MPB
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PIRS

PORTABLE IMMUNITY RADIATION SYSTEM

FREQUENCY RANGE 10 KHz - 3 GHz

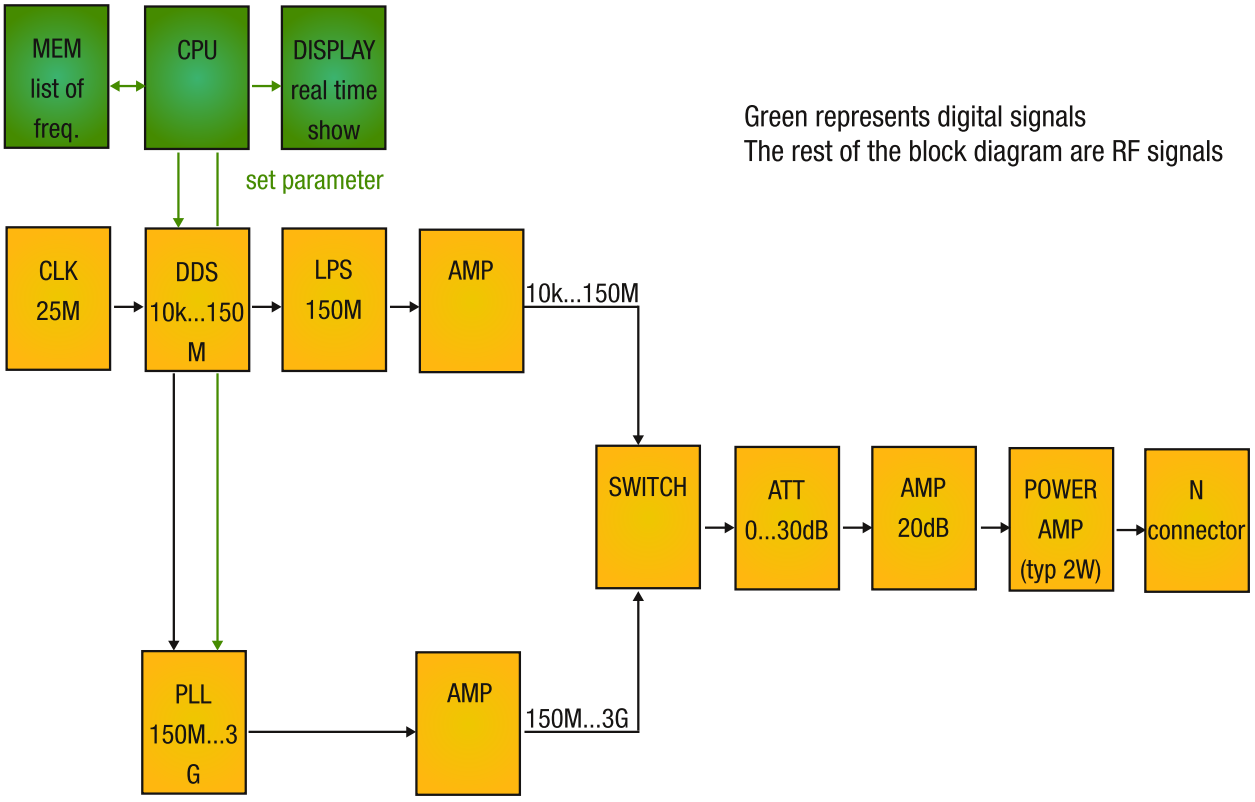
The PIRS is an innovative system for generating amplified and feedback CW signals.
It can be used in radiated immunity tests (precompliance according to IEC 61000-4-3) and to generate electric field intensity signals from 1 V/m to 30 V/m in shielded environments, TEM and GTEM cells, anechoic or semi anechoic chambers.
Thanks to its battery power supply and its 8-hour autonomy (in generation and continuous amplification), it can be used with extreme ease in any environment, especially in "Situ" to perform radiated immunity tests on large systems and devices which are difficult to transport inside semi/anechoic chambers.




PIRS block diagram

After programming a list of frequencies through the PC software, the PIRS (thanks to its feedback circuit) can generate every single tone in CW, vary its amplitude up to the achievement of the target set by the operator (in dBm if a power meter is used or in V/m if a broadband electromagnetic field meter is used) to compile the table that will ultimately be saved within its non-volatile memory.
This procedure called calibration or table compilation is carried out using a RF power meter or a broadband electromagnetic field meter.

Frequency [MHz]	AF or Gain [dB/m dBi]	Power meter [dBm]	Broadband meter [V/m]	PIRS/DUT distance [m]
30	Antenna property		2,94	1
50	Antenna property		3,01	1
100	Antenna property		2,98	1
500	Antenna property		3,05	1
700	Antenna property		3,00	1
900	Antenna property		3,12	1
1000	Antenna property		3,15	1
2000	Antenna property		2,90	1
3000	Antenna property		3,14	1



The system receives as input (through its software) a list of frequencies that the CPU (Central Processing Unit) transmits to the DDS (Direct Digital Synthesis).
The signal is digitally converted by the DDS and filtered at 150 MHz by the low-pass filter (LPF).

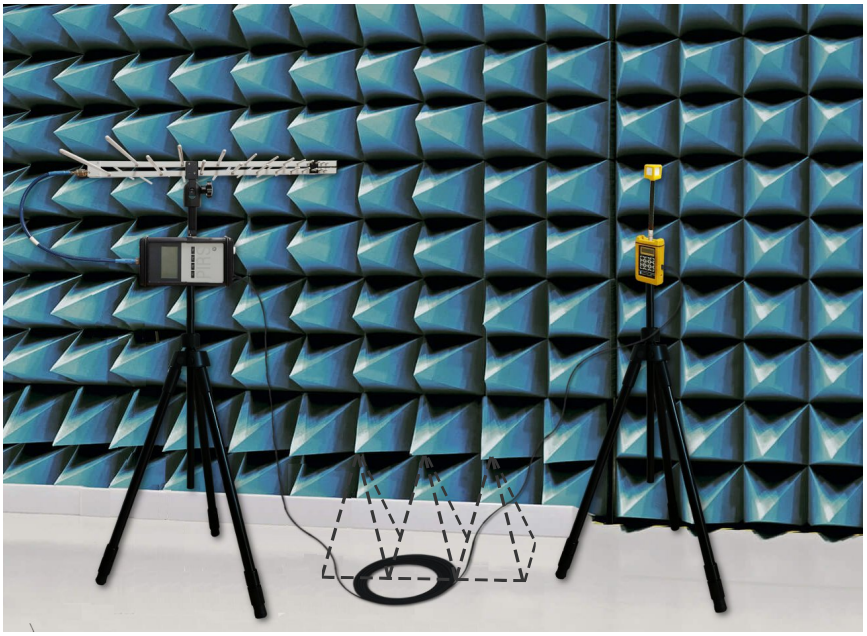
Before having it available at the "N" connector output, it is attenuated and amplified to around 4 Watts (36 dBm), if necessary.
Over 150 MHz and up to 3 GHz the generation is performed by the PLL.

Calibration with broadband Electromagnetic Field Meter and radio frequency Power Meter

The two operating modes allow the PIRS to create one or more tables to be saved in memory, to then perform the test without feedback circuit.
In this way the operator can have several tables (up to 128), each obtained at different intensity levels in V/m and/or with multiple frequency ranges depending on the test requirements.
The two methods differ in the setup and measuring instruments to be used for feedback.

- Calibration with broadband Field Meter

This method is mainly used to create the electromagnetic quiet zone in which the device under test (DUT) must be inserted to then be subjected to the radiated immunity test.
The PIRS can perform this test in precompliance mode according to IEC 61000-4-3 standard as it is not able to generate modulated signals in AM but only in CW mode (sine wave).
In the test setup, the PIRS must be positioned on the first non-magnetic and non-metallic tripod (NMR-01 type) to limit the undesired reflections of the transmitted electromagnetic wave as much as possible and then connected with the coaxial cable to the transmitting antenna.
On the second tripod and at a predetermined distance the broadband field meter must be installed with an appropriate isotropic sensor.



1 > D < 3 meters

The feedback circuit is made by the fiber optic connection between the broadband field meter output and the PIRS optical input.
The antenna and the broadband isotropic sensor must cover the same frequency range as the list entered in the PIRS.

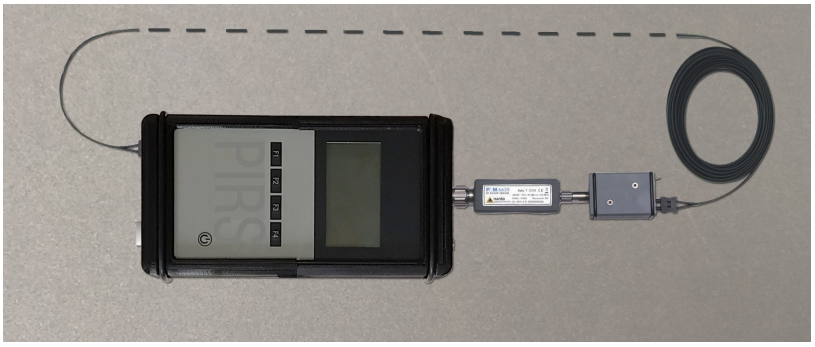
At the end of calibration, the entire list of frequencies with the relevant signal amplitude values will be complete and immediately saved automatically to be used in the final radiated immunity test.

Frequency [MHz]	Target [V/m]	Broadband meter [V/m]	PIRS/DUT distance [m]
200	3,00	2,98	3
500		3,05	
700		3,00	
900		3,12	
1000		3,15	
2000		2,90	
3000		3,14	

Example of table compilation with 3 V/m (+/- 5%) programmed Target at 3 meters distance between antenna and DUT via Feedback circuit - broadband field Meter.

- Calibration with the radio frequency power meter

This method can be used where a radio frequency power meter is available instead of the broadband field meter.
In this case, the antenna factors (AF) or the antenna gains to be used during transmission must be known in order to obtain the relative power value at the PIRS “N” connector automatically.



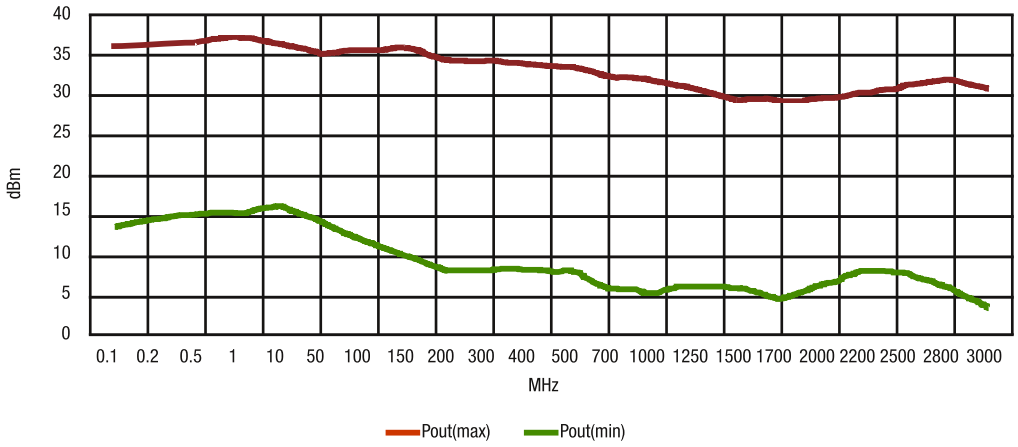
Frequency [MHz]	Target [V/m]	PIRS/DUT distance [m]	AF or Gain [dB/m dBi]	PIRS Power Target [dBm]	Power meter [dBm]
200	3,00	3	12	30.07	29,35
500			19	29,12	29,48
700			21	28,19	29,09
900			23	28,01	27,25
1000			24	28,09	27,79
2000			28	26,07	26,85
3000			35	29,55	30,25

Example of table compilation with 3V/m (+/- 5%) programmed target at 3 meters distance between antenna and DUT via Feedback circuit - RF power Meter.

The PIRS will automatically fill in the "Power Meter" column with the dBm values transmitted from the power meter to the "N" connector to satisfy the test set point at 3 V/m. In practice, however, the propagation of the electromagnetic wave in the far field must be considered. The software (when filling in the table) will warn the user if this condition is met.

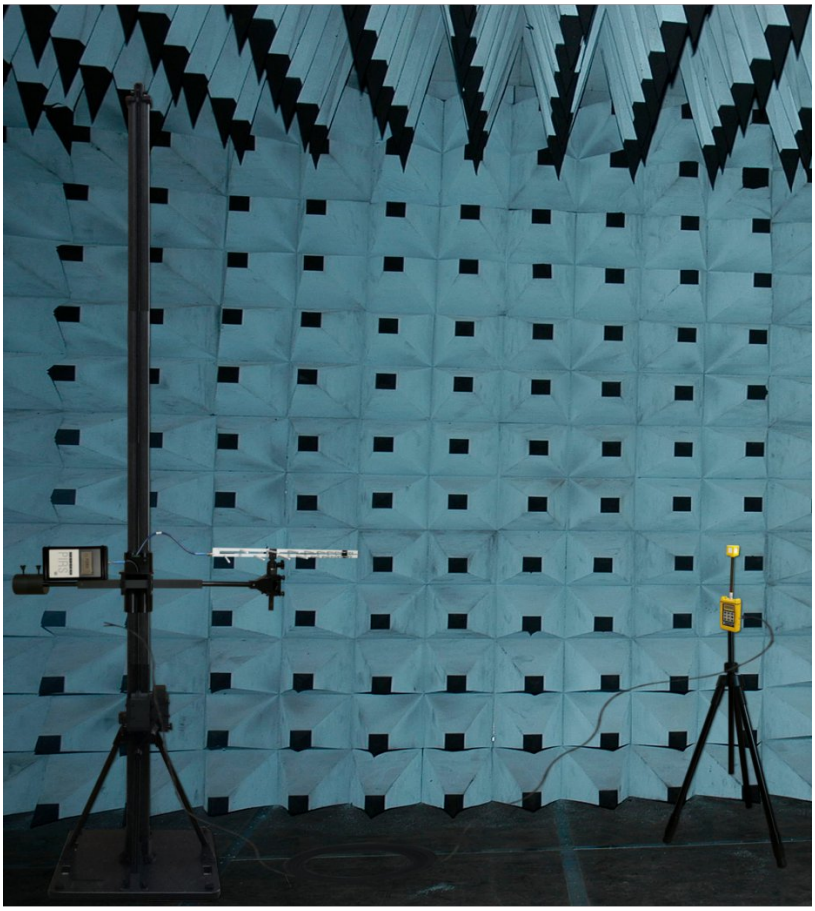
Generation

The PIRS system can generate CW signals from 10 kHz to 3 GHz, in amplitude variations from a minimum of 3 dBm (0.002 watt) up to a maximum of 36 dBm (4 watts)
The graph below shows all the Pout min/max output power variation values in the operating range of the system.



Application fields

- Radiated immunity in anechoic/semi-anechoic chamber or outdoor site



The possibility of storing the different lists of frequencies in the internal memory of the PIRS during the field calibration, as well as the possibility of having the power signal at the "N"connector output allows the operator to take advantage of all the power generated and directly available to the transmitting antenna connector, without attenuations due to the coaxial cable which sometimes can even exceed 6 meters in length (height 4 meters of mast + section to reach the amplifier room)

As shown in the picture, the PIRS can be attached to the mast with extension up to 4 meters - model NMR-03 near the "N" connector of the transmission antenna.
The presence of the fiber optic cable is an integral part of the calibration setup if the broadband field meter is used.

- Radiated immunity in TEM or GTEM cell, Helmholtz coil
- Functional checks of the isotropic sensors up to 3GHz

The PIRS can be connected directly to the connector of a TEM or a GTEM cell.
Also in this case the "almost" total absence of the coaxial cable gives the system the possibility of fully using the power available at the PIRS "N" connector.
The simple height adjustment of the NMR-01 tripod allows the setup to position and align the system to the TEM/GTEM cell with extreme precision.
Test setups can be carried out with the TEM and GTEM cell to verify the good operation of the broadband isotropic sensors for measuring the electrical component from 10 kHz up to 3 GHz.

By means of a Helmholtz coil it is instead possible to carry out the test setup for the broadband isotropic sensors for measuring the magnetic part of the electromagnetic field.

Examples of electric field (V/m) generations with different setups

The table below was created using the PIRS system in different setup configurations:

In anechoic Chamber
PIRS directly connected to a Log-periodic antenna of Mod. LP-02 and suitably positioned on the NMR-03 mast.
Calibration through a broadband field meter and optical fiber connection for the table compilation.

In TEM /GTEM cell
PIRS directly connected to the TEM/GTEM cell connector and suitably positioned on the NMR-01 tripod.
Calibration through a broadband field meter and optical fiber connection for the table compilation.

With Helmholtz Coil
PIRS directly connected to the Helmholtz coil connector and suitably positioned on the work bench.
Calibration through a radio frequency power meter and optical fiber connection for the table compilation.

TEST NAME	DISTANCE	f START [MHz]	f STOP [MHz]	TARGET [V/m]	RESULT
GTEM	0.24m	0.1	3000	1	PASS
GTEM	0.24m	0.1	3000	3	PASS
GTEM	0.24m	0.1	3000	10	PASS
TEM	0.15m	0.1	200	1	PASS
TEM	0.15m	0.1	200	3	PASS
TEM	0.15m	0.1	200	10	PASS
ANECHOIC 1m	1m	200	3000	1	PASS
ANECHOIC 1m	1m	200	3000	3	PASS
ANECHOIC 1m	1m	200	3000	10	PASS
ANECHOIC 3m	3m	200	3000	1	PASS
ANECHOIC 3m	3m	200	3000	3	PASS

Configurations with automatic calibration

Options

PIRS-BAG	Transport bag
NMR-01	Non-metallic and non-magnetic tripod
NMR-03	Non-metallic and non-magnetic mast - 4 meters
LP-02	200 MHz – 3 GHz Periodic Log Antenna
BC-01	30-200 MHz Biconical antenna
BL-01	30 MHz – 6 GHz Biconical Log periodic antenna
PIRS-CONV	Optical converter for broadband meter/RF power meter

TECHNICAL SPECIFICATIONS

Frequency range	10 kHz…3 GHz
Frequency resolution	1 Hz
Connectorization	N-Type
Maximum output power (Typ)	37 dBm @1 MHz
Minimum output power (Typ)	3 dBm @3 GHz
Display	graphic 240x128
I/O Interface	USB/fiber optic
Reference standard	IEC 61000-4-3 (pre-compliance)
Operating temperature	-10° ... 40° C
Calibration certificates	standard; LAT
Dimensions	30 x 15 x 8 cm
Weight	1.7 kg
Power supply	8 18650 rechargeable batteries that can be replaced by the operator
Programmable lists	128 lists of 500 points each
Autocalibration - set point - feedback tolerance	with sample probe or with mathematical model configurable for each list via software defined by the user, minimum 2.5% (Typ 5%)
Feedback - with sample probe - with power meter	configurable from minimum 1 sec f freely configurable via PC f available on the antenna certificate
Generation persistence	configurable from minimum 1 sec
Compatible instruments	8053B, OR03, WBM, 6630FOA + 6630

Subject to change without notice

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