

Soldering Guide

CHARM

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1 USB-C Port

1.1 Materials

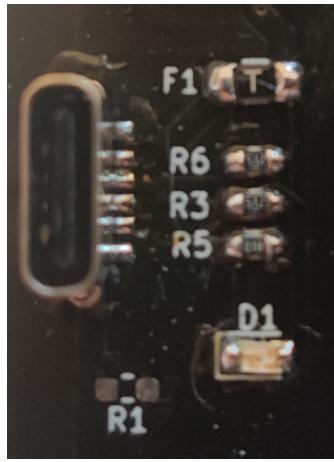
Begin by retrieving the components in Table 1.

Part No.	Description	Silkscreen No(s.)	Quantity
USB4140-GF-0070-C	USB-C Port	J1	1
SF-1206F250-2	2.5A Fuse	F1	1
RT0603DRE075K1L	5.1kΩ Resistor	R3,R6	2
RT0603FRE131KL	1kΩ Resistor	R5	1
150080RS75000	USB LED	D1	1

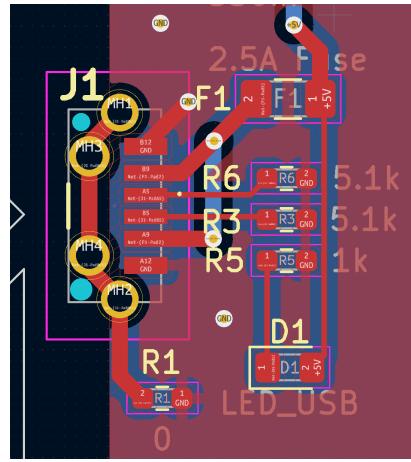
Table 1: Required Components for USB-C Subsystem

1.2 Layout

Reference Figure 1 to properly place the components.



(a) Soldered Example



(b) PCB Layout

Figure 1: USB-C Subsystem Layout Reference

Polarity Notes

Pay special attention to the orientation of the following components.

- D1: USB LED (Arrow towards H1/H3 side of board)

1.3 Soldering

Solder the components.

Recommended Order

1. F1: 2.5A Fuse
2. R6: $5.1\text{k}\Omega$ Resistor
3. R3: $5.1\text{k}\Omega$ Resistor
4. R5: $1\text{k}\Omega$ Resistor
5. D1: USB LED
6. J1: USB-C Port

Do not solder R1.

1.4 Quality Assurance

TREVOR TODO

2 Boost Converter

2.1 Materials

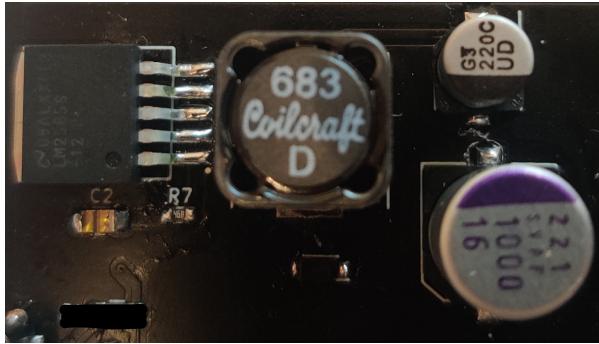
Begin by retrieving the components in Figure 2.

Part No.	Description	Silkscreen No(s.)	Quantity
LM2585S-12/NOPB	Boost Converter IC	IC3	1
UUID1C221MCL1GS	220uF Capacitor	C7	1
16SVPF1000M	1mF Capacitor	C9	1
ECPU1C334MA5	330nF Capacitor	C2	1
MSS1210-683MED	68uH Inductor	L2	1
RC0603FR-072K94L	$2.94\text{k}\Omega$ Resistor	R7	1
SS24FL	Schottky Diode	D4	1

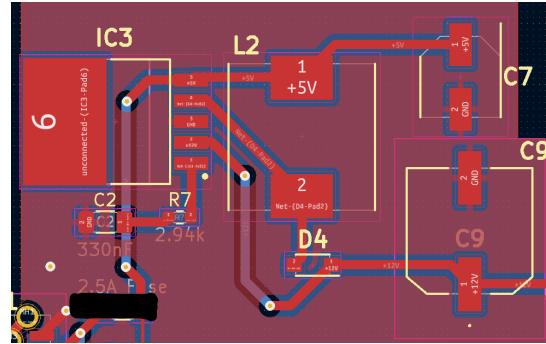
Figure 2: Required Components for Boost Converter Subsystem

2.2 Layout

Reference Figure 3 to properly place the components.



(a) Soldered Example



(b) PCB Layout

Figure 3: Boost Converter Subsystem Layout Reference

Polarity Notes

Pay special attention to the orientation of the following components.

- C9: 1mF Capacitor (Reference Figure 3.a)
- C7: 220uF Capacitor (Reference Figure 3.a)
- C2: TODO TREVOR
- D4: TODO TREVOR

2.3 Soldering

Solder the components.

Recommended Order

1. IC3: Boost Converter IC
2. C2: 330nF Capacitor
3. R7: $2.94\text{k}\Omega$ Resistor
4. D4: Schottky Diode
5. L2: 68uH Inductor
6. C7: 1mF Capacitor
7. C9: 220uF Capacitor

2.4 Quality Assurance

3 Battery Charge Controller

3.1 Materials

Begin by retrieving the components in Figure 4.

Part No.	Description	Silkscreen No(s.)	Quantity
MCP73844-840I/MS	Battery Charge IC	IC1	1
EEE-FN1E100R	10uF Capacitor	C1, C6	2
T491A104K035AT	0.1uF Capacitor	C3	1
RT0603BRD0750KL	50kΩ Resistor	R2	1
ERJ-6RQFR22V	220mΩ Resistor	R4	1
150080RS75000	Red LED	D2	1
IRF7404TRPBF	MOSFET	Q1	1
MCP73844-840I/MS	Battery Holder	J2	1
L101011MS02Q	Switch	SW1	1

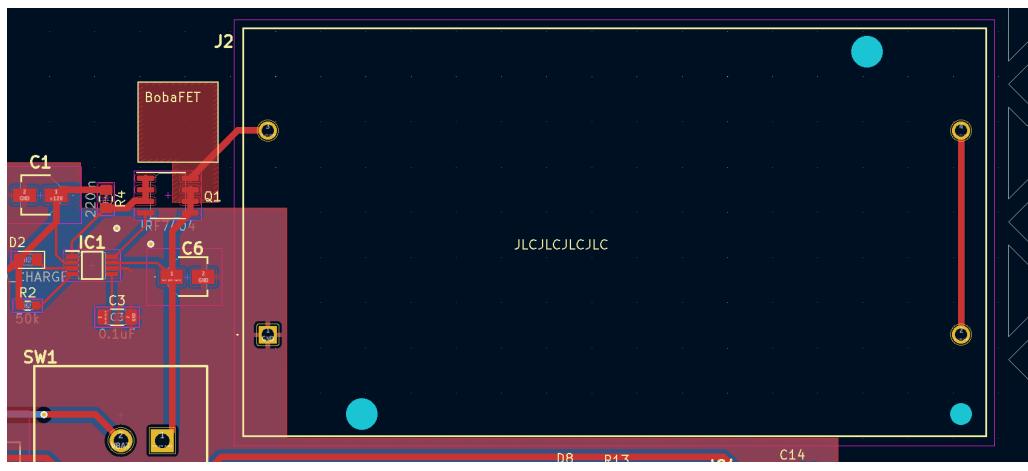
Figure 4: Required Components for the Battery Charge Controller Subsystem

3.2 Layout

Reference Figure 5 to properly place the components.



(a) Soldered Example



(b) PCB Layout

Figure 5: Battery Charge Controller Subsystem Layout Reference

Polarity Notes

Pay special attention to the orientation of the following components.

- C1: 10uF Capacitor (Reference Figure 5.a)
- C6: 10uF Capacitor (Reference Figure 5.a)
- C3: 0.1uF Capacitor (Banded, bevelled side towards H1/H3 board side)
- D2: Red LED (Arrow towards H2/H4 side of board)
- IC1: Battery Charge IC (Dot in top-left corner, towards H1 board corner)
- Q1: TODO TREVOR

3.3 Soldering

Solder the components.

Recommended Order

1. IC1: Battery Charge IC
2. Q1: MOSFET
3. R4: 220mΩ Resistor
4. D2: Red LED
5. R2: 50kΩ Resistor
6. C3: 0.1uF Capacitor
7. C1, C6: 10uF Capacitors
8. SW1: Switch
9. J2: Battery Holder

After soldering, attach heatsink to BobaFET square.

3.4 Quality Assurance

TREVOR TODO

4 Buck Converter

4.1 Materials

Begin by retrieving the components in Figure 6.

Part No.	Description	Silkscreen No(s.)	Quantity
LM2576SX-3.3/NOPB	Buck Converter IC	IC2	1
RT0603FRE131KL	1kΩ Resistor	R8	1
16SVP100M	100uF Capacitor	C8	1
UUD1C221MCL1GS	220uF Capacitor	C4, C5	2
B520C-13-F	Schottky Diode	D3	1
150080RS75000	Red LED	D5	1
74437429203101	100uH Inductor	L1	1

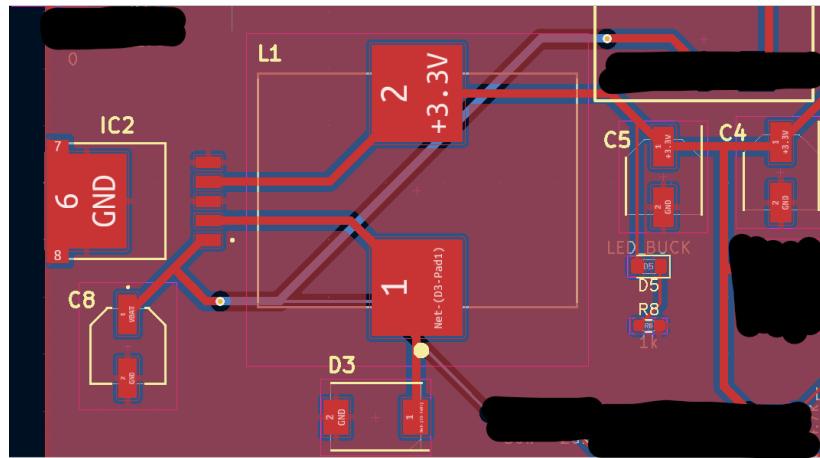
Figure 6: Required Components for Buck Converter Subsystem

4.2 Layout

Reference Figure 7 to properly place the components.



(a) Soldered Example



(b) PCB Layout

Figure 7: Buck Converter Subsystem Layout Reference

Polarity Notes

Pay special attention to the orientation of the following components.

- D3: Schottky Diode (Ensure band is on H2/H4 side of board)
- D5: Red LED (Arrow towards H2/H4 side of board)
- C4, C5: 220uF Capacitor (Reference Figure 7.a)
- C8: 100uF Capacitor (Reference Figure 7.a)

4.3 Soldering

Solder the components.

Recommended Order

1. R8: 1k Ω Resistor

2. D5: Red LED
3. D3: Schottky Diode
4. C4, C5: 220uF Capacitors
5. C8: 100uF Capacitor
6. IC2: Buck Converter IC
7. L1: 100uH Inductor

4.4 Quality Assurance

TREVOR TODO

5 Omega 2S+

5.1 Materials

Begin by retrieving the components in Figure 8.

Part No.	Description	Silkscreen No(s.)	Quantity
OM-O2SP	Omega2S+	U2	1
RT0603BRE0750RL	50Ω Resistor	R11	1
RT0603FRE131KL	1kΩ Resistor	R12	1
RT0603BRD0750KL	50kΩ Resistor	R21	1
150080VS75000	Green LED	D7	1
1N5819	Schottky Diode	D6	1
EEE-FN1E100R	10uF Capacitor	C12	1
T491A104K035AT	0.1uF Capacitor	C13	1

Figure 8: Required Components for Omega2S+ Subsystem

5.2 Layout

Reference Figure 9 to properly place the components.

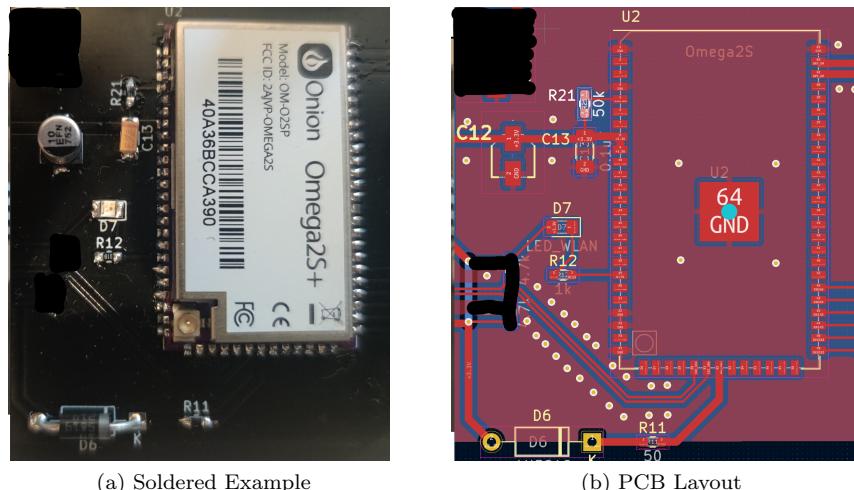


Figure 9: Omega2S+ Subsystem Layout Reference

Polarity Notes

Pay special attention to the orientation of the following components.

- C12: 10uF Capacitor (Reference Figure 9.a)
- C13: 0.1uF Capacitor (Bevel and band towards H1/H2 side of board)
- D6: Schottky Diode (Band towards H2/H4 side of board)
- D7: Green LED (Arrow towards H2/H4 side of board)

5.3 Soldering

Solder the components.

Recommended Order

1. R11: 50Ω Resistor
2. R12: $1k\Omega$ Resistor
3. R21: $50k\Omega$ Resistor
4. D7: Green LED
5. D6: Schottky Diode
6. C12: 10uF Capacitor
7. C13: 0.1uF Capacitor
8. U2: Omega2S+

After soldering, attach antenna to U2's U.FL connector.

5.4 Quality Assurance

1. Complete assembly of all previous subsystems in the guide.
2. Insert two batteries into the PCB battery holder, ensuring switch is in the "off" position.
3. Flip the switch.
4. The Omega2S+ LED should light up, begin flashing, and then eventually remain solid.
5. Once the LED remains solid (should be around 1 minute), check the WiFi networks in the lab. There should be a WiFi network with SSID **Omega-XXXX** where **XXXX** are the last two bytes of the Omega2S+'s MAC address, in hexadecimal notation.

6 Battery Monitor Subsystem

6.1 Materials

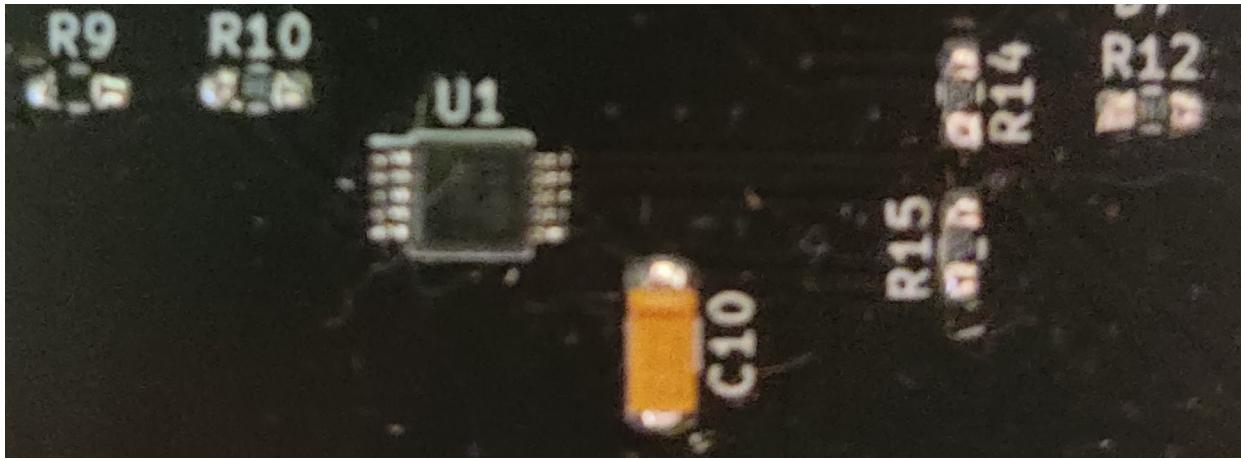
Begin by retrieving the components in Figure 10.

Part No.	Description	Silkscreen No(s.)	Quantity
ADS1113IDGST	ADC	U1	1
RT0603BRD0750KL	50kΩ Resistor	R9	1
RT0603DRE0720KL	20kΩ Resistor	R10	1
RT0603DRE074K7L	4.7kΩ Resistor	R14, R15	2
T491A104K035AT	0.1uF Capacitor	C10	1

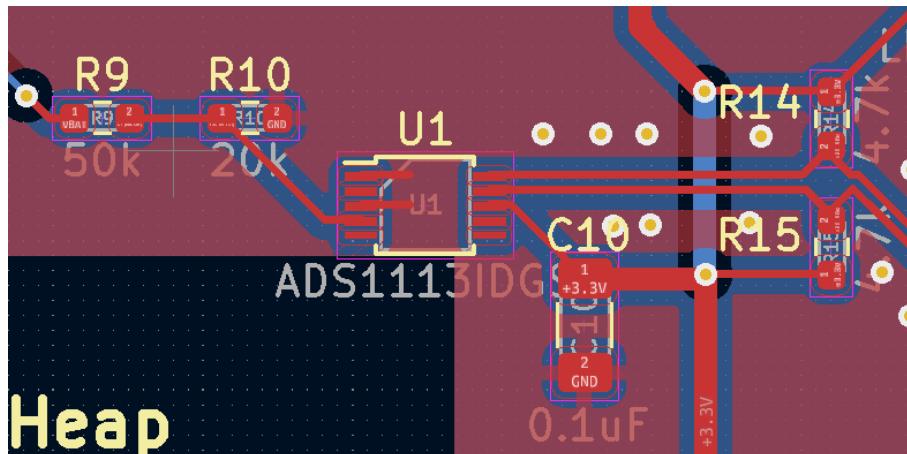
Figure 10: Required Components for Battery Monitor Subsystem

6.2 Layout

Reference Figure 11 to properly place the components.



(a) Soldered Example



(b) PCB Layout

Figure 11: Battery Monitor Subsystem Layout Reference

Polarity Notes

Pay special attention to the orientation of the following components

- C10: 0.1uF Capacitor (Bevelled side towards H1/H2 side of the board)
- U1: ADC (Dot towards the H1 corner of the board)

6.3 Soldering

Solder the components.

Recommended Order

1. U1: ADC
2. R9: 50kΩ Resistor
3. R10: 20kΩ Resistor
4. R14, R15: 4.7kΩ Resistor
5. C10: 0.1uF Capacitor

6.4 Quality Assurance

1. Do the steps in the Omega2S+ Quality Assurance section.
2. Connect to the Omega2S+'s WiFi network.
3. SSH into the Omega2S+ via the `ssh root@omega-XXXX.local` command.
4. Enter the default password when prompted: `onioneer`.
5. Download our script for testing the ADC: `wget TODO`.
6. Run the script: `./TODO.sh`.
7. Measure the voltage of the battery and confirm that it matches that output by the script.

7 GPS Sensor Subsystem

7.1 Materials

Begin by retrieving the components in Figure 12.

Part No.	Description	Silkscreen No(s.)	Quantity
NEO-M9N-00B	GPS IC	IC4	1
C1005X7R1C104K050BC	100nF Capacitor	C11	1
T491A104K035AT	0.1uF Capacitor	C14	1
150080YS75000	Yellow LED	D8	1
AQ3522-01LTG	TVS Diode	D9	1
LQW18AN27NG00D	27nH Inductor	L3	1
U.FL-R-SMT(01)	U.FL Connector	J3	1
RT0603FRE131KL	1kΩ Resistor	R13	1
RT1206FRE1310RL	10Ω Resistor	R16	1

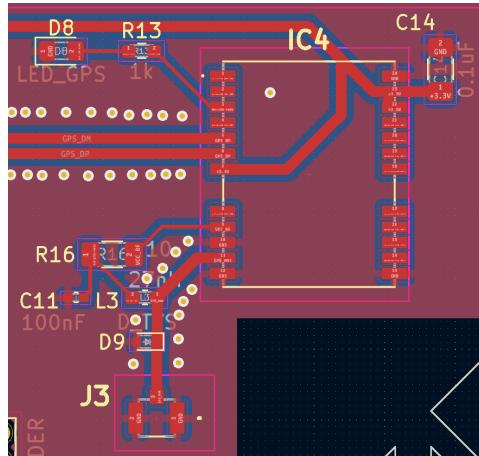
Figure 12: Required Components for GPS Sensor Subsystem

7.2 Layout

Reference Figure 13 to properly place the components.



(a) Soldered Example



(b) PCB Layout

Figure 13: GPS Sensor Subsystem Layout Reference

Polarity Notes

Pay special attention to the orientation of the following components

- IC4: GPS IC (Dot towards the H1 corner of the board)
- C11: TREVOR TODO
- C14: 0.1uF Capacitor (Bevelled, banded edge towards H3/H4 side of the board)
- D8: Yellow LED (Arrow towards H1/H3 side of the board)
- D9: TREVOR TODO

7.3 Soldering

Solder the components.

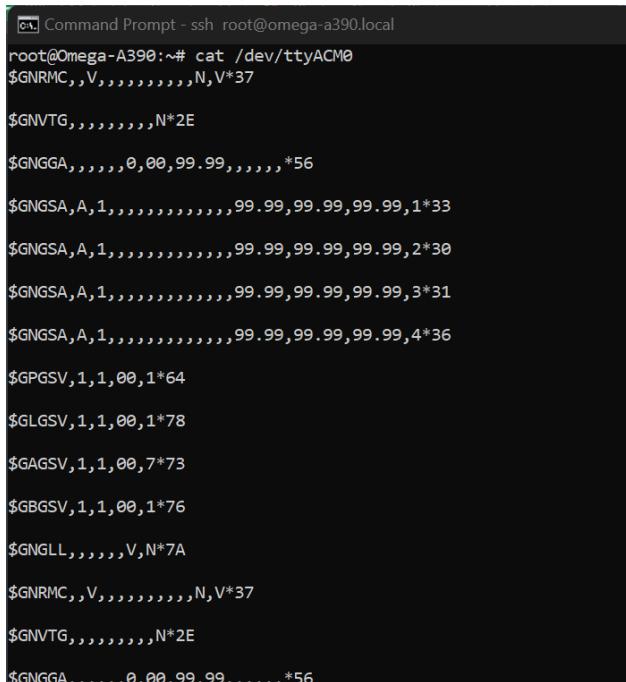
Recommended Order

1. IC4: GPS IC
2. C11: 100nF Capacitor
3. C14: 0.1uF Capacitor
4. D8: Yellow LED
5. D9: TVS Diode
6. L3: 27nH Inductor
7. J3: U.FL Connector
8. R13: 1kΩ Resistor
9. R16: 10Ω Resistor

After soldering, attach GPS antenna to J3.

7.4 Quality Assurance

1. Do the steps in the Omega2S+ Quality Assurance section.
2. Connect to the Omega2S+'s WiFi network.
3. SSH into the Omega2S+ via the `ssh root@omega-XXXX.local` command.
4. Enter the default password when prompted: `onioneer`.
5. Run the following command: `cat /dev/ttyACM0`.
6. You should see the output similar to that pictured in Figure 14.



The screenshot shows a terminal window with the title "Command Prompt - ssh root@omega-a390.local". The window displays the output of the command `cat /dev/ttyACM0`. The output consists of several lines of GPS NMEA data, starting with \$GNRMC, followed by \$GNVTG, \$GNGGA, \$GNGSA, \$GNGSV, \$GLGSV, \$GAGSV, \$GBGSV, \$GNGLL, and ending with \$GNGGA. Each line contains various fields separated by commas, such as latitude, longitude, and timestamp information.

```
root@Omega-A390:~# cat /dev/ttyACM0
$GNRMC,,V,,,,,,,,,N,V*37
$GNVTG,,,,,,N*2E
$GNGGA,,,0,00,99.99,,,,,*56
$GNGSA,A,1,,,,,,99.99,99.99,99.99,1*33
$GNGSA,A,1,,,,,,99.99,99.99,99.99,2*30
$GNGSA,A,1,,,,,,99.99,99.99,99.99,3*31
$GNGSA,A,1,,,,,,99.99,99.99,99.99,4*36
$GPGSV,1,1,00,1*64
$GLGSV,1,1,00,1*78
$GAGSV,1,1,00,7*73
$GBGSV,1,1,00,1*76
$GNGLL,,V,N*7A
$GNRMC,,V,,,,,,,,,N,V*37
$GNVTG,,,,,,N*2E
$GNGGA,,,0,00,99.99,,,*56
```

Figure 14: Expected `cat /dev/ttyACM0` command output