

Public Safety Cross Band Communications Platform

700 MHz
Solution

“RF to Ethernet” Solution For Public Safety Application Providers



Need a solution that bridges the 700 MHz frequency band? Spectrum’s Public Safety Cross Band Communications Platform enables rapid deployment for public safety and commercial application providers. Most importantly, the platform supports interoperable, resilient and durable communications across first responder services in times of emergencies such as natural disasters, major incidents, and terrorist acts.

Your Challenges

Do you face any of these challenges as a provider of public safety solutions?

- Deploying new or enhanced features for first responder services
- Communicating across multiple first responder frequencies bands
- Developing a solution for the 700 MHz band that can satisfy public safety and commercial requirements
- Accessing spectrum on demand at an incident scene requiring a multi-jurisdictional response
- Interoperating with non-public safety organizations such as the National Guard and foreign services
- Minimizing the cost of future technology upgrades
- Operating in spectrally limited environments, such as dense urban areas

Spectrum's Solution

Spectrum’s *flexComm*™ Public Safety Cross Band Communications Platform can help you overcome your challenges:

- Develop on a deployment grade “RF to Ethernet” subsystem with a complete software stack and development tools.
- Spectrum’s software defined radio (SDR) platform offers allows a single hardware configuration to support multiple waveform applications.
- The standard RF front end available with the platform enables cross band operation on frequencies from 350 to 800 MHz and from 4.940 to 4.990 GHz.
- Support for cognitive radio functionality allows the radio to sense its RF environment and location, and alter its power, frequency, modulation and other operating parameters to dynamically use the available radio spectrum.
- Spectrum’s SDR platform can operate across a broad range of frequencies.
- The modular architecture of the platform eases technology refresh, allowing replacement of partial components or upgrades done via software versus a forklift upgrade to the entire system.
- Spectrum’s solution can support Multiple Input/Multiple Output (MIMO) technology for improved performance in urban environments.

Description

Spectrum’s Public Safety Cross Band Communications Platform uses SDR technology to enable interoperable communications across multiple radio frequencies allowing first responder services to share critical information. The SDR architecture of the solution supports advanced communications capabilities such as MIMO and cognitive radio that enables efficient use of available frequency spectrum. The wireless communications platform is compact and can be ruggedized for operation in many types of harsh environments, allowing rapid deployment in a disaster area when primary communication systems are rendered inoperable.

The platform is a commercial-off-the-shelf solution integrating a high performance IF and baseband processing subsystem with two independent RF subsystems: one operating in the Ultra High Frequency (UHF) band between 350–800 MHz, and one operating in the 4.9 GHz public safety band.



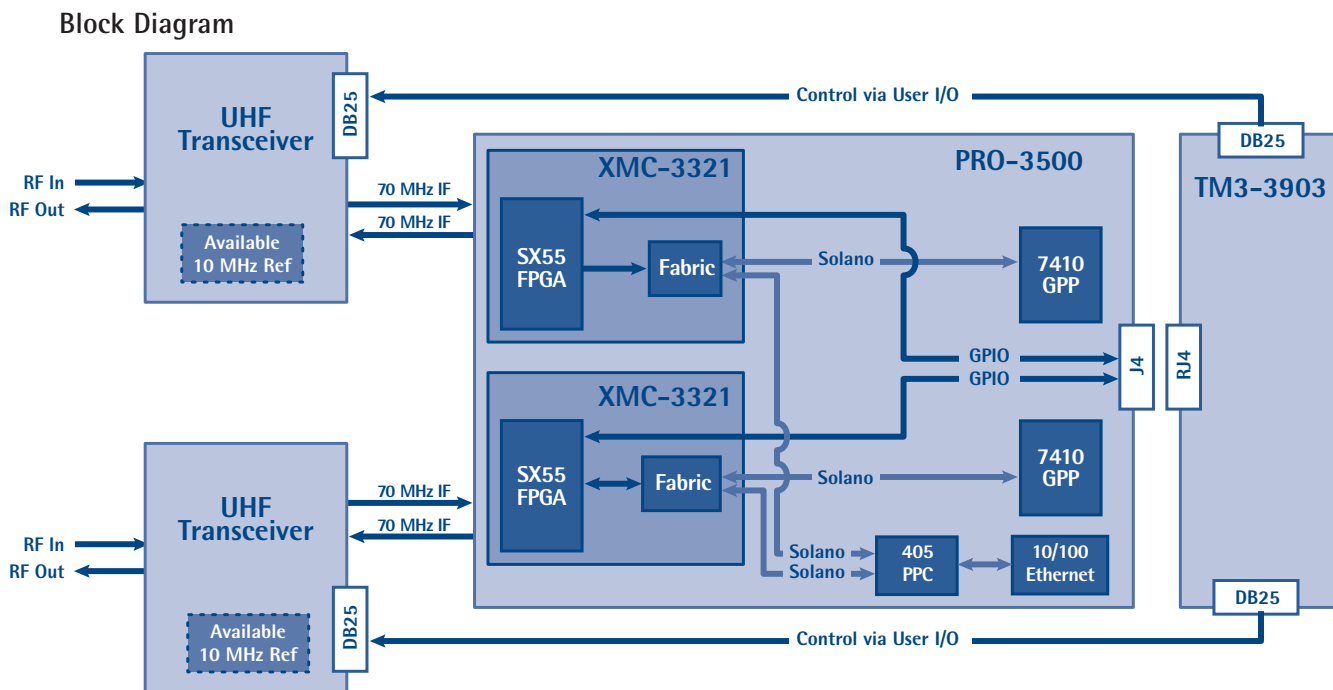


Figure 1. Public Safety Cross Band Communications Platform Block Diagram

Architecture

The *flexComm* Public Safety Cross Band Communications Platform integrates a crossband RF transceiver subsystem, a high performance IF and baseband signal processing platform and a complete software operating environment.

[RF Transceiver Subsystem]

The RF Transceiver Subsystem is provided by TRL Microwave Technology Inc., a designer and manufacturer of microwave components and systems since 1987. The RF Transceiver Subsystem consists of two spectral ranges: the 350-800 MHz TRL TR4575, and the 4.9 GHz TRL T4965. Both transceivers offer Simplex capabilities at their respective RF frequencies, and communicate with the IF and Baseband Signal Processing Subsystem using a 70 MHz IF. Each unit includes a remote control interface, allowing full configuration of the unit features from the IF and Baseband Signal Processing Subsystem. These programmable features include channel bandwidth selectability (see individual specifications), digital gain control, and tuning frequency selection. Each unit can also accept a 10 MHz external PLL reference clock, or can run on its own internal reference. Unit specifications are suited for public safety frequency band operation. Front panel control and an ample supply of status indicators are present, facilitating development and on-site diagnosis.

[IF and Baseband Signal Processing Subsystem]

The SDR-3000 signal processing platform family was designed specifically for the requirements of software defined radio communications applications. It integrates heterogeneous processing elements (FPGAs, GPPs and DSPs (optional) seamlessly using a high performance embedded communication fabric. The Public Safety Cross Band Communications Platform uses two of Spectrum's XMC-3321 dual transceiver modules that sit upon the mezzanine sites of the PRO-3500 baseband processing engine. Each XMC-3321 provides one IF input and one IF output connected to the RF subsystem. These modules can be changed based on the application needs. Please contact Spectrum Sales for more information.

More details on the SDR-3000, PRO-3500 and XMC-3321 can be found at www.spectrumsignal.com/products/sdr.

Operation

The RF subsystem consists of two Simplex transceivers; the TR4575 for the 350-800 MHz band, and the TR4965 for the 4.940-4.990 GHz band. Each of the two RF transceivers is connected to one XMC-3321 FPGA and IF transceiver XMC module, mounted on the PRO-3500 baseband processor board.

During normal operation, the RF subsystem is controlled by user software, using an API on a PowerPC processor on the PRO-3500 board. The API provides control of gain, frequency, transmit/receive switching and bandwidth selection (on the TR4965). The physical control interface is implemented on the user FPGA on the XMC-3321, with GPIO pins routed out through the TM3-3903 transition module to a rear-panel DB25 connector, and a cable to the TR4965 or TR4575 transceiver.

A front-panel pushbutton interface is also provided for manual control, generally used for testing. An LCD display shows frequency and attenuation setting, and LEDs provide status information.

Fine tuning of the frequency setting is achieved through a combination of coarse tuning of the RF subsystem and fine tuning of DDC and DUC cores on the FPGA processor. IF data flows through the FPGA processor allowing for precise control of data burst insertion or acquisition.

GPS absolute time via IRIG-B and 10 MHz reference are available as an option, and can be used to time stamp the incoming packets or to schedule outgoing packets.

Software

In addition to the base software layers (Spectrum's *quicComm*) offered in the RF subsystem and the Public Safety Cross Band Communications Platform provides other valuable software and FPGA core functionality:

- Optimized, programmable digital down converter (DDC) and digital up converter (DUC) FPGA cores interfacing to the IF
 - Fully programmable FIR coefficients on up/down converters
 - Capability to downconvert multiple channels from same digital IF (optional)
 - Highly resource-efficient cores due to serialized implementation
 - Support for time sensitive and time slotted applications through:
 - Time stamping of ADC input samples
 - Time triggering of DAC output samples
- An RF control API to manage all functionality of the RF subsystem
- A comprehensive data flow example from the RF input, through the entire signal processing chain, and back out the RF output

Source code for the RF control, DDC/DUC cores and time stamping is provided as part of the platform.

Customization

The supplied example application, including source code, shows the capability of the Radio System. Spectrum's Application Engineering Services (AES) team will help you map your air interface application to the platform and tailor the platform to your specific needs. In addition, the team's existing application software/firmware IP can be employed to speed your time to deployment.

Spectral Efficiency – The 700 MHz Band

Spectrum has a long history of providing interoperable standards-based communication subsystems for military and defense system integrators. These deployment systems require reliable, assured communications. Leverage this experience and expertise for your public safety and national networks.

The reallocation of the 700 MHz spectrum provides an opportunity for seamless, nation-wide coverage for public safety services. Utilize Spectrum's SDR technology to maximize this limited band and allow for development of next-generation capability, such as cognitive radio and/or MIMO functionality. Spectrum's integrated solutions provide the hardware, software, development tools, training and support to get you developing immediately and reduce your time to deployment.

Specifications

[export regulations]	Processors	The Public Safety Cross Band Communications Platform is subject to the export control laws of Canada.
[general]	RF Subsystems	350-800 MHz SIMPLEX TRL TR4575, 70 MHz IF 4.9 GHz SIMPLEX TRL TR4965, 70 MHz IF
	Processing Subsystem	Spectrum PRO-3500, XMC-3321 Two XMC-3321 modules, each with one IF input & output connected to the RF subsystem. One additional un-connected IF input & output available on each module. Please refer to the XMC-3321 datasheet
[UHF RF subsystem]	TR4575 Tx/Rx RF frequency TR4575 TxRx bandwidth TR4575 RF Tuning Step Size	350-800 MHz 6 MHz (3dB) 1 MHz, start at 350 MHz
[5 GHz RF subsystem]	TR4965 Tx/Rx RF frequency TR4965 RF Tuning Step Size TR4965 Tx/Rx Bandwidth	4.940 to 4.990 GHz 2.5 MHz, start at 4.940 GHz 5 MHz or 10 MHz, switchable (3 dB)
[common RF specs]	RF tuning time Digital Attenuation Control Tx/Rx IF Frequency External Reference Input RF Rx signal level range RF Tx signal output RF Mode of operation Tx/Rx switching time	<2 millisecond per tuning step 0 to 63 dB in 1 dB steps (6 bits), <1 microsecond change time 70 MHz (both Transmit and Receive) 10 MHz sinusoidal, 0 dBm +/- 3 dB. Can run on internal reference or external reference. -78.5 to -15.5 dBm 0 dBm max Simplex <3.5 microseconds
[processing subsystem]	User FPGA General Purpose Processor	Xilinx Virtex-4 4VSX55, one per XMC-3321 Two 500 MHz Freescale MPC7410 PowerPCs on PRO-3500
[external interfaces]		Please refer to the PRO-3500 and XMC-3321 datasheets
[development software]		Please refer to the PRO-3500 datasheet
[environmental]	Operating Temperature RoHS	Operating temperature range of 0 to 45 C, forced air cooling for 600 LFM Please see component level datasheets for RoHS compliance or contact Spectrum Sales.
[ordering information]	901-00001 901-00080	Public Safety Cross Band Communication Platform – 1st Platform Public Safety Cross Band Communication Platform – Recurring Platform
[additional options]	650-00141	ePMC-8311 TI DSP-based multiprocessor engine (requires an additional 600-00443 PRO-3500 carrier board)
[custom configurations]		For custom configuration options, please contact Spectrum Sales.
[future options]		Future options may be implemented at the discretion of Vecima Networks Inc. or its subsidiaries based on market demand.* RF interface to military communication systems RF interface to satellite communications systems Semi-rugged platform for mobile deployment in benign environments Direction finding