

Narragansett Bay Campus, 215 South Ferry Road, Narragansett, RI 02882 USA

November 5, 2009

Subject: Shipment of IMO Class 9/UN3091 Lithium Batteries Contained in Equipment

The lithium batteries contained in URI/GSO Inverted Echo Sounders (PIES/CPIES) are Tadiran model number TL-5137, size DD. These batteries meet the requirements of each test of the UN Manual of Tests and Criteria Part III, Section 38.3 as documented on the attached Transport Certificate from Tadiran Batteries Ltd.

As required by IMDG Code Chapter 3.3, Special Provisions 230/.3, each lithium cell is equipped with an effective means of preventing external short circuits. Specifically the lithium cells contained in equipment are diode protected (Diodes D13 on IES-Power Conditioner Schematic) from shorting to one another on the main electronics board that has the battery connector. All stacks have in-line fuses as well as isolation and protection in several places (see IES 62B Battery Pack Schematic).

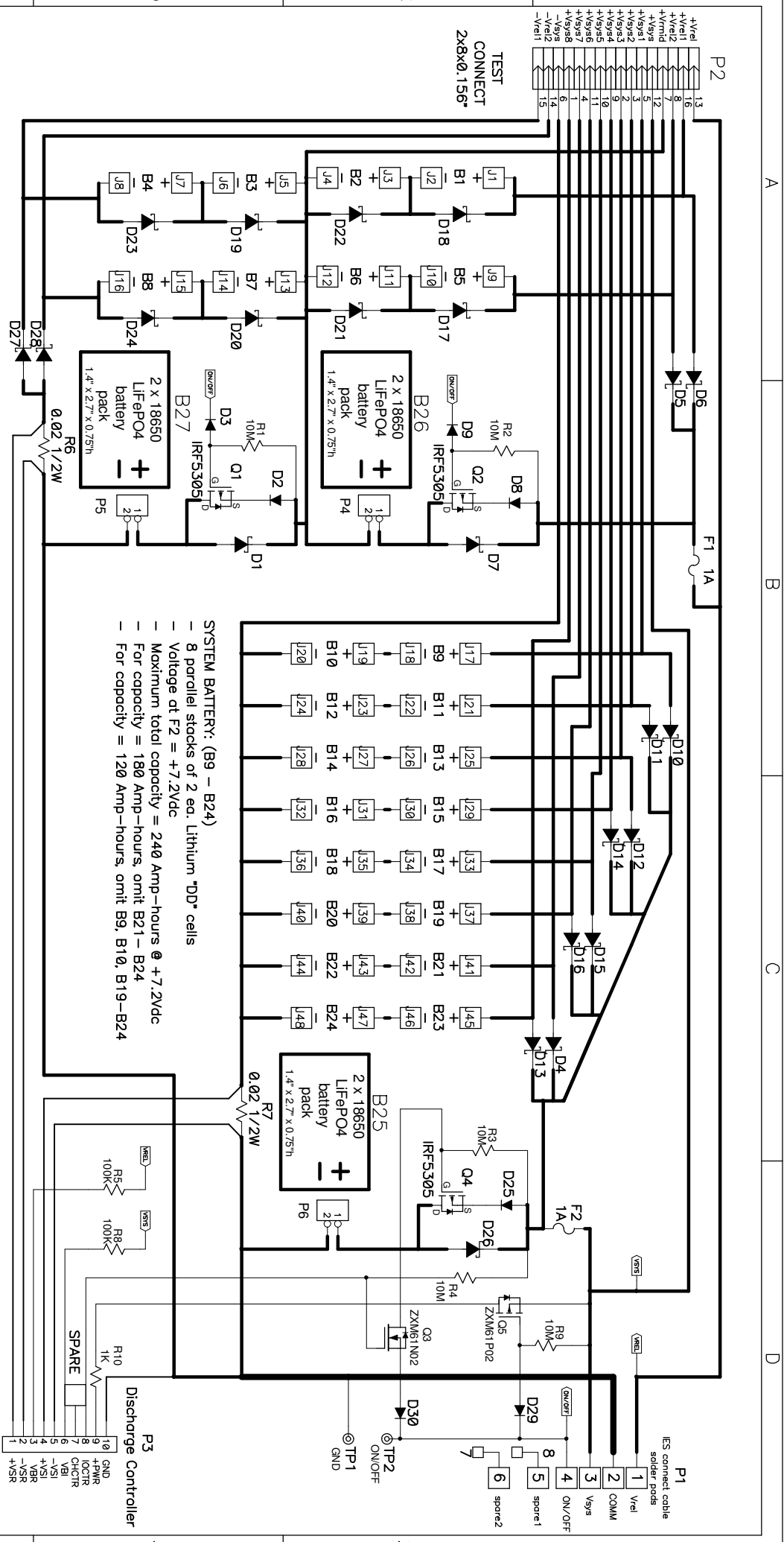
The Material Safety Data Sheet for Tadiran model TL batteries is also included in this shipping package.

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TEST  
CONNECT  
2x8x0.156"

- RELEASE BATTERY: (B1 – B8)
- 2 parallel stacks of 4 ea. Lithium "D" cells
  - Voltage at F1 = +14.4Vdc
  - Maximum total capacity = 60 Amp-hours @ +14.4Vdc

- BOOSTER BATTERY: (B25 – B27)
- Each pack contains 2 cells in series of type LiFePO4 Li-Ion, size: 18650
  - Voltage: 6.4V (working), 7.6V (peak), 5.0V (cutoff)
  - Safety circuit: 4 Amp max discharge, reverse polarity protection

- SYSTEM BATTERY: (B9 – B24)
- 8 parallel stacks of 2 ea. Lithium "D" cells
  - Voltage at F2 = +7.2Vdc
  - Maximum total capacity = 240 Amp-hours @ +7.2Vdc
  - For capacity = 180 Amp-hours, omit B21 – B24
  - For capacity = 120 Amp-hours, omit B9, B10, B19 – B24

- ASSEMBLY NOTES:
- Cablewire length = 12", 20AWG color-code wire /w shrink tubing cover
  - IES connector: 6-pin matrix cable plug, Digi-Key# A14288-ND
  - Cable strain relief: Digi-Key# A14344-ND

University of Rhode Island			
Graduate School of Oceanography			
Title IES 6.2B Battery Pack with Boosters			
Size	Number	GFC – GKE	Rev
B	Design		A
Date	March 13, 2008	GFC	Drawn by Chaplin
Filename	BatBoost2-B.sch	Sheet	1 of 1

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July 30, 2008

Our Ref.: C-280718

**Transport Certificate, Tadiran TL-5137 battery**

We hereby certify that the Tadiran TL-5137 lithium cells meet all the requirements of each test in the current UN Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria, Part III, Section 38.3, as detailed in Tadiran internal report 15Q-611, dated April 2003 per the following table:

UN Manual of Tests and Criteria	Results	Remarks
<b>T1: Altitude Simulation</b>	Pass	
<b>T2: Thermal Test</b>	Pass	
<b>T3: Vibrations</b>	Pass	
<b>T4: Shock</b>	Pass	
<b>T5: External Short Circuit</b>	Pass	
<b>T6: Impact</b>	Pass	
<b>T7: Overcharge</b>	-----	Only for rechargeable cells
<b>T8: Forced Discharge</b>	Pass	

**Product description-**

The TL-5137 battery consists of a single 3.7V primary lithium cell. The TL-5137 battery may come with optional suffixes consisting of a "/" followed by one or more letters. These suffixes indicate different finishing (e.g., S- standard, T-tab, P-pin, etc).

- Maximum Open Circuit Voltage- 3.7V
- Nominal Capacity- 35 Ah (at 10 ma discharge current to 2V end voltage).
- Lithium content per cell- 10.2 gram.

**Product Classification-**

**Worldwide besides the United States-** - TL-5137 lithium cell is subject to the Dangerous Goods Regulation, and thus can be transported as **Class 9**. The cell must be shipped and packed in accordance with the relevant Specific Provisions and Packing Instructions of the applicable code, e.g., IATA, ICAO, IMO, and ADR/RID. Regulations changes necessitate referring to UN number 3090 (lithium batteries) and to UN 3091 (when packed with and in equipment).

**Within the US-** the US DOT CFR 49 regulations, Parts 171, 172, 173 and 175 are governing the transportation of lithium cells and batteries. The TL-5137 cell and its finishing versions are defined as "*large lithium cells and batteries*". Requirements for different transportation modes (e.g., Air, Sea, with and within equipment and for disposal) are defined in part 173.185 "Lithium cells and batteries". TL-5137 cells should be transported as **Class 9**.

**Signed in Behalf of Tadiran:**



Dr. M. Babai, Quality Manager,

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MSDS No.- T-36-01 (Revision. -G)

## **MATERIAL SAFETY DATA SHEET**

### **SECTION 1- CHEMICAL PRODUCT AND COMPANY IDENTIFICATION**

Manufacturer Name- Tadiran Batteries Ltd., P. O. Box 1, Kiryat Ekron, Israel 70500.

US office address- 2 Seaview Blvd. Port Washington NY 11050

Emergency Telephone No. – CHEMTREC: 1-800-424-9300  
Tel. for information: 1-516-621-4980  
Tel. for information 972-8-944-4503

Products Name: Primary Lithium Thionyl Chloride (Li/SOCl<sub>2</sub>) cells and batteries, Non-rechargeable. Cells include the models of TL, TLH, and TLL, 3.6V series.

### **SECTION 2- COMPOSITION, INFORMATION ON INGREDIENTS**

Ingredient Name	CAS #	%	ACGIH (TLV)	OHSA (PEL)	CHIP Classification
Lithium Metal (Li)	7439-93-2	<5%	Not Established	None	<b>F:</b> R14/15 <b>C:</b> R34 <b>R:</b> 14/15, 34 <b>S:</b> (1/2), 8,43,45
Thionyl Chloride (SOCl <sub>2</sub> )	7719-09-7	<47 %	<b>1 ppm</b> (5 mg/M <sup>3</sup> )	5 mg/m <sup>3</sup>	<b>R:</b> 14,20/22,29, 35. <b>S:</b> (1/2),26,36/ 37/39, 45
Carbon (C)	1333-86-4	<6%	3.5 mg/m <sup>3</sup>	3.5 mg/m <sup>3</sup>	None known
Aluminum Chloride (AlCl <sub>3</sub> )	7446-70-0	<5%	2 mg/m <sup>3</sup> (Al salt, soluble)		<b>R:</b> 34 <b>S:</b> (1/2),7/8,28, 45
Lithium Chloride (LiCl)	7447-41-8	<2%	Not Established		
Glass		<1%	Not Established		
PVC	9002-86-2	<1%	Not Established		
PTFE	9002-84-0	<1%	Not Established		

### **SECTION 3 - HAZARD IDENTIFICATION**

The lithium Thionyl chloride batteries described in this MSDS are hermetically sealed units, which are not hazardous when used according to the recommendations of the manufacturer.

Under normal condition of use of the batteries, the electrode materials and the liquid electrolyte they contained are non-reactive provided the battery integrity is maintained. Risk of exposure exists only in case of mechanical, electrical or thermal abuse. Thus the batteries should not short circuit, recharge, puncture, incinerate, crush, immerse in water, force discharge, or expose to temperatures above the temperature range of the cell or battery. In these cases there is risk of fire or explosion

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#### **SECTION 4- FIRST AID MEASURES**

In case of battery rupture, explosion, or major leakage, evacuate personnel from contaminated area and provide good ventilation to clear out corrosive fumes, gases or the pungent odor. Seek immediate medical attention.

**Eyes** - First rinse with plenty of water for 15 minutes (remove contact lenses if easily possible), and then seek medical attention.

**Skin** - Remove contaminated clothes and rinse skin with plenty of water or shower for 15 min. Refer to medical attention.

**Inhalation** - Remove to fresh air, rest, and half-upright position, use artificial respiration if needed, and refer to medical attention.

**Ingestion** - rinse mouth, ***DO NOT*** induce vomiting, give plenty of water to drink, and refer to medical attention.

#### **SECTION 5- FIRE FIGHTING MEASURES**

**FLASH POINT:** NA LOWER (LEL): NA

**FLAMMABLE LIMIT IN AIR:** NA UPPER (LEL): NA

##### **EXTINGUISHING MEDIA:**

1. Lith- X (Class D extinguishing media) is the **only** effective on fires involving a few lithium batteries. If the cells are directly involved in a fire **DO NOT USE:** WATER, SAND, CO<sub>2</sub>, HALON, and DRY POWDER OR SODA ASH EXTINGUISHERS.

2. If the fire is in adjacent area and the cells that are either packed in their original containers or unpacked, the fire can be fought based on fueling material, e.g., paper and plastic products. In these cases the use of copious amounts of **cold** water is effective extinguishing media. Storage area may employ sprinkler system with cold water.

**AUTO-IGNITION:** NA

**SPECIAL FIRE FIGHTING PROCEDURES:** Wear self-contained breathing apparatus to avoid breathing of irritant fumes (NIOSH approved SCBA & full protective equipment). Wear protective clothing and equipment to prevent body contact with electrolyte solution.

Fire may be fought, but only from safe fire-fighting distance. Evacuate all persons from immediate area of fire.

**UNUSUAL EXPLOSION AND FIRE EXPLOSION:** Battery may explode when subject to: excessive heat (above 150°C), recharged, over-discharged (discharge below 0V), punctured and crushed. During thermal decomposition generation of chlorine (Cl<sub>2</sub>), hydrogen chloride (HCl), and sulfur dioxide (SO<sub>2</sub>) can be formed.

#### **SECTION 6- SPILL OR LEAKAGE PROCEDURES**

**PROCEDURES TO CONTAIN AND CLEAN UP LEAKS OR SPILLS:** The material contained within the battery would only be released under abusive conditions.

In the event of battery rupture and leakage: contain the spill while wearing proper protective clothing and ventilate the area. Then, cover with sodium carbonate

( $\text{Na}_2\text{CO}_3$ ) or 1:1 mixture of soda ash and slaked lime. Keep away from water, rain, and snow. Placed in approved container (after cooling if necessary) and disposed according to the local regulations.

NEUTRALIZING AGENT: Sodium carbonate ( $\text{Na}_2\text{CO}_3$ ) or 1:1 mixture of soda ash and slaked lime.

WASTE DISPOSAL METHOD: Product decomposed by water must be neutralized. May be added to waste water in sufficiently diluted form.

PRECAUTIONS IN HANDLING AND STORING: Avoid short-circuiting, over-charging and heating to high temperatures. Store the batteries in dry and cool area and keep container dry and tightly closed in well-ventilated area. Store away from food and drink.

OTHER PRECAUTIONS: Never attempt to disassemble, machine, or otherwise modify batteries or injury may result.

## **SECTION 7- HANDLING AND STORAGE**

The batteries should not be opened, destroyed or incinerate, since they may leak or rupture and release to the environment the ingredients that they normally contained in the hermetically sealed container.

**HANDLING-** Do not short circuit terminals, or expose to temperatures above the temperature rating of the battery, over charge the battery, forced over-discharge (voltage below 0.0V), throw to fire.

Do not crush or puncture the battery, or immerse in liquids.

**STORAGE-** Storage preferably in cool (below 30°C), dry and ventilated area, which is subject to little temperature change.

Do not place the battery near heating equipment, nor expose to direct sunlight for long periods. Elevated temperatures can result in shortened battery life and degrade performance.

Keep batteries in original packaging until use and do not jumble them.

Do not store batteries in high humidity environment for long periods.

**OTHER-** the cells and the batteries are not rechargeable batteries and should not be charged.

Applying pressure and deforming the battery may lead to disassembly followed by eye skin and throat irritation.

Follow manufacturers recommendations regarding maximum recommended current and operating temperature range.

## **SECTION 8 - EXPOSURE CONTROLS & PERSONAL PROTECTION**

RESPIRATORY PROTECTION: None necessary under normal use. In case of abuse and leak of liquid or fumes, use NIOSH approved Acid Gas Filter Mask or Self-Contained Breathing Apparatus.

VENTILATION: Not necessary under normal use. In case of abuse, use adequate mechanical ventilation (local exhaust) for battery that vent gas or fumes.

PROTECTIVE GLOVES: None under normal use. In case of spill use PVC or Nitrile gloves of 15 mils (0.015 inch) or thicker.

**EYE PROTECTION:** Use ANSI approved chemical worker safety goggles or face shield.

**OTHER PROTECTIVE EQUIPMENT:** Chemical resistance clothing is recommended along with eye wash station and safety shower should be available meeting ANSI design criteria.

**WORK HYGIENIC PRACTICES:** Use good chemical hygiene practice. Wash hands after use and before drinking, eating or smoking. Launder contaminated cloth before reuse.

**SUPPLEMENTARY SAFETY AND HEALTH DATA:** If the battery is broken or leaked the main hazard is the electrolyte. The electrolyte is mainly solution of Lithium chloride (LiCl), and aluminum chloride (AlCl<sub>3</sub>) in Thionyl chloride (SOCl<sub>2</sub>).

Fires may be fought but only from safe fire fighting distance, evacuate all persons from immediate area of fire.

Prevent heating of the battery, charging the battery, discharge to predetermined limit, do not crush, disassemble, incinerate or short circuit.

## **SECTION 9- PHYSICAL DATA**

BOILING POINT (760 mm Hg)	NA, unless individual components exposed
VAPOR PRESSURE (mm Hg, 25°C)	NA, unless individual components exposed
VAPOR DENSITY (air=1)	NA, unless individual components exposed
DENSITY (gr/cc)	> 1 gr/cc
VOLATILE BY VOLUME (%)	NA
EVAPORATION RATE (butyl acetate=1)	NA, unless individual components exposed
PHYSICAL STATE	Solid
SOLUBILITY IN WATER (% by weight)	NA, unless individual components exposed
PH	NA, unless individual components exposed
APPEARANCE	Geometric Solid Object
ODOR	If leaking, gives off pungent corrosive odor

## **SECTION 10- STABILITY AND REACTIVITY**

**STABLE OR NOT STABLE** Stable

**INCOMPATIBILITY (MATERIAL TO AVOID)** Strong mineral acids, water and alkali solutions.

**HAZARDOUS DECOMPOSITION PRODUCTS**

1. Reaction of lithium with water: Hydrogen (H<sub>2</sub>), Lithium hydroxide (LiOH).
2. Thermal decomposition over 150°C: Sulfur oxides, (SO<sub>2</sub>, SO<sub>3</sub>), Sulfur chlorides (SCl<sub>2</sub>, S<sub>2</sub>Cl<sub>2</sub>), Chlorine (Cl<sub>2</sub>), Lithium oxide (Li<sub>2</sub>O).
3. Electrolyte with water: Hydrogen Chloride (HCl) and SO<sub>2</sub>

**DECOMPOSITION TEMPERATURE (°F)** NA

**HAZARDOUS POLYMERIZATION:** May Occur \_\_\_\_\_ Will Not Occur  X

**CONDITIONS TO AVOID** Avoid mechanical abuse, and electrical abuse such as short-circuiting, overcharge, over-discharge, (voltage reversal) and heating.

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## **SECTION 11- TOXICOLOGICAL INFORMATION**

THRESHOLD LIMIT VALUE (TLV) AND SOURCE: NA

HEALTH HAZARD ACUTE AND CHRONIC: Inhalation, skin contact, eye contact and ingestion are not likely by exposure to sealed battery.

Inhalation, skin contact and eye contact are possible when the battery is opened.

Exposure to internal contents, the corrosive fumes will be very irritating to skin, eyes and mucous membranes. Overexposure can cause symptoms of non-fibrotic lung injury and membrane irritation.

Carcinogenicity- NTP: No

Carcinogenicity- IARC: No

Carcinogenicity- OSHA: No

Explanation of Carcinogenicity- No ingredient of a concentration of 0.1% or greater is listed as a carcinogen or suspected carcinogen.

SIGNS AND SYMPTOMS OF OVEREXPOSURE: Exposure to leaking electrolyte from ruptured or leaking battery can cause:

**Inhalation**- Burns and irritation of the respiratory system, coughing, wheezing, and shortness of breath.

**Eyes**- Redness, tearing, burns. The electrolyte is corrosive to all ocular tissues.

**Skin**- The electrolyte is corrosive and causes skin irritation and burns.

**Ingestion**- The electrolyte solution causes tissue damage to throat and gastro/ respiratory track.

MEDICAL CONDITION AGGRAVATED BY EXPOSURE: Preexisting skin, asthma and respiratory diseases are generally aggravated by exposure to liquid electrolyte vapors or liquid. For further information refer to section 4.

## **SECTION 12- ECOLOGICAL INFORMATION**

1. When properly used and disposed the battery does not present environmental hazard.
2. The battery does not contain mercury, cadmium, or lead.
3. Do not let internal components enter marine environment. Avoid release to waterways, wastewater or ground water.

## **SECTION 13- DISPOSAL CONSIDERATIONS**

1. Disposal must be in accordance with the applicable regulations in every country and state.
2. Disposal of the Lithium batteries should be performed by permitted, professional disposal firms knowledgeable in Federal, State or Local requirements of hazardous waste treatment and hazardous waste transportation.
3. Incineration should never be performed by battery users, but eventually by trained professional in authorized facility with proper gas and fume treatment.
4. Recycling of battery can be done in authorized facility, through licensed waste carrier.

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## **SECTION 14- TRANSPORTATION /SHIPPING**

Lithium batteries UN number 3090, class 9 (miscellaneous)

Lithium batteries contained in equipment, UN number 3091, class 9 (miscellaneous).

Packing instructions for 3090- ICAO 903 for air transport

IMDG 903 for sea transport

ADR/RID 903 and 903a for road /rail transport

Packing instructions for 3091- ICAO 912/918 for air transport

IMDG 903 for sea transport

ADR/RID 903 and 903a for road /rail transport

In the USA transportation is according to Code of Federal Regulations (CFR 49 Chapter 1, paragraph 173.185)

A list of Tadiran batteries and cells that are subject to transport regulations and those that are exempted can be obtained from Tadiran Batteries Ltd.

Identification and labeling in compliance with the product drawing should include the battery title, nominal voltage, lot number and warning.

## **SECTION 15- REGULATORY INFORMATION**

1. The transport of the lithium batteries is regulated by the United Nations, "Model Regulations on Transport of Dangerous Goods", 13 revised edition-2003 (special provisions 188, 230, and 310).
2. Within the US the lithium batteries and cells are subject to shipping requirements under 49 CFRCh. 1, paragraph 173.185, "lithium batteries".
3. Shipping of lithium batteries in aircrafts are regulated by the International Civil Aviation Organization (ICAO) and the International Air Transport Association (IATA) 2003 requirements in Special Provisions A45, A88 and A99.
4. Shipping of lithium batteries on sea are regulated the International Maritime Dangerous Goods (IMDG) 2002 requirements in special provisions 188, 230 and 310.
5. Shipping of lithium batteries on Road and Rail, 2002 requirements in special provisions 188, 230 and 310.
6. The internal component (thionyl chloride) is hazardous under the criteria of the Federal OSHA Hazard Communication Standard 29 CFR 1920.1200.

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## **SECTION 16- OTHER INFORMATION/DISCLAIMER**

*The information and the recommendations set forth are made in good faith and believed to be accurate at the date of preparation. The present file refers to normal use of the product in question. Tadiran Batteries makes no warranty expressed or implied.*