



CL-20 User Manual

Rev.1.7

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Foreword

The CL-20 adds cellular and Wi-Fi capability to the X-Family consoles. It allows access to the new Topcon Agriculture Platform (TAP), which is a cloud based integrated agronomic management platform. It also provides access to the XTEND feature in the Horizon console operating system.

General Information

Description

The CL-20 is proposed as a USB-powered plug and play box hosted by a remote processor and with an internal smart Linux processor. It will provide 3G/LTE global, and WiFi 802/11 b,g,n communication capability to the host processor, along with a multimode positioning system (a-GPS and telephone cell geo-referencing). Furthermore 1 high speed USB ports will be made available to the user. The CL-20 has 2 SIMs: an internal soldered SIM on chip, not replaceable by the user, and a micro-SIM Socket, accessible from the outside, replaceable by the user.

The IP65 plastic box, the industrial grade working temperature range of the electronics and the ruggedized mechanics allow the use of CL-20 inside the cabin compartment of any agricultural or construction machine and other on-road and off-road transportation means.

CL-20 variants

The CL-20 is available in different hardware versions with different modem characteristics:

- CL-20 3G
- CL-20 LTE EU
- CL-20 LTE VZW
- CL-20 LTE AUS
- CL-20 LTE JPN
- CL-20 GLOBAL

The versions for European market are CL-20 3G, CL-20 LTE EU and CL-20 GLOBAL. See “Electrical characteristics” for details on every modem.

Hardware

Mechanical characteristics

The Mechanical components of CL-20 are:

- Back housing / aluminum carrier
- Plastic front cover with integrated LED-windows
- Mainboard
- Antennas (external & internal)
- Supporting parts (gasket, screws, M8-harness, venting membrane, Label, ...)

Accessories:

- CL-20 Power Harness connecting M8 to USB-Type A (host) and vehicle battery
- Sim-card
- The CL20 has 3 RF antennas into the box:

The CL20 GPS antenna is a patch antenna soldered on the board.

The WiFi antenna is included in the WiFi module.

The CL20 has a modem antenna (2G/3G or LTE Primary antenna) inside of the box. The LTE diversity antenna (not used with 3G Modem) is placed outside of the box.

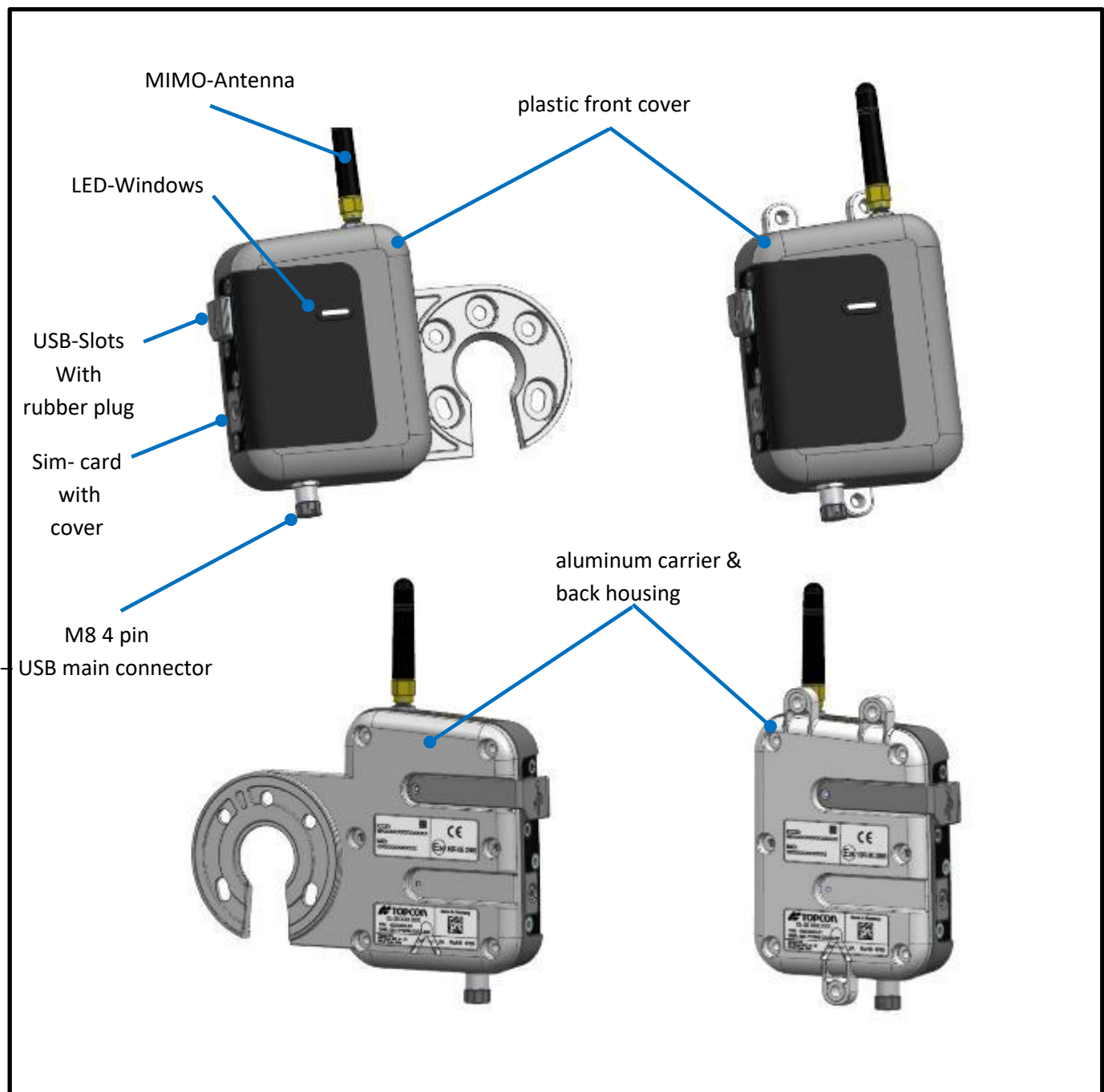


Figure 1



Figure 2

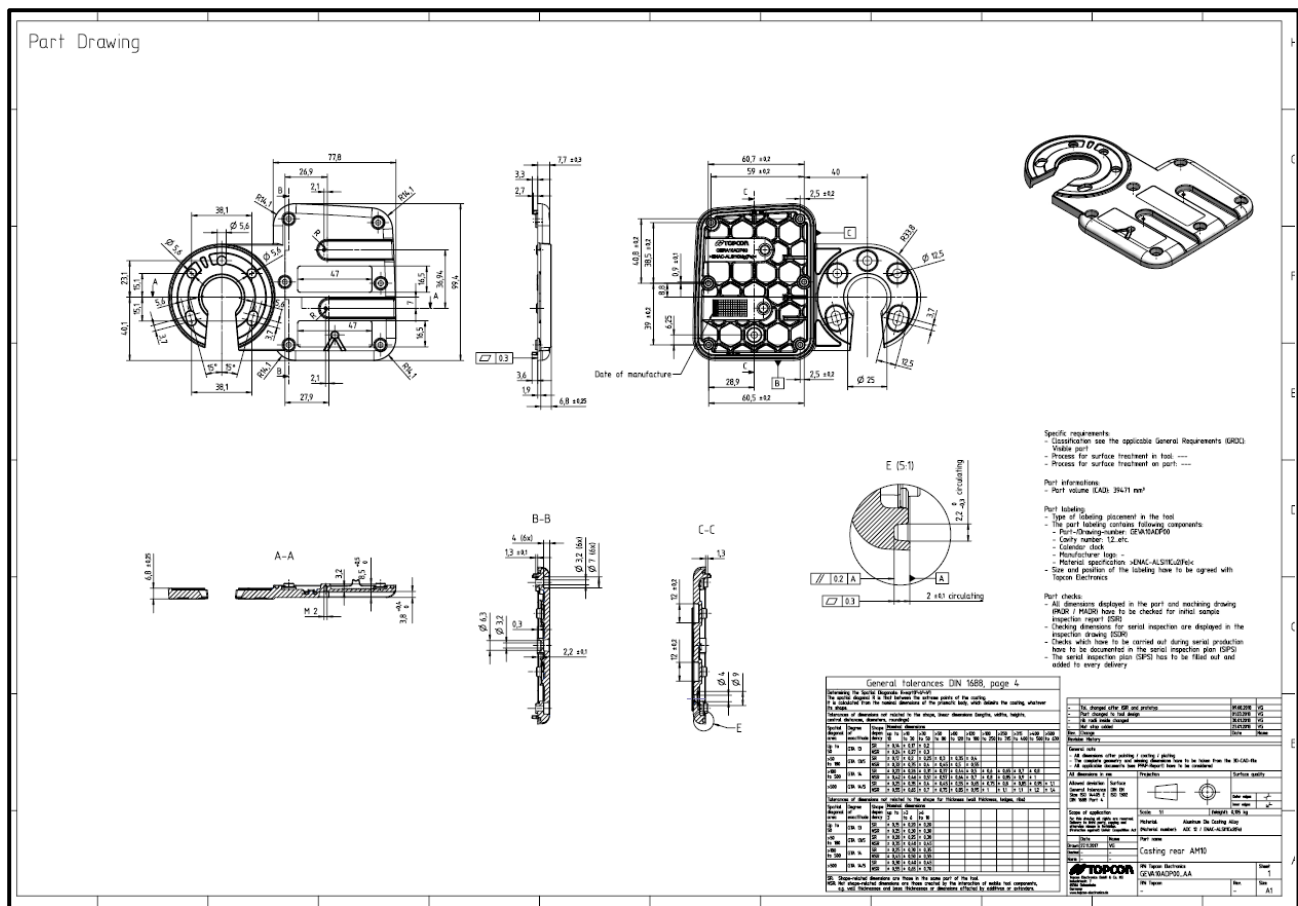


Figure 3

Cover characteristics

Back housing / aluminum carrier

- Aluminum die cast
- Supporting the venting membrane and the label field
- Powder coating with structure, semigloss, RAL 9006



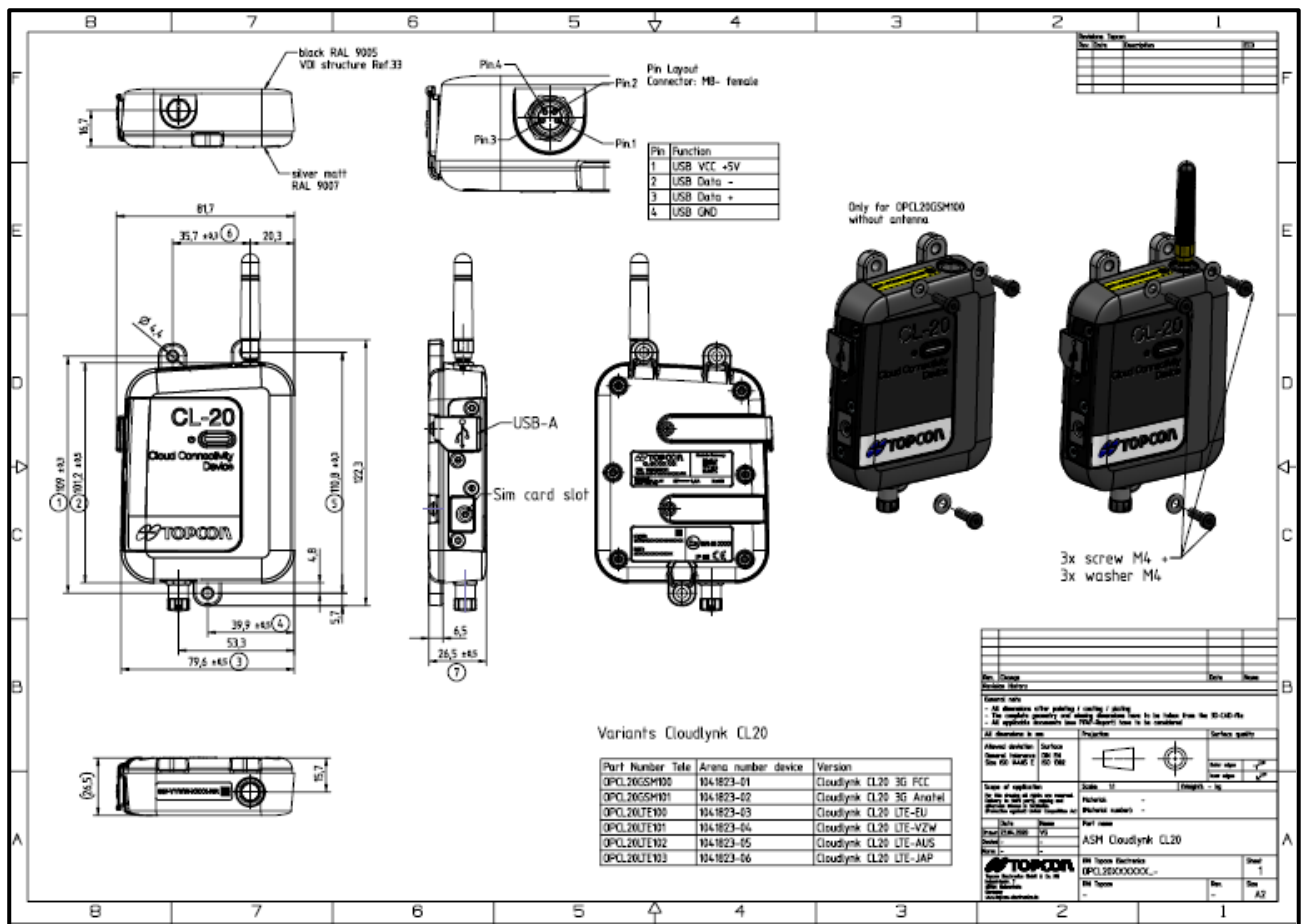


Figure 5

Mass

The CL-20 total mass is 0,3 kg max including the USB connection cable/plug and the USB ports sealing caps.

Mechanical dimensions

The CL-20 box board can be contained into a prism having the following dimensions: 103x80x28 mm.

The length of the harness connection cable is 200 mm including the plug. The USB ports rubber protection caps are considered pugged.

Fastening

The fastening method of the CL-20 will be available in 2 Version:

- With mounting arm for RAM



Figure 6

- With flat backplate for mounting with screws



Figure 7

Technical Specifications

Thermal characteristics

Operating temperature

The CL-20 will be able to operate in accordance with the specification while exposed to a still air environment at a temperature range of $-25\text{ }^{\circ}\text{C} < T_{op} < +65\text{ }^{\circ}\text{C}$.

Storage temperature

The CL-20, not connected to the host device, will withstand an indefinite storage period in an environment at a temperature range of $-40^{\circ}\text{C} < T_s < +85\text{ }^{\circ}\text{C}$.

Altitude

The CL-20 meets the specification requirements if kept to an altitude up to 2500 m a.s.l.

Humidity

The CL-20 will be able to operate in accordance with the specification while kept in an ambient of RH included in the range 5% - 85% non-condensing.

A proper moisture coating could protect the CL-20 PCB; the type and extent of the coating, if any, will be defined after the prototype test.

General environmental characteristics

Protection degree

The CL-20, properly installed and connected, will meet the IP65 protection level.

The M8 on CL-20 side is specified with IP65 so in combination with appropriate host connector this connection is sealed to IP65.

If CL-20 will work properly also in case of water drops or dust contamination (IP66 protection level), a proper PCB coating will be implemented.

Chemicals

The CL-20 will meet the chemical exposure requirements specified in the Test Plan specification, either in terms of atmosphere and fluids.

Weather and ageing

The CL-20 will meet the requirements specified in the Test Plan specification in terms of weather exposure and ageing.

Vibration and shock

The CL-20, properly mounted and connected, will be able to operate in accordance with the specification while exposed to a 10 – 300 Hz 50 m/s² 24 hours 1 octave/min along each geometrical axis.

Special care must be taken to protect the connection cable and the USB plug from vibration field.

The CL-20 will survive the application of 3 impulses 300 m/s^2 11mS along each geometrical axis.

Electrical characteristics

Electrical architecture

The TABLE 1 lists the CL-20 Main hw characteristics.

The TABLE 2 lists the CL-20 Functional blocks.

The TABLE 3 shows the Processor block diagram.

TABLE 1 Main hw characteristics:

Features	Type	Notes
Modem 3G	SARA-U201(U-Blox) Global coverage Approvals: • R&TTE • GCF • CE • FCC • PTCRB • Anatel(Brazil) • AT&T and other local approvals & provider certifications • RCM(Australia) • CCC (China) IMPORTANT NOTICE: The radio module identified as u-blox AG type SARA-U201 (FCC ID: XPY1CGM5NNN, IC: 8595A-1CGM5NNN) implements 3G functionality only (2G is disabled).	Bands: • Five Bands UMTS (WCDMA/FDD) Bands: 800, 850, 900, 1900 and 2100 MHz • Quad-Band GSM Bands: 850, 900, 1800 and 1900 MHz • 3GPP Rel.7 Compliant Protocol Stack Data speed: • HSDPA Cat.8 / HSUPA Cat.6 data rates DL: max. 7.2 Mbps, UL: max. 5.76 Mbps • EDGE Class 12 data rates DL: max. 237 kbps, UL: max. 237 kbps • GPRS Class 12 data rates DL: max. 85.6 kbps, UL: max. 85.6 kbps • 2 W (33 dBm $\pm$ 2dB) – Class 4 @ GSM 900 • 1 W (30 dBm $\pm$ 2dB) – Class 1 @ DCS 1800 • 0.5 W (27 dBm $\pm$ 3 dB) – Class E2 @ EDGE 900 • 0.4 W (26 dBm +3/-4 dB) – Class E2 @ EDGE 1800 • 0.25 W (24 dBm +1,7/-3,7 dB) – Class 3 @ WCDMA

Modem LTE Cat 1	LARA-R204 (America/Verizon) LARA-R203 (America/AT&T, T-Mobile) Approvals: • FCC • GCF • ISED • Verizon certification • RoHS	LTE (FDD) 3GPP Rel.9 Compliant Bands: • Bands 4,13 (Verizon) • Bands 2, 4, 12 (AT&T, T-Mobile) Data speed: • LTE Cat. 1 single layer DL-MIMO DL/UL max: 10.3Mbps / 5.2 Mbps
Modem LTE Cat 1	LARA-R211 (EU) LARA-R280 (AUS) LARA-R220 (JPN) Approvals: • CE • R&TTE • GCF • PTCRB • IC • AT&T	LTE (FDD) 3GPP Rel.9 Compliant Protocol Stack, RX-Diversity Bands • EU -> Bands 3, 7, 20 (LTE), 900MHz, 1800MHz (2G) • AUS -> Bands 3, 8, 28 (LTE), 1 (UMTS) • JPN -> Bands 1, 19 (LTE) Data speed • LTE Cat.1 DL: max. 10.2 Mbps, UL: max. 5.2 Mbps • HSPA+ Cat.8 (ELS61-US) data rates DL: max. 7.2 Mbps, UL: max. 5.76 Mbps • GPRS Class 12 (ELS61-E) DL: max. 85.6 kbps, UL: max 85.6 kbps • SMS text and PDU mode support • 2 W (33 dBm ± 2dB) – Class 4 @ GSM 900 • 1 W (30 dBm ± 2dB) – Class 1 @ DCS 1800 • 0.5 W (27 dBm ± 3 dB) – Class E2 @ EDGE 900 • 0.4 W (26 dBm +3/-4 dB) – Class E2 @ EDGE 1800 • 0.2 W (23 dBm ± 2,7 dB) – Class 3 @ E-UTRA LTE

Modem GLOBAL (LTE Cat 1)	LARA-R6001D Approvals: • CE • RED • GCF • RCM(Australia) IMPORTANT NOTICE: The original radio module identified as u-blox AG type LARA-R6001D (FCC ID: XPYUBX21BE01, IC: 8595A-UBX21BE01) operates also in the frequency band GSM 850 (2G); however, this operating mode is not enabled in all hosts.	Bands • LTE FDD: 12 (700 MHz) 28 (700 MHz) 13 (700 MHz) 20 (800 MHz) 18 (850 MHz) 19 (850 MHz) 26 (850 MHz) 5 (850 MHz) 8 (900 MHz) 4 (1700 MHz) 3 (1800 MHz) 2 (1900 MHz) 1 (2100 MHz) 7 (2600 MHz) Power Class 3 (23 dBm) • LTE TDD: 39 (1900 MHz) 40 (2300 MHz) 41 (2600 MHz) 38 (2600 MHz) Power Class 3 (23 dBm) • WCDMA: 5 (850 MHz) 8 (900 MHz) 2 (1900 MHz) 1 (2100 MHz) Class 3 (24 dBm) • GSM: GSM 850 E-GSM 900 DCS 1800 PCS 1900 GSM/GPRS (GMSK) Power Class • Class 4 (33 dBm) for 850/900 band • Class 1 (30 dBm) for 1800/1900 band EDGE (8-PSK) Power Class • Class E2 (27 dBm) for 850/900 band • Class E2 (26 dBm) for 1800/1900 band
SIM	Global Coverage SIM on Chip (KPN) Verizon SIM on Chip for US	Lock on local provider possible
External SIM	Micro SIM Socket accessible from the outside	
GPS	EVA – M8M0 (uBLOX)	• 72-channel u-blox M8 engine GPS/QZSS L1C/A, GLONASS L1OF, BeiDou B1I, Galileo E1B/C, SBAS L1C/A: WAAS, EGNOS, MSAS, GAGAN • FA-GPS and SBAS compliant PPS available

WiFi	CL20 Topcon Positioning Systems Approval for US (FCC), Canada (IC) and Japan (MIC)	• 802.11 b/g/n compliant • Output frequency: 2,4 GHz • Channels: 1 – 13 • Station and micro access point operation (up to 8 clients) • 802.11 PHY data rates up to 72 Mbps • LTE coexistence BAW filter included • 19dBm EIRP
Processor	SAMA5D27C-D1G (Microchip)	ARM Cortex A5 core (see below the block diagram) with integrated RAM
Flash memory	8GBytes eMMC (Sandisk)	
RAM memory	128MBytes DDR2	Embedded in the uP
USB Hub	USB2512 (Microchip)	• 1 upstream to 2 downstream USB Hub • 1 User available downstream ports • Full Speed compliant (480 Mb/s) • Port Speed autotdetect capability
Power supply	5 Vdc from CL20 Power Harness	TBD

TABLE 2 Functional blocks:

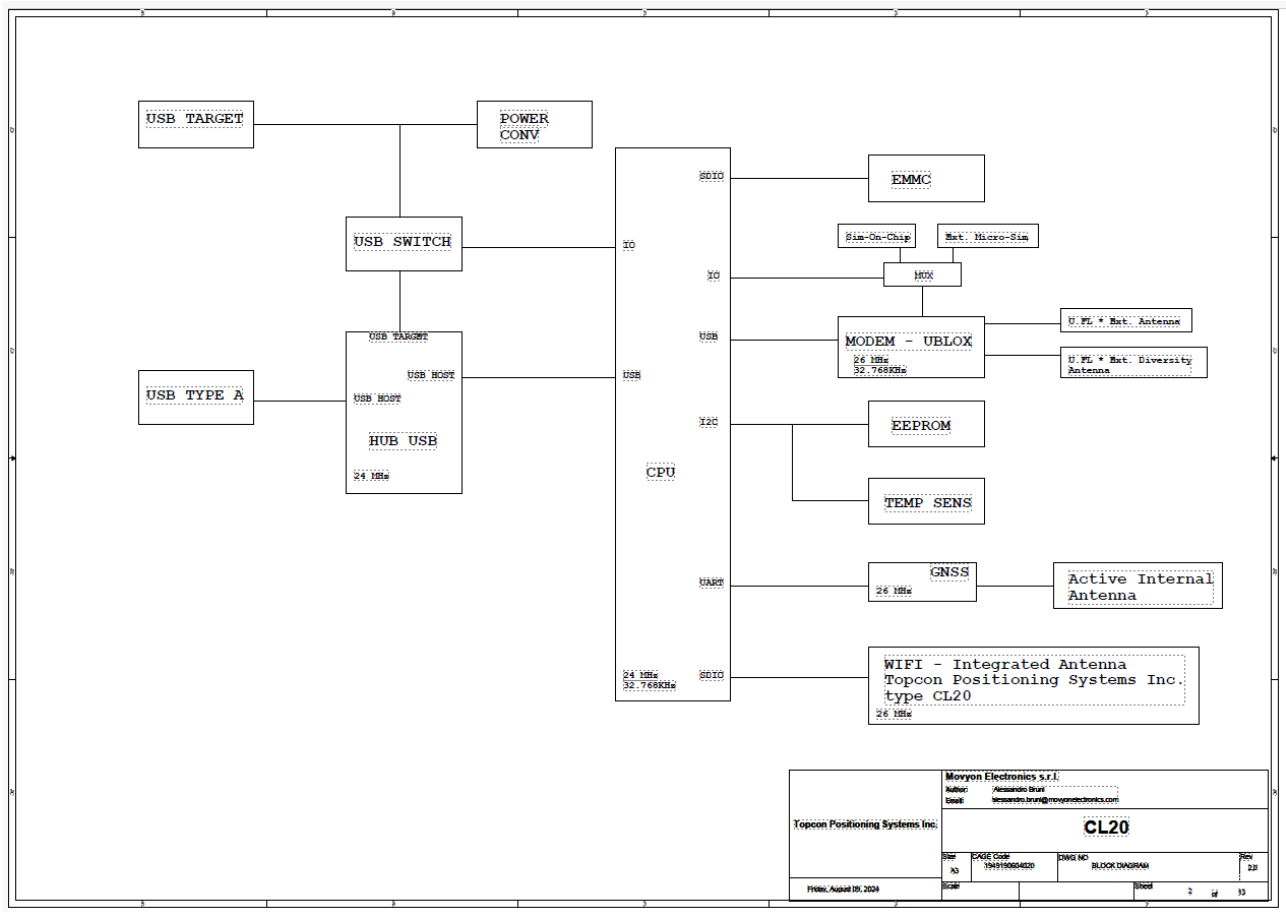
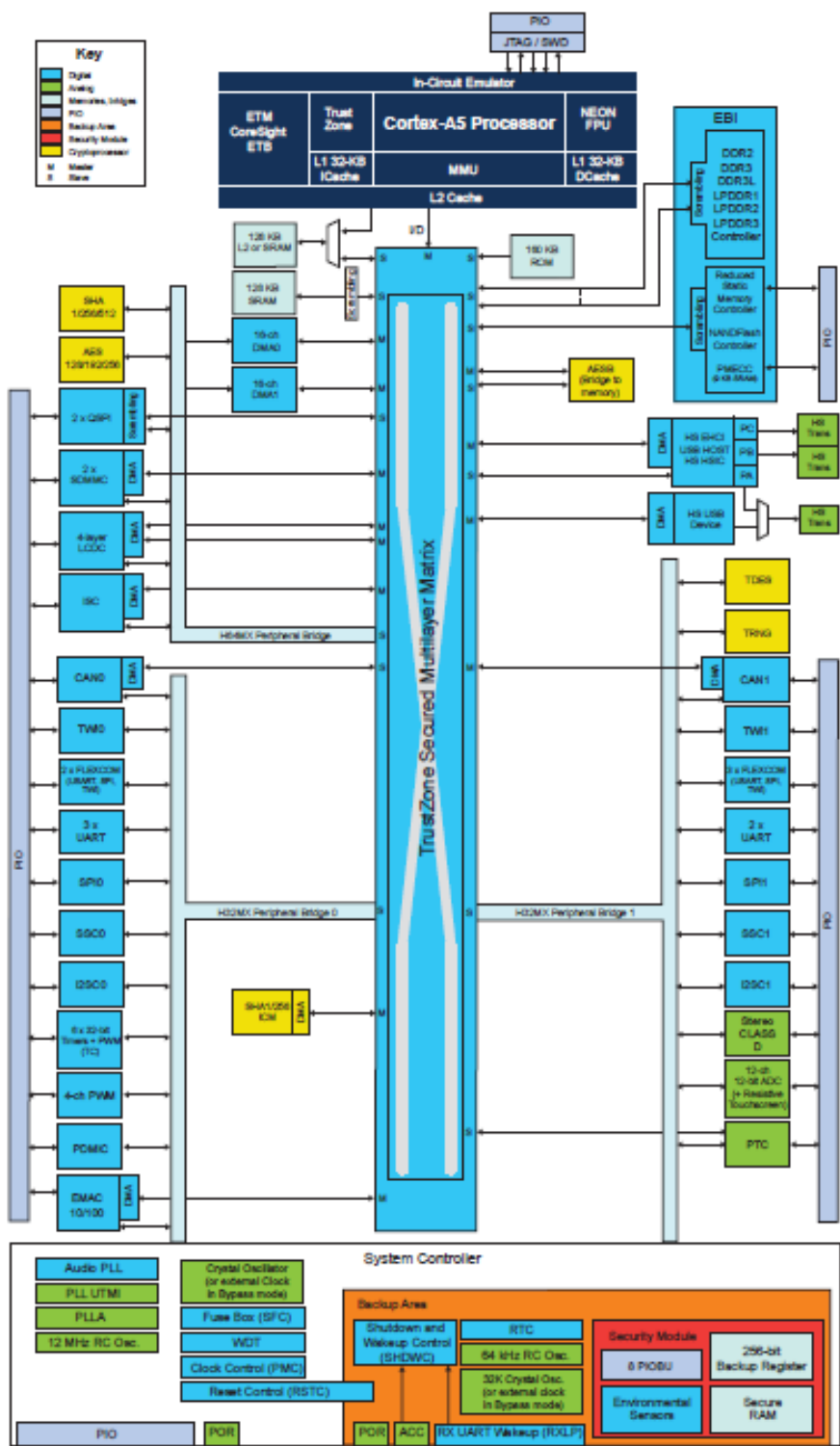


TABLE 3 Processor block diagram:



Supply voltage

The CL-20, properly connected, will be able to operate in accordance with the specification when the supply voltage will be in the range of 4.5 – 5.5 Vdc*.

The nominal supply voltage will be 5.0 Vdc* (USB standard)

* For continuous voltage indication the symbol  (IEC 60417-5031) is used on the label.

Current consumption

The CL-20 current consumption will depend on the actual functional status. The table below reports the current consumption.

OP mode	Mode characteristics	Current consumption
Standby mode	uP running, USB host connected, GPS in acquisition mode, USB downstream ports ready	TBD
Wi-Fi active	uP running, USB host connected, WiFi module in data exchange mode, GPS active, USB downstream ports ready	TBD
MODEM active	uP running, USB host connected, MODEM in data exchange mode, GPS in standby mode. USB downstream ports ready	TBD

Being CL-20 powered by CL-20 Power Harness, the power lines are not protected against the polarity inversion.

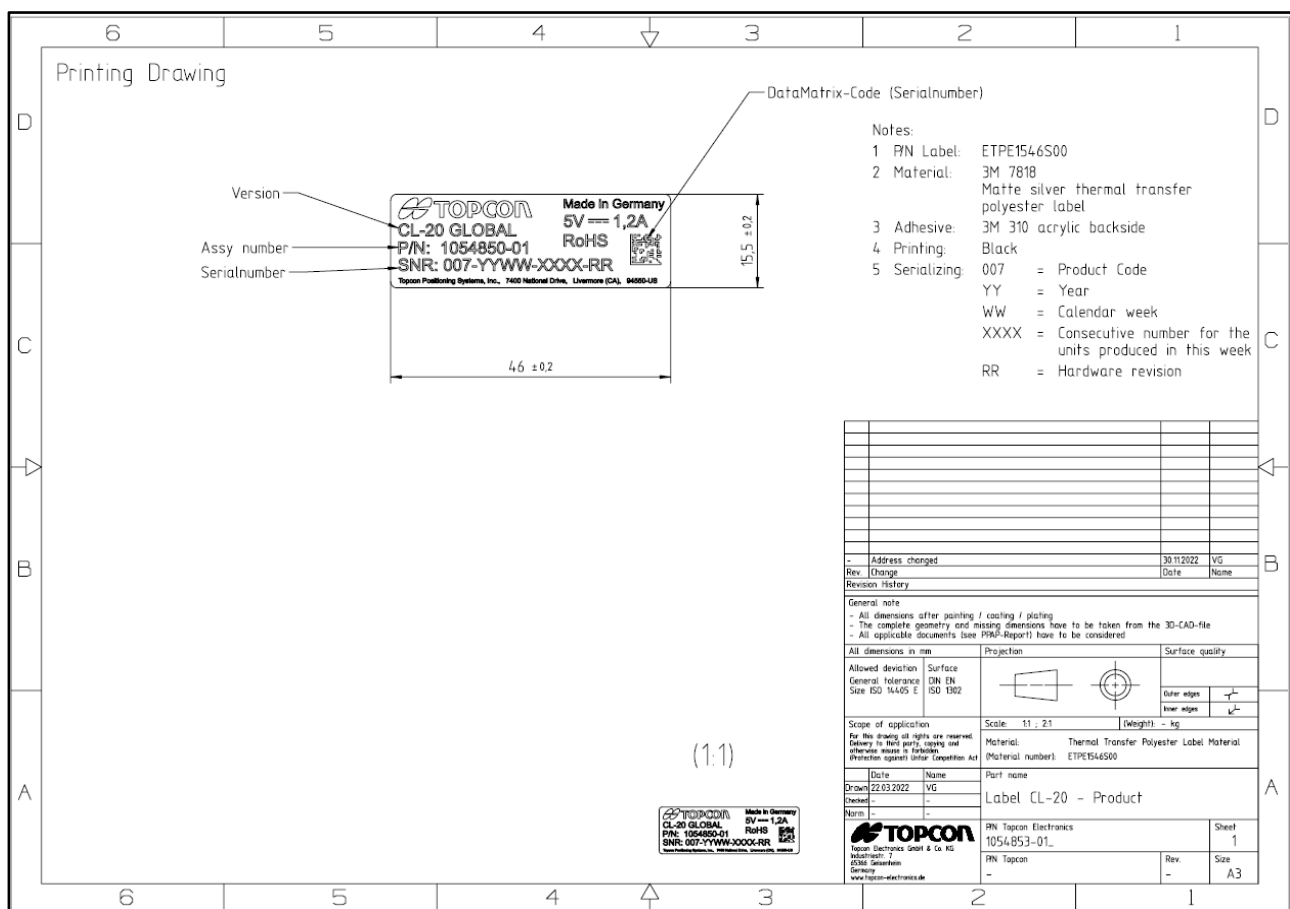
Note: Due to limited power availability from the upstream port, the USB user available downstream ports power lines DOES NOT COMPLY with USB standards in terms of current availability.

For this reason, a “CL-20 power harness” can be used: this special cable can be connected to a 8 – 36 VDC power source (a 12V / 24V vehicle battery for example) and then it generates a 5V 2A for CL-10. The power harness has an USB connection for the host also, see following picture.



Figure 8

Label Product



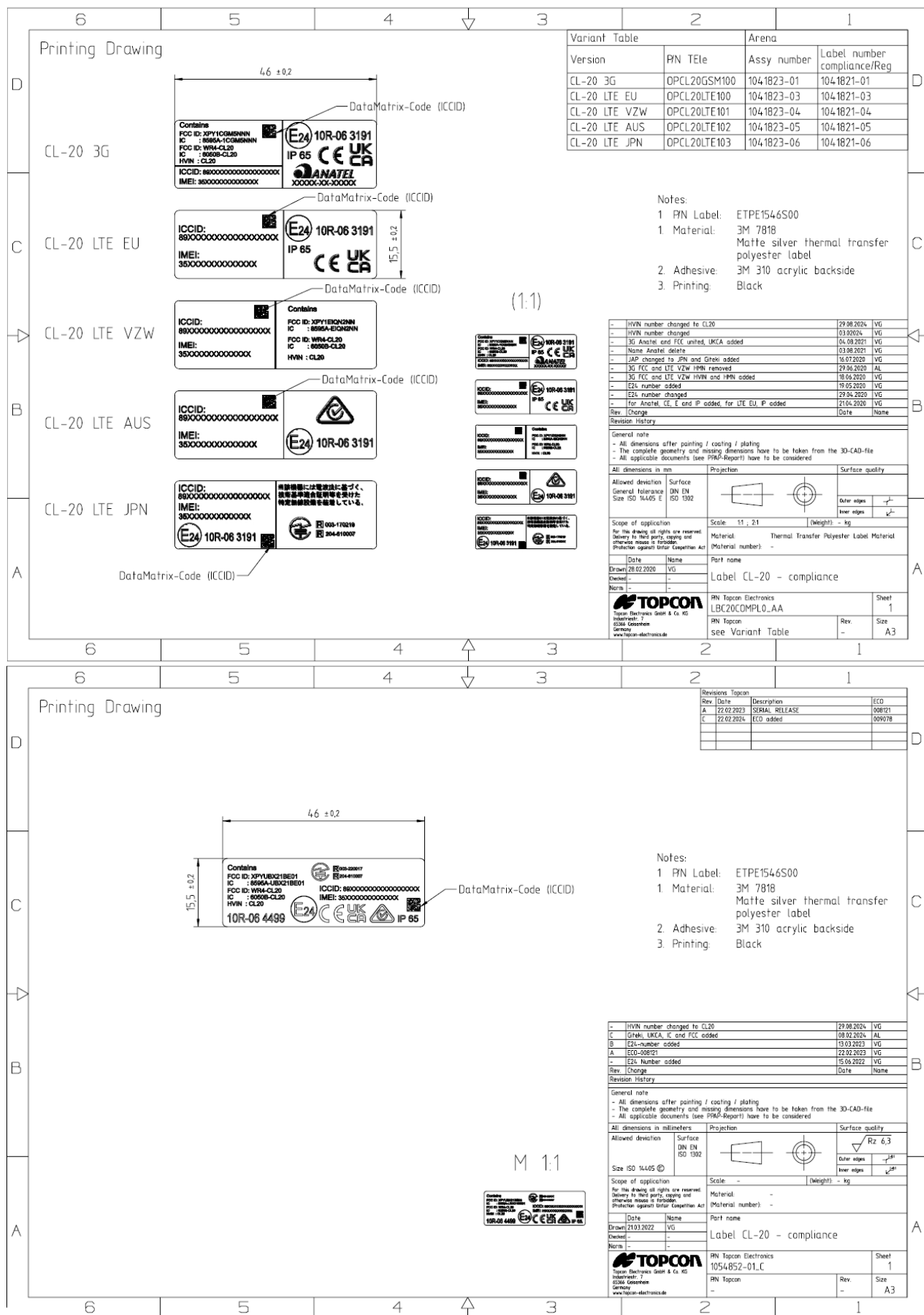


Figure 10

User interface

The LEDs on the CL-20 are currently not used.

The CL-20 has one double LED lamp mounted on the PCB for signalling and diagnostic purposes. The LEDs are visible from the outside through a transparent window placed on the CL-20 body (see F01 LED Windows).

Product Warranty

Topcon warrants that the electronic components shall be free of defects in materials and workmanship for a period of two years from the original date of shipment to the dealer. Warranty does not cover damages due to an improper use of the device and/or to the non-compliance with the indications contained in this document.

Assistance and repair

For assistance and repair please contact:

Topcon Precision Agriculture Europe S.L., Avenida de la Industria, 35, 28760 - Tres Cantos, Madrid, Spain

Email: tasupportemea@topcon.com

Use restrictions and warnings UE (RED)

The exposure limit set by the standard is respected for distances ≥ 20 cm from the device.

Use restrictions and warnings USA/CAN (FCC / ISED)

1. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
2. Device model CL-20 3G:

CONTAINS FCC ID: WR4-CL20

IC: 6050B-CL20

CONTAINS: FCC ID: XPY1CGM5NNN

IC: 8595A-1CGM5NNN

HVIN: CL20

Device model CL-20 LTE VZW:

CONTAINS FCC ID: WR4-CL20 IC: 6050B-CL20

CONTAINS: FCC ID: XPY1EIQN2NN IC: 8595A-1EIQN2NN

HVIN: CL20

Device model CL-20 GLOBAL:

CONTAINS FCC ID: WR4-CL20 IC: 6050B-CL20

CONTAINS: FCC ID: XPYUBX21BE01 IC: 8595A-UBX21BE01

HVIN: CL20

3. Responsible party's contact located in the United States:

Company: Topcon Positioning Systems, Inc.
Address: 7400 NATIONAL DRIVE, LIVERMORE, CA, USA 94551
Contact Name: Ferdinand Riodique
Contact's email: friodique@topcon.com
Phone #: 925-245-8300

- 4.** 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.
- 5.** 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.

6. Responsible party's contact located in Canada:

Company: Topcon Positioning Systems, Inc.
Address: 855- 2 Street SW, Suite 3500, Calgary AB T2P 4J8, Canada

Contact Name: Stephen Rosenegger
Contact's email: srosenegger@topcon.com
Phone #: +1 403 450 4262

7. This device contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's license exempt RSS(s). Operation is subject to the following two conditions: (1) This device may not cause interference. (2) This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique 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'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement du dispositif.

8. ICES-003 Class B Notice -Avis NMB-003 Classe B:

This Class B digital device complies with Canadian ICES-003

Cet appareil numérique classe B est conforme à la norme Canadien NMB-003.

CAN ICES-3(B) /NMB-3(B)

RF Radiation Exposure statement

This product complies with FCC and ISED radiation exposure limits set forth for an uncontrolled environment. The antenna should be installed and operated with minimum distance of 20 cm between the radiator and your body.

This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with FCC and ISED multi-transmitter product procedures.

Cet appareil est conforme aux limites d'exposition aux rayonnements de l'ISED 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.

Cet appareil et son (ses) antenne(s) ne doivent pas être co-localisés ou utilisés en conjonction avec une autre antenne ou un autre émetteur, sauf en conformité avec les procédures du produit multi-émetteur de la FCC et ISED.

This device complies with Health Canada's Safety Code. The installer of this device should ensure that RF radiation is not emitted in excess of the Health Canada's requirement.

Cet appareil est conforme avec Santé Canada Code de sécurité 6. Le programme d'installation de cet appareil doit s'assurer que les rayonnements RF n'est pas émis au-delà de l'exigence de Santé Canada.

Use restrictions and warnings Brazil (Anatel)

Certificações

Certificação ANATEL

‘Este produto não é apropriado para uso em ambientes domésticos, pois poderá causar interferências eletromagnéticas que obrigam o usuário a tomar medidas necessárias para minimizar estas interferências’

Para maiores informações, consulte o site da ANATEL www.anatel.gov.br

Modelo: CL-20 3G



XXXXXX-XX-XXXXXX

Este equipamento não tem direito à proteção contra interferência prejudicial e não pode causar interferência em sistemas devidamente autorizados.

Use restrictions and warnings UK (UKCA)

LH Agro (UK) Ltd
56 Edison Road
St. Ives (Cambs)
PE27 3LF

United Kingdom

The antenna should be installed and operated with minimum distance of 20 cm between the radiator and your body.

For frequency bands and RF power transmitted please see TABLE 1.

Declaration of conformity



EU Declaration of Conformity

We,

Company Name: Topcon Positioning Systems, Inc.
Headquarter address: 7400 National Drive, Livermore (CA), 94550 - USA
Telephone: +1 925-245-8300
E-Mail Address: tasupportemea@topcon.com

declare under our sole responsibility that the products:

Type: Telecommunication device
Basic Models: CL-20 GLOBAL, CL-20 3G, CL-20 LTE EU
Intended use: USB-powered plug and play box for Agriculture application

are in conformity with the relevant European Union directives:

Directive RoHS: 2015/863/EU
Directive RED: 2014/53/EU

The following harmonized standards were applied:

Safety & Health (Art. 3.1a Directive 2014/53/EU):
EN 62368-1:2014 + A11:2017
EN IEC 62368-1:2020 + A11:2020 (GLOBAL variant only)
EN 62311:2008
EN IEC 62311:2020 (GLOBAL variant only)

EMC (Art. 3.1b Directive 2014/53/EU):
ETSI EN 301 489-1 V2.2.3:2019
ETSI EN 301 489-17 V3.2.4:2020
ETSI EN 301 489-19 V2.2.0:2020
ETSI EN 301 489-52 V1.2.1:2021

Radio (Art. 3.2 Directive 2014/53/EU):
ETSI EN 300 328 V2.2.2:2019
ETSI EN 301 511 V12.5.1:2017
ETSI EN 301 908-1 V13.1.1:2019
ETSI EN 301 908-1 V15.1.1:2021 (GLOBAL variant only)
ETSI EN 301 908-2 V13.1.1:2020
ETSI EN 301 908-13 V13.1.1:2019
ETSI EN 301 908-13 V13.2.1:2022 (GLOBAL variant only)
ETSI EN 303 413 V1.1.1:2017

RoHS (Art. 4 Directive 2015/863/EU):
EN 63000:2018

Topcon Positioning Systems, Inc.
7400 National Drive
Livermore, CA 94550
Phone: 925-245-8300



The Notified Body Nemko S.p.A. performed the conformity assessment of the technical documentation according to the procedure of Annex III (Module B) of the Directive 2014/53/EU and issued the EU-type examination certificate no. 2051-RED-231101.

EU Representative:

Name: Topcon Precision Agriculture Europe S.L.
Address: Avenida de la Industria, 35, 28760 - Tres Cantos, Madrid, Spain
Tel: +34 - 91 - 804 92 31

Livermore (CA), March 16th, 2023

Salvatore Iacono
Vice President Engineering

A handwritten signature in black ink, appearing to read 'Salvatore Iacono'.