RF-550

MF/HF Independent Sideband Communications Receiver

HARRIS
COMMUNICATIONS AND INFORMATION HANDLING

RF COMMUNICATIONS DIVISION

RF-550 Fully Synthesized ISB Receiver

FREQUENCY TUNING AND STABILITY

The RF-550 tunes the complete MF/HF frequency range from 100 kHz to 30 MHz in 100 Hz increments. Tuning is accomplished by six easily operated decade switches. A high visibility six digit electronic display provides readout of frequency in both the local and remote modes of operation. In addition to synthesized tuning, a VFO mode is provided for ± 1.1 kHz incremental tuning. CW reception is further enhanced with a BFO tuning ± 1.1 kHz about the indicated receive frequency.

By use of a frequency synthesizer the receiver tuning accuracy is completely determined by a single high stability reference oscillator. The basic receiver includes a temperature compensated crystal oscillator (TCXO) reference exhibiting a stability of 1 part in 10^6 per day. The same stability applies over the rated temperature and power line voltage ranges. For critical applications, the optional RF-560 temperature controlled 1 MHz frequency standard is offered replacing the TCXO. The corresponding receiver stability with the RF-560 option is 1 part in 10^8. An external input also permits operation from the user's frequency standard (either 1 MHz or 5 MHz).

For reception of reduced carrier sideband signals, an AFC mode of operation automatically locks the receiver to the reduced carrier with zero frequency error. Capture range is ± 50 Hz and hold-in range is ± 1100 Hz. The high performance phase-lock AFC system will maintain lock to below 0.08 uV.

RECEIVING MODES

The standard RF-550 receiver is supplied with five receiving modes: CW, AM, USB, LSB and two channel ISB. CW reception is directly at the indicated receive frequency, with a variable BFO for optimum signal readability. The standard SSB filters have a 3 dB bandwidth of 3.2 kHz. Sideband filter bandwidth options include delay compensated 2.8 kHz filters and 5.7 kHz wideband filters.

Additional modes available include the RF-561 four channel ISB option, the RF-568 narrowband FM demodulator option, and special USB filter options for optimum reception of 850 Hz and 170 Hz shift radio teletype (RATT).

AUTOMATIC GAIN CONTROL

Automatic Gain Control (AGC) maintains demodulated outputs constant within 3 dB for RF signals ranging from 1 uV to 1.0 volt. Shaping circuitry provides linear 3dB scale AGC/RF characteristics. A front panel RF meter indicates signal level within ± 3 dB over a 120 dB range (1 uV to 1 volt). The AGC voltage is also available externally for use in diversity operation.

A front panel AGC selector switch provides five AGC modes. (1) OFF: the receiver gain is manually adjusted by the RF Gain control. (2) FAST: this provides fast AGC attack and a moderately fast decay time (0.1 second). (3) SLOW: this provides fast AGC attack and a slow decay time (1 second). (4) COHERENT: this mode is available with AFC operation; the AGC voltage is derived coherently from the pilot carrier and provides gain control completely independent of signal modulation. (5) EXTERNAL: receiver gain is controlled by an external DC voltage input; this position is useful for diversity operation.

SPURIOUS PERFORMANCE

The RF-550 uses the most modern receiver design concepts to provide near spurious free performance. A double conversion design employs a first intermediate frequency (IF) of 158.25 MHz with crystal filtering located near the input of the receiver. The second IF operates at 1.75 MHz, an optimum frequency for the design of delay compensated sideband filters. This selection of IF frequencies permits image and IF spurious responses to be suppressed better than 100 dB. All other spurious responses are held to better than 80 dB down.

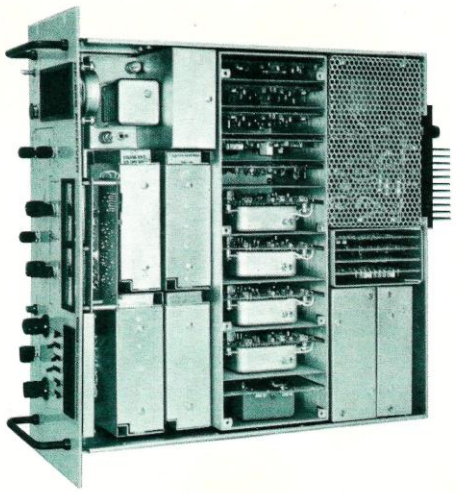
The front end design uses a low noise very wide dynamic range preamplifier followed by a balanced FET mixer. The basic receiver is supplied with an internal preselector consisting of eight half octave bandpass filters automatically switched at appropriate intervals through the 2 to 30 MHz range. The filters utilize a fifth order elliptic design. Rejection at one octave removed from band centers is 60 dB. A fifth order elliptic low pass filter (2 MHz cutoff) preceeds the amplifier in the 100 kHz to 2 MHz frequency range. This high degree of input filtering provides outstanding performance in most receiving situations.

Where the RF-550 will be used in duplex applications with nearby transmitters operating to within 5% of the received frequencies, the RF-551 Preselector is recommended. The externally mounted RF-551 is a four pole high Q bandpass filter which automatically tracks the RF-550 frequency.

Internally generated spurious signals are held to an equivalent input level of 0.5 uV or less through the extensive use of internal shielding and filtering.

REMOTE CONTROL

The RF-550 provides remote control capability for frequency, mode, bandwidth and AGC selection. A front panel toggle switch establishes the control point: LOCAL, FREQUENCY REMOTE only and FULL REMOTE. Logic interfaces are TLL compatible; analog voltages control the VFO and BFO. Full compatibility is maintained with the RF-130 Transmitter and the RF-551 Preselector.

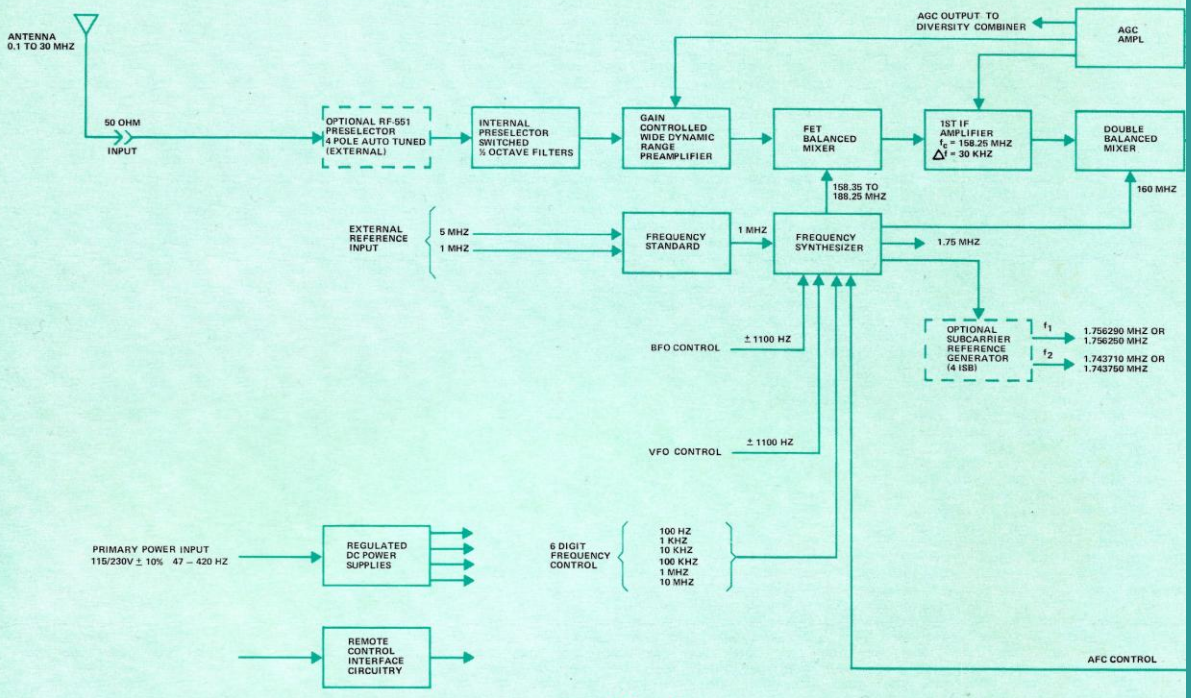


RELIABILITY AND MAINTENANCE

The RF-550 is a fully solid state design with all components substantially derated for long term dependable operation. Medium scale integrated (MSI) circuitry is used extensively in the receiver frequency synthesizer thereby enhancing reliability.

The basic design philosophy for the RF-550 established a modular plug-in concept for rapid maintenance by personnel with limited training. 95 percent of all circuitry is within plug-in assemblies. The standard receiver has 7 plug-in modules and 11 plug-in printed circuit cards. The synthesizer modules are directly interchangeable with the RF-130 transmitter modules thereby permitting common logistics support for both the RF-130 and the RF-550.

Receiver System



Specifications

Frequency Range 0.1 to 30 MHz, in synthesized 100 Hz increments plus VFO.

Frequency Display 6 digit electronic display.

Frequency Stability ± 1 part in 10^6 – standard (with TCXO).
± 1 in 10^8 – optional (with RF-560 high stability oven controlled oscillator). Capable of being driven from either a 1 MHz or 5 MHz external standard.

VFO Mode Selectable ON/OFF. Continuous tuning range ± 1100 Hz calibrated in 100 Hz increments.

BFO Mode Selectable ON/OFF. Continuous tuning range ± 1100 Hz calibrated in 100 Hz increments.

Phase Jitter Less than 3° rms for 10 ms averaging time.

Receive Modes CW (A1), AM (A3). USB (A3J or A3A), LSB and 2 channel ISB (A3B) are standard. Optional modes: 4 channel ISB (RF-562) or ± 7 kHz deviation FM (F3) (RF-568). Radio teletype (F1) and facsimile (F4) modes are available with an external demodulator.

Sensitivity

CW	0.15 uV Maximum	For 10 dB $\frac{S+N}{N}$	(NOTE: Sensitivity reduced below 1.5 MHz)
AM	1.5 uV Maximum		
USB, LSB, ISB	0.35 uV Maximum		

Noise Figure 13 dB maximum.

Intermodulation Distortion In band third order: – 40 dB or better for two equal 0.1V signals falling within 3 kHz sideband filter.
Out of band third order: –80 dB or better for two equal 5 mV signals falling at f_o +30 kHz and f_o + 60 kHz.
Out of band second order: –80 dB or better for two equal 5 mV signalls falling at f_o + 30 kHz and $2f_o$ + 30 kHz.

Cross Modulation –20 dB or better for a 0.1V 30% modulated interfering signal at f_o + 30 kHz (desired signal 0.01V or less).

Maximum Signal Input Receiver protected for inputs to 10V rms.

RF Input Impedance 50 ohm unbalanced (BNC jack).

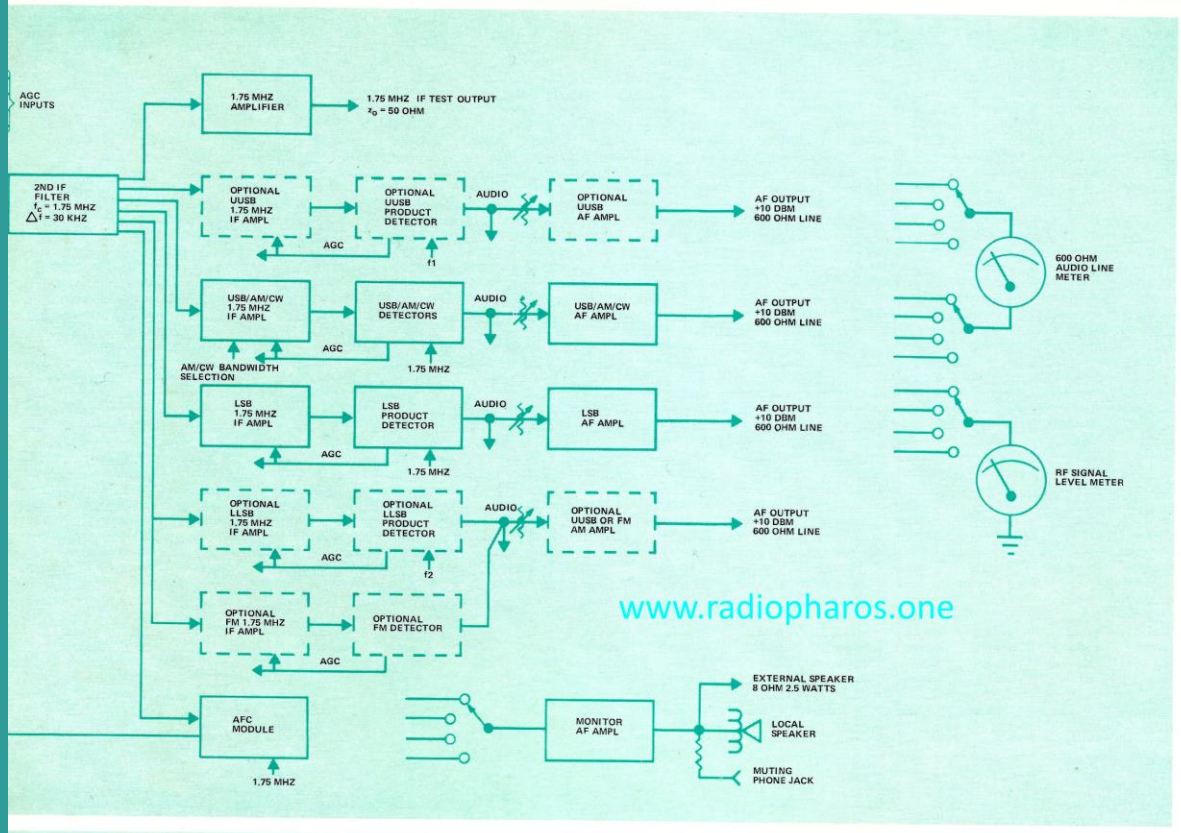
Automatic Frequency Control For Pilot Carrier Selectable ON/OFF.
Operates with reduced carrier levels of –6 to –26 dB (internally adjustable).
Automatic acquisition range: ± 50 Hz.
Manual acquisition and tracking range: ± 1100 Hz.
Lock error: 0 Hz (phase lock to carrier).
Coherent AGC selectable ON/OFF. Front panel indication of carrier lock.

Image And IF Feedthru Responses –100 dB.

Spurious Responses –80 dB.

RF Gain Control Manual control on front panel (operable in all modes, 125 dB range).
Three position front panel AGC Switch:
1) AGC slow – Attack 10 ms, decay 1 second.
2) AGC fast – Attack 10 ms, decay 0.1 second.
3) AGC OFF.

AF output held constant within 3 dB from 1 uV to 1.0V input signal level.



Audio Outputs For each sideband channel: +10 dBm driving 600 ohm balanced line at 1% distortion (transformer isolated). 600 ohm source impedance (26 dB return loss). Local or remote speaker 2.5 watts at 5% distortion 8 ohms. USB output used for AM and CW modes. 600 ohm local earphone jack; +10 dBm.

IF Filter Bandwidths

STANDARD

Mode	3 dB Bandwidth	3 dB Points
USB	3.2 kHz	+300 to +3500 Hz
LSB	3.2 kHz	−300 to −3500 Hz
AM/CW	0.5 kHz	± 250 Hz
	6.0 kHz	± 3000 Hz
	20.0 kHz	± 10,000 Hz

OPTIONAL

Mode	3 dB Bandwidth	3 dB Points
USB	5.7 kHz	+300 to +6000 Hz
LSB	5.7 kHz	−300 to −6000 Hz

Mode	3 dB Bandwidth	3 dB Points
RATT (850 Hz Shift)	1.2 kHz	+1400 to +2600 Hz
RATT (170 Hz Shift)	0.4 kHz	+1800 to +2200 Hz
	0.5 dB Bandwidth	0.5 dB Points
*UUSB (A2)	2.79 kHz	+3250 to +6040 Hz
*USB (A1)	2.79 kHz	+250 to +3040 Hz
*LSB (B1)	2.79 kHz	−250 to −3040 Hz
*LLSB (B2)	2.79 kHz	−3250 to −6040 Hz

*Filters are delay compensated to provide less than 500 usec differential time delay from 350 to 3040 Hz (referenced to baseband).

Metering RF Input Signal Level: 1 uV to 1V linear dB scale ± 3 dB calibration switchable to all sideband channels.
Audio Output Level: −6 to +14 dBm on 600 ohm output lines switchable to all sideband channels.

Diversity Provision AGC voltages with controlled characteristic available from each sideband channel for use in external frequency diversity combiner.
Single combined AGC voltage available for use in external space or polarization diversity combiner.

Remote Control Capability Three position front panel switch selects:
1) Local control
2) Remote control, synthesized frequency only (vernier can be remoted by internal wiring change).
3) Full remote control

Full remote control includes:
- synthesized frequency
- VFO ON/OFF plus analog voltage
- BFO ON/OFF plus analog voltage
- AGC speeds
- receiver modes
- AFC controls and indicators

Temperature −10 to +55°C operational −40 to +70°C storage.

Humidity 0 to 95%.

Size And Weight

Standard Rack Mount
width 19 inches (48.3 cm)
height 7 inches (17.8 cm)
depth 18.5 inches (47.0 cm)
weight 45 pounds (20.4 kg)

Desk Mount Case
width 19.5 inches (49.5 cm)
height 7.5 inches (19.1 cm)
depth 18.5 inches (47.0 cm)
weight 48 pounds (21.8 kg)

Power Requirements 115/230 VAC ± 10%, 47 to 420 Hz, 75 watts basic receiver, 90 watts with full options.

Note: Signal levels are given in terms of signal generator voltage delivered to a 50 ohm load. Thus in the terms used 1.0 uV is equivalent to −107 dBm available signal generator power.

Specifications subject to change without notice.

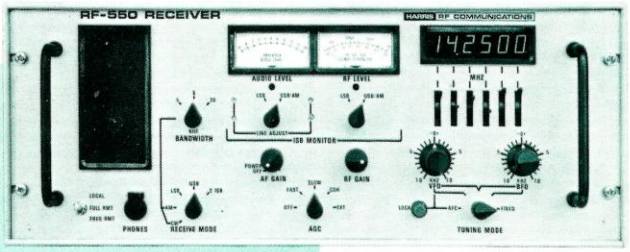
FEATURES

100 kHz TO 30 MHz
FULLY SYNTHESIZED
4-ISB CAPABILITY
AFC ON PILOT CARRIER
COHERENT AGC
REMOTE CONTROL
SOLID STATE RELIABILITY
MODULAR CONSTRUCTION
ULTRA LOW SPURIOUS

The RF-550 Receiver provides the highest level of performance for modern HF system requirements. Covering the 100 kHz to 30 MHz frequency range in synthesized 100 Hz increments, the RF-550 is expressly designed for reduced and suppressed carrier applications including reception of voice, data and facsimile signals. A unique automatic frequency control (AFC) system, provides for zero frequency error when operating with reduced carrier signals.

Other standard features of the RF-550 include remote control capability, variable bandwidth control, calibrated BFO and incremental VFO tuning. A precisely controlled AGC system provides accurate readout of signal level and the capability for diversity operation. Delay compensated filters for high speed data applications are available as an option.

The RF-550 Receiver is the ideal companion for the widely accepted RF-130 HF Transmitter. Synthesizer modules and sideband filters are common between the RF-550 and the RF-130, thereby simplifying field logistics and training.



FRONT PANEL INDICATORS

Frequency Display (6 digits to 100 Hz steps)
Audio Level Meter (–6 to +14 dBm, 600 ohm line)
RF Level Meter (1 uV to 1V and dB ref 1 uV)
Lock Indicator (AFC mode)
Loudspeaker (3" x 5" oval)
Earphone jack

FRONT PANEL CONTROLS

(*Indicates optional item.)

	REMOTE CAPABILITY
LOCAL/FREQUENCY REMOTE/FULL REMOTE	No
RECEIVE MODE (CW, AM, LSB, USB, 2 ISB, RATT*, 4 ISB* or FM*)	Yes
BANDWIDTH (0.5, 6, 20 kHz; used in CW and AM)	Yes
AF GAIN/POWER OFF	No
RF GAIN	No
AUDIO LEVEL (LLSB*, LSB, USB/AM, UUSB*) meter selector	No
RF LEVEL (LLSB*, LSB, USB/AM, UUSB*) meter selector	No
AGC (OFF, FAST, SLOW, COHERENT, EXTERNAL)	Yes
TUNING MODE (AFC, VFO, VFO/BFO, BFO, FIXED)	Yes
VFO (± 1.1 kHz)	Yes
BFO (± 1.1 kHz)	Yes
Frequency steps (6 digit control, 10 MHz to 100 Hz steps)	Yes

Interface Capability

The standard RF-550 Receiver provides the following interfaces.

RF-130 TRANSMITTER

Key line interface with appropriate muting for simplex and half duplex transceiver type operation.

RF-130 TRANSMITTER

Remote synthesized frequency control interfaces directly with RF-130 remote output. This permits simplex transceiver operation with RF-130 controlling frequency of the system.

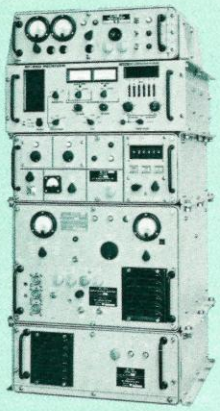
RF-551/552 PRESELECTOR

Remote BCD synthesized frequency output interfaces directly with remotely tuned RF-551. In this mode the RF-551 is slaved to the RF-550.

RF-550 RECEIVER

Will control frequency of a second RF-550 Receiver. Useful in diversity applications.

RF-550 Receiver
with RF-551 Preselector



RF-550 in "Stack" Configuration
with RF-130 Transmitter,
RF-131 Exciter and
RF-601A Antenna Coupler

Options and Accessories

RF-560 HIGH STABILITY FREQUENCY STANDARD OPTION

High stability 1 MHz frequency standard with proportional temperature control. Provides 1 part in 10^8 stability. Mounts internally in place of TCXO.

RF-561 DELAY COMPENSATED ISB FILTER OPTION

Provides delay compensated USB and LSB filters. Less than 500 usec differential time delay from 350 to 3040 Hz (referenced to baseband). Amplitude response within 0.5 dB from 250 to 3040 Hz.

RF-562 FOUR CHANNEL ISB OPTION

Adds four channel ISB capability to the basic RF-550 Receiver. Channel filters are delay compensated for high speed data applications. (Same baseband characteristics as RF-561 option).

RF-563 WIDEBAND ISB FILTER OPTION

Provides 5.7 kHz bandwidth USB and LSB filters. Amplitude response within 3 dB from 300 to 6000 Hz (referenced to baseband).

RF-564 850 HZ SHIFT RATT FILTER OPTION

Provides additional USB filter for optimum reception of 850 Hz shift radio teletype. Amplitude response within 3 dB from 1400 to 2600 Hz (referenced to baseband). Additional position included on mode switch.

RF-565 170 HZ SHIFT RATT FILTER OPTION

Provides additional USB filter for optimum reception of 170 Hz shift radio teletype. Amplitude response within 3 dB from 1800 to 2200 Hz (referenced to baseband). Additional position included on mode switch. Not available with RF-564 above.

RF-567 HIGH IMPEDANCE RF INPUT TRANSFORMER

Enhances reception with electrically short untuned antennas. Mounts on rear of receiver.

RF-568 FM DEMODULATOR OPTION

Provides narrowband FM mode of operation. Optimum demodulation of voice band signals with FM deviation up to ± 7 kHz. This option cannot be supplied when RF-561 4 ISB option is ordered.

RF-569 DESK TOP CASE

Enclosed case for mounting receiver in "Desk Top" applications. Dimensions 7.5 in. high x 19.5 in. wide x 18.5 in. deep.

RF-570 STACK MOUNTING BRACKETS

For use in standard stacking applications with RF-130 Transmitter.

RF-571 SLIDES FOR RACK MOUNT INSTALLATIONS:

Permits rapid maintenance access to receiver when rack mounted.

RF-572 INTERCONNECTION KIT FOR RF-130

Interconnects RF-550 to RF-130 Series transmitters. Provides for transceiver operation with frequency control of the RF-550 from the RF-130.

RF-573 INTERCONNECTION KIT FOR RF-551/552

Interconnects RF-550 to the remote controlled RF-551/552 preselector. Provides for automatic tuning of the RF-551/552 from RF-550 frequency information. Not required when RF-551 preselector is operated in manual tuned mode.

RF-551/552 PRESELECTOR

Four pole automatically tuned preselector/preamplifier with 2% 3 dB bandwidth covering 2 to 30 MHz. For use in critical duplex applications. External unit.

RF-518 HEADSET

High quality headset recommended for private listening in areas with audio noise levels.

RF-3300 SERIES RATT DEMODULATORS

Radio teletype (RATT) demodulator for conversion of audio FSK signals to teletype keying. Available in a wide series of shifts and keying interfaces. Mounts externally.

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