

DHU4 User Manual

Model Name: **DHU4**



Picture showing the Toyota DHU4 unit to the left. Connected with a four-port mini-fakra to the Smarteq antenna to the right.

General

DHU4 is a telematic node, intended to be mounted into a Toyota forklift. It is always stationary installed in a forklift where it has several wired connections e.g., power, can buses etc.

It also communicates wireless with LTE, WiFi and Bluetooth technology. It has an external antenna connected.

Information to the user

This product is communicating wirelessly with LTE and/or Bluetooth/WiFi.

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

- **Warning:** Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
- 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 device for operation in the band 5150 – 5250 MHz is only for indoor use to prevent harmful interference to co-channel mobile satellite systems;
- The maximum antenna gain permitted for devices in the band 5250 – 5350 MHz and 5470 – 5725 MHz shall comply with the e.i.r.p. limit
- The maximum antenna gain permitted for devices in the band 5725 – 5825 MHz shall comply with the e.i.r.p. limits specified for point-to-point and non point-to-point operation as appropriate.
- High-power radars are allocated as primary users of the bands 5250 – 5350 MHz and 5650 – 5850 MHz and these radars could cause interference and/or damage to LE-LAN devices"

This device complies with ISED Canada licence-exempt RSS standard(s). 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, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement. Cet appareil est conforme aux limites d'exposition aux rayonnements de la IC pour un environnement non contrôlé. L'antenne doit être installée de façon à garder une distance minimale de 20 centimètres entre la source de rayonnements et votre corps. Gain de l'antenne doit être ci-dessous.

Testing has been performed on the module in a co-located configuration with the identified module(s) to determine if new sources of interference are created when the two transmitter modules are simultaneously transmitting.

Warning:

- This device is approved for use in a mobile rf exposure environment. A minimum separation distance of 20 cm must be maintained between the antenna and nearby persons.
- The module may only be co-located in a host device with the following radio modules: Quectel EG25, Quectel FC20.

List of applicable FCC rules

The following FCC rules are applicable to the equipment:

- CFR 47, Part 15, Subpart C
- CFR 47, Part 2, Subpart J – Radiofrequency radiation exposure: mobile devices

Specific operational use conditions

Most of the installations are performed at Toyota production facilities by qualified personnel into a Toyota Forklift. However, after market installations also exists. The user can never operate the DHU4 directly.

Important: *The DHU4 transmitting antenna must be installed and operated with minimum distance of 20 cm between the radiator and nearby persons.*

Co-location

The following modules have been evaluated and may be co-located in a mobile configuration.

Cellular module Quectel EG25:

FCC ID: XMR201903EG25G

IC ID: 10224A-201903EG25G

WiFi/Bluetooth module Quectel FC20:

FCC ID: XMR201703FC20

IC ID: 10224A-201703FC20

RF exposure consideration

The application conditions are 'Class B' product, 'Mobile', always at least 20cm from a person's body.

Warning

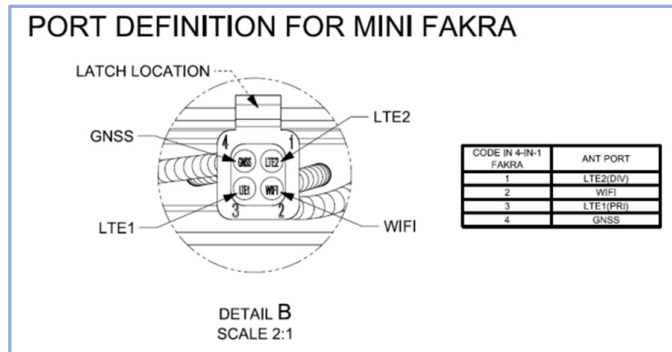
This device is approved for use in a mobile rf exposure environment. A minimum separation distance of 20 cm must be maintained between the antenna and nearby persons.

The module may only be co-located in a host device with the following radio modules: Quectel Wireless Solutions Co., Ltd. FC20 and EG25.

Antennas

Smarteq Combination antenna, P/N 550237, with different cable lengths for different forklifts. Shortest cable length is 200mm. This length is used during certification for all tests, since this will transmit highest RF power due to minimum of cable loss. Other lengths exists, but it can never be shorter than 200mm.

The antenna has four antenna elements. The antenna is always connected to the DHU4 antenna port with a Quad Mini Fakra (QMF) cable.



Antenna element LTE1

Main LTE/cellular main antenna. Can receive and transmit.

Antenna element LTE2

Main LTE/cellular diversity antenna. Can only receive.

Antenna element WiFi/Bluetooth

WiFi/Bluetooth antenna. Can receive and transmit. 2.4GHz WiFi/BT and 5GHz WiFi.

Antenna element GNSS

GNSS/GPS antenna. Can only receive.

Cellular	Antenna 1		Antenna 2
Frequencies	698-960MHz 1710-2170MHz 2500-2690MHz		1710-2170MHz 2500-2690MHz
Impedance	50Ω		50Ω
Polarization	Linear		Linear
VSWR*	698-790MHz	5:1	NA
	790-960MHz	3.5:1	NA
	1710-2170MHz	2:1	2:1
	2500-2690MHz	2:1	2:1
Gain Peak** (Averaged over frequency band)	698-790MHz	-3.8dBi	-
	790-960MHz	-0.5dBi	-
	1710-2170MHz	3.5dBi	5dBi
	2500-2690MHz	2dBi	3.5dBi
Radiation Efficiency**	698-790MHz	17%	NA
	790-960MHz	34%	NA
	1710-2170MHz	67%	77%
	2500-2690MHz	42%	75%
*Measured with 2m cable			
**Measured in free space 10cm cable			

Specification of Antenna 1 = Antenna LTE1 and Antenna 2 = Antenna LTE 2

BT / WiFi		
Frequencies	2400-2485 / 4900-5900MHz	
Impedance	50Ω	
Polarization	Linear	
VSWR*	2400-2485MHz	4900-5900MHz
	< 1.5:1	< 1.5 :1
Gain (Peak)**	4.4dBi	4.5dBi
Radiation efficiency**	97%	77%
Isolation*		
	WiFi to LTE-1	>14.5dB
	WiFi to LTE-2	>24.5dB
*Measured with 2m cable		
**Measured in free space 10cm cable		

Specification of WiFi/Bluetooth Antenna

GNSS**

Frequencies	1559-1606MHz (GPS, Galileo, Glonass, Beidou)	
Impedance	50Ω	
Polarization	RHCP	
VSWR	< 2.5:1	
Gain Passive (peak gain)	GPS	3.0dBic
	GLONASS	2.0dBic
	BEIDOU	1,5dBic
	GALILEO	2.0dBic
Gain Active	30 ± 1 dB	
Noise figure	< 2.5 dB with pre-filter	
Out of band rejection	< 960MHz	> 60dB
	> 1710MHz	> 60dB
Compression point	-20 dBm	
Supply Voltage	2.5 - 6V (voltage regulator in LNA)	
Current Consumption	8 - 10mA	

*Measured with 2m cable

**Measured in free space 10cm cable

GNSS Antenna Specification

Label



Information on test modes and additional test

Testing has been performed on the module in a co-located configuration with the identified module(s) to determine if new sources of interference are created when the two transmitter modules are simultaneously transmitting.

Additional test requirements

This module is only authorized for FCC rule parts listed on the FCC grant. The host equipment manufacturer is responsible to test the host device for compliance with Unintentional Radiator requirements with the modules installed to determine if the host device in combination with the module(s) is in compliance with emissions requirements of CFR 47, Part 15, Subpart B and ICES-003.