



Assessment of Compliance

for

**FCC part 2.1053 AND 25.202(f)
Field Strength of Spurious Radiation**

**GMPCS Terminal Single Mode
IRIDIUM Handset, Model SS-66K
Kyocera Corporation**



April 1999

51 Spectrum Way Nepean ON K2R 1E6
Tel: (613) 820-2730 Fax: (613) 820-4161
email: info@aprel.com

Engineering Report

Subject: Assessment of Compliance with
Respect to FCC Part 2.1053 and 25.202(f)
Field Strength of Spurious Radiation

Product: GMPCS Terminal
Single Mode IRIDIUM Handset

Model: SS-66K

FCC ID: JOYKC-SSSD-66K

Project #: KYOB-IRIDIUM-T/A-1-3200

Client: Kyocera Corporation
2-1-1 Kagahara, Tsuzuki-ku
Yokohama-shi 224 Japan

Prepared by: *APREL Laboratories,*
Regulatory Compliance Division

Approved by:

Date:

Jay Sarkar
Jay Sarkar,
Director, Standards & Certification

Released by:

Date:

J. J. Wojcik
Dr. J.J. Wojcik, P.Eng.



"SOLUTIONS FOR THE WIRELESS FUTURE"

Project No.: KYOB-IRIDIUM-T/A-1-3200
Client: Kyocera Corporation
Product: GMPCS Terminal Single Mode IRIDIUM Handset
Model: SS-66K
FCC ID: JOYKC-SSSD-66K

ENGINEERING SUMMARY

This report contains the results of the Field Strength of Spurious Radiation measurements performed on a GMPCS Terminal Single Mode IRIDIUM Handset. The tests were carried out in accordance with FCC Rules and Regulations Part 2.1053 and Part 25.202(f) for Field Strength of Spurious Radiation.

Based on the test results, it is certified that the product meets the requirements as set forth in the above specifications.

The handset was tested for three channels:

- i) Low Ch.: 1621.6875 MHz
- ii) Medium Ch.: 1623.8125 MHz
- iii) High Ch.: 1625.9795 MHz

Test data for all three channels are presented in this report.

INTRODUCTION

General

This report describes the Electromagnetic Interference tests performed on a GMPCS Terminal, Single Mode IRIDIUM Handset, Model SS-66K, referred to as DUI (Device Under Investigation), S/N: 30002209500240.

The tests were performed by APREL Laboratories for Kyocera Corporation at APREL's EMI facility located in Nepean, Ontario, Canada. The laboratory operates a 3 and 10 meter Open Area Test Site (OATS) measurement facility. The test site is calibrated to ANSI C63.4-1992 document.

A description of the measurement facility in accordance with the radiated and AC line conducted test site criteria in ANSI C63.4-1992 is on file with the Federal Communications Commission and is in compliance with the requirements of Section 2.948 of the Commissions rules and regulations

APREL's registration number is 31040/SIT (1300F2).

APREL is accredited by Standard Council of Canada (SCC), under PALCAN program (ISO Guide 25). All equipment used is calibrated or verified in accordance with the intent of AQAP-6/MIL-STD-45662. APREL is also accredited by Industry Canada and recognized by the Federal Communications Commission (FCC). ***Under the terms of the MRA between NVLAP and SCC, APREL is acceptable by FCC to perform Declaration of Conformity (DoC) testing under the FCC rules.***

This report was originated by Jay Sarkar. The tests were performed by Haitao Yang under the supervision of Jay Sarkar.

Standard

The evaluation and analysis were conducted in accordance with FCC Part 15, Subpart B requirements for Class B Digital Devices.

Sample for Evaluation

The sample of the evaluation consisted of the following:

<u>Description</u>	<u>Model No</u>	<u>Serial No</u>
GMPCS Terminal Single Mode IRIDIUM Handset	SS-66K	30002209500240

Test Equipment

The test equipment used during the evaluation is listed in Appendix A.

Environmental Conditions

Measurements were conducted under normal laboratory conditions in both shielded room and open area test site.

Temperature	: $23 \pm 2^{\circ}\text{C}$
Relative humidity	: 30-60 %
Air pressure	: $101 \pm 3 \text{ kPa}$

Measurement Repeatability Information:

The test data presented in this report was acquired using the guidelines set forth in ANSI C63.4-1992 and are valid only for the equipment identified herein under the test conditions described. Repeatability of these test results will only be achieved with identical measurement conditions. These conditions include the same test distance, DUI height, measurement site characteristics, and the same DUI and system components. The system must have the same interconnecting cables arranged in identical placement, with the system and/or DUI functioning in the identical mode of operation (i.e. software and so on) as on the date of the test. Any deviation from the test conditions and environment on the date of the test may result in measurement uncertainty which may be difficult to track.

Kyocera Corporation
SS-66K
Single Mode IRIDIUM Handset

Test: Field Strength of Spurious Radiation

Reference: FCC Part 25 paragraph 25.202(f) and Part 2.1053

Criteria: The mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:

1. In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 50% up to and including 100% of the authorized bandwidth: 25 decibels.
2. In any 4 kHz band , the center frequency of which is removed form the assigned frequency by more than 100% up to and including 250% of the authorized bandwidth: 35 decibels.
3. In any 4 kHz band , the center frequency of which is removed form the assigned frequency by more than 250% of the authorized bandwidth: an amount equal to 43 decibels plus 10 times the logarithm (to the base 10) of the transmitter power in watts.

It is calculated to be: -43 dBW.

Mean power of transmitter is 7 Watts.

The criteria (reference) level is:

$$10\log_{10}(7) - (43 + 10\log_{10}(7)) \\ = -43 \text{ dBW}$$

Set-up: See Figure No. 1.

Environmental

Conditions: Temperature: $23^{\circ}\text{C} \pm 2$.
Air pressure: 101 ± 3 kPa

Equipment: See Appendix A.

Procedure: Field Strength of Spurious Radiation Test Method

- 1) The handset was configured to operate at maximum power. The handset was keyed on Channel Low .
- 2) The final measurements were taken at APREL Laboratory's 3m open area test site (OATS). This open area test site is calibrated to ANSI C63.4 document and a is on file with the FCC (FCC File No.: 31040/SIT).
- 3) Prior to final measurements in OATS, preliminary radiated spurious emissions were scanned in a shielded enclosure at a distance of 1 m using a broadband Discone and Horn antenna in order to determine the characteristic frequencies of the filed strength of spurious radiation. Based on this information, measurements were performed in the OATS at these characteristic frequencies using calibrated antennas.
- 4) The mean power at antenna terminals was measured using spectrum analyzer with RB 3 kHz. The measured value was corrected for a resolution bandwidth (RB) of 4 kHz. Power Output was measured with the maximum rated input level.
- 5) The equipment under test was placed on a turntable positioned 3 meters away from the calibrated receiving antenna, which in turn was connected to the spectrum analyzer. For each identified frequency, the received signal was maximized by the positioning of the turntable and the height of the antenna. The process was repeated for both horizontal and vertical polarization.
- 6) Steps 1-5 were repeated with the handset operating at Channels Medium and High.
- 7) **The criteria level in EIRP is calculated as follows:**

The mean power of transmitter is 7 Watts, the criteria level is attenuated $43 + 10\log_{10}(7)$ below the mean power of the transmitter. The criteria is:

$$\begin{aligned}
 &\text{Mean power of transmitter in dBW} - (43 + 10\log_{10}(7)) \\
 &= 10\log_{10}(7) - 51.45 \\
 &= -43 \text{ dBW}
 \end{aligned}$$

8) The calculation of the test results

If the antenna is not detachable from the circuit then the Peak Power Output is derived from the peak radiated field strength of the fundamental emission by using the plane wave relation showing as followings:

$$P = \frac{E^2 R^2}{30 G}$$

Where,

P = the equivalent isotropic radiated power in watts

E = the maximum measured field strength in V/m

R = the measurement distance (3 meters)

G = the numeric gain of the transmit antenna in relation to an isotropic radiator (G=1)

or,

$$\begin{aligned}
 P_{\text{dBW}} &= E_{\text{dBV/m}} + 20\log_{10}(3) - 10\log_{10}(30) \\
 &= E_{\text{dBV/m}} - 5.23 \\
 &= (E_{\text{dB}\mu\text{V/m}} - 120) - 5.23 \\
 &= E_{\text{dB}\mu\text{V/m}} - 125.23
 \end{aligned}
 \tag{Equation 1}$$

eg, at 54 MHz, the reading on spectrum analyzer is 25 dB μ V , the related E-Field is :

$$\begin{aligned}
 &\text{Reading} + (\text{Cable Loss} - \text{Pre-amp. Gain}) + \text{Antenna Factor} \\
 &= 25 + (-28.7) + 10 \\
 &= 6.3 \text{ dB}\mu\text{V/m}
 \end{aligned}$$

The EIRP can be calculated using equation 1 as follows:

$$\begin{aligned}
 P_{\text{dBW}} &= E_{\text{dB}\mu\text{V/m}} - 125.23 \\
 &= 6.3 - 125.23 \\
 &= -118.9 \text{ dBW}
 \end{aligned}$$

Results: Test Data is tabulated in Tables 1 – 6.

This GMPCS Terminal Single Mode IRIDIUM Handset meets the limit of FCC Part 25.202(f) for Field Strength of Spurious Radiation.

Table 1
 Spurious Emission Levels
 Transmitter Frequency: Low Ch.(1621.6875 MHz)
 Antenna Polarization: Horizontal

Frequency (MHz)	Measured Level At 3 m (dBμV) (1)	Measuring Bandwidth (kHz)	Cable + Pre-Amp. Loss. (dB) (2)	Antenna Factor (dB/m) (3)	EIRP dBW (4)	Limit EIRP dBW (5)	Margin (dB) (6)
54.0	25.0	4.0	-28.7	10.0	-118.9	-43.0	75.9
90.0	27.0	4.0	-28.3	11.0	-115.5	-43.0	72.5
126.0	38.0	4.0	-27.6	12.0	-102.8	-43.0	59.8
216.0	20.0	4.0	-26.1	16.8	-114.5	-43.0	71.5
234.0	15.0	4.0	-26.1	16.8	-119.5	-43.0	76.5
432.0	18.0	4.0	-21.0	16.0	-112.2	-43.0	69.2

(4) = (1) + (2) + (3) – 125.23

(6) = (5) – (4)

Table 2
 Spurious Emission Levels
 Transmitter Frequency: Low Ch.(1621.6875 MHz)
 Antenna Polarization: Vertical

Frequency (MHz)	Measured Level At 3 m (dBμV) (1)	Measuring Bandwidth (kHz)	Cable + Pre-Amp. Loss. (dB) (2)	Antenna Factor (dB/m) (3)	EIRP dBW (4)	Limit EIRP dBW (5)	Margin (dB) (6)
54.0	20.0	4.0	-28.7	10.0	-123.9	-43.0	80.9
90.0	18.0	4.0	-28.3	11.0	-124.5	-43.0	81.5
126.0	18.5	4.0	-27.6	12.0	-122.3	-43.0	79.3
216.0	20.0	4.0	-26.1	16.8	-114.5	-43.0	71.5
234.0	15.0	4.0	-26.1	16.8	-119.5	-43.0	76.5
432.0	18.0	4.0	-21.0	16.0	-112.2	-43.0	69.2

(4) = (1) + (2) + (3) – 125.23

(6) = (5) – (4)

Table 3
 Spurious Emission Levels
 Transmitter Frequency: Medium Ch. (1623.8125 MHz)
 Antenna Polarization: Horizontal

Frequency (MHz)	Measured Level At 3 m (dBμV) (1)	Measuring Bandwidth (kHz)	Cable + Pre-Amp. Loss. (dB) (2)	Antenna Factor (dB/m) (3)	EIRP dBW (4)	Limit EIRP dBW (5)	Margin (dB) (6)
54.0	27.0	4.0	-28.7	10.0	-116.9	-43.0	73.9
90.0	25.0	4.0	-28.3	11.0	-117.5	-43.0	74.5
234.0	33.0	4.0	-26.1	16.8	-101.5	-43.0	58.5
306.0	31.0	4.0	-26.2	14.9	-105.5	-43.0	62.5
540.0	18.0	4.0	-18.0	18.0	-107.2	-43.0	64.2
576.0	15.0	4.0	-17.0	18.0	-109.2	-43.0	66.2

(4) = (1) + (2) + (3) -125.23

(6) = (5) - (4)

Table 4
 Spurious Emission Levels
 Transmitter Frequency: Medium Ch. (1623.8125 MHz)
 Antenna Polarization: Vertical

Frequency (MHz)	Measured Level At 3 m (dBμV) (1)	Measuring Bandwidth (kHz)	Cable + Pre-Amp. Loss. (dB) (2)	Antenna Factor (dB/m) (3)	EIRP dBW (4)	Limit EIRP dBW (5)	Margin (dB) (6)
54.0	30.0	4.0	-28.7	10.0	-113.9	-43.0	70.9
90.0	25.0	4.0	-28.3	11.0	-117.5	-43.0	74.5
234.0	27.0	4.0	-26.1	16.8	-107.5	-43.0	64.5
306.0	23.0	4.0	-26.2	14.9	-113.5	-43.0	70.5
540.0	18.0	4.0	-18.0	18.0	-107.2	-43.0	64.2
576.0	13.0	4.0	-17.0	18.0	-111.2	-43.0	68.2

(4) = (1) + (2) + (3) -125.23

(6) = (5) - (4)

Table 5
 Spurious Emission Levels
 Transmitter Frequency: High Ch. (1625.9795 MHz)
 Antenna Polarization: Horizontal

Frequency (MHz)	Measured Level At 3 m (dBμV) (1)	Measuring Bandwidth (kHz)	Cable + Pre-Amp. Loss. (dB) (2)	Antenna Factor (dB/m) (3)	EIRP dBW (4)	Limit EIRP dBW (5)	Margin (dB) (6)
90.0	31.0	4.0	-28.3	11.0	-111.5	-43.0	68.5
126.0	40.0	4.0	-27.6	12.0	-100.8	-43.0	57.8
216.0	24.0	4.0	-26.1	16.8	-110.5	-43.0	67.5
234.0	30.0	4.0	-26.1	16.8	-104.5	-43.0	61.5
432.0	17.0	4.0	-21.0	16.0	-113.2	-43.0	70.2
540.0	24.0	4.0	-18.0	18.0	-101.2	-43.0	58.2

(4) = (1) + (2) + (3) -125.23

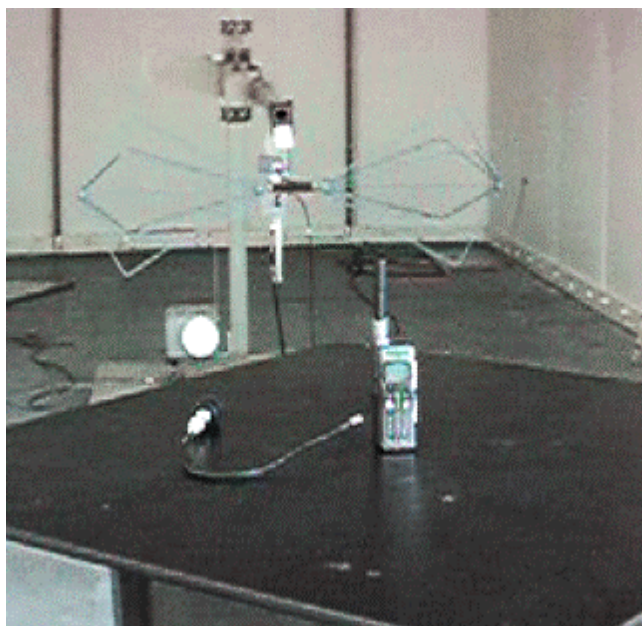
(6) = (5) - (4)

Table 6
 Spurious Emission Levels
 Transmitter Frequency: High Ch. (1625.9795 MHz)
 Antenna Polarization: Vertical

Frequency (MHz)	Measured Level At 3 m (dBμV) (1)	Measuring Bandwidth (kHz)	Cable + Pre-Amp. Loss. (dB) (2)	Antenna Factor (dB/m) (3)	EIRP dBW (4)	Limit EIRP dBW (5)	Margin (dB) (6)
90.0	28.0	4.0	-28.3	11.0	-114.5	-43.0	71.5
126.0	31.0	4.0	-27.6	12.0	-109.8	-43.0	66.8
216.0	21.0	4.0	-26.1	16.8	-113.5	-43.0	70.5
234.0	25.0	4.0	-26.1	16.8	-109.5	-43.0	66.5
432.0	21.0	4.0	-21.0	16.0	-109.2	-43.0	66.2
540.0	19.0	4.0	-18.0	18.0	-106.2	-43.0	63.2

(4) = (1) + (2) + (3) -125.23

(6) = (5) - (4)



Picture of radiated emission measurements in Open Area Test Site (OATS)



Picture of DUI Configuration in Open Area Test Site (OATS)

APREL's 10 metre Open Area Test Site is fully protected against climatic changes. The site is used for studies on electromagnetic radiation and for antenna calibration, and was developed as the most advanced structure of this type in North America. All laboratory instruments, a turntable and cables are located below a perforated metal ground plane, while the building itself is constructed with specially formed fibreglass modules.



Shown is one of two complete SAR (Specific Absorption Rate) labs at APREL. These are used for dosimetry measurements, as well as for near-field antenna design studies. APREL was the first fully independent (and ISO Guide 25 accredited) organization to offer SAR expertise.



Spectrum Sciences™ Institute is an almost 30,000 sq. ft facility nestled in 18 acres of treed land known as Spectrum Sciences™ Park, and located in Ottawa- Canada's high-tech hot-spot.

The current building consists of:

- the Technology Gallery and Conference facility
- APREL Laboratories and NCL Calibration Labs
- Spectrum Sciences™ Institute offices
- "Incubation" offices

APREL Laboratories
51 Spectrum Way Nepean ON K2R 1E6
Tel: (613) 820-2730 Fax: (613) 820-4161
email: info@aprel.com