


Functional Overview - BOBCAT DIS NGD

| | |
|-----------|----------------|
| Project: | BOBCAT-DIS-NGD |
| Customer | BOBCAT |
| Author: | W. Weisser |
| Revision: | V1.3 |
| Maturity: | initial |
| Status: | draft |

Transmittal, reproduction, dissemination and/or editing of this document as well as utilization of its contents and communication thereof to others without express authorization are prohibited. Offenders will be held liable for payment of damages. All rights created by patent grant or registration of a utility model or design patent are reserved.


| | | | | |
|---|---|-------------------------------------|------------|--------------------------|
| Confidential | | Date | Department | Sign |
| Designed by | | 09.12.2016 | I CVAM | |
| Released by | | XX-XX-XX | I CVAM | |
|  | Designation | | | |
| | FunctionalOverview RE BOBCAT-DIS-NGD V1.3.docx (V1.3) | | | |
| Document key | | Pages | | |
| | | 1 of 21 | | |
| Continental AG, Continental Automotive GmbH | | Copyright (C) Continental AG 2008 | | A4 : 10097480 SPD 000 AC |

Functional Overview - BOBCAT DIS NGD

1 Table of Contents

| | | |
|----------|--|-----------|
| 1 | Table of Contents | 2 |
| | History..... | 4 |
| 2 | Introduction..... | 5 |
| 2.1 | Overview..... | 5 |
| 2.2 | Vehicles / Application | 5 |
| 2.3 | System Architecture / Design | 6 |
| 2.4 | System Overview..... | 7 |
| 2.5 | Scope | 8 |
| 3 | Non-Functional Product Requirements..... | 9 |
| 3.1 | Legal Requirements | 9 |
| 3.1.1 | Open Source Software..... | 9 |
| 3.1.2 | Manual Requirements according 15.105 (according to FCC Rules) | 9 |
| 3.1.3 | RF Exposure Information according 2.1091 / 2.1093 / OET bulletin 65 (according to Canadian Rules)..... | 10 |
| 3.1.4 | Manual Requirements according 15.19 / RSS-GEN | 11 |
| 3.1.5 | Manual Requirements according 15.21 | 11 |
| 3.1.6 | Certification Approval Signs Requirements..... | 11 |
| 3.2 | Design and implementation constraints..... | 12 |
| 4 | Functional Product Requirements | 13 |
| 4.1 | General Requirements | 13 |
| 4.1.1 | Third-party Application | 13 |
| 4.1.2 | Smartphone Interfacing..... | 13 |
| 4.1.3 | Telephony | 14 |
| 4.1.4 | Virtual Gauges | 14 |
| 4.1.5 | Steering Wheel Controls | 14 |
| 4.1.6 | Link to Vehicle CAN | 14 |
| 4.1.7 | Cameras requirements..... | 14 |
| 4.1.8 | Radio Functions | 14 |


Transmittal, reproduction, dissemination and/or editing of this document as well as utilization of its contents and communication thereof to others without express authorization are prohibited. Offenders will be held liable for payment of damages. All rights created by patent grant or registration of a utility model or design patent are reserved.

| | | | | |
|---|--|-------------------------------------|------------|--------------------------|
| Confidential | | Date | Department | Sign |
| Designed by Wolfgang.weisser@continental-corporation.com | | 09.12.2016 | I CVAM | |
| Released by | | XX-XX-XX | I CVAM | |
|  | Designation FunctionalOverview RE BOBCAT-DIS-NGD V1.3.docx (V1.3) | | | |
| | Document key | | | Pages 2 of 21 |
| Continental AG, Continental Automotive GmbH | | Copyright (C) Continental AG 2008 | | A4 : 10097480 SPD 000 AC |

Functional Overview - BOBCAT DIS NGD

- 4.1.9 Bluetooth Audio Streaming 15
- 4.1.10 USB Audio Media 15
- 4.1.11 IPod® Controls requirements 15
- 4.2 Software Requirements 15
 - 4.2.1 MONITOR 15
 - 4.2.2 RADIO..... 15
 - 4.2.3 DISPLAY CONTROLLER Subsystem – base software 16
 - 4.2.4 DISPLAY CONTROLLER Subsystem – MultiViu Media Reference Application 21
- 4.3 SW deliverables..... 21

Transmittal, reproduction, dissemination and/or editing of this document as well as utilization of its contents and communication thereof to others without express authorization are prohibited. Offenders will be held liable for payment of damages. All rights created by patent grant or registration of a utility model or design patent are reserved.


| | | | | |
|---|---|--|------------|--------------------------|
| Confidential | | Date | Department | Sign |
| Designed by | | Wolfgang.weisser@continental-corporation.com | 09.12.2016 | I CVAM |
| Released by | | XX-XX-XX | I CVAM | |
|  | Designation | | | |
| | FunctionalOverview RE BOBCAT-DIS-NGD V1.3.docx (V1.3) | | | |
| Document key | | Pages | | |
| | | 3 of 21 | | |
| Continental AG, Continental Automotive GmbH | | Copyright (C) Continental AG 2008 | | A4 : 10097480 SPD 000 AC |

Functional Overview - BOBCAT DIS NGD

History

| Revision | Maturity | Date | Author, Editor | Reason |
|----------|----------|----------|----------------|---|
| 1.1 | Initial | 20.11.16 | W.Weisser | Initial revision, generated as extract from Performance SPEC V3.3 |
| 1.2 | Initial | 29.11.16 | W.Weisser | “Design and implementation constraints” chapter from Performance SPEC V3.3 added |
| 1.3 | Initial | 09.12.16 | W.Weisser | “Design and implementation constraints” chapter updated. Legal Requirements subchapters added. |
| | | | | |
| | | | | |

Transmittal, reproduction, dissemination and/or editing of this document as well as utilization of its contents and communication thereof to others without express authorization are prohibited. Offenders will be held liable for payment of damages. All rights created by patent grant or registration of a utility model or design patent are reserved.

| | | | | |
|---|--|-------------------------------------|------------|--------------------------|
| Confidential | | Date | Department | Sign |
| Designed by Wolfgang.weisser@continental-corporation.com | | 09.12.2016 | I CVAM | |
| Released by | | XX-XX-XX | I CVAM | |
|  | Designation FunctionalOverview RE BOBCAT-DIS-NGD V1.3.docx (V1.3) | | | |
| | Document key | | | Pages 4 of 21 |
| Continental AG, Continental Automotive GmbH | | Copyright (C) Continental AG 2008 | | A4 : 10097480 SPD 000 AC |

Functional Overview - BOBCAT DIS NGD

2 Introduction

2.1 Overview

The BOBCAT Gen 5.5 DISPLAY ELECTRONICS is based on the CONTINENTAL MultiViu Media platform.

The BOBCAT Gen 5.5 DISPLAY ELECTRONICS consists of three parts:

- (1) a RADIO on which, all basic entertainment and audio related features are integrated
- (2) a MONITOR, which provides the Human Machine Interface (HMI)
- (3) a DISPLAY CONTROLLER, which controls both, the RADIO and MONITOR and offers a variety of other features including possibilities to integrate 3rd party applications via smart phone applications.

2.2 Vehicles / Application

BOBCAT Gen 5.5 DISPLAY ELECTRONICS will be used on


- Mini-Excavators (MEX)
- Compact Loaders: skid steer, all wheel steer, track

BOBCAT Gen 5.5 DISPLAY ELECTRONICS might be used on

- Work Machines: Toolcat
- Telehandlers

There are vehicles with closed / open cabins.

Transmittal, reproduction, dissemination and/or editing of this document as well as utilization of its contents and communication thereof to others without express authorization are prohibited. Offenders will be held liable for payment of damages. All rights created by patent grant or registration of a utility model or design patent are reserved.

| | | | | |
|---|--|-------------------------------------|------------|--------------------------|
| Confidential | | Date | Department | Sign |
| Designed by Wolfgang.weisser@continental-corporation.com | | 09.12.2016 | I CVAM | |
| Released by | | XX-XX-XX | I CVAM | |
|  | Designation FunctionalOverview RE BOBCAT-DIS-NGD V1.3.docx (V1.3) | | | |
| | Document key | | | Pages 5 of 21 |
| Continental AG, Continental Automotive GmbH | | Copyright (C) Continental AG 2008 | | A4 : 10097480 SPD 000 AC |

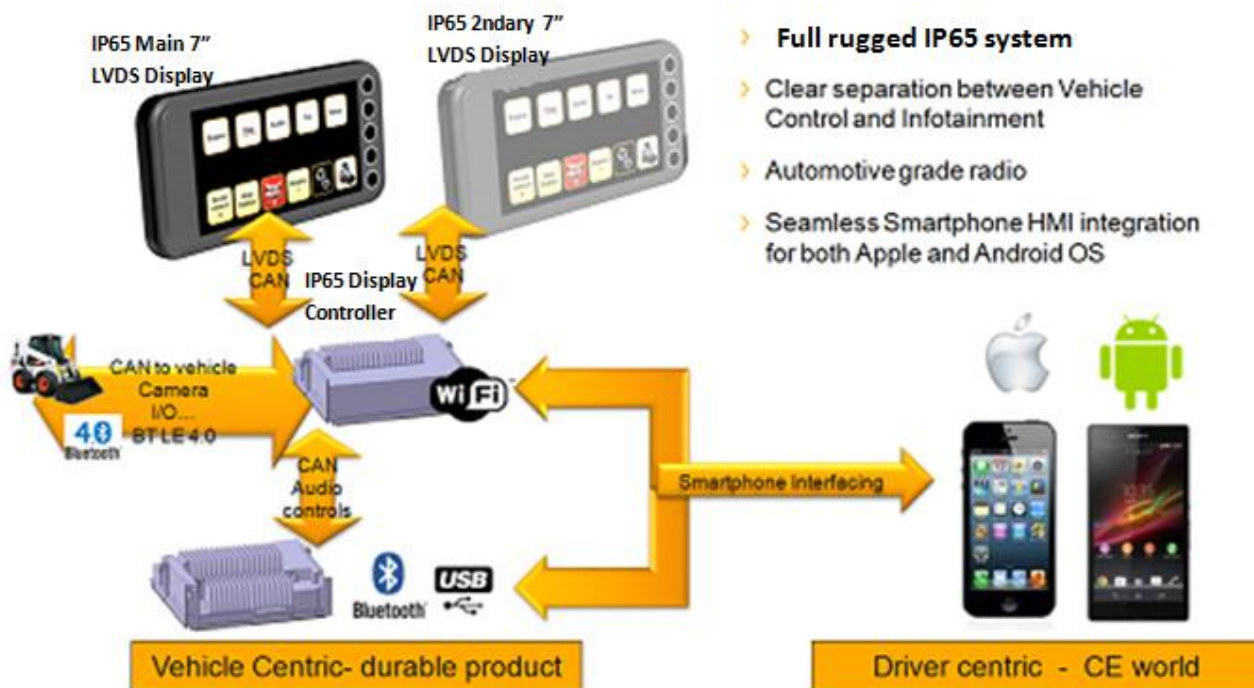
Functional Overview - BOBCAT DIS NGD

2.3 System Architecture / Design

Illustration Picture only (including options).

Note: Options are defined in the Product Overview only.

Picture below shows the system approach and does not reflect any ECU design



Transmittal, reproduction, dissemination and/or editing of this document as well as utilization of its contents and communication thereof to others without express authorization are prohibited. Offenders will be held liable for payment of damages. All rights created by patent grant or registration of a utility model or design patent are reserved.

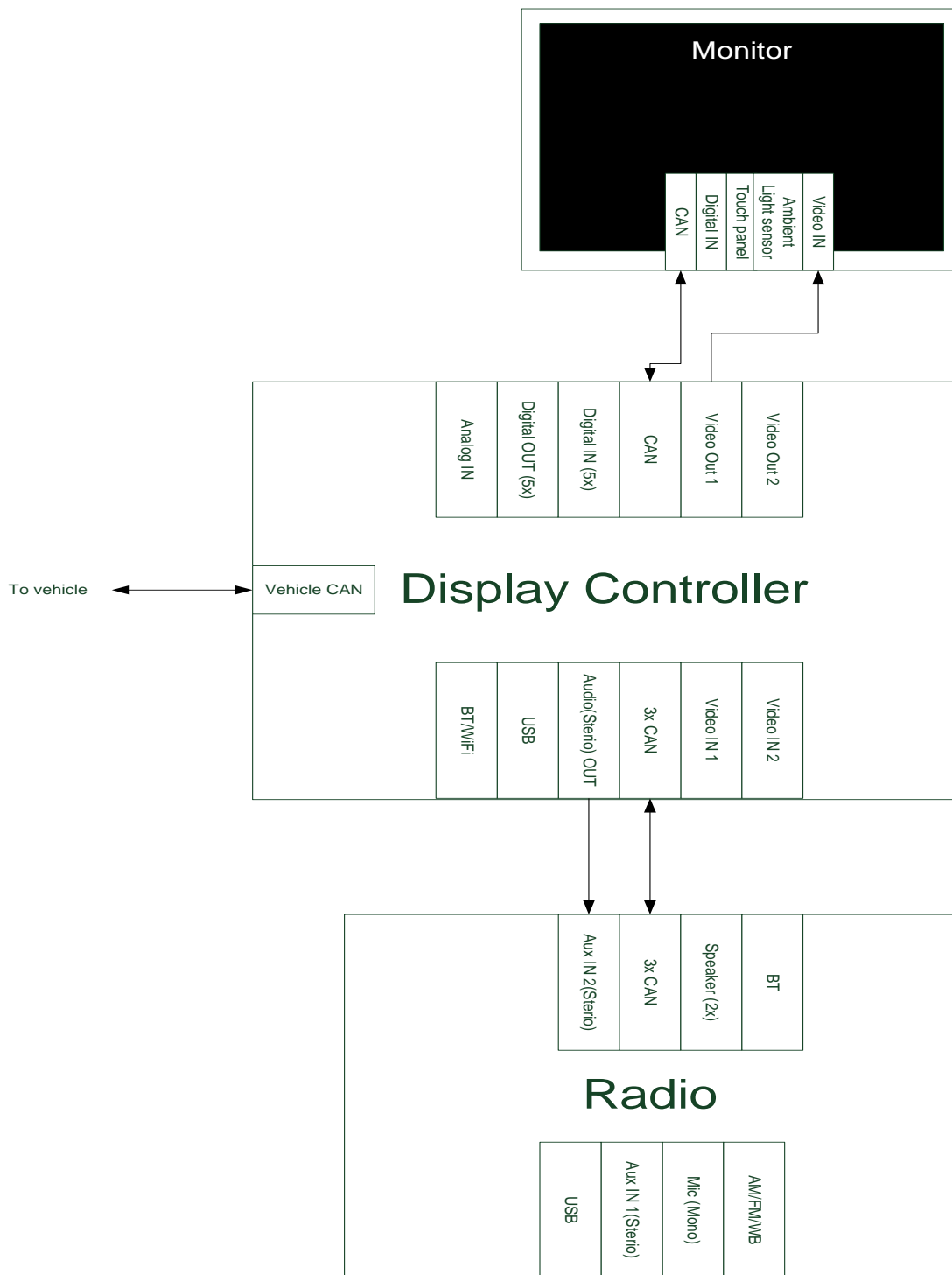
| | | | | |
|--|--|-------------------------------------|------------|--------------------------|
| Confidential | | Date | Department | Sign |
| Designed by Wolfgang.weisser@continental-corporation.com | | 09.12.2016 | I CVAM | |
| Released by | | XX-XX-XX | I CVAM | |
| | Designation FunctionalOverview RE BOBCAT-DIS-NGD V1.3.docx (V1.3) | | | |
| | Document key | | | Pages 6 of 21 |
| Continental AG, Continental Automotive GmbH | | Copyright (C) Continental AG 2008 | | A4 : 10097480 SPD 000 AC |

Functional Overview - BOBCAT DIS NGD

2.4 System Overview

Illustration Picture only (including options):

Note: Options are defined in the Product Overview only.



Transmittal, reproduction, dissemination and/or editing of this document as well as utilization of its contents and communication thereof to others without express authorization are prohibited. Offenders will be held liable for payment of damages. All rights created by patent grant or registration of a utility model or design patent are reserved.

| | | | | |
|--|--|-------------------------------------|------------|--------------------------|
| Confidential | | Date | Department | Sign |
| Designed by Wolfgang.weisser@continental-corporation.com | | 09.12.2016 | I CVAM | |
| Released by | | XX-XX-XX | I CVAM | |
| | Designation FunctionalOverview RE BOBCAT-DIS-NGD V1.3.docx (V1.3) | | | |
| | Document key | | | Pages 7 of 21 |
| Continental AG, Continental Automotive GmbH | | Copyright (C) Continental AG 2008 | | A4 : 10097480 SPD 000 AC |

Functional Overview - BOBCAT DIS NGD


2.5 Scope

This Performance Specification describes the requirements for the project BOBCAT Gen5.5 which is based on the Continental platform MultiViu Media.

The SW application, HMI and Smartphone Apps will be defined and implemented by BOBCAT.

Both, SW application and HMI described in this document shall be understood as an example, which describes the capabilities of the MultiViu Media system.

Transmittal, reproduction, dissemination and/or editing of this document as well as utilization of its contents and communication thereof to others without express authorization are prohibited. Offenders will be held liable for payment of damages. All rights created by patent grant or registration of a utility model or design patent are reserved.

| | | | | |
|---|--|-------------------------------------|------------|--------------------------|
| Confidential | | Date | Department | Sign |
| Designed by Wolfgang.weisser@continental-corporation.com | | 09.12.2016 | I CVAM | |
| Released by | | XX-XX-XX | I CVAM | |
|  | Designation FunctionalOverview RE BOBCAT-DIS-NGD V1.3.docx (V1.3) | | | |
| | Document key | | | Pages 8 of 21 |
| Continental AG, Continental Automotive GmbH | | Copyright (C) Continental AG 2008 | | A4 : 10097480 SPD 000 AC |

3 Non-Functional Product Requirements

3.1 Legal Requirements

3.1.1 Open Source Software

Since the software uses 'Free Open Source Software', Bobcat is legally obligated to print the following chapter in the vehicle end user manual:

"

This product uses Free Open Source Software.

For further information refer to <http://www.opensourceautomotive.com/yqFEcvQnjc5j>

"

Note: This webpage is maintained by Continental Automotive GmbH.

3.1.2 Manual Requirements according 15.105 (according to FCC Rules)


Definitions:

Digital device. (Previously defined as a computing device): An unintentional radiator (device or system) that generates and uses timing signals or pulses at a rate in excess of 9,000 pulses (cycles) per second and uses digital techniques; inclusive of telephone equipment that uses digital techniques or any device or system that generates and uses radio frequency energy for the purpose of performing data processing functions, such as electronic computations, operations, transformations, recording, filing, sorting, storage, retrieval, or transfer. A radio frequency device that is specifically subject to an emanation requirement in any other FCC Rule Part or an intentional radiator subject to Subpart C of this Part that contains a digital device is not subject to the standards for digital devices,

Class A digital device: A digital device that is marketed for use in a commercial, industrial or business environment, exclusive of a device which is marketed for use by the general public or is intended to be used in the home.

Class B digital device: A digital device that is marketed for use in a residential environment notwithstanding use in commercial, business and industrial environments. Examples of such devices include, but are not limited to, personal computers, calculators, and similar electronic devices that are marketed for use by the general public. Note: The responsible party may also qualify a device intended to be marketed in a commercial, business or industrial environment as a Class B device, and in fact is encouraged to do so, provided the device complies with the technical specifications for a Class B digital device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a digital device as a Class B digital device, regardless of its intended use.

Transmittal, reproduction, dissemination and/or editing of this document as well as utilization of its contents and communication thereof to others without express authorization are prohibited. Offenders will be held liable for payment of damages. All rights created by patent grant or registration of a utility model or design patent are reserved.

| | | | | |
|---|--|-------------------------------------|------------|--------------------------|
| Confidential | | Date | Department | Sign |
| Designed by Wolfgang.weisser@continental-corporation.com | | 09.12.2016 | I CVAM | |
| Released by | | XX-XX-XX | I CVAM | |
|  | Designation FunctionalOverview RE BOBCAT-DIS-NGD V1.3.docx (V1.3) | | | |
| | Document key | | | Pages 9 of 21 |
| Continental AG, Continental Automotive GmbH | | Copyright (C) Continental AG 2008 | | A4 : 10097480 SPD 000 AC |

Functional Overview - BOBCAT DIS NGD

Classification for Display Controller and Radio:

The Display Controller and Radio are classified as a Class A digital device.

Text for User Manual (cursive text below)

For a Class A digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

NOTE: *This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.*

3.1.3 RF Exposure Information according 2.1091 / 2.1093 / OET bulletin 65 (according to Canadian Rules)

Definitions:

Mobile device:

A mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons. In this context, the term "fixed location" means that the device is physically secured at one location and is not able to be easily moved to another location.


Portable device:

For purposes of this section, a portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user.

Classification for Display Controller and Radio:

The Display Controller and Radio are classified as a mobile device.

Transmittal, reproduction, dissemination and/or editing of this document as well as utilization of its contents and communication thereof to others without express authorization are prohibited. Offenders will be held liable for payment of damages. All rights created by patent grant or registration of a utility model or design patent are reserved.

| | | | | |
|---|--|-------------------------------------|------------|--------------------------|
| Confidential | | Date | Department | Sign |
| Designed by | Wolfgang.weisser@continental-corporation.com | 09.12.2016 | I CVAM | |
| Released by | | XX-XX-XX | I CVAM | |
|  | Designation FunctionalOverview RE BOBCAT-DIS-NGD V1.3.docx (V1.3) | | | |
| | Document key | | | Pages 10 of 21 |
| Continental AG, Continental Automotive GmbH | | Copyright (C) Continental AG 2008 | | A4 : 10097480 SPD 000 AC |

Functional Overview - BOBCAT DIS NGD

Text for User Manual (cursive text below)

For a mobile device which intended use is at least 20 cm between human body and antenna: (e.g. devices for use on desk, use on vehicles,...)

Radiofrequency radiation exposure Information:

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

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

3.1.4 Manual Requirements according 15.19 / RSS-GEN

Below text shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user.

NOTICE:

This device complies with Part 15 of the FCC Rules [and with Industry Canada licence-exempt RSS standard(s)].

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*

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

- (1) l'appareil ne doit pas produire de brouillage, et*
- (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.*


3.1.5 Manual Requirements according 15.21

NOTICE:

Changes or modifications made to this equipment not expressly approved by (Continental Automotive GmbH) may void the FCC authorization to operate this equipment.

3.1.6 Certification Approval Signs Requirements

Specifications for the approval signs and the placement of additional information for the Display Controller and the Radio are described in the document "01_Lists_pecifications _approval signs _placement _different contries.docx".

| | | | | |
|---|--|-------------------------------------|------------|--------------------------|
| Confidential | | Date | Department | Sign |
| Designed by Wolfgang.weisser@continental-corporation.com | | 09.12.2016 | I CVAM | |
| Released by | | XX-XX-XX | I CVAM | |
|  | Designation FunctionalOverview RE BOBCAT-DIS-NGD V1.3.docx (V1.3) | | | |
| | Document key | | | Pages 11 of 21 |
| Continental AG, Continental Automotive GmbH | | Copyright (C) Continental AG 2008 | | A4 : 10097480 SPD 000 AC |

Functional Overview - BOBCAT DIS NGD

3.2 Design and implementation constraints

Using the USB connectors on a mounted system requires a Cabin internal wiring to a driver accessible area. (For firmware updates on the RADIO, and for firmware updates + Smartphone interfacing on/to DISPLAY CONTROLLER).

The actual mounting position and surrounding parts may influence the units, as they have an effect on the overall thermal performance of the component and the range of the Bluetooth and WLAN signals. Metal or harnesses must not cover the antennas of the radio and Display Controller.

- In the vehicle MEX the Display Controller is located on the right side under the seat.
- In the vehicle MEX the Radio is located on the left side under the seat
- In the vehicle loader the Radio is located on the front right side (floor area, Bobcat Radio today) behind of the plastic cover.
- In the vehicle loader the Display Controller is located on the front left side (floor area, near the horn) behind of the plastic cover.

The MONITOR, DISPLAY CONTROLLER and RADIO shall be designed to be IP65 (MT0035) proof when the harness is connected. If the harness is not connected, then IP40 shall be applicable.

All harness connectors must be IP65 (MT0035) proof.

In the vehicle the device must be mounted in a way that no water can remain on the connector side. A drip loop has to be foreseen on the vehicle wiring.

No anti-theft protection for units implemented.

The separation distance between the human body and the DISPLAY CONTROLLER's radiating structure(s) and the human body and the RADIO's radiating structure has to be at least 20 centimeters.

TRM30 of DISPLAY CONTROLLER and RADIO have to be fused.

TRM15 of MONITOR has to be fused.


Note:

BOBCAT applies on the vehicles:

- 1 fast acting 25A fuse for TRM30 used for supplying the DISPLAY CONTROLLER's and the RADIO.
- 1 fast acting 25A fuse for TRM15 used for supplying the MONITOR.

BOBCAT's fusing details were provided to the safety test lab and are part of the safety tests.

Transmittal, reproduction, dissemination and/or editing of this document as well as utilization of its contents and communication thereof to others without express authorization are prohibited. Offenders will be held liable for payment of damages. All rights created by patent grant or registration of a utility model or design patent are reserved.

| | | | | |
|---|--|-------------------------------------|------------|--------------------------|
| Confidential | | Date | Department | Sign |
| Designed by | Wolfgang.weisser@continental-corporation.com | 09.12.2016 | I CVAM | |
| Released by | | XX-XX-XX | I CVAM | |
|  | Designation FunctionalOverview RE BOBCAT-DIS-NGD V1.3.docx (V1.3) | | | |
| | Document key | | | Pages 12 of 21 |
| Continental AG, Continental Automotive GmbH | | Copyright (C) Continental AG 2008 | | A4 : 10097480 SPD 000 AC |

4 Functional Product Requirements

The support of functions described in the following subchapters is based on the constraint, that the option is available/selected on the specific hardware.

As already highlighted in “Scope”, the SW application, HMI and Smartphone Apps will be defined and implemented by BOBCAT.

Therefore, all features which are described in the following paragraphs shall be understood as an example, which describes the capabilities of the system.

4.1 General Requirements

The unit shall consist of the MONITOR, a DISPLAY CONTROLLER and a RADIO.

The MONITOR shall support capacitive touch screen.

The unit shall allow the update of the software of all 3 sub systems, MONITOR, DISPLAY CONTROLLER and RADIO, in the field.

The software update shall be performed on the units as below.

- Radio - via USB
- Monitor - via CAN (Field update not part of update concept of display controller)
- Display Controller - via Middleware API (The interface to transfer the update file is part of Customer Application SW)

4.1.1 Third-party Application

Not applicable as BOBCAT is developing the applications.

4.1.2 Smartphone Interfacing

Apple iOS versions 8 and above and Android version 4 and above shall be supported.

The unit shall be connected to a Smartphone for Remote Control Mode.

The unit shall be connected to the Smartphone for Display Sync Mode.

The unit should be ready for Wi-Fi only (USB optional) connection for future usage.

In Remote Control Mode the unit acts as an interface to dedicated Smartphone apps to allow data exchange with the DISPLAY CONTROLLER.


The Display Sync Mode shall allow to display dedicated apps running on the Smartphone and to control them from the touch panel of the unit. Audio can be transferred to the RADIO.

The frame rate of Smartphone display content update in Display Sync Mode shall be at least 8 fps.

The unit shall offer an initial pairing method.

The unit shall offer access control for paired smart phones.

Transmittal, reproduction, dissemination and/or editing of this document as well as utilization of its contents and communication thereof to others without express authorization are prohibited. Offenders will be held liable for payment of damages. All rights created by patent grant or registration of a utility model or design patent are reserved.

| | | | | |
|---|--|-------------------------------------|------------|--------------------------|
| Confidential | | Date | Department | Sign |
| Designed by | Wolfgang.weisser@continental-corporation.com | 09.12.2016 | I CVAM | |
| Released by | | XX-XX-XX | I CVAM | |
|  | Designation FunctionalOverview RE BOBCAT-DIS-NGD V1.3.docx (V1.3) | | | |
| | Document key | | | Pages 13 of 21 |
| Continental AG, Continental Automotive GmbH | | Copyright (C) Continental AG 2008 | | A4 : 10097480 SPD 000 AC |

Functional Overview - BOBCAT DIS NGD

4.1.3 Telephony

- The unit shall be able to connect via Bluetooth to a mobile phone.
- The unit shall be able to access the phonebook of the mobile phone.
- The unit shall be able to display the phonebook entries of the mobile phone.
- The unit shall be able to initiate a voice call via Bluetooth.
- The unit shall use the vehicle's microphone and loudspeakers for voice call.
- The phone call shall be initiated by selecting a phonebook entry or by manually entering a phone number.
- The unit shall provide echo and noise cancellation for hands free phone calls.
- The unit should be able to use the Smartphone's internal voice recognition system to initiate a voice call (e.g. SIRI).

4.1.4 Virtual Gauges

The unit shall support the displaying of virtual gauges, connected to different input signals.

4.1.5 Steering Wheel Controls

Steering Wheel Control signals are received on CAN.

4.1.6 Link to Vehicle CAN

The unit shall be prepared to provide dedicated information on CAN.

The content and the amount of information is limited to the existing CAN interface.

4.1.7 Cameras requirements

The unit shall be able to display one out of two analogue camera streams, which represent different views of the vehicle.

The unit shall be able to display automatically a certain camera view on top of the current HMI context on defined driving situations. Appropriate commands will be sent via CAN.


A combined view like e.g. "bird view" will not be part of the system.

4.1.8 Radio Functions

The unit shall provide the user access to the available radio sources.

The unit shall provide the following radio bands: FM, AM and WB.

Transmittal, reproduction, dissemination and/or editing of this document as well as utilization of its contents and communication thereof to others without express authorization are prohibited. Offenders will be held liable for payment of damages. All rights created by patent grant or registration of a utility model or design patent are reserved.

| | | | | |
|---|--|-------------------------------------|------------|--------------------------|
| Confidential | | Date | Department | Sign |
| Designed by Wolfgang.weisser@continental-corporation.com | | 09.12.2016 | I CVAM | |
| Released by | | XX-XX-XX | I CVAM | |
|  | Designation FunctionalOverview RE BOBCAT-DIS-NGD V1.3.docx (V1.3) | | | |
| | Document key | | | Pages 14 of 21 |
| Continental AG, Continental Automotive GmbH | | Copyright (C) Continental AG 2008 | | A4 : 10097480 SPD 000 AC |

Functional Overview - BOBCAT DIS NGD

4.1.9 Bluetooth Audio Streaming

The unit shall be able to support Bluetooth audio streaming from BT devices.

The unit shall be able to control Bluetooth audio players from BT devices.

4.1.10 USB Audio Media

The unit shall be able to play audio files stored on a USB stick connected to the RADIO.

The supported audio format shall be MP3, WMA and AAC.

4.1.11 iPod® Controls requirements

The unit shall allow the user to access and play iPod® information when an iPod® is connected to the USB port of the RADIO.

4.2 Software Requirements

The following section describes the capabilities of the software for all three product subsystems.

4.2.1 MONITOR

The embedded software of the MONITOR manages the remote display and its communication to the DISPLAY CONTROLLER in terms of

- Touch event
- Light sensor
- display diagnosis status


4.2.2 RADIO

The RADIO shall have an interface to the DISPLAY CONTROLLER, which allows it to be completely remotely controlled by the DISPLAY CONTROLLER.

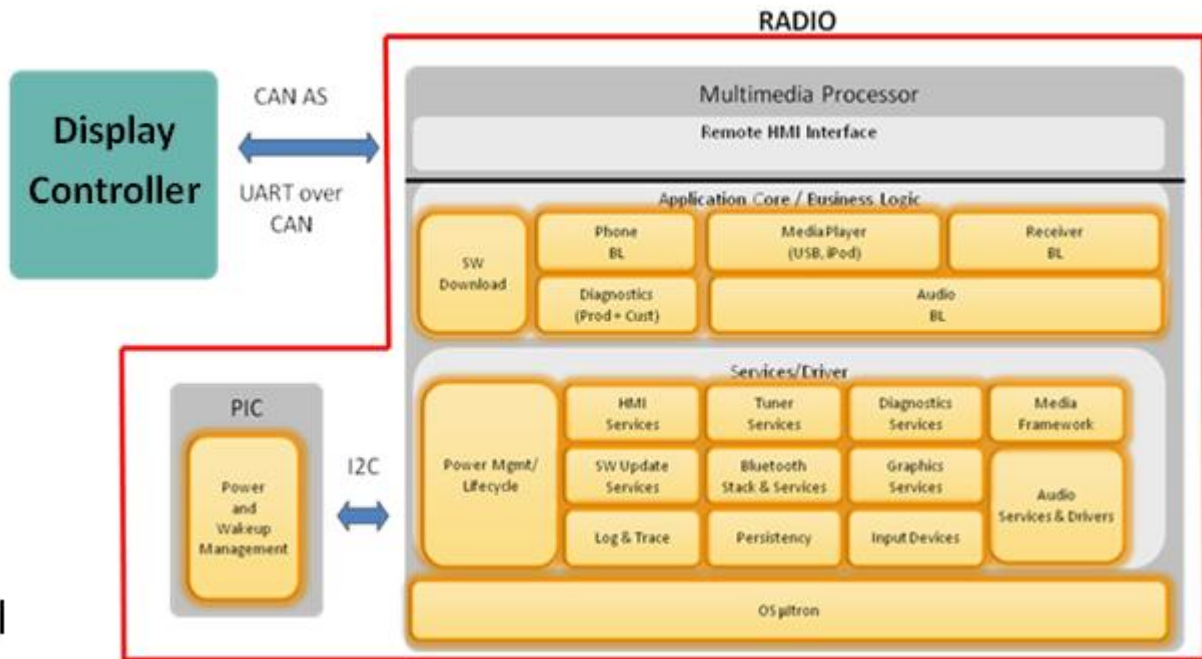
The Interface shall allow e.g. the following actions:

- controlling of all Bluetooth related functions, including pairing, hands free telephony, phonebook access and media player control
- controlling of all broadcast services
- controlling of media player
- controlling of volume and audio setup
- controlling of audio mixing

Block diagram:

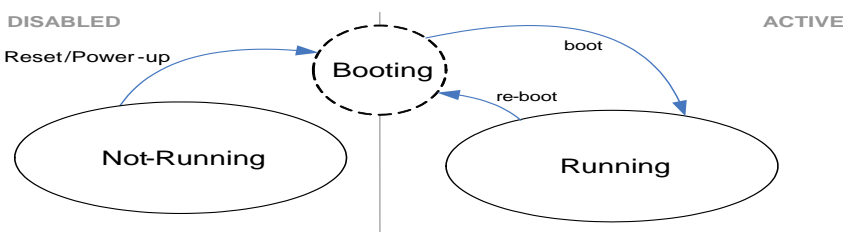
| | | | | |
|---|--|-------------------------------------|------------|--------------------------|
| Confidential | | Date | Department | Sign |
| Designed by Wolfgang.weisser@continental-corporation.com | | 09.12.2016 | I CVAM | |
| Released by | | XX-XX-XX | I CVAM | |
|  | Designation FunctionalOverview RE BOBCAT-DIS-NGD V1.3.docx (V1.3) | | | |
| | Document key | | | Pages 15 of 21 |
| Continental AG, Continental Automotive GmbH | | Copyright (C) Continental AG 2008 | | A4 : 10097480 SPD 000 AC |

Functional Overview - BOBCAT DIS NGD



The software of the RADIO has two main states and one transitional state which can be mapped onto the system operating modes:

State chart



Transmittal, reproduction, dissemination and/or editing of this document as well as utilization of its contents and communication thereof to others without express authorization are prohibited. Offenders will be held liable for payment of damages. All rights created by patent grant or registration of a utility model or design patent are reserved.

4.2.3 DISPLAY CONTROLLER Subsystem – base software

The DISPLAY CONTROLLER base software shall be Continental’s Linux Embedded Automotive Platform (LEAP). On top there is a multimedia middleware component offering Qt signals and slots to access all peripheral and system functionality. Qt version above 5.3 is used as the HMI framework.

| | | | | |
|--|--|-------------------------------------|------------|--------------------------|
| Confidential | | Date | Department | Sign |
| Designed by Wolfgang.weisser@continental-corporation.com | | 09.12.2016 | I CVAM | |
| Released by | | XX-XX-XX | I CVAM | |
| | Designation FunctionalOverview RE BOBCAT-DIS-NGD V1.3.docx (V1.3) | | | |
| | Document key | | | Pages 16 of 21 |
| Continental AG, Continental Automotive GmbH | | Copyright (C) Continental AG 2008 | | A4 : 10097480 SPD 000 AC |

Functional Overview - BOBCAT DIS NGD

The DISPLAY CONTROLLER base software provides high level hardware abstraction. All use cases, including the control of the RADIO, shall be implemented by the DISPLAY CONTROLLER Qt based application.

Diagnostic infrastructure for customer diagnostics shall be provided by the DISPLAY CONTROLLER base software, diagnostic services shall be implemented within the application.

The DISPLAY CONTROLLER base software shall provide hardware abstractions for the following peripherals:


- Display
- Touch screen
- Bluetooth/Wi-Fi
- USB
- RADIO
- Smartphone
- CAN
- Diagnostics
- Software update
- Flash memory / file system
- UART and Audio out
- Camera input

The software of the DISPLAY CONTROLLER shall be grouped into several layers from low level hardware access up to high level application functionality. With the higher layers the hardware abstraction and hardware independence of the software shall be increasing.

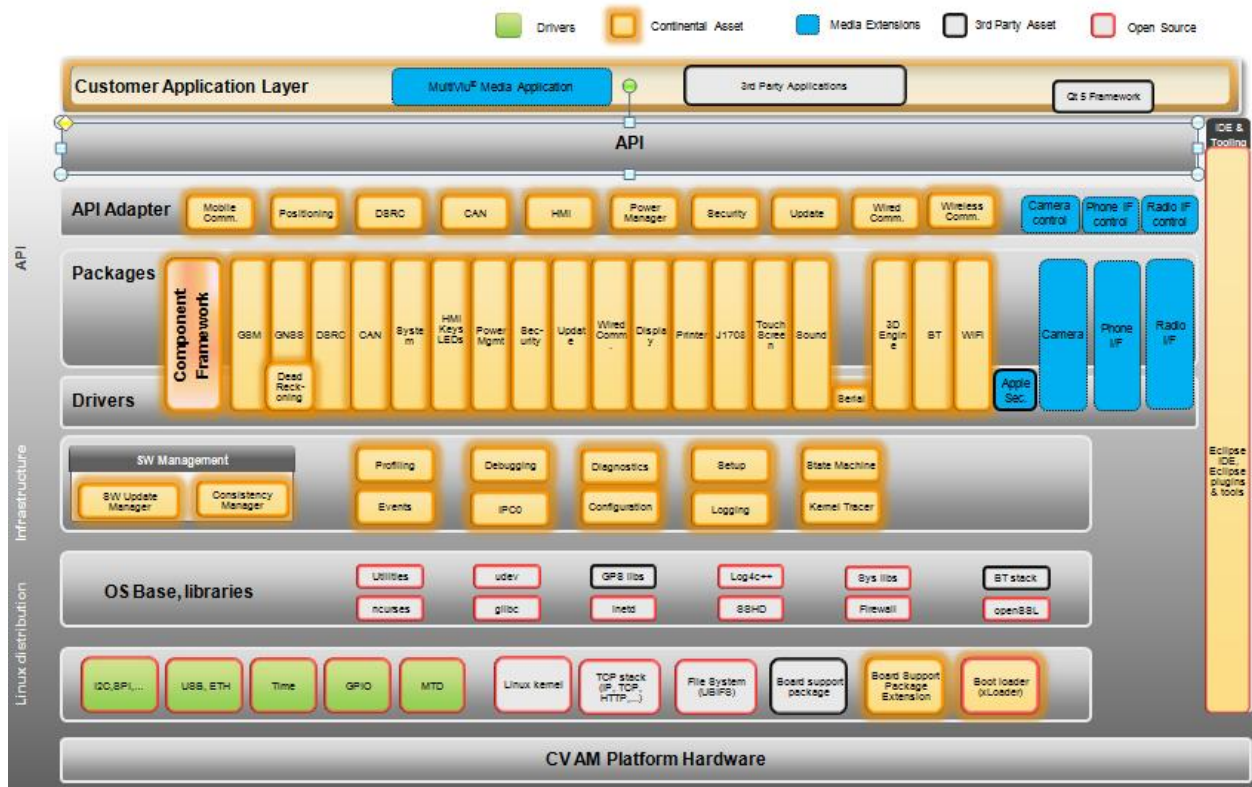
The DISPLAY CONTROLLER base software shall be copied from flash memory to RAM by the boot loader and started there. After having booted the base software the application software shall be started.

The figure below gives an overview of the DISPLAY CONTROLLER base software architecture of LEAP and the platform reuse:

Transmittal, reproduction, dissemination and/or editing of this document as well as utilization of its contents and communication thereof to others without express authorization are prohibited. Offenders will be held liable for payment of damages. All rights created by patent grant or registration of a utility model or design patent are reserved.

| | | | | |
|---|---|--|------------|--------------------------|
| Confidential | | Date | Department | Sign |
| Designed by | | Wolfgang.weisser@continental-corporation.com | 09.12.2016 | I CVAM |
| Released by | | XX-XX-XX | I CVAM | |
|  | Designation | | | |
| | FunctionalOverview RE BOBCAT-DIS-NGD V1.3.docx (V1.3) | | | |
| Document key | | Pages | | |
| | | 17 of 21 | | |
| Continental AG, Continental Automotive GmbH | | Copyright (C) Continental AG 2008 | | A4 : 10097480 SPD 000 AC |

Functional Overview - BOBCAT DIS NGD

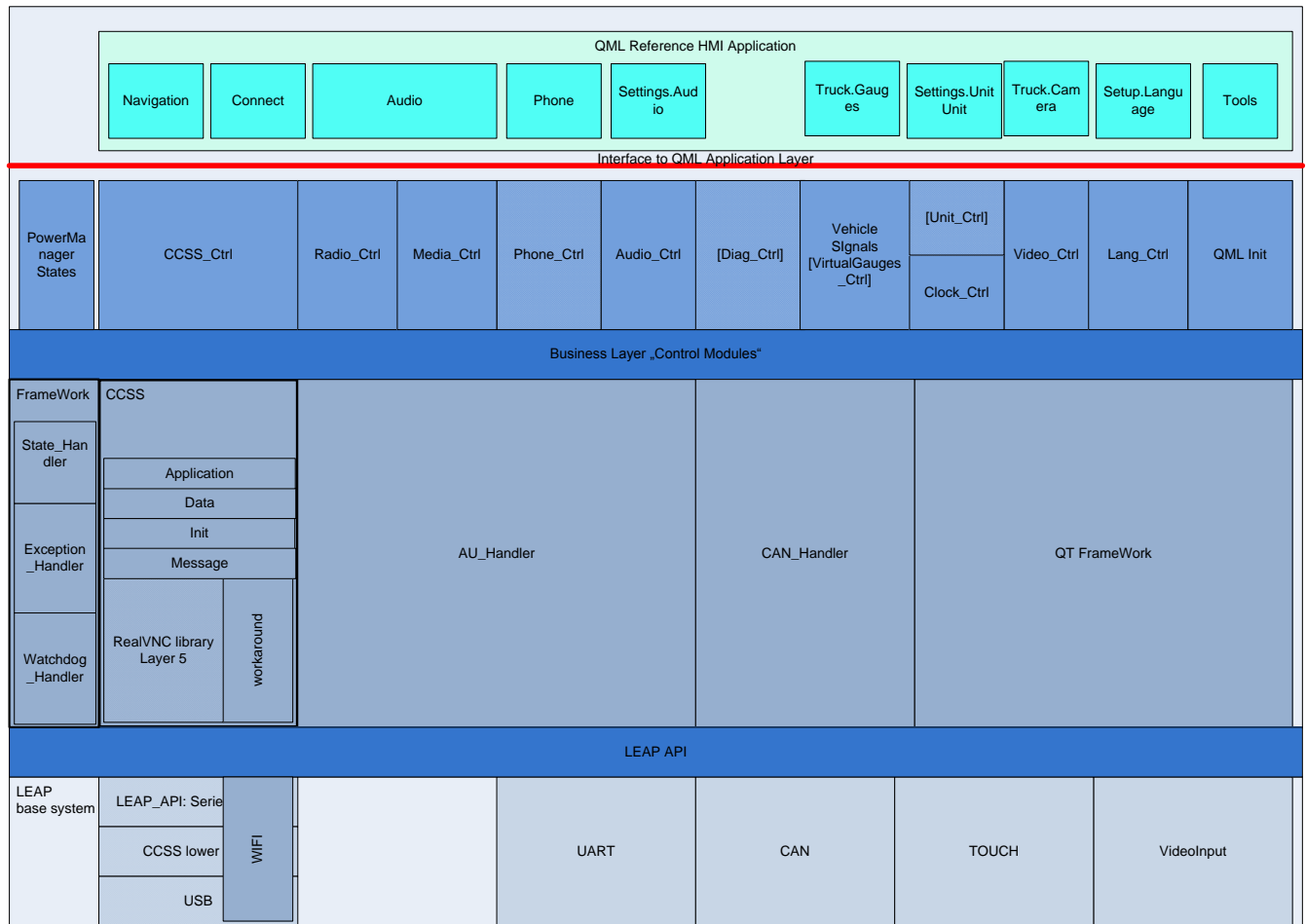


Transmittal, reproduction, dissemination and/or editing of this document as well as utilization of its contents and communication thereof to others without express authorization are prohibited. Offenders will be held liable for payment of damages. All rights created by patent grant or registration of a utility model or design patent are reserved.

The multimedia middleware component resides on top of LEAP provides Qt based signals and slots, so that all features of the base SW can be used inside the Qt framework using QML. The architecture of the middleware is shown in the following diagram:

| | | | | |
|--|--|-------------------------------------|------------|--------------------------|
| Confidential | | Date | Department | Sign |
| Designed by Wolfgang.weisser@continental-corporation.com | | 09.12.2016 | I CVAM | |
| Released by | | XX-XX-XX | I CVAM | |
| | Designation FunctionalOverview RE BOBCAT-DIS-NGD V1.3.docx (V1.3) | | | |
| | Document key | | | Pages 18 of 21 |
| Continental AG, Continental Automotive GmbH | | Copyright (C) Continental AG 2008 | | A4 : 10097480 SPD 000 AC |

Functional Overview - BOBCAT DIS NGD



Transmittal, reproduction, dissemination and/or editing of this document as well as utilization of its contents and communication thereof to others without express authorization are prohibited. Offenders will be held liable for payment of damages. All rights created by patent grant or registration of a utility model or design patent are reserved.

4.2.3.1 Safety requirements

Error correcting code (ECC) mechanism shall be implemented for RAM access.

If a non correctable ECC fault is identified during RAM access, the following steps to be performed

- Perform uC reset
- Set error flag
- Remain in fail safe state

Error correcting code (ECC) mechanism shall be implemented for Flash memory access.

If ECC fault is identified during Flash memory access, memory correction shall be performed for 1 bit failures.

Monitoring of safety related code execution (PFM) shall be performed by BSW.

If PFM detects a failure, the following steps to be performed

| | | | | |
|---|--|-------------------------------------|------------|--------------------------|
| Confidential | | Date | Department | Sign |
| Designed by | Wolfgang.weisser@continental-corporation.com | 09.12.2016 | I CVAM | |
| Released by | | XX-XX-XX | I CVAM | |
| | Designation FunctionalOverview RE BOBCAT-DIS-NGD V1.3.docx (V1.3) | | | |
| | Document key | | | Pages 19 of 21 |
| Continental AG, Continental Automotive GmbH | | Copyright (C) Continental AG 2008 | | A4 : 10097480 SPD 000 AC |

Functional Overview - BOBCAT DIS NGD

- Perform uC reset
- Set error flag
- Remain in fail safe state

Monitoring using internal watchdog shall be implemented in BSW.

If watchdog fault is detected, the following steps to be performed

- Perform uC reset
- Set error flag
- Remain in fail safe state

If DI2 and DI5 is implemented as switched to GND, BSW shall be able to detect short to battery error condition in the respective input pins.

BSW shall be able to control and detect the status of DO2 output pin.

When DI2/DI5 input pin is not active for at least 200mSec in normal operation state, Display controller shall send 00(OFF) as the value for the corresponding input via vehicle CAN.

When DI2/DI5 input pin is active for at least 200mSec in normal operation state, Display controller shall send 01(ON) as the value for the corresponding input via vehicle CAN.

If short to Battery error is detected in DI2/DI5 input, the corresponding CAN parameter value shall be transmitted as 10(Error) via vehicle CAN.

If Display controller is in under voltage or over voltage state, the CAN parameter value of DI2 and DI5 shall be transmitted as 10(Error) via vehicle CAN.

If DO2 CAN parameter value is 00, DO2 output shall be disabled(inactive).

If DO2 CAN parameter value is 01, DO2 output shall be enabled(active).

If DO2 CAN parameter value is 11, DO2 output shall be retained as last value.

If Vehicle CAN bus communication is not available, the last state shall be retained.


If DO2 CAN parameter value is 10, DO2 output shall flash at the rate of 1 Hz.

When Display controller is in Under voltage, Over voltage state or fail safe state, DO2 output shall be disabled(inactive) despite the value received via CAN.

Display controller shall transmit the status(01-ON, 00-OFF) of DO2 output via CAN based on output sensing.

If DO2 output error is detected, DO2 status shall be transmitted as 10 via vehicle CAN.

Transmittal, reproduction, dissemination and/or editing of this document as well as utilization of its contents and communication thereof to others without express authorization are prohibited. Offenders will be held liable for payment of damages. All rights created by patent grant or registration of a utility model or design patent are reserved.

| | | | | |
|---|--|-------------------------------------|------------|--------------------------|
| Confidential | | Date | Department | Sign |
| Designed by | Wolfgang.weisser@continental-corporation.com | 09.12.2016 | I CVAM | |
| Released by | | XX-XX-XX | I CVAM | |
|  | Designation FunctionalOverview RE BOBCAT-DIS-NGD V1.3.docx (V1.3) | | | |
| | Document key | | | Pages 20 of 21 |
| Continental AG, Continental Automotive GmbH | | Copyright (C) Continental AG 2008 | | A4 : 10097480 SPD 000 AC |

Functional Overview - BOBCAT DIS NGD

4.2.4 DISPLAY CONTROLLER Subsystem – MultiViu Media Reference Application

MultiViu Media comes along with a reference implementation of an HMI using Qt 5 as a framework. Qt 5 offers a scripting language with JavaScript syntax. By this, HMI development can be performed clean and efficiently as design and logic of the application can be controlled at one place. For optimized performance Qt 5 is using OpenGL. So, the underlying HW acceleration is used.

The feature set of the reference application is covering the main functionality of the MultiViu Media middleware for demonstration purposes.


4.3 SW deliverables

MultiViu Media will be delivered with:

- Leap base SW and multimedia middleware as object libraries configured and integrated for the project hardware
- QML based reference application in source code
- Target compiler
- Tool to configure the CAN database.

Note: the build environment is Linux. Qt Creator is open source and can be used on Linux/Windows/Mac.

Transmittal, reproduction, dissemination and/or editing of this document as well as utilization of its contents and communication thereof to others without express authorization are prohibited. Offenders will be held liable for payment of damages. All rights created by patent grant or registration of a utility model or design patent are reserved.

| | | | | |
|---|--|-------------------------------------|------------|--------------------------|
| Confidential | | Date | Department | Sign |
| Designed by Wolfgang.weisser@continental-corporation.com | | 09.12.2016 | I CVAM | |
| Released by | | XX-XX-XX | I CVAM | |
|  | Designation FunctionalOverview RE BOBCAT-DIS-NGD V1.3.docx (V1.3) | | | |
| | Document key | | | Pages 21 of 21 |
| Continental AG, Continental Automotive GmbH | | Copyright (C) Continental AG 2008 | | A4 : 10097480 SPD 000 AC |