ICOM

THE TRANSCEIVER

IC-7851

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HF Excellence Unparalleled
Hear What You Couldn't Hear
See What You Couldn't See

Solid Design Basics and HF Expertise Raising the Bar

Contesters and DXers are always looking for that competitive edge to magically pull out the weak signal that is either the rare country or multiplier they need to climb up the list. Larger antennas, higher gain pre-amps and other devices in line are great. However, what happens inside the radio with all those signals coming down your feedline can defeat all your efforts.
With the design of the IC-7851, Icom's engineers focused on a new Local Oscillator (LO) that drastically reduces the phase noise. As a result of this design, the purity of the LO achieves a Reciprocal Mixing Dynamic Range (RMDR) of 110dB.
In addition to the incredibly clean LO allowing you to hear the weak signals, the new spectrum scope design enables you to see the weak ones! Faster processors, higher input gain, higher display resolution and a cleaner signal from the receiver's LO will give you a new window into the RF world. Adding this performance and functionality for both receivers give you a dual scope portal.

THE **TRANSCEIVER**

IC-7851

Competitive Advantage: Reciprocal Mixing Dynamic Range

RMDR: 110dB Raising the Bar

Design advances developed by the Icom HF engineers for the Local Oscillator (LO) enable the IC-7851 to set a new benchmark for amateur radio receivers. The goal was to dramatically reduce the phase noise that degrades the target signal due to the sum of the entire signal present. The result was a RMDR of 110dB*. Below is a comparison of the improvement over the IC-7800.

* At a 1kHz offset frequency
Receiving frequency: 14.2 MHz Mode: CW, IF BW: 500 Hz
Roofing Filter IC-7800 = 3 kHz, IC-7851 = 1.2 kHz

RMDR Comparison

RMDR(dB)				
	1kHz	2kHz	10kHz	20kHz
IC-7851	110	116	121	124
IC-7800	78	87	106	112

RMDR

RMDR (Reciprocal Mixing Dynamic Range) is the relative level of an undesired signal, offset “n” kHz from the RX passband, which will raise noise floor by 3 dB. The local oscillator phase noise will mix with strong unwanted signals and unavoidably generate noise which masks a wanted signal.

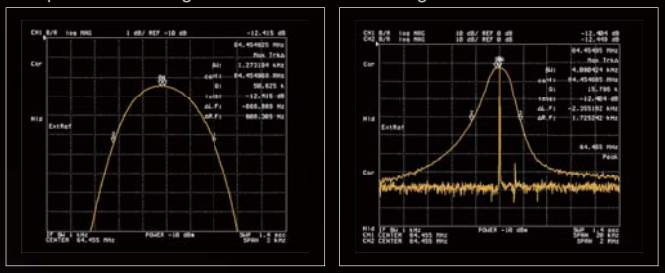
1.2kHz Optimum Roofing Filter

Despite the trend to switch to a down conversion or a hybrid conversion receive design, Icom believes in the solid performance of the up-conversion design. In an up-conversion receiver, suppression of image interference and reduce distortion from electric components is easily overcome. A flat consistent performance is delivered over a wider frequency range.


Optimum Roofing Filter

The IC-7851 introduces a new 1.2kHz Optimum Roofing Filter, greatly improving the in-band adjacent signal performance. This newly developed filter overcomes the gap of a narrower roofing filter in an up-conversion receiver.

Optimum Roofing Filter Characteristic Diagram

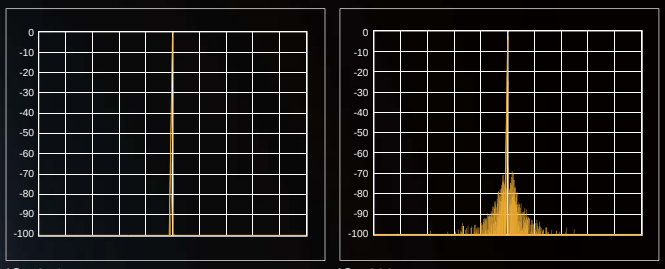


Crystal Clear LO (Local Oscillator) Design

Breaking the boundaries of traditional designs, the IC-7851 employs a Direct Digital Synthesizer (DDS) along with a Phase Locked Oscillator for the LO. The C/N ratio excels beyond the IC-7800 and other similar class HF transceivers. This design significantly reduces noise components in both receive and transmit signals.

LO C/N Characteristics Comparisons

Receiving Frequency: 14.2 MHz Mode: CW 1st LO frequency: 78.655 MHz
SPAN = 20 kHz, RBW = 30 Hz, VBW = 10 Hz



IC-7851 IC-7800

Improved Phase Noise Characteristics

Phase noise is coherent in radio circuit design and the new LO design introduced in the IC-7851 makes some major breakthroughs while utilizing the 64MHz, up-conversion receiver design introduced in the IC-7800. An impressive 20dB improvement is seen with the IC-7851’s 10 kHz measurement and more than 30dB improvement at a 1 kHz measurement in comparison to the IC-7800.

Phase Noise Characteristics Comparisons

Receiving Frequency: 14.2 MHz Mode: CW 1st LO frequency: 78.655 MHz

IC-7851 IC-7800

Twice the Speed, Sensitivity, Resolution and More Control

Improved Spectrum Scope

Following the design linage of the IC-7800, the IC-7851 uses a dedicated DSP unit for the Fast Fourier Transform (FFT) spectrum. The 2250 MFLOPS DSP processor enables a new dual scope function and significantly faster sweep speeds and better accuracy than in the IC-7800.

Scope DSP
TMS320C6745 by Texas Instruments
32-bit floating point
2250 MFLOPS
370 MHz clock speed

Scope Comparison

	IC-7851	IC-7800
Span Width	5kHz–1000kHz	5kHz–500kHz
Resolution *1	1 pixel minimum *2	20 pixels minimum *4
Sweep Speed	29.3 frames/Sec *3	4 frames/Sec *3
Display Dynamic Range	100dB	80dB
Noise Floor Level	–30dBμ	–19dBμ

*1 Number of dots shown at the 60 dB level, when receiving a signal.
*2 SPAN = More than 20 kHz, SPEED = Slow
*3 SPAN = Less than 20 kHz, SPEED = Fast
*4 SPAN = 500 kHz, SPEED = Slow

Audio Scope Function

The audio scope simultaneously shows an oscilloscope and FFT for receive and transmit audio. Adjust your transmit audio by watching your compressor level, equalization and mic gain settings to give you the audio you want for SSB. The oscilloscope shows the CW waveform. On receive, you can see the power of your filtering by watching filtering adjustments take out interfering signals including filter width and notch filter placement. The processing power in the IC-7851 allows for dual mini band scopes as well as the audio scope.

■ Specifications for the audio scope
- Attenuator: 0 dB, –10 dB, –20 dB and –30 dB
- FFT scope with waterfall and FFT scope without waterfall
- Waveform color and drawing (outline or fill) settings for the FFT scope

■ Specifications for the oscilloscope
- Level: 0dB, –10 dB, –20 dB and –30 dB
- Sample rate: 1ms/Div, 3ms/Div, 10ms/Div, 30ms/Div, 100ms/Div and 300ms/Div, 5 Div width
- Waveform color setting


Mini spectrum scope and audio scope


Mini dual spectrum scope and audio scope

Dual Scope Function

While you can watch both receivers on the scope of the IC-7800, within the limits of the scope bandwidth, the IC-7851 introduces the new dual scope – the ability of watching both receivers in separate spectrum scopes. The dual scope function is vital for watching for multipliers or band openings in contests, or working all bands/modes on a DXpedition.


Dual scope example (Vertically aligned)


Dual scope example (Horizontally aligned)

High Resolution Spectrum Waterfall Display

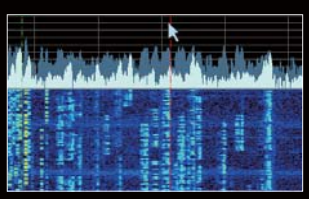
The waterfall display captures signal strengths over time. This allows you to see signals that may not be apparent on a normal scope. Additionally, the combination of the scope attenuator and the wide screen mode gives you a better view of weaker signals as band conditions change. For the ultimate scope enhancement, the IC-7851 has a digital video interface (DVI-I) for a larger display.


Spectrum scope with waterfall
(wide screen setting)

Click Control

By connecting a human interface device (such as a USB mouse, trackball or touchpad) to the USB port on the rear panel, you gain control over the spectrum display pointer for “Click-and-Listen” receiver control. Fix/Center mode, sweep speed and other settings are controllable.

<For example>
- Left click to change operating frequency
- Click a button (either left or right) and move right or left side on the screen to increase or decrease the operating frequency (similar to rotating the main dial)
- Right click to temporarily change the receive frequency. Release the mouse button to return.

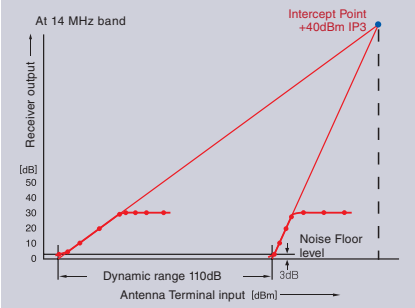


Premium components yield premium performance

+40dBm IP3 (3rd Order Intercept Point)

The IC-7851 continues the +40dBm, 3rd order intercept point and 110dB receiver dynamic range benchmark set by the IC-7800. To achieve this superb receiver performance, the entire analog circuitry and components have been re-engineered to match the DSP units. A newly designed LO amplifier generates high output while keeping flat frequency characteristics over a 60MHz wide range.

Dynamic Range Characteristics



Dynamic Range (typical)

	Roofing Filter Bandwidth	Dynamic Range (dB)			
		Spacing			
		1kHz	2kHz	5kHz	20 kHz
IC-7851	15kHz	100	101	104	114
	1.2kHz	99	105	111	113

BPF Switching: Mechanical Relays

The IC-7851 incorporates high-grade, long-term reliable mechanical relays rather than PIN diodes for switching the Band Pass Filters (BPF). This deployment of relays removes secondary distortion products from the primary stage of signal processing.

BPF unit

Four 1st IF "Roofing" Filters

Three high-spec 1st IF "Roofing" filters plus the new 1.2kHz Optimum Roofing Filter allow only signals within the filter passband to the 1st IF amplifier stage. You can select the filter width from 15kHz, 6kHz, 3kHz and 1.2kHz, depending on your operating mode. (FM mode is fixed at 15kHz)

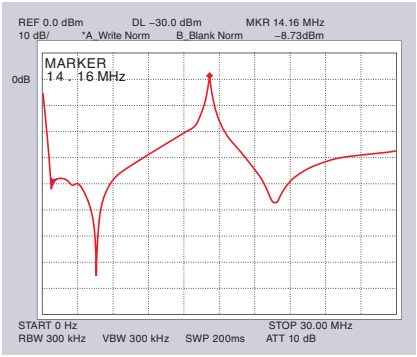
1.2kHz
Optimum Roofing Filter
3, 6, 15kHz
High-Spec 1st IF filters

Digi-Sel Preselector

The preselector works between 1.5MHz and 30MHz and rejects distortion components derived from out of band interference such as multi-multi operation or strong broadcast stations. It automatically tracks the intended signal keeping the preselector's bandwidth centered on the operating frequency. The center frequency of the preselector is manually adjustable from the DIGI-SEL tuning knob on the front panel.

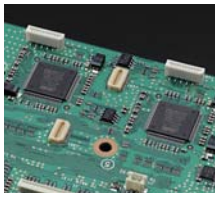
Automatic Preselector

Automatic Preselector bandwidth characteristics



Triple DSP Power

Three separate 24-bit AD/DA converters and dedicated DSP processors are at the heart of the IC-7851. With one AD/DA and DSP dedicated to the spectrum scope and two 24-bit AD/DA and DSP chips for the receivers and transmit circuits, there is plenty of DSP power for the most demanding RF environment.



Transmit/
Receiver DSP (left) and
Receiver DSP (right)
ADSP-21489
by Analog Devices
32-bit floating point DSP
2400 MFLOPS
393 MHz clock speed

Image Rejection Mixer

Simple receiver system configuration is the best way to eliminate sources of the spurious signals and distortion from transceivers. The IC-7851 uses a double conversion system composed of a D-MOS FET 1st mixer and image rejection mixer for the 2nd stage. The 1st mixer stage is driven with a signal from the high-drive Local Oscillator with excellent C/N. The image rejection mixer for the 2nd stage reduces signal distortion through IF processing and provides a high-fidelity signal to the DSP unit. This system provides wide dynamic range, reducing the distortion from strong signals and lower intermodulation.

High Performance OCXO Unit

The IC-7851 uses the OCXO (Oven Control Crystal Oscillator) unit which is stable to within ±0.05ppm at 0°C to 50°C. This specification means that even on the 50MHz band, frequency error is less than 2.5Hz! In addition, a 10MHz reference frequency can be input and output for accurate tuning.

OCXO unit

200W Output Power at Full Duty Cycle

The push-pull power amplifiers using power MOS-FETs work on 48V DC. They provide a powerful 200W output power at full duty cycle and low transmit intermodulation. An effective cooling system maintains internal temperatures within a safe range and prevents thermal runaway.

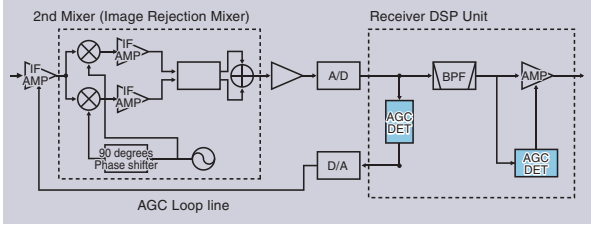
PA unit and heat sink

Solid Aluminum Main Dial Knob

The main dial tuning knob is pure functional beauty. Machined from a solid aluminum block, the main dial tuning knob gives you a solid operational feel. The diamond engraved accents are cosmetic perfection – expected only from a radio of this caliber.

Dual AGC Loops

The IC-7851 has multiple AGC loops. The AGC voltages detected in front of and behind the digital IF filter in the DSP unit. The first AGC loop prevents saturation of the 1st IF amplifier. The other AGC loop detects the AGC voltage at the digital IF filter output which has only passed the intended signal and draws the full potential from the digital IF filter. Combining the digital IF filter, manual notch, and the 1st IF stage, these are all controlled by the DSP unit. 110dB of ultra wide dynamic range in the receiver means the IF amplifier is distortion free from strong signals.



Operational functionality for the most advanced operators

Dual Receivers

The IC-7851 incorporates two completely independent receivers, from the antenna inputs all the way through to the stereo headphone and individual external speaker outputs. All the performance of the first receiver is duplicated for a perfectly matched set of "Twins". When connected to external stereo headphone, main and sub receiver audio can be mixed or separated to the right and left.

RTTY/PSK31 and PSK63

RTTY, PSK31 as well as the new PSK63 modes are available at your fingertips without the use of a computer. The built-in Modulator/Demodulators are activated by via the radio's functions buttons or an optional USB keyboard. TX memories make contacts a snap and communications logs can be stored on an SD memory card.

RTTY mode display

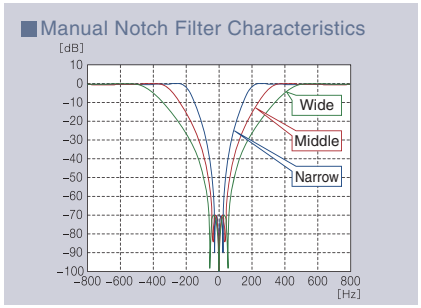
Digital IF Filters

"Build your own" IF filters by adjusting the IF filter width, 50 – 3600Hz, as well as soft or sharp filter characteristics for your perfect sound. Save these settings in three user-defined filter presets, Wide/Mid/Narrow, by mode to give you full customization of your filters.

Filter preset screen

Digital Manual Notch

HF operators marvel at how well DSP reduces interfering signals and noise. Signals such as heterodynes and AM Carriers can be eliminated with automatic notch filter technology. Making interference from RF sources such as beat signals and RTTY signals is a thing of the past. Additionally, the filter shape of the manual notch can be adjusted in three steps – with more than 70dB of attenuation!



Digital Twin PBT (Passband Tuning)

Once the IF filters have been "tweaked," the operator has additional control with the digital twin passband tuning (PBT). The digital twin PBT allows flexibility of both the IF shift and narrowing of the digital IF passband by moving the IF passband. With the digital IF filters, PBT performance allows you to cut away all the interference and noise to hear the actual signal.

Variable Level Noise Reduction

The digital noise reduction separates a target signal from noise components and noise suppression level is variable in 16 -steps, depending on the noise level. The low latency digital noise reduction is achieved by applying an adaptive filter using the high speed DSP computing power.

New Auto Digital Noise Blanker

While most noise blanker reduces pulse type noise, the IC-7851 introduces a new automatic digital noise blanker circuit. While using the 15/9/6kHz roofing filters, the digital noise blanker gives you full control. When the 1.2kHz Optimum Roofing Filter is activated, the best blanking level is automatically selected. Additional adjustments allow you to tweak the threshold level, blank time and attenuation level parameters.

Digital Transmit Bandwidth (TBW) and Audio Equalizer

With the flexibility of DSP-based waveform shaping, transmit and receive audio quality is adjustable to suit your preference. Three user-adjustable transmit filters, Wide/Mid/Narrow, allow you to set both the low and high cut-off frequency limits. (100 – 500Hz for lower and 2500 – 2900Hz for higher frequencies.) In addition to the TBW filter, the IC-7851 has an equalizer to digitally tweaks your transmit audio with separate bass and treble controls (11 steps each for bass and treble). The receive audio can be tailored with mode-specific Bass/Treble or audio passband settings.

Digital RF Speech Compressor

The DSP controlled RF speech compressor provides additional punch while maintaining the original tone quality of the operator. The IC-7851 utilizes the 32-bit DSP for the RF speech compressor, providing the maximum punch without the fuzzy sound. It's great for breaking through the noise and hash to complete the QSO.

SD Memory Card Slot

Save operator profiles, digital voice keyer, CW memory keyer, RTTY/PSK logs, IC-7851 "Screen Shots" and various other operational settings to your SD Memory card.

SD Memory Card Slot

Digital Voice Recorder

The digital voice recorder captures both receive and transmit audio to your SD or USB storage devices. Up to 9 hours of continuous audio recording is possible with 2 GB of storage. Record your QSO with a rare entity or record your operating time in a contest. Operating frequency, mode, S-meter and output power are automatically captured.

Recorded list display

Memory Keyer

Whether operating phone, CW, RTTY or PSK31/63, the IC-7851 has a convenient memory keyer to ease operations. Record your CQ, station information or other items in one of 8 keyer memories for the CW and digital modes; 4 memories for phone operation. For CW, the memory keyer has timesaving functions like auto repeat, contest serial number counter and short Morse number functions. For phone operation, you have a voice-saving auto repeat function.

Improved Automatic Antenna Tuner

The automatic antenna tuner utilizes tune-setting memories to record the best tuner configuration for the lowest SWR. This allows a faster response time when jumping bands or moving around in the same band.

Internal Antenna Switch

With six antenna ports – two receive-only and four receive/transmit – the IC-7851 enables the operator to have fingertip control over a vast array of antenna configurations. Switch to 80/160m and you want to use your beverage antenna for receive, but transmit on your vertical. Not a problem: the antenna switch memory will automatically switch antennas when you select the band you want to operate. This is very convenient when using the RS-BA1 for remote base operation.

Enhanced PC Connectivity

The IC-7851 has various computer interfaces, giving you maximum connectivity between your computer and radio. Digital modes become a snap when controlling with the USB port. USB audio and some CI-V commands including USB send (DTR/RTS) and USB keying (CW and RTTY) are selectable. You can also interface your computer with the S/P DIF optical digital interface provides audio I/O. The Ethernet jack allows you to connect the IC-7851 directly to your router and control your radio over your wireless Internet, or travel the globe and operate your station remotely over the Internet.

Firmware Update Capability

The IC-7851 can grow as feature and function enhancements become available via the USB or your SD Card.

Simplified Remote Control (Optional RS-BA1)

Remote base operation is made easy as the IC-7851 operating system incorporates the remote base server software. A computer is not required in the shack for audio or rig control. Up to three, unique user log-in/password configurations are part of the internal server. As the rig control has a priority of service, the controls will feel like you are right in front of your rig.

Optional RS-BA1 main features

- Most functions of your transceiver, including interference rejection functions and IF filter settings, can be controlled.
- The spectrum scope with the waterfall function can be observed.
- Received voice recording function.
- Optional RC-28 USB remote encoder provides a hardware dial/transmit functions for a realistic dial operation.
- The IC-7851 can wake-up from the standby mode through the RS-BA1 software.

▼Other Outstanding Features

[Antenna]

- BNC type RX input/output connectors for receiver antennas or external attenuators

[Receiver]

- General coverage receiver covers from 30Hz to 60MHz* (* Some frequency ranges are not guaranteed.)
- Two types of preamplifiers:
  Preamp 1: improves intermodulation characteristics
  Preamp 2: High gain preamp for high bands
- A seven step attenuator (3, 6, 9, 12, 18, 21dB and OFF)
- A dedicated 50MHz band mixer using a Quad FET
- Twin peak filters for better RTTY signal reception

[Transmitter]

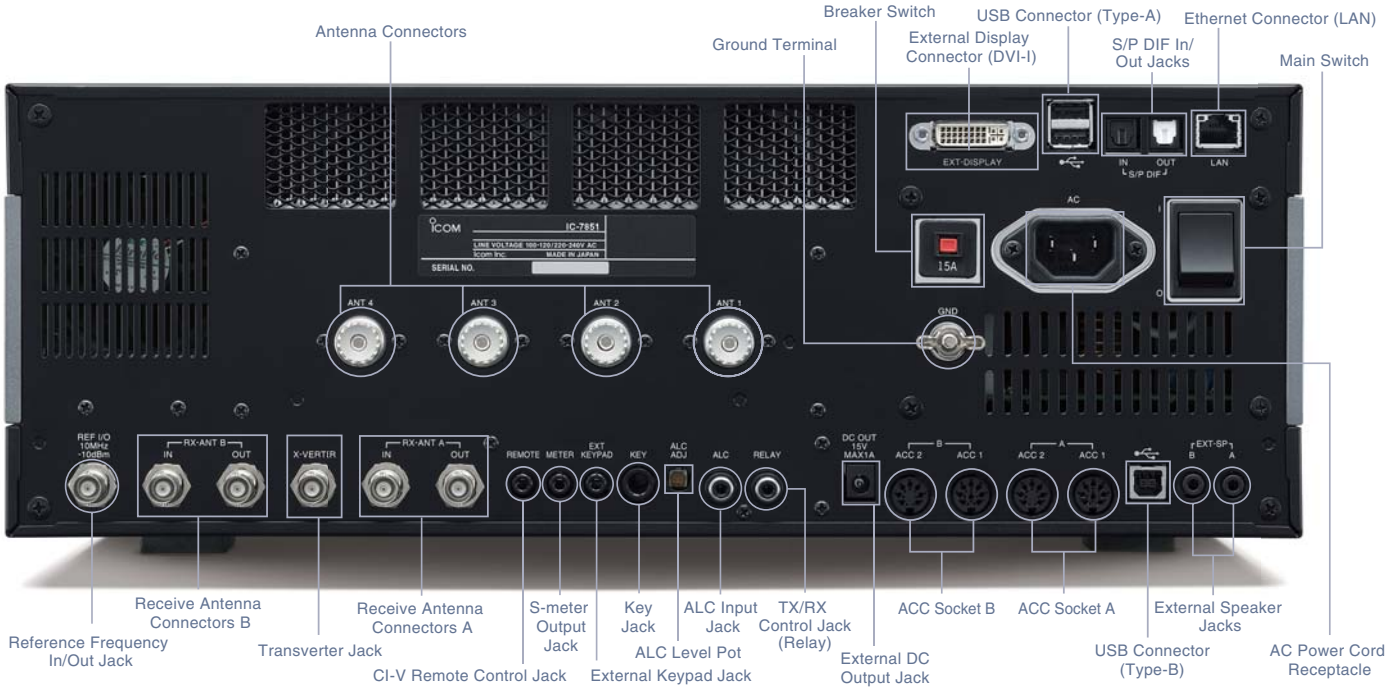
- Speech compressor increases average talk power (SSB mode)
- TX monitor functions
- Fifty sub-audible tones (CTCSS) for repeater access
- VOX (Voice operated transmission) capability
- All mode power control

[CW]

- DSP controlled CW keying waveform shaping
- Multi-function electronic keyer with adjustable keying speed, dot/dash ratio, keyer type, rise time and paddle polarity
- Electronic keyer speed popup
- CW pitch control from 300 to 900Hz (5Hz pitch)
- CW reverse mode operation for receiving USB side signal
- Double key jacks for front and rear panels
- Full break-in and semi break-in functions
- CW/AM auto tuning function helps to zero in on intended signals within ±500Hz range
- Soft and sharp audio filter shapes for the Audio Peak Filter (APF)

[Operation]

- Set mode functions for flexible and speedy settings
- Memo pads stores up to 10 operating frequencies and modes
- Quick split function and split lock functions
- Quick Dualwatch function
- SSB/CW synchronous tuning
- RIT and ⊿TX variable up to 9.999kHz
- UTC/Local clock and timer function
- 1Hz pitch tuning and display
- 101 memory channels with 10-character channel name
- Built-in voice synthesizer announces the operating frequency, mode, and S-meter level
- Programmed scan, memory scan, select memory scan, VSC scan and ⊿f scan
- Auto tuning step function
- Dial lock function
- Main dial tension control
- Programmable band edge beeps
- S/P DIF input/output connectors
- BNC type transverter connector
- External speaker connectors for Main/Sub receivers
- FFT scope waveform averaging function for PSK and RTTY decoder
- Screen saver function



SPECIFICATIONS

GENERAL

Frequency coverage*1	(Unit: MHz)
Receiver	0.030–60.000*2
Transmit	0.1357–0.1378 1.810–1.999 3.500–3.800 7.000–7.200 10.100–10.150 14.000–14.350 18.068–18.168 21.000–21.450 24.890–24.990 28.000–29.700 50.000–52.000

*1 Showing EUR version. Varies according to version. *2 Some frequency bands are not guaranteed.

Mode	USB, LSB, CW, RTTY, PSK31/63, AM, FM
No. of memory channels	101 (99 regular, 2 scan edges)
Antenna connector	SO-239×4 and BNC×2 (50Ω unbalanced (Tuner off))
Operating temp. range	0°C to +50°C; +32°F to +122°F
Frequency stability	Less than ±0.05ppm (0°C to +50°C @ 54MHz, after warm up)
Frequency resolution	1Hz (minimum)
Power supply requirement	85–265V AC
Current drain	TX: 800VA (Max. power) RX: 130VA/120VA typ. (Max. audio/standby)
Dimensions (W×H×D, projections not included)	425×149×435 mm; 16.73×5.87×17.13 in
Weight (approximate)	23.5 kg; 51.8 lb

TRANSMITTER

Output power	SSB/CW/FM/RTTY/PSK: 5–200W AM: 5–50W Transverter connector (CW): More than –20dBm
Modulation system	SSB : Digital P.S.N. modulation AM : Digital low power modulation FM : Digital phase modulation
Spurious emissions	HF bands: More than 60dB 50MHz band: More than 70dB
Carrier suppression	More than 63dB
Unwanted sideband suppression	More than 70dB
⊿TX variable range	±9.999kHz
Microphone impedance	600Ω (8-pin connector)

All stated specifications are subject to change without notice or obligation.

RECEIVER

Receive system	Double conversion super-heterodyne system
Intermediate frequencies	Main receiver: 64.455MHz/36kHz (1st/2nd) Sub receiver: 64.555MHz/36kHz (1st/2nd)
Sensitivity (typical)	(HF: Pre-amp 1 ON, 50MHz: Pre-amp 2 ON)

	0.1–1.799MHz	1.8–29.990MHz	50–54MHz
SSB, CW, RTTY, PSK (BW=2.4kHz, at 10dB S/N)	0.5μV	0.16μV	0.13μV
AM (BW=6kHz, at 10dB S/N)	6.3μV	2μV	1μV
FM (BW=15kHz, at 12dB SINAD)	–	0.5μV (28–29.9MHz)	0.32μV

Squelch sensitivity	SSB, CW, RTTY, PSK: Less than 5.6μV (Pre-amp: OFF) FM: Less than 1μV (Pre-amp: OFF)
Selectivity	

	More than	Less than
SSB (BW=2.4kHz, sharp)	2.4kHz/–3dB	3.6kHz/–60dB
CW/RTTY/PSK (BW=500Hz, sharp)	500Hz/–3dB	700Hz/–60dB
AM (BW=6kHz)	6.0kHz/–3dB	15.0kHz/–60dB
FM (BW=15kHz)	12.0kHz/–6dB	20.0kHz/–60dB

Spurious and image rejection ratio	More than 70dB
Audio output power	More than 2.6W (10% distortion, 8Ω load)
RIT variable range	±9.999kHz

ANTENNA TUNER

Matching impedance range	HF bands: 16.7Ω to 150Ω unbalanced (VSWR better than 3:1) 50MHz: 20Ω to 125Ω unbalanced (VSWR better than 2.5:1)
Minimum operating power	HF bands: 8W 50MHz band: 15W
Tuning accuracy	VSWR 1.5:1 or less
Insertion loss	Less than 1.0 dB (after tuning)

Supplied accessories: (* May differs depending on version)
• Rack mount handles • SD card • AC power cable • Spare fuses • Plugs

OPTIONS

Some options may not be available in some countries. Please ask your dealer for details.

IC-PW1/IC-PW1EURO
HF+50MHz 1kW LINEAR AMPLIFIER
Automatic antenna tuner and compact detach able controller are standard. 2 exciter inputs and 4 antenna connectors are available.

SP-34 EXTERNAL SPEAKER
4 audio filters; headphone jack; can connect to 2 transceivers.
Input impedance: 8Ω Max. input: 5W

SM-50 DESKTOP MICROPHONE
Dynamic microphone with [UP/DOWN] switches.

HM-36 HAND MICROPHONE

SP-33 EXTERNAL SPEAKER
Wooden box speaker.

SM-30 DESKTOP MICROPHONE

CT-17 CI-V LEVEL CONVERTER

RS-BA1 IP REMOTE CONTROL SOFTWARE
Windows® based software

RC-28 USB REMOTE ENCODER
For use with RS-BA1

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