

User's Guide for MR803D, MR853D, MR903D and MR1903D miniRepeaters

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1. Safety and Environmental

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. The antennas of the repeater (integrated and / or external) have to be installed in a way that the regional and national RF exposure compliance requirements are met.

To comply with FCC RF exposure compliance requirements, the following antenna installation and device operating configurations must be satisfied: A separation distance of at least 20 cm must be maintained between the antenna of this device and all persons. 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). Maximum permissible antenna gain is 12 dBi.



The miniRepeaters must only be used for indoor applications!

2. Quick-Start Checklist

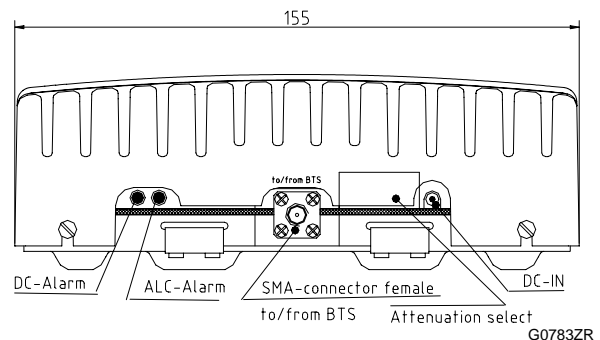
- Adjust channel(s); see chapter 10.
- Mount the repeater; see chapter 6.
- Install donor and coverage antennas.
- Provide the repeater with power; see chapter 3.
- Adjust the attenuation; see chapter 12.

Start the adjustment with the maximum attenuation and decrease attenuation until the ALC becomes active and the ALC alarm LED lights up. Then increase attenuation until the ALC alarm is inactive again.

or

- Select auto-setup; see chapter 12.
- Check for alarms; see chapter 13.

3. RF and Power Connectors



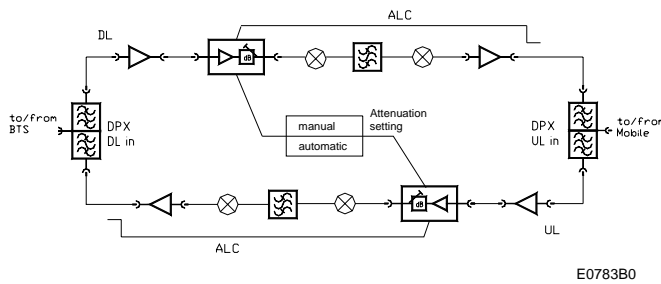
The miniRepeaters are equipped with two RF antenna ports: one antenna port that provides RF signals to/from mobile(s) and another antenna port on the opposite side of the miniRepeater that provides RF signals side to/from the BTS. Both of these connectors are SMA-Female. Two coaxial jumper cables are included with the miniRepeaters to provide N-female connection ports.

The socket for the DC supply is situated to the right of the "to/from BTS" RF connector. The power supply voltage for this connection point is 6.7 to 7.5 VDC, with a typical current draw of 1.7 amps. Only the Power Supply Unit (PSU) supplied with the MiniRepeater must be used.

An alternative method to provide power to the MiniRepeater is through the "to/from BTS" RF connector via the coaxial cable and a bias-T at the source. The DC socket of the repeater must not be connected if the unit is biased via the RF port.

4. Functional Description

The operation principle of the miniRepeaters is given with regard to the following block diagram.

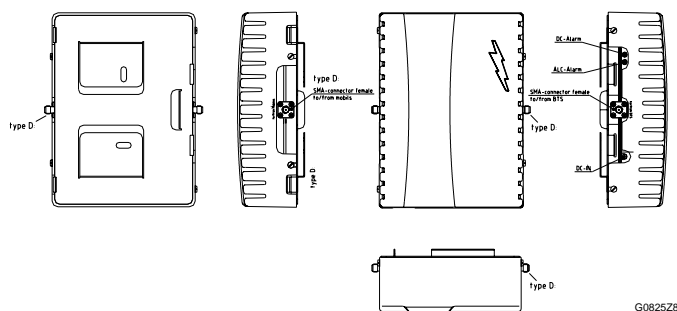


Downlink signals from the BTS reach the internal duplexer through the “to/from BTS” RF port. Following the DL path from the duplexer, the RF signals are amplified by an LNA, which feeds the amplified signals to a mixer. The mixer converts the signals down to an intermediate frequency (IF), where a high rejection IF filter provides excellent selectivity to allow only the user’s frequency band to be repeated. After the IF filter, the signals are re-converted to the original frequency by means of another mixer. A final amplifier boosts the RF signals to the required output power.

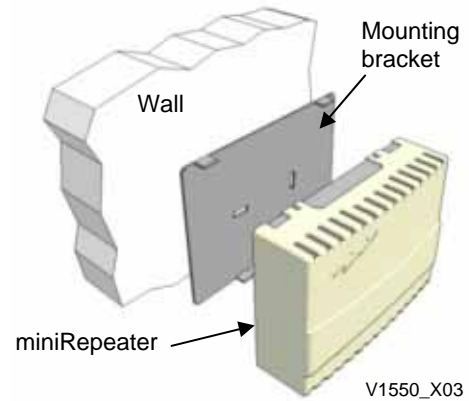
After the final amplifier, a power detection circuit measures the output power and controls the gain through a closed loop feedback circuit. This feature is the automatic level control (ALC), which prevents the repeater from being overdriven and maintains intermodulation products and spectrum emissions below the regulation limits. Finally, the RF signals are fed to the external antenna through the duplexer and “to/from Mobile” RF port.

The uplink signals are received by the external antenna through the “to/from Mobile” RF port and are then fed to the duplexer. After the duplexer the RF circuitry and functionality is identical to the downlink path, which provides high rejection filtering for the desired operation frequency band and ALC functionality.

5. Cabinet Drawing



6. Wall Mounting



The miniRepeater may only be mounted horizontally to a **wall** according to the above drawing to ensure the natural convection cooling. Do **not** mount the miniRepeater to the ceiling!

Always choose a mounting location that avoids condensation!

7. Mechanical Specification

Size H x W x D	114 x 154 x 51.5 mm (4.5 x 6.1 x 2.0 inch)
Weight	0.7 kg
Sealing Class	IP30

8. Environmental and Safety Specifications

The environmental specifications are according to ETS 300 019 (European Telecommunication Standard) and the safety specifications are according to UL Std No 1950 and CAN/CSA-C22.2 No. 60950. For further details please ask your supplier.

9. 20 dB Bandwidth

MR803D, 18 MHz Filter	18.7 MHz
MR853D, 1.5 MHz Filter	2.1 MHz
MR853D, 10 MHz Filter	10.7 MHz
MR853D, 12.5 MHz Filter	13.2 MHz
MR853D, 25 MHz Filter	24.7 MHz
MR903D, 6 MHz Filter	6.6 MHz
MR1903D, 5 MHz Filter	7.0 MHz
MR1903D, 10 MHz Filter	11.0 MHz
MR1903D, 15 MHz Filter	16.0 MHz

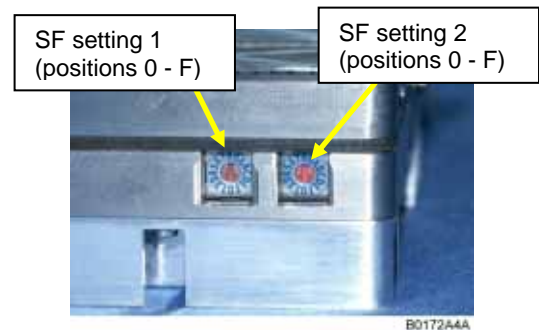
20 dB bandwidth

10. Start-Frequency Switch Settings

As described in chapter 4 *Functional Description*, the miniRepeaters utilise a high rejection filter to allow only the desired frequency band to be repeated. The miniRepeaters are available in different bandwidths with field adjustable start frequencies to support the desired frequency band of the user.

Two rotary switches, located on the side of the miniRepeater, are provided for setting the start frequency (SF) of the high rejection filter. The SF of the high rejection filter may be adjusted in either 200 or 250 kHz steps, dependent upon the miniRepeater model.

Following are tables that show the filter band-pass start frequencies corresponding to the switch settings. The following section will show tables of standard user settings.



Rotary switches for start-frequency setting

miniRepeater Model: MR803D		Frequency Step Size: 200 kHz	
Start Frequency Setting 1	Start Frequency Setting 2	Start Frequency UL (MHz)	Start Frequency DL (MHz)
0	0	796.00	841.00
0	1	796.20	841.20
0	2	796.40	841.40
...
0	F	799.00	844.00
1	0	799.20	844.20
1	1	799.40	844.40
...
1	F	802.20	847.20
...
F	0	844.00	889.00
F	1	844.20	889.20
...
F	F	847.00	892.00

Start-frequency setting MR803D

miniRepeater Model: MR853D		Frequency Step Size: 200 kHz	
Start Frequency Setting 1	Start Frequency Setting 2	Start Frequency UL (MHz)	Start Frequency DL (MHz)
0	0	814.00	859.00
0	1	814.20	859.20
0	2	814.40	859.40
...
0	F	817.00	862.00
1	0	817.20	862.20
1	1	817.40	862.40
...
1	F	820.20	865.20
...
F	0	862.00	907.00
F	1	862.20	907.20
...
F	F	865.00	910.00

Start-frequency setting MR853D

miniRepeater Model: MR903D		Frequency Step Size: 200 kHz	
Start Frequency Setting 1	Start Frequency Setting 2	Start Frequency UL (MHz)	Start Frequency DL (MHz)
0	0	870.00	909.00
0	1	870.20	909.20
0	2	870.40	909.40
...
0	F	873.00	912.00
1	0	873.20	912.20
1	1	873.40	912.40
...
1	F	876.20	915.20
...
F	0	918.00	957.00
F	1	918.20	957.20
...
F	F	921.00	960.00

Start-frequency setting MR903D

miniRepeater Model: MR1903D		Frequency Step Size: 250 kHz	
Start Frequency Setting 1	Start Frequency Setting 2	Start Frequency UL (MHz)	Start Frequency DL (MHz)
0	0	1848.00	1928.00
0	1	1848.25	1928.25
0	2	1848.50	1928.50
...
0	F	1851.75	1931.75
1	0	1852.00	1932.00
1	1	1852.25	1932.25
...
1	F	1855.75	1935.75
...
F	0	1908.00	1988.00
F	1	1908.25	1988.25
...
F	F	1911.75	1991.75

Start-frequency setting MR1903D

11. Standard Frequency Band Settings

The following tables show SF switch settings that would provide the appropriate passband frequency response required for specific SF bands. Note that the passband response may be different than the filter bandwidth of the miniRepeater. In these instances, the miniRepeater high rejection filter is used in conjunction with the duplexer response to narrow the actual band-pass response.

MR803D Available IF Filters: 18 MHz							
IF Filter Bandwidth	UL Start Frequency	UL Stop Frequency	DL Start Frequency	DL Stop Frequency	Passband Bandwidth	SF 1 Setting	SF 2 Setting
18 MHz	806 MHz	817 MHz	851 MHz	862 MHz	11 MHz	0	F
18 MHz	817 MHz	824 MHz	862 MHz	869 MHz	7 MHz	6	9
18 MHz	806 MHz	821 MHz	851 MHz	866 MHz	15 MHz	2	3
18 MHz	821 MHz	824 MHz	866 MHz	869 MHz	3 MHz	7	D
18 MHz	806 MHz	824 MHz	851 MHz	869 MHz	18 MHz	3	2

Standard frequency band setting MR803D

MR853D Available IF Filters: 1.5, 10, 12.5, and 25 MHz							
IF Filter Bandwidth	UL Start Frequency	UL Stop Frequency	DL Start Frequency	DL Stop Frequency	Passband Bandwidth	SF 1 Setting	SF 2 Setting
12.5 MHz	824 MHz	835 MHz	869 MHz	880 MHz	A: 11 MHz	2	B
1.5 MHz	845 MHz	846.5 MHz	890 MHz	891.5 MHz	AE: 1.5 MHz	A	0
10 MHz	835 MHz	845 MHz	880 MHz	890 MHz	B: 10 MHz	6	9
10 MHz	846.5 MHz	849 MHz	891.5 MHz	894 MHz	BE: 2.5 MHz	A	2
25 MHz	824 MHz	849 MHz	869 MHz	894 MHz	25 MHz	3	2

Standard frequency band setting MR853D

MR903D Available IF Filters: 6 MHz							
IF Filter Bandwidth	UL Start Frequency	UL Stop Frequency	DL Start Frequency	DL Stop Frequency	Passband Bandwidth	SF 1 Setting	SF 2 Setting
6 MHz	896 MHz	901 MHz	935 MHz	940 MHz	5 MHz	7	D
6 MHz	901 MHz	902 MHz	940 MHz	941 MHz	1 MHz	9	B
6 MHz	896 MHz	902 MHz	935 MHz	941 MHz	6 MHz	8	2

Standard frequency band setting MR903D

MR1903D Available IF Filters: 5, 10, and 15 MHz							
IF Filter Bandwidth	UL Start Frequency	UL Stop Frequency	DL Start Frequency	DL Stop Frequency	PCS Block	SF 1 Setting	SF 2 Setting
5 MHz	1850 MHz	1855 MHz	1930 MHz	1935 MHz	A1	0	8
5 MHz	1855 MHz	1860 MHz	1935 MHz	1940 MHz	A2	1	C
5 MHz	1860 MHz	1865 MHz	1940 MHz	1945 MHz	A3	3	0
5 MHz	1865 MHz	1870 MHz	1945 MHz	1950 MHz	D	4	4
5 MHz	1870 MHz	1875 MHz	1950 MHz	1955 MHz	B1	5	8
5 MHz	1875 MHz	1880 MHz	1955 MHz	1960 MHz	B2	6	C
5 MHz	1880 MHz	1885 MHz	1960 MHz	1965 MHz	B3	8	0
5 MHz	1885 MHz	1890 MHz	1965 MHz	1970 MHz	E	9	4
5 MHz	1890 MHz	1895 MHz	1970 MHz	1975 MHz	F	A	8
5 MHz	1895 MHz	1900 MHz	1975 MHz	1980 MHz	C1	B	C
5 MHz	1900 MHz	1905 MHz	1980 MHz	1985 MHz	C2	D	0
5 MHz	1905 MHz	1910 MHz	1985 MHz	1990 MHz	C3	E	4
10 MHz	1850 MHz	1860 MHz	1930 MHz	1940 MHz	A1 + A2	0	8
10 MHz	1855 MHz	1865 MHz	1935 MHz	1945 MHz	A2+ A3	1	C
10 MHz	1860 MHz	1870 MHz	1940 MHz	1950 MHz	A3 + D	3	0
10 MHz	1865 MHz	1875 MHz	1945 MHz	1955 MHz	D+ B1	4	4
10 MHz	1870 MHz	1880 MHz	1950 MHz	1960 MHz	B1 + B2	5	8
10 MHz	1875 MHz	1885 MHz	1955 MHz	1965 MHz	B2+ B3	6	C
10 MHz	1880 MHz	1890 MHz	1960 MHz	1970 MHz	B3 + E	8	0
10 MHz	1885 MHz	1895 MHz	1965 MHz	1975 MHz	E+ F	9	4
10 MHz	1890 MHz	1900 MHz	1970 MHz	1980 MHz	F + C1	A	8
10 MHz	1895 MHz	1905 MHz	1975 MHz	1985 MHz	C1+ C2	B	C
10 MHz	1900 MHz	1910 MHz	1980 MHz	1990 MHz	C2 + C3	D	0
15 MHz	1850 MHz	1865 MHz	1930 MHz	1945 MHz	A	0	8
15 MHz	1870 MHz	1885 MHz	1950 MHz	1965 MHz	B	5	8
15 MHz	1895 MHz	1910 MHz	1975 MHz	1990 MHz	C	B	C

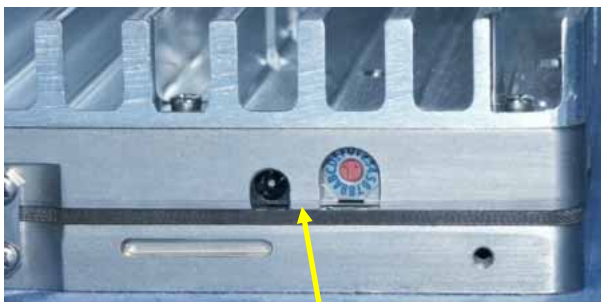
Standard frequency band setting MR1903D

12. Attenuation Setting

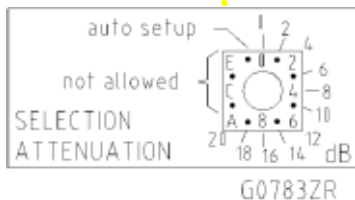
The attenuation of the miniRepeater can be set by means of a rotary switch. There is a label on the miniRepeater that shows the possible positions of the rotary switch and the corresponding values of the attenuation. The attenuation can be set, using a small screwdriver, in the range from 0 dB to 20 dB in steps of 2 dB or "auto setup" may be selected.

When auto setup is selected, the miniRepeater will automatically set its gain to maximize RF performance. The downlink gain will be automatically set to operate the repeater at its maximum output power, while not exceeding the ALC limit. The uplink gain will be set to the value of the downlink path.

If the level of the BTS signal increases, the miniRepeater will decrease the gain in the downlink and uplink paths automatically. However, the miniRepeater will increase the gain again in timely intervals of 24 hours if the level of the BTS signal decreases.



B0172A5A



Rotary switch for attenuation setting

13. Alarming and Supervision

13.1. Functional Description of the Alarming-Interface

For alarming and supervision, the miniRepeater is provided with an alarming interface represented by two LEDs and output contacts:



LEDs and output contacts

LED1: This three-colour LED provides visual equipment status information:

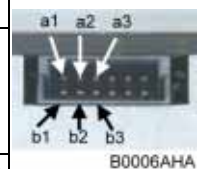
- off no power feed
- green normal operation condition
- orange hardware alarm (out of defined power-window) or LO (Local Oscillator) does not lock
- red temperature of repeater too high

LED2: This one-colour LED provides visual information about the ALC-status (Automatic Level Control):

- off normal operation condition
- red ALC-Alarm, ALC active

13.2. Output-Contact Configuration

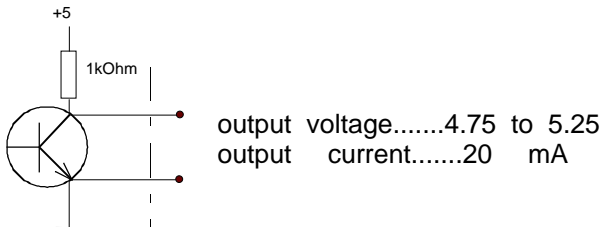
Output1 (TTL level)	a3 GND b3 Heartbeat
Output2 (Optocoupler output)	b1 Hardware-Alarm – C b2 Hardware-Alarm – E
Output3 (Optocoupler output)	a1 ALC-Alarm – C a2 ALC-Alarm – E



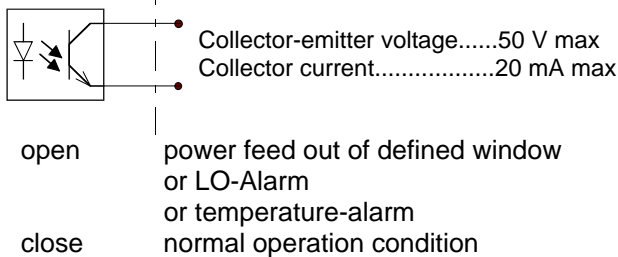
Output-contact configuration

13.3. Output-Contact Descriptions

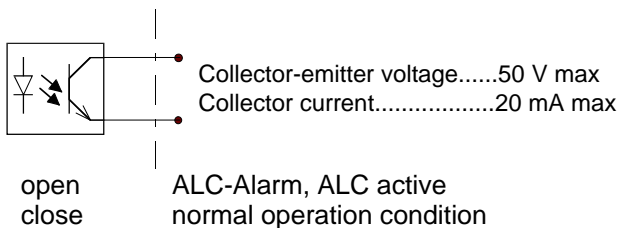
Output1: This is a transistor output for heartbeat signalling. The heartbeat interval can be set in the 1-to-72-hours range.



Output2: This optocoupler output, which is signalling the operating condition, represents the same functionality as LED1.



Output3: This optocoupler output, which is signalling the ALC condition, represents the same functionality as LED2.



14. Heartbeat Setting

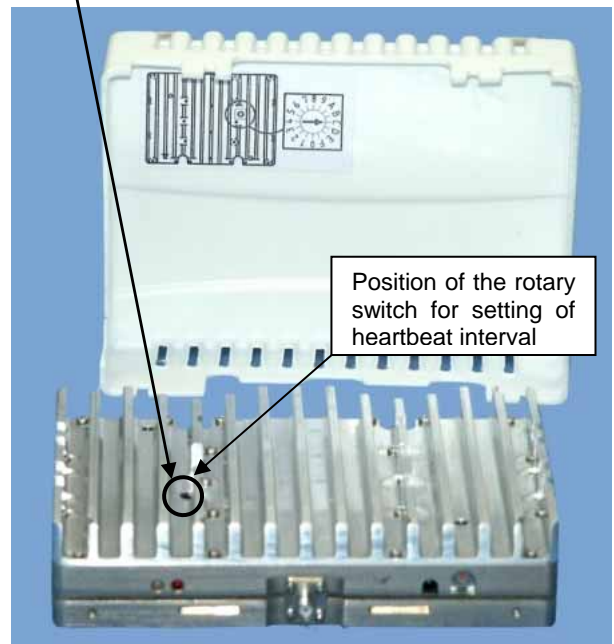
In a remote monitoring system, heartbeat signalling is a very useful method to monitor whether the supervision connection to a device is still operational. Without heartbeat signalling, there would be no indication if the supervision connection failed.

The heartbeat interval can be set by means of a rotary switch, which is accessible on the top of the miniRepeater. Use a small screwdriver to turn the switch carefully to the position for the required interval (1 to 72 hours) according to the label in the cover.

0	not allowed	2	1 h	A	24 h
1	not allowed	3	2 h	B	30 h
		4	3 h	C	36 h
		5	4 h	D	48 h
		6	5 h	E	60 h
		7	6 h	F	72 h
		8	12 h		
		9	18 h		



Heartbeat-switch settings



Position of the rotary switch for setting of heartbeat interval

B0127APA

miniRepeater with cover

15. List of Changes

Version	Changes	Release Date
M0041AMA		07-Feb.-06
M0041AMB	- Mikom GmbH changed its name into Andrew Wireless Systems GmbH - Chapter 1 changed - Chapter 5 changed - Chapter 7 changed	21-Nov.-06

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