FIH 富智康™
FIH Mobile Limited

neXtpert Inc.

RTBM-EAXX
User Manual

DATE: 2024/08/05

Customer	End Customer	Customer Project Owner	Document No.	
Stellantis	Stellantis	TBD	TBD	
Customer Project Code	**FIH Project Code**	**FIH Project Owner**	**Doc. Type**	**Versions**
RTBM	RTBM	Tim Chen	User Manual	1.0
Customer PIN	**FIH PIN**	**Document Description**		
TBD	TBD	RTBM User Manual		

Role	Name	Department	Date	eSign-ID
Homologation Lead			<2024-month-day>	
Radio Frequency Lead			<2024-month-day>	
Electrical Engineering Lead			<2024-month-day>	
Mechanical Engineering Lead			<2024-month-day>	
Technical Project Manager			<2024-month-day>	

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1. Preface

Copyrights

Objectives

This documentation is prepared to provide a thorough product information and installation guideline. FIH Mobile Limited is dedicated in ensuring the accuracy and consistency of the contents in this document upon each version release. However, our products are subject to continuous upgrades without prior notices. The texts and images herein are subject to future updates without notices. Please note that the contents and information described herein does not imply any liability for warranty. It is the sole responsibility of the customers to properly install and use this product.

Disclaimer

Any change or modification made to this product without expressed or written consent from FIH Mobile Limited will void the warranty. This includes usages not intended by this documentation. FIH will not assume any liability for any incurred damage or injury caused by any misuse of the product.

Recommendations for users

The installation of this product must be performed by a professionally trained technician only. Personnel without proper training or sufficient experience should not perform the installation alone and must work under guidance from an experienced professional.

1.1 Revision History

Version	Date	Description	Note
1.0	2024-08-05	First release	

1.2 List of Abbreviations

Abbreviation	Description
AGC	Automatic Gain Control
AP	Access Point
Beidou	China's Beidou Navigation Satellite System
BUB	Backup Battery
CAN	Controller Area Network
CW	Continuous Wave
DAB	Digital Audio Broadcasting
DIM	Driver Information Module
DTC	Diagnostic Trouble Code
DUT	Device under Test
EMC	Electromagnetic Compatibility
Galileo	European union's Navigation Satellite System
GLONASS	Russia's Navigation Satellite System
GNSS	Global Navigation Satellite System
GPS	United States' Global Positioning System
GSM	Global System for Mobile Communications
GTW	Gateway
HW	Hardware
HU	Head Unit
IVI	In-vehicle infotainment
LNA	Low Noise Amplifier
LTE	Long Term Evolution
MFF2	Embedded Form Factor (embedded SIM)
MMI	Man Machine Interface
MNO	Mobile Network Operator
NAD	Network Access Device
PCB	Printed Circuit Board
PWM	Pulse Width Modulation
RED	Radio Equipment Directive
RF	Radio Frequency
ROW	Rest of World
RTBM	Radio Telematic Box Module
SIM	Subscriber Identity Module
STA	Station
SVT	Stolen Vehicle Tracking
SW	Software
TCU	Telematic Control Unit
UMTS	Universal Mobile Telecommunications System
WCDMA	Wideband Code Division Multiple Access
PWM	Pulse Width Modulation
VSM	Vehicle Security Module (Body Control Module)

1.3 Scope of Document

The aim of this document is to provide general descriptions of multiple functional aspects of the RTBM intelligent antenna module. The document shall cover the following subjects:

- Function design

- Product variants

- Product features

- Mechanical design

- Associated parts and components

- Pins and signals

- Communication protocols

- Mounting guideline

- Compliance

2.   Manufacturer Information

Manufacturer and Applicant

FIH Co., Ltd.
No. 4, Minsheng St.,
Tucheng Dist., New Taipei City 23679, Taiwan (R.O.C.)

Brand/Trademark

FIH Mobile Limited

3. System Overview & Features

RTBM (Radio Telematic Box Module) is a multi-functional telematics box customized by FIH for customers, powered by a dual-core application processor up to 1.5 GHz. This telematics device supports multiple connectivity and cellular technologies including Ethernet, 3G, 4G, Wi-Fi, GNSS and Radio.

RTBM is a hidden or embedded concept designed to be installed in the car, without built-in 3G/4G, AM/FM/DAB and GNSS antennas. This EA version connects the external antenna with cables through the external connectors to receive signals for realizing wireless services.

The Wi-Fi and 3G/4G backup antennas of RTBM are embedded on the PCB using printed antenna process. The system of RTBM will automatically switch to the built-in 3G/4G backup antenna to maintain cellular network connection in case the primary antenna is diagnosed failure. For example, antenna damage in rollover crash scenarios.

In addition to providing the radio functions mentioned above, the communication between the RTBM and the vehicle is realized through CAN and Ethernet, for instance, responding the diagnosis to the host machine (Head Unit, HU) in the vehicle through the CAN bus.

The RTBM connects to the backup battery (BuB) via a 2-pin battery connector and connects to host machine via a 20-pin main connector and a 2-pin Ethernet connector (HMTD).

At this stage, RTBM is not programmed with a direct user interface, with the only exceptions being emergency call and assistance call functions, which drivers or passengers can operate autonomously in the vehicle or via push buttons.

Programmed with automatic eCall dialing service, RTBM will simultaneously dial eCall to the Public Safety Answering Point (PSAP) to seek emergency assistance services when a vehicle collision triggers the airbag activation.

RTBM is designed with cooling and thermal suppression mechanisms to ensure normal operations, such as data service and eCall functions, under high ambient temperature. With a diagnostic mechanism, RTBM can promptly respond to the abnormal status of the antenna, microphone, speaker, eCall button, A-call button, LED, Airbag, and report to the host computer in the vehicle. RTBM uses a factory installed embedded SIM (MFF2) to ensure the user data security.

RTBM supports the following features:

- Radio broadcast reception services: AM, FM, DAB
- FM antenna input for FM phase diversity (2nd FM antenna external)
- Telematics and data connection via mobile networks (3G/4G)
- Embedded cellular network (3G/4G) modem featuring one external WCDMA/LTE1 antenna and one external LTE2 antenna
- Embedded backup cellular antenna supporting 3G and 4G
- Features a BuB (Backup Battery) to support eCall if the main vehicle battery is disconnected or out of power
- Supports Wi-Fi IEEE802.11 a/b/g/n/ac
- Emergency and Assistance Call Management
- GNSS positioning (GPS, GLONASS, Galileo, Beidou)
- Features one high-speed CAN driver for interoperating with vehicles
- Built-in Ethernet BroadR-Reach bus for communication with multimedia control unit
- Communicates with eCall MMI via wired signals
- SW Update
- Cyber security

Note: VoLTE is not supported.

3.1 Functional application diagram of RTBM in a vehicle

Radio Broadcast
AM/FM/DAB

GNSS
Positioning

Cellular Technologies
3G/4G LTE

Emergency Call
eCall
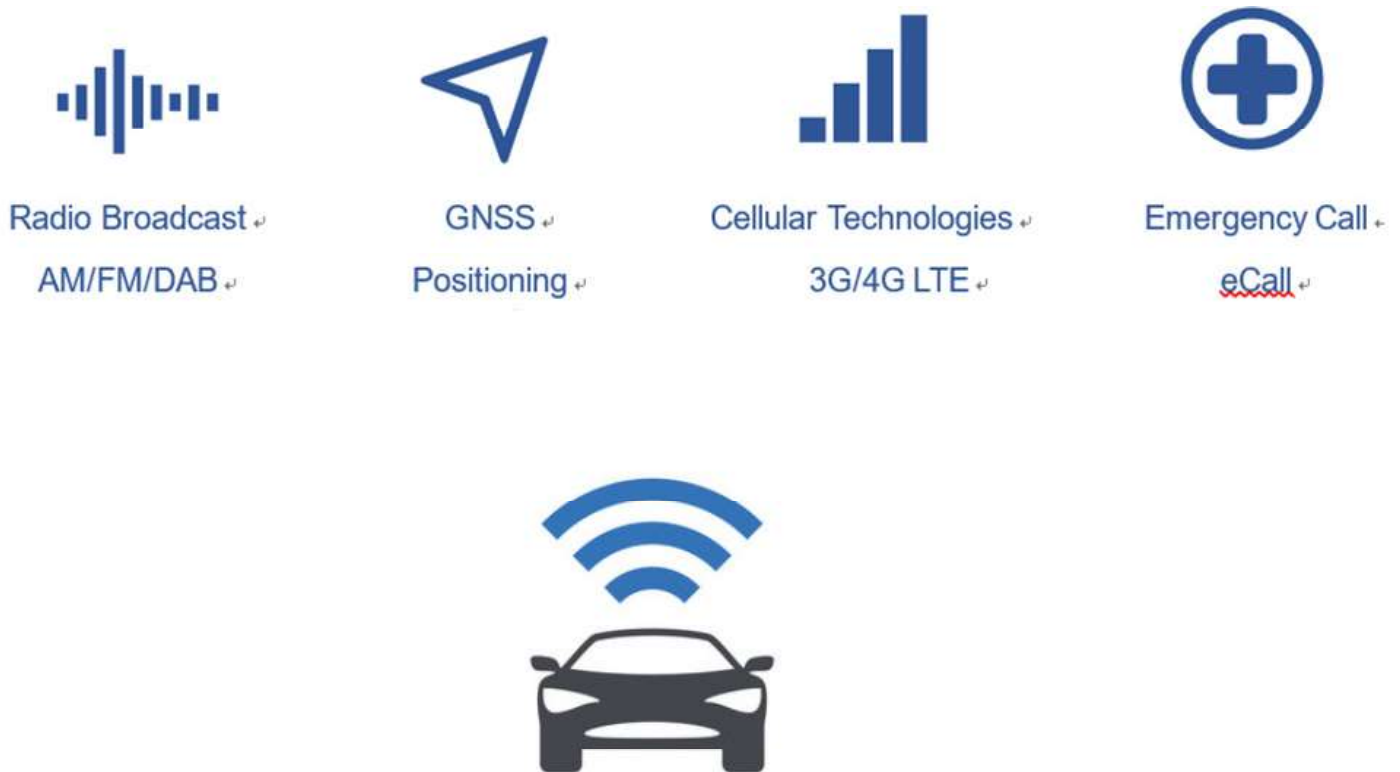
Radio reception will be used by other control units in the vehicle e.g. the Head Unit. The Broadcast RF signals are demodulated inside the RTBM and the content (audio/data) is provided in digital format to the vehicle gateway.

3.2 RTBM System Architecture
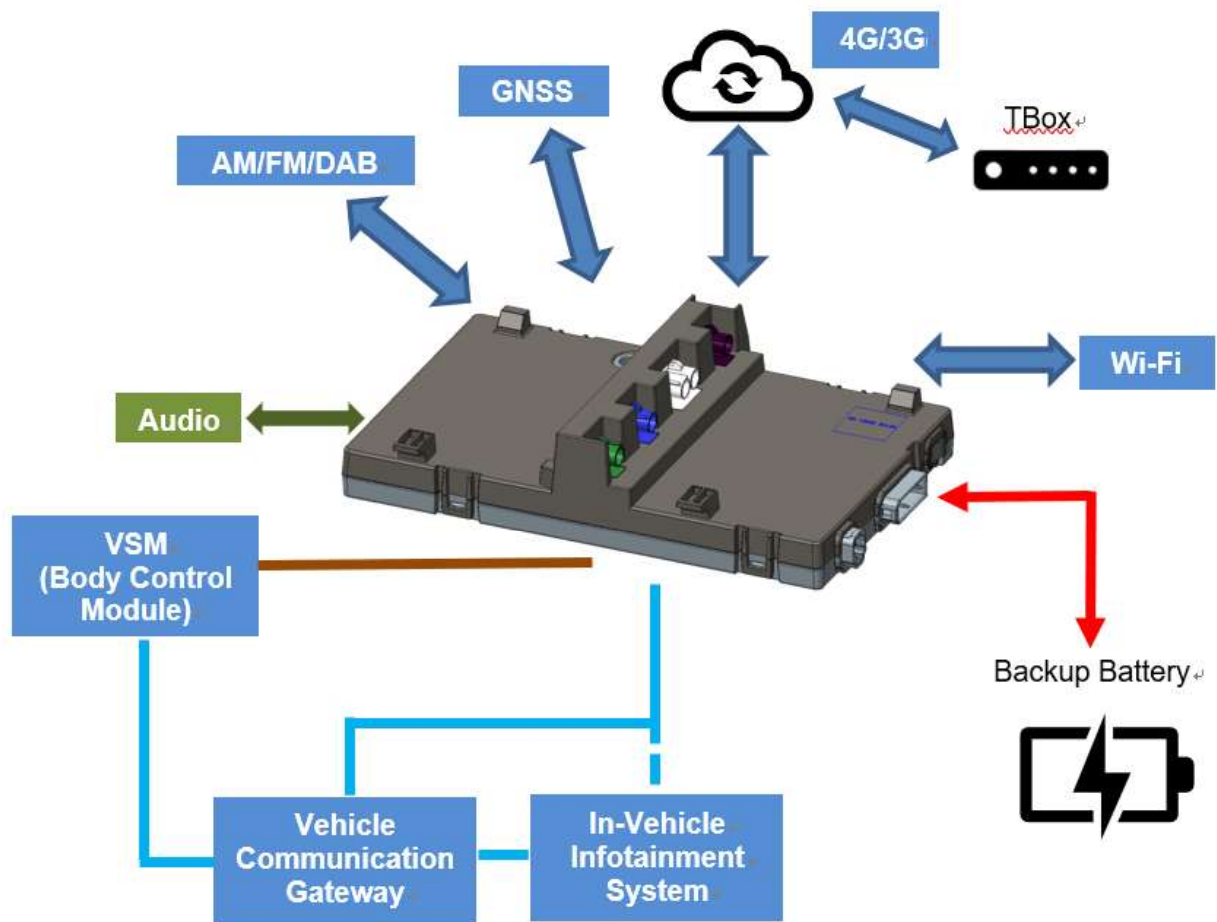
RF Frequency Bands	
CAN HS	—
Ethernet	—
Power Trace	—

3.3 Quick Tour of RTBM External Antenna Version

Top view
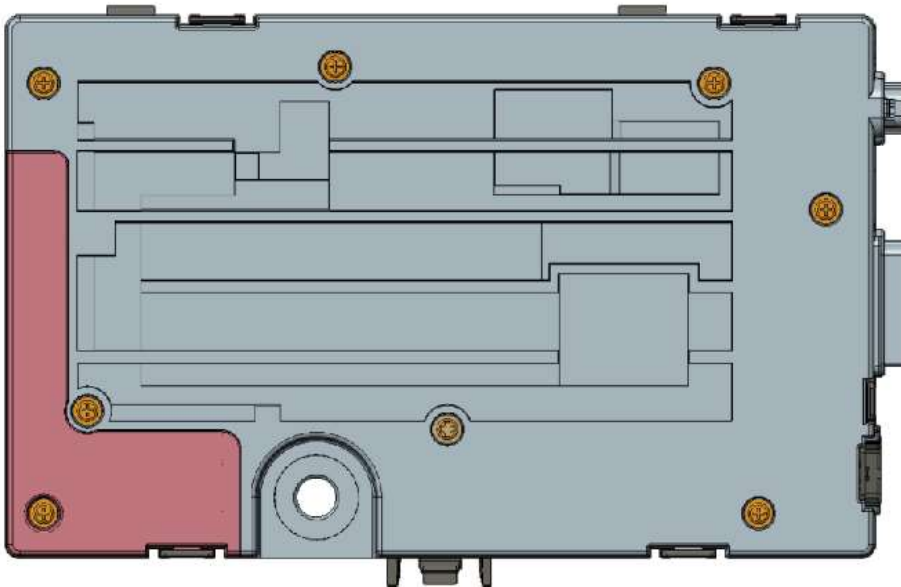
Right side view
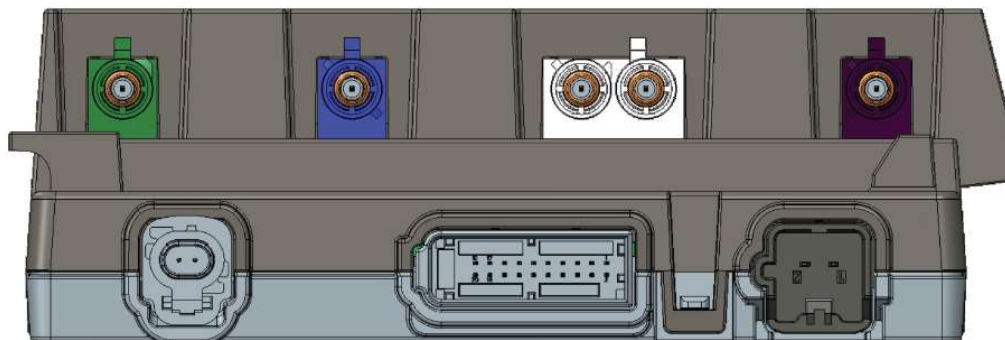
Left side view
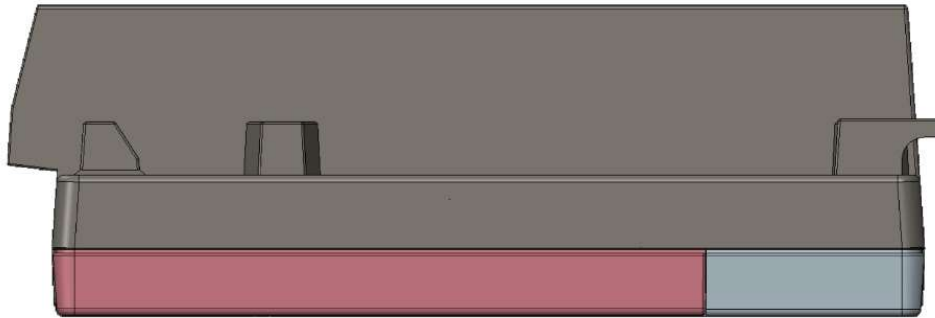
Bottom view
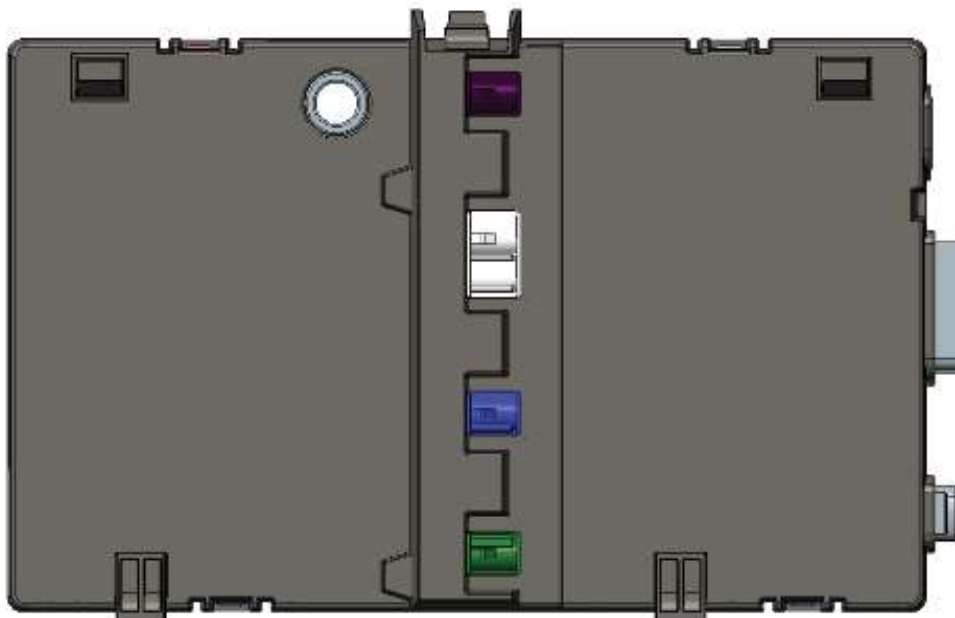
Front view
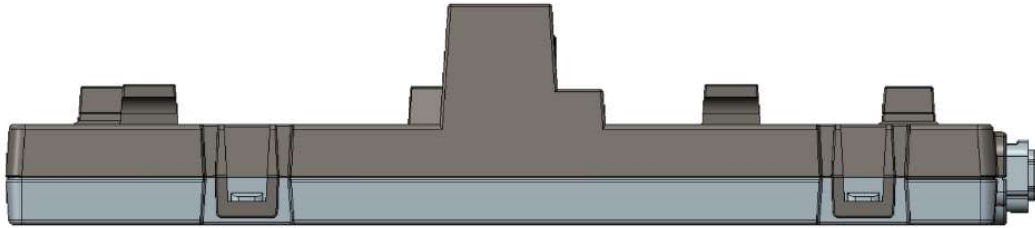
Rear view
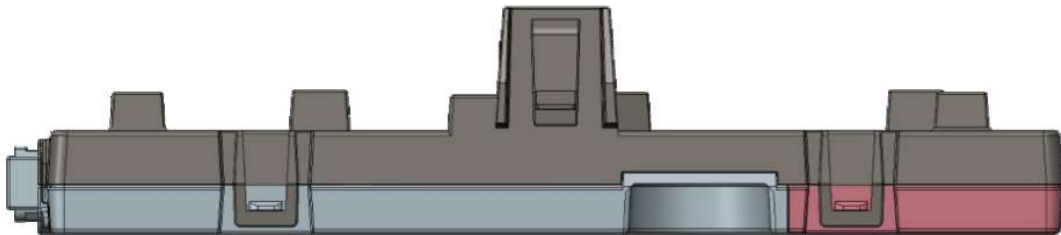
4. Product Variants

4.1 Model Names

Variant	Country	Hardware version	EMC reference
RTBM-EANAGEN	External Antenna North America General	Step 1.1	FIH-RTBM-EANA-EMC00

RTBM Diversity Variants by Countries/Regions

North America
MNO: local MNO eCall: 911 Radio: FM/AM

Refer to **4.2 Variants and Features Table** for details.

4.2 Variants and Features Table

Variant HW	Step 1.1
Country	North America
Variant Marketing	RTBM-EANAGEN
EMC Reference	FIH-RTBM-EANA-EMC00
HW Band Configuration SKU	NA
Specificity	Local SIM card
Vehicle Architecture	AEE2010 (CAN-HS + Eth100Mb)
SW Branch	
Associated Intotainment	IVI2020R1/R2
Style	External Antennas TCU position in the car (TBD)
Radio	FM/AM
Modem	4G (to be adapted to the country)
SIM 8 pin eUICC	Profile local MNO for KSA
V2X	NO
SVT (Stolen Vehice tracking)	NO
E-Call	YES - follow country regulation
GNSS	
Dual Band GNSS	NO
External Back Up Battery - BuB (link with E-call)	YES
OTA	OTA RTBM / IVI
Full OTA (FOTA)	NO
L2+REM	NO
TPS E-call	NO
GPDR	NO

5. Hardware Design Concepts

5.1 Block Diagrams

AM/FM/DAB antenna   Wi-Fi antenna   GNSS/GPS antenna   LTE Main antenna   LTE Diversity antenna

LTE Backup antenna

The EA only provides connectors, requiring cables and external antennas for connectivity

PCB layer

FAKRA   Ethernet   Main   BuB   Connector interface

Head Unit   Gateway   Mic & Speaker   eCall   Airbag   CAN bus   System power   Backup battery
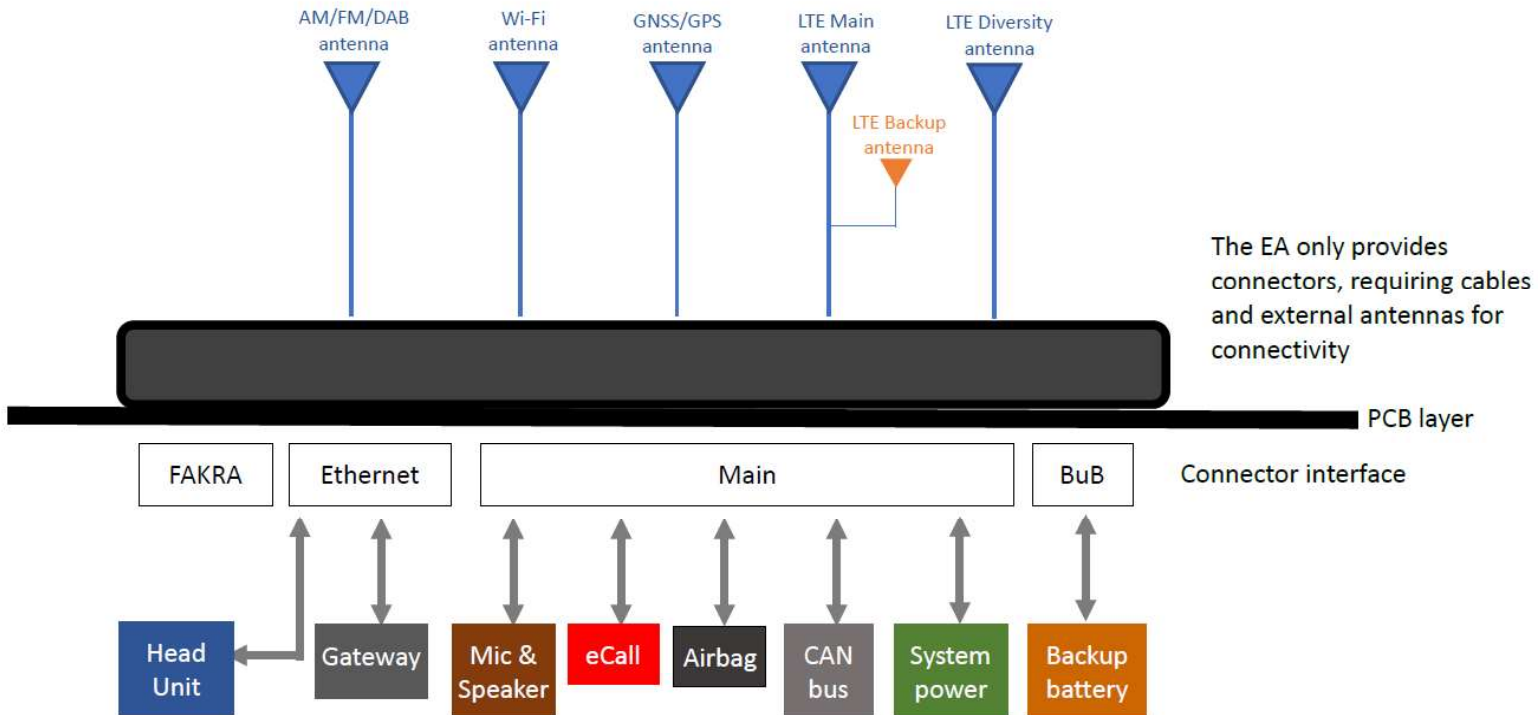
5.2 Mechanical Dimensions

Unit: mm

SECTION A-A

SECTION D-D

Unit: mm

SCALE 1:4
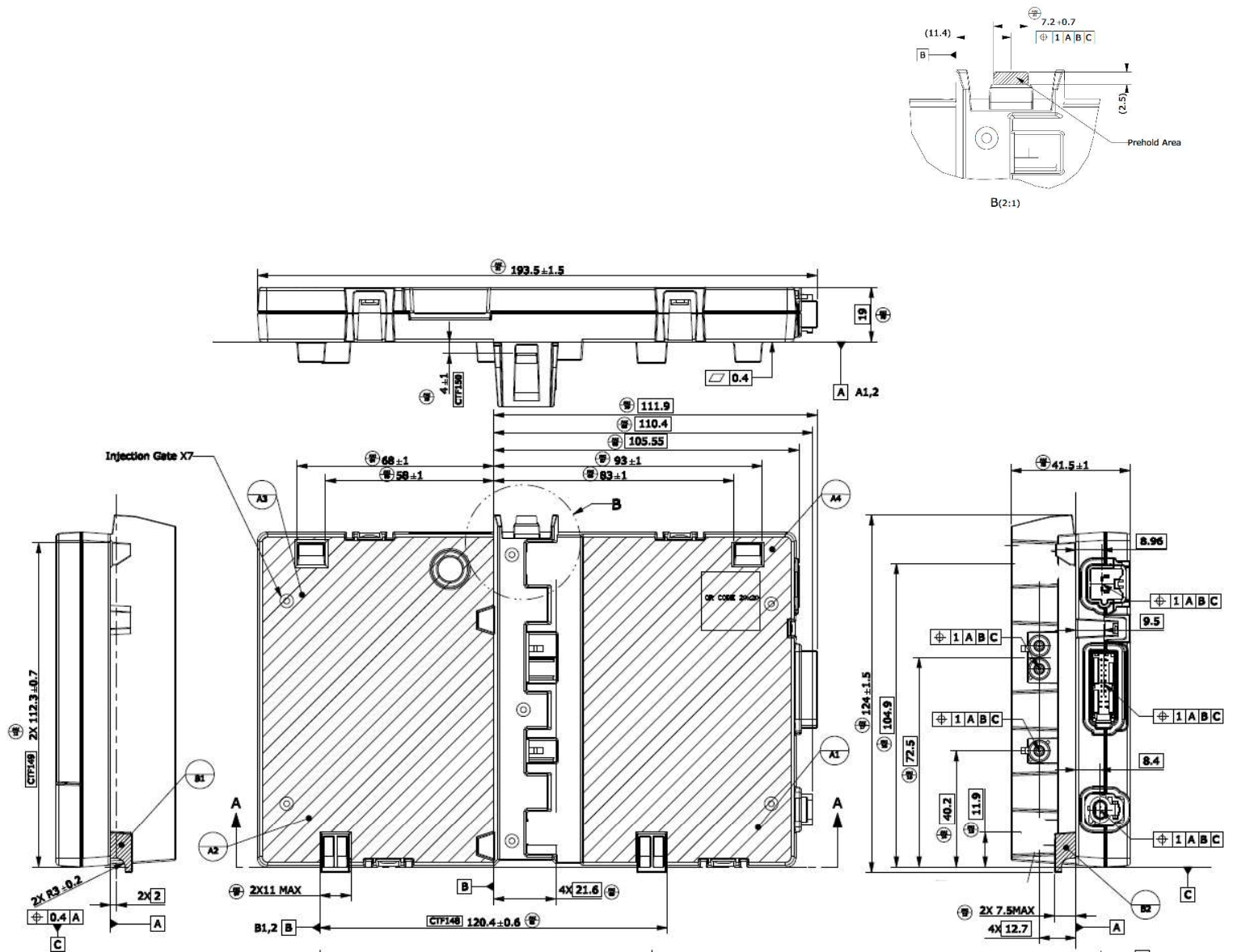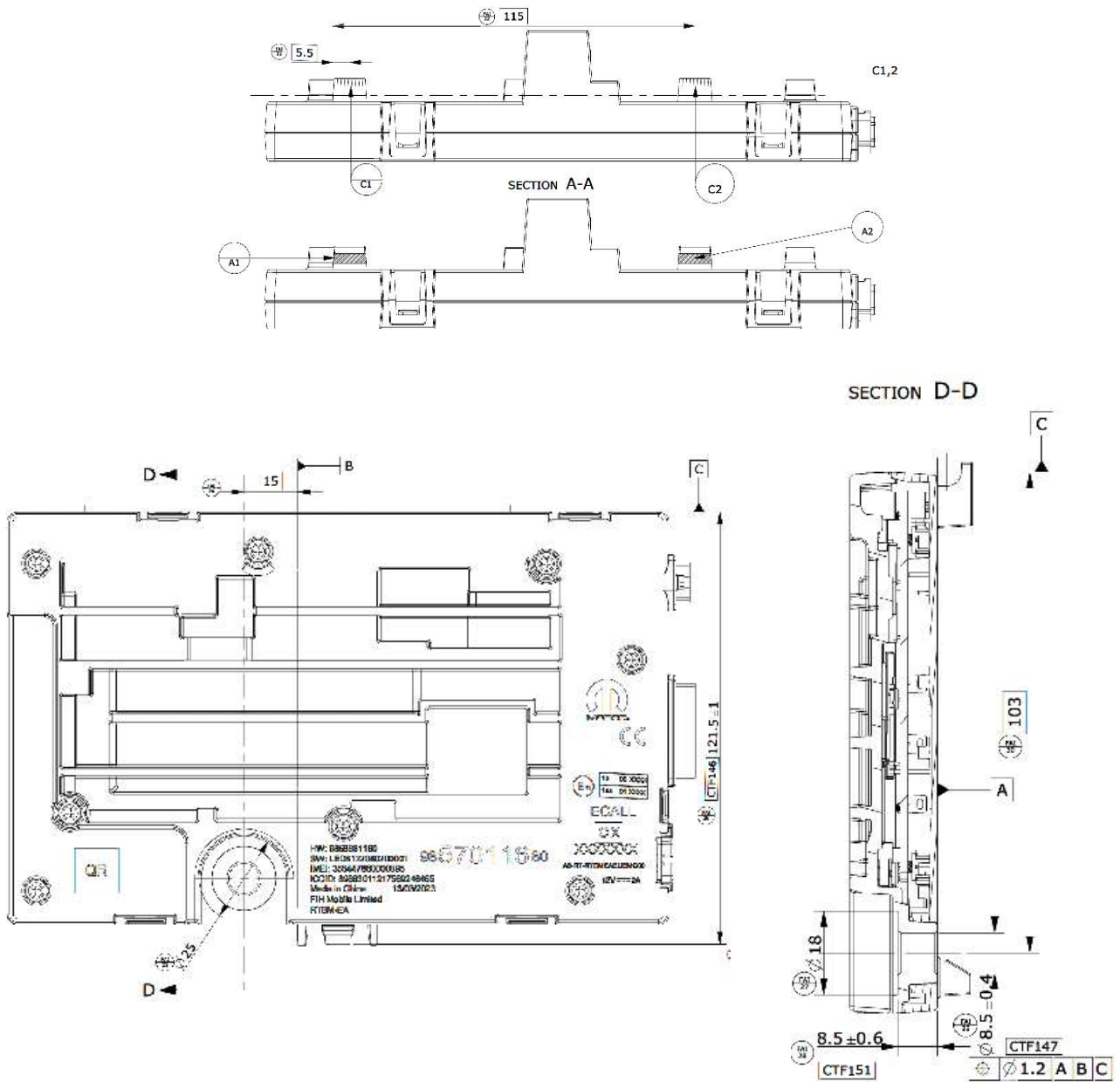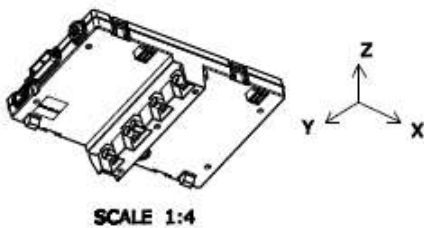
	Tx	Ty	Tz	Rx	Ry	Rz
A	0	0	1	1	1	0
B	1	0	0	0	0	0
C	0	1	0	0	0	1

CTF	ZONE-AREA	DESCRIPTION-CONTENT
CTF146	B-2	Counter support position
CTF147	A-1	Hole 8.5 geometric tolerance
CTF148	D-6	B referential geometric tolerance
CTF153	E-8	Distance C referential and counter support
CTF155	H-6	High A referential and counter support
CTF156	A-1	Hole 8.5 thickness

5.3 Connector Signals
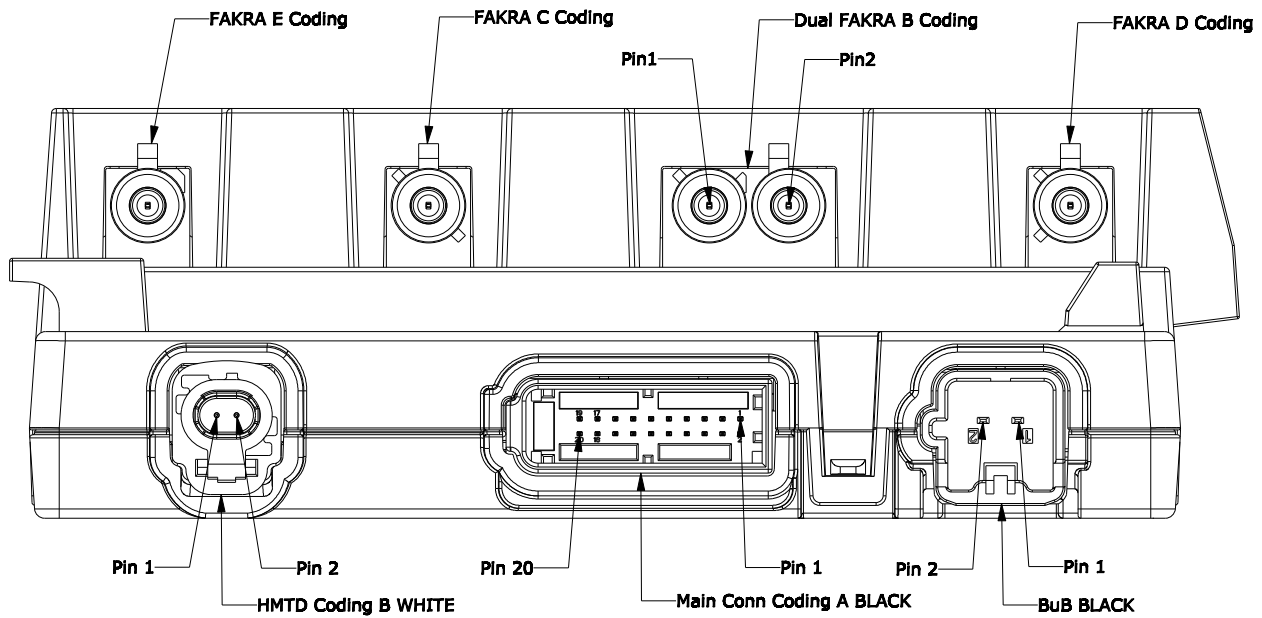
1. FAKRA

Pin	Signal Name
FAKRA E	LTE2
FAKRA C	GNSS
Dual FAKRA B	Pin 1: FM2 / DAB Pin 2: AM / FM1
FAKRA D	LTE1

2. BuB
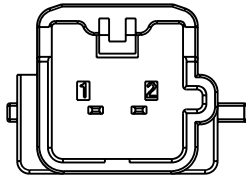
Pin	Signal Name
1	VBAT
2	GND

3. HMTD
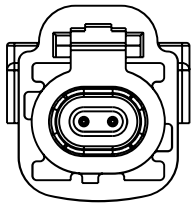
Pin	Signal Name
1	TRD_N
2	TRD_P

4. Main Connector
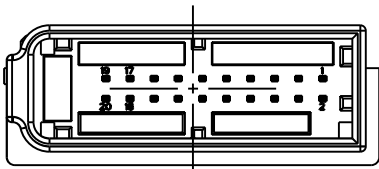
Pin	Signal Name
1	CAN1H
2	BUB SUPPLIER CODING_R
3	NC
4	CAN1L
5	M2M_MIC_0_M
6	BUB THERMAL SENSOR_R
7	M2M_MIC_0_M
8	M2M_MIC_0_P
9	WAKE_UP
10	M2M_MIC_0_P
11	GND_PUSH
12	WIRE_AIRBAG
13	SPK_OUT-
14	SPK_OUT+
15	VCC_5V_RED LED
16	VBAT_IN_CN
17	GND_POWER
18	ACALL_BUTTON
19	ECALL_BUTTON
20	VCC_5V_GREEN LED

6. Mounting and Assembly

6.1 Installation

RTBM is designed to be installed under the dashboard, behind the glove compartment, connecting to the vehicle's wiring harness. The antennas are external, and thus the installation require external connectors and cables to connect the antennas. **Remember to turn off the vehicle and disconnect related parts if necessary.**

Establishing connections:

Inside the RTBM is a PCB circuit board with connectors for communications with the vehicle, RF signals, and automotive networking. Refer to the following order to establish connectors:

- **Step 1:** connect the FAKRA connector for LTE / GNSS / radio antennas
- **Step 2:** connect the HMTD connector to establish Ethernet connection
- **Step 3:** connect the 2-pin BuB connector to the backup battery
- **Step 4:** connect the 20-pin Main Connector to the CAN electrical harnesses.

Under the dashboard, behind the glove compartment
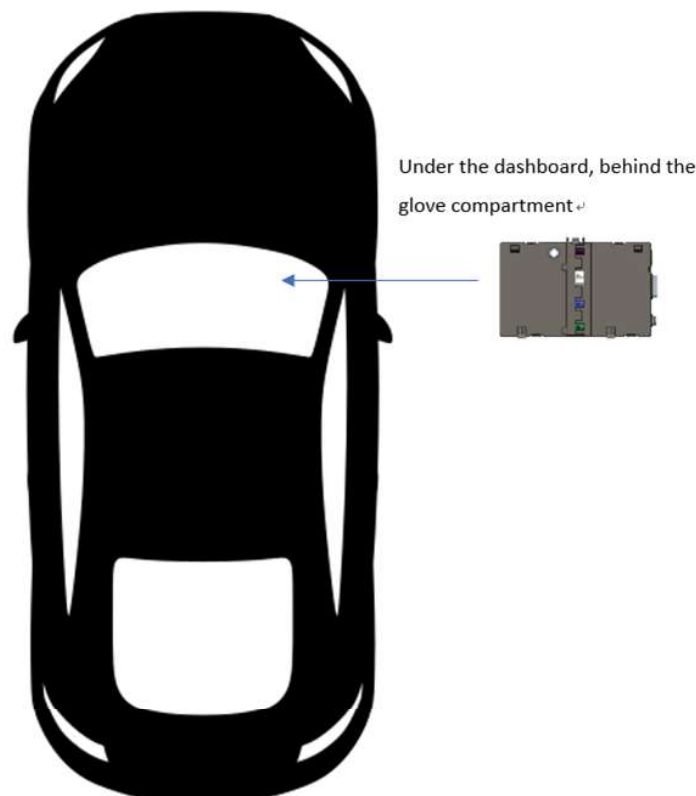
6.2 Mounting Concept

The following illustration presents a mounting concept, and may vary depending on the specific wiring harness of the vehicle models to be installed with RTBM. For instance, additional bracket(s) or module(s) are required.

Connecting with the vehicle's wiring harness behind the glove compartment (model dependent)

Installers must maintain at least 20cm separation distance between RTBM and the passenger.
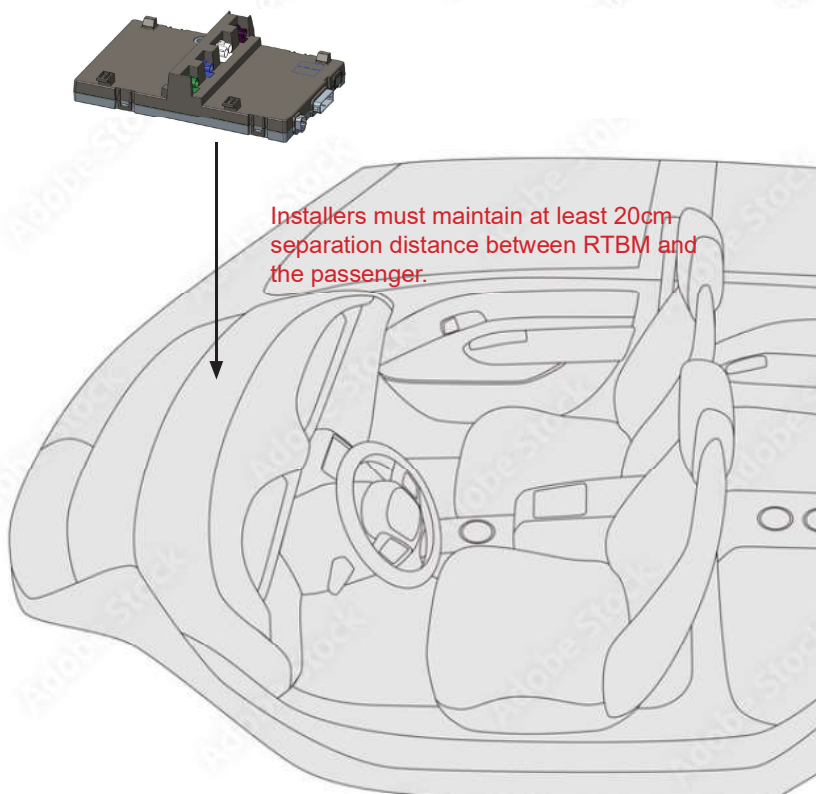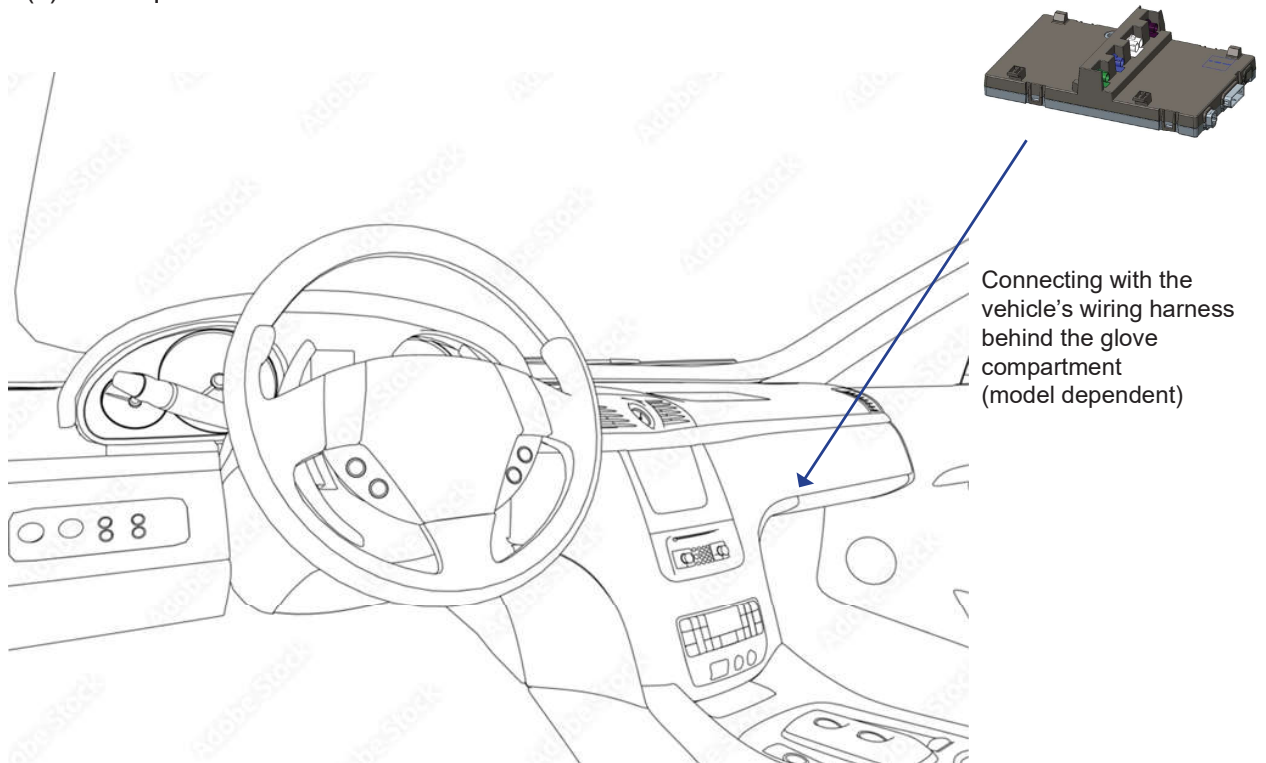
Handling Precautions and Warnings for ESD:
- When installing RTBM and connecting it to the vehicle, wear ESD gloves or straps and conduct grounding methods to avoid ESD risks.
- Do not get in contact with any connectors while handling to avoid any damage like pin bending, pollution that may affect the connection to harness or ESD potential damages. Gloves aren't mandatory but recommended.
- Do not get in contact with premaintain clip.
- Do not drop. A drop product shall not be mounted in vehicle.
- Prevent any water ingress in product. Product is IP42 and can not withstand any liquid ingress.   - During the handling of the RTBM EA, product shall be installed in an environment without openings or other means for water to drop on the product.

6.3 Mounting Steps

1. Before performing the assembly, it shall be ensured that the support (holder), the RTBM EA itself and the BuB are "clean", meaning without presence of any liquid (e.g oil) or solid (unwanted parts or particles) that may disturb the mounting (assembly), generate some unwanted rattle noise or disturb the product to perform as expected.

Mounting on a damaged support holder, such as interface fixture for fixation, or loose nut, shall be avoided.

When connected to harness, RTBM EA is handled "upside-down" with an angle between 10 to 30°.

2. Hooks (x2) are engaged in their respective slot on counter part and into contact.

3. While in this position, RTBM EA is rotated in "floor" direction to reach its correct location.

4. Pre-maintain clip is engaged in front of its slot on counterpart. Note that this premaintain clip shall only be active until the RTBM EA is screwed on counterpart. A sound of "clipping" should be heard by operator but a visual check by operator of active clipping shall be made anyway. A gap with counterpart slot is a "normal" situation.

A broken pre-maintain clip should not lead to a replacement of RTBM EA as it is:

- only there to ease RTBM EA assembly on vehicle,

- non-functional when RTBM EA is screwed to vehicle. In fact, pre-maintain clip is NOT active after screwing.

However, the loose clip shall not be left in vehicle, as it may cause potential rattle noise!

5. A M6 screw with "large head" shall be used to screw the RTBM EA and ensure its assembly.

Note about assembly tools:

- Torque : 8Nm +/-15%.

- Speed of screw driver device is reduced to < 200 rpm after reaching 1Nm to avoid any damages.

Cautions:

- Higher torque may lead to breakage.

- Lower torque may lead to RTBM EAassembly looseness and potential rattle noise.

Notes about parts replacement

RTBM EA with damages listed hereafter shall be replaced:

- Hooks by 2 damaged or broken ,

- Plastic with visible cracks or loose parts,

- Connectors broken or with cracks.

The following images provide references for assembly steps in a lab environment, and vary slightly in real world vehicle settings.
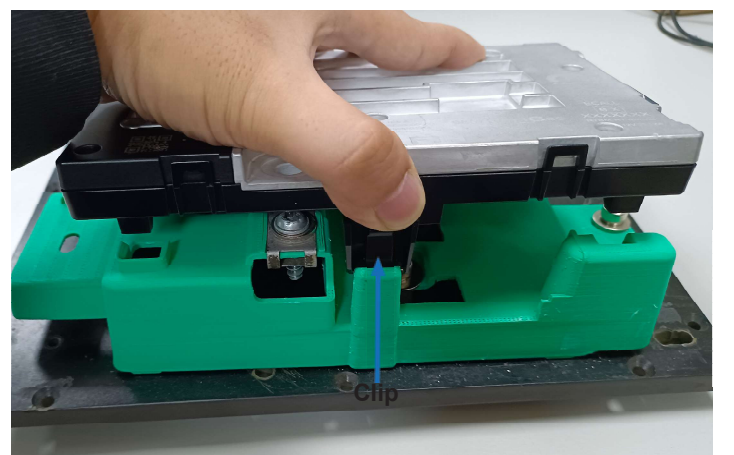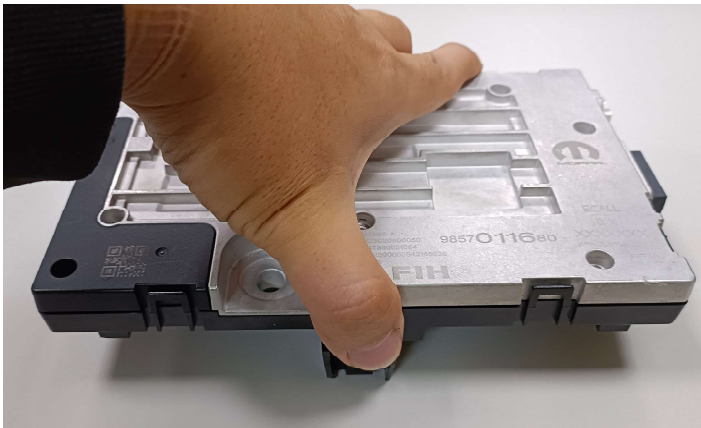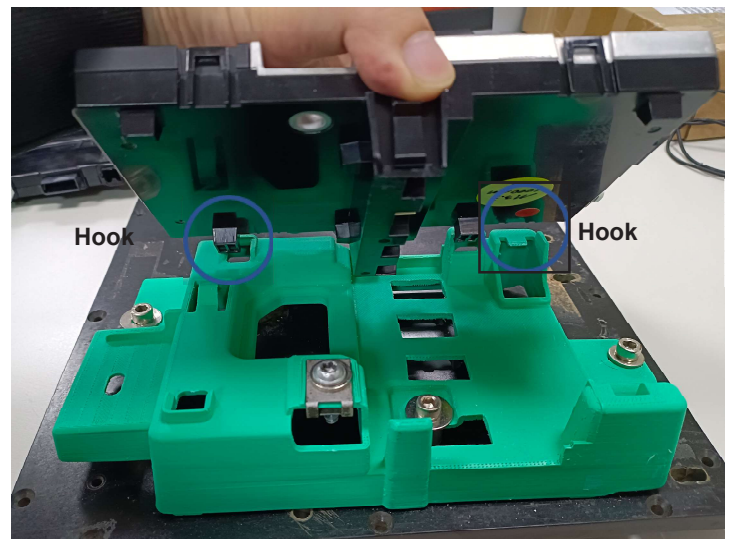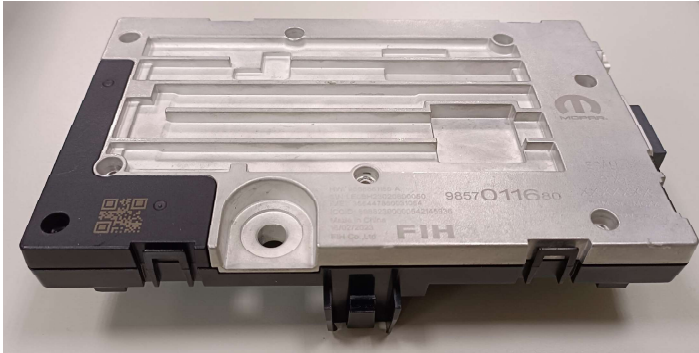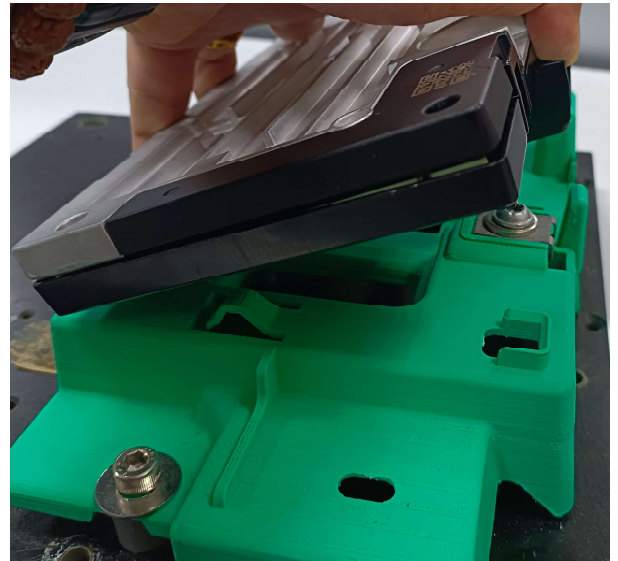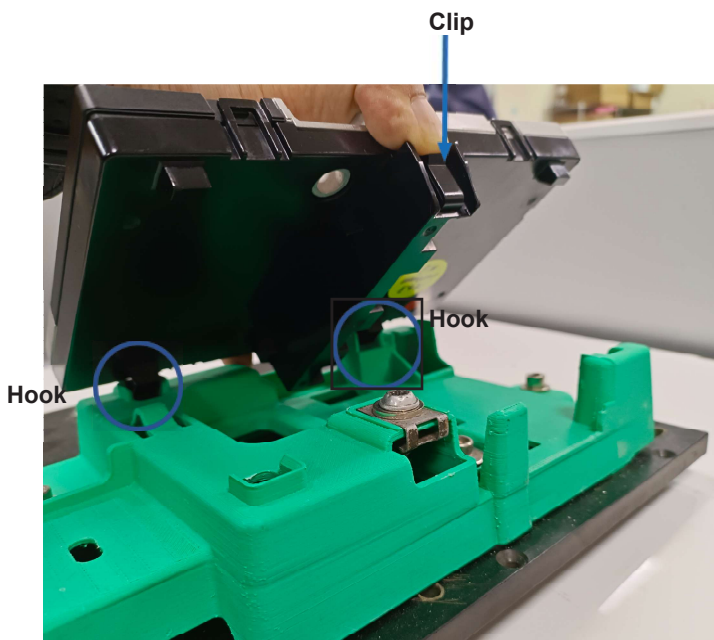
6.4 Dismounting Steps

1. Unscrew the M6 screw from the RTBM EA. Store this screw in a safe place if it is not damaged.

2. Pre-maintain clip need to be deactivated from its slot in counterpart. For this, a "flat head" screwdriver could be used to release the clip. While "pushing" on the clip with screwdriver, RTBM EA should be pulled on upper side direction.

3. While in this position, RTBM EA is rotated in "roof" direction to reach its correct location. Hooks (x2) are dis-engaged in their respective slot on counter part and into contact. RTBM EA can be then disengaged from counterpart (hooks out of their slot) by a small rotation.

4. Product disconnection from harness is conducted after its disassembly from vehicle due to limited access to the 4 FAKRA connections when product is installed in vehicle.

Order for dis-connection is:
- First, disconnect the main connector (Main)
- Then disconnect the Ethernet and BuB connectors (no specific order between these connectors)
- Lastly, disconnect the Fakra connectors (there is no specific order between these Fakra connectors).

7. Replacement of RTBM

7.1 Calibration

A spare RTBM (without downloading calibration and variant coding) is required to download a calibration and followed by a variant coding for the first time.
It can be executed by a wired Diagnostic Tool like the one in the plant.

7.1.1 Diagnostic Tool

Refer to the instructions below to update the calibration and DOTE in the plant:

- In the plant, the update of the DOTE and the calibration can be performed with a wired solution through diagnosis tool like the one usually seen in the plant (Full UDS solution).
- When the RTBM EA is delivered for the first time to the plant, the SW is pre-downloaded but there is no calibration and no variant coding in the memory of the RTBM EA.
- The DTC B1003-00 and B1000-51 and B15B4-00 will be stored in the memory of the RTBM EA once these calibration and variant coding operations are executed correctly.
- In this case, it is mandatory to run a calibration followed by a variant coding.
- During a variant coding update, the data are saved on the fly. Duing a calibration update, a restart of the RTBM EA is necessary.
- At the end of this process (calibration and variant coding), the RTBM EA goes into sleep state and will reboot at the end of the variant coding step. The shutdown and the restart of the RTBM EA will take around 50 seconds.
- If the variant coding and the calibration are already done, and if the RTBM EA is installed with SW version 12 or equivalent, a new variant coding does not require an update of the calibration.

7.2 Variant Coding

There is an electronic integration mode for STLA OD2 process.

Please follow the frame condition below to enter/exit electronic integration mode.

1. NEA2020

ENTER	receive 3 0x92 (DIAG_INTEGRA_ELEC=1, MODE_DIAG= 1) within 1s
EXIT	receive 3 0x92 (DIAG_INTEGRA_ELEC=0, MODE_DIAG= 0) within 1s 0x92 EFFAC_DEFAUT_DIAG (Clear fault)

2. AEE2010

ENTER	receive 3 0x36 (INTERD_MEMO_DEF=1) AND PHASE_VIE = COM_OFF within 1s
EXIT	receive 3 0x36 (INTERD_MEMO_DEF=0) AND PHASE_VIE != COM_ OFF within 1s 0x36 DEM_EFFAC_DEF (Clear fault)

Some of the functions need to apply safety conditions for access to be granted.

Please refer services below and their relative safety condition setups.

Steps	Condition
Open programming session (DSC 10 02)	Ignition ON (ETAT_PRINCIP_SEV= CONTACT) and Vehicle speed < 5kmh (VITV<500 or VITV=0xFFFF)
Calibration downloading process: erase calibration (RC 31 FF00)	Ignition ON (ETAT_PRINCIP_SEV= CONTACT) and Vehicle speed < 5kmh (VITV<500 or VITV=0xFFFF)
Calibration downloading process: check memory (RC 31 FF04)	Ignition ON (ETAT_PRINCIP_SEV= CONTACT) and Vehicle speed < 5kmh (VITV<500 or VITV=0xFFFF)
Variant coding: session send key (SA 27 03)	Engine not running (ETAT_GMP=0x00) and Vehicle speed < 0.5kmh (VITV<50)
Variant coding: release key sent (SA 27 04)	Engine not running (ETAT_GMP=0x00) and Vehicle speed < 0.5kmh (VITV<50)
Write VIN code (WDBI 2E F190 …)	Engine not running (ETAT_GMP=0x00) and Vehicle speed < 0.5kmh (VITV<50)
Write Variant Coding (WDBI 2E 2100 …)	Engine not running (ETAT_GMP=0x00) and Vehicle speed < 0.5kmh (VITV<50)
Write DID Body Secured Coding (WDBI 2E 2901 …)	Engine not running (ETAT_GMP=0x00) and Vehicle speed < 0.5kmh (VITV<50)
ER 11 SoftReset	Engine not running (ETAT_GMP=0x00) and Vehicle speed < 0.5kmh (VITV<50)

7.3 Rewriting BuB Parameters

Replacement of RTBM is according to documentation, "D405 and D407 of ODXExport_ RTBM_0000004388_03_4_0.pdx3", 6.2 and 6.3 of 01840_23_00161_Plant_and_After_Sales_ Guide_RTBM_EA_v1.1.

6.2BUB TEST(DD03)
6.3BUB SOH TEST RESET(DD02)

Refer to the steps below:
- Step1. Execute D405 to read BUB parameters.
- Step2. Execute D407 to read the SOH inspection results
- Step3. Execute BUB test preplaced, and the part of battery value will be set to 0.
- Step4. Execute BUB TEST RESET, and the data will be reset to its default value.

7.4 Learning of Secure Time

1. MASCOM Secure Time to RTBM:

After replacing the new RTBM, and if there is no GSM or GNSS signal in the current environment, Secure Time will be automatically sent to RTBM. Nominal will use Secure Time to update the system time once and wait two minutes.

N°Requirement	Content of the Requirement
REQ-0738751 A GEN-TCU-ST-TIME_Management-0006(0) Owner: sc62740 Grade: Flexibility	At startup of the TCU, the system shall wait 2 minutes before comparing the Secure Clock coming from Body Controller to the External Clock.
REQ-0738747 A GEN-TCU-ST-Time_Management-0003(0) Owner: sc84086 Grade: Flexibility:	The TCU shall updateits system time with the Secure Time from the CAN network under the following conditions: • Every startup of the TCU • Every hour it will check if the difference between System Time and Secure Time have a drift of 1 minute. • The TCU does not get GNSS signal and GSM signal

2. RTBM update Time to MASCOM Secure Time:

Note: NEA 2020 must be MASCOM PSK Provision first. Without certification, you will not be able to update.

When external time send to RTBM, Secure Time will be updated at the same time. If NEA 2020 cannot be updated without certification, the Secure Time time written back by MASCOM will be inaccurate when a new RTBM is replaced.

N°Requirement	Content of the Requirement

REQ-0369833 D
GEN-TCU-ST-TIME_Management-0025(3)
Owner: sc62740
Grade:
Flexibility
	The TCU shall use the REQUEST_UPDATE_SECURE_TIME function by updating UpdSecureClkReq with the secure time GNSS ExtGPSClk
	    UpdSecureClkYrReq = ExtGPSClkYr
	    UpdSecureClkMthReq = ExtGPSClkMth
	    UpdSecureClkDayReq = ExtGPSClkDay
	    UpdSecureClkHrReq = ExtGPSClkHr
	    UpdSecureClkMinsReq = ExtGPSClkMins

7.5 Installing Third-Party App

The regular shipment will only include IDS log APK.

7.6 Read DTC

Pre-condition:

1. Active session is under DS, EXTDS and DVAS.

2. LCM power state under Nominal mode.

Refer to the steps below:

1.Using can tool and send following can frame/signal to RTBM

   1.1: Send CanID 0x36 with CAN signal(PHASE_VIE) value as "0b011 =Reveil II Wake"

   1.2: Send CanID 0x36 with CAN signal(PHASE_VIE) value as "0b001 =Mode normal"

   1.3: Stop send CanID 0x36 with CAN signal(PHASE_VIE) value as "0b011 =Reveil II Wake"

   1.4: Send CanID 0xF6 with CAN signal(ETAT_PRINCIP_SEV) value as "0b01 =Contact II "

2. Using can tool and send following UDS command to RTBM

   2.1: Execute UDS#14 Clear DTC service, send CanID 0x77C/77F with CAN signal 04 14 FF FF FF 00 00 00

   2.2: Execute UDS#19 Read DTC service, send CanID 0x77C/77F with CAN signal 03 19 02 FF 00 00 00 00

8. Wireless Connectivity

RTBM realizes 3G/4G, WiFi and GNSS wireless connectivity by adopting the NAD module. The NAD module contains a single processor, memory and related power management IC. To optimize wireless connectivity, the module also integrates the RF circuit of 3G/4G, WiFi and GNSS, compliant with the international standards such as 3GPP and IEEE 802.11x.

AM/FM/DAB features are realized by tuner ICs, with the I2S signal output from Tuner IC to the NAD. The signal is transformed to RGMII by the NAD, and then eventually transformed into 100Base-T1 format to be sent to the head machine via Ethernet.

8.1 Embedded NAD Module

The NAD (Network Access Device) module of the RTBM provides multiple wireless connectivity. The NAD is powered by MTK 2731R, a high-performance, dual-core SoC featuring ARM Cortex-A53 CPU, operating up to 1.46GHz, and by MTK MT6177AW, a multi-mode multi-band highly integrated transceiver offering LTE/WCDMA/GSM communications, and by MTK MT6630N, a value combo wireless connectivity SoC offering 802.11 a/b/g/n/ac dual-band WLAN, and multi-GNSS protocols (GPS, GLONASS, Beidou, Galileo, and QZSS). The NAD module is designed in LGA package for automotive applications such as eCall, telematics control, and vehicle communications.

The NAD is RoHS compliant to meet the environmental regulations. Regarding cybersecurity, it meets the compliance requirements by UNECE WP29 and SAE/ISO21434.

Key features of the NAD module
- Dual-core ARM Cortex-A53 SoC operating up to 1.46GHz
- Carrier connectivity: LTE/WCDMA/GSM, LTE maximum data rate: Cat 4
- WLAN connectivity: 2.4/5.0GHz Wi-Fi
- Multi-GNSS; GPS, GLONASS, Beidou, Galileo, and QZSS
- RoHS compliant
- Cybersecurity: UNECE WP29 and SAE/ISO21434 compliance

8.2 Operating Conditions of the NAD

The operating conditions of the NAD is listed in the table below:

Parameter		Min.	Typ.	Max.	Unit
Operating temperature		-40		85	°C
3GPP RF performance temperature range		-30		70	°C
Power supply voltage		3.6	4.0	4.2	V
ESD voltage	Human body model			2000	
	Charge device model			500	
Operating humidity		0		95	%RH

8.3 Power Consumption of the NAD

The power consumptions of the NAD listed in the table below are measured in typical conditions and may vary in real-world applications.

Mode	Min.	Typ.	Max.	Unit
Deactivated (Airplane/Flight/Suspended mode)		2.0		mA
WCDMA standby 2.56 sec (WiFi/GPS off)		2.8		mA
LTE standby 2.56 sec (WiFi/GPS off)		3.0		mA
WCDMA talk 5-dBm; IMT		222		mA
LTE Cat 4 (150/50-Mbps,5-dBm)		270		mA

8.4 Cellular Services

8.4.1 Tune up procedures

During manufacturing each device is individually calibrated. Measurement is performed in a fully calibrated setup using a standard base station simulator.

1. Set the device to operational voltage and on a predefined channel in a special test mode.

2. The actual output power is measured at several power levels.

3. The gain factors of each individual device are adjusted until the target value is met. The appropriate gain control settings for each output power level are stored in each device individually (for each power level).

4. The maximum gains of each individual device are adjusted and measured until the target value is met. The production target power with tolerance compiles with the maximum power in test report.

8.4.2 WCDMA

Frequency Bands		Band 2 (1850 – 1910 MHz) Band 4 (1710 – 1755 MHz) Band 5 (824 – 849 MHz)			
Maximum Output Power (tune-up) Unit: dBm		AMR 12.2Kbps	RMC 12.2Kbps	HSDPA	HSUPA
	WCDMA B2	24 ± 2	24 ± 2	24 ± 2	24 ± 2
	WCDMA B4	24 ± 2	24 ± 2	24 ± 2	24 ± 2
	WCDMA B5	23 ± 2	23 ± 2	23 ± 2	23 ± 2

8.4.3 4G/LTE

Frequency Bands		Band 2 (1850 - 1910 MHz) Band 4 (1710 - 1755 MHz) Band 5 (824 - 849 MHz) Band 7 (2500 - 2570 MHz) Band 12 (698 - 716 MHz) Band 13 (777 - 787 MHz) Band 17 (704 - 716 MHz) Band 25 (1850 - 1915 MHz) Band 26 (814 - 849 MHz) Band 66 (1710 - 1780 MHz) Band 71 (663 - 698 MHz)		
		QPSK	16QAM	64QAM
Maximum Output Power (tune-up) Unit: dBm	LTE Band 2	23 ± 2	23 ± 2	23 ± 2
	LTE Band 4	23 ± 2	23 ± 2	23 ± 2
	LTE Band 5	23 ± 2	23 ± 2	23 ± 2
	LTE Band 7	23 ± 2	23 ± 2	23 ± 2
	LTE Band 12	23 ± 2	23 ± 2	23 ± 2
	LTE Band 13	23 ± 2	23 ± 2	23 ± 2
	LTE Band 17	23 ± 2	23 ± 2	23 ± 2
	LTE Band 25	23 ± 2	23 ± 2	23 ± 2
	LTE Band 26	23 ± 2	23 ± 2	23 ± 2
	LTE Band 66	23 ± 2	23 ± 2	23 ± 2
	LTE Band 71	23 ± 2	23 ± 2	23 ± 2

8.5   GNSS Receiver Characteristic

GNSS receiver is included in the NAD. It is a multi-constellation compatible receiver implementing GPS, GLONASS, Galileo and Beidou positioning systems.

Positioning data is used for telematics services (eCall and Assistance Call).

Positioning data is also provided to other control units and applications in the vehicle.

Parameter	Condition	Min.	Typ.	Max.	Unit
Sensitivity	Cold start		-148		dBm
	Tracking		-164		dBm
C/N	@-130dBm		38		dB
Time To First Fix	Cold start@-130dBm		35		Sec
	Warm start@- 130dBm		34		Sec
	Hot start@-130dBm		1		Sec

8.5.1 GPS, Galileo, and GLONASS Frequencies (for ROW SKU)

GPS	1575.42 MHz
GLONASS	1602 MHz + n x 0.5625 MHz, where "n" is a satellite frequency channel number from -7 to 6.
Galileo	1575.42 MHz

8.6   WLAN Characteristics

8.6.1 WLAN RF Parameters (2.4 GHz)

Mode	Channel	Frequency	Max tune-up output power (in dBm)
802.11b	1	2412	15 ± 2
	6	2437	15 ± 2
	11	2462	15 ± 2
802.11g	1	2412	12 ± 2
	6	2437	12 ± 2
	11	2462	12 ± 2
802.11n20	1	2412	12 ± 2
	6	2437	12 ± 2
	11	2462	12 ± 2
802.11n40	1	2412	11 ± 2
	6	2437	11 ± 2
	11	2462	11 ± 2

8.6.2 WLAN RF Parameters (5.0 GHz)

Mode (in 5.2 GHz)	Channel	Frequency	Max tune-up output power (in dBm)
802.11a	36	5180	15 ± 2
	40	5200	15 ± 2
	44	5220	15 ± 2
	48	5240	15 ± 2
802.11n20	36	5180	15 ± 2
	40	5200	15 ± 2
	44	5220	15 ± 2
	48	5240	15 ± 2
802.11n40	38	5190	15 ± 2
	46	5230	15 ± 2
802.11ac20	36	5180	14 ± 2
	40	5200	14 ± 2
	44	5220	14 ± 2
	48	5240	14 ± 2
802.11ac40	38	5190	13 ± 2
	46	5230	13 ± 2
802.11ac80	42	5210	13 ± 2

Mode (in 5.8 GHz)	Channel	Frequency	Max tune-up output power (in dBm)
802.11a	149	5745	15 ± 2
	157	5785	15 ± 2
	165	5825	15 ± 2
802.11n20	149	5745	15 ± 2
	157	5785	15 ± 2
	165	5825	15 ± 2
802.11n40	151	5755	15 ± 2
	159	5795	15 ± 2
802.11ac20	149	5745	14 ± 2
	157	5785	14 ± 2
	165	5825	14 ± 2
802.11ac40	151	5755	13 ± 2
	159	5795	13 ± 2
802.11ac80	155	5775	13 ± 2

8.7   Radio Broadcast Receiver

Radio reception are used by control units in the vehicle, for instance, the Head Unit. The Broadcast RF signals are demodulated inside the RTBM and the content (audio/data) is provided in digital format to the vehicle gateway.

8.7.1 Key Features

The highly integrated, multi-standard automotive radio tuner ICs in the receiver offer software defined radio capabilities through monolithic integration of up to four tuners including the analog and digital radio processing and a multi-channel audio processing. The innovative wideband tuner concept allows for exceptional performance compared to conventional tuners. Seamless and flexible turbo tuners operating in the digital domain ensure high-speed band scans for analog and digital radio in AM/FM and DAB III bands.

Key features of the Tuner ICs:
* AM Low-Noise Amplifier with AGC, matching active and passive antenna applications
* AM Wideband Noise Cancellation (EVAM)
* AM and FM noise blanking
* FM receiver with a tuning range from 64 MHz to 108 MHz covering Eastern European (OIRT), Japan, Europe and US bands.
* FM improved multipath suppression
* Hybrid DAB / FM Low-Noise Amplifier (LNA) with Automatic Gain Control (AGC)
* Signal quality detection and weak signal processing
* Advanced RDS and RBDS demodulation and decoding

8.7.2 AM Characteristics

Band	Frequency range	Unit
MF	526.5 - 1606.5	kHz
LF	148.5 - 283.5	kHz

8.7.3 FM Characteristics

Band	Frequency range	Unit
VHF Band II	87.5 - 108	MHz

8.7.4 DAB Characteristics

Band	Frequency range	Unit
Band III	174 - 240	MHz

9. Physical and Electrical Characteristics

9.1 SIM Card

The RTBM uses an embedded SIM Card (MFF2 with a carrier specific profile).

9.2 Operating Temperature Range

Operating temperature range: -40°C to +75°C.
NAD operating temperature range which complies with 3GPP specification: -10°C to +55°C.

9.3 Supply Voltage

Nominal Supply Voltage: 12V DC.
Supply Voltage Range: 8V – 16V DC.

9.4 Power Consumption

Typical current consumption is around 850mA (Tuner, NAD, Wi-Fi, GNSS on).
Max continuous current estimated: 2A at 13V.

9.5 Maximum Humidity

40°C, 93 % to be tested for 504 hours.

9.6 IP Rating

This product complies with IP42 protection.

1st Digit	Intrusion	2nd Digit	Moisture Protection
4	Protected against solid objects over 1mm, e.g. wires & nails.	2	Protected against water splashed from all directions, limited ingress permitted.

9.7 Frequency Range for Europe:

AM (LW/MW): 148.5 kHz – 283.5 kHz / 526.5 kHz – 1 606.5 kHz
FM: 87,5 MHz – 108 MHz
DAB Band-III: 174 MHz – 240 MHz

Via telecoding, the OEM will set the correct frequencies of operation in every other country.

9.8 Product Weights

Approx. 450 g

9.9 Warehousing Conditions

Storage temperature range: -40°C to +75°C.

- It is necessary to ensure that the RTBM EA shall be stored within this predefined temperature range to prevent thermal mitigations from happening, which might adversely impact functionalities of the products.
- It shall be ensured that the support (holder), the RTBM EA itself are stored in a "clean" room, meaning without presence of any liquid (e.g oil) or solid (non wanted parts or particles) that may disturb the mounting (assembly), generate some unwanted rattle noise or disturb or even avoid the product to perform as expected.

10. FCC and ISED Compliance 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.

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

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.

FCC Radiation Exposure statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

ISED compliance statement

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-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.

ISED Radiation Exposure statement

This equipment complies with IC RSS-102 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.

Cet équipement est conforme aux limites d'exposition aux radiations IC CNR-102 établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec une distance minimale de 20cm entre le radiateur et votre corps.

11. Product Label

Refer to the table below for key information printed on the product label on RTBM.
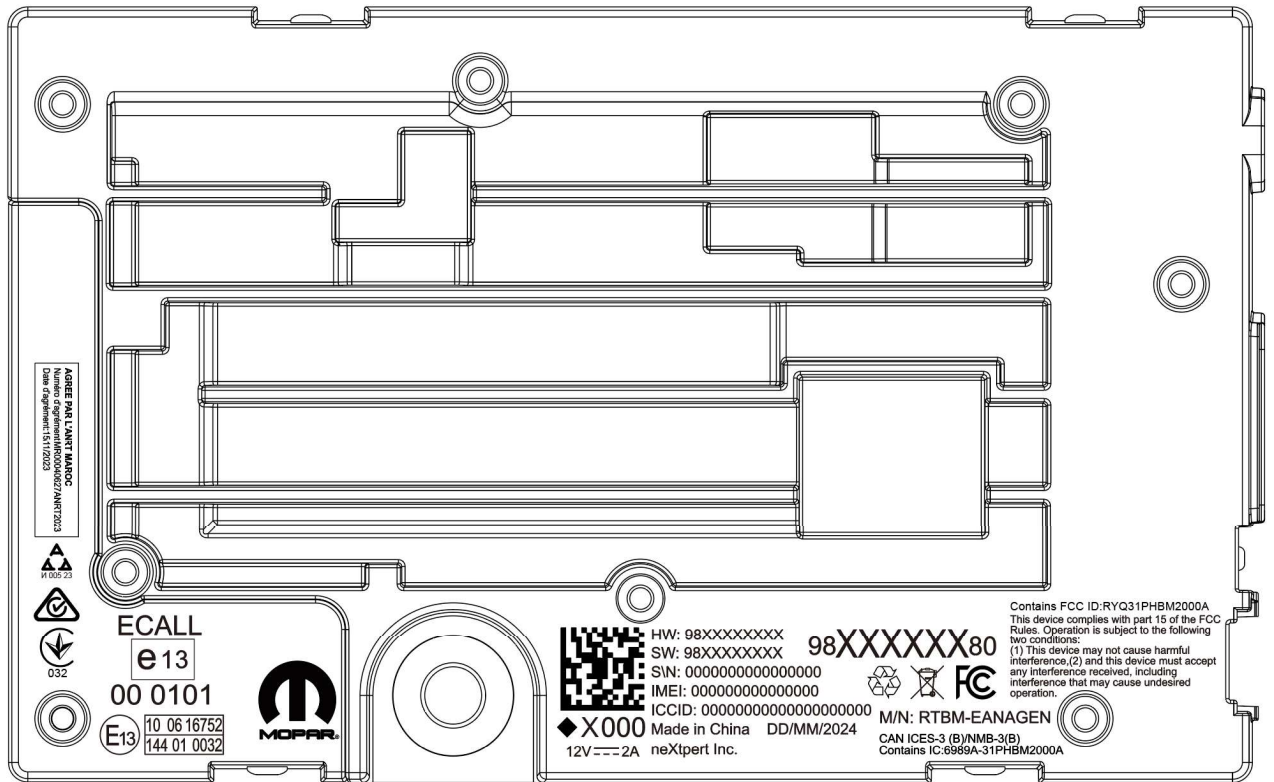
No.	Description	No.	Description
01	Stellantis HW supplier reference	02	SW reference
03	Device serial number	04	Device IMEI
05	ICCID of eSIM	06	Production date
07	Supplier name	08	Manufacturer date
09	Model/Variant name	10	Stellantis product assembly reference
11	MOPAR trademark	12	Certification marking
13	EMC regulation	14	DM code for Stellantis product assembly reference (DM code = Data Matrix code)
15	Version remark		