

P1110-XX-EVB

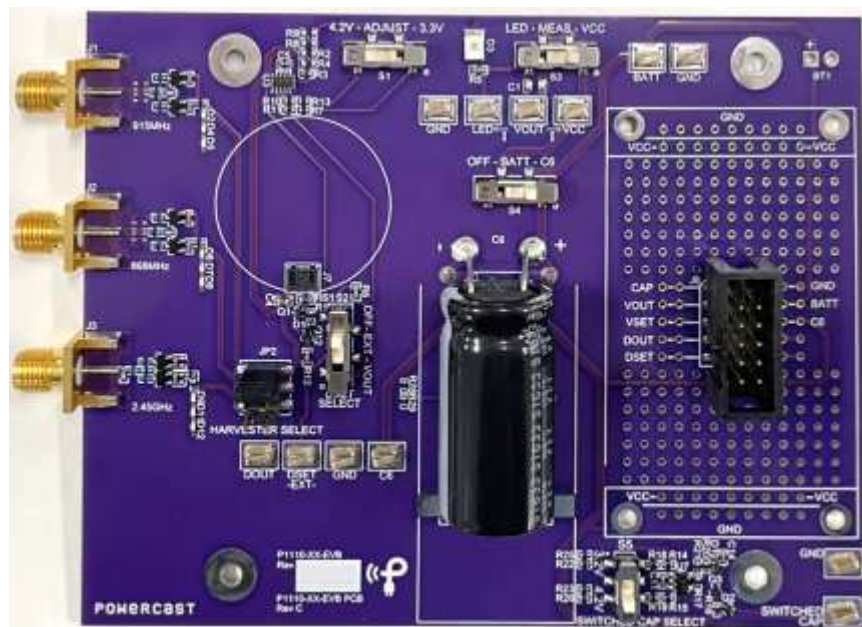
Evaluation Board for PCC110 Powerharvester®



DESCRIPTION

The P1110-XX-EVB features the Powercast PCC110 Powerharvester® with support for three frequency bands to test. The EVB converts radio frequency (RF) energy into DC power which can be used to charge a capacitor or battery.

The three frequency bands supported by this EVB are 868MHz, 915MHz, and 2.45GHz.



ORDERING INFORMATION AND ITEMS INCLUDED

The Evaluation Board (EVB) is orderable under part number P1110-XX-EVB.

The EVB requires a user-provided antenna. Powercast offers several options for the antennas:

Powercast Antenna Part Number	Frequency Band	Antenna Type
PA-915-01	915MHz	Patch
DA-915-01	915MHz	Dipole
PA-868-01	868MHz	Patch
DA-868-01	868MHz	Dipole
PA-2450-RM-01	2.45GHz	Patch
DA-2450-RM-01	2.45GHz	Dipole

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This EVB along with a user provided antenna needs to receive power from an RF source with sufficient transmit power. Test equipment, such as RF signal generators, can also be used to test any of the three frequency bands.

A DC block must be added if the antenna or test equipment being connected to the EVB is a DC short.

ABSOLUTE MAXIMUM RATINGS

T_A = 25°C, unless otherwise noted.

Parameter	Rating	Unit
RF Input Power	20	dBm
RF DC Voltage to GND	0	V
V _{OUT}	5.5	V
DSET EXT	6	V
Operating Temperature Range	-40 to +85	°C
Storage Temperature Range	-40 to +100	°C



Exceeding the absolute maximum ratings may cause permanent damage to the device.

ESD CAUTION

This is an ESD (electrostatic discharge) sensitive device. Proper ESD precautions should be taken to avoid degradation or damage to the component.



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FUNCTIONAL DESCRIPTION

POWER HARVESTING

The P1110-XX-EVB has 3 SMA input connectors to harvest from 3 different frequency bands. An antenna or conducted RF input signal can be connected to any of these 3 frequency bands. The maximum RF input signal is 20dBm. If the antenna or RF input is a DC short, a DC block must also be used. The JP2 HARVESTER SELECT jumper must be jumpered to match the RF input being used (JP2 row 1 = J1 RF input (915 MHz), JP2 row 2 = J2 RF input (868 MHz), JP2 row 3 = J3 RF input (2.45 GHz). JP2 connects the harvested RF input signal to the rest of the EVB. After JP2 the harvested signal is connected to VOUT and the maximum voltage of VOUT can be set with the S1 switch. Using S3, VOUT can be connected to an LED (D3), VCC, or MEAS which allows the user to put a current sense in series between VOUT and VCC test points. When VCC is selected S4 can be used to connect the harvested power to either bulk capacitor C6 or an external storage element (BATT). The VCC test point can then be used as a power source (V+) for a user supplied device.

ADDITIONAL FEATURES

Power input can be monitored by connecting the Powercast RB1 radio board to the EVB J7 header. The radio board measures the charge current and voltage data from the EVB and transmits that data via Bluetooth to the Powercast Charging Monitor App (Available for IOS and Android). Each radio board has its own unique ID and is powered from an included CR2032 coin cell battery. Connect the radio board to the EVB in the location shown by the EVB silkscreen. Orientation is critical, do not attempt to plug in the radio board backwards. The radio board is powered separately so that it does not draw power from the EVB. Press the wakeup button on the radio board momentarily (1 second) by gently squeezing the radio board and EVB together (opposite end as the connector). This will begin transmitting the charging data to the app. The app will automatically receive the data; no pairing is required. The charging data will be sent to the app for a period of 5 minutes before going to sleep. Press the wakeup button again to begin another 5-minute period of data transmission. If you wish to end the data transmission earlier than 5 minutes, simply press the button on the radio board again.

The harvested RF input signal can be routed to a 49.9Ω load resistor via the S2 switch. This allows the user to measure a relative DC value for received signal strength and interpret data if the RF input signal is on-off-keying for communications. EXT allows for an external trigger to activate data read mode and VOUT allows for a constant data read mode. When data read mode is

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activated the harvested signal is passed through the 49.9Ω resistor to ground. Amplitude modulated data such as on-off-keying can be read using the voltage at the DOUT test point.

When C6 is selected via S4, the SWITCHED CAP test point can act as a voltage switched output. This output is only enabled when VCC is greater than the voltage threshold set by the S5 switch. This allows C6 to charge up to a useable voltage before being used by an external load via the SWITCHED CAP test point.

The table below describes the RF inputs, switches, jumpers, and test points:

Function	Description
RF input to harvest	Selectable via JP2 jumper: <ul style="list-style-type: none">• J1 – 915MHz center frequency• J2 – 868MHz center frequency• J3 – 2.45GHz center frequency
Maximum harvested voltage	Selectable via S1 switch: <ul style="list-style-type: none">• 4.2V – Maximum harvested voltage of 4.2V ADJUST – Adjustable output via R8 and R9 added by the user $V_{max} = 1.24 \times \frac{10 \times 10^6 + R_8 + R_9}{R_8 + R_9}$ <ul style="list-style-type: none">• 3.3V – Maximum harvested voltage of 3.3V If the maximum voltage as set by S1 is reached, the harvested output power will dissipate into the 49.9Ω R12 resistor until the voltage decreases.
Harvested output load	Selectable via S3 switch: <ul style="list-style-type: none">• LED – Connects the harvester output to LED D3• MEAS – allows the user to put a current sense in series between VOUT and VCC test points. Note that in this configuration VOUT is disconnected from VCC and as a result to measure the current, a series current sense can be placed between the VOUT and VCC test points.• VCC – Connects the harvester output to the VCC test point
Power Storage Selection	Selectable via S4 switch: <ul style="list-style-type: none">• OFF – VCC isn't connected to anything• BATT – Connects VCC to BATT test point and BT1 terminals (can be used for charging a battery or capacitor provided by the user)• C6 – Connects VCC to C6 15mF bulk capacitor
Data output	Selectable via S2 switch:

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	<ul style="list-style-type: none">• OFF – Harvested RF input signal is passed to VOUT (normal operation)• EXT – Harvested RF input signal is connected to a 49.9ohm resistive load when the user drives the DSET EXT signal to 3V (can be used to measure relative received signal strength or on-off-keying communication data from the RF input by monitoring the DOUT test point). Note that in this configuration VOUT is disconnected from the harvested RF output.• VOUT – Harvested RF input signal is connected to a 49.9ohm resistive load when VOUT is high (can be used to measure relative received signal strength or on-off-keying communication data from the RF input by monitoring the DOUT test point).
Switched Cap Select	<ul style="list-style-type: none">• 3.2V – Sets SWITCHED CAP minimum activation voltage to ~3.2V. When set, the SWITCHED CAP test point voltage will not be present until C6 is charged to ~3.2V and then will remain present until the voltage at C6 drops to ~2.2V.• 4.2V – Sets SWITCHED CAP minimum activation voltage to ~4.1V. When set, the SWITCHED CAP test point voltage will not be present until C6 is charged to ~4.1V and then will remain present until the voltage at C6 drops to ~3.1V.
Test points	<ul style="list-style-type: none">• GND – Ground• VOUT – Harvester output after maximum voltage clamping• LED – Voltage across the LED, which is equal to VOUT when S3 is set to LED• VCC – Voltage of VCC, which is equal to VOUT when S3 is set to VCC• DSET EXT – External 3V signal from the user to route the harvested DC input signal through a 49.9ohm load resistor to measure DOUT• DOUT – Harvested DC input signal across a 49.9ohm load resistor when• DSET is enabled (can be used to measure relative received signal strength or on-off-keying communication data from the RF input)• C6 – Voltage on the C6 capacitor, equivalent to VCC when C6 is selected in switch S4

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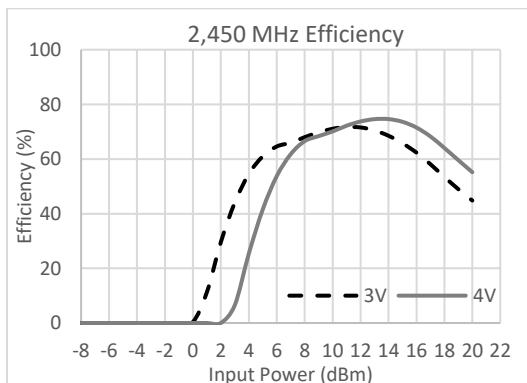
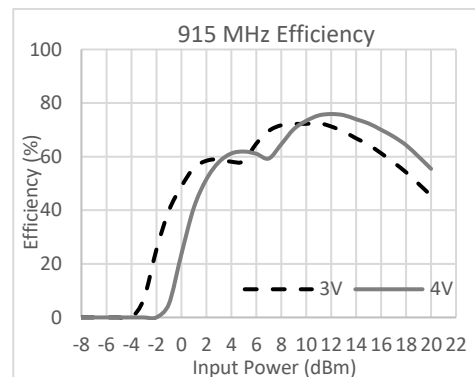
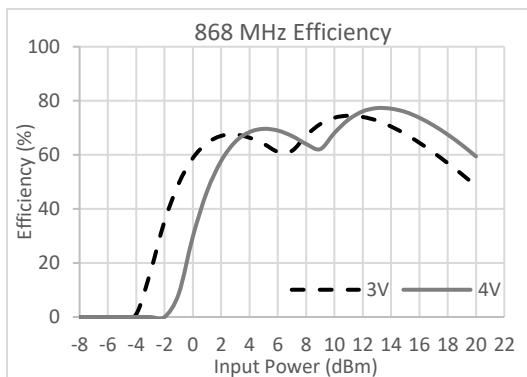


	<ul style="list-style-type: none"> • BATT – Board output to user supplied battery or energy storage medium, equivalent to VCC when BATT is selected on switch S4 • SWITCHED CAP – Switched voltage output that enables only after VCC and C6 reach a minimum voltage determined by S5
Prototype area	J8 and various test pads for prototyping
RB1 Radio Board	Separate Powercast module used for taking voltage and current readings, connects via J7.

TYPICAL PERFORMANCE GRAPHS

T_A = 25°C, unless otherwise noted

Typical RF to DC conversion efficiency of the EVB for three frequency bands at 3V and 4V load output

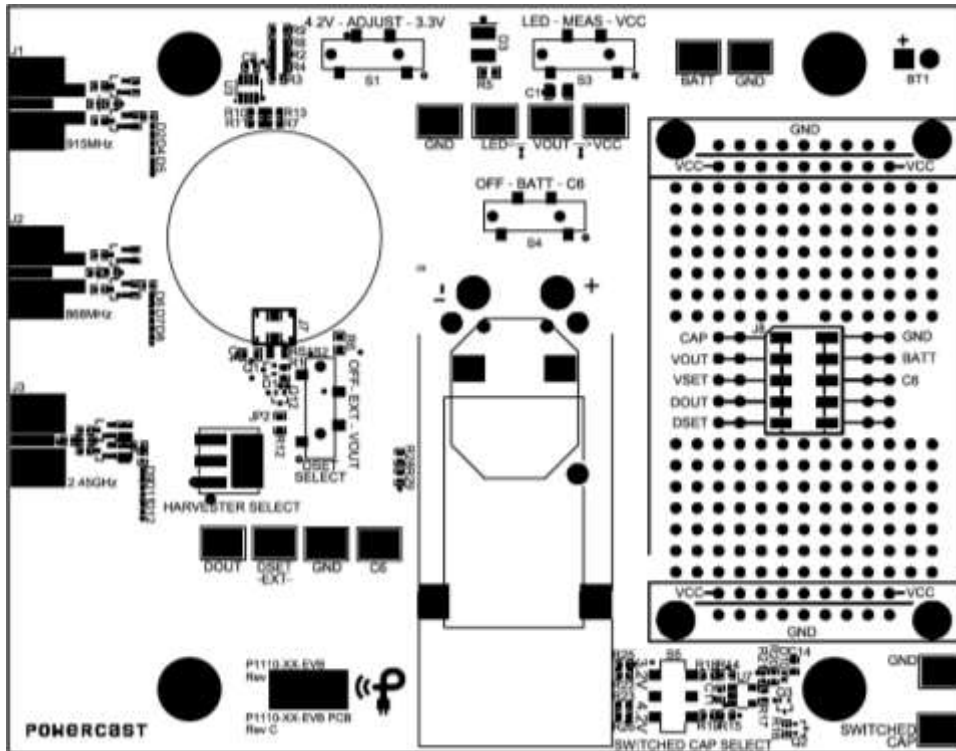


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EVALUATION BOARD LAYOUT



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