CHELTON

Electronic Warfare Antennas

Man Pack Antennas

Antennas for Light Vehicles

Antennas for Armoured Vehicles

Control links and robotics

Electronic Warfare

Antennas - Ultra Wideband Antennas:

Omni, Multi-stacked Omni, Cavity Backed and High Power Planar Spiral Antennas

Electronic Warfare

Electronic Warfare (EW) is the use and denial of the RF spectrum to the enemy.

It encompasses long term tactical electronic intelligence Gathering (ELINT) and the immediate protection of high value assets such as aircraft and ships. In modern warfare the protection of vehicles and foot-soldier from RF activated IEDs is critical.

EW has two distinct branches:

- receiving and analysing the threat signal.
- countering the threat signal by transmitting a high power jamming signal.

The likely source and nature of the threat is understood for any specific theatre of operation, but the systems have to respond instantaneously over a wide range of frequencies for both transmit and receive.

All antennas used in EW systems must have wide, instantaneous bandwidth.

Ultra wideband omni and directional antennas can be used for systems for foot-soldier to ship-borne and from land-vehicle to helicopter.

Having detected RF signals associated with threats (missile, radar or IED), one possible evasiveaction is to deny use of the RF spectrum by countering (jamming) with appropriate levels (1 to 500 Watts) of microwave energy at the same frequencies.

If the location of the threat is known a directional high power, high gain antenna would be most appropriate. If the direction is unknown then an omni antenna would provide 360° blanket coverage.

As RF sources and amplifiers used for jamming are developed to cover wider bands at higher power, it is important that appropriate antennas are developedin parallel. The antennasmust be wide-open, covering all specified bands without the need for tuning. For omni antennas peak gain must be on the horizon at all frequencies, they must be small enough to be used by foot soldiers and rugged for vehicle applications, with high efficiency to extend battery life.

Chelton have developed a portfolio of ultra wideband omni and directional (planar spiral) antennas in the range 100MHz to 18GHz to cover all of the bands in which high power amplifiers currently operate.

Ultra Wideband Omni

Biconical omnis are fully efficient, vertically polarised broadband antennas.

Depending on design, bandwidths from 3:1 to 30:1 are achievable. Multi-stacked omnis can offer versatile configurations to counter multiple threats.

Multi stacked Omni antenna

Ultra Wideband antenna, 0.8to 6 GHz, XPO2V-0.8-6.0/1485

Cavity Backed Spirals

High fidelity cavity backed spirals for traditional EW direction finding systems. Phase and amplitude matching available.

A pair of phase matched cavity-backed spiral antennas PSA0218L/1333

High Power Planar Spiral Antennas

Directional, ultra wideband, high power, circular polarised antennas are available with bandwidths up to 30:1. This range is expanding with new developments to meet customers' deployment requirements.

A planar spiral antenna with 100W power, 0.15 to 3GHz, PSA-50200-LP/1211

High Power Planar Spiral Antennas

High Power Planar Spiral Antennas

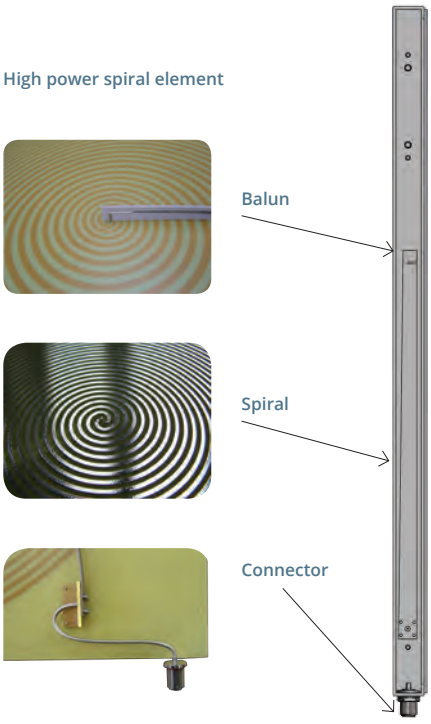
The flat-panel, reflector-backed spiral has no absorber so it can handle up to 100Watts, fully efficiently, with up to 8dBi peak gain, giving an impressive level of EIRP for Countermeasures.

Like their receive-only cavity-backed spiral counterparts, the reflector-spiral antenna provides circular polarisation which can
have benefits in many scenarios where the polarisation of the threat signal is unknown.

Very wide bandwidths of 10:1 and more have been achieved with better than 10dB return loss and without tuning circuits. Products working down to 150MHz have been developed (900mm/36inches square) with the low frequency response being directly proportional to the dimensions of the antenna.

Where it may be useful to provide signal in opposite directions simultaneously (peanut-shaped) from one structure, a variation of the planar spiral is one which is bi-directional. In this structure the peak of beam is from both flat faces of the antenna simultaneously and the gain is 3dB lower than for the equivalent size reflector-spiral, but remains just as efficient.

The planar spiral also has uses for multi-band communications in commercial applications such as in-building Distributive Antenna Systems (DAS) for cellular, WiMAX and emergency services.



Section view through planar spiral

Antenna	Frequency GHz	Gain dBi	Beamwidth Az°	Beamwidth El°	Polarisation	Dimensions mm	Connector	Power W	Photo P
UWBA15300/1221	0.15 - 3.00	-2 to +8	60	60	Right Circular	705x671x36	N(F)	100	P
PES-200-500-NC/581	0.20 - 1.00	2	n/a	n/a	Dual Circular	560x372x34	N(F)	200	P
PSA-50200-LP/1211	0.50 - 3.00	8	70	60	Right Circular	490x365x30	N(F)	100	P

UWBA15300/1221

PES-200-500-NC/581

High power planar spiral antenna mounted under vehicle provide countermeasures

Electronic Warfare

Ultra Wideband Omni Antennas

Left to right
XPO2V-2.0-18.0/1397
XPO2V-0.8-6.0GF/1441

Ultra-wideband Omni-directional antennas

Biconical omnis are fully efficient, vertically polarised broadband antennas which have 1-3dBi gain across the band with low azimuth ripple and typical elevation beamwidths of 60°. This provides excellent coverage whatever the orientation of the vehicle or man-pack. Being centre-fed and ground-plane independent, the peak gain is on the horizon across all bands so that high power can be delivered where needed.

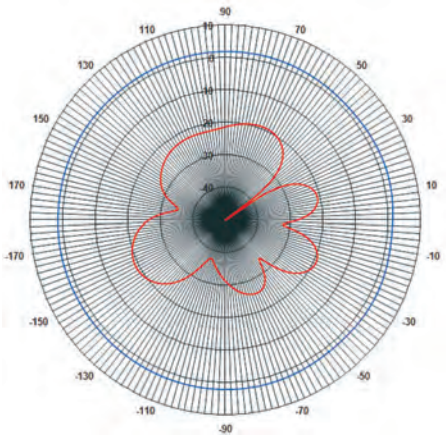
Biconical antennas can be configured to have bandwidths up to 30:1. At lower frequencies the diameter becomes disproportionately larger, so the slimmer hybrid-bicones can be used which have bandwidths up to 5:1.

XPO2V-0.8-6.0-GF/1441

- Frequencies from 100MHz to 18GHz
- Ground plane independent
- Vertically polarised
- Elevation HPBW typically 60°
- Typically 1 to 3dBi gain across the band
- Excellent azimuth ripple
- High power
- Peak gain on horizon across bandwidth

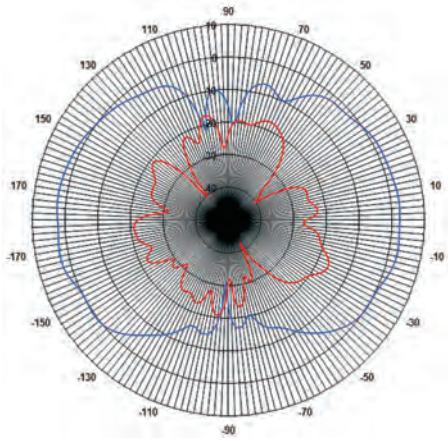
Azimuth Pattern

The measured azimuth pattern shown for XPO2V-0.8-6.0-GF/1441 demonstrates very low azimuth ripple, which is essential to ensure maximum area protection



Elevation Pattern

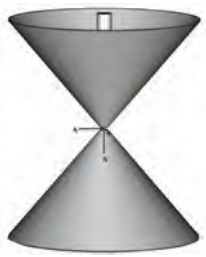
The measured elevation pattern shown for OA2-0.3-10.0V/1505 demonstrates that the peak gain is on the horizon and remains so across all frequencies



Bicone Omni antennas

Hybrid bicone has smaller diameter than bicone, and up to 5:1 frequency bandwidth

True biconical element provides up to 30:1 frequency bandwidth



Multi-stacked Omni-directional antennas

To cover very wide bands without obvious frequency gaps, “Feed-Through” technology has been developed which allows several wideband omni antennas to be ‘stacked’ so that they may be designed into a single housing.
A stacked omni will have a single mounting point on a vehicle, saving space and reducing the shadowing of one antenna with another.

As a bonus, high isolation between antennas allows systems with the capability of providing overlapping frequencies to target multiple threats without self-jamming.

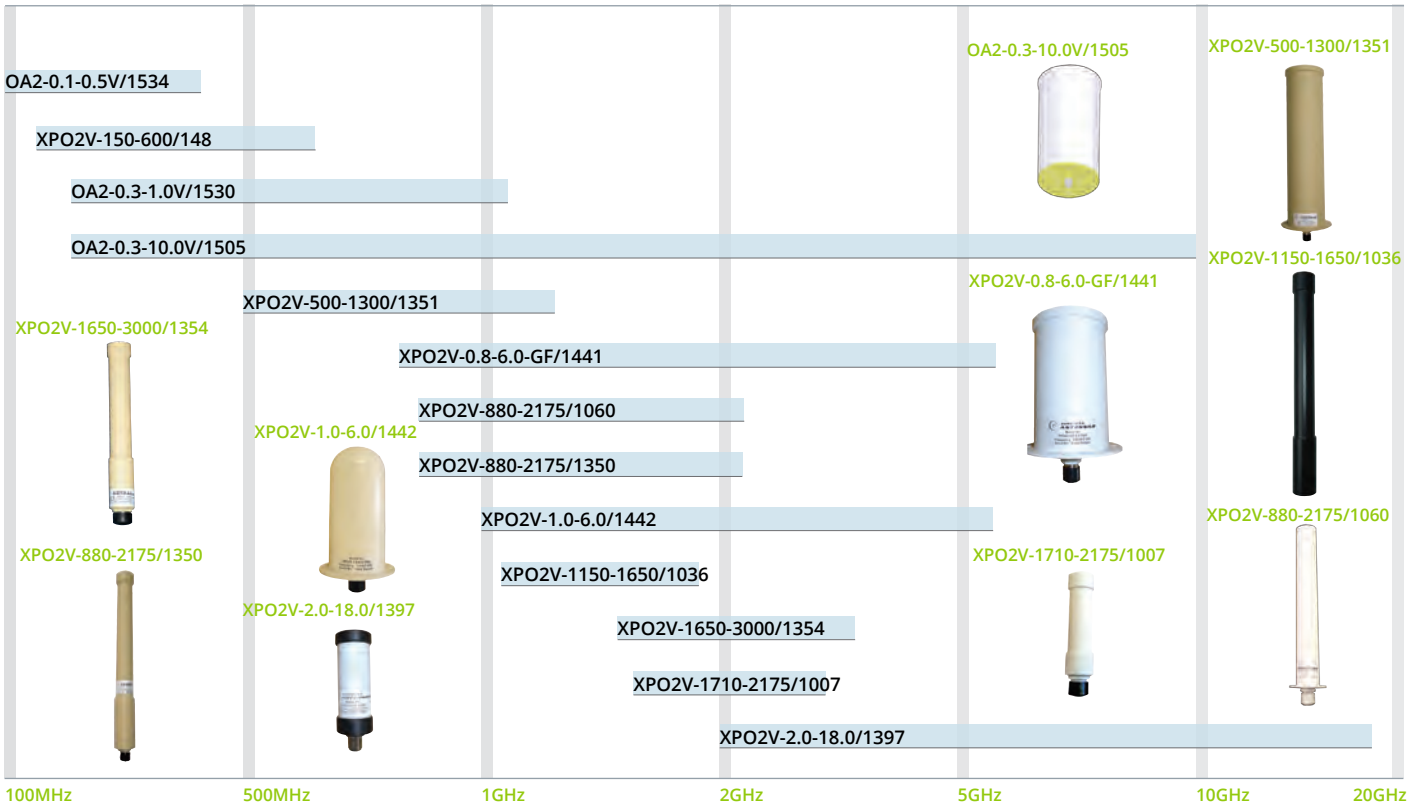
- New feed-through technology allows multiple antennas to be co-located, saving space and shadowing
- Overlapping frequencies for multiple applications
- High isolation between bands
- 200W per band simultaneously
- Good return loss across all bands
- Optional spring with NATO mount

Ultra Wideband Omni Antennas

Omni antennas on light vehicles for army patrols

Omni Antenna Matrix - Single and Multi-stacked

Some of the ultra wideband omni antennas that form the cornerstone of multi-stacked omnis and new development projects



Ultra-wideband Omni-directional antennas

Antenna	Frequency GHz	Gain dBi	Beamwidth Az°	Beamwidth El°	Polarisation	Dimensions mm	Connector	Power W	Photo P
OA2-0.1-0.5V/1534	0.13 - 0.50	0 (<200)							
		2 (>200)	360	60	Vertical	855x104 Ø	N(F)	50	
XPO2V-150-600/148	0.15 - 0.60	2	360	80	Vertical	805x155 Ø	N(F)	250	
OA2-0.3-1.0V/1530	0.30 - 1.00	2	360	60	Vertical	472x104 Ø	N(F)	50	
OA2-0.3-10.0V/1505	0.30 - 10.0	2	360	65	Vertical	305x161 Ø	N(F)	100	P
XPO2V-500-1300/1351	0.50 - 1.30	2	360	80	Vertical	338x108 Ø	N(F)	100	P
XPO2V-0.8-6.0-GF/1441	0.80 - 6.00	2	360	75	Vertical	143x108 Ø	N(F)	100	P
XPO2V-0.8-6.0/1485	0.80 - 6.00	2	360	75	Vertical	143x108 Ø	N(F)	100	P
XPO2V-880-2175/1060	0.88 - 2.17	2	360	50	Vertical	221x31 Ø	N(F)	50	P
XPO2V-880-2175/1350	0.88 - 2.17	2.5	360	50	Vertical	344x36 Ø	N(F)	50	P
XPO2V-1.0-6.0/1442	1.00 - 6.00	2	360	70	Vertical	134x59 Ø	N(F)	100	P
XPO2V-1150-1650/1036	1.15 - 1.65	2	360	70	Vertical	249x25 Ø	N(M)	25	P
XPO2V-1650-3000/1354	1.65 - 3.00	2	360	80	Vertical	253x25 Ø	N(F)	50	P
XPO2V-1710-2175/1007	1.70 - 2.17	3	360	50	Vertical	147x26 Ø	N(F)	50	P
XPO2V-2.0-18.0/1397	2.00 - 18.00	2	360	70	Vertical	104x39 Ø	N(F)	50	P
XPO2V-4.0-18.0/1382	4.00 - 18.00	2	360	60	Vertical	78x26 Ø	N(F)	40	

Electronic Warfare

Cavity-Backed Spiral Antennas - Receive only

Omni antennas on armoured vehicles

Cavity-Backed Spiral Antennas - Receive only

The cavity-backed spiral is the traditional antenna that provides very wide bandwidth, circular polarization and high fidelity monotonic patterns and is the mainstay of an EW direction-finding system for instantaneous threat analysis.

The spiral element comprises two parallel transmission lines formed into a planar spiral which are fed via a broadband balun, usually at the centre point of the spiral. The highest frequency of the spiral is determined by the fineness of the feed structure at the centre of the spiral, whilst the lowest usable frequency is determined by its diameter.

The spiral is mounted at the front of a cavity which is filled with RF absorbing material to ensure that internal reflections, which could corrupt the forward-looking radiation patterns, are nullified.

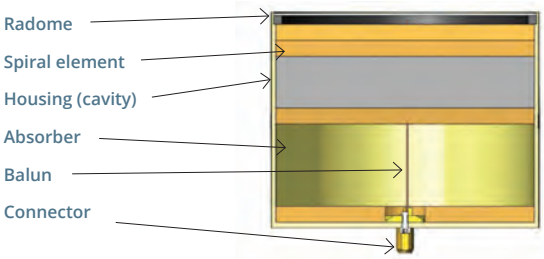
It is important that cavity–backed spiral antennas provide a high level of fidelity from one antenna to another and therefore critical components are sourced from the same batch, with antennas manufactured and tested in batches.

To provide accurate direction finding (DF), an array of spiral antennas (usually 4, 6 or 8), each with 60-90° beamwidths are arranged to provide 360° coverage.

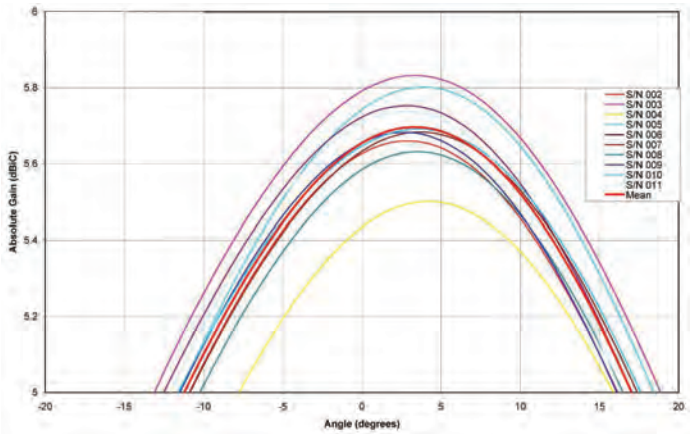
The antennas in a DF system must be phase and/or amplitude matched across the range of frequencies (for example 2-18GHz). This means that all spiral antennas used for this type of application must be fully characterized (at 10 to 100 frequencies) and grouped into matched batches.

High accuracy phase and amplitude measurement is carried out in the company's spherical anechoic test chamber.

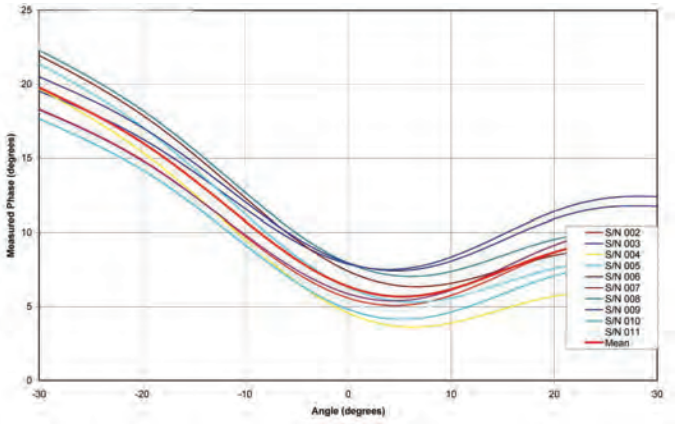
Many of our standard cavity-backed spirals may be used in DF systems, covering bands from 300MHz to 20GHz, for a variety of platforms including UAVs, helicopters, sub-sonic aircraft and terrestrial systems. Special frequencies and functions can be incorporated into designs for new applications.



Wide band cavity-backed spirals (10) showing better than 0.4dB amplitude matching over wide beamwidth



Wideband cavity backed spirals (10) at 3.5GHz showing better than 10° phase matching over ±30° in azimuth



Cavity-Backed Spiral Antennas - Receive only

Cavity-Backed Spiral Antennas - Receive only

Antenna	Frequency GHz	Gain dBi	Beamwidth Az°	Beamwidth El°	Polarisation	Dimensions mm	Connector	Power W	Photo P
PSA45010R/356	0.42 - 1.00, 1.70 - 1.90	6	90	90	Right Circular	205x374 Ø	N(F)	50	
PSA7530L/1147	0.50 - 3.00	1 (0.5) 4-6 (1-3)	70 90	70 90	Left Circular	79x240 Ø	SMA(F)	90°∞ 2-5	
PSA75301R/170	0.50 - 3.00	4 to 6	70	90	Right Circular	57x246 Ø	SMA(F)	90°∞ 5	P
PSA-8025R/707	0.80 - 2.50	4.5 - 8	65	65	Right Circular	48x220 Ø	N(F)	25	
PSA10401L/1169	1.00 - 4.00	4-6	90	90	Left Circular	42x150 Ø	N(F)	20	
PSA1040R/1366	1.00 - 4.00	-5 to +7.5	75	75	Right Circular	80x100 Ø	SMA(F)	5	
PSA10401R/643	1.00 - 4.00	6	90	90	Right Circular	76x150 Ø	N(F)	20	
PSA0218L/1501	2.00 - 18.00	0	75	75	Left Circular	40x51 Ø	SMA(F)	5	
PSA0218R/1142	2.00 - 18.00	0	75	57	Right Circular	40x51 Ø	SMA(F)	5	P
PSA0218L/1276	2.00 - 18.00	1(2-4) 2(4-18)	75	75	Left Circular	39x61 Ø	SMA(F)	2-5 varies across band	P
PSA0218R/1277	2.00 - 18.00	-1 to +2	75	75	Right Circular	65x68 Ø	SMA(F)	2-5 varies across band	
PSA0218R/1278	2.00 - 18.00	-1 to +2	75	75	Right Circular	39x62 Ø	SMA(F)	2-5 varies across band	
PSA0218L/1084	2.00 - 18.00	-3 to +2	75	75	Left Circular	65x68 Ø	SMA(F)	2-5 varies across band	P
PSA0218L/1361	2.00 - 18.00	-4 to +2	75	75	Left Circular	59x61 Ø	N(F)	2-5, varies across band	P
PSA0218L/1333	2.00 - 18.00	-4 to +2	75	75	Left Circular	51x61 Ø	SMA(F)	2-5 varies across band	p-2
PSA0218R/1360	2.00 - 18.00	-4 to +2	75	75	Right Circular	51x61 Ø	SMA(F)	2-5, varies across band	
PSA0218R/1362	2.00 - 18.00	-4 to +2	75	75	Right Circular	51x61 Ø	N(F)	2-5, varies across band	
PSA0818L/1045	8.00 - 18.00	4	90	90	Left Circular	21x24 Ø	SMA(F)	1	P
PSA0818R/1308	8.00 - 18.00	4	90	90	Right Circular	21x24 Ø	SMA(F)	1	

PSA75301R/170

PSA0218R/1142

PSA0218L/1276

PSA0218L/1084

PSA0218L/1361

PSA0818L/1045

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