Visual Environment Evaluation Tool 2.1 Manual

This manual provides operation instructions for the Visual Environment Evaluation Tool (VEET) and VEETManager configuration software, enabling researchers to gather and process their own data from the device. This manual is not intended for distribution to end-users or study participants.

Adult VEET *supplied as two temple arms designed to be installed on a single glasses frames model*

***Adjustable VEET** supplied as two temple arms with swappable temple tips to maximize compatibility with multiple glasses frames*

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Intended Use

The Visual Environment Evaluation Tool (VEET) is a pair of temple arms that gather quantitative data on characteristics of light near the eye without disrupting the wearer's normal activities. Each temple arm is an independent instrument that uses state-of-the-art sensors to measure illuminance, spectrum, optical distance to near objects, and motion.

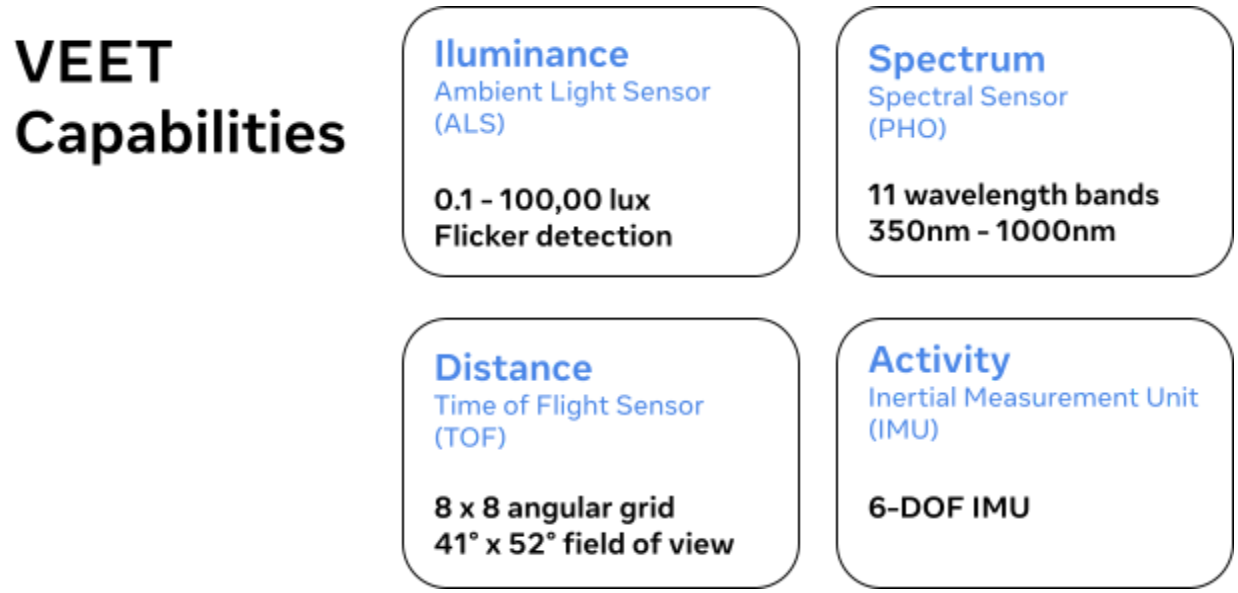
The VEET is intended for researchers studying human ocular development in controlled experiments and studies under supervision of their Institutional Review Boards (IRBs) or equivalent. The VEET is not intended for sale, general distribution, or use in clinical settings.

As a research device, the VEET should only be configured by the researcher and the associated support staff. A participant should only wear and charge the VEET as defined by the researcher per the protocols of the study. Use of the VEET outside of study protocols may result in data corruption. Data is accessible using a USB connection to a computer and is not protected against tampering.

This product may not be placed on the market or put into service until it has been made to comply with local law, including laws in the EU, UK and Switzerland if the device is in use in these jurisdictions. The VEET is not for use with young children.

Introduction

At sensing rates of up to two seconds (1/2 hz), the VEET gathers the following information through four robust solid state sensors.



Each temple arm is equipped with a full sensor suite and an individual set of processing and storage capabilities.

VEET Sensors *(right temple arm)*

To cover a range of potential gaze behaviors, the right temple arm's sensors are aimed 20 degrees downward and 4 degrees towards the sagittal plane while the left temple arm's sensors are perpendicular to the glasses frame.

VEET Right and Left Sensor Angles

The VEET has no camera, no microphone, no bluetooth or wifi connectivity, and does not record any personally identifying information. The device gathers data without compromising the wearer's privacy or comfort.

Each VEET temple arm comes with a battery that supports all-day use. If charged daily, the VEET has a data storage capacity of more than one year.

Safety Guidance

Find the Health and Safety Information for the VEET in Appendix A to this Manual. Read and follow all warnings and instructions before use to reduce risk of injury, discomfort, or damage. Provide a copy of the Health and Safety Information in Appendix A to research participants prior to use of the VEET.

Operating Conditions

The VEET is rated for non-charging use from -10ºC to 37ºC (98ºF) and up to 95% humidity, non-condensing. When charging or connecting the VEET to a computer for data transfer, the ambient temperature must be below 27ºC (80ºF).

Do not leave the device where it could be exposed to extremely high temperatures, such as in an enclosed automobile in direct sunlight.

Do not disassemble

There are no user-serviceable internal components. Touching the device's internal components could result in injury. In the event of a malfunction, contact Meta for next steps.

Should the device break open as a result of a fall or other accident, collect and isolate the components and contact Meta for data retrieval and return instructions.

Skin contact

The device is manufactured with the common spectacle frame and temple arm material Grilamid TR-90, which is in contact with the skin of the user. Should the user experience any redness, swelling or other skin irritation, immediately discontinue use.

Data Loss with RF interference

Operation of the VEET in the presence of strong radio frequency (RF) interference or near high-powered RF sources may result in data loss or degradation. This data degradation may appear as a mismatch between actual time and VEET time. This condition has been observed under controlled testing environments but has not been seen in real world testing to date. The device is safe to operate in these environments.

Australia Regulatory Compliance

The VEET 2 complies with Australian Communication and Media Authority (ACMA) mandated standards: EN 55032:2015+All:2020; EN 55035:2017+All:2020; EN 61000-3-2:2014; and EN 61000-3-3:2013.

Getting Started

Accessories required for device configuration:

- 2 USB-C chargers with either USB-C type A or C cable
- Charger current output of 500mA, 5V minimum per port for max charging rate
- PC / Mac

Charging

WARNING: Do not attempt to charge the device from a computer when the VEET is fully discharged or in a deep sleep state. The VEET consumes more power when connected to a computer and charges at a slower rate.

The VEET arrives either fully discharged or in a deep sleep state and should be charged from a dedicated power supply prior to use. Each VEET temple arm has its own battery and operates independently; both temple arms should be charged.

Charging time for a full day of use (with the default sensing rate of 2 seconds (1/2 hz)) is 3 hours. It is normal for the temple arm to feel warm while charging.

Battery Runtime

The VEET sensors' logging intervals affect the battery runtime and, as a result, the number of days the device can continuously log data between charges. By increasing the logging interval from the default 2 seconds (1/2 Hz) to 60 seconds (1/60 Hz) for all 4 sensors, you can extend the VEET battery runtime to 5 days.

VEET Battery Runtime

Interval (Seconds)	Minimum Observed Battery Life (Days)	Maximum Observed Battery Life (Days)	Average Observed Battery Life (Days)
2	1.22	1.37	1.30
5	2.41	2.55	2.48
10	3.23	3.68	3.46
15	3.83	4.27	4.08
30	4.72	5.06	4.81
60	4.84	5.64	5.31

This table shows results from 5 trials with a new battery, with all 4 sensors on and set to the indicated interval.

You can further extend the VEET battery runtime by turning off the Time of Flight (ToF) sensor if this sensor data isn't relevant to your study. Turn the ToF sensor off by setting it to 0 seconds in the VEETManager.

VEET Battery Runtime with Time of Flight Sensor Off

Interval	Minimum Observed Battery Life (Days)	Maximum Observed Battery Life (Days)	Average Observed Battery Life (Days)
2	2.50	2.66	2.56
5	3.73	3.92	3.81
10	4.62	4.82	4.73
15	4.63	5.15	4.87
30	5.25	5.71	5.45
60	5.19	5.69	5.48

This table shows results from 5 trials with a new battery, with only the IMU, ALS and PHO sensors on (the ToF sensor turned off) and set to the indicated interval.

As with other lithium polymer batteries, the VEET's maximum battery capacity is reduced with time and usage. The device's battery is rated to maintain 80% capacity after 500 charge/discharge cycles.

Device States

It's important to know when the VEET is logging data. The VEET continuously logs data when running on battery power and while charging from an outlet. The VEET **does not** log data when connected to a computer, while in Deep Sleep, and when the battery is depleted.

Logging Data

- On battery power
- Charging from power outlet

Not Logging Data

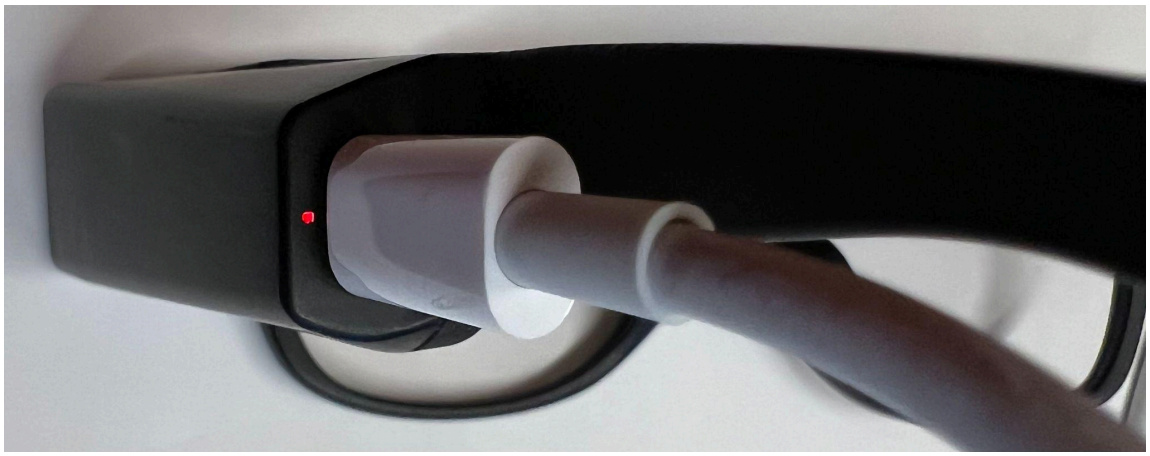
- Connected to a computer
- Deep Sleep
- Battery is depleted

Each VEET temple arm is equipped with an LED to help you distinguish between these device states. To show the VEET is running on battery power, a white LED will turn on for 5 seconds once the device is unplugged from the USB.

VEET White LED

When the VEET is charging on wall power, both the red LED and the white LED alternate for 5 seconds.

When the VEET is connected to a computer, the red LED turns on for 5 seconds to indicate the device is not logging data. The researcher can live-view the sensors, configure the device, download data, and perform other device maintenance while the VEET is connected to a computer, but note that the device charges at a slower rate.



VEET Red LED

When the VEET is in Deep Sleep, no LED turns on. In Deep Sleep, the device keeps its clock time and configuration for up to 1 month.

Similarly, no LED turns on when the Battery is Depleted. The VEET enters this state after it's been in Deep Sleep for about 1 month. Its clock time is lost and it may take a few minutes for it

to transition out of this state after being plugged into power. To reset the clock time after Deep Sleep, reconnect the VEET to a computer and run the VEETManager.

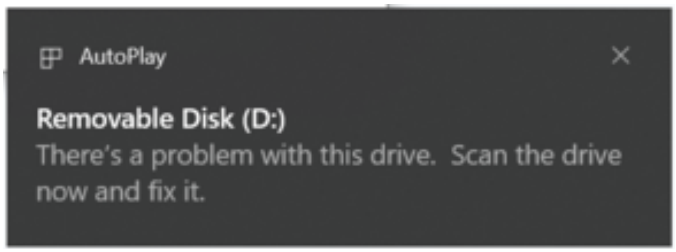
Setting Up Your Device

WARNING: The VEETManager Software is designed to connect with one temple arm at a time. To avoid device conflicts, connect only one temple arm to your computer.

NOTE: The VEETManager software is compatible with macOS 14 Sonoma and Windows 10 and 11 operating systems. The software may function on other versions of MacOS and Windows, but it has not been extensively tested.

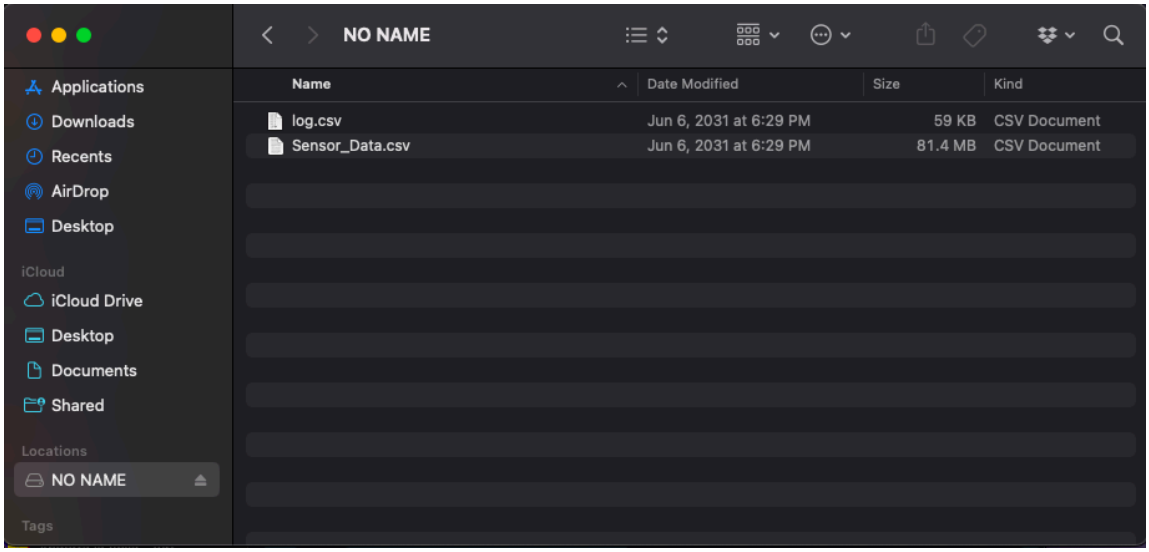
HOW-TO VIDEOS: For how-to videos on setting up your device, go to https://projectveet.com

1. Charge each VEET temple arm on wall power for at least 5 minutes to ensure enough battery. A VEET temple arm with a completely discharged battery may not properly connect to your computer until the battery is partially charged.
    - Both the red LED and the white LED alternate for 5 seconds.
2. Connect one VEET temple arm to your computer.
    - Windows may display the following AutoPlay pop-up window. This Removable Disk error can be safely ignored.



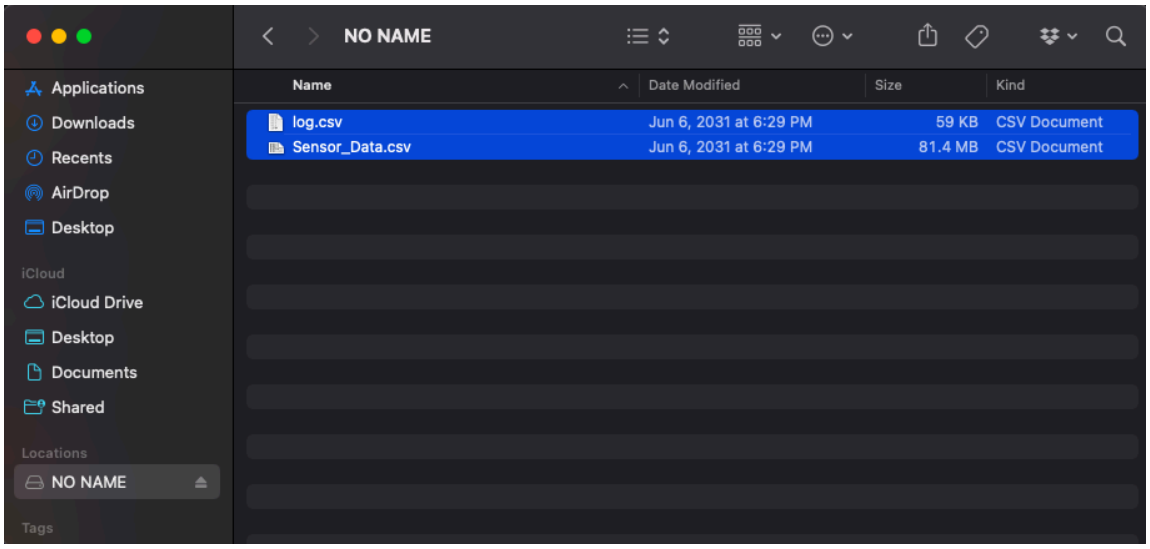
AutoPlay pop-up window

3. Find the device hard drive on MacOS Finder / Windows Explorer. The VEET temple arm automatically comes up as an external hard drive.



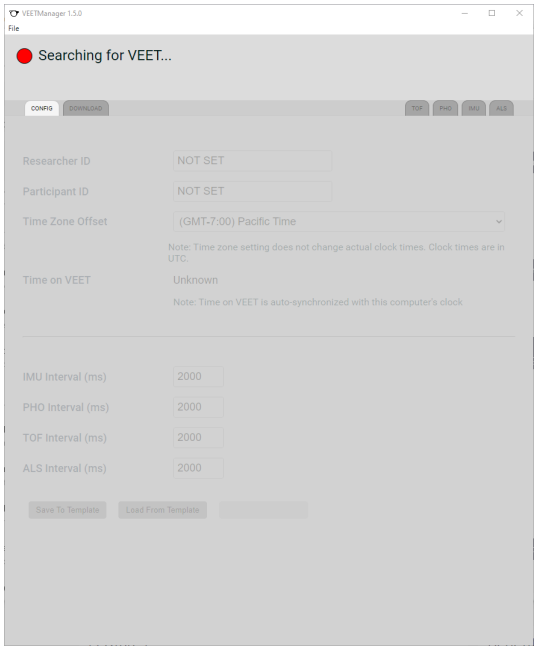
VEET temple arm as USB drive

4. Delete the Sensor Data and Log Files.
    - Since the VEET is constantly logging data when running on battery power or charging from a power outlet, this ensures you delete data recorded while the device was in transit or in storage.
      WARNING: Deleted files cannot be recovered. Ensure you are not accidentally deleting data from a previous study that hasn't been backed up.
    - Sensor_Data.csv stores all the sensor data. Log.csv stores the event logging information. Both of these files are recreated automatically after deletion.



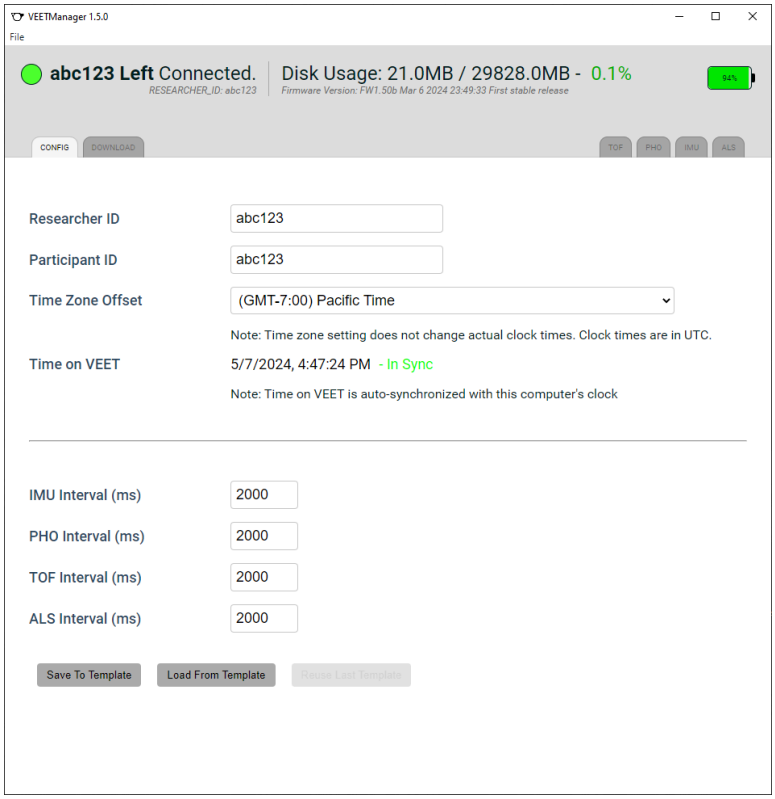
Sensor Data and Log Files

5. Download the latest version of the VEETManager software through projectveet.com
6. Open the VEETManager and confirm that the software is "Searching for VEET."



VEETManager searching for VEET *when opened*

7. Confirm that VEETManager discovers the device and shows an active screen.



VEETManager showing active screen

8. Select the Configuration (CONFIG) tab.
9. Enter Researcher and Participant ID.
   NOTE: Avoid including any personally identifiable information, such as name, address, or physical description in the labels to protect user privacy in case the device is misplaced.
10. Select Time Zone Offset from the drop down menu.
11. Confirm that the “Time on VEET” matches your local time.
    - The VEETManager automatically synchronizes the time on the VEET with the clock on your PC. If the time on the VEET does not match your local time, confirm that the time on your PC is correct.
12. Set the logging interval for each sensor.
    - The default and minimum interval for all sensors is 2 seconds (2000ms).
    - Battery life increases with larger sensor intervals (see Battery Runtime).
      TIP: To optimize the device’s battery performance, make the intervals the same for all sensors.
13. Unplug the VEET temple arm from your computer.
    - Within a few seconds, a white LED indicates your VEET has started logging data.
14. Connect the other VEET temple arm and repeat the process.

NOTE: Time on the VEET is synchronized with the clock on your PC but may lose its accuracy over the course of a week by up to 10 seconds. Since temple arms function independently, time on each device may differ by <20 seconds.

USING TEMPLATES

When configuring many devices, use the “Save to Template” feature to save time. This button saves the interval configuration settings to a local .json file.

1. Connect and configure one VEET temple arm using the steps outlined above.
2. Click “Save to Template.”
3. Disconnect the VEET temple arm.
4. Connect the next VEET temple arm.
5. Click “Load from Template” or “Reuse Last Template.”
6. Adjust Researcher ID, Participant ID and Timezone Offset.
7. Disconnect the temple arm and repeat the procedure.

Live-Viewing VEET Sensors

The VEETManager enables a live view of the four VEET sensors. For more information, go to Appendix: VEET Sensors Live View.

Assembling the VEET

VEET-compatible glasses frames with either plano (no prescription) or prescription lenses, as appropriate, are required for assembly and field usage. Please see the Adult VEET / Adjustable VEET research kit for the current list of compatible frames.

The VEET 2.1 comes in two models, which are identical except for frame compatibility:

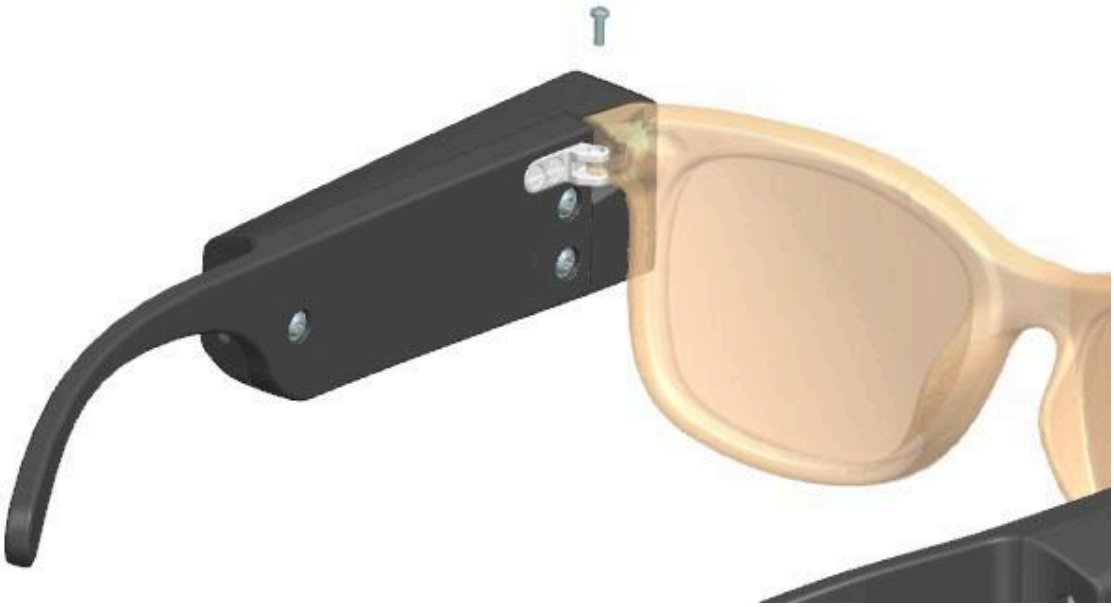
1. **Adult VEET 2.1**: The temple arms have fixed temple tips and come with one pair of hinges already installed. The Adult VEET is compatible with a single glasses frame model and is intended for researchers evaluating the device (not for studies with research participants).
2. **Adjustable VEET 2.1**: The temple arms have adjustable temple tips. The Adjustable VEET comes with four pairs of temple tips of different lengths and four pairs of hinges, making it compatible with multiple glasses frame models.

Please contact veetsupport@meta.com for the latest list of compatible frames.

For instructions on how to attach and remove the Adjustable VEET temple tips, go to our Optician's Guide on https://projectveet.com.

STEPS FOR ASSEMBLING VEET ON GLASSES FRAME

1. Remove the screws attaching the glasses frame to the existing temple arm. Set this temple arm aside.
2. Line up the corresponding VEET temple arm with the glasses frame.
3. Screw the VEET temple arm into place.
4. Repeat this process with the opposite temple arm.



Assembling VEET temple arm

Instructions for Study Participants

NOTE TO RESEARCHERS

- Charge the VEET before handing the device to study participants.
- Take note of the time and date the VEET is handed to the participant to allow for data trimming at the end of the study.
- Provide participants with a copy of the Health and Safety information in Appendix A.

TIPS

- Provide a USB charger with dual-headed USB-C cable or two USB-C cables to encourage correct charging behavior.
- Study participants should not charge the device by connecting it to a computer: the VEET charges more slowly, if at all, and goes into data access mode—data collection is suspended until the device is unplugged.
- Ask study participants to charge the temple arms at night, on wall power, and in the room where they sleep so the VEET can log illuminance data about their nighttime and early morning environments.

DIRECTIONS FOR USE

WARNING

- Do not use the VEET during activities where use may create a safety hazard or potentially cause damage to the VEET such as during water-based activities, activities requiring the use of a helmet or other safety gear, or other sports or while driving or in other situations where full, unobscured vision is required.
- Do not attempt to charge your VEET from a computer or a USB hub.

To protect your privacy and safety, the VEET has no cameras, no microphones, and no wireless or cloud connectivity.

1. Wear the VEET while performing your usual daily activities.
2. Charge **both** VEET temple arms every night using USB-C cables and wall power charger(s).
    - Make sure the temple arms are uncovered and in the same room where you sleep, so it can gather information about light in your sleeping environment.

Charging the VEET

Retrieving the VEET from Study Participants

NOTE: Take note of the date and time you receive the device from each research participant to allow for data trimming.

Unloading Data

1. Charge each VEET temple arm on wall power for at least 5 minutes to ensure enough battery.
2. Connect one VEET temple arm to your computer.
3. Find the device hard drive on MacOS Finder / Windows Explorer. The VEET temple arm automatically comes up as an external hard drive.
4. Copy (or cut) the Sensor Data (Sensor_Data.csv) and Log (log.csv) files from the VEET hard drive to your local computer.
5. Rename the files.

NOTE: All VEET temple arms produce files with the same name. Immediately renaming the files mitigates the risk of overwriting prior data.

TIP: Consider file management strategies prior to launching a study. We recommend a naming convention that uses the Participant ID and R/L to indicate whether the file belongs to the right or left temple arm.

Preparing VEET for Reuse

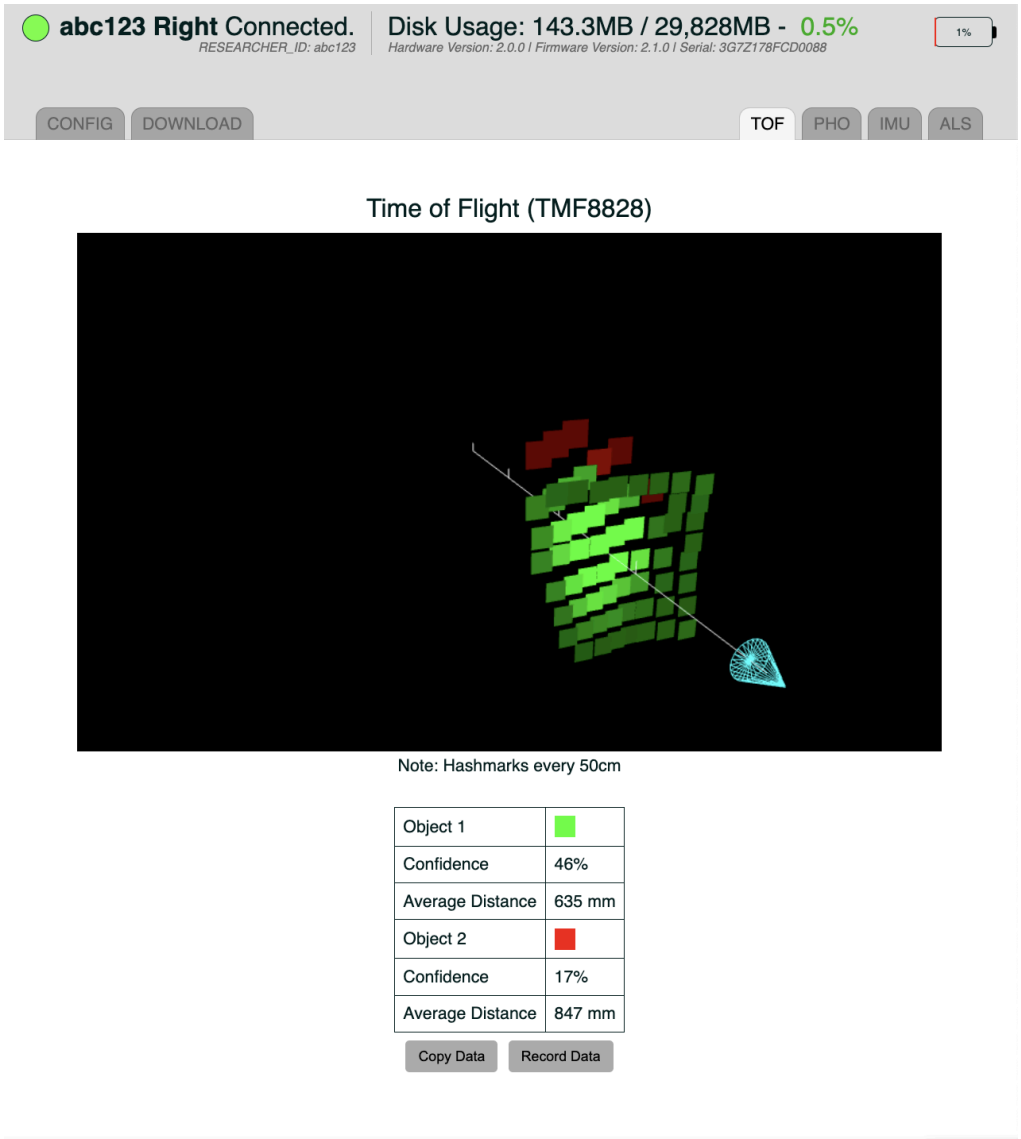
CAUTION: The VEET is not waterproof. Do not immerse it in liquid.

1. Inspect the device for damage or modifications.
    - The device should have no observable cracks, dents, bulges/swelling, corrosion, or damage resulting from drops or submersion.
    - The metal hinge interface should be attached with 2 screws.
    - The glass covering the sensor aperture should be clean and unobstructed.
2. Charge each VEET temple arm on wall power for ~5 minutes to ensure enough battery.
3. Connect one VEET temple arm to the computer.
4. Unload relevant data (see **Unloading Data**).
5. Delete Sensor Data (Sensor_Data.csv) and Log (log.csv) files from the VEET hard drive (see **Unloading Data**).
6. Run the VEETManager Software.
7. Reset / change the Researcher ID, Participant ID, Time Zone Offset and sensor recording intervals.
8. Disconnect the VEET temple arm and repeat the process with the next temple arm.
9. Wipe all surfaces of VEET with an isopropyl alcohol wipe to remove potential contaminants from previous users, storage, or handling.

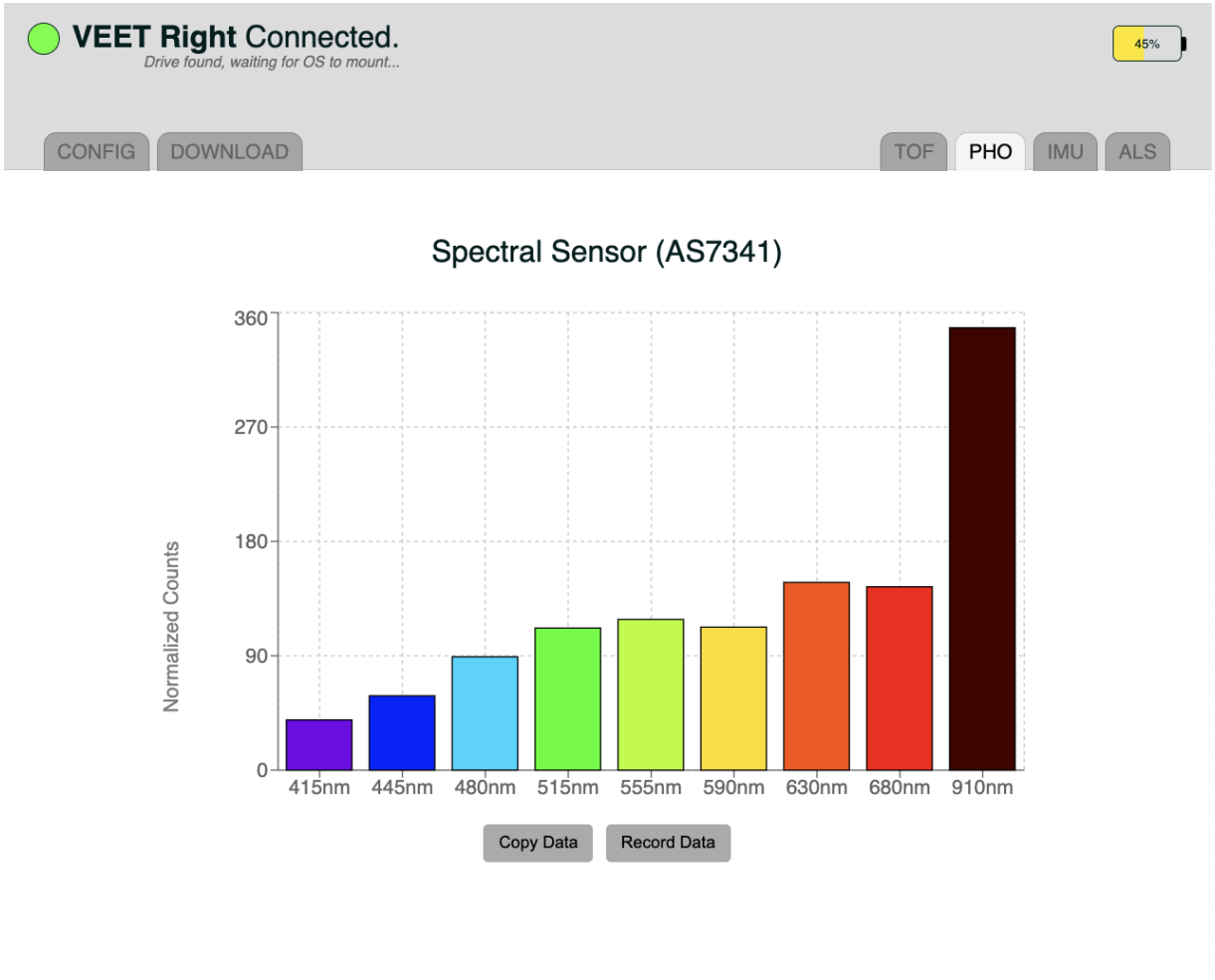
Appendix: VEET Sensor Live View

Connect one VEET temple arm to your computer and navigate to the following tabs for a live view of the VEET sensors.

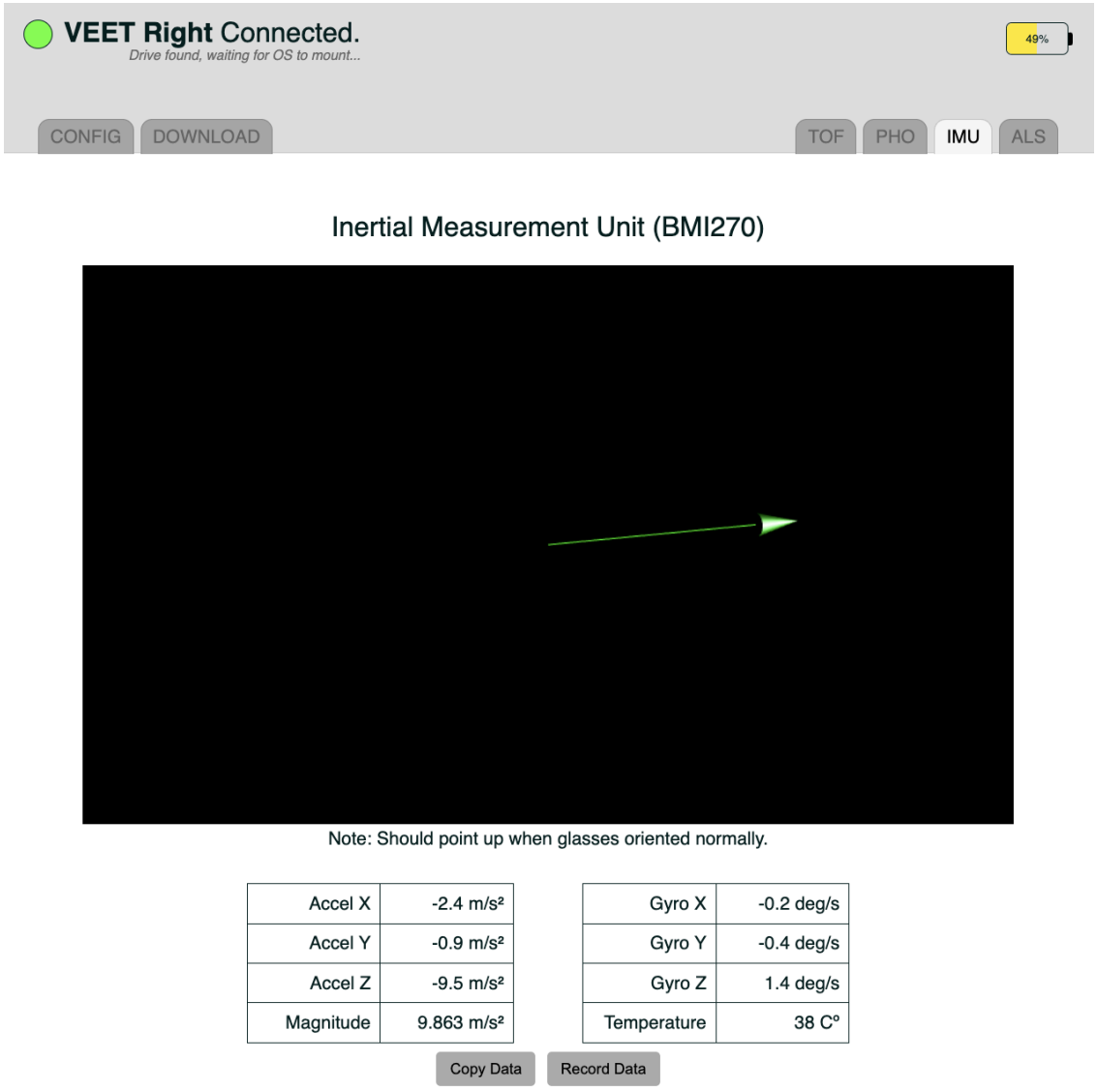
The Time of Flight (TOF) tab shows the VEET's average distance to nearby objects.



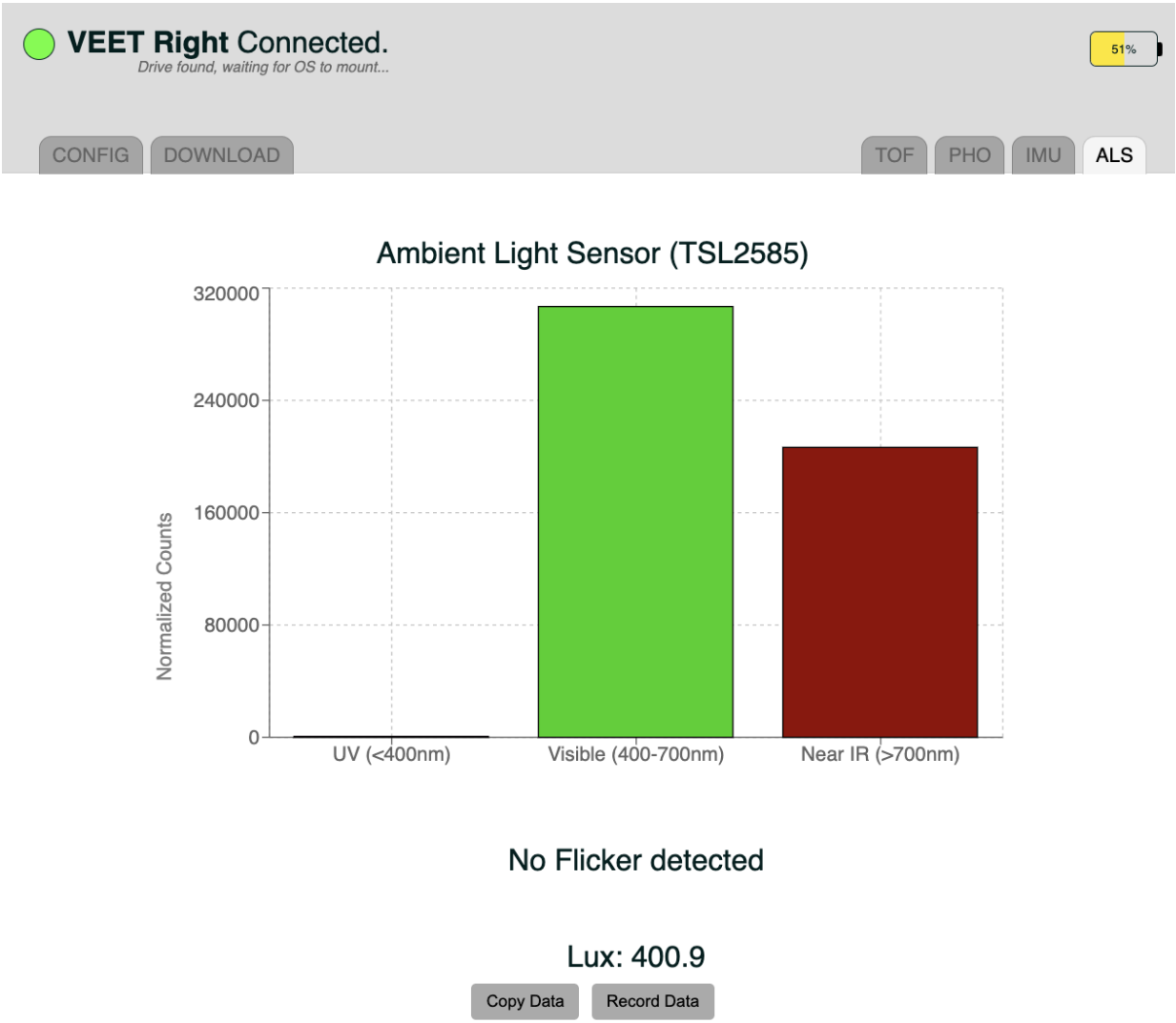
The Spectral Sensor (PHO) tab shows the wavelengths of lights captured by the VEET sensor.



The Inertial Measurement Unit (IMU) tab shows the acceleration and tilt of the glasses.



The Ambient Light Sensor (ALS) tab shows the brightness (LUX) of light captured by the sensor.



Each sensor data preview has a Copy Data button that enables copying the last sampled data to the clipboard and a Record Data button that allows you to record a stream of data in real-time and save it to a file on your computer.

Appendix A

Visual Environment Evaluation Tool Health & Safety Information

RESEARCH PROTOTYPE. NOT INTENDED FOR SALE OR GENERAL DISTRIBUTION.

This device has not been authorized as required by the rules of the Federal Communications Commission. This device is not, and may not be, offered for sale or lease, or sold or leased, until authorization is obtained.

This product may not be placed on the market or put into service until it has been made to comply with local law, including laws in the EU, UK and Switzerland if the device is in use in these jurisdictions.

⚠ **WARNING: Read and follow all provided health and safety information to reduce risk of personal injury, discomfort or property damage**

Intended Users & Uses

Non-consumer use only. The Visual Environment Evaluation Tool ("VEET"; includes temple arms and provided charging accessories, if any), as currently designed, is intended for limited distribution for research and data collection purposes only and is not intended for sale or distribution. Not for use with young children.

⚠ **WARNING:** Choking hazard—Small parts. Keep away from children under 3 years.

Unsafe Use. Do not use the VEET during activities where use may create a safety hazard or potentially cause damage to the VEET such as during water-based activities, activities requiring the use of a helmet or other sports or safety gear, or while driving or in other situations where full, unobscured vision is required.

Discomfort & Other Conditions

Skin Reactions. Wearable products that have prolonged contact with the skin may result in skin reactions due to interactions with certain materials, external irritants (e.g., soap, sweat, or lotion/sunscreen), or other environmental factors. To avoid skin reactions, follow all provided cleaning and care instructions and take breaks from wearing the VEET. Stop use if pressure, chafing, itching, irritation, lasting changes in skin appearance, swelling, unusual hair loss, or other skin discomfort arises. Check fit and cleanliness as symptoms may resolve after adjusting/cleaning. Stop use and consult a doctor if symptoms continue.

Laser safety. Do not hack, tamper, attempt to repair, modify, override programming for, disassemble, or alter the drive/safety circuit or install additional components inside the VEET. If the VEET is exposed to liquid or is mechanically damaged, please stop use immediately.

RESEARCH PURPOSES ONLY
WARNING: CLASS 1 LASER

This device contains a Class 1 laser. Use other than as described in the user guide, repair, or disassembly may cause damage, which may result in hazardous exposure to infrared emissions that are not visible. This equipment may only be serviced by Meta.

NOTE: This device complies with FDA performance standards for laser products except for conformance with IEC 60825-1 Ed. 3., as described in Laser Notice No. 56, dated May 8, 2019.

Electrical Safety

Charging. Follow all provided charging instructions. Improperly charging may permanently damage the VEET and increase the risk of injury or property damage. Use only provided charging accessories. Keep the charging ports clear of debris, moisture, and residue using the provided cleaning and care instructions.

- Do not wear or clean the VEET while charging.
- Periodically inspect the VEET including charging accessories for damage or signs of wear.
- If any part is damaged or cracked or any internal component is exposed, stop using or charging immediately.
- Do not use the VEET or continue charging attempts if the VEET does not power on after attempted charging.

Overheating. It is normal for the VEET to feel warm to the touch while in use or while charging; however, if the VEET feels hot to the touch, stop using or charging immediately and allow the VEET to cool down. Prolonged skin contact when hot may produce discomfort, redness, or low-temperature burns. Do not leave the VEET in direct sunlight or expose to excessive heat or fire.

Approved Accessories Only. Using non-approved accessories or spare parts may permanently damage the VEET and increase the risk of injury or property damage.

Battery Safety

The VEET contains lithium-ion batteries that are not user-replaceable. Special care should be exercised when handling the battery or charging accessories. If proper handling procedure and these instructions are not followed, the internal lithium ion battery may present a risk of explosion, fire, burn, electrolyte leakage or injury to the user or others, or damage to the device or other property.

- Do not remove or attempt to remove the battery
- Do not expose the VEET to fire or expose to or soak in water or other liquids
- Do not touch, disassemble, puncture, crush, bend, or damage the battery
- Avoid dropping the VEET. Dropping the VEET, especially on a hard surface can potentially cause damage that can result in increased risk of injury or property damage.
- Do not use or charge the VEET if you know or suspect it is damaged, will not turn on after attempted charging, it gets abnormally warm when used or charged, or if the battery compartments are swollen, leaking liquid or smoking.
- In the event of a battery leak, do not allow the liquid to come in contact with the skin or eyes. If contact has been made, wash the affected area with large amounts of water and seek medical advice.

Handling & Maintenance

Handle with care and avoid damage. The VEET is sensitive electronic equipment and should be handled with care.

- Do not disassemble, crush, bend, deform, puncture, shred, or put a high degree of pressure on the VEET.
- Do not drop, strike, or shake the VEET excessively.
- Do not use the VEET if damaged.

- Do not attempt to open, disassemble, repair, or tamper with the VEET. Touching internal components could result in injury.

Keep the VEET Clean and Dry. Clean the VEET between uses and users to avoid possibly transferring a contagious condition. Keep the VEET and charging accessories away from any liquids, including sunscreen and lotion. The VEET is not designed to resist submersion, or extended exposure to liquids, which could cause property damage or injury. Use only approved cleaning solutions.

Store the VEET as instructed. Do not place VEET in high-temperature locations or environments, such as on or near a cooking surface, cooking appliance, iron, radiator, direct sunlight, or extended periods inside a car.

Potentially explosive atmospheres. Do not use, charge, or store with explosive materials or in any area with a potentially explosive atmosphere.