

HF AIRBORNE TRANSCEIVER





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DESCRIPTION

Extensive research and development activities by Marconi Selenia Communications in the HF field have led to the design and production of advanced HF/SSB system for fixed-wing aircraft and helicopters.

These transceivers provide voice/data radiocommunications for airborne applications over the 2 to 30 MHz frequency range.

Designed to meet the most diverse requirements, they provide various output power possibilities (from 100 W to 400 W) and a wide range of voice/data services in the USB/LSB/AM and CW modes.

Data communication capabilities include Link-11, as per STANAG 5511.

The components of this HF systems family has been specifically designed for airborne applications, where a very tough EMI environment is expected, such as in co-located installations requiring simultaneous operation of several radios (i.e. voice/data) on the same airborne platform.

Storage of operation-related data reduce the operator workload during the mission phase.

Maintenance is simplified by advanced BITE facilities allowing failure isolation down to module level.

Extensive flight tests on helicopters and fixed-wing aircraft have demonstrated excellent performance in the most severe environments.

All the systems are powered by 115Vac / 400 Hz 3-phase power line, but there is also a DC powered version of the SRT-[170, 270]/L version, i.e. the SRT-170/M system, which is suitable for installation in very severe EMI environments.

The SRT-170/M combines high flexibility and simplified operation in a reduced size and weight package, achieved through innovative electrical and mechanical design.

The receiver/exciter and RF amplifier are assembled into a single, 1/2 ATR sized LRU.

All these HF systems are currently in service on several airborne platforms.

Any of these transceivers can be interfaced with various Antenna Tuning Units (ATU) dedicated to Loop, Wire or Notch antennas.

As an example, a typical configuration for helicopter installation includes an externally mounted ATU (ATU-1992, an aerodynamically shaped unit, suited for external installation on the fuselage of low-speed aircraft), and a Loop antenna.

The external ATU installation reduces the problems of EMI with other equipment onboard.

The Loop antenna allows use of HF ionospheric propagation in the 'Near Vertical Incidence Skywave' (NVIS) mode.

The combination of NVIS and surface-wave modes provides reliable radio communication over adverse terrain.



SRT 470-L



SRT 170-M

MAIN FEATURES

- Voice and data operation
- Adaptive communication (ALE), according to MIL-STD-188-141A
- SELCAL function i.a.w.ARINC 714
- Microprocessor control and LSI component design
- Direct Digital Synthesis (DDS) technology for fast frequency setting
- Digital Signal Processing (DSP)
- 100W systems built in a single, compact unit of 1/2 ATR-short package, which combines receiver/exciter and power amplifier functions
- Use of whip, wire, loop or structural antennas by using the appropriate ATU
- 100 presettable channels
- FSK mode by optional internal modem
- Extensive, continuous and interruptive BITE to locate failures and minimize turnaround time
- Modular construction combined with advanced BITE facilities for quick, simple and economical maintenance
- Crypto voice by optional external modem
- Fast, automatic tuning
- Embedded growth capability for EPM/ARCS and high-speed serial modem
- Complete remote control for all operating functions, through bus interface or dedicated control panel

CONFIGURATION

A typical HF system consists of the following units:

- Receiver/Exciter
- Power amplifier
- Pre- post-selector (option, only to meet severe co-location / simop requirements).
- Mounting tray.
- Antenna Tuning Unit (ATU)

See table above for a complete list of available system components.

OPERATION

The HF system provides simplex receive/transmit operation over the 2 to 30 MHz range.

Mission-oriented data are stored in the SRT-170/M including frequency, mode, and time of operation.

The ATU is able to store up to 256 channels. Antenna tuning data are acquired and stored prior to the mission. When any of the stored channels is selected during the mission, the stored tuning data are used to speed up the antenna tuning operation, without power emission ('silent tuning').

By using this approach, tuning times of the order of 50 ms are achieved.

Status signals are made available by the HF system for a central aircraft maintenance panel, allowing quick maintenance.

The BITE function of the modules is designed to allow tests and checkouts by automatic test equipment (ATE) and fast,

faulty-unit repair at the maintenance organisation level.

The HF system can be controlled via either MIL-STD- 1553B, or

ARINC 429 data bus, or from a dedicated Remote

Control Panel (SP-648/L).

The HF System can interface to the following devices:

- Adaptive Communications Processor, for automatic selection of the best operating frequency, based on data on the channel conditions
- Data Link Modem, to set up point-to-point and network links
- Crypto Modem, to operate in the crypto voice narrowband mode.

OVERVIEW OF HF SYSTEMS COMPONENTS LRU

Systems Types	Systems Components	Description	Power Supply	Dimensions (mm)			
				Mass (Kg)			
				W	H	D	M
SRT-170/M (SRT-170/L)		100W lightweight HF system. Note that the SRT-170/L version is powered by 115Vac / 400 Hz 3-phase	+ 28Vdc				
	RT-170/M	100 W, lightweight, HF transceiver, includes internal Receiver/Exciter and Power Amplifier		124	193.5	360.5	9
	SP-1127/L	ATU for Wire antennas		124	193	457	7
	SP-1992	ATU for Loop antennas		115	323	367	4
SRT-270/L		200W HF system	115Vac / 400 Hz 3-phase				
	SP-649/L	Receiver/Exciter		90	197.5	320.5	6
	SP-480/L1	200W Power Amplifier		90	197.5	320.5	6
	SP-1325/L	Pre-post selector (optional) for loop and notch antennas. Used to meet severe constraints of co-location and simop requirements		92	200	361	3.2
SRT-470/L	SP-1992	ATU for Loop antennas		115	323	318	4
		400W HF system	115Vac / 400 Hz 3-phase				
	SP-649/L	Receiver/Exciter		90	197.5	320.5	6
	SP-484/L	400W Power Amplifier		257	193.5	320.5	15
	SP-1325/L	Pre-post selector (optional) for loop and notch antennas. Used to meet severe constraints of co-location and simop requirements		92	200	361	3.2
	SP-1325/L1	Pre-post selector (optional) for wire antennas. Used to meet severe constraints of co-location and simop requirements		92	200	361	3.2
	SP-1992/LM4	ATU for 400W Wire antennas		257	193.5	498	13
SP-1999	ATU for Loop antennas		213	429	604	14	
SP-1992/LN	ATU for Notch antennas		190.5	193.5	360	8.5	

TECHNICAL CHARACTERISTICS

GENERAL

Frequency range	2 to 29.9999 MHz
Tuning time	Typical 1s (including ATU); 50 ms on learned channel
Modes of operation	Simplex Rx/Tx on any available channel
Modulation	Clear and secure voice (USB/LSB/AM), CW (USB), Link-11 data (USB,LSB,SB), TTY (USB), SELCAL (Arinc 714-6), ALE (8-FSK)
Preset channels	100 (stored in the Control Panel)
Frequency stability	1 part in 10 ⁷
Power supply	115 Vac / 400 Hz 3-phase, except for SRT-170/M powered by +28 VDC
Power consumption	dependent on system type (as an example, for a 400W, fully configured, system)
Tx: 1500W	
Rx: 150W	
Dimensions & Mass	See table 1
Environmental conditions:	
General:	MIL-STD-810C (temperature, altitude, vibration, shock, salt, fog)
Operating Temperature:	-54°C to + 55°C
Altitude:	70'000 ft

TRANSMISSION

RF output power	for the 170 family: 175W PEP / 85 W average for the 270 family: 200W PEP / 100 W average for the 470 family: 400W PEP / 400 W average
RF power selection	1/2 or 1/4 of max RF output power selectable
Intermodulation (linearity)	Better than 30 dB below each of the two-tone
Harmonic attenuation (in band)	Better than 50 dB below PEP
Spurious suppression	Better than 60 dB below PEP
Carrier attenuation in SSB mode	Better than 50 dB below PEP
Undesired sideband attenuation	Better than 50 dB below PEP
Duty cycle	1 minutes Tx and 5 minutes Rx in CW, AM and Data mode; continuous in SSB Voice and Link-11 mode
Audio input Voice:	0 dBm/600 ohm balanced
Data:	0 dBm/600 ohm balanced
Crypto voice:	0 dBm/600 ohm balanced
RF Output Protection	Automatic protection against short circuit or open circuit of the RF output path and against over temperature

RECEPTION

Sensitivity for 10 dB min. (S+N)/N	
CW/SSB:	0.7 μ V
AM:	2.5 μ V
Selectivity	not more than 3dB down from Fc \pm 300 Hz to Fc \pm 3050 Hz
Image rejection	Better than 100 dB
IF rejection	Better than 100 dB
Cross-modulation	Better than 3% of nominal audio output
Input impedance	500 ohm (nominal) unbalanced
Intermodulation (linearity)	Better than 35 dB below the output level of either tone
Desensitization	3 dB max.
AGC (figure of merit)	
Voice:	\pm 3 dB max output audio variation for input variations between 10 μ Vrms and 1 Vrms
Data:	according to STANAG 5511 / ML-STD-188-203-1A
AGC time constants	
Voice:	12ms max rise time, 1.5s max fall time
Data:	LINK-11 according to STANAG 5511
Audio output	
Voice:	100 mW/600 ohm or 150 ohm balanced
Data:	0 dBm/600 ohm balanced
Audio distortion	Better than 5%
Squelch Voice SSB:	adjustable for (S+N)/N = 5 to 20 dB



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