KWS | ELECTRONIC TEST EQUIPMENT GMBH

AMA 310/UMS

Head end unit for return channel monitoring
Manual

KWS | GERMAN ENGINEERING

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Revisions

Version	Reason	Chapter
V18.0	First Publication	all
V19.0	No changes for derivate AMA 310/UMS	no
V20.0	No changes for derivate AMA 310/UMS	no
V21.0	No changes for derivate AMA 310/UMS	no

Reference Documents

This operating instruction refers to the following other documents:

- SW 024 Operating Instruction
- Application Note 006 - Upstream-Monitoring-System UMS

Chapter 1   Notes on Safety, Usage, Maintenance and Service

1.1   Safety Instructions

This instrument has been built and tested in accordance with EN 61010-1, protective measures for electronic measuring equipment. The instrument has been supplied ex works in a perfectly safe condition. To maintain this condition and to ensure a safe operation, the user has to observe the instructions and warnings included in these operations instructions.

The instrument corresponds to protection class II (protective insulation).

The instrument corresponds to protection class IP20 according to EN 60529.

The instrument must only be operated with supply voltages between 100-240 V with 50-60 Hz.

Discharges through a plug and socket connection may damage the instrument. During handling and operation, the instrument has to be protected against electrostatic discharge.

No external voltages higher than 70 Veff must be applied to the RF input of the measuring receiver, as otherwise the input circuits may be destroyed.

The ventilation slots of the instrument must not be covered. If covered, this may result in a reduced air circulation in the instrument, leading to a heat accumulation and thus to an overheating and damaging of the electronic components.

1.2   Usage Notes

The warranty for a new instrument ends 24 months after leaving the factory.

If the instrument is opened, the warranty claim becomes void!

Pointed tools (e.g. screwdrivers) may damage the plastic pane of the TFT display and thus result in a destruction of the TFT.

If the ambient temperature falls below 5 °C, the contrast of the TFT display is impaired.

After a cold start of the instrument, the TFT display reaches its maximum brightness only after some seconds.

The instrument reaches the full measuring accuracy only after an operating time of about 5 minutes.

Cordless DECT telephones as well as GSM or LTE mobile phones may lead to functional disorders and faulty measurements when operated in the immediate vicinity of the measuring receiver.

1.3   Maintenance of the Instrument

The instrument is maintenance-free.

1.4   Cleaning of the Instrument

The casing and the TFT display should be cleaned with a soft, lint-free cloth. Never use solvents such as cellulose thinners, acetone and the like, as otherwise the front foil coating may be damaged.

The ventilation slots should be cleaned from dust at regular intervals, such that the air circulation through the instrument by the built-in ventilators will not be impaired.

1.5   Calibration

The measuring instrument should be calibrated at least every two years. During servicing the instrument will be automatically calibrated in the factory.

1.6   Service

The service address is given on the back cover of this instruction manual.

Chapter 2   Technical Data

FREQUENCY RANGES

  RC (Return Channel)   4.32 – 65.76 MHz
                                        Resolution (RBW)   10 kHz
                                        Display Resolution   120 kHz

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OPERATION

  Input   Illuminated silicone keypad (numeric keypad)
  Monitor   5.5" TFT, VGA Resolution 640*480)
  Display   Separate LCD for measured values (320*64)
  User Prompting   German and English

RF INPUT   F Socket / 75 Ohm (IEC 60169-24)

  Return Loss   > 14 dB
  RF Sum Power   < 500 mW
  External Voltage   < 70 V_{eff} (DC – 50 Hz)

INPUT ATTENUATOR   0 – 60 dB in 2 dB increments

LEVEL RANGE

  Measuring Range   20 – 120 dBµV
                                        Resolution   0.1 dB
                                Measuring Accuracy   ± 1.0 dB (at 20 ˚C) warm up time > 5 min.
                                                                  ± 2.0 dB (0°C - 40°C) warm up time > 5 min.

  Measuring Bandwidth   1 MHz, 200 kHz or 90 kHz
  (RBW(-3dB))   depending on bandwidth / symbol rate
                                                                  setting

REALTIME ANALYZER

Measuring Bandwidth	0 – 120 dBµV
Resolution	0.1 dB
Measuring Accuracy	± 1.0 dB (at 20°C) warm up time > 5 min.
	± 2.0 dB (0°C - 40°C) warm up time > 5 min.
Measuring Dynamics	70 dB
Measuring Bandwidth (RBW(-3 dB))	10 kHz
Span (Frequency Segment)	Total range
Real-time MAX Hold Function	

PRBS

QAM Demodulator	
Data	PRBS23
Symbol Rates	0.3 – 7.2 MSym/s
Modulation Schemes	QPSK, 16, 64 and 256 QAM
Measuring Parameters	(per ETR 290)
BER	$1.00 \cdot 10^{-6}$ / $1.00 \cdot 10^{-7}$ / $1.00 \cdot 10^{-8}$
	depending on bandwidth / symbol rate setting
MER	up to 40 dB
Resolution	0.1 dB
Measuring Accuracy	± 1.5 dB

ASI

Output	Output level	typ. 800 mV$_{pp}$
	Connection	BNC Socket
Output Impedance		75 Ohm

USB

Management	USB-A	V1.1 (Full Speed)
Switch Control	USB-A	KWS proprietary protocol and assignment; Control output to optional cluster switch SW 024

ETHERNET

Management (front panel)		RJ-45
		10Base-T (10 MBit/s)
Streaming (rear panel)		RJ-45
		10/100Base-T (100 MBit/s)
	Protocol	UDP / RTP

UPSTREAM MONITORING SYSTEM (UMS)

Return channel measurement system (together with appropriate handheld devices VAROS 107)
Measurements during active DOCSIS modem service
Up to 10 handheld devices connectable
Net data rate of DVB transport stream for data transmission between headend device and field devices:
< 800 kbit/s
ASI/IP TS Output
ASK modulation for signaling of the handheld device to the head end device
Sweep (wobbling) function
TILT function

CPU

32 bit RISC architecture
RTOS (Real Time Operating System)
FAT32 file system
64 MByte flash disk

Software update   Via USB stick

POWER SUPPLY

Mains   Built-In primary Power Supply Unit
Mains voltage   100-120 VAC, 200-240 VAC; 50 – 60 Hz
Power consumption   45 W max.

ENVIRONMENTAL CONDITIONS

Operating Temperature   0 ˚C - +45 ˚C
Storage Temperature   -10 ˚C - +55 ˚C

ELECTROMAGNETIC COMPATIBILITY   per EN 61326-1

PROTECTION   per EN 61010-1

DIMENSIONS   W: 440 mm, H: 155.5 mm, D: 275 mm
(19" / 3.5 RU / without clamping angle)

W: 483 mm, H: 155.5 mm, D: 275 mm
(19" / 3.5 RU / with clamping angle)

WEIGHT   approx. 7.9 kg

QUANTITY OF DELIVERY	
Included in the delivery	User Manual
	USB stick
	Power Cable
	2 pieces clamping angle for 19" rack mounting
	8 pieces M4 x 8 mm crosshead screws

Chapter 3   Operating and Connection Elements, Connection Assignments

3.1   Front Panel
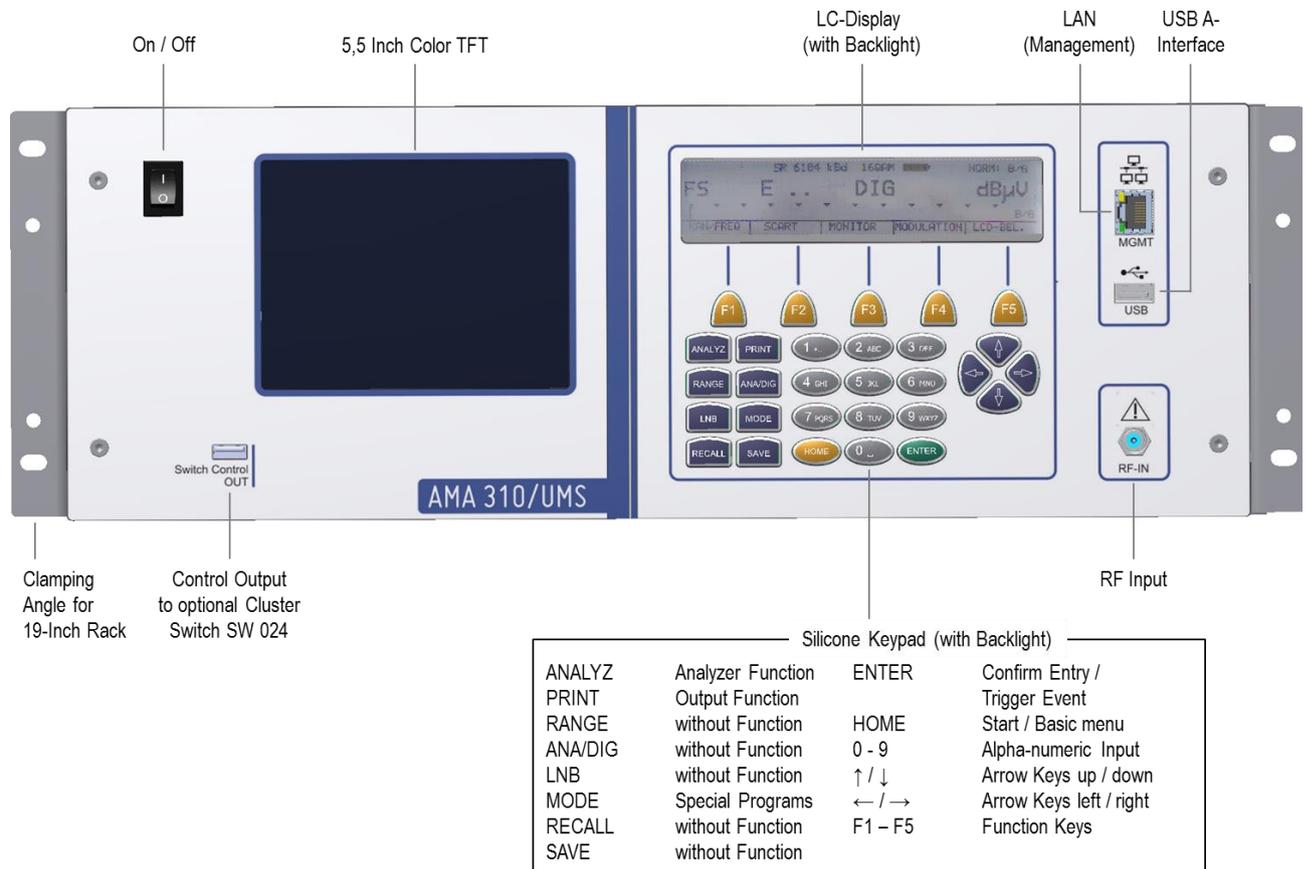
Figure 3-1 Front panel

3.2   Right Side of the Instrument

The ventilation slots are on the right side of the instrument. They are positioned in such a way that they will not be covered if the instrument is mounted in a 19" rack by means of the clamping angles. Please make sure that the ventilation slots are not covered and sufficient ventilation is guaranteed in case it is mounted in the rack in order to avoid overheating.

3.3   Back Panel
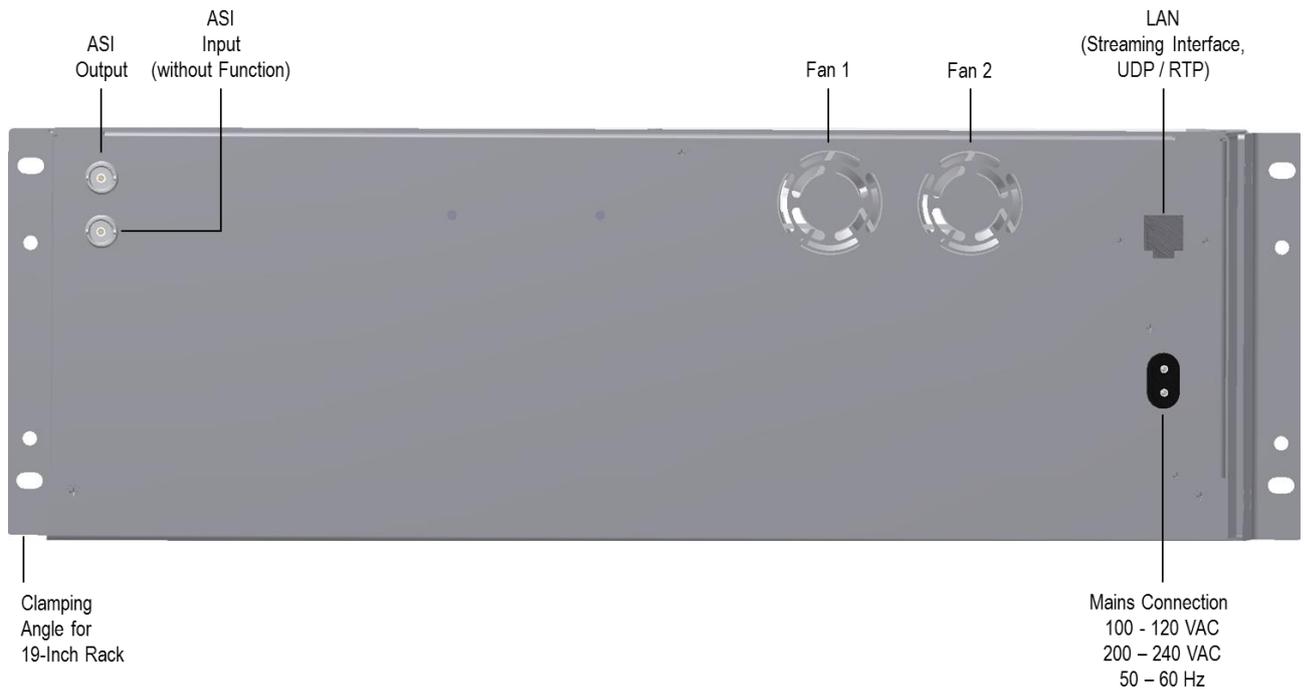
Figure 3-2 Back panel

3.4   USB-A-Interface

Pin 1 = Vcc (+5 V)
Pin 2 = Data D -
Pin 3 = Data D +
Pin 4 = GND
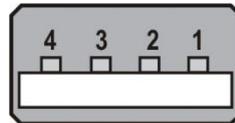
Figure 3-3 USB-A-interface

According to the specification 1.1 the interface works in full speed with a maximum of 12 MBit/s. The measuring instrument serves as a master here, i.e. it takes over the full control of the interface. Before an application can communicate with a USB unit, the host has to know the type of the device and load an appropriate driver. This happens after a device has been connected to the USB interface. This process is called enumeration. The standard defines several USB device classes. However, the measuring instrument only supports the class MASS STORAGE DEVICE (USB stick).

Via the integrated FAT32 file system the software of the measuring receiver can write files on the USB stick and read them.

The USB driver has been optimized for the stick provided. This means that this stick should be used.

If the software tries to access the USB interface without a stick being connected, the LC display shows the error message "ERROR USB-MassStorage Aborting!"

3.5   Ethernet (Management- and Streaming-Interface)

Pin 1 = TXD +
Pin 2 = TXD -
Pin 3 = RXD +
Pin 4 = n. c.
Pin 5 = n. c.
Pin 6 = RXD -
Pin 7 = n. c.
Pin 8 = n. c.
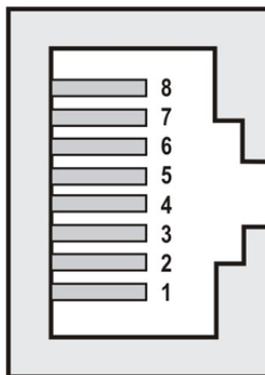
Figure 3-4 Ethernet (management- and streaming-interface)

3.5.1   Management Interface

For management purposes the measuring instrument is equipped with an Ethernet interface in standard 10Base-T with a maximum data rate of 10 MBit/s.

The RJ-45 socket used is situated on the front panel.

In the current version of the instrument this interface has no function.

3.5.2   Streaming Interface

The measuring instrument is equipped with an Ethernet interface in standard 10/100Base-T with a maximum signaling rate of 100 MBit/s.

The RJ-45 socket used is situated on the back panel.

This interface is used to stream an MPEG transport stream to the headend equipment, this can either be done via the ASI interface (see chapter 3.6 - ASI-IN / -OUT) or via Ethernet. A signal is applied at the streaming interface as soon as the UMS mode is activated and the IP output has been set as transport stream interface in the UMS settings, this will be described in subsequent chapters of this manual.

The protocol versions UDP and RTP/UDP are supported.

3.6   ASI-IN / -OUT
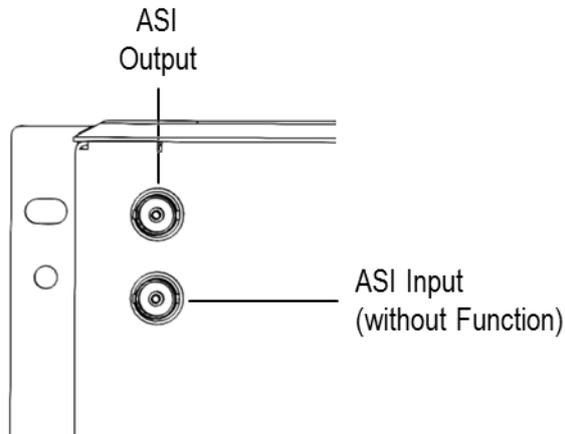
Figure 3-5 ASI input and output

The measuring instrument has a serial transport stream interface ASI (Asynchronous Serial Interface) as standard equipment. The instrument has one input and one output as separate BNC socket on the back panel. In the current version of the instrument, the ASI input has no function. At the ASI output, a signal is applied as soon as the UMS mode is activated and the ASI interface has been set as transport stream interface in the UMS settings, this will be described in subsequent chapters of this manual.

3.7   Control Output to optional Cluster-Switch SW 024

The control output to the optionally available return channel switch SW 024 is designed as USB socket. However, the pin assignment and the protocol used are KWS proprietary.

Chapter 4   Initial Operation

4.1   Mains Operation

The mains connection is located on the back panel of the instrument. The measuring receiver is operated by the two-pole mains cable supplied. The instrument has protection class II (protective insulation).

Caution!   **During assembly (e.g. when mounting the instrument in a 19" rack) the instrument has always to be separated from the supply voltage.**

4.2   Mounting of the 19" Clamping Angles

If the receiver AMA 310/UMS is to be mounted in a 19" rack, the angles supplied first have to be mounted on both sides of the instrument.
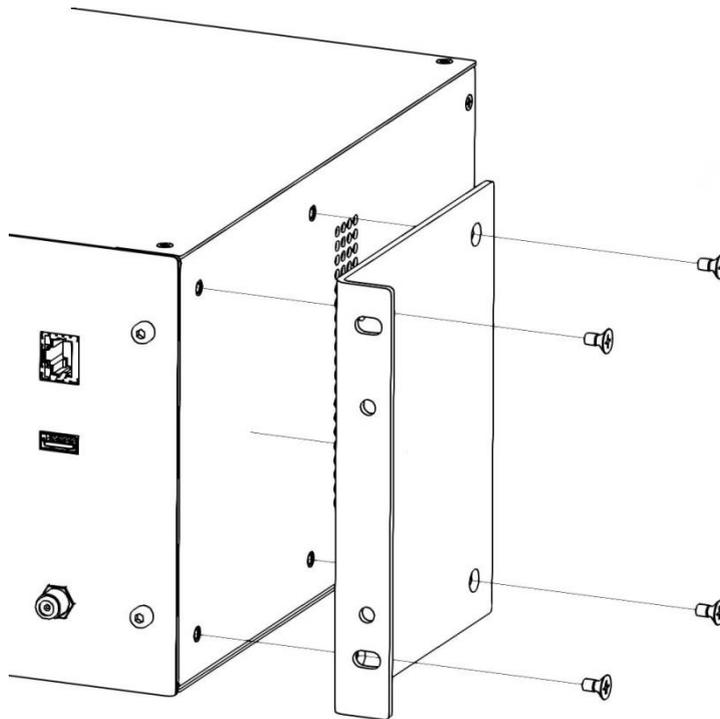
Figure 4-1 Assembly of 19" installation angle

The assembly is made by the M4 crosshead screws included in delivery. Each angle is to be fixed with four screws on the housing, as shown above. The screws should be tightened firmly.

The height of the AMA 310/UMS corresponds to 3.5 19-inch rack units (1 RU = 44.45 mm). In order to permit flexibility when installing it in the 19 inch rack, it is possible to mount the instrument half a rack unit higher or lower in the rack by means of the clamping angle.

4.2.1   Assembly with Half a 19" Rack Unit on the Top

If the clamping angles are mounted as labelled with "right" and "left" when delivered, the half height unit is on the top.
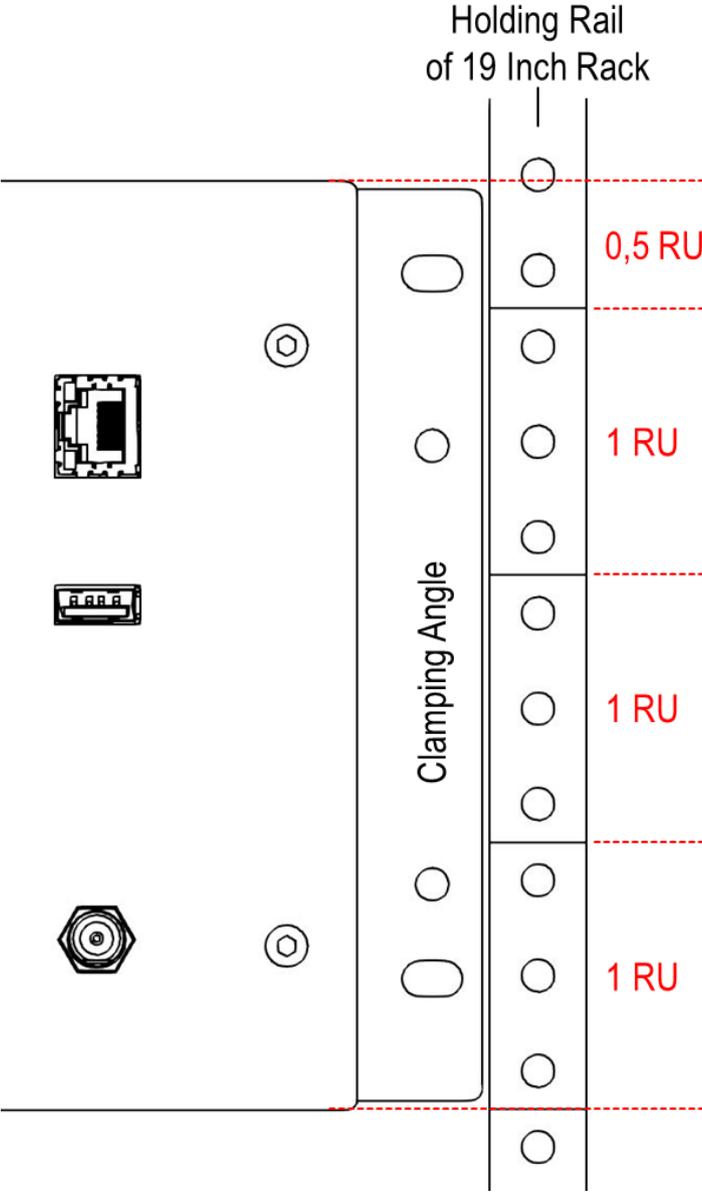
Figure 4-2 Clamping angle assembly with half 19" rack unit on the top

4.2.2   Assembly with Half 19" Rack Unit at the Bottom

If the clamping angles are interchanged and assembled, the half rack unit is at the bottom, as shown in the graphic below.
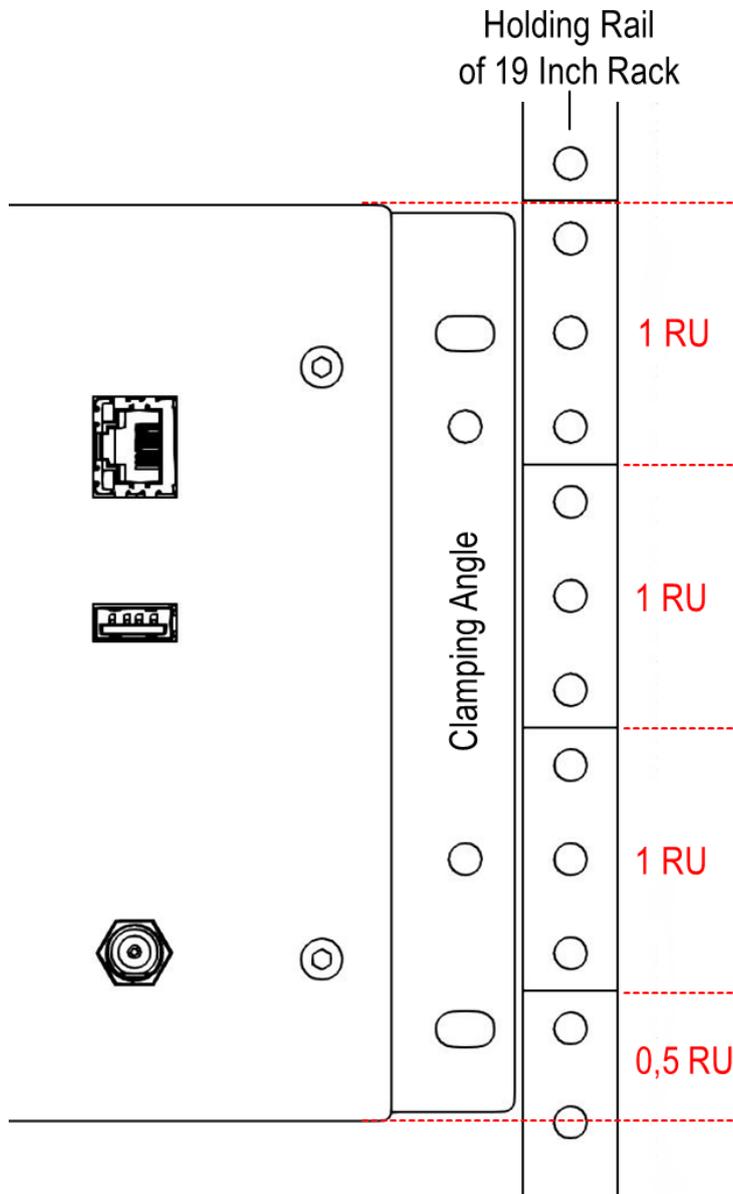
Figure 4-3 Clamping angle assembly with half 19" rack unit at the bottom

4.3   Fan Control

Two integrated fans supply sufficient ventilation for the electronic components. These are controlled by a microprocessor by measuring the internal temperature of the instrument. Make sure that the ventilation slots on the right-hand side of the instrument and the ventilation outlet ports on the back of the instrument are not covered in order to avoid overheating.

4.4   Connection of the Instrument

For the operation as central unit of the Upstream-Monitoring-System, the instrument has to be connected to the mains supply and also to a receiver for the transport stream data, which serves to send the information to the field units VAROS 107 (see Chapter 6 et seq.). For this purpose either an IP or an ASI output are provided on the back panel of the instrument. One of these outputs has to be connected to the processing headend equipment.

Now a return channel RF signal has to be supplied to the AMA 310/UMS via the F input on the front panel of the instrument.

This may either come from the optionally available RF switch SW 024 (for connection see Chapter 4.5 and the relevant operating instructions) or directly from the headend.

In case the SW 024 is used, up to 24 RF clusters or CMTS upstream inputs can be assessed independently from each other. If operated without RF switch either only one upstream signal can be measured or several upstream signals are fed together via combiner components on the RF input of the AMA 310/UMS. In the latter case the disadvantage is given that noise and ingress components of several upstream paths on the instrument input superimpose which results in a deterioration of the signal quality (S/N) and may impede the search for the source of the ingress noises.

4.5   Connection with the optional Cluster-Switch SW 024

The SW 024 switch is to be connected with AMA 310/UMS via two lines. These are supplied as accessories together with the switch.

The output "Switch Control OUT" of AMA 310/UMS is to be interconnected with the input "Switch Control IN" of SW 024 via the supplied USB cable. The front output "OUT" of SW 024 is to be connected to the RF input "RF-IN" of AMA 310/UMS by the supplied F cable bridge.

The length of both cable bridges is made for the intended standard arrangement where the SW 024 is placed below AMA 310/UMS or mounted in the 19" rack. If another arrangement is necessary, longer cables may be used, but keep in mind that the RF connection always should be as short as possible such that the calibration is not impaired.

4.6   Switch-On

When the instrument is connected to the mains supply, it is switched on by the ON/OFF switch on the front panel and set to the basic state. In the basic state, the display now starts showing the measured values (LC display on the right side of the instrument).

Caution!   **In combination with the optional RF switch SW 024 the switch always has to be switched on before the AMA 310/UMS!**

Chapter 5   Menu Structure

The instrument works in a clearly arranged menu structure. The individual menu items are to be selected by so-called soft keys (**F1**...**F5**). A menu page may include up to five menu items. In addition, the menu includes further menu pages. By the menu items `>>>` and/or `<<<` it is possible to scroll forwards or backwards in the menu. By `BACK` you get back to the previous menu.

Every measuring range has its own menu, which is adapted to the relevant operating mode. For easier operation, the composition of the range menus adapts to the current operating condition of the measuring receiver. This means that different menus appear in the basic state and when the instrument is tuned.

Apart from that after pressing the keys **ANALYZ** (for Analyzer), **PRINT** and **MODE**, further independent main menus appear which additionally structure the scope of functions of the instrument.

The keys **RANGE**, **ANA/DIG**, **LNB**, **RECALL** and/or **SAVE** have no function in AMA 310/UMS.

Via the key **HOME** the measuring receiver is reset to the basic state.

The functions of the **MODE** key are only available in the basic state of the instrument.

For the subsequent chapters the following notation is used for describing the menu navigation:

KEY → `Menu Item Main Menu` → `Menu Item Submenu` ….

Example: The change of the menu language from English to German in the basic state is done via:

MODE → `LANGUAGE` → `GERMAN`

The following figures illustrate the process:

Figure 5-1 Menu display in the basic state of the instrument

Pressing the key **MODE** →

```
                        UMS

                              18.11.16  14:29:23
 FIRMWARE  │ LANGUAGE │TIME/DATE │    >>>    │    BACK
```

Figure 5-2 MODE Menu

Pressing the key **F2 (LANGUAGE)** →

```
                        UMS

                              18.11.16  14:33:03
  GERMAN   │ ENGLISH  │          │           │    BACK
```

Figure 5-3 Language Menu

Pressing the key **F1 (GERMAN)** switches the language to German.

5.1   Navigation in the Menus and Editing of Parameters

For navigating in the submenus and for editing the parameters the blue arrow keys (→, ←, ↓, ↑) as well as the numeric keyboard of the instrument are used. This will be illustrated below by the example of the editable downstream frequencies for report generation (see Chapter 8.1.6 Forward Path Measurement). The relevant submenu will be selected from the basic state of the instrument via the operating steps UMS SETTING → >>> → DNSTREAMS.

The following LC display content is shown:

```
DS01: Frq: 333.00MHz USDOC⬍  SR:5361kSym/s  256QAM⬍
DS02: Frq: 339.00MHz USDOC⬍  SR:5361kSym/s  256QAM⬍
DS03: Frq: 345.00MHz USDOC⬍  SR:5361kSym/s  256QAM⬍
DS04: Frq: 351.00MHz USDOC⬍  SR:5361kSym/s  256QAM⬍
                             APPLY
    <<<    │    >>>   │          │           │    BACK
```

Figure 5-4 UMS downstream menu

5.1.1   Navigation with Arrow Keys

If the downstream frequency DS02 is to be changed for example, the arrow key ← has to be pressed twelve times to select the relevant field.

```
DS01: Frq: 333.00MHz USDOC⬍  SR:5361kSym/s  256QAM⬍
DS02: Frq: 339.00MHz USDOC⬍  SR:5361kSym/s  256QAM⬍
DS03: Frq: 345.00MHz USDOC⬍  SR:5361kSym/s  256QAM⬍
DS04: Frq: 351.00MHz USDOC⬍  SR:5361kSym/s  256QAM⬍
                             APPLY
    <<<    │    >>>   │          │           │    BACK
```

Figure 5-5 UMS downstream menu - frequency of DS no. 2 selected

5.1.2   Editing of Parameters via the Numeric Keyboard

5.1.2.1   Numeric Parameters

If a parameter is selected, it may be edited via the numeric keyboard. In case of the DS frequency from the example, the key sequence **6 → 3 → 4 → 0 → 0** has to be entered for a frequency of 634 MHz. This input has to be confirmed by pressing **ENTER**. You can see that the input is accepted and the next parameter (in this case the modulation) is selected.

```
DS01: Frq: 333.00MHz USDOC♦   SR:5361kSym/s    256QAM♦
DS02: Frq: 634.00MHz USDOC♦   SR:5361kSym/s    256QAM♦
DS03: Frq: 345.00MHz USDOC♦   SR:5361kSym/s    256QAM♦
DS04: Frq: 351.00MHz USDOC♦   SR:5361kSym/s    256QAM♦
                          APPLY
    <<<          >>>                                BACK
```

Figure 5-6 UMS downstream menu - frequency of DS no. 2 edited and confirmed

Now the modulation can be changed. The two arrows next to the standard default USDOC (for US-DOCSIS) indicate that this parameter can be changed by the arrow keys ↑ and ↓. For example, a key stroke to the top changes the modulation from USDOC to DVBC.

5.1.2.2   Alphanumeric Parameters

In case of parameters which allow alphanumeric strings, i.e. a combination of letters (possibly also in upper and lower case letters) and numeric characters, the course of action is different. Examples for alphanumeric input fields are file names of screen shots (upper case and numeric characters are permitted, see Chapter 10) and the input of cleartext names for the field instruments which are used at the UMS (upper and lower case letters as well as numeric characters are allowed, see Chapter 8.1.4).

In these cases, each character to be edited has to be selected in sequence via the arrow keys (←, →). The different characters possible can be generated by a multiple pressing of the keys of the numeric keyboard. The labelling of the keys indicates which characters can be generated by which key. The following characters can be generated as a maximum:

Key	Character
1	_ 1 + - . ! /
2	A B C a b c 2
3	D E F d e f 3
4	G H I g h i 4
5	J K L j k l 5
6	M N O m n o 6
7	P Q R S p q r s 7
8	T U V t u v 8
9	W X Y Z w x y z 9
0	Space character 0

A character of a string can be deleted by selecting the relevant position via the arrow keys and pressing the key **0** once.

If the input is complete, the next input field or menu item can usually be selected by pressing the **ENTER** key. This means it is not necessary to press an arrow key several times to skip each character of a longer character string. If you are satisfied with an input, it is possible to change right to the next input parameter even from the middle of a character string.

5.1.3   Save Settings

As mentioned above a setting is accepted by pressing the ENTER key. This induces the cursor to jump one position further. Now this parameter can be edited. In this way, it is possible to change from parameter to parameter until all settings have been made.

If further parameters shall be retained in their settings and not changed, you can skip the relevant parameter quickly and without making any changes either by **ENTER** or by →.

At the end of all settings, it is important to move the cursor in a submenu to "APPLY" and to acknowledge this menu item by **ENTER**. Only in this way will the settings made be permanently saved. Then the menu automatically goes one level back.

Chapter 6   Measuring Mode UMS (Upstream-Monitoring-System)

6.1   Introduction

The Upstream-Monitoring-System (UMS) is a measuring system consisting of an instrument in the headend and one or several handheld devices for field use. The UMS serves for measuring the return path in a DOCSIS net. The following measurements can be performed with this system: sweeping (= frequency response measurement), TILT measurement, BER measurement, MER measurement, constellation diagram, real time spectrum. The measurements can be performed during active modem operation.

The data transmission from the headend device to the handheld devices will be done via transport stream and DVB-C modulation. If the headend has a transport stream multiplexer, the UMS data stream may be added to an existing DVB-C channel.

The commands from the field device VAROS 107 to the headend AMA 310/UMS will be sent via narrow-band telemetry carriers which are directly located in the upstream frequency range on otherwise unused frequencies.

The overall communication is thus directly made via the cable net to be measured. No additional transmission channel (Internet, mobile communication connection, …) is required.

Further information can be found in the Application-Note "AN006 – Upstream-Monitoring-System UMS" on www.kws-electronic.de in "SUPPORT" → "Application Notes".

Basically the overall measurement functionality is initiated from the field device, during on-going UMS operation virtually no operating steps are required at the AMA 310/UMS. Therefore, we also refer to the operating instructions of the field device VAROS 107 apart from the Application Note mentioned above.

6.2   Starting the System

Before the UMS system can be used successfully, some settings have to be made on the headend. These are summarized in Chapter 8 - UMS Configuration.

Unless "AUTO-START" has been set in the configuration (see Chapter 8.1.1.1 - Auto-Start), the function UMS can be started manually from the basic state via the **F2** key (START).

First all hardware modules are initiated. Subsequently the return path spectrum can be seen on the graphics screen (see Figure 6-1).

The level raster is 10 dB/DIV. The dynamic range may be a maximum of 70 dB.

The labeling of the level lines in the unit dBµV can be seen on the left. In the lower blue bar the start and stop frequencies (band limits) are shown.

The horizontal dotted line with red labeling "ref" is the level reference preset in the UMS setting (see Chapter 8.1.3 - Network Settings) which should correspond to the nominal input level of the CMTS.

Note: **The scaling of the level axis is done automatically depending on the reference level set!**
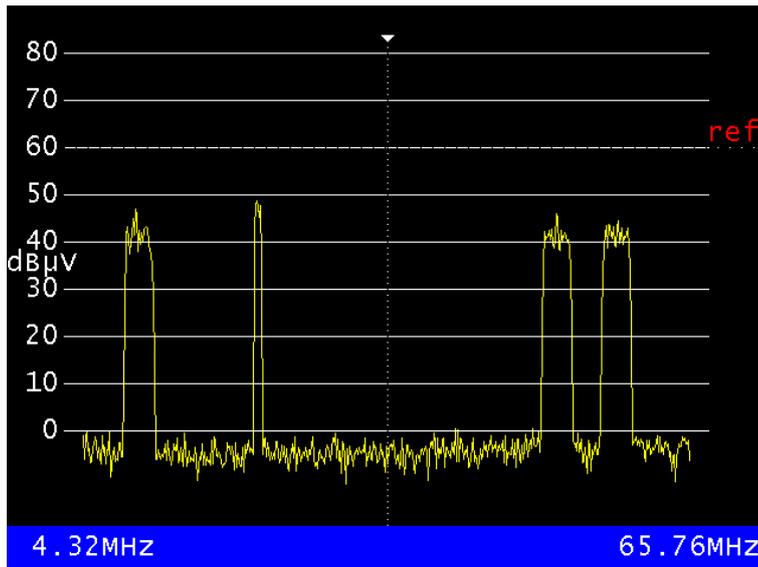
Figure 6-1 Graphics screen content after starting the UMS measuring mode

Now the LC display shows the following information:

Figure 6-2 Start display of the LC display after starting the UMS (TS output via IP)

The state "Idle" means that no field instrument is performing an exclusive measurement at the moment, i.e. at the moment the headend AMA 310/UMS is not exclusively available for any field instrument VAROS 107. In this state, each field instrument can require a measurement from the headend. Status reports apart from "Idle" can be taken from chapter "6.6 - Displays for Measurements in Connection with the Field Device VAROS 107").

The key ABORT (Cancel) terminates the UMS operation and puts the instrument back into the basic state.

If the back-side Ethernet interface in the UMS settings is chosen as transport stream output (see Chapter 8.1.1.4 - TS Output) there is also a status message as regards this interface in the LC display as can be seen above. In case of a not successful IP link, the following is shown:

Figure 6-3 Start display in the LC display after starting the UMS (missing IP link)

If the back-side ASI interface in the UMS settings is chosen as transport stream output (see Chapter 8.1.1.4 - TS Output) the connectivity status display is missing completely and the following display results:

```
┌──────────────────────────────────────────────────────┬──────────┐
│State: Idle                                             │          │
│                                                        │          │
│                                                        │          │
│                                                        │          │
│                              18.11.16   15:30:29       │          │
├──────────────────────────────────────────────────────┼──────────┤
│Upstream-Meas-System running...                         │  ABORT   │
└──────────────────────────────────────────────────────┴──────────┘
```

Figure 6-4 Start display of the LC display after starting the UMS (TS output via ASI)

On the right bottom in the LCD, the current time and the date are shown.

6.3   Power Save Mode

If the saving mode is set (see chapter 8.1.1.3 - Power Save Mode), the graphics screen (together with the LC display illumination and the keyboard illumination) switches off automatically after a short time. Above the **F5** key an inverted note regarding this saving mode appears:

```
┌──────────────────────────────────────────────────────┬──────────┐
│State: Idle                                             │          │
│                                                        │          │
│                                                        │          │
│                                                        │          │
│                              19.11.16   06:53:04       │          │
├──────────────────────────────────────────────────────┼──────────┤
│Upstream-Meas-System running...                         │POWER SAVE│
└──────────────────────────────────────────────────────┴──────────┘
```

Figure 6-5 Power save mode active (TS via ASI)

In the saving mode, which is set as the standard mode in permanent operation in the headend for energy reasons, the accidental interruption of the UMS mode is made more difficult by the fact that the display POWER SAVE replaces the menu item ABORT . An interruption in the power save mode is only possible by pressing the **HOME** key.

By pressing the **F5** key, the saving mode may be temporarily deactivated, for example in order to check the graphics display. The following display is shown:

```
┌──────────────────────────────────────────────────────┬──────────┐
│State: Idle                                             │          │
│TS->IP-Link:Ok!                                         │          │
│                                                        │          │
│                                                        │          │
│                              19.11.16   06:56:05       │          │
├──────────────────────────────────────────────────────┼──────────┤
│Upstream-Meas-System running...                         │POWER SAVE│
└──────────────────────────────────────────────────────┴──────────┘
```

Figure 6-6 Power save mode inactive (TS via IP)

After about 10 seconds, the instrument returns automatically to the power save mode.

The power save mode remains switched on as long as it is not de-activated manually. This means, even if the UMS function is once left via **HOME** or if the autostart mechanism takes effect (see Chapter 6.4) and the instrument has been current less for some time, after a renewed activation of the UMS mode, the power save mode is active again.

6.4   Autostart

The headend can be set such that the UMS function is automatically started after switching the instrument on (see Chapter 8.1.1.1). It is recommended to activate this function if the instrument is firmly installed in a headend. Thus, the instrument is automatically ready for operation again after a power failure.

The autostart function remains switched on as long as it is not deactivated again manually. This means, even if the UMS function is once left via ABORT or **HOME** (see above) or if the spectrum analyzer is called up (see Chapter 7 - Analyzer Mode), the UMS mode is activated again automatically after switching the instrument off and on again.

6.5   Keyboard Lock

As described in chapter 8.1.1.2 - Keyboard Lock, a key lock may be activated.

If the instrument is located in a headend, it is recommendable to switch it on to prevent an accidental switch-off of the UMS function. Even leaving the power save mode is not possible with the key lock. The following LC display is shown:

```
State: Idle



                          19.11.16  06:53:04
Upstream-Meas-System running..Keyb. locked POWER SAVE
```

Figure 6-7 Keyboard lock active

Note: **The key lock may be cancelled by the key combination HOME → 3 → 1 → 0 → ENTER.**

Subsequently the instrument can be operated normally for 10 seconds. However, if the UMS function is not left during this time period, the key lock switches on again.

Just as the functions Autostart and Power Save Mode the key lock will be maintained, even if the instrument is switched off. The function has to be deactivated explicitly in the UMS settings.

6.6   Displays for Measurements in Connection with the Field Device VAROS 107

Below some displays are described which may appear in the different measurement situations in connection with the field instrument VAROS 107. However, as these cannot be influenced at the AMA 310/UMS, we refer to the operating instructions of the field instrument and to the already mentioned Application Note AN006[1] for operating the system and for interpreting the results.

The displays presented here are examples and may deviate in field use depending on which TS output has been selected, which mode has been selected (power save mode, keyboard lock) and whether an optional cluster switch SW 024 (see Chapter 6.8 - Operation with optional Cluster-Switch SW 024) is used.

6.6.1   Spectrum Display, Waterfall Diagram Display and TS Information on Field Instrument

The measuring and/or display modes of the field instrument mentioned in the headline are so-called passive modes, which can be performed by every field instrument. Here the graphics display shows the spectrum as shown in Figure 6-1. The LC displays also correspond to the above shown displays, provided there is a working TS connection. Thus, it is not possible to read out on the headend how many field instruments are just working "passively".

6.6.2   Ranging and Commands via Telemetry Carriers from Field Instruments

Narrow-band signals can be detected from time to time in the spectrum which vary substantially also in their level. This may be ranging processes of the field instruments where the upstream transmission level is adjusted in such a way that signals of the field instruments arrive exactly with the reference level set at the headend. This ranging is performed on one of the four TILT carriers (see also Chapter 8.1.5.3 - TILT Measurement). On the other hand the narrow-band signals may

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[1] Can be found on the KWS homepage: www.kws-electronic.de → Support → Application Notes

be telemetry commands from field instruments, for example if a field instrument wants to change from the passive measuring mode into an exclusive access to the headend, e.g. for a frequency sweep.
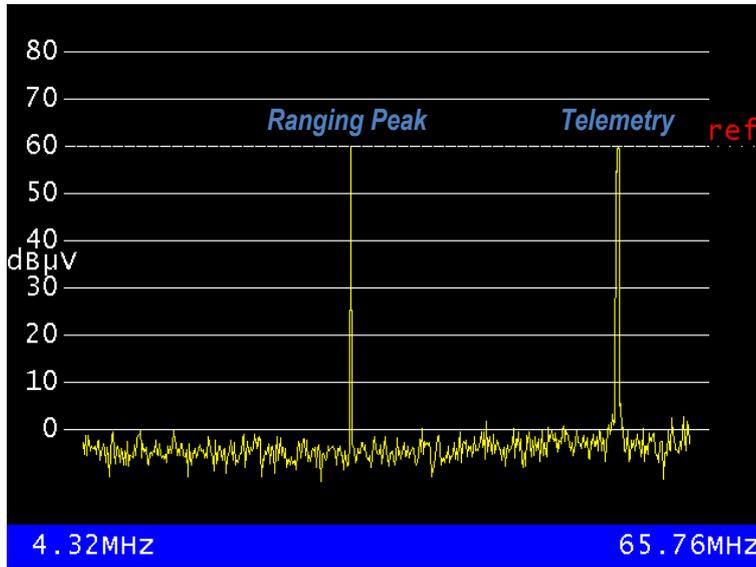

Figure 6-8 Ranging and telemetry signals in the return path spectrum

6.6.3   MAX-HOLD-Function in the Spectrum

In the graphics display of AMA 310/UMS, also this mode does not lead to a changed display. However, the LC display now shows the state "MaxHold" as well as the storage space number within the UMS settings (here: 3) and the serial number (here 61317) of the field instrument which requested the MAX-HOLD display:

Figure 6-9 LC display after MAX-HOLD request by a field instrument

6.6.4   Frequency Sweep by a Field Instrument

Also this mode (sweeping = determination of the frequency response) does not lead to a changed representation in the graphics display. In the real time spectrum, you can see that "frequency packets" of four sinus signals, which are close to one another, are pushed through the return path frequency range, such that the frequency response is determined. The LC display now shows the status "Sweeping" as well as the storage space number within the UMS settings (here: 3) and the serial number (here 61317) of the field instrument performing the frequency sweep:

Figure 6-10 LC display during sweeping measurement by a field instrument

6.6.5 MER/BER Measurement and Quickcheck

The LC display here shows the status "BER-Measurem." as well as the storage place number within the UMS settings (here: 3) and the serial number (here: 61317) of the field instrument performing the quality measurement:

```
State: BER-Measurem.    Handheld: 3 (61317)
TS->IP-Link:Ok!
 24.50MHz    LOCK    PRBS   256QAM   SR=2560
          L= 59.7dBuV  MER>40.0dB  BER<1.00e-8

Upstream-Mess-System running...              ABORT
```

Figure 6-11 LC display during MER/BER measurement by a field instrument

Apart from all parameters defined above the display continues to show:

MER/BER Parameters	Indicated Value
Frequency	24.50 MHz
LOCK Status	LOCK
Transmission data format	PRBS (pseudo-random bit sequence)
Modulation	256QAM
Symbol rate	SR = 2560 kSymb/s
Reception level	L = 59.7 dBμV
MER (modulation error rate)	> 40 dB
BER (bit error rate)	< 1.00e-8 (corresponds to < $1 \cdot 10^{-8}$)

In case of the Quickcheck, the display switches between up to four BER measurements.

During a MER/BER measurement, the graphics screen shows the real-time constellation:
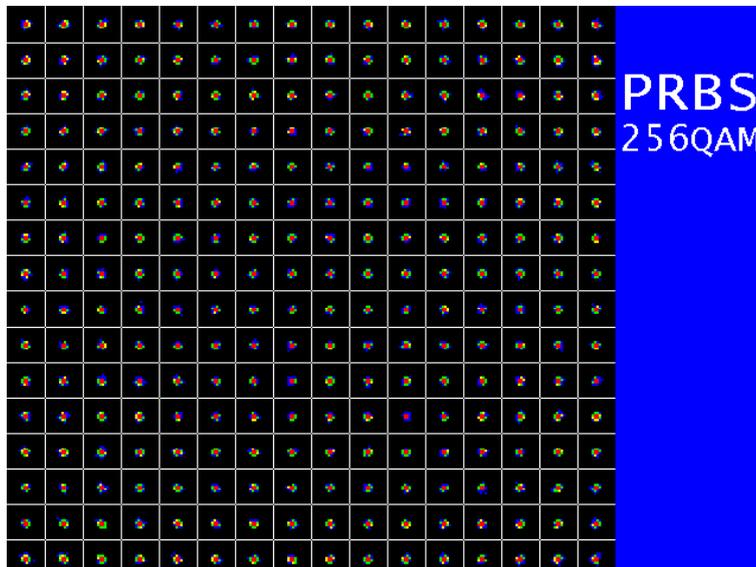
Figure 6-12 Constellation diagram during MER/BER measurement by a field instrument

6.6.6 Line-up Assistance and TILT Measurement

During measurements which are based on the transmission of 4 sinusoidal carriers by the field instrument, the status "TILT-Measurem.", the storage space number within the UMS settings (here: 3) as well as the serial number (here: 61317) of the field instrument performing the TILT measurement or the line-up process is shown in the LC display. The graphics screen shows the real time spectrum in which now the four sinusoidal carriers as they have been defined in the UMS

settings (see Chapter 8.1.5.3 - TILT Measurement), can be seen. The following two figures show both display screens as an example.

```
State: TILT-Measurem.    Handheld: 3 (61317)
TS->IP-Link:Ok!



                              19.11.16  07:28:18
Upstream-Mess-System running...            ABORT
```

Figure 6-13 LC display during TILT measurement by a field instrument
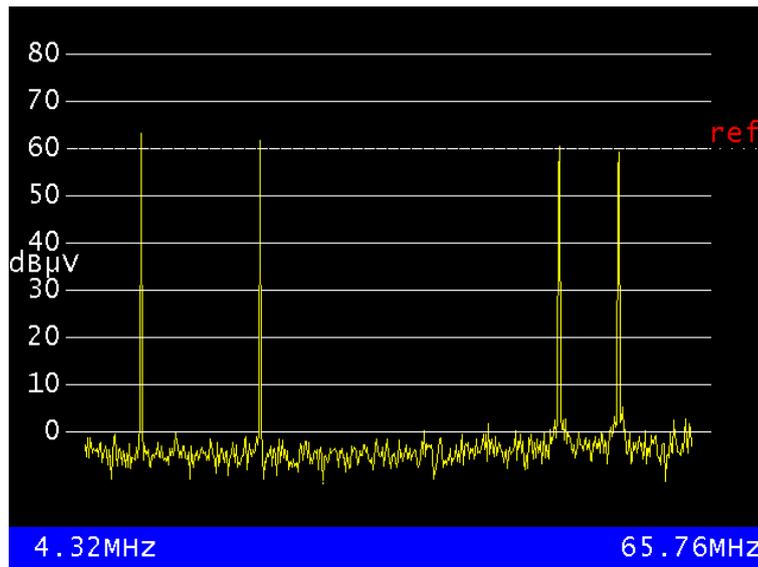
Figure 6-14 Graphics display during TILT measurement by a field instrument

6.6.7   Report Generation by a Field Instrument

The field instruments can generate an automated report (protocol) as specified by the headend. For the report, all measurements which the measurement system is able to perform are carried out one after the other. This means: a MER/BER measurement on up to four test carriers, a frequency sweep for exact frequency response analysis of the overall return channel frequency range as well as (independent of the UMS system!) a measurement of forward channels by the field instrument.

For the displays at the headend, this simply means that the above described displays for BER measurement, frequency sweep, ranging processes and telemetry communication alternate.

6.7   Timeout

If a field instrument does not actively terminate an exclusive measurement (e.g. sweeping, BER measurement) (e.g. because the battery of the field instrument is empty or a technician forgets to terminate the measurement), the exclusive measurement of the headend is terminated according to a fixed timeout of about 10 minutes.

In this case, a relevant message is shown on the field instrument ("Measurement stopped from Headend").

This ensures that a forgotten or defect field instrument does not block the UMS system too long and also other field technicians can perform their active measurements.

The counter performing the timeout is reset whenever the headend receives new instructions from the field instrument by telemetry commands.

6.8   Operation with optional Cluster-Switch SW 024

This chapter refers exclusively to the displays at the headend AMA 310/UMS. As regards the advantages of a measurement with the connected optional cluster switch SW 024, installation, initial operation, switch-on sequence and configuration options we here refer to the following chapters and documents:

- Application-Note AN006 – Upstream-Monitoring-System UMS[2]
- Operating Instructions SW 024
- Chapter 3.7 - Control Output to optional Cluster-Switch SW 024
- Chapter 4.4 - Connection of the Instrument
- Chapter 4.5 - Connection with the optional Cluster-Switch SW 024
- Chapter 4.6 - Switch-On
- Chapter 8.1.7 - Cluster Differentiation when using the RF Switch SW 024

For the operation of the SW 024 at the AMA 310/UMS, no specific operating steps at the headend are required after installation, cabling and configuration in the UMS settings. The AMA 310/UMS only has to "know" of the existence of an SW 024 switch and this is ensured by the switch-on sequence, which has to be observed (see Chapter 4.6 - Switch-On). Via the transport stream, this information is also passed on to all field instruments. The switch is then controlled automatically and/or this is activated by the field instrument.

The displays presented here are examples and in field use there may be deviations depending on which TS output or which mode is chosen (power save mode, keyboard lock).

6.8.1   Summary and Selective Path

When operated with the cluster switch SW 024 there are two fundamentally different operating types. On the one hand, the switch can lead the summary signal of all 24 inputs to the AMA 310/UMS, on the other hand, the signal of an individual path can be applied selectively on the headend unit.

Note: **With one exception, (MAX-HOLD function) only passive measurements by the field instruments are possible in the summary mode.**

The following measurements/displays can be performed by the field instrument in the summary mode:

- Spectrum display of the summary signal
- Waterfall diagram display of the summary signal
- Display of meta data within the transport stream (TS-Info)
- MAX-Hold function

The following measurements/displays can be performed by the field instrument in the selective mode:

- Spectrum display of the selective path
- Waterfall diagram display in the selective path
- Display of meta data within the transport stream (TS-Info)
- MAX-HOLD function
- Frequency sweep
- MER/BER measurement and Quickcheck
- Line-up assistance and TILT measurement
- Report / protocol generation

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[2] Can be found on the KWS homepage: www.kws-electronic.de → Support → Application Notes

After switch-on and if no field instrument is actively measuring in the system, the summary mode is active by default.

6.8.2 Displays in the Summary Mode

The displays during measurements in the summary mode correspond to the displays shown in the preceding chapters. There is just a reference to the summary mode in the LC display and in the graphics display.

```
State: Idle
TS->IP-Link:Ok!          Summary Path


                                19.11.16  07:31:05
Upstream-Meas-System running...          ABORT
```

Figure 6-15 Start display of the LC display in the summary mode of the SW 024 (TS output via IP)
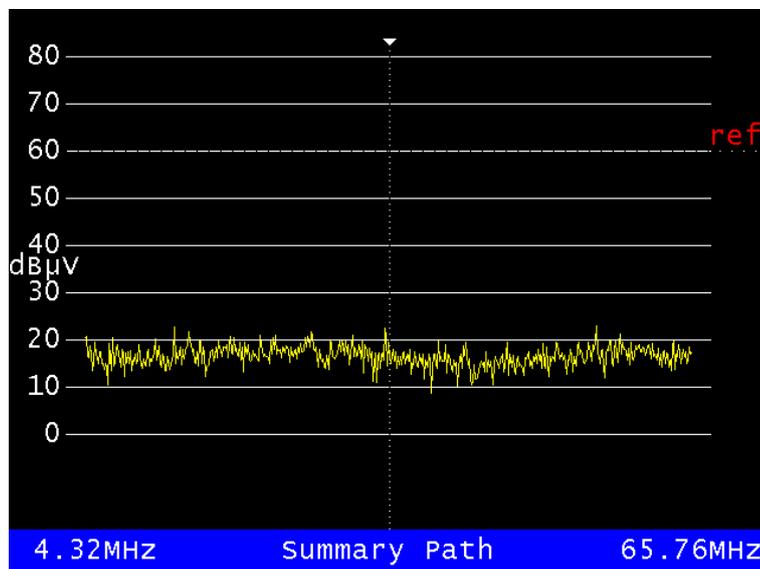
Figure 6-16 Graphics screen content in the basic state of the UMS measuring mode with switch

```
State: MaxHold          Handheld: 3 (61317)
TS->IP-Link:Ok!          Summary Path


                                19.11.16  07:38:24
Upstream-Meas-System running...          ABORT
```

Figure 6-17 LC display at MAX-HOLD request by a field instrument in summary mode

6.8.3 Displays in the Selective Mode

In a cluster-selective measurement by a field instrument the measuring system automatically determines the input of the switch to which the field instrument which makes the current measuring request is connected. This input will then be exclusively connected to the headend unit.

The displays during measurements in the selective mode correspond to the displays shown in the preceding chapters. There is just a reference to the cluster presently connected through to the AMA 310/UMS in the LC display and also in the graphics display.

```
State: Sweeping         Handheld: 3 (61317)
TS->IP-Link:Ok!         Cluster04: Any Street


                        19.11.16  07:44:07
Upstream-Meas-System running...        │ ABORT
```

Figure 6-18 LC display during a frequency sweep by a field instrument at switch input 4

```
State: BER-Measurem.    Handheld: 3 (61317)
TS->IP-Link:Ok!         Cluster04: Any Street
 24.50MHz    LOCK    PRBS  256QAM   SR=2560
         L= 60.7dBuV  MER>40.0dB  BER=3.63e-3

Upstream-Meas-System running...        │ ABORT
```

Figure 6-19 LC display during MER/BER measurement by a field instrument at switch input 4

```
State: TILT-Measurem.   Handheld: 3 (61317)
TS->IP-Link:Ok!         Cluster04: Any Street



                        19.11.16   07:47:21
Upstream-Meas-System running...        │ ABORT
```

Figure 6-20 LC display during TILT measurement by a field instrument at switch input 4
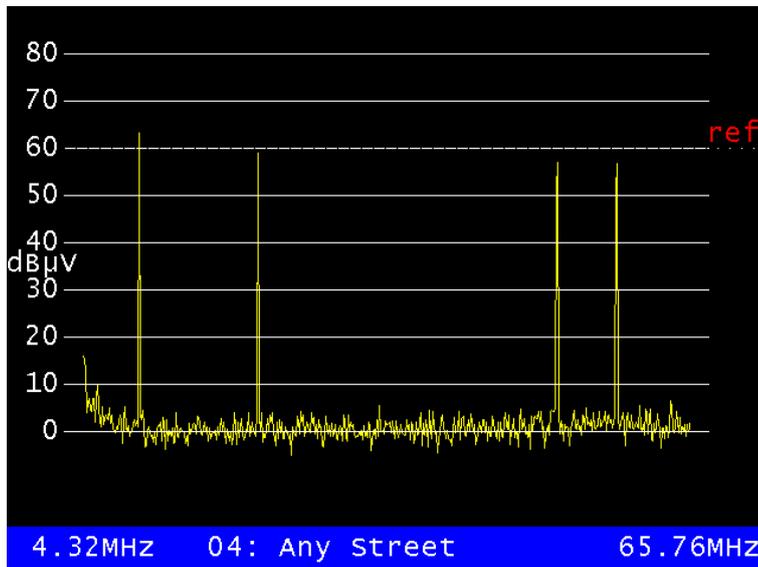
Figure 6-21 Graphics display during TILT measurement by a field instrument at switch input 4

6.8.4   Final Remarks

The remarks on ranging and telemetry signals which can be found in "Chapter 6.6.2 - Ranging and Commands via Telemetry Carriers from Field Instruments" apply by analogy for the operation with the cluster switch.

Moreover, certain commands and/or frequencies are down mixed to a frequency below the return path spectrum (4.33 MHz) within the switch. Therefore, spectral activities may sometimes be visible here.

The constellation view does not differ from the UMS operation without the switch SW 024.

Chapter 7   Analyzer Mode

The AMA 310/UMS headend device may also be used as a "stand-alone" spectrum analyzer for the return path range. For the return path frequency range the spectrum analyzer may be selected from the basic state of the AMA 310/UMS.

Caution: **During the "stand-alone" analyzer mode no transport stream will be passed on to the field instruments and communication of the field instruments to the headend is also not possible!**

The following display shows a return path spectrum as an example:
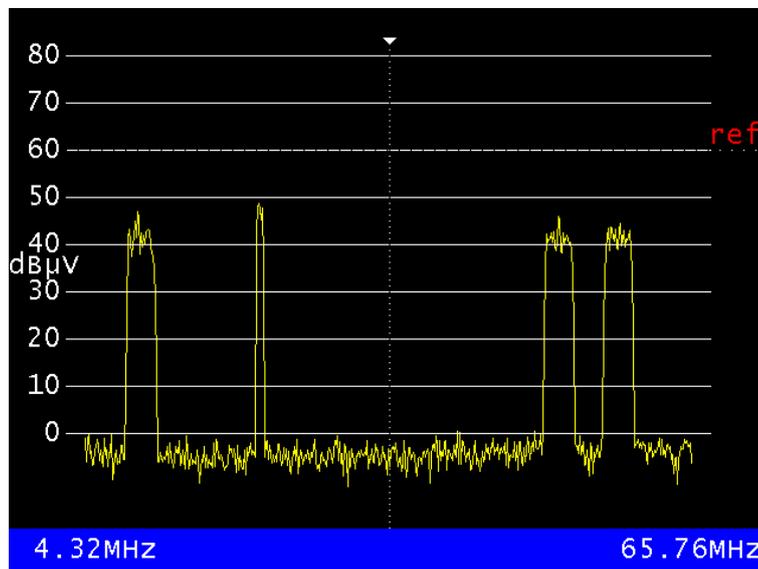
Figure 7-1 Graphics display after start of the real time spectrum analyzer

The level raster is 10 dB/DIV. The dynamics can be a maximum of 70 dB.

The labelling of the level lines in the unit dBμV can be seen on the left side. In the blue bottom line the start and stop frequency (band limits) are shown. At the same time, further information is shown in the LC display. These are the current cursor position, the level measured at the cursor position as well as the attenuation of the input RF level set.

Figure 7-2 LC display content after call-up of the return path spectrum analyzer

7.1   Call-Up and Abort of the Analyzer

The analyzer is called up by pressing the **ANALYZ** key in the basic state of the instrument. Now the analyzer determines the spectrum in real time over the complete return path frequency range.

The menu item ABORT terminates the analyzer and the instrument returns to the basic state.

7.2   Cursor

After calling up the analyzer the cursor (vertical dotted line) is exactly in the center of the spectrum shown at 35.04 MHz. The cursor can be moved within the display to the left and/or right by the arrow keys ← and →. One-time, short pressing of an arrow key moves the cursor by exactly one pixel on the graphics screen into the desired direction. If an arrow key is pressed longer, the cursor movement accelerates. The LC display shows the frequency of the current cursor position in MHz.

7.3   Level Display

Apart from the current cursor position, the LC display constantly shows the level measured at this position. In this level measurement it has to be taken into account that the level shown refers to the measurement bandwidth corresponding to one pixel of the graphics display (120 kHz). A level measurement by the cursor is thus only possible for sinusoidal carriers, but not for QAM-modulated broadband channels.

In the following two representations, all carriers have a level of about 60 dBµV. However, the signal level in case of the QAM carrier in Figure 7-4 is distributed over a 6.4 MHz bandwidth, whereas in the sinus case the overall level is concentrated in the discrete carrier.

Please take more detailed information from the Application Note AN005 - Spectrum Analysis. You can find it on our homepage www.kws-electronic.de → Support → Application Notes.
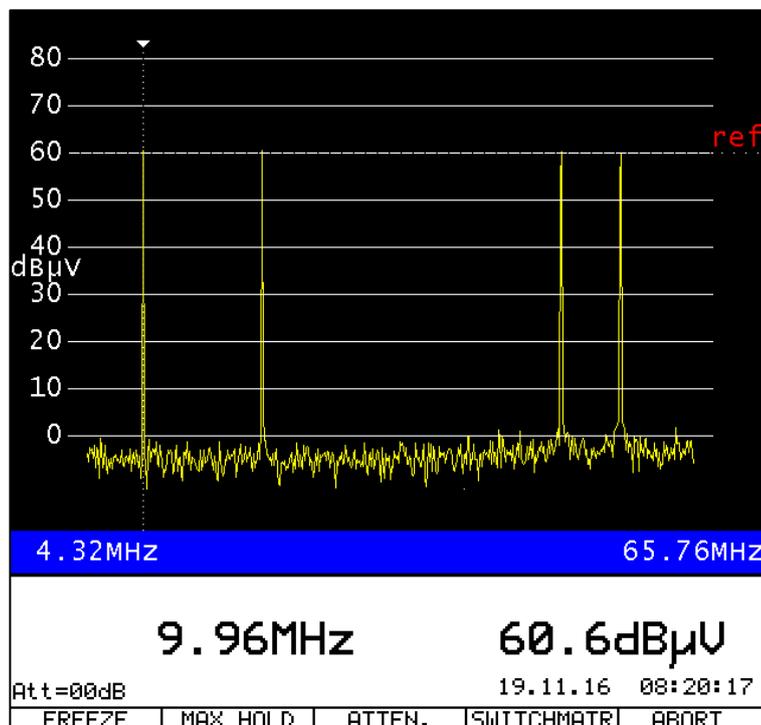
Figure 7-3 Level measurement of a sinusoidal carrier with approx. 60 dBµV in the analyzer
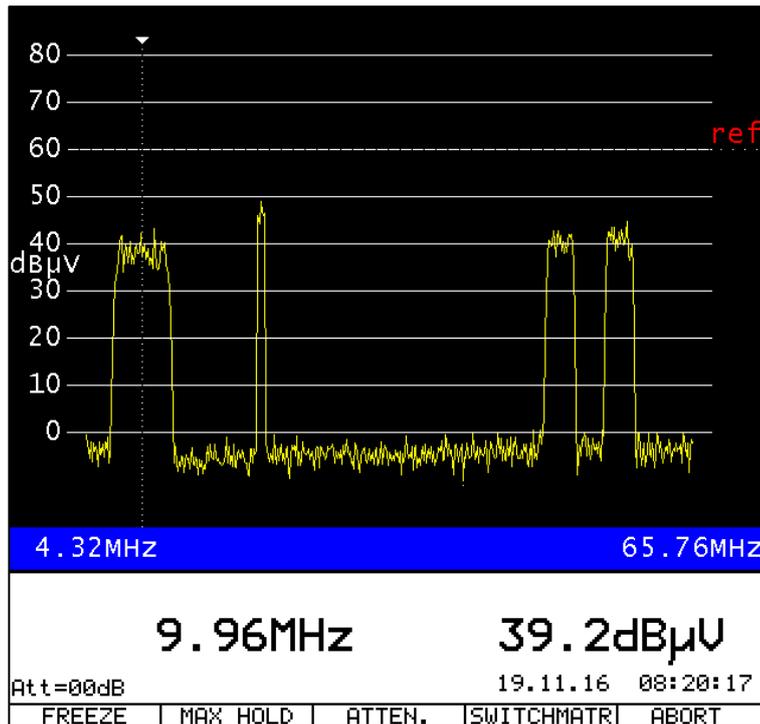
Figure 7-4 Level measurement of a 6.4-MHz-QAM-carrier with approx. 60 dBµV in the analyzer

7.4 Freezing of the Spectrum

By selecting FREEZE the current spectrum can be frozen. In this state, the menu item FREEZE is shown inverted. If the menu item FREEZE is selected once more, the analyzer picture will be constantly updated again.

7.5 MAX-HOLD Function

By the menu item MAX HOLD the Max-Hold function is activated. The menu item is then shown inverted. If the menu item MAX HOLD is selected once again, the function is deactivated again.

Figure 7-5 Activation of the MAX-HOLD function in the real-time analyzer

In the MAX-HOLD operation, the spectrum is only updated if the level between two measurement cycles has increased. Particularly when searching ingress disturbers this function is of crucial importance, as they often occur only for a very short time.

As the spectrum is continuously (real-time!) determined within the instrument by AD converter sampling, even shortest ingress peaks can be identified and shown reliably, even if they occur between to screen updates.

Apart from the inverted representation of the MAX HOLD menu item there is on the top right in the graphics display also a reference to the activated MAX-HOLD function for screen shots and documentation purposes:
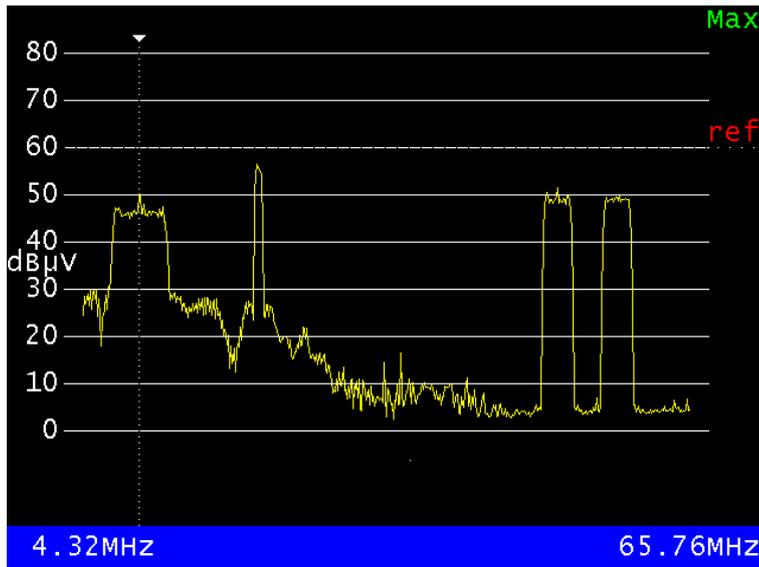
Figure 7-6 Graphics display of the spectrum with activated MAX-HOLD function

7.6   Reference Line

In all figures above a horizontal dotted line in red lettering "ref" can be seen. This is the level reference preset in the UMS settings (see Chapter 8.1.3 - Network Settings) which should correspond to the nominal input level of the CMTS. The scaling of the level axis is done automatically depending on the reference level set!

7.7   Input Attenuation

In order to drive the sensitive RF input stages and the analog-to-digital-converter (ADC) of the instrument in an optimum way and/or not to overload it, the RF input signal of the AMA 310/UMS has to be attenuated depending on the expected level conditions at the RF input. The instrument derives the "level conditions to be expected" from the reference level set.

The automatically selected attenuation is shown on the bottom left in the LC display.

As shown for example in Figure 7-3 and Figure 7-4 no RF attenuation is required for a reference level of 60 dBµV, the display in the LCD therefore reads "Att=00dB".

If for example a value of 75 dBµV is predefined as reference level in the UMS settings (see Chapter 8.1.3 - Network Settings), the display reads "Att=15dB". This means that the input signal is attenuated by 15 dB before it is passed on to further signal processing.

The following figure shows the graphics and LC display for exactly this case (Ref = 75 dBµV, Att = 15 dB). Four sinusoidal carriers at about reference level are measured:
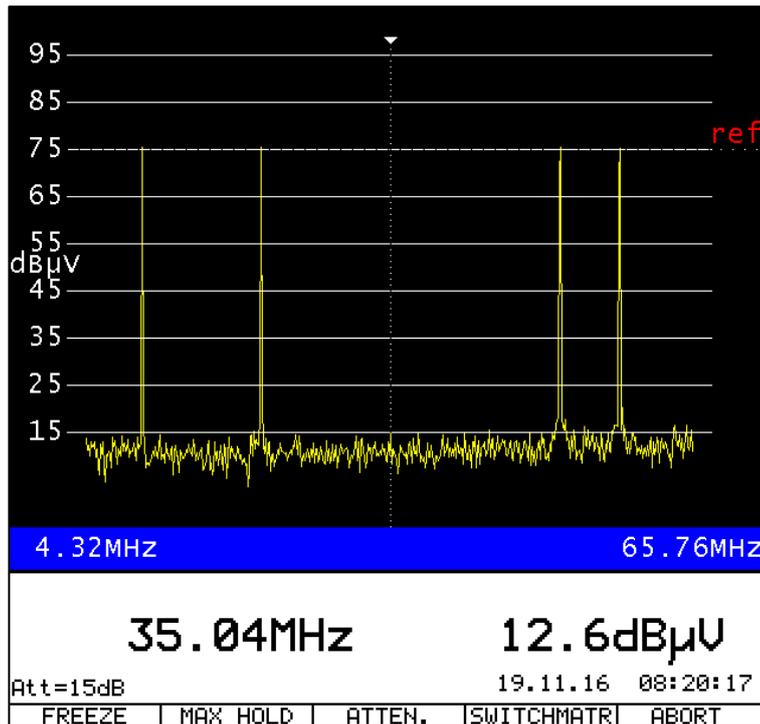
Figure 7-7 Graphics and LC display of the analyzer at a reference level of 75 dBµV

The attenuation selected automatically by the measuring instrument can be manipulated by the menu item **ATTEN.** in 5-dB steps. **-5dB** reduces the input attenuation of the instrument, **+5dB** increases it.
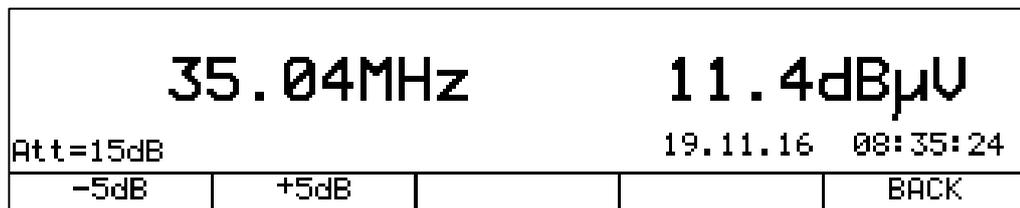
Figure 7-8 Attenuation menu in analyzer mode

A higher attenuation than the one automatically selected is required if levels are to be measured which are significantly higher than the reference level (higher large-signal immunity of the RF input!).

A lower attenuation can be set if small ingress portions and/or the noise floor among the useful signals have to be evaluated more exactly.

Care should be taken if the attenuation is reduced. Thus, the RF input may be easily overloaded by the useful signals applied. The result of an overload are distortions, which become noticeable by harmonics and mixing products from the useful signals. This means signal portions arise which are not contained in the measured signal, but are produced by the measuring instrument itself. Particularly disturbing is this effect with narrow-band signals (high signal level within a small bandwidth), a maximum results when sinusoidal carriers are measured, as is proven by the following figures. Based on Figure 7-7 (ideal attenuation (15 dB) and measuring electronics optimally driven) the attenuation is reduced step by step by 5 dB. Due to the very good properties of the receiver, still no negative effect is visible at attenuations of 10 dB and 5 dB, actually more detailed information on the signal portions "below" the sinusoidal carrier can be gathered. However, at 0 dB attenuation the overloading of the instrument is immediately visible.
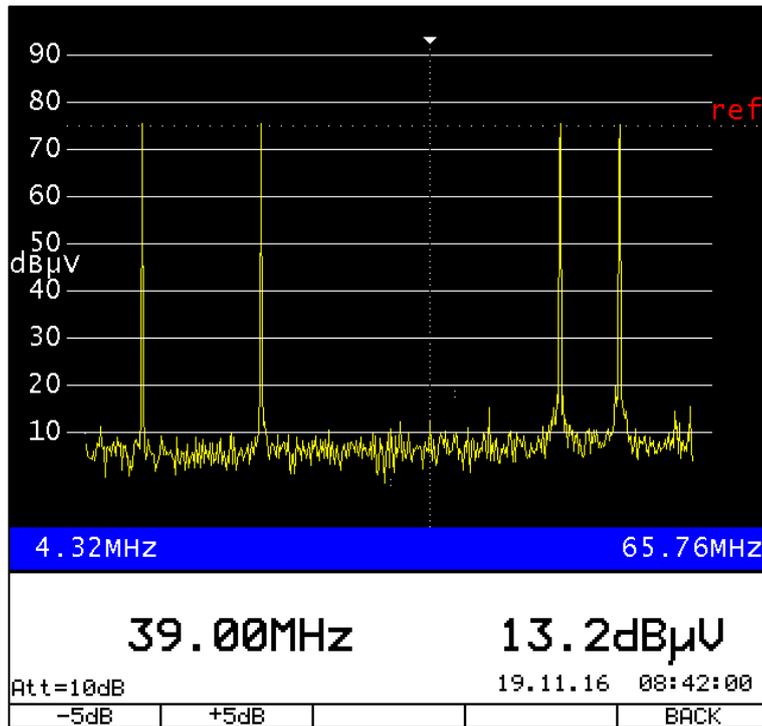
Figure 7-9 Analyzer: Reference level = 75 dBμV; attenuation = 10 dB
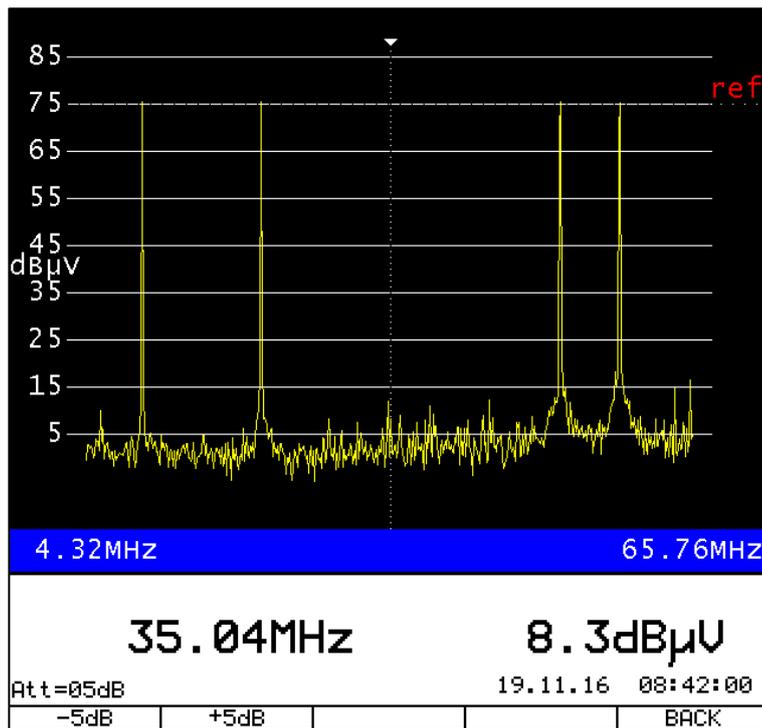
Figure 7-10 Analyzer: Reference level = 75 dBμV; attenuation = 5 dB
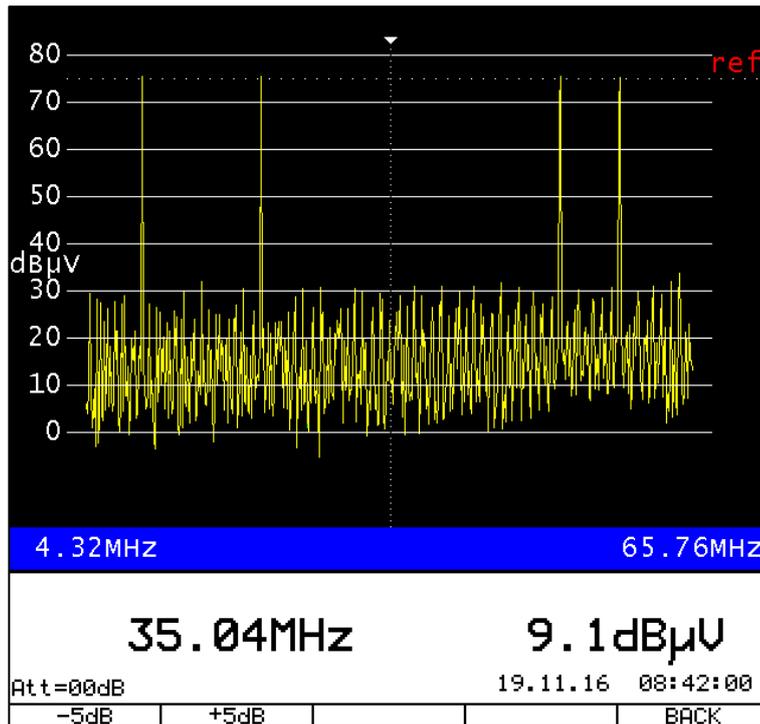
Figure 7-11 Analyzer: Reference level = 75 dBµV; attenuation = 0 dB → Overload

7.8   Operation with optional Cluster-Switch SW 024

For the analyzer operation of AMA 310/UMS in combination with the optionally available cluster switch SW 024 basically all contexts as they have been described in "Chapter 7 - Analyzer Mode" are equally valid.

When switching the system on, the sequence described in "Chapter 4.6 - Switch-On" has to be observed!

More detailed information regarding the RF Switch SW 024 can be taken from the relevant operating instructions as well as from the Application-Note "AN006 – Upstream-Monitoring-System UMS"[3].

Differences in the display are only given in the graphics display where in the blue line at the bottom of the display now the configurable alias name of the selected switch input is additionally shown between the band edge frequencies of the spectrum.

After activating the analyzer with the switch connected, the spectrum of the summary path is shown as a standard (see also operating instructions of SW 024), this will be illustrated via the expression "Summary Path" in the graphics display (see the following figure). The noise floor in this representation is higher than in the measurement without switch or a selective path of SW 024, as here the noise of all 24 input channels is added up at the RF input of the AMA 310/UM.

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[3] Can be found on the KWS homepage: www.kws-electronic.de → SUPPORT → Application Notes
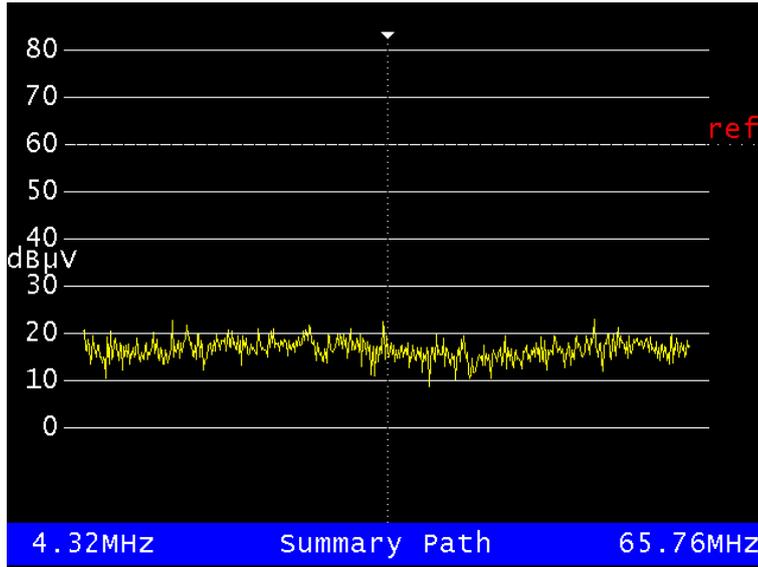
Figure 7-12 Analyzer operation with switch SW 024: summary path

By the menu item **SWITCHMATR** (**F4** key, see Figure 7-2) it is possible to switch between the inputs of the RF switch and the summary signal generation.
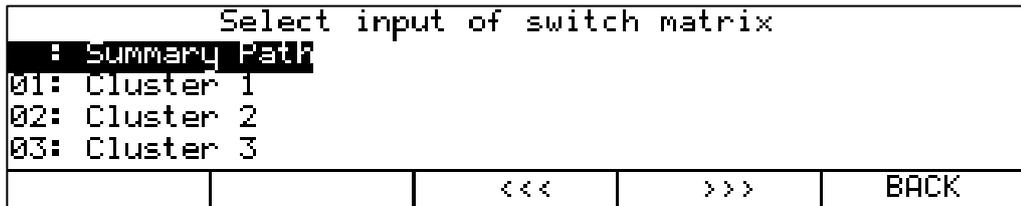
Figure 7-13 Analyzer operation with switch SW 024: input selection

The alias names shown here for the switch inputs can be configured. This will be described in "Chapter 8.1.7 - Cluster Differentiation when using the RF Switch SW 024".
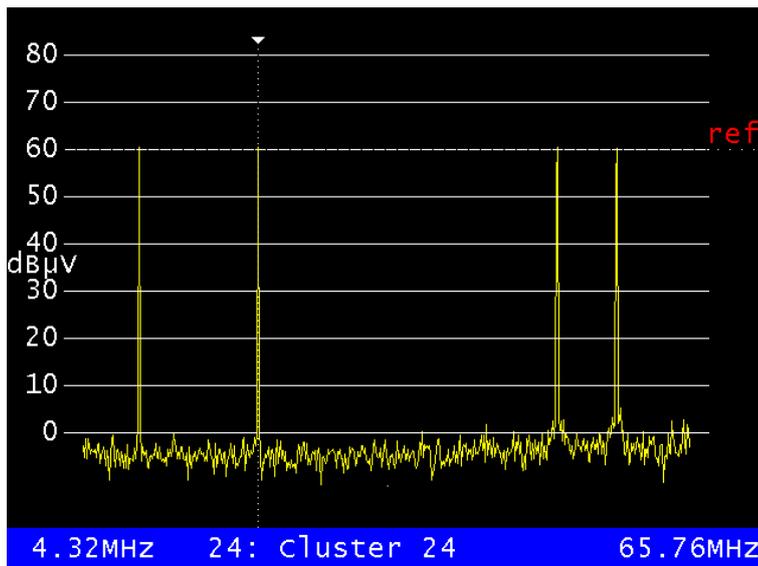

Figure 7-14 Analyzer operation with switch SW 024: selective path

If the menu item **SWITCHMATR** is selected without connecting a RF switch, the following error message appears:

```
        35.04  ┌─────INFO─────┐ 4.5dBµV
               │Not available!│
Att=00dB       │     OK       │.11.16  08:56:20
               └──────────────┘
 FREEZE  │ MAX HOLD │  ATTEN.  │SWITCHMATR│  ABORT
```

Figure 7-15 Input selection in analyzer operation with switch SW 024 without connected switch

Chapter 8   UMS Configuration

8.1   Settings Headend Device

Before initial operation of the UMS, some settings have to be made at the headend.
The menu for the basic settings can be called up via **UMS SETUP** from the basic state of the AMA 310/UMS.

8.1.1   Configuration

By selecting these menu items, instrument-specific settings can be made for the operation mode UMS.

8.1.1.1   Auto-Start

By selecting **CONFIG.** → **AUTO-START** the headend can be set such that the UMS function will be started immediately after switching on the instrument. It is recommended to activate AUTO-START if the instrument is permanently installed in a headend. Thus, the instrument is automatically ready for operation again after a mains failure.

8.1.1.2   Keyboard Lock

By selecting the menu item **CONFIG.** → **KEYB.LOCK** a key lock can be activated.
If the instrument is located in a headend, it is recommendable to switch it on to avoid accidental switch-off of the UMS function. The key lock can be cancelled by the key combination **HOME** → **3** → **1** → **0** → **ENTER.** Subsequently the instrument can be operated normally for 10 seconds. However, if the UMS function is not left within this time, the key lock switches on again.

8.1.1.3   Power Save Mode

By selecting the menu item **CONFIG.** → **POWER SAVE** an energy saving mode can be activated. In this setting shortly after the start of the UMS function, the graphics screen, the LC display illumination and the keyboard illumination switch off.

8.1.1.4   TS Output

By selecting the menu item **CONFIG.** → **TS-OUTPUT** the interface for the transport stream output can be selected and configured, if required.

By selecting **CONFIG.** → **TS OUTPUT** → **ASI** or → **IP** the interface for the transport stream output can be set.

For the transport stream output via IP the instrument has a second Ethernet socket on the back panel of the instrument. The standard is Fast Ethernet 10/100Base-T.

When the transport stream is transmitted via an IP network, the transport stream packets are encapsulated in IP packets. UDP or UDP/RTP are used as protocol. Up to 7 TS packets can be put into one IP packet.

By selecting **CONFIG.** → **TS OUTPUT** → **TSoIP CONF** the IP interface (streaming interface) can be configured. This includes IP address, subnet mask, standard gateway and data encapsulation (UDP or UDP/RTP). By selecting **TSoIP CONF** → **IP-ADR**, **SUBNETMASK**, and **STDGATEWAY** the IP settings for the streaming interface can be made. For the transmission of the transport stream via the UDP and/or UDP/RTP protocol, in addition the IP address and the port of the

receiver have to be set. This is made by selecting the menu item TSoIP CONF → DEST IPADR. The input behind the ":" corresponds to the destination port:

```
    ENTER THE DEST-IP-ADDRESS:PORT
  192.001.005.003: 8000
                  OK
                                        BACK
```

Figure 8-1 Input of the destination IP address and port for the TS streaming interface

- Unicast and Multicast

UDP or UDP/RTP packets can be transmitted via a point-to-point connection (Unicast) or a point-to-multipoint connection (Multicast). For Multicast a reserved destination IP address range is reserved which includes the range from 224.0.0.0 to 239.255.255.255.

If the IP data stream of the instrument is supposed to be sent to several receivers a destination address from the above mentioned range has to be set.

- Data Encapsulation

The transport stream packets can either be sent via UPD- or UDP/RTP protocol. By selecting the menu item ENCAPSULA. → UDP or UDP/RTP the data encapsulation can be configured.

Always 7 transport stream packets are packed into one IP frame.

The MAC address of the second streaming interface can be retrieved by selecting the menu item - MACADR. It is firmly coupled to the hardware of the instrument.

8.1.2   Transport Stream Settings

By selecting the menu item TS-PSI an input window can be called up in which some transport stream settings can be made. In the UMS mode the instrument supplies a DVB-compliant transport stream with several PES (Packet Elementary Stream) data streams as well as SI (Service Information) data.

By selecting the input window the following parameters can be set:

Provider Name: 16 characters for the name are available here
Service Name: 16 characters can be used here as well

In addition the following PIDs can be entered in decimal form:

PMT-PID, ServiceID, PES-PIDspec, PES-PIDconst, PES-PIDmeta, PES-PIDtele.

The service ID is the identification number for the overall service of the AMA 310/UMS to the field instruments. By means of this ID the transport stream with all its elementary streams can be uniquely identified. In addition, this is the only number, which has to be known later on in field use, such that the field instruments can successfully communicate with the headend unit.

Caution!   **If multiplexers are used in the headend for example, the service ID set in the instrument may be overwritten in the headend. For the configuration of the field instruments the service ID is of importance which the service after the QAM modulation in the RF channel really has!**

8.1.3 Network Settings

By selecting the menu item NET an input window can be called up in which some settings regarding the cable network can be made. 16 characters each can be used for the network name (**NetName**) and the name of the clusters (**ClustName**). The handheld uses this information for identifying the network.

In the setting **RefLevel** a reference level in [dBµV] can be entered which will be used for all measurements of the UMS. This reference level can be compared to that of the CMTS to which all cable modems connected line up. If the same upstream level is connected to the RF input of the headend as to the CMTS, then this reference level should be set to the same value as that of the CMTS (e.g. 60 or 75 dBµV).

In **TSDelay** a value in [ms] for the system-dependent delay of the transport stream from the output of the headend to the input of the DVB-C modulators can be set. Should this delay which may for instance result from the IP distribution of the transport stream, be in the range of 100 ms and more, a corresponding value has to be entered in **TSDelay.** Otherwise the factory setting of 0 ms can be maintained. This delay value is of vital importance in the synchronization of the field instruments and/or in the correct display of the measuring and sweeping results.

8.1.4 Handhelds

All handhelds, which shall be used in UMS, have to be registered in the headend with its serial numbers. The signaling from handhelds to the headend is done by ASK-modulated telemetry carriers and their frequencies have to be in the upstream frequency range.

By selecting the menu item HANDHELD an input window can be called up in which all handhelds with its serial numbers, telemetry carriers and -if required- the names of the owners/technicians can be registered. At the same time a system graphics appears on the screen, which shows all frequency inputs of the UMS. More detailed information to the system graphics can be taken from Chapter 8.2 - System Plan.

A telemetry carrier is a sine tone, which will be assigned with its frequency to a handheld. Via this frequency the communication of the handheld with the headend will be made. Up to 10 handhelds may be operated at one headend.

Giving the name of the owner of the handheld and/or technician facilitates conflict solution when several field instruments access a headend at the same time.

8.1.5 Profiles

For all frequency settings apart from the telemetry frequencies of the handhelds two profiles are available.

The configuration of the profiles is done via PROFILE → PROFILE1 and/or PROFILE2.

If e.g. upstreams or clusters with varied modem frequencies are connected to its inputs when using the RF switch SW 024, this may be provided by assigning different frequency profiles to the different inputs of the SW 024. This is explained in "Chapter 8.1.7 - Cluster Differentiation when using the RF Switch SW 024".

Caution: **If the cluster switch is not used, the last configured and/or selected profile for the RF input of the AMA 310/UMS will apply.**

8.1.5.1 Modem Upstreams

As the UMS operates when the DOCSIS modems are running, there must by no means be collisions with the upstream frequencies of the cable modems. Therefore, the UMS has to know on which upstream frequencies and with which bandwidth (symbol rate) the cable modems transmit in the network.

By selecting the menu item UPSTREAMS an input window can be called up in which all active modem upstreams with their center frequency and symbol rate can be put in. Up to eight active upstream frequencies can be defined. When entering the frequency 0, an upstream can be cancelled from the system. Valid symbol rates are 320 kSym/s, 640 kSym/s, 1280 kSym/s, 2560 kSym/s and 5120 kSym/s. Even here the input of a system graphics shown (see chapter 8.2 - System Plan) is supported.

8.1.5.2 Bit Error Rate Measurement (BER)

The UMS supports a BER measurement (including MER measurement and constellation diagram display) in the upstream path. For this purpose e.g. at the subscriber connecting socket modulated upstream carriers are fed into the return channel by means of the handhelds and they will be evaluated in the headend. The measurement results will be returned again to the handheld. This measurement can be performed with active DOCSIS modem operation. However, these test carriers must not overlap with the modem frequencies. The system supports the BER measurement in four different frequencies. These can be distributed freely in the return path taking into account the modem frequencies.

By selecting the menu item BER-MEAS an input window can be called up in which up to four test frequencies with their symbol rates and modulation schemas can be entered. When entering the frequency 0 a test carrier can be deleted from the system. Valid symbol rates are 320 kSym/s, 640 kSym/s, 1280 kSym/s, 2560 kSym/s and 5120 kSym/s. Admissible modulation schemas are QPSK, 16QAM, 64QAM, 256QAM. Here again the input of a system graphics shown (see chapter 8.2 - System Plan) is supported.

8.1.5.3 TILT Measurement

Apart from the frequency sweep function the UMS also supports a special TILT function. This is used in the handhelds for a quick and uncomplicated line-up assistance for return-path-capable amplifiers as well as for an equalization of a tilted frequency response. Here the handheld transmits four pilot carriers at the same time, which the headend measures and their levels are transmitted back to the handheld in real time.

This measurement can be performed during active DOCSIS modem operation. However, the pilot carriers must not overlap with the modem frequencies. The pilots for the tilt measurement can be distributed freely in the return path range.

By selecting the menu item TILT-MEAS an input window can be called up where four pilot frequencies can be entered. Here again the input is supported by a system graphics shown (see chapter 8.2 System Plan).

8.1.6 Forward Path Measurement

The UMS can also be configured for measurements in the forward path. For this purpose certain downstream frequencies may be set in the headend unit, which can be measured systematically by the handheld within the scope of the report function (see chapter 8.1.9 - Report). The idea here is that at a central point it is possible to set which measurements shall be performed and recorded in situ via the handhelds in the forward path.

By selecting the menu item DNSTREAMS an input window can be called up in which several downstream frequencies with their symbol rates and modulation schemas can be entered. When

entering the frequency 0 a test carrier can be deleted from the system. Up to 24 DS channels can be defined. Digital channels with 64- and 256-QAM with EuroDOCSIS, US-DOCSIS or DVB-C modulation can be set. The symbol rates with DOCSIS are given by the standard, with DVB-C 6111 kSymb/s, 6875 kSymb/s and 6900 kSymb/s are possible.

8.1.7   Cluster Differentiation when using the RF Switch SW 024

If the optional cluster switch SW 024 is used together with the AMA 310/UMS distinct names for the 24 RF inputs of the switch can be assigned in the menu item CLUSTERS. These names will be shown by the handhelds during measurements in the field as soon as a handheld has connected exclusively with the headend, for example for a MER/BER measurement.

Note: **For each input it is also possible to set apart from the name which of the two frequency profiles (see chapter 8.1.5 et seq.) applies to the input.**

8.1.8   Export/Import of the UMS Settings

All UMS settings can be stored in a file and stored back again from the file or copied to another headend device.

By selecting the menu item EXPORT an input window may be called up in which a file name can be assigned and the storage medium (USB stick or FLASH disk) can be determined. The data are stored in a *.UMS file as soon as the cursor is on the **START** option and the **ENTER** key is pressed.

By selecting the menu item IMPORT the directory of all *.UMS files can be called up. By selecting the desired file and the subsequent activation of the **ENTER** key the UMS settings are transmitted from the file to the headend unit.

8.1.9   Report / Protocol

The field instruments can generate an automated report according to the specifications of the headend. For the report all measurements, which the measurement system is able to do, are performed one after the other. This means: one MER/BER measurement on up to four test carriers (see chapter 8.1.5.2 - Bit Error Rate Measurement (BER)), a sweep measurement for exact frequency response analysis of the overall return path frequency range, as well as the forward path measurement mentioned in "Chapter 8.1.6 - Forward Path Measurement".

The idea in the overall report subject is that the user does not have to know anything about the frequencies to be transmitted or received, the QAM orders, symbol rates etc. as well as about modem channels to be protected. Everything will be configured once in the headend on the AMA 310/UMS and all field technicians generate automatically the same and thus comparable report for later evaluation and filing.

In the field instrument the report is written in the form of a *.XML-File on a USB stick. The file name and up to five free text fields are the only parameters, which can and/or must be influenced by the field technician.

For this purpose a maximum of five categories of a maximum of 25 characters are to be configured in the headend by the menu item UMS SETUP → PROTOCOL on two menu pages which the field technician then has to fill with data in situ. In the following example four of the five categories are used, the fifth is not available as here no character string has been entered.

Apart from the name for the free text category it can also be determined in the headend whether the field technician has only letters ("A-Z"), only numeric characters ("0..9") or a combination of both available for filling the text fields.

```
Field1: Customer                    0..9    ⬍
Field2: Job Number                  0..9    ⬍
Field3: Technician             0..9,A..Z⬍
Field4: Location               0..9,A..Z⬍
                         APPLY
```
| <<< | >>> | | | BACK |

Figure 8-2 Input of free text categories in the headend unit - page 1

```
Field5:                        0..9,A..Z⬍



                         APPLY
```
| <<< | >>> | | | BACK |

Figure 8-3 Input of free text categories in the headend unit - page 2

These five categories shown above will then be displayed exactly like that on the field instrument and can then be filled with information by the technician (see the next figures).

Figure 8-4 VAROS 107 Report menu page 1 - free text categories 1 and 2

Now the technician can enter the name or the number of the customers as well as the order number for the report currently to be made on the report menu page 1. On the report menu page 2 the measurement location and the name of the technician are entered (please take the information on the operation of the field instrument VAROS 107 from the relevant operating instructions). The fifth free text field is empty in the example used here, therefore the relevant function field of VAROS 107 cannot be selected:
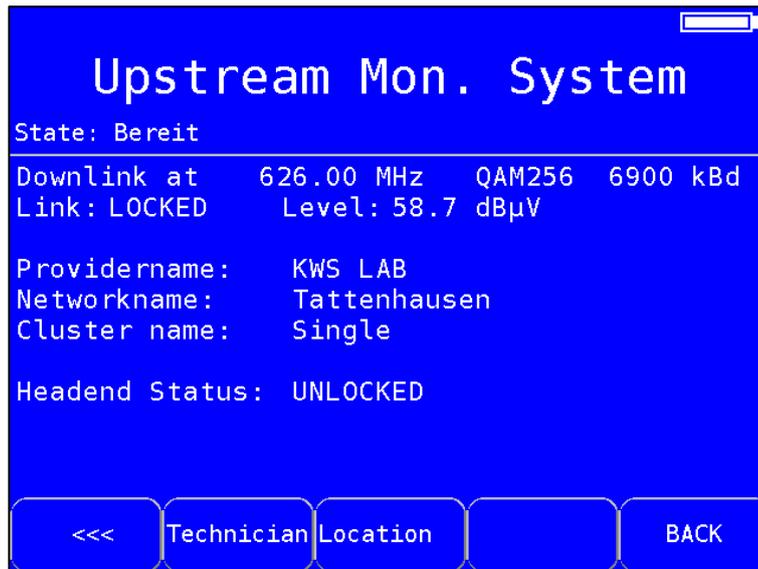
Figure 8-5 VAROS 107 report menu page 2 - free text categories 3 to 5

After preparing the report an *.XML-File is generated, as mentioned. This can be opened and edited with standard spreadsheets. The file includes several workbooks with different measurements. In the first workbook exactly the free text categories described above can be found. Here again category 5 is missing, as it has not been provided by the headend. The categories 1 to 4 have been filled with information ("John Doe", "33495", "John Sample" and "Any Street") by the technician:
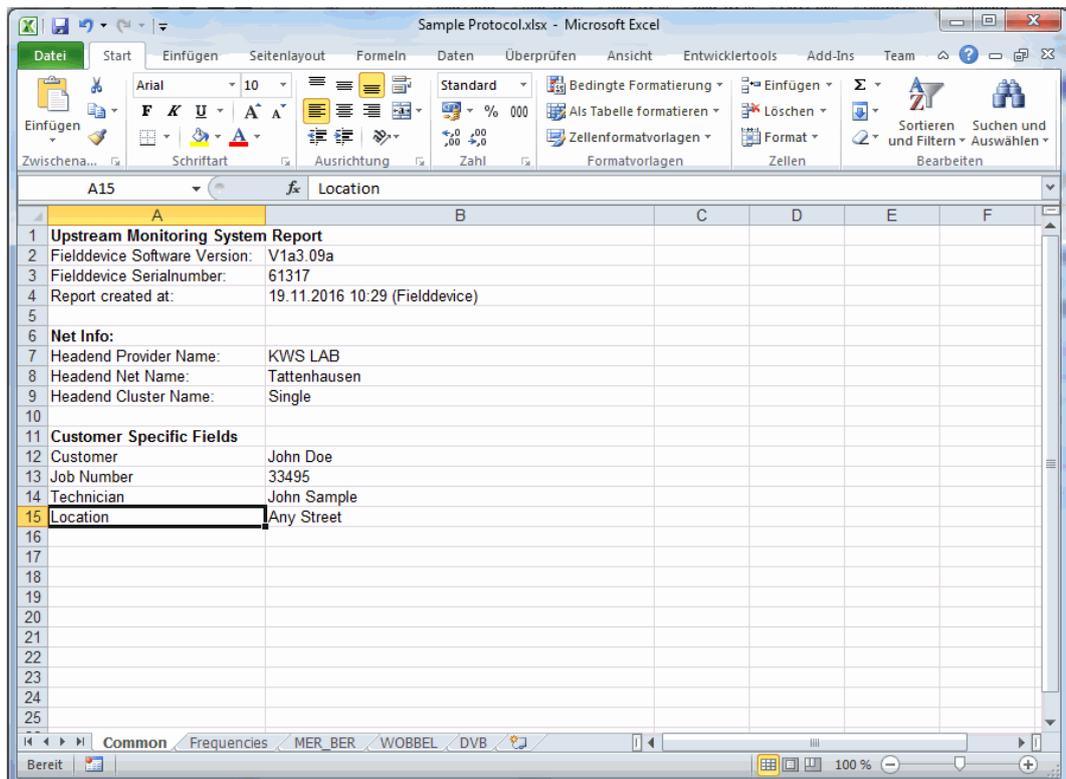
Figure 8-6 Report workbook "Common" with filled-in free text fields

The advantage of the *.XML data file format is that you can process the report with standard PC programs. For example from the X-Y coordinates (frequency and level) of the sweeping curve (frequency response measurement) the frequency response in form of a diagram can be restored very quickly and transferred to the usual representation of the measurement instrument display:
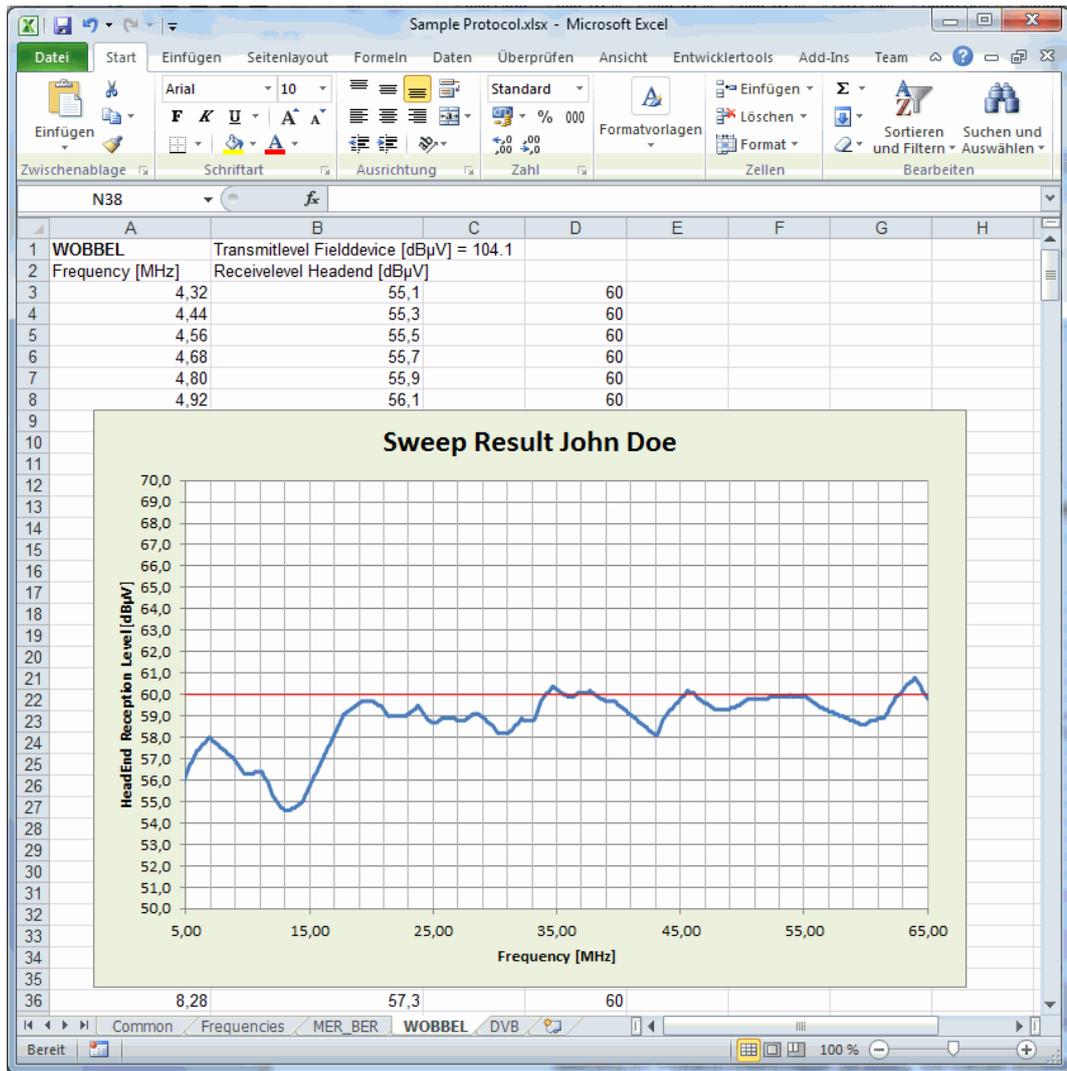
Figure 8-7 Report workbook "WOBBEL" with manually prepared frequency sweep curve

8.2 System Plan

For supporting the input of the varied frequencies in the return path range the instrument provides a graphic representation of the system where all frequencies involved in the system are shown with their bandwidths. This graphics always appears when a frequency in the system is changed or added (see chapter 8.1.5 - Profiles). An asterisk before the frequency type shows which carrier type of the profile is currently processed (see next figure). In case a frequency is put in which leads to a collision in the system, an error message will appear. If a faulty setting is not corrected, the UMS mode cannot be started as this might possibly disturb the cable modem operation.

A system plan can be exported as bitmap file. If the **PRINT** key is pressed when the system plan is shown, an input window will appear where the file name and the storage location can be put in. The following figure shows a print-out of a system plan as an example.


```
System-planning   (Profile2)
Modem-Upstreams
Telemetry
*BER-Measurement
Tilt-Measurement




             10        20        5MHz/        50        60

Modem-Upstreams
   1: Frq: 10.0 MHz   SR: 2560
   2: Frq: 25.0 MHz   SR: 2560
   3: Frq: 33.0 MHz   SR: 2560
   4: Frq: 37.0 MHz   SR: 2560
   5: Frq: 41.0 MHz   SR: 2560
   6: Frq: 50.0 MHz   SR: 2560
Telemetrie
   Common                    TeleFrq: 59.9 MHz
   HH01: SerNum: 60473       TeleFrq: 60.0 MHz
   HH02: SerNum: 60474       TeleFrq: 60.1 MHz
   HH03: SerNum: 61317       TeleFrq: 60.2 MHz
   HH04: SerNum: 61910       TeleFrq: 60.3 MHz
   HH05: SerNum: 61911       TeleFrq: 60.4 MHz
   HH06: SerNum: 61926       TeleFrq: 60.5 MHz
   HH07: SerNum: 61645       TeleFrq: 60.6 MHz
   HH08: SerNum: 61927       TeleFrq: 60.7 MHz
   HH09: SerNum: 61921       TeleFrq: 60.8 MHz
   HH10: SerNum: 52358       TeleFrq: 60.9 MHz
BER
   1: Frq: 14.0 MHz   SR: 2560   MOD: 256QAM
   2: Frq: 29.0 MHz   SR: 2560   MOD: 256QAM
   3: Frq: 45.5 MHz   SR: 2560   MOD: 256QAM
   4: Frq: 55.0 MHz   SR: 2560   MOD: 256QAM
TILT
   1: Frq:  7.0 MHz
   2: Frq: 20.0 MHz
   3: Frq: 39.0 MHz
   4: Frq: 59.0 MHz
```

Figure 8-8 System plan profile 2 when configuring the BER measurement without errors
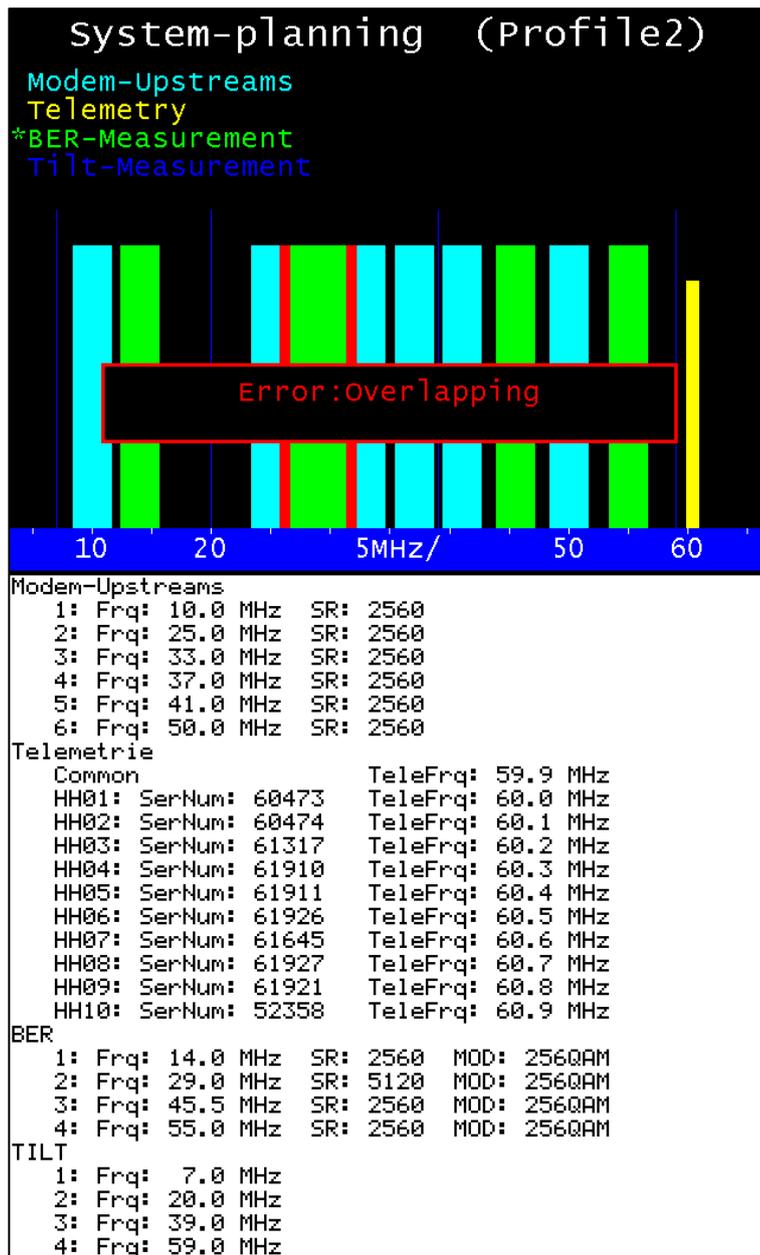
Figure 8-9 System plan profile 2 when configuring the BER measurement with overlapping

The height of the frequency bars does not say anything, it just serves for better differentiation. The width of the bars corresponds to the bandwidth used (symbol rate). The active modem frequencies are shown in light blue in the system plan. The test frequencies for the bit error rate and the MER measurement are shown in green.

The sine tones shown in dark blue are used for the TILT measurement. They should be distributed as evenly as possible over the complete frequency range used (Be careful if ingress block filters are used in the lower part of the return path spectrum!). The telemetry frequencies shown in yellow can be distributed at will in the return path spectrum. It is recommended to either use the upper or lower return path area for this.

Chapter 9   Instrument Management

By selecting **MODE** the following menu can be called up in the basic state:

```
                        UMS

                              18.11.16  14:29:23
 FIRMWARE  │ LANGUAGE │TIME/DATE │    >>>    │   BACK
```

Figure 9-1 MODE menu

This menu consists of several pages and you can scroll between them by using >>> and <<<. By selecting **BACK** you get back to the previous menu level. By selecting **HOME** the instrument can be set back into the basic state from every menu level.

9.1   Language for Operator Guidance

The instrument supports the operator guidance in German and English. By selecting **MODE** → **LANGUAGE** → **GERMAN** and/or **ENGLISH** the desired language can be chosen. The setting is nonvolatile. The factory setting is German.

9.2   Query of Software Status and Hardware Configuration

By means of this function the user can query all relevant hardware and firmware statuses of the instrument. The menu item **MODE** → **FIRMWARE** → **INFO** has to be called up. Then the instrument shows the current firmware status as well as some information on the MPEG decoder and the DSP module (UMS hardware including real time spectrum analyzer). In the firmware status the figure combination is before the dot (here 01) for the hardware status of the instrument. Behind the dot the current firmware release (in this case 18d) is given.

```
                        INFO
            Firmware: V01.18d (UMS19Inch)
                  HEVC-Decoder V1.4
                   DSP-Modul V2.2           10:14:57
     INFO                OK
                                              BACK
```

Figure 9-2 Menu for querying the hardware and software statuses of the instrument

The note "(UMS19INCH)" behind the firmware status shows that an AMA 310/UMS is concerned which is treated as derivative (derived version) of the classic AMA 310.

By pressing the **ENTER** key the INFO window can be closed again.

9.3   Software Update Device Firmware

The user may at any time install a new firmware release on the device. The software is stored in a file with the ending *.bin2.

An update can be requested from the manufacturer or downloaded directly from www.kws-electronic.de and then copied into the main directory via PC to the USB stick supplied.

While the update is running, the instrument must in no case be switched off, as otherwise the old firmware is deleted and the new one has not yet been completely stored.

For the update the USB stick has to be plugged into the device and the menu item **MODE →** **FIRMWARE** → **UPDATE** is to be selected. Then a choice of all .bin2 files stored appears. By using the keys ↑ and/or ↓ the cursor can be moved to the desired file. By using the ← and → keys you can scroll if there is a choice of more than five files on the stick.

```
001  Test107_9a_62.bin2          12.10.2016 13:23
002  Test107_9a_64.bin2          26.10.2016 15:43
003  Vxx_18b.bin2                27.10.2016 13:26


                                              BACK
```

Figure 9-3 Selection of the .bin2 file for the firmware update

By pressing the **ENTER** key the software update is started. The device first deletes the old version from the memory and then the new software is installed into the internal flash memory.

This process can take about 70 seconds. As soon as the update is finished, a short beep can be heard and the device reboots with the new firmware.

9.4   Update of Hardware Modules

The device includes some components equipped with their own software and/or with programmable logic (FPGA). In order to permit that the update can also be performed by the user, the device provides the possibility to program the most important components via the device software. For this purpose the device has to fulfill the relevant prerequisites. By selecting the menu item **MODE → FIRMWARE → ADVANCED** a submenu can be called up listing the components, which can be programmed with the current device status. The update process is comparable to the software update of the device firmware. More detailed information can be gathered from the KWS service department and/or the internet page www.kws-electronic.de.

```
                      UMS

                          19.11.16  10:18:58
UPDATE MPG            UPDATE DSP              BACK
```

Figure 9-4 Menu for the update of individual components of the AMA 310/UMS

9.5   Serial Number

Additionally to the printed serial number on the type plate on the back of the device, the serial number of the measurement receiver can be retrieved from a menu.

This is done by **MODE → SERIALNUM.**

```
                          INFO
               Serialnumber:  12345
                           OK              .16   10:20:13
         START                                   UMS SETUP
```

Figure 9-5 Query of the Serial Number

By pressing the **ENTER** key the INFO window can be closed again.

9.6   MAC Address

The MAC address (Media-Access-Control-Address) is the physical address of each individual network adapter, which serves for the definite identification of the device in a computer network. Each device receives a worldwide unique MAC address. It can be called up by **MODE → MACADR** .

```
                          INFO
              MAC-ADR:  00-50-C2-A2-C0-00
                           OK                    10:21:50
      <<<    KEYBOARD   SERIALNUM.   MACADR        >>>
```

Figure 9-6 Query of the MAC address

The MAC address displayed in the device management refers to the management Ethernet interface on the front panel of the device, which is not used in the current extension stage of the AMA 310/UMS. This MAC address should not be confused with the address of the streaming interface on the back panel of the device. The readout of this hardware address is described in "Chapter 8.1.1.4 - TS Output".

By pressing the **ENTER** key the INFO window can be closed again.

9.7   Readout of the Hardware Configuration

By selecting **MODE → SERVICE → HARDWARE** the device reads out all modules plugged in and shows their number and version.

If the AMA 310/UMS is operated together with the optionally available cluster switch SW 024, the status of the switch can also be read out via the HARDWARE menu. For this purpose the switch has to be connected to the AMA 310/UMS via the USB patch cable supplied and switched on.

```
                        HARDWARE
MPEG-DECODER   258L28: FPGA V01.00   DSP V01.01
DSP-MODUL      251L47: FPGA V01.01   ARM V02.02
SWITCH-MATRIX  261L48: FPGA V01.00

                           <<<       >>>       BACK
```

Figure 9-7 HARDWARE menu and query of the FPGA version of the SW 024

If no cluster switch is connected to the AMA 310/UMS the note "not plugged!" is given behind the item "SWITCH-MATRIX"!

9.8   Factory Setting

Via **MODE** → **PRESET** all non-volatile device settings can be reset to the factory setting. For this purpose the key ← "**YES"** has to be selected and confirmed by **ENTER**.

```
                        WARNING
                  PRESETing the device?
                      YES      NO       .16   10:31:51

        <<<        PRESET    SERVICE  FLASH-DISK
```
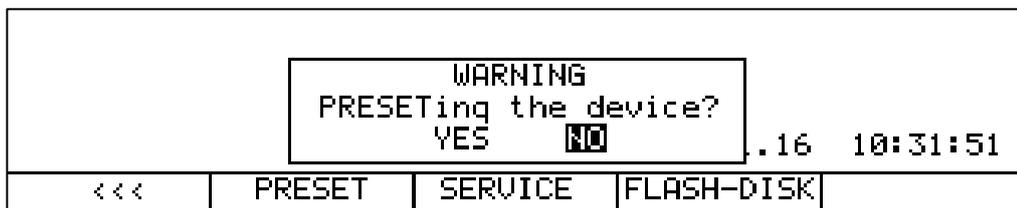
Figure 9-8 Resetting of the device to the delivery state

Note!   **If applicable, save all UMS settings before resetting the device to the delivery state (see Chapter 8.1.8 - Export/Import of the UMS Settings)!**

9.9   Setting of Date and Time

The measurement receiver is equipped with a clock module. In some operating conditions date and time are shown in the display line above the menu bar. By selecting the menu item **MODE** → **TIME/DATE** the following input menu can be called up. Here date and time can be changed, e.g. for changing between summer and winter time.

```
                  SETTING DATE AND TIME
                    new time: 10:34:06
                    new date: 19.11.16
                         APPLY


                                              BACK
```

Figure 9-9 Menu for setting date and time

By the keys ← and/or → the cursor can be moved to the desired input field. Now the changed input can be made by the numeric keyboard. Each input has to be confirmed by the **ENTER** key. Then the cursor moves to the next field.

The inputs are saved if the cursor is moved to the field **APPLY** and then the **ENTER** key is pressed.

9.10   Keyboard Settings

By means of the menu item **MODE** → **KEYBOARD** the illumination of the keys and the buzzer can be switch off and on.

```
                        UMS

                               19.11.16   10:36:58
        BUZZER     ILLUM.                          BACK
```
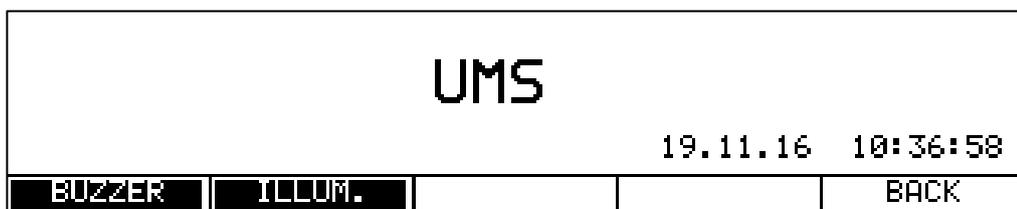
Figure 9-10 Configuration of the silicone keyboard

The picture shows the factory setting. This means the buzzer and the illumination are switched on. These settings are non-volatile.

Note!   **If the power save mode is activated (see Chapter 8.1.1.3) the keyboard illumination is switched off while the return path monitoring is active despite the explicit activation in the above shown menu. "Chapter 6.3 - Power Save Mode" explains how the keyboard illumination can be switched on again by temporarily deactivating the power save mode for a short time.**

9.11   Formatting the Internal Flash Disk

The device is equipped with a 64-MByte flash disk. The formatting of the data carrier has been provided by the factory. By selecting **MODE** → **FLASH-DISK** → **FORM.FLDSK** a new formatting of the flash disk can be made. In this way all data, which had been created by the user, are deleted again.

9.12   Export of the Internal Flash Disk

By selecting **MODE** → **FLASH-DISK** → **EXPO.FLDSK** all files of the flash disk can be copied to a USB stick connected. If formatting is performed subsequently, the internal data carrier returns again to the delivery state.

Chapter 10 Output on File

The operating system of the measuring receiver supports the file system FAT32.

In certain operating conditions this permits to save copies from the LC display and from the graphics screen as .BMP file for documentary purposes. The bitmap format works in an uncompressed way, i.e. without losses. As media a USB stick and/or the internal flash disk may be used.

10.1   Hardcopy from the LC Display

Here the current content of the LC display can be stored as .BMP file.

By selecting the menu item **PRINT** → **HARDCOPY** → **LCD** → **->BMP-FILE** a window opens for entering the file name.

```
          HARDCOPY -> BMP-File

        TITLE: DEMO_002
                  START

FLASHDISK  USB-STICK                          BACK
```

Figure 10-1 Hardcopy of the LC display content on a USB stick

By the keys ← and/or → the cursor can be moved. By the numeric keyboard up to 20 characters for the file name can be entered.

The standard file name or a file name entered before is automatically incremented in its index during each saving process such that even several files can be saved one after the other without having to change the file name manually each time and without running the risk that already saved data will be overwritten.

Via **FLASHDISK** or **USB-STICK** the destination medium is preset. If the file name is completely edited, the cursor can be moved by pressing **ENTER** to the **START** field. After activating the **ENTER** key again, the content of the LC display (at the time before pressing the **PRINT** key) is written into a .BMP file with the name entered before. In the above example this means the file DEMO_002.BMP is generated.

10.2   Hardcopy from the Graphics

Here a copy of the current graphics screen (e.g. Analyzer) can be saved as .BMP file. By selecting the menu item **PRINT** → **HARDCOPY** → **GRAPHIC** → **->BMP-FILE** the input window for the file name opens. If **+LCD** is also selected, the device adds the content of the LC display to the .BMP file.

The keys ← and/or → are used to move the cursor. By the numeric keyboard up to 20 characters for the file name can be entered.

The standard file name or a file name entered before is automatically incremented in its index during each saving process such that even several files can be saved one after the other without having to change the file name manually each time and without running the risk that already saved data will be overwritten.

By selecting **FLASHDISK** or **USB-STICK** the storage destination medium is provided. As soon as the file name has been completely edited, the cursor may be moved to the START field by pressing **ENTER**. After activating the **ENTER** key once more the content of the graphics display (and possibly that of the LC display in addition) will be written into a .BMP-file with the name entered before.

The following figure shows a screenshot of the graphics display in analyzer operation (see Chapter 7 - Analyzer Mode) of the AMA 310/UMS with added LC display content:
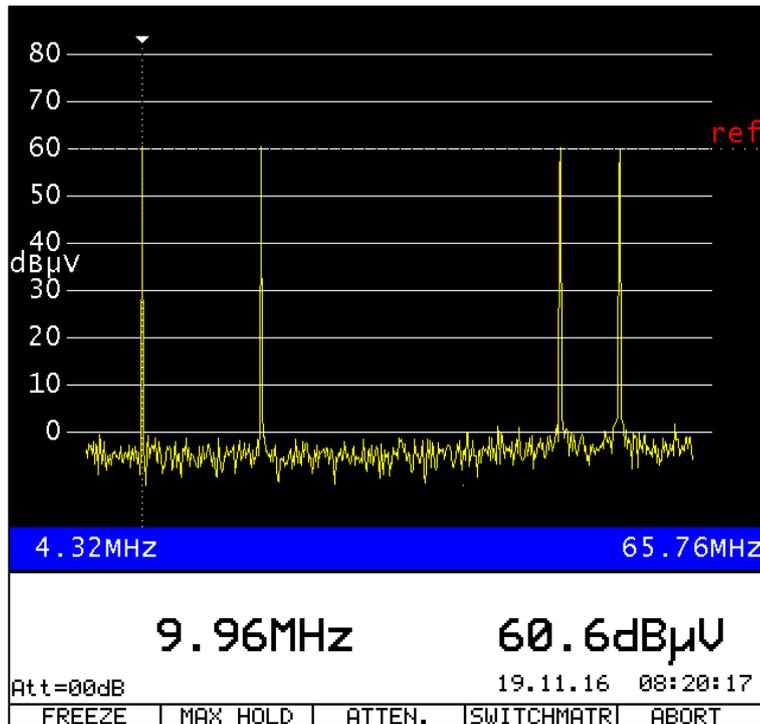
Figure 10-2 HARDCOPY of the graphics screen with added LC display content

10.3   Setting the Standard Drive

By selecting the menu item **PRINT** → **HARDCOPY** → **VOLUME** → **FLASHDISK** or **USB-STICK** it can be set which drive shall be selected by default for future storage processes (example: USB drive in Figure 10-1 Hardcopy of the LC display content on a USB stick
"). The drive, which is set here, will also be called up if files are to be deleted or copied via the submenu **DIRECTORY** (see Chapter 10.4).

10.4   Calling-Up the Directory of the BMP Files

By selecting the menu item **PRINT** → **HARDCOPY** → **DIRECTORY** a list with all .BMP files is shown. The list can be closed again by selecting **BACK** . By pressing the keys ← and/or → it is possible to scroll between the pages of the list. By selecting the menu items **FLASHDISK** and/or **USB-STICK** it is possible to change between the storage media.

By selecting the menu item **SELECT ALL** all .BMP files can be selected. In this way it is possible to handle all files in one process by the functions "Remove BMP files" and "Copy BMP files" (please refer to the following Chapters).

```
001 DEMO.BMP                              21.07.2010 15:14
002 HARDCOPY1.BMP                         21.07.2010 15:16




FLASHDISK USB-STICK SELECT ALL                    BACK
```
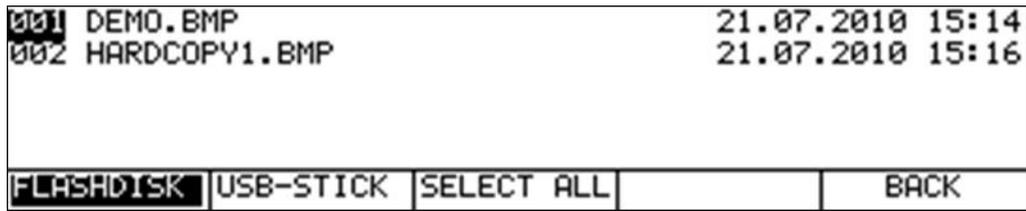
Figure 10-3 Directory FLASHDISK

10.4.1   Remove BMP Files

When the directory is open, it is possible to move the cursor to the desired file name by pressing the keys ↑ and/or ↓ . By pressing the **ENTER** key the following choice appears.

```
001 DEMO.BMP                              21.07.2010 15:14
002 HARDCOPY1 BMP              CHOICE     21 07.2010 15:16
                            What to do?
                       REMOVE   COPY   CANCEL

FLASHDISK USB-STICK SELECT ALL                    BACK
```
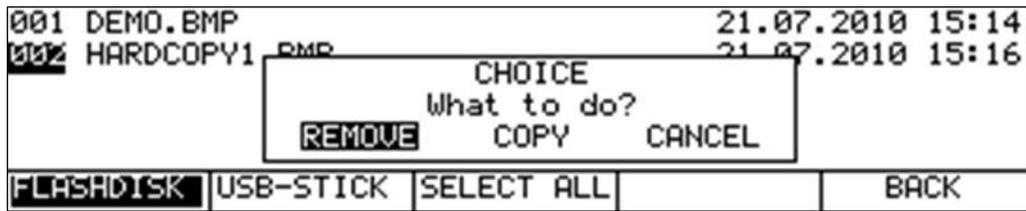
Figure 10-4 Deletion of a .BMP file in the directory FLASHDISK

By the keys ← and/or → the choice **REMOVE** can be selected. If the **ENTER** key is pressed now, the device deletes the file HARDCOPY1.BMP from the Flash-Disk in this case.

10.4.2   Copy BMP Files

When the directory is open, it is possible to move the cursor to the desired file name by pressing the keys ↑ and/or ↓ . By pressing the **ENTER** key the following choice appears:

```
001 DEMO.BMP                              21.07.2010 15:14
002 HARDCOPY1 BMP              CHOICE     21 07 2010 15:16
                            What to do?
                  REMOVE ALL   COPY ALL   CANCEL

FLASHDISK USB-STICK SELECT ALL                    BACK
```
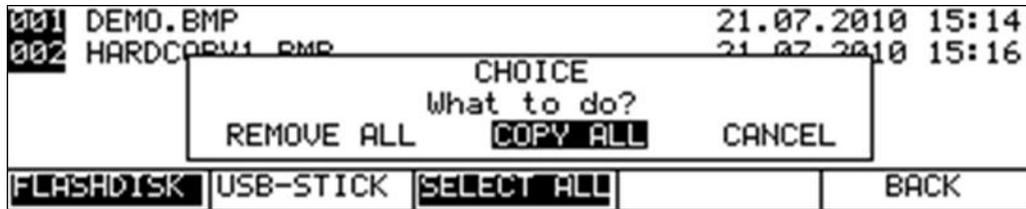
Figure 10-5 Copy of .BMP files in the FLASHDISK directory

By pressing the keys ← and/or → the process **COPY ALL** may be selected. After pressing the **ENTER** key all files from the internal flash disk are copied to the USB stick.

Chapter 11 List of Figures