

**FreeWave Technologies Inc.**

1880 S. Flatiron Court, Suite F

Boulder CO 80301

August 8, 2003

**RE: Grantee Code KNY  
FCC ID No. KNY-6231812519  
Model No. DGR09RMS  
Request for Class II Permissive Change**

**The antenna's specifications**

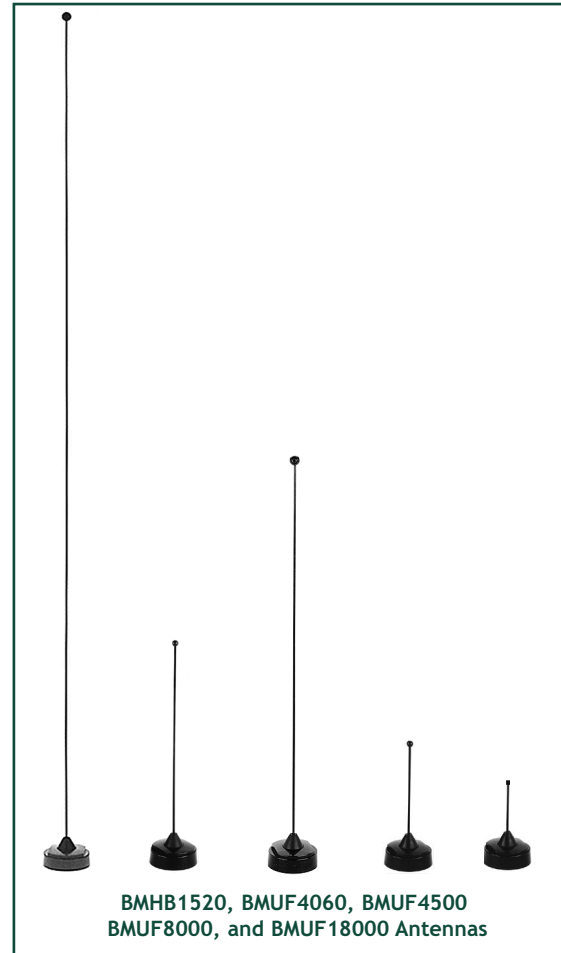
<b>Manufacturer</b>	<b>Part Number</b>	<b>Pages</b>
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### Chrome Nut Antennas

These antennas feature a super flexible design that protects the .062" diameter rod against damage that can be caused by limited vehicle height clearance. They also include a rubber seal gasket to prevent water leakage. All models are available in bright chrome or black finish.

#### Features

- Economical
- Flexible rod
- Ready to install; no rod cutting is required
- Available in either bright chrome or black finish
- Antenna includes rubber seal gasket to prevent water leakage
- Mates with all 1-1/8"-18 thread mounts, including 3/4" mounts



Multiple Bands

Electrical Specifications	Mechanical Specifications
<p><b>Maximum Power:</b> 150 Watts: UHF and VHF models 100 Watts: PCS, DCS, 700, 800 and 900 MHz models</p> <p><b>VSWR at Resonant Point:</b> &lt;1.5:1</p> <p><b>Nominal Impedance:</b> 50 Ohms</p> <p><b>Antenna Type:</b> 1/4 Wave (all models except 800/900 MHz colinears) 5/8 Wave over a 1/4 Wave (800/900 MHz colinear)</p>	<p><b>Radiator Material:</b> .062" diameter stainless steel, bright or black finish</p> <p><b>Mount Nut:</b> Brass; bright or black chrome finish</p> <p><b>Antenna Height:</b> (B)MUF19000: 1-1/2" at 1.9 GHz (B)MUF18000: 1-5/8" at 1.8 GHz</p> <p>(Approximate height at lowest frequency) (B)MUF7000: 3.3" (B)MUF8063: 14-1/2" (B)MUF8253: 14" (B)MUF8963: 12" (B)MUF9093: 12-3/8"</p> <p>All collinear models: 2.9" All UHF models: 7-3/8" All VHF models: 21-5/8"</p>

### Chrome Nut Antennas

Model #	Frequency Range	Factory Tuned Frequency	Gain	List Price Chrome Models	List Price Black Models
(B)MUF19000	1850-1990 MHz	1900 MHz	Unity	\$7.84	\$14.10
(B)MUF18000	1710-1880 MHz	1800 MHz	Unity	\$7.84	\$14.10
(B)MUF9000	896-940 MHz	898 MHz	Unity	\$7.84	\$14.10
(B)MUF8000	806-896 MHz	835 MHz	Unity	\$7.84	\$14.10
(B)MUF7000	760-870 MHz	811 MHz	Unity	\$7.84	\$14.10
(B)MUF9093	870-950 MHz	898 MHz	3 dB	\$12.00	\$18.35
(B)MUF8963	896-940 MHz	898 MHz	3 dB	\$12.00	\$18.35
(B)MUF8253	825-896 MHz	835 MHz	3 dB	\$12.00	\$18.35
(B)MUF8063	806-866 MHz	815 MHz	3 dB	\$12.00	\$18.35
(B)MUF4900	490-512 MHz	501 MHz	Unity	\$7.84	\$14.10
(B)MUF4700	470-490 MHz	480 MHz	Unity	\$7.84	\$14.10
(B)MUF4500	450-470 MHz	460 MHz	Unity	\$7.84	\$14.10
(B)MUF4300	430-450 MHz	440 MHz	Unity	\$7.84	\$14.10
(B)MUF4060	406-430 MHz	418 MHz	Unity	\$7.84	\$14.10
(B)MUF3800	380-406 MHz	393 MHz	Unity	\$7.84	\$14.10
(B)MHB2200	220-225 MHz	222 MHz	Unity	\$7.84	\$14.10
(B)MHB1620	162-174 MHz	167 MHz	Unity	\$7.84	\$14.10
(B)MHB1520	152-162 MHz	157 MHz	Unity	\$7.84	\$14.10
(B)MHB1440	144-152 MHz	148 MHz	Unity	\$7.84	\$14.10
(B)MHB1360	136-144 MHz	140 MHz	Unity	\$7.84	\$14.10

Prefix "B" indicates black


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### 3dB Gain Omnidirectional Antenna - Model V-9183 902-928 MHz



**2 year warranty**  
**Made in the USA**

**Advantages**

- This is a rugged 3dB gain omni optimized for wide bandwidth, all-weather performance. The broad vertical beamwidth provides wide area coverage and no field tuning is required to obtain maximum performance.
- Astron's all-brass center fed dipole delivers a clean radiation pattern without ground radials.

**Features**

- Encased in a heavy wall fiberglass radome for superior weather resistance.
- Flexible feedline with N Female termination simplifies the final installation.
- Stainless steel V-Bolts and custom V-Blocks for easy and secure mounting.
- Individually factory tested.

**ELECTRICAL SPECIFICATIONS**

Frequency Range, MHz	902-928
Gain, dBd	3 dB
VSWR (50 Ohms)	1.5:1 typical
1.5:1 bandwidth, MHz	26 minimum
3 dB Beamwidth E/H Planes, degrees	33/360
Maximum Power, watts	50*
Termination, feet (m), coax	N Female, 1 (.3), RG58 type
Polarization	Vertical

\*Limited by feedline. Higher power ratings are available as an option.

**MECHANICAL SPECIFICATIONS**

Overall Length, inches (cm)	30 (76)
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Radome Material	1.0" OD; .125" wall Fiberglass
Element Material	All-brass components
Mast Diameter, inches, (cm)	1.25-2.0 (3.2-5.1)
Mounting Hardware	Base to mast, supplied
Wind Surface Area, feet <sup>2</sup> (m <sup>2</sup> )	.14 (.013)
Wind Survival, mph (kph)	150 (240)
Weight, pounds (kg)	2.0 (.9)

**ASTRON** specializes in designing and manufacturing custom antennas. If this particular antenna does not meet with your requirements, **ASTRON** can provide you with other antenna solutions optimized to your specific application. This antenna is available in various frequencies.

Astron Wireless Technologies, Inc.  
22560 Glenn Drive, Suite 114 , Sterling, Virginia 20164-4440  
Voice: 703.450.5517 Fax:703.450.9753 [Commercial Sales](#)  
or call **Toll Free: 1-877-567-7646**



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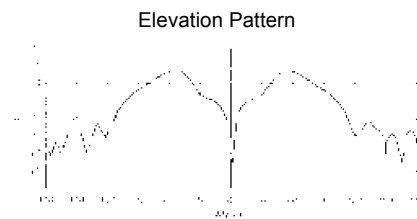
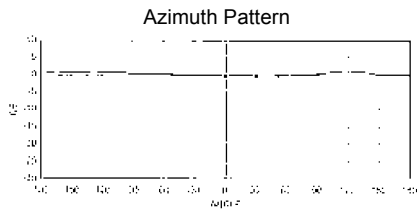
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**Low Profile "Disc" Antenna  
800/900/2400 MHz**



<b>Advantages</b>	
•	Broadband Performance
•	Low Profile, Economical Design
•	Designed for Indoor & Outdoor Use
•	Rugged UV ABS Stable Radome
•	Easy to Mount

<b>Electrical Specifications</b>	
Frequency	*824-896, 890-940,806-866, 2400-2500 MHz
Element Type	Edge Slot Radiator
Polarization	Vertical
Gain (min)	+3 dBi
Azimuth	Omnidirectional
Elevation	Cosine Shaped Monopole
VSWR	<1.5:1 @ resonance 2:1
Impedance	50 Ohm
Power	100 Watts
Cable Type	RG-58U



<b>Mechanical Specifications</b>	
Connector	Several Types Available
Mounting	Base Mounting Plate, Adhesive Backed
Wind Survival	150 MPH
Temperature	-40° to 160°F
Dimensions	3.0" Dia. Top, 4.5" Dia. Base, 0.62" Height
Weight	<1 lbs

\*Please note: Model No. PCNLP-08V is for the 824-896 MHz frequency range, Model No. PCNLP-09V is for the 890-940 MHz frequency range, Model No. PCNLP-08V1 is for the 806-866 MHz Frequency Range and Model No. PCNLP-24V is for frequency 2400-2500 MHz.

**ASTRON** specializes in designing and manufacturing custom antennas. If this particular antenna does not meet with your requirements, **ASTRON** can provide you with other antenna solutions optimized to your specific application. This antenna is available in various frequencies.

Astron Wireless Technologies, Inc.  
22560 Glenn Drive, Suite 114 , Sterling, Virginia 20164-4440  
Voice: 703.450.5517 Fax: 703.450.9753 [Commercial Sales](#)

**EXR**

Part Number (P/N):

- EXR150 + Connector**
- EXR450 + Connector**
- EXR806 + Connector**
- EXR821 + Connector**
- EXR902 + Connector**

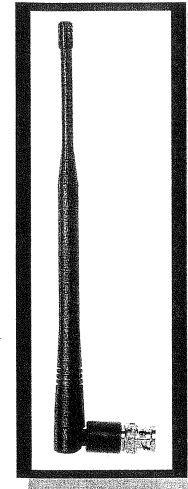
**Features:**

- Injection molded flexible right angle antenna
- 1/4 wave antenna in VHF and UHF and a 1/2 wave antenna in
- High durability, high efficiency
- Textured finish with adjustable 0-90° elbow
- Allows for 360° movement
- Available in various standard connectors
- An original 'Tuf Duck' antenna

**Specifications:**

All Centurion products are designed for maximum efficiency and are customizable and scalable to meet your frequency and application requirements.

<b>Frequency Range</b>	VHF UHF Trunking/ Cellular
<b>Polarization</b>	Vertical
<b>Nominal Impedance</b>	50 ohms
<b>VSWR</b>	1.5:1 max at resonance
<b>Power Rating</b>	50 watts
<b>Temperature Range</b>	-40°C to +85°C
<b>Drop Test</b>	1M



**EXR806BN**

The EXR model antenna is available in the following frequencies and connectors. Order by antenna model, frequency and connector. For example: EXR806TN. Length of each antenna will vary according to the connector chosen.

Part Number	Frequency Band	Connectors	Average Length (inches)	Color Code
EXR-150	150-162 MHz	BN	7.70	-
EXR-450	450-470 MHz	BN & TN	6.62 - 6.95	-
EXR-806	806-869 MHz	BN, MU & TN	9.25 - 9.50	-
EXR-821	824-896 MHz	BN	9.16	Yellow
EXR-902	902-960 MHz	BN & TN	8.85 - 9.03	Green

Specifications subject to change without notice

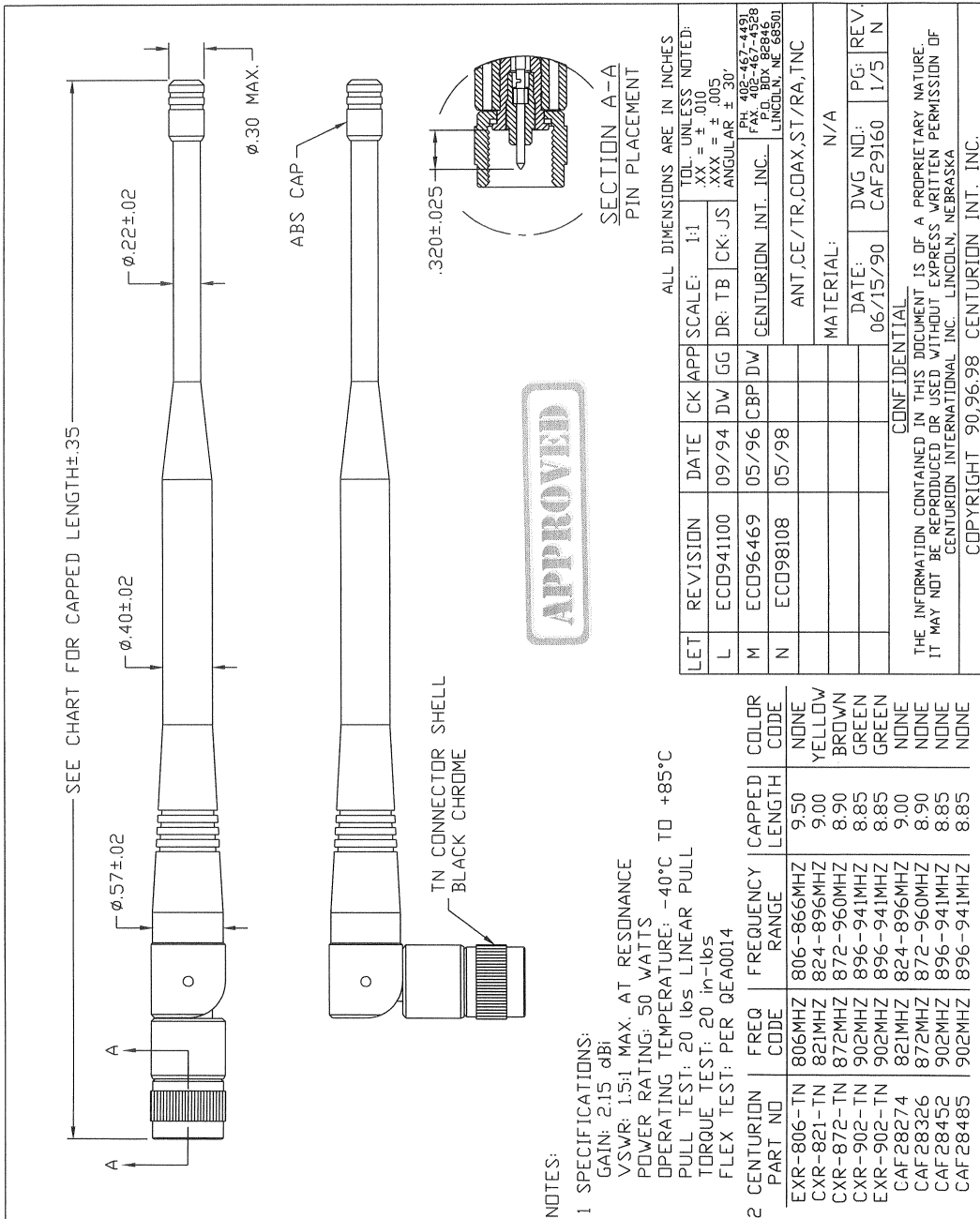
EXR 3 - 4/29/03



3425 N.44th St., LINCOLN, NE 68504 USA  
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**INTERNATIONAL PHONE** 402.474.0706 • **FAX** 402.467.4528  
[www.centurion.com](http://www.centurion.com) • [sales@centurion.com](mailto:sales@centurion.com)



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NOTES:

- 1 SPECIFICATIONS:  
 GAIN: 2.15 dBi  
 VSWR: 1.5:1 MAX. AT RESONANCE  
 POWER RATING: 50 WATTS  
 OPERATING TEMPERATURE: -40°C TO +85°C  
 PULL TEST: 20 lbs LINEAR PULL  
 TORQUE TEST: 20 in-lbs  
 FLEX TEST: PER QEA0014

CENTURION PART NO	FREQ CODE	FREQ RANGE	CAPPED LENGTH	COLOR CODE
EXR-806-TN	806MHZ	806-866MHZ	9.50	NONE
CXR-821-TN	821MHZ	824-896MHZ	9.00	YELLOW
CXR-872-TN	872MHZ	872-960MHZ	8.90	BROWN
CXR-902-TN	902MHZ	896-941MHZ	8.85	GREEN
EXR-902-TN	902MHZ	896-941MHZ	8.85	GREEN
CAF28274	821MHZ	824-896MHZ	9.00	NONE
CAF28326	872MHZ	872-960MHZ	8.90	NONE
CAF28452	902MHZ	896-941MHZ	8.85	NONE
CAF28485	902MHZ	896-941MHZ	8.85	NONE

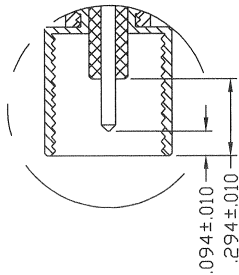
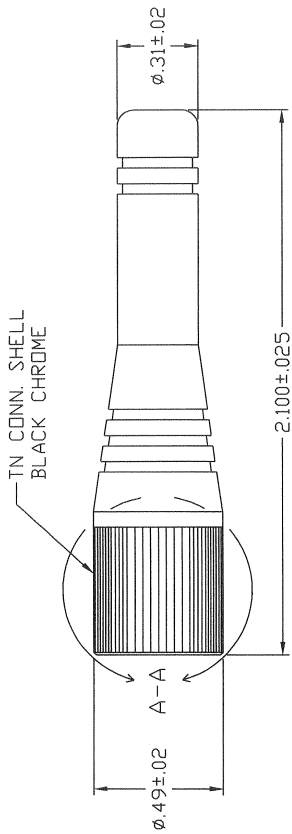
LET	REVISION	DATE	CK	APP	SCALE	TOL. UNLESS NOTED:
L	ECD941100	09/94	TB	JS	1:1	XX = ±.010 XXX = ±.005
M	ECD96469	05/96	CK	JS	DR: TB	ANGULAR ±.30°
N	ECU98108	05/98	DW	DW		PH: 402-467-4491 FAX: 402-467-4528 P.O. BOX 86846 LINCOLN, NE 68501

MATERIAL: N/A	
DATE: 06/15/90	DWG NO: CAF29160
PG: 1/5	REV: N

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**APPROVED**

**NOTES:**

- 1 SPECIFICATIONS:
  - GAIN: UNITY (>-2.5dB)
  - VSWR 1.5:1 MAX AT RESONANCE
  - POWER RATING: 50 WATTS
  - IMPEDANCE: 50 OHMS NOMINAL
  - OPERATING TEMPERATURE: -40°C TO +85°C
  - LINEAR PULL: 2216s (10kg) MINIMUM

2 CENTURION PART NO.	FREQUENCY CODE	FREQUENCY RANGE	COLOR CODE
EXS-806-TN	806MHZ	806-866MHZ	NONE
CXS-821-TN	821MHZ	824-896MHZ	YELLOW
CXS-872-TN	872MHZ	872-950MHZ	BROWN
CXS-902-TN	902MHZ	896-941MHZ	GREEN
CXS-950-TN	950MHZ	930-1000MHZ	RED
CAF25304	821MHZ	824-896MHZ	BLUE
CAF25510	821MHZ	824-896MHZ	NONE
CAF25511	872/902/950MHZ	872-1000MHZ	NONE

LET	REVISION	DATE	CK	APP	SCALE	TOL. UNLESS NOTED:
A	EC090155	10/90	BT		2:1	XXX = ±.005 XXX = ±.005 ANGULAR ±.30°
B	EC092413	08/92	SP			CENTURION INT., INC. PH. 402-467-4491 P.O. BOX 88946 LINCOLN, NE 68501
C	EC093697	06/93	MS			ANT.CELL,HELICAL,CXS-TN
D	EC0931295	10/93	DM			MATERIAL: N/A
E	EC0931376	11/93	MS			DATE: 10/17/90 DWG NO: CAF29250 PG: REV. 1/2 E

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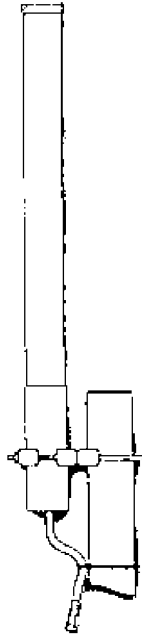
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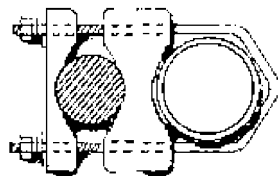
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**Omnidirectional Antenna - Model V-9180  
902-928 MHz**



**Top View**



2 year warranty

**Advantages**

- This is a rugged unity gain omni optimized for wide bandwidth, all-weather performance. The broad vertical beamwidth provides wide area coverage and no field tuning is required to obtain maximum performance.
- Astron's all-brass center fed dipole delivers a clean radiation pattern without ground radials.

**Features**

- Encased in a heavy wall fiberglass radome for superior weather resistance.
- Flexible feedline with N Female termination simplifies the final installation.
- Stainless steel V-Bolts and custom V-Blocks for easy and secure mounting.
- Individually factory tested.

**Electrical Specifications**

Frequency Range, MHz	902-928
Gain, dBd	Unity
VSWR (50 Ohms)	1.2:1 typical
1.5:1 bandwidth, MHz	26 minimum
3 dB Beamwidth E/H Planes, degrees	77/360
Maximum Power, watts	50*
Termination, feet (m), coax	N Female, 1 (.3), RG58 type
Polarization	Vertical
*Limited by feedline. Higher power ratings are available as an option.	

**Mechanical Specifications**

Overall Length, inches (cm)	12.0 (30.5)
Radome Material	1.0" OD; .125" wall Fiberglass
Element Material	All-brass components
Mast Diameter, inches, (cm)	1.25-2.0 (3.2-5.1)
Mounting Hardware	Supplied
Wind Surface Area, feet <sup>2</sup> (m <sup>2</sup> )	.071 (.007)
Wind Survival, mph (kph)	150 (240)
Weight, pounds (kg)	1.5 (.68)