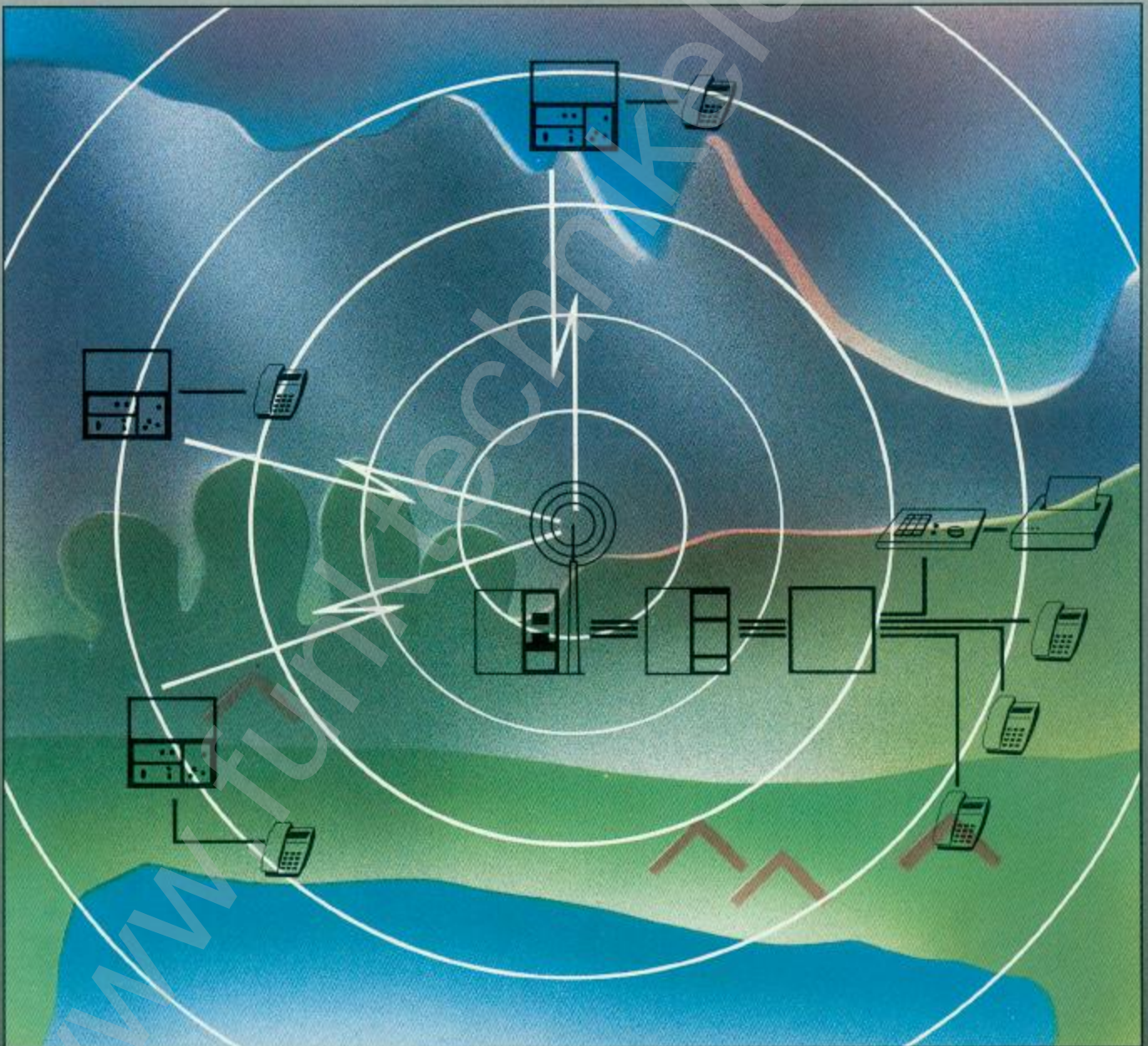




Funkwerk Köpenick GmbH

Radiotelephony System



Special features

The Radiotelephony System designed by Funkwerk Köpenick GmbH permits the extension of the national telephone network in thinly populated rural areas for the purpose of developing the infrastructure and the national economy. For subscribers scattered over an area of 4 km to 7 km from the telephone exchange, the use of the radiotelephony system is more efficient than the installation of wirelines.

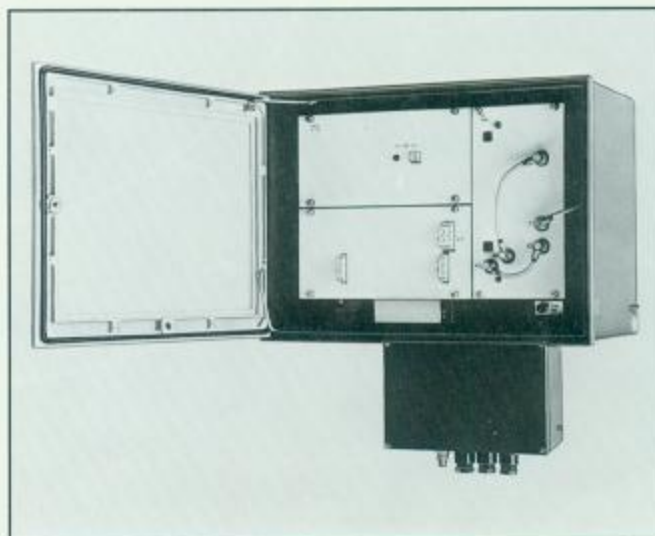
Other examples for the application of this radiotelephony system are:

- establishing of telephone communication in difficult terrains
- installation of temporary networks which will be otherwise shaped in their final state
- short-term establishing of temporary telephone connections to building sites
- quick set up of a telephone network in case of catastrophe
- establishing of telephone communications in areas where often dangerous natural phenomena as there are high water, avalanches, earth-quakes, quicksand, or the risk of wanton destruction are expected.

Using the Data Modem VM 2400 allows teletype operation via the telephone network without requiring a telex exchange as well as data transmission with 2400 bits/s or 1200 bits/s. The data interface meets the international standard V 24. Island networks, the radio sight of which is limited, can be set up by means of a Base Radio Station. Extension of the radio coverage area is provided by relay stations.

- Up to 120 telephone subscribers can be connected.
- Ease of maintenance and optimum adaptation to customer's requirements provided due to modular design. Subsequent increase of the number of subscribers up to max. 120 and of up to 8 channels is possible.
- The whole telephone network is supervised from the Transfer Station, mounted at the site of the telephone exchange, without troubling the subscribers.
- Observance of privacy by ciphony.
- The system is suitable for Telefax operation.
- The available radio channels are efficiently used thanks to the concentration principle of the multiaccess technology. Each subscriber has access to every clear channel of the system. Channel allocation is performed automatically. The failure of channel facilities does not affect the functionality of the system; only the traffic capacity will be reduced for a short time.
- Low power consumption and high reliability are obtained by the application of up-to-date semiconductor technologies.
- The assortment of power supply modules makes all equipment parts of the radiotelephony system compatible with the different primary voltage sources. Module exchange is possible at any time.
- In radiotelephony networks, teletype and data transmission can be accomplished in conjunction with data modem via telephone exchanges.

Subscriber's Radio station URS



Construction and mode of operation

The **Subscriber's Radio Station URS** represents the radio terminal for the radiotelephony subscriber. By simply connecting a conventional telephone set the subscriber is linked via radio to an automatic telephone exchange. Logic facilities supervise permanently all radio channels of the radiotelephony network and organize independently all identification and signalling procedures. The logic recognizes seized channels and selects the clear ones in case of call demands. A transceiver of the system U 700 operates as duplex radio set in the UHF- and VHF range. The Subscriber's Radio Station operating with 13.8 V dc can be matched to the respective requirements by pluggable power supply modules. Directional aerials with gain are recommended. For mobile application, the variant URS-A2 with supply voltage of 13.8 V dc is provided.

The **Base Radio Station URB** is the concentration point of all subscribers of the radiotelephony group. The station is mounted on a place providing optimum radio conditions. It operates unmanned and is controlled via a four-wire connection per channel from the Transfer Radio Station URT. The standard version contains four channels. Variants permit the use of only two up to eight channels depending on the number of subscribers and the traffic value. A transceiver of the series U 700 is used as duplex radio set for each channel in the UHF and VHF range, resp. Channel connection units for cable and radio links serve to match the radio sets to the conditions of far-end operation in four-wire technology.

The aerial terminals of the radio sets are connected to one or more aerials via multiplexer. For energy-saving reasons, the transmitters are only switched on in case of channel occupation. Each radio channel operates with 13.8 V dc and is matched to the given requirements via its own pluggable power supply module. Omnidirectional aerials with gain are preferably used.

The **Relay Radio Station URR** provides the connection of the subscribers to the radiotelephony network groups that cannot be reached by radio sight from the Base Radio Station URB.

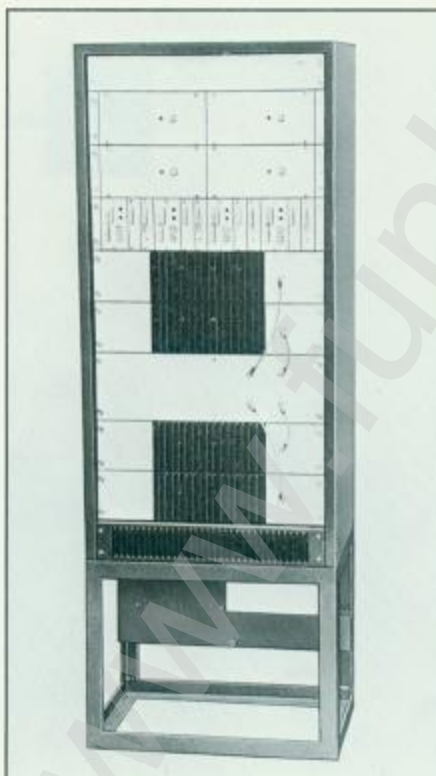
In the Relay Station, special control facilities are mounted instead of the channel connection devices used in the Base Station. The standard version of the Relay Station, equipped with four transceivers, transmits two base station channels. Variants as one-channel or four-channel URB are available.

The **Transfer Radio Station URT**, located at the site of the telephone exchange, concentrates „s“ conventional two-wire subscriber's connections of the exchange to „C“ transmission channels of the radiotelephony network (for max. equipping: s = 120, C = 8).

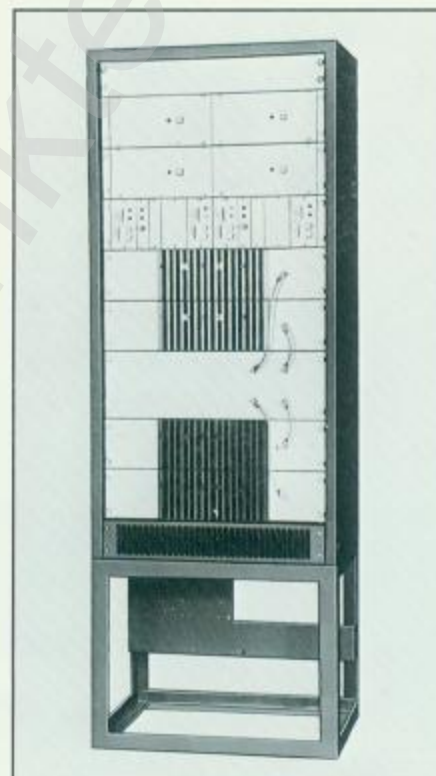
For matching to the conditions of the customers, any partial complementation and further extension is possible. Each channel of the Transfer Station is connected via channel connection units and four-wire connections by cable or radio links to the Base Station URB.

The allocation of the subscriber's modules to the channels is performed electronically and is controlled by logic sub-assemblies. Occupied channels are recognized to avoid multiple seizure. Faulty channels are indicated and not used. In order to reduce the postdialling delay for the calling party to a minimum, unsuccessful efforts of establishing a communication are limited automatically. The functionality of the channels and the subscriber's equipment can be checked from the Transfer Station. Malfunctioning channels and subscriber's equipment are signalized automatically. The Transfer Station operating with 9 V dc can be matched to the respective requirements by pluggable power supply modules.

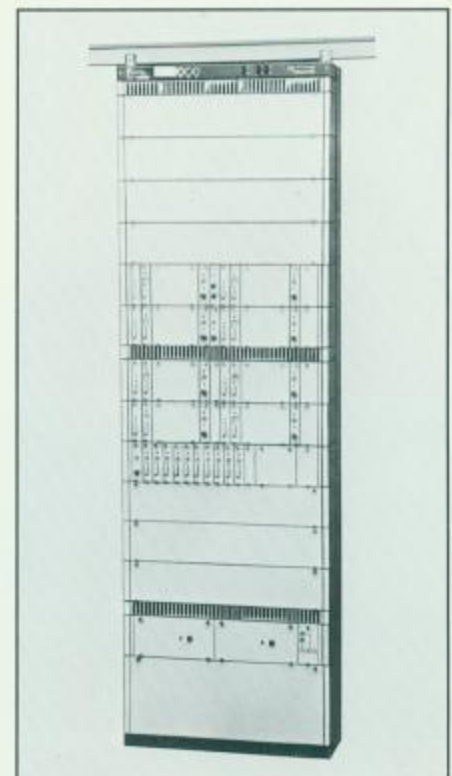
Base Radio Station URB



Relay Radio Station URR



Transfer Radio Station URT



Principle of function

Teletype transmission to radiotelephony subscribers

The duplex radio channels of the radiotelephony system replace the conventional wirelines to the telephone subscribers, i. e. all functions of a standard telephone set must be transmitted by radio. For this purpose, the required direction-dependant signals are transferred into the audiofrequency transmission range of the radio sets and transmitted in the duplex channels or generated from logic combinations.

Furthermore, each subscriber gets a special identification that is checked before each through-connection of the speech paths by an acknowledgement system. Complete privacy is guaranteed to all subscribers. In respect to energy saving purposes, all radio sets transmit only during the establishment of the connection and during conversation. Seized channels signalize their state by emitting a pilote tone. The Subscriber's Radio Stations URS are scanning cyclically all channels of the Base Station or the Relay Station and check if there is a call for them. The called Subscriber's Station only is acknowledged and releases the call in the telephone set connected. All other Subscriber's Stations go on scanning.

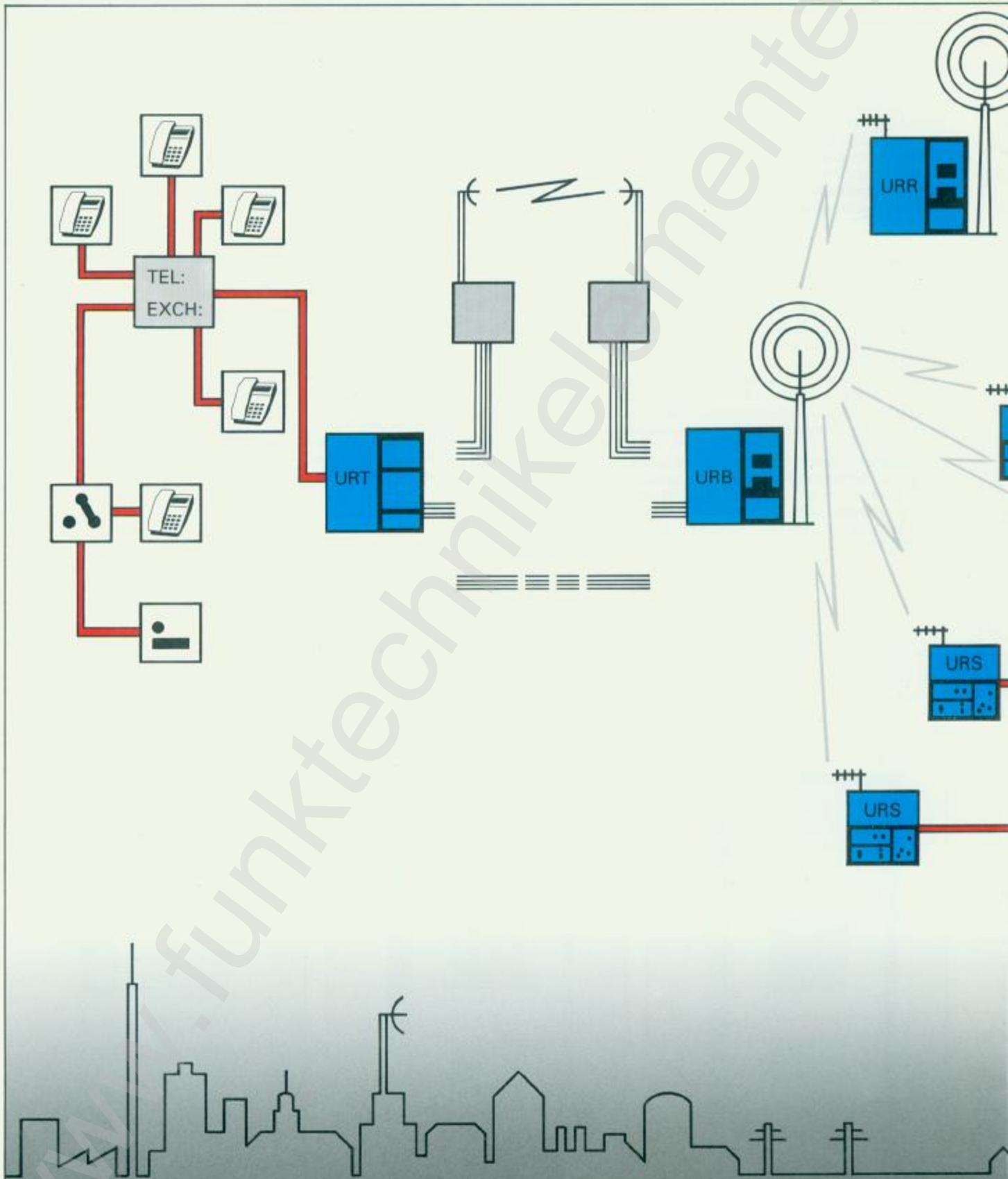
When the communication had been established from one of the URS's, establishing of the connection to the exchange is automatically initiated on a clear channel by unhooking the handset.

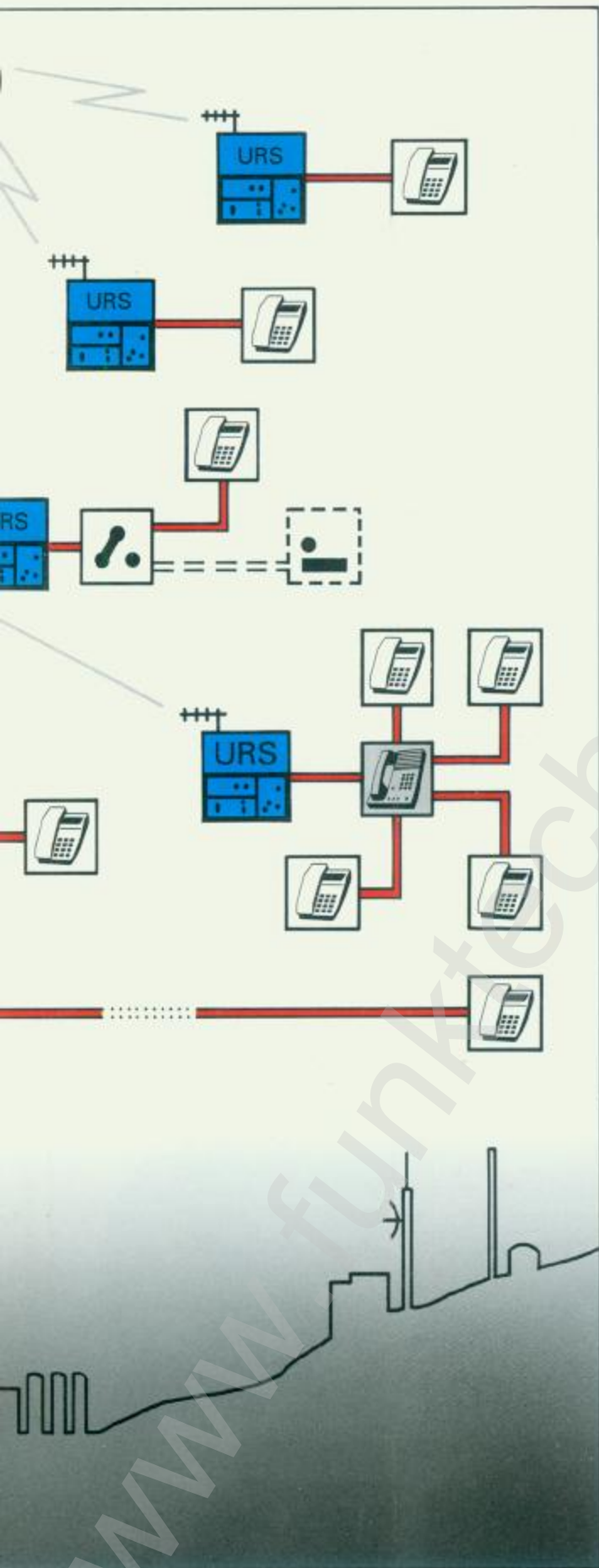
In radiotelephony networks of any configuration, teletype transmission can be realized on the basis of the modem principle. Thus, teletype signals are transmitted via the telephone network without requiring a telex exchange. Existing radiotelephony networks can be used without modifications. Retro-fitting with MODEM variant is possible at any time. When using the Data Modem VM 2400, a V 24 interface is mounted in the subscriber's Station permitting, besides teletype operation, the connection of office computers with a data throughput of up to 2400 bit/s. In the beginning, each communication is established via the telephone set. Then, following an arrangement between both parties, teletype- or data transmission is performed by manual change-over on the modem to data transmission.

Data modem VM 2400



Radiotelephony System





Transfer Radio Station URT



Base Radio Station URB



Subscriber's Radio Station URS



Relay Radio Station URR



Subscriber's circuit



Telephone Subscriber



Teleprinter



Telephone exchange (dial system)



Radio link



Telephone exchange (manual)

Technical data

Data for transmission

Mode of operation duplex
 Mode of transmission G3E
 Frequency deviation ± 5 kHz max.
 Channel spacing 25 kHz, 20 kHz optional
 Frequency range optional: 146 MHz to 174 MHz
 duplex spacing 4.5 MHz*
 440 MHz to 470 MHz**
 duplex spacing 10 MHz+

Frequency stability

URS ± 2 kHz
 URB ± 1 kHz
 URR ± 1 kHz
 Speech frequency range 300 Hz to 3400 Hz
 Unwanted emission 1 μ W max.
 0,25 μ W in the range
 174 MHz to 230 MHz and
 470 MHz to 790 MHz

Intermodulation attenuation

Max. transmission loss 75 dB min.
 112 dB*** with 20 dB
 for reception

Max. data throughput with MODEM operation

2400 bit/s

* other duplex spacings on special demand

** other frequency range on special demand

*** without considering the aerial system

Connection conditions

Subscriber's Radio Station URS

Telephone set connection to dial telephone set
 acc. to CCITT loop resistance of
 the two-wire feeder
 max. 300 ohm

MODEM

two-wire connection acc. to
 CCITT
 Teleprinter via Modem acc. to V24 interface
 Aerial rated impedance 50 ohm coaxial
 type N

Aerial connection socket 13.8 V dc (neg. pole to earth) or
 220/127/110 V ac 50 Hz to 50 Hz
 with automatic charging of
 emergency battery and
 changeover or
 11 V to 36 V dc or 33 V to 70 V dc

Base radio Station URB

Transmitting facility to URT

four-wire connection per
 channel
 impedance 600 ohm symm.
 level - cable: input - 26 dBm
 output + 4 dBm
 level - radio
 link: input + 4 dBm
 output - 14 dBm

Aerial(s)

Aerial connecting socket(s) rated impedance 50 ohm coax.
 type 7/16
 Power supply 13.8 V dc (neg. pole to earth) or
 220/127/110 V ac 50 Hz to 60 Hz
 or 11 V to 36 V dc or
 33 V to 70 V dc

Relay Radio Station URR

Aerials rated impedance 50 ohm coaxial
 Aerial connecting sockets 7/16
 Power supply 13.8 V dc (neg. pole to earth) or
 220/127/110 V ac 50 Hz to 60 Hz
 or 11 V to 36 V dc or
 33 V to 70 V dc

Transfer Radio Station URT

Transmission facility to URB

four-wire connection per
 channel
 impedance 600 ohm symm.
 level - cable: input - 26 dBm
 output + 4 dBm

Telephone exchange

level - radio
 link: input + 4 dBm,
 output - 14 dBm
 max. 120 subscriber's two-wire
 connections

Power supply

impedance 600 ohm symm.
 220/127/110 V ac 50 Hz to 60 Hz
 or 11 V to 36 V dc or
 33 V to 70 V dc

Dimensions

	Height	Width	Depth
Subscriber's Radio Station URS	320 mm	440 mm	260 mm
Base Radio Station 4 channels URB	1680 mm	575 mm	400 mm
8 channels Δ 2 x 4 channels Relay Radio Station 2 channels URR	1680 mm	575 mm	400 mm
4 channels Δ 2 x 2 channels Transfer Radio Station URT			
60 subscribers	1400 mm	600 mm	225 mm
120 subscribers	2000 mm*	600 mm	225 mm
	* 2300 mm,		
	2600 mm as variants		

Climatic conditions

Subscriber's Radio Station URS - 10 °C to + 50 °C
 Base Radio Station URB - 10 °C to + 50 °C
 Relay Radio Station URR - 10 °C to + 50 °C
 Transfer Radio Station URT - 10 °C to + 55 °C

Aerial types

2-m band
 Omnidirectional aerial 2 AR 20 gain 4.3 dB
 Directional aerial 2 AY 10 gain 6 dB
 Directional aerial 2 AY 11 gain 9 dB
 0.7-m band

	Type	Frequency range	Gain
Omnidirectional aerial	UAZ 770	420 to 470 MHz	2 dB
	UAZ 771	450 to 470 MHz	8 dB
Directional aerial	UAZ 777	420 to 470 MHz	13 dB
Directional aerial	UAZ 778	420 to 470 MHz	16 dB

Order data

When placing an order, the following has to be indicated for each radiotelephony network:

- Type of transmission equipment between URT and URB
- Number of channels URT/URB
- Number of URSs with number of channels
- Number of URSs operation via URB
- Number of URSs operation via the respective URSs
- Frequencies for URB and each URR*
- Power supply for URT, URB, URR and URS
- Number of subscriber's shelves for the URT with number of subscribers per shelf with regard to the complementation with subassemblies for servicing.
- Types and numbers of aerials

* On special request, assistance in network designing is provided.