


**SK TECH CO., LTD.**

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## Certificate of Compliance

<b>Test Report No.:</b>	SKTOS-02058		
<b>NVLAP CODE :</b>	200220-0		
<b>Applicant:</b>	WTC Electronics		
<b>Applicant Address:</b>	3731 Wilshire Blvd. Suite 506, Los Angeles CA U.S.A		
<b>Product:</b>	ADSL Modem/Router		
<b>FCC ID:</b>	QFKWTM4151	<b>Model No.:</b>	WTM4151
<b>Receipt No.:</b>	SKE20020419-261	<b>Date of receipt:</b>	Apr. 19, 2002
<b>Date of Issue:</b>	June 11, 2002		
<b>Testing location:</b>	SK TECH CO., LTD. 820-2, Wolmoon-Ri, Wabu-Up, Namyangju-Si, Kyunggi-Do, Korea		
<b>Test Standards:</b>	ANSI C63.4 / 2000		
<b>Rule Parts:</b>	FCC part 15 Subpart B		
<b>Equipment Class :</b>	Class B Digital Device Peripheral		
<b>Test Result:</b>	The above mentioned product has been tested and passed.		

Prepared by: Y.H.Kang

Tested by: J.S.Hyun/Engineer

Approved by: K.S.Kim/Manager  
& Chief Engineer

Signature	Date	Signature	Date	Signature	Date
<b>Other Aspects :</b>					
<b>Abbreviations :</b>	· 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 by the client 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.

NVLAP Lab. Code: 200220-0



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## 1. General

This equipment has been shown to be capable of compliance with the applicable technical standards and was tested in accordance with the measurement procedures as indicated in this report.

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

The 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

Table 1 : List of Test and Measurement Equipment

- Conducted Disturbance

Kind of Equipment	Type	S/N	Calibrated until
EMI Receiver	ESHS10	862970/019	02.2003
Artificial Mains Network	ESH3-Z5	834549/001	10.2002
EMI Receiver	ESHS10	835871/002	10.2002
Artificial Mains Network	ESH3-Z5	836679/018	10.2002
Conducted Cable	N/A	N/A	N/A

- Radiated Disturbance

Kind of Equipment	Type	S/N	Calibrated until
EMI Receiver	ESVS 10	825120/013	02.2003
EMI Receiver	ESVS 10	834468/008	11.2002
Spectrum Analyzer	R3361A	11730187	06.2002
Amplifier	8447F	3113A05153	06.2003
Log Periodic Antenna	UHALP9107	1819	02.2003
Biconical Antenna	BBA9106	91031626	02.2003
Antenna Mast	5907	N/A	N/A
Antenna & Turntable controller	5906	N/A	N/A
Amp & Receiver connection cables	N/A	N/A	N/A
50Ω Switcher	MP59B	6100214538	N/A

## 2.3 Test Date

Date of Application : Apr. 19, 2002

Date of Test : June 08, 2002 ~ June 10, 2002

## 2.4 Test Environment

See each test item's description.



### **3. Description of the tested samples**

The EUT is the ADSL Modem/Router.

#### **3.1 Rating and Physical Characteristics**

- LAN : One 10/100 Base-T Ethernet port (RJ-45) Compliant with IEEE 802.3,
- USB : One USB port
- ADSL Line : One ADSL port (RJ-11),
- Phone : optional telephone port with micro-filter built-in supporting Full-Rate and G.Lite
- Power Switch : On/Off Switch
- External Power : Input : AC 110 ~ 220 , Output : DC 18V 1A, Frequency : 50~60Hz
- Transmission Rate : Downstream : Maximum 8 Mbps, Upstream : Maximum 1Mbps

#### **3.2 Submitted Documents**

N/A



## 4. Measurement Conditions

Operating of EUT voltage is DC 18V supplied by the Adapter.

(Adapter Input Voltage : AC 120V, 60Hz)

### 4.1 Modes of Operation

The EUT was in the following operation mode during all testing;

EUT is connected to PC with LAN cable & USB cable.

Testing mode is TX/RX mode with LAN cable between PC and EUT.

### 4.2 List of Peripherals

Description	Manufacturer	Model Name	Serial No.	FCC ID
Personal Computer	LG IBM	W8S	202KI10585	DoC
Monitor	Comtec	CT-151B	N/A	DoC
Keyboard	LG IBM	LKB-0107	102009670	N/A
Mouse	Logitech	M-S69	HCA20302722	JNZ211443
Adapter 1 (for EUT)	SYN Electronics	SYS1089-1818-T3	R0204500	N/A
Adapter 2 (for Monitor)	ILAN Elec.	F1650K	N/A	N/A



## 4.3 Type of Used Cables

Description	Length	Type of shield	Manufacturer	Remark
PC Power cable	1.6m	Non-Shield	None	
AC/DC Adapter cable	1.8m	Non-Shield	None	For EUT
AC/DC Adapter cable	1.8m	Non-Shield	None	For Monitor
VGA cable	1.8m	Shield	None	
Keyboard Interface cable	1.2m	Non-Shield	None	
Mouse Interface cable	1.5m	Non-Shield	None	
LAN cable	1.0m	Shield	None	For EUT
USB cable	1.2m	Shield	None	For EUT

## 4.4 Test Setup

The test setup photographs showed the external supply connections and interfaces.

## 4.5 Uncertainty

### 1) Radiated disturbance

$$U_c \text{ (Combined standard Uncertainty)} = \pm 1.9 \text{ dB}$$

$$\text{Expanded uncertainty } U = K U_c$$

$$K = 2$$

$$\therefore U = \pm 3.8 \text{ dB}$$

### 2) Conducted disturbance

$$U_c = \pm 0.88 \text{ dB}$$

$$U = K U_c = 2 \times U_c = \pm 1.8 \text{ dB}$$



## 5. EMISSION Test

### 5.1 Conducted Emissions

**Result:****Pass**

The line-conducted facility is located inside a 2.0M x 3.6M x 7.2M shielded enclosure.

The shielding effectiveness of the shielded room is in accordance with MIL-Std-285 or NSA 604-05.

A 1m x 1.5m wooden table 80cm. high is placed 40cm. away from the vertical wall and 1.5m away from the side wall of the shielded room. ROHDE & SCHWARZ Model ESH3-Z5 (10kHz-30MHz) 50ohm/50 uH Line-Impedance Stabilization Networks(LISNs) are bonded to the shielded room.

The EUT is powered from the ROHDE & SCHWARZ LISN and the support equipment is powered from the ROHDE & SCHWARZ LISN. Power to the LISNs are filtered by a high-current high-insertion loss Lindgren enclosures power line filters (100dB 14kHz-10GHz).

The purpose of the filter is to attenuate ambient signal interference and this filter is also bonded to the shielded enclosure.

All electrical cables are shielded by braided tinned copper zipper tubing with inner diameter of 1/2".

If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply lines will be connected to the ROHDE & SCHWARZ LISN.

All interconnecting cables more than 1 meter were shortened by non-inductive bundling (serpentine fashion) to a 1-meter length.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the spectrum analyzer to determine the frequency producing the maximum EME from the EUT.

The spectrum was scanned from 450kHz to 30MHz with 100msec. sweep time.

The frequency producing the maximum level was reexamined using EMI/field Intensity Meter (ESHS 10) and Quasi-Peak adapter. The detector function was set to CISPR quasi-peak mode.

The bandwidth of the receiver was set to 10kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each EME emission.

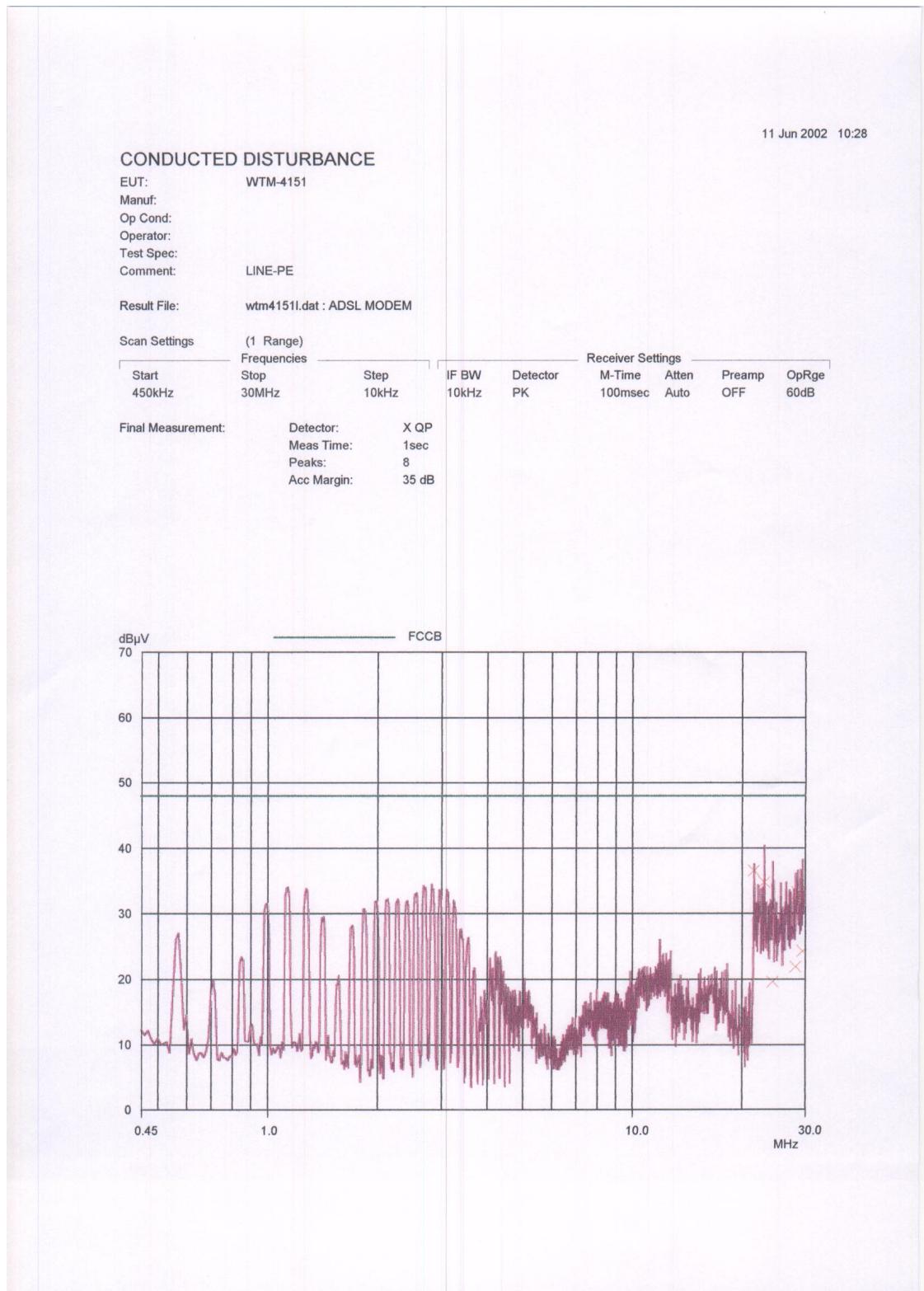
Each emission was maximized by: switching power lines; varying the mode of operation or resolution; clock or data exchange speed; if applicable; whichever determined the worst-case emission.

Photographs of the worst-case emission can be seen in photograph of conducted test.

Each EME reported was calibrated using self-calibrating mode.

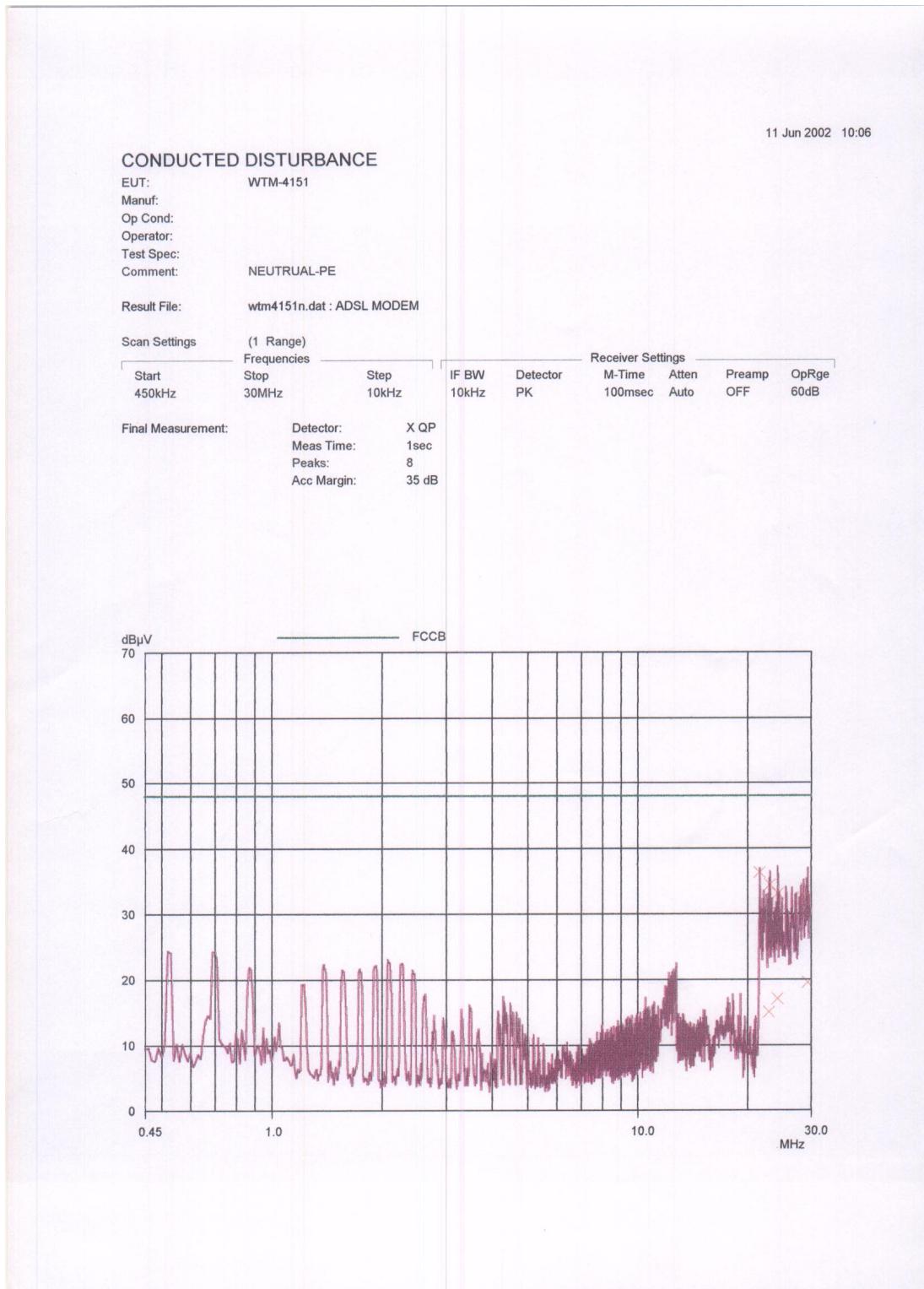


Figure 1 : Spectral Diagram, LINE - PE



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**Figure 2 : Spectral Diagram, NEUTRAL – PE**

**Table 2: Test Data, Conducted Emissions**

Frequency (MHz)	(1)Reading (dB $\mu$ V)	Line	(2)C/F (dB)	(3)C/L (dB)	(4)Actual (dB $\mu$ V)	(5)Limit (dB $\mu$ V)	(6)Margin (dB)
21.660	36.58	A	0.6	0.6	37.78	48.0	10.22
23.130	34.49	B	0.5	0.6	35.59	48.0	12.41
24.300	17.07	B	0.5	0.7	18.27	48.0	29.73
28.280	21.93	A	0.8	0.7	23.43	48.0	24.57
29.570	24.35	A	0.8	0.8	25.95	48.0	22.05

**NOTES:**

1. All modes of operation were investigated and the worst-case emission are reported.
2. All other emissions are non-significant.
3. All readings are calibrated by self-mode in receiver.
4. Measurements using CISPR quasi-peak mode.
5. Line A = LINE-PE, Line B = NEUTRAL-PE
6. C/F = Correction Factor
7. C/L = Cable Loss

**◆ Margin Calculation**

$$(6)\text{Margin} = (5)\text{Limit} - (4)\text{Actual}$$

$$[(4)\text{Actual} = (1)\text{Reading} + (2)\text{C/F} + (3)\text{C/L}]$$



## 5.2 Radiated Emissions

**Result :****Pass**

Preliminary measurements were made indoors at 1 meter using broadband antennas, broadband amplifier, and spectrum analyzer to determine the frequency producing the maximum EME.

Appropriate precaution was taken to ensure that all EME from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, turntable azimuth with respect to the antenna were noted for each frequency found.

The spectrum was scanned from 30 to 300 MHz using biconical antenna and from 300 to 1000 MHz using log-periodic antenna. Above 1GHz, linearly polarized double ridge horn antennas were used.

Final measurements were made outdoors at 3-meter test range using SCHWARZBECK dipole antennas. The test equipment was placed on a wooden table situated on a 4x4 meter area adjacent to the measurement area. Turntable was to protect from weather in the dome that made with FRP.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. Each frequency found during pre-scan measurements was re-examined and investigated using EMI/Field Intensity Meter(ESVS 10) and Quasi-Peak Adapter. The detector function was set to CISPR quasi-peak mode and the bandwidth of the receiver was set to 100kHz or 1MHz depending on the frequency or type of signal.

The half-wave dipole antenna was tuned to the frequency found during preliminary radiated measurements. The EUT, support equipment and interconnecting cables were re-configured to the set-up producing the maximum emission for the frequency and were placed on top of a 0.8-meter high non-metallic 1 x 1.5 meter table.

The EUT, support equipment, and interconnecting cables were re-arranged and manipulated to maximize each EME emission. The turntable containing the system was rotated; the antenna height was varied 1 to 4 meters and stopped at the azimuth or height producing the maximum emission.

Each emission was maximized by: varying the mode of operation or resolution; clock or data exchange speed, and/or support equipment, if applicable; and changing the polarity of the antenna, whichever determined the worst-case emission.

Photographs of the worst-case emission can be seen in photograph of radiated emission test.

Each EME reported was calibrated using self-calibrating mode.

**Table 3 : Test Data, Radiated Emissions**

Frequency (MHz)	Pol.	Height [m]	Angle [°]	(1) Reading (dB $\mu$ V)	(2) AFCL (dB/m)	(3) Actual (dB $\mu$ V/m)	(4) Limit (dB $\mu$ V/m)	(5) Margin (dB)
132.48	H	1.3	3	24.2	15.8	40.0	43.5	3.5
198.72	V	3.1	318	22.0	18.5	40.5	43.5	3.0
499.96	H	1.8	109	15.1	23.3	38.4	46.0	7.6

Table. Radiated Measurements at 3-meters

※ *The measured result is below the upper limit, but by a margin less than half of the uncertainty interval; it is therefore not possible to state compliance based on the 95% level of confidence.*  
*However, the result indicates that compliance is more probable than non-compliance.*

### NOTES:

1. All modes of operation were investigated and the worst-case emission are reported.
2. All other emission are non-significant.
3. All readings are calibrated by self-mode in receiver.
4. Measurements using CISPR quasi-peak mode.
5. AFCL = Antenna factor and cable loss
6. H = Horizontal, V = Vertical Polarization

### ◆ Margin Calculation

$$\begin{aligned}
 (5) \text{Margin} &= (4) \text{Limit} - (3) \text{Actual} \\
 (3) \text{Actual} &= (1) \text{Reading} + (2) \text{AFCL}
 \end{aligned}$$