ACcess Series

User Manual

Teleste Corporation

AC9000

Intelligent fibre optic platform

Contents

Introduction

AC9000 is an intelligent 4 output optical node, engineered to provide reliable performance and easy alignment. Along with its enviable performance, easy installation and smooth operation stand out as its key advantages.

Up to 2 downstream receivers can be fed with separate signals allowing the node to act as two independent nodes, or they can be configured for backup operation. Upstream signals are connected to up to 4 optical transmitters via a software configurable signal routing matrix which allows various routing and backup options. When more segmentation is needed, the optical transmitters can be fed with separate individual return signals.

The analogue transmitters can be replaced with two digital return path modules thus providing savings on fibre infrastructure costs. The new digital return path technology also ensures excellent upstream signal quality and allows longer fibre links.

The amplifier stages are based on the latest GaN technology to ensure optimised power consumption and performance. The platform and accessories of AC9000 are fully functional up to 1 GHz.

True plug-and-play

An intelligent automatic alignment system with wide level control range ensures optimum operation of the AC9000 node. It replaces conventional mechanical plug-in module adjustments and laborious control of parameters.

Local configuration of AC9000 is done via its USB interface using a PC or PDA equipped with CATVisor Commander software.

AC6990 / AC6991 / AC6980 transponder unit

AC9000 node can be monitored and controlled remotely via optional plug-in transponder unit, which also adds ALC with fully user programmable pilots and both forward and return path monitoring functionality. AC6990 supports forward path measurement up to 862 MHz, AC6991 and AC6980 up to 1000 MHz.

AC6990 and AC6991 support CATVisor and HMS protocols. AC6980 supports DOCSIS protocol. Remote monitoring and control is possible with CATVisor tools or with 3rd party SNMP management applications.

AC9000 feature map	Without transponder	With transponder
Intelligent continuous adjustments	●	●
Local control through USB connection	●	●
Remote monitoring and control	-	●
ALC with fully user programmable pilots	-	●
Intelligent backup functionality in both forward and return path	●	●
Automatic forward path OMI alignment	●	●
Automatic return path OMI alignment	●	●
Automatic forward and return path alignment with single pushbutton[1]	-	●
Forward path spectrum analyser[1]	-	●
Return path signal quality monitoring with automatic ingress control[1]	-	●
Return path pilot generator[1]	-	●[2]

1) These features need to be enabled with a Product Key.
2) AC6980 DOCSIS transponder does not support pilot generator.

Table 1. AC9000 feature map

AC9000 generations

There are two AC9000 generations with some differences in hardware and/or software functionality:

1st generation AC9000:

- Manufactured until Q2/2013

- Transponder receiver is switched between output 1 and output 3, depending on the pilot and spectrum signal measurements. Thus the same management signal (HEC / HMTS / CMTS) must be arranged to be present at both outputs. The switching is done synchronously with the management data reception and does not affect AC6990 and AC6991 remote communication. With AC6980 DOCSIS transponder minor packet loss may occur due to receiver resynchronisation if there are timing (caused by signal path length differences in dual node mode) and/or level differences in output 1 and output 3 signals.

2nd generation AC9000:

- Manufacturing started Q2/2013

- AC6980 DOCSIS transponder receiver always connected to output 1. Thus CMTS signal must be present at output 1 and doesn't have to be present at output 3. Other transponders as in 1st generation.

The generation information is visible in "Properties" viewer page.

Installation

Housing

The AC9000 can be installed either into a street cabinet or to the outdoor environment. The fibre node should be installed vertically so that the external cable connectors and ventilation hole are underneath, securing the housing with three mounting brackets. Figure 1 depicts for the positions of mounting brackets as well as other installation dimensions.

The lid opens with the hinges to the left. The open cover can be removed by first opening the lid into a 90 degrees angle and the lifting it off the hinges.

Before closing the lid is should be checked that:

- nothing is trapped between the lid and the case
- all case gaskets are in their correct positions
- lid seats evenly on the rubber gasket

Using 4 mm Allen key, the lid retaining bolts are fasten in a diagonal sequence with a tightening torque of 3 Nm. The class of enclosure is IP54 when correctly installed and tightened.

Node housing should be grounded with at least 4 mm^2 grounding wire (Cu) from a proper earth to the grounding point.
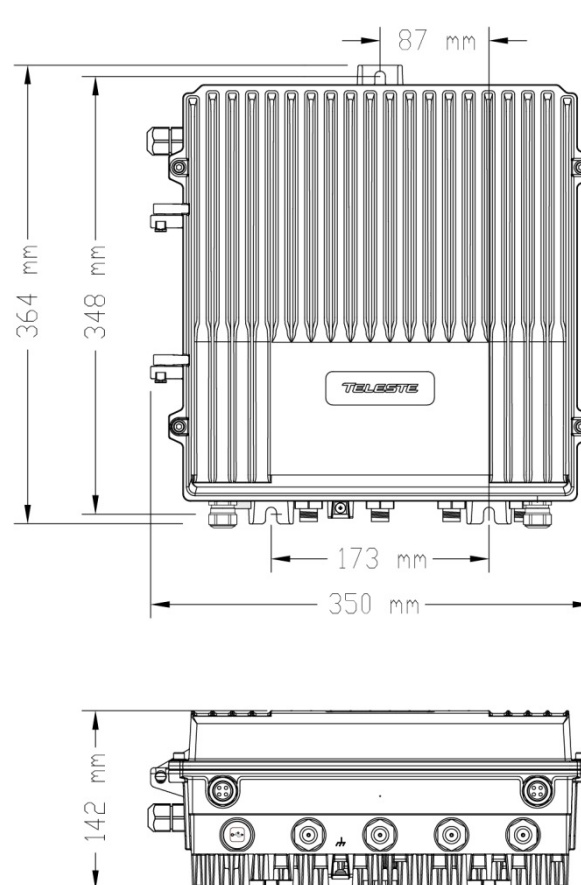

Figure 1. AC9000 housing dimensions – top and side view
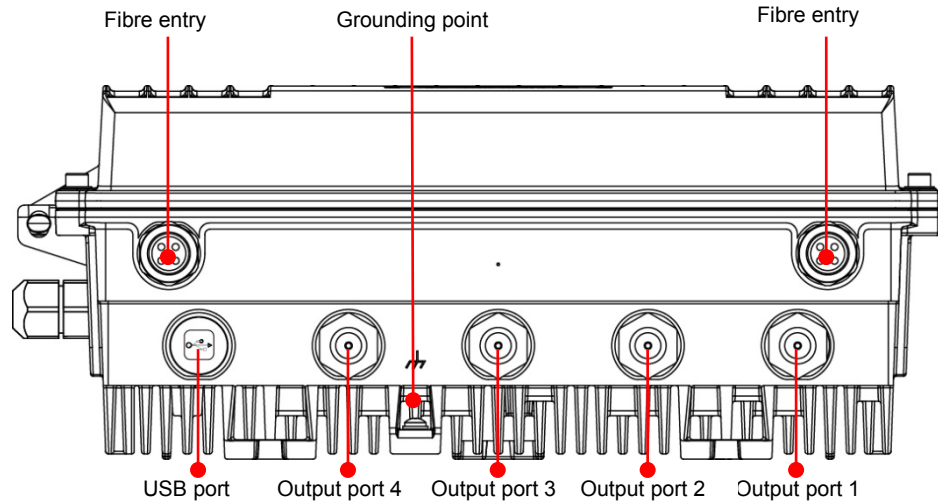
Interfaces

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Figure 2. Port locations

The AC9000 node has six dedicated cable connection points: two inputs for fibre entries and four coaxial RF outputs. In addition there is a port for the USB management interface.

All coaxial outputs have a standard PG11 thread and they accept any KDC type adapter or connector. Suitable length for the centre conductor pin is approximately 20 mm (Figure 3). Screw the KDC connector/adapter body into the port. Tighten the centre conductor seizure screw and torque to 0.7 Nm. Do not over tighten.
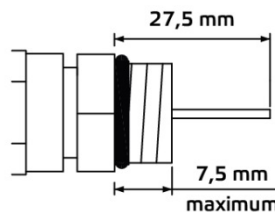
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Figure 3. Centre conductor length
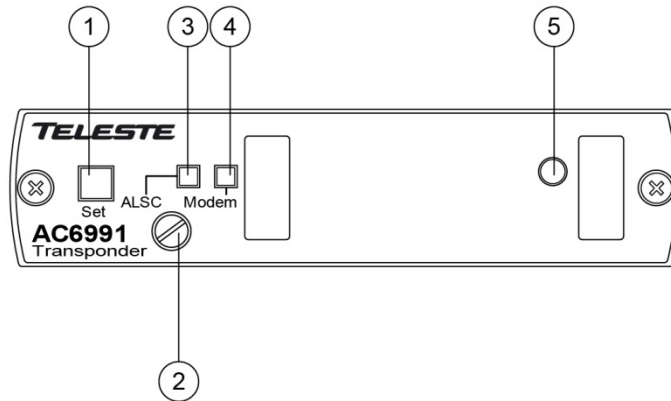
Transponder

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Figure 4. AC6991 transponder unit, 1) "Set" -button, 2) Fastening bolt, 3) Indicator for ALSC status , 4) Indicator for modem status, 5) Light sensor
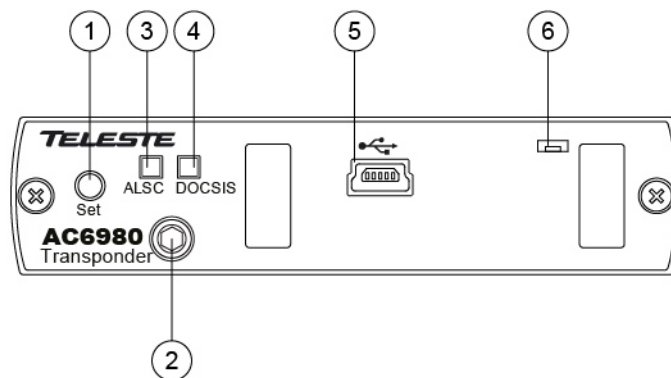

Figure 5. AC6980 DOCSIS transponder unit, 1) "Set" -button, 2) Fastening bolt, 3) Indicator for ALSC status, 4) Indicator for DOCSIS status, 5) Remote management USB connector, 6) Light sensor

To install a transponder unit, first locate the correct installation position. Snap off the segments of the shrouds break-away type slot cover and remove the slot cover. Insert the unit by pressing it gently into place. The unit will fit only in one orientation. Finally tightly fasten the mounting bolt to ensure proper grounding and cooling, using flat screwdriver with AC6990/AC6991 transponders and 3 mm allen key with AC6980 transponder. There is no need to switch off the supply voltage during module installation.

The USB connector in AC6980 transponder front panel is reserved for remote management connection. Local management of the AC9000 unit should be done via motherboard USB connector.

Fibre connections

The node accepts up to eight fibre cables. These fibres carry forward path and return path optical signals. When feeding the optical cable into the node a PG11 threaded feed-through adapter type KDO900 is available.

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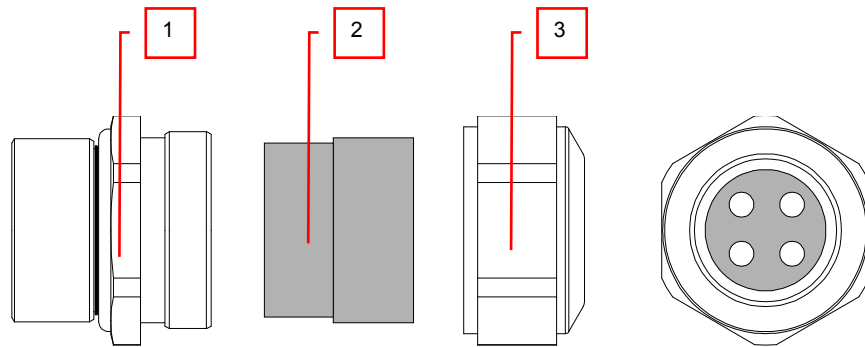
Figure 6. KDO900 adapter components

KDO900 adapter and fibre fitting

Remove the outer ring of the cable gland, thread the installation fibre filaments with connectors through the outer ring (Figure 6 pos. 3), through the sealing insert (Figure 6 pos. 2) and finally through the cable gland (Figure 6 pos. 1).

Mount the cable gland on the housing. The fibre filament length inside the fibre organiser is adjusted to sufficient measurement before tightening the outer ring.

Use the synthetic locking pins (supplied) to seal up unused holes in the sealing insert.

Optical receivers

The housing has slots for two optical receivers but it is possible to order the AC9000 with only one optical receiver installed and add a second receiver later.

AC6610 is a fibre optic receiver module for AC9000 optical node. The led on the receiver's front panel gives a visual indication of the optical input power.

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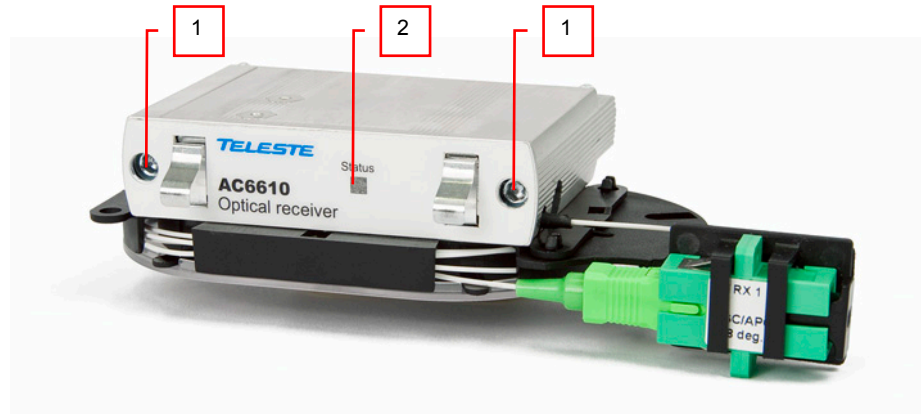
Figure 7. AC66B10 Fibre optic receiver with integrated fibre organiser,
1) Retaining screw, 2) Status indicator

AC6610 led	Description
Yellow	Optical input power is below low major alarm limit (user editable, default -7.0 dBm)
Green	Optical input power is within major alarm limits
Red	Optical input power exceeds high major alarm limit (user editable, default +3.0 dBm)

Table 2. Optical receiver module status led

Optical return transmitters

The housing has slots for four return path transmitters but it is possible to order the AC9000 with any number of transmitter installed. For signal routing reasons, a single transmitter should be installed into slot 1. Two transmitters go into slots 1 and 2 or 1 and 3, depending on the desired signal routing and backup functionality, see "Return path" chapter for details. Three transmitters go into slots 1, 2 and 3.

There are a variety of options for transmitter modules available for the return path applications of ACcess platform (AC67 Tx). The return path transmitters are available either in 1310 nm or 1550 nm DFB versions. In addition the platform can be equipped with CWDM transmitters. The CWDM lasers deploy eight wavelengths in range of 1470…1610 nm. The wavelength and optical output power are marked on the product label.

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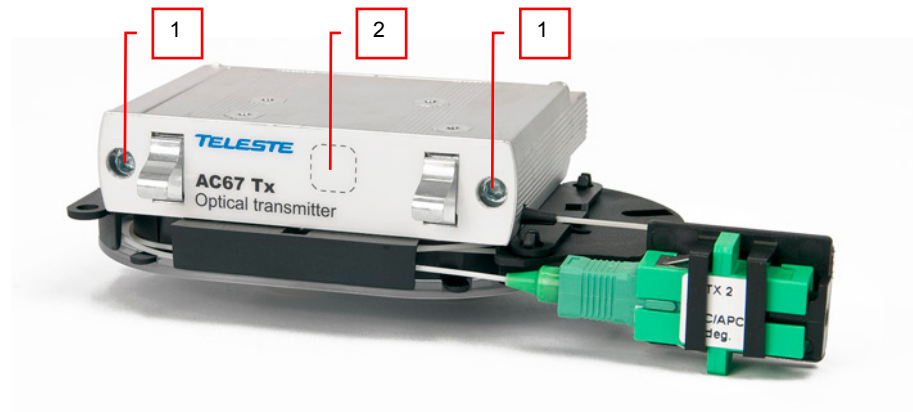
Figure 8. AC67B Fibre optic transmitter with integrated fibre organiser,
1) Retaining screw, 2) Product label

Installation of optical units

To install any of the AC6610 / AC67 Tx optical units, first locate the correct installation position. Insert the unit by pressing it gently into place. The unit will fit only in one orientation. Finally, using 3 mm Allen key, fasten the retaining screws with a tightening torque of 1.2 Nm. There is no need to switch off the supply voltage during module installation.

Note that optical units shouldn't be installed or removed while the unit is powered via USB only.

Powering

The AC6316 is a 27...65 VAC / 35...90 VDC switch mode power supply unit for AC9000. Power can be supplied through coaxial cable by inserting a fuse to the corresponding fuse holder or directly via the external input. The external input is located on the power distribution board at the upper left corner of the node. External power can also be fed through the node into the network. Maximum feed-through current is 12 A per port (16 A total). If powering will be provided through a dedicated output port, the port must be equipped with a fuse (supplied).

The PSU can work alone or parallel with shared load. The input connection is equipped with a fuse of 6.3 A TR5 type and is protected against short transients. Output of the PSU is protected against over current and short circuits by automatic, self-resetting electronic current limit. The output voltages can be separately monitored via user interface.

Cable gland at external input

The cable gland assembly provides the necessary protection against ingress of solid objects and moisture as well as providing cable retention.

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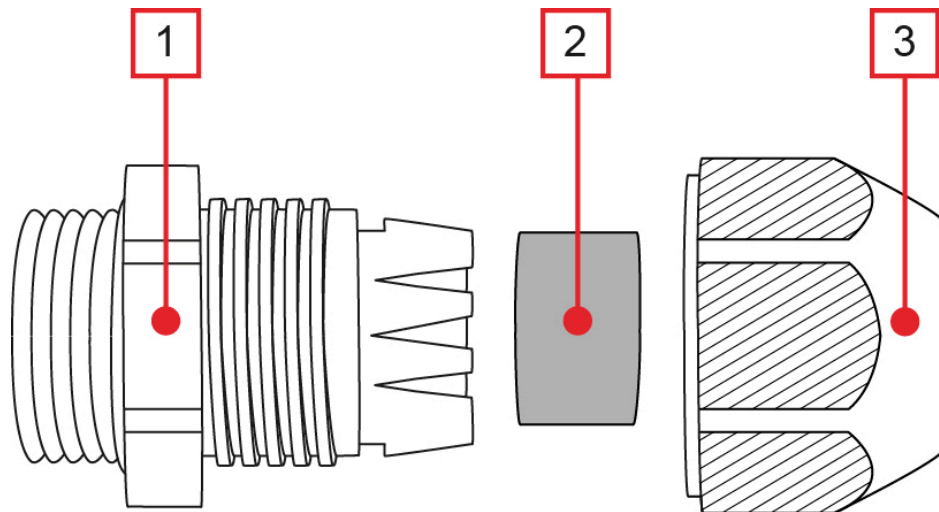
Figure 9. Cable gland components

Strip the cable sheath of the supply cord with a suitable length to suit the equipment and pass it through gland nut (3), seal (2) and plug body (1). Place appropriate conductors into plug pin housing assembly terminals and tighten screws to secure bared conductors and ensure good electrical contact. Screw the plug body tight onto the node housing to ensure that IP rating is maintained. Position the end of the cable sheath in line with the plug body and tighten the gland nut.

Installation

Note that the electrical installation must be carried out in accordance with the current national electrical regulations by a competent person.

To gain access to PSU retaining screws, first remove the protective shroud. The primary PSU of AC9000 must be installed into the first place (closest to the hinges). Remove and retain the hexagonal spacers.
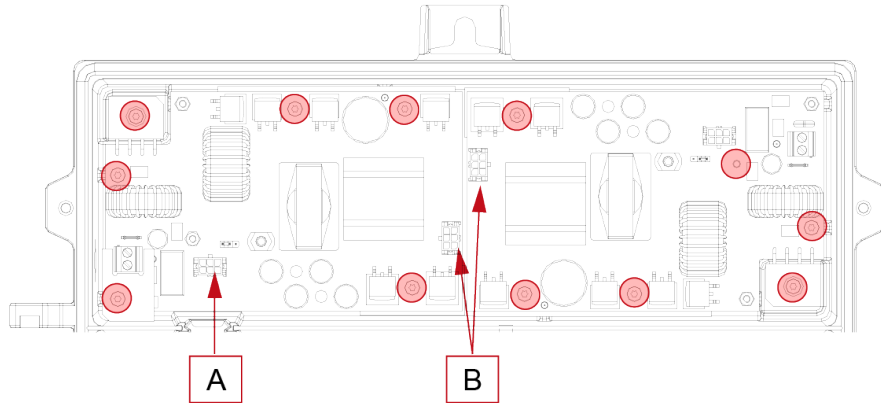
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Figure 10. PSU installation - position of securing screws and wiring connections

Use the silicon elastomers (Figure 11 pos. B) between the PSU and the heatsink brackets. When the unit is in position tighten the retaining screws and hexagonal spacers (Figure 11 pos. A) to a torque of 1.2 Nm.
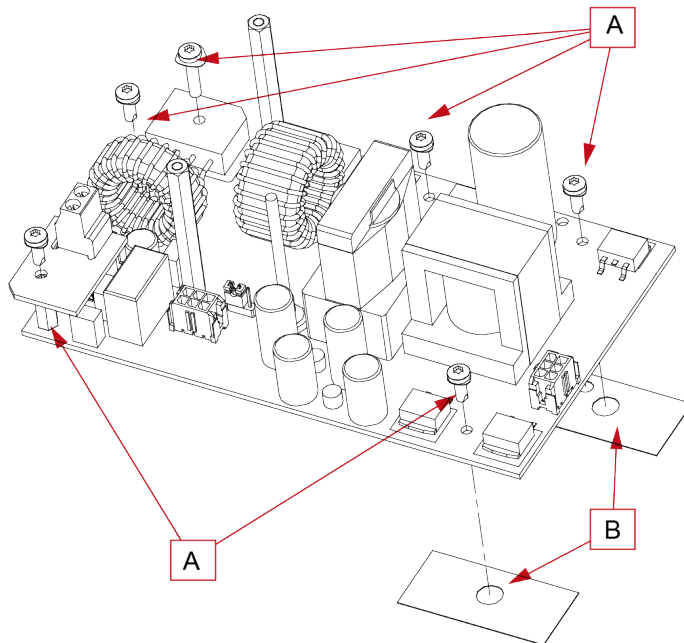
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Figure 11. AC6316 mounting screws (A), and silicon elastomers (B)

Connect the power cable from the primary PSU to the motherboard (Figure 10 pos. A). Back-up PSU requires additional power connection from the primary power supply. Locate the 6-pin connectors and attach the supplied ribbon cable to connect the PSUs (Figure 10 pos. B).

Primary and back-up power supplies are physically identical. Their functional differences are controlled by a jumper. See (Figure 12) for locations of the jumper pins. The jumper specifies which of the PSU output voltages is shown via user interface as primary PSU1 "+24V #1" or back-up PSU2 "+24V #2".
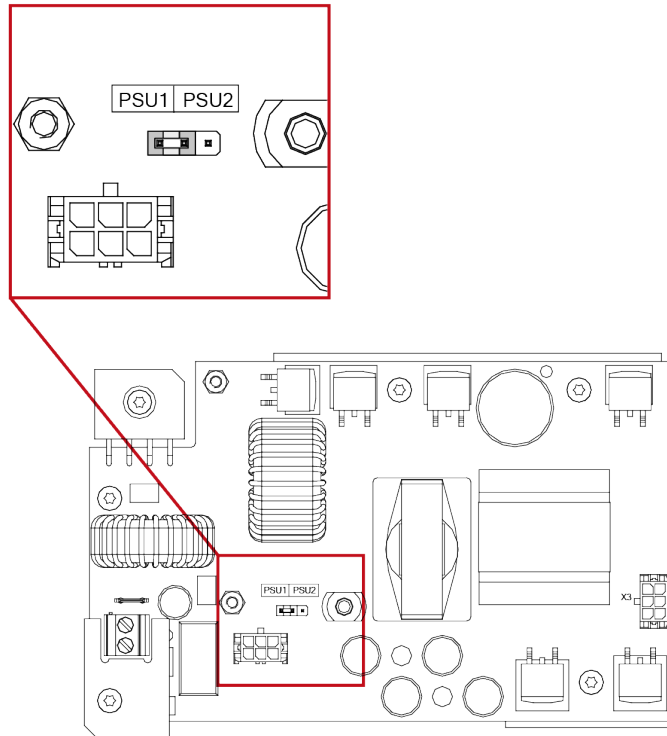
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Figure 12. AC6316 jumper setting

After PSU installation carefully refit the shroud in the reverse order of removal. Connect the power source. The led on the PSU circuit board indicates that the unit is powered up and that the DC power supply voltage is present.

Fibre installation

Fibre installation is a critical procedure and it should be done with carefulness. Incorrect handling of the fibres can result in damage and degraded performance. Example of routing the fibres can be seen in figure 8.

Cleaning fibre connectors

- For correct optical operation ensure that all optical connectors are cleaned immediately before mating using a suitable optical connector cleaning kit.

- If a cleaning kit is not available, wipe the end of the connector using pure isopropyl alcohol (99%) and a lint-free wipe. Dry it with filtered compressed air. Wait until dry to insert connector into the adapter.

- When fibre optic connectors are unmated, the optical fibre end faces must be protected from contamination using suitable dust caps. Contamination of fibre end faces will reduce the performance of the optical fibre and could ultimately cause failure of the system. Contamination could also damage the fibre end faces when the connectors are mated.

DANGER! Do not look into the optical connector of the return transmitter with power applied. Laser light, visible or invisible, can seriously injure eyes or even cause blindness.

Fibre management

The fibre tray provides means for terminating outside plant cables and fibre optic terminal fibres. The fibre tray is hinged to the chassis of the node and swings outwards to provide access for connecting installation fibre filaments (external fibre optic cables) and fibre pigtails (ACcess units).

Fibre tray together with fibre organiser modules are used to provide a convenient splicing and storing location for fibre pigtails. Connectors and adapters are held in place in the fibre tray by universal type holders ensuring compatibility with variety of existing connectors and adapters. Fibre organiser modules are stackable and are secured to each other using a latching arrangement. Referring to Figure 13 the topmost fibre organiser module can be equipped with a lid for further fibre protection.

When installing optical units positioned on the right hand side of the node gently wind the fibre pigtails onto the left fibre organiser module and around the right fibre organiser module for optical modules installed on the left hand side of the node. Figure 13 shows the fibre tray with a typical configuration with one downstream receiver and four upstream transmitter installed.

Be sure to leave sufficient slack for the pigtails to permit closing or opening the termination tray without damaging fibres. Ensure that no fibres are pinched while the tray or lid is closed.
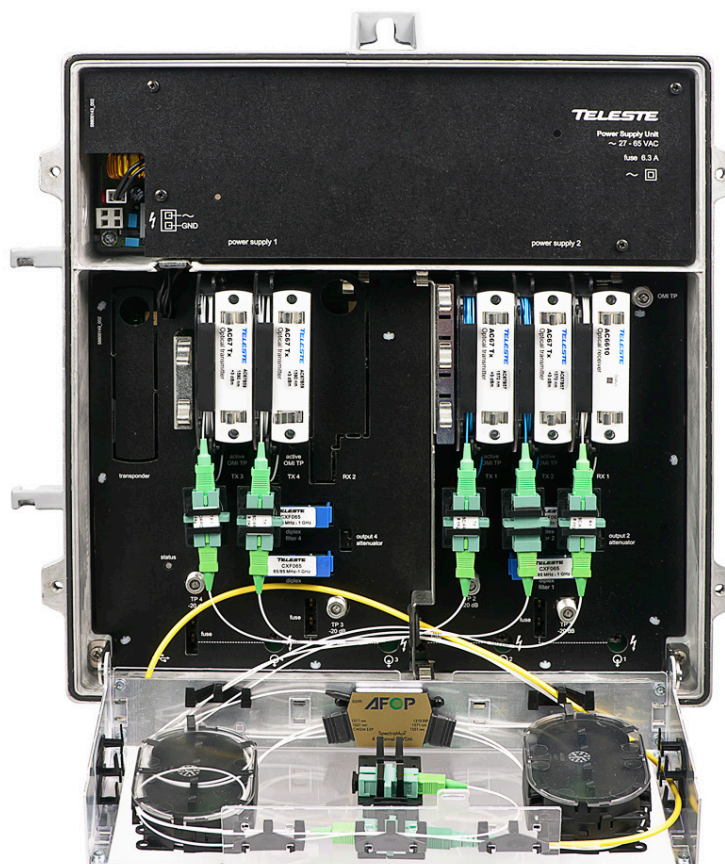
AC9000_DSC2007
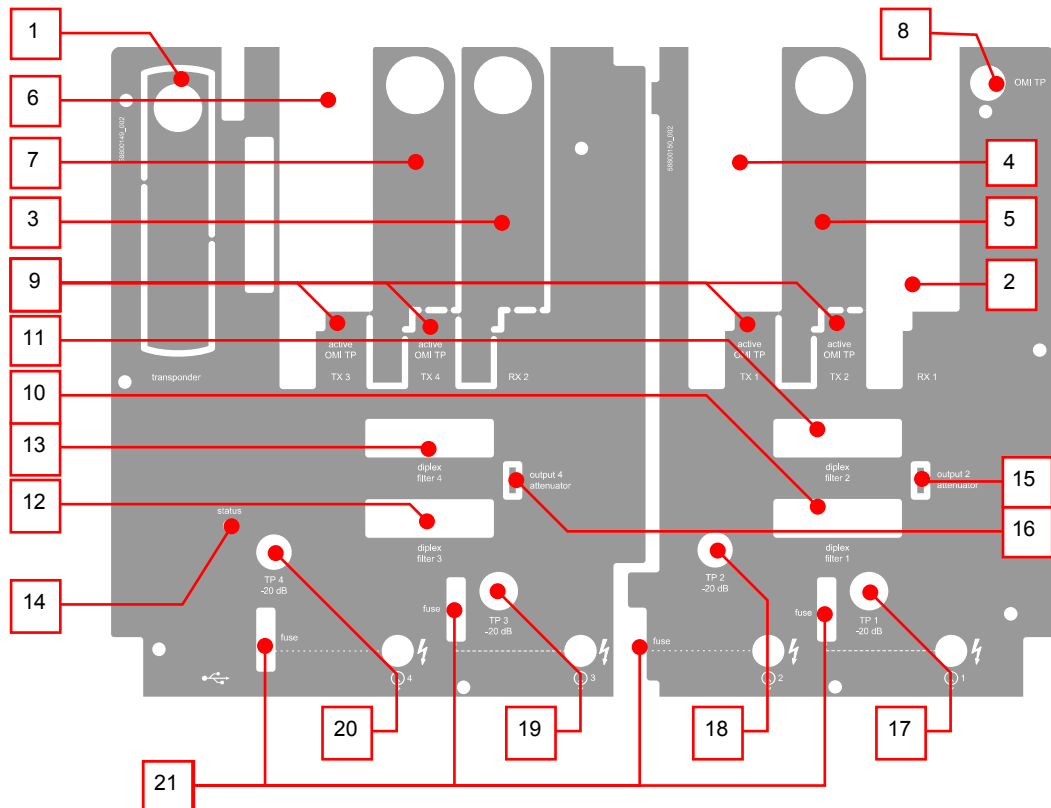

Figure 13. Routing fibres

Front panel

8611014

Figure 14. AC9000 front panel

1)	Slot for transponder	14)	Status indicator led
2)	Slot for optical receiver 1	15)	Output 2 attenuator slot
3)	Slot for optical receiver 2	16)	Output 4 attenuator slot
4)	Slot for optical transmitter 1	17)	Output 1 test / injection point
5)	Slot for optical transmitter 2		-20 dB directional coupler
6)	Slot for optical transmitter 3	18)	Output 2 test / injection point
7)	Slot for optical transmitter 4		-20 dB directional coupler
8)	OMI test point	19)	Output 3 test / injection point
9)	Active OMI test point indicator leds		-20 dB directional coupler
10)	Output 1 diplex filter	20)	Output 4 test / injection point
11)	Output 2 diplex filter		-20 dB directional coupler
12)	Output 3 diplex filter	21)	Fuses
13)	Output 4 diplex filter		

Features

Diplex modules

The AC9000 node is delivered according to the specifications defined in the ordering code. Optional return path operation needs plug-in diplex filters (Figure 14, positions 10-13. The available diplex filter types are CXF000 (0 dB jumper), CXF050 (50/70 MHz), CXF055 (55/70 MHz) CXF065 (65/85 MHz), CXF065 18 (65/85 MHz) and CXF085 (85/108 MHz). It is also possible to order the node without diplex filters. Note that the return path transmitters' bandwidth setting in the user interface should be set according to the installed diplex filters.

Forward path

The input and output amplifier stages are both based on high performance solutions which allow the user to set AC9000 outputs to high and low output levels. The output stage uses a GaN hybrid to improve RF performance over the entire 70 to 1006 MHz pass band. Note that AC9000 must have a proper matching at output port to ensure optimal and reliable operation.

The performance and power consumption of the RF stages can be adjusted automatically or by the user according to the RF load and output level.

Optical receiver modules

Optical receiver module optical input power is measured and monitored. The low major alarm limits are also used in backup switching logic.

Optical receivers in AC9000 can be independently disabled via the user interface. Disabled optical receiver's RF stages are shut down; it does not generate optical input power alarms and is not used in backup switching. This feature can be used e.g. when two receivers are installed but only one has a fibre connected.

Forward path signal routing and backup

Forward path signal routing and backup modes can be configured independently of return path routing and backup configuration.

AC9000 supports three forward path signal routing modes:

- **Dual node**: Receiver 1 signal is routed to output 1 (and 2). Receiver 2 signal is routed to output 3 (and 4).

- **Rx 1 only**: Receiver 1 signal is routed to all outputs.

- **Rx 2 only**: Receiver 2 signal is routed to all outputs.

Forward path backup can be set to three modes:

- **No backup**: The selected signal routing mode stays the same even if optical input is missing or receiver modules are removed.

- **Automatic**: If a receiver in use is missing or disabled or its optical input power is below low alarm limit, and a second receiver is installed and enabled and its optical input power is above low alarm limit + deadband, then the signal from the second receiver is routed to all outputs. When the failed receiver is installed, enabled and its optical input power is above low alarm limit + deadband, the original routing is restored.

- **Automatic with manual restore**: Identical to "Automatic" mode, except that original routing is not restored automatically. The user has to select "No backup" and then "Automatic with manual restore" again to restore the original routing.

Forward path level control

AC9000 has two level control elements in its both forward path signal paths:

1) Gain control in optical receiver module, controlled manually or by OLC. Adjustable in 0.5 dB steps between -30 and 0 dB.

2) Interstage level control in node motherboard, controlled manually or by ALC. Adjustable in 0.2 dB steps between -13 and 0 dB.

The forward path level control elements and thus the resulting forward path output level can be controlled with three different adjustment methods:

1) "Manual" mode: Optical module gain controls and interstage level controls are all available to the user with no restrictions. This mode should be used only if "OLC" or "ALC + OLC" mode doesn't give wanted results, or level fine-tuning is required.

2) "OLC" mode: Interstage level controls can be adjusted by the user. The node software adjusts optical receiver module gain control based on the measured optical input power so that node performance is optimised.

3) "ALC + OLC" mode, available with transponders: The node software adjusts optical receiver gain as in "OLC" mode and interstage level controls based on pilot levels.

Forward path slope is adjusted with separate controls for both signal paths, adjustable in 0.5 dB steps between 0 and 20 dB. Slope is always in user control regardless of the selected adjustment mode.

OLC offset

The "OLC offset" parameter is used in "OLC" and "ALC + OLC" adjustment modes. Its value is added to the optical module gain value calculated from optical input power and can thus be used to adjust the balance between optical input module gain control and interstage level control.

OLC offset is normally 0. If necessary, it is adjusted in 0.5 steps between -10 dB and +5 dB by pilot based or OMI based automatic alignment to optimise RF performance. The OLC offset has no effect in "Manual" mode.

Note that positive OLC offset values cause minimum optical input level for OLC operation to shift up by half of OLC offset value. For example, if optical receiver normal OLC operation range starts from -7 dBm, then with +4 dB OLC offset OLC operation range starts from -5 dBm.

RF performance

The RF performance and power consumption of AC9000 can be adjusted by controlling the output hybrids' current. In "Automatic" mode the node adjusts both hybrids independently based on e.g. the level / slope controls and measured optical input power. The idea in this adjustment is that the amplifier doesn't have to be better than the optical transmission path.

The factory default value "High" ensures full performance and should be used if manual control is desired and output levels at one or more outputs exceed 106 dBµV using 8 dB sloped response without output splitting. "Standard" is a good choice if maximum output levels are between 100 and 106 dBµV, and "Power save" is maximum levels are below 100 dBµV. If output response is flat, these levels are approximately 4 dB lower.

Output 2 and 4 control

Outputs 2 and 4 can be independently enabled or disabled. Disabling output 2 adds 4 dB to output 1 levels. Disabling output 4 adds 4 dB to output 3 levels.

When enabled, output 2 and 4 levels follow outputs 1 and 3, respectively, at 0 dB offset. The levels can be adjusted by inserting JDA series attenuators to plug-in slots. The plug-in slots are automatically bypassed if no attenuator is installed.

ALC

ALSC (Automatic Level and Slope Control) in AC9000 adjusts only level, not slope, thus the term ALC is also used. Forward path slope is automatically adjusted only during pilot based automatic alignment. Outputs 1 and 3 are adjusted independently.

AC9000 uses the transponder RF level measurement unit to sequentially measure signal levels of output 1 and output 3 at user defined pilot frequencies. The measurement unit is also used to measure the forward path spectrum and return path ingress frequencies.

ALC keeps the output signal levels stable irrespective of input signal level variations by adjusting the interstage level control based on the pilots. Level is adjusted slowly in small steps to guarantee stable operation in long amplifier cascades.

AC9000 has high main pilot, low main pilot and high reserve pilot for both outputs. The high pilot is used to control interstage level. The low pilot is not used by ALC. It is only used for slope control during pilot based forward path automatic alignment. Pilot target levels for all six pilots can be independently configured by the user.

Setting all pilot frequencies to 0 MHz will effectively disable ALC for that output. This can be used in cases when ALC functionality is only desired at one output, leaving the other output in manual control. Setting low pilot frequency to 0 MHz will disable slope adjustment during pilot based forward path automatic alignment.

If either output 1 or output 3 interstage level control is adjusted against its limit, AC9000 gives "ALC saturated" alarm but continues to adjust the other output as long as possible.

If the high main pilot is lost, i.e. its level falls below "Lost level", AC9000 uses the high reserve pilot for ALC and gives "ALC main pilot missing" alarm.

If both high main and high reserve pilots are lost, AC9000 gives "ALC all pilots missing" alarm and, depending on user selection, either freezes the level control for that output or slowly steps it to predefined value. The other output continues to adjust normally.

Forward path pilot based alignment

The forward and return paths can be automatically aligned with a single pushbutton, provided that transponder is installed and the feature is enabled with correct Product Key. Correct pilot settings need to be programmed, either at the factory or by the user.

If low main pilot is enabled, i.e. its frequency is >0 MHz, it will be used for slope adjustment during pilot based alignment. If it is disabled, i.e. its frequency is 0 MHz, slope will not be adjusted during pilot based alignment.

Pilot based alignment can be activated with transponder front panel "Set" button, if it is enabled in software. This button also activates return path OMI based alignment after forward path alignment has been successfully completed. It is also possible to activate forward or return path automatic alignment procedures separately via the user interface.

The pilot based alignment adjusts the optical receiver module gain and OLC offset together with node level and slope settings so that pilot targets are reached while simultaneously optimising node performance and making sure ALC has enough adjustment range.

The pilot backoff values need to be set for correct slope adjustment during automatic alignment in intelligent AC amplifiers. They are not used in AC9000.

When forward path pilot based alignment starts, the "ALSC" led starts blinking in green. If the alignment completes successfully, the calculated level/slope values are taken into use, ALC is activated and the led returns to its normal status dictated by ALC related flags, i.e. usually green. If the alignment stops due to an error, the led flashes in red for a couple of seconds, all controls return to their original values and ALC is not activated.

Possible pilot based alignment error reasons and their explanations, which are displayed in the dialog box when the alignment is started via the user interface (see also Figure 15):

- "*Pilot target out of range*": Main pilot target levels are outside 80…120 dBµV range, low pilot target level is above high pilot target level, or high and low pilots have less than 100 MHz between them.

- "*Optical input power out of range*": Measured optical input power is below -8 dBm, or optical receiver module is missing or disabled.

- "*Pilot not found*": Measured high main or low main pilot (if enabled) level is below 75 dBµV. Pilot frequency may be incorrect.

- "*Interstage slope out of range*": Calculated output 1 interstage slope is outside -1…20 dB range.

- "*Interstage 2 slope out of range*": Calculated output 3 interstage slope is outside -1…20 dB range.

- "*Gain out of range*": Calculated value for optical input module gain, output 1 or output 3 interstage level control is outside adjustment range or interstage level control is less than 1 dB from adjustment range limit, not leaving room for ALC adjustments.
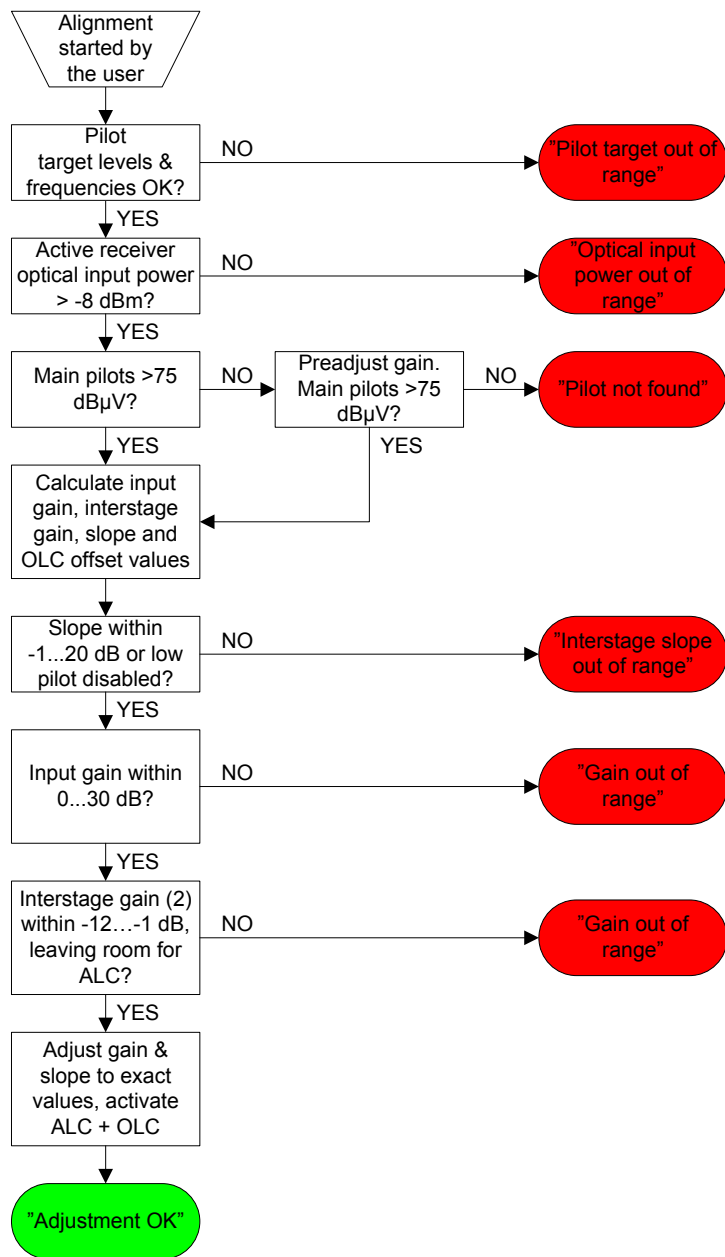
Figure 15. Simplified forward path pilot based alignment flowchart

Forward path OMI based alignment

Forward path can be also aligned based on the desired output 1 and output 3 levels and the OMI of the optical transmitter feeding forward path signal to AC9000. This feature does not need transponder module and Product Key activation.

The OMI based alignment adjusts only optical receiver module gain and OLC offset and interstage level controls. Slope control is not adjusted. OMI based alignment accuracy is typically worse than with pilot based alignment.

The transmitter OMI, output 1 and output 3 target levels and slope values need to be programmed, either at the factory or by the user.

If the alignment completes successfully, the calculated level and level values are taken into use and OLC is activated. If the alignment stops due to an error, all controls return to their original values and OLC is not activated.

Possible OMI based alignment error reasons and their explanations, which are displayed in the dialog box when the alignment is started via the user interface:

- "*Optical input power out of range*": Measured optical input power is below -8 dBm, or optical receiver module is missing or disabled.

- "*Gain out of range*": Calculated value for optical input module gain, output 1 level or output 3 level is outside adjustment range.

Spectrum analyser

AC9000 spectrum analyser can be used to measure and monitor output 1 and output 3 forward path signals, provided that transponder is installed and the spectrum analyser feature is enabled with correct Product Key.

Up to 100 measurement frequencies with individual peak / average detector (for PAL / QAM signals, respectively) selection and high / low limits can be specified by the user separately for each output. The measurement frequencies, detector types and alarm limits can be specified separately for each output port. It is also possible to measure and monitor only one port.

The spectrum analyser uses the same tuner unit than ALC pilot measuring and ingress analyser. Pilot measurements have higher priority, but when pilots are stable and no level adjustment is needed, spectrum and ingress analysers get more time.

Each measurement frequency can have both, either or no alarm limits. The measurement result is compared against its limits. When all frequencies have been measured the number of output 1 measurements exceeding their limits is compared to the "Tolerance" parameter and the "Spectrum out of limits" alarm status is updated. The "Spectrum 3 out of limits" alarm is generated in the same way from output 3 measurements. The "Tolerance" parameter can be used to fine-tune alarm sensitivity; default value 0 activates the alarm even if only one measurement result exceeds its limits.

Return path

Optical transmitters

Optical transmitter modules have an internal pilot generator which can be controlled via user interface separately from the transponder return path pilot generator. The optical modules' pilot generator can be disabled or set to 4.5/5.5 MHz (depending on HW version) or 6.5 MHz. See spec sheet for details.

Optical transmitter module laser bias current is measured and monitored. The major alarm limits are also used in return path backup switching logic.

The "Bandwidth" setting of the optical transmitter module should be set according to installed diplex filters.

Optical transmitter RF stages are shut down to save power for transmitters not receiving signal from the routing matrix. However if the transmitter's pilot signal generator is enabled, the RF stages are always active. Laser is always on.

Return path routing and backup

Return path signal routing and backup modes can be configured independently of forward path routing and backup configuration.

AC9000 currently supports 8 return path signal routing modes (see Figure 16):

- **Mode 1**: All RF ports combined to optical transmitter 1.

- **Mode 2**: RF ports 1 + 2 to Tx1, RF ports 3 + 4 to Tx3.

- **Mode 3**: RF ports 1 + 3 to Tx1, RF ports 2 + 4 to Tx2.

- **Mode 4**: RF port 1 to Tx1, RF port 2 to Tx2, RF ports 3 + 4 to Tx3.

- **Mode 5**: All RF ports to respective transmitters.

- **Mode 6**: RF ports 1 + 2 to Tx1, RF ports 3 + 4 to Tx2.

- **Mode 7**: RF ports 1 + 2 to Tx1, RF port 3 to Tx3, RF port 4 to Tx4.

- **Mode 8**: All RF ports to respective transmitters. Differs from Mode 5 only in backup switching, see Figure 16.

Return path backup can be set to three modes:

- **No backup**: The selected signal routing mode stays the same even if optical input is missing or receiver modules are removed or transmitter laser bias current fails.

- **Automatic**: The signal to a specific optical transmitter is routed to associated backup transmitter if any of the following is true (see Figure 16):

  o The transmitter is missing or its laser bias current is outside major alarm limits

  o The related optical receiver is missing or disabled or its optical input power is below low alarm limit

- **Automatic with manual restore**: Identical to "Automatic" mode, except that the original routing is not restored automatically. The user has to select "No backup" and then "Automatic with manual restore" again to restore the original routing.
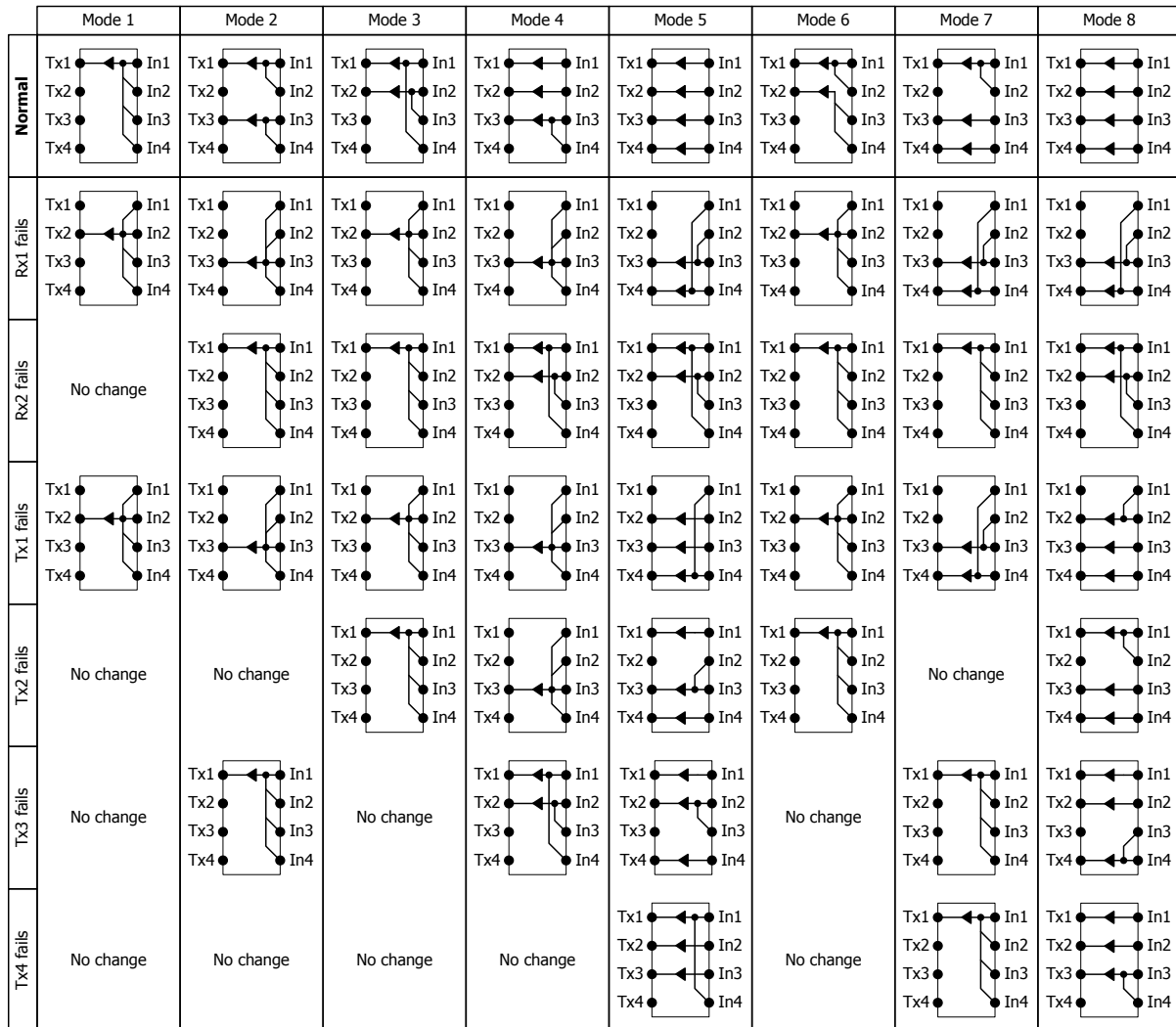
Figure 16. Return path signal routing

OMI test point

The single OMI test point of AC9000 can be used for measuring all the optical transmitter module's OMI. Each installed module is connected to the F connector for 10 seconds, then the next one for 10 seconds, and so on. It is also possible to override this feature via the user interface and connect the F connector to a single transmitter. AC9000 reverts to OMI testpoint cycling after ~30 minutes.

Return path level adjustment

Return path levels can be adjusted independently in 0.5 dB steps between -20 and 0 dB.

Ingress control switches

Ingress control switches are independent for all inputs and can be used to attenuate return path or to cut it off completely. Ingress measurement and modem communication are not affected by ingress switch, thus it is possible to monitor incoming ingress and communicate with RF modem even when return path is cut off.

Ingress control switches can also be controlled automatically based on detected ingress, separately for each input. When automatic attenuation during ingress alarm is enabled, ingress control switches are disabled from the user and AC9000 operates them between "0 dB" and "attenuated" values.

When "Ingress alarm" alarm of an input is active for at least "activation delay" time, ingress control switch for that input will go to attenuated state. When "Ingress alarm" is not active for at least "deactivation delay" time, ingress control switch will return to 0 dB state. These delays allow fine-tuning the operation and prevent unwanted switching on spurious signals. Note that ingress alarm status is only updated after each ingress measurement cycle.

The default attenuation value 6 dB can be adjusted independently for all inputs between 3 and 10 dB to further fine-tune the automatic ingress attenuation feature.

Return path OMI based alignment

The return path OMI based alignment is performed after the user has pressed transponder front panel "Set" button and forward path alignment has completed successfully. It is also possible to start return path OMI based alignment via user interface, also when transponder is not installed. See "Forward path" chapter for details on forward path, ALC and automatic alignment.

Return path OMI based alignment adjusts level controls independently based on the target OMI-% of the optical transmitter and the estimated RF level at return path input port. The target OMI (common for all ports) and RF input level (separately for each port) values need to be programmed either at the factory or by the user before starting the alignment.

If the alignment completes successfully, the level control values are taken into use and the "ALSC" led flashes in green for a couple of seconds. If the alignment stops due to an error, the level controls are set to closest possible value and "ALSC" led flashes in yellow for a couple of seconds.

Possible OMI based alignment error reasons and their explanations, which are displayed in the dialog box when the alignment is started via the user interface:

- "*Gain out of range*": Calculated value for one or more level control(s) is outside adjustment range.

Ingress analyser

AC9000 ingress analyser can be used to measure and monitor return path signals, provided that transponder is installed and the ingress analyser feature is enabled with correct Product Key.

Up to 20 measurement frequencies with individual peak / average detector (for signals / noise, respectively) selection and high warning / high alarm limits can be specified by the user. The measurement files containing frequencies, detector types and alarm limits can be specified separately for each input port. It is also possible to measure and monitor only some of the ports.

The ingress analyser uses the same tuner unit than ALC pilot measuring and spectrum analyser. Pilot measurements have higher priority, but when pilots are stable and no level adjustment is needed, spectrum and ingress analysers get more time.

Each measurement frequency can have both, either or no alarm limits. Each measurement result is compared against its limits. When all frequencies have been measured the number of measurements exceeding limit is compared to "Tolerance" parameter and "Ingress warning (2/3/4)" and "Ingress alarm (2/3/4)" statuses are updated. The "Tolerance" parameter can be used to fine-tune alarm sensitivity; default value 0 activates the alarm even if only one measurement result exceeds its limits.

When ingress is to be measured, measurement frequencies should be selected so that there are no other return path signals nearby. Selecting a measurement frequency close to other signals will affect the dynamic range of the ingress analyser.

Ingress analyser alarm can also be used to trigger automatic return path ingress switch attenuation.

Return path pilot generator

AC9000 return path pilot generator can be activated when transponder is installed and the feature is enabled with Product Key. It is supported by AC6990 and AC6991 transponders.

There can be up to 4 user programmable pilot frequencies in the frequency range of 5…65 MHz (0.1 MHz steps). The pilot generator signal (and also the RF modem transmit signal) is fed to all return transmitters regardless of the return path signal routing settings. Pilot levels are specified at the transponder output as with modem transmit levels, and restricted to 75…100 dBµV range. The viewer displays resulting equivalent input level, i.e. the level at which a signal should be injected to return path inputs to appear at equivalent level with the generated pilot signal at return path output.

When the pilot generator is enabled, AC9000 outputs one of the pilot signals for a user defined pilot duration, then switches to the next pilot signal and then repeats again. The pilot duration parameter is ignored if only one pilot signal is activated.

Possible RF modem transmissions occur asynchronously, i.e. in the middle of any pilot transmission. Pilot output is switched off during modem transmission and resumes after the modem transmission has been completed.

Pilot signals closer than 0.3 MHz from modem transmit frequency are not generated. Pilot signals can cause problems to modem communication if the pilot is close to modem frequency and pilot level is high compared to modem transmit level. Thus it is recommended to keep pilots at least 0.5 MHz from modem frequency.

Detection of these time domain multiplexed return path pilot signals can be accomplished at head end with e.g. a standard spectrum analyser instrument used in "Max hold" mode, or with another amplifier/node capable of return path signal measurement.

Remote communication

The transponder module is used for remote communication. Software version 3.0 and above supports AC6990, AC6991 and AC6980 transponders and CATVisor, HMS and DOCSIS communication protocols.

With AC6990 and AC6991 it is possible to set the communication protocol to CATVisor or HMS via the user interface. CATVisor protocol is compatible with Teleste CATVisor Commander and EMS system. HMS protocol uses SNMP for remote communication and can thus be used also with 3rd party management software. It is possible to change between CATVisor and HMS also remotely. All modem related settings should be carefully reviewed before changing the protocol to avoid loss of remote communication.

With AC6980 the remote communication protocol is SNMP. CATVisor protocol is also supported and thus e.g. CATVisor SmartLoader can be used.

The reported modem receive and transmit levels are measured at transponder RF input and output ports. The receive level is directly related to amplifier forward path output level. Transmit level vs. amplifier return path input level varies with return path gain as depicted in technical specification.

Transponder "Modem" led is dark while the unit is scanning for communication channel and blinks while it is establishing the communication link. During normal communication the led colour is decided from modem-related alarms.

Forward path signal routing and transponder signals

In 1st generation AC9000 (see "AC9000 generations" chapter) both output 1 and output 3 are connected to transponder slot via software controlled RF switch. The switch position is changed dynamically according to forward path signals (pilot / spectrum) to be measured. Thus also the remote management modem receive signal is changed between ports 1 and 3.

This means that the same management signal must be present in both ports. In "dual node" mode is it thus necessary to inject the same management signal into both optical receivers.

With AC6990 and AC6991 CATVisor / HMS transponders the AC9000 software can change the switch position synchronously with the modem packet reception so that packet loss will not occur. Also the modem receiver is able to resynchronise so fast that timing differences and/or RF level differences between ports 1 and 3 do not affect remote communication.

However, with AC6980 DOCSIS transponder it is not possible to synchronise the RF switch with modem communication due to the higher data rates of DOCSIS communication. Thus some minor (< 1%) packet loss will naturally occur if the switch is changed during packet reception. If the output level difference between outputs 1 and 3 is big, or there is timing difference due to signal propagation delays in "dual node" mode, typical packet loss can increase due to longer receiver resynchronisation time.

In 2nd generation AC9000 the RF interface to AC6980 transponder has been modified so that the management signal is taken always from output 1 and the RF switch signal line is used only for pilot / spectrum measurements. Thus no packet loss will occur and it is enough to have the management signal in output 1 of 2nd generation AC9000. AC6990 and AC6991 transponders do not support this new transponder RF interface, so they need management signal to be present at both ports also with 2nd generation AC9000.

Return path signal routing and transponder signals

The transponder transmit signals (and also return path pilot generator in AC6990 and AC6991) are fed to all optical transmitters by default. When the same signal is transferred to the headend via different optical links with different propagation delays and then combined again before feeding to HEC / HMTS / CMTS, it can interfere with itself and cause poor performance or communication loss.

AC9000 allows selecting which return path inputs receive the modem transmit signal. This makes it possible to prevent the multi-path propagation problem. AC9000 software uses the routing matrix to determine which return transmitters the modem signal should be connected to based on the selected inputs. Thus the modem signal routing changes dynamically with return path signal routing changes during e.g. backup operation. Note that this also affects AC6990 and AC6991 transponder return path pilot generator signals.

CATVisor modem functionality

After reset the transponder starts scanning for HEC (HeadEnd Controller, e.g. Teleste HDM100 T) carrier within the user specified frequency range. When a communication channel is found, it waits for registration slot and sends its registration request. If the HEC accepts the registration, transponder enters normal communication mode where it is periodically polled by the HEC.

If the registration fails, or transponder is in normal communication mode but doesn't receive any packets from the HEC it starts scanning again. During registration the HEC sends communication parameters such as transmitter frequency and transmitter level.

All communication between the transponder and CATVisor Commander, EMS or SmartLoader is done with UDP/IP packets via the HEC. This means that transponder IP address has to be unique and match HEC's subnet settings.

HMS modem functionality

HMS mode is similar to CATvisor mode. The transponder scans for HMTS (Hybrid Management Termination System, e.g. Teleste HDM100 H) carrier. Transmit level is not set by the HMTS and thus has to be adjusted manually. In HMS the behaviour when forward communication is lost is controlled by the HMTS settings.

For details on HMS modem functionality, please refer to HMTS documentation and HMS standards.

DOCSIS modem functionality

AC6980 transponder acts as a standard DOCSIS 2.0 cable modem. It scans through the whole forward path band. There are no communication settings available for user, everything is done automatically as commanded by the CMTS (Cable Modem Termination System). Depending on the CMTS and headend LAN settings it is usually necessary to configure the transponder MAC address to DHCP server and allow SNMP (UDP ports 161 and 162) and CATVisor (UDP port 2500) traffic to transponders.

Establishing connection

All the needed configurations and adjustments can be carried out locally or remotely by using the CATVisor Commander software. Detailed CATVisor Commander hardware requirements and installation instructions can be found from the User Manual supplied with Commander.

Connection to AC9000 is possible using the following methods:

Local configuration with PC through standard USB port

Commander 2.7 or later is needed for USB support.

Connection to AC9000 USB port can be done with a standard USB A plug to USB mini B plug cable, or via AC6901 USB to Bluetooth adapter. The cable or adapter should be disconnected when not in use to avoid possible EMC problems caused by the cable acting as an antenna.

Windows may ask for USB driver when connecting to AC9000 via USB for the first time. If not found automatically, the driver can be found in 'C:\Program Files\Common\Teleste\Drivers', select 'telestecdc.inf' file. During the installation Windows may ask if it should stop the installation because the installation file is not signed. Select 'Continue Anyway'.

AC9000 will draw power from the USB connector for its microcontroller and memory if no external power supply is available. This makes it possible to configure AC9000 settings and update the software without any power supply.

Note that as only the CPU part of the unit is powered via USB and many parameters visible via the user interface may display incorrect values. Installing and removing plug-in modules while the unit is USB powered is not recommended and may lead to unexpected behaviour.

The USB connector in AC6980 transponder front panel is reserved for remote management connection.

Remote CATVisor connection

Remote IP connection via a HEC (e.g. Teleste HDM100 T) with AC6990/AC6991 transponder. Transponder IP address has to be correctly set before remote IP communication is possible. It has to match the subnet settings of the HEC's HFC network interface and it must also be unique for each transponder.

Note that it is also possible to set the IP address remotely via the HEC, see HEC documentation for details.

Remote HMS connection

Remote SNMP connection via a HMTS (e.g. Teleste HDM100 H) with AC6990/AC6991 transponder. AC9000 can be accessed remotely using an SNMP Manager application. Usually there is no need to pre-configure any communication parameters to establish connection with the HMTS. However, the selected installation procedure may include presetting e.g. the IP address, transmit level and the forward path frequency scanning limits.

Remote DOCSIS connection

Remote SNMP connection via a CMTS with AC6980 transponder. AC9000 can be accessed remotely using an SNMP Manager application. The CMTS system must be preconfigured to accept the transponder and the used protocols.

Alarms

The module alarms, also known as "flags", displayed in CATVisor Commander and EMS are described in the table below. Equivalent SNMP traps are also available via remote connection with HMS and DOCSIS protocols.

The affected led and factory default severity settings are presented next to each alarm in Table 3. All alarm severities (Major / Minor / Notification / Disabled) and alarm limits can be fully configured by the user. See the 'Monitoring' chapter for more details.

Note that some alarm limits (e.g. remote AC supply voltage) are factory configured so that alarms will only appear when hardware specifications are exceeded. The alarm limits should be reconfigured to match network parameters if more precise monitoring is needed.

Alarm text	Description & suggested corrective action	Led	Default severity
Temperature high	Temperature is above high limit.	Status	Major & Minor
Temperature low	Temperature is below low limit.	Status	Minor
AC voltage high	AC voltage is above high limit.	Status	Minor
AC voltage low	AC voltage is below low limit. As some units are equipped with mains power supply, this alarm is disabled as factory default and should be enabled by the user if AC voltage is to be monitored.	Status	Disabled
+24V voltage high	+24V voltage is above high limit. Common for both power supplies.	Status	Major & Minor
+24V voltage low	+24V voltage is below low limit. Common for both power supplies.	Status	Major & Minor
+12V voltage high	+12V voltage is above high limit.	Status	Major & Minor
+12V voltage low	+12V voltage is below low limit.	Status	Major & Minor
Optical Rx 1/2 level high	Optical receiver 1/2 input power is above high limit.	OptRx1	Major
Optical Rx 1/2 level low	Optical receiver 1/2 input power is below low limit. The major alarm is used for backup switching logic.	OptRx1	Major
Optical Tx 1/2/3/4 laser current high	Optical transmitter 1/2/3/4 laser current is above high limit.	Status	Minor
Optical Tx 1/2/3/4 laser current low	Optical transmitter 1/2/3/4 laser current is below low limit.	Status	Minor
Unknown module	Device is not able to recognize other module(s). Possible reason is old embedded software or bad installation of the transponder or optical modules. If the embedded software is up to date and removing and reinstalling the modules doesn't help, it should be sent to service.	Status	Major
Internal error	Device has an internal error. If resetting the unit does not help, it should be sent to service.	Status	Major
Lid open	Transponder's light sensor light level has been above limit during last minute. Generated only if transponder is installed.	Status	Notification
Return path off	Return path is turned off by user. Common for all return paths.	Status	Notification
Return path attenuated	Return path is attenuated, either by user or automatically due to ingress. Common for all return paths.	Status	Notification
Settings changed	Unit's settings have been modified by user during last minute.	Status	Notification
Application started	Unit was reset or rebooted during last minute.	Status	Notification
Service terminal connected	There has been activity on local USB connector during last minute.	Status	Notification

Modem receive level low	RF modem receive level is too low for reliable communication. Generated only if transponder is communicating. Not generated with AC6980 DOCSIS transponder.	Modem	Minor
Modem not connected	RF modem is not communicating. Generated only if transponder is installed.	Modem	Notification
Modem transmit level saturated	Commanded transmit level is outside range. RF modem transmit level is saturated at minimum or maximum value. Generated only if transponder is communicating and minimum < maximum. Not generated with AC6980 DOCSIS transponder.	Modem	Notification
Tuner module error	Internal error in transponder's level measurement unit. May be due to out-of-range measurement frequencies. If resetting the unit doesn't help, it should be sent to service. Generated only if transponder is installed.	Status	Major
ALC all pilots missing	Output 1 and/or output 3 all pilots are missing. Generated only if transponder is installed and ALC is enabled	ALSC	Major
ALC saturated	Output 1 and/or output 3 ALC is saturated, i.e. level adjustment limits have been reached. Generated only if transponder is installed and ALC is enabled.	ALSC	Minor
ALC main pilot(s) missing	Output 1 and/or output 3 main pilot is missing; ALC uses reserve pilot. Generated only if transponder is installed and ALC is enabled.	ALSC	Notification
ALC off	Transponder is installed but ALC is switched off by user. Or ALC is switched on by user but transponder is missing.	ALSC	Notification
Spectrum 1/3 out of limits	Spectrum analyser measurement results for output 1/3 are not within high/low limits.	Status	Minor
Ingress 1/2/3/4 warning	Return path ingress measurement results of port 1/2/3/4 are above warning limits.	Status	Minor
Ingress 1/2/3/4 alarm	Return path ingress measurement results of port 1/2/3/4 are above alarm limits.	Status	Major
Powered from USB	Processor powered from USB, rest of motherboard not alive.	Status	Notification
Backup activated	Forward path routing and/or return path routing has switched to backup mode.	Status	Notification

Table 3. AC9000 alarms in CATVisor / HMS

Led usage

Modem related alarms are indicated with transponder "Modem" led, ALC related alarms are indicated with transponder "ALSC" led, other alarms are indicated with AC9000's "Status" led with the exception of optical alarms which are indicated with optical receiver's status led. The affected led and factory default severity settings are presented next to each alarm in Table 3. Alarms with "notification" severity do not affect leds.

ALSC led		Description
	red	ALC enabled, ≥1 major alarm
	yellow	ALC enabled, ≥1 minor alarm
	green	ALC enabled, no alarms
	green blink	Automatic alignment running
	yellow blink	Automatic alignment targets not fully achieved
	red blink	Automatic alignment stopped due to an error
	dark	ALC off

Modem led		Description
	red	Modem connected, ≥1 major alarm
	yellow	Modem connected, ≥1 minor alarm
	green	Modem connected, no alarms
	green blink	Modem registering
	dark	Modem not connected

Optical receiver led		Description
	red	Optical power high major alarm
	yellow	Optical power low major alarm
	green	Optical power within major alarm limits
	dark	Optical receiver disabled

Status led		Description
	red	≥1 major alarm (other than modem/ALC/OptRx)
	yellow	≥1 minor alarm (other than modem/ALC/OptRx)
	green	No alarms (other than modem/ALC/OptRx)
	red blink	Software cannot start
	dark	Software / CPU / power failure

Product key activation of advanced features

Some AC9000 software features need to be activated with correct product key:

- Automatic forward and return path alignment

- Forward path spectrum analyser

- Return path ingress analyser with automatic ingress control and filtering

- Return path pilot generator

The activation can be done when ordering the product and also later by contacting Teleste support. CATVisor Commander user manual provides more details on entering the product key.

Transferring AC9000 settings

All user accessible settings are stored on the motherboard memory. Thus plug-in modules can be changed without losing any settings.

A "Settings Saver" DLL component for AC9000 is included in the latest DUS100 viewer packet release. It can be used with CATVisor Commander and CATVisor SmartLoader to transfer partial or complete device settings between a file and AC9000. This feature can be accessed through Commander > "Tools" > "Load/Save element configuration" when it has been activated with correct serial number. SmartLoader supports also transferring settings from/to multiple units simultaneously.

Note that the Settings Saver component uses CATVisor protocol and cannot thus be used remotely with HMS communication protocol.

The settings are stored as *.ECML files in XML format. These files can be also edited with standard text editors, provided that the XML tags and structure are maintained. Tags can be removed to create partial settings files. This makes it easy to download e.g. new pilot target levels to multiple units simultaneously.

The settings saver ECML files can also be edited in user-friendly format with an Excel tool. This tool can be downloaded from Teleste Club. The settings saver ECML files can also be used for specifying factory settings when ordering preconfigured AC9000.

AC9000 will draw power from the USB connector for its microcontroller and memory if no external power supply is available. This makes it possible to configure AC9000 settings and update the software without any power supply.

Note that as only the CPU part of the unit is powered via USB, many parameters visible via the user interface may display incorrect values. Installing and removing plug-in modules while the unit is USB powered may lead to unexpected behaviour.

Settings download and upload is possible only to installed and enabled modules. This means that it is not possible to set the optical input power alarm limits of a disabled optical receiver module or read the pilot settings of a missing optical transmitter module.

Downloading device settings containing modem parameters over remote connection may cause loss of remote connection. Thus some settings may be not written correctly. If modem parameters need to be written, it is recommended to put them into a separate ECML file which is downloaded after other settings.

Updating AC9000 software

New software versions for AC9000 are published at Teleste Club. These may contain bug fixes, enhancements and completely new features. For details see "AC9000 software release history" document also available in the Club.

AC9000 software can be updated locally via USB using CATVisor Commander or remotely via modem connection using CATVisor Commander or SmartLoader or 3rd party download tool. AC9000 stays fully operational during the update, i.e. RF paths are not affected, ALSC continues to operate etc. During the update no other communication except software update is replied, so the management system may report the AC9000 as missing during the update.

The new software is taken into use after it has been completely downloaded and the device is reset. The reset takes a couple of seconds after which the device is fully functional and running the new software. If the download fails, AC9000 continues to use its previous software.

For CATVisor updates the same file is used for both local and remote update.

For remote SNMP update a different file must be used.

Local update

AC9000 software can be updated locally via USB using CATVisor Commander. Local software update of AC9000 takes ~1 minute.

AC9000 will draw power from the USB connector for its microcontroller and memory if no external power supply is available. This makes it possible to configure AC9000 settings and update the software without any power supply.

Remote update – CATVisor protocol

Remote update for CATVisor is done using CATVisor Commander or SmartLoader. It is also possible to download new software to multiple devices simultaneously without resetting them and take the new software into use later by sending a broadcast reset with CATVisor SmartLoader.

Remote update – HMS protocol

Remote update for HMS is done using SNMP protocol according to the standard HMS-DOWNLOAD-MIB. Special software tools are available for this purpose. Please refer to the documentation of the specific tool in use.

Remote update – DOCSIS protocol

AC9000 software can be updated remotely with either CATVisor or HMS protocols as described above.

Updating transponder software

AC6991 and AC6980 transponders have their own tuner software which handles the pilot / spectrum / ingress measurements. The tuner software can be updated locally or remotely by using the methods above.

When the tuner software transfer has completed, it can take up to 1 minute for the transponder software to be updated by AC9000. Wait until the new software version appears in the user interface before removing power or the transponder.

AC6980 transponder DOCSIS software update

AC6980 transponder has its own DOCSIS software which handles the remote communication. This software is updated by using the standard DOCSIS methods, i.e. TFTP file download initiated by DHCP server configuration.

SNMP MIBs

The parameters of a unit in HMS or DOCSIS mode can be accessed remotely using SNMP MIBs (Management Information Base). Should they be needed for e.g. integration with 3rd part management systems, the Teleste-proprietary MIBs are available for download in Teleste Club. SCTE MIBs can be downloaded from SCTE website.

Supported MIBs for AC product family:

- RFC1213-MIB
- SNMPv2-MIB
- TELESTE-ROOT-MIB
- TELESTE-ACX-MIB
- TELESTE-COMMON-MIB
- TELESTE-HE-STATUS-MIB
- TELESTE-HMSMODEM-MIB
- TELESTE-ANALYSER-MIB
- TELESTE-PILOTGENERATOR-MIB
- TELESTE-ALARMS-MIB
- SCTE-HMS-PROPERTY-MIB
- SCTE-HMS-ALARMS-MIB
- SCTE-HMS-COMMON-MIB
- SCTE-HMS-FIBERNODE-MIB
- SCTE-HMS-DOWNLOAD-MIB

Viewer pages

This chapter presents AC9000 viewer pages used with local or remote CATVisor protocol connection. The viewer pages used with SNMP remote connection with HMS or DOCSIS protocols slightly different in layout but contain all the same parameters.

The viewer pages used to control AC9000 using CATVisor Commander or EMS are explained in this chapter. For a complete description of each feature, see corresponding "Features" chapter.

Some features may be greyed out, indicating that they can not be used at the moment due to e.g. missing plug-in module.

AC9000 viewer pages in CATVisor Commander / EMS:

- Status
- Forward path
- Return path
- Transponder (different pages for CATVisor / HMS / DOCSIS)
- Monitoring
- Spectrum
- Ingress
- Properties

Some viewer pages have fields with coloured background, e.g. "Temperature" on "Status" page. These colours indicate the alarms related to this field. Green means no alarms or notifications; red is major alarm, yellow is minor alarm and blue is notification.

Status viewer page
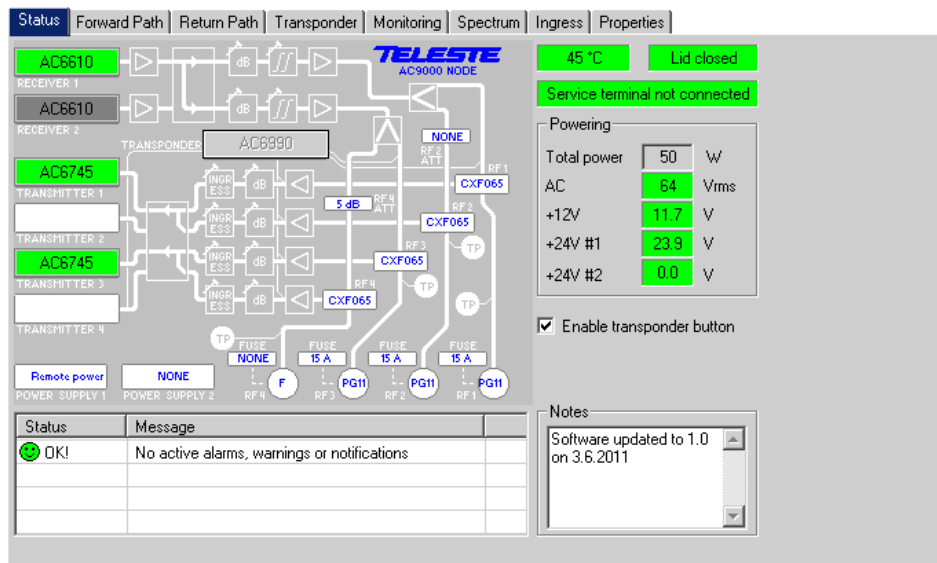
Figure 17. Status page

The Status page displays unit's alarm list together with measurement data and a graphical view of the current configuration similar to the actual station layout.

Alarm list

Each alarm in the alarm list on the bottom left corner is colour coded according to its severity. The severities can be configured through "Monitoring" viewer page. For additional information about alarms, see table of module alarm descriptions in the "Alarms" chapter.

Station layout

The transponder is detected automatically and represented as grey box. Some modules and plugs, e.g. fuses, cannot be detected automatically. These are presented with blue texts. Selecting a text tag representing a passive device will open a pull down selection list in which an appropriate device according the assembly can be selected. The user can also type in the desired information (up to 12 characters, 6 characters for fuses). The information entered in these fields does not affect unit operation in any way, it's just a "checklist".

See "Features" chapter for details on plug-in modules and configuration.

Measurements

The background colour of each field shows the parameter's alarm status. Alarm limits and severities can be configured through "Monitoring" page.

AC9000's internal temperature is displayed in top-left field next to layout view.

Lid status information is based on a light sensor in the transponder's front panel. "Lid open" is displayed if light level has been above limit during the last minute. In dark environment "Lid closed" may be displayed even if the lid is open. "Lid unknown" indicates that the transponder is not installed.

The "Service terminal" field shows whether there has been activity on the local USB service connector during the last minute.

The "Powering" frame displays measured supply voltages of the station.

The "Total power" field displays the estimated total power consumption of the AC9000 based on the installed modules, power supplies and selected routing and RF performance modes.

The "AC voltage" field shows true RMS value (DC+AC component) of the remote supply voltage. This value is calculated using sliding average and thus reacts quite slowly to changes. The factory default limit values are based on AC9000's power supply specifications and are thus quite broad. They should be adjusted to match the network's AC supply voltages if accurate monitoring is needed.

+12 V and +24 V factory default alarm limits are based on power supply specifications and usually shouldn't be altered.

Transponder front panel has a "Set" button which starts automatic alignment for both forward and return paths. The button can be disabled to prevent accidental presses by clearing the "Enable transponder button" checkbox.

Notes

The "Notes" field allows storing up to 100 character message into AC9000 non-volatile memory. It can be used e.g. as a reminder for the pilot settings.

Forward path viewer page
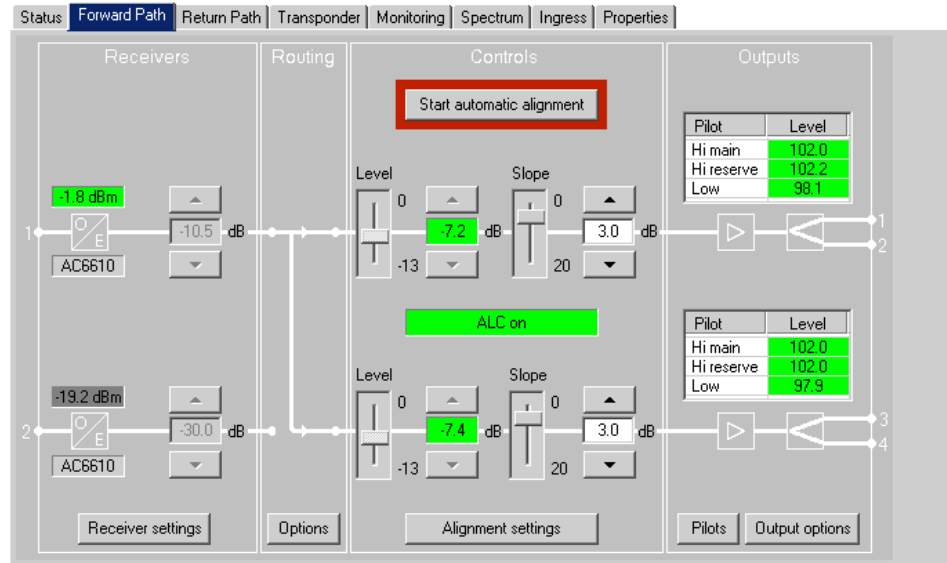
Figure 18. Forward path page

The "Forward path" page displays a graphical view of the forward path signal routing. Detailed setting dialogs can be opened with respective buttons. See "Forward path" chapter for details on forward path, ALC and automatic alignment.

Receivers

This section of the "Forward path" viewer page displays installed optical receiver types, statuses and optical input powers. The background colour of the optical input power field changes according to related alarms.

The gain field and up and down buttons can be used to adjust the level values in 0.5 dB steps in "Manual" adjustment mode. In "ALC + OLC" and "OLC" adjustment modes OLC has the control and this field is read-only.

The "Receiver settings" buttons opens a dialog box (Figure 19).
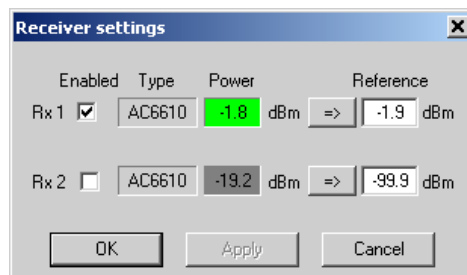
Figure 19. Forward path receiver settings dialog

Clearing the "Enabled" checkbox disables the optical receiver and forces the node to function as if the receiver module was not installed. The optical input power is still measured and displayed, but no alarms nor backup switching is done.

The background colour of the "Power" data field changes to indicate alarms.

The "Reference" field can be edited to store the optical input power value for future reference. The "=>" button opens a dialog box (Figure 20) which allows copying the current value to reference value. In the dialog it is also possible to enable optical input power minor alarm limits and set them according to the current value with user specified marginal, default ±1.0 dBm.
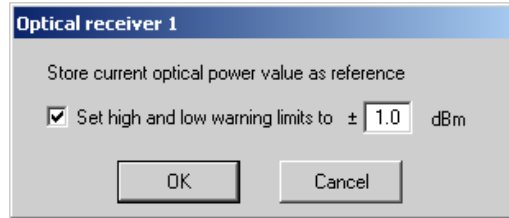

Figure 20. Forward path optical power reference dialog

Routing

This section of the "Forward path" viewer page displays the forward path routing status. The "Options" buttons opens a dialog box (Figure 21) for configuring the routing and backup. See "Forward path routing and backup" section in "Forward path" chapter for details on backup switching logic. The backup triggering alarm limits and deadband can be configured through "Monitoring" viewer page.
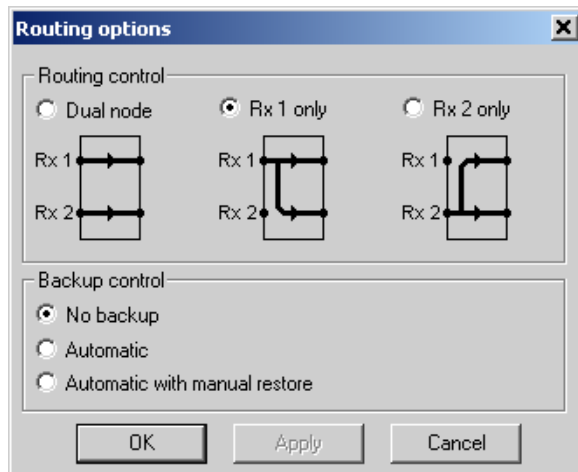
Figure 21. Forward path routing options dialog

Controls

This section of the "Forward path" viewer page contains the interstage level and slope controls, which can be adjusted by clicking the up and down buttons, dragging the sliders or typing a value into the fields. The availability of these controls depends on the selected adjustment mode.

The data field displays the ALC status:

− "ALC on": ALC is enabled and works properly.
− "ALC off": ALC is disabled by user.
− "ALC saturated": ALC is saturated (=adjustments limits reached), interstage 1 and/or 3 level is adjusted to limit.
− "ALC main pilot missing": Main pilot is missing. ALC uses reserve pilot.
− "ALC all pilots missing": All pilots are missing. ALC is frozen or using "go to" values.
− "No transponder": No transponder unit installed. ALC is disabled.

- "Tuner module error": Error in transponder tuner module. ALC is disabled.

Start automatic alignment

Clicking the "Start automatic alignment" button will start forward path pilot based alignment, provided that transponder is installed and the automatic alignment feature is enabled with correct Product Key. A dialog box (Figure 22) is opened which displays the status of the alignment.
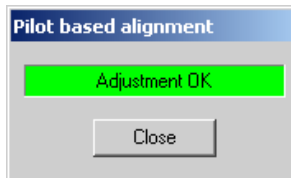

Figure 22. Forward path pilot based automatic alignment dialog

Alignment settings

Clicking the "Alignment settings" button opens a dialog box (Figure 23) for configuring the adjustment mode and automatic alignment settings.
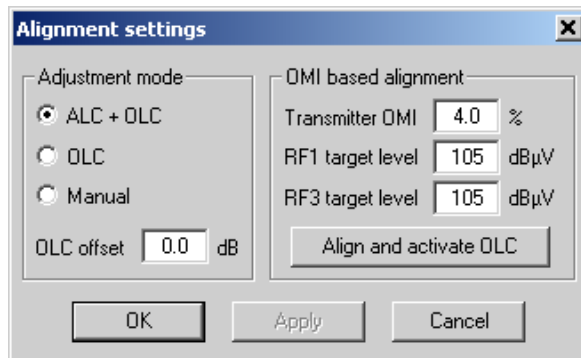
Figure 23. Forward path alignment settings dialog

The "Adjustment mode" controls how the forward path level is adjusted:

- ALC + OLC: This is a combination of adjustment functions where ALC (Automatic Level Control) measures the levels of pilot signals and adjusts interstage level control accordingly while OLC (Optical Level Control) adjusts optical receiver output level based on the optical input level. The OLC offset parameter is added to the optical receiver output level.

- OLC: OLC (Optical Level Control) adjusts optical receiver output level based on the optical input level. The OLC offset parameter is added to the optical receiver output level.

- Manual: All level and slope controls can be adjusted by the user. OLC offset has no effect.

See "Forward path level control" section under "Forward path" chapter for details on adjustment modes and OLC offset parameter.

Clicking the "Align and activate OLC" button will start forward path OMI based alignment. A dialog box (similar to Figure 22) is opened which displays the status of the alignment. The adjustment procedure is based on the desired "Transmitter OMI" (0…20%), "RF1 target level" and "RF3 target level" (80…120 dBμV) values given by the user.

Outputs

This section of the "Forward path" viewer page displays the measured pilot levels and output configuration. Pilot level background is green when the level is within +-1 dB from the target level, otherwise yellow, or "N/A" in grey if transponder is not installed.

Pilots

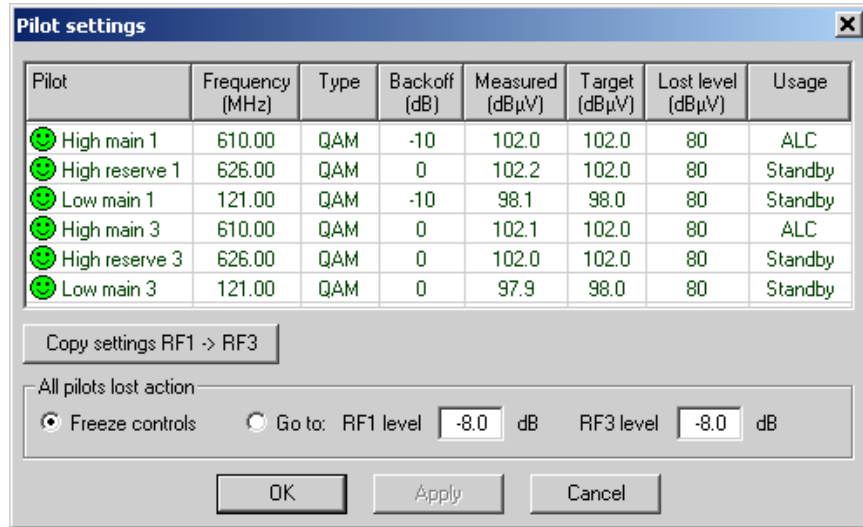The "Pilots" button opens a dialog box (Figure 24) for configuring the pilots.

Figure 24. Forward path pilot settings dialog

The pilot table consist of the following columns:

Pilot name: Icon and pilot name colour coding indicates pilot status: 🙂 green for pilot OK, ⊗ red for pilot lost.

Frequency (MHz): Pilot signal frequency, adjustable in 0.25 MHz steps. If 0 MHz is entered as pilot frequency, the pilot is disabled and thus it is not used in adjustment and no alarms of missing pilot are generated.

Type: Detector type. The measurement detector can be individually selected for each frequency to be either peak detect ("Analog") or averaging ("QAM").

Backoff (dB): Pilot signal backoff. For information only.

Measured (dBµV): Measured level of pilot signal.

Target (dBµV): Pilot signal target level for ALC operation.

Lost level (dBµV): Limit below which the pilot is considered as lost.

Usage: Shows whether pilot is used by ALC or not.

The pilot signal frequency, type, backoff, target level and lost level can be edited by double-clicking a row in pilot table. This opens a dialog box (Figure 25) with pilot's properties that can be edited by users with at least "Service" level user rights. After editing the pilot settings they must be taken into use by clicking "Apply" button.
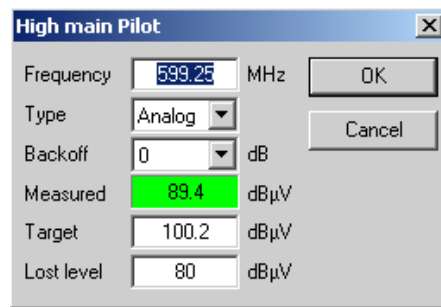
Figure 25. Forward path pilot signal configuration dialog

The "Copy settings RF1 -> RF3" button can be used to quickly copy all output 1 pilot settings to output 3 pilot settings.

When all pilots for an output are lost, AC9000 gives "ALC all pilots missing" alarm and operates as selected by "All pilots lost action" radio buttons:

− Freeze controls: Interstage level control keeps the value it had immediately before the pilot signals were lost.
− Go to: Level control will slowly step towards user defined value.

Output options

The "Output options" button opens a dialog box for configuring the outputs.
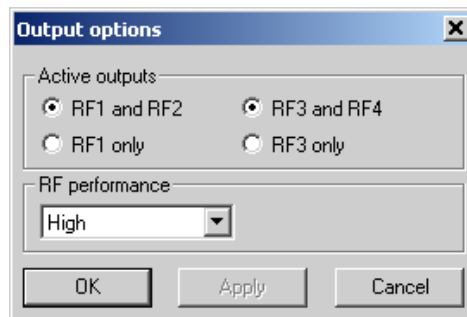
Figure 26. Forward path output options dialog

The active outputs can be selected with the radio buttons. The RF performance and power consumption of the output hybrids can be adjusted from the drop-down menu. For details on output options, see the "Forward path" chapter.

Return path viewer page
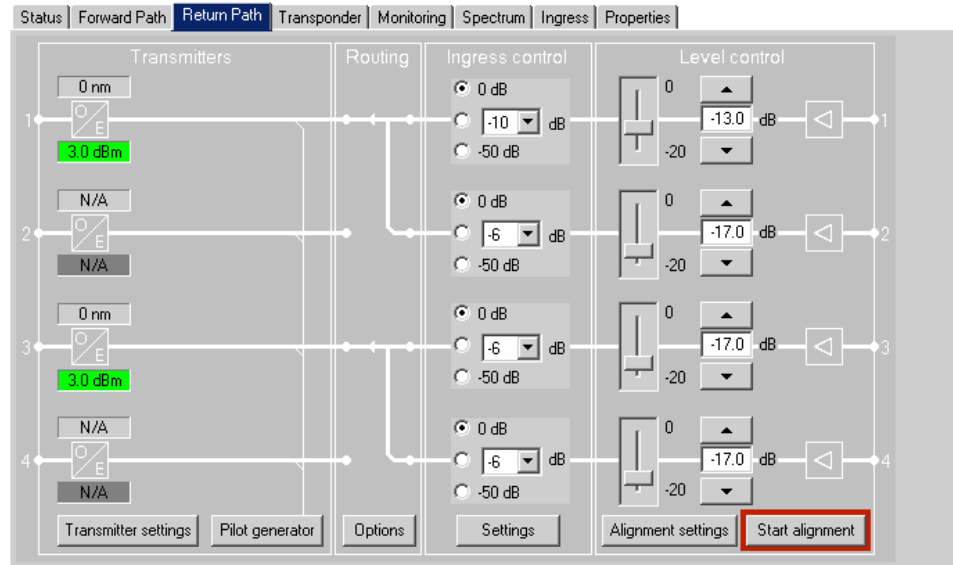
Figure 27. Return path page

The "Return path" page displays a graphical view of the return path signal routing. Detailed setting dialogs can be opened with respective buttons. See "Return path" chapter for details on return path and ingress control.

Transmitters

This section of the "Return path" viewer page displays installed optical transmitter types, wavelengths and nominal optical output powers. The background colour of the optical output power field changes according to alarms related to transmitter laser bias current.

The "Transmitter settings" button opens a dialog box (Figure 28) for configuring the transmitter modules.
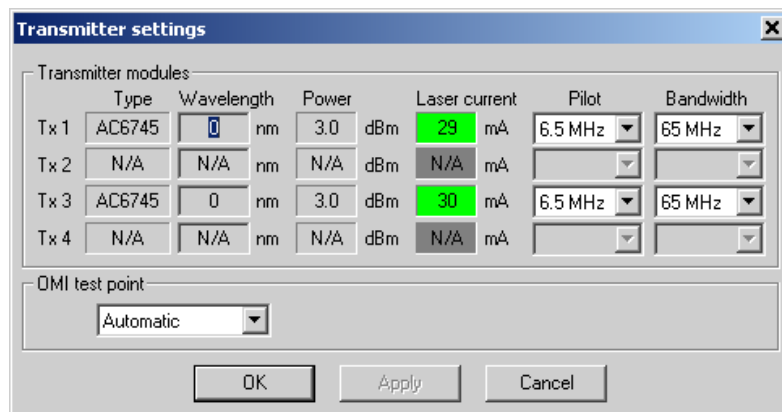
Figure 28. Return path transmitter settings dialog

The type and information about transmitter modules as well as measured laser currents are displayed. The background colour of the "Laser current" field changes to indicate alarms. The desired pilot signal frequency (4.5 (or 5.5 MHz in later HW versions, but shown as 4.5 MHz) or 6.5 MHz) is defined individually for each transmitter. The pilot signal can also be disabled. The "Bandwidth"

selection controls return path low pass filters. It has to be set to match the installed diplex filters. If the installed diplexers and "Bandwidth selection" do not match, the performance of the node may be severely deteriorated. The default value is 65 MHz.

In the default "Automatic" mode each installed transmitter is connected to the OMI test point F connector for 10 seconds, then the next one and so on. The connected transmitter can also be selected from the drop-down menu. OMI testpoint cycling is restored after ~30 minutes.

Pilot generator

The "Pilot generator" button opens a dialog box (Figure 29) for configuring the return path pilot generator available with AC6990 and AC6991 transponders.
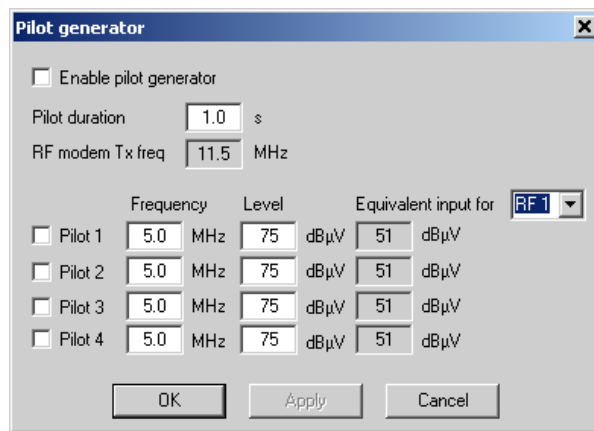
Figure 29. Return path pilot generator dialog

The pilot generator settings are active when AC6990 or AC6991 transponder is installed and the pilot generator feature is enabled with correct Product Key

The "Enable pilot generator" checkbox is the master switch for return path pilot generator. When the pilot generator is enabled, AC9000 outputs one of the pilot signals for a user defined "Pilot duration", then switches to the next pilot signal and then repeats again. The "RF modem Tx frequency" data field shows as read-only information the used transmitter frequency commanded by the HEC. The pilot generator signal is fed those return transmitters which are connected to RF inputs enabled in "Transponder signal routing" of "Routing options" dialog (Figure 30).

Pilot frequency, level and enabling can be controlled for all four pilots separately. Equivalent input level for the selected return path RF input is shown next to each pilot. It takes into account return path losses, gain setting and ingress switch setting. When ingress switch is set to "Off" the equivalent input level is not valid and shown as "N/A".

Routing

This section of the "Return path" viewer page displays the forward path routing status. The "Options" buttons opens a dialog box (Figure 30) for configuring the routing and backup. See "Return path routing and backup" section in "Return path" chapter for details on backup switching logic. The backup triggering alarm limits and deadband can be configured through "Monitoring" viewer page.

The transponder transmit signal can be routed to selected return path inputs. Note that this also affects AC6990 and AC6991 transponder return path pilot generator signals. See "Remote communication" chapter for details.

Optical transmitter RF stages are shut down to save power for transmitters not receiving signal from the routing matrix. However if the transmitter's pilot signal generator is enabled, the RF stages are always active. Laser is always on.
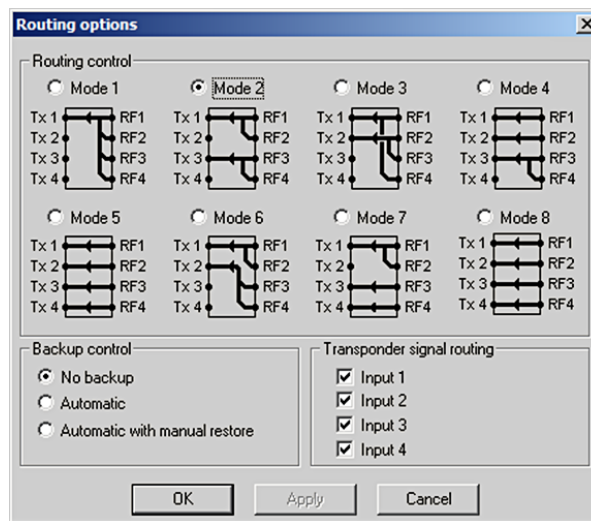
Figure 30. Return path routing options dialog

Ingress control

This section of the "Return path" viewer page contains the ingress switch controls. The "-50 dB" selection cuts off the incoming return path RF signal and thus disconnects all transponders behind this node, but the AC9000 itself can still measure return path ingress and communicate with its modem.

The ingress switch attenuation value can be adjusted between 3…10 dB. This can be used to fine-tune the automatic ingress attenuation feature.

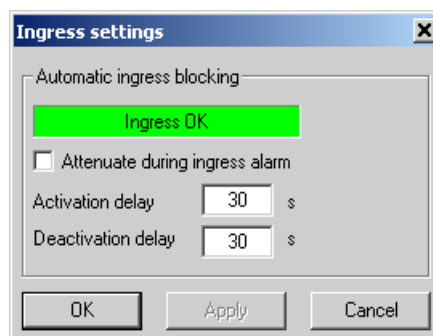The "Settings" button opens a dialog box (Figure 31) for configuring the automatic ingress blocking feature.

Figure 31. Return path ingress settings dialog

The Ingress measurement status is displayed on the top of the frame:

- "Ingress OK": Ingress measurement results are within limits.
- "Ingress warning": Ingress measurement results are above warning limits.
- "Ingress alarm": Ingress measurement results are above alarm limits.
- "Ingress analyser off": Analyser is disabled by user.
- "No transponder": No transponder module installed.
- "Tuner module error": Error in transponder tuner module.

When "Attenuate during ingress alarm" checkbox is selected, ingress switches are controlled by AC9000 based on "Ingress alarm" statuses and activation and deactivation delays. The activation and deactivation delays can be used to fine-tune this feature.

Level control

This section of the " Return path" viewer page contains the input level controls, which can be adjusted by clicking the up and down buttons, dragging the sliders or typing a value into the fields.

The "Alignment settings" button opens a dialog box (Figure 32) for configuring the OMI based alignment parameters. RF input levels can be entered separately for each input, or use same value by entering just the input 1 value and checking "Use for all".
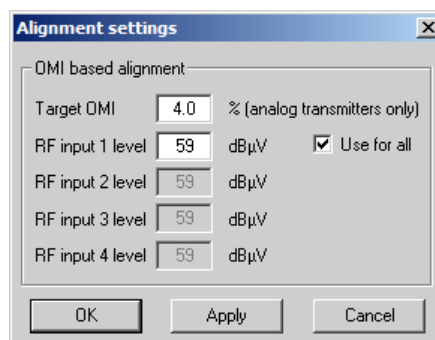

Figure 32. Return path alignment settings dialog

Start alignment

Clicking the "Start alignment" button will start return path OMI based alignment. A dialog box (similar to Figure 22) is opened which displays the status of the alignment.

Transponder viewer page (CATVisor)

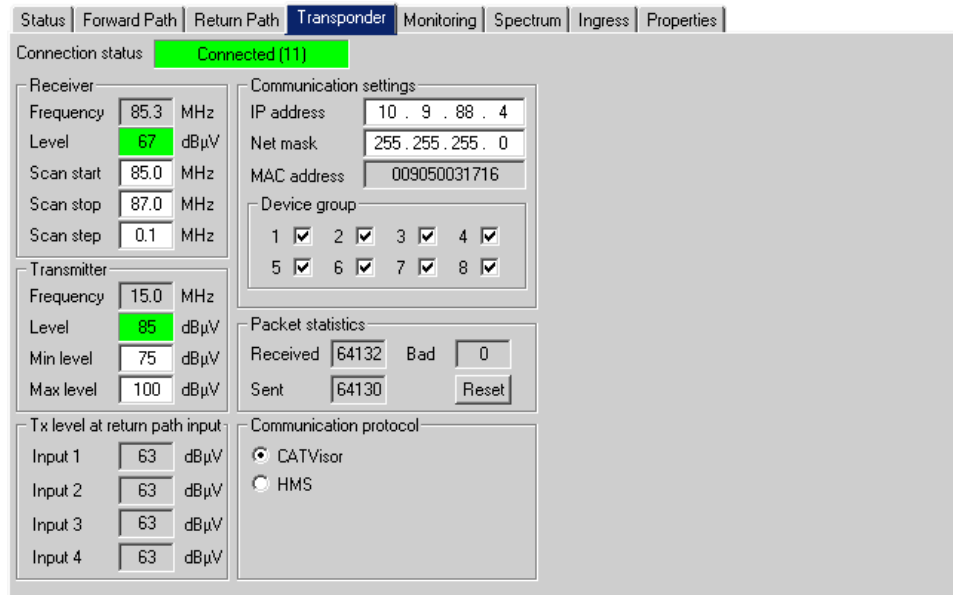This page is visible with AC6990 / AC6991 transponder in CATVisor mode.

Figure 33. Transponder (CATVisor) page

The "Transponder" page displays all the data and settings of the transponder's RF modem and remote communication. See "Remote communication" chapter for details.

Connection status

The current communication status between the transponder and HEC is shown in the "Connection status" field with

- "Scanning: searching for the HEC carrier.
- "Data carrier found": waiting for communication parameters.
- "Registering": registration in progress.
- "Connected": registration complete, communication OK.

The number in parenthesis is a more detailed status indicator for diagnostics purposes, ranging from 0 to 11.

Receiver

The "Frequency" data field shows the used receiver frequency.

The "Level" data field shows the measured signal level.

The "Scan start" and "Scan stop" fields determine the frequency band that the unit scans through when searching for the HEC carrier. Scanning can be disabled by setting the start and stop frequencies to the same value. Scanning speed can be improved by limiting the scanning range. The default and maximum range is 80…155 MHz. The scan will start from the last known HEC carrier frequency.

The "Scan step" field sets the frequency increments of the scanning process, default and minimum value is 0.1 MHz.

Changing any of these fields will reset RF modem communication.

Transmitter

The "Frequency" data field shows the used transmitter frequency commanded by the HEC. The "Level" data field shows the transmitter signal level.

The range for transmit signal level can be set in the "Min level" and "Max level" fields. The default range is 75…100 dBμV and maximum range is 75…104 dBμV. If the HEC commands transponder to use transmit level outside this range, nearest allowed value is used and "Modem transmit level saturated" alarm is activated.

Changes in these values will not reset RF modem communication and will be taken into use immediately if HEC's ALC is enabled.

Tx level at return path input

These fields show the calculated equivalent input level for the transponder transmit level. This is the signal level that needs to be injected to return path input to appear at return path output at same level than transponder signal.

Communication settings

The "IP address" field is used to define the IP address of the unit. The address has to be unique and match the HEC's IP subnet settings to ensure proper operation and IP level communication with the HEC.

If the IP address is set incorrectly, e.g. 0.0.0.0, the transponder can still communicate with the HEC on MAC level, but IP traffic (i.e. viewer / EMS messages) is not possible. It is possible to set the IP remotely via the HEC.

The "Net mask" field defines the corresponding IP subnet. It is only needed for broadcast software updates and has to be set according to the HFC subnet of the HEC; otherwise it can be left as 255.255.255.255.

The "MAC address" is the unit's unique, read-only hardware address that is also printed on the transponder front panel sticker.

Manageable devices in the same HFC network can be divided into different device groups. The "Device group" check boxes can be used to group transponders under multiple HECs. For more information, consult HEC user manual.

Changing any of these fields will reset RF modem communication.

Packet statistics

The "Received" field displays the total number of IP packets addressed to and received by this unit.

The "Sent" field displays the total number of IP packets sent by this unit.

The "Bad" field displays the number of all bad packets received and is a good indicator of the forward path condition.

Packet counters wrap around at 65535, so absolute values are not meaningful.

The "Reset" button will reset all packet counters to zero.

Communication protocol

It is possible to change between CATVisor and HMS on the fly. Careful planning is needed in e.g. HEC / HMTS setup for successful change, especially over remote connection. Changing the setting and clicking "Apply" will open a dialog for entering parameters specific for the selected protocol. After accepting the values the unit will reset and start communication using the new protocol.

Transponder viewer page (HMS)

This page is visible with AC6990 / AC6991 transponder inHMS mode.

Figure 34. Transponder (HMS) page

The " **Connection status** ", "**Receiver**", "**Transmitter**", "**Packet statistics**", "**Tx level at return path input**" and "**Communication protocol**" frames are the same as in the CATVisor version of this page and are described in the preceding chapter. However, HMS standard does not support automatic transmit level alignment and therefore the transmit level is manually adjusted in the HMS version.

IP address

This is the transponder's IP address. In HMS the this field is just a storage place. Depending on the used addressing method, the HMTS may or may not use this value. It may also change this value using MAC layer commands.

MAC

Unicast MAC: The transponder's globally unique MAC layer address.

Multicast MAC: The transponder supports up to four (4) multicast addresses that can be used for setting parameters in groups of devices. Note that not all HMTS's support multicast.

CHNLDESC timeout: HMTS broadcasts periodically the CHNLDESC datagram that informs the transponders about data channel frequencies. This timeout defines how long the transponder waits for an eventual CHNLDESC datagram, to define whether the carrier is an HMS channel. After the transponder is registered, it uses a timeout twice as long as the set value, to avoid the transponder from leaving the channel in case the reception of one CHNLDESC is unsuccessful. The HMTS should be set to broadcast CHNLDESC 0.5…0.9 x CHNLDESC timeout.

Poll timeout: If the transponder receives no datagrams to its own MAC address, it will wait up to this timeout, before declaring itself as 'forgotten' by the HMTS. After this timeout expires, the transponder will start reregistration.

"**Period**", "**Ack timeout**", "**Retries**", "**Kmin**", "**Kmax**": These values are used by the backoff calculation algorithm, in case a collision happens in the return path transmission (two or more transponders transmitting simultaneously). These values are for experts only and should be changed only in very special cases. The default 'Period' value is 60 ms.

SNMP communities

SNMPv1 community strings. The transponder will only accept SNMP GET/GET NEXT commands containing the Read or Write community string and SET commands containing the Write community string. Traps are sent containing the Trap community string. Communities can be adjusted **only locally**.

SNMP traps

Enabled: Enables/disables sending of HMS SNMP traps.

Delay: The time to wait before sending an HMS alarm trap, once an alarm is detected. This parameter can be used to control trap storms in amplifier cascades. By setting a longer delay deeper in the cascade, traps can be set to arrive on due order.

Interval: The minimum time between successive traps. This parameter applies only if several alarms are detected simultaneously.

Lifetime: The time the transponder keeps an HMS alarm trap in the transmit queue, if it cannot be sent for some reason (controlled by HMTS).

All trap parameters are adjustable also remotely via TELESTE-COMMON-MIB. Teleste MIBs are available at Teleste Club.

Transponder viewer page (DOCSIS)

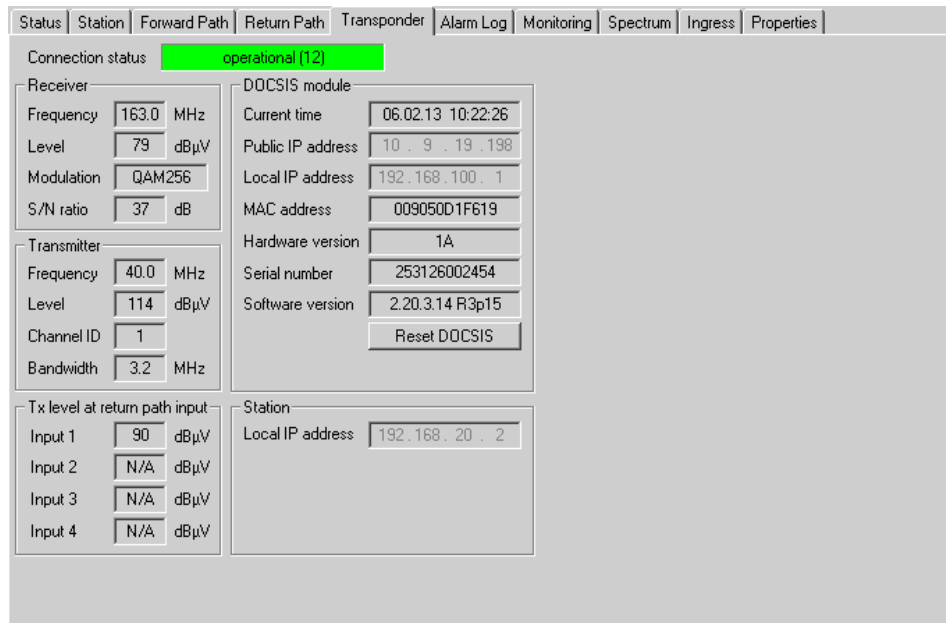This page is visible with AC6980 transponder.

Figure 35. The Transponder (DOCSIS) page

The "Transponder" page with AC6980 transponder displays read-only status information on the DOCSIS communication. See "Remote communication" chapter for details.

Connection status

The current communication status between the transponder and CMTS is shown in the "Connection status" field. The number in parenthesis is a more detailed status indicator for diagnostics purposes, ranging from 1 to 13.

Receiver

The used forward path frequency, receive level at transponder input and modulation are shown in respective fields. "S/N ratio" is the measured signal to noise ratio at DOCSIS receiver.

Transmitter

The return path frequency, transmit level at transponder output, channel ID and bandwidth are shown in respective fields.

DOCSIS module

The current time and public IP address obtained from CMTS are shown in respective fields together with DOCSIS module hardware version, serial number and software version. DOCSIS module software can be updated only remotely via CMTS (DHCP/TFTP).

The local IP addresses are shown for reference only.

The MAC address is the unit's unique, read-only hardware address that is also printed on the transponder front panel sticker.

The "Reset DOCSIS" button forces the module to re-establish the communication link.
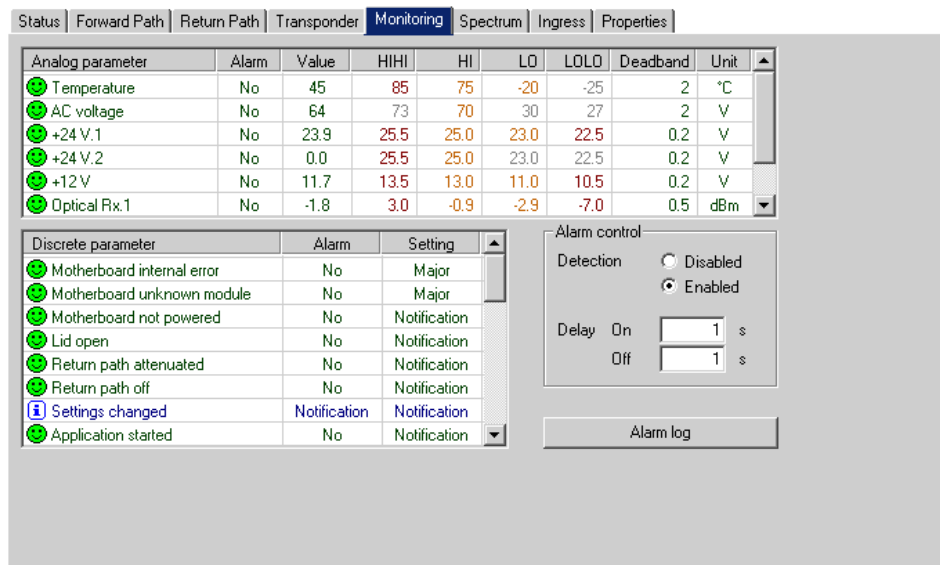
Monitoring viewer page

Analog parameter	Alarm	Value	HIHI	HI	LO	LOLO	Deadband	Unit
Temperature	No	45	85	75	-20	-25	2	°C
AC voltage	No	64	73	70	30	27	2	V
+24 V.1	No	23.9	25.5	25.0	23.0	22.5	0.2	V
+24 V.2	No	0.0	25.5	25.0	23.0	22.5	0.2	V
+12 V	No	11.7	13.5	13.0	11.0	10.5	0.2	V
Optical Rx.1	No	-1.8	3.0	-0.9	-2.9	-7.0	0.5	dBm

Discrete parameter	Alarm	Setting
Motherboard internal error	No	Major
Motherboard unknown module	No	Major
Motherboard not powered	No	Notification
Lid open	No	Notification
Return path attenuated	No	Notification
Return path off	No	Notification
Settings changed	Notification	Notification
Application started	No	Notification

Alarm control

Detection   Disabled   Enabled

Delay   On   1   s

    Off   1   s

Alarm log

Figure 36. Monitoring page

The "Monitoring" page displays all monitored parameters and their values as well as alarm limits, statuses and severity settings.

See "Alarms" chapter for descriptions of individual AC9000 alarms.

Analog parameters

Each monitored analog parameter of the unit is displayed in the upper half of the frame with following information in the list:

Analog parameter: Name of the monitored parameter.
Alarm: Alarm status of the parameter: No / HIHI / HI / LO / LOLO
Value: Current measured value.
HIHI: High major alarm limit
HI: High minor alarm limit.
LO: Low minor alarm limit
LOLO: Low major alarm limit.
Deadband: Specifies how much the measured value has to be on the "safe" side of alarm limit before turning off the alarm.
Unit: Unit of the measured parameter.

The colour of each list entry and the icon next to parameter name indicate alarm status:

- 🟢 green for nominal value

- ❌ red for major alarm

- ⚠️ yellow for minor alarm

- ⚫ grey for disabled alarm

The alarm settings are user configurable by double-clicking an analog parameter. This will open a dialog box with parameter's alarm limits and deadband that can be edited by users with at least "Service" level user rights. For others this is read-only information.
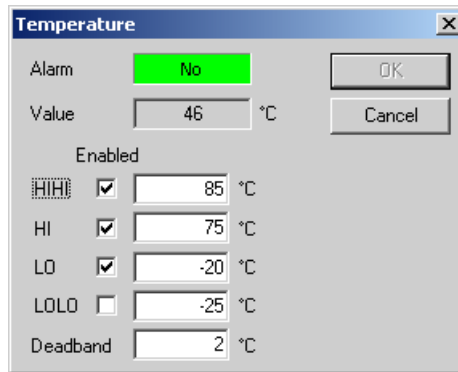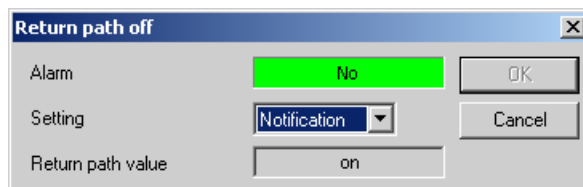
Figure 37. Monitoring analog alarm configuration dialog

Each alarm limit can be individually enabled/disabled and configured. The alarm limits should be in decreasing order for correct alarm processing, preferably with more than "Deadband" units between each limit.

Discrete parameters

Each monitored discrete parameter of the unit is displayed in the lower half of the frame with following information in the list:

Discrete parameter: Name of the monitored parameter.

Alarm: Alarm status of the parameter: No / Notification / Minor / Major. If the alarm is disabled, but parameter is in alarming state, "Yes" is shown.

Setting: Alarm severity can be configured to Major, Minor, Notification or Disabled.

The colour of each list entry and the icon next to parameter name indicate alarm status:

- 🙂 green for nominal value
- ❌ red for major alarm
- ⚠️ yellow for minor alarm
- ℹ️ blue for notification
- 😐 grey for disabled alarm

The alarm severity setting is user configurable by double-clicking a discrete parameter. This will open a dialog box which can be edited by users with at least "Service" level user rights. For others this is read-only information.

Figure 38. Monitoring discrete alarm configuration dialog

Alarm control

Alarm control frame provides independent on-delay and off-delay timers. The time delay feature can be used to eliminate false alarm triggering due to momentary disturbances. An alarm is only active when "Detection" is enabled and the monitored parameter has been over limit longer than "Delay On" time. Alarm goes off when the parameter has been inside limits longer than "Delay Off" time.

The settings on the "Alarm control" frame can be edited by a user with at least Service level user rights. For others this is read-only information. It is recommended not to change these values from their factory default value 1 s without fully understanding the effects on EMS system performance.

Alarm log

Clicking the "Alarm log" button on "Monitoring" page opens alarm log dialog.

Figure 39. Monitoring alarm log dialog

The "Alarm log" dialog box displays the alarm history for latest 32 events. The list is stored in non-volatile memory. All entries are date and time stamped with the most current entry at the bottom. Note that date/time information may not be correct for events that occurred before latest reset.

The icon and colour of each list entry indicate alarm status:

- 🟢 green for nominal value
- 🔴 red for a major alarm
- 🟡 yellow for a minor alarm
- 🔵 blue for a notification

The total number of entries in the alarm log list is shown in the "Number of entries" field. The index number of the last entry is displayed in the accompanying field. Total number of entries is limited to 32. The oldest entry is overwritten when the log becomes full.

To update "Alarm log" page, click the "Refresh" button.

"Clear and regenerate log" button clears alarm log and restarts alarm detection.
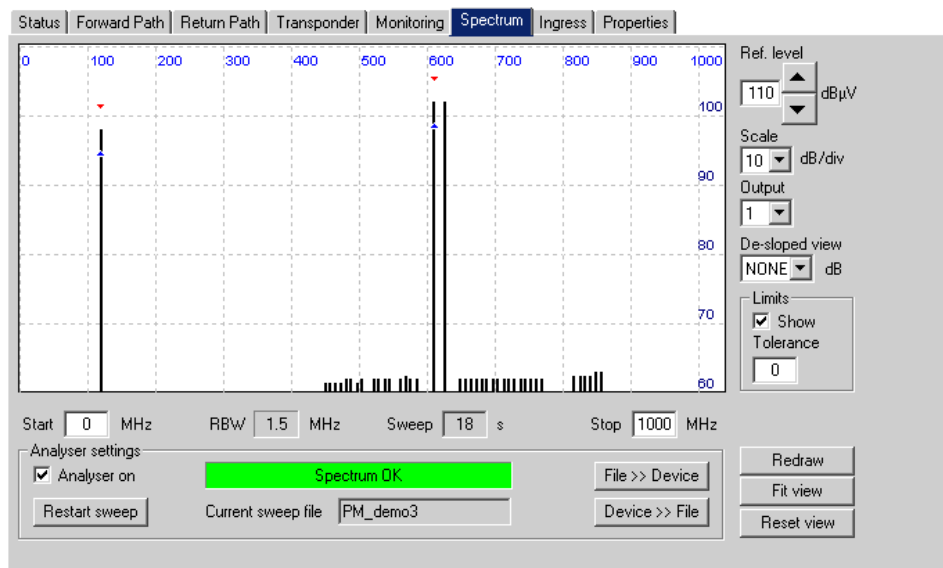
Spectrum viewer page

Figure 40. Spectrum page

When the spectrum analyser feature is enabled with correct Product Key, the "Spectrum" viewer page presents forward path level measurements in a graphical "spectrum analyser" display. Up to 100 measurement frequencies with individual peak / average detector selection and alarm limits can be specified with a simple text file separately for outputs 1 and 3. The measurement results can be saved back to a text file.

Display settings

When the viewer page is opened, the measurement results are retrieved from the device and displayed. The display can be zoomed or re-centred by entering new values into start and stop frequency, reference level and scale dialogs and clicking "Redraw" button. The "Fit view" button scales the display so that all measurement frequencies are visible; "Reset view" button restores full-scale display.

The RBW (resolution bandwidth) is fixed by transponder HW and depends on the installed transponder type, see transponder spec sheet.

The "Sweep" field displays the last elapsed time it took to scan through the complete set of measurement frequencies.

The "Output" drop-down box selects the displayed output. The spectrum measurement file, tolerance and all display settings are individual for each channel, but the spectrum analyser main switch is common for both outputs.

The "De-sloped view" drop-down box can be used to simulate a view of a flat frequency response by reducing the level at the high end of the node's response. Signal level at 1006 MHz is displayed with the attenuation specified in "De-sloped view", signal level at 47 MHz is not affected at all and attenuation of the frequencies between these two are calculated using a standard coaxial cable model. The "De-sloped view" function acts only as a visual aid for making adjustments and does not affect device operation in any way.

If the graphical display is clicked with mouse the frequency, measured level, detector mode and possible alarm limit values of the clicked measurement are displayed next to the clicked point.

Limits

When "Show" is checked the alarm limits for each measurement frequency are shown in the graphical display with blue triangles for low limit and red triangles for high limit. If a measurement is over high limit it will be drawn in red; in blue if it is below low limit; otherwise in black.

The "Tolerance" field specifies how many measurements are allowed to be outside limits before the "Spectrum out of limits" alarm is generated. The default value 0 will generate the alarm even if only one value is outside limits. "Tolerance" allows fine-tuning the limit testing so that e.g. it doesn't react to one missing TV channel. The alarm is set or cleared at the end of each measurement cycle.

Analyser settings

The "Analyser on" is the master switch for spectrum analyser feature.

The data field next to "Analyser ON" check box displays the ingress status: Spectrum OK / Spectrum out of limits / Spectrum analyser off.

The "Restart sweep" button clears the measurement results table and restarts the sweep. The "Current sweep file" field displays the first 15 characters of the filename of the last sweep file downloaded to the device for selected output.

The "File >> Device" and "Device >> File" buttons open a file dialog for transferring a sweep / result file to / from the device. Files for each output are transferred separately.

Sweep and result file formats

The sweep file is a simple text file than can be edited with any text editor and most spreadsheet applications. Each line in the sweep file defines one measurement frequency, preferably in ascending order. Each line has 2-4 fields separated with tab characters and dot (.) as the decimal separator:

1. The measurement frequency in multiples of 0.25 MHz.

2: The detector mode as "P" or "PAL" for peak detection or "Q" or "QAM" for averaging measurement. Detector mode designation is not case sensitive.

3: Optional low limit in multiples of 0.5 dBμV.

4: Optional high limit in multiples of 0.5 dBμV.

Comments can be inserted at the end of the line, preceded with a tab character, or on a separate row which starts with a non-numeric character. Comments are for information only and will not be downloaded into the device and so they are lost if result table is uploaded back from device.

An example of a valid sweep file:

```
113     QAM     98.0    103.5   Channel S2
121.00  Q               101     Channel S3
126.25  P                       Another comment
133.25  PAL     95
```

The result file format is identical to the sweep file format, except that it has a header row and a 5th column which contains the measurement results. An example of a result file produced by the above sweep file could be like this:

```
MHz     Type    LoLimit HiLimit dBμV
113.00  Q       98.0    103.5   100.5
121.00  Q               101     99.5
126.25  P                       101
133.25  P       95              98
```
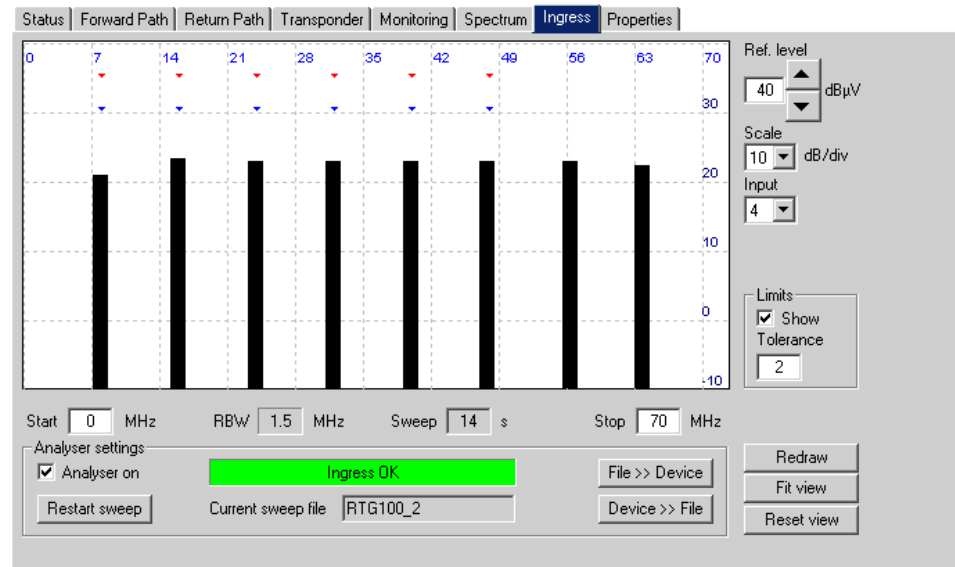
Ingress viewer page

Figure 41. Ingress page

When the ingress analyser feature is enabled with correct Product Key, the "Ingress" viewer page presents return path level measurements in a graphical "spectrum analyser" display. Up to 20 measurement frequencies with individual signal / noise detector selection and alarm limits can be specified with a simple text file. The measurement results can be saved back to a text file.

Display settings

When the viewer page is opened, the measurement results are retrieved from the device and displayed. The display can be zoomed or re-centred by entering new values into start and stop frequency, reference level and scale dialogs and clicking "Redraw" button. The "Fit view" button scales the display so that all measurement frequencies are visible; "Reset view" button restores full-scale display.

The "Input" drop-down box selects the displayed return path input. The ingress measurement file, tolerance and all display settings are individual for each channel, but the ingress analyser main switch is common for all inputs.

The RBW (resolution bandwidth) is fixed by transponder HW and depends on the installed transponder type, see transponder spec sheet. Note that due to the roll off of the RBW filter, a payload-free area is needed if noise levels are to be measured.

The "Sweep" field displays the last elapsed time it took to scan through the complete set of measurement frequencies.

If the graphical display is clicked with mouse the frequency, measured level, detector mode and possible alarm limit values of the clicked measurement are displayed next to the clicked point.

Limits

When "Show" is checked the alarm limits for each measurement frequency are shown in the graphical display with red triangles for alarm limit and blue triangles for warning limit. If a measurement is over alarm limit it will be drawn in red; in blue if it is over warning limit but not over alarm limit; otherwise in black.

The "Tolerance" field specifies how many measurements are allowed to be over limits before the "Ingress warning" or "Ingress alarm" alarm is generated. The default value 0 will generate alarm even if only one value is outside limits. The alarms are set or cleared at the end of each measurement cycle.

Analyser settings

The "Analyser on" is the master switch for ingress analyser feature.

The data field next to "Analyser ON" check box displays the ingress status: Ingress OK / Ingress alarm / Ingress warning / Ingress analyser off.

The "Restart sweep" button clears the measurement results table and restarts the sweep. The "Current sweep file" field displays the first 15 characters of the filename of the last sweep file downloaded to the device for selected input.

The "File >> Device" and "Device >> File" buttons open a file dialog for transferring a sweep / result file to / from the device. Files for each input are transferred separately.

Sweep and result file formats

The sweep file is a simple text file than can be edited with any text editor and most spreadsheet applications. Each line in the sweep file defines one measurement frequency, preferably in ascending order. Each line has 2-4 fields separated with tab characters and dot (.) as the decimal separator:

1. The measurement frequency in multiples of 0.25 MHz.

2: The detector mode as "P" or "PAL" for peak detection of return path payload signals or "Q" or "QAM" for averaging measurement of return path ingress noise. Detector mode designation is not case sensitive.

3: Optional warning limit in multiples of 0.5 dBμV.

4: Optional alarm limit is in multiples of 0.5 dBμV.

Comments can be inserted at the end of the line, preceded with a tab character, or on a separate row which starts with a non-numeric character. Comments are for information only and will not be downloaded into the device and so they are lost if result table is uploaded back from device.

An example of a valid sweep file:

```
Measures return path lowest frequencies
5.00    Q       35.0    40.0    Comment
7.50    Q       35.0    40.0    Another comment
10.00   Q       35.0    40.0
12.50   Q       35.0    40.0
```

The result file format is identical to the sweep file format, except that it has a header row and a 5th column which contains the measurement results. An example of a result file produced by the above sweep file could be like this:

```
MHz     Type    HiLimit HIHILimit       dBμV
5.00    Q       35.0    40.0    48.0
7.50    Q       35.0    40.0    49.0
10.00   Q       35.0    40.0    44.5
12.50   Q       35.0    40.0    44.0
```

Properties viewer page

Figure 42. Properties page

The "Properties" page displays unit identification and statistics data.

Identification

A descriptive alias name for the station can be entered into the "Name" field, site location into "Location" field and contact information into "Contact" field. All these fields can contain up to 63 characters.

The geographical coordinates can be entered into respective latitude and longitude fields. The preferred format for the coordinates can be selected from the "Format" drop-down field. When entering coordinates, special characters (º/'/") can be simply omitted.

Properties

The type (and generation, if applicable), hardware version, serial number and software version (if applicable) are shown for the station and installed modules.

Advanced functions

The statuses of advanced functions associated with Product Key are shown. These fields only indicate that the function is possible in the software, but does not display whether correct transponder module is installed for that function.

Statistics

The "Uptime" field shows the time since the last reset or power up. The format is days, hours, minutes and seconds, with ±5 s/day accuracy.

The "Total uptime" field shows the total number of full operating days. The "Reset count" field shows the total number of resets.

The "Save debug info" button reads the unit's non-volatile memory contents and opens a dialog for saving it into "*devicetype-serial-date.fun*" and ".*sad*" files which can then be sent to Teleste support to help troubleshooting problems.

Legal declarations

WEEE Notice

This product complies with the relevant clauses of the European Directive 2002/96/EC on Waste Electrical and Electronic Equipment (WEEE). The unit must be recycled or discarded according to applicable local and national regulations.

European Conformity

This equipment conforms to all applicable regulations and directives of European Union which concern it and has gone through relevant conformity assessment procedures.

Teleste Corporation
P.O. Box 323
FI-20101 Turku
FINLAND

www.teleste.com

Notes

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