SK TECH CO., LTD.

Certificate of Compliance

Test Report No.:	**SKTTRT-050723-015**		
NVLAP CODE:	**200220-0**		
Applicant:	**DAEWOO PRECISION INDUSTRIES LTD.**		
Applicant Address:	609-600 P.O.BOX 25, KumJeong, Busan, Korea		
Manufacturer:	**DAEWOO PRECISION INDUSTRIES LTD.**		
Manufacturer Address:	609-600 P.O.BOX 25, KumJeong, Busan, Korea		
Device Under Test:	**Immobilizer, Model IM850**		
FCC ID: **IC:**	**IT7-IM850** **1176A-IM850**	**Trade Name:**	**GMDAT, DPI**
Receipt No.:	SKTEU05-0469	**Date of receipt:**	July 9, 2005
Date of Issue:	July 23, 2005		
Location of Testing:	**SK TECH CO., LTD.** 820-2, Wolmoon-Ri, Wabu-Up, Namyangju-Si, Kyunggi-Do, Korea		
Test Specification:	**FCC Part 15 Rules, RSS-210 Issue 5**		
FCC Equipment Class: **IC Equipment Category:**	**DCD - Part 15 Low Power Transmitter Below 1705kHz** **Category I Equipment**		
Test Result:	The above-mentioned device has been tested and passed.		

Tested & Reported by: *Jong-Soo, Yoon*

2005. 07. 23

Signature *Date*

Approved by: *Jae-Kyung, Bae*

2005. 07. 23

Signature *Date*

Other Aspects:	
Abbreviations:	**· OK, Pass = passed · Fail = failed · N/A = not applicable**

- **This test report is not permitted to copy partly without our permission.**
- **This test result is dependent on only equipment to be used.**
- **This test result is based on a single evaluation of one sample of the above mentioned.**
- **This test report must not be used to claim product endorsement by NVLAP or any agency of the U.S Government.**
- **We certify that this test report has been based on the measurement standards that is traceable to the national or International standards.**

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1. GENERAL

These tests were performed using the test procedure outlined in ANSI C63.4, 2003 for intentional radiators, and in accordance with the limits set forth in FCC Part 15.209. The EUT (Equipment Under Test) has been shown to be capable of compliance with the applicable technical standards.

We attest to the accuracy of data. All measurements reported herein were performed by SK Tech Co., Ltd. and were made under Chief Engineer's supervision.
We assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

2. TEST SITE

SK TECH Co., Ltd.

2.1 Location

820-2, Wolmoon Ri, Wabu-Up, Namyangju-Si, Kyunggi-Do, Korea

This test site is in compliance with ISO/IEC 17025 for general requirements for the competence of testing and calibration laboratories.
This laboratory is accredited by NVLAP for NVLAP Lab. Code: 200220-0 and DATech for DAR-Registration No.: TTI-P-G155/97-10

2.2 List of Test and Measurement Instruments

Description	Manufacturer	Model #	Serial #	
Spectrum Analyzer	Agilent	E4405B	US40520856	☒
EMC Spectrum Analyzer	Agilent	E7405A	US40240203	☒
EMI Test Receiver	Rohde&Schwarz	ESVS10	825120/013	☒
EMI Test Receiver	Rohde&Schwarz	ESVS10	834468/008	☒
EMI Test Receiver	Rohde&Schwarz	ESHS10	825120/013	☒
EMI Test Receiver	Rohde&Schwarz	ESHS10	834468/008	☒
Artificial Mains Network	Rohde&Schwarz	ESH3-Z5	836679/018	
Pre-amplifier	HP	8447F	3113A05153	☒
Pre-amplifier	HP	8349B	2644A03250	
Power Meter	Agilent	E4418B	3318A13916	
Power Sensor	HP	8485A	3318A13916	
VHF Precision Dipole Antenna (TX & RX)	Schwarzbeck	VHAP	1014 & 1015	
UHF Precision Dipole Antenna (TX & RX)	Schwarzbeck	UHAP	989 & 990	
Loop Antenna	Schwarzbeck	HFH2-Z2	863048/019	☒
TRILOG Broadband Antenna	Schwarzbeck	VULB9160	3141	☒
Biconical Antenna	Schwarzbeck	VHA9103	2265	☒
Log-Periodic Antenna	Schwarzbeck	UHALP9107	1819	☒
Horn Antenna	AH Systems	SAS-200/571	304	
Horn Antenna	ETS-LINDGREN	3115	00040723	
Horn Antenna	ETS-LINDGREN	3115	00056768	
Vector Signal Generator	Agilent	E4438C	MY42080359	
Signal Generator	HP	8349B	2644A03250	
DC Power Supply	HP	6634A	2926A-01078	☒
DC Power Supply	HP	6268B	2542A-07856	
Digital Multimeter	HP	HP3458A	2328A14389	☒
PCS Interface	HP	83236B	3711J00881	
CDMA Mobile Test Set	HP	8924C	US35360253	
Hygro/Thermo Graph	SATO	PC-5000TRH-II	-	☒
Temperature/Humidity Chamber	All Three	ATH-50M	20030425	

2.3 Test Date

Date of Application : July 9, 2005

Date of Test : July 22, 2005 ~ July 23, 2005

2.4 Test Environment

See each test item's description.

3. DESCRIPTION OF THE EQUIPMENT UNDER TEST

The EUT is an immobilizer intended to provide additional theft deterrence to the vehicle in which it is installed and to prevent it from being driven by unauthorized users. The verification of the user authorization is done by using an ignition key with integrated transponder. The EUT transmits radio signals within one second only when a key is inserted in key barrel.

3.1 Rating and Physical Characteristics

	EUT: Immobilizer
Model Name	IM850
Power source	DC 12V lead-acid battery in vehicles
Consumption current	200mA under
Local Oscillator	8 MHz
Operating frequency	125 kHz
Type of Modulation	AM
Output power	50mW under
Antenna	Loop coil antenna (toroidal coil - diameter: 30mm, turns: 80)

3.2 Equipment Modifications

The EUT was programmed to transmit RF signals repeatedly by using modified firmware, during the field strength measurements of the fundamental and spurious/harmonic emissions. This unit was then returned to normal operation for testing of spurious emissions in standby mode.

3.3 Submitted Documents

Block diagram

Schematic diagram

Part List

Instruction manual

4. MEASUREMENT CONDITIONS

4.1 Description of test configuration

The EUT was tested in a typical fashion with its associated peripherals.

4.2 List of Peripherals

Equipment Type	Manufacture	Model	S/N
Key cylinder	DAEWOO PRECISION INDUSTRIES LTD.	-	-
Ignition Key	DAEWOO PRECISION INDUSTRIES LTD.	-	-

4.3 Type of Used Cables

Description	Length	Type of shield	Manufacturer
DC power line	2.0 m	Unshielded	DAEWOO PRECISION INDUSTRIES LTD.

4.4 Uncertainty

Measurement Item	Combined Standard Uncertainty Uc	Expanded Uncertainty U = KUc (K = 2)
Conducted RF power	± 1.49 dB	±2.98dB
Radiated disturbance	± 2.37 dB	±4.74dB
Conducted disturbance	± 1.47 dB	±2.94dB

5. TEST AND MEASUREMENTS

Summary of Test Results

Requirement	FCC, 47CFR15	RSS-210, Issue 5	Report Section	Test Result
Antenna Requirement	15.203	5.5, 5.11	5.1	PASS
Radiated Emission – Field Strength	15.209(a)	6.2.1 Table 3 & 7	5.2	PASS
Occupied bandwidth	N/A	5.9.1	5.3	PASS
Conducted Emissions	15.207(a)	6.6	N/A **	N/A**

*** Not required, the EUT is only battery powered.**

5.1 ANTENNA REQUIREMENT

5.1.1 Regulation

FCC 47CFR15 – 15.203
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

RSS-210, Issue 5 – 5.5, 5.11
The transmitter antenna shall be integral with the device, or the antenna coupling be so designed that no antenna other than that furnished by the party responsible for compliance shall be used. Example: Special antenna connectors not readily available in retail shops in Canada may be acceptable. The antenna design may be such as to allow a broken antenna to be replaced by the user, but the use of a standard jack or electrical connector is prohibited. The special antenna connector requirement does not apply to 6.2.2 (a), 6.2.2 (b), and 8.1 to 8.5. Further, this requirement does not apply to transmitters that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to transmitters which require unwanted emission measurements after installation (section 5.15). In the installation/ user manual, the user shall be notified that a proper type of antenna must be employed and of the RF field limits to be met. When the standard limits the antenna gain to N dB, this limit applies only to the transmitting antenna system net gain, i.e. antenna gain minus its cabling loss. When a measurement at the antenna connector (section 10) is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on measurement or on data from the antenna manufacturer. Any antenna gain in excess of 6 dBi (6 dB above isotropic gain) shall be added to the measured RF output power before using the power limits specified in this Standard for devices of RF output powers 10 milliwatts or less. In the case of devices of output powers more than 10 milliwatts, the total antenna gain shall be added, except for the case of 6.2.2 (o) on spread spectrum systems. User Manual (for transmitter with detachable antenna): The user manual of transmitter devices equipped with a detachable antenna shall contain the following information in a conspicuous location: *"This device has been designed to operate with an antenna having a maximum gain of [x] dB. Antenna having a higher gain is strictly prohibited per regulations of Industry Canada. The required antenna impedance is [y] ohms."* Equipment manufacturer shall provide proper values of x and y to comply with the standard. If the antenna is detachable (selectable by the user), see the user manual requirement in section 5.5. The following instructions in the user manual is also required: *"To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (EIRP) is not more than that required for successful communication".*

5.1.2 Result: PASS

The transmitter has an integral loop coil antenna that is directly soldered on the PCB, and meets the requirements of this section.

5.2 RADIATED EMISSIONS – FILED STRENGTH

5.2.1 Regulation

FCC 47CFR15 – 15.209

(a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Measurement Distance (m)
0.009 – 0.490	2400/F (kHz) = 266.7 – 4.9	48.5 – 13.8	300
0.490 – 1.705	24000/F (kHz) = 49.0 – 14.1	33.8 – 23.0	30
1.705 – 30.0	30	29.5	30
30 – 88	100 **	40.0	3
88 – 216	150 **	43.5	3
216 – 960	200 **	46.0	3
Above 960	500	54.0	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

(b) In the emission table above, the tighter limit applies at the band edges.

(c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other Sections within this Part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.

(d) The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

(e) The provisions in Sections 15.31, 15.33, and 15.35 for measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this Part.

(f) In accordance with Section 15.33(a), in some cases the emissions from an intentional radiator must be measured to beyond the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator because of the incorporation of a digital device. If measurements above the tenth harmonic are so required, the radiated emissions above the tenth harmonic shall comply with the general radiated emission limits applicable to the incorporated digital device, as shown in Section 15.109 and as based on the frequency of the emission being measured, or, except for emissions contained in the restricted frequency bands shown in Section 15.205, the limit on spurious emissions specified for the intentional radiator, whichever is the higher limit. Emissions which must be measured above the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator and which fall within the restricted bands shall comply with the general radiated emission limits in Section 15.109 that are applicable to the incorporated digital device.

(g) Perimeter protection systems may operate in the 54-72 MHz and 76-88 MHz bands under the provisions of this section. The use of such perimeter protection systems is limited to industrial, business and commercial applications.

RSS-210, Issue 5 – 6.2.1

The same as FCC requirements

5.2.2 Measurement Procedure

Radiated Emissions Test, 9 kHz to 30 MHz (Magnetic Field Test)

1. The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions at a distance of 3 meters according to Section 15.31(f)(2).
2. The EUT was placed on the top of the 0.8-meter height, 1 × 1.5 meter non-metallic table.
3. Emissions from the EUT are maximized by adjusting the orientation of the Loop antenna and rotating the EUT on the turntable. Manipulating the system cables also maximizes EUT emissions if applicable.
4. To obtain the final measurement data, each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.

Radiated Emissions Test, 30 MHz to 18000 MHz

1. The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions in an anechoic chamber at a distance of 3 meters.
2. The EUT was placed on the top of the 0.8-meter height, 1 × 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360˚.
3. The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 30 to 1000 MHz using the TRILOG broadband antenna, and from 1000 MHz to 18000 MHz using the horn antenna.
4. To obtain the final measurement data, the EUT was arranged on a turntable situated on a 4 × 4 meter at the Open Area Test Site. The EUT was tested at a distance 3 meters.
5. Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.
6. The presence of ambient signals was verified by turning the EUT off. In case an ambient signal was detected, the measurement bandwidth was reduced temporarily and verification was made that an additional adjacent peak did not exist. This ensures that the ambient signal does not hide any emissions from the EUT.

5.2.3 Calculation of the field strength limits below 30 MHz

1. No special calculation for obtaining the field strength in dBμV/m is necessary, because the EMI receiver and the active loop antenna operate as a system, where the reading gives directly the field strength result (dBμV/m). The gain, antenna factors and cable losses are already taken into consideration.
2. For test distance other than what is specified, but fulfilling the requirements of section 15.31 (f) (2) the field strength is calculated by adding additionally an extrapolation factor of 40dB/decade (inverse linear distance for field strength measurements).
3. All following emission measurements were performed using the test receiver's average, peak, and quasi-peak detector function with specified bandwidth.
4. The basic equation is as follows;

FS= RA + DF

Where

FS = Field strength in dBμV/m

RA = Receiver Amplitude in dBμV/m

DF = Distance Extrapolation Factor in dB

Where DF = $20\log(D_{TEST} / D_{SPEC})$ where D_{TEST} = Test Distance and D_{SPEC} = Specified Distance

DF = 40log(3m/300m) = -80dB, for frequency band: 0.009 to 0.490MHz

DF = 40log(3m/30m) = -40dB, for frequency band: 0.490 to 30MHz

5.2.4 Test Results: PASS

Table 1: Measured values of the Field strength below 30 MHz

Frequency [kHz]	Receiver Bandwidth [kHz]	Reading (at 3m) [dB(μV/m)]	Limit (at 3m) [dB(μV/m)]	Margin [dB]
Emissions PEAK DATA below 490 kHz				
125.16	0.2	75.2	125.6	50.4
375.42	0.2	43.7	116.1	72.4
Emissions AVERAGE DATA below 490 kHz				
125.16	0.2	75.1	105.6	30.5
375.42	0.2	40.5	96.1	55.6
Emissions Quasi-peak DATA above 490 kHz				
625.32	10	33.8	71.6	37.8

Margin (dB) = Limit – Actual

Table 2: Measured values of the Field strength above 30 MHz										
Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. (V/H)	Antenna Height [m]	Table Angle [°]	Reading [dB(μV)]	Amp Gain [dB]	AF / CL [dB(1/m)]	Actual [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Emissions Quasi-peak DATA 15.209										
92.86	120	H	2.3	190	44.7	28.0	8.9/1.4	27.0	43.5	16.5
92.98	120	H	3.3	180	47.2	28.0	8.9/1.4	29.5	43.5	14.0
112.23	120	H	2.6	310	42.0	27.9	11.8/1.7	27.6	43.5	15.9
192.35	120	H	1.4	280	33.2	27.4	15.9/2.3	24.0	43.5	19.5
224.14	120	H	1.5	305	34.3	27.2	17.1/2.6	26.8	46.0	19.2

Margin (dB) = Limit – Actual
[Actual = Reading – Amp Gain + AF + CL]
1. H = Horizontal, V = Vertical Polarization
2. AF/CL = Antenna Factor and Cable Loss

NOTE: The spectrum was scanned from 30 MHz to 1 GHz. All emissions not reported were more than 20 dB below the specified limit or in the noise floor.

5.3 OCCUPIED BANDWIDTH

5.3.1 Regulation

RSS-210, Issue 5 – 5.9.1
Where indicated, the 6 dB (or 20 dB) bandwidth is measured at the points when the spectral density of the signal is 6 dB (or 20 dB) down from the inband spectral density of the modulated signal, with the transmitter modulated by a representative signal. Spectral density (power per unit bandwidth) is to be measured with a meter of 300 Hz resolution bandwidth or alternatively equal to approximately 1.0% of the emission bandwidth. An alternative to the 20 dB bandwidth is the 99% emission bandwidth. This bandwidth is determined such that below the lower and above the upper frequency limits, the mean powers emitted are each equal to 0.5% of the total mean power of the emission. The bandwidth of the transmitted signal and the type of meter (CISPR quasi-peak or averaging) used in the measurement shall always be stated when submitting information or test report to Industry Canada for equipment certification. However, where a bandwidth value is not specified in this Standard, the transmitted signal bandwidth to be reported is to be its 20 dB or 99% emission bandwidth, as calculated or measured. This is also known as the emission bandwidth, or the occupied bandwidth (for the purpose of Annex A), or the necessary bandwidth (for the purpose of designation of emissions in section 5.9.2, and in Annex A) or the fundamental emission bandwidth.

5.3.2 Test Procedure

The bandwidth is measured using conducted measurement methods at 50Ω terminal antenna port on the spectrum analyzer through the 20dB attenuator after removing the loop coil antenna. See test setup photographs. The measurement was performed at the operating frequency, 125 kHz. The spectrum trace data around fundamental frequency of the EUT was obtained with the spectrum analyzer in “Max Hold” mode. The bandwidth value was determined as 99% emission bandwidth.

5.3.3 Test Results: PASS

Operating frequency (kHz)	RBW (Hz)	OBW (99%) (kHz)	Limit (kHz)
125	300	36.3	-

Figure 1: Measured value of the Occupied bandwidth