

Document: **Functional Description**

Product: Radio Frequency Receiver

Project name: BCM Sweet 400

Model: **BCMS400**

Date: February 11, 2019

Internal

	Name:	Department:	Phone:	Date:	Sign:
Author:	C. Prince	A HEAT CE		28/03/2022	
1. Check:	J. Lee	A HEAT CE			
2. Check:	L. Weigert				
Responsible:	F. Marou				

## VERSIONS LIST

Version	Date	Author	Comment, Description
V1	28/03/2022	C. Prince	Creation
V1	21/08/2023	L. Weigert	Model name on first page improved
V1	25/10/2023	L. Weigert	Model name on last page improved
V1	28/11/2023	L. Weigert	FCC notice entry

## RELATED DOCUMENTS

Document	Version	Date	Author	Comment, Description

## ABBREVIATION REGISTER

Abbreviation	Description
As	Assistant
ASK	Amplitude Shift Keying
BCM	Body Control Module
CW	Continuous Wave
DR	Driver
FCC	Federal Communication Commission
FSK	Frequency Shift Keying
LF	Low Frequency
RF	Radio Frequency
RKE	Remote Keyless Entry
TPMS	Tire Pressure Monitoring System

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## 1 Scope of Document

The aim of this document is to describe BCM S400/S410 product and system for homologation purposes.

BCM S410 is using same layout and same receiver than BCM S400. The only difference is Micro memory which is 4MB for BCM S400 and 8MB for BCM S410.

For simplification purposes, BCMS400 will be used for both BCM S400 and S410 products in this document.

## 2 General Product Information

### 2.1 Design Location

Continental Automotive France SAS  
1 Avenue Paul OURLIAC  
31036 Toulouse, France

### 2.2 Manufacturing Locations

Continental Automotive France SAS  
1 Avenue Paul OURLIAC  
31036 Toulouse, France

Continental Automotive Changchun  
1981 Wuhan Road,  
130033 Changchun, P.R.China

### 2.3 Short Description of the complete system including BCM S400

BCM S400 01 and BCM S400 02 is Body Control Module including a radio frequency receiver used in vehicle for access (RKE) and TPMS functions. BCM S400 also interfaces with Immobilizer coil and Hand Free Module (HFM). The BCM S400 communicates on CAN and LIN vehicle communication buses.

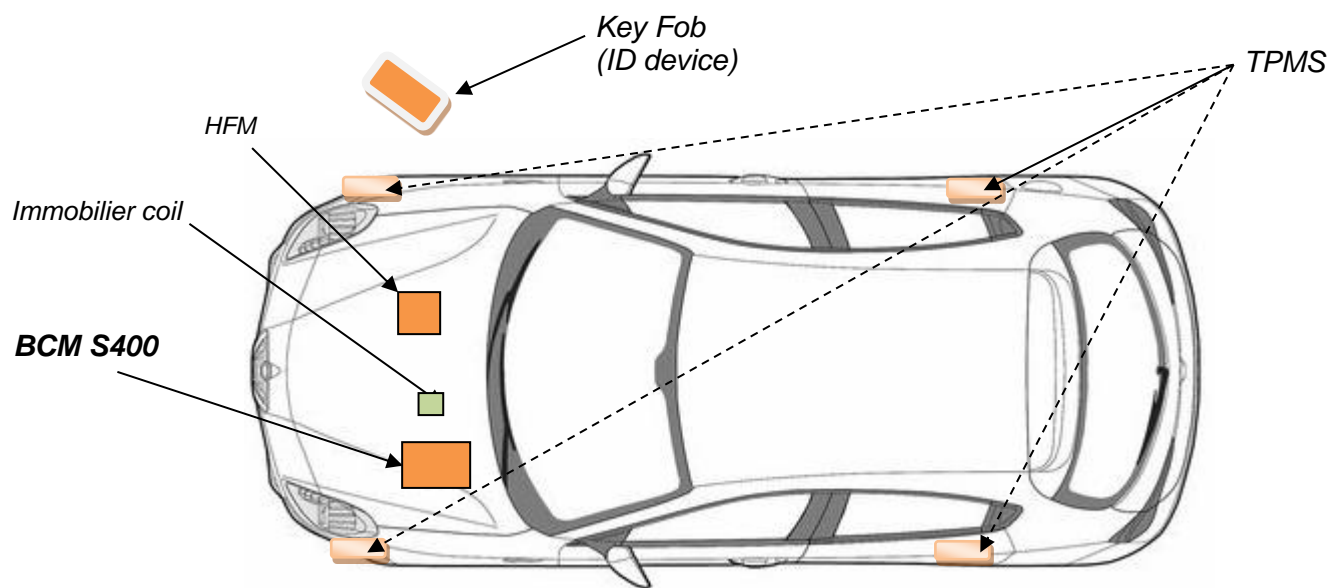
The vehicle access and TPMS system includes:

- ✓ Key fob (ID device), which is not part of the Homologation
- ✓ Tire Pressure Monitoring Sensor (TPMS), which is not part of the Homologation
- ✓ Immobilizer coil which is not part of the Homologation
- ✓ Hand Free Module which is not part of this Homologation
- ✓ Body Control Module (BCM)

It includes an integrated RF receiver for 433.92 MHz or 315 MHz frequencies. The receiver is designed in direct placement and the BCM integrates a RF printed antenna.

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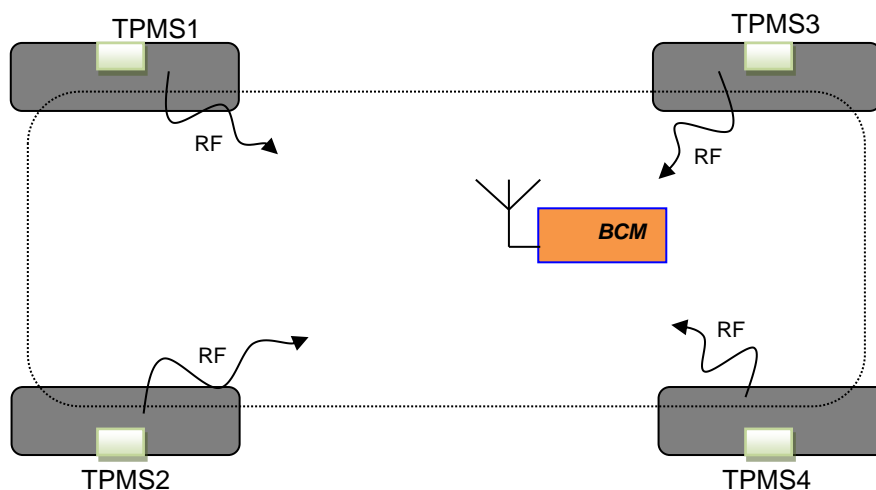
## 2.4 System overview



## 3 Functions Variants

### 3.1 TPMS (Tire Pressure Monitoring System)

#### 3.1.1 System explanation



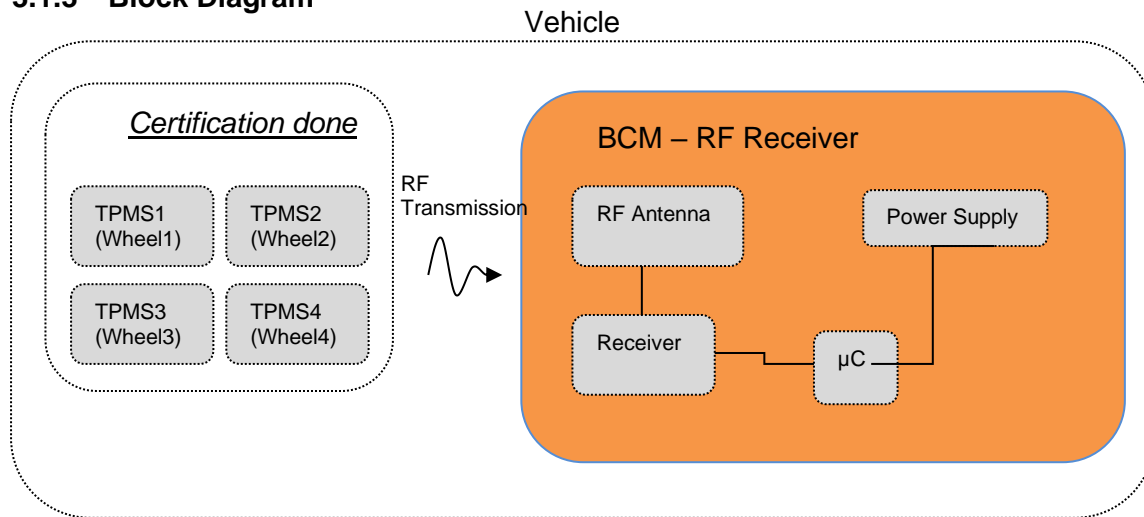
To control the wheels pressure of vehicle, the Tire pressure sensor (certificate done) transmit information to the BCM by RF. The BCM decodes the signal (with RF Receiver) and transmit data on SPI bus.

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### 3.1.2 Protocol

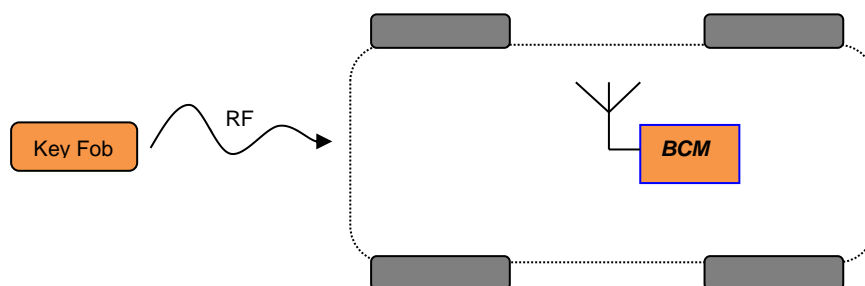
RF Parameter	Comments	Units
Type	RF Receiver	-
RF Frequency	315 or 433.92	MHz
DATA Rate	9.6	kbps
RF Modulation	FSK	-

### 3.1.3 Block Diagram



## 3.2 RKE (Remote Keyless Entry System)

### 3.2.1 System Explanation



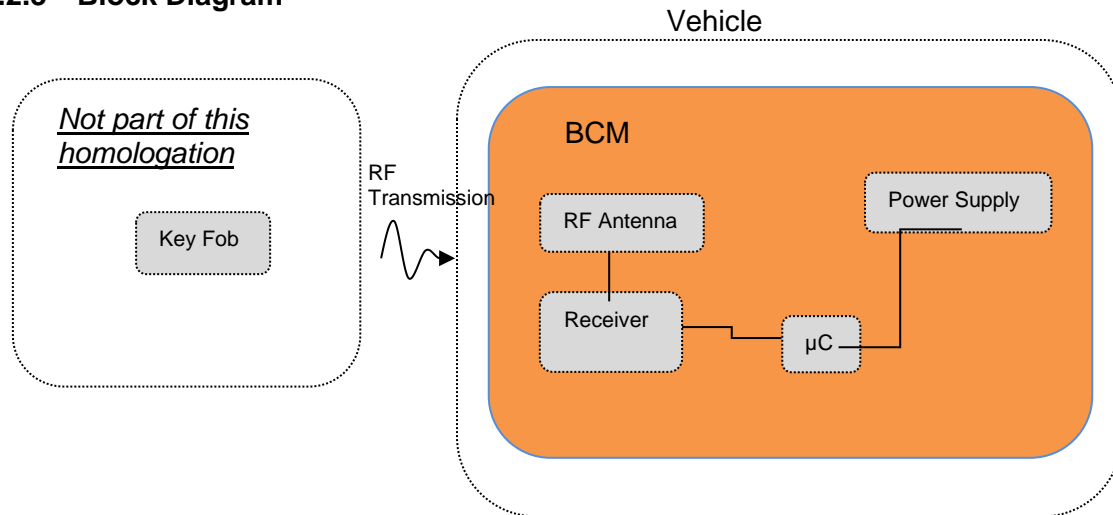
To remotely lock and unlock the vehicle, the RKE function is implemented in the system. The Key Fob transmits to the receiver an order. That it transmits on the CAN bus and allows to achieve function.

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### 3.2.2 Protocol

RF Parameter	Comments	Units
Type	RF Receiver	-
RF Frequency	315 or 433.92	MHz
DATA Rate	9.6	kbps
RF Modulation	FSK	-

### 3.2.3 Block Diagram



## 4 Technical description

### 4.1 BCM S400 Block Diagram

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## 4.2 RF Receiver definition and overview

- The BCM S400 RF Receiver is based on the NCK2910 integrated circuit (IC) Receiver (from NXP):

The IC NCK2910 is a fully integrated single-chip receiver based on a low IF Weaver architecture. The device incorporates several commonly used building blocks including a crystal stabilized oscillator, a fractional-N based Phase Locked Loop (PLL) for accurate frequency selection, Low Noise Amplifier (LNA), attenuator for Automatic Gain Control (AGC), I/Q down-mixer and two high resolution Analog to Digital Converters (ADC). The conversion into the digital domain is done in an early phase, enabling a software defined radio like approach. To achieve a low average system current consumption, the device offers a fully autonomous RF polling. When an incoming signal fulfils the selected criteria, the host processor is alerted by an interrupt and data payload is available from the internal memory. Then the data can be read by SPI communication bus.

Following are the RF receiver parameters of the BCM S400 01 and BCM S400 02:

- The RF receiver module is designed to handle the following features:

Functions	RKE / TPMS	
Market	US / EUR / KOR	JPN
Frequency	433.92 MHz	315 MHz
Coding	Manchester	
Data Rate	9,6Kbps	
Modulation	FSK [+/- 40 kHz deviation]	
Conducted Rx sensitivity MER 10%	Min.: -103 dBm Typ.: -106 dBm	

- The receiver is configured for supporting RF data rate of 9.6 Kbit/s.
- The receiver is configured for supporting Manchester data coding.
- The receiver is configured in self-polling mode whatever the system state (Low power, high power, IGN ON/OFF, engine ON/OFF) except during RKE/TPMS frames treatment (receiver ON for RF reception window) and during driving for TPMS (receiver is ON).
- The receiver is configured to comply with the RKE protocol particularly, to handle a RKE Wake Up Pattern of minimum 400 bits.
- The receiver is also configured to comply with the TPMS protocol defined in the system specification.
- The RF receiver is in self polling mode (with double polling period than normal mode) during the delivery mode.
- The RF antenna is integrated in the BCM S400 and it is a PCB printed antenna.

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### 4.3 RF Rx Antenna parameters

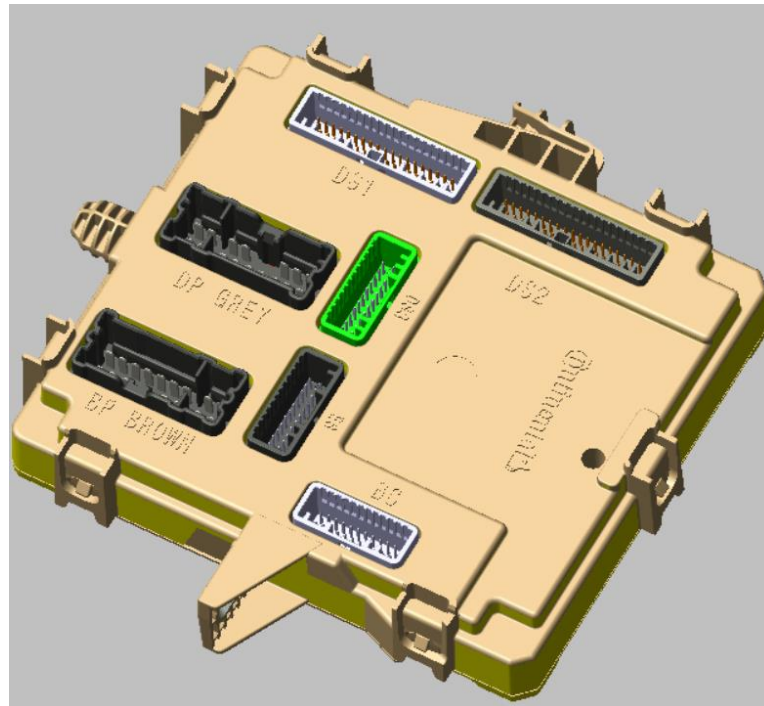
Antenna Model: BCM S400 01\_433M92  
 Rated operating frequency: 433.92 MHz  
 Operating Temperature range: - 40°C to 85°C  
 Antenna type: Printed circuit board antenna trace structure (electrical field antenna)  
 Antenna Brand: Continental  
 Antenna gain: max.: - 1 dBi

Antenna Model: BCM S400 02\_315M  
 Rated operating frequency: 315 MHz  
 Operating Temperature range: - 40°C to 85°C  
 Antenna type: Printed circuit board antenna trace structure (electrical field antenna)  
 Antenna Brand: Continental  
 Antenna gain: max.: - 3 dBi

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## 5 Pictures of the product

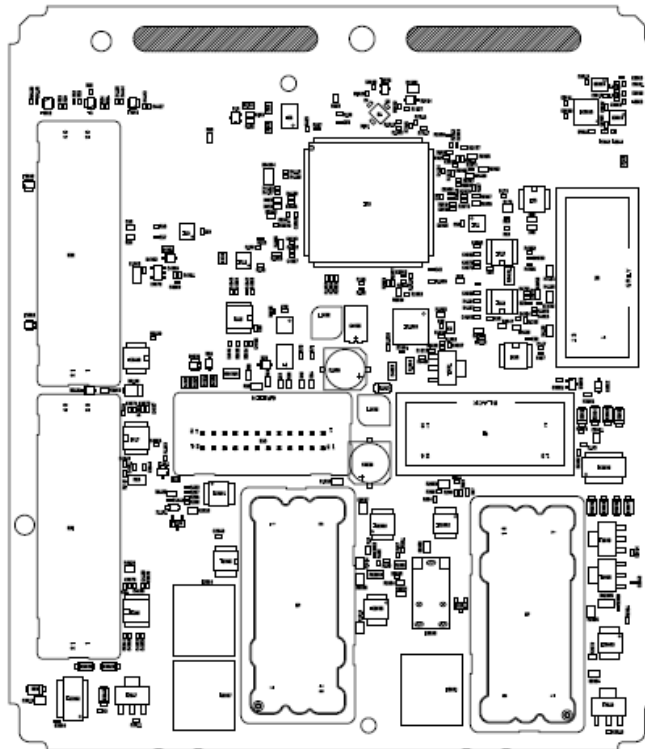
### 5.1 Exploded view



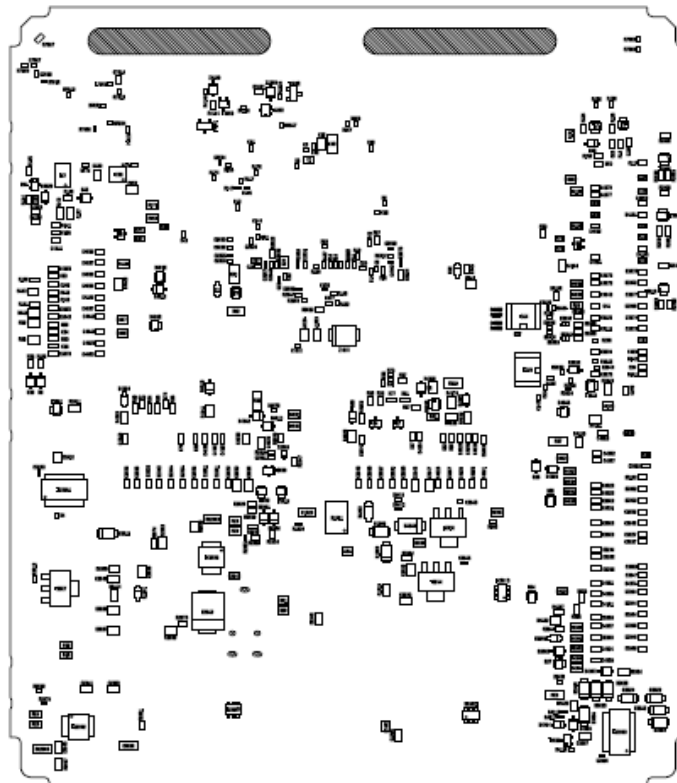
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## 5.2 PCB overview

TOP Layer



BOTTOM Layer



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## 6 Product Variants (To be updated)

<i>Product version</i>	<i>CONTINENTAL part number</i>

## 7 Homologation reference Model numbers

<i>Product variant</i>	<i>Model number:</i>
BCM S400 433.92MHz variants	BCM S400
BCM S400 315MHz variants	BCM S400 02

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**NOTICE for FCC certification:**

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 made to this equipment not expressly approved by Continental Automotive Technologies GmbH may void the FCC authorization to operate this equipment.

*Note: 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.

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END OF DOCUMENT

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