

RF MICROWAVE COMPONENTS

Coaxial Attenuators



RADIALL 
The next connexion

COMPANY Profile

Founded in 1952 in France, Radiall started as a family owned company making coaxial plugs. Today, Radiall is an international and global manufacturer of interconnect components including **RF coaxial connectors and cable assemblies, antennas, fiber optic components, microwave components, and multipin connectors** for the Automotive, Civil Aviation, Defense, Industrial, Medical, Space and Telecommunications.



QSE (Quality Safety Environment) POLICY

Radiall maintains a quality management system conforming to international standards, including for environmental protection. Our customers' recognition for the quality of our products and the sustainability of our company, demonstrates the efficiency of our quality system.



CERTIFICATIONS

Certified ISO 9001 since 1994, Radiall has a pro-active policy in terms of conforming to international standards. Today, all Radiall sites are certified to **ISO 9001:2000** and some

dedicated activities are AS9100 or TS 16949. Our process approach gives us the tool for continuous improvement in all our activities.



A major step in our environment policy was the **ISO 14001** certification in 2001 of the Voreppe plant. Radiall complies with European directives such as **RoHS** for hazardous substance restrictions and **EuP** for environmentally friendly designs for energy-using products.

Some Radiall product lines are on **MIL, ESA/SCC** Qualified Product Lists.

Radiall is consequently proud to be recognized by leading industrial customers for the quality of its service and products.



A WORLDWIDE ENGINEERING & MANUFACTURING CAPABILITY

With expertise centers and manufacturing locations in 3 continents. Radiall offers its customers, through 12 industrial sites, the proximity they need to obtain the best quality of service and delivery performance. Our facilities feature state of the art equipment for the many technologies involved in the design, manufacturing and assembly of interconnect products. Manufacturing plants based in **China, India, Tunisia** and **Mexico** give the opportunity to offer Radiall quality at competitive prices.

Technical information and sales contacts are available on: www.radiall.com

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I DEFINITION

A coaxial attenuator is a linear passive bidirectional transmission line component designed to be inserted between two coaxial lines in order to reduce the input power in a matched system by a predetermined ratio without otherwise disturbing the behaviour of the equipment. The ratio of input to output power is expressed in logarithmic terms where 3 dB as a power ratio is 2, 6 dB is 10, 20 dB is 100 and 30 dB is 1000 etc... The power absorbed by an attenuator is returned to the environment through heat transfer by convection or conduction cooling.

II GENERAL SPECIFICATIONS

In general, RADIALL attenuators are designed in accordance with MIL and NFC standards.

► TECHNOLOGY

RADIALL coaxial attenuators can be classified technically into 3 main types depending upon the resistive element used.

- High frequency and low power attenuators use Tantalum Nitride thin film deposits on Alumina substrates.
- High frequency and medium power attenuators use Tantalum Nitride thin film deposits on Aluminium Nitride substrates.
- High power attenuators use Ruthenium Oxide thick film circuits printed on alumina substrates stuck to a shape of Aluminium Nitride as a cooling sink.

RADIALL has decided to remove Beryllium material from its whole range of medium and high power attenuators. Indeed, Beryllium Oxide dust is highly toxic when scribing or machining or laser trimming. RADIALL has replaced this material by Aluminium Nitride which has excellent heat conductive properties and is absolutely safe for the environment.

► MECHANICAL CHARACTERISTICS, MATERIALS AND FINISHES

All materials and finishes are in accordance with applicable MIL and NF specifications.

All connectors used in our attenuators are in accordance with applicable MIL, DIN, NF and CEI specifications.

All dimensions in this catalogue are given in inches and (millimeters). The non-specified dimensions are given within ± 0.5 mm.

► MANUFACTURING AND QUALITY ASSURANCE

Thin film and thick film circuits of RADIALL attenuators are produced in-house, in class 10000 clean rooms, using advanced processing technologies. Our microelectronic laboratory uses a tightly controlled and highly repeatable process, necessary to achieve consistent microwave performances.

RADIALL maintains a state-of-the-art computer aided designed system, a well equipped precision machine factory, a modern component assembly area and an extensive collection of RF test equipments.

Specific testing is available upon request.

III LIST OF APPLICABLE DOCUMENTS :

List of related standards covering the general mechanical and climatic tests applicable to the devices described in this catalog.

- AIR 7304
- CEI 169.13
- DIN 47295
- GAM EG 13
- NFC 207xx
- NFC 93561
- NFC 93562
- NFC 93563
- NFC 93564
- NFC 93566
- NFC 96315
- MIL C 39012
- MIL A 3933
- MIL E 5400
- MIL STD 202

IV ENVIRONMENTAL CHARACTERISTICS :

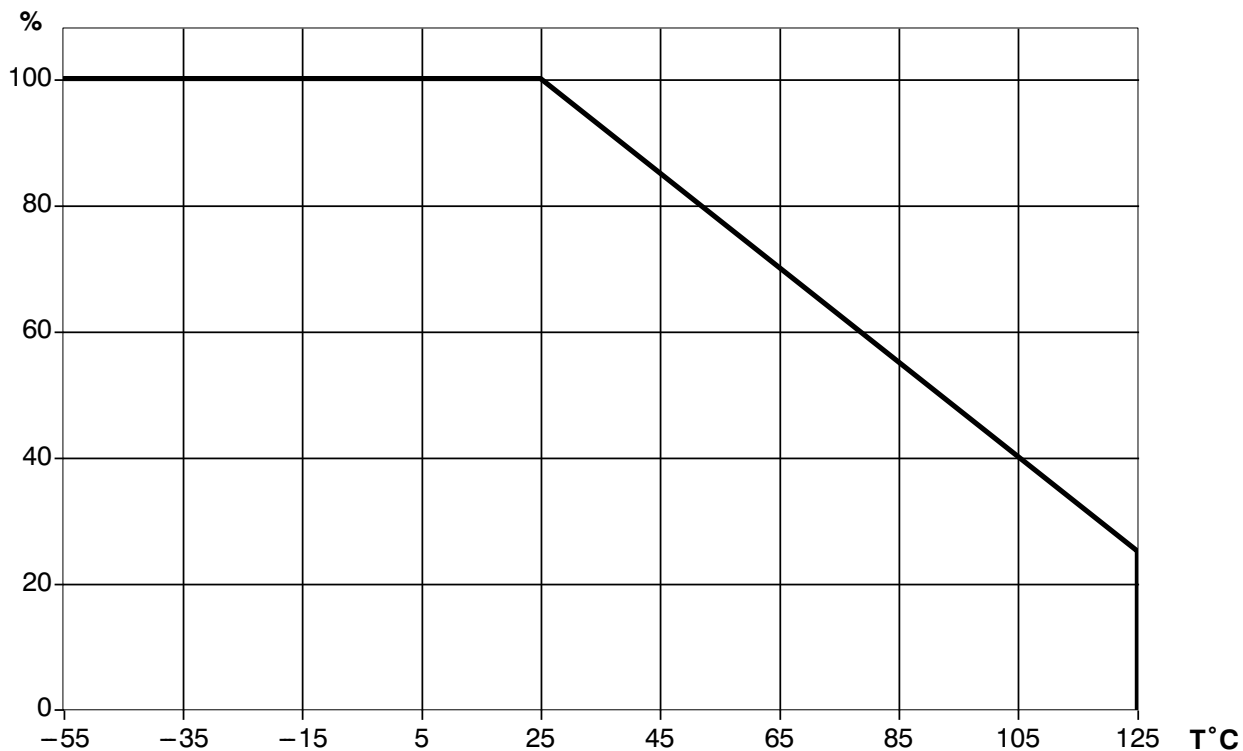
	Operating temperature range	Storage temperature range
All the models	- 55°C, + 125°C	- 55°C, + 125°C

V MATERIALS AND FINISHES :

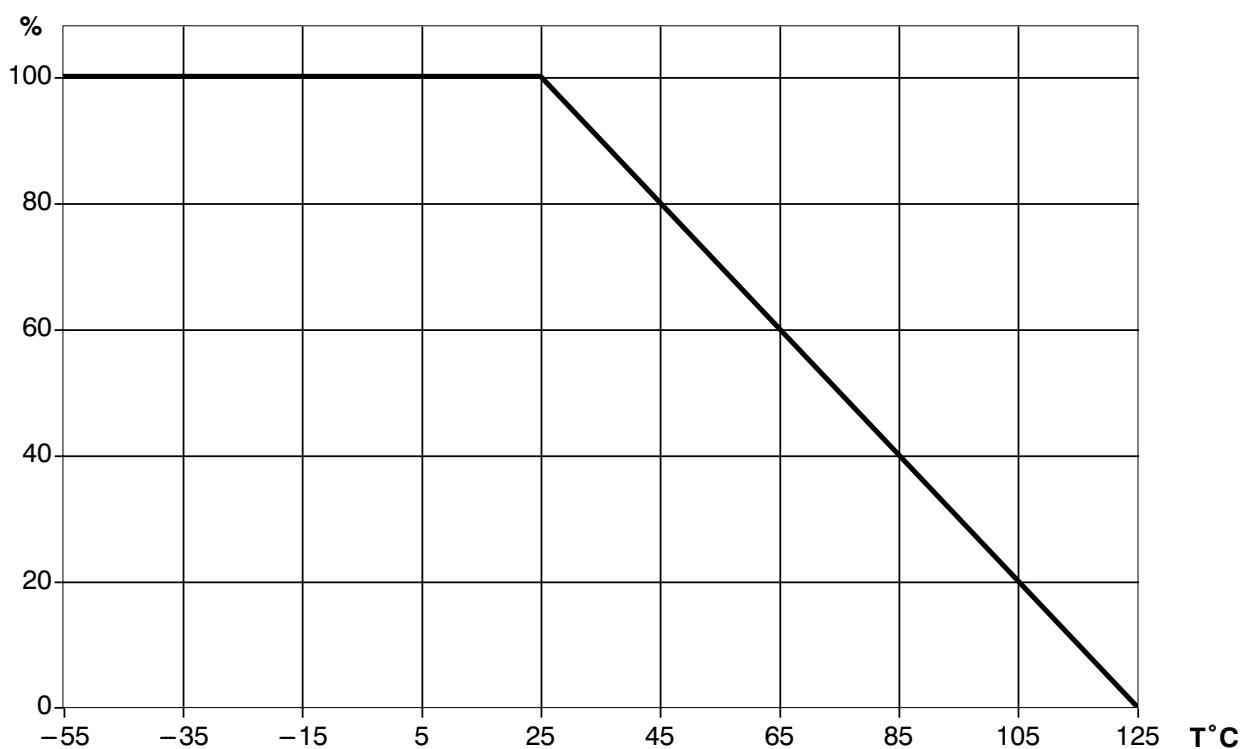
Body	Passivated Stainless Steel or Brass Nickel plated
Contact	Beryllium Copper Gold plated (CuBe2)
Heatsink	Aluminium black anodized
Insulator	P T F E or ULTEM 1000
Resistor circuits	Tantalum Nitride Thin film on ceramic substrates Ruthenium Oxide Thick film on ceramic substrates Tantalum Nitride Thin film on Aluminium Nitride substrates

VI TEMPERATURE POWER DERATING CURVE :

a) *FOR MODELS WITH AVERAGE POWER < 10 WATTS*



b) *FOR MODELS WITH AVERAGE POWER ≥ 10 WATTS*



VII DEFINITIONS OF ATTENUATOR RELATED PARAMETERS

► NOMINAL ATTENUATION OR ATTENUATION VALUE

The nominal value of attenuation is the standard value determined by the manufacturer. This parameter is a representation of the power ratio between the input and the output of the attenuator. It is expressed in dB :

$$\text{Attenuation in dB} = 10 \log \frac{P_{\text{out}} \text{ (W)}}{P_{\text{in}} \text{ (W)}}$$

► ATTENUATION DEVIATION

The attenuation over full specified bandwidth does not exceed the nominal value $\pm$ attenuation deviation. This parameter is expressed in dB. For example, an attenuator with 6 dB nominal value and ± 0.3 dB deviation do not exceed 5.7 dB minimum value and 6.3 dB maximum value.

► TEMPERATURE SENSITIVITY

The maximum change of attenuation in dB per dB per °C over the operating temperature range.

Example : If temperature sensitivity is $5 \cdot 10^{-4}$ dB/dB/°C, for a 20 dB attenuator over a 20°C 20°C $5 \cdot 10^{-4} = 0.2$ dB attenuation variation.

► CONNECTORS

Microwave connectors have a characteristic impedance from 50 ohms. Adaptation interfaces, materials and platings are in accordance with the applicable specifications quoted in this catalog.

► FREQUENCY RANGE

The frequency range indicated for each device is the range which RADIALL specifies the device performance.

► AVERAGE POWER HANDLING

It is the maximum Continuous Wave input power applied for a long time at room temperature, or at the maximum temperature of 75°C. that the attenuator can handle without permanently changing the specifications of the component. Any overpowering beyond this limit can significantly alter the input power handling of the attenuator.

► PEAK POWER HANDLING

It is the maximum peak power which, when applied at maximum room temperature under a pulse of one microsecond every millisecond, will not permanently change the specifications of the attenuator. Any overpowering beyond this limit will alter the input power handling of the attenuator.

► V.S.W.R.

The **V**oltage **S**tanding **W**ave **R**atio is a measure of the return loss or level of the reflected signal of a device connected on a transmission line.

V.S.W.R. is linked to the coefficient of reflection (ρ) by the equation :

$$\text{V.S.W.R.} = \frac{1 + |\rho|}{1 - |\rho|}$$

(ρ) represents the coefficient of reflection vector standard

$$\text{with } \rho = \frac{Z - Z_0}{Z + Z_0} \quad \begin{array}{l} (Z \text{ is the component impedance}) \\ (Z_0 \text{ is the characteristic impedance of the line}) \end{array}$$

Variation within 0 and 1, V.S.W.R. equal to 1 represents the perfect adaptation.
This value can be expressed in dB's and is known as return loss,
when expressed as $20\log_{10} |\rho|$

► CONDUCTION AND CONVECTION COOLING

Heat dissipation for medium and high power attenuators can be done by convection or conduction cooling.

- Convection cooling:

The attenuator is equipped with a heatsink with cooling fins. A heat sink with cooling fins increases the effective heat exchange toward the environment. The heat sink is characterized by its thermal resistance or by the increase of surface temperature per watt (in °C per W). The shorter this value is, the greater the power will be. Cooling shapes and sizes have an important effect on this parameter.

- Conduction cooling:

The component has to be mounted to a heat sink, plate or chassis of the equipment to ensure a good heat transfer. The dimensions of the plate or chassis are calculated according to the characteristics of the components.

1 WATT

QMA	p 12
SMA	p 13
SMA 2.9	p 18
BNC	p 28
TNC	p 31
QN	p 42
N	p 43
7/16	p 56

2 WATTS

SMA	p 14 to 17
SMB	p 27
SMC	p 27
BNC	p 29-30
TNC	p 32 to 34
N	p 44 to 46

10 WATTS to 15 WATTS

SMA	p 19
BNC	p 30
TNC	p 35
N	p 47

25 WATTS

SMA	p 20
TNC	p 36
N	p 48
7/16	p 56

30 WATTS

SMA	p 21
TNC	p 37
N	p 49

50 WATTS

SMA	p 22 to 24
TNC	p 38 to 40
N	p 50 to 52
7/16	p 57

80 - 100 WATTS

SMA	p 25-26
TNC	p 40-41
N	p 53-54
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SPACE QUALIFIED ATTENUATORS	p 58 to 61
CALIBRATED ATTENUATORS SET	p 55
MILITARY P.P.L	p 62

FIXED MINIATURE COAXIAL ATTENUATORS

Connector	Average Power (W)	Frequency range (GHz)	Attenuation values (dB)	Page
QMA	1	DC - 3	0 to 20	12
SMA	1	DC - 3	0 to 20	13
	2	DC - 4	0 to 60	14
		DC - 18	0 to 30	15
			0 to 60	16
		DC - 26.5	0 to 30	17
	10 to 15	DC - 8	3 - 6 - 10 - 12 - 15 - 20	19
		DC - 18	3 - 6 - 10 - 20	
	25 - 30	DC - 4	3 - 6 - 10 - 20 - 30	20 - 21
	50	DC - 3		22 to 24
	80 - 100	DC - 2		25 - 26
SMA 2.9	1	DC - 40	0 to 10 - 20	18
SMC	2	DC - 8	3 - 6 - 10 - 20	27
SMB	2	DC - 8	3 - 6 - 10 - 20	27

SPECIFIC MINIATURE COAXIAL ATTENUATORS

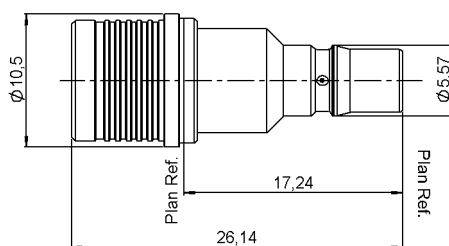
Connector	Observation	Avg. Power (W)	Frequency (GHz)	Attenuation values (dB)	Page
SMA	E.S.A. /S.C.C. Space qualified attenuators	2	DC - 22	10 to 20 dB by 1 dB step	59
		1		0 to 10 dB by 0.5 dB step	
		1	DC - 40	0 to 10 dB by 0.5 dB step	61

FIXED STANDARD COAXIAL ATTENUATORS

Connector	Average Power (W)	Frequency (GHz)	Attenuation values (dB)	Page
BNC	1	DC - 3	0 to 20	28
	2	DC - 2	0 to 50	29
	2	DC - 8	0 to 60	30
	10 - 15	DC - 4	3 - 6 - 10 - 20	
TNC	1	DC - 3	0 to 20	31
	2	DC - 2	0 to 50	32
		DC - 12.4	0 to 60	33
		DC - 18	0 to 20	34
	10 - 15	DC - 8	3 - 6 - 10 - 20	35
		DC - 18		
	25 - 30	DC - 4	3 - 6 - 10 - 20 - 30	36 - 37
	50	DC - 3		38 to 40
	80 - 100	DC - 2	3 - 6 - 10 - 20	40 - 41
QN	1	DC - 3	0 to 20	42
N	1	DC - 3	0 to 20	43
	2	DC - 2	0 to 50	44
		DC - 12.4	0 to 60	45
		DC - 18	0 to 20	46
	10 - 15	DC - 8	3 - 6 - 10 - 20	47
		DC - 18		
	25 - 30	DC - 4	3 - 6 - 10 - 20 - 30	48 - 49
	50	DC - 3		50 to 52
	80 - 100	DC - 2	3 - 6 - 10 - 20	53 - 54
7/16	1	DC - 4	3 - 6 - 10 - 20	56
	25	DC - 2		
	50	DC - 2		57
	100			

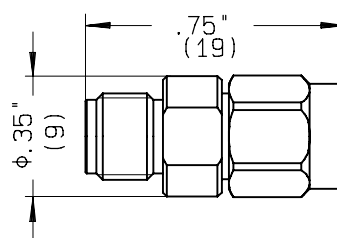
1 WATT, STANDARD TYPE

Part number	Frequency range (GHz)	ATTENUATION (dB)			V.S.W.R.		Power (W)
		Nom.	DEVIATION				
			DC - 2	2 - 3	DC - 2	2 - 3	peak
R411 700 124	DC - 3	0	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100
R411 701 124		1	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100
R411 702 124		2	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100
R411 703 124		3	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100
R411 704 124		4	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100
R411 705 124		5	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100
R411 706 124		6	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100
R411 707 124		7	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R411 708 124		8	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R411 709 124		9	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R411 710 124		10	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R411 711 124		11	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R411 712 124		12	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R411 713 124		13	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R411 714 124		14	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R411 715 124		15	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R411 716 124		16	± 0,7	± 0,7	≤ 1,20	≤ 1,30	100
R411 717 124		17	± 0,7	± 0,7	≤ 1,20	≤ 1,30	100
R411 718 124		18	± 0,7	± 0,7	≤ 1,20	≤ 1,30	100
R411 719 124		19	± 0,7	± 0,7	≤ 1,20	≤ 1,30	100
R411 720 124		20	± 0,7	± 0,7	≤ 1,20	≤ 1,30	100



1 WATT, STANDARD TYPE

Part number	Frequency range (GHz)	ATTENUATION (dB)			V.S.W.R.		Power (W)	Weight (g)
		Nom.	DEVIATION					
			DC - 2	2 - 3	DC - 2	2 - 3	peak	
R411 800 124	DC - 3	0	+ 0,3	+ 0,5	≤ 1,20	≤ 1,30	100	5
R411 801 124		1	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100	5
R411 802 124		2	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100	5
R411 803 124		3	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100	5
R411 804 124		4	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100	5
R411 805 124		5	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100	5
R411 806 124		6	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100	5
R411 807 124		7	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100	5
R411 808 124		8	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100	5
R411 809 124		9	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100	5
R411 810 124		10	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100	5
R411 811 124		11	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100	5
R411 812 124		12	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100	5
R411 813 124		13	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100	5
R411 814 124		14	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100	5
R411 815 124		15	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100	5
R411 816 124		16	± 0,7	± 0,7	≤ 1,20	≤ 1,30	100	5
R411 817 124		17	± 0,7	± 0,7	≤ 1,20	≤ 1,30	100	5
R411 818 124		18	± 0,7	± 1.0	≤ 1,20	≤ 1,30	100	5
R411 819 124		19	± 0,7	± 1.0	≤ 1,20	≤ 1,30	100	5
R411 820 124		20	± 0,7	± 1.0	≤ 1,20	≤ 1,30	100	5



2 WATTS FLAT FREQUENCY RESPONSE, HIGH PERFORMANCE TYPE

Part Number	Frequency range (GHz)	ATTENUATION (dB)		V.S.W.R.	Power (W) peak	Fig.
		Nominal	DEVIATION			
			DC - 4			
R413 800 115	DC - 4	0	+ 0.3	≤ 1.15	100	1
R413 801 115		1	± 0.3	≤ 1.15	100	1
R413 802 115		2	± 0.3	≤ 1.15	100	1
R413 803 115		3	± 0.3	≤ 1.15	100	1
R413 804 115		4	± 0.3	≤ 1.15	100	1
R413 805 115		5	± 0.3	≤ 1.15	100	1
R413 806 115		6	± 0.3	≤ 1.15	100	1
R413 807 115		7	± 0.4	≤ 1.15	100	1
R413 808 115		8	± 0.4	≤ 1.15	100	1
R413 809 115		9	± 0.5	≤ 1.15	100	1
R413 810 115		10	± 0.5	≤ 1.15	100	1
R413 811 115		11	± 0.5	≤ 1.15	100	1
R413 812 115		12	± 0.5	≤ 1.15	100	1
R413 813 115		13	± 0.5	≤ 1.15	100	1
R413 814 115		14	± 0.5	≤ 1.15	100	1
R413 815 115		15	± 0.6	≤ 1.15	100	1
R413 816 115		16	± 0.6	≤ 1.15	100	1
R413 817 115		17	± 0.6	≤ 1.15	100	1
R413 818 115		18	± 0.6	≤ 1.15	100	1
R413 819 115		19	± 0.6	≤ 1.15	100	1
R413 820 115		20	± 0.6	≤ 1.15	100	1
R413 830 115		30	± 1.0	≤ 1.15	100	2
R413 840 115		40	± 1.0	≤ 1.15	100	2
R413 850 115		50	± 2.0	≤ 1.15	100	2
R413 860 115		60	± 2.0	≤ 1.15	100	2

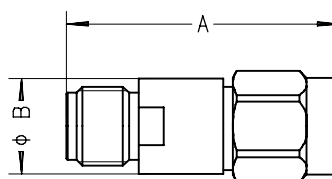


Figure	A inch (mm)	B inch (mm)	Weight (g)
1	.86" (21.8)	.28" (7.1)	5
2	1.14" (29)		10

2 WATTS, STANDARD TYPE

Part Number	Freq range (GHz)	ATTENUATION (dB)				V.S.W.R.				Power (W)	Fig.	
		Nom.	DEVIATION				DC - 4	4 - 8	8 - 12.4	12.4-18		peak
			DC - 4	4 - 8	8 - 12.4	12.4-18						
R411 800 121	DC - 18	0	+ 0.2		+ 0.3	+ 0.5	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R411 801 121		1	± 0.3		± 0.4	± 0.7	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R411 802 121		2	± 0.3		± 0.4	± 0.7	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R411 803 121		3	± 0.3		± 0.4	± 0.8	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R411 804 121		4	± 0.3		± 0.4	± 0.8	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R411 805 121		5	± 0.4	± 0.3	± 0.5	± 0.8	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R411 806 121		6	± 0.4	± 0.3	± 0.5	± 0.8	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R411 807 121		7	± 0.4	± 0.3	± 0.5	± 0.8	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R411 808 121		8	± 0.4	± 0.4	± 0.4	± 0.9	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R411 809 121		9	± 0.4	± 0.4	± 0.4	± 0.9	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R411 810 121		10	± 0.4	± 0.4	± 0.4	± 0.9	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R411 811 121		11	± 0.4	± 0.4	± 0.4	± 0.9	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R411 812 121		12	± 0.4	± 0.4	± 0.4	± 0.9	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R411 813 121		13	± 0.5	± 0.5	± 0.6	± 1.0	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R411 814 121		14	± 0.5	± 0.5	± 0.6	± 1.0	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R411 815 121		15	± 0.5	± 0.5	± 0.6	± 1.0	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R411 816 121		16	± 0.5	± 0.5	± 0.6	± 1.0	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R411 817 121		17	± 0.5	± 0.5	± 0.6	± 1.0	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R411 818 121		18	± 0.5	± 0.5	± 0.6	± 1.0	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R411 819 121		19	± 0.5	± 0.5	± 0.6	± 1.0	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R411 820 121		20	± 0.5	± 0.5	± 0.6	± 1.0	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R411 830 121		30	± 0.6	± 0.7	± 0.9	**	≤ 1.20	≤ 1.25	≤ 1.30	≤ 1.50	100	2

** : From 12.4 to 15 GHz : +0.9 / - 1.5 dB and From 15 to 18 GHz : +3 / - 2 dB

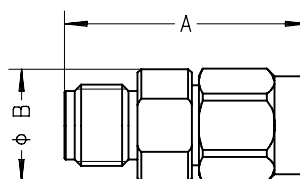


Figure	A inch (mm)	B inch (mm)	Weight (g)
1	.75" (19)	.35" (9)	5
2	.95" (24)		7

2 WATTS FLAT FREQUENCY RESPONSE, HIGH PERFORMANCE TYPE

Part Number	Frequency range (GHz)	ATTENUATION (dB)		V.S.W.R.					Power (W) peak	Fig.
		Nom.	DEVIATION							
			DC - 18	DC - 2	2 - 4	4 - 8	8 - 12.4	12.4 - 18		
R413 800 000	DC - 18	0	+ 0.3	≤ 1.10	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R413 801 000		1	± 0.3	≤ 1.10	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R413 802 000		2	± 0.3	≤ 1.10	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R413 803 000		3	± 0.3	≤ 1.10	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R413 804 000		4	± 0.3	≤ 1.10	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R413 805 000		5	± 0.3	≤ 1.10	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R413 806 000		6	± 0.3	≤ 1.10	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R413 807 000		7	± 0.4	≤ 1.10	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R413 808 000		8	± 0.4	≤ 1.10	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R413 809 000		9	± 0.5	≤ 1.10	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R413 810 000		10	± 0.5	≤ 1.10	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R413 811 000		11	± 0.5	≤ 1.10	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R413 812 000		12	± 0.5	≤ 1.10	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R413 813 000		13	± 0.5	≤ 1.10	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R413 814 000		14	± 0.5	≤ 1.10	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R413 815 000		15	± 0.6	≤ 1.10	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R413 816 000		16	± 0.6	≤ 1.10	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R413 817 000		17	± 0.6	≤ 1.10	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R413 818 000		18	± 0.6	≤ 1.10	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R413 819 000		19	± 0.6	≤ 1.10	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R413 820 000		20	± 0.6	≤ 1.10	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	1
R413 825 000		25	± 1.0	≤ 1.15	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	2
R413 830 000		30	± 1.0	≤ 1.15	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	2
R413 835 000		35	± 1.0	≤ 1.15	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	2
R413 840 000		40	± 1.0	≤ 1.15	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	2
R413 845 000		45	± 1.0	≤ 1.15	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	2
R413 850 000		50	± 2.0	≤ 1.15	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	2
R413 855 000		55	± 2.0	≤ 1.15	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	2
R413 860 000		60	± 2.0	≤ 1.15	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	2

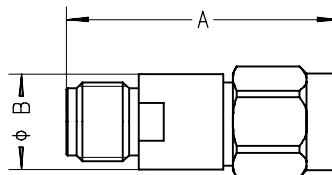


Figure	A inch (mm)	B inch (mm)	Weight (g)
1	.86" (21.8)	.28" (7.1)	5
2	1.14" (29)		10

2 WATTS FLAT FREQUENCY RESPONSE

Part Number	Frequency range (GHz)	ATTENUATION (dB)		V.S.W.R.					Power (W) peak	Fig.
		Nom.	DEVIATION							
			DC - 26.5	DC - 4	4 - 8	8 - 12.4	12.4 - 18	18 - 26.5		
R413 800 121	DC - 26.5	0	+ 0.5	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	≤ 1.50	100	1
R413 801 121		1	± 0.5	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	≤ 1.50	100	1
R413 802 121		2	± 0.5	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	≤ 1.50	100	1
R413 803 121		3	± 0.5	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	≤ 1.50	100	1
R413 804 121		4	± 0.5	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	≤ 1.50	100	1
R413 805 121		5	± 0.5	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	≤ 1.50	100	1
R413 806 121		6	± 0.5	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	≤ 1.50	100	1
R413 807 121		7	± 0.6	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	≤ 1.50	100	1
R413 808 121		8	± 0.6	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	≤ 1.50	100	1
R413 809 121		9	± 0.7	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	≤ 1.50	100	1
R413 810 121		10	± 0.7	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	≤ 1.50	100	1
R413 811 121		11	± 0.7	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	≤ 1.50	100	1
R413 812 121		12	± 0.7	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	≤ 1.50	100	1
R413 813 121		13	± 0.7	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	≤ 1.50	100	1
R413 814 121		14	± 0.7	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	≤ 1.50	100	1
R413 815 121		15	± 0.7	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	≤ 1.50	100	1
R413 816 121		16	± 0.7	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	≤ 1.50	100	1
R413 817 121		17	± 0.7	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	≤ 1.50	100	1
R413 818 121		18	± 0.7	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	≤ 1.50	100	1
R413 819 121		19	± 0.7	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	≤ 1.50	100	1
R413 820 121		20	± 0.7	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	≤ 1.50	100	1
R413 825 121		25	± 1.2	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	≤ 1.50	100	2
R413 830 121		30	± 1.2	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	≤ 1.50	100	2

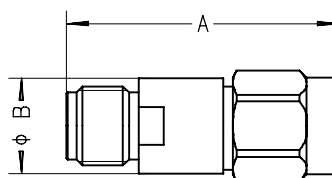
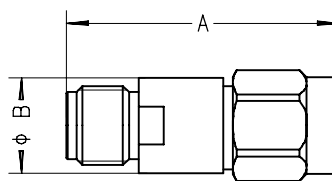


Figure	A inch (mm)	B inch (mm)	Weight (g)
1	.86" (21.8)	.28" (7.1)	5
2	1.14" (29)		10

1 WATTS FLAT FREQUENCY RESPONSE

Part Number	Frequency range (GHz)	ATTENUATION (dB)		V.S.W.R.	Power (W)
		Nom.	DEVIATION		
			DC - 40		peak
R413 301 000	DC - 40 *	1	± 0.8	≤ 1.60	100
R413 302 000		2	± 0.8	≤ 1.60	100
R413 303 000		3	± 0.8	≤ 1.60	100
R413 304 000		4	± 0.8	≤ 1.60	100
R413 305 000		5	± 0.8	≤ 1.60	100
R413 306 000		6	± 0.8	≤ 1.60	100
R413 307 000		7	± 0.8	≤ 1.60	100
R413 308 000		8	± 0.8	≤ 1.60	100
R413 309 000		9	± 0.8	≤ 1.60	100
R413 310 000		10	± 0.8	≤ 1.60	100
R413 320 000		20	± 0.8	≤ 1.60	100

* **SMA 2.9** Connector 100% compatible with *K*TM connector (*K*TM : Trade Mark of WILTRON)



A inch (mm)	B inch (mm)	Weight (g)
1.02" (25.9)	.28" (7.1)	7

Space qualified product are available at the end of the catalogue on page 58 to 61.

10 to 15 WATTS MEDIUM POWER

Part Number	Frequency range (GHz)	ATTENUATION (dB)			V.S.W.R.			Power (W)		Fig
		Nominal	DEVIATION							
			DC - 8	8 - 18	DC - 4	4 - 8	8 - 18	avg.	peak	
R415 303 000	DC - 8	3	± 0.3		≤ 1.15	≤ 1.25		15	250	1
R415 306 000		6	± 0.3		≤ 1.15	≤ 1.25		12	250	1
R415 310 000		10	± 0.3		≤ 1.15	≤ 1.25		10	250	1
R415 312 000		12	± 0.5		≤ 1.15	≤ 1.25		10	250	1
R415 315 000		15	± 0.5		≤ 1.15	≤ 1.25		10	250	1
R415 320 000		20	± 0.5		≤ 1.15	≤ 1.25		10	250	1
R416 103 000	DC-18	3	± 0.5		≤ 1.20	≤ 1.30	≤ 1.40	15	250	2
R416 106 000		6	± 0.5		≤ 1.20	≤ 1.30	≤ 1.40	12	250	2
R416 110 000		10	± 0.5		≤ 1.20	≤ 1.30	≤ 1.40	10	250	2
R416 120 000		20	± 0.5		≤ 1.20	≤ 1.30	≤ 1.40	10	250	2

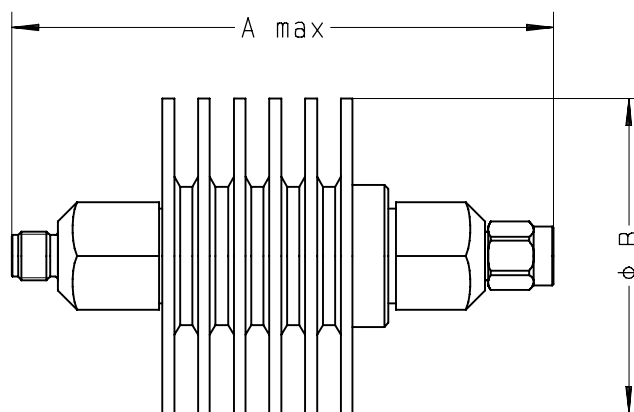
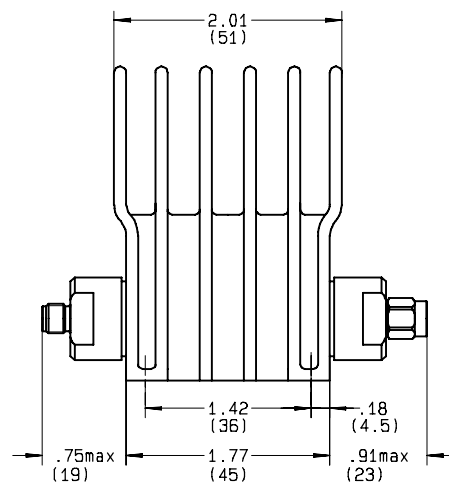
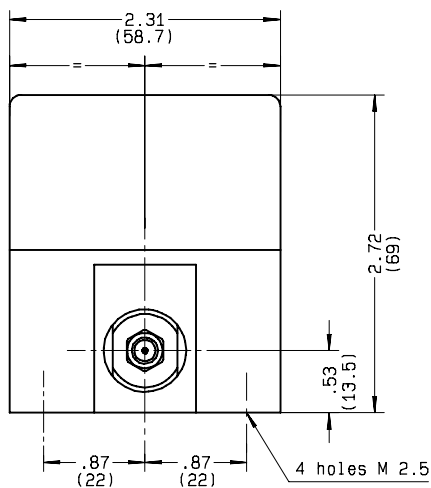


Figure	A inch (mm)	B inch (mm)	Weight (g)
1	1.19" (30.2)	1.02" (26)	21
2	2.79" (71)	1.57" (40)	90

25 WATTS MEDIUM POWER

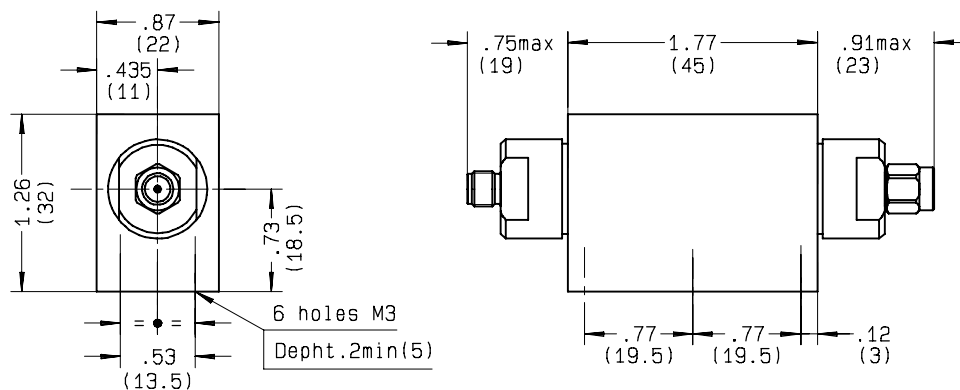
Part Number	Frequency range (GHz)	ATTENUATION (dB)				V.S.W.R.			Power (W)	Weight (Max) (g)
		Nominal	DEVIATION							
			DC - 1	1 - 2	2 - 4	DC - 1	1 - 2	2 - 4	peak	
R417 503 110	DC - 4	3	± 0.6			≤ 1.10	≤ 1.20	≤ 1.35	5000	350
R417 506 110		6	± 0.6			≤ 1.10	≤ 1.20	≤ 1.35	5000	350
R417 510 110		10	± 0.6			≤ 1.10	≤ 1.20	≤ 1.35	5000	350
R417 520 110		20	± 0.8			≤ 1.10	≤ 1.20	≤ 1.35	5000	350
R417 530 110		30	± 0.8			≤ 1.10	≤ 1.20	≤ 1.35	5000	350



30 WATTS MEDIUM POWER

Part Number	Frequency range (GHz)	ATTENUATION (dB)				V.S.W.R.			Power (W)	Weight (Max) (g)
		Nominal	DEVIATION							
			DC - 1	1 - 2	2 - 4	DC - 1	1 - 2	2 - 4	peak	
R417 503 130	DC - 4	3	± 0.6			≤ 1.10	≤ 1.20	≤ 1.35	5000	150
R417 506 130		6	± 0.6			≤ 1.10	≤ 1.20	≤ 1.35	5000	150
R417 510 130		10	± 0.6			≤ 1.10	≤ 1.20	≤ 1.35	5000	150
R417 520 130		20	± 0.8			≤ 1.10	≤ 1.20	≤ 1.35	5000	150
R417 530 130		30	± 0.8			≤ 1.10	≤ 1.20	≤ 1.35	5000	150

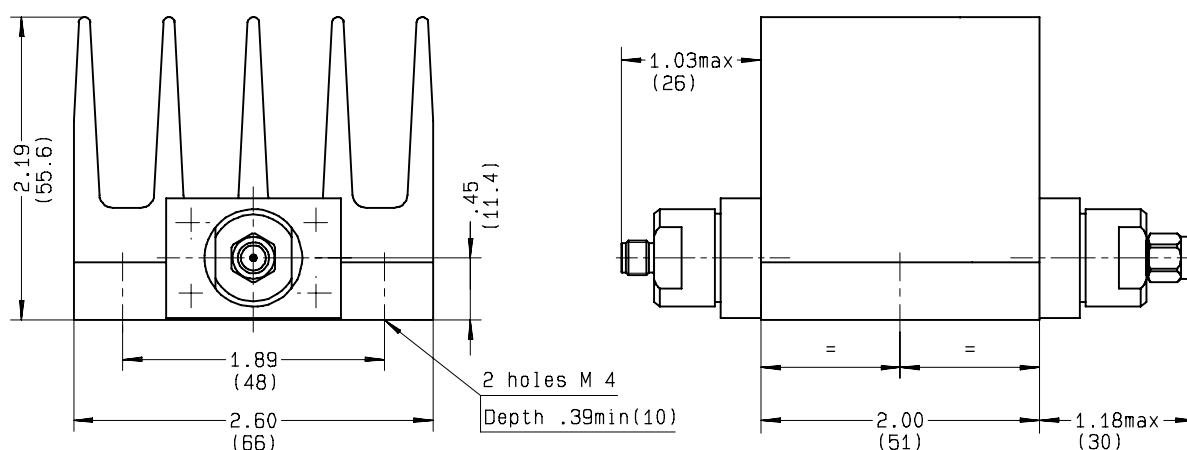
NOTA : These attenuators must be used with conduction cooling, a 78 sq. in. plate *1/8" (500 cm²* 3mm) min. is required.



50 WATTS MEDIUM POWER

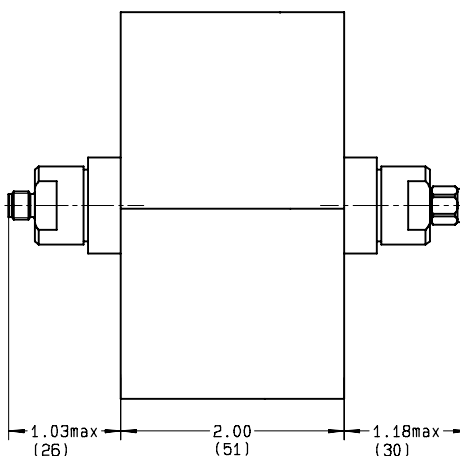
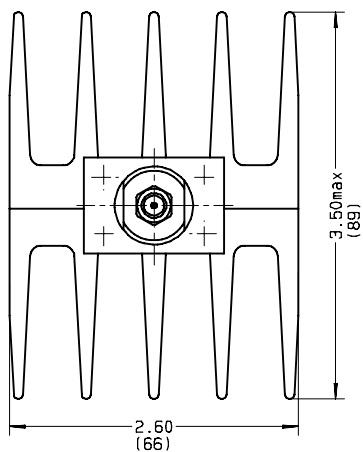
Part Number	Frequency range (GHz)	ATTENUATION (dB)		V.S.W.R.			Power (W)	Weight (Max) (g)
		Nominal	DEVIATION				peak	
				DC - 3	DC - 1	1 - 2	2 - 3	
R417 103 120	DC - 3	3	± 0.7	≤ 1.10	≤ 1.25	≤ 1.35	5000	350
R417 106 120		6	± 0.7	≤ 1.10	≤ 1.25	≤ 1.35	5000	350
R417 110 120		10	± 0.7	≤ 1.10	≤ 1.25	≤ 1.35	5000	350
R417 120 120		20	± 2.0	≤ 1.10	≤ 1.25	≤ 1.35	5000	350
R417 130 120		30	± 2.0	≤ 1.10	≤ 1.25	≤ 1.35	5000	350

NOTA : These attenuators can be used with conduction cooling (50 Watts) or convection cooling (40 Watts)
For conduction cooling a 78 sq. in. plate *1/8" (500 cm² * 3mm) min. is required.



50 WATTS MEDIUM POWER

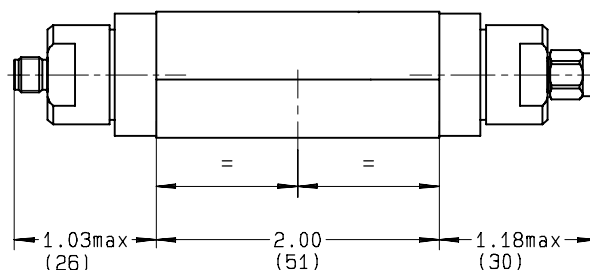
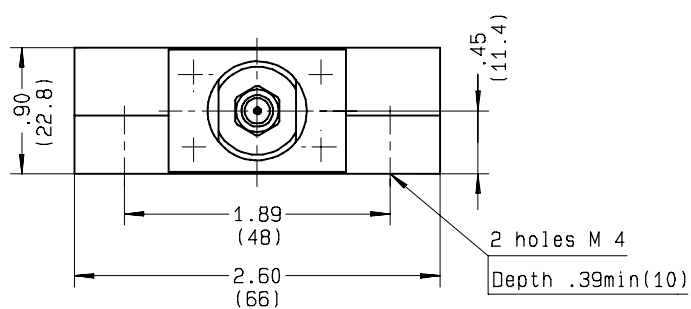
Part Number	Frequency range (GHz)	ATTENUATION (dB)		V.S.W.R.			Power (W)	Weight (Max) (g)
		Nominal	DEVIATION					
			DC - 3	DC - 1	1 - 2	2 - 3	peak	
R417 103 110	DC - 3	3	± 0.7	≤ 1.10	≤ 1.25	≤ 1.35	5000	430
R417 106 110		6	± 0.7	≤ 1.10	≤ 1.25	≤ 1.35	5000	430
R417 110 110		10	± 0.7	≤ 1.10	≤ 1.25	≤ 1.35	5000	430
R417 120 110		20	± 2.0	≤ 1.10	≤ 1.25	≤ 1.35	5000	430
R417 130 110		30	± 2.0	≤ 1.10	≤ 1.25	≤ 1.35	5000	430



50 WATTS MEDIUM POWER

Part Number	Frequency range (GHz)	ATTENUATION (dB)		V.S.W.R.			Power (W)	Weight (Max) (g)
		Nominal	DEVIATION				peak	
				DC - 3	DC - 1	1 - 2	2 - 3	
R417 103 130	DC - 3	3	± 0.7	≤ 1.10	≤ 1.25	≤ 1.35	5000	280
R417 106 130		6	± 0.7	≤ 1.10	≤ 1.25	≤ 1.35	5000	280
R417 110 130		10	± 0.7	≤ 1.10	≤ 1.25	≤ 1.35	5000	280
R417 120 130		20	± 2.0	≤ 1.10	≤ 1.25	≤ 1.35	5000	280
R417 130 130		30	± 2.0	≤ 1.10	≤ 1.25	≤ 1.35	5000	280

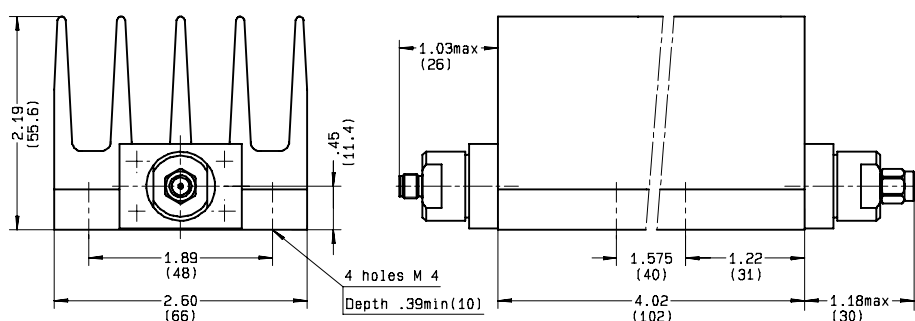
NOTA : These attenuators must be used with conduction cooling, a 78 sq. in. plate *1/8" (500 cm²* 3mm) min. is required.



80 - 100 WATTS HIGH POWER

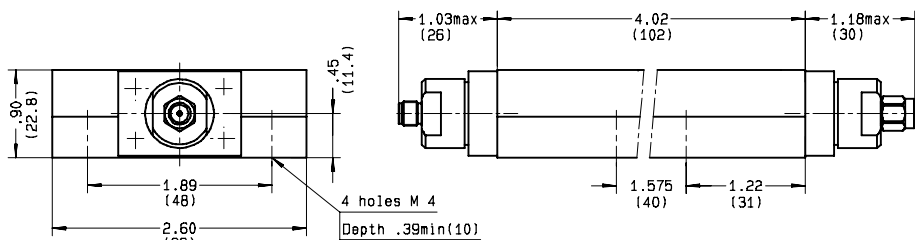
Part Number	Frequency range (GHz)	ATTENUATION (dB)		V.S.W.R.		Power (W)		Weight (Max) (g)
		Nominal	DEVIATION					
			DC - 2	DC - 1	1 - 2	avg.	peak	
R417 803 128	DC - 2	3	± 1.0	≤ 1.10	≤ 1.25	100	5000	650
R417 806 128		6	± 1.0	≤ 1.10	≤ 1.25	100	5000	650
R417 810 128		10	± 1.0	≤ 1.10	≤ 1.25	80	5000	650
R417 820 128		20	± 1.0	≤ 1.10	≤ 1.25	80	5000	650

NOTA : These attenuators can be used with conduction cooling (100 and 80 Watts) or convection cooling (80 and 50 Watts)
For conduction cooling a 156 sq. in. plate *1/8" (1000 cm² * 3mm) min. is required.



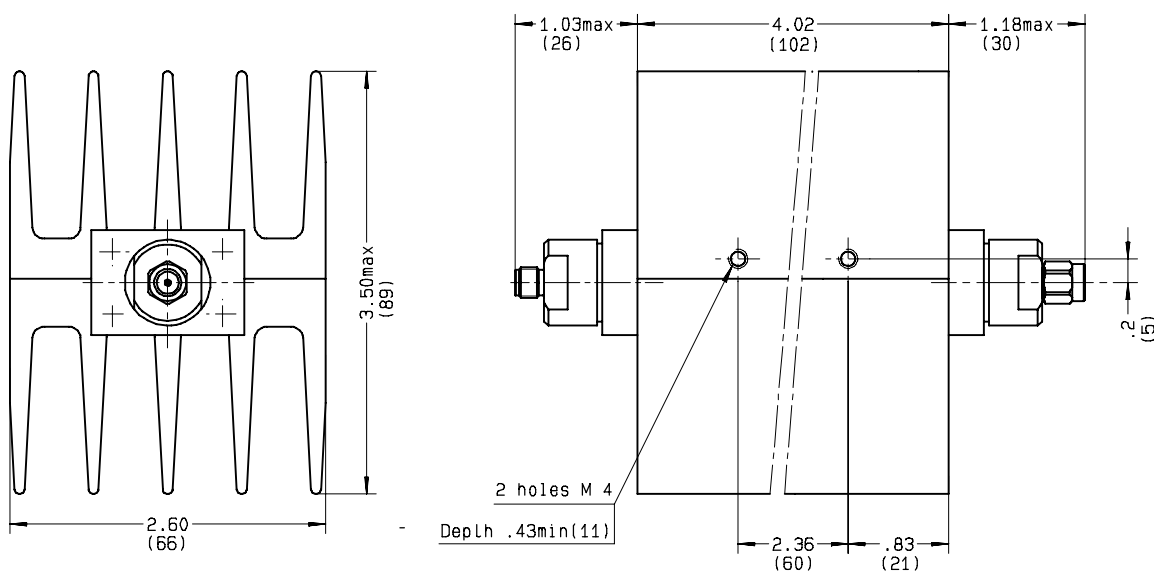
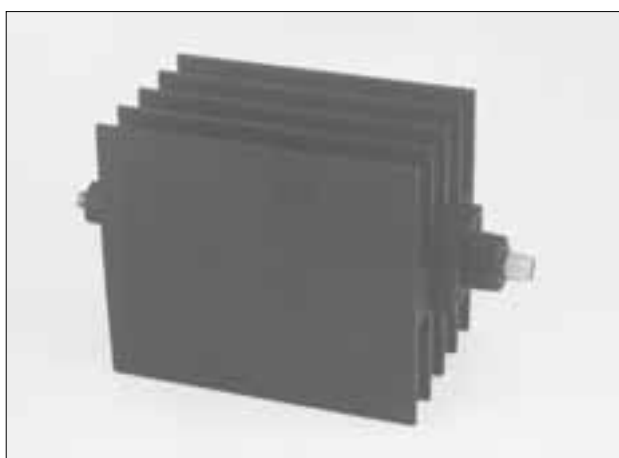
Part Number	Frequency range (GHz)	ATTENUATION (dB)		V.S.W.R.		Power (W)		Weight (Max) (g)
		Nominal	DEVIATION					
			DC - 2	DC - 1	1 - 2	avg.	peak	
R417 803 138	DC - 2	3	± 1.0	≤ 1.10	≤ 1.25	100	5000	580
R417 806 138		6	± 1.0	≤ 1.10	≤ 1.25	100	5000	580
R417 810 138		10	± 1.0	≤ 1.10	≤ 1.25	80	5000	580
R417 820 138		20	± 1.0	≤ 1.10	≤ 1.25	80	5000	580

NOTA : These attenuators must be used with conduction cooling, a 156 sq. in. plate *1/8" (1000 cm² * 3mm) min. is required.



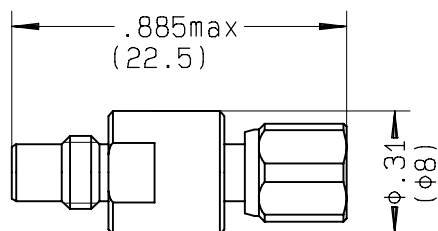
80 - 100 WATTS HIGH POWER

Part Number	Frequency range (GHz)	ATTENUATION (dB)		V.S.W.R.		Power (W)		Weight (Max) (g)
		Nominal	DEVIATION					
			DC - 2	DC - 1	1 - 2	avg.	peak	
R417 803 118	DC - 2	3	± 1.0	≤ 1.10	≤ 1.25	100	5000	1050
R417 806 118		6	± 1.0	≤ 1.10	≤ 1.25	100	5000	1050
R417 810 118		10	± 1.0	≤ 1.10	≤ 1.25	80	5000	1050
R417 820 118		20	± 1.0	≤ 1.10	≤ 1.25	80	5000	1050



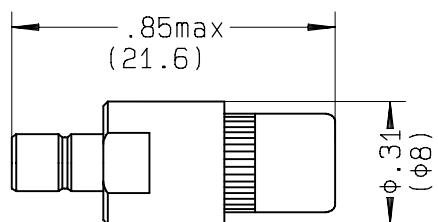
2 WATTS SMC

Part Number	Frequency range (GHz)	ATTENUATION (dB)			V.S.W.R.		Power (W)	Weight (Max) (g)
		Nominal	DEVIATION					
			DC - 4	4 - 8	DC - 4	4 - 8	peak	
R410 103 121	DC - 8	3	± 0.3	± 0.5	≤ 1.15	≤ 1.30	100	5
R410 106 121		6	± 0.4	± 0.5	≤ 1.15	≤ 1.30	100	5
R410 110 121		10	± 0.4	± 0.5	≤ 1.15	≤ 1.30	100	5
R410 120 121		20	± 0.5	± 0.5	≤ 1.15	≤ 1.30	100	5



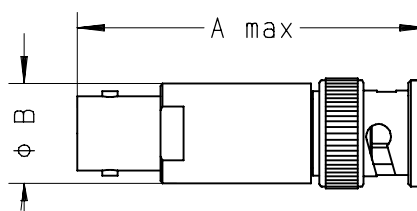
2 WATTS SMB

Part Number	Frequency range (GHz)	ATTENUATION (dB)			V.S.W.R.		Power (W)	Weight (Max) (g)
		Nominal	DEVIATION					
			DC - 4	4 - 8	DC - 4	4 - 8	peak	
R410 203 121	DC - 8	3	± 0.3	± 0.5	≤ 1.15	≤ 1.30	100	5
R410 206 121		6	± 0.4	± 0.5	≤ 1.15	≤ 1.30	100	5
R410 210 121		10	± 0.4	± 0.5	≤ 1.15	≤ 1.30	100	5
R410 220 121		20	± 0.5	± 0.5	≤ 1.15	≤ 1.30	100	5



1 WATT, STANDARD TYPE

Part Number	Frequency range (GHz)	ATTENUATION (dB)			V.S.W.R.		Power (W)
		Nominal	DEVIATION				
			DC - 2	2 - 3	DC - 2	2 - 3	peak
R412 400 124	DC - 3	0	+ 0,3	+ 0,5	≤ 1,20	≤ 1,30	100
R412 401 124		1	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100
R412 402 124		2	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100
R412 403 124		3	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100
R412 404 124		4	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100
R412 405 124		5	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100
R412 406 124		6	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100
R412 407 124		7	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R412 408 124		8	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R412 409 124		9	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R412 410 124		10	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R412 411 124		11	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R412 412 124		12	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R412 413 124		13	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R412 414 124		14	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R412 415 124		15	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R412 416 124		16	± 0,7	± 0,7	≤ 1,20	≤ 1,30	100
R412 417 124		17	± 0,7	± 0,7	≤ 1,20	≤ 1,30	100
R412 418 124		18	± 1,0	± 1,0	≤ 1,20	≤ 1,30	100
R412 419 124		19	± 1,0	± 1,0	≤ 1,20	≤ 1,30	100
R412 420 124		20	± 1,0	± 1,0	≤ 1,20	≤ 1,30	100



A inch (mm)	B inch (mm)	Weight (g)
1.26" (32)	.51" (13)	17

2 WATTS

Part Number	Frequency range (GHz)	ATTENUATION (dB)		V.S.W.R.	Power (W)	Fig.
		Nominal	DEVIATION			
			DC - 2		peak	
R412 400 000	DC - 2	0	+ 0,35	$\leq 1,20$	100	1
R412 401 000		1	$\pm 0,35$	$\leq 1,20$	100	1
R412 402 000		2	$\pm 0,35$	$\leq 1,20$	100	1
R412 403 000		3	$\pm 0,35$	$\leq 1,20$	100	1
R412 404 000		4	$\pm 0,35$	$\leq 1,20$	100	1
R412 405 000		5	$\pm 0,35$	$\leq 1,20$	100	1
R412 406 000		6	$\pm 0,35$	$\leq 1,20$	100	1
R412 407 000		7	$\pm 0,35$	$\leq 1,20$	100	1
R412 408 000		8	$\pm 0,35$	$\leq 1,20$	100	1
R412 409 000		9	$\pm 0,35$	$\leq 1,20$	100	1
R412 410 000		10	$\pm 0,35$	$\leq 1,20$	100	1
R412 411 000		11	$\pm 0,35$	$\leq 1,20$	100	1
R412 412 000		12	$\pm 0,35$	$\leq 1,20$	100	1
R412 413 000		13	$\pm 0,35$	$\leq 1,20$	100	1
R412 414 000		14	$\pm 0,35$	$\leq 1,20$	100	1
R412 415 000		15	$\pm 0,40$	$\leq 1,20$	100	1
R412 416 000		16	$\pm 0,40$	$\leq 1,20$	100	1
R412 417 000		17	$\pm 0,40$	$\leq 1,20$	100	1
R412 418 000		18	$\pm 0,40$	$\leq 1,20$	100	1
R412 419 000		19	$\pm 0,40$	$\leq 1,20$	100	1
R412 420 000		20	$\pm 0,45$	$\leq 1,20$	100	1
R412 430 000		30	$\pm 0,80$	$\leq 1,20$	100	2
R412 440 000		40	$\pm 0,80$	$\leq 1,20$	100	2
R412 450 000		50	$\pm 1,00$	$\leq 1,25$	100	2

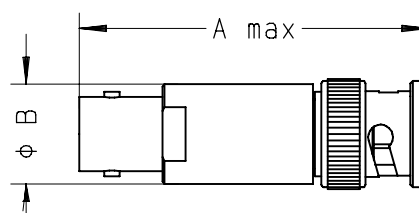


Figure	A inch (mm)	B inch (mm)	Weight (g)
1	1.83" (46.5)	.51" (13)	30
2	2.25" (57.1)		40

2 WATTS

Part Number	Frequency range (GHz)	ATTENUATION (dB)			V.S.W.R.		Power (W)	Fig.
		Nom.	DEVIATION				peak	
			DC - 4	4 - 8	DC - 4	4 - 8		
R414 400 000	DC - 8	0	+ 0.30	+ 0.50	≤ 1.20	≤ 1.25	100	1
R414 401 000		1	± 0.30	± 0.50	≤ 1.20	≤ 1.25	100	1
R414 402 000		2	± 0.30	± 0.50	≤ 1.20	≤ 1.25	100	1
R414 403 000		3	± 0.30	± 0.50	≤ 1.20	≤ 1.25	100	1
R414 404 000		4	± 0.30	± 0.50	≤ 1.20	≤ 1.25	100	1
R414 405 000		5	± 0.30	± 0.50	≤ 1.20	≤ 1.25	100	1
R414 406 000		6	± 0.30	± 0.50	≤ 1.20	≤ 1.25	100	1
R414 407 000		7	± 0.30	± 0.50	≤ 1.20	≤ 1.25	100	1
R414 408 000		8	± 0.30	± 0.50	≤ 1.20	≤ 1.25	100	1
R414 409 000		9	± 0.30	± 0.50	≤ 1.20	≤ 1.25	100	1
R414 410 000		10	± 0.30	± 0.50	≤ 1.20	≤ 1.25	100	1
R414 411 000		11	± 0.30	± 0.50	≤ 1.20	≤ 1.25	100	1
R414 412 000		12	± 0.30	± 0.50	≤ 1.20	≤ 1.25	100	1
R414 413 000		13	± 0.30	± 0.50	≤ 1.20	≤ 1.25	100	1
R414 414 000		14	± 0.30	± 0.50	≤ 1.20	≤ 1.25	100	1
R414 415 000		15	± 0.50	± 0.50	≤ 1.20	≤ 1.25	100	1
R414 420 000		20	± 0.50	± 0.50	≤ 1.20	≤ 1.25	100	1
R414 425 000		25	± 0.50	± 0.50	≤ 1.20	≤ 1.25	100	2
R414 430 000		30	± 0.80	± 0.80	≤ 1.20	≤ 1.25	100	2
R414 440 000		40	± 0.80	± 0.80	≤ 1.20	≤ 1.25	100	2
R414 450 000		50	± 1.00	± 1.00	≤ 1.20	≤ 1.25	100	2
R414 460 000		60	± 1.00	± 1.00	≤ 1.20	≤ 1.25	100	2

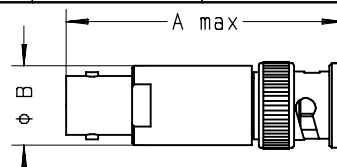
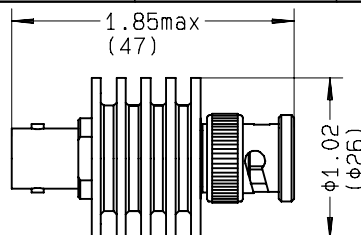


Figure	A inch (mm)	B inch (mm)	Weight (g)
1	1.83" (46.5)	.51" (13)	30
2	2.25" (57.1)		40

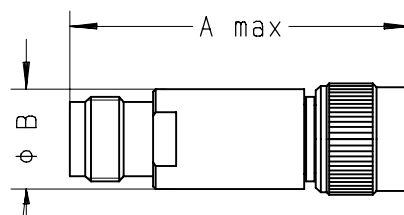
10 to 15 WATTS MEDIUM POWER

Part Number	Frequency range (GHz)	ATTENUATION (dB)		V.S.W.R.	Power (W)		Weight (Max) (g)
		Nominal	DEVIATION		DC - 4	avg.	
			DC - 4				
R415 403 000	DC - 4	3	± 0.50	≤ 1.30	15	250	70
R415 406 000		6	± 0.50	≤ 1.30	12	250	70
R415 410 000		10	± 0.50	≤ 1.30	10	250	70
R415 420 000		20	± 0.50	≤ 1.30	10	250	70



1 WATT, STANDARD TYPE

Part Number	Frequency range (GHz)	ATTENUATION (dB)			V.S.W.R.		Power (W)
		Nom.	DEVIATION				
			DC - 2	2 - 3	DC - 2	2 - 3	peak
R412 500 124	DC - 3	0	+ 0,3	+ 0,5	≤ 1,20	≤ 1,30	100
R412 501 124		1	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100
R412 502 124		2	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100
R412 503 124		3	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100
R412 504 124		4	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100
R412 505 124		5	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100
R412 506 124		6	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100
R412 507 124		7	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R412 508 124		8	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R412 509 124		9	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R412 510 124		10	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R412 511 124		11	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R412 512 124		12	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R412 513 124		13	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R412 514 124		14	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R412 515 124		15	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R412 516 124		16	± 0,7	± 0,7	≤ 1,20	≤ 1,30	100
R412 517 124		17	± 0,7	± 0,7	≤ 1,20	≤ 1,30	100
R412 518 124		18	± 1,0	± 1,0	≤ 1,20	≤ 1,30	100
R412 519 124		19	± 1,0	± 1,0	≤ 1,20	≤ 1,30	100
R412 520 124		20	± 1,0	± 1,0	≤ 1,20	≤ 1,30	100



A inch (mm)	B inch (mm)	Weight (g)
1.26" (32)	.51" (13)	17

2 WATTS, HIGH PERFORMANCE

Part Number	Frequency range (GHz)	ATTENUATION (dB)		V.S.W.R.	Power (W)	Fig.
		Nom.	DEVIATION			
			DC - 2		peak	
R412 500 000	DC - 2	0	+ 0,35	≤ 1,15	100	1
R412 501 000		1	± 0,35	≤ 1,15	100	1
R412 502 000		2	± 0,35	≤ 1,15	100	1
R412 503 000		3	± 0,35	≤ 1,15	100	1
R412 504 000		4	± 0,35	≤ 1,15	100	1
R412 505 000		5	± 0,35	≤ 1,15	100	1
R412 506 000		6	± 0,35	≤ 1,15	100	1
R412 507 000		7	± 0,35	≤ 1,15	100	1
R412 508 000		8	± 0,35	≤ 1,15	100	1
R412 509 000		9	± 0,35	≤ 1,15	100	1
R412 510 000		10	± 0,35	≤ 1,15	100	1
R412 511 000		11	± 0,35	≤ 1,15	100	1
R412 512 000		12	± 0,35	≤ 1,15	100	1
R412 513 000		13	± 0,35	≤ 1,15	100	1
R412 514 000		14	± 0,35	≤ 1,15	100	1
R412 515 000		15	± 0,35	≤ 1,15	100	1
R412 520 000		20	± 0,45	≤ 1,15	100	1
R412 530 000		30	± 0,80	≤ 1,15	100	2
R412 540 000		40	± 0,80	≤ 1,15	100	2
R412 550 000		50	± 1,00	≤ 1,15	100	2

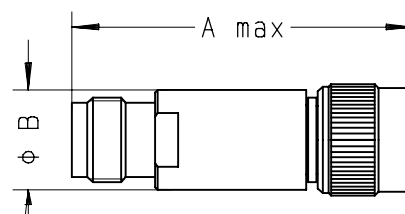


Figure	A inch (mm)	B inch (mm)	Weight (g)
1	1.79" (45.5)	.51" (13)	30
2	2.21" (56.1)		40

2 WATTS, STANDARD TYPE

Part Number	Frequency range (GHz)	ATTENUATION (dB)				V.S.W.R.			Power (W)	Fig.
		Nom.	DEVIATION			DC - 4	4 - 8	8 - 12.4	peak	
			DC - 4	4 - 8	8 - 12.4					
R414 500 000	DC - 12.4	0	+ 0.30	+ 0.50	+ 0.70	≤ 1.20	≤ 1.25	≤ 1.30	100	1
R414 501 000		1	± 0.30	± 0.50	± 0.70	≤ 1.20	≤ 1.25	≤ 1.30	100	1
R414 502 000		2	± 0.30	± 0.50	± 0.70	≤ 1.20	≤ 1.25	≤ 1.30	100	1
R414 503 000		3	± 0.30	± 0.50	± 0.70	≤ 1.20	≤ 1.25	≤ 1.30	100	1
R414 504 000		4	± 0.30	± 0.50	± 0.70	≤ 1.20	≤ 1.25	≤ 1.30	100	1
R414 505 000		5	± 0.30	± 0.50	± 0.70	≤ 1.20	≤ 1.25	≤ 1.30	100	1
R414 506 000		6	± 0.30	± 0.50	± 0.70	≤ 1.20	≤ 1.25	≤ 1.30	100	1
R414 507 000		7	± 0.30	± 0.50	± 0.70	≤ 1.20	≤ 1.25	≤ 1.30	100	1
R414 508 000		8	± 0.30	± 0.50	± 0.70	≤ 1.20	≤ 1.25	≤ 1.30	100	1
R414 509 000		9	± 0.30	± 0.50	± 0.70	≤ 1.20	≤ 1.25	≤ 1.30	100	1
R414 510 000		10	± 0.30	± 0.50	± 0.70	≤ 1.20	≤ 1.25	≤ 1.30	100	1
R414 511 000		11	± 0.30	± 0.50	± 0.70	≤ 1.20	≤ 1.25	≤ 1.30	100	1
R414 512 000		12	± 0.30	± 0.50	± 0.70	≤ 1.20	≤ 1.25	≤ 1.30	100	1
R414 513 000		13	± 0.30	± 0.50	± 0.70	≤ 1.20	≤ 1.25	≤ 1.30	100	1
R414 514 000		14	± 0.30	± 0.50	± 0.70	≤ 1.20	≤ 1.25	≤ 1.30	100	1
R414 515 000		15	± 0.50	± 0.50	± 0.70	≤ 1.20	≤ 1.25	≤ 1.30	100	1
R414 520 000		20	± 0.50	± 0.50	± 0.70	≤ 1.20	≤ 1.25	≤ 1.30	100	1
R414 525 000		25	± 0.80	± 0.80	± 1.20	≤ 1.20	≤ 1.25	≤ 1.30	100	2
R414 530 000		30	± 0.80	± 0.80	± 1.20	≤ 1.20	≤ 1.25	≤ 1.30	100	2
R414 540 000		40	± 0.80	± 0.80	± 1.30	≤ 1.20	≤ 1.25	≤ 1.30	100	2
R414 550 000		50	± 1.00	± 1.20	± 1.50	≤ 1.20	≤ 1.25	≤ 1.30	100	2
R414 560 000		60	± 1.20	± 1.20	± 1.20	≤ 1.20	≤ 1.25	≤ 1.30	100	2

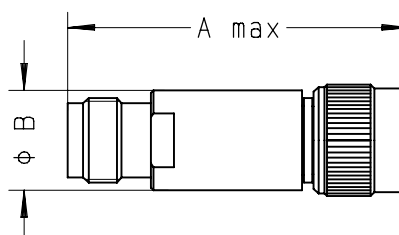
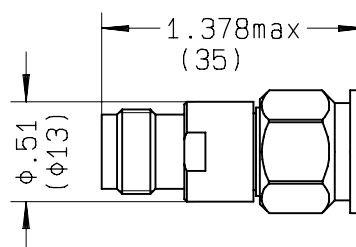


Figure	A inch (mm)	B inch (mm)	Weight (g)
1	1.79" (45.5)	.51"(13)	30
2	2.21" (56.1)		40

2 WATTS, HIGH PERFORMANCE TYPE

Part Number	Frequency range (GHz)	ATTENUATION (dB)		V.S.W.R.				Power (W)	Weight (Max) (g)
		Nom.	DEVIATION	DC - 4	4 - 8	8 - 12.4	12.4 - 18		
R414 500 161	DC - 18	0	+ 0.40	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	30
R414 501 161		1	± 0.40	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	30
R414 502 161		2	± 0.40	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	30
R414 503 161		3	± 0.40	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	30
R414 504 161		4	± 0.40	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	30
R414 505 161		5	± 0.40	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	30
R414 506 161		6	± 0.40	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	30
R414 507 161		7	± 0.50	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	30
R414 508 161		8	± 0.50	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	30
R414 509 161		9	± 0.50	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	30
R414 510 161		10	± 0.50	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	30
R414 511 161		11	± 0.50	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	30
R414 512 161		12	± 0.50	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	30
R414 513 161		13	± 0.50	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	30
R414 514 161		14	± 0.50	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	30
R414 515 161		15	± 0.50	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	30
R414 516 161		16	± 0.60	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	30
R414 517 161		17	± 0.60	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	30
R414 518 161		18	± 0.60	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	30
R414 519 161		19	± 0.60	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	30
R414 520 161		20	± 0.60	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	30



10 to 15 WATTS MEDIUM POWER

Part Number	Frequency range (GHz)	ATTENUATION (dB)			V.S.W.R.			Power (W)		Fig.
		Nominal	DEVIATION							
			DC - 8	DC - 18	DC - 4	4 - 8	8 - 18	avg.	peak	
R415 503 000	DC - 8	3	± 0.30		≤ 1.15	≤ 1.25		15	250	1
R415 506 000		6	± 0.30		≤ 1.15	≤ 1.25		12	250	1
R415 510 000		10	± 0.30		≤ 1.15	≤ 1.25		10	250	1
R415 520 000		20	± 0.50		≤ 1.15	≤ 1.25		10	250	1
R416 803 000	DC - 18	3	± 0.50		≤ 1.20	≤ 1.30	≤ 1.40	15	250	2
R416 806 000		6	± 0.50		≤ 1.20	≤ 1.30	≤ 1.40	12	250	2
R416 810 000		10	± 0.50		≤ 1.20	≤ 1.30	≤ 1.40	10	250	2
R416 820 000		20	± 0.50		≤ 1.20	≤ 1.30	≤ 1.40	10	250	2

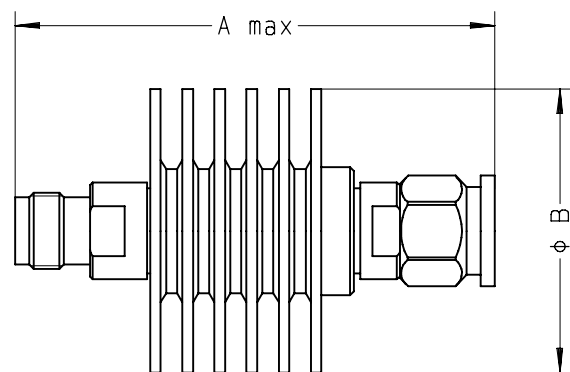
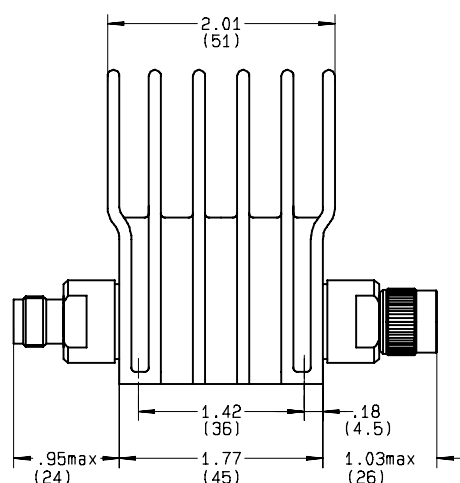
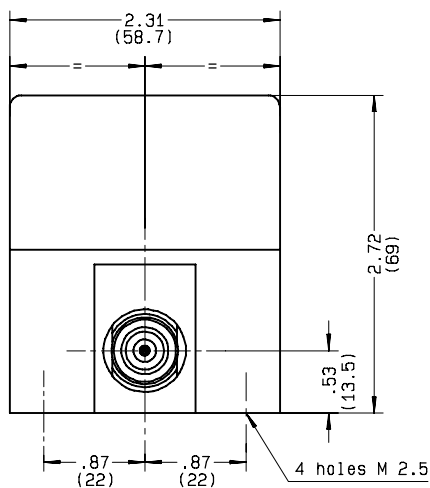


Figure	A inch (mm)	B inch (mm)	Weight (g)
1	1.81" (46)	1.02" (26)	70
2	2.75" (70)	1.57" (40)	90

25 WATTS MEDIUM POWER

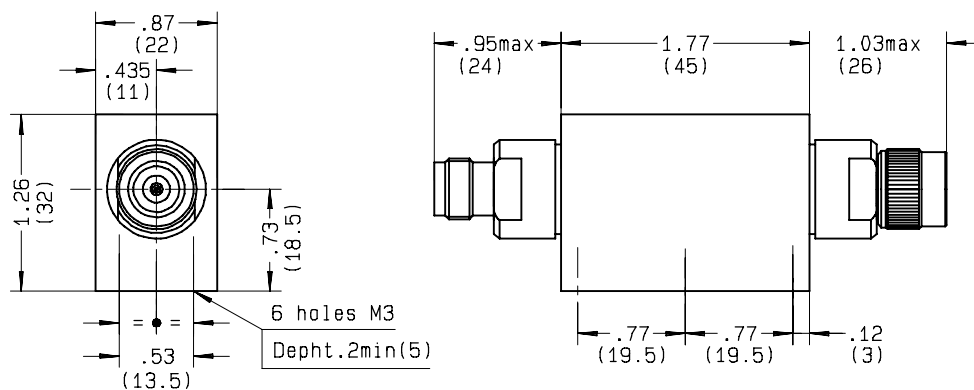
Part Number	Frequency range (GHz)	ATTENUATION (dB)		V.S.W.R.			Power (W) peak	Weight (Max) (g)
		Nominal	DEVIATION DC - 4	DC - 1	1 - 2	2 - 4		
R417 603 110	DC - 4	3	± 0.60	≤ 1.10	≤ 1.20	≤ 1.35	5000	350
R417 606 110		6	± 0.60	≤ 1.10	≤ 1.20	≤ 1.35	5000	350
R417 610 110		10	± 0.60	≤ 1.10	≤ 1.20	≤ 1.35	5000	350
R417 620 110		20	± 0.80	≤ 1.10	≤ 1.20	≤ 1.35	5000	350
R417 630 110		30	± 0.80	≤ 1.10	≤ 1.20	≤ 1.35	5000	350



30 WATTS MEDIUM POWER

Part Number	Frequency range (GHz)	ATTENUATION (dB)		V.S.W.R.			Power (W) peak	Weight (Max) (g)
		Nominal	DEVIATION	DC - 1	1 - 2	2 - 4		
R417 603 130	DC - 4	3	± 0.60	≤ 1.10	≤ 1.20	≤ 1.35	5000	150
R417 606 130		6	± 0.60	≤ 1.10	≤ 1.20	≤ 1.35	5000	150
R417 610 130		10	± 0.60	≤ 1.10	≤ 1.20	≤ 1.35	5000	150
R417 620 130		20	± 0.80	≤ 1.10	≤ 1.20	≤ 1.35	5000	150
R417 630 130		30	± 0.80	≤ 1.10	≤ 1.20	≤ 1.35	5000	150

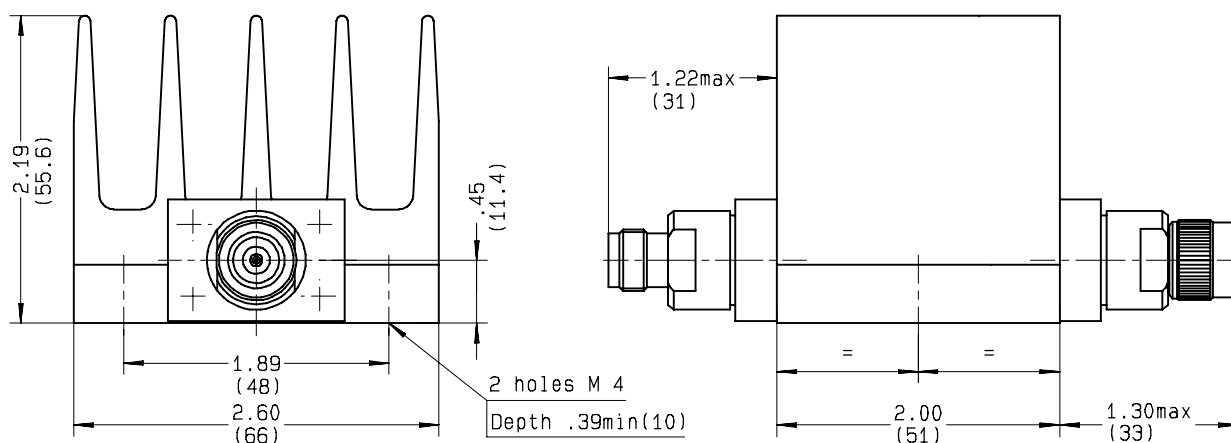
NOTA : These attenuators must be used with conduction cooling, a 78 sq. in. plate *1/8" (500 cm²* 3mm) min. is required.



50 WATTS MEDIUM POWER

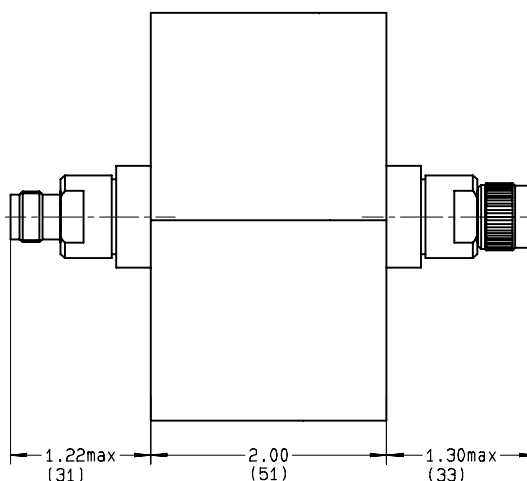
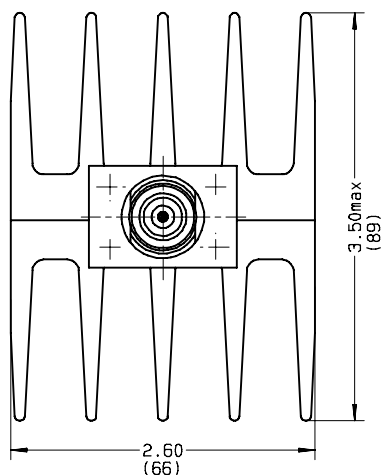
Part Number	Frequency range (GHz)	ATTENUATION (dB)		V.S.W.R.			Power (W)	Weight (Max) (g)
		Nominal	DEVIATION					
			DC - 3	DC - 1	1 - 2	2 - 3	peak	
R417 203 120	DC - 3	3	± 0.70	≤ 1.10	≤ 1.25	≤ 1.35	5000	350
R417 206 120		6	± 0.70	≤ 1.10	≤ 1.25	≤ 1.35	5000	350
R417 210 120		10	± 0.70	≤ 1.10	≤ 1.25	≤ 1.35	5000	350
R417 220 120		20	± 2.00	≤ 1.10	≤ 1.25	≤ 1.35	5000	350
R417 230 120		30	± 2.00	≤ 1.10	≤ 1.25	≤ 1.35	5000	350

NOTA : These attenuators can be used with conduction cooling (50 Watts) or convection cooling (40 Watts)
For conduction cooling a 78 sq. in. plate *1/8" (500 cm² * 3mm) min. is required.



50 WATTS MEDIUM POWER

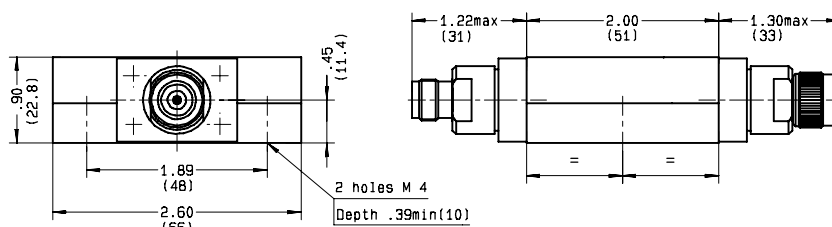
Part Number	Frequency range (GHz)	ATTENUATION (dB)		V.S.W.R.			Power (W)	Weight (Max) (g)
		Nominal	DEVIATION					
			DC - 3	DC - 1	1 - 2	2 - 3	peak	
R417 203 110	DC - 3	3	± 0.70	≤ 1.10	≤ 1.25	≤ 1.35	5000	430
R417 206 110		6	± 0.70	≤ 1.10	≤ 1.25	≤ 1.35	5000	430
R417 210 110		10	± 0.70	≤ 1.10	≤ 1.25	≤ 1.35	5000	430
R417 220 110		20	± 2.00	≤ 1.10	≤ 1.25	≤ 1.35	5000	430
R417 230 110		30	± 2.00	≤ 1.10	≤ 1.25	≤ 1.35	5000	430



50 WATTS MEDIUM POWER

Part Number	Frequency range (GHz)	ATTENUATION (dB)		V.S.W.R.			Power (W) peak	Weight (Max) (g)
		Nominal	DEVIATION DC - 3	DC - 1	1 - 2	2 - 3		
R417 203 130	DC - 3	3	± 0.70	≤ 1.10	≤ 1.25	≤ 1.35	5000	280
R417 206 130		6	± 0.70	≤ 1.10	≤ 1.25	≤ 1.35	5000	280
R417 210 130		10	± 0.70	≤ 1.10	≤ 1.25	≤ 1.35	5000	280
R417 220 130		20	± 2.00	≤ 1.10	≤ 1.25	≤ 1.35	5000	280
R417 230 130		30	± 2.00	≤ 1.10	≤ 1.25	≤ 1.35	5000	280

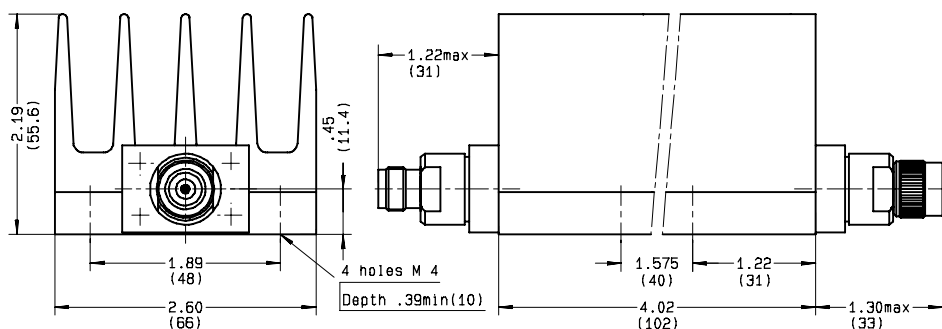
NOTA : These attenuators must be used with conduction cooling, a 78 sq. in. plate *1/8" (500 cm²* 3mm) min. is required.



80 - 100 WATTS HIGH POWER

Part Number	Frequency range (GHz)	ATTENUATION (dB)		V.S.W.R.		Power (W)		Weight (Max) (g)
		Nominal	DEVIATION DC - 2	DC - 1	1 - 2	avg.	peak	
R417 903 128	DC - 2	3	± 1.00	≤ 1.10	≤ 1.25	100	5000	650
R417 906 128		6	± 1.00	≤ 1.10	≤ 1.25	100	5000	650
R417 910 128		10	± 1.00	≤ 1.10	≤ 1.25	80	5000	650
R417 920 128		20	± 1.00	≤ 1.10	≤ 1.25	80	5000	650

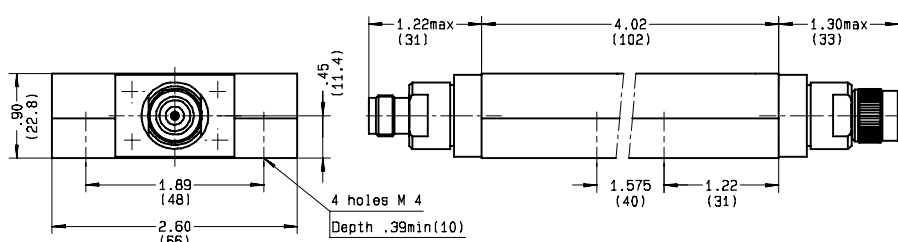
NOTA : These attenuators can be used with conduction cooling (100 and 80 Watts) or convection cooling (80 and 50 Watts). For conduction cooling a 156 sq. in. plate *1/8" (1000 cm²* 3mm) min. is required.



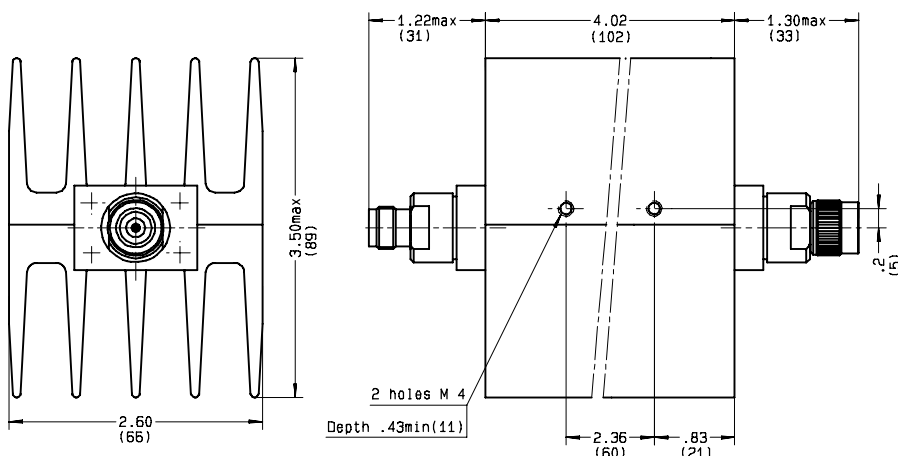
80 - 100 WATTS HIGH POWER

Part Number	Frequency range (GHz)	ATTENUATION (dB)		V.S.W.R.		Power (W)		Weight (Max) (g)
		Nominal	DEVIATION					
			DC - 2	DC - 1	1 - 2	avg.	peak	
R417 903 138	DC - 2	3	± 1.00	≤ 1.10	≤ 1.25	100	5000	580
R417 906 138		6	± 1.00	≤ 1.10	≤ 1.25	100	5000	580
R417 910 138		10	± 1.00	≤ 1.10	≤ 1.25	80	5000	580
R417 920 138		20	± 1.00	≤ 1.10	≤ 1.25	80	5000	580

NOTA : These attenuators must be used with conduction cooling, a 156 sq. in. plate *1/8" (1000 cm²* 3mm) min. is required.

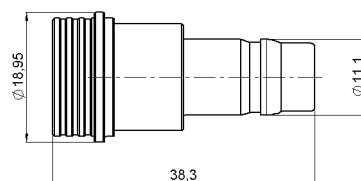


Part Number	Frequency range (GHz)	ATTENUATION (dB)		V.S.W.R.		Power (W)		Weight (Max) (g)
		Nominal	DEVIATION					
			DC - 2	DC - 1	1 - 2	avg.	peak	
R417 903 118	DC - 2	3	± 1.00	≤ 1.10	≤ 1.25	100	5000	1050
R417 906 118		6	± 1.00	≤ 1.10	≤ 1.25	100	5000	1050
R417 910 118		10	± 1.00	≤ 1.10	≤ 1.25	80	5000	1050
R417 920 118		20	± 1.00	≤ 1.10	≤ 1.25	80	5000	1050



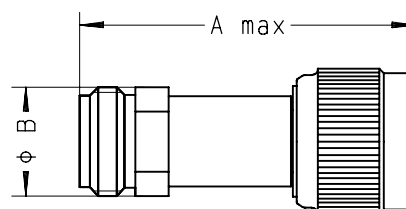
1 WATT, STANDARD TYPE

Part number	Frequency range (GHz)	ATTENUATION (dB)			V.S.W.R.		Power (W)
		Nom.	DEVIATION				
			DC - 2	2 - 3	DC - 2	2 - 3	peak
R411 300 124	DC - 3	0	+ 0,3	+ 0,5	≤ 1,20	≤ 1,30	100
R411 301 124		1	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100
R411 302 124		2	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100
R411 303 124		3	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100
R411 304 124		4	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100
R411 305 124		5	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100
R411 306 124		6	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100
R411 307 124		7	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R411 308 124		8	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R411 309 124		9	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R411 310 124		10	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R411 311 124		11	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R411 312 124		12	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R411 313 124		13	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R411 314 124		14	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R411 315 124		15	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R411 316 124		16	± 0,7	± 0,7	≤ 1,20	≤ 1,30	100
R411 317 124		17	± 0,7	± 0,7	≤ 1,20	≤ 1,30	100
R411 318 124		18	± 0,7	± 0,7	≤ 1,20	≤ 1,30	100
R411 319 124		19	± 0,7	± 0,7	≤ 1,20	≤ 1,30	100
R411 320 124		20	± 0,7	± 0,7	≤ 1,20	≤ 1,30	100



1 WATT, STANDARD TYPE

Part Number	Frequency range (GHz)	ATTENUATION (dB)			V.S.W.R.		Power (W)
		Nominal	DEVIATION				
			CC - 2	2 - 3	DC - 2	2 - 3	peak
R412 700 124	DC - 3	0	+ 0,3	+ 0,5	≤ 1,20	≤ 1,30	100
R412 701 124		1	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100
R412 702 124		2	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100
R412 703 124		3	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100
R412 704 124		4	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100
R412 705 124		5	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100
R412 706 124		6	± 0,3	± 0,5	≤ 1,20	≤ 1,30	100
R412 707 124		7	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R412 708 124		8	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R412 709 124		9	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R412 710 124		10	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R412 711 124		11	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R412 712 124		12	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R412 713 124		13	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R412 714 124		14	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R412 715 124		15	± 0,5	± 0,5	≤ 1,20	≤ 1,30	100
R412 716 124		16	± 0,7	± 0,7	≤ 1,20	≤ 1,30	100
R412 717 124		17	± 0,7	± 0,7	≤ 1,20	≤ 1,30	100
R412 718 124		18	± 0,7	± 1,0	≤ 1,20	≤ 1,30	100
R412 719 124		19	± 0,7	± 1,0	≤ 1,20	≤ 1,30	100
R412 720 124		20	± 0,7	± 1,0	≤ 1,20	≤ 1,30	100



A inch (mm)	B inch (mm)	Weight (g)
1.38" (35)	.62" (15.8)	43

2 WATTS FLAT FREQUENCY RESPONSE, HIGH PERFORMANCE

Part Number	Frequency range (GHz)	ATTENUATION (dB)		V.S.W.R.	Power (W)		Figure
		Nominal	DEVIATION		avg.	peak	
			CC - 2				
R412 700 000	DC - 2	0	+ 0,35	≤ 1,20	2	100	1
R412 701 000		1	± 0,35	≤ 1,15	2	100	1
R412 702 000		2	± 0,35	≤ 1,15	2	100	1
R412 703 000		3	± 0,35	≤ 1,15	2	100	1
R412 704 000		4	± 0,35	≤ 1,15	2	100	1
R412 705 000		5	± 0,35	≤ 1,15	2	100	1
R412 706 000		6	± 0,35	≤ 1,15	2	100	1
R412 707 000		7	± 0,35	≤ 1,15	2	100	1
R412 708 000		8	± 0,35	≤ 1,15	2	100	1
R412 709 000		9	± 0,35	≤ 1,15	2	100	1
R412 710 000		10	± 0,35	≤ 1,15	2	100	1
R412 711 000		11	± 0,35	≤ 1,15	2	100	1
R412 712 000		12	± 0,35	≤ 1,15	2	100	1
R412 713 000		13	± 0,35	≤ 1,15	2	100	1
R412 714 000		14	± 0,35	≤ 1,15	2	100	1
R412 715 000		15	± 0,35	≤ 1,15	2	100	1
R412 720 000		20	± 0,45	≤ 1,15	2	100	1
R412 730 000		30	± 0,80	≤ 1,15	2	100	2
R412 740 000		40	± 0,80	≤ 1,15	2	100	2
R412 750 000		50	± 1,00	≤ 1,15	2	100	2

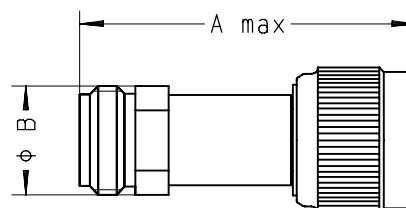


Figure	A inch (mm)	B inch (mm)	Weight (g)
1	1.97" (50)	.62" (15.8)	60
2	2.39" (60.7)		70

2 WATTS, STANDARD TYPE

Part Number	Frequency range (GHz)	ATTENUATION (dB)				V.S.W.R.			Power (W)	Fig.
		Nom.	DEVIATION							
			DC - 4	4 - 8	8 - 12.4	DC - 4	4 - 8	8 - 12.4	peak	
R414 700 000	DC - 12.4	0	+ 0.30	+ 0.50	+ 0.70	≤ 1.20	≤ 1.25	≤ 1.40	100	1
R414 701 000		1	± 0.30	± 0.50	± 0.70	≤ 1.12	≤ 1.15	≤ 1.20	100	1
R414 702 000		2	± 0.30	± 0.50	± 0.70	≤ 1.12	≤ 1.15	≤ 1.20	100	1
R414 703 000		3	± 0.30	± 0.50	± 0.70	≤ 1.12	≤ 1.15	≤ 1.20	100	1
R414 704 000		4	± 0.30	± 0.50	± 0.70	≤ 1.12	≤ 1.15	≤ 1.20	100	1
R414 705 000		5	± 0.30	± 0.50	± 0.70	≤ 1.12	≤ 1.15	≤ 1.20	100	1
R414 706 000		6	± 0.30	± 0.50	± 0.70	≤ 1.12	≤ 1.15	≤ 1.20	100	1
R414 707 000		7	± 0.30	± 0.50	± 0.70	≤ 1.12	≤ 1.15	≤ 1.20	100	1
R414 708 000		8	± 0.30	± 0.50	± 0.70	≤ 1.12	≤ 1.15	≤ 1.20	100	1
R414 709 000		9	± 0.30	± 0.50	± 0.70	≤ 1.12	≤ 1.15	≤ 1.20	100	1
R414 710 000		10	± 0.30	± 0.50	± 0.70	≤ 1.12	≤ 1.15	≤ 1.20	100	1
R414 711 000		11	± 0.30	± 0.50	± 0.70	≤ 1.12	≤ 1.15	≤ 1.20	100	1
R414 712 000		12	± 0.30	± 0.50	± 0.70	≤ 1.12	≤ 1.15	≤ 1.20	100	1
R414 713 000		13	± 0.30	± 0.50	± 0.70	≤ 1.12	≤ 1.15	≤ 1.20	100	1
R414 714 000		14	± 0.30	± 0.50	± 0.70	≤ 1.12	≤ 1.15	≤ 1.20	100	1
R414 715 000		15	± 0.50	± 0.50	± 0.70	≤ 1.12	≤ 1.15	≤ 1.20	100	1
R414 720 000		20	± 0.50	± 0.50	± 0.70	≤ 1.12	≤ 1.15	≤ 1.20	100	1
R414 725 000		25	± 0.80	± 0.80	± 1.20	≤ 1.12	≤ 1.15	≤ 1.20	100	2
R414 730 000		30	± 0.80	± 0.80	± 1.20	≤ 1.12	≤ 1.15	≤ 1.20	100	2
R414 740 000		40	± 0.80	± 0.80	± 1.30	≤ 1.12	≤ 1.15	≤ 1.20	100	2
R414 750 000		50	± 1.00	± 1.20	± 1.50	≤ 1.12	≤ 1.15	≤ 1.20	100	2
R414 760 000		60	± 1.20	± 1.20	± 1.20	≤ 1.12	≤ 1.15	≤ 1.20	100	2

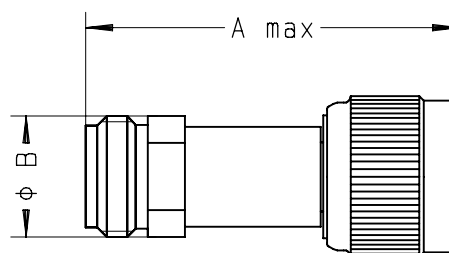
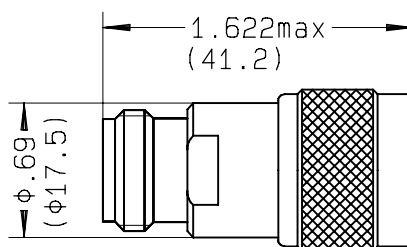


Figure	A inch (mm)	B inch (mm)	Weight (g)
1	1.97" (50)	.62" (15.9)	60
2	2.39" (60.7)		70

2 WATTS, HIGH PERFORMANCE TYPE

Part Number	Frequency range (GHz)	ATTENUATION (dB)		V.S.W.R.				Power (W)	Weight (Max) (g)
		Nom.	DEVIATION						
			DC - 18	DC - 4	4 - 8	8 - 12.4	12.4 - 18	peak	
R414 700 161	DC - 18	0	+ 0.40	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	60
R414 701 161		1	± 0.40	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	60
R414 702 161		2	± 0.40	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	60
R414 703 161		3	± 0.40	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	60
R414 704 161		4	± 0.40	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	60
R414 705 161		5	± 0.40	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	60
R414 706 161		6	± 0.40	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	60
R414 707 161		7	± 0.50	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	60
R414 708 161		8	± 0.50	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	60
R414 709 161		9	± 0.50	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	60
R414 710 161		10	± 0.50	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	60
R414 711 161		11	± 0.50	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	60
R414 712 161		12	± 0.50	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	60
R414 713 161		13	± 0.50	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	60
R414 714 161		14	± 0.50	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	60
R414 715 161		15	± 0.50	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	60
R414 716 161		16	± 0.60	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	60
R414 717 161		17	± 0.60	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	60
R414 718 161		18	± 0.60	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	60
R414 719 161		19	± 0.60	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	60
R414 720 161		20	± 0.60	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	100	60



10 to 15 WATTS MEDIUM POWER

Part Number	Frequency range (GHz)	ATTENUATION (dB)			V.S.W.R.			Power (W)		Fig.
		Nom.	DEVIATION							
			DC - 8	1 - 18	DC - 4	4 - 8	8 - 18	avg.	peak	
R415 703 000	DC - 8	3	± 0.30		≤ 1.15	≤ 1.25		15	250	1
R415 706 000		6	± 0.30		≤ 1.15	≤ 1.25		12	250	1
R415 710 000		10	± 0.30		≤ 1.15	≤ 1.25		10	250	1
R415 720 000		20	± 0.50		≤ 1.15	≤ 1.25		10	250	1
R416 003 000	DC - 18	3	± 0.50		≤ 1.20	≤ 1.30	≤ 1.40	15	250	2
R416 006 000		6	± 0.50		≤ 1.20	≤ 1.30	≤ 1.40	12	250	2
R416 010 000		10	± 0.50		≤ 1.20	≤ 1.30	≤ 1.40	10	250	2
R416 020 000		20	± 0.50		≤ 1.20	≤ 1.30	≤ 1.40	10	250	2

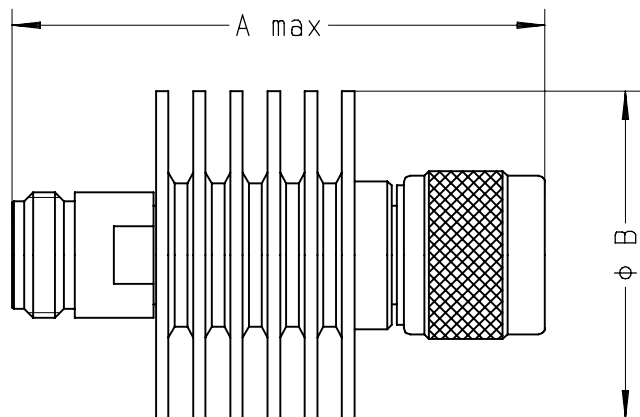
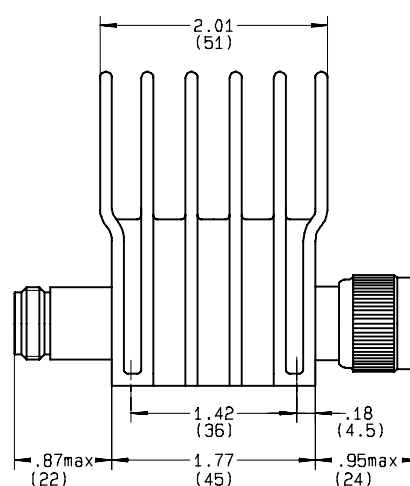
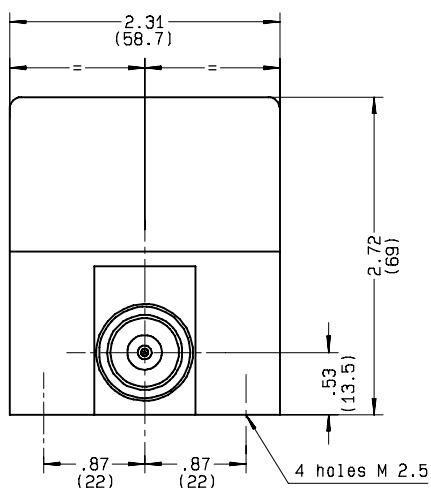


Figure	A inch (mm)	B inch (mm)	Weight (g)
1	1.97" (50)	1.02" (26)	70
2	2.66" (67.5)	1.57" (40)	110

25 WATTS MEDIUM POWER

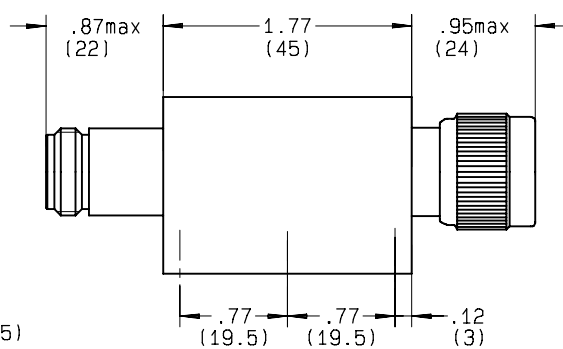
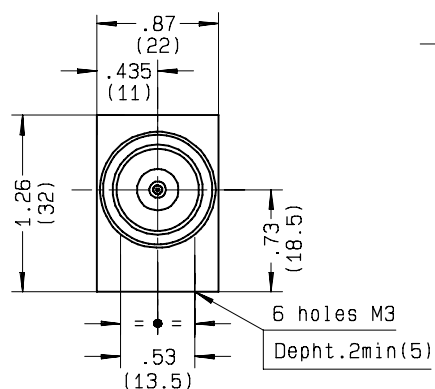
Part Number	Frequency range (GHz)	ATTENUATION (dB)		V.S.W.R.			Power (W)	Weight (Max) (g)
		Nom.	DEVIATION					
			DC - 4	DC - 1	1 - 2	2 - 4	peak	
R417 303 110	DC - 4	3	± 0.60	≤ 1.10	≤ 1.20	≤ 1.35	5000	350
R417 306 110		6	± 0.60	≤ 1.10	≤ 1.20	≤ 1.35	5000	350
R417 310 110		10	± 0.60	≤ 1.10	≤ 1.20	≤ 1.35	5000	350
R417 320 110		20	± 0.80	≤ 1.10	≤ 1.20	≤ 1.35	5000	350
R417 330 110		30	± 0.80	≤ 1.10	≤ 1.20	≤ 1.35	5000	350



30 WATTS MEDIUM POWER

Part Number	Frequency range (GHz)	ATTENUATION (dB)		V.S.W.R.			Power (W)	Weight (Max) (g)
		Nom.	DEVIATION					
			DC - 4	DC - 1	1 - 2	2 - 4	peak	
R417 303 130	DC - 4	3	± 0.60	≤ 1.10	≤ 1.20	≤ 1.35	5000	150
R417 306 130		6	± 0.60	≤ 1.10	≤ 1.20	≤ 1.35	5000	150
R417 310 130		10	± 0.60	≤ 1.10	≤ 1.20	≤ 1.35	5000	150
R417 320 130		20	± 0.80	≤ 1.10	≤ 1.20	≤ 1.35	5000	150
R417 330 130		30	± 0.80	≤ 1.10	≤ 1.20	≤ 1.35	5000	150

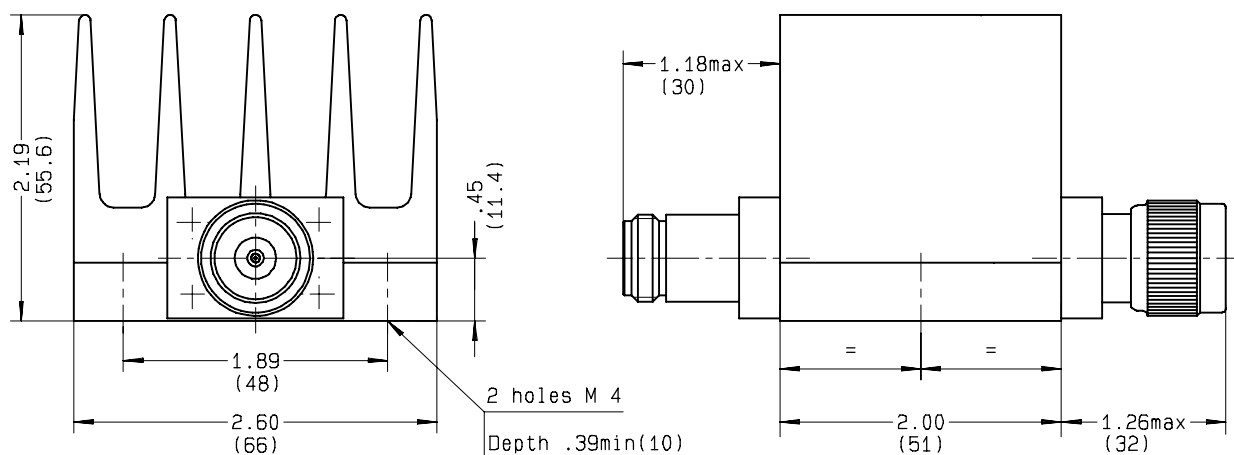
NOTA : These attenuators must be used with conduction cooling, a 78 sq. in. plate *1/8" (500 cm²* 3mm) min. is required.



50 WATTS MEDIUM POWER

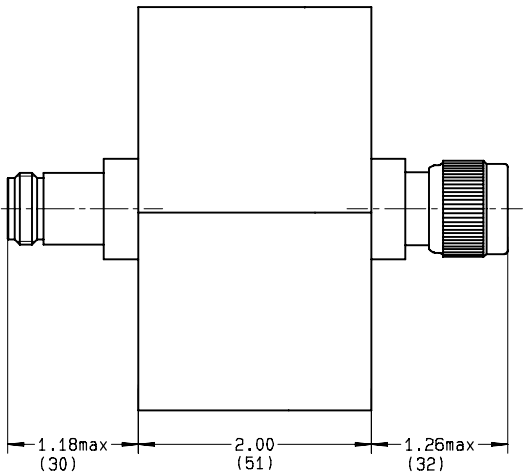
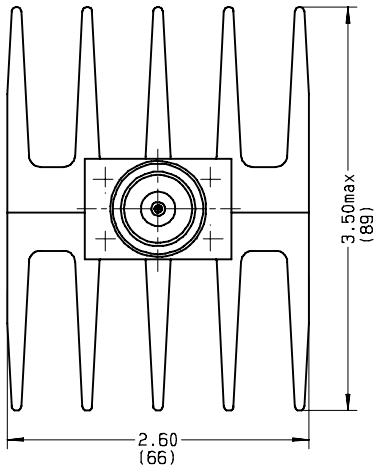
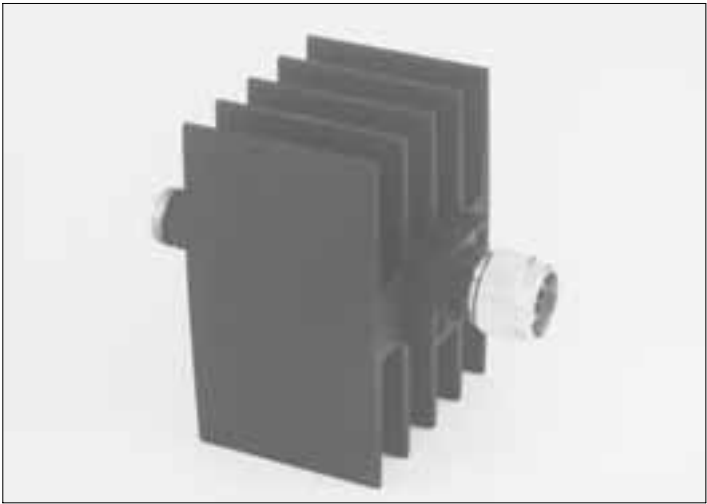
Part Number	Frequency range (GHz)	ATTENUATION (dB)		V.S.W.R.			Power (W) peak	Weight (Max) (g)
		Nom.	DEVIATION DC - 3					
R417 003 120	DC - 3	3	± 0.70	≤ 1.10	≤ 1.25	≤ 1.35	5000	350
R417 006 120		6	± 0.70	≤ 1.10	≤ 1.25	≤ 1.35	5000	350
R417 010 120		10	± 0.70	≤ 1.10	≤ 1.25	≤ 1.35	5000	350
R417 020 120		20	± 2.00	≤ 1.10	≤ 1.25	≤ 1.35	5000	350
R417 030 120		30	± 2.00	≤ 1.10	≤ 1.25	≤ 1.35	5000	350

NOTA : These attenuators can be used with conduction cooling (50 Watts) or convection cooling (40 Watts)
For conduction cooling a 78 sq. in. plate *1/8" (500 cm² * 3mm) min. is required.



50 WATTS MEDIUM POWER

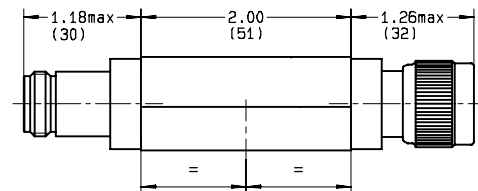
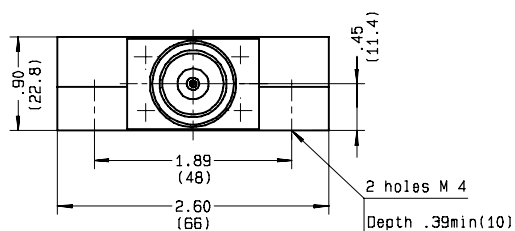
Part Number	Frequency range (GHz)	ATTENUATION (dB)		V.S.W.R.			Power (W)	Weight (Max) (g)
		Nom.	DEVIATION					
			DC - 3	DC - 1	1 - 2	2 - 3	peak	
R417 003 110	DC - 3	3	± 0.70	≤ 1.10	≤ 1.25	≤ 1.35	5000	430
R417 006 110		6	± 0.70	≤ 1.10	≤ 1.25	≤ 1.35	5000	430
R417 010 110		10	± 0.70	≤ 1.10	≤ 1.25	≤ 1.35	5000	430
R417 020 110		20	± 2.00	≤ 1.10	≤ 1.25	≤ 1.35	5000	430
R417 030 110		30	± 2.00	≤ 1.10	≤ 1.25	≤ 1.35	5000	430



50 WATTS MEDIUM POWER

Part Number	Frequency range (GHz)	ATTENUATION (dB)		V.S.W.R.			Power (W)	Weight (Max) (g)
		Nom.	DEVIATION	DC - 1	1 - 2	2 - 3		
R417 003 130	DC - 3	3	± 0.70	≤ 1.10	≤ 1.25	≤ 1.35	5000	280
R417 006 130		6	± 0.70	≤ 1.10	≤ 1.25	≤ 1.35	5000	280
R417 010 130		10	± 0.70	≤ 1.10	≤ 1.25	≤ 1.35	5000	280
R417 020 130		20	± 2.00	≤ 1.10	≤ 1.25	≤ 1.35	5000	280
R417 030 130		30	± 2.00	≤ 1.10	≤ 1.25	≤ 1.35	5000	280

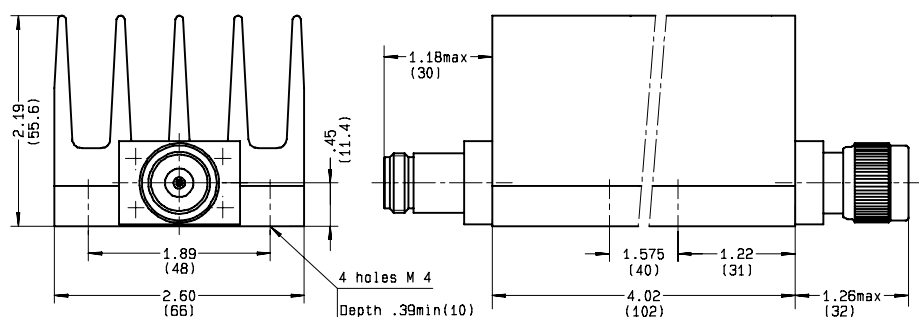
NOTA : These attenuators must be used with conduction cooling, a 78 sq. in. plate *1/8" (500 cm²* 3mm) min. is required.



80 - 100 WATTS HIGH POWER

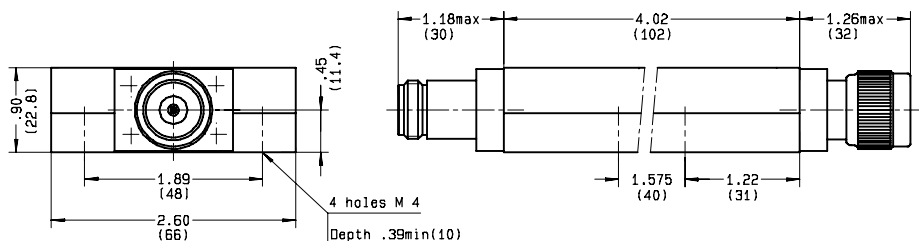
Part Number	Frequency range (GHz)	ATTENUATION (dB)		V.S.W.R.		Power (W)		Weight (Max) (g)
		Nominal	DEVIATION			avg.	peak	
R417 703 128	DC - 2	3	± 1.00	≤ 1.10	≤ 1.25	100	5000	650
R417 706 128		6	± 1.00	≤ 1.10	≤ 1.25	100	5000	650
R417 710 128		10	± 1.00	≤ 1.10	≤ 1.25	80	5000	650
R417 720 128		20	± 1.00	≤ 1.10	≤ 1.25	80	5000	650

NOTA : These attenuators can be used with conduction cooling (100 and 80 Watts) or convection cooling (80 and 50 Watts)
For conduction cooling a 156 sq. in. plate *1/8" (1000 cm² * 3mm) min. is required.



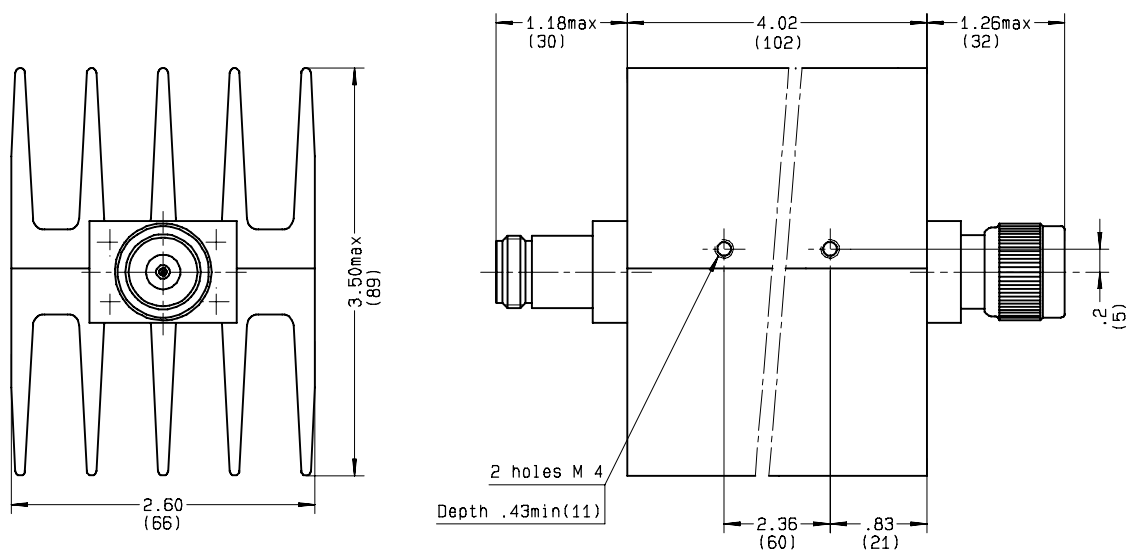
Part Number	Frequency range (GHz)	ATTENUATION (dB)		V.S.W.R.		Power (W)		Weight (Max) (g)
		Nominal	DEVIATION			avg.	peak	
R417 703 138	DC - 2	3	± 1.00	≤ 1.10	≤ 1.25	100	5000	580
R417 706 138		6	± 1.00	≤ 1.10	≤ 1.25	100	5000	580
R417 710 138		10	± 1.00	≤ 1.10	≤ 1.25	80	5000	580
R417 720 138		20	± 1.00	≤ 1.10	≤ 1.25	80	5000	580

NOTA : These attenuators must be used with conduction cooling, a 156 sq. in. plate *1/8" (1000 cm² * 3mm) min. is required.



80 - 100 WATTS HIGH POWER

Part Number	Frequency range (GHz)	ATTENUATION (dB)		V.S.W.R.		Power (W)		Weight (Max) (g)
		Nominal	DEVIATION DC - 2	DC - 1	1 - 2	avg.	peak	
R417 703 118	DC - 2	3	± 1.00	≤ 1.10	≤ 1.25	100	5000	1050
R417 706 118		6	± 1.00	≤ 1.10	≤ 1.25	100	5000	1050
R417 710 118		10	± 1.00	≤ 1.10	≤ 1.25	80	5000	1050
R417 720 118		20	± 1.00	≤ 1.10	≤ 1.25	80	5000	1050



1 WATT CALIBRATED ATTENUATOR SET

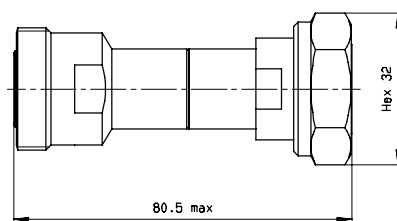
Part Number	Frequency range (GHz)	ATTENUATION (dB)		V.S.W.R.				Power (W)	Weight (Max) (g)
		Nominal	Deviation	DC - 4	4 - 8	8 - 12.4	12.4 - 18	peak	
R414 799 127	DC - 18	3	± 0.40	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	50	60
		6	± 0.40	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	50	60
		10	± 0.50	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	50	60
		20	± 0.60	≤ 1.15	≤ 1.20	≤ 1.25	≤ 1.35	50	60

NOTA : Within the box, a certificat of calibration provide both attenuation and V.S.W.R. values from DC to 18 GHz with a 1 GHz step.



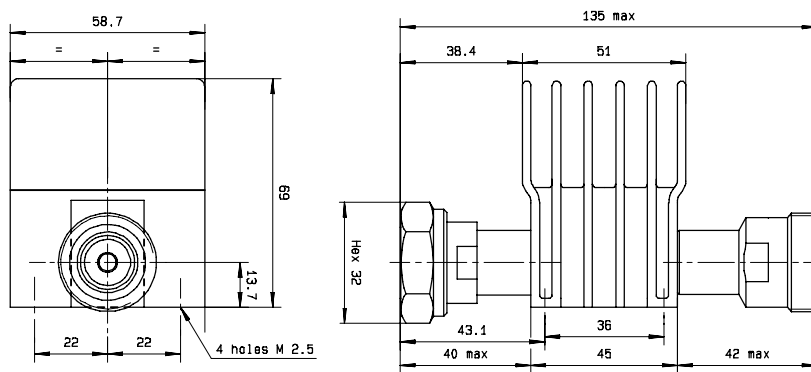
1 WATT

Part Number	Frequency range (GHz)	ATTENUATION (dB)			V.S.W.R.		Power (W)	Weight (g)
		Nominal	DEVIATION					
			DC - 2	2 - 3	DC - 2	2 - 3	peak	
R412 803 000	DC - 3	3	± 0.30	± 0.50	≤ 1.20	≤ 1.30	100	205
R412 806 000		6	± 0.30	± 0.50	≤ 1.20	≤ 1.30	100	205
R412 810 000		10	± 0.50	± 0.50	≤ 1.20	≤ 1.30	100	205
R412 820 000		20	± 0.50	± 0.50	≤ 1.20	≤ 1.30	100	205



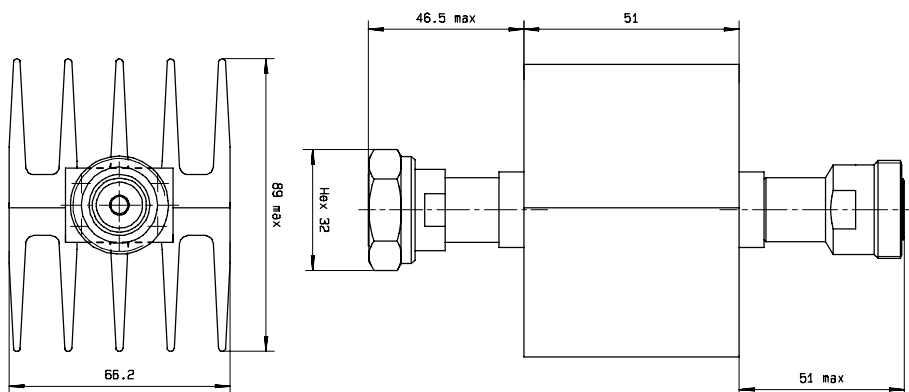
25 WATTS

Part Number	Frequency range (GHz)	ATTENUATION (dB)		V.S.W.R.			Power (W)	Weight (g)
		Nominal	DEVIATION					
			DC - 4	DC - 1	1 - 2	2 - 4	peak	
R420 303 110	DC - 4	3	± 0.60	≤ 1.10	≤ 1.20	≤ 1.35	5000	480
R420 306 110		6	± 0.60	≤ 1.10	≤ 1.20	≤ 1.35	5000	480
R420 310 110		10	± 0.60	≤ 1.10	≤ 1.20	≤ 1.35	5000	480
R420 320 110		20	± 0.80	≤ 1.10	≤ 1.20	≤ 1.35	5000	480



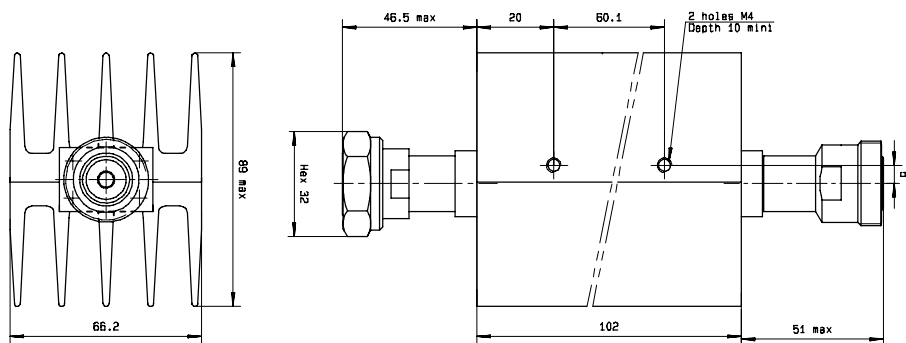
50 WATTS

Part Number	Frequency range (GHz)	ATTENUATION (dB)			V.S.W.R.			Power (W)	Weight (g)
		Nominal	DEVIATION						
			DC - 2	2 - 3	DC - 1	1 - 2	2 - 3	peak	
R420 003 110	DC - 3	3	± 0.70	± 0.70	≤ 1.10	≤ 1.25	≤ 1.35	5000	560
R420 006 110		6	± 0.60	± 0.70	≤ 1.10	≤ 1.25	≤ 1.35	5000	560
R420 010 110		10	± 0.60	± 0.70	≤ 1.10	≤ 1.25	≤ 1.35	5000	560
R420 020 110		20	± 1.0	± 2.0	≤ 1.10	≤ 1.25	≤ 1.35	5000	560



100 WATTS

Part Number	Frequency range (GHz)	ATTENUATION (dB)			V.S.W.R.			Power (W)	Weight (g)
		Nominal	DEVIATION						
				DC - 2	2 - 3	DC - 1	1 - 2	2 - 3	
R420 703 110	DC - 3	3	± 1.0	± 1.0	≤ 1.10	≤ 1.25	≤ 1.30	5000	870
R420 706 110		6	± 1.0	± 1.0	≤ 1.10	≤ 1.25	≤ 1.30	5000	870
R420 710 110		10	± 1.0	± 1.0	≤ 1.10	≤ 1.25	≤ 1.30	5000	870
R420 720 110		20	± 1.0	± 1.5	≤ 1.10	≤ 1.25	≤ 1.30	5000	870





RADIALL high Reliability SPACE QUALIFIED attenuators have been designed and are built to satisfy the stringent demands of space environment via intensive manufacturing and quality procedures, such as European Space Agency ESA / SCC.





1 - 2 WATTS DC - 22 GHz range :

This range of attenuators can be delivered :

- 1) ESA qualified products (ESA certificate N° 178). They can be supplied to different levels of tracability (B or C) and Lot Acceptance Tests (LAT 1, 2 or 3) according to ESA generic specification ESCC3403 and detail specification ESCC3403005.

Cross references RADIALl / ESA

RADIALl P/N	ESCC P/N LEVEL B	Attenuation value (dB)
R413 600 000	340300501B	0
R413 601 000	340300502B	0,5
R413 602 000	340300503B	1
R413 603 000	340300504B	1,5
R413 604 000	340300505B	2
R413 605 000	340300506B	2,5
R413 606 000	340300507B	3
R413 607 000	340300508B	3,5
R413 608 000	340300509B	4
R413 609 000	340300510B	4,5
R413 610 000	340300511B	5
R413 611 000	340300512B	5,5
R413 612 000	340300513B	6
R413 613 000	340300514B	6,5
R413 614 000	340300515B	7
R413 615 000	340300516B	7,5
R413 616 000	340300517B	8
R413 617 000	340300518B	8,5
R413 618 000	340300519B	9
R413 619 000	340300520B	9,5
R413 620 000	340300521B	10
R413 622 000	340300522B	11
R413 624 000	340300523B	12
R413 626 000	340300524B	13
R413 628 000	340300525B	14
R413 630 000	340300526B	15
R413 632 000	340300527B	16
R413 640 000	340300528B	17
R413 636 000	340300529B	18
R413 638 000	340300530B	19
R413 640 000	340300531B	20

RADIALl P/N	ESCC P/N LEVEL C	Attenuation value (dB)
R413 600 650	340300501C	0
R413 601 650	340300502C	0,5
R413 602 650	340300503C	1
R413 603 650	340300504C	1,5
R413 604 650	340300505C	2
R413 605 650	340300506C	2,5
R413 606 650	340300507C	3
R413 607 650	340300508C	3,5
R413 608 650	340300509C	4
R413 609 650	340300510C	4,5
R413 610 650	340300511C	5
R413 611 650	340300512C	5,5
R413 612 650	340300513C	6
R413 613 650	340300514C	6,5
R413 614 650	340300515C	7
R413 615 650	340300516C	7,5
R413 616 650	340300517C	8
R413 617 650	340300518C	8,5
R413 618 650	340300519C	9
R413 619 650	340300520C	9,5
R413 620 650	340300521C	10
R413 622 650	340300522C	11
R413 624 650	340300523C	12
R413 626 650	340300524C	13
R413 628 650	340300525C	14
R413 630 650	340300526C	15
R413 632 650	340300527C	16
R413 634 650	340300528C	17
R413 636 650	340300529C	18
R413 638 650	340300530C	19
R413 640 650	340300531C	20



2) RADIAL qualified products as High Reliability products according to RADIAL specification RAD-GEN-ATCH-001.

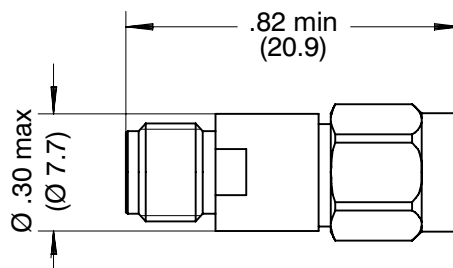
RADIAL P/N	RADIAL Specification	Attenuation value (dB)
R413 800 650	RAD-GEN-ATCH-001	0
R413 801 650	RAD-GEN-ATCH-001	0,5
R413 802 650	RAD-GEN-ATCH-001	1
R413 803 650	RAD-GEN-ATCH-001	1,5
R413 804 650	RAD-GEN-ATCH-001	2
R413 805 650	RAD-GEN-ATCH-001	2,5
R413 806 650	RAD-GEN-ATCH-001	3
R413 807 650	RAD-GEN-ATCH-001	3,5
R413 808 650	RAD-GEN-ATCH-001	4
R413 809 650	RAD-GEN-ATCH-001	4,5
R413 810 650	RAD-GEN-ATCH-001	5
R413 811 650	RAD-GEN-ATCH-001	5,5
R413 812 650	RAD-GEN-ATCH-001	6
R413 813 650	RAD-GEN-ATCH-001	6,5
R413 814 650	RAD-GEN-ATCH-001	7

RADIAL P/N	RADIAL Specification	Attenuation value (dB)
R413 815 650	RAD-GEN-ATCH-001	7,5
R413 816 650	RAD-GEN-ATCH-001	8
R413 817 650	RAD-GEN-ATCH-001	8,5
R413 818 650	RAD-GEN-ATCH-001	9
R413 819 650	RAD-GEN-ATCH-001	9,5
R413 820 650	RAD-GEN-ATCH-001	10
R413 822 650	RAD-GEN-ATCH-001	11
R413 824 650	RAD-GEN-ATCH-001	12
R413 826 650	RAD-GEN-ATCH-001	13
R413 828 650	RAD-GEN-ATCH-001	14
R413 830 650	RAD-GEN-ATCH-001	15
R413 832 650	RAD-GEN-ATCH-001	16
R413 834 650	RAD-GEN-ATCH-001	17
R413 836 650	RAD-GEN-ATCH-001	18
R413 838 650	RAD-GEN-ATCH-001	19
R413 840 650	RAD-GEN-ATCH-001	20

Microwave performances :

Same for all DC-22 GHz attenuators

Nominal Attenuation	Power (W)	Attenuation (dB)			VSWR max				
		DC	DC-18 GHz	18-22 GHz	DC-4GHz	4-8 GHz	8-12.4 GHz	12,4-18 GHz	18-22 GHz
0 to 6.5 dB / 0.5 dB step	2	+/- 0.15	+/- 0.30	+/- 0.40	1.15	1.20	1.25	1.35	1.50
7 to 10 dB / 0.5 dB step	2	+/- 0.20	+/- 0.40	+/- 0.50	1.15	1.20	1.25	1.35	1.50
11 to 14 / 1 dB step	1	+/- 0.20	+/- 0.40	+/- 0.50	1.15	1.20	1.25	1.35	1.50
15 to 20 dB / 1 dB step	1	+/-0.30	+/- 0.50	+/- 0.60	1.15	1.20	1.25	1.35	1.50



Weight : 5 g max.



1 WATT, DC - 40 GHz range :

This range of attenuators can be delivered :

- 1) ESA specification. They can be supplied with 3 levels of Lot Acceptance Tests (LAT 1, 2 or 3) according to ESA generic specification ESCC3403 and detail specification ESCC3403008.

Cross references RADIALL / ESA

RADIALL P/N	ESCC P/N LEVEL B	Attenuation value (dB)
R413 300 000	3403000801B	0
R413 301 000	3403000802B	0,5
R413 302 000	3403000803B	1
R413 303 000	3403000804B	1,5
R413 304 000	3403000805B	2
R413 305 000	3403000806B	2,5
R413 306 000	3403000807B	3
R413 307 000	3403000808B	3,5
R413 308 000	3403000809B	4
R413 309 000	3403000810B	4,5
R413 310 000	3403000811B	5

RADIALL P/N	ESCC P/N LEVEL B	Attenuation value (dB)
R413 311 600	3403000812B	5,5
R413 312 600	3403000812B	6
R413 313 600	3403000812B	6,5
R413 314 600	3403000812B	7
R413 315 600	3403000812B	7,5
R413 316 600	3403000812B	8
R413 317 600	3403000812B	8,5
R413 318 600	3403000812B	9
R413 319 600	3403000812B	9,5
R413 320 600	3403000812B	10

- 2) RADIALL qualified products as High Reliability products according to RADIALL specification RAD-GEN-ATCH-001

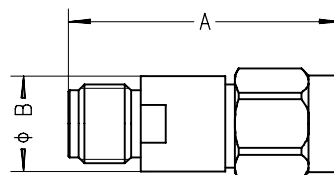
RADIALL P/N	RADIALL Specification	Attenuation value (dB)
R413 300 650	RAD-GEN-ATCH-001	0
R413 301 650	RAD-GEN-ATCH-001	0,5
R413 302 650	RAD-GEN-ATCH-001	1
R413 303 650	RAD-GEN-ATCH-001	1,5
R413 304 650	RAD-GEN-ATCH-001	2
R413 305 650	RAD-GEN-ATCH-001	2,5
R413 306 650	RAD-GEN-ATCH-001	3
R413 307 650	RAD-GEN-ATCH-001	3,5
R413 308 650	RAD-GEN-ATCH-001	4
R413 309 650	RAD-GEN-ATCH-001	4,5
R413 310 650	RAD-GEN-ATCH-001	5

RADIALL P/N	RADIALL Specification	Attenuation value (dB)
R413 311 650	RAD-GEN-ATCH-001	5.5
R413 312 650	RAD-GEN-ATCH-001	6
R413 313 650	RAD-GEN-ATCH-001	6.5
R413 314 650	RAD-GEN-ATCH-001	7
R413 315 650	RAD-GEN-ATCH-001	7.5
R413 316 650	RAD-GEN-ATCH-001	8
R413 317 650	RAD-GEN-ATCH-001	8.5
R413 318 650	RAD-GEN-ATCH-001	9
R413 319 650	RAD-GEN-ATCH-001	9.5
R413 320 650	RAD-GEN-ATCH-001	10

Microwave performances :

Same for all DC-40 GHz attenuators

Nominal Attenuation	Attenuation (dB)		VSWR max	
	DC-17.5 GHz	17.5-31.5 GHz	DC-17.5 GHz	17.5-31.5 GHz
0 to 10 dB / 0.5 dB step	+/- 0.80	+/- 0.50	1.50	1.50



A inch (mm)	B inch (mm)	Weight (g)
1.02" (25.9)	.28" (7.1)	7

PREFERRED PRODUCTS LIST MICROWAVE COMPONENTS :

Förderverein Für Elektrotechnische Normung eV
Cenelec Electronic Components Committee
Military Usage And Harmonisation
Advisory Group

CECC
MUAHAG

LISTE PREFERENTIELLE
DE
COMPOSANTS
ELECTRONIQUES

COMPOSANTS

TOME
VOLUME 12
BAND

Fixed attenuators (coaxial) - 2x50 Ω

Specification	Ident./ Generic Style	Manufacturer		Cat/ Qual	Characteristics				Connector	Climate Category	Observations				
		Country/Code	Part. No.		F (GHz)	P (W)		Att. (dB)							
						C.M.	Peak								
MICROWAVE		FR/RAY	R41440X	0/WO	0-8	2-3		5-6-10-20-30-40	BNC m/f	55/125/23					
			R41450X	0/WO	0-12,4	1,3		5-6-10-20	TNC m/f	55/125/23					
			R41470X	0/WO	0-12,4	2-3		5-6-10-20-30-40	B m/f	55/125/23					
			R41440X	0/WO	0-2	2-3		5-6-10-20-30-40	BNC m/f	55/125/23					
			R41270X	0/WO	0-2	2-3		5-6-10-20-30	B m/f	55/125/23					
			R41100X119	0/WO	0-8	2-3,5		5-6-10-20	DNA m/f	55/125/23					
			R41100X	0/WO	0-15	2-3,5		5-6-10-20	DNA m/f	55/125/23					
			R41100X121	0/WO	0-10	2-3,5		5-6-10-20	DNA m/f	55/125/23					
			R41300X	0/WO	0-10	2		0...20	DNA m/f	55/125/23					
			R41300X121	0/WO	0-20,5	2		5-6-10-20	B m/f	55/125/23					
			R41470X161	0/WO	0-10	2		5-6-10-20	TNC m/f	55/125/23					
			R41450X161	0/WO	0-10	2		5-6-10-20	DNA m/f	55/125/23					
			R41500X	0/WO	0-8	10-15		5-6-10-20	TNC m/f	55/125/23					
			R41600X	0/WO	0-10	10-15		5-6-10-20	B m/f	55/125/23					
		FR/RAY	R418035	0/WO	0-4			0-5	B m/f	55/125	5dB steps				
			R418040	0/WO	0-4			0-25	B m/f	55/125	5dB steps				
			R418045	0/WO	0-4			0-50	B m/f	55/125	10dB steps				
			R418050	0/WO	0-12,4			0-5	B m/f	55/125	5dB steps				
			R418055	0/WO	0-12,4			0-25	B m/f	55/125	5dB steps				
			R418050	0/WO	0-12,4			0-50	B m/f	55/125	10dB steps				
			R419133	0/WO	2-12,4			0-20	DNA f	55/125	const induct				
			R419157	0/WO	2-12,4			0-40	B f	55/125	const induct				
			R419213	0/WO	7-10			0-20	DNA f	55/125	const induct				

MANUFACTURERS CODE NUMBERS

RADIALL, manufacturer code **F0503** and **F6507**, is a military qualified supplier of attenuators, as well as other microwave components, to various governmental agencies. RADIALL Quality Assurance is fully approved by NATO (AQAP4). The following is a partial listing of national stock numbers which RADIALL has provided to the French Ministry of Defence.

PART NUMBER	NATO CODE	PART NUMBER	NATO CODE	PART NUMBER	NATO CODE
R410 206 121	6625 14 362 7995	R411 808 121	5985 14 430 3219	R413 806 000	5905 14 331 9514
R410 210 121	5985 14 352 5879	R411 809 121	5985 14 430 3228	R413 810 000	5905 14 313 1341
R411 801 000	5985 14 358 7807	R411 810 000	5985 14 359 7617	R413 820 000	5905 14 313 1340
R411 801 121	5985 14 430 3220	R411 810 119	5985 14 402 9686	R414 420 000	5905 14 349 4471
R411 802 121	5985 14 430 3221	R411 820 119	5985 14 393 0810	R414 510 000	5905 14 294 1008
R411 803 000	5985 14 358 7809	R411 840 000	5985 14 397 9952	R414 520 000	5905 14 294 1009
R411 803 119	5905 14 448 7459	R412 403 000	6625 14 355 5454	R414 703 000	5905 14 296 7618
R411 803 121	5985 14 411 9628	R412 406 000	5905 14 342 1905	R414 705 000	5905 14 426 0687
R411 805 000	5985 14 397 2651	R412 410 000	5905 14 352 2604	R414 706 000	5905 14 300 2506
R411 805 121	5985 14 412 7040	R412 703 000	5905 14 356 2486	R414 710 000	5905 14 293 2779
R411 806 000	5985 14 369 5745	R412 706 000	5905 14 356 2487	R414 720 000	5905 14 290 5672
R411 806 119	5985 14 412 7044	R412 710 000	5905 14 334 7742	R414 730 000	5905 14 302 6074
R411 807 000	5985 14 452 1930	R412 720 000	5905 14 356 2488	R414 740 000	5905 14 300 2507
R411 807 121	5985 14 430 3222	R413 803 000	5905 14 341 4222	R418 045 000	5905 14 308 2807

CUSTOMS ATTENUATORS

Contact RADIALL for your specific requirements.



This 1 dB 75 Ohms coaxial attenuator was developed with IEC 169-2 male connector. It is suited for Telecom network applications up to 1 GHz.



This ultra miniature 12 Watts panel mounting 3 dB attenuator is designed for use in a classified military airborne ECM system.



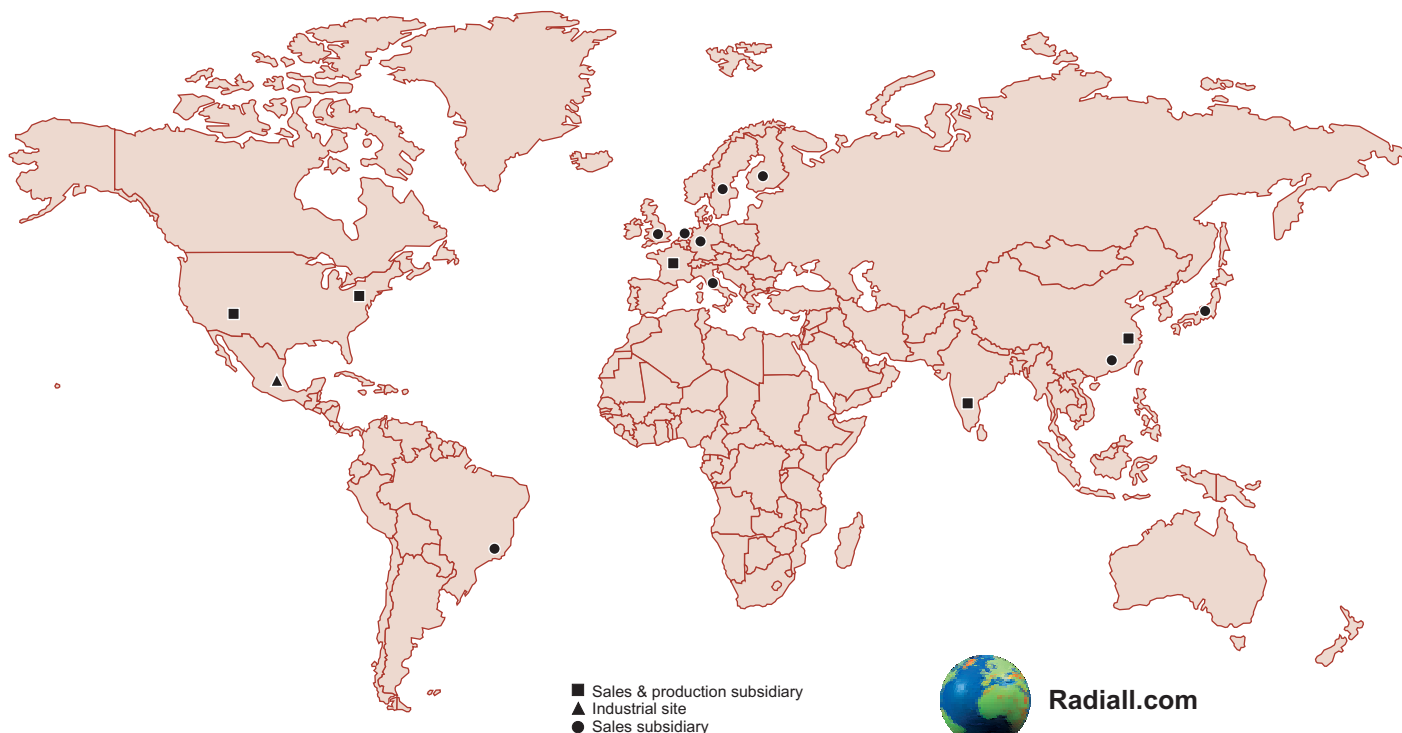
This 6 dB up to 1.5 GHz panel mounting attenuator is designed for use in a measuring instrument.

Part Numbers	Avg. Power(W)	Connect.	Page	Part Numbers	Avg. Power(W)	Connect.	Page	Part Numbers	Avg. Power(W)	Connect.	Page
R410 103 121	2	SMC	27	R411 802 121	2	SMA	15-62	R412 403 000	2	BNC	29-62
R410 106 121	2	SMC	27	R411 802 124	1	SMA	13	R412 403 124	1	BNC	28
R410 110 121	2	SMC	27	R411 803 000	2	SMA	62	R412 404 000	2	BNC	29
R410 120 121	2	SMC	27	R411 803 119	2	SMA	62	R412 404 124	1	BNC	28
R410 203 121	2	SMB	27	R411 803 121	2	SMA	15-62	R412 405 000	2	BNC	29
R410 206 121	2	SMB	27-62	R411 803 124	1	SMA	13	R412 405 124	1	BNC	28
R410 210 121	2	SMB	27-62	R411 804 121	2	SMA	15	R412 406 000	2	BNC	29-62
R410 220 121	2	SMB	27	R411 804 124	1	SMA	13	R412 406 124	1	BNC	28
R411 300 124	1	QN	42	R411 805 000	2	SMA	62	R412 407 000	2	BNC	29
R411 301 124	1	QN	42	R411 805 121	2	SMA	15-62	R412 407 124	1	BNC	28
R411 302 124	1	QN	42	R411 805 124	1	SMA	13	R412 408 000	2	BNC	29
R411 303 124	1	QN	42	R411 806 000	2	SMA	62	R412 408 124	1	BNC	28
R411 304 124	1	QN	42	R411 806 119	2	SMA	62	R412 409 000	2	BNC	29
R411 305 124	1	QN	42	R411 806 121	2	SMA	15	R412 409 124	1	BNC	28
R411 306 124	1	QN	42	R411 806 124	1	SMA	13	R412 410 000	2	BNC	29-62
R411 307 124	1	QN	42	R411 807 000	2	SMA	62	R412 410 124	1	BNC	28
R411 308 124	1	QN	42	R411 807 121	2	SMA	15-62	R412 411 000	2	BNC	29
R411 309 124	1	QN	42	R411 807 124	1	SMA	13	R412 411 124	1	BNC	28
R411 310 124	1	QN	42	R411 808 121	2	SMA	15-62	R412 412 000	2	BNC	29
R411 311 124	1	QN	42	R411 808 124	1	SMA	13	R412 412 124	1	BNC	28
R411 312 124	1	QN	42	R411 809 121	2	SMA	15-62	R412 413 000	2	BNC	29
R411 313 124	1	QN	42	R411 809 124	1	SMA	13	R412 413 124	1	BNC	28
R411 314 124	1	QN	42	R411 810 000	2	SMA	62	R412 414 000	2	BNC	29
R411 315 124	1	QN	42	R411 810 119	2	SMA	62	R412 414 124	1	BNC	28
R411 316 124	1	QN	42	R411 810 121	2	SMA	15	R412 415 000	2	BNC	29
R411 317 124	1	QN	42	R411 810 124	1	SMA	13	R412 415 124	1	BNC	28
R411 318 124	1	QN	42	R411 811 121	2	SMA	15	R412 416 000	2	BNC	29
R411 319 124	1	QN	42	R411 811 124	1	SMA	13	R412 416 124	1	BNC	28
R411 320 124	1	QN	42	R411 812 121	2	SMA	15	R412 417 000	2	BNC	29
R411 700 124	1	QMA	12	R411 812 124	1	SMA	13	R412 417 124	1	BNC	28
R411 701 124	1	QMA	12	R411 813 121	2	SMA	15	R412 418 000	2	BNC	29
R411 702 124	1	QMA	12	R411 813 124	1	SMA	13	R412 418 124	1	BNC	28
R411 703 124	1	QMA	12	R411 814 121	2	SMA	15	R412 419 000	2	BNC	29
R411 704 124	1	QMA	12	R411 814 124	1	SMA	13	R412 419 124	1	BNC	28
R411 705 124	1	QMA	12	R411 815 121	2	SMA	15	R412 420 000	2	BNC	29
R411 706 124	1	QMA	12	R411 815 124	1	SMA	13	R412 420 124	1	BNC	28
R411 707 124	1	QMA	12	R411 816 121	2	SMA	15	R412 430 000	2	BNC	29
R411 708 124	1	QMA	12	R411 816 124	1	SMA	13	R412 440 000	2	BNC	29
R411 709 124	1	QMA	12	R411 817 121	2	SMA	15	R412 450 000	2	BNC	29
R411 710 124	1	QMA	12	R411 817 124	1	SMA	13	R412 500 000	2	TNC	32
R411 711 124	1	QMA	12	R411 818 121	2	SMA	15	R412 500 124	1	TNC	31
R411 712 124	1	QMA	12	R411 818 124	1	SMA	13	R412 501 000	2	TNC	32
R411 713 124	1	QMA	12	R411 819 121	2	SMA	15	R412 501 124	1	TNC	31
R411 714 124	1	QMA	12	R411 819 124	1	SMA	13	R412 502 000	2	TNC	32
R411 715 124	1	QMA	12	R411 820 119	2	SMA	62	R412 502 124	1	TNC	31
R411 716 124	1	QMA	12	R411 820 121	2	SMA	15	R412 503 000	2	TNC	32
R411 717 124	1	QMA	12	R411 820 124	1	SMA	13	R412 503 124	1	TNC	31
R411 718 124	1	QMA	12	R411 830 121	2	SMA	15	R412 504 000	2	TNC	32
R411 719 124	1	QMA	12	R411 840 000	2	SMA	62	R412 504 124	1	TNC	31
R411 720 124	1	QMA	12					R412 505 000	2	TNC	32
R411 800 121	2	SMA	15	R412 400 000	2	BNC	29	R412 505 124	1	TNC	31
R411 800 124	1	SMA	13	R412 400 124	1	BNC	28	R412 506 000	2	TNC	32
R411 801 000	2	SMA	62	R412 401 000	2	BNC	29	R412 506 124	1	TNC	31
R411 801 121	2	SMA	15-62	R412 401 124	1	BNC	28	R412 507 000	2	TNC	32
R411 801 124	1	SMA	13	R412 402 000	2	BNC	29	R412 507 124	1	TNC	31
				R412 402 124	1	BNC	28	R412 508 000	2	TNC	32

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R412 508 124	1	TNC	31	R412 719 124	1	N	43	R413 812 000	2	SMA	16
R412 509 000	2	TNC	32	R412 720 000	2	N	44-62	R413 812 115	2	SMA	14
R412 509 124	1	TNC	31	R412 720 124	1	N	43	R413 812 121	2	SMA	17
R412 510 000	2	TNC	32	R412 730 000	2	N	44	R413 813 000	2	SMA	16
R412 510 124	1	TNC	31	R412 740 000	2	N	44	R413 813 115	2	SMA	14
R412 511 000	2	TNC	32	R412 750 000	2	N	44	R413 813 121	2	SMA	17
R412 511 124	1	TNC	31	R412 803 000	1	7/16	56	R413 814 000	2	SMA	16
R412 512 000	2	TNC	32	R412 806 000	1	7/16	56	R413 814 115	2	SMA	14
R412 512 124	1	TNC	31	R412 810 000	1	7/16	56	R413 814 121	2	SMA	17
R412 513 000	2	TNC	32	R412 820 000	1	7/16	56	R413 815 000	2	SMA	16
R412 513 124	1	TNC	31					R413 815 115	2	SMA	14
R412 514 000	2	TNC	32	R413 301 000	2	SMA 2.9	18	R413 815 121	2	SMA	17
R412 514 124	1	TNC	31	R413 302 000	2	SMA 2.9	18	R413 816 000	2	SMA	16
R412 515 000	2	TNC	32	R413 303 000	2	SMA 2.9	18	R413 816 115	2	SMA	14
R412 515 124	1	TNC	31	R413 304 000	2	SMA 2.9	18	R413 816 121	2	SMA	17
R412 516 124	1	TNC	31	R413 305 000	2	SMA 2.9	18	R413 817 000	2	SMA	16
R412 517 124	1	TNC	31	R413 306 000	2	SMA 2.9	18	R413 817 115	2	SMA	14
R412 518 124	1	TNC	31	R413 307 000	2	SMA 2.9	18	R413 817 121	2	SMA	17
R412 519 124	1	TNC	31	R413 308 000	2	SMA 2.9	18	R413 818 000	2	SMA	16
R412 520 000	2	TNC	32	R413 309 000	2	SMA 2.9	18	R413 818 115	2	SMA	14
R412 520 124	2	TNC	31	R413 310 000	2	SMA 2.9	18	R413 818 121	2	SMA	17
R412 530 000	2	TNC	32	R413 320 000	2	SMA 2.9	18	R413 819 000	2	SMA	16
R412 540 000	2	TNC	32	R413 800 000	2	SMA	16	R413 819 115	2	SMA	14
R412 550 000	2	TNC	32	R413 800 115	2	SMA	14	R413 819 121	2	SMA	17
R412 700 000	2	N	44	R413 800 121	2	SMA	17	R413 820 000	2	SMA	16-62
R412 700 124	1	N	43	R413 801 000	2	SMA	16	R413 820 115	2	SMA	14
R412 701 000	2	N	44	R413 801 115	2	SMA	14	R413 820 121	2	SMA	17
R412 701 124	1	N	43	R413 801 121	2	SMA	17	R413 825 000	2	SMA	16
R412 702 000	2	N	44	R413 802 000	2	SMA	16	R413 825 121	2	SMA	17
R412 702 124	1	N	43	R413 802 115	2	SMA	14	R413 830 000	2	SMA	16
R412 703 000	2	N	44-62	R413 802 121	2	SMA	17	R413 830 115	2	SMA	14
R412 703 124	1	N	43	R413 803 000	2	SMA	16-62	R413 830 121	2	SMA	17
R412 704 000	2	N	44	R413 803 115	2	SMA	14	R413 835 000	2	SMA	16
R412 704 124	1	N	43	R413 803 121	2	SMA	17	R413 840 000	2	SMA	16
R412 705 000	2	N	44	R413 804 000	2	SMA	16	R413 840 115	2	SMA	14
R412 705 124	1	N	43	R413 804 115	2	SMA	14	R413 845 000	2	SMA	16
R412 706 000	2	N	44-62	R413 804 121	2	SMA	17	R413 850 000	2	SMA	16
R412 706 124	1	N	43	R413 805 000	2	SMA	16	R413 850 115	2	SMA	14
R412 707 000	2	N	44	R413 805 115	2	SMA	14	R413 855 000	2	SMA	16
R412 707 124	1	N	43	R413 805 121	2	SMA	17	R413 860 000	2	SMA	16
R412 708 000	2	N	44	R413 806 000	2	SMA	16-62	R413 860 115	2	SMA	14
R412 708 124	1	N	43	R413 806 115	2	SMA	14				
R412 709 000	2	N	44	R413 806 121	2	SMA	17	R414 400 000	2	BNC	30
R412 709 124	1	N	43	R413 807 000	2	SMA	16	R414 401 000	2	BNC	30
R412 710 000	2	N	44-62	R413 807 115	2	SMA	14	R414 402 000	2	BNC	30
R412 710 124	1	N	43	R413 807 121	2	SMA	17	R414 403 000	2	BNC	30
R412 711 000	2	N	44	R413 808 000	2	SMA	16	R414 404 000	2	BNC	30
R412 711 124	1	N	43	R413 808 115	2	SMA	14	R414 405 000	2	BNC	30
R412 712 000	2	N	44	R413 808 121	2	SMA	17	R414 406 000	2	BNC	30
R412 712 124	1	N	43	R413 809 000	2	SMA	16	R414 407 000	2	BNC	30
R412 713 000	2	N	44	R413 809 115	2	SMA	14	R414 408 000	2	BNC	30
R412 713 124	1	N	43	R413 809 121	2	SMA	17	R414 409 000	2	BNC	30
R412 714 000	2	N	44	R413 810 000	2	SMA	16-62	R414 410 000	2	BNC	30
R412 714 124	1	N	43	R413 810 115	2	SMA	14	R414 411 000	2	BNC	30
R412 715 000	2	N	44	R413 810 121	2	SMA	17	R414 412 000	2	BNC	30
R412 715 124	1	N	43	R413 811 000	2	SMA	16	R414 413 000	2	BNC	30
R412 716 124	1	N	43	R413 811 115	2	SMA	14	R414 414 000	2	BNC	30
R412 717 124	1	N	43	R413 811 121	2	SMA	17	R414 415 000	2	BNC	30
R412 718 124	1	N	43								

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R414 420 000	2	BNC	30-62	R414 703 161	2	N	46	R415 720 000	10	N	47
R414 425 000	2	BNC	30	R414 704 000	2	N	45	R416 003 000	15	N	47
R414 430 000	2	BNC	30	R414 704 161	2	N	46	R416 006 000	12	N	47
R414 440 000	2	BNC	30	R414 705 000	2	N	45-62	R416 010 000	10	N	47
R414 450 000	2	BNC	30	R414 705 161	2	N	46	R416 020 000	10	N	47
R414 460 000	2	BNC	30	R414 706 000	2	N	45-62	R416 103 000	15	SMA	19
R414 500 000	2	TNC	33	R414 706 161	2	N	46	R416 106 000	12	SMA	19
R414 500 161	2	TNC	34	R414 707 000	2	N	45	R416 110 000	10	SMA	19
R414 501 000	2	TNC	33	R414 707 161	2	N	46	R416 120 000	10	SMA	19
R414 501 161	2	TNC	34	R414 708 000	2	N	45	R416 803 000	15	TNC	35
R414 502 000	2	TNC	33	R414 708 161	2	N	46	R416 806 000	12	TNC	35
R414 502 161	2	TNC	34	R414 709 000	2	N	45	R416 810 000	10	TNC	35
R414 503 000	2	TNC	33	R414 709 161	2	N	46	R416 820 000	10	TNC	35
R414 503 161	2	TNC	34	R414 710 000	2	N	45-62	R417 003 110	50	N	51
R414 504 000	2	TNC	33	R414 710 161	2	N	46	R417 003 120	50	N	50
R414 504 161	2	TNC	34	R414 711 000	2	N	45	R417 003 130	50	N	52
R414 505 000	2	TNC	33	R414 711 161	2	N	46	R417 006 110	50	N	51
R414 505 161	2	TNC	34	R414 712 000	2	N	45	R417 006 120	50	N	50
R414 506 000	2	TNC	33	R414 712 161	2	N	46	R417 006 130	50	N	52
R414 506 161	2	TNC	34	R414 713 000	2	N	45	R417 010 110	50	N	51
R414 507 000	2	TNC	33	R414 713 161	2	N	46	R417 010 120	50	N	50
R414 507 161	2	TNC	34	R414 714 000	2	N	45	R417 010 130	50	N	52
R414 508 000	2	TNC	33	R414 714 161	2	N	46	R417 020 110	50	N	51
R414 508 161	2	TNC	34	R414 715 000	2	N	45	R417 020 120	50	N	50
R414 509 000	2	TNC	33	R414 715 161	2	N	46	R417 020 130	50	N	52
R414 509 161	2	TNC	34	R414 716 161	2	N	46	R417 030 110	50	N	51
R414 510 000	2	TNC	33-62	R414 717 161	2	N	46	R417 030 120	50	N	50
R414 510 161	2	TNC	34	R414 718 161	2	N	46	R417 030 130	50	N	52
R414 511 000	2	TNC	33	R414 719 161	2	N	46	R417 103 110	50	SMA	23
R414 511 161	2	TNC	34	R414 720 000	2	N	45-62	R417 103 120	50	SMA	22
R414 512 000	2	TNC	33	R414 720 161	2	N	46	R417 103 130	50	SMA	24
R414 512 161	2	TNC	34	R414 725 000	2	N	45	R417 106 110	50	SMA	23
R414 513 000	2	TNC	33	R414 730 000	2	N	45-62	R417 106 120	50	SMA	22
R414 513 161	2	TNC	34	R414 740 000	2	N	45-62	R417 106 130	50	SMA	24
R414 514 000	2	TNC	33	R414 750 000	2	N	45	R417 110 110	50	SMA	23
R414 514 161	2	TNC	34	R414 760 000	2	N	45	R417 110 120	50	SMA	22
R414 515 000	2	TNC	33	R414 799 127	1	N	55	R417 110 130	50	SMA	24
R414 515 161	2	TNC	34	R415 303 000	15	SMA	19	R417 120 110	50	SMA	23
R414 516 161	2	TNC	34	R415 306 000	12	SMA	19	R417 120 120	50	SMA	22
R414 517 161	2	TNC	34	R415 310 000	10	SMA	19	R417 120 130	50	SMA	24
R414 518 161	2	TNC	34	R415 312 000	10	SMA	19	R417 130 110	50	SMA	23
R414 519 161	2	TNC	34	R415 315 000	10	SMA	19	R417 130 120	50	SMA	22
R414 520 000	2	TNC	33-62	R415 320 000	10	SMA	19	R417 130 130	50	SMA	24
R414 520 161	2	TNC	34	R415 403 000	15	BNC	30	R417 203 110	50	TNC	39
R414 525 000	2	TNC	33	R415 406 000	12	BNC	30	R417 203 120	50	TNC	38
R414 530 000	2	TNC	33	R415 410 000	10	BNC	30	R417 203 130	50	TNC	40
R414 540 000	2	TNC	33	R415 420 000	10	BNC	30	R417 206 110	50	TNC	39
R414 550 000	2	TNC	33	R415 503 000	15	TNC	35	R417 206 120	50	TNC	38
R414 560 000	2	TNC	33	R415 506 000	12	TNC	35	R417 206 130	50	TNC	40
R414 700 000	2	N	45	R415 510 000	10	TNC	35	R417 210 110	50	TNC	39
R414 700 161	2	N	46	R415 520 000	10	TNC	35	R417 210 120	50	TNC	38
R414 701 000	2	N	45	R415 703 000	15	N	47	R417 210 130	50	TNC	40
R414 701 161	2	N	46	R415 706 000	12	N	47	R417 220 110	50	TNC	39
R414 702 000	2	N	45	R415 710 000	10	N	47				
R414 702 161	2	N	46								
R414 703 000	2	N	45-62								

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R417 220 120	50	TNC	38	R417 610 110	30	TNC	36	R417 820 138	80	SMA	25
R417 220 130	50	TNC	40	R417 610 130	30	TNC	37	R417 903 118	100	TNC	41
R417 230 110	50	TNC	39	R417 620 110	25	TNC	36	R417 903 128	100	TNC	40
R417 230 120	50	TNC	38	R417 620 130	30	TNC	37	R417 903 138	100	TNC	41
R417 230 130	50	TNC	40	R417 630 110	100	TNC	36	R417 906 118	100	TNC	40
R417 303 110	25	N	48	R417 630 130	30	TNC	37	R417 906 128	100	TNC	40
R417 303 130	30	N	49	R417 703 118	100	N	54	R417 906 138	100	TNC	41
R417 306 110	25	N	48	R417 703 128	100	N	53	R417 910 118	80	TNC	41
R417 306 130	30	N	49	R417 703 138	100	N	53	R417 910 128	80	TNC	40
R417 310 110	25	N	48	R417 706 118	100	N	54	R417 910 138	80	TNC	41
R417 310 130	30	N	49	R417 706 128	100	N	53	R417 920 118	80	TNC	41
R417 320 110	25	N	48	R417 706 138	100	N	53	R417 920 128	80	TNC	40
R417 320 130	30	N	49	R417 710 118	80	N	54	R417 920 138	80	TNC	41
R417 330 110	25	N	48	R417 710 128	80	N	53				
R417 330 130	30	N	49	R417 710 138	80	N	53	R418 045 000	2	N	62
R417 503 110	25	SMA	20	R417 720 118	80	N	54				
R417 503 130	30	SMA	21	R417 720 128	80	N	53	R420 003 110	50	7/16	57
R417 506 110	25	SMA	20	R417 720 138	80	N	53	R420 006 110	50	7/16	57
R417 506 130	30	SMA	21	R417 803 118	100	SMA	26	R420 010 110	50	7/16	57
R417 510 110	25	SMA	20	R417 803 128	100	SMA	25	R420 020 110	50	7/16	57
R417 510 130	30	SMA	21	R417 803 138	100	SMA	25	R420 303 110	25	7/16	56
R417 520 110	25	SMA	20	R417 806 118	100	SMA	26	R420 306 110	25	7/16	56
R417 520 130	30	SMA	21	R417 806 128	100	SMA	25	R420 310 110	25	7/16	56
R417 530 110	25	SMA	20	R417 806 138	100	SMA	25	R420 320 110	25	7/16	56
R417 530 130	30	SMA	21	R417 810 118	80	SMA	26	R420 703 110	100	7/16	57
R417 603 110	25	TNC	36	R417 810 128	80	SMA	25	R420 706 110	100	7/16	57
R417 603 130	30	TNC	37	R417 810 138	80	SMA	25	R420 710 110	100	7/16	57
R417 606 110	25	TNC	36	R417 820 118	80	SMA	26	R420 720 110	100	7/16	57
R417 606 130	30	TNC	37	R417 820 128	80	SMA	25				



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