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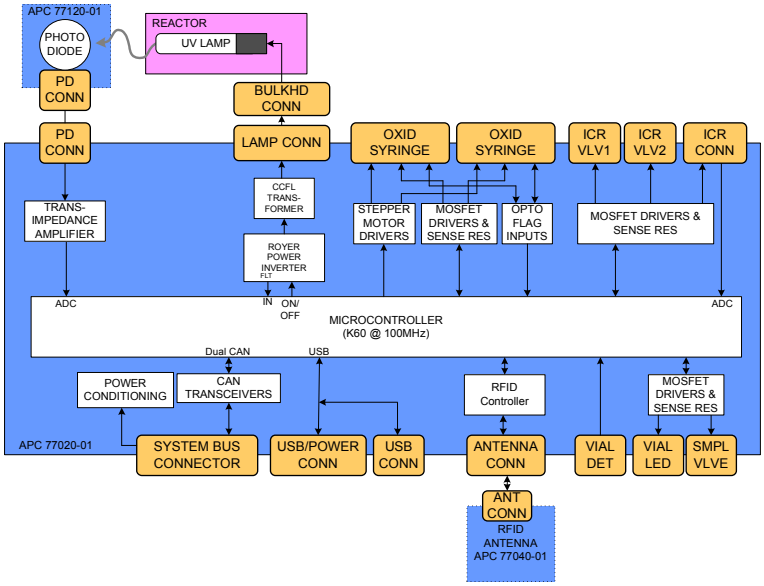
Sievers M9 Series RFID Radio Operational Description

GE Analytical Instruments has developed a circuit and antenna for its Sievers M9 series of TOC analyzers to use RFID tags for monitoring the use and viability of the reagents used in the analyzer. The RFID function is one of several functions incorporated on a single circuit board (Instrument Controller Board part number APC 77020-01).

The Instrument Controller Board incorporates a Texas Instruments TRF7960A RFID reader/writer integrated circuit to communicate with RFID tags located on the instrument's reagent bottles. The TRF7960A is used in a configuration based on a reference design from the manufacturer. The SPI interface was chosen to communicate with the TRF7960A. The ISO15693 protocol is implemented to communicate with the RFID tags.

The circuit board block diagram is shown below:

Instrument Controller Board



Following is a description of the TRF7960A excerpted from the manufacturer's datasheet:

The TRF7960A is a high-performance 13.56-MHz HF RFID reader IC comprising an integrated analog front end (AFE) and a built-in data framing engine for ISO15693, ISO14443A/B, and FeliCa. It supports data rates up to 848 kbps for ISO14443 with all framing and synchronization tasks on board (in ISO Mode, default). The TRF7960A also supports NFC Forum Tag Types 1, 2, 3, and 4 operations (as reader/writer only). This architecture enables the customer to build a complete and cost-effective yet high-performance multiprotocol HF RFID/NFC reader/writer using a low-cost microcontroller.

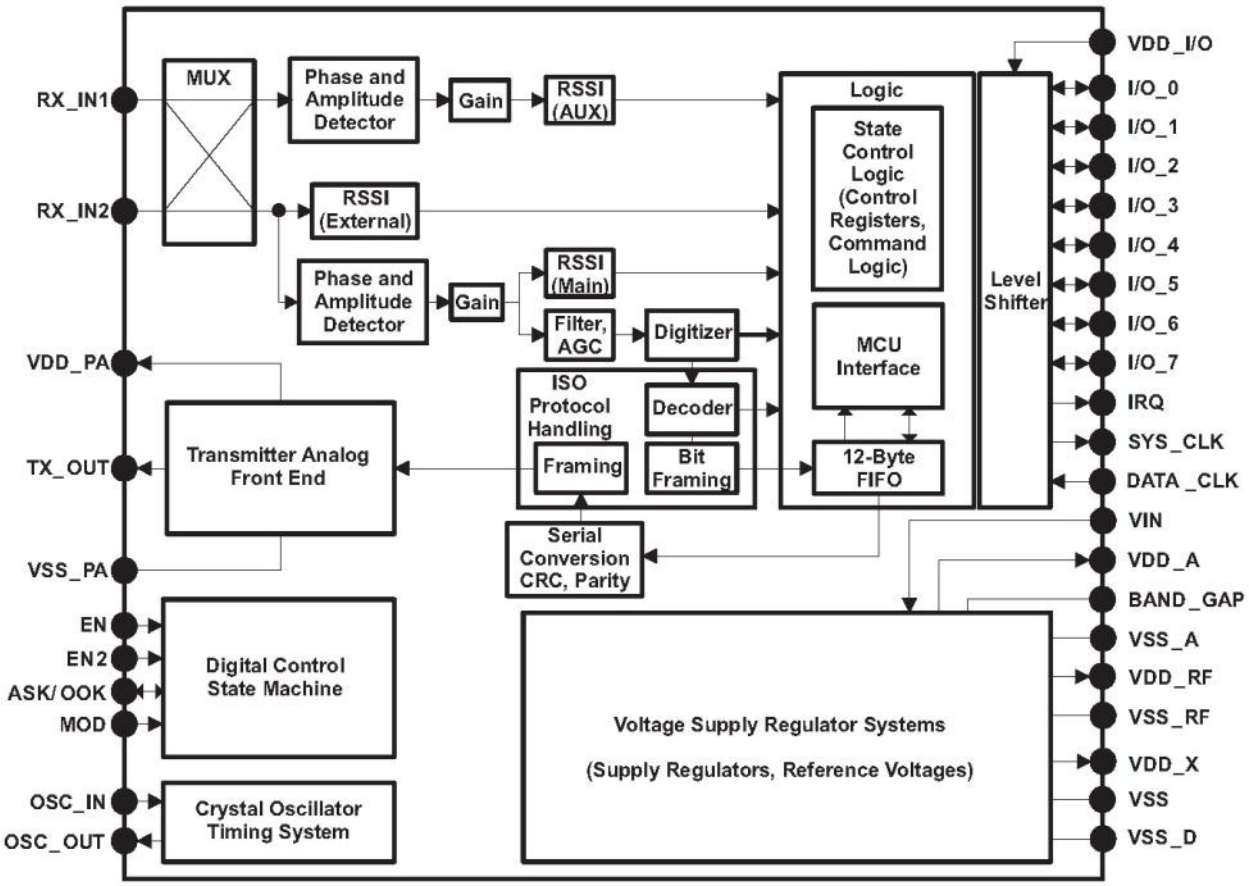


Figure 1-1. Block Diagram

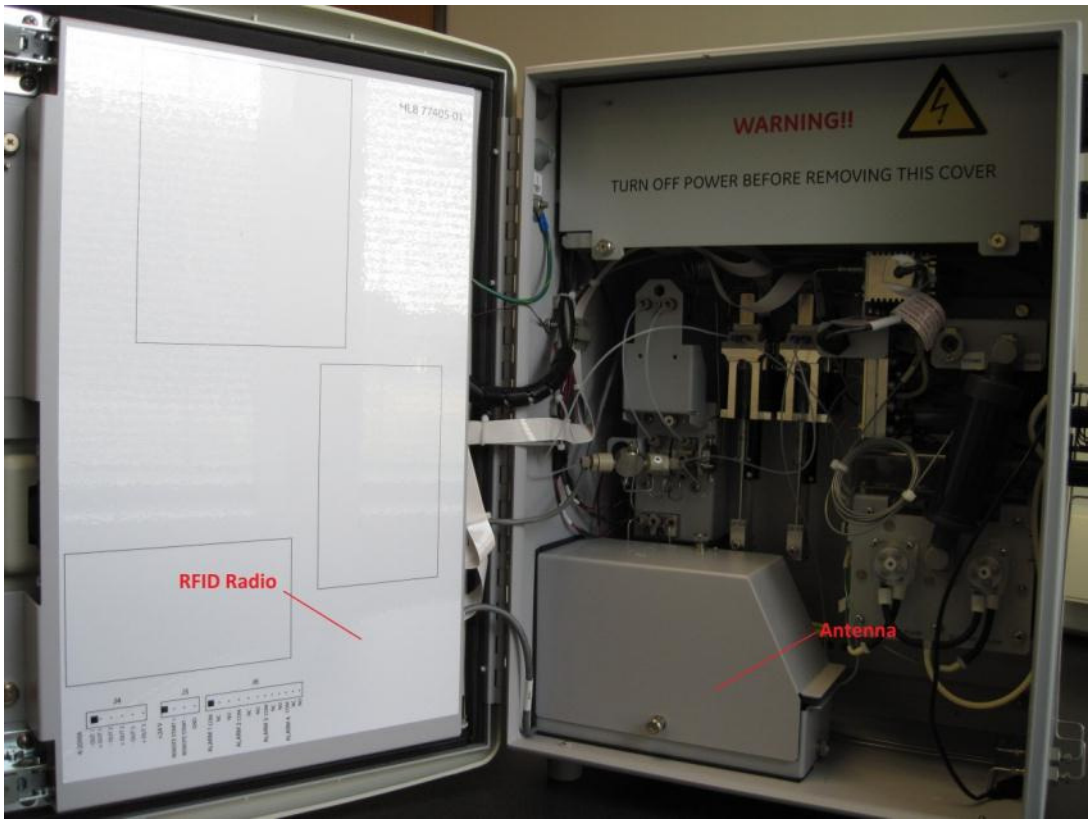
The transmitter supports OOK and ASK modulation with selectable modulation depth. The TRF7960A includes a data transmission engine that supports low-level encoding for ISO15693 and modified Miller encoding for ISO14443A/B and FeliCa. Included with the transmit data coding is the automatic generation of Start Of Frame (SOF), End Of Frame (EOF), Cyclic Redundancy Check (CRC), and parity bits. Several integrated voltage regulators ensure a proper power-supply noise rejection for the complete reader system. The built-in programmable auxiliary voltage regulator VDD_X (pin32) delivers up to 20mA to supply a microcontroller and additional external circuits within the reader system.

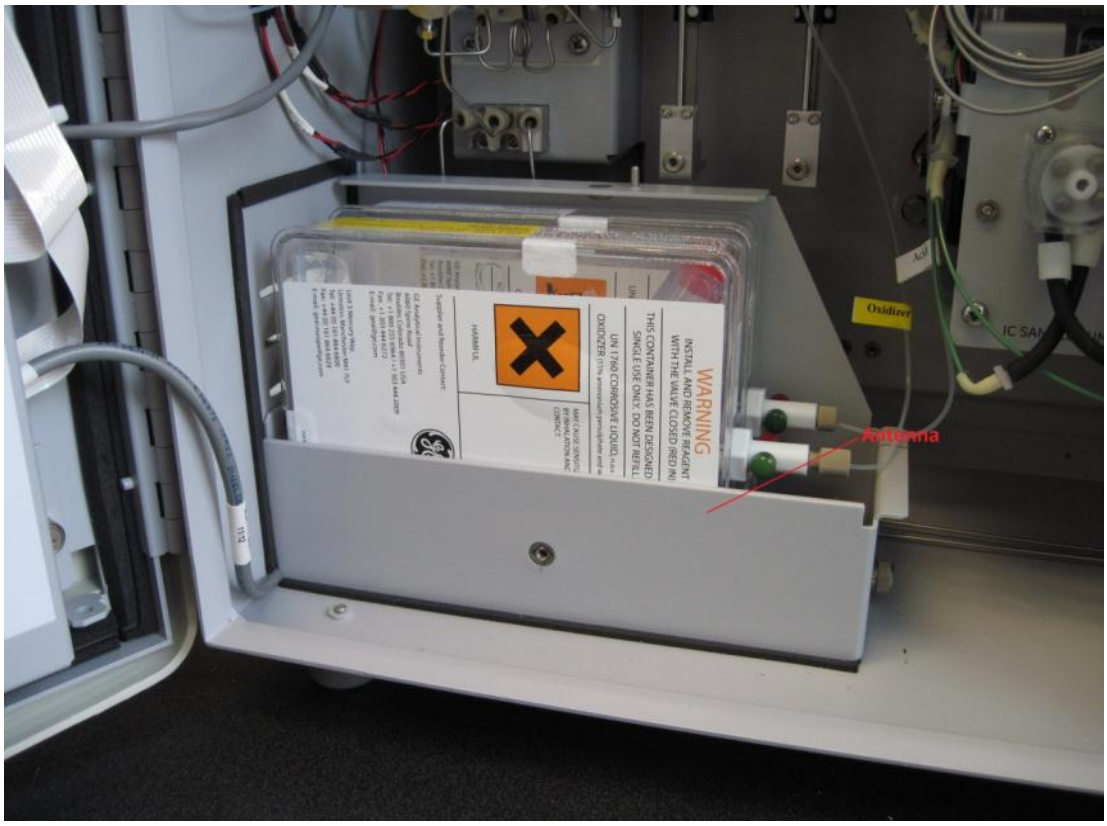
The receiver system has a dual-input receiver architecture. The receivers also include various automatic and manual gain control options. The received input bandwidth can be selected to cover a broad range of input subcarrier signal options.

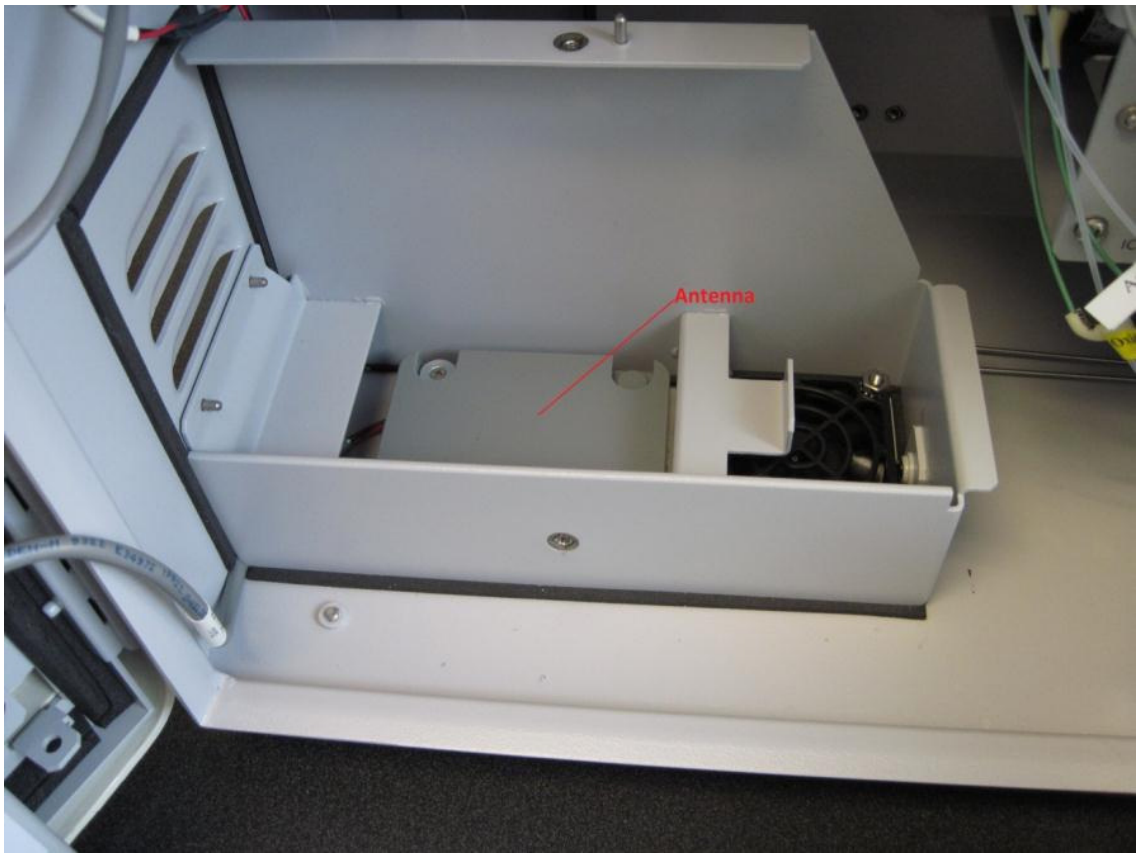
The received signal strength from transponders, ambient sources or internal levels is available via the RSSI register. The receiver output is selectable among a digitized subcarrier signal and any of the integrated subcarrier decoders. The selected subcarrier decoder delivers the data bit stream and the data clock as outputs.

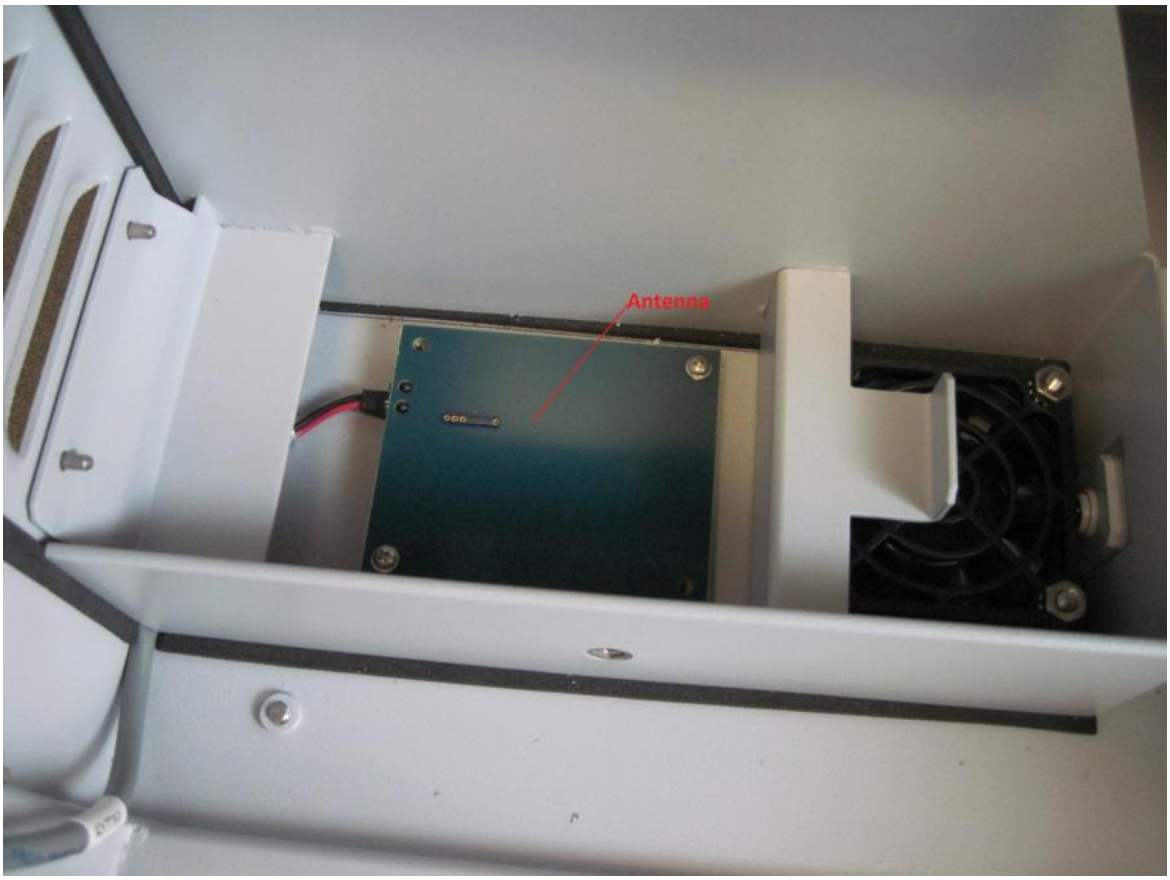
Following are pictures of the RFID Radio and Antenna locations in the three instrument configurations:

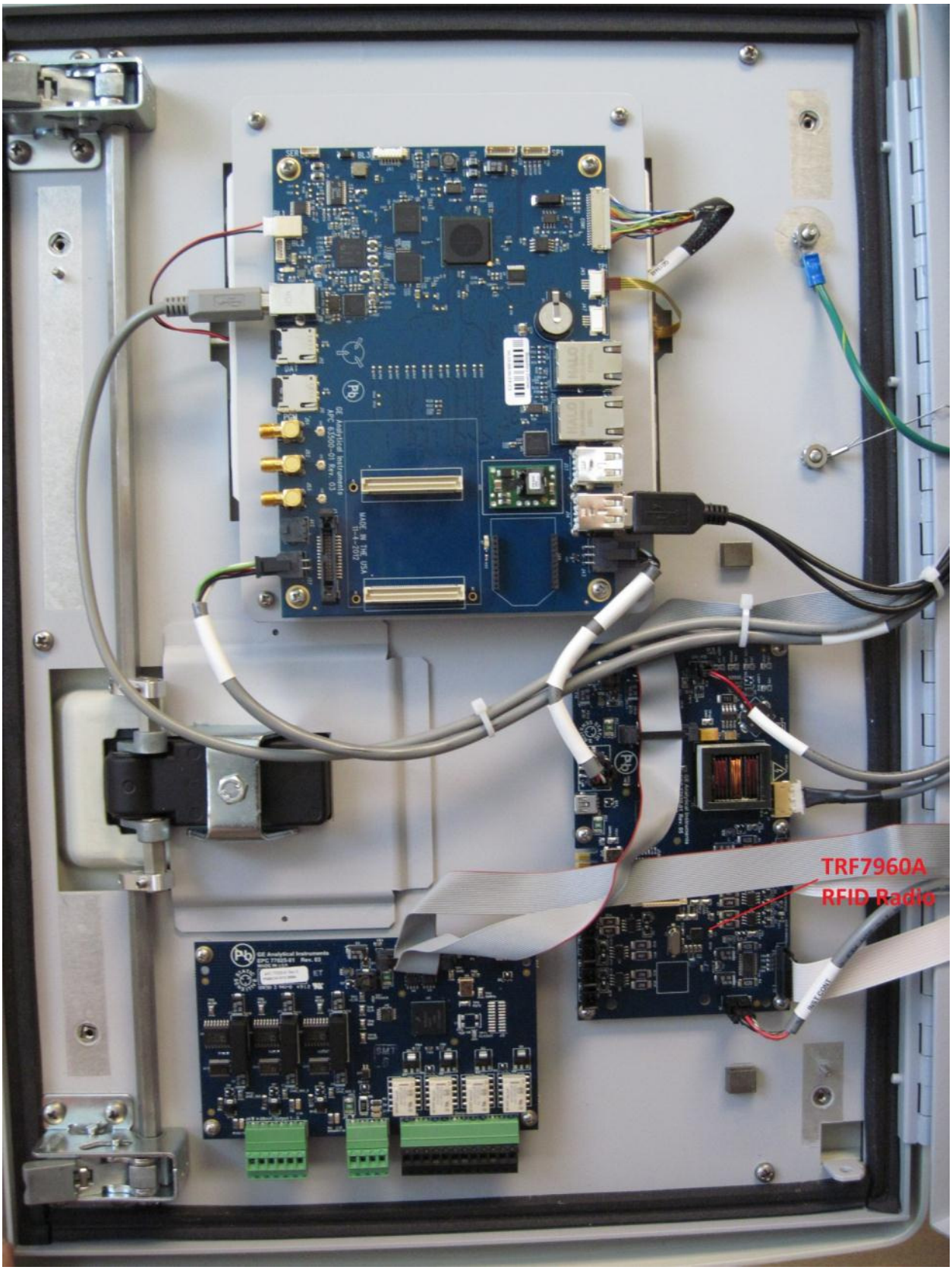
Online Model:



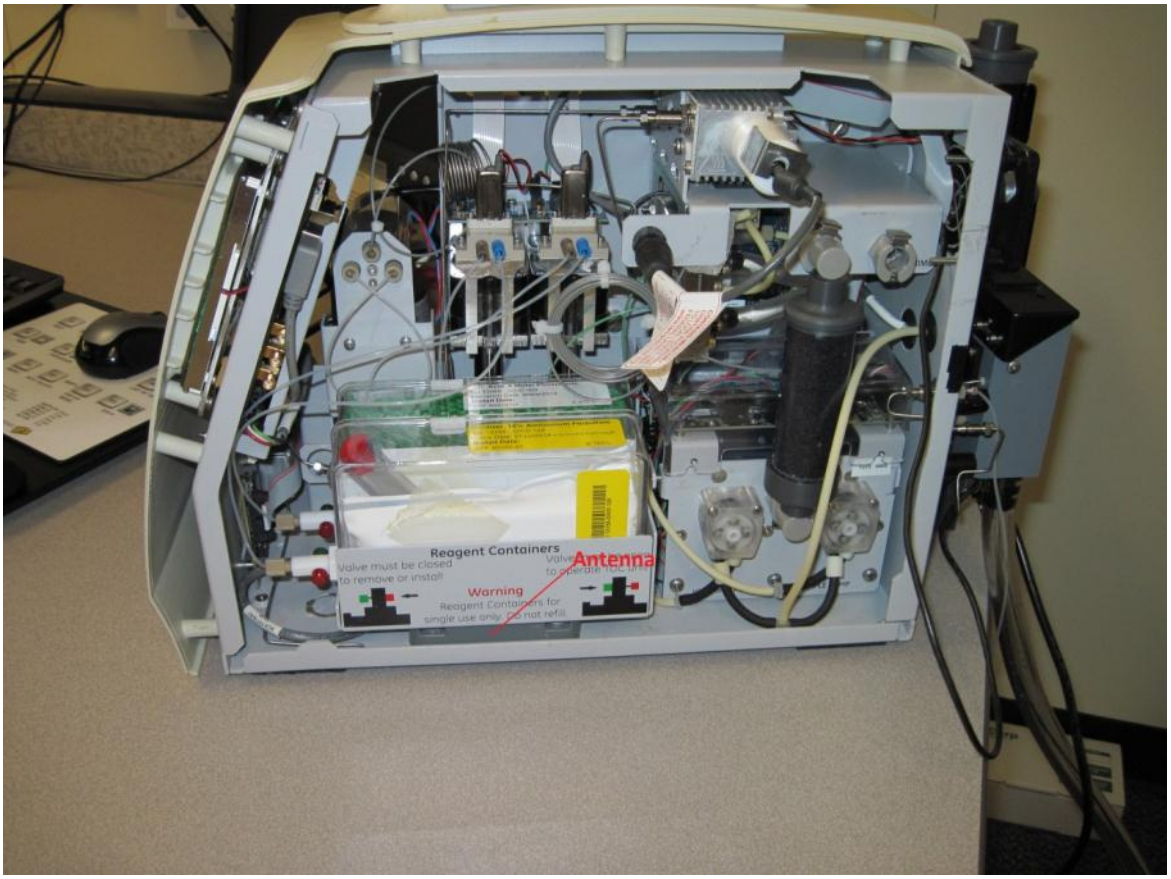

Oxidizer
WARNING
Antenna

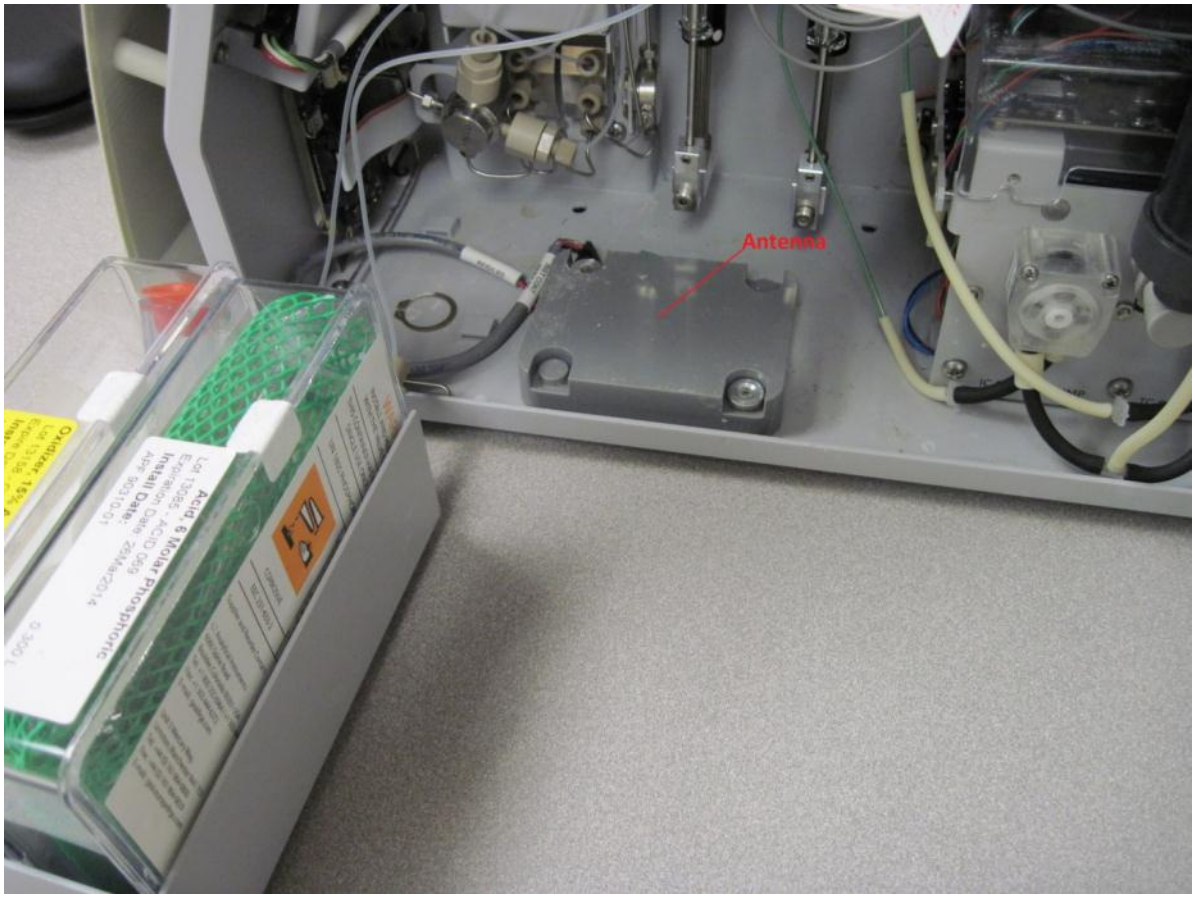

Antenna

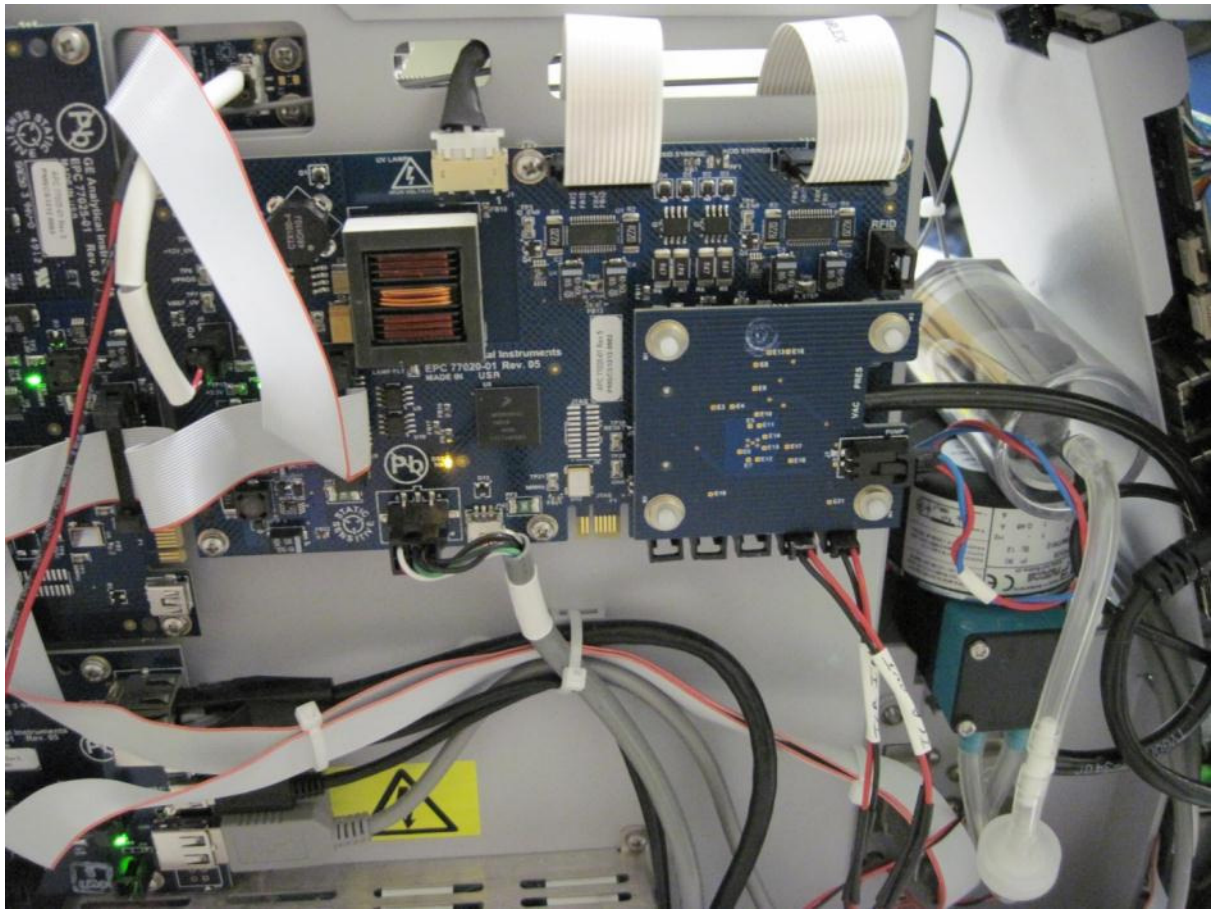

Antenna

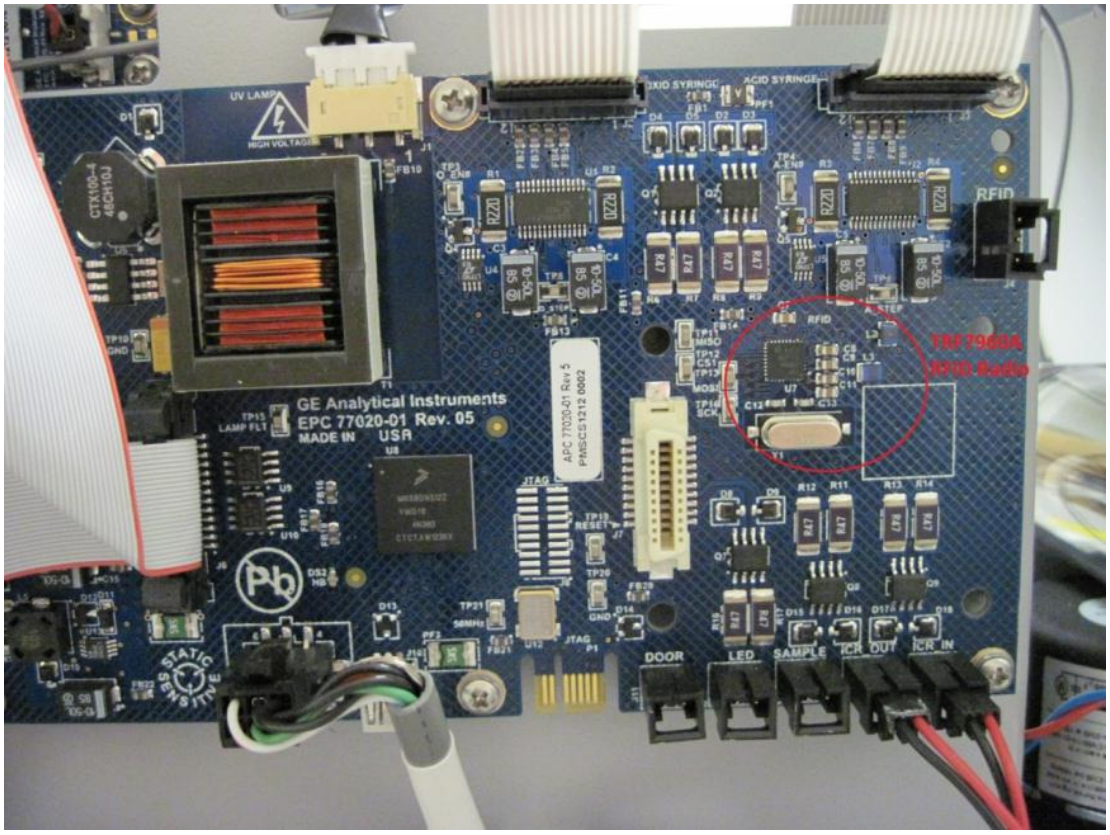

TRF7960A
RFID Radio

Portable Model:

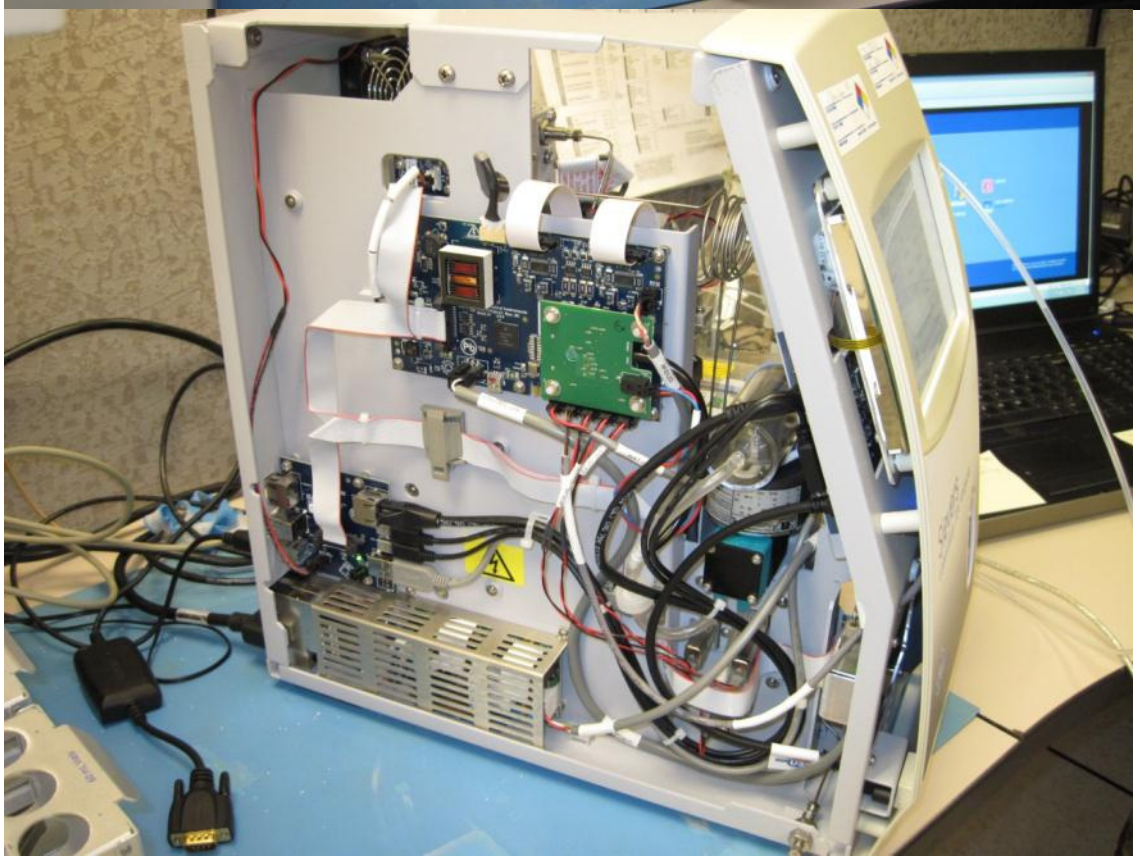


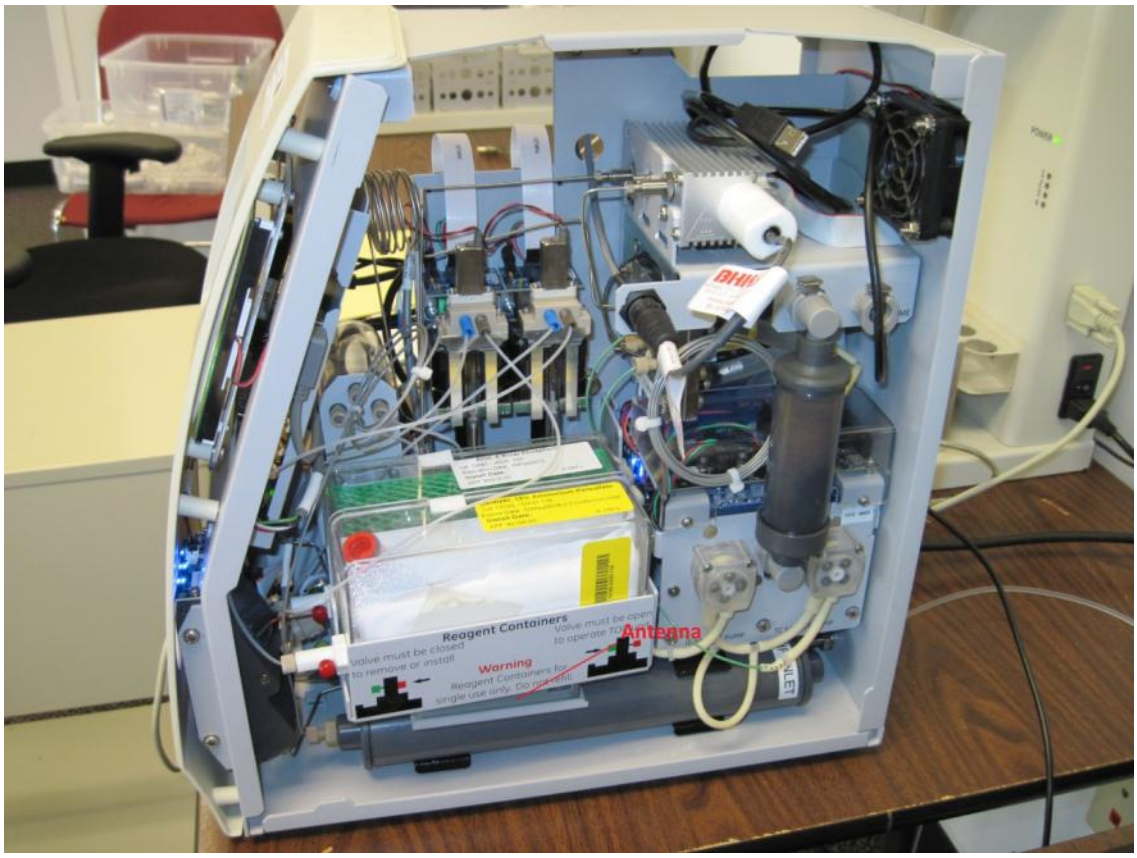

Antenna

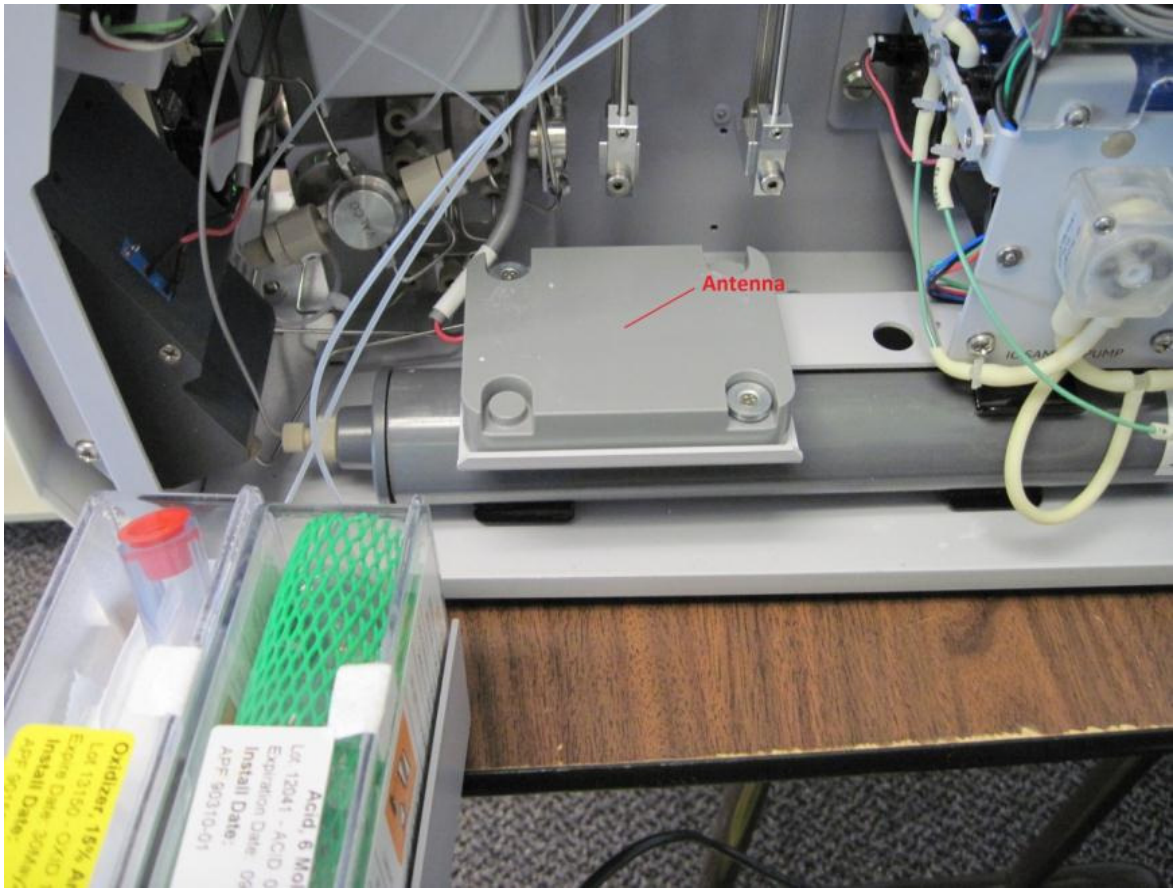



TRF7960A
RFID Radio
GE Analytical Instruments
EPC 77020-01 Rev. 05
MADE IN USA
RFID
DOOR
LED
SAMPLE
ICR OUT
ICR IN

Laboratory Model:




Reagent Containers
Valve must be closed
to remove or install
Warning
Reagent Containers for
single use only. Do not refill.
Antenna

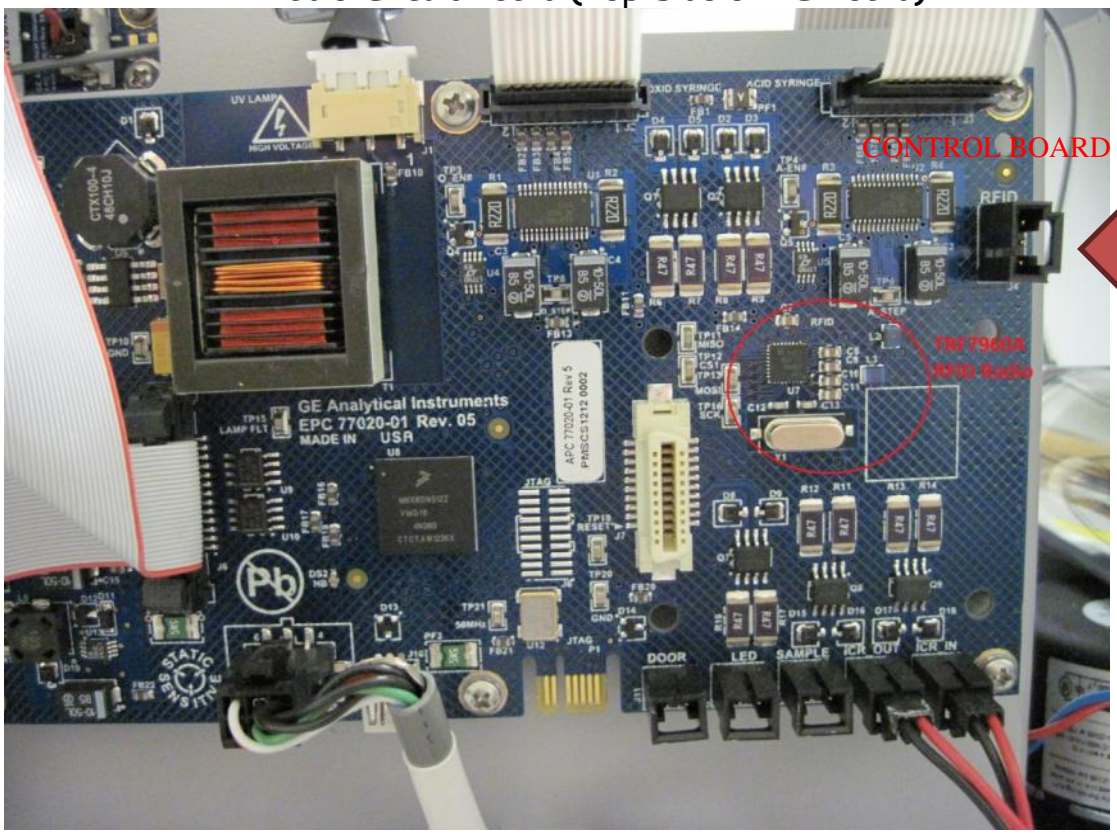

Antenna

RFID Antenna: (Top-Side of PC Board)

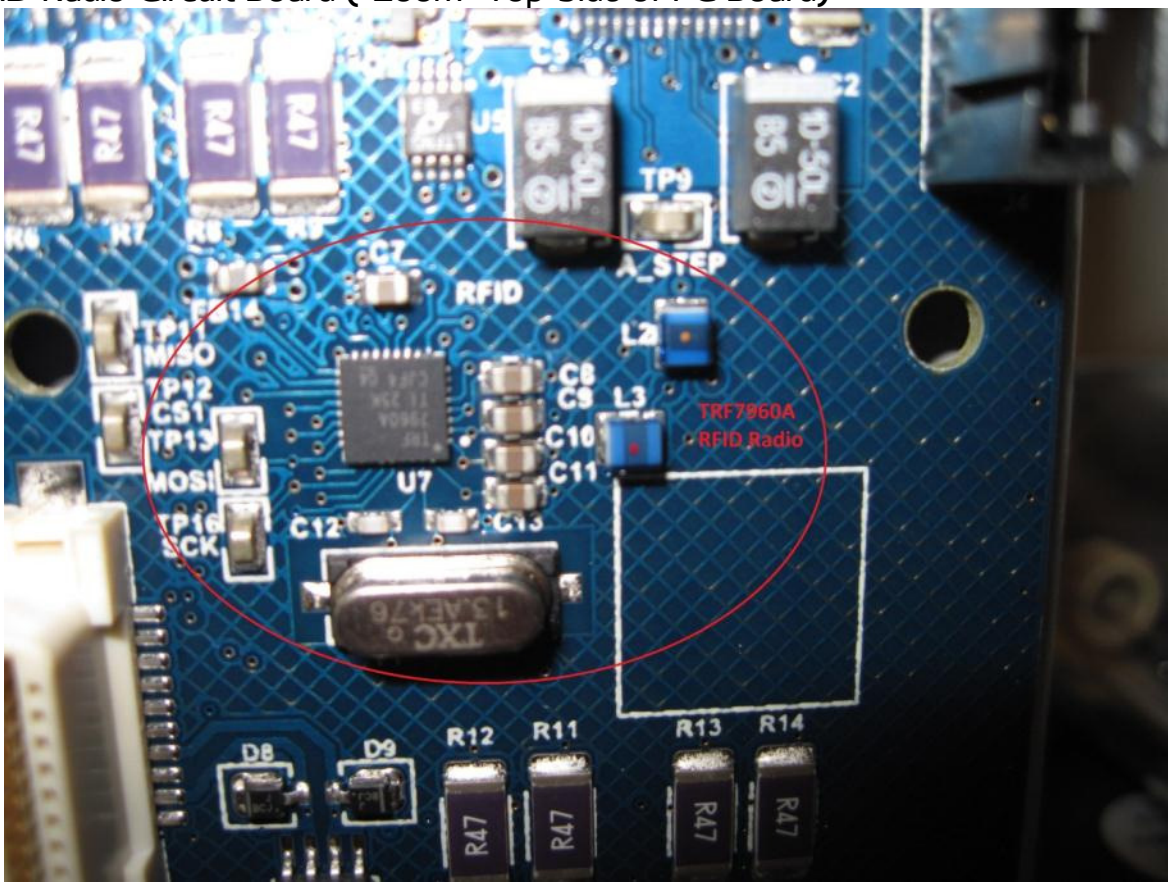
ANTENNA TO CONTROL BOARD

RFID Antenna (Bottom Side of PC Board)

RFID Radio Circuit Board (Top-Side of PC Board)



RFID Radio Circuit Board ("Zoom" Top-Side of PC Board)



Instrument Controller PCA Bottom