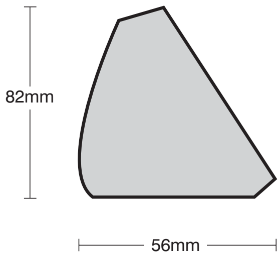
Microphones

Part No.	Description	Illustration
DM507	Standard 500 Ohm dynamic fist microphone with metal hang-up button	 DMC900  SMP-150  DM507
DMC900	500 Ohm dynamic fist microphone with metal hang-up button	
SMP-150	Small Speaker/Microphone with PTT (Press to Talk) & Metal clip	
SMP-400	Heavy Duty Speaker/Microphone with PTT & Metal Clip	
SMP-650	Heavy Duty Speaker/Microphone with Metal Clip	

Microphone Clips, Cords & Connectors

Part No.	Description	Illustration
Microphone Clips		
MC-SC MC-ST MC-MG	Screw-on Stick-on Magnetic	 MC-SC
Microphone Cords		
MC-5	5 Core (1 shielded) coiled cord 1.2m	 MC-5
Microphone Connectors		
MP-3 MP-4 MP-5 MP-6 MP-7 MP-8	3 Pin Plug, In-line 4 Pin Plug, In-line 5 Pin Plug, In-line 6 Pin Plug, In-line 7 Pin Plug, In-line 8 Pin Plug, In-line	 MP-4
MF-3 MS-6 MS-8	3 Pin Socket, In-line 6 Pin Socket, In-line 8 Pin Socket, In-line	 MS-6
MF-4 MF-6 MF-8	4 Pin Socket, Panel mount 6 Pin Socket, Panel mount 8 Pin Socket, Panel mount	 MF-8  MPRA4
MPRA4	4 Pin right angle plug	

Extension Speakers



324/328

Teknika universal extension speakers are compact speakers for professional radio installations. With a choice of 4W and 8W and a variety of mounting options, these speakers will suit the requirements of virtually any installation.

- Versatile Mounting - Magnetic, screw down and double-sided tape mounting available
- Small and Compact
- Rugged Construction - ABS plastic casing with metal mesh, metal screws and swivel brackets
- Excellent audio output volume
- Universal 3.5mm phono plug for quick and easy connection

Specifications

Model	324	328
Cabinet Size ***H x W x D***	82 x 82 x 56	
Cone Construction	Mylar	
Cone Size	57mm	
Impedance	4 Ohms	8 Ohms
Power (Maximum)	5 Watts	
Mounting Options	Magnetic, screw down or double sided tape	
Weight	300g	

Valve Regulated Lead Acid Batteries

Model	Nominal Voltage *V*	Rated Capacity (Ah)	Terminal Type	Dimensions *mm* L x W x D	Weight *kg*	Carton Qty
LC-R061R3P	6	1.3	Faston 187 Tab	97 x 24 x 55	0.3	40
LC-R063R4P	6	3.4	Faston 187 Tab	134 x 34 x 66	0.62	24
LC-R064R2P	6	4.2	Faston 187 Tab	70 x 48 x 108	0.78	24
LC-R067R2P	6	7.2	Faston 187 Tab	151 x 34 x 100	1.26	12
LC-R0612P	6	12	Faston 187 Tab	151 x 50 x 100	1.95	12
LC-R0612P1	6	12	Faston 250 Tab	151 x 50 x 100	1.95	12
LC-R121R3P	12	1.3	Faston 187 Tab	97 x 47.5 x 55	0.59	20
LC-R122R2P	12	2.2	Faston 187 Tab	177 x 34 x 66	0.8	24
LC-R123R4P	12	3.4	Faston 187 Tab	134 x 67 x 66	1.2	12
LC-R127R2P	12	7.2	Faston 187 Tab	151 x 64.5 x 100	2.47	10
LC-R127R2P1	12	7.2	Faston 250 Tab	151 x 64.5 x 100	2.47	10
LC-RA1212P1	12	12	Faston 250 Tab	151 x 98 x 100	3.8	6
LC-RD1217P	12	17	M5 Bolt & Nut	181 x 76 x 167	6.5	4
LC-X1220P	12	20	M5 Bolt & Nut	181 x 76 x 167	6.6	4
LC-X1224P	12	24	M5 Bolt & Nut	165 x 125 x 175	9	2
LC-X1228P	12	28	M5 Bolt & Nut	165 x 125 x 175	11	2
LC-R1233P	12	33	M6 Bolt & Nut	195.6 x 130x 180	12	1
LC-X1242P	12	42	M6 Bolt & Nut	197 x 165 x 180	16	1
LC-X1265P	12	65	M6 Bolt & Nut	350 x 166 x 175	20	1
LC-XA12100P	12	100	M8 Bolt & Nut	407 x 173 x 236	33	1

Cycling Models

Model	Nominal Voltage *V*	Rated Capacity (Ah)	Terminal Type	Dimensions *mm* L x W x D	Weight *kg*	Carton Qty
LC-XC1228AP	12	28	M5 threaded post	165 x 125 x 179.5	10	2
LC-XC1238P	12	38	M6 Bolt & Nut	197 x 165 x 180	15	1

UP Series

Model	Nominal Voltage *V*	Rated Capacity *W* cell @ 10 minute rate	Terminal Type	Dimensions *mm* L x W x D	Weight *kg*	Carton Qty
UP-RW0645P1	6	45	Faston 250 Tab	151 x 34 x 100	1.3	10
UP-RW1220P1	12	20	Faston 250 Tab	140 x 38.5 x 100	1.35	12
UP-RWA1232P1	12	32	Faston 250 Tab	151 x 51 x 100	2	12
UP-RWA1232P2	12	32	Faston 250+ Faston 187-	151 x 51 x 100	2	12
UP-RW1245P1	12	45	Faston 250 Tab	151 x 64.5 x 100	2.6	10

Note: Height includes terminal height

tech support

Antenna Gain

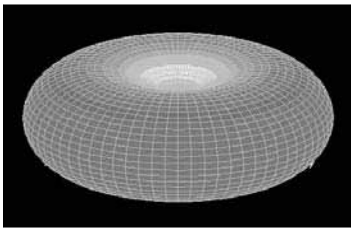
WHAT IS GAIN?

The gain of an antenna is a measure of the improvement in transmitted or received signal strength when its performance is measured against the theoretical standard isotropic radiator, whose radiation pattern represents a perfect sphere. Gain can only be achieved by focussing the radiation pattern in the direction in which it is needed by the addition of more radiating elements and/or directors and reflectors (such as in the case of yagis).

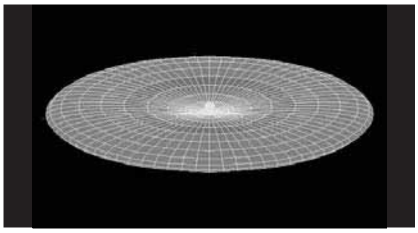
Some antennas can produce a "spotlight" radiation beam (or main lobe), focussing on a narrow target but covering large distances. Others produce a broad coverage area like a lantern. Generally, the higher the amount of gain the better the range, but this depends entirely on the application.

A well-designed high gain antenna will ensure the main radiation lobe is focussed on the horizon rather than up to the sky. That's great for rural areas, but for city use where base stations are located atop tall buildings, too much gain may not always be the best solution.

Typical unity gain radiation pattern



Typical high gain radiation pattern

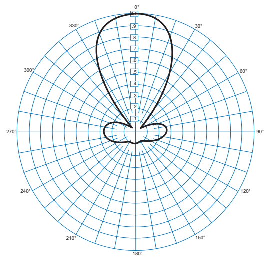


HOW IS GAIN DEFINED?

Various antenna manufacturers use different references when declaring their gain figures. Some use a dipole reference, some the theoretical isotropic radiator and some use a figure that in fact has no claimed reference.

Most readers of this catalogue know roughly how long an antenna must physically be to deliver it's claimed gain in a particular frequency band. The laws of physics cannot be defeated and without "capture area" there is simply no way to increase antenna gain.

Unfortunately, in the absence of a defined reference, some claims made in catalogues and on retail packaging by some manufacturers, are, well, wrong. Whilst this is "understood" by experienced dealers, who make their own informed judgments, publishing these often-exaggerated claims is very much an attempt to entice customers to purchase one product (with superior ratings) over another.



Typical yagi directional antenna pattern

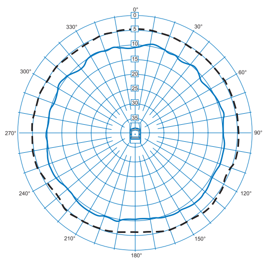
It is important to remember that the gain of an antenna MUST be related to a reference of some description, which in most cases will be either the isotropic radiator or a lossless half wave dipole. Gain statements that are made without an indication of a suitable reference are meaningless and misleading. The most commonly used and accepted gain measures are dB¼λ, dBi and dBd.

The gain specifications listed in our catalogue for our range of base station antennas are all referenced to an isotropic radiator, and are thus expressed in dBi. Also listed is the gain referenced to a lossless half wave dipole in dBd, which is simply 2.15dB below the dBi rating.

WHY ARE MOBILE ANTENNAS TREATED DIFFERENTLY?

Whilst the isotropic radiator and half wave dipole are appropriate gain references for base station antennas, a more meaningful and practical reference has been used for our range of mobile antenna gain specifications. This is the ¼ wave centre roof mounted whip (dB¼λ). Why? Because we can measure it, and we DO measure it. It is not a theoretical reference, but a practical one, and we believe it serves our customers best.

As a matter of almost pure coincidence, should you measure a roof mounted ¼ wave antenna on the horizon, it is a close approximation to the theoretical isotropic radiator. We have tested this in the field, comparing the ¼ wave whip to the ½ wave dipole, since we could not find an isotropic radiator in our toolbox. (Well perhaps it was there, but being infinitely small we just couldn't see it!).



Typical mobile antenna pattern

CONSISTENT WITH THEORY

Theoretically, a ¼ wave whip mounted on an infinite ground plane will exhibit the gain of a half wave dipole, or 2.15dBi, in a direction perpendicular to the axis of the whip. As the ground plane diminishes, the main lobe of the whip's radiation pattern will tilt upwards, away from the ground plane. Our pattern tests have shown that when mounted in the centre of a standard vehicle roof, a ¼ wave whip exhibits a gain of approximately 0dBi in the direction perpendicular to the whip, that is, at the horizon, and

Antenna Gain (cont.)

that the gain peak is at a point some 25-30 degrees above the horizon, due to the effect of the limited ground plane.

Therefore, when referencing the gain of a mobile antenna against a ¼ wave centre roof mounted whip, the gain can be considered as being referenced to an isotropic radiator at a plane perpendicular to the whip (that is, at the horizon or 0 degree elevation).

BUT THEN THERE'S MOUNTING

All antenna radiation patterns are affected by their mounting environment.

The gain exhibited by certain mobile antennas when mounted on a vehicle gutter or roof bar can be better than their specifications would suggest.

This is especially true for the ground independent Mopoles and high gain Mopoles offered by RFI. These antennas, being ground independent, are usually range tested and rated against a standard dipole reference. When a Mopole is placed on a vehicle gutter or roof bar, the vehicle's roof, again being a less than infinite ground plane, causes a slight uptilting AND compression of the major lobe, increasing the effective gain of the antenna. Thus, an end fed dipole antenna, range tested at 0dBd in controlled field tests (2.15dBi gain at the horizon) will, when gutter or roof bar mounted, perform significantly better than a roof mounted quarter wave due to this additional gain contribution.

The brief statements made on our Mopole antenna pages characterize this additional gain as "improved performance" rather than textbook gain, as the additional performance claimed is dependent on the mounting position for the antenna. RFI have collated and published extensive information on the performance of mobile antennas in various mounting locations to help illustrate the resulting compromises of antenna mounting and operational performance in mobile antennas.

Similarly, base station antennas are dramatically affected by antenna mounting positions. The side mounting of base station antennas is a point of particular interest and this can be characterized, and even quite accurately modelled. Each application however tends to be individual and mounting arrangements are rarely precisely controlled enough to allow system planners to take this into account.

The RFI engineering team is happy to advise on individual antenna selection and regularly prepares papers and presentations on the optimal antenna choices in typical applications.

CATALOGUED GAIN FIGURES

In general, stated gain specifications are nominal, and taken at the centre of the tuned bandwidth of the antenna, but slight variations can be expected. Where comprehensive data is required for use in coverage analysis software packages, RFI can provide digitised antenna pattern data in accordance with industry standard TIA-804-B formats for most of our base station antennas. For more specific gain information please contact your local RFI representative.

WIND RATINGS

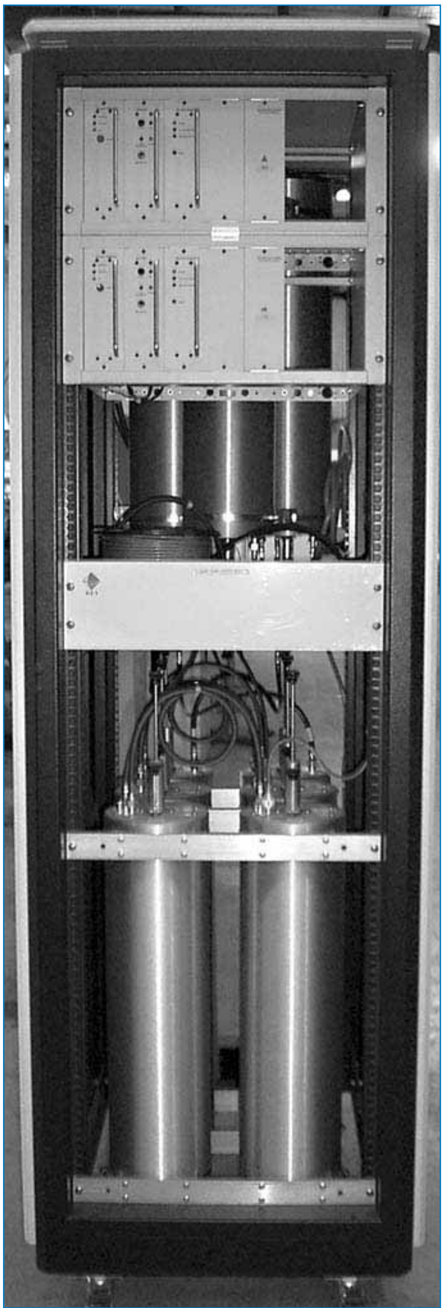
The listed wind ratings for base station antennas are defined as follows:

- **Projected Area (no ice)** - A statement of the equivalent flat plate surface area of the antenna. This has been calculated in accordance with AS1170.2:2002, the Australian Wind Loading standard, which is based on ISO4354, an international standard covering wind actions on structures.
- **Projected Area (with ice)** - A uniform radial build-up of 12.7mm of ice is applied to all surfaces of the antenna, in accordance with TIA329C. The projected area is then re-calculated in accordance with AS1170.2:2002.
- **Wind Load (thrust)** - The effective force applied perpendicular to the plane of the antenna presenting the greatest projected area, as a result of the pressure applied due to a constant 160km/h wind velocity.
- **Wind Gust Rating** - A structural engineering calculation in accordance with AS1170.2:2002, giving consideration to the yield strength of the materials used in the construction of the antenna. This figure determines the maximum wind velocity at which the mechanical stresses in the antenna components are just below the allowable yield strength of the boom and/or other elements.
- **Torque** - The bending or turning moment resulting from the Wind Load (thrust) calculated above, acting at the uppermost clamping point. For Corner Reflectors, the torque figure represents a rotational torque.

These important engineering specifications have been published in metric units. The following conversion factors may be used to convert these and other listed mechanical units to imperial units:

Length	1 ft = 0.305 m
	1 in = 25.4 mm
Weight	1 lbs = 0.454 kg
Projected Area	1 ft² = 929 cm²
Wind Load	1lbs (f) = 4.448 N
Wind Gust Rating	1 mph = 1.609 km/h
Torque	1 ft-lbs = 1.356 Nm

Passive Intermodulation (PIM) Information



RFI's VHF Test Bed

WHAT IS PIM?

Intermodulation, or intermod, as it is commonly abbreviated, is generated whenever multiple RF signals are present in a conductor of RF energy. Any non-linearities in the signal path, whether through an amplifier or an antenna system for example, will cause a mixing of the fundamental RF signal frequencies and the creation of new RF signals at different, mathematically related frequencies.

These new signals, or intermod products, can become a source of interference if not carefully controlled. This has been a topic of much discussion and there is a wealth of technically detailed literature available on the subject.

The intermodulation products of greatest concern are the so-called odd-order products, since these will exist at frequencies that are close to the original fundamental signal frequencies. The 3rd order and 5th order products have the potential to cause the greatest harm, since their signal level can be substantial, and their frequencies are most likely to fall within co-sited receiver frequency bands.

Passive intermodulation, or PIM as it is commonly referred to, is intermodulation that occurs in passive devices, such as antennas, tower structures, antenna clamps and the like. The signals are mixed by non-linear properties of junctions between dissimilar metals, or where corrosion exists. Poor mechanical junctions, the use of material that exhibits hysteresis, or contaminated surfaces or contacts within the RF path can also cause high PIM levels.

HOW IS PIM CONTROLLED?

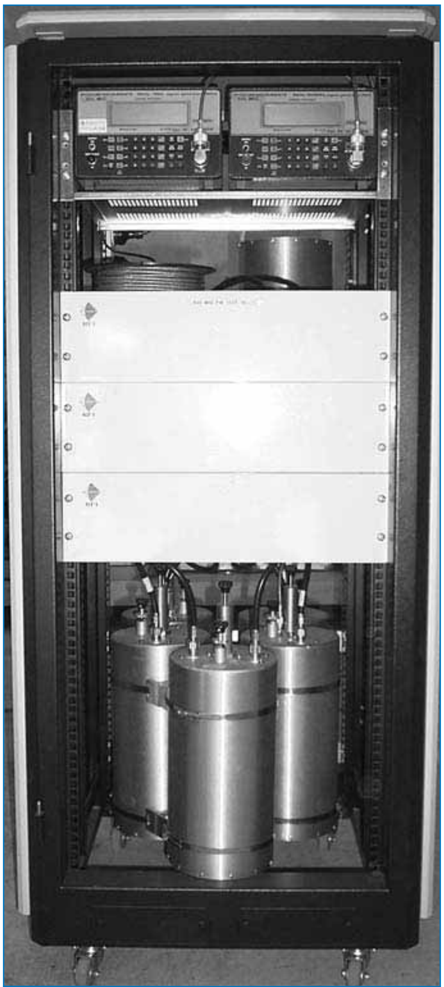
Careful selection of materials, construction methods and the use of high performance cables and connectors, are all factors that need to be considered in the construction of antennas to ensure good PIM performance. As multi-user sites become more and more congested, excellent PIM performance is essential to ensure lower levels of interference and improved receiver performance.

We at RFI are very proud of our achievements in obtaining world-class PIM specifications on our range of high spec base station antennas. This has not happened by chance, but has involved many years of research, testing and re-evaluation of mechanical construction methods. The knowledge gained as a result has raised our awareness of PIM related issues to such an extent that it is now an embedded part of our design approach - a design approach that started with the development of some of the earliest PIM measurement facilities.

HOW IS IT MEASURED?

PIM specifications must always be referenced to the power level of the two fundamental RF signal sources, which for testing purposes will always be set to the same level. Therefore, a PIM specification of -150dBc (150dB below carrier) for example will indicate that the actual PIM level generated by the antenna is 150dB below the carrier input level of the RF signal sources.

PIM Information cont'd



RFI's 800MHz Test Bed

The measurement of PIM in antennas requires sophisticated PIM test facilities, which are generally designed to measure the 3rd order PIM levels in the devices being tested. These test "beds" will comprise two or more separate RF signal sources, combining and filtering equipment, and amplifiers to boost the resultant antenna PIM level above the noise floor of the test and measurement equipment.

However, even the most fastidiously constructed test bed itself will generate intermodulation products, referred to as the residual IM. Typically, a good antenna may exhibit a PIM spec of -140dBc, which means that the residual test bed IM must be at least -150dBc for this to be able to be measured reliably. This level of residual IM can only be achieved by paying a great deal of attention to the design and layout of the test bed, and through the use of the highest quality combining equipment, cables and connectors.

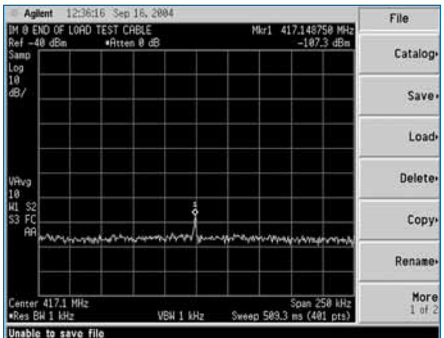
RFI'S PIM TEST BEDS

Four separate PIM test beds, covering VHF, UHF and 800 MHz test requirements, have been set up at our manufacturing facility in Melbourne. These test beds have the following specifications:

Test Bed	Frequency	Signal Sources	Residual IM
VHF	147-174 MHz	2 x 20W (+43dBm)	-160dBc
UHF	400-420 MHz	2 x 20W (+43dBm)	-161dBc
UHF	400-420 MHz	4 x 10W (+40dBm)	-161dBc
800 MHz	700- 1000 MHz	2 x 0.4W (+26dBm)	-160dBc

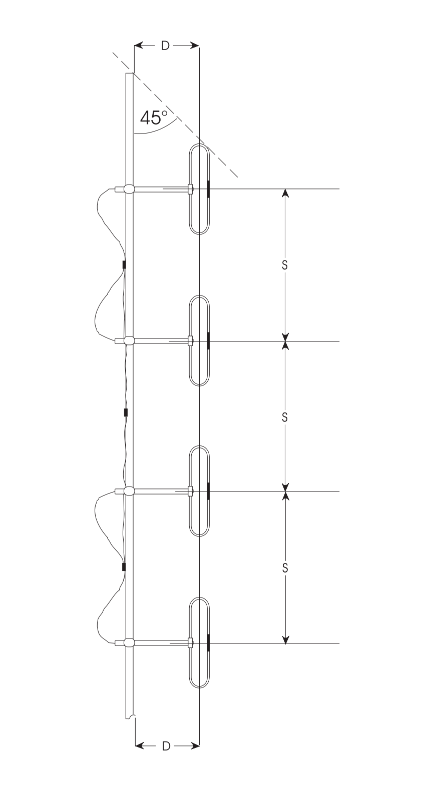
PIM measurements are made based on 3rd order products as these occur at higher, and therefore more easily measured, levels. The construction techniques which define the PIM performance of an antenna system component ensure that reducing the 3rd order PIM response has a like effect on all PIM outputs.

There are no true industry-defined power and performance levels for PIM, especially in the digital radio domain, but these are emerging. The power input levels chosen for our PIM test beds have been based on the anticipated typical power levels at the antenna and are therefore a close approximation to real site conditions.



Test bed residual PIM

Phasing of Side Mounted Dipole Antennas



Four Stack

MOUNTING

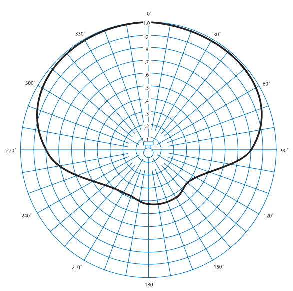
The SMD range of side mounted dipole antennas offer system designers a wide choice in the areas of horizontal radiation patterns and gain. The following radiation patterns were measured when an SMD1 was mounted with the stated antenna to mast spacings. The pattern changes dramatically with this spacing on other than a 50mm diameter mast. In the case of a larger mast (eg: lattice mast structure), the overall effect is thinner main lobes and more pronounced nulls.

PHASING

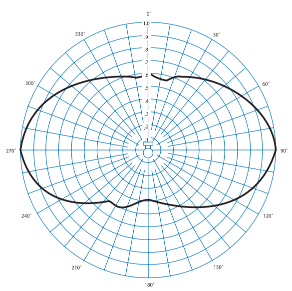
When phasing SMD antennas, designers should first take into account the antenna to mast spacings. The effect in the H plane of phasing SMD antennas is fairly minimal, with only a slight reduction in the horizontal beamwidths (as shown for a single antenna) when up to four antennas are phased. Gain is increased nominally by 3dB when a second antenna is used and 6db for an array of four.

Vertical radiation patterns are generally larger than for a series fed colinear (ie fibreglass enclosed) due to the directional nature of the array - one of the obvious advantages of using an SMD antenna. SMD antennas also offer beamtilt stability over a fairly broad bandwidth (up to +/- 10%) and direct grounding for lightning protection. The chart below indicates the optimum spacings between antennas when phasing. Our range of phasing harnesses is listed on page 74.

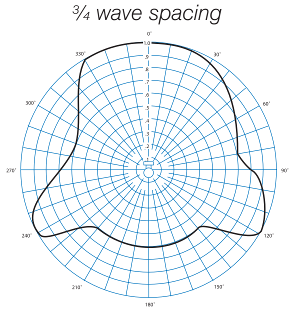
¼ wave spacing



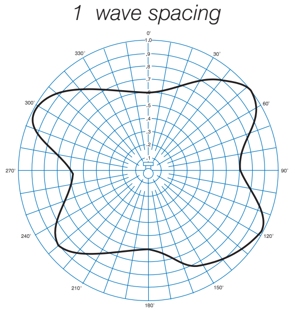
½ wave spacing



¾ wave spacing



1 wave spacing



Model Number	MHz Centre frequency	D= ¼ wave	D= ½ wave	D= ¾ wave	D= 1 wave	S
SMD1	77	974	1948	2922	3896	2922
SMD2	161	466	932	1398	1863	1398
SMD4	460	163	326	489	652	489

Phasing of Side Mounted Dipole Antennas cont'd

Phasing UHF Dipole Antennas

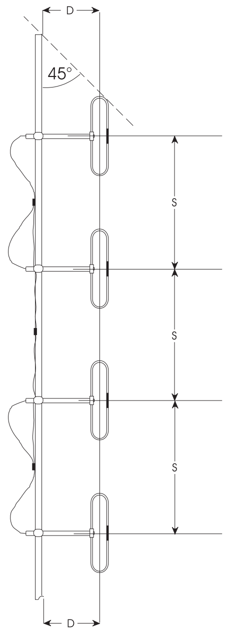
When using side mounted dipole antennas it is important to ensure that the antenna to mast spacings AND the antenna to antenna spacings are optimised for your application. The following graphs indicate the optimum antenna centre to antenna centre spacings and antenna to mast spacings for your frequency of use.

On the previous page is an illustration of the various patterns effected at VHF frequencies when side mounted dipole antennas are mounted at differing distances from the support mast.

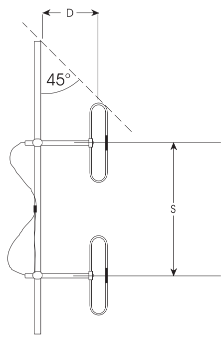
A similar series of patterns will also be effected at UHF frequencies, however it is important to note that for any given support mast, the effect on a UHF antenna will be greatly exaggerated, with deeper nulls and more pronounced peaks in the pattern. We urge the use of our BA, EA and OA Series arrays at UHF for predictable pattern performance.

Please note that when using two side mounted dipole antennas phased together, total antenna gain will be increased by 3 dB and if using four antennas, the antenna gain will be increased by 6 dB. This increase in gain is IN ADDITION to any gain which is afforded by the manipulation of the antenna pattern through antenna to mast spacings as shown opposite.

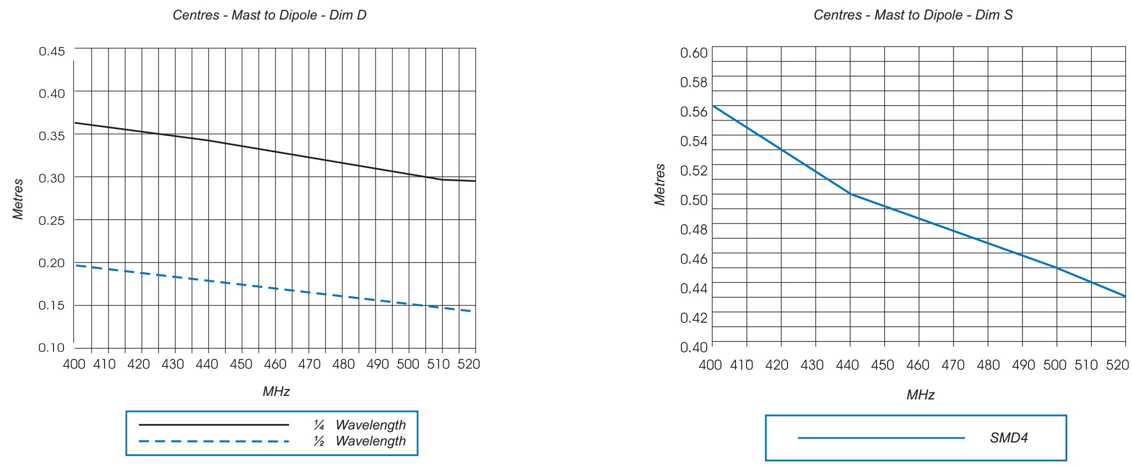
PLEASE NOTE: We strongly recommend against the phasing of 800 MHz side mounted dipole antennas as the control of the dimensions is far too critical to be adequately controlled in the field. Thus, we do not publish any information to assist in the phasing of our 800 MHz side mount dipole antennas.



Four stack



Two stack



Dipole Spacing vs Frequency

Phasing of Side Mounted Dipole Antennas cont'd

Phasing VHF Dipole Antennas

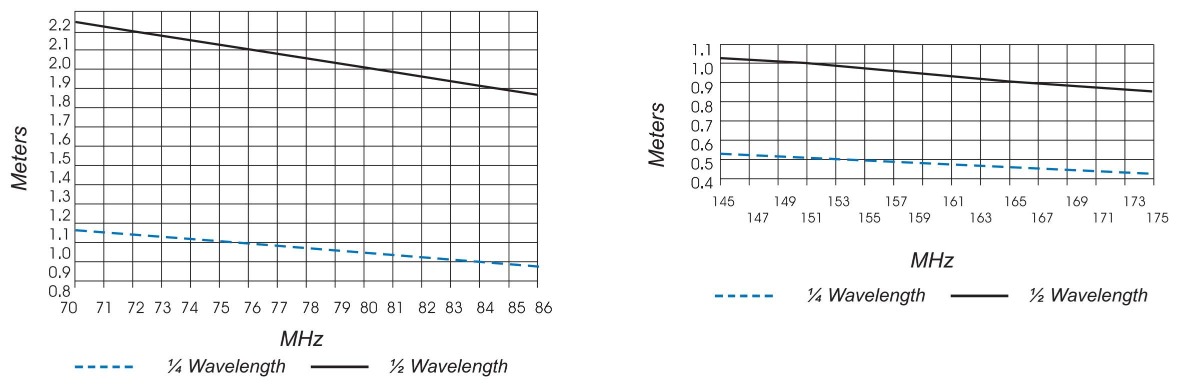
When using side mounted dipole antennas it is important to ensure that the antenna to mast spacings AND the antenna to antenna spacings are optimised for your application. The following graphs indicate the optimum vertical spacings and antenna to mast spacings for your frequency of use.

Earlier in this section is an illustration of the various patterns effected at VHF frequencies when side mounted dipole antennas are mounted at differing distances from the support mast.

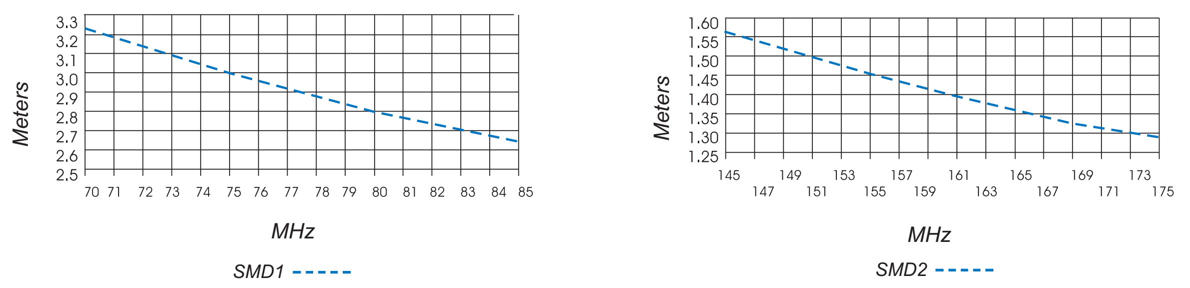
Please note that when using two side mounted dipole antennas phased together, total antenna gain will be increased by 3 dB and if using four antennas, the antenna gain will be increased by 6dB.

This increase in gains is IN ADDITION to any gain which is afforded by the manipulation of the antenna pattern through antenna to mast spacings as shown opposite.

PLEASE NOTE: For both SMD1 and SMD2 antennas, the full band coverage of the antennas can be maintained for a stack of two or four antennas if the correct phasing harness is used.



Two and four stack dipoles - D



Two and four stack dipoles - S

Phasing Yagi Antennas

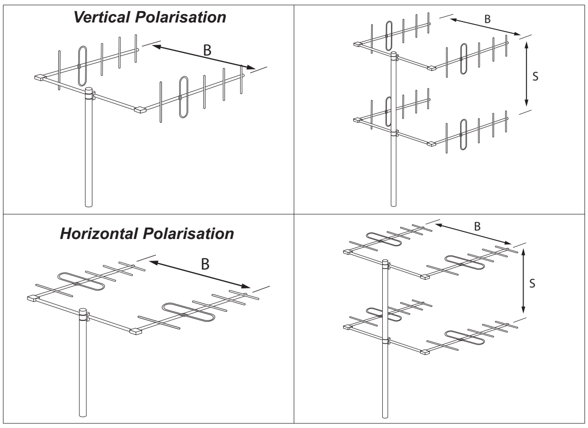
The phasing of yagi antennas can be done in vertical or horizontal polarisation and will, when properly implemented, boost the available gain by 3.0 dB (for two antennas) or 6.0 dB (for four antennas) over the gain for a single antenna.

The phasing of yagi antennas requires critical control of both the "Baying" and "Stacking" dimensions as shown in the illustrations. It is important to note that in all cases, these dimensions (B and S from our illustrations) should be identical at any one frequency.

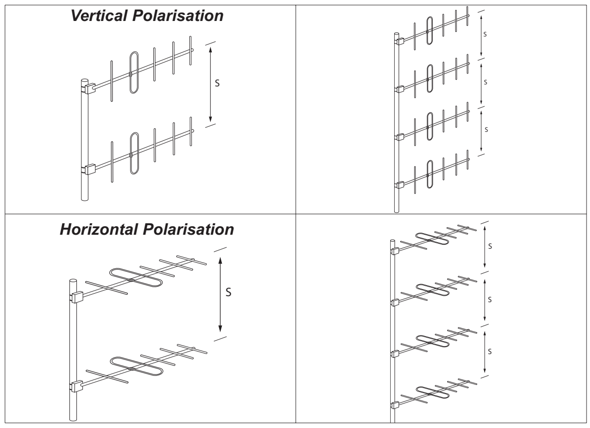
These distances vary with the number of antenna elements and the frequency of operation. To ensure that your antennas are phased at the optimum distance, use the following charts to determine the distance which should be used for the antennas you are using.

PLEASE NOTE: If you are phasing antennas in MULTIPLE directions, rather than phasing yagi antennas together for additional gain in a single direction, you will experience a net LOSS in gain over your individual antenna gain of 3.0 dB for a two way split and 6.0 dB for a four way split.

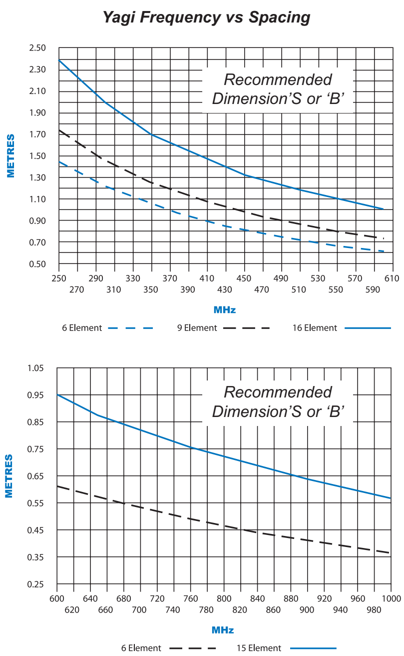
For more information on the effect of phasing yagi antennas, please contact your nearest RFI office.



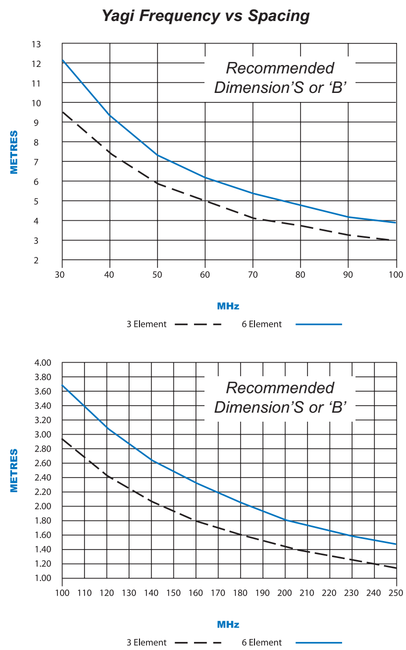
Baying Dimensions



Stacking Dimensions

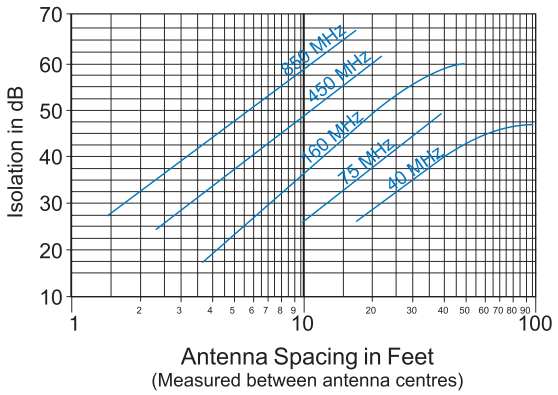


UHF

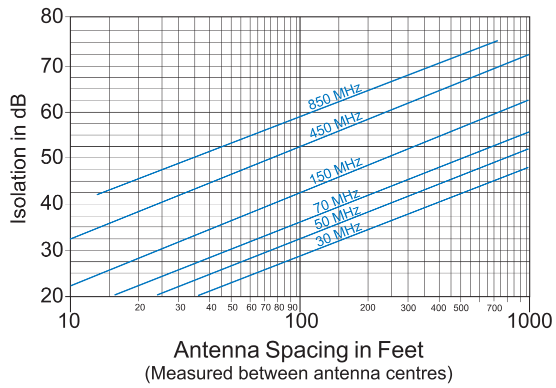


VHF

Isolation vs. Antenna Separation



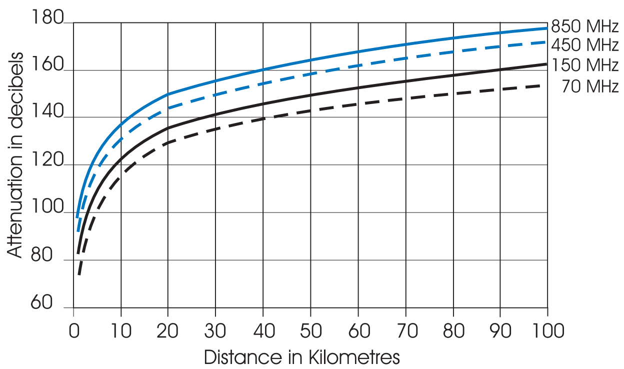
*Attenuation provided by **VERTICAL** separation of dipole antennas*



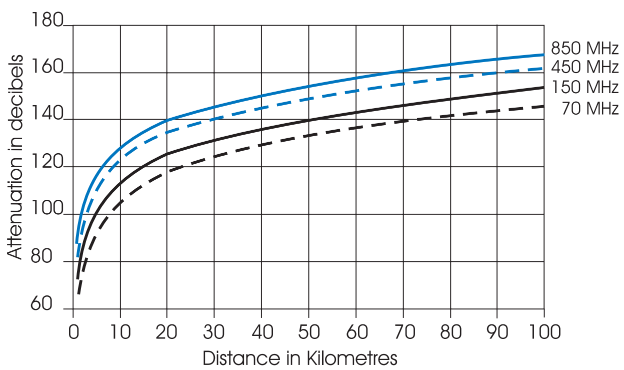
*Attenuation provided by **HORIZONTAL** separation of dipole antennas*

Range Estimation

The following graphs are based on the "Egli" model of propagation loss. This is an empirically based formula which is particularly valid for the gentle terrain conditions which prevail in much of Australia.



Base Station to Mobile Station
Base Station Height Above Average Terrain - 150 metres



Base Station to Mobile Station
Base Station Height Above Average Terrain - 450 metres

Estimated propagation loss

Explanatory Notes

Radiation Patterns

In our catalogue we have included radiation patterns for almost every antenna shown, both mobile and base station. These patterns are a "snapshot" of antenna characteristics and an important tool both in choosing antennas and undertaking system planning.

We have recently decided to move to "logarithmic" or power based plots from the previous default method of providing "linear" scaled (voltage based) plots. Linear plots offer greater "fine" definition of the major lobes of antennas but our new logarithmic based plots give output directly graduated in decibels, and this convenience has found great support amongst systems engineers.

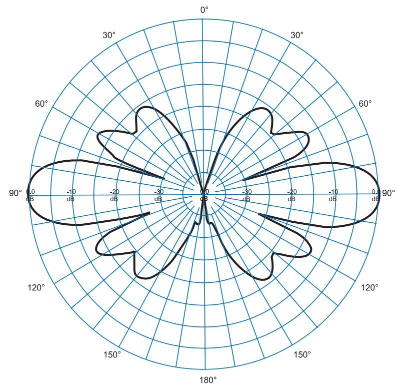
To check if the pattern you are viewing is linear or logarithmic, refer to the scale on the plot. Linear plots are scaled down from 1.0 to 0.1 per graduation on the perpendicular of the plot and our logarithmic plots are generally graduated in decibels, from 0dB (peak level) to -40dB on the centreline of the plot in 5dB increments.

BA80-67 Pattern - Logarithmic

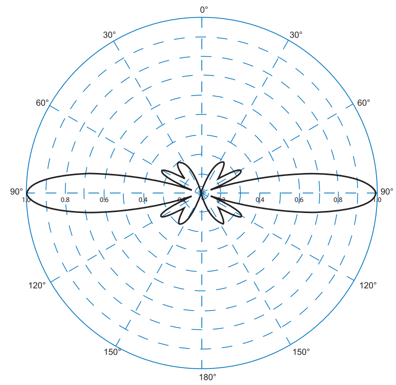
This is an example of our BA80-67 plotted in the logarithmic form. The power level in each "lobe" of the antenna can be clearly read from this pattern, with the level e.g. at -30° from the horizon (120° on plot shown) being 12.5 dB down on the peak gain level at the centreline.

BA80-67 Pattern - Linear

When the same plot for the BA80-67 is displayed based on a linear scale, there is excellent definition in the major lobe, but defining the actual gain offered at -30° from the main lobe becomes much more difficult. For this reason, we have moved to show all antenna plots in a logarithmic form.



BA80-67 Pattern - Logarithmic



BA80-67 Pattern - Linear

What is alodining?

Most of our base station antennas feature "alodined aluminium" construction. Alodining is the end result of the "chromate passivation" of aluminium and in some countries is referred to as "iridited finish". This is a passive dip finish on aluminium which affords excellent environmental protection (similar to anodising) but maintains the full conductivity of the surface. Alodining our base station antennas ensures that the earthing of the antennas is guaranteed when they are clamped to towers, minimising intermodulation and noise generation at the clamp point and still providing the environmental protection needed for superior service life.

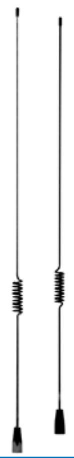
Explanatory Notes

Designed and Manufactured in Australia

RFI is an Australian company committed to designing and manufacturing as many products as possible in Australia. Most (>75%) of the antennas featured in this catalogue are manufactured in Australia. Our research and development teams utilise some of the most sophisticated software and hardware solutions in a constant drive to improve antenna performance and reliability and naturally, to keep pace with the changes in the marketplace.

Custom Tuned Antennas

Our “Custom tuned” logo is to highlight the need to specify transmit and receive frequencies when ordering. The antennas shown on pages with this logo are custom tuned to your specified frequencies and will be shipped including a full VSWR plot of performance. Should you have any doubt when ordering, simply specify the frequencies on your order in any case and we will review and accept full responsibility to ensure that the antenna functions of your nominated frequency.



17-7PH Stainless Steel

Throughout the mobile antenna section of this catalogue you will notice that many of our antenna whips are constructed from 17-7PH stainless steel. This is an extremely rugged grade of precipitation hardened stainless steel, which is incredibly strong, yet takes on a resilient "bounce back" characteristic. 17-7PH stainless steel is excellent in mobile antennas because it can take the knocks, bumps and bends common in mobile applications, and still returns to its original shape.

Quality Systems

RF Industries is an ISO-9001 accredited company, having achieved and maintained accreditation to this international standard since 1992. The company also maintains QS9000 accreditation, an enhanced level quality system for the automotive industry worldwide.

Recently we achieved accreditation to ISO14001 for our environmental management system.

Our quality systems provide us with the framework to deliver on every promise we make in product quality and service levels.

In purchasing or specifying RFI products you are assured of world class product from the design concept forward.

Explanatory Notes

Lightning Protection

Lightning damages equipment at radio communications sites every day. Although lightning is a DC pulse, the time from zero current to peak current can be very fast. When lightning energy travels through a coaxial cable, there is a slight propagation delay that occurs due to the unbalanced inductances of the shield and centre conductor, and the centre conductor's capacitive relationship through the dielectric to the shield. The higher-frequency shield energy will arrive at the equipment first, followed by the centre conductor energy. Since the pulse energy arrives at different times, a differential voltage occurs. A properly designed coaxial protector equalises this potential difference, which prevents current flow and therefore damage to the site's equipment.

However, the choice of a standard gas tube type coaxial protector without DC blocking may not offer the user complete protection. The fast rise-time lightning pulse can produce over 1000 Volts across the gas tube before the gas can ionise and become conductive. Since there is no DC blocking mechanism, this high voltage is applied directly to the equipment input before the gas tube turns on.

A quarter wave stub coaxial protector creates a band-pass filter, at a frequency determined by the length of the quarter wave coaxial section from the horizontal centre conductor to the grounded base. However, if the equipment input is DC-shorted, the quarter wave stub can allow significant divided DC and low frequency energy to flow towards the equipment input.

A "DC blocking mechanism" inside the protector (no DC continuity through the protector) will prevent harmful levels of throughput energy from reaching the equipment. RFI stocks and distributes the patented PolyPhaser DC-blocked coaxial protector line, which has the lowest throughput specifications in the industry. There is also a series of PolyPhaser coaxial protectors that block DC in the RF path to the equipment, and either inject, pass through, or pick off a specified DC voltage on the feeder's coaxial cable centre conductor. This series of protectors is particularly suited to applications requiring DC to be passed up the coaxial feeder cable to power tower-top amplifier electronics.

Remember that no matter how good your lightning protector is, it's not a fuse. It still needs to be correctly installed and connected to a suitable grounding system. RFI offers a complete range of products to protect your system, including the coaxial protector, grounding rods, copper strapping and grounding kits for the feeder cables.

Explanatory Notes

VSWR Conversion Chart

VSWR	Return loss *dB*	Transmission loss *dB*	Reflected power %
1.00		0.000	0.0
1.01	46.1	0.000	0.0
1.02	40.1	0.000	0.0
1.03	36.6	0.001	0.0
1.04	34.2	0.003	0.0
1.05	32.3	0.003	0.1
1.06	30.7	0.004	0.1
1.07	29.4	0.005	0.1
1.08	28.3	0.006	0.1
1.09	27.3	0.008	0.2
1.10	26.4	0.010	0.2
1.11	25.7	0.012	0.3
1.12	24.9	0.014	0.3
1.13	24.3	0.016	0.4
1.14	23.7	0.019	0.4
1.15	23.1	0.021	0.5
1.16	22.6	0.024	0.5
1.17	22.1	0.027	0.6
1.18	21.7	0.030	0.7
1.19	21.2	0.033	0.8
1.20	20.8	0.036	0.8
1.21	20.4	0.039	0.9
1.22	20.1	0.043	1.0
1.23	19.7	0.046	1.1
1.24	19.4	0.050	1.1
1.25	19.1	0.054	1.2
1.26	18.8	0.058	1.3
1.27	18.5	0.062	1.4
1.28	18.2	0.066	1.5
1.29	17.9	0.070	1.6
1.30	17.7	0.075	1.7
1.32	17.2	0.083	1.9
1.34	16.8	0.093	2.1
1.36	16.3	0.102	2.3
1.38	15.9	0.112	2.5
1.40	15.6	0.122	2.8
1.42	15.2	0.133	3.0
1.44	14.9	0.144	3.3
1.46	14.6	0.155	3.5
1.48	14.3	0.166	3.7
1.50	14.0	0.177	4.0
1.52	13.7	0.189	4.3
1.54	13.4	0.201	4.5
1.56	13.2	0.213	4.8
1.58	13.0	0.225	5.1
1.60	12.7	0.238	5.3
1.62	12.5	0.250	5.6
1.66	12.1	0.276	6.2
1.68	11.9	0.289	6.4
1.70	11.7	0.302	6.7
1.72	11.5	0.315	7.0
1.74	11.4	0.329	7.3
1.76	11.2	0.342	7.6
1.78	11.0	0.356	7.9
1.80	10.9	0.370	8.2
1.82	10.7	0.384	8.5
1.84	10.6	0.398	8.7
1.86	10.4	0.412	9.0
1.88	10.3	0.426	9.3
1.90	10.2	0.440	9.6
1.92	10.0	0.454	9.9
1.94	9.9	0.468	10.2
1.96	9.8	0.483	10.5
1.98	9.7	0.497	10.8
2.00	9.5	0.512	11.1
2.50	7.4	0.881	18.4
3.0	6.0	1.249	25.0
4.0	4.4	1.938	36.0
5.0	3.5	2.553	44.4
10	1.7	4.810	66.9
20	0.9	7.413	81.9

Explanatory Notes

Galvanic Table/ Dissimilar Metals
ELECTROCHEMICAL CORROSION POTENTIALS

The following table lists the corrosion potential (in volts) for various materials measured against a saturated calomel electrode in sea water at 25°C. The potential difference between any two materials should not exceed 0.50 volts for equipment installed inside, subject to salt free condensation, and 0.25 volts for equipment installed outside at any location. The material with the more negative potential will corrode.

Example, combination of stainless steel (CRS316) and galvanized Iron:

From table, stainless steel (CRS316) = -0.35 V, galvanized iron = -1.05 V
Potential difference = -0.35 - (-1.05) = 0.7 V
Therefore the galvanized iron will exhibit accelerated corrosion

Material	Potential (volts)
Magnesium & its alloys	-1.60
Zinc & its alloys	
Zinc die casting alloy	-1.10
Zinc plating on steel	-1.10
Zinc plating on steel, chromate passivated	-1.10
Zinc coated (galvanized) iron	-1.05
Tin-Zinc (80/20) alloy plating on steel	-1.05
Cadmium plating on steel	-0.80
Aluminium & its alloys	
Wrought aluminium-alloy-clad aluminium alloy	-0.90
Cast aluminium	-0.75
Wrought aluminium	-0.75
Aluminium-manganese alloy	-0.75
Aluminium-magnesium alloy	-0.75
Aluminium-silicon-magnesium alloy	-0.75
Duralium (unclad)	-0.60
Irons & steels	
Non corrosion resisting	-0.70
Stainless steel (CRS304)	-0.45
High chromium stainless steel (CRS316)	-0.35
Austenitic	-0.20
Lead & its alloys	
Lead	-0.55
Lead-silver solder (2.5% silver)	-0.50
Tin & its alloys (other than zinc plating)	-0.50
Tin-lead solders	-0.50
Tin plate	-0.50
Tin plating on steel	-0.45
Chromium	
Chromium plating on steel	-0.50
Chromium and nickel plating on steel	-0.45
Chromium	-0.45
Copper & its alloys (bronze, brass etc.)	-0.20
Nickel & its alloys	
Nickel copper alloys	-0.25
Nickel plating on steel	-0.15
Silver & its alloys	
Silver solder	-0.20
Silver	0.00
Silver plating on copper	0.00
Silver-gold alloy	+0.05
Electrical contact metals	
Rhodium plating on silver plated copper	+0.15
Gold	+0.15
Platinium	+0.15
Carbon	+0.10

We would like to share our vision with you…

RFI is a growing company, one which we are immensely proud of. Like any successful business we need to know we are all heading in the same direction. Our company vision simply ensures that all our team know the framework for our future success:

- **Be locally dominant in our chosen fields**
- **Be globally relevant in our chosen fields**
- **Be profitable**
- **Continue to add shareholder value**
- **Provide a strong and supportive employment environment**
- **Be environmentally responsible**

RFI

www.rfi.com.au

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Company background

RFI has been serving the needs of the wireless communications market for over 25 years. First founded as a manufacturer of antenna systems, RFI has grown to be a key player in the development, manufacturing and distribution of wireless technology and energy products. Through our extensive network of resellers, systems integrators and retail outlets, RFI is a key supplier to industry and Government.

A global approach

RFI is active around the globe, taking our Australian designed and manufactured products to key markets in Asia, the Pacific and throughout the world. Currently RFI exports to 47 countries.

A complete service

RFI's major strength is the company's ability to offer our customers a completely integrated service from design through to the manufacture, distribution and supply of antennas and multicoupling systems, lightning protection products, cables and connectors, rechargeable batteries and solar modules. Extensive engineering research and design expertise, sophisticated test equipment, state of the art software and a superior manufacturing environment, means that RFI can offer complete turnkey project services which includes consulting, testing, training, installation and technical support.

Manufacturing

Our research and manufacturing facility has talented people, sophisticated test equipment, state of the art software and a superior manufacturing environment. We have in place a quality management program which is certified to ISO9001, QS9000 and recently have achieved certification to ISO14001 for our environmental management system, giving you confidence in everything we do.

Distribution

We have formed alliances with “best of breed” wireless technology companies around the world. So, whatever your network, land mobile, cellular, paging, telemetry, telematics or WLAN, we are able to provide components from antenna port to air interface.

In renewable energy we are fast gaining the reputation as the industry’s benchmark distributor. Extensive stockholdings, competitive pricing, comprehensive range and an extensive dealer network all contribute to this reputation for service.

For our customer

Many thousand lines of inventory, conveniently located warehousing, more than two decades of industry experience and knowledgeable sales personnel nationwide means we offer a smooth, simple ordering process to make it easy for you.

RFI is totally customer focused and we recognise our future depends on the success of our customers. We know that to be chosen as your supplier we must add value to your business and to achieve this we will work hard to deliver the best product when and where you need it and will back this up with the very best technical support.

So, whatever your goals, we want you to know we are working with you.

for more information visit our website at **www.rfi.com.au** catalogue 29

the RFI antenna catalogue

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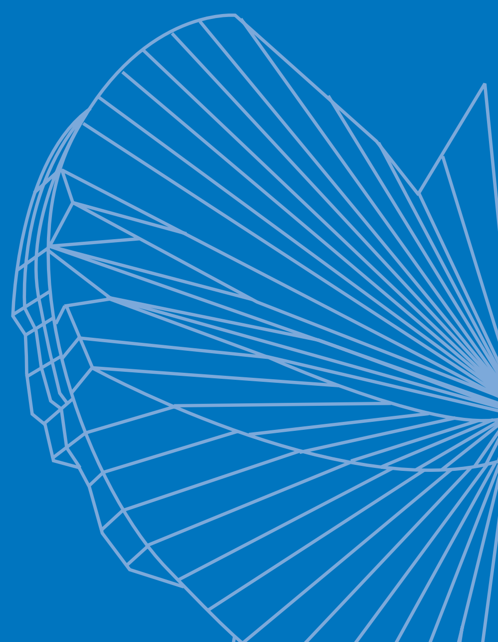

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