



Switch Matrix Systems

An overview of the systems from
MTS Systemtechnik GmbH

Individual high-frequency technology



Concepted and build in Germany.

// Content



Your partner for customised solutions -
„Development, Production & Service“
all from a single source.

// High frequency technology
// EMC technology
// CNC milling technology

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// About MTS Systemtechnik

Tailor-made solutions for high frequency technology, EMC, electronics and mechanics

Our customers include manufacturers of highly sensitive equipment in the market segments of mobile communications, telecommunications, aerospace, defense, medical, automotive and electronics. Our devices, systems and components are used worldwide by leading, internationally active companies.

For over 25 years, MTS Systemtechnik stands for state-of-the-art technology, absolute reliability, discretion, transparent processes and certified quality according to DIN EN ISO 9001.

With about 50 employees we develop and manufacture individual and high-quality devices, systems and components „Made in Germany“, as well as customer-specific products.

Our electronic products include coax relays, attenuators, power splitters, systems for the distribution of LF-, video-, RF-signals, RF matrices, assembled coax cables, etc. complex switching and distribution tasks in the high frequency range have made us a leading manufacturer of relay switching units, air interface emulators, power splitter units and matrices.

For the mobile radio and telecommunications industry we supply customised shielding boxes, air interface emulators for various test scenarios and smart antenna simulators.

With our modern CNC production centre we manufacture customer-specific precision milled parts for the aerospace, optical and high-frequency industries.

The distribution of coaxial connectors from IMS Connectors and the assembly of coaxial cables complete our product range.



Systems for the distribution of LF, video and RF signals in the fields of tele- and satellite communication and radio surveillance



Production of mechanical components for the aerospace, optical and high-frequency industries



Development and production of active and passive components for high frequency technology

// Introduction

MTS Systemtechnik builds switching matrices that are ideally suited for the RF inter-connection of test stations in the range of mobile radio, IoT, Bluetooth, Wi-Fi and Terrestrial Trunked Radio. By designing new, ultra high isolated semiconductor switches (HLS), we are able to produce automated RF 'patch panels' at low cost.

Fast and reproducible switching of signal paths to the most diverse test applications enables valuable time savings.

In addition, interesting savings effects result because cost-intensive RF measurement equipment, base stations and user equipment can be better utilized.

The third major advantage of a semiconductor switch matrix is the high switching reliability, because typical problems of mechanical patch fields, such as connector wear, cable breakage or loss of shielding on the patch cables, do not occur here due to the design. Also fluctuations of the insertion loss, or disturbances by contact surfaces which are contaminated by abrasion, as it is possible with electromechanical relays, need not be feared here. The use of semiconductor switches also allows very high isolation values to be achieved.

Compared to matrices built with mechanical relays, semiconductor matrices have much lower space requirements. For example, a MX-32/32-FFO-HLS matrix with 1024 nodes is only a 9U rack unit. This is also accomplished, by using partly plug-in modules instead of cables. This tidy design increases the robustness and also reduces the effort in case of repair.

Last but not least the power consumption is also much lower in comparison with mechanical relay matrices.

Alternatively, MTS Systemtechnik also provides conventional matrix systems and relay switching units based on electromechanical relays.

Both types of Matrix systems are purely passive and therefore equally permeable for both signal directions.

A Windows program which allows to quickly program ramps for handover tests is available as an accessory.

The new MTS semiconductor matrices allow

- // The digitization of RF patch panels
- // State-of-the-art signal routing,
- // Versatile linking of test benches with mobile radio base stations and
- // Flexible interconnection of any kind of radio test stands up to 6 GHz.

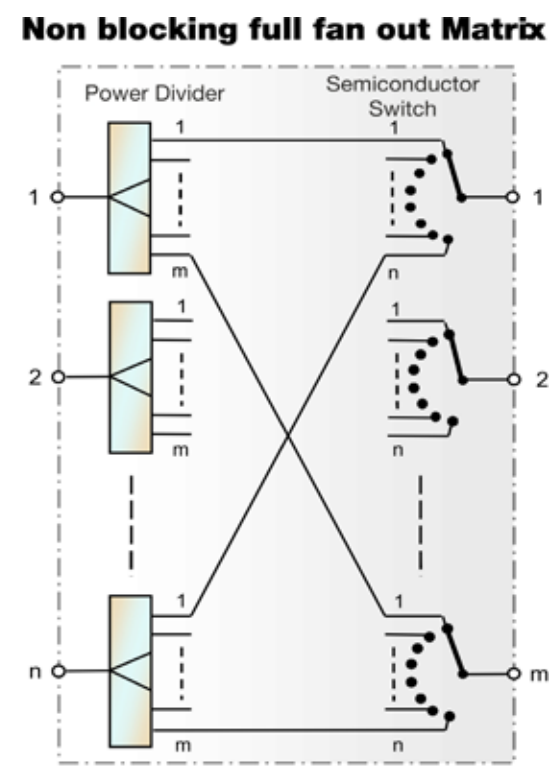
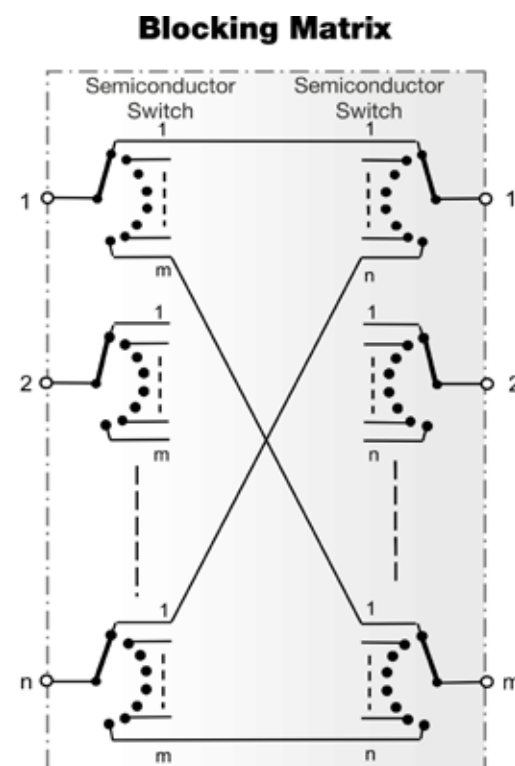
// Basic Topologies

Blocking Matrix n/m (n/m = number of inputs/outputs)

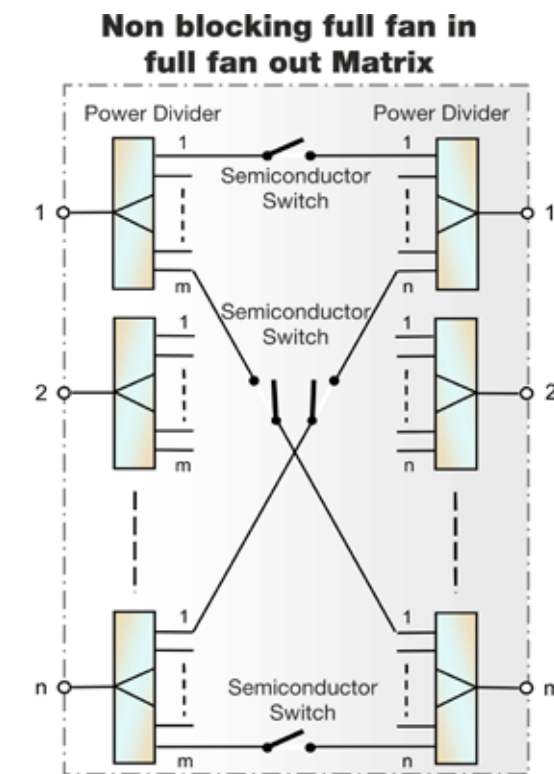
If an application is only about patching RF connections, a matrix consisting internally only of switches is sufficient (see picture on the right). This matrix also provides relatively easily achievable high isolation values.

Non Blocking Matrix n/m

However, if input signals are to be available at several test benches at the same time, this is made possible by built-in Wilkinson power splitters, which are positioned at the input side instead of the HLS switches.



Block diagram, Non Blocking Matrix:



Such a switch matrix is called „non blocking full fan out“. With a „non blocking full fan in“ matrix, the power splitters would be on the output side, i.e. mirrored (no picture). There is also a third variant of the non blocking matrix called „full fan in / full fan out“. In this matrix there are power splitters on the input side as well as on the output side and the semiconductor switches are located in between (see picture on the right).

A disadvantage of using power splitters, however, is that the bandwidth of the switch matrix can be smaller. Other drawbacks are a higher insertion loss and a lower isolation (approx. 30 dB) between outputs (or inputs in the case of full fan in) as soon as they are switched to the same input (or output in the case of full fan in).

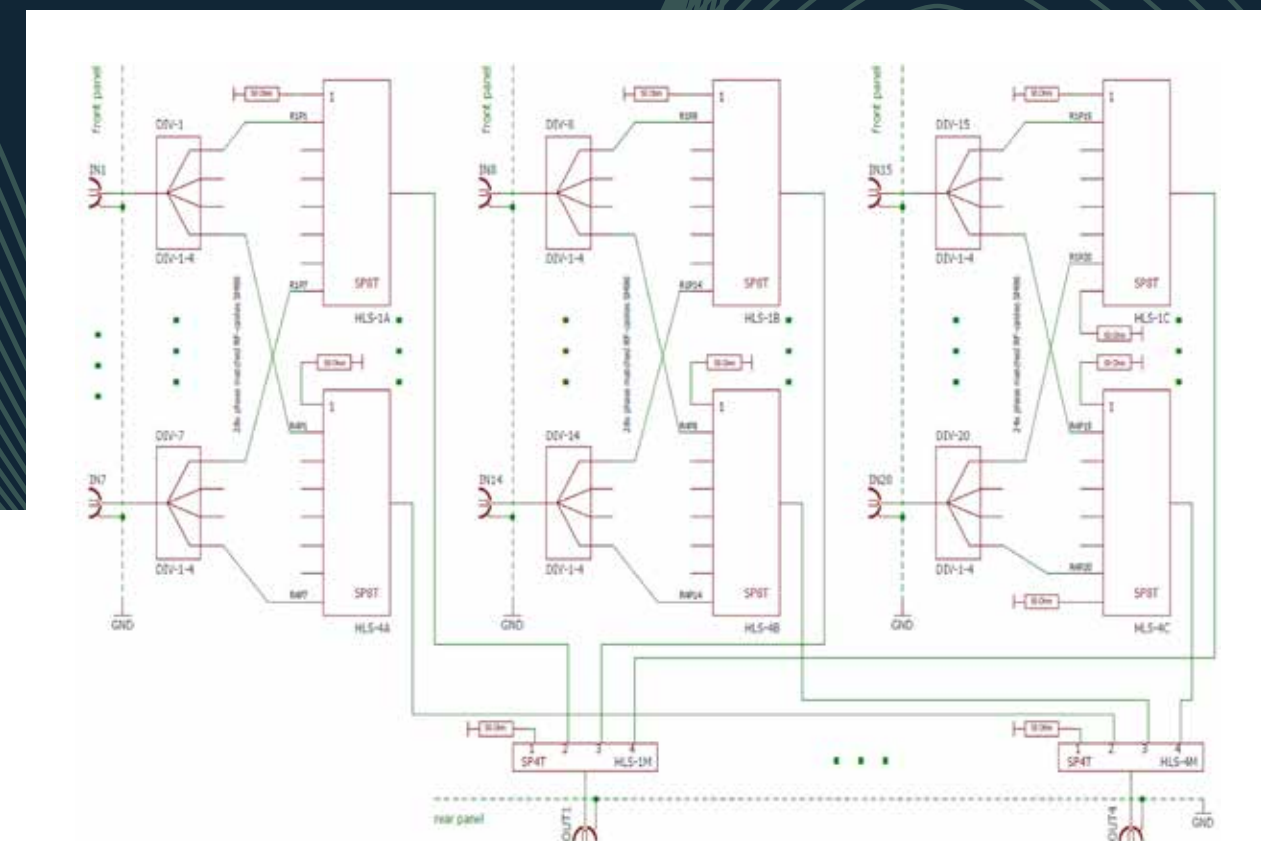
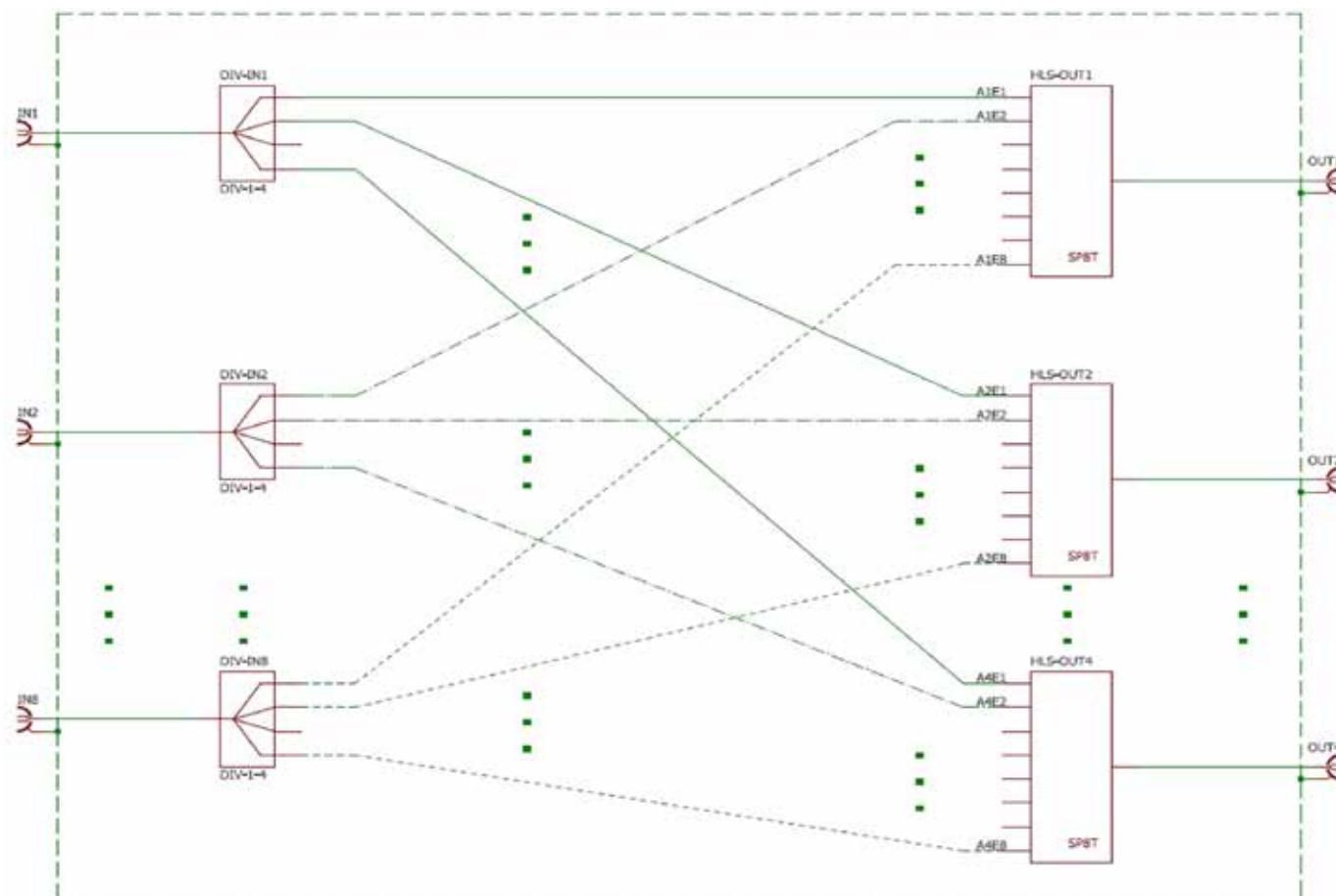
Switch matrix systems can be controlled via LAN or USB interfaces. Manual operation via an optional built-in touch panel display is also possible.

- // Robust design due to solid state components
- // No calibration is required

// Examples

Semiconductor Switch Matrix MX-8/4-HLS-FFO-6G

This semiconductor switching matrix has a non blocking full fan out function. With this small 3HU rack unit 8 input signals can be distributed to different 4 users. The unit has a frequency range from 500 MHz to 6000 MHz and the VSWR is only 1.4 : 1 typ. It has also a low insertion loss of 10.5 dB at 500 MHz rising to 18 dB max. at 6000 MHz. The matrix can be controlled by RS-232 and via LAN interface.



Semiconductor Switch Matrix MX-20/4-HLS-FFO-6G

This is a non blocking full fan out semiconductor switching matrix with 20 input and 4 output connectors. It can be used in the range from 500 MHz to 6000 MHz. The outstanding isolation qualifies this matrix for demanding applications, such as IoT and 5G mobile communication:

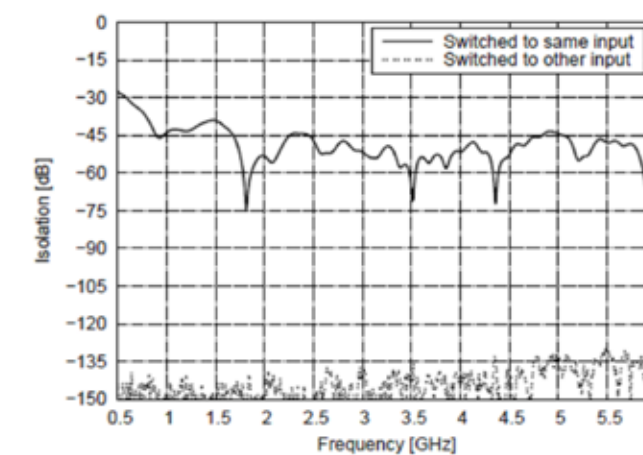


Fig. 3: Isolation between output ports

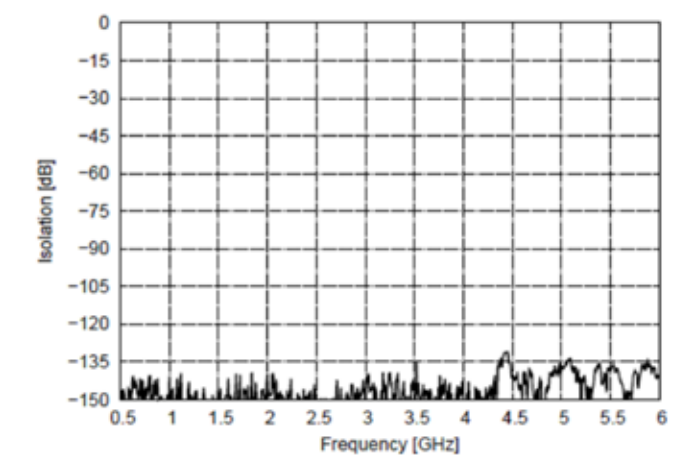


Fig. 4: Isolation between in- and output ports

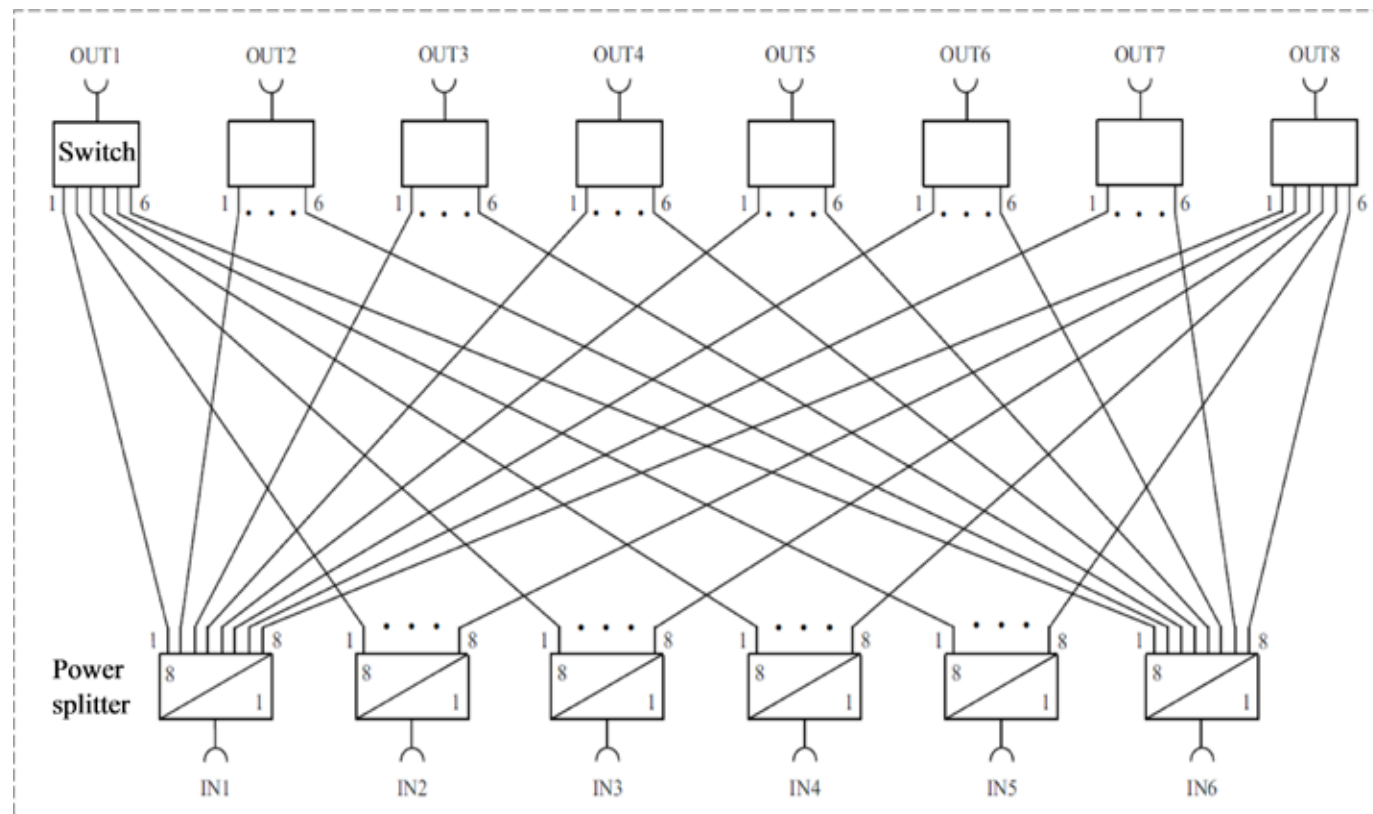
- // Robust design due to solid state switches (no wear by switching)
- // No calibration is required

Electromechanical Switching Matrices

Switching functions are performed by electromechanical relays. The advantage of this design is the extreme power handling up to the kilowatt range and excellent low insertion loss.

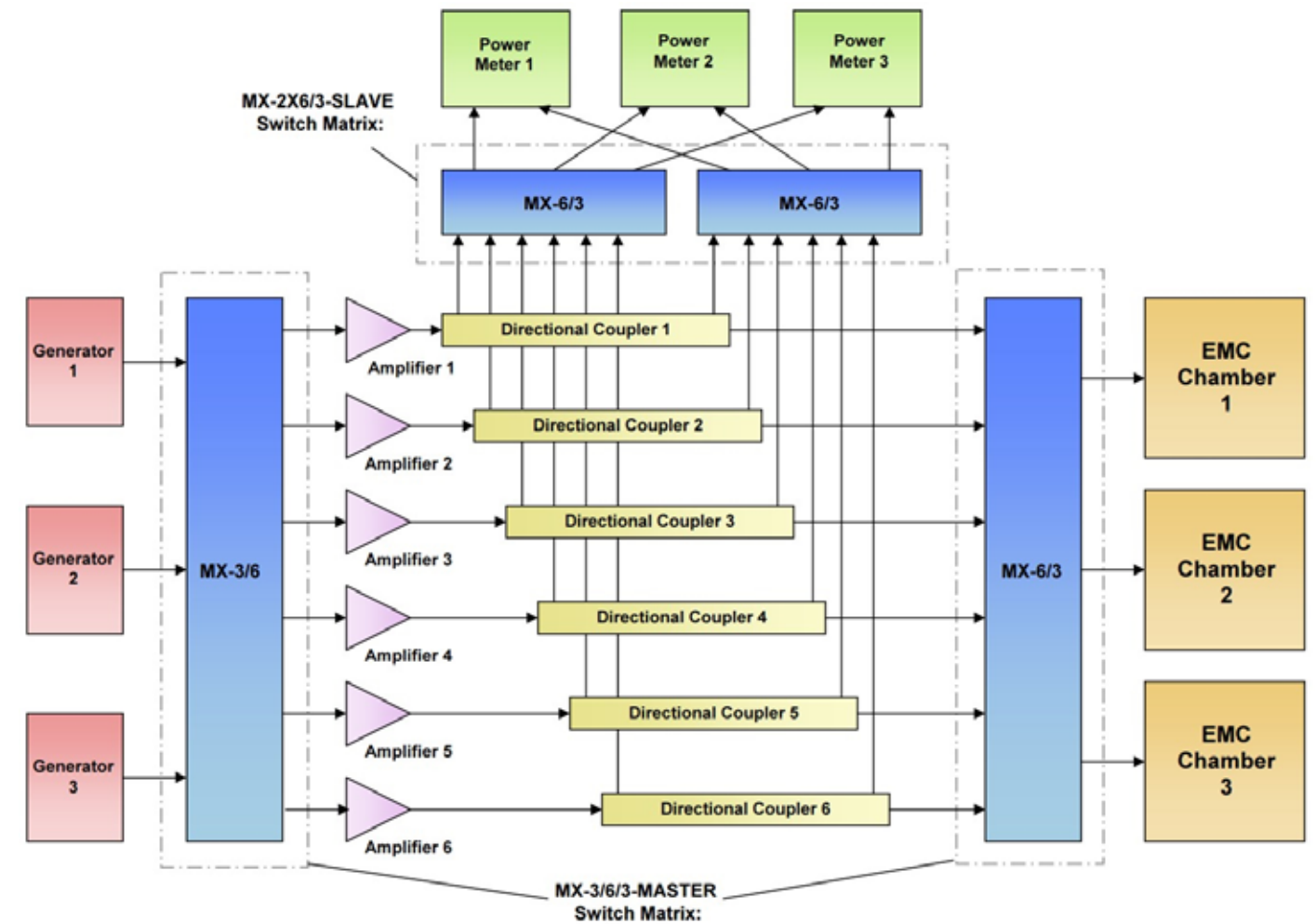
MX-6/8-N-50

This 4HU rack unit switching matrix is non blocking with full fan out capability and is built with electromechanical relays. The frequency range is from 500 to 2900 MHz (other frequency range is possible on request). It has a maximum insertion loss of 15 dB and maximum VSWR of 2.0 : 1. The lifetime of the relays are specified with 1.000.000 cycles. This matrix is manually controlled (controlling via interfaces is available on request).



MX-3/6/3-MASTER / MX-2x6/3-SLAVE

This complex 4-fold matrix system makes it possible to remotely distribute six different RF power amplifiers flexibly to three different adjacent shielding chambers. A signal generator and two power meters are assigned to each shielded chamber (see picture), which always switch synchronously with the shielded chambers. This comfortable switching device allows an optimal utilization of very expensive investment (RF power amplifier) and saves high costs.



The matrix can be controlled by three different IEEE-488 interfaces (one for each shielding chamber). It is not possible to select an amplifier that is already connected to another shielding chamber, so that no measurement in progress may be interrupted.

As a special feature there is also an interlock connection for all three shielding chambers. This ensures that the selected amplifier does not receive an input signal at any time when the door is open by switching the input to a 50Ω termination. Additionally, there is an interlock output for each amplifier. For safety reasons, the connection is electromechanical and therefore independent of the firmware.

The matrix has a minimum isolation of 110 dB and can be used up to 6 GHz. The power section of the matrix can be loaded with a maximum of 1000 Watt CW up to 1 GHz and 400 Watt CW up to 6 GHz, with an insertion loss of only 1.5 dB up to 4 GHz and 2.0 dB up to 6 GHz maximum.

Customized Products for Mobile Radio Test

The configuration of switching matrices, air interface emulators, shielding boxes and other devices can be customized!

- // Interfaces RS-232, LAN, USB, GPIB, Fibre optic
- // Manual Control via Touch Panel or Up/Down buttons wit 7-segment display
- // BITE-Option, with the Built-In-Test system an automatic self-test is performed on power-up. This option is available for air interface emulators and switching matrices.
- // Cases for Devices - 19"-rack units, table top units with different formats and surfaces
- // Control Programs - Windows program „Device Control“
- // Accessories for Devices. For our devices we can deliver also accessories like RF-cables, antennas, terminations, fixed-attenuators and more.

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