SK TECH CO., LTD.

Certificate of Compliance

Test Report No.:	**SKTTRT-060724-021**		
NVLAP CODE:	**200220-0**		
Applicant:	**SEJIN ELECTRON INC.**		
Applicant Address:	4F, SJ Technovile, 60-19, Gasan-dong, Geumcheon-gu, Seoul, 153-769 Korea		
Manufacturer:	**SEJIN ELECTRON INC.**		
Manufacturer Address:	157-1, Gajang-dong, Osan-si, Gyeonggi-do, 447-210 Korea		
Device Under Test:	**2.4GHz RF DONGLE**		
FCC ID:	**GJJSWR-300**	**Model No.:**	**SWR-300**
Receipt No.:	SKTEU06-0344	**Date of receipt:**	June 13, 2006
Date of Issue:	July 24, 2006		
Location of Testing:	**SK TECH CO., LTD.** 820-2, Wolmoon-Ri, Wabu-Up, Namyangju-Si, Kyunggi-Do, Korea		
Test Procedure:	**ANSI C63.4**		
Test Specification:	**47CFR, Part 15 Rules**		
FCC Equipment Class:	**DXX - Part 15 Low Power Communication Device Transmitter**		
Test Result:	The above-mentioned device has been tested and passed.		

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

2006. 07. 24

Signature *Date*

Approved by: *Jae-Kyung, Bae*

2006. 07. 24

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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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 15.249 for Part 15 Low Power Communication Device Transmitter. 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	825120/008	
EMI Test Receiver	Rohde&Schwarz	ESVS10	834468/013	
EMI Test Receiver	Rohde&Schwarz	ESHS10	835871/002	
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	
Oscilloscope	Agilent	54820A	US40240160	
Diode detector	Agilent	8473C	1882A03173	
High Pass Filter	Wainwright	WHKX3.0/18G	8	☒
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 : June 13, 2006

Date of Test : June 14, 2006 ~ July 24, 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 of EUT	2.4GHz RF DONGLE, Model SWR-300
FCC ID	FCC ID: GJJSWR-300
Power source	DC 5.0V fed from USB interface
Local Oscillator or X-Tal	X-Tal: 26 MHz
Transmit Frequency	2403.5 MHz ~ 2479.9 MHz (1212.4 kHz step)
Spread spectrum mode	Adaptive Frequency Hopping
Number of Channels	64 Channels, Number of Hopping Channels used: 4 channels
Type of Modulation	MSK
Antenna Type	Integrated PCB patch antenna
RF Output power	< 0dBm
External Ports	USB interface

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 the TEST MODE provided by the applicant so that the operating frequency of the EUT could be changed with the frequency hopping turned off. The TEST MODE was established by pushing the button on the EUT when turning the power on, and then controlled by an external keyboard:

- Num-Lock: Tx/Rx selection
- Caps-Lock: Modulated/Unmodulated selection
- Scroll-Lock: Hopping/Operating channel selection (CH1, CH33, or CH64)

The test modulation used was representative of normal use of the equipment. Period was approximately 8 ms and transmission duration was about 720 μs.

4.2 List of Peripherals

Equipment Type	Manufacturer	Model	Remark
Desktop PC	SAMSUNG	DM-V50	TO AC mains: unshielded, 1.8 m S/N: 371F97BA100133V
Monitor	LG IBM	1510TFT Rev B	TO AC mains: unshielded, 1.8 m TO Desktop PC: shielded, 1.8m S/N: 304KG04862
Keyboard (PS2 Type)	HP	SK-1688	S/N: C0509036394
Mouse (USB type)	LG	LMULBGS011	S/N: 04CU000254
Notebook PC **	Trigem	Dreambook	S/N: 50036 350 00106
AC/DC Adaptor **	ASUSTek COMPUTER INC.	ADP-50SB	TO AC mains: unshielded, 1.8 m TO NOTEBOOK: unshielded, 1.5 m

** The Notebook PC was used during the measurements of the AC power line conducted emission.

4.3 Uncertainty

Measurement Item	Combined Standard Uncertainty Uc	Expanded Uncertainty U = KUc (K = 2)
Radiated disturbance	± 2.30 dB	±4.60 dB
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	5.1	PASS
Radiated Emissions	15.249(a)&(d), 15.209(a)	5.2	PASS
Conducted Emissions	15.207(a)	5.3	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.

5.1.2 Result: PASS

The transmitter has an integrated PCB patch antenna.

5.2 RADIATED EMISSIONS

5.2.1 Regulation

According to §15.249(a), the filed strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency (MHz)	Field strength of Fundamental (mV/m @ 3m)	Field strength of Fundamental (dBμV/m @ 3m)	Field strength of Harmonics (μV/m @ 3m)	Field strength of Harmonics (dBμV/m @ 3m)
902 – 928	50	94	500	54
2400 – 2483.5	50	94	500	54
5725 – 5875	50	94	500	54
24000 – 24250	250	108	2500	68

According to §15.249(d), emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.
According to §15.109(a), for Class B digital devices, the field strength of radiated emissions has the same limits specified in §15.209(a).

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 tables are based on measurement instrumentation employing a CISPR quasi-peak detector below 1000 MHz and an average detector above 1000 MHz. However, the peak field strength of any emission shall not exceed the average limit by more than 20 dB.

According to §15.215(c), intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

5.2.2 Test Procedure

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 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.
7. If the emission on which a radiated measurement must be made is located at the edge of the authorized band of operation, then the alternative “marker-delta” method may be employed.

Marker-Delta Method at the edge of the authorized band of operation:

1. Perform an in-band field strength measurement of the fundamental emission using the RBW and detector function as the above Spurious Radiated Emissions test procedure.
2. Choose a spectrum analyzer span that encompasses both the peak of the fundamental emission and the band-edge emission under investigation. Set the analyzer RBW to 1% of the total span (but never less than 30 kHz) with a video bandwidth equal to or greater than the RBW. Record the peak levels of the fundamental emission and the relevant band-edge emission (i.e., run several sweeps in peak hold mode). Observe the stored trace and measure the amplitude delta between the peak of the fundamental and the peak of the band-edge emission. This is not a field strength measurement; it is only a relative measurement to determine the amount by which the emission drops at the band-edge relative to the highest fundamental emission level.
3. Subtract the delta measured in step (2) from the field strengths measured in step (1). The resultant field strengths (CISPR QP, average, or peak, as appropriate) are then used to determine band-edge compliance as required by Section 15.205.
4. The above "delta" measurement technique may be used for measuring emissions that are up to two "standard" bandwidths away from the band-edge, where a "standard" bandwidth is the bandwidth specified by C63.4 for the frequency being measured. For example, for band-edge measurements in the restricted band that begins at 2483.5 MHz, C63.4 specifies a measurement bandwidth of at least 1 MHz. Therefore you may use the "delta" technique for measuring emissions up to 2 MHz removed from the band-edge. Radiated emissions that are removed by more than two “standard” bandwidths must be measured as the above Spurious Radiated Emissions test procedure.

5.2.3 Test Results: PASS

Table 1: Measured values of the Field strength of spurious emission

Frequency [MHz]	RBW [kHz]	ANT. [m]	Pol. [V/H]	Reading [dB(μV)]	Amp Gain [dB]	ATT [dB]	AF [dB(1/m)]	CL [dB]	Actual [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Emissions in 15.249 (a) – Fundamental											
PEAK											
2403.47	1000	1.19	H	94.12	44.0	10.2	28.6	5.2	94.12	113.98	19.86
2442.27	1000	1.12	H	93.27	44.0	10.2	28.6	5.2	93.27	113.98	20.71
2479.86	1000	1.12	H	92.00	44.0	10.2	28.6	5.2	92.00	113.98	21.98
AVERAGE											
2403.47	1000	1.19	H	73.07	44.0	10.2	28.6	5.2	73.07	93.98	20.91
2442.27	1000	1.12	H	72.21	44.0	10.2	28.6	5.2	72.21	93.98	21.77
2479.86	1000	1.12	H	71.05	44.0	10.2	28.6	5.2	71.05	93.98	22.93
Emissions in 15.249 (a) – Harmonics											
PEAK											
4806.97	1000	1.37	H	73.87	45.0	0.5	34.0	7.7	71.07	73.98	2.91
4884.56	1000	1.38	H	71.86	45.0	0.5	34.0	7.7	69.06	73.98	4.92
4959.73	1000	1.36	H	71.18	45.0	0.5	34.0	7.7	68.38	73.98	5.60
7210.45	1000	1.30	H	63.19	43.6	0.5	36.7	8.5	65.29	73.98	8.69
7326.84	1000	1.52	H	62.37	43.6	0.5	36.7	8.5	64.47	73.98	9.51
7439.60	1000	1.29	H	56.84	43.6	0.5	36.7	8.5	58.94	73.98	15.04
AVERAGE											
4806.97	1000	1.37	H	53.20	45.0	0.5	34.0	7.7	50.40	53.98	3.58
4884.56	1000	1.38	H	51.50	45.0	0.5	34.0	7.7	48.70	53.98	5.28
4959.73	1000	1.36	H	51.03	45.0	0.5	34.0	7.7	48.23	53.98	5.75
7210.45	1000	1.30	H	43.41	43.6	0.5	36.7	8.5	45.51	53.98	8.47
7326.84	1000	1.52	H	43.59	43.6	0.5	36.7	8.5	45.69	53.98	8.29
7439.60	1000	1.29	H	39.49	43.6	0.5	36.7	8.5	41.59	53.98	12.39
Emissions in 15.249 (d) and 15.209 (a) – Spurious											
PEAK above 1 GHz											
2400.00	1000	1.19	H	68.11	44.0	10.2	28.6	5.2	68.11	73.98	5.87
2483.50	1000	1.12	H	64.86	44.0	10.2	28.6	5.2	64.86	73.98	9.12
AVERAGE above 1 GHz											
2400.00	1000	1.19	H	38.39	44.0	10.2	28.6	5.2	38.39	53.98	15.59
2483.50	1000	1.12	H	37.80	44.0	10.2	28.6	5.2	37.80	53.98	16.18

Continued

Table 1: Measured values of the Field strength of spurious emission

Frequency [MHz]	RBW [kHz]	ANT. [m]	Pol. [V/H]	Reading [dB(μV)]	Amp Gain [dB]	ATT [dB]	AF [dB(1/m)]	CL [dB]	Actual [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Emissions in 15.249 (d) and 15.209 (a) – Spurious											
QUASI-PEAK below 1 GHz											
182.00	120	1.8	H	43.5	27.5	-	15.8	1.2	33.0	43.5	10.5
223.99	120	1.4	H	42.3	27.2	-	17.1	1.4	33.6	46.0	12.4
339.64	120	1.2	V	43.0	27.3	-	16.8	1.6	34.1	46.0	11.9
373.61	120	1.7	V	43.4	27.4	-	17.6	1.7	35.3	46.0	10.7
545.99	120	2.9	H	36.0	28.3	-	19.8	2.0	29.5	46.0	16.5
597.99	120	2.2	H	36.0	28.4	-	21.0	2.1	30.7	46.0	15.3
649.99	120	2.2	H	36.0	28.4	-	22.0	2.3	31.9	46.0	14.1
701.99	120	3.5	H	31.9	28.5	-	22.3	2.4	28.1	46.0	17.9
753.99	120	2.9	H	38.9	28.1	-	22.9	2.4	36.1	46.0	9.9
805.99	120	2.4	H	39.1	28.1	-	22.9	2.5	36.4	46.0	9.6
857.99	120	2.1	H	39.5	28.3	-	23.6	2.5	37.3	46.0	8.7
909.99	120	1.8	H	38.2	27.8	-	25.2	2.6	38.2	46.0	7.8
961.99	120	2.0	H	33.6	27.8	-	25.1	2.8	33.7	54.0	20.3

Margin (dB) = Limit – Actual

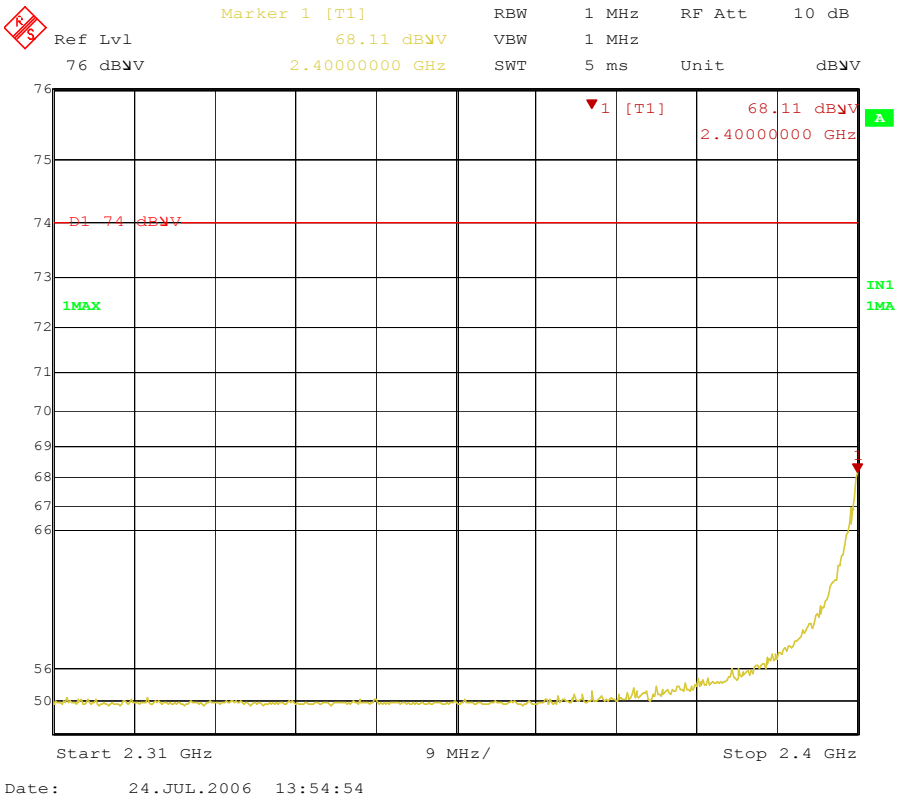
[Actual = Reading – Amp Gain + ATT + AF + CL]

1. RBW = Receiver bandwidth, ANT = Receiving antenna height, H/V = Horizontal / Vertical Polarization,
2. ATT = Attenuation (10dB pad and/or Insertion Loss of HPF), AF/CL = Antenna Factor / Cable Loss

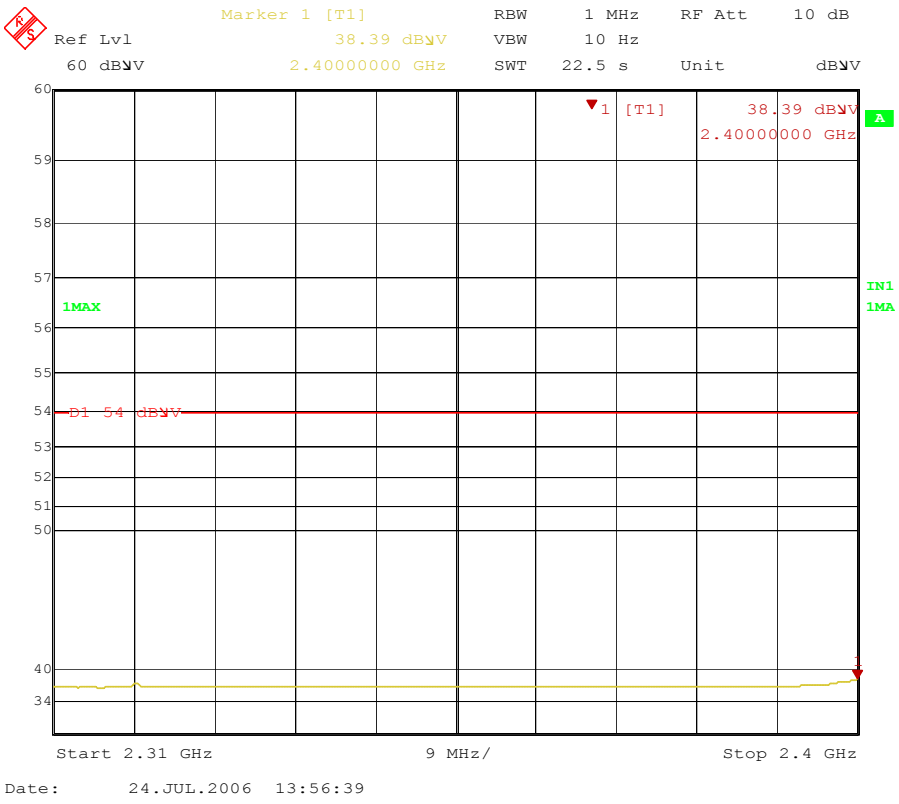
NOTE: All emissions not reported were more than 20 dB below the specified limit or in the noise floor.

Figure 1. Plot of the band edge

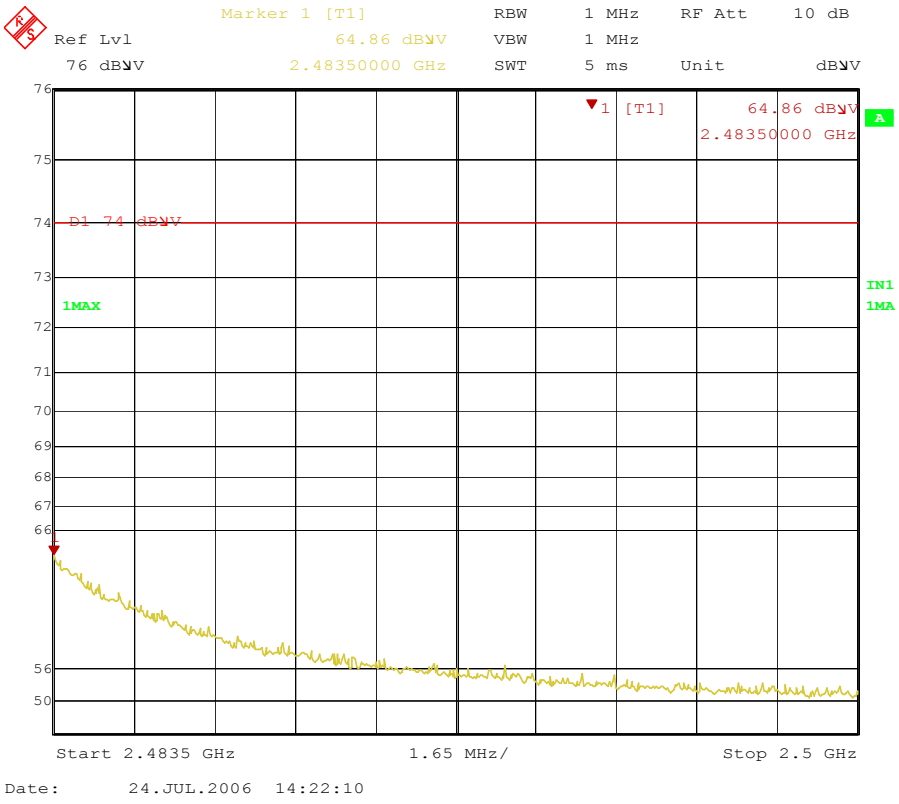
Lowest Channel (operating at 2403.5 MHz): PEAK



Lowest Channel (operating at 2403.5 MHz): AVERAGE



Highest Channel (operating at 2479.9 MHz): PEAK



Highest Channel (operating at 2479.9 MHz): AVERAGE

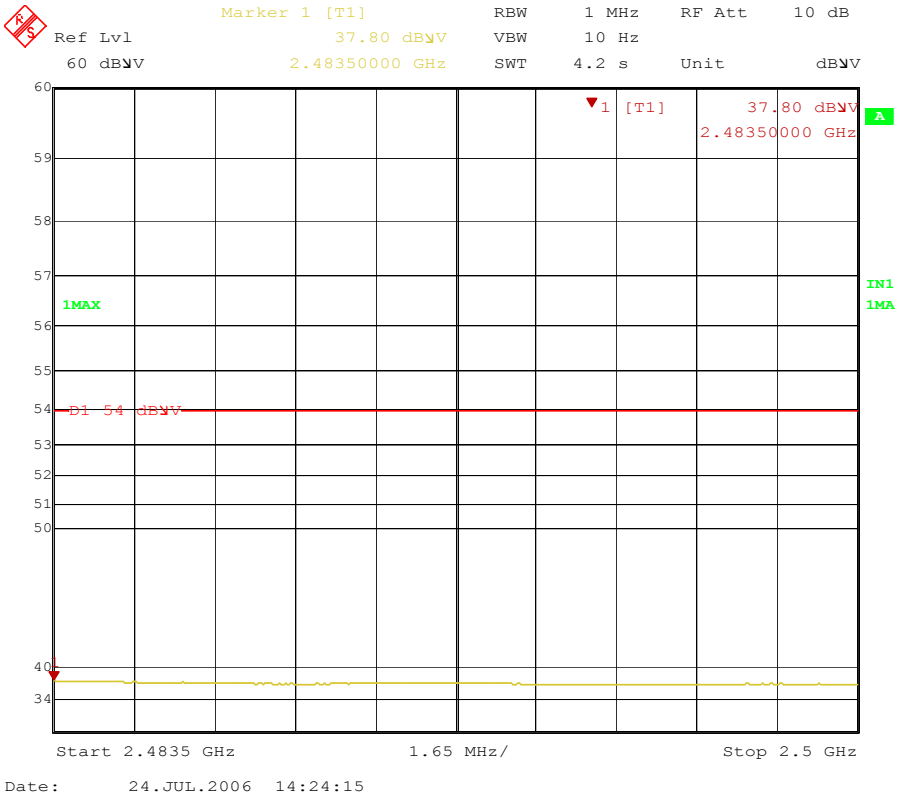
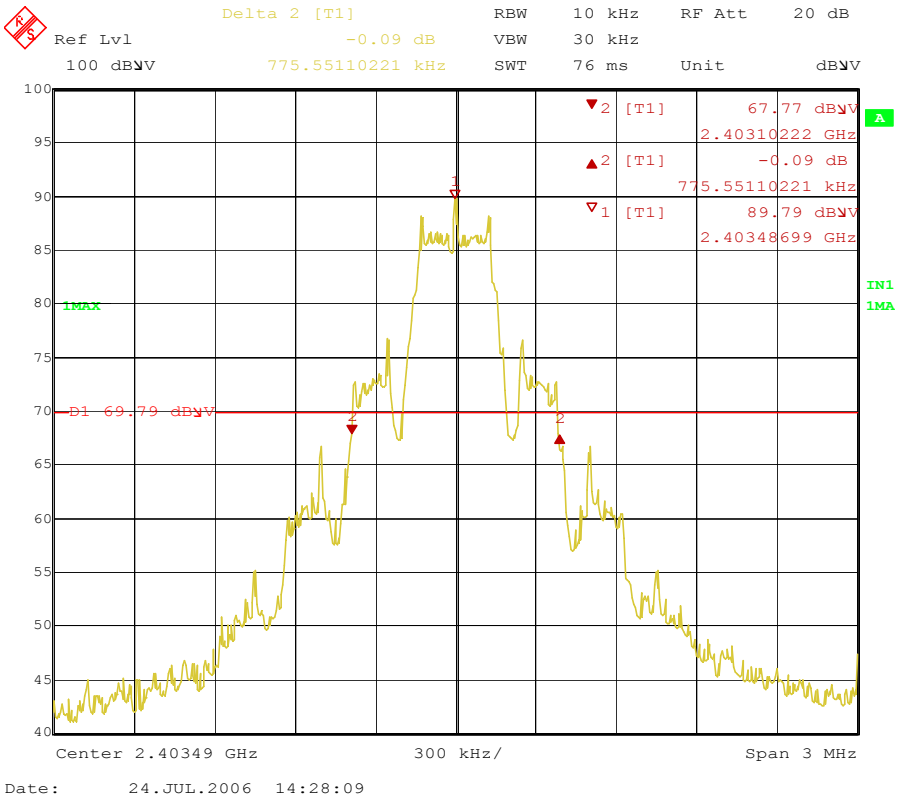
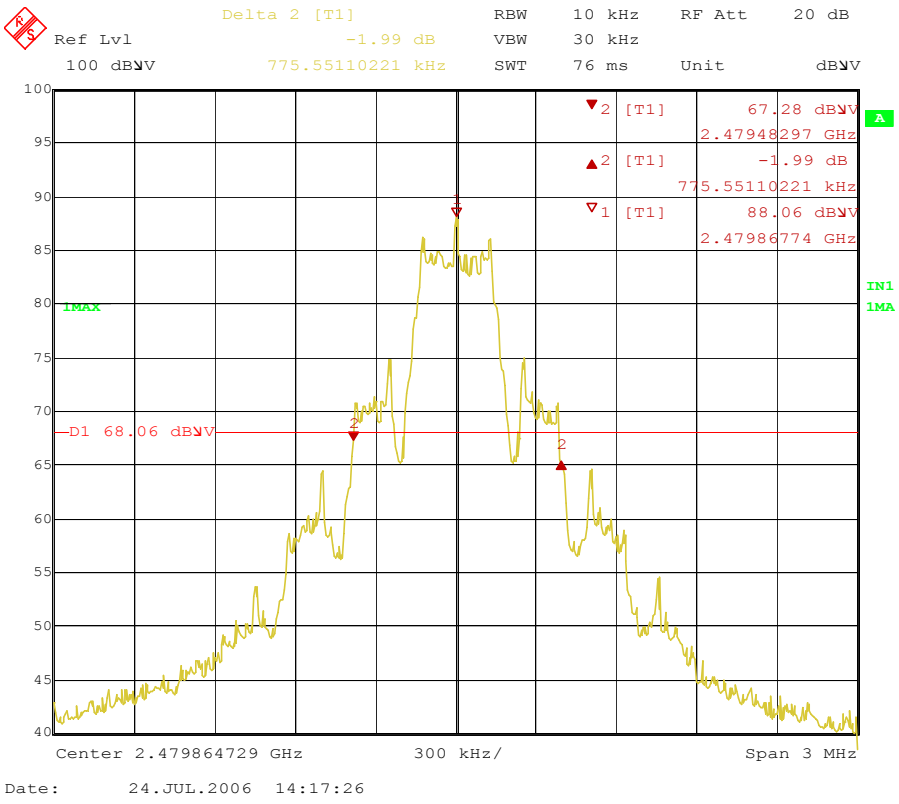


Figure 2. Plot of the 20dB bandwidth

Lowest Channel (operating at 2403.5 MHz)



Highest Channel (operating at 2479.9 MHz)



5.3 CONDUCTED EMISSIONS

5.3.1 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.

5.3.2 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.

5.3.3 Test Results: PASS

Table 2: Measured values of the Conducted Emissions

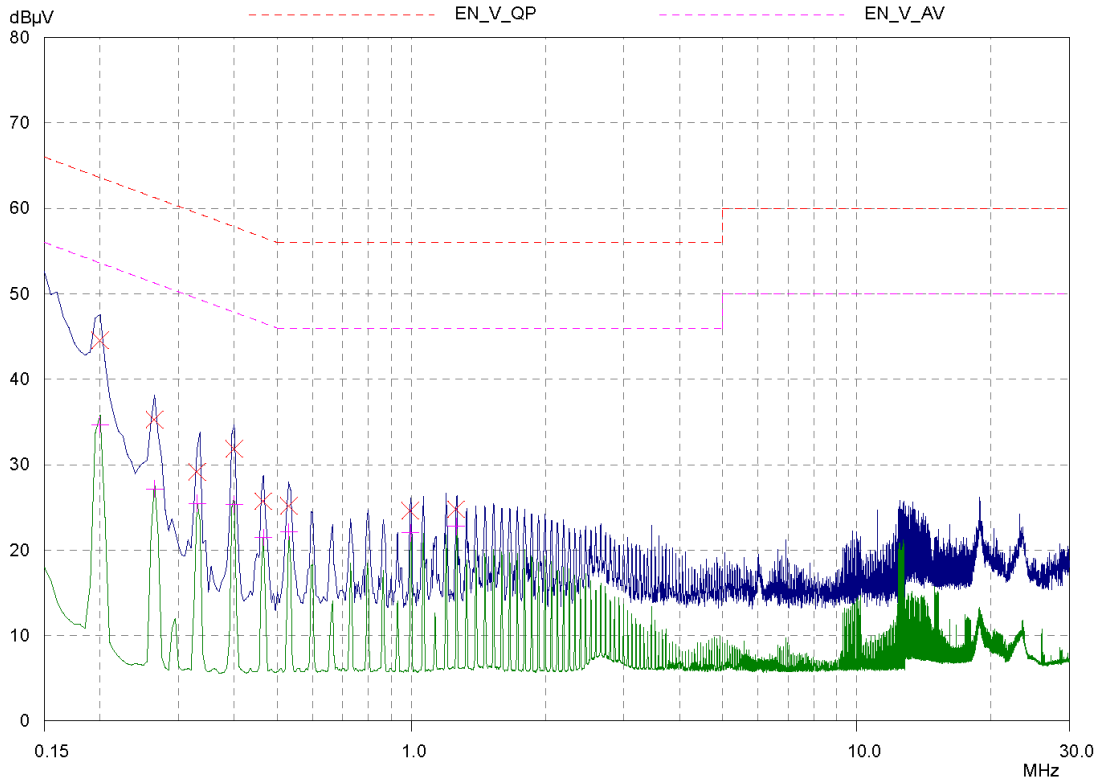
Frequency [MHz]	Reading [dBμV]	L / N	CF [dB]	CL [dB]	Actual [dBμV]	Limit [dBμV]	Margin [dB]
QUASI-PEAK DATA							
0.200	44.57	L	0.13	0.02	44.72	63.61	18.89
0.265	35.27	L	0.13	0.02	35.42	61.27	25.85
0.330	29.15	L	0.13	0.04	29.32	59.45	30.13
0.400	31.85	L	0.13	0.04	32.02	57.85	25.83
0.465	25.72	L	0.13	0.04	25.89	56.60	30.71
0.530	25.17	L	0.13	0.04	25.34	56.00	30.66
0.595	20.98	N	0.12	0.05	21.15	56.00	34.85
0.995	24.62	L	0.15	0.07	24.84	56.00	31.16
1.260	24.78	L	0.15	0.07	25.00	56.00	31.00
1.460	26.80	N	0.14	0.07	27.01	56.00	28.99
1.860	24.25	N	0.14	0.07	24.46	56.00	31.54
AVERAGE DATA							
0.200	34.61	L	0.13	0.02	34.76	53.61	18.85
0.265	27.16	L	0.13	0.02	27.31	51.27	23.96
0.330	25.46	L	0.13	0.04	25.63	49.45	23.82
0.400	25.34	L	0.13	0.04	25.51	47.85	22.34
0.465	21.48	L	0.13	0.04	21.65	46.60	24.95
0.530	22.14	L	0.13	0.04	22.31	46.00	23.69
0.595	19.66	N	0.12	0.05	19.83	46.00	26.17
0.995	22.01	L	0.15	0.07	22.23	46.00	23.77
1.260	22.77	L	0.15	0.07	22.99	46.00	23.01
1.460	22.71	N	0.14	0.07	22.92	46.00	23.08
1.860	21.92	N	0.14	0.07	22.13	46.00	23.87

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 3. Plot of the conducted emissions

Line – PE



Neutral – PE