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MRx18

Remote Monitoring Option

User's Manual

M0139AFL

Andrew Wireless Systems GmbH, 27-February-2018

TABLE OF CONTENTS

FIGURES AND TABLES

1. General

1.1. Abbreviations

3GPP	3rd Generation Partnership Project Channel
ALC	Automatic Level Control
BCCH	Broadcast Control
BITE	Built-In Test Equipment
BTS	Base Transceiver Station
CDMA	Code Division Multiple Access
CF	Center Frequency
CFO	Center Frequency Offset
CFR	Code of Federal Regulations
DL	Downlink
DoC	Declaration of Conformity
EDGE	Enhanced Data Rates for GSM Evolution
ESD	Electrostatic Discharge
ETS	European Telecommunication Standard
ETSI	European Telecommunication Standards Institute
GSM	Global System for Mobile Communication
GUI	Graphical User Interface
I2C-Bus	Inter-Integrated Circuit Bus (Philips)
ID No	Identification Number
IF	Intermediate Frequency
ISDE	Innovation, Sciences et Développement économique Canada
ISED	Innovation, Science and Economic Development Canada; formerly IC / Industry Canada
LED	Light Emitting Diode
LMT	Local Maintenance Terminal

LNA	Low Noise Amplifier
MCC	Mobile Country Code
MNC	Mobile Network Code
MR	Microwave Repeater
MS	Mobile Station
OIP-3	Output Intercept Point of the 3rdOorder
OMC	Operation and Maintenance Center
PA	Power Amplifier
PCS	Personal Communication System
PSTN	Public Switched Telephone Network
PSU	Power Supply Unit
RED	Radio Equipment Directive
Rev	Revision
RF	Radio Frequency
RoHS	Directive on Restriction of certain Hazardous Substances
RLP	Radio Link Protocol
RSSI	Receive Signal Strength Indication
RTC	Real-Time Clock
RX	Receiver
SCL	Serial Clock
SDA	Serial Data
SMSC	Short Message Service Center
TCH	Traffic Channel
TDMA	Time Division Multiple Access
TX	Transmitter
UE	User Equipment
UL	Uplink
UMTS	Universal Mobile Telecommunication System
UPS	Uninterruptable Power Supply
URL	Uniform Resource Locutor
VSWR	Voltage Standing Wave Ratio

1.2. Health and Safety

⚠ **1. Caution:** High frequency radiation in operation. Risk of health hazards associated with radiation from the antenna(s) connected to the unit. Implement prevention measures to avoid the possibility of very close proximity to the antenna(s) while in operation.

1.3. Property Damage Warnings

1. **Attention:** Due to power dissipation, the unit may reach a high temperature. Do not operate this equipment on or close to flammable materials. Use caution when servicing the unit.

2. **Notice**: ESD precautions must be observed. Before commencing maintenance work, use the available grounding (earthing) system to connect ESD protection measures.

3. **Notice:** Only suitably qualified personnel are allowed to work on this unit and only after becoming familiar with all safety notices, installation, operation and maintenance procedures contained in this manual.

4. **Notice:** Keep operating instructions within easy reach and make them available to all users.

1.4. Compliance

1. **Notice:** For installations, which have to comply with FCC RF exposure requirements, the antenna selection and installation must be completed in a way to ensure compliance with those FCC requirements. Depending on the RF frequency, rated output power, antenna gain, and the loss between the repeater and antenna, the minimum distance D to be maintained between the antenna location and human beings is calculated according to this formula:

$$D_{[cm]} = \sqrt{\frac{P_{[mW]}}{4 * \pi * PD_{[mW/cm^2]}}}$$

where

- P (mW) is the radiated power at the antenna, i.e. the max. rated repeater output power in addition to the antenna gain minus the loss between the repeater and the antenna.

- PD (mW/cm²) is the allowed Power Density limit acc. to 47 CFR 1.1310 (B) for general population / uncontrolled exposures which is
  - o   F (MHz) / 1500 for frequencies from 300MHz to 1500MHz
  - o   1 for frequencies from 1500MHz to 100,000MHz

RF exposure compliance may need to be addressed at the time of licensing, as required by the responsible FCC Bureau(s), including antenna co-location requirements of 1.1307(b)(3).

2. **Notice:** For installations which have to comply with European EN50385 exposure compliance requirements, the following Power Density limits/guidelines (mW/cm²) according to ICNIRP are valid:
  - o   0.2 for frequencies from 10 MHz to 400 MHz
  - o   F (MHz) / 2000 for frequencies from 400 MHz to 2 GHz
  - o   1 for frequencies from 2 GHz to 300 GHz

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3. **Notice:** For installations which have to comply with FCC/ISED requirements:

English:

This device complies with FCC Part 15 and Industry Canada license exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

This device complies with Health Canada's Safety Code. The installer of this device should ensure that RF radiation is not emitted in excess of the Health Canada's requirement. Information can be obtained at http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radio_guide-lignes_direct-eng.php.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Antenna Stmt for ISED:

This device has been designated to operate with the antennas having a maximum gain of 9 dBi. Antennas having a gain greater than 9 dBi are prohibited for use with this device without consent by ISED regulators. The required antenna impedance is 50 ohms.

The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 100 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. Users and installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance.

French:

Cet appareil est conforme à FCC Partie15. Son utilisation est soumise à Les deux conditions suivantes: (1) cet appareil ne peut pas provoquer d'interférences et (2) cet appareil doit accepter Toute interférence, y compris les interférences qui peuvent causer un mauvais fonctionnement du dispositif.

Cet appareil est conforme avec Santé Canada Code de sécurité 6. Le programme d'installation de cet appareil doit s'assurer que les rayonnements RF n'est pas émis au-delà de l'exigence de Santé Canada. Les informations peuvent être obtenues: http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radio_guide-lignes_direct-fra.php

Les changements ou modifications non expressément approuvés par la partie responsable de la conformité pourraient annuler l'autorité de l'utilisateur à utiliser cet équipement.

Antenne Stmt pour ISDE:

Ce dispositif a été désigné pour fonctionner avec les antennes ayant un gain maximal de 9 dBi. Antennes ayant un gain plus grand que 9 dBi sont interdites pour une utilisation avec cet appareil sans le consentement des organismes de réglementation d'ISDE. L'impédance d'antenne requise est 50 ohms.

L'antenne (s) utilisé pour cet émetteur doit être installé pour fournir une distance de séparation d'au moins 100 cm de toutes les personnes et ne doit pas être co-localisées ou opérant en conjonction avec une autre antenne ou émetteur. Les utilisateurs et les installateurs doivent être fournis avec des instructions d'installation de l'antenne et des conditions de fonctionnement de l'émetteur pour satisfaire la conformité aux expositions RF.

4. **Notice:** Installation of this equipment is in full responsibility of the installer, who has also the responsibility, that cables and couplers are calculated into the maximum gain of the antennas, so that this value, which is filed in the FCC Grant and can be requested from the FCC data base, is not exceeded. The industrial boosters are shipped only as a naked booster without any installation devices or antennas as it needs for professional installation.

5. **Notice:** Corresponding local particularities and regulations must be observed. For national deviations, please refer to the respective documents that can be downloaded as well.

6. **Notice:** The power supply of the unit complies with Overvoltage Category II. It also complies with the surge requirement according to EN 61000-4-5 (fine protection); however, installation of an additional medium (via local supply connection) and/or coarse protection (external surge protection) is recommended depending on the individual application in order to avoid damage caused by overcurrent.

   For Canada and US, components used to reduce the Overvoltage Category shall comply with the requirements of IEC 61643-series. As an alternative, components used to reduce the Overvoltage Category may comply with ANSI/IEEE C62.11, CSA Certification Notice No. 516, CSA C22.2 No. 1, or UL 1449. Suitability of the component for the application shall be determined for the intended installation.

7. **Note:** For a Class A digital device or peripheral:
   This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

8. **Note:** For a Class B digital device or peripheral:
   This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference.

9. **Note:** This unit complies with European standard EN60950-1 / EN62368-1.

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Equipment Symbols Used / Compliance

Please observe the meanings of the following symbols used in our equipment and the compliance warnings:

Symbol	Compliance	Meaning / Warning
---	FCC	For industrial (Part 20) signal booster: WARNING: This is NOT a CONSUMER device. It is designed for installation by FCC LICENSEES and QUALIFIED INSTALLERS. You MUST have an FCC LICENSE or express consent of an FCC Licensee to operate this device. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of $100,000 for each continuing violation.
		For (Part 90) signal booster: WARNING: This is NOT a CONSUMER device. It is designed for installation by FCC LICENSEES and QUALIFIED INSTALLERS. You MUST have an FCC LICENSE or express consent of an FCC Licensee to operate this device. You MUST register Class B signal boosters (as defined in 47 CFR 90.219) online at www.fcc.gov/signal-boosters/registration. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of $100,000 for each continuing violation.
---	ISED	WARNING: This is NOT a CONSUMER device. It is designed for installation by an installer approved by an ISED licensee. You MUST have an ISED LICENCE or the express consent of an ISED licensee to operate this device. AVERTISSEMENT: Ce produit N'EST PAS un appareil de CONSOMMATION. Il est conçu pour être installé par un installateur approuvé par un titulaire de licence d'ISDE. Pour utiliser cet appareil, vous DEVEZ détenir une LICENCE d'ISDE ou avoir obtenu le consentement exprès d'un titulaire de licence autorisé par ISDE.
CE	CE	To be sold exclusively to mobile operators or authorized installers – no harmonized frequency bands, operation requires license. Intended use: EU and EFTA countries
		Indicates conformity with the RED directive 2014/53/EU and/or RoHS directive 2011/65/EU.
CE 0700	CE	Indicates conformity with the RED directive 2014/53/EU and RoHS directive 2011/65/EU certified by the notified body no. 0700.

1.5. About CommScope

CommScope is the foremost supplier of one-stop, end-to-end radio frequency (RF) solutions. Part of the *CommScope* portfolio are complete solutions for wireless infrastructure from top-of-the-tower base station antennas to cable systems and cabinets, RF site solutions, signal distribution, and network optimization. For patents see www.cs-pat.com.

CommScope has global engineering and manufacturing facilities. In addition, it maintains field engineering offices throughout the world.

Andrew Wireless Systems GmbH based in Buchdorf/ Germany, which is part of *CommScope*, is a leading manufacturer of coverage equipment for mobile radio networks, specializing in high performance, RF and optical repeaters. Our optical distributed networks and RF repeater systems provide coverage and capacity solution for wireless networks in both indoor installations and outdoor environments, e.g. tunnels, subways, in-trains, airport buildings, stadiums, skyscrapers, shopping malls, hotels and conference rooms.

Andrew Wireless Systems GmbH operates a quality management system in compliance with the requirements of ISO 9001 and TL 9000. All equipment is manufactured using highly reliable material. To maintain highest quality of the products, comprehensive quality monitoring is conducted at all fabrication stages. Finished products leave the factory only after a thorough final acceptance test, accompanied by a test certificate guaranteeing optimal operation.

Hereby Andrew Wireless Systems declares that the radio equipment type Repeater is in compliance with Directive 2014/53/EU.
The full text of the EU declaration is available at the following internet address: www.commscope.com/collateral/Declarations_of_Conformity/.

According to the DoC, our "CE"-marked equipment can be used in all member states of the European Union.

Note: Exceptions of and national deviations from this intended use may be possible. To observe corresponding local particularities and regulations, please refer to the respective documents (also in national language) which can be downloaded as well.

To make the most of this product, we recommend you carefully read the instructions in this manual and commission the system only according to these instructions.

For technical assistance and support, please also contact the local office or *CommScope* directly at one of the addresses listed in the following chapter.

1.6. International Contact Addresses for Customer Support

Canada	
CommScope Canada	
Mail	505 Consumers Road, Suite 803 Toronto M2J 4V8, Canada
Phone	+1-905-878-3457 (Office) +1-416-721-5058 (Cell)
Fax	+1-905-878-3297
E-mail	wisupport@commscope.com

Caribbean & South American Region	
CommScope Cabos do Brasil Ltda.	
Mail	CALA Tech Support for *Distributed Coverage & Capacity Solutions (DCCS) products*: Rua Guaporanga, 49 Praça Seca – Rio de Janeiro – RJ ZIP: 21320-180, Brazil
Phone	+1-815-546-7154 (Cell) +55-15-9104-7722 (Office)
Fax	+ 55-15-2102-4001
E-mail	wisupport@commscope.com

AMERICAS

United States	
Andrew LLC, A CommScope Company	
Mail	620 North Greenfield Parkway Garner, NC 27529, U.S.A.
Phone	+1-888-297-6433
Fax	+1-919-329-8950
E-mail	wisupport@commscope.com

Caribbean & Central American Region	
CommScope Mexico S.A. de C.V.	
Mail	CALA Tech Support for *Distributed Coverage & Capacity Solutions (DCCS) products*: Av. Insurgentes Sur 688, Piso 6 Col. Del Valle, CP: 03100 Mexico City, Mexico
Phone	+52-55-1346-1900 (Office)
Fax	+52-55-1346-1901
E-mail	wisupport@commscope.com

China, India and Rest of Asia	
Andrew International Corporation	
Mail	Room 915, 9/F Chevalier Commercial Centre 8 Wang Hoi Rd Kowloon Bay, Hong Kong
Phone	+852-3106-6100
Fax	+852-2751-7800
E-mail	wisupport.China@commscope.com

APAC

Australia & New Zealand	
Andrew Corporation (Australia) Pty Ltd.	
Mail	Unit 1 153 Barry Road Campbellfield VIC 3061, Australia
Phone	+613-9300-7969
Fax	+613-9357-9110
E-mail	wisupport.Australia@commscope.com

Middle East & North Africa	
CommScope Solutions International Inc. (Branch)	
Mail	PO Box 48 78 22 Unit 3206, Floor 32, Jumeirah Business Center 5, Jumeirah Lakes Towers, Dubai, United Arab Emirates
Phone	+971 4 390 09 80
Fax	+971 4 390 86 23
E-mail	wisupport@commscope.com

Africa & Middle East

South Africa	
Andrew Wireless Solutions Africa (PTY) LTD	
Mail	11 Commerce Crescent West Eastgate, Sandton PO Box 786117 Sandton 2146 South Africa
Phone	+ 27 11-719-6000
Fax	+ 27 11-444-5393
E-mail	wisupport@commscope.com

United Kingdom		Scandinavia	
Andrew Wireless Systems UK Ltd		**Andrew Norway (AMNW)**	
Mail	Unit 15, Ilex Building Mulberry Business Park Fishponds Road Wokingham Berkshire RG41 2GY, England	Mail	P.O. Box 3066 Osloveien 10 Hoenefoss 3501 Norway
Phone	+44-1189-366-792	Phone	+ 47 32-12-3530
Fax	+44-1189-366-773	Fax	+ 47 32-12-3531
E-mail	wisupport.uk@commscope.com	E-mail	wisupport@commscope.com
Germany		**France**	
Andrew Wireless Systems GmbH		**CommScope France**	
Mail	Industriering 10 86675 Buchdorf Germany	Mail	Immeuble Le Lavoisier 4, Place des Vosges 92052 Courbevoie, France
Phone	+49-9099-69-0	Phone	+33-1 82 97 04 00
Fax	+49-9099-69-930	Fax	+33-1 47 89 45 25
E-mail	wisupport@commscope.com	E-mail	wisupport@commscope.com
Austria		**Switzerland**	
Andrew Wireless Systems (Austria) GmbH		**CommScope Wireless Systems AG**	
Mail	Weglgasse 10 2320 Wien-Schwechat Austria	Mail	Tiergartenweg 1 CH-4710 Balsthal Switzerland
Phone	+43-1706-39-99-10	Phone	+41-62-386-1260
Fax	+43-1706-39-99-9	Fax	+41-62-386-1261
E-mail	wisupport.austria@commscope.com	E-mail	wisupport.ch@commscope.com
Italy		**Iberia Region - Spain & Portugal**	
CommScope Italy S.r.l., Faenza, Italy		**Andrew España S.A. A CommScope Company**	
Mail	Via Mengolina, 20 48018 Faenza (RA) Italy	Mail	Avda. de Europa, 4 - 2ª pta. Parque Empresarial de la Moraleja Alcobendas, Madrid 28108, Spain
Phone	+39-0546-697111	Phone	+34-91-745-20 40
Fax	+39-0546-682768	Fax	+34-91-661-87 02
E-mail	wisupport.italia@commscope.com	E-mail	wisupport.iberia@commscope.com
Czech Republic			
CommScope Solutions Czech Republic C-Com, spol. s r.o			
Mail	U Moruší 888 53006 Pardubice, Czech Republic		
Phone	+49 871 9659171 (Office) +49 171 4001166 (Mobile)		
Fax	+49 871 9659172		
E-mail	wisupport@commscope.com		

EUROPE

2. Functional Description

The modem kits have been designed to work beside MRx18 type of miniRepeaters.

The MRx18 modem kits can only be installed alongside the MRx18 miniRepeaters. Detailed information on MRx18 miniRepeaters is provided in separate manuals. If required, please refer to the user's manual of the respective repeater.

The MRx18 is equipped with PHS8 modem kits* and provides remote monitoring of the MRx18 via SMS. Alarms are forwarded to an SMS receiver or A.I.M.O.S.; the settings of MRx18 can be changed via SMS command sent from an SMS receiver or A.I.M.O.S., as well.

* The Modem-Kit PHS8 MRx18 replaces Modem-Kit HC25 which is discontinued.

Moreover, a heartbeat SMS can be transmitted to show that the MRx18 is still in operation and the modem connection between modem and SMS receiver / A.I.M.O.S. is available.

The remote monitoring option via SMS can be easily activated by sending a special configuration SMS or locally via the webpages.

In the following it is described how the individual modem kits must be configured in order to work with the MRx18 miniRepeater family.

3. Installation

3.1. Mechanical Installation

3.1.1. Property Damage Warnings for Mechanical Installation

1. **Attention:** Do not install the unit in a way or at a place where the specifications outlined in the Environmental and Safety Specifications leaflet of the supplier are not met.

2. **Attention:** It is the responsibility of the installer to verify that the supporting surface will safely support the combined load of the electronic equipment and all attached hardware and components and to ensure that the unit is safely and securely mounted.

3. **Notice:** Use proper mounting hardware depending on the structure of e.g. the wall where the unit will be installed.

3.1.2. Wall Mounting

The MRx18 modem kit is designed for wall mounting.

Note: The following figure shows an MRx18 including modem kit. Slight variations in design are possible.

figure 3-1 Wall-mounting recommendation

Mount the MRx18 modem kit **horizontally** to the wall with two screws (circle-marked in figure above). Connect the flat and RF cables between modem kit and MRx18 (see chapter *3.2.2*) and fasten the cover of the modem kit (pre-installed) carefully on top of the MRx18 cabinet. The bracket of the modem kit is fixed by the same sort of screw used to mount the MRx18 miniRepeater to the wall.

3.2. Electrical Installation

3.2.1. General

1. **Notice:** The electrical installation has to be performed in accordance with the safety regulations of the local authorities. Due to safety reasons, the electrical installation must be performed by qualified personnel only. The repeater must not be opened.

2. **Notice:** Observe the labels on the front panels before connecting or disconnecting any cables.

3.2.2. Power Connection - Connection with the miniRepeater

Note that the modem and DC/DC converter are already mounted on the bracket and the RF and flat cables are also part of the delivery.

The modem is entirely supplied with power from the MRx18 via the flat cable. Note that the MRx18 is supplied with 6 V, whereas the modem needs to be supplied with higher voltage (approx. 10 V). To meet this shortfall, the DC/DC converter is equipped to safeguard sufficient modem power supply by converting 6 V up to the required approx. 10 V.

For power connection, connect the flat cable originating from the DC/DC converter (soldered on top) to the MRx18 Molex connector (6 poles) provided for the modem.

For RF connection, connect the brown RF cable from the RF connector at the modem to the SMA connector at the MRx18 (designated as "RF modem connector SMA" in the illustration below).
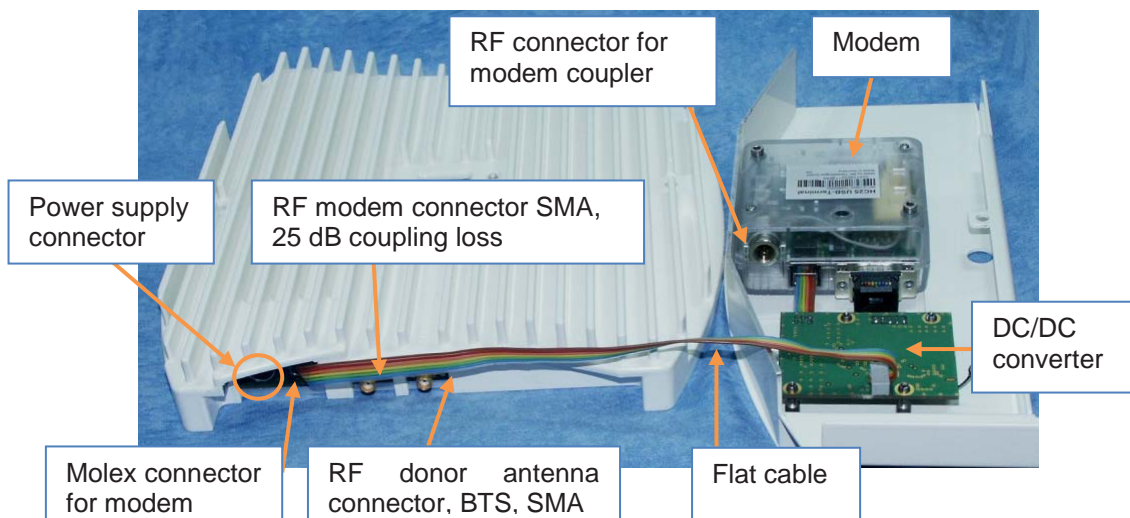

figure 3-2 Power connection of modem kit with MRx18, exemplary

☞ **Notes:** For proper operation the minimum level <u>at the modem antenna port</u> has to be >-100 dBm.

The coupling loss of the modem coupler integrated to the MRx18 repeater is about 25 dB. Thus the minimum level <u>at the BTS port of the repeater</u> has to be >-75 dBm.

4. Commissioning

4.1. General

Read and observe chapter 1.2.

The following installation steps must be carried out to commission the modem:

1. Insert the SIM card into the drawer (as described in chapter *4.2*).
2. Provide connection of modem kit with miniRepeater MRx18 (as described in chapter *3.2.2*).
3. Mount miniRepeater and modem kit to a wall (see chapter *3.1*).
4. Connect miniRepeater to power supply.
5. Configure modem via Ethernet webpage – Modem Control Page (as described in chapter *5.5*) or via config SMS and SMS commands (see chapter *5.3.1 SET / GET Commands*).

Ethernet Connector

The Ethernet connector is used to configure the entire modem settings via the *Modem Control* webpage (as described in chapter *5.5*). Locally, the webpages are accessible via the Ethernet connector (as described in the MRx18 manual).
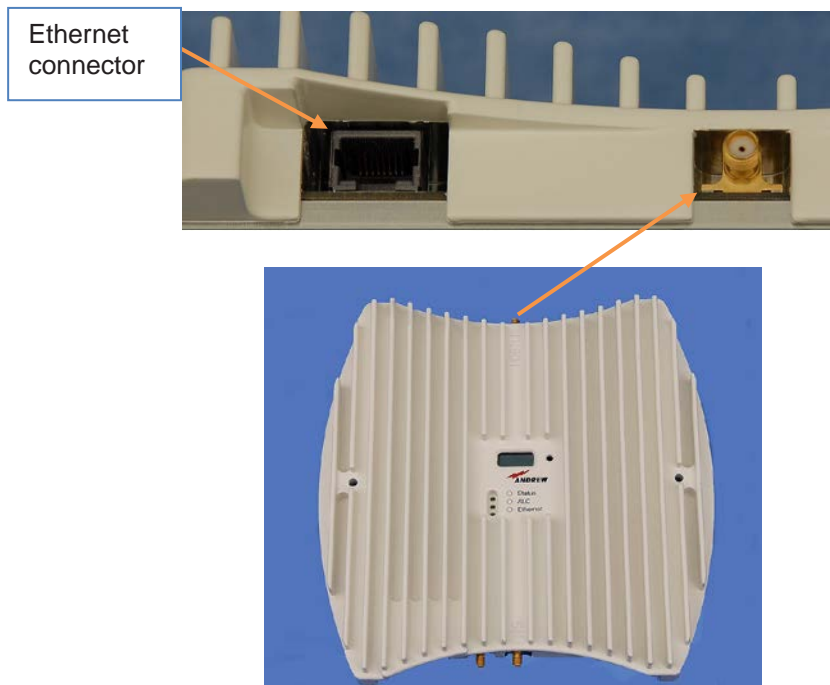
figure 4-1 Ethernet connector of MRx18

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4.2. Inserting the SIM Card

In order to insert the SIM card into the drawer proceed in the following order:

- **Note: The SIM-card drawer is hidden by the bracket which serves to block the SIM-card drawer (anti-theft protection).**

Modem

- First loosen the two socket-head-cap screws (circle-marked in illustration to the right) by which the modem is fastened to the modem bracket.

- Then the bracket can be pulled out and the SIM-card drawer is no longer blocked.

SIM-card drawer

Anti-theft protection

Bracket – (pulled out)

- Use a pen or any other appropriate tool to press on the yellow button of the SIM-card drawer.

- Insert the SIM card.

Button (yellow)
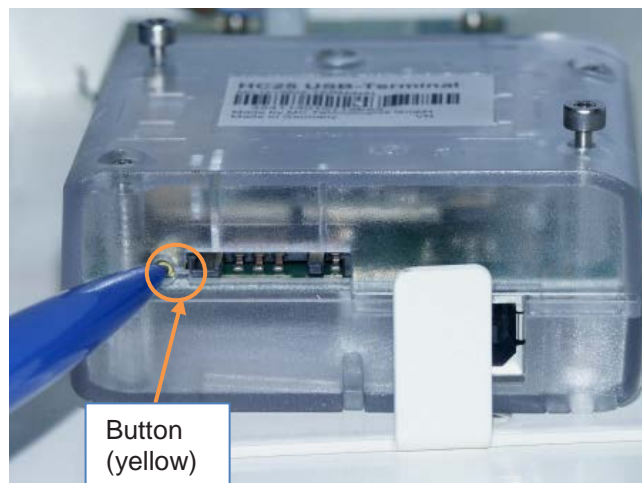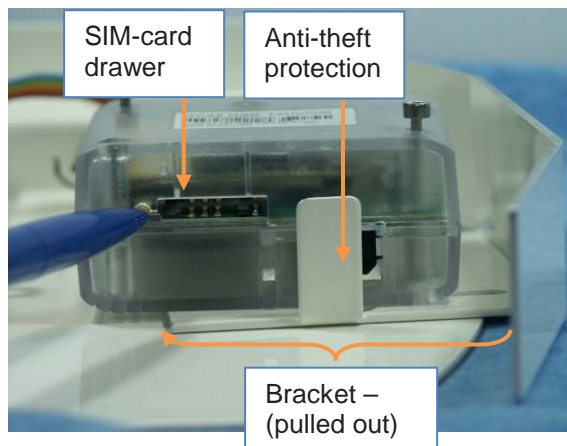
- Push the modem bracket again to its original position to block the SIM-card drawer.

- Fasten the two screws on top of the modem.

Fasten the bracket of the modem kit (by turning it upside down) on the right-hand side of the MRx18.

Note: Ensure the lug of the modem bracket slips into the notch of the MRx18 cabinet in a way the bracket is clamped with the inner lug of the modem bracket beneath the notch and the outer lug above the notch (as illustrated to the right).

Use the same screw by which the MRx18 is mounted to a wall.

Note: The modem has to be configured before it can work.

Notch of MRx18 cabinet

Lug **ABOVE** notch

Lug **BENEATH** notch
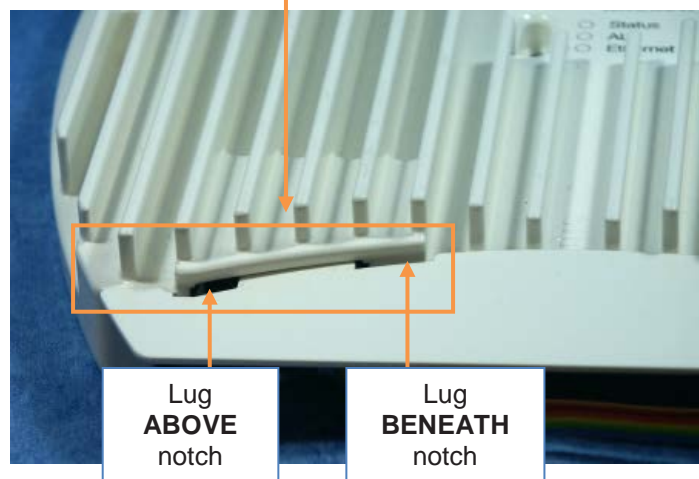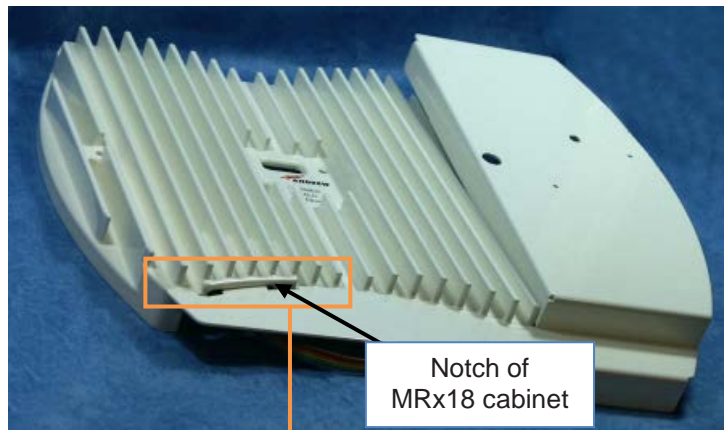
The Ethernet connector is used to configure the entire modem settings via the Modem webpage (as described in chapter *5.5*). For its design please refer to previous chapter *4.1 General*.

5. Modem Control and Remote Access via SMS

5.1. Optional Alarming and Adjustments via SMS

Besides the transfer of alarms and heartbeat, the repeater is also configurable via SMS sent from A.I.M.O.S. or a mobile phone. The SMS interface is described in the following chapters.

The repeater polls the modem for any SMS received by the modem. The polling interval is max. 20 seconds.

5.2. SMS Interface – Commands and Notifications

There are two basic communication message types used within the MRx18 SMS interface:

- **Commands**
  Commands are sent from a mobile or A.I.M.O.S. to the MRx18 in order to read or write repeater status or configuration values.
  Every command request is responded by the MRx18 with one or more responses.

- **Notifications (alarms, response notifications)**
  Notifications are sent by the MRx18 to a mobile or A.I.M.O.S. in order to report repeater events, i.e. successful actions, response of faulty commands, alarms and heartbeat.

General to all message types:

- For better legibility of this manual, any space within a message will be represented by the underscore character "_".

- Separator between identification prefix of command-string response (see below) and first parameter is the colon character followed by a space (":_")

- Variable message parameters are enclosed by angle brackets, e.g. "<UniqueSystemID>"

- Within the "<UniqueSystemID>" parameter no space characters are allowed.

- All messages are treated as case insensitive.

5.3. SMS Commands

Note:

- Every correct SMS SET/ GET command is acknowledged by sending back the current settings (as if responding to the corresponding GET command.)

- When the SMS contains an error, a **not-acknowlegde SMS ("nak" SMS)** will be sent back.

- Note that a response SMS / not-acknowledge SMS will only be sent when all its parameters have been stored successfully to external non-volatile memory. Therefore, no response is received when the phone number the SMS command has been sent to is incorrect.

- Almost every SMS SET command has its associated SMS GET command (see details at description of SMS commands).

- All field parameters of a command are separated by **'#' character between two spaces**. Please note that for reasons of better legibility, these spaces will be represented in this document by the **underscore character '_'.**

- Phone number validation:
  The phone number of the SMS command sender normally always matches with the phone number configured. However, this does not apply to the *set / get smsc* and *set / get config* commands.

Not-Acknowledge Response (nak)

In case of an error in a SET or GET command in general, a **Not-Acknowledge ("nak")** response will be sent to the SMS receiver or A.I.M.O.S..

☞ **Note:**

- **"nak" response** via modem only when first command word is **set / get**
- **no "nak" response** via modem with faulty**"set configuration"** command

5.3.1. SET / GET Commands

5.3.1.1. Config SMS

The Config SMS provides all necessary information to the MRx18. This command establishes remote monitoring via SMS.
SET command:
***set_config**:_phone_<+491701234567>_#_loc_<UnitLocation>_#_ID_<UniqueSystemID>*

> - phone: destination phone number (max. 20 numbers including "+") where all SMS messages, alarms, heartbeat are sent to. Either national or international format is allowed. The latter has to be preceded with a "+".
>
> - loc: Unit location, is used just for information and is part of each SMS, no validation is done in this field (max. 20 characters).
>
> - ID: Unique System ID, is used for identification issues and is part of an alarm SMS, no validation is done in this field (max. 20 characters).

The ***set_config*** command is accepted by the MRx18 from every sender (Mobile or A.I.M.O.S.) independent from the destination phone number. The response is sent to the destination phone number.

By sending a config SMS the alarming is always enabled automatically. Alarming can be enabled/ disabled by a different command described in a later item of this document.

GET command:
get_config

-> SET/GET Response:
***config**:_phone_<+491701234567>_#_loc_<UnitLocation>_#_ID_<Unique SystemID>*

5.3.1.2. Service Center Number

Use this SMS command to set the Service Center Address (= phone number). The number has to be entered in international format (e.g. +49...).

The number of the SMS Service Center is used for sending out SMS messages. In most cases this number has already been stored to the SIM card when receiving the card from the provider.

Otherwise, it is necessary to store the number of the SMS Service Center to the SIM-card inside the modem. With the following SMS it is possible to set the Service Center Address:

SET command:
set_smsc:_<+491701234567>

> smsc: service center number (max. 20 numbers incl. "+") has to be entered in international format, starting with a "+"

GET command:
get_smsc

-> SET/GET Response:
smsc:_<+491701234567>_#_loc_<UnitLocation>_#_ID_<UniqueSystemID>

5.3.1.3. Heartbeat Interval

The heartbeat-time interval of the MRx18 can be set/ queried by this command.

SET command:
set_h-beat:_<interval>

interval: range of 0 to 72 hours allowed (max. 2 characters)
                0 means heartbeat is switched off.

GET command:
get_h-beat

-> SET/ GET Response:

> a) heartbeat enabled:
> **h-beat**:_<interval>h_(next_hbeat_in_less_than_<HeartBeat rounded to next whole hour>)_#_loc_<UnitLocation>_#_ID_<Unit ID>

> b) heartbeat disabled:
> **h-beat**:_0h_(disabled)_ #_loc_<UnitLocation>_#_ID_<UniqueSystemID>

5.3.1.4. Alarm Severity

It is possible to change/ query the severity of each individual alarm.

A SET command gets effective for new alarms only; already raised alarms are not affected from this.

SET command:
set_alsev:_<AlarmID1>=<severity>{_#_<AlarmIDn>=<severity>}

- <AlarmID>: each alarm with ID<n> can be assigned by a certain severity.
Alarm IDs see chapter *5.4.1 Alarm*).

- <severity>: The severity is expressed in numbers from 1 to 5:
1: critical
2: major
3: minor
4: warning
5: disabled

- More than one alarm severity can be changed within one SMS command by only repeating the part in curly brackets. However, the maximum length of 160 characters must not be exceeded.

-> SET Response:
alsev:_<AlarmID1>=<severity>{_#_<AlarmIDn>=<severity>}_#_loc_<UnitLocation>_#_ID_<UniqueSystemID>
☞ **Note: The SET response contains the severities for all alarms, even if only one was given in the request.**

GET command:
get_alsev

-> GET Response (always the severities for all alarms are responded):
alsev:_<AlarmID1>=<severity>_#_<AlarmID2>=<severity>_#_..._#_<AlarmIDn>=<severity>_#_loc_<UnitLocation>_#_ID_<UniqueSystemID>

5.3.1.5.   Alarming Status

This command enables or disables alarming via SMS.

SET Command:
set_alarming:_ena|dis

- *Alarming enable* means that all active alarms are automatically sent to the destination phone number.
- By setting alarming to "*disable*" no alarms are received by the modem/ mobile assigned with destination phone number. The heartbeat is not concerned by this setting.

GET Command:
get_alarming

-> SET/GET Response:
alarming:_ena|dis_#_loc_<UnitLocation>_#_ID_<UniqueSystemID>

5.3.1.6. Technical Setup (Settings - Radio Frequency)

In order to change RF parameters of the MRx18, an individual command per segment must be sent. The numbering of the segments is based on the naming of the MRx18 series.

The exemplary illustration below is to explain the segment numbering with relation to the MRx18 naming.
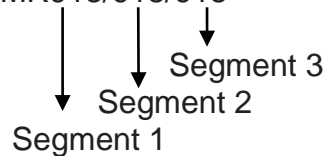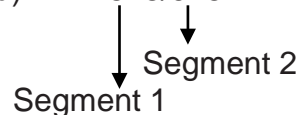
Single band/ segment: MR918
↓
Segment 1

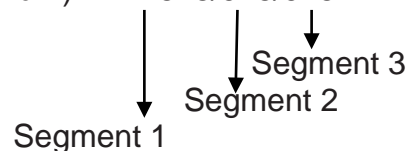Dual segment: MR918/918
↓   ↓
Segment 2
Segment 1

Triple segment: MR918/918/918
↓   ↓   ↓
Segment 3
Segment 2
Segment 1

Dual band (1 segment each band): MR1818/918
↓   ↓
Segment 2
Segment 1

Dual band (1 segment band 1, 2 segments band 2): MR1818/918/918
↓   ↓   ↓
Segment 3
Segment 2
Segment 1

SET/ GET Segment Commands

SET command (any parameter is optional, but at least one has to be given):

set_segment_<SegNo>:_freq_xxxx.xx-yyyy.yy_#_gain_<UL>_<DL>_#_Pout_<UL>_<DL>_#_AG_<x>_#_AI_<y>_#_PD_<ena/dis>_#_AF_<z>

-     <SegNo>: number of segment, 1 to 3
-     freq: frequency setting in DL, start and stop frequency in MHz (max. 15 characters included). In case a value is entered that does not fit to the repeater type (see chapter *5.3.2.6 Repeater Type (Model)*), a "nak" response would be received.

> **Note:** Always enter the frequency in the format *freq_xxxx.xx-yyyy.yy*, i.e. **with frequencies <1000 MHz** always enter a "**0**" **before the actual frequency**, e.g. for 935.20 to 945.20 MHz => enter *freq_0935.20-0945.20*

- gain: gain setting UL and DL in dB (max. 2 characters), values for gain must not deviate from the values as stated in the specification of corresponding repeater type (see chapter *5.3.2.6 Repeater Type (Model)*). Otherwise, a "nak" response will be received.

- P_{out}: max output power (ALC) in UL and DL in dBm, range (max. 2 characters) depends on repeater type and on mobile network/ service, the max. rated output power must not exceed the value stated in the specification of the respective MRx18 manual. In case a value is entered that does not fit to the repeater type (see chapter *5.3.2.6 Repeater Type (Model)*), a "nak" response would be received.

- AG: Auto Gain function (Auto Gain Time Interval), values allowed: (<x>)
  0: disabled
  1: 0s/ 24 h
  2: 0s/ 12 h
  3: 10s/ 12 h
  4: 10s/ 24 h

- AI: Auto Gain imbalance (*Auto Gain UL/ DL Imbalance*), UL gain is decreased by the Auto Gain imbalance value compared with DL gain, allowed values(<y>): 0; 1; 2; 3; 4; 5

- PD: power down, enable <ena> means the segment is switched off,
  disable <dis> means the segment is switched on

- AF: Auto Gain function (*Auto Gain Mode*): With Auto Gain activated, two different behaviours of Auto Gain can be chosen from:

  0 $\triangleq$ **Uniform Gain**: Gain of each segment within a frequency band assigned with "Uniform Gain" is set according to the highest DL input signal, i.e. all input levels of segments operating in "Uniform Gain" are compared, depending on the highest level, the gain is set accordingly. Gain Mode might be chosen, for instance, when frequency hopping is done between the segments.

  1 $\triangleq$ **Independent Gain:** Gain of segments assigned with "Independent Gain" is set individually in order to get the maximum output power, independent of other segments operating in the same frequency range. For example, "Independent Gain" might be chosen if different services, e.g. GSM900 and UMTS900, are transmitted on a separate frequency segment allocated in one frequency band.

- All parameters are optional and need not be stated in the SMS command unless the value is not changed. Anyhow, at least one parameter has to be followed by the *"set segment"* command.

GET command:

get_segment_<SegNo>

- <SegNo>: Optional number of segment, 1 to 3. If omitted, one response per segment is sent using the extended response identification (<SegNo><seq>/<Count>)

-> SET/ GET Response (always all parameters are responded):
segment_<SegNo><seq>/<Count>:_freq_xxxx.xx-yyyy.yy_#_gain_<UL>_<DL>_#_Pout_<UL>_<DL>_#_AG_<x>_#_AI_<y>_#_PD_<ena/dis_#_AF_<z>_#_loc_<UnitLocation>_#_ID_<UniqueSystemID>

- <SegNo>: number of segment
- <seq>: number of response message
- <Count>: response messages to be received overall

Examplary GET command of 2 segments (MR2118/918):

get_segment

Response 1:
segment_1_1/2:_freq_2120.00_2130.00_#_gain_60_60_#_Pout_18_18_#AG_0_#_AI_0_#_PD_dis_#_AF_1_#_loc_Buchdorf_#_ID_ExampleUniqueSystemID

Response 2:
segment_2_2/2:_freq_0940.00_0947.60_#_gain_60_60_#_Pout_18_18_#_AG_0_#_AI_0_#_PD_dis_#_AF_1_#_loc_Buchdorf_#_ID_ExampleUniqueSystemID

SET / GET Uplink Frequency Commands

Command **get freq ul** and command **set freq ul**

So far, the UL frequency has been inherited according to the DL frequency and the DL frequency could have been changed via the "set/get segment" command. However, from SW V3.1.0 onwards, the UL frequency can additionally be adjusted independently from the DL frequency (see "manual setting" in the GUI).
SET command

set_freq_UL:_seg<SegNo>_#_xxxx.xx-yyyy.yy{_#_seg<SegNo>_#_xxxx.xx-yyyy.yy}

- <SegNo>: number of segment, 1 to 4
- *xxxx.xx-yyyy.yy*: frequency setting in UL, start and stop frequency in MHz
- UL frequency band of more than one segment can be changed by one SMS
  by just repeating the part in curly brackets { }. Maximum length of 160
  characters must not be exceeded.

get_freq_UL

Set/Get Response {enclosed in curly brackets means occurrence zero, one ore more times}:

freq_UL[[<seq>[+]][-]]/<Count>]:_seg<SegNo>_#_xxxx.xx-yyyy.yy{_#_seg<SegNo>_#_xxxx.xx-yyyy.yy}_#_loc_<UnitLocation>_#_ID_<UniqueSystemID>

- <SegNo>: number of segment, 1 to 4
- *xxxx.xx-yyyy.yy*: frequency setting in UL, start and stop frequency in MHz

Preconditions:
Once the "set freq UL" command has been sent, the separate UL/DL entering of the frequencies is active, thus corresponding to the checkmark checked before. The separate UL/DL input can only be deactivated (i.e. unchecked checkmark before), by means of entering '0000.00-0000-00', instead of the frequency values 'xxxx.xx-yyyy.yy'. The UL frequency will be adjusted corresponding to the DL frequency.

☞ **Note:** This command is only supported from SW V3.1.0 for the MRx18. This command cannot be applied for the MR418.

SET / GET RSSI Based Power Off Commands

This feature is used to switch on /disable the automatic RSSI dependent band power control. If the RSSI level exceeds the set RSSI level threshold, the band amplifiers are switched off.

Command **get_rbpo[_<BandNo>]** and command **set_rbpo_<BandNo>**

SET command

set_rbpo_<BandNo>:[_rbpoEN_<x>][_#_rbpoTHR_<Thr>][_#_rbpoOFF <Off>][_#_rbpoLT_<LT>][_#_rbpoAT_<AT>
- <BandNo>: number of frequency band, 1 to 2
All parameters are optional, but at least one should be given:
- rbpoEN: en-/disable the RSSIBasedPowerOff functionality with 0, 1
- rbpoTHR: threshold for RSSIBasedPowerOff, -50..-20dBm (1dB steps)
- rbpoOFF: offset to threshold, where RF will switch on again, 0 to 10dB
- rbpoLT: LatencyTime, 30, 60, 180, 300, 600, 900s
- rbpoAT: Attempt to next Try to switch on again, 0, 1 to 24h in 1h steps

GET command

get_rbpo[_<BandNo>]
- <BandNo>: Optional number of segment, 1 to 2. If omitted, one response per segment is sent using the extended response identification (<SegNo>[<seq>[+]|[-]]/<Count>, see also response syntax description in chapter 'General')

-> Set/Get Response (always all parameters are responded):
rbpo_<BandNo>[[<seq>[+]|-]]/<Count>]:_rbpoEN_<ena/dis>_#_rbpoTHR_<THR>_#_rbpoOFF_<Off>_#_rbpoLT_<LT>_#_rbpoAT_<AT>_#_rbpoStatus_<active/not_active>_#_loc_<UnitLocation>_#_<UnitID>*

5.3.2.   GET-Only Commands

5.3.2.1.   Active Alarms

This command is used for requesting all currently active alarms from the miniRepeater.

Command:
get_active_alarms

Note:
Response(s) to this command always contain(s) the extended response identification (<No><seq>/<Count>, see response description in previous chapter.

a) Response when there are currently active alarms:
One response is forwarded for every active alarm according to chapter *5.4.1 Alarm*, each response with extended response identification prefix.

b) Response when no alarms are active:

active_alarms|rid_<ID>_1/1:_info_#_MRx18_#_loc_<UnitLocation>_#_<leaveTimeEmpty>_#_<leaveNextHbEmpty>_#_ID_<UniqueSystemID>_#_1_#_<leaveSpEmpty>_#_no_active_alarms

rid_<ID>: optional field for system internal issues

<leaveTimeEmpty>, <leaveNextHbEmpty>, <leaveSpEmpty>: empty fields

Example:
active_alarms_1/1:_info_#_MRx18_#_loc_Buchdorf_#_   _#_ _#_ID_ExampleUniqueSystemID_#_1_#_ _#_no_active_alarms

5.3.2.2.   RSSI

The command RSSI (abbr. of <u>R</u>eceived <u>S</u>ignal <u>S</u>trength <u>I</u>ndication) enables to query the DL Input Level received from the base station at the BTS antenna port of the MRx18.

Command:
get_rssi

-> Response (always all available segments are responded:
   rssi:_<seg1>_dBm_#_<seg2>_dBm_#_<seg3>_dBm_#_loc_<UnitLocation>_#_ID_<UniqueSystemID>

- <segN>: RSSI value of segment N = 1..3

In case only one segment is equipped in the miniRepeater, the response command includes only segment 1:

rssi:_1_-55dBm_#_loc_Buchdorf_#_ID_ExampleUniqueSystemID

5.3.2.3. Actual Gain and Output Power

The current values of gain and output power can be received after this command has been sent.

Command:
Get_rf_status

-> Response (always all available segments are responded):

rf_status:_<seg>_#_gain_<UL>_<DL>_#_Pout_<UL>_<DL>{_#_<seg2>_#_gain_<UL>_<DL>_#_Pout_<UL>_<DL>}_#_loc_<UnitLocation>_#_ID_<UniqueSystemID>

- <segN>: actual gain and output power values of segment N = 1..3
For output power levels lower than 0 dBm the message "<0" is shown. Gain and output power are stated in full 1 dB steps.

For more than one segment equipped, the part in curly brackets is repeated for each segment.

5.3.2.4. Cell Information

The Get Cell Information command (**get ci**) gets the following network information about the serving cell of the modem.

RSSI:	Received Signal Strength Indication:	-115 … -47 dBm
CI:	Cell Identifier (hexa-decimal notation):	Format: xxxx
LAC:	Location Area Code (hexadecimal notation):	Format: xxxx
PLMN:	Public Land Mobile Network: mmm = MCC (mobile country code) nn = MNC (mobile network code)	Format: mmmnn

Command:
get_ci

-> Response:
ci:_rssi_<xxxx>_dBm_ci_<xxxx>_lac_<xxxx>_plmn_<mmmnn>_#_loc_<UnitLocation>_#_ID_<UniqueSystemID>

<u>Example:</u>
ci:_rssi_-70dBm_ci_0E40_loc_8201_plmn_26201_#_loc_Buchdorf_#_ID_Example UniqueSystemID

5.3.2.5. Software Version

The command queries the current software version of the repeater.

get_sw-version

-> Response:
***sw-version**:_MRx18_V<a.b.c.d>_#_loc_<UnitLocation>_#_ID_<UniqueSystemID>*

<u>Example:</u>
sw-version:_MRx18_V1.0.0.1_#_loc_Buchdorf_#_ID_ExampleUniqueSystemID

5.3.2.6. Repeater Type (Model)

The command identifies the model of the repeater. The content of the response is the name of the unit determined by Andrew.

get_repeater_type

-> Response:
***repeater_type**:_MR<xxxx>/<yyyy>/<yyyy>_#_loc_<UnitLocation>_#_ID_<UniqueSystemID>*

- <xxxx>, <yyyy>: see explanations in chapter *5.3.1.6 Technical Setup (Settings - Radio Frequency)*.
Note: /<yyyy> values are optional

5.3.2.7. Repeater Data

The ID No and serial numbers of the repeater can be captured by this command.

get_repeater_data

→ Response:
***repeater_data:**_MR<xxxx>[/<yyyy>[/<yyyy>]]_#_IDNO_<7digit ID No>_#_SN_<8digit alphanurmerical SN>_#_loc_<UnitLocation>_#_ID_<UniqueSystemID>*

- <xxxx>, <yyyy>: see explanations in chapter '*Technical Setup*'.
Note: /<yyyy> values are optional

☞ **Note:** **The command is only supported from SW V2.1.1 for MRx18 and from SW V1.0.0 for MR418.**

5.3.3. SET-Only Command: Reboot

This command performs a reboot of the miniRepeater.

set_reboot
-> Response:
No special response is sent; system start-up notification (see chapter *5.4.3 System Startup*) follows anyway and all active alarms are forwarded (when alarming is enabled)*.*

5.4. Notifications

5.4.1. Alarm

Every alarm is indicated by a separate SMS message. Alarm SMSs are sent when alarming is enabled (see chapter *5.3.1.5 Alarming Status*) and an alarm state has changed.

Format:

<severity>_#_MRx18_#_<UnitLocation>_#_<TimeStamp>_#_<NextHB>_#_<UniqueSystemID>_#_<AlarmID>:<segNo>_#_<SpecificProblem>_#_<AlarmText>

- <severity>:   The following severity levels are defined for MRx18: critical, major, minor, warning, cleared

- <TimeStamp>:   This field is left empty as MRx18 has no Real-Time Clock (RTC).

- <NextHB>:   This field contains the time in hours when the next heartbeat (HB) is expected. The value is always round up to next full hours, e.g. next HB in 10 hours and 1 minute => round up to 11.

- <AlarmID>:   unique ID for each alarm

- <segNo>:   Segment number 1 to 3

- <SpecificProblem>:   This field is not supported => no values are provided for here.

- <AlarmText>:   corresponding alarm text for <AlarmID>:<segNo>:
<AlarmID> = 5035: "Segment <segNo> ALC UL Alarm"
<AlarmID> = 5036: "Segment <segNo> ALC DL Alarm"
<AlarmID> = 5037: "Segment <segNo> RSSI Alarm"
<AlarmID> = 5038: "Segment <segNo> Current Alarm"
<AlarmID> = 5039: "Segment <segNo> LO Alarm"
<AlarmID> = 5040: "Segment <segNo> Temperature Alarm"

Example:
critical_#_MRx18_#_loc_Buchdorf_#_
_#_11_#_ID_ExampleUniqueSystemID_#_5035:1_#_   _#
_Segment_1_ALC_UL_Alarm

5.4.2. Heartbeat

The heartbeat message is forwarded after the heartbeat time interval has expired or after a power-up of the miniRepeater when heartbeat is activated.

Format:
h-beat_#_MRx18_#_<UnitLocation>_#_<TimeStamp>_#_<NextHB>_#_<Unit ID>_#_5000_#_<SpecificProblem>_#_system_is_alive(<NoOfActiveAlarms>_ala rms_are_active)

- <TimeStamp>:   This field is left empty as MRx18 has no Real-Time Clock (RTC).

- <NextHB>:   This field contains the time in hours when the next heartbeat (HB) is expected. The value is always round up to next full hours, e.g. next HB in 10 hours and 1 minute => round up to 11.

- <SpecificProblem>:   This field is not supported => no values are provided for here.

- <NoOfActiveAlarms>:   i.e. number of currently active alarms

5.4.3. System Startup

This notification is sent after every startup/ restart of the MRx18, independent on the current heartbeat configuration.

Format:
system_is_up_and_running_#_loc_<UnitLocation>_#_ID_<UniqueSystemID>

5.4.4. System Configuration Changed

This notification is sent every time after any repeater configuration has changed via the webpages when locally connected to the MRx18. It is sent immediately after session logout of the webpage.

Format:
system_configuration_changed_#_loc_<UnitLocation>_#_ID_<UniqueSystemID >

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5.5. Repeater Setup & Alarming via Ethernet (Webpages) – Modem Control

5.5.1. Setup and Alarming via Ethernet (Webpages)

Several pages are stored to the implemented web server, which are listed below:

- **Login**
    - Login window after a failed login
- **Status**
- **Settings**
    - o Radio Frequency
    - o Alarms
    - o Modem Control
    - o LAN Connectivity (change Ethernet connectivity setup)
    - o User Account
- **Maintenance**
    - High-contrast
    - Help
    - Logout

Via Ethernet access the customer can change any parameters.

All functions are intended for the following browsers:

- *Internet Explorer 7* (Windows) or higher or *Mozilla Firefox* (any version)
- Netscape Version 7.0

For any detailed description of buttons, the menu and status bars, functions and configurations provided that can be done in the webpages listed above - apart from the Modem Control page explained in the following chapter - please refer to the MRx18 User's Manual which can be downloaded as well.

5.5.2. Settings - Modem Control

figure 5-1 Modem Control

Settings - Modem Control	
Parameter	**Description** *of Value*
Modem Type	Different modems can be selected for SMS remote monitoring. If a modem is connected to the repeater, it is automatically initialized during the boot process of the repeater. If no reboot is performed, the modem type has to be selected manually.
Software Version	The software version of the modem connected to the repeater is shown. If no modem is connected or the modem cannot be recognized, the message "no valid modem found" appears.
SMSC	The Service Center Phone Number (SMSC) is entered here (including country code, +CC, e.g. +49 for Germany). If the SMSC is stored to the SIM card of the modem, no entry needs to be done.
Destination Phone Number [1)	Both the number of the destination for alarm messages and heartbeat SMS and the sender for SMS are determined herein. The number should be preceded with the country code. Only decimal digits are allowed, no spaces. The phone number shall consist of min. 7 decimal digits, max. 20 decimal digits.
Unit Location [1)	The Unit Location is sent with each SMS to get information about e.g. address location or building where the repeater is installed. No validation is done with the entry. The Unit Location is a user-defined field. The content of Unit Location on the Modem Control page corresponds to that of the Unit Location on LAN Connectivity page. The settings are only applied in the status bar at the bottom of each page after a new login. Max. 20 characters are allowed.
Unique System ID [1)	The Unique System ID is for identification of the repeater within A.I.M.O.S. software. This field is read-only.
Heartbeat Interval	A heartbeat SMS is sent after a certain period of time that can be selected in this field. The heartbeat indicates that the supervision of the repeater is working. If no heartbeat message is sent after the interval entered, the connection and supervision is down. If heartbeat interval is set to "0", the heartbeat functionality is disabled.
Time to Next Heartbeat	Depending on the heartbeat interval the time that still remains until the next heartbeat will be sent to the destination phone number is indicated.
Alarming via SMS	The alarming via SMS can be disabled in case no alarm and heartbeat SMS shall be sent to the destination phone number. When *Alarming via SMS* is disabled these parameters cannot be accessed.
Test SMS Phone Number	To check connectivity of the modem, a test SMS can be sent to a different receiver, e.g. your own mobile. The test SMS will contain Unit Location, Modem RSSI level, date, and timestamp.
Send Test SMS	Click this button to send a test SMS to the receiver entered in Test SMS Phone Number field.

[1) With integration in A.I.M.O.S. a configuration SMS is sent from A.I.M.O.S. that overwrites the entries of these fields by the entries coming from A.I.M.O.S.

table 5-1 Settings - Modem Control

To make the changes valid the Apply button has to be pressed and the user has to log out.

5.5.3. Maintenance - Modem Debugging

figure 5-2 Maintenance – Modem Debugging

In the page *Maintenance - Modem Debuggin*g, which is the **third** tab, current information on the modem is available (e.g. cell information). The following parameters can be queried here:

Maintenance	
Parameter	**Description of *Modem Debugging***
Location Area Code	The Location Area Code of the existing server cell is indicated. This information is provided by the connected modem. "No network" is stated in case no modem is connected or is recognized to/by the repeater or the modem is not able to access to a mobile network.
MCC / MNC	The Mobile Country Code (MCC) and Mobile Network Code (MNC) of the server cell is indicated. The first three digits show the MCC, the last two digits the MNC. The MCC and MNC are detected by the connected modem. "No network" is stated in case no modem is connected or is recognized to/ by the repeater or the modem is not able to access to a mobile network.
Cell Information	The cell information displays the ID of the cell the modem is served. "No network" is stated in case no modem is connected or is recognized to/by the repeater or the modem is not able to access a mobile network.
RSSI (dBm)	The received signal level at the antenna port of the modem is displayed. The loss of 25 dB of the modem coupler integrated in the repeater is considered. "No network" is stated in case no modem is connected or is recognized to/by the repeater or the modem is not able to access to a mobile network. The recommended level of the RF input power (at modem RF port) is -50 dBm to -90 dBm.
Software Version	The software version of the modem connected to the repeater is shown. If no modem is connected or the modem can not be recognized, the message "no valid modem found" appears.

table 5-2 Maintenance - Modem Debugging

6. Maintenance

Since replacing components inside the modem kits is a very time-consuming and intricate matter, we strongly recommend to have it done in factory.

Read and observe chapter 1.2.

1. **Observe the special protective measures for electrostatic-sensitive devices.**

2. **Before disconnecting any cables, label any unlabelled cables to ensure correct re-connection. Incorrectly wired connections may destroy electronic components.**

The MRx18 modem kits do not require preventative maintenance measures.

For screwing procedures, please observe that all our screws have a right-hand thread, i.e. for fastening the screws turn the tool clockwise and for unscrewing them turn it counter-clockwise. For SMA connectors, a specified torque of 45 N/cm has to be observed. Use an appropriate tool for this.

7. Appendix

7.1. Illustration - Layout
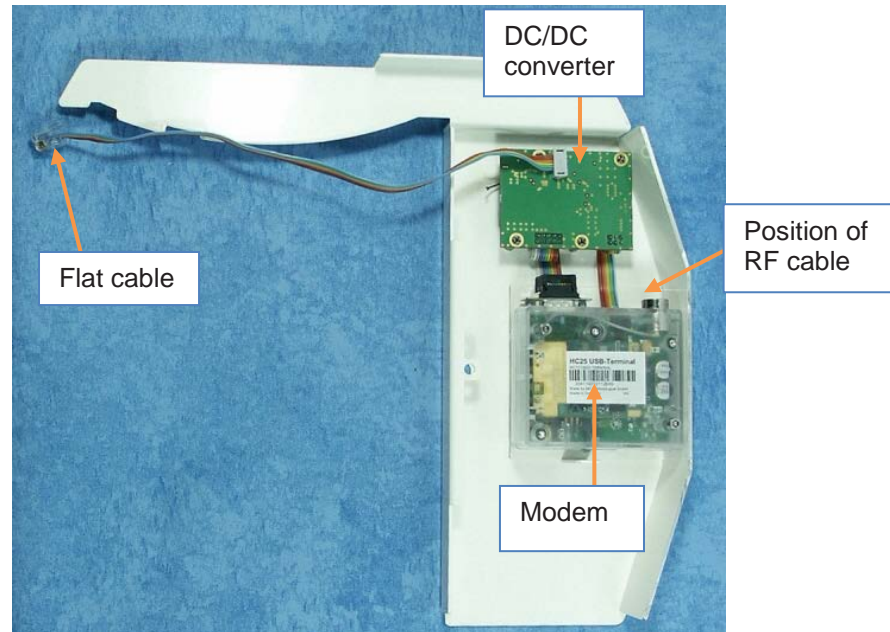
figure 7-1 Layout of the modem kit and bracket

7.2. System Specifications

7.2.1. Electrical Specifications

Frequency range		UL	DL
Modem kit HC25* / Modem-Kit PHS8 MRx18	GSM/ UMTS850	824 - 849 MHz	869 - 894 MHz
	GSM900	880 - 915 MHz	925 - 960 MHz
	GSM/UMTS1800	1710 - 1785 MHz	1805 - 1880 MHz
	GSM1900	1850 - 1910 MHz	1930 - 1990 MHz
	UMTS2100	1920 - 1980 MHz	2110 - 2170 MHz
RF input power (at modem RF port) *		-45 dBm to -105 dBm -50 dBm to -90 dBm (recommended)	
Power supply	Mains power	via MRx18	
Power consumption		4 W	

*   The Modem-Kit HC25 is discontinued and will be replaced by Modem-Kit PHS8 MRx18.

**   coupling loss of internal modem coupler in MRx18 approx. -25 dB

All figures are typical values.

All data is subject to change without notice.

7.2.2. Mechanical Specifications

Height, width, depth (incl. MRx18)	Single-band	254 x 314 x 35 mm (10.0 x 12.4 x 1.4 inch)
	Multi-band	254 x 314 x 70 mm (10.0 x 12.4 x 2.8 inch)
Weight (Modem kit)		0.5 kg (1.1 lb)

All data is subject to change without notice.

7.2.3. Environmental and Safety Specifications

Temperature range	+5° C to 40°C

All data is subject to change without notice.

7.3. Spare Parts

Description:	ID No:
Modem-Kit HC25 *	7598812
Modem-Kit PHS8 MRx18 *	7679560

* Modem-Kit PHS8 MRx18 replaces Modem-Kit HC25, which is discontinued.

The Last Replaceable Unit (LRU) is the respective entire modem kit, except for the manual listed above which can be optionally ordered.

☞ **Note:** To ensure compatibility with your system, do not order any individual modems of the kits available! Make sure to always order the complete kit (ID must be listed above) as spare part.

8. Index

9. List of Changes

Version	Changes	Release Date
M0139AFK		21-September-2016
M0139AFL	- ISED information added in chapters *1.1* and *1.4*. - CE information updated in chapter *1.5*. - RSSI Based Power Off commands added in chapter *5.3.1.6*.	27-February-2018

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