ViVOpay OEM S500 Technical Reference

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Product Overview

The *ViVOpay OEM S500 Vending Reader* (the Reader) is an electronic module capable of communicating with ISO 14443 Type A and Type B compatible cards and tags using Radio Frequency (RF). Data stored on the cards and tags is read by the Reader and transmitted to a host. This section provides general information about the Reader. Refer to Appendix A, B, and C for technical details.

Overview

The Reader consists of a set of printed circuit boards consisting of a Control PCA and an Antenna PCA. The two circuit boards together contain all circuitry required to communicate with between the host and RFID cards and tags. An optional Interface PCA may be connected to the Control PCA to add additional Reader to Host configurations. All circuit boards are designed to be assembled as a single module for simple mounting, or they may be separated to accommodate space constraints.

Type A & B cards and tags do not contain internal power and are activated by the RF power transmitted by the Reader. When a card or tag is positioned close to the antenna the card/tag is powered and activated, and it transmits its data as a modulated RF signal to the RF receiver. The RF receiver demodulates the signal and sends the demodulated tag data to the microcontroller. The microcontroller collects the tag data, decrypts it (if required), and transmits it to the host terminal. The LEDs and beeper indicate when a tag has been read successfully.

Features

- Read of ISO 14443 Type A & Type B cards and tags.

- ARM LPC2124 32-bit Microcontroller.

- Crypto data processing for contactless Smartcards (optional).

- RS-232 (9600, 19200, 38,400, 57,600 baud)

- Magnetic Stripe Card and Magnetic Stripe Card Reader emulation.

- Horizontal (4) or Vertical (3) LED indicators, or external LED drive.

- Beeper or external beeper drive.

- Field replaceable firmware.

- Compact packaging fits in the space of a typical Card Reader or Bill Collector.

- Expandable interface for use with custom Interface PCAs.

Reader Installation

This section describes how to install the ViVOtech *S500 OEM Vending Reader* into a vending or terminal system. Installation will vary depending upon the specific use of the product.

Physical Placement

Because the Reader relies on radio frequency communications, the reader can be susceptible to electrical interference and affected by metal materials. Therefore, for optimal performance, please observe the following important guidelines before physically locating or mounting the Reader.

- Do not position the Antenna PCB on any metal surface or within approximately 2 inches (5 cm.) in any direction of any grounded metal such as metal shelving, steel beams, or electrical conduit. When attaching the Reader to a metallic face panel frame the Antenna with a non-metallic material as shown below to ensure clearance with the metal.
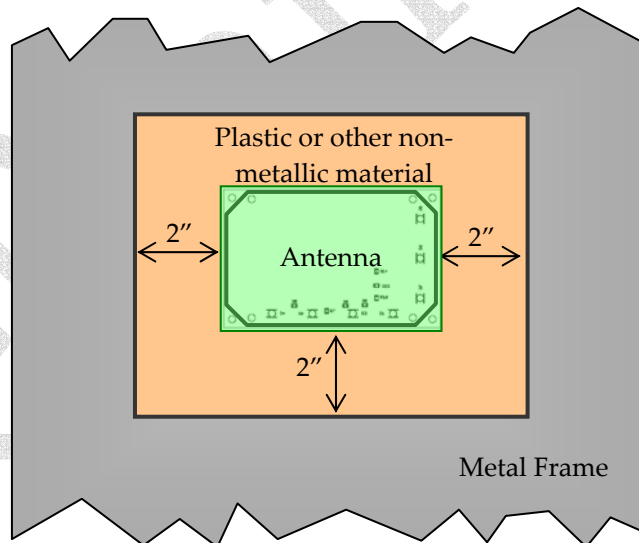
- Do not place the Reader PCB in the near vicinity of broad spectrum EMI noise sources (such as motors, pumps, power supplies, light dimmers, CRTs, etc.).

- Avoid sources of RF (such as cellular telephones, portable 2-way radios, etc.) which may reduce the ability of the reader to communicate with the tag.

- Make sure that all cables and wiring associated with the Reader is at least 6 inches (15 cm.) away from other cabling and wiring (such as AC power cables from other electrical devices, computer data cabling, telephone wiring, or wiring associated with electric-powered locking mechanisms).

Orientation of Reader PCAs

The physical design of the Reader provides for stacking of the PCAs using standoffs to form a single unit requiring a volume as small as 10 cu in. However, if space constraints or mounting configurations do not support a stacked assembly the individual PCAs may be mounted separately such as side by side. Dual mounting holes are provided on both the Antenna PCA and Control PCA to accommodate various mounting configurations. Additionally, the Antenna PCB contains both horizontal (4) and vertical (3) LED placement and may be oriented as such.
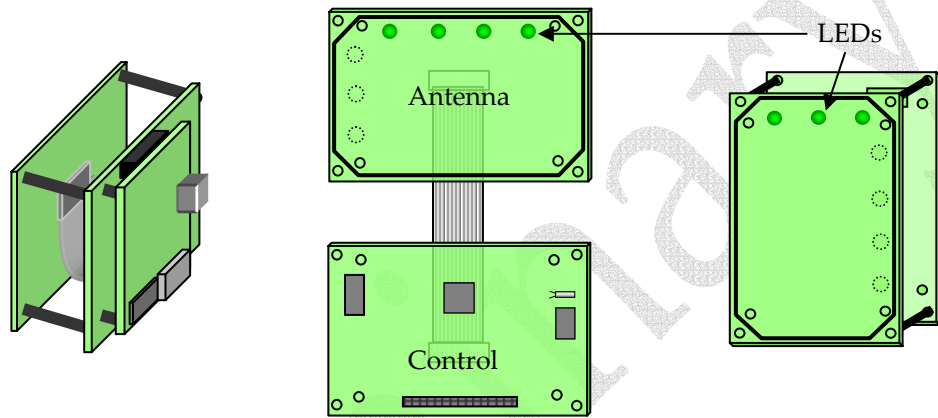

Stacked Configuration   **Horizontal/Separated**   **Vertical LED Orientation**

IMPORTANT: When configuring the Antenna and Control boards in a stacked configuration the distance between the two boards is critical with respect to the read range of cards and tags. It is recommended the boards are placed no closer than 1″ (2.54 cm.) to achieve typical read range with most cards. Some cards/tags may require more distance between the boards. Always use non-metallic standoffs to connect the boards together.

2.54 cm. min.
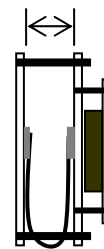
Connecting to a Host

The connection from the Reader to the Host depends upon the configuration desired. The J2 connector on the Control PCA contains all data signals along with input +5V power. For typical RS-232 communications or when the Reader performs as a single Magnetic Stripe Card Reader then connect from J2 on the Control PCA to the host. Refer to the diagram below.

If adding the Reader into a system with an existing magnetic stripe card reader then an additional optional Interface PCA is required. With this configuration the Reader

multiplexes the card reader signals from itself and the existing card reader and passes them to the host. The Reader is invisible to the host and behaves like the existing magnetic card reader. This configuration requires a second cable identical to the one connecting the existing card reader to the host. Connect the cable from the existing card reader to the J1 connector on the Interface PCA, and connect the second cable from the J2 connector to the host. The host does not need any other change. Note the Host Controller must supply +5VDC to both devices.
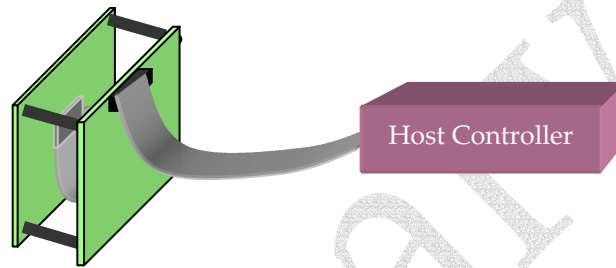
RS-232 or Single Emulated Magnetic Card Reader Connections
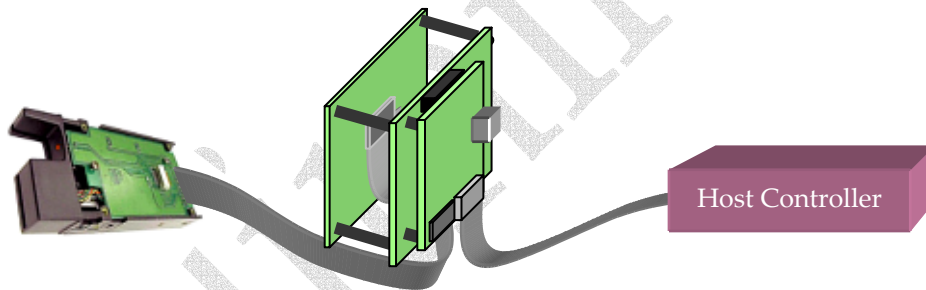
Dual Magnetic Card Reader Connections

Applying Power

The *ViVOpay OEM S500* does not have a switch to turn on/off power. After connecting the cable from the Reader to the host apply power to the host and/or power supply. The Reader will perform a power-up sequence as follows:

- All LEDs will illuminate an internal self-test is being performed.
- The default RS-232 parameters (19,200 bps, 8 data, 1 stop, no parity) will be set.
- If self-test and initialization is successful the beeper will emit two short beeps and the leftmost LED will remain illuminated indicating the Reader is ready.

With the power-up sequence successfully completed, the unit will read a valid card or tag if presented and send the data to the host.

Reader Operation

This section describes how to present cards and tags to the Reader and obtain the data read from the card.

Presenting Cards/Tags

Presenting a card or tag to the Reader so it can be read is simple. Simply bring the card/tag within a few centimeters of the antenna. It is also OK to gently touch the card on the antenna. Present a card/tag so that its maximum surface area is parallel to the antenna to obtain the best read range.

If a card/tag is read successfully the beeper will emit a single beep and, if connected, all LEDs on the Antenna PCA will illuminate (the leftmost LED remains on to indicate power, the others illuminate briefly). If a card is not read successfully no beep will occur nor will the LEDs flash.

Note that only one card/tag can be in the antenna's field at a give time. Once a card/tag has been read it must be removed from the antenna's field (about 6 in. or 15 cm.) for at least 1 second and then presented again to be read again. However, different cards/tags can be read at less than 0.5 second intervals.

After a card/tag has been read successfully the Reader will store its data in the buffer and send it to the host through the RS-232 interface, the Magnetic Card Reader interface, and through the Strip Drive interface.

RS-232 Operation

RS-232 communications use the J2 signals *RX* and *TX* to send and transmit serial data to/from the host. No flow control is used with 8 bits of data, 1 stop bit, and no parity. Baud rates are 9600, 19200 (default), 38,400, and 57,600.

The default serial mode is "Burst" which automatically (without a host command) transmits the data to the host when a valid card/tag is read. Refer to the *ViVOPay Serial Port Interface* document for details on serial packet formatting and other serial interface commands.

Magnetic Stripe Card Reader Emulation

The Reader emulates a Magnetic Stripe Card Reader by sending the data read from a card/tag out as Track 1 and Track 2 data using the *–IT1D*, *–IT1CLK*, *–IT2D*, *–IT2CLK*, and *–ICP* signals located at J2 on the Control PCA. The output signals are TTL (+5V) levels.

Data read from a card/tag is sent to the host only if valid Track 1 and/or Track 2 data is present on the card. Track 1 data is sent using the *–IT1D*, *–IT1CLK* signals; Track 2 data is sent using the *–IT2D* and *–IT2CLK* signals. Data is valid for both Track 1 and Track 2 when the *–ICP* signal is active.

The timing diagram below illustrates the timing used with Magnetic Card emulation. The timing represents an average card swiping speed of 20 cm/s.
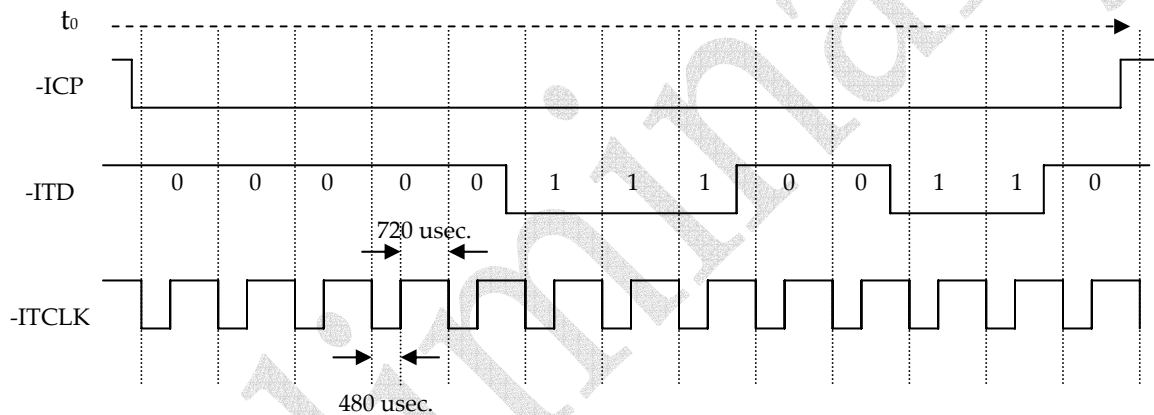
Emulated Magnetic Card Reader Timing

Magnetic Strip Card Emulation

The Reader can also output Track 1 and Track 2 magnetic stripe F2F encoded data which can be injected into the heads of a magnetic strip card reader and read by it. Low power Track 1 and Track 2 analog data is output on the J2 Strip Drive signals TRACK1 and TRACK2. High Power Strip Drive 9V differential signals are output on TRACK2+ and TRACK2-. Note that operation of the High Power Strip Drive signals requires an additional 9VDC, 500ma. power input on J2 pin 4.

Troubleshooting

There are no user-serviceable parts within the reader. If the Reader does not operate properly when installed according to instructions use the Troubleshooting Table below to help solve simple problems. If the cause of the problem still can not be determined, you may contact our Technical Support Staff at the numbers listed below. Please have the model number and serial numbers available.

Telephone Customer Support
(888) 363-3753

Troubleshooting Table

Symptom	Possible Cause	Probable Cause and Remedy
General Issues		
Reader does not seem to be powered (no LEDs lit).	Reader not powered or incorrect voltage	• Check cable connections. • Ensure power is on and correct voltage and current is present.
Reading Cards/Tags		
LEDs do not light and beeper does not sound when any card/tag is presented.	Cards/tags not presented properly	• Present card/tag closer to antenna. • Ensure valid cards/tags used.
	Power supply voltage	• Ensure voltage/current correct.
	Metal or RF interference	• Ensure no metal or RF interference is near unit.
	Wrong firmware	• Ensure correct firmware
Some cards/tags are read, but not all.	See causes above for no cards/tags read.	• See remedies above for no cards/tags read.
	Possible bad card/tag	• Check if card/tag damaged.
Can read all cards/tags, but only at very close range.	Metal or RF interference	• Ensure no metal or RF interference is near unit.
Communications		
No data received from reader or data garbled.	Faulty or incorrect cable connections	• Check and/or replace cable.
	RS-232 parameters	• Ensure host parameters correct. • Ensure no COM port conflicts.

Appendices

Appendix A - Performance Specifications

Electrical

DC Input Voltage (at reader)	5VDC +/- 10%; 50 mV P-P ripple
DC Input Current (at reader)	250 mA. (nominal) (see Note 1)
Reader Power Up Time	Less than 1 second after power applied
Note 1: Does not include Strip Drive power requirements.	

Environmental

|	
Operating Temperature	-25° C to 70° C (-13° F to 158° F)
Storage Temperature	-40° C to 85° C (-40° F to 185° F)
Cold and Heat Shock	-40° C to 85° C (-40° F to 185° F) within 2 hrs.
Operating Humidity	10% to 90% non-condensing
Operating Environment	Indoor and sealed outdoor use only

Operational

Transmitter Frequency	13.56 MHz +/- 0.01%
Transmitter Modulation	**ISO 14443-2 Type A** Rise/Fall Time: 2-3 μsec. Rise, < 1 μsec fall **ISO 14443-2 Type B** Rise/Fall Time: < 2 μsec. each; 8% - 14% ASK
Receiver Subcarrier Frequency	847.5 KHz
Receiver Subcarrier Data	**ISO 14443-2 Type A:** Modified Manchester **ISO 14443-2 Type B:** NRZ-L, BPSK
Typical Read Range	5-7 cm.

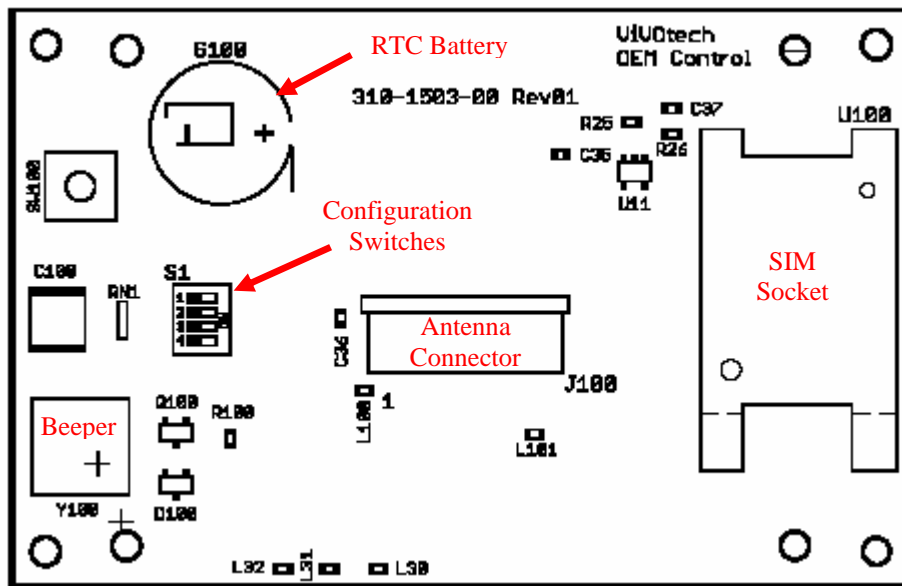# Appendix B - Component & Pin-out Detail

Control PCA - Front View

JTAG Connector (not installed on production units)
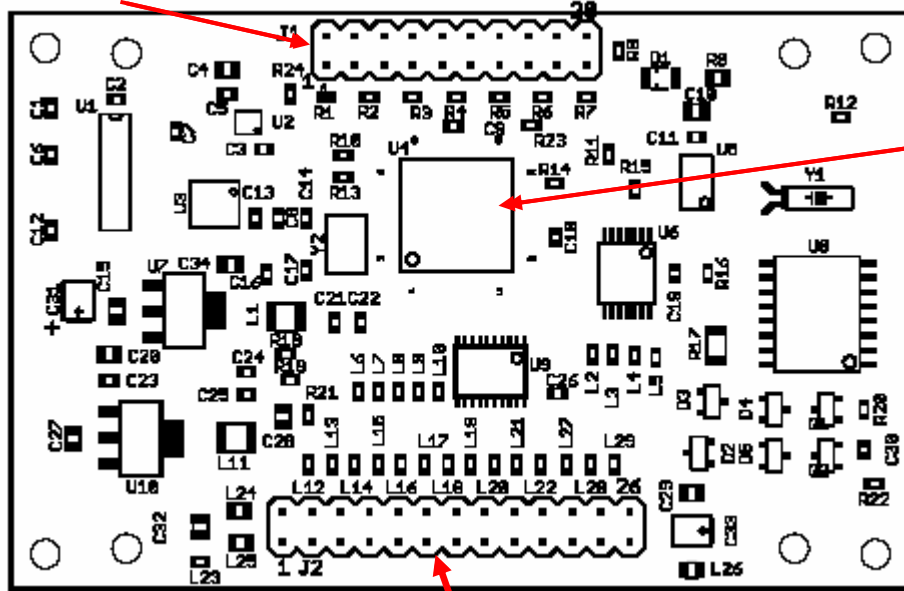
ARM Microcontroller

J2 Connector (see pinouts next page)

Control PCA - Rear View

RTC Battery

Configuration Switches

SIM Socket

Antenna Connector

Beeper

Control PCA - Pinouts

J2 – Power and Data		
Pin #	Signal	Function
1	GND	Power supply ground input
2	+5VDC	5VDC Power supply input
3	RS232RET	RS-232 Return input
4	+9VDC	9VDC power input for HI Power Strip Drive
5	TX	RS-232 Transmit signal output
6	-RST	External Reset input
7	RX	RS-232 Receive signal input
8	-ISP	Enable for firmware download input
9	GND	Power Supply Ground input
10	IT1D	Internal Track 1 Data output
11	STRIPRET	Strip Drive Return
12	-IT1CLK	Internal Track 1 Clock output
13	TRACK1	LO Power Strip Drive Track 1 output
14	IT2D	Internal Track 2 Data output
15	TRACK2	LO Power Strip Drive Track 2 output
16	-IT2CLK	Internal Track 2 Clock output
17	TRACK2+	HI Power Strip Drive Track 2 positive output
18	-ICP	Internal Card Present output
19	TRACK2-	HI Power Strip Drive Track 2 negative output
20	CPENABLE	Card Present Enable – blocks external CP output
21	XLED1	External LED #1 Drive output
22	XLED2	External LED #2 Drive output
23	XLED3	External LED #3 Drive output
24	XLED4	External LED #4 Drive output
25	GND	Power Supply Ground
26	XBUZZ	External Buzzer Drive output

J100 – Antenna Connector		
Pin #	Signal	Function
1	RF_VCC	RF +5VDC output
2	LED1	LED 1 drive output (power on LED)
3	LED2	LED 2 drive output
4	LED3	LED 3 drive output
5	LED 4	LED 4 drive output
6	RF_DIN	RF Data input
7	RF_DOUT	RF Data output
8	RF_SCK	RF Clock output
9	RF_SCS	RF Chip Enable output
10	RF_RST	RF Reset output
11	VCC	Logic +5VDC output
12	GND	Ground output

Antenna PCA - Front View
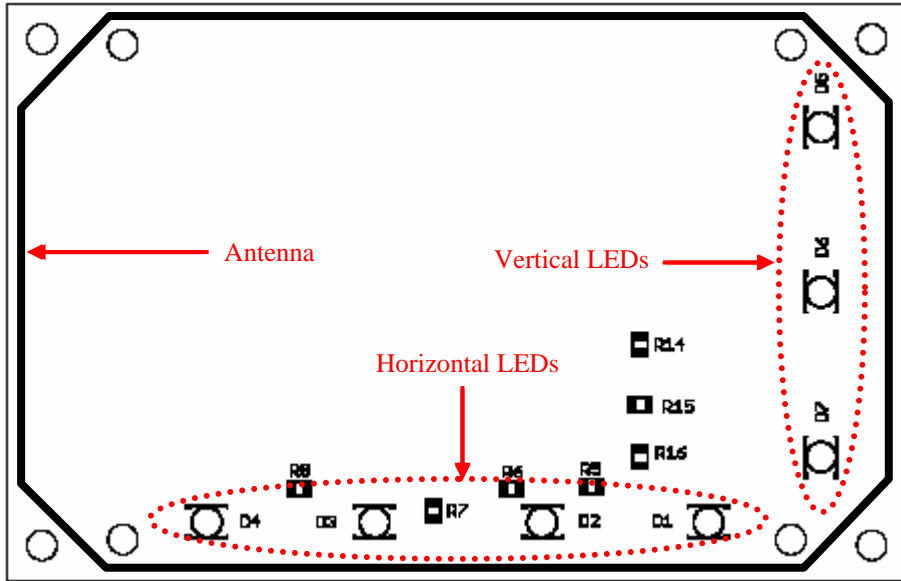
Antenna PCA - Rear View
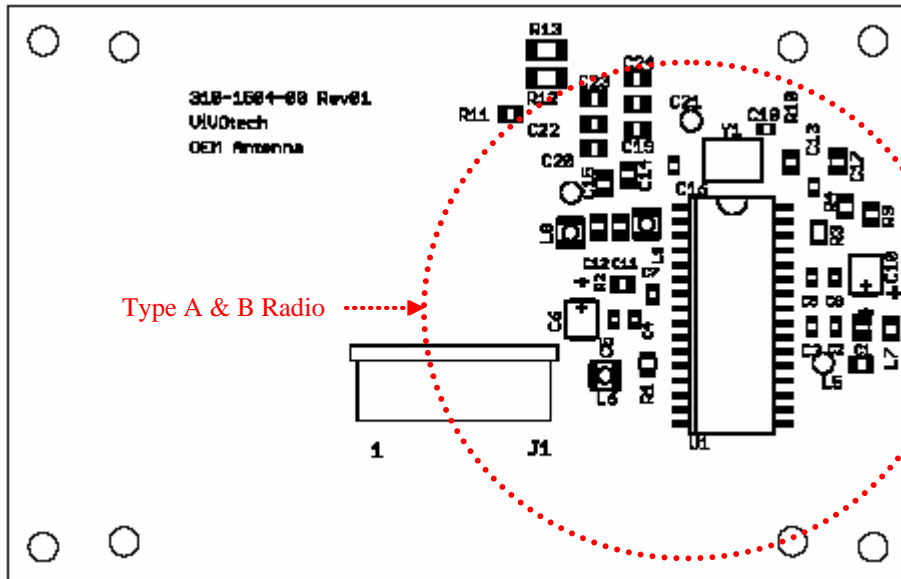
Appendix C - Dimensions and Clearances

(dimensions in millimeters)
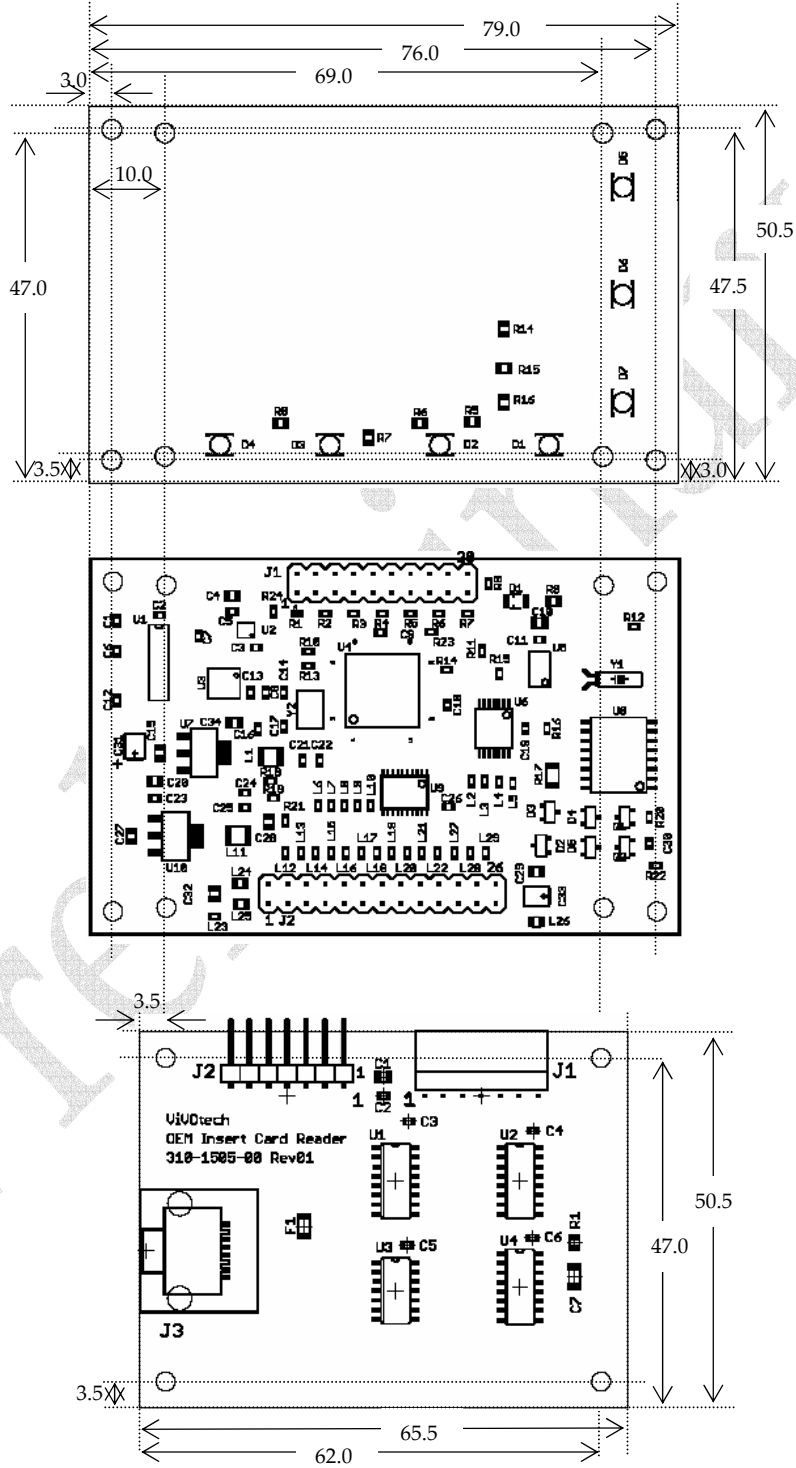
FCC Regulatory Compliance: Notices Class B Equipment: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

-- Reorient or relocate the receiving antenna.

-- Increase the separation between the equipment and receiver.

-- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

-- Consult the dealer or an experienced radio/TV technician for help. This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

WARNING:

1. The S500 hardware or software can not be replaced or modified by any third party other than VIVOtech.

2. Minimum separation distance between 2 S500 devices should be at least 2 feet.

3. The device should be mounted and seated on a non metal surface and be at least 6 inches far from any metal surface.

ViVOpay

S500

USER GUIDE

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ViVOtech Corporate Headquarters