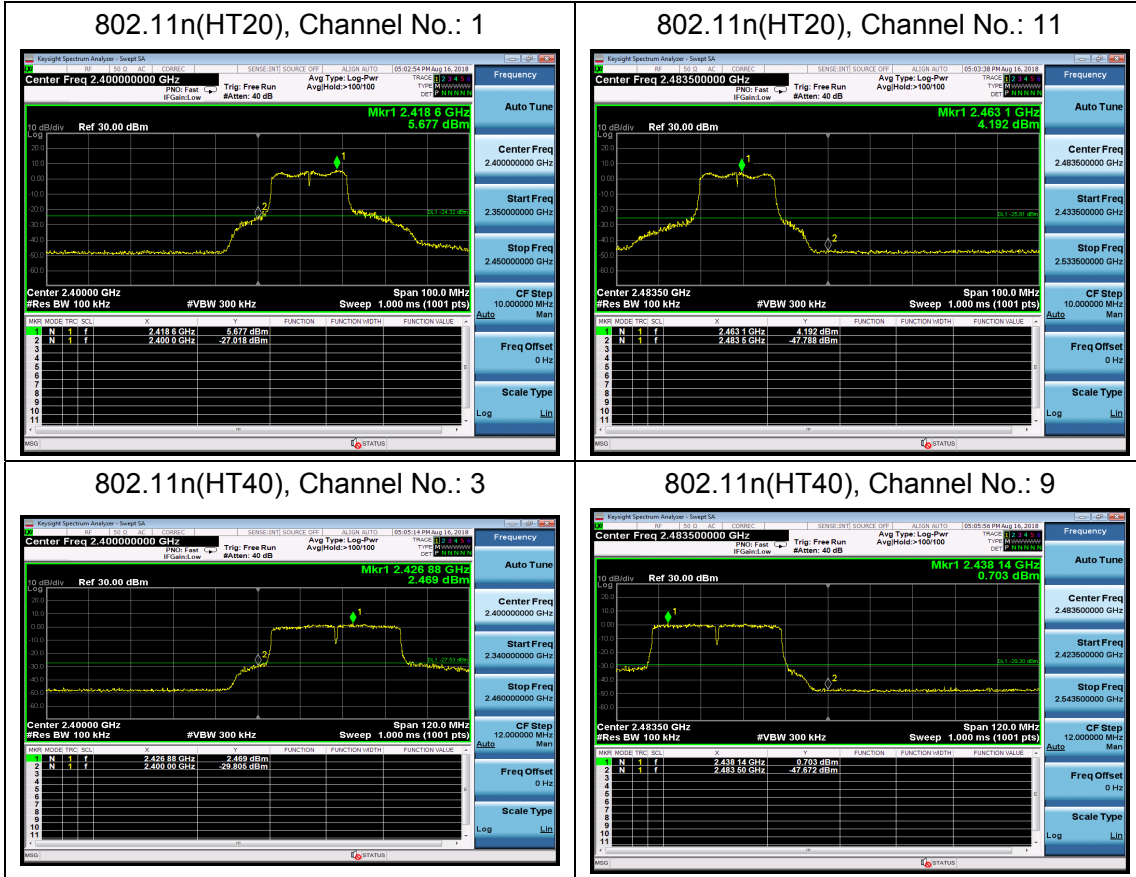
Test Results:

According to RF Output power results in chapter 5.1, MIMO was selected as the worst antenna for 802.11n HT20/ HT40. SISO Antenna 2 was selected as the worst SISO antenna. SISO Antenna 2

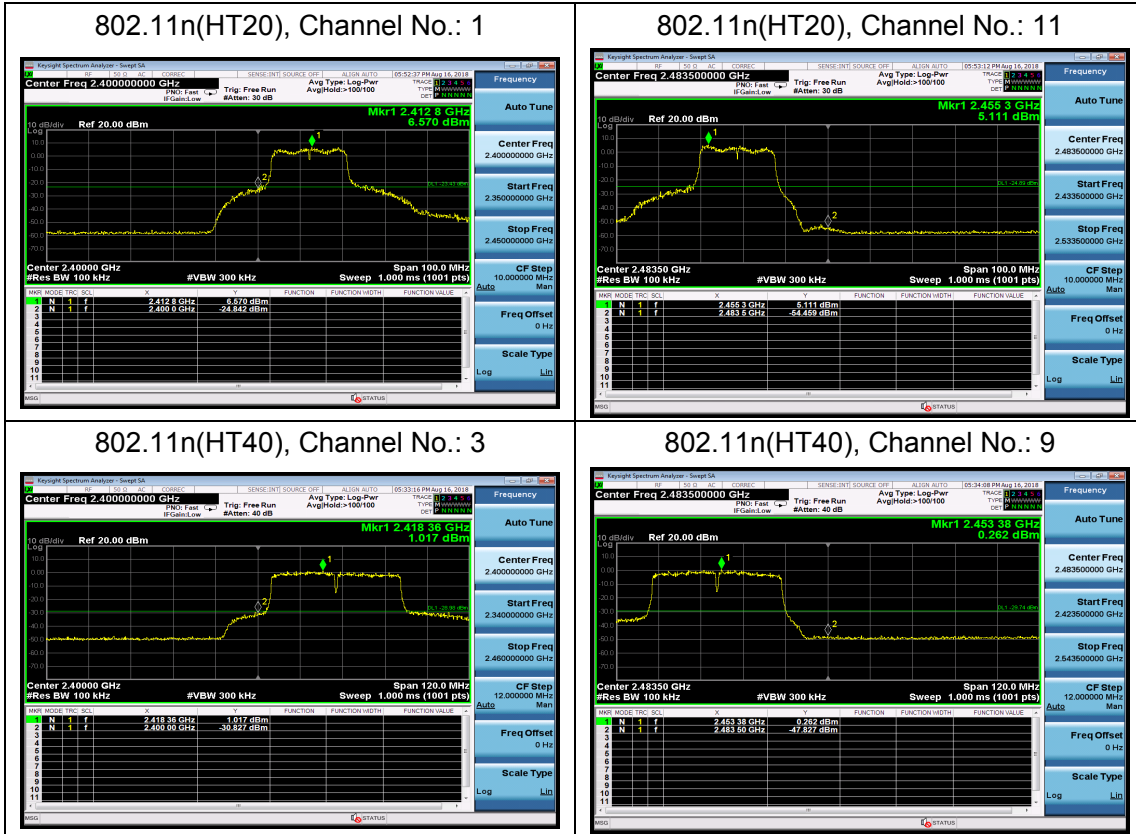




MIMO Antenna 1



MIMO Antenna 2



5.4. Power Spectral Density

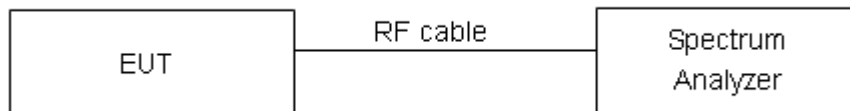
Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

During the process of the testing, The EUT was connected to Spectrum Analyzer with a known loss. The EUT is max power transmission with proper modulation. Method AVGPSD-2 in KDB558074 D01 was used for this test.

Test setup



Limits

Rule Part 15.247(e) specifies that” For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. ”

Limits	≤ 8 dBm / 3kHz
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Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 0.75\text{dB}$.

**Test Results:****SISO Antenna 1**

Network Standards	Channel Number	Read Value (dBm / 3kHz)	Power Spectral Density (dBm / 3kHz)	Limit (dBm / 3kHz)	Conclusion
802.11b	1	-14.31	-14.31	8	PASS
	6	-14.04	-14.04	8	PASS
	11	-14.00	-14.00	8	PASS
802.11g	1	-17.69	-17.69	8	PASS
	6	-14.95	-14.95	8	PASS
	11	-18.13	-18.13	8	PASS
802.11n HT20	1	-17.26	-17.26	8	PASS
	6	-15.45	-15.45	8	PASS
	11	-18.45	-18.45	8	PASS
802.11n HT40	3	-21.37	-21.37	8	PASS
	6	-19.42	-19.42	8	PASS
	9	-22.74	-22.74	8	PASS

Note: Power Spectral Density =Read Value+Duty cycle correction factor

**SISO Antenna 2**

Network Standards	Channel Number	Read Value (dBm / 3kHz)	Power Spectral Density (dBm / 3kHz)	Limit (dBm / 3kHz)	Conclusion
802.11b	1	-13.13	-13.13	8	PASS
	6	-13.93	-13.93	8	PASS
	11	-13.35	-13.35	8	PASS
802.11g	1	-16.98	-16.98	8	PASS
	6	-15.27	-15.27	8	PASS
	11	-17.14	-17.14	8	PASS
802.11n HT20	1	-17.04	-17.04	8	PASS
	6	-15.45	-15.45	8	PASS
	11	-18.65	-18.65	8	PASS
802.11n HT40	3	-21.14	-21.14	8	PASS
	6	-19.62	-19.62	8	PASS
	9	-22.61	-22.61	8	PASS

Note: Power Spectral Density =Read Value+Duty cycle correction factor



MIMO

Network Standards	Channel Number	Power Spectral Density				Total PSD (dBm / 3kHz)	Limit (dBm / 3kHz)	Conclusion
		Antenna 1		Antenna 2				
		Read Value (dBm / 3kHz)	Power Spectral Density (dBm / 3kHz)	Read Value (dBm / 3kHz)	Power Spectral Density (dBm / 3kHz)			
802.11n HT20	1	-17.41	-17.41	-16.94	-16.94	-14.16	8.00	PASS
	6	-16.44	-16.44	-16.24	-16.24	-13.33	8.00	PASS
	11	-18.62	-18.62	-18.44	-18.44	-15.52	8.00	PASS
802.11n HT40	3	-20.98	-20.98	-20.68	-20.68	-17.81	8.00	PASS
	6	-18.97	-18.97	-18.88	-18.88	-15.92	8.00	PASS
	9	-22.40	-22.40	-21.55	-21.55	-18.94	8.00	PASS

Note: 1. Power Spectral Density = Read Value + Duty cycle correction factor

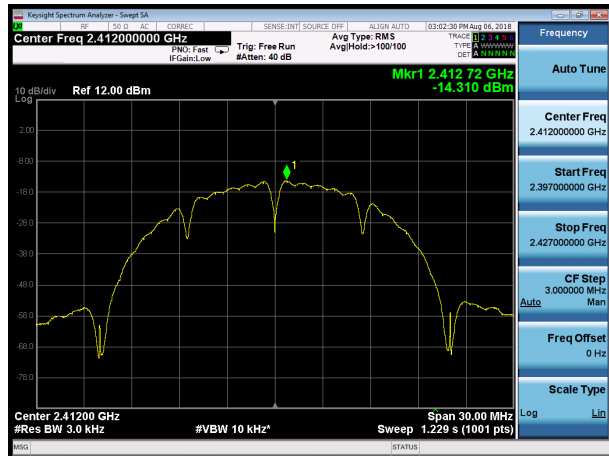
2. For Total PSD, according to KDB 662911 D01 Multiple Transmitter Output v02r01 2)a), the power spectral density = $10 \log(10^{(\text{PSD antenna1 in dBm}/10)} + 10^{(\text{PSD antenna2 in dBm}/10)})$

2. The manufacturer declared the transmitter output signals is CDD mode. And $N_{ss}=1$. According to KDB 662911 D01 Multiple Transmitter Output v02r01 2)f)(i): If all antennas have the same gain, Directional gain = $G_{ANT} + \text{Array Gain}$, For PSD measurements on all devices, Array Gain = $10 \log(N_{ant}/N_{ss}) \text{ dB}$, so directional gain = $G_{ANT} + \text{Array Gain} = 2 + 10 \log(2/2) = 2 < 6 \text{ dBi}$. So the power limit is 8 dBm

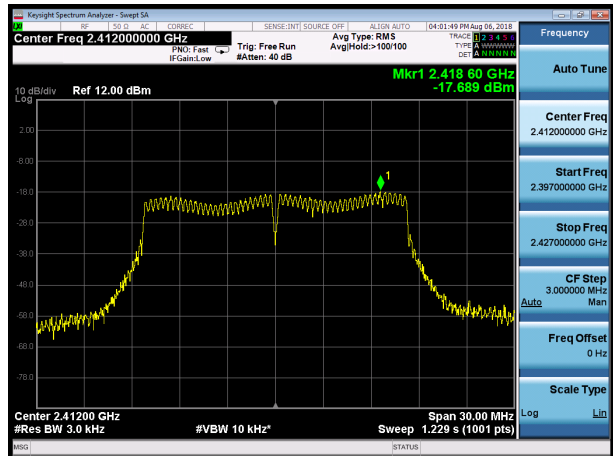


SISO Antenna 1

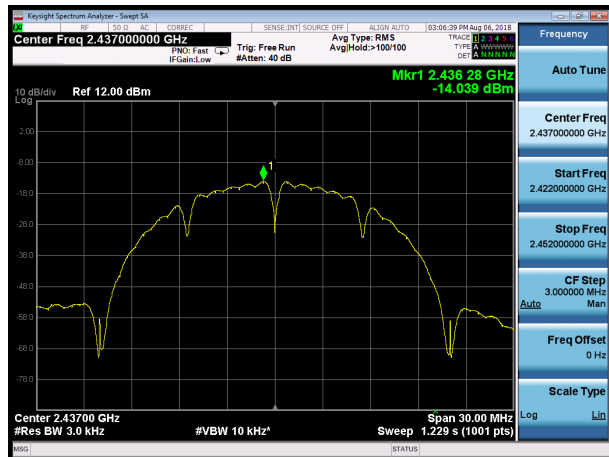
802.11b, Channel No.: 1



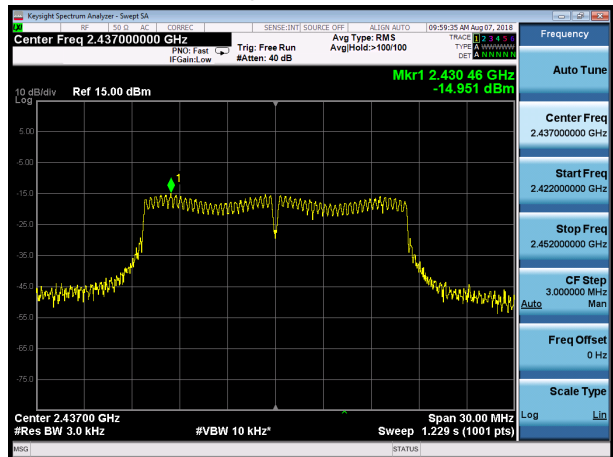
802.11g, Channel No.: 1



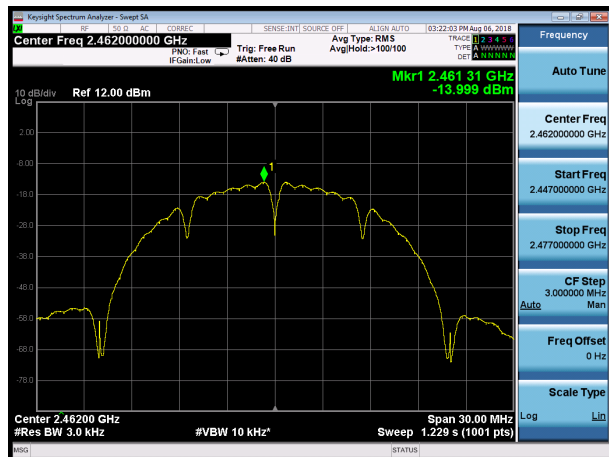
802.11b, Channel No.: 6



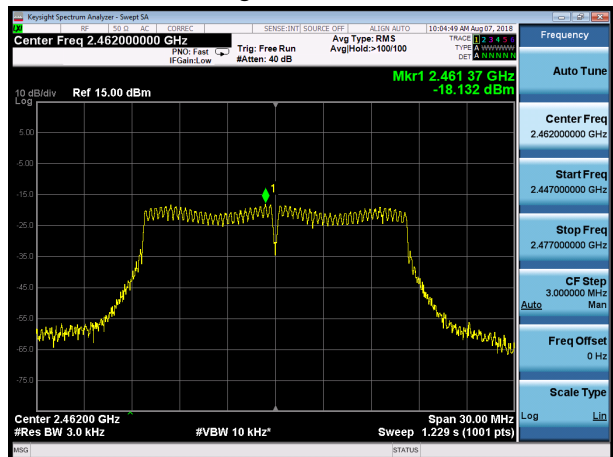
802.11g, Channel No.: 6



802.11b, Channel No.: 11

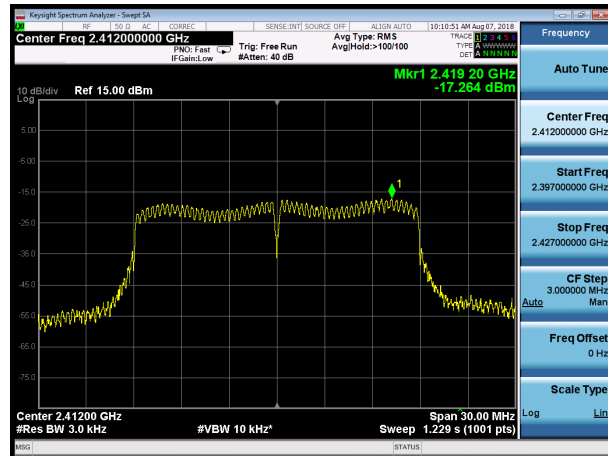


802.11g, Channel No.: 11

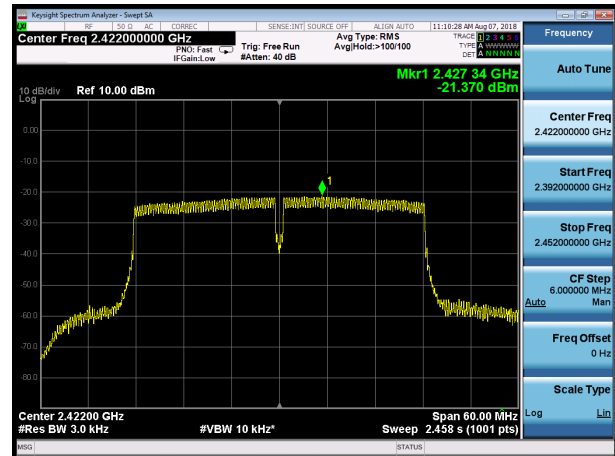




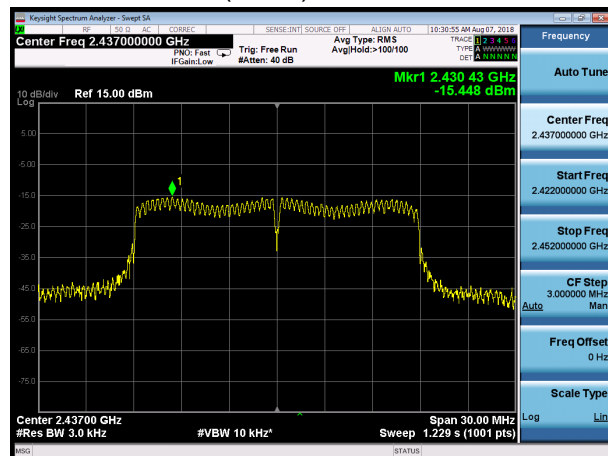
802.11n(HT20), Channel No. 1



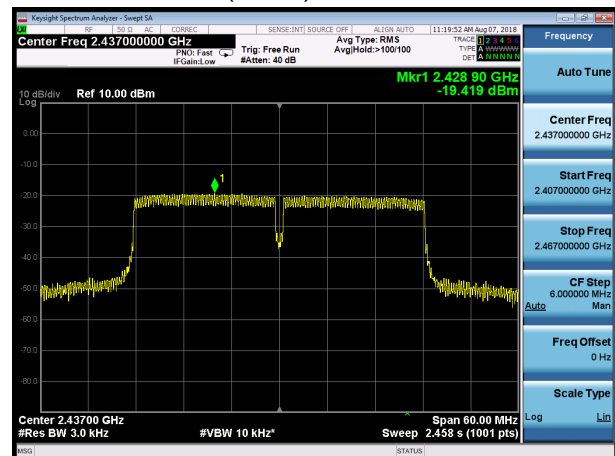
802.11n(HT40), Channel No. 3



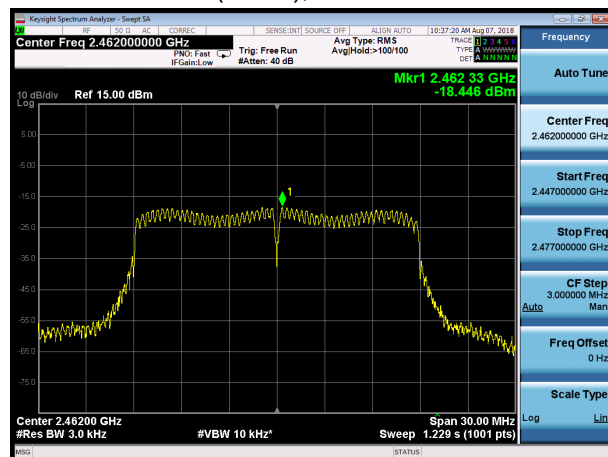
802.11n(HT20), Channel No. 6



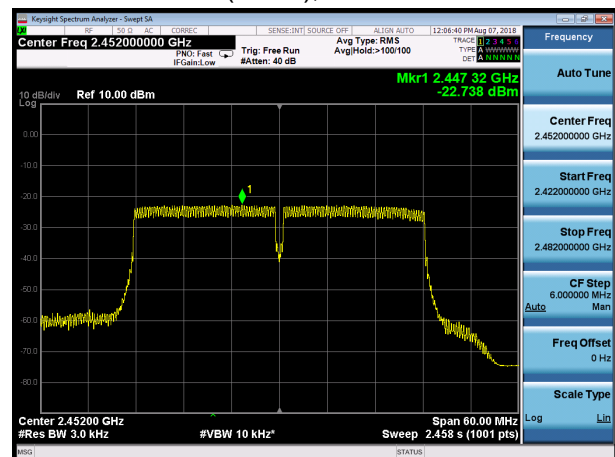
802.11n(HT40), Channel No. 6



802.11n(HT20), Channel No. 11



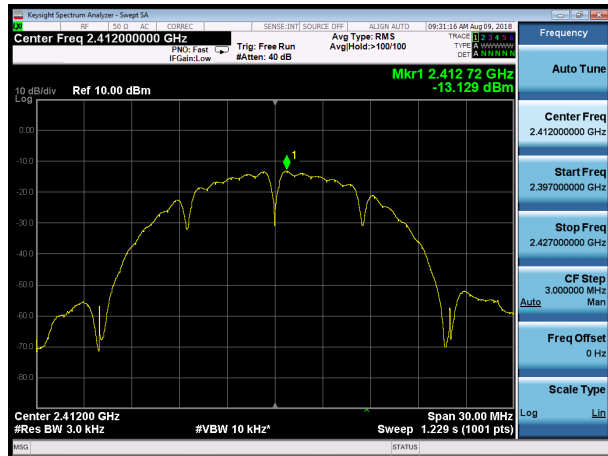
802.11n(HT40), Channel No. 9



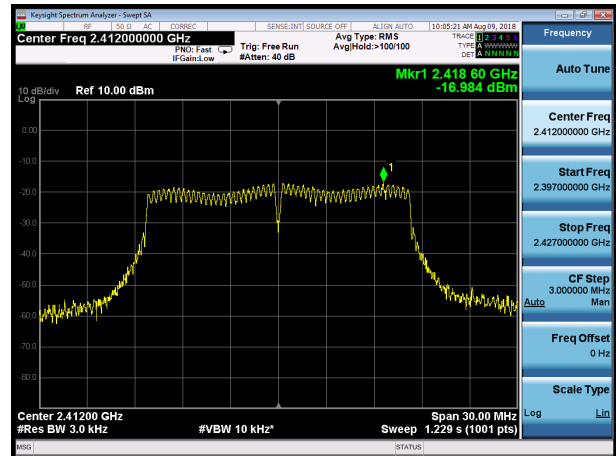


SISO Antenna 2

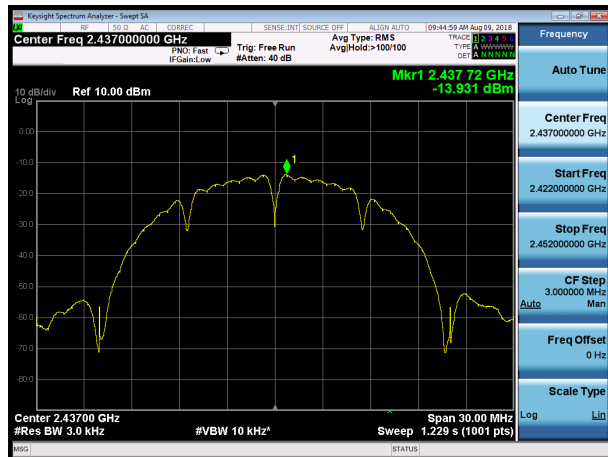
802.11b, Channel No.: 1



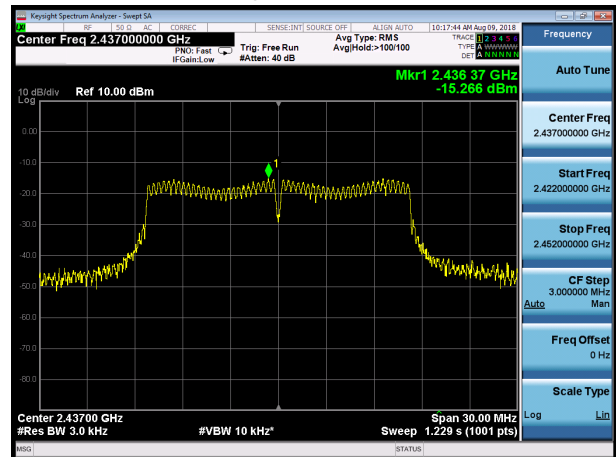
802.11g, Channel No.: 1



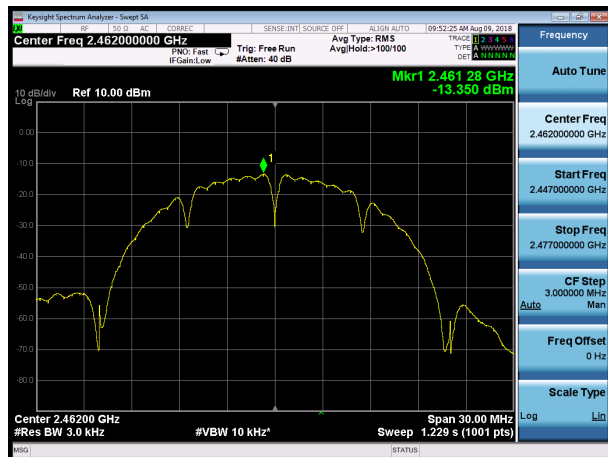
802.11b, Channel No.: 6



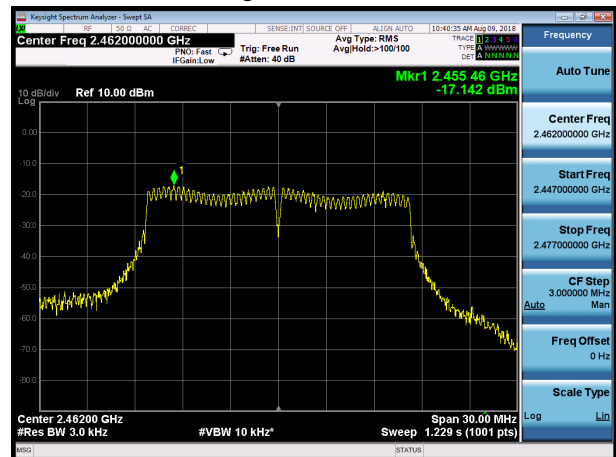
802.11g, Channel No.: 6



802.11b, Channel No.: 11

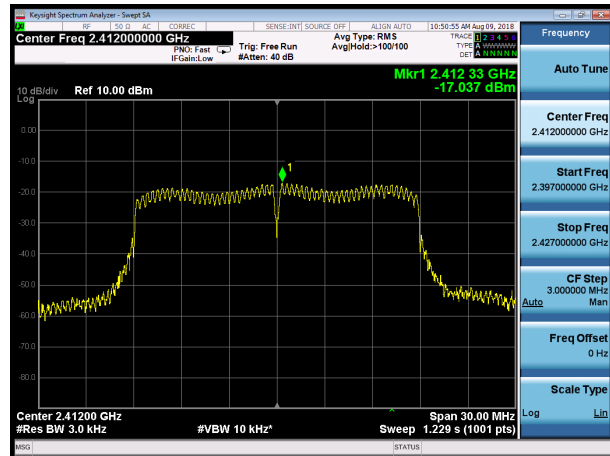


802.11g, Channel No.: 11

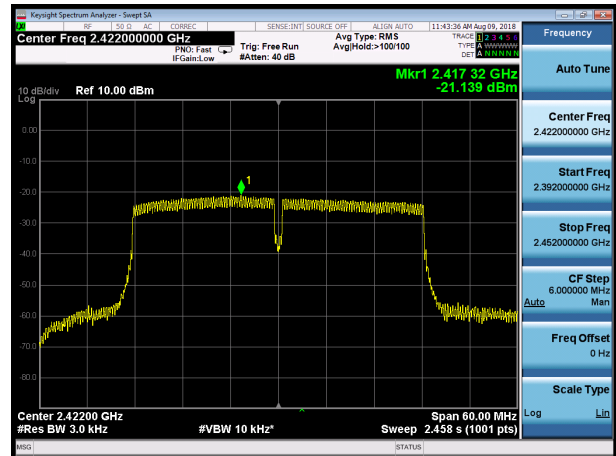




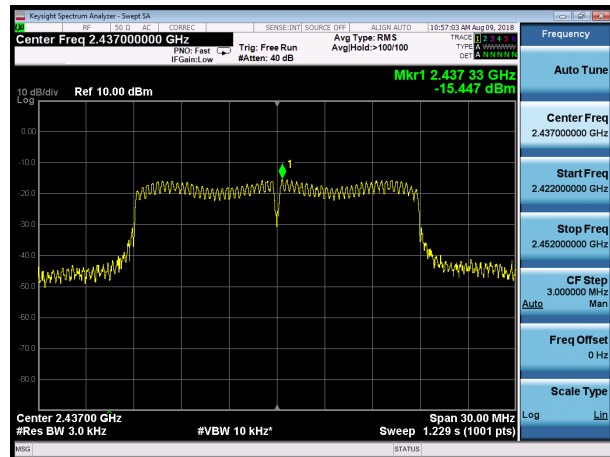
802.11n(HT20), Channel No. 1



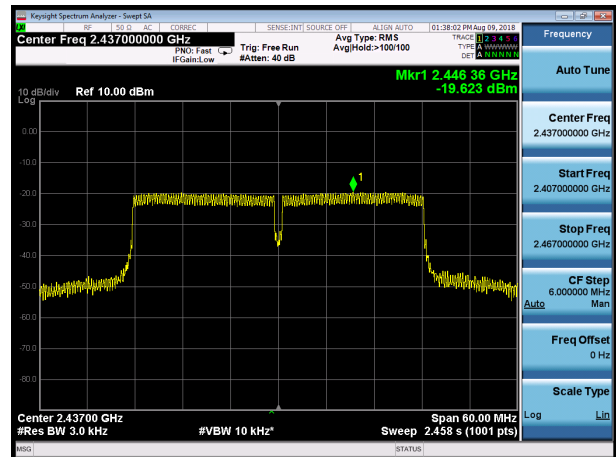
802.11n(HT40), Channel No. 3



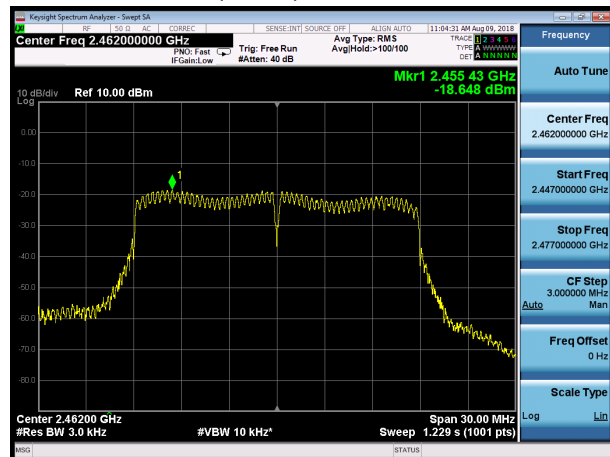
802.11n(HT20), Channel No. 6



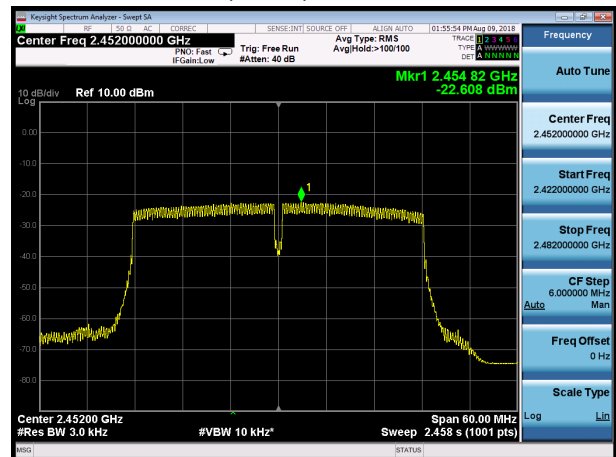
802.11n(HT40), Channel No. 6



802.11n(HT20), Channel No. 11



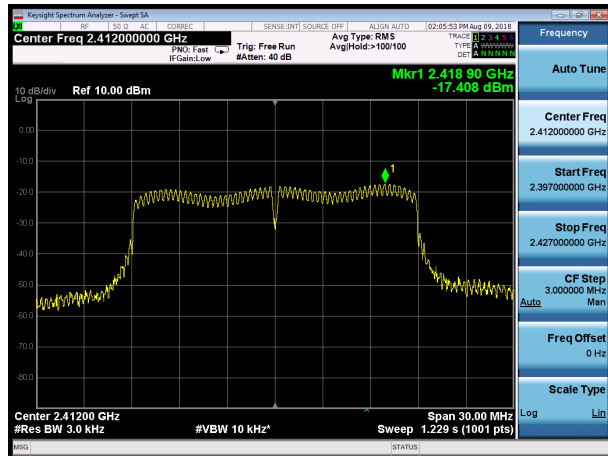
802.11n(HT40), Channel No. 9



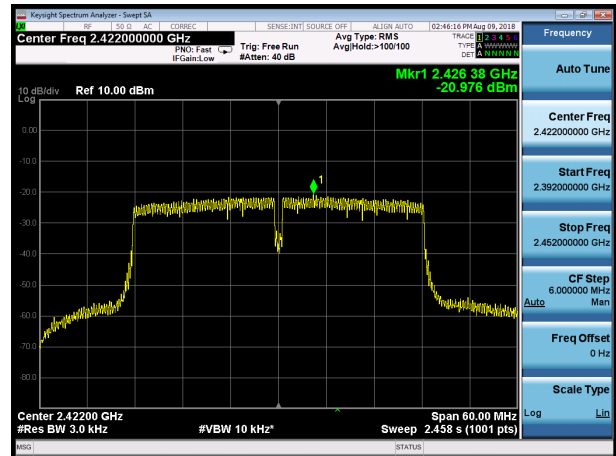


MIMO Antenna 1

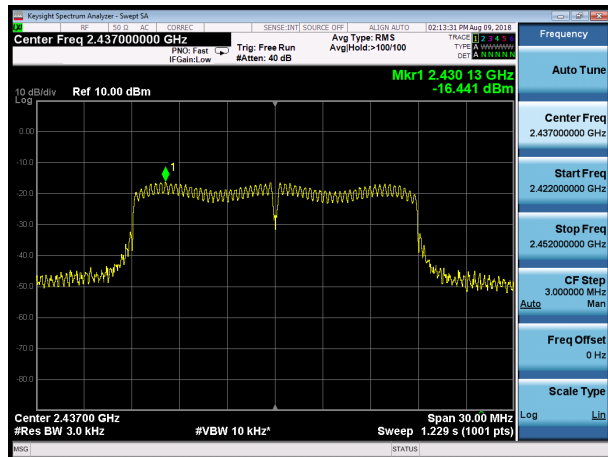
802.11n(HT20), Channel No. 1



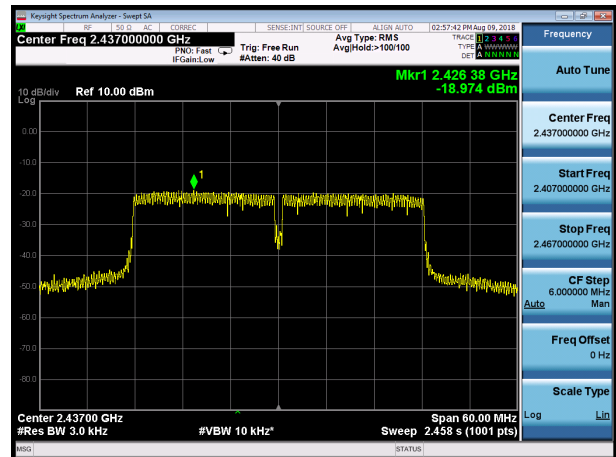
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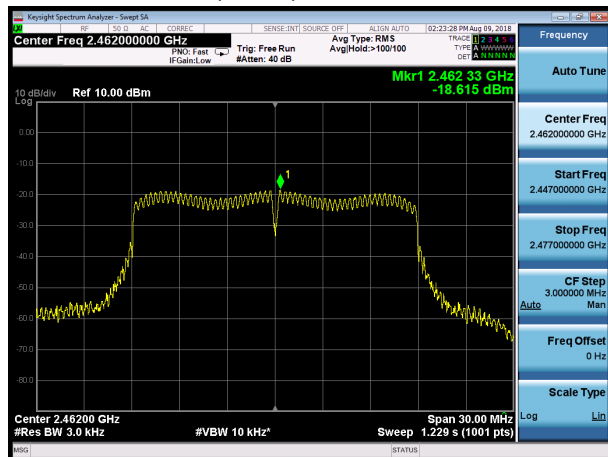
802.11n(HT20), Channel No. 6



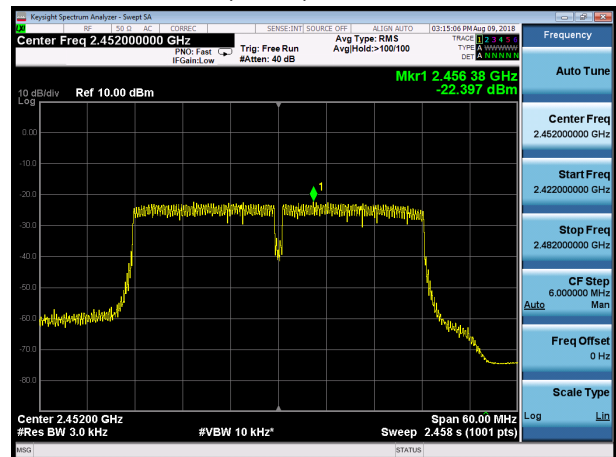
802.11n(HT40), Channel No. 6



802.11n(HT20), Channel No. 11



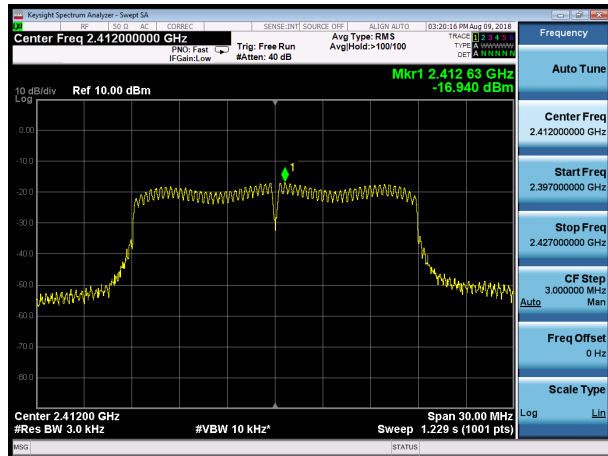
802.11n(HT40), Channel No. 9



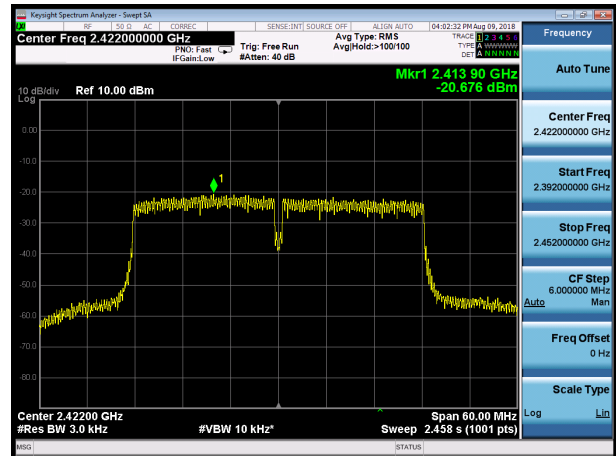


MIMO Antenna 2

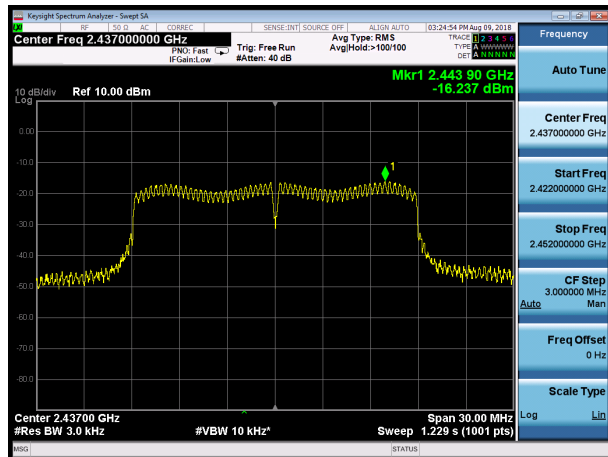
802.11n(HT20), Channel No. 1



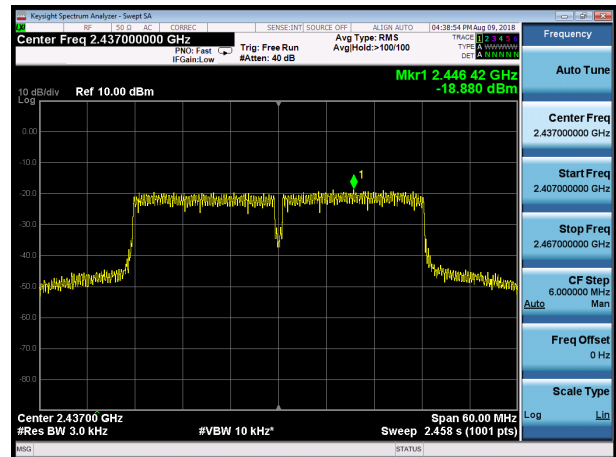
802.11n(HT40), Channel No. 3



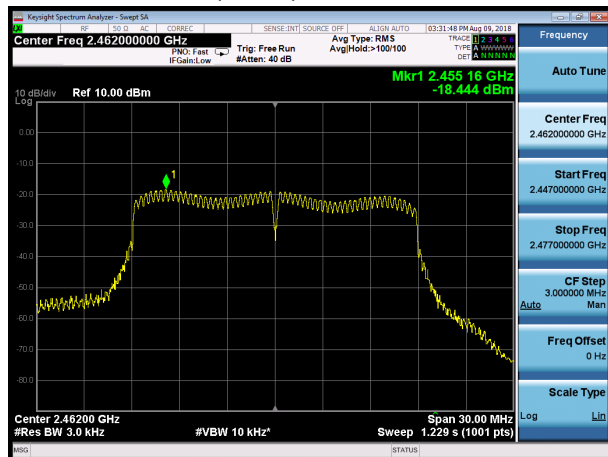
802.11n(HT20), Channel No. 6



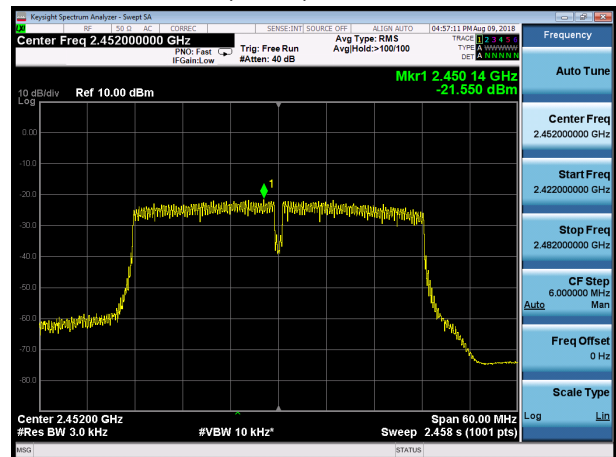
802.11n(HT40), Channel No. 6



802.11n(HT20), Channel No. 11



802.11n(HT40), Channel No. 9



5.5. Spurious RF Conducted Emissions

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

The EUT was connected to the spectrum analyzer with a known loss. The spectrum analyzer scans from 30MHz to the 10th harmonic of the carrier. The peak detector is used. Set RBW to100kHz and VBW to 300 kHz, Sweep is set to ATUO.

The test is in transmitting mode.

Test setup



Limits

Rule Part 15.247(d) pacifies that “In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 30 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.” 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.”

SISO Antenna 2

Network Standards	Carrier frequency (MHz)	Reference value (dBm)	Limit
802.11b	2412	9.61	-20.39
	2437	9.15	-20.85
	2462	9.34	-20.66
802.11g	2412	3.67	-26.33
	2437	5.68	-24.32
	2462	3.33	-26.67

MIMO Antenna 1

Network Standards	Carrier frequency (MHz)	Reference value (dBm)	Limit
802.11n HT20	2412	3.52	-26.48
	2437	4.18	-25.82
	2462	2.07	-27.93
802.11n HT40	2422	-0.31	-30.31
	2437	2.23	-27.77
	2452	-1.59	-31.59

MIMO Antenna 2

Network Standards	Carrier frequency (MHz)	Reference value (dBm)	Limit
802.11n HT20	2412	4.08	-25.92
	2437	5.51	-24.49
	2462	3.64	-26.36
802.11n HT40	2422	0.03	-29.97
	2437	2.59	-27.41
	2452	0.13	-29.87

Measurement Uncertainty

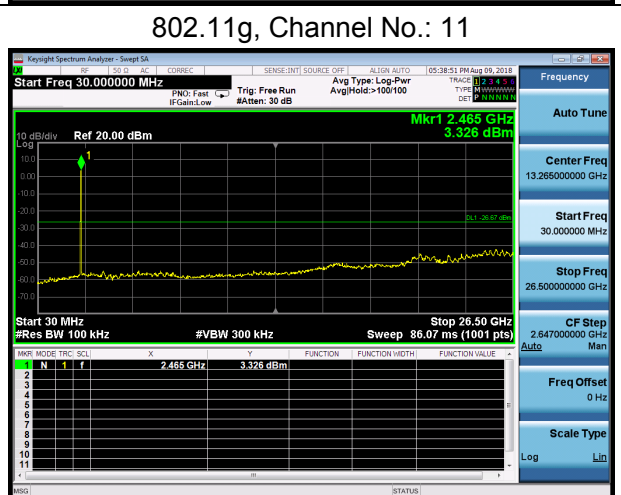
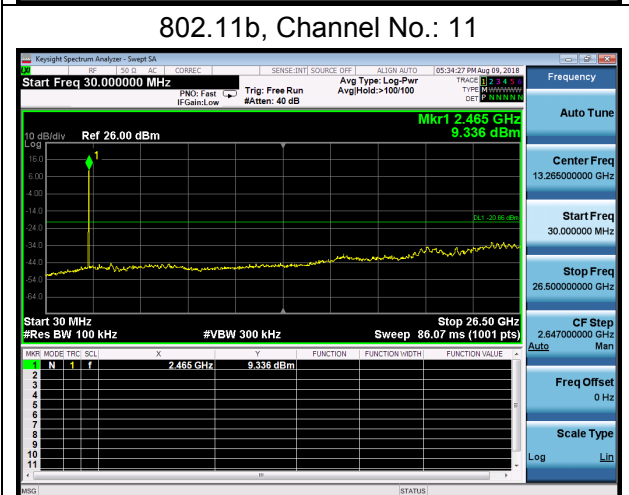
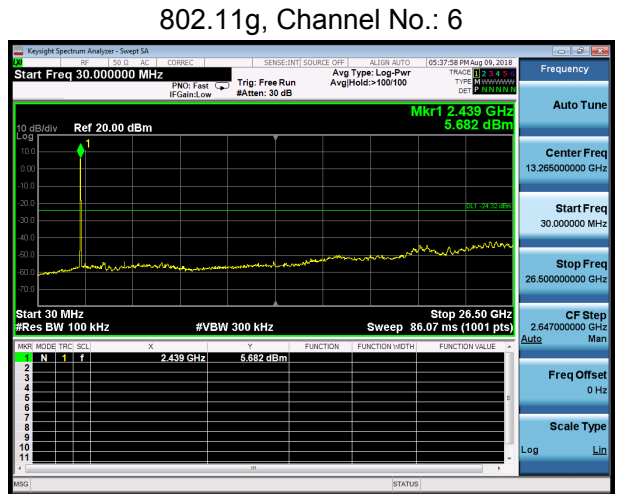
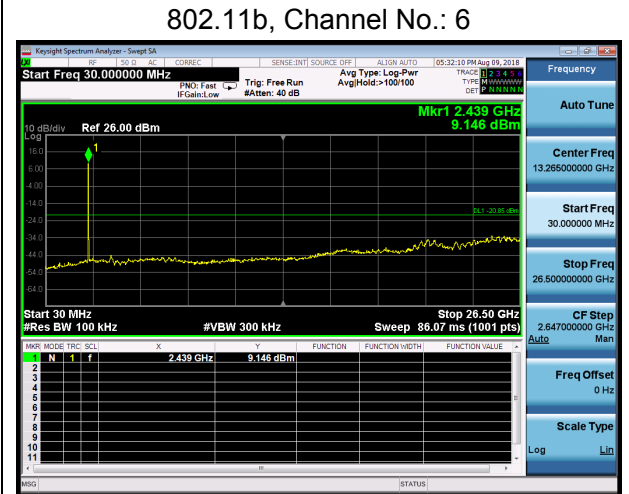
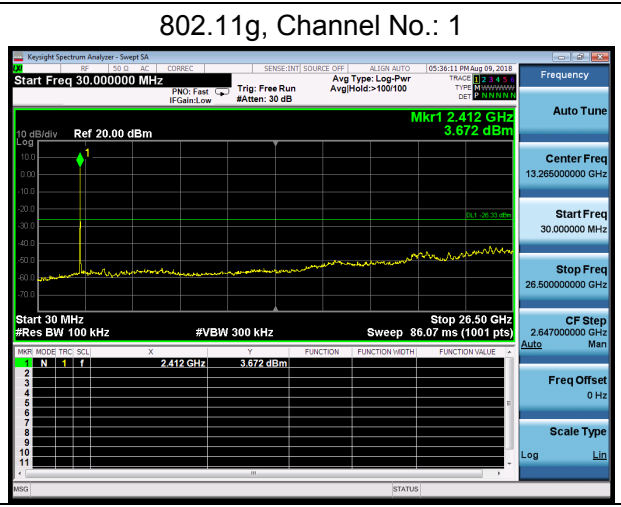
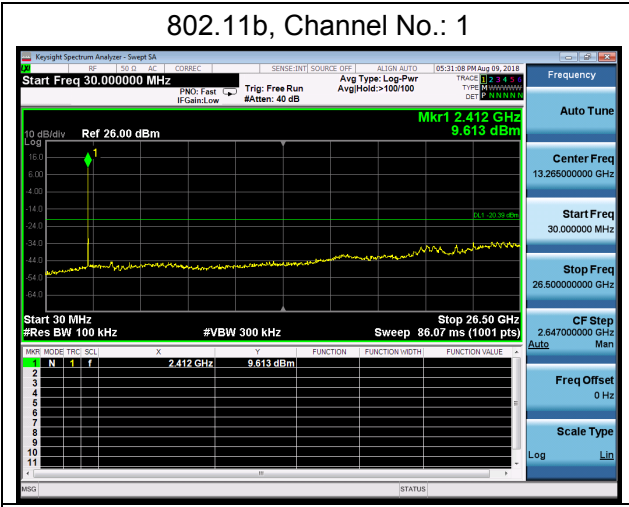
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 1.96$.

Frequency	Uncertainty
100kHz-2GHz	0.684 dB
2GHz-26GHz	1.407 dB



Test Results:

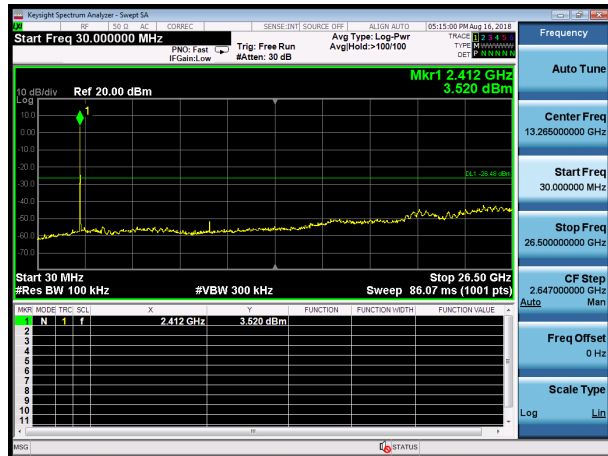
According to RF Output power results in chapter 5.1, MIMO was selected as the worst antenna for 802.11n HT20/ HT40. SISO Antenna 2 was selected as the worst SISO antenna. SISO Antenna 2



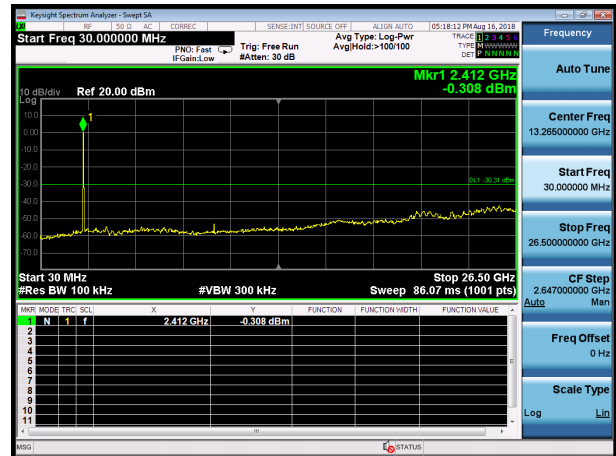


MIMO Antenna 1

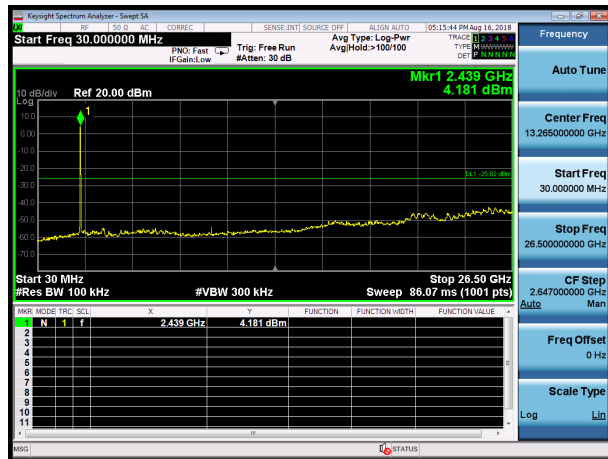
802.11n(HT20), Channel No. 1



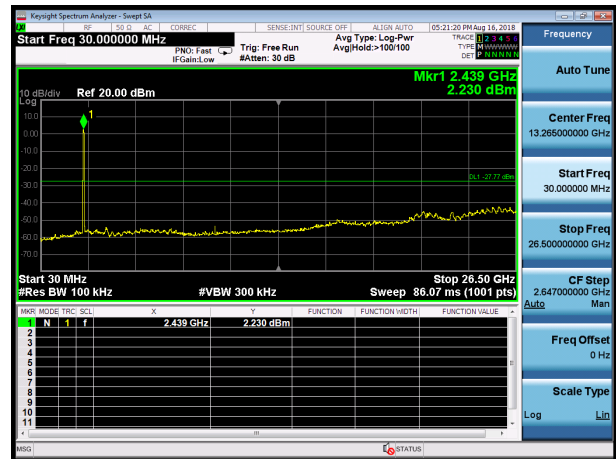
802.11n(HT40), Channel No. 3



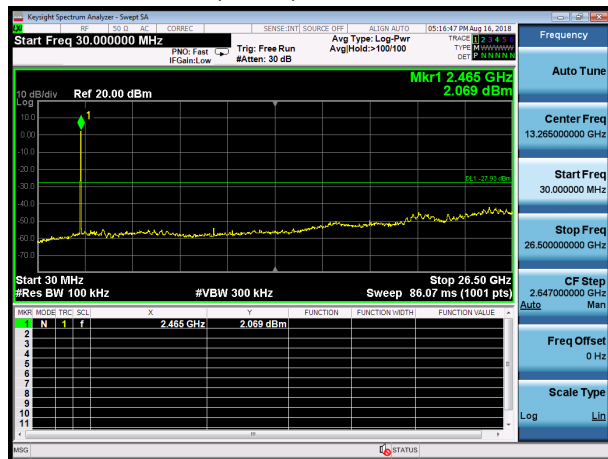
802.11n(HT20), Channel No. 6



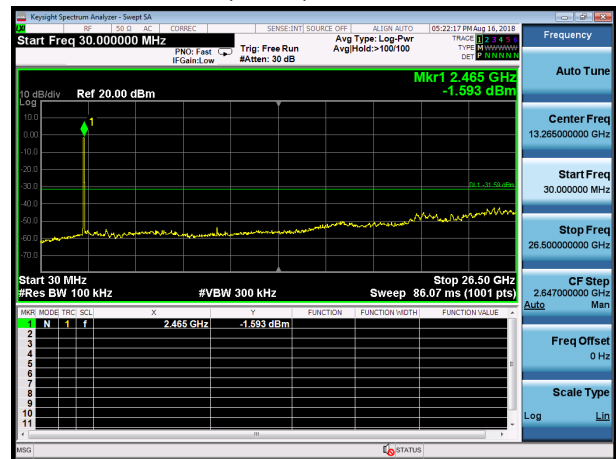
802.11n(HT40), Channel No. 6



802.11n(HT20), Channel No. 11



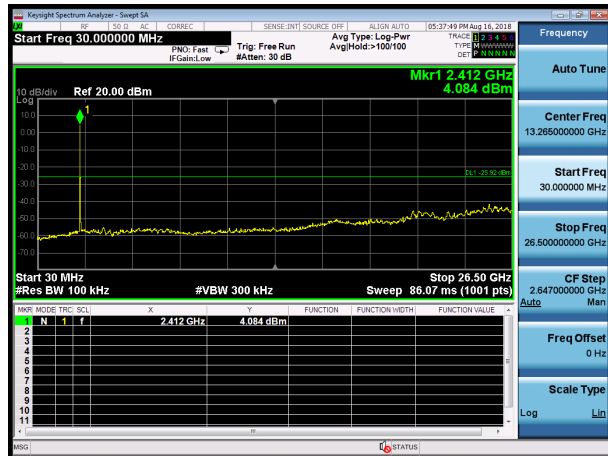
802.11n(HT40), Channel No. 9



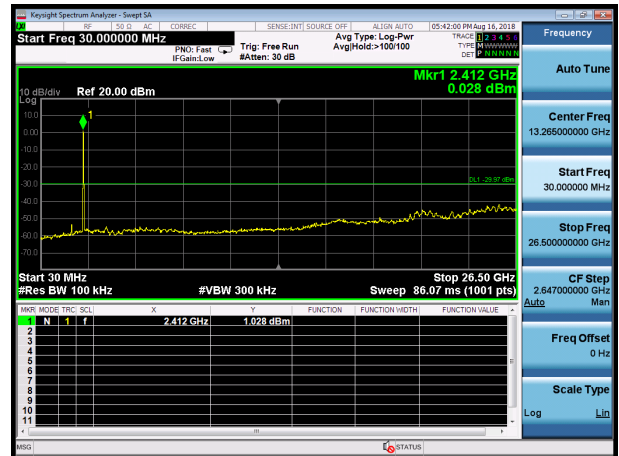


MIMO Antenna 2

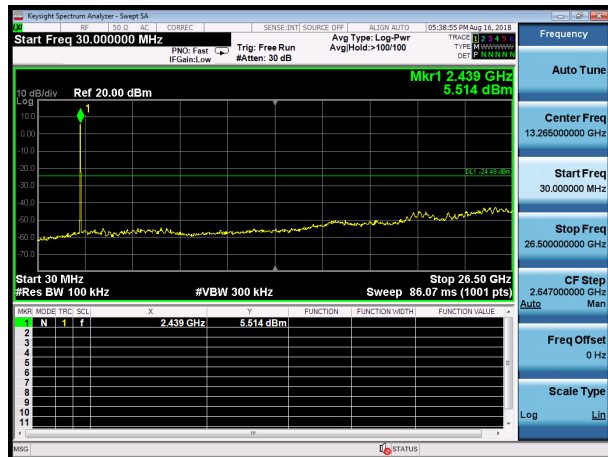
802.11n(HT20), Channel No. 1



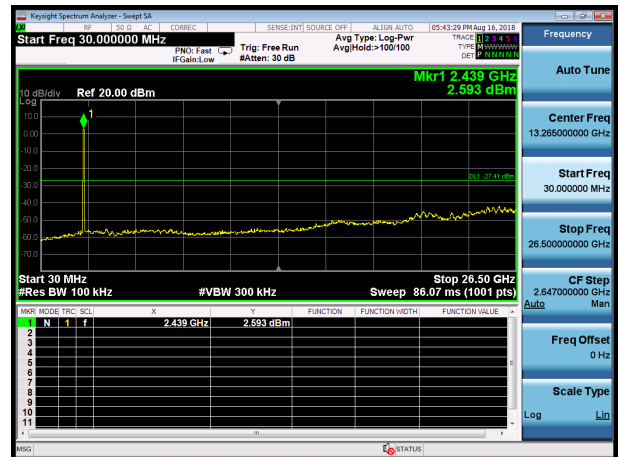
802.11n(HT40), Channel No. 3



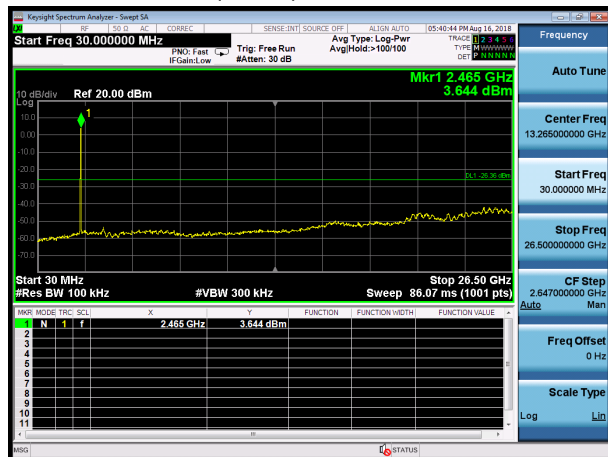
802.11n(HT20), Channel No. 6



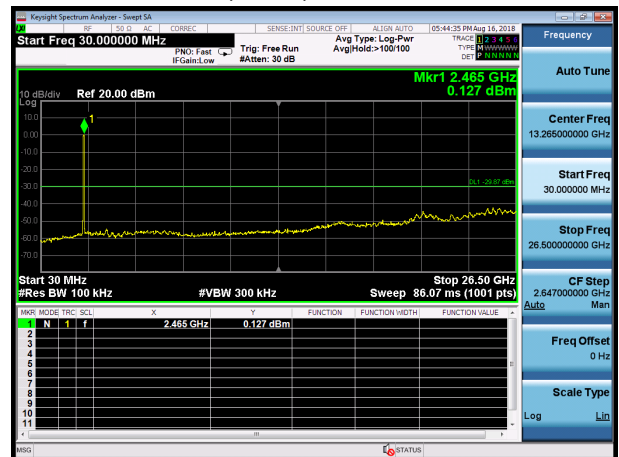
802.11n(HT40), Channel No. 6



802.11n(HT20), Channel No. 11



802.11n(HT40), Channel No. 9



5.6. Unwanted Emission

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	102.5kPa

Method of Measurement

The test set-up was made in accordance to the general provisions of ANSI C63.10-2013.

The Equipment Under Test (EUT) was set up on a non-conductive table in the semi-anechoic chamber. The test was performed at the distance of 3 m between the EUT and the receiving antenna.

The turntable shall be rotated from 0 to 360 degrees for detecting the maximum of radiated spurious signal level. The measurements shall be repeated with orthogonal polarization of the test antenna. The data of cable loss and antenna factor has been calibrated in full testing frequency range before the testing. Sweep the Restricted Band and the emissions less than 20 dB below the permissible value are reported.

The radiated emissions measurements were made in a typical installation configuration.

Sweep the whole frequency band through the range from 9 kHz to the 10th harmonic of the carrier, and the emissions less than 20 dB below the permissible value are reported.

This method refer to KDB 558074.

The procedure for peak unwanted emissions measurements above 1000 MHz is as follows:

I) Peak emission levels are measured by setting the instrument as follows:

- 1) RBW = 1 MHz.
- 2) VBW \geq [3 \times RBW]
- 3) Detector = peak.
- 4) Sweep time = auto.
- 5) Trace mode = max hold.
- 6) Allow sweeps to continue until the trace stabilizes. Note that if the transmission is not continuous, then the time required for the trace to stabilize will increase by a factor of approximately 1 / D, where D is the duty cycle.

II) Average emission levels are measured by setting the instrument as follows:

- a) RBW = 1 MHz.
- b) VBW \geq [3 \times RBW].
- c) Detector = RMS (power averaging), if [span / (# of points in sweep)] \leq RBW / 2. Satisfying this condition can require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, then the detector mode shall be set to peak.
- d) Averaging type = power (i.e., rms) (As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode to use linear voltage



averaging. Log or dB averaging shall not be used.)

e) Sweep time = auto.

f) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, then the number of traces shall be increased by a factor of $1 / D$, where D is the duty cycle. For example, with 50% duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 100 traces shall be averaged.)

g) If tests are performed with the EUT transmitting at a duty cycle less than 98%, then a correction factor shall be added to the measurement results prior to comparing with the emission limit, to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:

1) If power averaging (rms) mode was used in the preceding step e), then the correction factor is $[10 \log (1 / D)]$, where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 3 dB shall be added to the measured emission levels.

2) If linear voltage averaging mode was used in the preceding step e), then the correction factor is $[20 \log (1 / D)]$, where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 6 dB shall be added to the measured emission levels.

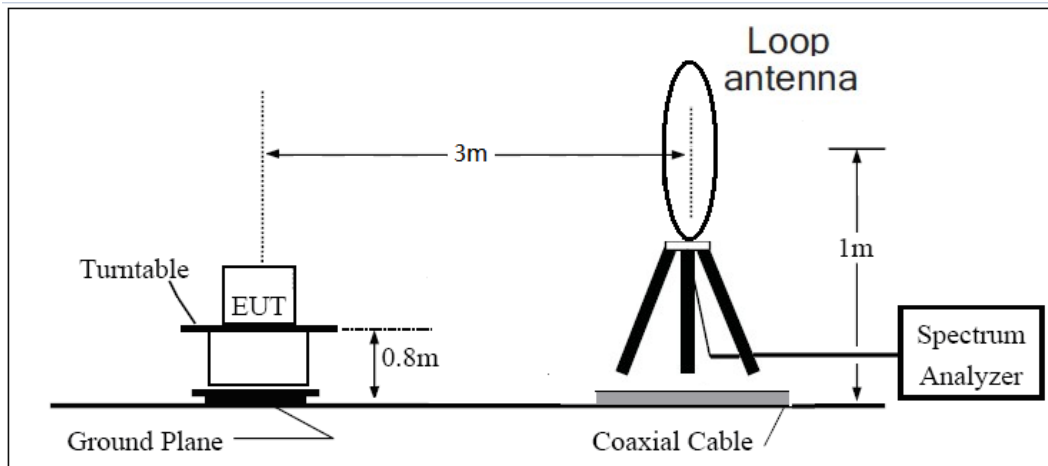
3) If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission.

The field strength of spurious emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in lie-down position (Xaxis) and the antenna is vertical.

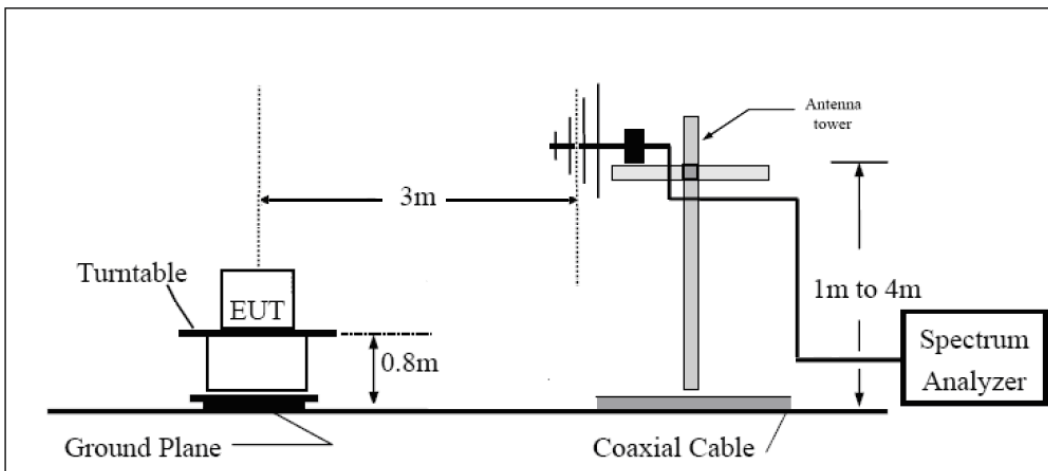
The test is in transmitting mode.

Test setup

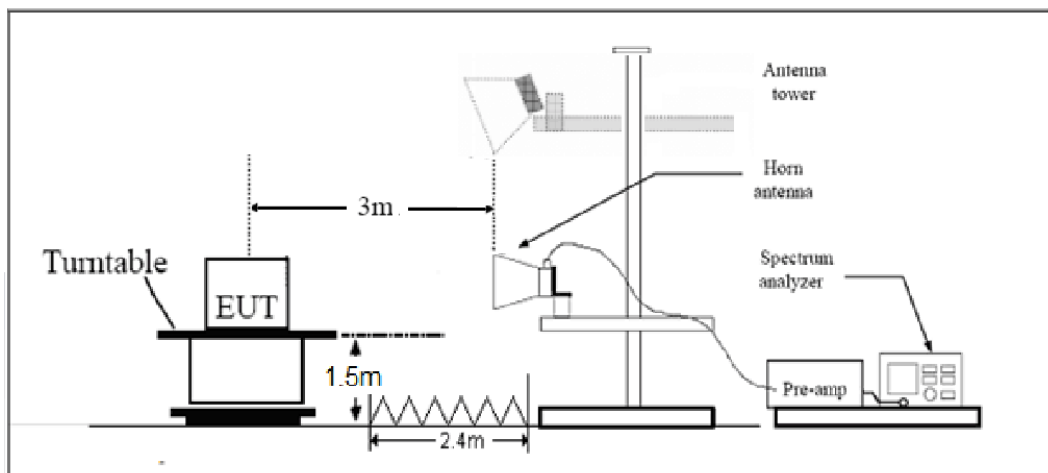
9KHz ~ 30MHz



30MHz ~ 1GHz



Above 1GHz



Note: Area side:2.4mX3.6m

Limits

Rule Part 15.247(d) specifies that “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)).”

Limit in restricted band

Frequency of emission (MHz)	Field strength(uV/m)	Field strength(dBuV/m)
0.009–0.490	2400/F(kHz)	/
0.490–1.705	24000/F(kHz)	/
1.705–30.0	30	/
30-88	100	40
88-216	150	43.5
216-960	200	46
Above960	500	54

§15.35(b)

There is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.

Peak Limit=74 dBuV/m

Average Limit=54 dBuV/m

Spurious Radiated Emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)
13.36 - 13.41			

**Measurement Uncertainty**

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 1.96$.

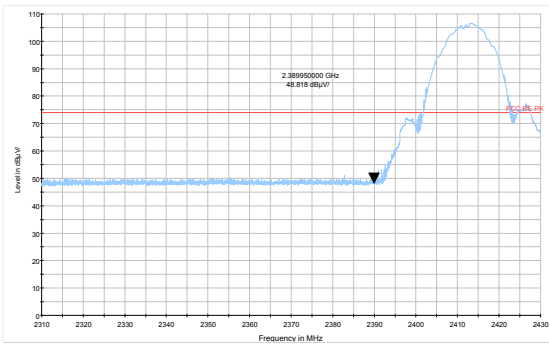
Frequency	Uncertainty
9KHz-30MHz	3.55 dB
30MHz-200MHz	4.19 dB
200MHz-1GHz	3.63 dB
Above 1GHz	3.68 dB



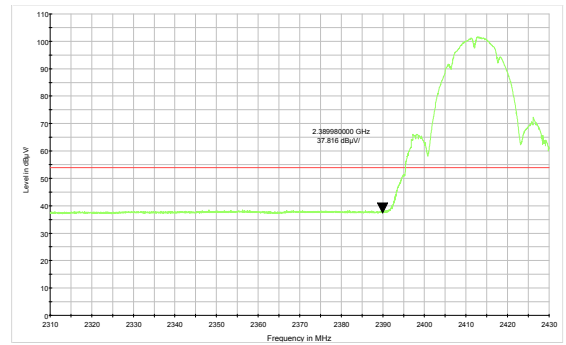
Test Results:

According to RF Output power results in chapter 5.1, MIMO was selected as the worst antenna for 802.11n HT20/ HT40. SISO Antenna 2 was selected as the worst SISO antenna.

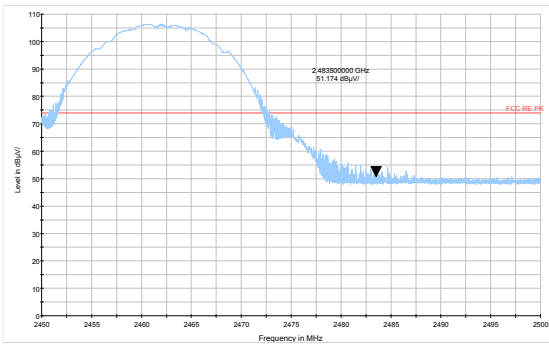
SISO Antenna 2



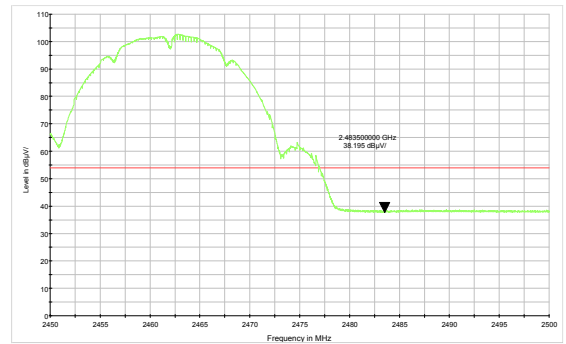
802.11b-Channel 1 Peak



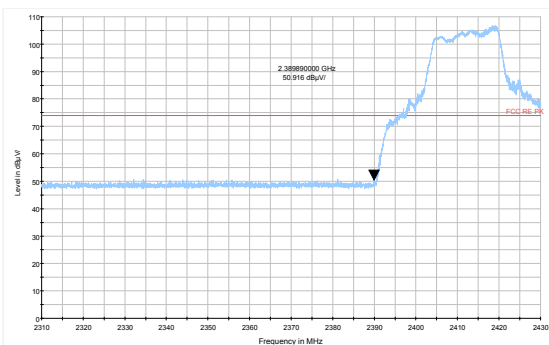
802.11b-Channel 1 Average



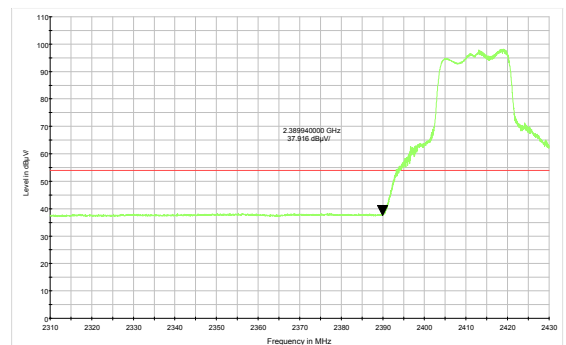
802.11b-Channel 11 Peak



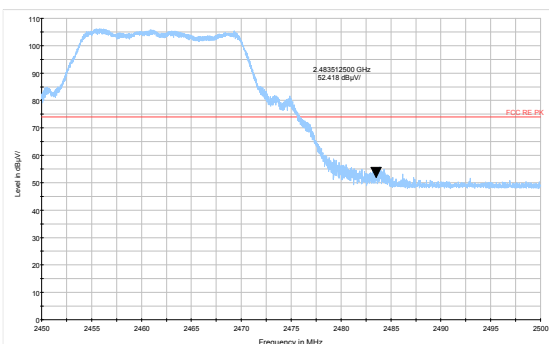
802.11b-Channel 11 Average



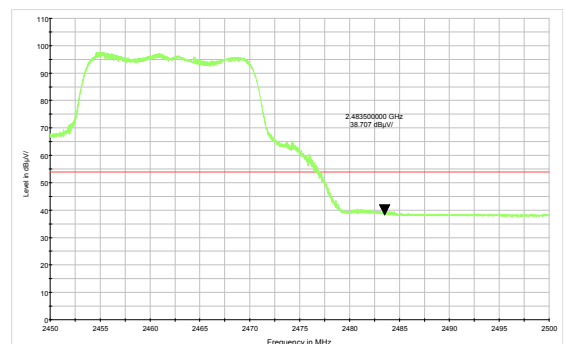
802.11g-Channel 1 Peak



802.11g-Channel 1 Average



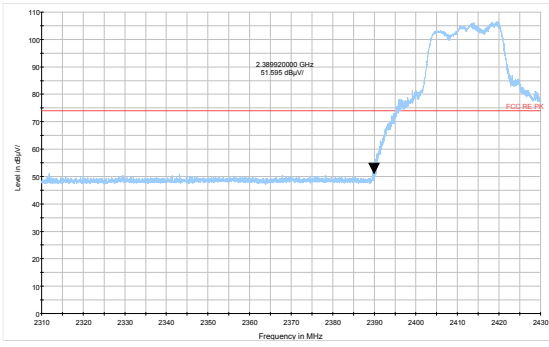
802.11g-Channel 11 Peak



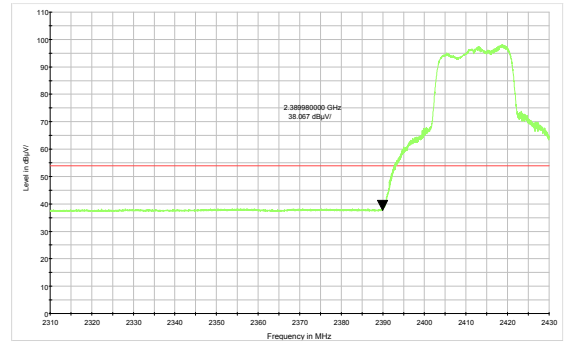
802.11g-Channel 11 Average



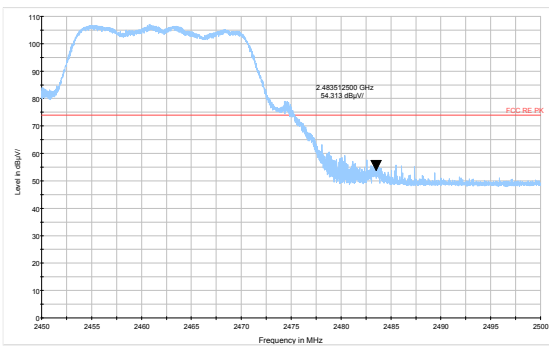
MIMO



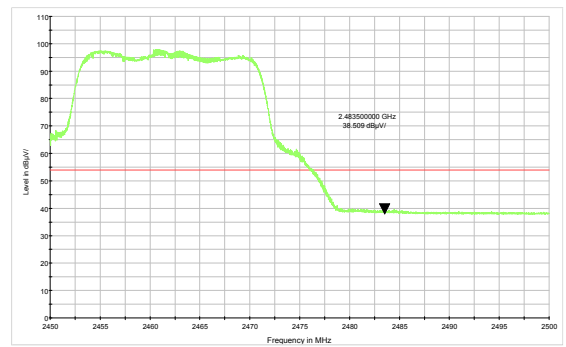
802.11n HT20 -Channel 1 Peak



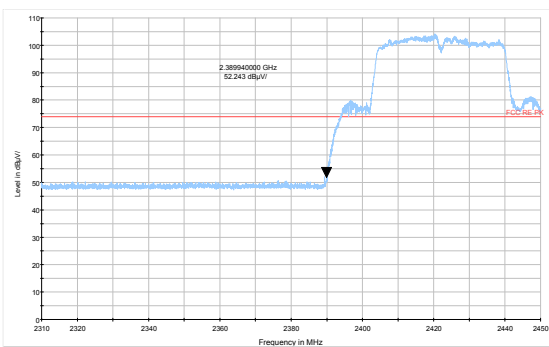
802.11n HT20 -Channel 1 Average



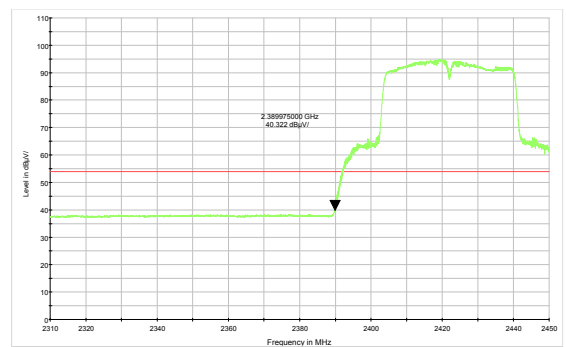
802.11n HT20 -Channel 11 Peak



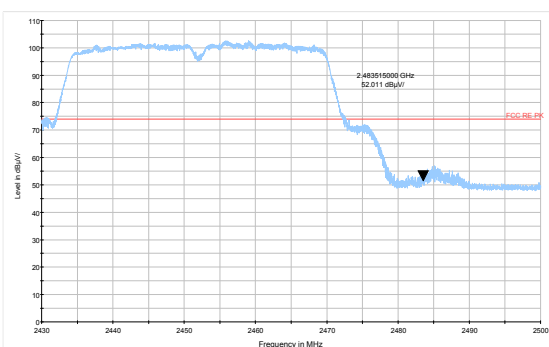
802.11n HT20 -Channel 11 Average



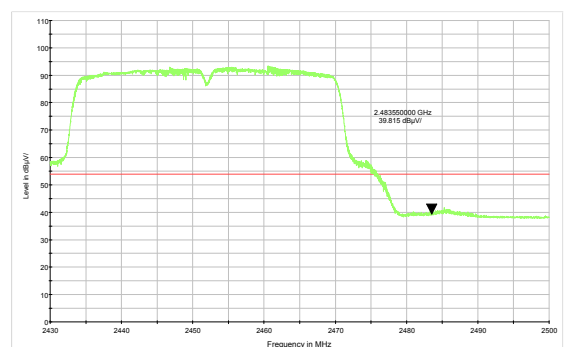
802.11n HT40 -Channel 3 Peak



802.11n HT40 -Channel 3 Average



802.11n HT40 -Channel 9 Peak



802.11n HT40 -Channel 9 Average



Band	T _{on} (ms)	T _(on+off) (ms)	Duty cycle	Duty cycle correction Factor(dB)
802.11b	1.00	1.00	1.00	0.00
802.11g	1.00	1.00	1.00	0.00
802.11n HT20	1.00	1.00	1.00	0.00
802.11n HT40	1.00	1.00	1.00	0.00

Note: when Duty cycle>0.98, Duty cycle correction Factor not required.

SISO Antenna 2**802.11b-Channel 1**

Frequency (MHz)	Peak (dBuV/m)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Duty cycle correction Factor(dB)	conclusion value (dBuV/m)	Margin (dB)	Limit (dBuV/m)
2390	48.818	--	200.0	V	135	0.00	48.818	25.182	74
2390	--	37.816	200.0	V	135	0.00	37.816	16.184	54

802.11b-Channel 11

Frequency (MHz)	Peak (dBuV/m)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Duty cycle correction Factor(dB)	conclusion value (dBuV/m)	Margin (dB)	Limit (dBuV/m)
2483.5	51.174	--	200.0	V	135	0.00	51.174	22.826	74
2483.5	--	38.195	200.0	V	135	0.00	38.195	15.805	54

802.11g-Channel 1

Frequency (MHz)	Peak (dBuV/m)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Duty cycle correction Factor(dB)	conclusion value (dBuV/m)	Margin (dB)	Limit (dBuV/m)
2390	50.916	--	150	V	65	0.00	50.916	23.084	74
2390	--	37.916	150	V	65	0.00	37.916	16.084	54

802.11g-Channel 11

Frequency (MHz)	Peak (dBuV/m)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Duty cycle correction Factor(dB)	conclusion value (dBuV/m)	Margin (dB)	Limit (dBuV/m)
2483.5	52.418	--	150	V	78	0.00	52.418	21.582	74
2483.5	--	38.707	150	V	78	0.00	38.707	15.293	54

**MIMO****802.11n HT20 -Channel 1**

Frequency (MHz)	Peak (dBuV/m)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Duty cycle correction Factor(dB)	conclusion value (dBuV/m)	Margin (dB)	Limit (dBuV/m)
2390	51.595	--	200	V	90	0.00	51.595	22.405	74
2390	--	38.067	200	V	90	0.00	38.067	15.933	54

802.11n HT20-Channel 11

Frequency (MHz)	Peak (dBuV/m)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Duty cycle correction Factor(dB)	conclusion value (dBuV/m)	Margin (dB)	Limit (dBuV/m)
2483.5	54.313	--	200	V	90	0.00	54.313	19.687	74
2483.5	--	38.509	200	V	90	0.00	38.509	15.491	54

802.11n HT40 -Channel 3

Frequency (MHz)	Peak (dBuV/m)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Duty cycle correction Factor(dB)	conclusion value (dBuV/m)	Margin (dB)	Limit (dBuV/m)
2390	52.243	--	150	V	46	0.00	52.243	21.757	74
2390	--	40.322	150	V	46	0.00	40.322	13.678	54

802.11n HT40-Channel 9

Frequency (MHz)	Peak (dBuV/m)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Duty cycle correction Factor(dB)	conclusion value (dBuV/m)	Margin (dB)	Limit (dBuV/m)
2483.5	52.011	--	150	V	46	0.00	52.011	21.989	74
2483.5	--	39.815	150	V	46	0.00	39.815	14.185	54



Result of RE

Test result

Sweep the whole frequency band through the range from 9kHz to the 10th harmonic of the carrier, the Emissions in the frequency band 9kHz-30MHz and 18GHz-26.5GHz are more than 20dB below the limit are not reported.

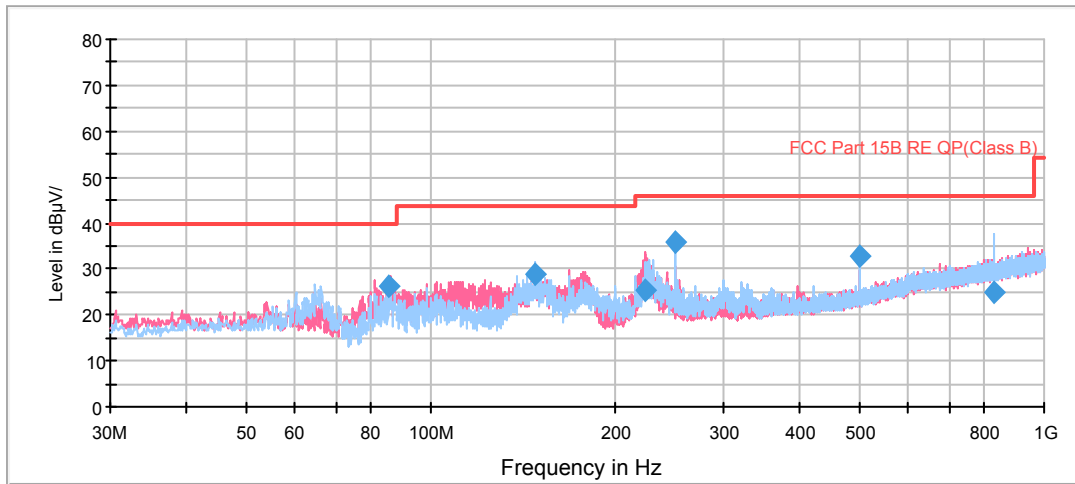
The following graphs display the maximum values of horizontal and vertical by software. For above 1GHz, Blue trace uses the peak detection, Green trace uses the average detection.

After the pretest, MIMO was selected as the worst antenna for 802.11n HT20/ HT40. SISO Antenna 2 was selected as the worst SISO antenna.

During the test, the Radiates Emission from 30MHz to 1GHz was performed in all modes with all channels, 802.11b, Channel 11 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.

Continuous TX mode:

Copy of RE 0.03-1GHz QP Class B



Radiates Emission from 30MHz to 1GHz

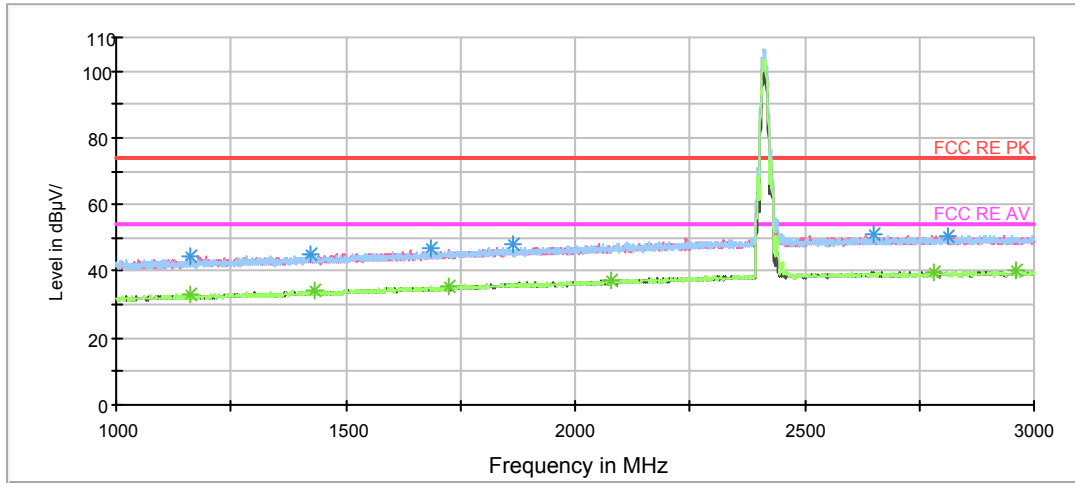
Frequency (MHz)	Quasi-Peak (dBuV/m)	Reading value (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
85.537500	26.1	15.6	100.0	V	170.0	10.5	13.9	40.0
148.137500	28.8	19.7	203.0	H	89.0	9.1	14.7	43.5
224.240000	25.2	12.1	175.0	V	302.0	13.1	20.8	46.0
249.988750	36.1	21.7	125.0	H	138.0	14.4	9.9	46.0
500.005000	32.8	12.9	175.0	H	286.0	19.9	13.2	46.0
825.965000	24.8	-0.8	175.0	H	73.0	25.6	21.2	46.0

- Remark: 1. Quasi-Peak = Reading value + Correction factor
- 2. Correction Factor = Antenna factor+ Insertion loss(cable loss+amplifier gain)
- 3. Margin = Limit – Quasi-Peak



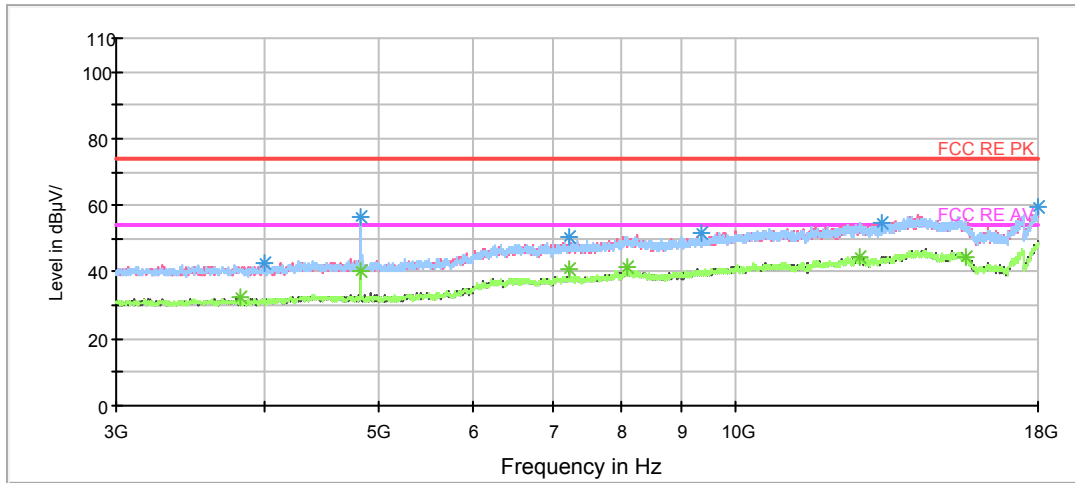
SISO Antenna 2
802.11b CH1

FCC RE 1G-3GHz PK+AV Class B



Note: The signal beyond the limit is carrier.
Radiates Emission from 1GHz to 3GHz

Copy of FCC RE 1G-18GHz PK+AV Class B



Radiates Emission from 3GHz to 18GHz



Frequency (MHz)	Peak (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1160.000000	44.4	200.0	V	30.0	38.9	5.5	29.6	74
1422.500000	45.2	100.0	V	67.0	38.4	6.8	28.8	74
1684.500000	46.9	100.0	H	154.0	38.8	8.1	27.1	74
1863.000000	48.0	200.0	V	182.0	38.9	9.1	26.0	74
2652.500000	50.8	200.0	H	222.0	38.5	12.3	23.2	74
2812.000000	50.4	200.0	V	92.0	37.7	12.7	23.6	74

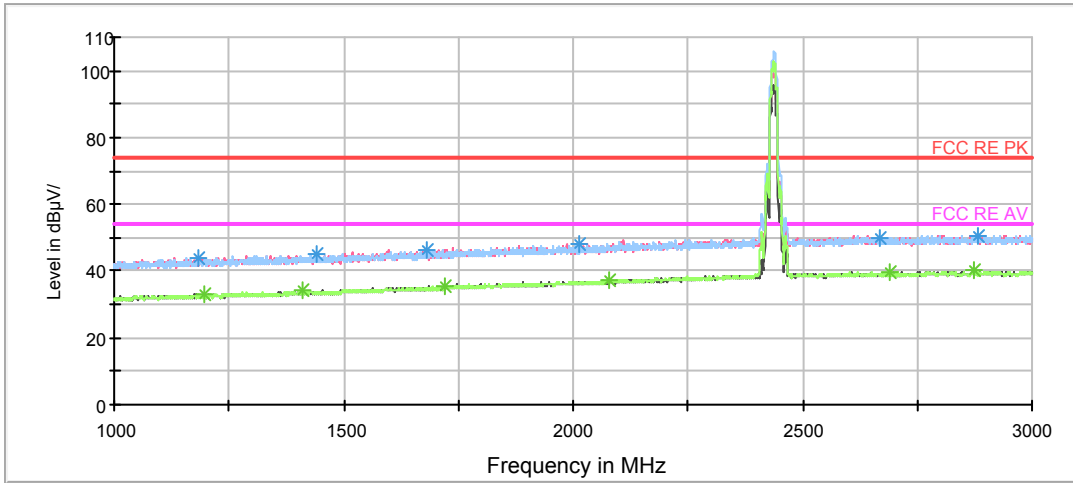
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1159.500000	32.9	200.0	H	205.0	27.5	5.4	21.1	54
1431.000000	34.2	100.0	H	119.0	27.4	6.8	19.8	54
1726.000000	35.7	100.0	H	110.0	27.3	8.4	18.3	54
2080.000000	37.2	200.0	V	0.0	26.9	10.3	16.8	54
2782.500000	39.9	200.0	H	213.0	27.2	12.7	14.1	54
2960.000000	40.0	200.0	V	66.0	27.3	12.7	14.0	54

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

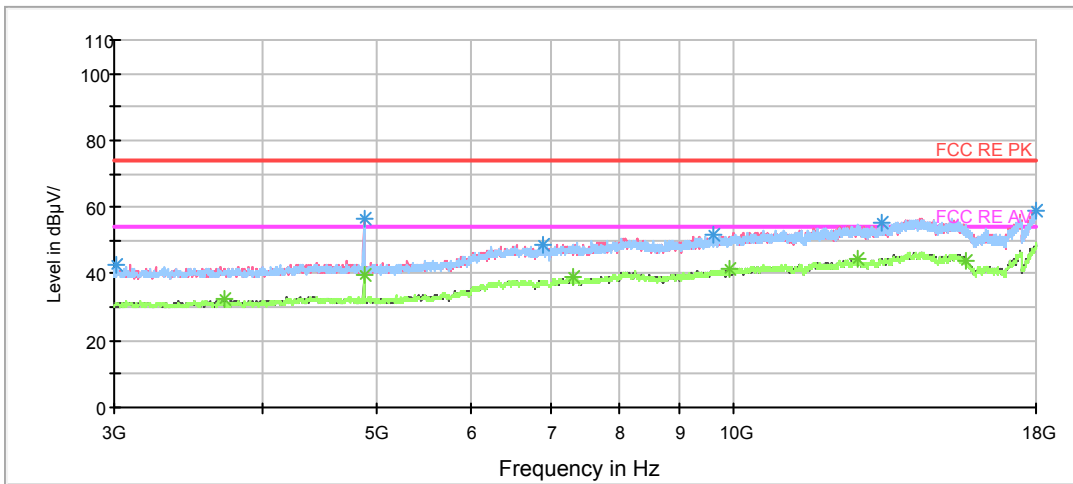
802.11b CH6

FCC RE 1G-3GHz PK+AV Class B



Note: The signal beyond the limit is carrier.
Radiates Emission from 1GHz to 3GHz

Copy of FCC RE 1G-18GHz PK+AV Class B



Radiates Emission from 3GHz to 18GHz



Frequency (MHz)	Peak (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1183.500000	43.9	100.0	V	356.0	38.2	5.7	30.1	74
1442.000000	45.1	200.0	H	258.0	38.3	6.8	28.9	74
1682.000000	46.3	200.0	H	302.0	38.1	8.2	27.7	74
2014.000000	48.3	200.0	V	246.0	38.5	9.8	25.7	74
2668.500000	50.1	200.0	H	311.0	37.7	12.4	23.9	74
2883.000000	50.8	100.0	H	256.0	38.2	12.6	23.2	74

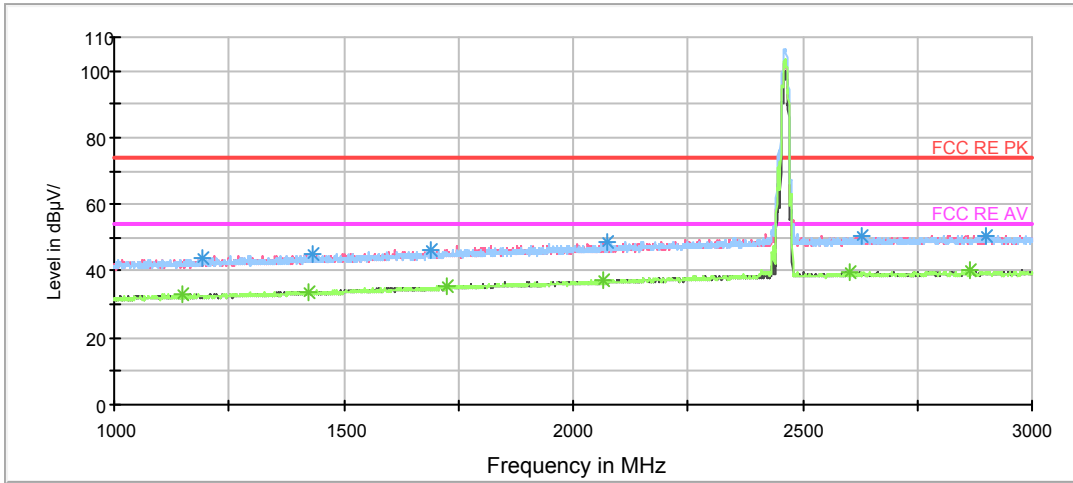
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1194.500000	33.1	200.0	H	344.0	27.4	5.7	20.9	54
1412.500000	34.0	200.0	H	241.0	27.3	6.7	20.0	54
1721.500000	35.4	200.0	V	88.0	27.0	8.4	18.6	54
2080.000000	37.1	200.0	H	0.0	26.8	10.3	16.9	54
2689.500000	39.4	100.0	H	27.0	26.9	12.5	14.6	54
2872.500000	40.0	200.0	V	158.0	27.2	12.8	14.0	54

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

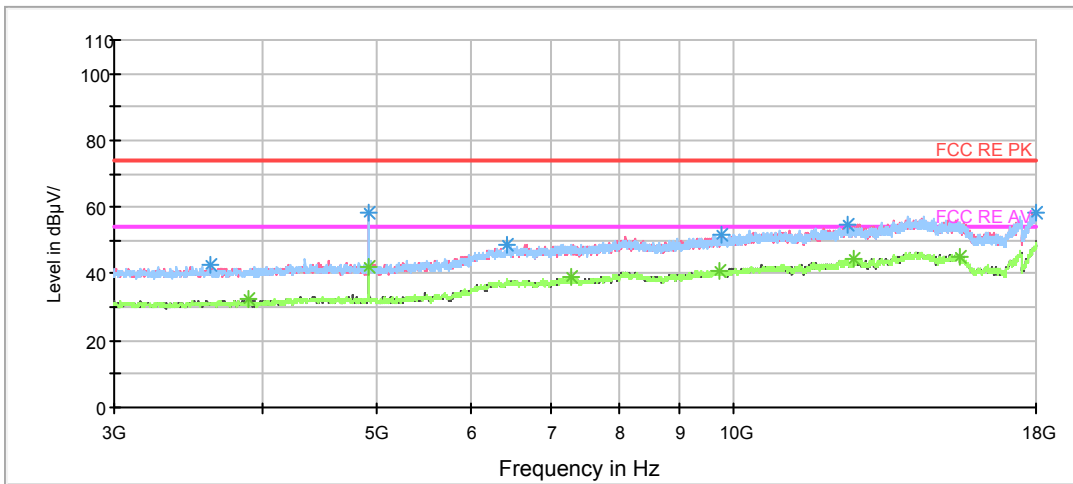
802.11b CH11

FCC RE 1G-3GHz PK+AV Class B



Note: The signal beyond the limit is carrier.
Radiates Emission from 1GHz to 3GHz

Copy of FCC RE 1G-18GHz PK+AV Class B



Radiates Emission from 3GHz to 18GHz



Frequency (MHz)	Peak (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1192.000000	43.7	200.0	H	0.0	38.0	5.7	30.3	74
1433.500000	45.3	100.0	H	0.0	38.5	6.8	28.7	74
1690.000000	46.5	200.0	H	283.0	38.4	8.1	27.5	74
2074.000000	48.6	100.0	H	36.0	38.5	10.1	25.4	74
2627.000000	50.4	200.0	V	0.0	38.0	12.4	23.6	74
2900.500000	50.7	200.0	V	354.0	38.0	12.7	23.3	74

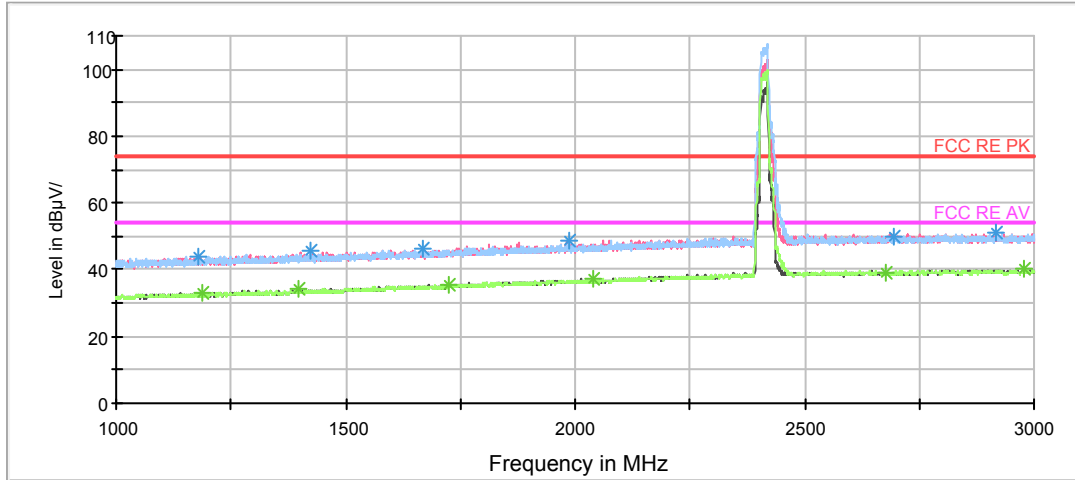
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1147.000000	32.9	200.0	V	1.0	27.5	5.4	21.1	54
1421.500000	33.9	100.0	V	345.0	27.1	6.8	20.1	54
1725.500000	35.5	100.0	H	80.0	27.1	8.4	18.5	54
2065.000000	37.3	100.0	H	186.0	27.2	10.1	16.7	54
2602.500000	39.5	100.0	V	338.0	27.0	12.5	14.5	54
2866.000000	40.1	100.0	V	0.0	27.5	12.6	13.9	54

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

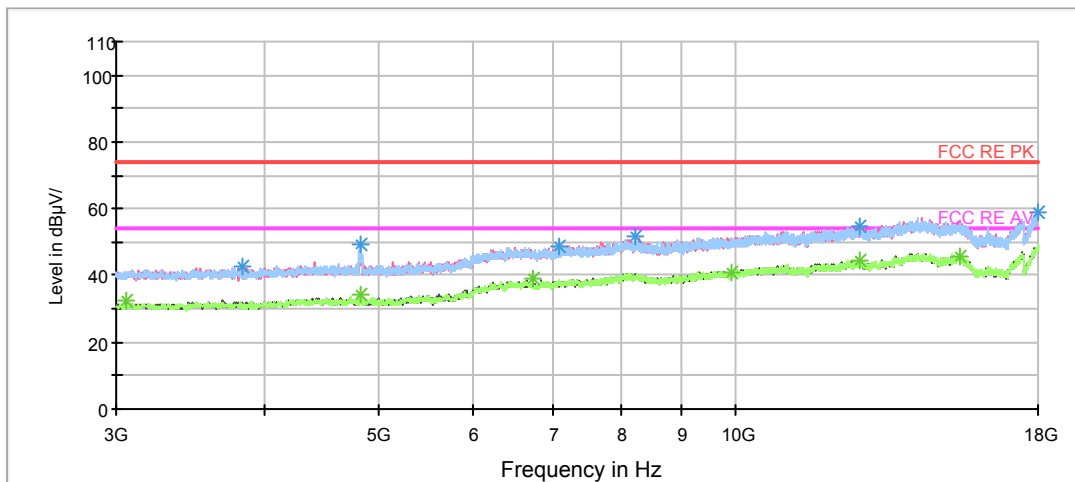
802.11g CH1

FCC RE 1G-3GHz PK+AV Class B



Note: The signal beyond the limit is carrier.
Radiates Emission from 1GHz to 3GHz

Copy of FCC RE 1G-18GHz PK+AV Class B



Radiates Emission from 3GHz to 18GHz



Frequency (MHz)	Peak (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1180.500000	44.1	200.0	V	69.0	38.5	5.6	29.9	74
1423.000000	45.5	100.0	V	215.0	38.7	6.8	28.5	74
1670.000000	46.2	200.0	H	186.0	38.2	8.0	27.8	74
1988.500000	48.6	100.0	H	79.0	39.0	9.6	25.4	74
2695.000000	50.2	100.0	H	3.0	37.7	12.5	23.8	74
2917.000000	51.2	100.0	H	52.0	38.4	12.8	22.8	74

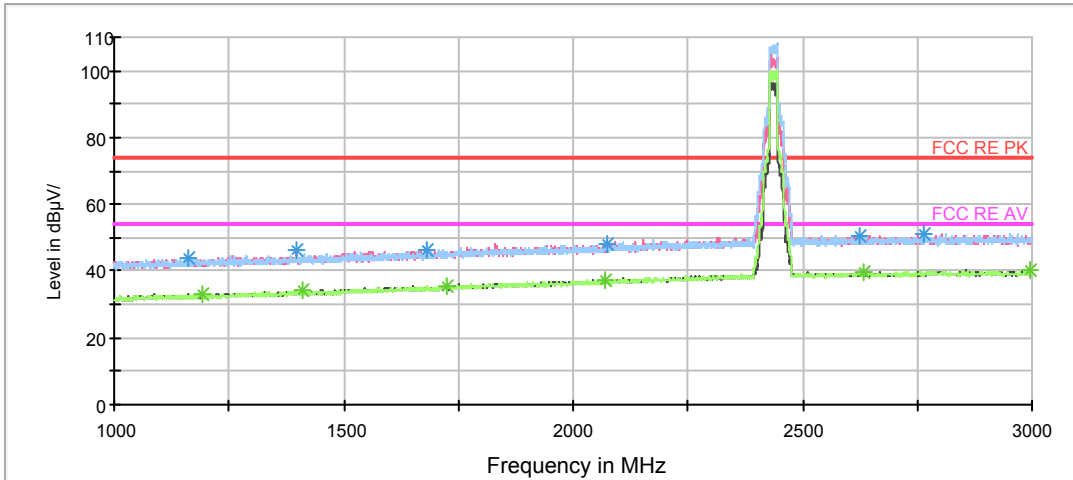
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1186.000000	33.0	100.0	V	312.0	27.3	5.7	21.0	54
1399.000000	34.1	100.0	V	356.0	27.5	6.6	19.9	54
1723.000000	35.5	200.0	H	292.0	27.1	8.4	18.5	54
2041.000000	37.4	200.0	H	292.0	27.5	9.9	16.6	54
2678.500000	39.1	100.0	H	70.0	26.8	12.3	14.9	54
2979.500000	40.0	200.0	V	11.0	27.1	12.9	14.0	54

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

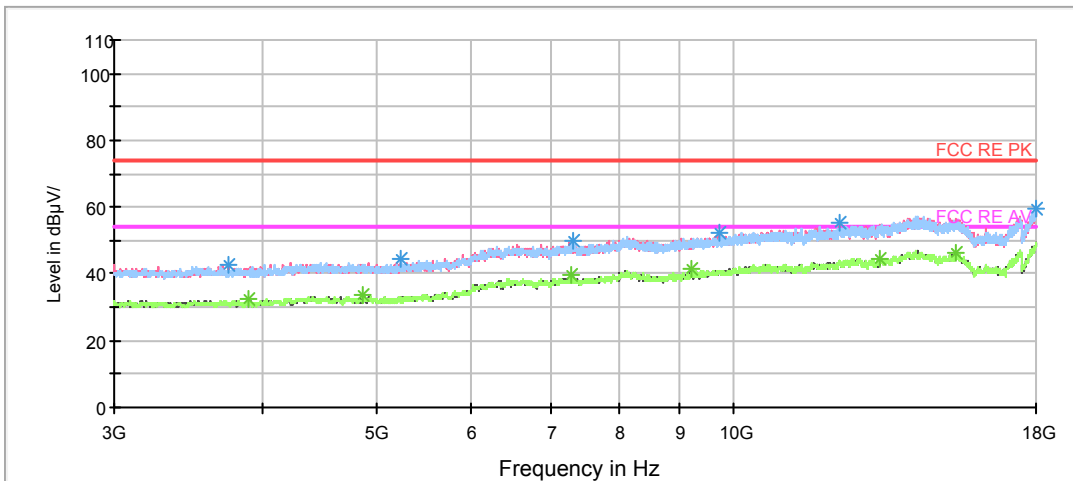
802.11g CH6

FCC RE 1G-3GHz PK+AV Class B



Note: The signal beyond the limit is carrier.
Radiates Emission from 1GHz to 3GHz

Copy of FCC RE 1G-18GHz PK+AV Class B



Radiates Emission from 3GHz to 18GHz



Frequency (MHz)	Peak (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1160.500000	43.9	100.0	V	167.0	38.4	5.5	30.1	74
1398.500000	46.1	100.0	V	3.0	39.5	6.6	27.9	74
1681.000000	46.2	100.0	H	3.0	38.0	8.2	27.8	74
2074.000000	48.3	200.0	V	5.0	38.2	10.1	25.7	74
2623.000000	50.5	200.0	V	81.0	38.0	12.5	23.5	74
2762.500000	51.2	100.0	H	14.0	38.8	12.4	22.8	74

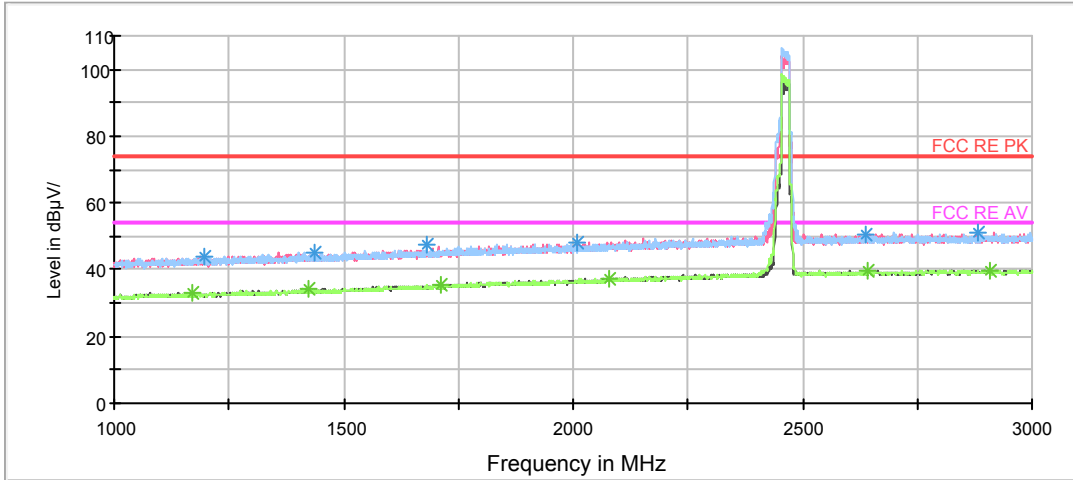
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1191.500000	32.9	100.0	V	167.0	27.2	5.7	21.1	54
1412.500000	34.1	100.0	V	0.0	27.4	6.7	19.9	54
1724.000000	35.6	100.0	H	0.0	27.1	8.5	18.4	54
2071.500000	37.2	200.0	V	14.0	27.0	10.2	16.8	54
2633.000000	39.7	200.0	H	347.0	27.2	12.5	14.3	54
2995.000000	40.1	100.0	H	30.0	27.4	12.7	13.9	54

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

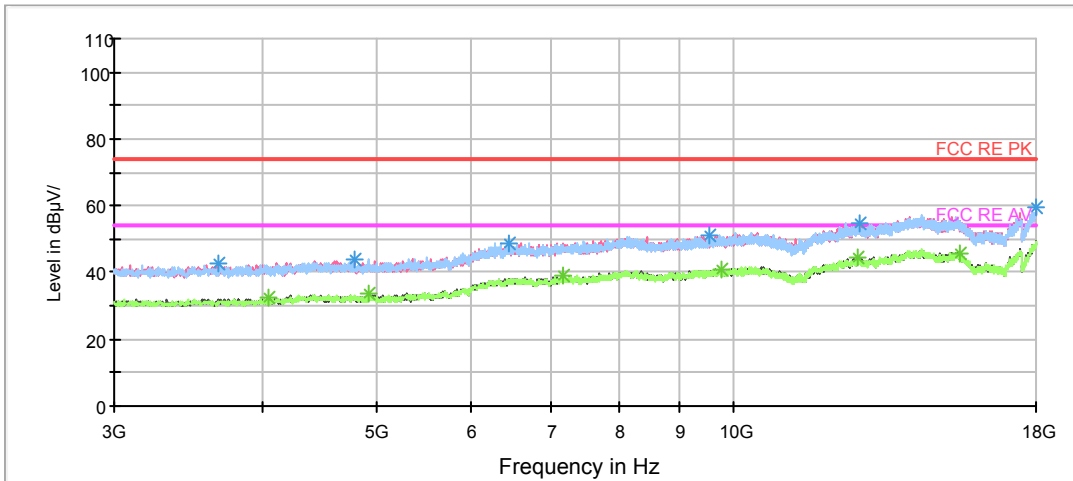
802.11g CH11

FCC RE 1G-3GHz PK+AV Class B



Note: The signal beyond the limit is carrier.
Radiates Emission from 1GHz to 3GHz

Copy of FCC RE 1G-18GHz PK+AV Class B



Radiates Emission from 3GHz to 18GHz



Frequency (MHz)	Peak (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1198.500000	44.0	200.0	H	243.0	38.4	5.6	30.0	74
1437.000000	45.1	100.0	H	6.0	38.3	6.8	28.9	74
1681.000000	47.2	200.0	H	359.0	39.0	8.2	26.8	74
2010.500000	48.4	100.0	V	342.0	38.7	9.7	25.6	74
2635.500000	50.5	100.0	H	102.0	38.0	12.5	23.5	74
2883.000000	51.2	200.0	V	328.0	38.6	12.6	22.8	74

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

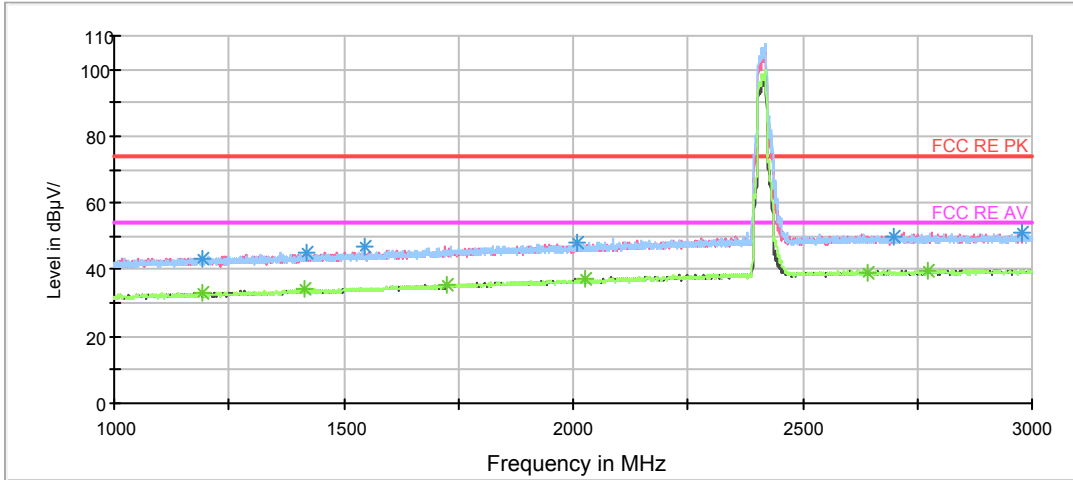
Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1171.000000	32.9	100.0	V	342.0	27.4	5.5	21.1	54
1423.000000	34.2	200.0	H	243.0	27.4	6.8	19.8	54
1713.500000	35.6	100.0	H	16.0	27.4	8.2	18.4	54
2078.000000	37.1	100.0	V	309.0	26.9	10.2	16.9	54
2640.000000	39.7	200.0	H	359.0	27.3	12.4	14.3	54
2908.000000	39.8	200.0	H	146.0	27.1	12.7	14.2	54

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

MIMO

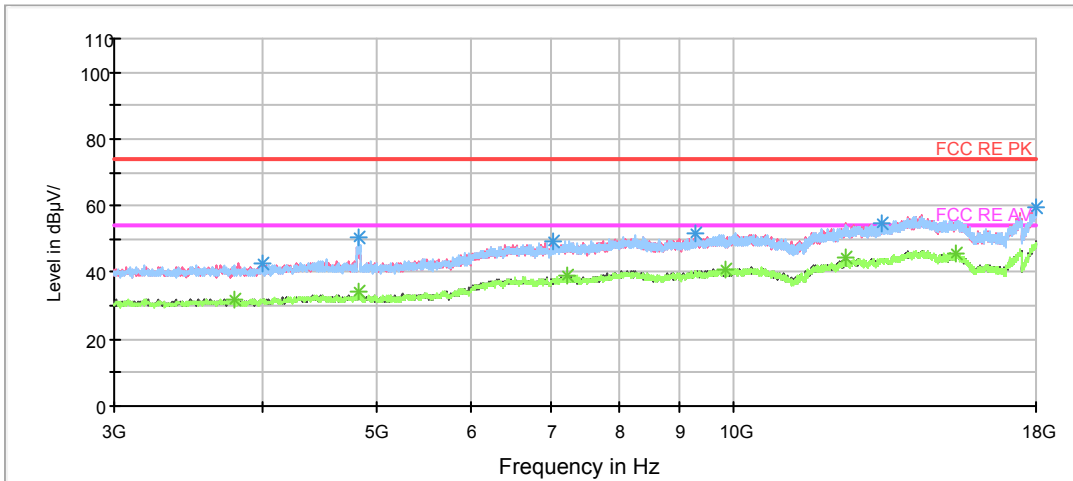
802.11n (HT20) CH1

FCC RE 1G-3GHz PK+AV Class B



Note: The signal beyond the limit is carrier.
Radiates Emission from 1GHz to 3GHz

Copy of FCC RE 1G-18GHz PK+AV Class B



Radiates Emission from 3GHz to 18GHz



Frequency (MHz)	Peak (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1190.000000	43.6	100.0	V	259.0	37.9	5.7	30.4	74
1420.500000	45.0	100.0	V	311.0	38.2	6.8	29.0	74
1544.000000	46.8	200.0	H	359.0	39.4	7.4	27.2	74
2009.000000	48.2	100.0	V	276.0	38.5	9.7	25.8	74
2698.500000	49.9	200.0	V	0.0	37.5	12.4	24.1	74
2979.500000	51.2	200.0	H	233.0	38.3	12.9	22.8	74

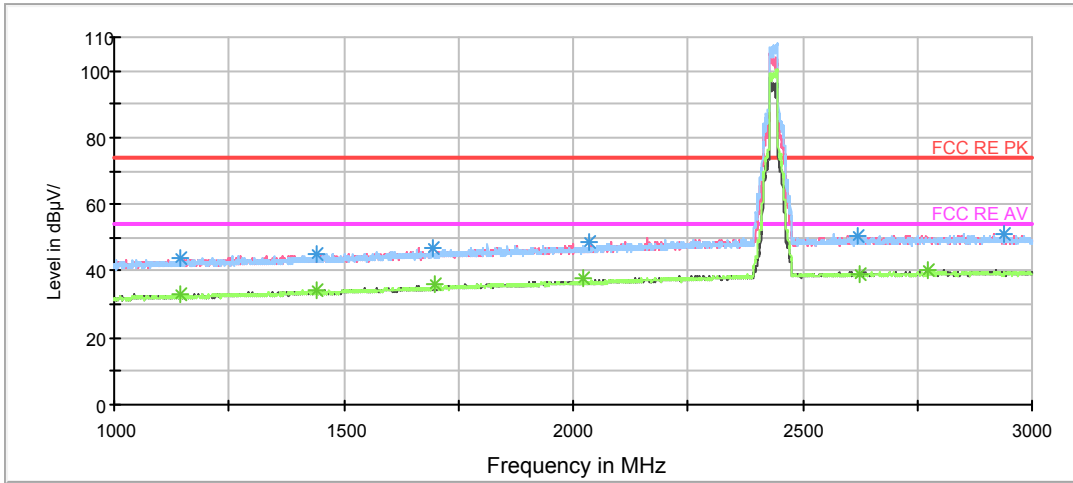
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1193.000000	33.1	100.0	V	358.0	27.4	5.7	20.9	54
1413.500000	34.1	200.0	V	10.0	27.4	6.7	19.9	54
1725.000000	35.5	100.0	H	211.0	27.0	8.5	18.5	54
2025.500000	37.3	100.0	V	285.0	27.4	9.9	16.7	54
2642.500000	39.3	200.0	V	152.0	26.9	12.4	14.7	54
2773.000000	39.9	100.0	V	86.0	27.2	12.7	14.1	54

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

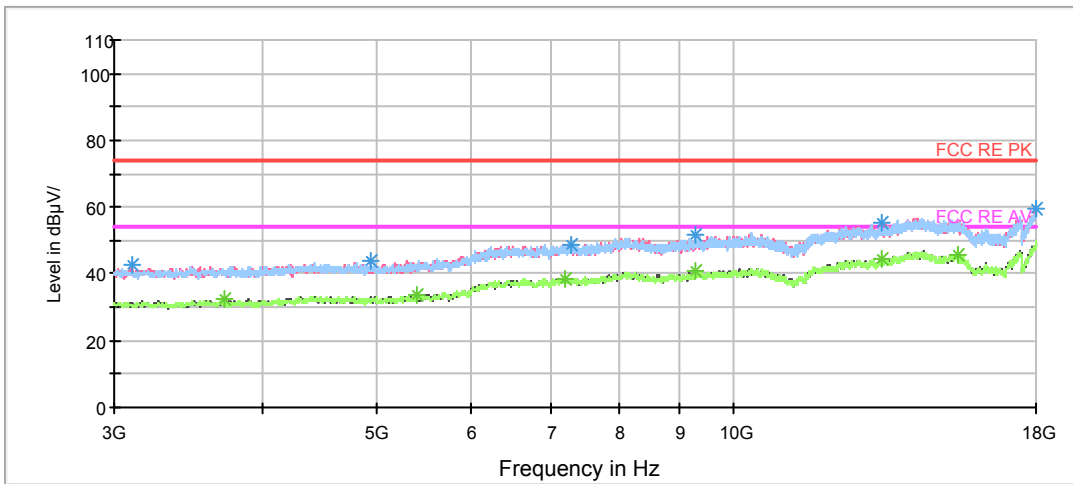
802.11n (HT20) CH6

FCC RE 1G-3GHz PK+AV Class B



Note: The signal beyond the limit is carrier.
Radiates Emission from 1GHz to 3GHz

Copy of FCC RE 1G-18GHz PK+AV Class B



Radiates Emission from 3GHz to 18GHz



Frequency (MHz)	Peak (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1144.000000	43.6	200.0	V	0.0	38.2	5.4	30.4	74
1442.000000	45.0	100.0	H	42.0	38.2	6.8	29.0	74
1692.500000	47.0	100.0	V	181.0	39.1	7.9	27.0	74
2035.500000	48.5	200.0	V	18.0	38.5	10.0	25.5	74
2620.500000	50.5	100.0	H	68.0	38.0	12.5	23.5	74
2938.500000	50.9	200.0	V	85.0	38.5	12.4	23.1	74

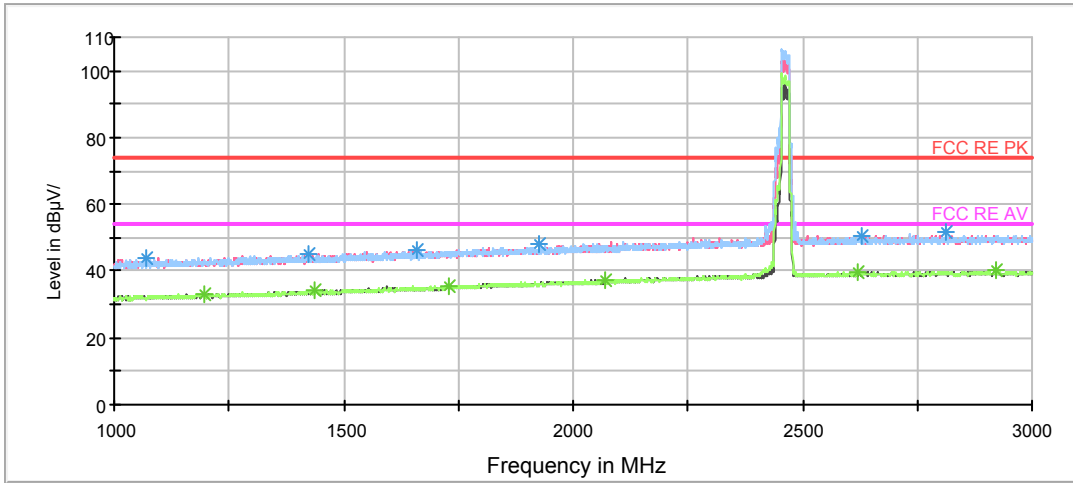
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1144.000000	33.0	100.0	H	218.0	27.6	5.4	21.0	54
1439.500000	34.3	200.0	H	350.0	27.5	6.8	19.7	54
1697.500000	35.9	100.0	H	50.0	27.7	8.2	18.1	54
2024.000000	37.6	100.0	V	207.0	27.7	9.9	16.4	54
2622.500000	39.3	200.0	H	327.0	26.8	12.5	14.7	54
2774.000000	40.1	100.0	H	138.0	27.4	12.7	13.9	54

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

802.11n (HT20) CH11

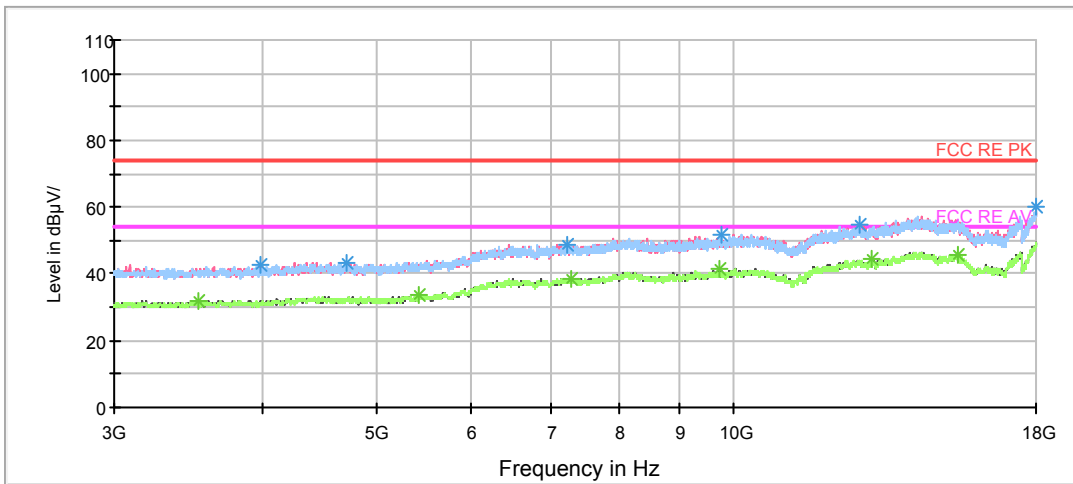
FCC RE 1G-3GHz PK+AV Class B



Note: The signal beyond the limit is carrier.

Radiates Emission from 1GHz to 3GHz

Copy of FCC RE 1G-18GHz PK+AV Class B



Radiates Emission from 3GHz to 18GHz



Frequency (MHz)	Peak (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1069.500000	44.0	200.0	H	321.0	38.8	5.2	30.0	74
1422.500000	44.9	200.0	V	77.0	38.1	6.8	29.1	74
1658.500000	46.4	200.0	H	278.0	38.5	7.9	27.6	74
1926.500000	48.3	100.0	V	178.0	38.9	9.4	25.7	74
2627.500000	50.6	100.0	H	228.0	38.2	12.4	23.4	74
2813.000000	51.4	100.0	H	0.0	38.8	12.6	22.6	74

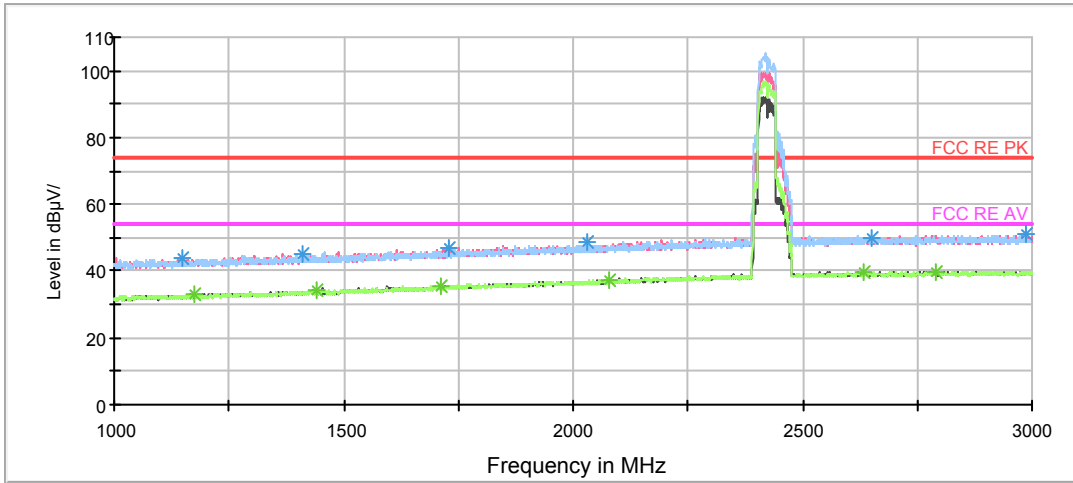
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1195.500000	33.1	100.0	H	183.0	27.4	5.7	20.9	54
1435.500000	34.0	200.0	V	77.0	27.2	6.8	20.0	54
1728.500000	35.6	200.0	H	339.0	27.3	8.3	18.4	54
2071.500000	37.3	200.0	H	359.0	27.1	10.2	16.7	54
2619.500000	39.9	200.0	H	304.0	27.5	12.4	14.1	54
2920.500000	40.0	100.0	V	187.0	27.1	12.9	14.0	54

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

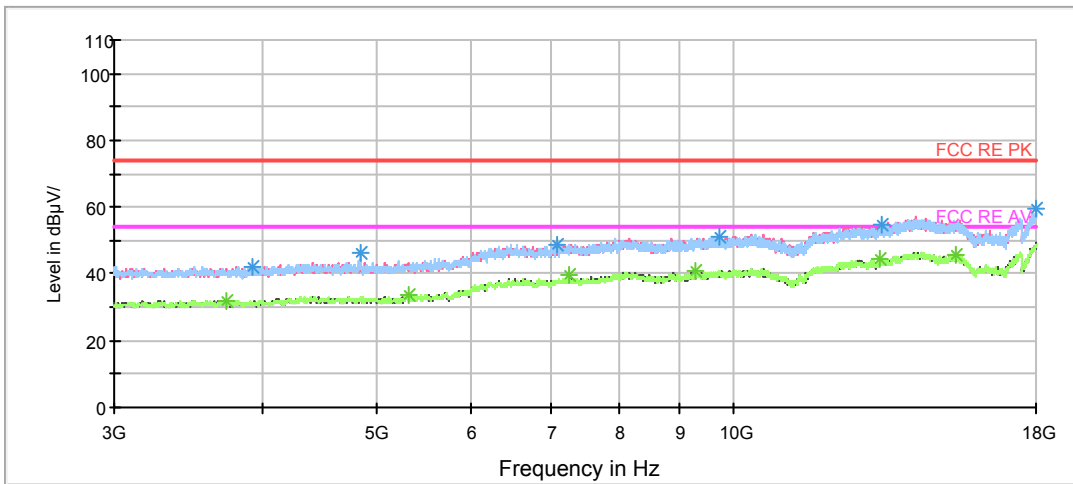
802.11n (HT40) CH3

FCC RE 1G-3GHz PK+AV Class B



Note: The signal beyond the limit is carrier.
Radiates Emission from 1GHz to 3GHz

Copy of FCC RE 1G-18GHz PK+AV Class B



Radiates Emission from 3GHz to 18GHz



Frequency (MHz)	Peak (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1149.000000	43.8	100.0	V	284.0	38.5	5.3	30.2	74
1410.500000	45.2	200.0	V	65.0	38.5	6.7	28.8	74
1730.000000	46.6	100.0	H	25.0	38.3	8.3	27.4	74
2029.500000	48.5	200.0	H	355.0	38.6	9.9	25.5	74
2648.500000	50.0	100.0	H	2.0	37.5	12.5	24.0	74
2987.000000	50.9	200.0	H	70.0	38.2	12.7	23.1	74

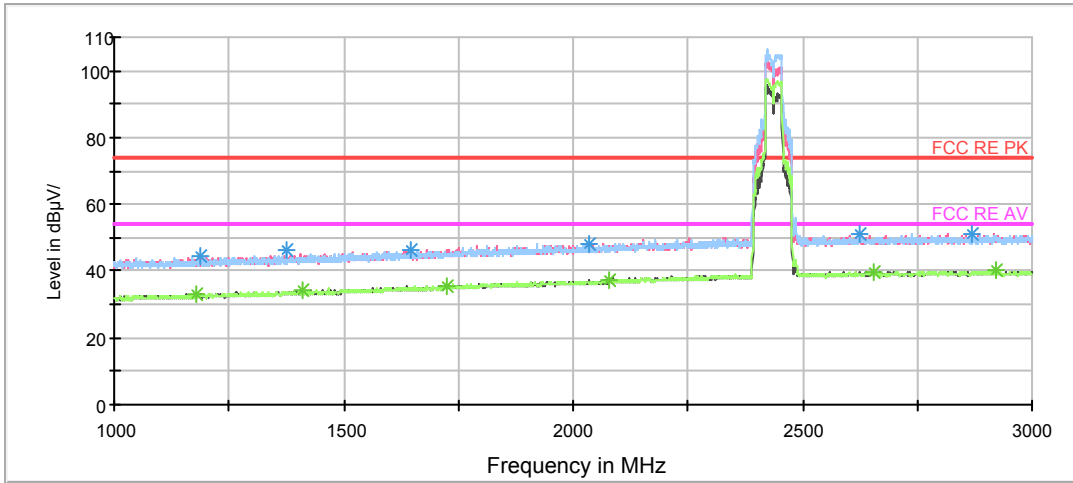
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1174.000000	33.1	200.0	V	14.0	27.5	5.6	20.9	54
1440.500000	34.0	200.0	H	348.0	27.2	6.8	20.0	54
1713.500000	35.5	100.0	V	232.0	27.3	8.2	18.5	54
2080.000000	37.2	100.0	H	104.0	26.9	10.3	16.8	54
2632.500000	39.4	200.0	V	14.0	26.9	12.5	14.6	54
2790.000000	40.0	200.0	V	101.0	27.4	12.6	14.0	54

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

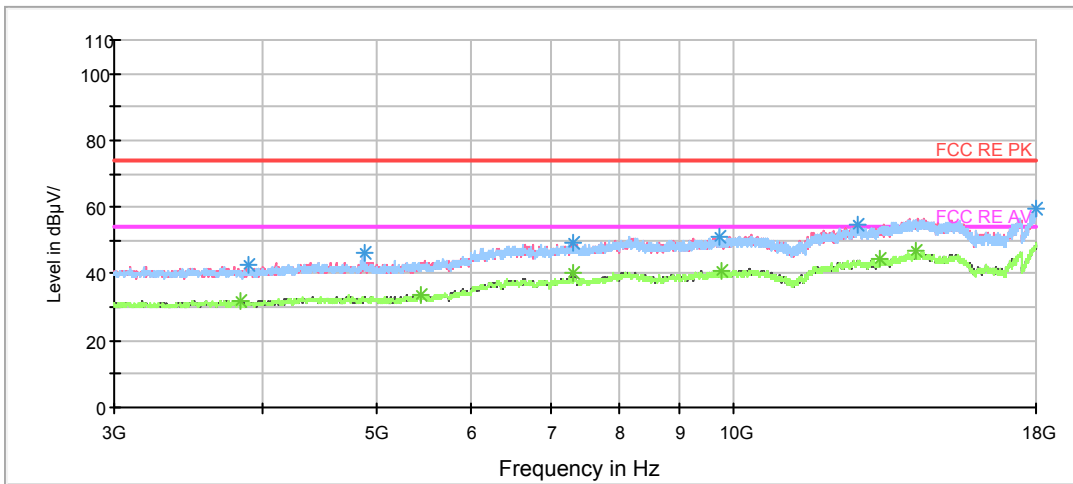
802.11n (HT40) CH6

FCC RE 1G-3GHz PK+AV Class B



Note: The signal beyond the limit is carrier.
Radiates Emission from 1GHz to 3GHz

Copy of FCC RE 1G-18GHz PK+AV Class B



Radiates Emission from 3GHz to 18GHz



Frequency (MHz)	Peak (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1186.500000	44.2	100.0	V	0.0	38.6	5.6	29.8	74
1374.000000	46.1	100.0	H	119.0	39.6	6.5	27.9	74
1645.000000	46.5	200.0	H	231.0	38.6	7.9	27.5	74
2033.500000	47.9	100.0	V	57.0	37.9	10.0	26.1	74
2622.500000	50.9	100.0	H	74.0	38.4	12.5	23.1	74
2869.000000	51.2	100.0	H	146.0	38.5	12.7	22.8	74

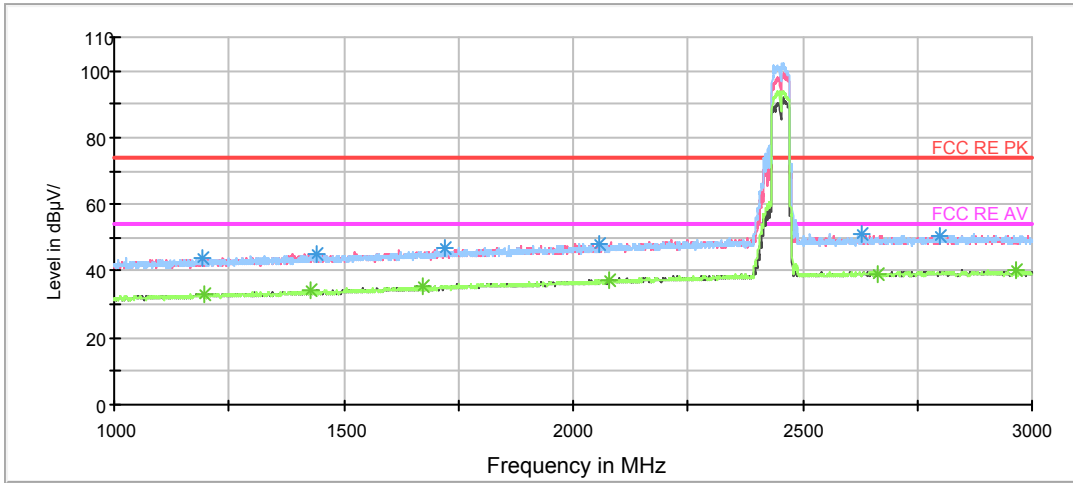
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1179.000000	33.0	200.0	V	41.0	27.4	5.6	21.0	54
1411.500000	34.2	200.0	H	178.0	27.5	6.7	19.8	54
1723.500000	35.7	100.0	H	119.0	27.3	8.4	18.3	54
2078.000000	37.3	200.0	H	328.0	27.1	10.2	16.7	54
2654.000000	39.4	100.0	H	318.0	27.1	12.3	14.6	54
2921.500000	40.2	200.0	H	0.0	27.4	12.8	13.8	54

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

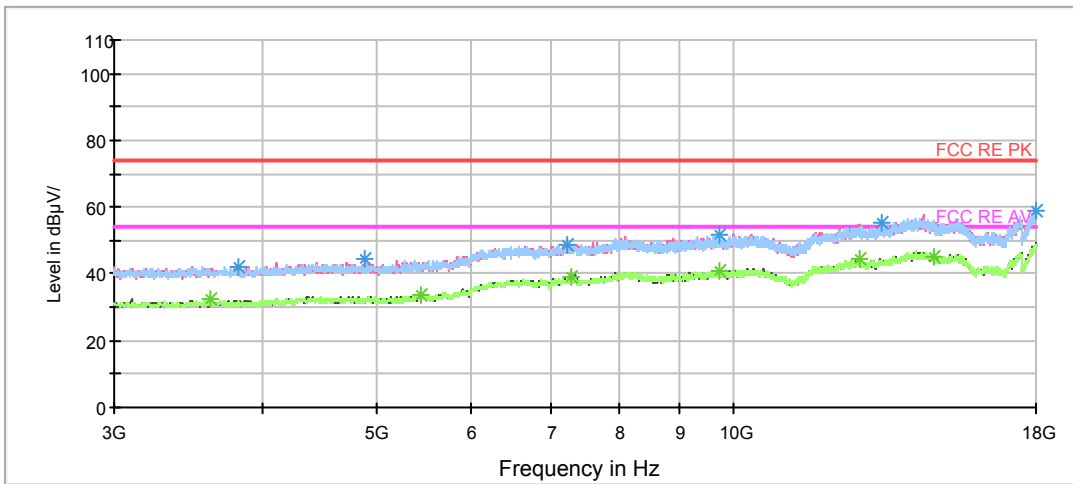
802.11n (HT40) CH9

FCC RE 1G-3GHz PK+AV Class B



Note: The signal beyond the limit is carrier.
Radiates Emission from 1GHz to 3GHz

Copy of FCC RE 1G-18GHz PK+AV Class B



Radiates Emission from 3GHz to 18GHz



Frequency (MHz)	Peak (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1194.000000	43.7	100.0	V	0.0	38.0	5.7	30.3	74
1441.000000	45.2	200.0	V	174.0	38.4	6.8	28.8	74
1721.000000	46.7	200.0	H	82.0	38.4	8.3	27.3	74
2058.000000	47.9	200.0	H	284.0	37.9	10.0	26.1	74
2630.000000	51.3	200.0	H	223.0	39.0	12.3	22.7	74
2798.500000	50.5	200.0	V	209.0	37.8	12.7	23.5	74

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1196.500000	33.2	100.0	H	0.0	27.5	5.7	20.8	54
1426.500000	34.1	100.0	H	7.0	27.3	6.8	19.9	54
1671.000000	35.6	200.0	V	174.0	27.7	7.9	18.4	54
2078.500000	37.4	200.0	H	267.0	27.2	10.2	16.6	54
2664.000000	39.3	200.0	V	41.0	26.8	12.5	14.7	54
2963.500000	40.1	100.0	H	220.0	27.4	12.7	13.9	54

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

5.7. Conducted Emission

Ambient condition

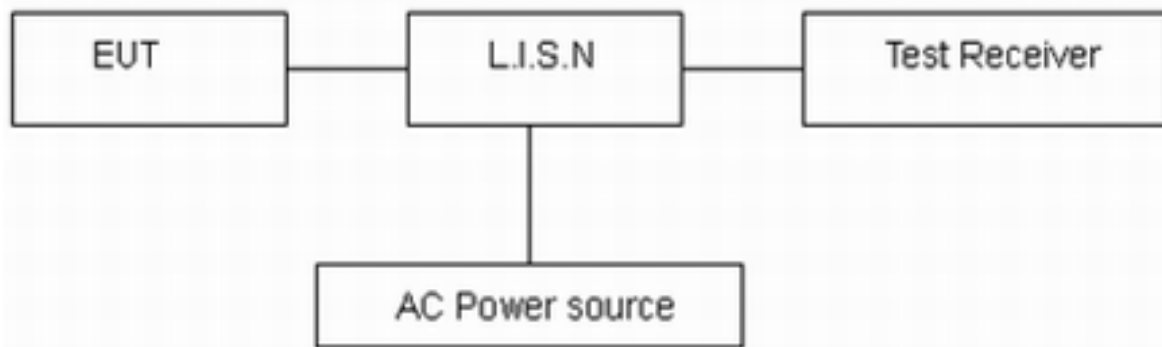
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Methods of Measurement

The EUT is placed on a non-metallic table of 80cm height above the horizontal metal reference ground plane. During the test, the EUT was operating in its typical mode. The test method is according to ANSI C63.10-2013. Connect the AC power line of the EUT to the L.I.S.N. Use EMI receiver to detect the average and Quasi-peak value. RBW is set to 9 kHz, VBW is set to 30kHz. The measurement result should include both L line and N line.

The test is in transmitting mode.

Test Setup



Note: AC Power source is used to change the voltage 110V/60Hz.

Limits

Frequency (MHz)	Conducted Limits(dBμV)	
	Quasi-peak	Average
0.15 - 0.5	66 to 56 *	56 to 46*
0.5 - 5	56	46
5 - 30	60	50

*: Decreases with the logarithm of the frequency.

Measurement Uncertainty

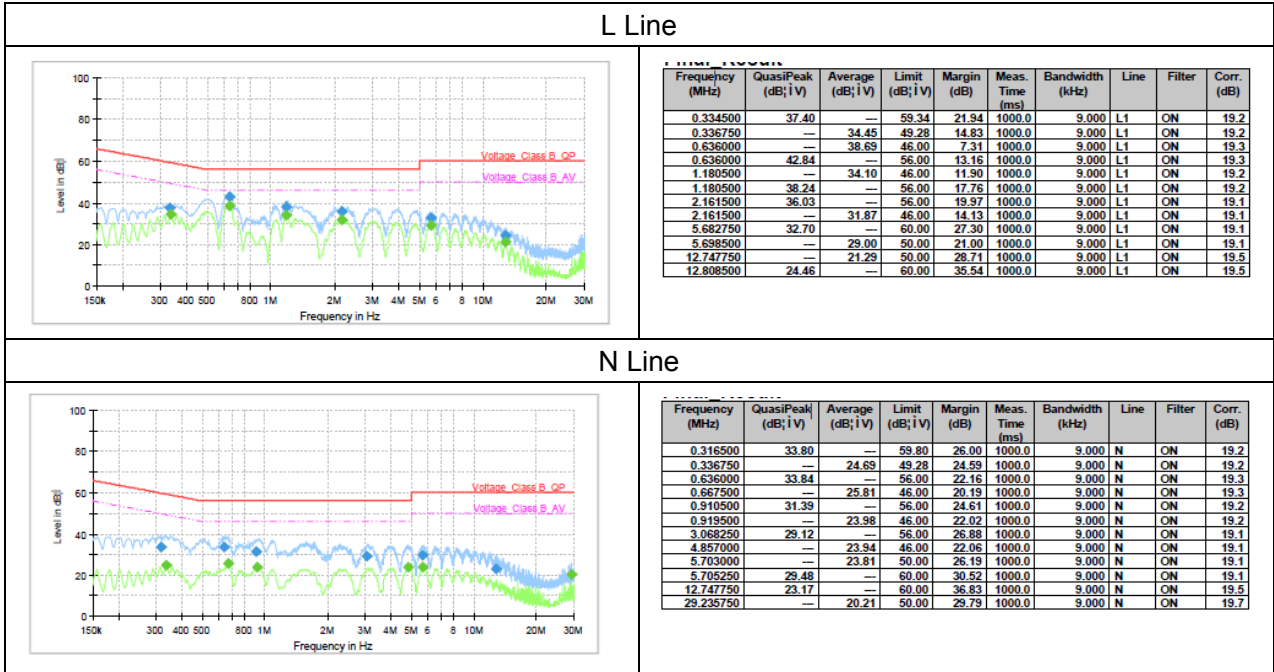
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 1.96$, $U = 2.69$ dB.



Test Results:

Following plots, Blue trace uses the peak detection and Green trace uses the average detection. During the test, the Conducted Emission was performed in all modes (WIFI 2.4G) with all channels, 802.11b, Channel 11 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.

SISO Antenna 2





6. Main Test Instruments

Name	Manufacturer	Type	Serial Number	Calibration Date	Expiration Date
Spectrum Analyzer	R&S	FSV30	100815	2017-12-17	2018-12-16
EMI Test Receiver	R&S	ESCI	100948	2018-05-20	2019-05-19
TRILOG Broadband Antenna	Schwarzbeck	VULB 9163	9163-201	2017-11-18	2020-11-17
Double Ridged Waveguide Horn Antenna	R&S	HF907	100126	2014-12-06	2019-12-05
Loop Antenna	SCHWARZBECK	FMZB1519	1519-047	2017-11-18	2020-11-17
Standard Gain Horn	ETS-Lindgren	3160-09	00102644	2015-01-30	2020-01-29
EMI Test Receiver	R&S	ESR	101667	2017-09-06	2018-09-05
LISN	R&S	ENV216	101171	2016-12-16	2019-12-15
Spectrum Analyzer	Agilent	N9010A	MY47191109	2018-05-20	2019-05-19
Power Meter	R&S	NRP2	1144.1374K02 -104306-EX	2017-12-21	2018-12-20
Power Sensor	R&S	NRP-Z21	104799	2018-05-20	2019-05-19
RF Cable	Agilent	SMA 15cm	0001	/	/
Software	R&S	EMC32	9.26.0	/	/

*****END OF REPORT *****