FCC 47 CFR PART 15 SUBPART C

TEST REPORT

Report Number: BATT20110905E-RF

FCC ID: ZK8-I11133WT

For

IP-CAM

Model: CM-I11133WT

Trade Name: Zmodo

Prepared for

ZMODO Technology Corp. Ltd.
1201 Sangda Building High Technology Park Shenzhen, P.R.China

Prepared by

SHENZHEN BATT TESTING TECHNOLOGY CO.,LTD.
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1. TEST CERTIFICATION

Applicant: ZMODO Technology Corp. Ltd.
1201 Sangda Building High Technology Park Shenzhen, P.R.China

Equipment Under Test: IP-CAM

Trade Name: Zmodo

Model: CM-I11133WT

APPLICABLE STANDARDS			
Standard	**Test Type**	**Standard**	**Test Type**
§15.247(a)(2)	6dB Bandwidth Measurement	§15.247(e)	Peak Power Spectral Density
§15.247(b)(3) §15.247(b)(4)	Peak Power Measurement	§15.247(d) §15.209(a) §15.205	Spurious Emissions ● Conducted Measurement ● Radiated Emissions
§15.247(d)	Band Edges Measurement	§15.207(a)	Power Line Conducted Emissions
§15.203	Antenna Requirement	§15.247 (i) §1.1307 (b)(1) §2.1091	Maximum Permissible exposure (MPE)

Deviation from Applicable Standard
None

The above equipment was tested by *SHENZHEN BATT TESTING TECHNOLOGY CO.,LTD* .The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4: 2003 and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 15.207, 15.209, 15.247.

Tested By: simon mo ***Date:*** ***2011-09-12***
(Simon Mo)

Check By: Mike Yong ***Date:*** ***2011-09-12***
(Mike Yong)

2. TEST RESULT SUMMARY

APPLICABLE STANDARDS			
Standard	**Test Type**	**Result**	**Remark**
§15.247(a)(2)	6dB Bandwidth Measurement	Pass	Meet the requirement of limit.
§15.247(b)(3) §15.247(b)(4)	Peak Power Measurement	Pass	Meet the requirement of limit.
§15.247(d)	Band Edges Measurement	Pass	Meet the requirement of limit.
§15.247(e)	Peak Power Spectral Density	Pass	Meet the requirement of limit.
§15.247(d) §15.209(a) §15.205	Spurious Emissions ● Conducted Measurement ● Radiated Emissions	Pass	Meet the requirement of limit.
§15.207(a)	Power line Conducted Emissions	Pass	Meet the requirement of limit.
§15.203	Antenna Requirement	Pass	Meet the requirement of limit.
§15.247(i) §1.1307 (b)(1) §2.1091	Maximum Permissible exposure (MPE)	Pass	Meet the requirement of limit.

Note: 1. The test result judgment is decided by the limit of test standard
2. The information of measurement uncertainty is available upon the customer's request.

3. EUT DESCRIPTION

Product	IP-CAM
Trade Name	Zmodo
Model Number	CM-I11133WT
Model Difference	N/A
Power Supply	DC 5V POWERED BY SWITCHING AC/DC POWER ADAPTER MODEL: GEO151UB-0520 I/P: AC 100-240V 50/60Hz 0.3A O/P: DC 5V, 2A
Frequency Range	802.11b mode: 2412 ~ 2462 MHz 802.11g mode: 2412 ~ 2462 MHz
Transmit Power	802.11b mode: 17.94 dBm 802.11g mode: 17.53 dBm
Modulation Technique	802.11b: DSSS (CCK; DQPSK; DBPSK) 802.11g: OFDM
Transmit Data Rate	IEEE 802.11b: 11, 5.5, 2, 1 Mbps IEEE 802.11g: 54, 48, 36, 24,18, 12, 9, 6 Mbps
Number of Channels	11 Channels
Antenna Specification	Built-in monopole antenna ; Gain: 2.0dBi (Max)

Note: *This submittal(s) (test report) comply with Section 15.207, 15.209 and 15.247 of the FCC Part 15, Subpart C Rules.*

4. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4: 2003 and FCC CFR 47 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055, 2.1057, 15.207, 15.209 and 15.247.

EUT CONFIGUTATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

EUT EXERCISE

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.4: 2003 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

(a) Except as shown in paragraph (d) of this section, only spurious 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
2. 17725 – 4.17775	37.5 – 38.25	1435 – 1626.5	9.0 – 9.2
2. 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 –	2483.5 – 2500	17.7 – 21.4
8.37625 – 8.38675	156.52525	2655 – 2900	22.01 – 23.12
8.41425 – 8.41475	156.7 – 156.9	3260 – 3267	23.6 – 24.0
12.29 – 12.293	162.0125 – 167.17	3332 – 3339	31.2 – 31.8
12.51975 – 12.52025	167.72 – 173.2	3345.8 – 3358	36.43 – 36.5
12.57675 – 12.57725	240 – 285	3600 – 4400	([2])
13.36 – 13.41	322 – 335.4		

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

[2] Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition.

Software used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

IEEE802.11b: Channel 1(2412MHz), Channel 6(2437MHz) and Channel 11(2462MHz) with 11Mbps highest data rate (worst case) are chosen for the final testing.

IEEE802.11g: Channel 1(2412MHz), Channel 6(2437MHz) and Channel 11(2462MHz) with 6Mbps data rate (worst case) are chosen for the final testing.

5. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

6. FACILITIES AND ACCREDITATIONS

FACILITIES

The Test site used by ShenZhen Emtek Co.,Ltd to collect test data is located in Bldg. 69, Majialong Industry Zone, Nanshan District, Shenzhen, Guangdong, China.

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4: 2003 and CISPR Publication 22.

EQUIPMENT

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

LABORATORY ACCREDITATIONS AND LISTING

Test site at ShenZhen Emtek Co.,Ltd has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on March 18, 2008 and October 28, 2010. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 709623 and 406365. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

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7. SETUP OF EQUIPMENT UNDER TEST

SETUP CONFIGURATION OF EUT

See test photographs for the actual connections between EUT and support equipment.

SUPPORT EQUIPMENT

Manufacturer	Description	Model	Serial Number	FCC ID
DELL	Notebook	D600	S2-B012	DOC
HP	Laser Jet5L	C3941A	JPTVOB2337	DOC
SAST	Modem	AEM-2100	0293	DOC

EXTERNAL I/O CABLE

Cable Description	Length (m)	From/Port	To
Shielded Detachable Printer Cable	1.8	Parallel Port/Host	Printer
Shielded Detachable Serial Cable	1.5	Serial Port/Host	Modem
Unshielded Detachable Power Cable	1.5	Notebook	LISN
Unshielded Detachable RJ45 Cable	1.5	EUT	Notebook

Notes:

1. *All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.*
2. *Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.*

8. FCC PART 15.247 REQUIREMENTS

6 DB BANDWIDTH

LIMIT

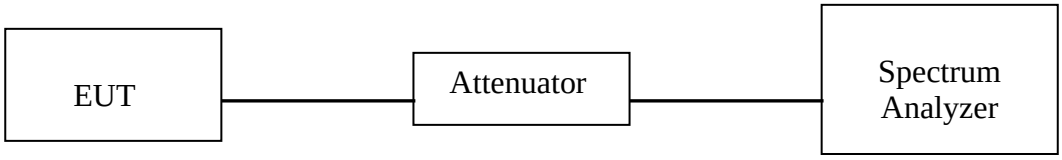
For the direct sequence systems, the minimum 6dB bandwidth shall be at least 500 kHz.

MEASUREMENT EQUIPMENT USED

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Spectrum Analyzer	FSP30	839511/010	2010-09-26	2011-09-25

Remark: *Each piece of equipment is scheduled for calibration once a year.*

TEST CONFIGURATION



TEST PROCEDURE

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW = 100kHz, VBW≥RBW, Span = 40MHz, Sweep = auto.
4. Mark the peak frequency and –6dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

Test Data

Environmental Conditions

Temperature:	25 ° C
Relative Humidity:	48 %
ATM Pressure:	100.0 kPa

The testing was performed by Simon Mo on 2011-08-20.

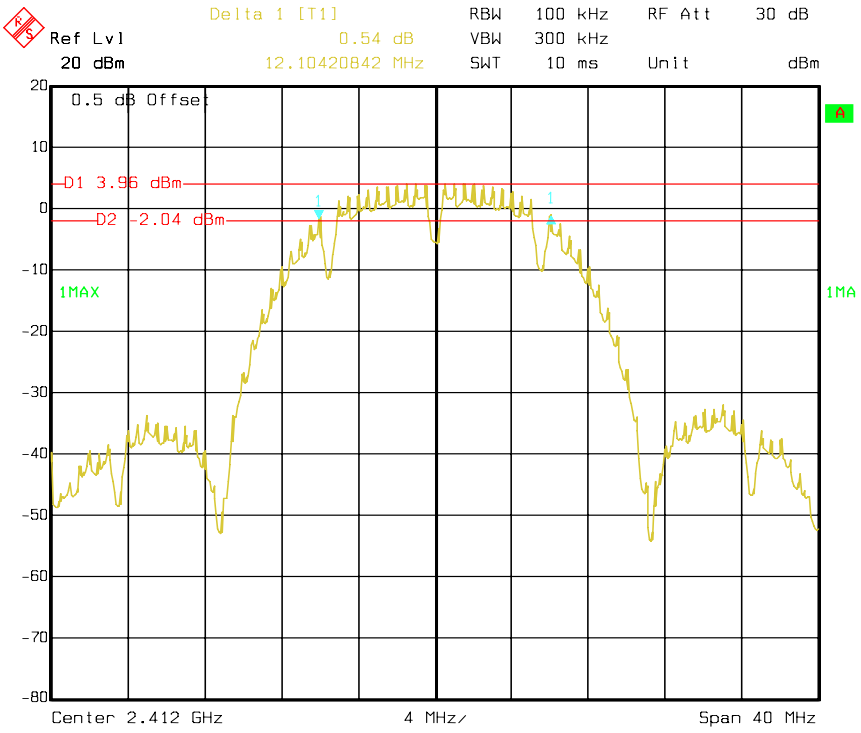
Test Mode: Transmitting

Test Result: Pass.

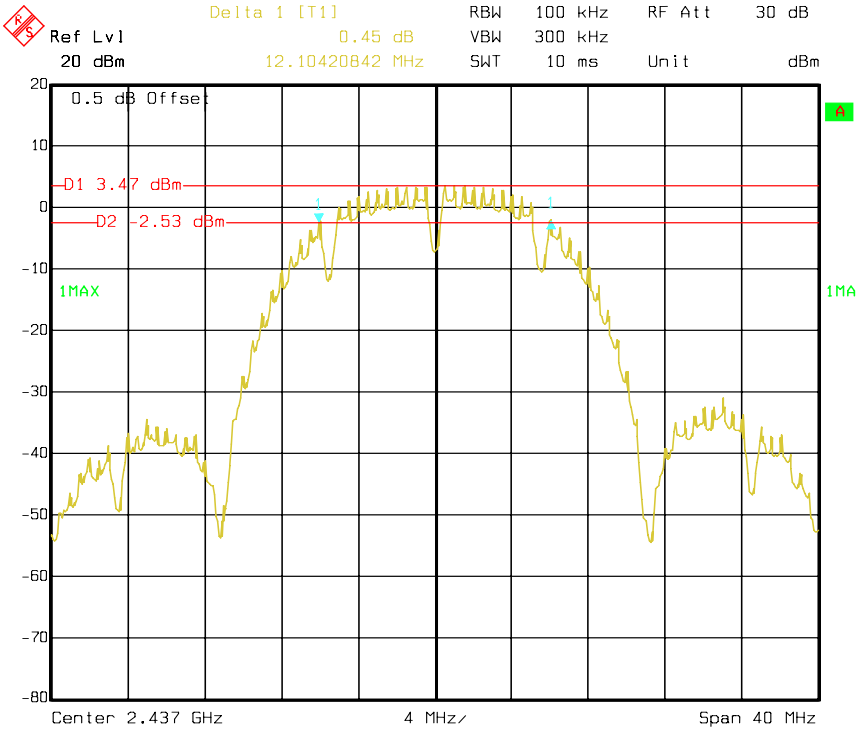
Channel	Frequency (MHz)	Data Rate (Mbps)	6 dB Bandwidth (MHz)	Limit (kHz)
802.11b mode				
Low	2412	11	12.10	>500
Middle	2437	11	12.10	>500
High	2462	11	12.10	>500
802.11g mode				
Low	2412	6	16.35	>500
Middle	2437	6	16.27	>500
High	2462	6	16.43	>500

Test Plot

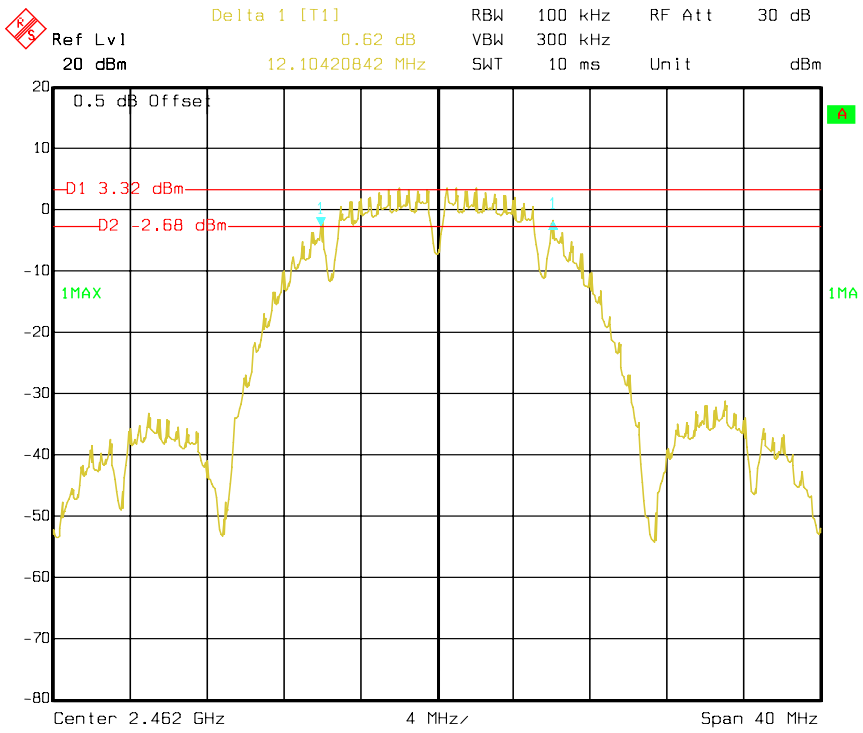
802.11b Low Channel



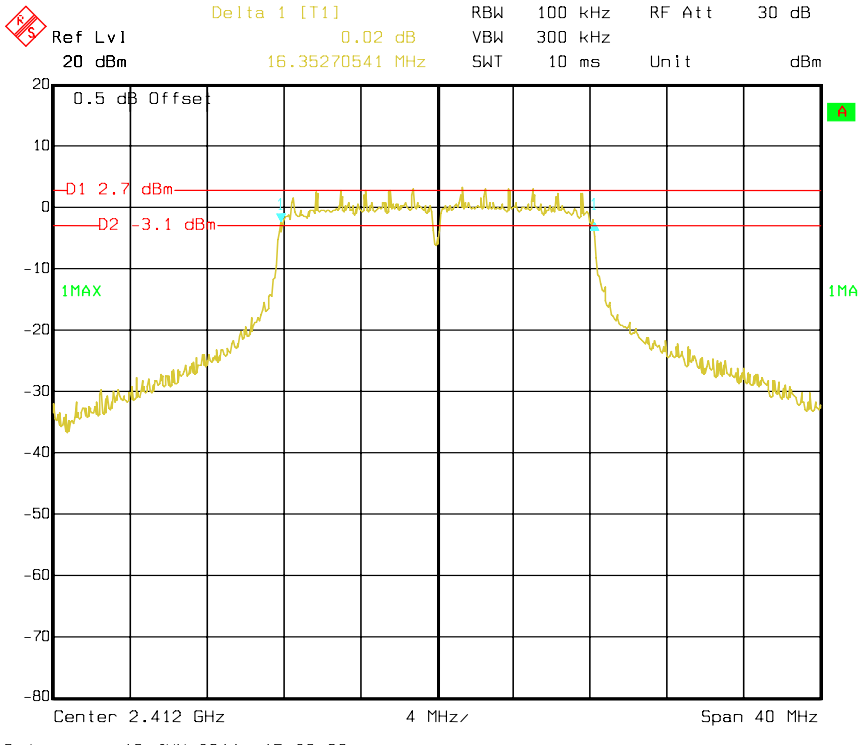
802.11b Middle Channel



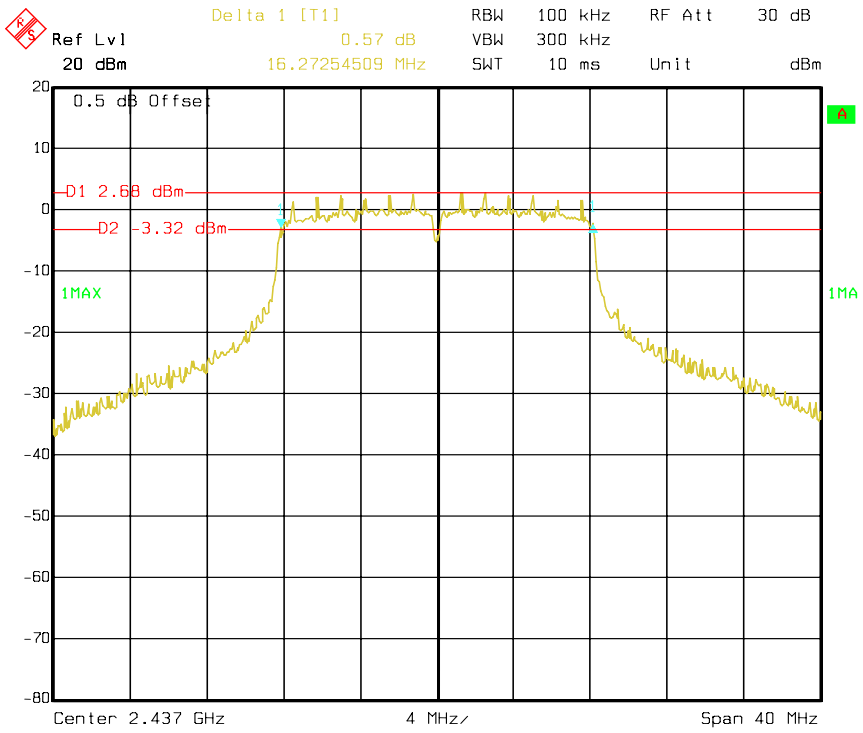
802.11b High Channel



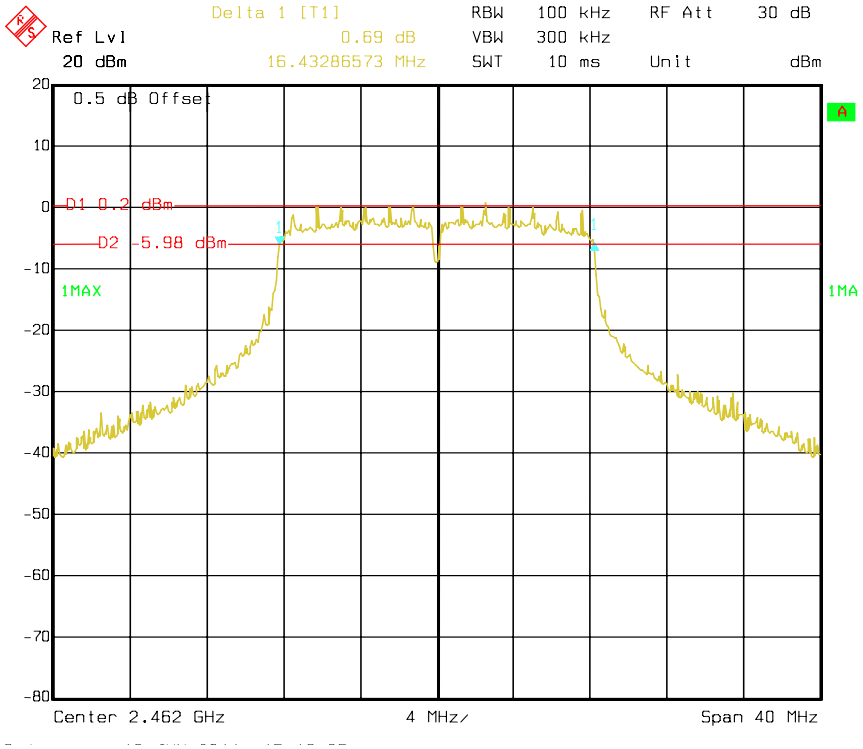
802.11g Low Channel



802.11g Middle Channel



802.11g High Channel



PEAK POWER

LIMIT

The maximum peak output power of the intentional radiator shall not exceed the following:

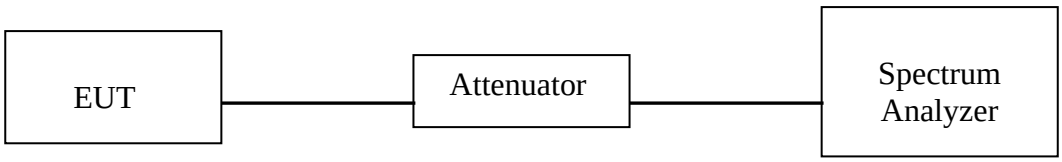
1. According to §15.247(b)(3), for systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz: 1 Watt.
2. According to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

MEASUREMENT EQUIPMENT USED

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100005	2011-03-03	2012-03-02

Remark: *Each piece of equipment is scheduled for calibration once a year.*

TEST CONFIGURATION



TEST PROCEDURE

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to an EMI Test Receiver.
3. Add a correction factor to the display.

Test Data

Environmental Conditions

Temperature:	25 ° C
Relative Humidity:	48 %
ATM Pressure:	100.0 kPa

The testing was performed by Simon Mo on 2011-08-20.

Test Mode: Transmitting

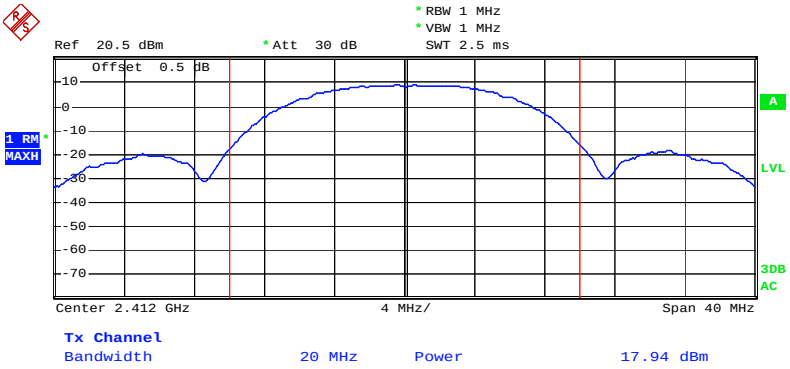
Test Result: Pass.

Channel	Frequency (MHz)	Data Rate (Mbps)	Output Power (dBm)	Limit (dBm)
802.11b				
Low	2412	11	17.94	30
Middle	2437	11	17.67	30
High	2462	11	17.69	30
802.11g				
Low	2412	6	17.48	30
Middle	2437	6	17.32	30
High	2462	6	17.53	30

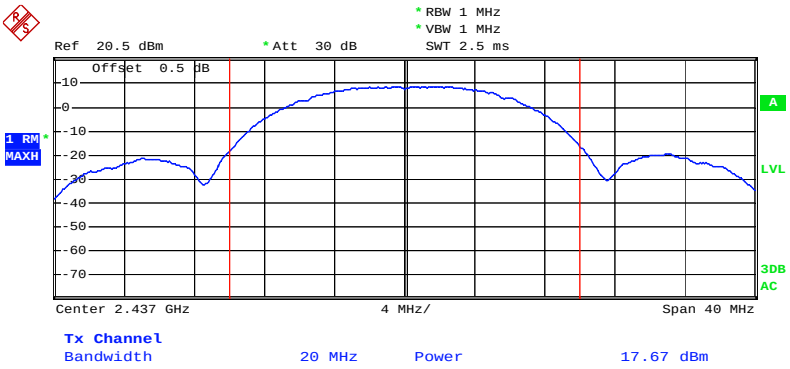
Test Plot

802.11b mode

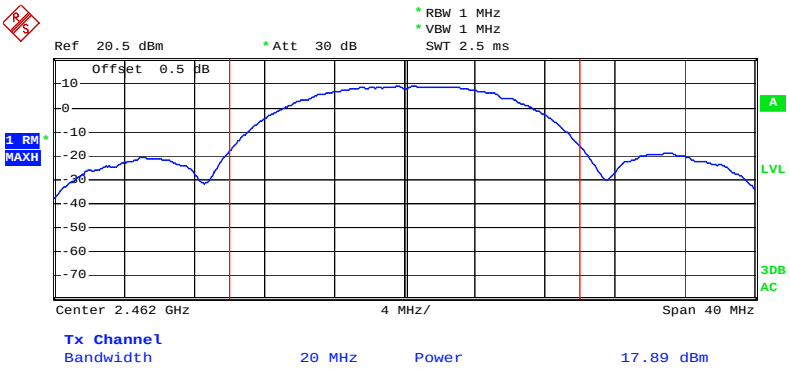
RF Output Power, Low Channel



RF Output Power, Middle Channel

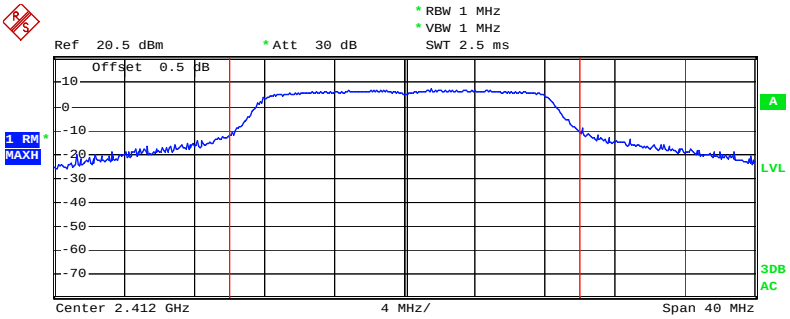


RF Output Power, High Channel

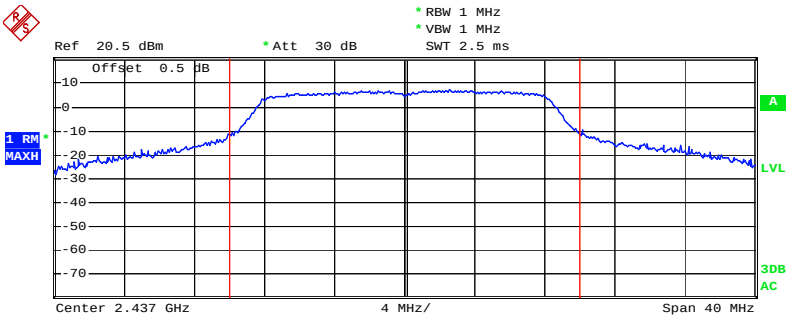


802.11g mode

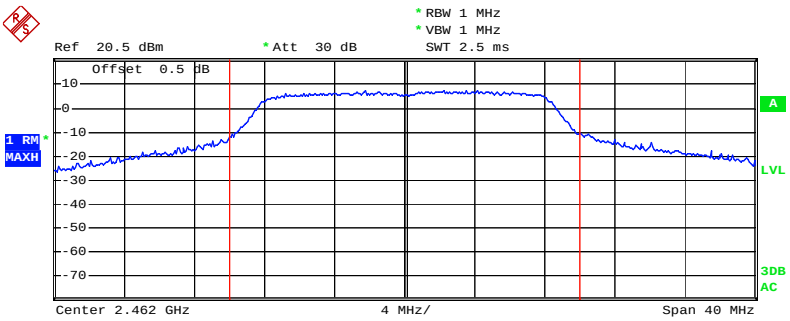
RF Output Power, Low Channel



RF Output Power, Middle Channel



RF Output Power, High Channel



BAND EDGES MEASUREMENT

LIMIT

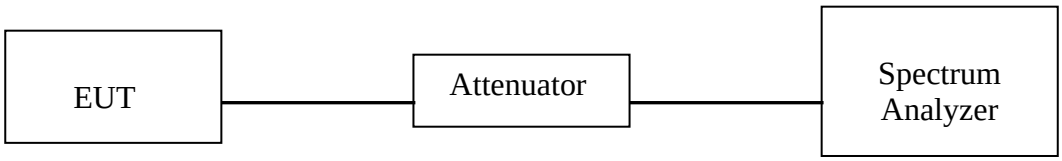
According to §15.247(c), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, 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 in15.209(a).

MEASUREMENT EQUIPMENT USED

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Spectrum Analyzer	FSP30	839511/010	2010-09-26	2011-09-25

Remark: *Each piece of equipment is scheduled for calibration once a year.*

TEST CONFIGURATION



TEST PROCEDURE

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

Test Data

Environmental Conditions

Temperature:	26 ° C
Relative Humidity:	48 %
ATM Pressure:	100.0 kPa

The testing was performed by Simon Mo on 2011-08-20.

Test Mode: Transmitting

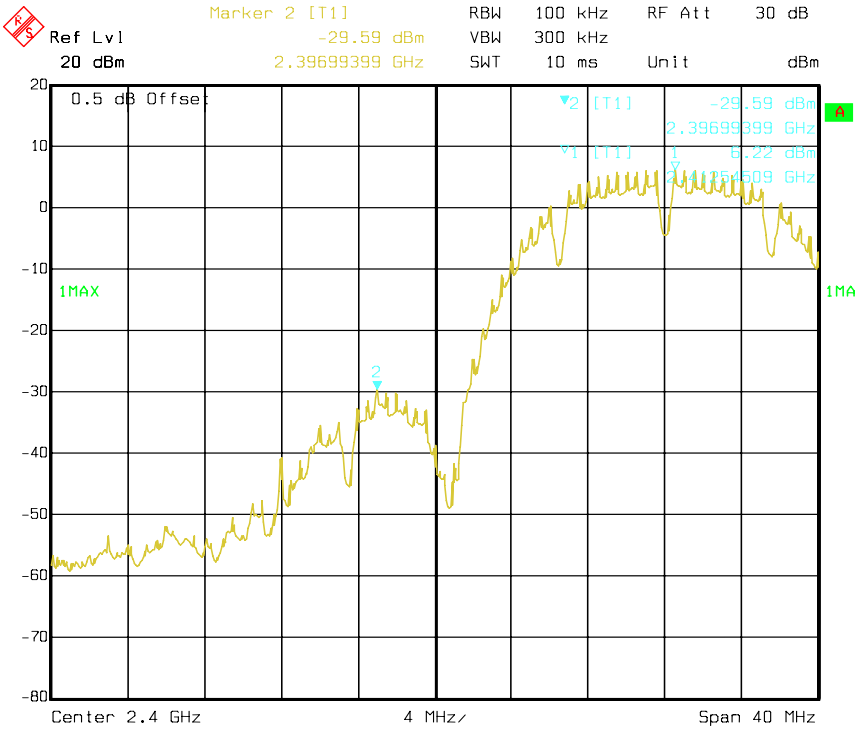
Test Result: Pass.

Frequency (MHz)	Delta Peak to band emission (dBc)	Limit (dBc)
802.11b mode		
2396.99	35.81	20
2483.56	54.28	20
802.11g mode		
2399.80	27.72	20
2483.80	40.25	20

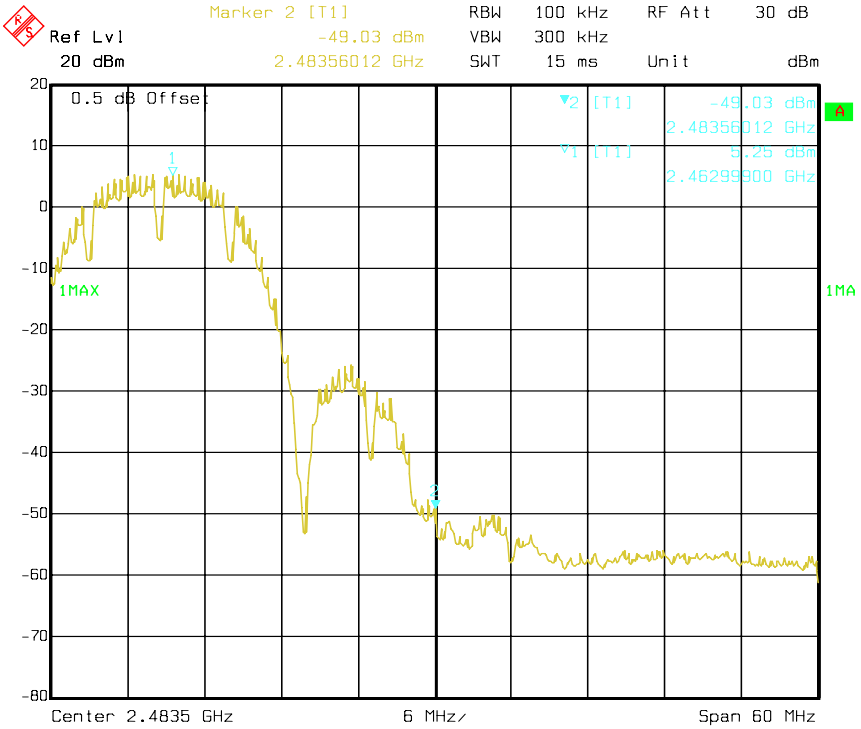
Please refer to following plots.

802.11b mode

Band Edge, Left Side,

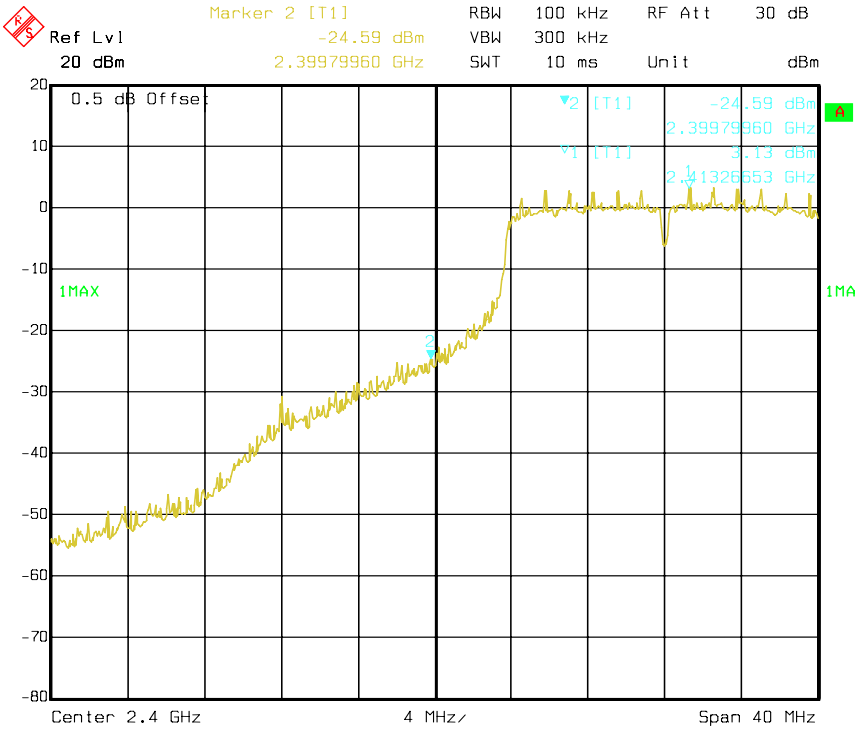


Band Edge, Right Side

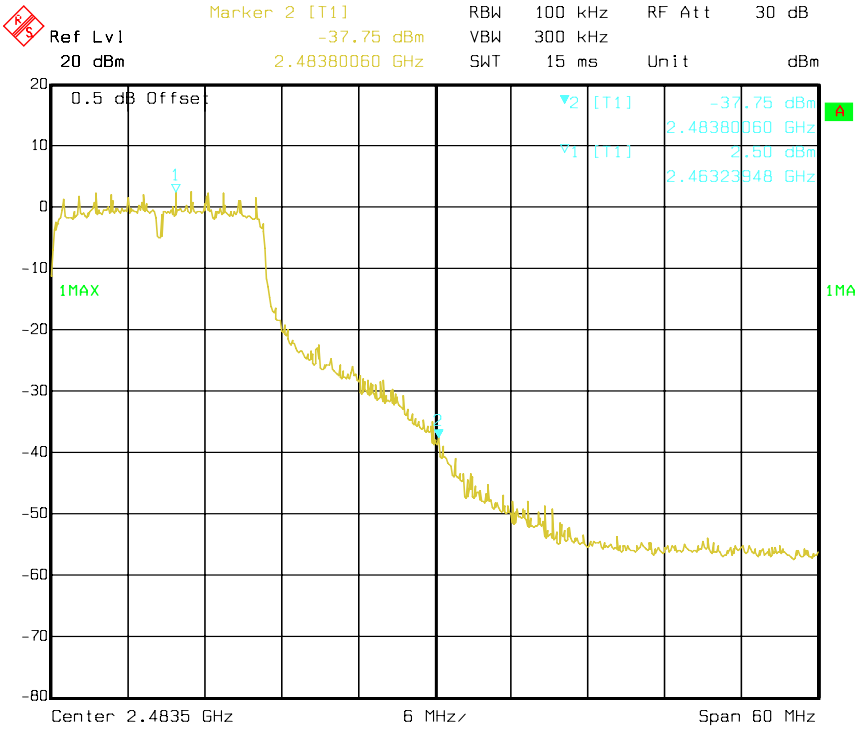


802.11g mode

Band Edge, Left Side,



Band Edge, Right Side



PEAK POWER SPECTRAL DENSITY

LIMIT

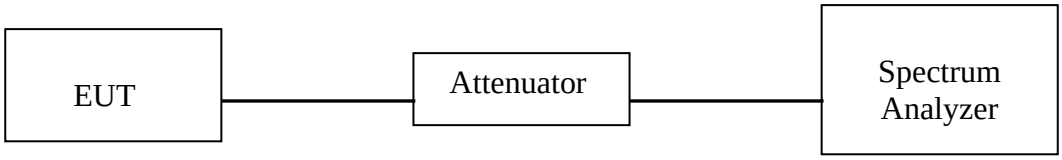
1. For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.
2. The direct sequence operating of the hybrid system, with the frequency hopping operation turned off, shall comply with the power density requirements of paragraph (d) of this section.

MEASUREMENT EQUIPMENT USED

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100005	2011-03-03	2012-03-02

Remark: *Each piece of equipment is scheduled for calibration once a year.*

TEST CONFIGURATION



TEST PROCEDURE

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Adjust the center frequency of SA on any frequency be measured and set SA to 1.5MHz span mode. And then, set RBW and VBW of spectrum analyzer to proper value. (DTS)
4. Repeat above procedures until all frequencies measured were complete.

Test Data

Environmental Conditions

Temperature:	26 ° C
Relative Humidity:	48 %
ATM Pressure:	100.0 kPa

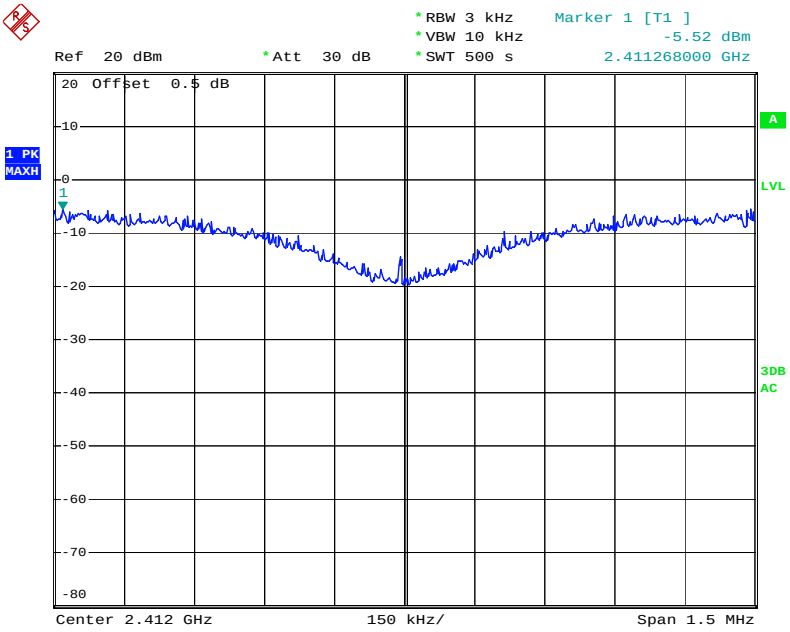
The testing was performed by Simon Mo on 2011-08-20.

Test Mode: Transmitting

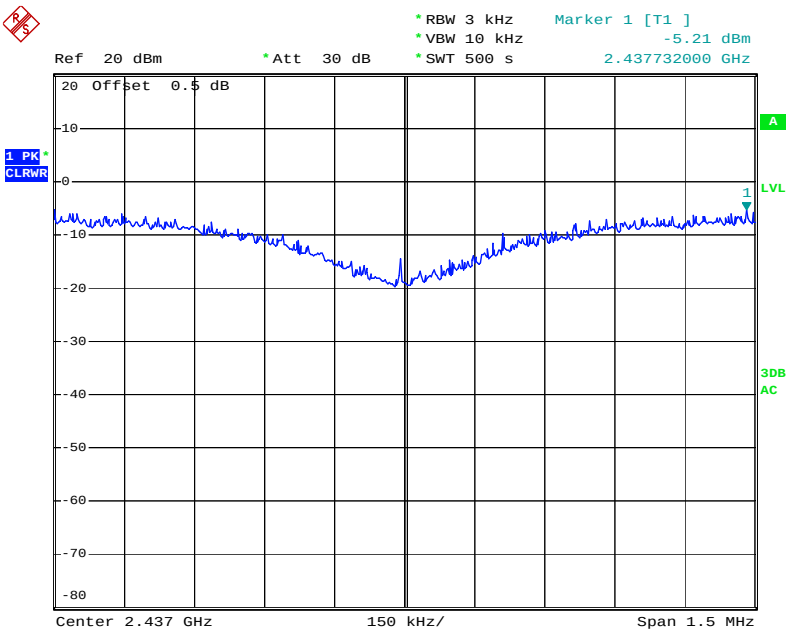
Channel	Frequency (MHz)	Data Rate	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Result
802.11b mode					
Low	2412	11	-5.52	8	Pass
Middle	2437	11	-5.21	8	Pass
High	2462	11	-5.27	8	Pass
802.11g mode					
Low	2412	6	-14.15	8	Pass
Middle	2437	6	-11.76	8	Pass
High	2462	6	-12.82	8	Pass

Test Plot

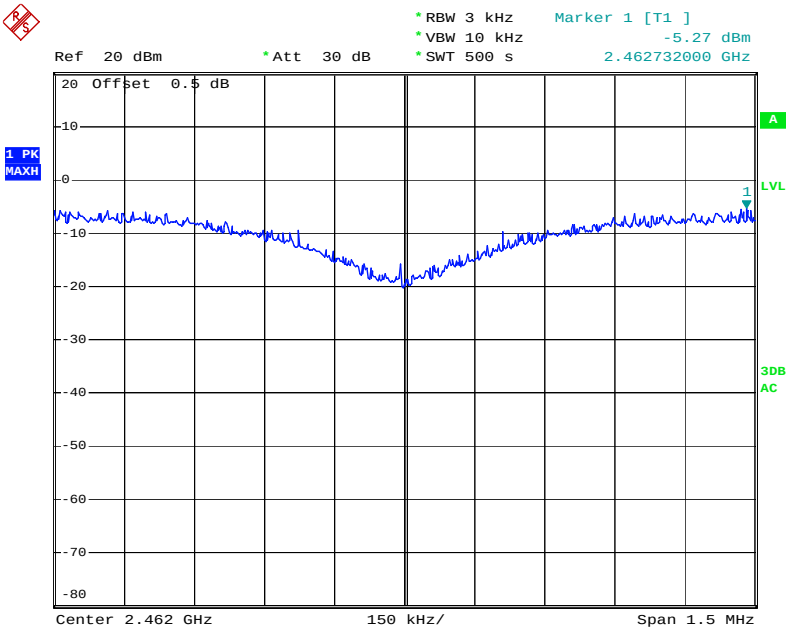
Power Spectral Density, 802.11b Low Channel



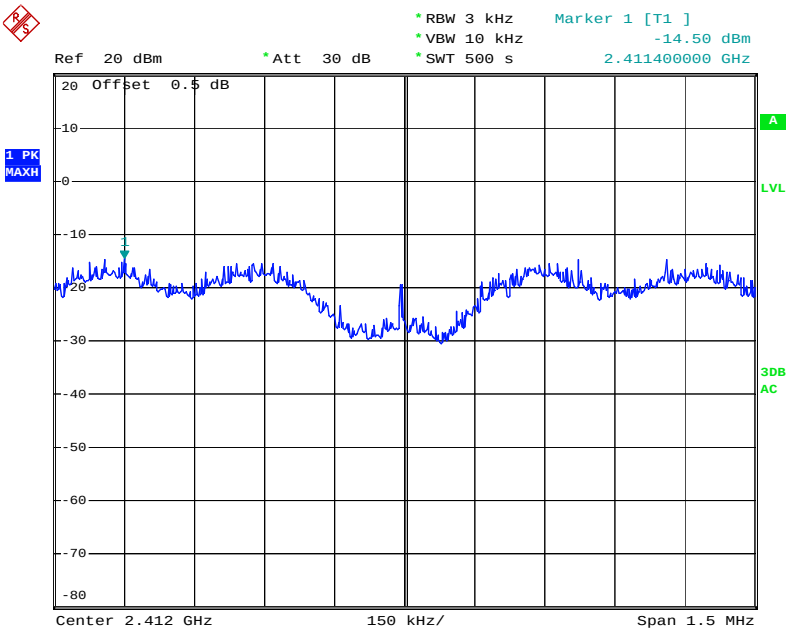
Power Spectral Density, 802.11b Middle Channel



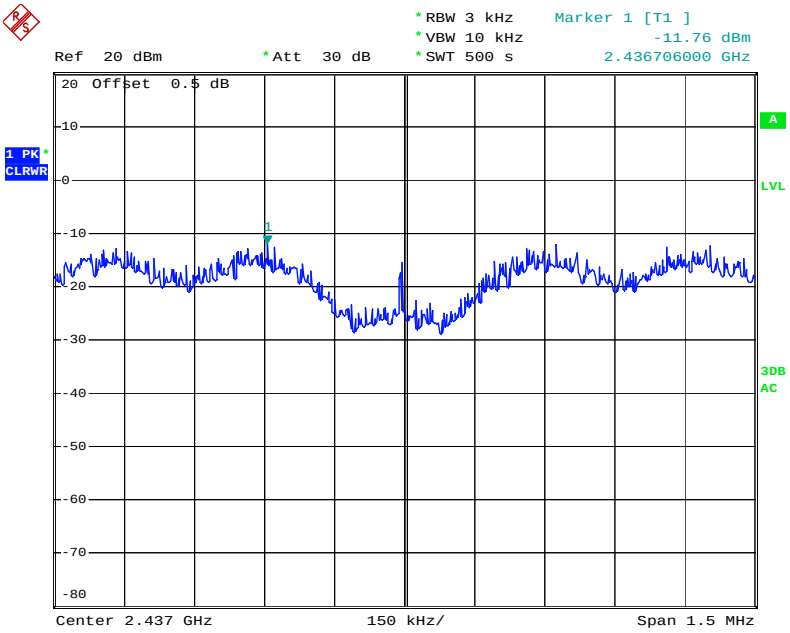
Power Spectral Density, 802.11b High Channel



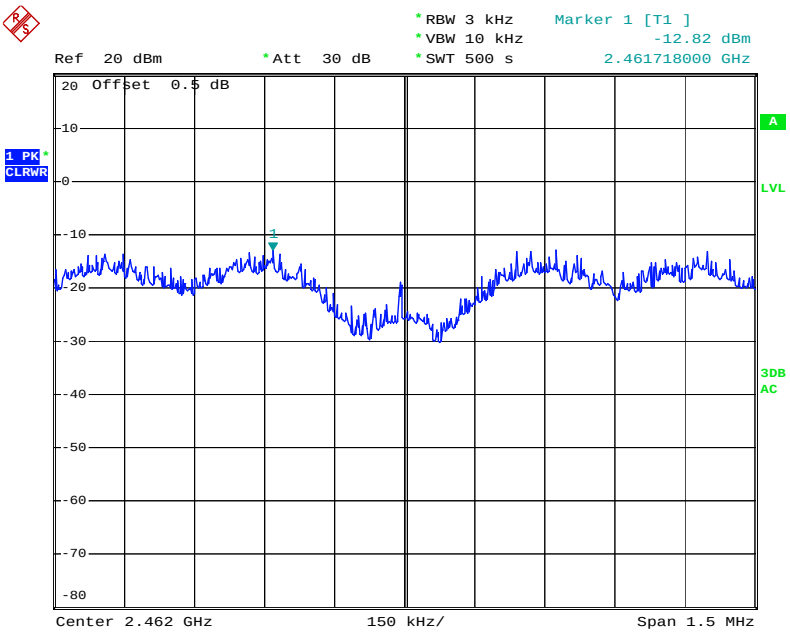
Power Spectral Density, 802.11g Low Channel



Power Spectral Density, 802.11g Middle Channel



Power Spectral Density, 802.11g High Channel



SPURIOUS EMISSIONS

7.6.1 Conducted Measurement

LIMIT

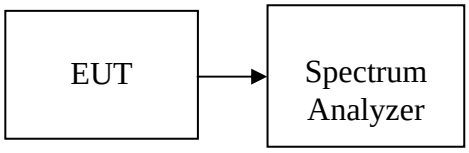
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

MEASUREMENT EQUIPMENT USED

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Spectrum Analyzer	FSP30	839511/010	2010-09-26	2011-09-25

Remark: *Each piece of equipment is scheduled for calibration once a year.*

TEST CONFIGURATION



TEST PROCEDURE

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

Measurements are made over the 30 MHz to 25 GHz range with the transmitter set to the lowest, middle, and highest channels.

Test Data

Environmental Conditions

Temperature:	26 ° C
Relative Humidity:	48 %
ATM Pressure:	100.0 kPa

The testing was performed by Simon Mo on 2011-08-20.

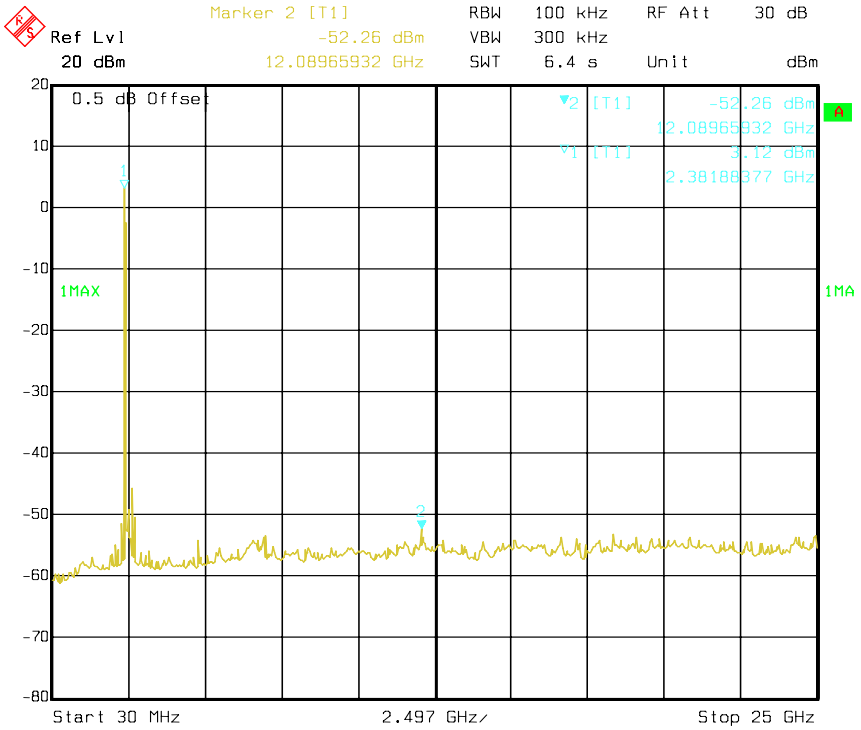
Test Mode: Transmitting

Antenna Port Conducted Spurious Emissions

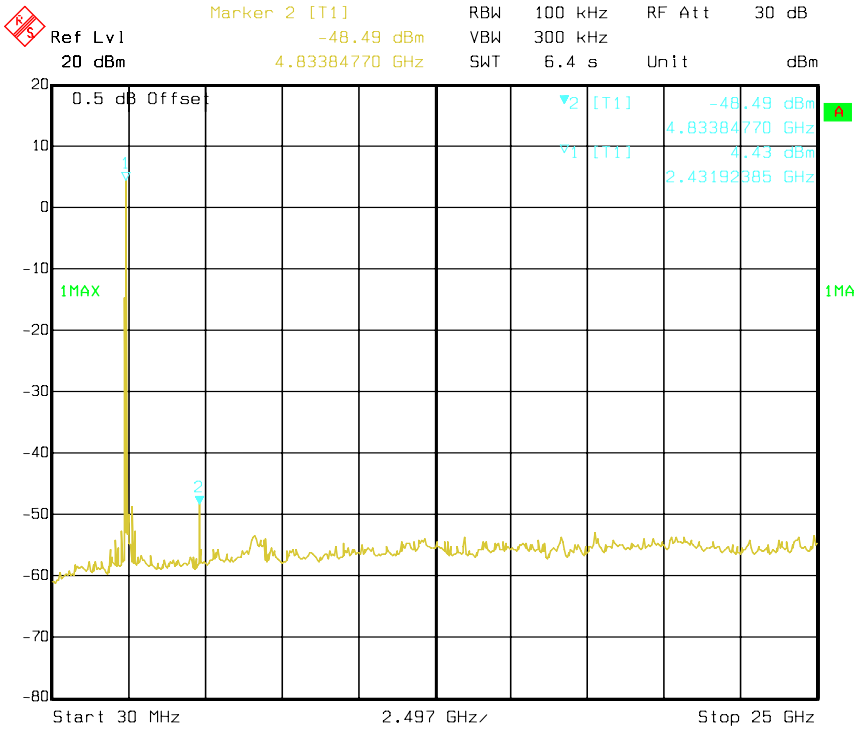
Channel Frequency (MHz)	Data Rate (Mbps)	Delta Value (dBc)	Limit (dBc)	Result
802.11b				
2412	11	55.38	20	Pass
2437	11	52.92	20	Pass
2462	11	52.46	20	Pass
802.11g				
2412	6	54.40	20	Pass
2437	6	52.14	20	Pass
2462	6	53.00	20	Pass

Test Plot

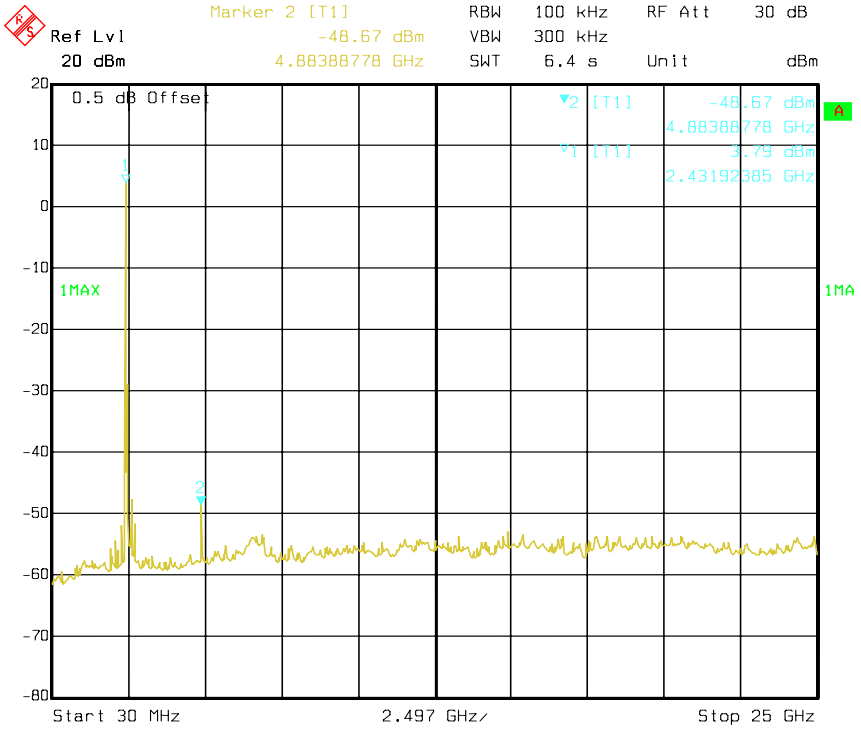
802.11b Low Channel



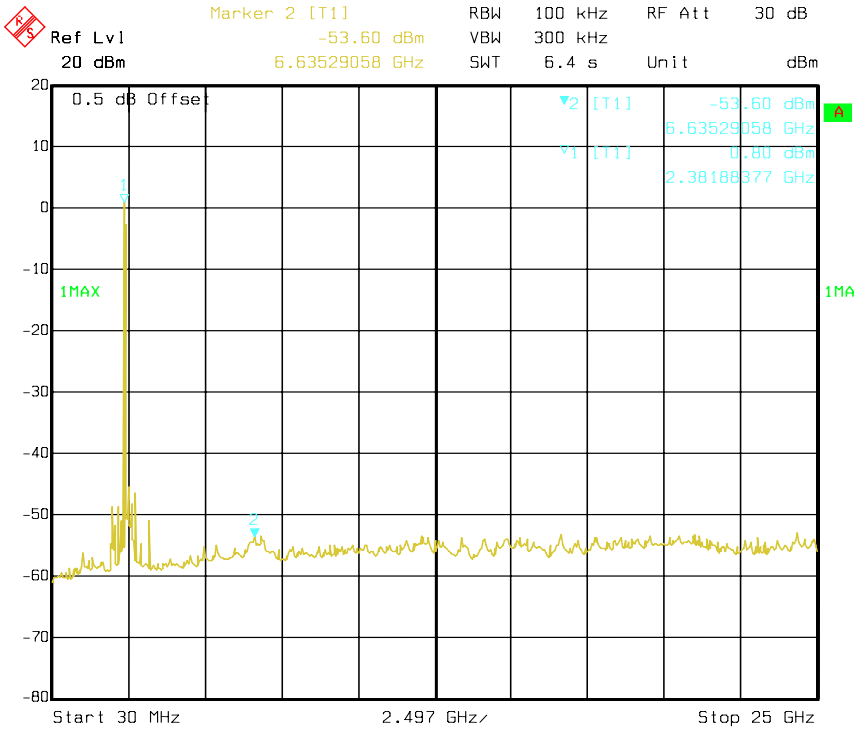
802.11b Middle Channel



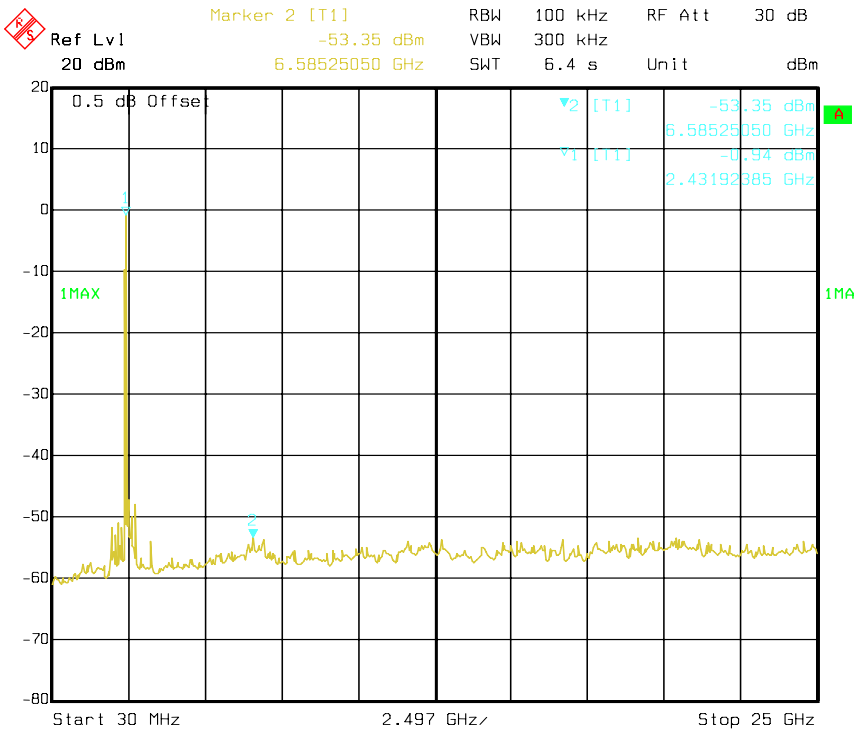
802.11b High Channel



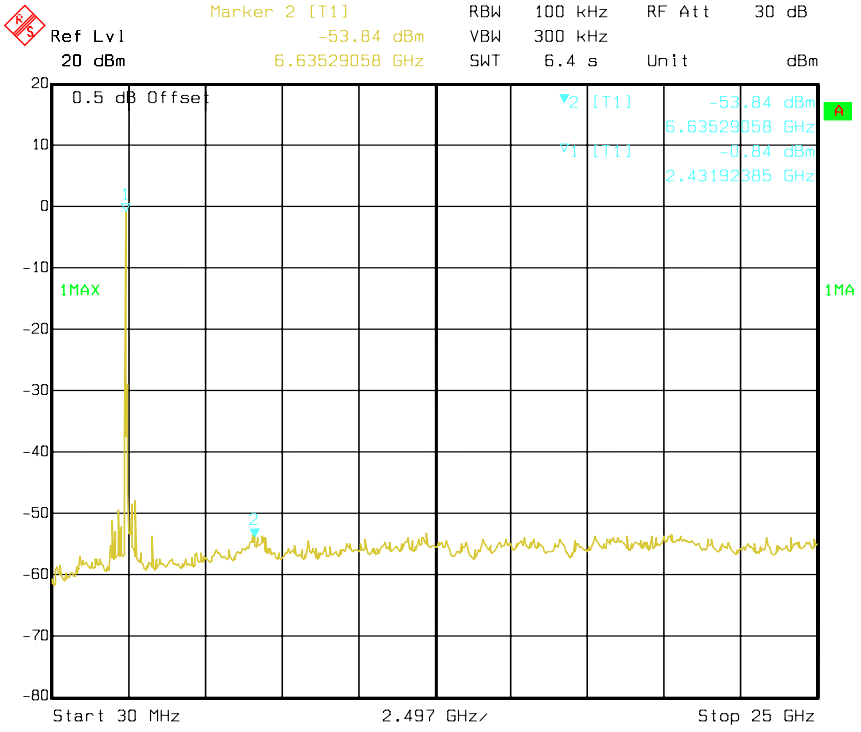
802.11g Low Channel



802.11g Middle Channel



802.11g High Channel



7.6.2 Radiated Emissions

LIMIT

1. Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (mV/m)	Measurement Distance (m)
30-88	100*	3
88-216	150*	3
216-960	200*	3
Above 960	500	3

Note: *Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.*

2. In the above emission table, the tighter limit applies at the band edges.

Frequency (Hz)	Field Strength (μV/m at 3-meter)	Field Strength (dBμV/m at 3-meter)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

MEASUREMENT UNCERTAINTY

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at ShenZhen Emtek Co.,Ltd is ±4.0 dB.

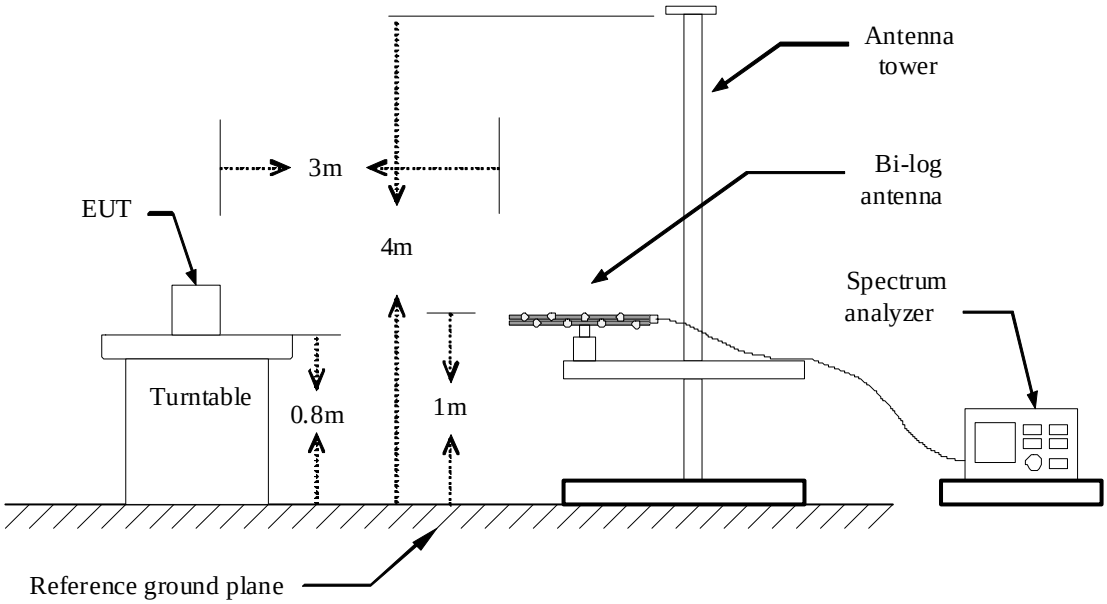
MEASUREMENT EQUIPMENT USED

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Spectrum Analyzer	FSP30	839511/010	2010-09-26	2011-09-25
Rohde & Schwarz	EMI Test Receiver	ESCI	100005	2011-03-08	2012-03-07
HP	Amplifier	8447D	2944A07999	2010-10-02	2011-10-02
HP	Amplifier	8449B	2624A00116	2011-03-03	2012-03-02
Schwardzbeck	Horn Antenna	BBHA 9120	D143	2011-09-02	2012-09-01
Schwardzbeck	Bilog Antenna	VULB9163	142	2011-04-12	2012-04-12
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2011-03-11	2012-03-10

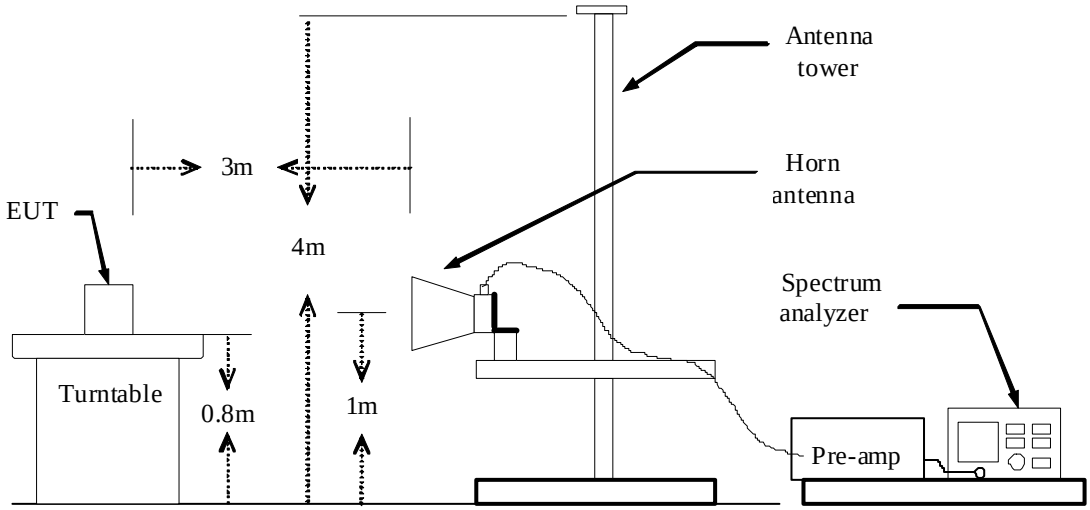
Remark: *Each piece of equipment is scheduled for calibration once a year.*

Test Configuration

Below 1 GHz



Above 1 GHz



The radiated emission tests were performed in the 3 meters chamber 966 test site, using the setup accordance with the ANSI C63.4-2003. The specification used was the FCC 15.209, and FCC 15.247 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

The adapter was connected to a 120 VAC/60 Hz power source.

EMI TEST RECEIVER & SPECTRUM ANALYZER SETUP

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	VBW	Detector
30 MHz – 1000 MHz	100 kHz	300 kHz	QP
1000 MHz – 25 GHz	1 MHz	3 MHz	PK
1000 MHz – 25 GHz	1 MHz	10 Hz	PK

TEST PROCEDURE

For the radiated emissions test, the adapter was connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1GHz and peak and Average detection modes for frequencies above 1GHz.

CORRECTED AMPLITUDE & MARGIN CALCULATUION

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Corrected Amplitude = Meter Reading + Antenna Factor + Cable Loss - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin = Limit – Corrected Amplitude

Test Data

Environmental Conditions

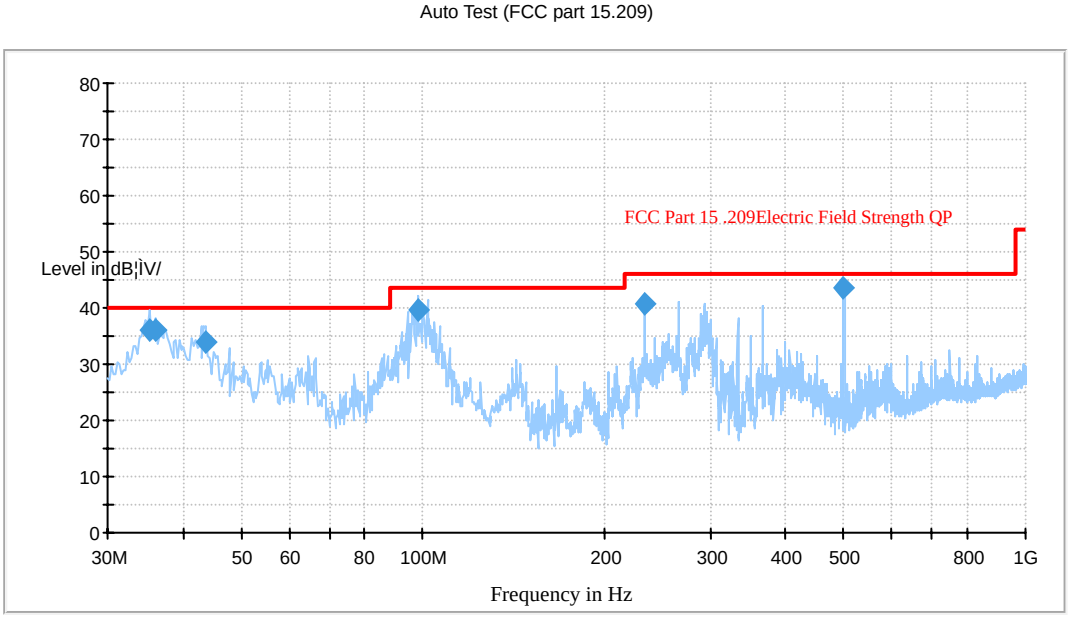
Temperature:	26 ° C
Relative Humidity:	50 %
ATM Pressure:	100.0 kPa

The testing was performed by Simon Mo on 2011-09-04.

Test Result: Pass.

Below 1 GHz

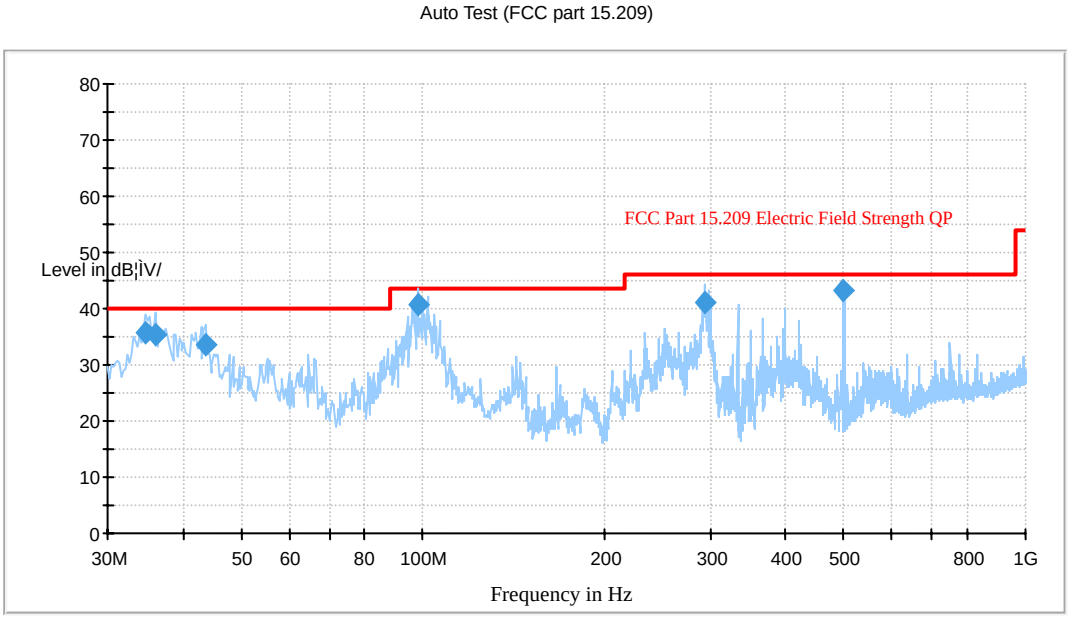
Test Mode: Transmitting (802.11b mode)



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Ant. Height (cm)	Antenna Polarity (H/V)	Turntable Position (degree)	Correction Factor (dB)	Limit (dBµV/m)	Margin (dB)
35.312250	36.1	104.0	V	211.0	-9.0	40.0	3.9*
36.153250	36.2	103.0	V	226.0	-9.6	40.0	3.8*
43.793250	34.0	102.0	V	42.0	-14.4	40.0	6.0
98.442500	39.7	102.0	V	281.0	-15.0	43.5	3.8*
233.288250	40.8	123.0	H	144.0	-13.8	46.0	5.2
500.046750	43.6	205.0	H	210.0	-8.4	46.0	2.4*

**Within measurement uncertainty.*

Test Mode: Transmitting (802.11g mode)



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Ant. Height (cm)	Antenna Polarity (H/V)	Turntable Position (degree)	Correction Factor (dB)	Limit (dBµV/m)	Margin (dB)
34.646750	35.8	103.0	V	238.0	-8.6	40.0	4.2
36.179000	35.2	106.0	V	111.0	-9.6	40.0	4.8
43.782500	33.4	105.0	V	164.0	-14.4	40.0	6.6
98.431500	40.6	102.0	V	266.0	-15.0	43.5	2.9*
293.416750	41.2	104.0	H	196.0	-12.5	46.0	4.8
500.036250	43.4	211.0	H	204.0	-8.4	46.0	2.6*

**Within measurement uncertainty.*

Above 1 GHz:

802.11b Mode:

Indicated		Detector (PK/Ave)	Table Angle Degree	Antenna		Correction Factor			FCC Part 15.247/15.205/15.209		
Frequency (MHz)	S.A. Reading (dBμV)			Height (m)	Polar (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dBμV/m)	Limit (dBμV/m)	Margin(dB)
Low Channel (2412 MHz)											
2386.64	36.51	PK	145	1.0	H	30.90	3.03	0	70.44	74	3.56*
2386.64	16.63	Ave	145	1.0	H	30.90	3.03	0	50.56	54	3.44*
2386.64	34.05	PK	334	1.0	V	30.30	3.03	0	67.38	74	6.62
2386.64	17.06	Ave	334	1.0	V	30.30	3.03	0	50.39	54	3.61*
4824	54.95	PK	320	1.1	H	36.30	4.30	27.51	68.04	74	5.96
4824	37.83	Ave	320	1.1	H	36.30	4.30	27.51	50.92	54	3.08*
4824	48.78	PK	210	1.0	V	35.00	4.30	27.51	60.57	74	13.43
4824	37.21	Ave	210	1.0	V	35.00	4.30	27.51	49.00	54	5.00
7236	46.01	PK	156	1.0	H	39.20	5.24	27.49	62.96	74	11.04
7236	33.36	Ave	156	1.0	H	39.20	5.24	27.49	50.31	54	3.69*
7236	45.15	PK	89	1.0	V	38.00	5.24	27.49	60.9	74	13.1
7236	33.47	Ave	89	1.0	V	38.00	5.24	27.49	49.22	54	4.78
Middle Channel (2437 MHz)											
4874	54.26	PK	125	1.2	H	36.30	4.30	27.51	67.35	74	6.65
4874	37.20	Ave	125	1.2	H	36.30	4.30	27.51	50.29	54	3.71*
4874	54.13	PK	356	1.5	V	35.00	4.30	27.49	65.94	74	8.06
4874	36.15	Ave	356	1.5	V	35.00	4.30	27.49	47.96	54	6.04
7311	46.23	PK	245	1.2	H	39.20	5.24	27.49	63.18	74	10.82
7311	33.82	Ave	245	1.2	H	39.20	5.24	27.49	50.77	54	3.23*
7311	44.68	PK	178	1.6	V	38.00	5.24	27.49	60.43	74	13.57
7311	30.45	Ave	178	1.6	V	38.00	5.24	27.49	46.20	54	7.80
High Channel (2462 MHz)											
2487.69	35.23	PK	130	1.0	H	30.90	3.03	0	69.16	74	4.84
2487.69	16.36	Ave	130	1.0	H	30.90	3.03	0	50.29	54	3.71*
2487.69	35.12	PK	145	1.0	V	30.30	3.03	0	68.45	74	5.55
2487.69	15.35	Ave	145	1.0	V	30.30	3.03	0	48.68	54	5.32
4924	54.32	PK	253	1.4	H	36.30	4.30	27.51	67.41	74	6.59
4924	37.25	Ave	253	1.4	H	36.30	4.30	27.51	50.34	54	3.66*
4924	52.77	PK	35	1.3	V	35.00	4.30	27.51	64.56	74	9.44
4924	36.26	Ave	35	1.3	V	35.00	4.30	27.51	48.05	54	5.95
7386	47.55	PK	118	1.2	H	39.20	5.24	27.49	64.50	74	9.50
7386	33.13	Ave	118	1.2	H	39.20	5.24	27.49	50.08	54	3.92*
7386	45.22	PK	235	1.8	V	38.00	5.24	27.49	60.97	74	13.03
7386	32.62	Ave	235	1.6	V	38.00	5.24	27.49	48.37	54	5.63

**Within measurement uncertainty.*

802.11g Mode:

Indicated		Detector (PK/Ave)	Table Angle Degree	Antenna		Correction Factor			FCC Part 15.247/15.205/15.209		
Frequency (MHz)	S.A. Reading (dBμV)			Height (m)	Polar (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dBμV/m)	Limit (dBμV/m)	Margin(dB)
Low Channel (2412 MHz)											
2388.15	36.35	PK	145	1.0	H	30.90	3.03	0	70.28	74	3.72*
2388.15	17.2	Ave	145	1.0	H	30.90	3.03	0	51.13	54	2.87*
2392.34	35.25	PK	334	1.0	V	30.30	3.03	0	68.58	74	5.42
2392.34	16.45	Ave	334	1.0	V	30.30	3.03	0	49.78	54	4.22
4824	54.36	PK	320	1.1	H	36.30	4.30	27.51	67.45	74	6.55
4824	37.25	Ave	320	1.1	H	36.30	4.30	27.51	50.34	54	3.66*
4824	50.38	PK	210	1.0	V	35.00	4.30	27.51	62.17	74	11.83
4824	35.82	Ave	210	1.0	V	35.00	4.30	27.51	47.61	54	6.39
7236	46.22	PK	156	1.0	H	39.20	5.24	27.49	63.17	74	10.83
7236	33.68	Ave	156	1.0	H	39.20	5.24	27.49	50.63	54	3.37
7236	44.89	PK	89	1.0	V	38.00	5.24	27.49	60.64	74	13.36
7236	31.07	Ave	89	1.0	V	38.00	5.24	27.49	46.82	54	7.18
Middle Channel (2437 MHz)											
4874	54.83	PK	65	1.1	H	36.30	4.3	27.51	67.92	74	6.08
4874	37.26	Ave	65	1.1	H	36.30	4.3	27.51	50.35	54	3.65*
4874	49.58	PK	235	1.1	V	35.00	4.3	27.49	61.39	74	12.61
4874	34	Ave	235	1.1	V	35.00	4.3	27.49	45.81	54	8.19
7311	47.23	PK	227	1.0	H	39.20	5.24	27.49	64.18	74	9.82
7311	34.82	Ave	227	1.0	H	39.20	5.24	27.49	51.77	54	2.23*
7311	45.68	PK	360	1.0	V	38.00	5.24	27.49	61.43	74	12.57
7311	31.45	Ave	360	1.0	V	38.00	5.24	27.49	47.20	54	6.80
High Channel (2462 MHz)											
2485.63	37.15	PK	130	1.0	H	30.90	3.03	0	71.08	74	2.92*
2485.63	17.82	Ave	130	1.0	H	30.90	3.03	0	51.75	54	2.25*
2489.34	36.25	PK	145	1.0	V	30.30	3.03	0	69.58	74	4.42
2489.34	17.38	Ave	145	1.0	V	30.30	3.03	0	50.71	54	3.29*
4924	54.45	PK	253	1.4	H	36.30	4.30	27.51	67.54	74	6.46
4924	37.82	Ave	253	1.4	H	36.30	4.30	27.51	50.91	54	3.09*
4924	53.77	PK	35	1.3	V	35.00	4.30	27.51	65.56	74	8.44
4924	37.05	Ave	35	1.3	V	35.00	4.30	27.51	48.84	54	5.16
7386	47.86	PK	118	1.2	H	39.20	5.24	27.49	64.81	74	9.19
7386	34.75	Ave	118	1.2	H	39.20	5.24	27.49	51.70	54	2.30*
7386	46.15	PK	235	1.8	V	38.00	5.24	27.49	61.9	74	12.1
7386	31.5	Ave	235	1.6	V	38.00	5.24	27.49	47.25	54	6.75

**Within measurement uncertainty.*

POWERLINE CONDUCTED EMISSIONS

LIMIT

For an intentional radiator which is designed to be connected to the public utility (AC) power Line, the radio frequency voltage that is conducted back onto the AC power Line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolts (The limit decreases Linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

Frequency Range (MHz)	Limits (dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power Line (LINE and NEUTRAL) and ground at the power terminals.

MEASUREMENT UNCERTAINTY

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, and LISN.

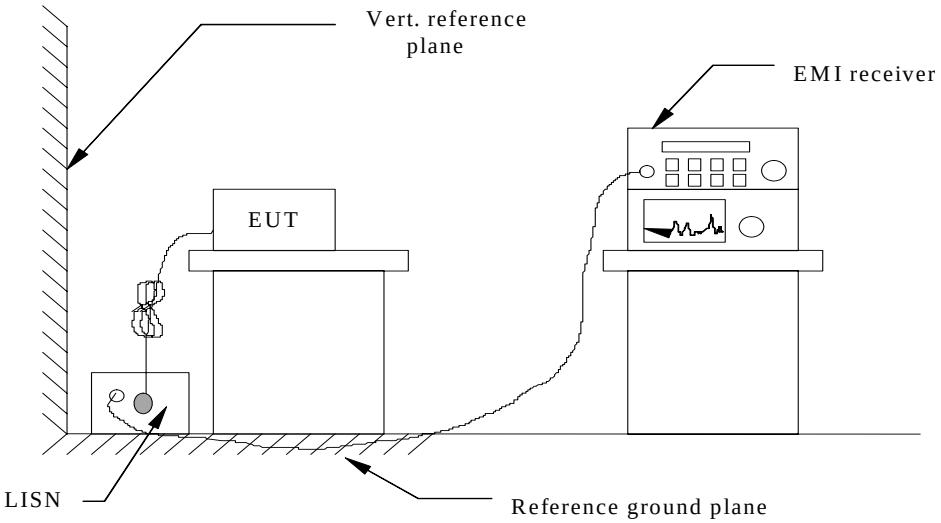
Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement at ShenZhen Emtek Co.,Ltd is ±2.4 dB.

MEASUREMENT EQUIPMENT USED

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	L.I.S.N.	ESH2-Z5	834549/006	2011-09-02	2012-09-01
Rohde &Schwarz	L.I.S.N.	ENV216	834548/112	2011-09-02	2012-09-01
Rohde & Schwarz	EMI Test Receiver	ESCS30	828985/018	2011-09-02	2012-09-01

Remark: *Each piece of equipment is scheduled for calibration once a year.*

Test Configuration



See test photographs for the actual connections between EUT and support equipment.

TEST PROCEDURE

During the conducted emission test, the adapter of laptop was connected to the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

Test Data

Environmental Conditions

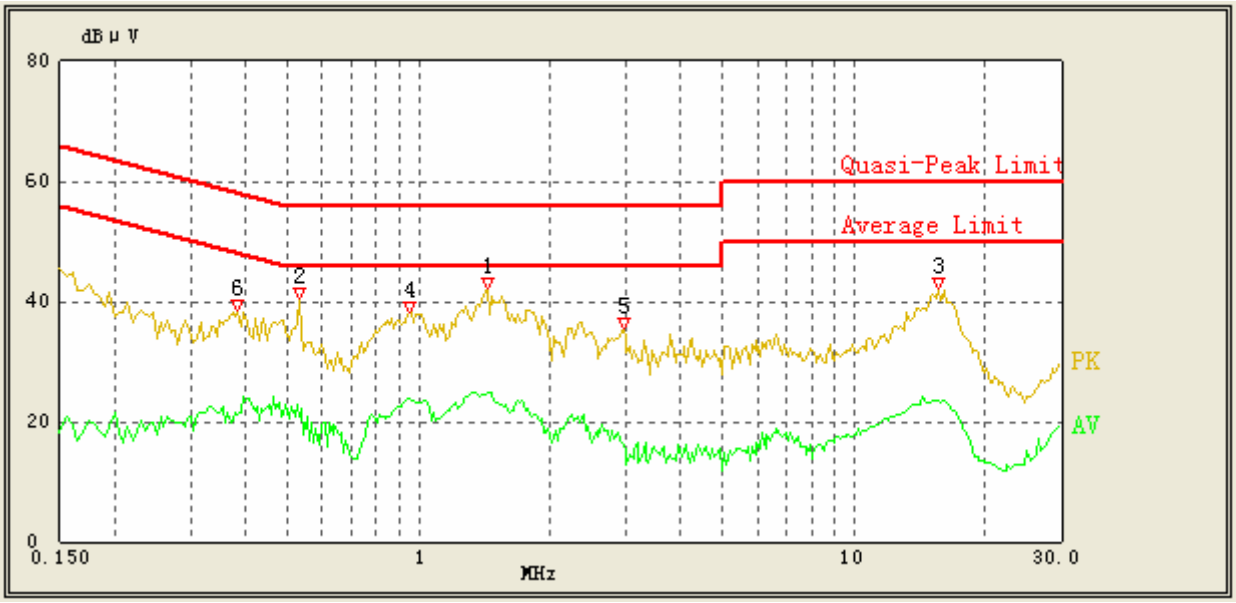
Temperature:	26 ° C
Relative Humidity:	48 %
ATM Pressure:	100.0 kPa

The testing was performed by Simon Mo on 2011-09-03.

Test Result: Pass

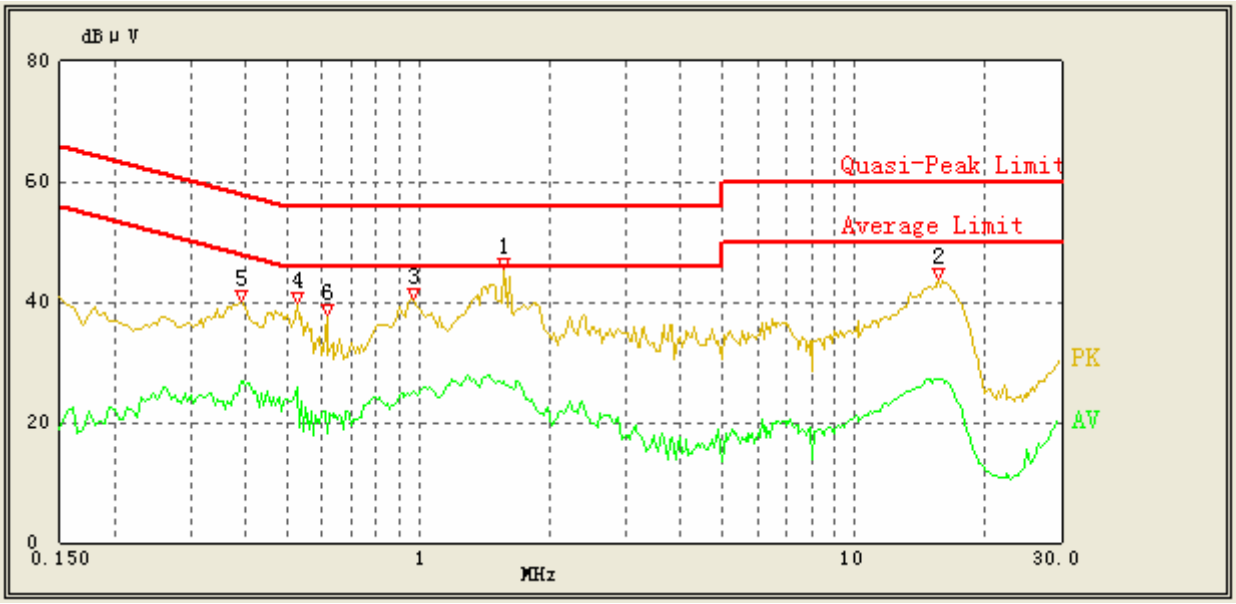
Test Mode: Operating

AC 120 V/60 Hz, Line



Conducted Emissions			FCC Part 15.207		
Frequency (MHz)	**Corrected Result (dBµV)**	**Corrected Factor (dB)**	**Limit (dBµV)**	**Margin (dB)**	**Detector (PK /QP/Ave)**
1.435	38.60	10.10	56.00	17.40	QP
1.435	24.85	10.10	46.00	21.15	Ave
0.530	33.05	10.10	56.00	22.95	QP
0.530	21.00	10.10	46.00	25.00	Ave
15.585	35.11	10.10	60.00	24.89	QP
15.600	23.66	10.10	50.00	26.34	Ave
0.955	36.46	10.10	56.00	19.54	QP
0.950	23.69	10.10	46.00	22.31	Ave
2.950	29.74	10.10	56.00	26.26	QP
2.920	16.38	10.10	46.00	29.62	Ave
0.385	32.96	10.10	59.29	26.33	QP
0.385	21.14	10.10	49.29	28.15	Ave

AC 120 V/ 60 Hz, Neutral



Conducted Emissions			FCC Part 15.207		
Frequency (MHz)	Corrected Result (dBμV)	Corrected Factor (dB)	Limit (dBμV)	Margin (dB)	Detector (PK /QP/Ave)
1.565	33.65	10.10	56.00	22.35	QP
1.565	26.90	10.10	46.00	19.10	Ave
15.630	37.77	10.10	60.00	22.23	QP
15.625	27.19	10.10	50.00	22.81	Ave
0.965	24.96	10.10	46.00	21.04	Ave
0.970	34.42	10.10	56.00	21.58	QP
0.525	33.23	10.10	56.00	22.77	QP
0.525	25.97	10.10	46.00	20.03	Ave
0.390	36.14	10.10	59.14	23.00	QP
0.390	26.71	10.10	49.14	22.43	Ave
0.615	24.93	10.10	56.00	31.07	QP
0.615	18.06	10.10	46.00	27.94	Ave

9. ANTENNA REQUIREMENT

APPLICABLE STANDARD

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

a. Antenna must be permanently attached to the unit.
b. Antenna must use a unique type of connector to attach to the EUT.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.
And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

ANTENNA CONNECTOR CONSTRRUCTION

The EUT use a built-in monopole antenna, the maximum antenna gain is 2.0dBi, which complies with the Part 15.203. Please see EUT photo for details.

Result: Compliant.