ELECTRONIC TECHNOLOGY SYSTEMS
DR. GENZ GMBH

TEST - REPORT

SAR Compliance Test Report

Test report no.:

G0M20512-0062-S-1

SAR

ELECTRONIC TECHNOLOGY SYSTEMS
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1 General Information

1.1 Notes

The purpose of conformity testing is to increase the probability of adherence to the essential requirements or conformity specifications, as appropriate.
The complexity of the technical specifications, however, means that full and thorough testing is impractical for both technical and economic reasons.
Furthermore, there is no guarantee that a test sample which has passed all the relevant tests conforms to a specification.
The existence of the tests nevertheless provides the confidence that the test sample possesses the qualities as maintained and that is performance generally conforms to representative cases of communications equipment.

The test results of this test report relate exclusively to the item tested as specified in 1.5.
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Reproduction or publication of extracts from the report requires the prior written approval of the ELECTRONIC TECHNOLOGY SYSTEMS DR. GENZ GMBH.

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 qualification of all persons taking them.

Tester:

Date	ETS-Lab.	Name	Signature
09.02.2006		Mr. Cersovsky	i.s. Kurs

Technical responsibility for area of testing:

Date	ETS	Name	Signature
09.02.2006		N. Kaspar	Norbert Kaspar

1.2 Testing laboratory

1.2.1 Location

ELECTRONIC TECHNOLOGY SYSTEM DR. GENZ GMBH (ETS)
Storkower Straße 38c
D-15526 Reichenwalde b. Berlin
Germany
Telephone : +49 33631 888 00
Fax : +49 33631 888 660

1.2.2 Details of accreditation status

ACCREDITED TESTING LABORATORY
DAR-REGISTRATION NUMBER: DAT-P-201/96

FCC FILED TEST LABORATORY REG. NO. 96970

BLUETOOTH QUALIFICATION TEST FACILITY (BQTF)
ACCREDITED BY BLUETOOTH QUALIFICATION REVIEW BOARD

INDUSTRY CANADA FILED TEST LABORATORY REG. NO. IC 3470

A2LA ACCREDITED Certificate Number 1983-01

1.3 Details of approval holder

Name	: BIOTRONIK GmbH & Co. KG
Street	: Woermannkehre 1
Town	: 12359 Berlin
Country	: Germany
Telephone	: 030/689054440
Fax	: 030/689054980
Contact	: Herr Wolfgang Buske
E-Mail	: Wolfgang.Buske@Biotronik.de

1.4 **Manufacturer**: (if applicable)

Name	:
Street	:
Town	:
Country	:

1.5 Application details

Date of receipt of application : 14.12.2005
Date of receipt of test item : 14.12.2005
Date of test : 27.01.2005 - 30.01.2006

1.6 Test item

FCC ID : QRICM06-1

Description of test item : Cardiomessenger II/M / Cardiomessenger II/L -LLT

Type identification : Cardiomessenger II

Serial number : without; Identical prototype

Device category : PCB (Licensed Base Station)

Technical data

	GSM 850	**EGSM 900**
TX Frequency range	: 824,2 - 848,8 MHz	880,2 - 914,8 MHz
RX Frequency range	: 869,2 - 893,8 MHz	925,2 - 959,8 MHz
Max. Conducted RF output power	: 32,0 dBm / (1584,89 mW)	32,6 dBm / (1819,7 mW)
	DCS 1800	**PCS 1900**
TX Frequency range	: 1710,2 - 1784,8 MHz	1850,2 - 1909,8 MHz
RX Frequency range	: 1805,2 - 1879,8MHz	1930,2 - 1989,8 MHz
Max. Conducted RF output power	: 29,1 dBm / (812,83 mW)	28,4 dBm / (691,83 mW)

Power supply : 4.2 V DC

Antenna Tx : integral

Antenna RX : integral

Additional information : Tx and Rx. antenna are the same.

This test sample was tested according FCC OET Bulletin 65, Supplement C, Edition 01-01 on the used (European) Frequency band. This Procedure is requested by customer.
This device contains 900 MHz GSM and 1800 MHz DCS functions that are not operational in U. S. Territories. This filing is only applicable for 850 MHz GSM and 1900 MHz PCS operations.

1.7 Test Results

Max. SAR Measurement : 1.27 W/kg (averaged over 1 gram)

This EUT has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE Std. C95.1-1992 and had been tested in accordance with the measurement procedures specified in FCC/OET Bulletin 65 Supplement C (2001) and IEEE Std. 1528-2003, December 2003.

1.8 Test standards

Standards : - IEEE Std. 1528-2003, December 2003

FCC Rule Part(s) : - FCC OET Bulletin 65, Supplement C, Edition 01-01

2 Technical test

2.1 Summary of test results

Handset (Head)	
Handset (Body)	
Headset (Head)	
Body Worn Equipment	X

EUT complies with the RF radiation exposure limits of the FCC as shown by the SAR measurement results. These measurements are taken to simulate the RF effects exposure under worst-case conditions. The EUT complies with the requirements in respect to all parameters subject to the test. The test results and statements relate only to the item(s) tested.

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. [1]

In case of multiple hotspots the secondary hotspots within 2dB of the maximum SAR value will be recorded and displayed in the measurement plots. The secondary hotspots with a peak SAR value below 0.5 W/kg will not be measured by the system, due to the high margin to the limits.

2.2 Test environment

Room temperature : 22.1 - 22.7 °C

Liquid temperature : 22.2 - 22.4 °C

Relative humidity content : 20 ... 75 %

Air pressure : 86 ... 103 k P a

Details of power supply : 4.2 V DC

2.3 Test equipment utilized

No.	Measurement device:	Type:	Manufacturer:
ETS 0449	Stäubli Robot	RX90B L	Stäubli
ETS 0450	Stäubli Robot Controller	CS/MBs&p	Stäubli
ETS 0451	DASY 4 Measurement Server		Schmid & Partner
ETS 0452	Control Pendant		Stäubli
ETS 0453	Compaq Computer	Pentium IV, 2 GHz,	Schmid & Partner
ETS 0454	Dabu Acquisition Electronics	DAE3V1	Schmid & Partner
ETS 0455	Dummy Probe		Schmid & Partner
ETS 0456	Dosimetric E-Field Probe	ET3DV6	Schmid & Partner
ETS 0457	Dosimetric E-Field Probe	ET3DV6	Schmid & Partner
ETS 0458	Dosimetric H-Field Probe	H3DV6	Schmid & Partner
ETS 0459	System Validation Kit	D900V2	Schmid & Partner
ETS 0460	System Validation Kit	D1800V2	Schmid & Partner
ETS 0461	System Validation Kit	D1900V2	Schmid & Partner
ETS 0462	System Validation Kit	D2450V2	Schmid & Partner
ETS 0463	Probe Alignment Unit	LBV2	Schmid & Partner
ETS 0464	SAM Twin phantom	V 4.0	Schmid & Partner
ETS 0465	Mounting Device	V 3.1	Schmid & Partner
ETS 0224a	Millivoltmeter	URV 5	Rohde & Schwarz
ETS 0219	Power sensor	NRV-Z2	Rohde & Schwarz
ETS 0268	RF signal generator	SMP 02	Rohde & Schwarz
ETS 0322	Insertion unit	URV5-Z4	Rohde & Schwarz
ETS 0466	Directional Coupler	HP 87300B	HP
ETS0231	Radio Communication Tester	CMD65	Rohde & Schwarz
ETS 0467	Universal Radio Communication Tester	CMU 200	Rohde & Schwarz
ETS 0468	Network Analyzer 300 kHz to 3 GHz	8753C	Agilent
ETS 0469	Dielectric Probe Kit	85070C	Agilent

2.4 Definitions

2.4.1 SAR

The specific absorption rate (SAR) is defined as the time derivative of the incremental energy (*dW*) absorbed by (dissipated in) an incremental mass (*dm*) contained in a volume element *(dV)* of a given density (ρ_t), expressed in watts per kilogram (W/kg)

SAR = $$\frac{d}{dt}\left(\frac{dW}{dm}\right)=\frac{d}{dt}\left(\frac{dW}{\rho_t dV}\right)=\frac{\sigma}{\rho_t}\left|E_t\right|^2$$

where:

$$\frac{dW}{dt}=\int_v E\cdot J\,dV=\int_v \sigma E^2 dV$$

2.4.2 Uncontrolled Exposure

The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity. Warning labels placed on low-power consumer devices such as cellular telephones are not considered sufficient to allow the device to be considered under the occupational/controlled category, and the general population/uncontrolled exposure limits apply to these devices. [2]

2.4.3 Controlled Exposure

In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means. Awareness of the potential for RF exposure in a workplace or similar environment can be provided through specific training as part of a RF safety program. If appropriate, warning signs and labels can also be used to establish such awareness by providing prominent information on the risk of potential exposure and instructions on the risk of potential exposure and instructions on methods to minimize such exposure risks. [2]

2.5 Measurement System Description

2.5.1 System Setup

Measurements are performed using the DASY4 automated dosimetric assessment system (figure 1) made by Schmid & Partner Engineering AG (SPEAG)in Zurich, Switzerland.

Figure 1

The DASY4 system for performing compliance tests consists of the following items:

- A standard high precision 6-axis robot (Stäubli RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is powered by USB port. The signal is optically transmitted to the EOC.
- An unit to operate the optical surface detector which is connected to the EOC.
- The Electro-optical converter (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the measurement server.
- The functions of the measurement server is to perform the time critical task such as signal filtering, surveillance of the robot operation, fast movement interrupts.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows 2000 or Windows NT.
- DASY4 software.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes (see Application Notes).
- System validation dipoles allowing to validate the proper functioning of the system.

2.5.2 Phantom Description

Figure 2

The SAM twin phantom V4.0 (figure 2) is a fiberglass shell phantom with 2 mm shell thickness. It has three measurement areas:

- Left hand
- Right hand
- Flat phantom

The phantom is integrated in a wooden table.

The bottom plate of the table contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. Only one device holder is necessary if two phantoms are used (e.g., for different liquids).

A cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. Free space scans of devices on the cover are possible.

On the phantom top, three reference markers are provided to identify the phantom positions with respect to the robot.

2.5.3 Tissue Simulating Liquids

The parameters of the tissue simulating liquid strongly influence the SAR. The parameters for the different frequencies are defined in the corresponding compliance standards (e.g. EN 50361, IEEE P1528-2003, December 2003).

Tissue dielectric properties

	Head		Body	
Frequency (MHz)	**Relative Dielectric Constant (ε_r)**	**Conductivity (σ) (S/m)**	**Relative Dielectric Constant (ε_r)**	**Conductivity (σ) (S/m)**
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
1450	40.5	1.20	54.0	1.30
1800	40.0	1.40	53.3	1.52
1900	40.0	1.40	53.3	1.52
2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73