NOT TUNING RFID ANTENNA

Posted by RAGHU KUMAR on Sep 28, 2012 1:52 PM
Community Member - Score: 10 points

Hi all,

ple find RFID TRF7767A schematic as attachment. By this schematic we have divided two PCB BOARDS one for main board and another for antenna board. my problem is not getting signal and antenna is not tuning. can any one provide reason why antenna is not tuning....

[Attachment: nsp2370_RFID_sch.pdf]

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note 1: I set the driving source resistance to 4 ohms (8 ohms does change things a little)

note 2: check your values for ... C27=56pF(68pF), R17=1k(6.8k), C24=47pF(12pF), C25=10pF(12pF)

note 3: your note reference C27 says 10pF..47pF, you are using 56pF =?

note 4: are you speaking of harmonics of 13.56Mhz (27.12MHz..40.68MHz...)

note 5: BEWARE THE HUGE RECEIVER SPURIOUS PEAK AT 18.43mHz (both receive channels)

note 6: observe the lower plot, it is of CURRENT in L3 when Transmitting = emitted flux
Figure 4-1 shows a sample application schematic for a parallel MCU interface.

Figure 4-1. Application Schematic – Parallel MCU Interface

An MSP430F2370 (32kB Flash, 2kB RAM) is shown in Figure 4-1. Minimum MCU requirements depend on application requirements and coding style. If using true JTAG protocol as a limited command set of a standard platform.
TI Application Schematic

note1: Set Source impedance to (4+j0)...high power?

note2: antenna coli L3 = 1.5uH

note3: component numbering as per Fig4.1

note4: OBSERVE TI ENGINEERING PRECISION IN RESONATING THESE VALUES TO 13.56MHz...not bad
TRF7960 Tuning Original Stepping C14 CIR C14=65p

This is my reference...against which all other schematic variations are compared...seem fair thing to do

Phase Detector Receiver Input

Amplitude Modulation Receiver Input

NOTE DEEP MATCH HERE

5M 9M 12M 20M

Left 150.4m 744.6m 13.56M

Right 1.8 2.2 18.51M

Delta 1.5 1.5 4.95M

Slope 331.3n 300.4n 1.00

Stepping C14 from 56pF to 80pF in 4pF steps...for your consideration on coil capacitance sensitivity

Transmitter coil current oscillating around L3

Left 47.8m 13.56M 67.9m

Right 40.9m -7.0m 18.51M

Delta 40.9m -7.0m 4.95M

Slope -1.4n 1.00
Features Common to Both TRF7960 and TRF7960A

The following features are common to both the TRF7960 and the TRF7960A:
- Pin assignments
- Terminal functions and features
- Package is a 32-pin QFN (RH: 6x-PQFP-N32) (MPCF139)
- Reference schematic/recommended layout
- ISO standards protocol support (ISO14443A/B, ISO15693)
- Basic non-ISO standard compliant protocol support (MIFARE™, Felica, HF EPC, etc.)

2 Background

The TRF7960 has limitations with ISO14443A and ISO14443A-like protocols, and these limitations require firmware workarounds. Resolving these limitations directly inside the TRF7960A is the primary reason for the introduction of the new device. New users implementing the ISO14443A protocol may want to consider using the TRF7960A first. Users who are already familiar with the workarounds and are in full production with the TRF7960 may consider migrating to the TRF7960A only when it makes logical sense for them. See Table 1 for details on the device limitations with the TRF7960 when using ISO14443A protocol.

Table 1. Device Limitations and Workarounds Using TRF7960 for ISO14443A Operations

<table>
<thead>
<tr>
<th>Item</th>
<th>Issue</th>
<th>Workaround</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ISO14443A decoder gives wrong data using certain data rates (106 kbps, 424 kbps and 848 kbps) and under certain hardware conditions</td>
<td>Switch to auxiliary receive channel and/or adjust gain</td>
<td>When the analog filter overshoot is such that the digitalizer produces a ringing edge of the subcarrier data in a small time window the decoder will produce false data. This is rare condition and is also dependent on the output impedance matching/low pass filter circuit. This condition is also dependent upon the resonant antenna characteristics.</td>
</tr>
<tr>
<td>2</td>
<td>ISO14443A anti-collision not flexible</td>
<td>Firmware must accommodate different results from 8 and 7 subcarrier pulses in a given bit period</td>
<td>Anti-collision is possible with ISO14443A, but detailed knowledge of understanding of the ISO standard is required.</td>
</tr>
<tr>
<td>3</td>
<td>TRF7960 does not support 4 bit replay (ACK, RX OFF) used by some non-ISO standard ISO14443A-like protocols</td>
<td>Direct Mode 0</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>TRF7960 does not allow frames in ISO14443A Layer 4 which would start with the same Select (SEL) code as anti-collision frames (first byte = 0x03h, 0x05h or 0x07h)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Hello Ray,

Thanks for this info as it makes more sense to me and just re-confirms my findings. I might go with a multi-layer PCB to kind of mimic the solenoid as much as possible and round my corners. I need a rectangular shape antenna so I can maximize the field coverage as the tag moves from one side of the antenna to the other. (Parallel motion) Antenna size is about 160mm x 75mm.

Problem is that when trying to maximize the number of turns of the antenna the inductance increase a lot like you stated previously. Going with a parallel or series resonance I have to keep my inductance value below around 1.5 to 2uH or else I can't match the output impedance of the 4W amplifier (60 ohm antennas). Are there other topologies I can approach so that using an inductor value higher than 2uH won't be an issue? I would like to increase the turns as much as possible. Just having 2 full turns at 150mm x 75mm is already ~1.5uH.

I would like to go series resonance but that means I have to re-calculate the 4W amplifier output impedance to be lower, closer to 10 ohms or less. If I'm not mistaken the output impedance of the amplifier from TI EVM is more or less 50 ohms? Since the low pass and band pass filters were designed to be optimized at 50 ohms.

I have also noticed that even if I completely tuned an antenna at 50ohms my RFID carrier frequency (13.56MHz) slightly distorts if I load a pure 50ohm resistor the output has minimal distortion.

I also designed a 6 turn spiral antenna at 100mm x 100mm where it is impossible to tune the circuit to 13.56MHz at 50 ohms using parallel resonance topology. Therefore I just placed a cap value to try to remove as much as possible any reactance and to my surprise this was the best result for reading distances.

Vlad