SK TECH CO., LTD.

Certificate of Compliance

Test Report No.:	**SKTTRT-060406-013**		
NVLAP CODE:	**200220-0**		
Applicant:	**Sigmacom Co., Ltd.**		
Applicant Address:	DaeGo Bldg, 6F 1591-10 Gwanyang-dong, Dongan-gu, Anyang, 431-060 South Korea		
Manufacturer:	**Sigmacom Co., Ltd.**		
Manufacturer Address:	DaeGo Bldg, 6F 1591-10 Gwanyang-dong, Dongan-gu, Anyang, 431-060 South Korea		
Device Under Test:	**WiViEW**		
FCC ID:	**PCO-WMT-1000O**	**Model No.:**	**WMT-1000O**
Receipt No.:	SKTEU06-0158	**Date of receipt:**	March 17, 2006
Date of Issue:	April 6, 2006		
Location of Testing:	**SK TECH CO., LTD.** 820-2, Wolmoon-Ri, Wabu-Up, Namyangju-Si, Kyunggi-Do, Korea		
Test Procedure:	**ANSI C63.4, FCC Public Notice DA 02-2138 (August 30, 2002)**		
Test Specification:	**47CFR, Part 15 Rules**		
Equipment Class:	**NII - Unlicensed National Information Infrastructure TX**		
Test Result:	The above-mentioned device has been tested and passed.		

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

2006.04.06

Signature *Date*

Approved by: *Jae-Kyung, Bae*

2006.04.06

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 15.407 for Unlicensed National Information Infrastructure TX. 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.: DAT-P-076/97-01

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	ESIB40	100277	☒
EMI Test Receiver	Rohde&Schwarz	ESVS10	834468/013	
EMI Test Receiver	Rohde&Schwarz	ESHS10	862970/019	☒
Artificial Mains Network	Rohde&Schwarz	ESH3-Z5	836679/018	☒
Pre-amplifier	HP	8447F	3113A05153	☒
Pre-amplifier	MITEQ	AFS44	1116321	☒
Pre-amplifier	MITEQ	AFS44	1116322	
Power Meter	Agilent	E4418B	US39402179	☒
Power Sensor	HP	8485A	3318A13916	☒
Frequency Counter	HP	5343A	2022A00167	☒
Oscilloscope	Agilent	54820A	US40240160	☒
Diode detector	Agilent	8473C	1882A03173	☒
VHF Precision Dipole Antenna (TX/RX)	Schwarzbeck	VHAP	1014 / 1015	
UHF Precision Dipole Antenna (TX/RX)	Schwarzbeck	UHAP	989 / 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	EMCO	3115	00040723	☒
Horn Antenna	EMCO	3115	00056768	☒
Vector Signal Generator	Agilent	E4438C	MY42080359	☒
PSG analog signal generator	Agilent	E8257D-520	MY45141255	☒
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 : March 17, 2006

Date of Test : April 2, 2006 ~ April 6, 2006

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 designation	WiViEW, Model WMT-1000O
FCC ID	PCO-WMT-1000O During the tests, the EUT was not labeled with the FCC-label
Power source	DC 12V from the AC/DC adaptor supplied with the product
Local Oscillator or X-Tal	OSC: 33.333 MHz, 40 MHz, X-Tal: 27 MHz
Transmit Frequency	5180 MHz, 5200 MHz, and 5220 MHz (3 channels)
Antenna Type	External (Model WPS008, Peak Gain: 2.79 dBi @ 5250 MHz)
Type of Modulation	OFDM (BPSK, QPSK, 16QAM, 64QAM)
Transfer Rate	6, 9, 12, 18, 24, 36, 48, 54 Mbps
RF Output power	< 17 dBm
External Ports	- DC INPUT - A/V OUTPUT (×2) - S-VIDEO

** The test report for compliance with FCC Part 15B as a Class B digital device should be issued with other test report number.

3.2 Equipment Modifications

None

3.3 Submitted Documents

Block diagram

Schematic diagram

Antenna Specification

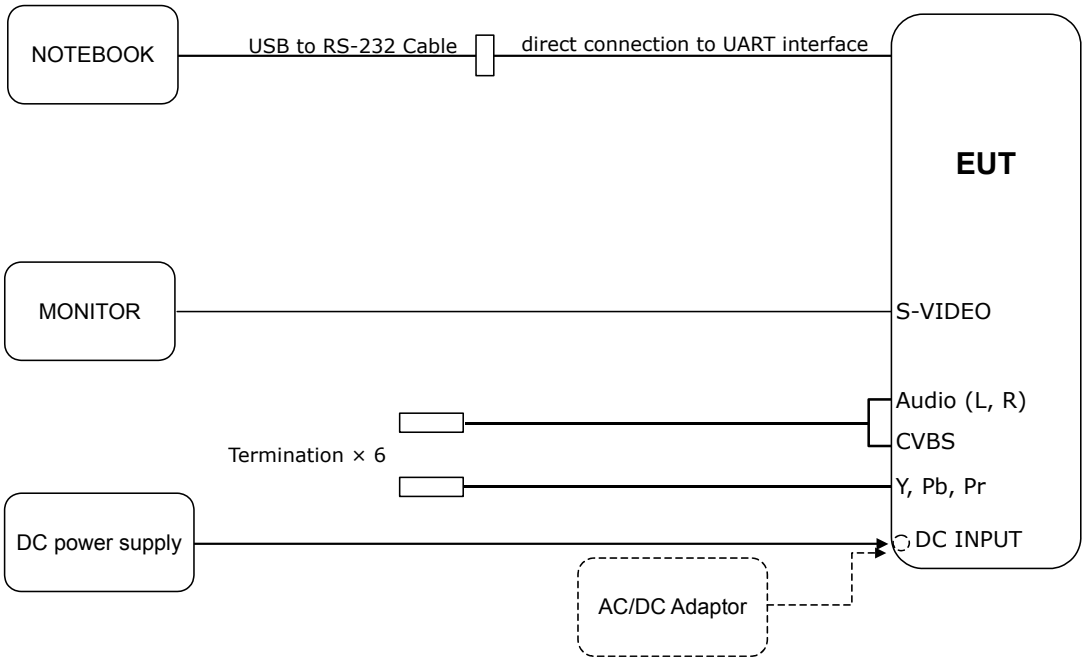
Part List

User manual

4. MEASUREMENT CONDITIONS

4.1 Description of test configuration

The measurements were taken in continuous transmitting mode using the TEST SOFTWARE (ComDebugger.exe) provided by the applicant for controlling the EUT via UART interface so that the operating frequency of the EUT could be changed, and that the EUT could continuously transmit RF signals with no off intervals. If not otherwise stated, BPSK modulation with 6 Mbps transfer rate was used.



4.2 List of Peripherals

Equipment Type	Manufacturer	Model	Cable Description
Notebook PC **	Trigem	Dreambook	1.8m, Shielded, USB to RS-232 Cable
MONITOR	HITRON SYSTEMS INC	CVM 1054X	1.2 m, Unshielded power line
AC/DC Adaptor	HUA JUNG COMP CO., LTD.	HAPU05F5	1.2 m, Unshielded power line
EUT	Sigmacom Co., Ltd.	WMT-1000I	S-Video cable, 1.2 m, Unshielded AV cable (× 2), 1.2 m, Unshielded

** For control of RF module via UART 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	± 2.30 dB	±4.60dB
Conducted disturbance	± 1.96 dB	±3.92 dB

5. TEST AND MEASUREMENTS

Summary of Test Results

Requirement	CFR 47 Section	Report Section	Test Result
Antenna Requirement	15.203, 15.407(a)(1)	5.1	PASS
Maximum Conducted Output Power	15.407(a)(1)	5.2	PASS
Peak Power Spectral Density	15.407(a)(1)	5.3	PASS
Peak Power Excursion	15.407(a)(6)	5.4	PASS
Spurious Emission, Band Edge, and Restricted bands	15.407(b), 15.205(a), 15.209(a)	5.5	PASS
Conducted Emissions	15.407(b), 15.207(a)	5.6	PASS
RF Exposure	15.407(f), 1.1307(b)	5.7	PASS
Frequency Stability	15.407(g)	5.8	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.

According to §15.407(a)(1) For the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10log B, where B is the 26dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced 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 2.79 dBi.

5.2 MAXIMUM CONDUCTED OUTPUT POWER

5.2.1 Regulation

According to §15.407(a)(1), for the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10log B, where B is the 26dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

According to §15.407(a)(4), the maximum conducted output power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement conforming to the above definitions for the emission in question.

5.2.2 Test Procedure

FCC Public Notice DA 02-2138 (August 30, 2002) - Measurement Procedure Updated for Peak Transmit Power in the Unlicensed National Information Infrastructure (U-NII) Bands.

APPENDIX A: Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices

PEAK CONDUCTED TRANSMIT OUTPUT POWER

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.

EMISSION BANDWIDTH "B" MHZ (EBW, ENTIRE EMISSION BANDWIDTH)

1. Use a RBW = approximately 1% of the emission bandwidth.
2. Set the VBW > RBW, Use a peak detector.
3. Do not use the Max Hold function. Rather, use the view button to capture the emission.
4. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

5.2.3 Test Results: PASS

Table 1: Measured values of the Maximum Conducted Output Power

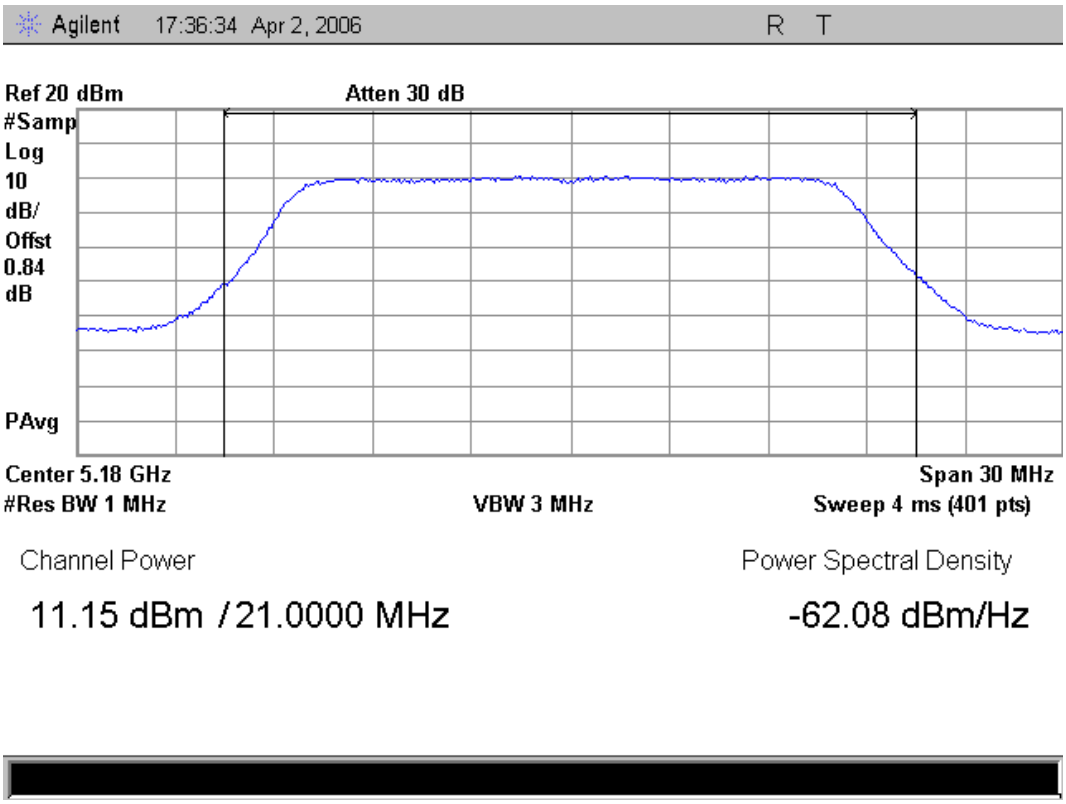
Operating Frequency	Cable Loss	Reading	Limit	EBW (26 dBc)
5180 MHz	0.84 dB	+11.15 dBm	17 dBm or 4 dBm + 10log B	20.19 MHz
5120 MHz	0.84 dB	+11.53 dBm	17 dBm or 4 dBm + 10log B	20.07 MHz
5220 MHz	0.84 dB	+11.89 dBm	17 dBm or 4 dBm + 10log B	20.28 MHz

Cable Loss was included in Reading as Offset.

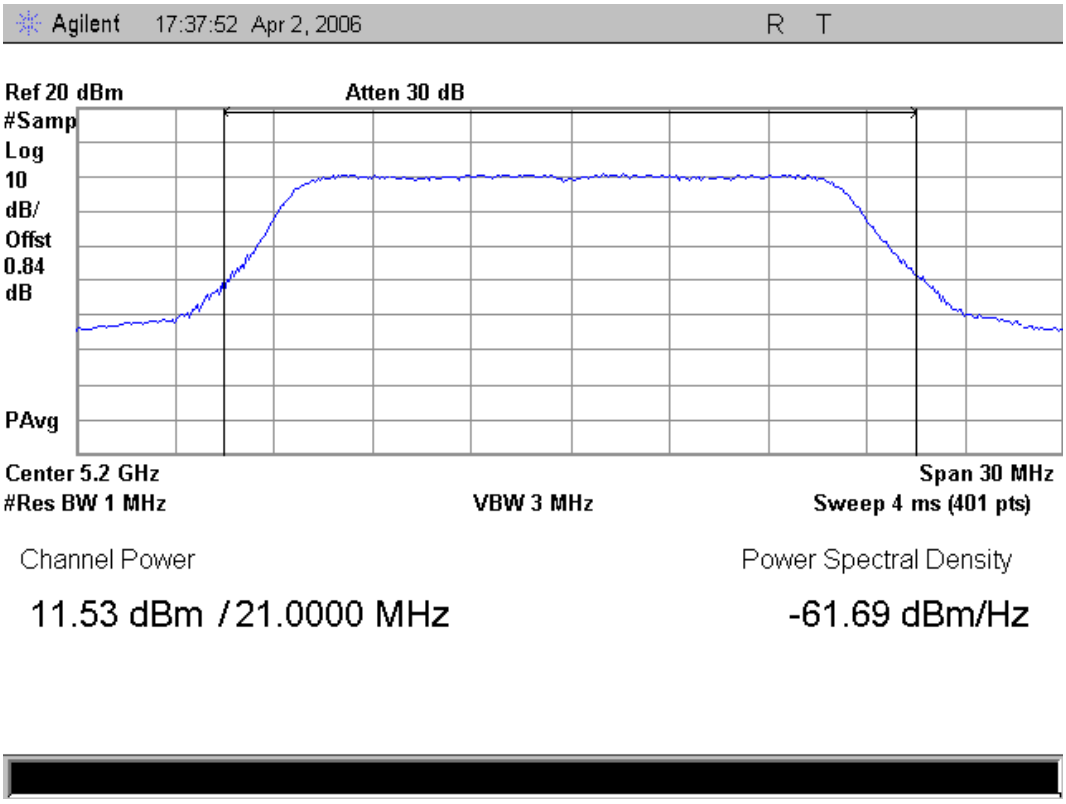
NOTE: Since the directional gain of the internal antenna declared by manufacturer (G_{ANT} = 2.79 dBi) does not exceed 6.0 dBi, there was no need to reduce the output power.

Figure 1. Plot of the Maximum Conducted Output Power

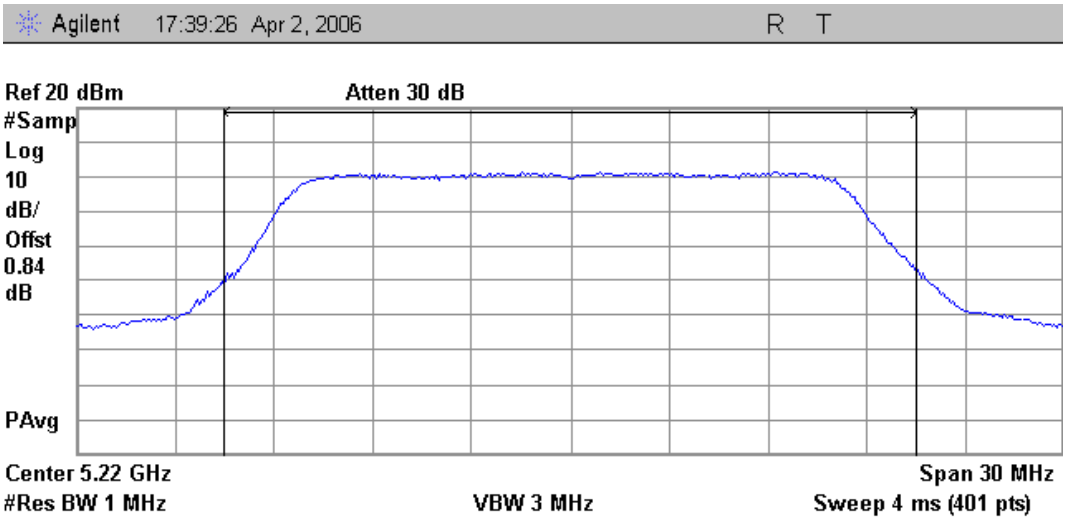
Maximum Conducted Output Power (operating at 5180 MHz)



Maximum Conducted Output Power (operating at 5200 MHz)



Maximum Conducted Output Power (operating at 5220 MHz)



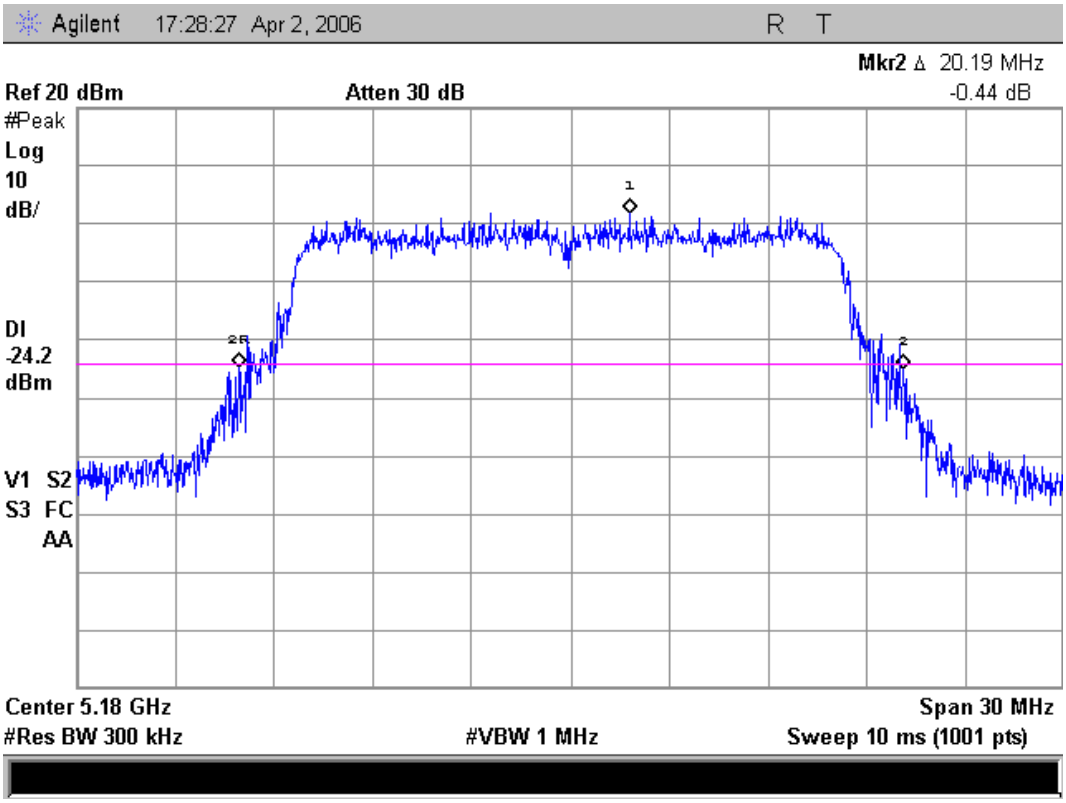
Channel Power

11.89 dBm / 21.0000 MHz

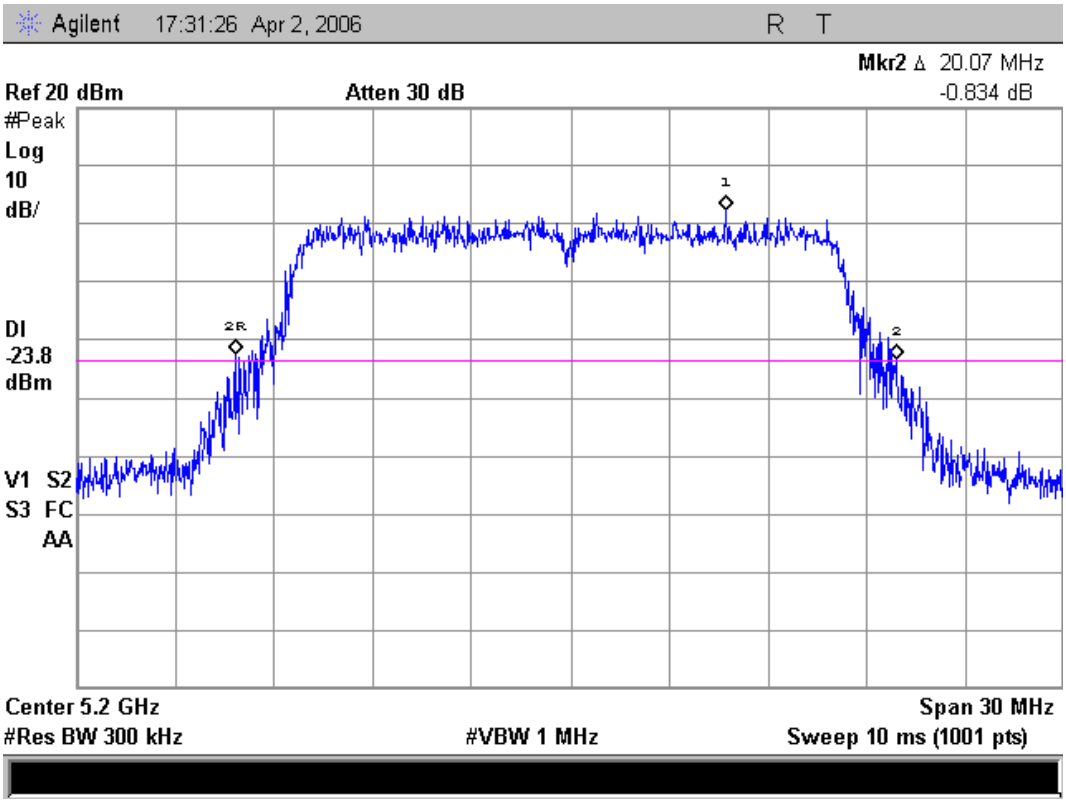
Power Spectral Density

-61.33 dBm/Hz

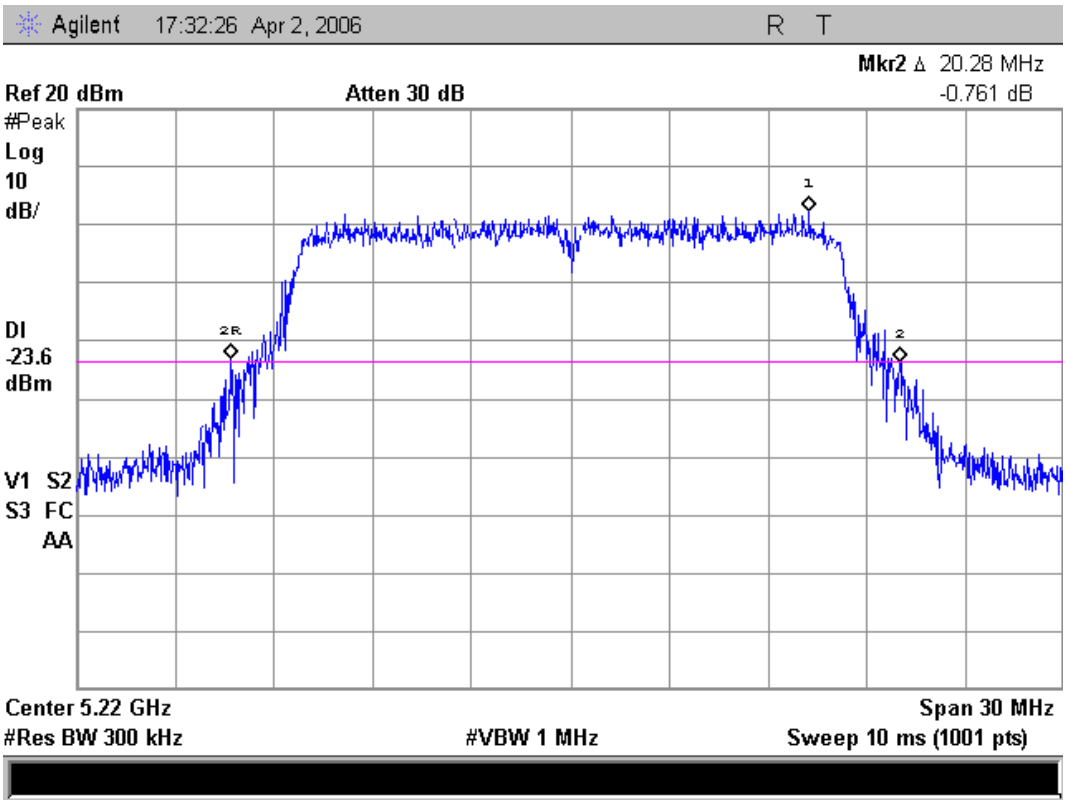
Entire Emission Bandwidth (operating at 5180 MHz)



Entire Emission Bandwidth (operating at 5200 MHz)



Entire Emission Bandwidth (operating at 5220 MHz)



5.3 PEAK POWER SPECTRAL DENSITY

5.3.1 Regulation

According to §15.407(a)(1), for the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10log B, where B is the 26dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

According to §15.407(a)(5), the peak power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A resolution bandwidth less than the measurement bandwidth can be used, provided that the measured power is integrated to show total power over the measurement bandwidth. If the resolution bandwidth is approximately equal to the measurement bandwidth, and much less than the emission bandwidth of the equipment under test, the measured results shall be corrected to account for any difference between the resolution bandwidth of the test instrument and its actual noise bandwidth.

5.3.2 Test Procedure

This is an antenna conducted measurement using a spectrum analyzer. Method #2 provides the most accurate implementation of the rule; however, equipment limitations may preclude its use for short pulses. Method #1 is also acceptable to show compliance; it may overestimate the PPSD, but is easier to implement than method #2, and must be used when the conditions of method #2 cannot be achieved.

Method 1:

1. Use peak detector mode and max hold.
2. Set RBW= 1MHz* and VBW > 1 MHz.
3. The PPSD is the highest level found across the emission in any 1-MHz band.

Method 2:

1. Use sample detector and power averaging (not video averaging) mode.
2. Set RBW= 1 MHz*, VBW > 1 MHz.
3. The PPSD is the highest level found across the emission in any 1-MHz band after 100 sweeps of averaging.
4. This method is permitted only if the transmission pulse or sequence of pulses remains at maximum transmit power throughout each of the 100 sweeps of averaging and that the interval between pulses is not included in any of the sweeps (e.g., 100 sweeps should occur during one transmission, or each sweep gated to occur during a transmission).

5.3.3 Test Results: PASS

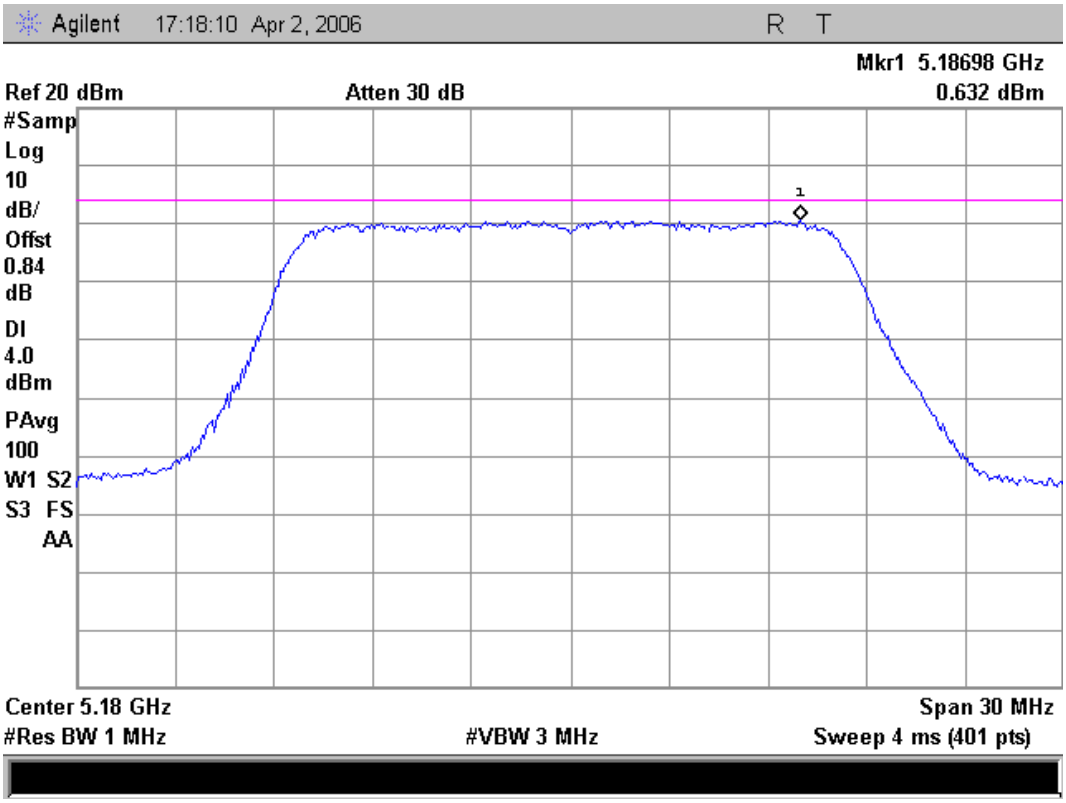
Table 2: Measured values of the Peak Power Spectral Density

Operating frequency	Cable Loss	Reading	Limit
5180 MHz	0.84 dB	0.632 dBm	4.0 dBm
5200 MHz	0.84 dB	0.725 dBm	4.0 dBm
5220 MHz	0.84 dB	1.352 dBm	4.0 dBm

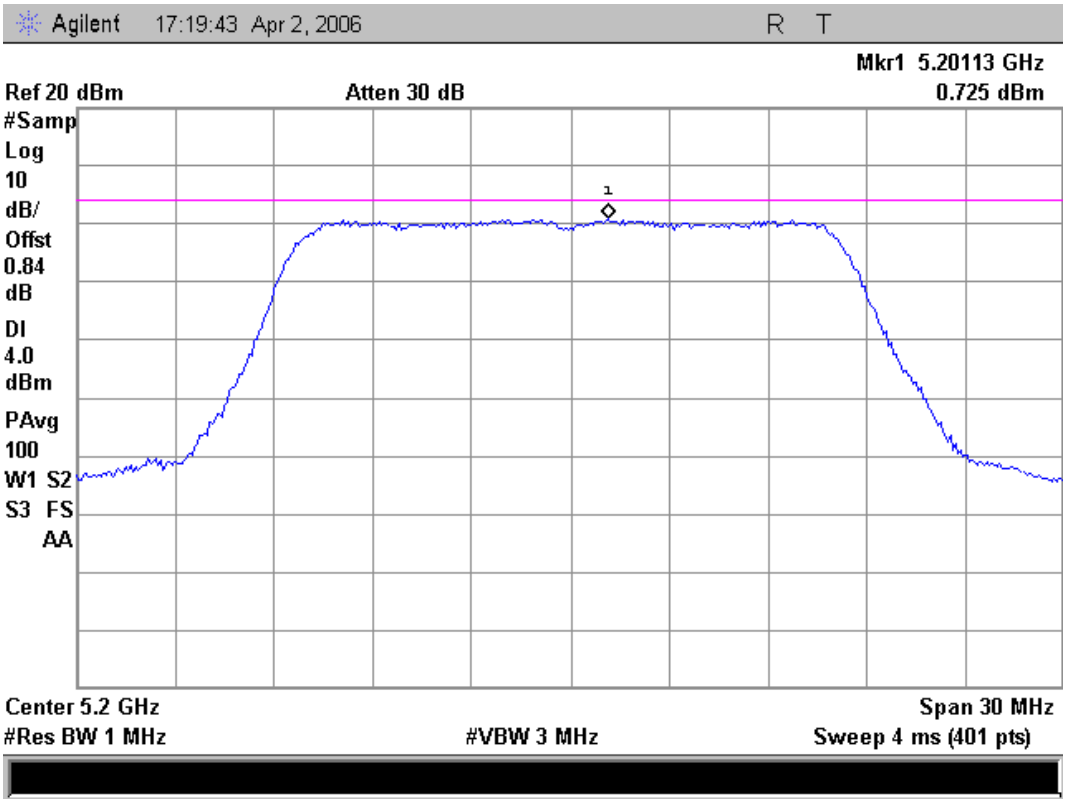
Cable Loss was included in Reading as Offset.

Figure 2. Plot of the Peak Power Spectral Density

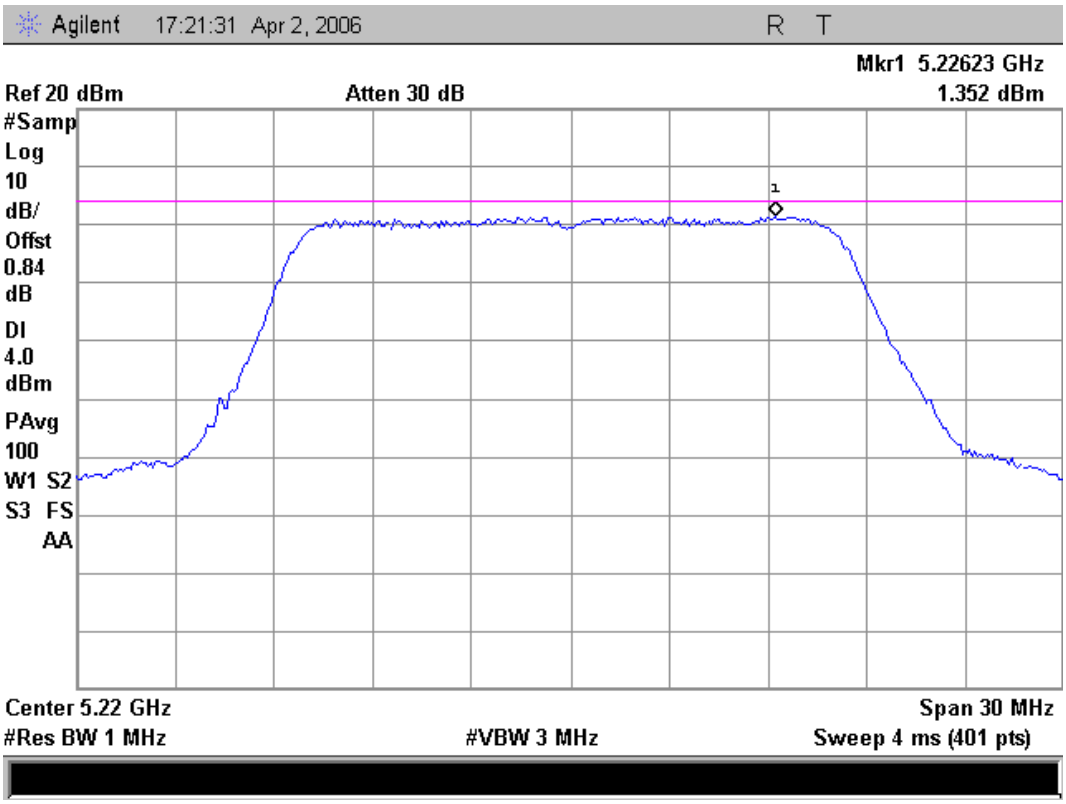
Lowest Channel (operating at 5180 MHz)



Middle Channel (operating at 5200 MHz)



Highest Channel (operating at 5220 MHz)



5.4 PEAK POWER EXCURSION

5.4.1 Regulation

According to §15.407(a)(6), the ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

5.4.2 Test Procedure

1. Set the spectrum analyzer span to view the entire emission bandwidth.
2. The largest difference between the following two traces must be ≤ 13 dB for all frequencies across the emission bandwidth.

1st Trace:

Set RBW = 1 MHz, VBW ≥ 3 MHz with peak detector and max-hold settings.

2nd Trace:

If Method #1 was used for the peak conducted transmit output power test, then create the 2nd trace using the settings described in Method #1.

If Methods #2 or #3 were used for the peak conducted transmit power test, then create the 2nd trace using the setting described in Method #3.

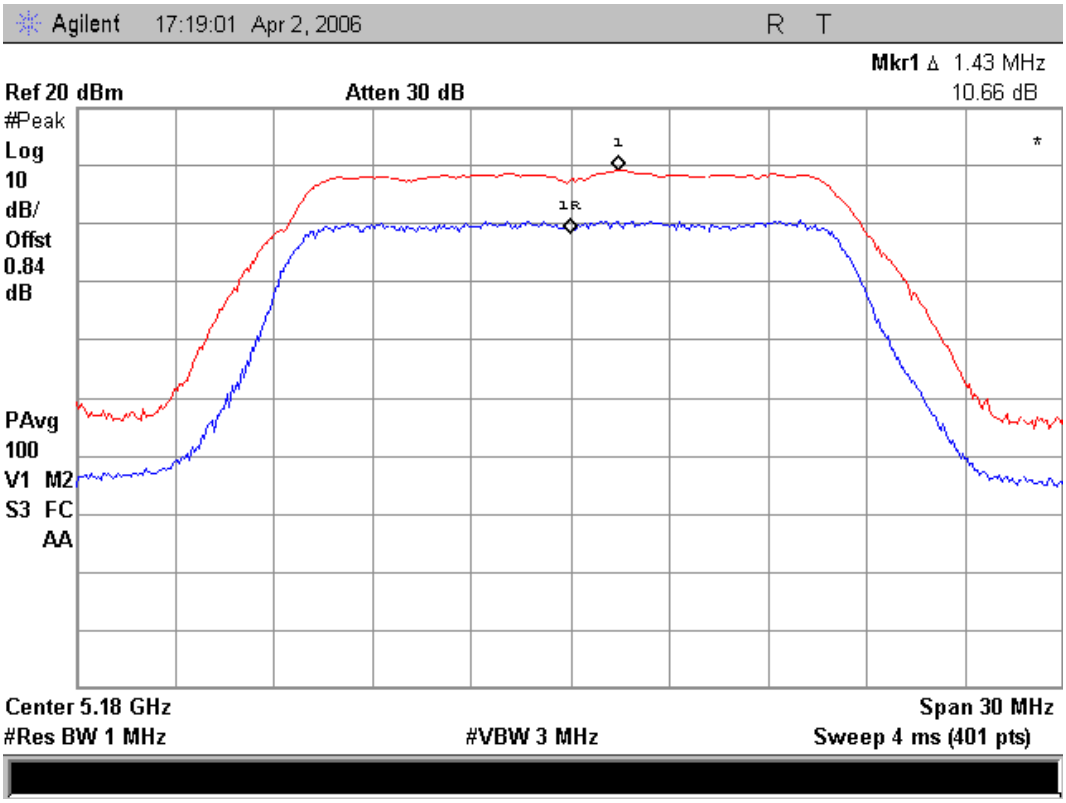
5.4.3 Test Results: PASS

Table 3: Measured values of the Peak Power Excursion

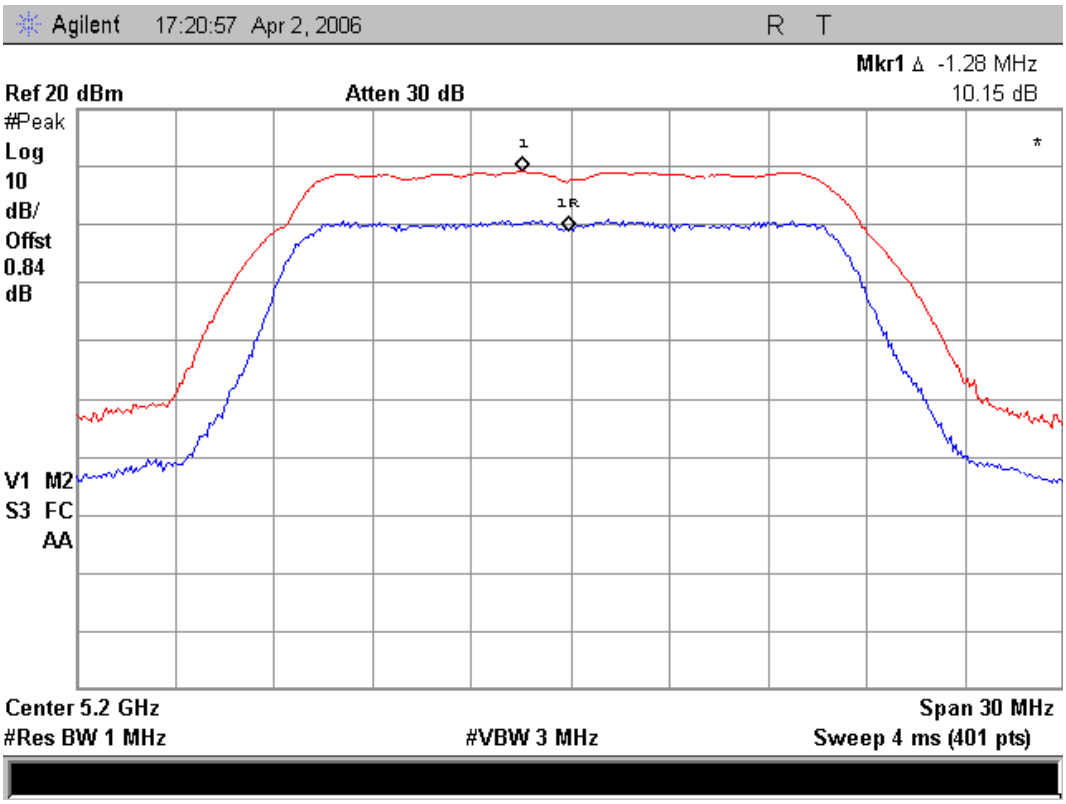
Operating frequency	Reading (delta-marker)	Limit
5180 MHz	10.66 dB	≤ 13 dB
5200 MHz	10.15 dB	≤ 13 dB
5220 MHz	10.77 dB	≤ 13 dB

Figure 3. Plot of the Peak Power Excursion

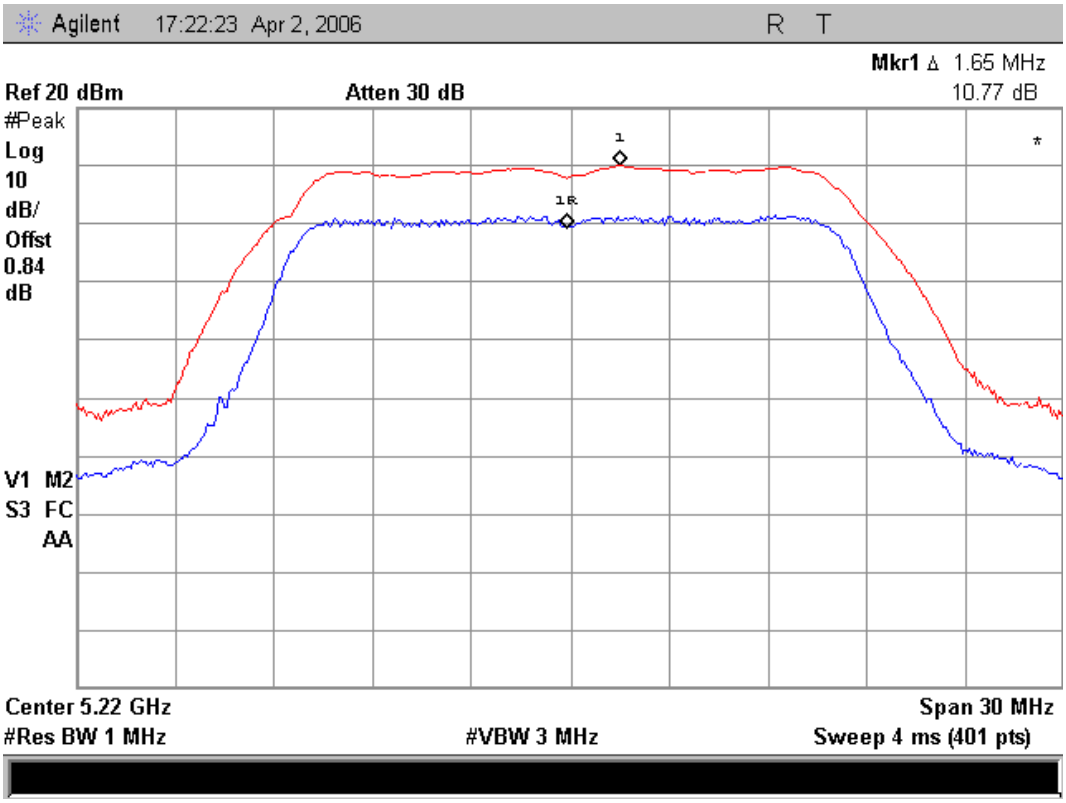
Lowest Channel (operating at 5180 MHz)



Middle Channel (operating at 5200 MHz)



Highest Channel (operating at 5220 MHz)



5.5 SPURIOUS EMISSIONS, BAND EDGE, AND RESTRICTED BANDS

5.5.1 Regulation

According to §15.407(b), undesirable Emission Limits: Except as shown in Paragraph (b)(6) of this section, the peak emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz.

(5) The above emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

(6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in Section 15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in Section 15.207.

(7) The provisions of Section 15.205 of this part apply to intentional radiators operating under this section.

(8) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency block edges as the design of the equipment permits.

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

** 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.

5.5.2 Test Procedure

1) Spurious RF Conducted Emissions:

Conducted measurements were performed to identify any spurious emissions from the EUT antenna port, which require further investigation or radiated emission measurements at the test site.

Set the spectrum analyzer as follows:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic.
RBW = VBW = 1MHz
Sweep = auto
Detector function = peak
Trace = max hold

2) Band-edge Compliance:

1. Set the spectrum analyzer as follows:
   Span = wide enough to capture the peak level of the emission operating on the channel closest to the band-edge, as well as any modulation products which fall outside of the authorized band of operation
   RBW = 1 MHz
   VBW = 1 MHz for peak detection, and 10 Hz for average detection
   Sweep = auto
   Detector function = peak
   Trace = max hold
2. Allow the trace to stabilize. Set the marker on the emission at the band-edge, or on the highest modulation product outside of the band, if this level is greater than that at the band-edge. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

3) 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 40000 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 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.

5.5.3 Test Results: PASS

Table 4: Measured values of the Field strength of spurious emission

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Antenna Height [m]	Reading [dB(μV)]	Amp Gain [dB]	AF [dB(1/m)]	CL [dB]	Actual [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Quasi-peak data, emissions below 1000 MHz										
344.05	120	H	1.0	41.1	27.3	16.9	1.6	32.3	46.0	13.7
399.99	120	H	2.3	33.9	27.8	18.3	1.7	26.1	46.0	19.9
408.19	120	H	2.2	29.7	27.8	17.7	1.7	21.3	46.0	24.7
439.99	120	H	1.7	42.3	27.8	17.7	1.8	34.0	46.0	12.0
499.99	120	H	1.7	41.9	27.8	18.9	2.0	35.0	46.0	11.0
599.99	120	H	1.3	40.5	28.5	21.0	2.2	35.2	46.0	10.8
799.99	120	H	1.8	35.3	28.1	22.9	2.5	32.6	46.0	13.4
AVERAGE data, emissions above 1000 MHz										
1199.15	1000	V	1.0	48.5	42.9	25.0	3.9	34.5	54.0	19.5
1391.92	1000	V	1.8	39.5	43.0	25.4	4.0	25.9	54.0	28.1
1599.48	1000	V	1.4	38.7	43.2	25.7	4.1	25.3	54.0	28.7
5179.38	1000	V	1.0	100.3	44.8	34.2	7.9	97.6	---	---
5150.00	1000	V	1.0	45.9	44.8	34.2	7.9	43.2	54.0	10.8
6216.05	1000	V	1.0	50.8	44.6	35.1	8.2	49.5	54.0	4.5
5221.24	1000	V	1.0	101.8	44.8	34.2	7.9	99.1	---	---
5350.00	1000	V	1.0	45.9	44.8	34.2	7.9	43.2	54.0	10.8
6262.83	1000	V	1.0	51.2	44.6	35.1	8.2	49.9	54.0	4.1
PEAK data, emissions above 1000 MHz										
1199.15	1000	V	1.0	66.1	42.9	25.0	3.9	52.1	74.0	21.9
1391.92	1000	V	1.8	60.9	43.0	25.4	4.0	47.3	74.0	26.7
1599.48	1000	V	1.4	59.5	43.2	25.7	4.1	46.1	74.0	27.9
5178.98	1000	V	1.0	109.8	44.8	34.2	7.9	107.1	---	---
5150.00	1000	V	1.0	60.1	44.8	34.2	7.9	57.4	74.0	16.6
6216.05*	1000	V	1.0	61.3	44.6	35.1	8.2	60.0	74.0	14.0
5215.63	1000	V	1.0	111.0	44.8	34.2	7.9	108.3	---	---
5350.00	1000	V	1.0	58.9	44.8	34.2	7.9	56.2	74.0	17.8
6262.83*	1000	V	1.0	62.7	44.6	35.1	8.2	61.4	74.0	12.6

Margin (dB) = Limit – Actual

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

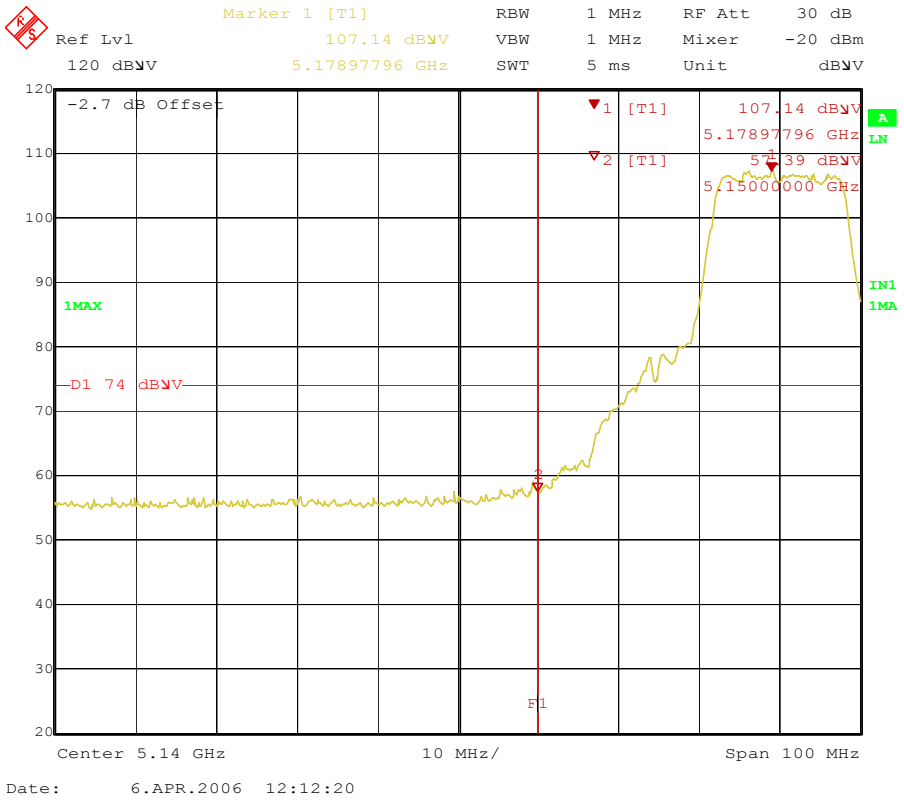
1. H = Horizontal, V = Vertical Polarization
2. AF/CL = Antenna Factor and Cable Loss

* The spurious emission at the frequency does not fall in the restricted bands.

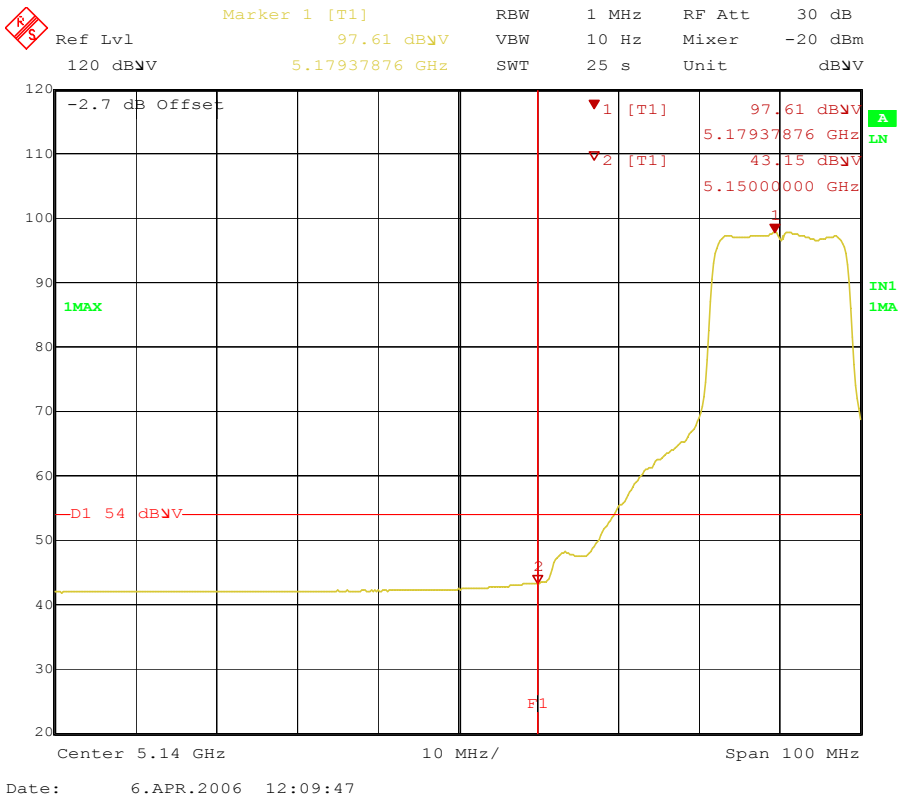
NOTE: The spectrum was scanned from 30 MHz to 40 GHz. All emissions not reported were more than 20 dB below the specified limit or in the noise floor.

Figure 4. Plot of the Band Edge

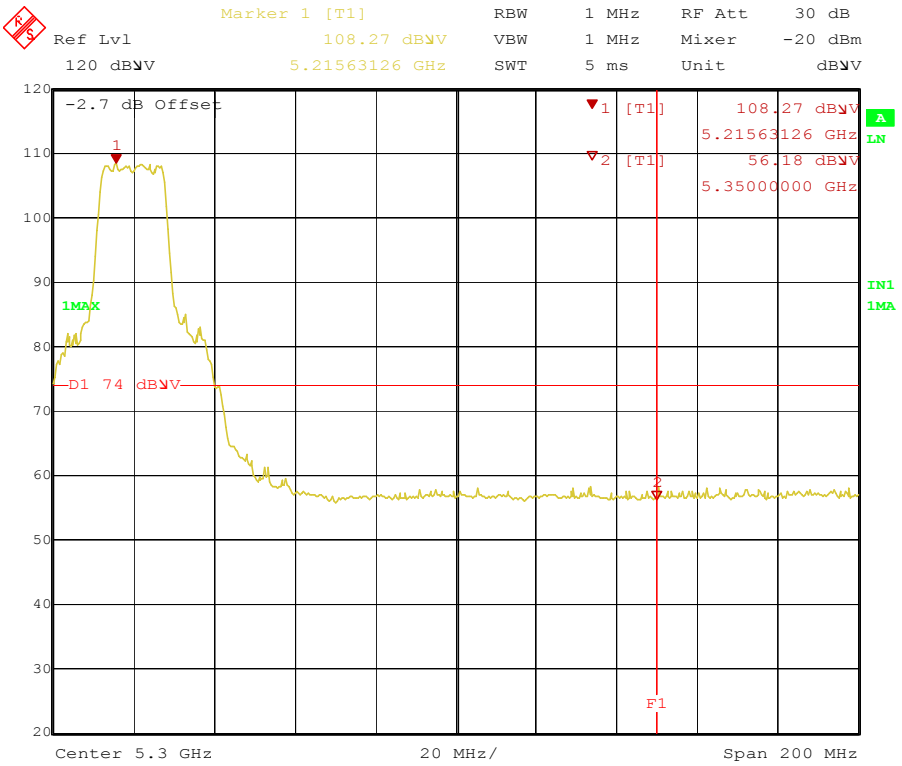
Lowest Channel (operating at 5180 MHz): PEAK



Lowest Channel (operating at 5180 MHz): AVERAGE



Highest Channel (operating at 5220 MHz): PEAK



Highest Channel (operating at 5220 MHz): AVERAGE

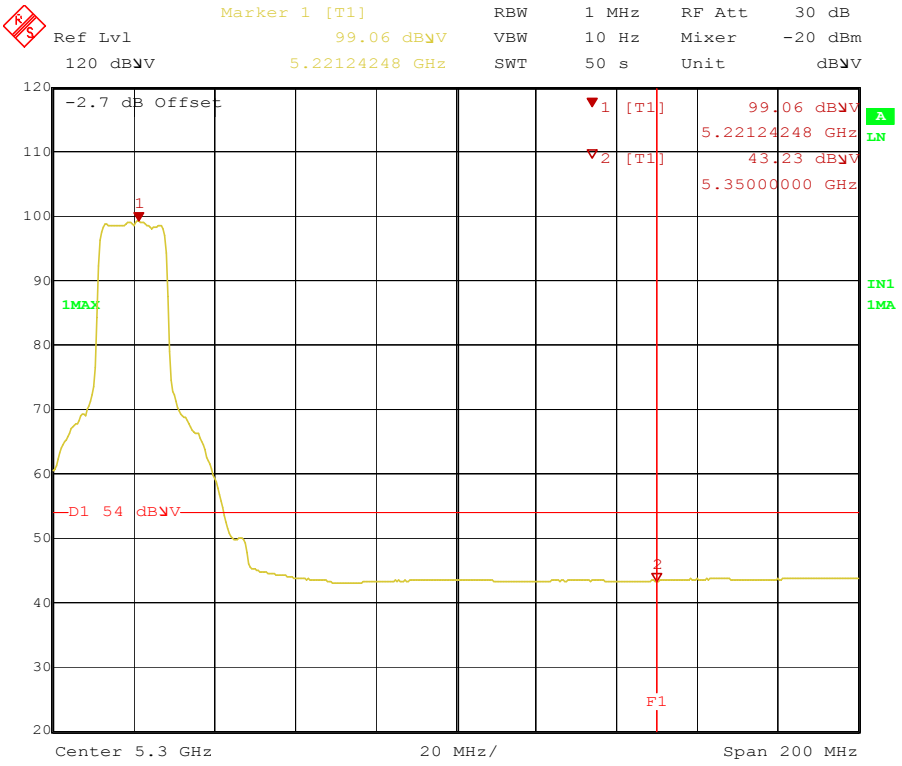
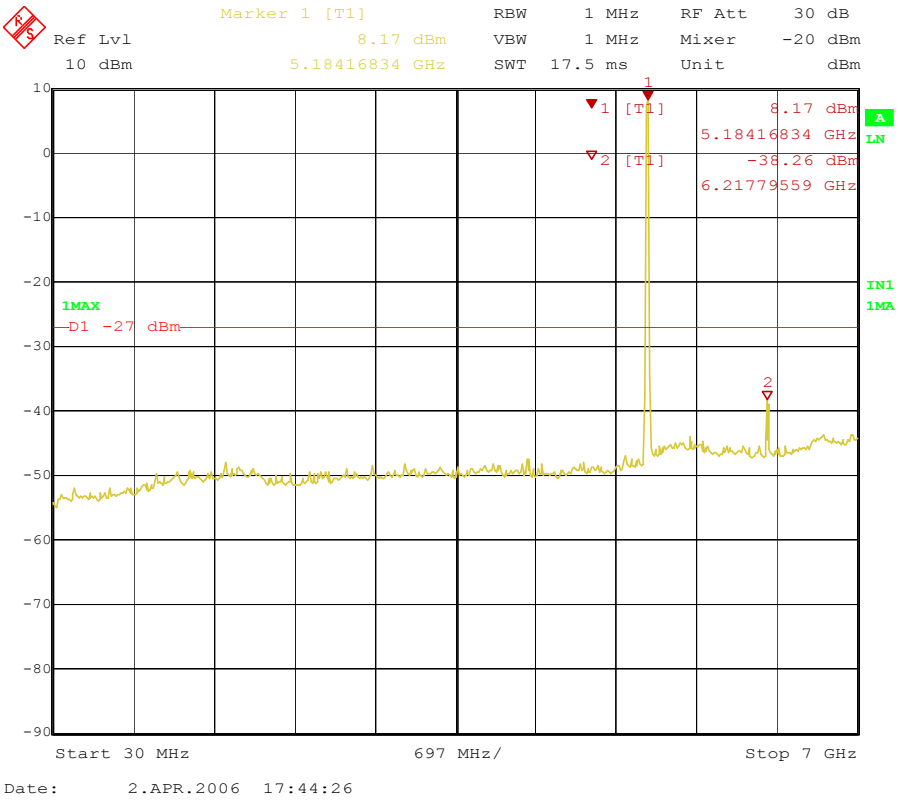
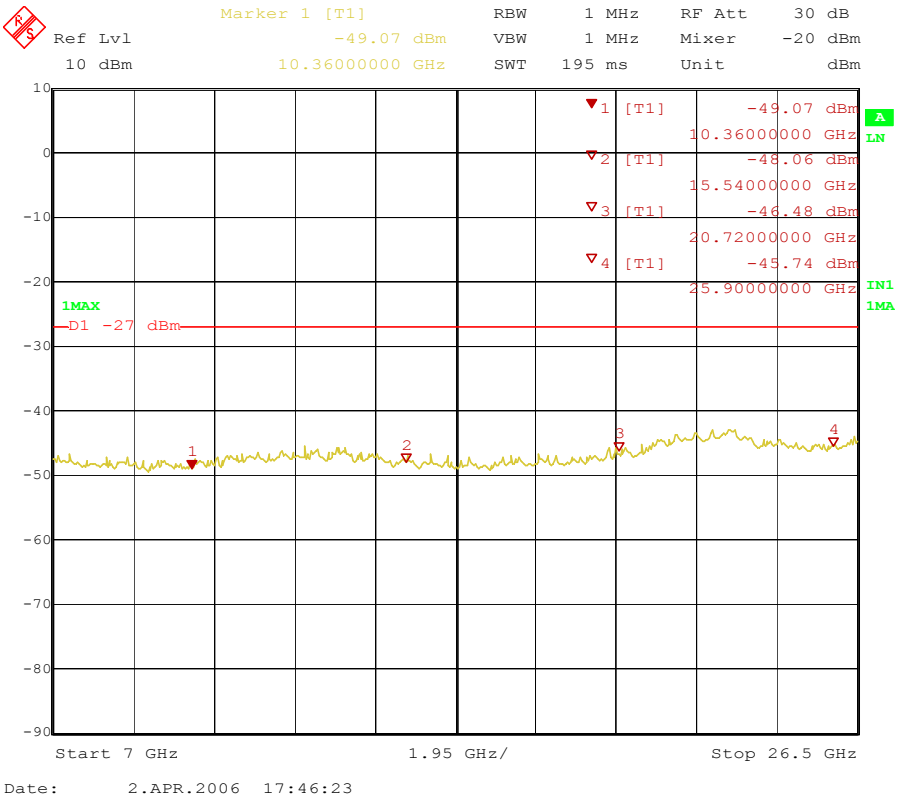


Figure 5. Plot of the RF antenna port emissions (Conducted)

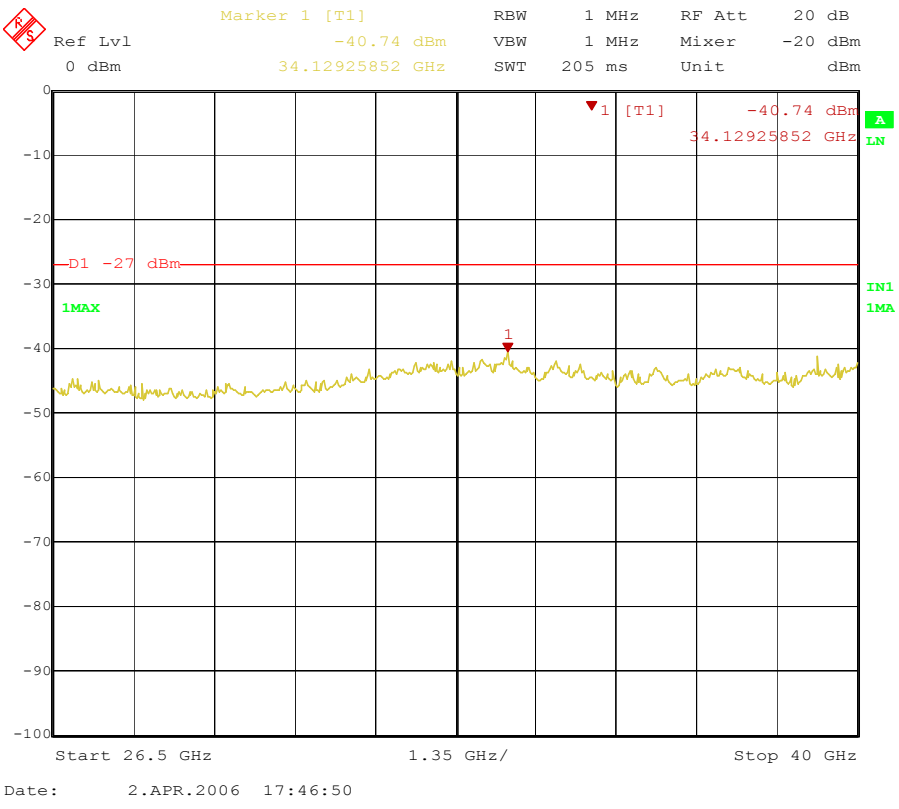
Lowest Channel (operating at 5180 MHz): 30MHz ~ 7GHz



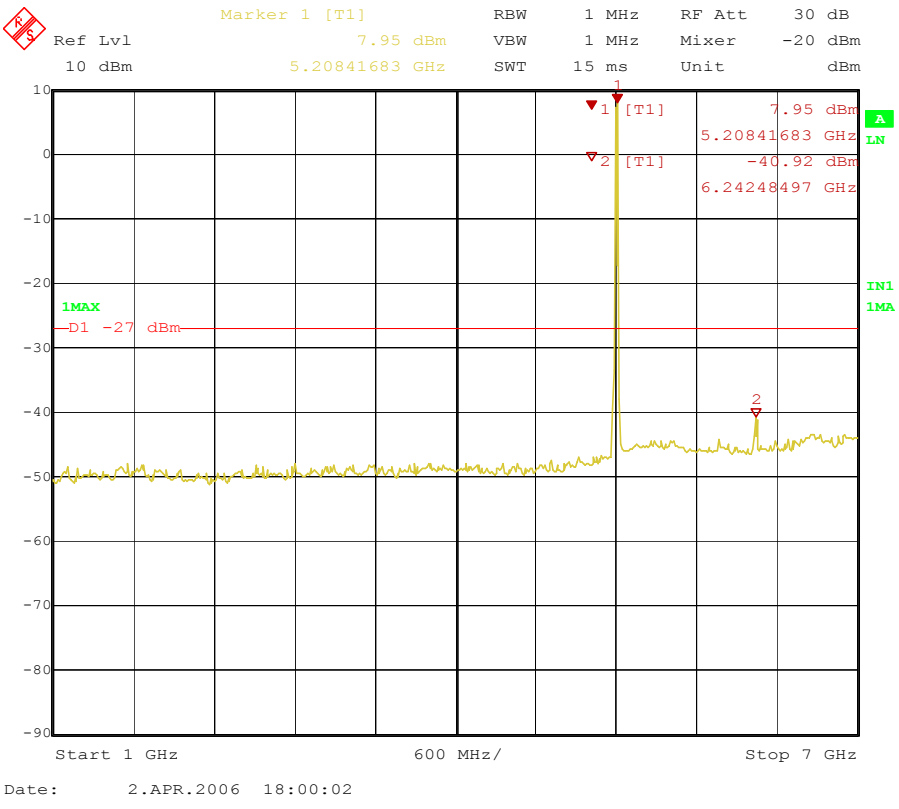
Lowest Channel (operating at 5180 MHz): 7GHz ~ 26.5GHz



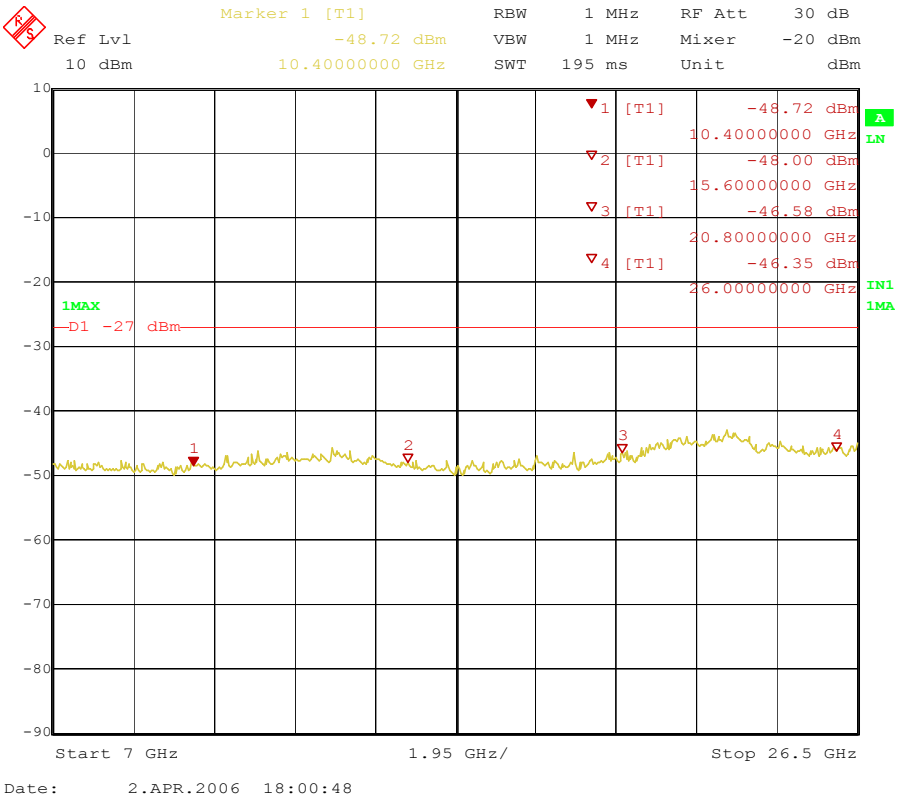
Lowest Channel (operating at 5180 MHz): 26.5GHz ~ 40GHz



Middle Channel (operating at 5200 MHz): 30MHz ~ 7GHz



Middle Channel (operating at 5200 MHz): 7GHz ~ 26.5GHz



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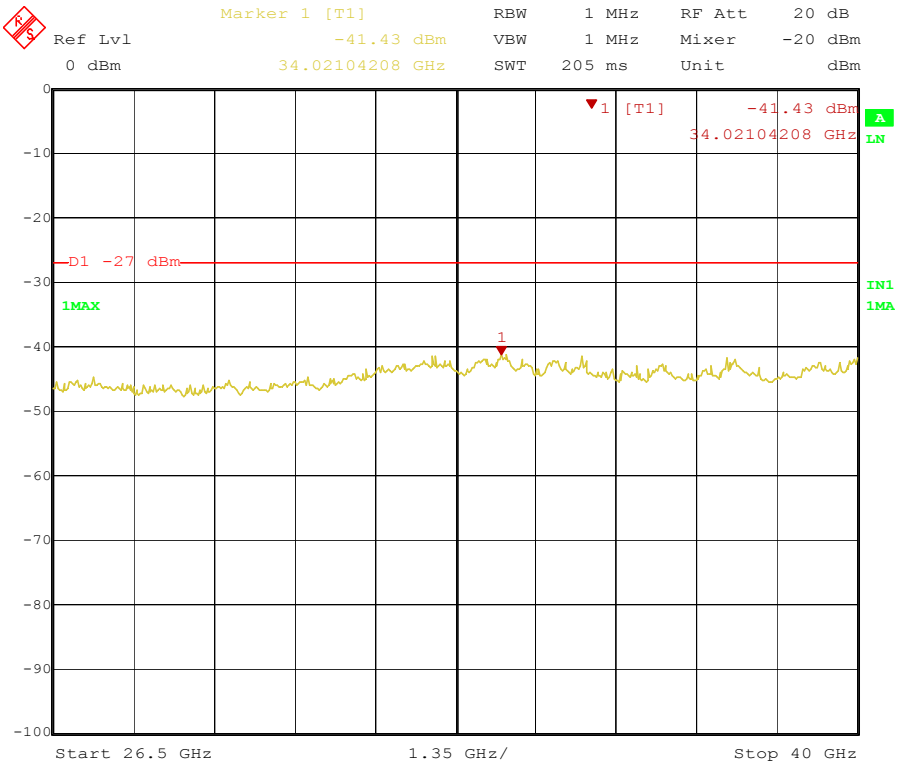
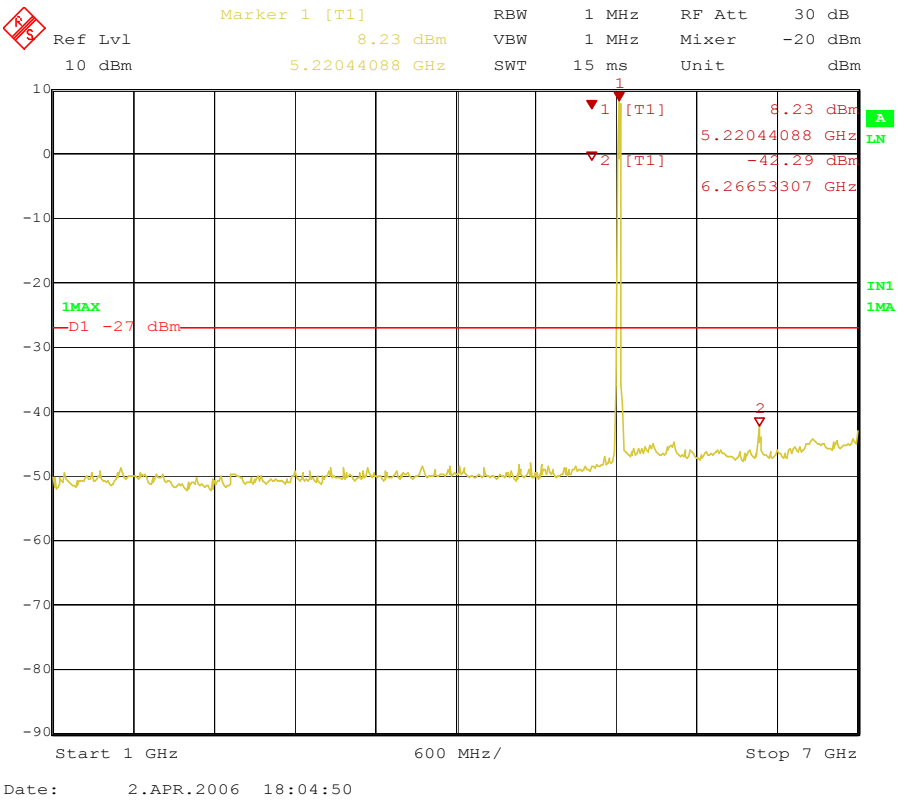
Middle Channel (operating at 5200 MHz): 26.5GHz ~ 40GHz

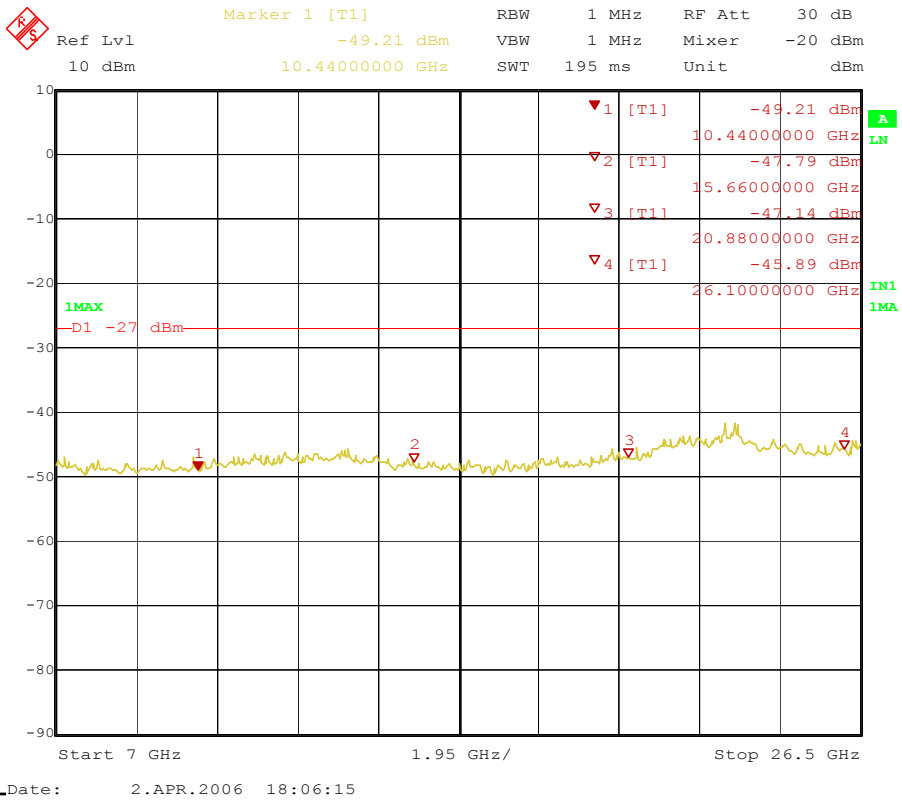


Date: 2.APR.2006 18:01:45

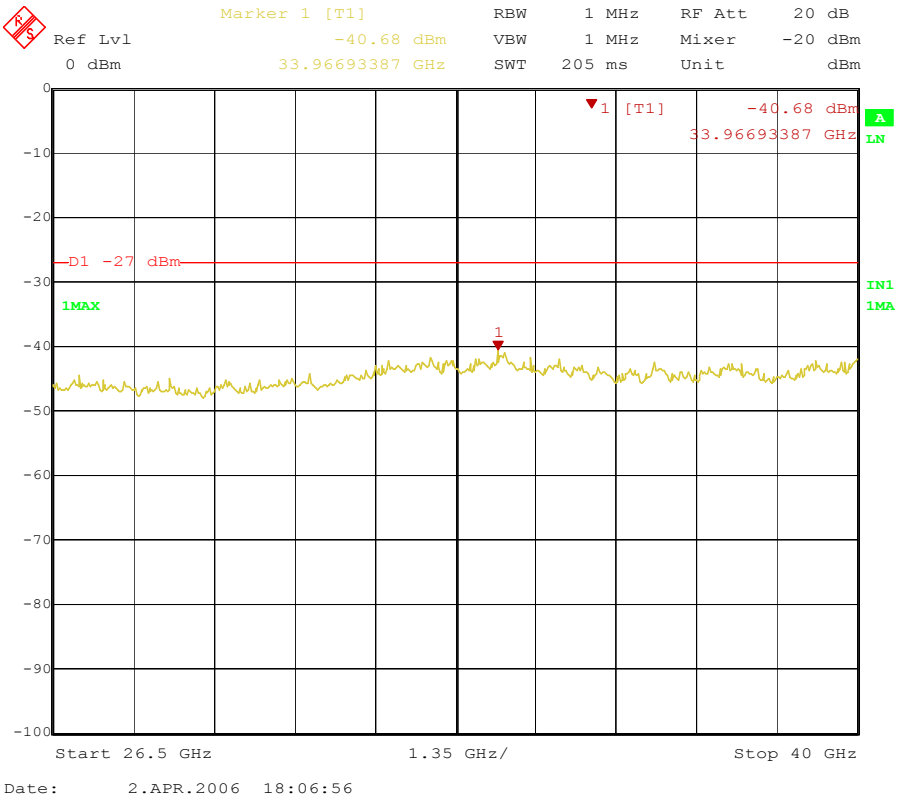
Highest Channel (operating at 5220 MHz): 30MHz ~ 7GHz



Highest Channel (operating at 5220 MHz): 7GHz ~ 26.5GHz



Highest Channel (operating at 5220 MHz): 26.5GHz ~ 40GHz



5.6 CONDUCTED EMISSIONS

5.6.1 Regulation

According to §15.407(b)(6), unwanted emissions below 1 GHz must comply with the general field strength limits set forth in Section 15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in Section 15.207.

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.

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 5: Measured values of the Conducted Emissions

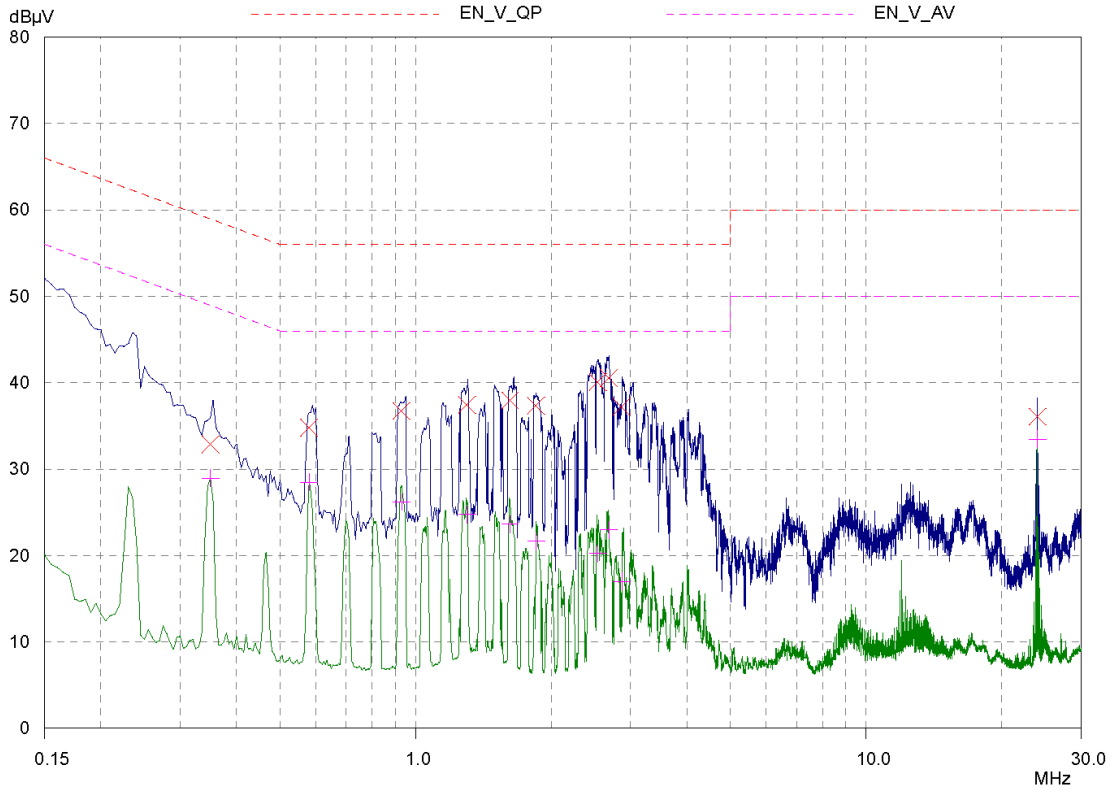
Frequency [MHz]	Reading [dBμV]	L / N	CF [dB]	CL [dB]	Actual [dBμV]	Limit [dBμV]	Margin [dB]
QUASI-PEAK DATA							
0.235	44.07	N	0.12	0.02	44.21	62.27	18.06
0.465	37.64	N	0.12	0.04	37.80	56.60	18.80
0.585	36.29	N	0.12	0.04	36.45	56.00	19.55
0.810	37.5	N	0.13	0.06	37.69	56.00	18.31
0.930	36.73	L	0.14	0.06	36.93	56.00	19.07
1.160	36.91	N	0.14	0.07	37.12	56.00	18.88
1.300	37.43	L	0.15	0.07	37.65	56.00	18.35
1.620	37.96	L	0.15	0.07	38.18	56.00	17.82
1.850	37.34	L	0.15	0.07	37.56	56.00	18.44
2.330	41.66	N	0.15	0.11	41.92	56.00	14.08
2.445	40.50	N	0.15	0.11	40.76	56.00	15.24
2.535	40.08	L	0.18	0.11	40.37	56.00	15.63
2.545	41.95	N	0.15	0.11	42.21	56.00	13.79
2.685	40.55	L	0.18	0.11	40.84	56.00	15.16
2.870	37.21	L	0.18	0.11	37.50	56.00	18.50
AVERAGE DATA							
0.235	35.95	N	0.12	0.02	36.09	52.27	16.18
0.350	28.96	L	0.13	0.04	29.13	48.96	19.83
0.465	32.32	N	0.12	0.04	32.48	46.60	14.12
0.580	28.48	L	0.13	0.04	28.65	46.00	17.35
0.585	30.68	N	0.12	0.04	30.84	46.00	15.16
0.810	27.18	N	0.13	0.06	27.37	46.00	18.63
0.930	26.18	L	0.14	0.06	26.38	46.00	19.62
0.935	24.73	N	0.13	0.06	24.92	46.00	21.08
24.00	33.48	L	1.18	0.41	35.07	50.00	14.93

Margin (dB) = Limit – Actual
[Actual = Reading + CF + CL]
L/N = LINE / NEUTRAL
CF/CL = Correction Factor and Cable Loss

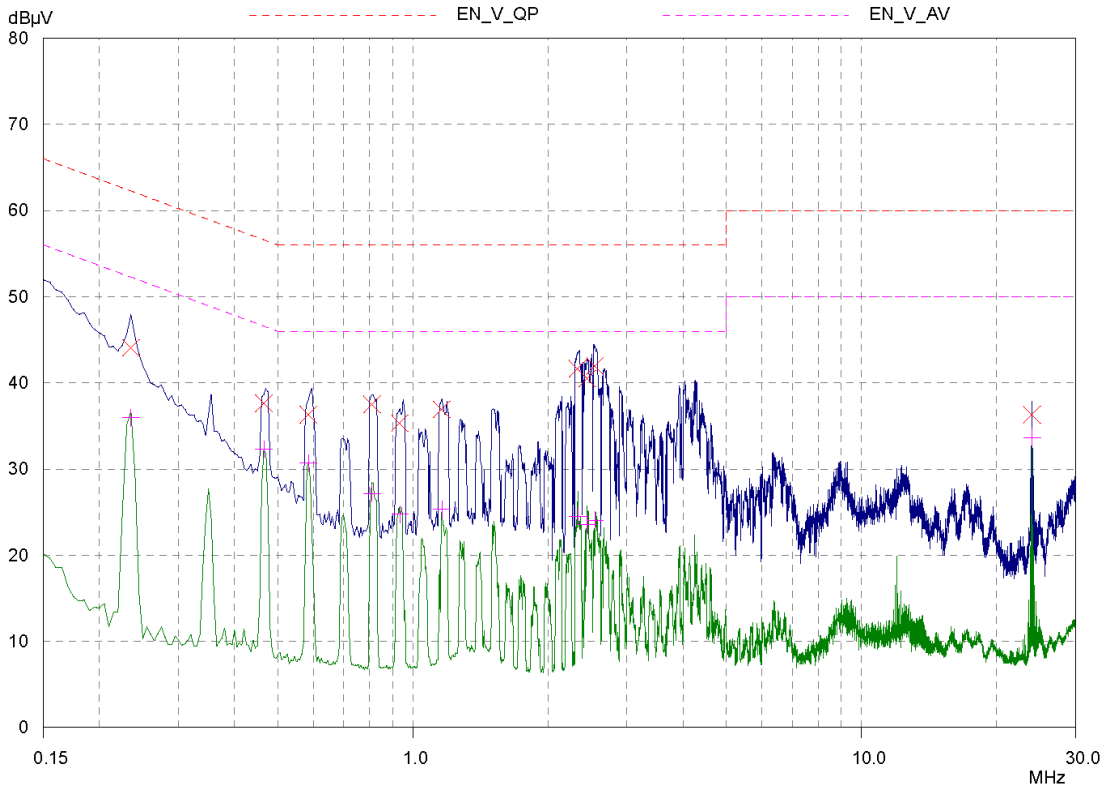
NOTE: The frequency range was scanned from 150 kHz to 30 MHz. All emissions not reported were more than 20 dB below the specified limit.

Figure 6. Plot of the Conducted Emissions

Line – PE



Neutral – PE



5.7 RF Exposure

5.7.1 Regulation

According to §15.407(f), U-NII devices are subject to the radio frequency radiation exposure requirements specified in §§ 1.1307(b), 2.1091 and 2.1093 of this chapter, as appropriate. All equipment shall be considered to operate in a "general population/uncontrolled" environment. Applications for equipment authorization of devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. Technical information showing the basis for this statement must be submitted to the Commission upon request.

Limits for Maximum Permissive Exposure: 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 = 11.89[dBm] (= 15.5 [mW]) & Antenna gain = 2.79 [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]
15.5mW, at 20cm from the antenna 2.79 [dBi]	S = PG/4πR² = 0.0059 [mW/cm^2] < 1.0 [mW/cm^2]
15.5mW, at 5cm from the antenna 2.79 [dBi]	S = PG/4πR² = 0.0938 [mW/cm^2] < 1.0 [mW/cm^2]
15.5mW, at 2.5cm from the antenna 2.79 [dBi]	S = PG/4πR² = 0.3752 [mW/cm^2] < 1.0 [mW/cm^2]

NOTE: The antenna used for the EUT is an integral SMD chip antenna. The calculated values of MPE for the EUT show that MPE is safe beyond 2.5 cm from the antenna.

5.7.2 RF Exposure Compliance Issue

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

This appliance and its antenna must not be co-located or operating in conjunction with any other antenna or transmitter. 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.

5.8 FREQUENCY STABILITY

5.8.1 Regulation

According to §15.407(g), manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

5.8.2 Test Procedure

Frequency stability versus environmental temperature

1. Supply the EUT with nominal voltage.
2. Turn the EUT off, and place it inside an environmental temperature chamber. For devices that are normally operated continuously, the EUT may be energized while inside the test chamber. For devices that have oscillator heaters, energize only the heater circuit while the EUT is inside the chamber.
3. RF output was connected to a frequency counter or other frequency-measuring instrument via feed through attenuators.
4. Set the temperature control on the chamber to the highest specified EUT operating temperature, and allow the temperature inside the chamber to stabilize at the set temperature before starting frequency measurements.
5. While maintaining a constant temperature inside the environmental chamber, turn the EUT on and record the operating frequency at startup and two, five, and ten minutes after the EUT is energized.
6. After all measurements have been made at the highest specified temperature turn the EUT off.
7. Repeat the above measurement process for the EUT with the test chamber set at the appropriate temperature.

Frequency Stability versus Input Voltage

1. At room temperature (20 ± 5 °C), supply the EUT with nominal AC voltage.
2. Couple RF output to a frequency counter or other frequency-measuring instrument.
3. Turn the EUT on, and measure the EUT operating frequency at startup and two, five, and ten minutes after startup.
4. Supply it with 85% of the nominal voltage and repeat the above procedure.
5. Supply it with 115% of the nominal voltage and repeat the above procedure.

5.8.3 Test Results: PASS

TEST MODE: EUT unmodulated

Table 6: Frequency Tolerance

Reference Frequency: 5180 MHz, LIMIT: ± 20 ppm (± 103600 Hz) Input voltage: 12.0 V_{DC}								
Environment Temperature	Carrier Frequency Measured with Time Elapsed							
	STARUP		2 minutes		5 minutes		10 minutes	
[°C]	[MHZ]	Err [Hz]	[MHZ]	Err [Hz]	[MHZ]	Err [Hz]	[MHZ]	Err [Hz]
+50	5179.926059	-73941	5179.919620	-80380	5179.916455	-83545	5179.919513	-80487
+40	5179.970297	-29703	5179.958483	-41517	5179.950055	-49945	5179.941603	-58397
+30	5179.978068	-21932	5179.972448	-27552	5179.963223	-36777	5179.952408	-47592
+20	5179.968559	-31441	5179.972816	-27184	5179.972076	-27924	5179.969582	-30418
+10	5179.977017	-22983	5179.962598	-37402	5179.967901	-32099	5179.975431	-24569
0	5179.992330	-7670	5179.986038	-13962	5179.975959	-24041	5179.971013	-28987
-10	5179.985329	-14671	5179.984113	-15887	5179.982618	-17382	5179.979591	-20409
-20	5179.989218	-10782	5179.989106	-10894	5179.986613	-13387	5179.984724	-15276

Reference Frequency: 5180 MHz, LIMIT: ± 20 ppm (± 103600 Hz) Environment Temperature: +20 °C								
Power Supplied	Carrier Frequency Measured with Time Elapsed							
	STARUP		2 minutes		5 minutes		10 minutes	
[V_{DC}]	[MHZ]	Err [Hz]	[MHZ]	Err [Hz]	[MHZ]	Err [Hz]	[MHZ]	Err [Hz]
85 %	5179.968769	-31231	5179.967770	-32230	5179.966331	-33669	5179.966538	-33462
100 %	5179.968559	-31441	5179.972816	-27184	5179.972076	-27924	5179.969582	-30418
115 %	5179.965471	-34529	5179.964907	-35093	5179.963779	-36221	5179.963157	-36843

Err [Hz] = Measured carrier frequency (MHz) - Reference Frequency (5180 MHz)