RF & MICROWAVE ATTENUATOR SERIES

RF & Microwave Fixed Attenuators

Selection Guide | DC to 110 GHz

Precision fixed attenuation platforms for microwave, mmWave, high-power and cryogenic RF signal paths.

DC TO 110 GHz | SELECTED MODELS TO 1000 $^{50\ \Omega}$

NDARD & CRYOGENIC



RF Attenuator Selection Criteria

Five parameters define the operating requirement for fixed attenuator selection.

CORE SELECTION PARAMETERS

01	02	03	04	05
Frequency	**Attenuation**	**RF Power**	**Interface & Configuration**	**Operating Conditions**
Full operating band	Nominal value & accuracy	CW / average; peak / pulse if applicable	Connector type, port configuration, mounting	Temperature, cooling, cryogenic, mounting

SELECTION REQUIREMENT MATRIX

Selection Parameter	Engineering Requirement	Selection Impact
Frequency	Full operating frequency range	Defines the required RF bandwidth and interface capability.
Attenuation	Nominal attenuation and required accuracy	Defines the intended signal reduction and allowable deviation.
RF Power	Maximum CW / average power; peak / pulse where applicable	Defines thermal and overload margin.
Interface & Configuration	Connector type, port configuration and mounting	Ensures mechanical and system compatibility.
Operating Conditions	Temperature, cooling, cryogenic use and mounting constraints	Defines applicable construction and rating conditions.

RF Attenuator Portfolio

Portfolio coverage by interface, frequency, power and operating class.

DC-110 GHz	Up to 1000 W*	1.0 mm to N-Type	Standard & Cryogenic
Maximum Frequency	Selected High-Power Models	Interface Coverage	Operating Platforms

CORE PLATFORM SELECTION

Interface / Platform	Frequency Range	Power Capability	Product Class
1.0 mm	DC-110 GHz	2 W	Precision mmWave
1.85 mm	DC-67 GHz	Up to 10 W @ 67 GHz	Precision mmWave / power
2.4 mm	DC-50 GHz	Up to 35 W @ 50 GHz	Precision / power
2.92 mm	DC-40 GHz	Up to 50 W @ 40 GHz	Precision / power
3.5 mm	DC-26.5 GHz	Up to 150 W @ 26.5 GHz	Precision / power
SMA	Up to DC-26.5 GHz	Up to 100 W @ 26.5 GHz; selected models to 200 W at lower bands	Precision / general / power
N-Type	Up to DC-18 GHz	Up to 500 W @ 18 GHz; 1000 W @ 6 GHz	General / high power
Cryogenic RF	DC-40 GHz (2.92 mm); DC-18 GHz (SMA / SMP / SSMP)	Model-dependent	Low-temperature RF

ADDITIONAL INTERFACE OPTIONS

SSMA | TNC | SMP | QMA | SMB | NEX10 | BNC | 4.3-10 | F-Type

CONTINUE BY REQUIREMENT

Precision / mmWave | P4 SMA Platform | P5 High-Power | P6 Cryogenic | P8

Power ratings are model-, frequency-, attenuation- and thermal-condition dependent.

Precision Microwave & mmWave Attenuators

Precision fixed attenuation from DC to 110 GHz across 1.0 mm, 1.85 mm, 2.4 mm, 2.92 mm, 3.5 mm and SMA interfaces.

At microwave and mmWave frequencies, attenuation accuracy, impedance match and connector geometry become increasingly important toward the upper operating band.

PRECISION INTERFACE PLATFORM LINEUP



1.0 mm
DC-110 GHz



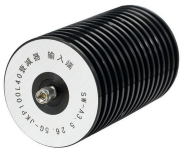
1.85 mm
DC-67 GHz



2.4 mm
DC-50 GHz



2.92 mm
DC-40 GHz



3.5 mm
DC-26.5 GHz



SMA
Up to DC-26.5 GHz

CORE PRECISION PLATFORM SELECTION

Interface	Frequency Range	Power Rating	Attenuation Options	Max. VSWR	Representative Model
1.0 mm	DC-110 GHz	2 W	3, 6, 10, 20 dB	≤ 1.60	VST-U-10XX0201-110G
1.85 mm	DC-67 GHz	2 W	1-9, 10, 20 dB	≤ 1.45	VST-U-185XX0201-67G
2.4 mm	DC-50 GHz	10 W	30 dB	≤ 1.55	VST-U-24301001-50G
2.92 mm	DC-40 GHz	2 W	1-10, 20, 30 dB	≤ 1.40	VST-U-292XX0201-40G
3.5 mm	DC-26.5 GHz	2 W	3, 6, 10, 20 dB	≤ 1.45	VST-U-35XX0201-26.5G
SMA	DC-26.5 GHz	2 W	0-10, 20-30 dB	≤ 1.30	VST-U-SMAXX0201-26.5G

Engineering note: Mechanical connector compatibility alone does not guarantee specified attenuation or VSWR at the upper frequency limit.

SMA Attenuator Portfolio

Frequency, power and configuration options across the SMA attenuator platform.

Up to DC-26.5 GHz

Frequency Coverage

Selected Models to 200 W

Power Capability

Multiple Configurations

Connector & Body Options

REPRESENTATIVE SMA PLATFORM



CONFIGURATION OPTIONS

Standard inline · Compact / short body

Female-to-female · Hex body

Finned power designs

REPRESENTATIVE SMA SELECTION

Platform	Frequency Range	Power Rating	Attenuation Options	Configuration	Representative Model
Precision	DC-26.5 GHz	2 W	0-10, 20-30 dB	Standard inline	VST-U-SMAXX0201-26.5G
General-Purpose	DC-18 GHz	5 W	0-10, 20, 30, 40 dB	Finned / inline	VST-U-SMAXX0501-18G
Power	DC-18 GHz	20 W	3, 6, 10, 20, 30, 40 dB	Power body	VST-U-SMAXX2003-18G
Power	DC-18 GHz	50 W	30, 40 dB	Power body	VST-U-SMAXX5003-18G
DC-12.4 GHz Power	DC-12.4 GHz	10 W	3-6, 10, 20, 30 dB	Model-dependent	VST-U-SMAXX1001-12.4G

SELECTION NOTE

SMA connector compatibility alone does not define electrical performance. Select frequency and power first, then confirm attenuation value, connector configuration and mechanical form.

Frequency and power limits vary by model and operating band.

High-Power RF Attenuators

Power capability across selected microwave frequency bands and interface platforms.



High-Power RF Attenuator Platform

POWER CAPABILITY BY PLATFORM

50 W — 2.92 mm · DC-40 GHz

100 W — SMA · DC-26.5 GHz

500 W — N-Type · DC-18 GHz

1000 W — N-Type · DC-6 GHz

POWER RATING CONDITIONS

- Rated RF Power
- Frequency & Attenuation
- Cooling / Heatsinking
- Peak / Pulse Conditions
- Thermal Reference
- Duty Cycle

HIGH-POWER MODEL SELECTION

Interface	Frequency Range	Rated Power	Attenuation Options	Representative Model
2.92 mm	DC-40 GHz	50 W	10, 20, 30 dB	VST-U-292FXX5001-40G
SMA	DC-26.5 GHz	100 W	10, 20, 30, 40 dB	VST-U-SMAXX10001-26.5G
N-Type	DC-18 GHz	200 W	30 dB	VST-U-N3020003-18G
N-Type	DC-18 GHz	500 W	30, 40 dB	VST-U-NXX50003-18G
N-Type	DC-6 GHz	1000 W	60 dB	VST-U-N60100003-6G

Engineering note: Frequency and power ratings apply to specific models and must not be combined across product families.

Electrical Performance & Power Ratings

Electrical performance, impedance match and power-rating parameters for fixed attenuator selection.

ELECTRICAL PERFORMANCE

Nominal Attenuation

Specified signal reduction at the stated nominal attenuation value.

Attenuation Accuracy

Permitted deviation from nominal attenuation under specified frequency and test conditions.

Flatness vs. Frequency

Variation in attenuation across the operating band; particularly important in broadband measurement paths.

VSWR / Return Loss

Port-match performance and reflected-power behavior at the attenuator interfaces.

POWER & THERMAL RATINGS

Rated RF Power

Maximum RF power under the specified frequency and thermal conditions.

Peak / Pulse Power

Short-duration RF power capability under specified pulse conditions, where provided.

Temperature Derating

Reduction in allowable RF power as temperature increases, where specified.

MATCH TERMINOLOGY

VSWR and return loss express the same port-match behavior in different forms.

REFERENCE - IDEAL POWER RATIO

3 dB	6 dB	10 dB	20 dB	30 dB
50.1% to load	25.1% to load	10% to load	1% to load	0.1% to load

POWER DISSIPATION EXAMPLE

Ideal matched-system relation: Pout / Pin = 10^(-A/10). With 20 W input and 10 dB attenuation, approximately 2 W is delivered to the load and 18 W is dissipated in the attenuator. Actual allowable input power is limited by the applicable model's frequency and thermal rating.

Specification note: Typical values and maximum specification limits should not be interchanged.

Cryogenic RF Attenuators

Cryogenic attenuation platforms across 2.92 mm, SMA, SMP and SSMP interfaces, with selected models to 40 GHz.

Cryogenic attenuators provide controlled RF loss within low-temperature signal chains. Component selection should account for frequency, attenuation, interface, stage temperature and thermal anchoring.

CRYOGENIC INTERFACE PLATFORM



2.92 mm
DC-40 GHz



SMA
DC-18 GHz



SMP
DC-18 GHz



SSMP
DC-18 GHz

CRYOGENIC MODEL SELECTION

Interface	Frequency Range	Attenuation Options	Max. VSWR	Configuration	Representative Model
2.92 mm	DC-40 GHz	1-6, 10-15, 20, 30 dB	≤ 1.40	Inline	VST-QU-292XX0202-40G
SMA	DC-18 GHz	1-6, 10-15, 20, 30 dB	≤ 1.35	Inline	VST-QU-SMAXX0202-18G
SMA	DC-18 GHz	1-6, 10-15, 20, 30 dB	≤ 1.45	Panel / Bulkhead	VST-QU-SMAPFXX0202-18G
SMP	DC-18 GHz	1-6, 10-15, 20, 30 dB	≤ 1.45	Inline	VST-QU-SMPXX0202-18G
SSMP	DC-18 GHz	10, 12, 20, 30 dB	≤ 1.45	Inline	VST-QU-SSMPXX0202-18G

APPLICATION CONTEXT

Quantum Control · Dilution Refrigerators · Cryogenic Microwave Measurement

CRYOGENIC OPERATING CONDITIONS

Stage Temperature

Validated operating temperature must match the intended cryostat stage.

Thermal Anchoring

Mechanical installation should support the required thermal path.

Attenuation Distribution

dB allocation and stage placement are system-level design decisions.

RF Power / Heat Load

Available cooling power and component dissipation must be reviewed together.

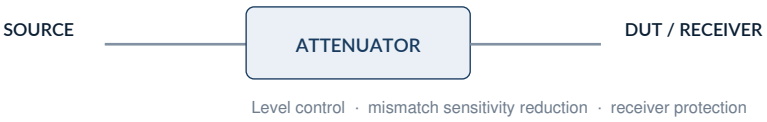
Minimum operating temperature and RF power are model-specific and should be confirmed for the intended cryostat stage.

Applications & Selection Examples

Application requirements determine which attenuator parameters carry the greatest selection weight.

APPLICATION REQUIREMENTS

Application	Primary Function	Selection Priorities
Receiver / Instrument Protection	Reduce level ahead of a sensitive input.	Frequency, attenuation, max. input power, VSWR
Signal Level Conditioning	Establish a controlled fixed level offset.	Attenuation accuracy, flatness, frequency, power
Mismatch Sensitivity Reduction	Reduce reflection interaction in suitable RF paths.	VSWR, attenuation, available dynamic range
Production Test & Characterization	Create repeatable level offsets in benches and fixtures.	Repeatability, connector durability, attenuation accuracy
High-Power RF Paths	Dissipate controlled RF power while maintaining impedance.	Rated power requency, cooling, attenuation
Cryogenic RF Chains	Distribute attenuation through low-temperature signal paths.	Frequency, attenuation, stage temperature, thermal anchoring



Level control · mismatch sensitivity reduction · receiver protection

REPRESENTATIVE SELECTION SCENARIOS

40 GHz Precision Test Path

REQUIREMENT

40 GHz · 20 dB · 50 Ω

STARTING PLATFORM

2.92 mm

SELECTION CHECK

Power rating, connector configuration, attenuation tolerance

20 W Input · 10 dB

POWER DISSIPATION

≈18 W under ideal matched conditions

SELECTION IMPLICATION

Select adequate CW margin at the required frequency

THERMAL CHECK

Mounting, temperature and cooling

Cryogenic 40 GHz Signal Chain

STARTING PLATFORM

2.92 mm cryogenic attenuator

SELECTION CHECK

Attenuation, interface, validated temperature range

SYSTEM CHECK

Stage location and thermal anchoring

RFQ Requirements & Engineering Review

Application data required for model selection and engineering review.

RFQ REQUIREMENTS

Parameter	Required Information	Example / Notes
Frequency Range	Full operating band	e.g. DC-40 GHz
Nominal Attenuation	Required attenuation value	e.g. 10 dB / 20 dB
RF Power	Rated RF power; peak / pulse where applicable	e.g. 20 W
Interface / Configuration	Connector family, mating configuration and mounting style	e.g. 2.92 mm male-to-female
Performance Requirements	Attenuation tolerance, VSWR or other RF limits where specified	e.g. VSWR ≤ 1.30
Operating Conditions	Temperature, cryogenic use, cooling / heatsinking	e.g. 25 °C ambient
Mechanical Requirements	Envelope, bulkhead / panel mounting, orientation	e.g. panel mount
Quantity & Project Stage	Prototype, qualification or production	e.g. 20 pcs prototype

APPLICATION-SPECIFIC DATA

Peak / Pulse Conditions

Peak power, pulse width and duty cycle

Special Mechanical Requirements

Panel / bulkhead, custom envelope or mounting

Material / Magnetic Requirements

Non-magnetic construction where required

Thermal Conditions

Cooling, heatsinking or thermal interface

ENGINEERING REVIEW

RF Attenuator Application Review

Submit the required operating parameters for model and configuration review. Vinstronics will evaluate the applicable interface, attenuation, power rating and mechanical configuration against the application requirements.

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