

1 BRIEF DESCRIPTION AND SPECIFICATION

1.1 BRIEF DESCRIPTION

The R551 Receiver is a general purpose SSB/DSB communications receiver providing continuous coverage over the MF/HF frequency range of 100kHz to 30MHz and operation down to 10kHz. The receiver meets Specification MPT1201: Performance Specification for a Radio Receiver for Double Sideband and Single Sideband reception of Radiotelegraphy and Radiotelephony for use on Merchant Ships over the range 100kHz to 30MHz.

Solid-state devices are used throughout to achieve compactness and ensure reliability, whilst the modular form of construction greatly facilitates servicing. Digital readout of frequency is incorporated.

A number of optional extras are available, which allow the receiver to be tailored to meet the requirements of individual systems.

The R551 is a double-conversion superhet providing reception on single sideband, DSB, MCW and CW, a choice of bandwidth being available on the latter three services.

Frequency setting is accomplished by a six-figure, in-line, digital decimal readout. The 10MHz, 1MHz and 100kHz positions are synthesised and are selected by rotary control knobs; the remaining 10kHz, 1kHz and 100Hz settings are presented on a three digit mechanical counter which controls a VFO. If required, full frequency synthesis, down to 100Hz steps, with or without 100Hz interpolation, may be realised by use of the ARU11B Synthesiser. When using the optional High Stability reference oscillator module provision is made for the connection of an external frequency standard if enhanced frequency stability is considered necessary.

A comprehensive AGC system is incorporated to give a large dynamic range with good linearity and a minimum of intermodulation products. Two interconnected AGC systems are employed; one in the RF amplifier, and one over four stages of IF amplification.

The front-end AGC system will operate in the presence of large unwanted signals which fall outside the IF but within the RF passband, thus minimising blocking and consequent cross-modulation. Circuit time constants are automatically selected by the Service Bandwidth kHz switch, but in conditions of rapid fading, a position of the AGC switch allows the decay times to be reduced to approximately $\frac{1}{8}$ th. An OFF setting of the AGC switch disables the AGC.

The sensitivity of the receiver is set by the Service Bandwidth kHz switch so that the AGC threshold comes into operation at a similar signal-to-noise ratio for all services.

An internal loudspeaker with associated On-Off switch is fitted and a 600 Ω line output; two front panel sockets also allow the use of headphones. If required, the

receiver will provide simultaneous outputs to the internal loudspeaker and 600 Ω line. When the headphone jacks are in use, the internal and external loudspeakers are automatically muted. The line level is set by a pre-set front panel Line Level control, in conjunction with a front panel Line/Signal meter. The maximum level for normal line operation is 10mW, but if necessary, an output of 1.25W into 600 Ω is available instead of the external loudspeaker output.

Signal strength is indicated on the Line/Signal meter, which can also be used in conjunction with the TEST/CAL position of the Service switch, to provide a function check of the receiver.

Front-end protection is afforded against inputs up to 30V, and even if this voltage is exceeded, an easily accessible fuse ensures that the receiver is not damaged.

When used with an associated transmitter, the R551 provides facilities for sidetone amplification, aerial muting and receiver desensitising.

An IF output of 1.4MHz is provided for test purposes.

A 115V or 230V $\pm 6\%$ AC supply is required to power the equipment, normal variations in supply voltage will not cause the performance of the equipment to be degraded. When emergency conditions so demand, it can be powered from a 24V DC supply with negative earth.

The R551 is designed to meet the British Ministry of Posts and Telecommunications Specification MPT1201 and the Performance Specification for a Reserve Receiver; it also meets the Climatic and Durability Class B clauses in Specification MPT1204, relevant clauses of British Defence Specification DEF 133, class L1, and the vibration test specified in Class L2 clauses 8.1B and 8.2B "Main Region".

The receiver is adaptable to many uses. The R551 version is intended for marine use and the R551C is mainly intended for general purpose communications, it may have the options of Lower Sideband and Independent Sideband reception by using adaptor ARU10A.

For A3A Lincompex use, Carrier Tuning Adaptor ARU16 may be fitted.

A complete receiving terminal, comprising R551 Receiver and ARU11B Synthesiser in one cabinet is the R554A. If Carrier Tuning Adaptor ARU16 is fitted the type number is R554B. The R554 meets the requirements of MPT1201 and the environmental clauses of MPT1204 applicable to Class B equipment.

1.2 SPECIFICATION

Frequency Range:

100kHz to 30MHz continuous coverage. Extends down to 10kHz with degraded performance.

Frequency Presentation:

Fully digital. Sub-divisions of 20Hz provided on final digit.

R551 Receiver

10MHz, 1MHz and 100kHz set on synthesiser dials. VFO completes tuning over 100kHz range with dual concentric coarse and fine controls giving a resolution of 10Hz.

Using ARU11B Synthesiser

Full frequency synthesis in 100Hz steps, with or without 100Hz interpolation.

Frequency Accuracy:

R551 Receiver

Frequency is set with a typical accuracy of 20Hz and always better than 100Hz.

Using ARU11B Synthesiser

The major limitation is that imposed by the accuracy of the receiver internal or external frequency reference.

Calibration:

VFO calibrated against signal derived from internal frequency reference (necessary only at infrequent intervals).

Frequency Stability:

R551 Receiver

After a 30min warm-up period, the frequency drift over any subsequent 15min period is less than 20Hz, with constant or $\pm 10\%$ supply changes. After a 30min warm-up period whilst the temperature is raised 7°C in a time of one hour, it is less than 20Hz. When vibrated at frequencies up to 12.5Hz with an excursion of 0.32cm, the frequency deviation due to vibration is less than ± 25 Hz.

Using ARU11B Synthesiser

The long term stability is normally ± 1 part in 10^6 , but using the optional high stability module will be within 5 parts in 10^6 .

Modes of Operation:

	R551			
A3J usb	A3dsb	A2 mcw	A1 cw	
	R551C			
A3J lsb	A3J usb	A3 dsb	A2 mcw	A1 cw
A3B using ARU10 Adaptor				

Selectivity:

Service	Nominal 6dB Bandwidths (Selectable)
A1 cw	Wide 8kHz
A2 mcw	Intermediate 3kHz
A3 dsb	Narrow 1kHz
A1 cw	Very Narrow 300Hz
A3J lsb	2.35kHz
	or 2.75kHz
A3J usb	or 5.5kHz

Noise Factor:

Typically 8dB, not worse than 10dB above 4MHz

Sensitivity:

Standard audio output is obtained, using the appropriate antenna, with the emf inputs indicated below:

(a) A3J lsb and A3J usb:

For frequencies between 4 and 30MHz
2µV for 20dB SINAD

(b) A3 dsb and A1 cw:

For A3 dsb, a type A2 test signal is modulated 30% at 1kHz when the bandwidth is WIDE, or 30% at 400Hz, when the bandwidth is INTERMEDIATE

Frequency	Bandwidth	SINAD	Input for A1	Input for A2
100 to 160kHz	Narrow	10dB	4µV	—
160 to 525kHz	Narrow	10dB	5µV	—
160 to 525kHz	Intermediate	10dB	—	22µV
525 to 1605kHz	Intermediate	10dB	—	20µV
1605 to 4000kHz	Wide	20dB	—	20µV
4.0 to 30MHz	Wide	20dB	—	10µV
4.0 to 30MHz	Narrow	10dB	0.35µV	—

Cross Modulation:

The cross modulation level produced by an unwanted signal of 300mV in the presence of a wanted signal of 1mV is better than 30dB below the wanted output.

Intermodulation:

With a wanted signal of 30dB above 1µV, the unwanted output due to intermodulation will be less than the wanted output, when those unwanted levels are as below:

for frequencies 100 to 525kHz the unwanted levels are 100dB above 1µV

for frequencies 525 to 1605kHz the unwanted levels are 90dB above 1µV

for frequencies 1.6 to 30MHz the unwanted levels are 80dB above 1µV

Blocking:

The output resulting from an A2 wanted signal of 1mV will not be reduced by more than 3dB in the presence of an unwanted signal of 6V.

Spurious Responses:

(not including image or intermediate frequencies)

All spuriously received signals are at least 70dB below wanted signal for tune frequencies above 1.6MHz and at least 80dB for tune frequencies below 1.6MHz.

Aerial Impedance:

Below 4MHz: 10Ω in series with 200 to 700pF
Above 4MHz: 50Ω unbalanced

Aerial Protection:

Withstands aerial emf of up to 30V

A fuse affords protection against damage by input emf in excess of 30V.

AGC:

2dB change in output for 100dB change in input, with respect to AGC threshold.

AGC Time-Constants:

DSB—attack 100mS, decay 1S

Other Services—attack 3mS, decay 10S

A switch (FAST position) reduces decay times to approximately one-eighth of above.

RF Gain Control Range:

At least 120dB

IF Output:

100mV across 50Ω at 1.4MHz (AGC ON)

AF Outputs:

(a) +10dBm into a 600Ω load, with separate Set Level control

(b) Two outputs, each 2mW into 600Ω headphones via front panel jacks or to headset outlets

also either

(c) 0.5W into internal 10Ω loudspeaker, with

(d) 1.5W into external 3Ω load.

OR

(e) 0.5W into internal 10Ω loudspeaker, with

(f) 1.25W into an external 600Ω load.

BFO:

Variable ±3kHz

Overall AF Distortion:

Less than 2%

AM Fidelity (8kHz bandwidth):

AF output variations are less than 5dB for modulation frequencies between 300 and 3000Hz

Radiation:

Not more than 20μV across 50Ω at the aerial input socket

IF Rejection:

38MHz (1st IF): better than 80dB

1.4MHz (2nd IF): better than 100dB

Image Rejection:

Better than 90dB and 80dB for 1st and 2nd conversion images respectively

Front Panel Meter:

Used for:

(a) Signal strength indication

(b) Line Level indication

(c) Circuit check indication

(d) Calibrate indication.

AC Power Supply:

106 to 124, 204 to 255V

Damage is not caused by 1mS transients of 100% over-voltage or by a sustained short circuit on the HT line.

DC Power Supply:

24V DC negative earth standard. The receiver tolerates voltage variations of ±10% without relaxation of the specification. An increase in voltage of 25% or reversal of supply will not cause damage to the equipment.

Power Consumption:

40W maximum

Operating Temperature:

−15°C to +55°C

Storage Temperature:

−40°C to +70°C

Climatic and Durability Standard:

MPT1204 for Class B equipment

DEF133 Class L1

Overall Dimensions and Weight (Without Cabinet)

height	width	depth	weight
13cm (5¼in)	48cm (19in)	49cm (19¼in)	17kg (38lb)