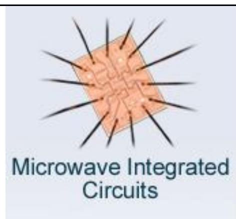
MESL Microwave



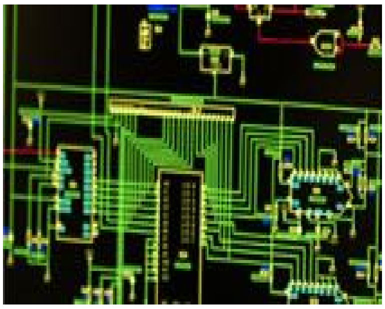
MESL Microwave has more than 40 years' experience in design and manufacture of waveguide components, from straightforward isolators to complex subsystems such as transmit/receive duplexers.

All waveguide components and subsystems are designed, manufactured and tested in Scotland, in keeping with the nature of the end customers and markets we supply. Typical power levels that these units can operate with are 100W-10kW average power and 100W-8MW peak power.

Our expertise in handling high power levels has enabled us to supply Europe's leading radar manufacturers throughout our company history.

Our Company

- Key Facts
- Innovative people
- Contact Us
- Awards & Accreditations
- Become a Supplier
- Sales Team
- Opportunities



Capabilities

- Facilities
- Design and Innovation
- Manufacturing
- Testing and Alignment
- Quality
- Logistics

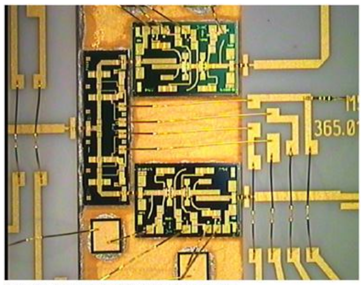


Fig. 2: Electrical interconnects

Browse by Sector

- Telecoms
- Defence
- Space
- Aerospace
- Security
- Medical

Key Features

- L-band to Ka-band frequencies
- High peak power (MW) and average power (kW) handling
- Proven reliability for harsh environments e.g. maritime
- Fluid conduction or forced air cooling
- Low loss

Proven Track recored

- High Power Waveguide Junction Isolators and Circulators
- Differential 4-Port Phaseshift Isolators and Circulators
- Waveguide Loads
- Torodial Phase Shifter
- Torodial Phaseshift Switches
- Latching Ferrite Switches

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  Differential Phaseshift Switches

- Waveguide Rotary Switches
- High Power Waveguide sub-systems

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Target Markets

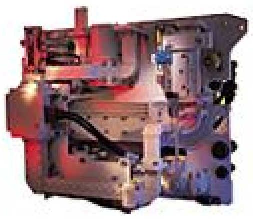
- Defence
- Aerospace
- Space
- Security

Subsystem Capability

MESL Microwave's expertise in design and manufacture of waveguide components and electronic design is further extended by bringing these individual elements together to form complex waveguide subsystems. During our company history we have developed a high level of expertise in integrated subsystem capability. This starts with the initial design phase, continues through integration to test and qualification in order to meet the stringent operating environmental requirements. We also offer program and logistics management throughout the life cycle of the subsystem.

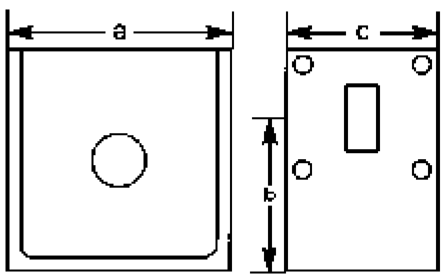
These subsystems demand the highest standards of build and functional quality, and with this in mind we have been certified to ISO 9001 as a company fro some years now. We do constantly strive to improve on our processes and standards to exceed customer expectations in this area.

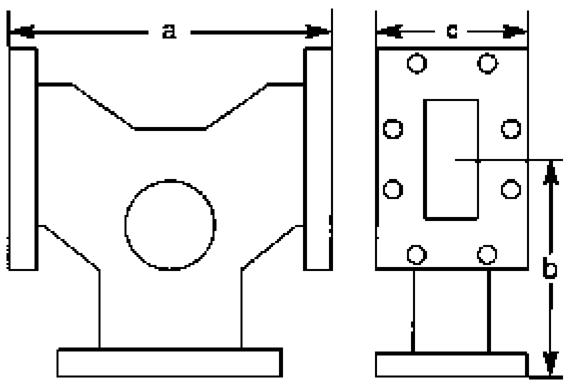
Circulators 3-port



A full range of waveguide junction circulators and isolators are available covering the frequency range 3.4GHz - 65.0GHz. This range includes units manufactured from investment castings and precision machined bodies to ensure optimum microwave performance.

Custom designs are available on request.





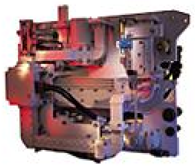
3.4 to 26.5GHz

Waveguide Designation			Frequency (GHz)	Type Number		Specification			Operating Temperature (°C)	Dimensions (mm)			Mating Flange
British Standard	IEC	RETMA		Circulator	Isolator	Isol'n (dB) min	Insert Loss (dB) max	Ret'n Loss (dB) min		a	b	c	
WG11A	R40	WR229	3.400 - 3.800	11C 3041	11F3041	28	0.2	28	0 to +50	120	79	58	UER 40
			3.700 - 4.200	11C 3051	11F3051	28	0.2	28	0 to +50	120	79	58	UER 40
WG12	R48	WR187	4.400 - 5.000	12C 3051	12F3051	30	0.3	30	0 to +50	121	80	67	UER 48
WG14	R70	WR137	5.800 - 6.425	14C 3041	14F3041	28	0.1	28	0 to +50	82	51	40	UER 70
			5.925 - 6.425	14C 3042	14F3042	28	0.1	28	0 to +50	82	51	40	UER 70
			6.400 - 7.110	14C 3043	14F3043	28	0.15	28	0 to +50	82	51	40	UER 70
			6.750 - 7.250	14C 3031	14F3031	28	0.15	28	0 to +50	82	51	40	UER 70
			7.100 - 7.800	14C 3044	14F3044	28	0.15	28	0 to +50	82	51	40	UER 70
WG15	R84	WR112	7.000 - 7.500	15C 3031	15F3031	30	0.2	29	0 to +50	76	50	48	UBR 84
			7.250 - 7.750	15C 3032	15F3032	30	0.2	29	0 to +50	76	50	48	UBR 84
			7.250 - 7.750	15C 3033	15F3033	30	0.2	29	0 to +50	76	50	38	UER 84
			7.700 - 8.400	15C 3041	15F3041	30	0.2	29	0 to +50	76	50	38	UER 84
			7.900 - 8.500	15C 3034	15F3034	30	0.2	29	0 to +50	76	50	48	UBR 84
			7.900 - 8.500	15C 3035	15F3035	30	0.2	29	0 to +50	76	50	38	UER 84
			8.100 - 8.600	15C 3036	15F3036	30	0.2	29	0 to +50	76	50	48	UBR 84
			8.100 – 8.600	15C 3037	15F3037	30	0.2	29	0 to +50	76	50	38	UER 84
WG16	R100	WR90	8.200 - 10.000	16C 3041	16F3041	20	0.3	21	0 to +50	61	41	41	UBR 100
			8.500 - 9.600	16C 3042	16F3042	25	0.2	26	0 to +50	61	41	41	UBR 100
			9.000 - 9.500	16C 3031	16F3031	25	0.2	26	0 to +50	61	41	41	UBR 100
			9.300 - 9.500	16C 3021	16F3021	25	0.2	26	-20 to +50	61	41	41	UBR 100
			9.500 - 11.000	16C 3051	16F3051	20	0.3	21	0 to +50	61	41	41	UBR 100
			9.500 - 12.000	16C 3061	16F3061	20	0.3	19	0 to +50	61	41	41	UBR 100
			10.000 - 10.500	16C 3032	16F3032	25	0.25	26	-40 to +85	61	41	41	UBR 100
			10.700 - 11.700	16C 3043	16F3043	30	0.15	30	0 to +50	61	41	41	UBR 100
			11.700 - 12.300	16C 3033	16F3033	30	0.3	30	0 to +50	61	41	41	UBR 100
			11.700 - 12.500	16C 3034	16F3034	30	0.3	26	0 to +50	61	41	41	UBR 100
WG17	R120	WR75	10.700 - 11.700	17C 3041	17F3041	30	0.2	29	0 to +50	51	32	38	UBR 120
			11.800 - 13.000	17C 3042	17F3042	25	0.3	23	-30 to +60	51	32	38	UBR 120
			12.250 - 13.250	17C 3043	17F3043	27	0.2	26	0 to +50	51	32	38	UBR 120
WG18	R140	WR62	12.400 - 18.000	18C 3081	18F3081	20	0.5	19	0 to +50	50	28	35	UBR 140
			12.500 - 13.250	18C 3031	18F3031	30	0.3	29	0 to +50	50	28	35	UBR 140
			14.050 - 14.850	18C 3032	18F3032	28	0.3	26	-20 to +60	50	28	35	UBR 140
			14.400 - 15.350	18C 3033	18F3033	28	0.3	26	-40 to +85	50	28	35	UBR 140
			14.900 - 15.700	18C 3034	18F3034	28	0.3	26	-20 to +60	50	28	35	UBR 140
			15.500 - 17.500	18C 3041	18F3041	20	0.4	19	-40 to +85	50	28	35	UBR 140
WG20	R220	WR42	17.700 - 19.700	20C 3041	20F3041	25	0.3	23	0 to +50	32	21	25	UBR 220
			21.200 - 23.600	20C 3042	20F3042	25	0.3	23	0 to +50	32	21	25	UBR 220
			24.200 - 26.500	20C 3043	20F3043	25	0.3	23	0 to +50	32	21	25	UBR 220

26.5 to 65.0GHz

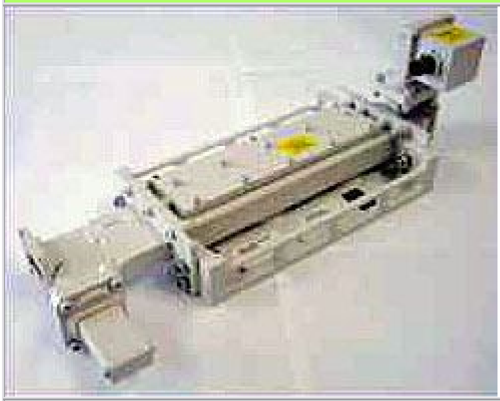
Waveguide Designation			Freq'y (GHz)	Band Width (MHz)	Type Number		Specification			Operating Temperature (°C)	Dimensions (mm)			Mating Flange
British Standard	IEC	RETMA			Circulator	Isolator	Isol'n (dB) min	Insert Loss (dB) max	Ret'n Loss (dB) min		a	b	c	
WG22	R320	WR28	26.500-40.000	100	22C3011	22F3011	30	0.5	26	0 to +50	25	16	20	UBR 320
				250	22C3012	22F3012	27	0.5	26	-40 to +85	25	16	20	UBR 320
				500	22C3013	22F3013	25	0.5	23	-40 to +85	25	16	20	UBR 320
				1000	22C3021	22F3021	23	0.5	23	-40 to +85	25	16	20	UBR 320
				2000	22C3031	22F3031	20	0.5	21	-40 to +85	25	16	20	UBR 320
WG25	R620	WR15	55.000-65.000	500	25C3011	25F3011	25	0.6	21	-30 to +85	25	19	25	UG 385/U
				1000	25C3012	25F3012	20	0.6	19	-30 to +85	25	19	25	UG 385/U

Isolators



X-band Differential 4-port Isolator

Data Sheet: F0006



Applications

- Airborne, Ground and Naval Radars
- Satellite Transmission Uplinks

Features

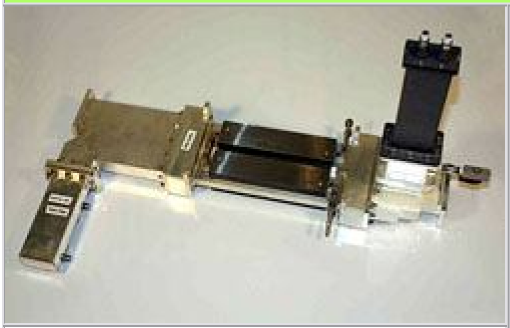
- Frequency ranges available - E-Band to M-Band
- High peak and average power designs
- Fluid & forced air cooling options
- Custom designs based on existing products
- Reverse power load temperature sensor

Electrical Specification	
Frequency Range	8.5 to 11.0 GHz
Peak Power	80 kW
Average Power	1,100 W
Output Port VSWR	<2.0:1
Maximum Pulse Length	20 µSec
Minimum Pulse Length	2 µSec
Insertion Loss	<0.3 dB
Isolation	>20 dB
VSWR (all ports)	<1.2:1
Temperature Range	-40 °C to +70 °C
Reverse Power Load Temperature Sensor	
Operating Voltage	+28 V
Operating Current	<100 mA
Speed of Response	<1 Sec
Connectors	Waveguide 16 (I/P &O/P) Reverse Power Load Temperature Sensor -

	Weight	2 kg nominal

S-Band High Power Isolator

Data Sheet: F0031



Applications

Microwave components for

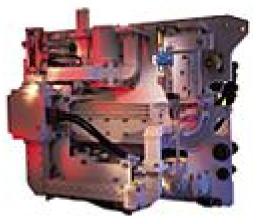
- Medical
- Security X-ray
- Defence

Features

- Water cooled isolator used to provide protection for up to 7.5MW peak, 10kW average of reflected RF power

Electrical Specification	
Operating Frequency	2856 ± 10MHz or 2998 ± 10MHz
Peak Pulse Power	7.5MW Typ.
Average Power	10kW Typ.
Isolation	20dB min
Insertion Loss	0.3dB max
Max Input VSWR	1.2:1
Max Output VSWR	inf : 1 any phase
Waveguide Size	WR284
Waveguide Gas	SF6
Waveguide Operating Pressure	25 - 45 psig
Operating Temp	0°C to 35°C

Circulators 4-port Differential



X-Band Differential 4-port

Data Sheet: F0008

Applications

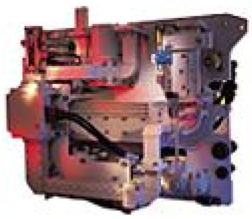
- Airborne, Ground and Naval Radars
- Satellite Transmission Uplinks

Features

- Frequency ranges available - E-Band to M-Band
- High peak and average power designs
- Fluid & forced air cooling options
- Custom designs based on existing products

Electrical Specification	
Frequency Range	8.5 to 11.0 GHz
Peak Power	80 kW
Average Power	2,400 W
Output Port VSWR	2:1
Maximum Pulse Length	120 µSec
Insertion Loss	<0.3 dB
Isolation	>20 dB
VSWR (all ports)	<1.2:1
Temperature Range	-40 °C to +70 °C
Connectors	Waveguide 16 (I/P &O/P) Stainless Steel Water Connector
Weight	2 kg nominal

Loads



Waveguide termination available from S-Band to Ka-Band.

- Fluid finned or unfinned designs
- Custom designs available
- Silicon carbide machined load inserts available

Peak power capability is approximately equal to the waveguide maximum power rating. The average power ratings are for convection cooled units, these values can be increased by applying water cooling circuits. Designs operating at higher power levels are achievable.

S-Band High Power Water Cooled Load

Data Sheet: F0032

Applications

Microwave Components for:

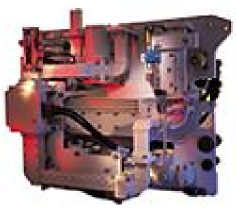
- Medical
- Security X-ray
- Defence

Features

- S-Band Water Load capable of absorbing 7.5MW peak, 10kW average of reflected RF power
- Options include - E plane probe & pressure release valve

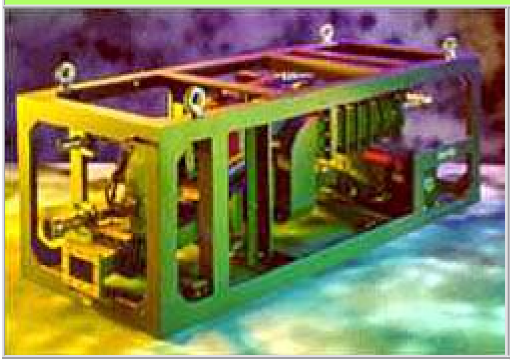
Electrical Specification	
Operating Frequency	2.6 - 3.95 GHz
Bandwidth	10% Typ.
Peak Pulse Power	7.5 kW Typ.
Average Power	10 kW Typ.
Max Input VSWR	1.2:1
Waveguide Size	WR284
Cooling Fluid	Water with/without antifreeze
Cooling Fluid Flow Rate	> 10 L/Minute
Operating Temp	0°C to 35°C
Dimensions	397mm x 115mm x 77mm Typ.

Subsystems



S-Band Waveguide Subsystem

Data Sheet: F0004



Electrical Specification	
Waveguide Subsystem	
Frequency Range	2.7 to 3.6 GHz
Bandwidth	15%
Peak Power	200 kW (2:1 mismatch at the output port)
Average Power	8.0 kW
Pulse Width	150 µSec

Applications

- Air, Ground and Naval Radars
- Satellite Transmission Uplinks

Building Blocks

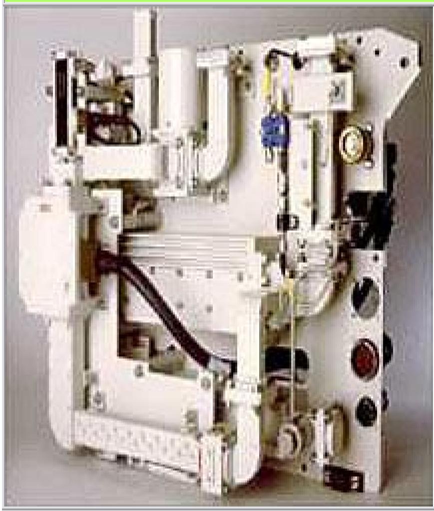
- Differential Phaseshift Isolator, High Power Loads, Waveguide Rotary Switch and associated components

Features

- Frequency ranges available include E-Band to J-Band
- High Peak and Average Power Designs
- Water and Air Cooled Loads
- Key Lock Protection

X-Band Transmit & Receive Duplexor

Data Sheet: F0005



Electrical Specification	
Frequency Range	8.5 to 11.0GHz
Bandwidth	10%
Peak Power	80 kW
Average Power	1100 W (2:1 mismatch at o/p)
Pulse Width	20 µSec (max) 2.0 µSec (min)
Load VSWR	2:1 (max)
Insertion Loss	0.2 to 0.3 dB (Tx to Antenna)
Gain	35 +/- 0.5 dB (Antenna to Rx)
Isolation	26 dB min @ 20 °C 21 dB min: -40 °C to +70 °C
Input Return Loss	23 dB min (O/P matched load) 19.6 dB min (O/P short circuit)
Harmonic Power	<-12dBc

Applications

- Air, Ground and Naval Radars

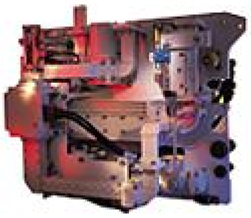
Building Blocks

- Waveguide Rotary Switch
- Forward and Reverse Power Monitors
- High Powered Load
- Receiver Protector
- 4 Port Differential Phase Shift Circulator
- Low Noise Amplifier
- Electronic Monitoring and BITE.

Features

- Frequency ranges available include E-Band to J-Band
- High Peak and Average Power Designs

Combiners, Power Dividers



MESL Microwave offers a range of solutions for combining/ splitting power. Options include using ferrite switches to switch or power split, waveguide couplers with integrated isolators and differential phase shift power splitters.

Our designs offer high power handling with low loss and our breadth of experience means we can offer a customized solution optimized for your unique application.

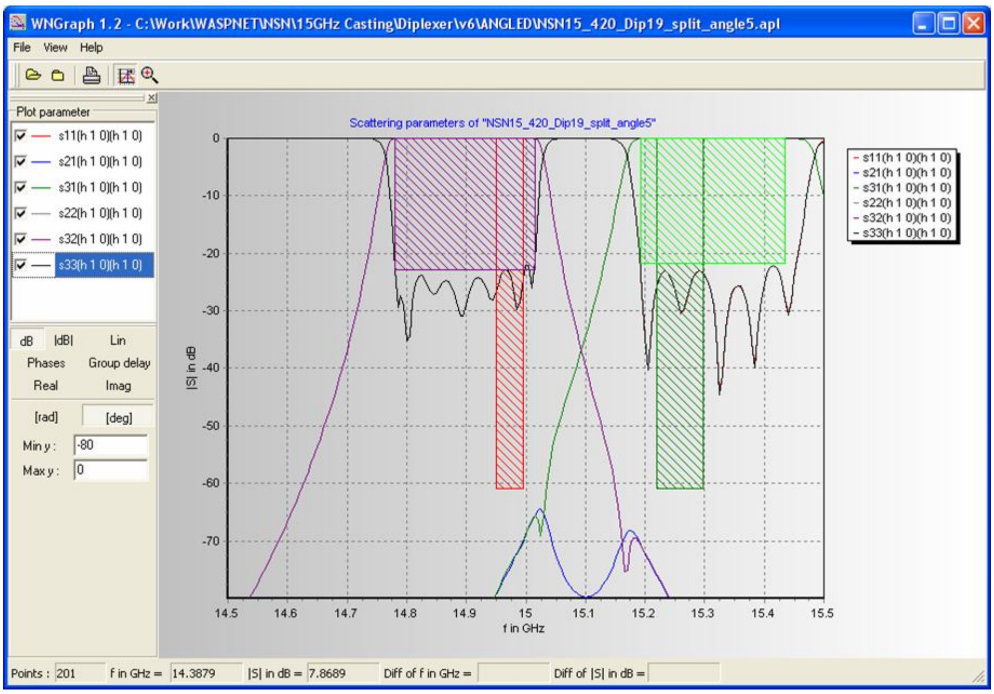
Diplexers Index

MESL Microwave designs and produces a wide range of diplexers, spanning the 6GHz to 38GHz frequency range, to address the point-to-point and point-to-multipoint radios in wireless communication infrastructure.

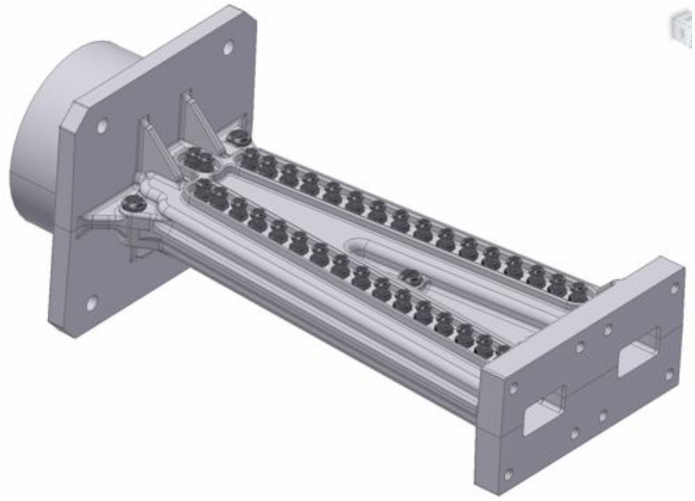
Our experience includes:

- E-plane and H-plane designs.
- Waveguide
- Coax
- dielectric resonator
- Interdigital
- Combline
- Stripline
- Edge Coupled
- End Coupled
- Cross Coupled
- Integrated Circulators

Customer designs are implemented and simulated on state of the art filter design software, which facilitates the creation of mechanical filter designs from supplied electrical specifications. In addition, MESL is able to design and implement filters using coupled iris elements, metal-insert elements and / or post-coupled elements. Simulation software also aids verification of designs which use more complex filter geometries, such as notch, multi-mode or cross-coupled cavities.



Environmental considerations are also taken into account during the design process. We have the capability to design and manufacture diplexers and couplers which are subject to extremes of temperature and weather. All materials in such a design are tested rigorously to demanding customers' requirements.



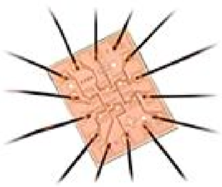
Prototypes are crafted within our in-house machine shop before volume production quantities are machined or cast by low cost suppliers situated around the world.

Experience of Die Cast solutions for diplexers:

Diplexers have been in volume production at MESL since 2000 with a proven track record of high quality and reliability.

We operate various logisitics models from a basic forecast driven supply to a complete Supplier Managed Inventory service

Microwave Integrated Circuits



MESL Microwave has extensive experience and expertise in the area of microwave integrated circuits (MICs). We are engaged in a variety of markets, from commercial wireless telecommunications to military subsystems, spanning a frequency range from 1GHz up to 77GHz. We not only design MICs but also provide qualification testing and volume manufacturing capability on site.

A modern, well equipped and dedicated class 10,000 clean room provides the setting for the manufacture of all such MICs. Furthermore, the quality of design and excellent reliability of these units has been fully demonstrated with many years of operation in the field, maintaining the European standards for all this wireless technology implementation set by ETSI.

Some of the building blocks for transceiver based products are:

- FET oscillators and Dielectric Resonator Oscillators (DRO) that are highly stable over temperature
- MMIC mixers, Power Amplifiers, LNAs, Ultra Fast Switches, Attenuators
- High order multipliers using step recovery diodes (up to times 13)

Products
- Transceivers
- Mixers (Up and Down Converters)
- Oscillator modules (VCOs and DROs)
- Phase shifting Modules
- Filter based modules

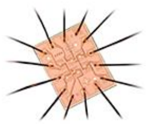
Markets
- Wireless Communication Infrastructure
- Defence
- Security
- Automotive

Core Technologies
- Microwave softboard processing
- Automatic bonding of MMICs, PIN diodes, Hybrid, Beam Lead chips
- Thermo-sonic and thermo compression bonders on gold and aluminium wire and tape to 1 thou diameter
- Semi-automatic Pick and Place and IR reflow techniques
- Environmental qualification for vibration, temperature and humidity
- Fully automatic test facilities

Design
The closest partnerships with clients are formed at the initial design stage of a project. With a large percentage of our work being custom designed products, our ability to understand client goals is an essential component of our success. Rapid prototyping of designs is a key capability that provides a client with a hardware example of a specific design. The use of 2½D and 3D CAD, along with both linear and non-linear circuit simulations assist in producing a "right first time" design. We have a breadth of technological expertise that allows us to see the overall requirement when designing subsystems. This leads to overall product benefits.

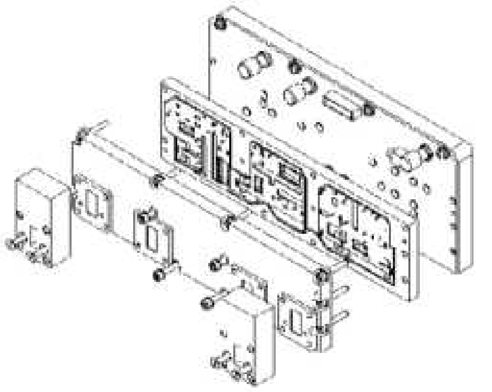
Testing and Alignment
MESL has invested in unique automated microwave test facilities. The most sophisticated automatic vector network analysers combined with computer controlled environmental chambers and custom thermal management systems allow the test of complex waveguide components over the range -70°C to +120°C with unsurpassed phase accuracy. High volume Millimetre wave transceiver testing is achieved by parallel testing of multiple units in a rapid temperature cycle.

Transceivers



18 GHz Millimetrewave Transceiver

Data Sheet: AMSM0001



Applications

- Point-to-Point wireless communications
- Point-to-Multi Point Radio Links

Building Blocks

- MMICs for LNA and PA functions
- Double balanced mixer
- Modular PTFE substrate design
- Low cost, high performance construction

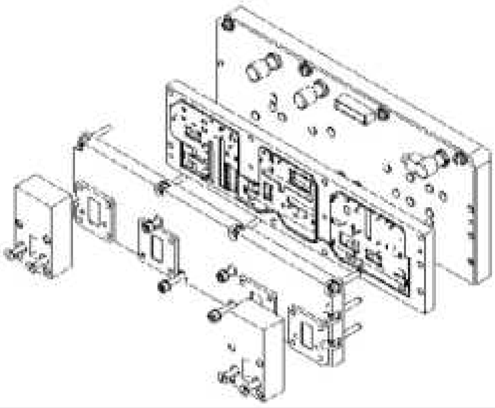
Features

- Combined up and down converter
- Output power of 23 dBm
- Receiver Gain 25 dB
- Power control and mute functions
- BITE function

Electrical Specification	
Operating frequency range	17.7 - 19.7GHz
TXIF frequency	1630 - 3275MHz
LO frequency range	8000 - 8550 MHz
TX output Psat	>23 dBm
RX gain (RX input to RXIF)	25 dB + 5 dB
TX to RX isolation (ref. to RX input)	>70 dB
RX input noise figure	<5 dB
Rx input 3rd order Intercept Point	>-10 dBm
Supply voltages	+ 5.0V <1.5A + 6.2V <0.4A - 5.0V <0.1A
Operating temperature range Cold start	-35°C to +75°C -45°C
Weight	<500g
Connections	SMA/BMA MCX Waveguide WR42/WG20

23 GHz Millimetrewave Transceiver

Data Sheet: AMSM0003



Applications

- Point-to-Point wireless communications
- Point-to-Multi Point Radio Links

Building Blocks

- MMICs for LNA and PA functions
- Modular PTFE substrate design
- Low cost, high performance construction

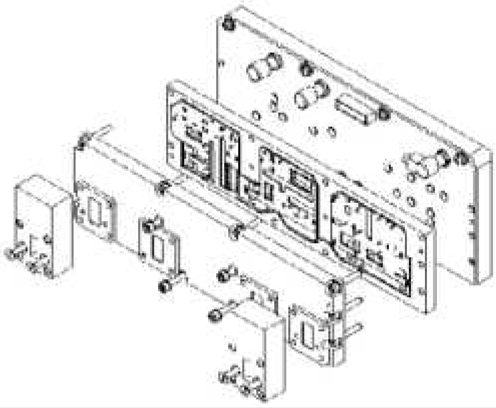
Features

- Combined up and down converter
- Output power of 21 dBm
- Receiver Gain 25 dB
- Power control and mute functions
- BITE function

Electrical Specification	
Operating frequency range	21.2 - 23.6 GHz
TXIF frequency	1630 - 2920MHz
LO frequency range	8010 - 8420 MHz
TX output Psat	>21 dBm
RX gain (RX input to RXIF)	25 dB + 5 dB
TX to RX isolation (ref. to RX input)	>70 dB
RX input noise figure	<6 dB
Rx input 3rd order Intercept Point	>-10 dBm
Supply voltages	+ 5.0V <1.5A + 6.2V <0.4A - 5.0V <0.1A
Operating temperature range Cold start	-35°C to +75°C -45°C
Weight	<500g
Connections	SMA/BMA MCX Waveguide WR34/WG21

26 GHz Millimetrewave Transceiver

Data Sheet: AMSM0004



Applications

- Point-to-Point wireless communications
- Point-to-Multi Point Radio Links

Building Blocks

- MMICs for LNA and PA functions
- Modular PTFE substrate design
- Low cost, high performance construction

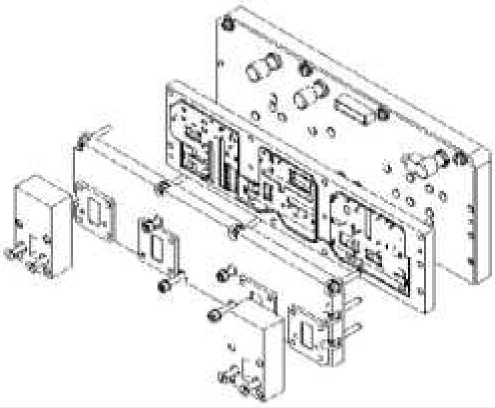
Features

- Combined up and down converter
- Output power of 21 dBm
- Receiver Gain 25 dB
- Power control and mute functions
- BITE function

Electrical Specification	
Operating frequency range	24.5 - 26.5 GHz
TXIF frequency	1630 - 2920 MHz
LO frequency range	7630 - 7640 MHz
TX output Psat	>21 dBm
RX gain (RX input to RXIF)	25 dB + 5 dB
TX to RX isolation (ref. to RX input)	>70 dB
RX input noise figure	<6 dB
Rx input 3rd order Intercept Point	>-10 dBm
Supply voltages	+ 5.0V <1.5A + 6.2V <0.4A - 5.0V <0.1A
Operating temperature range Cold start	-35°C to +75°C -45°C
Weight	<500g
Connections	SMA/BMA MCX Waveguide WR34/WG21

28 GHz Millimetrewave Transceiver

Data Sheet: AMSM0005



Applications

- Point-to-Point wireless communications
- Point-to-Multi Point Radio Links

Building Blocks

- MMICs for LNA and PA functions
- Modular PTFE substrate design
- Low cost, high performance construction

Features

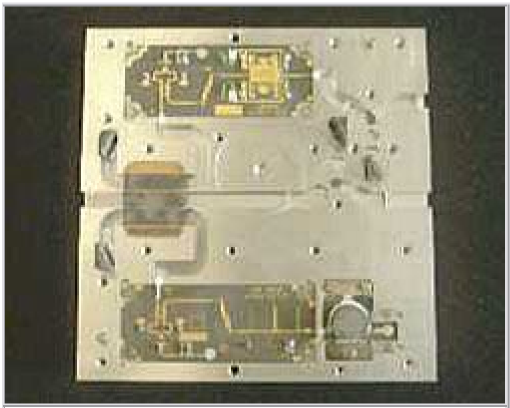
- Combined up and down converter
- Output power of 21 dBm
- Receiver Gain 25 dB
- Power control and mute functions
- BITE function

Electrical Specification	
Operating frequency range	27.5 - 29.5 GHz
TXIF frequency	1630 - 2920 MHz
LO frequency range	8630 - 8935 MHz
TX output Psat	>21 dBm
RX gain (RX input to RXIF)	25 dB + 5 dB
TX to RX isolation (ref. to RX input)	>70 dB
RX input noise figure	<6 dB
Rx input 3rd order Intercept Point	>-10 dBm
Supply voltages	+ 5.0V <1.5A + 6.2V <0.4A - 5.0V <0.1A
Operating temperature range Cold start	-35°C to +75°C -45°C
Weight	<500g
Connections	SMA/BMA MCX Waveguide WR34/WG21

VCOs

18 GHz Transceiver

Data Sheet: AMSM0002



Applications

- Cellular Radio Infrastructure - GSM, PCN, PCS
- Short Haul Access Links

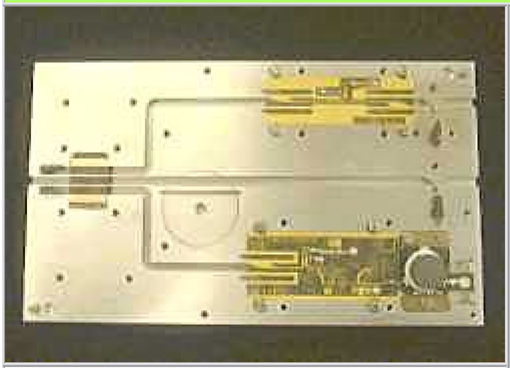
Features

- Single Gunn VCO
- Wide Operating temperature
- Designed to minimise microphonics and phase hits
- Separate Diplexer Assembly

Electrical Specification	
Frequency Range	17.7 to 19.75 GHz
Sub Band Width	250 MHz
Output Power	-14.0 to +16.2 dBm
Rx conversion loss	8.0 dB max
Phase Noise	-85 dBc/Hz 100 KHz from carrier -110 MHz @ 1 MHz
Receive IF	1010 MHz
Attenuator Range	0 to 30 dB
Receiver Gain	2 dB
Image Frequency Rejection	60 dB
Tuning linearity	-10 to +5% max over 10 MHz
Varactor tuning voltage	2 to 27V
DC supplies	10V, 2.6A -5V, 25mA
Temperature Range	-40 °C to +70 °C

38 GHz Transceiver

Data Sheet: AMSM0006



Applications

- Cellular Radio Infrastructure - GSM, PCN, PCS
- Short Haul Access Links

Features

Electrical Specification	
Frequency Range	37.0 to 39.5 GHz
Sub Band Width	280 MHz
Output Power	-15.0 to +15.0 dBm
Rx conversion loss	8.0 dB max
Phase Noise	-85 dBc/Hz 100 KHz from carrier -110 MHz @ 1 MHz
Receive IF	1260 MHz

- Single Gunn VCO
- Wide Operating temperature
- Designed to minimise microphonics and phase hits
- Separate Diplexer Assembly

Attenuator Range	0 to 30 dB
Image Frequency Rejection	60 dB
Tuning linearity	-10 to +5% max over 10 MHz
Varactor tuning voltage	2 to 27V
DC supplies	10V, 2.6A -5V, 25mA

Up Down Converters

Since 2001, MESL Microwave has manufactured up- and down-converters, which are MICs used in commercial radio systems. We manage this as a build-to-print (B2P) activity, managing the complete supply chain for these systems on behalf of the customer.

Please contact us if you have an interest or requirement for a similar service.

Sub Contract Manufacture

MESL Microwave has a broad range of expertise and experience with different manufacturing techniques, which enables us to offer a sub-contract manufacturing service. Using a combination of in-house skills and equipment and a network of local external specialist companies, we are able to offer a managed build-to-print (B2P) service to customers in market areas as diverse as military, telecommunications and security.

In-house facilities

- Automatic bonding of various MMICs, PIN Diodes, Hybrid, Beam Lead Chips using thermo-sonic and thermo-compression bonders on gold and aluminium wires and tape to 1 thou diameter
- Semi-automatic Pick and Place and IR Reflow techniques
- In-house machining CNC linked to 3D CAD
- SMT and TH Assembly
- Vibration, Humidity and Temperature testing
- MRSI

Please contact us to discuss any potential opportunities you may have.

Please also refer to the "Manufacturing" page in the "Capabilities" section of the site for more details.

SAW Pulse Compression

Our Experience

Pulse Compression is a signal processing technique widely used in modern radars to achieve improvements in key system parameters such as range and resolution. It can be achieved in a number of ways, but the technique which has been used most frequently and effectively involves the use of **Surface Acoustic Wave** (SAW) technology.

MESL is one of the premier world class designers of **SAW Pulse Compression Subsystems** and has designed equipment for all of the following applications:

- Air Traffic Control
- Long Range Surveillance
- Marine Reconnaisance
- Helicopter Terrain Surveillance
- Man Pack Battlefield Surveillance
- Tracking
- Phased Array
- Synthetic aperture

SAW Subsystems

MESL has over 25 years of experience in the design of **SAW pulse compression products**, we have specialised in the design and manufacture of subsystems which simplify the integration of the unit into a radar system, and ease the problems of interfacing with the individual, complex SAW devices. SAW delay lines have a high insertion loss and poor electrical match, so we have developed specialised circuits to reduce interface and test difficulties, and to ensure the ultimate in pulse compression performance is achieved.

Using a MESL subsystem the interface simplifies to a TTL logic signal and 50 ohm (1.5 VSWR) RF terminations. With this in mind the radar designer can concentrate on the system problem - leaving the detailed complexities of the subsystem to our experts.

Devices

Fabricated on quartz for high temperature stability, SAW dispersive delay lines (DDL's) - sometimes described as 'chirp' filters - are used for pulse compression. Their delay from input to output varies continuously with frequency over their operating bandwidth, and this can be preprogrammed almost arbitrarily at the mask level. Two devices, one in the transmitter and one in the receiver, are programmed as matched filters.

They have complementary dispersive delay characteristics and yield a constant delay when used in cascade as their dispersions mutually cancel. A pulse input to the cascade consequently appears at the output virtually undistorted. However, the pulse emanating from the first device (the transmit pulse) is unrecognisable in terms of the input applied - its length may have been stretched by a factor of several hundred times because of inherent dispersive delay. It sounds almost too good to be true that the SAW device forming the other half of the cascade (i.e. the receive device) can pack this back up again to the near equivalent of the original!

Naturally, the first device is called an expander and the other a compressor

What We Need to Know

Before the radar system designer can completely define the pulse compression subsystem, it is necessary to specify the fundamental parameters dictated by the system requirement, these are:

Receiver Resolution
This includes the 3dB width and the sidelobe level of the compressed pulse and hence is the parameter which determines the required bandwidth for the system.

Transmit Pulse Length
Determined by the system range requirement and available peak transmitter power.

Doppler Shift
Determined by the radar RF frequency and relative target velocity.

Mismatch Loss
There is an inherent mismatch loss associated with linear-FM pulse compression techniques caused by the use of a weighting function in the compression filter to reduce time sidelobes. Values of between 1dB and 1.5dB loss are typical. This can be reduced to ~0.1dB through use of matched non-linear FM coding at the expense of increased sensitivity to Doppler shifted frequencies. MESL Microwave has a comprehensive range of linear and non-linear designs and can provide hybrid non-linear versions which provide a design trade-off between low mismatch loss and Doppler sensitivity.

From a knowledge of these parameters, MESL Microwave may be able to offer a number of standard subsystem designs which are close to your requirement. When you have finally settled on the specification you require, we will offer help on trade-offs, interfacing, MTBFs, mechanical aspects (together with a host of other details) and will complete a full subsystem specification or Statement of Compliance, as appropriate. Either way, you can be assured of the best balance of performance parameters for your system.

Subsystem Configuration

In its simplest form, a pulse compression subsystem comprises:

- **Transmitter (Expander)** section which houses one SAW device* with its associated electronics to generate a transmit waveform.
- **Receiver (Compressor)** section which houses one complementary SAW device with its associated electronics to produce a compressed pulse from the transmitted waveform.

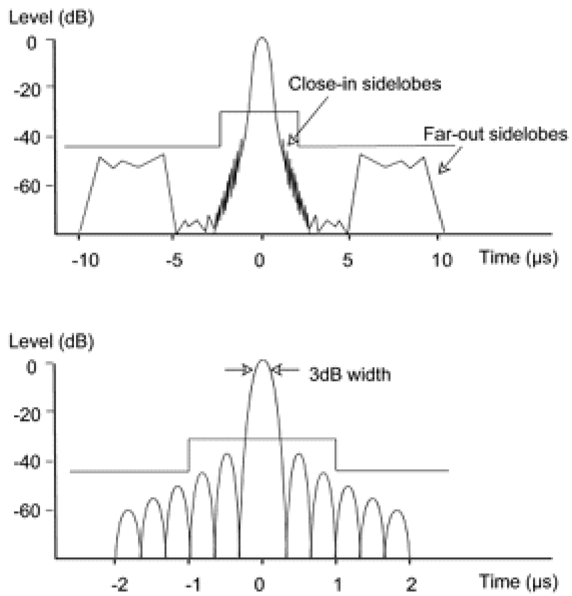


Figure 3: Compressed pulse design features

These two sections can be combined into one box or two separate boxes for maximum flexibility. Some radar systems require complex configurations combining a number of expander and/or compressor devices.

MESL Microwave supplies subsystems which include:

- Multiple pulse lengths for switched range and resolution.
- Multiple matched compressor channels for use in tracking or sidelobe cancellation applications.
- Coherent operation with pulse-to-pulse phase jitter less than 0.1° rms
- Low sidelobe levels

MESL Microwave will be pleased to discuss capabilities and requirements with customers who have a need of these or other specialised requirements.

For an entirely new system design there is a need to explore the optimum parameters and the effects of errors. Our experts will advise and supply simulations if required.

Compressor

The Compressor or Receive section of the Pulse Compression Subsystem comprises the SAW compressor dispersive delay line(s) plus the device matching and amplification circuits required to meet the system dynamic range/signal to noise parameters.

Single compressors or multiple, matched compressor sets can be provided, e.g. for phased array or monopulse radars. The key subsystem parameters are explained below.

Compressed Pulse Width (t)

The pulse width is normally defined at its -3dB level. It is also common to specify the pulse width at the base of the pulse somewhat above the peak sidelobe level, say at -35dB, as this determines discrimination between a small target and an adjacent larger one.

Sidelobe Levels

Sidelobe levels fall into categories:

Close-In Sidelobes
These are caused by minor waveform distortions, including Doppler shift.

Far-Out Sidelobes

Caused by gating effects related to finite pulse length.

In order to simplify specification, close-in sidelobes are those lying within a range of ± 5 where is the -3dB compressed pulse width. The level of sidelobe suppression is dependent on the time bandwidth product, TB, and the weighting function applied. Values in the range 30 to 50dB have been achieved in current systems. Estimates of performance for specific parameters are provided through computer simulation and based on a considerable database of practical designs.

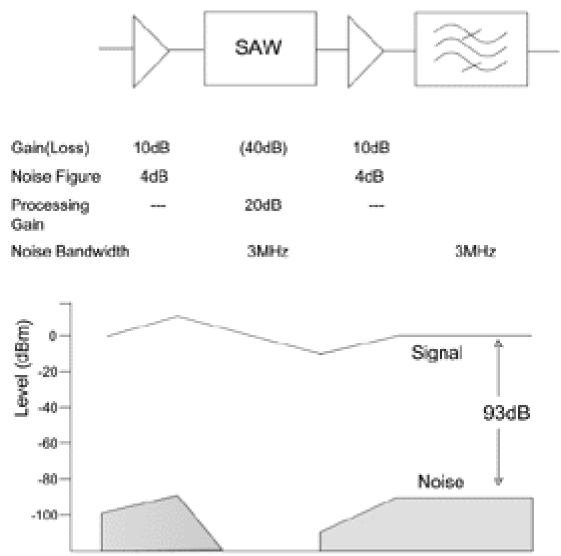


Figure 4: Receiver schematic and level diagram

Loop Delay

As discussed in the Expander Section, the centre frequency delay is measured at the nominal centre frequency of the compressor. As long as expander and compressor delays are specified at the same absolute frequency, the addition of expander and compressor delays gives the loop delay. This corresponds to the time after the trigger point at which the compressed pulse peak is produced and it will normally be no less than twice the centre frequency delay (t0) specified in the expander. Since loop delay is affected by Doppler shift, it is normally specified at zero Doppler.

The maximum input signal to the compressor is normally specified to be 0dBm. Additional internal amplification can be provided if requested. Design practice ensures that signal levels in the compressor channel give maximum dynamic range.

Output Level

This is the peak level of the compressed pulse with a maximum working signal level applied at the input. Common practice is to have either unity gain to the signal or unity gain to noise. Remember, compression gain makes a big difference and it may be impractical to have unity gain to noise!

Dynamic Range

The dynamic range is usually specified as the ratio of the peak available signal output and the rms output noise level when the compressor input is terminated in a matched impedance. The required dynamic range should be specified by the systems engineer so that MESL can determine the required signal levels at the various points within the compressor channel. A design example is given in Figure 4.

Here, a processing gain of 20dB is assumed (see Additional Technical Notes). The equivalent noise bandwidth is approximately half the nominal bandwidth. For practical purposes, only noise from the post-compression amplifier is relevant and the bandwidth of the output filter is assumed to be equal to the compressor bandwidth channel since this is the optimum situation.

Input and Output Impedances

As stated for the expander, MESL subsystems are designed to operate in a 50W system with impedances which generally provide an operating VSWR of 1.5. Other values may be provided when required.

Technical Notes

Pulse Compression is a complex topic and MESL Microwave has close to 20 years' experience in interpreting the needs of radar system designers to optimise their specific system's performance.

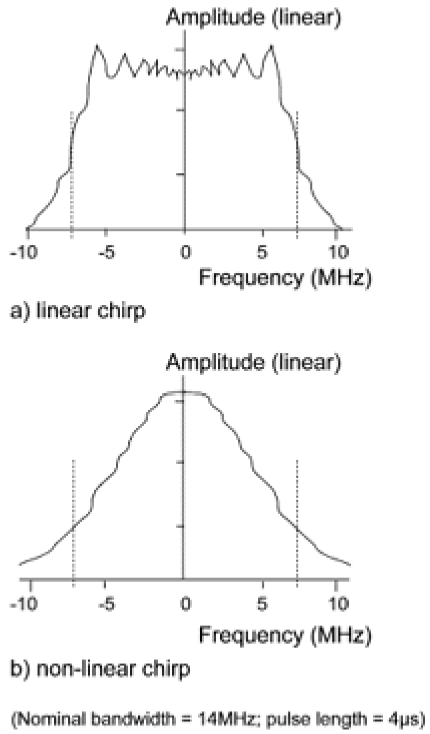


Figure 5: Spectra of linear and non-linear FM waveforms

Processing Gain (PG)

Processing gain is the term given to the signal to noise improvement achieved by pulse compression. It can be expressed as: PG 10log10 (TB). In practice, this factor is reduced by the mismatch loss. Incidentally, the mismatch loss can be measured fairly precisely, but not so the processing gain since bandwidth can be somewhat arbitrarily defined in a Non-linear FM pulse compression system.

Spectral Shape

Most pulse compression radars require a drive signal for the power amplifier which has an essentially rectangular envelope. For a linear FM (chirp) signal the associated frequency spectrum is also approximately rectangular, as shown in Figure 5a, for a chirp with TB equal to 56. The deviation from the nominal 14MHz bandwidth is due to Fresnel ripple associated with linear FM waveforms. This in turn introduces gating sidelobes at a level -20log10(TB), which for this case are at a level of -35dB. The processes of weighting and ripple compensation in the compressor can significantly reduce both close-in and gating sidelobes. Figure 5b shows the spectrum of a non-linear chirp with similar pulse compression characteristics. With this type of spectrum, low sidelobe levels can also be achieved without the introduction of mismatch loss and some ripple compensation may enhance performance at the expense of a minor mismatch loss penalty. The spectral shape of the chirps defined by linear and non-linear design rules can differ significantly and, although these shapes can be accurately computed in the course of design procedure, it is sometimes difficult to specify reference points for bandwidth measurement, e.g. there may be a 2dB amplitude ripple at the band centre. This needs to be recognised when defining bandwidths for test specification purposes.

Pulse Broadening and Mismatch Loss

In most radars it is necessary to employ a weighting function to achieve adequate sidelobe suppression. A wide range of suitable functions is available and MESL would normally select the one best suited to a customer's requirement. The effect of weighting in both linear or non-linear coded systems is to produce broadening of the compressed pulse for any given use of bandwidth. For a specified pulse width it is common to select the required bandwidth accordingly. The introduction of the weighting function in linear coded systems creates a mismatch loss of approximately 1.2dB for 40dB sidelobe suppression. Where non-linear coding f□□0□□□□□□□□□□□□□□□□□□□ÿ□□□ÿ□□□□□□□ö□□□ā□□
at this sidelobe level, although there is no advantage in terms of overall bandwidth which remains the same as for linear FM.

Expander

The Expander or Transmit section of the Pulse Compression Subsystem comprises the digital interface circuits which control and define the transmitted (or expanded pulse), the SAW expansion dispersive delay line (DDL or chirp filter), the impulse generator which drives the SAW DDL and the device matching and amplification circuits. The key subsystem parameters are explained below.

Centre Frequency (IF)

The range of centre frequencies is 30-600MHz. The frequency should be chosen to give a fractional bandwidth of less than 33%. Very high centre frequencies give poorer sidelobe levels - higher percentage bandwidths give poorer system SNR and dynamic range. A maximum practical bandwidth of approximately 200MHz is possible using current techniques.

Bandwidth

The bandwidth, B, will normally be determined by MESL since it depends on:

- Compressed Pulse Width (specified by customer)
- Weighting Function (selected by MESL to achieve the required time sidelobe level)

Any restriction on the spectral shape of the transmitted (expanded) pulse should be specified by the customer, as this may affect the available performance.

Waveform Coding and Coding Sense

The coding sense (i.e. upchirp or downchirp) is not normally important to the radar performance, but MESL recommend a downchirp for the IF waveform. The most important waveform decision is between Linear or Non-Linear FM coding. In general, linear coding is recommended for applications where high Doppler shifts are expected. Non-linear coding is recommended where mismatch loss is critical and low Doppler shifts expected. However, we can also design hybrid non-linear systems which optimise mismatch loss against Doppler sensitivity for any given application. Figure 1 gives a schematic of the typical FM coding used for Linear and Non-Linear applications, and, as expected, Hybrid designs lie within these extremes.

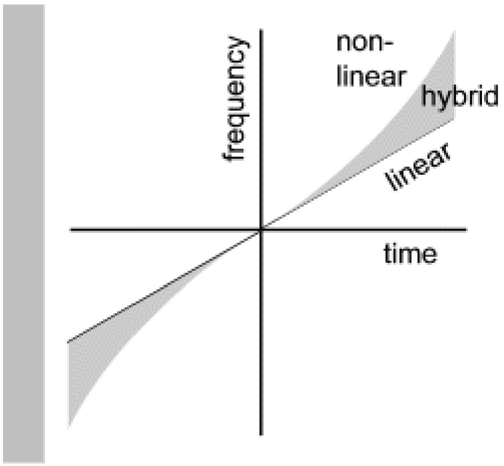


Figure 1: Frequency/Time Laws for typical linear and non-linear chirp signals

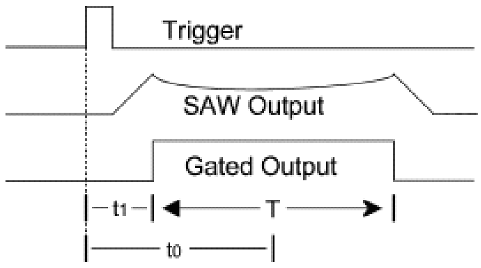


Figure 2: Timing in the expander unit

Pulse Length

The range of pulse lengths, T, available is from 0.5µs to 100µs and beyond. The signal is normally accurately internally gated to match the receiver characteristics. Sidelobe performance can be degraded if the radar system does not allow the full pulse length to be transmitted.

Time Bandwidth Product

A common figure which characterises pulse compression devices is the time bandwidth product expressed as T(µs)B(MHz). In MESL subsystems values of TB between 5 and 1000 can be achieved. For low values of TB, say between 5 and 15, MESL have successfully developed techniques which allow sidelobe suppression exceeding 35dB, which is considerably better than expected. For TB between 15 and 500 (the highest "off-the-shelf" TB), sidelobe levels can vary from 35dB to 45dB, depending on such things as the Doppler shift v mismatch loss trade-off, and the selected IF.

Signal Delay

The timing of the expanded pulse is generally derived from the parent system. Inherent in the SAW device is a delay, t1, to the leading edge of the expanded pulse as shown in Figure 2. It is often more convenient, however, to define time, t0, as the delay from trigger reference to the "centre frequency" of the expanded pulse. This delay, when added to the corresponding delay in the compressor, gives the minimum total delay between the trigger input and compressed pulse output, in the absence of any Doppler shift. Commonly known as the loop delay, this parameter is specified with a tolerance of 100ns in most systems, but will track to typically better than 5% of the loop delay.

Output Signal Level

MESL provides a nominal output signal level in the range 0 to +6dBm. Other values can be accommodated on request.

Amplitude Ripple

Amplitude ripple on the output waveform generally results from its rapid frequency sweep and is typically ± 0.25dB. In order to preserve the sidelobe level, the system designer must ensure that no additional ripple is introduced within his system.

Signal-to-Noise Ratio (SNR)

The SNR at the output of the expander subsystem varies typically between 40dB and 60dB for wideband and narrowband subsystems respectively. Because of processing gain, this parameter is not as critical as it may at first seem. Our Digital Waveform Generators have practically immeasurable in-band noise, even using sophisticated spectrum analysers.

Output Impedance

The impedance of a MESL subsystem is typically 50W with a VSWR of 1.5. On special request MESL will provide, where possible, different impedance and VSWR levels

Couplers

MESL Microwave has recently launched a range of waveguide couplers from 7GHz to 23GHz for the point-to-point radios used in commercial wireless infrastructure. Coupling values of 3dB, 6dB and 10dB are available at the moment, with the additional capability to design for other values. Our couplers have been designed to offer excellent performance across all key criteria, such as VSWR, response and directivity over the required frequency range. Performance enhancements are possible according to application needs.

The couplers also include a polarisation flange. MESL can support fast prototyping using machined parts before moving to casting suitable for the production volumes. Global supply can be supported from our manufacturing sites in Europe and Asia.

This range complements our wide range of diplexing filters covering the range of 6GHz to 38GHz for the commercial wireless point-to-point radio market.

In addition, we have an excellent combination of expertise and tools to create new designs according to market and customer needs.

Isolators and Circulators

MESL Microwave has specialised in the design and manufacture of isolators and circulators for over 40 years. All MESL Microwave are designed in-house, using our vast range of engineering expertise and experience. Our products range in frequency from 350MHz to 65GHz.

Product Range

- Coaxial
- Iso-hybrid
- Package Drop-Ins
- Substrate Drop-Ins
- Surface MountTechnology (SMT)
- Waveguide

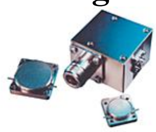
Target Markets

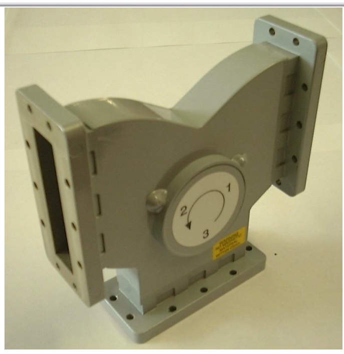
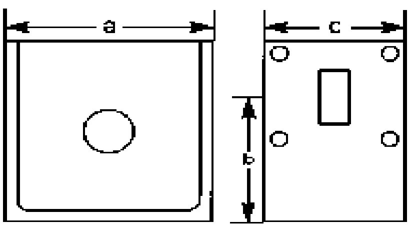
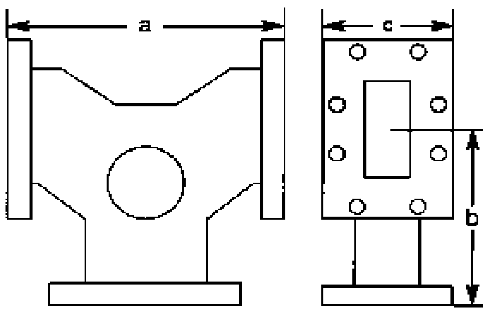
- Wireless communications – TETRA, GSM, UMTS, PDH / SDH, WiMAX
- Defence
- Aerospace

We manufacture both in-house and externally, according to market requirements. High volume products for the telecommunications market, for example, are manufactured externally to optimise cost.

Innovation is a key driver for MESL in this competitive market, and we are currently actively involved in enhancing and further developing our substrate drop-in and SMT designs to improve performance and cost-effectiveness.

Waveguide



	A full range of waveguide junction circulators and isolators are available covering the frequency range 3.4GHz - 65.0GHz. This range includes units manufactured from investment castings and precision machined bodies to ensure optimum microwave performance. Custom designs are available on request.
	

Waveguide Junction Circulators and Isolators - 3.4 to 26.5GHz													
Waveguide Designation			Frequency (GHz)	Type Number		Specification			Operating Temperature (°C)	Dimensions (mm)			Mating Flange
British Standard	IEC	RETMA		Circulator	Isolator	Isol'n (dB) min	Insert Loss (dB)	Ret'n Loss (dB)		a	b	c	

							max	min					
WG11A	R40	WR229	3.400 - 3.800	11C 3041	11F3041	28	0.2	28	0 to +50	120	79	58	UER 40
			3.700 - 4.200	11C 3051	11F3051	28	0.2	28	0 to +50	120	79	58	UER 40
WG12	R48	WR187	4.400 - 5.000	12C 3051	12F3051	30	0.3	30	0 to +50	121	80	67	UER 48
WG14	R70	WR137	5.800 - 6.425	14C 3041	14F3041	28	0.1	28	0 to +50	82	51	40	UER 70
			5.925 - 6.425	14C 3042	14F3042	28	0.1	28	0 to +50	82	51	40	UER 70
			6.400 - 7.110	14C 3043	14F3043	28	0.15	28	0 to +50	82	51	40	UER 70
			6.750 - 7.250	14C 3031	14F3031	28	0.15	28	0 to +50	82	51	40	UER 70
			7.100 - 7.800	14C 3044	14F3044	28	0.15	28	0 to +50	82	51	40	UER 70
WG15	R84	WR112	7.000 - 7.500	15C 3031	15F3031	30	0.2	29	0 to +50	76	50	48	UBR 84
			7.250 - 7.750	15C 3032	15F3032	30	0.2	29	0 to +50	76	50	48	UBR 84
			7.250 - 7.750	15C 3033	15F3033	30	0.2	29	0 to +50	76	50	38	UER 84
			7.700 - 8.400	15C 3041	15F3041	30	0.2	29	0 to +50	76	50	38	UER 84
			7.900 - 8.500	15C 3034	15F3034	30	0.2	29	0 to +50	76	50	48	UBR 84
			7.900 - 8.500	15C 3035	15F3035	30	0.2	29	0 to +50	76	50	38	UER 84
			8.100 - 8.600	15C 3036	15F3036	30	0.2	29	0 to +50	76	50	48	UBR 84
			8.100 – 8.600	15C 3037	15F3037	30	0.2	29	0 to +50	76	50	38	UER 84
WG16	R100	WR90	8.200 - 10.000	16C 3041	16F3041	20	0.3	21	0 to +50	61	41	41	UBR 100
			8.500 - 9.600	16C 3042	16F3042	25	0.2	26	0 to +50	61	41	41	UBR 100
			9.000 - 9.500	16C 3031	16F3031	25	0.2	26	0 to +50	61	41	41	UBR 100
			9.300 - 9.500	16C 3021	16F3021	25	0.2	26	-20 to +50	61	41	41	UBR 100
			9.500 - 11.000	16C 3051	16F3051	20	0.3	21	0 to +50	61	41	41	UBR 100
			9.500 - 12.000	16C 3061	16F3061	20	0.3	19	0 to +50	61	41	41	UBR 100
			10.000 - 10.500	16C 3032	16F3032	25	0.25	26	-40 to +85	61	41	41	UBR 100
			10.700 - 11.700	16C 3043	16F3043	30	0.15	30	0 to +50	61	41	41	UBR 100
			11.700 - 12.300	16C 3033	16F3033	30	0.3	30	0 to +50	61	41	41	UBR 100
			11.700 - 12.500	16C 3034	16F3034	30	0.3	26	0 to +50	61	41	41	UBR 100
WG17	R120	WR75	10.700 - 11.700	17C 3041	17F3041	30	0.2	29	0 to +50	51	32	38	UBR 120
			11.800 - 13.000	17C 3042	17F3042	25	0.3	23	-30 to +60	51	32	38	UBR 120
			12.250 - 13.250	17C 3043	17F3043	27	0.2	26	0 to +50	51	32	38	UBR 120
WG18	R140	WR62	12.400 - 18.000	18C 3081	18F3081	20	0.5	19	0 to +50	50	28	35	UBR 140
			12.500 - 13.250	18C 3031	18F3031	30	0.3	29	0 to +50	50	28	35	UBR 140
			14.050 - 14.850	18C 3032	18F3032	28	0.3	26	-20 to +60	50	28	35	UBR 140
			14.400 - 15.350	18C 3033	18F3033	28	0.3	26	-40 to +85	50	28	35	UBR 140
			14.900 - 15.700	18C 3034	18F3034	28	0.3	26	-20 to +60	50	28	35	UBR 140
			15.500 - 17.500	18C 3041	18F3041	20	0.4	19	-40 to +85	50	28	35	UBR 140
WG20	R220	WR42	17.700 - 19.700	20C 3041	20F3041	25	0.3	23	0 to +50	32	21	25	UBR 220
			21.200 - 23.600	20C 3042	20F3042	25	0.3	23	0 to +50	32	21	25	UBR 220
			24.200 - 26.500	20C 3043	20F3043	25	0.3	23	0 to +50	32	21	25	UBR 220

top

Waveguide Junction Circulators and Isolators - 26.5 to 65.0GHz

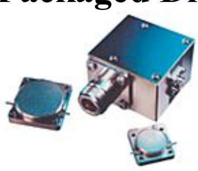
Waveguide Designation			Freq'y (GHz)	Band Width (MHz)	Type Number		Specification			Operating Temperature (°C)	Dimensions (mm)			Mating Flange
British Standard	IEC	RETMA			Circulator	Isolator	Isol'n (dB) min	Insert Loss (dB) max	Ret'n Loss (dB) min		a	b	c	
WG22	R320	WR28	26.500-40.000	100	22C3011	22F3011	30	0.5	26	0 to +50	25	16	20	UBR 320
				250	22C3012	22F3012	27	0.5	26	-40 to +85	25	16	20	UBR 320
				500	22C3013	22F3013	25	0.5	23	-40 to +85	25	16	20	UBR 320
				1000	22C3021	22F3021	23	0.5	23	-40 to +85	25	16	20	UBR 320
				2000	22C3031	22F3031	20	0.5	21	-40 to +85	25	16	20	UBR 320
WG25	R620	WR15	55.000-65.000	500	25C3011	25F3011	25	0.6	21	-30 to +85	25	19	25	UG 385/U
				1000	25C3012	25F3012	20	0.6	19	-30 to +85	25	19	25	UG 385/U

Surface Mount Technology

For some time now, several electronic components in various markets, such as telecoms, have made use of surface mount technology (SMT). There is a increasing requirement for RF components to follow suit, in order to save customers time and money when assembling their boards and systems. There is a desire, for example, by customers to be able to have RF isolators and circulators in tape and reel packaging for automated board population.

MESL Microwave has an expanding range of drop-ins using SMT, one of the key focus areas of research and development within our engineering team.

Packaged Drop-Ins



These compact Ferrite Isolator and circulator devices utilise MESL's 40+ years of expertise in the design and manufacture of ferrite and dielectric materials. Coupled with modern packaging and manufacturing techniques, this range of Isolator and Circulators offer:

- Low cost
- High performance

- Proven reliability.

Custom designs, alternative power handling and multi-port versions are available on request.

300MHz to 500MHz

Frequency (GHz)	Isolation (Min)	Insertion Loss (Max)	Return Loss (min)	Power Watts		IMD 2 tones	Foot Print (mm x mm)	Operating Temp (ºC)	MESL Part No
				Reverse	Forward				
0.380 - 0.420	17	0.4	17	100	100	55 @ 10W	38.1 x 46.75	-45 to +85	HZFR 9976
0.414 - 0.437	21	0.25	21	120	150	70 @40W	52.5 x 60	-10 to +85	HZA 9691
0.420 - 0.470	19	0.4	17	100	100	55 @ 10W	38.1 x 46.75	-45 to +85	HZFR 9977
0.450 - 0.476	21	0.3	21	120	150	55 @ 20W	38.1 x 46.75	-10 to +85	HZFR 9695
0.453 - 0.477	21	0.25	21	120	150	70 @40W	52.5 x 60	-10 to +85	HZA 9690
0.454 - 0.476	21	0.3	21	120	150	55 @ 20W	38 x 48.6	-10 to +85	HZF 9487
0.460 - 0.468	23	0.2	21	125	125	73 @ 80W	59.3 x 57.48	-40 to +85	HZA 9697

500MHz to 1GHz

Frequency (GHz)	Isolation (Min)	Insertion Loss (Max)	Return Loss (min)	Power Watts		IMD 2 tones	Foot Print (mm x mm)	Operating Temp (ºC)	MESL Part No
				Reverse	Forward				
0.824 - 0.849	23	0.2	23	2	2	80 @ 1W	25.4 x 28	-40 to +70	PZF 9957
0.851 - 0.894	20	0.3	20	100	100	80 @ 20W	25.4 x 31.8	-40 to +85	PZA 10034
0.869 - 0.894	21	0.2	21	125	200	75 @ 35W	25.4 x 31.8	-40 to +100	PZF 9939
0.869 - 0.894	23	0.25	23	100	100	70 @ 20W	22 x 22	-10 to +85	PZF 9554
0.869 - 0.960	23	0.3	23	60	70	80 @ 40W	25.4 x 31.8	-10 to +70	PZF 9948
0.869 - 0.960	21	0.3	21	120	150	75 @ 60W	36 x 31.75	-40 to +100	PZA 9945
0.869 - 0.960	20	0.25	20	100	120	70 @ 60W	25.4 x 31.75	-30 to +85	PZA 9722
0.880 - 0.915	23	0.2	23	2	2	80 @ 1W	25.4 x 28	-40 to +70	PZF 9955
0.909 - 0.922	21	0.25	21	50	60	60 @ 4W	25.4 x 30.75	-40 to +85	PZF 9843
0.921 - 0.960	20	0.35	20	100	100	79 @ 35W	36 x 31.75	-25 to +100	PZA 9814
0.925 - 0.960	25	0.4	21	60	60	80 @ 20W	25.4 x 35	-10 to +70	PZF 9317

1GHz to 2 GHz

Frequency (GHz)	Isolation (Min)	Insertion Loss	Return Loss	Power Watts	IMD 2 tones	Foot Print (mm x mm)	Operating Temp (ºC)	MESL Part No

		(Max)	(min)	Reverse	Forward				
1.025 - 1.150	20	0.3	20	100	100	65 @ 20W	25.4 x 25.4	-40 to +85	LZM 9834
1.080 - 1.100	1	0.5	18	60	60	65 @ 20W	25.4 x 25.4	-40 to +85	LZM 9756
1.200 - 1.400	20	0.4	20	60	60	65 @ 20W	31.75 x 38	-10 to +65	LZF 9725
1.315 - 1.515	20	0.4	20	60	60	65 @ 20W	31.75 x 38	-10 to +65	LZF 9741
1.805 - 1.990	25	0.5	23	60	70	80 @ 20W	25.4 x 30.75	-10 to +70	NZF 9973
1.805 - 1.880	25	0.35	21	60	60	70 @ 20W	25.4 x 34.8	-10 to +70	NZF 9373
1.805 - 1.880	20	0.3	20	100	100	80 @ 20W	25.4 x 31.75	-40 to +85	NZF 10045
1.805 - 1.880	21	0.35	21	100	100	70 @ 30W	36 x 31.75	-40 to +100	NZA 9726
1.805 - 1.880	21	0.3	20	60	100	80 @ 20W	19.05 x 25.4	-10 to +80	NZF 9705
1.805 - 1.990	20	0.35	20	15	100	80 @ 20W	19.05 x 19.05	-10 to +70	NZF 9810
1.930 - 1.990	20	0.3	20	100	100	80 @ 20W	25.4 x 31.75	-40 to +85	NZA 10055
1.930 - 1.990	21	0.25	22	100	120	75 @ 35W	25.4 x 31.8	-40 to +100	NZA 9961
1.930 - 1.990	25	0.35	21	60	60	70 @ 30W	25.4 x 34.8	-10 to +70	NZF 9372
1.930 - 1.990	21	0.35	21	60	100	70 @ 40W	19.05 x 25.4	-10 to +85	NZF 9531

2GHz to 5GHz

Frequency (GHz)	Isolation (Min)	Insertion Loss (Max)	Return Loss (min)	Power Watts		IMD 2 tones	Foot Print (mm x mm)	Operating Temp (ºC)	MESL Part No
				Reverse	Forward				
2.010 - 2.025	20	0.25	20	100	100	70 @ 3W	12.7 x 12.7	-40 to +85	SZF 9910
2.080 - 2.200	21	0.35	21	60	100	70 @ 40W	19.05 x 25.4	-10 to +80	SZF 9530
2.100 - 2.300	20	0.35	19.5	100	100	80 @ 20W	19.05 x 19.05	-10 to +85	SZM 9382
2.110 - 2.170	21	0.25	21	120	150	75 @ 35W	25.4 x 31.8	-40 to +100	SZA 9941
2.110 - 2.170	23	0.35	21	100	100	79 @ 35W	36 x 31.75	-40 to +100	SZA 9702
2.110 - 2.170	18	0.4	18	100	100	80 @ 20W	22 x 22	-10 to +85	SZM 9610
2.110 - 2.170	23	0.25	23	40	100	70 @ 20W	25.4 x 30.75	-25 to +75	SZF 9627
2.110 - 2.170	20	0.3	20	100	100	80 @ 20W	25.4 x 31.75	-40 to +85	SZA 10057
2.469 - 2.690	23	0.35	20	40	40	55 @ 20W	19.05 x 19.05	-40 to +55	SZN 10039
2.495 - 2.700	20	0.4	20	60	60	65 @ 5W	19.05 x 25.4	-40 to +85	SZF 9991
2.495 - 2.700	20	0.04	20	100	100	65 @ 5W	19.05 x 19.05	-40 to +85	SZM 10072
2.500 - 2.700	20	0.4	20	100	100	65 @ 5W	19.05 x 25.4	-10 to +85	SZF 9993
2.620 - 2.690	21	0.25	21	50	50	70 @40W	19.05 x 25.4	-10 to +95	SZA 9636
3.300 - 3.600	20	0.4	20	10	60	65 @ 5W	19.05 x 25.4	-30 to +85	SZF 9992
3.400 - 3.800	20	0.25	20	20	20	70 @ 20W	19.05 x 19.05	-40 to +85	SZM 10131

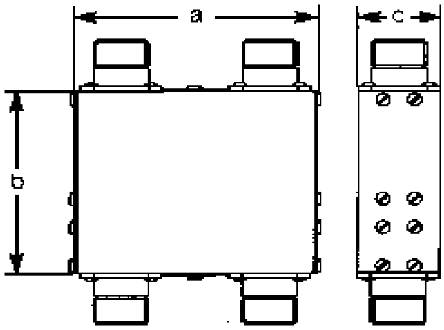
5GHz to 12GHz

Frequency (GHz)	Isolation (Min)	Insertion Loss (Max)	Return Loss (min)	Power Watts		IMD 2 tones	Foot Print (mm x mm)	Operating Temp (ºC)	MESL Part No
				Reverse	Forward				
5.600 - 7.100	20	0.4	20	15	30	n/a	12.7 x 14.5	-30 to +85	CZF 9974
5.700 - 8.500	20	0.4	20	5	10	n/a	12.7 x 14	-30 to +85	CZF 9906
7.100 - 8.500	20	0.6	20	3	10	n/a	12.7 x 12.7	-30 to +85	CZF 9883
8.500 - 11.500	19	0.4	19	7	7	n/a	16 x 3	0 to +70	XZF 9864
9.110 - 9.310	20	0.3	20	0.5	15	n/a	6.35 x 12.7	-40 to +75	XZF 9989
9.200 - 10.100	20	0.4	20	0.5	20	n/a	6.35 x 12.7	-40 to +85	XZF 9812
9.200 - 10.300	20	0.08	20	5	15	n/a	12.7 x 16	-30 to +90	XZM 9832

- All the above power levels are relative to the heat sink not exceeding the operating temperature.
- All units are RoHs compliant by Design.
- All part numbers can be supplied in clock wise and counter clockwise directions.

Iso-hybrid

Covering all the standard cellular radio frequency bands, these components offer either single or double junction isolators integrated with a 3dB hybrid coupler.
Custom designs are available on request.



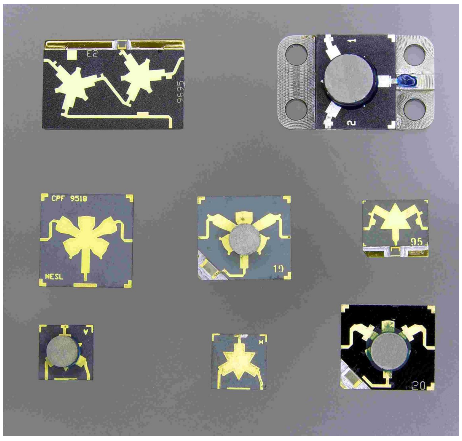
Single Junction Iso-Hybrids

Frequency (GHz)	Type Number	Specification				Operating Temperature (°C)	Dimensions (mm)			Power	
		Isolation O/P - I/p (dB) min	Isolation I/P - I/p (dB) min	Insertion Loss (dB) max	Return Loss (dB) min		a	b	c	Fowr. (W)	Rev. (W)
925 - 960	PFY4031	23	48	3.4	21	-10 to +70	77.12	67.38	26	60	60
1805 - 1880	NFY4031	23	48	3.4	21	-10 to +70	77.12	67.38	26	60	60
1930 - 1990	NFY4032	23	48	3.4	21	-10 to +70	77.12	67.38	26	60	60

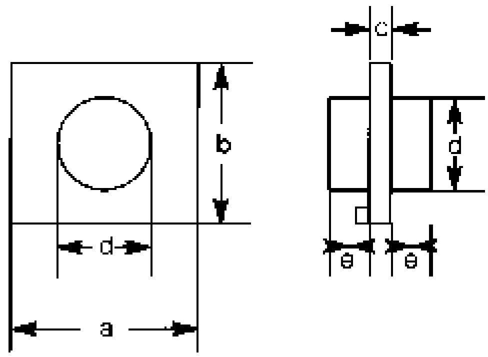
Double Junction Iso-Hybrids

Frequency (GHz)	Type Number	Specification				Operating Temperature (°C)	Dimensions (mm)			Power	
		Isolation O/P - I/p (dB) min	Isolation I/P - I/p (dB) min	Insertion Loss (dB) max	Return Loss (dB) min		a	b	c	Fowr. (W)	Rev. (W)
925 - 960	PFY4032	45	72	3.6	23	-10 to +70	76.8	101.1	26	60	60
1805 - 1880	NFY4033	45	72	3.6	23	-10 to +70	76.8	101.1	26	60	60
1930 - 1990	NFY4034	45	72	3.6	23	-10 to +70	76.8	101.1	26	60	60

Substrate Drop-Ins



These compact isolators are realised on ferrite substrates. The microwave circuit is printed on the ferrite substrate using thick film silver and magnets mounted on both sides to provide the magnetic field.
Custom designs and multi-port versions are available on request.



Frequency (GHz)	Type Number	Specification			Operating Temperature (°C)	Dimensions (mm)					Power
		Isolation (dB) min	Insertion Loss (dB) max	Return Loss (dB) min		a	b	c	d	e	Reverse (W)
1.7 - 2.1	NPF3041	19	0.5	18	0 to +50	25.30	25.30	2.00	17.50	5.0	0.5
1.9 - 2.3	NPF3042	19	0.45	18	0 to +50	25.30	25.30	2.00	17.50	5.0	0.5
2.3 - 2.7	SPF3061	20	0.4	20	0 to +50	25.40	25.40	2.00	18.00	5.0	0.5
3.1 - 3.6	SPF3062	20	0.4	20	-10 to +50	19.00	19.00	1.00	10.00	5.0	0.5
3.6 - 4.2	UPF3061	20	0.4	21	-10 to +70	18.98	18.98	1.02	9.50	3.0	0.5
4.4 - 5.0	UPF3062	20	0.4	20	-20 to +70	15.00	17.50	1.90	11.00	4.1	0.5
4.7 - 5.2	UPF3041	20	0.4	21	-10 to +70	12.62	12.62	1.02	6.50	3.5	0.5
5.4 - 5.8	UPF3042	20	0.4	21	-10 to +70	12.62	12.62	1.02	6.50	4.5	0.5
5.9 - 6.5	CPF3041	20	0.4	21	-10 to +70	12.62	12.62	1.02	6.50	4.5	0.5
6.4 - 7.1	CPF3042	20	0.4	21	-10 to +70	12.62	12.62	1.02	6.50	4.5	0.5
7.1 - 7.7	CPF3043	20	0.4	21	-10 to +70	12.62	12.62	1.02	6.50	4.5	0.5
7.7 - 8.3	CPF3044	20	0.4	21	-10 to +70	12.62	12.62	1.02	6.50	4.5	0.5
7.7 - 8.5	CPF3045	20	0.4	21	-10 to +70	10.40	16.00	0.51	6.00	3.5	0.5
8.0 - 10.4	XPF3061	20	0.4	19	10 to +70	8.17	12.62	0.51	5.20	3.0	0.5
8.5 - 9.6	XPF3041	20	0.4	21	-10 to +70	8.17	12.62	0.51	5.20	3.0	0.5
9.0 - 11.5	XPF3062	20	0.4	19	-10 to +70	8.17	12.62	>0.51	4.30	3.0	0.5
9.4 - 10.3	XPF3042	20	0.4	19	-30 to +70	8.89	10.16	0.64	5.00	6.0	0.5
10.6 - 11.7	XPF3043	20	0.4	18	0 to +50	8.90	10.20	0.80	6.40	5.1	0.5
10.5 - 13.0	XPF3063	20	0.4	19	-10 to +70	8.17	12.62	0.51	3.70	3.5	0.5
12.75 - 13.25	JPF3041	20	0.5	19	-20 to +55	6.32	11.00	0.51	3.00	3.5	0.5
13.0 - 14.5	JPF3042	20	0.5	19	-10 to +70	6.32	11.00	0.51	3.00	3.5	0.5
14.4 - 15.25	JPF3043	20	0.5	19	-10 to +70	6.32	11.00	0.51	3.00	4.0	0.5
14.5 - 15.4	JPF3044	20	0.5	18	0 to +50	6.32	7.71	0.51	2.50	1.9	0.5
NB - there is an option of a 2W termination on the above devices											

Ferrite Components Request

http://www.meslmicrowave.com/FerriteComponentsRequest.aspx

Rotary Switches

MESL's range of waveguide rotary switches provide a low loss, high performance means of switching power between waveguide runs, components or loads in satellite, telecommunication, radar or electronic warfare (EW) applications.

We provide two different ranges of Rotary Switches, covering waveguide sizes WG6 (R14,WR650) through to WG25 (R620,WR15).

Key Features

- Manual or motorised operation
- Solenoid or brushless motor based standard designs
- Lightweight torque motors for airborne application
- High Reliability: >300,000 operations
- Shock up to 100g, ½ sine pulse, 6ms duration
- Excellent Microwave Performance
  - Low loss, high isolation
- Magnetic coupling of motor to rotor
- Switching time quoted over -40 to +85°C
- Interchangeable drive assembly

Waveguide Rotary Switches

Standard Designs

Waveguide Size		Freq'y Range (GHz)	Isolation min (dB)	Insertion Loss max (dB)	VSWR Max	Power Rating		Voltage Operated Electrical		
						Peak	Average	Nominal Current @25°C	Switching time ms	
UK	153 IEC RETMA								typ	max
WG8	R22 WR430	1.7-2.6	100	0.01	1.04:1	6MW	8kW	3A	260	400
WG10	R32 WR284	2.6-3.95	100	0.01	1.04:1	3MW	4kW	3A	260	400

WG11a	R40 WR229	3.3-4.9	100	0.01	1.04:1	2MW	4kW	3A	160	200
WG12	R48 WR187	3.95-5.85	100	0.01	1.04:1	1MW	4kW	3A	150	200
WG14	R70 WR137	5.85-8.2	100	0.01	1.04:1	500kW	4kW	2A	100	150
WG15	R84 WR112	7.05-10.0	100	0.01	1.04:1	350kW	4kW	2A	100	150
WG16	R100 WR90	8.2-12.4	100	0.01	1.05:1	300kW	3kW	2A	53	100
WG17	R120 WR75	10.0-15.0	100	0.01	1.05:1	300kW	3.5kW	2A	60	100
WG18	R140 WR62	12.4-18.0	100	0.01	1.05:1	125kW	3kW	2A	50	100
WG20	R220 WR42	18.0-26.5	85	0.02	1.05:1	50kW	0.8kW	2A	45	75
WG22	R320 WR28	26.5-40.0	85	0.03	1.06:1	25kW	0.4kW	2A	45	75
WG23	R400 WR22	33.0-50.0	60	0.05	1.1:1	15kW	0.2kW	2A	45	75
WG26	R740 WR12	60.0-90.0	85	0.02	1.1:1	15kW	0.2kW	2A	45	75

Light Weight Designs

Waveguide Size		Freq'y Range (GHz)	Isolation min (dB)	Insertion Loss max (dB)	VSWR Max	Power Rating		Voltage Operated Electrical (DC Voltage = 28V±10%)		
						Peak	Average	Nominal Current @25°C	Switching time ms	
UK	153 IEC RETMA								typ	max
WG14	R70 WR137	5.85-8.2	90	0.02	1.04:1	500kW	4kW	4A	60	100
WG15	R84 WR112	7.05-10.0	85	0.02	1.04:1	350kW	4kW	2A	100	150
WG16	R100 WR90	8.2-12.4	80	0.03	1.05:1	300kW	3kW	1A 2A	95 65	130 90
WG17	R120 WR75	10.0-15.0	85	0.03	1.05:1	300kW	3kW	1A 2A	95 65	130 90
WG18	R140 WR62	12.4-18.0	85	0.03	1.06:1	125kW	2kW	1A 2A	55 35	100 60
WG25	R620 WR15	50.0-75.0	80	0.15	1.1:1	10kW	0.1kW	2A	40	50

Type Numbering

A switch is specified either by a MESL alpha-numeric part number or by a numeric one which is cross-referred to a customer specification. A MESL part number has the following format:

16	-	42	E	DS	/	P	/	O	/	C	/	D
16	**WAVEGUIDE SIZE** The British Standard numbering of waveguide sizes is used. A conversion table to other											

	designations and frequency is provided.
42	**SWITCH CONFIGURATION** The switch configuration is dictated by the number of ports incorporated in the switch stator and the number of channels through the switch rotor. The most common switch is the 4 port - 2 channel type (42). This is also known as a 'transfer' or DPDT switch. A 4 port - 2 channel can be configured as a 3 port - 2 channel (32) or SPDT switch by terminating one of the ports.
E	**FLANGES** The switches can accommodate any appropriate series of flange. The two standard series of flanges supplied by MESL are:- 'N' Series -- British mating flange with UNC threads. 'E' Series -- European 154-IEC mating flanges with metric threads.
DS	**ACTUATOR MECHANISM** (1) A manual switch has no designation. (2) An electrically driven switch has one of the following designations. (a) LATCHING SWITCHES. These use either, two solenoids, or a brushless motor and the letters 'DS' and 'BM' are used, respectively. (b) FAIL SAFE SWITCHES. These use a single solenoid and the designating letters are 'FS'. The 'FS' holding current is typically 300mA. (c) LARGE ROTOR SWITCHES. These are switches for waveguide sizes 11A and larger. They employ two solenoids in conjunction with a 'Geneva Mechanism'. They are denoted by the letter 'B' and have the same drive circuit as a 'DS' switch.
P	**POSITION INDICATION** 'P' A simple tell-back facility, using a maximum of three micro-switches can be provided to indicate the position of the switch. This option is incorporated in a Fail Safe Switch and is not specified separately.
O	**MANUAL OVERRIDE** 'O' All electrically operated, latching, switches can be fitted with a means of setting the switch by hand to one of its positions .This option is never fitted to the Fail Safe Switches.
C	**CIRCUIT INTERRUPT** 'C' Electrically operated switches require a voltage pulse to change their state. This should be long enough to drive the switch firmly to the next home position and then be removed. If only a constant power source can be provided, or as a safety precaution, the fitting of this internal option ensures that the drive voltage will be removed when the home position has been reached. This option is incorporated in a Fail Safe Switch and is not specified separately.
D	**DIODE PROTECTION** 'D' This option provides for the fitting of diodes across the drive motor supply lines to suppress the back e.m.f. generated. It is fitted automatically if the Circuit Interrupt option is selected and in those circumstances it does not need to be specified.
-	**PRESSURISATION** This is considered a special option and there is no designation letter. A low pressure of between 2 and 5 p.s.i. can easily be provided. It may be possible to give special consideration for a higher pressure to permit the switch to be operated at a higher peak power level than those specified for the waveguide size.
-	**KEYLOCK** This is considered a special option and there is no designation letter. For security or safety purposes this option will allow the switch to be manually locked in any position. The status of the lock can be monitored by circuitry in this option.

Waveguide Frequency Range and Designation

Frequency Range (GHz)	Waveguide Designations		
	UK Standard	European 153-IEC	USA RETMA
1.14 - 1.73	WG 6	R14	WR 650
1.45 - 2.20	WG 7	R 18	WR 510
1.72 - 2.61	WG 8	R 22	WR 430
2.60 - 3.95	WG 10	R 32	WR 284
3.22 - 4.90	WG 11A	R 40	WR 229
3.94 - 5.99	WG 12	R 48	WR 187
4.64 - 7.05	WG 13	R 58	WR 159
5.38 - 8.17	WG 14	R 70	WR 137
6.57 - 9.99	WG 15	R 84	WR 112
8.20 - 12.5	WG 16	R 100	WR 90
9.84 - 15.0	WG 17	R 120	WR 75
11.9 - 18.0	WG 18	R 140	WR 62
14.5 - 22.0	WG 19	R 180	WR 51
17.6 - 26.7	WG 20	R 220	WR 42
21.7 - 33.0	WG 21	R 260	WR 34
26.4 - 40.0	WG 22	R 320	WR 28
32.9 - 50.1	WG 23	R 400	WR 22
39.2 - 59.6	WG 24	R 500	WR 19
49.8 - 75.8	WG 25	R 620	WR 15

Phase Shifters and Switches

Phase Shifters

MESL Microwave is Europe's leading supplier of Ferrite Phase Shifters and can integrate our designs for use within a variety of Phased Array Antenna configurations. Key markets are defence radars and satellite communication.

Our product range includes designs covering the frequency range of S-Band to Ka-Band. Key features include Integrated Electronic Drivers, Built-In Test Equipment (BITE), Differential and Insertion Phase Control and Transmit/Receive Operation.

Types of phase shifter offered includes toroidal, dual-mode and switched line.

Key Features

- phase accuracy
- power handling
- switching time (tens of microseconds)
- temperature stability
- reliability

Switches

MESL Microwave's range of toroidal and latching ferrite switches includes many of the key features that are found within our ferrite phase shifters. Designs are currently available with 2, 3 or 4 port configurations and can offer switching speeds of between 0.5 to 50 microseconds.

Functionality which can be added to our switches includes power splitting, polarisation and cascading of individual elements to create switch matrices.

Key Features

- S-band to Ka-band frequency ranges
- 2, 3 or 4 port designs
- High peak (MW) and average power (kW) designs
- Fluid, conduction or forced air cooling
- Fast switching times

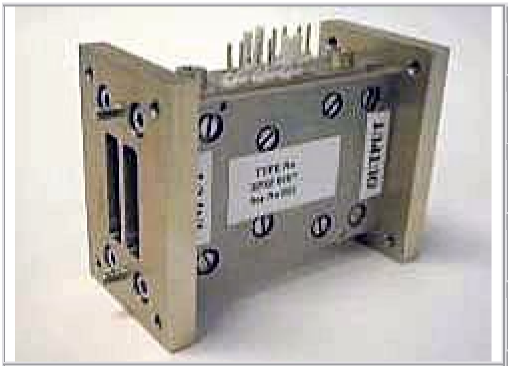
Markets

- Radar
- Satellite Communication
- Medical
- Security

Toroidal Ferrite Phase Shifters

X-band dual channel ferrite phase shifter

Data Sheet: F0002



Applications

- 3-D Air, Ground and Naval Radars
- Beam Forming Networks
- Phase element for a Power Divider or SPDT switch

Features

- Frequency ranges available include S-Band to Ku-Band
- High Peak and Average Power Designs
- Optional Integrated Electronic Driver
- Temperature Compensation
- BITE
- Accurate Differential and Insertion Phase Control
- Transmit/Receive Operation

Electrical Specification	
Frequency Range	10.0 to 14.0 GHz
Bandwidth	15%
Peak Power	2 kW (approx)
Average Power	100 W
Insertion Loss	0.25dB max
Insertion Loss Modulation	0.02dB max
Return Loss	25 dB
Phase range	120°
Insertion Phase Shift repeatability between channels	2° max
Phase Dispertion over a 15% bw	1.5° max
Differential Phase Tracking between channels	±4° max
Differential Phase shift variation across operating Temperature range	30° max
Insertion Phase Variation	0.3°/°C max
Power Consumption	+24V 600mA av current
Temperature Range	
- Operating	-15°C to +90°C
- Storage	-40°C to +100°C
Connectors	Waveguide WR75 WG height 4.76mm
Interface	N/A. Within the context of the final system the unit plugs directly into a PCB.
Weight	50g max

S-Band Ferrite Phaseshifter

Data Sheet: F0009

Applications

- 3-D Air, Ground and Naval Radars
- Satellite Beam Forming Networks

Features

- Frequency ranges available include S-Band to Ku-Band
- High peak and average power designs
- Integrated electronic driver
- Temperature compensation
- BITE
- Accurate differential and insertion phase control
- Transmit/receive operation

Electrical Specification	
Frequency Range	2.5-3.5 GHz
Bandwidth	15%
Peak Power	10 kW
Average Power	320 W
Insertion Loss	1.3 +/- 0.2 dB @ 20°C
Return Loss	20 dB
PRF	1 kHz
Phase Accuracy (inclusive of insertion phase)	+/- 6deg peak
Phase Bits	6
Switching Time	20 µSec
Power Consumption	+28V 120mA av 140mA pk +12V 50mA -12V 25mA +5V 200mA
Temperature Range	-40 °C to +55 °C

C-Band Ferrite Phaseshifter

Data Sheet: F0003

Applications

- 3-D Air, Ground and Naval Radars
- Satellite Beam Forming Networks

Electrical Specification	
Frequency Range	5.0 to 6.5 GHz
Bandwidth	10%
Peak Power	4 kW
Average Power	75 W
Insertion Loss	0.9dB @ 20°C av.
Insertion Loss Modulation	0.25B @ 25°C av.

Features

- Frequency ranges available include S-Band to Ku-Band
- High peak and average power designs
- Integrated electronic driver
- Temperature compensation
- BITE
- Accurate differential and insertion phase control
- Transmit/receive operation

Return Loss	20 dB
PRF	10 kHz
Phase Accuracy (inclusive of insertion phase)	3° rms
Phase Bits	8
Frequency Bits	2
Switching Time	10 µSec
Power Consumption	+24V 600mA av current
Temperature Range	-40 °C to +100 °C
Connectors	10mm high Waveguide WR159
Interface	Tx/Rx mode. Serial & Parallel Interface
Weight	1.2kg nominal

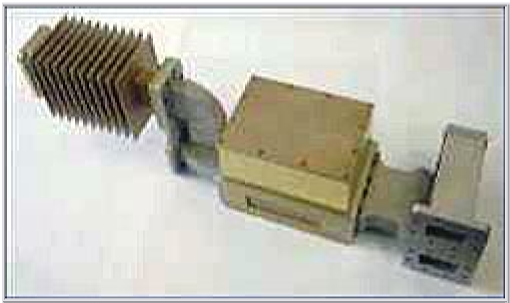
Latching Ferrite Switches

MESL Microwave Ltd has added a high power S-Band SP2T switch to its range of ferrite waveguide switches. Using electromagnets driven by an amplifier to switch the ferrite, this unit is capable of handling 7 MW of peak power with losses <0.3dB, whilst switching a rate of 240 actuations per second. This extends the range of switches that MESL offers from Ka-Band down to S-Band.

Toroidal Ferrite Switches

C-Band Ferrite Switch

Data Sheet: F0007



Applications

- 3-D Air, Ground and Naval Radars
- Satellite Beam Forming Networks

Features

- 2 or 4 port designs
- Frequency ranges available include S-Band to Ku-Band
- High peak and average power designs
- Fluid or forced air cooling
- Custom designs based on existing products

Electrical Specification	
Frequency Range	5.0 to 6.5 GHz
Bandwidth	10%
Peak Power	50 kW
Average Power	1.5 kW
Switching Time	<2 µSec
Switching Cycle (PRF)	6 kHz
VSWR (all ports)	1.2:1 max.
Insertion Loss	<0.6dB max.
Isolation (o/p to i/p)	>20 dB
VSWR	1.2:1 max.
Supply Voltages	+/- 15 V 200mA max. +5 V 500 mA max.
Temperature Range	-40 °C to +50 °C
Connectors	WR 187 (i/p & o/p) Power supply and logic signal connector - 3899/24 WB 35 PN
Weight	9 kg nominal

Dual-mode Ferrite Phase Shifters

MESL Microwave has the engineering expertise and capability to design and manufacture dual-mode ferrite phase shifters.

Please contact us to discuss any opportunities you have.

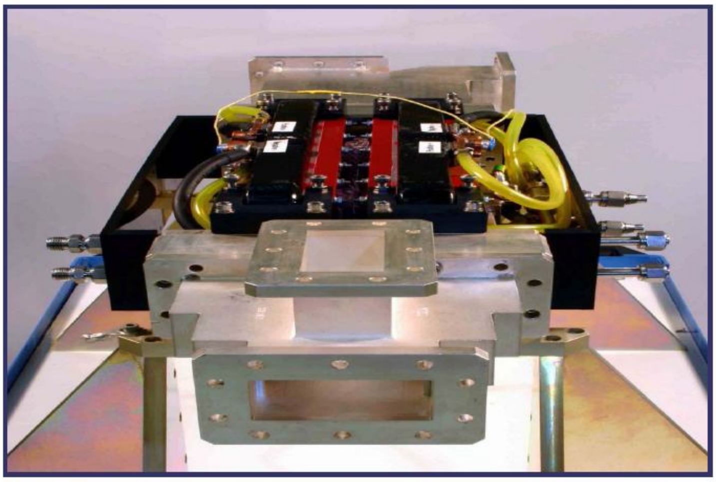
Switched line Ferrite Phase Shifter

MESL Microwave has the engineering expertise and production capability to successfully design and manufacture swtiched line ferrite phase shifters.

Please contact us to discuss your opportunity in more detail.

S-BAND HIGH POWER FERRITE SWITCH

- Microwave Components for Medical & Security X-ray Systems
- Larger Bandwidths available for defence applications
- Electro magnet driven SP2T switch capable of switching up to 7.5 MW of Peak Power in 4 ms



SPECIFICATION	
Operating Frequency	2856 ± 2 MHz or 2998 ± 2MHz
Peak Pulse Power	7.5 MW
Switching Speed	4ms Min
Average Power	10 kW
Isolation	20dB
Insertion Loss	0.3dB
Maximum Input VSWR	1.2:1
Waveguide Size	WR284
Waveguide Gas	SF6
Waveguide Operating Pressure	25 – 45 psig
Operating Temp	0℃ to 35℃
Voltage Supply	300 V Typ.
Current consumption	60A Typ.

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