TXE-315-KH
TXE-418-KH
TXE-433-KH

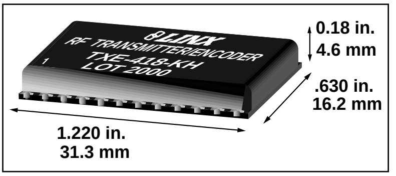
WIRELESS MADE SIMPLE

KH SERIES RF TRANSMITTER W/ INTEGRATED ENCODER

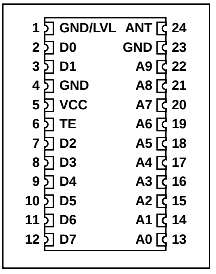
DESCRIPTION:

The KH Series is ideally suited for volume use in OEM applications such as remote control/command and keyless entry. It combines a highly optimized RF transmitter with an on-board encoder. When paired with a matching KH series receiver/decoder module, a highly reliable wireless link is formed, capable of transferring the status of 1 to 8 parallel inputs along with 3^{10} address information for distances in excess of 300 feet. Packaged in a compact SMD package, the KH module utilizes a highly optimized SAW architecture to achieve an unmatched blend of performance, size, and cost. No external RF components, except an antenna, are required, making design integration straightforward.

PHYSICAL DIMENSIONS



PINOUTS (VIEWED FROM TOP)



FEATURES:

- Low Cost
- On-Board Encoder
- 8 Parallel Binary Outputs Allow Direct Connection of Peripherals
- 3^{10} Address Lines for Security and Uniqueness
- No External RF Components Required
- Ultra-Low Power Consumption
- Compact Surface-Mount Package
- Stable SAW-Based Architecture
- No Production Tuning

APPLICATIONS INCLUDE:

- Remote Control/Command
- Keyless Entry
- Garage / Gate Openers
- Lighting Control
- Call Systems
- Home / Industrial Automation
- Fire / Security Alarms
- Remote Status Monitoring
- Wire Elimination

ORDERING INFORMATION

PART #	DESCRIPTION
EVAL-***-KH	KH Evaluation Kit
TXE-315-KH	TX/Encoder 315 MHZ
TXE-418-KH	TX/Encoder 418 MHZ
TXE-433-KH	TX/Encoder 433 MHZ
RXD-315-KH	RX/Decoder 315 MHZ
RXD-418-KH	RX/Decoder 418 MHZ
RXD-433-KH	RX/Decoder 433 MHZ

*** Insert Frequency

KH modules are supplied in tube packaging.

PERFORMANCE DATA– TXE-***-KH

ABOUT THESE MEASUREMENTS

The performance parameters listed below are based on module operation at 25°C from a 3Vdc supply unless otherwise noted. Figure 1 at the right illustrates the connections necessary for testing and operation. It is recommended that all ground pins be connected to the groundplane.

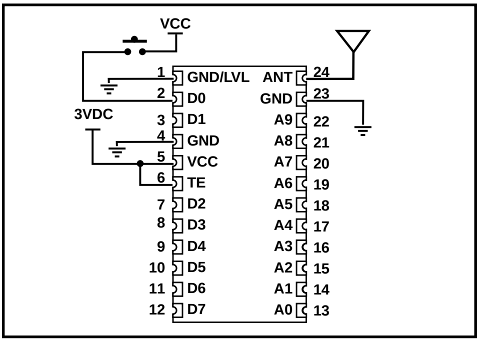


figure 1: Test circuit (Top View)

RF-Parameters TXE-315-KH	Designation	Min.	Typical	Max.	Units	Notes
Frequency of Carrier	F_C	314.925	315.0	315.075	MHz	–
Harmonic Emissions	P_H	–	–	-40	dBc	3

RF-Parameters TXE-418-KH	Designation	Min.	Typical	Max.	Units	Notes
Frequency of Carrier	F_C	417.925	418	418.075	MHz	–
Harmonic Emissions	P_H	–	–	-40	dBc	3

RF-Parameters TXE-433-KH	Designation	Min.	Typical	Max.	Units	Notes
Frequency of Carrier	F_C	433.845	433.92	433.995	MHz	–
Harmonic Emissions	P_H	–	–	-45	dBc	3

Electrical Parameters All Frequencies	Designation	Min.	Typical	Max.	Units	Notes
Operating Voltage Range	V_{CC}	2.7	–	5.2	Vdc	–
Current Average	I_{CA}	–	1.5	–	mA	1, 4
Current In Sleep	I_{SLP}	–	1	-	µA	2
Output Power	P_O	-2	+2	+4	dBm	3
Input Low	V_{IL}			.3	Vdc	
Input Hi	V_{IH}	.7xVcc				
TX Data Length			26bits 3x			
Average Data Duty Cycle			50%			
Encoder Oscillator	F_{ENC}		70		KHz	

Notes:

1. Current draw with 50% mark/space ratio.
2. Current draw in standby.
3. RF out connected to 50Ω load.
4. With 430Ω resistor at LVL (pad 1).

Absolute Maximum Ratings:			
Supply voltage V_{CC}	-0.3	to	+6 VDC
Operating temperature	-30°C	to	+70°C
Storage temperature	-45°C	to	+85°C
Soldering temperature	+225°C for 10 sec.		
Any input or output pin	-0.3	to	V_{CC}

***NOTE* Exceeding any of the limits of this section may lead to permanent damage to the device. Furthermore, extended operation at these maximum ratings may reduce the life of this device.**

TYPICAL PERFORMANCE GRAPHS

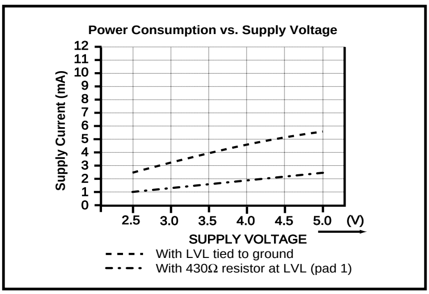


figure 2: Consumption vs. Supply Voltage

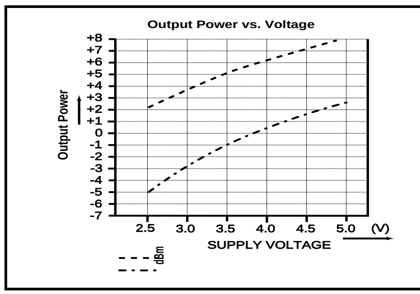
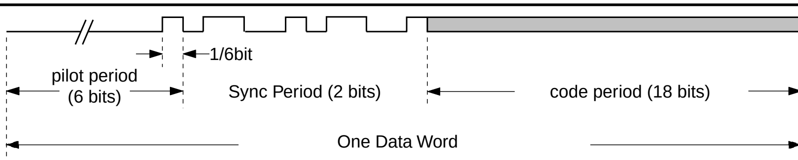


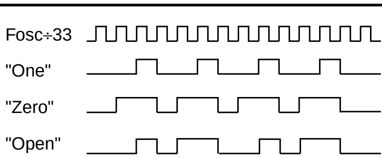
figure 3: Typical RF Power Into 50Ω

ENCODER OPERATION



Upon receipt of the TE signal (active high), the KH-TXE begins a 3-word transmission cycle and repeats this transmission cycle until the TE signal has been removed. One transmission cycle is composed of 3 data words, each containing 3 periods as shown above.

figure 4: Packet Structure



The KH-TXE detects the logic state of address (A0~A9) and data (D0-D7) lines and transmits this information during code period. Each address pin can be set as one of the logic states.

figure 5: Code Word Format

PRODUCTION GUIDELINES

The KH modules are packaged in a hybrid SMD package which has been designed to support hand- or automated-assembly techniques. Since KH devices contain discrete components internally, the assembly procedures are critical to insuring the reliable function of the KH product. The following procedures should be reviewed with and practiced by all assembly personnel.

PAD LAYOUT

The following pad layout diagrams are designed to facilitate both hand and automated assembly.

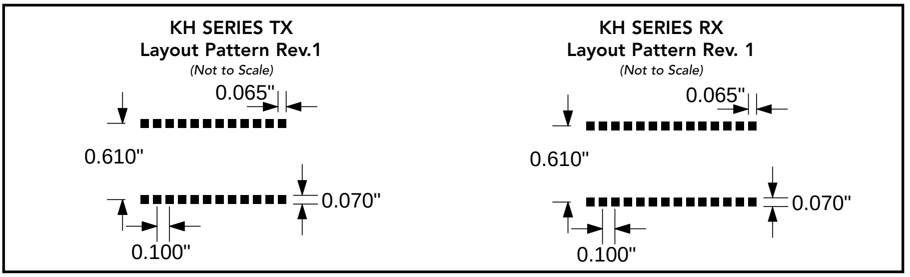


figure 6: Suggested Pad Layout

KH SERIES HAND ASSEMBLY

The transmitter's primary mounting surface is twenty-four pads located on the bottom of the module. Since these pads are inaccessible during mounting, castellations that run up the side of the module have been provided to facilitate solder wicking to the module's underside. If the recommended pad placement has been followed, the pad on the board will extend slightly past the edge of the module. For best soldering results touch both the PCB pad and the module castellation with a fine soldering tip. Tack one module corner first, then work around the remaining attachment points using care not to exceed the solder times listed below.

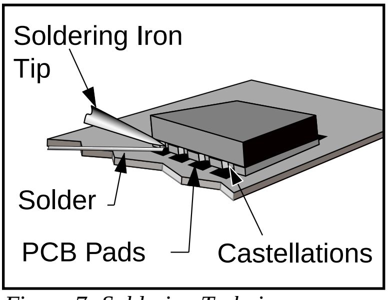


Figure 7: Soldering Technique

Absolute Maximum Solder Times

Hand-Solder Temp. TX +225°C for 10 Sec.
Hand-Solder Temp. RX +225°C for 10 Sec.
Recommended Solder Melting Point +180°C
Reflow Oven: +220° Max. (See adjoining diagram)

AUTOMATED ASSEMBLY

For high-volume assembly most users will want to auto-place the modules. The modules have been designed to maintain compatibility with most pick-and-place equipment; however, due to the module's hybrid nature certain aspects of the automated-assembly process are more critical than for other component types.

Following are brief discussions of the three primary areas where caution must be observed.

Reflow Temperature Profile

The single most critical stage in the automated-assembly process is the reflow process. The reflow profile below should be closely followed since excessive temperatures or transport times during reflow will irreparably damage the modules. Assembly personnel will need to pay careful attention to the oven's profile to insure that it meets the requirements necessary to successfully reflow all components while still meeting the limits mandated by the modules themselves.

Shock During Reflow Transport

Since some internal module components may reflow along with the components placed on the board being assembled, it is imperative that the module not be subjected to shock or vibration during the time solder is liquidus.

Washability

The modules are wash resistant, but are not hermetically sealed. They may be subject to a standard wash cycle; however, a twenty-four-hour drying time should be allowed before applying electrical power to the modules. This will allow any moisture that has migrated into the module to evaporate, thus eliminating the potential for shorting during power-up or testing.

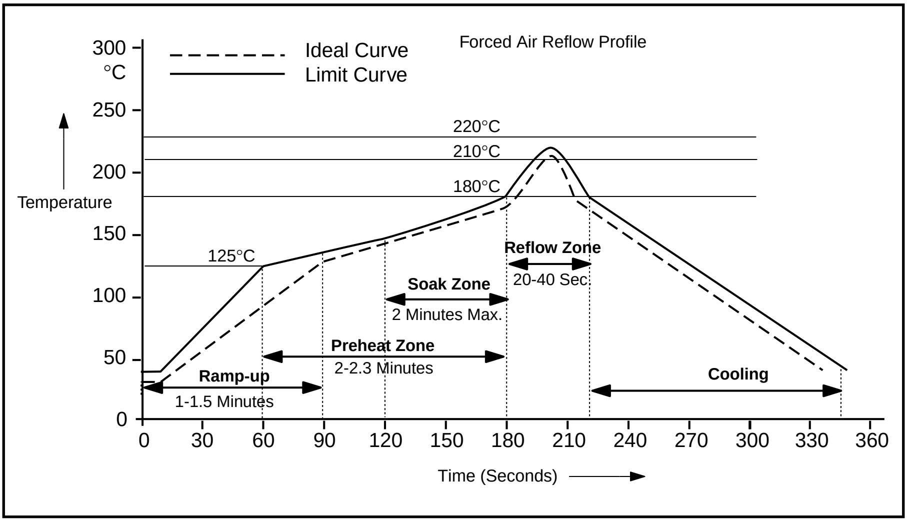


figure 8: Required Reflow Profile

PHYSICAL PACKAGING

The KH-TX module is packaged in a hybrid SMD module with 24 pads spaced 0.100" apart on center. The reflow compatible package is equipped with castellations which simplifies prototyping or hand assembly while maintaining compatibility with automated pick-and-place equipment.

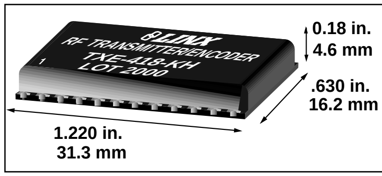


figure 9: TXE-KH Package

PIN DESCRIPTIONS:

Pin 1 - GROUND/LEVEL

Connect to quiet ground or insert series resistor to adjust output power.

Pins 2,3,7,8,9,10,11,12 - DATA IN

Logic level input pin. TTL- and CMOS-compatible.

State of all pins is sent during transmission.

Pins 4, 23 - GROUND

Connect to quiet ground or groundplane.

Pin 5 - POSITIVE SUPPLY (V_{CC} 2.7-6 VDC)

The supply must be clean (<20 mV pp), stable and free of high-frequency noise. A supply filter is recommended unless the module is operated from its own regulated supply or battery.

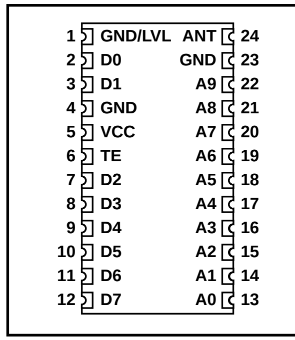


figure 10: TXE-KH Package (Bottom View)

Pin 6 - TRANSMIT ENABLE

When taken high this pin initiates transmission. Transmission continues until the pin is restored low or power to the device is removed.

Pin 13-22 - ADDRESS LINES

Ten tri-state address inputs are used to set transmitter address to avoid contention and create unique tx/rx relationships. Note: tri-state means that the address lines have three distinct states, high, low, and floating. All address pin states must match that of the KH receiver module for transmission to be recognized.

Pin 24 - RF OUT

Connect to 50Ω antenna.

POWER SUPPLY REQUIREMENTS

The transmitter module requires a clean, well-regulated power source. While it is preferable to power the unit from a battery, the unit can also be operated from a power supply as long as noise and ‘hash’ are kept to less than 20 mV. A 10Ω resistor in series with the supply followed by a 10µF tantalum capacitor from Vcc to ground as shown at the right will help in cases where the quality of supply power is poor.

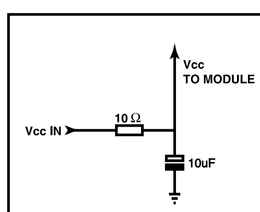


figure 11: Supply Filter

MODULE DESCRIPTION

The KH Series Transmitter/Encoder module combines a high-performance SAW-(Surface Acoustic Wave) based transmitter with an on-board encoder. When combined with a Linx KH series receiver/decoder a highly reliable RF link capable of transferring control or command data over line-of-sight distances in excess of 300 feet (90M) is formed. The module accepts up to 8 parallel inputs such as switches or contact closures and provides ten tri-state address lines for security and creation of 59,049 unique transmitter/receiver relationships. The KH's compact surface-mount package integrates easily into existing designs and is friendly to hand production or automated assembly.

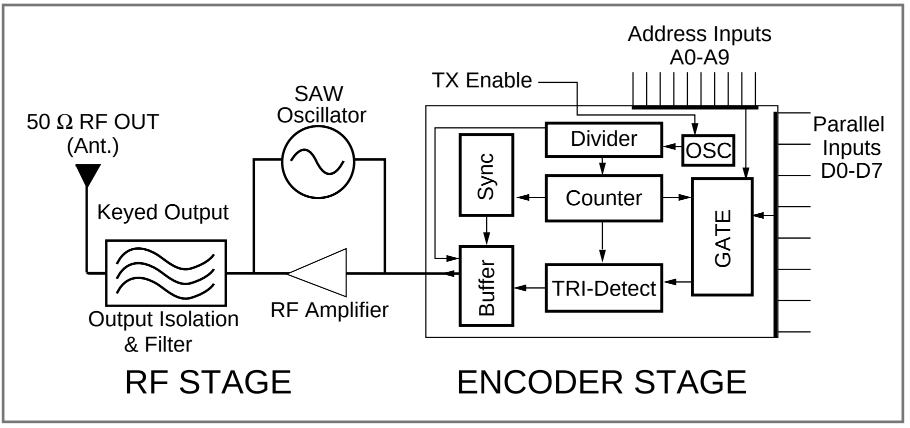


figure 12: KH Series Transmitter Block Diagram

THEORY OF OPERATION

The KH series operation is straightforward. When the transmit enable line is taken high the on-board encoder IC is enabled. The encoder then detects the logic states of the data and address lines. These states are formatted into a 3-word transmission cycle which continues until the enable line is taken low. The encoder creates a serial data packet which is used to modulate the KH transmitter.

The TXE-KH transmitter section is based on a simple but highly optimized architecture which achieves a high fundamental output power with low harmonic content. This insures that most approval standards can be met without external filter components. The KH transmitter is exceptionally stable over variations in time, temperature, and physical shock as a result of the precision SAW (Surface Acoustic Wave) device that is incorporated as its frequency reference.

The transmitted signal may be received by any Linx KH receiver/decoder module or Linx LC receiver combined with the appropriate decoder IC. Once data is received it is decoded using a decoder IC or custom microcontroller. The transmitted address bits are checked against the address settings of the receiving device. If a match is confirmed, the decoder's output(s) are set to replicate the transmitter's button status.

SETTING THE TRANSMITTER ADDRESS

The module provides 10 tri-state address pads. This allows for the formation of up to 59,049 unique Transmitter-Receiver relationships. Tri-State means that the address lines have three distinct states, hi, low, and floating. These pins may be hardwired or configured via a microprocessor, DIP switch or jumpers. NOTE: Address pad states must match that of the receiver's decoder exactly for a transmission to be recognized.

THE DATA INPUTS

Eight logic level input lines are provided. Any or all may be used. The pins can be hardwired in open, low or high states or configured via a microprocessor, switch, or jumper. When a transmission is initiated the state of all lines is sent.

ENABLING TRANSMISSION

The module's transmit enable pad (P6) controls transmission status. When taken high this pad initiates transmission. Transmission continues until the pad is pulled low or power to the device is removed. In many cases this pad will be wired permanently to VCC and transmission controlled by switching VCC to the device. This is particularly useful in applications where the module powers up and sends a transmission only when a button is pressed on the remote.

CONTENTION CONSIDERATIONS

It is important to understand that only one transmitter at a time can be activated within a reception area. While the transmitted signal consists of encoded digital data, only one carrier of any frequency can occupy airspace at any given time. In many applications, brief transmission periods and randomization can minimize contention and allow the successful operation of multiple units. Further comments on contention appear in the KH receiver data guide.

TYPICAL APPLICATION

Below you will find an example of a basic remote control transmitter. When a key is pressed at the transmitter, a corresponding pad at the receiver goes high. A schematic for the receiver/decoder circuit may be found in the KH receiver guide. These circuits can be easily modified and clearly demonstrate the ease of using the Linx KH modules.

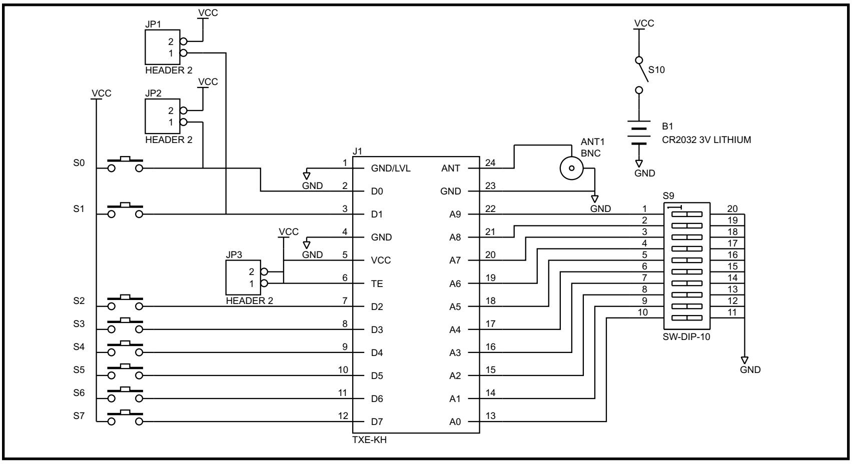


figure 13: Basic Remote Control Transmitter Circuit

Notes: 1) DIP Switch used to set ID code. A 10-position switch was chosen for this example but all or none of the address bits may be used. Settings of the TX and RX must match for signal to be recognized.

BOARD LAYOUT CONSIDERATIONS

If you are at all familiar with RF devices you may be concerned about specialized board layout requirements. Fortunately, because of the care taken by Linx in designing the KH series, integration is very straightforward. This ease of application results from the advanced multi-layer construction of the module. By adhering to the following layout principles and observing a few basic design rules, you can enjoy a straightforward path to RF success.

1. A groundplane should be placed under the module as shown. It will generally be placed on the bottom layer. The amount of overall plane is also critical for the correct function of many antenna styles and is covered in the next section.
2. Observe appropriate layout practice between the module and its antenna. A simple trace may suffice for runs of less than .25" but longer distances should be covered using 50Ω coax or a 50Ω microstrip transmission line. In order to minimize loss and detuning, a microstrip transmission line is commonly utilized. The term microstrip refers to a PCB trace running over a groundplane, the width of which has been calculated to serve as a 50Ω transmission line. This effectively removes the trace as a source of detuning.

   The correct trace width can be easily calculated using the information below. The width is based on the desired characteristic impedance, the thickness of the PCB, and its dielectric constant.

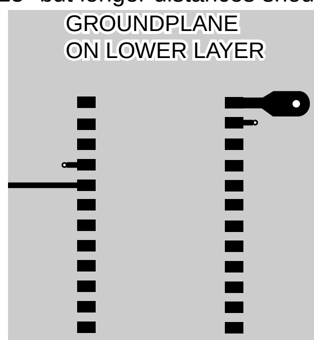
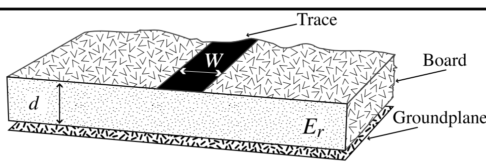


figure 14: Example of Proper Groundplane (shaded area)



$$E_e = \frac{E_r+1}{2} + \frac{E_r-1}{2} \cdot \frac{1}{\sqrt{1+12d/W}}$$

$$Z_0 = \begin{cases} \dfrac{60}{\sqrt{E_e}} \cdot \ln\left(\dfrac{8d}{W} + \dfrac{W}{4d}\right) & \text{For } \dfrac{W}{d} \le 1 \\[2ex] \dfrac{120\pi}{\sqrt{E_e} \cdot \left(\dfrac{W}{d} + 1.393 + 0.667 \cdot \ln\left(\dfrac{W}{d} + 1.444\right)\right)} & \text{For } \dfrac{W}{d} \ge 1 \end{cases}$$

Dielectric Constant	Width/Height (W/d)	Effective Dielectric Constant	Characteristic Impedance
4.8	1.8	3.59	50.0
4	2	3.07	51.0
2.55	3	2.12	48.0

figure 15: Microstrip Formulas (E_r = Dielectric constant of pc board material)

BOARD LAYOUT CONSIDERATIONS (CONTINUED)

3. Depending on the type of antenna being used and duty cycle of incoming data, the output power of the KH module may be significantly higher than FCC regulations allow. The output power of the module is intentionally set high since many designers pair the module with an inefficient antenna in order to realize cost or space savings. Since attenuation is often required it is generally wise to provide for its implementation.

   Two methods of attenuation are available using the KH module. First, a resistor may be placed in series with Pad 1 (LVL. ADJ.) to achieve up to a 7 dB reduction in output power. The resistor value is easily determined from the diagram below. Do not exceed the resistance values shown as transmitter instability may result. This method can also be used to reduce transmission range and power consumption.

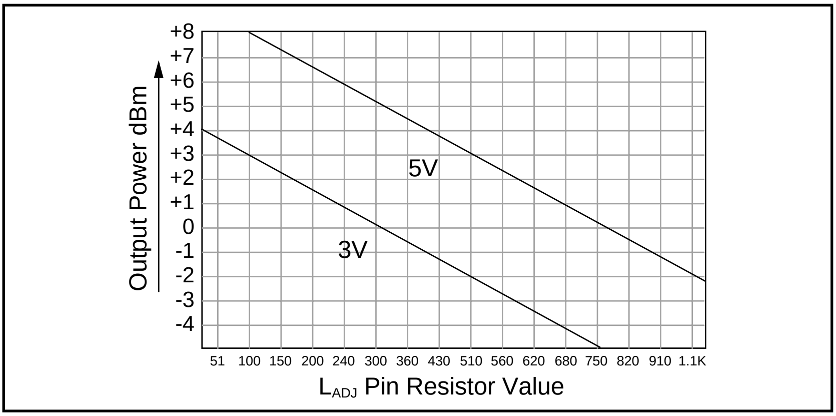


figure 16: Power Output vs. IADJ Pad Resistor Value

Another method commonly used to achieve attenuation, particularly at higher levels, is the use of a T-pad. A T-pad is a 3-resistor network that allows for variable attenuation while maintaining the quality of match to the antenna. For further details on T-pads please refer to Linx application note #00150.

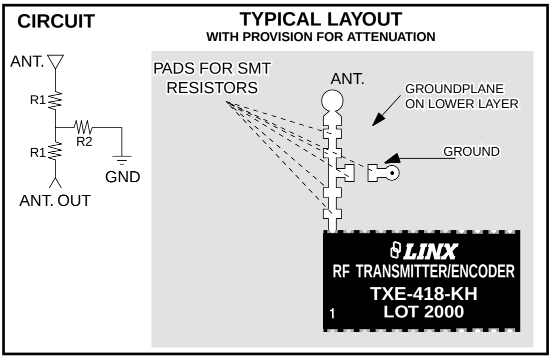


figure 17: Attenuation Pad Layout

ANTENNA CONSIDERATIONS

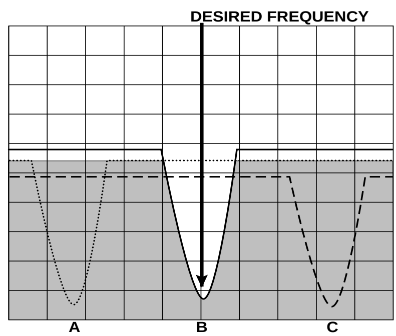
The choice of antennas is one of the most critical and often overlooked design considerations. The range, performance, and legality of an RF link is critically dependent upon the type of antenna employed. Proper design and matching of an antenna is a complex task requiring sophisticated test equipment and a strong background in principles of RF propagation. While adequate antenna performance can often be obtained by trial and error methods, you may also want to consider utilizing a professionally designed antenna such as those offered by Linx. Our low-cost antenna line is designed to ensure maximum performance and compliance with Part 15-attachment requirements. The purpose of the following sections is to give you a basic idea of some of the considerations involved in the design and selection of antennas. For a more comprehensive discussion please review Linx applications note #00500 “Antennas: Design, Application, Performance”.

THE TRANSMITTER ANTENNA

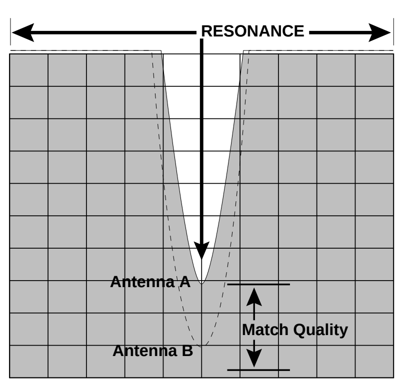
The transmitter antenna allows RF energy to be efficiently radiated from the output stage into free space. In modular designs such as the KH, a transmitter’s output power is often slightly higher than the legal limit. This allows a designer to utilize an inefficient antenna in order to achieve full legal power while meeting size, cost, or cosmetic objectives. For this reason a transmitter's antenna can generally be less efficient than the antenna used on the receiver.

It is usually best to utilize a basic 1/4-wave whip for your initial concept evaluation. Once the prototype product is operating satisfactorily, a production antenna should be selected to meet the cost, size and cosmetic requirements of the product.

Maximum antenna efficiency is always obtained when the antenna is at resonance. If the antenna is too short, capacitive reactance is present; if it is too long, inductive reactance will be present. The indicator of resonance is the minimum point in the VSWR curve. You will see from the following example that antenna (A) is resonant at too low a frequency, indicating excessive length, while antenna (C) is resonant at too high a frequency, indicating the antenna is too short. Antenna (B), however, is *“just right.”*



Antenna resonance should not be confused with antenna impedance. The difference between resonance and impedance is most easily understood by considering the value of VSWR at its lowest point. The lowest point of VSWR indicates the antenna is resonant, but the value of that low point is determined by the quality of the match between the antenna, the transmission line, and the device to which it is attached.



To fully appreciate the importance of an antenna that is both resonant and matched consider that an antenna with a VSWR of 1.5 will effectively transmit approximately 95% of its power while an antenna with a VSWR of 10 will only transmit about 30%.

GUIDELINES FOR ACHIEVING OPTIMUM ANTENNA PERFORMANCE

1. Proximity to objects such as a user's hand or body, or metal objects will cause an antenna to detune. For this reason the antenna shaft and tip should be positioned as far away from such objects as possible.

2. Optimum performance will be obtained from a 1/4- or 1/2-wave straight whip mounted at a right angle to the groundplane. In many cases this isn't desirable for practical or ergonomic reasons; thus, an alternative antenna style such as a helical, loop, patch, or base-loaded whip may be utilized.

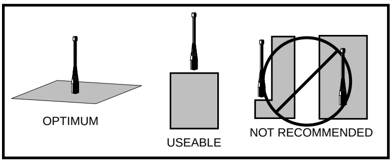
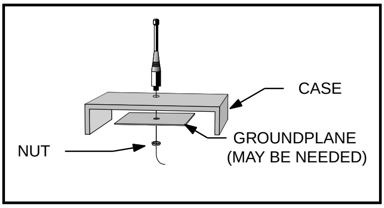


figure 17: Groundplane Orientation

3. If an internal antenna is to be used, keep it away from other metal components, particularly large items like transformers, batteries, and PCB tracks and groundplanes. In many cases, the space around the antenna is as important as the antenna itself.

4. In many antenna designs, particularly 1/4-wave whips, the groundplane acts as a counterpoise, forming, in essence, a 1/2-wave dipole. For this reason adequate groundplane area is essential. The groundplane can be a metal case or ground-fill areas on a circuit board. Ideally, the groundplane to be used as counterpoise should have a surface area ≥ the overall length of the 1/4-wave radiating element; however, Linx recognizes that this is impossible for most compact designs, so all Linx antennas are characterized using a 4.5" X 4.5" groundplane with the antenna centered and oriented at a 90° angle. Such an orientation is often not practical due to size and configuration constraints. In these instances a designer must make the best use of the area available to create as much groundplane in proximity to the base of the antenna as possible. In instances where the antenna is remotely located or the antenna is not in close proximity to a circuit board plane or grounded metal case, a small metal plate may be fabricated to maximize antenna performance.



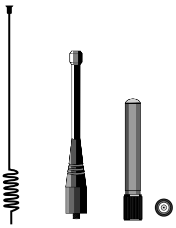
5. Remove the antenna as far as possible from potential interference sources. There are many possible sources of internally generated interference. Switching power supplies, oscillators, even relays can also be significant sources of potential interference. Remember, the single best weapon against such problems is attention to placement and layout. Filter the module's power supply with a high-frequency bypass capacitor. Place adequate groundplane under all potential sources of noise. Shield noisy board areas whenever practical.

6. In some applications it is advantageous to place the transmitter and its antenna away from the main equipment. This avoids interference problems and allows the antenna to be oriented for optimum RF performance. Always use 50Ω coax such as RG-174 for the remote feed.

COMMON ANTENNA STYLES

There are literally hundreds of antenna styles that can be successfully employed with the KH Series. Following is a brief discussion of the three styles most commonly utilized in compact RF designs. Additional antenna information can be found in Linx application notes #00500, #00100, #00126 and #00140. Linx also offers a broad line of antennas and connectors which offer outstanding performance and cost-effectiveness.

Whip Style



A whip-style monopole antenna provides outstanding overall performance and stability. A low-cost whip can be easily fabricated from wire or rod, but most product designers opt for the improved performance and cosmetic appeal of a professionally made model. To meet this need, Linx offers a wide variety of straight and reduced-height whip-style antennas in permanent and connectorized mounting styles.

The wavelength of the operational frequency determines an antenna's overall length. Since a full wavelength is often quite long, a partial 1/4-wave antenna is normally employed. Its size and natural radiation resistance make it well matched to Linx modules. The proper length for a 1/4-wave antenna can be easily found using the formula below. It is also possible to reduce the overall height of the antenna by using a helical winding. This decreases the antenna's bandwidth but is an excellent way to minimize the antenna's physical size for compact applications.

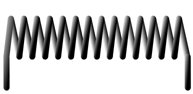
1/4-wave wire lengths for LC frequencies:

315Mhz=8.9"
418Mhz=6.7"
433Mhz=6.5"

$$L = \frac{234}{F_{\text{MHz}}}$$

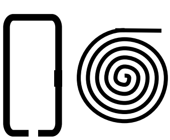
Where:
L=length in feet of quarter-wave length
F=operating frequency in megahertz

Helical Style

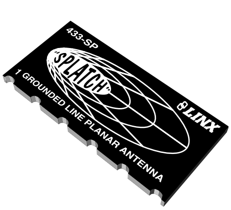


A helical antenna is precisely formed from wire or rod. A helical antenna is a good choice for low-cost products requiring average range-performance and internal concealment. A helical can detune badly in proximity to other objects and its bandwidth is quite narrow so care must be exercised in layout and placement.

Loop Style



A loop- or trace-style antenna is normally printed directly on a product's PCB. This makes it the most cost-effective of antenna styles. There are a variety of shapes and layout styles which can be utilized. The element can be made self-resonant or externally resonated with discrete components. Despite its cost advantages, PCB antenna styles are generally inefficient and useful only for short-range applications. Loop-style antennas are also very sensitive to changes in layout or substrate dielectric which can introduce consistency issues into the production process. In addition, printed styles initially are difficult to engineer, requiring the use of expensive equipment including a network analyzer. An improperly designed loop will have a high SWR at the desired frequency which can introduce substantial instability in the RF stages.



Linx offers a low-cost planar antenna called the “SPLATCH” which is an excellent alternative to the sometimes problematic PCB trace style. This tiny antenna mounts directly to a product's PCB and requires no testing or tuning. Its design is stable even in compact applications and it provides excellent performance in light of its compact size.

LEGAL CONSIDERATIONS

NOTE: KH Series Modules are designed as component devices which require external components to function. The modules are intended to allow for full Part 15 compliance; however, they are not approved by the FCC or any other agency worldwide. The purchaser understands that approvals may be required prior to the sale or operation of the device, and agrees to utilize the component in keeping with all laws governing its operation in the country of operation.

When working with RF, a clear distinction must be made between what is technically possible and what is legally acceptable in the country where operation is intended. Many manufacturers have avoided incorporating RF into their products as a result of uncertainty and even fear of the approval and certification process. Here at Linx our desire is not only to expedite the design process, but also to assist you in achieving a clear idea of what is involved in obtaining the necessary approvals to market your completed product legally.

In the United States the approval process is actually quite straightforward. The regulations governing RF devices and the enforcement of them are the responsibility of the Federal Communications Commission. The regulations are contained in the Code of Federal Regulations (CFR), Title 47. Title 47 is made up of numerous volumes; however, all regulations applicable to this module are contained in volume 0-19. It is strongly recommended that a copy be obtained from the Government Printing Office in Washington, or from your local government book store. Excerpts of applicable sections are included with Linx evaluation kits or may be obtained from the Linx Technologies web site (www.linxtechnologies.com). In brief, these rules require that any device which intentionally radiates RF energy be approved, that is, tested, for compliance and issued a unique identification number. This is a relatively painless process. Linx offers full EMC pre-compliance testing in our HP/Emco-equipped test center. Final compliance testing is then performed by one of the many independent testing laboratories across the country. Many labs can also provide other certifications the product may require at the same time, such as UL, CLASS A/B, etc. Once your completed product has passed, you will be issued an ID number which is then clearly placed on each product manufactured.

Questions regarding interpretations of the Part 2 and Part 15 rules or measurement procedures used to test intentional radiators, such as the KH modules, for compliance with the Part 15 technical standards, should be addressed to:

Federal Communications Commission
Equipment Authorization Division
Customer Service Branch, MS 1300F2
7435 Oakland Mills Road
Columbia, MD 21046
Tel: (301) 725-1585 / Fax: (301) 344-2050 E-Mail: labinfo@fcc.gov

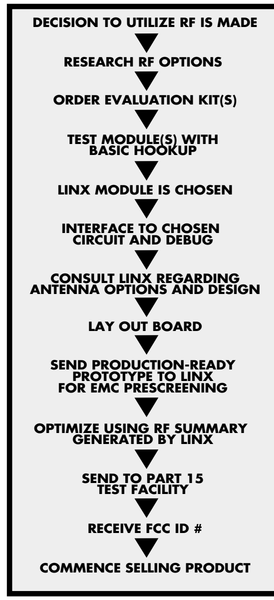
International approvals are slightly more complex, although many modules are designed to allow all international standards to be met. If you are considering the export of your product abroad, you should contact Linx Technologies to determine the specific suitability of the module to your application.

All Linx modules are designed with the approval process in mind and thus much of the frustration that is typically experienced with a discrete design is eliminated. Approval is still dependent on many factors such as the choice of antennas, correct use of the frequency selected, and physical packaging. While some extra cost and design effort are required to address these issues, the additional usefulness and profitability added to a product by RF makes the effort more than worthwhile.

SURVIVING AN RF IMPLEMENTATION

Adding an RF stage brings an exciting new dimension to any product. It also means that additional effort and commitment will be needed to bring the product successfully to market. By utilizing premade RF modules, such as the KH series, the design and approval process will be greatly simplified. It is still important, however, to have an objective view of the steps necessary to insure a successful RF integration. Since the capabilities of each customer vary widely it is difficult to recommend one particular design path, but most projects follow steps similar to those shown at the right.

In reviewing this sample design path you may notice that Linx offers a variety of services, such as antenna design, and FCC prequalification, that are unusual for a high-volume component manufacturer. These services, along with an exceptional level of technical support, are offered because we recognize that RF is a complex science requiring the highest caliber of products and support. “Wireless Made Simple” is more than just a motto, it’s our commitment. By choosing Linx as your RF partner and taking advantage of the resources we offer, you will not only survive implementing RF, you may even find the process enjoyable.



TYPICAL STEPS FOR IMPLEMENTING RF

HELPFUL APPLICATION NOTES FROM LINX

It is not the intention of this manual to address in depth many of the issues that should be considered to ensure that the modules function correctly and deliver the maximum possible performance. As you proceed with your design you may wish to obtain one or more of the following application notes, which address in depth key areas of RF design and application of Linx products.

NOTE #	LINX APPLICATION NOTE TITLE
00500	Antennas: Design, Application, Performance
00130	Modulation techniques for low-cost RF data links
00125	Considerations for operation in the 260 Mhz to 470 Mhz band
00100	RF 101: Information for the RF challenged
00140	The FCC Road: Part 15 from concept to approval
00150	Use and design of T-Attenuation Pads

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