PCTEST ENGINEERING LABORATORY, INC.

6660 – B Dobbin Road • Columbia, MD 21045 • USA
Telephone 410.290.6652 / Fax 410.290.6654
http://www.pctestlab.com (email: randy@pctestlab.com)

CERTIFICATE OF COMPLIANCE

MANUFACTURER NAME & ADDRESS:
SAMSUNG ELECTRONICS CO., LTD.
416 Maetan-3 Dong, Paldal-Ku
Suwon City, Kyungki-Do 441-742, Korea

DATE & LOCATION OF TESTING:
Date(s) of Tests: June 6, 2006
Test Report S/N: 0606010426
Test Site: PCTEST Lab, Columbia, MD USA

FCC ID:	**A3LSCHL106**
APPLICANT:	**SAMSUNG ELECTRONICS CO., LTD.**

SUMMARY:

Equipment EUT Type:	**Single-Mode Cellular Phone w/ Serial Data Link Cable**
FCC Rule Part(s):	**FCC Part 15 Subpart B**
FCC Classification:	**FCC Class B Digital Device (JBP)**
Test Procedure(s):	**ANSI C63.4-2003 / EN55022: 1998 w/ A1 (2000) + A2 (2003)**

The device bearing the FCC Identifier specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and has been tested in accordance with the measurement procedures specified in ANSI C63.4-2003 (See Test Report). These measurements were performed with no deviation from the standards.

I authorize and attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

NVLAP accreditation does not constitute any product endorsement by NVLAP or any agency of the United States Government. PCTEST certifies that no party to this application has been denied the FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. 862.

Randy Ortanez
President

NVLAP
Lab Code 100431-0

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MEASUREMENT REPORT

A. General Information

APPLICANT:	**SAMSUNG ELECTRONICS CO., LTD.**
APPLICANT ADDRESS:	**416 Maetan-3 Dong, Paldal-Ku Suwon City, Kyungki-Do 441-742, Korea**
TEST SITE:	**PCTEST ENGINEERING LABORATORY, INC.**
TEST SITE ADDRESS:	**6660-B Dobbin Road, Columbia, MD 21045 USA**
FCC RULE PART(S):	**FCC Part 15 Subpart B**
FCC ID:	**A3LSCHL160**
EUT TYPE:	**Single-Mode Cellular Phone w/ Serial Data Link Cable**
TEST DEVICE S/N:	**N/A**
SAMPLE:	☐ **Production** ☒ **Pre-Production** ☐ **Engineering**
FCC CLASSIFICATION:	**FCC Class B Digital Device (JBP)**
DATE(S) OF TEST:	**June 6, 2006**

A.1 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4-2003. Radiated testing was performed at an antenna to EUT distance of 3 meters.

A.2 Test Facility / NVLAP Accreditation

The conducted and radiated tests were performed at PCTEST Engineering Lab in Columbia, MD 21045 USA.

- PCTEST facility is an FCC registered (PCTEST Reg. No. 90864) test facility with the site description report on file and has met all the requirements specified in Section 2.948 of the FCC Rules.
- PCTEST Lab is recognized by U.S. National Institute of Standards & Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP) for compliance with ISO/IEC Guide 17025 and meeting the criteria established in Title 15, Part 285 Code of Federal Regulations. (NVLAP Lab code: 100431-0).
- PCTEST Lab is a recognized U.S. Conformity Assessment Body (CAB) in EMC and R&TTE (n.b. 0982) under the U.S.-EU Mutual Recognition Agreement (MRA).
- PCTEST is an accredited Telecommunication Certification Body (TCB) by the American National Standards Institute (ANSI) meeting the requirements set forth in ISO/IEC Guide 65.
- PCTEST is an Industry Canada Foreign Certification Body (FCB) in all Radio Standards (RSS).

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1.0 INTRODUCTION

1.1 Evaluation Procedure

The measurement procedure described in the American National Standard for Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz (ANSI C63.4-2003) was used in determining radiated and conducted emissions emanating from **SAMSUNG FCC ID: A3LSCHL160 Single-Mode Cellular Phone w/ Serial Data Link Cable.**

1.2 Scope

Measurement & determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission.

1.3 PCTEST Test Location

The map at the right shows the location of the PCTEST LABORATORY, its proximity to the FCC Laboratory, the Columbia vicinity are, the Baltimore-Washington Internt'l (BWI) airport, the city of Baltimore and the Washington, DC area. (see Figure 1.2-1).

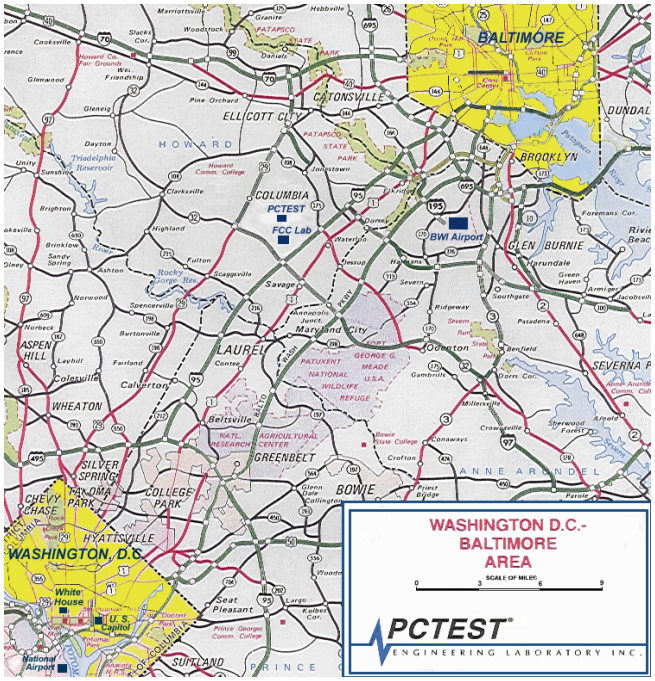

Figure 1.3-1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility in New Concept Business Park, Guilford Industrial Park, Columbia, Maryland. The site address is 6660-B Dobbin Road, Columbia, MD 21045. The test site is one of the highest points in the Columbia area with an elevation of 390 feet above mean sea level. The site coordinates are 39° 11'15" N latitude and 76° 49'38" W longitude. The facility is 1.5 miles North of the FCC laboratory, and the ambient signal and ambient signal strength are approximately equal to those of the FCC laboratory. There are no FM or TV transmitters within 15 miles of the site. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4 on October 19, 2002.

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the SAMSUNG FCC ID: A3LSCHL160 Single-Mode Cellular Phone w/ Serial Data Link Cable.

2.2 Operation Mode

The Single-Mode Cellular Phone FCC ID: A3LSCHL160 w/ Serial Data Link Cable was tested with a NOTEBOOK connected via serial interface port. Please see ATTACHMENT D for more information on the test setup and ATTACHMENT G for test setup photographs.

2.3 EMI Suppression Device(s)

EMI suppression device(s) added and/or modifications made during testing.

- none

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3.0 DESCRIPTION OF TEST

3.1 Conducted Emissions

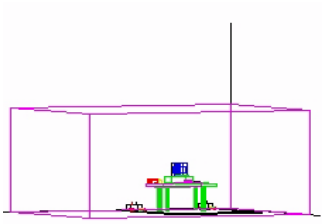

Figure 3.1-1. Shielded Enclosure Line-Conducted Test Facility

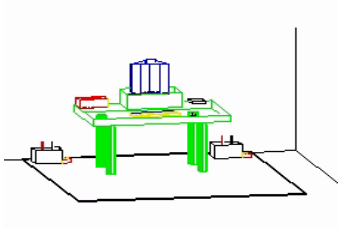

Figure 3.1-2. Line Conducted Emission Test Set-Up

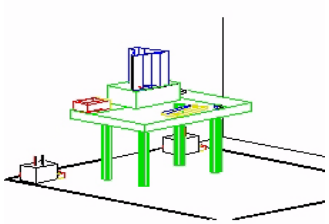

Figure 3.1-3. Wooden Table & Bonded LISNs

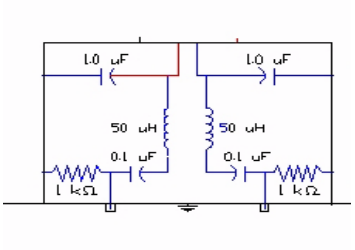

Figure 3.1-4. LISN Schematic Diagram

The line-conducted facility is located inside a 16'x20'x10' shielded enclosure. It is manufactured by Ray Proof Series 81 (see Figure 3.1-1). The shielding effectiveness of the shielded room is in accordance with MIL-Std-285 or NSA 65-5. A 1m x 1.5m wooden table 80cm high is placed 40cm away from the vertical wall and 1.5m away from the sidewall of the shielded room (see Figure 3.1-2). Solar Electronics and EMCO Model 3725/2 (10kHz-30MHz) 50Ω/50µH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room (See Figure 3.1-3). The EUT is powered from the Solar LISN and the support equipment is powered from the EMCO LISN. Power to the LISNs are filtered by a high-current high-insertion loss Ray Proof power line filters (100dB 14Hz-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 an inner diameter of ½". 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 line(s) will be connected to the Solar LISN. The LISN schematic diagram is shown (See Figure 3.1-4). 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 a 20msec. sweep time. The frequencies producing the maximum level were re-examined using an EMI/Field Intensity Meter and Quasi-Peak adapter. The detector function was set to CISPR quasi-peak mode and average 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; scrolling H patter to the EUT and/or support equipment, and powering the monitor from the floor mounted outlet box and the computer aux AC outlet, if applicable; whichever determined the worst-case emission. Photographs of the worst-case emission can be seen in Attachment H. Each EME reported was calibrated using the HP8640B signal generator.

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3.2 Radiated Emissions

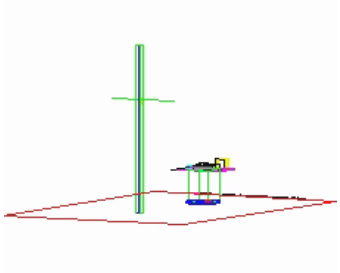

Figure 3.2-1. Meter Test Site

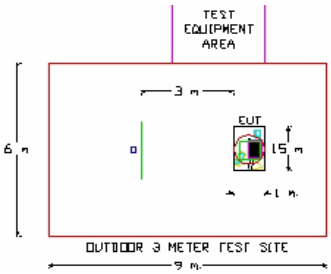

Figure 3.2-2. Dimensions of Outdoor Test Site

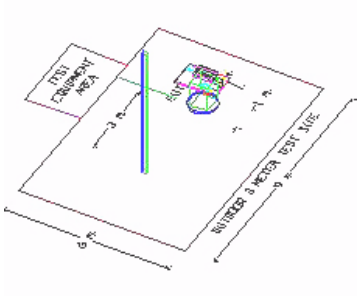

Figure 3.2-3. Turntable and System Setup

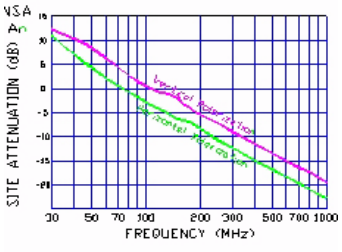

Figure 3.2-4. Normalized Site Attenuation Curves (H&V)

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 was noted for each frequency found. The spectrum was scanned from 30 to 200 MHz using biconical antenna and from 200 to 1000 MHz using log-spiral antenna. Above 1 GHz, linearly polarized double ridge horn antennas were used.

Final measurements were made outdoors at 3-meter test range using Roberts™ Dipole antennas or horn antenna (see Figure 3.2-1). The test equipment was placed on a wooden and plastic bench situated on a 1.5 x 2 meter area adjacent to the measurement area (see Figure 3.2-2). 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 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 1 MHz depending on the frequency or type of signal. Above 1GHz the detector function was set to CISPR average mode (RBW = 1MHz, VBW = 10Hz).

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 (see Figure 3.2-3). 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; scrolling H pattern to the EUT and/or support equipment, and powering the monitor from the floor mounted outlet box and the computer aux AC outlet, 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 Appendix G. Each EME reported was calibrated using the HP8640B signal generator. The Theoretical Normalized Site Attenuation Curves for both horizontal and vertical polarization are shown in Figure 3.2-4.

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4.0 SAMPLE CALCULATIONS

4.1 Conducted Emission Measurement Sample Calculation:

@ 20.3 MHz

Class B limit	= 250 µV = 47.96 dBµV
Reading	= - 67.8 dBm (calibrated level)
Convert to dbµV	= - 67.8 + 107 = 39.2 dBµV
$10^{(39.2/20)}$	= 91.2 µV
Margin	= 39.2 - 47.96 = - 8.76
	= 8.8 dB below limit

4.2 Radiated Emission Measurement Sample Calculation:

@ 66.7 MHz

Class B limit	= 100 µV/m = 40.0 dBµV/m	
Reading	= - 76.0 dBm (calibrated level)	
Convert to dbµV	= - 76.0 + 107	= 31.0 dBµV
Antenna Factor + Cable Loss		= 5.8 dB/m
	Total	= 36.8 dBµV/m
Margin	= 36.8 - 40.0	= - 3.2
	= 3.2 dB below limit	

$$\text{dB}\mu\text{V} = 20 \log_{10} (\mu\text{V/m})$$

$$\text{dB}\mu\text{V} = \text{dBm} + 107$$

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5.0 UNCERTAINTY OF MEASUREMENT

5.1 Line Conducted Measurement Uncertainty Calculations

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and NIS 81 (1994).

Table 5.1-1. Line Conducted Measurement Uncertainty Calculations

Contribution (Line Conducted)	Probability Distribution	Uncertainty (± dB)	
		9kHz-150kHz	150-30MHz
Receiver specification	Rectangular	1.5	1.5
LISN coupling specification	Rectangular	1.5	1.5
Cable and input attenuator calibration	Normal (k=2)	0.3	0.5
Mismatch: Receiver VRC Γ_1 = 0.03 LISN VRC Γ_R = 0.8 (9kHz) 0.2 (30MHz) Uncertainty limits 20Log(1 $\pm\Gamma_1\Gamma_R$)	U-Shaped	0.2	0.35
System repeatability	Std. deviation	0.2	0.05
Repeatability of EUT		-	-
Combined standard uncertainty	Normal	1.26	1.30
Expanded uncertainty	Normal (k=2)	2.5	2.6

Calculations for 150kHz to 30MHz:

$$u_c(y) = \sqrt{\sum_{i=1}^{m} u_i^2(y)} = \pm\sqrt{\frac{1.5^2+1.5^2}{3} + (\frac{0.5}{2})^2 + 0.35^2} = \pm 1.298\text{dB}$$

$$U = 2U_c(y) = \pm 2.6\text{dB}$$

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5.2 Radiated Emissions Measurement Uncertainty Calculations

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and NIS 81 (1994).

Table 5.2-1. Radiated Emissions Measurement Uncertainty Calculations

Contribution (Radiated Emissions)	Probability Distribution	Uncertainties (± dB)	
		3 m	10 m
Ambient Signals		-	-
Antenna factor calibration	Normal (k=2)	± 1.0	± 1.0
Cable loss calibration	Normal (k=2)	± 0.5	± 0.5
Receiver specification	Rectangular	± 1.5	±1.5
Antenna directivity	Rectangular	+ 0.5 / - 0	+ 0.5
Antenna factor variation with height	Rectangular	± 2.0	± 0.5
Antenna phase centre variation	Rectangular	0.0	± 0.2
Antenna factor frequency interpolation	Rectangular	±. 0.25	± 0.25
Measurement distance variation	Rectangular	± 0.6	± 0.4
Site imperfections	Rectangular	± 2.0	± 2.0
Mismatch: Receiver VRC $\Gamma_1 = 0.2$ Antenna VRC $\Gamma_R = 0.67$ (Bi) 0.3 (Lp) Uncertainty limits $20Log(1 \pm \Gamma_1\Gamma_R)$	U-Shaped	+ 1.1 - 1.25	± 0.5
System repeatability	Std. Deviation	± 0.5	± 0.5
Repeatability of EUT		-	-
Combined standard uncertainty	Normal	+ 2.19 / - 2.21	+ 1.74 / - 1.72
Expanded uncertainty	Normal (k=2)	+ 4.38 / - 4.42	+ 3.48 / - 3.44

Calculations for 3m-biconical antenna. Coverage factor of k=2 will ensure that the level of confidence will be approximately 95%, therefore:

$$U=2u_c(y) = 2 \times \pm 2.19 = \pm 4.38dB$$

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6.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST).

Table 6-1. Annual Test Equipment Calibration Schedule

TYPE	MODEL	CAL. DUE DATE	SERIAL No.
Microwave Spectrum Analyzer	HP 8566 (100Hz–22GHz)	12/05/06	3638A08713
Microwave Spectrum Analyzer	HP 8566 (100Hz-22GHz)	04/17/07	2542A11898
Spectrum Analyzer/Tracking Generator	HP 8591A (9kHz-1.8GHz)	03/24/07	3144A02458
Spectrum Analyzer	HP 8591A (9kHz-1.8GHz)	04/23/07	3108A02053
Spectrum Analyzer	HP 8594A (9kHz-2.9GHz)	11/02/06	3051A00187
Signal Generator	HP 8650B (500Hz-1GHz)	06/02/07	2232A19558
Signal Generator	HP 8640B (500Hz-1GHz)	06/02/07	1851A09816
Signal Generator	Rohde & Schwarz (0.1-1GHz)	09/22/06	894215/012
Ailtech/Eaton Receiver	NM 37/57A-SL (30MHz-1GHz)	04/12/07	0792-03271
Ailtech/Eaton Receiver	NM 37/57A (30MHz-1GHz)	03/11/07	0805-03334
Ailtech/Eaton Receiver	NM 17/27A (0.1-32MHz)	09/17/06	0608-03241
Quasi-Peak Adapter	HP 85650A	08/09/06	2043A00301
Ailtech/Eaton Adapter	CCA-7 CISPR/ANSI QP Adapter	03/11/07	0194-04082
RG58 Coax Test Cable	No.167	03/26/07	n/a
Harmonic/Flicker Test System	HP 6841A (IEC 555-2/3)	11/15/06	3531A00115
Broadband Amplifier	HP 8447D	02/26/07	1145A00470
Broadband Amplifier	HP 8447D	02/26/07	1937A03348
Horn Antenna (2)	EMCO Model 3115 (1-18GHz)	03/15/07	9704-5182, 9205-3874
Horn Antenna	EMCO Model 3116 (18-40GHz)	03/28/07	9203-2178
Roberts Dipoles	Compliance Design (1 set) A100	08/11/06	5118
EMCO LISN (3)	3816/2, 3816/2, 3725/2	10/26/06	1077, 1079, 2099
50-ohm Terminator	n/a	n/a	n/a
Microwave Preamp 30dB Gain	HP 83017A (0.5-26.5GHz)	03/26/07	3123A00181
Microwave Cables	MicroCoax (1.0-26.5GHz)	02/26/07	n/a
Spectrum Analyzer	HP 8591A	06/18/06	3034A01395
Modulation Analyzer	HP 8901A	06/26/06	2432A03467
Microwave Survey Meter	Holaday Model 1501 (2.45GHz)	02/21/07	80931
Digital Thermometer	Extech Instruments 421305	03/15/07	426966
Attenuator	4108 (6dB)	03/26/07	n/a
Shielded Screen Room	RF Lindgren Model 26-2/2-0	n/a	6710 (PCT270)
Shielded Semi-Anechoic Chamber	Ray Proof Model S81	04/15/07	R2437 (PCT278)
Environmental Chamber	Associated Systems 1025	08/08/06	PCT285
OATS	n/a	12/31/06	n/a

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7.0 ENVIRONMENTAL CONDITIONS

The temperature is controlled within range of 15°C to 35°C.

The relative humidity is controlled within range of 10% to 75%.

The atmospheric pressure is controlled within the range 86-106kPa (860-1060mbar).

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8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **SAMSUNG FCC ID: A3LSCHL160 Single-Mode Cellular Phone w/ Serial Data Link Cable** has been verified to comply with §§ 15.107 and 15.109 of the FCC Rules.

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ATTACHMENT D – Test Data

Summary of Test Results

Test Date(s): June 6, 2006

Test Engineer:

Table D-1. Summary of Test Results

FCC Part 15 Section	Description	Result
15.107	Conducted Emissions	PASS
15.109	Radiated Spurious Emissions	PASS

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ATTACHMENT D – Test Data (Cont.)

Radiated Test Data/Plots

FREQ (MHz)	Level (dBm)	AFCL (dB/m)	POL (H/V)	Height (m)	Azimuth (° angle)	F/S (uV/M)	Margin (dB)
71.73	-82.00	6.51	V	2.4	180	37.63	-8.5
133.31	-85.06	12.46	V	2.6	45	52.53	-9.1
179.80	-88.79	13.69	V	2.2	330	39.41	-11.6
191.74	-90.78	16.09	V	2.4	225	41.26	-11.2
211.30	-90.21	17.02	H	1.4	180	49.03	-9.7
471.24	-94.50	25.41	H	1.1	90	78.57	-8.1

Table D-2. Radiated Measurements at 3-meters

NOTES:

1. All modes of operation were investigated and the worst-case emissions are reported.
2. The radiated limits are shown on Figure A-1. Above 1 GHz the limit is 500µV/m.
3. Radiated Emissions were measured from 30 MHz – 2000 MHz.

---

1 All readings are calibrated by HP8640B signal generator with accuracy traceable to the National Institute of Standards and Technology (NIST).

2 AFCL = Antenna Factor (Roberts dipole) and Cable Loss (30 ft. RG58C/U).

3 Measurements using CISPR quasi-peak mode. Above 1GHz, peak detector function mode is used with a resolution bandwidth of 1MHz and a video bandwidth of 1MHz. The peak level complies with the average limit. Peak mode is used with linearly polarized horn antenna and low-loss microwave cable.

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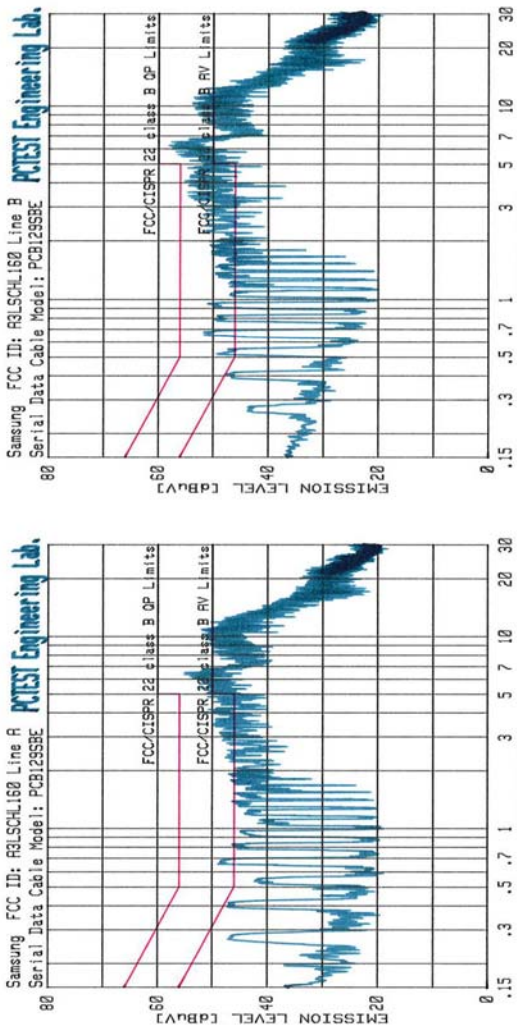
ATTACHMENT D – Test Data (Cont.)

Line-Conducted Test Data

Plot D-1. Line-Conducted Test Plot



No.	Freq. [MHz]	Quasi-Pk [dBuV]	Limit [dBuV]	Margin [dB]	Average [dBuV]	Limit [dBuV]	Margin [dB]
1	3.951	45.98	56.00	-10.02	25.46	46.00	-20.54
2	6.352	49.61	60.00	-10.39	26.66	50.00	-23.34
3	6.447	50.70	60.00	-9.30	26.12	50.00	-23.88
4	4.797	46.69	56.00	-9.31	28.58	46.00	-17.42
5	6.162	49.68	60.00	-10.32	27.86	50.00	-22.14
6	4.512	44.87	56.00	-11.13	25.72	46.00	-20.28
7	3.415	45.26	56.00	-10.74	25.73	46.00	-20.27
8	3.686	46.45	56.00	-9.55	25.43	46.00	-20.57
9	.646	46.71	56.00	-9.29	29.26	46.00	-16.74
10	3.123	43.38	56.00	-12.62	23.94	46.00	-22.06

No.	Freq. [MHz]	Quasi-Pk [dBuV]	Limit [dBuV]	Margin [dB]	Average [dBuV]	Limit [dBuV]	Margin [dB]
1	4.055	50.21	56.00	-5.79	29.79	46.00	-16.21
2	3.511	50.16	56.00	-5.84	28.84	46.00	-17.16
3	4.726	49.52	56.00	-6.48	32.53	46.00	-13.47
4	3.371	49.93	56.00	-6.07	29.26	46.00	-16.74
5	4.195	50.31	56.00	-5.69	29.22	46.00	-16.78
6	6.198	53.70	60.00	-6.30	33.98	50.00	-16.02
7	3.302	49.76	56.00	-6.24	30.36	46.00	-15.64
8	3.096	47.28	56.00	-8.72	28.19	46.00	-17.81
9	3.500	50.76	56.00	-5.24	29.42	46.00	-16.58
10	4.575	49.66	56.00	-6.34	30.75	46.00	-15.25

Notes:

1. All Modes of operation were investigated and the worst-case emissions are reported.
2. The limit for Class B device(s) from 150kHz to 30MHz are specified in EN55022.
3. Line A = Phase; Line B = Neutral
4. Deviations to the Specifications: *None*.

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ATTACHMENT D – Test Data (Cont.)

Test Support Equipment Used

1	SAMSUNG Phone	FCC ID:	A3LSCHL160	S/N:	N/A
	and Serial Data Link Cable	Model:	PCB129SBE	S/N:	RY1A201ZV
		1.1m	Shielded Serial Data Link Cable w/ ferrite on CPU end		
	and Travel Adapter	Model:	TAD037JBN	S/N:	DK3A304MS/7-
		1.8m	Unshielded AC Adapter		
2	Panasonic Toughbook	Model:	CF-28		
	w/ Panasonic AC Adapter	Model:	CF-AA1639A	S/N:	020413255A
		1.9m	Unshielded DC power cord with ferrite bead on computer end		
		1.8m	Unshielded AC power cord		
3	H/P Thinkjet Printer	FCC ID:	DS16XU2225C	S/N:	2604S10169
		1.8m	Unshielded AC power cord		
		1.0m	Shielded cable		

Note: See Attachment G – Test Setup Photographs, for actual system test setup.

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