

1-kW HF Dipole HX002 with integrated tuning unit

Optimum coverage also in the range up to 1000 km

- Single mast
- 1.6/2 to 30 MHz
- Fully automatic operation – no control signals required
- Silent tuning
- EMP protection and immunity to interference from adjacent transmitting antennas

- Omnidirectional coverage with high-angle radiation

Although only 10 m long the self-tuning HF Dipole HX002 with 1-kW input power guarantees optimum radiocommunication over any distance in the frequency range 2 to 30 MHz.

The HF Dipole integrates a tuning unit (FK859 from Rohde&Schwarz) and can be equipped with the Frequency-range Extension HX002F which ensures operation down to 1.6 MHz.



ROHDE & SCHWARZ

Characteristics of HF Dipole HX002

The HF Dipole HX002 permits radio-communication over all distance ranges, in particular the short and medium ranges (up to approx. 1000 km). Rod antennas, for example, do not ensure sufficient transmission reliability over short and medium distances due to the skip zone (right-hand picture) at these distances.

The antenna is specifically designed for operation with Rohde & Schwarz short-wave transmitters. If equipped with Junction Unit GX007, the dipole can also be used with other transmitters.

Radiation characteristics

The excellent radiation characteristics of the HX002 are the result of the radiator shape, the integrated lowloss tuning network and the high-grade balun.

Thanks to the fully automatic adaptive control of the tuning network the HF Dipole HX002 meets all requirements made on state-of-the-art transmission

systems, such as fast frequency change and matching over the complete frequency range, even under varying conditions in the near-field region, for instance with changing soil conductivity.

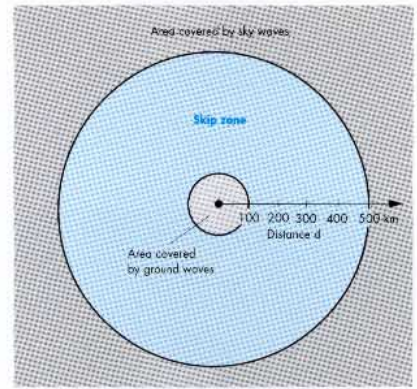
Tuning, operating modes

The nonvolatile tuning memory is updated every time matching correction is performed so that the tuning time is continually minimized.

No control signals are required from the transmitter for tuning, so the antenna can also be used in systems that are already in operation without the need for any modifications.

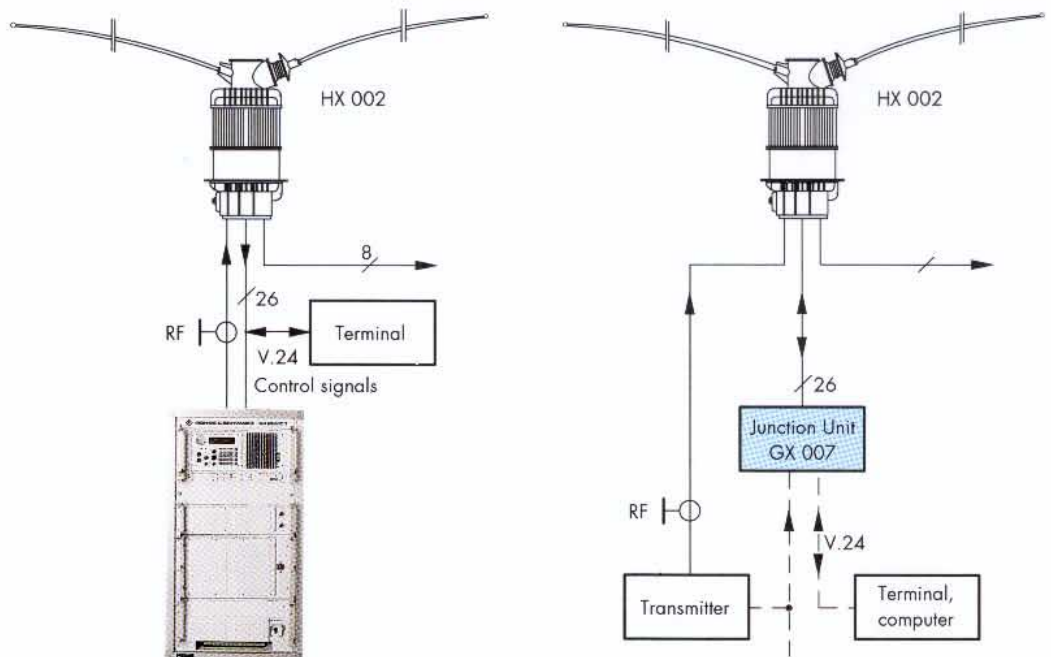
The following modes can be selected with a switch provided on the CPU module (picture below):

- Operation with transmitters of the HF 850 family
- Operation without transmitter control signals; Junction Unit GX007 is available for power supply and status monitoring



Skip zone at HF produced by vertically polarized antenna

In both modes utility programs can be called up via the V.24 interface of the HX002 and a terminal. These programs check the device status and allow a manual or a single-step tuning routine.



Applications of HF Dipole HX002; left: with transmitter of Rohde & Schwarz HF 850 series; right: with any other type of transmitter and Junction Unit GX007

Description of HF Dipole HX002

Subassemblies

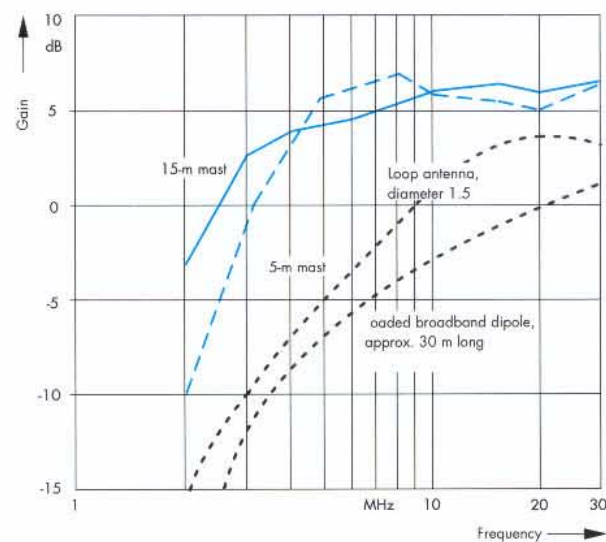
The HF Dipole HX002 consists of

- radiators,
- tuning network,
- balun,
- blower,
- control unit and
- EMP protection circuit.

These subassemblies are accommodated in the antenna housing (right-hand picture).

The prerequisite for achieving a high antenna gain (diagram below) is met by placing the matching network near the feedpoint of the dipole. The matching network is unbalanced and made up of binary-stepped inductors and capacitors. The balanced current distribution on the radiators is achieved by the use of a Guanella transformer acting as a balun.

The drive circuit for the switching elements in the matching network, the blower and the control unit are accom-



Gain of HF Dipole HX002 above perfectly conducting plane (15-m mast in terrain or 5-m mast on roof); for comparison: loop antenna and loaded broadband dipole



HF Dipole HX002 (2 to 30 MHz) with integrated tuning unit

modated at the balanced input of the balun.

Lightning and NEMP protection

Lightning and NEMP protection has been provided for the radiator connectors, the balun (spark gaps), the output of the control unit and the control line connector (filter).

Control unit

The control unit is part of a feedback circuit which ensures a frequency- and environment-independent SWR of less than typically 1.3. The control unit comprises the following sub-assemblies:

- Sensing element, which determines signal frequency, reflection coefficient and RF power from the current and voltage on the feeder.
- CPU module, which converts the data from the sensing element into switching commands for the matching network by means of a micro-processor and stores the optimum settings in a nonvolatile memory.
- Tuning attenuator, which prevents overloading of the RF circuit and mismatch of the transmitter during tuning.
- Power supply, which generates the required operating voltages from the 28-V supply.

The HF Dipole HX002 is of modular design. The plug-ins of the control unit are accessible after opening the front panel.

Tuning memory

The nonvolatile tuning memory (820 channels) covering the complete frequency range 2 to 30 MHz is updated every time matching correction is performed so that the tuning time of the antenna is automatically minimized.

The tuning routine is carried out in five steps:

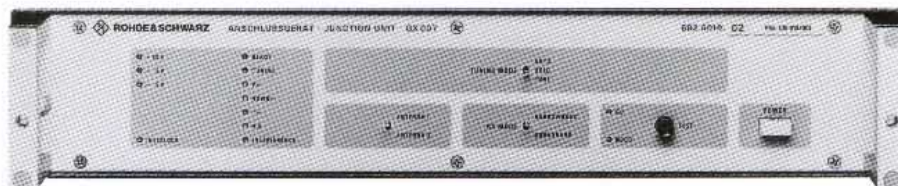
1. Measuring the frequency
2. Calculating the address of the corresponding location in the tuning memory
3. Setting the matching network according to the contents of the tuning memory
4. Measuring the SWR
5. a) If $SWR > 1.3$, a routine for correcting the matching network is carried out.
b) If $SWR < 1.3$, the tuning routine is terminated.

Screening, cooling

To ensure electromagnetic compatibility and optimum cooling, the RF section is electrically and mechanically isolated from the control unit. Components, such as inductors and capacitors, and the wiring are accommodated inside a square tubular insulator which also facilitates the flow of cooling air.

The RF contacts, which are actuated via insulating elements, are mounted on the outer surface of the tube. The compact RF contacts ideally fit into the RF lines without causing any parasitic reactances.

The RF section is isolated from the ambient air by a tubular heat exchanger. The RF lead-through insulator to the antenna is in the middle of the ribbed cover.



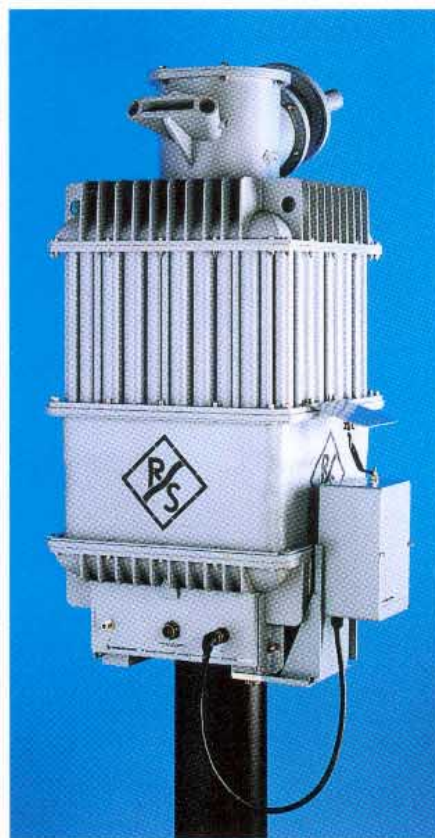
Junction Unit GX007 for HF Dipole HX002 for use in any radiocommunication system, operated without control signals from transmitter

Frequency-range Extension HX002F

The Frequency-range Extension HX002F permits the HF Dipole HX002 to be operated as an antenna with principally vertical polarization in the range 1.6 to 2 MHz. The HX002F can easily be retrofitted (no crane required; see photo below).

Function

Below 2 MHz the balun of the HF dipole is bypassed by the HX002F. In conjunction with the mast, the antenna operates as a monopole fed at the top.



HF Dipole HX002 (without rods) with Frequency-range Extension HX002F

Construction

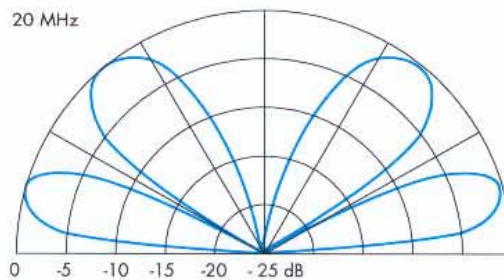
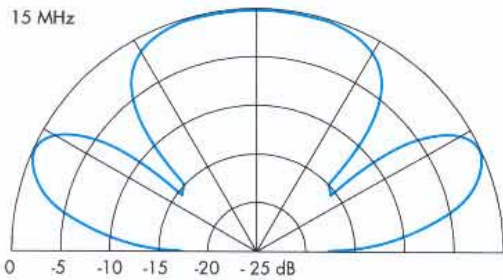
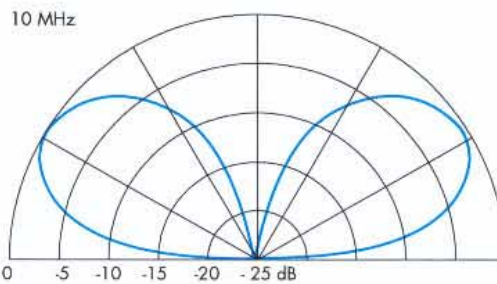
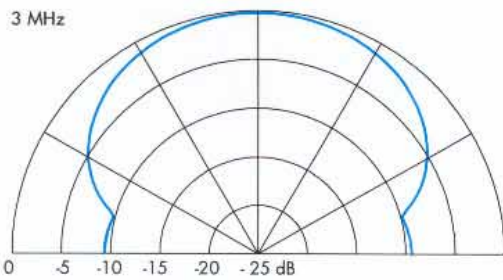
The unit is made up of a high-vacuum relay and an inductance, both accommodated in a plastic housing, and controlled and fed by the HF dipole.

Junction Unit GX007

The GX007 (photo above) is the control, display and power supply unit for HF Dipole HX002 (and for Antenna Tuning Unit FK859). It permits the antenna to be operated without control signals from the transmitter and can also be used with shortwave transmitters that do not belong to the HF850 series. Both HF dipole and junction unit can easily be integrated in existing HF radiocommunication systems.

The Junction Unit GX007 performs the following functions:

- Monitoring and indication of antenna status
- Setting the automatic tuning of the antenna
- Triggering the self-test and display of results
- Establishing the connections (via V.24, RS-232-C) for silent tuning and for control via processor as well as diagnostics via detached display terminal
- Generating the supply voltages from the AC supply



Vertical patterns of HF Dipole HX002 above perfectly conducting plane and for 15-m height above ground

Specifications

HF Dipole HX002 and Frequency-range Extension HX002F

Frequency range	2 to 30 MHz
with frequency-range extension	1.6 to 30 MHz
Max. input power	1.15 kW (CW and PEP)
Input impedance	50 Ω
SWR	typ. ≤1.3 (≤1.5)
Polarization	horizontal
with frequency-range extension below 2 MHz	mainly vertical
Vertical patterns	see above

Tuning

Tuning time	
Silent tuning (with transmitters of HF 850 series or processor control) without retuning (after initial tuning)	≤60 ms, typ. 56 ms 70 to 500 ms (depending on mode and interface)
Initial tuning (learn phase)	≤15 s in 95% of all cases ≤50 s in 100% of all cases
Tuning power	50 to 300 W

Connectors

HF dipole	
RF connector	N female
Control and power connector	26-contact circular connector using spark gap
Lightning protection	integrated, E < 50 kV/m, t _{rise} > 5 ns, 0.5 x t = 200 to 300 ns
NEMP protection	
Frequency range extension	
Antenna connectors	screwed terminals
Control and power connection	cable with 10-contact circular connector

Electromagnetic compatibility (EMC)

Immunity to interference from adjacent transmitting antennas	no malfunctioning; if interfering signal exceeds approx. 2% of input power (at 50-Ω input), automatic tuning is disabled
Susceptibility to external radiation	≤1 kW
Spurious emissions	to MIL-STD-461B and 462

General data

Operating temperature range	-30 to +55 °C
Storage temperature range	-40 to +85 °C
Relative humidity	95% at max. +55 °C
Vibration resistance (in transport crate)	0.3-mm amplitude at 10 to 55 Hz, 2 g at 55 to 500 Hz (to VG95332 and MIL-STD-810C)
Shock resistance (in transport crate)	30 g, 11 ms (half-sinewave to VG 95332 and MIL-STD-810C)
Resistance to salt fog, sand and dust	to MIL-STD-810C

Max. installation height

2000 m above NN (permissible input power is reduced at heights exceeding this value)

15 m

Required mast height for frequency-range extension

Permissible wind speed without ice accretion

wind load (at 188 km/h) with 3 cm radial ice accretion

MTBF (at +25 °C) with Transmitter XK 859 with other transmitters

Power supply

2000 m above NN (permissible input power is reduced at heights exceeding this value)

15 m

188 km/h (to DIN 4131)

3400 N

130 km/h

10500 h

6500 h

+21 to +32 V DC, 6 A max., 2.5 A average with +28 V (165 V_{Amax.})

Dimensions, weight

HF dipole

510 mm x 1128 mm x 510 mm (dipole length 10300 mm), 103 kg

Frequency-range extension

160 mm x 344 mm x 270 mm, 2.5 kg

Junction Unit GX 007

Connectors (rear panel)

Power connector

Connector for HX002

V.24 (RS-232-C) interface

Transmitter connector

Ground terminal

DIN 49 457

female, 26-contact

female, 25-contact

male, 12-contact

M5

LEDs

Status of GX007

HX002

+5 V, -5 V, +30 V

ready (antenna switched on)

tuning (tuning switched on)

P< (forward power insufficient)

SWR< (matching insufficient)

T> (temperature too high)

V<> (incorrect operating voltage)

interference (external transmitter)

interlock (transmitter interlock circuit)

Operating controls

power on/off

test

tuning mode (AUTO, HOLD, TUNE)

RX mode (narrow band/broad band)

antenna 1/antenna 2

General data

Operating temperature range

Storage temperature range

Vibration resistance

sinewave

random

Shock resistance

-25 to +55 °C

-40 to +85 °C

5 to 55 Hz/amplitude 0.2 mm

20 to 2000 Hz/6 to 7 g

30 g/11 ms (half-sinewave to MIL-STD-810C)

Electrical safety

EMC

MTBF

Power supply

VDE 0804

VDE 0871/0875, MIL-STD-461

9000 h

100/120/220/240 V, 47 to 63 Hz (225 VA max.)

Dimensions, weight

484 mm x 90 mm x 390 mm, 6.5 kg

Ordering information

Order designations

HF Dipole (with tuning unit)		
Colour RAL 7011 iron grey	HX002	682.3010.22
RAL 6014 yellow olive	HX002	682.3010.23
RAL 7001 silver grey	HX002	682.3010.24
RAL 1002 sand yellow	HX002	682.3010.25
Frequency-range Extension		
Colour RAL 7011 iron grey	HX002F	4017.9053.02
RAL 6014 yellow olive	HX002F	4017.9053.03
Equipment supplied: HX002F, blank panel, connection panel, 2 screws M6x35		

Recommended extras

5-m folding mast, for roof mounting, climbable, with guy ropes	HX002Z1	506.4425.02
Auxiliary Mast	HX002ZZ	682.6961.02
15-m mast, climbable, with guy ropes	KM451B2	4028.3400.03
Mast Adapter	KM451Z4	4032.2904.02
Service and Mounting Mast	HX002ZS	697.7669.02
Hoisting Device, with 20-m rope, tensile strength 0.8 t	HX002Z6	700.8950.02
Service Kit	ZR074	697.3711.02
Junction Unit for HX002 (and FK 859)		
Bench model	GX007	682.6010.02
19" rackmount	GX007	682.6010.03
Control cable between GX007 and HX002		
Length 40 m	FK 859K1	669.8112.40
60 m	FK 859K1	669.8112.60
80 m	FK 859K1	669.8112.80
Set of control cables between GX007 and HX002		
Length on request (max. 200 m)	HX002K1	720.8303.99
Control line socket		511.9296.00
Control line plug		612.7400.00



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