SIR-S/I

ELECTRONICS DIVISION

INTEGRATED SECONDARY SURVEILLANCE MODE S RADAR

SIR-S/I is a Mode S solution for the detection of cooperative targets in surveillance services. It has been designed to comply with the international standards for Secondary Surveillance Radar (SSR) systems and to guarantee a high degree of maintainability and reliability.

THE SOLUTION

The SIR-S/I Secondary Surveillance Radar is a modular system fully compliant with ICAO and EUROCONTROL recommendations on Mode S operation. It can be installed as standalone equipment or integrated (co-mounted) with a Primary Surveillance Radar (PSR). SIR-S/I is a dual-channel system with automatic changeover, solid state transmitter and receiver designed for unmanned operation. The dual channel system is housed in a single cabinet providing an integrated solution with embedded tracking function and embedded ADS-B channel.

SIR-S/I can operate in SSR Conventional Modes (1, 2, 3/A, C), Mode S Elementary and Enhanced Surveillance up to full Extended data link operation employing level 5 transponders. It is equipped with a dedicated ADS-B receiving channel and processing chain in order to acquire, decode and process 1090MHz Extended Squitter messages from Omni and Sum MSSR antenna channels. The SIR-S/I ADS-B receiving channel is designed according to ICAO Annex 10, RTCA DO-260, RTCA DO-260A, RTCA DO-260B specifications.
Mode S allows high data integrity (synchronous garbling elimination, defruiting), unambiguous aircraft identification, improved situation awareness and safety enhancements by the use of the additional information extracted from the transponder (Call-Sign, Selected Altitude, Ground Speed, Magnetic Heading, etc.).

The antenna used with the equipment is the ALE-9 LVA antenna, designed for full monopulse operation.
It provides high directional properties in azimuth and high aperture in the vertical plane, as recommended by ICAO, in particular for Enhanced Mode S Surveillance (EHS) operation.

The SIR-S/I Mode S operation has been fully tested and in the framework of the EUROCONTROL Pre-Operational Mode S Station Implementation Programme (POEMS). In addition, the system is compliant with all the SSR and Mode S performance requirements demonstrating outstanding performances in terms of accuracy figures and de-garbling, defruiting algorithm efficiency.

LEONARDO

SYSTEM FEATURES

State-of-the-art technology

› Latest generation of RF power transistors
› Very large scale integration (SMD technique)
› Latest generation processor and architectures

Full redundancy of critical items

The system includes two transmitter units, two receiver units, two processor units and an automatic changeover unit.

Improved azimuth monopulse estimation

Two algorithms (Amplitude and Sign Processing (ASP) and Dot Product Processing (DPP) are used for the azimuth angle estimation in order to improve detection performance. A selection logic activates DPP algorithm for replies very close to boresight in order to minimise estimate errors.

Full Mode S operation

Mode S can be activated with just one click both locally and remotely via Remote Control and Monitoring Station. Mode S functions include Surveillance Coordination (Cluster) among stations, data link with aircraft and extensive supervision by a graphical user-interface.

ADS-B channel

The SIR-S/I ADS-B processing chain processes Mode S ADS-B replies and outputs the positional information, the appropriate validity time, any quality factor, or other information included in the ADS-B message.
The processing chain decodes the ADS-B information as defined in the most recent version of the ICAO Manual on Mode S Specific Services, EUROCAE ED-129, RTCA DO-260/260A and DO-260B for the following Mode S ADS-B Extended Squitter (DF17/DF18/DF19) subtypes:

› Surface and airborne position
› Aircraft status identification and type
› Airborne Velocity
› Test Messages – Mode A Code
› Target State and Status
› Aircraft Operational Status

Extended performance monitoring

› Extensive embedded BITE for fault detection with local/remote capabilities
› Processing of replies from test transpondeZ
› Generation of replies at RF level with TTG circuitry
› On-line receiver logarithmic characteristic calibration

TECHNICAL DESCRIPTION

› Range	Up to 256 NM
› Detection volume	Up to 66000 feet, 360°horizontal plane, up to 45 vertical plane
› Scane rate	Up to 15 rpm
› Single cabinet with reduced	Height = 32U, Width = 19”, Depth = 27.56” physical dimensions
› Fully solid state transmitter with plug in modules	
› High TX duty cycle (66% peak - 6% average)	
› ISLS and IISLS capabilities	
› Receiver with three amplitude and phase matched LOG channels	
› (RX Dynamics > 80 dB)	
› RSLS capability	
› Range-azimuth programmable STC	
› Multiprocessor based on a power PC platform	
› Extensive monitoring logic for failure detection/isolation	
› II/SI code operation management	
› Mode S probability of detection	> 99%
› Probability of code validation	≥ 98% (3/A) and ≥ 96 (C) in the operational environment
› Mode S range accuracy	< 30m (RMS) for SSR equipped transponder aircrafts < 15m (RMS) for Mode S equipped transponder aircrafts
› Mode S azimuth accuracy	< 0.068° (RMS)
› Range/Azimuth resolution	Eurocontrol Area 1 (Pd > 98 %, Pdc > 98 %), Eurocontrol Area 2 (Pd > 98 %, Pdc > 90 %), Eurocontrol Area 3 (Pd > 60 %, Pdc > 30 %)
› MTBFc	> 63000 Hrs
› MTTR	< 20 min
› Availability (Ai)	> 0.99999
› Output data	Independently configurable (plot/track) interms of outputs number and data formats

SSR/MODE S SURVEILLANCE

› Target reports (plot/track) data - Asterix Cat 1, 2, 34, 48
› ADS-B SURVEILLANCE

TARGET REPORTS (PLOT/TRACK) DATA ADS-B MESSAGES - ASTERIX CAT 021

› Edition configurable: Ed. 0.23, 0.26, 2.1
› Target reports (plot/track) data ADS-B messages - Asterix Cat 010, Edition: 1.1
› CNS/ATM Ground Station Service messages - Asterix Cat 023, Edition: 1.2
› ASTERIX CAT 247 rev. 1.2: category Version Number

For more information:
infomarketing@leonardocompany.com

Electronics Division
Rome (Tiburtina)
Via Tiburtina
Km 12.400
00131 Rome - Italy
T +39 06 41501
F +39 06 4131133

MM08611 09-21

leonardocompany.com

LEONARDO