

PCTEST Engineering Laboratory, Inc.

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CERTIFICATE OF COMPLIANCE (MPE EVALUATION)

SAMSUNG ELECTRONICS CO., LTD.
416 Maetan-3 Dong, Paldal-Ku
Suwon City, Kyungki-Do 441-742, KOREA
Attention: D. H. KIM, General Manager

Dates of Tests: July 06-10, 1998
Test Report S/N: MPE.980706487.A3L
Test Site: PCTEST Lab, Columbia MD

FCC ID

A3LSCWF2000

APPLICANT

SAMSUNG ELECTRONICS CO., LTD.

EUT Type: PCS CDMA WLL Phone (Wireless Local Loop)
Tx Frequency: 1851.25 – 1908.75 MHz
Rx Frequency: 1931.25 – 1988.75 MHz
Max Output Power: 0.2 Watts
Trade Name/Model(s): **SAMSUNG SCW-F2000**
FCC Classification: Licensed Base Station for Part 24 (PCB)
Application Type: Type Acceptance
Serial Number: n/a (pre production)
FCC Rule Part(s): 24.52; ET Docket 96.326

This wireless portable device has been shown to be capable of compliance for localized maximum permissible exposure (MPE) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE Std. C95.1-1992 and was tested in accordance with the measurement procedures specified in ANSI/IEEE Std. C95.3-1992. (See Test Report).

I 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. 853(a)


Randy Ortanez
President & Chief Engineer



980706487. A3L

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LAB CODE 100431-0

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MPE MEASUREMENT REPORT

Scope - Environmental evaluation measurements of Maximum Permissible Exposure (MPE) exposed to radiofrequency (RF) radiation from transmitter for compliance with the rules and regulations of the U.S. Federal Communications Commission (FCC).¹

| | |
|----------------------|--|
| Company Name: | SAMSUNG ELECTRONICS CO., LTD. |
| ADDRESS : | 416 Maetan-3 Dong, Paldal-Ku Suwon City Kyungki-Do 441-742, KOREA |
| Attention : | D. H. KIM, General Manager |

- EUT Type: PCS CDMA WLL Phone (Wireless Local Loop)
- Trade Name: **SAMSUNG**
- FCC IDENTIFIER: **A3LSCWF2000**
- Model: **SCW-F2000**
- Tx Frequency Range: 1851.25 – 1908.75 MHz
- Rx Frequency Range: 1931.25 – 1988.75 MHz
- Application Type: Type Acceptance
- FCC Classification: Licensed Base Station for Part 24 (PCB)
- FCC Rule Part(s): § 24.52; Docket 96-326
- Max. Power Rating: 0.2 W
- Channel(s): 0025 - 1175
- Modulation : CDMA
- Dates of Test(s): July 06-10, 1998
- Place of Test(s): PCTEST Engineering Lab.
Columbia, MD, U.S.A.
- Test Report S/N: MPE.980706487.A3L



¹ IEEE/ANSI Std. C95.1-1992 limits are used to determine compliance with FCC ET-Docket 93-62.

1.1 INTRODUCTION

The Federal Communications Commissions (FCC) has adopted the guidelines for evaluating the environmental effects of radiofrequency radiation in ET Docket 93-62 on Aug. 6, 1996 to protect the public from the potential hazards of RF emissions.[1]

The safety limits used for the environmental evaluation measurements are based on the criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate (SAR) and maximum permissible exposure (MPE) in *IEEE/ANSI C95.1-1992 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz*. (c) 1992 by the Institute of Electrical and Electronics Engineers, Inc., New York, New York 10017.[2] The measurement procedure described in *IEEE/ANSI C95.3-1992 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave*[3] is used for guidance in measuring SAR/MPE due to the RF radiation exposure from the Equipment Under Test (EUT). The new guidelines incorporate limits for Maximum Permissible Exposure (MPE) in terms of electric and magnetic field strength and power density for transmitters operating at frequencies between 300 kHz and 100 GHz. These criteria for SAR/MPE evaluation are similar to those recommended by the National Council on Radiation Protection and Measurements (NCRP) in *Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields*, NCRP Report No. 86 (c) NCRP, 1986, Bethesda, MD 20814.[4] SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards. MPE is the rms and peak electric and magnetic strength, their squares, or the plane-wave equivalent power densities associated with these fields to which a person may be exposed without harmful effect and with an acceptable safety factor.

1.2 Section 24.52 RF Hazards

Licenses and manufacturers are subject to the radiofrequency radiation exposure requirements specified in §1.1307(b), §2.1091 and §2.1093 of this chapter, as appropriate. Applications for equipment authorization of mobile or portable devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. Technical information showing the basis of this statement must be submitted to the Commission upon request.

This equipment is designed to generate and radiate radio frequency (RF) energy. It should be installed and maintained only by trained technicians. Licensees of the Federal Communications Commission (FCC) using this equipment are responsible for insuring that its installation and operation comply with FCC regulations designed to limit human exposure to RF radiation in accordance with the American National Standards Institute IEEE Standard C95.1-1991, *IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz*.

This standard establishes two sets of "maximum permitted exposure" (MPE) limits, one for "controlled" environments and another, that allows less exposure, for "uncontrolled" environments. These terms are defined by the standard:

Uncontrolled Environment / General Population. Uncontrolled environments are locations where there is exposure of individuals who have no knowledge or control of their exposure. The exposures may occur in living quarters or workplaces where there are no expectations that the exposure levels may exceed those shown [in a table of exposure ceilings].

Controlled Environment / Occupational. Controlled environments are locations where there is exposure that may be incurred by persons who are aware of the potential for exposure as a concomitant of employment, by other cognizant persons, or as the incidental result of transient passage through areas where exposure levels may be above the general population/uncontrolled limits.

2.1 DEFINITION

2.2 Maximum Permissible Exposure (MPE)

The maximum permitted exposures (MPE) prescribed by the standard are set in terms of different parameters of effects, depending on the frequency generated by the equipment in question. At the frequency range of this Personal Communication System Base Transmitter equipment, 1930-1990 MHz, the maximum permitted exposure levels are set in terms of "power density", whose definition and relationship to electric field and magnetic field strengths are described by the following equation:

$$S(mW/cm^2) = \frac{E^2}{3770} = 37.7H^2$$

where:

S = Power density (mW/cm²).

Power per unit area normal to the direction of propagation, usually expressed in units of watts per square meter (W/m²) or for convenience, units such as milliwatts per square centimeter. For plane waves, power density, electric field strength (E) and magnetic field strength (H) are related by the impedance of free space (377 ohms).

E = electric field strength (V/m)

H = magnetic field strength (A/m)

Whether a given installation meets the maximum permitted exposure ceilings depends, in part, upon antenna type, antenna placement and the output power to which this equipment is adjusted.

3.1 MAXIMUM PERMISSIBLE EXPOSURE LIMITS

3.2 RadioFrequency Guides (ANSI/IEEE C95.1-1992)

| Frequency Range (f) | Electric Field Strength (E ²) | Magnetic Field Strength (H ²) | Power Density E-field; H-field (S) | Averaging Time E ² ; H ² ; S |
|------------------------|--|--|--|---|
| (MHz) | (V ² /m ²) | (A ² /m ²) | (mW/cm ²) | (minutes) |
| 0.3 - 3.0 | 400,000 | 2.5 | 100.0 | 6 |
| 3.0 - 30 | 4,000 (900/f ²) | 0.025 (900/f ²) | 900/f ² | 6 |
| 30 - 300 | 4,000 | 0.025 | 1.0 | 6 |
| 300 - 1500 | 4,000 (f/300) | 0.025 (f/300) | f/300 | 6 |
| 1500 - 100,000 | 20,000 | 0.125 | 5.0 | 6 |

Table 1. Occupational Exposure (Controlled Environment)

| Frequency Range (f) | Electric Field Strength (E ²) | Magnetic Field Strength (H ²) | Power Density E-field; H-field (S) | Averaging Time E ² ; H ² ; S |
|------------------------|--|--|--|---|
| (MHz) | (V ² /m ²) | (A ² /m ²) | (mW/cm ²) | (minutes) |
| 0.3 - 1.342 | 400,000 | 2.5 | 100.0 | 30 |
| 1.342 - 30 | 4,000 (180/f ²) | 0.025 | 180/f ² | 30 |
| 30 - 300 | 800 | 0.005 | 0.2 | 30 |
| 300 - 1500 | 4,000 (f/1500) | 0.025 (f/1500) | f/1500 | 30 |
| 1500 - 100,000 | 4,000 | 0.025 | 1.0 | 30 |

Table 2. General Public Exposure (Uncontrolled Environment)

NOTES:

- f = Frequency in Megahertz (MHz)
- E² = Electric Field Strength squared
- H² = Magnetic Field Strength squared
- V²/m² = Volts squared per meter squared
- A²/m² = Amperes squared per meter squared
- mw/cm² = Milliwatts per centimeter squared

4.1 FCC LIMITS FOR MPE

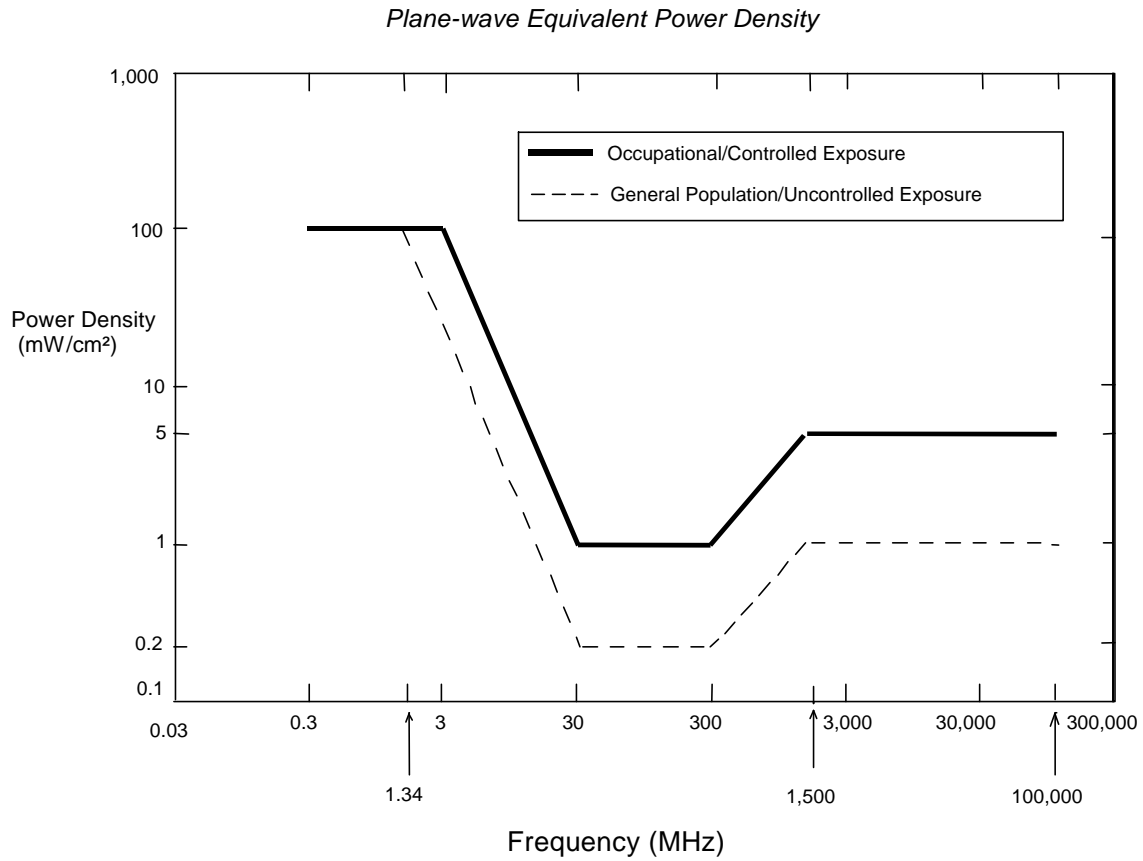


Figure 1. FCC Limits for Maximum Permissible Exposure (MPE)

5.1 RF Human Exposure Data and Measurement Procedure

This exhibit contains an outline of the measurement procedure and the data used to support the statement of compliance with FCC 47 CFR §24.52 and hence ANSI/IEEE C95.1-1992 IEEE *Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz*.

4.2 Measurement Procedure:

Measurements were made at PCTEST Engineering Laboratory, Inc. test facility in Columbia, Maryland. The following steps were followed when measuring the equipment for RF radiation (also see 'Notes' below):

1. Power up equipment and configure transmitters
2. Measure near front face of the frame with Wandel & Goltermann (W & G) EM Radiation Meter, Model number EMR-20.
3. Measure near left face of the frame with W&G EM Radiation Meter.
4. Measure near right face of the frame with W&G EM Radiation Meter.
5. Measure near back face of the frame with W&G EM Radiation Meter.
6. Measure near top face of the frame with W&G EM Radiation Meter.
7. Record measurement.

Notes:

1. Care was taken to ensure that the operator did not interfere with the probe.
2. A minimum separation distance of 20 cm was maintained.

6.1 TEST DATA SUMMARY

6.2 Measured Data:

Ambient TEMPERATURE (°C) _____ 21.0 _____
 Relative HUMIDITY (%) _____ 55.0 _____
 Atmospheric PRESSURE (kPa) _____ 99.0 _____

MODEL: _____ SCW-F2000 _____
 FREQUENCY (MHz): _____ 1880.00 _____
 CHANNEL: _____ 600 _____
 POWER: _____ +23.0 dBm (0.2 Watts) _____

Measurement Results

| FREQUENCY | | Modulation | POWER (dBm) | POSITION | POWER DENSITY (mW/cm ²) |
|--|---------|------------|----------------|------------------------------|---|
| MHz | Channel | | | | |
| 1880.00 | 600 | PCS CDMA | + 23.0 | FRONT | 0.011 |
| 1880.00 | 600 | PCS CDMA | + 23.0 | BACK | 00.04 |
| 1880.00 | 600 | PCS CDMA | + 23.0 | LEFT | 0.014 |
| 1880.00 | 600 | PCS CDMA | + 23.0 | RIGHT * | 0.045 |
| 1880.00 | 600 | PCS CDMA | + 23.0 | TOP | 0.023 |
| MPE SAFETY LIMIT | | | | 1.0 mW/cm² | |
| Uncontrolled Environment/General Public | | | | | |
| MPE SAFETY LIMIT | | | | 5.0 mW/cm² | |
| Controlled Environment/Occupational | | | | | |

NOTES:

1. All modes of operation were investigated and the worst-case are reported.
2. Power Density as measured with W&G EMR-20 Meter
3. Antenna is located on the right side of the EUT.


 Randy Ortanez
 President & Chief Engineer

PCTEST SEAL

7.1 SPECIFICATIONS

Applies to the EMR-20 EM Radiation Meter together with the Calibration Option BN 2244/90.40.

EMR-20

Type electrical field
Frequency range 100 kHz to 3 GHz
Measurement method true triaxial
H/V directional characteristic isotropic, triaxial

Isotropic deviation

Sensor ± 0.5 dB at $f > 1$ MHz
Complete instrument typically ± 1 dB at $f > 1$ MHz
Measurement range 0.8 to 800 V/m

Linearity

± 1 dB 2 to 800 V/m
 ± 3 dB 0.8 to 2 V/m

Overload protection

CW 0.7 W/cm^2
Pulse 70 W/cm^2
Frequency response typically ± 2 dB
Suppression of magnetic field components 20 dB
Settling time typically 1 s (0 to 90% of measured value)
Display refresh rate typically 400 ms
Temperature range 0 to 50 °C

Power Supply

Rechargeable batteries 2 x Mignon (AA) 1.2 V
Battery capacity 600 mAh
Dry batteries 2 x Mignon (AA) 1.5 V

Display and warning indicators

Display type device-specific LCD
Visual warning bright red LED's in foil keypad
Audible warning .. built-in piezoelectric generator; tone sequence (depends on measured value)
Range selection single continuous range

Measurement functions

Units V/m, A/m, mW/cm^2 , W/m^2
Detection type quasi-r.m.s.
Analog display instantaneous value; shown on logarithmic scale
Digital display instantaneous or average value or maximum thereof since switching on
Averaging instantaneous value or average over 6 minutes
Alarm functions on/off, variable threshold setting
Calibration variable probe calibration factor setting

Calibration

Recommended calibration interval 2 years
Calibration Due Date 11/08/98

Interfaces

Transfer Interface bi-directional/optical

Dimensions and Weight

Dimensions (incl. sensor & impact protection) approx. 95 x 50 x 450 mm (3.7" x 2.0" x 17.8")
Weight (incl. batteries) approx. 450 g

7.1 CONCLUSION

The SAR/MPE measurement indicates that the EUT complies with the RF radiation exposure limits of the FCC. These measurements are taken to simulate the RF effects exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests.

Please note that the absorption and distribution of electromagnetic energy in the body are very complex phenomena that depend on the mass, shape, and size of the body, the orientation of the body with respect to the field vectors, and the electrical properties of both the body and the environment. Other variables that may play a substantial role in possible biological effects are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease). Because innumerable factors may interact to determine the specific biological outcome of an exposure to electromagnetic fields, any protection guide shall consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables.[3]

Whether a given installation meets ANSI standards for human exposure to radio frequency radiation may depend not only on this equipment but also on whether the "environments" being assessed are being affected by radio frequency fields from other equipment, the effects of which may add to the level of exposure. Accordingly, the overall exposure may be affected by radio frequency generating facilities that exist at the time the licensee's equipment is being installed or even by equipment installed later. Therefore, the effects of any such facilities must be considered in site selection and in determining whether a particular installation meets the FCC requirements.

REFERENCES:

- [1] Federal Communications Commission, ET Docket 93-62, *Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation*, Aug. 1996.
- [2] ANSI/IEEE C95.1 - 1991, *American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 300kHz to 100GHz*, New York: IEEE, Aug. 1992
- [3] ANSI/IEEE C95.3 - 1991, *IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave*, New York: IEEE, 1992.
- [4] NCRP, National Council on Radiation Protection and Measurements, *Biological Effects and Exposure Criteria for RadioFrequency Electromagnetic Fields*, NCRP Report No. 86, 1986. Reprinted Feb. 1995.