SK TECH CO., LTD.

Certificate of Compliance

Test Report No.:	**SKTFCE-030709-090**		
NVLAP CODE :	**200220-0**		
Applicant:	**Smart Card Technology Inc.**		
Applicant Address:	1F, HIT(hanyang Univ. Institute of Technology) 17, Haengdang-Dong, Seongdong-Ku, Seoul, Korea		
Product:	**Smart Key**		
FCC ID:	**RA2SPK-2032**	**Model No.:**	**SPK-2032**
Multi-listing Model No.:	**SPK-2016**		
Receipt No.:	SKTEU03-0403	**Date of receipt:**	July 02, 2003
Date of Issue:	July 09, 2003		
Testing location:	**SK TECH CO., LTD.** 820-2, Wolmoon-Ri, Wabu-Up, Namyangju-Si, Kyunggi-Do, Korea		
Test Standards:	**ANSI C63.4 / 2001**		
Rule Parts:	**FCC part 15 Subpart B**		
Equipment Class :	**Class B Digital Device Peripheral**		

※ **This device has shown compliance with the conducted emissions limits in 15.107, 15.207 or 18.307 adopted under FCC 02-157(ET Docket 98-80). The device may be marketed after July 11, 2005, and is not affected by the 15.37(j) or 18.123 transition provisions.**

Test Result:	The above mentioned product has been tested and passed.

Prepared by: *Y.H.Kang* **Tested by**:*S.B.Kim/Engineer* **Approved by**: *C.H.Jung/Manager & Chief Engineer*

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 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

Table 1 : List of Test and Measurement Equipment

- **Conducted Disturbance**

Kind of Equipment	Type	S/N	Calibrated until
EMI Receiver	ESHS10	862970/019	10.2003
Artificial Mains Network	ESH2-Z5	834549/011	10.2003
EMI Receiver	ESHS10	835871/002	10.2003
Artificial Mains Network	ESH3-Z5	836679/018	10.2003
Conducted Cable	N/A	N/A	N/A

- **Radiated Disturbance**

Kind of Equipment	Type	S/N	Calibrated until
EMI Receiver	ESVS 10	825120/013	10.2003
EMI Receiver	ESVS 10	834468/008	10.2003
Spectrum Analyzer	R3361A	11730187	10.2003
Amplifier	8447F	3113A05153	10.2003
Log Periodic Antenna	UHALP9107	1819	10.2003
Biconical Antenna	BBA9106	91031626	10.2003
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 : July 02, 2003

Date of Test : July 03, 2003 ~ July 07, 2003

2.4 Test Environment

See each test item's description.

3. Description of the tested samples

The EUT is the Smart Key.
SPK-2032 is a public key infrastructure product.
It is combined with smart card reader and smart card technology.
It has security functions in bandware and fulfills security requirements in software.

3.1 Rating and Physical Characteristics

Model No.	SPK-2016	SPK-2032
Operating System	Windows98,NT4.0,2000,XP,WindowCE	
Memory	16K(EEPROM)	32K(EEPROM)
COS	General ST-COS(ISO-7816)	
PKI Interface	MSCAPI,PKCS#11	
Certifications & standards	PKCS#11 v2.01,CAPI(Microsoft Cryto API),APDU commands,PC/SC,X.509 v3 certificate storage, SSL v3,IPsec/IKE	
SDK	SDK,PKCS#11,MSCAPI Sample source	
Chip security level	1) Secured and encrypted EEPROM memory chip 2) NIST FIPS 140-1 Level 2 Authentication 3) Tamper Proof ability- Never reproduction 4) Public/private Key and signature are generated and verified inside smartkey and private key is not exposed outside. 5) Pesudo Random Number generation 6) Unique Key serial number made by 64bit	
On board security algorithms	RSA,SHA-1,3DES	
Application	All fields related on PKI certification	
Compatibility	Windows 2000,PC/SC,USB 1.1	
Dimensions	12 * 58 * 9 mm	
Operating temperature	0℃ to 70℃ (32 F to 158 F)	
Storage temperature	- 40℃ to 85℃ (-40 F to 185 F)	
Humidity rating	0 - 100 % without condensation	
Connector	USB type A (Universal Serial Bus)	

3.2 Submitted Documents

N/A

4. Measurement Conditions

Operating voltage of the EUT is ± DC 5V, Max 13mA.

4.1 Modes of Operation

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

Plug the EUT into an available USB port located at the back of computer.

The Device manager confirms.

4.2 List of Peripherals

Description	Manufacturer	Model Name	Serial No.	FCC ID
Notebook PC	LG Electronics	CM2080	5Y0AFHRBPD34	Doc
Adapter (for EUT)	Lite-On	PA-1600-02	0804041CA	
Printer	H.P	2225C	3132S00310	N/A
Mouse	Logitech	M-U48a	LZE20806413	N/A
Adapter (for Printer)	Dream Electronic	DR-05600U	N/A	N/A

4.3 Type of Used Cables

Description	Length	Type of shield	Manufacturer	Remark
AC/DC power cable	1.5m	Non-Shield	None	For Note PC
USB cable	1.2m	Non-Shield	None	For Mouse
Parallel interface cable	1.0m	Shield	None	For Printer
AC/DC power cable	1.5m	Non-Shield	None	For Printer

4.4 Test Setup

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

4.5 Uncertainty

1) Radiated disturbance

⊙ **Horizontally polarized radiated disturbances from 30MHz to 1000MHz at a distance of 10m**

Input quantity	Uncertainty of Xi		U(Xi)	Ci	Ciu(xi)	**CISPR 16-4**
	dB	Probability distribution function	dB			
1) Receiver reading	±0.1	K =1	0.1	1	**0.1**	0.10
2) Attenuation: antenna-receiver	±0.18	K=2	0.09	1	**0.09**	0.05
3) Antenna factor	±1.5	K=2	0.75	1	**0.75**	1.00
RECEIVER CORRECTIONS:						
4) Sine wave voltage	±0.56	K=2	0.28	1	**0.50**	0.50
5) Pulse amplitude response	±1.5	Rectangular (√3)	0.87	1	**0.87**	0.87
6) Pulse repetition rate response	±1.5	Rectangular (√3)	0.87	1	**0.87**	0.87
7) Noise floor proximity	±0.5	K=2	0.25	1	**0.25**	0.25
8) AF frequency interpolation	±0.3	Rectangular (√3)	0.17	1	**0.17**	0.17
9) Balance	±0.3	Rectangular (√3)	0.17	1	**0.17**	0.53
10) AF height deviations	±0.5	Rectangular (√3)	0.29	1	**0.29**	0.29
11) Phase center location	±0.3	Rectangular (√3)	0.17	1	**0.17**	0.17
12) Directive difference	+1.0	Rectangular (√3)	0.29	1	**0.29**	0.29
13) Cross polarization	±0.9	Rectangular (√3)	0.52	1	**0.52**	0.52
14) Site corrections	±2.6	Rectangular (√3)	1.5	1	**1.5**	1.63
15) Mismatch (ant-receiver)	±1.06	U-shaped (√2)	0.75	1	**0.75**	0.67

Combined Uncertainty

$Uc(xi) = \sqrt{(1)^2+(2)^2+(3)^2+(4)^2+(5)^2+(6)^2+(7)^2+(8)^2+(9)^2+(10)^2+(11)^2+(12)^2}$

$+(13)^2+(14)^2+(15)^2 = 2.37$

Expanded Uncertainty

U= k*Uc(xi) = 2 * 2.37= 4.74dB (The coverage factor k =2 yields approximately a 95% level of confidence)

⊙ **Vertically polarized radiated disturbances from 30MHz to 1000MHz at a distance of 10m**

Input quantity	Uncertainty of Xi		U(Xi)	Ci	Ciu(xi)	**CISPR 16-4**
	dB	Probability distribution function	dB			
1) Receiver reading	±0.1	K =1	0.1	1	**0.1**	0.10
2) Attenuation: antenna-receiver	±0.18	K=2	0.09	1	**0.09**	0.05
3) Antenna factor	±1.5	K=2	0.75	1	**0.75**	1.00
RECEIVER CORRECTIONS:						
4) Sine wave voltage	±0.56	K=2	0.28	1	**0.50**	0.50
5) Pulse amplitude response	±1.5	Rectangular (√3)	0.87	1	**0.87**	0.87
6) Pulse repetition rate response	±1.5	Rectangular (√3)	0.87	1	**0.87**	0.87
7) Noise floor proximity	±0.5	K=2	0.25	1	**0.25**	0.25
8) AF frequency interpolation	±0.3	Rectangular (√3)	0.17	1	**0.17**	0.17
9) Balance	±0.9	Rectangular (√3)	0.52	1	**0.52**	0.52
10)AF height deviations	±0.3	Rectangular (√3)	0.17	1	**0.17**	0.17
11) phase center location	±0.3	Rectangular (√3)	0.17	1	**0.17**	0.17
12) directive difference	+1.0	Rectangular (√3)	0.29	1	**0.29**	0.29
13)cross polarization	±0.9	Rectangular (√3)	0.52	1	**0.52**	0.52
14) site corrections	±2.6	Rectangular (√3)	1.5	1	**1.5**	1.63
15) Mismatch (ant-receiver)	±1.06	U-shaped (√2)	0.75	1	**0.75**	0.67

Combined Uncertainty

$$Uc(xi)= \sqrt{(1)^2+(2)^2+(3)^2+(4)^2+(5)^2+(6)^2+(7)^2+(8)^2+(9)^2+(10)^2+(11)^2+(12)^2+(13)^2+(14)^2+(15)^2} = \mathbf{2.43}$$

Expanded Uncertainty

U= k*Uc(xi) = 2 * 2.43 = 4.86dB

(The coverage factor k =2 yields approximately a 95% level of confidence)

2) Conducted disturbance

⊙ **Conducted disturbance from 150KHz to 30MHz using a 50Ω/50uH AMN**

input quantity	Uncertainty of Xi		U(Xi) dB	Ci	Ciu(xi)	**CISPR 16-4**
	dB	Probability distribution function				
1) Receiver Readeing	±0.1	K =1	0.1	1	**0.1**	0.10
2) Attenuation:AMN-receiver	±0.36	Triangular (√6)	0.15	1	**0.15**	0.05
RECEIVER CORRECTIONS:						
3) Sine wave voltage	±0.5	K=2	0.25	1	**0.25**	0.50
4) Pulse amplitude response	±1.5	Rectangular (√3)	0.87	1	**0.87**	0.87
5) Pulse repetition rate response	±1.5	Rectangular (√3)	0.87	1	**0.87**	0.87
6) AMN voltage division factor	±0.07	K=2	0.04	1	**0.04**	0.1
7) Mismatch : AMN-receiver	±0.55	U-shaped (√2)	0.39	1	**0.39**	0.53
8) AMN impedance	±1.52	Triangular (√6)	0.62	1	**0.62**	1.08

- 1)~8) For numbered comments, refer to following articles

Combined Uncertainty

Uc(xi)= √ (1) ²+(2) ²+(3) ²+(4) ²+(5) ²+(6) ²+(7) ²+(8) ² = **1.47**

Expanded uncertainty

U= k*Uc(xi) = 2 * 1.47 = 2.94dB

The coverage factor k =2 yields approximately a 95% level of confidence

⊙ **Refer**

1) receiver's resolution capacity

2) refer to the sub clause 11. of a calibration report

3) quoted from CISPR 16-4

4) refer to a calibration report

5) refer to CISPR 16-4 article 5. 7)

6) refer to a calibration report and a measured AMN impedance data

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 150kHz 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

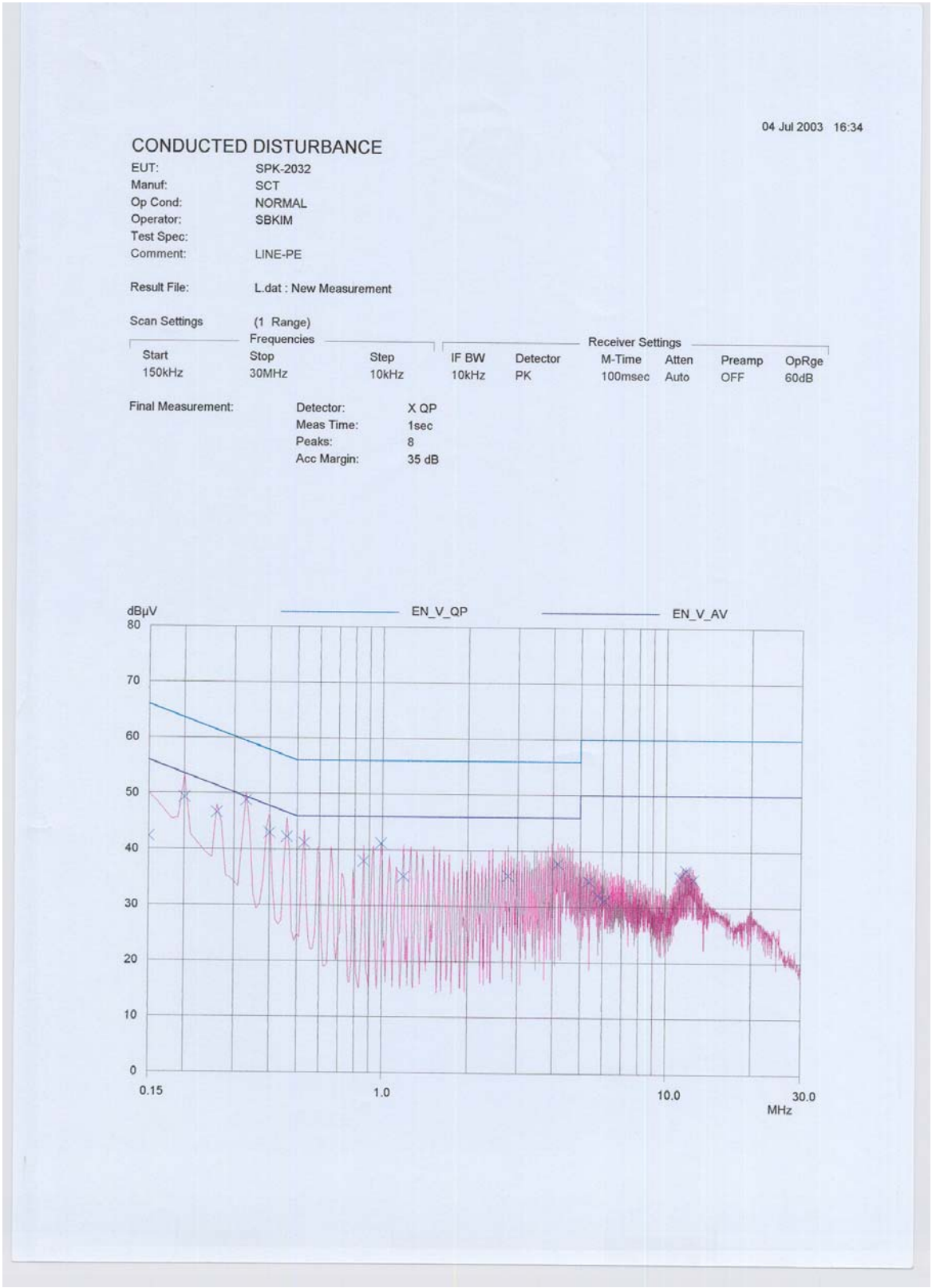
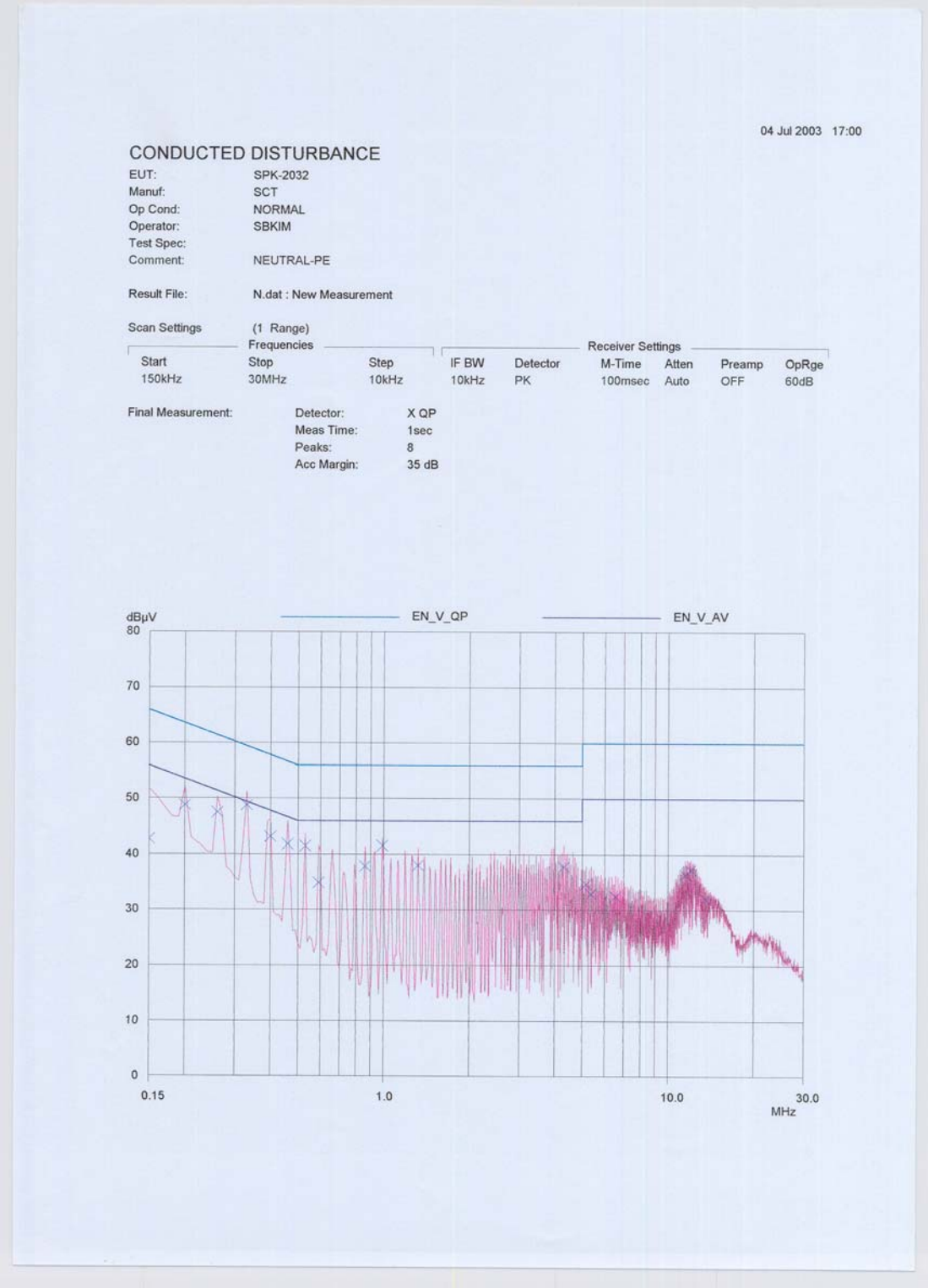


Figure 2 : Spectral Diagram, NEUTRAL – PE



- Table 2: Test Data, Conducted Emissions

▶ **LINE-PE**

Frequency (MHz)	Reading (dBμV)	C/F (dB)	CL (dB)	Limit (dBμV)	Margin (dB)
0.200	49.39	0.08	0.1	63.61	14.04
0.330	48.90	0.09	0.1	59.45	10.36
0.530	41.29	0.09	0.1	56.00	14.52
4.170	37.74	0.23	0.4	56.00	17.63
5.760	32.09	0.23	0.4	60.00	27.28
11.780	36.70	0.39	0.5	60.00	22.41

▶ **NEUTRAL-PE**

Frequency (MHz)	Reading (dBμV)	C/F (dB)	CL (dB)	Limit (dBμV)	Margin (dB)
0.200	48.87	0.13	0.1	63.61	14.51
0.330	48.88	0.15	0.1	59.45	10.32
0.400	43.15	0.15	0.1	57.85	14.45
0.530	41.51	0.15	0.1	56.00	14.24
0.990	41.58	0.15	0.1	56.00	14.17
12.040	37.32	0.33	0.5	60.00	21.85

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. C/F = Correction Factor
6. 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 3 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)

Table. Radiated Measurements at 3-meters

※Test results were under the required limit with 20dB margin or more.

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]