



## R3000 EMI TEST RECEIVERS

Fully IF digital EMI Receivers family for measurement of electromagnetic interference from 9kHz to 3GHz

Data Sheet



Compact designed and manufactured in compliance with CISPR 16-1, for measurements of electromagnetic interference in accordance with the requirements of EMI standards such as CISPR, EN 550xx standards, continuously active pre-selectors, advanced software for EMC automation.

**R3000** EMI Receivers are PC based microprocessor controlled with advanced software for EMC automation. Fitted with continuously active pre-selectors that allow excellent dynamic range and precise EMC measurements covering the frequency range from 9kHz to 31GHz. These receivers are ideally suited for measurement of electromagnetic interference in accordance with the requirements of **CISPR** and **EN**.



## EMI MEASUREMENTS TO STANDARD

Optimized easy-to-use EMI measurement concept.

Fitted with the internal pre-selector/ preamplifier all AFJ R3000 models feature an excellent dynamic range and are, therefore, able to perform precise EMC tests.

Measurements to commercial EMI standards such as **CISPR**, **EN 550xx**, shall be carried out directly by comparing the EMI spectrum with the associated limit lines and switching on the appropriate detectors.

### MAIN FEATURES

- Peak, Quasi-Peak, CISPR Average, RMS and CISPR RMS
- Correct pulse weighting to CISPR 16-1 from PRF of 1Hz
- High measurement speed and fast detection of critical frequencies (dwell time down to 2msec)
- EMI measurement bandwidths 200Hz, 9kHz, 120kHz , 1MHz
- High sensitivity
- Large-signal immunity
- Low measurement uncertainty
- High measurement speed
- Correction values for attenuator / amplifier cables loss, coupling networks, GTEM correction and antenna k factors
- Overload indicator
- Touch screen display for on site stand alone usage
- Tracking generator

### CISPR COMPLIANCE

R3000 EMI Receivers fully complies with CISPR 16-1-1 and CISPR 16-2.

The response of R3000 Quasi-Peak Detector in terms of both **absolute calibration** and **relative calibration** lays between the tolerances of CISPR 16-1.

The pulse weighting conformity meets down to the minimum value of the Pulse Repetition Frequency (PRF) coming from the DUT, **of 1Hz**.

**Accuracy and reproducibility are key parameters for AFJ R3000 EMI Receivers application.**

R3000 EMI Receivers are PC-based and totally controlled by easy-running WINDOWS™ software.

Software enables the operator to set all parameters and set-up the EMI Receiver as requested by CISPR 16-1 or to tailor it according to his specific needs.

Some examples are:

- Frequency range and frequency step
- Detectors (Peak, Quasi Peak, CISPR Average, RMS, CISPR RMS and combination of them)
- Limits set by European and other Standards
- Correction factors
- GTEM correction factors

#### DATA BASE

Receiver settings, measurements set-up, tests and measurements, frequency tables, external devices correction factors are automatically saved into powerful **data base** according to the proper **work spaces** defined by the user.

#### PRE-SELECTION FILTERS

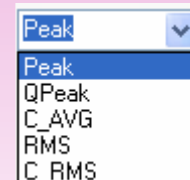
The input bandwidth of the front end is limited by pre-selection filters to reduce the total voltage level at the input mixer to an extent compatible with the wide dynamic range required for quasi-peak detection in the CISPR frequency range.

Up to 15 **fixed and tuned pre-selector filters** guarantee more than 40dB of attenuation for intermediate frequency, image frequency and intermodulation effects.

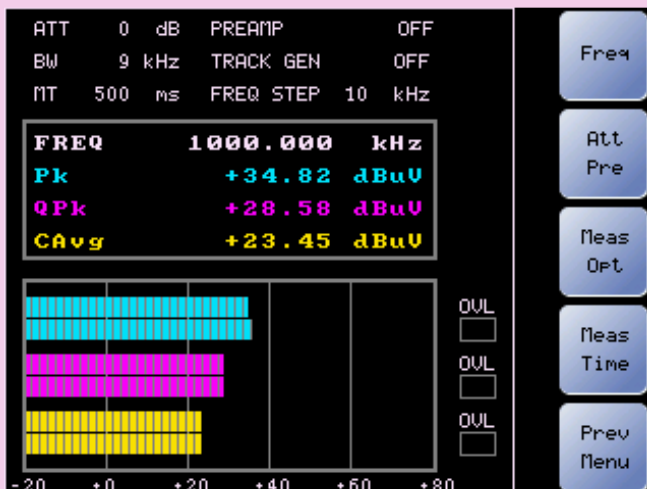
#### DETECTORS

Five different types of HW detectors and combinations of them can be selected by the user.

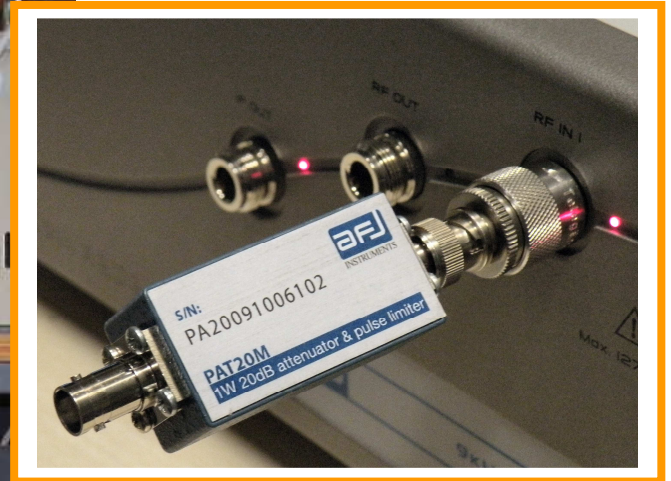
In addition to that, each detector type can be associated with a selectable timing, corresponding to the endurance of the measurement aperture gate.



In the Manual Mode, the bar graph, with current detector value and Max Hold display, shows the results of manual circuit adjustment an when DUT cabling is arranged for maximum emission.



Touch screen display for on site stand alone usage



#### Technical Specifications

Frequency Range	0Hz÷30MHz
Low pass filter up to	100MHz
Max continuous input power	1W
Max pulse input energy	1Ws (500μs)
Input / Output VSWR	1.05 / 1.15
Characteristic Impedance	50Ω
Insertion loss	20dB ± 0.3dB
In / Out RF connectors	BNC (f / m)
Dimensions	96x28x23mm
Weight	70g
Nominal Temperature range	-10°C÷+45°C
Storage temperature range	-25°C÷+70°C

A **Pulse Limiter/Attenuator** is required to protect the RF input stages of sensitive equipment from unpredictable spikes generated during conducted emission testing of a DUT.

We recommend the utilization of our Pulse Limiter/Attenuator with all our EMI receivers, in particular whenever DUT are tested for the first time.

These Spikes with high spectral density/Pulse energy can seriously damage all input stages such as, attenuators, pre-amplifier, preselector or mixer of our or other receivers as well as other RF sensitive equipment such as Spectrum Analysers.

PAT20M 20dB Attenuator is designed to stand Pulse Voltages up to 1Ws.

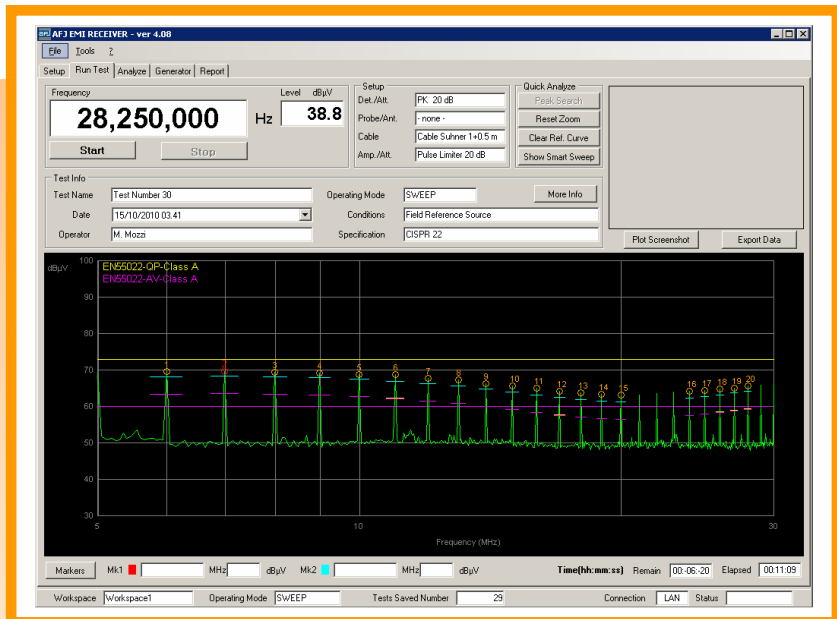
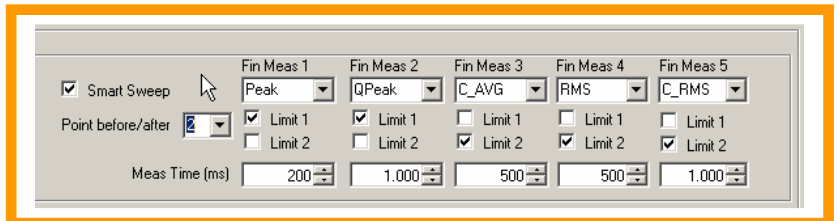
## SWEEP MODE

Fast overview measurements with logarithmic or linear frequency scale with tuning in user defined frequency step with selectable measuring time.



## SMART SWEEP

First measurement with one detector (usually Peak) and after peak searching the final measurement is repeated in these peaks with up to five detectors. Each peak can be check up to 10 points before / after, setting a Limit and a Measuring Time for each selected detector.

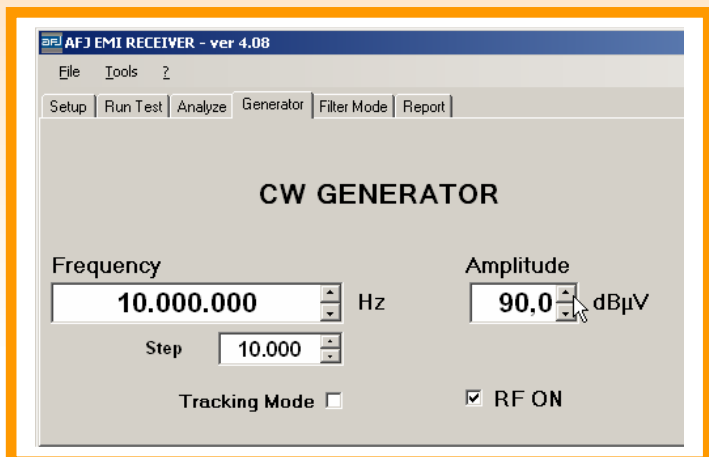


### Single Test Settings

Traces	Trace 1	Trace 2	Trace 3
Scan	Peak		
Limit 1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Limit 2	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

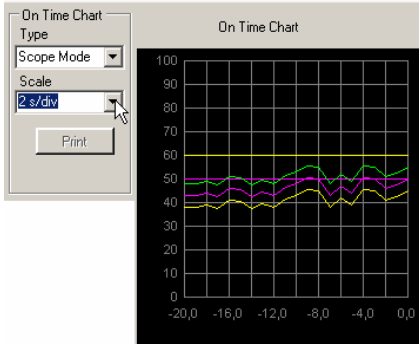
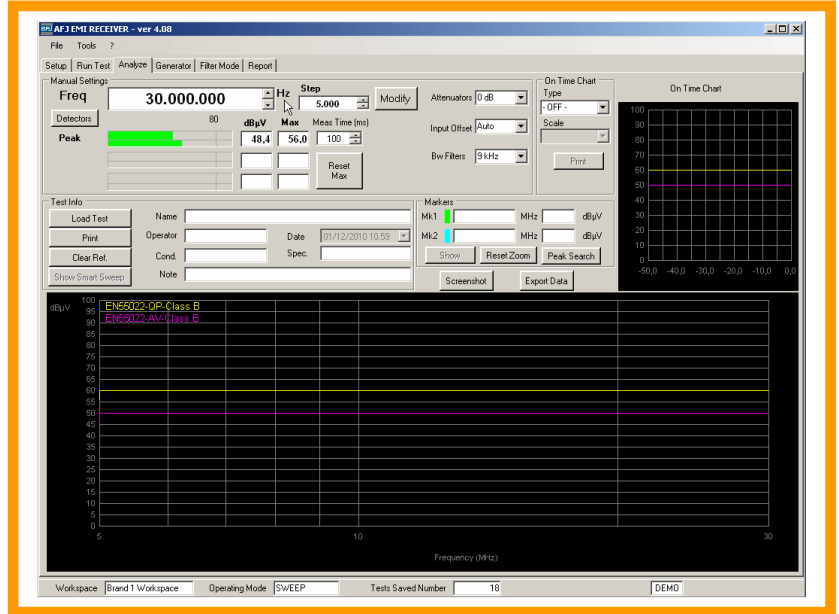
## TRACKING GENERATOR

CW Generator has to be activated by checking flag RF ON and then choosing the Tracking Mode (in this case a sweep is activated) or Single Frequency Mode.



## ANALYZE MODE

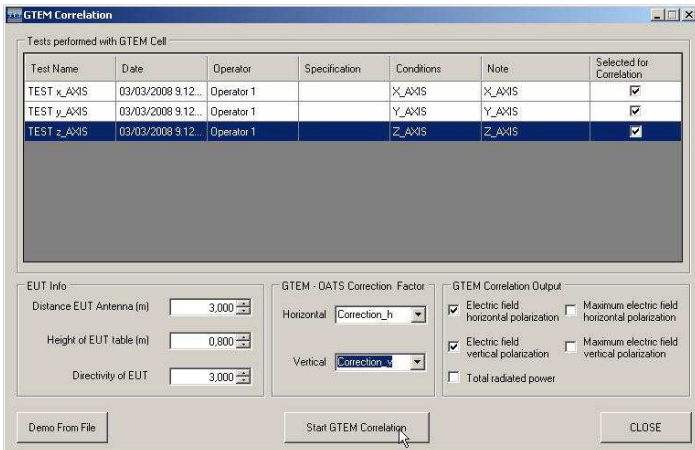
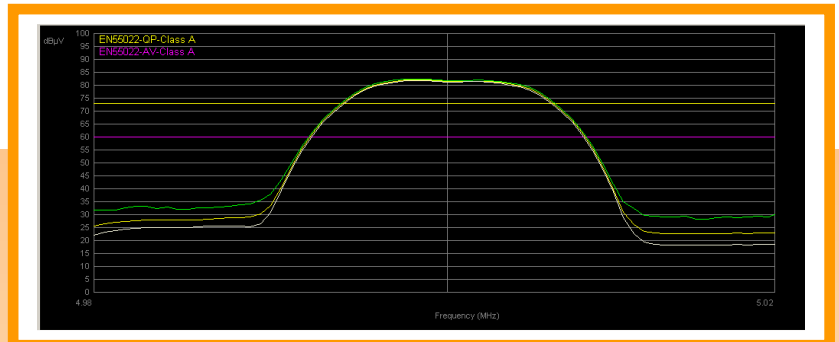
The purpose of the ANALYZE mode is to load old tests and measurements and perform monitoring of the events occurring on selected frequency through MANUAL settings, checking full sweep with MARKERS, PEAK SEARCH and ZOOM functions.



The **TIME DOMAIN** option allows to analyze the interference level on selected frequency in the time domain.

## ZOOM MODE

Performs a zooming operation on the diagram part that is selected pushing shift button of the keyboard and left key of the mouse at the same time. The new diagram can be checked with all ANALYZE MODE functions.

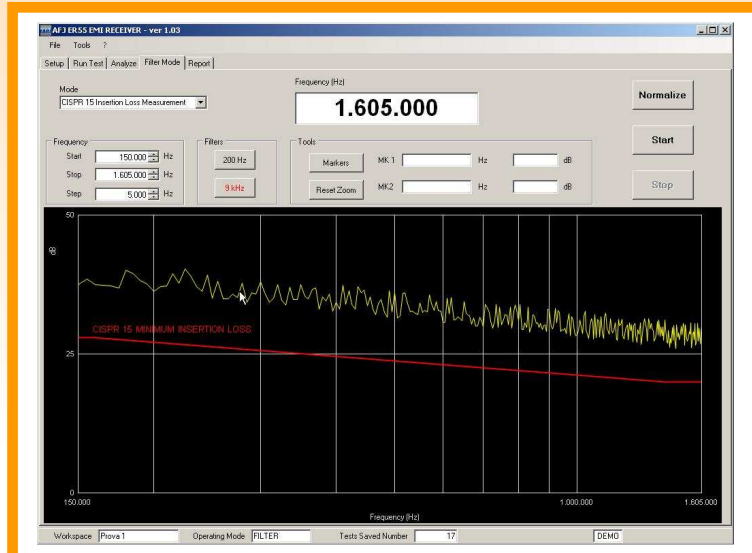


## GTEM CORRELATION

Software option allows end user to perform radiated emission measurements in GTEM cells and calculate final result through correlation algorithmic using measurement results and GTEM correction factors.

## CISPR 15 INSERTION LOSS

Software option allows end user to perform insertion loss measurements according to CISPR 15, selecting FILTER operating mode into the SET UP window.



## WORKSPACE

To define and set all data base work space parameters where all data and results will be automatically saved.

## TRACES

Five different types of HW detectors can be selected by the user to define up to three traces at the same time. Smart sweep can be activated and its parameters defined (points before / after, Limit and a Measuring Time for each selected detector).

## FREQUENCY TABLE

To set the parameters that will affect the SWEEP MODE.

## OPERATING MODE

To enables the selection of the measure conditions under which the R3000 Receiver will operate to perform the analysis  
**SWEEP, PEAK + QPEAK, FILTER**

## ANTENNA/PROBE, CABLE, Ampl/Att

To set Antenna/Probe correction factors, Cabling calibration files and additional device files (Amplifier and Attenuators).

The screenshot shows the AFJ EMI RECEIVER software interface with the following sections:

- Workspace:** Loaded Workspace (Workspace1), Display Name (Workspace1), D.U.T. (dut1), Model (model1), S/N (000).
- Single Test Settings:** Traces (Trace 1: Peak, Trace 2: Peak, Trace 3: Peak), Smart Sweep (checked), Point before/after (0), Meas Time (ms) (200).
- Frequency Table:**

Fstart	Fstop	Fstep	Bandwidth	Time (ms)	Attenuator Mode	Attenuator Level	Device	Antenna/Probe	Cable	Ampl/Att
9,000	150,000	100	200 Hz	2	Manual	0 dB	R3010	- none -	- none -	- none -
150,000	30,000,000	5,000	9 kHz	2	Manual	0 dB	R3010	- none -	- none -	- none -
- Diagram:** Freq Unit (Hz), Display Unit (dBμV), X start (9,000), X stop (30,000,000), X Division (10), Y start (-40), Y stop (70), Scale (Log), Point per Division (10), Auto Set Plot (checked), Enable Subrange Line (checked).
- System Automation:** LISN LINE (Neutral).

## Attenuator Level

- 0 dB
- 0 dB
- 0 dB
- 10 dB
- 20 dB
- 30 dB
- 40 dB
- 50 dB
- Preamp

## MANUAL ATTENUATION MODE

To set the right internal attenuation of the receiver to have the better dynamic range during measurement, with possibility to insert +20dB internal Preamp. All changes in this section, automatically affect the correction by a consistent extent.

## LIMIT

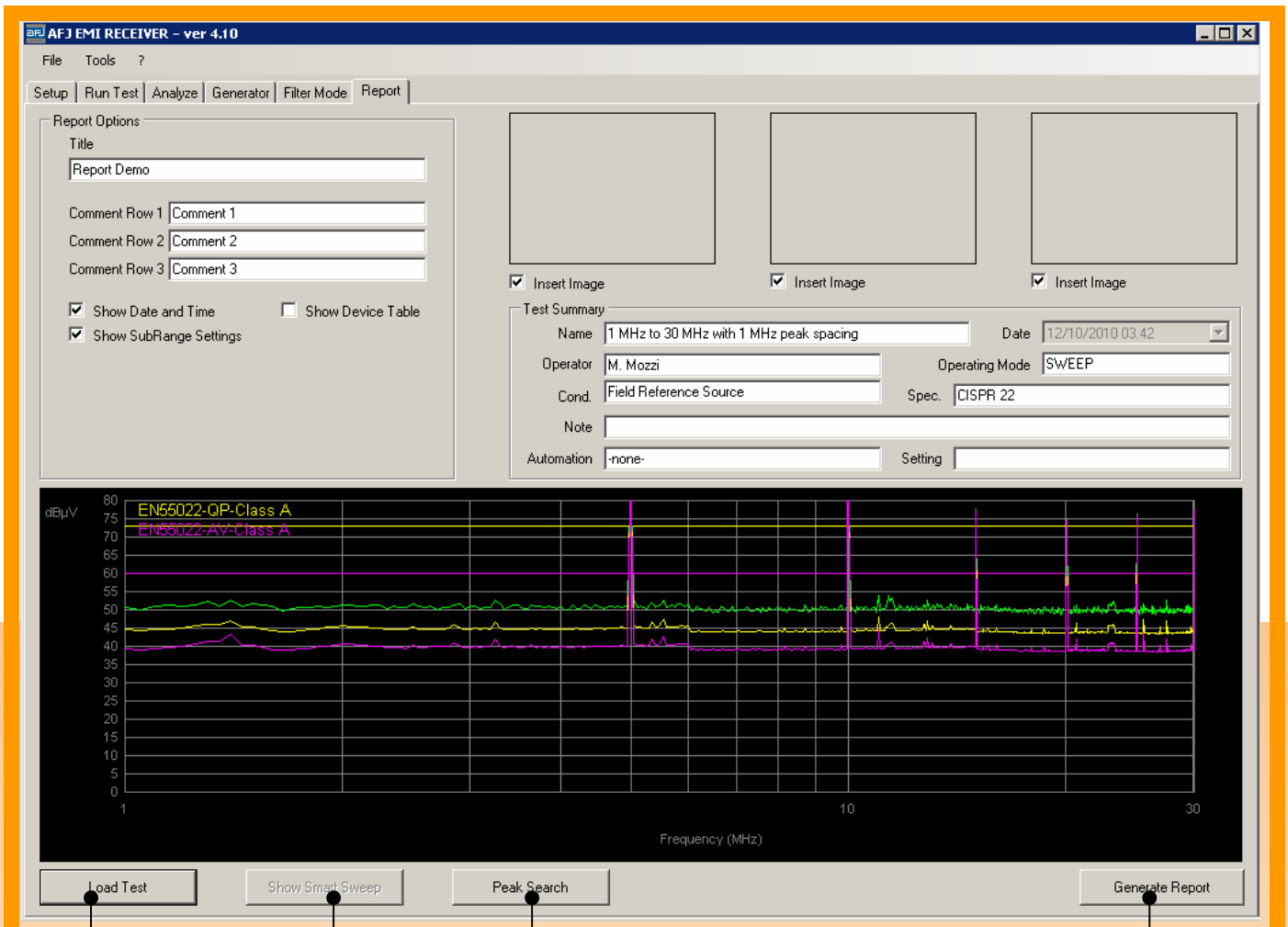
To recall of all possible **LIMIT files** that can be built using the **EDIT LIMIT** function.

## DIAGRAM

To set all necessary parameters for diagram settings.

## SYSTEM AUTOMATION

To control foreign equipment associated with the measurement site set-up, such as **LISN, Controller for Antenna Mast, Turntable and Slide Bar.**



## LOAD TEST

To load old tests and measurements and set all the necessary parameters and information for the test report.

## PEAK SEARCH

To search the peaks to insert into the test report.

## SHOW SMART SWEEP

To show smart sweep results (sweep and peaks table).

## GENERATE REPORT

To create the test report according to the information set by the user.

R3000 receiver offers all functions that are required for in-house tests to perform EMC diagnostic measurement as quickly, easily and as accurately as necessary and to document the test results.

- Manual measurement through Manual Mode function
- On site stand alone usage through touch screen display
- Semi automatic measurement with predefined scan and sweep tables allowing interactive interruption
- Individual of critical frequencies using markers and zoom functions
- Fully automatic interference measurements in conjunction of external devices, as LISN, turn table, antenna mast, slide bar controllers

The EMC compliance test then will be just a formality.

	R3010	R3030	
<b>Frequency Range</b>	9kHz÷30MHz	9kHz÷300MHz	
<b>Frequency Setting</b>	1Hz (9kHz÷30MHz)	1Hz (9kHz÷300MHz)	
<b>Internal Reference Frequency</b>			
Aging per Year	2 x 10 <sup>-6</sup>		
Temperature Drift	15 x 10 <sup>-5</sup> (+10 °C to +40 °C)		
<b>External Reference Frequency</b>	10 MHz		
<b>Frequency Display Local And Remote (manual mode)</b>	Numeric Display		
Resolution	1Hz		
<b>Frequency Display Remote (sweep mode)</b>	Graphic Display on PC SW		
Resolution	Frequency Step (zoom function)		
<b>Measurement Time (manual mode)</b>	2ms to 90min		
Resolution	1ms (< 60sec)		
	1sec (> 60sec)		
<b>Measurement Time (sweep mode)</b>	2ms to 60s		
Resolution	1ms		
<b>Digital EMI Filters BW</b>	200Hz (-6dB Bandwidth)		
	9kHz (-6dB Bandwidth)		
	120kHz (-6dB Bandwidth)		
<b>Hardware Filters BW</b>	15kHz		
	1MHz		
<b>Fixed &amp; Tunable Preselection Filters</b>	9 kHz to 150kHz	9 kHz to 150kHz	
	150 kHz to 2MHz	150 kHz to 2MHz	
	2MHz to 6MHz	2MHz to 6MHz	
	6MHz to 15MHz	6MHz to 15MHz	
	15MHz to 30MHz	15MHz to 30MHz	
		30 MHz to 60 MHz	
		60 MHz to 140 MHz	
	140 MHz to 300 MHz		
<b>Maximum Input Level</b>			
DC Voltage	50V (AC-coupled)		
CW RF Power	+20dBm		
Pulse Spectral Density	+97dBµV/MHz		
<b>Immunity to Interference</b>			
Image Frequency	> 60dB		
Intermediate Frequency	> 70dB		
<b>RF Shielding</b>	3V/m (50Ω termination)		
<b>Noise Floor</b>	IF 200 Hz	IF 9kHz	IF 120kHz (R3030)
Peak	< -10dBµV	< 10dBµV	< 10dBµV
Quasi Peak	< -15dBµV	< 5dBµV	< 5dBµV
CISPR Average	< -20dBµV	< 0dBµV	< 5dBµV
RMS	< -20dBµV	< 0dBµV	< 5dBµV
CISPR RMS	< -20dBµV	< 0dBµV	< 5dBµV
<b>FRONT PANEL with Knob</b>			
Display	3,5 Inch TFT with Touch Panel		
Features	Virtual Keyboard		
Level Display (digital)	Numeric (resolution 0,01dB)		
Level Display (analog)	Bargraph		
Detectors	Peak, Quasi-Peak, CISPR Average, RMS, CISPR RMS		
Number of Contemporary Detectors	3		
Display Units	dBµV, dBm, dBµV/m, dBµA/m, dBA/m, dBµA, dBpW		
<b>RF Input Impedance</b>	50Ω		
<b>RF Input Connector(s)</b>	N female (RF 9kHz to 30MHz)	N female (RF 9kHz to 30MHz)	
		N female (RF 30MHz to 300MHz)	
<b>RF Input VSWR</b>	2,0 to 1,0 (attenuation 0dB)		
<b>RF Input Attenuator</b>	1,2 to 1,0 (attenuation ≥ 10dB)		
<b>IF Output Impedance</b>	0dB to 50dB in 10dB steps		
<b>IF Output Connector</b>	50Ω		
	N female		
<b>IF Frequency</b>	10,7 MHz	10,7MHz (< 30MHz)	
		18MHz (> 300MHz)	
<b>Tracking Generator</b>	+50÷+95dBµV	+50÷+95dBµV (9kHz÷150MHz)	
<b>Interface</b>	Ethernet 10/100 MB (TCP Port: 1893)		
<b>PC Requirement</b>	Pentium Dual Core Processor		
	Above 1GB RAM (min)		
	Ethernet 10/100 MB Network Board		
	WIN XP, WIN VISTA, WIN 7 OS		
<b>Power Supply</b>	230Vac ± 10% 50-60Hz		
<b>Power Consumption</b>	50VA		
<b>Operating Temperature</b>	0° to 45°C		
<b>Storage Temperature</b>	-20° to 70°C		
<b>Size (W x H x D)</b>	450x135x436mm.		
<b>Weight</b>	14kg	15kg	



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