RF TEST REPORT

Applicant	UAB TELTONIKA
FCC ID	2AET4RUT950A
Product	LTE Router
Brand	Teltonika
Marketing	RUT950
Model	RUT950
Report No.	R1812A0564-R1V1
Issue Date	January 30, 2019

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.

Peng Tao

Performed by: Peng Tao

Kai Xu

Approved by: Kai Xu

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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: December 13, 2018 ~January 18, 2019			

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.
Address:	No.145, Jintang Rd, Tangzhen Industry Park, Pudong
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2. General Description of Equipment under Test

Client Information

Applicant	UAB TELTONIKA
Applicant address	Saltoniskiu st. 9B LT-08105 Vilnius, Lithuania
Manufacturer	UAB TELTONIKA
Manufacturer address	Saltoniskiu st. 9B-1 LT-08105 Vilnius, Lithuania

General information

EUT Description	
Model	RUT950
IMEI	861641040075300
Hardware Version	11
Software Version	RUT9xx_R_AA.BB.CCC
Power Supply	AC adapter
Antenna Type	External Antenna
Antenna Connector	RF Connector(meet with the standard FCC Part 15.203 requirement)
Antenna Gain	5dBi
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	Wi-Fi 2.4G :16.59dBm
Operating Frequency Range(s)	802.11b/g/n(HT20): 2412 ~ 2462 MHz 802.11n(HT40): 2422 ~ 2452 MHz
EUT Accessory	
Adapter	Manufacturer: Shenzen Shengji Mains CO., LTD Model: SJ-09010033
Wi-Fi antenna	Manufacturer: JC Antenna Model: JCW410-TEL
LTE antenna	Manufacturer: JC Antenna Model: JCG410L-TEL
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 15.247 Meas Guidance v05**
- **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 stand-up position (Z axis) and the loop antenna is vertical, the others are vertical and horizontal. 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 artgui

Worst-case data rates are shown as following table.

Band	Data Rate		
	SISO Antenna 1	SISO Antenna 2	MIMO
802.11b	1 Mbps	1 Mbps	/
802.11g	6 Mbps	6 Mbps	/
802.11n HT20	/	/	MCS0
802.11n HT40	/	/	MCS0

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	802.11b/g	802.11b/g	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	802.11b/g	802.11b/g	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			

According to RF Output power results in chapter 5.1, MIMO was selected as the worst antenna for 802.11n HT20/ HT40. SISO Antenna 1 was selected as the worst SISO antenna for 802.11b/g.

5. Test Case Results

5.1. Maximum output power

Ambient condition

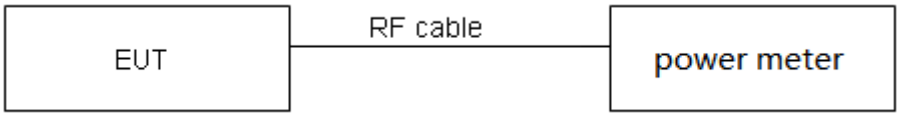
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

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	≤ 1W (30dBm)

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	15	15	15	15	15	15
802.11g	15	15	15	15	15	15

MIMO Power Index			
Packet Type	CH1	CH6	CH11
802.11n HT20	13	15	15
Packet Type	CH3	CH6	CH9
802.11n HT40	13	15	13

Band	T_{on} (ms)	$T_{(on+off)}$ (ms)	Duty cycle	Duty cycle correction Factor(dB)
802.11b	8.20	8.24	1.00	NA
802.11g	1.36	1.41	0.96	0.17
802.11n HT20	1.27	1.32	0.96	0.16
802.11n HT40	0.63	0.67	0.95	0.24
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	14.62	14.64	30	PASS
	2437	13.76	13.78	30	PASS
	2462	12.28	12.30	30	PASS
802.11g	2412	14.97	15.14	30	PASS
	2437	14.05	14.22	30	PASS
	2462	12.58	12.75	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	13.92	13.94	30	PASS
	2437	12.97	12.99	30	PASS
	2462	11.56	11.58	30	PASS
802.11g	2412	14.27	14.44	30	PASS
	2437	13.31	13.48	30	PASS
	2462	11.86	12.03	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	12.72	12.88	12.13	12.29	15.61	30	PASS
	2437	13.93	14.09	12.85	13.01	16.59	30	PASS
	2462	12.56	12.72	11.57	11.73	15.26	30	PASS
802.11n HT40	2422	12.34	12.58	11.35	11.59	15.12	30	PASS
	2437	13.57	13.81	12.65	12.89	16.39	30	PASS
	2452	11.27	11.51	10.18	10.42	14.01	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 $=10\log(10^{(\text{Power antenna1 in dBm}/10)}+10^{(\text{Power antenna2 in dBm}/10}$.

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} + 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} + Array Gain =5+0=5 dBi<6dBi. So the power limt is 30dBm

5.2. 6dB Bandwidth

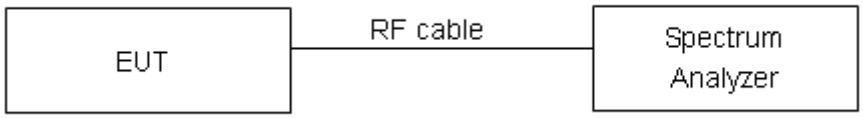
Ambient condition

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

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:

SISO Antenna 1

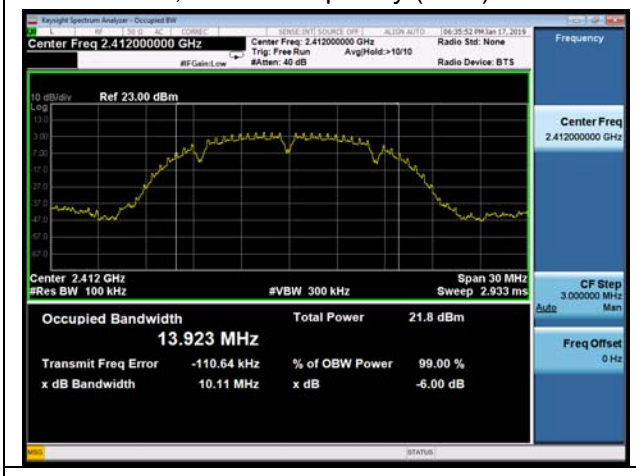
Network Standards	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 6 dB bandwidth (MHz)	Limit (kHz)	Conclusion
802.11b	2412	13.923	10.11	500	PASS
	2437	13.906	10.09	500	PASS
	2462	13.833	10.10	500	PASS
802.11g	2412	16.517	16.33	500	PASS
	2437	16.498	16.10	500	PASS
	2462	16.483	16.34	500	PASS

MIMO

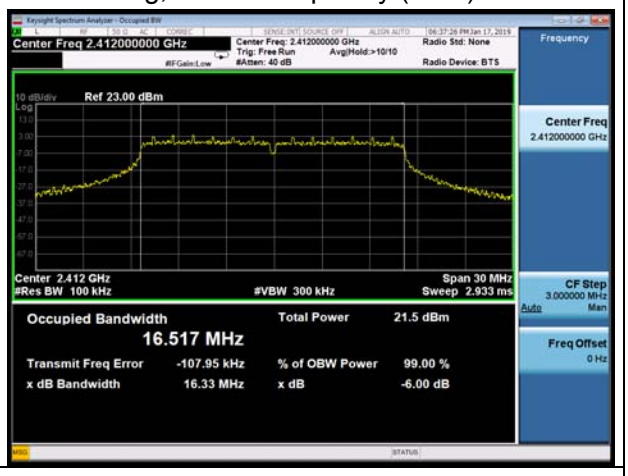
Network Standards	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 6 dB bandwidth (MHz)	Limit (kHz)	Conclusion
802.11n HT20	2412	17.646	17.32	500	PASS
	2437	17.637	17.56	500	PASS
	2462	17.653	17.34	500	PASS
802.11n HT40	2422	36.286	35.79	500	PASS
	2437	36.311	35.79	500	PASS
	2452	36.289	36.05	500	PASS

SISO Antenna 1

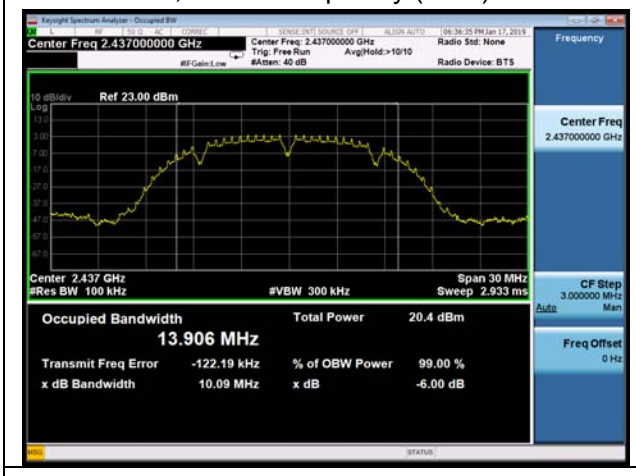
802.11b, Carrier frequency (MHz): 2412



802.11g, Carrier frequency (MHz): 2412



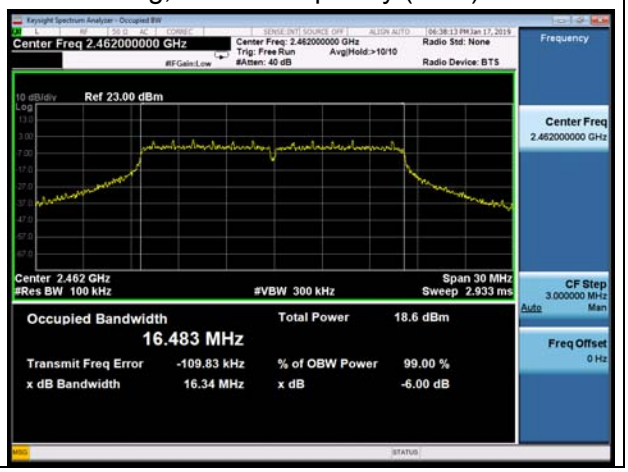
802.11b, Carrier frequency (MHz): 2437



802.11g, Carrier frequency (MHz): 2437

802.11b, Carrier frequency (MHz):2462

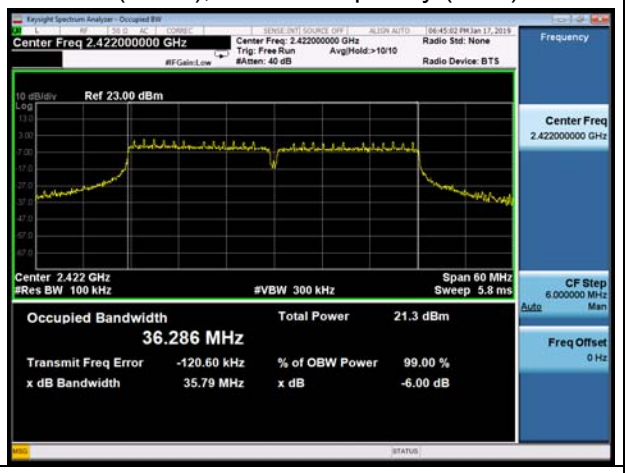
802.11g, Carrier frequency (MHz):2462



MIMO

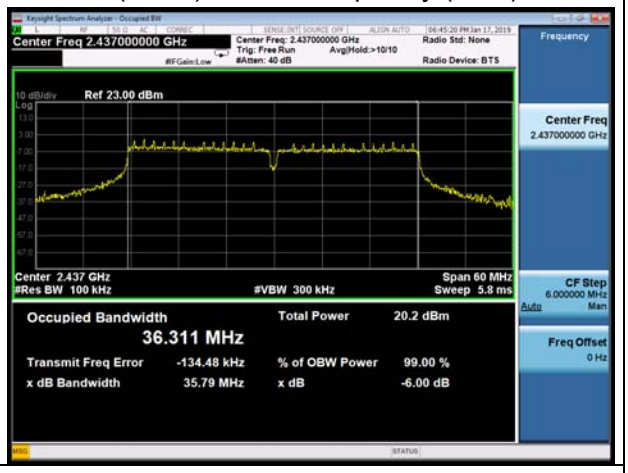
802.11n(HT20), Carrier frequency (MHz): 2412

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



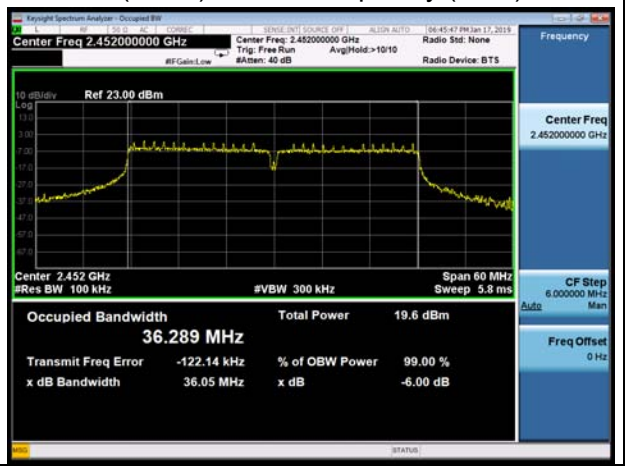
802.11n(HT20), Carrier frequency (MHz): 2437

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

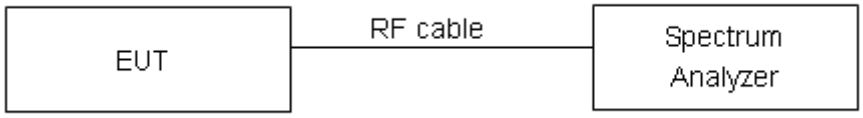
Ambient condition

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.”

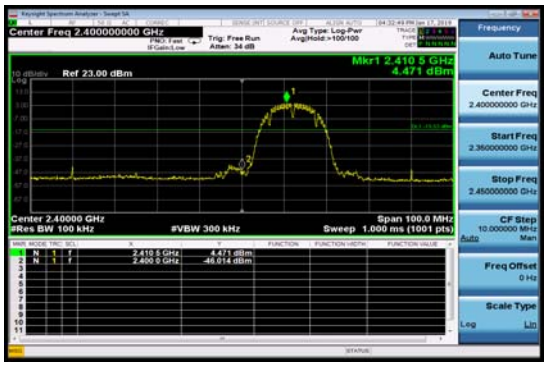
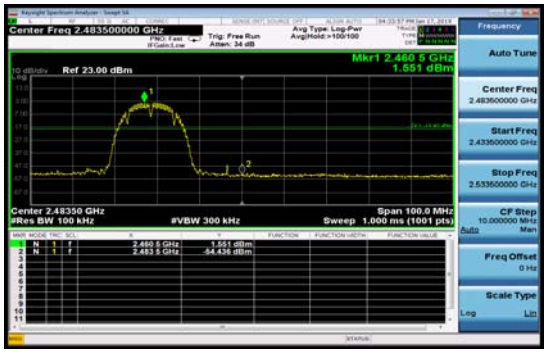
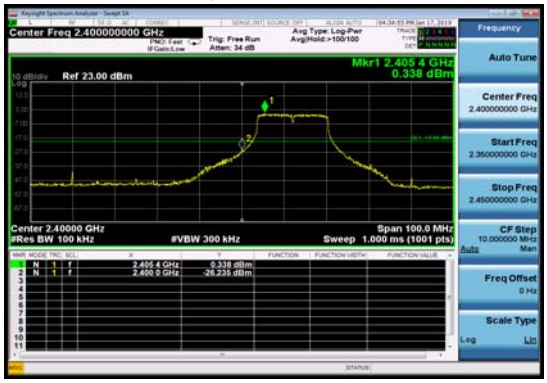
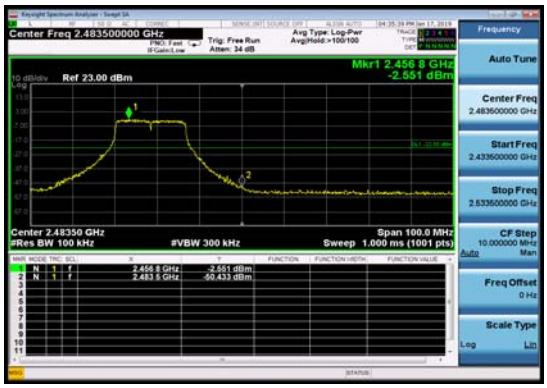
Measurement Uncertainty

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

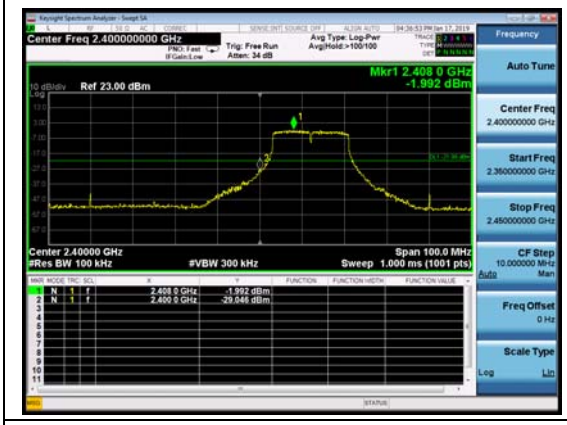
Test Results: PASS

SISO Antenna 1

802.11b, Channel No.: 1	802.11b, Channel No.: 11
	
802.11g, Channel No.: 1	802.11g, Channel No.: 11
	

MIMO

802.11n(HT20), Channel No.: 1



802.11n(HT20), Channel No.: 11

802.11n(HT40), Channel No.: 3

802.11n(HT40), Channel No.: 9

5.4. Power Spectral Density

Ambient condition

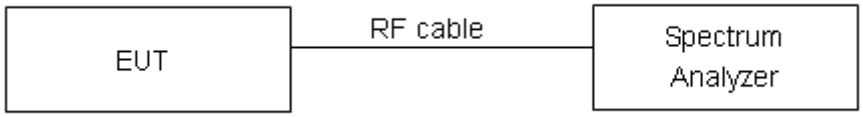
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

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.

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(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

Measurement Uncertainty

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

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	-18.19	-18.17	8	PASS
	6	-19.16	-19.13	8	PASS
	11	-20.30	-20.27	8	PASS
802.11g	1	-19.71	-19.54	8	PASS
	6	-21.18	-21.01	8	PASS
	11	-21.88	-21.71	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	-18.60	-18.58	8	PASS
	6	-20.00	-19.98	8	PASS
	11	-21.67	-21.65	8	PASS
802.11g	1	-20.36	-20.19	8	PASS
	6	-21.94	-21.77	8	PASS
	11	-23.23	-23.06	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	-22.29	-22.13	-22.44	-22.27	-19.19	8.00	PASS
	6	-21.39	-21.23	-22.18	-22.02	-18.59	8.00	PASS
	11	-21.49	-21.33	-23.35	-23.19	-19.15	8.00	PASS
802.11n HT40	3	-25.86	-25.62	-25.36	-25.12	-22.35	8.00	PASS
	6	-24.13	-23.89	-24.50	-24.26	-21.06	8.00	PASS
	9	-25.53	-25.29	-27.04	-26.80	-22.97	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=$10\log(10^{(\text{PSD antenna1 in dBm/10})}+10^{(\text{PSD antenna2 in dBm/10})})$

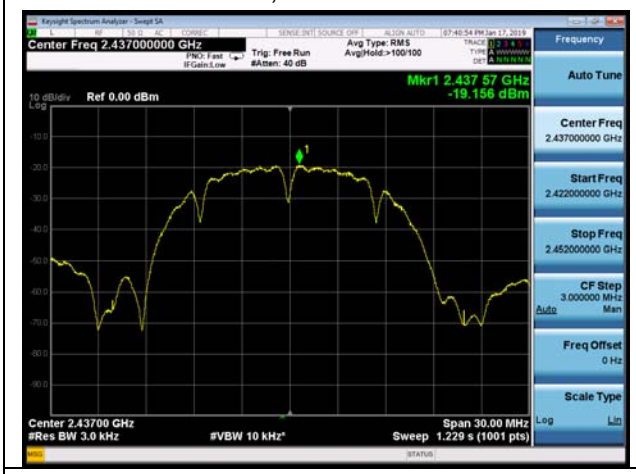
3. The manufacturer declared the transmitter output signals is CDD mode. And N_{ss}=2. According to KDB 662911 D01 Multiple Transmitter Output v02r01 2)f)(i): If all antennas have the same gain, Directional gain = G_{ANT} + Array Gain, For PSD measurements on all devices, Array Gain=10log(Nant/Nss)dB,so directional gain=GANT+Array Gain=5+10log(2/2)=5<6dBi. So the power limt is =8dBm

SISO Antenna 1

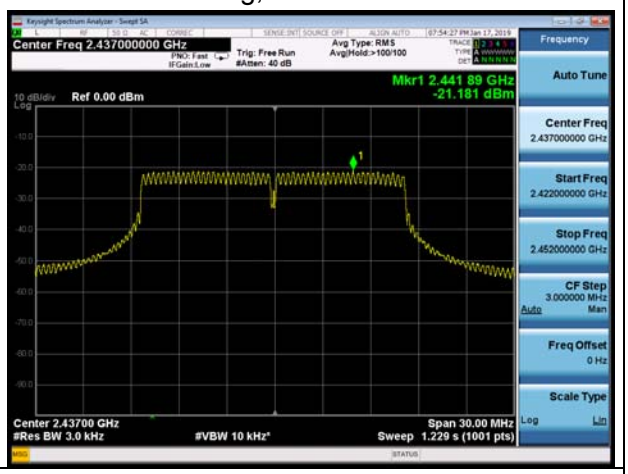
802.11b, Channel No.: 1

802.11g, Channel No.: 1

802.11b, Channel No.: 6

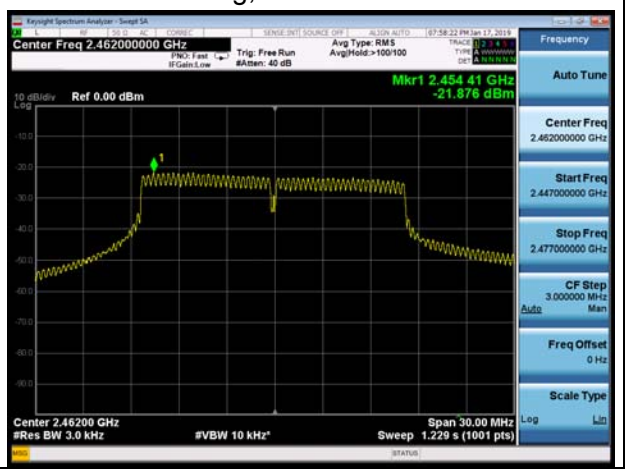


802.11g, Channel No.: 6



802.11b, Channel No.: 11

802.11g, Channel No.: 11



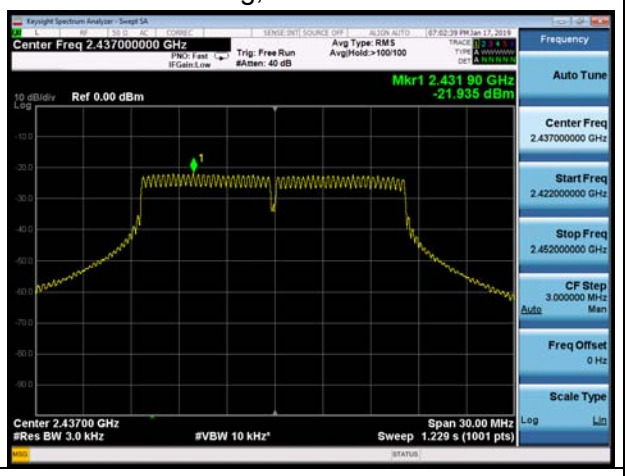
SISO Antenna 2

802.11b, Channel No.: 1

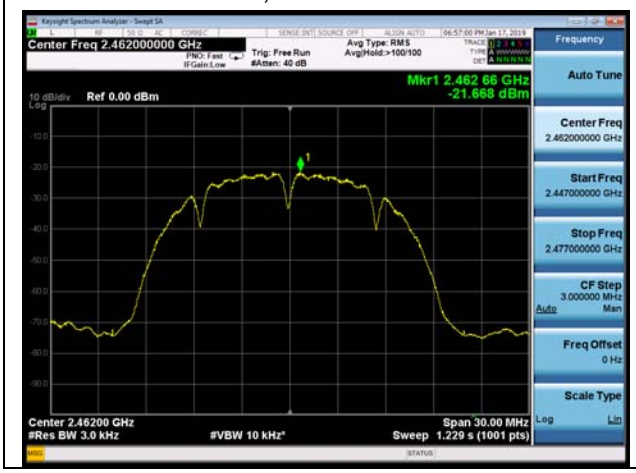
802.11g, Channel No.: 1

802.11b, Channel No.: 6

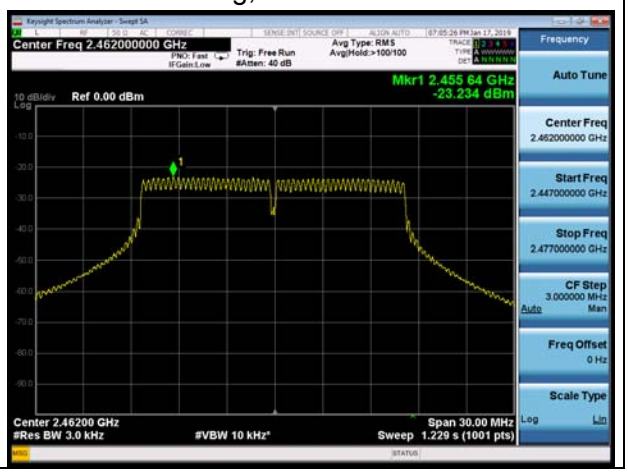
802.11g, Channel No.: 6



802.11b, Channel No.: 11

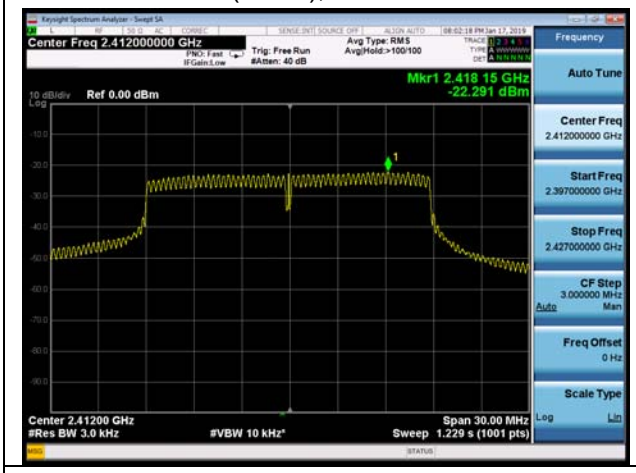


802.11g, Channel No.: 11

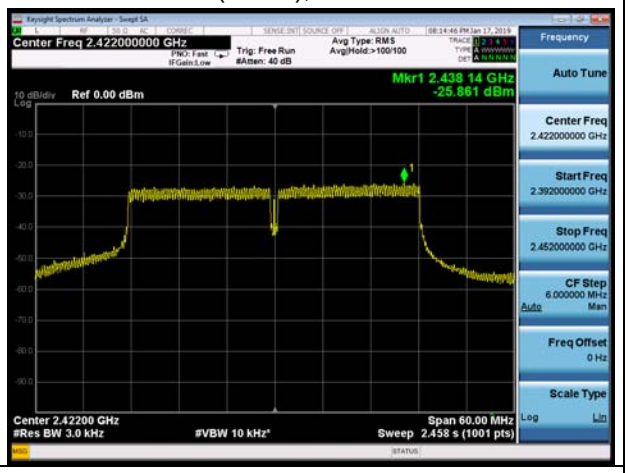


MIMO Antenna 1

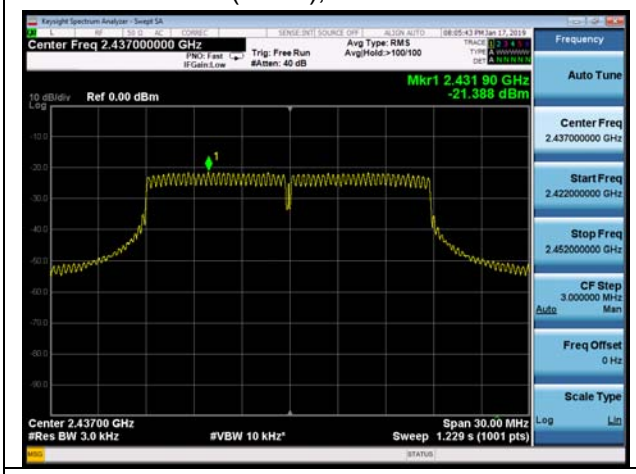
802.11n(HT20), Channel No. 1



802.11n(HT40), Channel No. 3



802.11n(HT20), Channel No. 6



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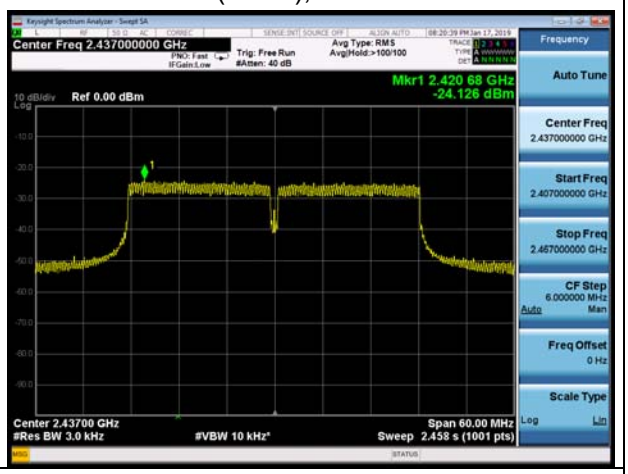
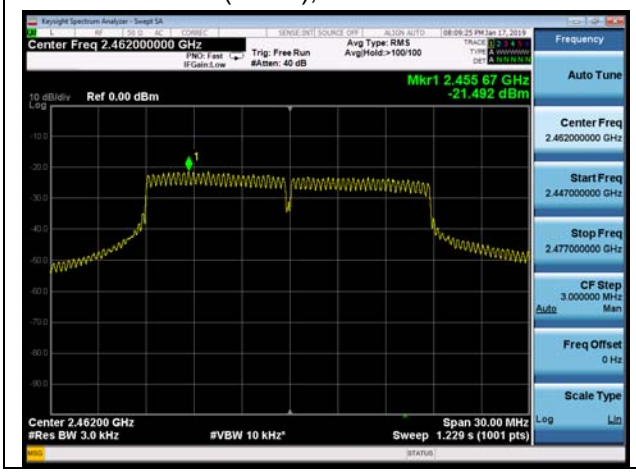
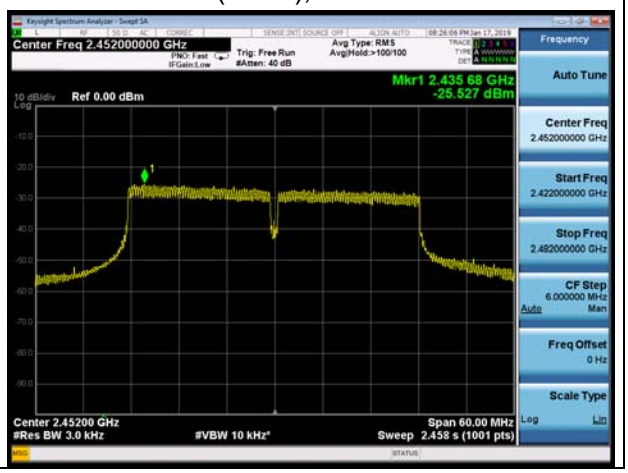


802.11n(HT20), Channel No. 11

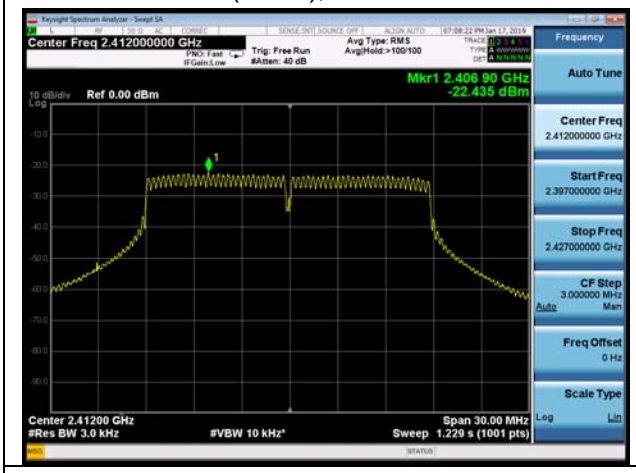


802.11n(HT40), Channel No. 9



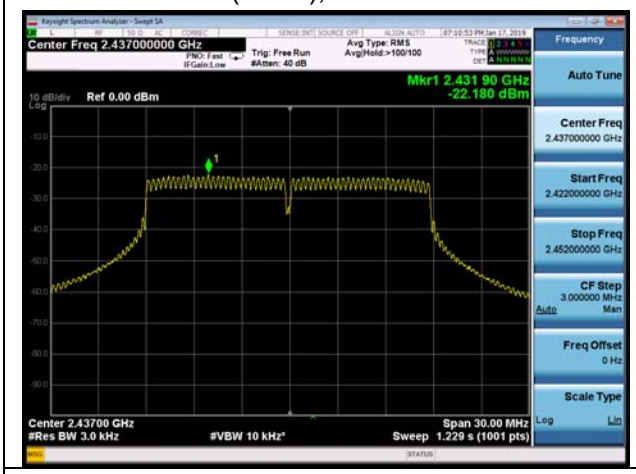
MIMO Antenna 2

802.11n(HT20), Channel No. 1

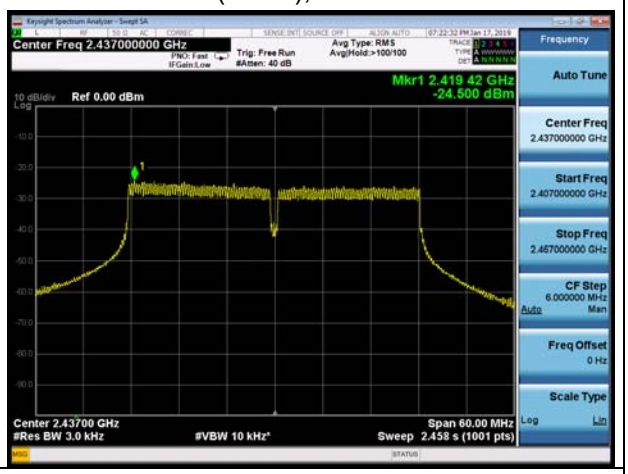


802.11n(HT40), Channel No. 3

802.11n(HT20), Channel No. 6



802.11n(HT40), Channel No. 6



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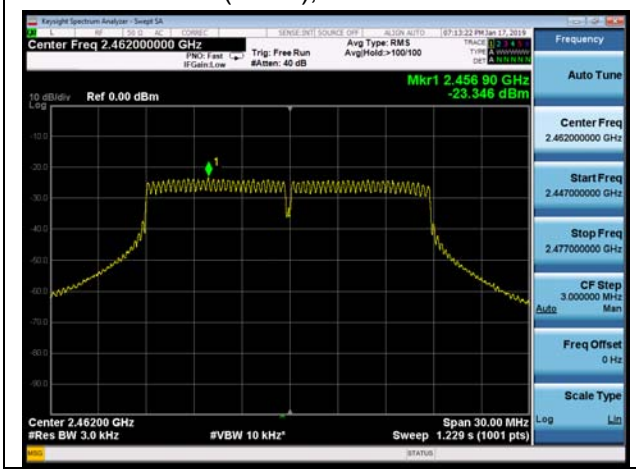
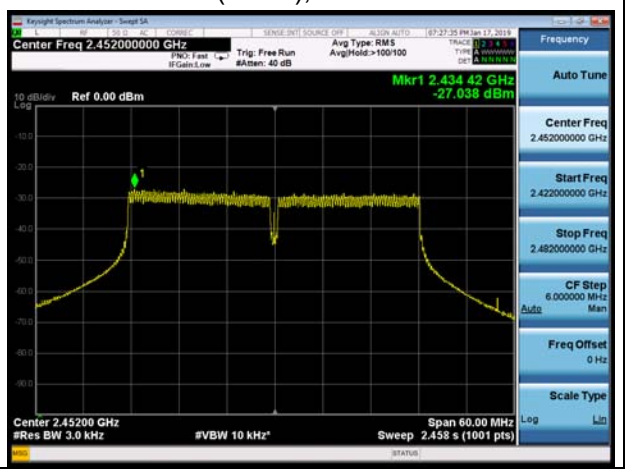


802.11n(HT40), Channel No. 9



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 to 100 kHz 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 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. ”

SISO Antenna 1

Network Standards	Carrier frequency (MHz)	Reference value (dBm)	Limit
802.11b	2412	0.95	-19.05
	2437	1.24	-18.76
	2462	0.40	-19.60
802.11g	2412	-1.22	-21.22
	2437	-2.62	-22.62
	2462	-3.71	-23.71

MIMO

Network Standards	Carrier frequency (MHz)	Reference value (dBm)	Limit
802.11n HT20	2412	-3.73	-23.73
	2437	-3.43	-23.43
	2462	-4.85	-24.85
802.11n HT40	2422	-1.14	-21.14
	2437	-0.52	-20.52
	2452	-3.24	-23.24

Measurement Uncertainty

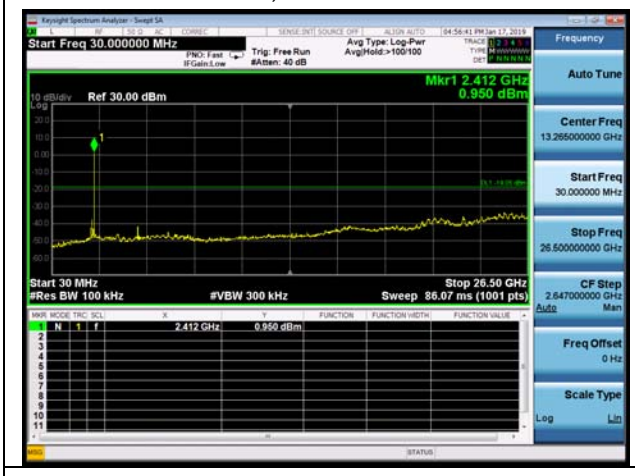
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor *k* = 1.96.

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

Test Results:

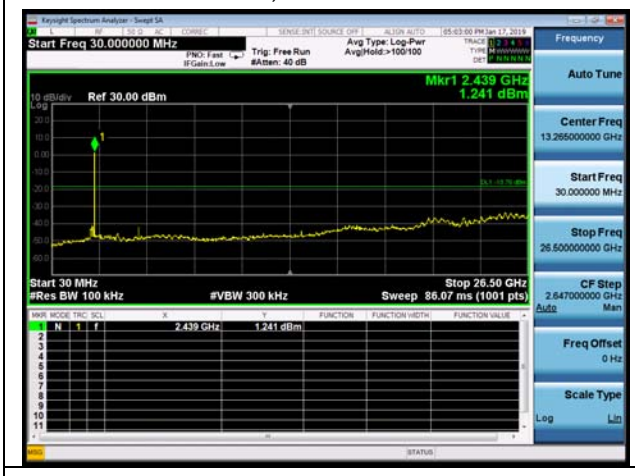
SISO Antenna 1

802.11b, Channel No.: 1



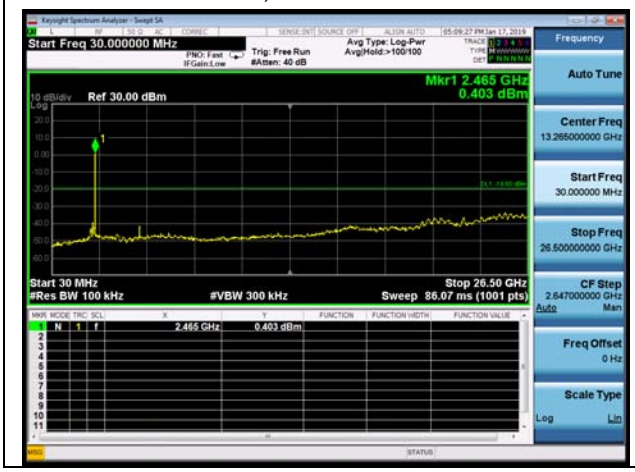
802.11g, Channel No.: 1

802.11b, Channel No.: 6



802.11g, Channel No.: 6

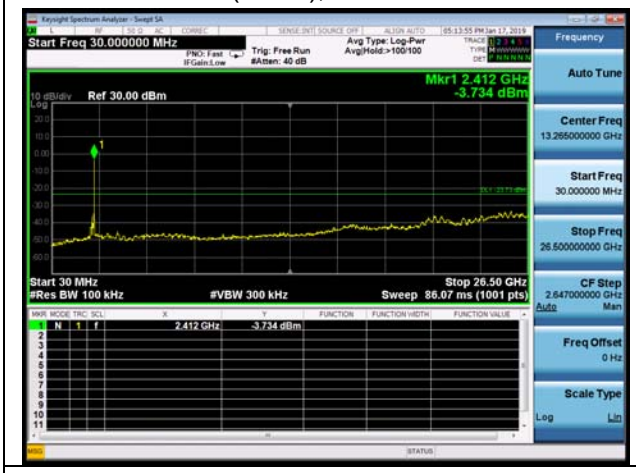
802.11b, Channel No.: 11



802.11g, Channel No.: 11

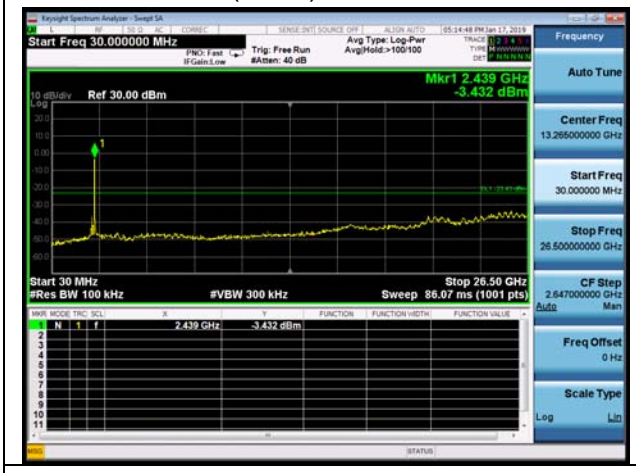
MIMO

802.11n(HT20), Channel No. 1



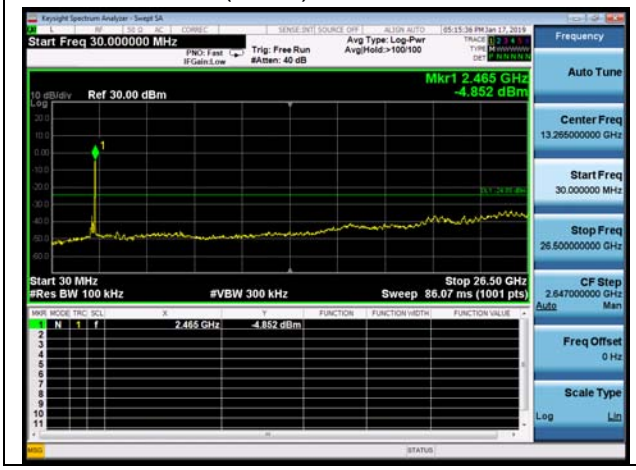
802.11n(HT40), Channel No. 3

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 ANSI C63.10-2013.
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 ≥ [3 × 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 ≥ [3 × RBW].
c) Detector = RMS (power averaging), if [span / (# of points in sweep)] ≤ 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.

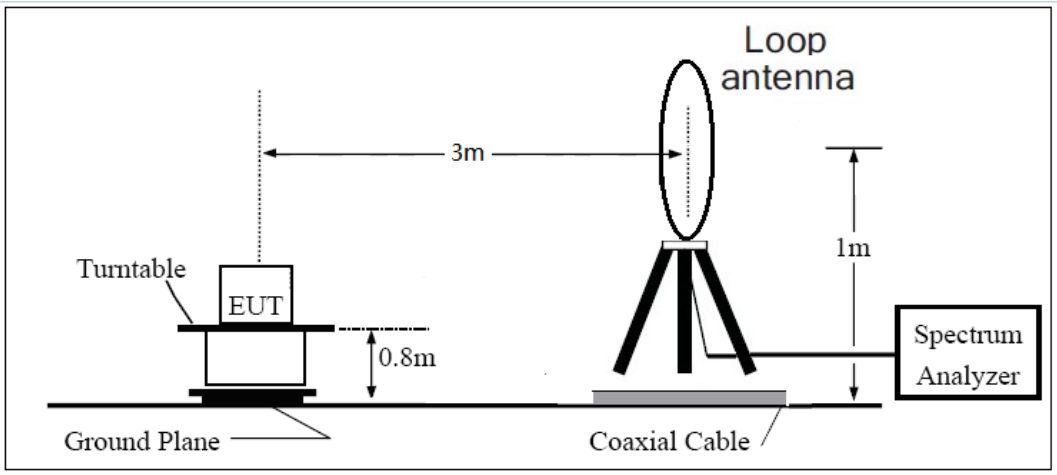
2) If linear voltage averaging mode was used in the preceding step e), then the correction factor is [20 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 6 dB shall be added to the measured emission levels.

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.

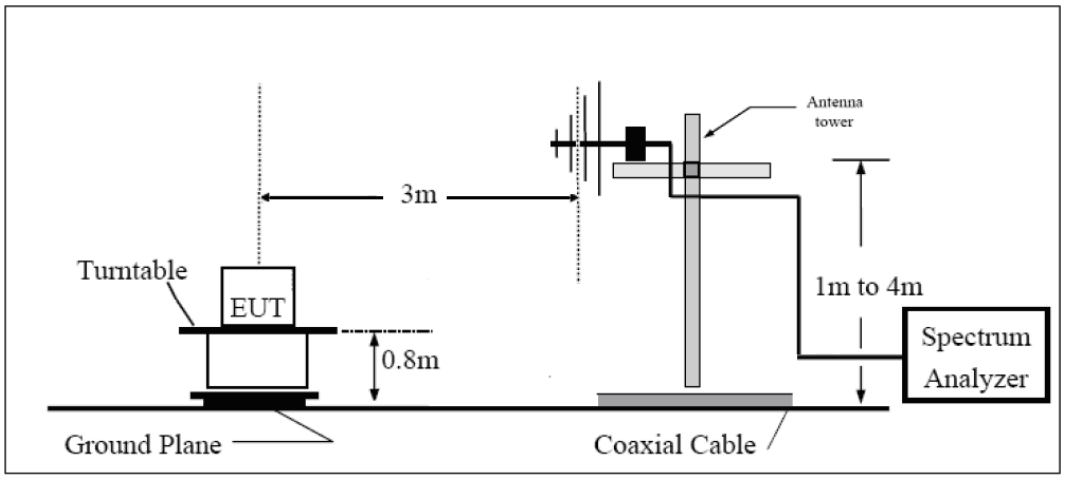
The test is in transmitting mode.

Test setup

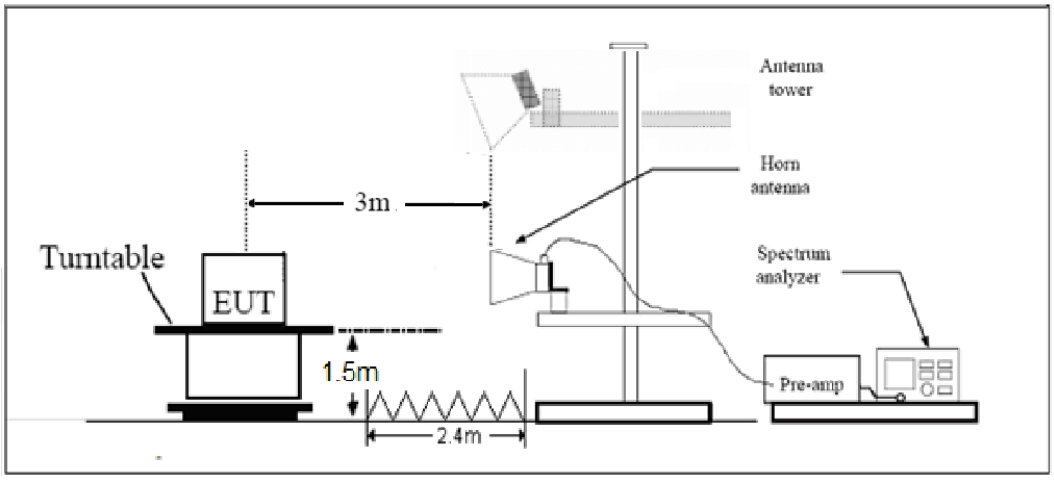
9KHz ~ 30MHz



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			

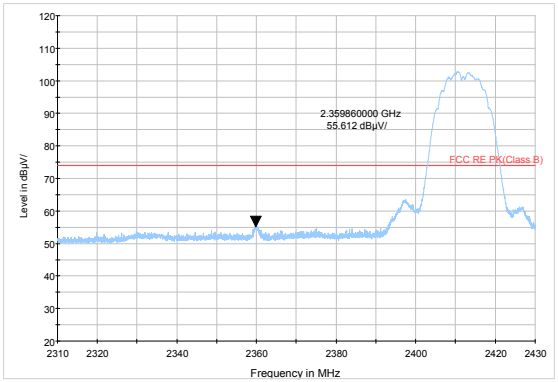
Measurement Uncertainty

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

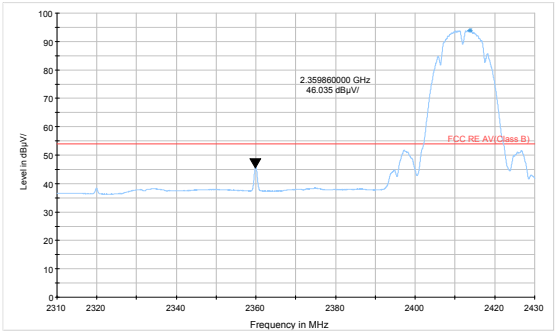
Frequency	Uncertainty
9KHz-30MHz	3.55 dB
30MHz-200MHz	4.02 dB
200MHz-1GHz	3.28 dB
1-18GHz	3.70 dB
18-26.5GHz	5.78 dB

Test Results:

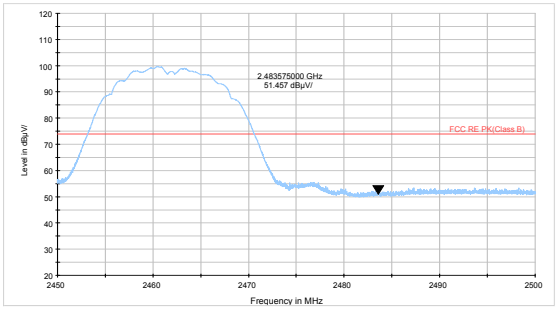
SISO Antenna 1



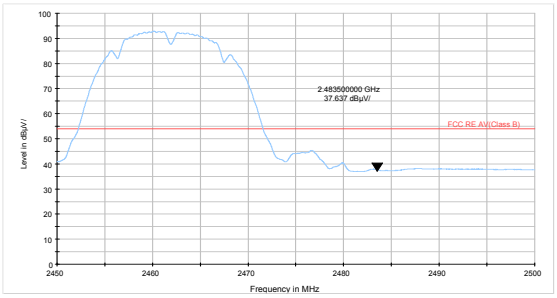
802.11b-Channel 1 Peak



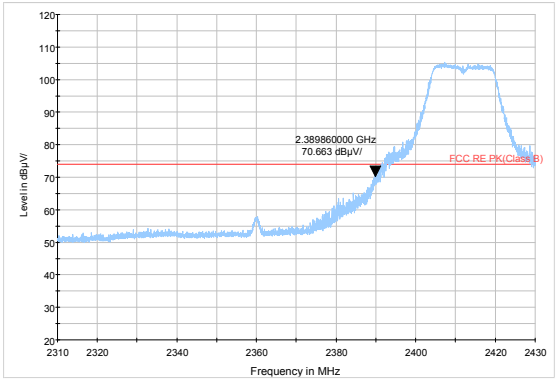
802.11b-Channel 1 Average



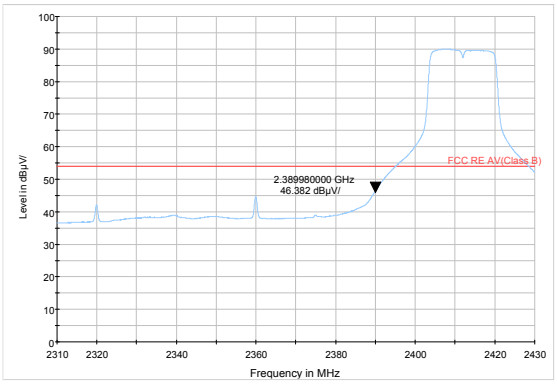
802.11b-Channel 11 Peak



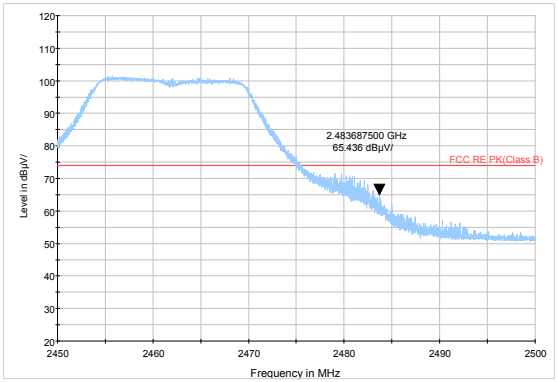
802.11b-Channel 11Average



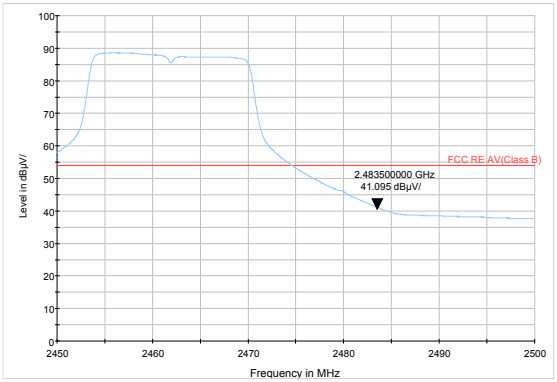
802.11g-Channel 1 Peak



802.11g-Channel 1 Average

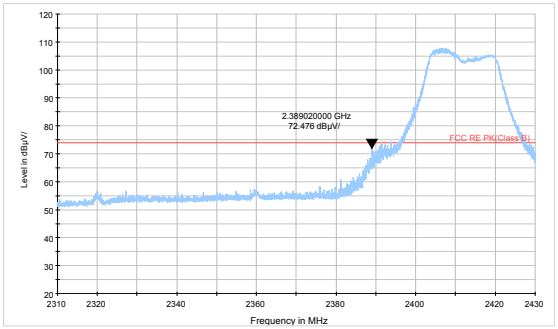


802.11g-Channel 11 Peak

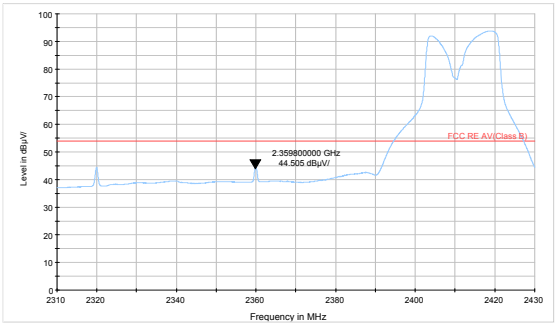


802.11g-Channel 11 Average

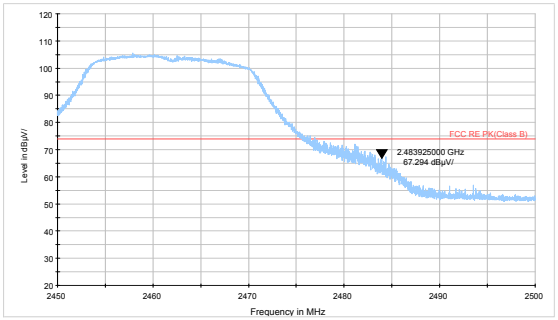
MIMO



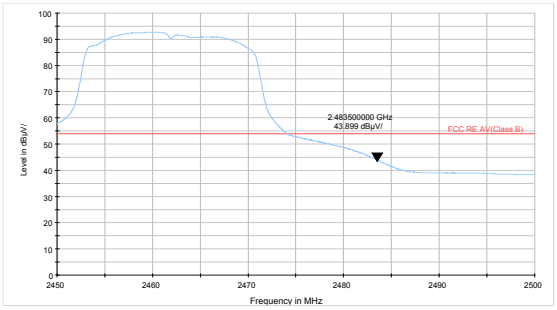
802.11n HT20 -Channel 1 Peak



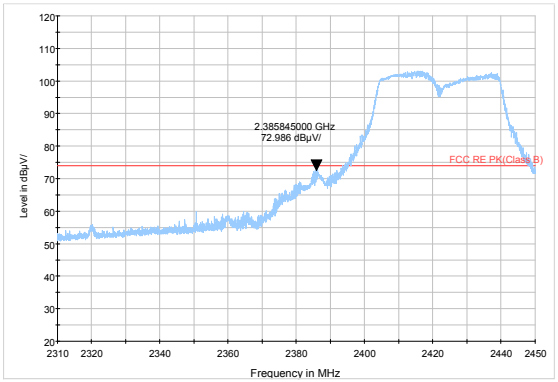
802.11n HT20 -Channel 1 Average



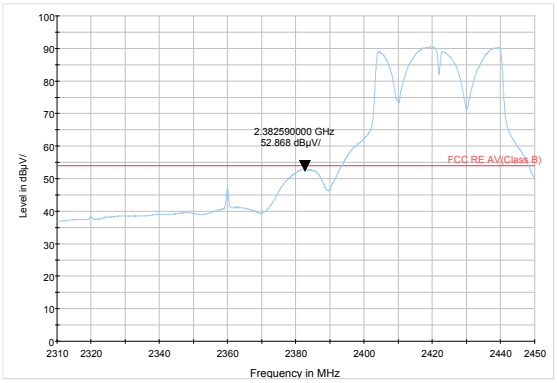
802.11n HT20 -Channel 11 Peak



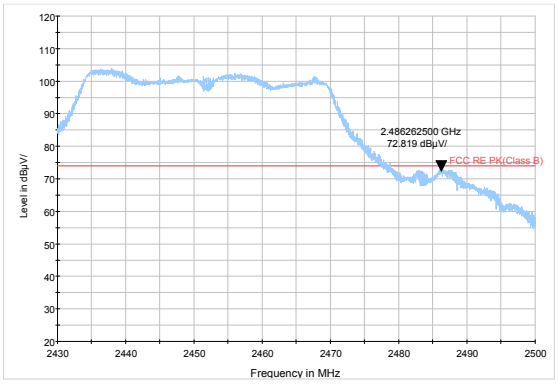
802.11n HT20 -Channel 11 Average



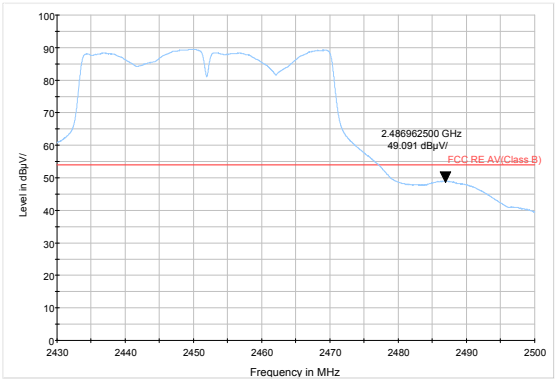
802.11n HT40 –Channel 3 Peak



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	8.18	8.22	1.00	0.02
802.11g	1.36	1.41	0.96	0.17
802.11n HT20	1.27	1.32	0.96	0.16
802.11n HT40	0.63	0.67	0.95	0.24
Note: when Duty cycle>0.98, Duty cycle correction Factor not required.				

SISO Antenna 1

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	55.612	--	200.0	V	135	0.02	55.632	18.368	74
2390	--	46.035	200.0	V	135	0.02	46.055	7.945	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	51.457	--	200.0	V	135	0.02	51.477	22.523	74
2483.5	--	37.637	200.0	V	135	0.02	37.657	16.343	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	70.663	--	150	V	65	0.17	70.833	3.167	74
2390	--	46.382	150	V	65	0.17	46.552	7.448	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	65.436	--	150	V	78	0.17	65.606	8.394	74
2483.5	--	41.095	150	V	78	0.17	41.265	12.735	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	72.476	--	200	V	90	0.16	72.636	1.364	74
2390	--	44.505	200	V	90	0.16	44.665	9.335	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	67.294	--	200	V	90	0.16	67.454	6.546	74
2483.5	--	43.899	200	V	90	0.16	44.059	9.941	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	72.986	--	150	V	46	0.24	73.226	0.774	74
2390	--	52.868	150	V	46	0.24	53.108	0.892	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	72.819	--	150	V	46	0.24	73.059	0.941	74
2483.5	--	49.091	150	V	46	0.24	49.331	4.669	54

Result of RE

Test result

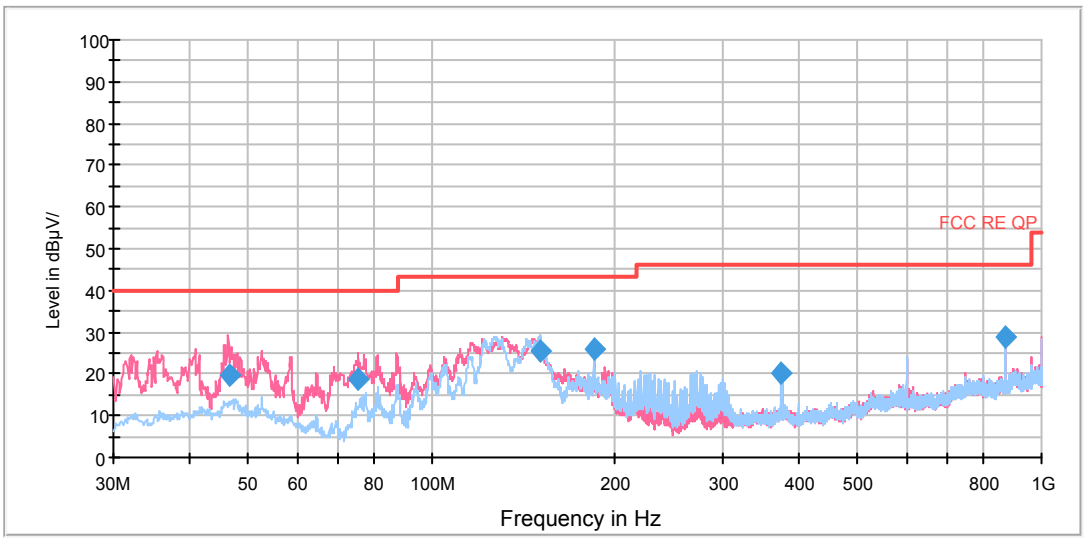
Sweep the whole frequency band through the range from 9kHz to the 10th harmonic of the carrier, the Emissions in the frequency band 9kHz-30MHz and 18GHz-26.5GHz are more than 20dB below the limit are not reported.

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 1 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, 802.11n (HT20) CH1 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.

Continuous TX mode:

RE 30M-1GHz QP



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)
46.412828	19.9	37.3	100.0	V	21.0	-17.4	20.1	40.0
75.521972	18.9	45.5	100.0	V	0.0	-26.6	21.1	40.0
150.025247	25.5	53.5	125.0	H	269.0	-28.0	18.0	43.5
184.249425	26.1	52.6	175.0	H	279.0	-26.5	17.4	43.5
374.978750	20.3	40.9	225.0	H	135.0	-20.6	25.7	46.0
874.964500	28.7	41.8	120.0	V	28.0	-13.1	17.3	46.0

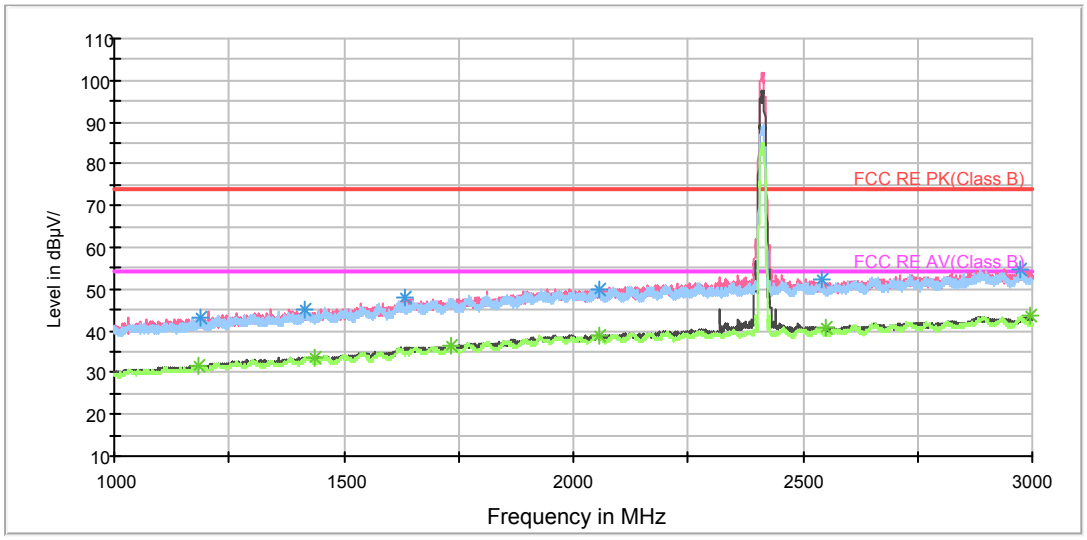
Remark: 1. Quasi-Peak = Reading value + Correction factor

2. Correction Factor = Antenna factor+ Insertion loss(cable loss+amplifier gain)

3. Margin = Limit – Quasi-Peak

802.11b CH1

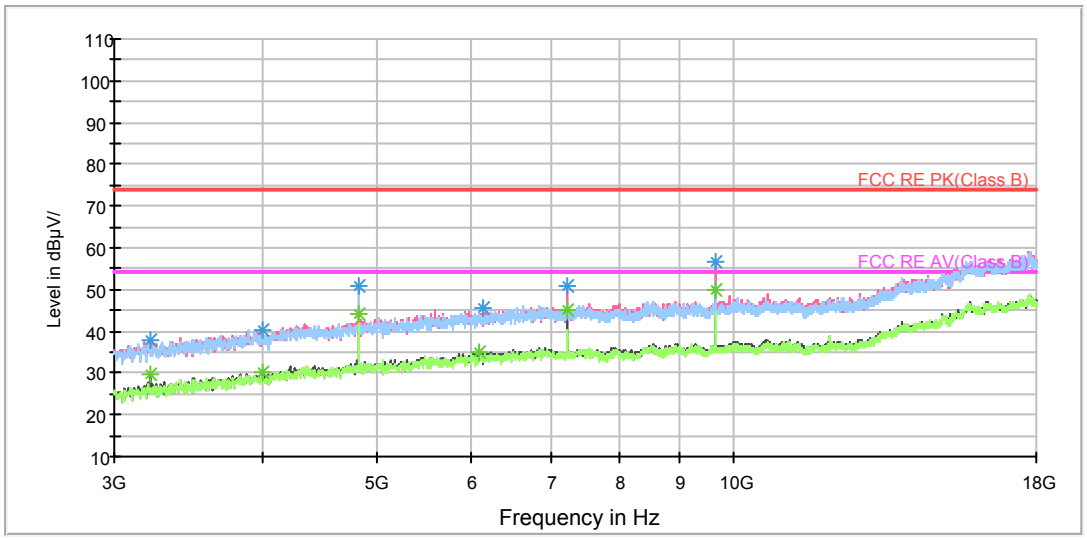
RE 1G-3GHz PK+AV



Note: The signal beyond the limit is carrier.

Radiates Emission from 1GHz to 3GHz

RE 3-18GHz PK+AV



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)
1188.000000	43.1	200.0	H	180.0	42.0	1.1	30.9	74
1413.250000	45.1	200.0	H	160.0	42.7	2.4	28.9	74
1632.000000	47.8	200.0	V	53.0	42.8	5.0	26.2	74
2058.500000	50.1	100.0	V	0.0	42.9	7.2	23.9	74
2543.500000	52.1	200.0	H	248.0	43.2	8.9	21.9	74
2973.250000	54.9	200.0	V	257.0	43.6	11.3	19.1	74

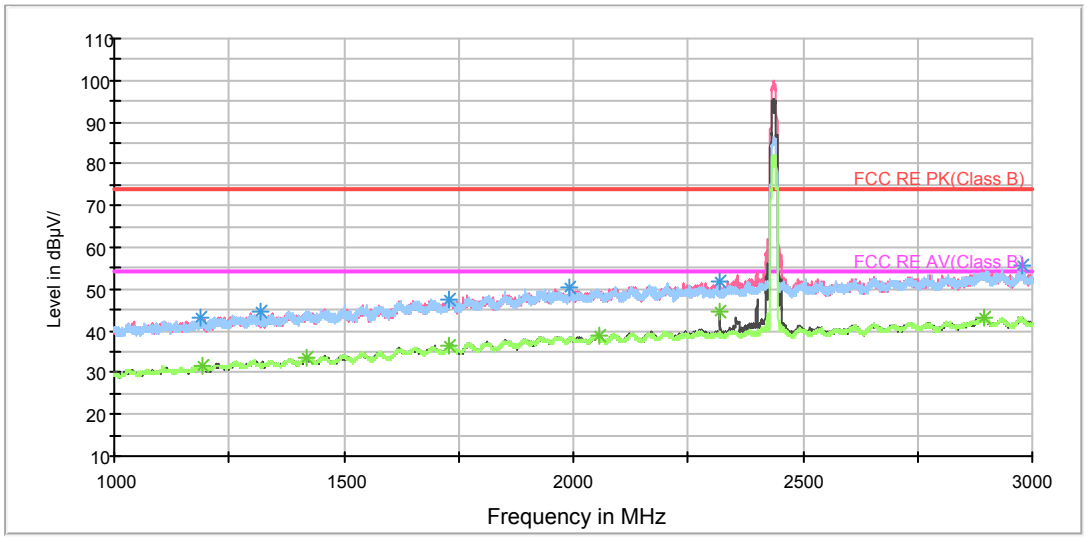
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1182.250000	31.9	200.0	V	99.0	30.7	1.2	22.1	54
1436.250000	33.7	100.0	V	224.0	31.2	2.5	20.3	54
1732.000000	36.3	200.0	H	329.0	31.2	5.1	17.7	54
2056.000000	39.0	200.0	H	72.0	31.8	7.2	15.0	54
2551.000000	40.6	200.0	V	174.0	31.7	8.9	13.4	54
2994.750000	43.5	100.0	V	324.0	32.1	11.4	10.5	54

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

802.11b CH6

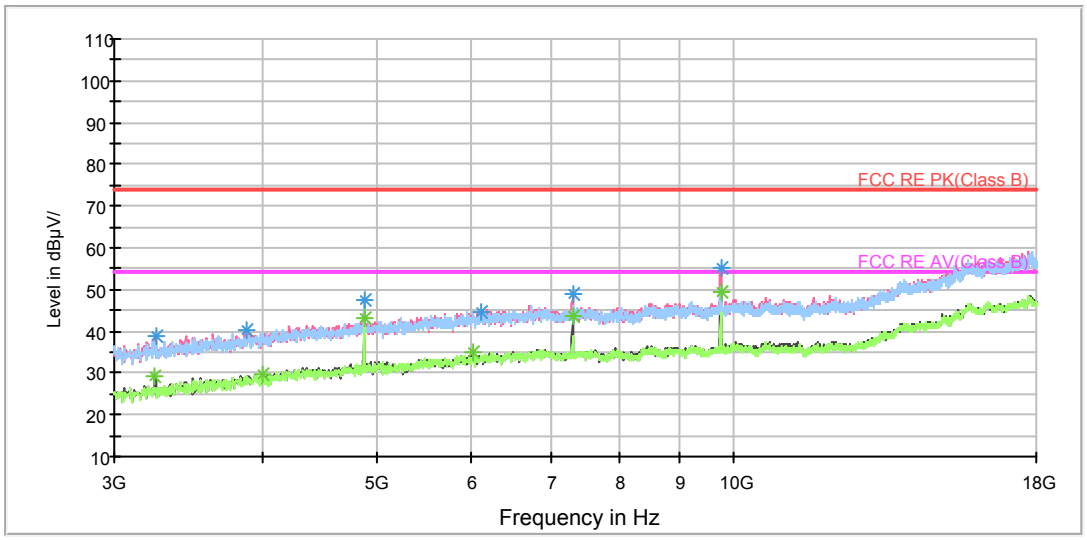
RE 1G-3GHz PK+AV



Note: The signal beyond the limit is carrier.

Radiates Emission from 1GHz to 3GHz

RE 3-18GHz PK+AV



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)
1187.750000	43.2	100.0	H	283.0	42.1	1.1	30.8	74
1318.500000	44.7	200.0	H	20.0	42.7	2.0	29.3	74
1729.250000	47.5	100.0	H	0.0	42.6	4.9	26.5	74
1990.000000	50.2	100.0	H	0.0	43.1	7.1	23.8	74
2320.000000	51.6	100.0	V	217.0	43.6	8.0	22.4	74
2977.000000	55.7	100.0	H	0.0	44.3	11.4	18.3	74

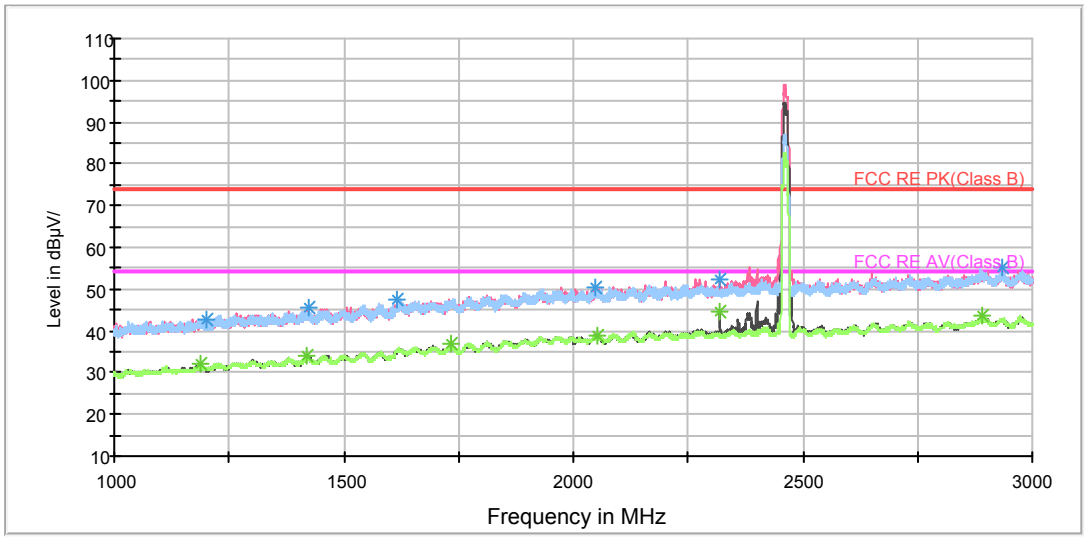
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1192.000000	31.7	200.0	H	288.0	30.7	1.0	22.3	54
1417.750000	33.7	100.0	V	338.0	31.2	2.5	20.3	54
1730.750000	36.5	200.0	H	0.0	31.5	5.0	17.5	54
2055.250000	39.0	200.0	H	161.0	31.8	7.2	15.0	54
2320.250000	44.4	200.0	V	292.0	36.4	8.0	9.6	54
2897.000000	43.3	100.0	H	2.0	32.0	11.3	10.7	54

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

802.11b CH11

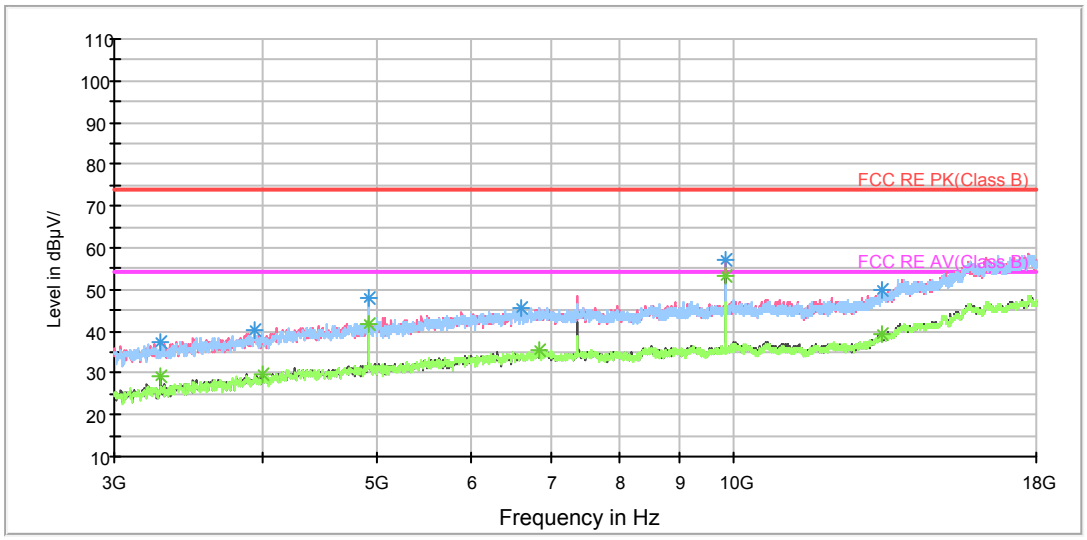
RE 1G-3GHz PK+AV



Note: The signal beyond the limit is carrier.

Radiates Emission from 1GHz to 3GHz

RE 3-18GHz PK+AV



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)
1199.000000	42.7	100.0	V	223.0	41.7	1.0	31.3	74
1423.250000	45.6	100.0	V	274.0	43.1	2.5	28.4	74
1615.250000	47.5	100.0	V	335.0	43.1	4.4	26.5	74
2049.500000	50.4	200.0	H	218.0	43.2	7.2	23.6	74
2319.750000	52.5	200.0	V	274.0	44.5	8.0	21.5	74
2934.750000	55.1	200.0	H	294.0	44.1	11.0	18.9	74

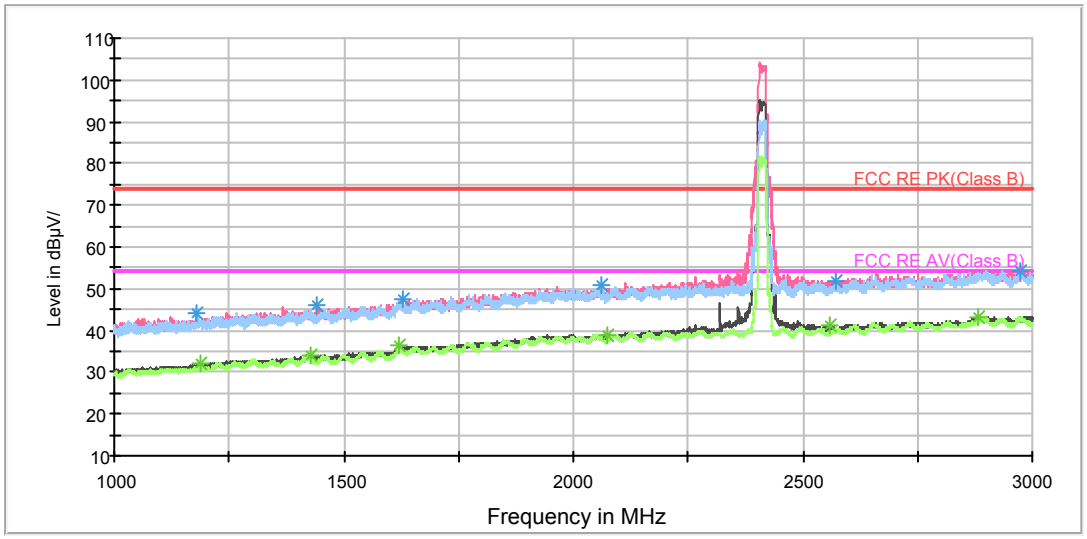
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1186.750000	32.1	200.0	V	205.0	31.0	1.1	21.9	54
1419.750000	34.0	100.0	H	0.0	31.4	2.6	20.0	54
1731.750000	36.7	100.0	H	97.0	31.6	5.1	17.3	54
2054.000000	38.8	200.0	V	160.0	31.6	7.2	15.2	54
2320.000000	44.6	200.0	V	306.0	36.6	8.0	9.4	54
2892.750000	43.4	200.0	H	218.0	32.1	11.3	10.6	54

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

802.11g CH1

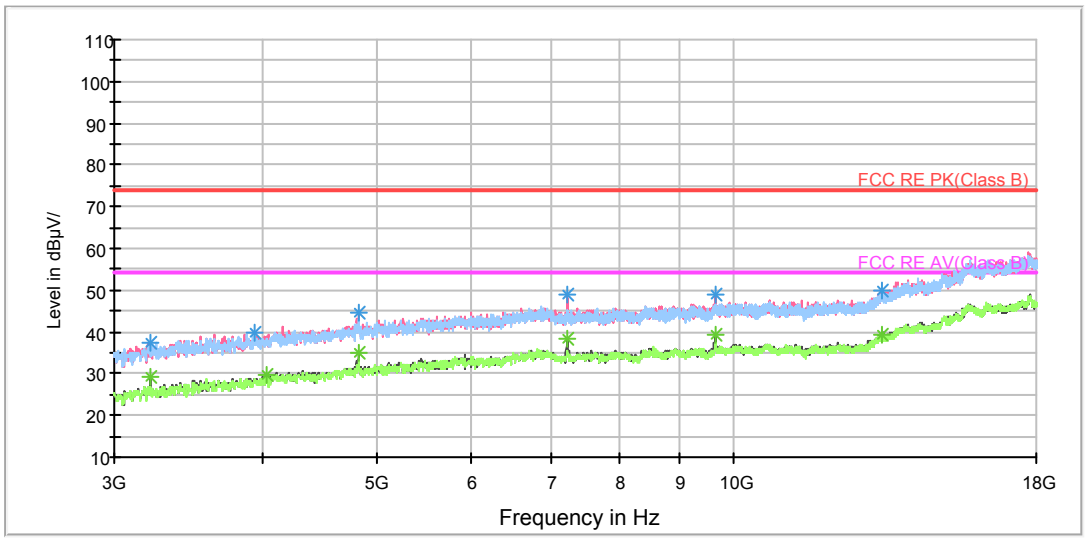
RE 1G-3GHz PK+AV



Note: The signal beyond the limit is carrier.

Radiates Emission from 1GHz to 3GHz

RE 3-18GHz PK+AV



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)
1177.500000	44.0	200.0	V	278.0	42.8	1.2	30.0	74
1440.500000	46.0	200.0	V	0.0	43.4	2.6	28.0	74
1628.250000	47.7	200.0	V	186.0	42.7	5.0	26.3	74
2060.250000	50.8	200.0	H	308.0	43.6	7.2	23.2	74
2573.000000	52.1	100.0	H	295.0	43.4	8.7	21.9	74
2975.750000	54.4	100.0	V	13.0	43.0	11.4	19.6	74

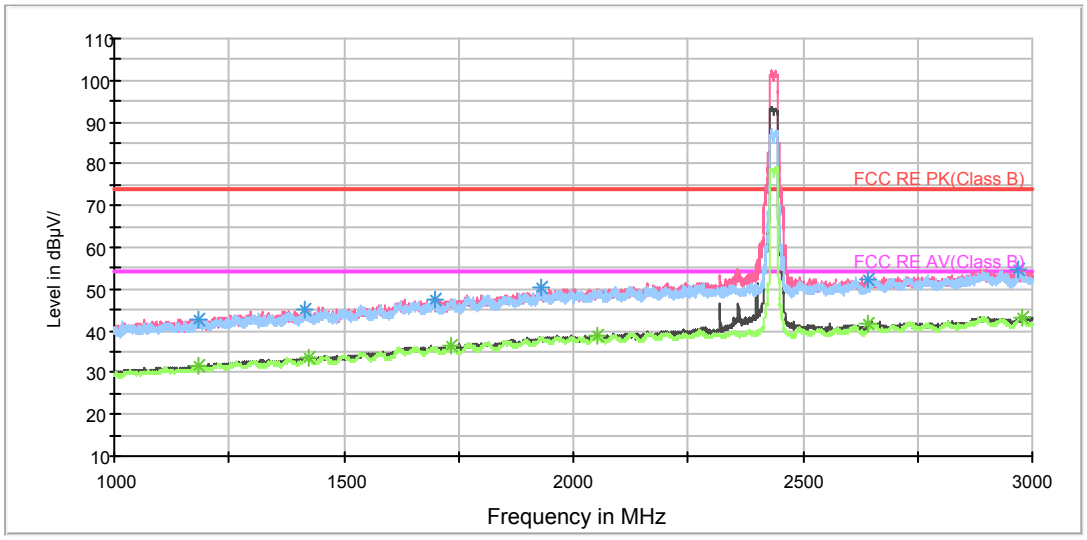
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1186.250000	31.9	200.0	V	76.0	30.8	1.1	22.1	54
1428.000000	33.9	100.0	V	348.0	31.4	2.5	20.1	54
1620.750000	36.4	200.0	V	51.0	31.5	4.9	17.6	54
2073.250000	39.0	200.0	V	0.0	31.8	7.2	15.0	54
2560.500000	41.3	200.0	V	349.0	32.5	8.8	12.7	54
2882.250000	43.4	200.0	V	242.0	32.0	11.4	10.6	54

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

802.11g CH6

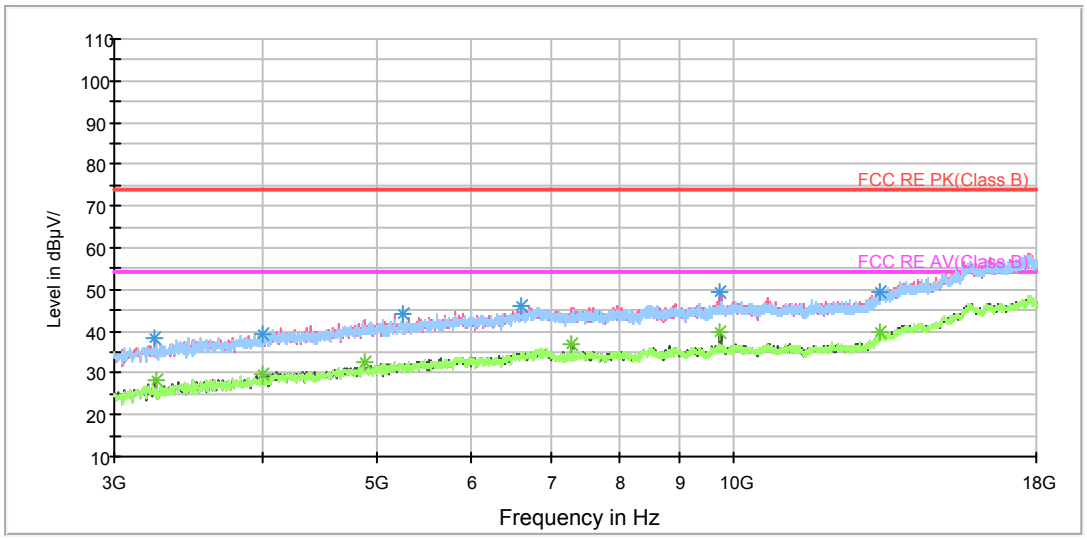
RE 1G-3GHz PK+AV



Note: The signal beyond the limit is carrier.

Radiates Emission from 1GHz to 3GHz

RE 3-18GHz PK+AV



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	42.9	100.0	H	35.0	41.7	1.2	31.1	74
1415.750000	44.9	100.0	V	356.0	42.5	2.4	29.1	74
1696.750000	47.5	200.0	H	265.0	42.6	4.9	26.5	74
1928.750000	50.4	100.0	V	0.0	43.7	6.7	23.6	74
2639.750000	52.2	200.0	V	260.0	42.7	9.5	21.8	74
2970.500000	54.7	200.0	H	265.0	43.4	11.3	19.3	74

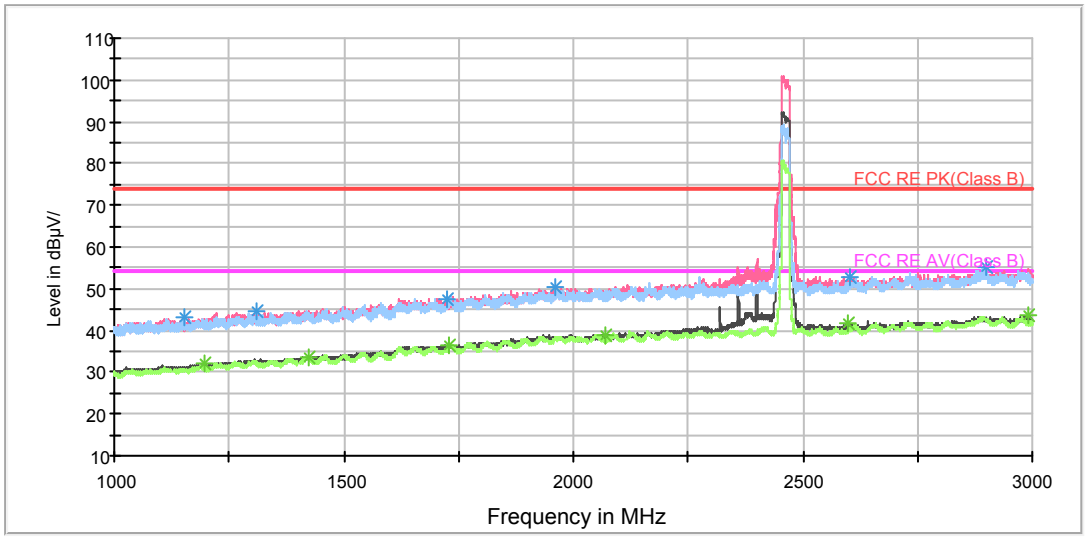
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1184.000000	31.7	200.0	V	192.0	30.6	1.1	22.3	54
1421.500000	33.6	100.0	H	207.0	31.0	2.6	20.4	54
1732.000000	36.5	200.0	H	355.0	31.4	5.1	17.5	54
2052.000000	39.0	200.0	H	240.0	31.8	7.2	15.0	54
2640.000000	41.5	200.0	V	0.0	32.0	9.5	12.5	54
2978.250000	43.3	200.0	H	355.0	31.9	11.4	10.7	54

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

802.11g CH11

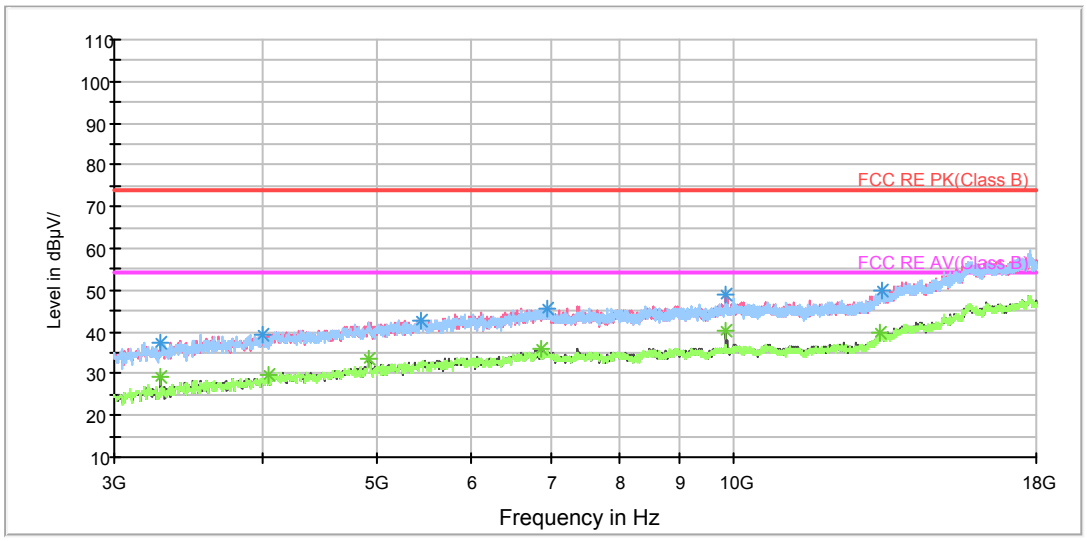
RE 1G-3GHz PK+AV



Note: The signal beyond the limit is carrier.

Radiates Emission from 1GHz to 3GHz

RE 3-18GHz PK+AV



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)
1151.250000	43.4	200.0	H	67.0	42.7	0.7	30.6	74
1309.250000	44.7	200.0	H	167.0	43.1	1.6	29.3	74
1723.000000	47.6	100.0	V	0.0	42.6	5.0	26.4	74
1959.000000	50.4	200.0	V	81.0	43.3	7.1	23.6	74
2602.000000	52.6	200.0	V	20.0	42.9	9.7	21.4	74
2901.250000	55.0	200.0	V	127.0	43.8	11.2	19.0	74

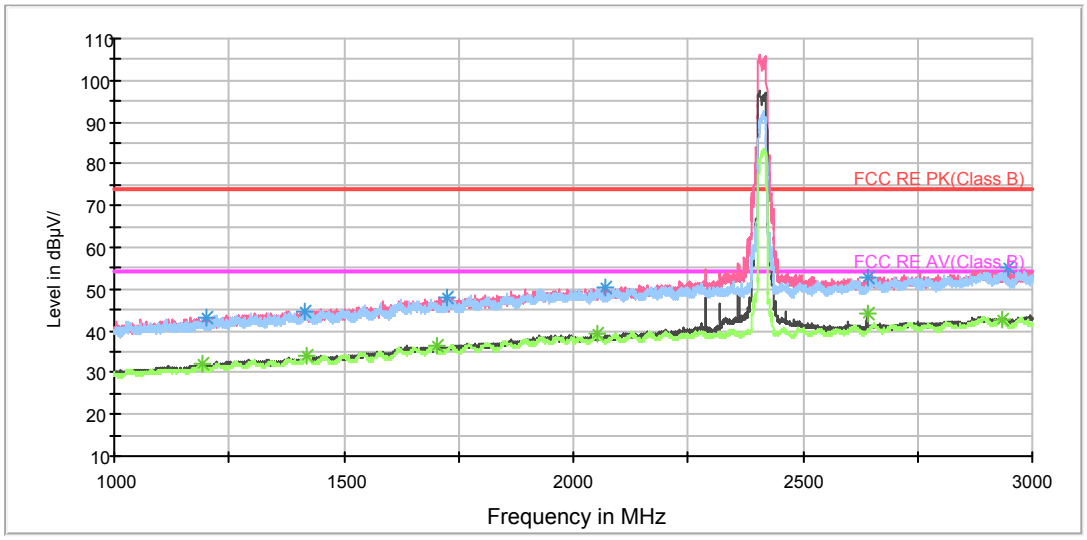
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1198.000000	32.1	200.0	V	56.0	31.1	1.0	21.9	54
1423.250000	33.7	200.0	H	0.0	31.2	2.5	20.3	54
1731.250000	36.3	100.0	H	297.0	31.2	5.1	17.7	54
2069.000000	39.0	200.0	V	81.0	31.8	7.2	15.0	54
2600.250000	41.7	200.0	V	312.0	32.0	9.7	12.3	54
2989.500000	43.5	100.0	V	0.0	32.1	11.4	10.5	54

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

802.11n (HT20) CH1

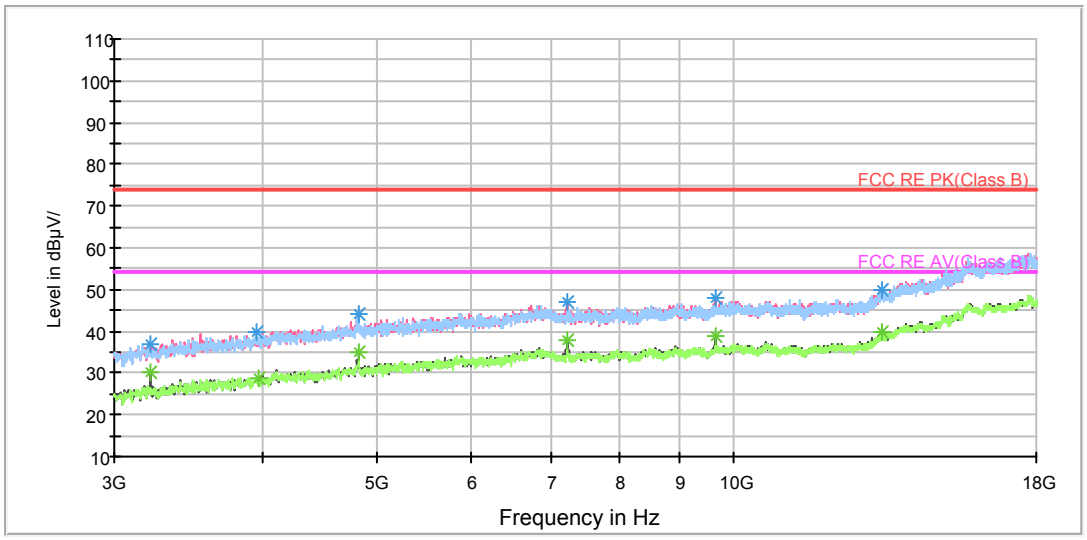
RE 1G-3GHz PK+AV



Note: The signal beyond the limit is carrier.

Radiates Emission from 1GHz to 3GHz

RE 3-18GHz PK+AV



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)
1199.500000	43.3	100.0	V	265.0	42.3	1.0	30.7	74
1414.500000	44.8	100.0	H	40.0	42.4	2.4	29.2	74
1726.250000	47.9	200.0	V	0.0	43.0	4.9	26.1	74
2071.500000	50.6	200.0	V	123.0	43.4	7.2	23.4	74
2640.000000	53.0	100.0	V	0.0	43.5	9.5	21.0	74
2949.000000	55.0	200.0	V	29.0	43.8	11.2	19.0	74

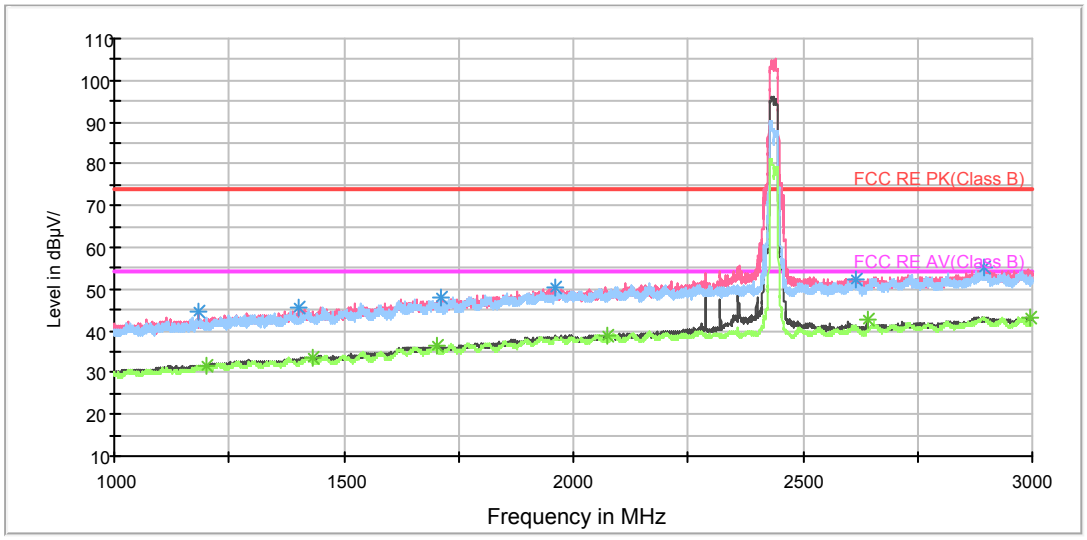
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1190.000000	32.1	200.0	V	0.0	31.1	1.0	21.9	54
1419.750000	33.8	200.0	H	173.0	31.2	2.6	20.2	54
1703.250000	36.4	200.0	V	159.0	31.4	5.0	17.6	54
2053.750000	39.1	200.0	H	43.0	31.9	7.2	14.9	54
2640.000000	44.2	200.0	V	4.0	34.7	9.5	9.8	54
2934.250000	42.9	200.0	H	342.0	31.9	11.0	11.1	54

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

802.11n (HT20) CH6

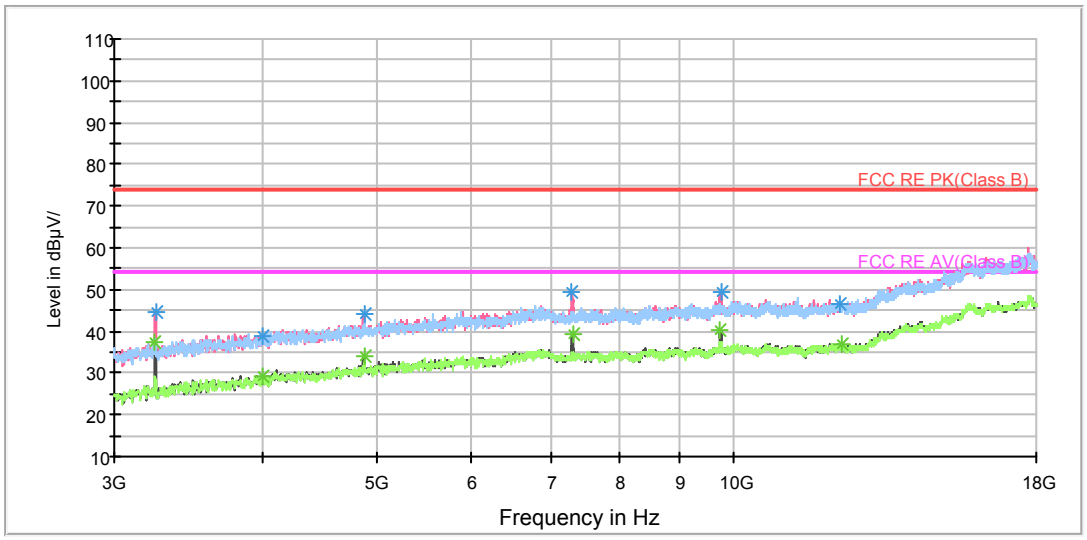
RE 1G-3GHz PK+AV



Note: The signal beyond the limit is carrier.

Radiates Emission from 1GHz to 3GHz

RE 3-18GHz PK+AV



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)
1183.000000	44.5	100.0	V	300.0	43.3	1.2	29.5	74
1402.000000	45.5	100.0	V	265.0	43.2	2.3	28.5	74
1713.750000	48.1	100.0	V	341.0	43.0	5.1	25.9	74
1961.250000	50.5	100.0	V	310.0	43.3	7.2	23.5	74
2617.000000	52.1	100.0	V	100.0	42.8	9.3	21.9	74
2896.750000	55.0	200.0	V	299.0	43.7	11.3	19.0	74

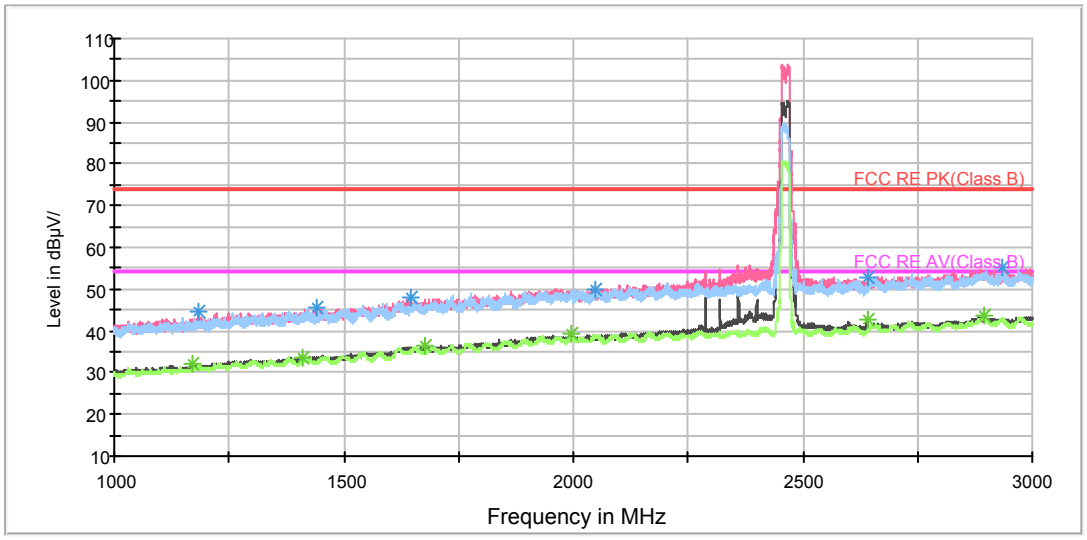
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1199.250000	31.8	200.0	V	77.0	30.8	1.0	22.2	54
1432.750000	33.6	100.0	V	125.0	31.1	2.5	20.4	54
1704.500000	36.5	100.0	V	316.0	31.5	5.0	17.5	54
2074.500000	39.0	200.0	V	0.0	31.8	7.2	15.0	54
2640.250000	42.8	200.0	V	0.0	33.3	9.5	11.2	54
2996.500000	43.4	100.0	V	188.0	32.0	11.4	10.6	54

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

802.11n (HT20) CH11

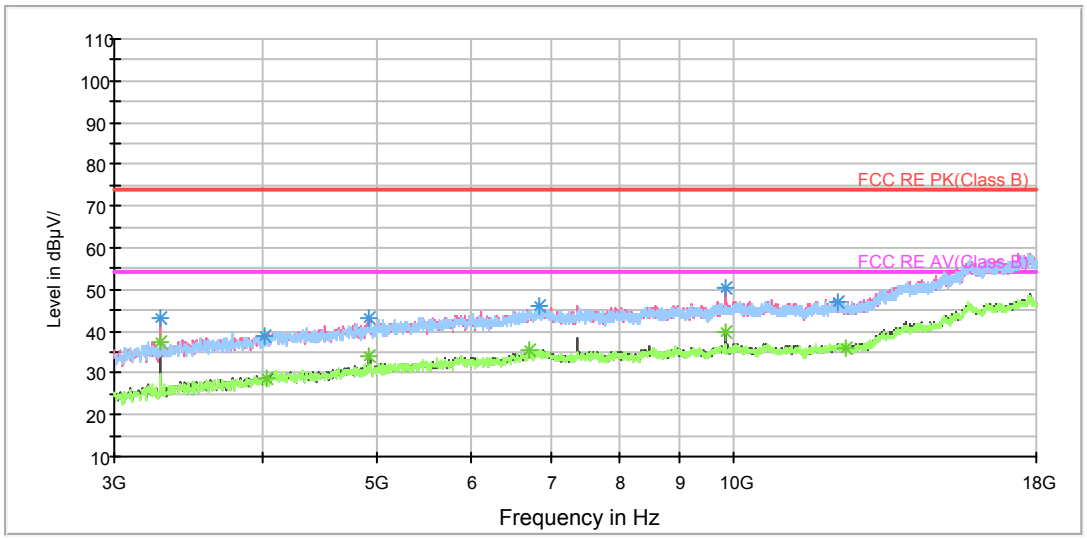
RE 1G-3GHz PK+AV



Note: The signal beyond the limit is carrier.

Radiates Emission from 1GHz to 3GHz

RE 3-18GHz PK+AV



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)
1182.250000	44.7	200.0	V	325.0	43.5	1.2	29.3	74
1440.500000	45.6	200.0	V	168.0	43.0	2.6	28.4	74
1644.500000	47.9	200.0	V	29.0	43.0	4.9	26.1	74
2047.250000	50.1	100.0	H	281.0	42.9	7.2	23.9	74
2640.000000	52.6	200.0	V	0.0	43.1	9.5	21.4	74
2935.000000	55.0	100.0	H	69.0	44.0	11.0	19.0	74

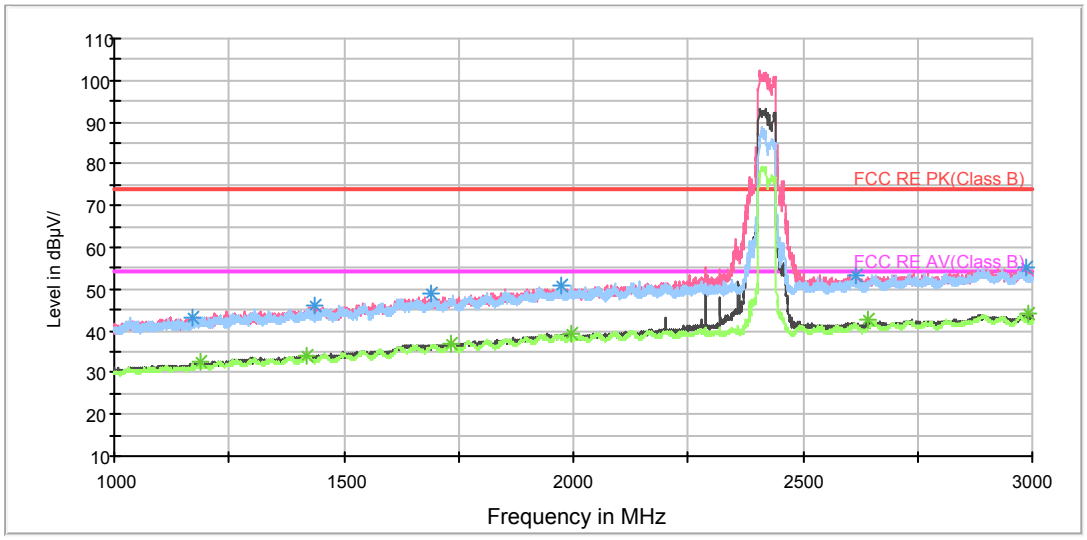
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1169.000000	31.9	200.0	V	204.0	30.8	1.1	22.1	54
1412.000000	33.7	100.0	V	237.0	31.4	2.3	20.3	54
1677.750000	36.6	200.0	V	204.0	31.8	4.8	17.4	54
1995.000000	39.1	200.0	V	0.0	31.9	7.2	14.9	54
2640.000000	42.8	200.0	V	0.0	33.3	9.5	11.2	54
2895.250000	43.5	200.0	H	346.0	32.2	11.3	10.5	54

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

802.11n (HT40) CH3

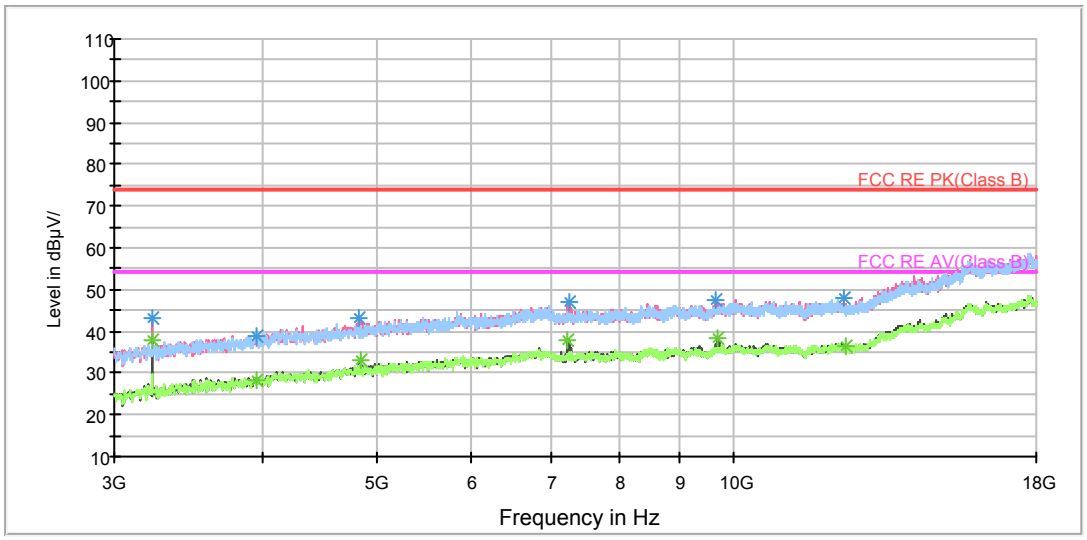
RE 1G-3GHz PK+AV



Note: The signal beyond the limit is carrier.

Radiates Emission from 1GHz to 3GHz

RE 3-18GHz PK+AV



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)
1171.000000	43.4	200.0	V	64.0	42.3	1.1	30.6	74
1434.750000	46.0	200.0	V	126.0	43.5	2.5	28.0	74
1691.500000	48.8	100.0	V	83.0	43.9	4.9	25.2	74
1972.250000	50.9	100.0	H	127.0	44.1	6.8	23.1	74
2615.750000	53.5	100.0	H	199.0	44.2	9.3	20.5	74
2986.750000	55.1	200.0	V	85.0	43.7	11.4	18.9	74

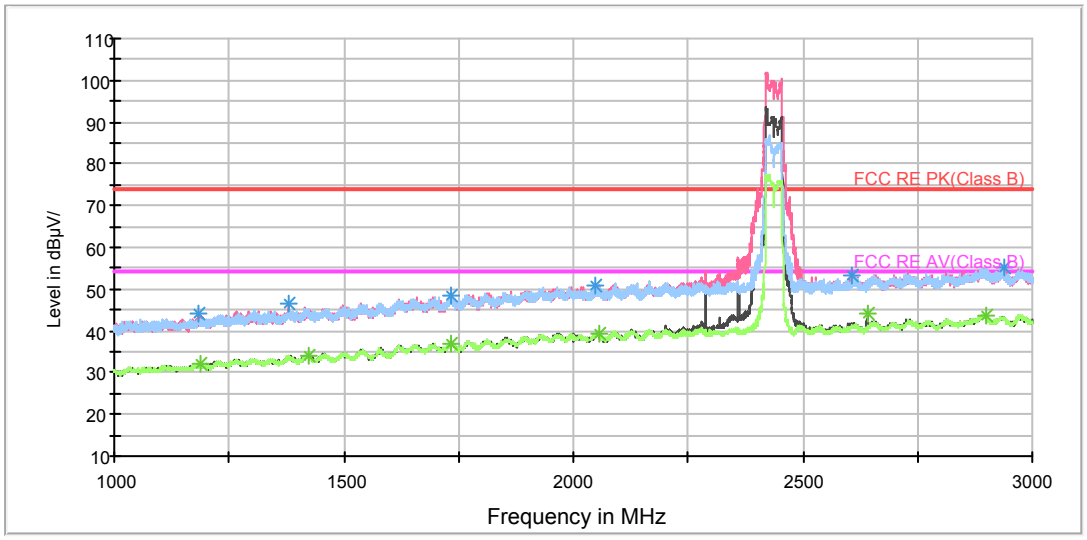
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1187.250000	32.4	200.0	H	275.0	31.3	1.1	21.6	54
1420.250000	34.2	200.0	H	131.0	31.6	2.6	19.8	54
1732.000000	36.8	100.0	H	132.0	31.7	5.1	17.2	54
1994.250000	39.4	200.0	V	0.0	32.2	7.2	14.6	54
2640.000000	42.9	100.0	V	203.0	33.4	9.5	11.1	54
2991.500000	43.9	200.0	V	240.0	32.5	11.4	10.1	54

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

802.11n (HT40) CH6

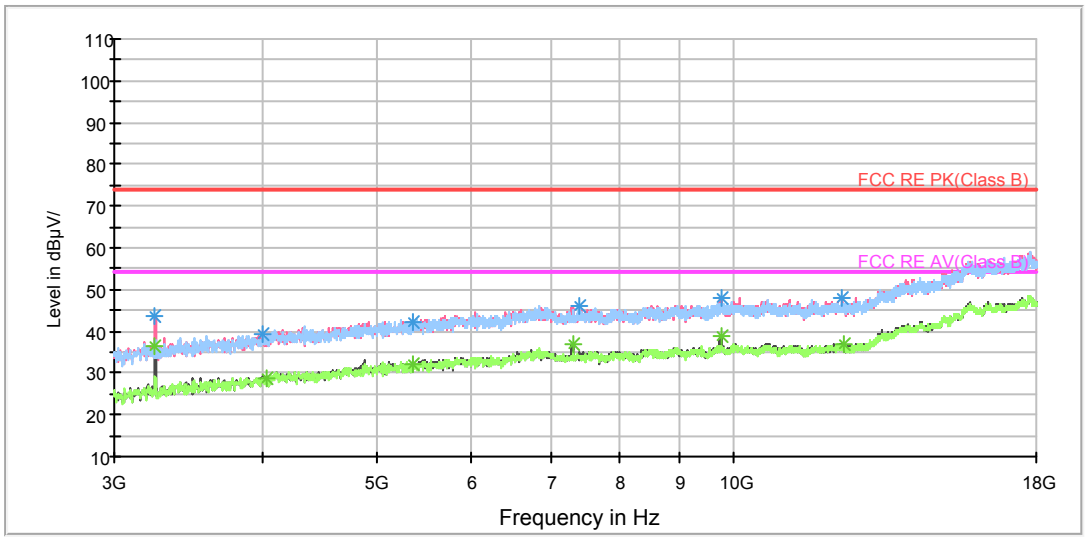
RE 1G-3GHz PK+AV



Note: The signal beyond the limit is carrier.

Radiates Emission from 1GHz to 3GHz

RE 3-18GHz PK+AV



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)
1183.000000	44.1	200.0	V	180.0	42.9	1.2	29.9	74
1381.000000	46.3	100.0	V	296.0	43.9	2.4	27.7	74
1731.750000	48.5	200.0	H	265.0	43.4	5.1	25.5	74
2048.000000	50.7	200.0	H	336.0	43.5	7.2	23.3	74
2607.000000	53.2	200.0	H	235.0	43.6	9.6	20.8	74
2939.250000	55.1	200.0	V	16.0	44.1	11.0	18.9	74

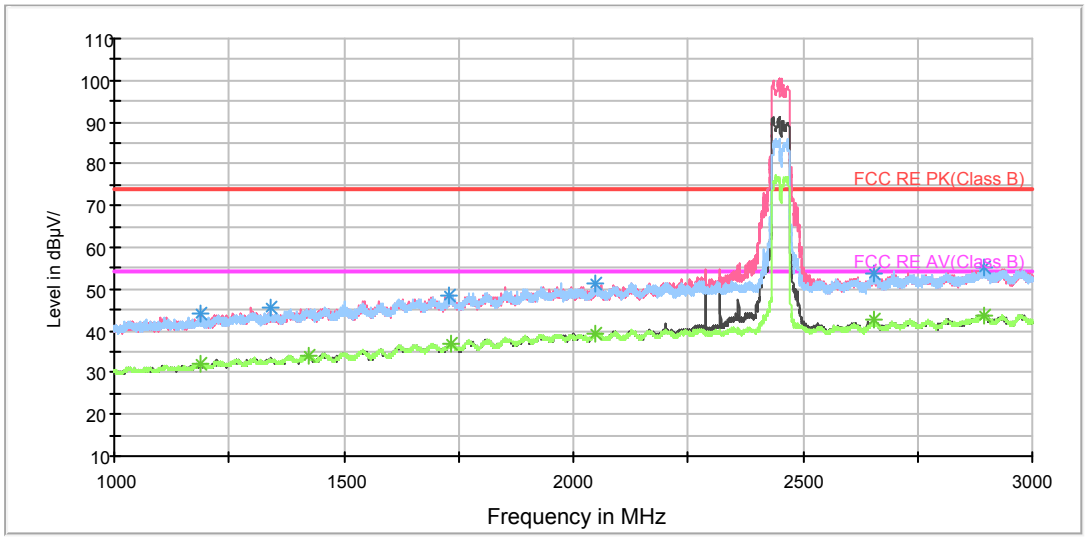
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1186.000000	32.1	200.0	V	159.0	31.0	1.1	21.9	54
1421.500000	34.2	100.0	H	60.0	31.6	2.6	19.8	54
1731.750000	37.0	200.0	V	57.0	31.9	5.1	17.0	54
2055.250000	39.4	100.0	H	313.0	32.2	7.2	14.6	54
2640.000000	44.0	200.0	V	344.0	34.5	9.5	10.0	54
2899.000000	43.8	200.0	V	78.0	32.6	11.2	10.2	54

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

802.11n (HT40) CH9

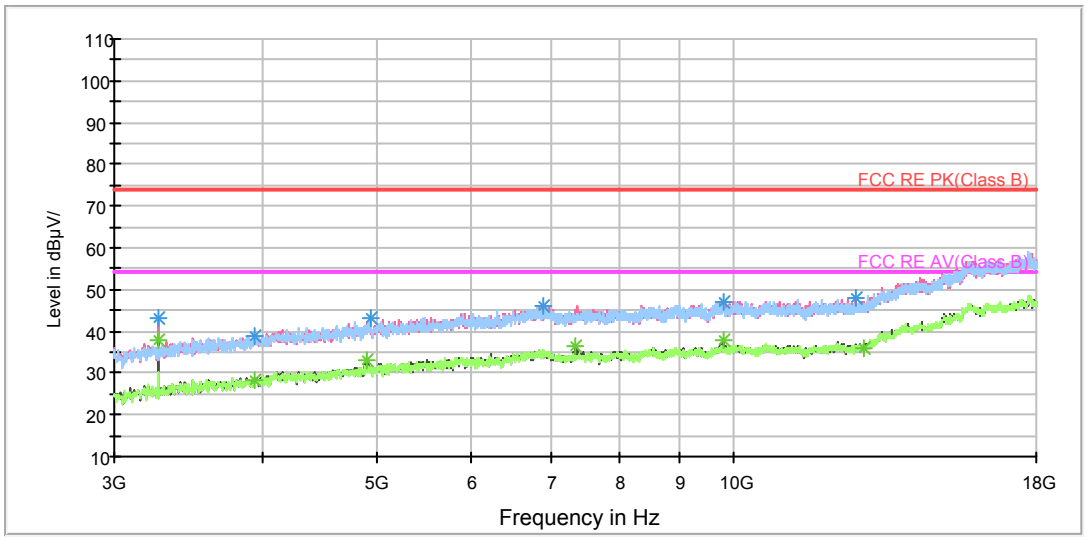
RE 1G-3GHz PK+AV



Note: The signal beyond the limit is carrier.

Radiates Emission from 1GHz to 3GHz

RE 3-18GHz PK+AV



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	200.0	V	3.0	43.1	1.1	29.8	74
1340.500000	45.6	100.0	H	0.0	43.7	1.9	28.4	74
1731.000000	48.5	100.0	H	239.0	43.4	5.1	25.5	74
2048.250000	51.6	100.0	V	339.0	44.4	7.2	22.4	74
2653.750000	53.8	100.0	H	101.0	44.1	9.7	20.2	74
2893.500000	55.0	100.0	H	101.0	43.7	11.3	19.0	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)
1187.500000	32.3	100.0	H	239.0	31.2	1.1	21.7	54
1425.250000	34.2	200.0	H	124.0	31.7	2.5	19.8	54
1731.750000	37.1	100.0	H	61.0	32.0	5.1	16.9	54
2047.000000	39.5	100.0	V	185.0	32.3	7.2	14.5	54
2655.250000	42.7	200.0	V	217.0	33.0	9.7	11.3	54
2896.250000	43.8	200.0	H	258.0	32.5	11.3	10.2	54

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

5.7. Conducted Emission

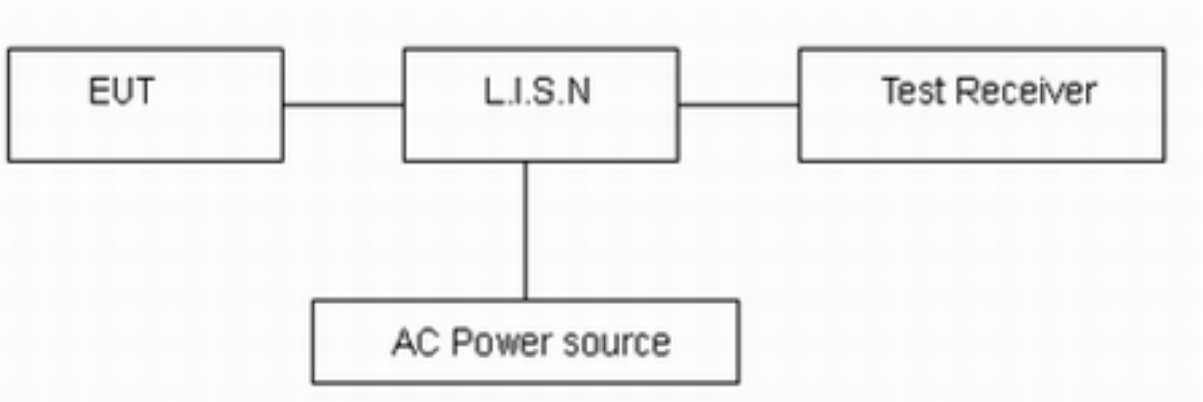
Ambient condition

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

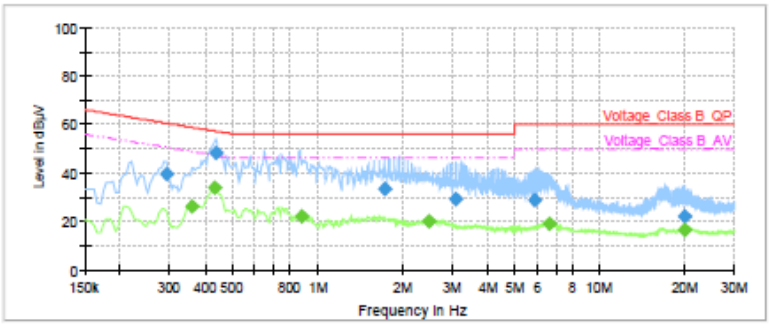
Frequency (MHz)	Conducted Limits(dBμV)	
	Quasi-peak	Average
0.15 - 0.5	66 to 56 *	56 to 46*
0.5 - 5	56	46
5 - 30	60	50
*: Decreases with the logarithm of the frequency.		

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:

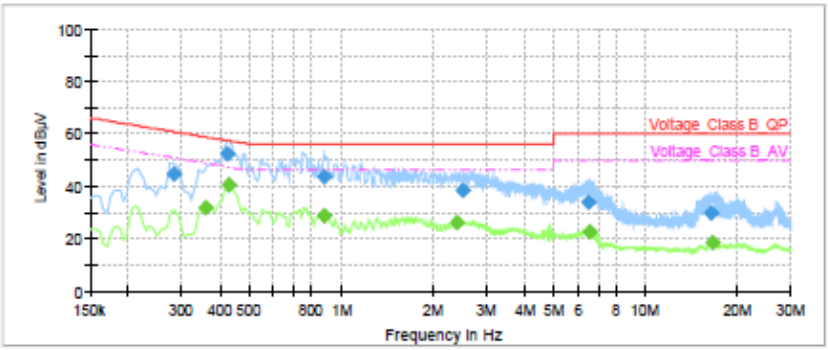
Following plots, Blue trace uses the peak detection and Green trace uses the average detection. During the test, the Conducted Emission was performed in all modes (WIFI 2.4G /BLE) with all channels, 802.11n HT20, Channel 1 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.



Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.29	39.51	---	60.47	20.97	1000.0	9.000	L1	ON	19.20
0.36	---	26.07	48.75	22.67	1000.0	9.000	L1	ON	19.18
0.43	---	33.86	47.23	13.36	1000.0	9.000	L1	ON	19.23
0.44	48.46	---	57.14	8.68	1000.0	9.000	L1	ON	19.23
0.88	---	21.91	46.00	24.09	1000.0	9.000	L1	ON	19.24
1.73	33.32	---	56.00	22.68	1000.0	9.000	L1	ON	19.17
2.48	---	20.09	46.00	25.91	1000.0	9.000	L1	ON	19.03
3.10	29.45	---	56.00	26.55	1000.0	9.000	L1	ON	19.09
5.91	28.51	---	60.00	31.49	1000.0	9.000	L1	ON	19.10
6.63	---	19.16	50.00	30.84	1000.0	9.000	L1	ON	19.14
19.95	---	16.65	50.00	33.35	1000.0	9.000	L1	ON	19.67
19.97	22.30	---	60.00	37.70	1000.0	9.000	L1	ON	19.67

L line

Conducted Emission from 150 KHz to 30 MHz



Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.28	44.51	---	60.74	16.23	1000.0	9.000	N	ON	19.18
0.36	---	31.82	48.75	16.93	1000.0	9.000	N	ON	19.18
0.42	52.52	---	57.40	4.88	1000.0	9.000	N	ON	19.23
0.43	---	40.55	47.32	6.76	1000.0	9.000	N	ON	19.23
0.88	43.52	---	56.00	12.48	1000.0	9.000	N	ON	19.24
0.88	---	28.69	46.00	17.31	1000.0	9.000	N	ON	19.24
2.41	---	26.09	46.00	19.91	1000.0	9.000	N	ON	19.03
2.52	38.27	---	56.00	17.73	1000.0	9.000	N	ON	19.02
6.50	33.80	---	60.00	26.20	1000.0	9.000	N	ON	19.13
6.54	---	22.34	50.00	27.66	1000.0	9.000	N	ON	19.13
16.44	29.59	---	60.00	30.41	1000.0	9.000	N	ON	19.45
16.60	---	18.21	50.00	31.79	1000.0	9.000	N	ON	19.46

N line

Conducted Emission from 150 KHz to 30 MHz

6. Main Test Instruments

Name	Manufacturer	Type	Serial Number	Calibration Date	Expiration Date
Spectrum Analyzer	R&S	FSV30	100815	2018-12-16	2019-12-15
EMI Test Receiver	R&S	ESCI	100948	2018-05-20	2019-05-19
Loop Antenna	SCHWARZBECK	FMZB1519	1519-047	2017-09-26	2019-09-25
TRILOG Broadband Antenna	Schwarzbeck	VULB 9163	9163-201	2017-11-18	2019-11-17
Double Ridged Waveguide Horn Antenna	R&S	HF907	100126	2018-07-07	2020-07-06
Standard Gain Horn	ETS-Lindgren	3160-09	00102643	2018-06-20	2020-06-19
Spectrum Analyzer	Agilent	N9010A	MY47191109	2018-05-20	2019-05-19
Power Meter	R&S	NRP	104306	2018-05-20	2019-05-19
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 *******