PCTEST ENGINEERING LABORATORY, INC.
6660-B Dobbin Road, Columbia, MD 21045 USA
Tel. 410.290.6652 / Fax 410.290.6554
http://www.pctestlab.com

CERTIFICATE OF COMPLIANCE

Applicant Name:
SAMSUNG ELECTRONICS CO., LTD.
416 Maetan-3 Dong, Paldal-Ku
Suwon City, Kyungki-Do 441-742, Korea

Date of Testing:
September 15, 2006
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Test Report Serial No.:
0609120797

FCC ID:	**A3LSGHE420**
APPLICANT:	**SAMSUNG ELECTRONICS CO., LTD.**

EUT Type:	Single-Band PCS GSM Phone
FCC Rule Part(s):	FCC Part 15 Subpart B
FCC Classification:	FCC Class B Digital Device (JBP)
Test Procedure:	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

Lab Code 100431-0

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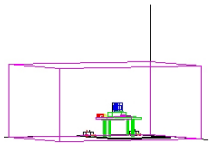

MEASUREMENT REPORT

FCC Part 15B – Unintentional Radiators

A. § 2.1033 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:	A3LSGHE420
Test Device Serial No.:	FD-129-B ☐ Production ☒ Pre-Production ☐ Engineering
FCC CLASSIFICATION:	FCC Class B Digital Device (JBP)
DATE(S) OF TEST:	September 15, 2006

A.1 Test Methodology

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

A.2 Test Facility / NVLAP Accreditation

Conducted and radiated tests were performed at PCTEST Engineering Lab in Columbia, MD 21045, U.S.A.

- 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 and Industry Canada (IC 2451).
- PCTEST Lab is accredited by U.S. National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP) in EMC, Telecommunication, and FCC for satisfactory compliance with 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 TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC Guide 65 by the American National Standards Institute (ANSI) in all scopes of FCC Rules and Industry Canada Standards (RSS).
- PCTEST facility is an IC registered (IC-2451) test laboratory with the site description on file at Industry Canada.

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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 the measurement of **Samsung Single-Band PCS GSM Phone FCC ID: A3LSGHE420.**

Deviation from measurement procedure…….....NONE

1.2 Scope

Measurement and 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 1.3-1).

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 C63.4-2003 on January 27, 2006 and Industry Canada.

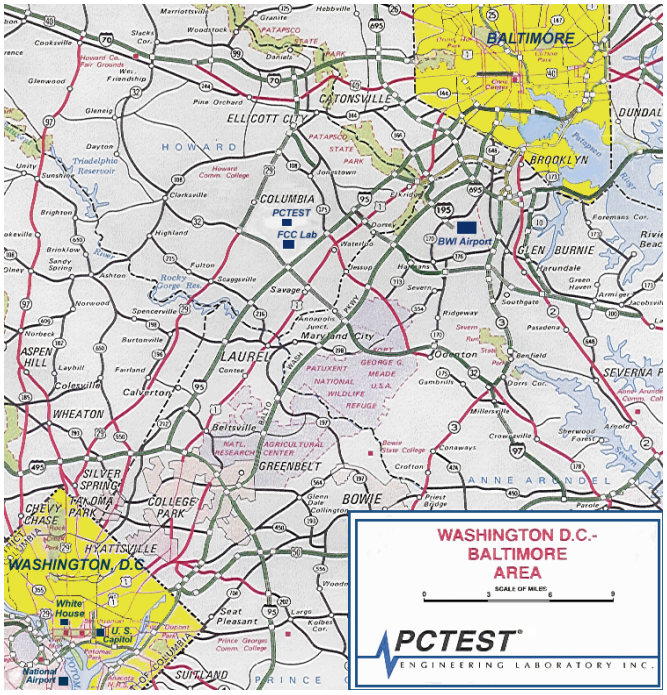

Figure 1.3-1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Samsung Single-Band PCS GSM Phone FCC ID: A3LSGHE420**.

2.2 Operation Mode

The Samsung Single-Band PCS GSM Phone FCC ID: A3LSGHE420 was tested with a NOTEBOOK connected via Serial interface port. Please see ATTACHMENT C for more information on the test setup and ATTACHMENT G for test setup photographs.

2.3 EMI Suppression Device(s)/Modifications

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

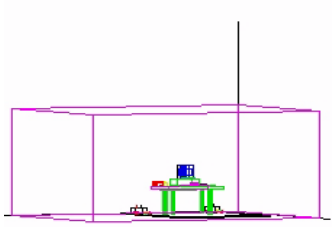

Figure 3.1-1. Shielded Enclosure Line-Conducted Test Facility

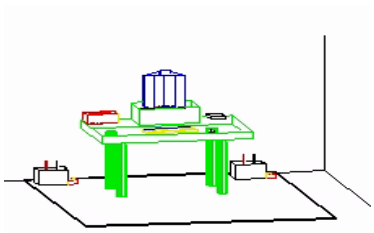

Figure 3.1-2. Line Conducted Emission Test Set-Up

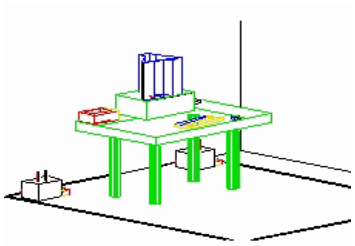

Figure 3.1-3. Wooden Table & Bonded LISNs

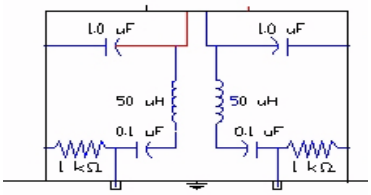

Figure 3.1-4. LISN Schematic Diagram

The line-conducted facility is located inside a 16'x20'x10' shielded enclosure, 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 filter (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 to a 1 meter length by non-inductive bundling (serpentine fashion). 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 spectrum analyzer. 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 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 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; whichever determined the worst-case emission. Photographs of the worst-case emission can be seen in Attachment G. Each EME reported was calibrated using the Agilent E8257D (250kHz – 20GHz) PSG Signal Generator.

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3.2 Radiated Emissions

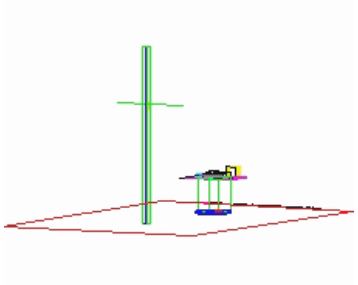

Figure 3.2-1. 3-Meter Test Site

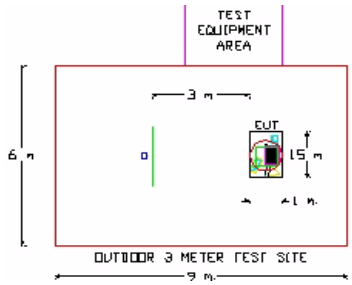

Figure 3.2-2. Dimensions of Outdoor Test Site

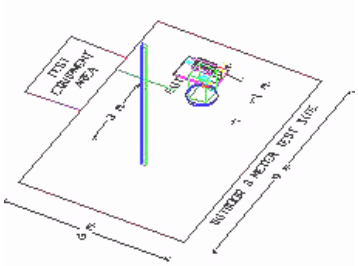

Figure 3.2-3. Turntable and System Setup

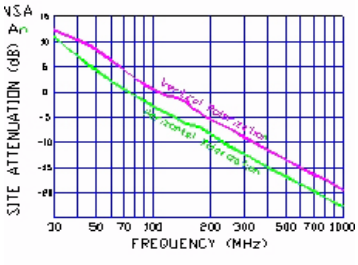

Figure 3.2-4. Normalized Site Attenuation Curves (H&V)

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, and turntable azimuth with respect to the antenna was noted for each frequency found. The spectrum was scanned from 30 to 200 MHz using a bi-conical antenna and from 200 to 1000 MHz using a 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 antennas (*see Figure 3.2-1*). The test equipment was placed on a wooden and plastic bench situated on a 1.5m x 2m 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 1MHz 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 Attachment G. Each EME reported was calibrated using the Agilent E8257D (250kHz – 20GHz) PSG 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 dB
	= 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 dB
	= 3.2 dB below limit

Note:

Level [dBμV] = 20 log $_{10}$ (Level [μV/m])

Level [dBμV] = Level [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).

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

Table 5-1. Line Conducted Measurement Uncertainty Calculations

Calculations for 150kHz to 30MHz: $u_c(y) = \sqrt{\sum_{i=1}^{m} u_i^2(y)} = \pm\sqrt{\frac{1.5^2+1.5^2}{3}+(\frac{0.5}{2})^2+0.35^2} = \pm 1.298\text{dB}$

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

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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).

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 Γ_1 = 0.2 Antenna VRC Γ_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

Table 5-2. Radiated Emissions Measurement Uncertainty Calculations

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).

TYPE	MODEL	CAL. DUE DATE	CAL. INTERVAL	SERIAL No.
Spectrum Analyzer/Tracking Generator	HP 8591A (9kHz-1.8GHz)	09/12/07	Annual	3144A02458
Spectrum Analyzer	HP 8591A (9kHz-1.8GHz)	10/15/06	Annual	3108A02053
Spectrum Analyzer	HP 8594A (9kHz-2.9GHz)	11/02/06	Annual	3051A00187
Spectrum Analyzer	HP 8566B (100Hz-22GHz)	12/22/06	Annual	3638A08713
PSG Signal Generator	Agilent E8257D (250kHz-20GHz)	02/11/07	Annual	MY45470194
Quasi-Peak Adapter	HP 85650A	12/22/06	Annual	2043A00301
Preamplifier	HP 8449B (1-26.5GHz)	12/22/06	Annual	3008A00985
Attenutation/Switch Driver	HP 11713A	12/22/06	Annual	N/A
Preselector	HP 85685A (20Hz-2GHz)	12/22/06	Annual	N/A
6dB Res BW Spec. Analyzer Display	OPT 462	12/22/06	Annual	3701A22204
Ailtech/Eaton Adapter	CCA-7 CISPR/ANSI QP Adapter	12/19/06	Annual	0194-04082
Ailtech/Eaton EMI/Field Intensity Meter	NM 37/57A-SL (30MHz – 1GHz)	06/07/07	Annual	0805-03334
Broadband Amplifier (2)	HP 8447D (0.1 – 1300MHz)	N/A	N/A	2443A01900, 1937A03348
Horn Antenna	EMCO Model 3115 (1-18GHz)	08/25/07	Bi-Annual	9704-5182
Roberts Dipoles	Compliance Design (1 set) A100	08/31/07	Bi-Annual	5118
EMCO LISN (3)	3816/2, 3816/2, 3725/2	10/26/06	Annual	1077, 1079, 2099
SOLAR LISN (2)	8012-50	11/18/07	Bi-Annual	0313233, 0310234
Microwave Preamp 40dB Gain	HP 83017A (0.5-26.5GHz)	N/A	N/A	3123A00181
Coax Cable	RG58	02/26/07	Annual	N/A
Microwave Cables	MicroCoax (1.0-26.5GHz)	02/26/07	Annual	N/A
Shielded Screen Room	RF Lindgren Model 26-2/2-0	N/A	N/A	6710 (PCT270)
Shielded Semi-Anechoic Chamber	Ray Proof Model S81	N/A	N/A	R2437 (PCT278)
Temperature & Humidity Chamber	ESPEC SCP-220	06/08/07	Annual	017620

Table 6-1. Annual Test Equipment Calibration Schedule

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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 Single-Band PCS GSM Phone** (**FCC ID: A3LSGHE420)** has been tested to comply with the requirements specified in §15.107 and §15.109 of the FCC Rules. Measurement uncertainty was not taken into account in this determination.

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Summary of Results

Test Date(s): September 15, 2006

Test Engineer:

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

Table C-1. Summary of Test Results

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ATTACHMENT C – Test Data (Cont'd)

Radiated Test Data

FREQ (MHz)	Level (dBm)	AFCL (dB/m)	POL (H/V)	Height (m)	Azimuth (° angle)	F/S (µV/m)	Margin (dB)
71.76	-88.11	6.51	V	2.5	45	18.67	-14.6
141.44	-90.48	13.09	V	2.3	180	30.25	-13.9
153.6	-90.75	13.85	H	2.4	270	32.04	-13.4
216.8	-89.57	17.27	V	1.7	315	54.38	-11.3
328.8	-92.03	21.64	H	1.4	225	67.66	-9.4
473.6	-94.86	25.47	V	1.2	270	75.91	-8.4

Table C-2. Radiated Measurements at 3-meters

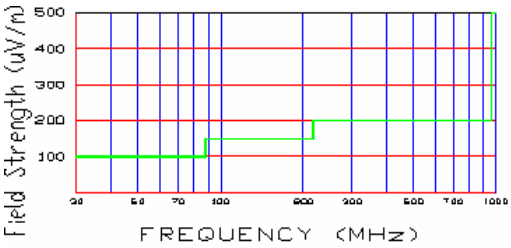

Figure C-1. 3 Meter Limits

NOTES:

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

---

1. All readings are calibrated by Agilent E8257D (250kHz – 20GHz) PSG 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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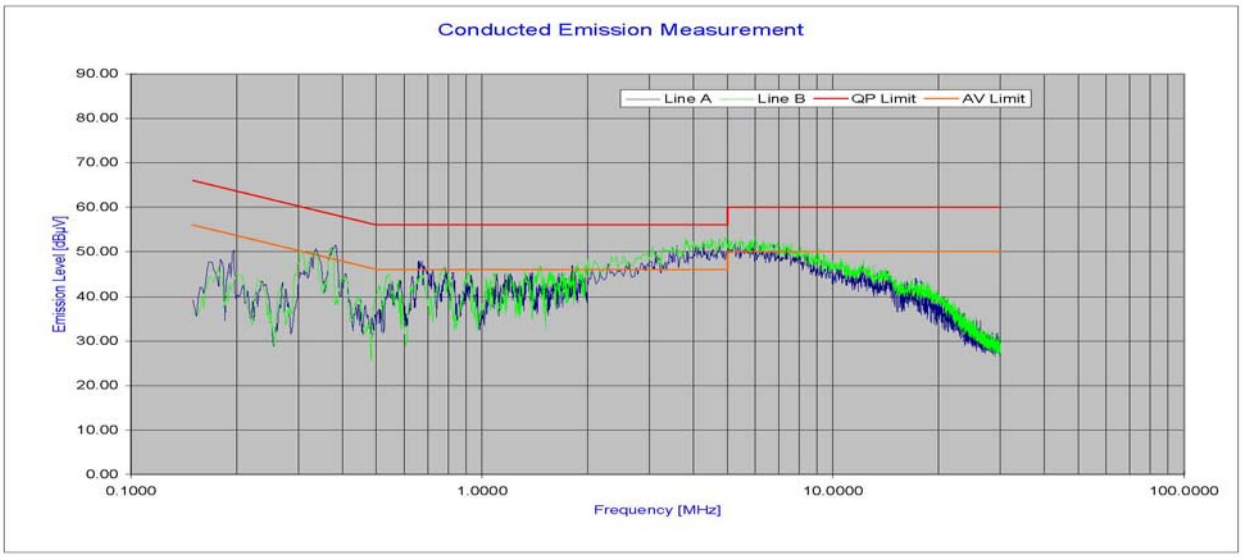
ATTACHMENT C – Test Data (Cont'd)
Line Conducted Test Data



No.	Line	Frequency [MHz]	Factor [dB]	QP [dBµV]	Limit [dBµV]	Margin [dB]	Average [dBµV]	Limit [dBµV]	Margin [dB]
1	A	4.197	7.49	45.47	56.00	-10.53	37.80	46.00	-8.20
2	A	4.737	7.50	45.60	56.00	-10.40	37.35	46.00	-8.65
3	A	3.653	7.47	45.10	56.00	-10.90	36.22	46.00	-9.78
4	A	3.076	7.45	44.57	56.00	-11.43	35.23	46.00	-10.77
5	A	5.012	7.51	46.32	60.00	-13.68	38.24	50.00	-11.76
6	A	0.393	7.50	48.47	58.00	-9.53	39.06	48.00	-8.94
7	A	0.647	7.39	42.49	56.00	-13.51	32.62	46.00	-13.38
8	A	6.703	7.55	45.03	60.00	-14.97	36.27	50.00	-13.73
9	A	2.564	7.42	43.50	56.00	-12.50	33.23	46.00	-12.77
10	A	0.350	7.53	49.20	58.96	-9.76	41.60	48.96	-7.36
11	B	4.869	7.51	47.87	56.00	-8.13	39.35	46.00	-6.65
12	B	3.881	7.48	47.36	56.00	-8.64	38.19	46.00	-7.81
13	B	4.342	7.49	47.23	56.00	-8.77	38.89	46.00	-7.11
14	B	3.917	7.48	47.39	56.00	-8.61	38.05	46.00	-7.95
15	B	3.405	7.46	45.96	56.00	-10.04	36.87	46.00	-9.13
16	B	3.097	7.45	44.64	56.00	-11.36	35.99	46.00	-10.01
17	B	5.950	7.53	47.14	60.00	-12.86	38.99	50.00	-11.01
18	B	2.552	7.42	43.69	56.00	-12.31	35.26	46.00	-10.74
19	B	5.401	7.52	47.64	60.00	-12.36	39.25	50.00	-10.75
20	B	6.953	7.55	46.40	60.00	-13.60	37.95	50.00	-12.05

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 C – Test Data (Cont'd)

Test Support Equipment

1	Samsung Phone	FCC ID:	A3LSGHE420	S/N:	FD-129-B
	With Travel Adapter	Model:	TAD437EBE	S/N:	DW2A626CS/7
		1.8m	Unshielded DC Power Cord		
2	Serial DataLink Cable	Model:	SGH-E420DLC	S/N:	RF1A830AS
		1.1m	Shielded Serial DataLink Cable with ferrite bead on computer end.		
3	Panasonic Toughbook	Model:	CF-28 (DoC)	S/N:	T0838ZA
	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		
4	H/P Thinkjet Printer	FCC ID:	DS16XU2225C	S/N:	2604S10169
		1.8m	Unshielded AC power cord		
		1.0m	Shielded parallel data cable		

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

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