



LNAS

Low Noise Amplifier Series Installation and Operation Manual

Part Number MN-LNAS
Revision 2

IMPORTANT NOTE: The information contained in this document supersedes all previously published information regarding this product. Product specifications are subject to change without prior notice.

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Revision History

Rev	Date	Description
0	-	Initial Release.
1	2017	Unknown
2	Aug 2021	Updated formatting to incorporate current styles. Added X-band and Ka-band.

TABLE OF CONTENTS

PREFACE	1
About this Manual	1
Conventions and References	1
Patents and Trademarks	1
Warnings, Cautions, and Notes	1
Examples of Multi-Hazard Notices	2
Recommended Standard Designations	2
Safety and Compliance	2
Electrical Safety and Compliance	2
Grounding	3
Fuses.....	3
Class I Pluggable Equipment Type A-Protective Earthing	3
Galvanic Isolator Use.....	3
Restricted Access Location.....	3
International Symbols.....	4
Operating Environment	4
European Union Electromagnetic Compatibility (EMC) Directive (2004/108/EC)	4
Regulatory Compliance	5
EMC (Electromagnetic Compatibility)	5
South Korean Electromagnetic Compatibility	5
European Union Telecommunications Terminal Equipment Directive (91/263/EEC)	5
CE Mark	5
Product Support	6
Comtech EF Data Headquarters	6
Warranty Policy	6
Limitations of Warranty	6
Exclusive Remedies.....	7
CHAPTER 1. INTRODUCTION	1-1
1.1 Introduction	1-1
1.2 Technology	1-2
1.3 Reliability	1-2
1.4 Construction	1-2
CHAPTER 2. INSTALLATION	2-1
2.1 Shipping Contents	2-1
2.2 Installation Tools	2-1
2.3 LNA Connector Pinouts.....	2-2
CHAPTER 3. DESCRIPTION	3-1
3.1 Introduction	3-1
3.2 C-band LNA Dimensions	3-3
3.3 X-band LNA Dimensions	3-4
3.4 Ku-band LNA Dimensions.....	3-5
3.5 Ka-band LNA Dimensions	3-6
CHAPTER 4. SPECIFICATIONS	4-1
4.1 Summary of Specifications	4-1
4.2 Power Consumption	4-2
4.3 Fuses	4-2

4.4	Cables and Connectors	4-2
4.5	Operating Requirements for Regulatory Compliance	4-2
CHAPTER 5.	REDUNDANCY	5-1
5.1	Typical System Noise Temperature	5-1
5.1.1	1:1 Redundant LNA System	5-1
5.1.2	1:2 Redundant LNA System	5-1
5.2	Block Diagrams	5-2

LIST OF TABLES

Table 2-1.	DC Power Connector, 4-Pin	2-2
Table 2-2.	DC Power Connector, 6-Pin	2-2
Table 5-1.	Typical Noise Temperature in Kelvin at 23°C	5-1

LIST OF FIGURES

Figure 1-1.	C-band LNA	1-1
Figure 1-2.	X-band LNA	1-1
Figure 1-3.	Ku-band LNA	1-2
Figure 1-4.	Ka-band LNA	1-2
Figure 3-1.	C-band LNA Dimensions	3-3
Figure 3-2.	X-band LNA Dimensions	3-4
Figure 3-3.	Ku-band LNA Dimensions	3-5
Figure 3-4.	Ka-band LNA Dimensions	3-6
Figure 5-1.	1:1 Redundant LNA System Block Diagram	5-2
Figure 5-2.	1:2 Redundant LNA System Block Diagram	5-2

Acronym List

Acronym	Description
CEFD	Comtech EF Data
GaA FET	Gallium Arsenide Feed Effect Transistor
HEMT	High Electron Mobility Transistors
LNA	Low Noise Amplifier
LNB	Low-noise Block Down Converter
MTBF	Mean Time Between Failures
VSAT	Very Small Amplifier Terminals

Units of Measurement

Unit / Symbol	Definition
Ω	Ohm
A	Ampere
bps	bits per second
°C	Celsius (degrees)
Hz	Hertz
kHz	kiloHertz
dB	decibel
dBc	Decibels relative to the carrier
dBm	Decibel-milliwatts
°F	Fahrenheit (degrees)
GHz	Gigahertz
Kbps	Kilobit per second
kg	kilogram
ksps	Kilosymbols per second
lbs.	pounds
mA	Milli-amp
Mbps	Megabit per second
MHz	Megahertz
mm	millimeter
ms	millisecond
Msps	Megasymbol per second
mW	milliwatt
in.	inch
Pps	Packets per second
μF	micro-farads
W	Watt
V	Volt
VAC	Volt Alternating Current
VDC	Volt Direct Current

PREFACE

About this Manual

This manual provides installation and operation information for the Comtech EF Data Low Noise Amplifier (LNA) Series. This is a document intended for the persons responsible for the operation and maintenance of the LNAs.

Conventions and References

Patents and Trademarks

See all of Comtech EF Data's Patents and Patents Pending at <http://patents.comtechedata.com>. Comtech EF Data acknowledges that all trademarks are the property of the trademark owners.

Warnings, Cautions, and Notes



A **WARNING** GIVES INFORMATION ABOUT A POSSIBLE HAZARD THAT MAY CAUSE DEATH OR SERIOUS INJURY.



A **CAUTION** gives information about a possible hazard that MAY CAUSE INJURY or PROPERTY DAMAGE.

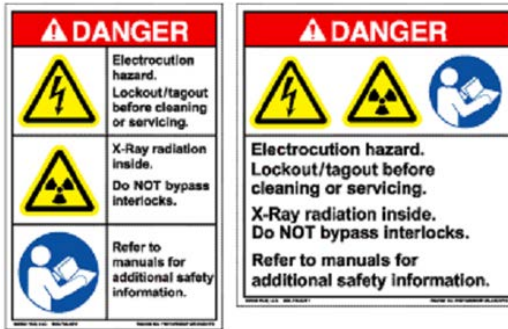


A **NOTE** gives important information about a task or the equipment.



A **REFERENCE** directs you to additional information about a task or the equipment.

Examples of Multi-Hazard Notices



Recommended Standard Designations

The new designation of the Electronic Industries Association (EIA) supersedes the Recommended Standard (RS) designations. References to the old designations may be shown when depicting actual text (e.g., RS-232) displayed on the Unit. All other references in the manual refer to EIA designations.



Carefully review the following information.

Safety and Compliance

Electrical Safety and Compliance

The unit complies with the **EN 60950 Safety of Information Technology Equipment (Including Electrical Business Machines)** safety standard.



Connect the unit to a power system that has separate ground, line and neutral conductors. Do not connect the unit without a direct connection to ground.

Grounding



PROPER GROUNDING PROTECTION IS REQUIRED: The installation instructions require that the integrity of the protective earth must be ensured, and that the equipment must be connected to the protective earth connection at all times.

- In Finland: "Laitte on liitettävä suojamaadoituskoskettimilla varustettuun pistorasiaan."
- In Norway: "Apparatet må tilkoples jordet stikkontakt."
- In Sweden: "Apparaten skall anslutas till jordat uttag."

Fuses



For continued operator safety, always replace the fuses with the correct type and rating.

Class I Pluggable Equipment Type A-Protective Earthing

The cable distribution system/telecommunication network of this product relies on protective earthing and the integrity of the protective earthing must be insured

In Finland:

"Laitte on liitettävä suojakoskettimilla varustettuun pistorasiaan"

In Norway:

"Apparatet må tilkoples jordet stikkontakt"

In Sweden:

"Apparaten skall anslutas till jordat uttag"

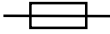
Galvanic Isolator Use



Utrustning som är kopplad till skyddsjord via jordat vägguttag och/eller via annan utrustning och samtidigt är kopplad till kabel-TV nät kan i vissa fall medföra risk för brand. För att undvika detta skall vid anslutning av utrustningen till kabel-TV nät galvanisk isolator finnas mellan utrustningen och kabel-TV nätet

Restricted Access Location

In Nordic Countries, equipotential bonding should be applied using the permanently connected ground stud by a qualified service person.

International Symbols

Symbol	Definition
~	Alternating Current
	Fuse

Symbol	Definition
	Protective Earth
	Chassis Ground

Operating Environment

Maximum storage temperature allowed is -4 to +158°F (-20 to +70°C).

Operation in vehicles or other transportable installations that are equipped to provide a stable environment is permitted. If such vehicles do not provide a stable environment, safety of the equipment to EN 60950 may not be guaranteed.



DO NOT OPERATE THE UNIT IN ANY OF THESE EXTREME OPERATING CONDITIONS:

- AMBIENT TEMPERATURES LESS THAN 0°C (32°F) OR MORE THAN 50°C (122°F)
- PRECIPITATION, CONDENSATION, OR HUMID ATMOSPHERES OF MORE THAN 95% RELATIVE HUMIDITY
- UNPRESSURIZED ALTITUDES OF MORE THAN 2000 METRES (6561.7 FEET)
- EXCESSIVE DUST
- FLAMMABLE GASES
- CORROSIVE OR EXPLOSIVE ATMOSPHERES.

European Union Electromagnetic Compatibility (EMC) Directive (2004/108/EC)

In accordance with European Directive 89/336/EEC, independent testing showed that the Revision 2 complied with these standards:

Emissions: EN 55022 Class B: Limits and methods of measurement of radio interference characteristics of Information Technology Equipment
(Also tested to FCC Part 15 Class B)

Immunity: EN 50082 Part 1: Generic immunity standard, Part 1: Domestic, commercial and light industrial environment.

Additionally, the Revision 2 complied with these standards:

- EN 61000-3-2 Harmonic Currents Emission
- EN 61000-3-3 Voltage Fluctuations and Flicker
- EN 61000-4-2 ESD Immunity
- EN 61000-4-4 EFT Burst Immunity
- EN 61000-4-5 Surge Immunity
- EN 61000-4-6 RF Conducted Immunity
- EN 61000-4-8 Power frequency Magnetic Field Immunity
- EN 61000-4-9 Pulse Magnetic Field Immunity
- EN 61000-4-11 Voltage Dips, Interruptions, and Variations Immunity
- EN 61000-4-13 Immunity to Harmonics

Regulatory Compliance

EMC (Electromagnetic Compatibility)

South Korean Electromagnetic Compatibility

A급 기기 (업무용 정보통신기기)

이 기기는 업무용으로 전자파적합등록을 한 기기이오니 판매자 또는 사용자는 이 점을 주의하시기 바라며, 만약 잘못판매 또는 구입하였을 때에는 가정용으로 교환하시기 바랍니다.

B급 기기 (가정용 정보통신기기)

이 기기는 가정용으로 전자파적합등록을 한 기기로서 주거지역에서는 물론 모든지역에서 사용할 수 있습니다.

Unofficial translation:

Class A: EMC Registration is done on this equipment for business use only (Class A). Product seller and user should notice that this equipment is not for household use.

Class B: EMC Registration is done on this equipment mainly for household use (Class B) and also can be used in all areas.

European Union Telecommunications Terminal Equipment Directive (91/263/EEC)

In accordance with the European Union Telecommunications Terminal Equipment Directive 91/263/EEC, do not directly connect the unit to the Public Telecommunications Network.

CE Mark

Comtech EF Data declares that the unit meets the necessary requirements for the CE Mark.

Product Support

For all product support, please call:

+1.240.243.1880

+1.866.472.3963 (toll free USA)

Comtech EF Data Headquarters

<http://www.comtechefdata.com>

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Tempe, Arizona USA 85281

+1.480.333.2200

Warranty Policy

Comtech EF Data products are warranted against defects in material and workmanship for a specific period from the date of shipment, and this period varies by product. In most cases, the warranty period is two years. During the warranty period, Comtech EF Data will, at its option, repair or replace products that prove to be defective. Repairs are warranted for the remainder of the original warranty or a 90 day extended warranty, whichever is longer. Contact Comtech EF Data for the warranty period specific to the product purchased.

For equipment under warranty, the owner is responsible for freight to Comtech EF Data and all related customs, taxes, tariffs, insurance, etc. Comtech EF Data is responsible for the freight charges only for return of the equipment from the factory to the owner. Comtech EF Data will return the equipment by the same method (i.e., Air, Express, Surface) as the equipment was sent to Comtech EF Data.

All equipment returned for warranty repair must have a valid RMA number issued prior to return and be marked clearly on the return packaging. Comtech EF Data strongly recommends all equipment be returned in its original packaging.

Comtech EF Data Corporation's obligations under this warranty are limited to repair or replacement of failed parts, and the return shipment to the buyer of the repaired or replaced parts.

Limitations of Warranty

The warranty does not apply to any part of a product that has been installed, altered, repaired, or misused in any way that, in the opinion of Comtech EF Data Corporation, would affect the reliability or detracts from the performance of any part of the product, or is damaged as the result of use in a way or with equipment that had not been previously approved by Comtech EF Data Corporation.

The warranty does not apply to any product or parts thereof where the serial number or the serial number of any of its parts has been altered, defaced, or removed.

The warranty does not cover damage or loss incurred in transportation of the product.

The warranty does not cover replacement or repair necessitated by loss or damage from any cause beyond the control of Comtech EF Data Corporation, such as lightning or other natural and weather-related events or wartime environments.

The warranty does not cover any labor involved in the removal and or reinstallation of warranted equipment or parts on site, or any labor required to diagnose the necessity for repair or replacement.

The warranty excludes any responsibility by Comtech EF Data Corporation for incidental or consequential damages arising from the use of the equipment or products, or for any inability to use them either separate from or in combination with any other equipment or products.

A fixed charge established for each product will be imposed for all equipment returned for warranty repair where Comtech EF Data Corporation cannot identify the cause of the reported failure.

Exclusive Remedies

Comtech EF Data Corporation's warranty, as stated is in lieu of all other warranties, expressed, implied, or statutory, including those of merchantability and fitness for a particular purpose. The buyer shall pass on to any purchaser, lessee, or other user of Comtech EF Data Corporation's products, the aforementioned warranty, and shall indemnify and hold harmless Comtech EF Data Corporation from any claims or liability of such purchaser, lessee, or user based upon allegations that the buyer, its agents, or employees have made additional warranties or representations as to product preference or use.

The remedies provided herein are the buyer's sole and exclusive remedies. Comtech EF Data shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.

Chapter 1. INTRODUCTION

1.1 Introduction

The Comtech EF Data (CEFD) Low Noise Amplifier (LNA) series includes LNA and redundant LNA/LB systems available in C-band (Figure 1-1), X-band (Figure 1-2), Ku-band (Figure 1-3), and Ka-band (Figure 1-4). They meet or exceed system requirements for commercial geosynchronous satellites worldwide. Their compact design and rugged construction make them ideal for transportable applications and severe environments.

The LNAs have a comprehensive set of options to accommodate systems ranging from Very Small Amplifier Terminals (VSATs) to major earth stations. The redundant LNA/Low-noise Block Down Converter (LNB) systems include primary and backup LNA(B)s and an automatic switching controller. The case of primary LNA/LNB failure, fast automatic switchover to the backup LNA/LNB minimizes downtime.



Figure 1-1. C-band LNA

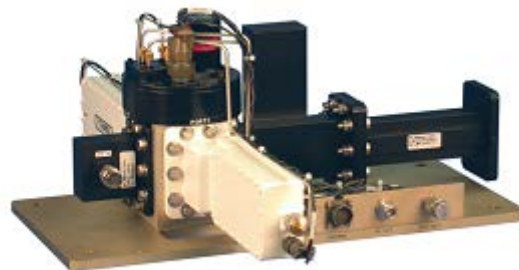


Figure 1-2. X-band LNA



Figure 1-3. Ku-band LNA



Figure 1-4. Ka-band LNA

1.2 Technology

The amplifiers incorporate both High Electron Mobility Transistors (HEMT) devices for low noise temperature performance and Gallium Arsenide Feed Effect Transistors (GaA FETs) devices for low intermodulation. The units use surface mounted components for robotic manufacturing techniques, thereby insuring maximum product consistency and enhanced reliability. The X-band LNA includes integrated filtering to address adjacent power issues peculiar to demanding X-band terminals.

1.3 Reliability

The amplifier series utilizes proprietary circuitry and high quality components to achieve a mean time between failures (MTBF) in excess of 160,000 hours. Each unit is temperature cycled from -40 to +60°C (-40 to 140°F).

1.4 Construction

The LNAs are housed in waterproof enclosures with a small profiles to better accommodate redundancy configurations. The enclosures also provide a pressurizable, integral waveguide flange. Subsystems

The one backup for one primary (1+1) and one backup for two primary (1+2) redundant LNA and LNB systems are available complete with mounting plate, brackets, and indoor Redundancy Controller/Power Supply (transmit reject filters, cables, and other integration materials are offered, as required).

Chapter 2. INSTALLATION

2.1 Shipping Contents

Inspect shipping containers for damage. If shipping containers are damaged, keep them until the contents of the shipment have been carefully inspected and checked for normal operation.

The modulator and manual are packaged in pre-formed, reusable, cardboard cartons containing foam spacing for maximum shipping protection.



CAUTION

Do not use any cutting tool that will extend more than 1-inch into the container. This can cause damage to the LNA.

Do these steps:

1. Cut the tape at the top of the carton indicated by OPEN THIS END.
2. Remove the cardboard/foam space covering the LNA.
3. Remove the LNA from the carton.
4. Save the packing material for storage or reshipment purposes.
5. Inspect the equipment for any possible damage incurred during shipment.
6. Check the equipment against the packing list to ensure the shipment is correct.
7. Refer to the following chapters/sections for further installation instructions.

2.2 Installation Tools

No special tools are required.

2.3 LNA Connector Pinouts

The LNA can be supplied with the following connector configurations, depending on the model and options:

- 4-pin
- 6-pin

Table 2-1. DC Power Connector, 4-Pin

Pin #	CLNA (Standard)	XLNA (Standard)	KLNA (Standard)	Ka LNA (Standard)
A	+Vdc	+Vdc	+Vdc	+Vdc
B	GND	GND	GND	GND
C	Normally Open	Normally Open	Normally Open	Normally Open
D	Fault Common	Fault Common	Fault Common	Fault Common

Table 2-2. DC Power Connector, 6-Pin

Pin #	CLNA (Standard)	XLNA (Standard)	KLNA (Standard)	Ka LNA (Standard)
A	+Vdc	+Vdc	+Vdc	+Vdc
B	GND	GND	GND	GND
C	Normally Open	GND	GND	GND
D	Fault Common	Normally Closed	Normally Closed	Normally Closed
E	Normally Closed	Fault Common	Fault Common	Fault Common
F	N/C	Normally Open	Normally Open	Normally Open

Chapter 3. DESCRIPTION

3.1 Introduction

All dimensions are in English units (metric units are in parentheses).

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3.2 C-band LNA Dimensions

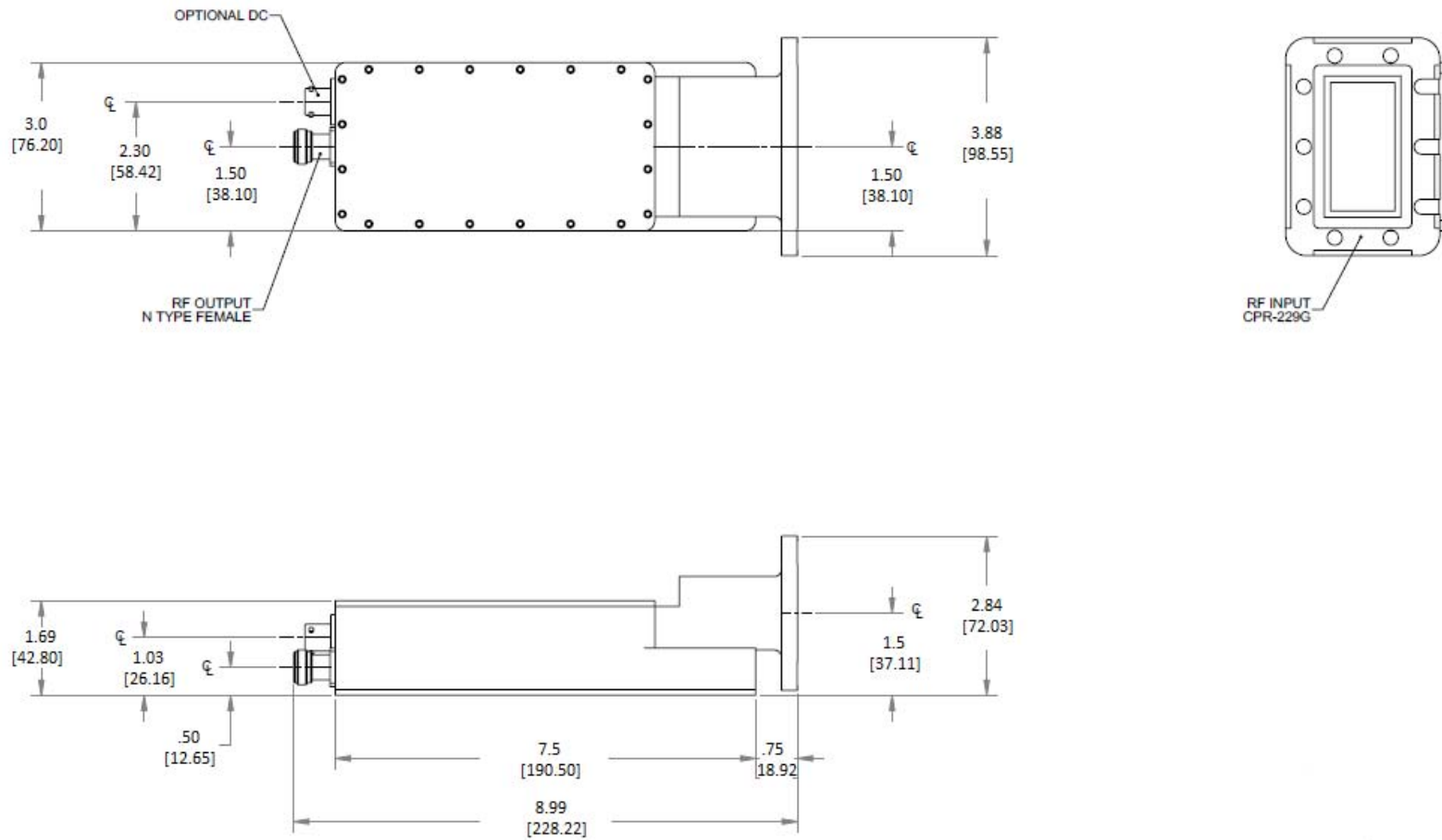


Figure 3-1. C-band LNA Dimensions

3.3 X-band LNA Dimensions

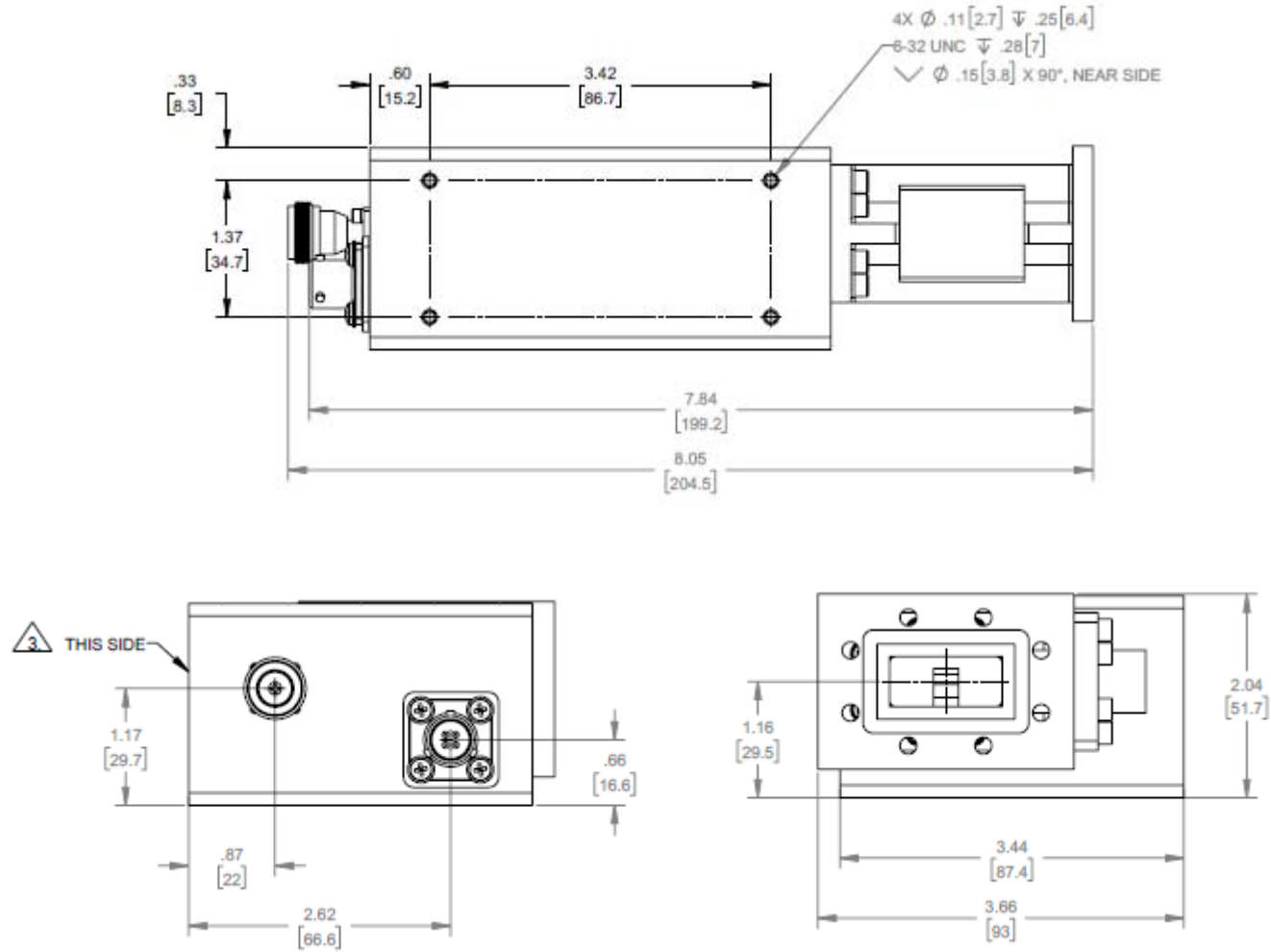


Figure 3-2. X-band LNA Dimensions

3.33.4 Ku-band LNA Dimensions

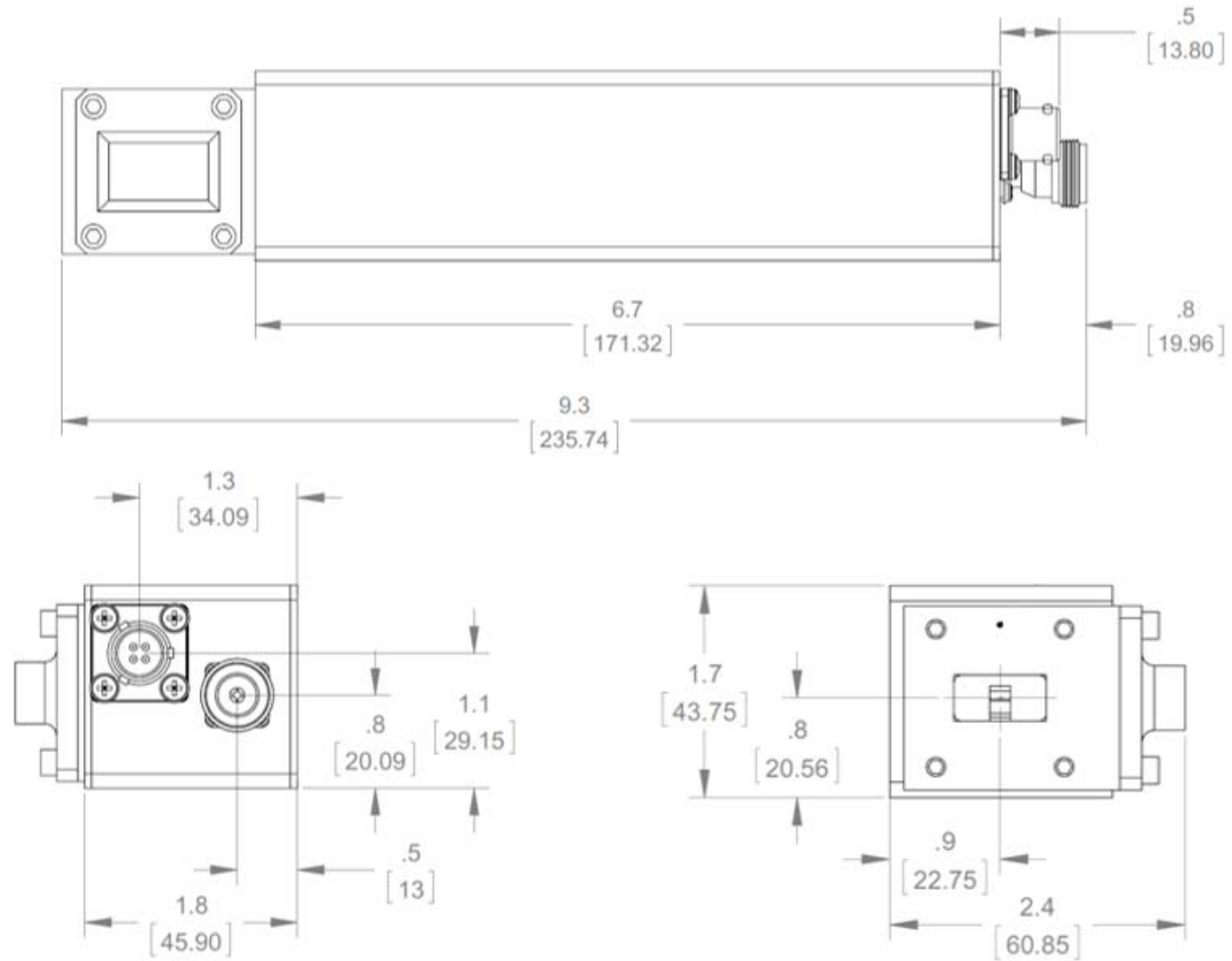


Figure 3-3. Ku-band LNA Dimensions

3.5 Ka-band LNA Dimensions

ES:

ALL MATERIALS MUST BE RoHS COMPLIANT IN ACCORDANCE WITH DIRECTIVE 2011/65/EU.

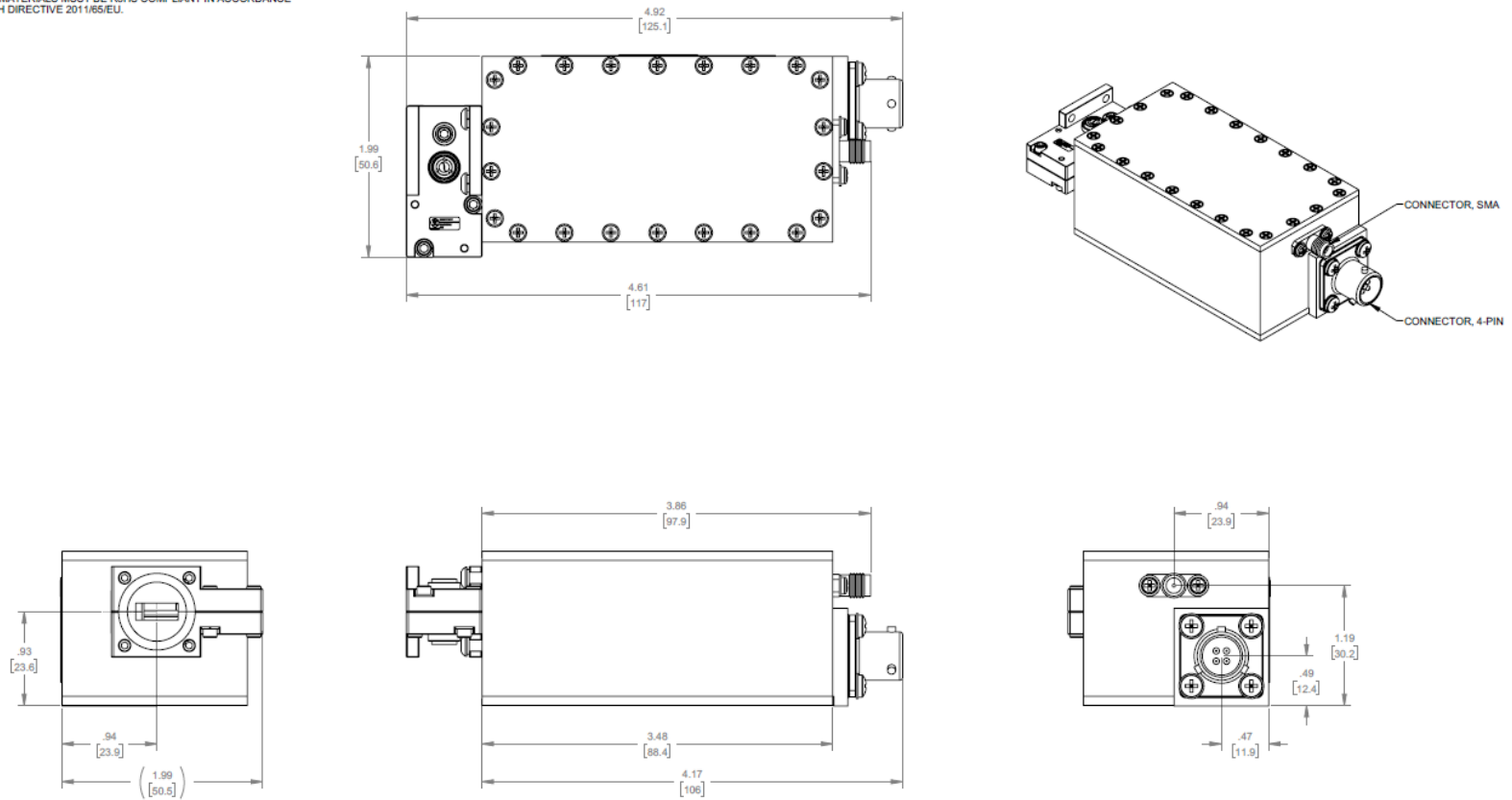


Figure 3-4. Ka-band LNA Dimensions

Chapter 4. SPECIFICATIONS

4.1 Summary of Specifications

Item	CLNA (Redundancy)	XLNA (Redundancy)	KuLNA (Redundancy)	KaLNA (Redundancy)
Frequency	3.4 to 4.2 GHz 3.625 to 4.2 GHz 3.625 to 4.8 GHz (45K only) 4.5 to 4.8 GHz	7.25 to 7.75 GHz	10.95 to 12.75 GHz 10.7 to 12.75 GHz	19.7 to 21.2 GHz 20.2 to 21.2 GHz 17.852 to 18.588 GHz 18.372 to 19.271 GHz
Noise Temperature	30, 35, 40, 45 K	40, 45 K	65, 70, 80, 85 K	110, 120, 130, 150 K
Gain	50, 60 dB	50, 60, 70 dB	50, 60 dB	50, 60 dB
Overall Stability (Over Temperature and Frequency)	CLNA: ± 0.75 dB from 3.625 to 4.2 GHz ± 1 dB from 3.4 to 4.2 GHz 0.40 dB p-p over 40 MHz Redundant CLNA: ± 1.5 dB over Full Band typical 0.50 dB p-p over 40 MHz typical	XLNA: ± 1.5 dB over Full Band typical 0.50 dB p-p over 40 MHz typical Redundant XLNA: ± 2 dB over Full Band typical 1 dB p-p over 40 MHz typical	KuLNA: ± 1.5 dB over Full Band 0.75 dB p-p over 40 MHz Redundant KuLNA: ± 2 dB over Full Band typical 1 dB p-p over 40 MHz typical	KaLNA: ± 2.0 dB over Full Band 1 dB p-p over 40 MHz Redundant KaLNA: ± 2.5 dB over Full Band typical 1.5 dB p-p over 40 MHz typical
Level @ 1 dB Comp.	+10 dBm			
Third Order Intercept	+20 dBm	+20 dBm (+30 dBm optional)	+20 dBm	+20 dBm
AM-PM Conversion	0.05°/dB @ -5 dBm	0.05°/dB @ -5 dBm	0.05°/dB @ -5 dBm	0.05°/dB @ -10 dBm
Linear Group Delay	0.01 ns/MHz	± .05 ns/MHz	0.01 ns/MHz	0.01 ns/MHz
Parabolic Group Delay	0.001 ns/MHz ²	± .005 ns/MHz ²	0.001 ns/MHz ²	0.001 ns/MHz ²
Ripple	0.1 ns p-p	± 1 ns p-p	0.1 ns p-p	0.1 ns p-p
Input/Output VSWR	1.25:1 Maximum (3.6 to 4.8 = 1.3:1)	1.25:1 Maximum (3.6 to 4.8 = 1.3:1)	1.25:1 Maximum (3.6 to 4.8 = 1.3:1)	1.5:1 Max Output VSWR
Input Waveguide	CPR229	CPR112	WR75	WR42

Item	CLNA (Redundancy)	XLNA (Redundancy)	KuLNA (Redundancy)	KaLNA (Redundancy)
Output Connector	Type N Standard, Optional SMA	Type N Standard, Optional SMA	Type N Standard, Optional SMA	SMA
Operating Temp.	-40 to +140°F (-40 to +60°C)	-40 to +140°F (-40 to +60°C)	-40 to +140°F (-40 to +60°C)	-40 to +140°F (-40 to +60°C)
Input Power	12 to 24 VDC @ 120 mA	12 to 24 VDC @ 120 mA	12 to 24 VDC @ 120 mA	12 to 24 VDC @ 120 mA
Power Connector	Coaxial or PT06E-8-4S	Coaxial or PT06E-8-4S	Coaxial or PT06E-8-4S	Coaxial or PT06E-8-4S

4.2 Power Consumption

The equipment is rated for operation over the range 100 - 240 Volts AC. It has a maximum power consumption of 60 Watts, and draws a maximum of 600 mA.

4.3 Fuses

The LNA is fitted with two fuses - one each for line and neutral connections. These are contained within the body of the IEC power inlet connector, behind a small plastic flap.

For 115 and 230 volt AC operation, use T1.25A, 20mm fuses.

4.4 Cables and Connectors

The LNA is shipped with a line inlet cable suitable for use in the country of operation.

If it is necessary to replace this cable, make sure the replacement has an equivalent specification.

Examples of acceptable ratings for the cable include HAR, BASEC and HOXXX-X.

Examples of acceptable connector ratings include VDE, NF-USE, UL, CSA, OVE, CEBEC, NEMKO, DEMKO, BS1636A, BSI, SETI, IMQ, KEMA-KEUR and SEV.

4.5 Operating Requirements for Regulatory Compliance

To maintain continued compliance with the European Directives:

- Make connections to the Tx and Rx IF ports (Type N or Type F connectors using a good quality coaxial cable - for example 50 Ω or 75 Ω).
- Make sure all D type connectors attached to the rear panel have back-shells that provide continuous metallic shielding. Cable with a continuous outer shield (either foil or braid, or both) must be used, and the shield must be bonded to the backshell.
- Make sure the equipment operates with its cover on at all times. If it becomes necessary to remove the cover, make sure that the cover is correctly reinstalled before normal operation resumes.

Chapter 5. REDUNDANCY

5.1 Typical System Noise Temperature

5.1.1 1:1 Redundant LNA System

$$T_{\text{system}} = T_{\text{LNA}} + T_{\text{SWITCH}} + T_{\text{OPTION 3}} + T_{\text{OPTION 1}}$$

5.1.2 1:2 Redundant LNA System

RF Input 1:LNA online signal path

$$T_{\text{system}} = T_{\text{LNA}} + T_{\text{SWITCH}} + T_{\text{OPTION 3}} + T_{\text{OPTION 1}}$$

RF Input 1:LNA 3 online signal path (LNA 1 Standby)

$$T_{\text{system}} = T_{\text{LNA}} + 2 * T_{\text{SWITCH}} + T_{\text{W2}} + T_{\text{OPTION 3}} + T_{\text{OPTION 1}}$$

RF Input 2:LNA 2 online signal path

$$T_{\text{system}} = T_{\text{LNA}} = T_{\text{W1}} + T_{\text{SWITCH}} + T_{\text{OPTION 3}} + T_{\text{OPTION 1}}$$

RF Input 1:LNA 3 online signal path (LNA 2 Standby)

$$T_{\text{system}} = T_{\text{LNA}} + 2 * T_{\text{SWITCH}} + T_{\text{W1}} + T_{\text{W2}} + T_{\text{OPTION 3}} + T_{\text{OPTION 1}}$$

Table 5-1. Typical Noise Temperature in Kelvin at 23°C

Band (GHz)	3.62 to 4.205	3.4 to 4.2	10.7 to 12.75	Ka-Band
Item	WR229	WR229	WR75	WR42
TSWITCH	1.50	1.50	3.50	10.00
TW1	1.50	1.50	4.00	7.00
TW2	1.50	1.50	4.00	7.00
TOPTION1	0.50	0.50	2.00	10.00
TOPTION3	2.40	7.00	7.00	NA

5.2 Block Diagrams

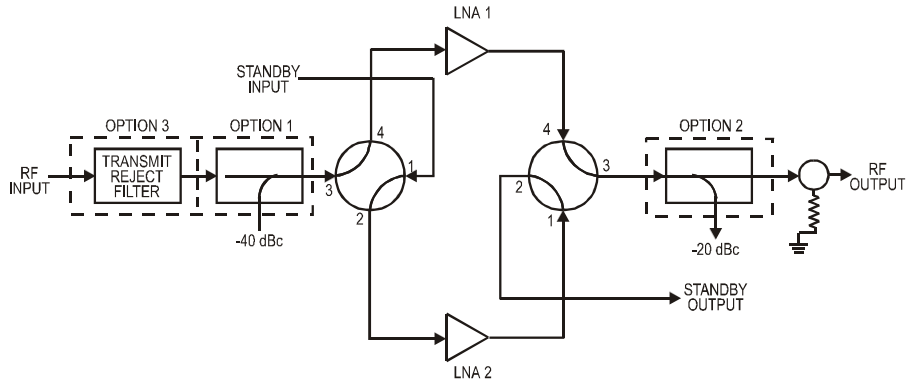


Figure 5-1. 1:1 Redundant LNA System Block Diagram

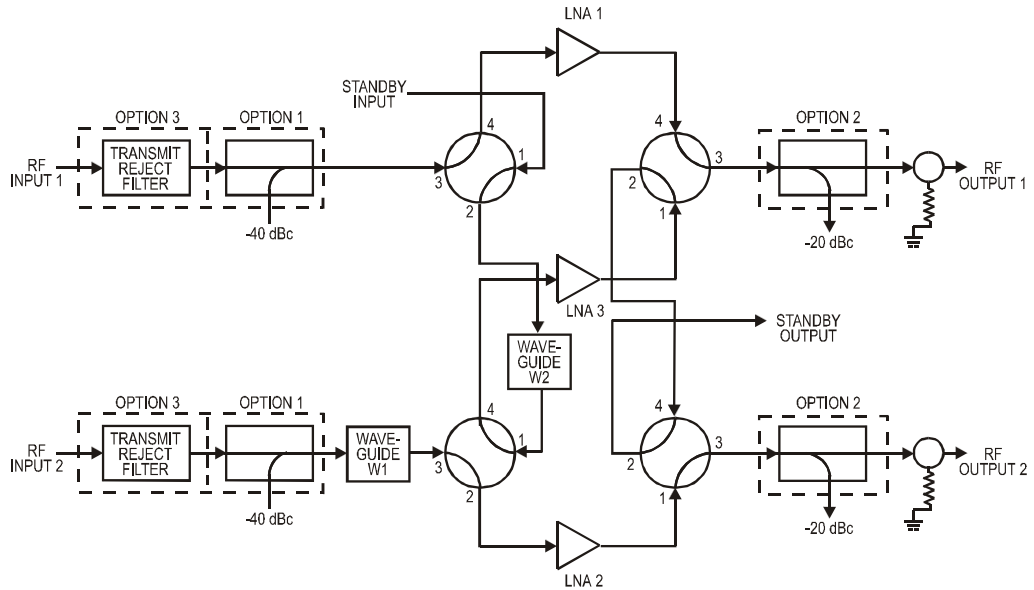


Figure 5-2. 1:2 Redundant LNA System Block Diagram



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