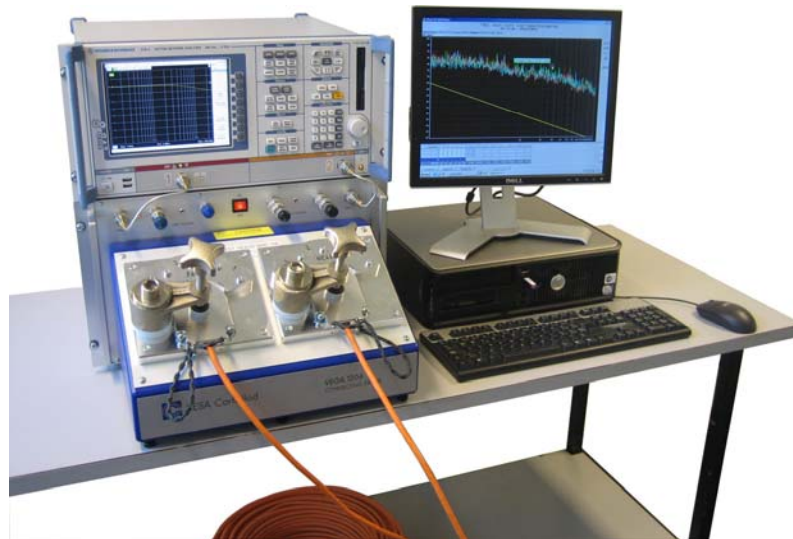


## Automatic measuring system for LAN cables

ISO17025

REGISTERED



Indicative picture

### Performances and key features

Perform all tests on cable responding to:

- ANSI/TIA/EIA-568-B.2-10 for Category 6A cables
- ISO/IEC 11801, IEC 61156-6 for Category 7 and Category 7A cables
- IEC 61156-7 for cables up to 1.2 GHz

- The fastest measuring system on the market
- No movable parts requiring mechanical adjustments or periodical maintenance
- Exclusive High-Tech HF switching using MIL standardized relays with MTBF >10'000'000

Test time

**4 attenuation, phase and impedance measurements, 6 NEXT and 6 FEXT combinations measured in 45 seconds!!** (Network analyzer E50xx. Settings: IF bandwidth 3 kHz, 401 points per sweep)

### Delivery details

- 4 pairs connecting frame for LF/HF measurements up to 1500 MHz.
- One computer system DELL Pentium IV 3GHz with 1024MB RAM, 80GB EIDE hard disk, floppy disk drive, CD-writer, GPIB board, DIO board, 17" color monitor and HP LaserJet P2035 printer
- Operating system Windows XP Professional
- One AESA measurement and result management software Optitest (1 license)
- Power supplies, interfaces, connecting cables and measurement accessories
- UPS unit 600W

Article number:

00.1504.0001.0

Remark

This price does not include the network analyzer. AESA can integrate an analyzer provided by the customer. Otherwise, please check later in this document the possibilities proposed by AESA.



**System advantages**

- Checked against certified ISO 17025 standards
- High accuracy
- Fast measurements
- Easy to operate
- State of the art software package
- Designed to measure UTP, FTP and ISTEP cables
- Highly modular to fit any requirement
- Can be upgraded with many options such as:
  - LF measurements
  - ISO 17025 certified HF calibration standards
  - ISO 17025 certified LF calibration standards
  - Technical software licenses

**System specifications**

Attenuation (corrected at 20°C)

Accuracy	772 kHz - 10 MHz	10 MHz – 100 MHz	100 MHz - 200 MHz	200 MHz - 400 MHz	400 MHz - 750 MHz	750 MHz - 1.5 GHz
-50 to -80 dB	± 1.3 dB	± 1.5 dB	± 1.7 dB	± 1.9 dB	± 3 dB	± 4 dB
-25 to -50 dB	± 0.5 dB	± 0.5 dB	± 0.6 dB	± 0.7 dB	± 0.9 dB	± 1.5 dB
-10 to -25 dB	± 0.2 dB	± 0.2 dB	± 0.3 dB	± 0.4 dB	± 0.8 dB	± 1.3 dB
0 to -10 dB	± 0.2 dB	± 0.2 dB	± 0.2 dB	± 0.4 dB	± 0.8 dB	± 1.3 dB

Near-End Crosstalk NEXT & Far-End Crosstalk FEXT

Accuracy	772 kHz - 10 MHz	10 MHz – 100 MHz	100 MHz - 200 MHz	200 MHz - 400 MHz	400 MHz - 750 MHz	750 MHz - 1.5 GHz
-60 to -90 dB	± 2 dB	± 2 dB	± 2 dB	± 2.5 dB	± 4 dB	± 6 dB
-30 to -60 dB	± 1.6 dB	± 1.4 dB	± 1.4 dB	± 1.6 dB	± 1.8 dB	± 4 dB
-10 to -30 dB	± 0.5 dB	± 0.8 dB	± 0.8 dB	± 1 dB	± 1.5 dB	± 2 dB

Impedance (open/short and terminated 100Ω)

Accuracy	772 kHz - 10 MHz	10 MHz - 100 MHz	100 MHz – 350 MHz	350 MHz - 750 MHz	750 MHz - 1.5 GHz
70Ω - 90Ω	± 1Ω	± 1.5Ω	± 2Ω	± 3Ω	± 4.5Ω
90Ω - 110Ω	± 0.75Ω	± 1Ω	± 1.5Ω	± 2Ω	± 4Ω
110Ω - 130Ω	± 1Ω	± 1.5Ω	± 2Ω	± 3Ω	± 4.5Ω

**Calculated HF Parameters**

- Fitted Impedance
- Return Loss (RL) (Open/Short and Terminated 100Ω) (fully complex method)
- NEXT Worst Case, Power Sum, Power Sum Worst Case
- FEXT Worst Case, Power Sum
- Individual ACR, ACR Worst Case, Power Sum ACR
- Global Power Sum (NEXT + FEXT)
- ELFEXT Pair to Pair, Worst Case, Power Sum, Power Sum Worst Case
- Velocity of Propagation (VOP)
- Propagation Delay (Phase Delay), Group Delay, Delay Skew
- Etc...



**Statistical HF means (pair)**

Maximum value, absolute maximum value  
Minimum value, absolute minimum value  
Average value, absolute average value  
Standard deviation, standard deviation (n-1)  
Average standard deviation  
Quadratic average  
Minimum margin, average margin  
Etc...

**Statistical HF means (cable)**

Minimum and maximum value  
Frequency for minimum or maximum values  
Pair for minimum or maximum values  
Minimum margin to the limit  
Frequency of minimum cable margin  
Value for minimum cable margin  
Average of the minimum margin for each pair  
Etc...

**Technical hardware features**

- No movable parts for maximum measurement speed, accuracy and reliability.
- Connecting frame equipped with 2 baluns per pair for highly accurate measurements
- Low floor noise level as low as -85dB at the maximum operating frequency
- Software assisted calibration method & Test heads with "open/short/load" facility allowing a fully automatic calibration procedure.
- No other calibration is required, which speeds up the measurements.
- Mechanical design studied to facilitate maintenance and servicing operations.

**Important comments**

Each delivered system comes with one software license protected with an electronic key. To use the Optitest software on other computers, typically to prepare cable specifications, reports or especially for results management and/or use the database for QA analysis, additional technical licenses are necessary. Please check the corresponding option later in this document.

The remote maintenance feature is using TeamViewer and allows AESA to get access to the customer's system using an internet connection. This allows updating or correcting the software, as well as diagnosing the reason of a breakdown in the system. The cost for an intervention using the remote maintenance is based on the addition of following points:

- During the warranty period: Free of charge
- Outside the warranty period: Working time of the AESA engineer

**Low Frequency parameters specifications**

The low frequency parameters measuring technology provides a self calibration. It is designed to test pairs and quads. 3 measuring frequencies are integrated in the capacitance bridge in two versions: one version provides measurements at 12.5Hz, 125Hz and 800Hz and the second version provides measurements at 12.5Hz, 125Hz and 1'000Hz. Please specify which type you prefer when ordering.

Description	Designation for pairs	Designation for quads	Accuracy	Scale
Conductor resistance	Ra, Rb	Ra, Rb Rc, Rd	± 0,1% + 10 mΩ	0 - 19,999 kΩ
Loop resistance	R	R1, R2		
Resistance unbalance	DR	DR1, DR2, DR3	Computed	%, Ω
Capacitance	C	C1, C2, C3	± 0,25% ± 10pF at 800 Hz ± 0,25% ± 10pF at 125 Hz ± 0,25% ± 50pF at 12,5Hz	0 – 2'000nF
Capacitance unbalance	K	K1 – K12	± 1% ± 6pF at 800 Hz	
Capacitance unbalance to ground	Ei, Ea, E	Ei1-Ei3 Ea1-Ea3 E1-E3	± 1% ± 3pF at 125 Hz ± 1% ± 30pF at 12,5 Hz	



**Calculated parameters at 800Hz (1'000Hz)**

Attenuation	Phase
Characteristic Impedance	Velocity of propagation (VOP)
Crosstalk	

**Statistical parameters**

Maximum and minimum measured values	Upper quality factor
Absolute minimum measured value	Lower quality factor
Average value	RC product
Quadratic average	Standard deviation RC
Standard deviation	Variance

**Main software features of OptiTest**

OptiTest is a stand-alone application specially designed for the cable and wire data capture with AESA and former M.E.A. automatic testing equipments. This module is a part of the AESA's Quality Management System CIQ 3.0 designed for the cable manufacturers.\*

- The software has been developed in the Microsoft® Windows™ environment and complies with the Windows features.
- User-friendly OptiTest software package, to be operated easily with a mouse or the keyboard.
- All data gathered with OptiTest can be used for further statistical evaluations and combined with other measurements gathered during the overall production process, from incoming good inspection until to the dispatch of the finished product.
- No HF or LF knowledge required, ideal for shop floor integration.
- Driver for the implemented Network Analyzer.
- Full automatic measurements.
- The measurements can be performed in the sweep mode and/or by using frequency tables.
- Open choice for start/stop frequencies and number of points (for HF sweep measurements, the test system allows to enter an unlimited number of measurement points, which is not limited by the specified number of points described in the manual of the Analyzer itself.
- Choice of logarithmic or linear scales.
- Fully self-configurable reports.
- Fully automatic calibration management including automated calibration procedure, calibration management depending on parameters to be measured.
- Possibility to create an unlimited number of cable specifications and test sequences. These "test specifications" will be stored with an individual customised name and are easily used by the operator for the call up of the specific cable type to be tested.
- Possibility to generate complex limit curves. Most of the limits and formulas recommended by the international standards are integrated. Their variables are programmable to enable the preparation of special specifications

OptiTest consists in CIQ 3.0 QDM and MERLIN modules\* for LF, HF and HV measurements. It facilitates the tasks itemised below

- Creation and administration of test specifications
- Performance of tests
- Report generation after testing
- Basic statistic evaluation

The core features of OptiTest comprise among others data evaluations and archiving functions as well as the connection of testing equipment.

\*Please contact AESA for more information about the Quality Management System CIQ 3.0

[www.aesaciq.com](http://www.aesaciq.com)    [www.aesa-cortailod.com](http://www.aesa-cortailod.com)

\*depending on the ordered system

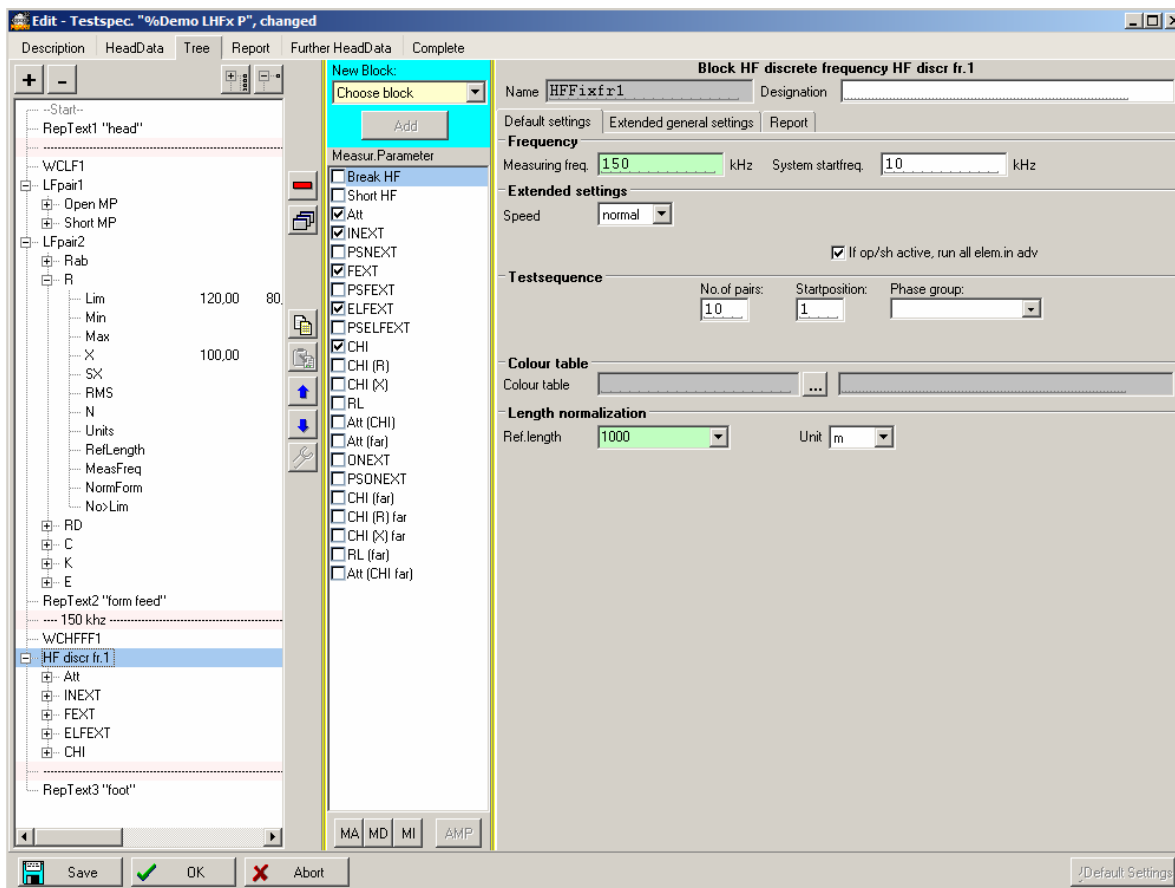
## Test Plan Creation ( Example includes options )

A wide range of measurement modes are available as options, such as HF Sweep, HF Sweep(Alien), HF Coax-50, HF Coax-75, HF fixed frequency, LF single cores, LF pairs, LF triples, LF quads, LCL, LCTL, TCL,

TCTL, TI, AS, worst case summaries for HF-Sweep / LF / HF discrete frequencies, inductance, conductance and high voltage.

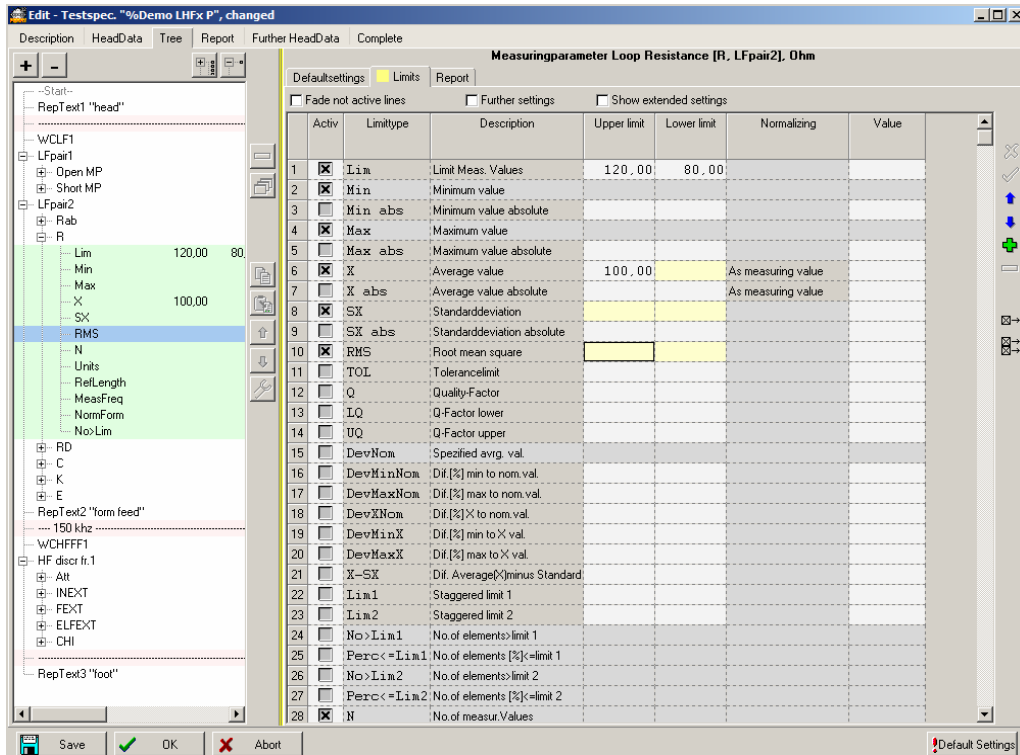
Report generation is very easy. If set by default, a highly comprehensive report is generated, containing a limit case compilation with graphics and for each measuring block a separate summary with related graphics. It goes without saying that dedicated features for customised reports are also available.

## Example of selecting the Parameters to be measured (and printed)





Example of adding the required limits for LF or HF specifications



Document

Reports

OptiTest offers various report options such as:

- Test certificates for the customer
- Creating (control) quality charts
- Graphical HF evaluations

The results may be printed, stored as PDF files, or sent as emails.

It is also possible to create data files for Office products such as Microsoft Excel.

Evaluation

All data are available for evaluation at any time. Thus, all test data of a cable can be collectively evaluated and printed.

Some examples of how to perform evaluations are:

- Sample list sorted by test order
- Search with pre-defined or customized filters (e.g. searching for the last 20 samples by cable number, date, certain characteristics)
- Free search through the data pool with user-specific search criteria

Filters and search criteria normally generate sample lists which facilitate multiple further actions. Examples are:

- Display and process measured values
- Print reports and labels
- Generate quality charts (statistics)

Archiving

Windows XP backup function used for archiving the data.

Statistics

Filtering tool: Select a group of measurements according to various criteria such as:

- Cable specification
- Cable structure
- Production period
- Production line, test station
- Etc...

Following the measurements management, this powerful tool allows generating many types of statistics.

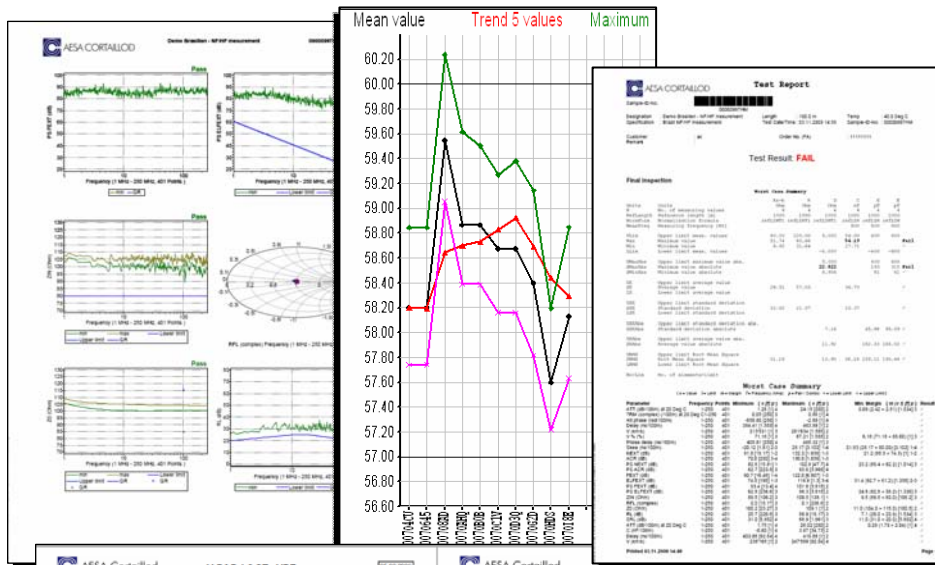
Worst case values for a pair or a cable

- Pair identification with extreme values
- Min, max, average values
- Standard deviation, quality factor, RMS values
- Etc...

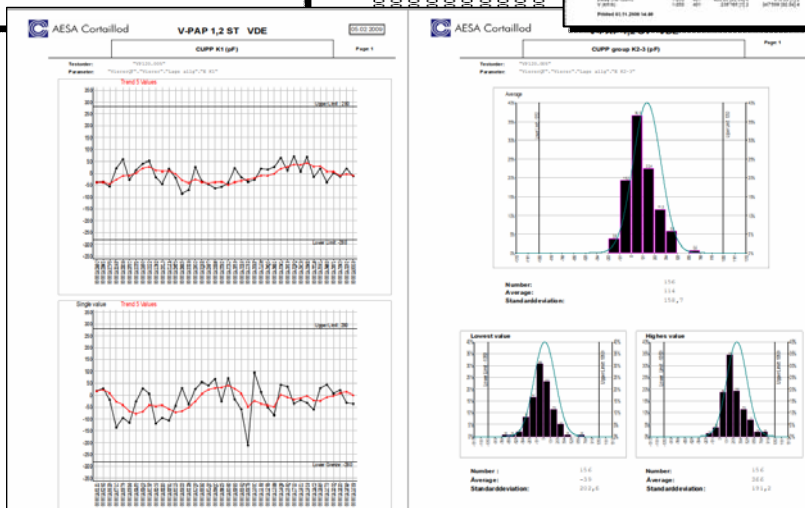
These statistical means are calculated for all measured LF (and partly HF) parameters

Graphical presentation

- Statistical distribution (Gauss type curve)
- Evolution and parameter survey in function of the time
- Measurements repartition in a defined time period to determine the testing load



**Examples of test and statistical reports with AESA Optitest**



**Examples of statistical reports with AESA Optitest**



**Options**

A) Network Analyzer

AESA proposes for its VEGA measuring systems following network analyzer types:

Agilent type E5061A ENA-L (300 kHz – 1.5 GHz) 51.0001.0004.0

Please see attached "Options" file for other NA.

B) Spare parts

AESA recommends following set of spare parts for an operation safety of two years:

- 1 CKE measuring bridge (only if LF measurements are ordered)
- 1 R measuring bridge (only if LF measurements are ordered)
- 1 LF relay matrix board (only if LF measurements are ordered)
- 1 LF intermatrix board (only if LF measurements are ordered)
- 1 A/D converter board (only if LF measurements are ordered)
- 2 test heads (4 if two different connecting frames)
- 2 HF relays (3 if two different connecting frames)
- 1 control boards set
- 1 set of HF cables
- 1 set of different mechanical and electronic hardware

Product No (full kit): 50.0900.0002.0  
 Product No (without the bridges and boards) 50.0900.0003.0

C) ISO 17025 certified LF calibration standards type AESA 9000

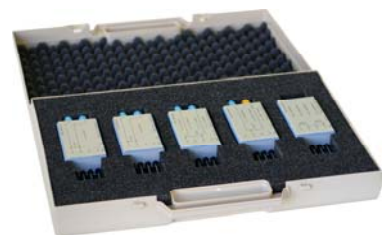
AESA proposes to its customers sets of LF and HF certified calibration standards. These standards are certified and compared to our internal secondary references, these references being directly related to primary standards based in the Swiss Federal Office of Metrology in Bern.

The standards are certified during a procedure according to the well known ISO 17025 standard and can be used in an ISO quality assurance supervision environment.

The standards are placed directly on the connecting frame during a calibration control procedure.

The kit of certified LF calibration standards is composed of:

<b>Standard type 9001</b>		
C1,2 with 19,20 nF	± 0,1 %	± 30 ppM/°C
<b>Standard type 9002</b>		
C1,2 with 192,0 nF	± 0,1 %	± 30 ppM/°C
<b>Standard type 9003</b>		
C3 with 16,00 nF	± 0,1 %	± 30 ppM/°C
K1, K2, K3 with 16000 pF	± 0,1 %	± 30 ppM/°C
<b>Standard type 9004</b>		
E1, E2, E3 with 12000 pF	± 0,1 %	± 30 ppM/°C
<b>Standard type 9005</b>		
RA, RD with 192 Ω	± 0,01 %	± 2 ppM/°C
RB, RC with 1920 Ω	± 0,01 %	± 2 ppM/°C



Article number: 45.9000.0001.0



## D) ISO 17025 certified HF calibration standards type AESA 9800

The kit of certified HF calibration standards is composed of:

- 2 attenuation references –3dB type 9801
- 2 attenuation references –6dB type 9802
- 2 attenuation references –10dB type 9803
- 2 attenuation references –20dB type 9804
- 2 attenuation references –30dB type 9805
- 2 x 50Ω terminations
- 2 special connectors for the terminations
- 4 HF connecting cables for the attenuation
- 1 set of small HF material




### Principle

With each sold measuring system, AESA delivers a "daily" calibration kit to create the different calibration files necessary to measure LAN cables. These easy-to-use standards have obviously been developed in the symmetrical way as they are placed immediately after the balun transformers to get the maximum accuracy. Unfortunately, these "daily" standards can not be referenced to primary standards. But AESA has developed its HF technology by using hi-tech strategic components. These miniaturized resistors are sorted and guaranteed up to 1GHz. Tolerance : 1% (50 ppm/deg.) for values between 50 and 200Ω.

During a quality control calibration, the symmetric elements have to be replaced by 50Ω coaxial standards which are this time certified. In fact, with an appropriate set of terminations and attenuators, it is possible to prove within a certain tolerance that our VEGA system (network analyzer + HF multiplexer + connecting frame) is measuring correctly. It is also possible to prove that the calibration used for the measurement of LAN cables has been done correctly.

Article number:

Delivered with certificate ISO 17025		<b>S</b>	<b>Schweizerischer Kalibrierdienst</b>
		<b>C</b>	<b>Service suisse d'étalonnage</b>
		<b>S</b>	<b>Servizio di tarature en Svizzera</b>
		<b>S</b>	<b>Swiss Calibration Service</b>

45.9800.0001.0

## E) Technical software licenses

The Optitest software is protected by Copyright laws. Copies are subject to licenses.

A technical license allows to do following jobs :

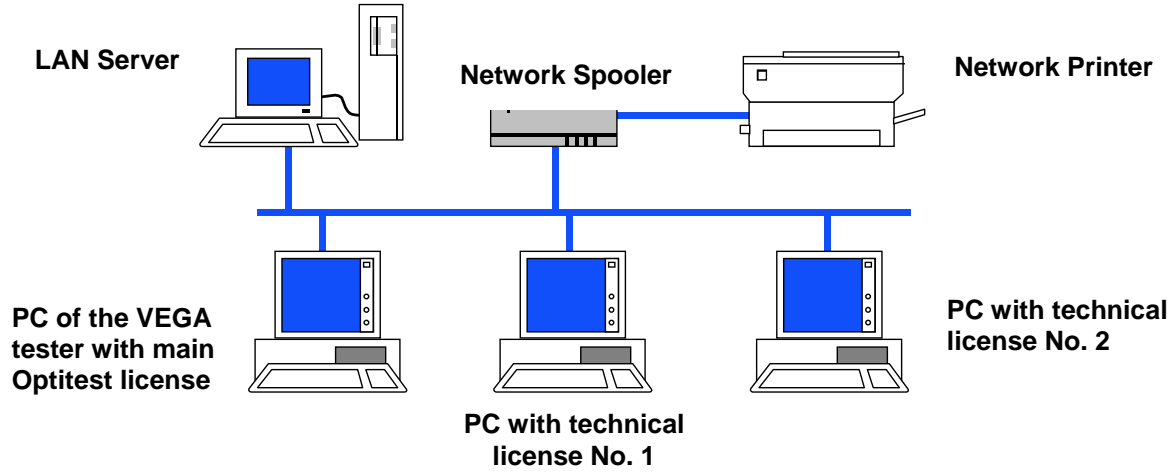
- Prepare cable specifications
- Use the measurement files management tools
- Use the database system and all its features
- Proceed with all statistical analysis which may be required

The advantage of having a selected number of technical licenses is that the VEGA system can be used without interruption while technical adjustments or Quality Assurance duties are made off-line. In other words, a technical license gives access to all features and possibilities of the Optitest software, except for making measurements.

A technical license can be added in any computer network (see diagram below). The VEGA tester can be networked or not. An unlimited number of technical licenses can be added. The update and maintenance operations of the technical licenses in a network or not are under the responsibility of the customer. Each technical license is delivered with an electronic key.



AESA can anytime provide installation and maintenance jobs by its own software engineers. These operations are subject to separate quotations.



Article number per license

52.0001.0006.0

F) Trolley

For convenience or operational reasons, it is possible to add a professional movable trolley to the system. In such a case, all tester components are integrated in the trolley, including the computer system and the printer.



Article number:

51.0190.0001.0

The AESA VEGA systems can be delivered with additional options such as coaxial cable testing, LCL, LCTL, TCL, TCTL, EL LCTL and EL TCTL parameters testing, transfer impedance measurements, screening and coupling attenuation testing, etc...

Please contact AESA for further information.

**AESA is an ISO 17025 certified company**