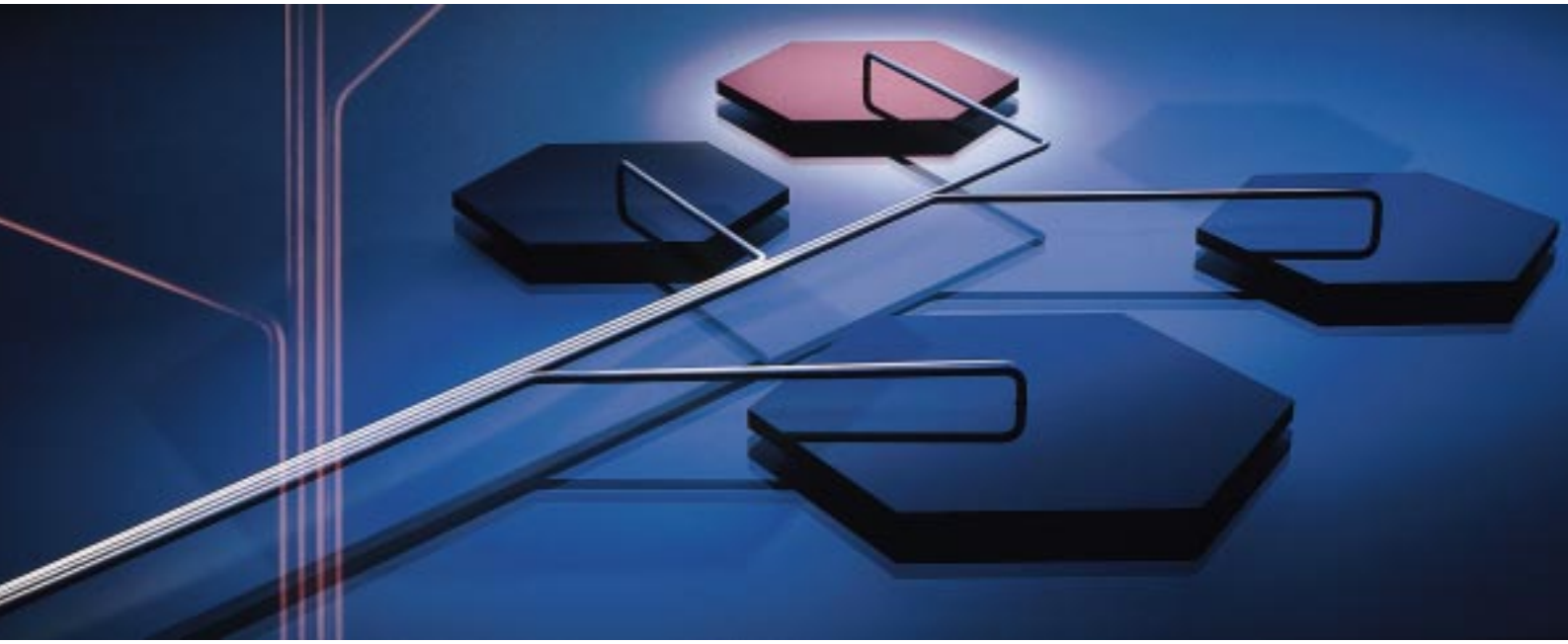


ACCESSNET ®

The Trunked Radio System for Professional Users

The growing demand for mobile communication is facing with a shortage of radio frequencies. A dilemma which can only be overcome with the help of state of the art radio systems and tailor-made solutions.

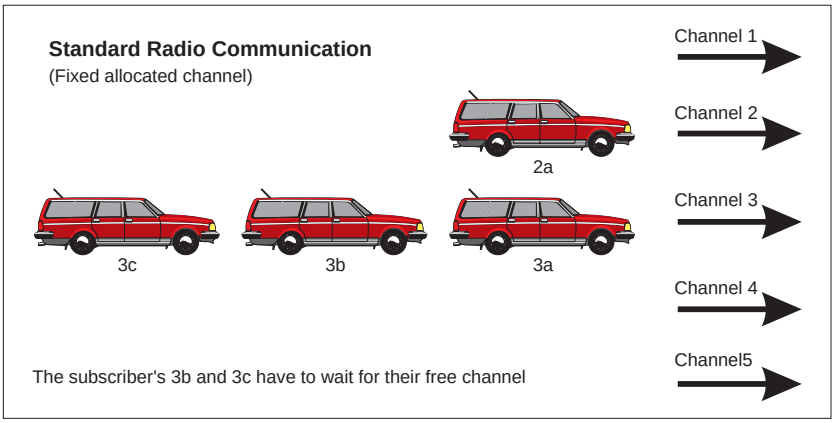
ACCESSNET® from R&S BICK Mobilfunk is the solution for this problem. A Trunked Radio System based on the MPT1327 signalling standard which does not impose terms, instead you determine what is needed. Whether single cell - or national network, on any scale it meets your requirements.

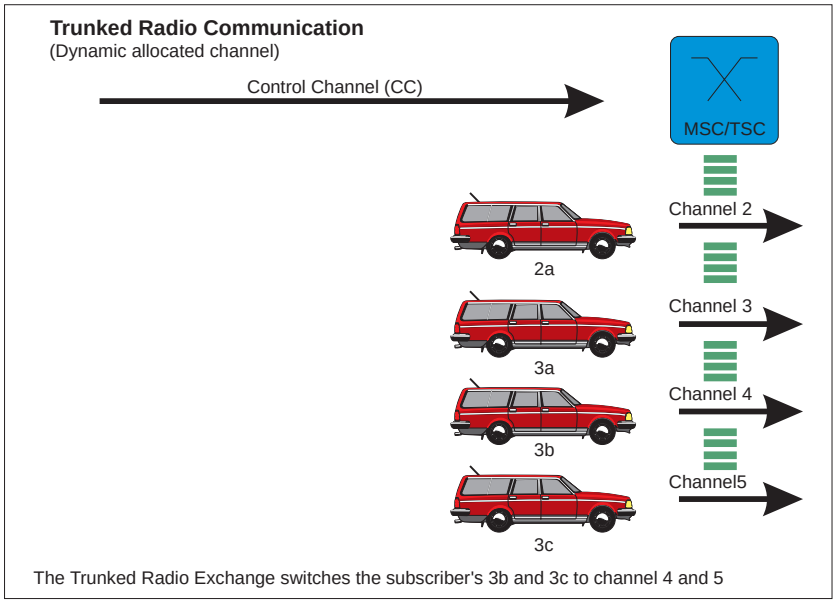
ACCESSNET® makes economic use of the radio channels. A traffic channel is exclusively allocated from a radio channel trunk to the participants in a call for the duration of the connection. This method offers a large subscriber capacity and availability which results in an excellent service quality. This is because of the intelligent trunked radio exchanges and an efficient frequency management which ensure coverage of a large area without mutual interference.

ROHDE&SCHWARZ

R&S BICK Mobilfunk GmbH

Contents





What is Trunked Radio?

A Trunked Radio System always comprises several radio channels of which one channel is used as the Control Channel (CC). This is used for registrations, the transmission of status messages and for call requests.

Upon requesting a call a traffic channel is exclusively allocated to the subscribers from the remaining trunk of radio channels. The call is then executed on this channel. If the trunked radio system receives further call requests other available channels are allocated to those subscribers. Once all channels are occupied call requests are stored in a queue. As soon as a channel becomes available the requested call is switched to the available channel.

This method means that a call request need only be sent once. If the call cannot be set up the system stores the call request and processes it later.

The Control Channel (CC)

Each radio cell consists of a Trunked Radio Exchange and a Radio Base Station (RBS). The Trunked Radio Exchange can be used as a Master System Controller (MSC) or as a Trunking System Controller (TSC). The Trunked Radio Exchange manages the radio channels of the Radio Base Station(s). One of these channels is used as the CC.

When a mobile is switched on it automatically registers on the CC. If the subscriber receives a positive acknowledgement his mobile is registered on the Trunked Radio System and he can use it. The mobile is constantly in con-

tact with the CC. If there is a call request the Trunked Radio System checks wether the addressed subscriber is available. If he is not available, not registered or engaged this information is given to the caller. If the requested subscriber is available the call is set up by the Trunked Radio Exchange using a free traffic channel. Status messages and short data are submitted on the CC.

The Trunked Radio System *ACCESSNET®*

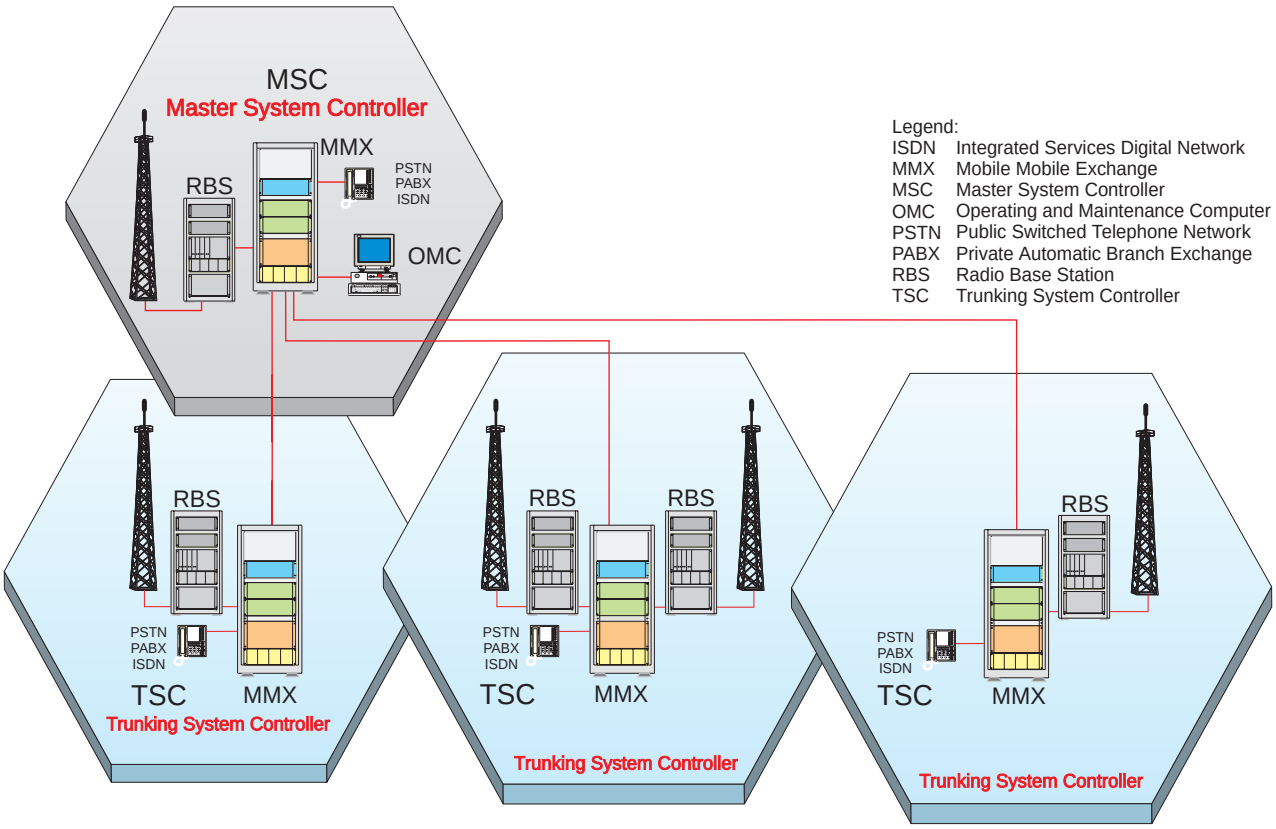
Due to the cellular structure, in conjunction with processor controlled exchange technology, small areas as well as local, regional and national economic areas can be covered. For example, a companies site or an airport may be covered with one small cell. If several radio cells are linked together this already results in a complete network. However, even this is not the limit because it is possible to link several *ACCESSNET®* networks. Interconnecting several networks allows to establish a national mobile communication system.

ACCESSNET® offers an expanded area of operation to subscribers due to being able to roam from one radio cell into another. The cell size depends on the capacity requirements. A large radio cell can have a cell size of 10 to 25 km in diameter. In densely built-up areas with a large number of subscribers the cell diameter is approx. 5 km.

Careful selection of antenna systems allows local conditions to be taken into account. R&S BICK Mobilfunk takes care of the planning of the radio coverage as well as choosing the sites and locations for the complete system.

ACCESSNET® Trunked Radio Systems are hierarchically structured and have a variable cell structure with a MSC and additional TSCs. In addition to the direct connections between the MSC and the TSCs trunk lines can also interconnect individual TSCs.

This further increases the performance of the *ACCESSNET®*. Analogue or digital lines are suitable for the connections between MSC and TSC or TSC and TSC. For digital lines basic rate as well as primary rate interfaces are supported.



Structure of the Trunked Radio System *ACCESSNET®*

Green Light with *ACCESSNET*®

There are virtually no limits when it comes to applications for *ACCESSNET*®. Whether a radio location on the companies site in the local area is sufficient or a network to cover complete larger areas is required, the decision is the operators. The system is flexible and can be adjusted to any requirements. On any scale it is efficient, economical and easy to operate. High reliability at very low maintenance, one of our primary development targets, is a matter of course and has been proven in applications around the world. *ACCESSNET*® does not just allow calls between mobile subscribers, it is also possible to communicate with subscribers via other communication systems such as the public telephone network (PSTN/ISDN) or company internal private branch exchanges (PABX/DECT). This allows functionally extended and even more efficient use of existing systems.

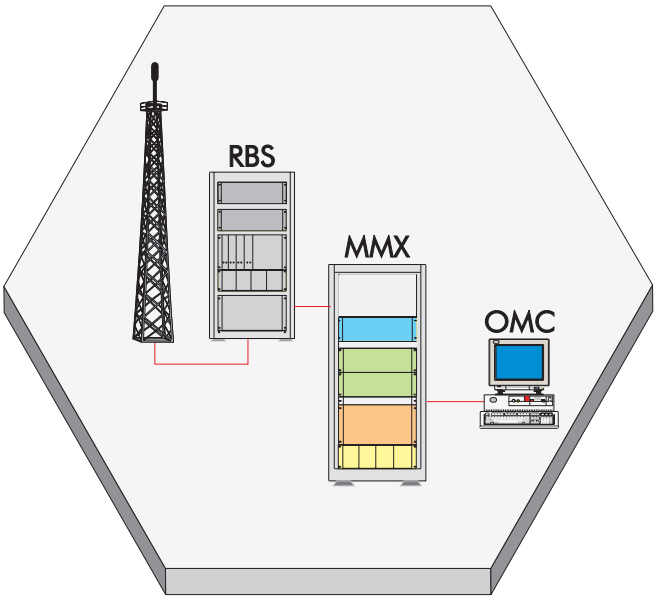
In practice this means that a telephone subscriber can reach individual radio subscribers in a fleet. Diverse entitlements for the various call types are individually allocated to each subscriber via an entry in the OMC (Operating and Maintenance Computer).

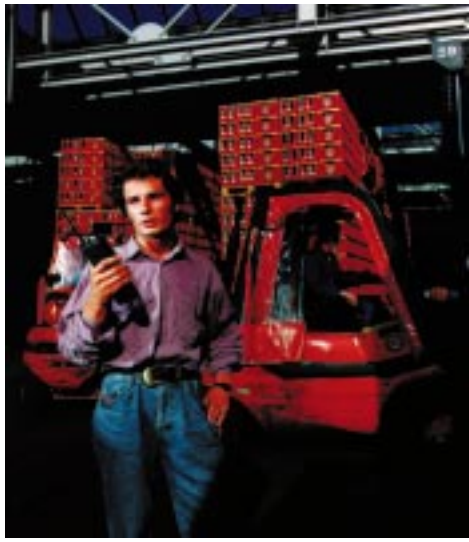
By using the MPT1327/1343 signalling standard all the advantages of an open system are provided to *ACCESSNET*® users such as:

- Guaranteed system improvements and system maintenance due to wide usage
- Free choice of mobile terminals
- Integrated data communication
- Cost reduction due to wide market penetration and a large number of suppliers
- Migration to future standards such as TETRA

Furthermore *ACCESSNET*® offers additional advantages such as:

- Secured and long-term system maintenance due to international market penetration
- Short response times due to our own network of service engineers
- Service friendly due to a low number of different modules
- High reliability due to the consequent use of SMD components
- Proven quality due to development and manufacture compliant with ISO9000





ACCESSNET® from R&S BICK Mobilfunk offers a multitude of persuasive features:

● Interoperability

ACCESSNET® operates in accordance with the MPT1327 and 1343 signalling standards of the British Department of Trade and Industry (DTI) as well as the German recommendations RegioNet 43 of the "Zentralverband der Elektrotechnik und Elektronikindustrie e. V. (ZVEI)". This ensures compatibility with mobile terminals from different manufacturers.

● Large Subscriber Capacity

With *ACCESSNET*® up to 50,000 subscribers can be managed and divided into groups, vehicle fleets, etc., the decision is yours. Subscriber data is easily entered and modified.

● Access Entitlement

The system excludes unauthorized subscribers. Each radio subscriber can only use those features for which he has explicit authorisation.

● Voice and Data

Apart from system internal services a host of voice and data calls are available to subscribers: individual call, group call, priority call, emergency call, broadcast call, dispatcher call, include call, short dialling, status messages, short messages (SDM/EDM), call diversion and callback request.

● Resource Management

Once all radio channels are occupied subsequent call requests are not rejected, they are added to queues instead. As soon as a channel becomes available the next call request in the queue is processed.

● Expansions

There are optional expansions to the service offered. Possible additional functions are: ISDN direct-dialling, dispatcher (ONSys), mailbox system (MBS), graphical network monitoring (MOMo-Maint) and billing system (MARS). Under certain conditions paging and simultaneous broadcasting are also possible.

● Monitoring and Reliability of Service

Numerous monitoring functions for network and load control, call time limiting, unit or subscriber checks and a maintenance access come as standard. Fallback levels, substitute path routing and switching of substitute control channels increase the reliability of service.

● Flexible Use

ACCESSNET® adjusts to almost any kind of usage: versions for stationary and mobile use are available for a 230V AC supply or 36V to 72V AC supply.

Where Everthing Meets...

The Trunked Radio Exchanges MMX

The Trunked Radio Exchanges are the heart of the *ACCESSNET*®, their task is to switch the calls or the connections on the various levels so that each connection occupies as few lines and interfaces as possible. You can choose from our range of Trunked Radio Exchanges, starting with the MMX-8 via the MMX-24 to the MMX-64.
The exchanges comprise:

- Main processor
- Interfaces and switching modules
- Power supply
- Rack including wiring

The MMX-8 is ideal for small systems with few radio channels and one or two sites. In conjunction with a Radio Base Station it can be installed in a vehicle as a mobile radio cell and can then be used, for example, in emergencies or at sporting events.
A MMX-24 is the basis for a medium sized Trunked Radio System. In the basic version it has 24 interface ports. The MMX-64 is used when a large network is installed. It can be equipped with digital switching modules. If required the number of interface ports can be increased. This applies to all MMX trunked radio exchanges.
Dependent on the planned network structure the MMX-8 and MMX-24 exchanges are installed as analogue and the MMX-64 exchanges as digital Trunked Radio Exchanges with a varying number of interface modules. All Trunked Radio Exchanges can be used as Master System Controller (MSC) or as Trunking System Controller (TSC).

Radio Base Station(RBS)

Due to their variable output power of 1.5 to 50W and different frequency bands the Radio Base Stations are suited to virtually any area of application.
Numerous test and monitoring functions ensure high reliability of service with the lowest possible maintenance.
System installation is easy as only a 4-wire line is needed between each radio channel and its allocated line interface. Apart from the voice transmissions this 4-wire line also submits alarm messages and all signals for controlling the Radio Base Station.
The standard frequency range of the radio base stations is between 410 and 430 MHz; further ranges between 453 and 457.5 MHz or 463 and 467.5 MHz are available if required. The supply voltage can be either 230V AC or 36 to 72V DC.
Optionally a digital 2 Mbit interface compliant with CCITT G.703 is also available. Which means that 30 radio channels can be switched to one MMX-64 using a single line. This simplifies the interconnection via microwave links and makes it more cost effective.
The Radio Base Station is available as ND951 or ND950. The ND951 is suitable for setting up a small radio cell with a maximum of 4 channels. Maintenance access is via PC or modem.
The ND950 supports an expansion to up to 24 channels. Maintenance access is via the common control unit (CCU). This can be achieved via modem or even easier using a keyboard.

Immediate Maintenance

NeOS, OMC and MOMo-Maint

To manage the subscriber and call data *ACCESSNET*® is equipped with its own Operating and Maintenance Computer (OMC) which is available in different sizes.
For smaller networks there is the NeOS (Network Operating System) and for medium to large networks there is the OMC. A major difference is the maximum number of subscribers which can be managed by the Operating and Maintenance Computer.
Below you will find a list of tasks which may be executed with the OMC:

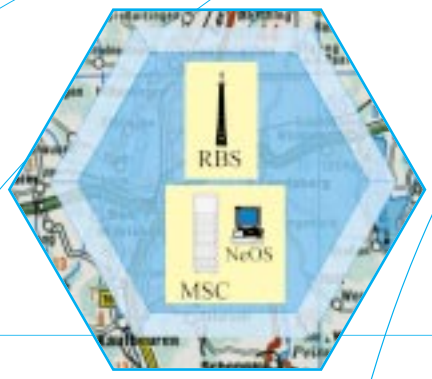
- Subscriber management
- Call data management
- Security management
- Data backup for all data
- Call data output

With the help of the OMC data is processed fast and efficiently. Further processing of the call data by the MARS billing system is also possible.
The OMC is connected to the main processor of the MSC via a serial connection, connection via a modem is a further option.
MOMo-Maint (Monitoring and Operating Module) visualises the network structure and its network components. Events within the network and incoming messages are graphically displayed on screen. Once events have occured they can be analysed quickly and specific actions can be taken.
MOMo-Maint can be connected to *ACCESSNET*® via the Operating and Maintenance Computer or via the maintenance access.

Universal Network Structures

Single Cell Network

This network is suitable for restricted areas such as airports, a companies site or medium sized towns. It can be expanded into a multi cell network in the same way as the connection to other *ACCESSNET*® networks.



MSC with Remote Radio Cells

Compared to a structure with distributed intelligence the advantages here are a minimum of waiting occupancy and short call setup times. Additional Trunked Radio Exchanges can be placed in the remote cells, however, in comparison with the star shaped network architecture the line costs incurred must be weighed against the low deployment of exchanges.

Star Shaped Network

With the star shaped architecture all TSCs are directly connected to the MSC. This configuration has the advantage of a high trunk gain on the interconnection paths.

Meshed Network

Cells with a high load are directly connected via trunk lines. These trunk lines take an essential part of the intercellular calls. These calls can then be processed without transit cells. However, this may reduce the trunk strength between MSC and TSC. Another advantage of this configuration is the fast call setup between the directly connected cells.

Joined Networks

You should design such networks with the help of our specialists. When planning network architectures not mentioned in this brochure or large area networks we will make sure that you will benefit from the optimum of line costs and throughput.

Special Achievements

Mailbox System (MBS)

Using the mailbox system radio subscribers can always be reached regardless of location. Only one mailbox system is required per network whereby the choice of location for its installation is yours.
The mailbox is divided into the voice mailbox for storage and replay of voice messages and the data mailbox for storage and retransmission of data calls. Each radio subscriber can be allocated a mailbox entitlement. If the radio subscriber activates the call diversion or if he is currently not registered on the network voice and data calls addressed to him are buffered in the mailbox system. Once the radio subscriber is directly available again via ACCESSNET® he is automatically informed that there are messages waiting for him.

Operating Console CON-912

The operating console CON-912 provides you with a desktop unit offering the comfort of a telephone and incorporating the operating functions of a mobile terminal. The large display, short dialling keys, hands-free talking and numerous special functions ensure ease of operation. Simple connection to *ACCESSNET®*, short call setup times, remote operation, automatic monitoring and completely maintenance free are features which round off the functionality. The CON-912 can be connected to a MMX Trunked Radio Exchange via a 4-wireline.
This console is useful if a fleet of vehicles operates within the range of a trunked radio network but the companys central location is outside the radio coverage. The CON-912 then takes over the complete signal and voice traffic to control the fleet.

Mobiles

For the trunked radio subscriber the solution to his communication problems is his main priority. In order to be able to make the most of the system different types of mobile terminals are required. A service engineer needs a hand-held unit, a haulier will want to equip his vehicles with mobiles and a fixed radio station will be required in the central location. *ACCESSNET®* uses the open MPT standard which provides a multitude of MPT compliant subscriber terminals from a variety of manufacturers.
MPT subscriber terminals are also available for specific requirements such as MOD, explosionproof or masking.

Looking ahead...

One of the primary delevopment goals when designing *ACCESSNET*® was being able to guarantee interference free operation around the clock. All hardware modules have considerable safety reserves. In the software too care was taken to provide for troublefree radio traffic and trouble free continuous operation.
Switching the traffic channels in turn, for example, does not only allow immediate access to an available channel it also ensures uniform load on all transmitting/receiving modules. Furthermore interferences on radio channels or network lines are automatically detected.

Even if individual components fail *ACCESSNET*® still remains operational. The system tolerates failures and uses the following protective mechanisms:

- Fallback Level

Due to its system structure *ACCESSNET*® is still operational even if individual components are faulty. Instead of the whole system going down it will continue to operate albeit at a reduced capacity.

- Alternate Path Routing

If lines are faulty call requests and calls are submitted on other lines.

- Substitute Control Channel

If the Control Channel fails its task is taken over by another channel from the same trunk.

- Uninterruptable Power Supply (UPS)

To protect the system against power failures *ACCESSNET*® can be equipped with an Uninterruptable Power Supply.

...Provides Security

ACCESSNET® runs continuous checks and passes fault messages on to the Operating and Maintenance Computer. Each status change is logged in the control printout which makes the awkward search for errors a thing of the past. All monitoring and control functions have proven themselves in *ACCESSNET*® systems installed years ago and the full range is available:

- Unit Check

The Trunked Radio Exchange requests each mobile to send its serial number and unit identity. If the data is incorrect the mobile is excluded from operation.

- Call Time Limits

The adjustable call time limit has been implemented to ensure that each subscriber quickly receives an available traffic channel. Once the preset time limit has been exceeded the exchange will terminate the call.

- Maintenance Access

ACCESSNET® has a maintenance access which can also be utilized via modem.

- Roaming

Radio subscribers can move between different radio cells *ACCESSNET*® knows their current position. Roaming is also possible between different joined networks.

The Services

With the Trunked Radio System *ACCESSNET*® R&S BICK Mobilfunk has summarized many years of experience in the field of mobile communication in what could be called a compressed format: The full service range in a compact structure.

Communication Services

Voice Calls:

- Individual call;
  is the connection between two radio subscribers.
- Group call;
  connects one calling subscriber with a group of subscribers.
- Broadcast call;
  is a group call in which the called radio subscribers only listen.
- Priority call;
  individual or group calls with this entitlement are given priority when calls are set up.
- Emergency call;
  is a individual or group call which takes absolute priority over all other call modes. Existing connections are terminated if there are no available channels.
- Include call;
  adds further subscribers to an existing call.

- PSTN call;
  using the telephone interface PIA (phone interface analogue) the MMX can be connected to the public telephone network.
- ISDN call;
  via an ISDN interface PID (phone interface digital) the Trunked Radio Exchange can be connected to ISDN.
- PABX call;
  different telephone interface modules (PIA) are available for *ACCESSNET*® which allow connection to different types of private branch exchanges.

Using the telephone calls telephone subscribers can be reached by radio subscribers. Dialling from the telephone network into *ACCESSNET*® is achieved by comfortable through-dialling, a maximum of 4 digits is sufficient to reach a radio subscriber directly.

Data Calls:

- Status message;
  30 message numbers can be sent using this feature.
- SDM;
  a Short Data Message contains data with a maximum of 23 bytes.
- EDM;
  an Extended Data Message can consist of up to four SDMs transmitted in sequence. The maximum character volume is 88 bytes.
- NPD;
  Non Prescribed Data means the transmission of large data volumes between two data terminals on a transparent traffic channel. The transfer protocol used on this channel solely depends on the type of data terminal used and is not dictated by the network.

Additional Services:

- Call diversion;
  the radio subscriber diverts calls for his mobile to a telephone, another mobile or to his mailbox.
- Callback request;
  a request for callback is sent to a radio subscriber.
- Object oriented calling;
  this is an objekt oriented dynamic group assignment.

Operating Modes

ACCESSNET® offers a range of different operating modes dependent on what is needed. Queueing mode and private radio mode are standard features, telephone and duplex mode are optional and can be ordered separately.

- Queueing mode;
  if all traffic channels are occupied a calling subscriber is added to the queue.
- Private radio mode;
  the call is set up as soon as the addressed terminal has been reached.
- Telephone mode;
  a connection is not switched until the addressed subscriber actively accepts the call.
- Duplex mode;
  each unit is exclusively allocated one traffic channel, the transmit button need not be pressed. Even if connections are set up within one radio cell two radio channels are always allocated.

Support and Service

The mobile radio experts at R&S BICK Mobilfunk will solve your problem, from design, installation and commissioning of tailor-made trunked radio networks for all applications to maintenance, repair and the supply of spare parts. It is part of the philosophy of our company to give the best possible service and to view your order as the start of a reliable partnership.

Link to TETRA

The acceptance of our Trunked Radio System *ACCESSNET*® and the MPT1327 standard has made us the market leader for public networks in Germany and has enabled us to set up an important international market position for special mobile radio networks. R&S BICK Mobilfunk offers advantages in a specific manner: The MPT1327 technology used as the basis of the *ACCESSNET*® is designed interoperable. This makes it possible to expand an existing fleet base into the TETRA network.

In the interest of our customers we feel obliged to guarantee a safe route from the analogue *ACCESSNET*® via the digital FDMA system *ACCESSNET*®-D to the TETRA mobile radio network *ACCESSNET*®-T, which will ensure that your investment is safe.

The Complete Range at a Glance

Features

Voice Call Modes
- Individual Call
- Group Call
- Broadcast Call
- Priority Call
- Emergency Call
- Include Call
- Calls via PSTN
- Calls via PABX
- Calls via ISDN

Data Call Modes
- Status Messages
- Short Data (SDM)
- Extended Short Data (EDM)
- Non Prescribed Data (NPD)

Additional Services
- Call Diversion
- Callback Request

Operating Modes
- Private Radio Mode
- Queueing Mode
- Telephone Mode
- Duplex Mode

Trunked Radio Exchanges:

Analogue Exchanges
- MMX-8/8
- MMX-8/16
- MMX-24N
- MMX-24E

Digital Exchanges
- MMX64/16
- MMX-64/32
- MMX-64/48
- MMX-64/64
- MMX-64/96

Operating and Maintenance Computers

NeOS
OMC
MOMo-Maint

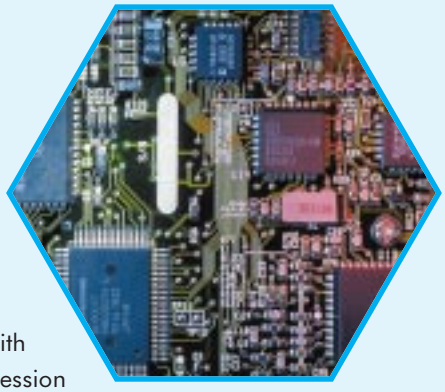
Radio Base Stations

ND951
ND950/4
ND950/8
ND950/16
ND950/24

Power Supply

Standard supply
230V AC
or
36 - 72V DC
Emergency power supply
via UPS

Interface Modules



Analogue Modules
Fixed Lines
Dial-up Lines

Digital Modules
Dial-up Lines
Fixed Lines
Fixed Lines with
Voice Compression
Primary Multiplex Connection

Service

Network Design
Project Engineering
Site Planning
Frequency Planning
Antenna Planning
Redundancy Designs
Project Management
Installation
Commissioning
After Sales Service
Training
Network Analysis

The Company Group

Rohde & Schwarz operates worldwide in the fields of communication and measurement technology. For more than 60 years we have been developing, manufacturing and distributing a wide range of electronic products.

With 4500 employees worldwide and branches and agencies in more than 70 countries the company has an annual turnover in excess of one billion Marks. The company is highly export oriented: Over two thirds of its turnover is made outside Germany. Due to the technological superiority of their products Rohde & Schwarz is among the market leaders in many fields.
Besides the mobile radio technology the Rohde & Schwarz Group is also active in the following areas:

- Test and measurement
- Professional radiocommunications
- Sound and TV broadcasting
- Radiomonitoring and radiolocation
- Environmental measurements and process engineering
- Calibration, service and training
- IT security

The professional way to communicate - *ACCESSNET®*

ROHDE&SCHWARZ

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