



Fixed Reader
Brief Operational Description

GE CommerceGuard AB

Prepared (Also subject responsible if other) Ola Myrin	Date 2006-08-21	Security Class Confidential		
Approved	Document No.	Rev. A	1 (5)	

Fixed Reader (CG-FR03)
Brief Operational Description



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1 Background

The CommerceGuard Fixed Reader is an Ethernet to RF transceiver. Its external connectors are

- Two N style antenna connectors
- One Ethernet connector that also contains 12VDC power supply to the unit.

The circuit board contains a microprocessor, DC/DC converter, two 2.44GHz radios, ethernet controller, glue logic and memory.

The Fixed Reader is used to scan for CSDs. When communications is established with a CSD, the Fixed Reader translates the 2.44GHz into Ethernet protocol that can be utilized by an external host.

The Fixed circuit board utilizes a 4-layer configuration that optimizes the RF performance using appropriate ground planes.



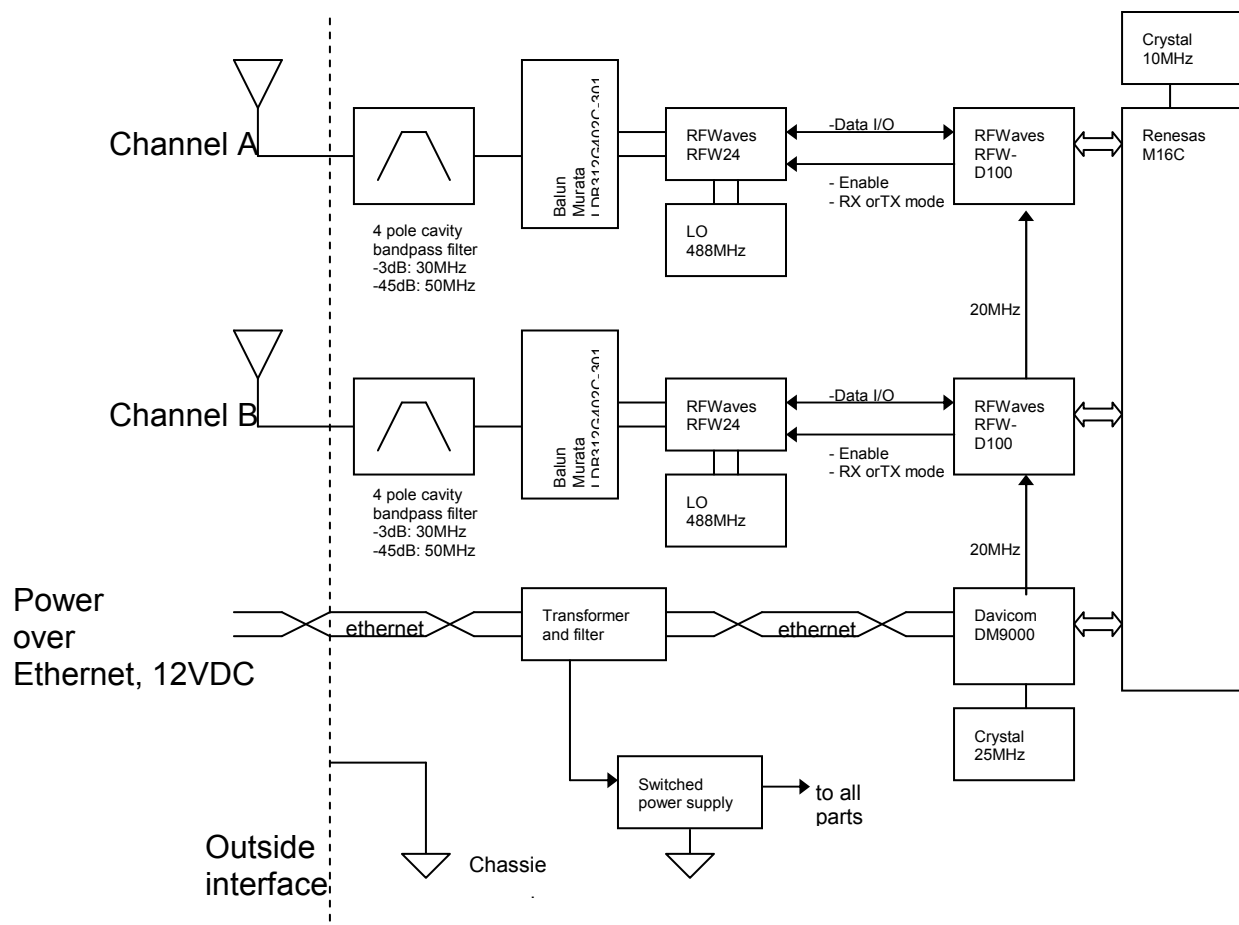
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2 Block Diagram





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3 Operational Description

Microcontroller

The microcontroller is a 16-bit MCU. It controls all functions on the board. It has a 10.000 MHz crystal and an internal PLL that multiply the external clock by 2 so the core is running at 20MHz.

A 32 Mbit memory is accessed through the 16bit data bus.

Extra glue logic is used to create extra chip select signals.

Ethernet controller, Davicom

The ethernet controller takes care of the ethernet communication.

It has a 25.000 MHz crystal and provides a divided down signal of 20.000 MHz on an output. The radio base band chips use this 20MHz signal.

Start-up parameters are stored in an EEPROM connected to the ethernet controller.

Three LEDs are available for link status information.

Ethernet transformer

The ethernet transformer isolates the Fixed reader and filters the signal.

A diode network adds ESD protection.

DC/DC converter

A diode bridge protects the Fixed reader from wrong polarity.

The DC/DC converter is a buck-converter with a good filter capacitor on the input.

The down converted voltage is distributed to three LDOs that regulates the voltage to 3.3V and increase the isolation between the different loads.

A voltage monitor creates a good power signal and resets the fixed reader if the digital system voltage drops below 3.0V.

Radio and baseband (RFWaves RFW122M and D100)

The MCU communicates with the D100, which control the RFW122M.

The D100 is a baseband circuit that takes care of the low-level part of the radio protocol, it adds and controls checksum, adds pre-amble etc). It puts the RFW122M in RX or TX mode. It receives (RX) serial data or transmits (TX) serial data. A 20 MHz signal from the ethernet chip is used to run the D100.



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The RFW122M is a pre-fabricated PCBA with components that is mounted onto the Fixed reader PCB. This module contains IF filter with matching, RFIC and LO resonator. The RFIC contains a LNA, a PA. They all have a fixed performance that can't be changed. The LO is operating at a fixed frequency of 488 MHz.

The LO frequency is multiplied by four and mixed with the IF to create the carrier at 2440 MHz. The occupied bandwidth of this signal is approx 20MHz for 99% of the power within the measured bandwidth.

The RFIC also outputs an analogue signal strength indicator that is sampled by the MCU.

The balanced I/O of the RFW122M is converted to single ended by the balun.

A 5bit, 1dB resolution step attenuator is used to set the output power at production.

An external PA is used to increase the output power at the antenna.

An external LNA is used to increase the receiver sensitivity.

The VSWR detector is used to detect a missing/faulty antenna.

The 4-pole cavity filter has an extremely sharp roll off and attenuates all spurious frequencies outside the 2400 to 2483.5 MHz band.

Abbreviations

IF	Intermediate frequency
LDO	Low Drop Out (voltage regulators)
LEDs	Light Emitting Diodes
LNA	Low Noise Amplifier
LO	Local Oscillator
PA	Power Amplifier
PCB	Printed Circuit Board
PCBA	Printed Circuit Board Assembly
RFIC	Radio Frequency Integrated Circuit
VSWR	Voltage Standing Wave Ratio