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Recipient

Cc

Topic **GM Next Gen: Product Technical Description**

GM Next Gen: Product Technical Description

Approval model name: NG 1.1 HMI

Revision History

Date	Name	Revision Number + Description
06.10.2011	Sven Nisse	Draft 00: internal submission
12.10.2011	Torsten Sahm	Draft 01: changes related for approval items
26.07.2012	Alexander Romanowski	v.1.1: Update for NGI 1.1 HMI
03.08.2012	Alexander Romanowski	v.1.2: Section Technical data added

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1 Introduction

GM will introduce a new architecture of infotainment for several car-lines for MY13 ff.:

- ➔ Chevrolet & GMC: FST, Full size trucks and SUVs (K2XX)
- ➔ Cadillac: XTS (P1LL)
- ➔ Cadillac: Alpha; ATS (A1SL)
- ➔ Chevrolet: Impala (GMX352)
- ➔ Chevrolet: Corvette (Y1XX)
- ➔ Cadillac: SRX (GMT166)
- ➔ Buick LaCrosse (GMX353)
- ➔ Buick LaCrosse (E16 / E15)
- ➔ Opel Insignia 3714
- ➔ Cadillac: Alpha, CTS (A1LL)
- ➔ Buick: Alpheon (VS390)



Target Markets:

- ➔ NAR, EU/Russia, China, Central-America, Middle East, Taiwan, Israel, S. Africa
- ➔ Only HMI module for Japan & S. Korea
- ➔ A detailed country list is available.

The new architecture foresees following Important System Elements:

- ➔ HMI-Module: HMI component with Nav, Speech recogn., BT-Phone BT 3.0+HS
- ➔ Silverbox: Radio and Amplifier unit, different tuner configurations
- ➔ CD: Remote CD player
- ➔ Display: 4.2" 480x272 non-touch for Color HMI
8" 800x480 (WVGA) touch for Color HMI and Premium Nav
- ➔ Faceplate: Including knobs, sliders, proximity sensors
- ➔ MFC/SWC: Multifunction-Controller, Steering Wheel Controller
- ➔ HVAC/ECC: Climate-Control
- ➔ IPC: Instrument Panel Cluster
- ➔ OnStar: Onstar Telematics Box (US)
- ➔ RSE: Rear Seat Entertainment Module
- ➔ RSC: Rear Seat Control
- ➔ Amplifier: optional sound amplifier (MOST controlled)
- ➔ LVM: Low Volume Module (Asian Market)
- ➔ Touchpad: Remote Display control & Handwrite Recognition (EU&CN)

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These components are connected via several bus-systems, as MOST 50 el., CAN, etc..
Bosch will provide only the HMI module, which will be described in more detail in following sections.

2 GM Next Gen: the HMI Module from Bosch

Next Generation project is the new platform following GM's Mid and Entry Level navigation systems of MY09 to MY12. Bosch part of this infotainment system is the HMI module, which serves as the central HMI interface in this system. There are two variants of the HMI module. Base variant is the so called Color HMI variant, which is a LINUX based system running on the Triton processor. The Premium Nav HMI variant is including additionally the navigation feature.

The purpose of the project is to establish a LINUX-based HMI- and connectivity module including Bluetooth-, GPS-, Speech Recognition- 3D Graphics-functionality.

Product Description:

- ➔ Second generation ADIT system-on-chip with integrated GPS, graphics, and video (TRITON)
- ➔ Dual architecture running both T-Engine and Linux operating systems
- ➔ One mechanical solution for all regions and variants
- ➔ Plastic housing for weight savings
- ➔ Support for HSCAN-, TLIN- and MOST-communication busses
- ➔ Single LVDS display driver supporting WVGA (up to 24 bit)
- ➔ Apple iPod support through USB (incl. 1A charging)
- ➔ Audio decoders for MP3, WMA, AAC, OGGVorbis, WAV, AI, 3GPP, AudioBooks
- ➔ Video decoders for WMV9, H.264, DivX, MPEG2, H.263, Flash Video
- ➔ Media Database with browsing
- ➔ Integrated Bluetooth 3.0+HS module and antenna
- ➔ Internet functionalities (e.g. Internet radio, external apps)
- ➔ Dual microphone inputs
- ➔ Voice recognition for all feature groups (radio, CD, media data base, phone, navigation)
- ➔ Dynamic guidance using XM or FM Traffic
- ➔ Text to Speech output
- ➔ Bosch navigation core with 3D navigation
- ➔ Wavemaker Echo Cancellation integrated
- ➔ Download for all MOST devices via USB
- ➔ Rear view camera

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2.1 **Overview DUT: GM NextGen Device**

The DUT is a stand alone module (HMI module) without faceplate or display. Following variants are available:

- GM NextGen Color HMI:

Triton main processor; LVDS Graphics output; 2 x Microphone inputs; Video input for Rear View Camera; MOST50 (electr.); HS-GMLAN; LIN for Touch screen control; 2 x USB2.0 Host Interface; iphone support; Bluetooth interface 3.0+HS; fan

- GM NextGen Premium Nav:

Equal to GM NextGen Color HMI plus

GPS module; Full-3D-Gyro; Navigation Software; Map data

The same housing, interfaces and PCB is used as in GM NextGen Color HMI. The difference is Software and mounting variants on PCB. This version is used for the approval.

- GM NextGen Premium Nav CHN:

This variant exists in two HW variants: one with acceleration sensor (China variant) and one without acceleration sensor (Navi variant for rest of the world). Purpose of the acceleration sensor is to distinguish between elevated- and normal roads. For EMC tests, the China variant including the acceleration sensor shall be taken.

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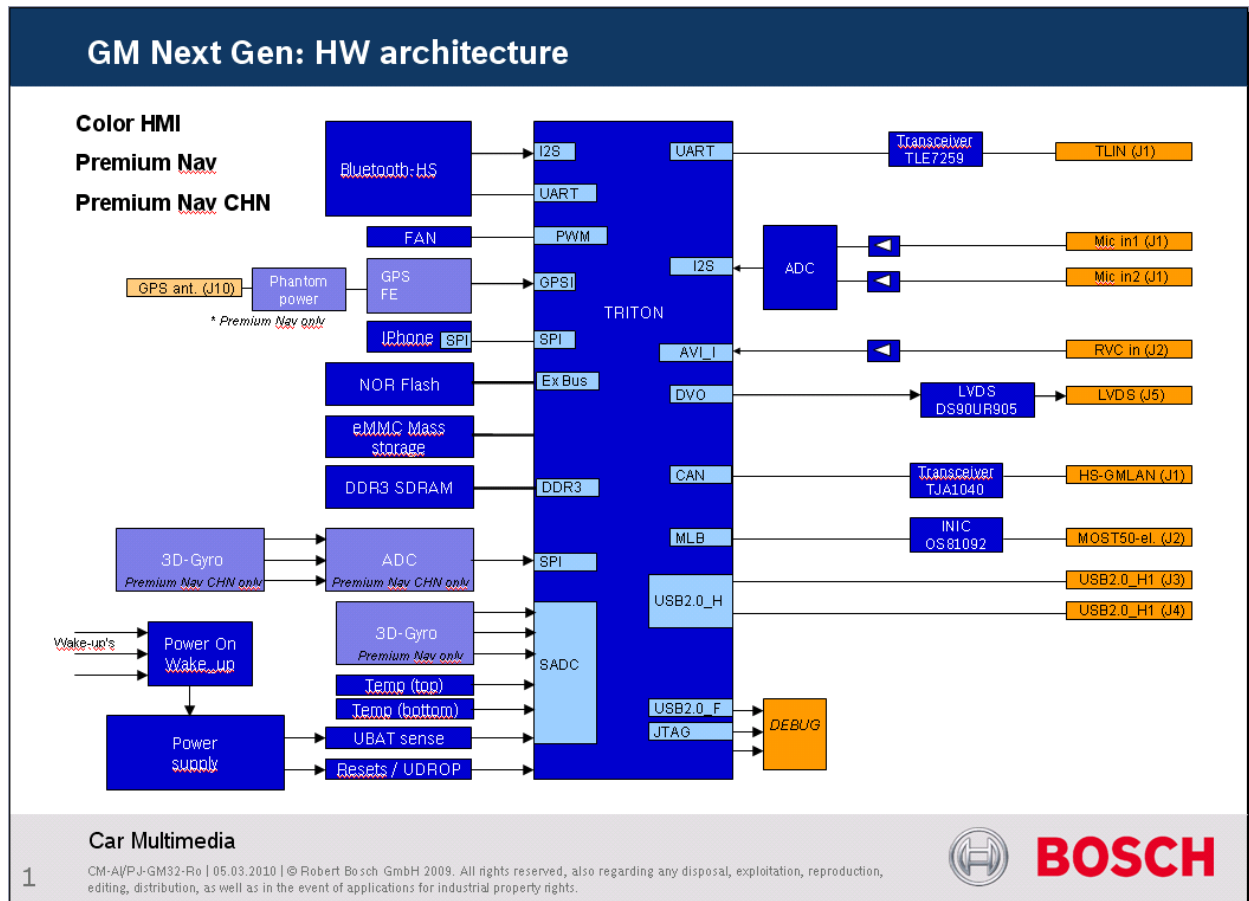
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2.2 Hardware architecture Block schematic



GM LAN is electrical similar to CAN.

The Debug interface is only used in the factory and for service items.

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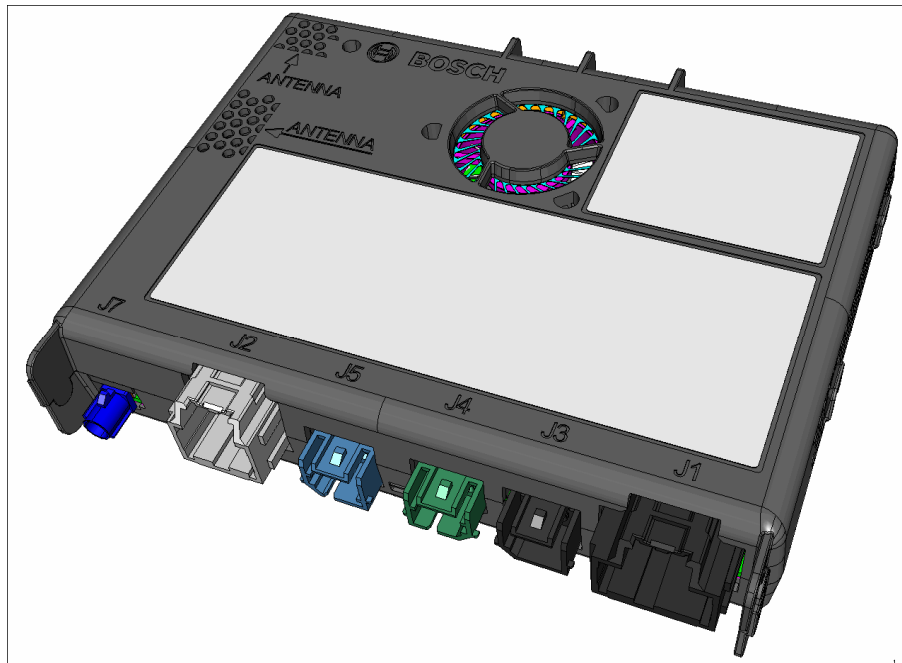
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2.2.1 Housing DUT



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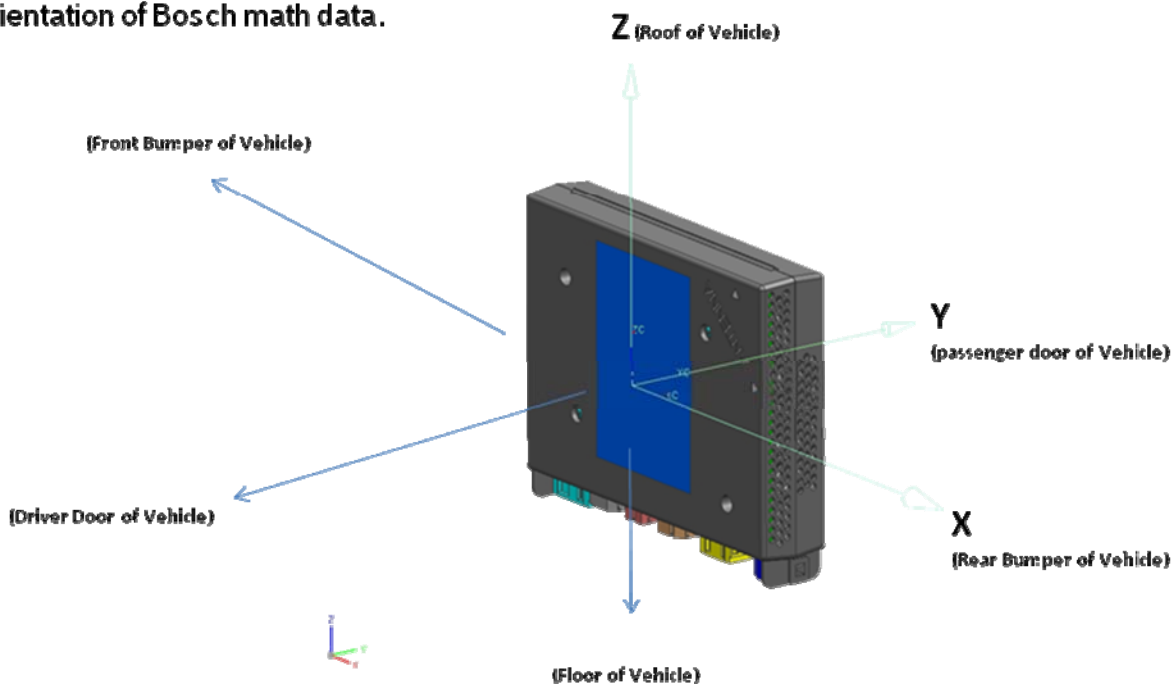
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2.2.2 Position and orientation of DUT inside the car

Orientation of Bosch math data.



The module is located normally behind glove compartment. In some cases the location is somewhere behind the dash board. The passengers or driver have no access to this device. No serviceable parts inside. No fuse inside.

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2.3 *Product Functional Description*

The HMI module serves as the central HMI interface in the Next Generation infotainment system. There are two variants of the HMI module, the so called Color HMI variant and the Premium Nav HMI variant which additionally includes the navigation feature using GPS and Full 3D gyro and supporting dynamic guidance using XM Traffic (for US).

Both modules are based on second generation ADIT system-on-chip (TRITON-processor) with integrated GPS, graphics, and video, which provides a dual architecture running both T-Engine and Linux operating systems.

The modules provide support for HS-GMLAN (CAN) and MOST 50 communication busses. Using these busses, command and control for all feature groups (radio, CD, phone, navigation) are processed. A Communication-Enable-Interface (COMM Enable) is used for device-wake up functionality. Similarly for MOST 50 el. There exists a MOST ECL line for wakeup of the device.

An external touch display is connected via single LVDS (**Low Voltage Differential Signaling**) **for video** signal output and LIN (Local Interconnect Network) for Touch-screen display inputs, a display driver for WVGA is included,

The Unit provides an analogue video input for Rear view camera signals.

An integrated Bluetooth module and antenna provide connectivity to e.g. mobile phones.

Apple iPhone is supported through USB2.0 Host interface 1, in total there are two USB interfaces, codecs for MP3, WMA, AAC, WAV are supported.

Two microphone inputs are provided, microphone 1 is used for speech recognition, microphone 2 is used for noise suppression. In addition 2 MOST (or one MOST plus one analogue) microphones can be connected via MOST.

2.4 *Product pin description*

Please refer to following document:



Connector_pinning_8
.pdf

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3 Sketch on how to test Features/Interfaces

The DUT can not be tested stand alone – GMLAN network, MOST network to stimulate the DUT as well as input/output media (display, amplifier, loudspeaker, ...) have to be “simulated”.

3.1.1 Startup/Shutdown DUT

The DUT doesn't have keys or built-in touch display. Therefore the device has to be operated (e.g. switched on/off) via the communication interfaces:

- CAN/HS-GMLAN: wakeup reason for DUT is switching the Comm Enable line to 12 V. This is interpreted as weak up reason and just partly awakes the DUT (i.e. all applications in DUT will be started, but display remains dark and audio is not switched on). CAN communication can be performed with DUT, as long as Comm Enable line is on 12 V. As long as Comm Enable line is set to 12 V, the DUT should not switch off.

To get into full operational state, the MOST protocol sequence (start up sequence) has to be performed with DUT.

In case Comm Enable line will be switched to 0 V, the device might be switched off (... if no further weak up reason is active for DUT, e.g. MOST still active). Please consider, that there is some Turn Off Timer, switching off the DUT after 3 Min (changed, see above).

- MOST: wake up reason for DUT is a pulse of 100 ms on MOST ECL line. This is interpreted as wake up reason and just partly awakes the DUT (i.e. all applications in DUT will be started, but display remains dark and audio is not switched on). MOST communication (MOST scanning) can be performed

To get into full operational state, the MOST protocol sequence, has to be performed with DUT.

The DUT might be switched off via MOST (... if no further weak up reason is active for DUT, e.g. Comm Enable line set to 12 V). Please consider, that there is some Turn Off Timer, switching off the DUT after 3 Min. This timer needs to disabled for approval measurements.

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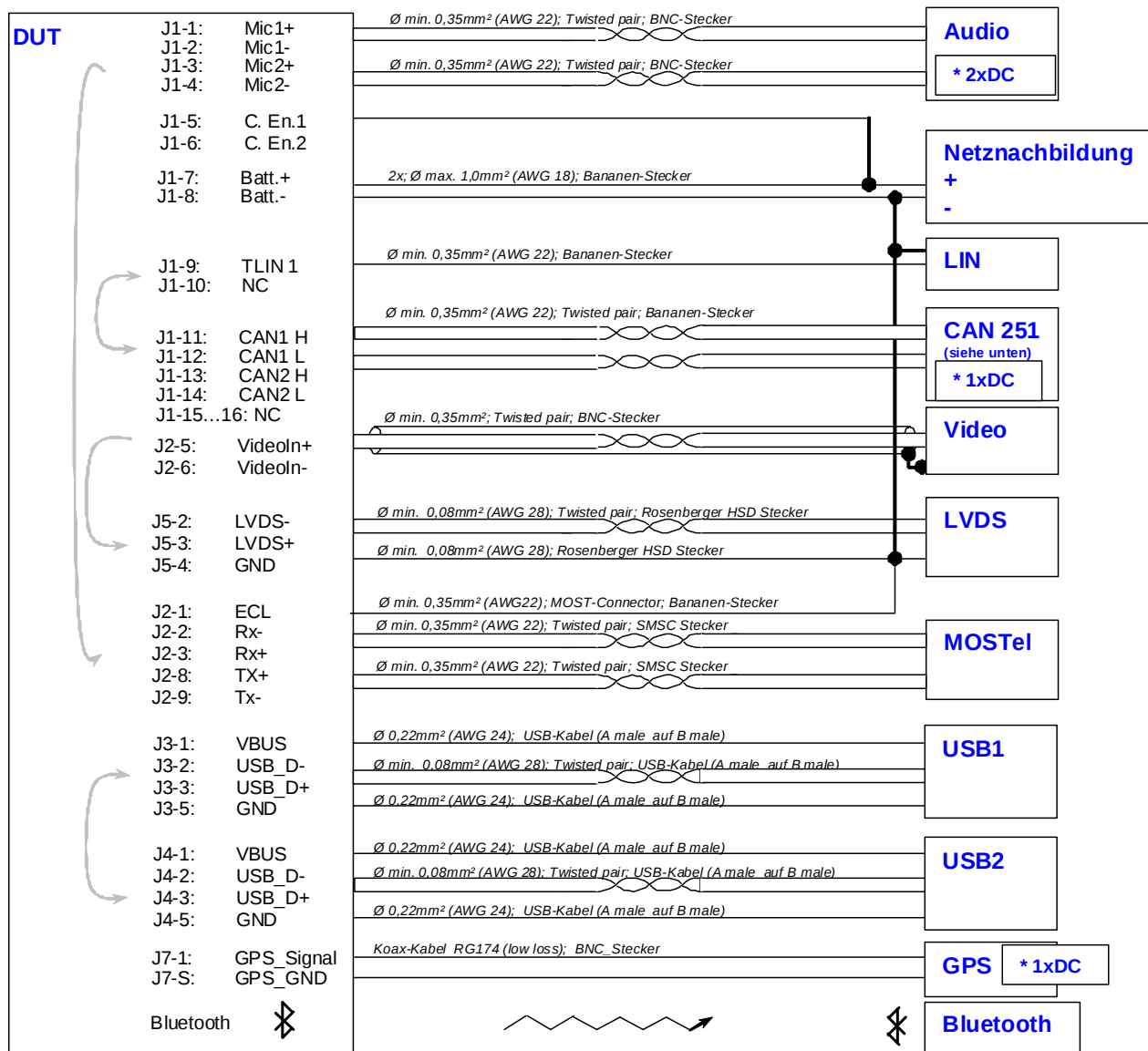
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3.1.2 Wiring Overview



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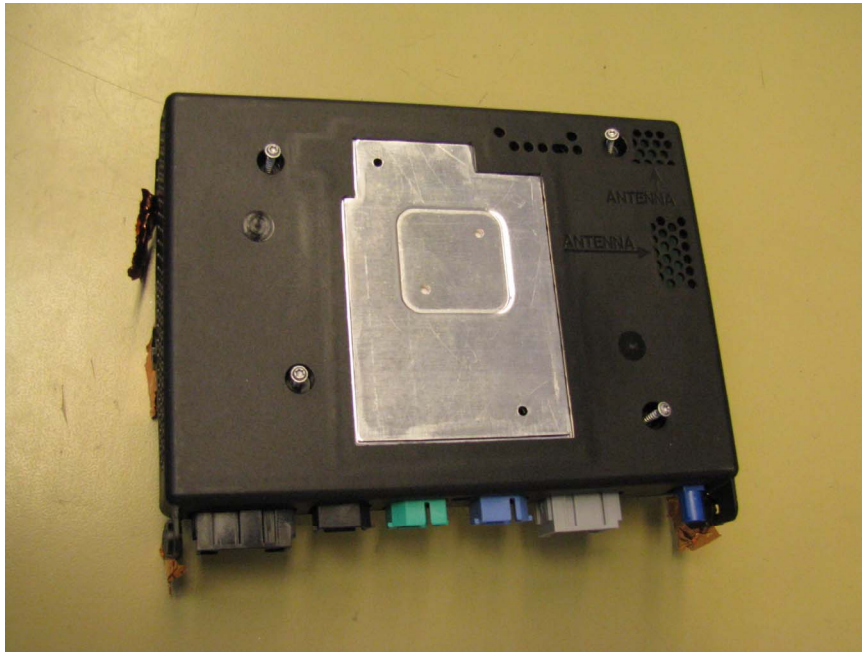
Ethernet Connection to DUT

Normally it is technically impossible to connect to the GM NextGen HMI 1.1 via USB / Ethernet.

There is a separate development package that enables the USB connection (it installs the ssh server on the target), which is intended for internal purposes only. Having these tools installed and configured in DUT, connection via Ethernet/USB can be established.

3.1.3 Opening of housing

Release 4 screws:





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Six release points at the small sides



One opening point





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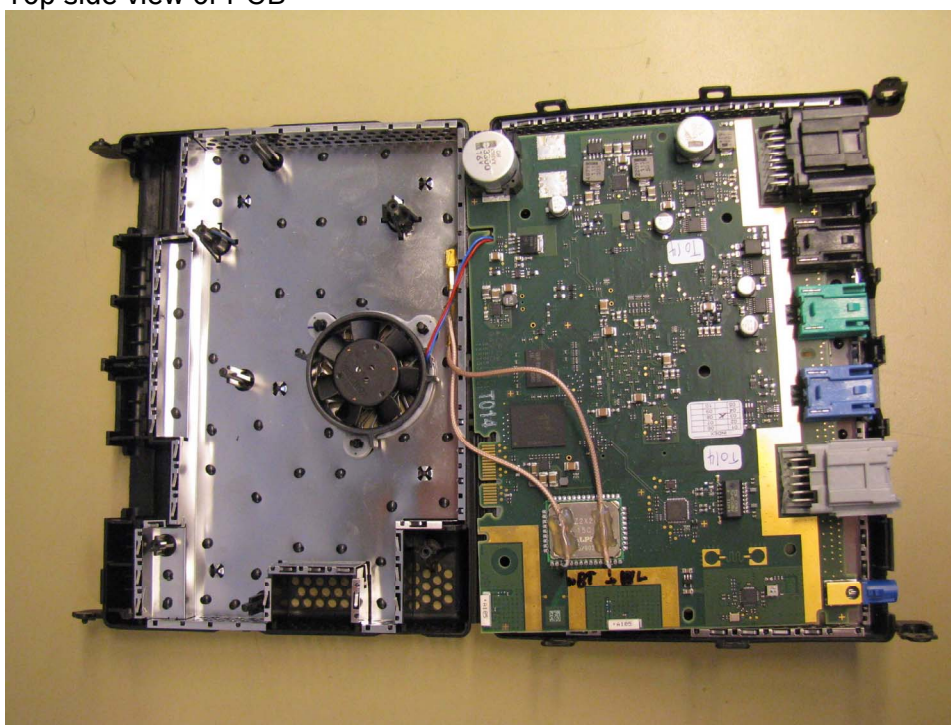
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3.1.4 PCB view

The attached pictures are from a modified sample. The modification are for the conductive measurement of RF power of Bluetooth and WiFi.

Top side view of PCB





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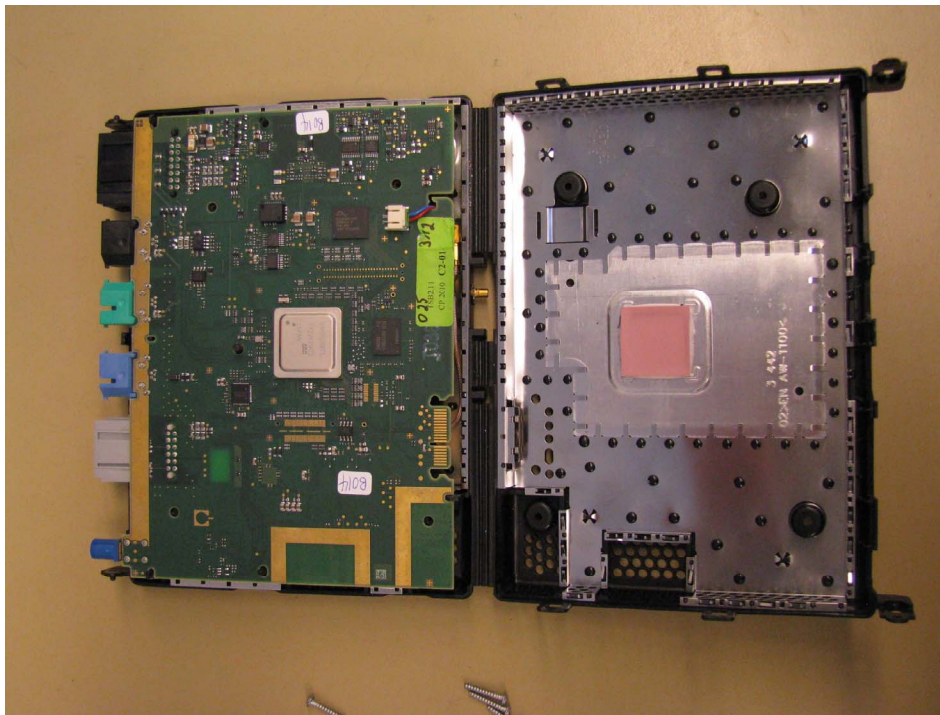
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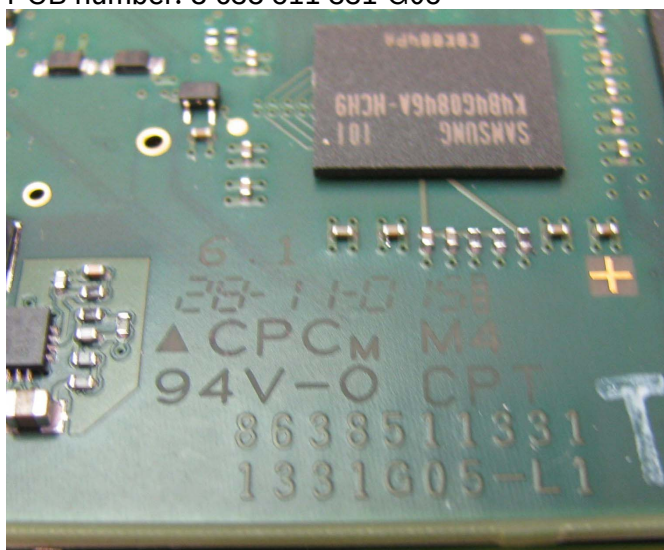
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Bottom side view of PCB



PCB number: 8 638 511 331 G05



The PCB approval will be 8 638 511 331 **G07**

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3.2 *Radio related functions*

Radio transmitter Bluetooth

RF power Class 2

Module factory adjusted to a fixed RF output value of 1 mW +- 0.1 mW under normal conditions.

Radio transmitter WiFi

The RF output power is depending on the data rate up to +9 dBm.

Only 2.5 GHz is used.

Only the functions which are needed for the Bluetooth High Speed are used.

The WiFi approval is made by ALPS.

Each transmitter has an independent antenna.

Each antenna is connected via an impedance stabilisation network to the RF module (ALPS UGKZ2)

GPS Receiver

The GPS receiver has a SMA connector for an external active antenna with phantom power supply.

3.3 *Factory*

The factory is located in Malaysia.

It is a Bosch factory.

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4 Technical data

- Temperature ranges

Operating temperature	-40°C .. +75°C
Storage temperature	-40°C .. +85°C

- Power consumption:

Normal operating voltage	9.5 .. 16.0 V
Max. current under operation	2.3 A @ (9.0 .. 16.0 V)
Typ. current under operation (* without USB load)	750 mA* @ 13.5 V
Max. quiescent current during 'system off'	0.15 mA @ (9.0 .. 16.0 V)

- Graphics output specification (serial LVDS)

Display resolution	800 x 480
Pixel clock	typ. 33.26 MHz
HSYNC frequency	31.5 kHz
VSNC frequency	60 Hz

- Camera input interface

Differential video input	NTSC
Input impedance	75 ohms

- Microphone inputs (2)

AC Signal (VSig)	typ. 670 mVeff.
AC Signal (VSig)	max. 5.5 Vpp
Bandwidth (+/- 3 dB range)	70 Hz - 7.0 KHz

- MOST bus interface

Interface type	MOST 50 (electrical)
Impedance	120 +/- 20 ohms
System frequency	48.0 kHz

- USB2.0 Host interfaces (2)

Speed	low / full / high
VBUS voltage	5V+/-0,25V
Max. current load (single interface)	1000 mA
Max. current load (total at both interfaces):	1100 mA.



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- GNSS module

RF Signal Center Frequency	1575.42 MHz (L1, E1)
Receiver bandwidth	4 MHz (± 3 dB)
Acquisition Sensitivity	min. -130 dBm

- Bluetooth

Frequency ranges	2.4000 .. 2.4835 GHz (Bluetooth)
	2.412 .. 2.472 GHz (IEEE802.11b,g)
Transmit power	0 dBm

WLAN

Frequency ranges:	2.412 .. 2.484 GHz (IEEE802.11b,g,n)
Transmit Power:	max. 9 dBm

(Only the functions which are needed for the Bluetooth High Speed are used.)