Annex acc. to FCC Title 47 CFR Part 15
relating to
Hirschmann Car Communication GmbH
920510A

Annex no. 5
User Manual
Functional Description

Title 47 - Telecommunication
Part 15 - Radio Frequency Devices
Subpart C – Intentional Radiators
ANSI C63.4-2014
ANSI C63.10-2013

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920510A

Transceiver Remote Control

User's manual / Operational Description

2.61

	Name, Department	Date	Sign
Author	J. Nebel, ODA		
Release			
Distrib	--		

1 Table of Contents

2 Change history

Datum	Chapter	Change	Author	Version
01.03.2017	all	initiale release	Nebel	V1.0
18.05.17	all	mods	Nebel	V1.1

3 User information

3.1 FCC

Section 15.19 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.

Section 15.21 statement:
Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

3.2 IC

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:
(1) this device may not cause interference, and
(2) this device must accept any interference, including interference that may cause undesired operation of the device.

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

4 Overview

4.1 Block diagram

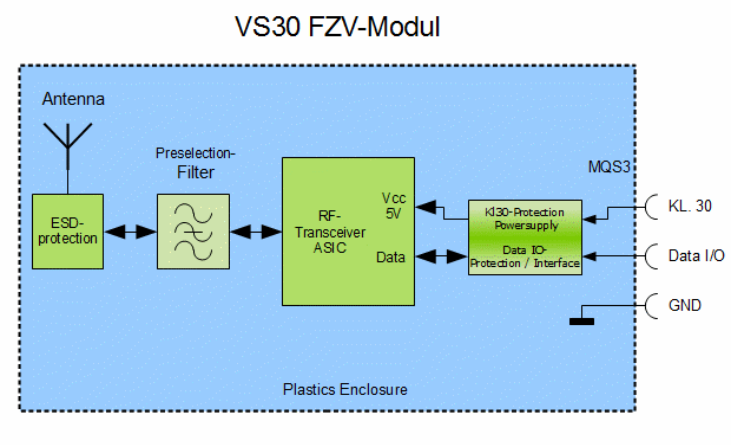

Figure 1: Blockdiagram of the remote control circuit

4.2 Functional description

The RF-Signal is received/transmitted by the integrated antenna and is filtered by a bandpass. An integrated circuit contains the complete transceiver and antenna switch.
The received signal is matched to the an LNA input, demodulated and transmitted via a digital interface to the ECU. The implemented µC configures PLL and the RF-frontend to create an output signal and sets the antenna switch according to the receive/transmit mode.
Received or transmitted signal is limited in bandwidth by a SAW filter.
Both use the same antenna.

4.3 Installation

The remote control box is installed inside a vehicle and behind the cabin cover. Only service personel is able to touch or handle it.

4.4 Operating temperature range

-40 … +85°C

4.5 Interface

- Supply Voltage (+12V)
- RF-Interface: integrated antenna
- Data-Interface 1-wire [bidirectional, digital, open-collector]

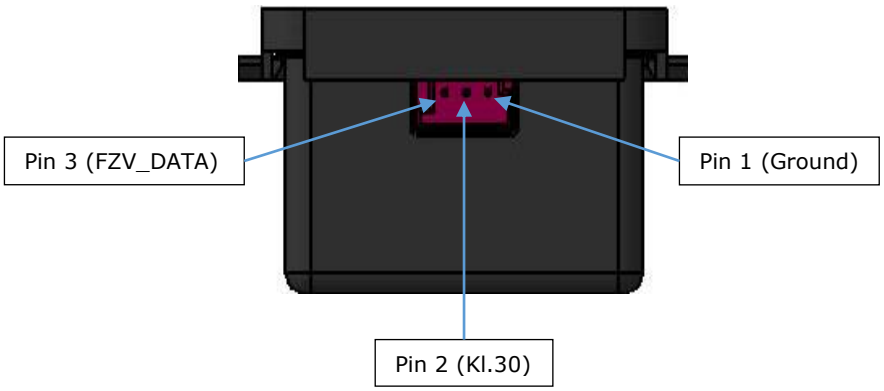

Figure 2: View of the Remote Control Module connector

5 Operational characteristics

5.1 General Information

parameter		**min**	**max**	
Supply voltage		10	14	V
Current consumption	Cyclic for 55ms pre-signal, 3 channels (f_0-450kHz, f_0, f_0+450kHz)		700	µA
Current consumption when strong interfering signals	Cyclic for 55ms pre-signal, 3 channels (f_0-450kHz, f_0, f_0+450kHz) interfering signals > -40dBm		900	µA
Current consumption (TX)	@+10dBm output power @ 50Ohm		40	mA
Frequency range	ECE USA	433,44 313,98	434,40 314,92	MHz

5.2 Receiver

Receiver category 2 EN300 220-1.

parameter		**min**	**max**	
Sensitivity	Matched to 50 Ohm Symbol rate: 10kBaud Manchester FSK-Modulation ±10kHz deviation		-98	dBm
Blocking (ratio of interfering signal to power of receiving signal)	≥ 150 kHz		≥ 30	dB
	≥ 225 kHz		≥ 40	dB
	≥ 450 kHz		≥ 45	dB
	≥ 800 kHz		≥ 50	dB
	≥ 1500 kHz		≥ 60	dB
	≥ 2500 kHz		≥ 70	dB
	≥ 5000 kHz		≥ 80	dB

5.3 Transmitter

parameter		**min**	**max**	
Transmit power	ECE	+5	+10	dBm
	USA	+0	+6	dBm

Conducted measurement of the transmit power

5.4 Transmission

5.4.1 Data rates

for digital 1-wire and RF:

10 kBit / sec ≤ ±1,0 %

5.4.2 Modulation

Frequency modulation FSK (shifting between two discrete frequencies) with a deviation of 10kHz.

5.4.3 Channel definition

The following table shows the center-frequencies for each channel.

The frequency-separation between two adjacent channels is 450 kHz.

Channel name		**Center-frequency**
name	**Short name**	
channel 1	CH1	USA/JAP: 314,00 MHz ECE: 433,47 MHz
channel 2	CH2	USA/JAP: 314,90 MHz ECE: 434,37 MHz
channel 3	CH3	USA/JAP: 314,45 MHz ECE: 433,92 MHz

table 1: center frequencies of all channels

5.4.4 Carrier frequency

The carrier frequency has a tolerance (including influences because of temperature, aging, manufacturing tolerance) of:

ECE: 433,47 MHz ± 70ppm, 433,92 MHz ± 70ppm, 434,47 MHz ± 70ppm

USA, Japan: 314,00 MHz ± 80ppm, 314,45 MHz ± 80ppm, 314,90 MHz ± 80ppm

5.5 Frequency creation and Frequency stability

The RF-frequencies are created with a fractional N PLL (phase locked loop). The frequency of the local oscillator is controlled by the fractional N Synthesizer. The discrete channel-frequencies are configured by digital settings

- The RX and TX- frequency deviation is ±10 kHz
- The RX intermediate frequency (IF) is 250kHz.
- RX receiver channel bandwidth is 165kHz.
- The PLL is referenced to a crystal oscillator
- The crystal oscillator (XTO) is operated at f_{XTO} = 24,2879 MHz
- The tolerance of the crystal is ±70ppm.

5.6 Further signal-sources (clock generators):

- Slow RC Oscillator: f_{SRC}=125kHz ±5% Sleep Time reference in polling mode.
- Fast RC Oscillator: f_{FRC}=6.36MHz±10% System clock reference CPU.

5.7 ON / OFF State of Oscillators in dependency of operating mode

- Polling cycle time : 50ms
- active (without signal): t_{AKTIV}= 3.05ms (typ.)
- Sleep-phase: t_{Sleep}=46.95ms (typ.)

Operating mode =>	Init	Polling		TX-Mode	RX-Mode
		active	sleep		
XTO Oscillator (f_{XTO}=24,2879MHz)	off	on	off	on	on
FRC Oscillator (f_{FRC}=6.36MHz)	on	on	off	on	on
SRC Oscillator (f_{SRC}=125kHz)	off	off	on	off	off

6 Operational procedures

After connecting supply voltage, the module is **NOT** in normal operating mode.
To get the module into normal operating mode (polling mode):

- Connect supply voltage (12V) and GND
- Pull the data line to GND for a short time (>5ms)