










Audio & Electrical Accessories

Microphones

Part No.	Description	Illustration
DM507	Standard 500 Ohm dynamic fist microphone with metal hang-up button	 <p>DMC900</p>  <p>SMP-150</p>  <p>DM507</p>
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	Screw-on	 <p>MC-SC</p>
MC-ST	Stick-on	
MC-MG	Magnetic	
Microphone Cords		
MC-5	5 Core (1 shielded) coiled cord 1.2m	 <p>MC-5</p>
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	 <p>MP-4</p>
MF-3 MS-6 MS-8	3 Pin Socket, In-line 6 Pin Socket, In-line 8 Pin Socket, In-line	 <p>MS-6</p>
MF-4 MF-6 MF-8	4 Pin Socket, Panel mount 6 Pin Socket, Panel mount 8 Pin Socket, Panel mount	 <p>MF-8</p>  <p>MPRA4</p>
MPRA4	4 Pin right angle plug	



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 <i>H x W x D</i>	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	

Panasonic Batteries

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

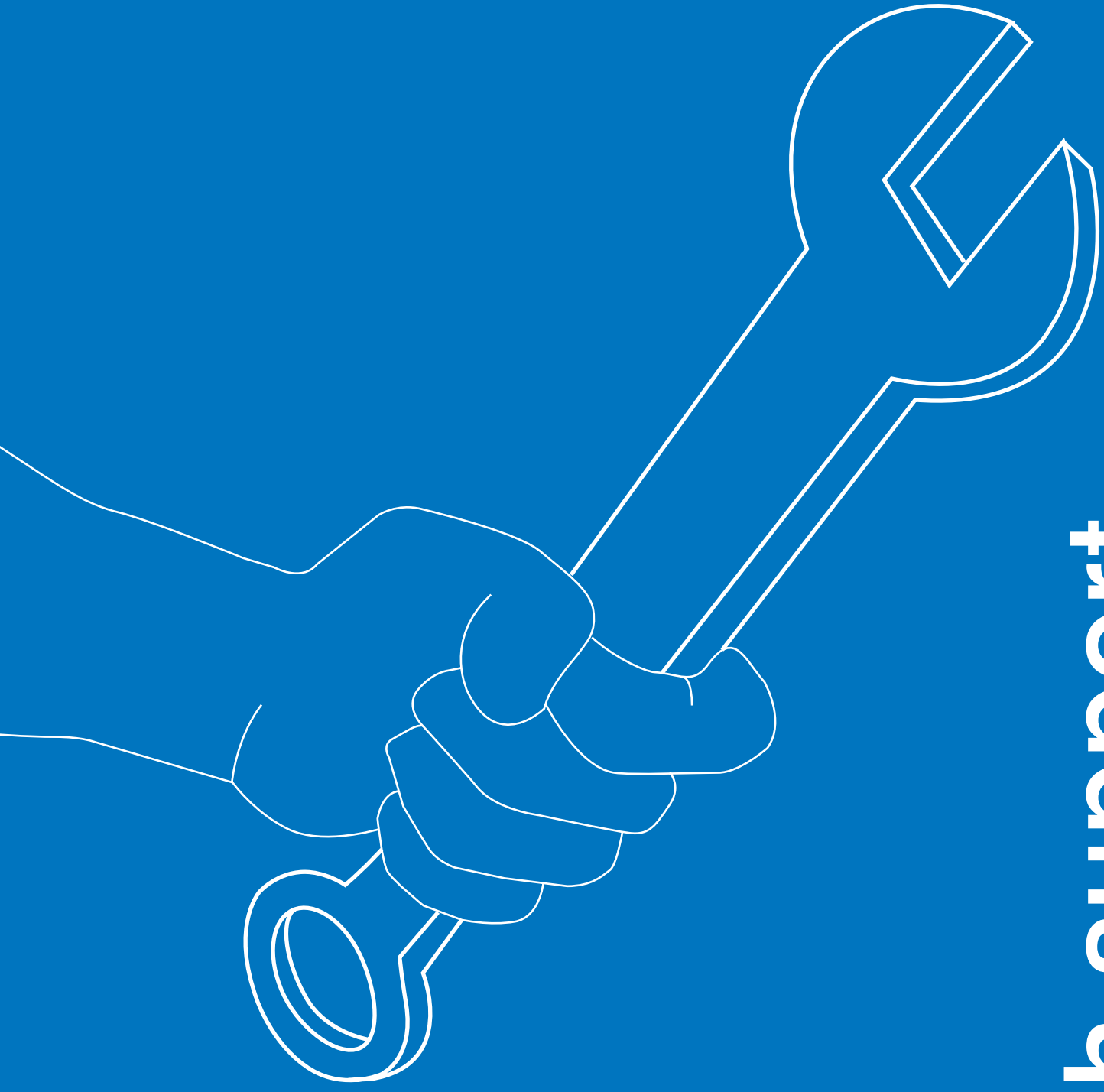
Model	Nominal Voltage V	Rated Capacity (Ah)	Terminal Type	Dimensions mm L x W x D	Weight kg	Carton Qty
LC-XC1228AP	12	28	M5 threaded post	165 x 125 x 179.5	10	2
LC-XC1238P	12	38	M6 Bolt & Nut	197 x 165 x 180	15	1

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

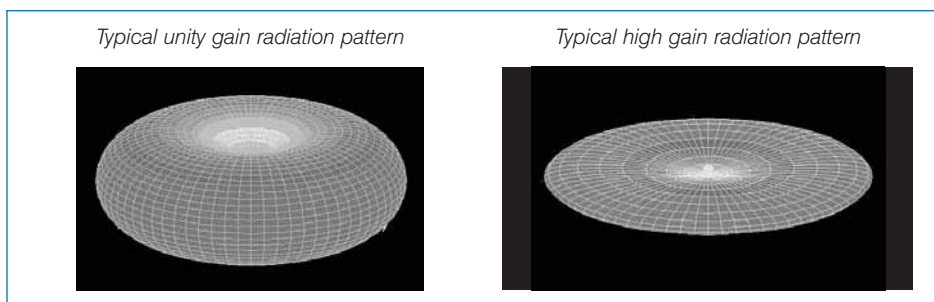
Antenna Gain

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.



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.

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 $\text{dB}/4\lambda$, 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.

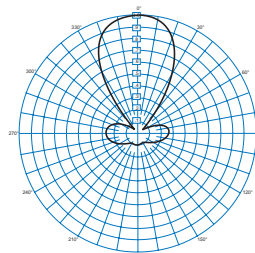
WHY ARE MOBILE ANTENNAS TREATED DIFFERENTLY?

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 $\frac{1}{4}$ wave centre roof mounted whip ($\text{dB}/4\lambda$). 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.

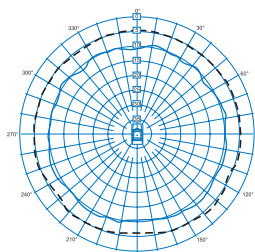
As a matter of almost pure coincidence, should you measure a roof mounted $\frac{1}{4}$ wave antenna on the horizon, it is a close approximation to the theoretical isotropic radiator. We have tested this in the field, comparing the $\frac{1}{4}$ wave whip to the $\frac{1}{2}$ wave dipole, since we could not find an isotropic radiator in our toolbox. (Well perhaps it was there, but being infinitely small we just couldn't see it!).

CONSISTENT WITH THEORY

Theoretically, a $\frac{1}{4}$ 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 $\frac{1}{4}$ wave whip exhibits a gain of approximately 0dBi in the direction perpendicular to the whip, that is, at the horizon, and



Typical yagi directional antenna pattern



Typical mobile antenna pattern

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

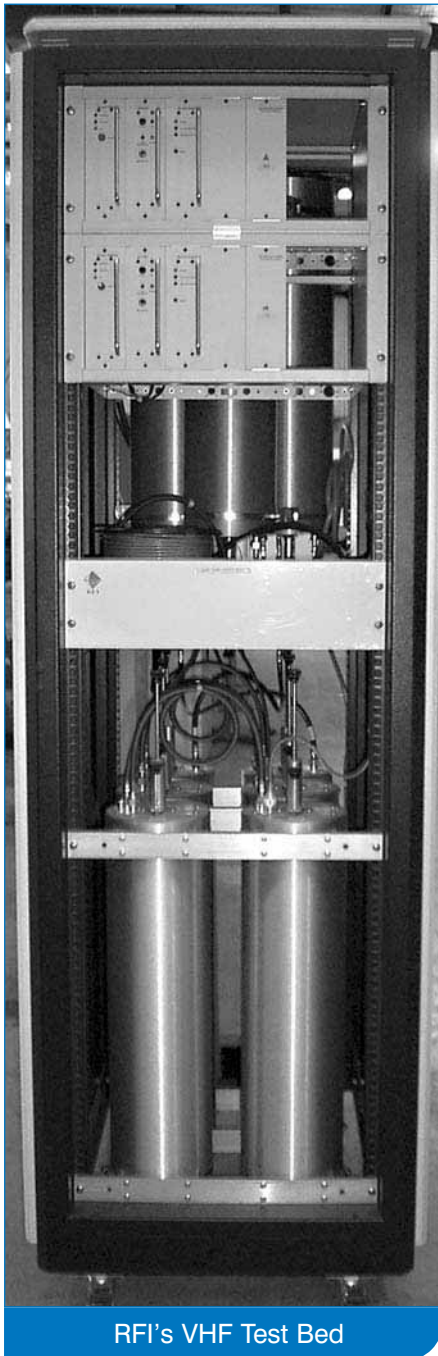
The listed wind ratings for base station antennas are defined as follows:

- **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 ft ² = 929 cm ²
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



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

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:

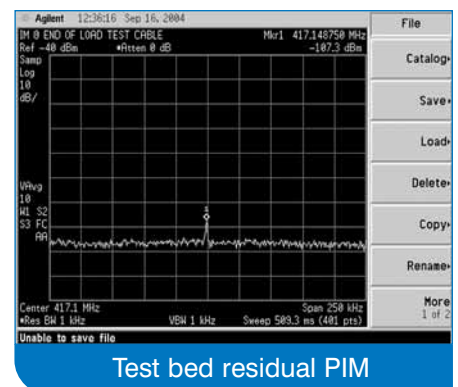
Test Bed	Frequency	Signal Sources	Residual IM
VHF	147-174 MHz	2 x 20W (+43dBm)	-160dBc
UHF	400-420 MHz	2 x 20W (+43dBm)	-161dBc
UHF	400-420 MHz	4 x 10W (+40dBm)	-161dBc
800 MHz	700- 1000 MHz	2 x 0.4W (+26dBm)	-160dBc

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.

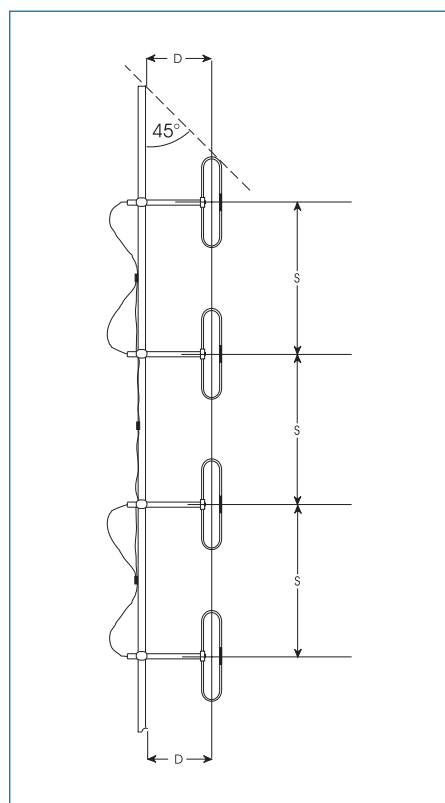


RFI's 800MHz Test Bed



Test bed residual PIM

Phasing of Side Mounted Dipole Antennas



Four Stack

MOUNTING

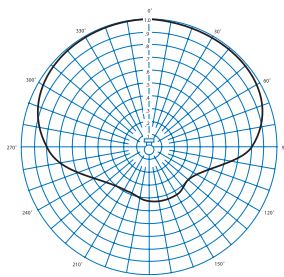
The SMD range of side mounted dipole antennas offer system designers a wide choice in the areas of horizontal radiation patterns and gain. The following radiation patterns were measured when an SMD1 was mounted with the stated antenna to mast spacings. The pattern changes dramatically with this spacing 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

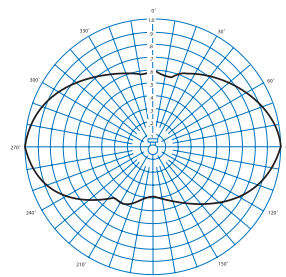
When phasing SMD antennas, designers should first take into account the antenna to mast spacings. The effect in the H plane of phasing SMD antennas is fairly minimal, with only a slight reduction in the horizontal beamwidths (as shown for a single antenna) when up to four antennas are phased. Gain is 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 fiberglass 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.

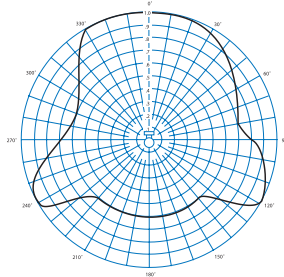
1/4 wave spacing



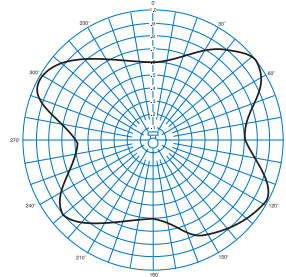
1/2 wave spacing



3/4 wave spacing



1 wave spacing



Model Number	MHz Centre frequency	D= 1/4 wave	D= 1/2 wave	D= 3/4 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

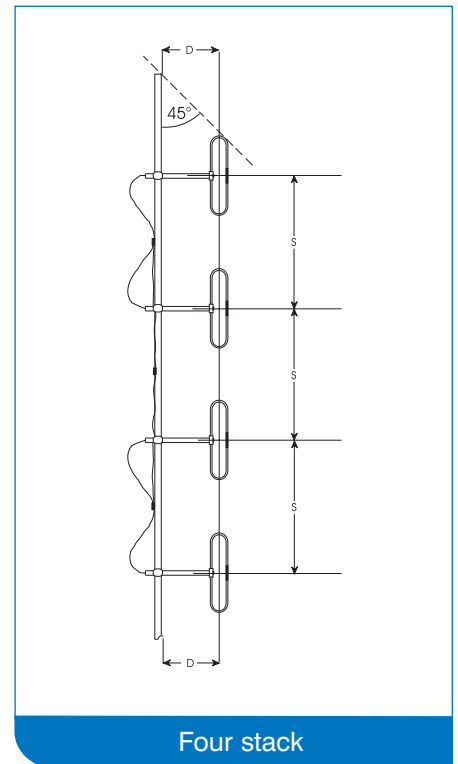
When using side mounted dipole antennas it is important to ensure that the antenna to mast spacings AND the antenna to antenna spacings are optimised for your application. The following graphs indicate the optimum antenna centre to antenna centre spacings and antenna to mast spacings for your frequency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

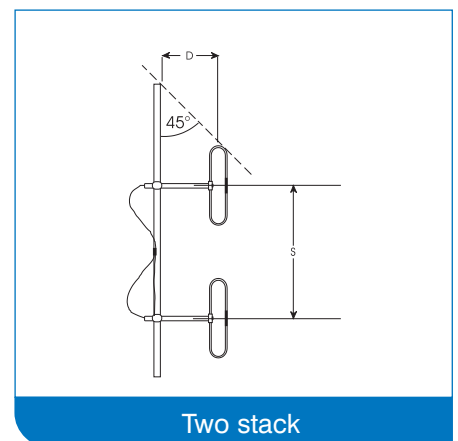
A similar series of patterns will also be effected at UHF frequencies, however it is important to note that for any given support mast, the effect on a UHF antenna will be greatly exaggerated, with deeper nulls and more pronounced peaks in the pattern. We urge the use of our BA, EA and OA Series arrays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

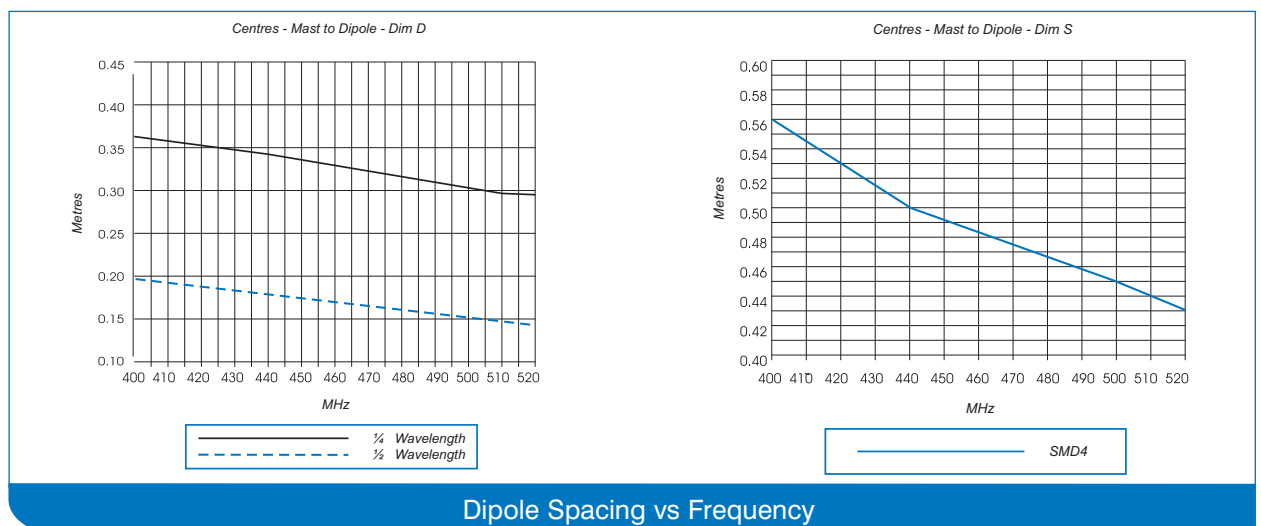
PLEASE NOTE: We strongly recommend against the phasing of 800 MHz side mounted dipole antennas as the control of the dimensions is far too critical to be adequately controlled in the field. Thus, we do not publish any information to assist in the phasing of our 800 MHz side mount dipole antennas.



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.

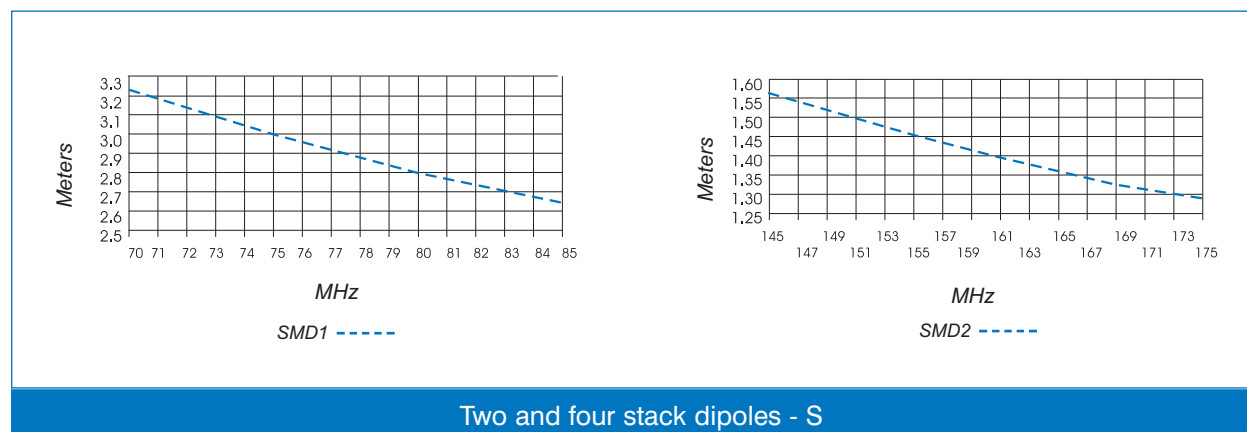
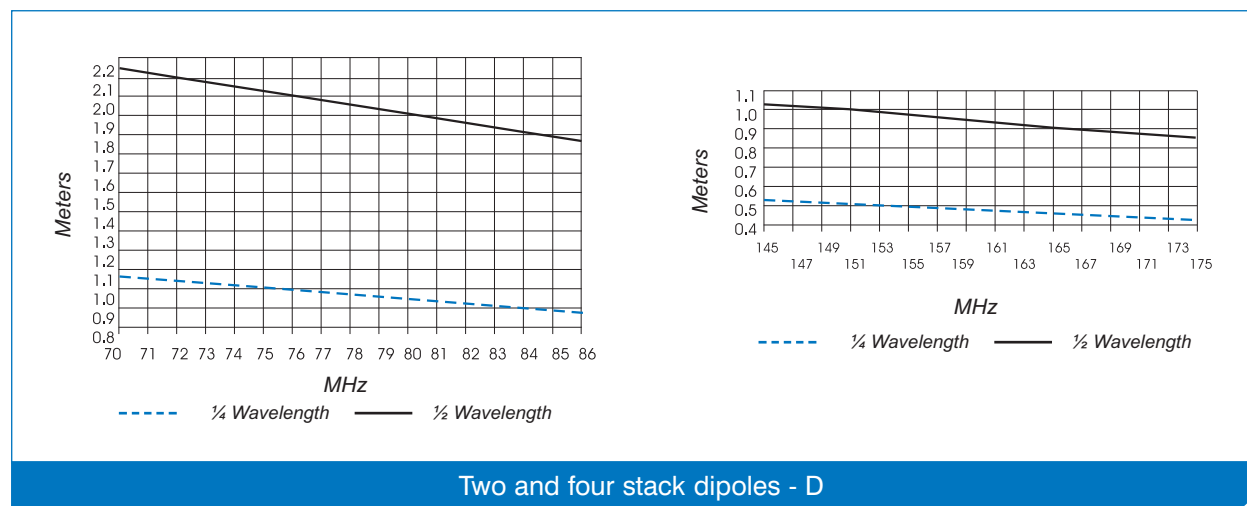
Earlier in this section is an illustration of the various patterns effected at VHF frequencies when side mounted dipole antennas are mounted at differing distances from the support mast.

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.



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.

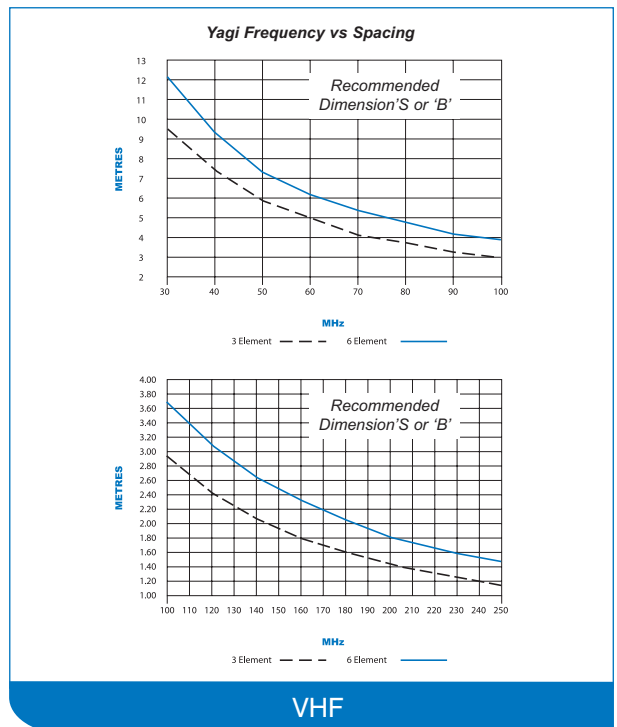
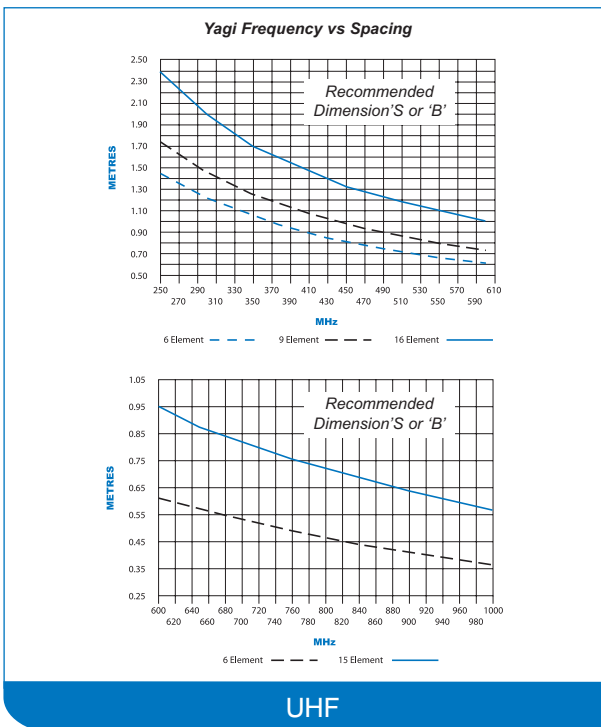
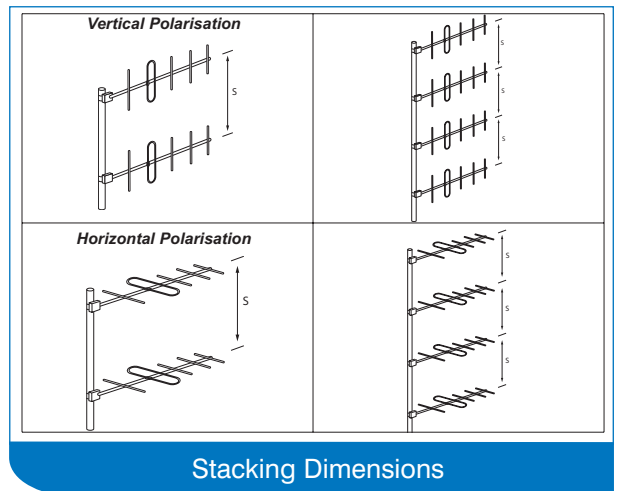
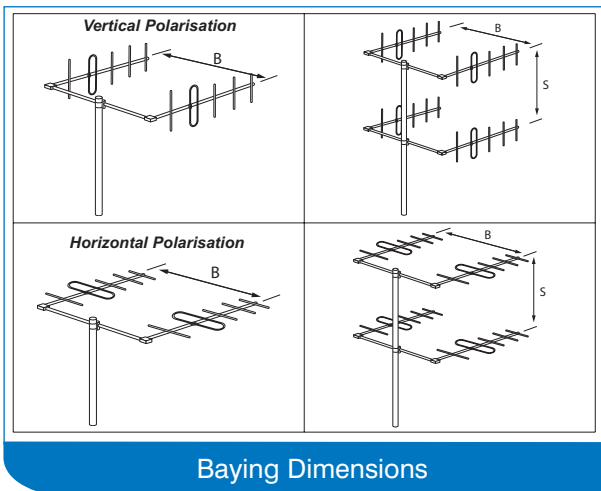
The phasing of yagi antennas requires critical control of both the "Baying" and "Stacking" dimensions as shown in the illustrations. It is important to note that in all cases, these dimensions (B and S from our illustrations) should be identical at any one frequency.

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.

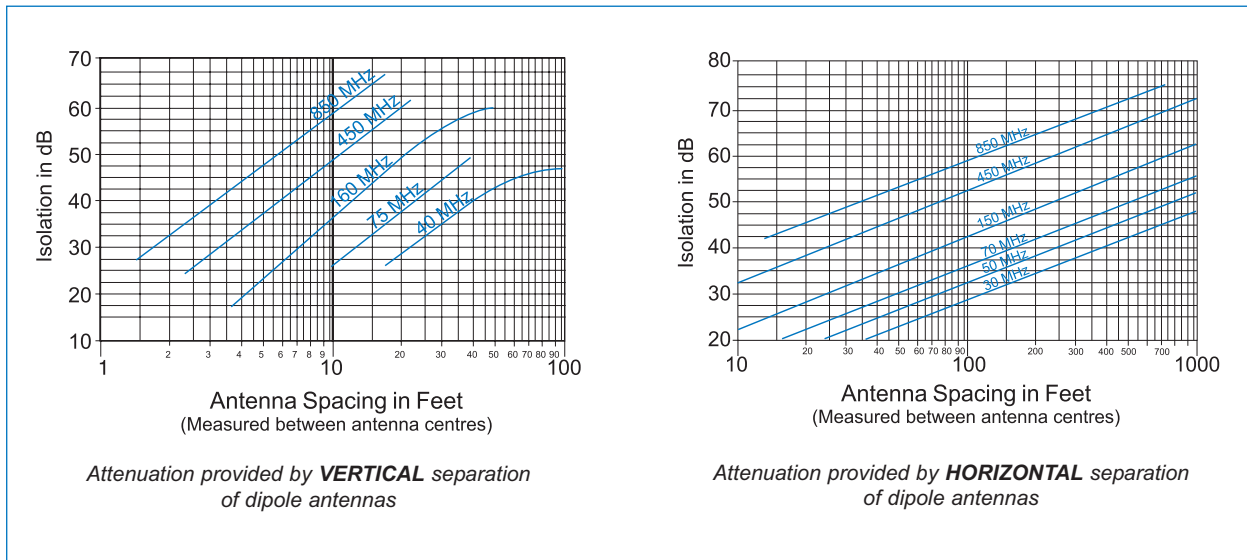
PLEASE NOTE: If you are phasing antennas in MULTIPLE directions, rather than phasing yagi antennas together for additional gain in a single direction, you will experience a net LOSS in gain over your individual antenna gain of 3.0 dB for a two way split and 6.0 dB for a four way split.

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



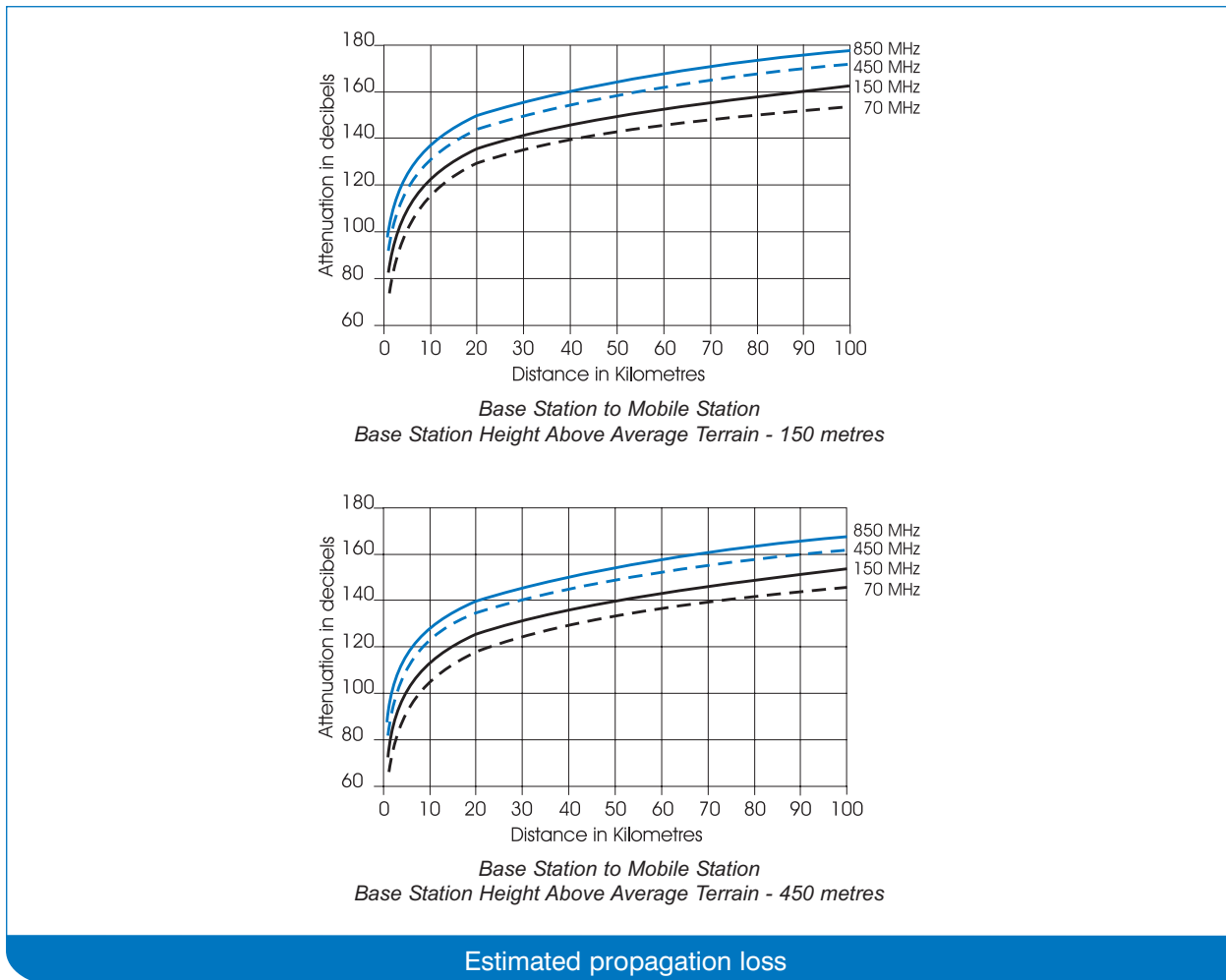
Technical Notes

Isolation vs. Antenna Separation



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.



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

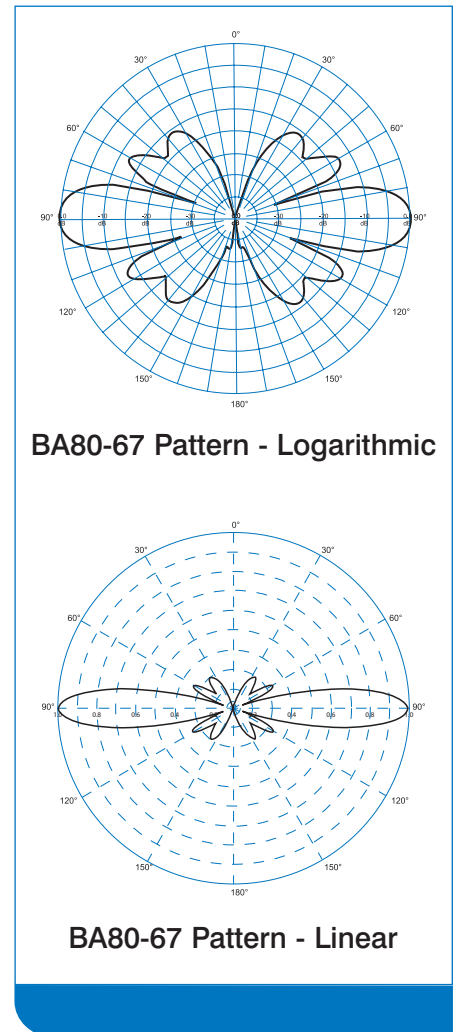
This is an example of our BA80-67 plotted in the logarithmic form. The power level in each “lobe” of the antenna can be clearly read from this pattern, with the level e.g. at -30° from the horizon (120° on plot shown) being 12.5 dB down on the peak gain level at the centreline.

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.

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-shortened, 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

VSWR	Return loss dB	Transmission loss dB	Reflected power %
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
Platinum	+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**



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Index

PART No.	PAGE No.	PART No.	PAGE No.	PART No.	PAGE No.
324	179	92-04DMDM-X	164	BNC-41	156
328	179	92-04NFNF-X	164	BNC-49	156
708	177	92-04NMNF-X	164	BNC-51	156
8011	152	92-04NMNM-X	164	BNC-54	156
8058	151	92-09DFDF-X	164	BNC-80	156
8059	152	92-09DMDF-X	164	BNC-86	156
8062	152	92-09DMDM-X	164	BNC-87	156
8142	151	92-09NFNF-X	164	BNC-88	156
8174	151	92-09NMNF-X	164	BNC-97	156
8178	151	92-09NMNM-X	164	BR-400	153
8179	152	92-12DFDF-X	164	BR400BHNF-TC	158
8213	152	92-12DMDF-X	164	BR400PDF-TC	159
8214	152	92-12DMDM-X	164	BR400PDM-TC	159
8223	151	92-12NFNF-X	164	BR400PNF-TC	158
8400	151	92-12NMNF-X	164	BR400PNM-TC	157
9001	151	92-12NMNM-X	164	BR400PTM-C	162
9005	152	92-13DFDF-X	164	BR-CPT-400	166
9006	151	92-13DMDF-X	164	BU-HFB	176
9008	152	92-13DMDM-X	164	BX40-67	29
9011	152	92-13NFNF-X	164	BX4040-67	29
9014	151	92-13NMNF-X	164	BX80-67	29
9142	151	92-13NMNM-X	164	CD1140	127
29961	168	92-23DFDF-X	164	CD1150	127
43094	168	92-23DMDF-X	164	CD1160	127
247763	168	92-23DMDM-X	164	CD1210	124
400PDF	159	92-23NFNF-X	164	CD1225 Series	125
111ST	86,91	92-23NMNF-X	164	CD1228 Series	125
15 Tape	177	92-23NMNM-X	164	CD1250	125
19256B	168	A5TDF-PS	159	CD1515	124
20-1	176	A5TDM-PS	159	CD1595	112
20-10	176	ACT-1	167	CD1610	124
20-2	176	AMD877.3 Series	123	CD1625 Series	125
23 Tape	174	AP354	102	CD1628 Series	125
241474-4	168	AP454-3G	103	CD1795	126
241474-5	168	AP454-65-5G	103	CD1797	126
24312A	168	AP454-70-5G	103	CD17-xx-50	89
243684-M	168	AP454-71-5G	103	CD17-xx-73	89
31768A	168	AP454-72-4G	103	CD18-xx-50	89
33 Tape	177	AP868.3	110	CD18-xx-73	89
3AG-1	176	APS151.3	94	CD25-42-50	92
3AG-10	176	AVA5-50	153	CD25-43-50	92
3AG-15	176	BA160-67-T3	22	CD28-37-50	93
3AG-20	176	BA4040-57	29	CD28-37-70	93
3AG-25	176	BA4040-57L	29	CD28-41-50	93
3AG-30	176	BA4040-67	29	CD28-41-70	93
3AG-35	176	BA4040-67L	29	CD33-71-73	130
3AG-5	176	BA40-41	16	CD440	101
3DS-100	155	BA40-57	22	CD5000	133
3T-100	155	BA40-67	22	CD50-65-50	96
3T-30	155	BA80-41	16	CD50-65-70	96
4008-0.5	177	BA80-57	22	CD50-68-50	96
4008-1	177	BA80-57L	29	CD50-68-70	96
400PDM	158	BA80-67	22	CD51-65-50	96
400PNF-BHC	158	BA80-67L	29	CD51-65-70	96
400PNF-C-CR	158	BAF2	145	CD51-68-50	96
400PNM-HC-CR	157	BBM-1	144	CD51-68-70	96
400PNM-H-CR	157	BBM-2	144	CD6000	134
40656A-1	168	BBWM-1	144	CD63-71-50	131
40656A-2	168	BBWM-2	144	CD63-71-70	131
40656A-3	168	BF-10-50	176	CD63-71-73	131
40656A-5	168	BF-15-50	176	CD91-65-70	99
43211A	169	BF-20-50	176	CD91-70-70	99
42396A-1	169	BF2-7	176	CD91-71-70	99
42396A-2	169	BF-30-50	176	CD91-72-70	99
42396A-5	169	BF-5-50	176	CD920-71-75	132
44ASP	160	BFH-003	176	CD921-71-75	132
44ASU	161	BG30	147	CD930-71-75	132
4DS-100	155	BG60	147	CD931-71-75	132
4DS-30	155	BK850	144	CD93-65-70	100
4T-100	155	BL-734P	163	CD93-70-70	100
4T-30	155	BM2-7	176	CD93-71-70	100
5DS-100	155	BNC-04	156	CD93-72-70	100
5DS-30	155	BNC-07	156	CD94-65-70	100
5S-100	155	BNC-09	156	CD94-70-70	100
5S-30	155	BNC-113	156	CD94-71-70	100
6DS-100	155	BNC-113RG	156	CD94-72-70	100
6DS-30	155	BNC-174	156	CDM2402	129
6S-100	155	BNC-223	156	CDM2406	129
6S-30	155	BNC-239	156	CDM2408	129
92-04DFDF-X	164	BNC-27	156	CDM2410	129
92-04DMDF-X	164	BNC-33	156	CEC-142	159

Index

PART No.	PAGE No.	PART No.	PAGE No.	PART No.	PAGE No.
CEC-214	159	CSW16/ CSW26	98	HPUS-BNC-67	141
CH-716J	159	DAS-M1	79	HPU-SF-67	141
CH-716P	159	DM507	178	HPU-SFU-67	141
CNT400	152	DMC900	178	HPUS-KR-67	141
COD1	4	DRL3	172	HPU-SM-67	141
COD12	4	DRL6	172	HPUS-MX-67	141
COD14	4	DRL63-3	172	HPUS-SF-67	141
COD2	5	DSW1401Series	84	HPUS-SFU-67	141
COD22	5	DSW1402Series	84	HPUS-SM-67	141
COD24	5	EA4040-57	29	HPUS-TNC-67	141
COD30	3	EA4040-57L	29	HPU-TNC-67	141
COD4-63	6	EA4040-67	29	HS48	172
COD4-65	6	EA4040-67L	29	HS63	172
COD4-70	6	EA40-41	18	HS72	172
COD4-71	6	EA40-67	24	IDC 100W	146
COD4-72	6	EA80-41	18	IDC 200W	146
COD4-99	6	EA80-57	24	IDC 360W	146
COD8-81	7	EA80-57L	29	INS-BK	177
COD8-82	7	EA80-67	24	IS-2	176
COD8-99	7	EA80-67L	29	IS-5	176
COL1	30	EAM2000	120	ISM-2403-C	78
COL11	41	EG880	122	ISM-2403-V	78
COL12	42	EG883	122	ISM-5803-C	78
COL15	34	EG884	122	ISM-5803-V	78
COL16	30	EX40-67	29	ITG2000	114
COL17	34	EX4040-67	29	ITG4000	116
COL1798	45	EX80-67	29	ITG5000	118
COL1799	45	F1PNM-HC	157	ITG5001	118
COL18	36	F2PNM-HC	157	KAV382	145
COL19	42	F4NMV2-HC	157	KAV385	145
COL22	32	F4PDF-C	159	KG2000	145
COL23	39	F4PDMV2-C	159	KG4000	145
COL23-T1	39	F4PDR-C	159	KG5000	145
COL24	36	F4PNF-C	158	KG880	145
COL2402	76	FIPBM-C	156	KP10F-403-NWM	73
COL2406	76	FM	176	KP10F-820-NWM	73
COL2408	76	FME-101	163	KP13F-403-NWM	73
COL2410	76	FME-116	163	KP13F-820-NWM	73
COL27	38	FME-120	163	KP6F-403-NWM	73
COL28	32	FME-140	163	KP6F-820-NWM	73
COL29	32	FME-150	163	L44P	160
COL3	34	FP-1	170	L44U	161
COL34-T1	30	FP-2	170	L4CLAMP-RDN-1	168
COL35	34	FPC10B-100	155	L4CLAMP-RDN-2	168
COL36	36	FPC10R-100	155	L4-CLICK	169
COL4	36	FPC6B-100	155	L4PDF-RC	159
COL42	40	FPC6R-100	155	L4PDM-RC	159
COL43	40	FSJ1-50	153	L4PNF-RC	158
COL477-6	44	FSJ2-50	153	L4PNM-RC	157
COL477-9	44	FSJ4-50	153	L4PNR-HC	157
COL5806	77	FTB-4	168	L5CLAMP-RDN-1	168
COL5808	77	FTB-5	168	L5CLAMP-RDN-2	168
COL5810	77	FTN-4	168	L5-CLICK	169
COL7	41	FTN-5	168	L5PDF-RPC	159
COL8	42	FW11	87	L5PDM-RPC	159
COL803 Series	46	FW11-28	87	L5PNF-RPC	158
COL806 Series	46	FW11-29	87	L5PNM-RPC	157
COL809 Series	46	FW12	90	L6CLAMP-RDN-1	168
COL903	48	GM2	144	L6CLAMP-RDN-2	168
COL906	48	GM7	144	L6-CLICK	169
CPB Conduit	174	GP1	2	L6PDF-RPC	159
CPTL1	166	GP2	2	L6PDM-RPC	159
CPT-E2L2N	166	GP3	2	L6PNF-RPC	158
CPT-L4ARC1	166	GP4	2	L6PNM-RPC	157
CPTL5A	166	GPS1	128	L7CLAMP-RDN-1	168
CPTL6	166	GPS1-BKT	128	L7CLAMP-RDN-2	168
CPTL7	166	HC213	177	L7-CLICK	169
CR2	49	HC58	177	L7PDF-RPC	159
CR4-67	49	HPCB-BNC	141	L7PDM-RPC	159
CR8	48	HPCB-UHF	141	L7PNF-RPC	158
CRA40-67	50	HPH-BNC-37	141	L7PNM-RPC	157
CRD-BNC-65	141	HPHS-BNC-33	141	LC-R0612P1	180
CRD-BNC-68	141	HPHS-SM-33	141	LC-R0612P1	180
CRD-TNC-68	141	HPHS-TNC-33	141	LC-R061R3P	180
CST-001	167	HPH-TNC-37	141	LC-R063R4P	180
CST-213	166	HPM-BNC-28	141	LC-R064R2P	180
CST-399	166	HPM-RM-99	88	LC-R067R2P	180
CSW13/ CSW23	98	HPM-SF-28	141	LC-R121R3P	180
CSW13-66/ CSW23-66	98	HPM-UHF-28	141	LC-R122R2P	180
CSW14/ CSW24	98	HPU-BNC-67	141	LC-R1233P	180
CSW15/ CSW25	98	HPU-MX-67	141	LC-R123R4P	180



Index

PART No.	PAGE No.	PART No.	PAGE No.	PART No.	PAGE No.
LC-R127R2P	180	N-20	158	PHE44-71	75
LC-R127R2P1	180	N-200	158	PHE44-72	75
LC-RA1212P1	180	N-201	157	PHE44-99	75
LC-RD1217P	180	N-202	158	PHE82-81	75
LC-X1220P	180	N-203	157	PHE82-82	75
LC-X1224P	180	N-204	158	PHE82-99	75
LC-X1228P	180	N-205	157	PHE84-99	75
LC-X1242P	180	N-210	158	QC2	176
LC-X1265P	180	N-213	158	QC2I	176
LC-XA12100P	180	N-223	157	QC5	176
LC-XC1228AP	180	N-237	158	QC5I	176
LC-XC1238P	180	N-243	158	QCM2	176
LDF1-50	153	N-245	158	QCPB2	176
LDF2-50	153	N-258	157	R1002	173
LDF4-50A	153	N-28	158	R1003	173
LDF5-50A	153	N-284	157	R1004	173
LDF6-50	153	N-288	158	R1005	173
LDF7-50	153	N-30	158	R1007	173
M-3519	177	N-38	158	R1008	173
M-3614	177	N-41	157	R1009	173
MB10	145	N-46P	158	R1010	173
MB12	145	N-48	158	R1014	173
MB14	145	N-49	158	R1017	173
MB3	145	N-87	157	R1021	174
MB9	145	N-88	157	R2001	174
MBC	145	N-89	157	R3001	174
MBC-00-50F	145	N-95	157	R3002	174
MC-5	178	N-96	158	R3003	174
MC-MG	178	N-98	158	R7500	172
MC-SC	178	NP-10DFB	157	R9720	172
MC-ST	178	OA2020-67	29	R9721	172
MCPT-1412	166	OA2020-67L	29	R9725	172
MCPT-3812	166	OA20-41	20	R9731	172
MCPT-L4	166	OA20-57	26	RCT-174	165
MCPT-78	166	OA20-67	26	RCT-213	165
MCX-02	163	OA40-41	20	RCT-214	165
MDA-201	135	OA40-57	26	RCT-301G	165
MDA-301	135	OA40-67	26	RCT-330K	165
MDD-203	138	OA40-67L	29	RCT5859	165
MDE-101	137	OX2020-67	29	DA16-63	60
MDE-331	137	OX40-67	29	DA16-65	60
MDG-203	138	PC-2F	177	DA16-70	60
MF-3	178	PC-2M	177	DA16-71	60
MF-4	178	PC-3F	177	DA16-72	60
MF-6	178	PC-3M	177	DA16-99	60
MF-8	178	PC-4F	177	DA3-99	60
MK-850	145	PC-4M	177	DA6-61	60
MM2	144	PC58	177	DA6-62	60
MMA-301	135	PH12-24	74	DA6-65	60
MMCX-01	163	PH12-99	74	DA6-99	60
MMCX-02	163	PH14-24	74	DA9-61	60
MMCX-03	163	PH14-99	74	DA9-62	60
MME-101	136	PH22-41	74	DA9-65	60
MME-331	136	PH22-99	74	DA9-99	60
MP10FB	160	PH24-41	74	RF523	177
MP-3	178	PH24-99	74	RF524	177
MP-4	178	PH42-65	75	RF525	177
MP-5	178	PH42-70	75	RF526	177
MP-6	178	PH42-71	75	RF527	177
MP-7	178	PH42-72	75	RF528	177
MP-8	178	PH42-99	75	RXL4-1A	153
MPL-604	163	PH44-65	75	SCF6	172
MPL-605	163	PH44-70	75	SDC05	146
MPL-86	163	PH44-71	75	SDC08	146
MPRA4	178	PH44-72	75	SDC12	146
MS-6	178	PH44-99	75	SDC20	146
MS-8	178	PH82-81	75	SDC30	146
MSF1	145	PH82-82	75	SGL4-06B2	169
MST4.5	172	PH82-99	75	SGL5-06B2	169
MSW25	144	PH84-99	75	SGL6-06B2	169
MUE1	171	PHE12-99	74	SGL7-06B2	169
MUE2	171	PHE14-99	74	SGPL5-06B2	169
N-07	157	PHE22-99	74	SGPL7-06B2	169
N-09P	158	PHE24-99	74	SK950	144
N-10	158	PHE42-65	75	SK953	144
N-114	157	PHE42-70	75	SK954	144
N-118	158	PHE42-71	75	SL2-4	176
N-119P	157	PHE42-72	75	SL2-6	176
N-12	158	PHE42-99	75	SL2-8	176
N-120	158	PHE44-65	75	SL5-4	176
N-15	157	PHE44-70	75	SL5-6	176

Index

PART No.	PAGE No.	PART No.	PAGE No.	PART No.	PAGE No.
SL5-8	176	TLM-3	144	YB16-99	54
SMA-05	163	TLM-4	144	YB6-61	54
SMA-06	163	TLM-5	144	YB6-62	54
SMA-07	163	TLM-6	144	YB6-65	54
SMA-104	163	TLM-7	144	YB6-75	54
SMA-104KN	163	TLR150	105	YB6-99	54
SMA-104RG	163	TLR160	105	YB703-99	64
SMA-104RT	163	TNC-01	162	YB706-99	64
SMA-174	163	TNC-11	162	YB709-99	64
SMA-186	163	TNC-15	162	YB715-99	64
SMA-40	163	TNC-206RG	162	YB803-82	66
SMD1	8	TNC-207	162	YB803-99	66
SMD12	8	TNC-207RG	162	YB806-81	66
SMD14	8	TNC-223	162	YB806-82	66
SMD1-99	8	TNC-26	162	YB806-94	66
SMD2	10	TNC-26RG	162	YB806-99	66
SMD22	10	TNC-26RT	162	YB809-81	66
SMD24	10	TNC-33	162	YB809-82	66
SMD2-99	10	TNC-42	162	YB809-94	66
SMD41-67	12	TNC-86	162	YB809-99	66
SMD41-99	12	TNC-86RG	162	YB815-81	68
SMD4-67	12	TNC-88	162	YB815-82	68
SMD4-99	12	TSW1	86,91	YB815-94	68
SMD8-90	14	TSW150	144	YB815-99	68
SME240-12-10	149	TY533M	177	YB820-82	68
SME240-12-5	149	TY534M	177	YB820-94	68
SMP-150	178	TY535M	177	YB9-61	54
SMP-400	178	UA-3	168	YB9-62	54
SMP-650	178	UB1	170	YB9-65	54
Snap-In Hangers	167	UB2	170	YB9-99	54
SPK-14	155	UC1	171	YBA818-82	69
SPK-24	155	UCR1	171	YBS803-82	70
SSH-12	169	UCR1-120	171	YBS803-99	70
SSH-78	169	UCR2	171	YBS806-81	70
SSH-114	169	UHF-04	160	YBS806-82	70
SSH-158	169	UHF-104	160	YBS806-94	70
STB-1.2	177	UHF-116	161	YBS806-99	70
STB-1.6	177	UHF-117	161	YBS809-81	72
STB-2.4	177	UHF-119	160	YBS809-82	72
STB-3	177	UHF-14	161	YBS809-94	72
STB-4	177	UHF-15	161	YBS809-99	72
STB-6	177	UHF-16	161	YBS815-81	72
STEP10	146	UHF-204	160	YBS815-82	72
STEP7	146	UHF-21	160	YBS815-94	72
SW1	86	UHF-27	160	YBS815-99	72
SW12	90	UHF-28	161	YBS815-99	72
SW1405	121	UHF-32	161	YBSS16-63	57
SW1485	121	UHF-36	161	YBSS16-65	57
SW1486	121	UHF-42P	161	YBSS16-70	57
SW1495	121	UHF-44	160	YBSS16-71	57
SW1585	111	UHF-45	160	YBSS16-99	57
SW1605	121	UHF-46	160	YBSS6-61	57
SW1685	121	UHF-60	161	YBSS6-62	57
SW1686	121	UHF-66	160	YBSS6-65	57
SW2	91	UHF-67	161	YBSS6-75	57
SW22	95	UG1215-06B1	169	YBSS6-99	57
SW23	95	UNV	170	YBSS9-61	57
SW24	95	UNV2	170	YBSS9-62	57
SW25	95	UP-RW0645P1	180	YBSS9-65	57
SW26	95	UP-RW1220P1	180	YBSS9-99	57
SW35	83	UP-RW1245P1	180	YH02	52
SW7	95	UP-RWA1232P1	180	YH02D	52
TC5344A	177	UP-RWA1232P2	180	YH03	52
TC5828	177	V5PDF-RPC	159	YH04	52
TLA150	105	V5PDM-RPC	159	YH06	52
TLA160	105	VC2412-10	148	YH09	52
TLA2000	109	VC2412-15	148	YL02	52
TLA3000	109	VC2412-20	148	YL02D	52
TLA400 Series	108	VC2412-3	148	YL03	52
TLA401 Series	108	VC2412-6	148	YL04	52
TLA600-57	106	VXL5-50	153		
TLA600-65	106	WF12	172		
TLA600-70	106	WF36	172		
TLA600-71	106	WM1	144		
TLA600-72	106	YB02-99	54		
TLA620-99	106	YB03-99	54		
TLA80-BK	104	YB16-63	54		
TLA80-G	104	YB16-65	54		
TLA80-R	104	YB16-70	54		
TLM-1	144	YB16-71	54		
TLM-2	144	YB16-72	54		



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.



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