

HF Receiver Mark II

Design Features and Technical Data

Mario Hellmich¹, Salzgitter

Receiver Frequency Range	10 kHz...30 MHz (−3 dB range) 1 kHz...30 MHz tuning range															
Tuning Resolution	1 Hz, receiver can be tuned by knob or by direct frequency entry on numeric keypad, frequency indication on 8-digit LED display															
Tuning Knob	128 steps/revolution, tuning speeds 1 Hz, 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz															
Time Base	TCXO at 40 MHz, ±0.28 ppm over commercial temperature range															
Antenna Input	Type N, 50 Ω															
Input Attenuator	Switchable, 0 dB, 20 dB															
Preamplifier	Switchable 25 dB low noise amplifier (currently not implemented)															
Preselector	Selectable, six automatically switched octave bands															
IF Frequencies	1st IF 86.85 MHz, 2nd IF 10.7 MHz, in FM mode 3rd IF 455 kHz															
IF Output	BNC 50 Ω, 10.7 MHz, −30 dBm level, bandwidth equal to selected bandwidth															
Roofing Filter	Dual SAW filter at first IF (86.85 MHz) with 25 kHz bandwidth															
IF Bandwidths	Four multi-pole crystal filters, electronically switched, at second IF (10.7 MHz) <table><thead><tr><th><i>Filter designation</i></th><th><i>Filter bandwidth</i></th><th><i>No. of Poles</i></th></tr></thead><tbody><tr><td>BW1</td><td>500 Hz</td><td>6</td></tr><tr><td>BW2</td><td>2.4 kHz</td><td>10</td></tr><tr><td>BW3</td><td>5 kHz</td><td>10</td></tr><tr><td>BW4</td><td>15 kHz</td><td>8</td></tr></tbody></table>	<i>Filter designation</i>	<i>Filter bandwidth</i>	<i>No. of Poles</i>	BW1	500 Hz	6	BW2	2.4 kHz	10	BW3	5 kHz	10	BW4	15 kHz	8
<i>Filter designation</i>	<i>Filter bandwidth</i>	<i>No. of Poles</i>														
BW1	500 Hz	6														
BW2	2.4 kHz	10														
BW3	5 kHz	10														
BW4	15 kHz	8														
Detection Modes	AM synchronous SSB (upper and lower sideband) FM															
BFO	Offset range ±3.5 kHz, tuning resolution 1 Hz, tuning steps 1 Hz, 10 Hz and 100 Hz, or direct keypad entry															
Gain Control	Automatic (fast, slow, hang), manual, approx. 120 dB range, distributed between first IF (−10 dB... + 30 dB) and second IF (0 dB... + 80 dB)															

¹mario.hellmich@web.de

HF Receiver Mark II

Performance Test Results

Mario Hellmich¹, Salzgitter

AM Sensitivity for 10 dB SINAD 2.4 kHz bandwidth AM at 60 % depth with 1 kHz attenuator out, preamp out, preselector out	≤ -110 dBm
SSB Sensitivity for 10 dB SINAD 2.4 kHz bandwidth input signal at 1 kHz offset from tuned frequency attenuator out, preamp out, preselector out	≤ -116 dBm
CW Sensitivity for 10 dB SINAD 500 Hz bandwidth receiver set up for 1 kHz beat note attenuator out, preamp out, preselector out	≤ -123 dBm
FM Sensitivity for 10 dB SINAD FM at 2.5 kHz deviation with 1 kHz 15 kHz bandwidth attenuator out, preamp out, preselector out	≤ -96 dBm
Second Order Intercept Point $\Delta f = 50$ kHz antenna input referred, gain control manual, attenuator out, preamp out, pre-selector out	≥ 57 dBm
Third Order Intercept Point $\Delta f = 50$ kHz antenna input referred, gain control manual, attenuator out, preamp out, pre-selector out	≥ 30 dBm
Image Rejection gain control manual, attenuator out, preamp out, preselector out	≥ 110 dB
IF Rejection gain control manual, attenuator out, preamp out, preselector out	≥ 100 dB
LO Isolation measured at antenna input when terminated into 50Ω attenuator out, preamp out, preselector out frequency range 56.85 MHz . . . 86.85 MHz	≤ -95 dBm
Return Loss measured at antenna input, 100 kHz . . . 30 MHz attenuator out, preamp out, preselector out	≈ 10 dB

¹mario.hellmich@web.de

Distortion

1 mV input signal
AM at 50% depth with 1 kHz
attenuator out, AGC slow

$\leq 0.7\%$ THD
with 30 kHz bandwidth

SSB Unwanted Sideband Rejection

input signal at 1 kHz offset from tuned frequency
bandwidth 2 (2.4 kHz)

≥ 38 dB

RSSI Readout Accuracy

bandwidth 2 (2.4 kHz)
attenuator out, preamp out, preselector out
unmodulated carrier

≤ 3 dB
in the range from
-110 dBm to -10 dBm