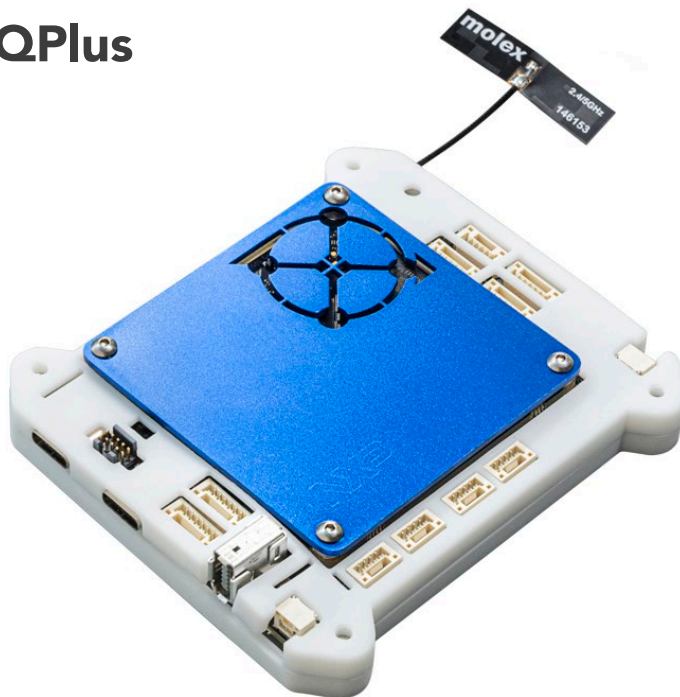




NavQPlus



**Mobile Robotics companion computer
reference design using i.MX 8M Plus MPU**

ABOUT THE NavQPlus

The NavQPlus is a small purpose-built Linux computer evaluation kit (EVK) based on the NXP i.MX 8M Plus applications processor. It is focused on the common needs of mobile robotics systems, with a small form factor, Dronecode-compliant JST-GH connectors, and available software stack including Linux Desktop POC and Robot Operating System (ROS2). It has a SOM identical to the i.MX 8M Plus EVK, with a minor exception that the NavQPlus supports 8GB LPDDR4 while the i.MX 8M Plus EVK SOM supports 6GB LPDDR4. The NavQPlus is an intermediate step between the i.MX 8M Plus EVK and a fully custom board design.

FEATURES

Compute Module

- i.MX 8M Plus applications processor with up to five cores:
 - 4× Arm® Cortex®-A53
 - 1× Arm® Cortex® -M7
- 1x Neural Processing Unit (2.3 TOPS)
- LPDDR4 DRAM
- eMMC flash
- Power management IC (NXP PCA9450C)

Base Board

- SD card connector
- Two USB Type-C connectors
- Two CAN-FD interfaces
- I²C, SPI, UART, GPIO
- One Gigabit Ethernet with ix Industrial connector. Only available on the 8MPNAVQ-8GB-G variant
 - The 8MPNAVQ-8GB-XG variant does not include the IX Industrial gigabit ethernet Connector
- Murata LBEE5QD1ZM (Using NXP 88W8987): Shielded Ultra Small Dual Band (2.4 GHz & 5 GHz) Wi-Fi® 11a/b/g/n/ac + Bluetooth® 5.1
- Two MIPI-CSI connectors for camera
- One Micro-HDMI, One MIPI-DSI, and Two LVDS for displays
- SE050 Secure Element with NFC
- JTAG

GET TO KNOW THE NavQPlus EVK

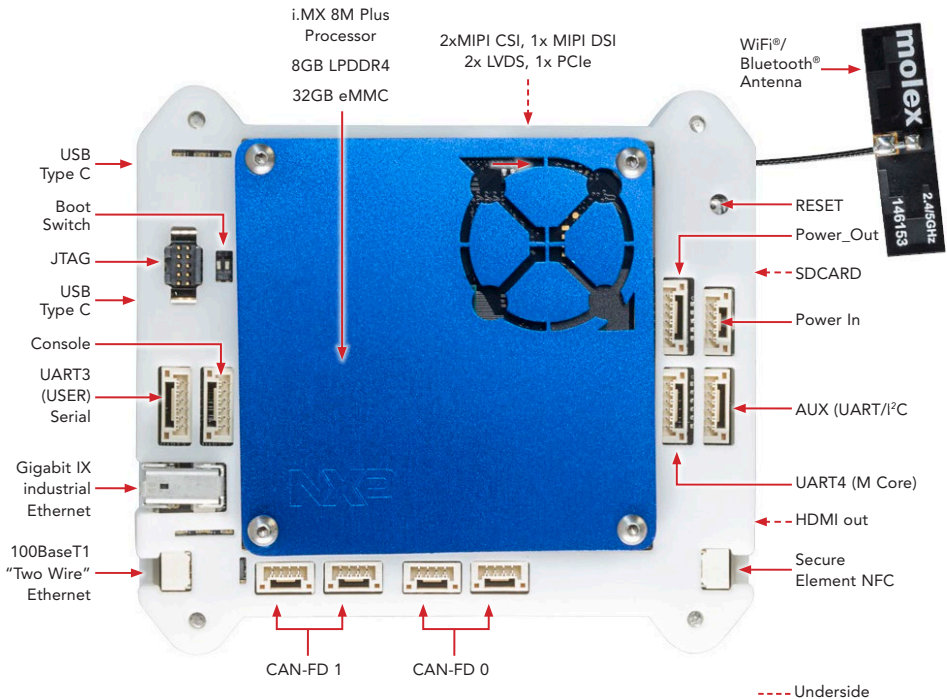


Figure 1: Top view NavQPlus

Note: 8MPNAVQ-8G-XG does not include the Gigbit IX-industrial connector or PHY

GET TO KNOW THE NavQPlus EVK CONTINUED

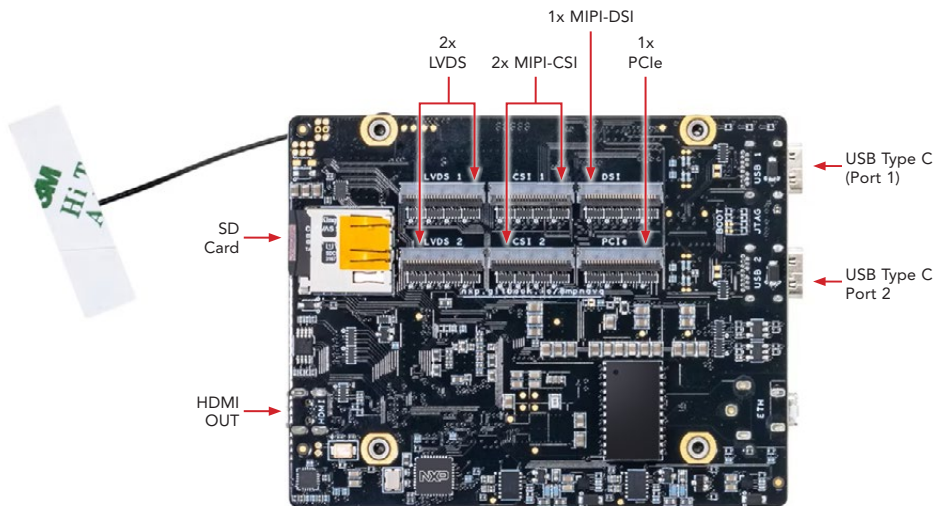


Figure 2: Bottom view — NavQPlus bare board



Figure 3: Bottom view — NavQPlus with case

GETTING STARTED

Unpack the kit

The NavQPlus is shipped with the items listed in Table 1. Ensure the items are available in the EVK box.

Table 1 Kit Contents

ITEM	DESCRIPTION
NavQPlus Board	NavQPlus i.MX 8M Plus Companion Computer EVK, 8GB LPDDR4, 32GB eMMC <ul style="list-style-type: none">• Enclosed in 3D printed enclosure
Camera module	InnoCAM_DCM_OV5645FF camera module <ul style="list-style-type: none">• OV5645 image sensor• 5MP resolution• MIPI interface
Communications cables	<ul style="list-style-type: none">• FTDI USB-UART Serial console cable and adapter board/Cable• IX industrial to RJ45 Ethernet cable (for 8MPNAVQ-8GB-G version)• 2-Pin JST-GH Cable for 100BaseT1 ethernet• 2x 4-Pin JST-GH with center wires twisted for CAN cables• USBC to USB A cable
Power cables	<ul style="list-style-type: none">• 5-Pin JST-GH power cable to RED SYP type cable• RED SYP type cable to XT-60 battery connector• 5-Pin JST-GH power cable to 5-Pin JST-GH power Cable
Software	Linux® image programmed in eMMC
Documentation	NavQPlus block diagram

GETTING STARTED CONTINUED**Download Software and Tools**

Installation software and documentation are available at www.nxp.com/8mpnavq. The following are available on the website:

Table 2 Kit Contents

ITEM	DESCRIPTION
Documentation	<ul style="list-style-type: none">• Schematics, Layout, and Gerber files• NavQPlus User's Guide• Quick Start Guide• Hardware Design Guide
Software Development	Copy of the latest Linux and Android BSP images that are available to program on to the eMMC or SD Card NavQPlus software can be found at www.nxp.com/IMXLINUX
Additional Resources	This board is used in the NXP HoverGames program. Additional engineering notes, guides, and examples for robotics are available on nxp.gitbook.io/navqplus

SETTING UP THE SYSTEM

The NavQPlus is shipped with the items listed in Table 1. Ensure the items are available in the EVK box.

1 Confirm Boot Switches

The boot switches should be set to boot from the eMMC. SW2[1-2] are used for boot. See table.

MODE	SW1	SW2
eMMC/SDHC3	OFF	ON
MicroSD/SDHC2	ON	ON

2 Connect Power Supply

Power on the NavQPlus by plugging in a USB-C cable to the centermost USB-C port (USB2). To ensure enough power is provided, a >5W supply is recommended. The NavQPlus will boot - the three LEDs by the USB1 port should all be on, as well as two LEDs next to the CAN bus connectors.

3 Connect USB Debug Cable

Adapter to the UART2 (A53 Debug/ Console) port on the NavQPlus. Connect the other end of the cable to a PC acting as a host terminal. One UART connection will appear on the PC.

If the serial port is not recognized, download and install updated drivers. The drivers can be found at www.ftdichip.com/Drivers/VCP.htm

Open the serial console application (e.g. PuTTY for Windows, Minicom on Linux), choose the COM port number and set the baud rate to 115200.

SETTING UP THE SYSTEM CONTINUED

4 Login

If the boot was successful, in the terminal it will ask for the username and then the password. The default username/password is as follows:

Username: user





Password: user

Congratulations, you are up and running.

Now with the NavQPlus setup complete, you can start to install other software packages and run your own code. For example, [ROS2](#) (Robot Operating System) is commonly used as a framework for controlling robotic systems, with plenty of compatible packages being available.

Please note the following FCC information.

- Contains Transmitter Module FCC ID: VPYLB1ZM or Contains FCC ID: VPYLB1ZM
- **FCC CAUTION:** Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
- This transmitter must not be co-located or operated in conjunction with any other antenna or transmitter.

	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.
	The available scientific evidence does not show that any health problems are associated with using low power wireless devices. There is no proof, however, that these low power wireless devices are absolutely safe. Low power Wireless devices emit low levels of radio frequency energy (RF) in the microwave range while being used. Whereas high levels of RF can produce health effects (by heating tissue), exposure of low-level RF that does not produce heating effects causes no known adverse health effects. Many studies of low-level RF exposures have not found any biological effects. Some studies have suggested that some biological effects might occur, but such findings have not been confirmed by additional research. LBEE5QD1ZM has been tested and found to comply with FCC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines
	It is necessary to take a SAR test with your set mounting this module (except to use only Bluetooth). Class II permissive change application is necessary using the SAR report. Please contact Murata.
	This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines. This equipment should be installed and operated keeping the radiator at least 20 cm or more away from person's body.

Please note the following Canadian IC information.

- Contains IC: 772C-LB1ZM
-

This device complies with Industry Canada's applicable license-exempt RSSs. Operation is subject to the following two conditions:

1. This device may not cause interference; and
 2. This device must accept any interference, including interference that may cause undesired operation of the device.
-

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

1. l'appareil ne doit pas produire de brouillage;
 2. l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.
-
-

Data transmission is always initiated by software, which is the passed down through the MAC, through the digital and analog baseband, and finally to the RF chip. Several special packets are initiated by the MAC. These are the only ways the digital baseband portion will turn on the RF transmitter, which it then turns off at the end of the packet. Therefore, the transmitter will be on only while one of the aforementioned packets is being transmitted. In other words, this device automatically discontinues transmission in case of either absence of information to transmit or operational failure.

La transmission des données est toujours initiée par le logiciel, puis les données sont transmises par l'intermédiaire du MAC, par la bande de base numérique et analogique et, enfin, à la puce RF. Plusieurs paquets spéciaux sont initiés par le MAC. Ce sont les seuls moyens pour qu'une partie de la bande de base numérique active l'émetteur RF, puis désactive celui-ci à la fin du paquet. En conséquence, l'émetteur reste uniquement activé lors de la transmission d'un des paquets susmentionnés. En d'autres termes, ce dispositif interrompt automatiquement toute transmission en cas d'absence d'information à transmettre ou de défaillance.

This radio transmitter (IC Number: 772C-LB1ZM) identify the device by certification number or model number if Category II) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

: 146153 Dual Dipole antenna Gain: +3.2dBi@2.4GHz + 4.25dBi@5GHz

: 146187 Dual Dipole antenna Gain: +3.4dBi@2.4GHz + 4.75dBi@5GHz

: LBEE5QD1ZM-Antenna monopole antenna Gain: +3.6dBi@2.4GHz + 4.6dBi@5GHz

Le présent émetteur radio (IC Number: 772C-LB1ZM) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci dessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

Type d'antenne

: 146153 Dual Dipole antenna Gain: +3.2dBi@2.4GHz + 4.25dBi@5GHz

: 146187 Dual Dipole antenna Gain: +3.4dBi@2.4GHz + 4.75dBi@5GHz

: LBEE5QD1ZM-Antenna monopole antenna Gain: +3.6dBi@2.4GHz + 4.6dBi@5GHz

The available scientific evidence does not show that any health problems are associated with using low power wireless devices. There is no proof, however, that these low power wireless devices are safe. Low power Wireless devices emit low levels of radio frequency energy (RF) in the microwave range while being used. Whereas high levels of RF can produce health effects (by heating tissue), exposure of low-level RF that does not produce heating effects causes no known adverse health effects. Many studies of low-level RF exposures have not found any biological effects. Some studies have suggested that some biological effects might occur, but such findings have not been confirmed by additional research. LBEE5QD1ZM has been tested and found to comply with IC radiation exposure limits set forth for an uncontrolled environment and meets RSS-102 of the IC radio frequency (RF) Exposure rules.

Les connaissances scientifiques dont nous disposons n'ont mis en évidence aucun problème de santé associé à l'usage des appareils sans fil à faible puissance. Nous ne sommes cependant pas en mesure de prouver que ces appareils sans fil à faible puissance sont entièrement sans danger. Les appareils sans fil à faible puissance émettent une énergie fréquence radioélectrique (RF) très faible dans le spectre des micro-ondes lorsqu'ils sont utilisés. Alors qu'une dose élevée de RF peut avoir des effets sur la santé (en chauffant les tissus), l'exposition à de faibles RF qui ne produisent pas de chaleur n'a pas de mauvais effets connus sur la santé. De nombreuses études ont été menées sur les expositions aux RF faibles et n'ont découvert aucun effet biologique. Certaines études ont suggéré qu'il pouvait y avoir certains effets biologiques, mais ces résultats n'ont pas été confirmés par des recherches supplémentaires. LBEE5QD1ZM a été testé et jugé conforme aux limites d'exposition aux rayonnements IC énoncées pour un environnement non contrôlé et respecte les règles d'exposition aux fréquences radioélectriques (RF) CNR-102 de l'IC.



It is necessary to take a SAR test with your set mounting this module.
Class 4 permissive change application is necessary using the SAR report.
Please contact Murata.

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment and meets RSS-102 of the IC radio frequency (RF) Exposure rules. This equipment should be installed and operated keeping the radiator at least 20 cm or more away from person's body.

Cet équipement est conforme aux limites d'exposition aux rayonnements énoncées pour un environnement non contrôlé et respecte les règles d'exposition aux fréquences radioélectriques (RF) CNR-102 de l'IC. Cet équipement doit être installé et utilisé en gardant une distance de 20 cm ou plus entre le radiateur et le corps humain.

Please note the following EU information.

The following information is provided per Article 10.8 of the Radio Equipment Directive 2014/53/EU:

(a) Frequency bands in which the equipment operates.

(b) The maximum RF power transmitted.

PN: **8MPNAVQ-8GB-G**

Europe Power Level 2.4 GHz WLAN Per Antenna Port

MODE	DATA RATE	OUTPUT POWER IN dBm (typical)	
		Ch. 1-13	
11a	1,2, 5.5, 11M	14	
	6, 9, 12, 18 M	14	
11g	24, 36 M	14	
	48, 54 M	14	
	MCS0, 1, 2	14	
11n-20	MCS3, 4	14	
	MCS5, 6, 7	14	

Europe Power Level 2.4 Ghz BT/BLE Per Antenna Port

MODE	MAXIMUM TUNE UP TOLERANCE (dBm)
BR	3 ± 3.0
EDR	0 ± 3.0
LE	3 ± 3.0
LE 2 Mbps	3 ± 3.0

Europe Power Level 5 Ghz WLAN Pert Antenna Port

MODE	DATA RATE	OUTPUT POWER IN dBm (typical)		
		Ch. 36-64	Ch. 100-144	CH. 149-165
11a	6, 9, 12, 18 M	15	15	7
	24, 36 M	15	15	7
	48, 54 M	15	15	7
11n/ac-20	MCS0, 1, 2	14	14	7
	MCS3, 4	14	14	7
	MCSS5, 6, 7	14	14	7
11ac-20	MCS8	14	14	7
MODE	DATA RATE	Ch. 38-62	Ch. 102-142	CH. 151-159
11n/ac-40	MCS0, 1, 2	14	14	7
	MCS3, 4	14	14	7
	MCSS5, 6, 7	14	14	7
11ac-40	MCS8, 9	13	13	7
MODE	DATA RATE	Ch. 42-58	Ch. 106-138	CH. 155
11ac-80	MCS0, 1, 2	14	14	7
	MCS3, 4	13	13	7
	MCSS5, 6, 7	13	13	7
	MCS8, 9	13	13	7

EUROPEAN DECLARATION OF CONFORMITY (Simplified DoC per Article 10.9 of the Radio Equipment Directive 2014/53/EU) This apparatus, named 8MPNAVQ-8GB-G, conforms to the Radio Equipment Directive 2014/53/EU. The full EU Declaration of Conformity for this apparatus can be found at this location:

<https://www.nxp.com/part/8MPNAVQ-8GB-G>
<https://www.nxp.com/part/8MPNAVQ-8GB-XG>



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