JRC

DSP RECEIVER
NRD-545

Enjoy Clear Digital Sound !

JRC Japan Radio Co., Ltd.

Clear, Distortion-Free Sound Reproduced

The quality of radio reception, especially in the shortwave bands, is greatly affected by the performance of the receiver, because of the high density of the shortwave radio spectrum and its wide dynamic range (of small to large signals). The receiver's sensitivity (capacity of receiving small signals) is constricted by the noise from the space or the atmosphere, and by the internal noise generated by the receiver itself, while the capacity of handling large signals is affected by intermodulation between strong radio signals.

If it is required to reject intermodulation distortion over a wide dynamic range, then digital signal processing (DSP) achieves a remarkable advantage.
Signal quantization (conversion of analog signals to digital quantities) is performed in a completely linear domain over the entire range, thus never generating any intermodulation distortion.

The NRD-545 DSP Receiver is loaded with a 40-bit extended floating point DSP IC (digital signal processor IC), a ΔΣ-type 18-bit over-sampling A/D converter, and a 16-bit D/A converter. The DSP IC performs signal processing in all the circuits after the intermediate frequency (IF) stage. The functions of 13 types of circuits after the IF stage, which have previously been configured as analog circuits, are now handled by the DSP IC.

The digital IF filter, one of the DSP features, provides a sharper attenuation gradient and frequency characteristic than a crystal filter, thus allowing continuous bandwidth adjustment. All traditional crystal filters and mechanical filters that have previously determined the selectivity characteristics of receivers are eliminated from the new DSP receiver.

In addition to JRC's recognized receiver front end, complete digital signal processing in all the circuits after the IF stage has been realized. Thus, the new-generation NRD-545 receiver has come into the world.

Digital signal processing uses an algebraic operation method for signal detection, generation, inference, processing, or transmission. Compared to analog signal processing circuits, digital signal processors are more advantageous: They only require less precise components; they are robust against drift and interference; they are easier to integrate with high precision; and they offer greater flexibility with software processing.

The DSP IC consists of a multiplier, an adder-subtractor, and a memory (shift register). The digital signal processing algorithm is based on repetition of operations such as data readout from the memory, multiplication, addition and subtraction.

Digital Signal Processing by One-Chip DSP

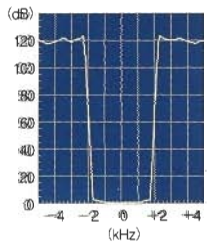
DSP All-Mode Detection
The DSP IC performs signal detection in all the modes including LSB, USB, CW, RTTY, FM, AM and ECSS (Exalted Carrier Selectable Sideband).

DSP Digital IF Filter
Superior selectivity performance is achieved by a simultaneous Chebyshev type digital IF filter with an IIR (infinite impulse response) configuration. Pass bandwidth is continuously adjustable in a range of 10Hz to 9.99kHz in 10Hz steps (BWC). Default values can also be set for each mode in NARROW, INTERmediate, and WIDE positions (except for AMS, FM and WFM modes).

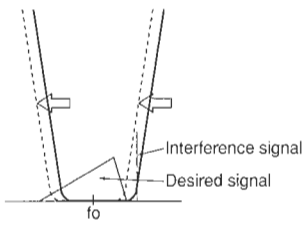

One-chip DSP

DSP Pass-Band Shift (PBS)
Radio interference is pushed out of the band by shifting the center frequency of the digital IF filter upward or downward in the variable range of within ±2.3kHz (in 50Hz steps).

●Digital filter simulation curve



●PBS concept



----- Band shifted by PBS

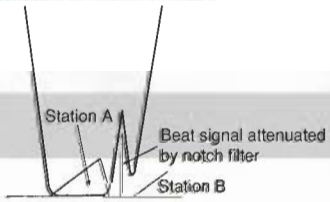
DSP Noise Reduction (NR)
Received signals become audible, emerging from mixed noise, because the spectrum of the periodic signals is enhanced while random signals such as noise are attenuated. Signal processing is adjustable in 256 steps, allowing the most audible conditions to be set. The NR feature is also very effective for such noise which the previous noise blanker has not been able to handle.

DSP Beat Canceller (BC)
Completely periodic signals such as beat sounds are exalted and cancelled. However, voice signals are not processed as periodic signals in this BC, but processed to be free from distortion. Signal processing can be set in 256 steps to achieve the most effective condition. The BC is also effective for multiple beats.

DSP Noise Blanker (NB)
Like the previous noise blanker, this NB detects noise amplitudes and removes noise depending on the amplitude level on the time axis. NB1 (narrow blanking width) and NB2 (wide blanking width) can be switched over, and the NB detection level is adjustable.

DSP Notch Filter (NOTCH)
Beat sounds are attenuated (at 40dB or more) using the steep attenuation characteristic of the IIR notch filter. Despite its steep characteristic, beat sounds are digitally processed and stably attenuated when once the NOTCH is preset. It is adjustable within ±2.5kHz in 10Hz steps. With the notch tracking set to ON, the notch filter follows in the range of ±10kHz even when the tuning dial is rotated.

●Notch filter characteristic



DSP AGC
Digital AGC is applied to all modes except in the WFM mode. An AGC loop is not only configured inside the DSP, but AGC is also applied to the primary IF amplifier via a D/A converter. Although the discharge time constant is fixed in the FM, WFM, AM and AMS modes, AGC is continuously adjustable between 0.04sec. and 5.1sec. in 20 msec. steps in the other modes.

DSP BFO
The beat frequency oscillator (BFO) generates the BFO signals to demodulate the received signals in the LSB, USB,CW and RTTY modes.

DSP RF Gain
The information transferred to the RF GAIN control via the A/D converter is entered into the DSP to adjust the gain inside the DSP and the gain of the primary IF amplifier.

DSP Squelch (SQ)
The squelch function is operated in all the modes. If an input signal is small, noise squelch is activated, while signal level squelch is operated as the input signal becomes larger.

DSP Tone Control (TONE)
The sound quality of the audio output can be continuously adjusted in a range of the low bandwidth of 1kHz or less to the high bandwidth of 10kHz (except in the RTTY and WFM modes).

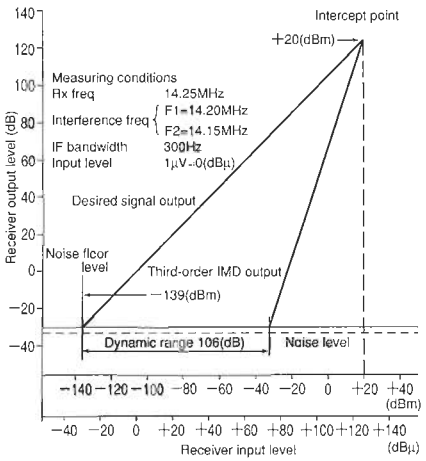
DSP S-Meter
The signal level is determined in reference to the input signal to the DSP, and the level is converted into an antenna input level, which activates the S-meter.

By Digital Signal Processing

High Sensitivity & Wide Dynamic Range

A wide dynamic range and improved sensitivity is achieved by four junction type FETs with low noise and superior cross modulation characteristic which are used each in the first-stage RF amplifier and the first mixer. The RF amplifier employs a high power gain circuit in which 4 FETs are interconnected in parallel in order to improve the receiving sensitivity. For the first mixer, a double-balanced mixer with 4 FETs in a quadruple connection is used in order to reduce odd-order intermodulation distortion (IMD).

●Dynamic range

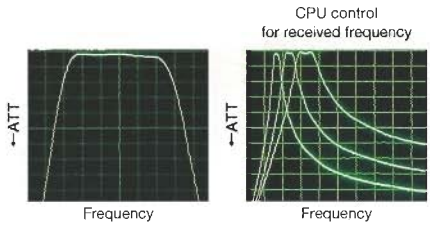


High-Speed DDS IC

A one-chip DDS (direct digital synthesizer) and a PLL (phase-locked loop) circuit are combined to substantially improve synthesizer performance. High-speed frequency switching in 1Hz steps which has been difficult only with the PLL, and a high C/N (carrier to noise) ratio and simplified entire circuit configuration are achieved. For frequency control in 1Hz steps, tuning operation can be made similarly to an analog-type VFO.

Variable Tuning for Excellent Reception

A variable tuning system (electronic variable tuning by a capacitor diode) is employed in the front-end double tuning circuit. Continuous adjustment of the center frequency of the double tuning circuit is made by a CPU depending on the received frequency. This enables unwanted radio waves to be drastically attenuated, compared with the wide-band BPF having a fixed bandwidth. As a result, multi-signal characteristics are significantly improved, ensuring enhanced receiving performance.



●Usual BPF curve ●Variable tuning

RTTY Demodulator Included

As an RTTY demodulation circuit is incorporated, demodulation is available in accordance with ITU-T No.2 codes for 170, 425 and 850Hz shifting widths at 37 to 75 baud rates. Demodulated output can be indicated on the display of a computer via RS-232C interface.

ECSS (Exalted Carrier Selectable Sideband)

The ECSS mode reduces signal distortion due to fading and beat interference from adjacent broadcast stations. This feature enables the receiver to selectively receive either USB or LSB which is suffering interference, ensuring clear reception with less degraded sound quality. To reject distortion due to fading, the signal synchronized with the carrier of the receiving signal is generated for signal detection.

※Fading is a phenomenon that sound becomes large or small, causing clear sound reception to be prevented in shortwave broadcasting. This is a bottleneck in shortwave reception.

※In AM broadcasting, the DSB (double sideband) system is adopted in which the modulation signal is transmitted on both USB and LSB. In many cases, however, beat interference due to adjacent stations appears either USB or LSB.

Multifunctional, Large Color LCD

The multifunctional LCD presents a digital bar-graph meter which can be seen in an analog fashion. Various indications such as all-digit frequency (down to the 10-Hz digit), memory channel, mode and bandwidth are also presented on the large color LCD.

[Actual Size]

OPERATING PANEL AND DISPLAY

1. ENT/kHz switch
2. MHz switch
3. CLEAR switch
4. Pass Band Shift control
5. TONE control
6. FINE control
7. AF GAIN control
8. AGC Time switch
9. Bandwidth Control switch
10. Channel Select switch
11. Up switch
12. Channel switch
13. SCAN switch
14. STEP switch
15. LOCK switch
16. Main tuning control
17. Variable torque control
18. Down switch
19. Frequency switch
20. SWEEP switch
21. RUN switch
22. ECSS switch
23. WIDE switch
24. INTER switch
25. NARROW switch
26. AGC switch
27. NOTCH control
28. RF GAIN control
29. NOTCH switch
30. Noise Blanker LEVEL control
31. Squelch LEVEL control
32. Noise Blanker switch
33. RECORD jack
34. POWER switch
35. PHONES jack
36. ATT switch
37. FM/WFM switch
38. AM/AMS switch
39. USB/LSB switch
40. CW/RTTY switch
41. DIMMER switch
42. CLOCK switch
43. Noise Reduction/Beat Canceller switch
44. LCD Display
45. Ten-key pad
46. Function switch

Remote Control by Personal Computer

Remote Control from a personal computer is available. All operations including receiving frequency setting can be remotely controlled by command from a personal computer. The data such as the receiver's setting conditions and S-meter values are also read out on the display screen.
Computer control software to be run on Windows 95 is available only for reference. This software includes display of RTTY signals on a computer screen, and display of panoramic reception (radio wave travelling in the air to be seen at a glance).

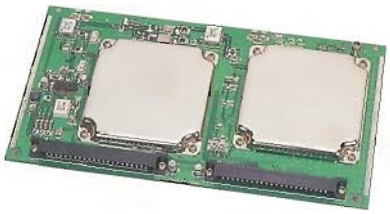
※This feature is just an appendix. So, JRC will not take any responsibility against software failure and JRC may not take inquiry for PC operation.

Large Memory Capacity of 1,000 Channels

The receiver incorporates a memory of 1,000 channels with lithium battery backup. Each channel can store a receiving frequency, mode, bandwidth, AGC, ATT and time of timer on/off (channel 0 to 19).

Wide-Band Converter Unit (Option)

The CHE-199 converter unit is designed to receive a wide band of 30MHz to 2,000MHz in order to meet the need of advanced users to get various types of radio communication information. This optional board enables receiving of aeronautical radio, FM broadcast, TV broadcast and other radio waves.



High-Stability Crystal Oscillator (Option)

All the internal synthesizers are controlled by a standard frequency oscillator. The frequency stability can be enhanced to ±0.5 ppm by the use of the CGD-197 TCXO (temperature compensated x'tal oscillator) which is optionally available.

Plug-In PC Boards on Mother Board

All the PC boards installed in the receiver are plug-in type. All the units are interconnected on the mother board, eliminating wiring, and ensuring enhanced reliability and serviceability.

Refined Design and Superior Functionality

The operation panel is designed to minimize controls and switches, and to realize refined design and superior functionality.

By Digital Signal Processing

Versatile Accessory Functions

■Scan
Designated memory channels can be scanned. The scanning time is user-defined.

■Sweep
Designated frequencies can be swept. The sweep time is user-defined.

■Automatic Scan/Sweep Stop
When squelch is activated during scan/sweep operation, the operation automatically stops and the frequency is received for a certain time duration.

■Mute Control
The AF output of the receiver can be muted according to external grounding information.

■Clock/Timer
The receiver's power supply is automatically set to on/off by setting the timer. Relay contact output can also be turned on/off.

■Sleep Timer
The sleep timer is provided to automatically turn the power off during bed time (180 minutes max).

■Tuning/Torque Dial
The torque of the tuning dial can be freely adjusted.

■RTTY Fine Tuning
The demodulating filter to receive RTTY signals can be finely adjusted.

- ■Dimmer Control
- ■RF Attenuator
- ■Direct Entry of Frequencies from Ten-Key Pad
- ■Built-In Speaker
- ■Tuning Dial Lock
- ■Up/Down Switch
- ■Record Output
- ■User-Defined Function Modification
- ■Others

Options

■CGD-197
Temperature Compensated X'tal Oscillator (TCXO)

■CHE-199
Wide-Band Converter Unit

■6ZCJD00350
RS-232C Cable

■NVA-319
External Speaker
Impedance: 8 ohms
Max.input: 3W
Dimensions: 180W×130H×280D mm
Weight: Approx. 3kg

■ST-3
Headphones
Weight: Approx. 300g

Specifications

Frequency range: 0.1 to 29.999999MHz
with option board (CHE-199) installed
NRD-545G: 100kHz to 1999.999MHz
NRD-545U: 100kHz to 823.900MHz
849.100MHz to 868.900MHz
894.100MHz to 1849.900MHz
1910.100MHz to 1929.900MHz
1990.100MHz to 1999.999MHz

Type of reception: USB、LSB、CW、RTTY、AM、FM
WFM(with option board installed)

Frequency stability: ±10ppm or less for 5min. to 60min. after tuning the power on, thereafter ±2 ppm or less per hour, and ±0.5 ppm or less (with option TCXO installed)

Adjustable Minimum tuning step: 1Hz
(10Hz, 100Hz, 1kHz, 5kHz, 6.25kHz, 9kHz, 10kHz, 12.5kHz, 20kHz, 25kHz, 30kHz, 50kHz or 100kHz steps available)

Sensitivity

	USB,LSB,CW,RTTY	AM	FM	WFM
0.1~0.499999 MHz	14dBμ(5μV)	24dBμ(15.8μV)	———	———
0.5~1.599999 MHz	6dBμ(2μV)	16dBμ(6.3μV)	———	———
1.6~29.999999 MHz	−10dBμ(0.32μV)	6dBμ(2μV)	−6dBμ(0.5μV)	———
30~1000 MHz	———	10dBμ(3.2μV)	−2dBμ(0.8μV)	6dBμ(2μV)
1260~1300 MHz	———	10dBμ(3.2μV)	−2dBμ(0.8μV)	———

Bandwidth(USB/LSB/CW/RTTY/AM) 2.4kHz
S/N:10dB Modulation (AM):400Hz,30% (at AM measurement)
12dB SINAD (FM/WFM)
*Fitted with option board for 30MHz or more.

Selectivity

	Bandwidth	6dB	60dB
WIDE	4.5kHz	4.5kHz or more	8kHz or less
INTER	2.4kHz	2.4kHz or more	5kHz or less
NARROW	1kHz	1.0kHz or more	4kHz or less
FM	10kHz	10kHz or more	———

Left bandwidths in WIDE, INTER, and NARROW are examples, but variable between 0.01 to 9.99kHz (except for AMS, FM and WFM).

Frequency memory: 1000 channels
(Frequency, mode, bandwidth, ATT, AGC, and tuning step)

Receiving system: Triple superheterodyne
1st IF 70.455MHz
2nd IF 455kHz
3rd IF 20.22kHz

Dynamic range: 106dB (300Hz IF bandwidth)

Image rejection: 70dB or more

Spurious response: 60dB or more

IF rejection: 70dB or more

PBS variable range: ±2.3kHz (in 50Hz steps)

Notch filter attenuation: 40dB or more
Notch variable range ±2.5kHz (in 10Hz steps)
Notch tracking range ±10kHz

Antenna impedance: 50 ohms (Lo-Z terminal)
600 ohms (Hi-Z terminal)

Antenna input attenuator: Approx. 20dB

AGC characteristics: The AF output varies 10dB or less for the antenna input of 3 μV to 100mV
Release time:40msec. to 5.1sec. (20msec. steps)

AF output:
Speaker: 1W or more (4 ohm load and 10% distortion)
Line/recorder: 1mW or more (600 ohm load, 10% distortion)

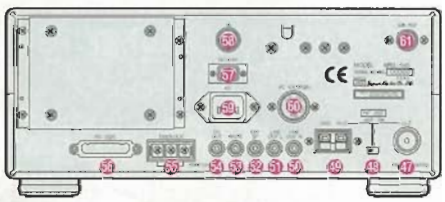
RS-232C interface: 4800 baud (Character format:1start bit, 8 data bits, non-parity,1 stop bit)

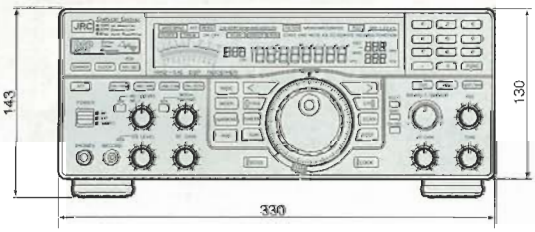
Power supply: 100/120/220/240 VAC ±10%, 40VA or less
12 to 16 VDC (13.8VDC standard), 30W or less

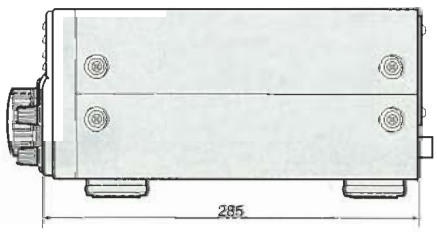
Dimensions: 330W×130(143)H×285(327)Dmm
( ):max. dimensions with projections

Weight: Approx. 7.5kg

Dimensions







47 Antenna connector (low impedance)
48 Antenna switch
49 Antenna terminal (high impedance)
50 Line output (R) jack
51 Line output (L) jack
52 External speaker jack
53 MUTE terminal
54 DC output jack
55 Timer output terminal
56 RS-232C connector
57 DC power connector
58 Fuse holder
59 AC power connector
60 AC voltage selector
61 Wide band antenna connector

Specifications and appearance may be subject to change without notice.

For further information, contact:

JRC Japan Radio Co., Ltd.
Since 1915
JRC Homepage http://www.jrc.co.jp/
Main Office: Akasaka Twin Tower(Main), 17-22,
Akasaka 2-chome, Minato-ku, Tokyo 107-8432, JAPAN
Telephone: Tokyo(03)3584-8836, 8844
Facsimile: Tokyo(03)3584-8878, 8879
Telex: 2425420 JRCTOK J Cable: JAPANRADIO TOKYO
Overseas Branches : New York, Seattle, London
Liaison Offices : Kaohsiung, Manila, Bangkok, Singapore, Jakarta, New Delhi, Rotterdam, Piraeus, Las Palmas, Rio de Janeiro

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