IDT WP3W-RK Testing Documentation

- Aiming to fully present all the features WP3W-RK implemented with WPC Qi Protocol
- connected with spark fun limo battery charging babysitter to implement charging for a single cell LiPo battery with 3.7V

Transmitter

Pinout:

Vin_USB

Vin_5V

LDO 33

LDO 18

A4, B2,B3

BUZ

SDA

SCL

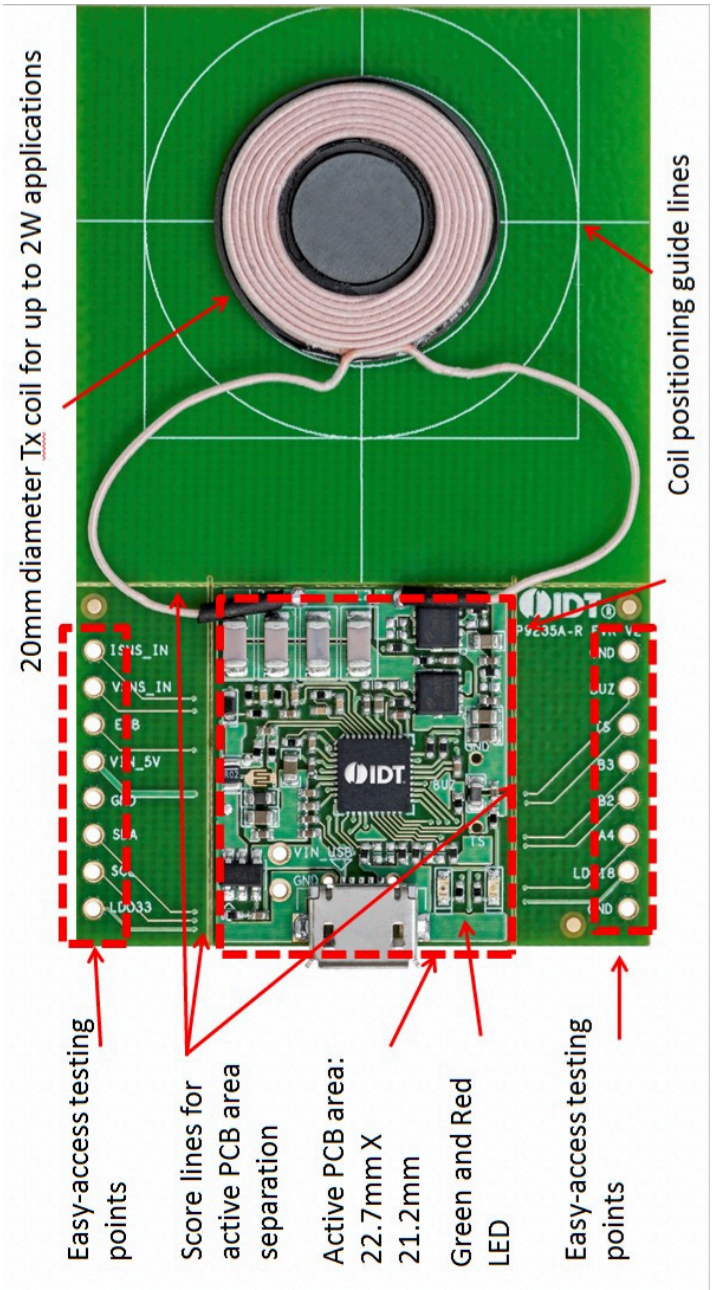
VSNS_IN

ISNS_IN

ENB

TS

GND



Receiver end:

Pinout:

RECT

EOC

SCL

SDA

/EN

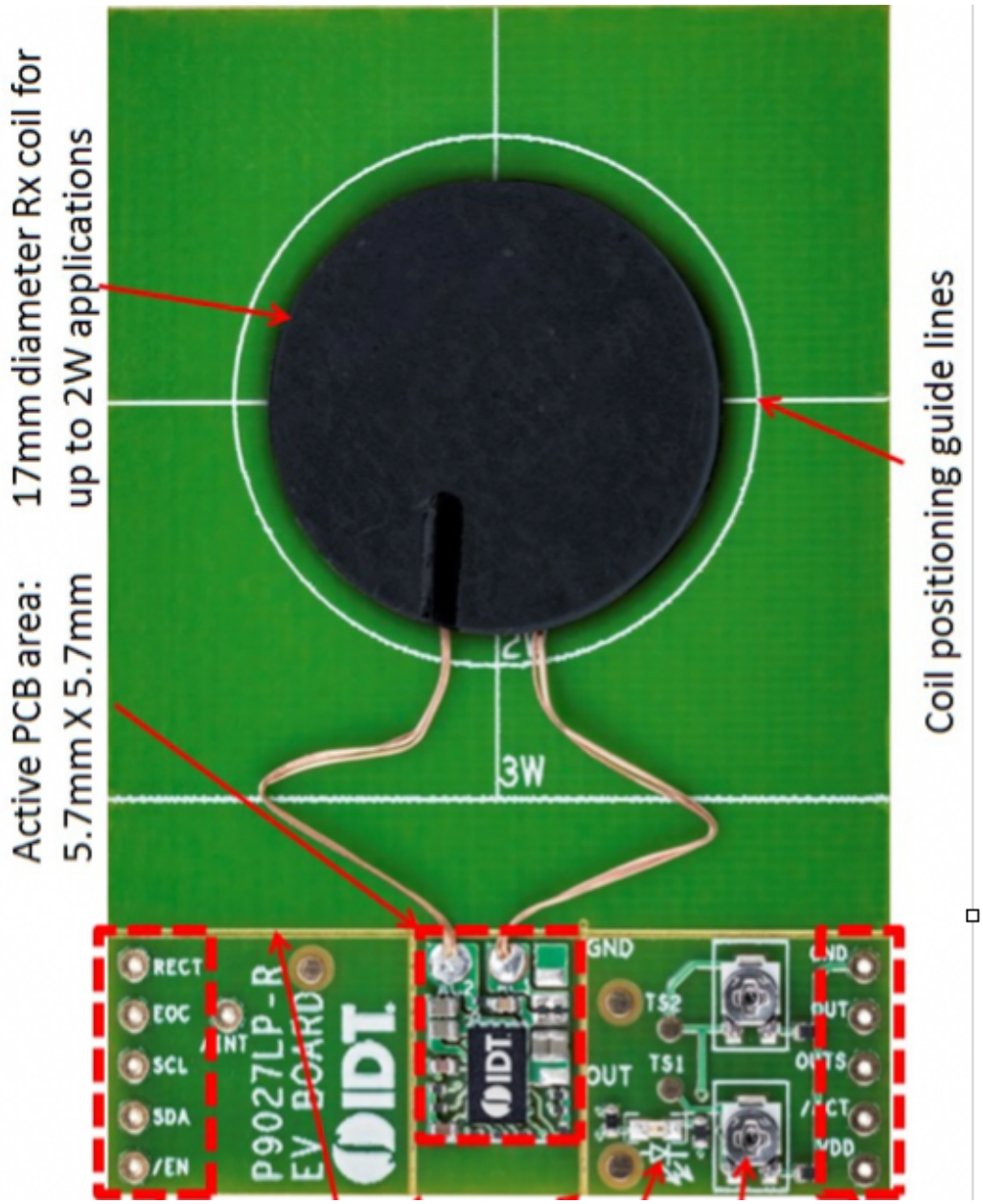
GND

OUT

OUTS

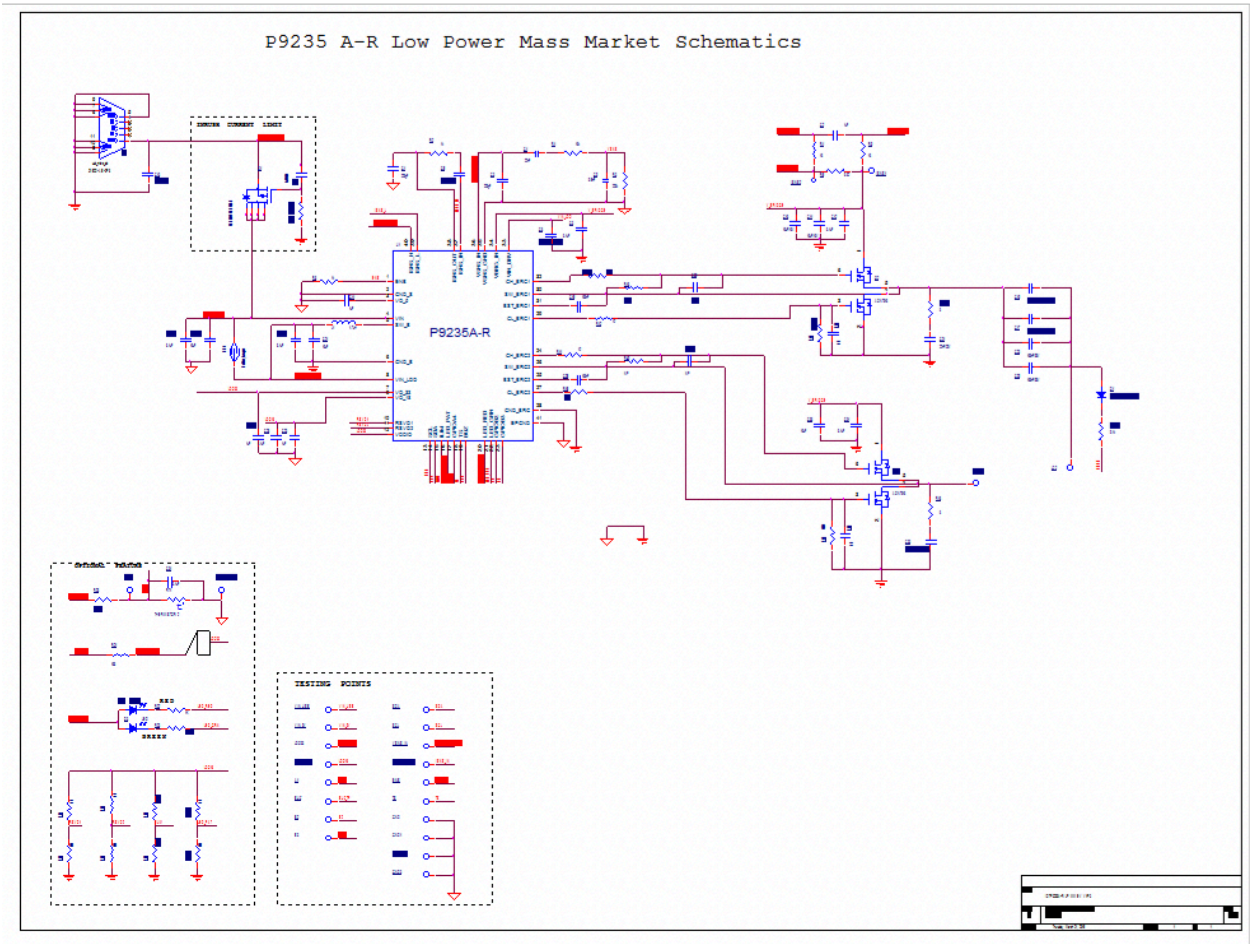
/ACT

VDD



Pinout specification(Transmitter):

Vin_USB	Micro usb power supply
Vin_5V	Input power supply (recommended 5V)
LDO 33	Regulated 3.3 V output voltage used for internal device biasing.
LDO 18	Regulated 1.8 V output voltage used for internal device biasing.
A4, B2,B3	General purpose GPIO
BUZ	Buzzer pin output.
SDA /SCL	Data and Clock for I^2C communication. Connect a 5.1 K resistor from this pin to VO_5
VSNS_IN	Voltage modulation signal input. (on test, just be the voltage sensing on the coil)
ISNS_IN	Current modulation signal input. (on test, just be the current sensing on the coil)
ENB	Active low enable pin. When connected to logic high, the device shuts down and consumes less than 25 µA of current. When connected to logic low, the device is in normal operation.
TS	Remote temperature sensing. Connect a 10 k NTC via a voltage divider to this pin.
GND	Ground connection



Transmitter Schematics

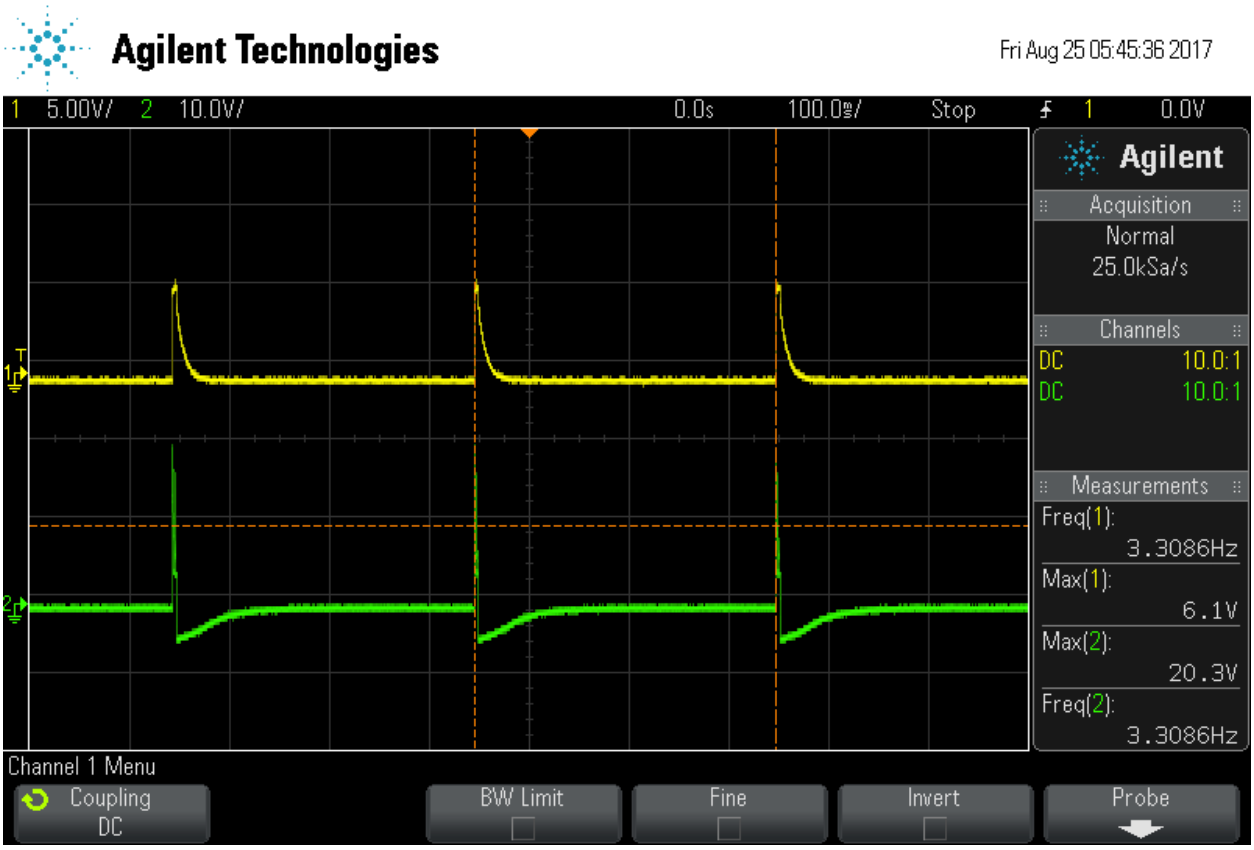
Tests on **transmitter side**:

• Basic functioning: Use a Micro USB connecter from the computer to power the transmitter, the red LED will blink once with the green led blink right after it, then both LEDs will light up for one second and turn off. When the receiver is put on the green LEDs on both the transmitter and the receiver will light up to show coupling

Power Consumption

Power the Transmitter with the Bench power supply (PSU, DC), if exactly 5V is supplied:

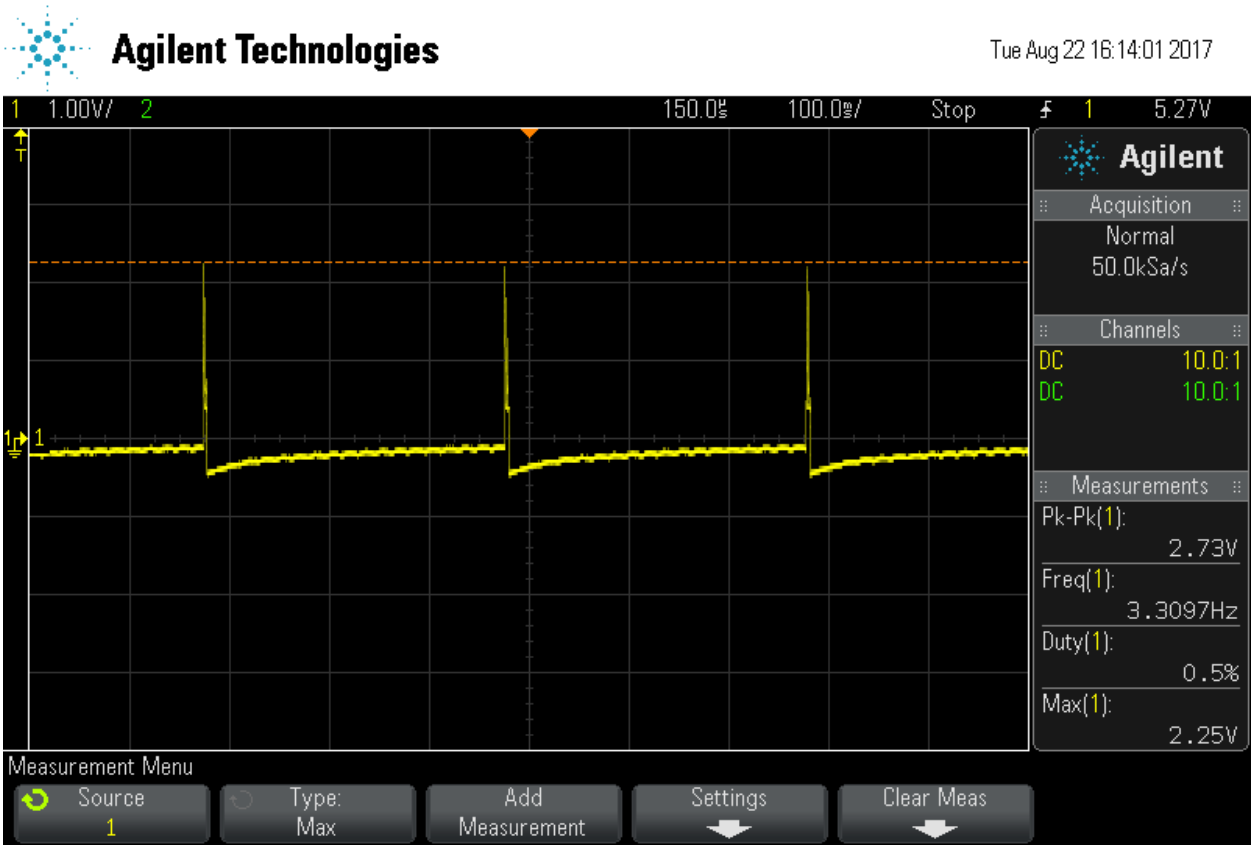
low power mode: voltage 5V current 0.01A when not in analog pinging and 0.03-0.05A(AC) in the pinging, according to estimate, the pinging is around 10 times per minute. (eye estimate)



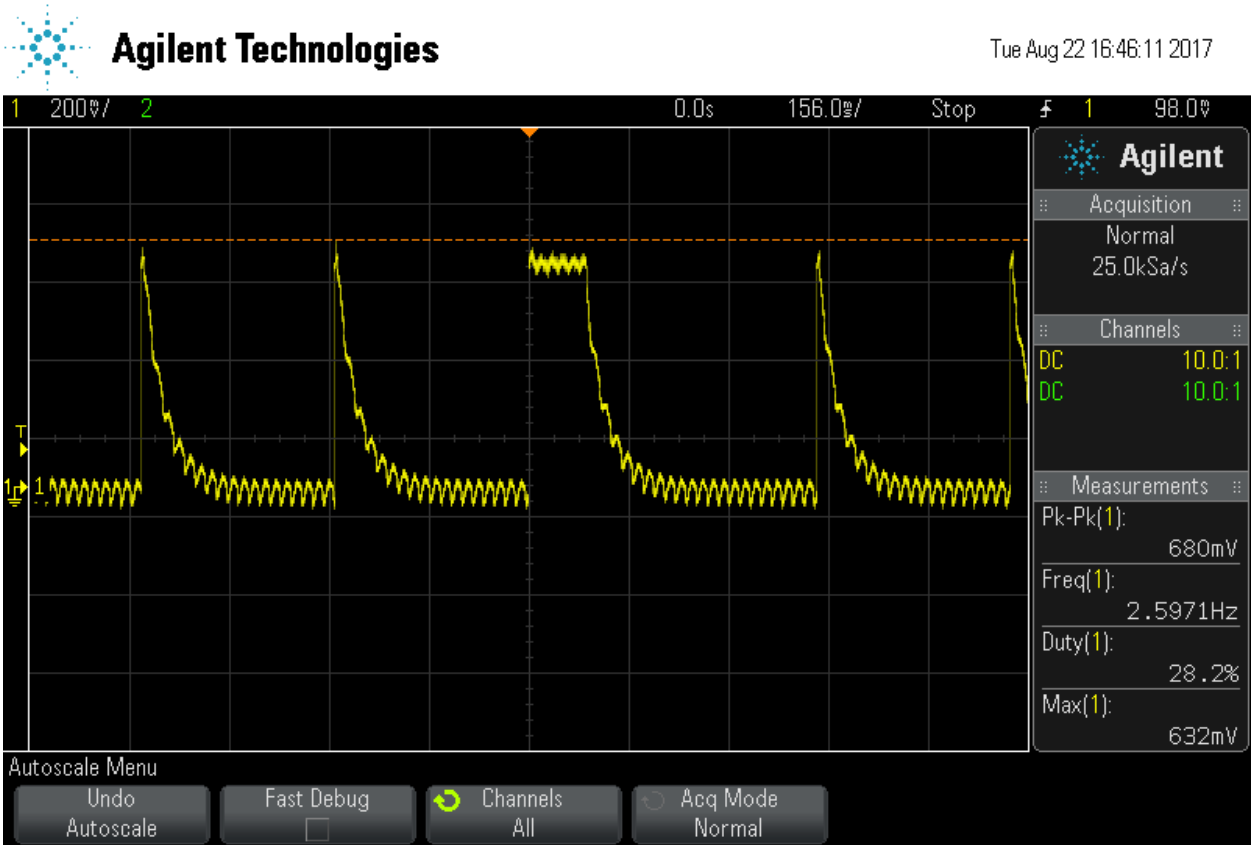
(Yellow from ISNS, Green from VSNS, Max scaled by 10X)

This demonstrates the analog pinging from the transmitter device to detect the presence of receiver coils. If the receiver is there, the transmitter will turn into digital pining to give enough energy pulse to active the receiver end circuit to start the handshake.

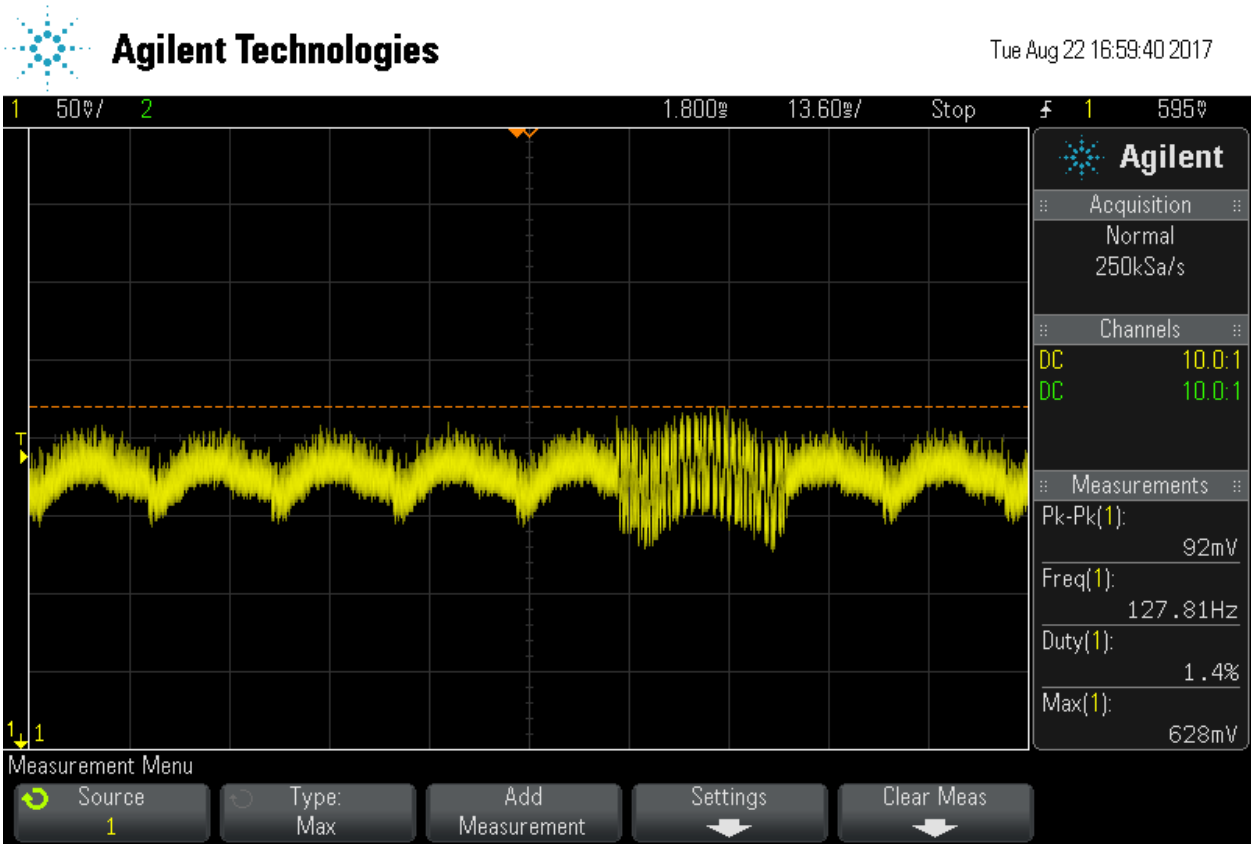
Analog pining zoom in:



(VSNS) (ISNS)



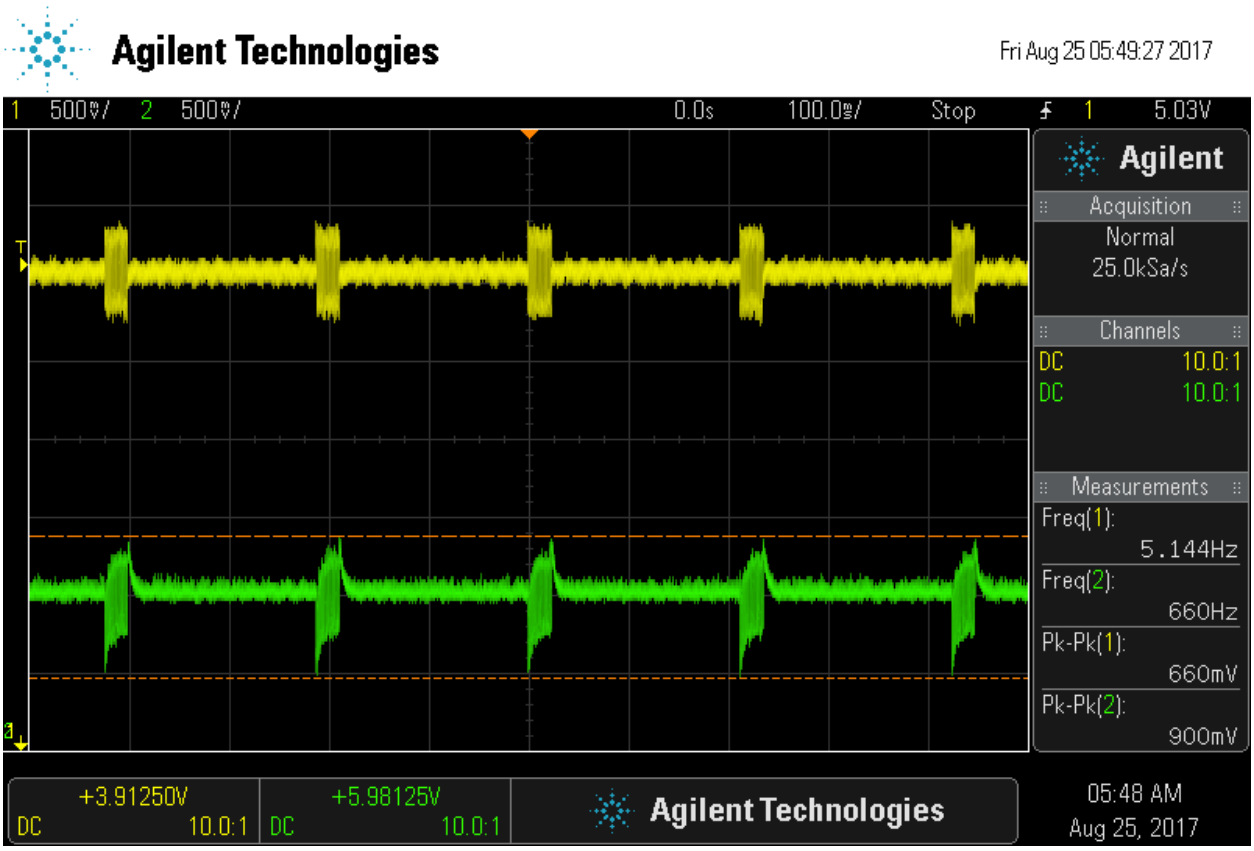
ISNS zoom in:



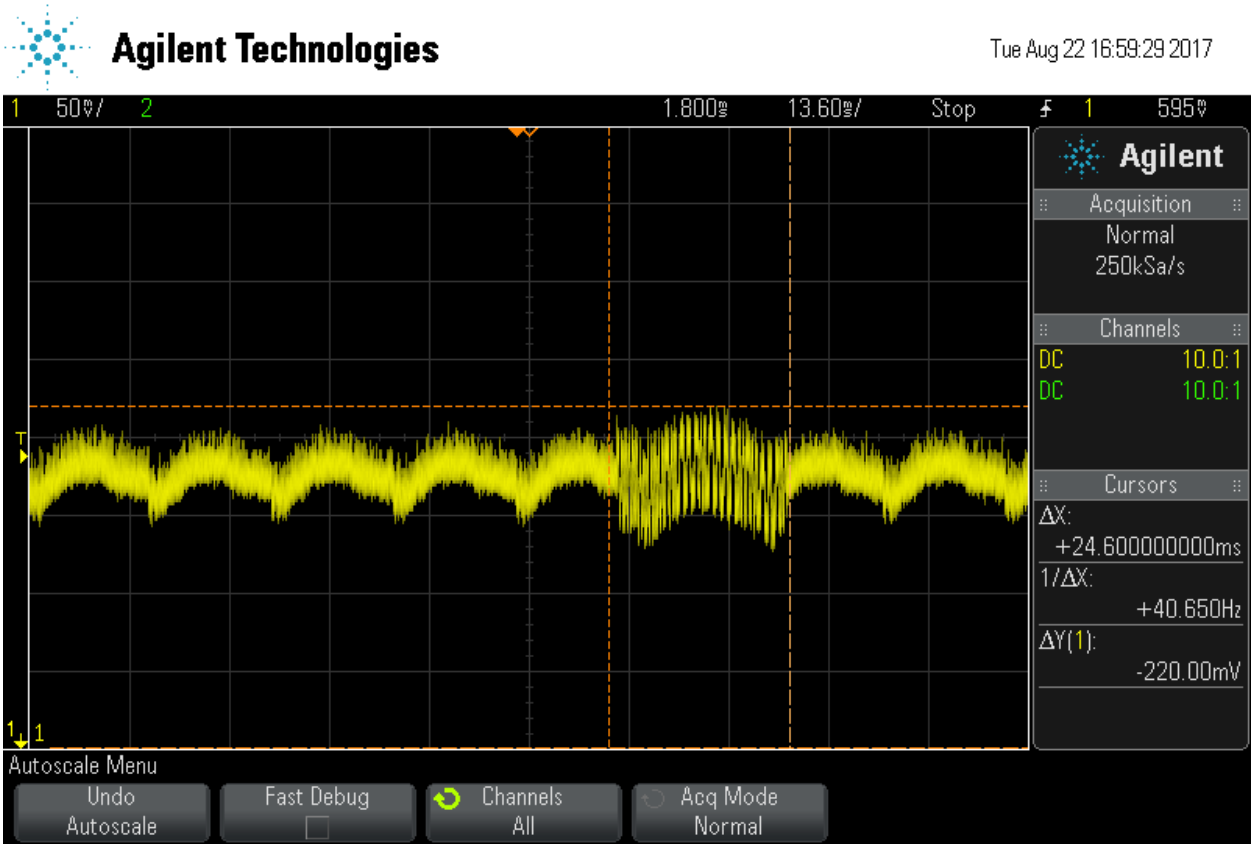
according to the acquired duty cycle the power consumption should be around 0.04 W (V*I *duty cycle) on the low power mode.

•by putting the receiver on the transmitter, a quick handshake should happen, with the digital pinging activate the device into identification and configuration phase where the Tx and Rx exchange information about protocol version and required voltage and maximum power output required. However, this process is too quick to capture on the Oscilloscope, will try to capture on future tests.

• the power transmission process then begin right after, with the receiver continuously sends back error packets on the coils back to the transmitter to fine-tune the power transmission. The received power packet can be viewed on the ISNS and VSNS both.



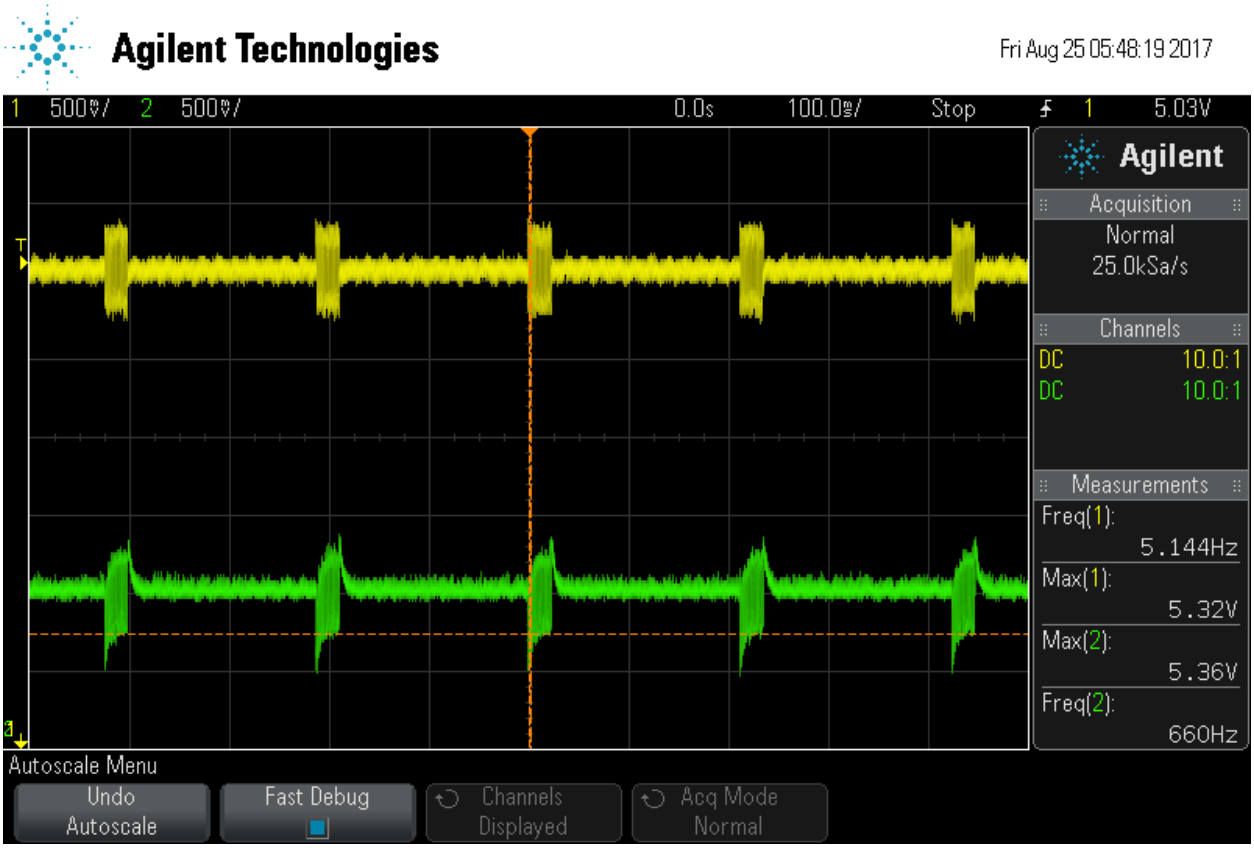
ISNS side (FSK around 120K hz bandwith, which is varying on a about 180Khz carrier wave, [120-240]according to the working frequency of this specific Tx and Rx)



•On both sides

(Y for ISNS, G for VSNS)[10X mult]

to show the power transmission and the communication frequency.(packet frequency) [10X multi]



Observation from the PSU:

• coupling without load : Draw 0.17-0.22 A current from the power supply with no load (Vin >4.5V)

• coupling with load : Draw about 0.6 A current from the power supply with load on, around 3 W consumption from the load

Low Voltage alert : if the voltage is below 4.4V (from PSU), red LED will blink continuously to disallow charging, current will stay at 0.01 A without any pinging . if the supply is from 4.4 to 4.5 V, the pining will happen and no low power alert, but when coupling, and the signal strength packet is received, the coupling will stop (after 1s approximately), and the power transfer will sop and the transmitter goes into low power mode with red LED blinking (no pinging).

corresponding text in the data sheet :

"Under voltage protection: If the transmitter V_{IN} is less than 4.5 V, the transmitter will shut down for five minutes, or until the V_{IN} is cycled. off/on. "

High Voltage alert: if the voltage supplied is larger than 6.5V, the start up will be normal for the transmitter , but the receiver won't allow coupling with the shake hand , the green LED on both devices wont even light up.

corresponding text in the data sheet :

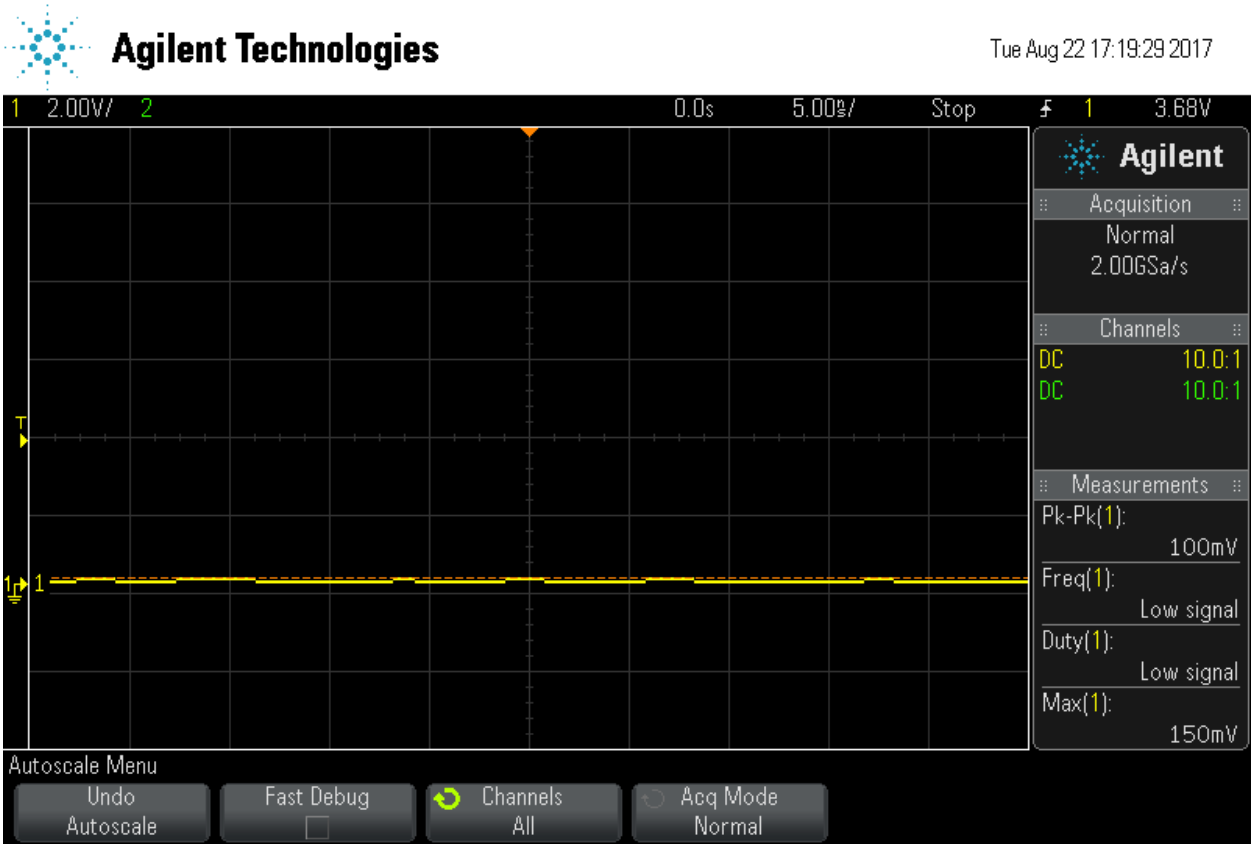
"Over voltage protection: If the transmitter V_{IN} is greater than 5.5 V, and the system is not in the Power Transfer mode, then the transmitter will shut down until the V_{IN} is in the range of 4.5 V to 5.5 V. If the system is already in the Power Transfer mode, then the transmitter takes no action. "

• **power consumption for the transmitter in low power mode** : around 0.04 W

•LDO pinout voltage test: 3.3 and 1.8 V respectively, corresponding to the data sheet.

•BUZ: buzzer pin, untested

•ENB: =Enable Pin: If connected to high, power transmission of power will stop and the communication will turned to almost none value with 17mv AT MAXIMUM

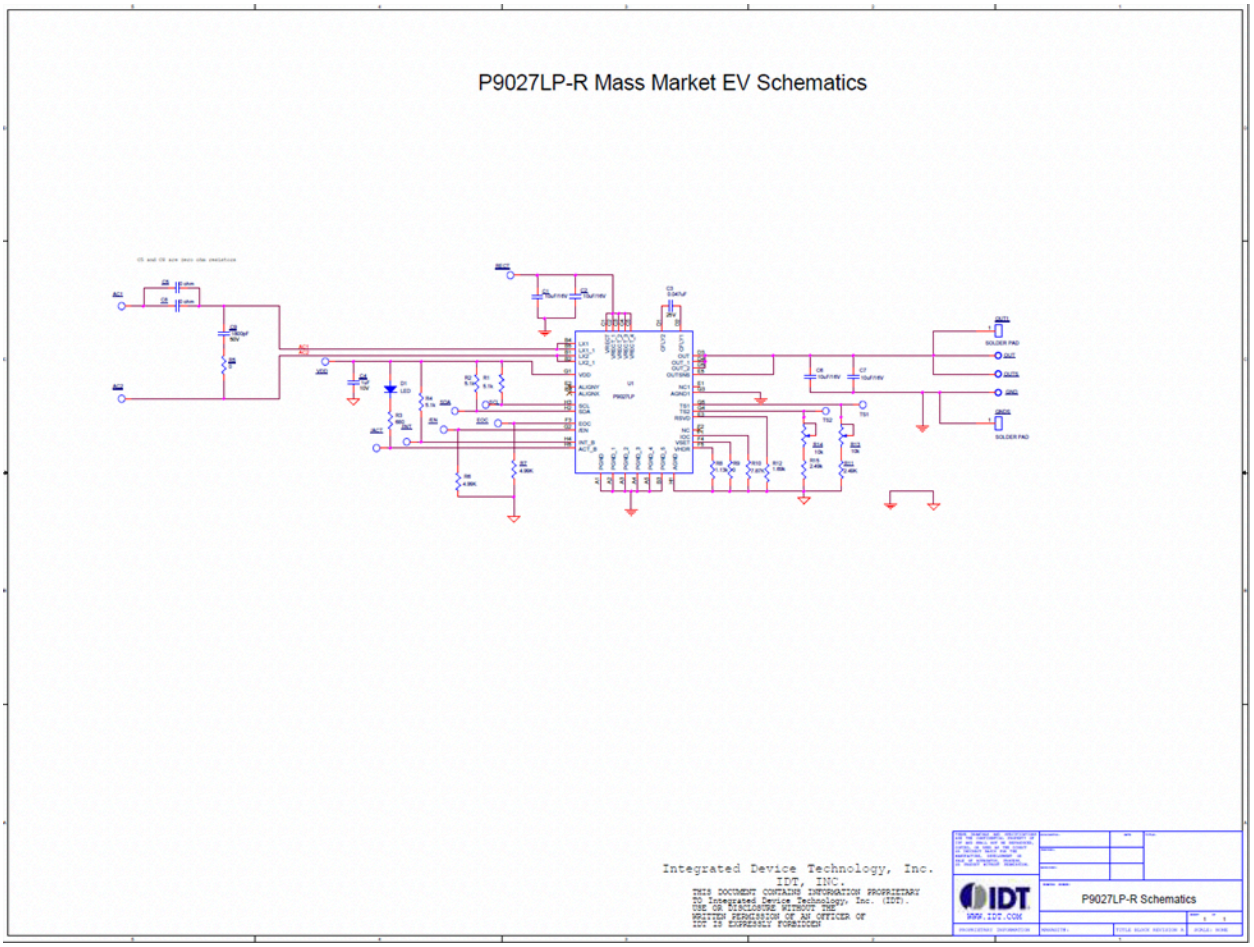


Receiver Pinout specification:

Pinout:

RECT	Output voltage of the synchronous rectifier bridge. Connect at least two 10 µF capacitors from this pin to PGND. The rectifier voltage dynamically changes as the load changes.
EOC	Active high end of charge input pin. When connected to logic high, the device sends end of power transfer packet (charge complete) to the transmitter to terminate power transfer and shuts down. The OUT pin is high impedance after P9027LP-R is shutdown
SCL	I^2C clock pin
SDA	I^2C data pin
/EN	Active low enable pin. Pulling this pin to logic high forces the device into shutdown mode. When connected to logic low, the device is enabled. Do not leave the pin floating.
GND	Power ground.
OUT	Regulated output voltage pin. Connect at least two 10 µF capacitors from this pin to PGND. The default voltage is set to 5V when VSET is directly shorted to GND.
OUTS	Feedback input pin. This pin must be connected directly to OUT pin to provide a regulated voltage.
/ACT	Active flag pin. Open drain output. Connect the cathode of the LED to this pin. When pulled low, it indicates connection between receiver and transmitter is established.
VDD	Charge pumps regulated 5 V supply to power the internal circuitry. Connect a 1 µF capacitor as close as possible from this pin to GND. Do not load the pin.

Schematics:


P9027LP-R Mass Market EV Schematics
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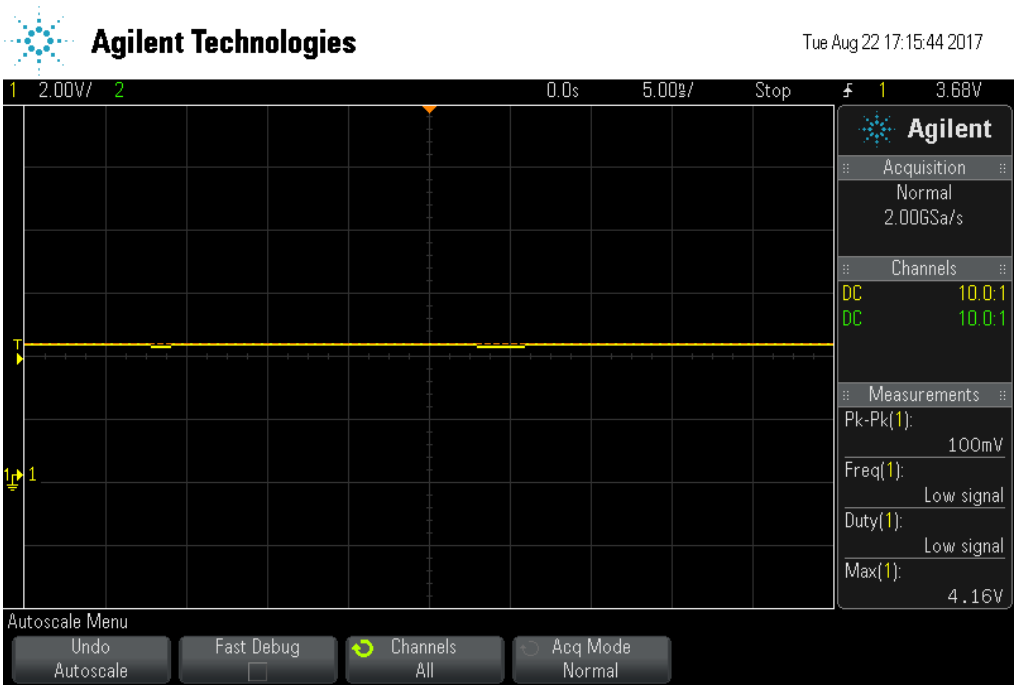
P9027LP-R Schematics

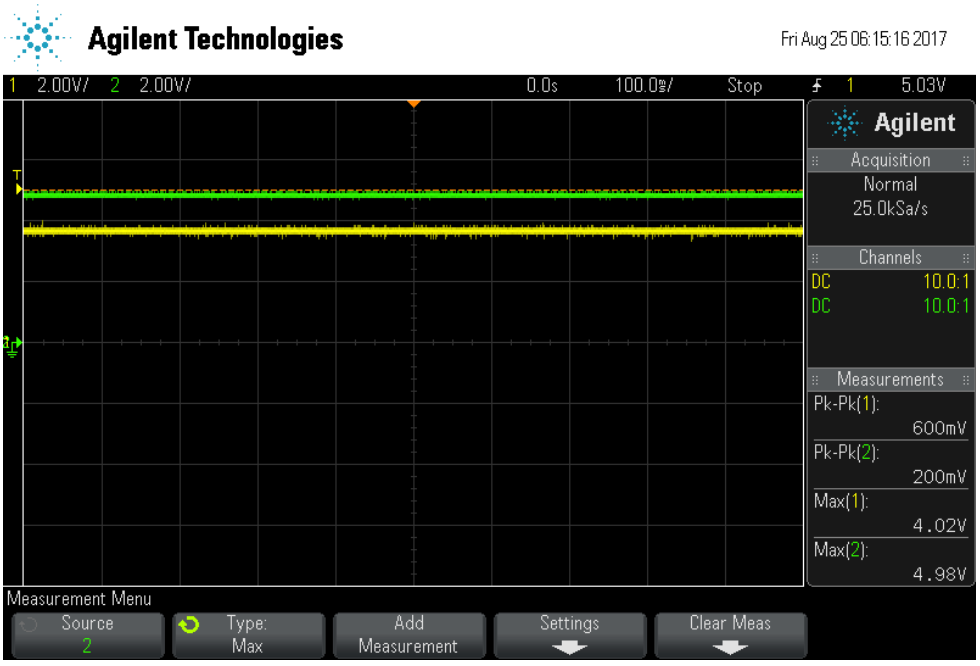
Tests:

•OUT pin

Test output without load:

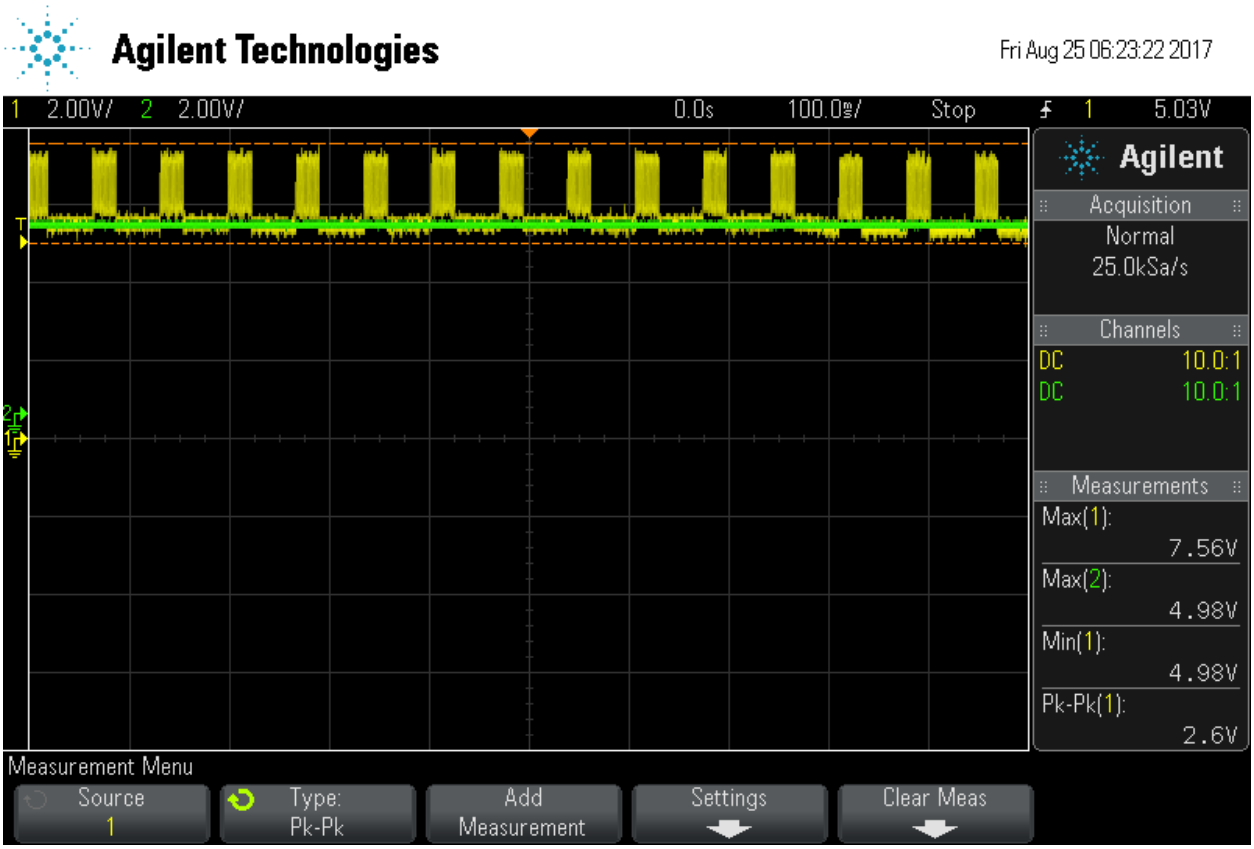


with load: (OUT is Yellow, with OUTS green)

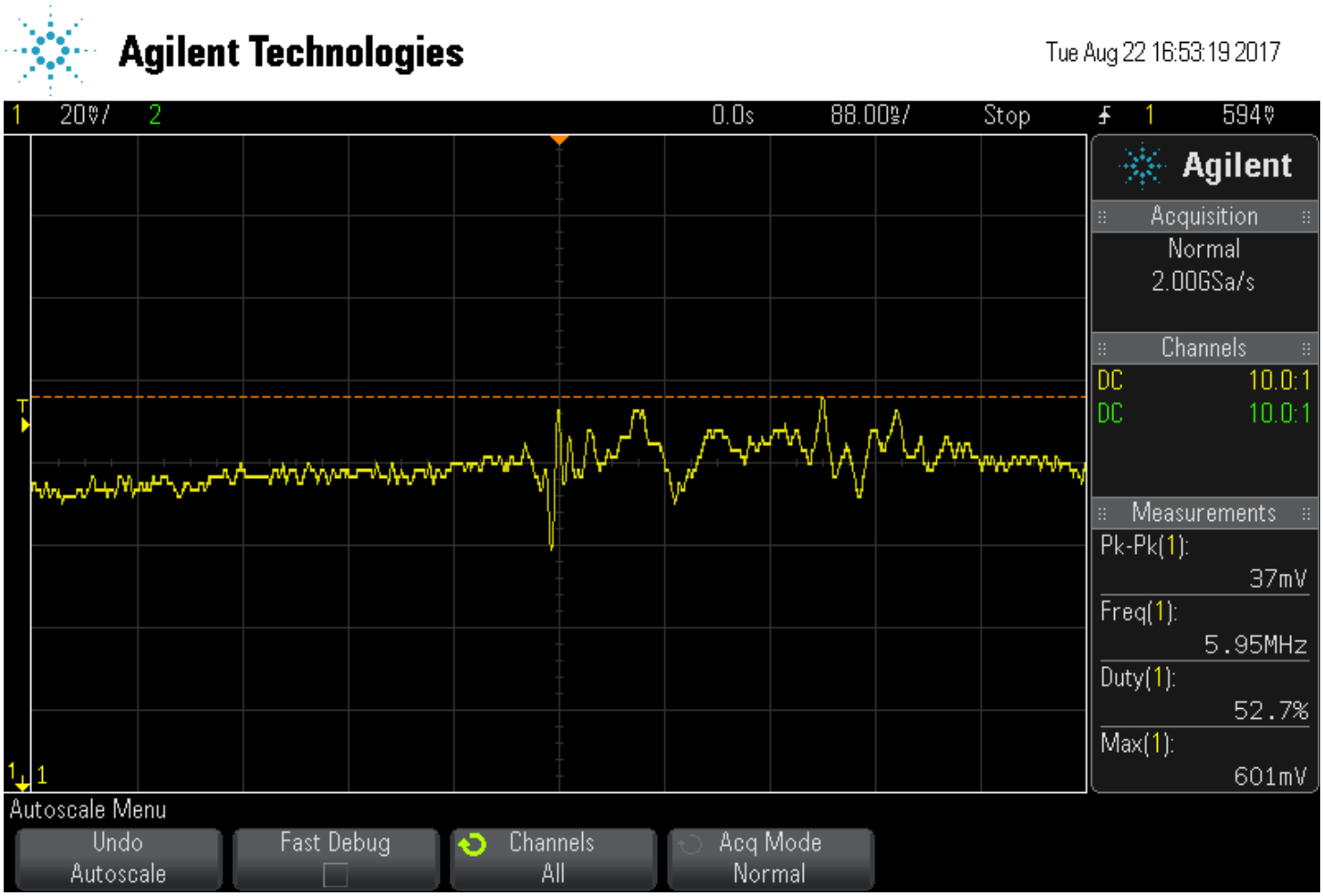


Doubt: the schematic showing they are connected together, however, voltage difference exists.

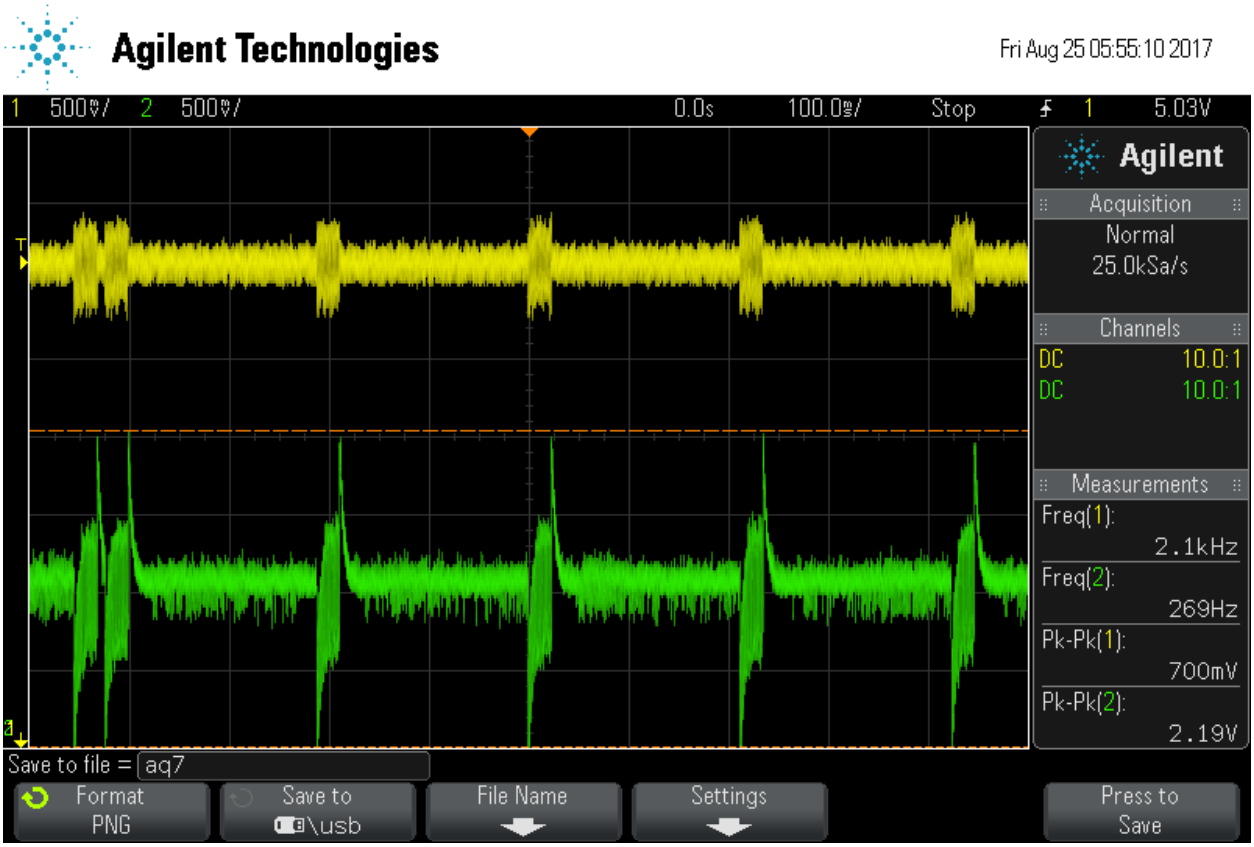
•Rect pin vs OUT pin : (AC stands for the communication backwards, message encrypted before bridge)



•At same time, encrypted message FSK shown in ISNS.



•EOC pin, will send a end of power packet to the transmitter if connected to high.



the extra packet (the second right following the first over the continuous regular received packet) in the graph following RECT DC value drops but stills in communication with VSNS and ISNS still has pinging and packets transfer in between.

(Y for ISNS, G for VSNS)