Gauss Meter & EMC spectrum analyzer
Series SPECTRAN® 50xx

Spectrum Analyzer at multi-meter price!

References / examples of proof:

- ◆ BOEING, USA
- ◆ NATO, Belgium
- ◆ Rohde & Schwarz, Belgium
- ◆ Shell Oil Company, USA
- ◆ ATI, USA
- ◆ Australian Government Department of Defence,Edingburgh, Australia
- ◆ Daimler Chrysler AG, Bremen, Germany
- ◆ BMW, München, Germany
- ◆ Eurocontrol (Flugüberwachung), Belgium
- ◆ DLR (Deutsches Zentrum für Luft- und Raumfahrt), Köln, Germany
- ◆ ThyssenKrupp, Stuttgart, Germany
- ◆ Siemens AG, Konstanz & Erlangen, Germany
- ◆ PHILIPS, Netherlands

Product of the year 2009

Our 3D magnetic-field measurement coil with homogeneous centre won the **first price** of Europe´s biggest electronic newspaper "Elektronik" at the category passive components. **This coil is installed in each NF-Spectran unit.**

AARONIA AG
WWW.AARONIA.DE

Made in Germany

Specifications

SPECTRAN® NF-5010 (1Hz to 1MHz)

- 1024 points BFT (FFT)
- Frequency range: 1Hz to **1MHz**
- Typ. level range E-Field: 1V/m to 5kV/m
- Typ. level range H-Field: 1nT to **100μT**
- Typ. precision: 3%
- Superfast FFT spectrum analysis
- High-performance DSP (Digital Signal Processor)
- 3D magnetic field measurement
- Frequency and signal strength display
- High-resolution multi-function display
- DIN/VDE 0848 Exposure limit calculation
- Simultaneous M-Display X, Y, Z axes
- True RMS signal strength measurement
- Average (AVG) measurement
- Internal data logger
- Internet Flash Software-Updates
- USB 2.0 Interface
- Dimensions (L/W/D): (260x86x23) mm
- Weight: 420gr
- **Warranty: 10 years**

SPECTRAN® NF-5030 (1Hz to 1MHz / 20MHz / 30MHz)

- Vastly expanded range
- Measurement range up to **DIN/VDE 0848**
- **65 MSPS** (Option 005)
- Lots of options
- NEW: 30MHz Option
- Frequency range: 1Hz to 1MHz (**30MHz**)
- Typ. level range E-Field: 0,1V/m to **20kV/m**
- Typ. level range H-Field: 0,1nT to 2mT
- Typ. level range DDC H-Field: **1pT** to 2mT
- Typ. level range DDC Analog in: **200nV** to 200mV / -150dBm (Hz)
- Typ. accuracy: 3%
- Superfast FFT spectrum analysis
- High-performance DSP (Digital Signal Processor)
- 3D magnetic field measurement
- Frequency and signal strength display
- High-resolution multi-function display
- DIN/VDE 0848 Exposure limit calculation
- Simultaneous M-Display X, Y, Z axes
- True RMS signal strength measurement
- Average (AVG) measurement
- Internal data logger
- Internet Flash Software-Updates
- USB 2.0 Interface
- Dimensions (L/W/D): (260x86x23) mm
- Weight: 420gr
- **Warranty: 10 years**

Application Examples Spectran NF-50xx Spectrum Analyzer

Analysis and measurement of:

- traction power
- power lines
- power cables
- lamps
- power supplies
- transformer
- DSL
- ADSL
- VDSL
- various home appliances, industry and office up to 30MHz

Description

CONFORMING TO STANDARDS

Real ANALYSIS:

Measurement of electric and magnetic fields in this price range has never been this PROFESSIONAL.

Find radiation sources in your surroundings. Find their respective frequencies and signal strengths, including direct display of exposure limits. This used to be impossible in this price category, professional units often costing several thousand euros and being excessively complicated in handling.

The highly complex calculations in spectrum analysis incl. exposure limit calculation is being performed, unnoticed in the background, by a high-performance DSP (digital signal processor). This ultra-fast processor even allows, depending on the settings, REAL-TIME display with a NF-5030 (could you ask for more?). Simply amazing!

Fast, handy, cost-effective, beautiful exterior and PRECISION - what more could you ask ?

Spectrum ANALYSIS

Real ANALYSIS:

Professional EMF measurement devices use a frequency dependant measurement approach, the so-called spectrum analysis. In a certain frequency range, the individuals signals and their respective strengths are being broken down, for example into a "bargraph" display (see SPECTRAN® screenshot on the right). The height of the individual bars represents the corresponding signal strength. For the 3 strongest signal sources, SPECTRAN® can automatically displays the frequency and signal level, thanks to its "Auto Marker" feature. Of course, you can also setup the filter width and the frequency range to be analysed as you like.

In the EMF (LF) spectrum shown here, a frequency range of approx. 20Hz to 60Hz from left to right is being analysed. During analysis, the Auto Marker feature has determined - fully automatic - two main signal sources:

Signal#1=30Hz at 45µT
**Signal#2=50 (mains power) at 75µT**
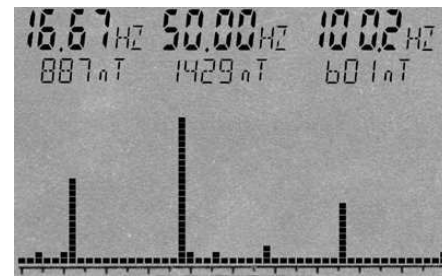
LF spectrum display and automatic multi-marker display on the digital screen of SPECTRAN® (Screenshot)

LONG-TERM MEASUREMENT (Data logging feature)

SPECTRAN® measurement devices with data logger allow long-term recordings of measurement results over a freely adjustable period of time. This is particularly indispensable for serious evaluation of exposure by appliances and machinery which have a changing power consumption or radiation strength over time. Examples for these include railroads, power lines and plants, but also home appliances and their respective power cables, and various high-frequency transmission facilities like mobile phone transmission towers, mobile phones, radar etc. Depending on the time of day, considerable variation of exposure can occur (see attached graphics). Without long-term recordings, MASSIVE misinterpretation of total exposure can occur. With long-term data logging using SPECTRAN®, the daily variation of exposure can be recorded and analysed. Thus, the actual total exposure can be evaluated precisely.

With this functionality, you can even discover sporadic EMC problems which would otherwise be very hard to detect.
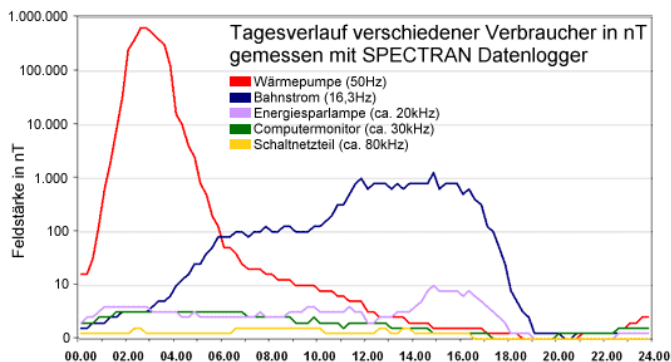
Daily variation of various radiation sources discloses MASSIVE variation in exposure
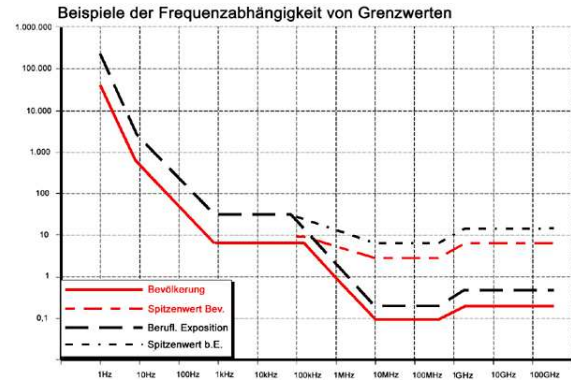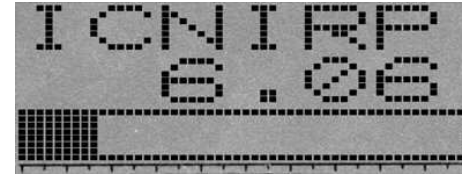
EXPOSURE LIMITS

At the push of a button:

Exposure limit calculation used to be a complex and awkward procedure even for the professional, as most of the time, a chaotic mixture of an abundance of different frequencies, modulations and signal strengths is present.

The indispensible, highly complex calculation of frequency-dependant exposure limits can ONLY be performed CONFORMING TO STANDARDS by a spectrum analyser with high-performance software. Not a problem for SPECTRAN® units: They can calculate even several authoritative exposure limits, precautionary limits and recommendations (simply selectable via a button) and display these as a practical bargraph display (including convergence display in percent!), while the measurement is running.

The attached SPECTRAN® screenshot demonstrates how it works: At the push of a button, the ICNIRP exposure limit has been chosen among the various available exposure limits. SPECTRAN® now automatically calculates convergence or excess of this limit. For achieving this, often thousands of complex calculations have to be performed per second, and a steady scan of the entire frequency range needs to be performed. A true nightmare for every processor. In our test case, the graphic display shows an approximation towards the ICNIRP limit by 6,06%. If you use a NF-5030 you can even cover the total ICNIRP-banwidth (depending on frequency). Hence, even the novice can perform exposure limit calculations ACCORDING TO STANDARDS without having to use complex tables and calculators.

Graphic display of frequency-dependant exposure limits.

SPECTRAN® displays exposure limits both as percentage as well as a bargraph display.

Aaronia REAL-3D magnetic field sensor

The new standard: 3D MEASUREMENT

Mismeasurement caused by wrongly adjusting the measurement device in space or troublesome and complex 3D calculations with a calculator are a problem of the past from now on, thanks to SPECTRAN® EMF (LF) measurement devices. All SPECTRAN® EMF measurement devices can measure magnetic fields directly in 3D! Starting with the SPECTRAN® NF-1010E, field strengths of the individual X, Y and Z axes can even be shown seperately. This has become possible thanks to the newest development from the Aaronia laboratories: Our high-tech REAL 3D miniature sensor coil. Consisting of a specially crafted nylon base with 3 independant windings made of ultra-thin, 0,05 mm! wire, it impresses with its extremely high sensitivity. It allows measurement of magnetic fields in all 3 spacial dimensions. The signal processor (DSP) of the SPECTRAN® performs the resulting highly complex calculations. You receive 3D measurement results which can otherwise only be achieved by using highly professional equipment.

INCLUDED WITH DELIVERY

- ◆ LF spectrum analyser SPECTRAN NF-50xx
- ◆ Sturdy aluminum-design carrycase (with custom padding!)
- ◆ 1300mAh Aaronia power battery with charger
- ◆ Exhaustive manual with lots of basic information, hints and exposure limit tables

Package contents SPECTRAN 50xx devices

4

SPECTRAN® NF (EMF) Spectrum Analyser

APPLICATION EXAMPLES: Traction power, power lines and cables incl. harmonics, transformer, switching power supplies, RFID, TFTs, DSL etc. Various appliances in home and office.

AARONIA AG
WWW.AARONIA.DE

Specifications base unit[1]	Entrance		Intermediate		Professional		Outdoor
	NF-1010	NF-1010E	NF-3010	NF-3020	NF-5010	NF-5030	NF-XFR
Frequency Range (min)	10Hz	10Hz	10Hz	10Hz	1Hz	1Hz	1Hz
Frequency Rance (max)	2kHz	10kHz	100kHz	400kHz	1MHz	30MHz[2]	30MHz[2]
Electric field [V/m] (min) (typical)	1V/m	1V/m	1V/m	1V/m	1V/m	0,1V/m[2]	see opt. PBS2
Electric field [V/m] (max) (typical)	2.000V/m	2.000V/m	5.000V/m	5.000V/m	5.000V/m	20kV/m	see opt. PBS2
Magnetic field [Tesla] (min (typical)	10nT	10nT	1nT	1nT	1nT	1pT[2]	see opt. PBS2
Magnetic field [Tesla] (max) typical	100µT	100µT	100µT	100µT	100µT	2mT[2]	see opt. PBS2
Magnetic field [Gauss] (min (typical)	100µG	100µG	10µG	10µG	10µG	10nG[2]	see opt. PBS2
Magnetic field [Gauss] (max) typical	1G	1G	1G	1G	1G	20G[2]	see opt. PBS2
Analog input [V] (min) typical	-	-	-	2µV	2µV	200nV[2]	200nV[2]
Analog input [V] (max) typical	-	-	-	200mV	200mV	2V[2]	2V[2]
RBW (resolution bandwidth) (min)	1Hz	1Hz	1Hz	1Hz	1Hz	0,3Hz	0,3Hz
RBW (resolution bandwidth) (max)	1kHz	3kHz	30kHz	100kHz	300kHz	1MHz	1MHz
Demodulator	-	-	AM	AM	AM/FM	AM/FM	AM/FM
Units (additional units via PC software)	V/m, T, G	V/m, T, G	V/m, T, G	V, V/m, T, G	V, V/m, T, G, A/m	V, V/m, T, G, A/m	V, dBV
Detector	RMS	RMS	RMS/MinMax	RMS/MinMax	RMS/MinMax	RMS/MinMax	RMS/MinMax
Internal Datalogger (size). Expandable to 1MB (option 001)	-	-	64K	64K	64K	64K	harddisk
FFT resolution (points)	64	64	64	64	1024	1024	1024
Lowest Sample Time	50mS	50mS	50mS	50mS	10mS	10mS	10mS
Accuracy (typical)	5%	5%	5%	5%	3%	3%	3%
Highlights							
Real-time remote control via USB	-	✓	✓	✓	✓	✓	internal
Integrated electric (E) & isotropic magnetic (H) sensor/antenna	✓	✓	✓	✓	✓	✓	-
3D, 2D or 1D mode switchable (only magnetic field sensor)	-	✓	✓	✓	✓	✓	✓
Calibration setup (selected antenna)	✓	✓	✓	✓	✓	✓	✓
Exposure limit calculation according to ICNIRP, BGV B11, BlmSchV etc.	-	✓	✓	✓	✓	✓	✓
Extended full ICNIRP range	-	-	-	-	-	✓	✓
Suitable for Pre-Compliance test	-	-	-	-	-	✓	✓
Real-time limit calculation with simultaneous percentage display	-	✓	✓	✓	✓	✓	Analyzer sw
Vector power measurement (I/Q) and True RMS	-	-	✓	✓	✓	✓	✓
Enhanced DFT spectrum analysis	-	✓	✓	✓	✓	✓	✓
Simultaneously displays frequency and signal strength	-	-	✓	✓	✓	✓	Analyzer sw
Up to 3 marker (showing both frequency and field strength)	-	✓	✓	✓	✓	✓	unlimited
Jog Dial controlled manual marker readout	-	-	✓	✓	✓	✓	key & touchpad
Linear or logarithmic spectrum display (log10, log100, log1000)	-	✓	✓	✓	✓	✓	unlimited
Automatic reference level adjustment (switchable)	-	✓	✓	✓	✓	✓	✓
Hold function	-	✓	✓	✓	✓	✓	unlimited
Free of charge firmware update (via Intenet)	-	✓	✓	✓	✓	✓	✓
Supports programming of custom P-Code & C++ based custom software	-	-	✓	✓	✓	✓	✓
High performance DSP (Digital Signal Processor)	✓	✓	✓	✓	✓	✓	✓
Large, high resolution multifunctional LCD (95mm)	✓	✓	✓	✓	✓	✓	14" TFT
Spectrum display (51x25 pixel)	✓	✓	✓	✓	✓	✓	Analyzer sw
High resolution 50 segment bargraph (trend display)	✓	✓	✓	✓	✓	✓	Analyzer sw
Enhanced, much sharper Aaronia LCD display (3d generation)	-	-	-	-	-	✓	14" TFT
Integrated battery charger (supports our optional LiPo battery)	✓	✓	✓	✓	✓	✓	XFR charger
Internal speaker	Piezo	Piezo	✓	✓	✓	✓	✓

Please continue on next page

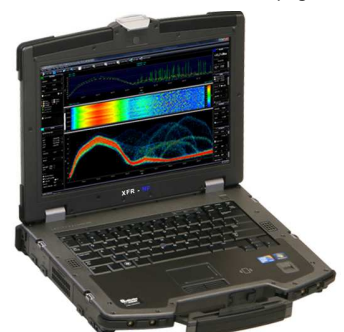NF-1010   NF-1010E   NF-3010   NF-3020   NF-5010   NF-5030   NF-XFR

SPECTRAN® NF (EMF) Spectrum Analyser

APPLICATION EXAMPLES: Traction power, power lines and cables incl. harmonics, transformer, switching power supplies, RFID, TFTs, DSL etc. Various appliances in home and office.

AARONIA AG
WWW.AARONIA.DE

	Entrance		Intermediate		Professional		Outdoor
Connectors / Interface	NF-1010	NF-1010E	NF-3010	NF-3020	NF-5010	NF-5030	NF-XFR
SMA input (f) with high impedance	-	-	-	✓	✓	✓	✓
USB 1.1/2.0	-	✓	✓	✓	✓	✓	2x
Audio output (2,5mm jack)	✓	✓	✓	✓	✓	✓	3,5mm jack
Charger plug (max. 15V)	✓	✓	✓	✓	✓	✓	✓
Jog Dial (easy usage of menu, marker and volume control)	-	-	✓	✓	✓	✓	key & touchpad
1/4" tripod connector	✓	✓	✓	✓	✓	✓	in-Vehicle docking
Included In Delivery							
Integrated electric (E) & isotropic magnetic (H) sensor/antenna	✓	✓	✓	✓	✓	✓	-
SPECTRAN 1300mAh rechargable battery (integrated)	✓	✓	✓	✓	✓	✓	6 cell battery
Battery charger and power supply incl. international adapter set	✓	✓	✓	✓	✓	✓	no adapter set
Aluminum carrying case with foam protection	✓	✓	✓	✓	✓	✓	-
Detailed English manual (on CD)	✓	✓	✓	✓	✓	✓	installed
Analyzer Software for MAC-OS, Linux and Windows (on CD)	-	✓	✓	✓	✓	✓	installed
SMA tool	-	-	-	-	-	✓	✓
Available Options (extra charge)							
Option 001 (1MB memory expansion)	-	-	-	-	✓	✓	harddisk
Option 005 (12Bit DDC for ultra high sensitivity)	-	-	-	-	-	✓	installed
Option 006 (Isotropic static magnetic field sensor)[1]	-	-	-	-	-	✓	-
Option 008 (20MHz expansion. New range: 1Hz-20MHz)	-	-	-	-	-	✓	installed
Option 009 (24Bit resolution for Option 006)	-	-	-	-	-	✓	-
Option 010 (30MHz expansion. New range: 1KHz-30MHz)	-	-	-	-	-	✓	✓
Option UBBV2 (40dB external preamplifier DC-8GHz)	-	-	-	-	-	✓	✓
Optional Accessories							
USB Cable (Special Version)	-	✓	✓	✓	✓	✓	installed
3000mAh Lithium Polymer (LiPo) Power-Battery	✓	✓	✓	✓	✓	✓	-
Car Power Adapter (operate or charge via cigarette lighter)	✓	✓	✓	✓	✓	✓	-
Outdoor Rubber Protection (perfect for outdoor usage)	✓	✓	✓	✓	✓	✓	-
Pistol Grip / Miniature Tripod	✓	✓	✓	✓	✓	✓	-
Aluminum Tripod (big version)	✓	✓	✓	✓	✓	✓	-
DC-Blocker (protects the input against DC voltage)	-	-	-	-	-	✓	✓
20dB Attenuator (offers a higher maximum voltage up to 2V)	-	-	-	-	-	✓	✓
PBS1 Near Field Probe Set (passive)	-	-	-	-	-	✓	✓
PBS2 Near Field Probe Set (active, incl. UBBV2 preamplifier)	-	-	-	-	-	✓	✓
ADP1 Active Differential Probe (conductive measurement)	-	-	-	-	-	✓	✓
GEO10 Vibrationsensor (4Hz-1kHz)	-	-	-	-	-	✓	✓
GEO14 Vibrationsensor (10Hz-1kHz)	-	-	-	-	-	✓	✓
Calibration Certificate	✓	✓	✓	✓	✓	✓	✓
Heavy Plastic Carrying Case	✓	✓	✓	✓	✓	✓	-

[1] Preliminary specifications dated 01.07.2011. Range, sensitivity and accuracy can change depending on frequency, setup, antenna and used parameters. Precision datas are based on Aaronias calibration-reference under specific test conditions. Unless otherwise stated, these specifications are according to the following reference conditions: Ambient temperature 22±3°C, relative air humidity 40% to 60%, continuous wave signal (CW), RMS detection.
Option 006 offers a range of 100µG-6G (10nT-600µT). You can "zero" the static field sensor (Option 006) by using our "Zero Gauss" chamber.
NF standard: 1MHz. Only with option 010 up to 30MHz. NF standard: 1nT. Only with option 005 down to 1pT. NF standard 2µV. Only with option 005 down to 200nV. NF standard: 200mV. Only with optional 20dB
[2] Attenuator up to 2V.

NF-1010 NF-1010E NF-3010 NF-3020 NF-5010 NF-5030 NF-XFR

Available Options for Spectran NF-50xx series

Option 001: 1MB memory expansion

Available for: NF-5010, NF-5030.
This memory expansion is a MUST-HAVE particularly when using the data logger, as the standard capacity can quickly become exhausted in this mode. The memory expansion provides space for more than 10,000 logs, while the standard memory will only accomodate approximately 100 of them.
Standard memory size is 64K.

Order/Art.-No.: 180

Option 005: 12Bit Dual DDC frequency filter

Available for: NF-5030 (inclusive at NF-XFR).
This cutting edge 12Bit DDC frequency filter allows extremely fast, crisp and accurate frequency filtering, while at the same time drastically enhancing the sensitivity. As an example, magnetic fields can (depending on their frequency) still be measured down to 1pT (0.001nT), compared to 0.1nT without the option. Option 005 is therefore a MUST-HAVE for professional measurement, especially considering its attractive price.

Order/Art.-No.: 186

Option 006: 3D sensor for static magnetic fields

Available for: NF-5030.
This top-grade geomagnetic field sensor provides the ability to conduct geophysical assessments and measurement of geomagnetic field anomalies. However, it can also be used to turn the instrument into a Gaussmeter, measuring the difference between field strengths (static fields) of permanent magnets. Thanks to its ISOTROPIC (3D) construction, measurements can be performed in all three spacial dimensions AT ONCE (or seperately). Sensitivity is about 10nT-600µT.

Order/Art.-No.: 188

Option 008: 20MHz frequency extension

Available for: NF-5030 (inclusive at NF-XFR).
This 20MHz frequency extension option vastly enhances the frequency range of the NF-5030. Amongst others, it brings the ADSL and 13.56MHz RFID frequency bands in range. What's more, we are already developing a PC-based analysis software for decoding RFID.
The maximum frequency range of the NF-5030 without option 008 is 1MHz.

Order/Art.-No.: 179

Option 009: 24Bit resolution for 3D static magnetic field sensor

Available for: NF-5030.
Option 006 provides a significantly higher resolution for the optional 3D magnetic field sensor for measurement of static magnetic fields (option 006); it is ABSOLUTELY mandatory for geomagnetic surveys.
The standard resolution of the NF-5030 without option 009 is 14Bit.

Order/Art.-No.: 178

Option 010: 30MHz frequency extension

Available for: NF-5030.
Our 30MHz frequency extension extends the frequency range of the NF-5030 to the absolute maximum. The new frequency range is 1kHz - 30MHz. Amongst others, it even allows measurement of VDSL2. The higher clock frequency of the DDC provided by this option is a MUST HAVE for technicians and authorities needing ACCURATE assessment of signal sources of up to 30MHz. The maximum frequency of the NF-5030 without option 010 is 1MHz.

Order/Art.-No.: 179-1

Recommended accessories for Aaronia Spectrum Analyzer

Heavy Plastic Carrycase PRO

Shock resistant, heavy version with padding. Offers spaces for 2 SPECTRAN units with all accessories and a HyperLOG 70xx or 60xx antenna. A MUST for the professional user or outdoor usage!

Order/Art.-No.: 243

Pistol grip / miniature tripod

Detachable handle with super-practical miniature tripod mode: this handle is attachable to the backside of the unit and allows optimal handling (esp. for directional measurement) and even fixed installation of the unit. STRONGLY recommended for PC use!

Order/Art.-No.: 280

Aluminum tripod

Height adjustable, high stability. STRONGLY recommended for PC use! Max. height: 105cm.

Order/Art.-No.: 281

Calibration Certificate

Available for all SPECTRAN® units. With detailed calibration sheet.

Order/Art.-No.: 786

USB Cable (Special Version)

To connect your Spectran to the PC. Special version with high performance EMC-ferrite. STRONGLY recommended for PC use!

Order/Art.-No.: 774

Protection rubber

Protect and personalize your SPECTRAN with a sturdy rubber case and keep it scratch-n-dent free. Allows full access to all functions.

Order/Art.-No.: 290

3000mAh LiPo Power-Battery

Offers a MUCH higher runtime of your SPECTRAN (up to 400%). Strongly recommended for autonomic measurement! The 1300mAh standard-battery will be replaced.

Order/Art.-No.: 254

Car power adapter for mobile use

With power-LED. For charging batteries or operating our units in your car, including special plug.
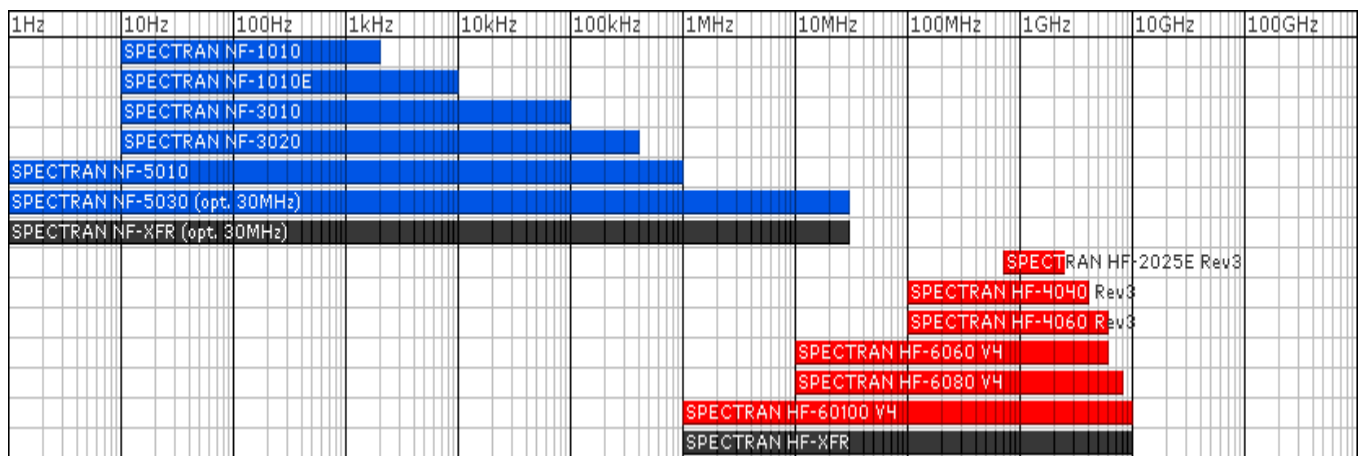
Order/Art.-No.: 260

DC-Blocker (SMA)

It prevents the RF-input of the SPECTRAN to be destroyed by the DC-voltages of f.e. DSL/ISDN lines.
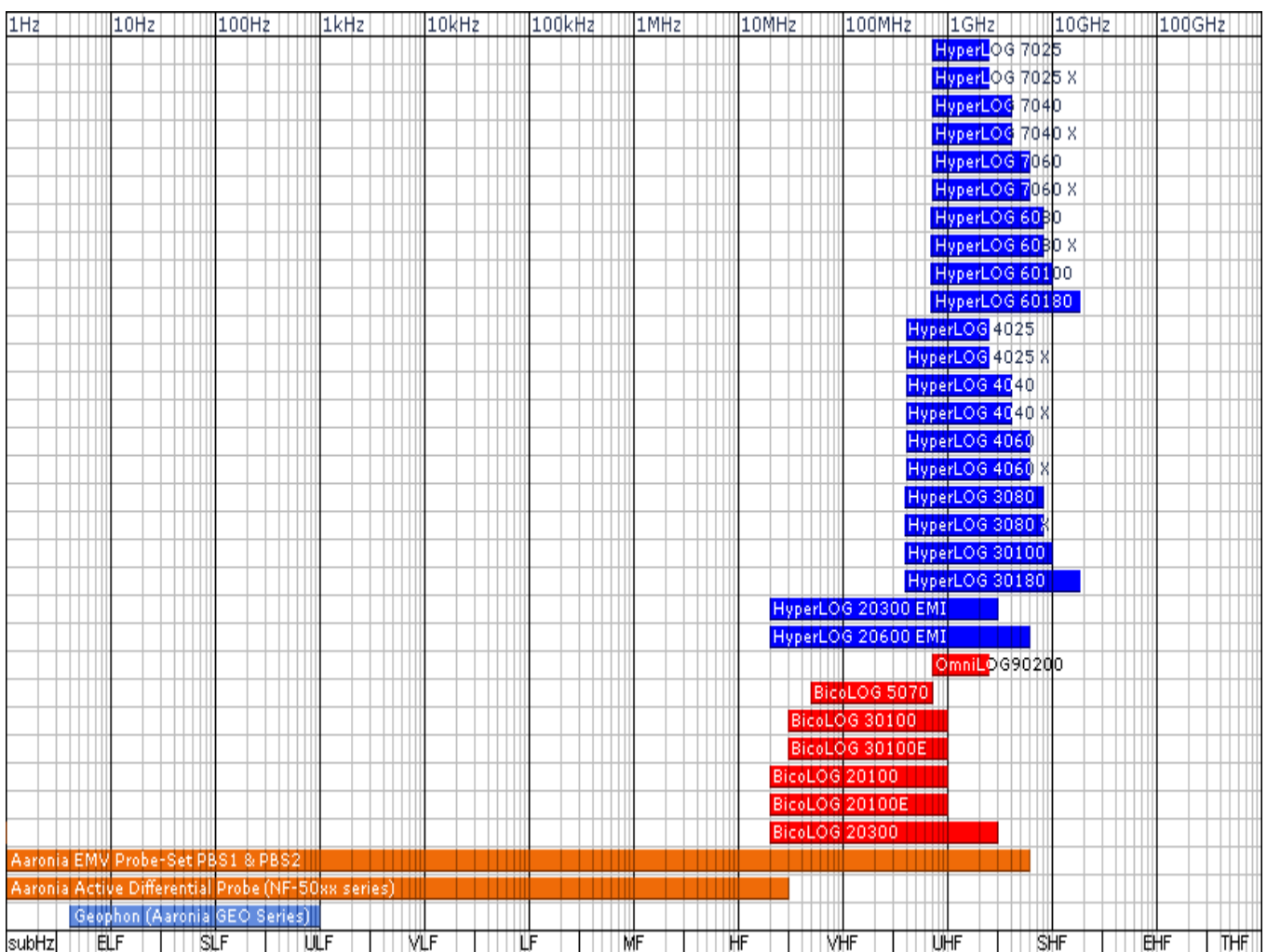
Order/Art.-No.: 778

Frequency overview Analyzer & Antennas

Frequency Overview SPECTRAN Spectrum Analyzer

Frequency Overview HyperLOG and BicoLOG Antennas and Probes

References

User of Aaronia Antennas and Spectrum Analyzers (Examples)

Government, Military, aeronautic, astronautic

- NATO, Belgien
- Boeing, USA
- Airbus, Hamburg
- Bund (Bundeswehr), Leer
- Bundeswehr (Technische Aufklärung), Hof
- Lufthansa, Hamburg
- DLR (Deutsches Zentrum für Luft- und Raumfahrt, Stuttgart
- Eurocontrol (Flugüberwachung), Belgien
- Australian Government Department of Defence, Australien
- EADS (European Aeronautic Defence & Space Company) GmbH, Ulm
- Institut für Luft- und Raumfahrtmedizin, Köln
- Deutscher Wetterdienst, Tauche
- Polizeipräsidium, Bonn
- Landesamt für Umweltschutz Sachsen-Anhalt, Halle
- Zentrale Polizeitechnische Dienste, NRW
- Bundesamt für Verfassungsschutz, Köln
- BEV (Bundesamt für Eich- und Vermessungswesen)

Research/Development, Science and Universitys

- Deutsches Forschungszentrum für Künstliche Intelligenz, Kaiserslautern
- Universität Freiburg
- Indonesien Institute of Sience, Indonesien
- Max-Planck-Institut für Polymerforschung, Mainz
- Los Alamos National Labratory, USA
- University of Bahrain, Bahrain
- University of Florida, USA
- Universität Erlangen, Erlangen
- Universität Hannover, Hannover
- University of Newcastle, Großbritannien
- Universität Strasbourg, Frankreich
- Universität Frankfurt, Frankfurt
- Uni München – Fakultät für Physik, Garching
- Technische Universität Hamburg, Hamburg
- Max-Planck Institut für Radioastronomie, Bad Münstereifel
- Max-Planck-Institut für Quantenoptik, Garching
- Max-Planck-Institut für Kernphysik, Heidelberg
- Max-Planck-Institut für Eisenforschung, Düsseldorf
- Forschungszentrum Karlsruhe, Karlsruhe

Industry

- Shell Oil Company, USA
- ATI, USA
- Fedex, USA
- Walt Disney, Kalifornien, USA
- Agilent Technologies Co. Ltd., China
- Motorola, Brasilien
- IBM, Schweiz
- Audi AG, Neckarsulm
- BMW, München
- Daimler Chrysler AG, Bremen
- BASF, Ludwigshafen
- Deutsche Bahn, Berlin
- Deutsche Telekom, Weiden
- Siemens AG, Erlangen
- Rohde & Schwarz, München
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