SCHWARZBECK MESS-ELEKTRONIK
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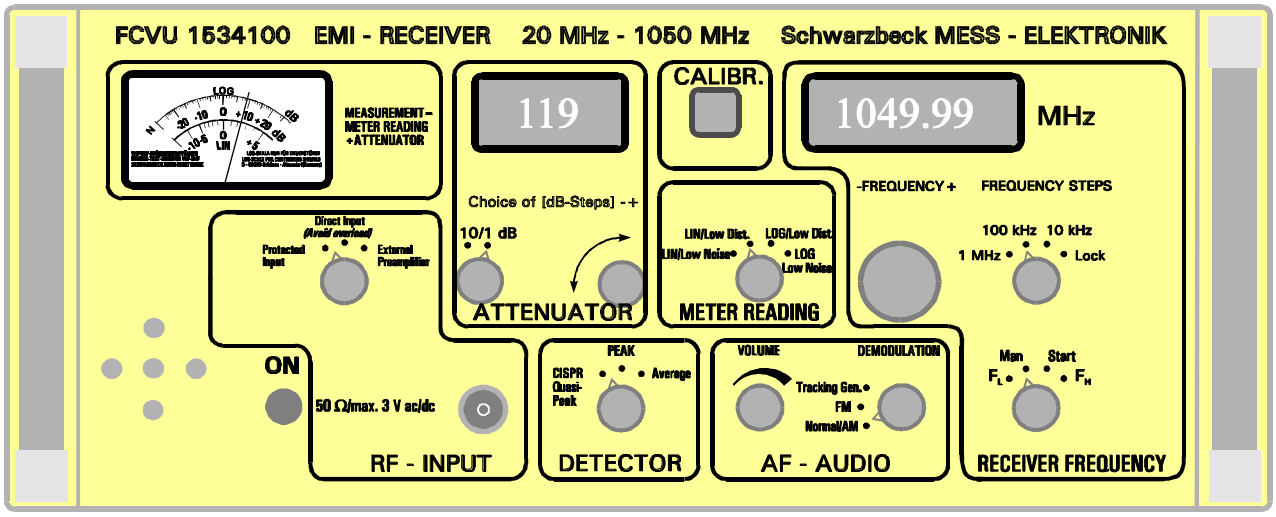
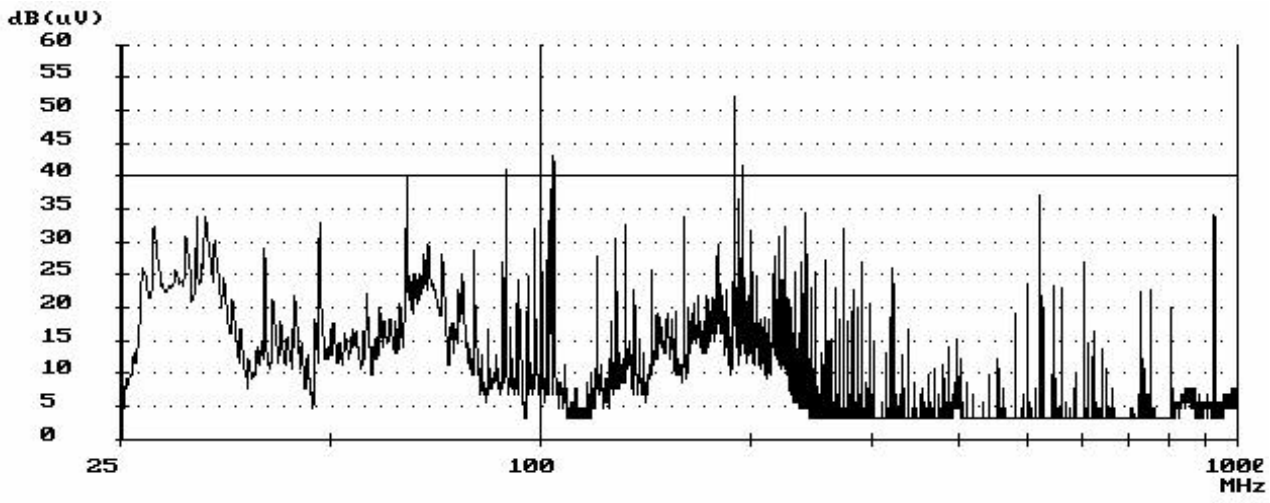
DESCRIPTION, DATA SHEET

Interference Measuring Receiver
20 MHz - 1050 MHz

FCVU 1534





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

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

- ♦ Frequency range 20 MHz - 1050 MHz
- ♦ Field strength measurement with antennas.
- ♦ Measurement of interference power with clamps.
- ♦ Measurement of conducted voltage with automotive L.I.S.N.s
- ♦ Integrated Power attenuator for receiver protection.
- ♦ Optional external Preamplifier for best sensitivity.
- ♦ Optional high level tracking generator is ideal to measure filter attenuation and to drive power amplifiers.
- ♦ Manual operation, semi-automatic operation with xy-recorder and PC-control via IEEE-488 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 FCVU 1534 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 FCVU 1534

Unique R.F.-circuitry

- ◆ Attenuator with coaxial relays uses resistive Π-attenuators with 2-dB-steps. Total resistive attenuation is 89 dB. (1-dB-steps in i.f.-stage)
- ◆ Switchable 10 dB High power attenuator for receiver protection.
- ◆ 7 selective preamplifiers with 28 tuned circuits for best large signal handling capability combined with low noise.
- ◆ Build in 100 Hz Pulse standard similar to IGU 2912 for calibration. Error is compensated by a EPROM list.
- ◆ Low noise, low distortion GaAs-MMIC preamplifier (Option) can be used directly at the antenna eliminating cable loss. The standard coaxial cable is used for remote power supply and remote control.
- ◆ Integrated (optional) tracking generator with 120 dBµV (1 V) / 50 Ω for measurement of filter attenuation, field attenuation with antennas and drive of power amplifiers acc. to ***IEC 801.*** **(**External optional modulator)

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 neter / +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.

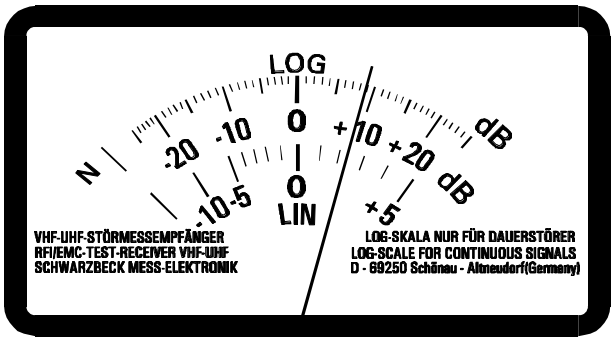
Modes of operation

The FCVU 1534 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. Both AM and FM signals can be monitored.
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 to measure safe 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 spectrums can be scanned directly in CISPR-Quasipeak and avoids 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

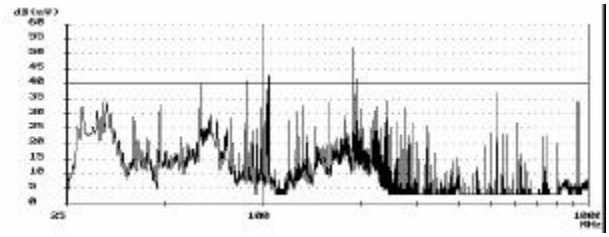
Using a standard PC, a IEEE-card and the Schwarzbeck software together with the FCVU 1534 gives PC-controlled measurement. Modern PCs offer high speed and high capacity hard disks which improves considerably storage and documentation of measurement.
Primary goal of development was safe measurement of 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 spectrums often show 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 amplitudes versus frequency can be stored.
- Complete numeric list of amplitudes higher than limit can be stored.
- List of characteristic amplitudes and frequencies can be stored.
- Graphic with frequency axis in linear or logarithmic scaling.
- Superposition of 2 measurements in 1 diagram.
- All files are DOS/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 for Frequency, Amplitude, Penlift.
- Output voltage of active Demodulator (Envelope) for auxiliary or monitoring with Oscilloscope
- Sub-D-connector 9 pins 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.

Priciple Operation

The quadruple conversion EMI-Receiver FCVU 1534 covers the frequency range 20 MHz - 1050 MHz.

Special features:

- R.F.-attenuator on receiver input from 0 dB - 89 dB in 2 dB steps.
- Build in power attenuator with 10 dB attenuation (+20 dB I.F.-atten. Low Dist)
- Seven narrow band, high level, low noise preamplifiers. Tuned bandfilters at input and output. A total of 28 tuned, tracking circuits. Tuning voltage is derived from a EPROM list via a D/A-converter.
- Automatic Calibration with *CISPR Quasi-peak standard pulse 100 Hz.* The build in generator is similar to the world wide standard generator IGU 2912, but has lower output level. Correction factors are programmed into an EPROM list. *So there is always a very 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.
- Standard 120 kHz-Filter in the fourth I.F..
- Active envelope demodulator, using OTA current feed back 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 FM
- Build in loudspeaker.
- Optional High-level tracking generator for filter- and field attenuation measurement and to drive power amplifiers.

FCVU 1534 Technical data

Frequency range	20 MHz - 1050 MHz
Frequency tuning with encoder wheel	10 kHz, 100 kHz, 1 MHz
Display	6 digits LED
Software	Start- and Stop frequency random, random steps > 10 kHz, automatic scanning with graphic.
Frequency error	$3*10^{-6}$
R.F-Input	N-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-amplifier frequency ranges

7 amplifiers with tracking band-filters at in- and output

1	20 MHz -	50 MHz
2	50 MHz -	100 MHz
3	100 MHz -	200 MHz
4	200 MHz -	400 MHz
5	400 MHz -	600 MHz
6	600 MHz -	800 MHz
7	800 MHz -	1050 MHz

Calibration

Pulse standard for CISPR-Standard pulses 100 Hz
Voltage nom. 30 dBµV (100 Hz)

Maximum Input level (w.o. ext. preamplifier.)

R.F-attenuation 0 dB (D. C.- isolation)
D.C. voltage 15 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 (<0,5 ns)

R.F.-attenuation 10 dB power attenuator
D.C.-voltage 15 V
Sine wave R.F.-voltage 137 dBµV (1 W)

Spurious, Large Signal Handling Capability

Image frequency atten. >65 dB/typ. 90 dB

I.F.-isolation >70 dB/typ. 90 dB
Third order Intercept d3 standard setup >17 dBm

R.F.-feed through

(1 dB error, w.o. receiver frequ.) 10 V/m

I.F.-frequencies

1. I.F. ranges 1-4	300 MHz
1. I.F. ranges 4-7	500 MHz
2. I.F.	82,72 MHz
3. I.F.	10,72 MHz
4. I.F.	2,03 MHz

I.F.-Standard filter bandwidths acc. to CISPR 120 kHz (-6 dB)

Noise indication

Average (120 kHz)	-5 dBµV (typ. -7 dBµV)
Peak (120 kHz) typ.	+1 dBµV
CISPR Quasipeak	typ. -4 dBµV

Noise indication with ext. preamplifier

Average (120 kHz)	typ -11 dBµV
Peak (120 kHz) typ.	-5 dBµV
CISPR Quasipeak	typ. -10 dBµV
Pulse compression	1 dB at 30 dBµV, 100 Hz CISPR Standard pulse

Range for voltage measurement

Lower limit for <1 dB noise error
Average (120 kHz) -1 dBµV
Peak (120 kHz) +15 dBµV
CISPR Quasipeak
Standard pulse 100 Hz <4 dBµV

with ext. preamplifier.
Average (120 kHz) -7 dBµV
Peak (120 kHz) +8 dBµV
CISPR Quasipeak
Standard pulse 100 Hz < -2 dBµV

Upper limit 137 dBµV (3,16 V)

with ext. preamplifier.
116 dBµV sine wave.

Spurious equiv. < - 3 dBµV
typ.: None

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 linear or
logarithmic.	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, FM

Inputs, outputs

Analogue

Recorder outputs	Y-axis, amplitude 0 dB centre of meter corresponds to 0,5 V linear logarithmic, Ri < 10 kΩ X-axis, frequency, 30 MHz at 0 V, 1000 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. 15 mV, Ri > 10 kΩ Pulse weighted output see Y-axis xy-recorder I.F.-output optional
Supply voltage for auxiliaries	+12 V / 100 mA -12 V / 50 mA

Control and supply

of optional external preamplifier	build in 5 V /100 mA on centre of R.F.-input N-connector (fuse on rear panel)
Digital	IEEE-Bus connector 24 socket

Options

Tracking generator	(optional, build in)
Frequency range	30 MHz-1000 MHz
Frequency steps	Same as receiver
Output voltage	120 dBµV (1 V) / 50 Ω
Control	Rotary switch on front, panel, software
Preamplifier	(optional, separately)
Frequency range	20 MHz-1050 MHz nom.
Amplification	10 dB typ.
Pulse compression	1 dB at 30 dBµV CISPR-Standard pulse 100 Hz
Connectors	N-socket, N-pin
Control	Switching amplifier ON/OFF via coaxial cable from front panel switch or software
Power supply	Remote supply via coaxial cable.
Dimension	(w.o. connectors) 50 mm x 30 mm x 30 mm

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. to 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 12V DC optional

Cabinet

B x H x T mm	447 mm x 180 mm x 460
	approx. 17 kg

Standard accessories

Mains cable,
Operation manual

Standard acc. for PC-control Rechnersteuerung

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

Recommended accessories

A) Measuring conducted voltage with manual or software control.

with automotive L.I.S.N. up to 300 MHz	NNBM 8126 b
50 Ω / 4 x 25 A up to 300 MHz	UNN 8122

B) Interference power

Absorbing clamp 30 MHz-1000 MHz	MDS 21
Absorbing clamp to 2 GHz	MDS 22

C) Radiated field strength with antennas

Biconic elements 30-300 MHz	BBA 9106
Holder for above elements	VHA 9103
Holder with balun 50/200 Ω	VHBA 9123
Holder with balun 50/200 Ω extr. symm.	VHBB 9124
Biconic antenna 200-100 MHz	UBA 9116

Log. Per. Antennas

VHF-UHF Log.-Per. Ant. 75 (50)-1500 MHz	VULP 9118 E
VHF-UHF Log.-Per. Ant. 95 (80)-1500 MHz	VULP 9118 D
VHF-UHF Log.-Per. Ant. 140-1100 MHz	VULP 9118 C
VHF-UHF Log.-Per. Ant. 170-1100 MHz	VULP 9118 B
VHF-UHF Log.-Per. Ant. 200-1100 MHz	VULP 9118 A
Log.-Per. Ant. 300-1000 MHz	UHALP 9108 A
Logbicon Super- Broad band-Combinations	VULB 9160 VULB 9165

λ/2 Dipole antennas with telescopes

VHF-Dipole with Telescopes	VHA 9103
UHF-Dipole with Telescopes	UHA 9105

Precession-Dipoles

VHF Precision-Dipole 30 MHz-300 MHz	VHAP
UHF Precision-Dipole 300 MHz-1000 MHz	UHAP

Cable

Calibrated coaxial cable Length 10 m	AK 9513

Mast

Complete mast, can be disassembled for, easy transportation, 4 m high	AM 9104
Small antenna mast	AM 9144

D) Others

Transformers, Transducers, Modulators

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

Modulator UVM 7002 30 MHz-1 GHz for modulated R.F. acc. to IEC 801

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

FCKL 1528 is the corresponding EMI receiver for the frequency range 9 kHz-30 MHz It is especially designed for EMI-requirements in this frequency range. A build in power attenuator protects the receiver especially in combination with high power L.I.S.N.s.. The optional tracking generator delivers 1 V/50 Ω. It can be used for filter measurement with extremely high dynamic range or to drive power amplifiers.
The receivers are similar in manual and PC controlled operation.

A multitude of L.I.S.N.s, probes, field strength adapters 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.