

ORION II

Ultra High-End HF Transceiver



TEN-TEC

TEN-TEC ORION II



- ORION II continues the high-performance legacy established by the original ORION transceiver. ORION II adds a brilliant color screen, a new roofing filter system (with a slight increase in receiver performance vs. ORION), new audio routing for line level outputs and an 8-pin microphone connector.
- Two 32-bit floating-point ADI SHARC DSP processors and a new 32-bit control processor using the latest generation Freescale DragonBall Super VZ chip. Provides faster front panel control response and accelerated remote operation via RS-232. This new processor also provides the horsepower for a future planned "HIGH SPEED SWEEP" accessory. Features, price, and availability of accessory to be determined.
- Full dual receive capability. An amateur-bands-only main receiver, (10 through 160 meters) utilizes selectable crystal roofing and IF-DSP bandwidth filtering. The sub receiver uses a single crystal roofing filter and IF-DSP bandwidth filtering and is general coverage to 30 MHz. Both receivers can be used simultaneously on any frequency, with no compromise in performance. The two receivers can share a single antenna or each can be fed from a separate antenna. Bandwidth, AGC, PBT, Hi-Lo Cut, AF and RF gain, attenuator, DSP noise reduction and notch are all selectable independently on each receiver.
- The main receiver accommodates up to seven crystal roofing filters in the first I-F stage. Four of the seven filters at 20, 6, 2.4, and 1 kHz are standard. Optional filters for 1.8 kHz, 600 Hz, and 300 Hz can be added. This all-new ORION II roofing filter system adds a subtle dynamic range increase over the original ORION transceiver. The roofing filters can be cascaded with any of 590 selectable IF-DSP bandwidth filters (100 Hz–6 kHz in 10 Hz steps). The sub receiver has its own set of 590 bandwidth filters that are selectable independent of the main receiver filtering.
- Very high RX intercept points, superior close-in dynamic range and an industry-best extremely low phase-noise synthesizer make ORION II's main receiver performance unmatched by any other HF transceiver.
- Programmable AGC response time for each receiver: FAST, MED, and SLOW are adjustable, and the new programmable mode is groundbreaking. Users may build their own personal AGC characteristic by selecting threshold, hang and decay rates. More than one million possible AGC combinations can be selected. Each receiver retains its own programmable setting.
- True diversity reception. Both receivers can be simultaneously fed from two separate antennas on the same frequency and controlled using a single VFO tuning knob. Superior low-band DXing capability using two separate receive antennas, on two receivers, and transmitting on a third TX antenna. Three antenna connections are provided: Two SO-239 connectors for transceive or receive antennas, a third via phono connector for RX-only use.
- Continuous real-time spectrum display allows monitoring of band activity. Five selectable sweep ranges allow user-definable limits to the amount of spectrum being monitored.
- Unlike "load-trimmers" used by competitors in their transceivers, ORION II's optional heavy-duty L-network automatic antenna tuner matches 6 to 800 ohms impedance—up to 10:1 SWR!
- Superb SSB audio is yours at a touch of the AUDIO button. Audio equalization is provided in both transmit and receive. The transmit response can be adjusted to have more bass or more treble. Separately, receiver audio can be EQed for bass and treble response. 18 selectable SSB transmit bandwidths to a maximum of 3.9 kHz are provided.
- Ten-Tec's Panoramic Stereo receive feature. Listening with stereo headphones, you can turn PS receive on and hear signals in stereo. As you tune across the band, signals move from one side through center to the other side in your headphones. Better than so-called "binaural" reception, this unique Ten-Tec feature can be used in SSB modes as well as CW. You've got to hear it to believe it!
- Nine adaptive DSP noise reduction filters let you select the right amount of NR for elimination of broadband hiss, noise, etc., plus DSP automatic notch for auto filtering of interfering carriers in SSB modes. Manual notch filter is also provided with greater than 60 dB of cut and with adjustable width.
- Dual noise blankers. Both a traditional-style analog and an IF-DSP noise blanker with a 9 stage selection control are provided for suppression of line noise and other pulse-type EMI.
- Mixing architecture for the analog stages has been rearranged to provide self-correction for frequency stability. All local oscillators are locked to a 1 PPM master TCXO. Drift correction circuitry assures ORION II stays within 1 PPM across full temperature range 0°–50° C.
- Variable (programmable) line level outputs on rear panel completely independent of front panel controls.
- ORION II is Flash-ROM updatable. To obtain the latest version of the ORION II, simply visit our firmware download website at www.rfsquared.com and download the software. Connect ORION II to your computer via a serial port cable, and send the software to the radio. It's that easy!

HOW IS ORION II DIFFERENT FROM OTHER HF RECEIVERS?

ORION II uses both crystal roofing filters and IF-DSP bandwidth filtering as part of the main receiver. The usual pitfall for top-notch performance in a modern HF receiver is the use of a 15- to 20-kHz wide roofing filter at the 1st I-F stage. This wide filter will allow unwanted signals outside of your receiver's passband to compromise receiver performance. By using crystal filters as selectable roofing filters at the 1st I-F, undesirable signals are kept out of the receiver chain and do not compromise close-in receiver performance.

ORION II is the only HF transceiver to utilize mode-appropriate roofing filters. A roofing filter of 20 or 6 or even 4 kHz is of limited utility because they are wide enough to continue to allow loud signals inside the filter to compromise overall receiver performance. These filters should be used for wide communications modes like AM and FM only, or for a more well-rounded SSB receive audio. For ultimate performance in SSB and CW modes, the narrower the roofing filter the better! Only ORION II allows you to take roofing filters down to very narrow bandwidths. Filters at 2.4, 1.8, and 1 kHz and 600 and 300 Hz assure that NO unwanted signal will EVER compromise sensitivity and dynamic range.

Any signal that appears inside the roofing filter – even if you do not hear it in your receiver passband – will have a negative impact on receiver performance. Loud signals inside a roofing filter lead to a loss of dynamic range and receiver sensitivity. Consult any ARRL product review from the past four years and look at the difference in receiver performance numbers for 20-kHz spacing and 5-kHz spacing two-tone dynamic range and third-order intercept. The 5-kHz spacing numbers are always significantly worse than the 20-kHz numbers for our competitors transceivers – this is because of the presence of the loud test signals inside their wide roofing filters. Imagine how much worse it is if you have several loud signals within 15 kHz rather than just two used for testing! The optimum receiver set up is to use high-rejection, very narrow crystal filtering up front, and brick-wall DSP filtering at the end of the chain at the 3rd I-F. No receiver system can top this! There are seven crystal roofing filter positions in ORION II; four of the seven roofing filters are standard, three are optional. ORION II's roofing filters are not to be confused with traditional crystal bandwidth filters – for bandwidth filtering, ORION II has 590 built in DSP filters from a minimum of 100 Hz to a maximum of 6 kHz. What is the result? Receiver performance that is better than any other transceiver on the market.



ORION II operations are displayed on an easy-to-read color screen. User-assignable functions are controlled by buttons surrounding the screen and by adjusting the bank of 6 knobs on the upper right side of the radio. The screen is a very bright, TFT color display with CCFL backlighting. It has ten user-selectable color schemes, eight using full color and two black/white and white/black mono reversible.



A matrix of 12 buttons on the ORION left side allows maximum operator flexibility. Assign either receiver to either VFO, or both to one VFO. Antennas are assigned by receiver; you can have both receivers on one antenna or route them to separate antennas. For maximum "DX-ability", connect a transmit antenna to ANT 1, a Beverage to ANT 2 and a second Beverage to RX ANT. Put separate receivers on each Beverage, and transmit on the third antenna. A menu option even allows the radio to select the desired antenna automatically based on band selection. Analog meter for main receiver signal strength and power output is provided.



The 6-knob control panel, bandchange keypad and tuning knobs were laid out with operator ergonomics in mind. Two large main tuning knobs for ease of use. Critical transceiver functions like AF gain, RIT, frequency entry, BW and PBT are all available with a minimum amount of hand or arm motion from main tuning knobs.



ORION II rear panel. Two SO-239 connectors for transceiver antennas, phono connector for RX ANT. Two linear amplifier keying loops are provided; for non-QSK amps, two PTT AMP KEY lines are provided. Dual band data outputs, one per VFO. 9-pin serial data connector for radio control via RS-232 and downloadable Flash-ROM updates. PC sound card connection for digital modes like PSK31 is done by connecting appropriate cables to the AUX I/O jack. No interface between rig and computer is necessary.

MODEL 566 ORION II TECHNICAL SPECIFICATIONS

GENERAL

Frequency Range: 500 kHz-30 MHz sub RX; 1.79-2.01, 3.49-4.07, 5.1-5.42, 6.89-7.43, 10.09-10.16, 13.99-15.01, 18.06-18.175, 20.99-21.46, 24.88-25.01, 27.99-29.71 MHz TX and main RX.

Tuning Step Size: Selectable 1, 10, 100 Hz, 1, 5, 10, 100 kHz.

Frequency Stability: ± 1 ppm 0-50° C. TCXO equipped.

Antenna Impedance: 50 ohms nominal.

Antenna Connectors: 2x SO-239; 1x RCA female.

Modes: USB, LSB, AM, FM, CW/USB, CW/LSB, FSK; advanced Panoramic Stereo.

IFs: IF1=9 MHz, IF2=455 kHz, IF3=14 kHz main, IF1=45 MHz, IF2=455 kHz, IF3=14 kHz sub.

Display: 320x240 TFT color screen with CCFL backlighting. Adjustable brightness. User

selectability of several color screen layouts plus white/black, black/white "monochrome" modes.

VFOs: Receivers operate on any two bands simultaneously; either VFO may be assigned to transmitter using the A/B system.

Supply voltage: 13.8 Vdc nominal, 23 amps; reverse-polarity and over-voltage protection standard.

Operating Temperature Range: 0-50° C

Dimensions (HxWxD): 5.25" x 17.0" x 18.75" (13.3 x 43.2 x 47.6 cm)

Weight: approx 20 lbs. (9.2 kg)

Construction: Aluminum chassis, steel cabinet, glass-epoxy printed-circuit boards.

PC Control Port: EIA-232 standard, DE-9F.

THE FOLLOWING SPECIFICATIONS APPLY TO BOTH RECEIVERS

Digital AGC System: Programmable threshold, hold, and decay times, fixed attack, independently programmable on each receiver.

RX Audio Equalizer: In addition to passband tuning, bass/treble boost/cut up to 6 dB/octave.

RX Audio Output Power: 2 W into 4 ohms, < 3% THD.

RX Headphone Output: Designed for 16-32 ohms headphone impedance.

Line-Level Output: Selectable .25, .5, 1 V p-p; 600 ohms.

RX Notch Filter: IF DSP, adjustable width, depth > 50 dB, notch reflected on S-meter; multi-tone auto-notch, adjustable 9 steps.

RX Noise Reduction: IF DSP, adjustable 9 steps.

MAIN RECEIVER

SSB Sensitivity: <0.18 μ V for 10 dB SINAD at 2.4 kHz BW, pre-amp on typical; <0.5 μ V for 10 dB SINAD at 2.4 kHz BW, pre-amp off typical.

AM Sensitivity: <1.50 μ V for 10 dB SINAD at 6.0 kHz BW, 30% modulation @ 1 kHz, pre-amp off.

FM Sensitivity: <2.50 μ V for 12 dB SINAD at 20 kHz BW, 5-kHz deviation @ 1 kHz, pre-amp off.

Selectivity: 590 built-in DSP filters from 100-6000 Hz, SSB, CW, AM; 20 kHz FM. Four 9-MHz IF crystal filters standard, 20 kHz, 6 kHz, 2.4 kHz, 1 kHz. Three optional, 1.8 kHz, 600 Hz, 300 Hz.

IP3: +25 dBm typical, 20-kHz spacing at BW=2.4 kHz, pre-amp off; +24 dBm typical, 5-kHz spacing, BW=500 Hz, pre-amp off. (see Figure 1 below).

IMD3 Dynamic Range: 101 dB typical, pre-amp off, 20-kHz and 5-kHz spacing.

IP2: +75 dBm typical.

LO Phase Noise: -136 dBc/Hz typical from 0.5-20 kHz. (see Figure 2 below)

Image Rejection: >70 dB.

IF Rejection: >70 dB.

Other Spurious Response Rejection: >90 dB, F>1 MHz.

Internal Spurious: None stronger than specified sensitivity.

Current Drain: 3.4 A min. audio, 3.6 A max. audio.

RIT Range: ± 10 kHz.

S-Meter: S-9=50 μ V.

Recovery Time: < 20 ms.

Noise Blanker: Hardware, on/off and software, adjustable 9 steps; operate together or separately.

SUB RECEIVER

Sensitivity: 0.35 μ V typical for 10 dB SINAD at 2.4 kHz BW, SSB mode.

Selectivity: 590 built-in DSP filters from 100-6000 Hz, SSB, CW, AM; 20 kHz FM.

IP3: +5 dBm typical, 20-kHz spacing.

IP2: +71 dBm typical.

Image Rejection: > 70 dB.

IF Rejection: > 70 dB.

S-meter: S-9=50 μ V.

Recovery Time: < 20 ms.

Noise Blanker: Software, adjustable 9 steps.

TRANSMITTER

Power Output: ALC controlled 5-100 W.

Duty Cycle: 100% CW and SSB modes. Continuous duty requires user-supplied cooling fan.

Microphone Input Impedance: >10 kohms at 1 kHz.

Microphone Sensitivity: 1.5 mV for 50 watts output, mic gain at 50%; internal gain adjustment; DC available for electrets.

Speech Processor: RF compression selectable in 9 steps.

Line-Level Input: -15 dBm into 600 ohms for full output.

SSB TX Bandwidth: 3900 Hz maximum, user-adjustable settings.

AM TX Bandwidth: 6 kHz fixed, 3 kHz transmitted audio.

TX Frequency Response: 50-3900 Hz max -6 dB points, adjustable.

TX Equalizer: Up to 6 dB/octave bass/treble boost/cut.

TX Speech Monitor: Audio taken after filtering, processing.

SSB Carrier Suppression: >50 dB.

Unwanted sideband suppression: >60 dB at 1 kHz.

Harmonic and Spurious Outputs: >50 dB below 100 W; >40 dB below 5 W.

T/R Switching: PTT or VOX on SSB, AM, FM, FSK; adjustable GSK on CW; adjustable rise and fall times on CW 3-10 ms;

CW Keyer Speed Range: 10-60 wpm; adjustable weighting, Curtis A or B.

CW Offset: Programmable 100-1200 Hz in 10 Hz steps. Sidetone pitch automatically matches selected offset.

XIT Range: ± 10 kHz

FM Deviation: ± 5 kHz peak nominal.

Current Drain: 25 A max.

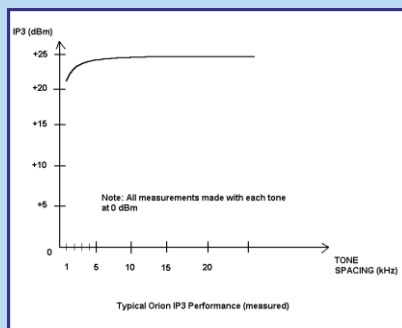


Fig. 1: ORION II Typical Third-Order Intercept Performance (measured)

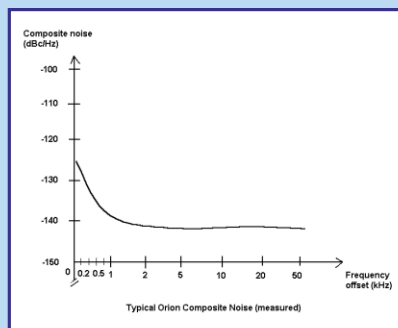


Fig 2: ORION II Typical LO Phase Noise (measured)



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