Linx TECHNOLOGIES

NT Series
Transceiver Module
Data Guide

Wireless made simple®

Warning: Linx radio frequency ("RF") products may be used to control machinery or devices remotely, including machinery or devices that can cause death, bodily injuries, and/or property damage if improperly or inadvertently triggered, particularly in industrial settings or other applications implicating life-safety concerns. No Linx Technologies product is intended for use in any application without redundancies where the safety of life or property is at risk.

The customers and users of devices and machinery controlled with RF products must understand and must use all appropriate safety procedures in connection with the devices, including without limitation, using appropriate safety procedures to prevent inadvertent triggering by the user of the device and using appropriate security codes to prevent triggering of the remote controlled machine or device by users of other remote controllers.

Do not use this or any Linx product to trigger an action directly from the data line or RSSI lines without a protocol or encoder/decoder to validate the data. Without validation, any signal from another unrelated transmitter in the environment received by the module could inadvertently trigger the action. This module does not have data validation built in.

All RF products are susceptible to RF interference that can prevent communication. RF products without frequency agility or hopping implemented are more subject to interference. This module does not have frequency agility built in, but the developer can implement frequency agility with a microcontroller and the example code in Linx Reference Guide RG-00101.

Do not use any Linx product over the limits in this data guide. Excessive voltage or extended operation at the maximum voltage could cause product failure. Exceeding the reflow temperature profile could cause product failure which is not immediately evident.

Do not make any physical or electrical modifications to any Linx product. This will void the warranty and regulatory and UL certifications and may cause product failure which is not immediately evident.

Ordering Information

Ordering Information	
Part Number	**Description**
TRM-868-NT	868MHz NT Series Transceiver
TRM-900-NT	900MHz NT Series Transceiver
MDEV-868-NT	868MHz NT Series Master Development System
MDEV-900-NT	900MHz NT Series Master Development System
Transceivers are supplied in tubes of 18 pcs.	

Figure 2: Ordering Information

Absolute Maximum Ratings

Absolute Maximum Ratings				
Supply Voltage V_{cc}	–0.3	to	+5.5	VDC
Any Input or Output Pin	–0.3	to	V_{CC} + 0.3	VDC
RF Input		0		dBm
Operating Temperature	–40	to	+85	ºC
Storage Temperature	–55	to	+125	ºC

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.

Figure 3: Absolute Maximum Ratings

NT Series Transceiver Specifications						
Parameter	**Symbol**	**Min.**	**Typ.**	**Max.**	**Units**	**Notes**
RSSI						
Dynamic Range			60		dB	
Transmitter Section						
Output Power	P_O	–15.5		+12.5	dBm	6
Output Power Control Range			28		dB	
Harmonic Emissions	P_H		–42	–36	dBc	7
Frequency Deviation						
Baud Band = 1			±30		kHz	3,11
Baud Band = 2			±55		kHz	3,11
Baud Band = 3			±80		kHz	3,11
Baud Band = 4			±120		kHz	3,11
Antenna Port						
RF In/Out Impedance	R_{IN}		50		Ω	
Environmental						
Operating Temp. Range		–40		+85	ºC	
Storage Temp. Range		–55		+125	ºC	
Timing						
Receiver Turn-On Time						
Via V_{CC}			5.0	6	ms	4,9
Via Power Down			5.0	6	ms	4,9
Via Standby			0.6	1	ms	4,8
Transmitter Turn-On Time						
Via V_{CC}			5.0	6	ms	4,9
Via Power Down			5.0	6	ms	4,9
Via Standby			0.7	1	ms	4,8
TX to RX Switch Time			0.7	1	ms	4,8
RX to TX Switch Time			0.7	1	ms	4,8
Channel Change Time			0.6	1	ms	4,8
Baud Band Change Time			4.0	5	ms	4,8
Interface Section						
DATA_IN						
Logic Low	V_{IL}		0.3	$0.2*V_{CC}$	VDC	
Logic High	V_{IH}	$0.7*V_{CC}$	$0.5*V_{CC}$		VDC	
DATA_OUT						

Typical Performance Graphs

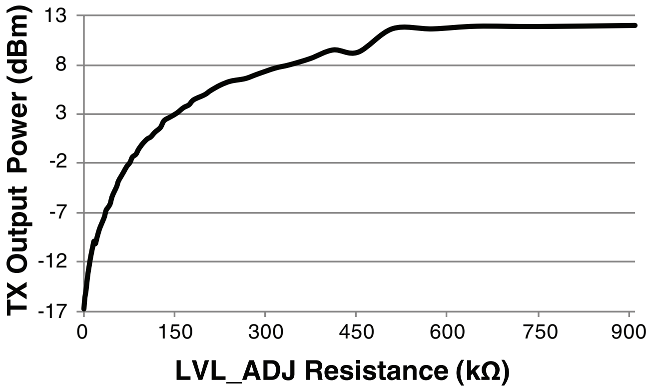

Figure 5: NT Series Transceiver Output Power vs. LVL_ADJ Resistance

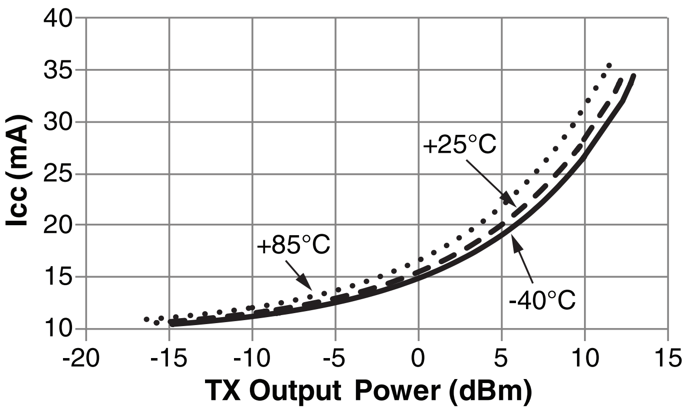

Figure 6: NT Series Transceiver Current Consumption vs. Transmitter Output Power at 3.3V

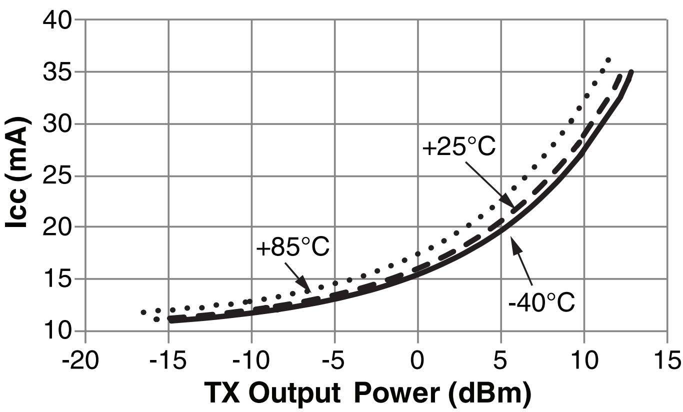

Figure 7: NT Series Transceiver Current Consumption vs. Transmitter Output Power at 5.5V

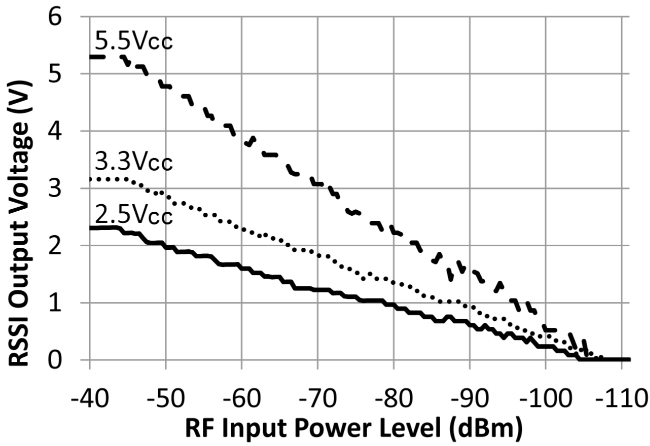

Figure 11: NT Series Transceiver RSSI Voltage vs. Input Power

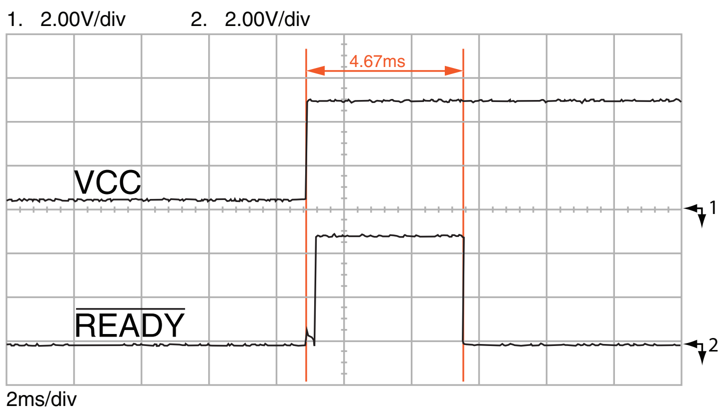

Figure 12: NT Series Transceiver Receiver Turn-On Time from VCC

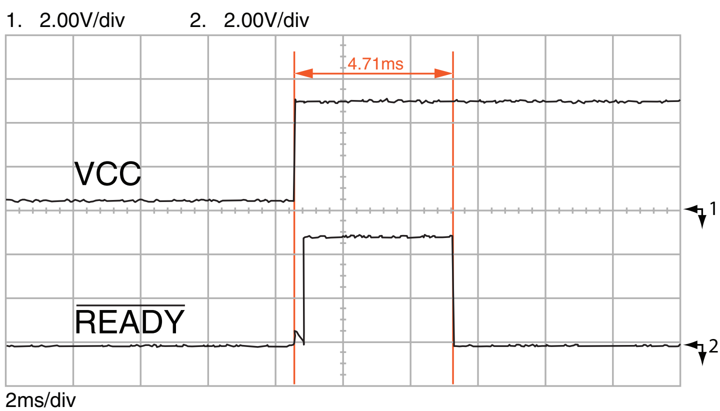

Figure 13: NT Series Transceiver Turn-On Time from VCC

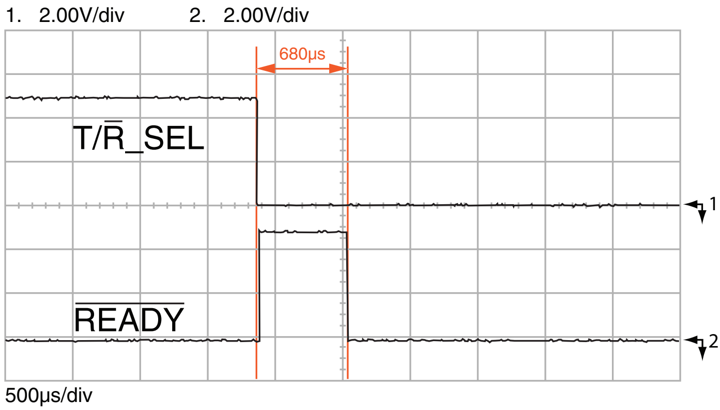

Figure 17: NT Series Transceiver RX to TX Change Time

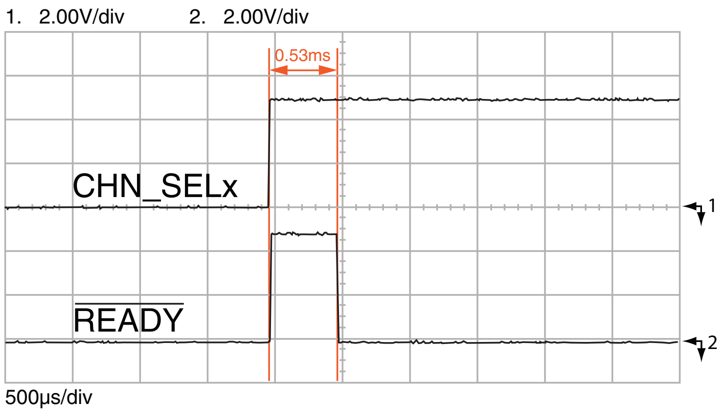

Figure 18: NT Series Transceiver Channel Change Time

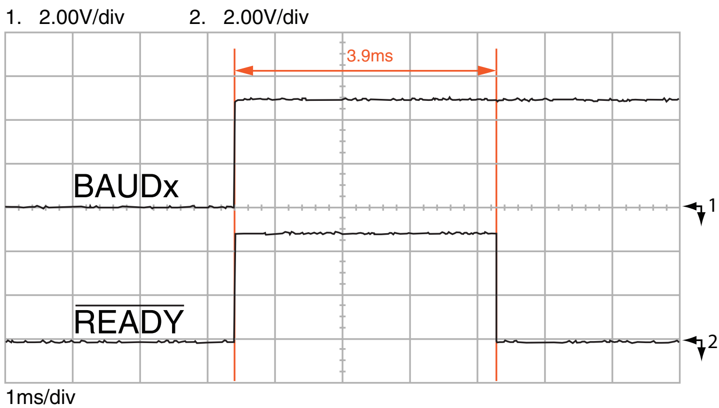

Figure 19: NT Series Transceiver Baud Band Change Time

A low-power onboard communications processor performs the radio control and management functions. An interface processor performs the higher level functions and controls the serial and hardware interfaces. This block also includes voltage translation to allow the internal circuits to operate at a low voltage to conserve power while enabling the interface to operate over the full external voltage. This prevents hardware damage and communication errors due to voltage level differences.

While operation is recommended from 3.3V to 5.0V, the transceiver can operate down to 2.5V.

Pin Assignments

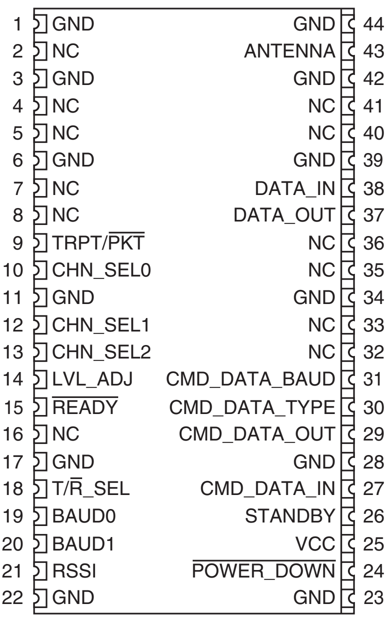

Figure 21: NT Series Transceiver Pinout (Top View)

Pin Descriptions

Pin Descriptions		
Pin Number	**Name**	**Description**
1, 3, 6, 11, 17, 22, 23, 28, 34, 39, 42, 44	GND	Ground
2, 4, 5, 7, 8, 16, 32, 33, 35, 36, 40, 41	NC	No Connection
9	TRPT / PKT [1,2]	Transparent/Packet Data Select. Pull high or float.

Sending Data

The NT Series transceiver module has two interfaces for sending data. One interface uses a UART to pass data in and out of the module. The modules put the data into a packet and take care of the transmission, reception and error check. This is a very low level over-the-air protocol and does not have any networking capabilites built in, but these capabilities can be added in a microcontroller outside the module. This interface and the protocol are detailed in RG-101 (NT Series Command Data Interface Reference Guide) and RG-102 (NT Series Transceiver Wireless UART Reference Guide).

This guide details the modules transparent interface. Through this interface the module does not encode or packetize the data in any manner. The data present on the DATA_IN line is used to modulate the transmitter. The received data is output on the DATA_OUT line and the transmit/receive state is controlled with the T/$\overline{R}$_SEL line. This transparency gives the designer great freedom in software and protocol development, allowing the creation of unique and proprietary data structures. This mode also allows the use of PWM and non-standard baud rate data.

The $\overline{READY}$ line outputs a logic low when the module is ready for use and logic high when it is busy. It can be used as hardware flow control to send streaming data and ensure that data is not missed.

The Data Input

Transmit Mode is enabled when the T/$\overline{R}$_SEL line is logic high. The data on the DATA_IN line is transmitted over the air. The DATA_IN line may be directly connected to virtually any digital peripheral, including microcontrollers and encoders. It can be used with any data that transitions from 0V to V_{CC} peak amplitude within the specified data rate range of the selected baud band. While it is possible to send data at higher rates, the internal filters will cause severe roll-off and attenuation.

Many RF products require a fixed data rate or place tight constraints on the mark/space ratio of the data being sent. The transceiver architecture eliminates such considerations and allows virtually any signal, including PWM, Manchester, and NRZ data, to be sent at rates from 1kbps to 300kbps.

Using the T/R_SEL Input

The transmit/receive select (T/R_SEL) line is used to switch the transceiver between transmit and receive mode. If it is pulled low, the transceiver exits transmit mode and enters receive mode. Alternatively, if the line is pulled high, the transceiver exits receive mode and enters transmit mode. The READY output switches high during the change and returns low when the module is ready to receive or transmit data. None of the other operating modes are affected by the change. The data rate and channel settings remain as set.

Using the Low Power Features

The Power Down (POWER_DOWN) line can be used to completely power down the transceiver module without the need for an external switch. This line allows easy control of the transceiver power state from external components, such as a microcontroller. The module is not functional while in power down mode.

Similar to the POWER_DOWN line, the Standby (STANDBY) line can be used to put the transceiver into a low-power sleep mode. This line has an internal pull-up, so when it is held high or left floating, the transceiver enters a low power (2.6mA) state. When the STANDBY line is pulled to ground, the module is fully active. During Standby, all operating modes are deactivated. The READY output is high during standby.

Standby has a higher current consumption than Power Down but a faster wake-up time. By periodically activating the transceiver, sending data, then powering down or entering standby, the transceiver's average current consumption can be greatly reduced, saving power in battery-operated applications.

> **Warning:** Pulling any of the module inputs high while in Power Down can partially activate the module, increasing current consumption and potentially placing it into an indeterminate state that could lead to unpredictable operation. Pull all inputs low before pulling POWER_DOWN low to prevent this issue. Lines that may be hardwired (for example, the BAUD lines) can be connected to the POWER_DOWN line so that they are lowered when POWER_DOWN is lowered.

Power Level vs. Resistor Value								
Power Level	P_O (dBm)	1% Resistor Value	Power Level	P_O (dBm)	1% Resistor Value	Power Level	P_O (dBm)	1% Resistor value
57	12.22	Open	38	3.49	154k	19	–5.47	44.2k
56	12.12	750k	37	3.11	143k	18	–5.78	41.2k
55	12.14	649k	36	2.77	133k	17	–6.12	37.4k
54	11.86	576k	35	2.12	127k	16	–6.72	34.8k
53	11.85	510k	34	1.65	118k	15	–7.09	32.4k
52	9.58	453k	33	1.16	111k	14	–7.52	29.4k
51	9.78	412k	32	0.81	105k	13	–7.91	26.7k
50	8.94	347k	31	0.38	97.6k	12	–8.36	24.3k
49	8.33	340k	30	–0.18	91k	11	–8.83	22k
48	8.02	316k	29	–0.66	86.6k	10	–9.39	19.6k
47	7.42	287k	28	–0.93	80.6k	9	–9.13	17.4k
46	6.99	267k	27	–1.46	76.8k	8	–9.68	15.4k
45	6.72	243k	26	–1.84	71.5k	7	–10.23	13.3k
44	6.33	226k	25	–2.39	66.5k	6	–10.86	11.3k
43	5.80	210k	24	–2.83	62k	5	–11.50	9.53k
42	5.38	200k	23	–3.27	57.6k	4	–12.23	7.5k
41	4.83	182k	22	–3.79	54.9k	3	–13.04	5.76k
40	4.33	174k	21	–4.30	51k	2	–13.98	4.02k
39	4.05	165k	20	–4.85	47k	1	–14.59	2.32k
						0	–15.78	750

Figure 23: NT Series Transceiver Power Level vs. Resistor Value

Baud Band Selection

There are two baud select lines (BAUD0 and BAUD1) that configure the transceiver for the desired over-the-air data rate. The two baud select lines choose among four baud bands, or ranges of data rate and IF bandwidth, as shown in Figure 24.

Setting the baud band appropriately for the desired baud rate configures the internal filters and circuitry for optimal performance at that rate. Data can be sent in at a lower rate than specified for the band, but the sensitivity, and therefore range, will not be as good as in a lower setting. Data can also be sent in faster than specified by the band, but the internal filters will cause distortion of the data stream and range will be significantly reduced.

900MHz Channel Selection				
CHN_SEL2	CHN_SEL1	CHN_SEL0	CHANNEL	FREQUENCY
0	0	0	3	903.37
0	0	1	15	906.37
0	1	0	21	907.87
0	1	1	27	909.37
1	0	0	39	912.37
1	0	1	51	915.37
1	1	0	69	919.87
1	1	1	75	921.37

Figure 26: NT Series Transceiver 900MHz Channel Selection

European Transmission Rules

While the FCC does not have any requirements other than power and harmonic levels for the 900MHz band, European rules are more complicated. The 863 to 870MHz band is subdivided into other bands that are designated for specific applications. These sub bands can be used for generic devices provided they meet one of two requirements.

The first requirement is duty cycle, which is defined as the amount of time the transmitter is on per hour. The duty cycle is different for the different bands and ranges from 0.1% to 10%.

The other option is that the transmitter implement Listen-Before-Talk (LBT) optionally combined with Adaptive Frequency Agility (AFA). This basically means that the transmitter will listen to a channel to be sure that it is clear before transmitting (LBT). If the channel is occupied by another transmitter, then it will wait until the channel is clear or change to another channel to transmit its data (AFA).

The NT Series does not implement LBT or AFA, but these features can be added to a microcontroller outside the module. Implementing these eliminates the need to track the transmit time to ensure compliance with the duty cycle limits.

Figure 27 lists the 868MHz channels and their duty cycle requirements if LBT is not implemented. It is recommended that the designer review ETSI EN 300 220-1 for the full requirements.

Figure 28 shows the 900MHz channels avaiable through the module's serial Command Data Interface.

NT Series Transceiver 900MHz Serial Channels							
Channel	Frequecy	Channel	Frequecy	Channel	Frequecy	Channel	Frequecy
0	902.62	26	909.12	51	915.37	76	921.62
1	902.87	27	909.37	52	915.62	77	921.87
2	903.12	28	909.62	53	915.87	78	922.12
3	903.37	29	909.87	54	916.12	79	922.37
4	903.62	30	910.12	55	916.37	80	922.62
5	903.87	31	910.37	56	916.62	81	922.87
6	904.12	32	910.62	57	916.87	82	923.12
7	904.37	33	910.87	58	917.12	83	923.37
8	904.62	34	911.12	59	917.37	84	923.62
9	904.87	35	911.37	60	917.62	85	923.87
10	905.12	36	911.62	61	917.87	86	924.12
11	905.37	37	911.87	62	918.12	87	924.37
12	905.62	38	912.12	63	918.37	88	924.62
13	905.87	39	912.37	64	918.62	89	924.87
14	906.12	40	912.62	65	918.87	90	925.12
15	906.37	41	912.87	66	919.12	91	925.37
16	906.62	42	913.12	67	919.37	92	925.62
17	906.87	43	913.37	68	919.62	93	925.87
18	907.12	44	913.62	69	919.87	94	926.12
19	907.37	45	913.87	70	920.12	95	926.37
20	907.62	46	914.12	71	920.37	96	926.62
21	907.87	47	914.37	72	920.62	97	926.87
22	908.12	48	914.62	73	920.87	98	927.12
23	908.37	49	914.87	74	921.12	99	927.37
24	908.62	50	915.12	75	921.37	100	927.62
25	908.87	Dark Gray = Hardware Selectable Channels					

Figure 28: NT Series Transceiver 900MHz Serial Channels

Power Supply Requirements

The transceiver incorporates a precision low-dropout regulator which allows operation over a wide input voltage range. Despite this regulator, it is still important to provide a supply that is free of noise. Power supply noise can significantly affect the module's performance, so providing a clean power supply for the module should be a high priority during design.

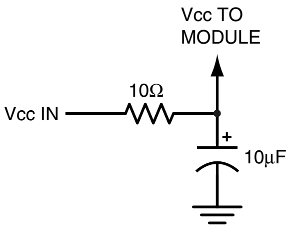

Figure 30: Supply Filter

A 10Ω resistor in series with the supply followed by a 10µF tantalum capacitor from V_{CC} to ground will help in cases where the quality of supply power is poor (Figure 30). This filter should be placed close to the module's supply lines. These values may need to be adjusted depending on the noise present on the supply line.

Antenna Considerations

The choice of antennas is a critical and often overlooked design consideration. The range, performance and legality of an RF link are critically dependent upon the antenna. While adequate antenna performance can often be obtained by trial and error methods, antenna design and matching is a complex task. Professionally designed antennas such as those from Linx (Figure 31) will help ensure maximum performance and FCC and other regulatory compliance.


Figure 31: Linx Antennas

Linx transmitter modules typically have an output power that is higher than the legal limits. This allows the designer to use an inefficient antenna such as a loop trace or helical to meet size, cost or cosmetic requirements and still achieve full legal output power for maximum range. If an efficient antenna is used, then some attenuation of the output power will likely be needed. This can easily be accomplished by using the LVL_ADJ line.

It is usually best to utilize a basic quarter-wave whip until your prototype product is operating satisfactorily. Other antennas can then be evaluated based on the cost, size and cosmetic requirements of the product. Additional details are in Application Note AN-00500 (Figure 47).

Interference Considerations

The RF spectrum is crowded and the potential for conflict with other unwanted sources of RF is very real. While all RF products are at risk from interference, its effects can be minimized by better understanding its characteristics.

Interference may come from internal or external sources. The first step is to eliminate interference from noise sources on the board. This means paying careful attention to layout, grounding, filtering and bypassing in order to eliminate all radiated and conducted interference paths. For many products, this is straightforward; however, products containing components such as switching power supplies, motors, crystals and other potential sources of noise must be approached with care. Comparing your own design with a Linx evaluation board can help to determine if and at what level design-specific interference is present.

External interference can manifest itself in a variety of ways. Low-level interference will produce noise and hashing on the output and reduce the link's overall range.

High-level interference is caused by nearby products sharing the same frequency or from near-band high-power devices. It can even come from your own products if more than one transmitter is active in the same area. It is important to remember that only one transmitter at a time can occupy a frequency, regardless of the coding of the transmitted signal. This type of interference is less common than those mentioned previously, but in severe cases it can prevent all useful function of the affected device.

Although technically not interference, multipath is also a factor to be understood. Multipath is a term used to refer to the signal cancellation effects that occur when RF waves arrive at the receiver in different phase relationships. This effect is a particularly significant factor in interior environments where objects provide many different signal reflection paths. Multipath cancellation results in lowered signal levels at the receiver and shorter useful distances for the link.

Do not route PCB traces directly under the module. There should not be any copper or traces under the module on the same layer as the module, just bare PCB. The underside of the module has traces and vias that could short or couple to traces on the product's circuit board.
The Pad Layout section shows a typical PCB footprint for the module.
A ground plane (as large and uninterrupted as possible) should be placed on a lower layer of your PC board opposite the module. This plane is essential for creating a low impedance return for ground and consistent stripline performance.

Use care in routing the RF trace between the module and the antenna or connector. Keep the trace as short as possible. Do not pass it under the module or any other component. Do not route the antenna trace on multiple PCB layers as vias will add inductance. Vias are acceptable for tying together ground layers and component grounds and should be used in multiples.

Each of the module's ground pins should have short traces tying immediately to the ground plane through a via.

Bypass caps should be low ESR ceramic types and located directly adjacent to the pin they are serving.

A 50-ohm coax should be used for connection to an external antenna.
A 50-ohm transmission line, such as a microstrip, stripline or coplanar waveguide should be used for routing RF on the PCB. The Microstrip Details section provides additional information.

In some instances, a designer may wish to encapsulate or "pot" the product. There are a wide variety of potting compounds with varying dielectric properties. Since such compounds can considerably impact RF performance and the ability to rework or service the product, it is the responsibility of the designer to evaluate and qualify the impact and suitability of such materials.

Production Guidelines

The module is housed in a hybrid SMD package that supports hand and automated assembly techniques. Since the modules contain discrete components internally, the assembly procedures are critical to ensuring the reliable function of the modules. The following procedures should be reviewed with and practiced by all assembly personnel.

Hand Assembly

Pads located on the bottom of the module are the primary mounting surface (Figure 35). 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. This allows for very quick hand soldering for prototyping and small volume production. If the recommended pad guidelines have been followed, the pads will protrude slightly past the edge of the module. Use a fine soldering tip to heat the board pad and the castellation, then introduce solder to the pad at the module's edge. The solder will wick underneath the module, providing reliable attachment. Tack one module corner first and then work around the device, taking care not to exceed the times in Figure 36.

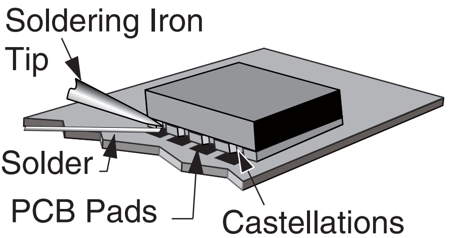

Figure 35: Soldering Technique

Warning: Pay attention to the absolute maximum solder times.

Absolute Maximum Solder Times
Hand Solder Temperature: +427ºC for 10 seconds for lead-free alloys
Reflow Oven: +255ºC max (see Figure 37)

Figure 36: Absolute Maximum Solder Times

Automated Assembly

For high-volume assembly, the modules are generally auto-placed. The modules have been designed to maintain compatibility with reflow processing techniques; however, due to their hybrid nature, certain aspects of the assembly process are far more critical than for other component types. Following are brief discussions of the three primary areas where caution must be observed.

General Antenna Rules

The following general rules should help in maximizing antenna performance.

1. Proximity to objects such as a user's hand, 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 is obtained from a ¼- or ½-wave straight whip mounted at a right angle to the ground plane (Figure 38). In many cases, this isn't desirable for practical or ergonomic reasons, thus, an alternative antenna style such as a helical, loop or patch may be utilized and the corresponding sacrifice in performance accepted.

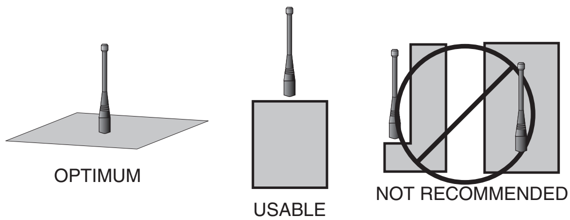

Figure 38: Ground Plane Orientation

3. If an internal antenna is to be used, keep it away from other metal components, particularly large items like transformers, batteries, PCB tracks and ground planes. In many cases, the space around the antenna is as important as the antenna itself. Objects in close proximity to the antenna can cause direct detuning, while those farther away will alter the antenna's symmetry.

4. In many antenna designs, particularly ¼-wave whips, the ground plane acts as a counterpoise, forming, in essence, a ½-wave dipole (Figure 39). For this reason, adequate ground plane area is essential. The ground plane can be a metal case or ground-fill areas on a circuit board. Ideally, it should have a surface area less than or equal to the overall length of the ¼-wave radiating element. This 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 ground

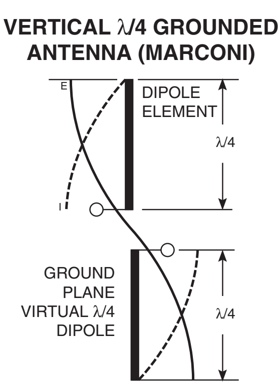

Figure 39: Dipole Antenna

Common Antenna Styles

There are hundreds of antenna styles and variations that can be employed with Linx RF modules. Following is a brief discussion of the styles most commonly utilized. Additional antenna information can be found in Linx Application Notes AN-00100, AN-00140, AN-00500 and AN-00501. Linx antennas and connectors offer outstanding performance at a low price.

Whip Style

A whip style antenna (Figure 41) provides outstanding overall performance and stability. A low-cost whip can be easily fabricated from a wire or rod, but most designers opt for the consistent 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.

Figure 41: Whip Style Antennas

The wavelength of the operational frequency determines an antenna's overall length. Since a full wavelength is often quite long, a partial ½- or ¼-wave antenna is normally employed. Its size and natural radiation resistance make it well matched to Linx modules. The proper length for a straight ¼-wave can be easily determined using the formula in Figure 42. It is also possible to reduce the overall height of the antenna by using a helical winding. This reduces the antenna's bandwidth but is a great way to minimize the antenna's physical size for compact applications. This also means that the physical appearance is not always an indicator of the antenna's frequency.

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

Figure 42:
L = length in feet of quarter-wave length
F = operating frequency in megahertz

Specialty Styles

Linx offers a wide variety of specialized antenna styles (Figure 43). Many of these styles utilize helical elements to reduce the overall antenna size while maintaining reasonable performance. A helical antenna's bandwidth is often quite narrow and the antenna can detune in proximity to other objects, so care must be exercised in layout and placement.

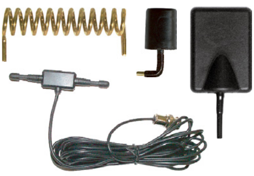

Figure 43: Specialty Style Antennas

Regulatory Considerations

> Note: Linx RF modules are designed as component devices that require external components to function. The purchaser understands that additional 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 use 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 legally market a completed product.

For information about regulatory approval, read AN-00142 on the Linx website or call Linx. Linx designs products with worldwide regulatory approval in mind.

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 (FCC). The regulations are contained in Title 47 of the United States Code of Federal Regulations (CFR). 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 FCC's website, the Government Printing Office in Washington or from your local government bookstore. Excerpts of applicable sections are included with Linx evaluation kits or may be obtained from the Linx Technologies website, www.linxtechnologies.com. In brief, these rules require that any device that intentionally radiates RF energy be approved, that is, tested for compliance and issued a unique identification number. This is a relatively painless process. Final compliance testing is performed by one of the many independent testing laboratories across the country. Many labs can also provide other certifications that the product may require at the same time, such as UL, CLASS A / B, etc. Once the completed product has passed, an ID number is issued that is to be clearly placed on each product manufactured.

Achieving a Successful 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 pre-made RF modules the design and approval process is greatly simplified. It is still important, however, to have an objective view of the steps necessary to ensure 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 in Figure 46.

In reviewing this sample design path, you may notice that Linx offers a variety of services (such as antenna design and FCC pre-qualification) 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.

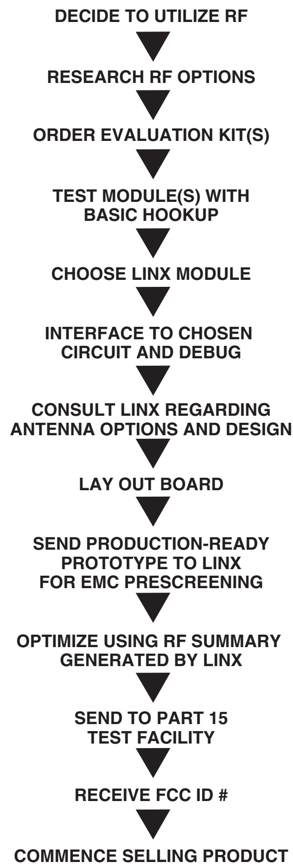

Figure 46: Typical Steps for Implementing RF

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