High Data Rate SAW-Stabilized ASK Transmitter
10Kbs to 100Kbs

The high Q SAW-Stabilized Colpitts Oscillator will achieve data rates to about 10Kbs due to the turn on time of the oscillator. The way to work around this turn on time constraint is to turn the oscillator on and then modulate the RF carrier in some manner. The easiest way to do this turns out to be ASK (Amplitude Shift Keying). There are other methods of achieving ASK modulation, but are hard to implement or hard to reproduce in manufacturing. This method however over comes the repeatability issues and does it without a current penalty.

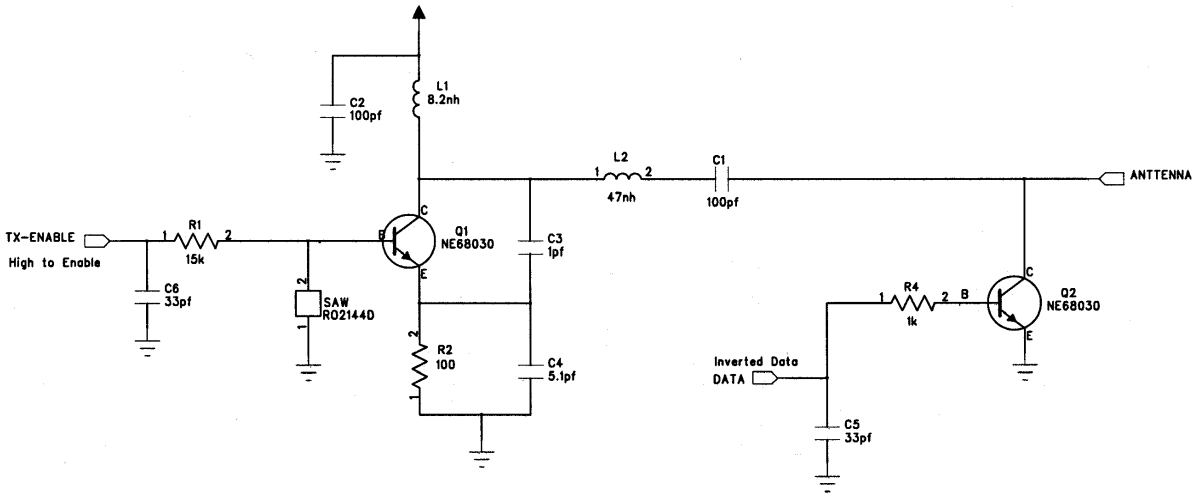
The amount of amplitude shift required to successfully transmit the desired data depends upon the application. Shifts of 1 dB or less can be detected under laboratory conditions, but such a data link might not be very reliable in the field. A reasonable compromise value of amplitude shift appears to be 6-10 dB. RFM's Receivers and Transceivers are well suited to work with this modulation depth.

One of the simplest approaches to making an ASK transmitter is to start with a known oscillator circuit and deliberately vary one or more of the quiescent parameters which results in a corresponding variation of the output RF signal power. For example, if the circuit output power is sensitive to power supply voltage variation, the supply voltage can be modulated. Similarly, if changing the oscillator current will vary the power output, the current can be modulated. To achieve ASK, it is desirable to vary a parameter that produces only desired results. While there may be many ways to modulate the output power of an oscillator circuit, some methods will produce more undesired side effects than others. For example, there may be excessive undesired frequency shift along with the desired amplitude shift. This may well be the case if the supply voltage is chosen as the modulation variable. Since the capacitances of the active device vary with applied voltage, there is likely to be a change in circuit tuning as the supply voltage varies.

By merely adding one more transistor to the output you can achieve the desired effects of an ASK transmitter with NO current penalties! The trick is to add a transistor on the oscillator RF output to squelch the RF output with data and not change the oscillator frequency, see figure 1. The one important thing is the layout and to keep the RF grounds as short as possible, see figure 2.

With this implementation the only additional current in this transmitter is the base to emitter current! In this case, the additional ASK transmitter current is merely micro amps but still achieving 10- 15db of modulation depth. One thing to remember is that the data-in must be inverted with this design. Keep in mind, oscillator start up time in a high Q SAW-Stabilized Colpitts Oscillator will be ~30us from the time Enable is taken high.

The following is the schematic (figure 1) and PCB layout for 916.5 Mhz using Murata RO2144D or RO2164D (figure 2). You may use this layout for low UHF if desired. There is a complete bill of materials (Bom) following figure 2.



TX Enable can be used for data at or below 9600 bs while "Data" is held low.
Tx Enable must be high while "Data" is used for Data rates higher than 9600bs
VCC is 3VDC

Figure 1

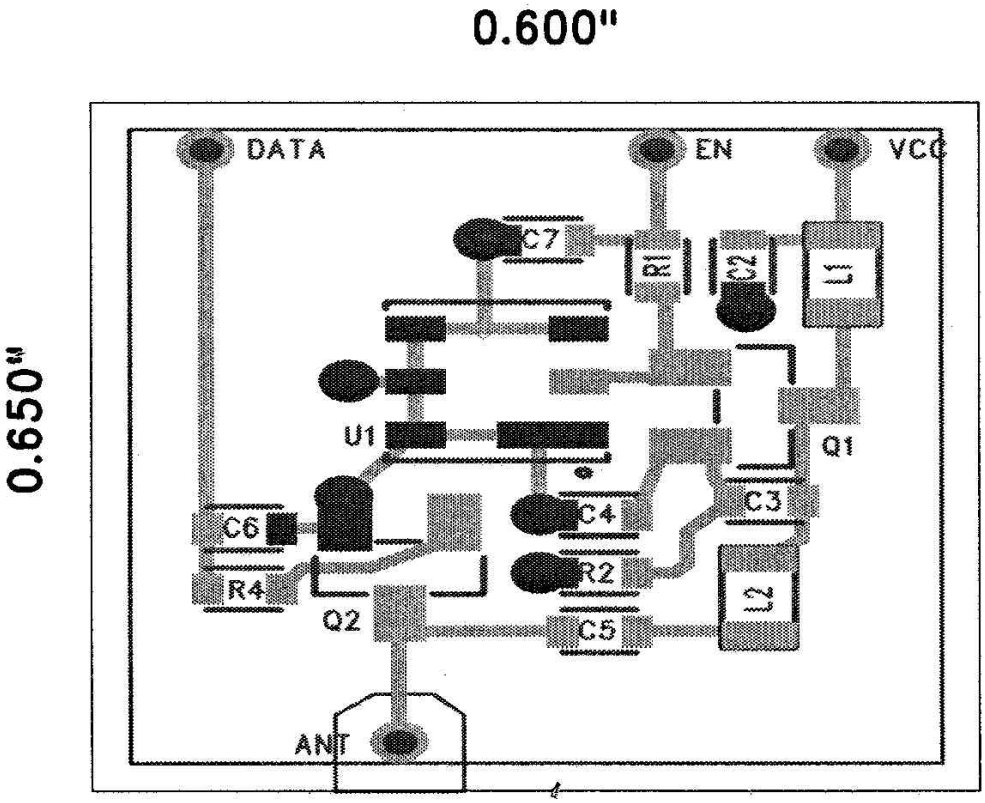


Figure 2

BOM for 916.5Mhz

Q1,2	NE68030 or equivalent
L1	8.2nh
L2	47nh
C1,2	100pf
C3	1pf
C4	5.1pf
C5,6	33pf (if needed)
R1	15k-20k
R2	100
R3	1k-10k
Saw	Murata RO2144D or RO2164D**
PCB	FR4

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If 868Mhz (RO2164), L1 may need to be increased slightly.

** Tuning Note**
A 100pf cap can be used instead of the Saw for tuning. After the oscillator is tuned, simply replace the 100pf cap with the saw and the oscillator will lock onto frequency. The frequency should be stable even while placing your hand close to the PCB. If the frequency shifts, the oscillator is to far from the Saw and must be tuned closer to the desired frequency.

** Current Note **
To reduce over all current, R2 may be increased up to 300 ohms. While increasing R1 to 20k ohms and R3 to 10k ohms.

** Antenna Tuning **
L2 and C1 can be used to tune to an unknown antenna. Care should be taken changing L2 to low and loading the oscillator. In some cases, a simple shunt cap can be added to the output to match the antenna.

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10/8/2003