

CHELTON

Tactical Vehicle Antennas

Dual element
omnidirectional
antennas for tactical
vehicle communications
applications

Company Overview

Chelton (previously European Antennas) specialises in the design, development and manufacture of a wide range of antennas including high gain, printed circuit arrays, ultra wideband directional antennas, multi-octave bicones and high gain collinear omni-directional antennas.

The Chelton Newmarket facility in Cheveley, Newmarket, is a centre of excellence for the design and manufacture of our range of microwave antennas. This facility is designed to manufacture high volume commercial products, while smaller, individual manufacturing cells provide specialist, highly technical facilities for military and security products. We have the flexibility to grow in order to satisfy the demands of our customers, meeting year-on-year increases in the quantities of antennas required.

Our key resource is our skilled and experienced engineering team. With more than 25 years' experience in the design and development of antennas, we always achieve the best solution for meeting our customers' requirement specifications. We can offer products from our standard antenna range with almost 2,500 designs available, make small modifications to meet your requirements or design a bespoke solution for you.

Chelton Newmarket's spherical near-field test facility operates at between 0.8 and 26 GHz. We can provide radiation pattern and antenna gain data, which can be used to verify antenna specification and performance.

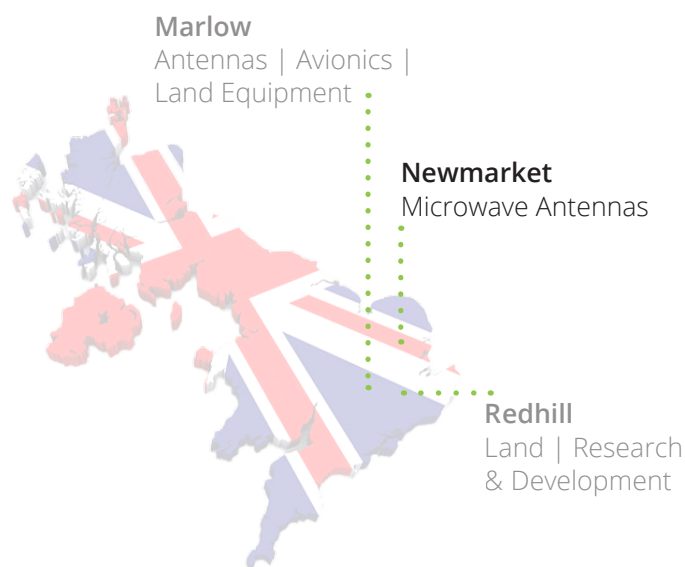


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Executive Summary

Selecting a military antenna has many complex considerations to ensure it not only fits the application requirements but performs well within a multitude of environments. Military antennas, especially, often have to face hostile environments and as such need to be built to the highest standards.

Chelton's specialist antennas are used worldwide for defence and military applications. Our extensive experience in the design and manufacture of antennas means that we are able to supply solutions to the most complex of RF problems.

This whitepaper will explore Chelton's current range of dual element omnidirectional antennas and discuss why they are selected by some of the most formidable agencies. This whitepaper will also introduce a new configuration option to allow a user to remove an antenna from its base using a simple, yet highly robust mechanism to enable removal without tools and within an NBC environment.

To be successful in a future multi-domain battlefield, formations will require robust network connectivity both stationary and on the go as well as heavy-duty and low profile antennas designed for use in remote locations on armoured or civilian vehicles. Typically, an antenna is made up of three major parts; the antenna base, the lower element and the upper element. The spring absorbs shocks and vibrations while also protecting the antenna from collision. Both radiating elements are made using of composite materials enabling the antenna to retain exceptional strength and roughness even in the harshest environments.

| Vehicle V/UHF

| Vehicle UHF

| Vehicle HF

| Vehicle VHF

| Vehicle MUOS SATCOM



1. Introduction

Many military vehicles are now being fitted with advanced mobile ad-hoc network (MANET) systems using multiple antennas to provide robust communications in congested or contested environments.

Generally, military MANET systems operate in L-band, S-band and C-band. Typically, a suite of antennas is fitted onto a vehicle, consisting of a mix of vertically and horizontally polarized dual band antennas which provide frequency, polarisation and spatial diversity, significantly increasing the performance of the system. Chelton has developed a portfolio of vertically and horizontally polarised dual band omnidirectional antennas designed for use in these systems, available in C+L, C+S, and L+S band combinations.

2. Product Features

The antennas have the following key features:

- A unique compact horizontally polarized antenna technology
- Broadband performance
- Rugged designs suitable for military vehicle and marine installations:
 - Qualified to MIL-STD-810 standards;
 - US/NATO standard mounting holes;
 - IP68 Rated
- Stacked solutions which:
 - *eliminate co-site interference*
 - *preserve the azimuth radiation patterns (low azimuth ripple)*
 - *reduce the number of installs per vehicle*

3. Product Options

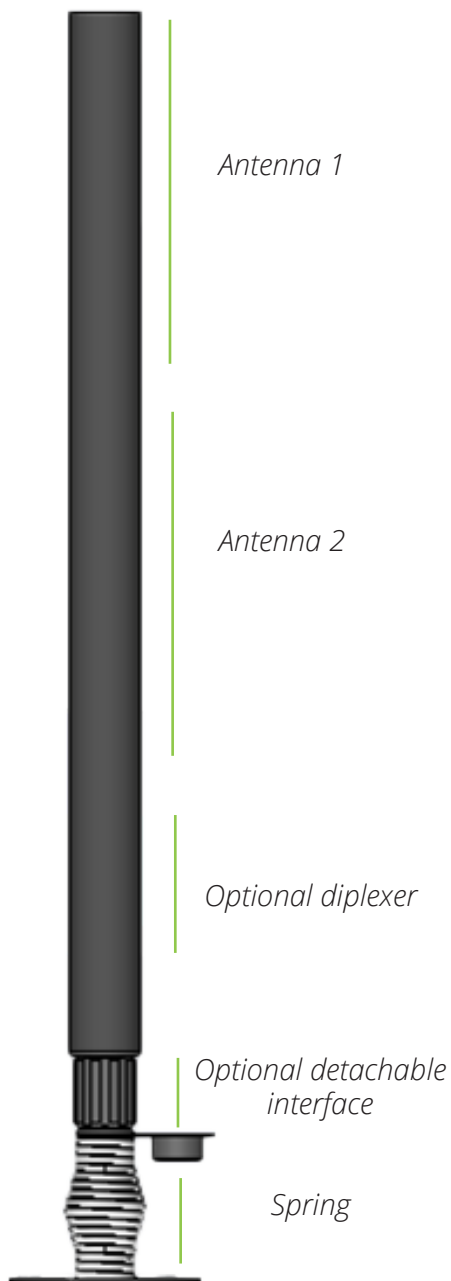
Chelton's ever expanding portfolio of dual element omnidirectional antennas is available in a wide range of configurations covering the following features.

| Gain Options | Polarisation Options | Frequency Bands | Integrated or Detachable Antennas |
|--|---|---|---|
| Multiple gain and elevation pattern options available to suit any operational requirement with antenna gain typically in the range of 2-9 dBi. | Vertically and horizontally polarised antenna designs available in L-Band, S-Band and C-Bands Single and dual polarised products | Single and dual band products covering L-Band, S-Band and C-Band Dual band products can be supplied with either a single connector fed to the antenna elements through an integrated diplexer, or with two connectors. | Antenna elements and spring base as a single integrated assembly Separate base units with interchangeable antennas |

Each dual element antenna consists of two, single-band omnidirectional antennas, one mounted above the other, on a spring mount base with a NATO standard base.

Each antenna is designed to radiate in all azimuth directions equally, with a peak in the elevation plane on the horizon. The antenna performance is completely independent of the host vehicle. In addition, because the antennas are placed relatively high above the mounting flange, and have a comparatively narrow beamwidth in the elevation plane, the potential for radiation pattern distortion due to metallic parts of the vehicle is minimised.

Dual band antennas are available with a single port and with two ports. The single port designs contain an integrated diplexer with a single interface cable which passes through a spring to an N-type connector in the base of the antenna. In the dual port options, each element is directly fed with interface cables which pass through a larger spring to two N-type connectors in the base.



The dual band omnidirectional antenna portfolio has been qualified against the military standards listed in Table 1.

| Category | Test |
|------------------|---|
| Vibration | MIL-STD-810H, Method 514.8, Procedure I, (Ground Mobile) Operational, Category 20, Figure 514.8D-10 for two hours per axis. |
| Hot Temperature | MIL-STD-810H, Method 501.7, Procedure II, Operational, Climatic Category A1 - Hot Dry, Table 501.7-III Induced Storage and transit conditions, 3 cycles |
| Cold Temperature | MIL-STD-810H, Method 502.7, Procedure II, Operational, Table 502.7-I, Severe Cold (C3), 4 hours |
| Humidity | MIL-STD-810H, Method 507.6, Procedure II, Aggressive, 10 x 24 hr cycles |
| Salt/Fog | MIL-STD-810H, Method 509.7, 5% salt solution, 96hrs (alternate 24 hour periods of wet and dry) |

Table 1: Qualification testing that has been carried out

The current portfolio of dual element omnidirectional antennas consists of 13 products, as listed below. Please contact Chelton for other configurations.

Vertically Polarised

| | | |
|--------------------|------------|---|
| OA-0.03-0.50V/2425 | VHF/UHF | 30 - 512MHz single port |
| OA-2.3V-4.7V/2513 | S / C band | 3dBi gain in S-Band, 5.5dBi gain in C-Band, single port |
| OA-1.4V-4.7V/2574 | L / C band | 3dBi gain in L-Band, 5.5dBi gain in C-Band, single port |
| OA-1.4V-2.3V/2567 | L / S band | 3dBi gain in L-Band, 3dBi gain in S-Band, single port |
| OA-1.4V-2.3V/2585 | L / S band | 6dBi gain in L-Band, 3dBi gain in S-Band, single port |
| OA-1.4V-4.7V/2596 | L / C band | 6dBi gain in L-Band, 5.5dBi gain in C-Band, single port |
| OA-2.3V-4.7V/2650 | S / C band | 6dBi gain in S-Band, 5.5dBi gain in C-Band, single port |
| OA-2.3V-4.7V/2679 | S / C band | 4dBi gain in S-Band, 6dBi gain in C-Band, dual port |

Horizontally Polarised

| | | |
|-------------------|------------|---|
| OA-2.3H-4.7H/2514 | S / C band | 3dBi gain in S-Band, 5.5dBi gain in C-Band, single port |
| OA-1.4H-4.7H/2575 | L / C band | 3dBi gain in L-Band, 5.5dBi gain in C-Band, single port |
| OA-1.4H-2.3H/2568 | L / S band | 3dBi gain in L-Band, 3dBi gain in S-Band, single port |
| OA-1.4H-2.3H/2586 | L / S band | 6dBi gain in L-Band, 3dBi gain in S-Band, single port |
| OA-1.4H-4.7H/2597 | L / C band | 6dBi gain in L-Band, 5.5dBi gain in C-Band, single port |
| OA-2.3H-4.7H/2680 | S / C band | 4dBi gain in S-Band, 6dBi gain in C-Band, dual port |

Table 2: Dual band omnidirectional antenna portfolio



4. Chelton's new detachable antenna option

Chelton has recently launched a new configuration option which allows the user to remove an antenna from its base using a simple, highly robust mechanism that makes removal possible without any tools and within an NBC Environment.

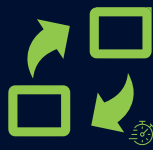
The new detachable interface has the following key features:

- It has been developed to ensure a repeatable RF connection between base and the antenna up to 6 GHz with a lifetime of at least 500 matings
- The interface can support single channel and dual channel antennas
- It has been designed to cope with dust and dirt at the mating surfaces
- It has been designed with an anti rotation feature to protect the connection and prevent damage during installation and removal
- The interface is internally protected and waterproof to IP68

Benefits of new detachable interface



Antenna can be quickly removed for maintenance, storage and transport.



Antenna can be quickly replaced following damage or swapped between vehicles.



Upgrades can be implemented without affecting the vehicle install and cabling.



Antenna mounts can easily be repurposed to suit operational requirements.*



Antennas can be quickly removed from the vehicle and mounted e.g. on a mast (via our range of ancillaries) to improve coverage and range.

- **Use of a low gain antenna in more urban environments providing higher angles of coverage*
- **Use of a high gain options to provide more range in open environments.*
- **Use of different frequency bands to suit operational needs*

TACTICAL MAST SYSTEMS MADE FROM COMPOSITE MATERIAL

Mastsystem provides wide range of tactical field and vehicle masts, accessories, mounting kits and antenna pointing devices for rapid top load repositioning.

**MAST
SYSTEM**

CHELTON

Detachable antennas are available with protective caps and bags to provide further protection during storage.

Alternative base mounts are also available as shown below. Other bespoke alternatives can be developed to suit specific mounting requirements.



5. Summary

High performance MANET systems rely heavily on a number of features, notably:

- Frequency diversity
- Spatial diversity
- Polarisation diversity
- High gain in the azimuth plane with uniform radiation in all azimuth directions

Chelton's unique and versatile range of high gain, dual polarised and dual band antennas provide the user with longer range and operational flexibility.

With the introduction of the new detachable antenna option, this versatility is further enhanced by making operational reconfiguration a task that takes just a few seconds.

6. Further Assistance

The primary points of contact for this whitepaper are as follows:

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