

December 28, 1997

Re: Certification for C-Spec Corporation
RF Wireless Bridge
Model: RF-2A
FCC ID: MBX-OLANWB2A
CANADA: 254 539 1104A

Connectors and Their Installation

Because the RF-2A Wireless Bridge is, in general, intended for long range links, it uses relatively high gain antennas, up to 23 dBi gain. Since high gain antennas have a narrow beam, antennas must be properly installed and aligned for proper operation of the system.

For this reason, only the C-spec Corporation and their authorized and trained dealers will install and repair the systems. This ensures that the installations and repairs and adjustments will be made only by professionals, i.e., professionally installed and maintained.

The RF-2 Wireless Bridge has only one "special" or unique connector and that is at the RF card. After that, the connectors on the lightning arrestor, cable, filter, and antenna are all SMA and N-type. When the installation will be made, these connectors will be permanently secured with a Loctite #271 (or equivalent) compound, and connectors that are outside of a building will also be taped with an adhesive tape for moisture protection.

EXHIBIT K

Page 1 of 15

U of Mich file 415031- 869

To RF-2A Antenna Installers:

It is the responsibility of C-SPEC and/or it's authorized antenna installers that the antenna be installed in a location such that the general public has restricted access.

For the RF-2A system, the distance from any installed antenna within which the FCC human exposure limit may be exceeded is 16 cm.

EXHIBIT K

Page 2 of 15

U of Mich file 415031- 869

C-SPEC

Corporation

2400 MHz Omni Directional Antenna

33cm Horizontally Polarized

Model# 200A801

This product is a quad array of Wheel antennas. A Wheel is made up of three broad band quarterwave radiators arranged in the form of a "three leaf clover". Four of these are phased to provide approximately 6 dB gain over a resonate dipole or 8.15 dBi and to provide a pattern that is 20 degrees wide in the H-Plane, or +/- 10 degrees of the horizon and less than 1 dB of deviation from a perfect circle in the E-Plane. Cross polarization is (worst case) -20 dB.

A capacitive strap (an inductor that is electrically shorter than a quarter wavelength) is employed to adjust the impedance of the three paralleled, broad band, monopoles to 50 ohms. All phasing lines are 1/4", copper jacketed, Teflon dielectric, hard line. Transmission line attachments is via a female "N" connector at the bottom of the array.

The array is housed in a Radome measuring 6" in diameter and 12" in length. The Radome is made of 1/4" thick PVC pipe. The bottom of the Radome is fitted with a Pipe Flange that will accommodate a standard thread 1.5" pipe for mounting. The Radome is sealed with RTV, a self curing, silicon rubber compound that will ensure watertight integrity.

These Omni directional antennas are in use throughout the United States, Canada and Mexico in the service of Wireless LANs, installed by many wireless LAN system provider companies. To date, there has only been good reports and there has never been a product returned to correct workmanship or dissatisfaction with performance. They will survive more than a 5 year service life in the most hostile environment.

EXHIBIT K

Page 3 of 15

U of Mich file 415031- 869

20 Marco Lane • Dayton, Ohio 45458 • Phone: (937) 439-2882 • Fax: (937) 439-2358

<http://www.c-spec.com/c-spec> • sales@c-spec.com

OverLAN[®] is a registered trademark of C-SPEC Corporation

Phone 1 (800) GO C-SPEC

DECIBEL PRODUCTS ALLEN TELECOM GROUP

C-SPEC No:
2DB8A01

DB906S .-P / DB906SN-T (Cspec)

6 dBd Low Profile Omni Antenna

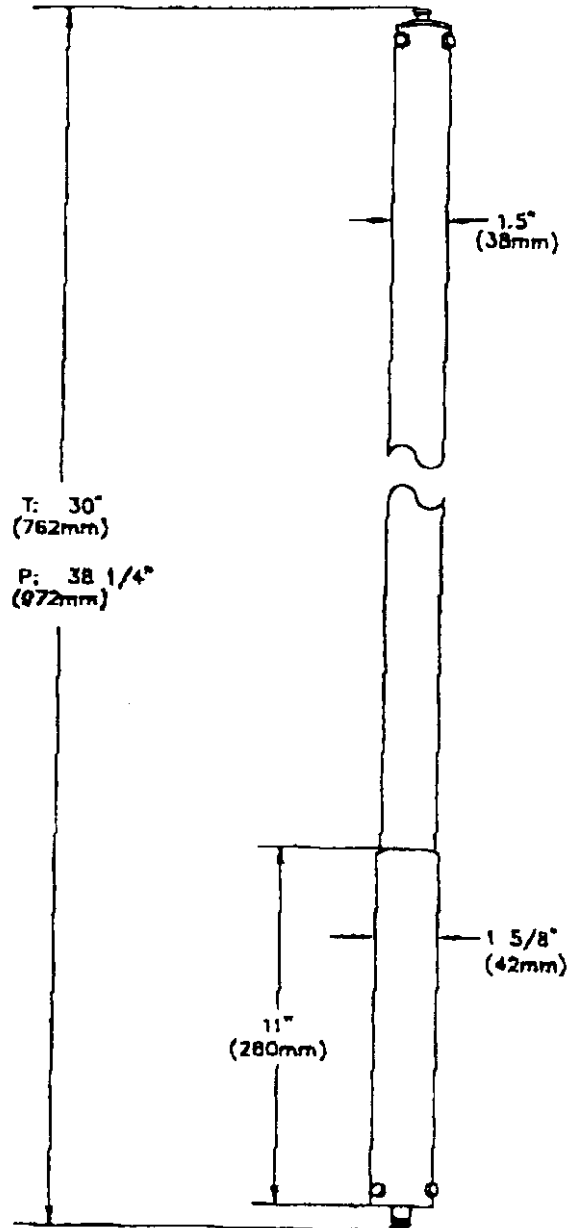
2130-2200 MHz / 2400-2483 MHz



#2

Model Number	DB906SN-P/T	DB906SE-S/T
Termination	N-Female	7-16 Female
Frequency Range	P: 2130-2200 MHz	T: 2400-2483 MHz
Gain (Mid Band)	6 dBd or 8.1 dBi	
VSWR	< 1.5 : 1	
Beamwidth (3 dB from max)	Vertical 15°	
Polarization	Vertical	
Max. Input Power	400 Watt	
Other Information	Application: Rx or Tx, Rx and Tx	
Weight	4 lb (1.8 kg)	5 lb (2.3 kg)
Wind Area	.22 ft ² (.02 m ²)	.27 ft ² (.03 m ²)
Wind Load	8.8lb (39N)	10.8lb (48N)
	(at 100 mph or 160 km/h)	
Max. Wind Speed	150 mph (240 km/h)	
Material	Radiator: Brass Radome: Fiberglass Mounting Casting: Passivated Aluminum Mounting Hardware: Steel, V2A or galvanized	
Color	Blue-green	
Lightning Protection	Direct ground.	
Packing Size	31.5 x 9.8 x 9.8 in (80 x 25 x 25 cm)	40 x 9.8 x 9.8 in (102 x 25 x 25 cm)
Shipping Weight	10 lb (4.6 kg)	13 lb (5.9 kg)

DB9052-000-A



Radiation Patterns (Relative Field Strength)

Bandwidth

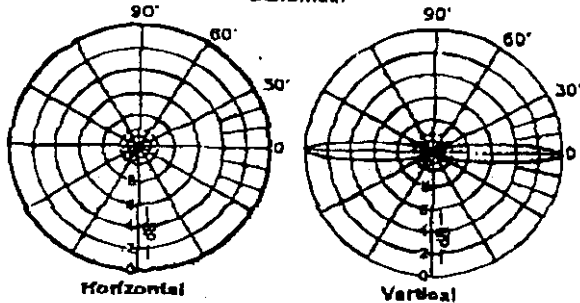
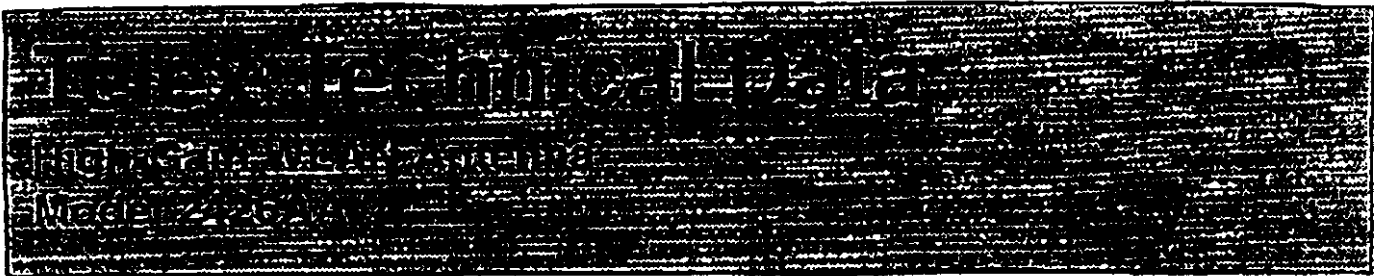

6 dBd (8.1 dBi) Low Profile Omni
Antenna for Receive and/or Transmit
Systems P: 2130-2200 MHz / T: 2400-
2483 MHz

EXHIBIT K

Page 4 of 15

U of Mich file 415031-869



General Description

This antenna is broadband and designed to operate throughout the ISM band of frequencies from 2400 to 2483 MHz.

The antenna features an omni directional pattern with a gain of 5 dB.

It is enclosed in a weatherproof radome for outdoor or indoor use. The antenna provides for mounting to a mast, or an optional ceiling mount is available.

Standard coax connectors, as well as connectors to meet Part 15 of FCC regulations, can be supplied. Contact the factory for information.



Specifications

Electrical:

Frequency Range	2400-2483 MHz
VSWR	Less than 2:1
Nominal Impedance	50 ohms
Gain	5 dBi
Polarization	Vertical

Mechanical:

Cable length	18"
Cable Type	RG-58 A/U Type, 50 ohm, low loss, white
Connector	Standard Type N Jack

TELEX

TELEX COMMUNICATIONS, INC.

8601 East Cornhusker Highway, Lincoln, NE 68505

Phone (402) 467-5321 FAX: (402) 467-3279

EXHIBIT K

Page 5 of 15

U of Mich file 41503- 868

03/07/97 15:14 514 444 3484

MICROROUTE TECHNOLOGIE

PAGE 02



MicroRoute
Technologies inc

AO2-12

1/2wave, 22-step High Gain Antenna for 2400MHz

Features:

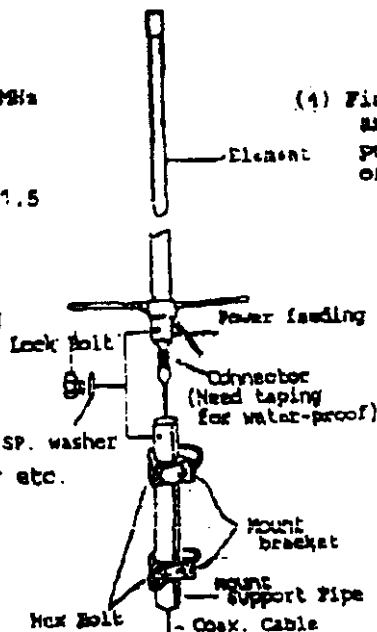
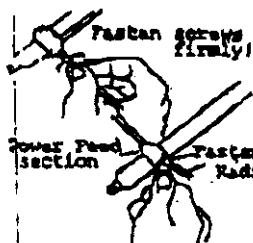
- * Wide band, which requires no frequency adjustment.
- * One-piece, heavy duty fiber Glass allows long durability, providing complete water/pollution-proof.

Specification:

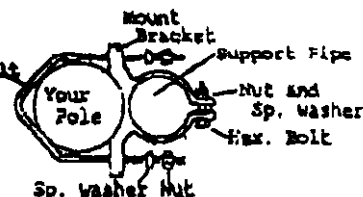
Frequency : 2,400 - 2,450MHz
Gain : 12.4 dBi
Max In-put power : 100 W
Impedance : 50 ohm
V. SWR : Less than 1: 1.5
W. Velocity : 50m/sec
Length : 1.78 m
Weight : 1.16 kg
Connector : N - type
Available Mast : 30 - 62 mm ϕ

Assembling & Mounting:

- (1) First, assemble 3 radials.
- (2) Then, fasten Radial Lock SP. washer Nets firmly, using spanner etc.



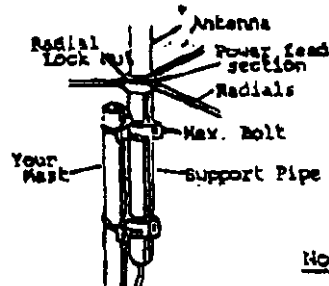
- (4) Finally, mount all assembled antenna to your mast. Please pay attention to the well-balancing of the antenna.



Parts List

No.	Qty	Parts Name
1)	1	Element
2)	3	Radials w/nut
3)	1	Power Feeding Section
4)	2	Mount Support Bracket
5)	1	Mount Support Pipe
6)	1	Lock Bolt w/sp. washer M6x8
7)	1	Hex Bolt w/sp. washer M6x30
8)	2	U-bolt w/sp. washer, nut

- (3) Then, mount 2 Mount Brackets onto the Mount Support Pipe. Pass the coax. cable through the Pipe and connect to the Power Feeding Section. Please fasten Hex. Bolts firmly. Then, assemble such Support pipe to whole antenna and fasten Lock Bolt strongly.

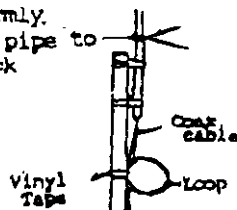


Note:

Please use, low-loss, high quality coaxial cable of 50 ohm standard.

Kindly proceed sufficient water-proof works by self-melting tape first, then by vinyl tape.

V. SWR Characters:



1400 Taschereau, La Prairie QC J5R 4E8
Tel.: (514) 444-3999 Fax: (514) 444-3404

EXHIBIT K

Page 6 of 15

U of Mich file 415031-869



MicroRoute
Technologies Inc.

1400 Tachereau Blvd.

La Prairie QC

Canada J5R 4S6

Tel : (514) 444-8999

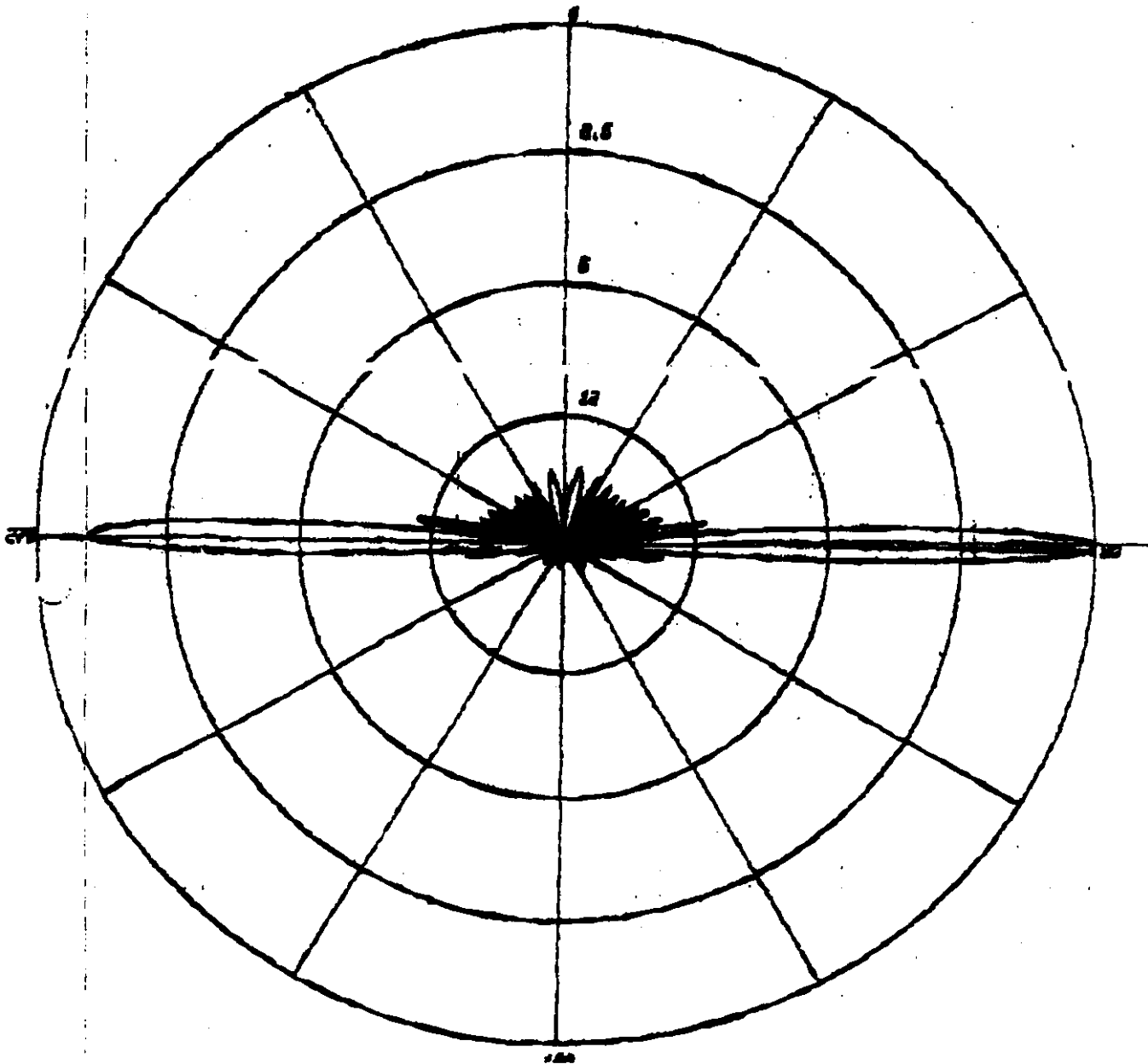
Fax : (514) 444-6404

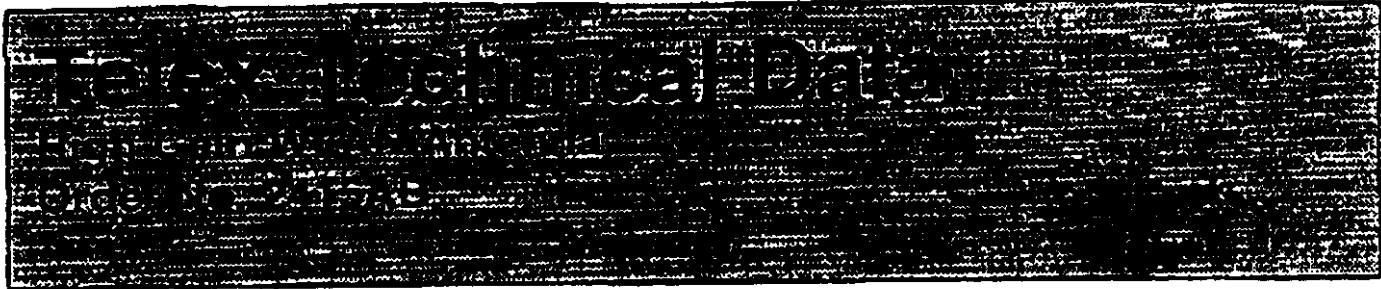
EXHIBIT K

Page 7 of 15

U of Mich file 415031- 869

AO2-12

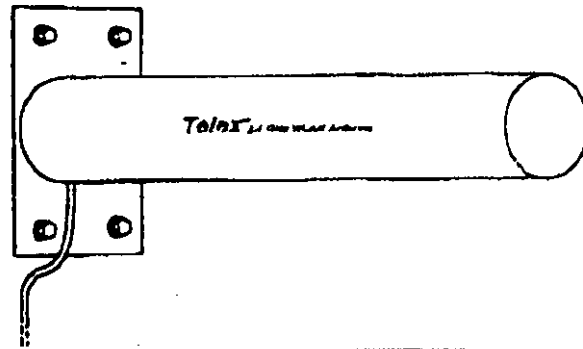




General Description

2415AL 11.3 dBi 18.5"

This antenna is a totally enclosed 16 element Yagi antenna for the 2400 to 2483 MHz frequency band. It is designed to be used as a bridge antenna between two networks or for point to point communications. It has a typical VSWR of 1.5:1 and is less than 2:1 over the entire frequency band. The gain is 13.5 dBi and the half-power beamwidth is 30 degrees. This antenna is normally mounted on a mast and is vertically polarized.



Specifications

Electrical:

Frequency Range	2400-2483 MHz
VSWR	Less than 2:1, typically 1.5:1
Nominal Impedance	50 ohms
Gain	1.5 13.5 dBi (11.3 dBd)
Front-to-Back ratio	Greater than 20 dB
Half-power Beamwidth	30 degrees
Polarization	Vertical

Mechanical:

Size	18" long
Mounting method	clamps to vertical mast, Up to - 2 5/8" O.D.
Cable length	36"
Cable Type	RG-58A/U type, 50 ohm, low loss, white
Connector	Specify Reverse TNC (polarized) or Reverse SMA (polarized)

TELEX

TELEX COMMUNICATIONS, INC.
6601 East Cornhusker Highway, Lincoln, NE 68505

EXHIBIT K

Page 8 of 15

U of Mich file 415031- 869

C-SPEC

Corporation

2300 - 2500 MHz Planar Model ANT2HU801

Specifications

Frequency Range:	2300-2500 MHz
Impedance:	50 Ω
Dimensions:	101 x 95 x 32 (mm)
Weight:	100 g
VSWR:	1.5
Polarization:	vertical
Gain:	8.5 dBi
3 dB beamwidth horizontal:	75°
3 dB beamwidth vertical:	60°
Front to back ratio:	15 dB
Standard connector:	SMA female

Assembly Instructions

- 1) Remove the antenna from the box. Locate the two screws, plastic wall sinkers, and plastic antenna base. These parts are used to mount the antenna to the wall.
- 2) **THIS IS AN INDOOR ANTENNA** so there is no need for water sealant when mounting and attaching the cable.
- 3) Once the antenna is in its desired position, attach the cable to the antenna and then to the OverLAN wireless card.

20 Marco Lane • Dayton, Ohio 45458 • Phone: (937) 439-2882 • Fax: (937) 439-2358

<http://www.c-spec.com/c-spec> • sales@c-spec.com

OverLAN® is a registered trademark of C-SPEC Corporation.

EXHIBIT K

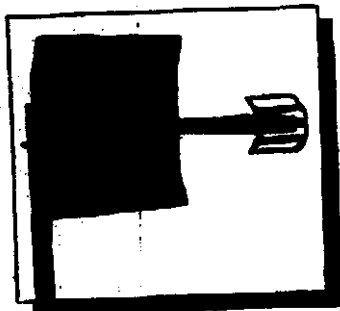
Page 9 of 15

U of Mich file 415031- 819

C-SPEC Corporation

2400 - 2500 MHz, 10 dBi, Model#2CON1001

Specifications



Reflector Material	Cast Magnesium Alloy
Mounting Hardware	Stainless Steel
Gain	10 dBi
Input Frequency	2400 - 2500 MHz
-3 dB Beam Width	22°
Cross Polarity Rejection	>20 dB
Front to Back Ratio	>20 dB
Impedance @ Output	50 OHMS
Elevation Adjustment	60° in 10° Increments
VSWR (Average)	1.4:1 @ 2450 MHz
Overall Size (inches)	11.4 x 11.75 x 15 (29.21 x 29.85 x 38.10 cm)
Weight	2.1 lbs. (1.05 Kg)
Mounting	1" - 2" O.D. Mast (2.54 - 5.08 cm)

FEATURES

- Lightest weight grid antenna with low wind resistance.
- Stamped aluminum 13 and die-cast 18/25 manufacturing processes provide unmatched uniformity resulting in consistently high performance from every antenna.
- Magnesium Alloy is comparable to anodized aluminum but weighs 33% less.
- Antennas and mounting hardware are manufactured with nonferrous material which will not rust. Magnesium alloy, stainless steel and aluminum.
- No need for mechanical adapters - one size fits all!
- Antennas can be mounted in horizontal, vertical, or 45° polarity.
- Easy installation.
- Antenna elevation adjustment up to 60°.
- Compact packaging for shipment.

20 Marco Lane • Dayton, Ohio 45458 • Phone: (937) 439-2882 • Fax: (937) 439-2358

<http://www.c-spec.com/c-spec> • sales@c-spec.com

OverLAN® is a registered trademark of C-SPEC Corporation.

EXHIBIT K

Phone 1 (E

Page 10 **of** 15

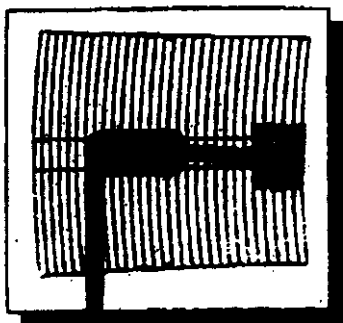
U of Mich file 415031-869

C-SPEC Corporation

EXHIBIT KPage 11 of 15U of Mich file 415031-869

2400 - 2500 MHz, 17 dBi, Model#2CON1701

Specifications



Reflector Material	Cast Magnesium Alloy
Mounting Hardware	Stainless Steel
Gain	17 dBi
Input Frequency	2400 - 2500 MHz
-3 dB Beam Width	14°
Cross Polarity Rejection	>23 dB
Front to Back Ratio	>23 dB
Impedance @ Output	50 OHMS
Elevation Adjustment	60° in 10° Increments
VSWR (Average)	1.4:1 @ 2450 MHz
Overall Size (inches)	16 x 20 x 15 (40.64 x 50.80 x 38.10 cm)
Weight	2.7 lbs. (1.22 Kg)
Mounting	1" - 2" O.D. Mast (2.54 - 5.08 cm)
Wind Load	MPH lb.
(Based on worst case	40 6.3
air temp. -30°F)	60 14.2
(Wind load would be	80 25.2
18% less at + 60°F)	100 39.4
	120 56.6

FEATURES

- Lightest weight grid antenna with low wind resistance.
- Stamped aluminum 13 and die-cast 18/25 manufacturing processes provide unmatched uniformity resulting in consistently high performance from every antenna.
- Magnesium Alloy is comparable to anodized aluminum but weighs 33% less.
- Antennas and mounting hardware are manufactured with nonferrous material which will not rust. Magnesium alloy, stainless steel and aluminum.
- No need for mechanical adapters - one size fits all!
- Antennas can be mounted in horizontal, vertical, or 45° polarity.
- Easy installation.
- Antenna elevation adjustment up to 60°.

20 Marco Lane • Dayton, Ohio 45458 • Phone: (937) 439-2882 • Fax: (937) 439-2358

<http://www.c-spec.com/c-spec> • sales@c-spec.com

OverLAN® is a registered trademark of C-SPEC Corporation.

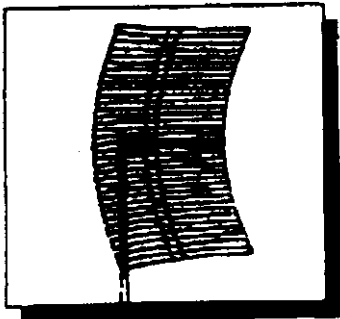
Phone 1 (800) GO C-SPEC

C-SPEC
Corporation

EXHIBIT K
Page 12 of 15
U of Mich file 415031-869

2400 - 2500 MHz, 23 dBi, Model # 2CON2301

Specifications



Reflector Material	Cast Magnesium Alloy	
Mounting Hardware	Stainless Steel	
Gain	23 dBi	
Input Frequency	2400 - 2500 MHz	
-3 dB Beam Width	7.5°	
Cross Polarity Rejection	>26 dB	
Front to Back Ratio	>31 dB	
Impedance @ Output	50 OHMS	
Elevation Adjustment	Optional	
VSWR (Average)	1.4:1 @ 2450 MHz	
Overall Size (inches)	24 x 36 x 15 (60.95 x 91.44 x 38.10 cm)	
Weight	4.9 lbs. (2.22 Kg)	
Mounting	1" - 2" O.D. Mast (2.54 - 5.08 cm)	
Wind Load	MPH	lb.
(Based on worst case	40	16
air temp. -30°F)	60	35
(Wind load would be	80	63
18% less at +60°F)	100	97
	120	141.5

FEATURES

- Lightest weight grid antenna with low wind resistance.
- Stamped aluminum 13 and die-cast 18/25 manufacturing processes provide unmatched uniformity resulting in consistently high performance from every antenna.
- Magnesium Alloy is comparable to anodized aluminum but weighs 33% less.
- Antennas and mounting hardware are manufactured with nonferrous material which will not rust. Magnesium alloy, stainless steel and aluminum.
- No need for mechanical adapters - one size fits all!
- Antennas can be mounted in horizontal, vertical, or 45° polarity.
- Easy installation.
- Antenna elevation adjustment up to 60°.

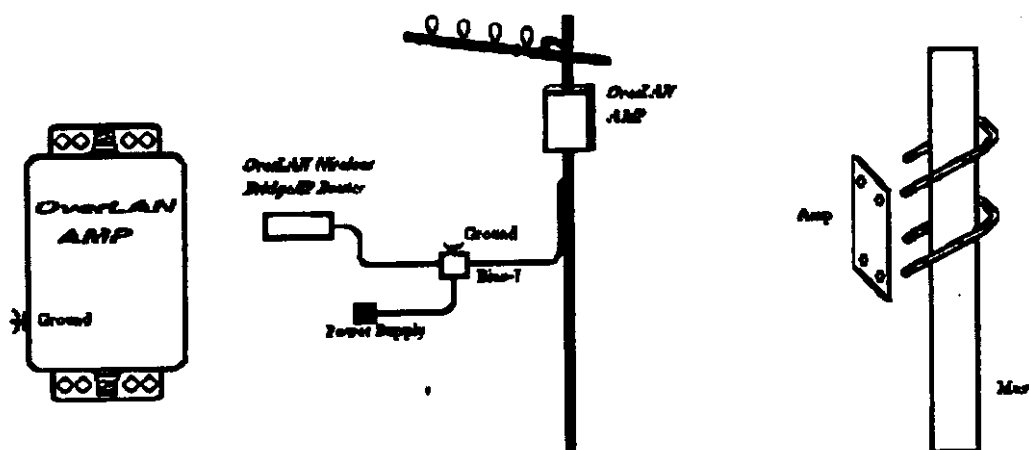
20 Marco Lane • Dayton, Ohio 45458 • Phone: (937) 439-2882 • Fax: (937) 439-2358
<http://www.c-spec.com> • sales@c-spec.com
OverLAN® is a registered trademark of C-SPEC Corporation.

Phone 1 (800) GO C-SPEC

C-SPEC Corporation

EXHIBIT KPage 13 of 15U of Mich file 415031- 868

OverLAN[®] AMP Part No. AMP90 (915 MHz) Part No. AMP20 (2.4 GHz) Mounting and Cabling Instructions



The **OverLAN[®] AMP** can be mast mounted using the U-bolts included with the unit. Refer to the sketch for proper positioning. Take care not to over-tighten the bolts or cause damage to the RF connectors on the amplifier. Since the amplifier is a sealed unit, these connectors cannot easily be repaired. Alternately, the unit can be mounted to a flat surface using any of the mounting holes on the unit's mounting flanges.

Power Supply

The **OverLAN[®] AMP** is powered through the coaxial antenna feed cable. The "Bias-T" supplied with the **OverLAN[®] AMP** unit couples the DC power from the included DC power supply to the antenna feed cable and replaces the lightning arrestor. Using a power supply which is not supplied with the **OverLAN[®] AMP** may cause permanent damage to the unit. Proper connection is shown above. Be sure to note the labeling on the Bias-T which denotes which "F" connector should be cabled to the **OverLAN[®] AMP** unit. The other "F" connector should be cabled to the radio unit. Both the power supply and Bias-T are designed for indoor use only.

Grounding the **OverLAN[®] AMP**

The **OverLAN[®] AMP** has to be grounded in two separate spots. One is on the amplifier itself and the other is on the Bias-T. Both of these pieces need to be grounded to ensure that the **OverLAN[®] AMP** and the OverLAN Wireless Bridge is protected from a lightning strike.

20 Marco Lane • Dayton, Ohio 45458 • Phone: (937) 439-2882 • Fax: (937) 439-2358
<http://www.c-spec.com> • sales@c-spec.com

C-Spec BP Filter Model 5P

TRILITHIC / CIR-Q-TEL (CODE 23042)
9202 EAST 33RD STREET
INDIANAPOLIS, IN 46236 U.S.A.

FILTER DATA SHEET
TEL: 800-344-2412
FAX: 317-895-3613

MODEL NUMBER: FB1081
CUSTOMER:
DRAWING:
PART NUMBER: 7130082000

REV:

DATE: 22 Aug 96
TRILITHIC SALES ORDER: 44485
SERIAL NUMBERS:
NSN:

PERFORMANCE SPECIFICATION		MEASURED PERFORMANCE ON SERIALIZED UNITS				
RELATIVE BANDWIDTH FOR SER #						
3.0dB AT 2470	MHz MIN	2472.6				
AT 2404	MHz MAX	2403.0				
dB AT	MHz MIN					
AT	MHz MAX					
INSERTION LOSS						
1.8 dB MAX AT 2437	MHz	1.3608				
dB MAX AT	MHz					
dB MAX AT	MHz					
RELATIVE REJECTION						
20 dB MIN AT 2483.5	MHz	28.408				
20 dB MIN AT 2390	MHz	30.008				
VSWR SPECIFICATION						
1.5:1 AT RC'D	MHz MIN	2472.0				
AT RC'D	MHz MAX	2403.8				
OTHER REQUIREMENTS						

WEIGHT:

LENGTH:

CONN: SMA JK/JK

IMPED: 50 Ω

TEMP RANGE: STD

TECHNICIAN: 

QUALITY ASSURANCE: _____

EXHIBIT K

Page 17 of 15

U of Mich file 415031- 869

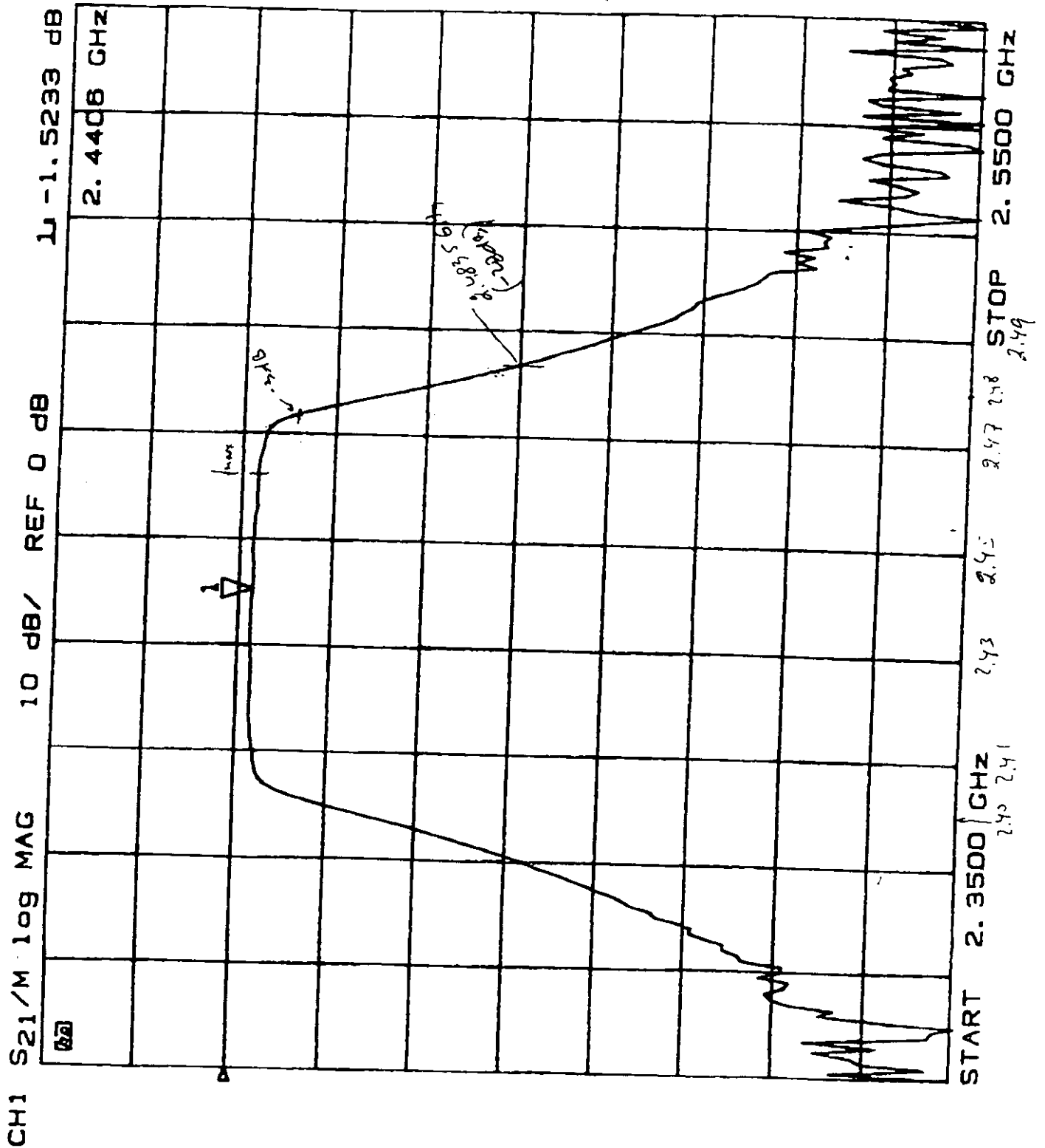


EXHIBIT K
 Page 15 of 15
 U of Mich file 415031-868

C-Spec BP Filter
 Model 5P
 (meas by UMICH)