

ELECTROMAGNETIC EMISSION COMPLIANCE REPORT FOR BROADBAND PCS BASE STATION TRANSMITTER

Test Report No. : E074R-041

AGR No. : A074A-032

Applicant : Samsung Electronics Co., Ltd.

Address : 416, Maetan 3-dong, Youngtong-gu, Suwon-si, Gyeonggi-do, Korea

Manufacturer : Samsung Electronics Co., Ltd.

Address : 416, Maetan 3-dong, Youngtong-gu, Suwon-si, Gyeonggi-do, Korea

Type of Equipment : Indoor Base Station Transceiver System

FCC ID. : A3LSCS-26UC

Model Name : SCS-26UC

Serial number : None

Total page of Report : 20 pages (including this page)

Date of Incoming : April 3, 2007

Date of issuing : April 17, 2007

SUMMARY

The equipment complies with the regulation; **FCC Part 24 Subpart E.**

This test report only contains the result of a single test of the sample supplied for the examination.

It is not a generally valid assessment of the features of the respective products of the mass-production.

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CONTENTS

	PAGE
1. VERIFICATION OF COMPLIANCE	4
2. TEST SUMMARY	5
2.1 TEST ITEMS AND RESULTS	5
2.2 ADDITIONS, DEVIATIONS, EXCLUSIONS FROM STANDARDS	5
2.3 RELATED SUBMITTAL(S) / GRANT(S).....	5
2.4 PURPOSE OF THE TEST	5
2.5 TEST METHODOLOGY	5
2.6 TEST FACILITY	6
3.1 PRODUCT DESCRIPTION	6
3.2 ALTERNATIVE TYPE(S)/MODEL(S); ALSO COVERED BY THIS TEST REPORT.....	6
4. EUT MODIFICATIONS	6
5. SYSTEM TEST CONFIGURATION	7
5.1 JUSTIFICATION	7
5.3 PERIPHERAL EQUIPMENT	7
5.4 MODE OF OPERATION DURING THE TEST	7
5.5 MODULATION CHARACTERISTICS	7
5.6 OUTPUT POWER VERIFICATION AND JUSTIFICATION FOR FINAL MEASUREMENT	8
6. RF POWER OUTPUT AT ANTENNA TERMINAL	9
6.1 OPERATING ENVIRONMENT	9
6.2 TEST SET-UP	9
6.3 TEST EQUIPMENT USED	9
6.4 TEST DATA	10
7. FIELD STRENGTH OF SPURIOUS RADIATION	13
7.1 OPERATING ENVIRONMENT	13
7.2 TEST SET-UP	13
7.3 TEST EQUIPMENT USED	13
7.4. TEST DATA	14
8. MAXIMUM PERMISSIBLE EXPOSURE	15
8.1 RF EXPOSURE CALCULATION	15
8.2 CALCULATED MPE SAFE DISTANCE	15

9. RADIATED EMISSION TEST FOR DIGITAL DEVICE PART	16
9.1 OPERATING ENVIRONMENT	16
9.2 TEST SET-UP	16
9.3 TEST EQUIPMENT USED	16
9.4 TEST DATA	17
10. CONDUCTED EMISSION TEST	18
10.1 OPERATING ENVIRONMENT	18
10.2 TEST SET-UP	18
10.3 TEST EQUIPMENT USED	18
10.4 TEST DATA	19

1. VERIFICATION OF COMPLIANCE

APPLICANT : Samsung Electronics Co., Ltd.
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CONTACT PERSON : Josep Kang / Principal Engineer
TELEPHONE NO : +82-31279-3140
FCC ID : A3LSCS-26UC
MODEL NO/NAME : SCS-26UC
SERIAL NUMBER : N/A
DATE : April 17, 2007

EQUIPMENT CLASS	PCB-PCS Licensed Transmitter
EQUIPMENT DESCRIPTION	Indoor Base Station Transceiver System
THIS REPORT CONCERNS	Class II Permissive Change
MEASUREMENT PROCEDURES	ANSI C63.4: 2003, EIA/TAI 603B
TYPE OF EQUIPMENT TESTED	PRE-PRODUCTION
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	CERTIFICATION
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	PART 24 Subpart E
MODIFICATIONS ON THE EQUIPMENT TO ACHIEVE COMPLIANCE	No
FINAL TEST WAS CONDUCTED ON	3 METER(S) OPEN AREA TEST SITE

- . The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

2. TEST SUMMARY

2.1 Test items and results

SECTION	TEST ITEMS	RESULTS
2.1046, 24.232	RF Power Output at Antenna Terminals	Met the Limit / PASS
2.1049, 24.238	Occupied Bandwidth	See Note / PASS
2.1051, 24.238 (a)	Spurious Emissions at Antenna Terminals	See Note / PASS
2.1051, 24.238 (b)	Spurious Emissions at Antenna Terminals at Block Edges ± 1 MHz	See Note / PASS
2.1053, 24.238 (a)	Field strength of Spurious Radiation	Met the Limit / PASS
2.1047	Modulation Characteristics	See Note / PASS
2.1055(a)(1), 24.235	Frequency Stability over Temperature variation	See Note / PASS
2.1055(d), 24.235	Frequency stability over Primary voltage variation	See Note / PASS
2.1093	RF Exposure	Met the Limit / PASS
15.207 and 15.107	Conducted Limits	Met the Limit / PASS

Note. The test was not performed, because the changed items do not affect the requirement.

2.2 Additions, deviations, exclusions from standards

No additions, deviations or exclusions have been made from standard.

2.3 Related Submittal(s) / Grant(s)

This report covers for following modifications on the device, which was granted on December 15, 2006.

Changed Item	Before	After
Modem Chip	FPGA Ver.	ASIC (Hard Copy) Ver.
Internal GPS Antenna Position		Move to near at RF Block Insert metal barrier between GPS antenna and other parts for noise reduction.

2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in section 2.1.

2.5 Test Methodology

Radiated testing was performed according to the procedures in ANSI C63.4: 2003. Radiated testing was performed at a distance of 3 meters from EUT to the antenna.

2.6 Test Facility

The Electromagnetic compatibility measurement facilities are located on at 307-51 Daessangryung-Ri, Chowol-Eup, Kwangju-City, Gyeonggi-Do, 464-080, Korea. Description details of test facilities were submitted to the Federal Communications Commission on August 31, 2005 (Registration Number: 92819 and 340658), accredited by KOLAS (Korea Laboratory Accreditation Scheme, No: 85) and approved by TUV, DNV and MIC (Ministry of Information and Communications in Korea) according to the requirement of ISO17025.

3.1 Product Description

The Samsung Electronics Co., Ltd., Model SCS-26UC (referred to as the EUT in this report) is an indoor broadband PCS Base Station Transceiver system. The product specification described herein was obtained from product data sheet or user's manual.

DEVICE TYPE		Indoor Base Station Transceiver System
EMISSION DESIGNATOR		1M25F9W
OPERATING FREQUENCY	Transmitting Frequency	1930 ~ 1990 MHz
	Receiving Frequency.	1850 ~ 1910 MHz
OUTPUT POWER		50 mW (17dBm)
Channel Bandwidth		1.25 MHz
ANTENNA	Type/Model No	Dipole Antenna/W6E-UP019
	Gain	2 dBi
	Impedance	50 Ohm
MS PROTOCOL REVISION NUMBER		6
LIST OF EACH OSC. ORCRY. FREQ.(FREQ.>=1MHz)		96, 61.44, 30.72, 25, 2.5 MHz
NUMBER OF LAYER		Main Board: 8 Layers
POWER REQUIREMENT		DC 5V, 3.0A from AC/DC Adapter
EXTERNAL CONNECTOR		GPS Antenna, LAN Port, and Adapter Input Port

3.2 Alternative type(s)/model(s); also covered by this test report.

No other model differences have been mentioned.

4. EUT MODIFICATIONS

- None

5. SYSTEM TEST CONFIGURATION

5.1 Justification

This device was configured for testing in a typical way as a normal customer is supposed to be used. During the test, the following components were installed inside of the EUT.

DEVICE TYPE	MANUFACTURER	MODEL/PART NUMBER	FCC ID
Main Board	Samsung Electronics Co., Ltd.	UCMB(EP92-01305B)	N/A
GPS Board	Trimble Navigation Limited	58833-05	N/A
Internal GPS Antenna	Jecon Inc	JC-MLA-1575H	N/A

5.3 Peripheral equipment

Defined as equipment needed for correct operation of the EUT, but not considered as tested:

Model	Manufacturer	FCC ID	Description	Connected to
SCS-26UC	Samsung Electronics Co., Ltd.	A3LSCS-26UC	Indoor Base Station Transceiver System (EUT)	-
PP01L	DELL Computer Corp.	DoC	Notebook PC	EUT
JC-MLA-1575H	Jecon Inc	N/A	External GPS Antenna	EUT
RX3041	Austek	DoC	Hub	EUT
JPW118KA0500N58	Ault Inc.	N/A	AC/DC Adapter	EUT

5.4 Mode of operation during the test

The Indoor Base Station Transceiver System (BTS) was configured with AC/DC Adapter, External GPS antenna, Hub and PC to control the EUT to transmit CDMA 2000 1x type PCS RF signal. The EUT with host external computer was configured for maximum signal gain and bandwidth. The EUT was operated in a manner representative of the typical usage of the equipment. During all testing, system components were manipulated within the confines of typical usage to maximize each emission.

5.5 Modulation Characteristics

The EUT uses CDMA modulation, so the voice is digitized and coded into a bit stream, so the test dose not performed and met the requirement.

5.6 Output Power Verification and Justification for Final Measurement

Pre-scan was performed on RF conducted port to determine the worst-case operating mode:

Modulation	Channel	Measured Peak Output Power	
		dBm	mW
1x RRT RC1, SO1	Low	16.89	48.86
1xRRT RC2, SO2		16.83	48.19
1xRRT RC3, SO1		16.78	47.64
1xRRT RC3, SO33		16.82	48.08
1xRRT RC4, SO3		16.77	47.53
1x RRT RC1, SO1	Middle	17.21	52.60
1xRRT RC2, SO2		17.23	52.84
1xRRT RC3, SO1		17.23	52.84
1xRRT RC3, SO33		16.89	48.87
1xRRT RC4, SO3		17.09	51.17
1x RRT RC1, SO1	High	16.97	49.77
1xRRT RC2, SO2		16.90	48.98
1xRRT RC3, SO1		16.98	49.89
1xRRT RC3, SO33		16.82	48.08
1xRRT RC4, SO3		16.73	47.10

Based on the above results from different modulations, RC3, SO1 is determined to be the worst-case mode for fundamental ERP/EIRP measurement, and radiated spurious emissions test.

6. RF POWER OUTPUT at ANTENNA TERMINAL

6.1 Operating environment

Temperature : 18°C

Relative humidity : 40 %

6.2 Test set-up

The RF output port of the EUT was connected to the input of the spectrum analyzer. The software for RF control on the notebook PC was set to transmit maximum signal gain and bandwidth. The test was performed at three frequencies (low, middle, and high channels).



6.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	8564E	HP	Spectrum Analyzer	3650A00756	June 22, 2006

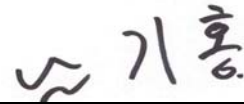
All test equipment used is calibrated on a regular basis.

6.4 Test data

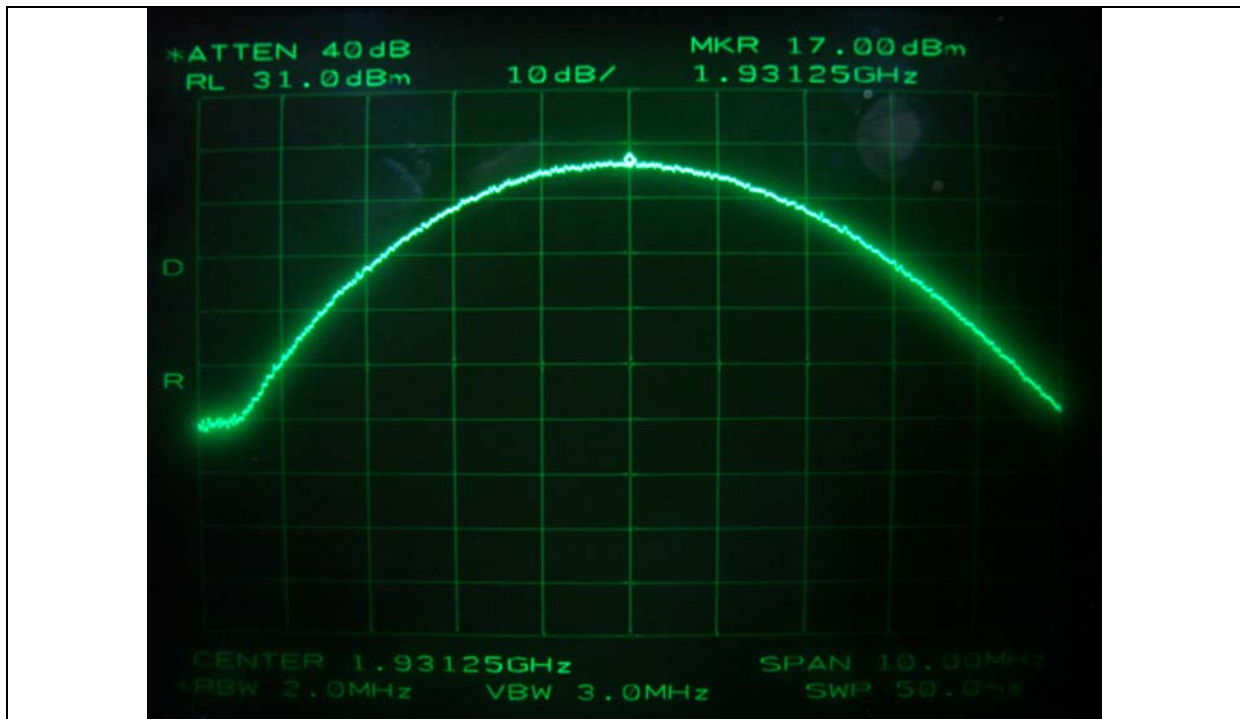
-. Test Date : April 9, 2006

-. Test Result : Pass

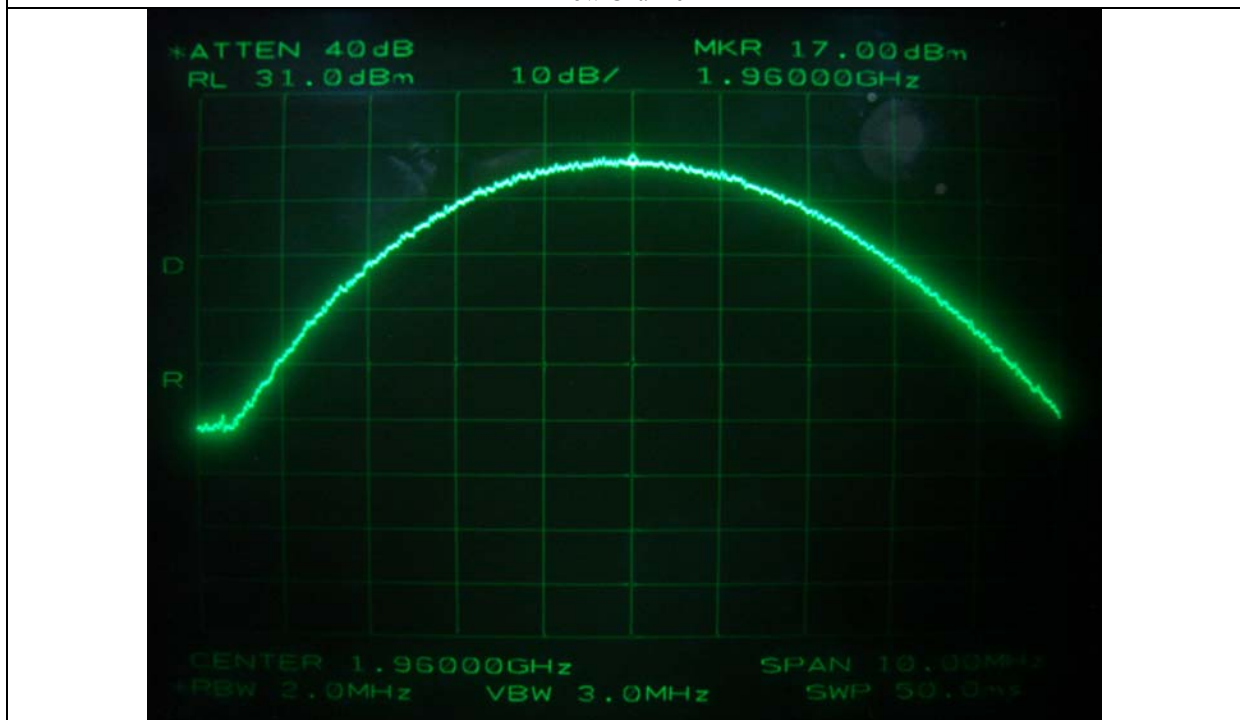
Modulation	Channel	Frequency	Measured Output Power		Limit (W)
			dBm	W	
CDMA	Low	1931.25	17.00	0.0501	2
	Middle	1960.00	17.00	0.0501	
	High	1988.75	17.00	0.0501	



Tested by: Ki-Hong, Nam / Test Engineer



Low Channel



Middle Channel



7. FIELD STRENGTH OF SPURIOUS RADIATION

7.1 Operating environment

Temperature	:	14 °C
Relative humidity	:	47 %

7.2 Test set-up

The radiated emissions measurements were on the 3 meters, open-field test site. The EUT and other support equipment were placed on a non-conductive turntable above the ground plane. The interconnecting cables from outside test site were inserted into ferrite clamps at the point where the cables reach the turntable.

The frequency spectrum from 30MHz to up to 10th harmonic of the fundamental frequency was scanned and emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in height between 1.0 and 4.0 meters in order to determine the maximum emission levels. The test was performed by placing the EUT on 3-orthogonal axis. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

The maximum radiated emission was recorded and used as reference for the effective radiated power measurement. The EUT was then replaced by a tuned dipole antenna or Horn antenna and was oriented for vertical polarization and then the length was adjusted to correspond to the frequency of the transmitter. The substitution antenna was connected to a signal generator with a coaxial cable. The receiving antenna height was raised and lowered again through the specified range of height until maximum signal level is detected by the measuring receiver. The signal to the substitution antenna was adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the EUT radiated power measured, corrected for the change of input attenuation setting of the measuring receiver. The signal generator level was recorded and corrected by the power loss in the cable between the signal generator and substitution antenna and further corrected for the gain of the dipole antenna or horn antenna used relative to an ideal tuned dipole antenna. The measurement was repeated with the test antenna and the substitution antenna oriented for horizontal polarization. The measure of the effective radiated power is the larger of the two levels recorded.

7.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	ESVS10	Rohde & Schwarz	EMI Test Receiver	827864/005	Dec. 20, 2005
■ -	85650A	Hewlett Packard	Quasi-Peak Adapter	3107A01542	June 20, 2006
■ -	8568B	Hewlett-Packard	Spectrum Analyzer	3109A05456	June 20, 2006
■ -	85685A	Hewlett-Packard	RF Preselector	3107A01264	June 20, 2006
■ -	8564E	Hewlett-Packard	Spectrum Analyzer	3650A00756	June 22, 2006
■ -	E4432B	Hewlett-Packard	Signal Generator	US38440950	June 22, 2006
■ -	83650L	Hewlett-Packard	Signal Generator	3844A00415	June 22, 2006
□ -	8447F	Hewlett-Packard	RF Amplifier	2944A12573	June 09, 2006
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D294	July 03, 2006
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	July 04, 2006
□ -	8447F	HP	RF Amplifier	2944A12573	June 09, 2006
■ -	DS420S	HD GmbH	Turn Table	N/A	N/A
■ -	MA240	HD GmbH	Antenna Master	N/A	N/A
■ -	VHA9103	Schwarzbeck	Biconical Antenna	91031852	Feb 13, 2006
■ -	9108-A(494)	Schwarzbeck	Log Periodic Antenna	62281001	Feb 13, 2006

All test equipment used is calibrated on a regular basis.

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EMC-003(Rev.0)

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EMC Testing Dept : 307-51 Daessangryung-Ri, Chowol-Eup, Kwangju-City, Kyunggi-Do 464-860 Korea. (TEL: 82-31-765-8289 FAX: 82-31-766-2904)

7.4. Test data

- Test Date : April 9, 2006
- Resolution bandwidth : 1 MHz
- Frequency range : 1 GHz ~ 20 GHz
- Operating Modulation : CDMA signal Transmitting Mode
- Result : PASSED BY -33.55 dB at High Channel
- Video bandwidth: 1 MHz
- Measurement distance: 3m

Frequency (MHz)	Spectrum Reading (dBuV)	Generator Reading (dBm)	Ant. Gain (dBi)	Ant. Pol. (H/V)	Dipole Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
Test Data for Low Channel									
1931.25	81.50	6.84	10.42	H	2.15	1.38	10.37		
	87.67	16.70		V			20.23		
3862.50	41.50	-59.55	12.70	H		2.58	-54.82	-13.0	-41.82
	46.67	-52.33		V			-47.60		-34.60
Test Data for Middle Channel									
1960.00	78.67	5.00	10.39	H	2.15	1.43	8.58		
	86.83	15.50		V			19.08		
3920.00	40.83	-60.77	12.66	H		2.62	-56.00	-13.0	-43.00
	46.50	-51.50		V			-46.73		-33.73
Test Data for High Channel									
1988.75	78.17	5.33	10.36	H	2.15	1.48	8.96		
	86.50	14.67		V			18.30		
3977.50	40.50	-61.68	12.62	H		2.66	-56.88	-13.0	-43.88
	46.67	-51.35		V			-46.55		-33.55

Tabulated test data for Restricted Band

8. MAXIMUM PERMISSIBLE EXPOSURE

8.1 RF Exposure Calculation

According to the FCC rule 1.1310 table 1B, the limit for the maximum permissible RF exposure for an uncontrolled environment is 1mW/cm².

The electric field generated for a 1mW/cm² exposure is calculated as follows:

$$E = \sqrt{(30 * P * G) / d}, \text{ and } S = E^2 / Z = E^2 / 377, \text{ because } 1\text{mW} / \text{cm}^2 = 10\text{W} / \text{m}^2$$

Where

S = Power density in mW/cm², Z = Impedance of free space, 377Ω

E = Electric field strength in Volts/m, G = Numeric antenna gain, and d = distance in meter

Combining equations and rearranging the terms to express the distance as a function of the remaining variable

$$d = \sqrt{(30 * P * G) / (377 * S)}$$

Changing to units of mW and cm, using P (mW) = P (W) / 1000, d (cm) = 100 * d (m)

$$d = 0.282 * \sqrt{(P * G) / S}$$

Where

d = distance in cm, P = Power in mW, G = Numeric antenna gain, and S = Power density in mW/cm²

8.2 Calculated MPE Safe Distance

According to above equation, the following result was obtained.

Peak Output Power		Antenna Gain		Safe Distance	Power Density (mW/cm ²)	FCC Limit
(dBm)	(mW)	Log	Linear	(cm)	@ 20cm Separation	(mW/cm ²)
17.0	50.0	2.0	1.59	2.51	0.016	1

According to above table, safe separation distance, $D = 0.282 * \sqrt{50.0 * 1.59} = 2.52 \text{ cm}$.

For getting power density at 20 cm separation in above table, following formula was used.

$$S = P * G / (4\pi * R^2)$$

Where:

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

9. RADIATED EMISSION TEST FOR DIGITAL DEVICE PART

9.1 Operating environment

Temperature : 15 °C

Relative humidity : 45 %

9.2 Test set-up

The radiated emissions measurements were on the 3 meters, open-field test site. The EUT and other support equipment were placed on a non-conductive turntable above the ground plane. The interconnecting cables from outside test site were inserted into ferrite clamps at the point where the cables reach the turntable.

The frequency spectrum from 30MHz to 1000MHz was scanned and emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in height between 1.0 and 4.0 meters in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

The test set-up photos are included in appendix VI.

9.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - ESVS10	Rohde & Schwarz	EMI Test Receiver	827864/005	Dec 20, 2005
■ - MA240	HD GmbH	Antenna Master	N/A	N/A
■ - HD100	HD GmbH	Position Controller	N/A	N/A
■ - DS420S	HD GmbH	Turn Table	N/A	N/A
■ - VHA9103	Schwarzbeck	Biconical Antenna	91031852	Feb 13, 2006
■ - 9108-A(494)	Schwarzbeck	Log Periodic Antenna	62281001	Feb 13, 2006

All test equipment used is calibrated on a regular basis.

9.4 Test data

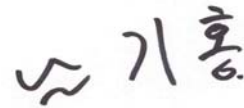
- Type of Test : FCC Part 15 Subpart B Class B
- Test Date : April 5, 2007
- Resolution bandwidth : 120 kHz
- Frequency range : 30MHz ~ 1000MHz
- Measurement distance : 3m
- Test result : Passed by -3.78 dB at 491.52 MHz

Frequency (MHz)	Reading (dBuV)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBuV/m)	Limits (dBuV/m)	Margin (dB)
52.78	22.50	V	10.16	1.60	34.26	40.00	-5.74
307.10	23.00	H	14.30	3.71	41.01	46.02	-5.01
430.08	17.90	H	18.40	4.82	41.12	46.02	-4.90
491.52	17.50	H	19.51	5.23	42.24	46.02	-3.78
737.28	10.90	H	21.19	6.55	38.64	46.02	-7.38
798.72	11.20	H	21.28	6.79	39.27	46.02	-6.75
921.60	9.50	H	22.63	7.39	39.52	46.02	-6.50

Tabulated test data for Radiated Electromagnetic Field

Remark: "H": Horizontal, "V": Vertical

Low, Middle and High channels were tested, but the worst emissions levels were recorded in this test report.



Tested by: Ki-Hong, Nam / Test Engineer

10. CONDUCTED EMISSION TEST

10.1 Operating environment

Temperature : 25°C

Relative humidity : 30 %

10.2 Test set-up

The conducted emission measurements of power line were performed in a shielded room. The EUT was placed on a wooden table, 0.8 meters height above the floor. Power was fed to the EUT through a 50 ohm/ 50 microhenry Line Impedance Stabilization Network (LISN). The ground plane was electrically bonded to the shield room ground system and all power lines entering the shield room were filtered.

10.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - ESHS10	Rohde & Schwarz	EMI Test Receiver	834467/007	May 15, 2006
■ - NSLK 8126	Schwarzbeck	AMN	8126-404	July. 04, 2006
□ - 3825/2	EMCO	AMN	9109-1867	June 23, 2006

All test equipment used is calibrated on a regular basis.

10.4 Test data

- Test Date : April 05, 2007
- Resolution bandwidth : 9 kHz
- Frequency range : 0.15MHz ~ 30MHz
- Operating Mode : CDMA Signal Transmitting Mode
- Result : PASSED BY -8.53 dB at 25.695 MHz with Aeverage Detector

Frequency (MHz)	Line	Peak (dBuV)			Margin (dB)	Average (dBuV)		Margin (dB)
		Emission level	Detector Mode	Limits		Emission level	Limits	
0.20	N	51.82	P	63.61	-11.79	38.84	53.61	-14.77
0.53	H	37.62	P	56.00	-18.38	-	-	-
1.46	N	33.20	P	56.00	-22.80	-	-	-
2.12	H	33.68	P	56.00	-22.32	-	-	-
25.695	H	44.44	P	56.00	-15.56	41.47	50.00	-8.53
25.875	N	39.73	P	56.00	-17.40	39.73	50.00	-10.27

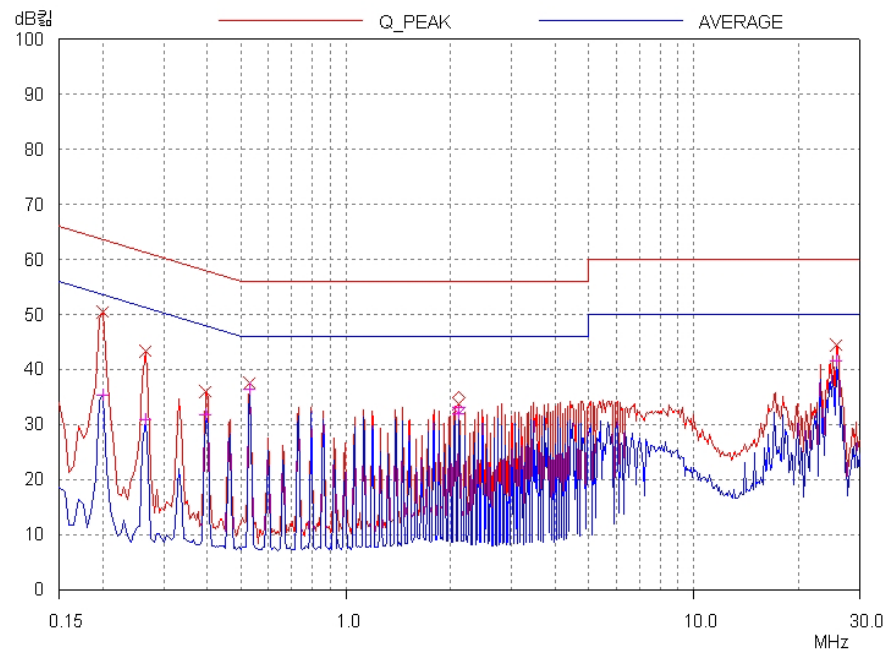
Line Conducted Emissions Tabulated Data

Remark : “H”: Hot Line, “N”: Neutral line, “P”: Peak detector.

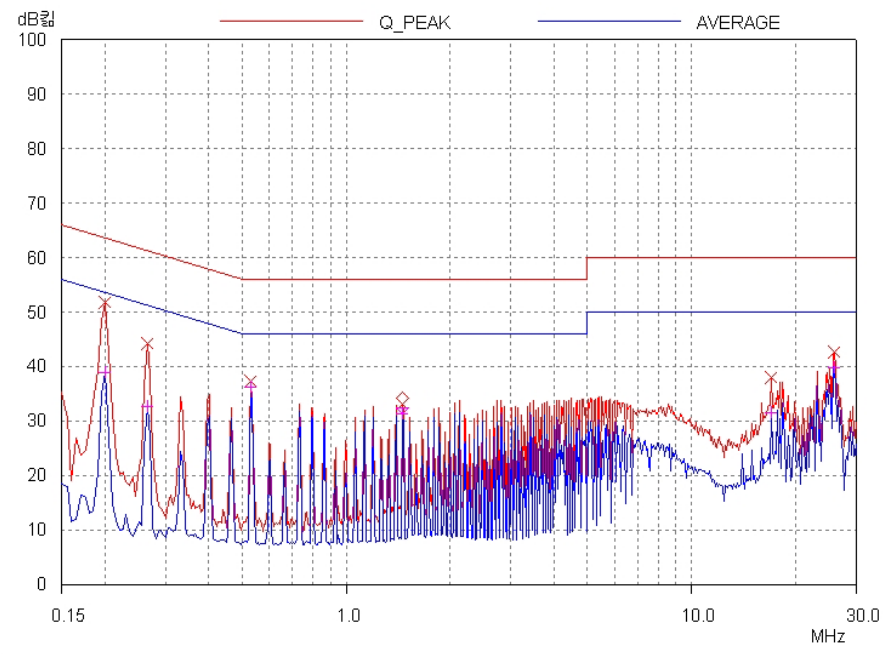
See next page for an overview sweep performed with peak and average detector.

기홍

Tested by: Ki-Hong, Nam / Test Engineer



HOT LINE



NEUTRAL LINE