REPORT ON

EMC Testing of a GA6059 Wrist Watch Personal Locator Beacon

Report No OR900741 February 2001

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PREPARED FOR

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STATUS

OBJECTIVE	To undertake measurements to determine the Equipment Under Test's (EUT's) compliance with the specifications.
MANUFACTURING DESCRIPTION	Wrist Watch Personal Locator Beacon
MANUFACTURER	SML Technologies
MANUFACTURERS MODEL NUMBER	GA6059
SERIAL NUMBER	B17/B18
TEST SPECIFICATION NUMBER	EN 60945: 1997
REGISTRATION NUMBER	Y900741
QUANTITY OF ITEMS TESTED	One
SECURITY CLASSIFICATION OF EUT	Unclassified
INCOMING RELEASE SERIAL NUMBER DATE	CEPT Application Form Y900741 13th December 2000
ORDER NUMBER DATE	11248 26th July 2000
START OF TEST FINISH OF TEST	20th January 2001 23rd January 2001
TEST ENGINEERS	A Guy S Carter
RELATED DOCUMENTS	EN 61000-4-2; March 1995 EN 61000-4-3; September 1996

SYSTEM CONFIGURATION DURING EMC TESTING

The Equipments Under Test (EUT), the GA6059 was a Wrist Watch Personal Locator Beacon, primarily designed to operate as a Maritime Emergency Radio Beacon for initial warning and location of personnel in the water.

The EUT was configured as a portable unit powered from a self contained battery.

A customer supplied Microprocessor controlled Surveillance Receiver (Crewguard), was set up remotely to monitor for the activation of the EUT. In transmit mode the EUT operated on 121.5MHz, power level.

Emissions Testing

The EUT together with all associated cabling, was set-up simulating a typical user installation, then tested in accordance with the specification.

The EUT was functioning correctly during all testing, and was operating in the Idle mode.

Immunity Testing

The EUT was functioning correctly prior to each test, and was tested with it operating in both the Transmit and Idle modes. The correct operation of the EUT was monitored throughout each test by viewing the PLB/ELT Code LED, Speaker and Level Indicator on the receiver as follows:

Idle Mode. For any unintentional (Alarm) operation of the PLB/ELT LED, audio output from the speaker or any level indications.

Transmit Mode. For any interruption in the flashing of the PLB/ELT LED, audio output from the speaker or loss of level indication.

EUT MODIFICATION CHRONOLOGY

Table 1 below details modifications necessary in order for the EUT to pass the relevant tests applied.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
0	As Supplied by Manufacturer	Not Applicable	Not Applicable

Table 1

BRIEF SUMMARY OF RESULTS

Table 2 below shows a brief summary of the results obtained.

Specification and Section Number	Test	EUT Modification State	Result
EN 60945 : 1997 (Table 5; Clause 9.2)	Conducted Emissions 10kHz - 30MHz (DC Power Port)	0	N/A
EN 60945 : 1997 (Table 5; Clause 9.3)	Radiated Emissions Electric Field 30MHz - 1000MHz (Enclosure Port)	0	Pass
EN 60945 : 1997 (Table 5; Clause 9.3)	Radiated Emissions Magnetic Field (Enclosure Port)	0	Pass
EN 60945 : 1997 (Table 6; Clause 10.2)	Immunity to Conducted Low frequency Interference 50Hz – 10kHz (AC Power Port)	0	N/A
EN 60945 : 1997 (Table 6: Clause 10.2)	Immunity to Conducted Low Frequency Interference 50Hz – 10kHz (DC Power Port)	0	N/A
EN 60945 : 1997 (Table 6; Clause 10.3)	Immunity to Conducted Radio frequency Interference 10kHz – 80MHz (AC Power Port)	0	N/A
EN 60945 : 1997 (Table 6; Clause 10.3)	Immunity to Conducted Radio Frequency Interference 10kHz – 80MHz (DC Power Port)	0	N/A
EN 60945 : 1997 (Table 6; Clause 10.3)	Immunity to Conducted Radio Frequency Interference 10kHz –80MHz (Signal & Control)	0	N/A
EN 60945 : 1997 (Table 6; Clause 10.4)	Radiated Interference 80MHz - 1000MHz (Enclosure Port)	0	Pass
EN 60945 : 1997 (Table 6; Clause 10.5)	Immunity to Fast Transients (AC Power Ports)	0	N/A
EN 60945 : 1997 (Table 6; Clause 10.5)	Immunity to Fast Transients (DC Power Ports)	0	N/A
EN 60945 : 1997 (Table 6; Clause 10.5)	Immunity to Fast Transients (Signal & Control Ports)	0	N/A
EN 60945 : 1997 (Table 6; Clause 10.6)	Immunity to Surges AC Power Port	0	N/A
EN 60945 : 1997 (Table 6; Clause 10.7)	Immunity to Power Supply Short Term Variations (AC Power Port)	0	N/A
EN 60945 : 1997 (Table 6; Clause 10.8)	Immunity to Power Supply Failure (AC Power Port)	0	N/A
EN 60945 : 1997 (Table 6; Clause 10.9)	Immunity to Electrostatic Discharge (Enclosure Port)	0	Pass

Table 2

EMISSION TESTING

Instrumentation used for Emission Testing:

Instrument	Manufacturer	Type No	EMC No
Spectrum Analyser	Hewlett Packard	8568B	184
Quasi-Peak Adaptor	Hewlett Packard	85650A	1302
RF Preselector	Hewlett Packard	85685A	1370
Biconical Antenna	Ailtech	94455-1	618
Log Periodic Antenna	Amplifier Research	AT1000	956
Auto Turntable & Controller	Emco	1060	1322
Auto Antenna Mast & Controller	Emco	1050	1321
Computer	Hewlett Packard	310	—
Printer	Hewlett Packard	Think Jet	—
Loop Antenna	Rohde & Schwarz	HFH-Z2	1311
Test Receiver	Rohde & Schwarz	ESH3	1020
Spectrum Monitor	Rohde & Schwarz	EZM	1416

IMMUNITY TESTING

Instrumentation used for Immunity Testing:

Instrument	Manufacturer	Type No	EMC No
Power Amplifier	Amplifier Research	30W1000M7	2238
Power Amplifier	Amplifier Research	150L	1922
Signal Generator	Marconi	2031	2199
Isotropic Field Probe	Amplifier Research	FP 2000	2433
Isotropic Field Monitor	Amplifier Research	FM 2000	2381
Bilog	Chase	CBL6111A	1963
ESD Generator	Keytek	Minizap	2192
Directional Coupler	Amplifier Research	DC 6180	2363
Millivoltmeter	Rohde & Schwarz	URV 5	2215
Insertion Unit	Rohde & Schwarz	URV 5 Z2	2531
Load	JFW	50T-054	2172
Load	JFW	50T-054	2175

RADIATED EMISSIONS TEST PROCEDURE

ENCLOSURE PORT

A preliminary profile of the Radiated Electric Field Emissions was obtained by placing the Equipment Under Test (EUT) in a Characterisation Chamber; measurements were taken at a 3m distance. Measurements of emissions from the EUT were obtained with the Measurement Antenna in Horizontal and Vertical Polarisations. The characterisation produced a list of the highest emissions, their bearing and associated antenna polarisation.

The EUT was then transferred to the Open Field Site and placed on a remotely controlled turntable. Using the information from the preliminary profiling of the EUT, a search was made of the frequency spectrum from 30MHz to 1000MHz. The list of the highest emissions was then confirmed or updated under Open Site conditions. These emissions were then formally measured using a Quasi-Peak Detector which met the CISPR requirements. The readings were maximised by adjusting the antenna height, polarisation and turntable azimuth, in accordance with the specification. The details of these highest emissions were then recorded in the Job Log Book. Details of the highest emissions are presented at Page 9.

The Radiated Electric Field Emissions measurements were made using a Hewlett Packard Spectrum Analyser, Preselector and Quasi-Peak Adaptor.

The test was performed in accordance with EN 55022/A2.

RADIATED EMISSIONS TEST RESULTS

ENCLOSURE PORT

The EUT met the requirements of EN 60945 (Table 5; Clause 9.3 [Enclosure Port]) Radiated Emissions test.

The emissions were measured at 3m.

Open Field Results: No emissions attributable to the EUT were detected above the noise floor of the measurement system, therefore no results have been presented.

Procedure	Test Performed in accordance with EN 60945.
Performed by	A Guy, EMC Engineer.

RADIATED EMISSIONS (MAGNETIC FIELD) TEST PROCEDURE

ENCLOSURE PORT

A preliminary profile of the Radiated Magnetic Field Emissions was obtained by placing the Equipment Under Test (EUT) in a Screened Chamber; measurements were taken at a 3m distance. Measurements of emissions from the EUT were obtained with the Measurement Antenna Face On and Side On to the EUT. The characterisation produced a list of the highest emissions, their bearing and associated antenna polarisation.

The EUT was then transferred to the Open Field Site and placed on a remotely controlled turntable. Using the information from the preliminary profiling of the EUT, a search was made of the frequency spectrum from 150kHz to 30MHz. The list of the highest emissions was then confirmed or updated under Open Site conditions. These emissions were then formally measured using a Quasi-Peak Detector which met the CISPR requirements. The readings were maximised by adjusting the, polarisation and turntable azimuth, in accordance with the specification. The details of these highest emissions were then recorded in the Job Log Book. Details of the highest emissions are presented at page 11.

The Radiated Magnetic Field Emissions measurements were made using a Rhode & Schwarz ESH-3 Test Receiver and EZM Spectrum Monitor.

The test was performed in accordance with EN 60945.

RADIATED EMISSIONS (MAGNETIC FIELD) TEST RESULTS

ENCLOSURE PORT

The EUT met the requirements of EN 60945 (Table 5; clause 9.3 [Enclosure Port]) Radiated Emissions, Magnetic Field.

The emissions were measured at 3m.

Open Field Results: No emissions related to the EUT were detected, therefore no results are presented.

Procedure Test Performed in accordance with EN 60945.

Performed by S Carter, EMC Engineer.

IMMUNITY TO RADIATED INTERFERENCES TEST PROCEDURE

ENCLOSURE PORT

All testing was conducted within a Shielded Enclosure.

The EUT was subjected to a field strength of 10V/m over the frequency range 80MHz to 1000MHz in both Horizontal and Vertical Polarisations. The carrier frequency was AM modulated with a 400Hz signal at a modulation depth of 80%.

The EUT was tested with it operating in both the Transmit and Idle modes.

The EUT was functioning correctly prior to each test, and was tested with it operating in both the Transmit and Idle modes. The correct operation of the EUT was monitored throughout each test by viewing the PLB/ELT Code LED, Speaker and Level Indicator on the receiver.

IMMUNITY TO RADIATED INTERFERENCES FIELD TEST RESULTS

Ambient Temperature 20.5°C Relative Humidity 34% Atmospheric Pressure 1003Pa.

The EUT met the requirements of EN 60945 (Table 6; 10.4 [Enclosure Port]) for Immunity to Radiated Interference.

The EUT's performance, defined in accordance with the specification, was not impaired during testing.

Procedure Test performed in accordance with EN 61000-4-3.

Performed by S Carter, E M C Engineer.

IMMUNITY TO ELECTROSTATIC DISCHARGE TEST PROCEDURE

ENCLOSURE PORT

The EUT was set-up on insulators 0.5 millimetres above the Horizontal Coupling Plane and tested in accordance with EN 61000-4-2.

Air Discharge

A potential of 8kV was applied to each applicable test point. Where discharges occurred the potential was then applied a total of 20 times to each test point, 10 positive discharges and 10 negative discharges.

Contact Discharge

All user accessible conductive surfaces (Test points) were subjected to contact discharges of 6kV, 10 positive and 10 negative.

Each vertical side of the EUT was subjected to Vertical Coupling Plane discharges of 6kV, 10 positive and 10 negative.

The base of the EUT was subjected to Horizontal Coupling Plane discharges of 6kV, 10 positive and 10 negative.

The EUT was tested with it operating in both the Transmit and Idle modes.

The EUT was functioning correctly prior to each test, and was tested with it operating in both the Transmit and Idle modes. The correct operation of the EUT was monitored throughout each test by viewing the PLB/ELT Code LED, Speaker and Level Indicator on the receiver.

IMMUNITY TO ELECTROSTATIC DISCHARGE TEST RESULTS

Ambient Temperature 22.6°C Relative Humidity 31% Atmospheric Pressure 1023hPa.

The EUT met the requirements of EN 60945 (Table 6; 10.9 [Enclosure Port]) for Immunity to Electrostatic Discharge.

The EUT's operation, defined in accordance with the specification, was impaired during testing.

Details of the points tested are presented in Table 3, with the EUT tested operating in both the Transmit and Idle modes.

Tes Test Observation.

When operating in Transmit mode, application of -6kV Air discharges to the Water Sensor Pin, adjacent to the Arm button, caused the Alarm to stop sounding and the speaker to emit static for about one minute after which the EUT returned to idle. Recovery was possible, after the test, by pushing the Arm and Confirm buttons.

The above phenomenon was discussed with SML Technologies and it was accepted that it would be unlikely that the EUT would be subjected to an ESD discharge whilst immersed in water.

SML Technologies declared that in their opinion this phenomena was highly unlikely to arise (ESD discharge whilst in water), therefore declared the performance as acceptable.

IMMUNITY TO ELECTROSTATIC DISCHARGE TEST RESULTS - Continued

ENCLOSURE PORT - TRANSMIT AND IDLE MODES

Test Points	Level					
	Contact				Air	
	4kV		6kV		2kV, 4kV & 8kV	
	Positive	Negative	Positive	Negative	Positive	Negative
Horizontal Coupling Plane	✓	✓	✓	✓	N/A	N/A
Vertical Coupling Plane	✓	✓	✓	✓	N/A	N/A
Watch Face	N/A	N/A	N/A	N/A	✓*	✓*
Light Button	N/A	N/A	N/A	N/A	N/A	N/A
Start Button	N/A	N/A	N/A	N/A	N/A	N/A
Reset button	N/A	N/A	N/A	N/A	N/A	N/A
Mode Button	N/A	N/A	N/A	N/A	N/A	N/A
Confirm Button	✓*	✓	✓*	✓	N/A	N/A
Alarm Button	✓	✓	✓	✓	N/A	N/A
Light Emitting Diode	N/A	N/A	N/A	N/A	N/A	N/A
Screws	✓*	✓*	✓	✓	N/A	N/A
Watch Rear, Seam	N/A	N/A	N/A	N/A	N/A	N/A
Water Sensor Pins	✓*	✓	✓	✓[1]	N/A	N/A
Case	✓*	✓	✓	✓	N/A	N/A

Table 3

✓ The EUT's performance was not impaired at this test point when the ESD pulse was applied

✓* No discharge occurred at this test point when the ESD pulse was applied

N/A Test not applicable as defined in the specification.

✓[1] In the Transmit mode and on applying -6kV Air discharges to the Water Sensor Pin, adjacent to the Arm Button, causes the Alarm to stop sounding and the speaker to emit static for about one minute after which the EUT goes into Idle mode. Recovery was possible, after the test, by pushing the Arm and Confirm buttons.

Procedure Test performed in accordance with EN 60945.

Performed by S Carter, EMC Engineer.

SYSTEM MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems, in accordance with the recommendations of NIS 81 Edition 1, May 1994 are :-

For Radiated Disturbance (Emissions), Quasi-Peak Measurements taken in Zero Span using the Hewlett Packard Spectrum Analyser, Preselector and Quasi-Peak Adaptor:-

Frequency	$\pm 2 \times 10^{-7}$ x Centre Frequency
Amplitude	+4.45dB (30-200MHz; 3m Measurements) –4.42dB (30-200MHz; 3m Measurements) +4.80dB (200-1000MHz; 3m Measurements) –3.81dB (200-1000MHz; 3m Measurements)

For Radiated E-Field Susceptibility Tests: -

Frequency	80MHz to 1000MHz ±2 parts in 10^7		
Modulation Depth	AM @1kHz ±(4% of setting + 1%)		
Amplitude	10V/m	80MHz to 250MHz	+1.24V/m –1.07V/m
		250MHz to 1GHz	+1.97V/m –1.61V/m

For Electrostatic Discharge: -

Discharge Current	±10% @1st peak ±30% @30ns ±30% @60ns
ESD Voltage	±5% of reading

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