SAR Test Report on

Dual-Band CDMA 1xRTT/1xEVDO PC Card

FCC Part 22 & 24 Certification	
FCC ID:	**OVFKWC-KPC680**
MODEL:	**KPC680**
DATE:	**January 29, 2007**

STATEMENT OF COMPLIANCE

Kyocera Wireless Corp declares under its sole responsibility that the product, FCC ID: OVFKWC-KPC680 to which this declaration relates, is in conformity with the appropriate General Population/Uncontrolled RF exposure standards, recommendations and guidelines. It also declares that the product was tested in accordance with the appropriate measurement standards, guidelines and recommended practices.

Any deviations from these standards, guidelines and recommended practices are noted: NONE.

Date of Test:	January 23 – January 25, 2007
Test performed by:	Kyocera Wireless Corp 10300 Campus Point Drive San Diego, CA 92121
Report Prepared by:	Jeff Flores, Test Technician
Report Reviewed by:	C.K. Li, Engineer Principle

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1 INTRODUCTION

This test report describes an environmental evaluation measurement of specific absorption rate (SAR) distribution in simulated human body tissues exposed to radio frequency (RF) radiation from a wireless portable device manufactured by Kyocera Wireless Corp. (KWC). These measurements were performed for compliance with the rules and regulations of the U.S. Federal Communications Commission (FCC). The testing was performed in accordance with FCC OET Bulletin 65 Supplement C (01/01) and IEEE P1528/D1.2 issued on April 21, 2003.

2 EQUIPMENT UNDER TEST (EUT)

The wireless device is described as follows:

FCC ID:	OVFKWC-KPC680	
Product:	Dual-Band CDMA 1XRTT/EVDO PC Card	
Trade Name:	Kyocera Wireless Corp.	
Model Number:	KPC680	
EUT S/N:	1901581238	
Type:	[X] Identical Prototype, [ ] Pre-production	
Device Category:	Portable	
RF Exposure Environment:	General Population / Uncontrolled	
External Input:	Digital Data	
Quantity:	Quantity production is planned	
Antenna Type:	Monopole, 0 to 90^{o} flip-up, Unique connector	
FCC Rule Parts:	§22H	§24H
Modes:	1xRTT, 1xEVDO (Rel 0, Rev A)	1xRTT, 1xEVDO (Rel 0, Rev A)
Multiple Access Scheme:	CDMA	CDMA
TX Frequency (MHz):	824 – 849	1850 - 1910
Emission Designators:	1M25F9W	1M25F9W
Rated Conducted Output Power (dBm):	24	24

2.1 Product Description

The OVFKWC-KPC680 is a Dual-Band 1xRTT and 1xEVDO modem in PC ExpressCard format. The dual-band architecture is defined as 1900MHz (PCS CDMA) and 800MHz (cellular CDMA).

The device is designed in compliance with the technical specifications for compatibility of mobile and base stations in the Cellular Radio telephone service contained in “Cellular System Mobile Station -Land Station Compatibility Specification” as specified in OET Bulletin 53 and TIA Standards.

2.2 Accessories:

KWC Antenna Model: Antenna
There are two antenna options available to operate the PC Card.
1. Integrated rotable antenna with unique connector
2. External antenna for receiving only.

2.3 Host Devices

The SAR evaluation was performed on the following hosts:

Host #	Description	Manufacturer	Model	Overall Dimension
1	Laptop Computer	Dell	M1210	29.5cm x 22cm x 3.5cm
2	Laptop Computer	Toshiba	Terca M5	31cm x 25.5cm x 3.5cm
3	Laptop Computer	IBM	T60	31cm x 25cm x 3cm

3 SAR TEST RESULT SUMMARY

This device has been tested for localised specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE Std. C95.1 ~ 1992 and has been tested in accordance with the measurement procedures specified in IEEE P1528_D1.2. Normal antenna operating positions were incorporated, with the device transmitting at frequencies consistent with normal usage of the device. The device has been shown capable of compliance for localised specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE std. C95.1-1992

3.1 Maximum Results Found during SAR Evaluation

The equipment is deemed to fulfil the requirements if the measured values are less than or equal to the limit.

Mode	Device Configuration	Ch/f(MHz)	Conducted Power (dBm)	Measured (mW/g)	Result
CDMA-800	S032 (FCH)	777 (848.31)	24.07	1.17	**PASSED**
CDMA-1900	S032 (FCH)	600 (1880)	23.84	0.576	**PASSED**

3.2 Measurement Uncertainty

Combined Uncertainty (Assessment & Source)	± **10.46**
Extended Uncertainty (k=2)	± **21.22**

4 TEST CONDITIONS

4.1 Ambient Conditions

All tests were performed under the following environmental conditions:

Ambient Temperature:	22 ±1 Degrees C
Tissue simulating liquid temperature:	22 ±1 Degrees C
Humidity:	38 %
Pressure:	1015 mB

4.2 RF characteristics of the test site

All SAR measurements were performed inside a shielded room that provide isolation from external EM fields.

The E-field probes of the DASY 4 system are capable of detecting signals as low as 5μW/g in the liquid dielectric. External fields are minimising by the shielded room, leaving the phone as the dominant radiation source. Two 2-foot square ferrite panels are placed on the floor of the room beneath the phantom area of the DASY system to minimise reflected energy that would otherwise re-enter the phantom and combine constructively or destructively with the desired fields. These ferrite panels provide roughly 12 to 13 dB of attenuation in the frequency range of 900 MHz, and 7 to 8 dB of attenuation in the frequency range of 1.9 GHz.

4.3 Test Signal, Frequencies and Output Power

The device was controlled by using a communication test set. Communication between the EUT and the test set was established by radio link. In all operating bands, the measurements were performed on low, mid and high channels. The EUT was set to nominal maximum power level ("All Up" bits) during all tests and at the beginning of the each test.

DASY4 system measures power drift during SAR testing by comparing E-field in the same location at the beginning and at the end of measurement. These records were used to monitor stability of power output.

4.3.1 CDMA2000 Test conditions

The device supports CDMA2000 in 1X (Phase I, Protocol revision 6), 1XEVDO Rel 0 and 1XEVDO Rev A. CDMA2000 1X includes TIA/EIA-95B as a subset and was approved for publishing in July 1999. It provides voice and data capabilities within a standard 1.25 MHz CDMA channel. This RF bandwidth is identical to the legacy IS-95 B system standard.

4.3.1.1 Body SAR Measurements

SAR for body exposure configurations was measured in RC3 with the DUT configured to transmit at full rate on FCH with all other code channels disabled using TDSO / SO32. SAR for multiple code channels (FCH + SCH_n) was not required when the maximum average output of each RF channel was less than ¼ dB higher than that measured with FCH only. Otherwise, SAR was measured on the maximum output channel (FCH + SCH_n) with FCH at full rate and SCH_0 enabled at 9600 bps using the exposure configuration that results in the highest SAR for that channel with FCH only. When multiple code channels were enabled, the DUT output may shift by more than 0.5 dB and lead to higher SAR drifts and SCH dropouts.

Body SAR in RC1 was not required when the maximum average output of each channel was less than ¼ dB higher than that measured in RC3. Otherwise, SAR was measured on the maximum output channel in RC1; with Loopback Service Option SO55, at full rate, using the body exposure configuration that resulted in the highest SAR for that channel in RC3.

4.3.1.2 Devices with Ev-Do

For devices with Ev-Do capabilities, when the maximum average output of each channel in Rev. 0 was less than ¼ dB higher than that measured in RC3 (1x RTT), body SAR for Ev-Do was not required. Otherwise, SAR for Rev. 0 was measured on the maximum output channel at 153.6 kbps using the body exposure configuration that resulted in the highest SAR for that channel in RC3. SAR for Rev. A was not required when the maximum average output of each channel was less than that measured in Rev. 0 or less than ¼ dB higher than that measured in RC3. Otherwise, SAR was measured on the maximum output channel for Rev. A using a Reverse Data Channel payload size of 4096 bits and a Termination Target of 16 slots defined for Subtype 2 Physical Layer configurations. A Forward Traffic Channel data rate corresponding to the 2-slot version of 307.2 kbps with the ACK Channel transmitting in all slots should be configured in the downlink for both Rev. 0 and Rev. A

Table 4 below shows the max. average power level vs SOs/RCs

CONFIGURATION (Full Rate)		**CONDUCTED POWER (dBm)**					
		CDMA 800			**CDMA 1900**		
		Ch 1013	**Ch 383**	**Ch 777**	**Ch 25**	**Ch 600**	**Ch 1175**
TDSO SO32	RC3 (FCH)	24.02	23.99	24.07	23.42	23.84	24.2
	RC3 (FCH+SCH)	24.03	23.96	24.09	23.45	23.87	24.18
1xEvDo Rev.0	FTAP	23.98	23.94	24.00	23.39	23.76	24.15
	RTAP	24.22	24.09	24.28	23.41	23.38	23.97
1xEvDo Rev.A	FETAP	24.27	24.29	24.26	23.75	24.04	24.26
	RETAP	22.14	22.11	22.26	21.84	22.16	22.14

Table 4 Average Power in varies Configuration tested

4.3.1.3 Simultaneous Multi-Band Transmission

The EUT

X	Contains CDMA transmission only
	does not allow simultaneous WLAN/CDMA transmission.
	can operate simultaneously in WLAN mode with the CDMA speech and data modes and the multi-mode SAR assessment were performed.

4.4 Device Test Conditions

The EUT was powered and tested with a fully charged laptop computer. Conducted RF power measurements were performed before and after each SAR measurements to confirm the output power.

5 DESCRIPTION OF THE TEST EQUIPMENT

5.1 Dosimetric System

The measurements were performed with an automated near-field scanning system (as shown in Figure 5.1), DASY4, manufactured by Schmid & Partner Engineering AG (SPEAG) of Zurich, Switzerland. The system is comprised of high precision robot, robot controller, computer, near-field probe, probe alignment sensor and the SAM phantom containing brain or muscle equivalent material. The overall RSS uncertainty of the measurement system is ±10.46% with an expanded uncertainty of ±21.22% (K=2). The measurement uncertainty budget is given in section 10. Below is a list of the calibrated equipment used for the measurements:

Test Equipment	Manufacturer	Model	Serial Number	Cal. Due Date
Data Acquisition	Speag	DAE4	493	11-07-07
E-field Probe	Speag	ET3DV6	1664	06-22-07
Dipole Validation kit,	Speag	D835V2	454	03-15-08
Dipole Validation kit,	Speag	D1900V2	5d003	03-21-08
Communication Test Set	Agilent	8960	GB44052736	8-16-08

The calibration records of E-field probe and dipoles are attached in Appendix C and Appendix D respectively.

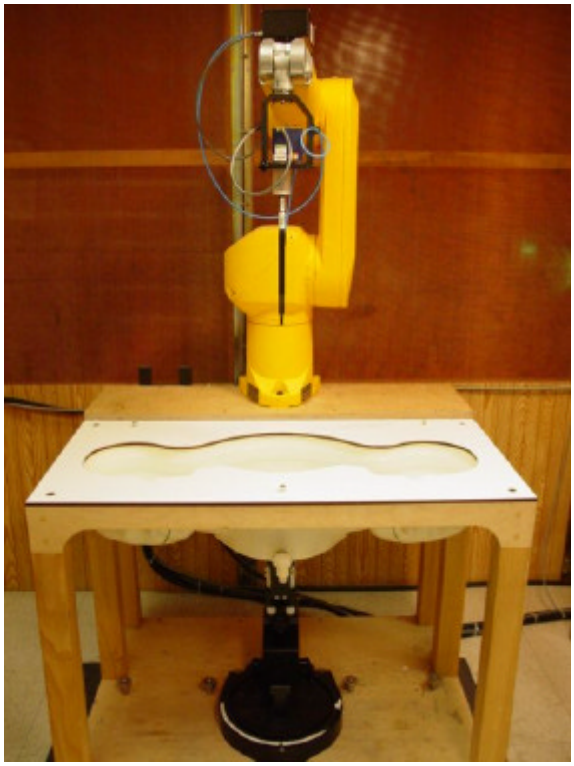


Figure 5.1 DASY 4 System

5.2 Additional equipment needed in validation

Test Equipment	Serial Number	Cal. Due Date
Signal Generator, Marconi Instruments 2026	US37231039	03-16-07
Power meter, Giga-tronics 8541C	1835328	03-03-07
Power Sensor, Giga-tronics 80601A	1830275	05-11-07
Serial Network Analyzer, HP 8753D	3410A04138	02-23-07
Thermometer	186700	05-22-07
Dielectric Probe, HP 85070E	--	No cal requied

5.3 Tissue Stimulants

All dielectric parameters of tissue stimulants were measured within 24 hours of SAR measurements. The depth of the tissue stimulant in the ear reference point and flat reference point of the phantom were at least 15 cm. during all the tests. The depth of the liquid is measured by running a program that brings the probe to the bottom surface of the phantom then raise it up 15 centimeters. The operator at this point performs a visual inspection and makes sure that the liquid level is at or above the probe tip.

The list of ingredients and the percent composition used for the Muscle tissue simulates are listed in the table below:

Ingredient (% by weight)	***MUSCLE***	
	835 MHz	**1900 MHz**
Water	65.45	69.91
Cellulose	--	--
Glycol monobutyl (DGBE)	--	29.96
Sugar	34.31	--
Preventol	0.1	--
Salt	0.62	0.13

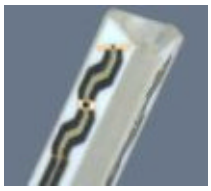
The ingredients above are adopted from Application Note: Recipes for Head/Muscle Tissue Simulating Liquid by SPEAG.

5.4 Phantoms Description

SAM v4.0 phantom, manufactured by SPEAG, was used during the measurement. It has fiberglass shell integrated in a wooden table. The shape of the shell corresponds to the phantom defined in IEEE 1528/D1.2. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. Reference markings on the phantom allow the complete set-up of all predefined phantom positions and measurement grids by manually teaching three points in the robot.

The thickness of phantom shell is 2mm except for the ear, where an integrated ear spacer provides 6mm spacing from the tissue boundary. Manufacturer reports tolerance in shell thickness to be ± 0.1mm**.**

5.5 Isotropic E-Field Probe

Model:	• ET3DV6 
Construction:	• Symmetrical design with triangular core • Built-in optical fiber for surface detection system • Built-in shielding against static charges • PEEK enclosure material (resistant to organic solvents, e.g., glycol)
Calibration:	• Calibration certificate in Appendix C
Frequency:	• 10MHz to 3GHz (dosimetry); Linearity: ± 0.2dB (30MHz to 3GHz)
Optical Surface:	• ± 0.2mm repeatability in air and clear liquid over diffuse reflecting
Detection:	• Surface
Directivity:	• ± 0.2dB in HSL (rotation around probe axis) • ± 0.4dB in HSL (rotation normal to probe axis)
Dynamic Range:	• 5 uW/g to > 100 mW/g; Linearity: ± 0.2dB
Dimensions:	• Overall length: 330mm • Tip length: 16mm • Body diameter: 12mm • Tip diameter: 6.8mm • Distance from probe tip to dipole centers: 2.7mm
Application:	• General dosimetry up to 3GHz • Compliance tests of mobile phones • Fast automatic scanning in arbitrary phantoms.

6 SYSTEM VALIDATION

The probes are calibrated annually by the manufacturer. Dielectric parameters of the stimulating liquids are measured with an automated Hewlett Packard 85070E dielectric probe in conjunction with an Agilent E5062A ENA serial network analyser.

The SAR measurements of the device were done within 24 hours of system accuracy verification, which was done using the dipole validation kit. Power level of 20dBm was supplied to a dipole antenna placed under the flat section of SAM phantom. The validation results are in the table below and printouts of the validation test are attached in Appendix A. All the measured parameters are within the specification.

The system validation with head tissues was used for the device testing in muscle. Based on OET 65 Supplement C EAB Part 22/24 SAR review Reminder Sheet 01/2002, this is a valid test.

Tissue	Freq. (MHz)	Description	Validation SAR (mW/g), 1g	Dielectric Parameters		Temp. (°C)	Test date	Comments
				e_r	S (S/m)			Validation testing -
Head	835	**Measured**	**0.942**	**41.44**	**0.910**	**22±0**	**01-25-07**	For device testing in Muscle
		SPEAG Reference	0.944	42.1	0.942	22.0	03-15-06	From Speag Certificate
		FCC Reference*		41.5	0.90	20-26		
	1900	**Measured**	**3.82**	**39.78**	**1.43**	**20-26**	**01-23-07**	For device testing in Muscle
		Measured	**3.79**	**39.32**	**1.45**	**20-26**	**01-24-07**	For device testing in Muscle
		SPEAG Reference	3.89	39.4	1.42	22.0	03-21-06	From Speag Certificate
		FCC Reference*		40.0	1.40	20-26		
Muscle	835	**Measured**		**54.10**	**0.931**	**23.0**	**01-25-07**	For device testing in Muscle
		FCC Reference*		55.2	0.97	20-26		
	1900	**Measured**		**53.50**	**1.47**	**23.0**	**01-23-07**	For device testing in Muscle
		Measured		**54.50**	**1.50**	**23.0**	**01-24-07**	For device testing in Muscle
		FCC Reference*		53.3	1.52	20-26		

**FCC reference values are adopted from OET Bulletin 65 (97-01) Supplement C (01-01).*

7 DESCRIPTION OF THE TEST PROCEDURE

Measurements were performed with 3 typical host laptop computers, using the same test sample and same SAR system.

For laptop computers having multiple card slots (e.g., two stacked), RF exposure was evaluated with the transmitter installed in the slot(s) producing the highest SAR.

The device was position against phantom according to OET Bulletin 65 (97-01) Supplement C (01-01). Definitions of terms used in aligning the device to a head phantom are available in IEEE Standard P1528/D1.2 “Recommended Practice for Determining the Spatial-Peak Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques”

7.1 Test Positions

The following position was evaluated for laptop computers:

- Bottom-face in parallel and in contact (0 cm) with flat phantom.

7.1.1 Test Configuration

The laptop was initially positioned such that laptop bottom is placed against the flat phantom. The device contains a flip antenna that can open from 0° to 90°. To determine the worst case configuration, tests were conducted with the antenna positioned at 0°, 45° and 90°. The distance between card base and flat phantom is determined by the card slot in the laptop.

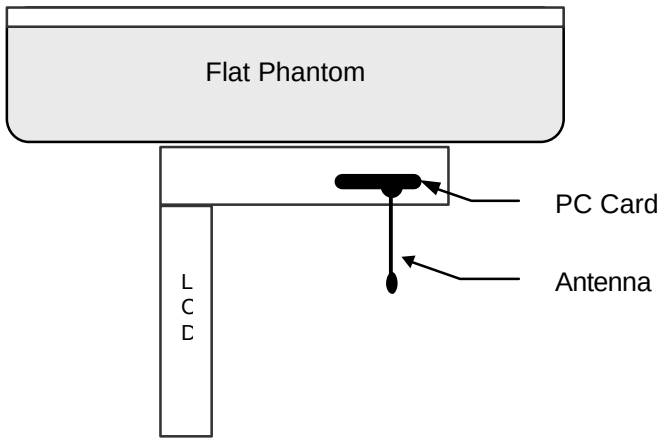


Figure 7-1 – Configuration (Antenna in Vertical 90^{o} Position)

7.2 Scan Procedures

First, coarse scans are used for a quick determination of the field distribution. Then an area scan measures all reachable points, it computes all of the field maxima found in the scanned area, within a range of 2dB as specified in IEEE P1528, (see the configuration below). For cases where multiple maxima were detected, the number of zoom scans could be increased accordingly.

Next a cube scan, 7x7x7 points (spacing between each point is 5x5x5mm), is performed around the highest E-field value to determine the averaged SAR-distribution over 1g. If two peaks are within 2dB of the highest one, two zoom scans are performed to provide the evaluations. A fine resolution volume scan determines the one-gram average SAR for both peaks.

7.3 SAR Averaging Methods

The maximum SAR value is average over its volume using interpolation and extrapolation.

The interpolation of the points is done with a 3d-Spline. The 3d-Spline is composed of three one-dimensional splines with the “Not a knot” –condition [W. Gander, Computermathematik, p. 141-150] (x, y and z – directions) [numerical Recipes in C, Second Edition, p 123].

The extrapolation is based on least square algorithm [W. Gander, Computermathematik, p. 168-180]. Through the points in the first 30mm in all z-axis, polynomials of order four are calculated. This polynomial is then used to evaluate the points between the surface and the probe tip. The points, calculated from the surface, have a distance of 1mm from one another.

8 MEASUREMENT UNCERTAINTY

Description of individual measurement uncertainty

Uncertainty Description	Uncert. Value (± %)	Prob. Dist.	Div	C_i^1 1g	Stand. Uncert (1g) (±%)	V_i^2 or V_{eff}
Measurement system						
Probe calibration	4.8	N	1	1	4.8	8
Axial isotropy	4.7	R	v3	0.7	1.9	8
Hemispherical Isotropy	9.6	R	v3	0.7	3.9	8
Boundary effects	1.0	R	v3	1	0.6	8
Linearity	4.7	R	v3	1	1.0	8
System Detection limit	1.0	R	v3	1	0.5	8
Readout Electronics	1.0	N	1	1	1.0	8
Response Time	0.8	R	v3	1	0.5	8
Integration Time	2.6	R	v3	1	1.5	8
RF ambient conditions	3.0	R	v3	1	1.7	8
Mech. Constrains of robot	0.4	R	v3	1	0.2	8
Probe positioning	2.9	R	v3	1	1.7	8
Extrapolation, integration and Integration Algorithms for Max. SAR Evaluation	1.0	R	v3	1	0.6	8
Test Sample Related						
Device positioning	3.0	N	1	1	3.0	8
Device Holder	3.0	N	1	1	3.0	8
Power drift	7.0	N	v3	1	4.0	8
Phantom and setup						
Phantom uncertainty	4.0	R	v3	1	2.3	8
Liquid conductivity (target)	5.0	R	v3	0.6	1.7	8
Liquid conductivity (meas.)	5.0	N	1	0.6	3.0	8
Liquid permittivity (target)	5.0	R	v3	0.6	1.7	8
Liquid permittivity (meas.)	5.0	N	1	0.6	1.5	8
Combined Standard Uncertainty:					**10.46**	
Extended Standard Uncertainty (k=2):					**21.22**	

N: Normal
R: Rectangular

9 TEST DATA

9.1 Body SAR Test Results

The following tables list the SAR results in each configuration and operating mode. The channels tested for each configuration have similar SAR distributions. Highest SAR (bold **blue** color) plots for each configuration is provided in Appendix B.

CDMA 800 BODY		Channel:		1013	383	777
		Frequency (MHz):		824.70	836.49	848.31
		Conducted Power (dBm):		24.02	23.99	24.07
Mode	**Host #**	**Antenna Position**	**Distance* from Flat Phantom**	**SAR, 1g (W/kg)**		
1xRTT (FCH) RC3, SO32	1	90°	19.77mm		**0.395**	
	2	0°	19.83mm		**0.433**	
	3	0°	14.83mm	0.988	1.12	**1.17**

CDMA 1900 BODY		Channel:		25	600	1175
		Frequency (MHz):		1851.25	1880	1908.75
		Conducted Power (dBm):		23.42	23.84	24.20
Mode	**Host #**	**Antenna Position**	**Distance* from Flat Phantom**	**SAR, 1g (W/kg)**		
1xRTT (FCH) RC3, SO32	1	0°	19.77mm		**0.576**	
	2	0°	19.83mm		**0.518**	
	3	0°	14.83mm		**0.548**	

Note:

1. *If the SAR measured at the mid-channel is at least 3dB lower than the SAR limit, testing at the low and high channels were no longer performed.*
2. *Justification for testing in 1xRTT FCH mode only:*
   a. *Maximum average output power in multiple code channels was less than ¼ dB higher than that measured with FCH only.*
   b. *Maximum average ouput power in EVDO (Rev 0 and A) mode was less than ¼ dB higher than that measured with 1xRTT in RC3.*
3. *Measured from EUT base to Phantom*

10 LIST OF APPENDIX

Appendix	Description	Note
A	Validation Test Plots	*Please see separate attachment*
B	SAR Distribution Plots	*Please see separate attachment*
C	Probe Calibration Parameters	*Please see separate attachment*
D	Dipole Calibration Parameters	*Please see separate attachment*
E	EUT Setup Photos	*Please see separate attachment*