SKT

# SK TECH CO., LTD.



# Certificate of Compliance

| | | | |
|---|---|---|---|
| **Test Report No.:** | **SKTOS-01027** | | |
| **NVLAP CODE :** | **200220-0** | | |
| **Applicant:** | **GARNET SYSTEMS Co., Ltd.** | | |
| **Applicant Address:** | MYUNGSUNG Bldg., 545-7, DOGOK-DONG, KANGNAM-GU, SEOUL, KOREA | | |
| **Product:** | **ADSL Modem** | | |
| **FCC ID:** | **LEMGAN-1030** | **Model No.:** | **GAN-1030** |
| **Receipt No.:** | SKE20001219-934 | **Date of receipt:** | Dec. 19, 2000 |
| **Date of Issue:** | Mar. 12, 2001 | | |
| **Testing location:** | **SK TECH CO., LTD.**<br>820-2, Wolmoon-Ri, Wabu-Up, Namyangju-Si, Kyunggi-Do, Korea | | |
| **Test Standards:** | **ANSI C63.4 / 1992** | | |
| **Rule Parts:** | **FCC part 15 Subpart B** | | |
| **Equipment Class :** | **Class B Digital Device Peripheral** | | |
| **Test Result:** | The above mentioned product has been tested and passed. | | |

| **Prepared by:** *Y.H. Kang* | **Tested by**: *K.T.Lee/Engineer* | **Approved by**: *J.Y.Hyun /Lab.Manager* |
|---|---|---|
| *Signature* *Date* | *Signature* *Date* | *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 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®

**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 ANSI C63.4/1992 for measurement of radio interference.

## 2.2 List of Test and Measurement Instruments

**Table 1 : List of Test and Measurement Equipment**

- **Conducted Emissions**

| Kind of Equipment | Type | S/N | Calibrated until |
|---|---|---|---|
| Field Strength Meter | ESHS 10 | 862970/019 | 04.2001 |
| LISN | KNW-407 | M63284 | 07.2001 |
| LISN | ESH2-Z5 | 862060/029 | 06.2001 |
| Conducted Cable | N/A | N/A | 07.2001 |

- **Radiated Emissions**

| Kind of Equipment | Type | S/N | Calibrated until |
|---|---|---|---|
| Field Strength Meter | ESVS 10 | 825120/013 | 04.2001 |
| Spectrum Analyzer | R3361A | 11730187 | 07.2001 |
| Amplifier | 8447F | 3113A05153 | 05.2001 |
| Log Periodic Antenna | UHALP9107 | 91071238 | 04.2001 |
| Biconical Antenna | BBA9106 | N/A | 04.2001 |
| Open Site Cable | N/A | N/A | 07.2001 |
| Antenna Mast | 5907 | N/A | N/A |
| Antenna & Turntable controller | 5906 | 91X519 | N/A |
| Amp & Receiver connection cable | N/A | N/A | 07.2001 |
| Amp & Spectrum connection cable | N/A | N/A | 07.2001 |
| 50Ω Switcher | MP59B | M93083 | 07.2001 |

## 2.3 Test Date

Date of Application : Dec. 19, 2001

Date of Test : Jan. 26, 2001~ Feb. 12, 2001

## 2.4 Test Environment

See each test item's description.

# 3. Description of the tested samples

The EUT is ADSL Modem.

## 3.1 Rating and Physical Characteristics

- Dimension : 145(L) x 75(W) x 21(H)mm
- Power Consumption : 0.11 ~ 1.1MHz(Down) / 30KHz ~ 110KHz (Up)
- Modulation : DMT (Discrete Multi Tone)
- Data Rates : Downstream : Max. 8Mbps
  Upstream : Max. 640Kbps
- Interface : PCI Specification 2.1 or higher
- Minimum System Requirements :
  - Pentium-based PCI bus PC, Pentium 400MHz or higher PCI slot, 32M bytes RAM
  - Monitor Minimum Resolution of 1024 X 768
  - CD-ROM drive
  - 30M bytes for Software only
- Virtual Path & Channel : 8bits VPI, 16bits VCI Address
- WAN Protocol : RFC1483, RFC2364

## 3.2 Submitted Documents

N/A

# 4. Measurement Conditions

Testing Input Voltage : AC 120V, 60Hz

## 4.1 Modes of Operation

The EUT was in the following operation mode during all testing;
Installed at PC, The EUT tested in mode of UP & Down loading data.

## 4.2 List of Peripherals

| Description | Manufacturer | Model Name | Serial No. | FCC ID |
|---|---|---|---|---|
| Monitor | Samsung | SyncMaster750P | PG17HS9U/ADC | Doc |
| PC | H.P | Brio BA 600 | SG03603357 | Doc |
| Printer | H.P | 2225C | 3245S12493 | DSI6XU2225 |
| Keyboard | I-GANG | IGK-2000i | 100060126134 | HQKBITS9001 |
| Mouse 1 | Logitech | M-S48 | LZA93274466 | HQKBITS9001 |
| Mouse 2 | Logitech | M-BE55 | LZE02551778 | Doc |
| Joystick | Logitech | J-ZA10 | LZS01651409 | Doc |
| Speaker | CAMAC | CMK600 | N/A | Doc |
| Mic | N/A | N/A | N/A | N/A |
| INNO dispenser | Biopia | BD-2000 | N/A | Doc |
| Telephone | LG telecom | GS-460F | 009KC20109 | N/A |

## 4.3 Type of Used Cables

| Description | Length | Type of shield | Manufacturer | Remark |
|---|---|---|---|---|
| Video interface cable | 1.5m | Shield | None | |
| PC power cable | 1.2m | Non-Shield | None | |
| Monitor power cable | 1.5m | Non-Shield | None | |
| Printer power cable | 1.5m | Non-Shield | None | |
| Printer interface cable | 1.5m | Shield | None | |
| Teline | 1.2m | Non-Shield | None | |
| Keyboard interface cable | 1.2m | Shield | None | |
| Mouse1 interface cable | 1.2m | Non-Shield | None | |
| Mouse2 interface cable | 1.0m | Non-Shield | None | |
| Joystick | 1.5m | Shield | None | |
| Speaker Power cable | 1.8m | Non-Shield | None | |
| Speaker interface cable | 1.0m | Non-Shield | None | |
| Mic interface cable | 1.0m | Non-Shield | None | |
| INNO dispenser | 1.2m | Non-Shield | None | |

## 4.4 Test Setup

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

## 4.5 Uncertainty

**1) Radiated disturbance**

Uc (Combined standard Uncertainty) = ± 1.9dB

Expanded uncertainty U = KUc

K = 2

∴ U = ± 3.8dB

**2) Conducted disturbance**

Uc = ± 0.88dB

U = KUc = 2xUc = ± 1.8dB

# 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. Kyoritsu Model KNW-407 (10kHz-30MHz) 50ohm/50 uH Line-Impedance Stabilization Networks(LISNs) are bonded to the shielded room.
The EUT is powered from the Kyoritsu LISN and the support equipment is powered from the Kyoritsu 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 Kyoritsu 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**

EUT: FCC ID: LEMGAN-1030
Comment: LINE-PE

Scan Settings (1 Range)

| Frequencies | | | Receiver Settings | | | | | |
|---|---|---|---|---|---|---|---|---|
| Start | Stop | Step | IF BW | Detector | M-Time | Atten | Preamp | OpRge |
| 150k | 30M | 10k | 10k | PK | 100ms | AUTO | LN OFF | 60dB |

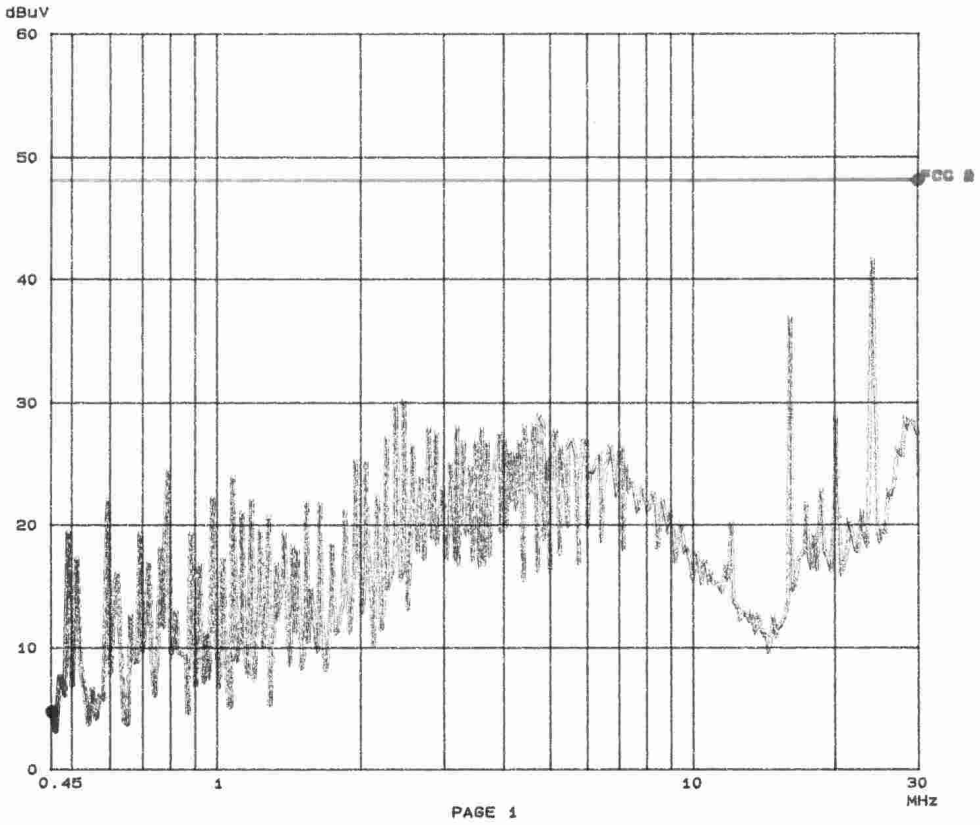

**Figure 2 : Spectral Diagram, NEUTRAL – PE**

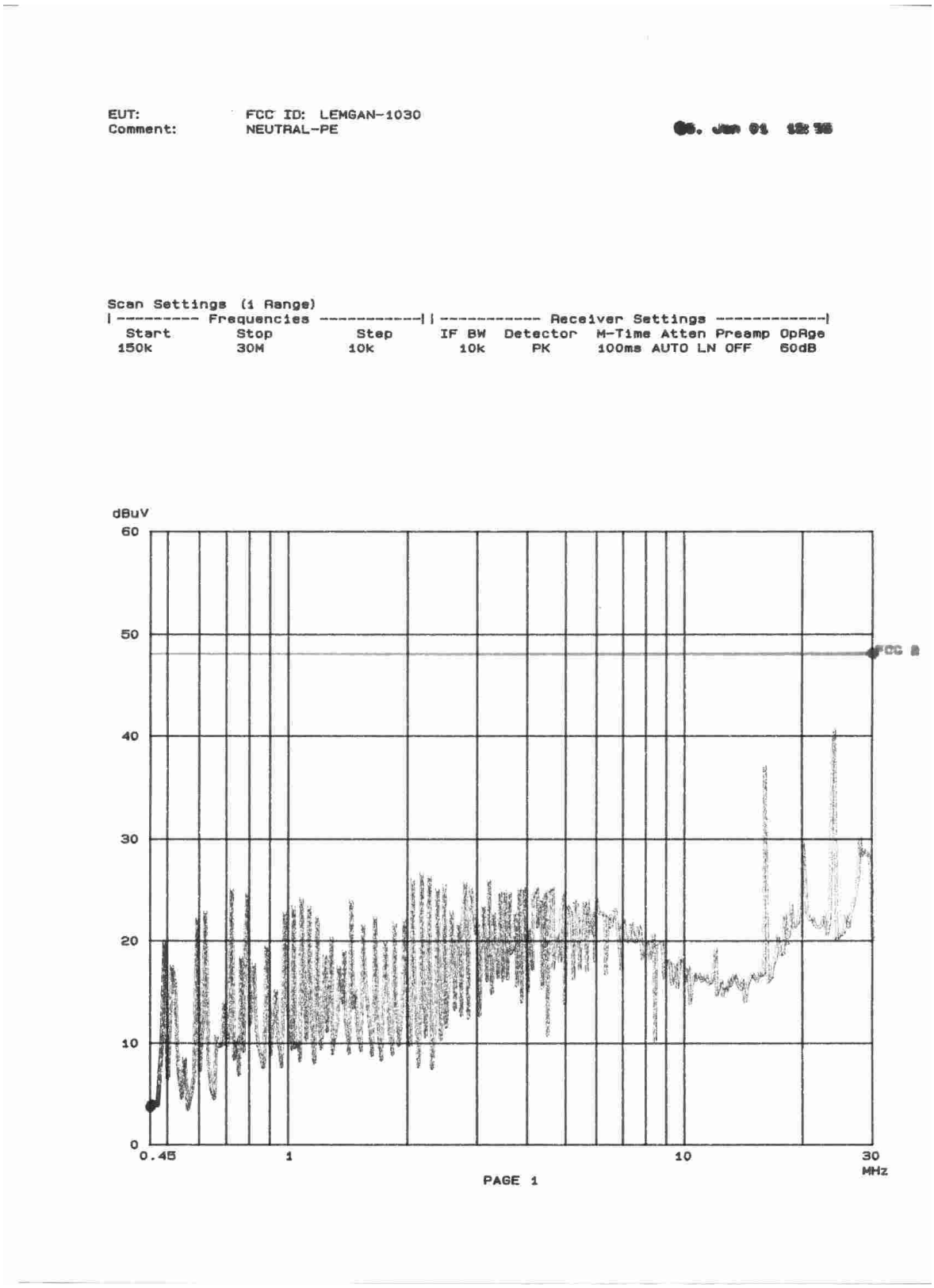

**Table 2: Test Data, Conducted Emissions**

| Frequency (MHz) | (1)Reading (dBμV) | Line | (2)C/F (dB) | (3)C/L (dB) | (4)Actual (dBμV) | (5)Limit (dBμV) | (6)Margin (dB) |
|---|---|---|---|---|---|---|---|
| 0.79 | 26.8 | B | 0.1 | 0.1 | 27.0 | 48.0 | 21.0 |
| 5.04 | 26.1 | A | 0.3 | 0.4 | 26.8 | 48.0 | 21.2 |
| 16.00 | 34.7 | B | 0.3 | 0.6 | 35.6 | 48.0 | 12.4 |
| 24.00 | 38.6 | A | 0.6 | 0.7 | 39.9 | 48.0 | 8.1 |
| 20.00 | 26.9 | A | 0.6 | 0.6 | 28.1 | 48.0 | 19.9 |
| 28.96 | 23.3 | A | 0.8 | 0.8 | 24.9 | 48.0 | 23.1 |

**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)Margin = (5)Limit - (4)Actual**

**[(4)Actual = (1)Reading + (2)C/F + (3)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 (dBμV) | (2) AFCL (dB/m) | (3) Actual (dBμV/m) | (4) Limit (dBμV/m) | (5) Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| 70.66 | H | 1.0 | 193 | 30.8 | 7.3 | 38.1 | 40.0 | 1.9 |
| 73.74 | V | 1.2 | 210 | 29.7 | 7.4 | 37.1 | 40.0 | 2.9 |
| 141.32 | H | 1.0 | 172 | 23.1 | 16.7 | 39.8 | 43.5 | 3.7 |
| 250.56 | H | 2.1 | 251 | 21.4 | 20.9 | 42.3 | 46.0 | 3.7 |

Table. Radiated Measurements at 3-meters

**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**

**(5)Margin = (4)Limit - (3)Actual**

**[(3)Actual = (1)Reading + (2)AFCL]**