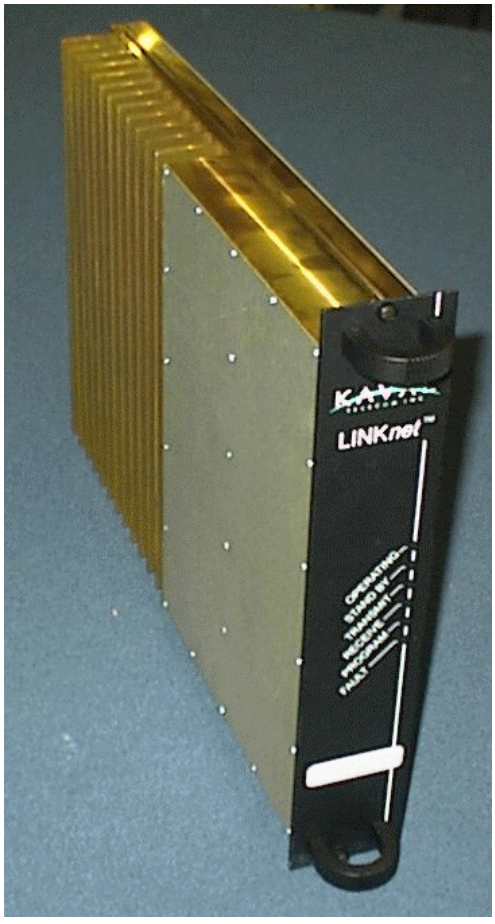
WIRELESS TECHNOLOGIES

LinkNet™
LNKF800 RF MODULES
USER MANUAL
INSTALLATION, OPERATION AND MAINTENANCE



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1. LNKF800 MODULES

Overview

Theory Of Operation

An LINKNET FM MODULE is a radio repeater that simultaneously receives and transmits a single narrow band radio channel on exactly the same frequency.

The LINKNET FM MODULE accomplishes its repeater function without store and forward circuitry, or expensive conventional simulcasting techniques. The fact that the same frequency is retransmitted by an LINKNET FM MODULE means that additional frequency allocations are not required in situations where an existing radio coverage pattern needs to be extended. The most common LINKNET FM 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.

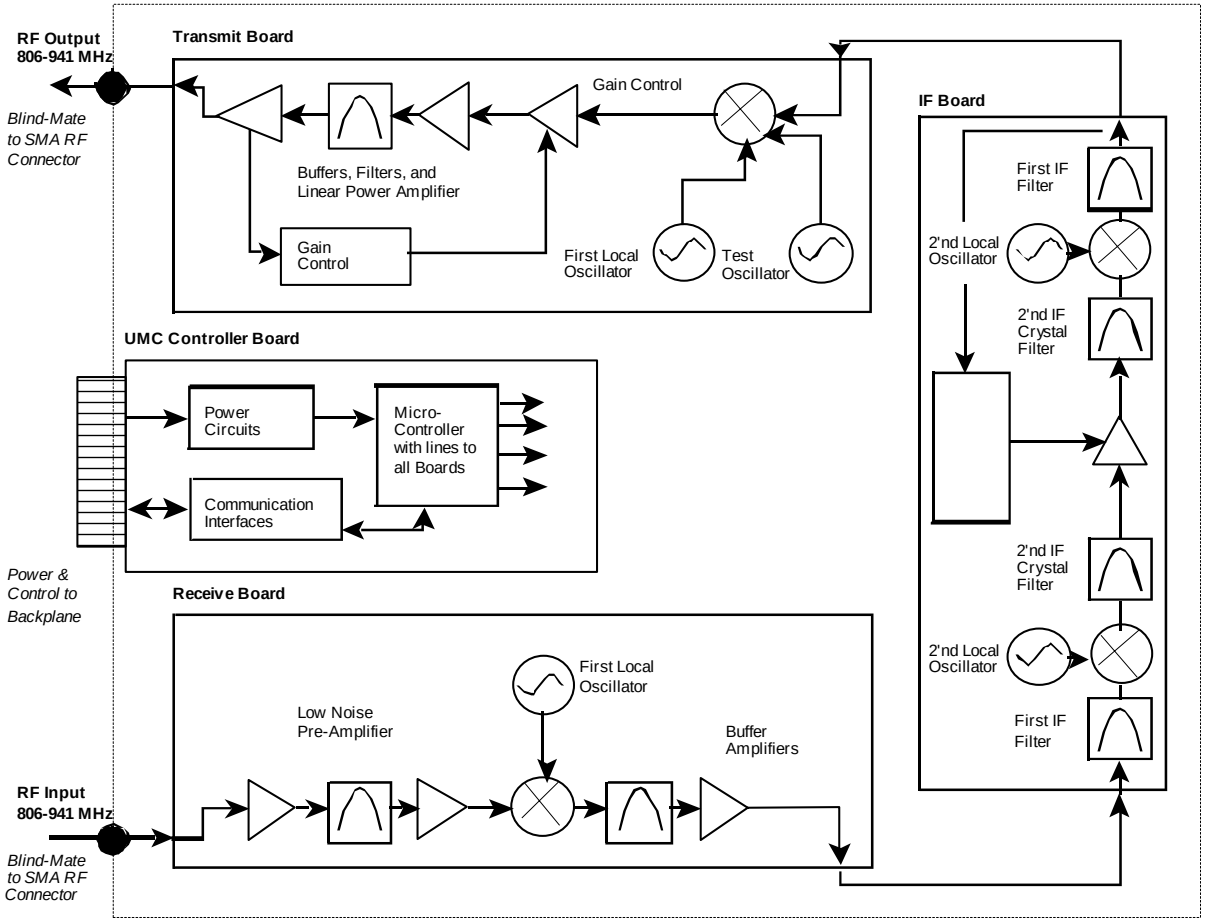
From an applications standpoint, an LINKNET FM MODULE is very similar to a regular two-way radio repeater. LINKNET FM MODULES can be combined using regular two-way radio multicoupling or duplexing equipment and have input and output signal characteristics to those of regular transmitters and receivers.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

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

Models

LNKF800 MODULE FAMILY		
MODEL	**TYPE**	**FREQUENCY**
LNKF800-A1	25 KHz FM Channels	806-824 MHz (FM)
LNKF800-B1	25 KHz FM Channels	851-869 MHz (FM)
LNKF800-C2	12.5 KHz FM Channels	806-824 MHz (FM)
LNKF800-D2	12.5 KHz FM Channels	851-869 MHz (FM)
LNKF800-G1	12.5 KHz FM Channels	896-902 MHz (FM)
LNKF800-H1	12.5 KHz FM Channels	935-941 MHz (FM)

Block diagram LNKF800 RF Module



Module Specifications

Frequency Bands	See Model Chart
Modulation & Channel Spacing	Narrowband FM, 25 or 12.5 KHz as per Model Chart
RF Frequency Stability	Tracks Input Signal Exactly
Max. RF Output Power	+38 dBm for A1,B1,C2,D2 Models +37 dBm for G1, H1 Models
RF Output Power Range	Power can be reduced 20 dB in 1 dB Steps (AGC Controlled)
RF Output Power Variation vs. Input (over -90 to -30 dBm)	+/- 1 dB
Input Dynamic Range	-110 to -30 dBm
Input Sensitivity Adjust Range	-110 to -50 dBm
Input Hysteresis	1 to 10 dB
Adjacent Channel Selectivity	60 dB Minimum
Transmit Duty Cycle	Continuous
Transmit Spurious	-13 dBm max
Receive Conducted Spurious	-57 dBm Max
Audio Distortion & Noise	<3% Increase for 25 KHz Modules <4% Increase for 12.5 KHz Modules
Transmit Key-Up & Key-Down Times	<2 mS Key-Up, <1 mS Key-Down
Group Delay	<120 uS for 25 KHz, <160 uS for 12.5 KHz
RF Connectors	SMA (50Ω) Connectors on back of Card-Cage
Module Power Supply Requirements	45 Watts Maximum
Connections	Edge Connector & 2 Blind-Mate RF Connectors to Card-Cage, DB-15 Connector on back of Card-Cage provides per-Module Fault Relay, Interconnect to other Modules, & RS-232
Front Panel Indicators	Operating, Stand by, Fault, Program Mode, Receive, Transmit
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

Also consult the main LinkNet™ Manual DCM000000008.

Operation

Software Set-up

The LNKF800 module is shipped with the following factory set options:

OPTION	RANGE OF VALUES	DEFAULT VALUE
Frequency	See Model Chart	Order Specific
Receive Threshold	–110 to -50 dB	-89 dB
Receive Hysteresis	1 to 10 dB	2.5 dB
Time Out	0 to 600 Seconds, or none	300 Seconds
Module Enabled	On / Off	On
Transmit Power Level	20 to 38 dBm	Order Specific

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

Configuration

In line with the versatility of the LinkNet™ Platform, it is possible to re-configure the LNKF800 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 CAB000000057 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.
TXFREQ #########:	Displays or Sets the current Transmit Frequency (in Hertz).
RXFREQ #########:	Displays or Sets the current Receive Frequency (in Hertz).
TXPOWER ###:	Displays or Sets the Transmit Power Level (in tenths of a dBm).
RXTHRESH -####:	Displays or Sets the Receive Threshold Level (in tenths of a dBm).
RXHYSTER ##:	Displays or Sets the Receive Hysteresis (in tenths of a dB).
TIMEOUT ####:	Displays or Sets the Timeout-Timer value (in Seconds).
TESTOSC 1 or 0:	Enables or Disables the Test Oscillator.

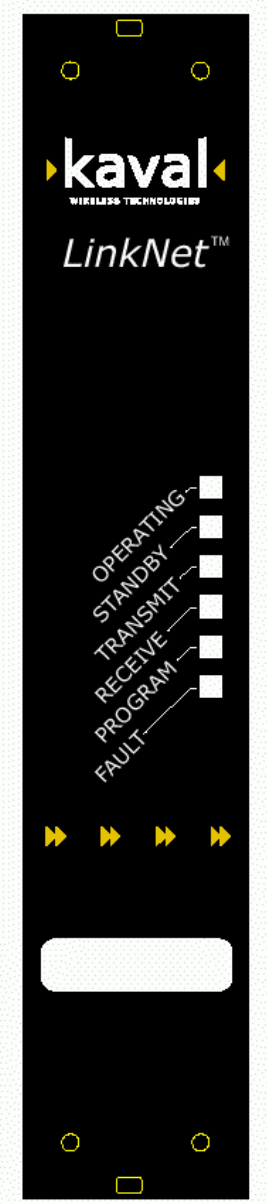
Please consult Kaval Wireless Technologies for further support.

Power On Self Test (POST)

Each system 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.



Normal Operation

The LNKF800 Module has six LED's on the faceplate:

1. OPERATING - Under normal operating conditions, this LED will flash GREEN when RF Data is present.

2. STANDBY – Under the control of the Controller Module, the LNKF800 Module has the ability to act as a duplex transmitter, sitting perpetually in Stand by Mode waiting for the primary transmitter to fail. This LED should be constant Amber. If a Fault should occur with the primary module, the "Stand by" unit will immediately become the primary unit, at which time the Stand by LED will be turned off and the LED's will show an operating Module.

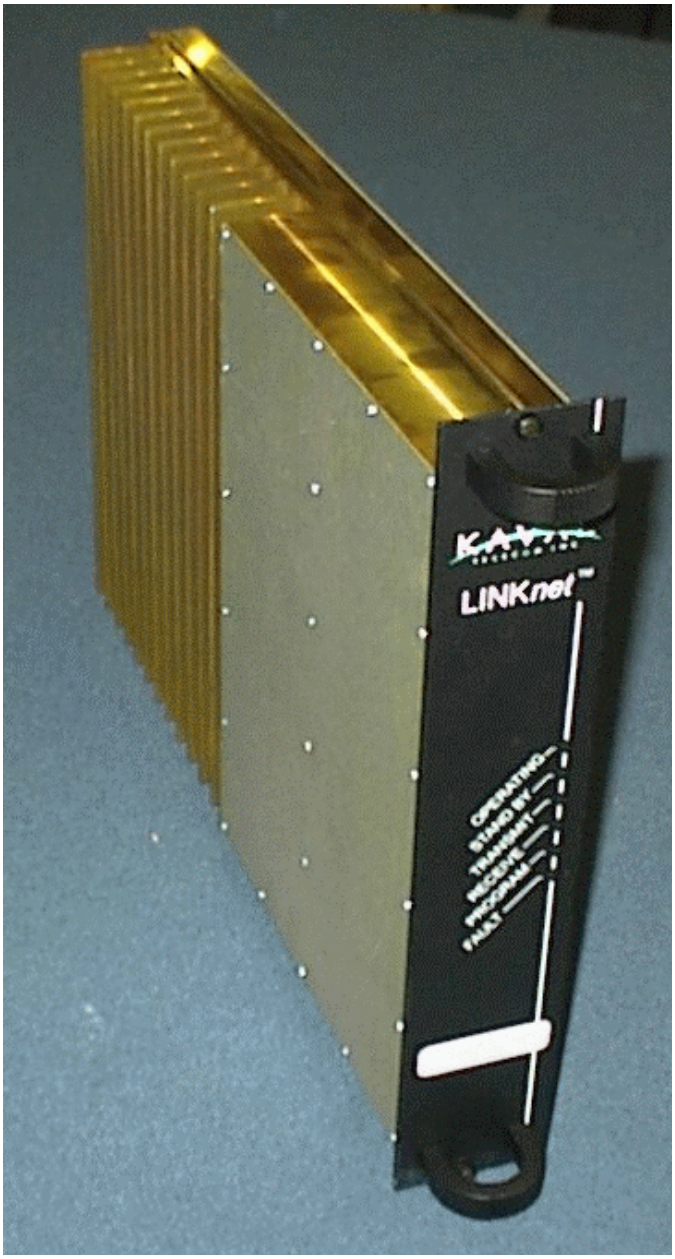
3. TRANSMIT – This Green LED will be on when a signal is being transmitted

4. RECEIVE – This Green LED will be on when a signal is being received

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 FM MODULE 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 10 dB. **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 100 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.
- 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.