

**ACE Series**

# User Manual

**Teleste Corporation**

**ACE3**  
**Intelligent broadband amplifier**

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## Introduction

ACE3 is an intelligent broadband amplifier with one active output and forward gain up to 44 dB. It offers high output level and supports 1.2 GHz / 204 MHz bandwidth.

ACE3 has an automatic alignment feature, which takes care of optimized SNR performance of both signal directions. ALSC circuits are built-in and they can be activated easily by adding a transponder unit. ACE3 has integrated electrical controls in both up- and downstream.

### True plug-and-play

An intelligent automatic alignment system with wide level control range ensures optimum operation of the ACE3 amplifier. It replaces conventional mechanical plug-in module adjustments and laborious control of parameters. All the adjustments are electrical and controlled with a management interface. Plug-in attenuators or equalisers are not needed.

Local configuration of ACE3 is done via its external USB interface using a Windows PC or tablet equipped with CATVisor Commander software or Android mobile device equipped with Teleste Commander software. Wireless Bluetooth connection can be established with AC6901 USB to Bluetooth adapter.

### AC6915, AC6918, AC6980, AC6981, AC6991 and AC6992 transponder units

ACE3 amplifier can be equipped with an optional plug-in transponder unit. The features with different transponder units are described in Table 1. See the transponder spec sheet for details.

ACE3 feature map vs transponders	None	AC6915	AC6918	AC6980 AC6981	AC6991 AC6992
Intelligent continuous adjustments	•	•	•	•	•
Automatic SNR optimisation	•	•	•	•	•
Local control through USB connection	•	•	•	•	•
Remote ingress switch control	-	•	•	•	•
CATVisor / HMS monitoring and control	-	-	-	-	•
DOCSIS remote monitoring and control	-	-	-	•	-
ALSC with fully programmable pilots	-	-	•	•	•
Automatic return path alignment	•	•	•	•	•
Automatic forward path alignment <sup>1)</sup>	-	-	-	•	•
Full single button automatic alignment <sup>1)</sup>	-	-	-	•	•
Forward path spectrum analyser <sup>1)</sup>	-	-	-	•	•
Return path ingress analyser with automatic ingress control <sup>1)</sup>	-	-	-	•	•
Return path pilot generator <sup>1)</sup>	-	-	-	-	•

1) These features need to be enabled with a Product Key.

Table 1. ACE3 feature map

## Installation

### Housing

The ACE3 can be installed either into a street cabinet or to the outdoor environment. The amplifier should be installed vertically so that the external cable connectors and ventilation hole are underneath, securing the housing with three mounting brackets. When positioning the amplifier in its final location, make certain that it has adequate ventilation on all sides. In particular, it is necessary to provide at least 150 mm of room above the amplifier for air circulation. The position of the mounting brackets as well as the installation dimensions are depicted in Figure 1.

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 ensure 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.

Amplifier housing should be grounded with at least 4 mm<sup>2</sup> grounding wire (Cu) from a proper earth to the grounding point.

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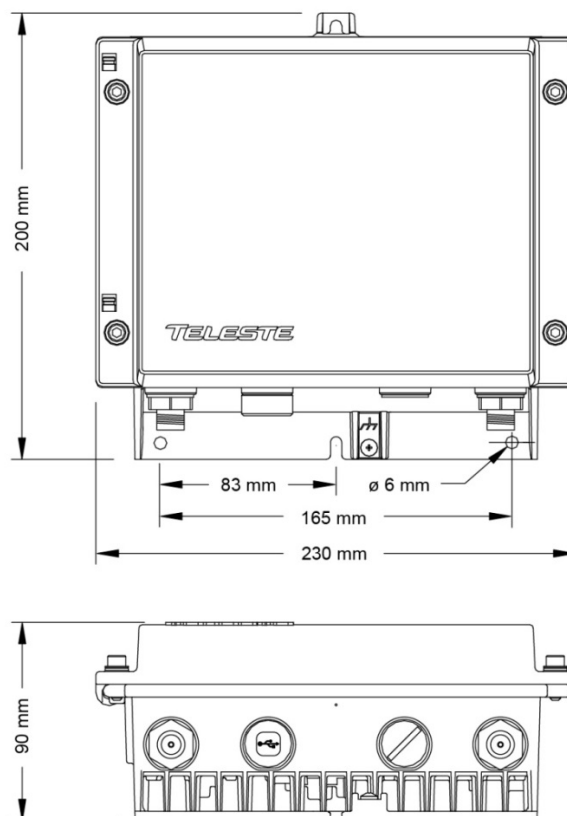


Figure 1. ACE3 housing dimensions – top and side view

## Interfaces

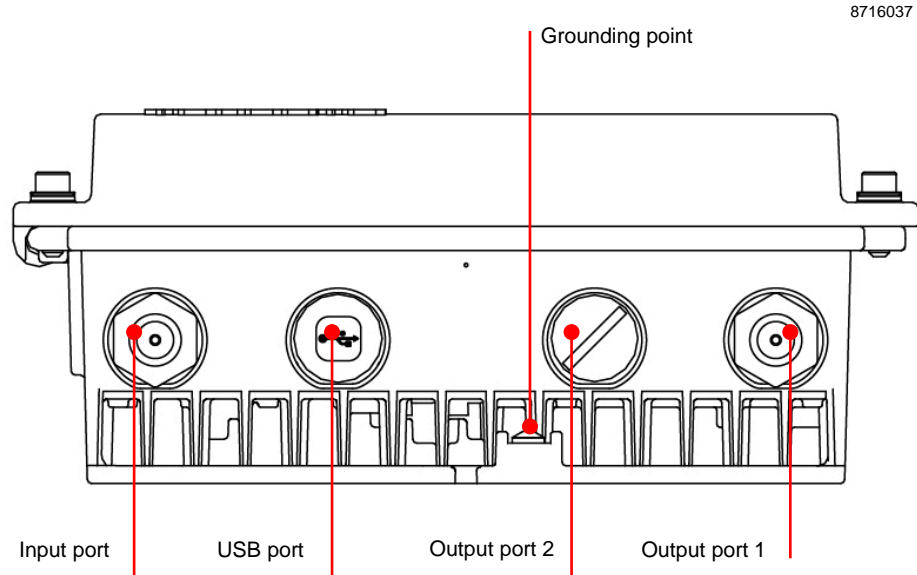


Figure 2. Port locations

The ACE3 amplifier has three RF ports underneath the housing: input and two outputs. In addition there is a port for the USB management interface.

All RF ports 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/adaptor body into the port. Tighten the centre conductor seizure screw and torque to 0.7 Nm. Do not over tighten.

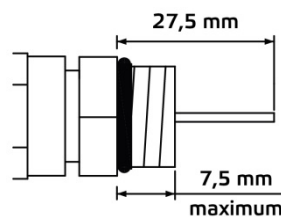


Figure 3. Centre conductor length

## Transponder

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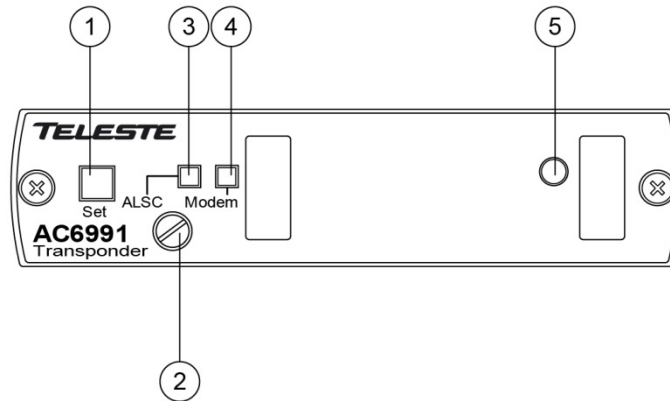


Figure 4. AC6991 transponder unit, 1) "Set" button, 2) Fastening bolt, 3) Indicator for ALSC status, 4) Indicator for modem status, 5) Light sensor

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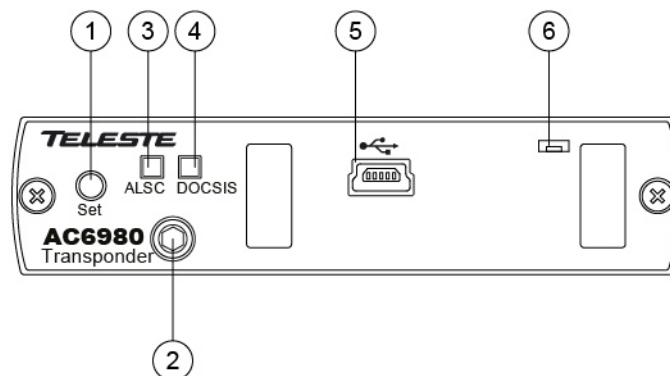


Figure 5. AC6980 DOCSIS transponder unit, 1) "Set" button, 2) Fastening bolt, 3) Indicator for ALSC status, 4) Indicator for DOCSIS status, 5) Remote management USB connector, 6) Light sensor

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 AC6991 transponder and 3 mm allen key with AC6980, AC6981 and AC6992 transponders. AC6915 and AC6918 modules do not have a mounting bolt. 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 ACE3 unit should be done via the motherboard USB connector.

## Powering



**NOTE!** To reduce the risk of electric shock, do not remove the shielding cover of the power supply unit if it is connected. All electrical installations must be carried out by authorized and competent technicians in accordance with the national or regional electrical regulations.

### Common precautions:

- The ACE3 amplifier is intended for installation in restricted access locations (dedicated equipment rooms, equipment closet, or the like)
- Operate the device only on the specified supply voltage.
- The ACE3 must never be operated without its power supply unit shielding cover.
- The ACE3 has no separate power switch thus the power plug must be easily accessible.
- Disconnect the power cord by the connector only. Never pull on the cable portion of the power cord.
- Do not place or drop heavy or sharp-edged objects on the power cord.
- The power must be disconnected when installing or removing the ACE3.

The ACE3 can be powered by several PSU options. Every option has its own advantages and limitations which are described briefly as follows.

### **230 V AC:**

The locally powered ACE3 amplifier is connected to the mains voltage of 205...255 V AC via its own power cord. The supply voltage fuse (T3.15 A / 250 V) is located on the upper left corner of the amplifier (Figure 8 pos. 1). The power supply is double shielded and does not require separate grounding. However, ensure that the housing of the ACE3 is properly connected to the earth in order to meet safety requirements. Proper grounding will also improve protection from the effects of interference and thus increase the overall reliability of the system.

### **27...65 V AC:**

The supply voltage of the remote powered ACE3 (27...65 V AC) is supplied via a coaxial cable by inserting a fuse to the corresponding fuse holder or directly at the external input. The external input is located on the power distribution board at the upper right corner of the node. External power can also be fed through the node into the network. Maximum feed-through current is 7 A per port (12 A total). If powering will be provided through a dedicated output port, the port must be equipped with a fuse (supplied).

## Front panel

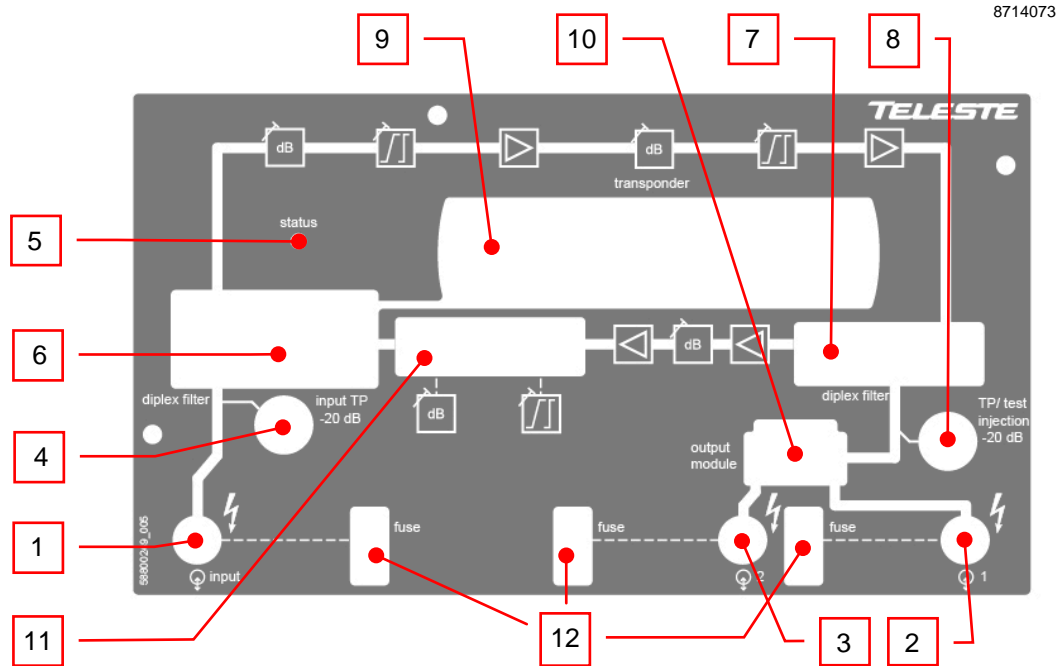


Figure 6. ACE3 front panel

- |                               |   |
|-------------------------------|---|
| 1) Input port                 | 7) Output diplex filter module              |
| 2) Output port 1              | 8) Output test / injection point            |
| 3) Output port 2              | -20 dB directional coupler                  |
| 4) Input test point           | 9) Transponder module                       |
| -20 dB resistive coupler      | 10) Output module (see Table 2)             |
| 5) Status indicator led       | 11) Return path output module (see Table 3) |
| 6) Input diplex filter module | 12) Fuses                                   |



## Features

### Diplex and output modules

The ACE3 amplifier is delivered according to the specifications defined in the ordering code.

The installed diplex filters (Figure 6 positions 6 and 7) must have same frequency range and they must be new 1.2 GHz types which are automatically detected by the software. The available diplex filter types are CXF065 (65/85 MHz), CXF085 (85/108 MHz) and CXF204 (204/258 MHz) and their high-pass versions (with "18/19" extension). If an unknown input diplex filter is detected, the "Unknown module" alarm is set.

Note that there are some special versions of the diplex filters, e.g. "CXF065 DA4" and "CXF204 UA6" which have built-in forward or return path attenuation or return path high-pass filtering. These diplex filters are detected as normal CXF065 / CXF204 respectively and the built-in attenuation is thus not taken into account in forward or return path automatic alignment. If these diplex filter types are used, their effect must be taken into account manually.

Output modules are passive plug-ins used to control the outputs – see Table 2.

Module	Functionality as output module	Output 1	Output 2
AC6120	0 dB output module, 1 output in use	0 dB	not used
AC6113	2/8 dB tap, 2 outputs in use	-2 dB	-8 dB
AC6114	2/12 dB tap, 2 outputs in use	-2 dB	-12 dB
AC6115	1/16 dB tap, 2 outputs in use	-1 dB	-16 dB
AC6124	Two-way splitter, 2 outputs in use	-4 dB	-4 dB

*Table 2. Output modules with corresponding nominal attenuation values*

Pilot and spectrum analyser measurements assume AC6120 module in use.

## Forward path frequency range

The forward path frequency range selection (1.0 GHz mode) can be selected independently of diplexer or other hardware modules. It affects only forward path interstage slope adjustment pivot point frequency and does not activate any kind of low-pass filtering etc.

## Return path frequency range and return path output module

ACE3 return path frequency split is controlled by the detected diplexer. Also the return path output module must be selected according to desired frequency split and installed diplexers.

The available module types are AC6254 (65 MHz), AC6255 (85 MHz), AC6256 (204 MHz) ) and AC6257 (204 MHz). The module type is automatically detected by the software. If the installed return path output module type does not match the installed diplexer or an unknown module is detected the "Unknown module" alarm is set.

The available return path gain and slope control ranges are affected by the installed return path output module as shown in Table 3 below.

Module type	Return path bandwidth	Diplex filter type	Return path gain range	Return path slope range
AC6254	65 MHz	CXF065	0...28 dB	0...15 dB
AC6255	85 MHz	CXF085	0...28 dB	0...15 dB
AC6256	204 MHz	CXF204	1...29 dB	3...18 dB
AC6257	204 MHz	CXF204	1...29 dB	0...18 dB

Table 3. Return path output modules, diplex filters and gain/slope ranges

## Automatic alignment

ACE3 automatic alignment can perform several tasks during the installation or at later stage of ACE3 lifecycle by just pressing a single button. The automatic alignment allows true plug-and-play installation and can be user configured to the finest detail already at factory.

The automatic alignment has to be enabled with a Product Key. It can run the following tasks when started with transponder "Set" button or via UI software:

- **Run forward path pilot based alignment** (default: enabled). The forward path level and slope are aligned based on measured pilot levels and preconfigured pilot settings. ALSC is enabled. Requires AC6991, AC6992, AC6980 or AC6981 transponder to be installed.
- **Run return path automatic alignment** (default: enabled). The return path is aligned based on forward path level and slope adjustment values. The "Return path boost" values (default: 0 dB) are added to the calculated return path gain and slope values and can be used to fine-tune automatic alignment. This can be useful e.g. in networks where pilots are placed on the "bumps" or "valleys" of the overall system frequency response.
- **Set reserve pilot target level to measured value** (default: disabled). Reserve pilot measurement value is stored as target value.
- **Set interstage gain minor alarm limits** with user specified offset to current value (default: disabled,  $\pm 3$  dB). Major alarms are not affected. After this the unit will alarm if ALSC adjusts interstage gain too much since installation, indicating a potential problem in input signal levels.
- **Set interstage slope minor alarm limits** with user specified offset to current value (default: disabled,  $\pm 3$  dB). Major alarms are not affected. After this the unit will alarm if ALSC adjusts interstage slope too much since installation, indicating a potential problem in input signal levels.
- **Set remote AC supply voltage minor alarm limits** with user specified offset to measured value (default: disabled,  $\pm 5$  Vrms). Not run if voltage is below 5 V, indicating local powering. Major alarms are not affected. After this the unit will alarm if the remote AC supply voltage has changed too much since installation, indicating a potential problem in remote powering.
- **Disable further automatic alignment** (default: disabled). Activated ~5 minutes after automatic alignment has completed. After this the automatic alignment cannot be restarted without first activating it via UI software.

During the alignment the transponder "ALSC" led will change colours fast. When the alignment has completed, the led blinks for 5 s according to the result (see below) and then returns to its normal status.

- **Red blink:** Forward path was not adjusted at all due to e.g. missing pilot signal or gain out of range. No further tasks were run, all controls return to their original values, ALSC is disabled.
- **Yellow blink:** Forward or return path could not be adjusted optimally. Gain/slope control(s) are at or near adjustment range limits. Best effort adjustment is made and rest of the tasks are run. User should check the forward and return path adjustments.
- **Green blink:** Automatic adjustment completed successfully.

Detailed status information is available when the automatic alignment has been started via the UI software.

## Forward path

The input and output amplifier stages are both based on high performance solutions which allow the user to set ACE3 outputs for high and low output levels. The output stage uses a GaN hybrid to improve RF performance over the entire 85 to 1218 MHz pass band. Note that ACE3 must have a proper matching at output port to ensure optimal and reliable operation.

### Built-in cable simulator

ACE3 has a built-in cable simulator in its input. The cable simulator is enabled when the input slope is set to negative value. This reduces the available gain by 13 dB (in 1.2 GHz mode).

### Forward path bandwidth selection

ACE3 can be configured to 1.0 GHz operation by enabling the 1.0 GHz mode. This selection affects only interstage slope pivot frequency. Input slope pilot frequency is always 1.2 GHz.

The 1.0 GHz mode can be useful in installations requiring high gain and slope where 1.2 GHz mode does not give enough maximum gain. Usually it is not necessary to enable the 1.0 GHz mode thanks to the high gain of ACE3.

Automatic alignment does not change the bandwidth selection. Thus it should be set correctly before running automatic alignment.

### Forward path gain control

ACE3 has two gain control elements in its forward path signal route:

- 1) **Input gain:** Adjustable between -20 and 0 dB in 1 dB steps.
- 2) **Interstage gain,** optionally controlled by ALSC: Adjustable between -15 and 0 dB in 0.1 dB steps.

The resulting "Total gain" is calculated based on the input and interstage gain controls and cable simulator activation. The maximum and minimum total gain values change according to cable simulator status: if cable simulator is enabled (i.e. input slope is negative) the maximum gain is reduced by 13 dB.

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

- 1) **Manual mode,** i.e. ALSC disabled, all controls available to the user:
  - a. Adjusting total gain causes input and interstage gain values to be adjusted automatically accordingly while optimising performance
  - b. Adjusting input gain or interstage gain affects that element only; resulting total gain value is updated. This can be used in special cases where adjusting total gain does not give desired performance.
- 2) **ALSC mode,** available with transponders: The amplifier software adjusts interstage gain and slope based on pilot level measurements. Input gain and slope can be adjusted by the user.

Note that when a special diplexer is used the displayed total gain value may be incorrect.

### Forward path slope control

ACE3 has two slope control elements in its forward path signal route:

- 1) **Input slope:** coupled with built-in cable simulator. Adjustable between -13 and 20 dB in 1 dB steps. Negative values enable the built-in cable simulator and reduce the maximum gain by 13 dB. Input slope control pivot frequency is always 1.2 GHz.
- 2) **Interstage slope,** optionally controlled by ALSC: Adjustable between 8 and 18 dB in 0.1 dB steps. The pivot frequency changes to 1.0 GHz when 1.0 GHz mode is selected; allowing higher gain with sloped output.

### Pilots and ALSC

Pilot measurements and ALSC are supported by AC6918, AC6980, AC6981, AC6991 and AC6992 transponders.

ACE3 uses the transponder's RF level measurement unit to sequentially measure signal levels at user defined pilot frequencies and, if enabled, also the forward path spectrum and return path ingress measurement frequencies.

ALSC (Automatic Level and Slope Control) keeps the output signal level stable irrespective of input signal level variations by adjusting the interstage gain and slope controls based on the pilot measurements. Gain and slope are adjusted slowly in small steps to guarantee stable operation in long amplifier cascades. If gain or slope is adjusted against its limits, ACE3 gives "ALSC saturated" alarm.

ACE3 has both high and low main pilots and reserve pilots for both. The high pilot controls interstage gain and the low pilot controls interstage slope. Input gain and slope are not controlled by ALSC. Pilot target levels for all four pilots can be independently configured by the user.

If a main pilot is lost, i.e. its level falls below "Lost level", ACE3 uses the respective reserve pilot for ALSC and gives "ALSC main pilot missing" alarm.

If either high main and high reserve or low main and low reserve pilots are lost, ACE3 gives "ALSC on 1 pilot only" alarm, freezes slope control and controls gain with the remaining pilot.

If all four pilots are lost, ACE3 gives "ALSC all pilots missing" alarm and freezes gain and slope controls.

If ALSC drives interstage gain or slope control over its low/high minor/major alarm limits, a corresponding alarm is activated. This can be used for early warning for potential problems in input signal levels. The minor alarm limits can be configured to be set automatically during automatic alignment.

Pilot backoff values and previous amplifier pilot target level settings are not used by ALSC; they are for forward and return path automatic alignment only.

### Forward path pilot based automatic alignment

The forward path can be automatically aligned with a single command, provided that AC6980, AC6981, AC6991 or AC6992 transponder is installed and the feature is enabled with correct Product Key. Pilot settings need to be set first, either at the factory or by the user.

Pilot based alignment can be included in the automatic alignment and can thus be started with transponder front panel "Set" button. It can also be started separately via the user interface.

The pilot based alignment adjusts the amplifier gain and slope settings so that pilot targets are reached while simultaneously optimising amplifier performance and making sure ALSC has enough adjustment range.

Total slope adjustment is divided between input and interstage controls based on pilot target level and backoff settings. The pilot backoff values need to be set for correct automatic alignment operation.

Forward path pilot based alignment status is indicated by the "ALSC" led as described in the "Automatic alignment" chapter. If the alignment stops due to an error (red blink) all controls return to their original values and ALSC is disabled.

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 7):

- **Pilot target out of range (red):** Adjustment aborted. Main pilot target levels are outside 80...120 dB $\mu$ V range or high and low pilots have less than 200 MHz between them.
- **Pilot not found (red):** Adjustment aborted. Measured high main or low main pilot level is below 65 dB $\mu$ V. Pilot frequency or type may be incorrect.
- **Slope too low (red):** Adjustment aborted. Calculated interstage slope is more than 1 dB below adjustment range minimum.
- **Slope too high (red):** Adjustment aborted. Calculated interstage slope is more than 1 dB above adjustment range maximum.
- **Gain out of range (red):** Adjustment aborted. Calculated total gain is more than 1 dB outside adjustment range.
- **Slope too low (yellow):** Best effort adjustment done. Calculated interstage slope is less than 1.5 dB from adjustment range minimum, leaving too little room for ALSC adjustments.
- **Slope too high (yellow):** Best effort adjustment done. Calculated interstage slope is less than 1.5 dB from adjustment range maximum, leaving too little room for ALSC adjustments.
- **Gain out of range (yellow):** Best effort adjustment done. Calculated total gain is less than 2 dB from adjustment range limit, leaving not enough room for ALSC adjustments.

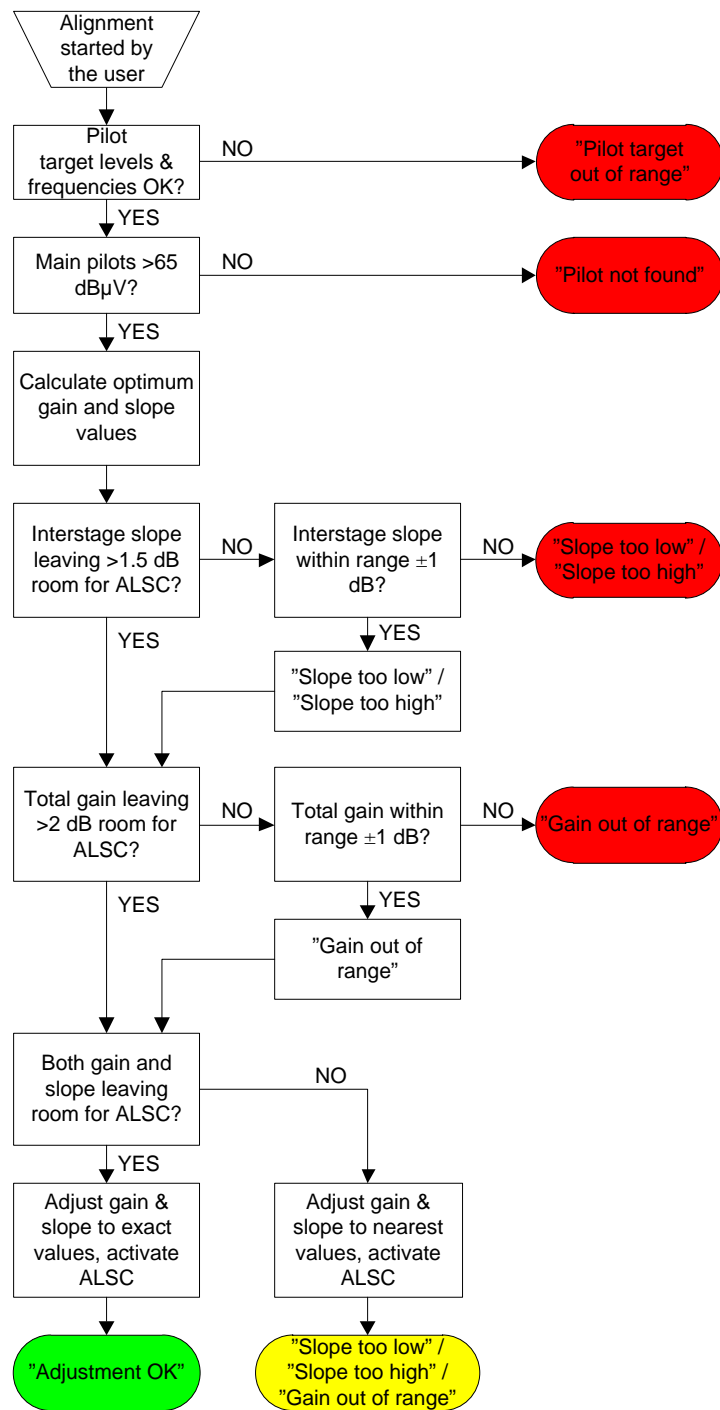


Figure 7. Simplified forward path pilot based automatic alignment flowchart

**Spectrum analyser**

Spectrum analyser is supported by AC6980, AC6981, AC6991 and AC6992 transponders.

ACE3 spectrum analyser can be used to measure and monitor output forward path signals, provided that a correct 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 analog / digital signals, respectively) selection and low/high minor/major alarm limits can be specified by the user.

Each measurement frequency can have up to 4 alarm limits. The measurement result is compared against its limits. When all frequencies have been measured the number of measurements exceeding their limits is compared to the "Tolerance" parameter and the "Spectrum warning" and "Spectrum alarm" 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.

"Spectrum alarm" is set if more than "Tolerance" values are above high major alarm limit or below low major alarm limit. "Spectrum warning" is set if more than "Tolerance" values are above high minor alarm limit or below low minor alarm limit and "Spectrum alarm" is not active.

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## Return path

ACE3 supports 65 MHz, 85 MHz and 204 MHz return path. The bandwidth can be changed by installing appropriate diplex filters and return path output module (Table 3).

### Return path gain and slope control

ACE3 adjusts its two gain control elements and one slope control element to achieve optimum return path performance based on the gain and slope values selected by the user. Gain and slope can be adjusted in 0.5 dB steps. The adjustment ranges depend on installed return path output module type as shown in Table 3.

### Return path input offset

The return path input offset can be used to add a fixed flat attenuation to the first return path gain control element. This can be useful e.g. in the last amplifier to force cable modems to transmit at higher levels, resulting in better SNR.

The use of return path input offset is roughly similar to adding a return path input attenuator plug to an amplifier equipped with plug-in slot. However care must be taken to avoid overdriving the return path input amplifier stage with too high levels caused by too much attenuation.

The return path input offset range is -10...0 dB, 1 dB steps, default value 0 dB.

The return path input offset is not taken into account by and not adjusted by return path automatic alignment. So also in this sense it is like a return path input attenuator plug. It is also not taken into account when calculating transponder equivalent transmit level at return path input.

### Ingress control switch

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

Ingress control switch can also be controlled automatically based on detected ingress. When automatic attenuation during ingress alarm is enabled, the ingress control switch is disabled from the user and the unit software operates it between 0 dB and attenuated values based on the "Ingress alarm" status. "Ingress warning" status does not affect ingress switch.

When "Ingress alarm" alarm is on for at least "activation delay" time, the ingress control switch will go to attenuated state. When "Ingress alarm" is off for at least "deactivation delay" time, the 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 between 3 and 10 dB to further fine-tune the automatic ingress attenuation feature.

The ingress switches are read-only if automatic ingress blocking is enabled.

### **Return path automatic alignment**

Return path automatic alignment can be included in the automatic alignment and can be activated with transponder front panel "Set" button. It can also be activated separately via the user interface. It does not require a transponder to be installed.

Note that the return path automatic alignment is run only once and is thus not a "return path ALSC", whereas ALSC adjusts forward path continuously.

Return path automatic alignment relies on forward path to be correctly aligned. The user must correctly specify previous amplifier pilot target levels. When specified these are taken into account in return path automatic alignment. Otherwise it is assumed that previous amplifier's level and slope settings are identical to this one, i.e. all needed gain and slope adjustment is due to either cable losses or passive splitting of signal between amplifiers.

The amount of cable and passive attenuation is calculated from forward path gain and slope values. Return path gain and slope values are then calculated from these values. Note that installed special diplex filter modules are not taken into account in return path automatic alignment calculation and may cause incorrect adjustment.

The "Return path gain boost" and "Return path slope boost" values are added to the calculated return path gain and slope values and can be used to fine-tune automatic alignment. This can be useful e.g. in networks where pilots are placed on the "bumps" or "valleys" of the overall system frequency response.

Return path input offset and ingress switch value are not taken into account by and not adjusted by return path automatic alignment.

Note that if the forward path automatic alignment cannot reach the calculated values but the error is less than 1 dB, the closest possible values are taken into use and the resulting error may thus affect also return path automatic alignment calculation.

A "best effort" alignment is made if target cannot be reached. This is indicated with "*Gain out of range*" status if return path alignment was started via the user interface and calculated gain and/or slope are at least 1 dB outside amplifier's adjustment range. Transponder led will blink in yellow if return path alignment was run as part of automatic alignment.

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### **Ingress analyser**

Ingress analyser is supported by AC6980, AC6981, AC6991 and AC6992 transponders.

ACE3 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 30 measurement frequencies with individual analog / digital detector (for signals / noise, respectively) selection and low/high minor/major alarm limits can be specified by the user.

Each measurement frequency can have up to 4 alarm limits. Each measurement result is compared against its limits. When all frequencies have been measured the number of measurements exceeding their limits is compared to the "Tolerance" parameter and the "Ingress warning" and "Ingress alarm" 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.

"Ingress alarm" is set if more than "Tolerance" values are above high major alarm limit or below low major alarm limit. "Ingress warning" is set if more than "Tolerance" values are above high minor alarm limit or below low minor alarm limit and "Ingress alarm" is not active.

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. See transponder spec sheet for information on measurement bandwidth.

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

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### **Return path pilot generator**

ACE3 return path pilot generator can be activated when AC6991 or AC6992 transponder is installed and the feature is enabled with correct Product Key.

There can be up to 4 user programmable pilot frequencies in the frequency range of 5...65 MHz (0.1 MHz steps). Pilot levels are specified at the transponder output as with modem transmit levels, and restricted to 75...100 dBμV range. The UI displays resulting equivalent input level, i.e. the level at which a signal should be injected to return path input to appear at equivalent level with the generated pilot signal at return path output. The "return path input offset" parameter is not taken into account in this calculation.

When the pilot generator is enabled, one of the pilot signals is output for user defined pilot duration, then switched to the next pilot signal and then repeated again. The pilot duration parameter is ignored if only one pilot signal is active.

Possible RF modem transmissions occur asynchronously, i.e. in the middle of any pilot transmission. Pilot output is switched off during modem transmission and resumed after the modem transmission has been completed. This causes typically less than 50 ms gaps in pilot transmission.

Pilot signals closer than 0.3 MHz to 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.

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## **Remote communication**

The transponder module is used for remote communication. The software supports AC6980, AC6981, AC6991 and AC6992 transponders and CATVisor, HMS and DOCSIS communication protocols. In addition AC6915 and AC6918 RIS receiver modules can be installed for RIS (Remote Ingress Switching) support.

With AC6992 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 with Teleste CATVisor or 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 and AC6981 the main 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. Modem receive level is directly related to forward path output level. Modem transmit level vs. return path input level varies with return path gain as described in the technical specification.

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

### **CATVisor modem functionality (AC6991 / AC6992)**

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 (AC6991 / AC6992)**

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 / AC6981)**

AC6980 / AC6981 transponder acts as a standard DOCSIS 2.0 cable modem. 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

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allow SNMP (UDP ports 161 and 162) and CATVisor (UDP port 2500) traffic to transponders. The SNMP community strings and other DOCSIS related settings are configured via DOCSIS configuration file as with other cable modems.

It is recommended to allocate dedicated DOCSIS channels for transponder communication. These channels should use more robust modulation than regular channels, for example QAM16 in forward path and QPSK in return path. This helps in keeping the transponders online even if there is massive ingress preventing normal cable modem communication.

**RIS receiver functionality (AC6915 / AC6918)**

There are no communication settings available for the user. RIS receiver automatically scans for RIS carrier (generated by HDM155 RIS controller) within its tuning range. When a RIS carrier is found, RIS receiver locks to the channel and reacts to commands sent to its MAC address. If the RIS receiver doesn't receive any packets during 1 minute it starts scanning again.

Transponder "RIS" led is dark while the unit is scanning for communication channel. Blinking green led indicates RIS link connected but no commands received during last 2 minutes. Stationary green/yellow/red led indicates RIS connected and "ingress on/att/off" command received during last 2 minutes.

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## 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 ACE3 is possible using the following methods:

### Local configuration with a PC

Commander 2.9 or later is needed for USB and Bluetooth support.

Connection to ACE3 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.

ACE3 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 ACE3 settings and update the software without any power supply.

Note that because only the CPU part of the unit is powered via USB many parameters visible via the user interface may display incorrect values. Installing or 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.

### Local configuration with an Android device

Teleste Commander software for Android devices can be downloaded from Google Play. Connection to ACE3 USB port can be done via AC6901 USB to Bluetooth adapter. The adapter should be disconnected when not in use to avoid possible EMC problems caused by the adapter acting as an antenna.

### Remote CATVisor connection

Remote IP connection via a HEC (e.g. Teleste HDM100 T) with AC6992 or 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 AC6992 or AC6991 transponder. ACE3 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 pre-setting 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 or AC6981 transponder. ACE3 can be accessed remotely using an SNMP Manager application or CATVisor Commander. The CMTS system must be preconfigured to accept the transponder and the used protocols.

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## Alarms

The module alarms, also known as "flags", displayed in CATVisor Commander and EMS are described in the table below. Equivalent SNMP traps and alarms 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 4. 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 (for example 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.

Analog alarm	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.	Status	Major & Minor
+24V voltage low	+24V voltage is below low limit.	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
Modem receive level high	RF modem receive level is above high limit. Generated only if AC6991 or AC6992 transponder is installed and modem is connected.	Modem	Minor
Modem receive level low	RF modem receive level is below low limit. Generated only if AC6991 or AC6992 transponder is installed and modem is connected.	Modem	Minor
Interstage gain high	Interstage gain control is driven above high limit by ALSC.	ALSC	Minor
Interstage gain low	Interstage gain control is driven below low limit by ALSC.	ALSC	Minor
Interstage slope high	Interstage slope control is driven above high limit by ALSC.	ALSC	Minor
Interstage slope low	Interstage slope control is driven below low limit by ALSC.	ALSC	Minor
Discrete alarm	Description & suggested corrective action	Led	Default severity
Unknown module	Device is not able to recognise duplex filter or transponder module(s). Possible reason is wrong module type, malfunction or bad installation of a plug-in module. If unit software is up to date and removing and reinstalling plug-in modules doesn't help, contact Teleste support.	Status	Major
Internal error	Device has an internal error. If resetting the unit does not help, contact Teleste support.	Status	Major
Lid open	Lid 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.	Status	Notification
Return path attenuated	Return path is attenuated, either by user or automatically due to ingress.	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








Application updating	Unit or plug-in module software is being updated. No changes should be made to powering, plug-in modules or settings during software update.	Status	Minor
Service terminal connected	There has been activity on local USB connector during last minute.	Status	Notification
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 transponder's allowed range, transmit level is saturated. Generated only if AC6991 or AC6992 transponder is installed, modem is connected and min < max.	Modem	Notification
Tuner module error	Internal error in transponder's level measurement unit. If resetting the unit doesn't help, contact Teleste support.	Status	Major
ALSC all pilots missing	All pilots are missing, ALSC is frozen. Generated only if transponder is installed and ALSC is enabled	ALSC	Major
ALSC saturated	ALSC is saturated, i.e. gain or slope adjustment limits have been reached. Generated only if transponder is installed and ALSC is enabled.	ALSC	Minor
ALSC on 1 pilot only	Upper/lower main and reserve pilots are missing. ALSC controls gain only. Slope control is frozen. Generated only if transponder is installed and ALSC is enabled.	ALSC	Minor
ALSC main pilot missing	Main pilot is missing. ALSC uses reserve pilot. Generated only if transponder is installed and ALSC is enabled.	ALSC	Notification
ALSC off	Transponder is installed but ALSC is switched off by user. Or ALSC is switched on by user but correct transponder is missing.	ALSC	Notification
Spectrum warning	Spectrum analyser measurements are outside minor alarm limits.	Status	Minor
Spectrum alarm	Spectrum analyser measurements are outside major alarm limits.	Status	Major
Ingress warning	Return path ingress measurements are outside minor alarm limits.	Status	Minor
Ingress alarm	Return path ingress measurements are outside major alarm limits.	Status	Major
Powered from USB	Processor powered from USB, rest of motherboard not alive.	Status	Notification









Table 4. ACE3 alarms

## Led usage






Modem related alarms are indicated with transponder "Modem" led. ALSC related alarms are indicated with transponder "ALSC" led. Other alarms are indicated with ACE3's "Status" led. The affected led and factory default severity settings are presented next to each alarm in Table 5. Alarms with "notification" severity do not affect leds.

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

ALSC led (AC6918, AC6980/-1, AC6991/-2)	Description
 red	ALSC enabled, ≥1 major alarm
 yellow	ALSC enabled, ≥1 minor alarm
 green	ALSC enabled, no alarms
 multicolour	Automatic alignment running
 green blink	Automatic alignment completed successfully
 yellow blink	Automatic alignment targets not fully achieved
 red blink	Automatic alignment stopped due to an error
 dark	ALSC off

Modem led (AC6991/-2) DOCSIS led (AC6980/-1)	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






RIS led (AC6915/-8)	Description
 red	RIS connected, receiving "ingress off" command
 yellow	RIS connected, receiving "ingress att" command
 green	RIS connected, receiving "ingress on" command
 green blink	RIS connected but no commands received
 dark	RIS not connected

Table 5. ACE3 and transponder leds

## Product key activation of advanced features

Some ACE3 software features need to be activated with correct product key:

- Automatic alignment (including pilot based 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 ACE3 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 ACE3 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 ACE3. 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 SNMP.

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 extranet (MyTeleste). The settings saver ECML files can also be used for specifying factory settings when ordering preconfigured ACE3 units.

ACE3 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 ACE3 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 e.g. it is not possible to read the pilot settings of a missing optical transmitter module, or write certain transponder settings if correct transponder type is not installed.

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 remotely, it is recommended to put them into a separate ECML file which is transferred separately after other settings.

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## Updating ACE3 software

New software versions for ACE3 are published at Teleste extranet (MyTeleste). These may contain bug fixes, enhancements and completely new features. For details see "ACE3 software release history" document also available in MyTeleste.

ACE3 software can be updated locally via USB using CATVisor Commander or remotely via modem connection using CATVisor Commander or SmartLoader or 3<sup>rd</sup> party download tool. ACE3 stays fully operational during the update, i.e. RF paths are not affected, ALSC continues to operate etc. The "Application updating" alarm is active during the update.

The new software is taken into use after it has been completely transferred 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, ACE3 continues to use its previous software.

### Local update

ACE3 software can be updated locally via USB using CATVisor Commander. Local software update of ACE3 takes ~1 minute.

ACE3 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 ACE3 settings and update the software without any power supply.

### Remote update – CATVisor

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

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

ACE3 software can be updated remotely with either CATVisor or HMS protocols as described above.

### Remote update – RIS

Contact Teleste support for more information on software update via RIS link.

## Updating transponder software

Some transponder types have their own software which handles the pilot measurements and/or remote communication. This software can be updated locally or remotely by using the methods above.

When transponder software update has completed, it can take up to 1 minute for the software to be taken into use. Wait until the new software version appears in the user interface before removing power or the transponder.

### AC6980 and AC6981 transponder DOCSIS software update

AC6980 and AC6981 transponders have DOCSIS software which handles the remote communication. This software can be updated using 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 extranet (MyTeleste). SCTE MIBs can be downloaded from SCTE website.

Supported MIBs for ACE3:

- RFC1213-MIB
- TELESTE-ROOT-MIB
- TELESTE-ACE-MIB
- TELESTE-COMMON-MIB
- TELESTE-HMSMODEM-MIB
- TELESTE-ANALYSER-MIB
- TELESTE-PILOTGENERATOR-MIB
- TELESTE-FUNCTIONAL-COMMON-MODEM-MIB
- TELESTE-FUNCTIONAL-INGRESS-SWITCH-MIB
- TELESTE-FUNCTIONAL-LEVEL-CONTROL-MIB
- TELESTE-FUNCTIONAL-LEVEL-DETECTOR-MIB
- TELESTE-FUNCTIONAL-ALSC-MIB
- TELESTE-FUNCTIONAL-PILOT-BASED-ALIGNMENT-MIB
- TELESTE-FUNCTIONAL-PERFORMANCE-MIB
- TELESTE-FUNCTIONAL-AUTOMATIC-ALIGNMENT-MIB
- TELESTE-FUNCTIONAL-ACCESSORIES-MIB
- TELESTE-FUNCTIONAL-MODULE-MIB
- TELESTE-ALARMS-MIB
- TELESTE-CM-CONFIG-MIB
- SCTE-ROOT
- SCTE-HMS-COMMON-MIB
- SCTE-HMS-PROPERTY-MIB
- SCTE-HMS-ALARMS-MIB
- SCTE-HMS-RFAMPLIFIER-MIB
- SCTE-HMS-DOWNLOAD-MIB
- Standard DOCSIS MIBs with AC6980 and AC6981 transponders

## Viewer pages

This chapter presents ACE3 viewer pages used with local or remote CATVisor protocol connection. The viewer pages used with SNMP remote connection with HMS or DOCSIS protocols are slightly different in layout but contain all the same parameters.

The viewer pages used to control ACE3 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 cannot be used at the moment due to e.g. missing plug-in module.

ACE3 viewer pages in CATVisor Commander / EMS:

- Status
- Forward path
- Return path
- Transponder (different pages for CATVisor / HMS / DOCSIS / RIS)
- 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.

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## Status viewer page

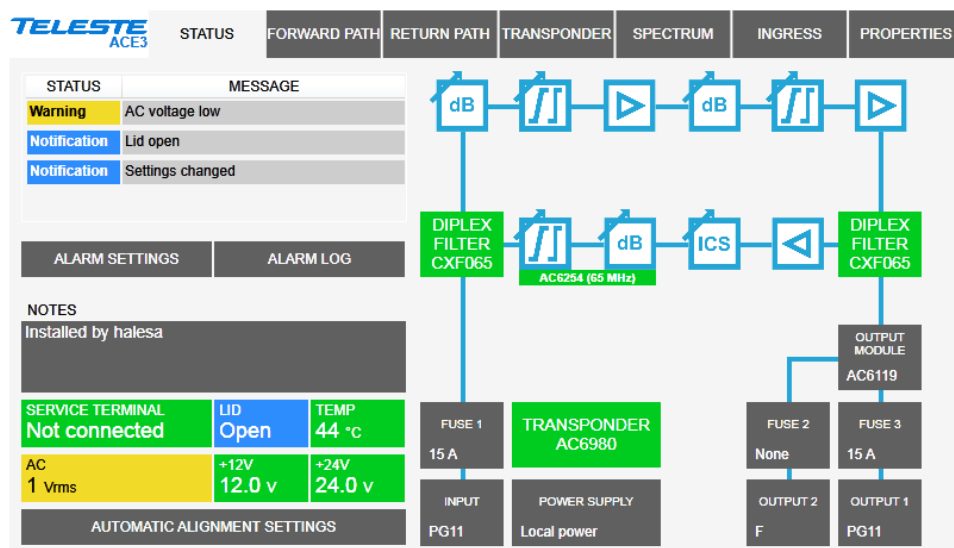


Figure 8. The Status page

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, settings and log

Each alarm in the alarm list on the top left corner is colour coded according to its severity. Alarm limits and severities can be configured through the "Alarm settings" dialog (see below), opened with "Alarm settings" button. The "Alarm history" dialog (see below) can be opened with the "Alarm log" button. For additional information about alarms, see table of module alarm descriptions in the "Features / Alarms" chapter.

### Notes

The "Notes" field allows storing up to 200 character message into unit non-volatile memory. It can be used for example as a reminder for the pilot settings.

### Measurements

The background colour of each field shows the parameter's alarm status.

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

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" is shown when a transponder is not installed.

ACE3's internal temperature is typically 10...25 degrees above ambient temperature depending on installation.

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 ACE3'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.

### Automatic alignment settings dialog

Transponder front panel has a "Set" button which starts automatic alignment. Clicking the "Automatic alignment settings" button on "Status" page opens a dialog for configuring the automatic alignment behaviour. The automatic alignment can also be started with the "Start automatic alignment" button in the settings dialog. For more information see "Features / Automatic alignment" chapter.

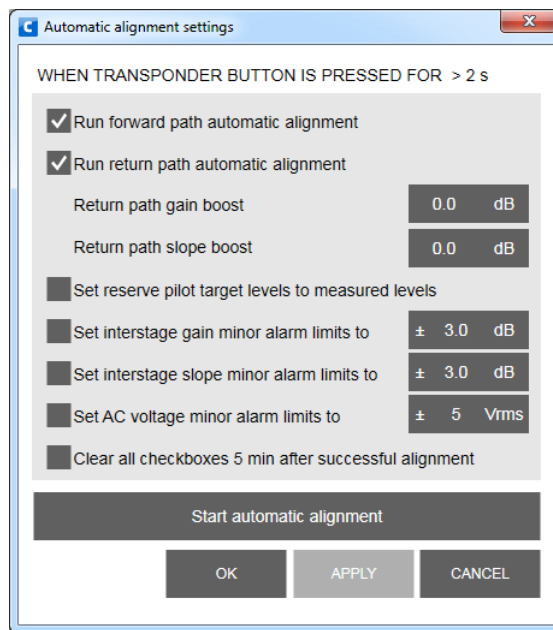


Figure 9. The Automatic alignment settings dialog

### Station layout

The transponder, duplex filter and return path output modules are detected automatically and represented as boxes with background colour reflecting alarm status. Some modules (output module, fuses, connectors and power supply) cannot be detected automatically. These are presented with grey boxes. 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.



## Alarm settings dialog

The "Alarm settings" button on "Status" page opens the alarm settings dialog.

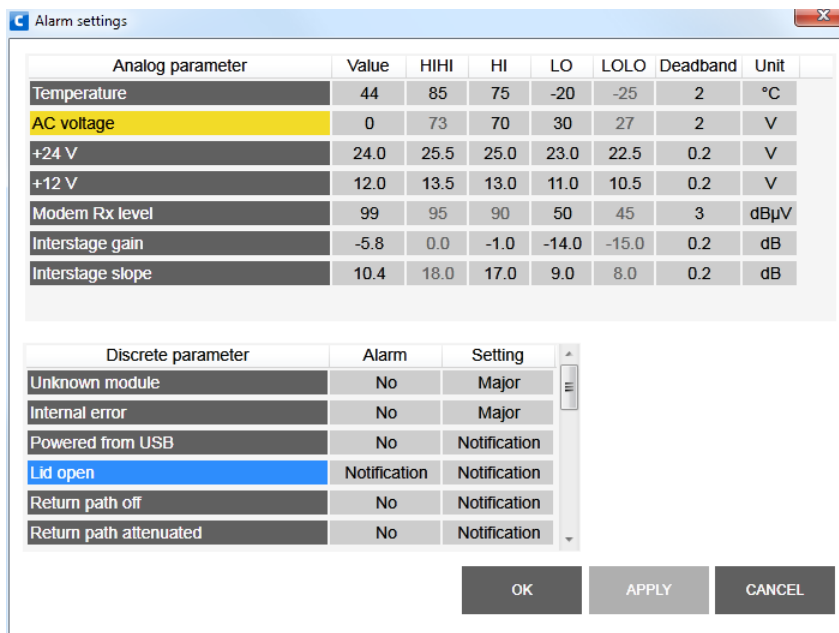


Figure 10. The Alarm settings dialog

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

See "Features / Alarms" chapter for descriptions of individual ACE3 alarms.

## Analog parameters

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

**Analog parameter:** Name of the monitored parameter, with background colour indicating active alarm.

**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 alarm settings can be configured by double-clicking an analog parameter name. This will open a dialog box with parameter's alarm limits and deadband.

Temperature		
ALARM	No	
VALUE	44	
ENABLE		
HIHI	<input checked="" type="checkbox"/>	85 °C
HI	<input checked="" type="checkbox"/>	75 °C
LO	<input checked="" type="checkbox"/>	-20 °C
LOLO	<input type="checkbox"/>	-25 °C
DEADBAND		2 °C
OK APPLY CANCEL		

Figure 11. The 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 dialog with the following information in the list:

**Discrete parameter:** Name of the monitored parameter, with background colour indicating active alarm.

**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.

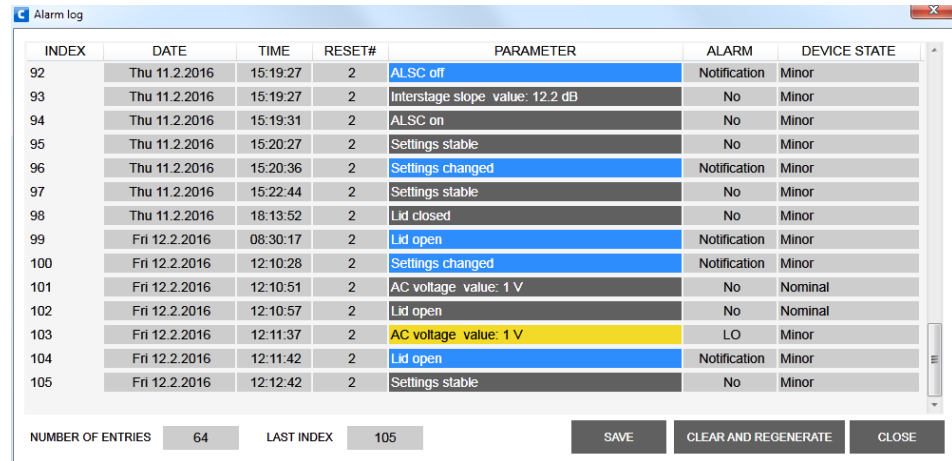
The alarm severity setting is user configurable by double-clicking a discrete parameter name. This will open a dialog box which can be edited by users with at least "Service" level user rights. For others this is read-only information.

Lid open	
ALARM	Notification
SETTING	Notification
Lid value	open
OK APPLY CANCEL	

Figure 12. The discrete alarm configuration dialog

## Alarm log dialog

The "Alarm log" button on "Status" page opens the alarm log dialog.



The screenshot shows the "Alarm log" dialog box with a table of alarm events. The table has columns for INDEX, DATE, TIME, RESET#, PARAMETER, ALARM, and DEVICE STATE. The events listed are as follows:

INDEX	DATE	TIME	RESET#	PARAMETER	ALARM	DEVICE STATE
92	Thu 11.2.2016	15:19:27	2	ALSC off	Notification	Minor
93	Thu 11.2.2016	15:19:27	2	Interstage slope value: 12.2 dB	No	Minor
94	Thu 11.2.2016	15:19:31	2	ALSC on	No	Minor
95	Thu 11.2.2016	15:20:27	2	Settings stable	No	Minor
96	Thu 11.2.2016	15:20:36	2	Settings changed	Notification	Minor
97	Thu 11.2.2016	15:22:44	2	Settings stable	No	Minor
98	Thu 11.2.2016	18:13:52	2	Lid closed	No	Minor
99	Fri 12.2.2016	08:30:17	2	Lid open	Notification	Minor
100	Fri 12.2.2016	12:10:28	2	Settings changed	Notification	Minor
101	Fri 12.2.2016	12:10:51	2	AC voltage value: 1 V	No	Nominal
102	Fri 12.2.2016	12:10:57	2	Lid open	No	Nominal
103	Fri 12.2.2016	12:11:37	2	AC voltage value: 1 V	LO	Minor
104	Fri 12.2.2016	12:11:42	2	Lid open	Notification	Minor
105	Fri 12.2.2016	12:12:42	2	Settings stable	No	Minor

At the bottom of the dialog, there are fields for "NUMBER OF ENTRIES" (64) and "LAST INDEX" (105), and buttons for "SAVE", "CLEAR AND REGENERATE", and "CLOSE".

Figure 13. The Alarm log dialog

The "Alarm log" dialog box displays the alarm history for latest 64 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 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 64. The oldest entry is overwritten when the log becomes full.

To save "Alarm log" page to a file, click the "Save" button.

The "Clear and regenerate" button clears log and restarts alarm detection.

## Forward path viewer page

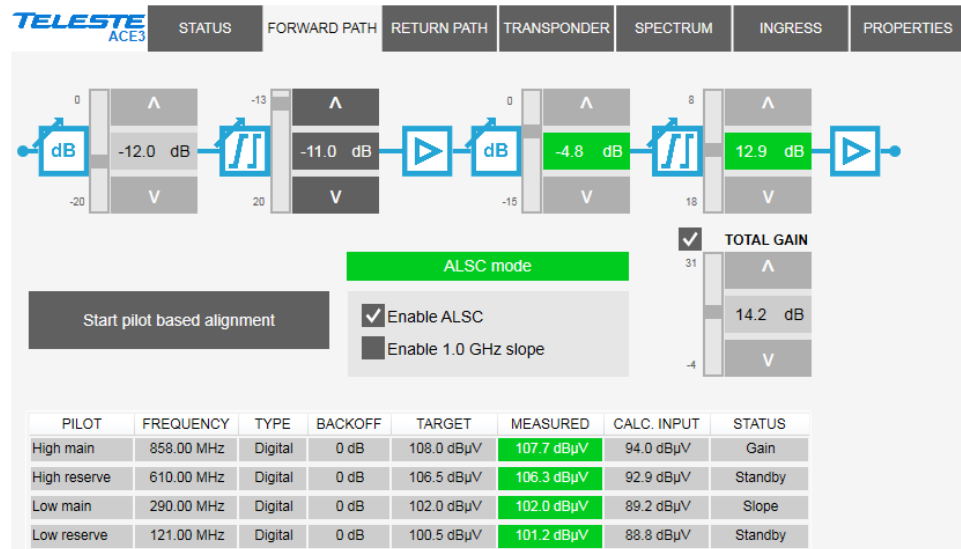


Figure 14. The Forward path page

The Forward path page displays all settings related to forward path adjustment. See "Forward path" chapter for details on forward path, ALSC and automatic alignment.

### Gain, slope and total gain adjustments

Input gain, input slope, interstage gain, interstage slope and total gain controls can be adjusted by clicking the up and down buttons or typing a value into the fields. The slider indicates relative position of the control to its limits.

When input slope is negative the cable simulator is activated automatically and total gain value and allowed range is reduced.

The total gain control shows the calculated total gain, taking into account input gain, interstage gain and cable simulator. Its minimum and maximum values change according to cable simulator activation. Adjusting total gain causes input and interstage gain values to be adjusted automatically accordingly while optimising performance.

The checkbox in front of total gain controls whether input and interstage gain controls are read-only. It is enabled by default, preventing accidental adjustment of input or interstage gain which could lead to non-optimal performance.

Interstage gain and slope and total gain controls are read-only when ALSC is enabled. Background colour shows interstage gain / slope alarm status.

### Adjustment mode and status

The adjustment mode (Manual / ALSC) can be selected with the "Enable ALSC" checkbox. The status is displayed in the status field in the centre of the page with background colour indicating alarm status:

- **Manual mode:** Manual adjustment mode, all controls user editable.
- **ALSC mode:** ALSC is enabled and works OK, interstage gain and slope and total gain controls are read-only.
- **ALSC saturated:** ALSC is enabled but saturated, i.e. interstage gain and/or slope control is adjusted to limit.

- **ALSC main pilot missing:** ALSA is enabled and works OK but one or both main pilot(s) are missing. ALSA uses reserve pilot(s).
- **ALSC on 1 pilot only:** ALSA is enabled but high or low main and reserve pilots are missing. ALSA controls only gain and slope control is frozen.
- **ALSC all pilots missing:** ALSA is enabled but all pilots are missing. Gain and slope controls are frozen.
- **No transponder:** ALSA is enabled but correct transponder is not installed.
- **Tuner module error:** ALSA is enabled but cannot adjust due to internal error in transponder tuner module.

### 1.0 GHz slope

This selection affects only interstage slope pivot frequency. Input slope pilot frequency is always 1.2 GHz.

The 1.0 GHz mode can be enabled in situations where:

- There are no signals above 1.0 GHz, and
- High gain is required, and
- Adjusting the slope to desired value in 1.2 GHz mode causes the signal levels at higher frequencies to be attenuated too much.

Usually 1.0 GHz mode is not needed thanks to the high gain of ACE3.

### Start pilot based alignment

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

When the alignment completes successfully it is also possible to set the gain and slope minor alarm limits according to adjustment result, disable them, or (by default) not change them (Figure 15). The gain and slope  $\pm$ -offsets can be configured via automatic alignment settings dialog (Figure 9).

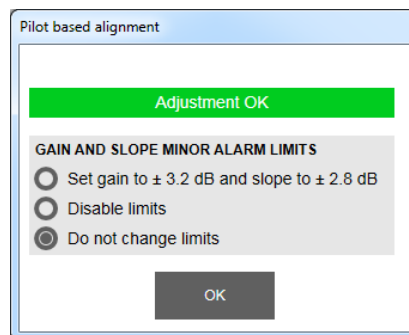


Figure 15. Pilot based alignment dialog

## Pilot table

Each pilot is shown in the table with the following information:

**Pilot:** Pilot name.

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

**Type:** Detector type. The measurement detector can be individually selected for each pilot to be either peak detect "Analog" or averaging "Digital".

**Backoff:** Pilot signal backoff for automatic alignment operation.

**Target:** Pilot signal target level for ALSC operation.

**Measured:** Measured pilot signal level. The background colour is grey when pilot is disabled, red when its level is below lost level, green when it is within 1 dB to the target level, otherwise yellow.

**Calc.input:** Calculated pilot level at amplifier input. The calculation is based on measured level, gain and slope settings, forward path bandwidth and assumes AC6110 (0 dB) input module. The value is only informative with no accuracy specification.

**Status:** Pilot status and usage. "Disabled": pilot disabled. "Lost": Pilot level below lost level. "Gain": Pilot OK and used for gain adjustment. "Slope": Pilot OK and used for slope adjustment. "Standby": Pilot OK but not used for adjustment.

The pilot frequency, type, backoff, target level and lost level can be edited by double-clicking a row in pilot table. This will open a dialog box (Figure 16) with the following parameters available in addition to the pilot table parameters:

**Lost level:** Limit below which the pilot is considered as lost.

**Previous amplifier target level:** Pilot target level at the amplifier feeding forward path signal to this amplifier. Displayed for main pilots only. Used by return path automatic alignment, by default identical to target level.

FREQUENCY	900.00 MHz
TYPE	Analog
BACKOFF	0 dB
TARGET	109.0 dBμV
MEASURED	109.2 dBμV
INPUT LEVEL (CALCULATED)	83.1 dBμV
LOST LEVEL	80.0 dBμV
STATUS	Gain
<b>PREVIOUS AMPLIFIER</b>	
<input checked="" type="checkbox"/> Same target level	
TARGET	109.0 dBμV

OK APPLY CANCEL

Figure 16. The pilot signal configuration dialog

## Return path viewer page

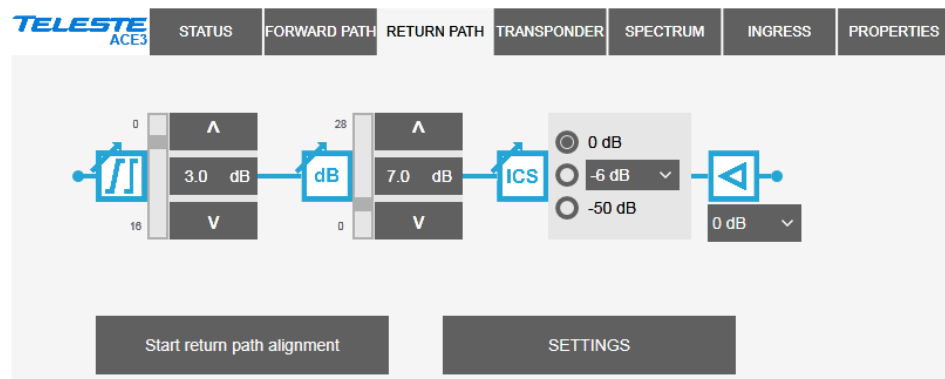


Figure 17. The Return path page

The Return path page displays all settings related to return path adjustment. See “Return path” chapter for details on return path features.

### Gain and slope

The gain and slope controls can be adjusted in 0.5 dB steps by clicking the up and down buttons or typing a value into the fields. The slider indicates the relative position of the control to its limits. The adjustment ranges depend on installed return path output module type as shown in Table 3.

### Ingress switch

The radio buttons are used to control the ingress switch. The “-50 dB” selection cuts off the incoming return path RF signal and thus also disconnects all transponders behind this unit, but unit itself can still measure return path ingress and communicate with its modem.

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

The ingress switch is read-only if automatic ingress blocking is enabled.

### Return path input offset

The return path input offset value below the input amplifier symbol can be used to add a fixed flat attenuation to the first return path gain control element. See “Return path” chapter for more details.

### Start return path alignment

Clicking the “Start return path alignment” button will start return path automatic alignment. A dialog box is opened which displays the status of the alignment.

## Return path settings dialog

The "Settings" button on "Return path" page opens the return path settings dialog (Figure 18).

AUTOMATIC INGRESS BLOCKING		TRANSPONDER PILOT GENERATOR	
Ingress OK		Enable transponder pilot generator	
Attenuate during ingress alarm		Pilot duration	1.0 s
Activation delay	30 s	RF modem Tx freq	13.2 MHz
Deactivation delay	30 s		
		FREQUENCY	LEVEL
Pilot 1	5.0 MHz	75 dBµV	38 dBµV
Pilot 2	5.0 MHz	75 dBµV	38 dBµV
Pilot 3	5.0 MHz	75 dBµV	38 dBµV
Pilot 4	5.0 MHz	75 dBµV	38 dBµV

Figure 18. The Return path settings dialog

## Automatic ingress blocking

The Ingress measurement status is displayed on the status field:

- **Ingress OK:** Ingress measurement results are within limits.
- **Ingress warning:** Ingress measurement results are outside minor alarm limits, but within major alarm limits.
- **Ingress alarm:** Ingress measurement results are outside major 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 switch is controlled by ACE3 based on "Ingress alarm" status and activation and deactivation delays. The activation and deactivation delays can be used to fine-tune this feature. "Ingress warning" status does not affect ingress switch.

## Transponder pilot generator

The "Transponder pilot generator" feature is available when AC6992 or AC6991 transponder is installed and the 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, ACE3 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 freq" field shows the modem transmit frequency as a reminder.

Pilot frequency, level and enabling can be controlled for all four pilots separately. Equivalent input level is shown next to each pilot. It takes into account return path losses, gain and ingress switch settings, but not "return path input offset" setting. When ingress switch is set to "-50 dB" the equivalent input level is shown as "N/A".



## Transponder viewer page (CATVisor)

This page is visible with AC6992 and AC6991 transponders in CATVisor mode.

The screenshot shows the 'Transponder' page in the CATVisor interface. At the top, there are tabs for STATUS, FORWARD PATH, RETURN PATH, TRANSPONDER (selected), SPECTRUM, INGRESS, and PROPERTIES. Below the tabs, a green bar indicates 'Connected (11)'. The page is divided into several sections:

- RECEIVER:**
  - FREQUENCY: 87.2 MHz
  - LEVEL: 77 dBμV (highlighted in green)
  - SCAN START: 87.2 MHz
  - SCAN STOP: 87.2 MHz
  - SCAN STEP: 0.1 MHz
- TRANSMITTER:**
  - FREQUENCY: 13.2 MHz
  - LEVEL: 91 dBμV (highlighted in green)
  - MIN LEVEL: 75 dBμV
  - MAX LEVEL: 104 dBμV
  - TX LEVEL AT RETURN PATH INPUT: 54 dBμV
- COMMUNICATION SETTINGS:**
  - IP ADDRESS: 10.9.15.166
  - NET MASK: 255.255.255.255
  - MAC ADDRESS: 00905005A53A
- DEVICE GROUP:**
  - Checkboxes for 1 through 8, all of which are checked.
- PACKET STATISTICS:**
  - RECEIVED: 64251
  - SENT: 64249
  - BAD: 0
  - RESET button
- COMMUNICATION PROTOCOL:**
  - Radiobuttons for CATVisor (selected) and HMS.

Figure 19. The Transponder (CATVisor) page

The "Transponder" page displays all the data and settings of the transponder's RF modem and remote communication.

Changing any of the fields except transmitter min and max level on "Transponder" page will reset RF modem communication.

### Connection status

The communication status of the transponder is shown in top of the page 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 at transponder input with background colour indicating alarm status.

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 maximum range depends on installed transponder type. 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.

### Transmitter

The "Frequency" field shows the used transmitter frequency commanded by the HEC. The "Level" data field shows the transmitter signal level at transponder output with background colour indicating alarm status.

The allowed range for transmit signal level can be set in the “Min level” and “Max level” fields. The maximum range depends on installed transponder type. 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.

**Tx level at return path input**

This field shows 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. It takes into account return path losses, gain and ingress switch settings, but not “return path input offset” setting.

**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 layer, but IP traffic (e.g. CATVisor viewer communication) 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.

**Device group**

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, see HEC manual.

**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.

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## Transponder viewer page (HMS)

This page is visible with AC6992 and AC6991 transponders in HMS mode.

The screenshot shows the 'Transponder viewer page (HMS)' with a green 'Registration complete' banner at the top. The page is divided into several sections:

- RECEIVER:**
  - FREQUENCY: 86.6 MHz
  - LEVEL: 83 dBμV
  - SCAN START: 86.6 MHz
  - SCAN STOP: 86.6 MHz
  - SCAN ENABLED: ☒
- TRANSMITTER:**
  - FREQUENCY: 12.0 MHz
  - LEVEL: 82 dBμV
  - MAX LEVEL: 104 dBμV
  - TX LEVEL AT RETURN PATH INPUT: 45 dBμV
- MAC:**
  - UNICAST MAC: 009050051350
  - CH DESC TIMEOUT: 35 s
  - POLL TIMEOUT: 120 s
  - PEDIOD: 6 ms
  - ACK TIMEOUT: 19 ms
  - RETRIES: 16
  - K MIN: 6
  - K MAX: 15
- COMMUNICATION PROTOCOL:**
  - ☐ CATVisor ☒ HMS
- IP ADDRESS:** 10.9.16.12
- PACKET STATISTICS:**
  - RECEIVED: 10499
  - SENT: 10521
  - BAD: 0
  - RESET button
- SNMP COMMUNITIES:**
  - READ: public
  - WRITE: private
  - TRAP: public
- SNMP TRAPS:**
  - ☒ Enabled
  - DELAY: 5 s
  - INTERVAL: 1 s
  - LIFETIME: 60 s

Figure 20. The 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.

HMS standard does not support automatic transmit level alignment and therefore the transmit level is manually adjusted in the HMS version. See Features / Remote communication" chapter for details.

### IP address

This is the transponder's IP address. In HMS 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.

**CHNLDESC timeout:** HMTS broadcasts periodically the CHNLDESC packet that informs the transponders about data channel frequencies. This timeout defines how long the transponder waits for an eventual CHNLDESC packet, 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.

**Poll timeout:** If the transponder receives no packets 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 special cases.

**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.

All trap parameters are adjustable also remotely via TELESTE-COMMON-MIB. Teleste MIBs are available at Teleste extranet (MyTeleste).

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## Transponder viewer page (DOCSIS)

This page is visible with AC6980 and AC6981 transponders.

TELESTE ACE3		STATUS	FORWARD PATH	RETURN PATH	TRANSPONDER	SPECTRUM	INGRESS	PROPERTIES
operational (12)								
<b>RECEIVER</b>					<b>DOCSIS MODULE</b>			
FREQUENCY	482.00	MHz	CURRENT TIME	15.2.2016 13:18				
LEVEL	99	dBμV	PUBLIC IP ADDRESS	10.9.19.203				
MODULATION	QAM256		LOCAL IP ADDRESS	192.168.100.1				
S/N RATIO	38	dB	MAC ADDRESS	009050D25726				
<b>TRANSMITTER</b>			HARDWARE VERSION	1A				
FREQUENCY	46.0	MHz	SERIAL NUMBER	253155004969				
LEVEL	80	dBμV	SOFTWARE VERSION	2.20.3.14 R3p32				
CHANNEL ID	6		<b>RESET DOCSIS</b>					
BANDWIDTH	3.2	MHz	<b>PACKET STATISTICS</b>					
<b>TX LEVEL AT RETURN PATH INPUT</b>			RECEIVED	7156	BAD	0		
INPUT 1	51	dBμV	SENT	7203	<b>RESET</b>			
<b>STATION</b>			LOCAL IP ADDRESS 192.168.20.2					

Figure 21. The Transponder (DOCSIS) page

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

### Connection status

The communication status of the transponder is shown in top of the page. 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.

### Tx level at return path input

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. The calculation takes into account return path losses, gain and ingress switch settings, but not "return path input offset" setting.

### 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 using DHCP/TFTP. The local IP address is 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.

## Transponder viewer page (RIS)

This page is visible with AC6915 or AC6918 transponder.

The screenshot shows the 'Transponder' tab selected in the top navigation bar. A green banner at the top of the content area indicates 'Connected'. Below this, the page is divided into three main sections: RECEIVER, MAC, and PACKET STATISTICS.

RECEIVER		MAC		PACKET STATISTICS	
FREQUENCY	256.00 MHz	MAC ADDRESS	00905006C485	TOTAL	32158
LEVEL	86 dBμV			UNICAST	10897
CONTROLLER IP ADDRESS	10.2.14.155			BAD	0
CONTROLLER ID	6				RESET

Figure 22. The Transponder (RIS) page

The “Transponder” page with AC6915 or AC6918 transponder displays read-only status information on the RIS communication. See “Remote communication” chapter for details.

### Connection status

The communication status of the transponder is shown in top of the page:

- **Scanning:** Searching for the RIS carrier.
- **Locked:** Locked to RIS carrier, no commands received in last 2 minutes.
- **Connected:** Locked to RIS carrier, commands received in last 2 minutes.

### Receiver

The “Frequency” data field shows the used receiver frequency.

The “Level” data field shows the measured signal level at transponder input.

The “Controller IP address” and “Controller ID” fields show the identification data received from the RIS controller.

### MAC

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

### Packet statistics

The “Total” field displays the total number of received RIS packets.

The “Unicast” field displays the number of RIS packets addressed to this unit.

The “Bad” field displays the number of all bad packets received.

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

The “Reset” button will reset all packet counters to zero.

## Spectrum viewer page

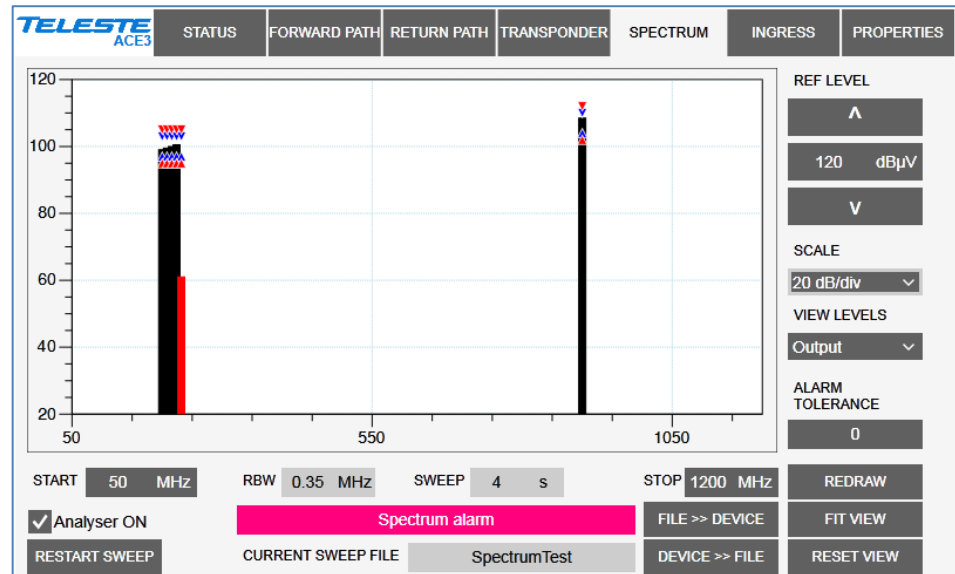


Figure 23. The Spectrum page

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. 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. If the graph is clicked the frequency, level, detector type and alarm limits of the measurement are displayed next to the clicked point. The display can be zoomed or re-centred by entering new values into start and stop frequency, reference level and scale fields 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 hardware 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 "View levels" drop-down box can be used to select the plotted data:

- **Output:** Displays the measured levels at amplifier output.
- **Calc. input:** Displays the calculated signal levels at amplifier input. These values are based on measured levels at amplifier output and amplifier gain and slope settings and assume 0 dB input module. Due to the nature of the calculation and multiple possible error sources, the value is only informative with no accuracy specification.
- **X dB de-sloped:** Simulates a view of a flat frequency response by reducing the level at the high end of the amplifier's response. Signal level at 1218 MHz is displayed with the attenuation specified in "De-sloped view", signal level at 85 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.

## Limits

The alarm limits for each measurement frequency are shown in the graph with blue triangles for minor limits and red triangles for major limits. If a measurement is outside major limits it will be drawn in red; in blue if it is outside minor limits; otherwise in black.

The "Tolerance" field specifies how many measurements are allowed to be outside limits before the "Spectrum warning" or "Spectrum alarm" 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 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 spectrum status: Spectrum OK / Spectrum warning / Spectrum alarm / 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.

The "File >> Device" and "Device >> File" buttons open a file dialog for transferring a sweep / result file to / from the device.

## 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 2-6 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 "A"/"Analog" for analog peak detection or "D"/"Digital" for digital averaging measurement. Detector mode designation is not case sensitive.
- 3: Optional low minor alarm limit in multiples of 0.5 dBµV.
- 4: Optional high minor alarm limit in multiples of 0.5 dBµV.
- 5: Optional low major alarm limit in multiples of 0.5 dBµV.
- 6: Optional high major alarm 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	D	97.0	103.0	94.0	106.0	All four limits
121.00	D	101				Low minor alarm
126.25	A					No limits
133.25	A			95		Low major alarm

The result file format is identical to the sweep file format, except that it has a header row and an additional last column which contains the measurement results.



## Ingress viewer page



Figure 24. The 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 30 measurement frequencies with individual detector type 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. If the graph is clicked the frequency, level, detector type and alarm limits of the measurement are displayed next to the clicked point. The display can be zoomed or re-centred by entering new values into start and stop frequency, reference level and scale fields 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 hardware and depends on the installed transponder type, see transponder spec sheet. Due to the roll off of the RBW filter, a signal-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.

### Limits

The alarm limits for each measurement frequency are shown in the graphical display with blue triangles for minor limits and red triangles for major limits. If a measurement is outside major limits it will be drawn in red; in blue if it is outside minor limits; otherwise in black.

The "Tolerance" field specifies how many measurements are allowed to be outside 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.

### 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 2-6 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 "A"/"Analog" for analog peak detection of return path payload signals or "D"/"Digital" for digital averaging measurement of return path ingress noise. Detector mode designation is not case sensitive.
- 3: Optional high minor alarm limit in multiples of 0.5 dB $\mu$ V.
- 4: Optional high major alarm limit in multiples of 0.5 dB $\mu$ V.
- 5: Optional low major alarm limit in multiples of 0.5 dB $\mu$ V.
- 6: Optional low minor alarm limit in multiples of 0.5 dB $\mu$ V.

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      D      35      40                      Comment
7.50      D      35      40                      Another comment
10.00     A      73      75      65      67      Pilot signal
12.50     D      35      40
```

The result file format is identical to the sweep file format, except that it has a header row and an additional last column which contains the measurement results.

## Properties viewer page

TELESTE ACE3		STATUS	FORWARD PATH	RETURN PATH	TRANSPONDER	SPECTRUM	INGRESS	PROPERTIES
<b>IDENTIFICATION</b>								
NAME	Test unit							
LOCATION	PAT							
CONTACT	ellika							
COORDINATES	NORTH	EAST	FORMAT					
	60° 26.575'	22° 22.392'	dd° mm.mmm' v					
<div>SAVE RIS INFO</div>								
<b>ADVANCED FUNCTIONS</b>								
SPECTRUM ANALYSER								Enabled
INGRESS ANALYSER								Enabled
AUTOMATIC ALIGNMENT								Enabled
RETURN PILOT GENERATOR								Enabled
<b>PROPERTIES</b>								
	STATION		TRANSPONDER		<b>STATISTICS</b>			
TYPE	ACE3		AC6980		UPTIME		3 d 22:48:40	
HARDWARE VERSION	A1.0		B1.0		TOTAL UPTIME		11 days	
SERIAL NUMBER	KK01544850		KK08501544		RESET COUNT		2	
SOFTWARE VERSION	1.0.1		3.2.3		<div>SAVE DEBUG INFO</div> <div>FOSS LIST</div>			

Figure 25. The 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 (°/'") can be simply omitted.

The "Save RIS info" button opens a dialog for saving RIS identification data to a file. This file can then be used for adding the amplifier to management system.

### Properties

The type, hardware version, serial number and software version are shown for both station and transponder.

### 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 a 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  $\pm 5$  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" file which can then be sent to Teleste support to help troubleshooting problems.

## Legal declarations

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### Free and open source software components (FOSS LIST)

"rsnewlib", RedSuite (FULL) newlib: <http://www.code-red-tech.com/RedSuite5/red-suite-5.php>  
"f4usb", STM32F4xx USB xxx Library: MCD-ST Liberty SW License Agreement V2:  
[http://www.st.com/software\\_license\\_agreement\\_liberty\\_v2](http://www.st.com/software_license_agreement_liberty_v2)  
"freertos", FreeRTOS: modified GPL: <http://www.freertos.org/a00114.html>  
"dspic": MPLAB X (free edition): <http://www.microchip.com/pagehandler/en-us/family/mplabx/#documentation>  
"redlib", RedSuite (FULL) redlib: <http://www.code-red-tech.com/RedSuite5/red-suite-5.php>  
"dspic": MPLAB X (free edition): <http://www.microchip.com/pagehandler/en-us/family/mplabx/#documentation>  
"steeprom": <http://www.st.com/web/catalog/tools/FM147/CL1794/SC961/SS1743/PF257846>  
"cdc": UART to CDC Modem Sample Application: <http://www.ftdichip.com/Firmware/Precompiled.htm>

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