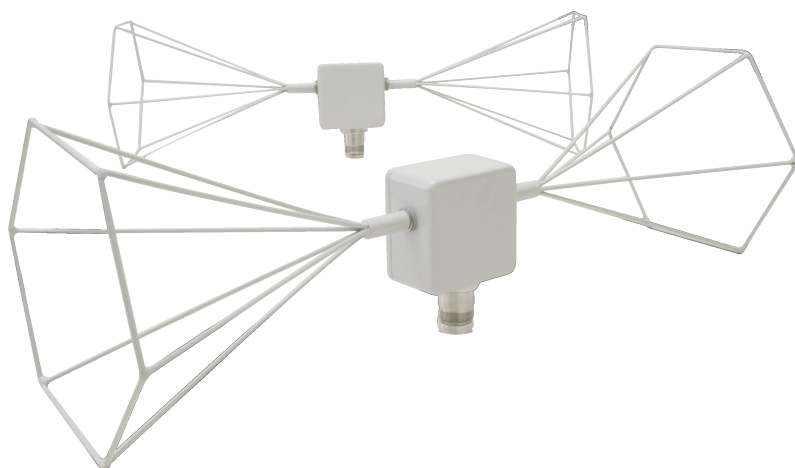


SEMS

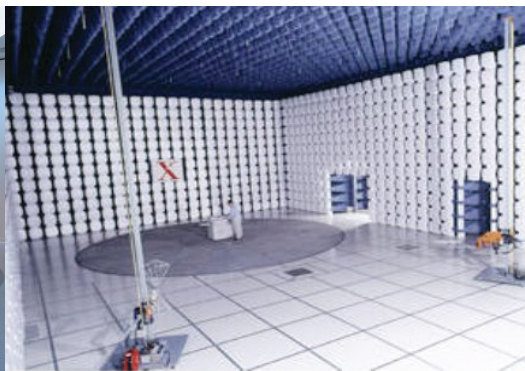
SHIELDING EFFECTIVENESS MEASUREMENT
SYSTEM IN MRI AND SHIELDED ENVIRONMENTS

ELECTRIC AND MAGNETIC FIELD
FROM 10 kHz TO 300 MHz





MRI shielding environment
(Magnetic Resonance Imaging)



Shielded and anechoic environment
for EMI/EMC testing



Shielded environment with high
electromagnetic protection for civil and
military applications (shelter)

The SEMS was designed to meet the growing test requirements of shielding effectiveness for shielded environments in hospitals, EMI-EMC chambers, military and civil shelters for telecommunications.

The SEMS allows fast, automatic and precise measures, in order to determinate the reduction value of the magnetic and the electric field in shielded environments.

NOT ONLY SHIELDING EFFECTIVENESS

(FAST AND PRECISE MEASUREMENTS)

THE MANY ADVANTAGES OF USING THE SEMS INNOVATIVE SYSTEM

EXAMPLE OF SETUP: TRADITIONAL SYSTEM



CONNECTION

Coaxial cables to connect transmitting and receiving antennas

POWER SUPPLY

Plug in power supplies required to supply power to the instrumental chain of the signal generator/spectrum analyzer

DYNAMIC

External amplifier to increase the signal strength and, consequently, the measurement's dynamic

CONNECTION TO THE PC

A PC is required for the automation of the measurement test and the subsequent data storage

OPERATORS

Two operators are required to perform the measure

EXAMPLE OF SETUP: SEMS SYSTEM



CONNECTION

The antennas of the SEMS system are directly connected to the TX and RX units without any cable

POWER SUPPLY

The TX and RX units of the SEMS system are equipped with rechargeable batteries with 6 hours operation

DYNAMIC

The TX unit of the SEMS system has got a power amplifier covering the whole range up to 300 MHz

CONNECTION TO THE PC

The SEMS system has an internal CPU that manages independently all the functions of calibration, zero setting and measurement with the related storing. Data can be downloaded through a PC via wireless connection

OPERATORS

Only one operator is required because the system synchronizes itself via wireless



SYSTEM DESCRIPTION

SEMS measurement system is made of a TX transmitting unit and a RX receiving unit.

They both use a pair of antennas to measure respectively the attenuation of the magnetic and the electric field. TX and RX cover the whole frequency range from 10 kHz to 300 MHz.

The measurement range being tested is determined by the antenna.

In the standard configuration the SEMS is equipped with L-1 loop antennas for magnetic fields from 2 to 128 MHz and B-1 biconical antennas for electric fields from 60 to 300 MHz.

Alternatively, two loops for the 10 kHz to 4 MHz coverage, two rod antennas for the electric field (1 MHz to 128 MHz coverage) and two D-2 dipole antennas for the electric field (40 MHz to 300 MHz coverage) can be supplied. Unlike traditional systems, which measure the shielding effectiveness only at a few frequency points, the SEMS performs the complete test continuously and on the whole frequency range.

A further innovation and development, compared to traditional test systems, is the synchronization of the TX and RX units. The two units communicate with each other thanks to a wireless technology, which is very useful to automate, speed up the test and minimize any error.

OPERATING PRINCIPLE

SEMS measures the shielding effectiveness of a shielded environment, that is the attenuation of the electric and magnetic field that such environment causes. The operating principle is simple:

FIRST PHASE OR “ZERO SETTING”

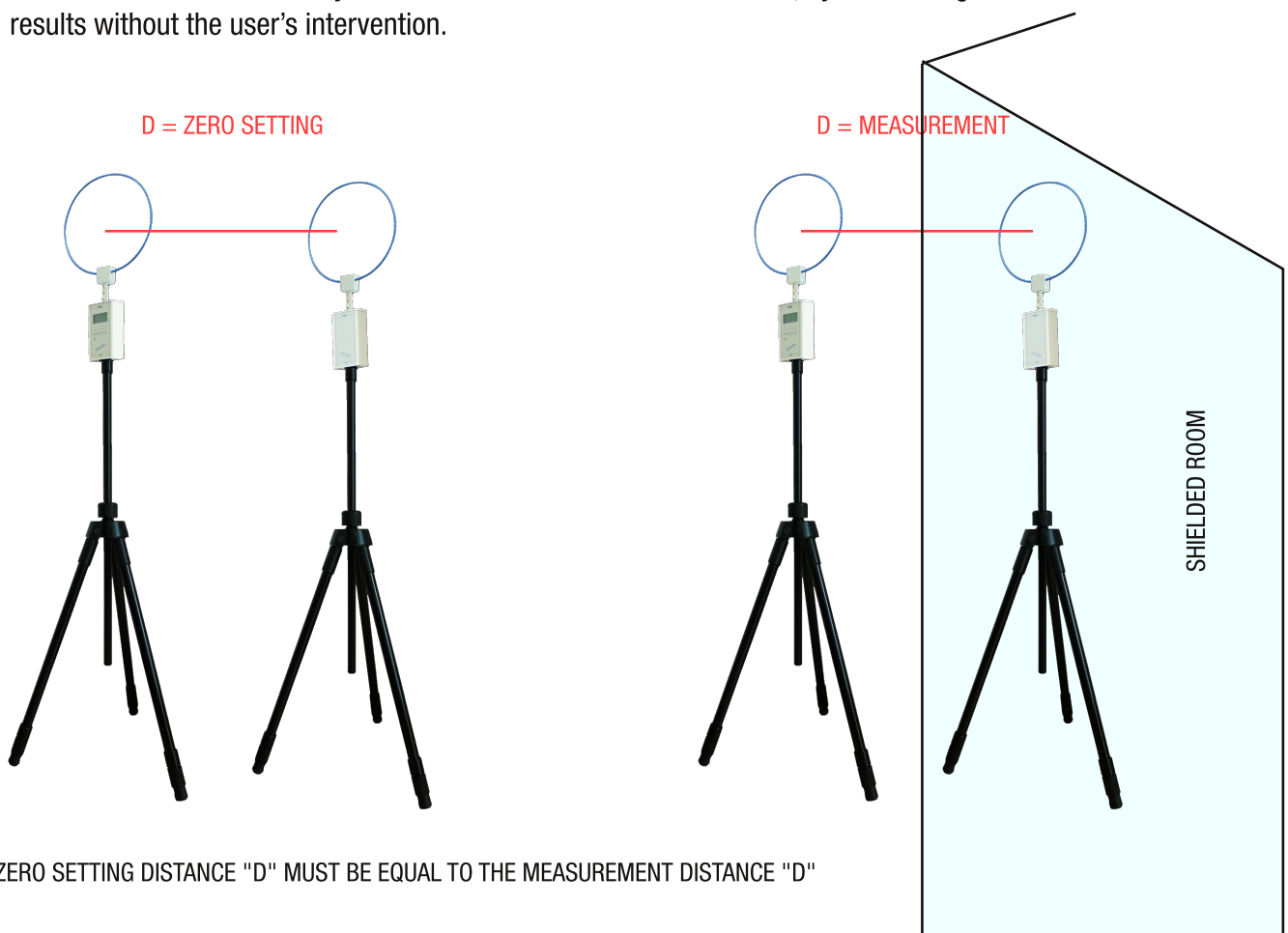
The TX transmitting unit generates a RF signal, which is radiated through the antenna.

The RX receiver is positioned at a predetermined distance, receives the signal via similar antenna and measures its level in dBm.

SECOND PHASE “MEASUREMENT”

Now, if the RX receiver is moved into the environment to be measured, being careful to maintain the same initial distance from the TX unit, a reduction of the measured signal is achieved.

The RX unit will show directly the reduction of the environment in dB, by subtracting the two measured results without the user's intervention.



THE ZERO SETTING DISTANCE "D" MUST BE EQUAL TO THE MEASUREMENT DISTANCE "D"

SEMS RECEIVER (RX)

The following block diagram represents the SEMS RX part. By following the RF signal coming from the receiving antenna, you will find the reduction module, which adjusts the level of the RF signal to the subsequent stages, and the filter modules, which select the bands according to the reception frequency. The RF signal thus adjusted gets into the digital part through a digital analog converter (ADC). Then a RSP and a DSP process the digital signal by using complex algorithms and eventually show it on the display.



SEMS TRANSMITTER (TX)

The SEMS transmitting part is represented by the following diagram. The signal to be transmitted is generated by the DDS, following the CPU commands. The CPU receives instructions by the wireless interface of the receiver. This signal is duplicated and amplified to reach the necessary level to the transmitting antenna.



SAME MEASUREMENT, DIFFERENT WAY

Unconnected Mode

This function enables performing the measurements in all environments where it is not possible to use either the bluetooth bridge or the fiber optic cable. The operator will make a list of frequencies with the SEMS software and upload it on the RX unit from the PC. It is fast and easy.

Sniffer Mode

Sniffing is an important function for all technicians that want to maintain the performance of the chamber. By using this operating mode, it is possible to find the weak spots in the shielding.

Prequiet Mode

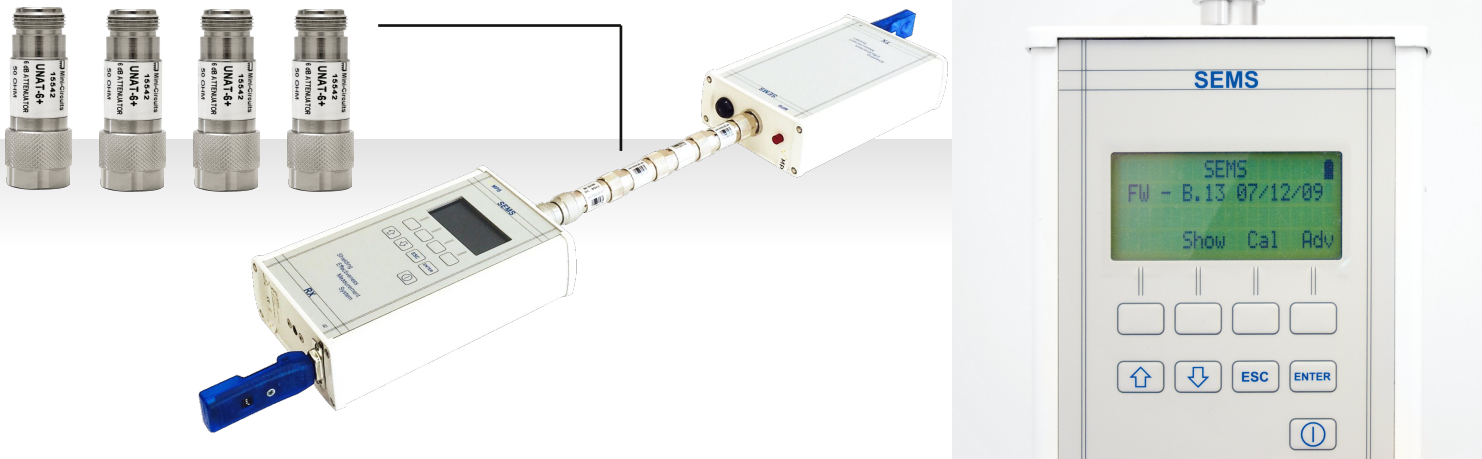
During the test there will be one or more noisy frequencies inside the chamber.

Before making the measurement, the RX unit can find these frequencies and re-start the test with a new list of frequencies. The new list differs from the previous one by few decimal units.

CALIBRATION WITH CAL-KIT

The SEMS system, while not taking measurements in absolute values, requires a periodic check of its linearity.

The Cal-Kit meets this requirement. It is supplied with Accredited Calibration. The calibration procedure can be recalled from the Cal menu. By selecting CalK, the display will show the correct execution step by step. The following pictures show the set-up to be used.



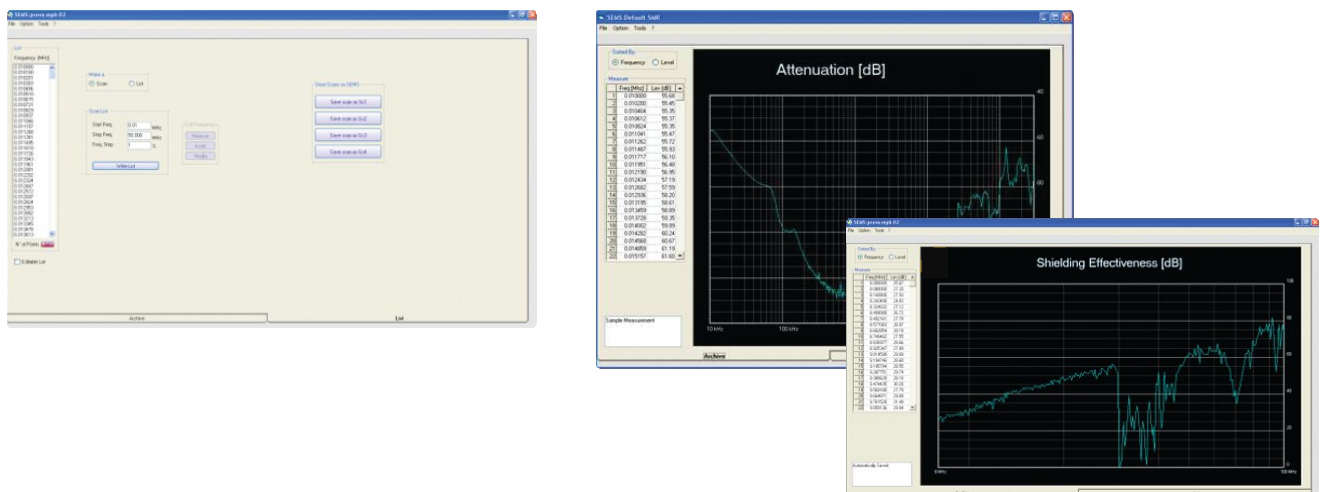
POWER SUPPLY

Both SEMS units, TX and RX are powered by rechargeable lithium batteries. The measurement read by the instrument is therefore not affected by the power supply.



USE AND OPERATION OF THE SEMS PC UTILITY SW

Thanks to the SEMS PC Utility software, the measurements recorded on the RX unit can be downloaded, stored and/or exported in ASCII format, in order to write customized measurement reports. Also, zero setting scans can be pre-programmed and then directly transferred to the non-volatile memory of the RX unit.



TECHNICAL SPECIFICATIONS

TX/RX frequency range	10 kHz...300 MHz
Resolution	10 Hz
RF output (TX Module)	Zout 50 Ω , N fem.
Max output power (typical)	+30 dBm
RF input (RX module)	Zin 50 Ω , N fem.
VSWR	< 1.2
Attenuators	0...20 dB
Max input level	110 dBuV
Dynamics	120 dB max
IF bandwidth (RX module)	5/150 Hz
3 dB bandwidth	
Precision of the attenuation measurement (typical)	10 kHz... 30 MHz \pm 1.0 dB 30 MHz...300 MHz \pm 1.5 dB
I/O Interface	RS232 / Wireless
Acoustic alarm	Programmable at the attenuation level
Compliance with international standards	MIL-Std-285 IEEE Std 299 EN50147-1 NSA65-6
Operating temperature	0° ... 40°C
Battery power	Rechargeable Li-Ion (4h) not replaceable by the user
Weight and dimensions:	
TX	708 g 106x46x194 mm
RX	774 g 106x46x194 mm
Total weight	9,4 kg
Rigid case dimension	52 x 43 x 23 cm
Set-Up of "0" Calibration & Measurement	Pre-programmable by the user via software

Subjec to change without notice



ORDER CODE

FIG	CODE	DESCRIPTION
1	SEMS	TX and RX up to 300 MHz
2	SEMS-LIGHT	TX and RX up to 128 MHz
3	KEY-300	Upgrade up to 300 MHz
4	L1	Loop antenna range from 2 to 128 MHz
5	L2	Loop antenna range from 10 KHz to 4 MHz
6	L3	Loop antenna leak detector
7	L4	Tuned loop antenna from 2 to 128 MHz
8	B1	Biconical antenna from 60 to 300 MHz
9	D2	Dipole antenna from 40 to 300 MHz
10	R2	Rod antenna from 1 to 128 MHz
11	CAL KIT	4x30 Db attenuator kit
12	OPTICAL LINK 10	Optical link with 10 m fiber optinc
13	OPTICAL LINK 20	Optical link with 20 m fiber optinc
14	NMR-01	Non-magnetic and non-reflective tripod

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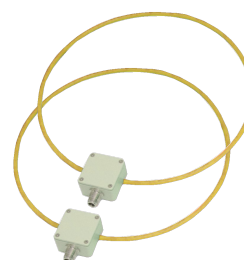
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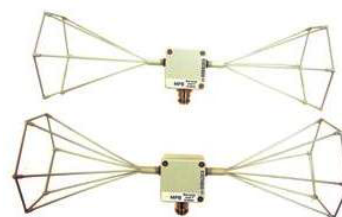
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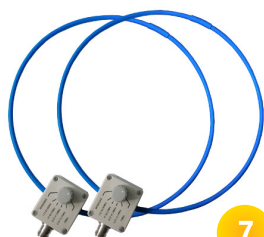
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