FOD Transmitter
User's Guide

Rev 4, 07/18/2013

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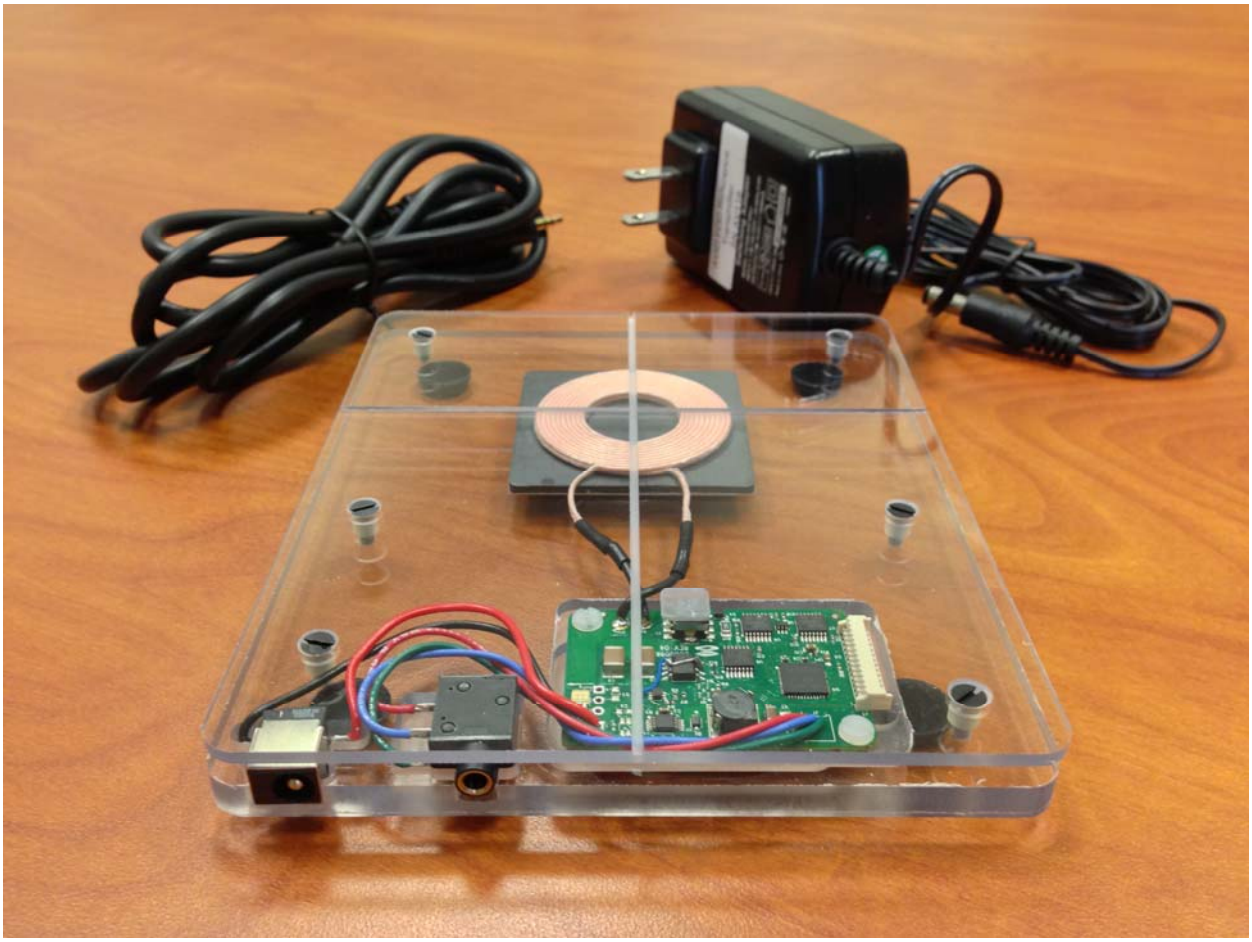
General Description

The AVID FOD (Foreign Object Detection) Transmitter is a standard WPC Qi V1.1 wireless power transmitter that has been calibrated and characterized to accurately measure and report transmitted power information. The FOD TX device is useful for testing all Qi receiver devices, for characterizing and optimizing V1.1 (and newer) receiver device FOD functionality and for doing mobile device Qi pre-compliance testing.

Here are the main features of the FOD Transmitter:

- Fully functional V1.1 Qi Transmitter
- Uses A10 TX coil as specified for TPT#2 in the WPC Part 3 spec
- Factory calibrated and characterized using AudioDev FOD calibrator unit
- Accurately measures and reports PPT (transmitted power) values per WPC V1.1 spec
- USB/serial port for displaying transmitted power, received power, power loss, and other parameters
- Decodes and displays 16-bit PPR values sent by AVID FOD Receiver and AVID V1.1 Receiver Simulator (proprietary packet 0x28)
- Programmable PPT offset, FOD threshold, and FOD shutdown timeout values (serial port commands)
- Can be run in open loop (fixed frequency) mode to help characterize receivers and to verify transmitted power accuracy using the AudioDev calibrator system
- Can be run in signal strength mode to help center align mobile devices (max signal strength)



AVID FOD Transmitter, DC Adapter, and FTDI USB Serial Cable

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Basic Setup and Operation

To operate the FOD Transmitter, first connect power by plugging in the 19.0V DC adapter supplied with the unit. The 5.0 mm DC barrel connector on the power supply cord mates with a DC jack on the transmitter. **To maintain good power measurement accuracy, always use the supplied DC adapter to power the transmitter and make sure the transmitter is not operated on or near metal desks or other large metal objects during testing.**

When the FOD transmitter is first powered up, the LED status indicator on the transmitter circuit board will flash once but will normally remain off until a receiver device is placed on the transmitter.

Any Qi compliant receiver (mobile device) should operate normally on this transmitter (base station). Place the receiver device on top of the transmitter coil platform. There are cross hairs etched into the coil platform to indicate the center position of the transmitter coil for rough device alignment. When a Qi compliant receiver is placed on the transmitter and power transfer begins, the status LED will light up solid amber color to indicate valid operation. If an error condition such as FOD fault occurs at power up or during power transfer, the status LED will change to solid red.

USB Serial Interface

The FOD Transmitter has a serial interface that facilitates communication with any USB-enabled computer and provides continuous status information as well as a means to program various features of the transmitter. Connect the included FTDI USB to Serial cable to your computer's USB port and into the serial connector on the transmitter. Earlier FOD transmitters used a 6-pin header for the serial port. Newer units use a audio jack connector for the serial port. For the 6-pin header, verify that pin 1 of both header connectors (indicated by an arrow on each connector housing) are aligned properly. The wires on the FOD transmitter and the FTDI cable may not match colors.

You may need to install drivers to use the FTDI USB serial adaptor cable. These drivers can be downloaded from the FTDI website at:

http://www.ftdichip.com/Drivers/VCP.htm

Once the drivers are installed the FTDI cable will be recognized as a serial COM port on your PC when connected. To determine which COM port number the FTDI cable is assigned to, open the Windows device manager under control panel.

Any terminal emulation program or other application program that provides user access to the assigned COM port can be used to display FOD Transmitter data and to send commands to the FOD Transmitter. A free terminal emulator program called TeraTerm can be downloaded at:

http://logmett.com/index.php?/download/tera-term-477-freeware.html

Select the COM port and use the following settings when establishing the serial connection:

Baud Rate	19200
Data	8 bits
Parity	None
Stop	1 bit
Flow Control	None

Serial Port Display

If the USB cable is already plugged in and the terminal program is running when the FOD Transmitter is powered up, the transmitter will display a "splash screen" that includes basic information such as the part name and the software revision. This is a good indication that the transmitter is operating properly and the USB serial interface is configured and working properly.

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After displaying the splash screen, the FOD Transmitter remains in an idle pinging state until a receiver is placed on the transmitter and detected. When a valid Qi receiver device is detected, the receiver signal strength and ID information are displayed. If the receiver is a V1.0 device, the transmitter will display operating frequency and input power information each time a rectified power packet message is sent by the receiver. If the receiver is a V1.1 (or newer) FOD capable device, the FOD Transmitter will additionally output FOD status information (PPT, PPR and Ploss) each time a received power packet message is sent by the receiver. Below are examples of the information displayed by the FOD Transmitter during power up and during normal operation while charging a V1.1 mobile device:

Splash Screen sent by FOD Transmitter	**/// Event**
AVID_FOD_REFERENCE_TRANSMITTER Built: Dec 14 2012 13:52:42 v1.1.2349 NumberOfChannels: 1 NumberOfCoilsPerChannel: 1	/// FOD TX powered up

Receiver ID information sent by FOD Transmitter	**/// Event**
Device Detected Signal Strength: 137 Ping Frequency: 175000Hz ID: v1.1, Mfg: 0x0017, Id: 0x00000162 EXTID: 0x00B9BA090101C308 Holdoff Time: 5ms, Max Pwr: 5000mW FOD Window: 64ms, FOD Offset: 12ms	/// V1.1 RX placed on FOD TX

Operating and FOD information sent by FOD Transmitter	**/// Event**
Frequency: 128901Hz Vin: 19238mV, Iin: 150mA, Pinput: 2899mW, Icoil: 940mA PPT Offset: +0mW, PPT (w/ offset): +2758mW, FOD Threshold: 300mW PPR (8-bit): +2890mW, PLoss: -132mW, FOD: PASS PPR (16-bit): +2926mW, PLoss: -168mW, FOD: PASS	/// 1st received power packet
Frequency: 128901Hz Vin: 19238mV, Iin: 150mA, Pinput: 2899mW, Icoil: 940mA PPT Offset: +0mW, PPT (w/ offset): +2758mW, FOD Threshold: 300mW PPR (8-bit): +2890mW, PLoss: -132mW, FOD: PASS PPR (16-bit): +2926mW, PLoss: -168mW, FOD: PASS	/// 2nd received power packet
Frequency: 128901Hz Vin: 19238mV, Iin: 150mA, Pinput: 2896mW, Icoil: 940mA PPT Offset: +0mW, PPT (w/ offset): +2755mW, FOD Threshold: 300mW PPR (8-bit): +2890mW, PLoss: -135mW, FOD: PASS PPR (16-bit): +2926mW, PLoss: -171mW, FOD: PASS	/// 3rd received power packet
CEP Timeout	/// RX removed from FOD TX

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Below are brief descriptions of each parameter that is displayed by the FOD Transmitter:

Message	Description
Device Detected	Displayed when valid Qi receiver device is placed on the transmitter
Signal Strength	Signal strength packet sent by the receiver. If Position Mode is enabled, this message is repeatedly displayed while a receiver is present.
Ping Frequency	Transmitter frequency used for device ID ping
ID	Identification packet sent by the receiver. WPC version, mfg code, and mfg ID
EXTID	Extended identification packet (optionally sent by the receiver)
Holdoff Time	Power control hold off time sent by the receiver
Max Pwr	Maximum power the receiver device supports
FOD Window	Window size for power sample averaging
FOD Offset	Start time offset for power sampling window
Frequency	Transmitter operating frequency during power transfer
Vin	Transmitter DC input voltage measured (millivolts)
Iin	Transmitter DC input current measured (milliamps)
Pinput	Transmitter DC power input calculated (milliwatts)
Icoil	Transmitter coil current measured (milliamps)
PPT Offset	Transmitter transmitted power (PPT) offset value – programmable
PPT (w/ offset)	Transmitter transmitted power value measured with PPT offset added
FOD Threshold [1]	Transmitter FOD power loss threshold setting – programmable
PPR (8-bit)	V1.1 received power packet value sent by receiver
PPR (16-bit)	AVID Receiver high resolution received power packet value Only displayed if AVID V1.1 or FOD RX device is used
PLoss	Power loss calculated = PPT – PPR
FOD [1]	Pass if Ploss <= FOD Threshold. Fail if Ploss > FOD Threshold

1 By default even when Ploss exceeds the FOD threshold setting, the AVID FOD Transmitter will continue power transfer for testing purposes. Use the shutdown, fault count, and fault timeout commands (see below) to terminate power transfer after the FOD threshold is exceeded.

Note: If a WPC V1.0 receiver device is placed on the FOD Transmitter, FOD (power loss) information will not be calculated or displayed.

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Serial Port Commands

The AVID FOD Transmitter supports several serial port commands for configuration and testing. Below is a list of the commands, their syntax, descriptions, and default values. Type the command in the terminal emulator window and **press the <enter> key to execute the command**. Commands can be executed at any time, but AVID recommends only entering commands while the transmitter is idle.

Below are brief descriptions of the commands supported by the FOD Transmitter:

Command	Syntax	Description	Default
Set FOD Threshold [1]	FT<value>	<value> = integer between 0 and 30000 mW	300
Set PPT Offset [2]	PO<value>	<value> = integer between -1000 and 1000 mW	0
Shutdown on FOD Fault after Timeout [3]	SD<value>	<value> = 0 to continue power after FOD timeout <value> = 1 to shut down power after FOD timeout	0
FOD Fault Count [3]	FC<value>	<value> = integer between 1 and 255	1
FOD Fault Timeout [3]	TO<value>	<value> = integer between 1 and 120,000 mSec	20,000
Position Mode [4]	PM<value>	<value> = 0 to disable position mode <value> = 1 to enable position mode	0
Closed Loop Mode	CL	Run transmitter in normal closed loop mode	On
Open Loop Mode at fixed frequency [5]	OL<value>	<value> = 110000 to 205000 Hz (coil on @ freq) <value> = 0 (coil off)	Off
Display FOD	F	Display FOD parameters while running open loop	

1. Ploss calculated greater than FOD threshold for Fault Count number of received power packets in a row will trigger the FOD fault timeout period. The status LED will turn red as long as the FOD fault persists or until the receiver is removed.
2. PPT offset is added to the calculated transmitted power value. PPT offsets are used for testing purposes such as when emulating TPT#2 for mobile device pre-compliance testing.
3. If shutdown is enabled and Ploss is greater than the FOD threshold for Fault Count number of received power packets in a row, the transmitter will trigger the FOD fault timeout, stop power transfer after the FOD timeout period, and remain idle for 5 minutes or until the receiver is removed.
4. When position mode is enabled, the FOD transmitter will run in a loop displaying the signal strength packet, resetting, and starting again so the user can find and mark the center position (highest signal strength location) for their mobile device. This is very useful for doing Qi pre-compliance testing.
5. In open loop mode the FOD transmitter runs at a fixed operating frequency and ignores RX communication packets. No control loop takes place. **!!!!! CAUTION: Operating the FOD Transmitter in open loop mode at lower frequencies can create an over voltage condition and damage receiver devices. AVID recommends starting at higher operating frequencies and working toward lower frequencies until the desired power level is achieved.**

V1.1 Receiver (Mobile Device) FOD Characterization

V1.1 QI compliant receiver (mobile device) product developers can use the AVID FOD Transmitter tool to characterize and adjust their mobile device power loss measurements. The FOD Transmitter has been calibrated and characterized using the AudioDev WPC approved V1.1 calibration tool and the results show good correlation between transmitted power and received power to within about 20 mW accuracy over a 0.25 W to 6.0 W load range.

AVID recommends characterizing mobile devices over their full operating load (or charging) range and at several spatial orientations such as the 5 positions called out for Qi compliance testing (centered 0,0), (0,5), (0,-5), (5,0) and (-5,0) mm.

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To use the AVID FOD Transmitter to characterize a mobile device, use the following procedure:

1) Connect the FOD Transmitter USB serial cable to a computer and run a terminal emulator program to display transmitter status messages (see above).
2) Place the mobile device under test on the FOD transmitter center aligned and record the received power and transmitted power values displayed in the terminal emulator window.
3) Repeat the steps above at several load points spanning the full power range of the mobile device and at several spatial positions.
4) Record/plot the received vs. the transmitted power values for each load point and position tested. The data should show good correlation. If the difference (Ploss) is greater than 350 mW at any of the load points, make adjustments to the mobile device to improve the received power values. Also, if the Ploss values displayed by the FOD Transmitter are positive when the mobile device is center aligned (see below), the mobile device should be adjusted to increase its received power values (over report more).

Note: Mobile devices should over report their received power values to account for tolerances and spatial movements (see pre-compliance test definitions below). Because of this over-reporting, when the mobile device is center aligned with no additional z-gap and no foreign objects present, the power loss values displayed by the FOD Transmitter should be zero or negative. If the power loss numbers are positive under these conditions, the mobile device should be adjusted to over report by higher values.

Mobile Device Qi Pre-Compliance Testing

V1.1 QI compliant receiver (mobile device) product developers can use the AVID FOD Transmitter tool to run Part 3 FOD pre-compliance tests.

Annex D of WPC low power specification Part 1 specifies that a mobile device shall over report its received power (PPR) by a maximum of 250 mW. During the WPC interim extension period in effect until May 2014, the over reporting allowance has been increased to 350 mW.

(PPR – 250 mW) <= PPM <= PPR

(PPR – 350 mW) <= PPM <= PPR ** Use this equation during the WPC interim period

PPM is the actual received power determined by the mobile device by measuring its load power and adding estimated parasitic power losses. Mobile devices should over report their received power (the received power packet value sent to the transmitter) to account for tolerances and spatial variations in the system. The minimum a mobile device should over report is 2x the transmitted power accuracy tolerance of the test transmitter (TPT#2) or 40 mW. In summary, mobile devices should send received power values to the transmitter (PPR) to meet the following requirements:

(PPM+40) <= PPR <= (PPM+250)

(PPM+40) <= PPR <= (PPM+350) ** Use this equation during the WPC interim period

The FOD received power test in Part 3 checks to make sure a mobile device accurately reports its received power values. To do this, the mobile device is placed on the test transmitter (TPT#2) in five different positions (cross shape with 5.0 mm offsets from center aligned) and the transmitted power and received power values are recorder and compared. Per WPC Part 3, TPT#2 is required to over report its transmitted power by 20 mW to account for accuracy tolerance. At all 5 positions (0,0), (0,5), (0,-5), (5,0) and (-5,0) the received power values must meet the following conditions to pass compliance:

(PPR – 250 mW) <= PPT <= PPR

(PPR – 350 mW) <= PPT <= PPR ** Use this equation during the WPC interim period

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Mobile Device Received Power Compliance Testing

To use the AVID FOD Transmitter to emulate TPT#2 and run FOD pre-compliance tests on a mobile device, use the following procedure:

1) Connect the USB serial cable to a computer and run a terminal emulator program to display status messages from the FOD Transmitter and to allow command entry (see above).
2) After the FOD Transmitter "splash screen" message is displayed, enter the following serial command to program the transmitter PPT offset to +20 mW.

   PO20 <enter>

3) Run Position Mode by entering the following serial command:

   PM1 <enter>

4) Place the mobile device on the transmitter and reposition the mobile device until the signal strength values being displayed are maximized. This is the center aligned position (0,0).
5) Exit Position Mode by entering the following serial command:

   PM0 <enter>

6) Record PPT (w/ offset) and PPR values displayed in the terminal emulator window for 1 minute. The number of values recorded will vary depending on how often the mobile device sends received power packets, but the number should range from about 12 to 20 sets of values.
7) Check the PPR values to make sure they meet the condition (PPR – 350 mW) <= PPT <= PPR
8) Repeat steps 6 and 7 for positions (0,5), (0,-5), (5,0) and (-5,0) mm.

If the mobile device meets the requirements above for reporting its received power, then the product will likely pass the FOD compliance tests at an approved Qi compliance lab. If the mobile device does not meet the requirements for reported received power, make adjustments to the mobile device received power values per the receiver IC manufacturer's recommendations and repeat the tests above.

It is also recommended to run the above tests at various receiver loads (or device charged states) to make sure the mobile device reports accurate received power values over its full load range.

NOTE: AVID FOD TOOLS ARE NOT APPROVED FOR FINAL QI COMPLIANCE TESTING. THEY ARE DESIGNED TO BE USED FOR DEVELOPMENT AND PRE-COMPLIANCE TESTING BY CUSTOMERS DESIGNING and PROTOTYPING WPC V1.1 WIRELESS POWER PRODUCTS.

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FOD Receiver
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General Description

The AVID FOD (Foreign Object Detection) Receiver is a standard WPC V1.1 wireless power receiver (5.0W) that has been calibrated and characterized to accurately measure and report received power information. This RX device is useful for testing transmitter devices, for characterizing and optimizing V1.1 (and newer) transmitter's FOD functionality, and for doing Qi pre-compliance testing.

Here are the main features of the AVID FOD Receiver:

- Fully functional V1.1 Qi Receiver
- Uses "naked" RX coil as specified for TPR#5 in the WPC Part 3 spec. Coil is isolated from the electronics and mounted in plastic frame that mates with the foreign object holders for good alignment
- Factory calibrated and characterized using calibrated AVID FOD Transmitter
- Accurately measures and reports PPR (received power) values per WPC V1.1 spec
- Calculates and sends additional 16-bit PPR values (proprietary packet 0x28) that can be decoded and reported using the AVID FOD Transmitter and AVID V1.1 Sniffer
- Programmable PPR offset and internal loads (DIP switch settings)
- External load board (included) has minimum, maximum and in-between loads for testing and characterizing transmitters and for running Qi pre-compliance tests
- Supports internal loads up to 2.0 Watts in 0.25 Watt increments (DIP switch settings) and external loads up to 5.0 Watts maximum.

AVID FOD Receiver, Top View

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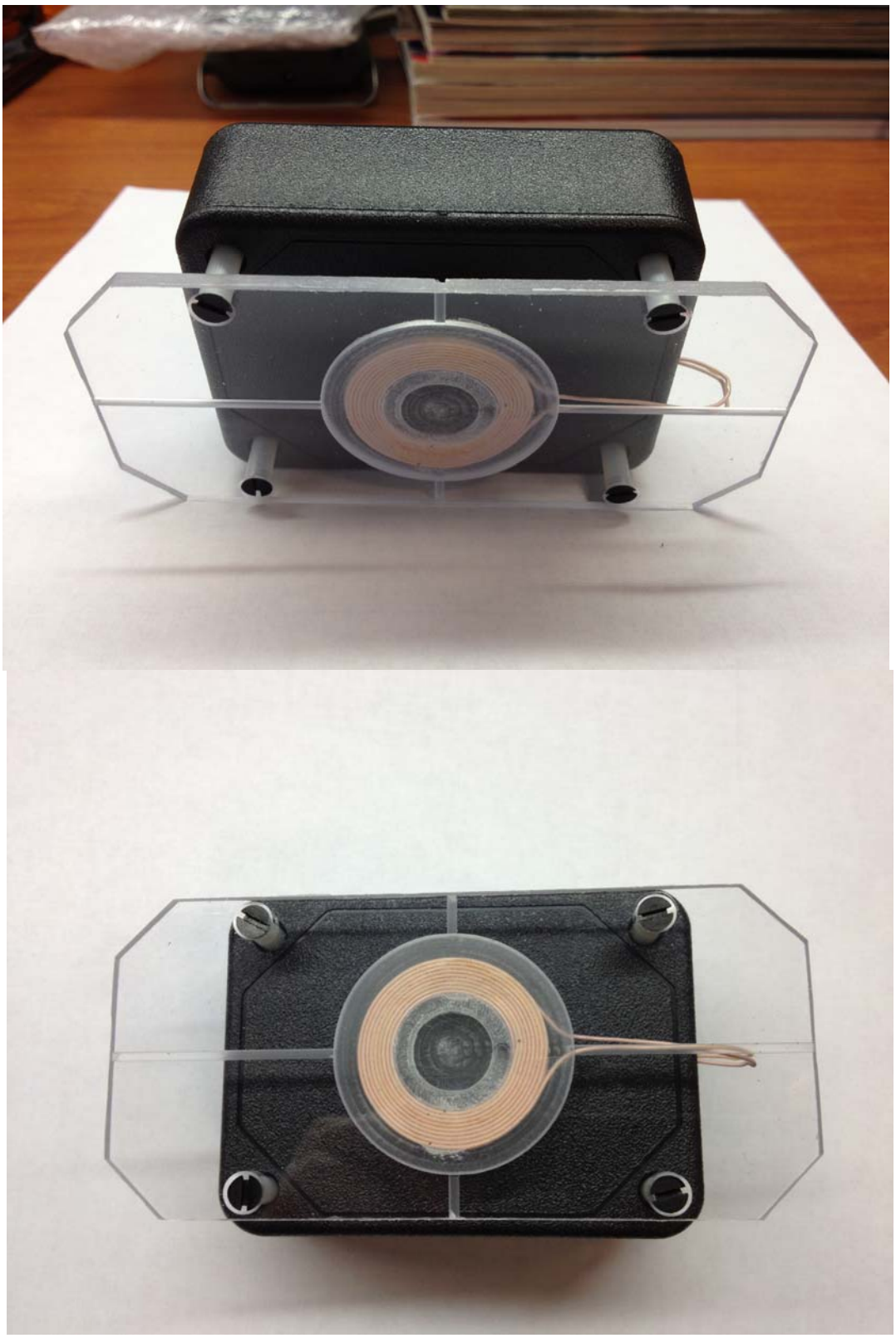

AVID FOD Receiver, Side and Bottom Views

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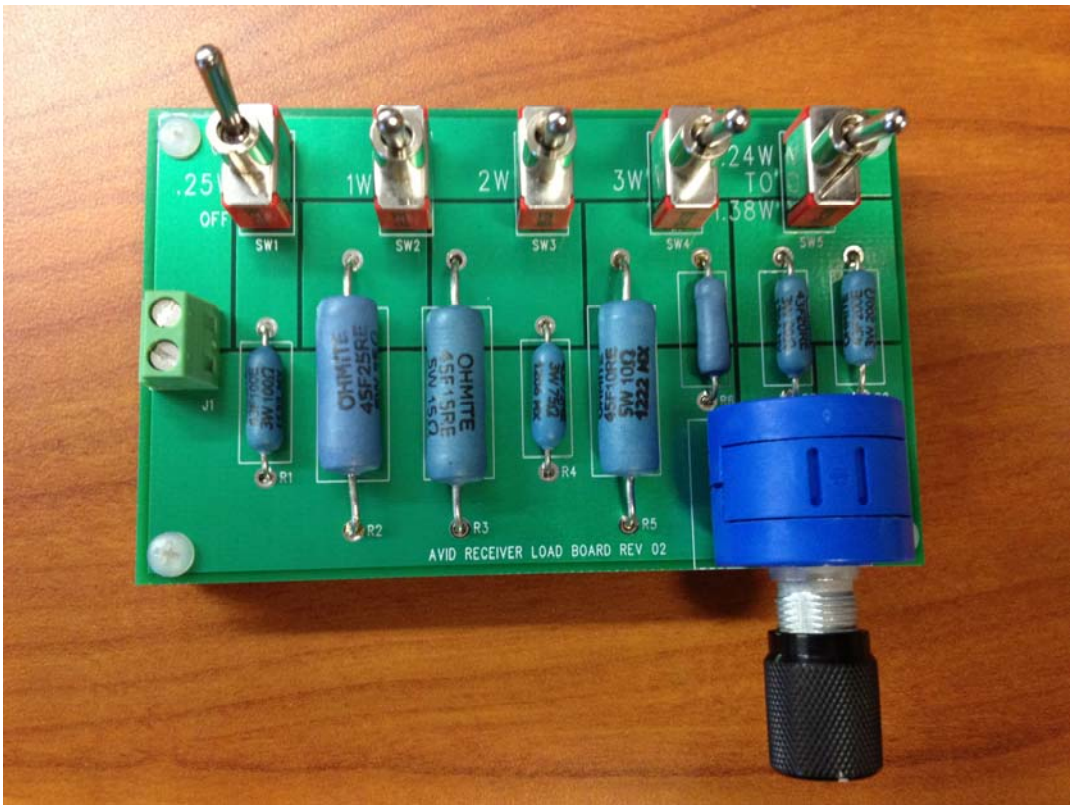

AVID Receiver Load Board

Basic Setup and Operation

To operate the FOD Receiver, first set the DIP switches on top of the unit to program the internal load and the PPR offset values (see below) as desired. The FOD receiver can be operated using internal loads up to 2.0 Watts, but AVID recommends leaving the Load DIP switches all off and connecting the external load board to the output screw terminals for testing because this will isolate the load from the receiver and keep the electronics at a more even temperature. Next, place the FOD Receiver on any Qi transmitter for characterization and testing.

The "Power" and "Status" LEDs on top of the FOD Receiver indicate the operational state of the receiver. The Power LED will light solid blue as long as the receiver is receiving enough power from the transmitter to power up its internal electronics. The Status LED will light solid green when the receiver is receiving enough power to supply the internal or external load and to regulate its output voltage to +5.0V. When the FOD Receiver is first placed on a transmitter, it connects a minimum internal load of 100 ohms (to ensure robust communications). Next the receiver adjusts its bridge voltage to about 5.8V and then connects the internal or external load and disconnects the minimum 100 ohm load. If an external load is connected to the terminal block on the receiver and current flow is detected through the output, all internal loads are disconnected otherwise the internal load programmed on the DIP switches is left connected. Once the load is connected, the receiver will send error messages to regulate the output to +5.0V +/- 5%.

The FOD Receiver should operate normally on any Qi transmitter (base station). If the FOD Receiver is powered up and regulating its output voltage, the status LED will remain green or amber. If the FOD Receiver cannot regulate its output voltage the status LED will turn off. If an error occurs (see below) the status LED will blink red. **To maintain good power measurement accuracy, always make sure the FOD Receiver is not operated on or near metal desks or other large metal objects during testing.**

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Below are brief descriptions of the functionality supported by the FOD Receiver:

Function	Description
Power LED	Solid blue when FOD Receiver receives sufficient power from the transmitter to power its internal circuitry
Status LED	Solid green when FOD Receiver receives sufficient power from the transmitter to power its internal load and regulate to +5.0V +/-5% Solid amber when FOD Receiver receives sufficient power from the transmitter to power an external load and regulate to +5.0V +/-5% Blinking red indicates various error codes (see quick start guide below)
VBRIDGE Pin	Rectified bridge voltage measurement test point
COMM Pin	Communication modulator digital signal test point
GND Pins	Internal circuitry ground reference
TEST DIP Switches	PPR offset multiplier (6 bits) 0 to 63. This value is multiplied by the PPR offset step size to get the resulting PPR offset value in mW
COMM DIP Switches	PPR step size (2 bits). This value is multiplied by the PPR offset multiplier to get the resulting PPR offset value in mW 00 = -5 mW, 01 = -10 mW, 10 = +5 mW, 11 = +10 mW
LOAD DIP Switches	Internal load (4 bits) 0 to 8 (positions 9-15 reserved) This value is multiplied by 0.25 to get the resulting internal load in Watts If external load >= 0.25W is sensed, all internal loads are switched off
Terminal Block	For connecting external loads. When operating properly the FOD Receiver will provide +5.0V +/- 5% at this output
External Load Board	Can be used to connect and switch on/off various external loads for characterizing V1.1 transmitters and running FOD pre-compliance tests

V1.1 Transmitter (Base Station) FOD Characterization

V1.1 QI compliant transmitter (base station) product developers can use the AVID FOD Receiver tool and the AVID external load board (or user supplied load) to characterize and adjust the transmitter power measurements. The FOD Receiver has been characterized using the AudioDev WPC approved V1.1 Test Transmitter and the results show good correlation between transmitted power and received power to within about 50 mW accuracy over a 0.25 W to 6.0 W load range.

If the transmitter under test has a means of providing an indication of its transmitted power values during power transfer, then it is possible to use the AVID FOD Receiver to characterize the transmitter's power loss measurements and FOD thresholds.

To use the AVID FOD Receiver to characterize a transmitter, use the following procedure:

1) Connect the external load board to the FOD Receiver terminal block and switch on the 0.25 W load only. The on position for the switches is toward the edge of the load board.
2) Place the FOD Receiver on the transmitter, center aligned, and record the transmitted power and received power values. If the transmitter does not already provide the received power values to the user, the AVID Qi Sniffer V1.1 can be used to capture the received power values including 16-bit high resolution values reported by the AVID FOD Receiver.
3) Repeat step 2 at several external load points such as at 1.0 W increments up to 5.0 W.
4) Plot the received power vs. transmitted power values for each load point. The data should show good correlation. If the difference is greater than 100 mW at any of the load points, make adjustments to the transmitter to improve the power measurements.

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Base Station Qi Pre-Compliance Testing

V1.1 QI compliant transmitter (base station) product developers can use the AVID FOD Receiver tool, the AVID external load board (or electronic load), and a set of WPC defined Foreign Objects to run Qi FOD Part 3 pre-compliance tests. AVID Technologies supplies (separately) the WPC defined foreign objects with an alignment frame and spacers that can be used for this testing.

The Part 3 Base Station FOD compliance tests use two test receivers: TPR#5 and TPR#6. These receivers use a low-loss coil with no shield to minimize parasitic losses.

TPR#5 is configured to output 5.0V +/-20% and to use a received power window size of 64 ms and a window offset size of 16 ms. TPR#5 is also configured to over report its received power values by 235 mW. During the WPC interim extension period in effect until May 2014, TPR#5 shall instead over report its received power values by 35 mW:

TPR#5 PPR = (PPM+235)

TPR#5 (INT) PPR = (PPM+35) ** Use this equation during the WPC interim period

PPM is the actual received power determined by the test receiver by measuring its load power and adding estimated parasitic power losses.

TPR#6 is identical to TPR#5 except TPR#6 is configured to under report its received power values by 15 mW. During the WPC interim extension period in effect until May 2014, TPR#6 shall instead under report its received power values by 115 mW.

TPR#6 PPR = (PPM-15)

TPR#6 (INT) PPR = (PPM-115) ** Use this equation during the WPC interim period

Base Station Thermal Compliance Testing

The Part 3 Base Station FOD thermal compliance tests consist of measurements that check the temperature rise (at +25 deg C ambient) of four different WPC defined foreign objects while they are placed between the test receiver (TPR#5) and the base station during power transfer. Each object has an allowed temperature limit as defined in the table below.

WPC Defined Foreign Objects:

Object	Configuration	Temperature Limit
#1	Steel disc centered	60 deg C
#2	Aluminum ring centered	60 deg C
#3	Aluminum foil centered	80 deg C
#4	Steel disc offset 15.5 mm	60 deg C

If any of the foreign objects reaches or exceeds the temperature limits above during testing, the transmitter's FOD measurements, thresholds, or reaction time may need to be adjusted to meet compliance.

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To use the AVID FOD Receiver to emulate TPR#5 and run the foreign object thermal pre-compliance tests on a base station, use the following procedure:

1) Set the DIP switches on the AVID FOD Receiver to emulate TPR#5 as follows:

   TEST = 000111 (PPR offset multiplier = 7)
   COMM = 10 (PPR offset step = +5 mW)
   LOAD = 0000 (no internal load)

2) Connect the external load board to the FOD Receiver and switch on the 0.25W (100 ohm) load only on the far left of the load board near the terminal block connector.
3) Connect foreign object #1 (steel disc) K-type thermocouple connector to a suitable thermometer or DMM that can measure temperature of a K-type thermocouple.
4) Fit the clear plastic alignment frame on top of the foreign object holder.
5) Place the foreign object and alignment frame on the base station under test and align the center of the foreign object holder with the center of the base station transmitter coil. The AVID foreign object holders have score marks that indicate the center lines.
6) Place the AVID FOD Receiver in the alignment frame on top of the foreign object and make sure the receiver and foreign object are still center aligned with the transmitter coil.
7) Increase the load on the external load until the transmitter hits its power loss (FOD) threshold and terminates (or lowers) its transmitted power. If you are using the AVID supplied external load board, leave the 0.25W load switched on, switch on the variable (0.24 W to 1.38 W) load, and slowly adjust the potentiometer until right at the point the power loss threshold is hit.
8) Reduce the external load by 50 mA. If you are using the AVID supplied external load board this can be accomplished by switching off the 0.25W (100 ohm) load.
9) Run the transmitter for 10 minutes (or until the transmitter terminates power transfer) and record the temperature of the foreign object.

If the transmitter terminates power transfer before 10 minutes during any of these tests, repeat steps 6 and 7 above and reduce the load slightly until the transmitter runs for 10 minutes OR until the minimum load of 0.25 W (50.0 mA) is reached. At the minimum load, if the transmitter still terminates power before 10 minutes, the temperature of the object is recorded at the point where power transfer was terminated.

The steps above are repeated as follows:
- Using object #1 with 2.0 mm spacer placed between the foreign object and the AVID FOD receiver
- Using object #1 with 5.0 mm spacer placed between the foreign object and the AVID FOD receiver
- Using foreign object #2
- Using foreign object #3
- Using foreign object #4

The steel disc objects present lower power losses and temperature rises than the other objects. For the steel objects, the thermal test may run for the full 10 minutes. The transmitter FOD power loss threshold should be set to keep the temperature of the objects below the limit at the end of the 10 minute test.

The aluminum foil and ring objects present higher power losses and temperature rises than the steel discs. For these objects, even at the minimum 50 mA load the thermal test may not run the full 10 minutes before the transmitter reaches its FOD power loss threshold. In this case the transmitter FOD threshold and reaction time should be adjusted to keep the foreign object temperature below the limit when the threshold is reached and the transmitter either terminates or reduces power.

If the transmitter can be adjusted to keep the foreign objects below the temperature limits for all of the above tests, then the product will likely pass the FOD thermal compliance tests at an approved Qi compliance lab. If not, adjust the transmitter FOD power loss thresholds and reaction time accordingly.

Base Station Guaranteed Power Compliance Testing

The Part 3 Base Station FOD guaranteed power compliance test consists of a measurement that checks to make sure the base station under test can deliver 5.0 Watts to a test receiver (TPR#6) that has no foreign object present, but is simulating power loss into a foreign object by under reporting its received power.

To use the AVID FOD Receiver to emulate TPR#6 and run the guaranteed power pre-compliance tests on a base station, use the following procedure:

1) Set the DIP switches on the AVID FOD Receiver to emulate TPR#6 as follows:

   TEST = 010111 (PPR offset multiplier = 23)
   COMM = 00 (PPR offset step = -5 mW)
   LOAD = 0000 (no internal load)

2) Connect the external load board to the FOD Receiver and switch on the 0.25W load only.
3) Place the FOD Receiver on the base station and make sure it is center aligned with the transmitter coil. Wait until the base station begins power transfer.
4) Switch on the 1W load on the external load board. Allow the base station to continue power transfer for 10 seconds.
5) Switch on the 2W load on the external load board. Allow the base station to continue power transfer for 10 seconds.
6) Switch on the 3W load and switch off the 0.25W and 1W loads on the external load board (total = 5W load). Allow the base station to continue power transfer for 5 minutes.
7) Measure the voltage at the terminal block output on the FOD Receiver and make sure it is between 4.75V and 5.25V (regulation tolerance of the FOD Receiver).

If the voltage measured in step 7 is between 4.75V and 5.25V, then the product will likely pass the FOD guaranteed power compliance tests at an approved Qi compliance lab. If the voltage is not between 4.75V to 5.25V, make adjustments to the base station device to improve the power transfer performance and repeat the tests above.

NOTE: AVID FOD TOOLS ARE NOT APPROVED FOR FINAL QI COMPLIANCE TESTING. THEY ARE DESIGNED TO BE USED FOR DEVELOPMENT AND PRE-COMPLIANCE TESTING BY CUSTOMERS DESIGNING and PROTOTYPING WPC V1.1 WIRELESS POWER PRODUCTS.

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AVID FOD Receiver Quick Start Guide:

SYSTEM MONITORING:

VBRIDGE: (5.0V +/- 0.5V)
Receiver DC Bridge Voltage

COMM. (0 - 3.3V Logic)
Modulation Signal

5V, 0-1A OUTPUT:
Internal load is disabled when external load (>0.25W) is connected.

CONFIGURATION SWITCHES:

TEST Position 1-6
PPR offset multiplier

LOAD Position 1-4
Selects internal load
0-2W, in 0.25W Steps

COMM Position 5
PPR offset polarity
Position 6
PPR offset step size

All switches can be changed during run time.

POWER LED:

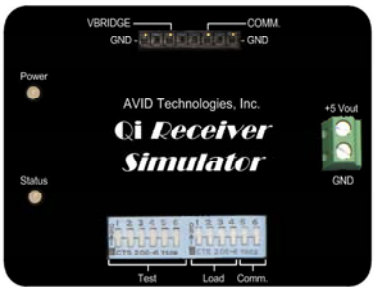
●	Wireless power present (Blue Solid)
○	Wireless power removed (OFF)

STATUS LED:

●	Output power good (Green Solid)
●	Output power good External load detected Internal load disabled (Amber Solid)
●	n/a (Red Solid)
ERROR BLINK PATTERNS: (Only valid for Test 0)	
●●	Over temperature (Red Single Blink Pattern)
●●	Output overload (Red Double Blink Pattern)
●●	Input over voltage (Red Triple Blink Pattern)

FOD Receiver

Quick Start Guide



AVID TECHNOLOGIES, INC.

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TEST Switch (PPR offset mult)		
0	000000	PPR offset = 0 x step
1	000001	PPR offset = 1 x step
...	...	...
63	111111	PPR offset = 63 x step

COMM Switch (PPR offset step)		
0	00	Negative 5 mW
1	01	Negative 10 mW
2	10	Positive 5 mW
3	11	Positive 10 mW

LOAD Switch		
0	0000	0.00 W internal load
1	0001	0.25 W internal load
2	0010	0.50 W internal load
3	0011	0.75 W internal load
4	0100	1.00 W internal load
5	0101	1.25 W internal load
6	0110	1.50 W internal load
7	0111	1.75 W internal load
8	1000	2.00 W internal load
9 - 15		*Reserved*

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