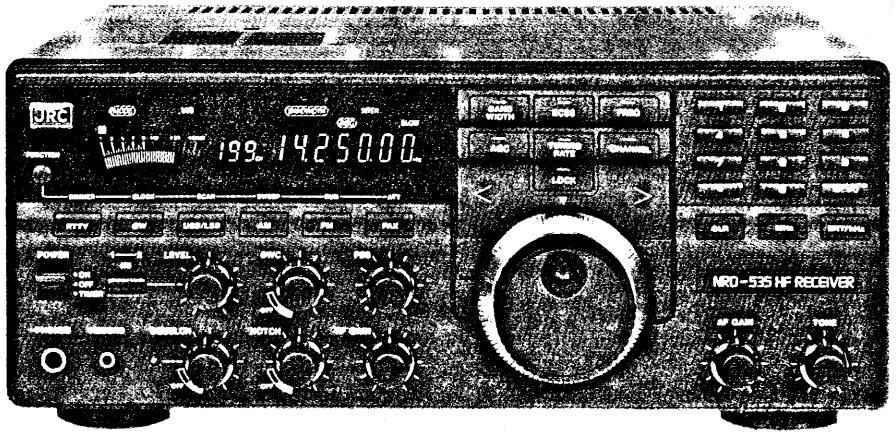
THE JAPANESE RADIO CORPORATION NRD-535

Bob Evans



INTRODUCTION

Japan Radio Company's NRD-535D communications receiver was first introduced to the North American marketplace in April of 1991. Despite its level of sophistication and quality, there were some initial design flaws with the original model. AM mode bandwidth was too wide, the AGC suffered from overshoot, the variable bandwidth control was not available for some of the bandwidths and the owner's manual was poorly written.

Fortunately for the radio enthusiast, JRC, through its New York office, heeded the criticisms of the shortwave community. The net result is that today's model comes with a better AM filter, an all-mode (FM excepted) variable bandwidth control operable in all modes and a completely rewritten owner's manual. Design and preliminary testing are currently underway to correct the AGC problem.

CONFIGURATION

The NRD-535 is produced in two configurations, standard and deluxe. The standard model is manufactured primarily for the European marketplace, where price was an obvious consideration.

In North America, the receiver is currently only available as the deluxe model, the NRD-535D. It includes the basic NRD-535 with the addition of the narrow CFL-233 1 kHz bandwidth crystal IF filter, the CMF-78 ECSS (Exalted Carrier Selectable Sideband) detector board and the CFL-243W BWC (variable Band Width Control) unit.

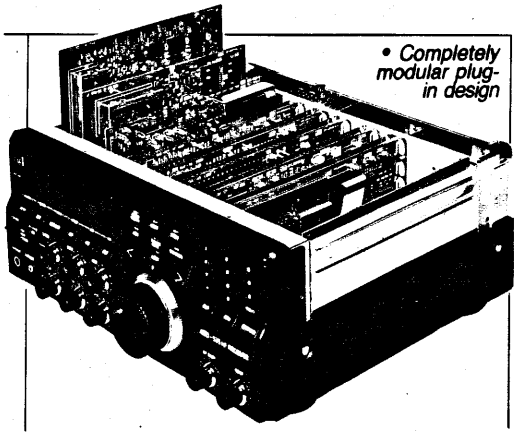
For the purposes of this article, the new "improved" NRD-535D will be reviewed.

ELECTRONICS

The NRD-535D utilizes a 35 MHz low-pass filter followed by a diode-switched, seven-band tuner that feeds the first mixer via a second 35 MHz low-pass filter and RF amplifier. Employing triple conversion, the first IF frequency of 70.445 MHz is amplified and passed to the second mixer to produce a second IF frequency of 455 kHz. Main IF filtering and signal processing take place here. With the exception of narrow FM, a third IF frequency of 98 kHz is employed before demodulation. The AGC control voltage is generated here. Advanced synthesizer techniques are utilized to supply the local oscillator feeds. Discreet components are used in preference to integrated circuits to achieve better performance, especially where critical RF signal processing circuits are concerned.

The receiver uses a variable tuning system (electronic tuning by capacitor diodes) in the front end of its double tuning circuit. The center frequency of the double tuning circuit is continuously controlled by a microprocessor to vary with the received frequencies. A phase-locked ECSS system provides selectable-sideband AM reception. Maximum IF flexibility is achieved through the Variable Bandwidth Control circuit (now available for all reception modes except FM).

CONSTRUCTION



The NRD-535D is manufactured with a complete modular design concept. All the printed circuit boards employ surface-mounted components and are plugged into the motherboard. When initially shipped, a protective foam strip holds the modular unit boards in place. The user must unscrew the top cover and remove the foam strip, otherwise the potential for overheating and fire is present.

The NRD-535D is an extremely cool running radio, thus ensuring long life for its electronic components.

The metal cabinet, with its stylish black sloping front, is a composite of the military ruggedness of the NRD-515 and the sleek plastic-looking shell of the NRD-525. All things considered, this is an elegant-looking radio.

The numeric keypad features large solid buttons with a better response and feel than the NRD-525 or the Drake R-8. Weighing in at 20 pounds, the NRD-535D is a first class contender in its category.

POWER SUPPLY

The receiver operates from 100/120, 220/240 VAC, 50/60 Hz, 35VA or less or 12 to 16 DC (13.8VD nominal) 25W or less. The supplied DC cable, complete with fuse, permits in-the-field operation from your car battery or other portable power source. Voltage settings are selectable from a dial incorporated within the main fuse housing.

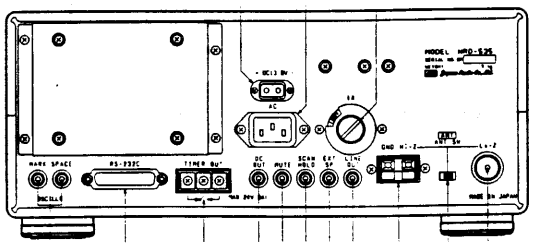
Two DC outputs are provided on the rear of the set. The first DC output jack (RCA phono plug type) provides 10.8VDC at approximately 30MA maximum. It is coupled to the receiver's main on-off power switch. (The writer uses it as a power source for his Datong FL-3 audio filter, which is conveniently turned on or off with the receiver.) The second is a timer-out (three-screw position) terminal that may be used in conjunction with the radio's clock/timer for relay control of an external tape recorder. Contact capacity is rated at 24VDC, 3A.

ANTENNA TERMINALS

Two antenna terminals and a separate grounding connector are provided. The LoZ (50 Ω Low Impedance) connector uses a PL-259 coaxial connector. The HiZ (300 to 600 Ω High Impedance) connector permits the direct connection of the antenna wire to the set. An antenna switch on the back of the receiver selects the appropriate antenna.

Front end circuitry employs varactor-tuned bypass filters which act as tracking preselectors to improve front end selectivity and help reduce antenna mismatch impedance effects.

EXTERNAL CONNECTORS



External connectors (RCA phono plug jacks) located on the rear of the set are used for Line Out (fixed audio level), Scan Hold (temporarily pauses SCAN/SWEEP operations when grounded), External Speaker (4 Ω), Mute (disables receiver when used in conjunction with a transmitter/transceiver) and DC Out (discussed elsewhere). Mark and Space jacks permit an oscilloscope hook-up for RTTY work.

On the front panel, the headphone jack (standard quarter inch phone plug) mutes the internal or external speaker when headphones are used. Stereo headphones may be used without modification. The Record jack also provides a fixed level output (600 Ω impedance) for a tape recorder. Since the Record and Line Out jacks appear to be connected in parallel, some NRD-535D owners have experienced unwanted interaction (in the form of howls) between external audio processing and tape recording devices.

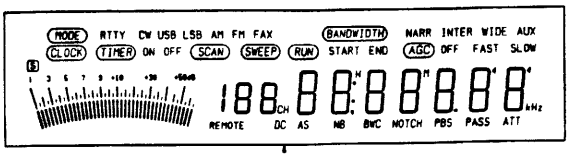
FREQUENCY RANGE/OPERATING MODES

The operating range provides continuous coverage between 100 Hz and 30 MHz. The NRD-535D operates in the following user-selectable modes: AM, USB, LSB, CW, RTTY, FAX and FM narrow. In addition, the ECSS unit supports AM USB and AM LSB. All modes are readily selectable from individual push buttons on the front of the receiver.

The reason for the inclusion of separate CW, SSB, RTTY and FAX modes is not immediately apparent, but directly affects the frequency range of the demodulated audio signal. For SSB reception, the displayed (carrier) frequency is required to produce a zero beat. For FAX reception, the displayed frequency needs to create a 1900 Hz audio tone. When resolving RTTY, a 2100 Hz audio tone is needed. CW requires a 850 Hz tone. The production of these different tones with the same

displayed frequency is achieved by automatic adjustment of the local oscillator. The primary advantage of this method is that the received signal is always kept in the center of the IF passband, allowing the user to make the best use of selectable filters.

DISPLAY



When turning the set on for the first time, you cannot help being impressed with the front panel display. Compared to the NRD-525, the frequency display is "billboard" in size and can be read from up to ten feet away. Lighted indicators easily identify when the PBS, BWC, Notch, Squelch and Noise Blanker circuits are engaged.

A three-position dimmer setting is selectable (but there is no display "off" setting).

Frequency display is user-selectable to two or one decimal positions, allowing the suppression of the 10 Hz digit. For SSB operations, the user may elect to display the shifted (sideband) or the center (carrier) frequency.

The S-meter features a curved 40 segment digital fluorescent bar indicator with measurements in S units. Signal strength may be displayed as a solid moving bar or a moving single line (similar to an analog unit). The NRD-535D's S-meter is a vast improvement over that of the NRD-525 and does not exhibit the spastic movements of its predecessor. If anything, it tends to be under-sensitive. (A signal under S5 [3 microvolts] doesn't record at all.)

TUNING

The second feature you're bound to like, after the front panel fluorescent display, is the feel of the tuning dial. Located just to the right of center is an excellent large tuning knob with a rubber rim, a fixed (non-rotating) tuning dimple and just enough mass for some fly-wheel effect when you turn the knob.

The frequency synthesizer employs a Direct Digital Synthesis (DDS) chip that permits digital tuning in 1 Hz steps, even though the frequency display resolves only to the nearest 10 Hz. The manual tuning knob tunes in user-selected, 1 Hz, 10 Hz or 100 Hz steps. In addition the user can select either 250 or 1000 steps per revolution of the main tuning knob. The UP and DOWN buttons shift frequencies in 10 Hz, 100 Hz or 1000 Hz steps.

Over time and constant usage many NRD-535D owners (the writer included) have found that the tuning knob has loosened and is just too sensitive (one NRD-535D reviewer stated that a light breeze in his shack was enough to spin the dial). The degree to which the knob had loosened became immediately apparent when operating side-by-side with a newer modified NRD-535D supplied by JRC New York for this review. Some owners have resorted to using the dial/controls lock feature when not tuning, others like the writer, have placed a felt washer at the back of the dial face and the tuning shaft. A set screw to adjust tension would be a welcome addition.

MEMORY CHANNELS

The NRD-535D supports 200 user-programmable memory channels (0 to 199) of C-MOS RAM. Memory contents are backed up through an internal lithium battery (5 year life rating).

In addition to storing frequency, each channel also stores mode, AGC time constant, IF filter bandwidth and ATT on or off status. With the optional CMH-530 RTTY unit installed, the baud rate, shift width and polarity settings may be stored for RTTY mode.

Frequencies may be entered in kHz or MHz. Memory channels may be programmed in random order. They can be accessed through direct channel number entry via the numeric keypad, through the UP or DOWN buttons, or by activating the memory channel SCAN feature.

Memory channel entry has been reduced from the major engineering exercise required on some receivers to a more simple procedure for this set. Unused channels can be cleared and set to blank.

All 200 memory channels may be tuned as VFO's (i.e. frequency, bandwidth, etc. can be changed without dumping the original memory settings). Unfortunately, when switching from a VFO frequency (one entered through the keypad or dial which is not stored in memory) to an occupied memory channel, the VFO frequency is lost unless a jumper resistor (RJ5) on the CPU board is cut. (This will not void your warranty.)

Many NRD-535D owners would like to have seen JRC include the traditional dual VFO's whose contents are generally more volatile and need not be saved when the set is switched off. In JRC's defense, they have provided 200 tunable VFOs — how many more do you want?

When switching from memory channel to memory channel through the UP and DOWN buttons, the radio goes dead for about a quarter of a second. While of no concern to the broadcast listener, RTTY and FAX monitors will loose some data when switching between memories used to store parallel frequencies.

STABILITY

The NRD-535D ranks as one of the most stable receivers the writer has had the good fortune to operate in over 30 years of DXing. The receiver often sits on idling Time Division Multiplex signals for hours on end and together with an RTTY decoder manages to capture perfect copy of the brief 10 second Circuit Ids. (Off-frequency tolerance is under 10 Hz for these stations.) Factory specifications rate receiver stability at ± 10 parts per million after 5 minutes and ± 2 p.p.m. after 1 hour. An optional highly stable Crystal Oscillator Kit (CGD-135) is available which improves frequency stability to within ± 0.5 p.p.m for those who require this precision.

SENSITIVITY

Sensitivity is the measurement of a radio's ability to "hear" more signals. That fact that the NRD-535D is a more sensitive radio than its predecessor doesn't mean that you'll necessarily hear more stations. At levels below one microVolt (1μV) HF signals become obscured in atmospheric noise.

Between 1.6 MHz and 30.0 MHz in AM mode, the NRD-535D is sensitivity-rated at 6dBμ (6 decibels relative to one microVolt measured at 10dB signal-to-noise ratio). Sensitivity rapidly drops off below 1.6 MHz. For most shortwave DXers, this is of no concern. Mediumwave AM listeners must content themselves with a rating of 16dBμ for frequencies between 500 kHz and 1600 kHz, while utility beacon chasers are reduced to 24dBμ under 500 kHz.

Below about 50 kHz, only the interference generated by the radio's internal synthesizer is audible. All microprocessors generate some RFI (Radio Frequency Interference). To confirm this fact, hold a portable AM radio (tuned off-station) to the front panel display of your receiver. Earlier models of the NRD-535D generated considerably more RFI, especially between 50 and 250 kHz.

AUDIO/DYNAMIC RANGE

Broadcast audio fidelity has never been the mainstay feature of any of the Japanese communications receivers and JRC's NRD-535D is no exception. Notwithstanding this, the NRD-535D has a vastly superior sound when compared to the NRD-525. The wideband audio hiss that plagued the NRD-525 is totally absent. Distortion is relatively low, running about 2% across all the bands. To a certain extent, broadcast audio fidelity and the shortwave medium are mutually exclusive. Audiophiles who require superior sound when listening to international broadcasters would do well to seek out the high-end tube receivers of yesteryear.

The NRD-535D is not a radio designed for the casual international broadcast listener. What it is though, is a superb DX machine for the Utility SSB monitor, with more than adequate audio quality for its purpose. True, you can use it to listen to megawatt broadcasters for hours on end, but when it comes to extracting the station Id of a 1 kilowatt SSB transmitter from the ionospheric muck, that's where it excels. Unfortunately, audio quality is only average for broadcast listening, and at low signal levels, voice intelligibility really suffers.

As with all table-top receivers, audio is greatly enhanced with the addition of an external speaker.

BANDWIDTH/SELECTIVITY

The NRD-535D currently ships with the following stock IF filters: NARR 1.0 kHz (CFL-233 crystal filter), INTER 2.0 kHz (mechanical type filter designed for SSB), and a WIDE 5.5 kHz (CFL-D6S ceramic filter designed for AM). The AUX position defaults to 12.0 kHz (unless an optional filter installed).

Optional filters available from JRC include the following: CFL-231 330 Hz, CFL-218A 1.8 kHz, CFL-232 500 Hz and CFL-251 2.4 kHz.

The NRD-535D originally came with a stock 8 kHz WIDE filter that was just was just too wide for the crowded broadcast bands. Since variable bandwidth control was not available at this IF bandwidth, severe signal interference could occur from other stations that were 5 kHz above or below the desired signal. While this problem could generally be rectified by using ECSS mode, there were times when this was either not possible or desirable.

Realizing this shortcoming, JRC New York has subsequently issued a replacement, the CFL-D6S ceramic 5.5 kHz filter. This filter now ships in all current production models. For owners of original sets, it is available free of charge from JRC New York. (It is also included with the Variable Bandwidth Control upgrade kit).

Variable bandwidth is now available in all modes (excluding FM) including ECSS with all filter combinations. On earlier models, it only functioned in sideband with the INTER bandwidth.

The 2.0 kHz INTER bandwidth is an excellent choice for CW/RTTY/FAX work when used in conjunction with variable Bandwidth Control. The UP/DOWN buttons may be user-programmed to switch bandwidths between WIDE and INTER without requiring cycling through the other bandwidth positions.

AGC CHARACTERISTICS

The Automatic Gain Control (AGC) button on the NRD-535D is used to select the time constants of the radio's AGC circuit. The timings are FAST, SLOW and OFF and work in all modes with the exception of FM. The FAST setting is normally used when tuning through the bands and for general broadcast listening. SLOW was designed for receiving relatively strong signals in SSB mode. Tropical Band DXers will appreciate the OFF setting as it prevents the radio from desensitizing itself during thunderstorm static bursts. JRC states that the AGC circuit provides 10dB or less AF output variation for an antenna input signal change from 3μV to 100μV.

For most general listening conditions, the attack time of the two settings is adequate. However, sudden strong signals, such as static crashes, cause the ACG circuit to severely overshoot, resulting in a momentary loss of signal. When combined with a slow release time (both in SLOW and FAST modes), the results are particularly bothersome. The slow release time can also be a problem when scanning across the band as weak signals may be muted when tuning past strong ones.

Stepping through the AGC settings form FAST to SLOW to OFF also results in a mighty blast of distortion at the OFF position. If you do this frequently enough, you'll soon learn to ride the RF gain. In fairness to JRC, they have provided two methods to avoid this. The first is to program the UP/DOWN keys to switch between FAST and SLOW. The second method, which is more drastic, requires the jumper resistor (RJ6) mounted on the CDC-493AD CPU board to be removed. This will permanently disable the OFF setting.

As a result of owner feedback, JRC has come up with a short-term modification to correct the AGC overshoot problem. It requires some minor surgery to the IF Amp circuit board (trace cutting, jumper wires, etc.). JRC's New York office will send complete details of the modification to anyone who requests it (along with a Warranty Disclaimer).

GAIN CONTROLS

The AF GAIN control adjusts the volume of the speaker or headphones. The RF GAIN control manually adjusts the gain of the first and second IF amplifiers. As gain is decreased, the S-meter deflects. By the time the S-meter reads S9, the amplifiers have been reduced by approximately 40 dB. Receiver sensitivity is so high that many NRD-535D owners generally operate their sets with the RF GAIN at 50%. Reduction of the gain appears to quieten the set.

The ATT (Attenuator) is a relay-switched one that unfortunately has only one setting (20 dB). Neither the ATT or the RF GAIN affect the receiver's intermodulation performance. An intermediate ATT setting (10 dB) would be a welcome addition.

INTERFERENCE REJECTION

The interference rejection capabilities of the NRD-535D place this radio in a class by itself. To achieve this objective, the NRD-535D makes maximum use of the following interference rejection techniques: Exalted Carrier Selectable Sideband (ECSS), Variable Bandwidth Control (BWC), Passband Shift Control (PBS), IF Notch Filter (NOTCH) and Noise Blanker (NB).

ECSS

The Exalted Carrier Selectable-Sideband (ECSS) unit is designed to improve reception of standard AM (DSB - double sideband with carrier) signals. JRC uses the term "ECSS" rather freely as a true ECSS circuit utilizes a user-controlled BFO and a Product Detector. The NRD-535D's ECSS is really a PLL Synchronous Detector with selectable side band.

The NRD-535D's ECSS module is an elaborate plug-in circuit board containing a special IF amplifier and a phase-locked-loop (PLL) with various decoders and shifters. In keeping with JRC's design philosophy for this radio, this is accomplished with discrete components instead of a dedicated PLL integrated circuit. For the listener, the end result is one sideband, demodulated into audio, with a very wide bandwidth, very low distortion and a reduction of fading effects.

The PBS and NOTCH controls alter the 97 kHz IF, while the ECSS circuit requires an exact 97 kHz signal. In order to work, the radio must be tuned to within 1 kHz of the signal's carrier frequency. Synchronous lock occurs very quickly (generally within about two seconds and is fairly stable. The ECSS circuit was designed to be used with the WIDE IF filter.

It is generally good practice to reduce the set's AF gain before engaging the circuit as the accompanying initial howl or whine may cause the family dog to exhibit strange fits of behaviour. A better solution is to set the RF Gain manually (with the AGC in the OFF position) to keep the ECSS unit from misbehaving with AGC variations. This proves to be the best method and keeps the receiver locked on much better than when the AGC is ON. Even if the AGC is left on, if the RF Gain is cut back, the unit will lock much better.

On extremely deep signal fades, lock is lost and the whine is back, however relock occurs almost immediately once the signal comes back up. The ECSS unit may not operate if the signal is very weak or if more than one carrier is present within the selected IF filter passband. For medium to strong AM signals, audio quality is significantly improved, although some base tone is sacrificed.

The ECSS circuit will eventually lose lock if the PBS or NOTCH filters are engaged, but there seems to be some latitude with these controls before this occurs. JRC New York has suggested using the PBS to offset the passband when in ECSS mode, but cautions that is does take some "tweaking". For example: on 5975 kHz in ECSS mode you would offset the main tuning by about ± 1 kHz and adjust the PBS accordingly to compensate. The ECSS unit will then lock with no problem and the passband will be shifted to achieve the desired AF response.

VARIABLE BANDWIDTH CONTROL

The Variable Bandwidth Control (BWC) varies the pass-bandwidth of the receiving IF filter, thereby reducing adjacent interference. The original BWC unit (CFL-243) supplied with the radio allowed continuous narrowing of the receiver's passband from a maximum of 2.4 kHz to a minimum of approximately 500 Hz, without changing the frequency of the passband. This feature was available only from the INTER filter position and did not support AM, ECSS or FM reception modes. The control performed admirably for the utility SSB listener, but did nothing for the shortwave broadcast DXer.

JRC has subsequently provided a BWC upgrade kit (CFL-243W) for owners of the older NRD-535D and now incorporates the new unit for those radios in current production. The BWC upgrade kit extends variable bandwidth control to operate in AM mode with the WIDE filter, thereby allowing continuous narrowing of the passband from 5.5 kHz to 2.0 kHz.

The kit is available to all North American owners of the NRD-535D with serial numbers below BR56006. List price is $169.00 (U.S.) from authorized JRC dealers. The kit consists of a new crystal filter for the BWC circuit board and two new PROM IC's to update the set's firmware (microprocessor's controlling software). A replacement ceramic filter is also included to improve the WIDE filter bandwidth. Competent technical skills are required as delicate surgery must be performed on several of the circuit boards. (JRC New York also makes this 5.5 kHz filter, the CFL-D6S, available free of charge to any NRD-535D owners in North America who require one - you do not have to purchase the optional BWC unit.)

The new filter skirt measurements for the CFL-243W carry the following factory specifications.

FILTER	BWC MAXIMUM SETTING			BWC MINIMUM SETTING		
	-6dB	-60dB	Ratio	-6dB	-60dB	Ratio
WIDE	5.53 kHz	7.30 kHz	1.3:1	2.00 kHz	4.55 kHz	2.3:1
INTER	2.22 kHz	3.35 kHz	1.5:1	0.49 kHz	2.60 kHz	5.3:1

The above figures suggest the new BWC is more effective with the WIDE filter. (In the WIDE setting, the control is actually in the off position.) It seems to be extremely useful for voice bandwidth, for which it was originally designed. Some concurrent adjustment of the PBS control may be required to maintain maximum voice intelligibility during SSB mode reception.

Although JRC suggests CW/RTTY monitors install a filter narrower than 1 kHz in the AUX position, the writer finds that the INTER bandwidth with the BWC control narrowed to about 750 Hz is quite acceptable.

PASSBAND SHIFT CONTROL

The Passband Shift Control (PBS) allows the center frequency of the selected IF filter to be adjusted ± 1 kHz without changing its overall bandwidth. (One oddity of this set is that the PBS range is doubled when using a computer interface to ± 2 kHz). The control is useful in suppressing adjacent channel interference and can help reduce the effects of deep fades. PBS works in all modes, with the exception of FM. The control is normally set at the 12 o'clock position. When receiving USB, it is rotated counterclockwise to cut the higher frequency components of the received signal. The reverse is true for LSB reception. The radio does not take kindly to moving this control to either extreme during ECSS reception.

IF NOTCH FILTER

The IF Notch filter provides a 40dB notch that can be adjusted across the IF passband. It can be used attenuate a single frequency. This provides an effective means of eliminating an interfering carrier or signal that is close enough to the operating frequency to be within the passband of the selected bandwidth filter. The NOTCH control is rotated clockwise until the offending signal is attenuated. Unfortunately, the NOTCH filter is not effective in AM or ECSS mode.

NOISE BLANKER

The NRD-535D features a two-position Noise Blanker. NB1 is effective for ignition type noise from automobiles, etc. NB2 is effective against wide-band noise such as OTH "woodpeckers" The blanking level for either button is set by the NB LEVEL rotary dial control. The NB circuit is very effective for localized QRM, but naturally has little effect on ionospheric noise and static.

CLOCK/TIMER OPERATIONS

The NRD-535D features an internal clock with a single event timer. Clock and frequency display are mutually exclusive; a sore point with may set owners. In addition, the clock does not display seconds, unless a jumper is cut. Nor is the clock visible when the receiver is off. The receiver continues to draw a small amount of power in the off state to maintain the clock. If disconnected from the power source, the clock must be reset the next time the set is turned on. A user-programmable option permits changing the display characteristics of the colon (:) found between the hours and minutes digits. You may set the colon to remain on constantly or have it blink once per second. (Was this feature really necessary?)

The event timer will switch the receiver on and off and engage or disengage the relay contacts of the DC Timer Out terminal, thus starting and stopping a tape recorder.

SCAN/SWEEP OPERATIONS

At first glance, scanning capability on an HF receiver appears to be almost a contradiction in terms, given the nature of background QRM and the workings of Squelch circuitry. The NRD-535D's SCAN function can be used to automatically step through all or specified consecutive memory channels. Through the alternate function selection, start and end channel numbers can be entered. The RUN button starts and stops the scan.

For SCAN, the user may select a delay period from between 0.05 and 5.0 seconds per channel on which the receiver will pause. If the AS (Auto Stop) feature is enabled, the radio will pause during the SCAN operation whenever a signal stronger than the Squelch threshold is detected.

The SWEEP feature is used to scan a specified range of frequencies. After entering the lower and upper frequency limits, the receiver will automatically increment the frequency according to the current tuning rate settings. Auto Stop and Squelch work in the same manner as in SCAN mode. For SWEEP operations, the Auto Stop period ranges from 0.05 to 0.5 seconds per frequency.

USER-DEFINABLE OPTIONS

The NRD-535D features 16 user-programmable options. Two of these user-defined items not previously mentioned in this review include:

1) Bypass Front End Tuning Filters — facilitates the reception of extremely weak signals by allowing the user to bypass the variable bandpass tuning filter in the receiver's front end. (Requires experimentation as it may also increase interference from strong out-of-band signals.)

2) BFO Offset Frequency — permits the BFO (Beat Frequency Oscillator) to be offset by ± 5000 Hz for CW work (the default is 800 Hz).

COMPUTER INTERFACE

More and more personal computers are finding their way into listener's shacks. Until recently, they focused primarily on database log management. But all that has changed - a new breed of software has emerged that not only performs logging chores, but actually controls the receiver from the computer itself. Until the arrival of the NRD-535D, computer control of the receiver was a manufacturer-supplied but non-supported option that required a certain amount of "black magic" to make it work. JRC broke tradition by making the computer interface a standard feature, not an option. The "hocus-pocus" surrounding programming was dispelled through a user-friendly ROM interface and detailed examples in the Instruction Manual.

A 25 pin (DB-25) serial RS-232-C connector on the rear panel of the set connects the receiver to your personal computer through a serial cable. The interface operates at 4800 baud, 1 start bit, 8 data bits, no parity bit and 1 stop bit; 10 bits per character.

No less than 36 separate operational receiver functions can be controlled from the computer. Nor is communication restricted to a one-sided computer-to-receiver dialog. The NRD-535D can be polled by the computer to provide frequency, memory channel, mode, bandwidth, AGC, ATT, clock time, signal strength and squelch status. About the only thing it can't tell your computer is the name of the station to which it's tuned. Even this shortcoming is easily overcome with the excellent logging/control software that has emerged. Features such as downloading and sampling all of one broadcaster's frequencies with automatic date/time/signal strength logging are commonplace for many of these reasonably priced commercial programs. Want to develop your own speciality control programs? The NRD-535D's ROM interface makes that easy. A BASIC statement like PRINT#1, "W0500" & RETURN sets the bandwidth control to the narrowest setting of 500 Hz. The statement PRINT#1, "D7" & RETURN places the receiver in ECSS USB mode. A value of "D8" would select ECSS LSB mode. Perhaps the greatest boon to computer interfacing is that you now have virtually limitless numbers of memory channels. Want to see which "Africans" are coming through this afternoon? Sort your database for appropriate stations/ frequencies and have your computer download and sample each frequency. The actual channel memory contents of the

receiver are not disturbed in any way. How about "Indonesians" at dawn or "Europeans" after dinner — the possibilities are endless.

The writer used his Macintosh SE as a diagnostic tool to confirm many of the NRD-535D's measurements for this article.

RECEIVER ADJUSTMENTS & MAINTENANCE

As with most receivers in this quality category, very little is required in terms of adjustments and maintenance. A recessed screw pot on the bottom of the set controls the volume of the receiver's Beep tone. The Reference Oscillator frequency can be user-adjusted on a trimmer capacitor, but the writer is not aware of any set owner who has found this necessary. The AC fuse is easily changed, although after 1000 hours of use, the fuse has not failed on the writer's set.

A lithium battery cell backs up the receiver's memory channels when the radio is off. Its rated life is five years. Judging from the Instruction Manual, removal and replacement is straightforward.

DOCUMENTATION

The English Instruction Manual that shipped with the original NRD-535D sets was an obvious attempt at a literal translation from the Japanese, and an unsuccessful one at that. Fortunately, Paul Lannuier of JRC New York quickly rewrote the offending document.

The current Instruction Manual (approximately 50 pages) is well illustrated with diagrams and photographs. Text is brief, but to the point. Many of the NRD-535D's features would not be self-evident if you did not read this manual. Almost four full pages are devoted to programming commands for operating your receiver from a personal computer. Armed with this information, even a novice programmer could write a rudimentary control program.

The optional Service Manual (30 pages) presents a brief, but adequate description of the set's unit blocks and circuits with a concise illustrated guide to receiver adjustments and calibration.

MATCHING EXTERNAL SPEAKER

NVA-319 is the model designation for the NRD-535D's matching speaker. As it was not initially available when the set was first introduced, the writer used the JRC NVA-88, designed for the NRD-525.

After several months, the matching speaker finally arrived. Unfortunately, it was a case where the anticipation was greater than the realization. For its price and performance the NVA-319 is a bit of a disappointment (it sells for three times the price of an NVA-88 with only marginal sound improvement).

Push Button Switch	ATTENUATION		
	-6dB	-10dB	-16dB
High Cut A	8.0 kHz	15.0 kHz	26.0 kHz
High Cut B	3.0 kHz	6.0 kHz	12.0 kHz
High Cut A + High Cut B	2.7 kHz	5.5 kHz	11.0 kHz
Low Cut	250 Hz	130 Hz	60 Hz

True, it does feature three selectable passive filters, but their effectiveness, particularly for broadcast band listening seems to be fairly subjective from listener to listener. Filter effects are more noticeable with headphones (a jack is supplied on the speaker that is placed after the filter circuits). Filter effects are more subtle in SSB mode. This speaker initially shipped without any documentation — nothing to even indicate filter characteristics. Full filter specifications are now shipped with the speaker. They appear in the table to the upper right.

Compared to the NVA-88, this speaker exhibits slightly more base. (The writer generally keeps the Low Cut filter engaged at all times for best sound). The speaker also features a jack for a second audio input source and a front panel switch for selection between the two sources. Despite its price, JRC New York can't keep enough of these units in stock to supply current North American demands.

RTTY DEMODULATOR

With the optional CMH-530 RTTY Demodulator installed, you can receive radioteletype (baudot) signals, decode them and output the data through the RS-232C port to a personal computer or printer.

Speed, shift and polarity of the signal are set through the alternate function keys and are stored in memory channels with RTTY mode. Fine tuning of the Space filter is accomplished with the Tone control. An outboard LED unit plugs into the Mark and Space jacks on the rear of the receiver to provide a visual tuning aid.

MODIFICATIONS

Currently, there are not many third-party modifications available for the NRD-535D. Lowe Electronics in England offers a slightly enhanced version, adjusting filter characteristics, the locking ability of the ECSS option and the addition of a more powerful audio amplifier. JRC authorized dealers in North America such as Universal and Electronic Equipment Bank

offer Collins mechanical filters. Sherwood Engineering has a modification to the IF filter board that will increase the rejection of the stock filters by about 20 dB. Kiwa Electronics also offers user-installable filter modules that can be used with the radio.

NRD-525 - THE IN-HOUSE COMPETITOR

For serious Utility monitoring, a multiple receiver set-up is a must. Before the NRD-535D arrived on the scene, the writer's sets included a NRD-515 and two NRD-525's. For the past 17 months, the NRD-535D has been utilized in conjunction with a "loaded" NRD-525. Five months ago the writer's NRD-535D was upgraded to the "new improved" version. Through the use of a solid-state antenna multicoupler, instant A/B comparisons can be made between the receivers on the same antennas.

Just how well does this "new kid on the block" stack up against its predecessor? First impressions are that the NRD-535D looks and "feels" better. Once you get past the "cosmetics" you begin to realize that there have been some significant changes in circuitry. The new receiver undoubtedly fares better in increased dynamic range and sensitivity and improved intermodulation distortion rejection.

The new tuning rates on the NRD-535D (1, 10 and 100 Hz on the main tuning dial and 10, 100, and 1000 Hz on the Up/Down tuning buttons) make the NRD-525 appear sluggish by comparison. The writer prefers to generally use the 10 Hz dial rate for both utility (voice/digital) and broadcast monitoring. The tuning knob itself has a better dampened feel on the NRD-535D. The keypad is a joy to use compared to the non-precise touch of the NRD-525's keys. Nearly all of the good features of the NRD-525 have been retained, such as PBS (Pass Band Shift) tuning and the IF Notch to combat Interference. There are still only 200 memory channels, but the amount of information they can now "memorize" has been expanded.

The front panel display is markedly larger than its predecessor and LED indicators confirm when various optional circuits have been engaged - this is certainly a welcome change from the lack of a PBS indicator on the NRD-525.

The NRD-535D lacks the front panel BFO offset control found on the NRD-525. Instead, this function has been relegated to keypad programming. The method used to tune CW signals on the NRD-525 was both cumbersome and time-consuming. The NRD-535D now makes this task a "snap" to accomplish.

Similar to the NRD-525, the NRD-535D's AGC decay times and filter bandwidths are selected by push button switches. Unlike the NRD-525, there is no need to cycle through so many unwanted settings. Indeed, the Up/Down buttons can be programmed to cycle between the user's most common choices.

The ECSS circuit (albeit JRC's interpretation of ECSS) is a standard feature on the NRD-535D. The corresponding ESKAB option for the NRD-525 continues to remain expensive.

Perhaps the most significant new feature is the addition the Variable Bandwidth Control - operational in all modes (except FM) and with all bandwidths. To achieve the same result on the NRD-525, several optional mechanical filters at about $169.00 per filter would be required. Unfortunately, the number that could be installed at one time is rather limited.

The NRD-525 features an event timer and two clocks, while the NRD-535D has only one. (Any clock display that requires the user to press a function key to replace the frequency display with the time and then press another key to return to the frequency, is in this writer's opinion, an option which will never be used. (JRC please take note).

The NRD-525's audio hiss is totally absent. SSB audio is so good that the only time the writer uses his Datong FL-3 audio filter is to quieten severe "hets". (On the contrary, the FL-3 on the NRD-525 is engaged at all times). While certainly not discernable from a comparison of receiver specifications, the NRD-535D has the edge on "hearing" more signals. Performing A/B comparisons by utilizing the Receiver 1/Receiver 2 inputs on the Universal M-7000 decoder has consistently shown the NRD-535D to be superior in resolving RTTY and other digital mode signals. There is absolutely no question in the writer's mind that the NRD-535D outperforms the NRD-525 in SSB, RTTY, CW and FAX modes.

The RS-232-C interface is a standard feature on the NRD-535D. Over four pages of the User Manual are devoted on how to write code to interface it with your personal computer. The interface board is an optional extra for the NRD-525, and although many programming commands are similar, no documentation exists to aid a would-be programmer.

Unfortunately nothing in this world of ours is perfect. In addition to improving on and adding to many of the NRD-525's features, the NRD-535D has also perpetuated some of its predecessor's shortcomings.

The AGC is still prone to static crashes and overshoots, resulting in temporary loss of signal. The Decay Attack Rate still is too slow. Medium Wave performance continues to remain poor for sets of this calibre. There are no facilities to select multiple antennas from the front panel and the receivers themselves have no means of elevating the front for ease of table-top operation.

Despite its faults, the NRD-535D continues to remain the writer's primary receiver for all types of monitoring, with the NRD-525 being relegated to stand-by frequency monitoring. The tuning rate, improved audio and increased "hearability" being the chief deciding factors.

The NRD-535D has not yet achieved absolute receiver perfection, but it is a marked improvement over the NRD-525. Given its added features, the price is more than reasonable.

THE BOTTOM LINE

Is the performance of the NRD-535D good value for its cost? As a NRD-525 owner, should you invest in upgrading your current machine or replace it with a NRD-535D? If you're considering a better table top receiver, how does the Drake R-8 compare in value for the dollar spent? If you have an older model NRD-535D, should you install the upgrade kit? For most of us the bottom line focuses on quality versus price, with price as the major limiting factor.

As of the time of writing, these three receivers may obtained at the following prices (U.S. dollars).

RECEIVER	STOCK MODEL	MATCHING SPEAKER	TOTAL PRICE	PERCENT
NRD-525	899.95	59.95	959.90	51%
DRAKE R-8	959.95	48.95	1008.80	54%
NRD-535D	1699.00	179.95	1878.95	100%

A stock model NRD-525 with matching speaker is now available at a price that is approximately one half the cost of a new NRD-535D. This represents about a $200.00 discount on the original price of this receiver. A stock model Drake R-8 retails for just over $1000.00 or 54% of the cost of a NRD-535D. The street price of the NRD-535D was raised by $110.00 when the "new improved" model was introduced.

Asking which receiver is best is much like deciding what car you should drive. For some, economy and efficiency are paramount, for others luxury and comfort are the rule, still others respond to performance and advanced engineering. Yet in the long run, each one is simply a mode of transportation.

Which receiver is best is generally a matter of personal preference tempered by what application it is intended to serve. As primarily a Utility DXer, it is this writer's belief that the "new improved" NRD-535D represents the finest communication receiver ever yet manufactured for this type of monitoring. Speaking as a former Broadcast Band DXer, it is an excellent top contender in this category (although some might consider it a bit pricey). Mediumwave DXers would do well to invest their dollars elsewhere. Mediumwave is generally just an adjunct on most shortwave receivers anyway, not their prime function. In this respect the NRD-535D is no different.

No, the NRD-535D is not a perfect radio, but then show me one that is. It comes close enough though, that after proof reading this review, in at least one shack there will be a "loaded" NRD-525 for sale soon to be replaced by another NRD-535D.

ACKNOWLEDGEMENT

Special thanks to Paul Lannuier of JRC New York for providing the "new improved" version of the NRD-535D for review purposes before it was released in the North American marketplace. Paul continues to provide a valuable "life-line" service to NRD-535D owners. While others might have a proverbial "axe to grind" in his position, Paul continues to be a source of unbiased information. Indeed, the improvements now reflected in JRC's latest model, are in no small part due to Paul's efforts in response to NRD-535D owners' suggestions and criticisms.