NAVIGATOR MODULATION ANALYZER

TEST AND MEASUREMENT EQUIPMENT

(Software version 1.6.x)

The following are found in this binder:

- User manual
- Technical specifications

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NAVIGATOR MODULATION ANALYZER

TEST AND MEASUREMENT EQUIPMENT

USER'S MANUAL

(Software version 1.6.x)

Date: 2008/09/18

Audemat Group – Audemat INC
web: www.audemat.com - e-mail: contact@audemat.com

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1. INTRODUCTION

1.1. General information

1.1.1. About the Audemat Group

Created in 1980, Audemat designs, develops and offers a complete line of products for Radio and TV broadcasters, stations, and telecommunication operators as well as regulation authorities.
The Audemat product line includes RF and data monitoring equipment for analog and digital radio (HD, DAB/DMB, AM, FM) and analog and digital TV (DVB T/H/SH, ATSC, PAL/SECAM, NTSC).
Audemat also offers mobile field strength meters for analog and digital Radio and TV with modulation monitors built-in; Facility remote control solutions; Digital test and measurement equipment, audio processors as well as world-class RDS encoders.
In 2006 Audemat acquired ECRESO (www.ecreso.com), a manufacturer of transmitters for FM (20 W to 10 kW solid state, air and liquid cooled) and DVB (low power 0.5 Watts to 200 Watts).
In 2008 Audemat acquired Nortek (www.nortek-tv.com), a TV monitoring and Test and Measurement equipment manufacturer, located in Lille-France.
About 100 employees are located in the Bordeaux-Merignac site in France.
Represented in more than 45 countries in Europe and Asia through a large distribution network, the Audemat group has also a subsidiary in Miami (Florida-USA), composed of 7 employees in charge of developing sales activities in North and South America, Australia and New-Zealand.
Since the beginning of 2008, Audemat has opened a sales office in Beijing (China).
Audemat has won a total of 12 awards for 8 years in a row at NAB.
Audemat is ISO 9001 and ISO 14001 (sustainable development) certified by BVC Bureau Veritas.

1.1.2. About the Navigator Modulation Analyzer

The Navigator Modulation Analyzer is an entirely digital demodulator. The RF, MPX or audio signal is digitalized as soon as it enters the device, and all processing in the device is then made through calculations.

For the RF input, this acquisition is made using an accurate and very quick converter, directly analyzing the entire FM band (88-108 MHz), without mixing.
Digitalizing in this way, at the input, gives the equipment measurement reproducibility over time, as well as from one device to another: the same signal applied to two devices will give the same result. The accuracy of the digital filters, used in this equipment, enables the FM multiplex signal's components to be accurately and repeatedly reproduced from one device to another, incurring no errors.

The processing power in this equipment enables all measurements to be refreshed simultaneously and synchronously, thereby allowing for detailed readings of all the Multiplex FM signal components, while viewing the 4 available spectrums and maintaining a review of the decoded RDS.

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1.2. Before beginning

To keep Audemat's devices safe and to ensure operation exempt from any danger, the user must respect the following instructions, symbols and precautions:

1 - The device should only be operated in the conditions described in this manual.
2 - Nothing must obstruct the ventilation.
3 - The device must only be used with a plug that incorporates a protective ground contact.
4 - To avoid any risk of electrocution, the protection conductor must not be cut, intentionally or not, either on the device or on the power cord.
5 - Before switching on the device, be sure that the nominal voltage specified on the device corresponds to that of the mains' nominal voltage.
6 - To avoid any electromagnetic interference, the device must only be used when it is closed. Shielded cables are mandatory.
7 - The device should only be operated on a stable electrical network. If the electrical network is not stable, a power conditioner, such as a UPS, must be used.
8 - Any operation concerning maintenance, adjusting or repairing must be carried out by qualified staff.

- **Caution: LITHIUM BATTERIES**

If the battery is not correctly replaced, there will be a risk of explosion.
Only replace it with a battery of the same type. Contact Audemat before attempting to use another type.

Do not throw away used batteries; send them back to us.

1.3. Licenses and options

The Navigator Modulation Analyzer comes in standard or Laboratory version. The Laboratory option includes the following features:

- RF frequency meter,
- AF distortion meter,
- AF frequency meter,
- Pilot frequency meter,
- Test signal generator (pure sine wave),
- RDS frequency meter,
- Pilot/RDS synchronization/phase difference
- Oscilloscope (0 – 200 kHz),
- Automation tools for remote access.

Please read section 6.7 for more information on getting and installing this option.

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2. PRODUCT PRESENTATION

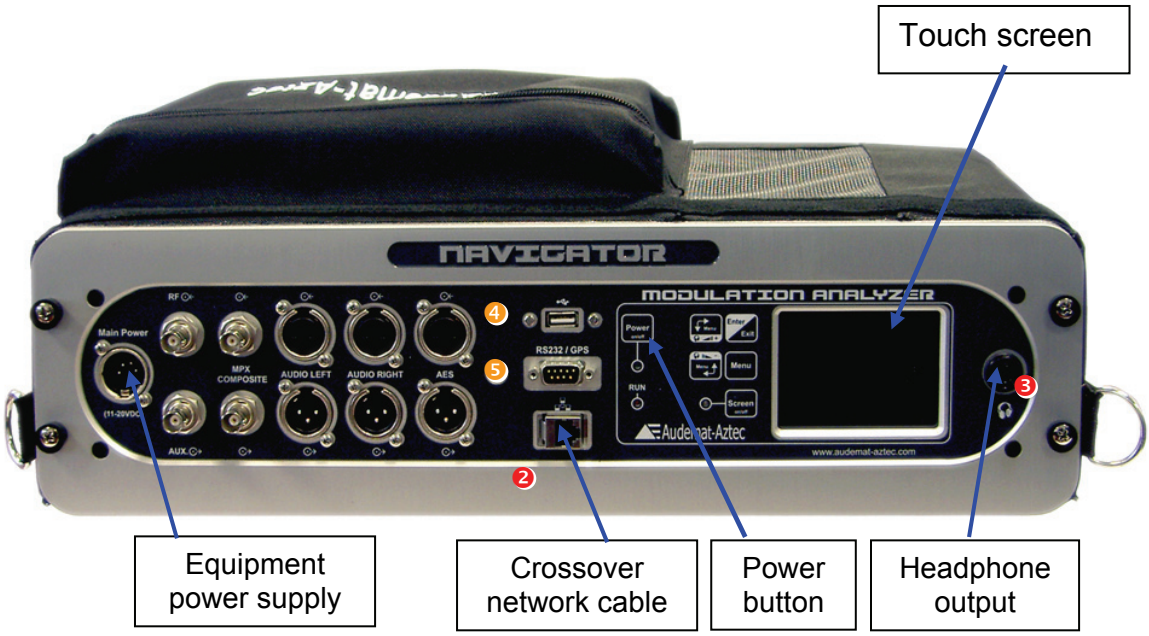
2.1. List of included accessories

Check that all accessories are present:

- 1 external 200V/12V power supply
- 1 crossed network cable (labeled "B")
- 1 male/male BNC cable ("N")
- 1 3-flap packet including a CD-Rom, a cable connection diagram, quality control document, a satisfaction survey and a quick start manual.
- 1 binder including the user manual and a measurement synthesis report for **your** equipment

2.2. Front panel

2.2.1. General view



Note:

❷ Network cable. When connecting to a network (via a router or switch), the cable must be standard (not crossed). If a computer is connected directly, a crossover cable must be used.

❸ Headphone output. The output is disabled when the screen is off

❹ ❺ Reserved for future use

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2.2.2. Connections

1. RF 50Ω input (87.5-108MHz).
   Min / max levels: -25 dBm / +10 dBm.
2. MPX input.
3. Analog audio inputs.
4. Audio AES/EBU input (48kHz).

1. Composite 2 output. See § 6.2.1 for directions on how to assign a signal to this output.
2. Composite 1 output. See § 6.2.1 for directions on how to assign a signal to this output
3. Analog outputs. See § 6.2.1 for directions on how to assign a signal to this output
4. AES/EBU output (48kHz). See § 6.2.1 for directions on how to assign a signal to this output

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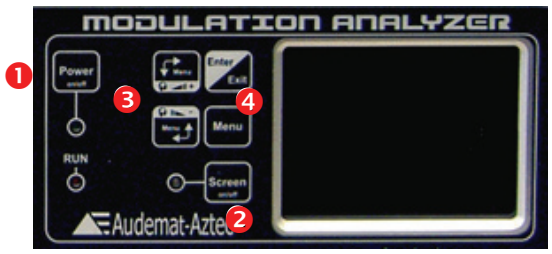
2.2.3. Screen:



❶ Power On/Off button.

We strongly recommend the use of the screen on the front panel to turn off the equipment. (see §4.1)

❷ Screen On/Off button.

When the screen is not necessary, we strongly recommend turning it off using this button.

This button also controls the headphone output: if the screen is off, the headphone output will be off.

❸ Volume control for headphone output and for screen configuration setting.

❹ Control for screen configuration setting

Note: The screen has a tactile faceplate for which a stylus has been supplied. When starting up the equipment, this faceplate requires calibration, so that the cursor follows the movements of the stylus. This calibration is done by dragging the stylus around the edges of the screen. Repeat this manipulation whenever the cursor does not track properly.

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3. QUICK START

3.1. PC System requirements

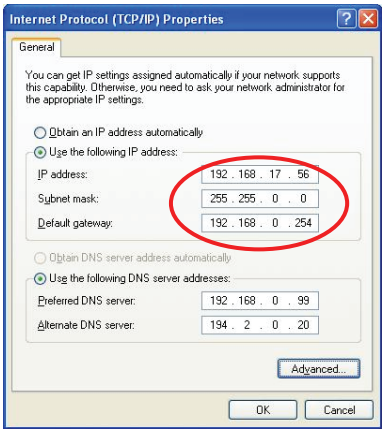
The minimum configuration required to run the Navigator Modulation Analyzer application is:

- Pentium IV
- 2 GHz processor
- Microsoft® Windows® XP
- 1 Go of RAM

3.2. Connection

Connect the power supply to the Navigator Modulation Analyzer and power on.
Connect the (crossover) IP cable between your computer's network port and the Navigator M.A.'s IP connection. Check the Navigator's network parameters using the front panel (IP address, mask address).
For a direct connection, set the IP address of the computer in the 192.168.x.x range so as to avoid conflicts with the Navigator Modulation Analyzer.

For this, if using **Windows 2000** or **Windows XP**, click the "Start" button, and:



- Control panel/Network connections/
- Local Area Connection / Properties
- Click on Internet Protocol (TCP/IP) in the scroll-down menu then on "Properties".
- Add the IP address and the sub-network mask. (for example 192.168.17.56/ Netmask 255.255.0.0)

With **Vista**, click the "Start" button, and:

- Control panel / Network and Internet / Network and Sharing Center.
- Click on "View Status" for your local area connection, and on Properties
- Click on Internet Protocol 6 or 4 depending on your network, then on Properties.
- Add the IP address and the sub-net mask. (for example 192.168.17.56 / Netmask 255.255.0.0)

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3.3. Configuration

⇨ **From this point, the configuration can be done using the embedded web site via Ethernet and Internet networks.**

Open a web browser (Internet Explorer, Mozilla…) and enter the IP address: 192.168.16.44 by default, or the one you just set via the front panel.
The default login and password are "Admin"/ "admin".

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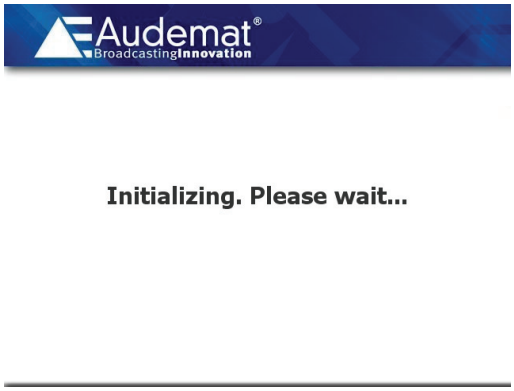
4. THE DEVICE'S FRONT PANEL APPLICATION

4.1. Overview

The Navigator Modulation Analyzer's front panel application makes it possible to configure the unit but also to launch measures and to view a large number of graphs and data.
When first activating the equipment, a screen appears on the front panel; this screen indicates that initialization is happening. Wait a few seconds.



The arrow on the lower right of the screen allows access to the menus. Using the stylus, touch it to display menus and touch it again to hide them.

A menu entry followed by an arrow pointing to the right indicates there is a sub-menu.

The last menu item (preceded by an arrow pointing to the left) will bring you back to the previous screen).

Note: If the cursor does not follow the movements of the stylus, touch all 4 corners of the screen in order to recalibrate the cursor.

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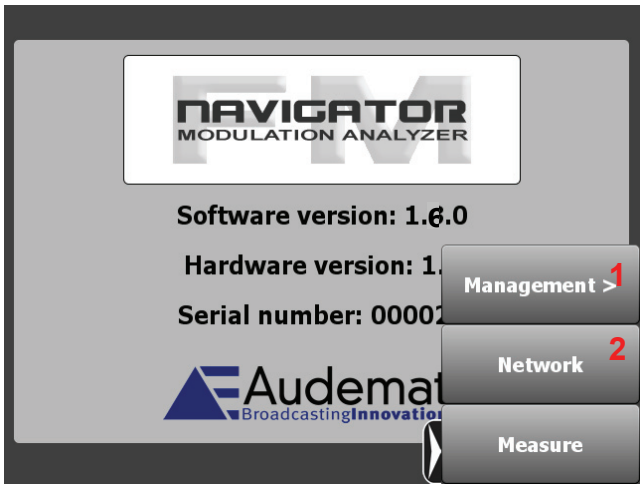
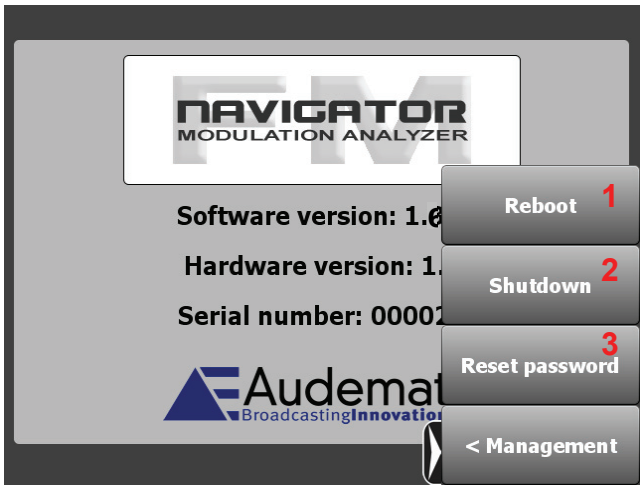
4.2. Unite configuration

➢ Touch the arrow to access the main menu:



➢ **1 :** Click on "Management" to display the following screen:



You may then:

1. "Reboot": restart the unit.
2. "Shutdown": this is the recommended method to shut down your Navigator Modulation Analyzer.
3. "Reset password" to factory settings (Admin/admin).

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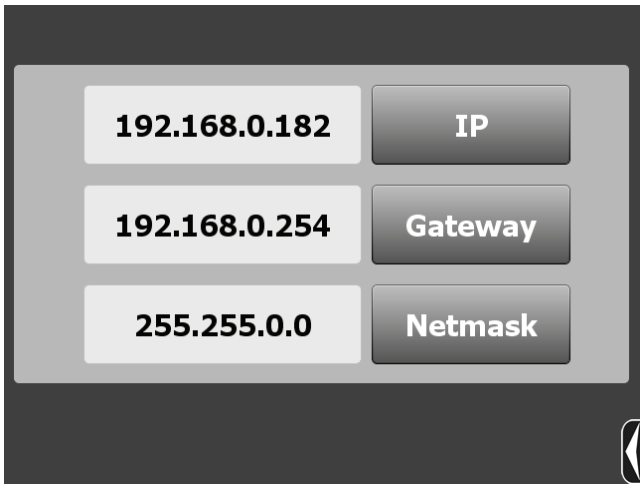
➢ **2:** Click on "Network" to display and modify network parameters: IP address, gateway and netmask.



➢ Click on the button for the parameter you wish to modify:

- Use the "Del" button to erase current value and enter the new value.
- Once the IP address (or mask or gateway) has been changed, the OK button is activated. Click on it to validate. New values are in effect right away.

Note: The IP address set here will be the one used to connect to the equipment with the remote application (see § 6.1.2).

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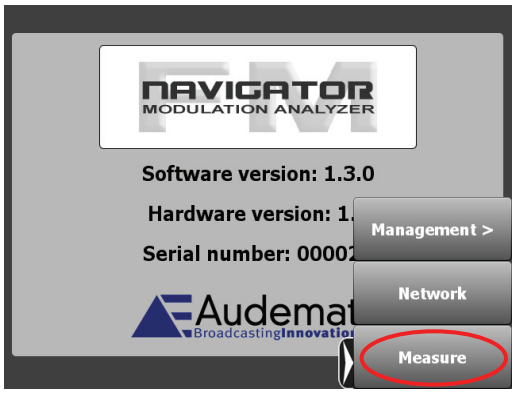
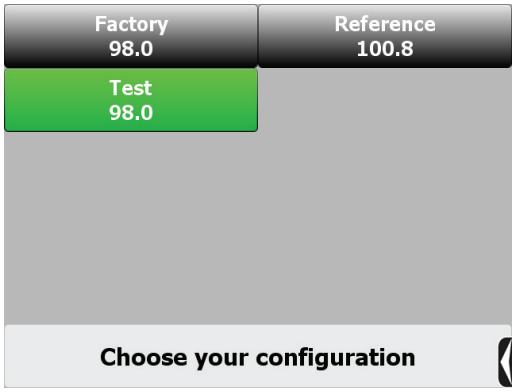
4.3. Measures

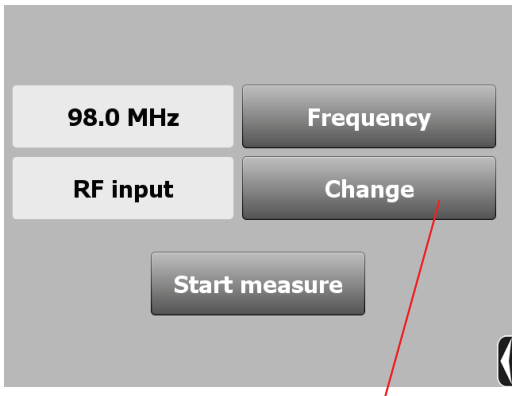
4.3.1. Launching measures



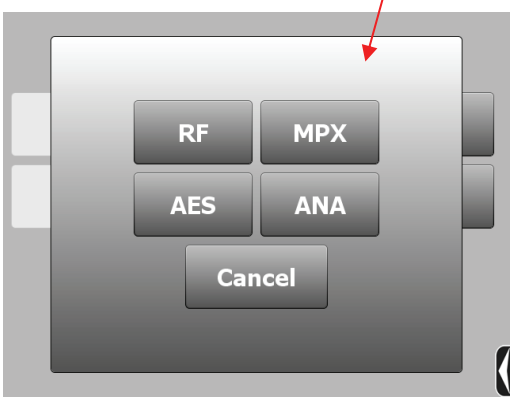
Click on "Measure" from the main screen menu.



The list of current configurations is displayed: default configurations and user configurations created from the remote application. The active configuration, if any, has a green background.



Once selected, details for this configuration are displayed. The frequency may be modified as is done with the IP address (see section 4.2).
To change the source, click on the "Change" button; then, simply click on the new source to update the configuration.



Click "Start measure" to launch measures.

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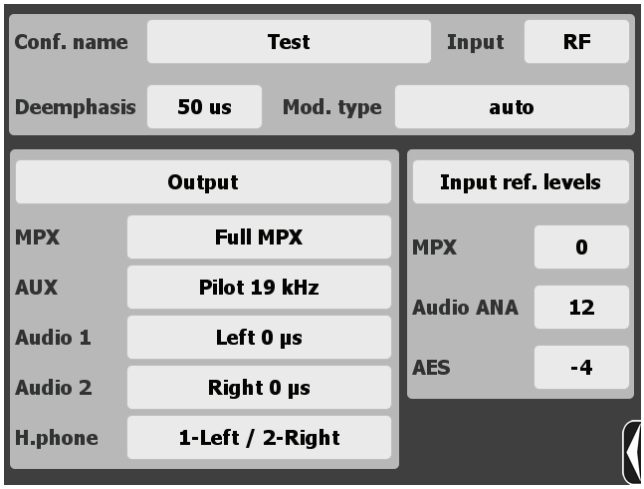
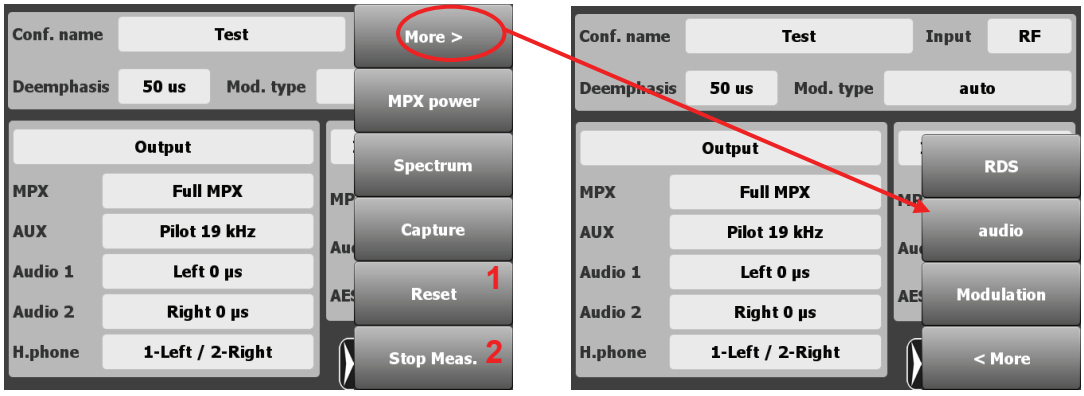
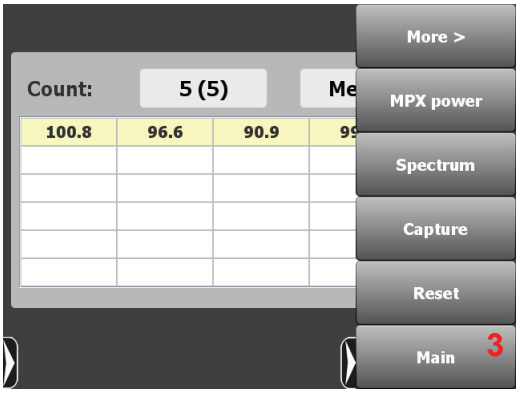


The measure main screen displays the following information:

- Configuration name
- Activated input
- Deemphasis
- Modulation type
- Output settings
- Input settings

You may then access the full measure menu and choose the type of measure you wish to perform on the frequency: spectrum analysis, modulation measurement, MPX power…
All menu items are not directly accessible; click on "More" to view the last menu items:





While in measure mode, you may:

1. "Reset" measurements: the current capture is stopped and a new one starts.
2. "Stop Measurements": this command is only available from the main measure screen.
3. Go back to the "Main" measurement screen.

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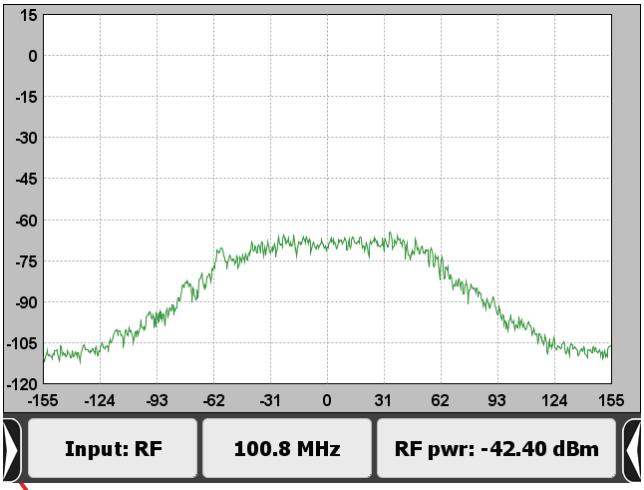
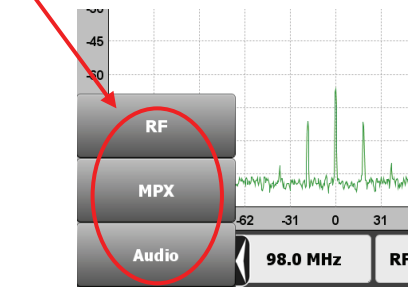
4.3.2. Spectrum

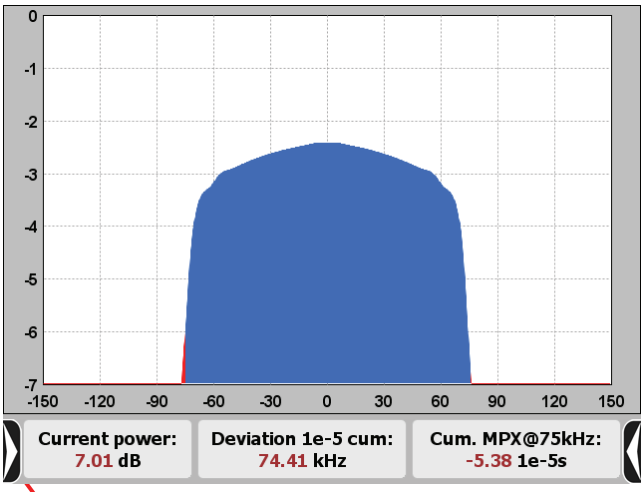


Click on "Spectrum": you get an **RF spectrum** on the chosen frequency.

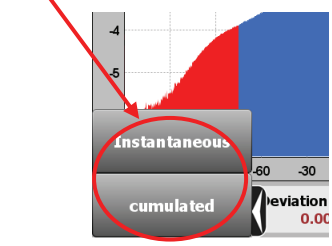


Display the left menu to be able to view the **MPX spectrum** or the **L and R audio spectrum**.

4.3.3. MPX Power



Select the MPX power menu to obtain a diagram of measured deviation repartition.



Display the left menu to be able to view the **instantaneous curve** or the **cumulated curve**.

4.3.4. Modulation

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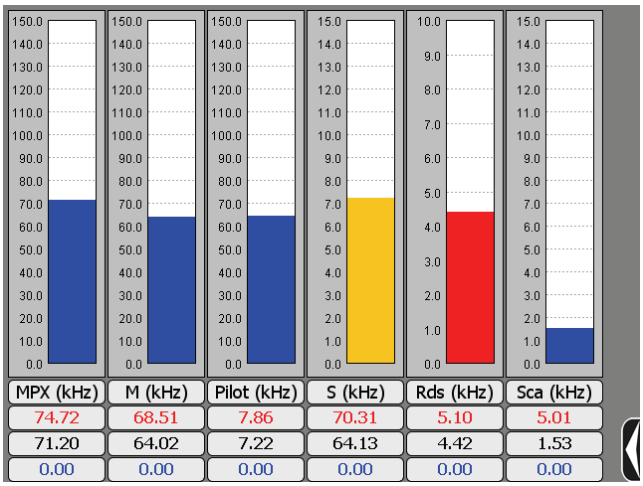
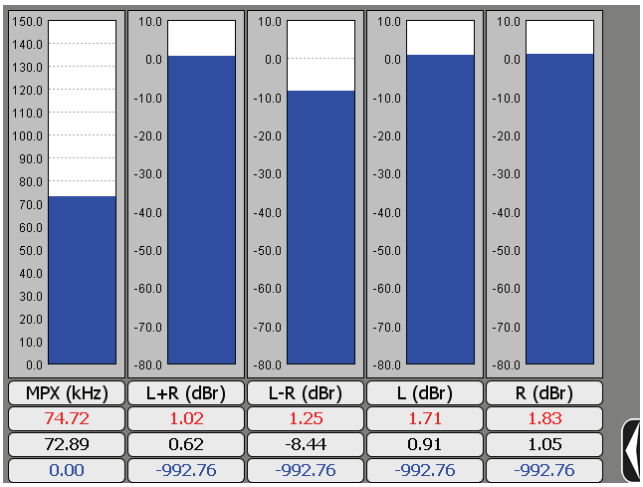


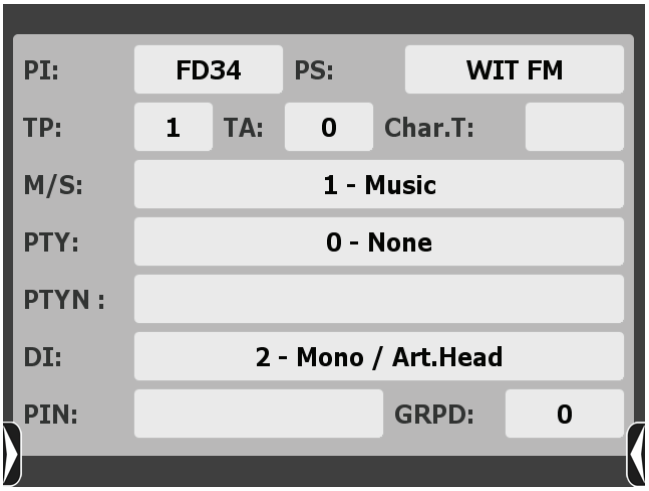
On this screen, you will see:
- The MPX modulation,
- M, pilot, S, RDS and SCA paths.

4.3.5. Audio



On this screen, you will see:
- The MPX modulation,
- L, R, L+R and L-R audio.

4.3.6. RDS



The information RDS screen offers a summary of decoded RDS information:

- PI
- PS
- TP
- TA
- Character table (or code table)
- PTY
- PTYN
- DI
- PIN
- GRPD

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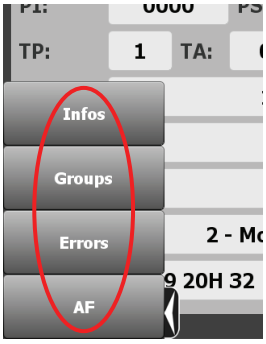
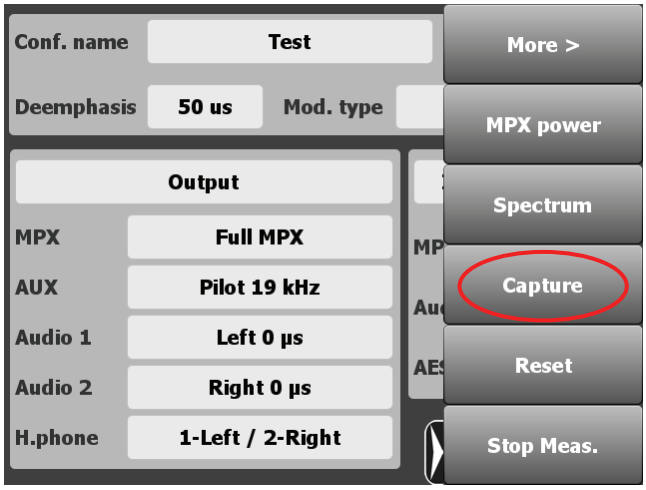


Display the left menu to be able to view the groups, instantaneous and global errors and AF.

4.3.7. Capturing measurements

Automatic measurement reports are only available from the Navigator Modulation Analyzer remote application. Capturing measurements from the front panel makes it possible to collect a set of data for a measurement run. You will then be able to download this measurement capture onto your PC from the remote application so as to be able to generate reports.
Simply click the Capture button from any measurement screen. The capture lasts about 3 s.
Please read section 6.6 on capture management with the remote application for further details.



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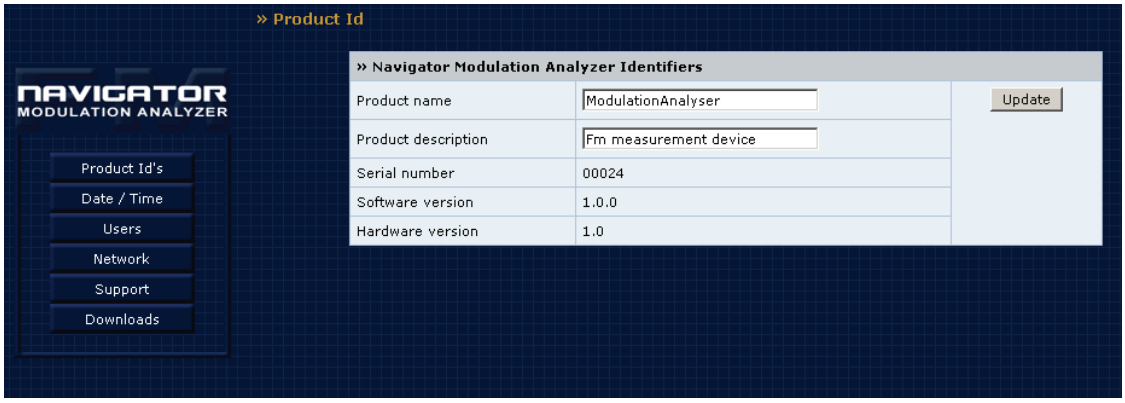
5. THE EMBEDDED WEB SITE

5.1. Product ID



On this page of the embedded website, the user can:

- Configure:
  - Product name: it can be used for connecting to the equipment from the java application. It is therefore recommended to use a unique and easily recognizable name.
  - Product description (optional)

- View:
  - Serial number
  - Software version
  - Hardware version

Note: Whenever the user enters new parameters, he/she must click on "Update" to save the changes. This applies to all NAVIGATOR MODULATION ANALYZER parameters.

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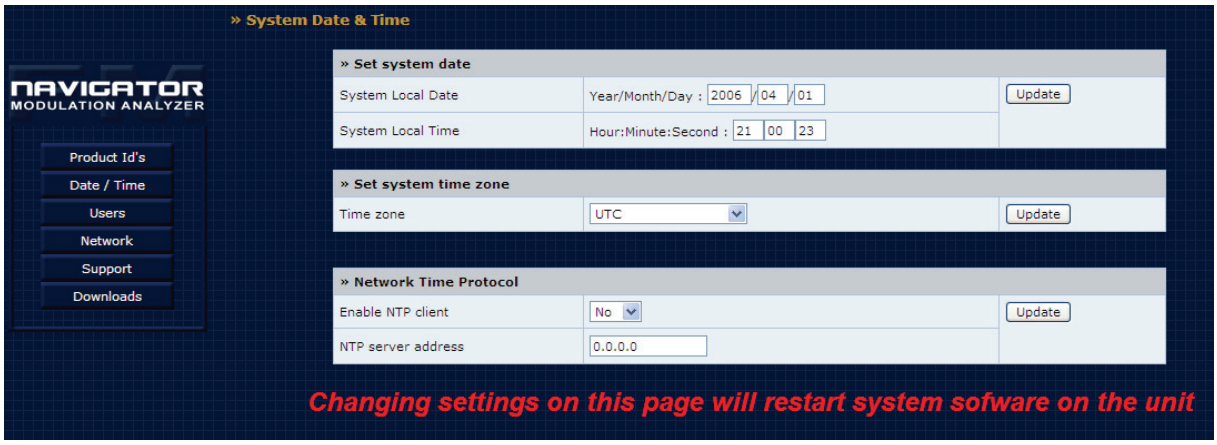
5.2. Date / Time



➢ "Set system date": date and time update.
The user may enter the date (year/month/day) as well as the time (hour/minute/second).

➢ "Set system time zone": updates the geographical time zone
The user selects the geographical zone from the list. Important to have this set correctly when using an NTP server.

➢ "Network Time Protocol": NTP update
The user can enter a time server address to update the equipment's internal clock automatically.
Example: 192.88.30.1

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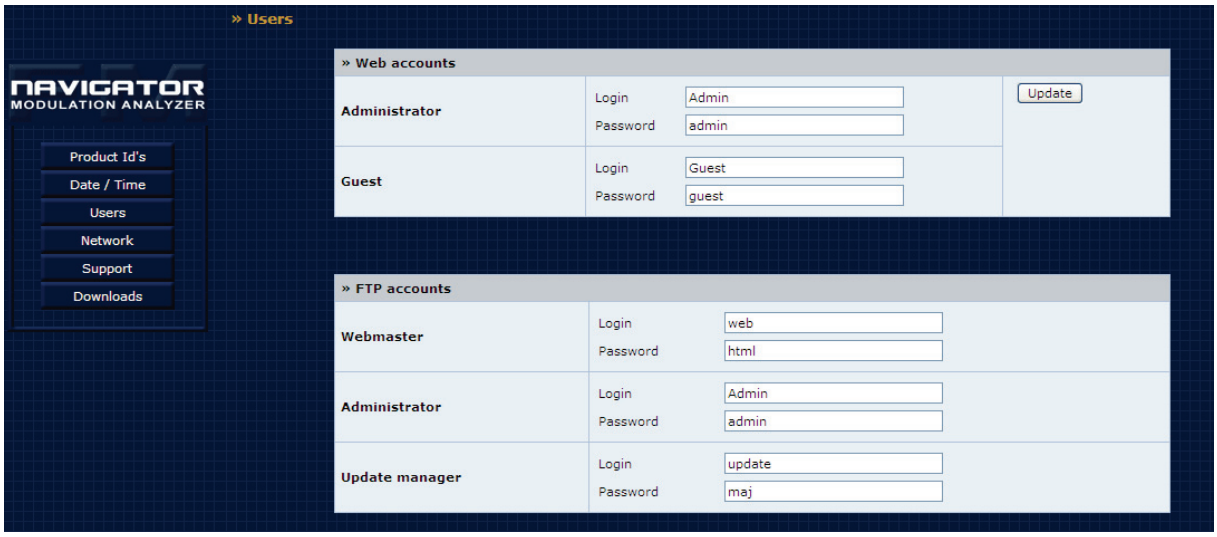
5.3. Users



- "Web accounts"
  There are 2 user levels on the equipment: "Administrator" and "Guest".
  - "Administrator": any user with the Administrator level has the possibility of changing any of the parameters.
  - "Guest": a user connected with the Guest level will be able to view measurements and settings but will not be able to change any configuration or settings.
- "FTP accounts":
  - Webmaster account: access to HTML pages. The user can personalize the embedded web pages (for example, by inserting company logos). He/she must be logged in as "Webmaster".
  - Administrator account: access to the equipment's entire directory.
  - Update Manager account: access to the equipment's update directory.

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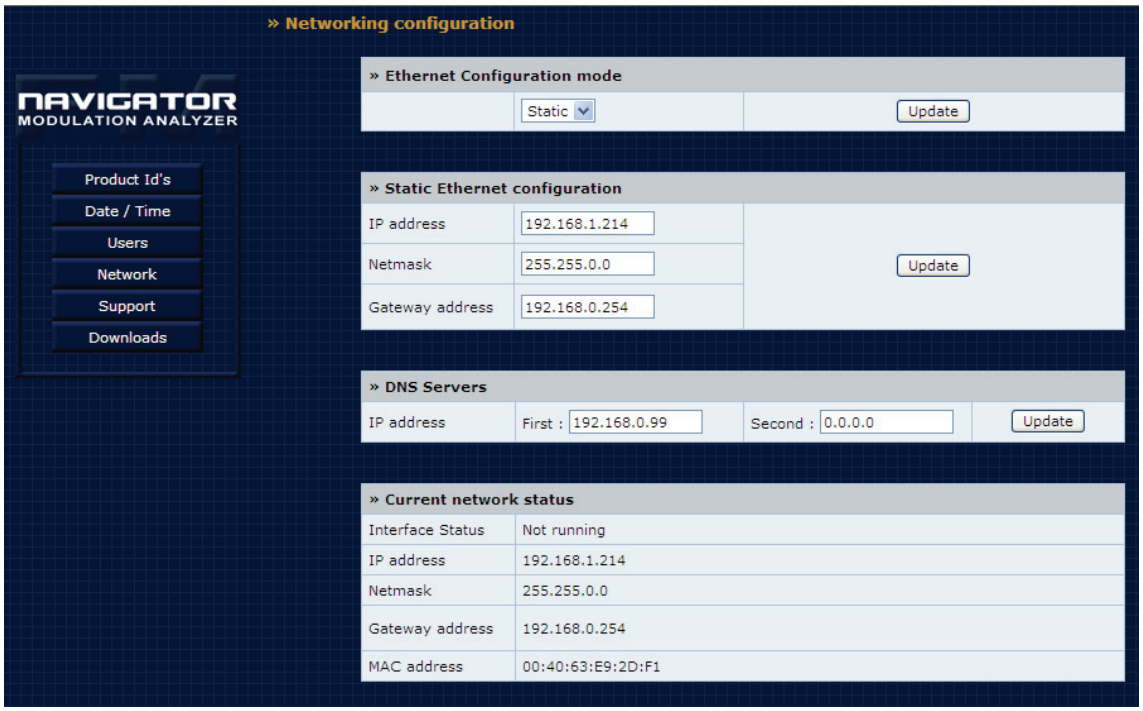
5.4. Network



➢ Ethernet configuration mode
The interface can be configured for dynamic or static IP.

➢ Static Ethernet configuration
If the IP address is a static address, enter the parameters in this window.

➢ DNS Servers: DNS configuration.

➢ Current network status: present network table.

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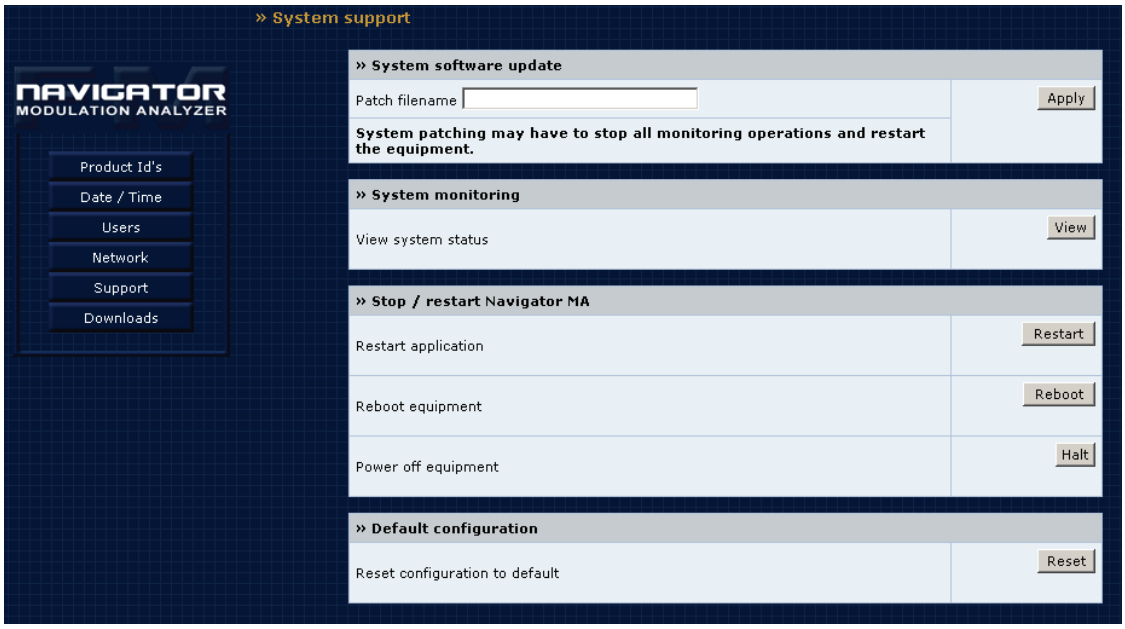
5.5. Support



➢ System software update: to update the equipment with the latest software versions. The user will put the name of the patch file in the window: by clicking on "apply", the update is automatic.

➢ System monitoring: by clicking on "view", the user can check the system status table (temperature, date, ram disk, etc.).

➢ STOP/Restart:

- Restart application: this function causes an application restart to re-initialize the parameters.
- Reboot equipment: this function causes a total reboot of the equipment.
- Power off: turns the equipment off remotely.

NOTE: it is not possible to turn on the equipment on remotely.

➢ Default configuration: Erases the current configuration and restores the original default configuration.

Caution: All configuration (except network settings) will be deleted!

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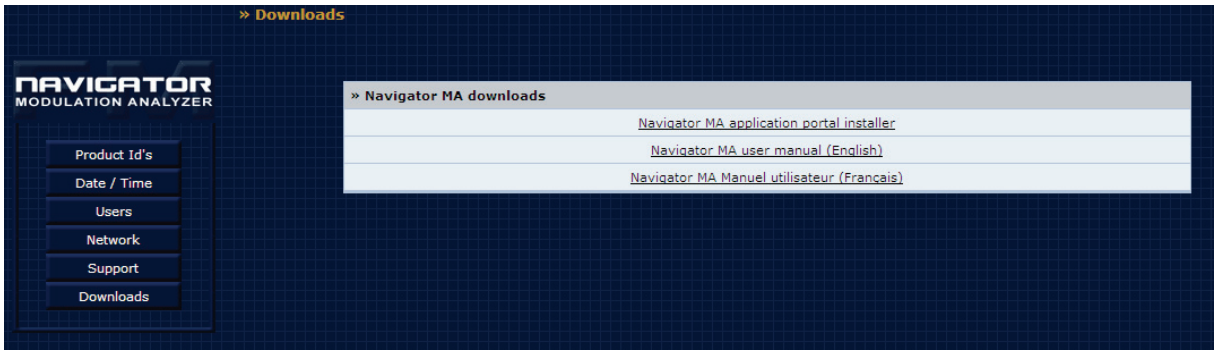
5.6. Download



This page enables you to download the Modulation Analyzer application for the equipment. Click on the first line to, and select 'Open' to install the application, or 'Save' to save the installer for later installation.

You can also download this manual from the embedded website link

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6. REMOTE COMPUTER APPLICATION

6.1. Launching the Navigator Modulation Analyzer's application

6.1.1. Prerequisite

A Java application, "Navigator Modulation Analyzer" is stored in the unit and is available to be downloaded from the embedded web site in the "Download" tab.

You should also check that the equipment's network parameters are compatible with those of your computer.

Note: The equipment does not have a DHCP server. It is therefore mandatory, when using a crossed cable, to configure the computer with a fixed IP address.

For a direct connection, configure the computer's IP address in the 192.168.x.x range (refer to section 3.2).

In case of doubt, and so as to be sure that the equipment can be contacted by the PC, use the ping command via the computer's command prompt, and check that a reply comes back from the Navigator Modulation Analyzer.

Note: If the equipment is on a network, it will be possible for several people to have access simultaneously. The equipment allows data viewing by several users at once. However, any change of the configuration by one of the users will have an effect on the equipment and an impact on all users; it is not possible for the equipment to be used in demodulator mode on the RF input by one user and at the same time in audio input mode by another. Using 'login/password' will limit access and possible interference.

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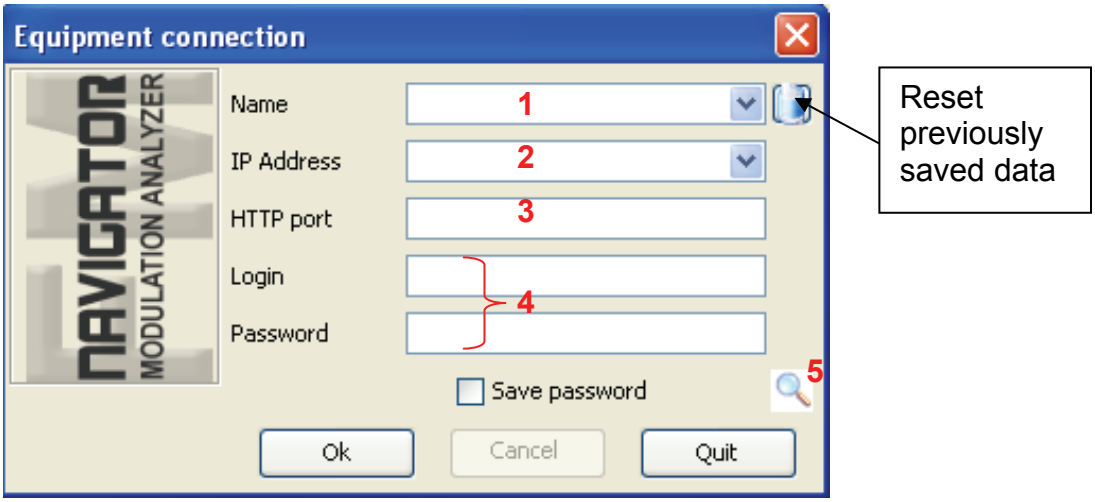
6.1.2. Connection to the equipment

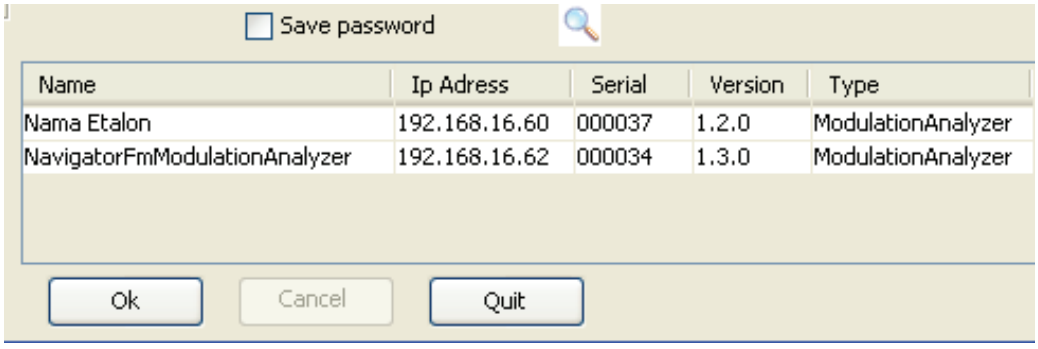
➢ The first time the software starts, the following screen is displayed :



➢ Enter the equipment's IP address (2) and the HTTP port (3) (port 80 by default), as well as the login and password (4).

- The IP address can be set and modified from the front screen (see § 4.1)
- The login and password can be modified from the embedded web site's "Users" tab (section 'Web'). Default values are "Admin"/ "admin" for the administrator and "Guest"/ "guest" for a basic user.

➢ **Or:** click on the magnifying glass (5) to display a list of equipment connected to the network.



Double-click on the line for the chosen equipment: its IP address and port will appear in (2) and (3). Just enter the login and password as described above.

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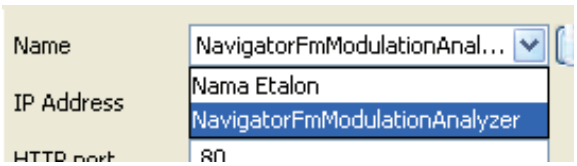
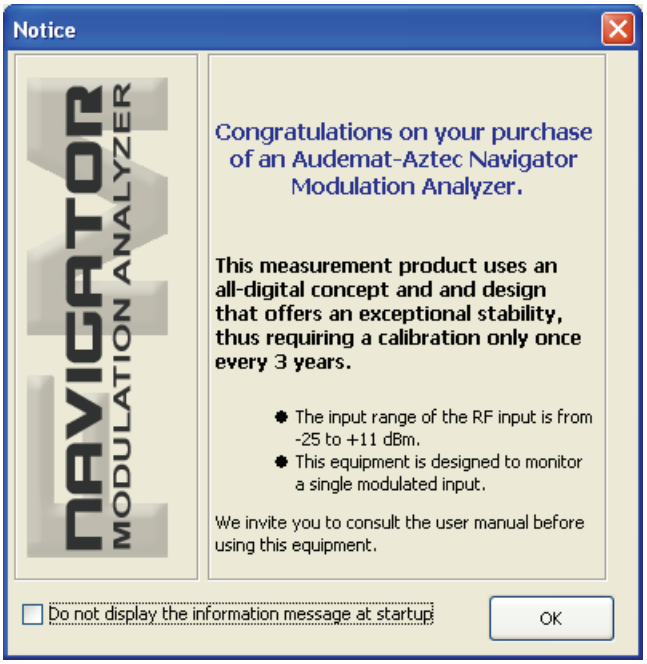
- Once the application has been used, a scroll-down menu is available (1) to select the equipment's name from a list of current connections:



Enter the login and password if the "Save password" box had not been checked.

- Click on the "OK" button. The application may take a few seconds to establish the connection.

- Each time the application is started up a note on the equipment will appear.



It is possible to disable it (check the 'Do not display' box, see § 6.3).

Once the connection has been established, click on the "Configuration" tab to begin your equipment's configuration.

Note:	it is possible to connect to different equipment, one after the other, without closing the software application. In the application, go to the menu File→ 'Connect', the connection dialog box will appear again.

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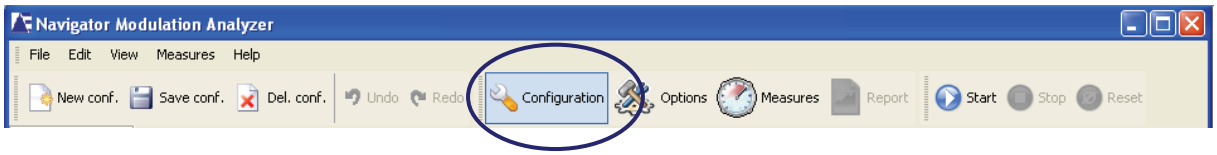
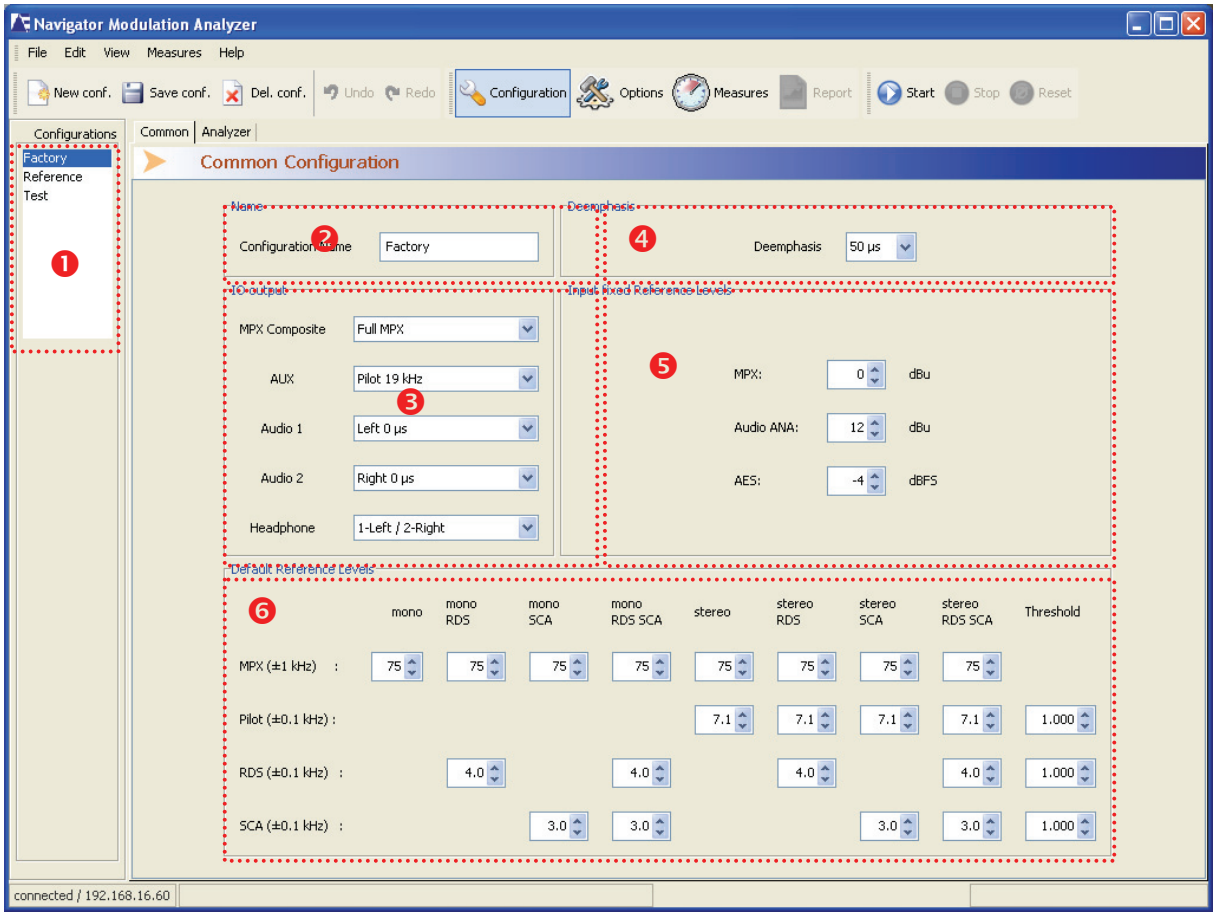
6.2. Configuration



The configuration settings, which are displayed by default on startup, are only accessible when no measurement is being carried out. It is necessary to stop measurements by pressing on the "Stop" button in order to toggle onto the configuration and modify the parameters.
To access the configuration view, click on the button, or go the menu "View"→"configuration".

CAUTION: The Navigator Modulation Analyzer comes with three default configurations. These configurations may be modified, but not deleted. They ensure the unit will work properly.

6.2.1. Configuration tab



❶ List of 10 recorded configurations: these configurations are available on the equipment's front panel. They enable configurations specific to a station to be memorized.

These configurations are stored in the equipment not locally on the PC.

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❷ Configuration name as selected in list ❶.

❸ List of signals which will be routed to the equipment's outputs.
Possible choices are summarized below:

	Tx output	Audio outputs	Head-phones
MPX	•		
Pilot	•		
RDS	•		
Mono		•	•
Stereo		•	
Left		•	•
Right		•	
Left with de-emphasis		•	•
Right with de-emphasis		•	
Sine wave 1 generator *			
Sine wave 2 generator *	•	•	•

Signals routed to the AES/EBU and audio Analog outputs are identical

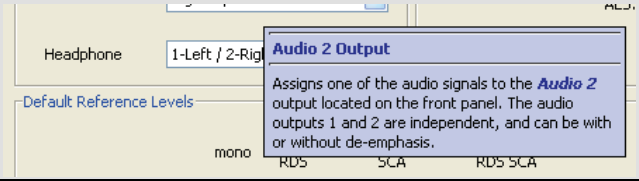
For the headphone output the outputs are 'linked': Mono/Stereo, Left/Right.

❹ Definition of the de-emphasis. The signals with or without de-emphasis are calculated continuously, which enables output of any audio signal with or without continuous de-emphasis.

❺ Definition of output levels generated by the reference levels.

❻ Definition of possible different configurations and associated levels. These reference levels are the ones used for calculating audio levels.

Note: So as to facilitate le learning curve on the Navigator Modulation Analyzer, tool tips may appear, containing short explanations. Simply hover over a text zone and keep the mouse still for one second:



**** Only available with the optional Laboratory tools.***

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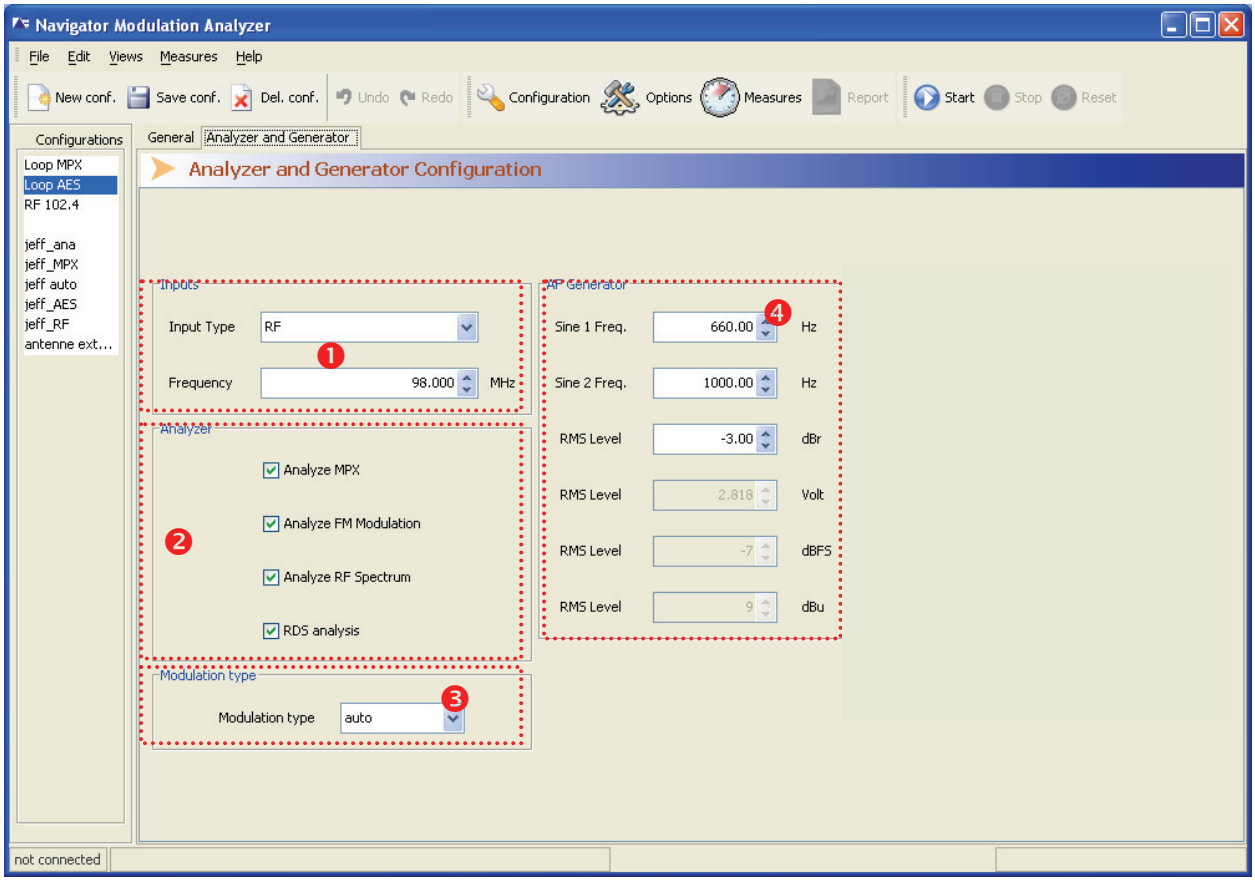
6.2.2. Flow tab



❶ Navigator Modulation Analyzer input selection.

This may be Analog Audio, AES Audio, MPX or RF input.

- If the RF is chosen, the frequency in MHz should be entered. The RF signal at the input must contain only that frequency to guarantee accuracy of the equipment, and the RF level must be in the -25dBm/+10dBm range.
- If the MPX input is chosen, the signal is a 0-100kHz signal, whose nominal level is defined in § 6.2.1 (if the reference level is 0 dBu, the reference deviation is 75kHz and the signal is applied with a level of 6 dBu, the deviation bargraphs will display 150kHz).
- If the audio inputs (AES or Analog) are chosen, the signal is a 0-16kHz signal, whose nominal level is defined in § 6.2.1 (if the reference level is 6dBu, and the signal is applied with a level of 0dBu the audio bargraphs will display a level of -6dB).

❷ Acquiring data and readings: all of the panels in the application are simultaneously refreshed at a frequency depending on the type of information displayed. The speed will also depend on the power of the computer being

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used, with a slow computer, it is best not to check all boxes.

Warning: 'Thd' and 'Oscilloscope' screens (Laboratory tools) are linked to the 'Analyze FM modulation' and 'Analyze RF spectrum' options.

❸ Choice of transmission mode: the reference levels used by the application to calculate the audio levels are dependent on this mode, as defined in the Configuration tab. The mode detection may be automatic.

❹ ***This section is only available with the Laboratory option.***

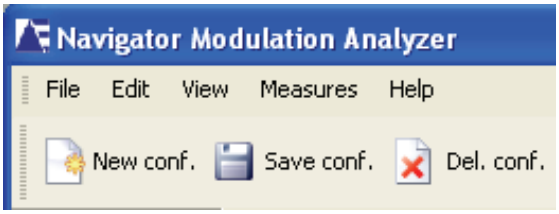
Choice of frequency generated by both local generators. These frequencies must be within 10Hz and 90 kHz. However, make sure you do not assign a sine wave with a frequency greater than 24 kHz on audio outputs.

The sine wave level is set in dBr. An immediate conversion gives access to digital (AES/EBU) and analog levels.

6.2.3. Configuration management

NOTE: The Navigator Modulation Analyzer comes with three default configurations. These configurations may be modified from the remote application, but not deleted. They ensure the unit will work properly.

Use the buttons on the tool bar:



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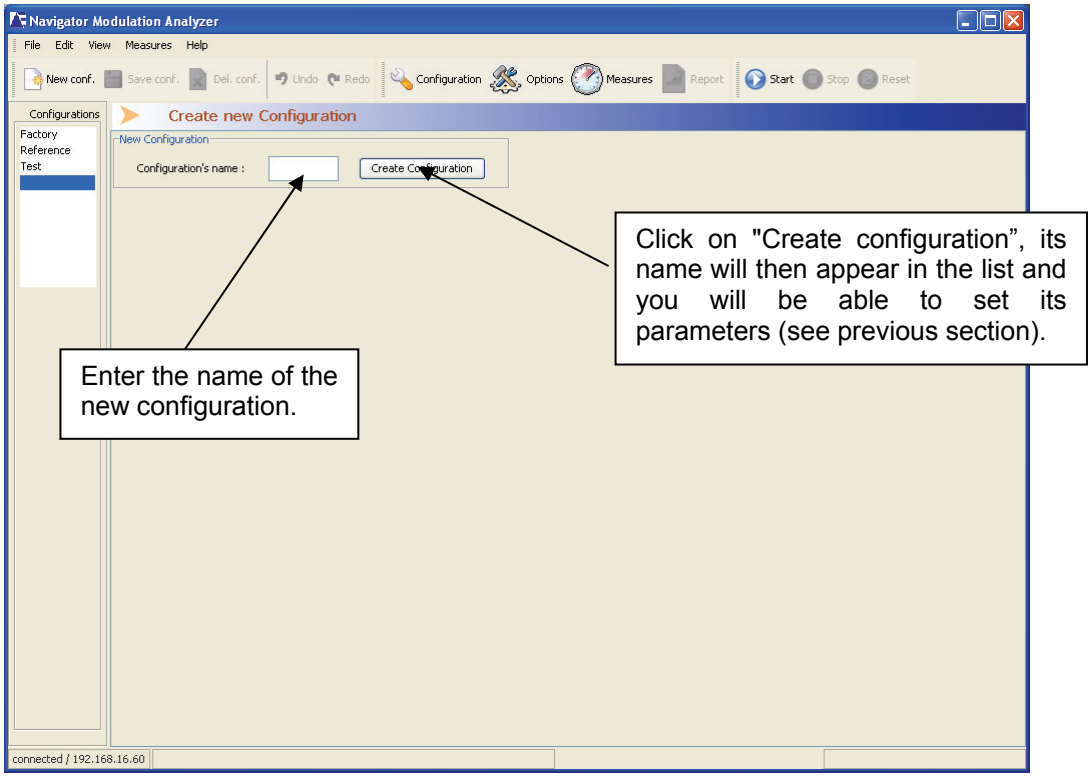
In order to create a new configuration, click on the "New conf." button:



When a configuration is modified, click on "Save conf." to save the changes. If you exit the Configuration mode without saving, the Navigator Modulation Analyzer will offer to do it.

To delete a configuration, select it from the list and click on the "Del. Conf." button.

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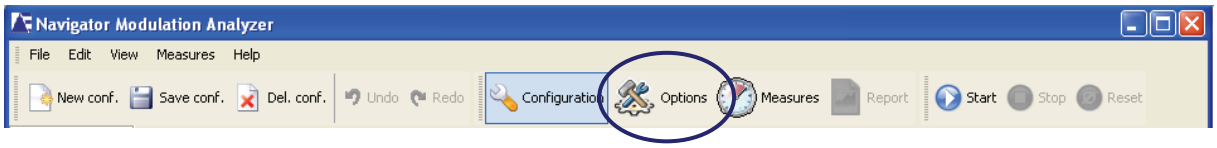
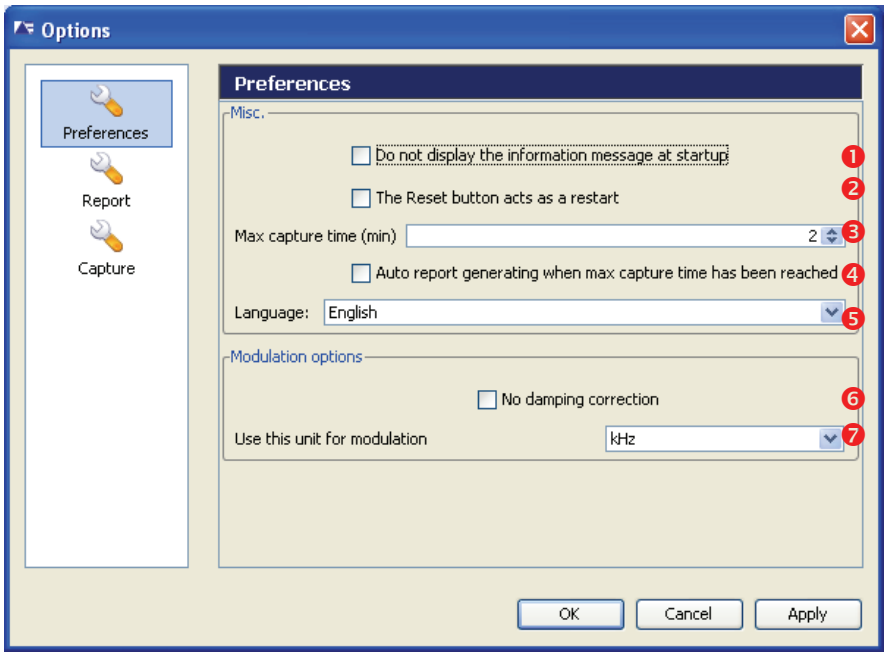
6.3. Options button



Click on the "Options" button (or menu "File"→'Options') to open the Preferences window.

6.3.1. Preferences



❶ Enables the note display on start up to be deactivated.

❷ Defines whether the Reset button starts a new capture (if checked) or only resets minima and maxima (see § 6.4.1).

❸ Maximum time for a measurement capture, in minutes.

❹ Automatically generates a report at the end of capture if checked.

❺ Choice of the language to be used for display: the operating system language is used by default.

❻ Check if damping correction should not be applied to bargraphs.

❼ Modulation unit type: kHz or %.

Note: Close and reopen the application in order for the language changes to be taken into account.

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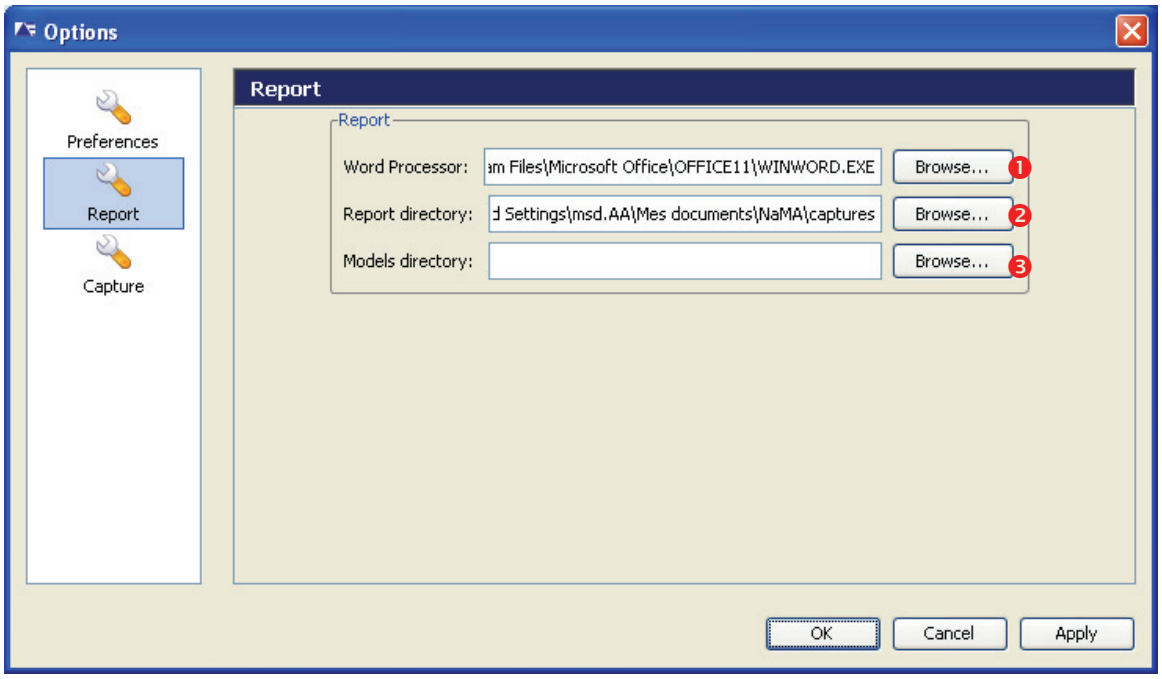
6.3.2. Report



1. Text editor used for the creation of reports. Ex: if Microsoft Word is used, select WINWORD.EXE, usually found in the directory: \Program Files\Microsoft Office\Office 11.
2. Directory in which reports and screen captures used for predefined reports are saved.
3. Directory in which report models created by the user are saved. This information is optional, if left blank, only Audemat standard report models will be used.

Note: Configuring the word processor and the report directory is mandatory in order to be able to launch measurements.

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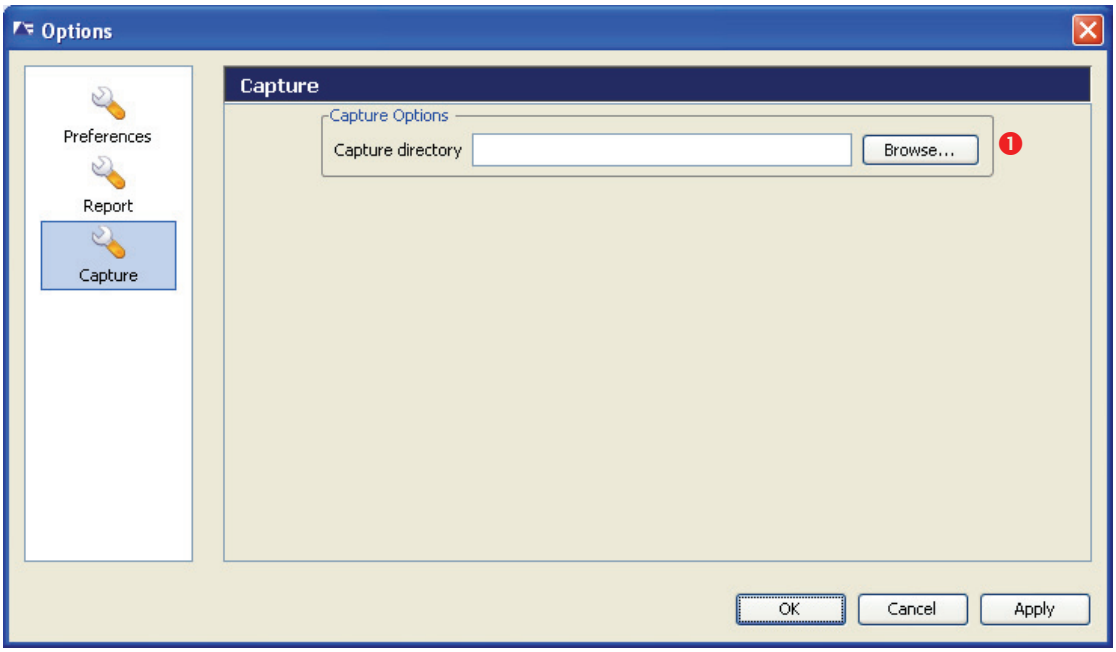
6.3.3. Capture



1 Directory in which captures from the front panel application are saved.

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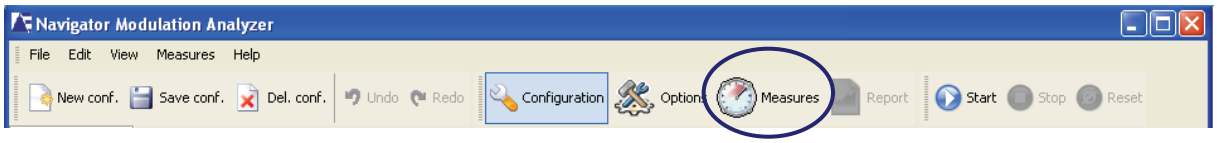
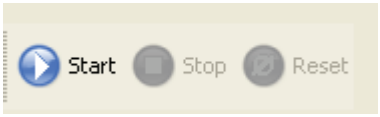
6.4. Measures button

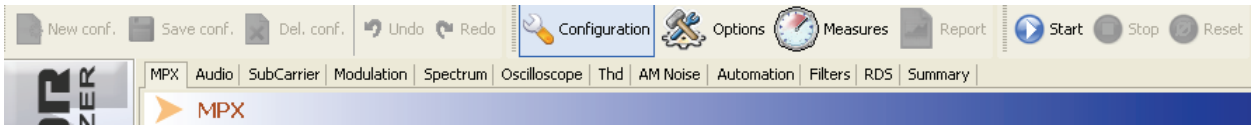


6.4.1. General points



Pressing the Measures button (or going to the menu "Views"→"Measures") switches the display to all measurement tabs. This does not trigger off value acquisitions; the graphs and their former values are displayed.

After having selected a configuration, the recording of measurements is launched by pressing on the "Start" button (or going to the menu "Measures"→"Start", or using the shortcut 's'). From this moment on, all selected tabs (see § 6.2.2) are simultaneously and continuously refreshed; time graphs store the measurements that, are not visible on the graph. Data is viewed by clicking from one tab to another. The process is the same for the RDS tabs.



Tabs composed of several graphs enable related data to be viewed in a grouping. This view is divided into two lines; the first line has three or four smaller graphs, the second contains the larger working graph. Contents of the large graph are chosen by clicking on one of the graphs on the first line.

This working graph can incorporate advanced functions, depending on its type. These functions include zoom, markers and maximum hold capabilities.

To view the RDS, press the "Stop" button (or go to the menu "Measures"→"Stop", or using the shortcut 'h') This is the only way to see the data (since the first measurement).

The "Reset" button (or the menu "Measures"→"Reset", or using the shortcut 'r') resets the displayed minima and maxima. If the option "The Reset button acts as restart" is checked (see § 6.4), clicking on the "Reset" button stops the current capture and starts a new one.

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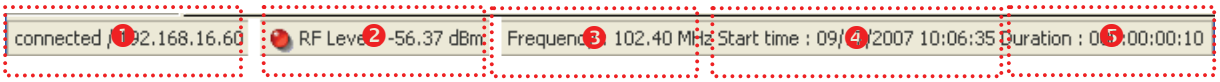
The status bar reminds the user of the input type, as well as the date and time of the beginning of the analysis and the time elapsed since the beginning of the measurements.



1. Equipment's IP address.
2. If the RF input is the active input, RF levels at equipment input are displayed.
   - RF level within the functional range will show a green LED.
   - A red LED indicates the level is too low (< -25 dBm).
   - An orange LED indicates the level is too high (> 11 dBm).
3. Type of input used (RF, MPX, AES or ANA).
   For the RF input, the analysis frequency is displayed.
4. Date of beginning of the analysis.
5. Time elapsed since the beginning of the analysis. This time is in *days*:*hours*:*minutes*:*seconds*.

6.4.2. Analysis tools

Some zoom and measurement tools are available for spectrum analysis. These tools are only available on the working graph and are dependant on this graph.

6.4.2.1 Zoom

It is possible to zoom on a specific part of the curve, by clicking the left mouse button and dragging to define the zone to be displayed. Click and drag from upper left towards the bottom right.
To go back to the previous zoom, click the left mouse button, drag up to the left and release the button; the graph will then show its original scale.

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6.4.2.2 Markers

It is possible to position two markers. To activate the markers:

1. Click the "Measurement" button.
2. Right-click on the desired spot on the curve, (marker 1).
3. Right-click a second time on the curve, on the desired spot (marker 2).
4. Right-click a third time on the graph to delete the two markers.

These markers can be linked to a curve (main curve, secondary or maximum curve), or be completely floating (not attached to a curve).

A Max hold function is also available on the RF graph. It memorizes the maximum RF level measured since the beginning of the application or since the last reset.

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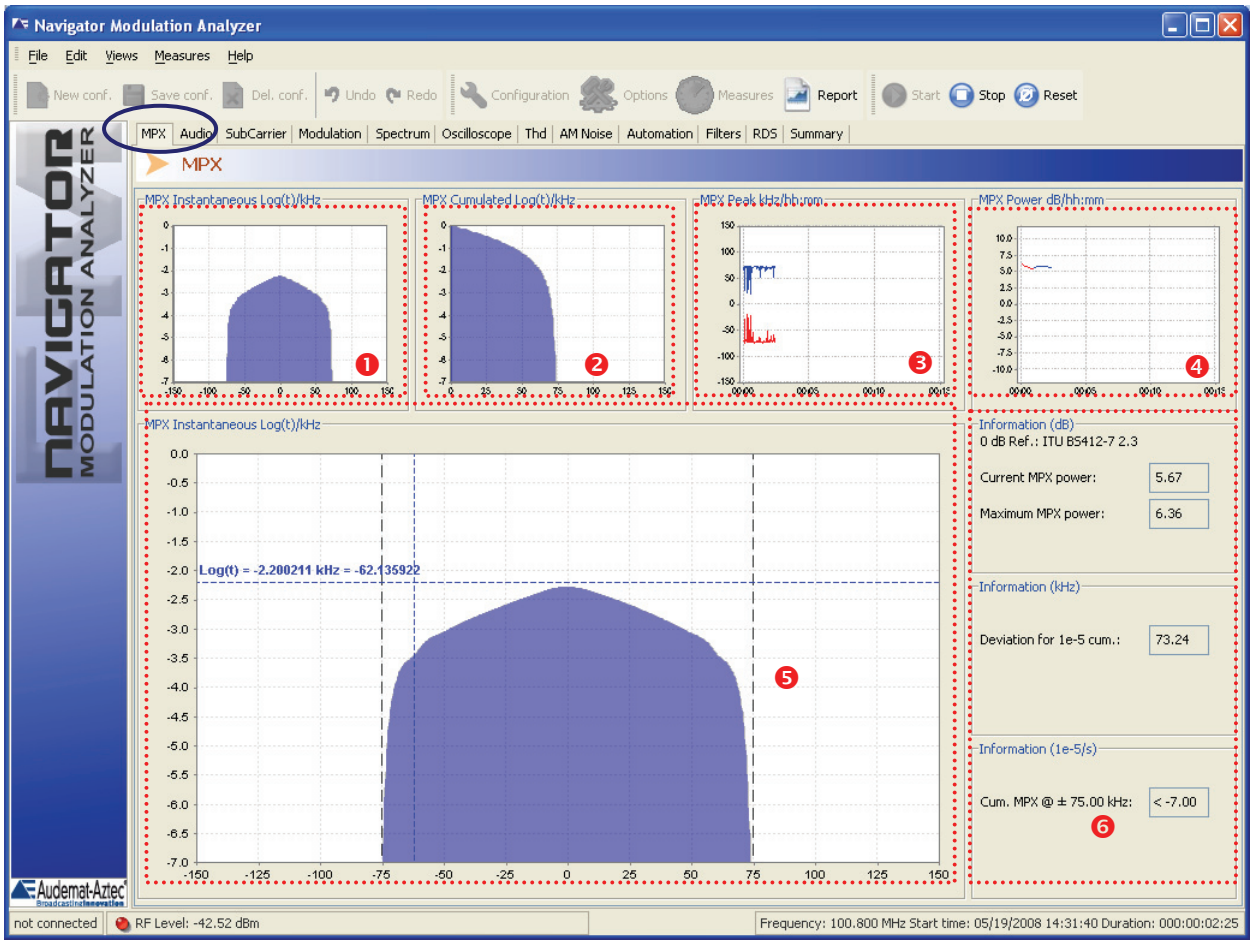
6.4.3. MPX tab

To access this tab, you may also go the "Measures" menu or use the "F1" shortcut.



❶ Diagram showing distribution of measured deviations.

❷ Cumulated MPX.

❸ Time representation of minimal and maximal deviation.

❹ Time representation of the calculated multiplex power (in dB, according to ITU BS412-7 standard).

❺ This graph is the zoom of the selected graph: click on the frames ❶❷❸ or ❹ on first line to see the graph displayed bigger, below.
Example in this tab with the "instantaneous MPX".

Note: this window is present in all tabs. Markers and zoom are available to facilitate readings (please refer to section 6.4.2).

❻ Display of data in numerical format for a better interpretation.

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6.4.4. Audio tab

To access this tab, you may also go the "Measures" menu or use the "F2" shortcut. Refer to section 6.4.2 to learn how to zoom on the graph.

❶ Time representation of positive and negative peaks linked to the Mono signal.

❷ Time representation of positive and negative peaks linked to the Stereo signal.

❸ Time representation of positive and negative peaks linked to Left signal without de-emphasis.

❹ Time representation of positive and negative peaks linked to the Right signal without de-emphasis.

❺ Peak levels of these 4 signals from the beginning of the acquisition or from the last reset.

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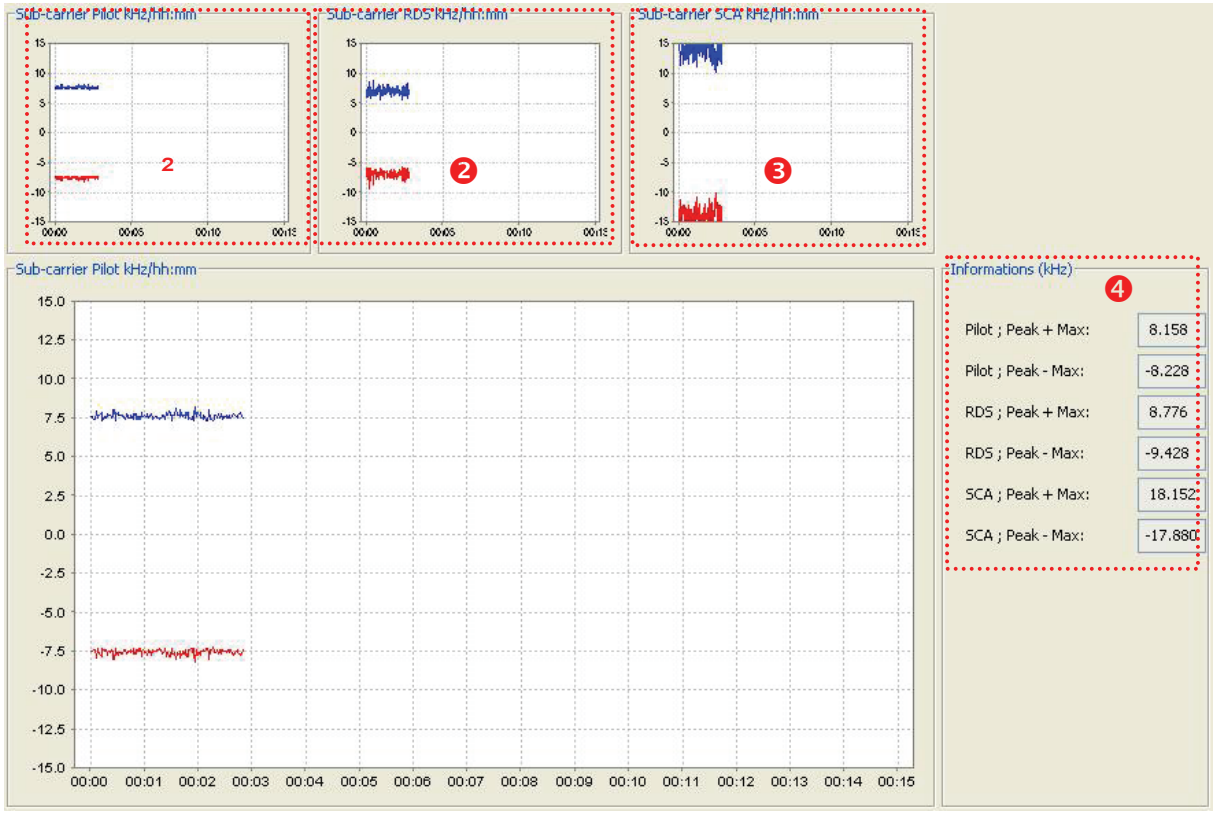
6.4.5. Sub-carrier tab

To access this tab, you may also go the "Measures" menu or use the "F3" shortcut. Refer to section 6.4.2 to learn how to zoom on the graph.



1. Time representation of positive and negative peaks linked to the Pilot signal.
2. Time representation of positive and negative peaks linked to the RDS signal.
3. Time representation of positive and negative peaks linked to the Auxiliary signal (DARC).
4. Peaks of these 3 signals from the beginning of the acquisition or from the last reset.

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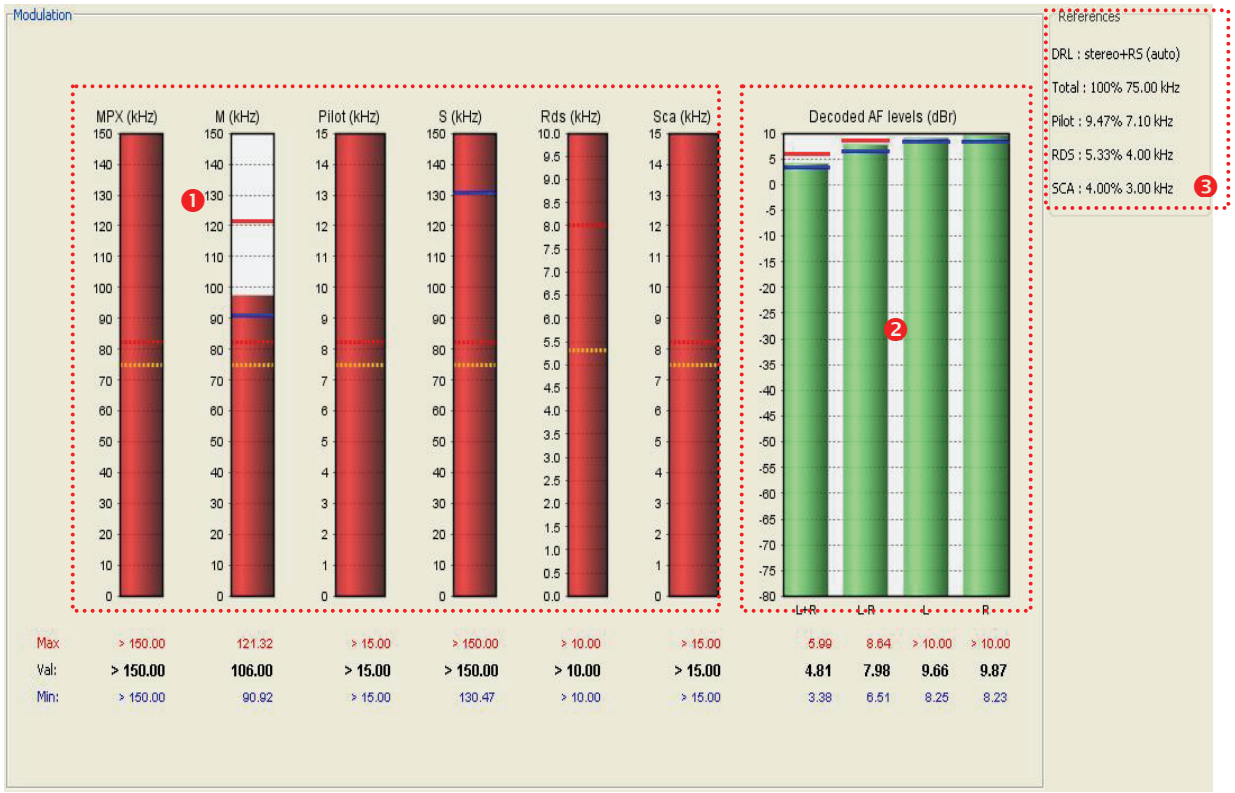
6.4.6. Modulation tab

To access this tab, you may also go the "Measures" menu or use the "F4" shortcut. Refer to section 6.4.2 to learn how to zoom on the graph.



❶ Level of Multiplex signal components:

- Total deviation,
- Mono component,
- Pilot,
- Stereo component (if pilot is detected),
- RDS,
- Auxiliary (DARC).

❷ Audio level without de-emphasis.

❸ Reminder of the current configuration: reference levels.

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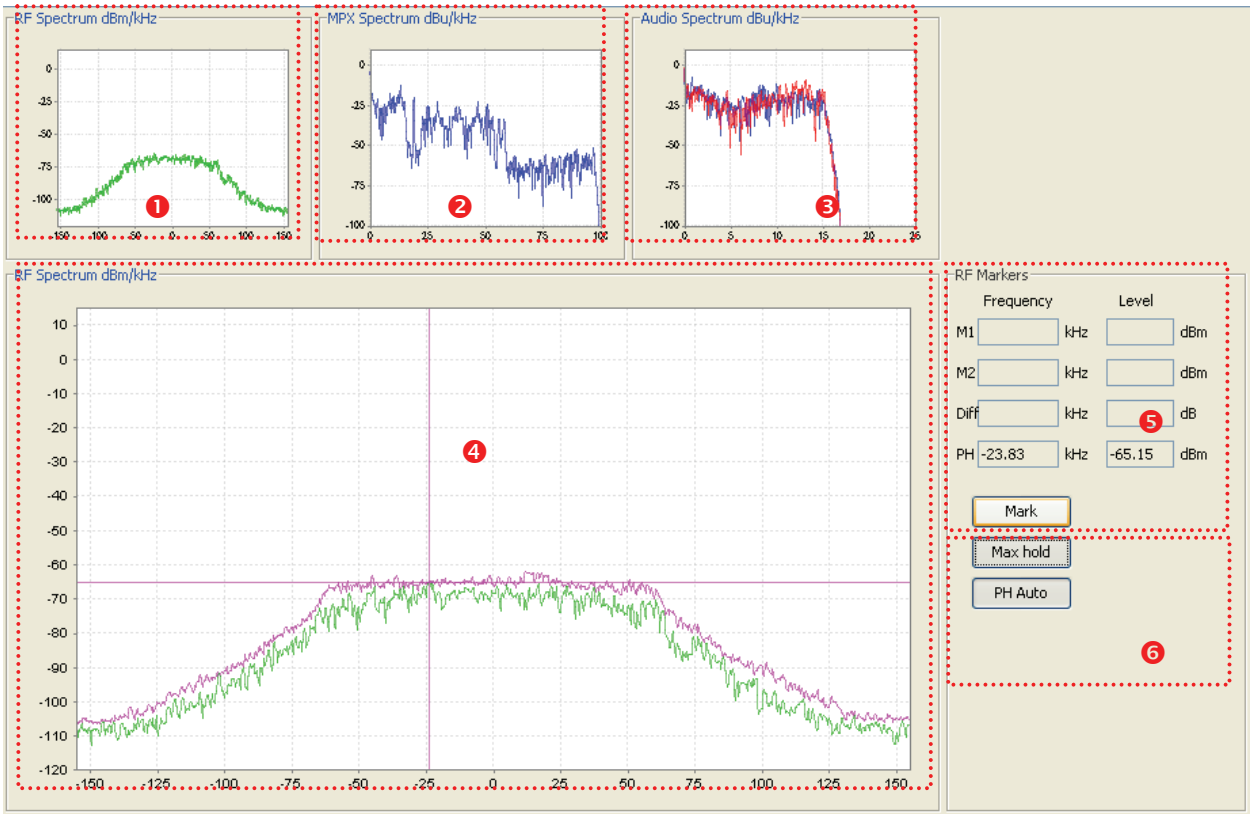
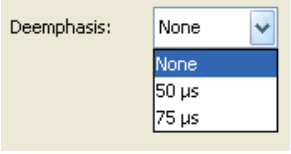
6.4.7. Spectrum tab

To access this tab, you may also go the "Measures" menu or use the "F5" shortcut.
This tab displays three spectrums simultaneously.
Refer to section 6.4.2 to learn how to zoom or position markers on the graph.



1. RF channel spectrum before demodulation, with a pass band of ±155 kHz. The spectral resolution is ~390 Hz/pixel.
2. 100 kHz MPX signal spectrum. The spectral resolution is 195Hz/ pixel.
3. Demodulated left (red) and right (blue) audio spectrums.
   The graph has 512 dots for a pass band of 25 kHz.
4. Enlarged view of selected spectrum.
5. Work panel: marker coordinates and delta in frequency and level.
6. With the RF and MPX spectrums, the "Max" button display the largest curve while "PH Auto" places a marker at the highest point.

   With the audio spectrums, a pull-down menu allows the user to select the deemphasis level. The default spectrum is for the signal without deemphasis.



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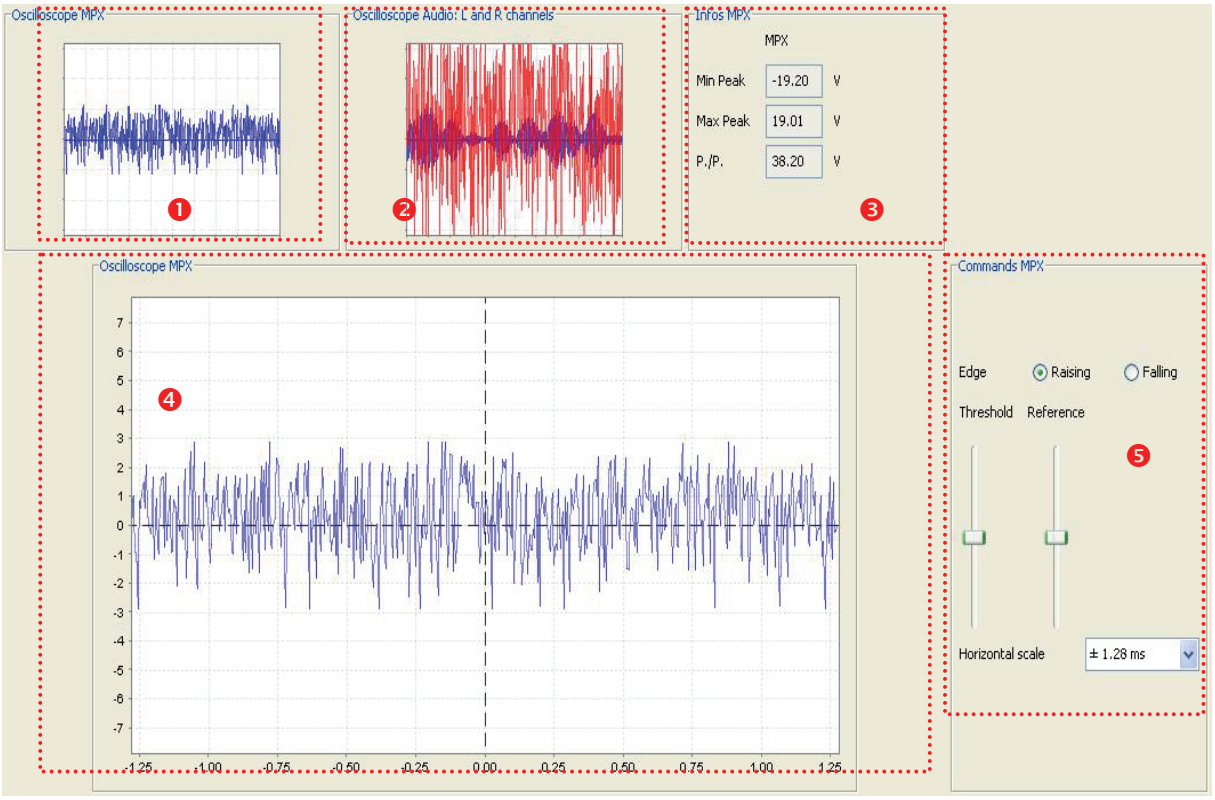
6.4.8. Oscilloscope tab

This option is only available with the Laboratory tools.

To access this tab, you may also go the "Measures" menu or use the "F6" shortcut. Refer to section 6.4.2 to learn how to zoom on the graph.

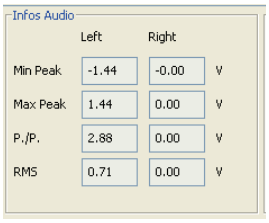


❶ View of the MPX signal oscilloscope.

❷ View of the **synchronized** left and right signals oscilloscope.

❸ Reminder of levels for the signal visible in section ❹, when the MPX oscilloscope ❶ is selected.

If the Audio oscilloscope ❷ is selected, displayed information in this zone is as shown here:



❹ Enlarged view of one of the oscilloscopes for a better analysis (zoom, choice of synchronization signal, detection level, horizontal scale).

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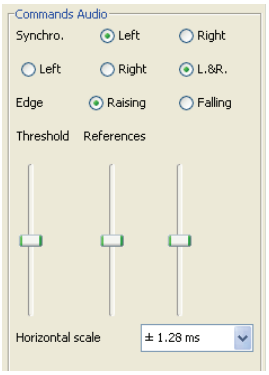
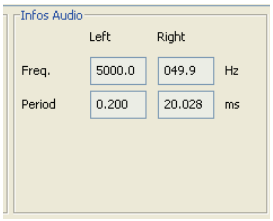
❺ Choice of displayed signals. Choice of edge type. Choice of thresholds and references.

For an Audio signal (graphic ❷), selection of the signal used for synchronization:



❻ If the Audio oscilloscope ❷ is selected, reminder of measured frequencies for each channel (from the THD tab):



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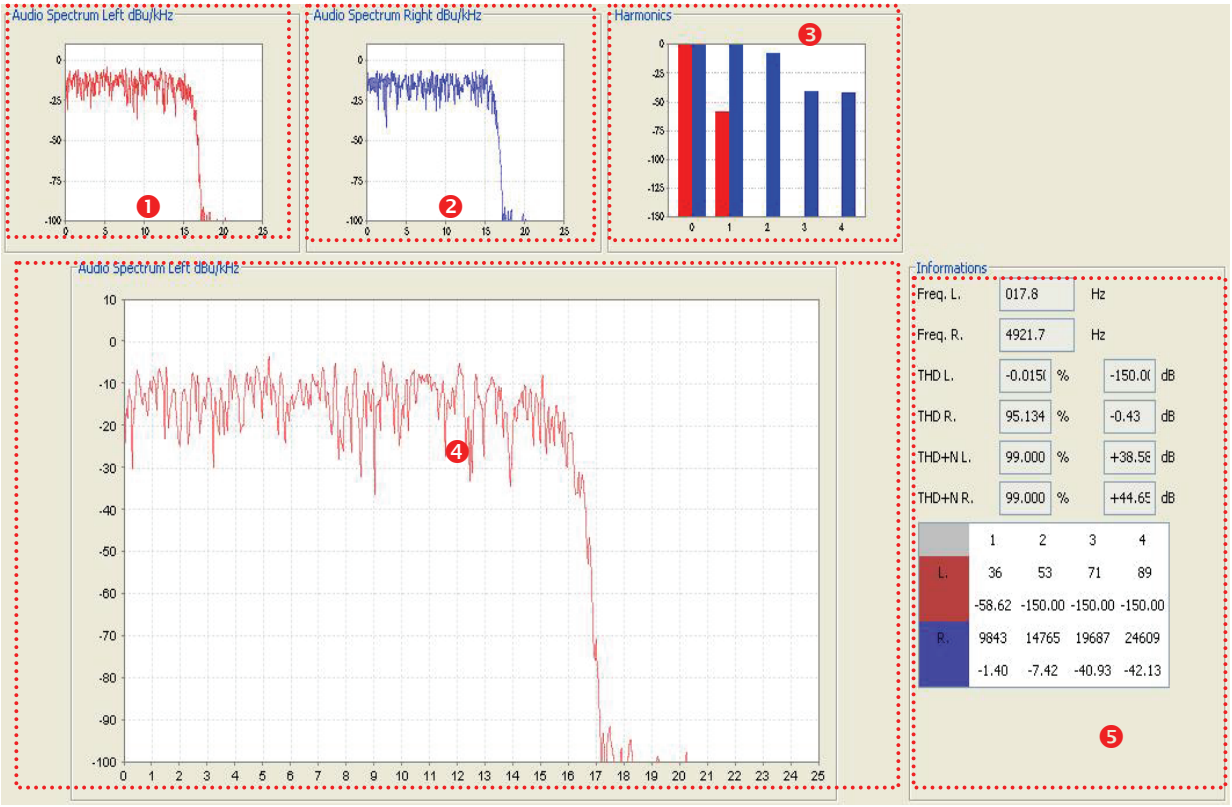
6.4.9. Thd tab

This option is only available with the Laboratory tools.

To access this tab, you may also go the "Measures" menu or use the "F7" shortcut. Refer to section 6.4.2 to learn how to zoom on the graph.



1. Left audio spectrum view (identical to the Spectrum tab).
2. Right audio spectrum view (identical to the Spectrum tab).
3. Level of the first 4 harmonics for each channel.
4. Enlarged view of selected graph (with zoom capability).
5. Detected frequency for each channel and THD [1] and THD+N [2] measurements for each channel with double display: % and dB. The table summarizes levels for the first 4 harmonics for each channel.

   1: Thd = Total Harmonic Distortion.

   2: Thd+N = Total Harmonic Distortion + Noise.

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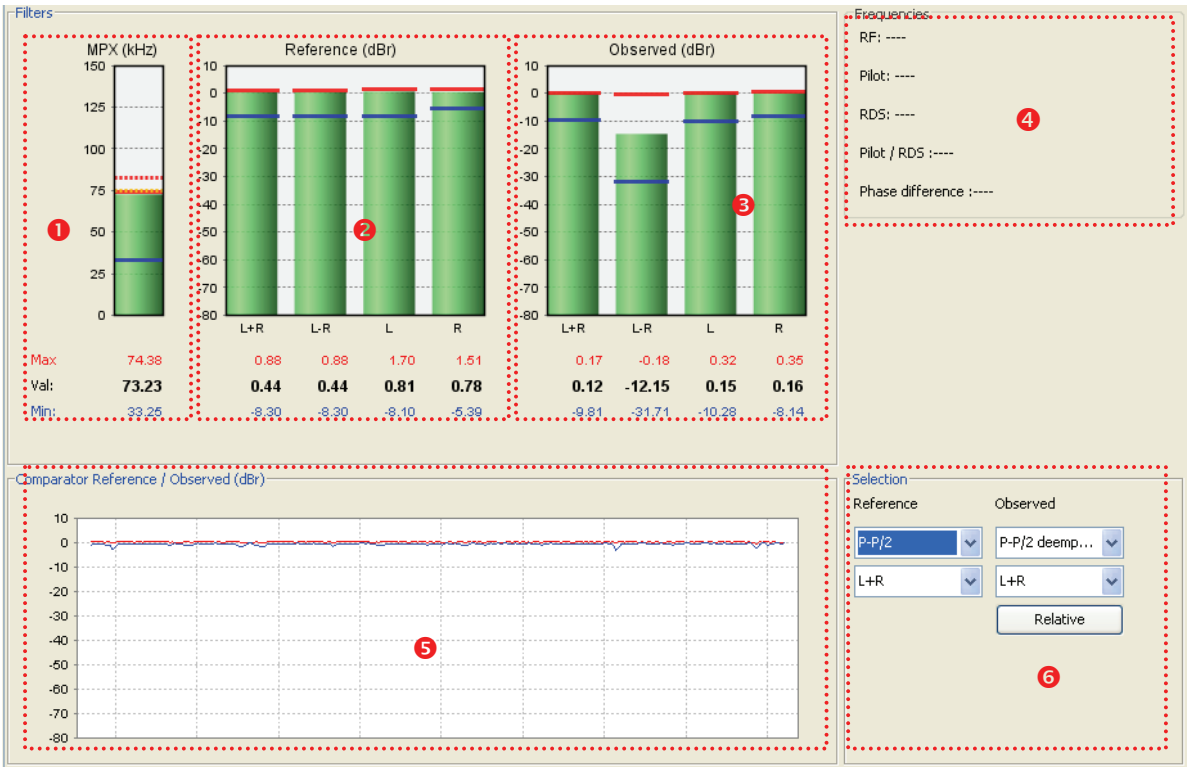
6.4.10. Filters tab

To access this tab, you may also go the "Measures" menu or use the "F8" shortcut. Refer to section 6.4.2 to learn how to zoom on the graph.



❶ P-P/2 deviation display.

❷ ❸ Display of signal levels for filters/detectors as selected in ❻.

❹ ***Laboratory tools option only.*** Display of detected RF frequency (around configured frequency ± 100 kHz). Display of pilot frequency and RDS when those signals are detected. Indication of synchronization RDS pilot / phase difference between these 2 signals.

❺ Display of selected 'reference' and 'observed' signals over time (In this example, L+R in P-P/2 and L+R in P-P/2 with de-emphasis)

❻ Choice of filters/detectors used for display.

Click on the "Relative" button to memorize the max signal measured amongst the 4 'reference' signals and use it as the new reference.

Available filters/detectors associations:

P-P/2

P-P/2 + with de-emphasis

RMS

RMS with de-emphasis

RMS CCIR 468-4 unweighted *

** This filter is only available with the Laboratory tools*

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6.4.11. RDS tab

6.4.11.1 General points

To access this tab, you may also go the "Measures" menu or use the "F9" shortcut.
All RDS tabs are refreshed simultaneously; this enables the user to view one data display then another with no risk of losing information.

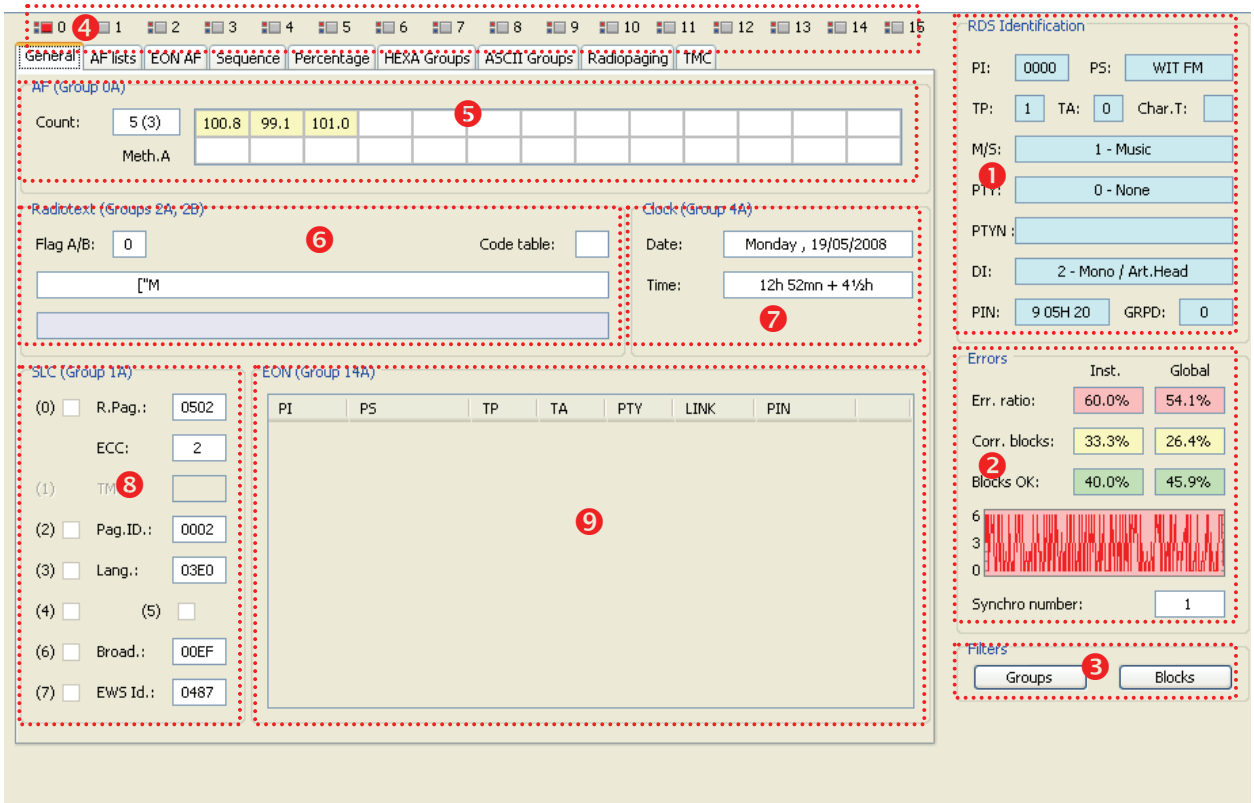
Some tabs have a history feature, with which the user can display all data received since the application was started or since the last reset. This is the case for the following tabs:

- List of AFs
- Hexa group
- ASCII groups
- Radio paging
- TMC

To prevent computer overloading, this history is not visible in real time; data viewing is only enabled by stopping the analyzer (***Stop** button*) (a scroll bar will then appear).

Note: Pressing *Stop* will stop the whole application and not just the RDS part.

Some information is available on every tab:



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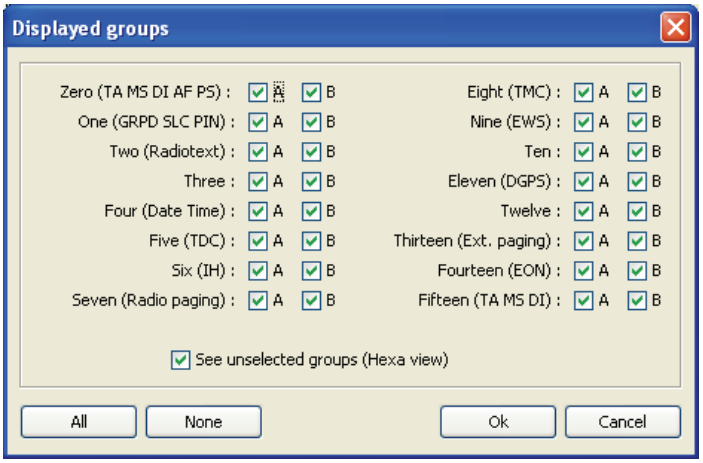
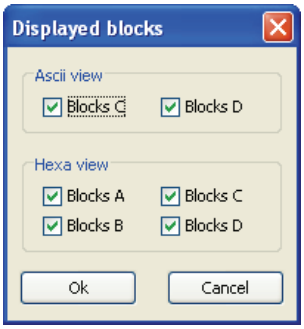
❶ Identifies the station main RDS data:

- PI, PS codes,
- Traffic information (TA / TP),
- Table of characters used,
- Information on contents: MS, DI, PTY, PIN, GRPD, PTYN.

❷ Displays RDS error information.

❸ Button for filtering groups and/or blocks: check boxes for groups and blocks to be displayed. By default, every box is checked.





❹  Indication of reception of an A type (red) or B type (blue) group. Red and blue dots on left indicate if the group is filtered or not.

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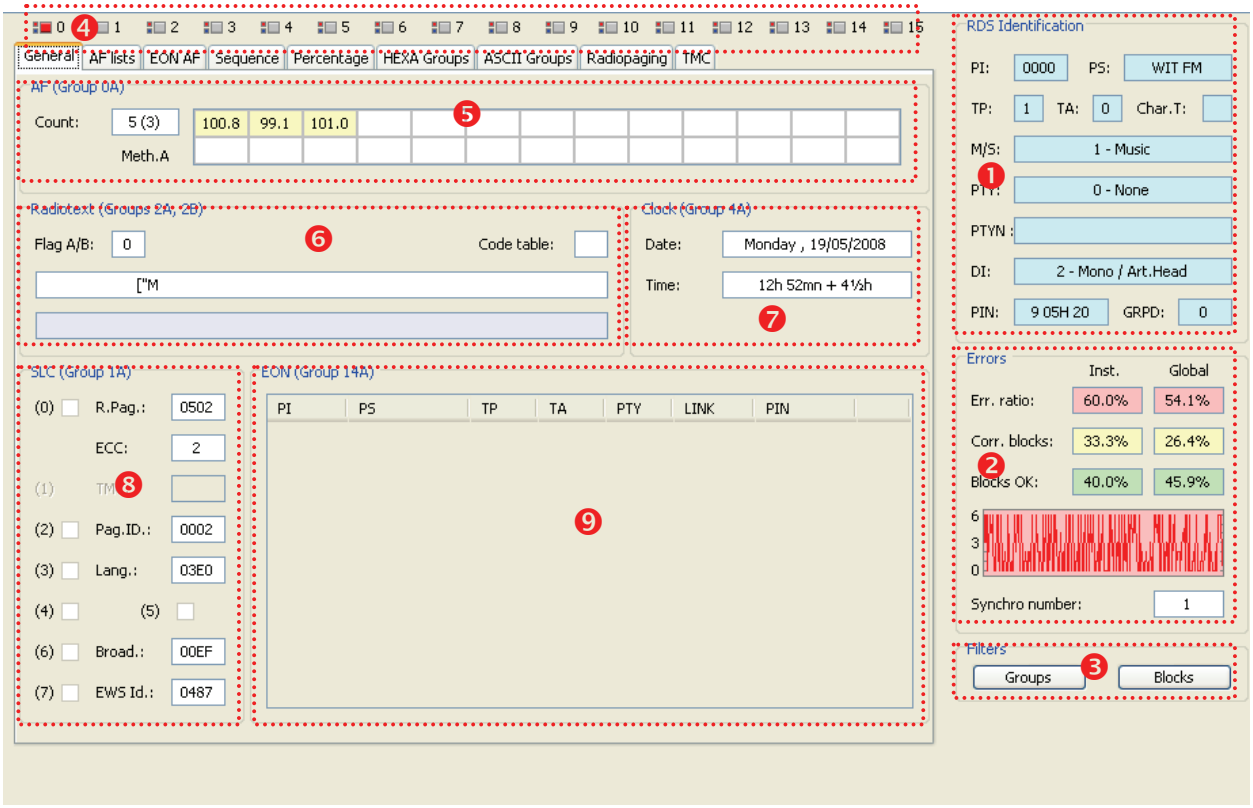
6.4.11.2 General tab



❺ Last decoded AF list. This panel contains:

- The number of AFs contained in the list,
- The type of method used for sending these frequencies (A or B).

❻ RadioText information:

- A/B flag (indication of new RadioText),
- Current RadioText,
- Previous RadioText.

❼ Decoded RDS date and time.

❽ Slow Labelling Code.

❾ Enhanced Other Network: information on the network's other stations.

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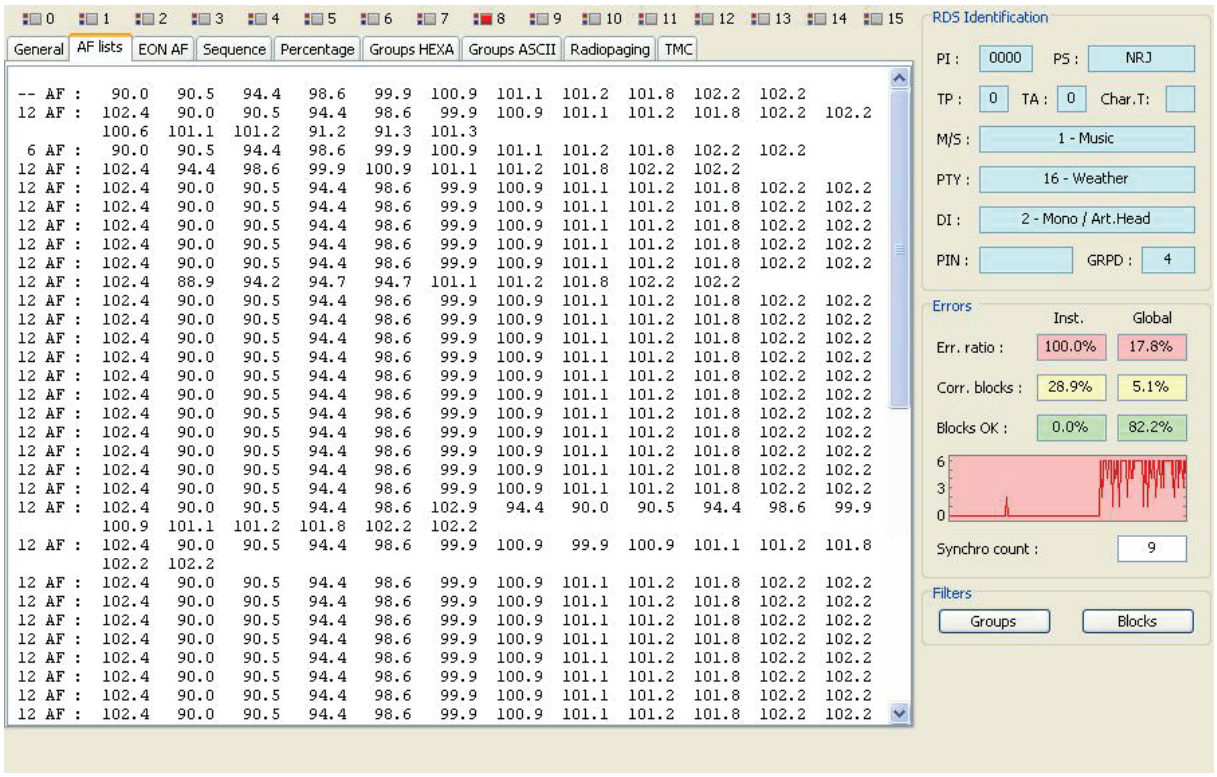
6.4.11.3 Lists of AF tab



List of AFs (Alternative Frequencies) received by the equipment since the beginning of the measure. These frequencies are sorted chronologically.

Note: When printing reports, all AF lists are saved in a text file: af_list.txt, stored in the report directory.

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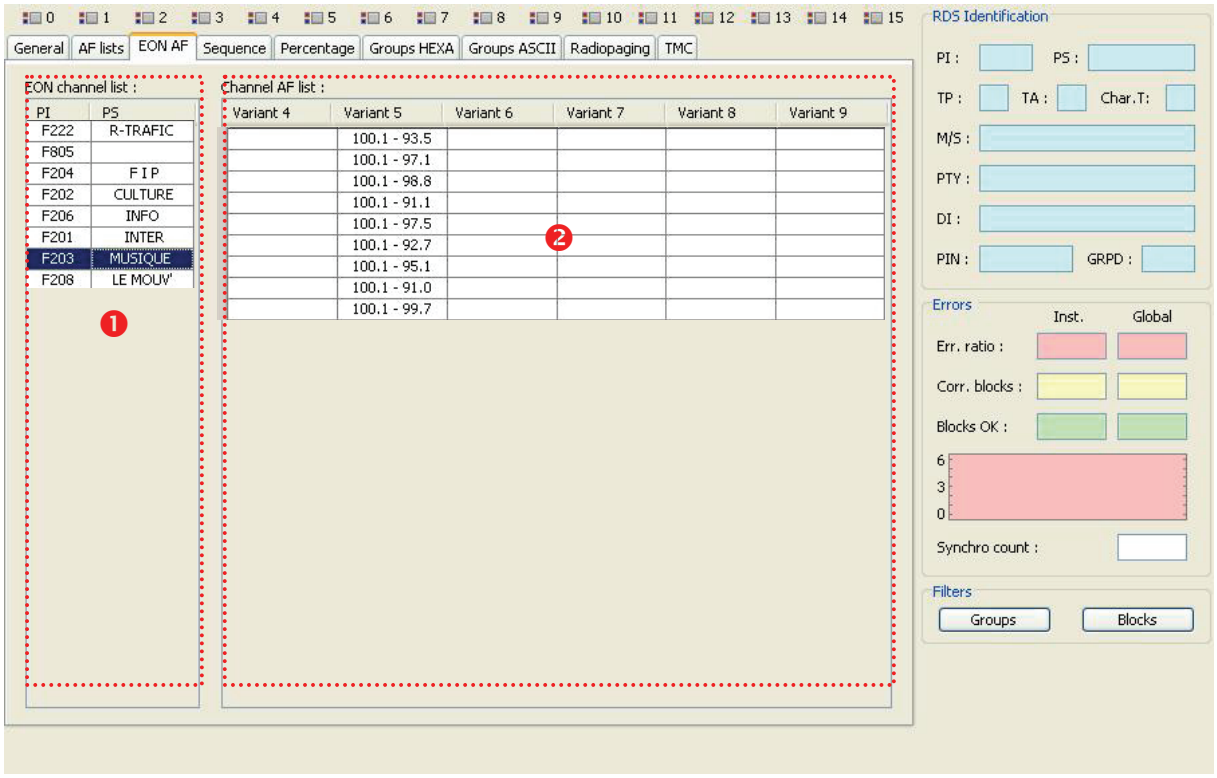
6.4.11.4 EON AF tab



❶ All EON network stations, received by the Navigator M.A.

❷ List of AFs sorted by Variant. The list displayed is the one associated with the station or program selected in ❶.

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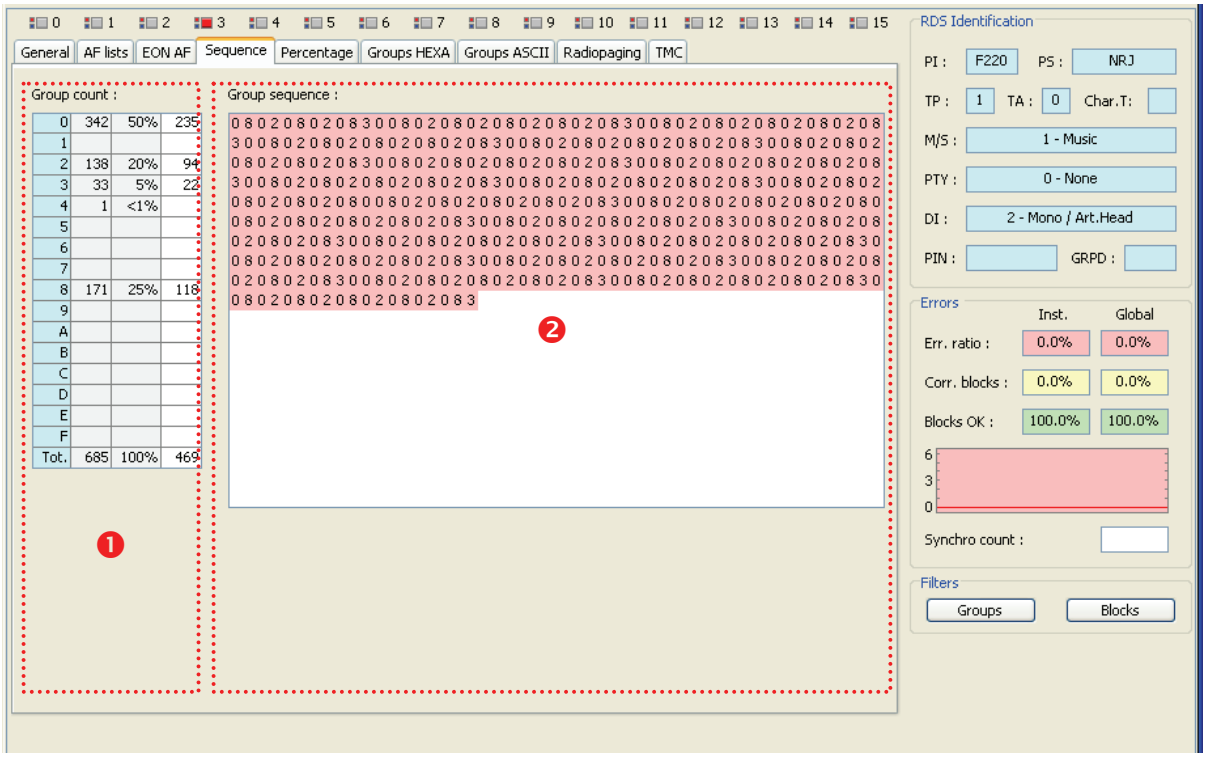
6.4.11.5 Sequence tab



0	342	50%	235
1			
2	138	20%	94
3	33	5%	22
4	1	<1%	
5			
6			
7			
8	171	25%	118
9			
A			
B			
C			
D			
E			
F			
Tot.	685	100%	469

❶ Statistics on the received RDS groups:

- Number of groups received over the last minute (or between two 4A groups if the RDS time and date are being transmitted).
- Percentage represented by each group (both A and B variants).
- Running total of group count.

❷ RDS groups received, displayed in order of reception:

- Red background: type A groups,
- Blue background: type B groups,
- Grey background: filtered groups.

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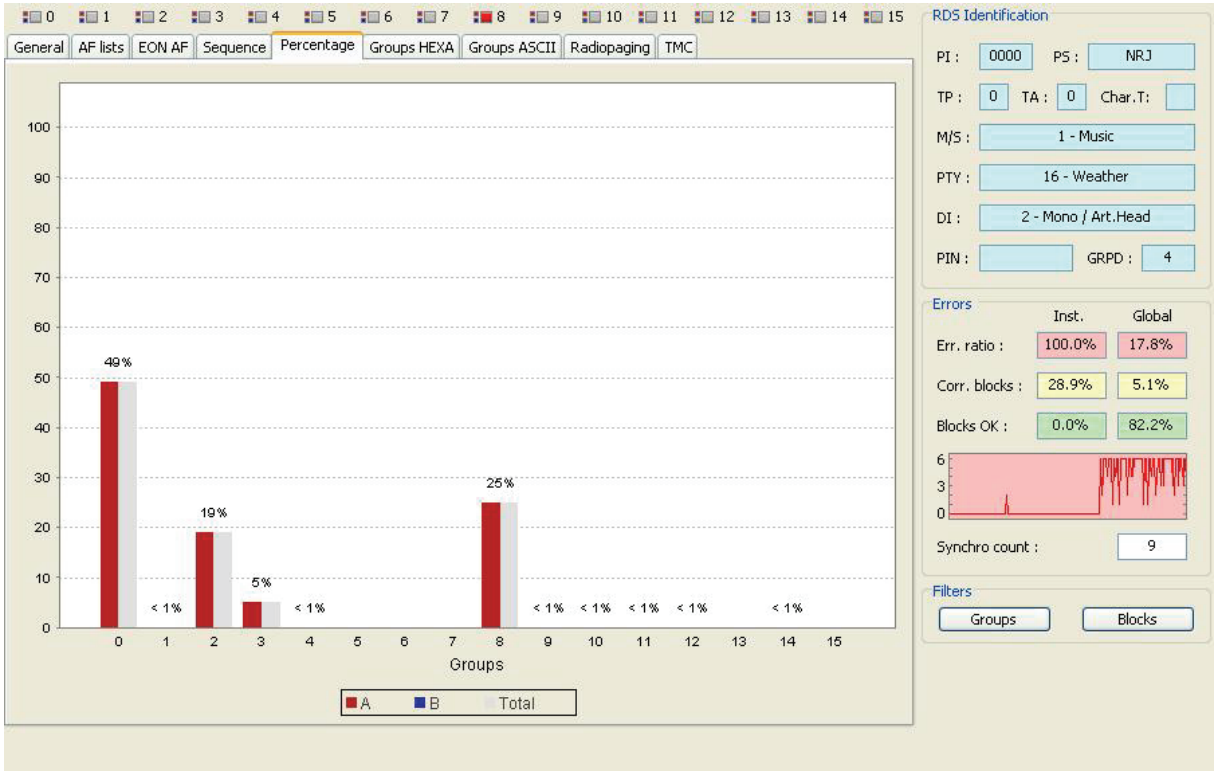
6.4.11.6 Percentage tab



Display of received RDS groups.

- The red bars on the graph represent the proportion of type A groups.
- The blue bars on the graph represent the proportion of type B groups.
- The grey bars on the graph part represent both A&B groups.

Putting the cursor over any grey bar will trigger a popup display of the group number and contents.

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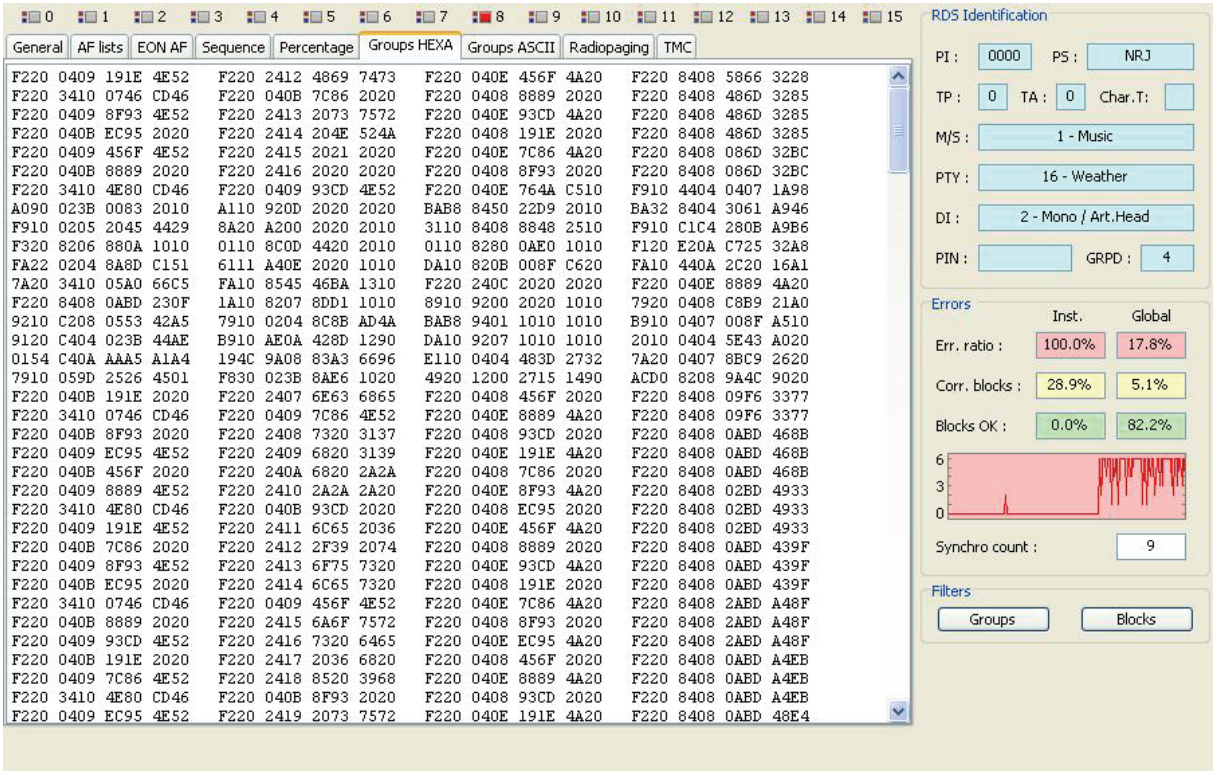
6.4.11.7 HEXA group tab



RDS data display in Hexadecimal form.
This display is dependant on the settings of the group and block filters.

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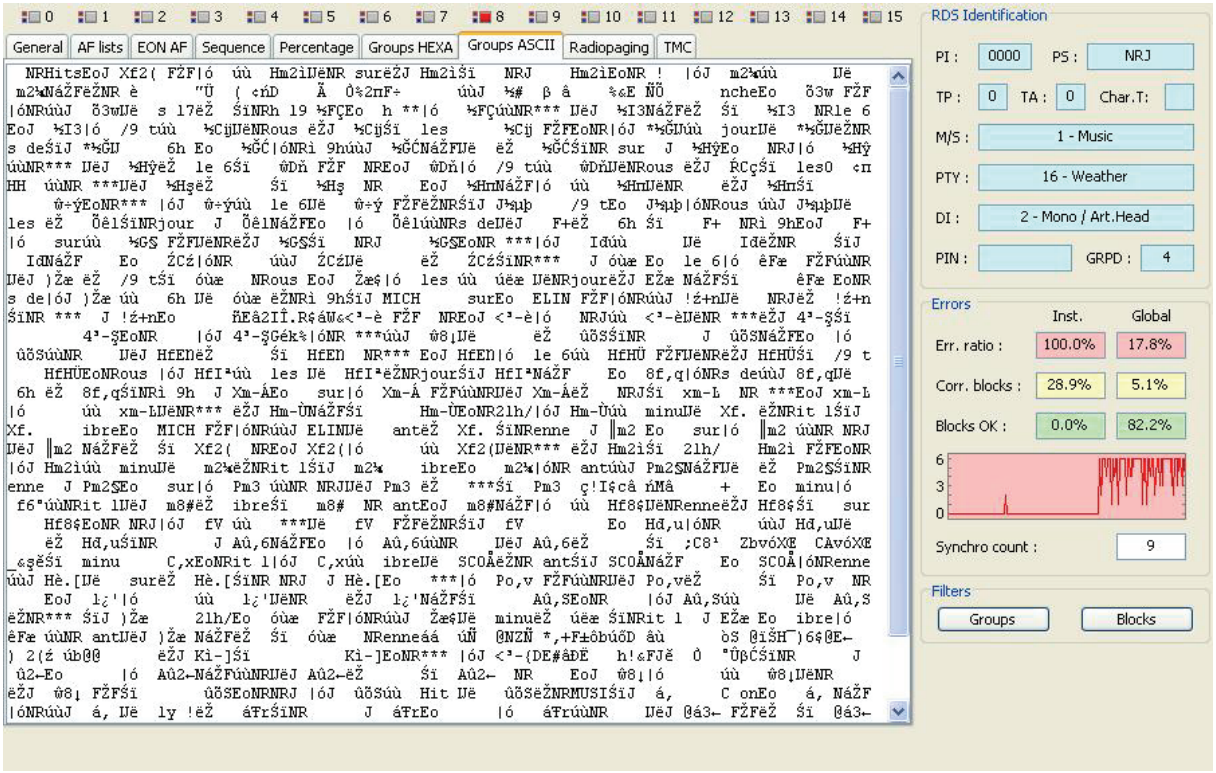
6.4.11.8 ASCII group tab



RDS data display in ASCII form.
This display is dependant on the settings of the group and block filters.

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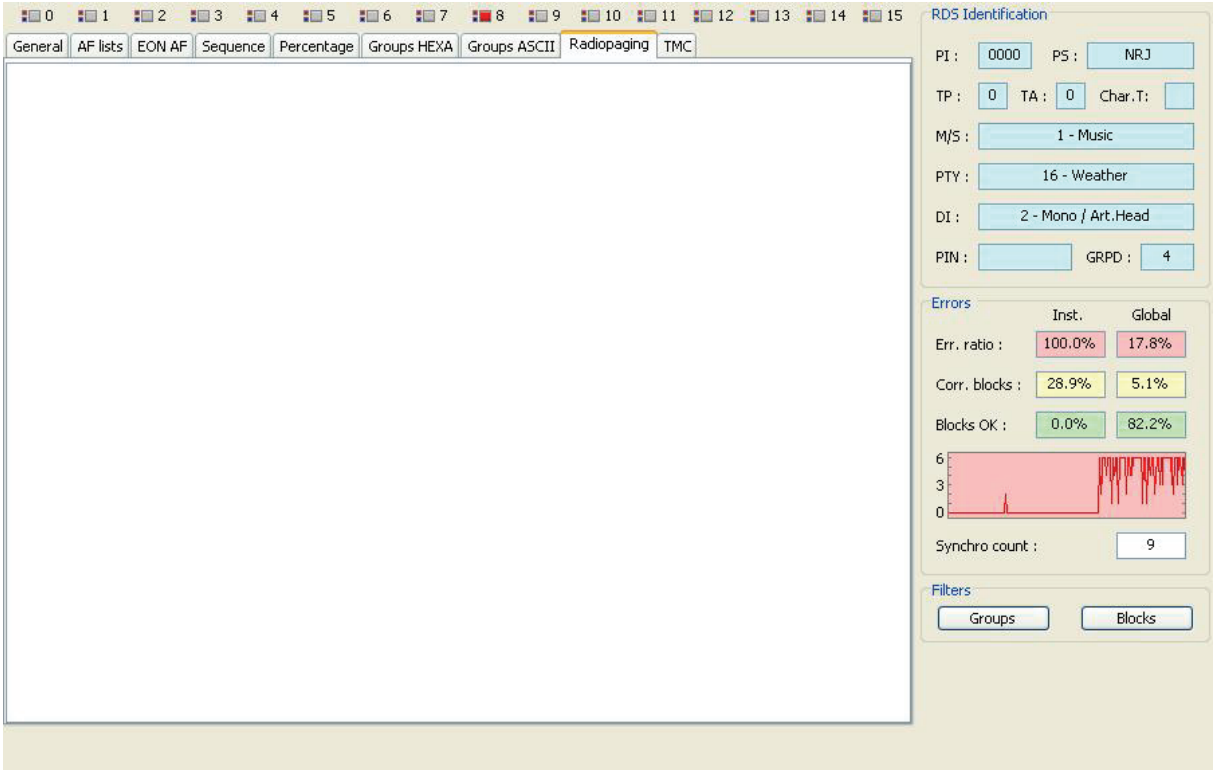
6.4.11.9 Radio paging tab



Radio Paging linked data display.

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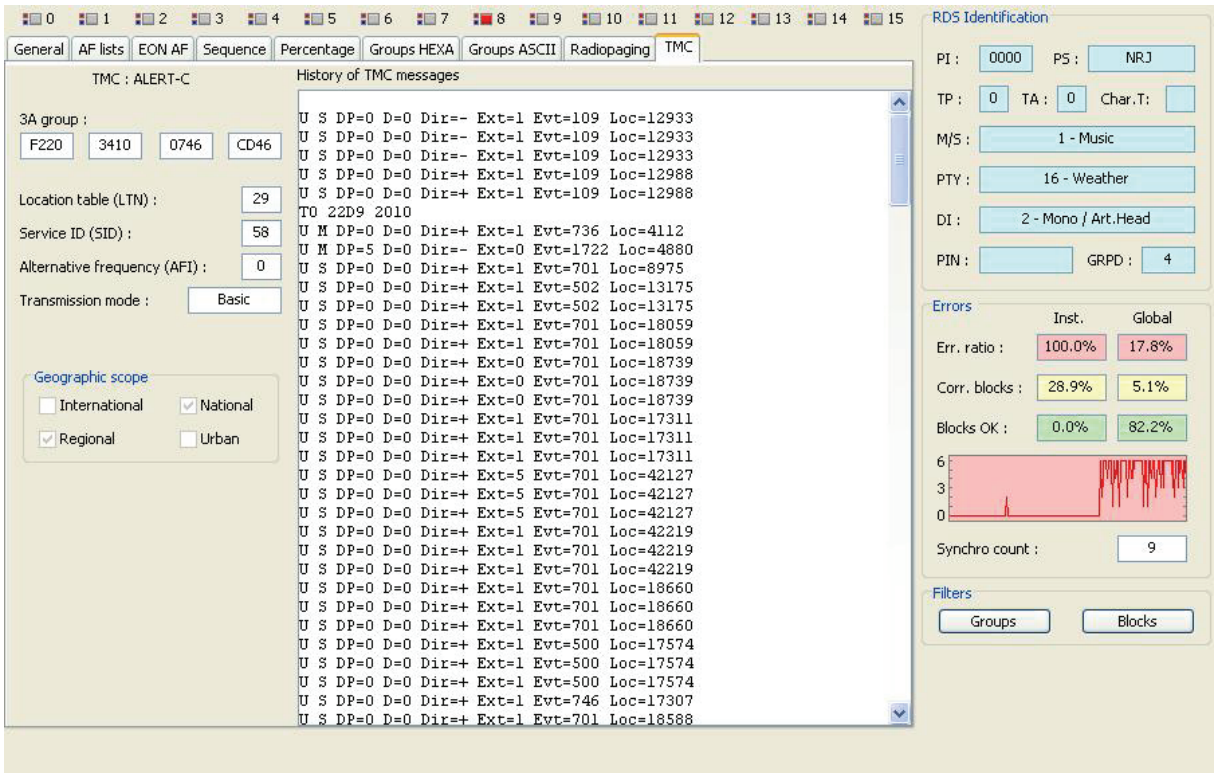
6.4.11.10 TMC tab



Traffic Message Channel (TMC) linked data display.

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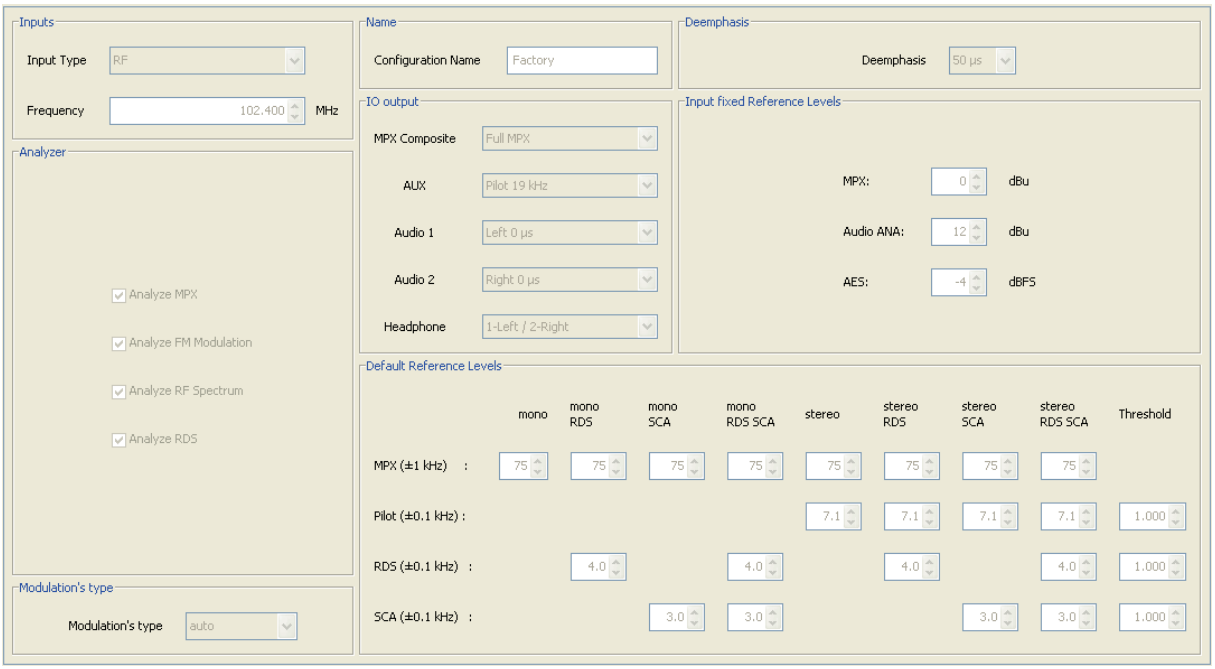
6.4.12. Summary tab

To access this tab, you may also go the "Measures" menu or use the "F10" shortcut.



When measurements are being carried out, it is not possible to access the equipment's configuration tab; measurements need to be stopped to modify configuration.

However, this page is a reminder of the equipment's current configuration. It groups all parameters and, therefore, enables input, output and reference level settings to be consulted without modifying them.

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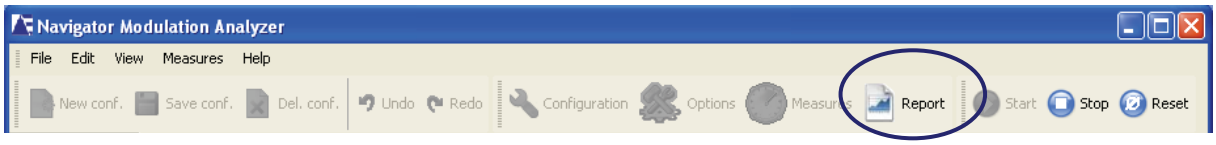
6.5. Reports button

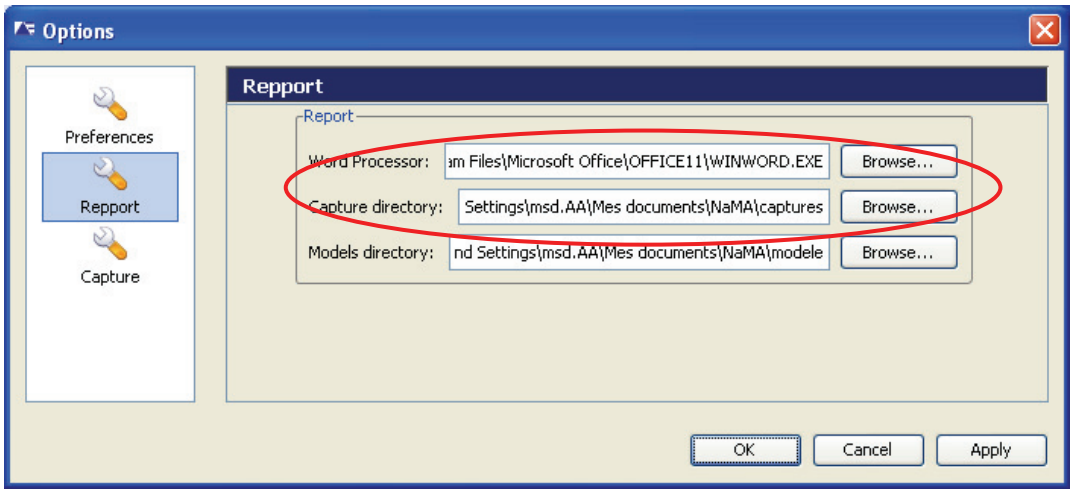


This button enables automatic measurement reports to be created from:

- RDS analysis
- Audio analysis
- Spectrum analysis
- MPX power analysis

The button is enabled only if data has been recorded since the beginning of the session.

Note: Make sure a word processor software and directory have been selected.



Several report models are supplied, automatically integrating values and graphs relative to a specific type of measurement. They have been created to be compatible with Microsoft Word 2003 (or more recent).

Note: Report Models can be found in the Navigator Modulation Analyzer installation directory. They can be modified so as to be compatible with other word processors. They can also be personalized

Note: Information regarding unit, environment, date, configuration, inputs, references and more, printed on pages 2 and 3 of standard reports, is required to guarantee report validity et must be included in all custom reports.

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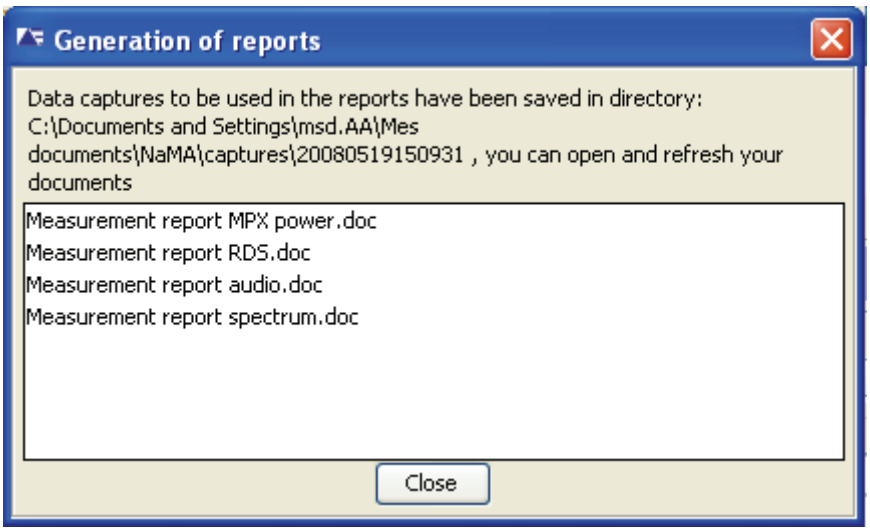
To generate a report, click on the "Report" button, the "File"→'Report' menu or the shortcut 'p'.



The word-processing software selected will then be launched to automatically merge the collected data with all 4 Navigator Modulation Analyzer models.

When generating the report, the application will freeze and all the tabs, graphs and minimal / maximal values will be archived in the selected directory. As for graphs with markers, these will also be saved. These values and images will be integrated thanks to the word-processing software mass mailing functions.

Click on one of the report button to open it.

Note: It may be necessary to modify the word processor security level so as to allow macro activation. In Microsoft Word, go to the menu « Tools »→'Macros'→ 'Security'→ Security level tab.

An alert message will indicate that an SQL command will be executed upon opening the document. Click "OK" to continue.
For graphics to appear in the report, in Word, go the menu "Tools"→"Macros"→"Macro" (or Alt + F8). Two macros can be used:

- 'refresh' to update links between the report file and the images, or
- 'incorporate' to place the images directly in the report.

All reports and associated screen captures are stored in the directory set in the options, in a sub-folder with a unique time stamp name: yyyymmddhhmmss.

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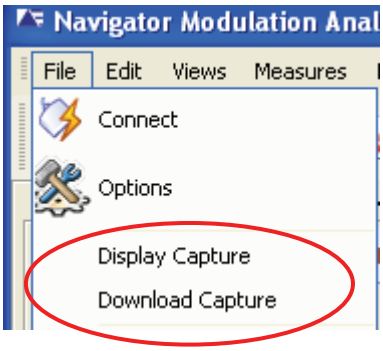
6.6. Managing captures

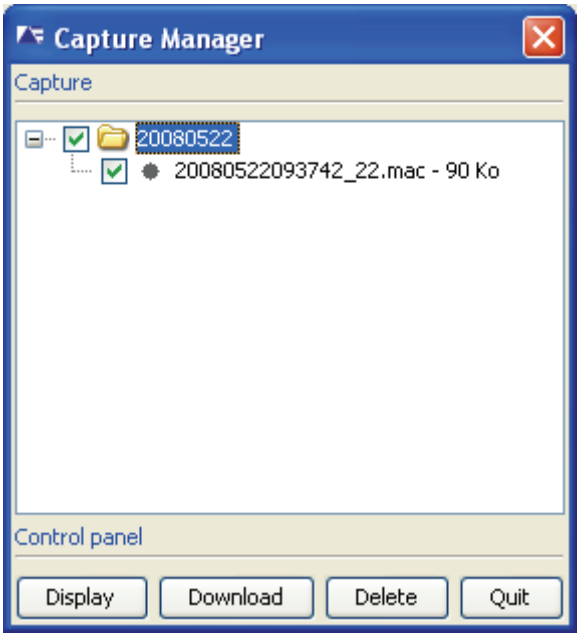
Captures can be done from the unit front panel application (see section 4.3.7). These captures can then be downloaded to the PC and viewed via the remote application so as to create automatic reports.

> **Note:** The following procedures may only be done if captures have already been taken from the front panel application. **Please make sure the capture is completed before downloading or the capture file may get corrupted** (wait for the 'RUN' LED to turn off, about 10 s).

Captures commands can be found in the "File" menu.



6.6.1. Download one or more captures



The list of available captures is displayed in a window in tree form. There is one folder per day (yyyymmdd).
Display details for a folder to see captures made that day. Names of capture files include date and time and the .mac extension.
Check the captures you wish to download. Check the folder if you want all captures for one day.
Click the Download button to retrieve the files from the unit to the PC, or the Display button to view the capture right away.

> **Note:** Captures are saved in the directory as set in the option window (see section 6.3.3).

6.6.2. Displaying a capture

Once a capture has been downloaded, the application can read it.
Simply select the .mac file from the "Open" window. Capture values are displayed. Proceed as with real time to generate reports.

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6.7. Option: Laboratory tools

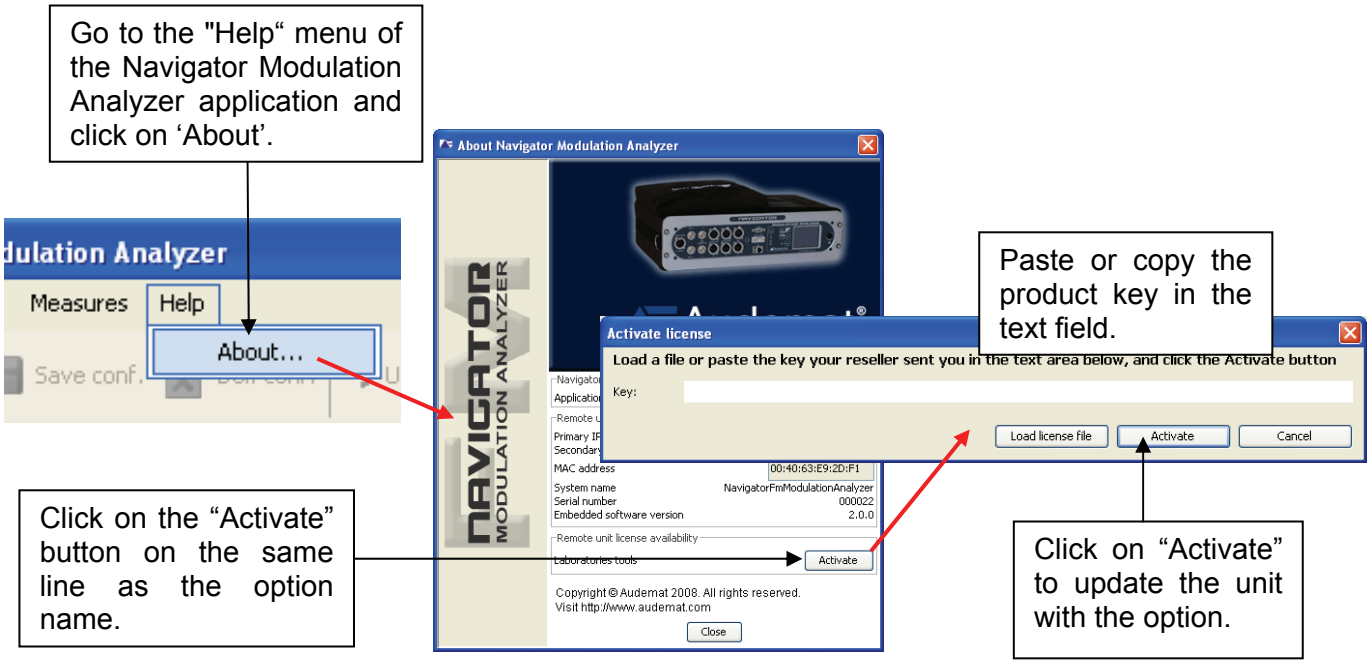
6.7.1. Laboratory tools features

Functionalities that are available only with the Laboratory tools options are:

- RF frequency meter,
- AF distortion meter,
- AF frequency meter,
- Pilot frequency meter,
- Test signal generator (pure sine wave),
- RDS frequency meter,
- Pilot/RDS synchronization/phase difference,
- Oscilloscope (0 – 200 kHz),
- Automation tools for remote access.

6.7.2. Activating the option

- Contact the sales department in order to obtain the software key to activate the option.
- Copy the product key from the Audemat CD that you receive.



- Close and restart the application
- Once an option has been activated, "Yes" appears on the option line.

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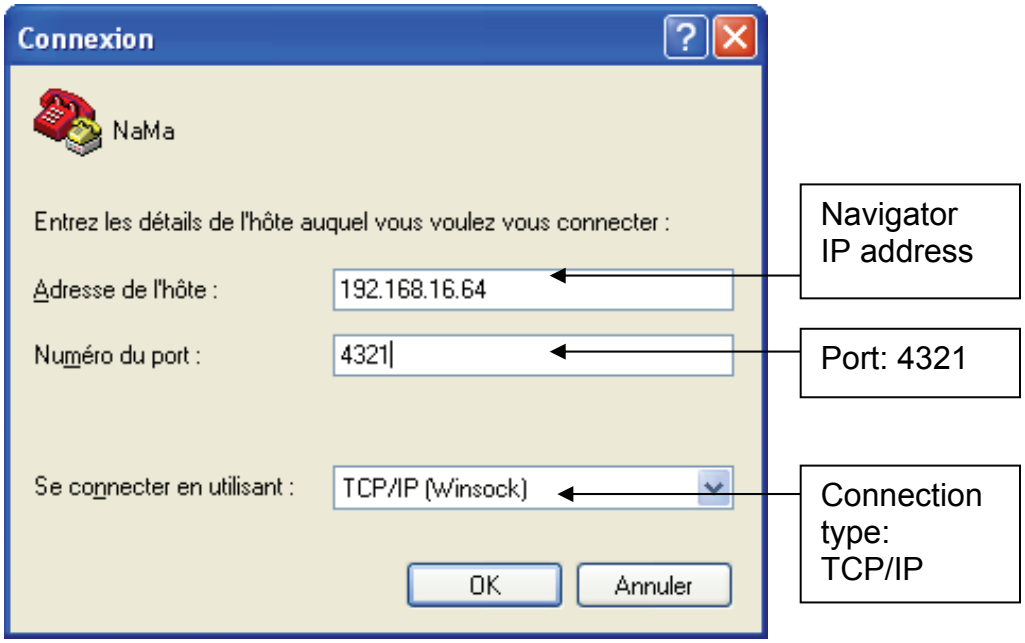
7. AUTOMATION TOOLS

Automation tools are only available with the Laboratory tools option.

Automation tools enable a remote access to the Navigator Modulation Analyzer via a Telnet connection, without using the java application.

7.1. Connection

- Open a Telnet application, such as HyperTerminal.
- Set connection parameters:



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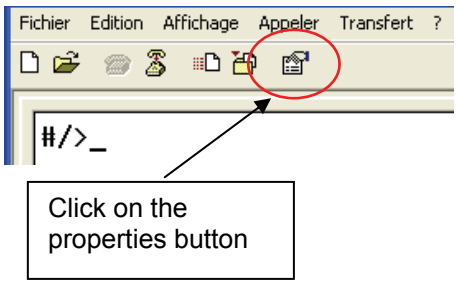
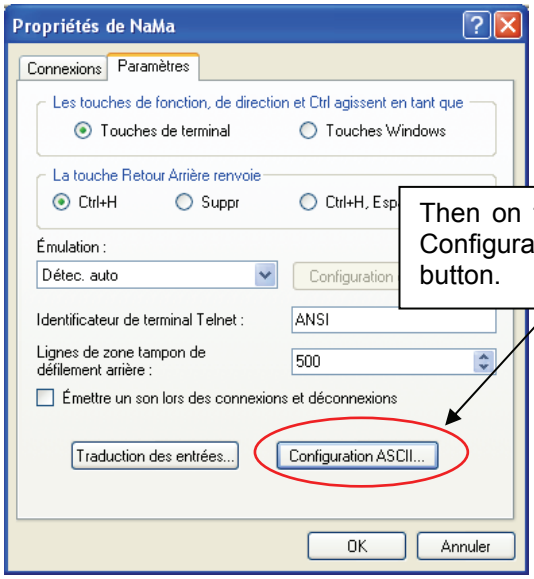
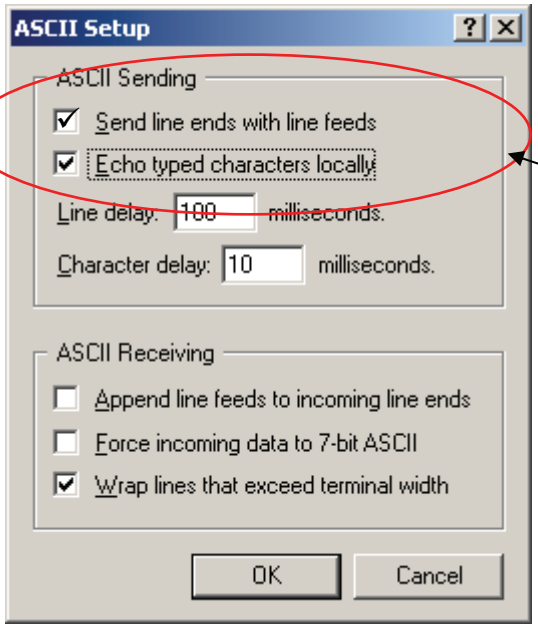
➢ It may be necessary to modify properties:



Click on the properties button



Then on the "ASCII Configuration" button.



Check both boxes for your commands to be readable.

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7.2. Using the automation tools

Now, simply write a command and press the "Enter" key.

> **Note:** The language is not case sensitive. Lower or upper case can be used.

With : `#/>list`

the complete list of commands is displayed.

`#/>?`

to obtain the list of commands, and get every possible argument.

For instance, the input type can be set:

```
INPUTTYPE:
0=RF   1=MPX    2=AES    3=ANA
```

To change it, type:

```
#/>INPUTTYPE=3
```

or `#/>INPUTTYPE=ANA`

for an analog input. To update the unit after a series of commands, always finish with:

`#/>UPDATE`

ten names are available for user created commands:

`USERCMDNAME0 , USERCMDNAME1 , … USERCMDNAME9`

They must be associated with:

`USERCMDLIST0 , USERCMDLIST1 , … USERCMDLIST9`

so as to define the commands.
Example:

```
#/>USERCMDNAME3=MACOMMANDE
#/>USERCMDLIST3=FREQ=96.8;SETDRL=STEREO;UPDATE
#/>MACOMMANDE
```

The command has been named, defined and executed. The response will be:

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```
OK
OK
OK
```

User commands can be deactivated:

```
#/>USERCMDLIST3=
```

7.3. A final note

Commands are recorded within the equipment; it is therefore possible to connect from a different machine and use previously set user commands..

It is possible to write a script to automate a series of frequently used commands:

- Each command must be typed on a new line.
- Copy the entire script in the Telnet application text window to be able to execute it.

Communication with the Navigator Modulation Analyzer is thus faster.

A list of available commands is available in Appendix A.

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APPENDIX A: AUTOMATION COMMAND LIST

A.1. Global commands

?	List of all commands - detailed mode
LIST	List of all commands
QUIT	Exit
UPDATE	Save all changes
USERCMDNAME<0-9>	Set or read user command name
USERCMDLIST<0-9>	Set or read user list of commands

CONFNUM	Select the configuration stored in the equipment	0-9 (if set in the application)

A.2. Set RF frequency

FREQ	Select RF frequency to tune	97.5-108.0 MHz

A.3. Set

DEEMPHASIS	select the de-emphasis value 0=50µs 1=75µs

A.4. Set Input/output matrix

INPUTTYPE	Select input measurement 0=RF 1=MPX 2=AES 3=ANA
TXOUTPUT1	Select output signal on TX1 (MPX Composite) 0=NONE 1=MPX 2=PILOT 3=RDS 4=SINE WAVE1 5=SINE WAVE2
TXOUTPUT2	Select output signal on TX2 (AUX) 0=NONE 1=MPX 2=PILOT 3=RDS 4=SINE WAVE1 5=SINE WAVE2
AUDIOOUTPUT1	Select output signal on Audio1 0=NONE 1=LEFT 2=RIGHT 3=M 4=S

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	5=LEFTD 6=RIGHTD 7=SINE WAVE1 8=SINE WAVE2
AUDIOOUTPUT2	Select output signal on Audio2 0=NONE 1=LEFT 2=RIGHT 3=M 4=S 5=LEFTD 6=RIGHTD 7=SINE WAVE1 8=SINE WAVE2
HEADOUTPUT	Select output signal on HeadPhone 0=LR 1=MS 2=MM 3=LRD 4=SINE WAVE1 5=SINE WAVE2

A.5. Set Generator

RMSDBRLEVEL	Set generator level	-50.00 – 6.00 dB
SIN0FREQ	Set sine wave1 frequency	10.00 – 90000.00 Hz
SIN1FREQ	Set sine wave2 frequency	10.00 – 90000.00 Hz

A.6. Reference levels

MPXREFLEVEL	Select MPX input/output level	-12 ; 12 dBu
AFREFLEVEL	Select Audio input/output level	-12 ; 12 dBu
AESREFLEVEL	Select AES input/output level	-25 ; 0 dBFS

SETDRL	Select modulation standard to use 0=MONO 1=MONO+R 2=MONO+S 3=MONO+R+S 4=STEREO 5=STEREO+R 6=STEREO+S 7=STEREO+R+S 8=AUTO
CURRENTDRL	Read current modulation standard (useful if in auto mode)

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A.7. Set references deviation for each modulation standard

A.7.1. Set MPX Level reference for each modulation standard

REFMONO_MPX	Mono mode	
REFMONORDS_MPX	Mono mode with RDS	
REFMONOAUX_MPX	Mono mode with AUX	
REFMONORDSAUX_MPX	Mono mode with RDS and AUX	
REFSTEREO_MPX	Stereo mode	
REFSTEREORDS_MPX	Stereo mode with RDS	
REFSTEREOAUX_MPX	Stereo mode with AUX	
REFSTEREORDSAUX_MPX	Stereo mode with RDS and AUX	

A.7.2. Set Pilot Level reference for each modulation standard

REFSTEREO_PILOT	Stereo mode *	
REFSTEREORDS_PILOT	Stereo mode with RDS *	
REFSTEREOAUX_PILOT	Stereo mode with AUX *	
REFSTEREORDSAUX_PILOT	Stereo mode with RDS and AUX *	

** Multiply by 10 the value you wish to set. Example: enter 68 for 6.8*

A.7.3. Set RDS Level reference for each modulation standard

REFMONORDS_RDS	Mono mode with RDS *	
REFMONORDSAUX_RDS	Mono mode with RDS and AUX *	
REFSTEREORDS_RDS	Stereo modewith RDS *	
REFSTEREORDSAUX_RDS	Stereo modewith RDS and AUX *	

** Multiply by 10 the value you wish to set. Example: enter 68 for 6.8*

A.7.4. Set AUX Level reference for each modulation standard

REFMONOAUX_AUX	Mono mode with AUX *	
REFMONORDSAUX_AUX	Mono mode with RDS and AUX *	
REFSTEREOAUX_AUX	Stereo modewith AUX *	
REFSTEREORDSAUX_AUX	Stereo modewith RDS and AUX *	

** Multiply by 10 the value you wish to set. Example: enter 68 for 6.8*

A.8. Get versions

VERSION_DSP1	Show DSP1 software version
VERSION_DSP2	Show DSP2 software version
VERSION_SOFT	Show embedded software version
VERSION_HARD	Show hardware version
SERIALNUMBER	Show equipment serial number

A.9. Get Levels

RFPOWER	Read current RF power measurement
RFFREQ	Read current RF frequency measured (in the channel)
PILOTFREQ	Read current PILOT frequency
RDSFREQ	Read current RDS frequency
MPXPOWER	Read current MPX power
MPXMAX	Read MPX power max
RESETMPX=1	Reset MPX measurement

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Following commands can be entered with one optional parameter:

<command> [=0] : value read in dBr (dependant on you reference settings)
[=1] : value read in kHz
[=2] : value read in % (dependant on you reference settings)

* default value is equivalent to =0.

DEVMIN	Read minimum deviation
DEVMAX	Read maximum deviation
DEV	Read current deviation
DEVRMS	Read MPX RMS deviation
RDSMIN	Read RDS minimum deviation
RDSMAX	Read RDS maximum deviation
RDS	Read RDS current deviation
RDSRMS	Read RDS RMS current deviation
PILOTMIN	Read Pilot minimum deviation
PILOTMAX	Read Pilot maximum deviation
PILOT	Read RDS current deviation
SCAMIN	Read SCA minimum deviation
SCAMAX	Read SCA maximum deviation
SCA	Read RDS current deviation
LPRMIN	Read L+R minimum deviation
LPRMAX	Read L+R maximum deviation
LPR	Read L+R current deviation
LPRRMS	Read L+R RMS deviation
LMRMIN	Read L-R minimum deviation
LMRMAX	Read L-R maximum deviation
LMR	Read L-R current deviation
LMRRMS	Read L-R RMS deviation
LEFTMIN	Read L minimum deviation
LEFTMAX	Read L maximum deviation
LEFT	Read L current deviation
LEFTRMS	Read L RMS deviation
RIGHTMIN	Read R minimum deviation
RIGHTMAX	Read R maximum deviation
RIGHT	Read R current deviation
RIGHTRMS	Read R RMS deviation
MONOMIN	Read M signal minimum deviation
MONOMAX	Read M signal maximum deviation
MONO	Read M signal current deviation
MONORMS	Read M signal RMS deviation
STEREOMIN	Read S signal minimum deviation
STEREOMAX	Read S signal maximum deviation
STEREO	Read S signal current deviation
STEREORMS	Read S RMS deviation
LPRMIND	Read L+R minimum with de-emphasis
LPRMAXD	Read L+R maximum with de-emphasis
LPRD	Read L+R current with de-emphasis
LPRRMSD	Read L+R RMS deviation with de-emphasis

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LMRMIND	Read L-R minimum with de-emphasis
LMRMAXD	Read L-R maximum with de-emphasis
LMRD	Read L-R current with de-emphasis
LMRRMSD	Read L-R RMS deviation with de-emphasis
LEFTMIND	Read L minimum with de-emphasis
LEFTMAXD	Read L maximum with de-emphasis
LEFTD	Read L current with de-emphasis
LEFTRMSD	Read L RMS deviation with de-emphasis
RIGHTMIND	Read R minimum with de-emphasis
RIGHTMAXD	Read R maximum with de-emphasis
RIGHTD	Read R current with de-emphasis
RIGHTRMSD	Read R RMS deviation with de-emphasis
LEFTQPW	Read L Quasi Peak CCIR Weighted deviation
RIGHTQPW	Read R Quasi Peak CCIR Weighted deviation
LPRQPW	Read L+R Quasi Peak CCIR Weighted deviation
LMRQPW	Read L-R Quasi Peak CCIR Weighted deviation
LEFTRMSUW	Read L RMS CCIR Unweighted deviation
RIGHTRMSUW	Read R RMS CCIR Unweighted deviation
LPRRMSUW	Read L+R RMS CCIR Unweighted deviation
LMRRMSUW	Read L-R RMS CCIR Unweighted deviation
THDFREQLEFT	Read L THD frequency
THDFREQRIGHT	Read R THD frequency
THDLEFT	Read THD L
THDRIGHT	Read THD R
THDNLEFT	Read THD+N L
THDNRIGHT	Read THD+N R
THDHARMOLEFT	Read harmonic level on L channel (0=1st harmonic to 3=4th harmonic)
THDHARMORIGHT	Read harmonic level on D channel (0=1st harmonic to 3=4th harmonic)
RDSPHASE	Read RDS-pilot phase difference

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APPENDIX B: KEYBOARD SHORTCUTS

Some commands available from menus or buttons can also be executed using the keyboard:

Start measurements	→	s
Stop measurements	→	h
Reset measurements	→	r
Generate reports	→	p
MPX tab	→	F1
Audio tab	→	F2
SubCarrier tab	→	F3
Modulation tab	→	F4
Spectrum tab	→	F5
Oscilloscope tab	→	F6
Thd tab	→	F7
AM noise tab	→	F8
Automation tab	→	F9
Filters tab	→	F10
RDS tab	→	F11
Summary tab	→	F12

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APPENDIX C: GLOSSARY

C.1. RDS

AF — **Alternative Frequency**: transmitter frequencies from an encoded station in digital list form. Two transmission methods are possible: method A (a single list of 25 frequencies) or method B (list of frequency pairs)

Code Table or **Character Table** — Alphanumeric character table used with radiotext, radio paging and PTYN. Three tables are defined by the RDS standards.

DI — **Decoder Identification**: a digital function which enables an RDS receiver's audio level to be adjusted according to the type of received audio (mono, stereo ...).

EON — **Enhanced Other Network**: a digital function which enables an RDS station to broadcast RDS parameters to other stations. The following EON codes are used nowadays:

- EON-PI: broadcasting PI identity from another station.
- EON-PS: broadcasting the name from another station.
- EON-TP: if the flag is at 1, it indicates that the other station is likely to broadcast traffic information.
- EON-TA: switches RDS receivers onto the local frequency of the other station when it broadcasts traffic information.
- EON-AF: broadcasts the list of alternate network frequencies from the other station.
- EON-PIN: broadcasts the time and day of the other station's program.
- EON-PTY: broadcasts the other station's program types.

EWS — **Emergency Warning System**: an emergency transmission system for alerting the population should there be any exceptional events, jeopardizing security (storms, a cyclone, earthquake, serious industrial accidents ...). This means of alert used exclusively by Civil Security organizations is developed primarily in geographical areas of high risk (overseas, seismic regions).

GRPD — See TNGD.

IH — **InHouse**
Transmission of data reserved for broadcasters' internal needs (urban remote display, remote monitoring, various controlling...).

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M/S **Music/Speech**: a digital flag which automatically modifies an RDS receiver's audio volume level according to the broadcast program (logical state 1 = musical program, logical state 0 = spoken program).

ODA **Open Data Application**: a system transmitting any data whose format is free and for which a normalizing procedure is not necessary.

PI **Program Identification**: a code identifying the received station

PIN **Program Item Number**: a digital code indicating the time and day of broadcast programs.

PS **Program Service name**: a station name of 8 characters

PTY **Program TYpe**: a function for identifying types of programs broadcast by an RDS station.

PTYN **Program TYpe Name**: a supplement to program type (PTY), specifying its nature using an 8 character alphanumeric string.

RP **Radio Paging**: software configuration to broadcast digital data. The transmission protocol is identified with some 1A group bits.

RT **Radio Text**: a function which enables text messages to be broadcast in groups of 64 characters. The RDS receiver must be equipped with a specific display. The RT function cannot be used on car radios as road safety commissions have forbidden its use on board a vehicle. Only home RDS receivers can have the advantage of this radio text system.

TA **Traffic Announcement**: a digital flag which instantaneously switches an RDS receiver onto road information reports. At the end of the report, the receiver will automatically go back to its former operating state.

TDC **Transparent Data Channel**: a transmission path which enables the broadcaster to broadcast diverse types of digital data for specific services. This function is not intended for FM network listeners.

TMC **Traffic Message Channel**: a road information system in real time, used by navigation terminals, such as Garmin, embedded in vehicles. Messages are broadcast in "localization code" and "event code" form conforming to EN12313-1 to 12313-5 CEN (European Standards Committee) standards.

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TNGD	**Transmitter Network Group Designation**: definition of the group number and range associated to a transmitter sending paging calls.
TP	**Traffic Program**: a digital flag showing RDS receivers that the allocated station is likely to broadcast road information. The TP code does not ensure receiver switching during road announcements; it simply lets the listener know if the station offers this type of information.
UTC	**Universal Time Clock**: digital source regularly transmitting UTC (universal time) and Julian date with time zone differential

C.2. Detector filters

de-emphasis	De-emphasis filter applied when audio signals are received (50 μs or 75 μs depending on the country).
P-P/2	Value (peak+max) - (peak -max)/2
RMS	Root – Mean –Square value, a widely used form of averaging various signals.
unweighted	Unweighted filter conforming to the CCIR 468-4 norm.
weighted	Weighted filter conform to the CCIR 468-4 norm.

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APPENDIX D: FOR FURTHER INFORMATION

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TEST AND MEASUREMENT EQUIPMENT

TECHNICAL SPECIFICATIONS

Date: 2008/08/27

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1. MEASUREMENT SPECIFICATIONS ON THE RF INPUT

Optimal specifications are guaranteed for a ambient temperature range from +20°C to +30°C (68°F to 86°F), with a warm-up time of: 15 minutes

1.1. RF

	Min.	*Typ.*	*Max.*	*Unit*
Frequency range (Tuning: manual)	87,5		108	MHz
Input impedance (BNC connector)		50		Ω
Frequency measurement: • RF level range: -25 dBm to +10 dBm.		± 70	± 100	Hz
Frequency resolution			1	Hz
Power measurement • -40 dBm to+10 dBm • -50 dBm to-40 dBm		± 0.2 ± 0.8	± 0.4 ± 0.5	dB
RF level for best precision on demodulated signals	-25/+10	-30/+15		dBm

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1.2. Demodulated signals

1.2.1. MPX

	Min.	Typ.	Max.	Unit
Frequency range	0.01		90	kHz
Measurable deviation			±150	kHz
Absolute deviation measurement precision (F_{af}=1kHz) • Deviation between±500 Hz and ±2 kHz • Deviation between± 2 kHz and ±80 kHz • Deviation between± 80 kHz and ±150 kHz		 ± 0.5 ± 0.2 ± 0.5	 ± 1.0 ± 0.5 ± 1.0	%

1.2.2. Pilot

	Min.	Typ.	Max.	Unit
Bandpass filter frequency		19		kHz
Rejection • 15 kHz • 23 kHz		 >70		dB
Measurable deviation			± 15.0	KHz
Absolute pilot deviation measurement precision • Measurement range: 0.1 to ±15 kHz		± 0.8	± 1.0	%
Pilot frequency resolution			0.1	Hz
Pilot Frequency measurement precision • Measurement range: 1 to ±15 kHz		± 0.3	± 0.5	Hz

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1.2.3. RDS

	Min.	Typ.	Max.	Unit
Bandpass filter bandwidth (-3dB)	54.3		59.7	kHz
Rejection (compared to F_0) • 53 kHz • 61 kHz		 >70		dB
Ripple within the band from 55 kHz to 59 kHz		<0,3		dB
Measurable deviation			± 10.0	KHz
Absolute RDS deviation measurement precision - Sine wave • Deviation between±1 kHz and ±2 kHz • Deviation between±2 kHz and ±10 kHz		 ± 1.2 ± 0.5	 ± 1.5 ± 0.8	%
Absolute RDS deviation measurement precision - Data • Deviation between±1 kHz and ±2 kHz • Deviation between±2 kHz and ±10 kHz		 ± 0.8 ± 0.6	 ± 1.2 ± 1.0	%

1.2.4. DARC (76 kHz)

	Min.	Typ.	Max.	Unit
Bandpass filter bandwidth (-3dB)	62,4		89,6	kHz
Rejection (compared to F_0) • 60 kHz • 93 kHz		 >50		dB
Ripple within the band from 64 kHz to 88 kHz		<0,4		dB
Measurable deviation			± 15.0	KHz
76 kHz deviation measurement precision– Sine wave • Deviation between±1 kHz and ±2 kHz • Deviation between±2 kHz and ±15 kHz		± 2.0 ± 1.2	± 3.0 ± 1.5	%
76 kHz deviation measurement precision – Data • Deviation between±1 kHz and ±2 kHz • Deviation between±2 kHz and ±15 kHz		± 3.0 ± 1.3	± 3.5 ± 1.6	%

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1.2.5. Power measurement for the MPX channel

	Min.	Typ.	Max.	Unit
Frequency range	0.01		90	kHz
Max error • With sine wave signal @ 1 kHz for -10 dBr < P < 9dB • With random signal @ 1 kHz for -10 dBr < P < 9dB		±0,08 ±0,30	±0,10 ±0,50	dB

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1.3. Outputs

1.3.1. Composite MPX /AUX output

	Possible output signals
A	No signal
B	MPX base band
C	Pilot signal
D	RDS subcarrier signal
E	Sine wave 1 generator signal
F	Sine wave 2 generator signal

Connector	BNC
Type	unbalanced – chassis ground

	Min.	*Typ.*	*Max.*	*Unit*
Frequency range	0.01		90	kHz
Max error @ +12 dBvcc @ 1 kHz		±0,3	±0,5	dB
MPX signal response curve (reference 1 kHz @ ±75 kHz deviation) • 10 Hz with 53 kHz @ 12 dBvcc • 53 kHz with 90 kHz @ 12 dBvcc		 ±0,1 +0/-0,2	 ±0,15 +0/-0,3	 dB
Stereo separation (Reference L=R @ ±75 kHz of deviation, without filter, without de-emphasis , RMS detection) : • F_{mod} = 1 kHz • 20 Hz < F_{mod} < 15 kHz		 >67 >52	 >65 >50	 dB

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1.3.2. AES output

	Signals that can be assigned to channel 1 and 2
A	No signal
B	L channel signal without de-emphasis
C	R channel signal without de-emphasis
D	M channel signal
E	S channel signal
F	L channel signal with de-emphasis
G	R channel signal with de-emphasis
H	Sine wave 1 generator signal
I	Sine wave 2 generator signal

Connector	XLR 3 male
Type	Balanced

	Min.	*Typ.*	*Max.*	*Unit*
Frequency range	0.01		15	kHz
Max error for the output level @ +12 dBu @ 1 kHz		±0,2	±0,3	dB
Max variation between L and R channels		<±0,07	<±0,1	dB
Response curve @ +12 dBu • 10 Hz – 15 kHz		±0,10	±0,20	dB
Distortion (THD + N). Reference L=R @ ±75 kHz deviation, without filter, without de-emphasis: • within the band 10 Hz – 2 kHz • within the band 2 kHz – 15 kHz		 <0,09 <0,06	 <0,1 <0,07	%
Signal/Noise (reference 0 dBFS with F_{mod} = 500 Hz @ ±75 kHz deviation, de-emphasis = 50 µs / Level RF = 0 dBm) : • Mono signal, RMS, without filter • Mono signal, weighted CCIR quasi-peak • Stereo signal, RMS, without filter • Stereo signal, weighted CCIR quasi-peak		 > 95 > 88 > 92 > 83	 > 93 > 85 > 90 > 80	dB
Stereo separation (L/ R & R/L), Reference L=R @ ±75 kHz deviation, without filter, without de-emphasis , RMS detection • 20 Hz < F_{mod} < 15 kHz		>63	>60	dB

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1.3.3. L and R analog outputs

	Signals that can be assigned to channel 1 and 2
A	No signal
B	L channel signal without de-emphasis
C	R channel signal without de-emphasis
D	M channel signal
E	S channel signal
F	L channel signal with de-emphasis
G	R channel signal with de-emphasis
H	Sine wave 1 generator signal
I	Sine wave 2 generator signal

Connector	XLR 3 male
Type	Balanced

	Min.	***Typ.***	***Max.***	***Unit***
Frequency range	0.01		15	kHz
Max error for the output level @ +12 dBu @ 1 kHz		±0,2	±0,3	dB
Max variation between L and R channels		<±0,07	<±0,1	dB
Response curve @ +12 dBu • 10 Hz – 15 kHz		±0,10	±0,20	dB
Distortion (THD + N). Reference L=R @ ±75 kHz deviation, without filter, without de-emphasis: • within the band 10 Hz – 2 kHz • within the band 2 kHz – 15 kHz		 <0,09 <0,06	 <0,1 <0,07	%
Signal/Noise (reference 0 dBFS with F_{mod} = 500 Hz @ ±75 kHz deviation, de-emphasis = 50 µs / Level RF = 0 dBm) : • Mono signal, RMS, without filter • Mono signal, weighted CCIR quasi-peak • Stereo signal, RMS, without filter • Stereo signal, weighted CCIR quasi-peak		 > 89 > 80 > 88 > 78	 > 86 > 77 > 85 > 75	dB
Stereo separation (L/ R & R/L), Reference L=R @ ±75 kHz deviation, without filter, without de-emphasis , RMS detection • 20 Hz < F_{mod} < 15 kHz		 >63	 >60	dB

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1.3.4. Headphone outputs

Output signal: dependant on equipment settings:

	Channel 1	Channel 2
A	L channel signal without de-emphasis	R channel signal without de-emphasis
B	M channel signal	S channel signal
C	M channel signal	M channel signal
D	L channel signal with de-emphasis	R channel signal with de-emphasis
E	Sine wave 1 generator signal	Sine wave 1 generator signal
F	Sine wave 2 generator signal	Sine wave 2 generator signal

Connector	Jack 6.35mm (1/4”) female
Type	Unbalanced, floating ground
Output level	Adjustable by the user on the front panel

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1.4. Multiplex decoder / AF stereo signals specifications

	Min.	Typ.	Max.	Unit
Frequency range	0.01		15	kHz
Max error with a mono or stereo L=R or stereo L=-R signal @ 1 kHz		>50		dB
Max error with a mono or stereo L=R or stereo L=-R signal • 1 kHz @ 0 dBu • 10 Hz – 15 kHz @ 0 dBu		 ±0,05 ±0,1	 ±0,03 +0,08/ -0,05	dB
Variation between L and R channels		<±0,02	<±0,03	dB

1.5. Distortion tool

Measurement types	THD, THD+N
Harmonics displayed	F2, F3, F4, F5

	Min.	Typ.	Max.	Unit
Frequency range	0.01		15	kHz
Measurement range	0,01		100	%
Max signal deviation for an internal distortion rate < 0,5 %		±180		kHz
Residual THD in the equipment from 10 Hz – 15 kHz @ ±75 kHz of deviation		<0,005		%
Frequency resolution		0,1		Hz

1.6. L&R channel noise measurements

	Min.	Typ.	Max.	Unit
Frequency range	0.01		15	kHz
Measurement range	-80		+6	dBu
Equipment residual noise rate (reference 0 dBFS with F_{mod} = 500 Hz @ ±75 kHz of deviation, de-emphasis = 50 µs / RF level = 0 dBm) : • Mono signal, RMS, without filter • Mono signal, weighted CCIR quasi-peak • Stereo signal, RMS, without filter • Stereo signal, weighted CCIR quasi-peak		 > 95 > 88 > 92 > 83	 > 93 > 85 > 90 > 80	dB

1.7. De-emphasis filters

Type	0 µs, 50 µs, 75 µs

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2. INTERNAL GENERATOR SPECIFICATIONS

	Min.	*Typ.*	*Max.*	*Unit*
Frequency range	0.01		90[1]	kHz
Frequency step		0.1		Hz

[1] 90k in the case of composite and AUX MPX outputs; 24kHz in the case of audio outputs

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