SCHWARZBECK MESS-ELEKTRONIK

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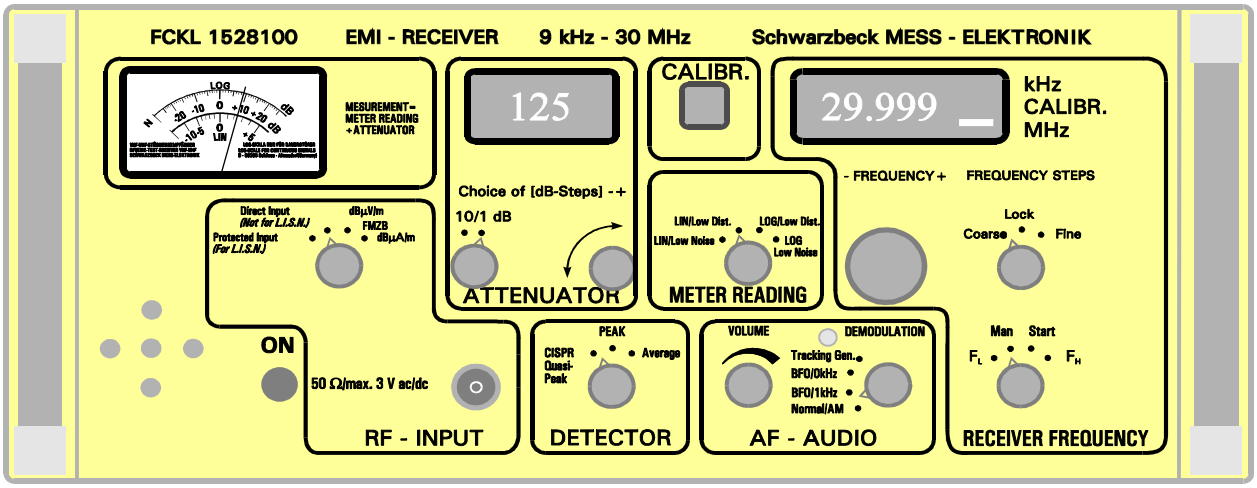
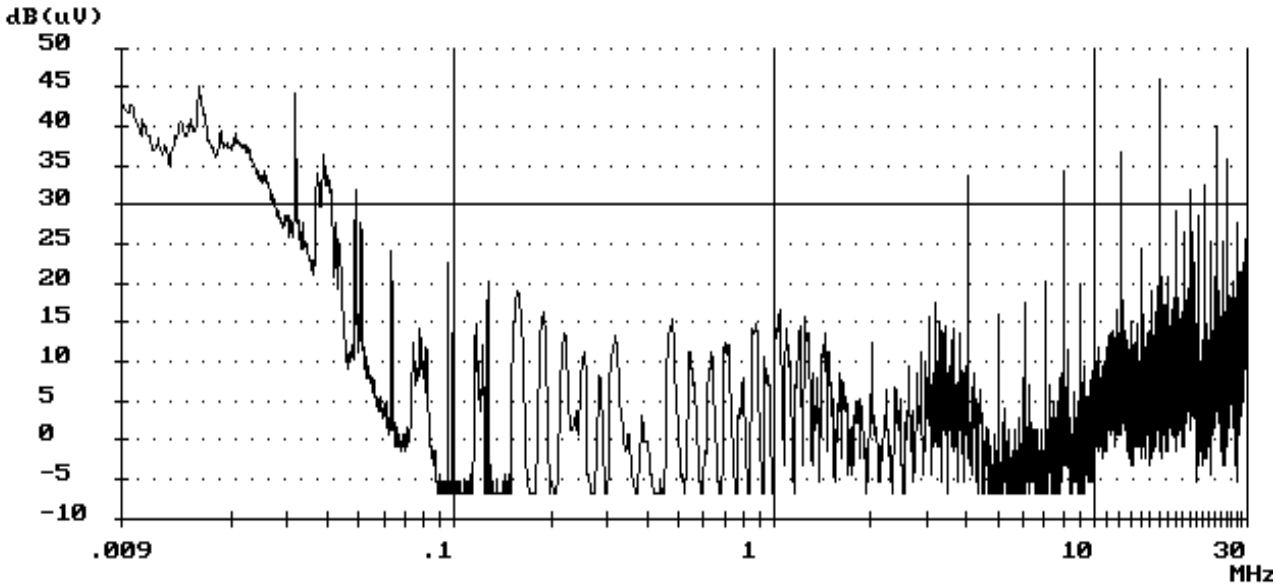
DESCRIPTION, DATA SHEET

Interference Measuring Receiver
9 kHz - 30 MHz

FCKL 1528





The receiver covers EN, FCC, VDE and CISPR - Specifications

The receiver can be used for measurement acc. to E 0871 to 0879
and EN 55011 to 55022

- ♦ Frequency range 9 kHz - 30 MHz
- ♦ 10 Hz - Frequency steps
- ♦ Conducted interference measurement with L.I.S.N.
- ♦ Field strength measurement with adapter.
- ♦ Integrated power attenuator for receiver protection.
- ♦ Optional high level tracking generator is ideal to measure ***Lamp attenuation acc. to EN 55015.***
  Also for filter attenuation, free area attenuation and to drive power amplifiers.
- ♦ Manual Operation, semi-automatic operation with xy-recorder and PC-control via IEEE-bus using the Schwarzbeck software.
- ♦ Fast 100% CISPR Quasipeak-measurement with VARISCAN.

For many decades, most of the interference measuring receivers were used in laboratories. They were operated manually using their front panel.
This type of operation including front panel control will still be there in the future, but PC-control gives value added measurement because of increased speed and better documentation.

The unique R.F. and analogue circuits of the FCKL 1528 give precise measurement with or without PC-control. The receiver comes complete for EMI-measurement, but can be upgraded with useful options.

Characteristics of the FCKL 1528

Unique R.F. - circuitry

- ◆ Attenuator with r.f.-relays uses resistive Π-attenuators with 1 dB steps. Total resistive attenuation is 95 dB.
- ◆ Switchable 10 dB high-power-attenuator with 10 W for safe measurement with L.I.S.N.s up to 4 x 400 A.
- ◆ 5 Input filters. Shape factors optimised for EMI - measurement.
- ◆ CISPR standard filters with 200 Hz and 9 kHz / - 6 dB. Filters are classic double tuned band filters.
- ◆ Integrated 25 Hz / 100 Hz Pulse-standard for CISPR Band A and B similar to IGLK 2914 for calibration. Error is compensated by a EPROM list.
- ◆ Integrated (optional) tracking generator with 120 dBµV (1 V) / 50 Ω for measurement of ***Lamp attenuation,*** filter attenuation, field attenuation with an-tennas and amplifier drive.

High precision measurement

- ◆ Meter with 2 large scales.
  Linear voltage scale with 1 dB - scaling for the amplitude range -10 dB / 0 dB centre of meter +6 dB according to EN 55014 C.2.1.

  Logarithmic overview -25 dB / 0 dB centre of meter +25 dB
- ◆ 12 Bit A/D-converter

Easy to use

- ◆ Functional areas of controls and displays.
- ◆ Small size, moderate weight
- ◆ Rugged Aluminium cabinet
- ◆ Low heat dissipation
- ◆ Due to effective shielding no problems even when used in the shielding room.

Modes of operation

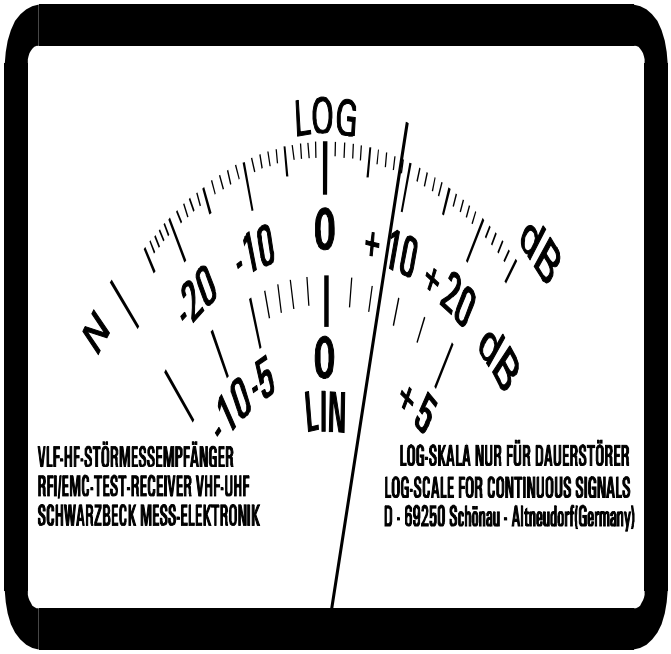
The FCKL 1528 covers the following modes:

- Manual operation with manual frequency tuning and reading the measurement from the meter.
- Semi-automatic operation using an xy-recorder for the reading.
- PC-controlled operation via IEEE - bus with Schwarzbeck Software.

Manual operation

As no other this mode of operation gives direct access to the receiver without any collision with PC or software. Especially in the measuring field outside of a shielding room, broadcast signals can be identified using the demodulator/loudspeaker. CW-signals can be monitored with 0 kHz and 1 kHz beat frequency.

Reading can be seen clearly on the meter which gives perfect reading from narrow band signals down to single click.



- The meter uses the classic 0 dB centre of meter scaling for safe measurement without interpretation.

- The linear scale gives true linear voltage reading avoiding problems with slow pulses.

- For any interference signal from continuous distortion to single click 0 dB centre of instrument is free of overload problems. For overview a 50 dB scaling can be used.

Semi-automatic operation

Spectrums can be recorded when the receiver is used in the scan mode together with an xy-recorder. The time consumption is reduced substantially, because VARISCAN adjusts scan speed to the signals ahead. So spectrum can be scanned directly in CISPR-Quasipeak to avoid switching CISPR/Peak.
The xy-recorder can be used in manual tuning mode as well. The xy-recorder then follows the manual frequency tuning on the encoder.
Doing so, it is very easy to stop on critical frequencies to find the maximum signal strength, which will be kept by the xy-recorder.

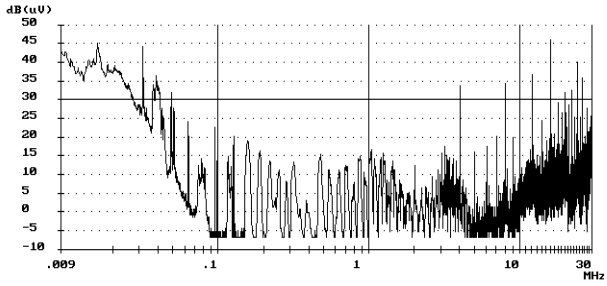
PC-controlled mode

Using a standard PC, a IEEE-card and the Schwarzbeck software together with the FCKL 1528 gives PC-controlled measurement. Modern PCs offer high speed and high capacity hard disks which improves considerably storage and documentation of measurement.
Primary goal of development was safe measurement of the complete range of interference signals keeping the high standard of manual measurement. This means that there must be no trade off considering even slow pulses.
The completely new approach using the fourth demodulator included in VARISCAN gives fast Quasipeak-measurement without using the Peak detector, which shows a very different behaviour. VARISCAN analyses the signal ahead before it is really measured. Practical spectrum often shows amplitude jitters which could be subject to misinterpretations using the Peak detector to decide which signal has to be re-measured in CISPR or not.

Using VARISCAN one thing is sure:

One Frequency - One Reading - CISPR only

The second step towards safe measurement is controlling the receiver by the limits given in the standards. Basically autorange can catch any signal, but there are restrictions when slow pulses occur. The way out of the problem is to guide the receiver along the limits in such a way, that it is centred in the middle between noise and overload. Even antenna factors are included in this strategy.



Special characteristics

- Measurement graphic appears on the monitor screen in real time without any delay. Results of changes can be seen immediately.
- VARISCAN gives fast general coverage CISPR - Quasipeak - Measurement without using other detectors.
- Receiver is controlled by the amplitude limits in the standards. This means safe measurement from narrow band signal to single click and optimised centring of the dynamic range exactly on the limit.
- No problems because of fast signal variations. Measurement is always in CISPR.
- AUTORANGE for automatic control of attenuator.
- Optimised control of 0 dB / 20 dB IF-attenuation (low distortion / low noise) using standard and pulse mode.
- Choice between single and continuous scan. New measurement erases old measurement with different colour.
- High precision using 12 Bit A/D-Converter for the meter voltage.
- Logarithmic function made by software, not by analogue circuitry.

- Powerful and fast zooming controlled by a "mouse". Zooming covers both frequency and amplitude axis.
- Storing of zoomed graphic.
- 200 settings can be stored permanently.
- 200 limits can be stored permanently.
- 200 transducer files (antennas a.s.o.) can be stored permanently.
- 200 Graphics can be permanently stored uncompressed. This means unconditional access to the full graphic resolution.
- Complete numeric list amplitude versus frequency can be stored.
- Complete numeric list of amplitude higher than limit can be stored.
- List of characteristic amplitude and frequencies can be stored.
- Graphic with frequency axis in linear or logarithmic scaling.
- Superposition of 2 measurements in 1 diagram.
- All files areDOS/ASCII-files easy to read with standard software.
- Direct printing with virtually all common printers (Needle, ink, laser).
- Easy export of graphic as pcx-files for DOS and WINDOWS software.
- Recording of amplitudes versus time up to 2 hours.
- Optional software to convert filter measurement to positive attenuation on y-axis.

Data Interface

IEC-Bus-Interface: Connector 24 sockets

Sub D-Connector 25 sockets

- Supply Voltages d.c. +12 V / -12 V for auxiliary equipment
- XY-recorder control Frequency Amplitude, Penlift
- Output voltage of active Demodulator (Envelope) for auxiliary or monitoring with Oscilloscope
- **Sub-D-connector 9 sockets for L.I.S.N-control**

BNC-Outputs

- I. F.-Output
- Tracking generator output 120 dBμV 50 Ω (optional)

Mechanical Construction

Rugged, light weight aluminium cabinet. Frame of special profiles, side walls are plastic covered.

2 handles on the front panel for easy transportation.

19" modification on request.

All r. f. units are within a double shielding.

Principle Operation

The triple conversion EMI-Receiver FCKL 1528 covers the frequency range 9 kHz- 30 MHz.

Special features:

- R. F.-attenuator on receiver input from 0 dB - 95 dB in 1 dB steps.
- Build in power attenuator with 10 dB attenuation (+20 dB I.F.-atten.)
- Five R. F. prefilters, especially optimised for EMI requirements.
- Separate, optimised R.F. front ends for the 2 frequency ranges 9 kHz - 150 kHz and 150 kHz - 30 MHz.
- Automatic Calibration with *CISPR-Band A-Quasi-peak standard pulse 25 Hz for the frequency range 9 kHz - 150 kHz. CISPR-Band B-standard pulse 100 Hz for the frequency range 150 kHz - 30 MHz.*
  The build in generators are similar to the *world wide standard generator IGLK 2914,* but have lower output level. Correction factors are pro-grammed into an EPROM list.
  So there is always a precise pulse reference present. Calibration can be monitored by loudspeaker and meter.
- Synthesiser with crystal reference for all oscillator frequencies.
- Shottky-Diode-symmetric mixers only.
- Standdard 200 Hz filter with 4 pot cores. 9 kHz - filter with 4 crystals.
- Active envelope demodulator, extremely linear using negative feedback operational amplifiers and low voltage Shottky-diodes.
- Four detectors, three of them are measuring detectors, the fourth is the VARISCAN-detector to decide broad- from narrow band signals.
- Very fast 12 Bit A/D-converter.
- Demodulator for AM and A0 (CW). Beat frequencies 0 kHz / 1 kHz
- Build in loudspeaker.
- Optional High-level tracking generator for filter- and field attenuation measurement and to drive power amplifiers.

FCKL 1528 Technical data

Frequency range	9 kHz - 30 MHz
Frequency tuning with encoder wheel	10 Hz - 10 kHz,
Display	6 digits LED
Software	Start- and Stop frequency random, random steps > 10 Hz, automatic scanning with graphic.
Frequency error	$3*10^{-6}$ +-45 Hz

R.F.-Input	BNC-connector, 50 Ω
SWR	< 1.2 for attenuator >10 dB < 2 for attenuator 0 dB
Oscillator voltage on R.F. Input	< 30 dBpW for attenuator 0 dB, < 20 dBpW for 10 dB power attenuator.

R.F.-Prefiltering

5 Bandpass filters switched by relays	1	9 kHz - 150 kHz
	2	150 kHz - 3 MHz
	3	3 MHz - 10 MHz
	4	10 MHz - 20 MHz
	5	20 MHz - 30 MHz

Calibration

Pulse standard for CISPR 16-1-1 Band A
Standard 25 Hz, nom. 30 dBµV (25 Hz)
Pulse standard for CISPR 16-1-1 Band B
Standard 100 Hz, nom. 30 dBµV (100 Hz)

Maximum Input Level

R.F-attenuation 0 dB (no D. C. - isolation)

D.C.	7 V
Sine wave R.F. voltage	130 dBµV (3,16 V)
R.F.-attenuation	10 dB (D. C.-isolation)
Spectrum pulse density	96 dBµV/MHz

R.F.-attenuation 10 dB power attenuator

D.C.-voltage	15 V
Sine wave R.F. voltage continuous	141 dBµV (3 W)
Intermittent 20% on, Burst <0,5 sec.	143 dBµV (5 W)

Spurious, Large Signal Handling Capability

Image frequency atten.	>65 dB / typ. 90 dB
I.F.-isolation	>70 dB / typ. 90 dB
Spurious:	None

Third order Intercept d3 standard setup >25 dBm,
(>15 dBm w.o. power attenuator.)

R.F.-feed through
(1 dB error, w.o. receiver frequ.)10 V/m

I.F. frequencies

range	9 kHz - 150 kHz
1. I.F.	455 kHz
2. I.F.	45 kHz
range	150 kHz - 30 MHz
1. I.F.	40 MHz
2. I.F.	455 kHz
3. I.F.	45 kHz

I.F.-Filter bandwidths acc. to CISPR 16-1-1
200 Hz / 9 kHz (-6 dB)

Noise indication	(bandwidth 200 Hz)
Average	typ. < -26 dBµV
Peak	typ. -13 dBµV
CISPR Quasipeak	typ. < -26 dBµV
Noise indication	(bandwidth 9 kHz)
Average	typ. < -10 dBµV
Peak	typ. < -3 dBµV
CISPR QP	typ. < -10 dBµV

Range for voltage measurement
(bandwidth 200 Hz)
Lower limit for <1 dB noise error

Average	typ. < -21 dBµV
Peak	typ. < -1 dBµV
CISPR QP Pulse 25 Hz	typ. < - 21 dBµV

Range for voltage measurement
(bandwidth 9 kHz)

Average	typ. -3 dBµV
Peak	typ. +12 dBµV

CISPR QP Pulse 100 Hz typ. < -3 dBµV

Level Indication

Digital	3 digit LED display for reference level
Analogue	Meter with 0 dB centre of instrument. Voltage linear scale with dB scaling w.o. logarithmic converter. Logarithmic scale with -25 dB / 0 dB / +25 dB (low noise).

Recording with XY-recorder	Y-axis within dynamic range of demodulator linear or logarithmic acc. to meter scale. X-axis via EPROM list and D/A-converter derived from receiver frequency. Prefabricated measure-ment diagrams ready to use.
Recording with PC-control and Software	Graphic with 180 dB range, Y-Axis with units defined by transducer (antenna, clamp a.s.o. in dBµV, dBµV/m, dBµA/m dBpW a.s.o.) X-axis lin. or log. Start- and Stop frequency define range and scaling. Zoom for X and Y- axis.
Detectors	Average, Peak, Quasipeak (CISPR)

Error analogue, digital

< 1 dB (0 dB centre of meter, limit)

Demodulation AM, A0 (CW, BFO)
Beat frequencies 0 kHz and 1 kHz.
Both zero beat frequency measurement and 1 kHz CW identification is possible even with 200 Hz - I.F.-Filter.

Inputs, outputs

Analogue

Recorder outputs	Y-axis, amplitude 0 dB centre of meter corresponds to 0,5V linear, logarithmic, Ri < 10 kΩ X-axis, frequency, 9 kHz at 0 V, 30 MHz at 1,000 V Pen Down Ri < 2 kΩ
Measuring outputs	Active demodulator (Envelope of I.F.) 0 dB centre of meter corresponds to 150 mV, Ri > 10 kΩ Pulse weighted output see Y-axis xy-recorder I.F.-output optional
Supply voltages for auxiliaries	+12 V / 100 mA -12 V / 50 mA

Control and supply

L.I.S.N.	4 Bit code
Connector 9-sockets	Path select, +12 V supply
Conn. 24-sockets	IEEE-Bus-Controller

Options

Tracking generator	(optional, build in)
Frequency range	9 kHz-30 MHz
Frequency steps	same as receiver
Output voltage	120 dBµV (1 V) / 50 Ω
Control	Rotary switch on front panel, Software

Option 19" build in capability

General

Nominal temperature range	0°C to 50°C
Storage temperature range	-20°C to +70°C
Cooling	Temperature controlled, low noise cooling fan.
EMI	acc. VDE 0876, 1a
Shock, Vibration	acc. to DIN IEC 68-2-27/29
Power supply	110,130,220,240 V +-10% 50 , 60 Hz 80 W 12 V DC optional

Cabinet

47 mm x 180 mm x 460 mm
approx. 17 kg

Standard accessories

Mains cable,
Operation manual

Standard acc. for PC-control

Software,
IEEE-card,
Bus cable,
Software manual.
IEEE-Bus controller

Recommended accessories

A) Measuring conducted voltage with manual or software control.

L.I.S.N.	2 x 10 A	NSLK 8127
L.I.S.N.	4 x 16 / 25 A	NSLK 8126
L.I.S.N.	4 x 32 / 50 A	NSLK 8128
L.I.S.N.	4 x 100 A	NNLK 8121
L.I.S.N.	4 x 200 A	NNLK 8129
L.I.S.N. 150 Ω / (V)	4 x 25 A	NNBM 8112
L.I.S.N. 150 Ω / (V)	2 x 10 A	NNBM 8114
L.I.S.N. 150 Ω / Delta (symm./asymm.)	2 x 10 A	NNBM 8116
Automotive L.I.S.N. 5 µH // 50 Ω, 70 A, 1 Path		NNBM 8125
Automotive 5 µH // 50 Ω, 100 A, 1 Path		NNBM 8126 A
300 MHz, 10 (20) A		NNBM 8126 B
VHF - L.I.S.N. 4 x 25 A, DC/AC 50/60/400 Hz		UNN 8122

T - L.I.S.N. (Telecommunication)

T-L.I.S.N HF, 10 kHz-30 MHz	NTFM 8132
T-L.I.S.N. VHF, 300 MHz	NTFM 8133
T-L.I.S.N. Extremely symmetric	NTFM 8135
T-L.I.S.N. Four wire, 9 kHz-30 MHz 150 Ω	NTFM 8138

B) Probes for conducted voltage

R.F.-Probe,	150 Ω	TK 9415
R.F.-Probe,	1,5 kΩ	TK 9416
R.F.-Probe	2,5 kΩ	TK 9417
High voltage probe		TK 9420

C) Adapters for field strength

Adapter for magnetic field strength 9 kHz-30 MHz with constant conversion factor	FMZB 1516
Adapter with small loop, up to 20 V/m fictive E - Field strength	FMZB 1517
same as FMZB 1517, but up to 150 V/m fictive E - Field strength	FMZB 1527

D) Others

Transformers, converters

Symmetric/Unsymmetric transformer 105 Ω	SYM 9223
Current converter 10 kHz - 200 MHz	SW 9602

Modulator HM 7001 9 kHz-30 MHz for modulated R.F. acc. to IEC 801

Near field probes FS-SET 7100, magnetic, elektric, separator, power supply, Box.

FCVU 1534 is the corresponding EMI receiver for the frequency range 20 MHz - 1050 MHz. It is especially designed for EMI-requirements in this frequency range. A build in power attenuator protects the receiver under all circumstances.

The optional external preamplifier uses a standard coaxial cable for remote power supply and remote control. Connecting the preamplifier directly at the antenna eliminates cable loss.

The optional tracking generator delivers 1 V / 50 Ω . It can be used for filter measurement with extremely high dynamic range or for testing attenuation between 2 antennas in free area or anechoic chamber.

The receivers are similar in manual and PC controlled operation.

A multitude of antennas, clamps and other accessories makes this receiver a versatile tool for EMI - measurement.

This is only a part of our EMI - program. Please ask for more information.

Equipment may be subject to modification without any notice. Specifications without tolerance should be considered as order of magnitude.