SK TECH CO., LTD.

Certificate of Compliance

Test Report No.:	**SKTTRT-050404-005**		
NVLAP CODE:	**200220-0**		
Applicant:	**iCanTek Co., Ltd.**		
Applicant Address:	211 2Fl, Seongnam Venture Building, #587 Sujin 1-Dong, Sujung-Gu, Seongnam-City, Kyonggi-Do, 461-804 Korea		
Device Under Test:	**Network Camera**		
FCC ID:	**S5MICANVIEW110W**	**Model No.:**	**iCanView110W**
Receipt No.:	SKTEU05-0141	**Date of receipt:**	February 28, 2005
Date of Issue:	April 04, 2005		
Location of Testing:	**SK TECH CO., LTD.** 820-2, Wolmoon-Ri, Wabu-Up, Namyangju-Si, Kyunggi-Do, Korea		
Test Procedure:	**ANSI C63.4 / 2003**		
Test Specification:	**47CFR, Part 15 Rules**		
Equipment Class:	**DTS - Digital Transmission System**		
Test Result:	The above-mentioned device has been tested and passed.		

Tested & Reported by: *Jong-Soo, Yoon*

2005. 04 .04

Signature *Date*

Approved by: *Jae-Kyung, Bae*

2005. 04 .04

Signature *Date*

Other Aspects:	
Abbreviations:	**· OK, Pass = passed · Fail = failed · N/A = not applicable**

☞
- **This test report is not permitted to copy partly without our permission.**
- **This test result is dependent on only equipment to be used.**
- **This test result is based on a single evaluation of one sample of the above mentioned.**
- **This test report must not be used to claim product endorsement by NVLAP or any agency of the U.S Government.**
- **We certify that this test report has been based on the measurement standards that is traceable to the national or International standards.**

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NVLAP Lab. Code: 200220-0

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1. GENERAL

These tests were performed using the test procedure outlined in ANSI C63.4, 2003 for intentional radiators, and in accordance with the limits set forth in FCC Part 15.247 for Digital Transmission System. The EUT (Equipment Under Test) has been shown to be capable of compliance with the applicable technical standards.

We attest to the accuracy of data. All measurements reported herein were performed by SK Tech Co., Ltd. and were made under Chief Engineer's supervision.
We assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

2. TEST SITE

SK TECH Co., Ltd.

2.1 Location

820-2, Wolmoon Ri, Wabu-Up, Namyangju-Si, Kyunggi-Do, Korea

This test site is in compliance with ISO/IEC 17025 for general requirements for the competence of testing and calibration laboratories.
This laboratory is accredited by NVLAP for NVLAP Lab. Code: 200220-0 and DATech for DAR-Registration No.: TTI-P-G155/97-10

2.2 List of Test and Measurement Instruments

Description	Manufacturer	Model #	Serial #	
Spectrum Analyzer	Agilent	E4405B	US40520856	☒
EMC Spectrum Analyzer	Agilent	E7405A	US40240203	☒
EMI Test Receiver	Rohde&Schwarz	ESVS10	825120/013	☒
EMI Test Receiver	Rohde&Schwarz	ESVS10	834468/008	☒
EMI Test Receiver	Rohde&Schwarz	ESHS10	825120/013	☒
EMI Test Receiver	Rohde&Schwarz	ESHS10	834468/008	☒
Artificial Mains Network	Rohde&Schwarz	ESH3-Z5	836679/018	☒
Pre-amplifier	HP	8447F	3113A05153	☒
Pre-amplifier	HP	8349B	2644A03250	☒
Power Meter	Agilent	E4418B	3318A13916	
Power Sensor	HP	8485A	3318A13916	
VHF Precision Dipole Antenna	Schwarzbeck	VHAP	1014	
VHF Precision Dipole Antenna	Schwarzbeck	VHAP	1015	
UHF Precision Dipole Antenna	Schwarzbeck	UHAP	989	
UHF Precision Dipole Antenna	Schwarzbeck	UHAP	990	
Loop Antenna	Schwarzbeck	HFH2-Z2	863048/019	
TRILOG Broadband Antenna	Schwarzbeck	VULB9160	3141	☒
Biconical Antenna	Schwarzbeck	VHA9103	2265	☒
Log-Periodic Antenna	Schwarzbeck	UHALP9107	1819	☒
Horn Antenna	AH Systems	SAS-200/571	304	☒
Horn Antenna	Electro Metrics	EM-6961	6297	
Horn Antenna	Electro Metrics	EM-6961	6298	
Vector Signal Generator	Agilent	E4438C	MY42080359	
Signal Generator	HP	8349B	2644A03250	
DC Power Supply	HP	6634A	2926A-01078	
DC Power Supply	HP	6268B	2542A-07856	
Digital Multimeter	HP	HP3458A	2328A14389	
PCS Interface	HP	83236B	3711J00881	
CDMA Mobile Test Set	HP	8924C	US35360253	
Hygro/Thermo Graph	SATO	PC-5000TRH-II	-	☒
Temperature/Humidity Chamber	All Three	ATH-50M	20030425	

2.3 Test Date

Date of Application : February 28, 2005

Date of Test : March 02, 2005 ~ March 04, 2005

2.4 Test Environment

See each test item's description.

3. DESCRIPTION OF THE EQUIPMENT UNDER TEST

The product specification described herein was obtained from the product data sheet or user's manual.

3.1 Rating and Physical Characteristics

Type / Model No.	Network Camera / iCanView110W
Power source	DC 12V from AC/DC Adaptor
Local Oscillator or X-Tal	X-Tal: 32.768kHz, 2.048MHz, 3.6864MHz, 20.0MHz, 24.576MHz, 27.0 MHz 19.069928MHz, 14.31818MHz
Transmit Frequency	2412 ~ 2462 MHz (11 channels, 5MHz step)
Antenna Type **	External (Model: W4E-WO-31, 50Ω, Max. 5.47dBi, WKE-2460, 50Ω, Max. 3dBi)
Type of Modulation	DSSS (DBPSK - 1Mbps, DQPSK - 2Mbps, CCK - 5.5/11 Mbps)
RF Output power	+15 dBm
External Ports	MIC/LINE-IN (Stereo Jack), LINE-OUT (Stereo Jack for speaker out), Video IN (BNC), ETHERNET (RJ-45), DC-Iris (standard DC Iris lens) RS-485 & Alarm IN/OUT, RS-232C (3Pin for debugging)

** The EUT uses FCC certificated RF module, FCC ID: MXF-C910530, except for the antenna that was used for the certification process. During the radiated measurements, the antenna Model W4E-WO-31, which has the highest gain, was used because the two antennas are of the same type.

3.2 Equipment Modifications

None.

3.3 Submitted Documents

Block diagram

Schematic diagram

Antenna Specification

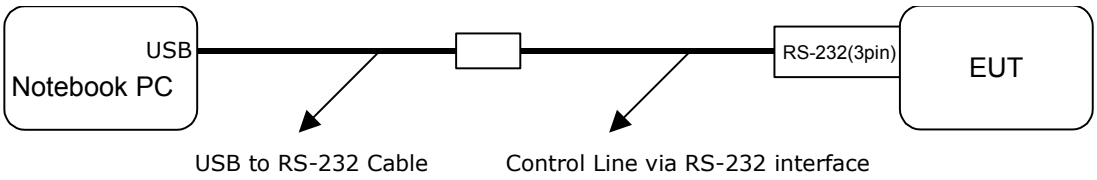
Part List

User manual

4. MEASUREMENT CONDITIONS

4.1 Description of test configuration

The measurements were taken in continuous transmitting mode. The operating frequency and modulation types of the EUT were controlled by the Notebook PC via RS-232 interface.



During the radiated measurements, the antenna Model W4E-WO-31, which has the highest gain maximum 5.47dBi, was used.

4.2 List of Peripherals

Equipment Type	Manufacturer	Model	Cable Description
AC Adaptor used for EUT	LI SHIN INTERNATIONAL ENTERPRISE CORP.	LES0107A1240	1.8m, Unshielded Power Line AC input: 100 - 240V, 50/60Hz DC output: 12V, 3.3A
Notebook PC	Trigem	Dreambook	1.8m, Shielded, USB to RS-232 Cable
Control Line**	--	--	1.0m, Unshielded

** For control of RF module via RS-232 interface in the EUT.

4.3 Uncertainty

Measurement Item	Combined Standard Uncertainty Uc	Expanded Uncertainty U = KUc (K = 2)
Conducted RF power	± 1.49 dB	±2.98dB
Radiated disturbance	± 2.37 dB	±4.74dB
Conducted disturbance	± 1.47 dB	±2.94dB

5. TEST AND MEASUREMENTS

Summary of Test Results

Requirement	CFR 47 Section	Report Section	Test Result
Antenna Requirement	15.203, 15.247(b)(4)	5.1	PASS
6dB Bandwidth	15.247(a)(2)	5.2	PASS
Maximum Peak Output Power	15.247(b)(3), (4)	5.3	PASS
Spurious Emission, Band Edge, and Restricted bands	15.247(d), 15.205(a), 15.209(a)	5.4	PASS
Peak Power Spectral Density	15.247(e)	5.5	PASS
Conducted Emissions	15.207(a)	5.6	PASS
RF Exposure	15.247(i), 1.1307(b)(1)	5.7	PASS

5.1 ANTENNA REQUIREMENT

5.1.1 Regulation

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 use of a standard antenna jack or electrical connector is prohibited.

And 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.

5.1.2 Result: PASS

The transmitter has a unique antenna connector, reverse polarity SMA type. The directional gain of the antenna is maximum 5.47 dBi for model W4E-WO-31 and 3 dBi for model WKE-2460.

5.2 6dB BANDWIDTH

5.2.1 Regulation

According to §15.247(a)(2), systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6dB bandwidth shall be at least 500 kHz.

5.2.2 Test Procedure

1. Connect the antenna port of the EUT to RF input on the spectrum analyzer via a low loss cable.
2. Set the spectrum analyzer as RBW = 100 kHz, VBW = 100 kHz, Span = 20 MHz, Sweep = AUTO.
3. Set the spectrum analyzer to MAX HOLD mode and then set a reference level on it equal to the highest peak value.
4. Mark the peak frequency and -6dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

5.2.3 Test Results: PASS

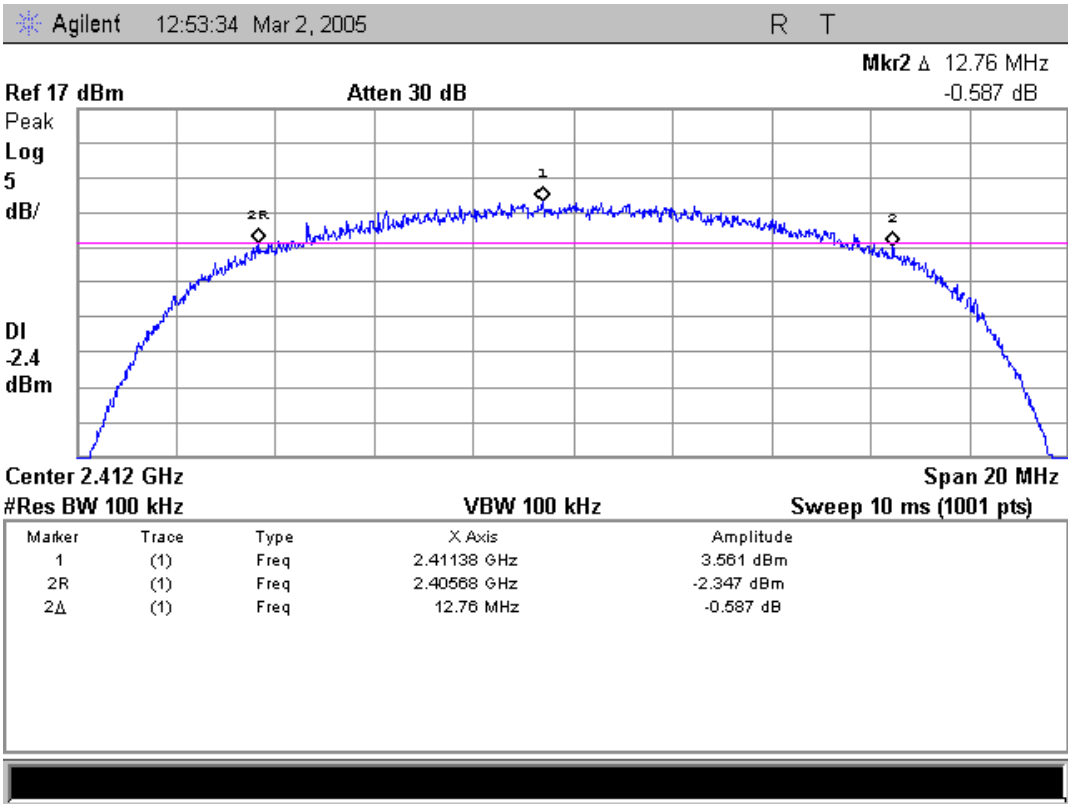
Table 1: Measured values of the 6dB Bandwidth (Conducted)

Operating frequency	6dB Bandwidth	Limit
2412 MHz	12.76 MHz	≥ 500 kHz
2437 MHz	12.48 MHz	≥ 500 kHz
2462 MHz	12.32 MHz	≥ 500 kHz

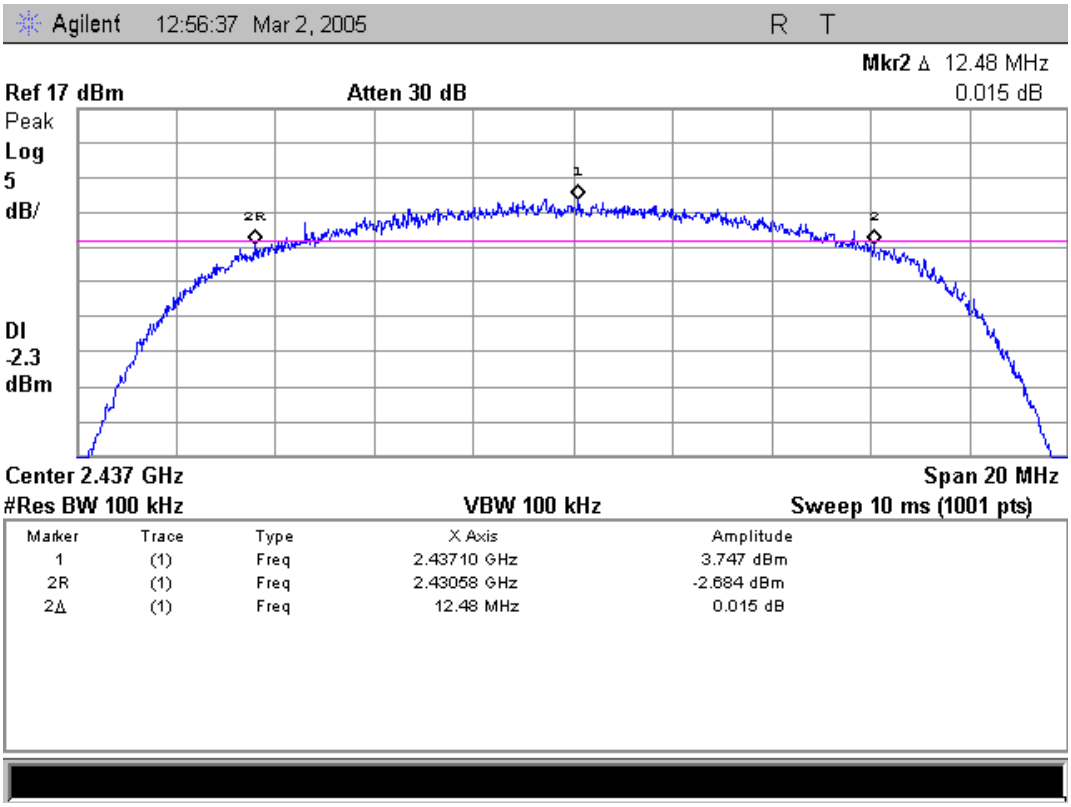
Initial investigations were performed with three modulation types: (DBPSK, DQPSK and CCK). No significant differences in 6dB bandwidth were observed. Final testing was performed while the transmitter continuously operating with the modulation rate of 5.5 Mbps (CCK).

Figure 1. Plot of the 6dB Bandwidth (Conducted)

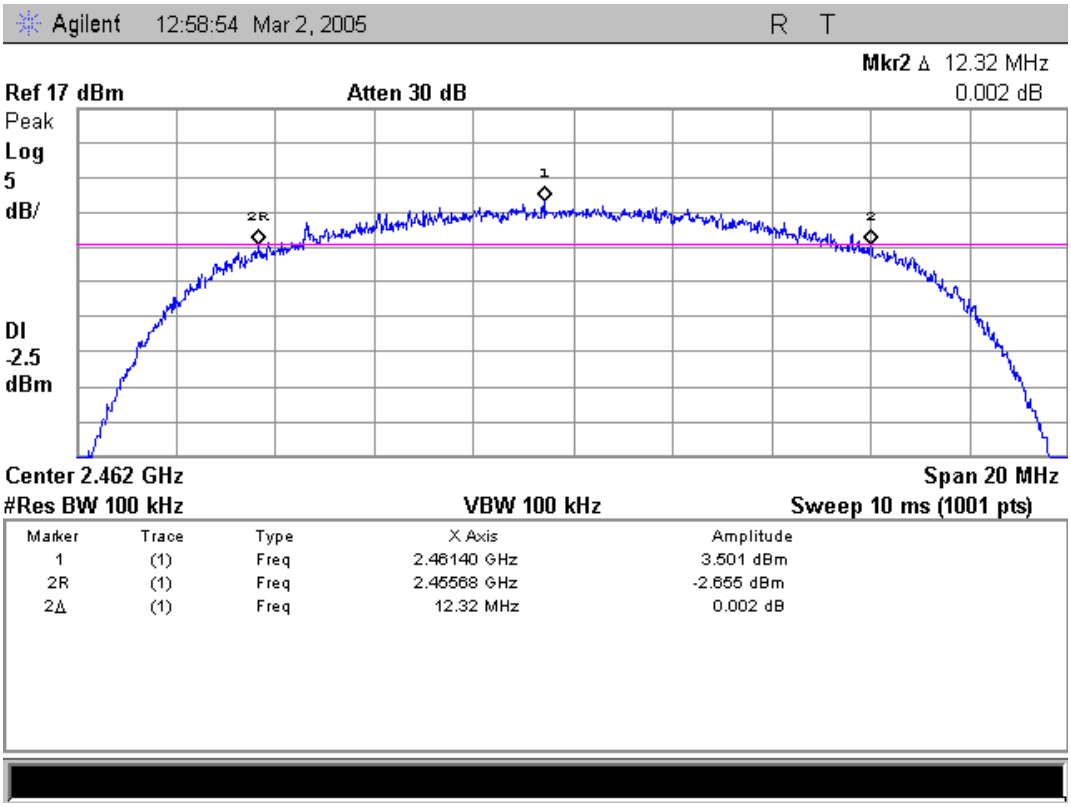
Lowest Channel (operating at 2412 MHz)



Middle Channel (operating at 2437 MHz)



Highest Channel (operating at 2462 MHz)



5.3 MAXIMUM PEAK OUTPUT POWER

5.3.1 Regulation

According to §15.247(b)(3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

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.

5.3.2 Test Procedure - Maximum Conducted Output Power

Power Output Option 1: Set the RBW > 6dB bandwidth of the emission or use a peak power meter.

Power Output Option 2: Public Notice 30Agust2002 - Measurement Procedure Updated for Peak Transmit Power in the Unlicensed National Information Infrastructure (U-NII) Bands.

1. Measure the transmission pulse duration (T) over which the transmitter is on and transmitting at its maximum power control level.
2. Measure entire emission bandwidth (EBW) that is 26 dB down from the peak of the emission.
3. Select the measurement method as following:

Sweep time	≤	T	Method #1 -- spectral trace averaging -- and sum the power across the band. (Method #1 may be used only if it results in averaging over intervals during which the transmitter is operating at its maximum power control level; intervals during which the transmitter is off or is transmitting at a reduced power level must not be included in the average)
Sweep time EBW	> ≤	T Largest available RBW	Method #2 --zero-span mode with trace averaging -- and find the temporal peak. (Method #2 may be used only if it results in averaging over intervals during which the transmitter is operating at its maximum power control level; intervals during which the transmitter is off or is transmitting at a reduced power level must not be included in the average)
Sweep time *EBW*	> >	*T* *Largest available RBW*	***Method #3** -- video averaging with max hold -- and sum power across the band.*

3.1 Method #1:

3.1.1 Set span to encompass the entire emission bandwidth (EBW) of the signal.
3.1.2 Set RBW = 1 MHz, VBW ≥ 3 MHz, and Sweep time = AUTO.
3.1.3 Use sample detector mode if bin width (i.e., span/number of points in spectrum display) < 0.5 RBW. Otherwise use peak detector mode.
3.1.4 Use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at full control power for entire sweep of every sweep. If the device transmits continuously, with no off intervals or reduced power intervals, the trigger may be set to "free run".
3.1.5 Trace average 100 traces in power averaging mode.
3.1.6 Compute power by integrating the spectrum across the 26 dB EBW of the signal. The integration can be performed using the spectrum analyzer's band power measurement function with band limits set equal to the EBW band edges.

3.2 Method #2:

3.2.1 Set zero span mode. Set center frequency to the midpoint between the -26 dB points of the signal.
3.2.2 Set RBW ≥ EBW, VBW ≥ 3 RBW. [If VBW ≥ 3 RBW is not available, use highest available VBW, but VBW must be ≥ RBW], and Sweep time = T
3.2.3 Use sample detector mode.
3.2.4 Use a video trigger with the trigger level set to enable triggering only on full power pulses.
3.2.5 Trace average 100 traces in power averaging mode.
3.2.6 Find the peak of the resulting average trace.

3.3 Method #3:

3.3.1 Set span to encompass the entire emission bandwidth (EBW) of the signal.
3.3.2 Set sweep trigger to "free run", Set RBW = 1 MHz, VBW ≥ 1/T, and Sweep time = AUTO.
3.3.3 Use linear display mode.
3.3.4 Use sample detector mode if bin width (i.e., span/number of points in spectrum) < 0.5 RBW. Otherwise use peak detector mode.
3.3.5 Set max hold.
3.3.6 Allow max hold to run for 60 seconds.
3.3.7 Compute power by integrating the spectrum across the 26 dB EBW or apply a bandwidth correction factor of 10 log(EBW/1 MHz) to the spectral peak of the emission. The integration can be performed using the spectrum analyzer's band power measurement function with band limits set equal to the EBW band edges.

5.3.3 Test Results: PASS

Table 2: Measured values of the Maximum Conducted Output Power (Conducted)

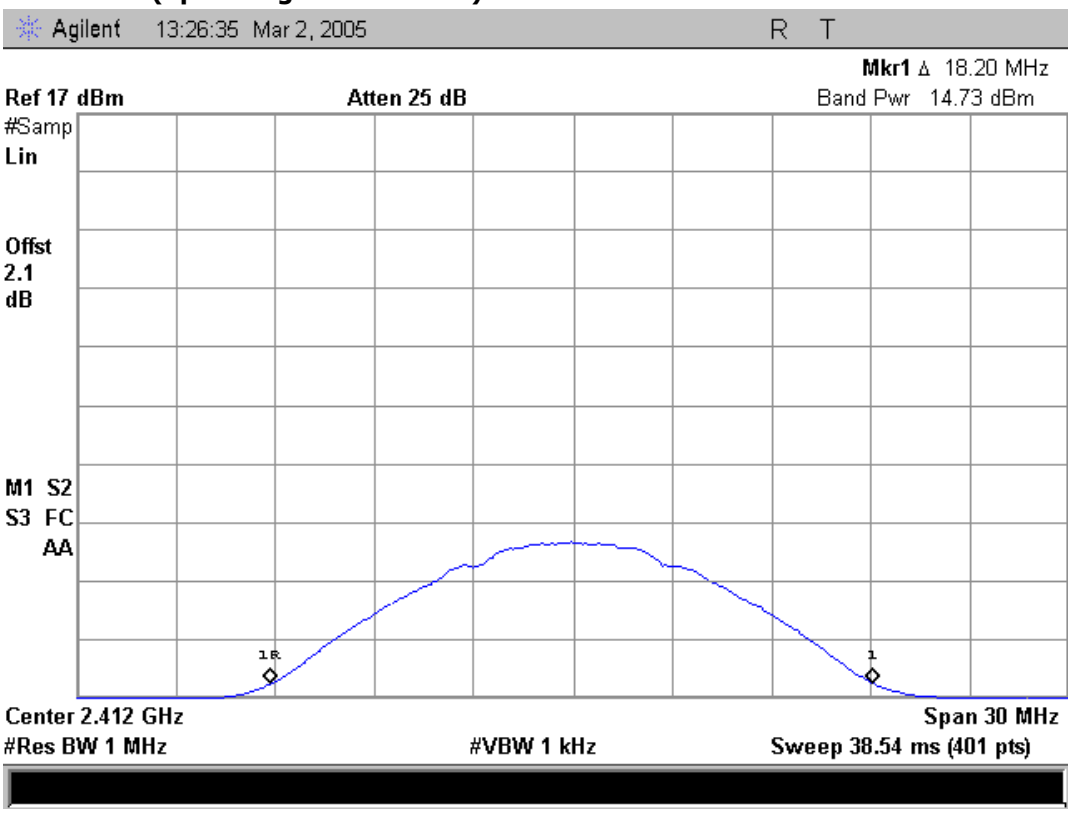
Operating Frequency	RBW	VBW	Detector	Cable Loss	Reading (Band Power)		Limit
2412 MHz	1 MHz	1 kHz	Sample	2.1 dB	14.73 dBm	0.0297 W	1 W
2437 MHz	1 MHz	1 kHz	Sample	2.1 dB	14.59 dBm	0.0288 W	1 W
2462 MHz	1 MHz	1 kHz	Sample	2.1 dB	14.39 dBm	0.0275 W	1 W

Cable Loss was included in Reading as Offset.
Transmission time (T) = 1.945 ms, 1/T = 514 Hz
Entire emission bandwidth (EBW) ≤ 18.2 MHz
Initial investigations were performed with three modulation types: (DBPSK, DQPSK and CCK). No significant differences in power were observed. Final testing was performed while the transmitter continuously operating with the modulation rate of 5.5 Mbps (CCK).

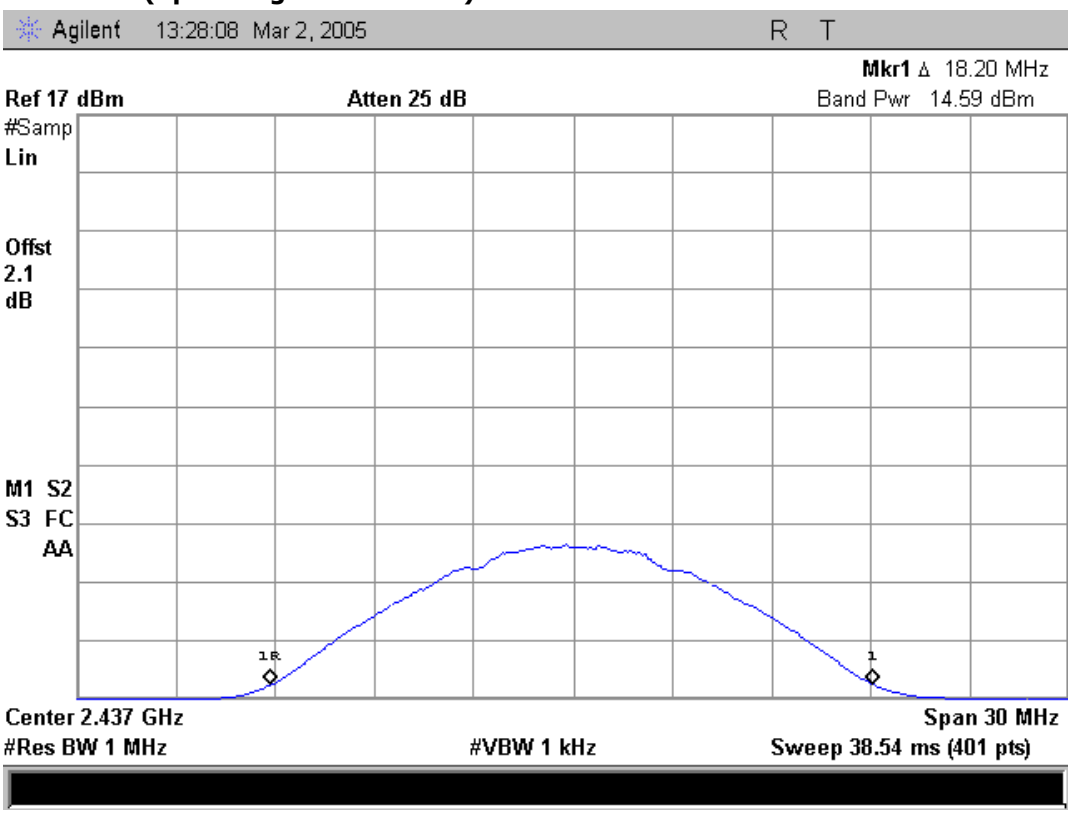
NOTE: Since the directional gain of the external antenna declared by manufacturer (G_{ANT} = 5.47 dBi and 3 dBi) does not exceed 6.0 dBi, there was no need to reduce the output power.

Figure 2. Plot of the Maximum Conducted Output Power (Conducted)

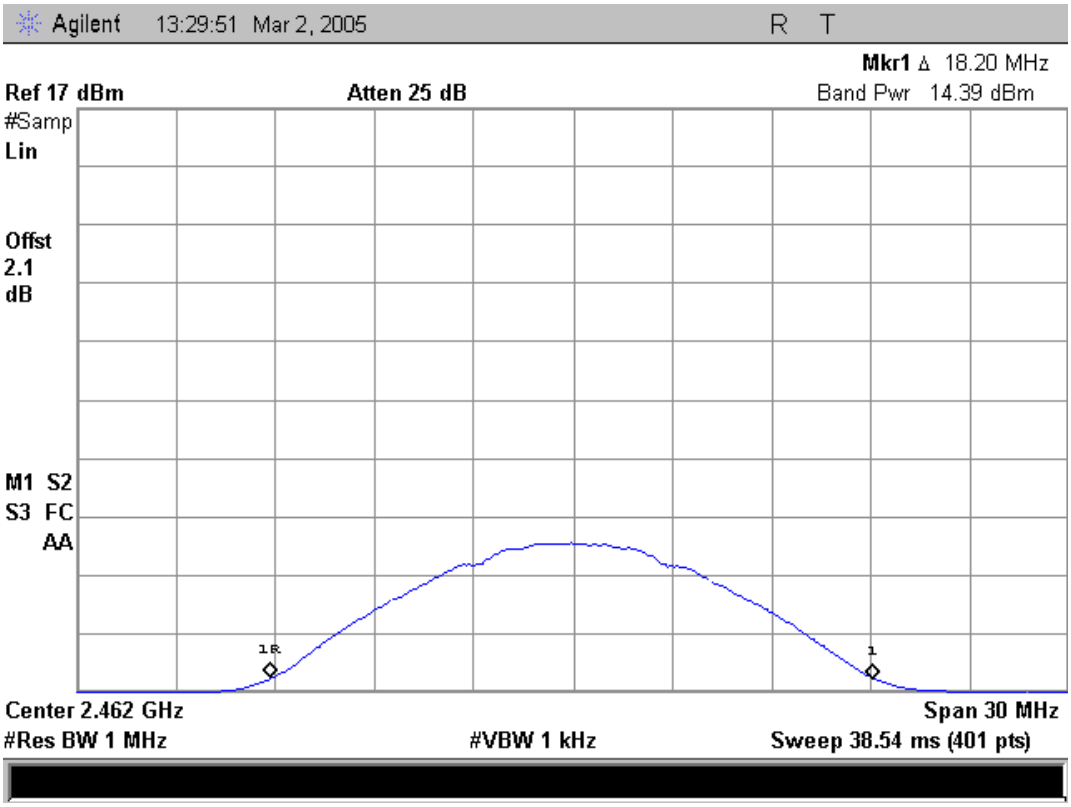
Lowest Channel (operating at 2412 MHz)



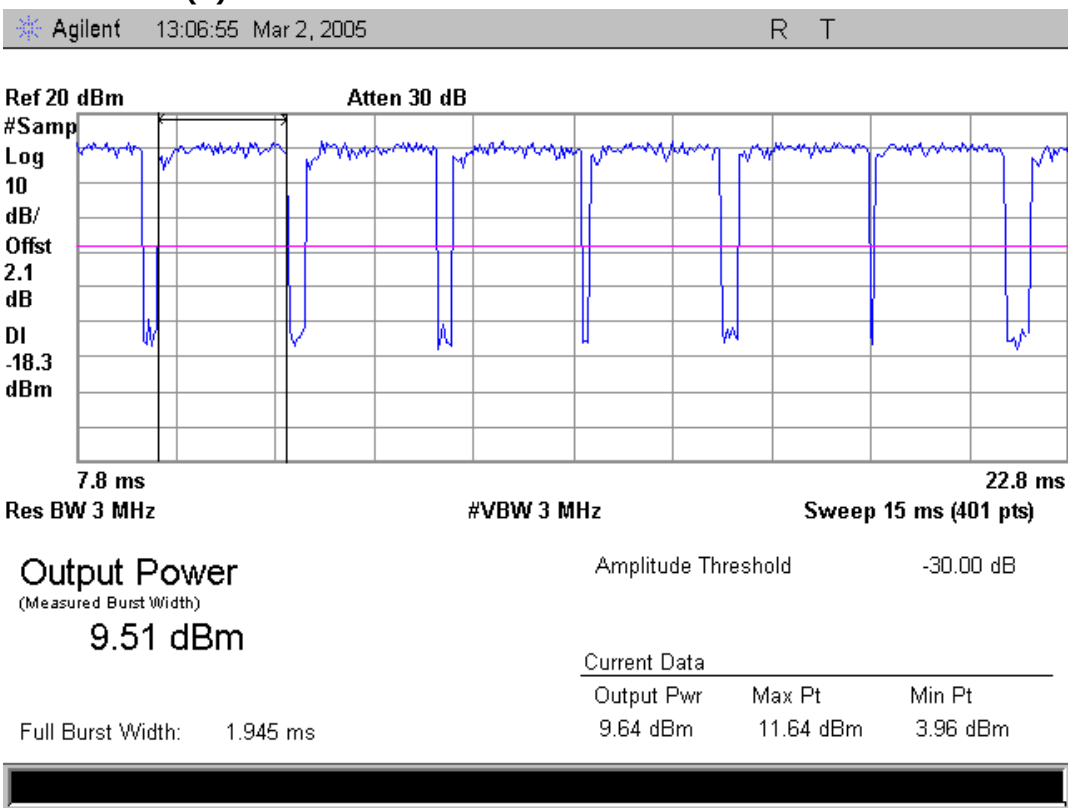
Middle Channel (operating at 2437 MHz)



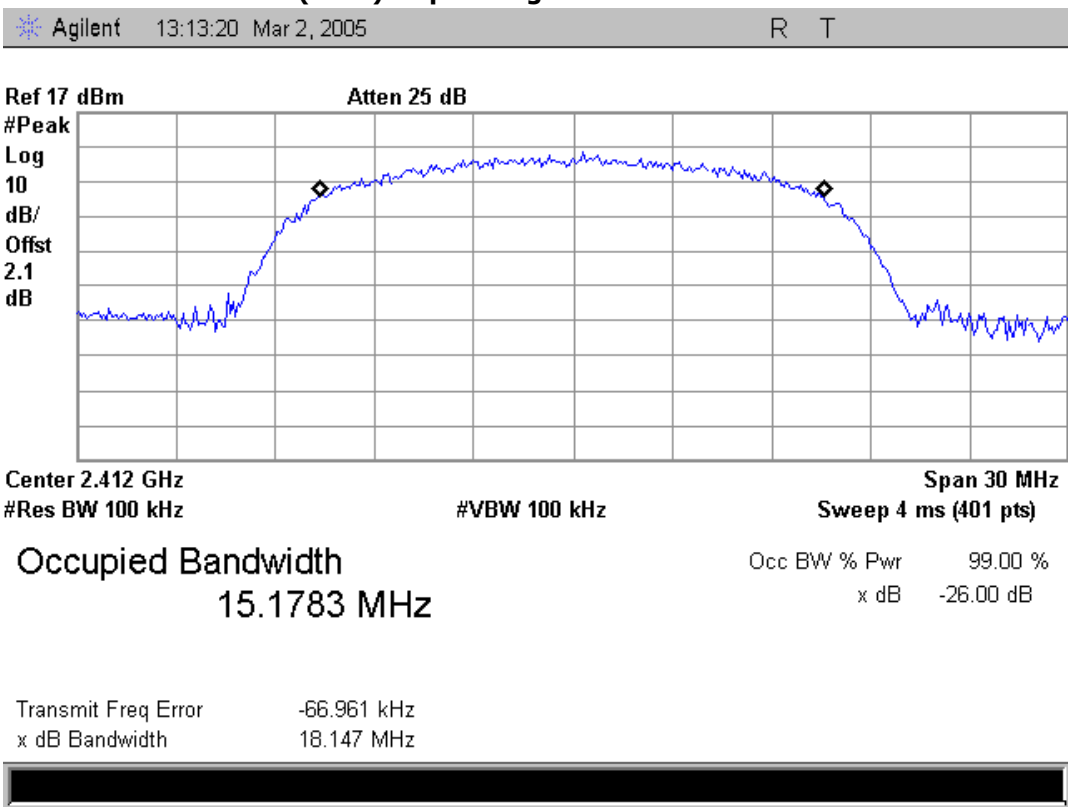
Highest Channel (operating at 2462 MHz)



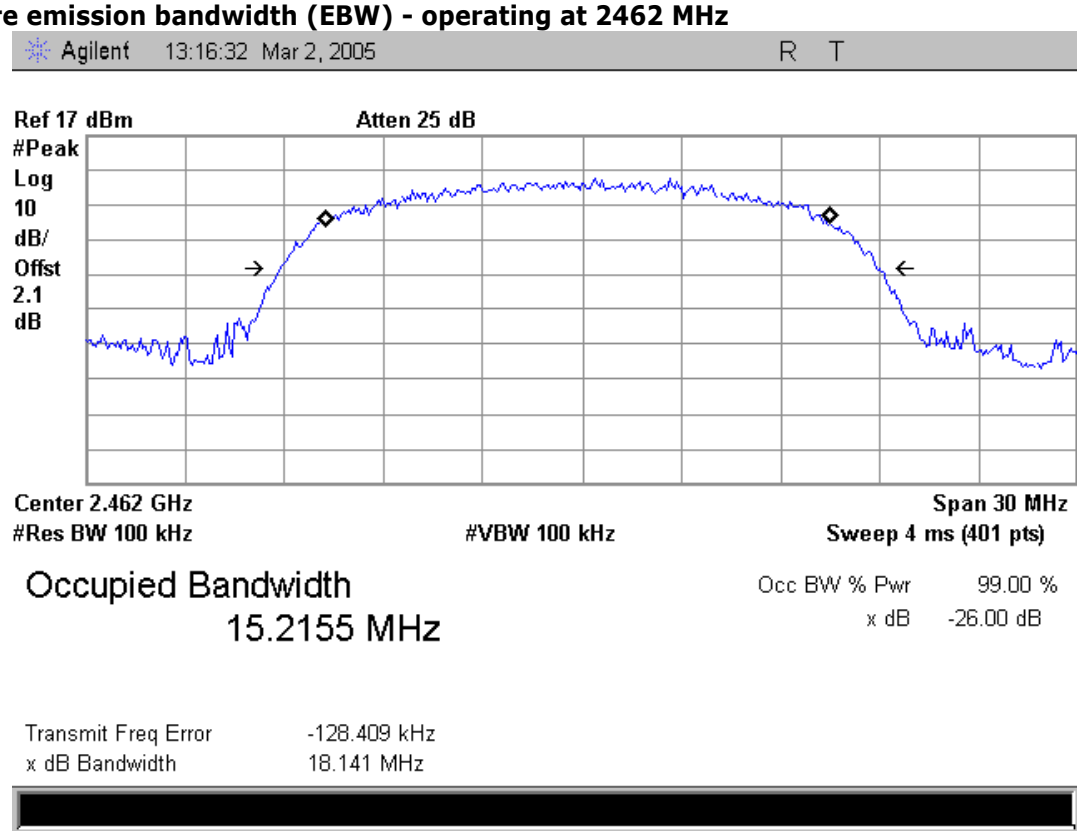
Transmission time (T)



Entire emission bandwidth (EBW) - operating at 2412 MHz



Entire emission bandwidth (EBW) - operating at 2462 MHz



5.4 SPURIOUS EMISSIONS, BAND EDGE, AND RESTRICTED BANDS

5.4.1 Regulation

According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in 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)).

According to §15.209(a), for an intentional device, the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency (MHz)	Field strength (μV/m @ 3m)	Field strength (dBμV/m @ 3m)
30–88	100	40.0
88–216	150	43.5
216–960	200	46.0
Above 960	500	54.0

According to §15.109(a), for an unintentional device, except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the above table.

** The emission limits shown in the above table are based on measurement instrumentation employing a CISPR quasi-peak detector and above 1000 MHz are based on the average value of measured emissions.

5.4.2 Test Procedure

1) Spurious RF Conducted Emissions:

1. Connect the antenna port of the EUT to RF input on the spectrum analyzer via a low loss cable.
2. Turn on the EUT and set it to any one measured frequency within its operating range by controlling and make sure the spectrum analyzer is operated in its linear range.
3. Set the spectrum analyzer to MAX HOLD mode with RBW = 100kHz, VBW = 100kHz and wide SPAN enough to capture the peak level of the in-band emission and all spurious emissions from the lowest frequency generated in the EUT up through the 10th harmonic.
4. Set the marker on the peak of any spurious emission, and then measure the peak level of the emissions marked, using the spectrum analyzer with RBW = 100kHz, VBW = 100kHz, and SPAN = 100MHz.
5. Repeat above procedures until all frequencies measured were complete.

2) Spurious Radiated Emissions:

1. The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions in an anechoic chamber at a distance of 3 meters.
2. The EUT was placed on the top of the 0.8-meter height, 1 × 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360˚.
3. The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 30 to 1000 MHz using the TRILOG broadband antenna, and from 1000 MHz to 18000 MHz using the horn antenna.
4. To obtain the final measurement data, the EUT was arranged on a turntable situated on a 4 × 4 meter at the Open Area Test Site. The EUT was tested at a distance 3 meters.
5. Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.
6. The EUT was operated in transmitting mode and tested in three orthogonal planes. The measurements were performed at the operating frequency: 1 near top, 1 near middle and 1 near bottom.
7. The presence of ambient signals was verified by turning the EUT off. In case an ambient signal was detected, the measurement bandwidth was reduced temporarily and verification was made that an additional adjacent peak did not exist. This ensures that the ambient signal does not hide any emissions from the EUT.
8. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:

   (a) PEAK: RBW = 1MHz, VBW = 1MHz, and Sweep = AUTO

   (b) AVERAGE: RBW = 1MHz, VBW = 30Hz, and Sweep = AUTO

5.4.3 Test Results: PASS

Table 3: Measured values of the RF antenna port emissions (Conducted)

Frequency [MHz]	Reading [dBm]	Cable Loss [dB]	Actual [dBm]	Limit [dBm]	Margin [dB]
Lowest Channel (operating at 2412 MHz)					
2412.0	+3.81	2.1	+5.91	-	-
2375.0	-52.38	2.1	-50.28	-24.09	26.19
2390.0	-51.50	2.1	-49.40	-24.09	25.31
2400.0	-39.13	2.1	-37.03	-24.09	12.94
4824.0	---	3.5	-	-24.09	-
Middle Channel (operating at 2437 MHz)					
2437.0	+3.80	2.1	+5.90	-	-
4874.0	---	3.5	-	-24.10	-
Highest Channel (operating at 2462 MHz)					
2462.0	+3.78	2.1	+5.88	-	-
2483.5	-53.03	2.1	-50.93	-24.12	26.81
2500.0	-52.61	2.1	-50.51	-24.12	26.39
4924.0	---	3.5	-	-24.12	-

Actual = Reading + Cable Loss

Remark "---" means the emission level was too low to be measured or in the noise floor.

NOTE: All the Reading values were taken using Spectrum Analyzer with RBW=100 kHz, VBW=100 kHz, and SPAN=100 MHz. If the EUT complies with the use of Power Output Option 2, all harmonics/spurs shall be at least 30 dB down from the highest emission level within the authorized band.

Table 4: Measured values of the Field strength of spurious emission (Radiated)

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Antenna Height [m]	Table Angle [°]	Reading [dB(μV)]	Amp Gain [dB]	AF / CL [dB(1/m)]	Actual [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Quasi-peak data, emissions below 1000 MHz										
132.4	120	H	1.2	175	47.8	27.7	13.9/1.7	35.7	43.5	7.8
171.5	120	H	2.4	89	38.9	27.4	15.6/2.1	29.2	43.5	14.3
176.1**	120	H	1.2	228	42.3	27.4	15.7/2.1	32.7	43.5	10.8
198.3**	120	H	1.2	250	41.5	27.2	16.1/2.3	32.7	43.5	10.8
220.7**	120	H	1.2	158	46.9	27.0	16.9/2.8	39.6	46.0	6.4
226.4**	120	H	1.0	89	40.7	27.2	17.1/2.5	33.1	46.0	12.9
352.2**	120	H	2.4	290	41.4	27.4	17.0/3.5	34.5	46.0	11.5
** Does not fall in the restricted bands specified in Section 15.205										
AVERAGE data, emissions above 1000 MHz										
2412.0	1000	H	1.0	86	88.36	30.1	29.2/7.4	94.86	-	-
2390.0	1000	H	1.0	86	39.10	30.1	29.2/7.4	45.60	54.00	8.40
2375.0	1000	H	1.0	86	40.85	30.1	29.2/7.4	47.35	54.00	6.65
2462.0	1000	H	1.0	37	89.23	30.1	29.2/7.4	95.73	-	-
2483.5	1000	H	1.0	37	38.92	30.1	29.2/7.4	45.42	54.00	8.58
2500.0	1000	H	1.0	37	40.22	30.1	29.2/7.4	46.72	54.00	7.28
PEAK data, emissions above 1000 MHz										
2412.0	1000	H	1.0	86	101.70	30.1	29.2/7.4	108.20	-	-
2390.0	1000	H	1.0	86	60.18	30.1	29.2/7.4	66.68	74.00	7.32
2375.0	1000	H	1.0	86	59.90	30.1	29.2/7.4	66.40	74.00	7.60
2462.0	1000	H	1.0	37	100.09	30.1	29.2/7.4	106.59	-	-
2483.5	1000	H	1.0	37	61.33	30.1	29.2/7.4	67.83	74.00	6.17
2500.0	1000	H	1.0	37	61.27	30.1	29.2/7.4	67.77	74.00	6.23

Margin (dB) = Limit – Actual

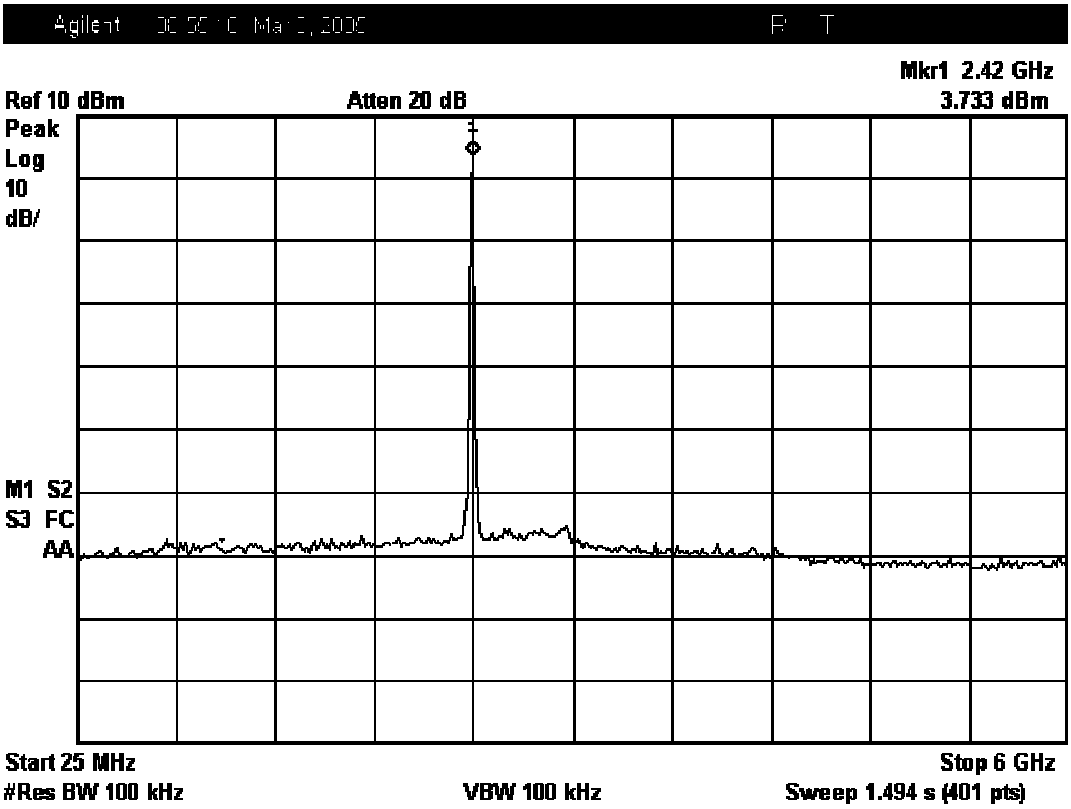
[Actual = Reading – Amp Gain + AF + CL]

1. H = Horizontal, V = Vertical Polarization
2. AF/CL = Antenna Factor and Cable Loss

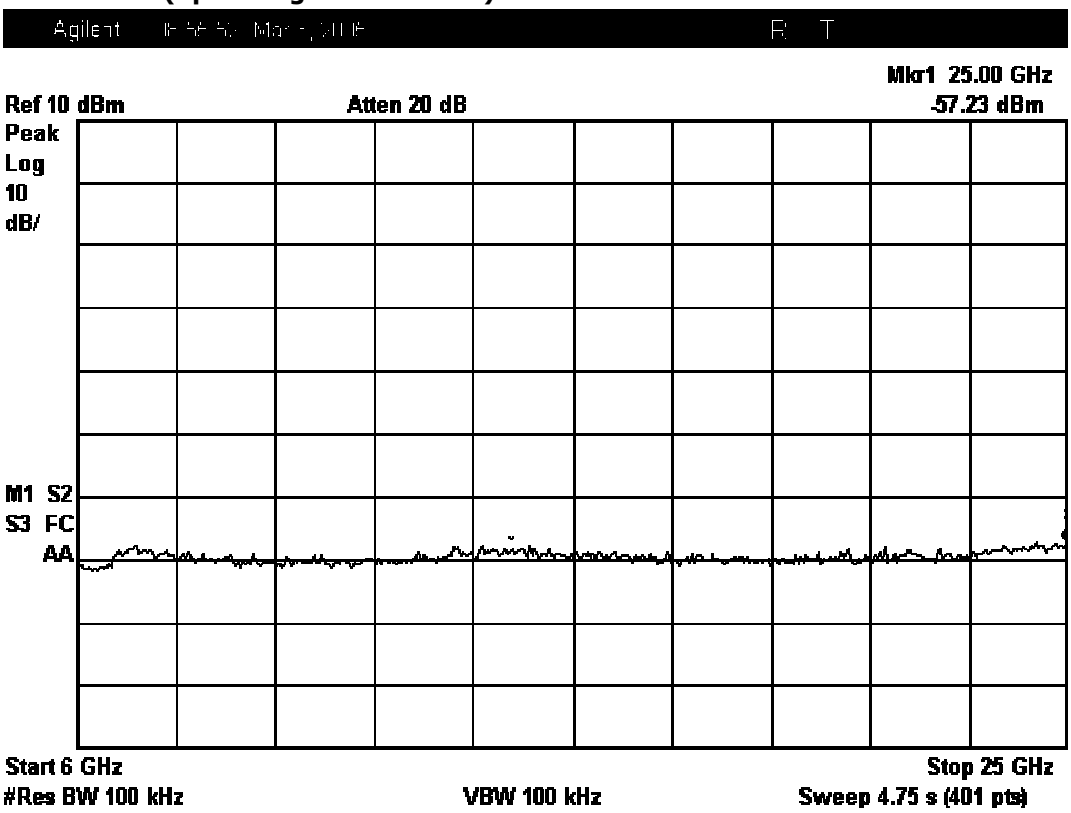
NOTE: The spectrum was scanned from 30 MHz to 18 GHz. All emissions not reported were more than 20 dB below the specified limit or in the noise floor. The measured data in the above table include the spurious radiated emissions that do not fall in the restricted bands.

Figure 3. Plot of the RF antenna port emissions (Conducted)

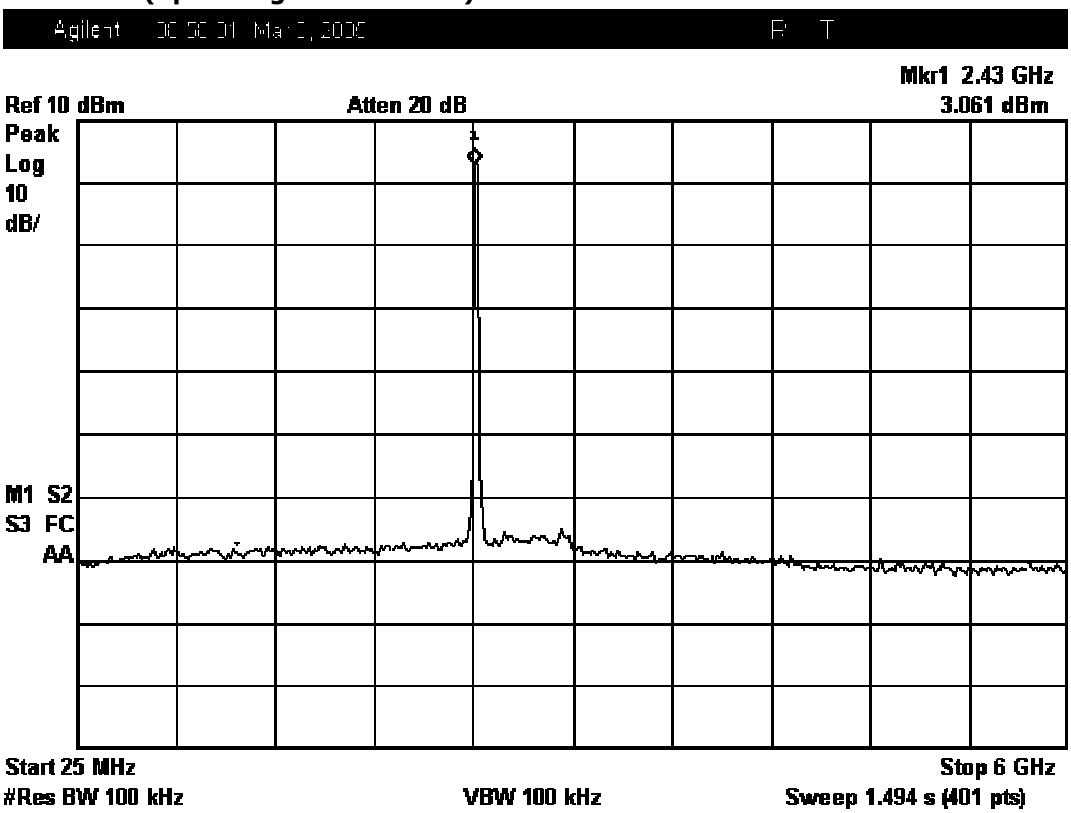
Lowest Channel (operating at 2412 MHz): 30MHz ~ 6GHz



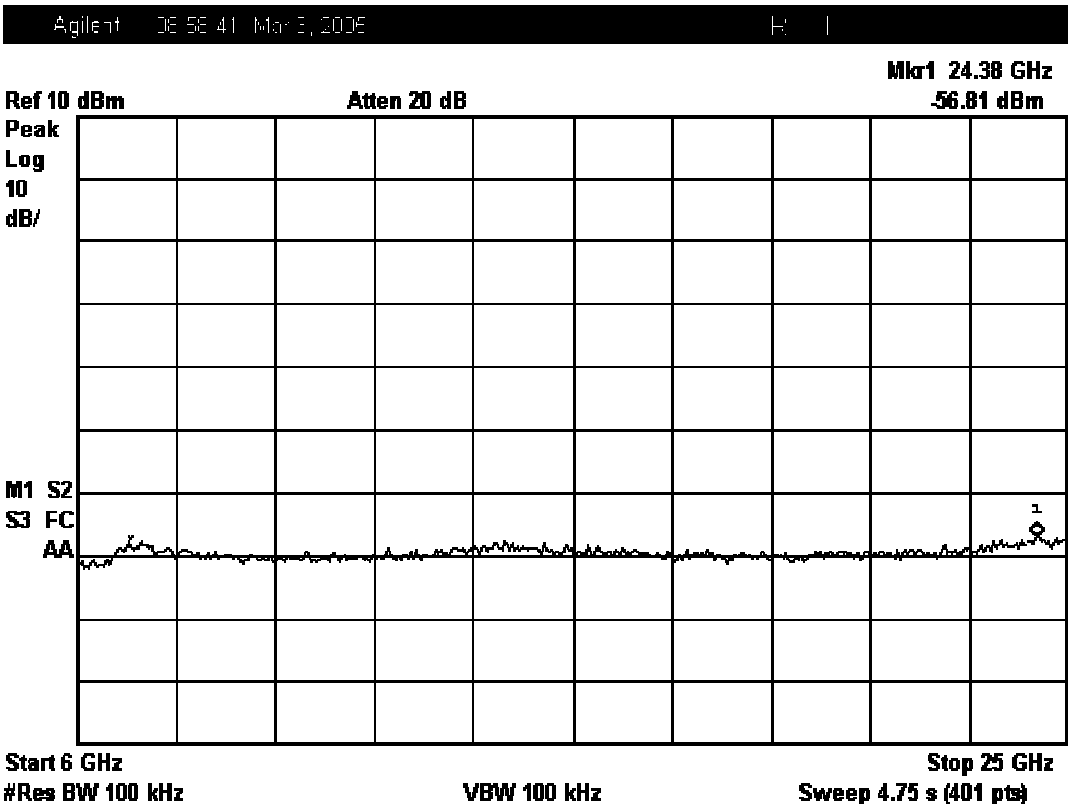
Lowest Channel (operating at 2412 MHz): 6GHz ~ 25GHz



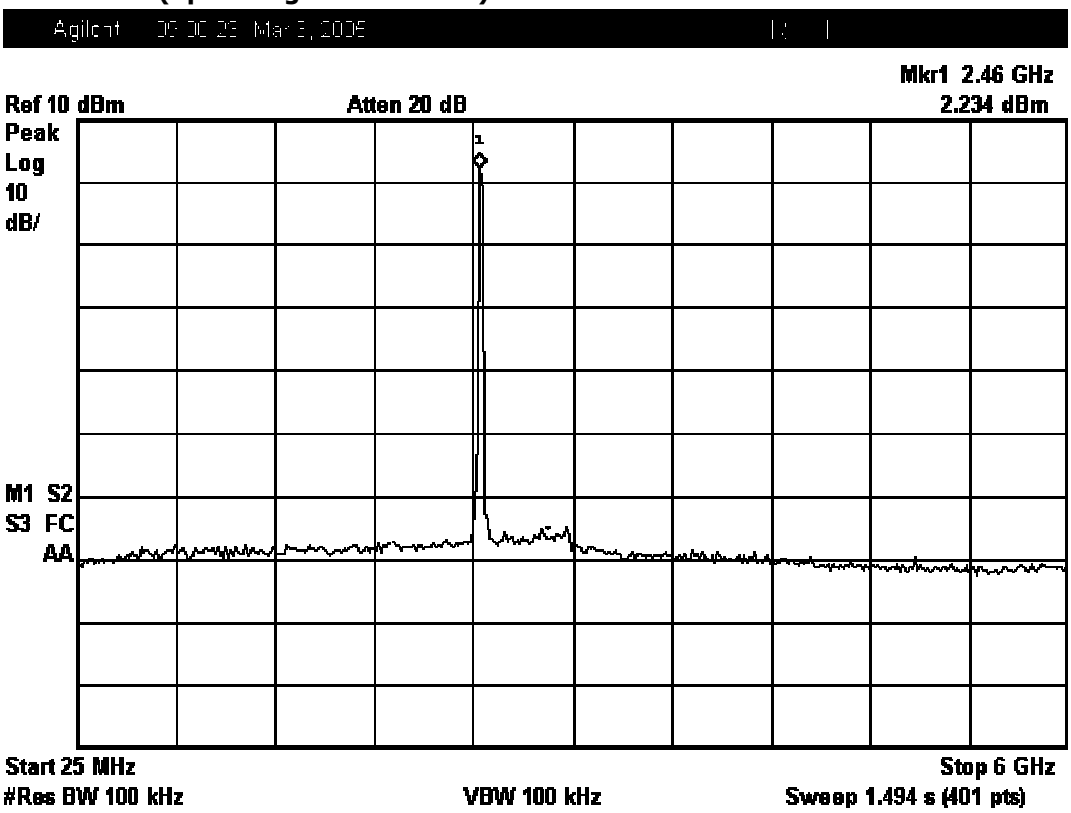
Middle Channel (operating at 2437 MHz): 30MHz ~ 6GHz



Middle Channel (operating at 2437 MHz): 6GHz ~ 25GHz



Highest Channel (operating at 2462 MHz): 30MHz ~ 6GHz



Highest Channel (operating at 2462 MHz): 6GHz ~ 25GHz

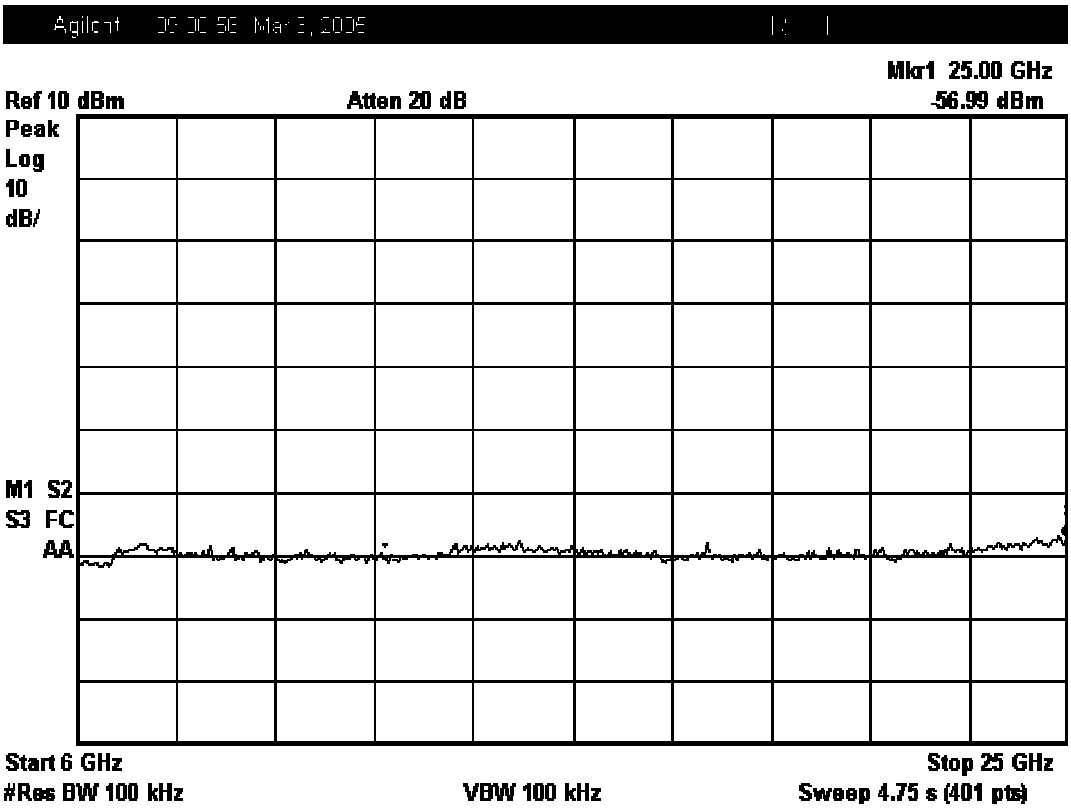
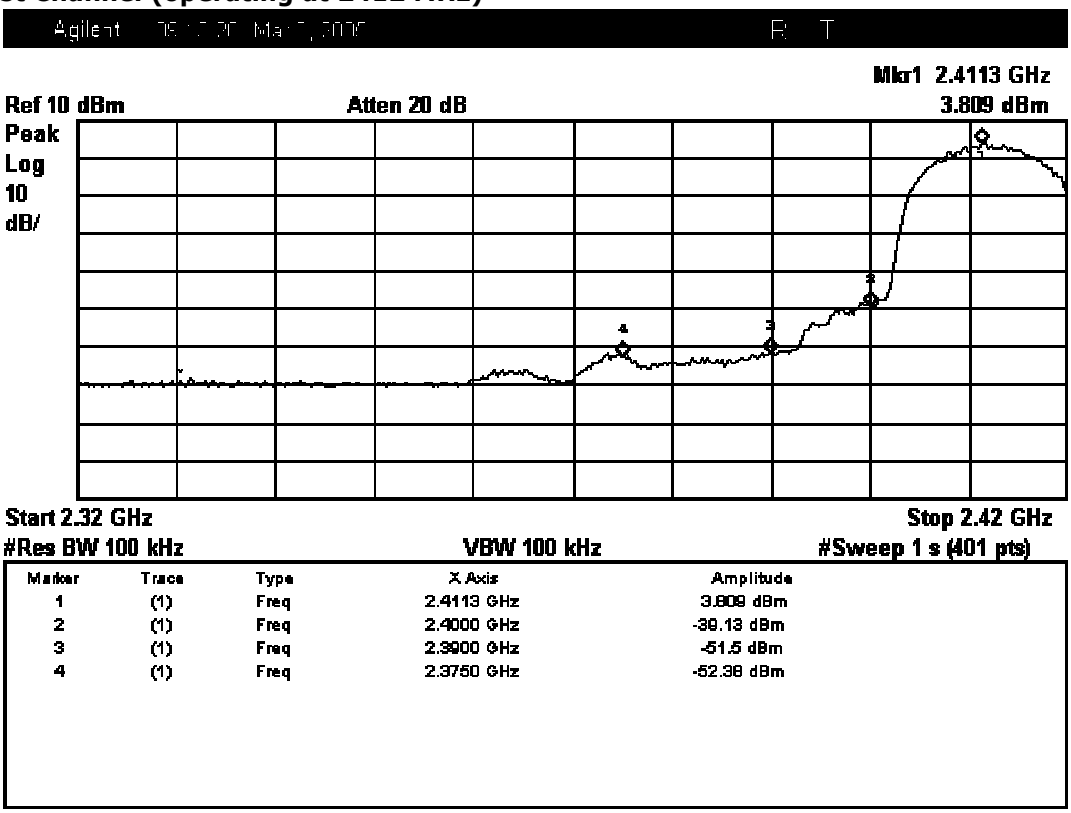


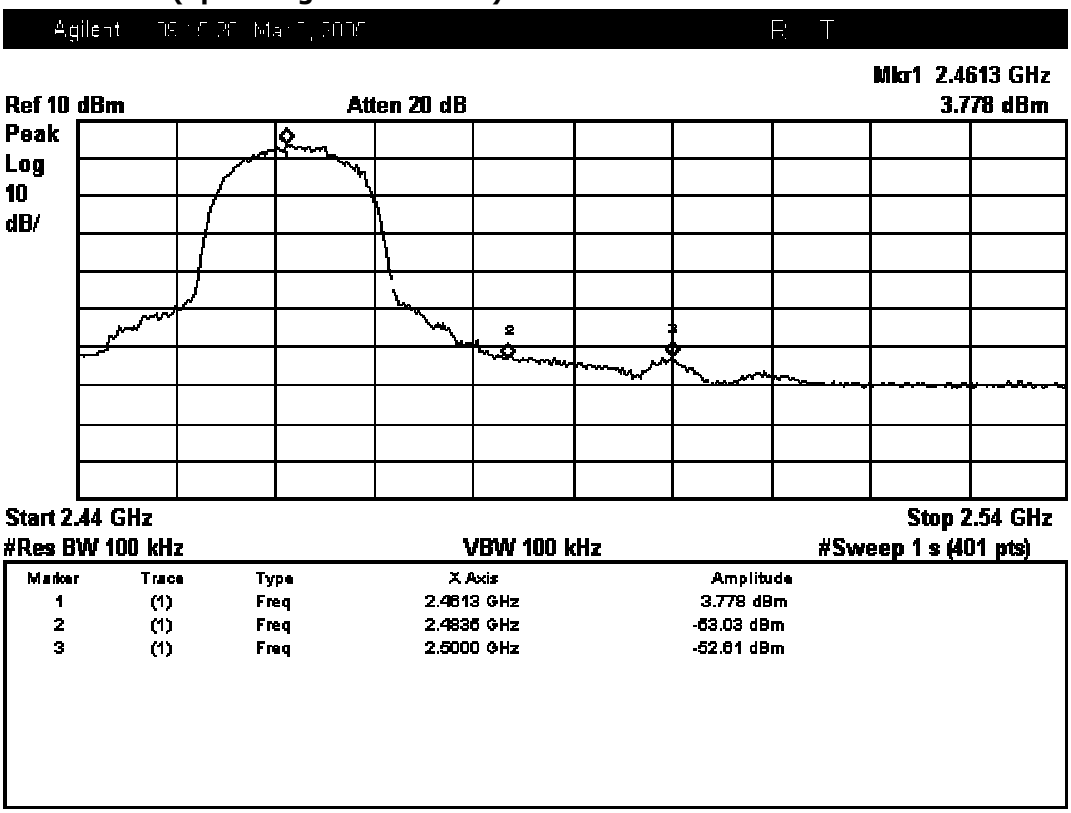
Figure 4. Plot of the Band Edge (Conducted)

Lowest Channel (operating at 2412 MHz)



Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.4113 GHz	3.809 dBm
2	(1)	Freq	2.4000 GHz	-39.13 dBm
3	(1)	Freq	2.3900 GHz	-51.5 dBm
4	(1)	Freq	2.3750 GHz	-52.38 dBm

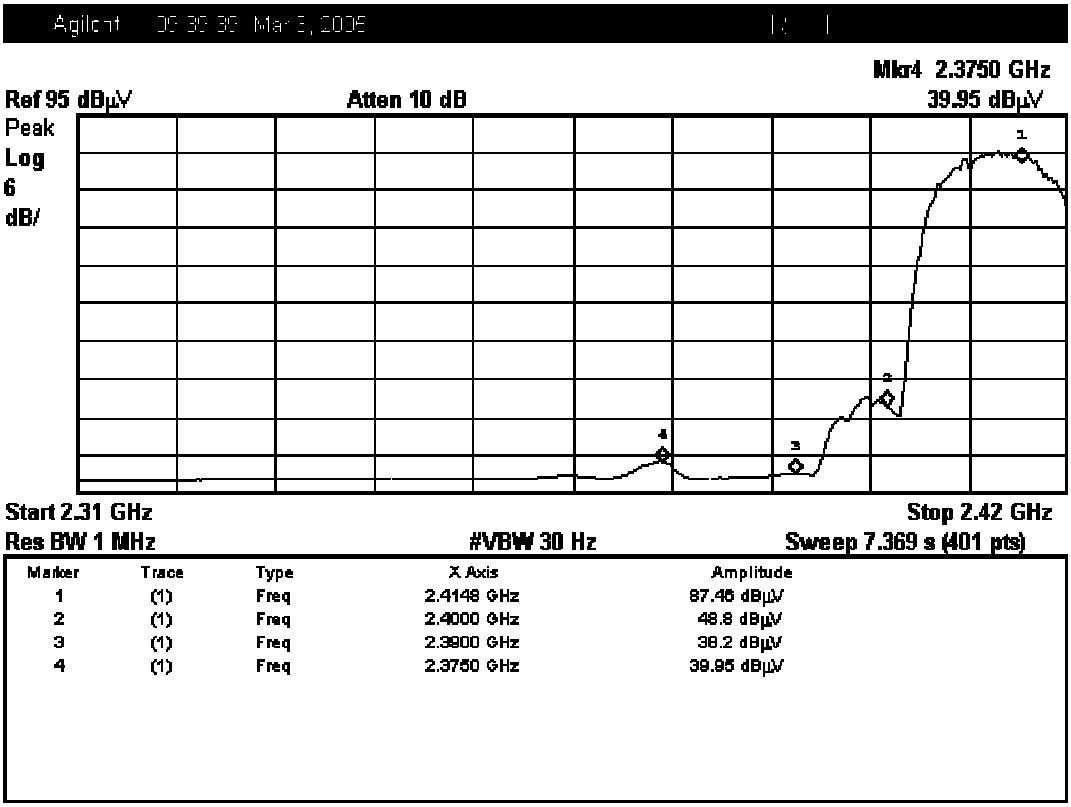
Highest Channel (operating at 2462 MHz)



Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.4613 GHz	3.778 dBm
2	(1)	Freq	2.4836 GHz	-53.03 dBm
3	(1)	Freq	2.5000 GHz	-52.61 dBm

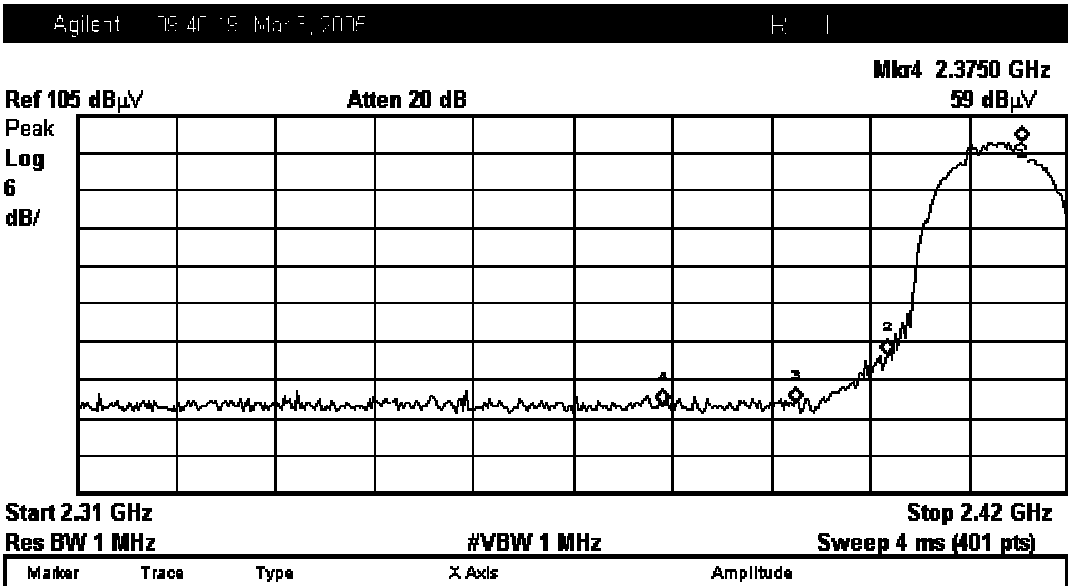
Figure 5. Plot of the Band Edge (Radiated)

Lowest Channel (operating at 2412 MHz): 2310 ~ 2390 MHz, AVERAGE



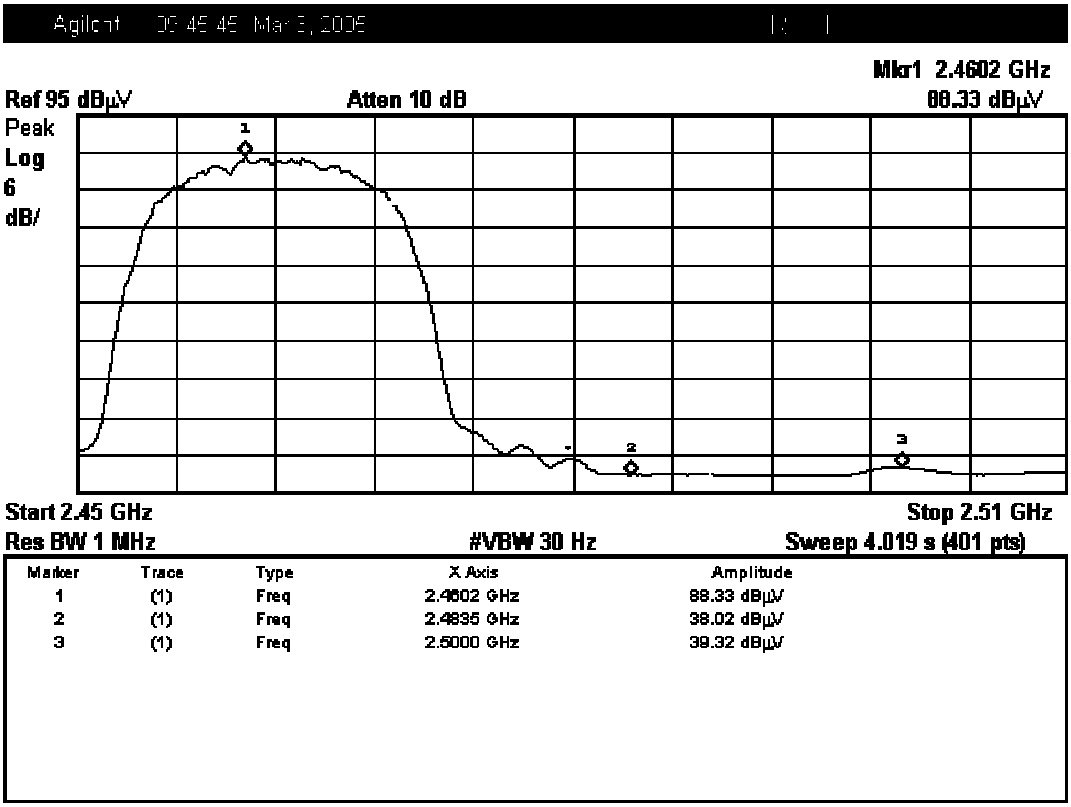
Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.4148 GHz	87.46 dBµV
2	(1)	Freq	2.4000 GHz	48.8 dBµV
3	(1)	Freq	2.3900 GHz	38.2 dBµV
4	(1)	Freq	2.3750 GHz	39.95 dBµV

Lowest Channel (operating at 2412 MHz): 2310 ~ 2390 MHz, PEAK



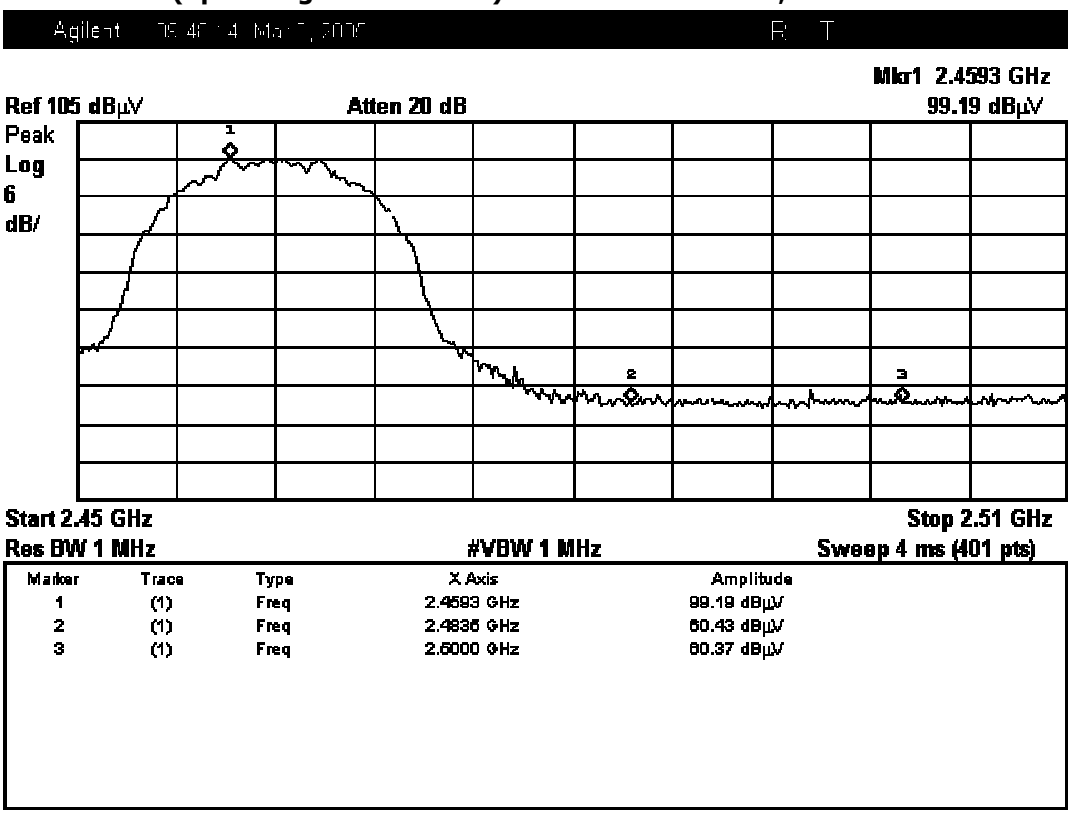
Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.4148 GHz	100.8 dBµV
2	(1)	Freq	2.4000 GHz	66.91 dBµV
3	(1)	Freq	2.3900 GHz	59.28 dBµV
4	(1)	Freq	2.3750 GHz	59 dBµV

Highest Channel (operating at 2462 MHz): 2483.5 ~ 2500MHz, AVERAGE



Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.4602 GHz	88.33 dBµV
2	(1)	Freq	2.4835 GHz	38.02 dBµV
3	(1)	Freq	2.5000 GHz	39.32 dBµV

Highest Channel (operating at 2462 MHz): 2483.5 ~ 2500MHz, PEAK



Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.4593 GHz	99.19 dBµV
2	(1)	Freq	2.4836 GHz	60.43 dBµV
3	(1)	Freq	2.5000 GHz	60.37 dBµV

5.5 PEAK POWER SPECTRAL DENSITY

5.5.1 Regulation

According to §15.247(e) 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. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

5.5.2 Test Procedure

1. Connect the antenna port of the EUT to RF input on the spectrum analyzer via a low loss cable.
2. Locate and zoom in on emission peak(s) within the passband.
3. Set RBW = 3kHz, VBW = 10kHz, Span = 1.5MHz, and Sweep = 500 seconds.
4. Measure the highest amplitude appearing on spectral display and record the level to calculate results.
5. Repeat above procedures until all frequencies measured were complete.

5.5.3 Test Results: PASS

Table 5: Measured values of the Peak Power Spectral Density (Conducted)

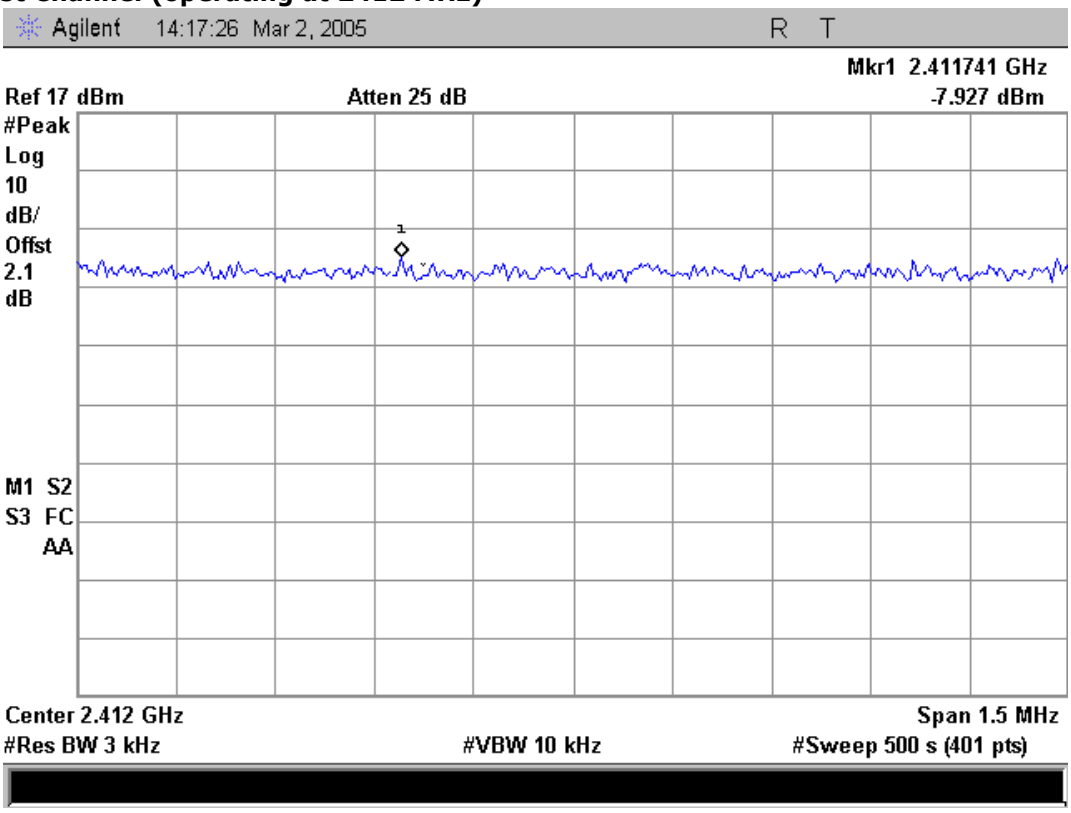
Operating frequency	Cable Loss	Reading (PPSD)	Limit
2412 MHz	2.1 dB	-7.927 dBm	8.0 dBm
2437 MHz	2.1 dB	-7.913 dBm	8.0 dBm
2462 MHz	2.1 dB	-8.282 dBm	8.0 dBm

Cable Loss was included in Reading as Offset.

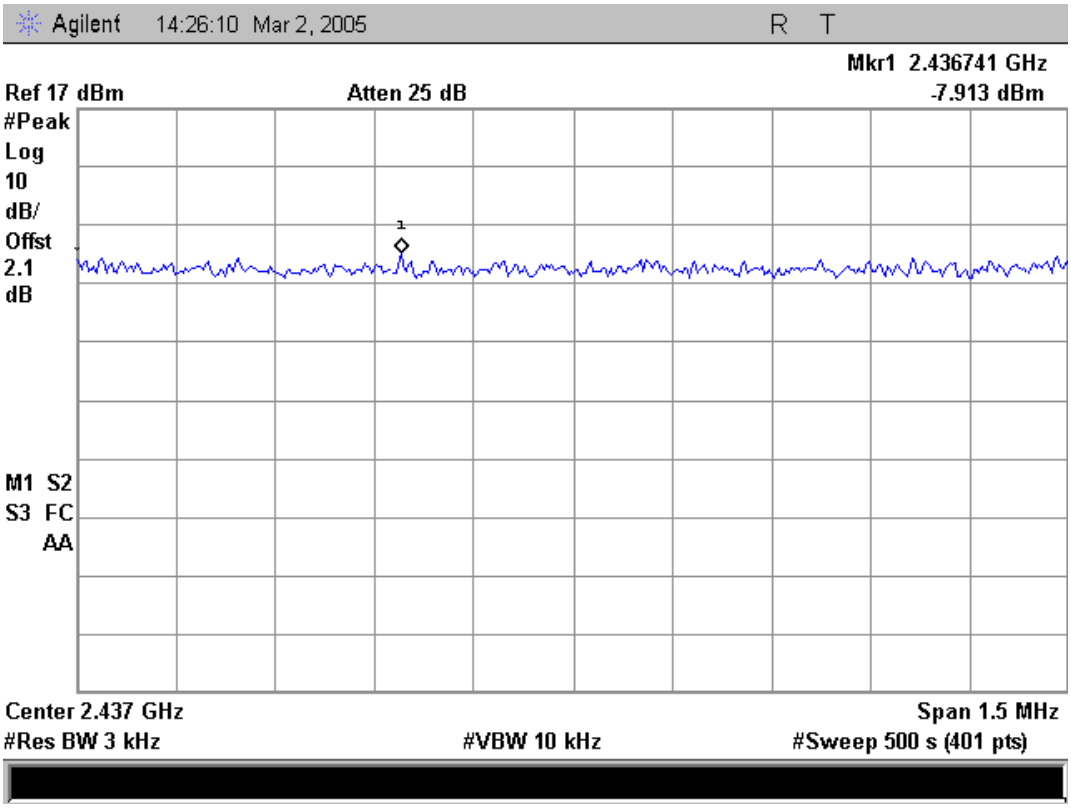
Initial investigations were performed with three modulation types: (DBPSK, DQPSK and CCK). No significant differences in power were observed. Final testing was performed while the transmitter continuously operating with the modulation rate of 5.5 Mbps (CCK).

Figure 6. Plot of the Peak Power Spectral Density (Conducted)

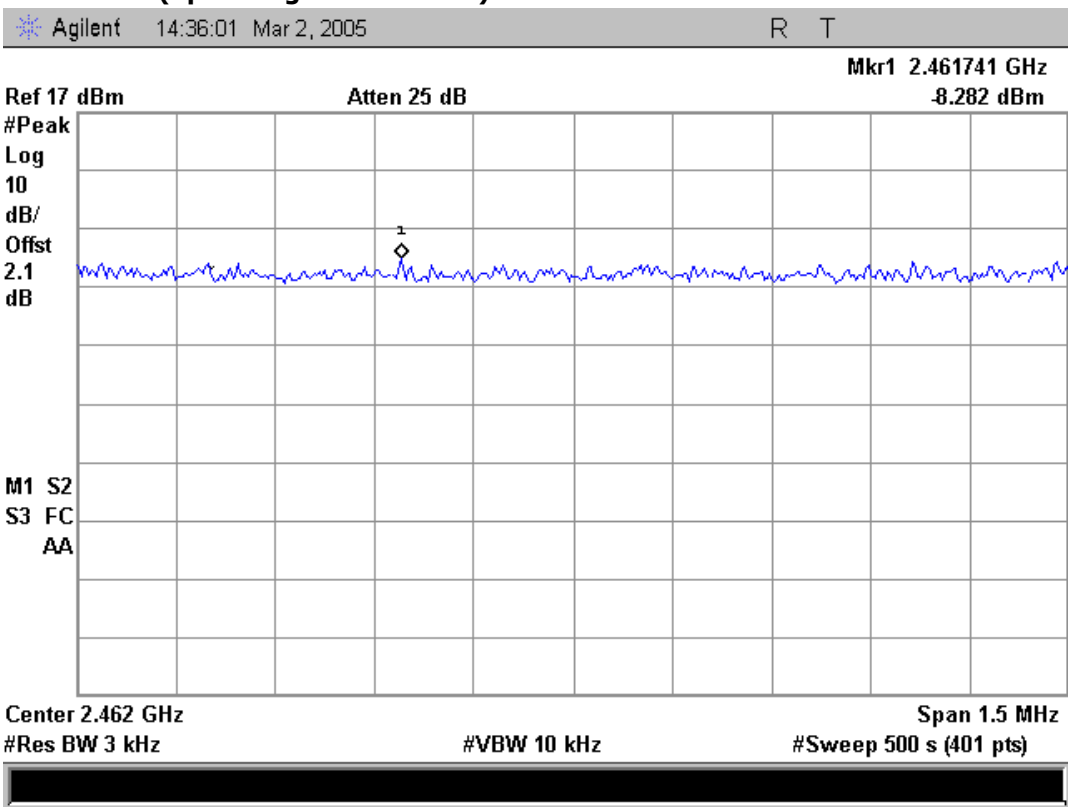
Lowest Channel (operating at 2412 MHz)



Middle Channel (operating at 2437 MHz)



Highest Channel (operating at 2462 MHz)



5.6 CONDUCTED EMISSIONS

5.6.1 Regulation

According to §15.207(a), for an intentional radiator that 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 the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Qausi-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.

According to §15.107(a), for unintentional device, except for Class A digital devices, line conducted emission limits are the same as the above table.

5.6.2 Test Procedure

1. The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 cm in which is located 40 cm away from the vertical wall and 1.5m away from the side wall of the shielded room.
2. Each current-carrying conductor of the EUT power cord was individually connected through a 50Ω/50μH LISN, which is an input transducer to a Spectrum Analyzer or an EMI/Field Intensity Meter, to the input power source.
3. Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
4. The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 MHz to 30 MHz.
5. The measurements were made with the detector set to PEAK amplitude within a bandwidth of 10 kHz or to QUASI-PEAK and AVERAGE within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.

5.6.3 Test Results: PASS

Table 6: Measured values of the Conducted Emissions (operating at 2412 MHz)

Frequency [MHz]	Reading [dBµV]		CF/CL [dB]	Actual [dBµV]		Limit [dBµV]		Margin [dB]	
	Qp	Avg		Qp	Avg	Qp	Avg	Qp	Avg
LINE – PE									
0.43	38.61	---	0.09/0.1	38.80	---	57.25	47.25	18.45	---
0.75	36.07	---	0.13/0.1	36.30	---	56.00	46.00	19.70	---
0.86	42.47	---	0.13/0.1	42.70	---	56.00	46.00	13.30	---
14.1	38.28	---	0.67/0.6	39.55	---	60.00	50.00	20.45	---
14.53	38.57	---	0.67/0.6	39.84	---	60.00	50.00	20.16	---
23.89	42.10	---	0.88/0.7	43.68	---	60.00	50.00	16.32	---
24.00	48.37	---	0.88/0.7	49.95	---	60.00	50.00	10.05	---
24.11	42.12	---	0.88/0.7	43.70	---	60.00	50.00	16.30	---
NEUTRAL – PE									
0.43	39.66	---	0.15/0.1	39.91	---	57.25	47.25	17.34	---
0.75	34.75	---	0.15/0.1	35.00	---	56.00	46.00	21.00	---
0.86	37.40	---	0.15/0.1	37.65	---	56.00	46.00	18.35	---
0.97	35.66	---	0.15/0.1	35.91	---	56.00	46.00	20.09	---
13.46	35.46	---	0.50/0.6	36.56	---	60.00	50.00	23.44	---
23.89	41.46	---	0.63/0.7	42.79	---	60.00	50.00	17.21	---
24.00	47.97	---	0.63/0.7	49.30	---	60.00	50.00	10.70	---
24.11	41.48	---	0.63/0.7	42.81	---	60.00	50.00	17.19	---

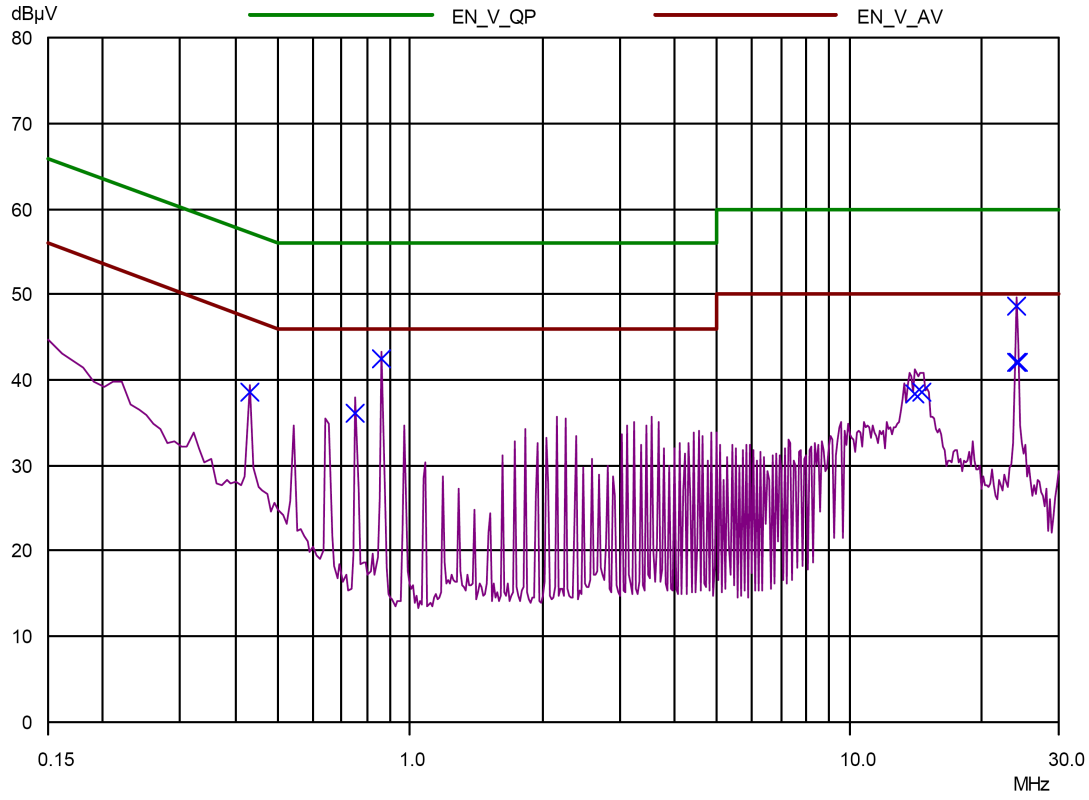
Margin (dB) = Limit – Actual
[Actual = Reading + CF + CL]

1. Remark "---" means the level is undetectable or the Qausi-peak value is lower than the limit of Average.
2. CF/CL = Correction Factor and Cable Loss
3. Qp = Quasi-peak, Avg = Average value

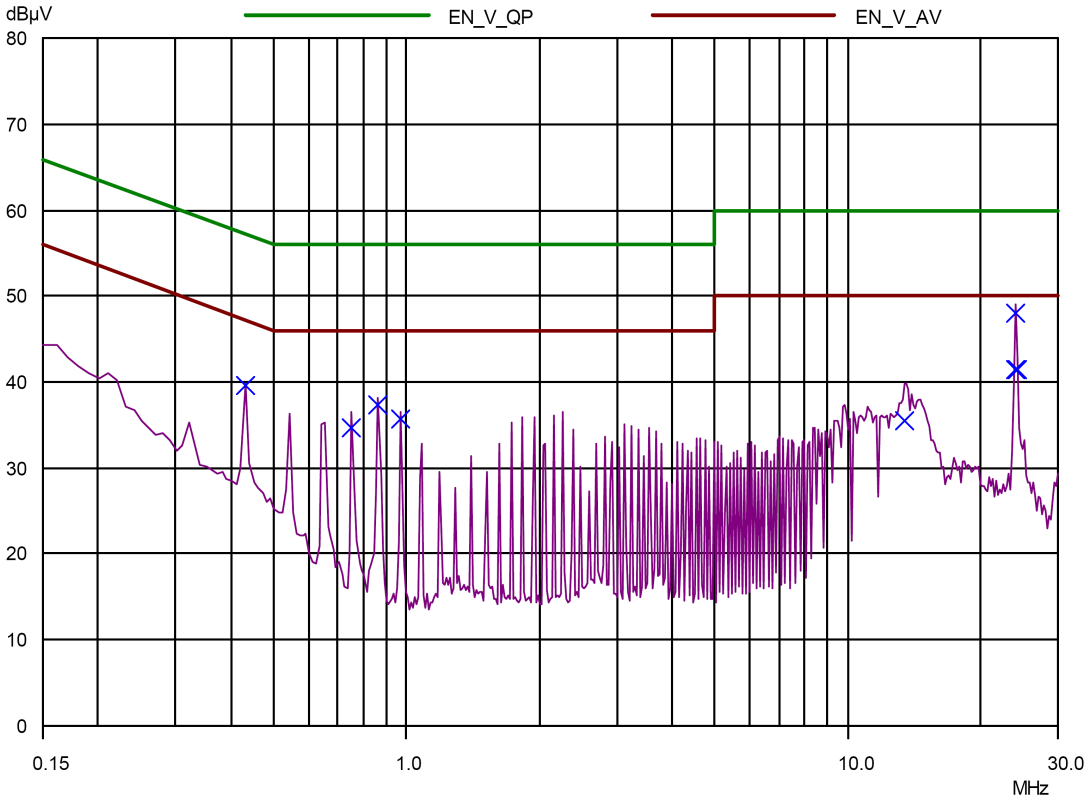
NOTE: The frequency range was scanned from 150 kHz to 30 MHz. All emissions not reported were more than 20 dB below the specified limit.

Figure 7. Plot of the Conducted Emissions

LINE - PE (operating at 2412 MHz)



Neutral - PE (operating at 2412 MHz)



5.7 RF Exposure

5.7.1 Regulation

According to §15.247(i), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See § 1.1307(b)(1) of this Chapter.

Limits for Maximum Permissive Exposure: According to §1.1310 and §2.1091, RF exposure is calculated.

Frequency Range	Electric Field Strength [V/m]	Magnetic Field Strength [A/m]	Power Density [mW/cm^2]	Averaging Time [minute]
Limits for General Population/Uncontrolled Exposure				
0.3 ~ 1.34	614	1.63	*(100)	30
1.34 ~ 30	824/f	2.19/f	*(180/f^2)	30
30 ~ 300	27.5	0.073	0.2	30
300 ~ 1500	/	/	f/1500	30
1500 ~ 15000	/	/	1.0	30

f = frequency in MHz, * = Plane-wave equivalent power density

MPE (Maximum Permissive Exposure) Prediction

Predication of MPE limit at a given distance: Equation from page 18 of OET Bulletin 65, Edition 97-01

$S = PG/4\pi R^2$ S = power density [mW/cm^2]

P = power input to antenna [mW]

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

$\left(\Rightarrow R = \sqrt{PG/4\pi S}\right)$ R = distance to the center of radiation of the antenna [cm]

EUT: Maximum peak output power = 14.73[dBm] (= 29.7 [mW]) & Antenna gain = 5.47[dBi]	
100mW, at 20cm from an antenna 6[dBi]	S = PG/4πR² = 100 × 3.98 / (4 × π × 400) = 0.0792 [mW/cm^2] < 1.0 [mW/cm^2]
29.7mW, at 20cm from the antenna 5.47[dBi]	***S = PG/4πR² = 0.0208 [mW/cm^2] < 1.0 [mW/cm^2]***
29.7mW, at 20cm from the antenna 3[dBi]	S = PG/4πR² = 0.0118 [mW/cm^2] < 1.0 [mW/cm^2]
29.7mW, at 3cm from the antenna 5.47[dBi]	S = PG/4πR² = 0.9253 [mW/cm^2] < 1.0 [mW/cm^2]

NOTE: The calculated values of MPE for the EUT show that MPE is safe beyond 3 cm from the antenna.

5.7.2 RF Exposure Compliance Issue

This information should be included in the user's manual:

1. *This appliance and its antenna must not be co-located or operating in conjunction with any other antenna or transmitter.*
2. *A minimum separation distance of 20 cm must be maintained between the antenna and the person for this appliance to satisfy the RF exposure requirements.*