Verification and Validation Protocol:

Ear EEG with cEEGrid & ADS1299EEGFE-PDK

Version	*1.0*
Date	*2026-03-15*
Status	*PROJECT*

Contents

1. Document metrics and environment

To be completed before testing begins.

Test made by	*Team Human++*
Test start date	*2026-03-14*
Hardware name	*ADS1299EEGFE-PDK*
Partia/ID	*ADS1299EEGFE-PDK: 8536600486, 9104200027*
Software name	*ADS1299EEGFE-PDK-SW Software for ADS1299EEGFE-PDK*

2. Main test scenario

Test Phase Overview

The verification process is split into four key phases, which must be completed in sequence:

- **Phase 1: Hardware Preparation** – Verifying whether individual components can be physically interconnected and ensuring they will not cause electrical damage.
- **Phase 2: ADS1299EEGFE-PDK and Software Configuration** – Launching the Texas Instruments application and verifying that the board communicates correctly with the computer.
- **Phase 3: Connection Testing** – Connecting the adapter to the ADS system without attaching electrodes to the body ("dry run" testing).
- **Phase 4: Bio-signal Testing (cEEGrid on ear)** – The critical stage involving gel application and skin preparation to record real-time EEG signals.

Detailed Scenario Table

The following table forms the basis of the documentation. Every step must be recorded.

No	Test description	Approach and Preconditions	Success Criteria (Pass/Fail)	Status (P/F)	Comments
1.1	Verification of MB1 Connector	Inserting the cEEGrid into the SAMTEC adapter.	The connector fits securely; no loose connections or damage to the electrode traces.	Pass	Photo 1.1
1.2	Insulation & Solder Quality Control	Visual inspection of heat-shrink tubing and solder joints (battery holder and PCB).	No short circuits; no cold solder joints; no exposed copper.	Pass	Photo 1.2

2.1	Preparing the virtual environment.	Install Windows XP on a VM and install the TI software. Enable USB prompts in VM settings to allow device redirection.	Windows XP boots correctly; TI software launches; VM asks which OS to use when a USB device is plugged in.	Pass	
2.2	Linking the ADS1299EEGFE-PDK to the VM.	Connect the powered ADS1299EEGFE-PDK board. Select the VM in the USB prompt and upload the firmware.	The board is recognized by Windows XP; Firmware upload is successful; The TI app shows "Connected" status.	Pass	Photo 2.2
3.1	Verifying the ADS1299EEGFE-PDK internal signal generator.	Enabling the internal test signal mode in the TI application (without external inputs).	A stable signal is visible in the application; confirms the ADS1299EEGFE-PDK chip is functioning correctly.	Pass	Photo 3.1
3.2	Software Configuration for External Test Signal	In the “Channel Registers” tab, change the input setting for each channel (1 to 8) to "Normal Electrode". In the “GPIO AND other Registers” tab, SRB1: Set to Open (Off).	Ensure all other parameters in the TI application are configured accordingly.	Pass	Photo 3.2
3.3	Verifying the physical connection: cEEGrid → Adapter → ADS1299EEGFE-PDK.	Connecting the cEEGrid to the adapter and the adapter to the ADS1299EEGFE-PDK according to the attached diagram. Connect 9V power and USB; then initialize the software.	The application displays signals from the electrodes; no disconnected channel errors; the board remains connected and stable.	Pass	Photo 3.3, Test detail 3.3
4.1	Preparing the electrode for application.	Wear protective rubber gloves. Apply double-sided adhesive tape to the cEEGrid. Fill electrode wells with conductive gel. Peel off the top protective layer of the tape to expose the adhesive.	Electrode is correctly gelled without cross-contamination; adhesive layer is ready for skin attachment.	Pass	Photo 4.1, Test detail 4.1

4.2	Preparing the skin and attaching the sensor.	Clean the retro-auricular area (behind the ear) using an antiseptic solution. Apply the cEEGrid around the ear and press firmly to ensure full contact.	Skin is free of oils/impurities; cEEGrid is securely attached and does not peel off during movement.	Pass	Test detail 4.1
4.3	First live bio-signal acquisition.	Connect cEEGrid to ADS1299EEGFE-PDK via adapter. Connect USB and 9V power (initially OFF). Power on the system, launch the TI app, and initialize data streaming.	Raw biopotential data is streaming in real-time; while the noise floor is high due to environment interference, the hardware remains synchronized; no 'Leads-off' alerts.	Pass	Photo 4.3, Test detail 4.1

3. Tests details & Procedures

Test detail 3.3: Pin mapping: cEEGrid to ADS1299EEGFE-PDK

The mapping is based on the standard cEEGrid layout and the ADS1299EEGFE-PDK input connectors. It should be used to verify the connections of your custom PCB adapter.

cEEGrid elektrod	**Pin for adapter MB1**	**Input ADS1299 pin (name according to the diagram, datasheet p. 48)**	**Function / Channel**	**Wire color**
R (Reference)	Pin 1	BIAS_ELEC shorted to REF_ELEC which connectes to SRB1 (JP25:5)	Common reference (center or edge electrode)	black
G (Mass)	Pin 2	BIAS_ELEC connected to all INPs (JP25:1)	Ground/Drive Polarity	red
E1	Pin 3	AIN1P (J6:35)	Channel EEG 1	gray
E2	Pin 4	AIN2P (J6:31)	Channel EEG 2	white
E3	Pin 5	AIN3P (J6:27)	Channel EEG 3	blue
E4	Pin 6	AIN4P (J6:23)	Channel EEG 4	yellow
E5	Pin 7	AIN5P (J6:19)	Channel EEG 5	green

E6	Pin 8	AIN6P (J6:15)	Channel EEG 6	purple
E7	Pin 9	AIN7P (J6:11)	Channel EEG 7	light-purple
E8	Pin 10	AIN8P (J6:7)	Channel EEG 8	orange

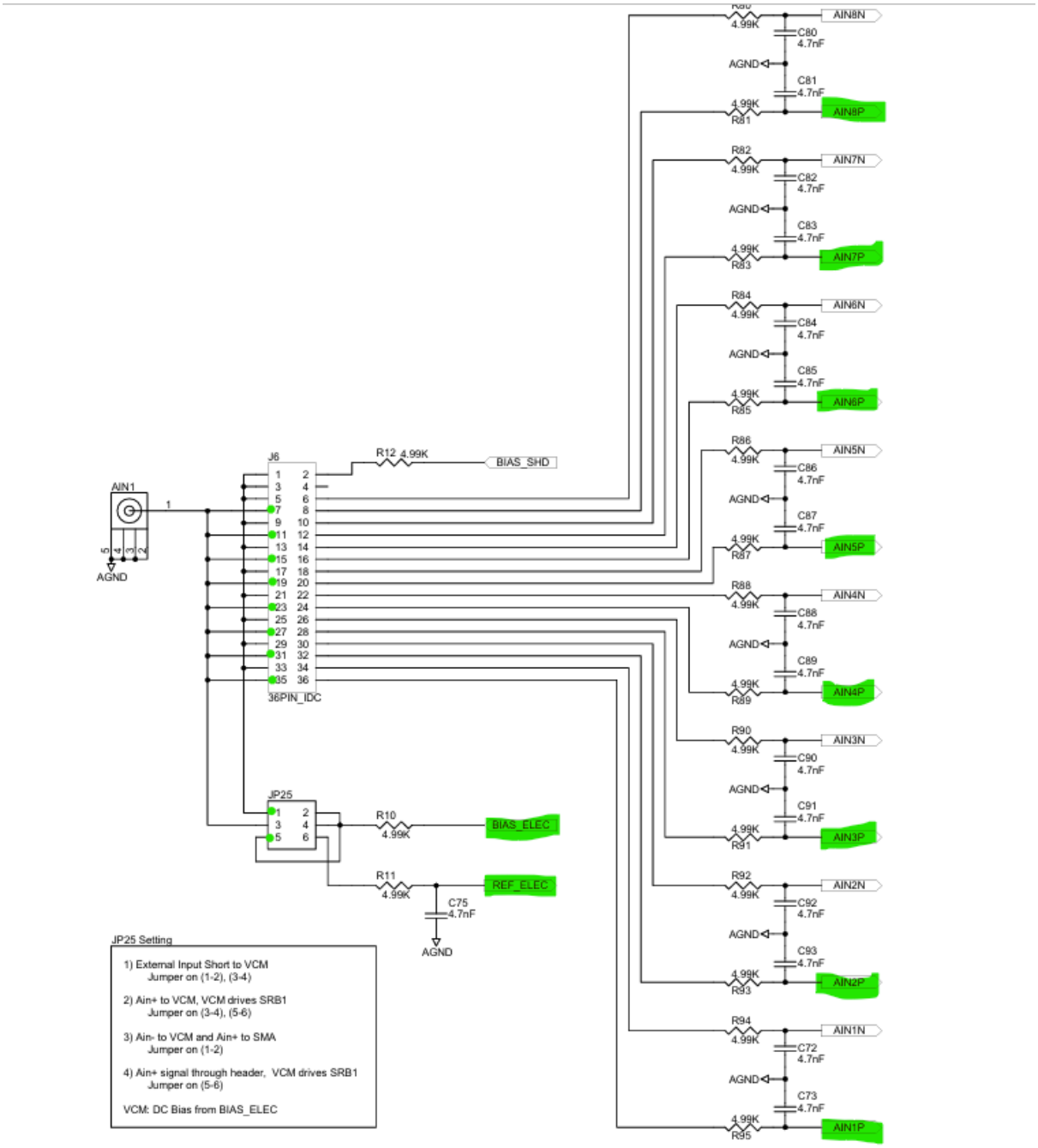


Figure 59. ADS1299EEG-FC Jumper Schematic

Point-to-Point Mapping Test Procedure

To effectively perform the point-to-point mapping test, follow these steps:

- **Preparation:** Connect the cEEGrid to the MB1 adapter. Do **not** connect the adapter to the ADS1299EEGFE-PDK yet.

- **Continuity Check:** Place one multimeter probe on a silver electrode pad on the cEEGrid (e.g., E1) and the other probe on the corresponding Molex pin at the end of the M-F cable.
- **Cross-Check:** Ensure that touching the probe to E1 triggers the continuity beep **only** for AIN1P and does not cause a short circuit with adjacent pins.
- **Verification:** Repeat this process for all 10 active electrodes.

Test detail 4.1: cEEGrid Electrode Application Guide

Description: The following video provides a detailed, step-by-step tutorial on the correct preparation and placement of the cEEGrid electrodes. It covers skin preparation, gel application, and precise anatomical positioning behind the ear to ensure optimal signal quality and minimize impedance.

Watch the tutorial here:
https://www.jove.com/pl/v/64897/recording-brain-activity-with-ear-electroencephalography

4. Non-Conformance Report (NCR)

Date	Test no	Problem description	Actions Taken	Retest Result
15.02.2026	1	Driver Conflict: Windows 11 host refuses to recognize the "vintage" USBStyx driver.	Set up a VMware Virtual Machine with Windows XP SP2 and enabled USB Passthrough to the guest OS.	Success: Device visible in Device Manager.
28.02.2026	2	Hardware Error 6004: "Cannot get a fid" and software freeze during acquisition.	Verified the physical stack of the ADS1299EEGFE-PDK. Reconnected the Daughterboard firmly to the Motherboard to ensure all pins were properly mated.	Success: Communication link established, data streaming started.

5. Engineering Remarks

- **Power Supply:** Prior to each connection, the polarity of the 5.5x2.1 mm DC plug was verified (center-positive).
- **Cables:** M-F jumper wires can be braided (e.g., in a braid pattern) to minimize noise induction.
- **Hygiene:** The skin surface can be prepared using alcohol-soaked swabs and abrasive gel.

6. Visual Evidence

Insert photos documenting key stages here.

Photo 1.1: Verification of MB1 Connector

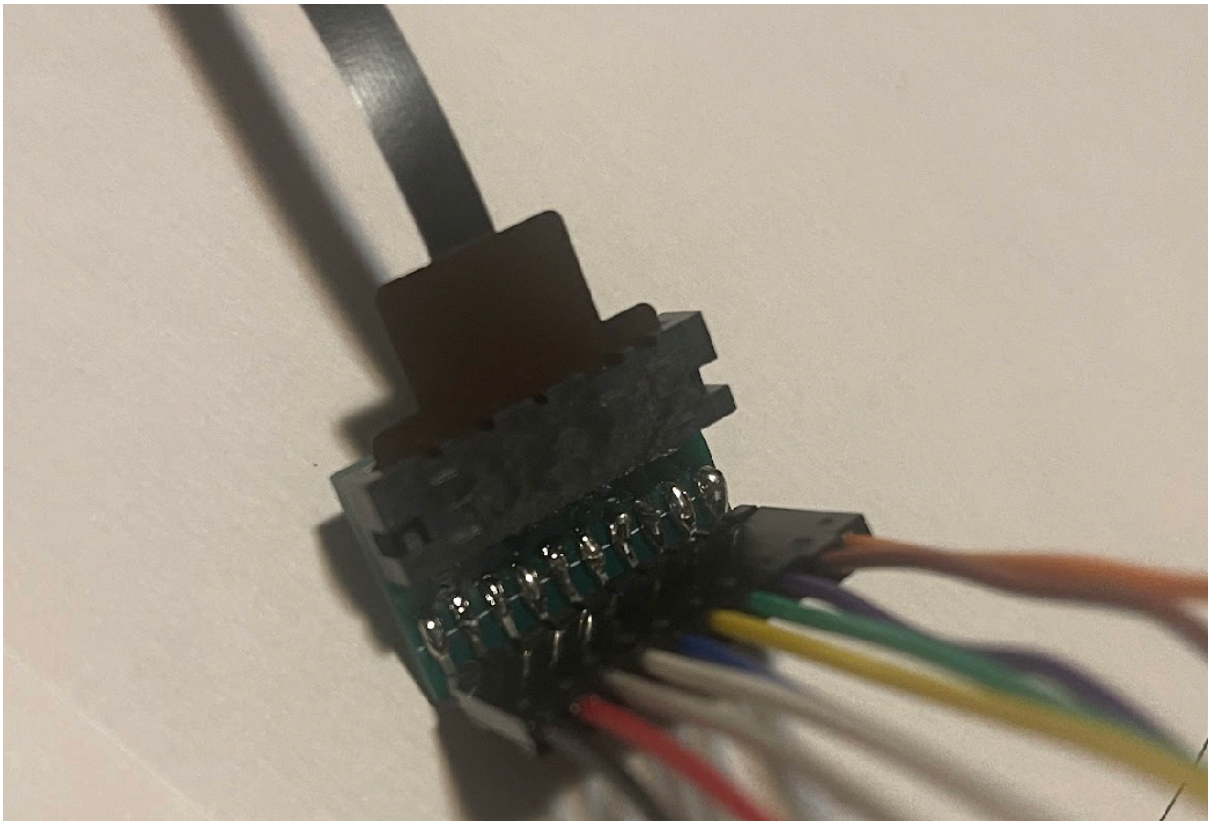
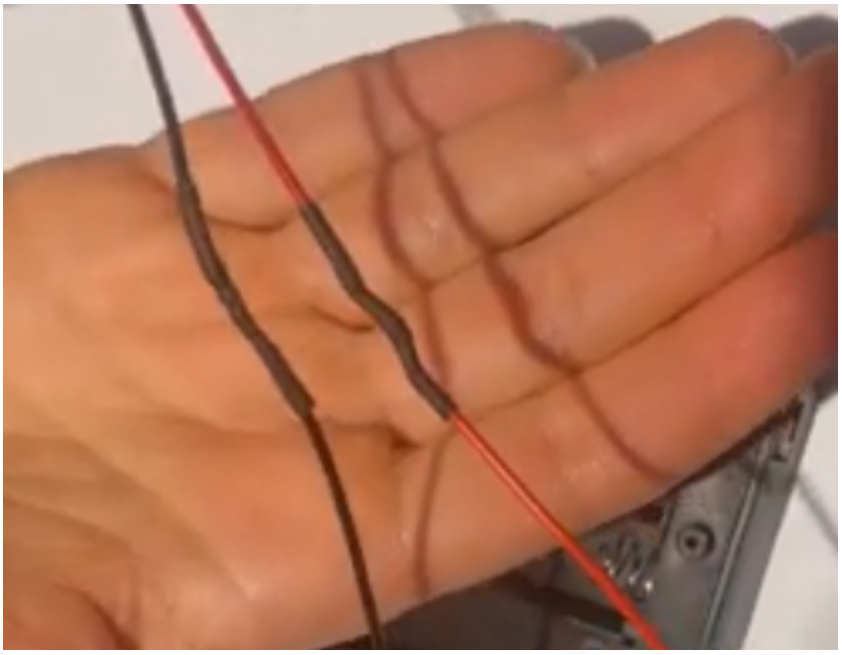


Photo 1.2: Visual inspection of heat-shrink tubing and solder joints (battery holder and PCB).



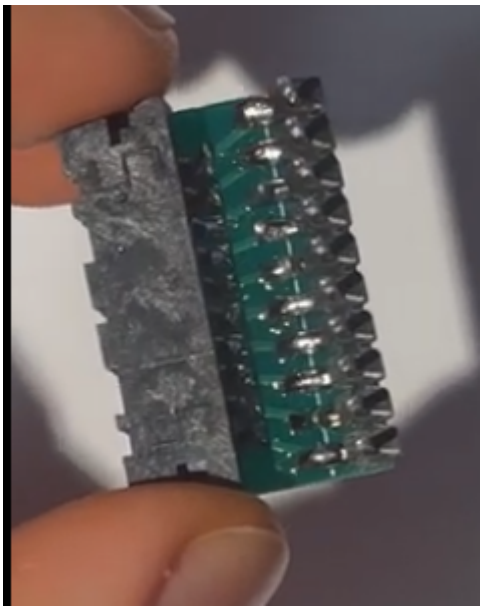
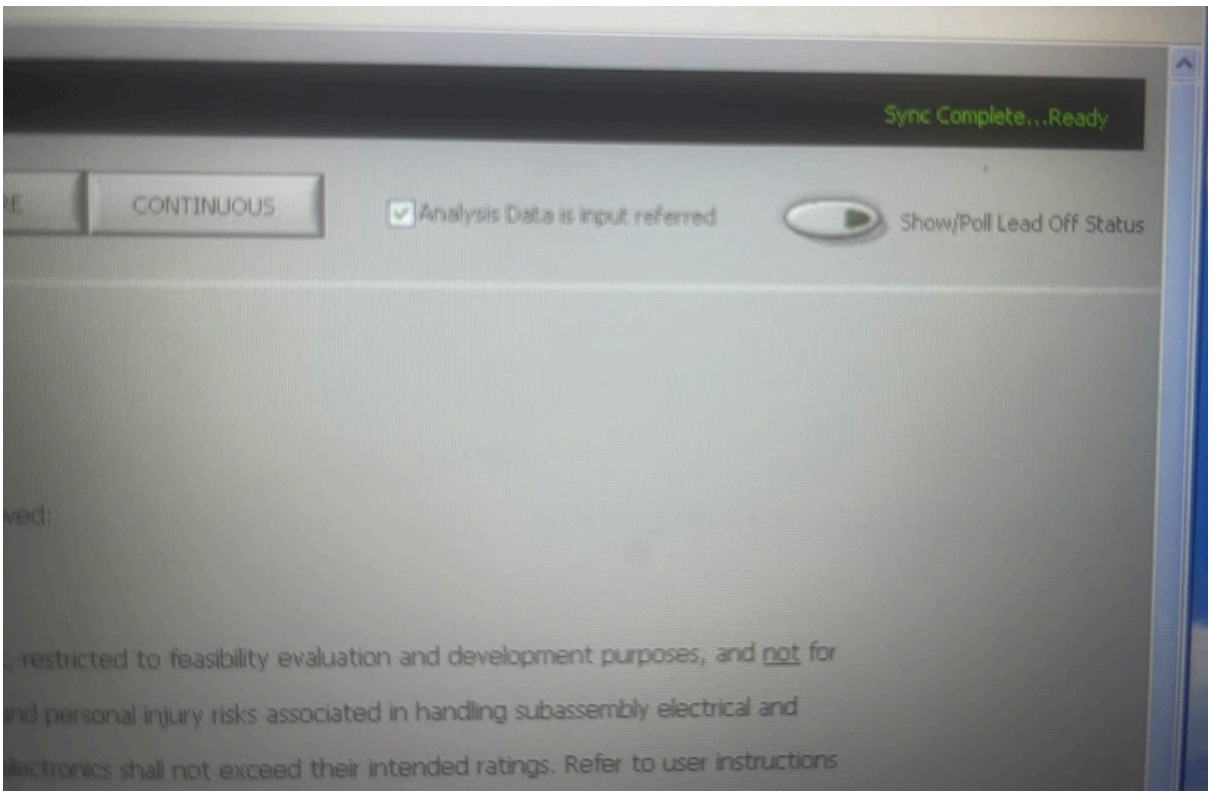


Photo 2.2: Linking the ADS1299EEGFE-PDK to the VM.



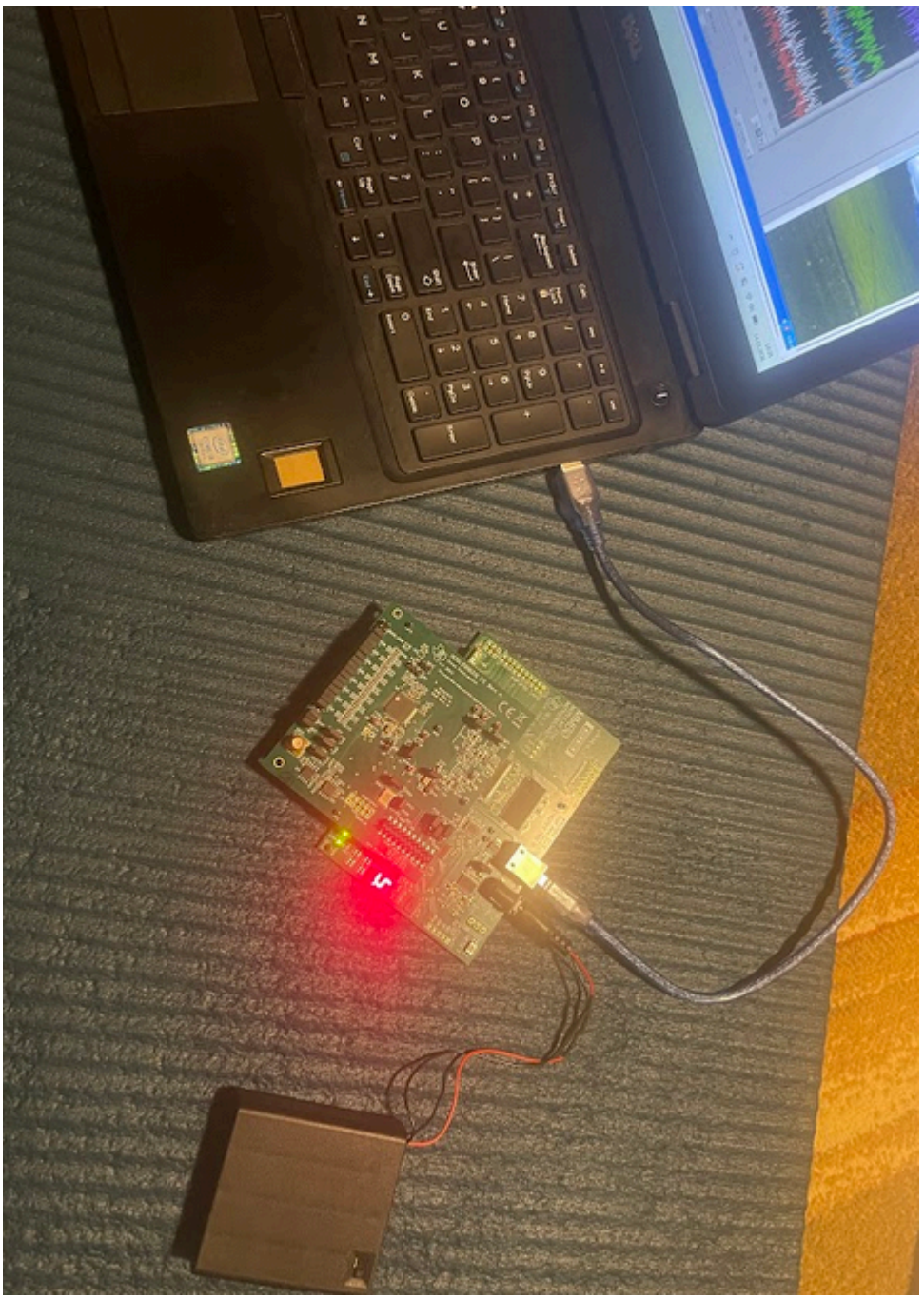


Photo 3.1: Verifying the ADS1299EEGFE-PDK internal signal generator.

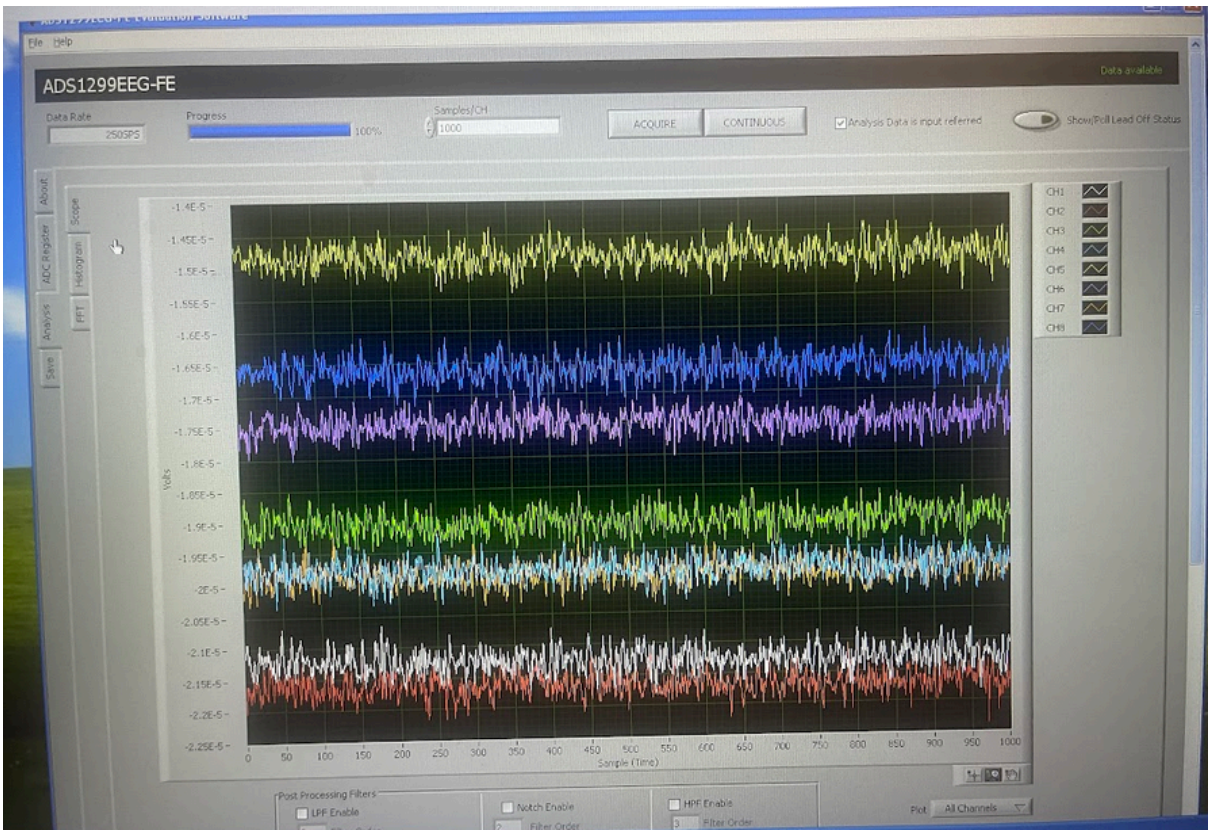
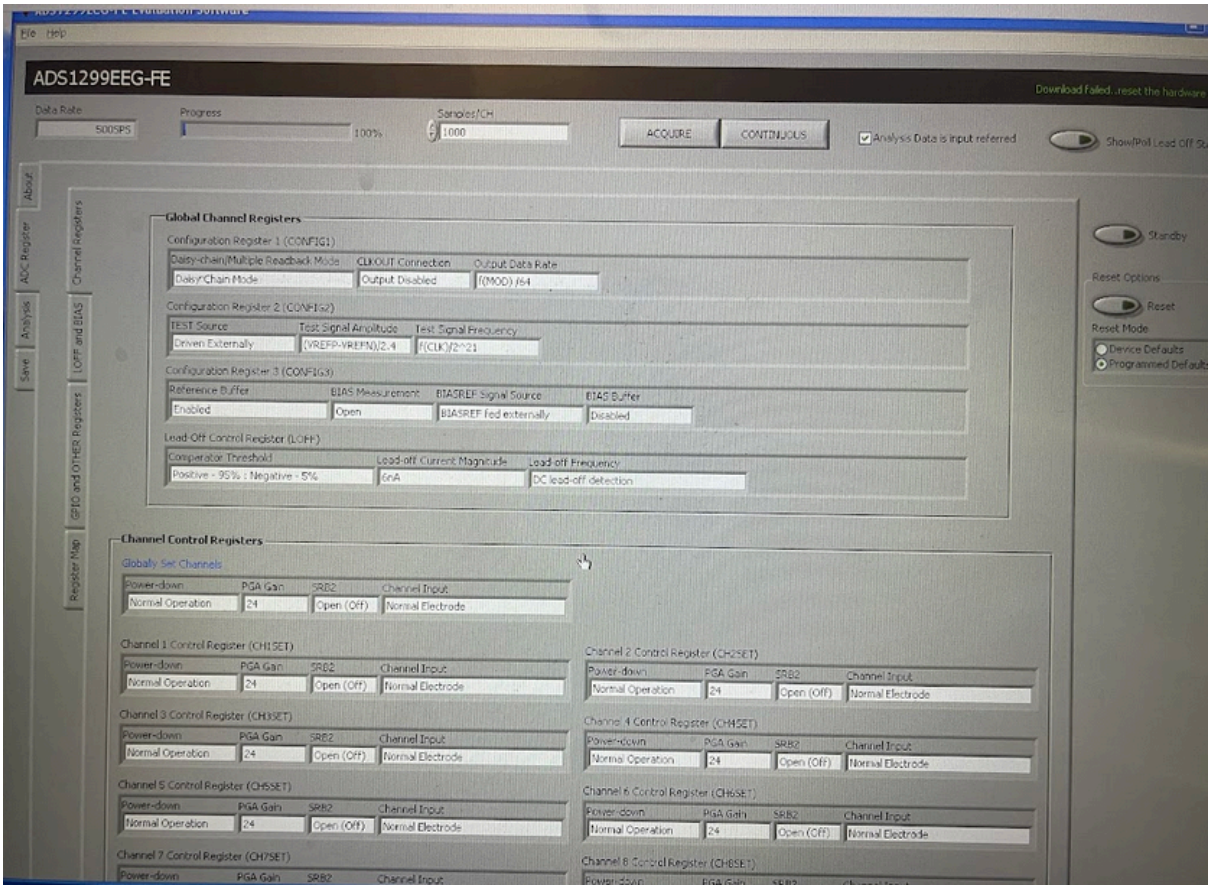


Photo 3.2: Software Configuration for External Test Signal



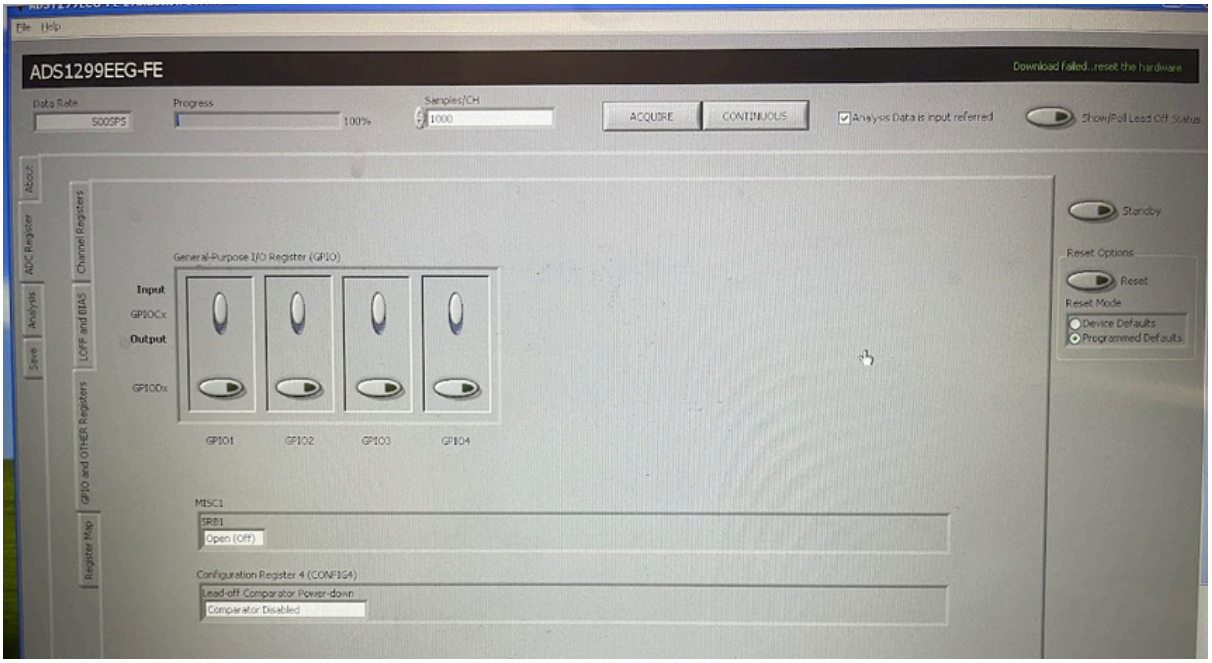
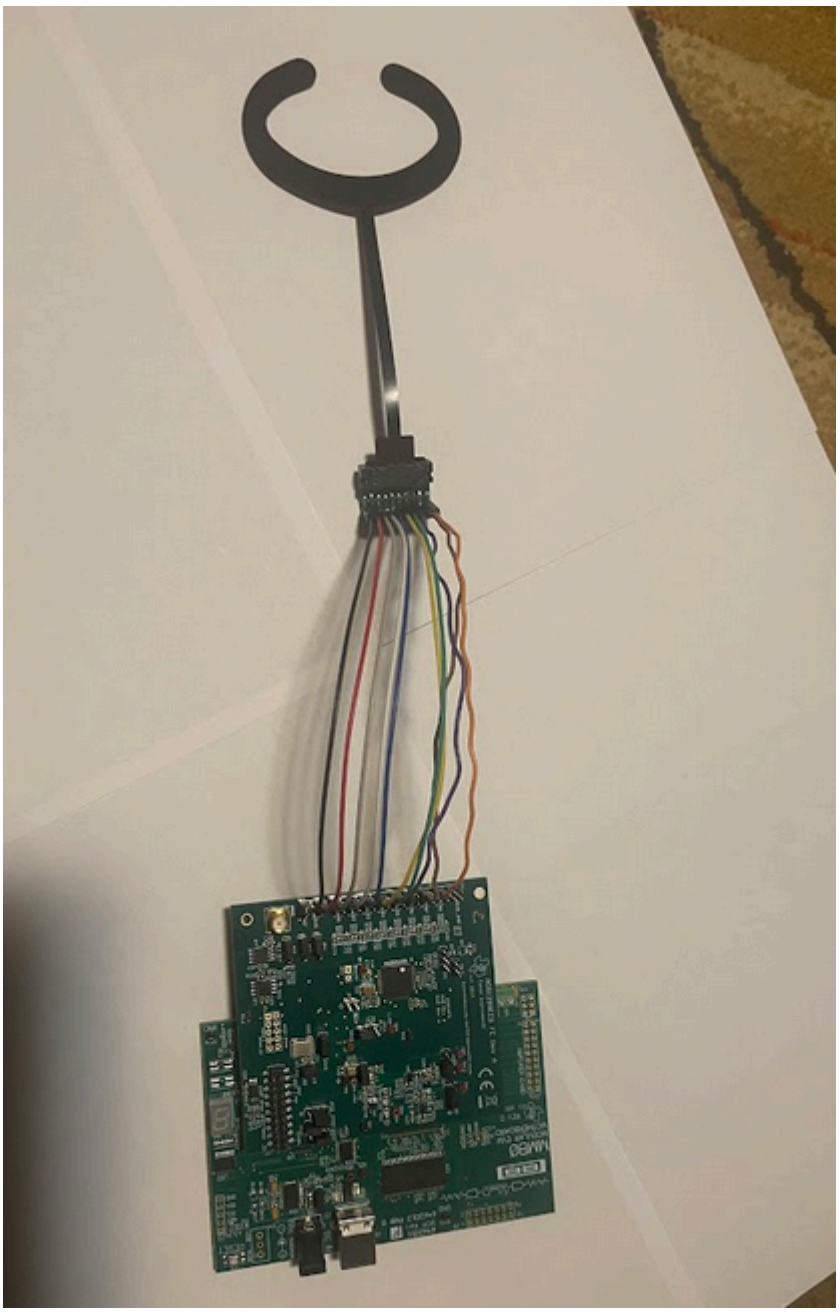
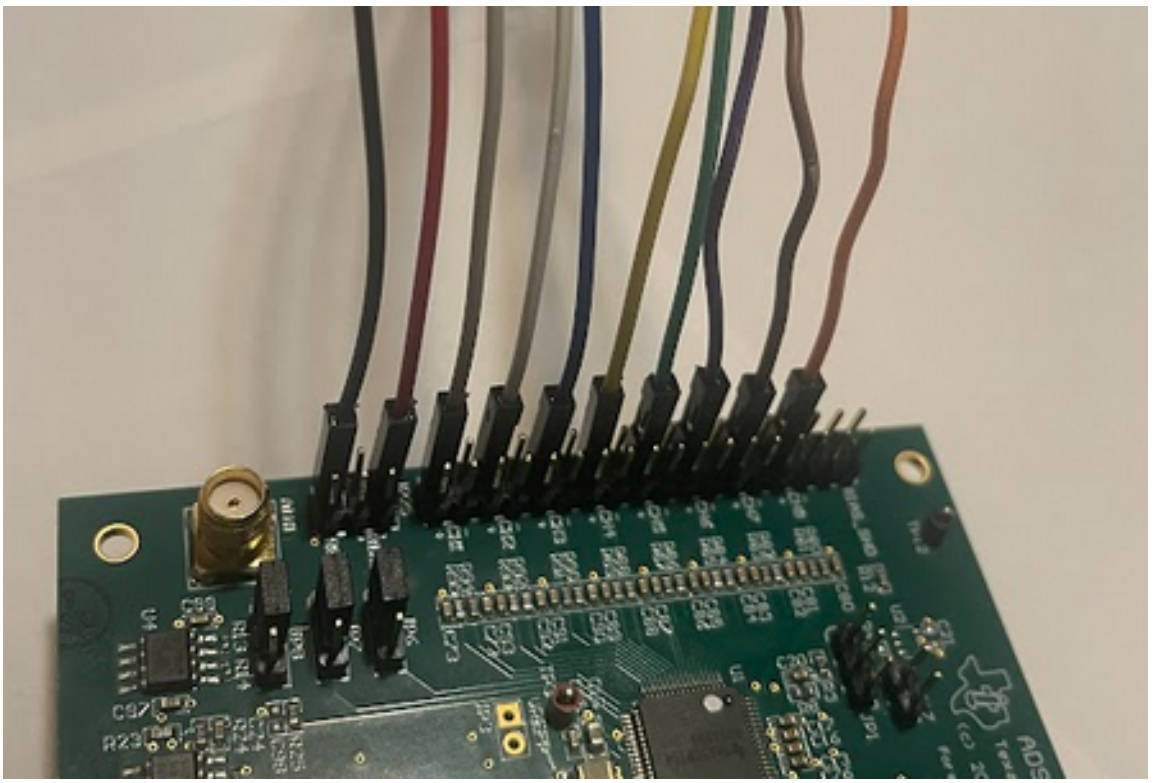


Photo 3.3: Verifying the physical connection: cEEGrid → Adapter → ADS1299EEGFE-PDK.





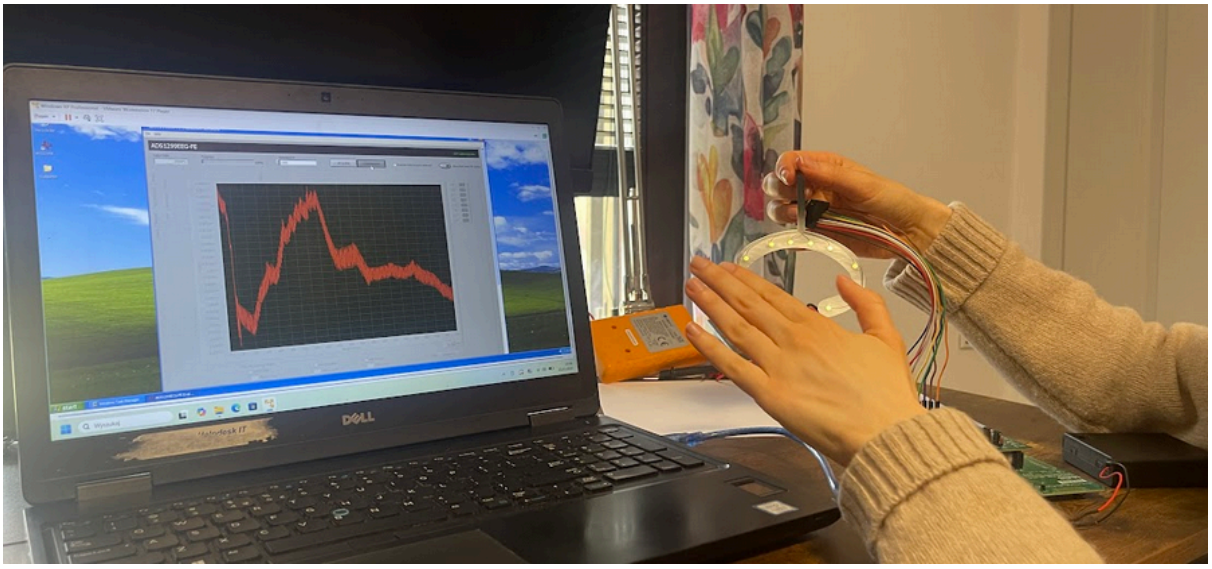

DELL

Photo 4.1: Preparing the electrode for application.

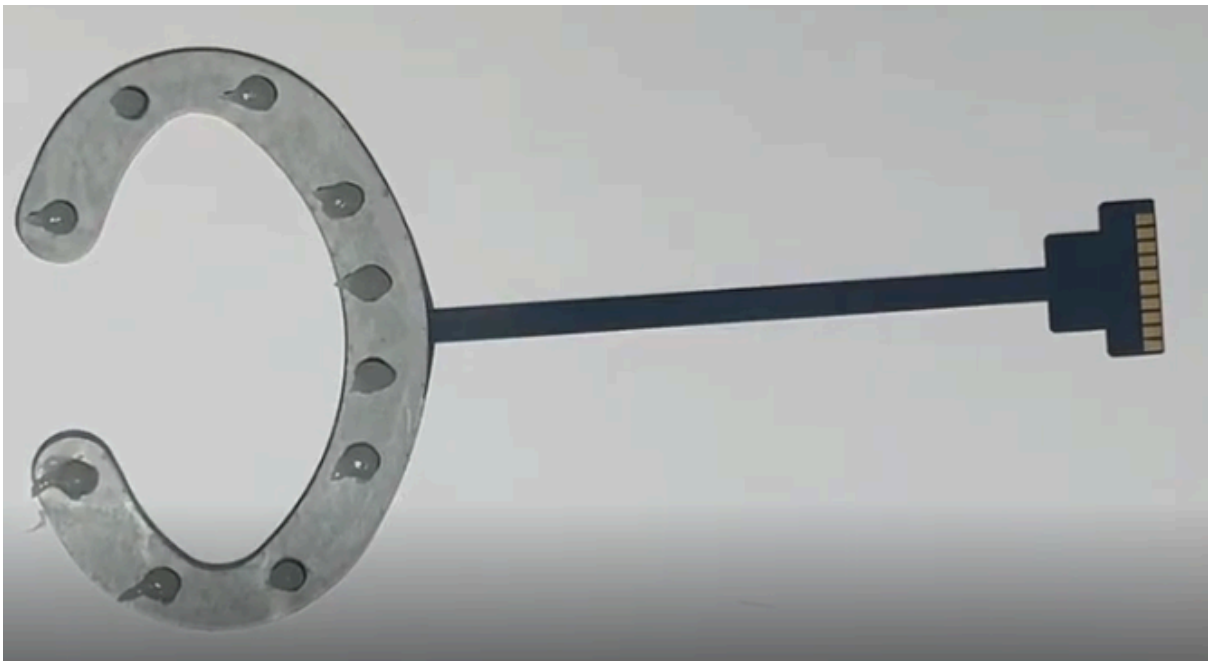


Photo 4.3: First live bio-signal acquisition.