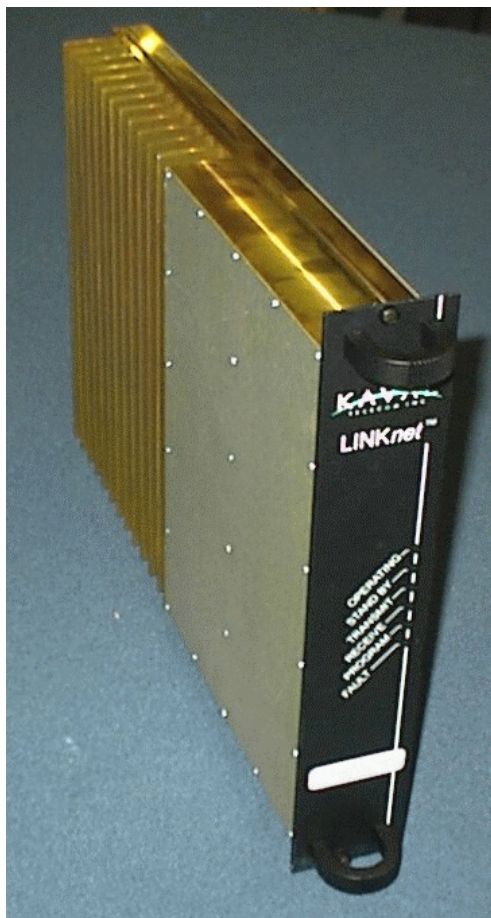




WIRELESS TECHNOLOGIES

**LinkNet™
LNKA100, LNKA400, LNKA800
RF BROADBAND
AMPLIFIER MODULES
USER MANUAL
INSTALLATION, OPERATION
AND MAINTENANCE**



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TABLE OF CONTENTS

<p>1. LNKA MODULES..... 4</p> <p>OVERVIEW..... 4</p> <p style="padding-left: 20px;"><i>Theory Of Operation</i> 4</p> <p>MODELS 4</p> <p>BLOCK DIAGRAM 5</p> <p style="padding-left: 20px;"><i>LNKA RF Module</i> 5</p> <p>MODULE SPECIFICATIONS 6</p> <p>OPERATION 7</p> <p style="padding-left: 20px;"><i>Software Set-up</i> 7</p> <p style="padding-left: 20px;"><i>Configuration</i>..... 7</p>	<p><i>De-Rating Chart</i>..... 8</p> <p><i>Power On Self Test (POST)</i>..... 9</p> <p><i>Fault Indications</i> 9</p> <p><i>Normal Operation</i>..... 10</p> <p>ANTENNA INSTALLATION 12</p> <p>FCC INFORMATION TO USERS..... 13</p>
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1. LNKA MODULES

Overview Theory Of Operation

A LINKNET AMPLIFIER MODULE is a Broad-Band Digitally Controlled Class-A Amplifier. The most common LINKNET AMPLIFIER MODULE applications are the extension of above ground signals into buildings, tunnels, vehicles or the extension of radio coverage patterns into outdoor shaded areas such as deep valleys.

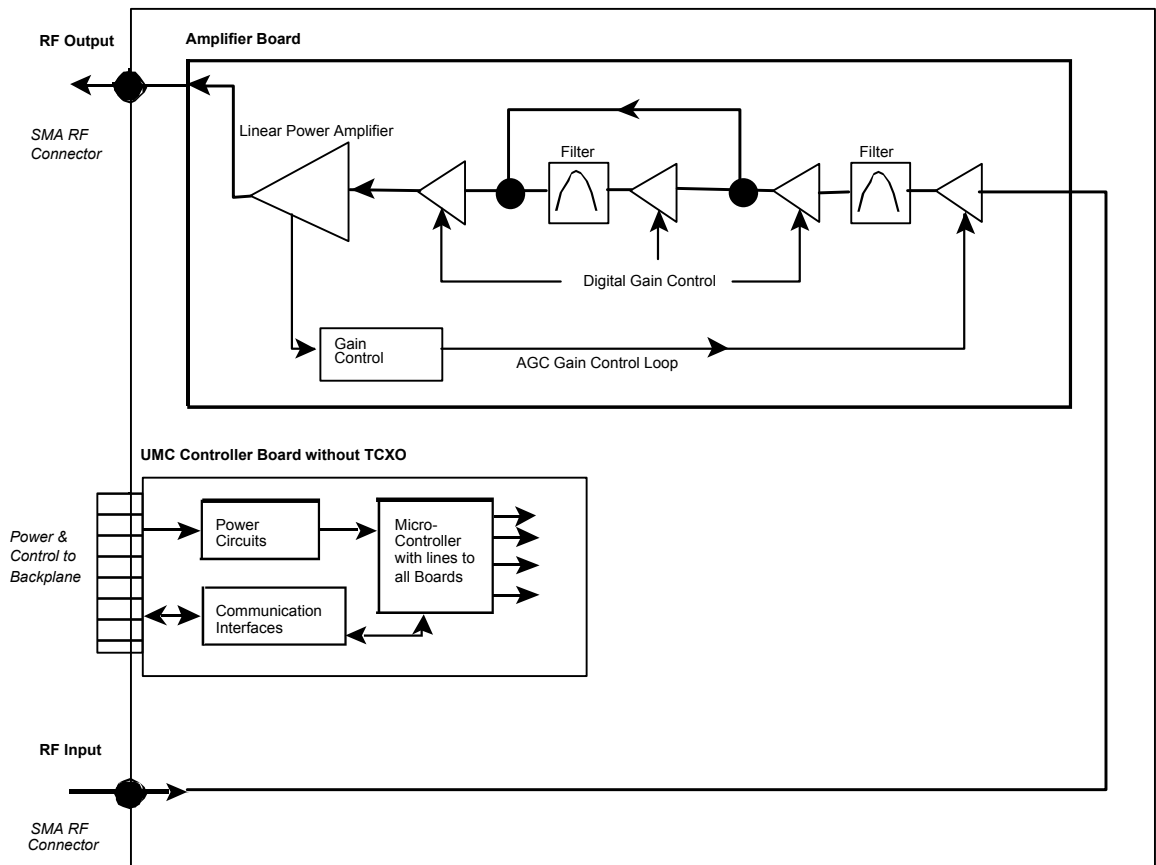
From an applications standpoint, an LINKNET AMPLIFIER MODULE is very similar to a regular two-way radio repeater. On Frequency Radio Repeaters can be combined using regular two-way radio multicoupling or duplexing equipment and have input and output signal characteristics to those of regular transmitters and receivers. The one special consideration in LINKNET AMPLIFIER MODULE systems is that of input to output antenna isolation. This must be carefully engineered for each installation.

These Modules are designed for indoor use only and are intended for mounting in a standard EIA 19 inch rack. Modular design of LINKNET AMPLIFIER MODULE circuitry allows for easy servicing, stocking of spares, adaptability and upgrade ability.

Models

LNKA MODULE FAMILY		
MODEL	TYPE	FREQUENCY
LNKA100-A	Broadband Amplifier	136-155 MHz
LNKA100-B	Broadband Amplifier	150-174 MHz
LNKA400-A	Broadband Amplifier	403-430 MHz Future Release
LNKA400-B	Broadband Amplifier	450-512 MHz Future Release
LNKA800-A	Broadband Amplifier	806-824 MHz
LNKA800-B	Broadband Amplifier	851-869 MHz
LNKA800-C	Broadband Amplifier	824-849 MHz
LNKA800-D	Broadband Amplifier	869-894 MHz
LNKA800-E	Broadband Amplifier	896-901 MHz
LNKA800-F	Broadband Amplifier	928-940 MHz Capable 929-930 / 935-940 FCC Approved

Block diagram LNKA RF Module



Module Specifications

Frequency Bands	See Model Chart
Modulation & Channel Spacing	Broadband Amplifiers
RF Output Power Capability	1dB Compression Point = +37 dBm Typical IP3 Intermodulation = +47 dBm Typical
AGC Control Adjustment Range	+15 to +30 dBm or Disabled
AGC Attack Time (10%-90%)	0.5 - 5 mS Typical
AGC Decay Time (90%-10%)	50 - 200 mS Typical
RF Gain Adjustment Range	+34 to +84 dB in 1 dB Steps
Gain Variation over Passband	2 dB Maximum
Max RF Input	+3 dBm with Min Gain & Max RF Out
Noise Figure	<8 dB, 5 dB Typical
Maximum RF Input	Output Level from De-rating Chart minus the Gain. As an example, for 1 FM Carrier (+37 dBm) at minimum Gain (+34 dB) the Maximum RF Input is +3 dBm.
Transmit Duty Cycle	Continuous
Transmit Spurious	-13 dBm max
Receive Conducted Spurious	-57 dBm Max
Group Delay	< 200 nS (< 100 nS Variation across Passband)
Input Return Loss	>14 dB
RF Connectors	SMA (50Ω) Connectors
Module Power Supply Requirements	40 Watts Maximum
Connections	Edge Connector & 2 SMA RF Connectors, DB-15 Connector on back of Card-Cage provides per- Module Fault Relay, Interconnect to other Modules, & RS-232 Connection
Front Panel Indicators	Operating, Stand by, Fault, Program Mode
Configuration Options	RF Modules may be configured either via the optional Controller Module, or via a PC and an RS-232 Connection via the Card-Cage.
Operating Temperature Range	-10 to +50°C; consult Manual DCM000000008 for cooling requirements
Operating Humidity Range	10 to 90% RH, Non-Condensing
Size & Weight	9.11" High, 2.00" Wide, 14.00" Deep, 10 lbs, 4.5 kg Max
FCC Identifiers	FCC: H6M-LNKA100 VHF (pending) H6M-LNKA400 UHF (pending) H6M-LNKA800 800-900MHz
Industry Canada Certifications	IC: 1541A-LNKA100 VHF (pending) 1541A-LNKA400 UHF (pending) 1541311246A 800-900MHz

Also consult the main LinkNet™ Manual DCM000000008.

Operation Software Set-up

LNKA modules are shipped with the following factory set options:

OPTION	RANGE OF VALUES	DEFAULT VALUE
Frequency	See Model Chart	Order Specific
Gain	+34 to +84 dB	+34 dB
AGC	+15 to +30 dBm or Disabled	+30 dBm
Module Enabled	On / Off	On

Default values may be changed when an order is placed. Check your order confirmation (shipped with modules) for customized values.

In line with the versatility of the LinkNet™ Platform, it is possible to re-configure the LNKA module in the field. For further information on the modification software and the PC adapter, contact KAVAL WIRELESS TECHNOLOGIES by E-mail: info@kaval.com



Configuration

In line with the versatility of the LinkNet™ Platform, it is possible to re-configure the LNKA module in the field, either with a **Personal Computer (PC)** or via the optional **Control Module**. To use a **PC** it is necessary to have a **Kaval CAB00000057 Control Cable** to connect between the appropriate Module's DB15 connector on the back of the Card-Cage and the standard DB9 RS232 Connector on the PC. On the PC a terminal emulation program such as **HyperTerminal** is used to communicate to the LinkNet Module. The settings are 9600 baud, 8 bits, no parity, and 1 stop bit. Commands are one or two words followed by pressing *Return*. Commands may be given in upper or lower-case. Available commands are...

- ACCESS USER:** Required as a simple password to gain access to customer settable parameters and diagnostics; This will time-out after 10 minutes, and may have to be re-typed.
- HELP or ?:** Displays a list of Available Commands.
- LIST:** Displays Current Settings and Status Faults, Etc.
- VER:** Display the current Version of Software.
- ENABLE 1 or 0:** Enables or Disables the Module.
- GAIN ##:** Displays or Sets the Module Gain (in tenths of a dB).
- AGCTHRESH ###:** Displays or Sets the AGC Level (in tenths of a dBm).
- AGCEN 1 or 0:** Enables or Disables AGC.

Please consult Kaval Wireless Technologies for further support.

De-Rating Chart

To maintain the FCC Spurious Emissions limit of -13 dBm maximum, for multiple carriers it is necessary to de-rate their power level. For FM carriers, they need to be de-rated as shown...

Number of Carriers	Power per Carrier
1	+37 dBm
2	+26 dBm
3	+24 dBm
4	+22 dBm
5	+20 dBm
6	+19 dBm
7	+18 dBm
8	+17 dBm
9	+16 dBm
10	+15 dBm
15	+13 dBm
20	+11 dBm
25	+10 dBm
30	+9 dBm

For complex CDMA, TDMA, GSM, etc. carriers, typically de-rate by a further 3 to 5 dB. Consult Kaval for more information.



Power On Self Test (POST)

Each Module automatically performs a self-diagnostics when inserted into the system Card-cage. These tests determine that the unit is a) correctly installed in the Card-cage and b) not damaged in transit.

- All six of the LED's on the front panel will flash 3 times
- If the LED's do NOT flash three times, then remove the module, check the power source, and re-insert the module, (See Installation Instructions).
- If the card is "OK" the LED's will continue normally. (See Normal Operation)
- If there is a fault, then the Red Fault LED will remain on. If this occurs, contact your KAVAL WIRELESS TECHNOLOGIES Service Representative, (See Warranty / RMA Procedures).



The Power On Self Test is *Not* an RF test, it only verifies that there is power to the unit and that the logical circuitry is functioning.

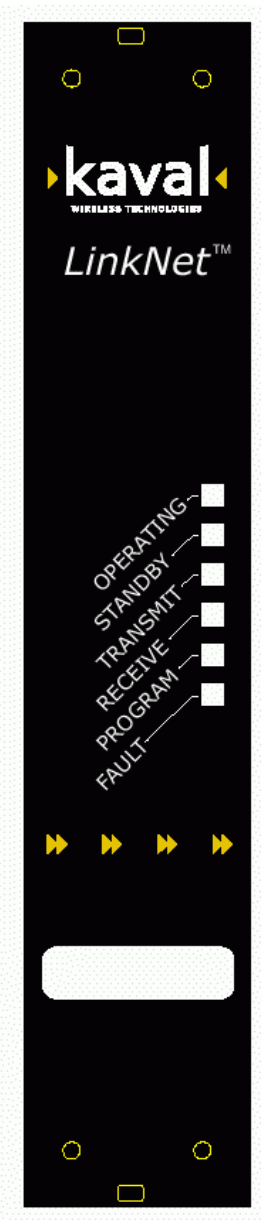


Fault Indications

Each Module continuously performs internal diagnostics. If a problem is detected it will activate its Red Fault LED and Fault Relay. Faults detected include...

- Over Temperature
- Misc. Internal Faults

Detailed Faults are detected by the optional Gateway Module. Details may also be determined via the Module's Control Port Connector and an RS232 connected Terminal Emulator using the **LIST** command.

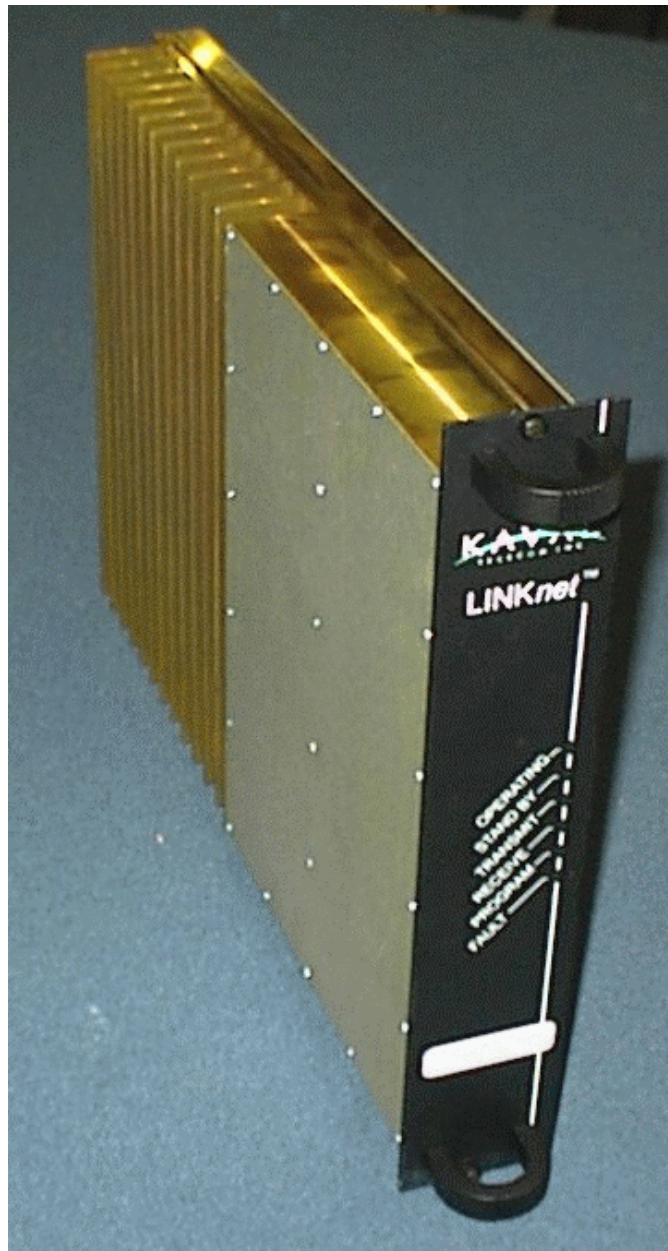


Normal Operation

The LNKA Module has six LED's on the faceplate:

1. OPERATING - Operating normally.
2. STANDBY – Under the control of the Gateway Module.
3. TRANSMIT – No function on these Modules.
4. RECEIVE – No function on these Modules.
5. PROGRAM – This LED will be constant Amber when the unit is being re-programmed by the Controller Module. This will signify that the unit is powered on but unavailable for use.
6. FAULT – Red LED, If the internal diagnostics for the module detect a problem, then this LED will remain on

LINKNET LNKA AMPLIFIER MODULE



Antenna Installation

- All Antenna Installation to be performed by Qualified Technical Personnel only.
- Antenna Installation Instructions and locations below are for the purpose of satisfying FCC RF Exposure Compliance requirements.
- **Note that if multiple LinkNet™ Modules are used, the Instructions below apply to the composite power output of all Modules when transmitting simultaneously.**
- The **Roof Top Antenna or Antennae** for linking to the *Donor Site(s)* is/are directional (high gain) Antennae, fixed-mounted physically on the side or top of a building, or on a tower. The Antenna Gain must be no more than 20 dBi. **If multiple LinkNet™ Modules are used with output combiners into any one Antenna, and/or multiple Antennae are used on one Roof Top, then the sum of composite powers into all Roof Top Antennae must not exceed 20 Watts maximum.** Please consult Kaval Wireless for assistance as required. The *Roof Top Antennae* location should be such that only Qualified Technical Personnel can access it, and that under normal operating conditions no other person can touch the Antenna, or approach within 10 meters of the Antenna.
- For the **Cellular Uplink Band** (824-849 MHz) the *Roof Top Antenna or Antennae* for linking to the *Donor Site(s)* has the added restriction that the Effective Radiated Power (ERP) must not exceed 7 Watts (+38 dBm). Thus, if the AGC is set (as per the Carrier De-Rating Chart) to +28dBm as an example, the maximum allowed Antenna Gain must be no more than 10 dBi.
- The **In-Building Antenna** connection is via a coaxial cable distribution system with Signal Taps at various points connected to the fixed-mounted *Indoor Antennae*. This is shown in the figure in the Introduction. The *Indoor Antennae* are simple 1/4 Wavelength (0 dB Gain) types. They are used with KAVAL WIRELESS TECHNOLOGIES 12, 16, or 20 dB Cable Taps. As such the maximum EIRP will be at the first Tapped Antenna, which will be 12 dB below the maximum signal level of the LinkNet™ (+40 dBm); +28 dBm, or 0.63 Watts EIRP. **If multiple LinkNet™ Modules are used with output combiners, then the composite power output of all Modules transmitting simultaneously must meet this maximum EIRP requirement.** Please consult Kaval Wireless for assistance as required. These Antennae are to be installed such that no person can touch the Antenna, or approach within 0.2 Meters.



ANTENNA INSTALLATION WARNING

ALL ANTENNA INSTALLATION IS TO BE PERFORMED BY QUALIFIED TECHNICAL PERSONNEL ONLY.

ANTENNA INSTALLATION INSTRUCTIONS AND LOCATIONS ARE FOR THE PURPOSE OF SATISFYING FCC RF EXPOSURE COMPLIANCE REQUIREMENTS, AND ARE NOT OPTIONAL.

ALL ROOF TOP ANTENNA INSTALLATION MUST BE SUCH THAT NO PERSON CAN TOUCH THE ANTENNA, OR APPROACH CLOSER THAN 10 METERS.

ALL IN-BUILDING ANTENNAE INSTALLATIONS MUST BE SUCH THAT NO PERSON CAN TOUCH THE ANTENNAE, OR APPROACH CLOSER THAN 0.2 METERS.

FCC Information to Users

- This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.



WARNING

CHANGES OR MODIFICATIONS NOT EXPRESSLY APPROVED BY KAVAL COULD VOID THE USER'S AUTHORITY TO OPERATE THE EQUIPMENT.