



## ANTENNA SYSTEMS

### REFLECTOR ANTENNAS

SELEX Sistemi Integrati G33 and G33I Integrated antennas are leading brand primary antennas used extensively all over the world.

G33 and G33I antennas are designed to operate in S-band (2700 to 2900 MHz). Antennas mainly comprise a reflector and an RF feed system for main and auxiliary beam functions.

The reflector contour is shaped to provide a cosecant square shaped beam. The beam has an improved coverage for elevation angles up to 45° and a rapid pattern drop-off below the horizon.

Antennas provide good rejection of interferences and weather clutter. Use of a very sophisticated polarizer system allows the selection of linear or circular polarization.

The antenna group incorporates a manual drive for reflector/feed tilting.

The mechanical design of the antenna group ensures the best operational performance. Protective finishes, gaskets, and hardware can withstand all environmental conditions. G33 antenna is able to support a Large Vertical Aperture

(LVA) on its top for Monopulse Secondary Surveillance Radar (MSSR) operation.

The special version of G33 antenna (G33 Integrated) consists of the S-Band primary antenna, equipped with additional L-band dipoles to provide improved monopulse SSR functions and enhanced transportability features.

It is well suited for transportable air traffic control radar systems, where both PSR and MSSR functions are required.

In this case an omnidirectional L-band antenna, located on the top of the reflector structure, provides the beacon SLS function.

### MAIN FEATURES

- Vertical elevation pattern with high roll-off below the horizon to eliminate the effects of ground multipath reflection on detection, accuracy, and resolution.
- Modified cosecant-squared pattern with enhanced high-angle coverage to maintain high signal/clutter ratio for short range targets.
- Narrow azimuth beamwidth to improve azimuth resolution, accuracy, and to reduce clutter cells.

- Low median azimuth sidelobes for reduced interference effects.
- Narrow azimuth beamwidth at all elevation angles.
- Multipolarization radar capability against rain and clutter due to elliptical polarization
- Single integral radar beacon feed and common reflector capable to minimize physical complexity for ease transport (G-33 Integrated antenna only).
- Monopulse compatible beacon radar for high azimuth accuracy (G-33 Integrated antenna only).
- High gain roll-off at underside of beacon sum elevation pattern capable to reduce beacon multipath (G-33 Integrated antenna only).

## TECHNICAL CHARACTERISTICS

### G33 Antenna - Characteristics

Operating frequency:	2700 to 2900 MHz
Polarization:	Linear (horizontal), circular
Beams:	Main (low), Auxiliary (high)
Type of coverage:	cos <sup>2</sup> with improved high elevation angle coverage
Dimensions:	5500 mm width 3150 mm height
Weight:	< 860 kg

### G33I Integrated Antenna - Characteristics

S-band section

Same characteristics of G33 Antenna

L-band section

Operating frequency: 1030 MHz / 1090 MHz  
within ICAO standards

Polarization: vertical, linear

Dimensions: 5500 mm width  
3150 mm height

Weight: < 860 kg

## PEDESTAL

Pedestal includes slip ring, rotary joint, dual drive motors, dual clutches, and dual encoders (14 bit at least).

Main ball bearings with connected tooth wheels run in oil bath. The reduction gear is designed to achieve a rotation rate of 10, 12 or 15 rpm (APP radar), or of 5 and 6 rpm (En-route radar). One of the two motors is operating, while the other is in stand-by. Antenna drive components (i.e. bearings, gears, encoders and motors) are protected by sealed units, enclosures, and proven surface finishes. Captive locking hardware is provided where accessibility and reliable sealing of antenna equipment components are available.

Weatherproof connectors, waveguide joints, and cabling are incorporated throughout the antenna group equipment.

## ALE-9

### MONOPULSE SECONDARY SURVEILLANCE RADAR PLANAR ARRAY ANTENNA



The high gain ALE-9 monopulse antenna is a planar array designed for En-route and TMA control. The newest technology has been applied to radiating columns and to distribution networks to ensure the best possible electric characteristic, minimum weight while providing optimum mechanical characteristic for operation in all environmental conditions. The elevation pattern, designed by applying modern CAD techniques, optimises the radar coverage range for its pencil-beam shape at lower elevation, and for its cosec-square shape at higher elevation. The large vertical aperture offers sharp roll-off and lower

sidelobes in below-horizon region thus minimizing ground illumination, reducing the ratio of false targets, and eliminating blind spots.

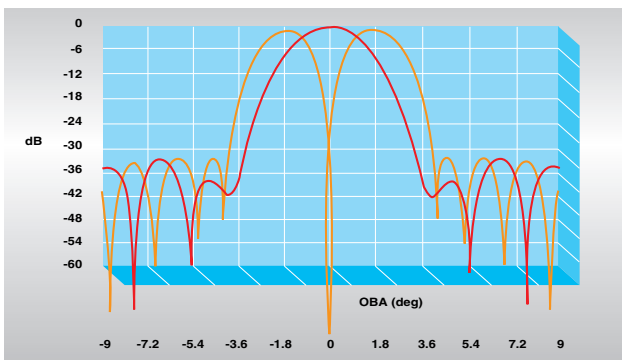
The non-resonant ground reflector ensures the radiation in the rear hemisphere of the antenna pattern coverage to be minimal, independently of its surface condition (e.g. presence of ice).

The SLS radiating system uses identical column radiators thus matching all lobe characteristics of the directional signal pattern and optimising its functional operation. Latest design techniques ensure accurate phase control

in the horizontal plane for best monopulse detection. Very accurate sum, difference and control patterns are obtained using an array of 36 vertical radiating columns (35 in the front array and 1 in the back), each one comprising 11 identical dipoles.

### MECHANICAL CHARACTERISTICS

The structure is open and presents a low wind resistance. The antenna is made of corrosion-resistant light alloys and is well suited for mounting on top of a primary antenna. Transportation and mounting are uncomplicated as the entire structure can be disassembled into 3 parts. A complete antenna, including distribution networks, filters, cables, and array structure (excluding the interface) weighs approximately 450 kg. All columns are identical and designed to be replaced in less than 10 minutes.



### ALE-9 Antenna - CHARACTERISTICS

Number of radiating front columns:	35
Number of radiating back columns:	1
Spacing of columns:	240 mm
Number of dipoles in radiating columns:	11
Overall length of array:	8400 mm
Overall height of array:	1850 mm
Overall depth of array (incl. back-fill radiator):	1450 mm
Height of radiating aperture:	1650 mm
Sum channel:	1030 MHz
Difference channel:	1090 MHz
Control channel:	1030 MHz
Polarization:	Vertical (all channels)

## ALE3X5 L AND S-BAND - PLANAR ARRAY ANTENNA SYSTEM



The ALE series of SELEX Sistemi Integrati antennas ensure optimum performance for the new generation of Air Traffic Control radar sensors. The family of planar arrays comprises a number of equal sub-array elements properly set in order to obtain the required antenna characteristics. Elements are combined in elevation and azimuth by two networks (vertical and horizontal).

Antenna outputs are fed to a programmable beam combiner in the Primary Radar Receiver in order to obtain a series of synthesized beams with different tilt, underside cut-off, gain, and shape. A single beam is always used in transmission to avoid high-power switching. In reception, one beam is selected on range/azimuth basis, in accordance with clutter, in order to minimize clutter returns.

For long range, a high gain pencil beam is used to maximize target visibility at long distance. A high squinted fan beam is used for short range coverage. Very sharp cut-off and very high gain in elevation increases detection of over-flying aircrafts. Intermediate beams between pencil and fan beams are selected in medium range to optimise clutter ratio. The antenna can operate in circular polarization for best visibility in rain condition. Beams obtained from cross polarized signals are used to detect weather when antenna operates in circular polarization. The mechanical structure, designed following military standards, increases resistance to weather and wind, eliminating the need of a radome. ALE 3x5 is designed for ALE 9 Monopulse SSR antenna mounting on top. In order to achieve maximum reliability and availability, no active elements are located in the antenna. The antenna is maintenance-free.

DESCRIPTION	Main	RX1 (pencil)	RX2 (interm.)	RX3 (fan)
3 dB Horizontal beamwidth (DEG)	1.45	1.45	1.45	1.45
3 dB Vertical beamwidth (DEG)	5	5	27	35
Gain (dB)	> 33.5	> 34	> 28	> 28
Slope on the horizon dB/DEG	> 2.2	> 1.4	> 3	> 3.5
Sidelobes (dB)	< -30	< -30	< -30	< -30

## MAIN FEATURES

- Highly adaptive
- L and S-band
- Very high gain
- Multiple adaptive beams
- Vertical beams adaptable to operational requirements
- Very sharp cut-off
- Improved height coverage
- Very low sidelobes
- Linear and circular polarisation
- Cross-polarised signal pick-up
- No radome required

DESCRIPTION	Main	RX1 (pencil)	RX2 (interm.)	RX3 (fan)
3 dB Horizontal beamwidth (DEG)	1.15	1.15	1.15	1.15
3 dB Vertical beamwidth (DEG)	3.7	3.2	5.5	27.7
Gain (dB)	35.7	37.3	34.8	> 26
Slope on the horizon dB/DEG	4.1	5.2	6.8	14.6
Sidelobes (dB)	≤ -28	≤ -28	≤ -28	≤ -28

