



M O D E L 3 1 1 0 B

Model 3104C
20 MHz – 200 MHz

Model 3109
20 MHz – 300 MHz

Model 3110B
30 MHz – 300 MHz

- Unique Element Design to Improve Performance
- Improved Balun Design for Increased Efficiency
- Power Handling Capability Up to 3 kW
- Compact Size for Use in Limited Space
- Quality Construction for Trouble-Free Service



Biconical

EMCO BICONICAL ANTENNAS are simplified, timesaving alternatives to dipole antennas. Although dipole antennas are extremely precise, they can be tedious to use because the elements must be manually adjusted each time a new frequency is measured. The same frequency range can be covered by using an EMCO biconical and log periodic antenna in tandem, or using an EMCO BiConiLog™ antenna alone. EMCO biconical antennas are light, easy to mount, polarization is easy to change, and the broadband characteristics make them ideal for automated measurements. Common applications include measurements to MIL-STD specifications; ANSI C63.4, FCC-18 and EN 55022 emissions testing; and IEC 61000-4-3 immunity testing.

EMCO offers three models of biconical antennas to provide a wide range of frequency and power handling capabilities. EMCO's biconical antennas are designed for maximum performance in the 20 to 300 MHz frequency range, and handle a broad power range — up to 3 kW. Two models feature excellent broadband sensitivity for emissions applications, and one has excellent power handling capability for immunity testing.

There's another advantage to EMCO biconical antennas. EMCO is the only manufacturer to offer optional extended elements. These elements are twice as long as standard elements and enable users to generate high fields at low frequencies with less than 25% of the power usually required.

EMCO Biconical Antenna Features

Unique Element Design

Some biconical antennas exhibit an electrical “bump” at 281 MHz, but EMCO's biconical element crosspiece design improves performance by eliminating this problem. The

biconical's crosspiece connects the center element to the outer element diminishing the “bump”. Another EMCO enhancement is element cages that cannot be overtightened when screwed into the balun.

Improved Balun Design

The Model 3109 uses a modified Guanella balun for optimal impedance-matching. The improved impedance-matching provides better high-frequency performance over other types of line transformers normally used in baluns. In addition, Guanella baluns are frequency-independent. EMCO's implementation of Guanella baluns provides superior performance at 300 MHz, with VSWR close to the ideal ratio of 1:1.

Power Handling Capability

Although all EMCO's biconical antennas provide good input power capabilities, the Model 3109 provides additional power input capability. Maximum continuous input power on the Model 3109 can exceed 2 kW, and 3 kW with limited duty cycle. Type N female connectors are provided on all models to handle the extended power and ensure repeatable test results.

Compact Size

The compact size of EMCO biconical antennas makes them ideal for anechoic chambers and shielded enclosures. Biconical antennas conserve limited space and help minimize proximity effects.

Quality Construction

Biconical elements are constructed of lightweight corrosion-resistant aluminum, providing years of trouble-free indoor and outdoor service. The mounting base on Models 3104C and 3110B uses standard 1/4 in x 20 threads to connect to an EMCO tripod or most other tripods for support. The Model 3109 has 1/4 in x 20 thread taps in its baluns for tripod mounting.

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Choosing Your Model: Three Models with Frequency Ranges of 20 to 300 MHz

Two biconical antenna models feature excellent broadband sensitivity for emissions applications, and one model has excellent power handling capability for immunity testing.

20 to 200 MHz for Emissions Testing

The **Model 3104C** biconical antenna has a traditional coaxial wound balun which provides a broad frequency range and moderate gain for both transmitting and receiving. Model 3104C may be used for radiated immunity measurements provided that the input power is limited to no more than 100 W peak.

20 to 300 MHz for Immunity Testing

The **Model 3109** biconical antenna is ideal for IEC 61000-4-3 testing. It provides both a broad frequency and high input power. The unit uses a modified Guanella balun for impedance transformation and matching, and it is constructed of much heavier materials so that maximum continuous input power can reach 2 kW. While this antenna typically has a high VSWR at frequencies below 70 MHz, it is still capable of generating a high field strength with acceptable input power in this region of the band. The optional extended elements markedly improve its performance in this region.

30 to 300 MHz for Emissions Testing

The **Model 3110B** biconical antenna combines several unique features, achieving high levels of performance. The balun, feedline, and element cage design give the Model 3110B response curves that are almost linear, making it ideal for sweep measurements. The antenna's insensitivity to orientation in the vertical plane helps eliminate any unnoticed or unrecorded change in orientation as the cause for a change in test results.

To achieve this kind of performance, the balun is designed using an unbalanced-to-balanced transformer. This results in very even current transformation. Ferrites are also placed along the feedlines, reducing common mode current that can interfere with the antenna pattern in the vertically polarized measurements.

Standard Configuration

- ▶ Antenna elements
- ▶ Balun
- ▶ Base
- ▶ Balun acts as base on the Model 3109 and is drilled to accept an EMCO tripod or most other tripods
- ▶ Separate base on Models 3104C and 3110B is drilled to accept tripod mount with 1/4 in x 20 threads
- ▶ Individually calibrated at 1 m per SAE ARP 958 and 3 and 10 m per ANSI C63.5. Actual factors and a signed Certificate of Calibration Conformance included in Manual

Options

Portable Elements (P) (Part # 101946B)

Collapsible folding elements are available for all biconicals, making the antennas portable and ideal for field use. Both the standard rigid and optional folding elements attach to the balun using screw mounts. This makes interchanging between the two types of elements very easy and quick. Optional carrying cases are available to further enhance portability.

Extended Portable Elements (XP) (Part# 103032B)

An extended version of the portable elements is available for all models. These folding elements are twice as long as the standard elements. The longer elements enable you to generate high fields at low frequencies with less than 25% of the power usually required. These elements are most effective with Models 3104C and 3109.

Carrying Cases for Portable Models

Carrying cases for portable elements and biconical antennas are readily available.

Custom Carrying Cases

Custom cases for other models are available on request.

EMCO Tripod

EMCO offers several nonmetallic, non-reflective tripods for use at EMC test sites.

Support Rod (See page 62-63)

Antenna mount with insert drilled to accept EMCO or other tripod with standard 1/4 in x 20 threads.

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Few EMC test engineers realize that the first biconical antenna was constructed 100 years ago. In 1897, Sir Oliver Lodge developed the biconical and today it is a common fixture at EMC test sites, finding use in both emissions and immunity applications.

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Applications

MODEL	FCC-15	FCC-18	IEC/CISPR/EN	SAE J1113	SAE J551	MIL-STD-461E	MIL-STD-1541	MIL-STD-285	NACSIM	VCCI
3104C	RE	RE	RE	RE	RE	RE	RE	TX, RX	RE	RE
3109			RI	RI	RI	RI	RI	TX, RX		
3110B	RE	RE	RE	RE	RE	RE		RX	RE	RE

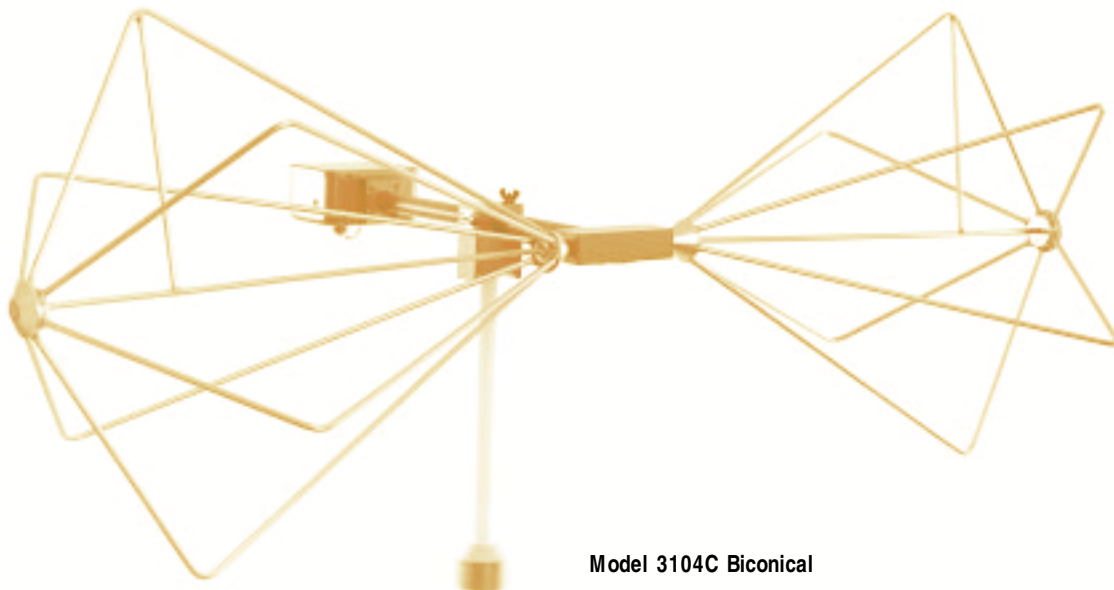
RE = Radiated Emissions RI = Radiated Immunity (Susceptibility) TX = Transmit RX = Receive

Electrical Specifications

MODEL	FREQUENCY RANGE	VSWR RATIO (AVG)	MAXIMUM CONTINUOUS POWER	PEAK POWER	IMPEDANCE (NOMINAL)	CONNECTOR
3104C	20 MHz – 200 MHz	2.8:1	50 W	100 W	50 Ω	Type N female
3109	20 MHz – 300 MHz	1.9:1	2 kW	3 kW	50 Ω	Type N female
3109XP	20 MHz – 200 MHz	1.9:1	2 kW	3 kW	50 Ω	Type N female
3110B	30 MHz – 300 MHz	2.0:1	250 mW	NA	50 Ω	Type N female

Physical Specifications

MODEL	WIDTH	DEPTH	DIAMETER	WEIGHT
3104C	143.5 cm 56.5 in	81.3 cm 32.0 in	52.0 cm 20.5 in	2.7 kg 6.0 lb
3109	133.0 cm 52.5 in	NA	52.0 cm 20.5 in	3.2 kg 7.0 lb
3110B	132.1 cm 52.0 in	55.9 cm 22.0 in	52.0 cm 20.5 in	2.7 kg 6.0 lb
P (each element)	66.0 cm 26.0 in	NA	61.0 cm 24.0 in	0.7 kg 1.5 lb
XP (each element)	121.9 cm 48.0 in	NA	76.2 cm 30.0 in	1.8 kg 4.0 lb



Model 3104C Biconical

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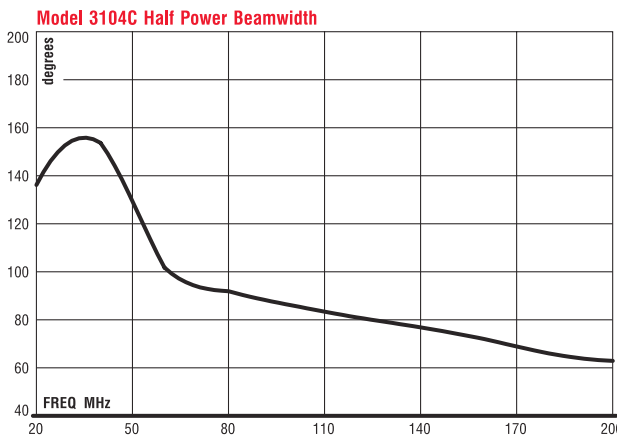
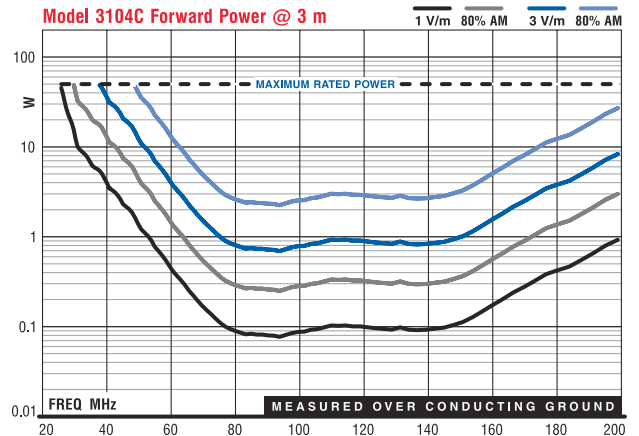
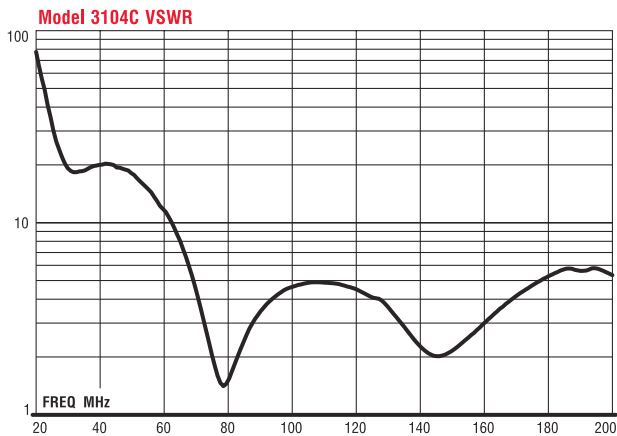
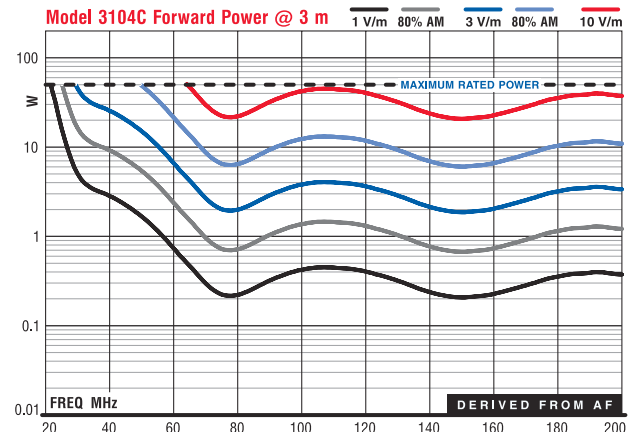
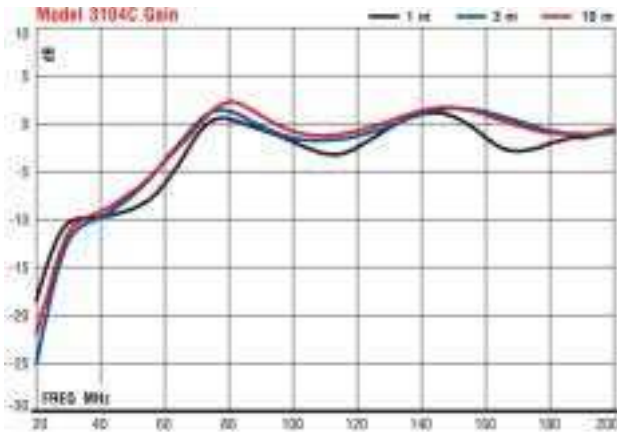
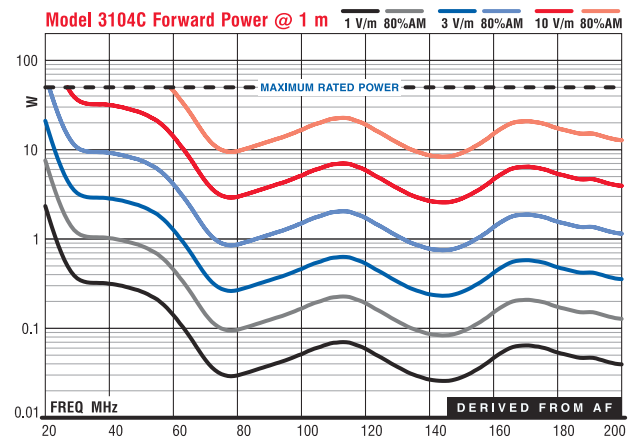
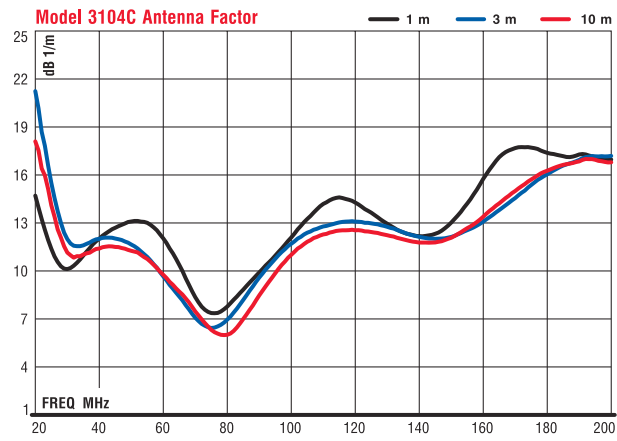
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Model 3104C Technical Data



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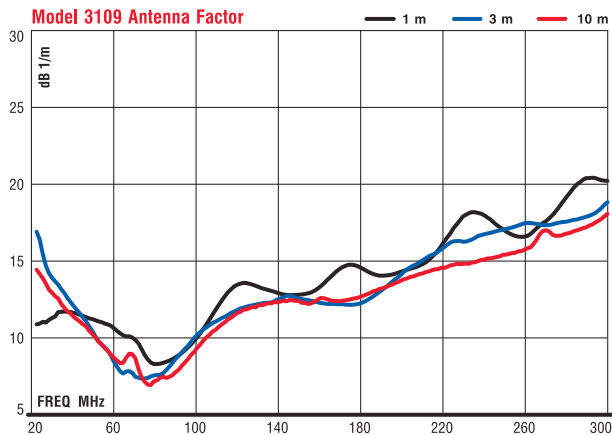
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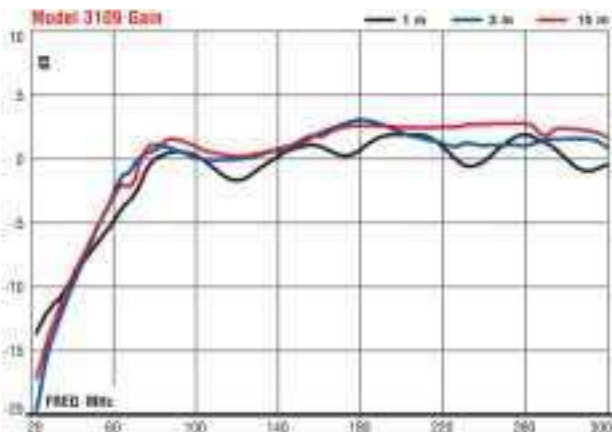
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Model 3109 Technical Data

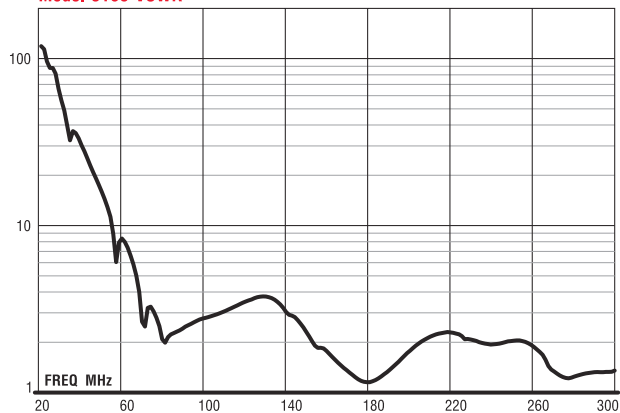
Model 3109 Antenna Factor



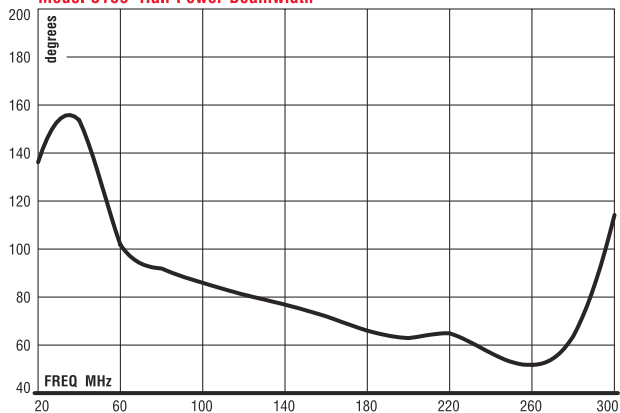
Model 3109 Gain



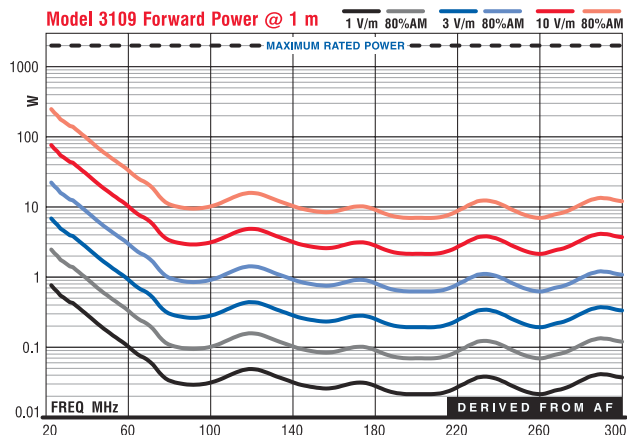
Model 3109 VSWR



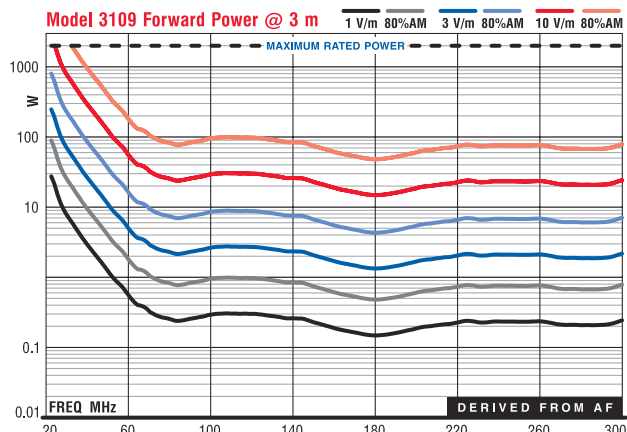
Model 3109 Half Power Beamwidth



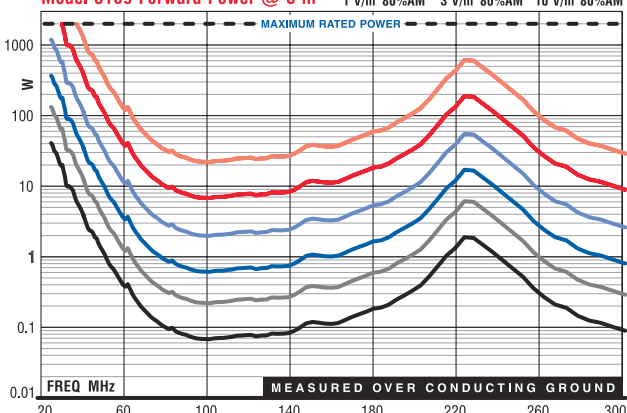
Model 3109 Forward Power @ 1 m



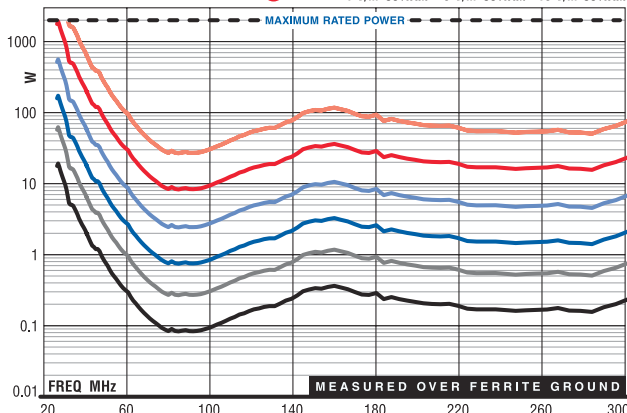
Model 3109 Forward Power @ 3 m



Model 3109 Forward Power @ 3 m



Model 3109 Forward Power @ 3 m



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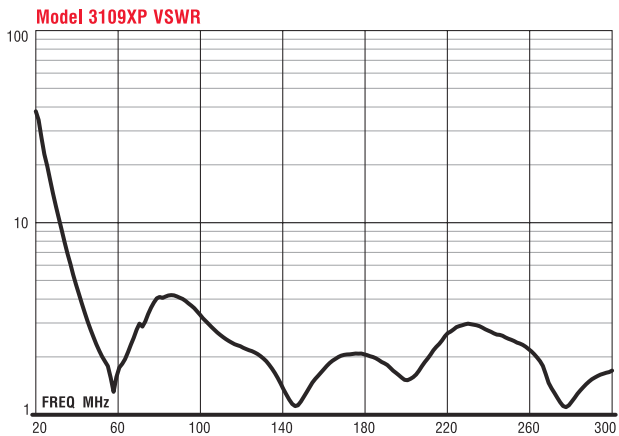
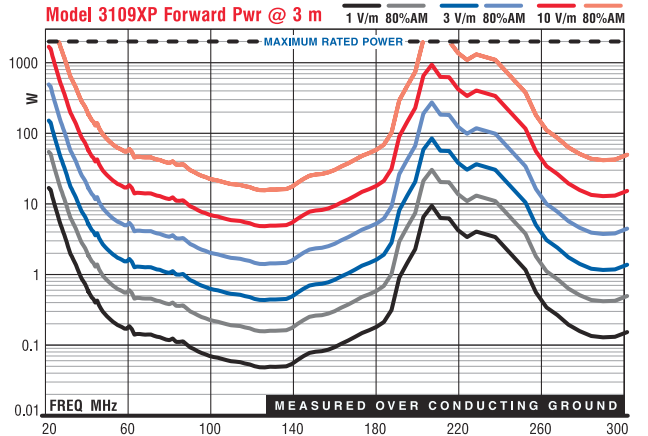
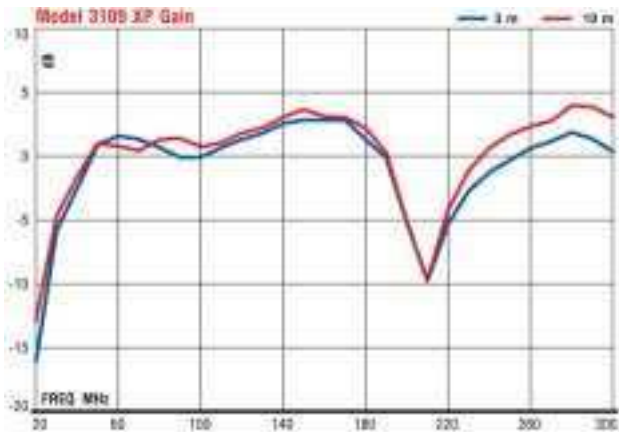
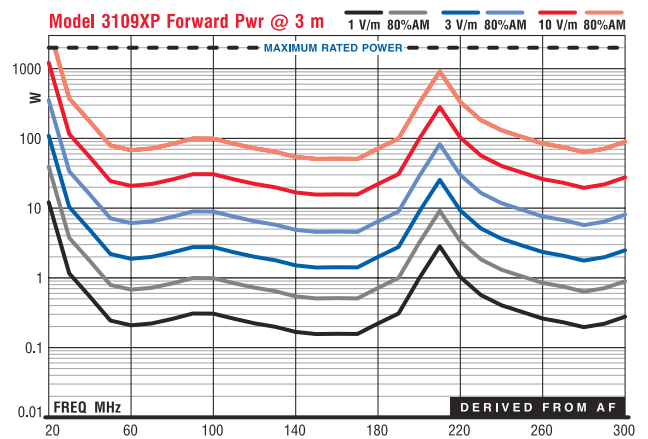
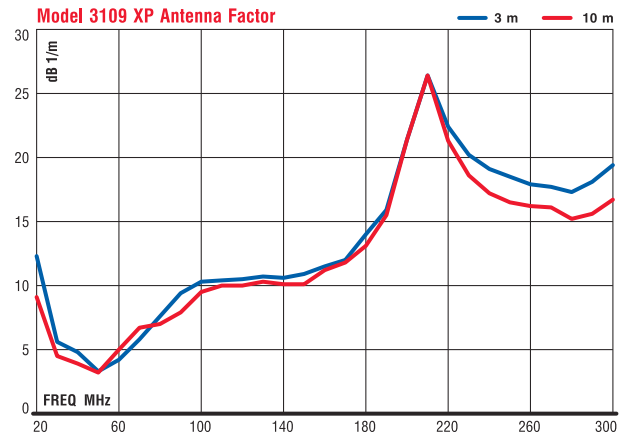
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Model 3109XP & 3109P Technical Data



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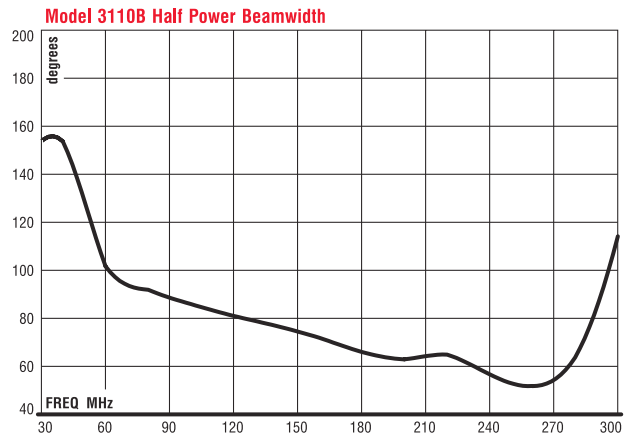
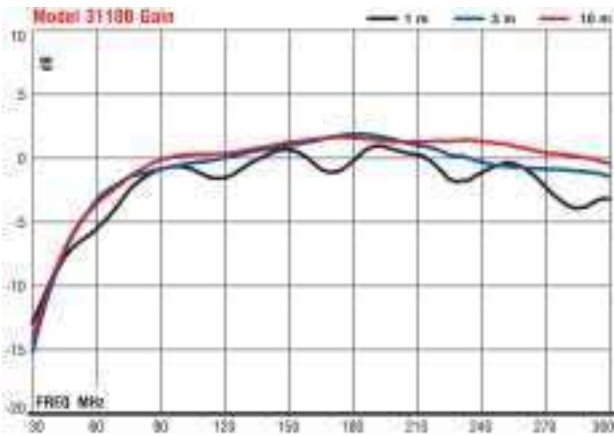
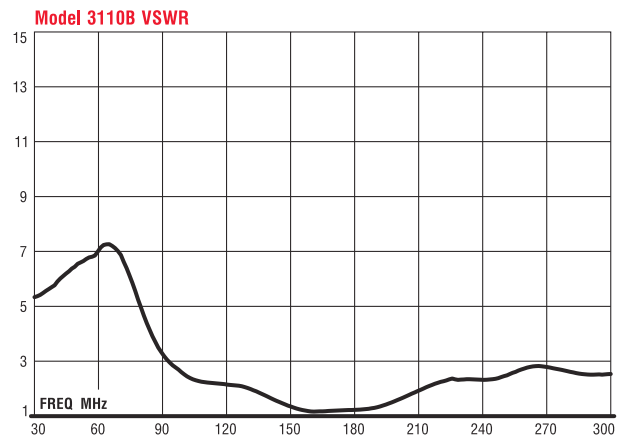
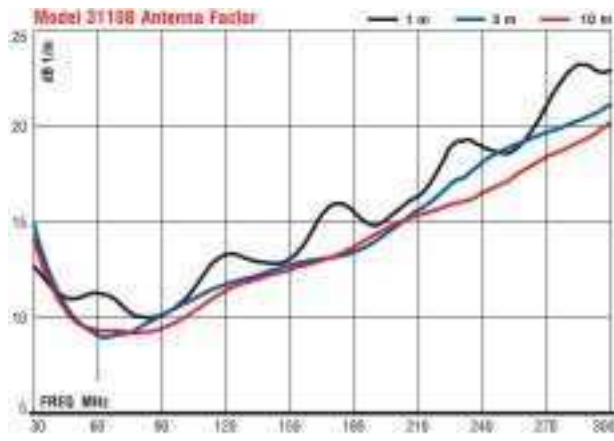
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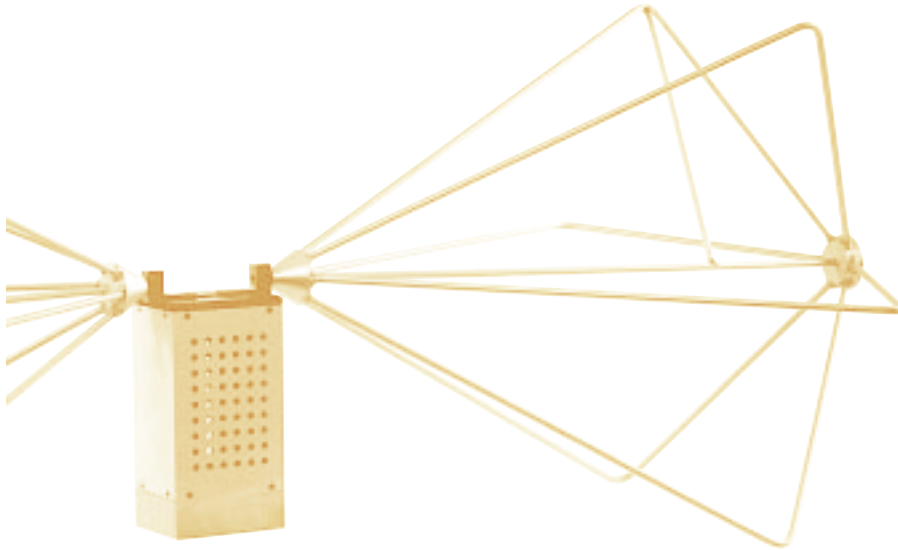
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Model 3110B Technical Data





MODEL 3109



Extended and Portable Elements

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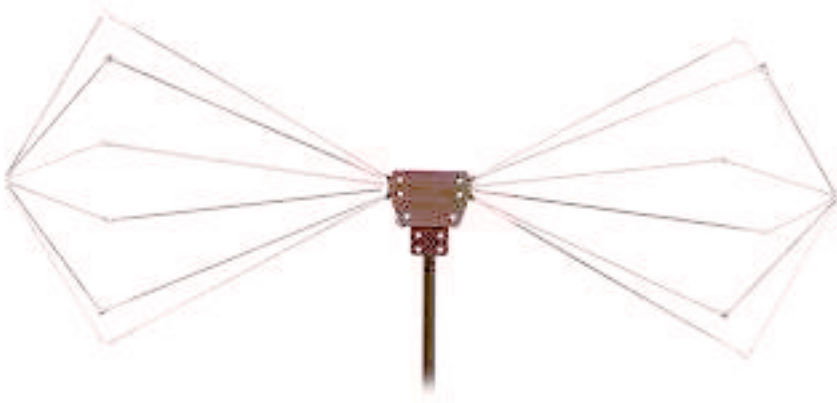
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M O D E L 3 1 2 4

- 30 MHz - 300 MHz Frequency Range
- < 2:1 VSWR
- Theoretically Calculable Performance
- Excellent Balun Balance
- Precise Controlled Mechanical Construction
- Includes Precise Factors for ANSI C63.4/C63.5



Calculable Biconical

The **EMCO MODEL 3124 BICAL™ CALCULABLE BICONICAL ANTENNA** is a linearly polarized, low-uncertainty standard antenna, which can be used for both field measurement and low strength field generation. The antenna balun has an excellent phase balance of better than $180^\circ \pm 2^\circ$, with an amplitude balance of better than ± 0.2 dB. The balun is measurable with a vector network analyzer. By combining the measured balun response with the numerical calculation of the antenna element response, the antenna factor (AF) and site attenuation (SA) between two antennas can be precisely calculated. For site characterization applications, two antennas are required.

Biconical antennas are a timesaving alternative to tunable dipole antennas. Although tunable dipoles are extremely precise, manual adjustment of the elements at each frequency makes them tedious and time consuming to use. When dipoles are used on an OATS or in a semi-anechoic chamber, site anomalies that don't coincide with tuned frequencies can be overlooked. The EMCO Model 3124 Biconical overcomes these problems, while providing the theoretically calculable feature of a tunable dipole antenna.

The antenna performance can be theoretically calculated based on the construction of the elements and the measured balun responses. As long as the antenna elements are maintained to their mechanical specifications, calibration on an OATS of the antenna factors or the gain of the Model 3124 is not necessary. The calibration only needs to be performed on the antenna balun.

A carrying case is included to protect the antenna from possible damage.

Applications

- ▶ Validation tests for scanned height OATS or semi-anechoic chambers per ANSI C63.4
- ▶ Low uncertainty free-space antenna factors for EUT emissions measurement
- ▶ Full Anechoic Room (FAR) validation
- ▶ Normalized Site Attenuation (NSA) and fixed height measurement
- ▶ Broadband site validation similar to CALTS procedure (CISPR 16-1)

Standard Configuration

- ▶ Antenna Elements, Balun, Software
- ▶ Support Rod, Clamp Block, Base, Manual
- ▶ Carrying Case

Options

- ▶ EMCO offers several nonmetallic, non-reflective tripods for use at EMC test sites.

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Electrical Specifications

MODEL	FREQUENCY RANGE	VSWR RATIO (AVG)	MAXIMUM CONTINUOUS POWER	IMPEDANCE (NOMINAL)	CONNECTORS
3124	30 MHz–300 MHz	< 2:1	500 mW	50 Ω	Type N female (1) SMA (2) Calibration ports

Physical Specifications

MODEL	WIDTH	DEPTH ¹	DIAMETER	WEIGHT
3124	24.5 cm 49.0 in	55.8 cm 22.0 in	52.0 cm 20.5 in	2.2 kg 4.8 lb

¹ Balun only

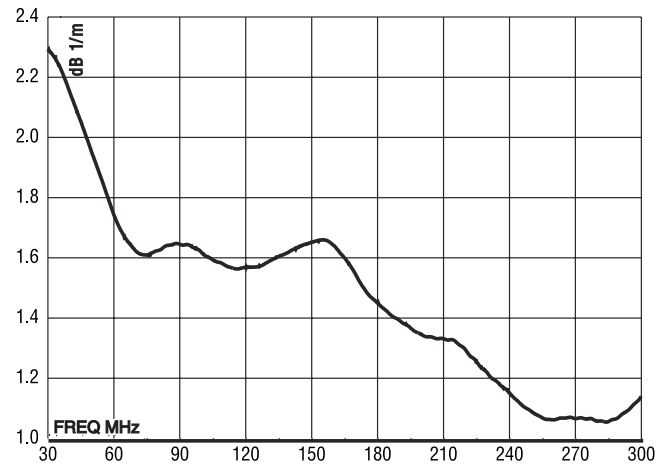
Uncertainties of the Calculated Parameters (with a 95% confidence level)

SA OR NSA FOR 2 ANTENNAS COMBINED	FREE-SPACE FACTOR
± 0.50 dB	± 0.25 dB

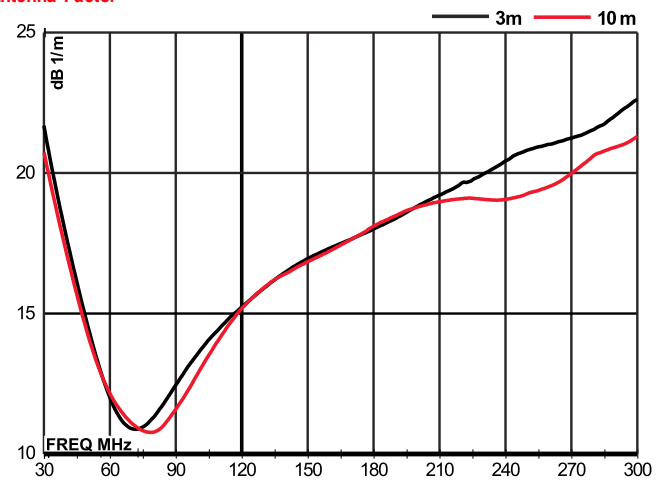


Model 3124 BiCal™ with 4-TR tripod

VSWR



Antenna Factor



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