CR300B 2G & 3G Overview

Cellocator Division
Pointer Telocation Ltd.

POINTER

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1 Introduction

The purpose of this document is to describe the features and capabilities of this new platform of CR300B 2G & 3G product, and is intended for product, marketing, support and sales teams of Cellocator partners, integrators and service provider customers.

1.1 Document Scope

The document describes the high-level system features and capabilities of the CR300B New Platform. This document does not deal with the protocols and interfaces between the CR300B device and the SW backend, nor with the low-level algorithms, state machines and logic engine implemented in order to deliver a complete remote diagnostics and enhanced driver behavior system. These protocols, APIs, algorithms, and state machines are described in separate documentation, as listed in the following sections.

1.2 Definitions, Acronyms and Abbreviations

Name	Description
CR300B	Cellocator's mid end fleet management solution.

Table 1 – Definitions, Acronyms and Abbreviations

1.3 References and Bibliography

No.	Document Name
1	Cellocator Cello Programming Manual
2	Cellocator Wireless Communication Protocol
3	Cellocator Serial Communication Protocol
5	Cellocator Programmer Manual
7	Evaluation Manual
8	Cello Family Hardware Installation Guide

Table 2 – References

1.4 List of Changes

Version	Change	Remarks	Date Approved
1.0	First Draft		5.5.2016
1.1	Minor change at the specification		28.7.2016
1.2	Update section 3.1		30.1.2017
1.3	New functionalities based on FW version 44d		7.12.2017

Table 3 – List of Changes

2 System Overview

2.1 General

The Cellocator CR300B is Cellocator's entry-level unit for the new CR platform, and is based on the Telit xE910 modem family.

The intended market for the CR300B is Track&Trace and security applications.

The CR300B is based on the hardware and feature set of the existing CR300B 2G. Several features and improvements have been added to the product, as detailed in this document (including full backward compatibility). The CR300B also supports all available maintenance and debugging (excluding external debug line) features. In addition, the CR300B is equipped with a built-in 1000mAh rechargeable battery and GSM jamming detection algorithms.

In addition, the CR300B now includes all Premium Features by default, which are included as part of the default code base. It also comes with 2G and 3G (EU, NA) HW variants.

2.2 Hardware

The CR300B includes the following components:

- ◆ **HW variants**:
  - CR300B 2G
  - CR300B 3G NA
  - CR300B 3G EU
- ◆ **SIM Holders**:
  - Regular SIM holder

    or
  - SIM on chip-ready layout
- ◆ **Cellular**:
  - 3G UE910 Quad Band modem
  - 2G GE910 modem
- ◆ **GPS**:
  - 2G: Telit JF2 EEPROM GPS
  - 3G: Telit 868 SiRFstar V GLONASS
- ◆ **Backup battery** (CR300B) with extended capacity of **1000mAh**
- ◆ **1-wire** port (Dallas) for Driver-ID
- ◆ **1 wire interface** supports power for one temperature sensor
- ◆ **Memory** supporting 5000 logged events
- ◆ **Accelerometer** for Motion sensor
- ◆ Ignition input
- ◆ Two multipurpose GPIOs supporting digital/analog/frequency input
- ◆ Two digital outputs (open collector)
- ◆ Gradual immobilizing as one of the outputs (LEDs or Lights output)

- TTL serial port for programming
- 10-pin main connector

2.3 System Narrative

The CR300B fulfills the following objectives:

- It addresses the evolving fleet management market, which is trending towards Track & Trace (AVL), Stolen Vehicle Recovery (SVR) and Anti-theft.

- It keeps pace with industry standards of communication technologies, location finding sensitivity and accuracy, and jamming immunity via advanced Cellular and GPS/GNSS engines.

3 Feature Improvements

3.1 Two Multipurpose GPIOs

The CR300B supports two multipurpose GPIOs that support digital/discrete analog.

NOTE: When connecting 12V to a GPIO programmed as output, the port is likely to be damaged. Therefore, when programming the port as output, first validate that no voltage is connected.

In addition, there is no ability to test the output capabilities on the programmable GPIO.

| PIN	Current CR300B	New Platform CR300B
1	Power	Power
2	LED - GPIO	LED - multipurpose GPIO ('Lock')
3	LIGHTS - GPIO	LIGHTS - multipurpose GPIO ('Unlock')
4	IGNITION - Input	IGNITION - Input
5	DOORS - Input	DOORS - Input +Drain output (programmable IOs)
6	GND	GND
7	SERIAL-TX	SERIAL-TX
8	SERIAL-RX	SERIAL-RX
9	SHOCK - Input	SHOCK - Input +Drain output (programmable IOs)
10	1WIRE - Input	1WIRE - Input

Table 4 – Pinout Scheme
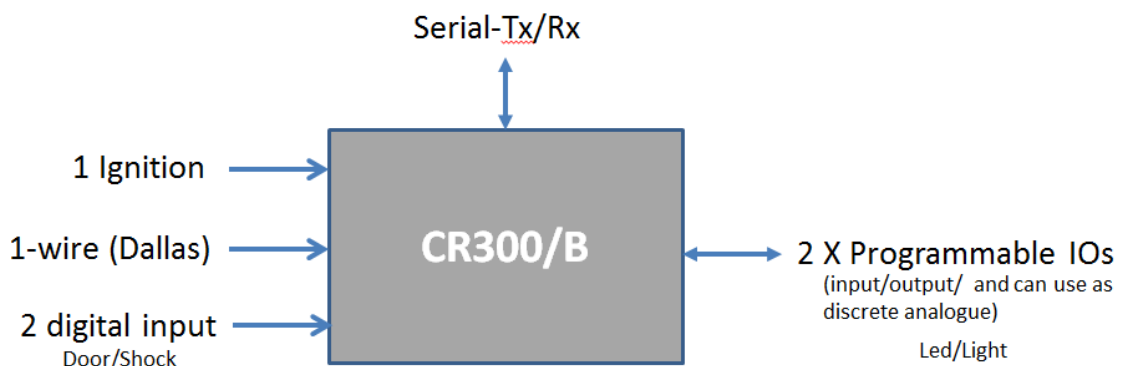
Figure 1 – Serial-Tx/Rx

3.2 Modem FOTA

With the Modem FOTA (FW over the air) process, the modem downloads a new FW file, and upgrades its own FW.

This feature is important in cases where a new modem FW is released or in cases when malfunctions are discovered in the modem (caused by the modem FW).

Upgrading the modem FW can only be managed by Cellocator CS.

3.3 Feature Authentication Codes

For dedicated customer projects, the "Feature Authentication Codes" option in the Programmer enables you to activate those special development projects into one source code with a "clean" PL that doesn't include non-relevant parameters.

In the Programmer, the code activation is entered in a dialog box (accessed via a toolbar button, as indicated below).

When connecting the Cello unit to the Programmer serial port for the first activation, you should click on the "Feature Authentication codes" toolbar icon and enter the code that was sent from Cellocator CS. By entering this code, the automatic relevant feature will be activated and the relevant PL folders are displayed, which will be activated for any connected device.

This feature is also supported OTA, so devices already in the field which are upgraded to a new version will also get this activation feature. For this purpose, a secured API/protocol to send the activation code to the device via the customer's backend was developed.

3.4 Premium Features

All features that were previously classified as Premium Features are now included by default and were added to the codebase. The features are described in the following table.

Premium Feature P/N	Premium Feature Name	Description
FR0001	Cell-ID	Defined per project. Note that because Cell-ID in a 3G network is implemented differently from a 2G network and includes many parameters, it is required to define the required parameter in tandem with the Cellocator CS team.
FR0002	Curve Smoothing	Report on changing compress vector directions.

Premium Feature P/N	Premium Feature Name	Description
FR0003	In Cabin Speed alert	Enables activation of one output in the event a speed limit is exceeded.
FR0004	Offline Tracking	Low battery feature that stores messages in a buffer and releases the buffer according to size / time.
FR0005	Transparent Mode	Required external TTL to RS232 converter. Enables setting the Serial Port Bit Rate to 9600 BPS.
FR0006	Advanced Roaming	Enables a list of up to 100 roaming options.
FR0007	Up to 100 Geo Fences	Instead of 16 as per the CR200.
FR0008	Usage Counter	Usage counters (HOS).
FR0009	Privacy Mode	Driver can report a trip as a private trip.
FR0010	Analog Input	Enables digital input functionality as analog input (for both inputs).
FR0011	Gradual Immobilize	Gradual Immobilization output can be defined utilizing one of the two legacy outputs (LED or Lights).
FR0012	Roam msg Rate	Roam/Home adaptive message rate.
FR0013	Driver ID	1-wire input including up to 30 Driver IDs / Trailer IDs list.
FR0014	Basic Satellite	New for the 41x FR release: basic satellite activation upon available GSM/GPRS. See Basic Satellite Activation.

Table 5 – Premium Features List

3.5 Jamming Detection while Ignition is ON/OFF

FW v43m includes the addition of advanced jamming detection (configurable). This feature builds a logic relationship between jamming detection and ignition reaction.

Case	Jamming	Ignition	Action
1	Yes	Off	Activate the immobilizer output (i.e. Immediate, Nested, Gradual) while monitoring jamming for a predefined duration (default: 10 seconds).
2	Yes	On	Activate the immobilizer output (i.e. Immediate, Nested, Gradual) while monitoring jamming for a predefined duration (default: 15 minutes).

Case	Jamming	Ignition	Action
3	No	On/Off	Deactivate the immobilizer output after no jamming detection for a predefined period of duration (i.e. 10 minutes).
			The unit notifies in the first communication that jamming was detected.

Table 6 – Jamming Detection Logic

3.6 Basic Satellite Activation

Basic Satellite Activation enables the use of an alternative satellite communication channel when the GPRS network is unavailable.

The functionality enables the turning on of the satellite modem power when the CR300B unit is out of GPRS coverage, and to switch back to GPRS when GPRS communication is once again available.

3.7 Offline Tracking

An Offline Tracking mode, designed to enable offline data logging, ensures that while the modem of the unit remains off, while the GPS, processor and all the peripherals are managed by the unit logic as usual. The unit generates and stores logged events in its non-volatile memory.

Upon one of the logical conditions listed below, the unit establishes an IP connection to upload the log during a single communication session. The communication session for accumulated data upload is initiated in the following cases:

- ◆ Upon expiration of a periodic timer
- ◆ Upon reaching 90% of memory capacity
- ◆ Upon reaching a certain amount of accumulated logged events
- ◆ At the end of a trip, upon expiration of the dedicated timeout after the Stop alert
- ◆ Upon activation (transition from 1 to 0) of input

The modem is also temporarily switched on upon the triggering of a distress session (if enabled).

3.8 Crash Detection Feature

The unit's accelerometer is used as a source for crash detection and reporting.

The feature includes two separate RMS-based thresholds, one for a light crash and one for a heavy crash.

The detection will not be possible when in full-hibernation mode (ignition is OFF).

Note that the light crash detection requires the unit to be installed horizontally for gravity to be eliminated.

3.9 Enable/Disable IP Up

The 'IP up' alert is generated with every dial-up to GPRS in order to update the Central Control with the resent IP address of the unit. In cases where the SIM card is associated with a static IP, it is possible to cancel IP up events.

3.10 RTC from the Network

This feature enables you to get RTC from the network for devices that are fixed and located underground.

3.11 2G Downgrade Restriction

This feature enables you to enforce the mode to work only in 3G by adding a restrictive 2G downgrade parameter.

3.12 Dallas Identifier in Ignition Off

This feature enables you to also get driver identification from the Dallas in Ignition Off mode.

3.13 1-Wire Temperature Sensor Measurement Event TR Change

In the wireless protocol, the Transmit Reason of '1-wire temperature sensor measurement event' was changed to 12 (instead of 10). The sub reasons are as follows:

- 0 – High 1-Wire Temperature Sensor Measurement
- 1 – Low 1-Wire Temperature Sensor Measurement

3.14 Tilt Tamper

Tilt Tamper logic measures the orientation (by earth gravity) on each axis and changes that breach the configured angle threshold. When compared to the steady state for a longer time than the configured time threshold, the unit will report it.

3.15 Cell ID for 3G variant

The following data related to 3G Cell ID will be sent as type 9:

- MCC – Mobile Country Code (200-901)
- MNC – Mobile Network Code (0-999)
- RAT – Radio Access Technology (G- GSM, W- WCDMA, L- LTE)
- LAC – Location Area Code (dynamic and required from the handset)
- RSCP [dBm] – Received Signal Code Power: energy after processing with gain from coding, which is parallel to RSSI [RSCP=RSSI+EC/No]
- CId – Cell ID: contains the BS (Base Station) and Sector

3.16 Overriding Operational Mode for Charging Activation

This is a new PL flag that allows the activation of charging, irrespective of the operational mode.

3.17 GSM Detection

This feature was developed for scenarios where a thief checks if a specific vehicle is equipped with a transmitting security unit by activating a GSM detector when the vehicle owner starts (Ignition On) the vehicle. If a thief successfully collects GSM transmissions (meaning a unit is installed in the car), the thief knows the transmission unit has to be removed before attempting to steal the vehicle.

To avoid these scenarios, the following logic was implemented:

When the car is started (Ignition On), the unit functions according to its standard logic, except for the modem which stays off (regardless of the unit mode before Ignition On).

The modem is switched on after expiration of a timer, which is measured from the Ignition On filter expiration (but when no Start event was transmitted). This timer is configurable via the "Modem On Delay Timer" parameter.

3.18 RSSI in Type 0

The RSSI is reported by the modem within the response to Cell ID querying, which is performed every 1 minute.

Two options were added in order to receive RSSI data:

- The OTA protocol provides four bytes in Type 0 messages, which are dedicated for the monitoring of analog inputs in a number of different message types. These bytes can contain measurements from the different fields as per the configuration. This feature added the RSSI data to the configurable measurements described above.

- The ability to always receive Cell ID sub-data with any event (Type 0), unconditionally.

4 Release Package Content

4.1 Evaluation Suite

The Cellocator Evaluation Suite Manual is a comprehensive guide that provides information required to run an initial appraisal and testing process of Cellocator units, without requiring connection to an actual vehicle during testing.

The Cellocator Evaluation Suite contains a complete set of components that simplifies bench testing of the system and serves as a demonstration platform for people wishing to understand the operational aspects of the system. The Suite is also intended to facilitate the development of interfaces to the Cellocator system by integrators or service providers.

4.1.1 Cellocator Programmer

The Cellocator Programmer enables you to perform the following:

♦ Modify a PL file to suit your communication needs.

♦ Upload and download PL files to Cellocator units via its serial interface.

♦ Test and debug units using a variety of features, including a platform manifest, the ability to test a unit's inputs and outputs, and the ability to forward data to a wireless channel.

The Cellocator Programmer is mainly used for the initial configuration of a unit, and typically communication settings such as the destination IP address, target port phone, and SMS numbers.

For more information, refer to the *Cellocator Programmer Manual*.

4.1.2 Communication Center

The CR300B supports the use of the Communication Center tool. The Communication Center performs the following:

♦ Receives, parses and monitors GPRS and SMS messages.

♦ Sends commands through GPRS or SMS communications.

♦ Interrogates the unit in order to get the current location (in text format) and the unit status (inputs, outputs, GPS data, etc.).

♦ Receives and monitors emergency transmissions from the unit (input triggering).

♦ Controls the unit's outputs. Programs the unit's behavior OTA (by changing the unit's EEPROM content).

♦ Upgrades the unit firmware.

For more information, please refer to the *Cellocator Evaluation Suite Manual*.

4.2 Cellocator+

The Cellocator+ System is a web-based application that enables Cellocator customers to perform configuration and firmware updates to Cellocator devices and view the status of these updates in real time and through reports via an intuitive interface.

The Cellocator+ System supports customers wishing to directly view and modify their device information. The user can request displays of device data and status and configuration management, and can perform configuration updates by attaching PL (Programming Library) files or firmware versions to a device or set of devices while the system manages the programming session.

The Cellocator+ System has a number of important features and benefits, including:

- Provides Cellocator customers with all major provisioning tools at the click of a mouse.
- Eliminates the need of all customers to maintain provisioning tools in their systems.
- Reduces time to market for new customers.
- Provides reports on update history (to be implemented in future versions).
- Cellocator+ manages the whole device management process.
- Customers can view update statuses in real time through the Web.

4.3 Integration Package

The Cellocator Gateway is a set of SW components offered to Cellocator customers wishing to integrate the Cellocator OTA protocol into their production environment.

Customers using Cellocator Gateway benefit from a quicker and easier integration process, and are also entitled to software upgrades, technical support and more. Cellocator Gateway is a multi-platform solution and can run on Windows or selected Linux OS. The integration package provides high availability and load balancing options, as well as enabling clients the opportunity to integrate and start working with Cellocator units without investing a large amount of time and resources.

5   CR300B Hardware Components

The CR300B hardware components are listed in the table below.

Name/Part Number	Description	Picture
CR300B Three HW variants: CR300B 2G **PN** CT7801201-000 CR300B 3G NA **PN** CT7801200-000 CR300B 3G EU **PN** CT7801202-000	Three HW variants with the same FW features.	
Ten wire mold main Harness **PN** 711-00328	10 wire harness, which supports all CR300B interfaces.	
Six wire mold optional Harness **PN** 711-00301		
Two wire Fuse Harness **PN** 711-00280	Two wire fuse harness	
CR300B Evaluation Kit Basic: 2G - K090-037 3G NA - K090-038 Full: 2G – K090-036 3G NA - K090-028 3G EU - K090-029	Two variants of CR300B Evaluation Kits exist; Basic and Full.	

Table 7 – CR300B Components

6   Documentation

The product is supported by set of documents including Evaluation, Integration and Installation manuals, Protocols description, programing reference etc. For more information, refer to the documents listed in section 1.3.

7 Technical Specifications

Communication		
Variant	**3G**	**2G**
GSM Modes	UMTS/HSPA/GSM/GPRS/EDGS: 5.76 Mbps [UL]/7.2 Mbps [DL]	GPRS class 10
Bands	850/1900MHz (NA); 900/2100MHz (EU)	850, 900, 1800, 1900MHz
Power Output	0.25W	2W, 1W
SIM	Internal, replaceable; SIM on chip support	
Antenna	Internal, Penta band GSM antenna	
Packet Data	TCP/IP, UDP/IP	
SMS	PDU	
GPS		
Variant	**3G**	**2G**
Technology	Chipset: SiRFstarV GLONASS	Chipset: SiRFstarIV GPS
Sensitivity (Tracking)	-166dBm	-163dBm
Acquisition (normal)	Cold<35Sec, Hot<1Sec	
Antenna	On board, internal patch antenna	
Inputs and Outputs		
Inputs	1 internally pulled down input dedicated for ignition switch 2 internally pulled up inputs with assignable functionality and configurable polarity	
Outputs	2 general purpose open drain outputs (250mA max) with assignable functionality Can also be utilized as inputs (configurable)	
Accelerometer	3D, 16g range, 12 bit representation, 1mg resolution	
Interfaces		
COM port	Selectable baud rate (9600 or 115000bps) TTL levels (external TTL-USB adaptor) 8 bit; 1 Stop Bit; No Parity Configuration update Firmware upgrade	

1-Wire™ (Dallas port)	DS1990A, DS1971 compliant for driver management Extended bus current source with 7mA driving capability DS18B20 compliant for temperature sensors	
Connectors	10pin Molex, Automotive	
Power		
Variant	**3G**	**2G**
Input Voltage	9-32VDC	
Average Current consumption	**Normal:** 46mA **Economic:** 25mA **Hibernation:** 2.4mA	**Normal:** 29mA **Economic:** 14mA **Hibernation:** 2mA
Internal Battery	Li-Ion Polymer, 3.7V, 1000mAh, rechargeable Embedded NTC for temperature controlled charging Operating Temperature: -20 (65% charge) to +60°C	
	Battery Monitoring: Temperature (NTC) & Voltage **Autonomy:** 142 messages from a fully charged battery at a TX rate of 1/5 minutes @ room temperature **Protections:** over current, overcharge and over discharge	
Vehicle Environment Immunity		
Immunity	Compliant with ISO 7637 test level #4 (in accordance with e-mark directive)	
Environment		
Temp, operating	-30°C to +70°C full performance	
Temp, storage	-40°C to +85°C	
Humidity	95% non-condensing	
Protection	IP40 (IP 66 with protector)	
Vibration, Impact	ISO 16750	
Mounting	Tie-wraps and/or two-sided adhesive	
Certifications		
FCC	Part 15 Subpart B, part 22/24 compliant	
CE	CE number – CE 1177,0889 CE EMC & R&TTE according to 89/336/EEC or 1999/5/EC CE Safety EN60950-1:2006+A11:2009 Automotive Directive 2004/104/EC (E-Mark)	

IC	Industrial Canada
EN12830 compliance With 1-wire temperature sensor	Suitability: T Climatic environment: • w/o CR Protector – B • with CR Protector – D Accuracy class: • (-10)°C to (+85)°C - 1 • <(-10)°C, > (+85)°C - 2 Range: -55°C to +125°C
Dimensions and Weight	
Dimensions	91x69x23mm
Weight	~100gr

Table 8 - Technical Specifications