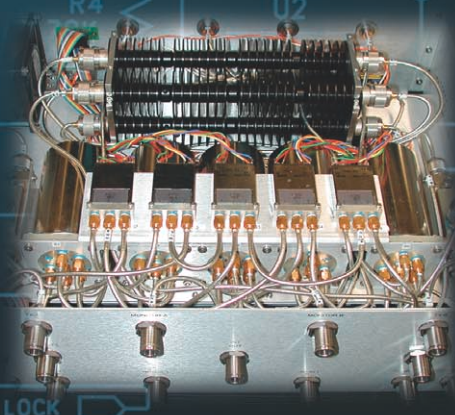
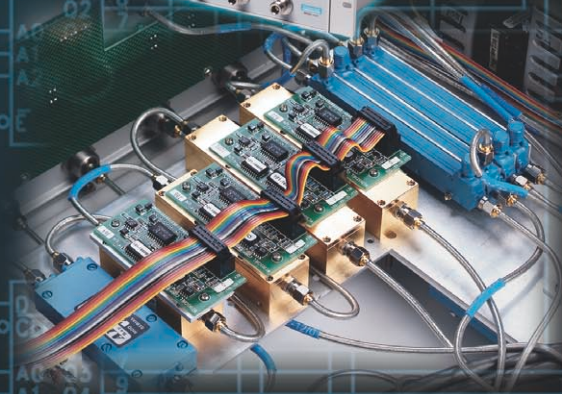
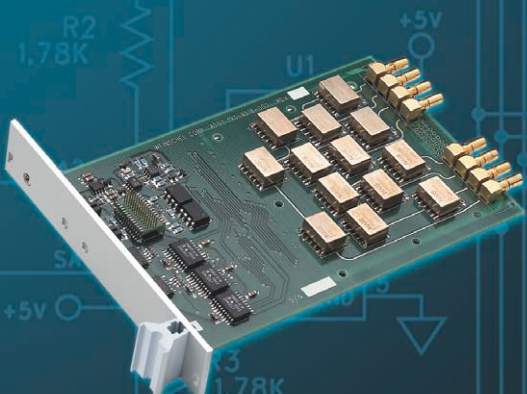
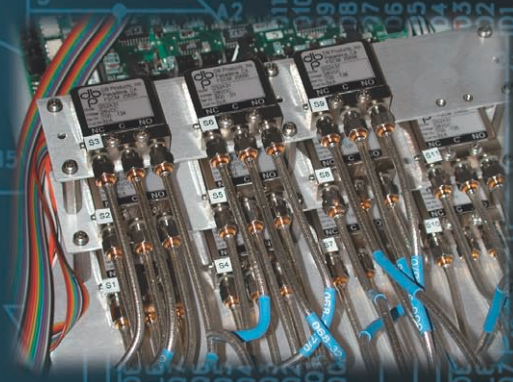
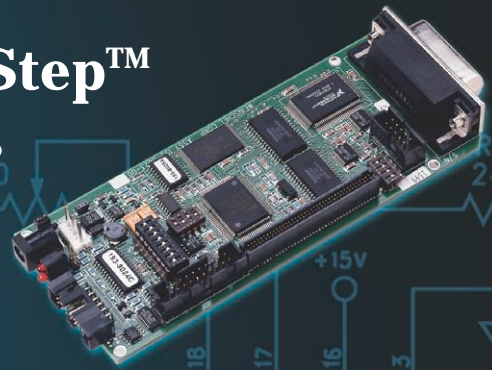
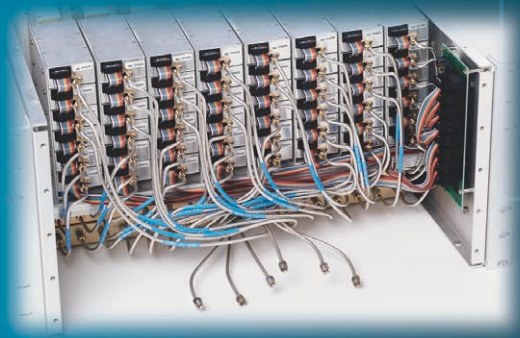
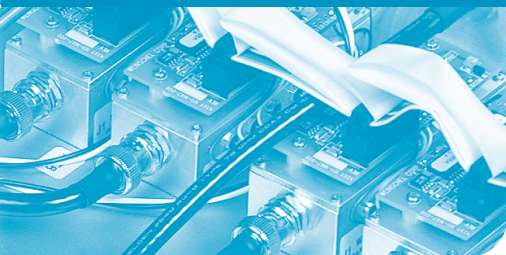


Make your first step a SmartStep™ Custom Subsystem Solutions



Weinschel
CORPORATION

An MCE Company



Products That Make A World of Difference

Weinschel Corporation develops, manufactures, markets, and sells high quality microwave and RF components and subsystems for wireless mobile and broadband infrastructure and test applications. Weinschel's mission is to provide superior design capabilities, products of consistent high quality, innovative solutions, and a high level of service to help its customers compete in today's demanding world markets.

The company was founded in the 1940's and offered the world's first commercially available coaxial attenuators. In 1952, the company founders formed Weinschel Engineering Co., and continued to pursue the advancement of microwave technologies. In 1994, Weinschel Corporation's Quality Management system was approved to: ISO 9001, EN 29001, BS5750: Part 1 and ANSI/ASQC Q9001-1994. Today Weinschel Corporation, a subsidiary of MCE Companies, Inc., is a name acknowledged to be synonymous with high reliability, quality, technical competence and leadership in the state-of-art microwave components and subsystems.

Weinschel's subsystem products are employed in standards laboratories, manufacturing and test departments, cable modem head-end sites, cellular telephone networks, engineering development facilities, and quality control positions of communications and aerospace companies, as well as government agencies and private research firms throughout the world. Applications include satellite and ground communications systems, cable modem signal switching, cell telephone testing, telecommunications, radar, OEM, signal analysis, air traffic control, and precision microwave related instruments and system use. Weinschel's subsystems products and capabilities include:



- /// Cable Modem Testing.
- /// Cellular PCS Fading Simulation.
- /// Cellular & PCS Subsystems with Low IM Components.
- /// Switch Matrices.
- /// Complex RF Matrices.
- /// Programmable/Switch Controllers
- /// SmartStep Programmable Attenuators.
- /// Plug & Go Switch/Relay Drivers.
- /// Attenuation Modules & Multi-Channel Subsystems.

One of the strengths of Weinschel's Subsystem group is the ability to use our other standard catalog as well as in-house developed production products such as:

- /// Fixed Coaxial Attenuators & Terminations (dc-40 GHz, 2-1,000 Watts)
- /// Variable Attenuators & Phase Shifters
- /// Programmable Attenuators (Relay)
- /// Solid-State Attenuators (GaAs & FET)
- /// Power Splitters & Dividers
- /// Coaxial Adapters, Planar Blind-Mate & Planar Crown® Connector Systems
- /// SmartStep™ Components
- /// Custom & Other Components



Make Your First Step The SmartStep™...



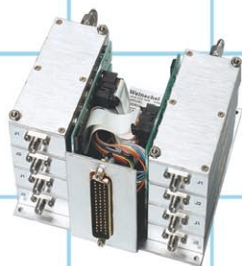
Cable Modem Test Sets



Switch Matrices



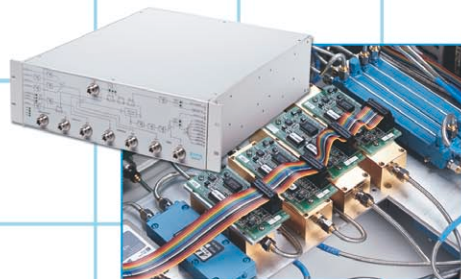
Multi-Channel Attenuation Subsystems



Custom Attenuation Modules



Attenuator Units & Controllers



Complex RF Subsystems



Cellular, Wireless, PCS Solutions



SmartStep Attenuators



Customized Mechanical Packaging

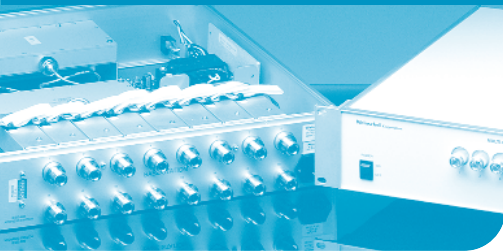
Streamline System Design & Device Integration!

Weinschel's new SmartStep technology streamlines system designs and device integration by providing a flexible bus interface as well as components that are simple to configure and control.

Creating Subsystems using Weinschel's Smartstep approach streamlines the design and layout of application specific subsystems that include a wide range of microwave and RF components such as programmable/fixed attenuators, power combiners/dividers/splitters, directional couplers, amplifiers, filters, noise sources and switches which can be controlled using various standard communications interfaces including IEEE-488, RS232, RS422, Ethernet (SNMP option) and RS485. Subsystem design options can also include:

- /// Turnkey subsystems built to customer specified design & layout.
- /// Wide dynamic and frequency ranges.
- /// Front panel and menu controls.
- /// 50 or 75 Ω configurations.
- /// Attenuation/switching schemes.
- /// Customer specified Input/Output parameters.
- /// Individual to complex matrix/channel configurations.
- /// Specialized testing and calibration.





Application Specific Subsystems...

Switch Matrices:

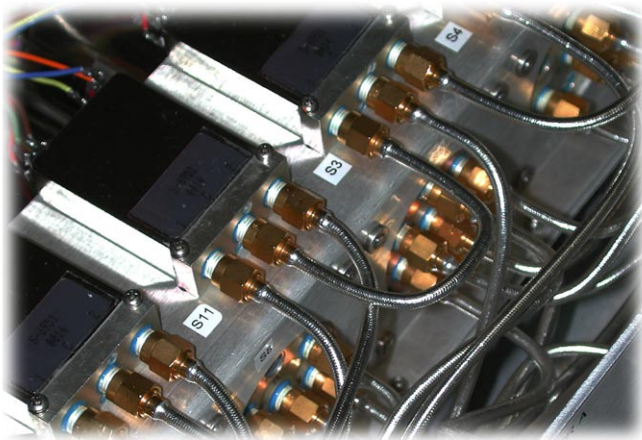


Switch matrices are being modularly designed which allows the end customer to order a variety of 8 x 8 or 8 x 16 configurations with only minor factory board level modifications. The switch matrix has been designed using latching relays so that the signal path integrity can be maintained even during power outages or loss of IEEE-488,

RS-232 and/or Ethernet control. These subsystems can be delivered either as a 50 or 75 Ω system.

In Weinschel's standard design approach, our designers use a highly adaptable platform that allows a dense integration of switches. The switch matrix chassis contains:

- /// Sixteen, 8x1 switch modules and eight, 16x1 modules designs.
- /// Modular Design allows easily exchange of front and rear panel switches, controllers or power modules.
- /// IEEE-488, Serial or Ethernet (SNMP option) Interface for computer control.
- /// Switch Matrix System firmware can be controlled through a 10 Base T TCP/IP software link as well as field level software upgrades or maintenance will be available through a TCP/IP link.
- /// Customer defined configurations, layout and packaging.

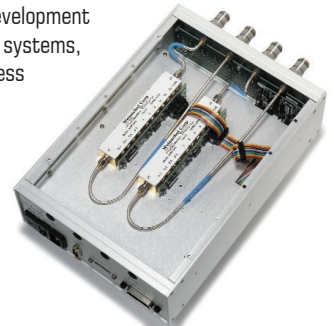


Other microwave switch matrix products and subsystems can be designed for Satellite Earth Stations, Uplink/Downlink Routing, Cellular Base Stations, Metrology, L-Band Intermediate and Frequency Routing.

Cellular, Wireless, PCS Solutions:

Weinschel has over 25 years of product development experience in satellite and communications systems, test, measurement and simulation of wireless systems. This includes:

- /// 3G, WCDMA, PCS, & GSM.
- /// Cable Modem Test Sets.
- /// Precision RF & Microwave Instrumentation.



Combining Weinschel's years of experience with our new SmartStep design approach enables our designers to provide the wireless infrastructure market with an almost endless amount of subsystem solutions.

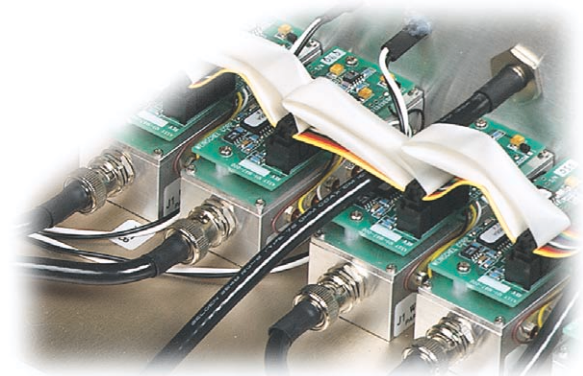
Cable Modem Testing Subsystems:



As cable modems become more readily available so does the need to calibrate and test their operational performance. Weinschel's cable modem testing solution starts with the design and manufacturing of 75 Ω subsystems that offer:

- /// Multi-channel inputs and outputs with front or rear panel connector mounting options.
- /// Operation over the dc to 1.2 GHz frequency range.
- /// IEEE-488, Serial or Ethernet (SNMP option) Interface for computer control.
- /// Wide dynamic range by employing Weinschel SmartStep Attenuators.
- /// Custom Mechanical Design & Layout.

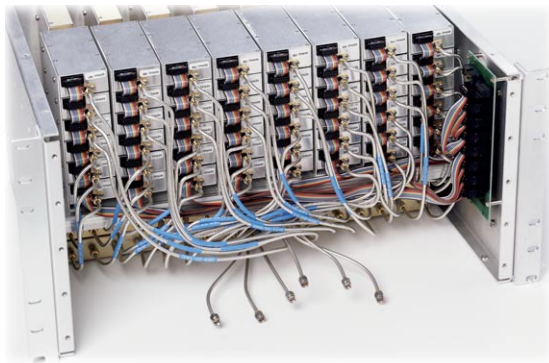
For convenience, Weinschel also offers standard 75 Ω attenuator units (8310-1-X) that operates over the dc-1 GHz frequency range and provides an adjustable attenuation range of 0-63 dB in 1 dB steps.



Attenuation Modules & Multi-Channel Subsystems:



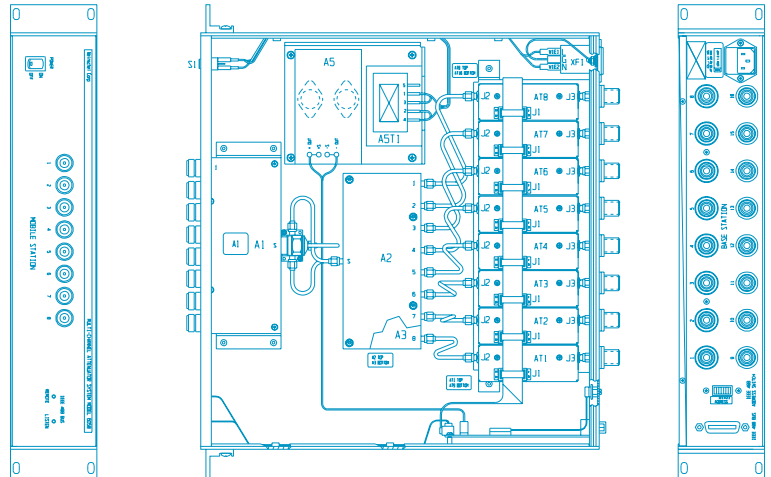
Whether the application is an individual attenuation module for satellites or complex matrix /channel configurations for cellular base station testing and operation, Weinschel's SmartStep design approach offers a versatile but simple method of creating and packaging fixed, solid-state and/or mechanical (relay) attenuators into customer specified modules and subsystems.



Advanced attenuation/switching schemes can be designed using other components such as switches, combiners/dividers/splitters and directional couplers. Our designers use the advanced SmartStep Interface firmware to create virtual devices with attenuation ranges up to 127 dB with resolutions of 0.25 dB that can operate over the dc-26.5 GHz frequency band. Other designs can include:

- /// Complex Matrix/Channel Configurations.
- /// Custom Mechanical Design & Layout.
- /// IEEE-488, Serial or Ethernet (SNMP option) Interface for computer control.
- /// Wide dynamic range & frequency range options available.
- /// Solid-State (GaAs FET & PIN) designs available.
- /// Customer specialized testing and calibration can also be supplied.

Customized Mechanical Packaging & Modular Design:

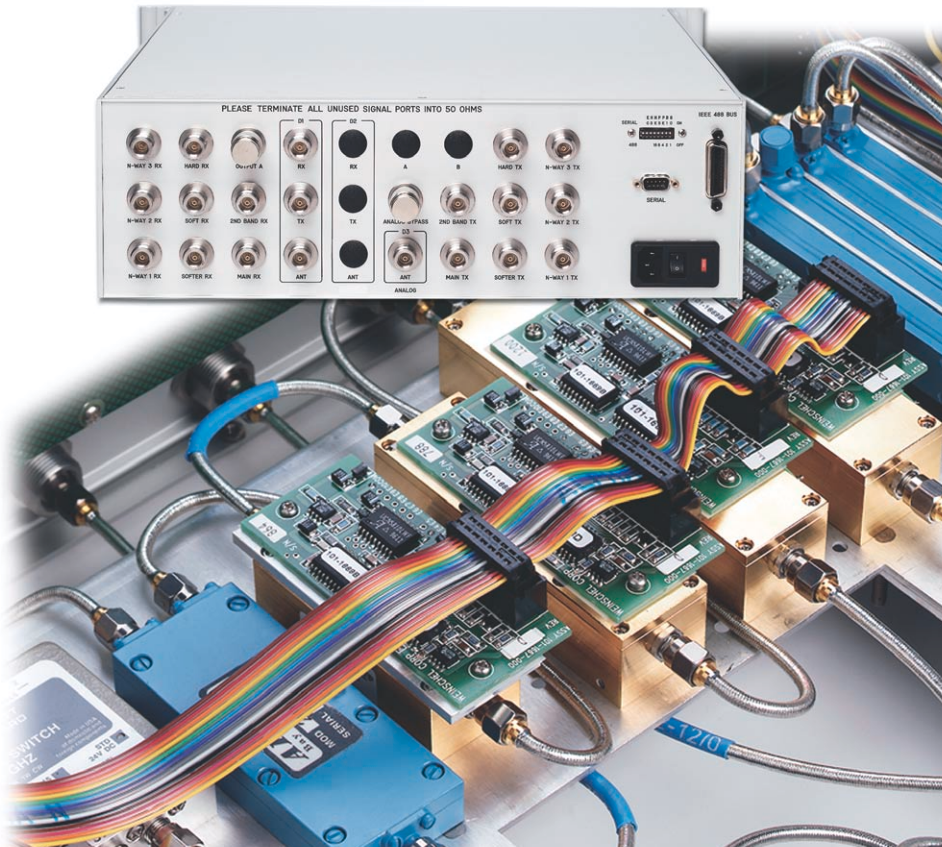


The strength of Weinschel's SmartStep design approach starts with an experienced engineering design staff. Using today's modern design tools and the latest software allows Weinschel's engineering staff to offer its customers a wide range of customized mechanical packaging & modular design solutions.

Specific PCB and driver configurations can be designed for operating various types of devices or retrofitting an existing device to operate with our SmartStep Approach!

Subsystems are easily configured for mounting into any rack or cabinet designed per EIA RS-310 or MIL-STD-189.

Although Weinschel specializes in the design of customized module and cabinet configurations, most subsystems are designed using off-the-shelf components, devices and cabinet configurations which allows Weinschel to design and manufacture subsystems with reduced lead times as well as lower overall design cost.





SmartStep Interfaces & Programmable Attenuators...

Programmable/Switch Controllers (8210A):

Weinschel's approach starts with the Model 8210A SmartStep Interface which provides a flexible, low cost solution for the control and operation of electromechanical switches and programmable step attenuators using standard communication interfaces. The 8210A represents a new concept in device control applications for bench test and subsystem designs.

- /// Designed to interface with Weinschel's new line of SmartStep programmable attenuators and other electromechanical devices.
- /// Simplifies your bench test setups and subsystem design.
- /// Available in two standard communication interfaces:

- Model 8210A-1: GPIB/IEEE-488 (HS-488 ready)
- Model 8210A-2: RS-232, RS-422, RS-485

Each model contains similar capabilities and provides switch-selectable parameters to tailor the interface's operation.

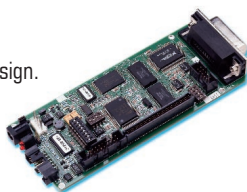
SmartStep Programmable Attenuators (3200T, 150T, 4200 Series):



Weinschel's approach also includes a new generation of intelligent programmable step attenuators with a built-in digital interface. These models are designed to simplify the control and integration of these devices into subsystem and bench applications.

The SmartStep attenuators feature a microcontroller-based driver that provides a TTL-level digital interface for control of the attenuator relays or solid-state circuitry. This new feature simplifies operation and interfacing requirements, while at the same time providing for greatly enhanced flexibility over past designs.

These SmartStep Devices contain non-volatile configuration memory used to hold a wide variety of attenuator and driver-dependent parameters, including serial number, attenuator cell dB values, mechanical relay or solid-State (GaAs FET & PIN) configurations, and switching requirements which are all accessible via the Device Interface Bus (DIB).



SmartStep Attenuator Units for Rack or Bench Use:

Weinschel's 8310 Series SmartStep Attenuator Units represent Weinschel's newest concept in programmable attenuation for bench test and subsystem applications. Standard 8310 Series designs house and control various Weinschel Programmable Attenuator Models (3200T, 150T, and 4200 Series) via front panel controls or standard communications interfaces including GPIB (IEEE-488) and RS-232/RS-422/RS485. The standard units combine the features of the Weinschel 8210A Device Controller with a front panel user interface to form a flexible, easy to use solution.

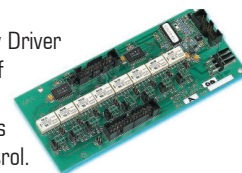


Most 8310 Series are single channel configurations where RF signal is routed through either the front or rear mounted Ports A & B but can be configured for up to four channels of attenuation, RF switching, or other functions and other features such as:

- /// Multi-Channel attenuation paths (up to 4 input/outputs).
- /// Relative vs. Nominal attenuation step function.
- /// Wide choice of Frequency & Attenuation Ranges.
 - dc to 1, 2, 3, 18 & 26.5 GHz
 - up to 127 dB
 - Solid-State (GaAs FET & PIN)
 - Relay Switched
 - 50 & 75 Ω Configurations
- /// High Accuracy & Repeatability.
- /// Easily mounted into racks or cabinets designed per EIA RS-310 or MIL-STD-189.

Plug & Go Switch/Relay Drivers:

Standard as well as custom designed Switch/Relay Driver Cards are available for controlling a wide variety of electromechanical switches and other TTL devices. For example, one of our standard designs contains eight electromechanical relays for output and control.



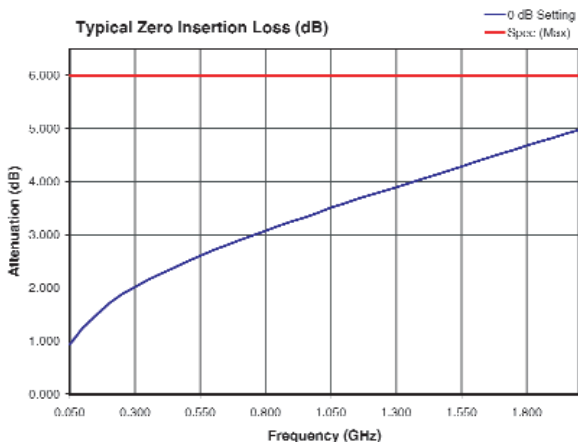
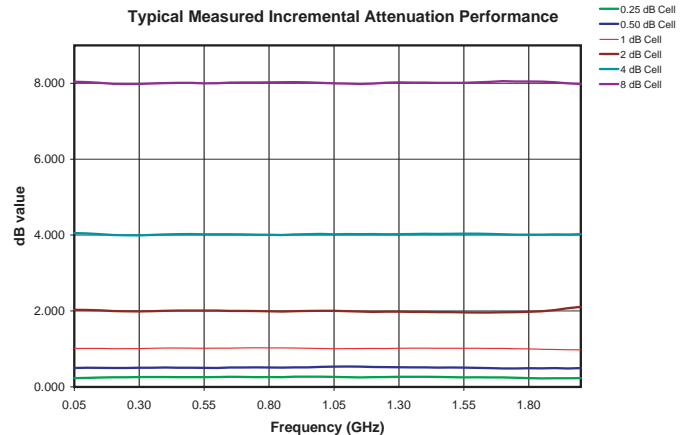
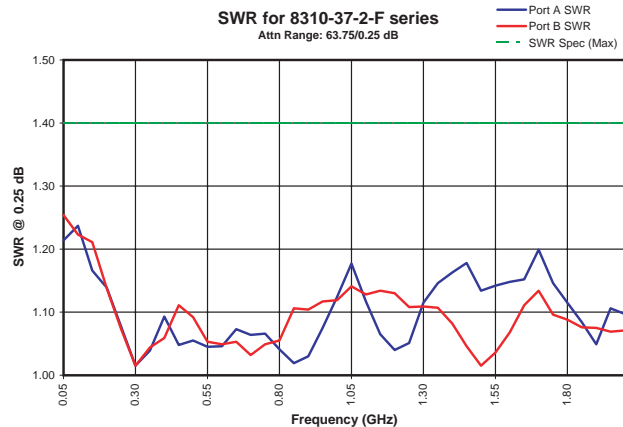
The relays are Form C (SPDT) latching type, which along with various jumper configurations, can be used with the 8210A to control a variety of devices such as RF Switches (+28V and latching) and other TTL compatible devices. This card also provides an optional three-pin external power connector which can be used to supply power to the device's under control, to simplify wiring. This external power is not used by the control circuitry on the relay driver, and its use is completely application dependent.

Available 8310 Series Programmable Attenuator Units...

Model No Value (dB)	Attenuation Range (GHz)	Frequency (maximum)	Insertion Loss (Maximum)	SWR	No of Channels	Attenuator Model No.	Connector Type	Conn Location
8310-1-F, -R	63/1	dc-1.2 (75Ω)	5.0 dB	1.5	1	3250T-63	BNC/F	Front or Rear
8310-1-2-F, -R	63/1	dc-1.2 (75Ω)	5.0 dB	1.5	2	3250T-63	BNC/F	Front or Rear
8310-35-F, -R	127/1	dc-2.0*	6.0 dB	1.4	1	3200T-1	N/F	Front or Rear
8310-35-2-F, -R	127/1	dc-2.0*	6.0 dB	1.4	2	3200T-1	N/F	Front or Rear
8310-35-3-T	127/1	dc-2.0*	6.0 dB	1.4	3	3200T-1	N/F	Front to Rear
8310-35-4-T	127/1	dc-2.0*	6.0 dB	1.4	4	3200T-1	N/F	Front to Rear
8310-36-F, -R	64.5/0.1	dc-2.0	8.0 dB	1.4	1	3209T-1	N/F	Front or Rear
8310-36-2-F, -R	64.5/0.1	dc-2.0	8.0 dB	1.4	2	3209T-1	N/F	Front or Rear
8310-36-3-T	64.5/0.1	dc-2.0	8.0 dB	1.4	3	3209T-1	N/F	Front to Rear
8310-37-F, -R	63.75/0.25	dc-2.0*	6.0 dB	1.4	1	3200T-2	N/F	Front or Rear
8310-37-2-F, -R	63.75/0.25	dc-2.0*	6.0 dB	1.4	2	3200T-2	N/F	Front or Rear
8310-37-3-T	63.75/0.25	dc-2.0*	6.0 dB	1.4	3	3200T-2	N/F	Front to Rear
8310-37-4-T	63.75/0.25	dc-2.0*	6.0 dB	1.4	4	3200T-2	N/F	Front to Rear
8310-38-F, -R	63/1	dc-2.0*	5.25 dB	1.4	1	3206T-1	N/F	Front or Rear
8310-38-2-F, -R	63/1	dc-2.0*	5.25 dB	1.4	2	3206T-1	N/F	Front or Rear
8310-38-3-T	63/1	dc-2.0*	5.25 dB	1.4	3	3206T-1	N/F	Front to Rear
8310-201-F, -R	70/10	dc-18.0	3.25	1.75	1	150T-70	SMA/F	Front or Rear
8310-201-2-F, -R	70/10	dc-18.0	3.25	1.75	2	150T-70	SMA/F	Front or Rear
8310-202-F, -R	121/1	dc-18.0	5.25	1.95	1	150T-11+150T-110	SMA/F	Front or Rear
8310-203-F, -R	105/1	dc-26.5	6.45	1.85	1	152T-15+152T-90	SMA/F	Front or Rear
8310-135-F, -R	127/1	0.8-2.3	6.0	1.5	1	4218T-127	N/F	Front or Rear
8310-135-2-F, -R	127/1	0.8-2.3	6.0	1.5	2	4218T-127	N/F	Front or Rear
8310-136-F, -R	63.75/0.25	0.8-2.3	6.0	1.5	1	4218T-63.75	N/F	Front or Rear
8310-136-2-F, -R	63.75/0.25	0.8-2.3	6.0	1.5	2	4218T-63.75	N/F	Front or Rear
8310-137-F, -R	63/1	0.8-2.3	4.5	1.5	1	4216T-63	N/F	Front or Rear
8310-137-2-F, -R	63/1	0.8-2.3	4.5	1.5	2	4216T-63	N/F	Front or Rear

* 3 GHz versions are also available.

Sample 8310 Performance





SmartStep Subsystem Design & Application Examples...

Applications for the SmartStep Components & Subsystems range from control of a single SmartStep Attenuator in a bench test/lab environment using a PC and a terminal emulator, to complex system applications where an 8210A style interface is employed to control many devices to create custom and semi-custom subsystems to reduce overall design cost.

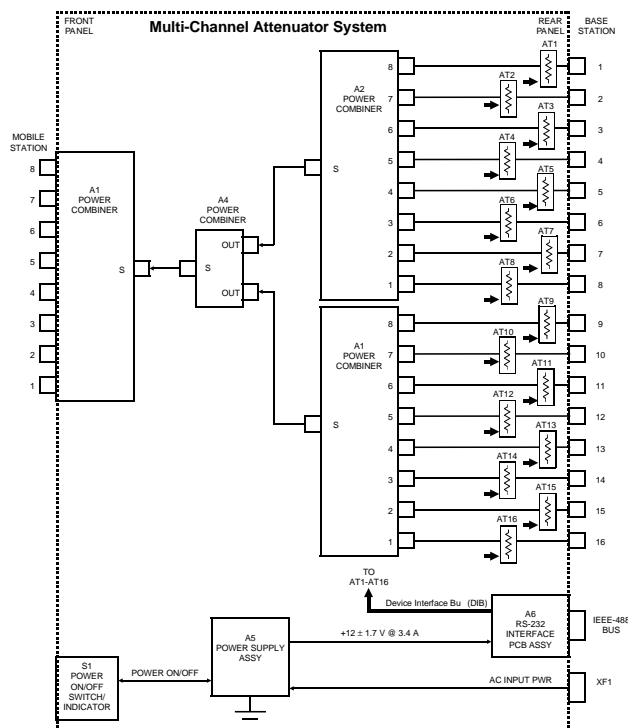
Weinschel can provide a variety of custom designed driver interfaces for various devices, such as RF switches, relays, PIN attenuators, displays and other devices, as well as complete subsystem design and integration services. This is the ideal solution for creating multi-path subsystems for use in specialized wireless communication test applications for Cellular, PCS, Modem, and CATV equipment and systems.

APPLICATION 1: CELLULAR/PCS FADING SIMULATION



Weinschel Corporation designs and manufactures multi-path attenuation subsystems for fading simulation/emulation of cellular, 3G, GSM, PCS systems, laboratory testing of CATV, cable modem, and wireless components and systems. This subsystem illustrated features:

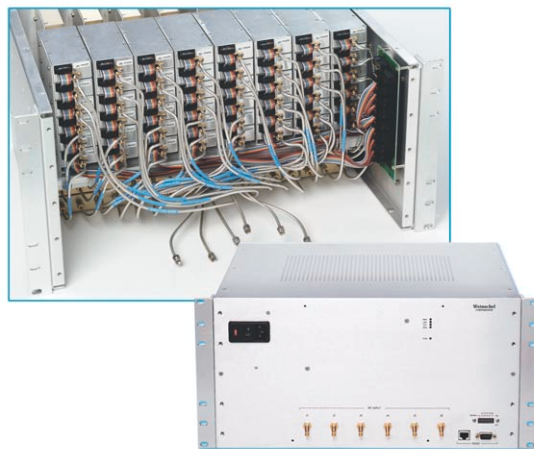
- /// 800-1900 MHz frequency range.
- /// 16 Input Channels to 8 Output Channels.
- /// RS-232 Serial Interface.
- /// Wide Dynamic Range: 127/1 dB steps.
- /// Weinschel 3200T SmartStep Programmable Attenuators.



APPLICATION 2: COMPLEX MULTI-CHANNEL ATTENUATOR MATRIX

This application illustrates Weinschel's ability to house and control a large number of solid-state programmable attenuators and power combiners creating a complex multichannel attenuator subsystems. Other features include:

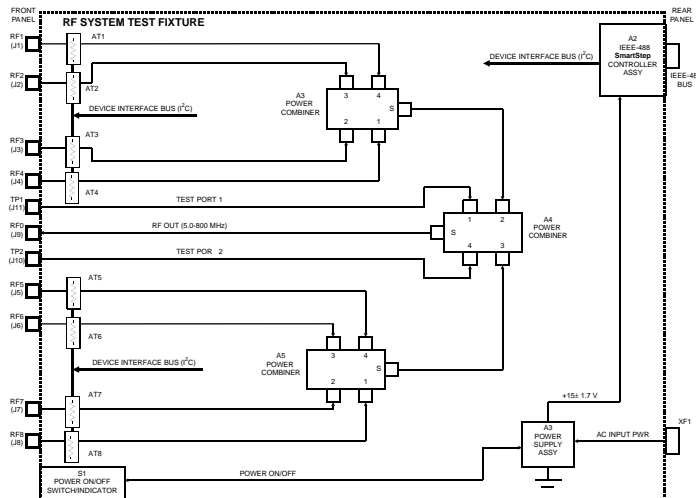
- /// 800 - 2,200 MHz frequency range.
- /// 6 front panel Input channels to 8 rear panel Output Channels.
- /// Wide Dynamic Range: 95 in 1 dB steps.
- /// RS-232 Serial Interface.
- /// Combiner Isolation 20 dB maximum.
- /// Designed to customer specified packaging requirements.
- /// 64 Weinschel SmartStep Solid-State Programmable Attenuators.
- /// Removable mounting brackets that can be located on either end of unit, can be mounted into racks or cabinets designed per EIA RS-310 or MIL-STD-189.



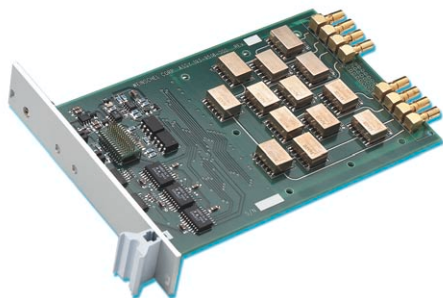
APPLICATION 3: CABLE MODEM TESTING...75 Ω



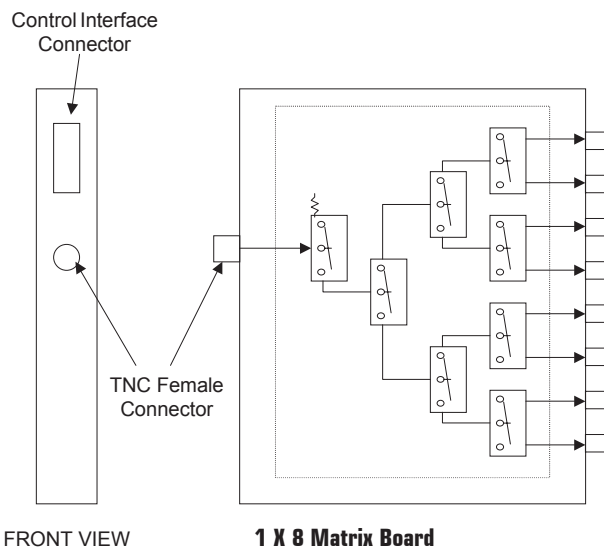
- /// 800-1900 MHz frequency range.
- /// 8 Input Channels to 1 Output Channel.
- /// IEEE-488 Interface.
- /// Standard BNC Connectors.
- /// Wide Dynamic Range: 63/1 dB steps, 75 Ω .
- /// Weinschel 3250T SmartStep Programmable Attenuators.



APPLICATION 4: SWITCH MATRICES...8X8 OR 8X16 BLOCKING MATRIX



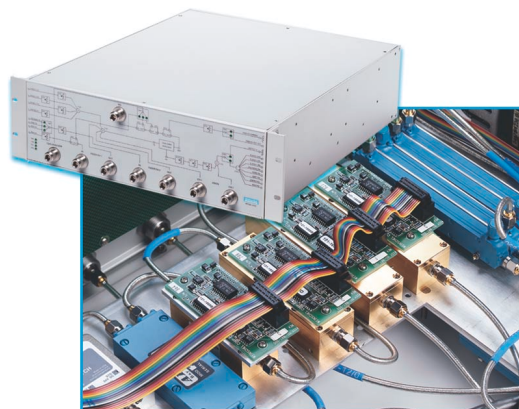
- /// Operates over the dc-2200 MHz frequency range.
- /// Ethernet SNMP Control.
- /// Configuration: 8x8 or 8x16 blocking matrix.
- /// TNC Female Connectors: 8 Front & 16 Back panel.
- /// Electromechanical Switch Design.
- /// 50 and 75 Ω Configurations.
- /// Modular Design and Layout.

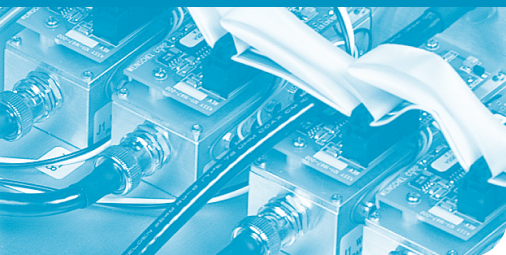


APPLICATION 5: COMPLEX RF MATRICES

This Subsystem contains a wide variety of high performance mechanical switches, combiners, directional couplers, and other standard microwave components creating a complex multi-function RF matrix that is controlled over various industry standard bus interfaces. Other features include:

- /// 800 - 3 GHz Frequency Range.
- /// Customized front panel layout and graphics.
- /// IEEE-488 & RS-232 Serial interfaces.
- /// Optional rack mounting hardware.
- /// Standard Stainless Steel Type N Connectors on front & rear panel.
- /// Weinschel 3200T SmartStep Programmable Attenuators.





Low Intermodulation Subsystems & Signal Conditioning Networks...

Some custom subsystem designs warrant the use of Low Intermodulation passive components such as programmable attenuators, terminations, fixed attenuators, couplers, cables, connectors and switches. Weinschel is a leading manufacturer of the first three items. The following paragraphs briefly describe the importance of low intermodulation and some design features and comparative test data for the same.

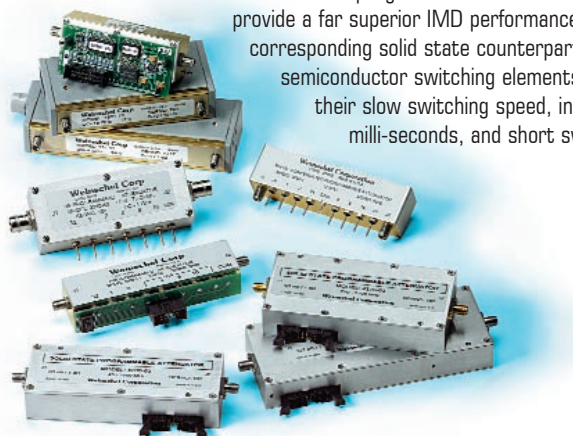
Programmable Attenuators

Historically the most demanding specifications for programmable components and subsystems have been low insertion loss and SWR, combined with a reasonable life expectancy of several million switching cycles. This was usually adequate for RF instruments like spectrum analyzers and signal generators, where the attenuator bandwidth rather than the switching speed was of prime concern. To achieve wide bandwidths, the programmable attenuators were mostly of electro-mechanical design and the linearity of these passive components was only taken for granted. Intermodulation distortion discussions and problems were usually limited to components such as amplifiers, mixers and filters.

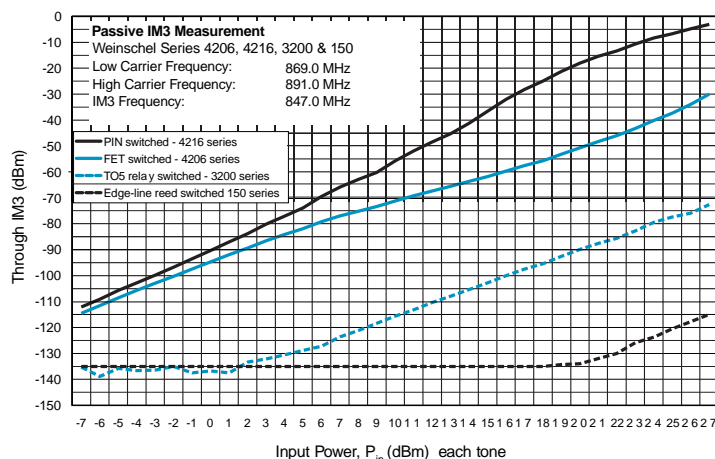
In recent years, however, wireless communication systems employing complex digital modulation schemes, increased channel capacity, high transmit power and extremely low receiver sensitivity have put into question the linearity of passive components. Even very low level multi-tone intermodulation products generated by attenuators can seriously degrade the efficiency of a system/instrument if these products fall within the user passband. For two closely spaced tones at frequencies f_1 and f_2 , the third order IM products at $2f_1 - f_2$ and $2f_2 - f_1$, are the most harmful distortion products. They are harmful because they are close to f_1 and f_2 and virtually impossible to filter out.

In today's base stations the multicarrier power amplifier (MCPA) is replacing banks of single-channel amplifiers and their corresponding power combining network. MCPAs have the capability of carrying a number of modulation schemes simultaneously and can also employ schemes such as dynamic channel allocation (DCA) to use the allocated frequency spectrum more efficiently. The in-band intermodulation distortion (IMD) performance of these amplifiers is extremely critical and needs to be measured using low distortion programmable multi-tone generators with superior IMD performance.

Electromechanical programmable attenuators obviously provide a far superior IMD performance than their corresponding solid state counterparts employing semiconductor switching elements. However, their slow switching speed, in the order of milli-seconds, and short switch life in



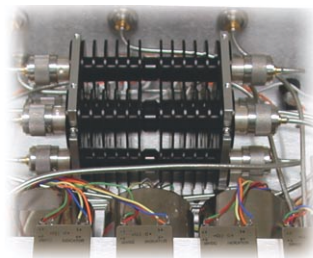
IM3 Performance of Electromechanical & Solid State Programmable Attenuators



the order of 5-10 million cycles make them unattractive in some applications like cell phone testing and other ATE systems. Solid State programmable attenuators overcome these two problems and are, therefore, included here for IMD performance comparison. The goal is to provide good basic IMD test data for a variety of commercial programmable attenuators and permit the end user to select the most appropriate type for his system application.

Fixed Attenuators & Terminations

These seemingly linear components generate low levels of IMD which must be considered, especially when incident power levels are high. Some of Weinschel custom subsystem designs include low IM versions of medium and high power fixed attenuators and terminations. These components are supplied with specified 3rd order through and reflected intermodulation levels (IM3) measured with a passive IM analyzer. Typically, the IM3 levels for these components are -110 dBc. Standard Models with this LIM (low IM) option are models 33, 24, 49, 53, 57, 58 and the corresponding terminations, ranging in incident power ratings of 25 to 500 Watts. Features of these components include specifically designed connectors and carefully processed and trimmed thin film resistors for low IM performance.



Couplers, Cables, Switches, Connectors, etc.

Although Weinschel does not manufacture these components we work very closely with our suppliers, providing them pertinent design input to achieve the lowest possible IMD performance on such products.

Conclusion....

Whether you're designing your own switching/combining/attenuation wireless simulation system or require a turnkey solution, contact Weinschel for a wide range of standard products or custom engineered subsystems at 800-638-2048, 301-846-9222 or e-mail us at sales@weinschel.com!



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