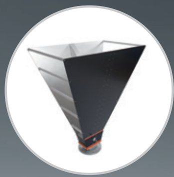
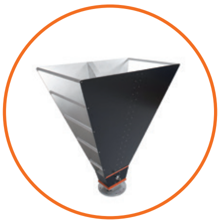
ANTENNA PRODUCT
OVERVIEW

MVG
Microwave Vision Group

Introduction



At MVG, we produce our antennas with outstanding performance in mind. It begins with a careful design process, alternating between simulations and measurements. It extends through fabrication, using the most advanced machining techniques of quality materials to achieve mechanically tight tolerances. This is why all our antenna specifications are outstanding. It is also why we can guarantee the best electrical performance/operational bandwidth trade-off in the industry.

Antennas Designed for Outstanding Performance

The MVG antenna design team is an experienced multi-disciplinary group that considers all aspects of the antenna during the full development sequence based on a concurrent engineering approach. Our design processes, involving state-of-the-art numerical simulation and CAD tools, are continuously validated with prototyping and measurements, enabling tight performance optimization and absolute confidence in the final result.
MVG antennas are manufactured from quality materials and benefit from advanced numerical machining technology. All processes, from conception and design to manufacturing and final testing, are regulated by high quality standards. Our commitment to excellence is demonstrated by our certification as an ISO 9001:2008 compliant manufacturer and ISO 17025 for antenna test and calibration.

International Standards and Projects Meeting Future Technological Challenges

MVG is actively involved in the continued development of international standards in antenna measurements. Our experts participate in numerous European and national research programs as part of a team of key players in research and innovation. Several of these projects have been in cooperation with the French Centre National des Etudes Spatiales (CNES) and the European Space Agency (ESA).

A Complete Antenna Product Range

Our portfolio includes a wide variety of antennas optimized for specific applications, including range measurements, high-power, EMC testing, and telecommunications and navigation.

Antennas for measurement applications comprise both *Reference Antennas* and *Measurement Probes and Feeds*. The first are ideally suited for calibration reference within antenna measurement systems thanks to their high reliability and repeatability. The latter are precision microwave sensors to collect the characteristics of the device under test for all antenna measurement ranges (Planar, Cylindrical and Spherical Near-field, Far-Field, Compact Antenna Test Range, quasi monostatic RCS measurements, etc.).

Antennas for high power applications are specifically conceived to handle high input RF power with no degradation to the radiation parameters.

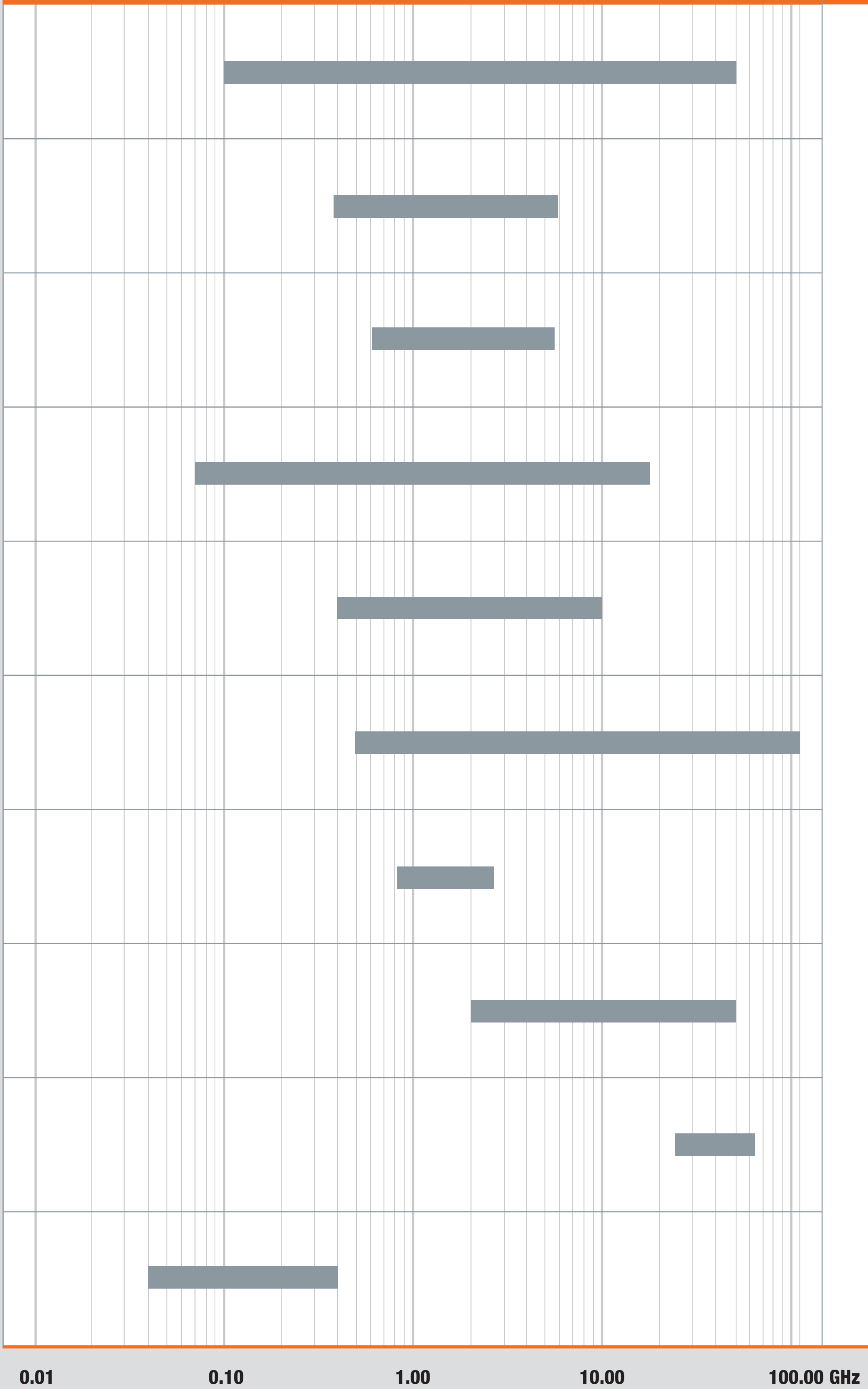
Telecommunication antennas are targeted to telecom standards and protocols ranging from 50 MHz to 18 GHz.

Positioning antennas encompass terminal antennas for GNSS receivers and for localization/safety applications.

EMC antennas an innovating product line specifically developed for the EMC/EMI testing, enabling more accurate test results and allowing detection of lower level emissions.

CATEGORY	ANTENNA	APPLICATION
Antennas for Measurement Applications **REFERENCE ANTENNAS** 	• Dual-Ridge Horns	• Gain reference for medium gain antennas; wideband probe for far-field test ranges; feeder for reflector antennas
	• Electric Sleeve Dipoles	• Gain/efficiency reference for omni-directional antennas; CTIA ripple test; chamber reflectivity evaluation
	• Magnetic Dipoles	• Gain/efficiency reference for omni-directional antennas; CTIA ripple test; chamber reflectivity evaluation
	• Monocones	• Wideband gain reference for automotive antenna test ranges
	• Wideband Dipoles	• Wideband gain reference for omni-directional antennas; CTIA ripple test; chamber reflectivity evaluation; efficiency reference; measurement accuracy evaluation
	• Standard Gain Horns	• Gain reference for high gain antennas
	• Linear Array Reference Antennas	• Gain reference for base station antennas and cylindrical near-field systems
	• High Precision Offset Parabolic Reflector	• Gain/pattern reference for high gain antennas; far-field antenna measurements
	• mm-Wave Chip Reference Antennas	• Gain reference for micro-probed antenna measurements
	• VHF Wideband Low-Profile Antenna	• Low profile reference for measurements in VHF frequencies

FREQUENCY RANGE (GHz)	WEBSITE PRODUCT PAGE



www.mvg.link/
reference-antennas

Quick Guide

CATEGORY	ANTENNA	APPLICATION
Antennas for Measurement Applications **MEASUREMENT PROBES AND FEEDS** 	• Open-Ended Waveguides	• Near-field measurements from UHF to W band; calibration and polarization reference
	• Dual Linear Polarized Minimum Scattering Probes for Planar Near-Field	• Planar near-field measurement
	• Dual Polarized Probes	• Far-field measurements; spherical near-field measurement; calibration and polarization reference
	• Low Frequency Probes	• Planar and spherical near-field low frequency measurements; Illumination of CATR systems
	• Open Boundary Quad-Ridge Horns	• Low frequency PNF/CNF measurements; wideband antenna measurements in SNF and Compact Antenna Test Ranges; reflector feed for high gain applications
	• Rear-Fed Open Boundary Quad-Ridge Horns	• Low frequency PNF/CNF/SNF/CATR measurements
	• Compact Range Feed Horns	• Illumination of compact antenna test range systems; Illumination of reflector antennas; direct range illumination
	• Dual Polarized CATR Feed for Cross-Polarization Reduction	• Feed for cross-polar reduction in non-compensated compact antenna test ranges
	• Quad-Ridge Flared Horn	• Wideband illumination of compact antenna test range systems; wideband feed for reflector antennas
	• Diagonal Horns	• Gain reference for medium/high gain antennas; measurements in far-field test ranges; quasi-monostatic radar cross section (RCS) measurements
	• Closed Boundary Quad-Ridge Horns	• Gain reference for medium/high gain antennas; wideband illumination of compact antenna test range systems; Quasi-bistatic radar cross-section measurements
	• VHF Wideband Dual Polarized Probe	• Dual polarized probe for spherical near-field measurements in VHF frequencies

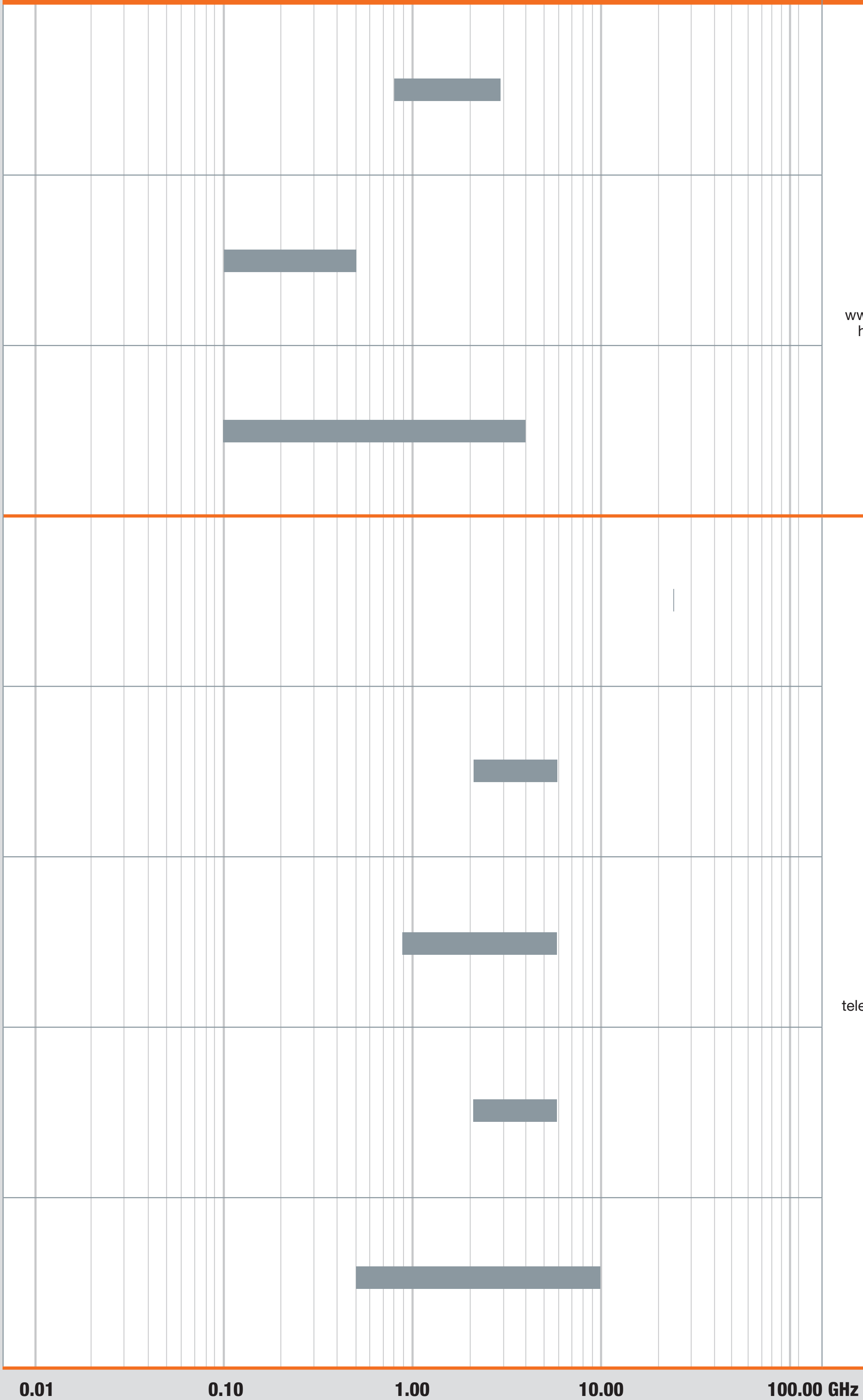
FREQUENCY RANGE (GHz)	WEBSITE PRODUCT PAGE

www.mvg.link/measurement-probes-and-feeds

Quick Guide

CATEGORY	ANTENNA	APPLICATION
Antennas for High Power Applications 	• Omni-directional High Power Antennas	• High power emission on cellular network frequencies
	• UWB Discone Antenna	• High power ultra-wide band application
	• Wideband Transmit Airborne Antenna	• Air-to-ground high power emission applications
Tele-communication Antennas 	• Planar Antennas For Integrated Application	• General transmitting and receiving applications at 24 GHz; radar and radio link point-to-point
	• Planar Antennas For WLAN Application	• General transmitting and receiving applications from 2.1 to 5.8 GHz; radar doppler and radio link point-to-point
	• Planar Antennas For Wireless Communication Application	• General transmitting and receiving applications from 880 MHz to 5.875 GHz; point-to-point telecommunications
	• Omni-directional Low Power Antennas	• Data transmission base station for telecommunications
	• UWB Antennas	• High speed data transmission for telecommunication applications

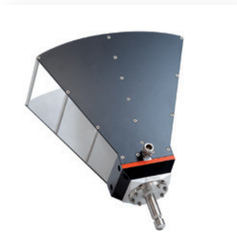
FREQUENCY RANGE (GHz)	WEBSITE PRODUCT PAGE

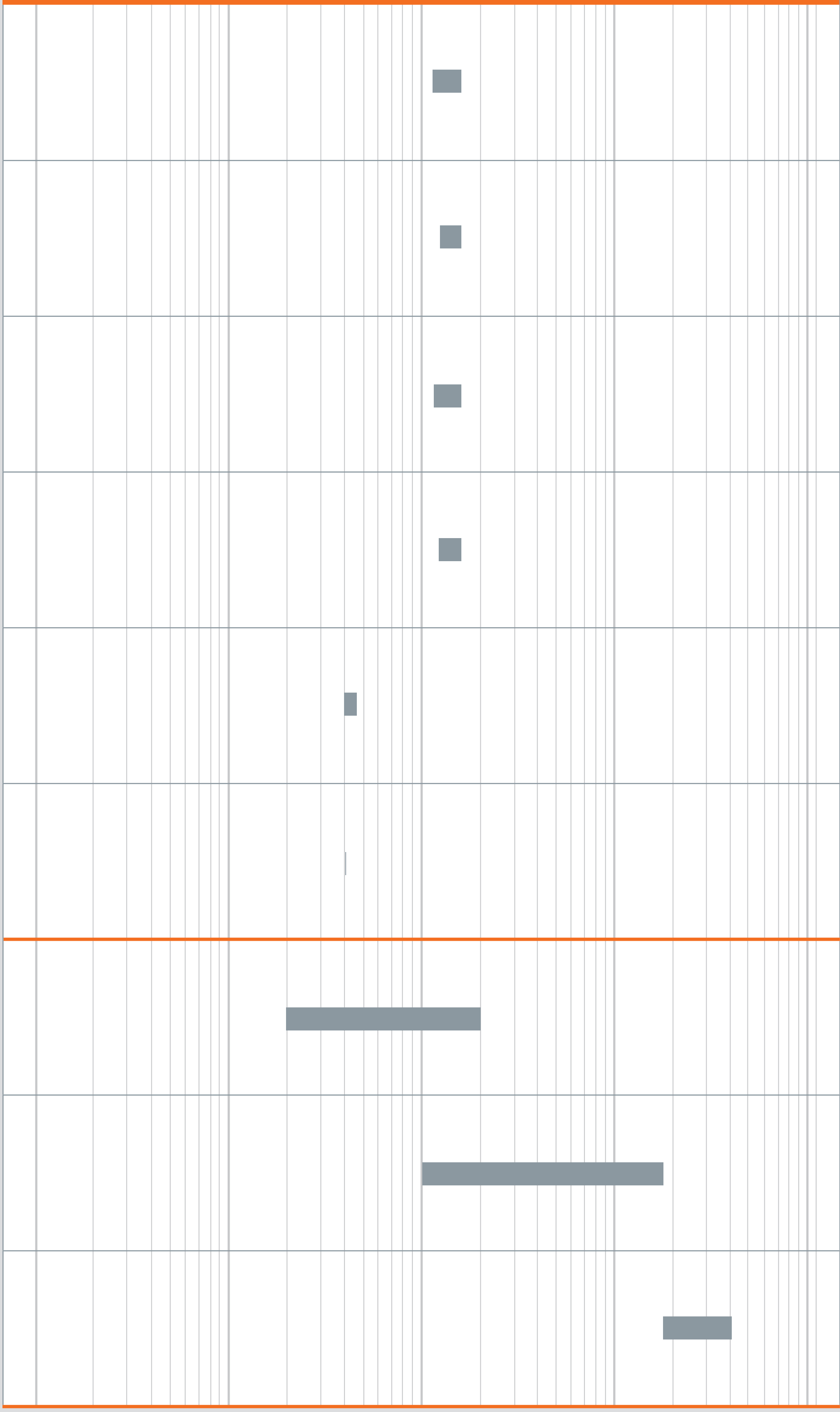


www.mvg.link/antennas-for-high-power-applications

www.mvg.link/telecommunication-antennas

Quick Guide

CATEGORY	ANTENNA	APPLICATION
Positioning Antennas 	• GNSS Antennas For Embedded Application	• Positioning of equipment for land, aerospace and maritime applications
	• Professional GALILEO/GPS Terminal Antenna	• Ground segment portable antenna for professional applications covering GALILEO E5, E6, L1 bands and GPS L5, L2, L1 bands
	• GALILEO/GPS/GLONASS Base Station Reference Antenna	• Reference applications covering GALILEO E5, E6, L1 bands, GPS L5, L2, L1 bands and GLONASS L2, L1 bands
	• GALILEO/GPS Base Station Reference Antenna	• Reference applications covering GALILEO E5, E6, L1 bands and GPS L5, L2, L1 bands
	• ARGOS Tx/Rx Ultra Compact Terminal Antenna	• Bi-directional data transmission (activity, environmental or localization) for Argos 3 user applications (ships, shipping containers, etc.)
	• COSPAS-SARSAT Ultra Compact Terminal Antenna	• Localization, safety and rescue applications
EMC Antennas 	• EMC Dual Ridge Horn Antenna EH022	• EMC/EMI testing
	• EMC Dual Ridge Horn Antenna EH118	• EMC/EMI testing
	• EMC Dual Ridge Horn Antenna EH1840	• EMC/EMI testing

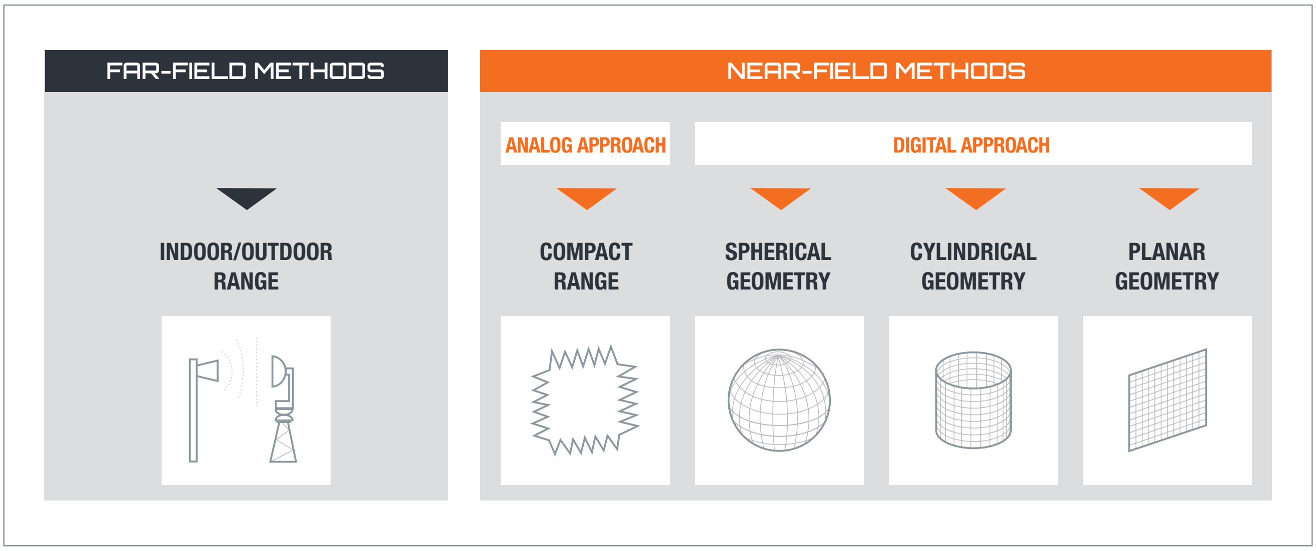
FREQUENCY RANGE (GHz)	WEBSITE PRODUCT PAGE
	www.mvg.link/positioning-antennas
	www.mvg.link/EMC-antennas

0.01 0.10 1.00 10.00 100.00 GHz

Measurement Probes and Feeds

HIGH PERFORMANCE PROBES AND FEEDS

MVG probes and feeds are dedicated microwave sensors used to characterize a device under test. Antenna specifications are tailored to the specific measurement range and technique used, either based on Near-field or Far-field methods.
Near-field methods have the advantage of operating in a more compact footprint; the measurement distance is only a few wavelengths. Transformation is then used to determine the far-field, which can be implemented by means of an analog approach, as in CATR systems, or by means of a numerical approach. The latter requires the field to be sampled in a specific geometry (planar, cylindrical, spherical) in order for the field transformation to be applied.
MVG measurement probes are designed to comply with the ideal physical constraints imposed by near-field and far-field measurement techniques, in order to obtain the most accurate characterization of the antenna under test.



A unique precision product

MVG measurement probes are the result of a unique combination of know-how in antenna measurement, antenna design, and manufacturing.

The probe design is supported by state-of-the-art electromagnetic simulation software and strengthened by the use of advanced numerical tools, specifically developed for MVG antenna measurement systems.

Composed of MIL-STD treated aluminum, MVG measurement probes are manufactured using high precision machining techniques in order to guarantee excellent repeatability and accurate electrical performance.

Closed Boundary Quad-Ridge Horns

Wide bandwidth

Reducing the number of probes required to perform a wideband test has many advantages.

Probe interchanging during a wideband test will modify the measurement conditions over the frequency band under test. Conversely, a single wideband probe preserves the measurement accuracy and allows an uninterrupted sweep, therefore shortening the measurement time.

Dual Polarized Probes

Dual linear polarization

The integrated orthomode junction allows simultaneous acquisition of the orthogonal field components, therefore speeding up the measurement process. Furthermore, MVG probes do not require complex positioners and have a minimum impact on the overall measurement accuracy since no mechanical rotation is required to change polarization.

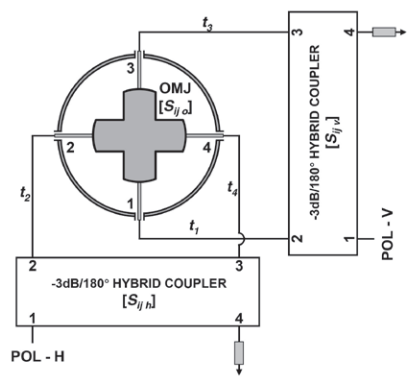
Ultra wideband ortho-mode junction

New developments in probe technology and ortho-mode junctions (OMJ) have enabled near and far-field probes to reach a 1:4 bandwidth, while maintaining high performance standards similar to traditional narrow band probes.

L. J. Foged, A. Giacomini, S. Pivnenko, "Wide band dual polarized probes for near and farfield measurement systems", AMTA 2007, November 4-9, 2007 St. Louis, MO, USA.
L. J. Foged, A. Giacomini, R. Morbidini, "Probe performance limitation due to excitation errors in external beam forming network", 33rd Annual Symposium of the Antenna Measurement Techniques Association, AMTA, October 2011, Englewood, Colorado, USA

Inverted quad-ridge circular waveguide

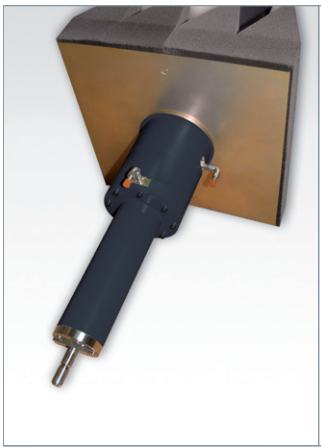
Traditional ortho-mode junctions in circular waveguide, based on balanced feeding, are realized by a pair of excitation pins per polarization, each pair fed by a 0°/180° hybrid coupler, and are able to provide excellent performance over a narrow bandwidth. The main drawback of such technology is the limit on the useable bandwidth due to the high sensitivity to excitation errors that cause higher order modes to arise and propagate. The inverted quad-ridge waveguide technology solves this problem. It is inherently wideband and can be fed by a balanced excitation layout. The result is a great improvement in terms of robustness to excitation errors, therefore providing an ultra broad operating bandwidth.

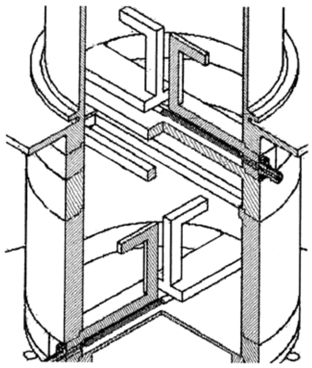


SATIMO Patent, 2010-02-11, Inventors: Foged Lars Jacob, Giacomini Andrea, Duchesne Luc, Publication number: US2010033264 (A1), FR2907601 (A1), WO2008049776 (A1), EP2092592 (A1), "Orthogonal-mode junction coupler with an ultra-broad operating bandwidth"

Auto-balanced ortho-mode junction

MVG has developed an innovative ortho-mode junction in a circular waveguide, providing excellent isolation between the polarizations and single mode excitation over 1:1.5 bandwidth, without the need of a feeding network based on 0°/180° hybrid couplers. This technology is derived from conventional ortho-mode junctions in circular waveguides, consisting of orthogonal feeding points that are offset along the axis of the coupler, and is aimed at solving the common drawbacks of traditional techology. In particular, conventional couplers have an asymmetry which leads to degradation of the modal purity due to the excitation of higher order modes. Furthermore, because of the close proximity between orthogonal feeding points, poor port-to-port decoupling can occur. In order to solve these drawbacks and provide single mode excitation, a capacitively coupled symmetrical structure, consisting of two C-shaped branches extending out from each side of the circular waveguide, has been introduced. Independent polarization short circuits allow the orthogonal feeding points to be well separated, thus greatly improving the port-to-port isolation.



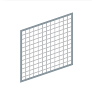
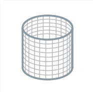


SATIMO Patent, 2007-10-18, Inventors: Foged Lars Jacob, Giacomini Andrea, Publication number: US20100090779 (A1), US8125294 (B2), WO2008049778 (A1), WO2008049778 (A8) (A1), EP2092595 (A1), "Method of orthogonal-mode junction coupling with a medium to broad operating bandwidth, and coupler employing said method"

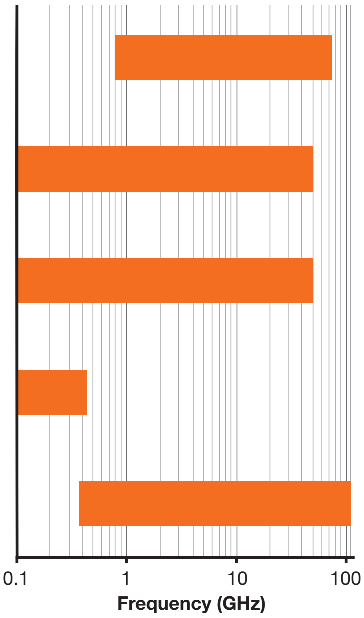
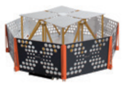
Main probe requirements in Antenna Measurement

PLANAR NEAR-FIELD	SPHERICAL NEAR-FIELD	FAR-FIELD
Low Directivity	**Low/Mid Directivity**	**High Directivity**
• No sidelobes and no pattern nulls in the forward hemisphere • Equalized beamwidth (E/H-planes) • Low backscattering	• Radiation pattern dominated by first-order spherical modes (allowing for first-order probe correction) • Low chamber illumination • High on-axis polarization purity	• High on-axis polarization purity • Low sidelobes • Stable phase center with frequency

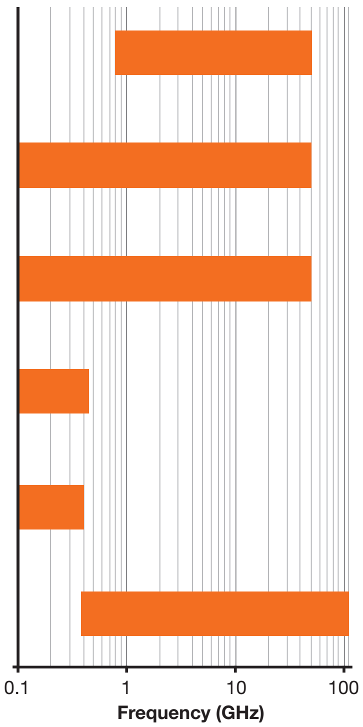
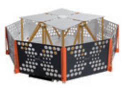
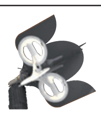
Which Measurement Probe or Feed for Which Configuration?

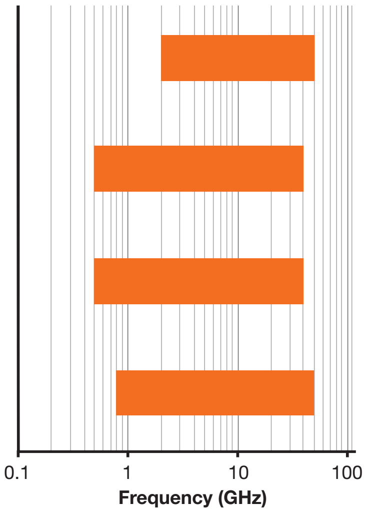
PLANAR AND CYLINDRICAL NEAR-FIELD

		Frequency Range	Single Pol.	Dual Pol.	Main Characteristics
DUAL POLARIZED MINIMUM SCATTERING PROBES				X	• Minimum waveguide cross-section for low backscattering • Tailored for Planar Near Field • Constant radiation pattern shape over frequency
OPEN BOUNDARY QUAD-RIDGE HORNS				X	• Suitable for PNF/CNF in the low-end of the frequency band (1.5 octaves) • Lightweight
REAR-FED OPEN BOUNDARY QUAD-RIDGE HORNS				X	• Suitable for PNF/CNF in the low-end of the frequency band (1.5 octaves)
LOW FREQUENCY PROBES				X	• Equalized beamwidths • Low profile and lightweight VHF/UHF band probe
OPEN-ENDED WAVEGUIDES			X		• Industry standard for PNF/CNF measurements • Integrated absorber panel

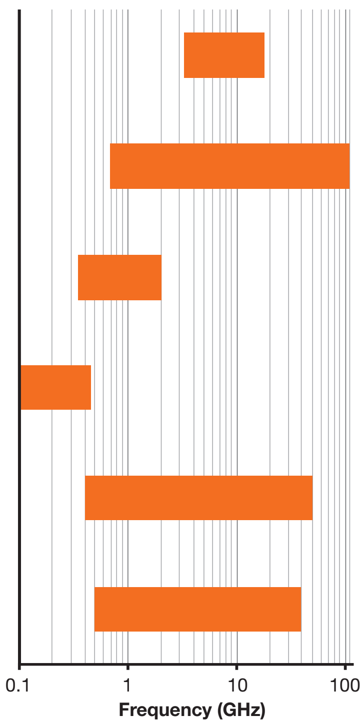
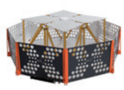
SPHERICAL NEAR FIELD

		Frequency Range	Single Pol.	Dual Pol.	Main Characteristics
DUAL POLARIZED PROBES				X	• Quasi first-order spherical probe, allowing for first-order probe correction • High on-axis polarization purity
OPEN BOUNDARY QUAD-RIDGE HORNS				X	• Suitable for SNF in the low/mid-end of the frequency band, in combination with full probe correction • Lightweight
REAR-FED OPEN BOUNDARY QUAD-RIDGE HORNS				X	• Suitable for SNF in the low/mid-end of the frequency band, in combination with full probe correction
LOW FREQUENCY PROBES				X	• Quasi first-order spherical probe, allowing for first-order probe correction • Low profile and lightweight VHF/UHF band probe
VHF WIDEBAND DUAL POLARIZED PROBE				X	• High efficiency • Low return loss / VSWR
OPEN-ENDED WAVEGUIDES			X		• Enry-level solution for SNF • Integrated absorber panel

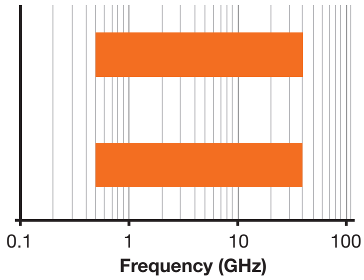
FAR-FIELD

	Frequency Range	Single Pol.	Dual Pol.	Main Characteristics
HIGH PRECISION OFFSET PARABOLIC REFLECTOR 		X	X	• High gain • Stable phase center over frequency • Excellent on-axis cross-polar discrimination
CLOSED BOUNDARY QUAD-RIDGE HORNS 			X	• Stable phase center over frequency • Excellent cross-polar discrimination and port-to-port isolation
DIAGONAL HORNS 		X		• High gain • Equalized beamwidths • Extremely low sidelobes
DUAL POLARIZED PROBES 			X	• High polarization purity • Equalized beamwidths

COMPACT ANTENNA TEST RANGE

	Frequency Range	Single Pol.	Dual Pol.	Main Characteristics
CATR FEEDS FOR CROSS-POLAR COMPENSATION 			X	• Cross-polar compensation of single- or dual-cylindrical reflector CATRs • Optimal reflector illumination within WR bands
COMPACT RANGE FEED HORNS 		X	X	• Optimal reflector illumination within WR bands
QUAD-RIDGE FLARED HORN 			X	• Flat gain over a wide frequency band • Stable phase center over frequency • Low chamber/Quiet Zone illumination
LOW FREQUENCY PROBES 			X	• Equalized beamwidths • Stable phase center over frequency • Low profile and lightweight VHF/UHF band feed
REAR-FED OPEN BOUNDARY QUAD-RIDGE HORNS 			X	• Entry-level solution for CATR measurements
CLOSED BOUNDARY QUAD-RIDGE HORNS 			X	• Stable phase center over frequency • Excellent cross-polar discrimination and port-to-port isolation

RCS MEASUREMENTS

	Frequency Range	Single Pol.	Dual Pol.	Main Characteristics
DIAGONAL HORNS 		X		• Extremely low sidelobes • Very low coupling between adjacent horns
CLOSED BOUNDARY QUAD-RIDGE HORNS 			X	• Excellent cross-polar discrimination and port-to-port isolation • Low coupling between adjacent horns

Custom probes

Product identification

DLP - S C - 1070 - A - 01 — Serial number

Polarization type
- **DLP** Dual linear
- **DCP** Dual circular

OMJ type
- Ultra broadband **S**
- Auto-balanced **A**
- Balanced feeding with external couplers **B**

Aperture type
- **C** Corrugated
- **F** Flared
- **S** Stepped-flared

Lower frequency
(e.g. 1070 = 10.7 GHz)

Revision
(optional)

Quality Products and Services,
the Key to Customer Satisfaction

Quality Management System

MVG is an ISO 9001: 2015 certified manufacturer of antennas and measurement systems. This certification ensures that:

- Our products meet customer and applicable regulatory requirements
- Our processes aim at continuous improvement of customer satisfaction and conformity of our products to requirements.

Controlling the Chain of Suppliers

In its drive for excellence in antenna design, MVG has established a network of suppliers that meet our demanding requirements. Working with local suppliers, each specializing in a different material processing and/or manufacturing technique, allows us to regularly check and validate those processes and maintain the quality control we demand. We believe that the use of quality raw materials and advanced machining complemented by cost-controlled processes leads to superior products at an optimal price for our customers.

Regular Calibration of our Measurement Facilities

To guarantee our customers high reliability and measurement quality during the antenna design, optimization and acceptance process, our measurement facilities are regularly calibrated. Antennas are tested in our facilities in Atlanta, GA (USA), Paris and Brest (France), or Rome (Italy). The facility in Atlanta is a2La accredited. The facility near Paris, has also received 3GPP test and calibration ISO 17025 accreditation.

The scope of accreditation is location dependent and does not include the entire scope of MVG activities. Visit our credentials page on the MVG website for details.

Antenna Final Acceptance Test

Each antenna produced by MVG goes through meticulous quality control before it is shipped to customers. This involves Inspection, Analysis, Demonstration and Test (IADT) qualification methods. It is well-known that antenna S-parameters are very sensitive indicators of manufacturing flaws, and severe measures of repeatability. The RF response of antennas manufactured by MVG is individually tested and compared with strict performance boundaries. The measured S-parameters data is supplied with each antenna. Depending on the specific antenna, additional verifications are conducted, such as metrological or RF testing, in order to verify full compliance with specification.

TYMEDA™ A Comprehensive Database of Antenna Performance Data

MVG antennas are supplied with TYMEDA™ performance data including uncertainty boundaries. The TYMEDA™ TYpical MEasured DAta originates from the collection of a comprehensive database on antenna performance, built over the years through a very large number of measurements using different techniques and system configurations, enriched by measurements in accredited and independent calibration labs. This database is further reinforced by International Facilities Comparison Campaigns [RD1], [RD2], [RD3], [RD4], [RD5], [RD6], [RD7]. Refined and detailed state-of-the-art electromagnetic models, accounting for realistic materials and relevant manufacturing details and constraints, give further support to the collected measurement data. A statistical approach is then used to combine multiple measured datasets and simulated data, thus reducing measurement uncertainties and improving the dynamic range of the data. The reliability of this approach has been widely validated and draws its strength from the high manufacturing accuracy and repeatability of MVG antennas [RD8], [RD9], [RD10], [RD11]. TYMEDA™ is therefore an accurate and reliable estimator of the actual performance of an antenna.

[RD1] L. J. Foged, P. Garreau, O. Breinbjerg, S. Pivnenko, M. Sierra-Castañer, J. Zackrisson, "Facility comparison and evaluation using dual ridge horn", AMTA 2005, Newport;

[RD2] L.J. Foged, O. Breinbjerg, S. Pivnenko, G. Di Massa, C. Sabatier, "Antenna measurement facility comparison within the European Antenna Centre of Excellence", EuMC 2005, Paris;L.J. Foged, A. Giacomini, L. Scialacqua, R. Morbidini, J. Estrada, "Investigation of SGH performance and repeatability", AMTA 2010, Atlanta;

[RD3] L. J. Foged, B. Bencivenga, L. Durand, O. Breinbjerg, S. Pivnenko, C. Sabatier, H. Ericsson, B. Svensson, A. Alexandridis, S. Burgos, M. Sierra-Castañer, J. Zackrisson, M. Boettcher, "Error calculation techniques and their application to the Antenna Measurement Facility Comparison within the European Antenna Centre of Excellence", EuCAP 2007, Edinburgh;

[RD4] L.J. Foged, B. Bencivenga, O. Breinbjerg, S. Pivnenko, M. Sierra-Castañer, "Measurement facility comparisons within the european antenna centre of excellence", ISAP 2008, Taipei;

[RD5] L.J. Foged, B. Bencivenga, L. Scialacqua, S. Pivnenko, O. Breinbjerg, M. Sierra-Castañer, P.C. Almena, E. Seguenot, C. Sabatier, M. Bottcher, E. Arnaud, T. Monediere, H. Garcia, D. Allenic, G. Hampton, A. Daya, "Facility comparison and evaluation using dual ridge horns", EuCAP 2009, Berlin;

[RD6] L.J. Foged, M. Sierra-Castañer, L. Scialacqua, "Facility comparison campaigns within EurAAP", EuCAP 2011, Rome;

[RD7] L. Scialacqua, F. Mioc, J. Zhang, L.J. Foged, M. Sierra-Castañer, "Antenna Measurement Intercomparison Campaigns in the framework of the European Association of Antennas and Propagation", ISAP 2013, Nanjing;

[RD8] A. Giacomini, B. Bencivenga, L. Duchesne, L.J. Foged, "Determination of high accuracy performance data for dipole reference antennas", European AMTA conference 2006, Munich;

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