



Draft

# Camera Aggregator

## User Guide

Version 1.0 • January 2023



## Revision History

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| 1/2023 | V1 Initial Draft |
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## FCC Statement

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Caution: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Certain of the unintentional radio frequency radiators in this vehicle that operate under Part 15 of the FCC Rules are exempt from a specific FCC approval requirement but are still subject to the requirement to operate without causing harmful interference. FCC Rules provide that the operator of the exempted device shall be required to stop operating the device upon a finding by the Federal Communications Commission or its representative that the device is causing harmful interference.

## FCC Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.

This system includes two distinct radio frequency identification devices that operate under Part 15 (and others) of the FCC Rules and have been approved under the certification approach under:

- (1) FCC ID: XMR202002EG18NA operates under FCC Rule Parts 22, 24, and 27.
- (2) FCC ID: XPYJODYW374 operates under FCC Rule Part 15.

## Nuro FRN

0031250137

## Overview

The CG's (short for cameragator or camera aggregator) main function is to combine or aggregate all video streams, preprocess them and then send them on to the appropriate devices or users within the vehicle. Each video stream goes through an ISP (Image Service Processor) and then to one of 4 SOM (system on a module) daughter boards. The SOM stitches video streams together to form a comprehensive view. Most video streams are compressed before forwarding them off-board in order to limit bandwidth consumption.

The main compute subsystem running the heavy lifting image processing software is the heaviest user of images. Some of the video streams will be directed to Guardian via LTE modems. Some video streams will be directed directly to FAS/PAS running a lighter footprint autonomy system locally. One particular video stream will be used to detect if a person is interacting with the vehicle. Some video data may get logged locally for various purposes.

To interact with the vehicle system and outside world, CG has many interfaces. Ethernet (1000BaseT and 1000BaseT1) is the primary interface tying into the rest of the vehicle architecture. The LTE modems allow connection to cellular networks of multiple carriers in parallel. The WiFi allows for maintenance tasks such as offloading logs and performing software updates and GPS provides position and time information.

## CG Details

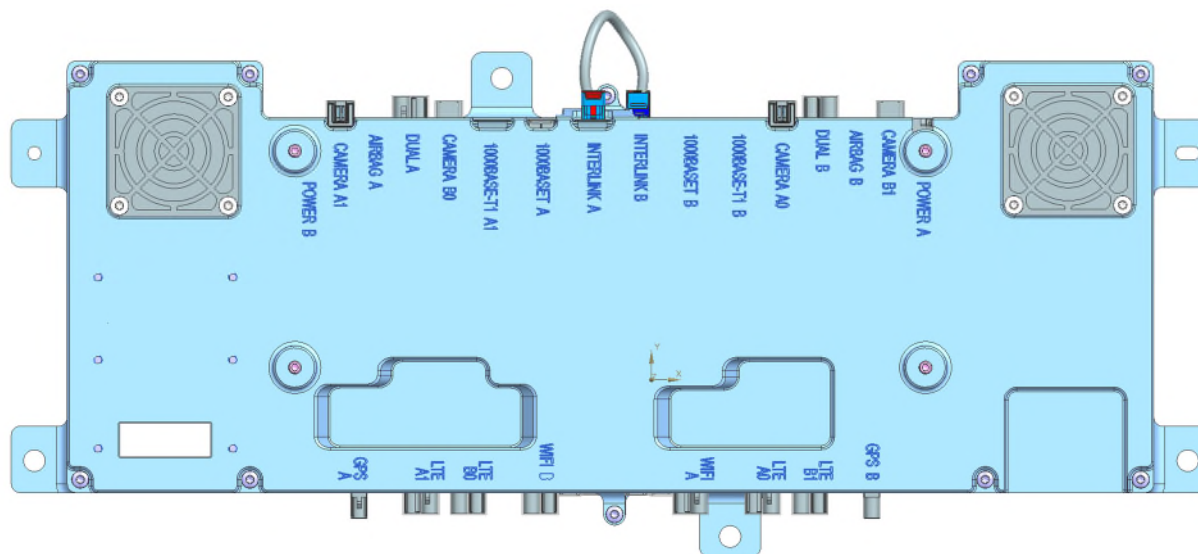
Below is a rendering of the CG component viewing the case with several markings for the various ports and connections it makes throughout the vehicle it's housed within.

The top of the picture contains several port labels. There are 17 cameras, 2 GigE ethernet, 2 Automotive GigE ethernet, and 2 Interlinks (both Automotive GigE ethernet special for board to board connection only—hence the short cable). There are also connections for airbags and 12 Vdc power.

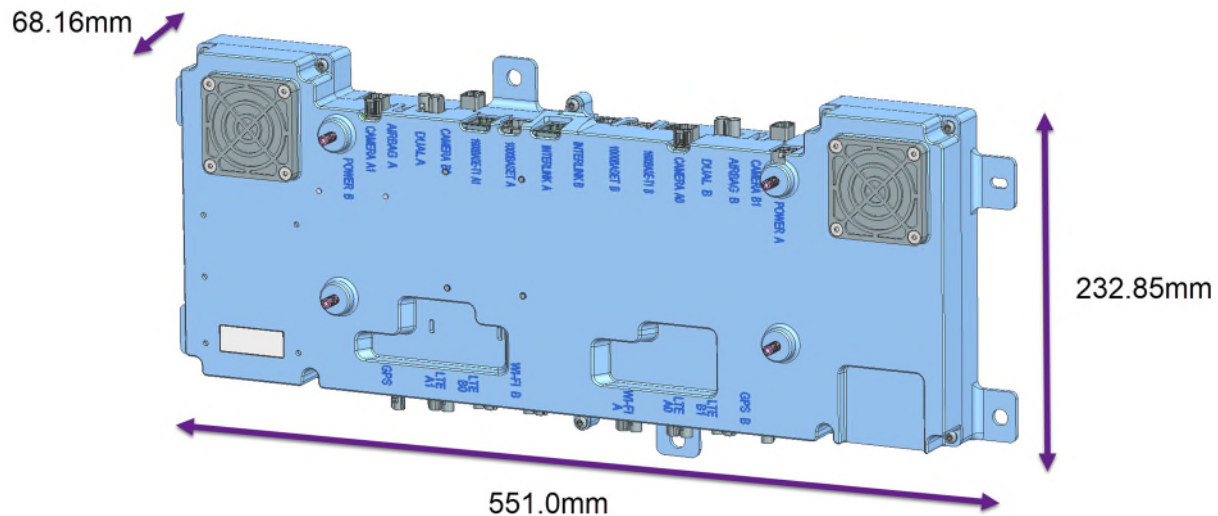
The A and B designations define two separate yet identical printed circuit boards within the enclosure. This is done for redundancy purposes.

The bottom of the picture contains all the antenna connections: 2 antennas modules housing the 8 LTE and 2 WiFi antennas. The single GPS has its own antenna. Only Wifi A and GPS A are enabled. WiFi B and GPS B will never be used or connected to—they are both completely disabled.

Finally, between the WiFi ports are 4 slots for USB-C and 4 slots for SIM cards (not readily visible in the picture).



Cameras with all the port labels etched into the metal lid.



Cameras with the main dimensions called out. It weighs about 4.6 kg.

## Operation

The CG is designed to work at 12 Vdc nominal (8–17 Vdc) from 0–65°C.

The LTE, WiFi and GPS all work pursuant to their datasheet specifications—nothing extra has been done or asked for of these devices. They are used *stock*.

The UNII Device Declaration Letter can be referred to for 2.4/5 WiFi channel plan.

Control of RF power will be done via software as needed per RF exposure calculations.

The 4 LTE modems are all expected to transmit simultaneously but not with WiFi. The WiFi will transmit on its own and not with LTE.

Reference to the antenna data sheets can be done for all LTE and WiFi.

RF Exposure shall be referenced to its spreadsheet/document.

Reference to the CG EMC Test Plan should work to list equipment used for testing.