Application Note 403

Title: **Frequently Asked Questions about EM4095 Analog Front End 125 KHz RFID Base Station**

Product Family: **RFID**

Part Number: EM4095
Keywords: FAQ, Analog Front End, RFID, 125 kHz
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***Question*: How can I send data from the base station to the RFID transponder?**

Answer: The pin MOD of the EM4095 is used to modulate the 125 kHz RF field. In effect, when you apply a:

- High level on this pin, you'll block the antenna drivers and switch the electromagnetic field off.
- Low level on MOD will put the on-chip VCO in a free running mode and you'll have a 125 kHz carrier without modulation on your antenna. More explanations can be found on page 6 of the EM4095 datasheet.

***Question*: During my project development with EM4095, some questions have been raised regarding the "EM4095 calculation spreadsheet":**

1. **What does the value Rant_r, stand for? (Antenna + IC's resistance - Rad (3-9Ω) +...?)**

   Answer: The term Rant means the serial resistor of your antenna. You can calculate it by using the quality factor Q, Q = (2 * π * F0 * Lant) / Rant_r.

2. **What does Rser exactly stand for in the spreadsheet?**

   Answer: Rser is the resistance that you connect in serial mode with your antenna. This resistance limits high voltage by reducing the overall quality factor. At the same time, it limits the driver's current.

3. **What are the recommended maximum voltage values across the antenna and on the DEMOD_IN pin?**

   Answer: The maximum voltage across the antenna depends on the antenna current. We recommended a maximum current of 250mA on the output drivers.

   The input voltage at DEMOD_IN has to be limited by a capacitor divider. This signal has to meet the EM4095 common range specifications (min= Vss+0.5 & max= Vdd-0.5V).

4. **I talked with a company that manufactures antennae and asked them whether they can produce an antenna with ±1% induction tolerance. They can only assure the wire resistance tolerance as it is given by the wire manufacturer (±10%). My question is what is the acceptable resistance tolerance in the wire in order to maintain ±1% induction tolerance as recommended by EM?**

   Answer: The resistance tolerance should not be a major issue regarding the inductance tolerance of the inductor: The resistive tolerance will only affect the tolerance of the Q factor, but should not interfere on the L value. If the coil supplier can guarantee the number of turns and the wire section you should be close enough the requested inductance tolerance.

5. **In the EM4102 datasheet, Manchester code "1" is represented with "01" and code "0" is represented with "10". In our tests, we found that it is exactly the opposite. Are we missing some information?**

   Answer: For more information, please refer to application note 411 "RFID Made Easy" .

***Question*: The Q factor has been calculated as follows:**

Q=34.9=2*π*Fo*Lr/Rl

where Fo=125Khz, Lr=410uH, Rl=9Ω (Given from the coil resistance). In the application note, coil with air core usually has Q=15; however, our design, which also has an air coil, the Q factor is calculated at 34.9. Is this ok, given that EM's recommendation is to take Q value as high as possible?

Answer: A quality factor of 35 should give you improved detection distance, while affecting the data transfer rate.

The recovery time to switch from one state to another is higher due to the increased time to dampen the oscillation.

***Question*: I'm using the EM4095 demoboard. How do I have to initialise the system in Write mode? (Bitmuster, Timing). With which data rate can EM4150 Transponders be programmed?**

Answer: The data rate of the EM4150 RFID transponder depends on the chip version that you have selected. Please refer to the last page of the corresponding data sheet.

Concerning your write mode problems, it could be due to one of the following causes:

- **The transponder's main supply**. In effect, notice in EM4150 datasheet (Page 3), that the supply current/write is 15 times bigger than the supply current/read. It means that the reading distance is always bigger than the write distance. One solution will be to reduce the distance between transponder and transceiver.
- **A chip write protection**. If you lock a part or the complete EEPROM area, your chip will protect all its data. For more information you could refer to the EM4150 datasheet, fig.6
- To write on a chip's memory, you've to **wait for a LIW** (Listen Window). At this moment your transceiver must send the RM pattern and the write command. If you send your command without waiting for a LIW, the transponder won't understand the command. In write mode, you don't need to initialize anything. The chip initialization is made just after the chip's Power On Reset.

***Question*: Our customer is using the EM4095 reader demoboard and needs the specification of the serial protocol (Start/stop bit etc.) to interface a microcontroller. Is an encrypted protocol version of the EM4095 in the roadmap? Our customer would like to copy the EM4095 reader demoboard layout for its application. Which program was used (eg. Orcad. Eagle) to create the layout file?**

Answer: Concerning your first question, the serial protocol sent by the microcontroller depends on the transponder that the customer is using. Each transponder has its own protocol.

Regarding data synchronization, please use the RDY/CLK pin.

The layout file of the EM4095 reader demoboard is a standard Gerber file format. Any software able to read this format can be used to process the file (i. e. Orcad).