4.2 Install the Repeater

Instructions in the left column are fast track instructions and can be used by experienced users. Other users are recommended to read the complete text in this installation guide

4.2.1 Unpack the Repeater

Unpack the repeater

Inspect the shipped material before unpacking the equipment, document any visual damage and report according to routines.

A delivery of a repeater from Avitec contains:

- Checklist with delivered items
- Repeater
- Wall mounting kit or rack mounting kit (defined in order)
- 4 bolts for attaching repeater to mounting kit
- Cable cover
- Keys to repeater and cable cover
- CD containing Product Description and User's Manual
- Any other specifically ordered item

4.2.2 Mount the Repeater

Mount the repeater on a wall, on a pole or in a rack

Mount the repeater in an accessible location and in a location that fulfils the environmental requirements.

The repeater can be mounted on the wall, on a pole or in a 19 inch rack. The Repeater is delivered with a wall mounting kit or a rack mounting kit.

The repeater needs to be mounted tightly to eliminate vibrations

Wall mounting kit

Rack mounting kit

Ensure proper ventilation

Mount the repeater so that heat can be dispersed from it. The repeater wall mounting kit ensures an optimum airflow between the wall and the repeater itself. Do not block this air channel as it will cause the MTBF of the repeater to drop dramatically, or even in the worst case cause the repeater to fail completely.

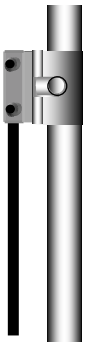
If possible use a wall in the shadow to minimize the overall sun loading. If sufficient shielding cannot be obtained, an additional sun shield should be mounted.

Example of a sun shield

4.2.3 Ensure Proper Grounding

Connect the grounding protection

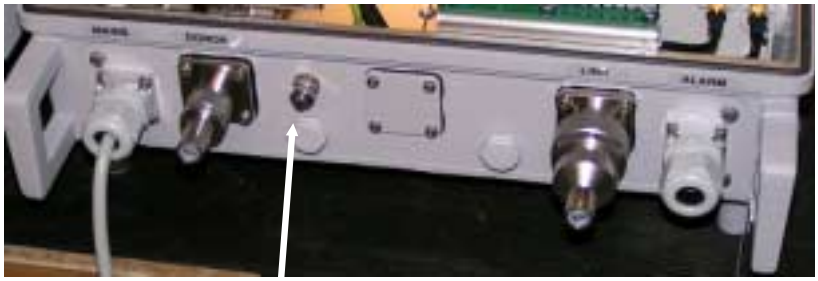
Ensure that good grounding protection measures are taken to create a reliable repeater site. Make sure to use adequately dimensioned grounding cables. The minimum recommended conductive area for a grounding cable is 16mm$^{2.}$



The antenna cabling should be connected to ground every 10m by a reliable grounding kit.

Make sure the grounding product used is suitable for the kind and size of cable being used.

Connect the repeater box bolt to the same ground.



Ground

Ground connector on repeater

4.2.4 Ensure Good EMV Protection (Lightning)

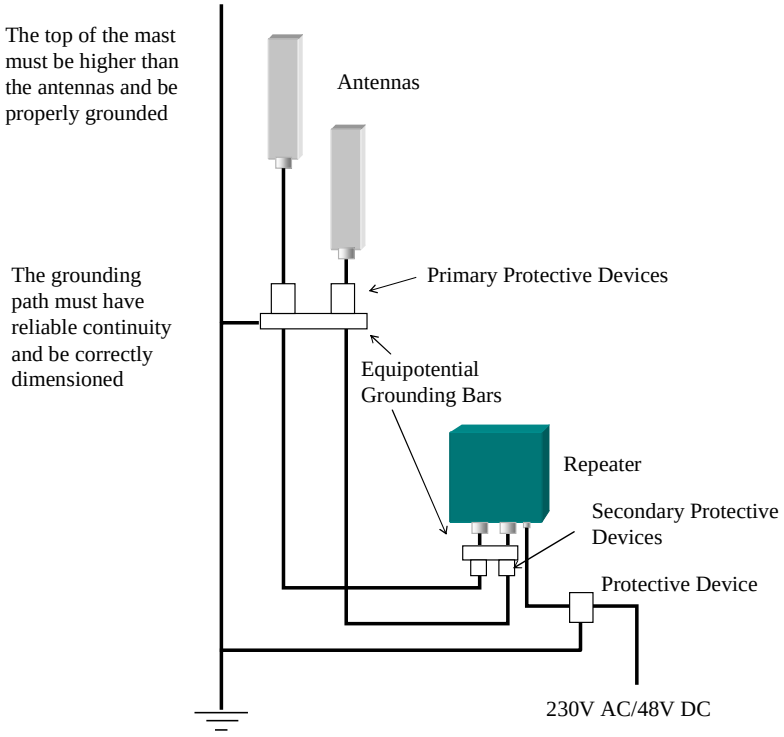
Caution
If insufficient Electro magnetic Protection is provided, or if EMV measures are not taken, warranties issued by Avitec are not valid.

Connect the lightning protection

The lightning hazard to electric and electronic equipment consists in the interferences of direct lightning current infections and high surge voltages induced by the electromagnetic field of nearby lightning channels or down conductors. Amplitudes from cloud-to-earth lightning amounts to several 10kA and may last longer than 2 ms. The damage caused depends on the energy involved and on the sensitivity of the electronics systems.

Ensure that lightning protection measures are taken to create a reliable repeater site. Protect all coaxial cables and power cables from the transients caused by lightning. Fit all cables with suitable lightning protection devices.

For detailed information please refer to IEC 61024-1 and 61312-1 for international standards for protection of information systems against LEMP, Lightning Electromagnetic Pulse, including radio transmitters. They define proper planning, installation and inspection of effective lightning protection systems.



The Avitec repeaters comply with the EN standard ETS 301 498-8 which stipulates demands on lightning/surge protection for typical infrastructure telecom equipment installations.

Several lightning protection devices should be used in series with declining threshold voltages to help attenuate the pulse component which makes it through the first layer of protection.

The primary protective device is part of the site installation and is not supplied by Avitec. Coaxial lightning protection is normally one of these three types: Gas capsule, High-pass and Bandpass.

There also need to be a protective device installed on the power supply cord.

Protective device installed in connection with the power supply

4.2.5 Attach Antenna Cables

Note!

For Frequency Translating Repeaters see also 4.2.8 Mount the Coupler

Note!

For site installation advice and descriptions of antenna installation see 4.1 Prepare the Site.

Attach the antenna cables to the repeater antenna connections

Connectors

The connector to the directional coupler (frequency translating repeaters donor unit) is N-type female. Antenna connections are DIN 7/16” connectors, female.

Compatibility

Make sure that cables and connectors are compatible. Using cables and connectors from the same manufacturer is helpful.

Connectors

All connectors must be clean and dry

Waterproof all outdoor connections

Waterproof all outdoor connections using silicone, vulcanizable tape or other suitable substance as moisture and dust can impair RF characteristics.

Make sure enough room has been allocated for the bending radius of the cable. RF cables must not be kinked, cut or damaged in any way

Connect the RF cables to the antennas tightly but without damaging threads

Fasten cables tight to cable ladder or aluminum sheet

Cable Dimensions

For short length of feeder cables use ½ “, for longer feeder cables use 7/8”. Chose thicker coax cables for lower attenuation. Minimize the length of the coax cables to reduce the attenuation

Jumper Cables

Use jumper cables for easy installation. The RF Coaxial cable can be substituted at each end with a jumper cable.

4.2.6 Attach Fiber Cable

Caution

Un-terminated optical receptacles may emit laser radiation.
Do not stare into beam or view with optical instruments.

4.2.6.1 Fiber Connector in the Repeater Casing

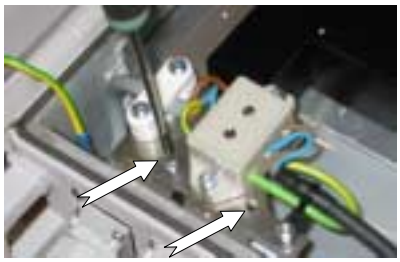
Select fibre	Recommended fiber cable is single mode 9/125.
Connect the fiber cable	Connect the fibre directly to the FC/APC connector in the casing. **Note!** Clean the fiber connector before it is connected to the Opto module, see instruction below. **Note!** This installation is only suitable for indoor use. The IP 65 classification of the repeater casing is no longer valid.

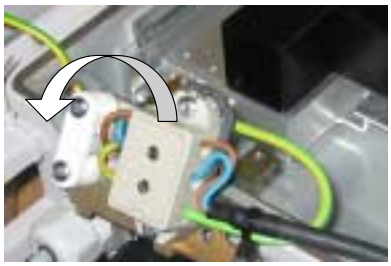
4.2.6.2 Fiber Connector in the Opto Module

Select fibre	Recommended fiber cable is single mode 9/125.
Insert the fiber into the repeater via the fitting	The casing of the repeater is equipped with a Pg connector for attachment of a corrugated hose (NW 17 mm, outer diameter 21.2 mm). The hose, together with the Pg connector, meet the protection standard IP50. Supplemented by O-rings, the protection standard IP67 is met.
Attach the fiber to the connector in the Opto Module	Make sure the fiber is not too sharply bent. Put the excess fiber cable in soft bends in the repeater. See illustration. Fasten the cable to make sure it is not damaged when the repeater lid is closed.  **Note!** Clean the fiber connector before it is connected to the Opto module, see instruction below.

Make necessary measurements	Make necessary measurements to ensure a correct installation. When the cable has been installed, the quality of the optical path should be checked for optical path loss and magnitude and location of any reflections. This can be done with an Optical Time Domain Reflectometer (OTDR). The total return loss should be > 45 dB. Optical reflections can degrade the noise and linearity of a fiber optic link. In particular, reflections that reach the laser can be a problem. Keep all discrete reflections to > 60 dB. The FC/APC connectors are polished to a return loss >60 dB.
Mount the hose to the connector	The casing of the repeater is equipped with a Pg connector for attachment of a corrugated hose (NW 17 mm, outer diameter 21.2 mm). The hose, together with the Pg connector, meet the protection standard IP50. Supplemented by O-rings, the protection standard IP67 is met.
Seal the hose	Seal the hose according to the demands at hand. If the IP classification of the casing should be maintained O-rings should be used and both ends of the hose should be sealed with for instance silicon (free of acetic acid).

If necessary to access the repeater end of the hose, the power plinth can be loosened (two screws) and moved forward.





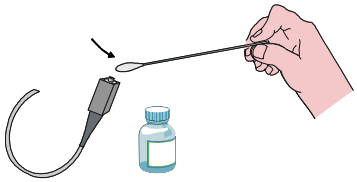
The repeater seen from the inside with the conduit marked by an arrow.

(No fiber is present in this illustration)

Cleaning Optical Connectors

Optical reflections from a discontinuity such as a poor connector interface appear on an RF spectrum analyzer trace as stable variations in the noise floor amplitude that are periodic with RF frequency. If the reflection is bad enough, it could impact the system performance. By far, the most common cause for a large discrete reflection is a dirty optical connector. A bit of dust or oil from a finger can easily interfere with, or block this light. Fortunately, it is very easy to clean the connector.

Be sure to use the correct procedure for the given connector. When disconnected, cap the FC/APC connector to keep it clean and prevent scratching the tip of the ferrule.



Alternative 1

Swipe the tip of the ferule 2-3 times with a cotton swab soaked in alcohol. Let it air dry.

Alternative 2

Use a product specially designed for the purpose.

4.2.7 Supply Power to the Repeater

Caution!
The antenna cables must be connected to the repeater before mains power is switched on. Alternatively the antenna connections on the repeater can be terminated with 50ohm termination plugs.

Note!

Connect the repeater to the power supply

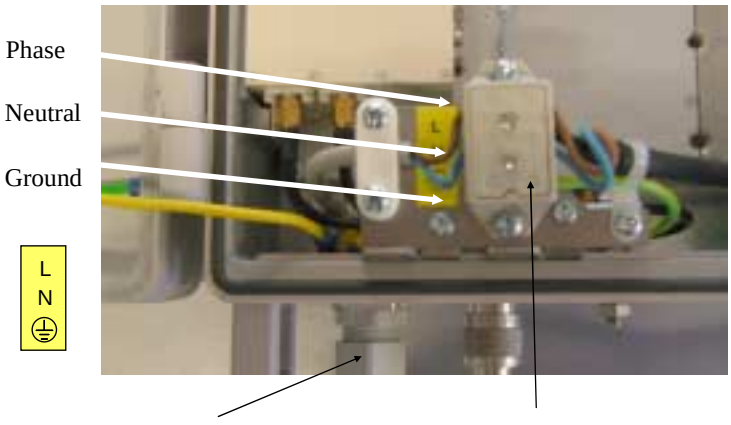
Avitec repeaters can be fed by 110/230 VAC, 50/60 Hz or 48 VDC. Ensure that the right voltage is used.

Mains power is connected to the repeater via a plinth inside the repeater.

The strain relief fitting is a Pg 13.5 suitable for a 6-12 mm cable diameter.

230VAC or 110 VAC

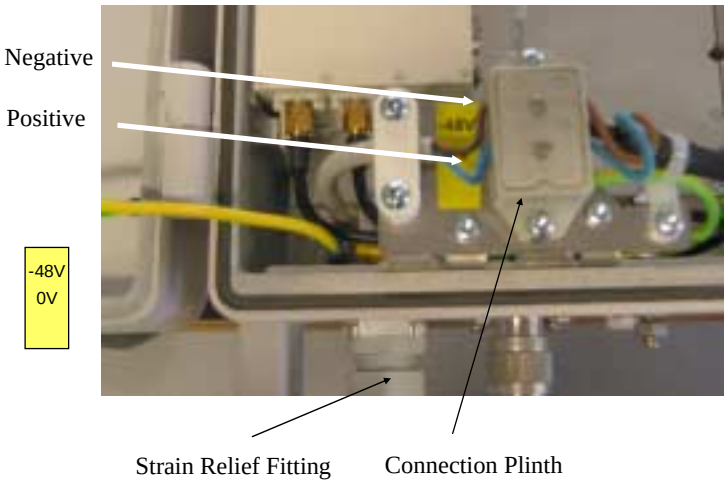
Connect the power cable to the plinth with the phase linked to the brown cable, neutral linked to the blue and ground to the yellow/green. See illustration below.



48 VDC

Connect the power cable to the plinth with negative (-48V) to the uppermost connection and positive (0V) to the middle connection. Leave the lower connection

empty. See illustration below.



Recommended cable areas for 48VDC

0 - 10 meters between repeater and power supply	2,5 mm²
10 – 50 meters between repeater and power supply	4 mm²
Over 50 meters between repeater and power supply	Recommendation is to reconfigure the installation, or to make special arrangements to increase cable area

Requirements on 48 V power supply

The 48V power supply must comply with SELV requirements, as defined in EN60950, which implies double isolation. The output power needs to be 48VDC +25%/-15%.

For a 2 channel repeater the maximum input current is 8A, for a 4-channel repeater 16A.

Note!

In 4-channel repeaters there are two power supplies – one in each part of the box. Each power supply has its own power switch. Both need to be switched on.

Back-up battery

Backup Battery

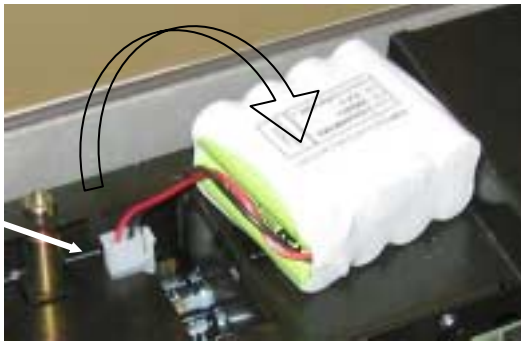
There is a back-up battery installed in connection with the power supply. If there is a power failure the battery will supply enough power for the Control Module in the repeater to send information about the power failure.

The backup battery can be switched on an off separately. The switch is placed adjacent to the mains power switch on the power supply.

In 4-channel repeaters there is a backup battery only in connection to the main power supply unit.

At delivery the back-up battery is connected. It can be replaced by lifting the battery pack out of the crate and disconnecting the cable.

Connector



4.2.8 Mount the Coupler

Caution!

When the coupler is connected the affected base station sector needs to be taken out of service. Turn the base station off before detaching the cable to the base station cell antenna. It might shut down the whole network – chose an off-peak time for this installation.

Note!

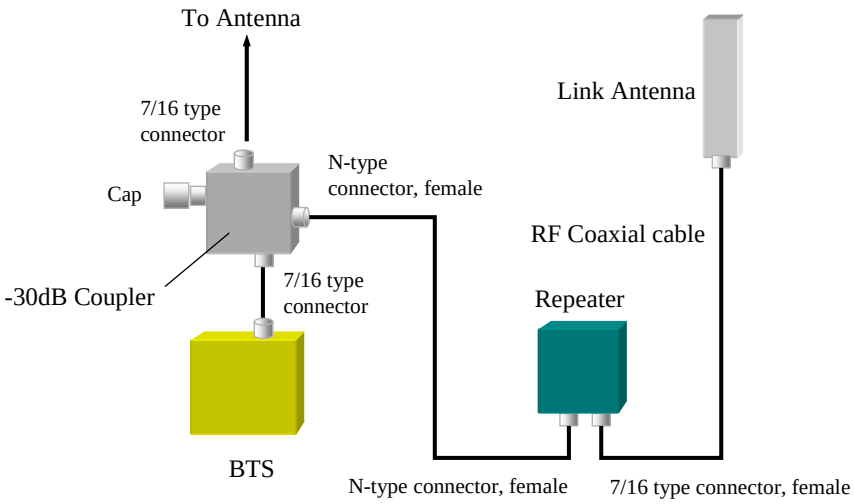
The Coupler is used only in connection with Frequency Translating Repeaters

Mount the coupler

The connection between the donor unit and the BTS is made using an Avitec Coupler. The attenuation from the BTS to the repeater is -30 dB. The attenuation through the coupler from the BTS to the antenna is minimal.

Avitec Coupler

The coupler is connected in series with the BTS antenna. J1 and J2 are used for the connection of the coupler in-between the BTS and the cable to the BTS antenna.



Coupler connections

J3 or J4 is connected to the repeater donor unit depending on the orientation of the coupler. If J1 is connected to the BTS; J3 is used for connection with the repeater, if J2 is connected to the BTS; J4 is used for connection with the repeater. The connector not used (J3 or J4) must be sealed with a cap to prevent the ingression of dust and water.

- J1 and J2 are DIN 7/16 connectors, one male and one female
- J3 and J4 are N-type connectors, female

1. Disconnect the antenna from the base station
2. Decide whether to connect a filter in series with the antenna cable (between the coupler and the antenna) to prevent any disturbances from the repeater to reach the antenna
3. Attach the coupler in-between the base station and the antenna cable. (J1 and J2).
4. Attach the coupler connector closest to the base station to the repeater donor antenna connector
5. Attach a cap to the connector closest to the antenna connection
6. Turn the base station back on and verify that it is operational.
7. Seal the coupler with rubber tape. Start on the base station antenna cable and wrap to the base station port cable. Wrap in a circular motion downwards. Cover the coupler and its connecting parts completely. This will provide a weather resistant seal. Complete by adding three layers of PVC tape for UV protection.

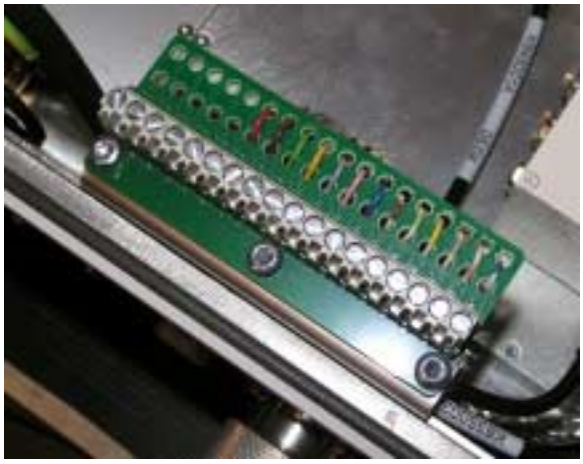
4.2.9 Connect External Alarms

Connect external alarms

If the repeater is equipped with an external alarm interface card the connector plinth for the external alarms is located at the bottom of the repeater.

The strain relief fitting in is a Pg 13.5 suitable for a 6-12 mm cable diameter.

Connect the alarm cords to the plinth according to the pin layout below (in the standard version pins 14 – 18 are not used).



Pin #	Signal
1	External alarm 1A
2	External alarm 1B
3	External alarm 2A
4	External alarm 2B
5	External alarm 3A
6	External alarm 3B
7	External alarm 4A
8	External alarm 4B
9	Alarm +15V
10	Alarm 0V
11	Relay A
12	Relay B
13	GND
14	NC
15	NC
16	NC
17	NC
18	NC

External Alarm

Four external alarm sources can be connected to the repeater. These alarms operate on a voltage between 12 and 24VDC. The presence or absence of this voltage will trigger the alarm depending on how the alarm polarity has been configured via software.

The alarms can be configured active-low or active-high, so that the alarm is given either in the presence or absence of applied power. Active high means that an applied voltage of between 12 and 24 V will cause the external alarm indicator to turn red. Active low means that when there is no voltage the alarm indicator will turn red.

The repeater can supply +15 VDC to an external alarm source through pin 9 and 10. The maximum allowed load is 50mA.

The repeater contains a relay (pin 11 and 12) that can be connected to an external device to indicate an alarm. The relay can be configured to trigger on any number of internal and external alarms. The maximum current that can be supplied is 50mA.

For configuration of external alarms see section 4.4.4 Alarm Configuration.

4.2.10 Close Repeater

Close repeater

Close lid and lock repeater, or continue with the next section: Start-up the Repeater

4.3 Start-up the Repeater

Caution!

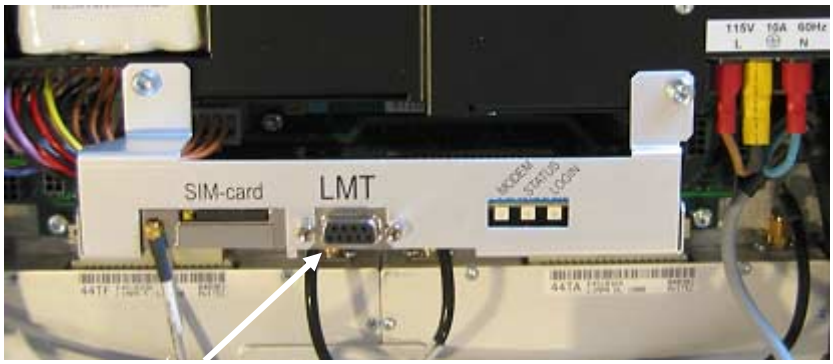
Make sure the antenna cables or 50 ohm terminations are connected to the repeater's antenna connectors before the repeater is turned on.

Install the RMC

Install the RMC software on a computer from a CD or a diskette.

Connect to the LMT port

Open the repeater and connect the computer to the LMT port via a DB9 male connector with serial RS232 interface.



LMT port

The communication parameters are set automatically by the RMC.

Switch the repeater on

Switch the repeater on by using the power switches on the power supply.

Note! See caution above!

Power switches

There are two switches. One is for the battery and one is for the mains.

Note! Always switch on both switches when the repeater should be switched on.

Note!

The power switch has two positions; "on" and "stand by". In the stand by position the repeater is still connected to the mains power but not operational.

Note!

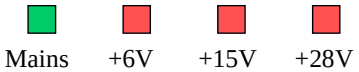
On 4-channel models both mains power supplies need to be switched on.

Check power supply LEDs

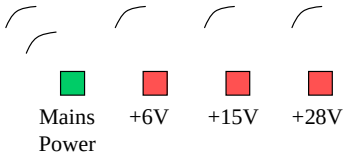
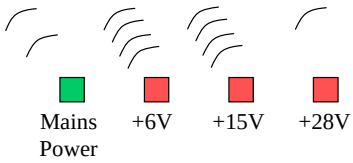
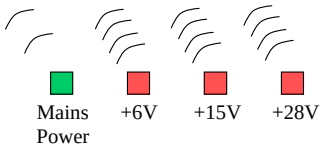
Power Supply LED

Check the LEDs on the Power unit and Control Module to ensure that normal operation conditions have been attained.

The power supply has 4 LEDs to indicate the status.



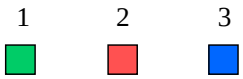
LED 1: Mains Power, green	
Slow flash	Power supply unit operating on AC or DC
OFF	Power supply unit not operating
LED 2: +6V, red	
Slow flash (every 10 seconds)	+6V power supply operating
Quick flash	+6V power supply not operating or operating with malfunction
LED 3: +15V, red	
Slow flash (every 10 seconds)	+15V power supply operating
Quick flash	+15V power supply not operating or operating with malfunction
LED 4: +28V, red	
Slow flash (every 10 seconds)	+28V power supply operating
Quick flash	+28V power supply not operating or operating with malfunction

Examples	
	LED 1 is flashing slowly, LED 2 – 4 are flashing slowly (once every 10 seconds) => power supply unit is operating without problem
	LED 1 is flashing slowly, one or two of the red LEDs are flashing quickly => Mains power is operating but there is a problem with some of the other voltages
	LED 1 is flashing slowly, all of the red LEDs are flashing quickly => Mains power is out and unit is operating on backup battery

Check Control Module LEDs

Control Module LED

The Control Module has 3 LEDs to indicate the status.



LED 1: green	
OFF	GSM Module switched OFF
Permanent ON	GSM Module Switched on, not registered on network
Slow Flash	GSM Module switched on, registered on network (approximately 1 flash per second)
Quick flash	Module switched on, registered on network, call active (approximately 3 flashes per second)
LED 2: red	
OFF	Control Module switched OFF
Slow Flash	Control Module switched on, status OK (once every 10 seconds)
Quick flash	Control Module switched on, one or more errors / alarms detected (except door status)
LED 3: blue	
OFF	Control Module switched OFF, or no one logged in
Slow Flash	Control Module switched on, nobody logged in locally OK (once every 10 seconds)
Quick flash	Control Module switched on, someone logged in remotely or locally

Check optic module LEDs.

Opto Module LED

On the optic module there are 4 green LEDs.

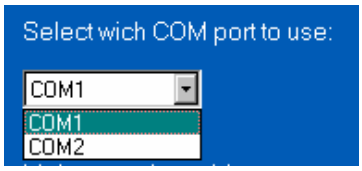
TEMP	Local temperature in opto module	green light = OK
POWER	Power to unit	green light = power on
OPTO TX	Transmitted signal on fiber	green light = OK
OPTO RX	Received signal on fiber	green light = OK

Start the RMC

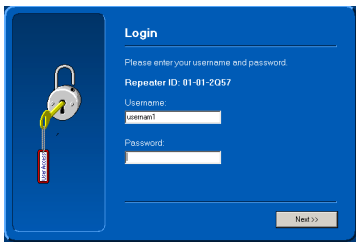
The RMC can be started from the Start menu (or by clicking on the RMC icon, if made available).

Select “Cable” connection

Select communication port



Enter user name and password



These are the default settings:

User Name	Password	Authority
USERNAM1	PASSWRD1	read/write
USERNAM2	PASSWRD2	read/write
USERNAM3	PASSWRD3	read only
USERNAM4	PASSWRD4	read only

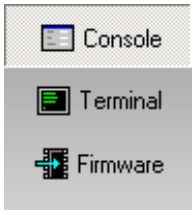
The system does not differentiate between upper and lower case letters.

Note! Do not use the number pad when entering numbers.

Note! Failed login attempts are logged. Default maximum number is 8. It is decremented by one every hour, which means that it takes one hour after the last failed attempt before a new try can be made.

4.3.1 Choose Work View

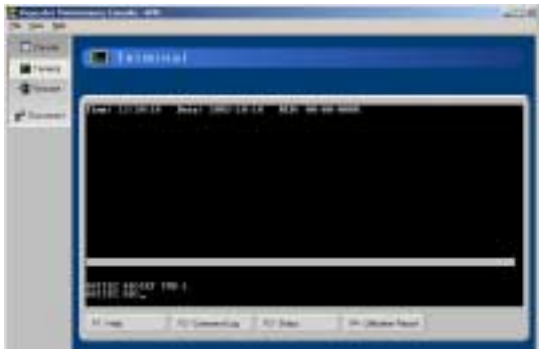
Choose “Console” mode, “Terminal” mode or “Firmware” mode



Console mode

The console mode displays a large number of repeater parameters and contains a number of console pages. It adjusts its user interface to adapt to the features of the connected repeater.

Terminal mode



The terminal mode is used for communication with the repeater using its native command line interface. This interface follows the VT100 standard. For some special actions and error tracing, this mode gives an enhanced availability of the repeater.

Firmware mode

The firmware mode is used for monitoring the currently installed software and for uploading new software to the repeater.

4.4 Configure the Repeater

The following pages will guide you through the configuration of Channel Selective repeaters as well as Frequency Translating repeaters utilizing the Repeater Maintenance Console (RMC) software.

Configuration of a repeater is made partially on site and partially remotely through the AEM. At site the RF parameters are set and verified, the repeater is given a name (a tag) and the remote communication is set and verified. All other configuration can, and should be made from the AEM.

4.4.1 Set up RF Configuration

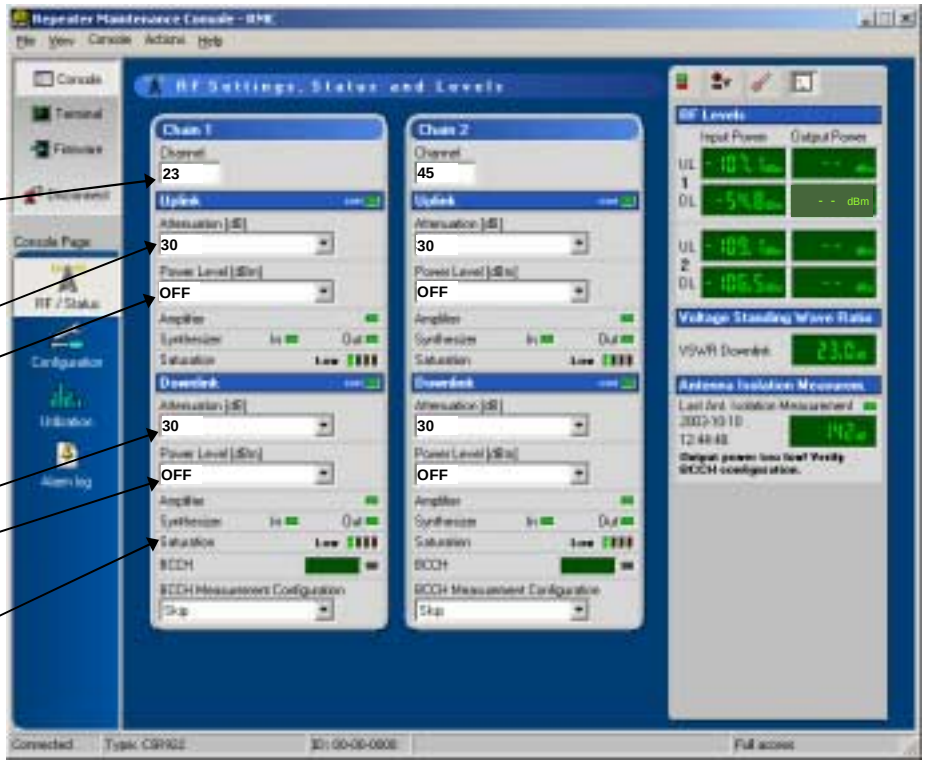
4.4.1.1 Channel Selective Repeaters

Ensure online communication with the repeater

Select “Console” mode

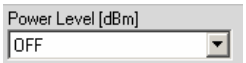
Select “RF/Status” window

This image will appear



Set all power levels to “OFF”

Set “Power Level” in uplink and downlink to “OFF” in all chains

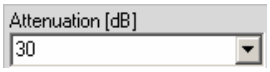


In the “Power Level” menu the output power can be limited to a specific value or the output power can be switched off completely by choosing “OFF”.

Set all attenuation levels to a maximum

Set “Attenuation” to the maximum value in both chains uplink and downlink (In a 4 channel repeater there are 4 chains).

Choose the maximum attenuation value from the drop down menu, in this case 30dB.



Set channel numbers

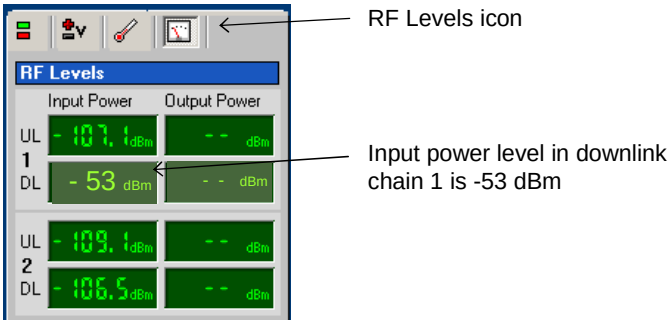
Set the channel numbers for all chains that are to be used in the installation.

In this example the channel in Chain 1 is set to 23 and the channel in Chain 2 is set to 45.

Note! Chain 1 must always contain the BCCH.

Monitor the input power

Click on the RF Levels icon to monitor the RF levels.

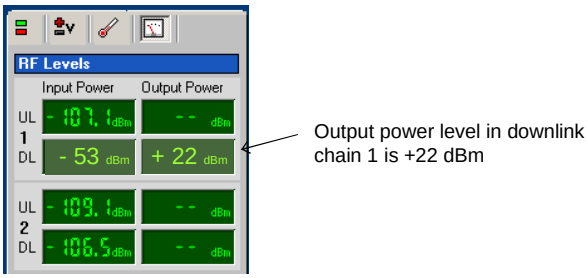


Input power in the downlink of Chain 1 is dependant on the signal from the serving Base Station, in this example it is -53 dBm

Configure the downlink of Chain1

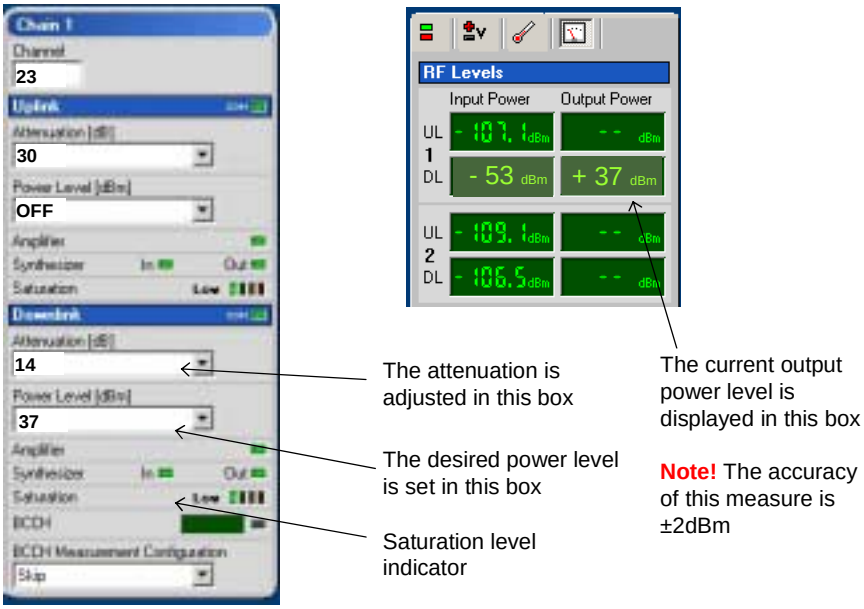
Set “Power Level” in Chain 1 downlink to the desired value, in this example +37 dBm. This value can be based on a link budget, or be the maximum output the repeater can generate.

View the power meter in the top right corner of the screen. In this example the output power is +22 dBm.



Adjust attenuation in the downlink

Lower the attenuation level step by step until the desired output power level is reached. In this example +37 dBm. Zero attenuation is the same as maximum gain.



Also use the saturation level indicator. The saturation level is indicated with plain text as well as with LEDs. The saturation level can be: Low (green), Ok (green), High (yellow) or Critical (red).

The optimal level is Ok, on the verge of High. To reach this value lower the attenuation step by step until the saturation reaches High. Then raise the attenuation one step. The saturation should now be back on Ok.

Note! Since the repeater has an ALC function (Automatic Level Control), the repeater will not transmit more power even if the attenuation is lowered even more.

Configure the downlink of Chain 2

Apply the same Power Level and Attenuation in downlink Chain 2 as in downlink Chain 1.

The presence of the BCCH in Chain 1 will ensure stable power levels whereas downlink and uplink power levels in Chain 2 will be dependant on the amount of traffic. This will make Chain 2 appear unstable.

In a 4-channel repeater also configure the downlink of Chain 3 and Chain 4.

Note! All channels that are not to be used should always be switched off (set Power Level to “OFF”.)

Configure the uplink of Chain 1 and 2

Set the Power Level for the uplink in Chain 1 and Chain 2 to the same value as for the downlink, in this example +37dBm, or any other level decided in the link budget.

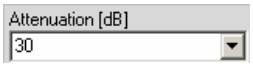
Set the Attenuation 2dB higher than in the downlink. In this example 16dB (14dB + 2dB)

In a 4-channel repeater also set the uplink for Chain 3 and Chain 4

Since the BTS is more sensitive than a mobile unit there may be less signal gain from the mobile unit in to the BTS (UL) than in the opposite direction. The uplink attenuation can be adjusted more accurately later on, once the drive test signal measurements have been completed.

Make an antenna isolation test	See 4.1.3 Antenna Isolation

4.4.1.2 Frequency Translating Repeaters

Start with the donor unit	The Single Donor (SD) and Double Donor (DD) units are configured in the same way.
Ensure online communication with the repeater	 Select “Console” mode  Select “RF/Status” window
This image will appear **Chain 1** Channel number Link channel **Uplink** Attenuation Power Level **Downlink** Attenuation Power Level Saturation Status	
Set all power levels to “OFF”	Set “Power Level” in uplink and downlink to “OFF” in all chains  In the “Power Level” menu the output power can be limited to a specific value or the output power can be switched off completely by choosing “OFF”.
Set all attenuation levels to a maximum	Set “Attenuation” to the maximum value in both chains uplink and downlink. Choose the maximum attenuation value from the drop down menu, in this case 30dB. 
Set channel numbers	Set the channel numbers for all chains that are to be used in the installation. In this example the channel in Chain 1 is set to 23 and the channel in Chain 2 is set

to 45.

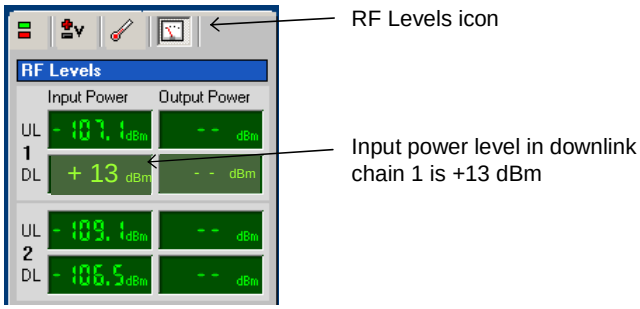
Note! Chain 1 must always contain the BCCH.

Set Link channel numbers

Set the Link channels to the desired values. In this example channel 12 in Chain 1 and channel 39 in Chain 2.

View the input power

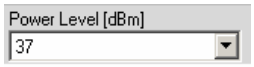
Click on the RF Levels icon to monitor the RF levels.



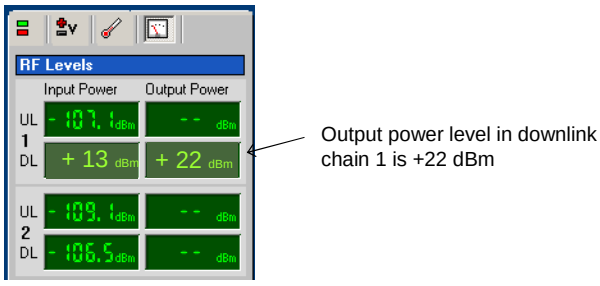
The input power in the downlink of Chain 1 is in this example approximately +13dBm (output power of the BTS -30dB from the coupler)

Configure the downlink of Chain1

Set “Power Level” in Chain 1 downlink (the link) to the desired value, in this example +37 dBm. This value can be based on a link budget and depends for instance on the distance to the remote unit.

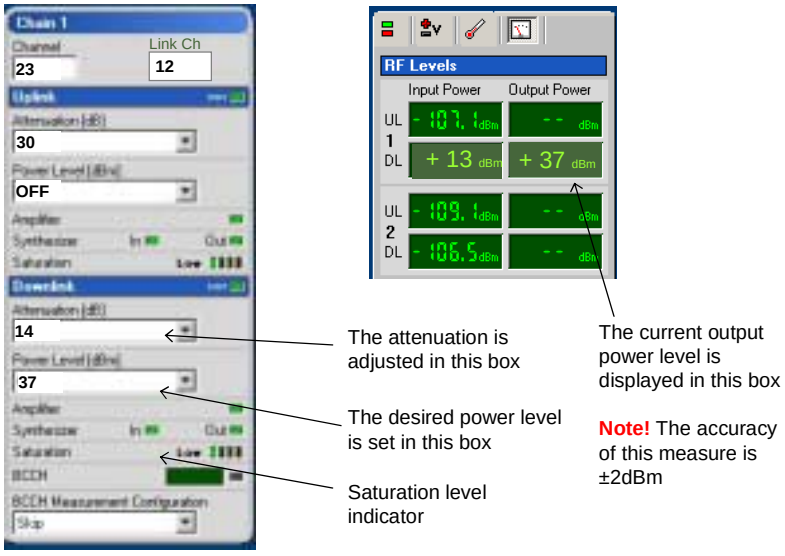


View the power meter in the top right corner of the screen. In this example the output power is +22 dBm.



Adjust attenuation in the downlink

Lower the attenuation level step by step until the desired output power is reached. In this example +37 dBm. Zero attenuation is the same as maximum gain



Also use the saturation level indicator. The saturation level is indicated with plain text as well as with LEDs. The saturation level can be: Low (green), Ok (green), High (yellow) or Critical (red).

The optimal level is Ok, on the verge of High. To reach this value lower the attenuation step by step until the saturation reaches High. Then raise the attenuation one step. The saturation should now be back on Ok.

Note! Since the repeater has an ALC function (Automatic Level Control), the repeater will not transmit more power even if you continue to lower the attenuation.

Configure the downlink of Chain2

Apply the same Power Level and Attenuation in downlink Chain 2 as in downlink Chain 1.

The presence of the BCCH in Chain 1 will ensure stable power levels whereas downlink and uplink power levels in Chain 2 will be dependant on the amount of traffic. This will make Chain 2 appear unstable.

Note! All channels that are not to be used should always be switched off. (Set Power Level to “OFF”.)

Configure the uplink in Chain 1 and 2

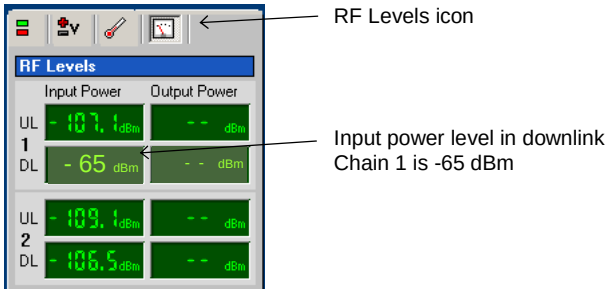
Set the Power Level for the uplink to -10/-13/-15 dBm depending on the site design, for instance the number of sectors in the BTS and the level of noise allowed.

Set the Attenuation 2dB higher than in the downlink. In this example the attenuation in the uplink is set to 16dB (14dB + 2dB= 16dB)

Since the BTS is more sensitive than a mobile unit there may be less signal gain from the mobile unit in to the BTS (UL) than in the opposite direction. The uplink attenuation can be adjusted more accurately later on once the drive test signal measurements have been completed.

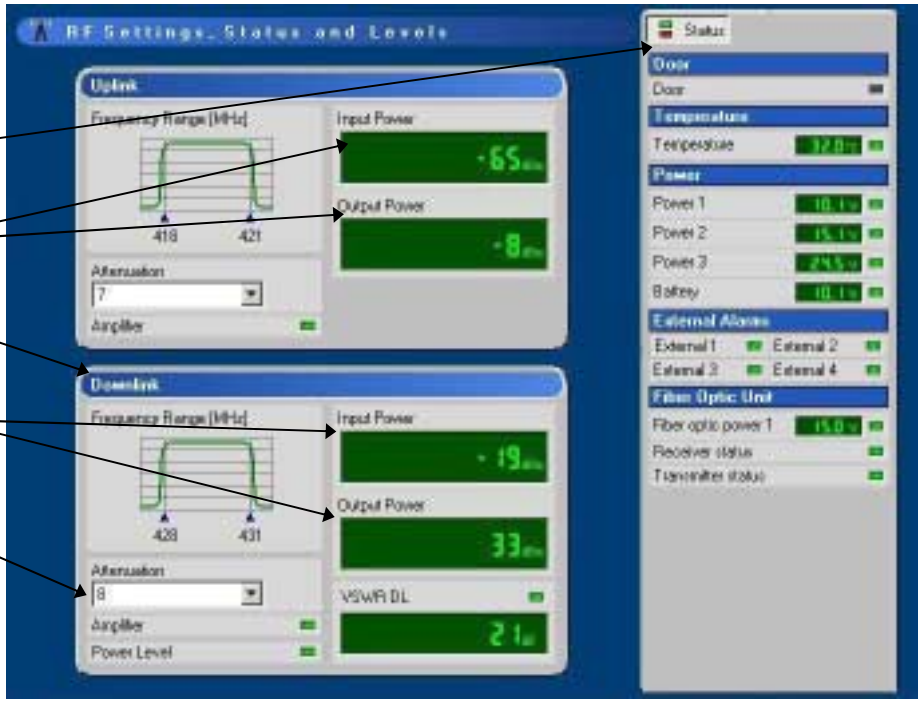
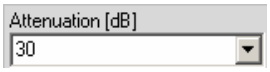
Continue with the remote unit

The configuration of the Remote Unit is almost identical to the configuration of the Donor Unit apart from the gain and output power settings.

Set all power levels to “OFF”	See instruction for donor unit above
Set all Attenuation levels to a maximum	See instruction for donor unit above
Set channel numbers	Set the same channel numbers as for the donor unit.
Set link channel numbers	Set the same link channel numbers as for the donor unit.
View the input power in the downlink	Click on the RF Levels icon to monitor the RF levels.  The input power in the downlink of Chain 1 is in this example approximately -65dBm. **Note!** The input signal level will vary between different repeater installations depending on the distance between the Donor Unit and the Remote Unit and other parameters affecting the signal’s propagation.
Configure the downlink of Chain1	Set “Power Level” in Chain 1 downlink to the desired value, in this example +43 dBm. This value can be based on a link budget, or be the maximum output the repeater can generate. 
Adjust attenuation in the downlink	Lower the attenuation level step by step until the desired output power is reached. In this example +43 dBm. See instruction for donor unit above
Configure the downlink of Chain2	Apply the same Power Level and Attenuation in downlink Chain 2 as in downlink Chain 1. The presence of the BCCH in Chain 1 will ensure stable power levels whereas downlink and uplink power levels in Chain 2 will be dependant on the amount of traffic. This will make Chain 2 appear unstable. **Note!** All channels that are not to be used should always be switched off. (Set Power Level to “off”.)
Configure the uplink in Chain 1 and Chain 2	Set the Power Level in the uplink of both Chain 1 and 2 (the link) to +37 dBm (the same as for downlink in the donor unit). Set the Attenuation 2dB higher than in the downlink.

4.4.1.3 Fiber Fed Repeaters

Configuration of the repeater amplification can be made locally. If the repeater is connected to a Hub the configuration can also be made via this Hub. See Hub User's Manual.

Ensure online communication with the repeater	 Select "Console" mode  Select "RF/Status" window
This image will appear Status and alarms Uplink input and output power Uplink attenuation Downlink input and output power Downlink attenuation	
Check that the fibre is OK	Make sure there are no alarms relating to the fibre.
Set attenuation level in uplink and downlink to a maximum	Choose the maximum attenuation value from the drop down menu, in this case 30dB. 
Configure the downlink	

Lower the attenuation level step by step until the desired output power level is reached. In this example +33 dBm. Zero attenuation is the same as maximum gain.

The input signal contains the MCCH and will have a stable value.

Configure the uplink

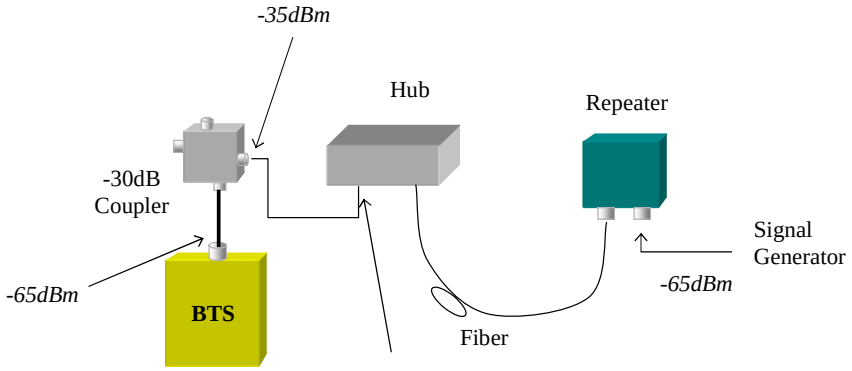
In the uplink direction the attenuation needs to be set based on a measurement of a known signal which is transmitted through the repeater and the Hub as well as the fibre. There are two ways of performing this measurement.

Alternative 1

Use a signal generator to insert a signal of approximately -65dBm to -75dBm into the repeater's server antenna port. Measure the signal level on the BTS or on the coupler and adjust the attenuation so that the total gain in the uplink is close to 0dB. (At 0dB gain the signal level at the coupler should be -35dBm and on the BTS -65dBm in this example.)

Alternative 2

Use a signal generator to insert a signal of approximately -65dBm to -75dBm into the repeater's server antenna port. Log into the Hub and monitor the uplink via the RMC. This measurement is not as accurate as alternative 1.



Alternative 2: Use the RMC to measure the uplink at the Hub

Note! If there are problems to reach 0dB gain in the whole chain extra attenuators might need to be added to the system.

Note! If several repeaters are connected to the same Hub the total gain in each chain should be slightly lower than 0dB not to insert too much noise into the BTS.

4.4.2 Set Repeater Name (TAG)

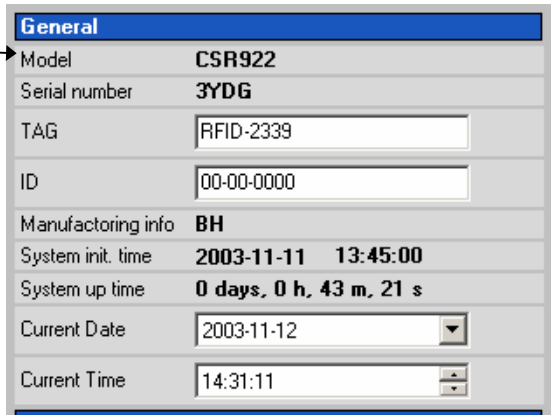
Give the repeater a unique name.

Select "Console" mode"

Select "Configuration" window

Select "Product" page

Insert the name in this box

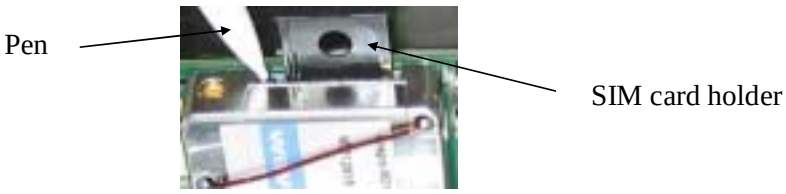


4.4.3 Set Up Remote Access

Insert the SIM card

Note! Make sure the SIM card has a Data Call/SMS number and is activated.

The modem is placed next to the LMT port close to the power supply



The SIM card holder is on top of the modem

Insert the SIM card by pressing the lever on the left side of the card holder on the modem (with a pen or another narrow item) so that the card holder pops up. Insert the SIM card and press the card holder back into place.

4.4.3.1 Data Call Configuration

Note! If the repeater should be controlled by the AEM this Data Call configuration needs to be made.

Set modem parameters

Select “Console” mode

Select “Configuration” window

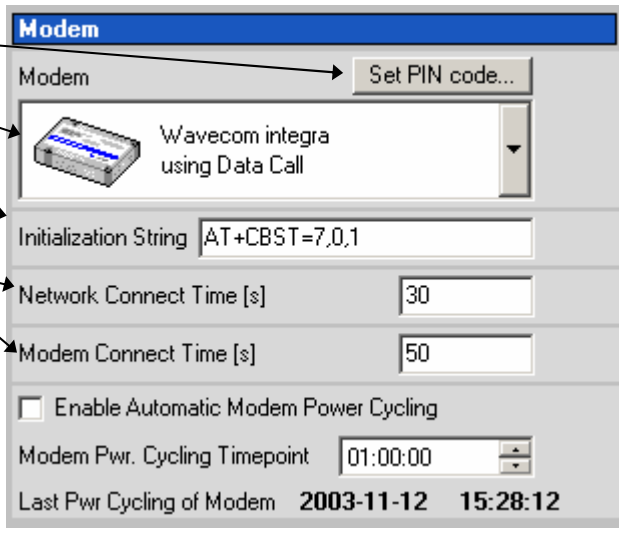
Select “Communication” page

Pin Code

Data Call

Initialization string

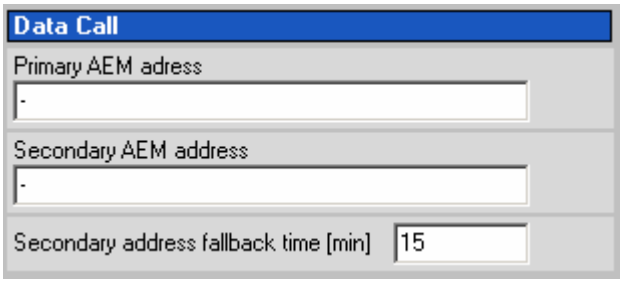
Connect times



1. Choose Data Call
2. Set pin code, if the SIM card has PIN code request enabled
3. Set the modem initialization string. This string differs between networks. Primary recommendation is AT+CBST=7,0,1. If remote communication cannot be established try 7,0,3 or 0,0,3 or 0,0,1.
4. Leave Network Connect Time and Modem Connect Time at default values.
5. Tick “Enable Automatic Modem Power Cycling” for the modem to be power cycled once every 24 hours. Set the time at which the modem should be tested. This function ensures that the repeater always is logged in to the network.

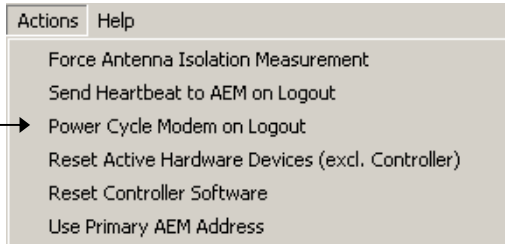
Data call address

Note! Not to be set at local installation

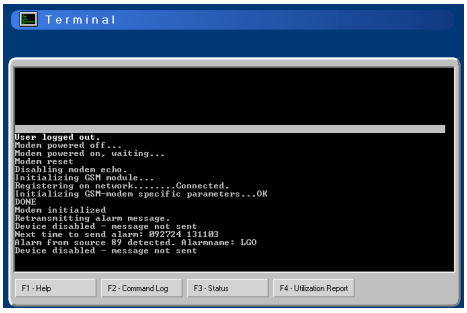
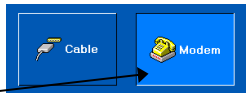
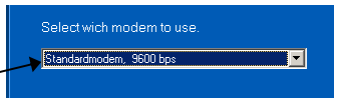
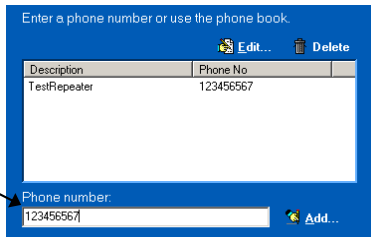


Note! Do not set addresses for the Data Call. The AEM will call the repeater after the installation is ready and initiate this communication.

Power Cycle Modem



Select Actions and initiate a Power Cycle Modem Logout from the drop-down menu.

Log out	 Select “terminal” mode. Type <LOGOUT> **Note!** Do not choose “Disconnect”.
Wait	Wait until verification is ready 
Log in remotely	Log in via the modem.
Select “Modem” connection	
Select communication port	
Save the repeater’s phone number in the RMC phone book	
Test	Test that the remote access is functioning correctly

4.4.3.2 SMS Configuration

Note! AEM can not be used if the repeater is configured for SMS communication.

Set modem parameters

Select “Console” mode

Select “Configuration” window

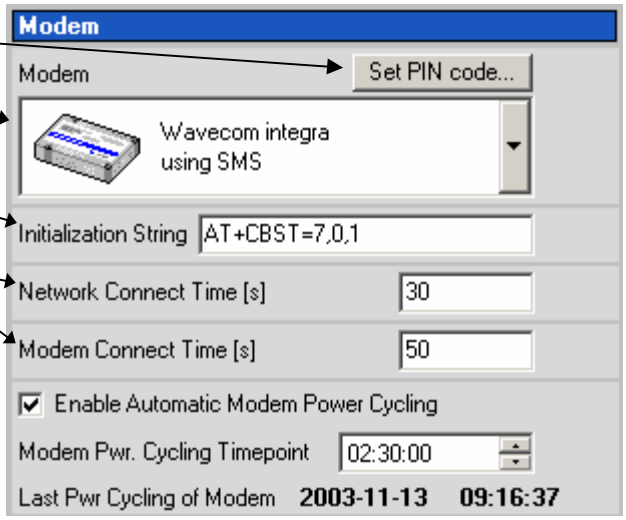
Select “Communication” page

Pin Code

SMS

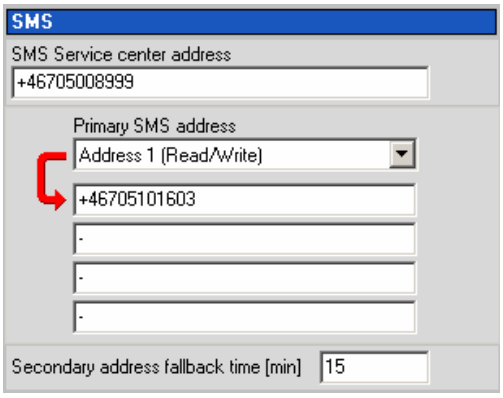
Initialization string

Connect times



1. Choose SMS
2. Set pin code, if the SIM card has PIN code request enabled
3. Set modem initialization string. This string differs between networks. Primary recommendation is AT+CBST=7,0,1. If remote communication cannot be established try 7,0,3 or 0,0,3 or 0,0,1.
4. Leave Network Connect Time and Modem Connect Time at default values.
5. Tick “Enable Automatic Modem Power Cycling” for the modem to be power cycled once every 24 hours. Set the time at which the modem should be tested. This function ensures that the repeater always is logged in to the network.

Set SMS addresses

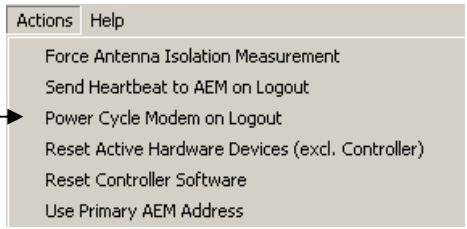


Set SMS service centre address (the SMSC number to be used).

Set Address 1. This is the address to which all SMS alarms and reports will be sent. **Note!** Always set this address.

Set Address 2, 3 and 4 if needed.

Power Cycle Modem



Select Actions and initiate a Power Cycle Modem Logout from the drop-down menu.

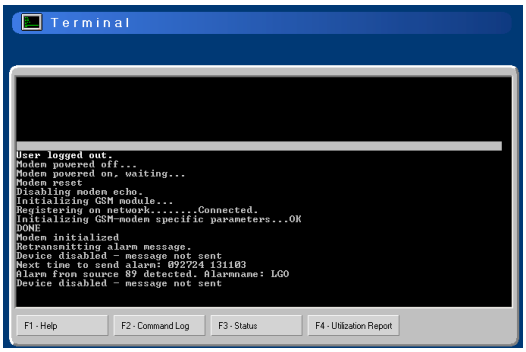
Log out

Select “terminal” mode Type <LOGOUT>

Note! Do not choose “Disconnect”.

Wait

Wait until verification is ready

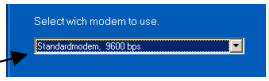


Log in remotely

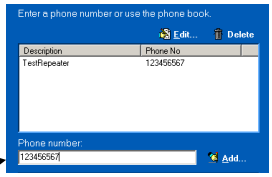
Log in via the modem

Select “Modem” connection

Select communication port



Save the repeater’s phone number in the RMC phone book



Test

Test that the remote access is functioning correctly

4.4.4 Alarm Configuration

Monitor alarm set up

Select “Console” mode

Select “Configuration” window

Select “Alarms” page

Relay connection enabled

Alarm enabled

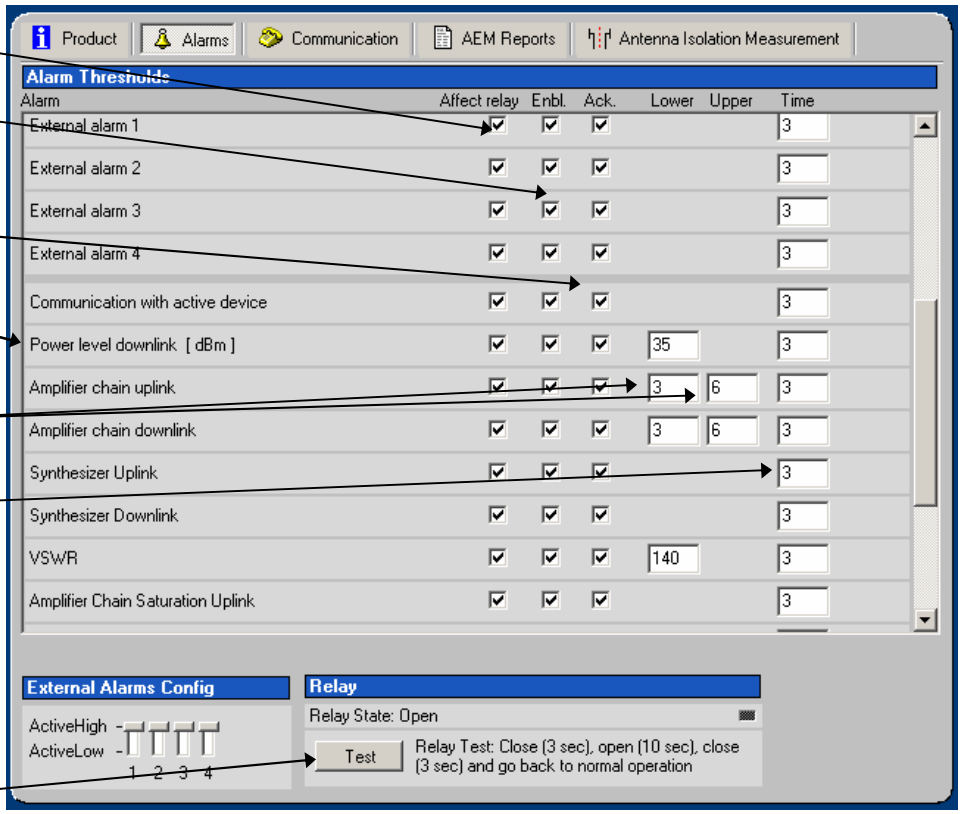
Acknowledgement is required

BCCH alarm

Trigger levels

Delay time

Relay test



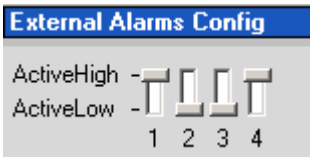
The alarm configuration is set up automatically and should be left unmodified, except for “Power level downlink”.

Note! Power level downlink (BCCH) should be adjusted to fit the installation in regards to the output power set. In this example a 3 second drop below 35dBm will cause an alarm.

Configure external alarms

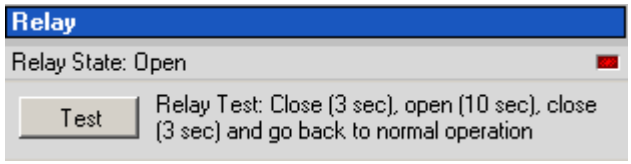
Four external alarms can be connected to the repeater. See section 4.2.9 Connect External Alarms.

Set active high or active low for each of these four alarms.



Test the relay

The built in relay can be tested by clicking on “Test”. The relay will then be closed for 3 seconds, open for 10 seconds and closed for 3 seconds.



4.4.5 Heartbeat Configuration

Monitor heartbeat set up

Select “Console” mode

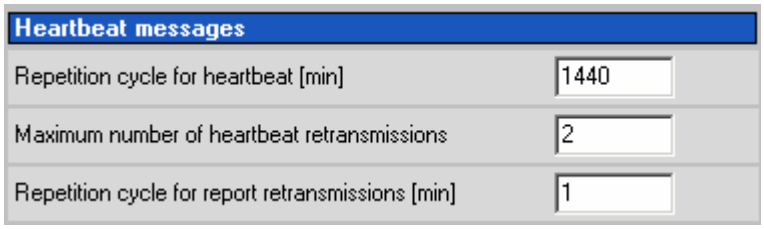
Select “Configuration” window

Select “AEM Reports” page

Repetition cycle

Retransmissions

Repetition cycle



4.4.6 AEM Report Configuration

Monitor set up

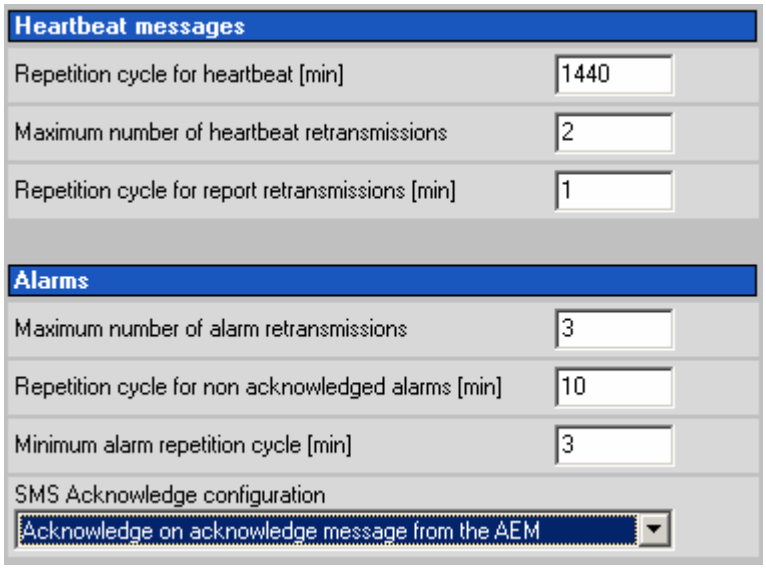
Select “Console” mode

Select “Configuration” window

Select “AEM Reports” page

Heartbeat

Alarm



4.5 Installation Checklists

4.5.1 Channel Selective Repeater Installation

Check box when done

1 Repeater Installation

1.1 Ensure isolation between server and donor antenna is adequate, repeater's gain plus 10– 25 dB (depending on situation)

1.2 Measured isolation ____

1.3 Proper grounding made and EMV protection installed

1.4 Cable from donor antenna connected to donor antenna port

1.5 Cable to server antenna connected to server antenna port

1.6 Mains cable connected to the repeater unit

1.7 Cable protection cover bolted to repeater unit, any outdoor connections waterproofed

2 Repeater Unit Setup

2.1 Repeater switched on

2.2 Power Supply led and Control Module led shows no error

2.3 Channels set to: 1 ___ 2 ___ 3___ 4___

2.4 BCCH in chain 1

2.5 Power level channel 1 downlink set to _____

2.6 Attenuation channel 1 downlink set to ___ (saturation level checked)

2.7 Power level channel 1 uplink set to same as downlink

2.8 Attenuation channel 1 uplink set to same as downlink

2.9 Power level and attenuation channel 2, 3 and 4 set to same levels as channel 1

2.10 Power Supply led and Control Module led shows no error

2.11 Output power downlink channel 1 ____ (reading from RMC)

2.12 Repeater TAG set to _____

2.13 Repeater secured and locked

Installation date:_____ Installer signature:_____

Site name: _____Site number: _____ GPS coordinates:_____

4.5.2 Preparation Sheet, Frequency Translating Repeater

General

Channels to be repeated____ and _____ => to donor checklist

Link channel (s) to be used ___ and ___ => to donor checklist

Donor Unit

BTS output power	+	__dBm
Feeder loss between BTS and coupler	-	___dB
Coupling loss in coupler	-	___dB
Feeder loss between coupler and donor unit	-	___dB
Downlink input power to donor unit (P_in)	=	__dBm
Desired link power (P_{link}): (+37/+34/+31dBm)		___dBm*
=> to donor checklist (Power level downlink)		
Required donor downlink gain (G) = $P_{link} – P_{in}$	=	___dB
Donor downlink attenuation = 42 – G (SD) / 45 - G (DD)	=	___dB
Attenuation setting to be used (closest larger even number)		___ dB
=> to donor checklist (Attenuation downlink)		
Desired uplink ALC level -10/-13/-16 (SD) / -7/-10/-13 (DD)		___dBm
=> to donor checklist (Power level uplink)		

Link path

Donor link antenna feeder loss	+	___dB
Donor link antenna gain	-	___dBi
Link path loss	+	___dB
Remote link antenna gain	-	___dBi
Remote link antenna feeder loss	+	___dB
Total link loss (L)	=	___dB

Remote Unit

Downlink input power from link antenna (P_{in}) = P_{link}-L		___dBm
Desired remote server power (P_{out}): 40/37/34 (IR) / 43/40/37 (ER)	___dBm	
=> to remote checklist (Power level downlink)		
Required remote downlink gain (G) = $P_{out} – P_{in}$	=	___dB
Remote unit downlink attenuation = 105–G (IR) / 108-G (ER)	=	___dB

Attenuation setting to be used (closest larger even number) ___dB

=> to remote checklist (Attenuation downlink)

Desired link power (+37/+34/+31) ___dBm*

=> to remote checklist (Power level uplink)

*Note! Link power should be the same for remote and donor

Date:_____ Calculated by:_____

Site Name: _____ Site Number: _____

4.5.3 Frequency Translating Repeater, Donor Unit

Check box when done

1. Coupler Installation

1.1 -30dB Coupler installed on BTS main antenna feeder

1.2 Type N connector closer to antenna terminated with 50 ohm plug

1.3 Type N connector closer to BTS connected to donor cable

1.4 BTS operating normally with coupler installed verified

1.5 Coupler weatherproofed

2. Donor Unit Installation

2.1 Proper grounding made and EMV protection installed

2.2 Cable from coupler connected to donor port

2.3 Cable to link antenna connected to link antenna port

2.4 Mains cable connected to the repeater unit

2.5 Cable protection cover bolted to donor unit, any outdoor connections waterproofed

3. Donor Unit Setup

3.1 Donor unit switched on

3.2 Power Supply led and Control Module led shows no error

3.3 Channels set to: 1 ___ 2 ___

3.4 Link channels set to: 1 ___ 2 ___

3.5 Power level link channel 1 downlink set to _____

3.6 Attenuation link channel 1 downlink set to ___ (according to budget)

3.7 Power level channel 1 uplink set to ___ (according to budget)

3.8 Attenuation channel 1 uplink set to same as link channel downlink

3.9 Power levels and attenuation link channel 2 and channel 2 set to same levels as link channel and channel 1

3.10 Power Supply led and Control Module led shows no error

3.11 Output power downlink channel 1 ____ (reading from RMC)

3.12 Repeater TAG set to _____

3.13 Repeater secured and locked

Installation date:_____ Installer signature:_____

Site name: _____Site number: _____ GPS coordinates:_____

4.5.4 Frequency Translating Repeater, Remote Unit

Check box when done

1. Remote Unit Installation

1.1 Ensure adequate isolation between link and serving antenna (>75dB)

1.2 Proper grounding made and EMV protection installed

1.3 Cable from link antenna connected to link antenna port

1.4 Cable to server antenna connected to server antenna port

1.5 Mains cable connected to the repeater unit

1.6 Cable protection cover bolted to donor unit, any outdoor connections waterproofed

2. Remote Unit Setup

2.1 Remote unit switched on

2.2 Power Supply led and Control Module led shows no error

2.3 Channels set to same as donor

2.4 Link channels set to same as donor

2.5 Power level channel 1 downlink set to ___ (according to budget)

2.6 Attenuation channel 1 downlink set to ___ (according to budget)

2.7 Power level link channel 1 uplink set to same as power level link channel 1 downlink in donor unit

2.8 Attenuation link channel 1 uplink set to same as attenuation channel 1 downlink

2.9 Power level and attenuation link channel 2 and channel 2 set to same levels as channel 1

2.10 Power Supply led and Control Module led shows no error

2.11 Output power downlink channel 1 ____ (reading from RMC)

2.12 Repeater TAG set to ___

2.13 Repeater secured and locked

Installation date:_____ Installer signature:_____

Site name: _____Site number: _____ GPS coordinates:_____

5 Maintenance

5.1 General

The system normally operates without any operator intervention or maintenance. In the unlikely event of a unit failure, the field replaceable components (antenna unit, cables, etc.) should be checked and replaced if faulty and the system restored. A failed unit can be removed and replaced with a spare while the rest of the system (other repeaters) is operating. However, the power supply of the failed repeater should be isolated from AC mains and DC power before any module is replaced.

Should the system malfunction, the condition of the antenna systems as well as the continuity of the cabling should be checked before replacing any of the repeater modules.

Caution
Please be aware that the equipment may, during certain conditions become very warm and can cause minor injuries if handled without any protection, such as gloves.

5.2 Preventive Maintenance

The Avitec repeaters do not require any preventative maintenance apart from changing the backup battery once every three years.

Caution
Risk of explosion if battery is replaced by an incorrect type.
Dispose of used batteries according to local laws and instructions.

6 Specifications

6.1 CSR 922

Electrical Specifications

Frequency range Uplink, UL	880 – 915 MHz (E-GSM900)
Frequency range Downlink, DL	925 – 960 MHz (E-GSM900)
Frequency range Uplink, UL	876 – 911 MHz (R-GSM900)
Frequency range Downlink, DL	921 – 956 MHz (R-GSM900)
Operational bandwidth	35 MHz
Number of channels	1 – 2
Channel programming	200 kHz channel spacing
Selectivity	> 60 dB at 400 kHz > 70 dB at 600 kHz
Ripple in pass band	< 2 dB
Sensitivity	< - 109 dBm at S/N 9 dB
Noise figure	2.5 dB typical, < 3 dB at max gain
Maximum input level, non destructive	+10 dBm
Propagation delay	5.5 µs typical
Output power per carrier (UL/DL)	+37 dBm GSM/ GMSK +34 dBm EDGE / 8-PSK average power
Modulation Accuracy	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at +37 dBm
EDGE / 8-PSK	< 3 % EVM RMS at + 34 dBm
Intermodulation	< - 36 dBm (two carriers at + 37 dBm, 600 kHz spacing)
Spurious responses	< - 36 dBm for 9 kHz – 1 GHz < - 30 dBm for 1 GHz – 13 GHz
Gain	60 – 90 dB, adjustable, in 1 dB steps
System impedance	50 ohm
Return loss at antenna connections	> 16 dB
Antenna connectors	DIN 7/16
Electrical ratings	110/230 VAC, 50/60 Hz or -48 VDC
Power Consumption	100 W typical / 200 W maximum (traffic dependent)

Mechanical Specifications

Dimensions	470 x 340 x 145 mm
Enclosure	Aluminum (IP 65)
Weight	16 kg

Environmental Specifications

EMC	See compliance below
Operating Temperature	- 25 to + 55 ° C
Storage	- 30 to + 70 ° C
Humidity	ETSI EN 300 019-2-4 (see compliance below)
MTBF	> 100 000 hrs
Complies with	R&TTE Directive including ETS EN 301 502 (ETS EN 300 609-4/GSM 11.26) ETS EN 301 498-8 EN 60 950

6.2 CSR 924

Electrical Specifications

Frequency range Uplink, UL	880 – 915 MHz (E-GSM900)
Frequency range Downlink, DL	925 – 960 MHz (E-GSM900)
Frequency range Uplink, UL	876 – 911 MHz (R-GSM900)
Frequency range Downlink, DL	921 – 956 MHz (R-GSM900)
Operational bandwidth	35 MHz
Number of channels	1 – 4
Channel programming	200 kHz channel spacing
Selectivity	> 60 dB at 400 kHz > 70 dB at 600 kHz
Ripple in pass band	< 2 dB
Sensitivity	< - 108 dBm at S/N 9 dB
Noise figure	3 dB typical, < 3.5 dB at max gain
Maximum input level, non destructive	+10 dBm
Propagation delay	5.5 µs typical
Output power per carrier (UL/DL)	+34 dBm GSM/ GMSK +31 dBm EDGE / 8-PSK average power
Modulation Accuracy	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at +34 dBm
EDGE / 8-PSK	< 3 % EVM RMS at +31 dBm
Intermodulation	< - 36 dBm (two carriers at + 34 dBm, 600 kHz spacing)
Spurious responses	< - 36 dBm for 9 kHz – 1 GHz < - 30 dBm for 1 GHz – 13 GHz
Gain	54 – 84 dB, adjustable, in 1 dB steps
System impedance	50 ohm
Return loss at antenna connections	> 16 dB
Antenna connectors	DIN 7/16
Electrical ratings	110/230 VAC, 50/60 Hz or -48 VDC
Power Consumption	180 W typical / 400 W maximum (traffic dependent)

Mechanical Specifications

Dimensions	470 x 340 x 220 mm
Enclosure	Aluminum (IP 65)
Weight	30 kg

Environmental Specifications

EMC	See compliance below
Operating Temperature	- 25 to + 55 °C
Storage	- 30 to + 70 °C
Humidity	ETSI EN 300 019-2-4 (see compliance below)
MTBF	> 100 000 hrs
Complies with	R&TTE Directive including ETS EN 301 502 (ETS EN 300 609-4/GSM 11.26) ETS EN 301 498-8 EN 60 950

6.3 CSR 924 H

Electrical Specifications

Frequency Ranges	
Frequency range Uplink, UL	880 – 915 MHz (E-GSM900)
Frequency range Downlink, DL	925 – 960 MHz (E-GSM900)
Frequency range Uplink, UL	876 – 911 MHz (R-GSM900)
Frequency range Downlink, DL	921 – 956 MHz (R-GSM900)
Operational bandwidth	35 MHz
Number of channels	1 – 4
Channel programming	200 kHz channel spacing
Selectivity	> 60 dB at 400 kHz > 70 dB at 600 kHz
Ripple in passband	< 2 dB
Sensitivity	< - 108 dBm at S/N 9 dB
Noise figure	3 dB typical, < 3,5 dB at max gain
Maximum input level, non destructive	+ 10 dBm
Propagation delay	5,5 µs typical
Output power per carrier, DL	+ 37 dBm GSM/ GMSK, + 34 dBm EDGE / 8-PSK average power
Output power per carrier, UL	+ 34 dBm GSM/ GMSK + 31 dBm EDGE / 8-PSK average power
Modulation Accuracy	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at + 37 dBm
EDGE / 8-PSK	< 3 % EVM RMS at + 34 dBm
Intermodulation	< - 36 dBm (two carriers at + 37 dBm, 600 kHz spacing)
Spurious responses	< - 36 dBm for 9 kHz – 1 GHz < - 30 dBm for 1 GHz – 13 GHz
Gain DL/UL	63 – 93 dB, adjustable, in 1 dB steps
System impedance	50 Ω
Return loss at antenna connections	> 16 dB
Antenna connectors	DIN 7/16
Electrical ratings	110/230 VAC, 50/60 Hz or -48 VDC
Power Consumption	180 W typical / 400 W maximum

Mechanical Specifications

Dimensions	470 x 340 x 220 mm
Enclosure	Aluminium (IP 65)
Weight	30 kg

Environmental Specifications

EMC	See compliance below
Operating Temperature	- 25 to + 55 ° C
Storage	- 30 to + 70 ° C
Humidity	ETSI EN 300 019-2-4 (see compliance below)
MTBF	> 100000 hrs
Complies with	R&TTE Directive including ETS EN 301 502 (ETS EN 300 609-4 / GSM 11.26) ETS EN 301 498-8 EN 60 950

6.4 CSR1822

Electrical Specifications

Frequency range Uplink, UL	1710 - 1785 MHz (DCS-1800)
Frequency range Downlink, DL	1805 - 1885 MHz (DCS-1800)
Operational bandwidth	75 MHz
Number of channels	1 - 2
Channel programming	200 kHz Channel spacing
Selectivity	> 60 dB at 400 kHz >70 dB at 600 kHz
Ripple in passband	< 2 dB
Sensitivity	< - 109 dBm at S/N 9 dB
Noise figure	2.5 dB typical, < 3 dB at max gain
Maximum input level, non destructive	+ 10 dBm
Propagation delay	5,5 µs typical
Output power per carrier (UL/DL)	+ 37dBm GSM/ GMSK + 34 dBm EDGE / 8-PSK average power
Modulation Accuracy	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at +37 dBm
EDGE / 8-PSK	< 3 % EVM RMS at + 34 dBm
Intermodulation	< - 36 dBm (two carriers at + 37 dBm, 600 kHz spacing)
Spurious responses	< - 36 dBm for 9 kHz - 1 GHz < - 30 dBm for 1 GHz - 13 GHz
Gain	60 - 90 dB, adjustable, in 1 dB steps
System impedance	50 ohm
Return loss at antenna connections	> 16 dB
Antenna connectors	DIN 7/16
Electrical ratings	110/230 VAC, 50/60 Hz or -48 VDC
Power Consumption	100 W typical / 200 W maximum (traffic dependent)

Mechanical Specifications

Dimensions	470 x 340 x 145 mm
Enclosure	Aluminum (IP 65)
Weight	16 kg

Environmental Specifications

EMC	See compliance below
Operating Temperature	- 25 to + 55 ° C
Storage	- 30 to + 70 ° C
Humidity	ETSI EN 300 019-2-4 (see compliance below)
MTBF	> 100 000 hrs
Complies with	R& TTE Directive including ETS EN 301 502 (ETS EN 300 609-4 / GSM 11.26) ETS EN 301 498-8 EN 60 950

6.5 CSR1824

Electrical Specifications

Frequency range Uplink, UL	1710 - 1785 MHz (DCS-1800)
Frequency range Downlink, DL	1805 - 1885 MHz (DCS-1800)
Operational bandwidth	75 MHz
Number of channels	1 - 4
Channel programming	200 kHz channel spacing
Selectivity	> 60 dB at 400 kHz >70 dB at 600 kHz
Ripple in passband	< 2 dB
Sensitivity	< - 108 dBm at S/N 9 dB 3 dB typical, < 3,5 dB at max gain
Maximum input level, non destructive	+ 10 dBm
Propagation delay	5,5 µs typical
Output power per carrier (UL/DL)	+ 34 dBm GSM/ GMSK + 31 dBm EDGE / 8-PSK average power
Modulation Accuracy	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at +37 dBm
EDGE / 8-PSK	< 3 % EVM RMS at + 34 dBm
Intermodulation	< - 36 dBm (two carriers at + 34 dBm, 600 kHz spacing)
Spurious responses	< - 36 dBm for 9 kHz - 1 GHz < - 30 dBm for 1 GHz - 13 GHz
Gain	54 - 84 dB, adjustable, in 1 dB steps.
System impedance	50 ohm
Return loss at antenna connections	> 16 dB
Antenna connectors	DIN 7/16
Electrical ratings	110/230 VAC, 50/60 Hz or -48 VDC
Power Consumption	180 W typical / 400 W maximum (traffic dependent)

Mechanical Specifications

Dimensions	470 x 340 x 220 mm
Enclosure	Aluminum (IP 65)
Weight	30 kg

Environmental Specifications

EMC	See compliance below
Operating Temperature	- 25 to + 55 ° C
Storage	- 30 to + 70 ° C
Humidity	ETSI EN 300 019-2-4 (see compliance below)
MTBF	> 100 000 hrs
Complies with	R& TTE Directive including ETS EN 301 502 (ETS EN 300 609-4 / GSM 11.26) ETS EN 301 498-8 EN 60 950

6.6 CSR1922

Electrical Specifications

Frequency range Uplink, UL	1850 - 1910 MHz (PCS-1900)
Frequency range Downlink, DL	1930 - 1990 MHz (PCS-1900)
Operational bandwidth	60 MHz
Number of channels	1 - 2
Channel programming	200 kHz Channel spacing
Selectivity	> 60 dB at 400 kHz >70 dB at 600 kHz
Ripple in passband	< 2 dB
Sensitivity	< - 109 dBm at S/N 9 dB
Noise figure	2.5 dB typical, < 3 dB at max gain
Maximum input level, non destructive	+ 10 dBm
Propagation delay	5,5 µs typical
Output power per carrier (UL/DL)	+ 37dBm GSM/ GMSK + 34 dBm EDGE / 8-PSK average power
Modulation Accuracy	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at +37 dBm
EDGE / 8-PSK	< 3 % EVM RMS at + 34 dBm
Intermodulation	< - 36 dBm (two carriers at + 37 dBm, 600 kHz spacing)
Spurious responses	< - 36 dBm for 9 kHz - 1 GHz < - 30 dBm for 1 GHz - 13 GHz
Gain	60 - 90 dB, adjustable, in 1 dB steps
System impedance	50 ohm
Return loss at antenna connections	> 16 dB
Antenna connectors	DIN 7/16
Electrical ratings	110/230 VAC, 50/60 Hz or -48 VDC
Power Consumption	100 W typical / 200 W maximum (traffic dependent)

Mechanical Specifications

Dimensions	470 x 340 x 145 mm
Enclosure	Aluminum (IP 65)
Weight	16 kg

Environmental Specifications

EMC	See compliance below
Operating Temperature	- 25 to + 55 ° C
Storage	- 30 to + 70 ° C
Humidity	ETSI EN 300 019-2-4 (see compliance below)
MTBF	> 100 000 hrs
Complies with	R& TTE Directive including ETS EN 301 502 (ETS EN 300 609-4 / GSM 11.26) ETS EN 301 498-8 EN 60 950

6.7 CSR1924

Electrical Specifications

Frequency range Uplink, UL	1850 - 1910 MHz (PCS-1900)
Frequency range Downlink, DL	1930 - 1990 MHz (PCS-1900)
Operational bandwidth	60 MHz
Number of channels	1 - 4
Channel programming	200 kHz channel spacing
Selectivity	> 60 dB at 400 kHz >70 dB at 600 kHz
Ripple in passband	< 2 dB
Sensitivity	< - 108 dBm at S/N 9 dB 3 dB typical, < 3,5 dB at max gain
Maximum input level, non destructive	+ 10 dBm
Propagation delay	5,5 µs typical
Output power per carrier (UL/DL)	+ 34 dBm GSM/ GMSK + 31 dBm EDGE / 8-PSK average power
Modulation Accuracy	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at +37 dBm
EDGE / 8-PSK	< 3 % EVM RMS at + 34 dBm
Intermodulation	< - 36 dBm (two carriers at + 34 dBm, 600 kHz spacing)
Spurious responses	< - 36 dBm for 9 kHz - 1 GHz < - 30 dBm for 1 GHz - 13 GHz
Gain	54 - 84 dB, adjustable, in 1 dB steps
System impedance	50 ohm
Return loss at antenna connections	> 16 dB
Antenna connectors	DIN 7/16
Electrical ratings	110/230 VAC, 50/60 Hz or -48 VDC
Power Consumption	180 W typical / 400 W maximum (traffic dependent)

Mechanical Specifications

Dimensions	470 x 340 x 220 mm
Enclosure	Aluminum (IP 65)
Weight	30 kg

Environmental Specifications

EMC	See compliance below
Operating Temperature	- 25 to + 55 ° C
Storage	- 30 to + 70 ° C
Humidity	ETSI EN 300 019-2-4 (see compliance below)
MTBF	> 100 000 hrs
Complies with	R& TTE Directive including ETS EN 301 502 (ETS EN 300 609-4 / GSM 11.26) ETS EN 301 498-8 EN 60 950

6.8 CSFT 922

Electrical Specification

Frequency range Uplink, UL	880 – 915 MHz (E-GSM900)
Frequency range Downlink, DL	925 – 960 MHz (E-GSM900)
Frequency range Uplink, UL	876 – 911 MHz (R-GSM900)
Frequency range Downlink, DL	921 – 956 MHz (R-GSM900)
Operational bandwidth	35 MHz
Number of channels	1 – 2
Channel programming	200 kHz Channel spacing
Selectivity	> 60 dB at 400 kHz > 70 dB at 600 kHz
Ripple in passband	< 2 dB
Sensitivity	
Donor unit (SD) and (DD)	
UL	< - 109 dBm at S/N 9 dB
DL	N/A
Remote unit (IR) and (ER)	< - 109 dBm at S/N 9 dB
Noise figure	
Donor unit (SD) and (DD)	
UL	2.5 dB typical, < 3 dB at max gain
DL	N/A
Remote unit (IR) and (ER) UL/DL	2.5 dB typical, < 3 dB at max gain
Maximum input level, no damage	
Donor unit (SD) and (DD)	
UL	+ 23 dBm
DL	+ 10 dBm
Remote unit (IR) and (ER) UL/DL	+ 10 dBm
Propagation delay	5.5 µs typical

Output power per carrier

Donor unit (SD)	
DL	+ 37 dBm GSM/ GMSK + 34 dBm EDGE / 8-PSK average power
UL	- 10 dBm GSM/ GMSK - 13 dBm EDGE / 8-PSK average power
Donor unit (DD)	
DL	+ 37 dBm GSM/ GMSK + 34 dBm EDGE / 8-PSK average power
UL	- 7 dBm GSM/ GMSK - 10 dBm EDGE / 8-PSK average power
Remote unit (IR)	
DL	+ 40 dBm GSM/ GMSK + 37 dBm EDGE / 8-PSK average power
UL	+ 37 dBm GSM/ GMSK + 34 dBm EDGE / 8-PSK average power
Remote unit (ER)	
DL	+ 43 dBm GSM/ GMSK + 40 dBm EDGE / 8-PSK average power
UL	+ 37 dBm GSM/ GMSK + 34 dBm EDGE / 8-PSK average power

Gain

Donor unit (SD)	max 42 dB, adjustable, in 1 dB steps
Donor unit (DD)	max 45 dB, adjustable, in 1 dB steps
Remote unit (IR)	
DL/UL	75 - 105 dB, adjustable, in 1 dB steps
Remote unit (ER)	
DL/UL	78 - 108 dB, adjustable, in 1 dB steps
Gain Flatness (200 kHz BW)	± 1 dB
Gain Flatness (15 MHz BW)	± 1 dB
Input to Link Channel Frequency Error	< 1 x 10^{-9}

Modulation Accuracy

Donor unit (SD) and (DD)	
DL	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at +33 dBm
EDGE / 8-PSK	< 3 % EVM RMS at +30 dBm average power
UL	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at -10 dBm

EDGE / 8-PSK	< 3 % EVM RMS at -13 dBm average power
Remote unit (IR)	
DL	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at +40 dBm
EDGE / 8-PSK	< 4 % EVM RMS at +37 dBm average power
UL	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at +37 dBm
EDGE / 8-PSK	< 3 % EVM RMS at +34 dBm average power
Remote unit (ER)	
DL	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at +43 dBm
EDGE / 8-PSK	< 4 % EVM RMS at +40 dBm average power
UL	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at +37 dBm
EDGE / 8-PSK	< 3 % EVM RMS at +34 dBm average power

Intermodulation

Donor unit (SD) and (DD)	< -36 dBm (two carriers at + 33 dBm DL, 600 kHz spacing) < -70 dBm (two carriers at -10 dBm UL, 600 kHz spacing)
Remote unit (IR)	< -36 dBm (two carriers at + 40 dBm DL, 600 kHz spacing) < -36 dBm (two carriers at +37 dBm UL, 600 kHz spacing)
Remote unit (ER)	< -36 dBm (two carriers at + 43 dBm DL, 600 kHz spacing) < -36 dBm (two carriers at +37 dBm UL, 600 kHz spacing)
Spurious responses	< - 36 dBm for 9 kHz – 1 GHz < - 30 dBm for 1 GHz – 13 GHz
System impedance	50 ohm
Return loss at antenna connections	> 16 dB
Antenna connectors	DIN 7/16
Electrical ratings	110/230 VAC, 50/60 Hz or -48 VDC
Power Consumption	100 W typical / 200 W maximum (traffic dependent)

Mechanical Specifications

Dimensions	470 x 340 x 145 mm

Enclosure	Aluminum (IP 65)
Weight	16 kg

Environmental Specifications

EMC	See compliance below
Operating Temperature	- 25 to + 55 ° C
Storage	- 30 to + 70 ° C
Humidity	ETSI EN 300 019-2-4 (see compliance below)
MTBF	> 100 000 hrs
Complies with	R& TTE Directive including ETS EN 301 502 (ETS EN 300 609-4 / GSM 11.26) ETS EN 301 498-8 EN 60 950

6.9 CSFT 1822

Electrical Specifications

Frequency range Uplink, UL	1710 - 1785 MHz (DCS 1800)
Frequency range Downlink, DL	1805 - 1880 MHz (DCS 1800)
Operational bandwidth	75 MHz
Number of channels	1 - 2
Channel programming	200 kHz Channel spacing
Selectivity	> 60 dB at 400 kHz > 70 dB at 600 kHz
Ripple in passband	< 2 dB

Sensitivity

Donor unit (SD) and (DD)	
UL	< - 109 dBm at S/N 9 dB
DL	N/A
Remote unit (IR) and (ER)	< - 109 dBm at S/N 9 dB

Noise figure

Donor unit (SD) and (DD)	
UL	2.5 dB typical, < 3 dB at max gain
DL	N/A
Remote unit (IR) and (ER) UL/DL	2.5 dB typical, < 3 dB at max gain

Maximum input level, no damage

Donor unit (SD) and (DD)	
UL	+ 23 dBm
DL	+ 10 dBm
Remote unit (IR) and (ER) UL/DL	+ 10 dBm

Propagation delay	5,5 µs typical

Output power per carrier

Donor unit (SD)	
DL	+ 37 dBm GSM/ GMSK + 34 dBm EDGE / 8-PSK average power
UL	- 10 dBm GSM/ GMSK - 13 dBm EDGE / 8-PSK average power
Donor unit (DD)	

DL	+ 37 dBm GSM/ GMSK + 34 dBm EDGE / 8-PSK average power
UL	- 10 dBm GSM/ GMSK - 13 dBm EDGE / 8-PSK average power
Remote unit (IR)	
DL	+ 40 dBm GSM/ GMSK + 37 dBm EDGE / 8-PSK average power
UL	+ 37 dBm GSM/ GMSK + 34 dBm EDGE / 8-PSK average power
Remote unit (ER)	
DL	+ 43 dBm GSM/ GMSK + 40 dBm EDGE / 8-PSK average power
UL	+ 37 dBm GSM/ GMSK + 34 dBm EDGE / 8-PSK average power

Gain

Donor unit (SD)	max 42 dB, adjustable, in 1 dB steps
Donor unit (DD)	max 45 dB, adjustable, in 1 dB steps
Remote unit (IR)	
DL/UL	75 - 105 dB, adjustable, in 1 dB steps
Remote unit (ER)	
DL/UL	78 - 108 dB, adjustable, in 1 dB steps

Gain Flatness (200 kHz BW)	± 1 dB
Gain Flatness (15 MHz BW)	± 1 dB
Input to Link Channel Frequency Error	< 1 x 10^{-9}

Modulation Accuracy

Donor unit (SD) and (DD)	
DL	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at +33 dBm
EDGE / 8-PSK	< 3 % EVM RMS at +30 dBm average power
UL	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at -10 dBm
EDGE / 8-PSK	< 3 % EVM RMS at -13 dBm average power
Remote unit (IR)	
DL	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at +40 dBm
EDGE / 8-PSK	< 4 % EVM RMS at +37 dBm average power
UL	

GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at +37 dBm
EDGE / 8-PSK	< 3 % EVM RMS at +34 dBm average power
Remote unit (ER)	
DL	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at +43 dBm
EDGE / 8-PSK	< 4 % EVM RMS at +40 dBm average power
UL	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at +37 dBm
EDGE / 8-PSK	< 3 % EVM RMS at +34 dBm average power

Intermodulation

Donor unit (SD) and (DD)	< -36 dBm (two carriers at + 33 dBm DL, 600 kHz spacing) < -70 dBm (two carriers at -10 dBm UL, 600 kHz spacing)
Remote unit (IR)	< -36 dBm (two carriers at + 40 dBm DL, 600 kHz spacing) < -36 dBm (two carriers at +37 dBm UL, 600 kHz spacing)
Remote unit (ER)	< -36 dBm (two carriers at + 43 dBm DL, 600 kHz spacing) < -36 dBm (two carriers at +37 dBm UL, 600 kHz spacing)
Spurious responses	< - 36 dBm for 9 kHz - 1 GHz < - 30 dBm for 1 GHz - 13 GHz
System impedance	50 ohm
Return loss at antenna connections	> 16 dB
Antenna connectors	DIN 7/16
Electrical ratings	110/230 VAC, 50/60 Hz or -48 VDC
Power Consumption	100 W typical / 200 W maximum (traffic dependent)

Mechanical Specifications

Dimensions	470 x 340 x 145 mm
Enclosure	Aluminum (IP 65)
Weight	16 kg

Environmental Specifications

EMC	See compliance below
Operating Temperature	- 25 to + 55 ° C
Storage	- 30 to + 70 ° C

Humidity	ETSI EN 300 019-2-4 (see compliance below)
MTBF	> 100 000 hrs
Complies with	R& TTE Directive including ETS EN 301 502 (ETS EN 300 609-4 / GSM 11.26) ETS EN 301 498-8 EN 60 950

6.10 CSFT 1922

Electrical Specifications

Frequency range Uplink, UL	1850 - 1920 MHz (PS 1900)
Frequency range Downlink, DL	1930 - 1990 MHz (PS 1900)
Operational bandwidth	60 MHz
Number of channels	1 - 2
Channel programming	200 kHz Channel spacing
Selectivity	> 60 dB at 400 kHz > 70 dB at 600 kHz
Ripple in passband	< 2 dB

Sensitivity

Donor unit (SD) and (DD)	
UL	< - 109 dBm at S/N 9 dB
DL	N/A
Remote unit (IR) and (ER)	< - 109 dBm at S/N 9 dB

Noise figure

Donor unit (SD) and (DD)	
UL	2.5 dB typical, < 3 dB at max gain
DL	N/A
Remote unit (IR) and (ER) UL/DL	2.5 dB typical, < 3 dB at max gain

Maximum input level, no damage

Donor unit (SD) and (DD)	
UL	+ 23 dBm
DL	+ 10 dBm
Remote unit (IR) and (ER) UL/DL	+ 10 dBm
Propagation delay	5,5 µs typical

Output power per carrier

Donor unit (SD)	
DL	+ 37 dBm GSM/ GMSK + 34 dBm EDGE / 8-PSK average power
UL	- 10 dBm GSM/ GMSK - 13 dBm EDGE / 8-PSK average power
Donor unit (DD)	

DL	+ 37 dBm GSM/ GMSK + 34 dBm EDGE / 8-PSK average power
UL	- 7 dBm GSM/ GMSK - 10 dBm EDGE / 8-PSK average power
Remote unit (IR)	
DL	+ 40 dBm GSM/ GMSK + 37 dBm EDGE / 8-PSK average power
UL	+ 37 dBm GSM/ GMSK + 34 dBm EDGE / 8-PSK average power
Remote unit (ER)	
DL	+ 43 dBm GSM/ GMSK + 40 dBm EDGE / 8-PSK average power
UL	+ 37 dBm GSM/ GMSK + 34 dBm EDGE / 8-PSK average power

Gain

Donor unit (SD)	max 42 dB, adjustable, in 1 dB steps
Donor unit (DD)	max 45 dB, adjustable, in 1 dB steps
Remote unit (IR)	
DL/UL	75 - 105 dB, adjustable, in 1 dB steps
Remote unit (ER)	
DL/UL	78 - 108 dB, adjustable, in 1 dB steps

Gain Flatness (200 kHz BW)	± 1 dB
Gain Flatness (15 MHz BW)	± 1 dB
Link to output Channel Frequency Error	< 1 x 10-9

Modulation Accuracy

Donor unit (SD) and (DD)	
DL	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at +33 dBm
EDGE / 8-PSK	< 3 % EVM RMS at +30 dBm average power
UL	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at -10 dBm
EDGE / 8-PSK	< 3 % EVM RMS at -13 dBm average power
Remote unit (IR)	
DL	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at +40 dBm
EDGE / 8-PSK	< 4 % EVM RMS at +37 dBm average power
UL	

GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at +37 dBm
EDGE / 8-PSK	< 3 % EVM RMS at +34 dBm average power
Remote unit (ER)	
DL	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at +43 dBm
EDGE / 8-PSK	< 4 % EVM RMS at +40 dBm average power
UL	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at +37 dBm
EDGE / 8-PSK	< 3 % EVM RMS at +34 dBm average power

Intermodulation

Donor unit (SD) and (DD)	< -36 dBm (two carriers at + 33 dBm DL, 600 kHz spacing) < -70 dBm (two carriers at -10 dBm UL, 600 kHz spacing)
Remote unit (IR)	< -36 dBm (two carriers at + 40 dBm DL, 600 kHz spacing) < -36 dBm (two carriers at +37 dBm UL, 600 kHz spacing)
Remote unit (ER)	< -36 dBm (two carriers at + 43 dBm DL, 600 kHz spacing) < -36 dBm (two carriers at +37 dBm UL, 600 kHz spacing)
Spurious responses	< - 36 dBm for 9 kHz - 1 GHz < - 30 dBm for 1 GHz - 13 GHz
System impedance	50 ohm
Return loss at antenna connections	> 16 dB
Antenna connectors	DIN 7/16
Electrical ratings	110/230 VAC, 50/60 Hz or -48 VDC
Power Consumption	100 W typical / 200 W maximum (traffic dependent)

Mechanical Specifications

Dimensions	470 x 340 x 145 mm
Enclosure	Aluminum (IP 65)
Weight	16 kg

Environmental Specifications

EMC	See compliance below
Operating Temperature	- 25 to + 55 ° C

Storage	- 30 to + 70 ° C
Humidity	ETSI EN 300 019-2-4 (see compliance below)
MTBF	> 100 000 hrs
Complies with	R& TTE Directive including ETS EN 301 502 (ETS EN 300 609-4 / GSM 11.26) ETS EN 301 498-8 EN 60 950

6.11 CSFT 91822

Electrical Specification

Frequency range Uplink, UL	880 – 915 MHz (E-GSM900)
Frequency range Downlink, DL	925 – 960 MHz (E-GSM900)
Link Frequency Range Uplink, UL	1805 – 1880 MHz
Link Frequency Range Downlink, DL	1710 – 1785 MHz
Operational bandwidth	35 MHz
Number of channels	1 – 2
Channel programming	200 kHz Channel spacing
Selectivity	> 60 dB at 400 kHz > 70 dB at 600 kHz
Ripple in passband	< 2 dB
Sensitivity	
Donor unit (SD) and (DD)	
UL	< - 109 dBm at S/N 9 dB
DL	N/A
Remote unit (IR) and (ER)	< - 109 dBm at S/N 9 dB
Noise figure	
Donor unit (SD) and (DD)	
UL	2.5 dB typical, < 3 dB at max gain
DL	N/A
Remote unit (IR) and (ER) UL/DL	2.5 dB typical, < 3 dB at max gain
Maximum input level, no damage	
Donor unit (SD) and (DD)	
UL	+ 23 dBm
DL	+ 10 dBm
Remote unit (IR) and (ER) UL/DL	+ 10 dBm
Propagation delay	5.5 µs typical

Output power per carrier

Donor unit (SD)	
DL	+ 37 dBm GSM/ GMSK + 34 dBm EDGE / 8-PSK average power
UL	- 10 dBm GSM/ GMSK - 13 dBm EDGE / 8-PSK average power
Donor unit (DD)	
DL	+ 37 dBm GSM/ GMSK + 34 dBm EDGE / 8-PSK average power
UL	- 7 dBm GSM/ GMSK - 10 dBm EDGE / 8-PSK average power
Remote unit (IR)	
DL	+ 40 dBm GSM/ GMSK + 37 dBm EDGE / 8-PSK average power
UL	+ 37 dBm GSM/ GMSK + 34 dBm EDGE / 8-PSK average power
Remote unit (ER)	
DL	+ 43 dBm GSM/ GMSK + 40 dBm EDGE / 8-PSK average power
UL	+ 37 dBm GSM/ GMSK + 34 dBm EDGE / 8-PSK average power

Gain

Donor unit (SD)	max 42 dB, adjustable, in 1 dB steps
Donor unit (DD)	max 45 dB, adjustable, in 1 dB steps
Remote unit (IR)	
DL/UL	75 - 105 dB, adjustable, in 1 dB steps
Remote unit (ER)	
DL/UL	78 - 108 dB, adjustable, in 1 dB steps
Gain Flatness (200 kHz BW)	± 1 dB
Gain Flatness (15 MHz BW)	± 1 dB
Input to Link Channel Frequency Error	< 1 x 10^{-9}

Modulation Accuracy

Donor unit (SD) and (DD)	
DL	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at +33 dBm
EDGE / 8-PSK	< 3 % EVM RMS at +30 dBm average power
UL	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at -10 dBm

EDGE / 8-PSK	< 3 % EVM RMS at -13 dBm average power
Remote unit (IR)	
DL	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at +40 dBm
EDGE / 8-PSK	< 4 % EVM RMS at +37 dBm average power
UL	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at +37 dBm
EDGE / 8-PSK	< 3 % EVM RMS at +34 dBm average power
Remote unit (ER)	
DL	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at +43 dBm
EDGE / 8-PSK	< 4 % EVM RMS at +40 dBm average power
UL	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at +37 dBm
EDGE / 8-PSK	< 3 % EVM RMS at +34 dBm average power

Intermodulation

Donor unit (SD) and (DD)	< -36 dBm (two carriers at + 33 dBm DL, 600 kHz spacing) < -70 dBm (two carriers at -10 dBm UL, 600 kHz spacing)
Remote unit (IR)	< -36 dBm (two carriers at + 40 dBm DL, 600 kHz spacing) < -36 dBm (two carriers at +37 dBm UL, 600 kHz spacing)
Remote unit (ER)	< -36 dBm (two carriers at + 43 dBm DL, 600 kHz spacing) < -36 dBm (two carriers at +37 dBm UL, 600 kHz spacing)
Spurious responses	< - 36 dBm for 9 kHz – 1 GHz < - 30 dBm for 1 GHz – 13 GHz
System impedance	50 ohm
Return loss at antenna connections	> 16 dB
Antenna connectors	DIN 7/16
Electrical ratings	110/230 VAC, 50/60 Hz or -48 VDC
Power Consumption	100 W maximum

Mechanical Specifications

Dimensions	470 x 340 x 145 mm

Enclosure	Aluminum (IP 65)
Weight	16 kg

Environmental Specifications

EMC	See compliance below
Operating Temperature	- 25 to + 55 ° C
Storage	- 30 to + 70 ° C
Humidity	ETSI EN 300 019-2-4 (see compliance below)
MTBF	> 100 000 hrs
Complies with	R& TTE Directive including ETS EN 301 502 (ETS EN 300 609-4 / GSM 11.26) ETS EN 301 498-8 EN 60 950

6.12 CSFT 18922

Electrical Specifications

Frequency range Uplink, UL	1710 - 1785 MHz (DCS 1800)
Frequency range Downlink, DL	1805 - 1880 MHz (DCS 1800)
Link Frequency Range Uplink, UL	880 – 915 MHz (E-GSM)
Link Frequency Range Downlink, DL	925 – 960 MHz (E-GSM)
Operational bandwidth	75 MHz
Number of channels	1 - 2
Channel programming	200 kHz Channel spacing
Selectivity	> 60 dB at 400 kHz > 70 dB at 600 kHz
Ripple in passband	< 2 dB

Sensitivity

Donor unit (SD) and (DD)	
UL	< - 109 dBm at S/N 9 dB
DL	N/A
Remote unit (IR) and (ER)	< - 109 dBm at S/N 9 dB

Noise figure

Donor unit (SD) and (DD)	
UL	2.5 dB typical, < 3 dB at max gain
DL	N/A
Remote unit (IR) and (ER) UL/DL	2.5 dB typical, < 3 dB at max gain

Maximum input level, no damage

Donor unit (SD) and (DD)	
UL	+ 23 dBm
DL	+ 10 dBm
Remote unit (IR) and (ER) UL/DL	+ 10 dBm
Propagation delay	5,5 µs typical

Output power per carrier

Donor unit (SD)

DL	+ 37 dBm GSM/ GMSK + 34 dBm EDGE / 8-PSK average power
UL	- 10 dBm GSM/ GMSK - 13 dBm EDGE / 8-PSK average power
Donor unit (DD)	
DL	+ 37 dBm GSM/ GMSK + 34 dBm EDGE / 8-PSK average power
UL	- 10 dBm GSM/ GMSK - 13 dBm EDGE / 8-PSK average power
Remote unit (IR)	
DL	+ 40 dBm GSM/ GMSK + 37 dBm EDGE / 8-PSK average power
UL	+ 37 dBm GSM/ GMSK + 34 dBm EDGE / 8-PSK average power
Remote unit (ER)	
DL	+ 43 dBm GSM/ GMSK + 40 dBm EDGE / 8-PSK average power
UL	+ 37 dBm GSM/ GMSK + 34 dBm EDGE / 8-PSK average power

Gain

Donor unit (SD)	max 42 dB, adjustable, in 1 dB steps
Donor unit (DD)	max 45 dB, adjustable, in 1 dB steps
Remote unit (IR)	
DL/UL	75 - 105 dB, adjustable, in 1 dB steps
Remote unit (ER)	
DL/UL	78 - 108 dB, adjustable, in 1 dB steps

Gain Flatness (200 kHz BW)	± 1 dB
Gain Flatness (15 MHz BW)	± 1 dB
Input to Link Channel Frequency Error	< 1 x 10^{-9}

Modulation Accuracy

Donor unit (SD) and (DD)	
DL	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at +33 dBm
EDGE / 8-PSK	< 3 % EVM RMS at +30 dBm average power
UL	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at -10 dBm
EDGE / 8-PSK	< 3 % EVM RMS at -13 dBm average power
Remote unit (IR)	

DL	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at +40 dBm
EDGE / 8-PSK	< 4 % EVM RMS at +37 dBm average power
UL	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at +37 dBm
EDGE / 8-PSK	< 3 % EVM RMS at +34 dBm average power
Remote unit (ER)	
DL	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at +43 dBm
EDGE / 8-PSK	< 4 % EVM RMS at +40 dBm average power
UL	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at +37 dBm
EDGE / 8-PSK	< 3 % EVM RMS at +34 dBm average power

Intermodulation

Donor unit (SD) and (DD)	< -36 dBm (two carriers at + 33 dBm DL, 600 kHz spacing) < -70 dBm (two carriers at -10 dBm UL, 600 kHz spacing)
Remote unit (IR)	< -36 dBm (two carriers at + 40 dBm DL, 600 kHz spacing) < -36 dBm (two carriers at +37 dBm UL, 600 kHz spacing)
Remote unit (ER)	< -36 dBm (two carriers at + 43 dBm DL, 600 kHz spacing) < -36 dBm (two carriers at +37 dBm UL, 600 kHz spacing)
Spurious responses	< - 36 dBm for 9 kHz - 1 GHz < - 30 dBm for 1 GHz - 13 GHz
System impedance	50 ohm
Return loss at antenna connections	> 16 dB
Antenna connectors	DIN 7/16
Electrical ratings	110/230 VAC, 50/60 Hz or -48 VDC
Power Consumption	100 W maximum

Mechanical Specifications

Dimensions	470 x 340 x 145 mm
Enclosure	Aluminum (IP 65)
Weight	16 kg

Environmental Specifications

EMC	See compliance below
Operating Temperature	- 25 to + 55 ° C
Storage	- 30 to + 70 ° C
Humidity	ETSI EN 300 019-2-4 (see compliance below)
MTBF	> 100 000 hrs
Complies with	R& TTE Directive including ETS EN 301 502 (ETS EN 300 609-4 / GSM 11.26) ETS EN 301 498-8 EN 60 950

6.13 CSF 922

Electrical Specifications

Frequency range Uplink, UL	880 – 915 MHz (E-GSM900)
Frequency range Downlink, DL	925 – 960 MHz (E-GSM900)
Operational bandwidth	35 MHz
Number of channels	1 – 2
Channel programming	200 kHz channel spacing
Selectivity	> 60 dB at 400 kHz > 70 dB at 600 kHz
Ripple in pass band	< 2 dB
Sensitivity	< - 109 dBm at S/N 9 dB
Noise figure	2.5 dB typical, < 3 dB at max gain
Maximum input level, non destructive	+10 dBm
Propagation delay	5 µs typical
Output power per carrier (UL/DL)	+37 dBm GSM/ GMSK +34 dBm EDGE / 8-PSK average power
Modulation Accuracy	
GSM / GMSK	< 2.5 ° RMS and < 10 ° peak at +37 dBm
EDGE / 8-PSK	< 3 % EVM RMS at + 34 dBm
Intermodulation	< - 36 dBm (two carriers at + 37 dBm, 600 kHz spacing)
Spurious responses	< - 36 dBm for 9 kHz – 1 GHz < - 30 dBm for 1 GHz – 13 GHz
Gain	38 - 68 dB, adjustable, in 1 dB steps
System impedance	50 ohm
Return loss at antenna connections	> 16 dB
Antenna connectors	DIN 7/16
Electrical ratings	110/230 VAC, 50/60 Hz or -48 VDC
Power Consumption	100 W typical / 200 W maximum (traffic dependent)

Mechanical Specifications

Dimensions	470 x 340 x 145 mm
Enclosure	Aluminium (IP 65)
Weight	16 kg

Environmental Specifications

EMC	See compliance below
Operating Temperature	- 25 to + 55 ° C
Storage	- 30 to + 70 ° C
Humidity	ETSI EN 300 019-2-4 (see compliance below)
MTBF	> 100 000 hrs
Complies with	R&TTE Directive including ETS EN 301 502 (ETS EN 300 609-4/GSM 11.26) ETS EN 301 498-8 EN 60 950