

# RADIATED IMMUNITY TEST SYSTEMS

acc. to

- IEC/EN 61000-4-3
- ISO 11452-2
- MIL-STD 461, RS 103

...and it's components like

- Signal Generator
- RF-Power-Amplifiers (see also separate brochure)
- Directional Couplers
- RF-Power-Meter
- Antennas (see also separate brochure)
- Electrical Field-Strength-meters
- Relay-switching units
- Control software (see also separate brochure)



# THE FRANKONIA GROUP



## Frankonia Group

The FRANKONIA GROUP was founded in 1987 as a solution provider for EMC laboratories to meet the increasing demand for highly specialized testing environments for the electronic and automotive industry. With more than 25 years of experience to date, FRANKONIA maintains its leading position in EMC solutions worldwide. Without limitations in capabilities and resources, FRANKONIA develops future-oriented concepts for EMC laboratories, which guarantees an optimal use of resources as well as the best possible customized solutions.

- FRANKONIA demonstrates a global presence in cooperation, with a well-structured network of productions, representations and service units.
- FRANKONIA strives to be the preferred partner for customized and state-of-the-art solutions.
- FRANKONIA provides fundamental knowledge to operate as a complete solution provider.
- FRANKONIA implements innovative technologies to enhance the efficiency and improve the outcomes and quality along with customers' needs.



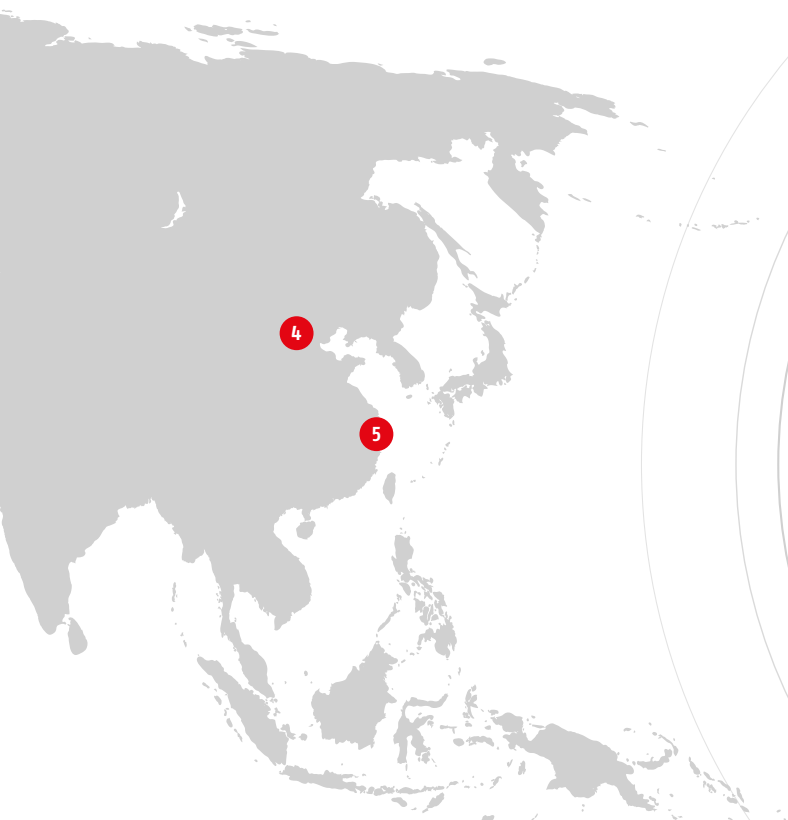
We are proud of our highly specialized team that is putting our customers' demands into practice. It is our philosophy to improve the products, to realize new ideas, and to complete our product range within our broad scope of business. The fact that FRANKONIA is able to offer complete solutions from the first sketch to the final handover makes FRANKONIA a unique and trustworthy partner worldwide.

## Frankonia's authenticity

FRANKONIA stands for latest technologies, highest quality, innovative concepts and materials and reliable solutions. Due to its easy and efficient usability along with its time-saving configuration, Frankonia's Anechoic Chambers set new standards for innovative and complete EMC testing solutions and offer a real added value to our customers.

## Frankonia solutions

FRANKONIA as a turnkey solution provider and manufacturer offers a complete range of anechoic chambers and RF-shielded enclosures, test equipment, instruments, software and accessories.



- 1 FRANKONIA GmbH
- 2 Frankonia EMC Test-Systems GmbH
- 3 FRANKONIA – POLAND Sp. z o.o.
- 4 FRANKONIA Huize Co., Ltd.
- 5 Jiashan FRANKONIA EMC Co., Ltd.

## Radiated Immunity Test Systems

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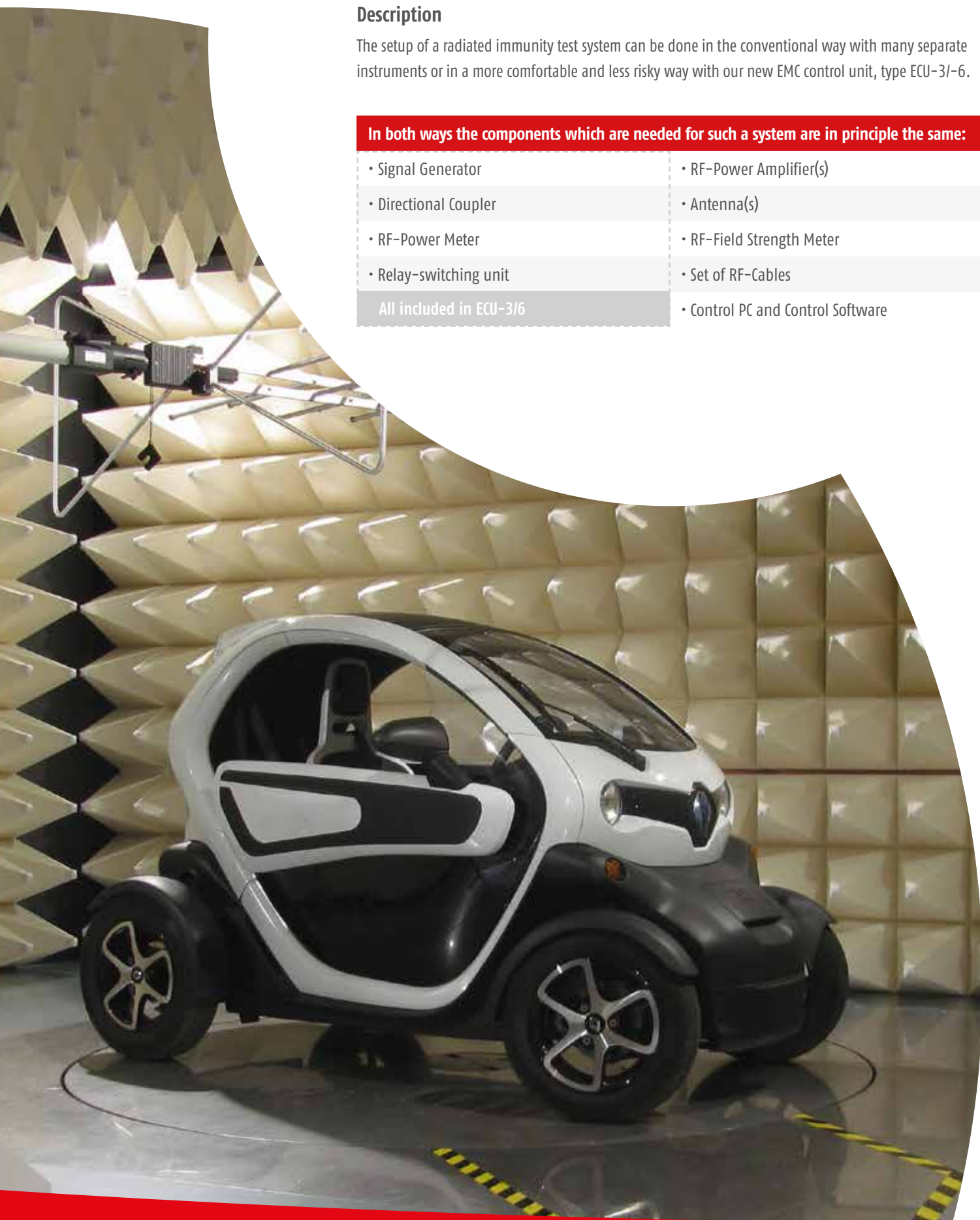
# GENERAL DESCRIPTION OF RADIATED IMMUNITY TEST SYSTEMS

## Description

The setup of a radiated immunity test system can be done in the conventional way with many separate instruments or in a more comfortable and less risky way with our new EMC control unit, type ECU-3/-6.

**In both ways the components which are needed for such a system are in principle the same:**

• Signal Generator	• RF-Power Amplifier(s)
• Directional Coupler	• Antenna(s)
• RF-Power Meter	• RF-Field Strength Meter
• Relay-switching unit	• Set of RF-Cables
All included in ECU-3/6	• Control PC and Control Software



# GENERAL DESCRIPTION OF RADIATED IMMUNITY TEST SYSTEMS

## Control Computer

The controller is a standard PC with operating system Microsoft® Windows. Depending on the system layout GPIB (IEEE488) with National Instruments interface card, serial bus RS232, USB and other bus systems are supported.

## Control Software

The control software is fully compliant to IEC/EN 61000-4-3, IEC/EN 61000-4-20, automotive and MIL standards. The software controls the complete test system and creates the test report. It performs measurement of the uniform area and generates reference calibration data from it. Alternatively reference data can be measured directly. Tests may be performed manually and fully automatic. A full automatic monitoring of the EUT's (Equipment Under Test) function is possible whenever its compliance can be controlled with preset tolerance limits. Up to four values can be monitored and recorded for example by means of multimeters.

### Essential data of the software are:

- Microsoft® Windows platform
- Simple operator's guide
- Online help function
- Presentation of the results in online graphics and reports
- Export function of the files for further processing under Microsoft® Word, Microsoft® Excel,...
- Measurement of homogeneous field incl. evaluation
- Calculation of reference data
- 2dB saturation test on base of homogeneous field measurement compliant to standard
- Measurement of reference data with fixed test level or profile of level vs. frequency
- Permanent VSWR control during test and operator defined limitation as well as restriction of max. input level of amplifier and max. allowed output power
- Automatic multiple repetition of test
- Manual test mode
- Manual increase / decrease of test level
- Automatic test mode incl. monitoring of the EUT
- Handshake function to EUT via serial interface
- Easy and fast graphical device set-up, system layout can be printed
- Fully compliant to IEC/EN61000-4-3, IEC/EN61000-4-20, automotive- and MIL standards
- Control of the test system by GPIB, USB interfaces,...
- Customized modifications possible

## Signal Generator

(find more detailed information on page 11 „ECU 3/6“ )

As signal source a commercial signal generator or the built-in signal generator of our EMC test & control unit ECU-3/-6 is used. It should cover at least the required frequency range such as 80 MHz to 6 GHz and allow amplitude modulation with a sine wave of 1 kHz and 80 %, as requested by the standards. Besides, it should meet the requirements regarding frequency step width (1 % of the preceding value). If the equipment offers further modulation depth and modes, as well as a higher frequency range and smaller steps, this might be advantageous for future applications.

### Minimum requirements:

- Frequency range: 9 kHz – 3.0 GHz (6.0 GHz or higher)
- RF output: -40 dBm to +10 dBm
- Frequency resolution: 1 Hz
- Level resolution: 0.1 dB
- Amplitude modulation: 0 to 99.9 %
- Further modulation types: frequency modulation, phase modulation, pulse modulation
- Interface: GPIB (IEEE-488), RS232, USB



# GENERAL DESCRIPTION OF RADIATED IMMUNITY TEST



## RF-Power Amplifier

(see also separate brochure)

The software controls the level of the signal generator output for each test frequency. This signal level is amplified by the power amplifier output in order to generate the required test field strength around the EUT. It depends on the testing setup, the distance between EUT and antenna (1 m – 3m) and the test level / test field strength (3/10/100/200 V/m or special requirements) whether an amplifier output of 10 W, 30 W, 200 W – 2 kW is required. Normally, field strength of 10 V/m, with 1 kHz / 80% AM, can be obtained with a 250 W amplifier in a testing distance of 3 m.



## RF-Power Meter / Directional Couplers

more detailed information on page 19 „PMS“

While testing the field strength probe is replaced by the EUT. A power measurement during the test runs assures that the EUT is actually exposed to the requested test condition. Thus a directional coupler is connected with the amplifier output. A power measuring device determines the forward and reverse power up to 6 GHz or higher. Both are stored and recorded by the control software. For this purpose directional couplers are connected with the amplifier output or the built-in directional couplers of our EMC test & control unit ECU-3/-6 are used. The forward and reverse power is measured by our RF-Power Meter PMS 1084 or by the built-in power measuring channels of the ECU-3/-6. Both metering values are recorded and stored by the control software.



## RF-Relay Switching Unit RSU

more detailed information on page 13 „RSU“

In most cases two or three RF-power amplifiers and two different antennas are needed to cover the whole test frequency range. It would be very time-consuming to change the cabling between the different amplifiers, antennas and power meters manually. For this purpose software controlled switching relays are used, as they work much faster and without any damage to the RF-cables, which might be caused by changing the connections manually. Furthermore, cabling mistakes cannot occur.



## RF-Field Strength Meter

more detailed information on page 14 – 18 „EFS-10 / 100 / 300 / 500 / EFS-Laser“

A field strength meter is necessary for the measurement of the uniform area and the generated field-strength. It should be of small size in order to avoid disturbances of the field by the physical size of the field strength meter itself. The data transfer from the anechoic chamber to the control room should be via fibre optic link. It makes sense to integrate the fibre optic converter directly into the sensor because long conductive cables could influence the accuracy, too. The test frequency range from 80 MHz to 3 or 6 GHz should at least be covered by the field strength meter. We suggest the use of our field strength meter type EFS-10/100 which works in the frequency range from 10 or 100 kHz up to 9.25 GHz and with a max. field strength from 0.14 V/m to 500 V/m. As alternative and for no more empty batteries we recommend our Laser powered field strength meter “EFS-Laser”



## Transmitting Antenna(s)

(see also separate brochure)

Broadband antennas, like our model ALX-4000, which cover the whole frequency range from 30 MHz up to 4 GHz may be used as a single-antenna-solution. The advantage of these antennas is that they can be used for immunity tests as well as for emission measurements. In order to save amplifier power and costs it is recommended to use so called double stacked log.-periodical antennas for immunity tests, like our model AXL-80. This antenna type offers a much higher gain compared to the above described broadband antennas. For our systems we recommend the following antenna types:

### Antenna types:

- 30 MHz – 4 GHz, type ALX-4000\*
- 80 MHz – 4 GHz, type AXL-80\*\*
- 80 MHz – 6 GHz, type AXL-80 6G\*\*
- 1 GHz – 6 GHz, type Max 9\*\*

As an alternative horn antennas can be used in the GHz range if a max. uniform area of 1.0 m is sufficient.

\* Emission + Immunity tests    \*\* Immunity tests

## RF-Cabling

The RF-cabling is a very important part of a radiated immunity test system, as the cable-attenuation could finally decide whether you reach your test level or not. All essential RF-cables are included in our systems and in the calculation according to the required amplifier output power.



# GENERAL DESCRIPTION OF RADIATED IMMUNITY TEST SYSTEMS



## System installation in a 19" Rack

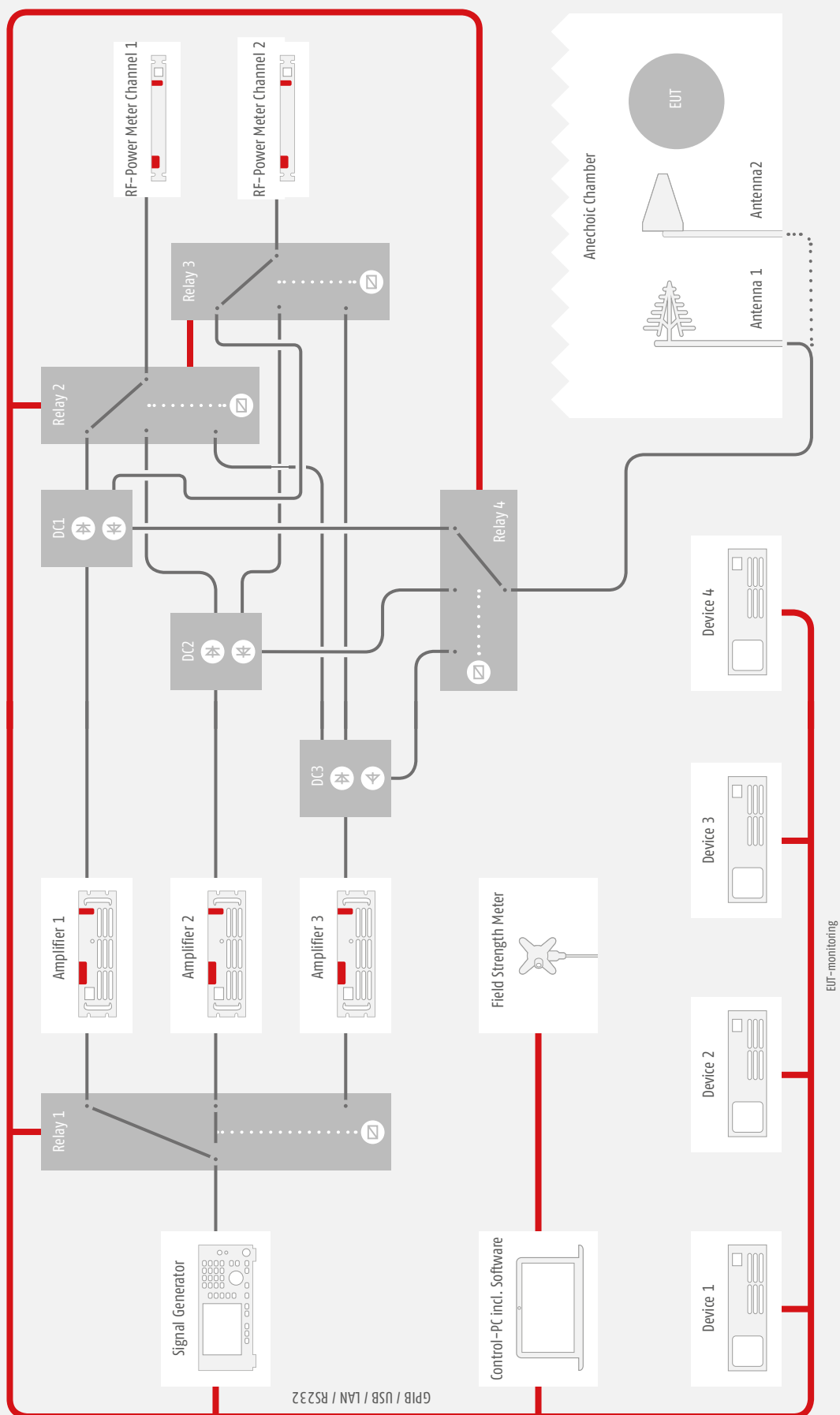
On request the test systems supplied are installed into a 19"-rack. The picture on the left shows an example of a radiated immunity test system acc. to IEC/EN 61000-4-3, type RIS 6000.

### Features:

- Moveable rack (on big rubber wheels)
- Instruments are installed into rack and cabled
- Main switch
- Easy mountable cover for front and rear side of the rack included
- Typical dimensions (HxDxW):  
1,270 x 710 x 540 mm
- Weight without instruments: 50kg

# CONVENTIONAL SET-UP

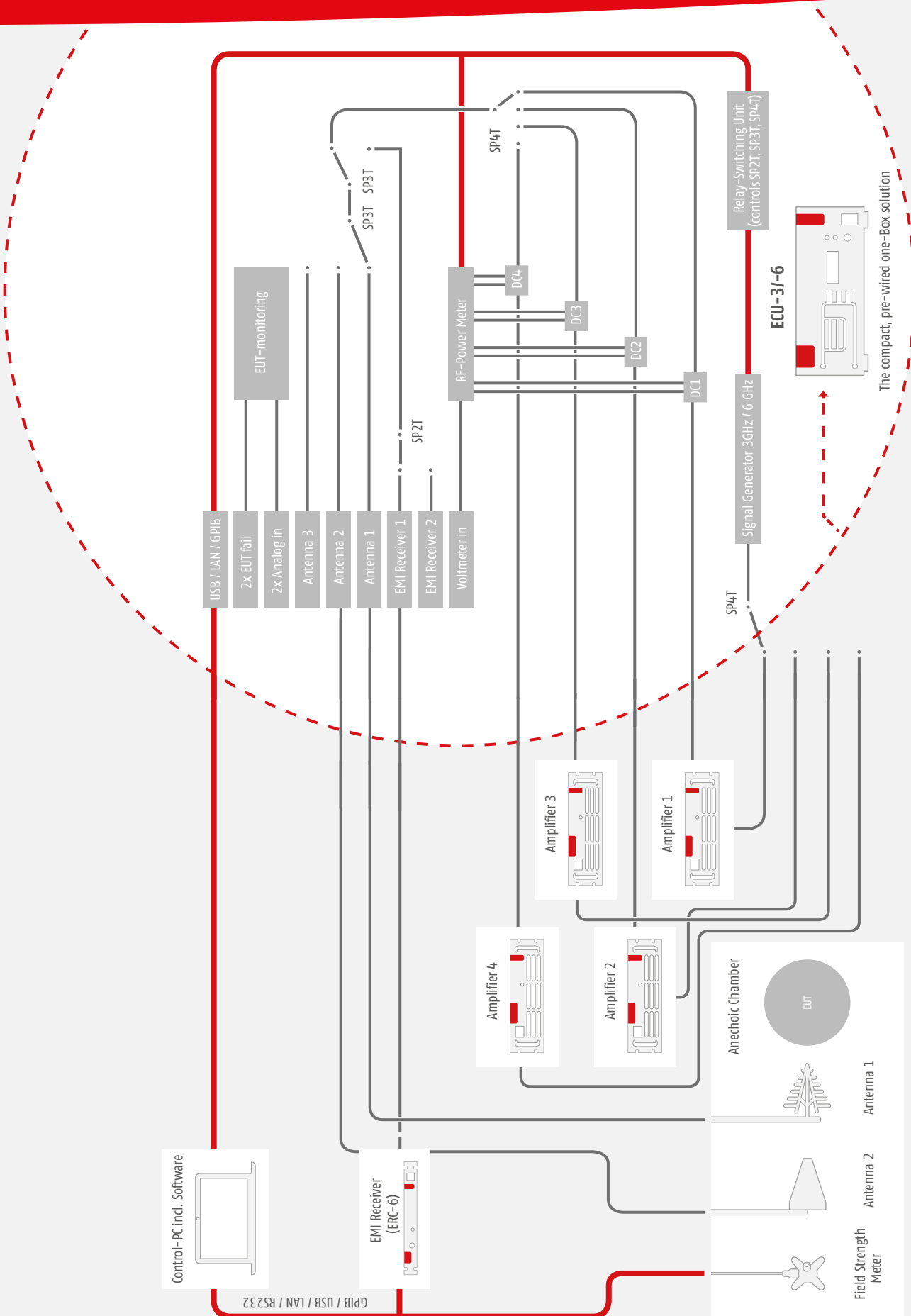
OF A RADIATED IMMUNITY TEST SYSTEM BY MEANS OF SEPERATE INSTRUMENTS





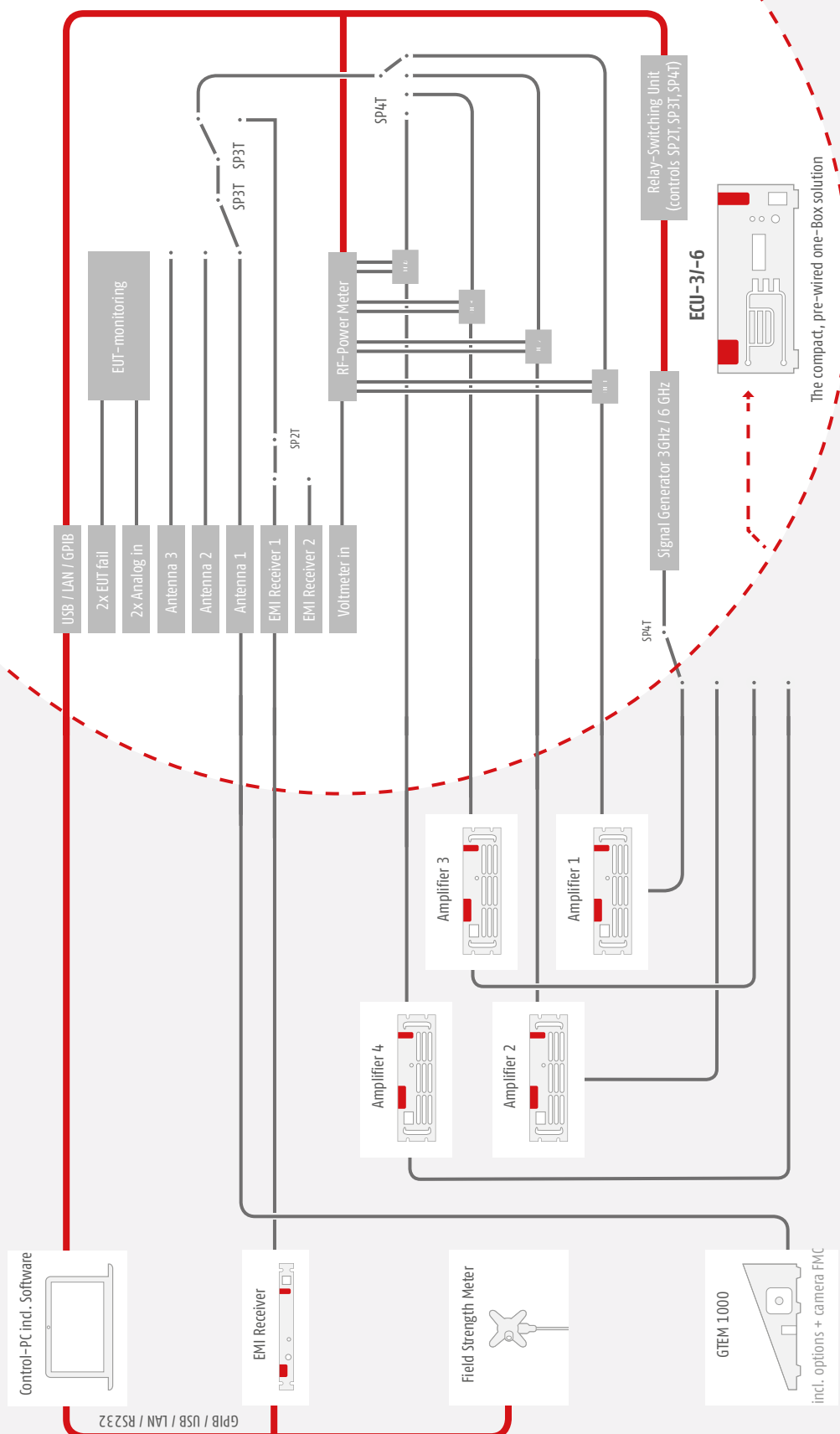
# ECU-3/-6 SET-UP

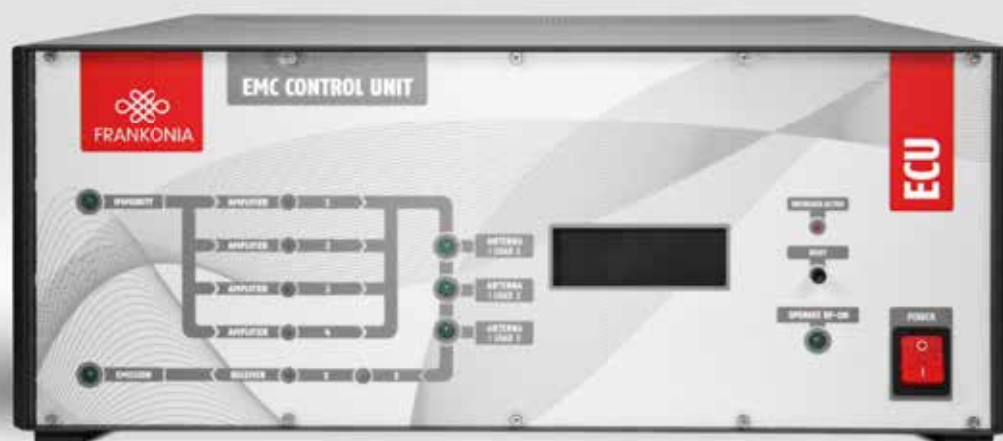
OF A RADIATED IMMUNITY TEST SYSTEM BY MEANS OF OUR EMC CONTROL UNIT, TYPE ECU-3/-6



# TEST SET-UP WITH A GTEM-CELL

## FOR RADIATED IMMUNITY TESTS AND EMISSION MEASUREMENTS





## ALL-IN-ONE UNIT: ECU-3 / -6

### Description

The ECU-3/-6 is a central EMC test and control unit, which combines in just one compact box many major test components like signal generator, power meter, directional couplers and relay switching unit, which are needed for EMC tests. That reduces the cabling work and possible cabling mistakes to a minimum. Furthermore it includes general functions like EUT-monitoring and an interlock safety-system. With all the functions described above, the ECU-3/-6 is a real all-rounder, which can be used for many different conducted and radiated immunity tests as well as control unit to switch between EMI-receiver and spectrum analyzer and different measuring antennas without time consuming cabling work. It allows to control and to switch automatically between up to four external amplifiers, all connected to the ECU-3/-6 and up to three different outputs for antennas or coupling devices (CDNs, EM-coupling clamp, BCI-clamps). The integrated signal generator is available to cover the frequency range from 9 kHz to 3 GHz or from 9 kHz to 6 GHz. Amplitude modulation is available with a modulation rate of 1 Hz to 30 kHz and a modulation depth of 0 % to 90 %. Pulse modulation can be switched on with a repetition frequency of 0.1 Hz to 100 kHz and a duty cycle of 1 % - 99 %. In a word, it includes all requirements according to present EMC standards and it is best prepared for possible future changes.

### Special Features:

- Conducted immunity tests according to IEC/EN 61000-4-6, 10 kHz – 230 MHz
- BCI-tests according to ISO 11452-4 and MIL-STD 461, CS 114
- Radiated immunity tests according to: IEC/EN 61000-4-3, ISO 11452-2/3/4/5, MIL-STD 461, RS 103
- Automatic switching between up to four external power amplifiers and connected coupling units / antennas
- Automatic switching between up to two EMI-receivers, spectrum analyzers and three different antennas
- Easy integration into any control software by dll-driver
- Integrated interlock safety system

Technical specifications	ECU-3	ECU-6
Signal Generator		
Output	50 Ω, N male	
Output (Relay)	3 x N male	4 x N male
Frequency range	9 kHz to 3 GHz	9 kHz to 6.5 GHz
Frequency resolution	0.1 Hz	0.001 Hz
Output level range	-65 dBm to +10 dBm	-100 dBm to +13 dBm
Output level resolution	0.1 dB	
Output level accuracy	±1 dB max.	
Accuracy (frequency)	±25 ppm	±100 ppb
Harmonics	< -30 dBc	
Non harmonics	< -55 dBc	
Amplitude modulation		
Modulation rate	1 Hz to 30 kHz; resolution 0.02 Hz	1 Hz to 20 kHz; resolution 0.1 Hz
Modulation depth	0 to 90 %; resolution 1 %	0 to 90 %; resolution 1 %
Modulation waveforms	sinusoidal, triangular, square	sinusoidal, triangular, square

# EMC TEST AND CONTROL UNIT – ECU-3/-6

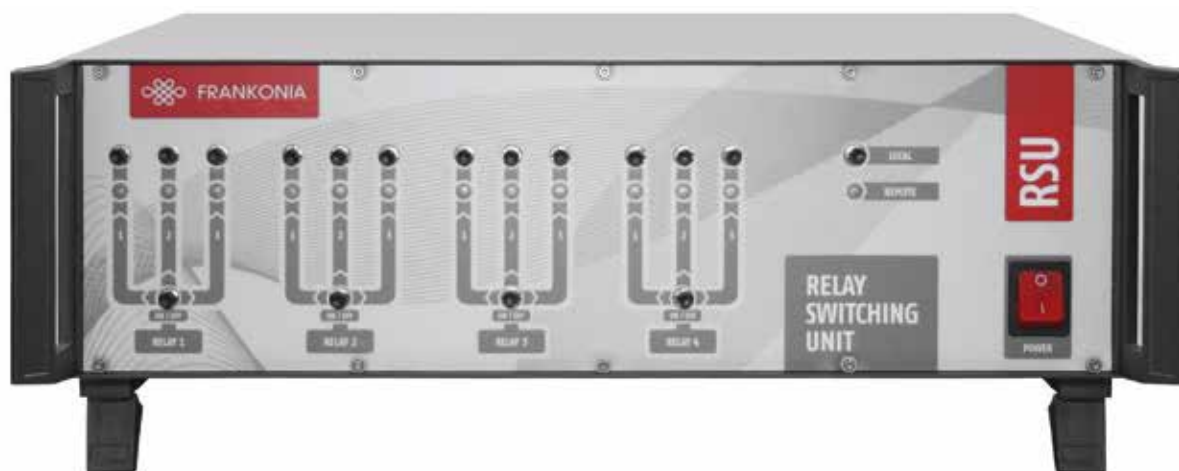
Technical specifications		ECU-3	ECU-6
Pulse modulation			
On/off ratio	>50dB		typ. 80 dB
Repetition frequency	0.1 Hz to 100 kHz	0.1 Hz to 100 kHz	
Duty cycle	1%–99%; resolution1%	1%–99%; resolution1%	
Frequency modulation			
Modulation rate	---		300 Hz to 300 kHz
RF-Power Meter			
Number of channels	7		9
Frequency Range	10 kHz – 500 MHz	10 kHz – 500 MHz	
	(channel 1,2,7)	(channel 1,2,9)	
	100 kHz – 6 GHz	100 kHz – 6 GHz	
	(channel 3,4,5,6)	(channel 3,4,5,6,7,8)	
Measuring range	-60 dBm to +20 dBm (10 kHz ≤ f ≤ 4 GHz) -45 dBm to +20 dBm (4 GHz < f ≤ 6 GHz)		
Accuracy	±1 dB (0.5 dB typical)		
Resolution	0.1 dB		
Max. input level	+27 dBm (= 500 mW)		
VSWR	1.15		
EUT-fail input	2 x TTL/CMOS compatible		
Input resistance	2.2 kΩ		
Level	TTL / CMos compatible, optical decoupled		
EUT-monitor input			
Input voltage (2 x)	0 – 10 V		
Resolution	2.5 mV		
Input impedance	100 kΩ		
USB-A	Multimeter (for EUT control)		
Remote control			
USB-B	Connection to computer		
GPIOB / IEEE488	Connection to computer		
Ethernet / RJ45	option		
Display			
Displayed items	Frequency, Power levels P(forw), P(rev), modulation (4 lines x 16 characters)		
RF-Relay Switching Unit			
max. power up to 100 MHz	2000 W		
max. power up to 600 MHz	1000 W		
max. power up to 1 GHz	700 W		
max. power up to 3 GHz	400 W		
max. power up to 6 GHz	300 W		
General data			
Temperature range	0 to 40°C		
Warm-up time	15 min.		
Housing	19"-Subrack or desktop case		
Dimensions(WxHxD)	449 mm x 177 mm x 580 m		
Weight	approx. 18 kg		
AC input	100 – 240 VAC, 50 / 60 Hz		

Part Numbers	
ECU-3	Compact EMC control unit, basic Instrument, 9 kHz – 3 GHz
ECU-6	Compact EMC control unit, basic Instrument, 9 kHz – 6 GHz
ECU-DC1A	Directional Coupler, 10 kHz – 250 MHz, 30 dB, 100 W
ECU-DC1B	Directional Coupler, 10 kHz – 400 MHz, 30 dB, 100 W
ECU-DC1C	Directional Coupler, 10 kHz – 250 W, 30 dB, 500 W
ECU-DC2	Directional Coupler, 80 MHz – 1000 MHz, 50dB, 1500 W
ECU-DC3	Directional Coupler, 1 GHz– 4 GHz, 40 dB, 600 W
ECU-DC4	Directional Coupler, 2 GHz – 8 GHz, 40 dB, 600 W
ECU-KS2	Cable-set and GPIB-interface for immunity test systems with 2 amplifiers
ECU-KS3	Cable-set and GPIB-interface for immunity test systems with 3 amplifiers
ECU-KS4	Cable-set and GPIB-interface for immunity test systems with 4 amplifiers
ECU-LAN	Additional interface: LAN
ECU-OUT2	Switching between 2 outputs (antenna/load)
ECU-OUT3	Switching between 3 outputs (antenna/load)
ECU-PM1	RF-Power Meter / RF-milli-voltmeter, 10 kHz – 500 MHz, 1 channel
ECU-PM2	RF-Power Meter / RF-milli-voltmeter, 100 kHz – 6 GHz, 1 channel
ECU-REC1	Switching to emission path and connection of 1 measuring receiver / spectrum analyzer
ECU-REC2	Switching to emission path and connection of 2 measuring receivers / spectrum analyzers
ECU-RI	19"-Rack version
ECU-SW6	Standard software for testing acc. to IEC/EN 61000-4-6 in a system with ECU-3/-6



# RF-RELAY SWITCHING UNIT – RSU

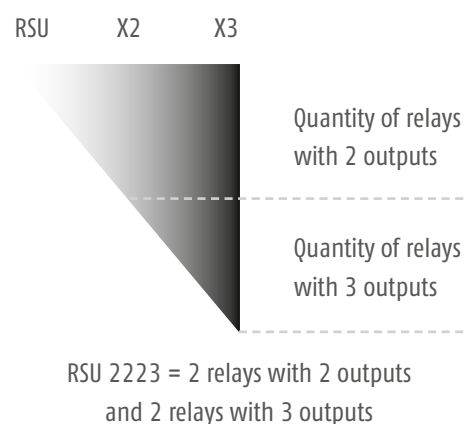
DC...12.4 GHz (up to 18 GHz or 40 GHz optional)



## Description

The RSU Relay Switching Unit is applicable for all fields of RF- and EMC measurements to switch (manual or remote-controlled) from one input to 2 or 3 outputs. Typical applications in measuring systems are changeover switching between different amplifiers, antennas or power meters. This does also prevent circuit faults due to wrong cabling. By means of a selector switch on the front panel of the RSU it is possible to work in manual mode or remote- control mode via the RS232, USB or GPIB interface. The input/output connectors of the relays are installed on the rear panel of the RSU, this allows an easy cabling when or where the RSU is mounted into a 19"-rack. A RSU can be equipped with a maximum of 4 relays with 2 or 3 outputs. The quantity of relays with 2 or respectively 3 outputs is variable. The delivery includes a Windows software for easy remote-controlled applications. However for extensive systems it is recommended to integrate the RSU driver into the system control software. The easy to follow commands for RS232 and GPIB interfaces are listed in the user manual.

## Definition of the relay assembly:



Technical specifications		RSU			
Frequency range	DC to 12.4 GHz (up to 18 GHz or 40 GHz optional)				
Test level	50 V cont., 300 V (1s) at energetically used frequencies				
	DC...1 GHz	1 GHz...5 GHz	5 GHz...10 GHz	10 GHz...12.4 GHz	
VSWR	≤ 1.04	≤ 1.14	≤ 1.3	≤ 1.5	
Isolation	≥ 90 dB	≥ 80 dB	≥ 70 dB	≥ 70 dB	
Insertion loss	≤ 0.05 dB	≤ 0.1 dB	≤ 0.2 dB	≤ 0.3 dB	
Max. power input	≤ 1.00 kW	≤ 0.44 kW	≤ 0.31 kW	≤ 0.28 kW	
Impedance	50Ω				
RF-connectors / Relays	N-female				
Switching time	≤ 60 ms				
Number of operations	Max. 10/Minute				
Operating temperature	+10 oC ... +40 oC				
Max. humidity	< 90 %				
Cabinet	19"-subrack or desktop case				
Dimensions (D x W x H)	435.5 x 448.9 x 132.55 mm				
Weight	7.6 kg				

# FIELD STRENGTH METER – EFS-10 / -100 / -300 / -500

FOR FIELD STRENGTH MEASUREMENTS DURING RADIATED IMMUNITY TESTS

## Description:

The Frankonia EFS field strength meters especially have been designed for field strength measurements / field homogeneity measurements during radiated immunity tests according to IEC/EN 61000-4-3 / -20. But it could also be used to measure the radiation exposure of the environment, for example at workplaces or flats.

The EFS is an isotropic miniature E-field sensor to ensure that the E-field will not be influenced by the size of the sensor itself. It even does not need any metering unit (which could also influence the field strength), because of its direct fibre optic output which allows direct connection of the sensor to the USB-interface of the control PC or laptop. The measuring values may be displayed via the individual IEC/EN 61000-4-3 / -20 control software or via a Windows software included in the delivery.

The EFS-10 / EFS-100 cover the frequency range from 10 kHz up

to 9.25 GHz and are able to detect electrical field strength in the range from 0.14 V/m to 500 V/m (depending on type).

The sensors are battery operated by Li-Mn batteries, which allow a maximum operation time of 80 hours before recharging.

### Features

- Extreme small size
- PC connection via fibre optic link
- Excellent isotropy (0.3 dB typical)
- Frequency range: 10 kHz to 26,5GHz
- Field strength measurements from 0.14 V/m to 500 V/m
- Up to 80 hours operating time before recharging



# FIELD STRENGTH METER – EFS-10 / -100 / -300 / -500

FOR FIELD STRENGTH MEASUREMENTS DURING RADIATED IMMUNITY TESTS

Technical specifications	EFS-10	EFS-100
Frequency range	10 kHz–9.25GHz	100 kHz – 9.25 GHz
Flatness	0.1MHz–150MHz: 0.4 dB	1 – 150 MHz: 0.8 dB
With frequency correction OFF	0.05GHz–6GHz: 1.6 dB 0.03GHz–7.5GHz: 3.2 dB	0.5 – 6 GHz: 1.6 dB 0.3 – 7.5 GHz: 3.2 dB
With frequency correction ON	0.05GHz–7.5GHz: 0.4 dB	0.3 – 7.5 GHz: 0.4 dB
Dynamic range (single range)	0.5–500 V/m (60 dB)	0.14 – 140 V/m (60 dB)
Linearity	0.4 dB @ 50 MHz / 1–500 V/m	0.4 dB @ 50 MHz / 0.3 – 100 V/m
Resolution	0.01 V/m	
Sensors	6 monopoles	
Isotropy	0.5 dB (0.3 dB typical) (@50 MHz)	
Overload	1000 V/m	300 V/m
Measured data X–Y–Z axis	sampling simultaneous on X–Y–Z axis	
Sampling rate	22 S/s to 0.03 S/s, depending on filter setting	
Digital filter	2.3 to 28 Hz, low-pass-pre-settable	
Internal battery	3V–5mAh, rechargeable Li–Mn	
Operation time	80 hours @0.4 S/sec., 28 Hz filter 60 hours @ 5 S/sec., 28 Hz filter	
Recharging time	48 for full operation time	
Internal data memory	serial number, calibration date, calibration factors, firmware version	
Communication	bidirectional fiber optic link	
Fibre optic connector	HFBR–0500	
Fibre optic length	10 m standard (20/40 m) optional	
Fibre optic to PC connection	fibre optic to RS232 converter, RS232 to USB converter	
PC Software	included (display of field, temperature and battery voltage measurements, setting of filters, sampling rate, frequency)	
Operating temperature	–10 °C ÷ +50 °C	
Temperature reading	0.1 °C resolution	
Battery voltage reading	10 mV resolution	
Dimensions	53 mm overall, (body: 17 mm diameter, sensor: 17 mm)	
Weight	25 g, including 1 m fibre optic pigtail	
Probe mount	20 UNC female	
Included accessories	10 m fibre optic cable, optical/RS232 adapter + RS232/USB adapter, software, battery charger	
Optional accessories	20 m fibre optic cable, order-no.: EFS–OF20 40 m fibre optic cable, order-no.: EFS–OF40	

# FIELD STRENGTH METER – EFS-10 / -100 / -300 / -500

FOR FIELD STRENGTH MEASUREMENTS DURING RADIATED IMMUNITY TESTS

Technical specifications	EFS-300	EFS-500
Frequency range	300kHz-18GHz	300kHz-26.5GHz
Flatness	0.3MHz-18000MHz: 0.4dB	0.10MHz-18000MHz: 1.8dB
With frequency correction OFF	3MHz-8200MHz: 1.4dB 1MHz-12000MHz: 2.4dB	3MHz-23000MHz: 3.2dB
With frequency correction ON	0.6MHz-18000MHz: 3.8dB	0.3MHz-26500MHz: 0.4dB
Dynamic range (single range)	0.17-170 V/m (60dB)	0.4-800 V/m (66dB)
Linearity	0.4dB @ 50MHz / 0.3-170V/m	0.4dB @ 50 MHz / 0.8-800V/m
Resolution	0.01 V/m	
Sensors	6 monopoles	
Isotropy	0.4dB (0.2dB typical @ 50MHz)	
Overload	350 V/m	1600 V/m
Measured data X-Y-Z axis	sampling simultaneous on X-Y-Z axis	
Sampling rate	22 S/s to 0.03 S/s, depending on filter setting	
Digital filter	2.3 to 28Hz, low-pass, pre-settable	
Internal battery	3V-5mAh, rechargeable Li-Mn	
Operation time	80 hours @ 0.4 S/sec., 28 Hz filter 60 hours @ 5 S/sec., 28 Hz filter	
Recharging time	48 hours for full operation time	
Internal data memory	serial number, calibration data, calibration factors, firmware version	
Communication	bidirectional fiber optic link	
Fibre optic connector	HFBR-0500	
Fibre optic length	10m standard (20/40m optional )	
Fibre optic to PC connection	fiber optic to RS232 converter, RS232 to USB converter	
PC Software	included (display of field, temperature and battery voltage measurements, setting of filters, sampling rate, frequency)	
Operating temperature	-10 °C ÷ +50 °C	
Temperature reading	0.1°C resolution	
Battery voltage reading	10mV resolution	
Dimensions	53mm overall, (body:17mm diameter, sensor: 17mm)	
Weight	25g, including 1m fiber optical pigtail	
Probe mount	20 UNC female	
Included accessories	10m fiber optical cable, optical RS232 adapter + RS232/USB adapter, software, battery charger	
Optional accessories	20m fiber optic cable, order-no.: EFS-OF20 40m fiber optic cable, order-no.: EFS-OF40	



# LASER-POWERED FIELD STRENGTH METER – EFS LASER

10 kHz to 6 GHz



## Description:

The Frankonia EFS-LASER Electric Field Probe especially has been designed for field strength measurements / field homogeneity measurements during radiated immunity tests according to IEC/EN 61000-4-3. However, it is also excellent to measure the radiation pollution of the environment, for example at workplaces or flats.

The EFS-LASER is an isotropic miniature E-field sensor to ensure, that the E-field will not be influenced by the size of the sensor itself. It even does not need any metering unit (which could also influence the field-strength), because of its direct fibre-optic output, which does allow direct connection of the sensor to the USB-interface of the control PC or laptop. The measuring values may be displayed via the individual IEC 61000-4-3 control software or via a windows-software included in the delivery.

The EFS-Laser cover the frequency-range from 10 KHz – 6 GHz. The utilized linearization technology provides a dynamic range up to 100 dB. The EFS-Laser is a smart, fast, extremely accurate electric field probe, which provides linearization, temperature compensation, control and communication functions. Noise

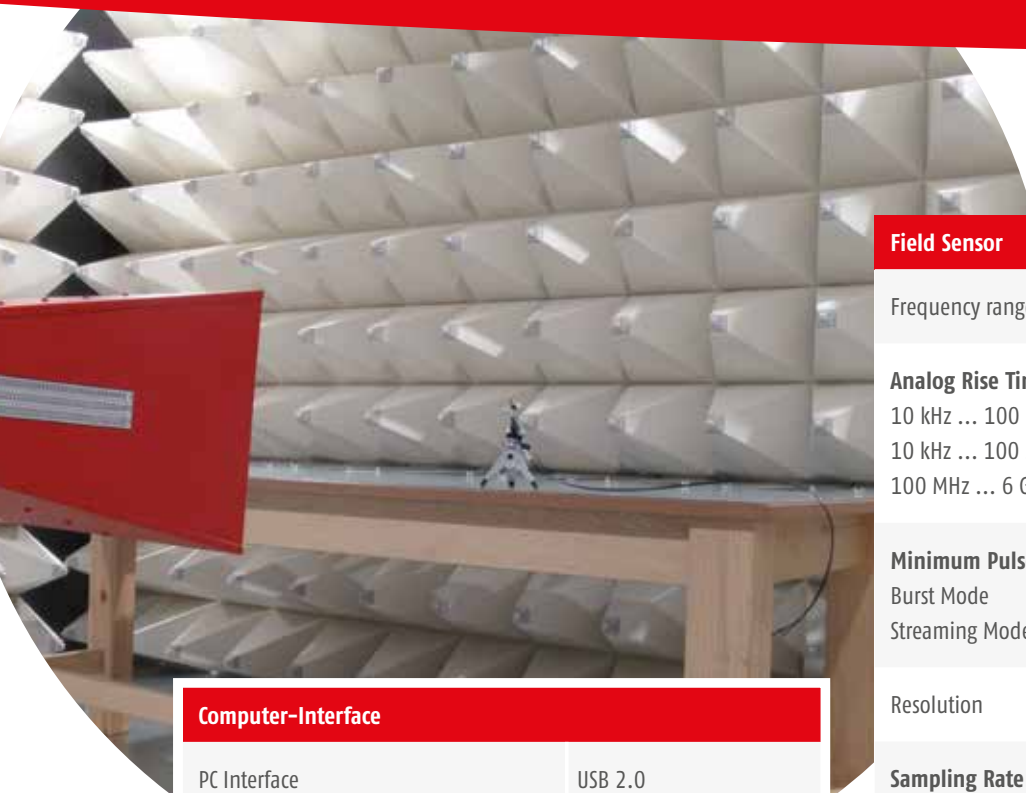
reduction and temperature compensation allow accurate measurements down to 0.1 V/m. The probe is laser-powered to allow continuous, galvanically isolated operation without recharging or battery replacement. The power supply unit comes in a small handy box.

## Features

- Laser powered – no more empty batteries
- Extreme small size
- High resolution, high speed, low noise
- Frequency range: 10 kHz to 6 GHz
- Field strength measurements from 0.1 V/m up to 10 kV/m
- Wide dynamic range
- Continuous real-time data streaming
- Temperature compensation

# LASER-POWERED FIELD STRENGTH METER – EFS LASER

10 kHz to 6 GHz



## Computer-Interface

PC Interface USB 2.0

Application Software included

Burst Trigger Output Level 3.3 V CMOS

Burst Trigger Output Connector BNC

Laser – Wavelength 850 nm

Laser – Output Power 750 mW

Laser – Shutdown Time 1 ms

Fiber Optic Connector FC / ST

Fiber Optic Cable Length 15 m

Max. Fiber Optic Cable Length 100 m (sold on request)

Input Voltage (power supply included) 5V ± 5%

Input Current < 2A

Ambient Temperature 10 °C ... 40 °C

Dimensions (W x D x H)av 483 x 43.5 (1HE) x 120 mm

## Field Sensor

Frequency range 10 kHz ... 6GHz

### Analog Rise Time

10 kHz ... 100 MHz low Bandwidth 4 µs

10 kHz ... 100 MHz high Bandwidth 40 ns

100 MHz ... 6 GHz 25 ns

### Minimum Pulse Width

Burst Mode 500 ns

Streaming Mode 2 µs

Resolution < 0.01 dB

### Sampling Rate

Burst Mode 2 MSample/s

Streaming Mode > 500 kSample/s

### Field Strength

10 kHz ... 100 MHz < 1 V/m ... > 10 kV/m

100 MHz ... 6 GHz < 0.1 V/m ... > 700 V/m

### Damage Level

10 kHz ... 100 MHz 40 kV/m

100 MHz ... 6 GHz 10 kV/m

### Dynamic Range

10 kHz ... 100 MHz 80 dB ... 100 dB

100 MHz ... 6 GHz 70 dB ... 80 dB

Isotropy, 900 MHz < 1dB

### Amplitude Accuracy

10 kHz ... 10 MHz (1.5 V/m to 30 V/m) 1.3 dB

> 10 MHz ... 1 GHz (1 V/m to 80 V/m) 1.5 dB

> 1 GHz ... 8 GHz (3 V/m to 100 V/m) 1.0 dB

Linearity Error < 0.1 dB

Temperature Stability 0.1 dB

Ambient Temperature 10 °C ... 40°C

Dimensions (W x D x H) 67 x 67 x 124 mm

# 2/4 CHANNEL RF-POWER METER – PMS 1084

10 kHz to 6 GHz



## Description:

The PMS 1084 is in the standard version a 2-channel RF-Power Meter for the frequency range from 100 kHz up to 6 GHz or from 10 kHz to 500 MHz (PMS 1084 B). The measuring range reaches from -60 dBm to +20 dBm. It is possible to upgrade the PMS 1084 up to max. 4 measuring channels at any time. The measured values can be displayed via a software which is included in the delivery or via

the control software of an automated test system. For the integration of the PMS 1084 into a remote-controlled test system it is equipped with serial and USB interface. Hence the PMS 1084 is very good suitable for the automated measurement of forward and reverse power in immunity test systems acc. to IEC/EN 61000-4-3 / -6. It is available for the installation into 19"-rack or as stand-alone unit.

Technical specifications	PMS 1084	PMS 1084B
Number of channels	2 (standard); up to 4 (option)	
Frequency range 2 x Input-Module LF	10 kHz – 500 MHz	
Frequency range 2 x Input-Module HF	100 kHz – 6 GHz	
Measuring range	-60 dBm to +20 dBm (10 kHz ≤ f ≤ 4 GHz) -45 dBm to +20 dBm (4 GHz < f ≤ 6 GHz)	
Accuracy	± 1 dB (0.5 dB typical)	
Resolution	0.1 dB	
Integration time	0.5 – 200 ms (firmware)	
Max. input level	+27 dBm (= 500 mW)	
VSWR	1.15	
RF-Impedance	50Ω	
Interface (PC)	USB, RS232 (9-pol Sub D. female)	
Input	N-type female connector	
Dimensions (D x W x H)	172 x 482.6 x 44.3 mm	
Weight	approx. 2.5 kg	
Power supply	115/230 V	
Accessories included	Power cord, USB cable, application software, user manual	
Options		
PMS-CHA	Expansion of 1 measuring channel (max. up to 4 channels); 100 kHz to 6 GHz	
PMS-CHAB	Expansion of 1 measuring channel (max. up to 4 channels); 10 kHz to 500 MHz	

# DIRECTIONAL COUPLER – Examples

## Description

A directional coupler is an electronic component having four-port circuits with one port being isolated from the input port and another being considered as a through port. The device is normally used to split the input signal and distributed power. The device couples part of the transmission power by a specific factor through one port. Directional couplers are used in a wide range of applications which involve measurement, power monitoring and other utilities.

C-3908: 80 MHz to 1 GHz, 1500 W, 50 dB



ECU-DC3: 1 GHz to 4 GHz, 40 dB



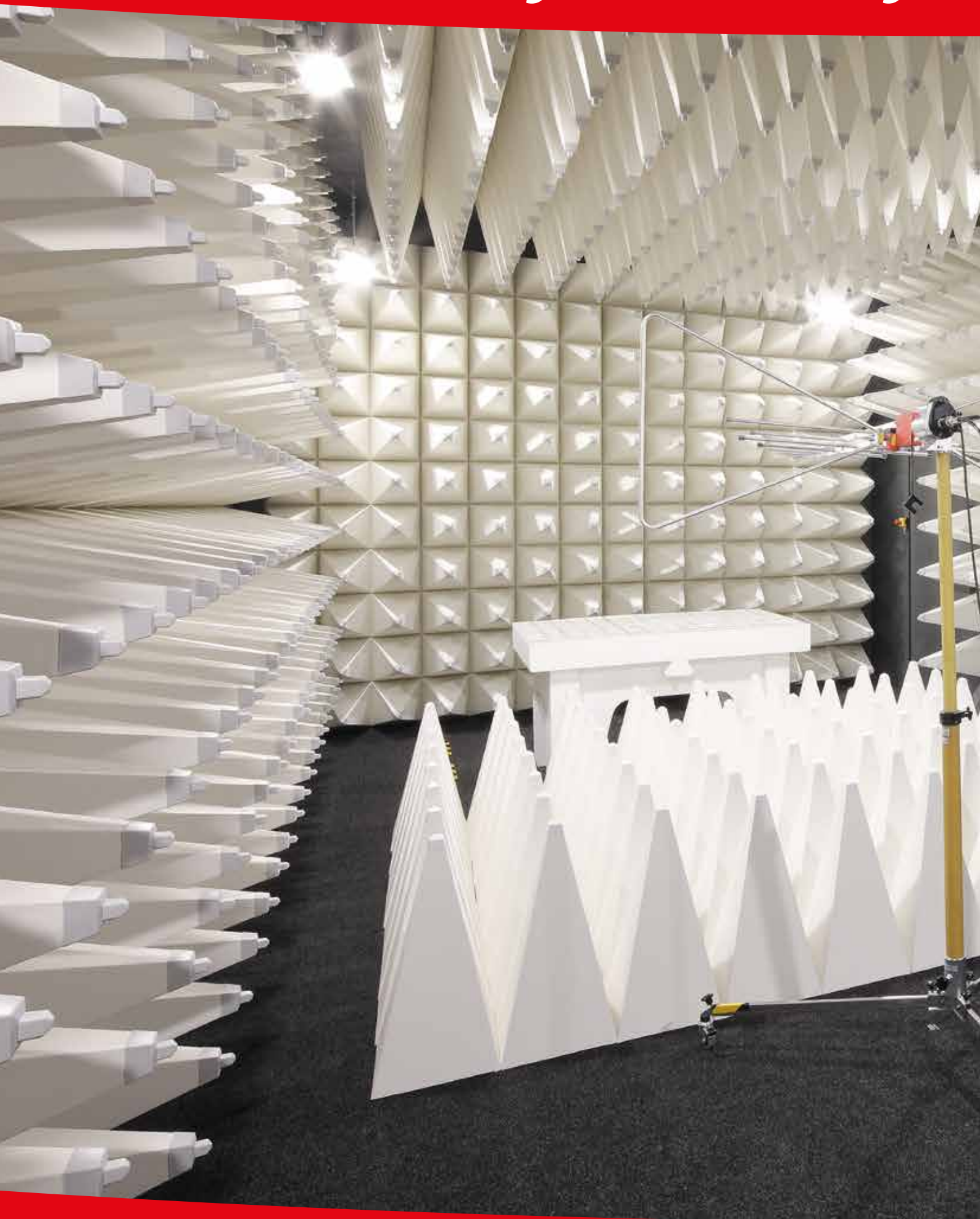
ECU-DC4: 2 GHz to 8 GHz, 40 dB



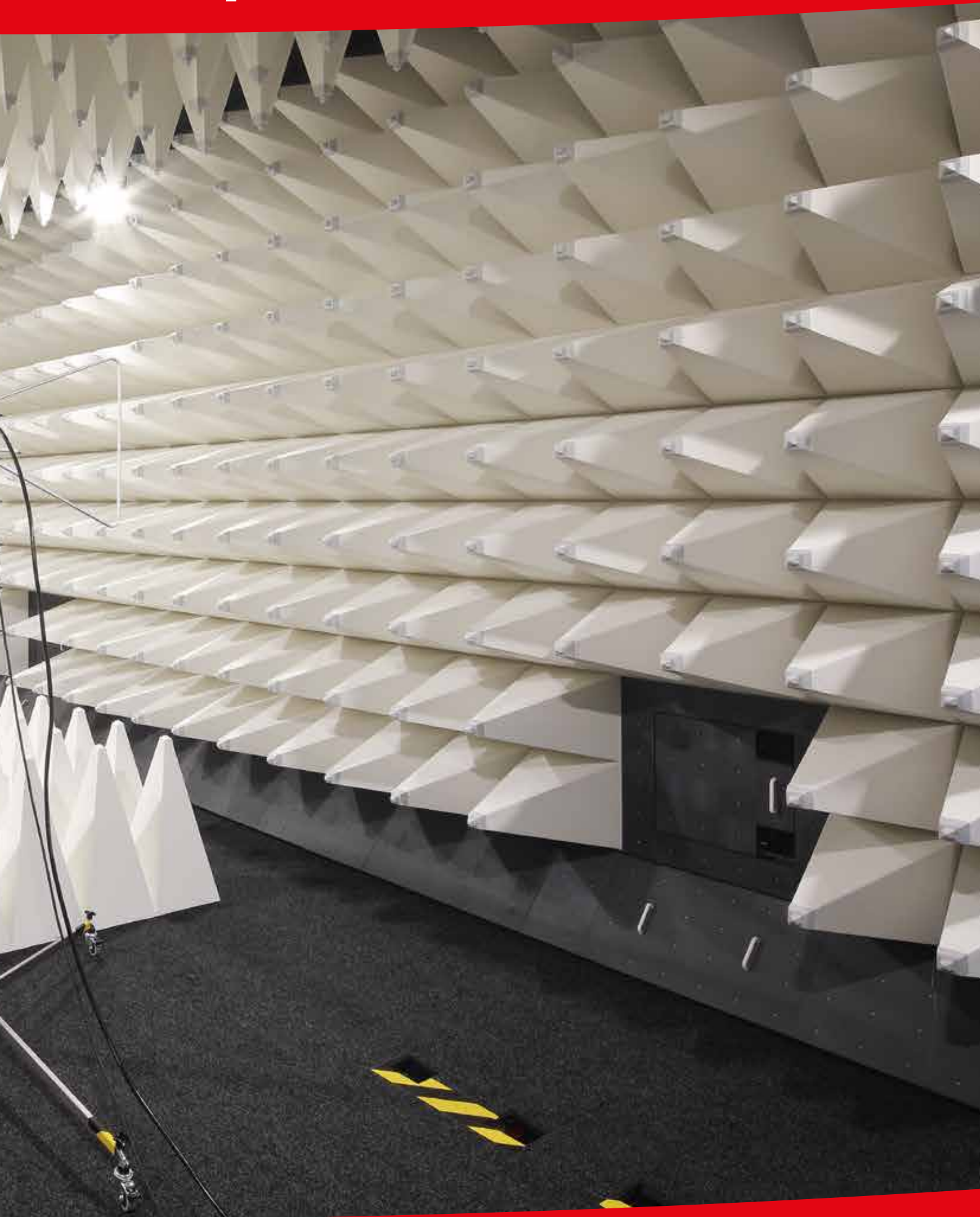




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