Receivers
Direction Finders

HF Receiver
E 863 KW/2
1.5 to 30 MHz

Leaflet
IB 663/1 E

3-16798.1

Applications

The HF Receiver E 863 KW/2 is suitable for universal utilisation as a high stability service receiver for telegraphy and telephony links, including SSB traffic, and as search and surveillance receiver.

Special Features

Single-knob tuning control permits rapid and exact search operation.

Electronic frequency setting readout with digital numicator tubes providing uniform resolution over the entire frequency range.

Excellent setting accuracy by virtue of the digital readout of the receiver frequency.

Pushbutton actuation locks any tuned in frequency with the accuracy of the built-in reference frequency generator.

Incorporates a precision reference frequency generator.

Binary coded output for remote communication or print-out of the reception frequency.

Signal preselection with five tuned preselector circuits.

Main selectivity (adjacent channel selectivity) provided by mechanical filters; maximum of eight different bandwidths available.

Noise limiter; can be switched off.

Fully transistorised, with extensive utilisation of integrated circuits, thus low current drain, long life expectancy and little maintenance requirements.

Synoptically arranged, sturdy light alloy construction in a small volume, using a readily accessible modular assembly system.

Optionally mains or battery operation.

Facility provided for connecting panorama units.

Suitable for operation in long distance traffic communications receiver equipments.

May be operated with ambient temperatures from −20 °C to +50 °C.

Technical Remarks

For good channel exploitation of an engaged frequency band, special types of modulation are used, which require very accurate matching between the transmitter and receiver operating frequencies. Very good setting accuracy is here demanded to permit sufficiently accurate tuning-in of the receiver to the frequency of the wanted transmitter, solely with reference to the receiver tuning scale. Very high frequency stability is also demanded to hold the tuned-in frequency, even without an AFC system.
The Receiver E 863 achieves excellent frequency stability and setting accuracy by deriving the local oscillator frequency from a standard reference frequency generator.

For search and surveillance operation, it is necessary to sweep-tune rapidly through large frequency bands whilst preserving high setting accuracy and frequency stability.

The E 863 covers the HF band in only 4 subranges, using single-knob tuning control. The frequency readout is effected with the built-in digital frequency meter employing digital luminous numicator tubes providing a resolution of 100 Hz. Any indicated frequency can be locked by pushbutton actuation and is then held with the same stability as the reference frequency generator.

The high congestion in the HF band calls for small channel spacing in the frequency processing system.
The E 863 can be locked to integral multiples of 100 Hz and an auxiliary fine tuning device (which can be switched off) permits interpolation between the 100 Hz harmonic points.

The setting accuracy and frequency stability of the receiver are determined solely by the precision of the reference frequency generator.
The E 863 uses a high precision 1 MHz reference frequency generator fitted with a thermostatically housed crystal. The operating voltage is well stabilised.

Remote communication (display) or registration of the reception frequency is necessary for certain tasks.
The E 863 possesses a binary coded reception frequency output, to which may be connected, for example, a data printer for quick registration, or a repeater display unit for remote readout of the reception frequency.

The severe traffic congestion of the HF bands calls for outstandingly good receiver selectivity.
The main selectivity (adjacent channel selectivity) of the E 863 is provided by mechanical filters located ahead of the IF amplifier.

A superheterodyne receiver is inherently prone to response ambiguities. The number of possible subsidiary reception frequencies increases with the number of frequency conversions performed in the receiver.
The E 863 has been designed as single superheterodyne receiver to keep the number of subsidiary response frequencies small.

The residual subsidiary reception frequencies must be suppressed to such an extent that they do not interfere with normal operation.
For this purpose, the E 863 has been provided with 5 RF preselector tuned circuits and therewith achieves very high rejection factors for image frequencies and IF breakthrough.

The atmospherics interference level is high in the HF band. A wanted transmitter can be received properly only if its signal strength at the site of the receiver exceeds the external noise level. Thus excessive receiver sensitivity is useless, and in fact detrimental because the susceptibility of a receiver to cross-modulation effects increases with increasing sensitivity. Thus excessive input sensitivity has deliberately been avoided in the design of the E 863.

It should be possible to operate the receiver independently of a mains power supply. The E 863 is fully transistorised. Apart from other advantages such as small volume, light weight and little maintenance, this results in low current drain and thus permits economical battery operation. The E 863 can readily be converted for battery operation.

It should be possible to adapt the receiver for all encountered service types and operating modes.

The E 863 is the master unit of a carefully planned receiver equipment system. Connecting facilities have been provided for numerous ancillary units permitting extentions to give complete long distance traffic communications receiver equipments.

Small size is an important requirement not only for radio stations operated in vehicles, but also for fixed station utilisation, to permit convenient accomodation of the receiver and its accessory units usually required for present day traffic operation, within the limited space of a radio operator working position.
In spite of improved performance, the volume of the E 863 is less than 20% of that of the HF Communications Receiver E 104.

Technical Specifications

Frequency Range:	1.5 MHz to 30 MHz
Service Types:	A1 CW telegraphy A2 MCW telegraphy A3 AM telephony A3J SSB telephony in conjunction with ancillary units: F1 2-frequency FSK telegraphy (teletype, multiplex) F1 3-frequency FSK telegraphy (data transmission) F4 2-frequency FSK telegraphy (facsimile, weather maps) F6 4-frequency FSK diplex telegraphy (code 1 and 2, channel A and B) A3A SSB telephony with AGC and AFC based on residual carrier component A3B SSB telephony with two independent sidebands (ISB) A4 facsimile, picture transmission

Frequency Subranges:

Range 1:	1.50 to 3.48 MHz
Range 2:	3.46 to 7.48 MHz
Range 3:	7.45 to 15.50 MHz
Range 4:	15.40 to 30.00 MHz

Tuning Control

Coarse Drive:	13.5 revolutions per range
Fine Drive (mechanically reduced):	400 revolutions per range

Fine Tuning Control (electrically reduced): about ±200 Hz (for 270° rotation angle)

Frequency Latching: receiver is locked to the indicated frequency by actuating a pushbutton

Resolution:	100 Hz
Fine Tuning:	at least ±50 Hz, without scale, can be switched off

Frequency Readout: 6-digit non-flicker display with numicator tubes

Frequency Latching: / Fine Tuning:	OFF / –	ON / OFF	ON / ON
Readout Tolerance	< 50 Hz $+ 4 \times 10^{-7}$ fe	$< 4 \times 10^{-7}$ fe	
Frequency Drift, for temperatures between +10 °C and +40 °C and ±10% mains voltage fluctuation or 21.5 V to 30 V battery voltage variation		< 0.1 Hz $+ 2 \times 10^{-7}$ fe	< 10 Hz $+ 2 \times 10^{-7}$ fe

Crystal Ageing: $< 1 \times 10^{-6}$/year after 4 weeks operation

RF Input (Antenna)

Signal Voltage:	0.5 µV to 100 mV EMF
Permissible Overvoltage:	$\leq$ 10 V EMF
Matching Impedance:	50 to 75 Ω, coaxial
Threshold Sensitivity:	average 10 kT_o (10 dB)
Oscillator Parasitic Voltage across 60 Ω:	1.5 to 15 MHz: average 20 µV, < 50 µV 15.0 to 30 MHz: average 50 µV, < 100 µV

Broadband IF Output

Nominal Frequency:	525 kHz
Bandwidth:	about ±1% of reception frequency, max. 100 kHz
Internal Impedance:	about 50 Ω
Signal Voltage across 50 Ω (with AGC):	> 20 µV for 1 µV antenna EMF > 100 µV for 100 µV antenna EMF > 1 mV for 100 mV antenna EMF

Narrow-Band IF Output

Nominal Frequency: 525 kHz

Signal Voltage across 50 Ω (with AGC): > 50 mV

Signal Voltage Variation (with AGC): < ±2 dB for 0.5 µV to 100 mV antenna EMF

Internal Impedance: about 20 Ω

IF Bandwidths and Selectivity:

Nominal Banwidth (kHz)	6 dB Bandwidth (kHz)	60 dB Bandwidth (kHz)	Center Frequency Discrepancy (Hz)
± 0.10*	> ± 0.10	< ± 0.55	< 150
± 0.25	> ± 0.22	< ± 0.90	< 180
± 0.75	> ± 0.70	< ± 2.5	< 250
± 1.5	> ± 1.45	< ± 4.0	< 300
± 3.0	> ± 2.7	< ± 6.5	< 300
± 6.0	> ± 5.7	< ±12.5	< 300
USB	> 2.9	< 8.0	< 300
LSB	> 2.9	< 8.0	< 300

* only for A1 service type

The basic version is equipped with the bandwidths of ±0.25 kHz, ±0.75 kHz and ±3 kHz.

Image Frequency Rejection Factor:

	Mean	Minimum
1.5 to 10 MHz	95 dB	80 dB
10 to 25 MHz	70 dB	60 dB
25 to 30 MHz	60 dB	50 dB

IF Breakthrough Rejection Factor: ≧ 100 dB from 1.5 to 30 MHz

Cross-Modulation: 2 unmodulated interfering transmitters produce a signal/interference ratio of ≧ 20 dB for

	Antenna EMF Mean Value	Detuning
Wanted Transmitter	100 µV	0
Interfering Transmitter 1	3 mV	± 20 kHz
Interfering Transmitter 2	3 mV	± 40 kHz
Interfering Transmitter 1	15 mV	$\frac{f_E}{2} \times 1.1$
Interfering Transmitter 2	15 mV	$\frac{f_E}{2} \times 0.9$

AF Outputs

Loudspeaker: 0.4 W maximum into internal loudspeaker

Headset, 19 mm sockets: 20 mW into 4000 Ω

Headset, jack socket: 20 mW into 4000 Ω

600 Ω Line Output

Nominal Signal Level: 0 dBm (max. +10 dBm)

Signal Level Change with AGC: < ±2 dB for 0.5 µV to 100 mV antenna EMF

Impedance: 600 Ω ±10%

AF Passband: 300 to max. 5700 Hz, depending on bandwidth setting, level to within better than ±3 dB

A1 Service Type	
Signal/Noise Ratio:	> 10 dB for 0.4 µV antenna EMF, ±0.25 kHz bandwidth
AGC Time Constants:	+20 dB in about 100 ms − 20 dB in about 2 s
BFO:	tunable through ±3 kHz, T_k < 10 Hz/°C
A2/A3 Service Type	
Signal/Noise Ratio:	> 20 dB for 10 µV antenna EMF, ±3 kHz bandwidth, m = 0.3
Cross-Modulation:	A modulated interfering transmitter produces a signal/interference ratio of 14 dB through cross-modulation, for:

	Antenna EMF	Modulation Depth	Detuning
Wanted Transmitter	100 µV	50 %	0
Interfering Transmitter	30 mV	50 %	± 20 kHz
Interfering Transmitter	100 mV	50 %	± 20 %

AGC Time Constant:	±20 dB in about 100 ms
Harmonic Distortion:	< 5 % for 0 dBm and 1 mV antenna EMF, m = 0.3
A3J Service Type	
Signal/Noise Ratio:	> 20 dB for 3 µV antenna EMF, 3 kHz bandwidth
AGC Time Constants:	+20 dB in about 100 ms − 20 dB in about 2 s
Harmonic Distortion:	< 5 % for 0 dBm, 1 mV antenna EMF
Carrier Reinsertion Oscillator:	frequency uncertainty < 20 Hz frequency drift < 20 Hz
Frequency Meter Output	
Binary Coded Output:	1–2–4–8 Code
Voltage for L:	> 5.5 V EMF
Voltage for O:	< 0.5 V EMF
Impedance:	about 5 kΩ
Takeover Blockage	by shorting to chassis
Short Circuit Impedance:	< 50 Ω
Clock Pulse	
Voltage Amplitude:	> 5 V_{pp} EMF
Impedance:	about 50 Ω
Pulse Duration (Width):	about 300 µs
Repetition Frequency:	≦ 25 Hz
Oscillator Output:	
Frequency:	2 MHz to 30.5 MHz
Signal Voltage:	> 5 mV across 50 Ω
Impedance:	about 50 Ω

Mains Power Supply

Voltage:	110/220 V ±10 %
Frequency:	45 to 480 Hz
Power Consumption:	for "preheating", max. 100 VA (at +25 °C for about 15 minutes after switching on) for "operation" about 60 VA at +25 °C

Battery Power Supply

Voltage:	21.5 V to 30 V, negative pole to chassis
Permissible Overvoltage:	max 90 V for 1 ms
Current Drain:	for "preheating", max. 3.6 A (at +25 °C for about 15 minutes after switching on) for "operation" about 2.3 A at +25 °C

Ambient Conditions

Temperature:	+10 °C to +40 °C	full guarantee of performance specifications
	– 20 °C to +50 °C	may be operated
	– 40 °C to +70 °C	may be stored

Humidity:

Operation is permissible for 96 hours at +40 °C temperature and 90% relative humidity. A mean relative humidity of 75 % is permissible over the full service life of the unit.

Vibration and Shock:

No damage is incurred if the switched-on unit is subjected to vibration with a stroke of ±0.5 mm at 10 to 30 Hz, or with an acceleration of 2 g in the range from 30 to 70 Hz.
The unit is able to operate whilst being shaken with a stroke of ±1 mm at 5 Hz.
No damage results if the switched-on unit is subjected to a 10 g jolt of 10 ms duration.

Dimensions and Weights:

	Height mm	Width mm	Depth mm	Weight approx. kg
in cabinet:	315*	274*	350	24
as drawer unit	270	256	324	20

* overall dimensions including rubber feet

Scope of Delivery

1 HF Receiver E 863 KW/2 with desk cabinet
1 Description and Operating Instructions
1 Mains Cable with Grounded Plug — according to drawing No. 5L 4941.001-58
1 Antenna Plug HF 4/13, 50 to 75 Ω
Type SHF 13/s-2 — according to drawing No. 5N 4521.401-11
suitable for type 1.5/6.5 L cable
1 26-pole Shorting Plug — according to drawing No. 52.1260.041-00
1 Set of Spare Fuses

Further details are given in our Description KB 107 E.

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