Digital PMR/LMR Products
(Private Mobile Radio/ Land Mobile Radio)

Product Information Pack
Digital PMR/LMR

Advantage

- Data capability
- Voice and data capability
- Additional features and flexibility
- Voice privacy without loss of quality
- Improved voice quality
- Greater range
- More clearly defined coverage area
- Static and noise rejection
Digital PMR/LMR

Positioning

<table>
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<tr>
<th>Market Categories</th>
<th>Example Vertical Markets</th>
<th>Digital TWR Standards</th>
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<tr>
<td>Public Safety</td>
<td>Emergency Services</td>
<td>TETRA / P25 4 Slot TDMA</td>
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<tr>
<td>Mission Critical</td>
<td>Public Transport</td>
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<td>Professional</td>
<td>Airports/Ports</td>
<td>DMR 2 Slot TDMA</td>
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<td>Business Critical</td>
<td>Local Government</td>
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<td>Rental Agencies</td>
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<td>Light Industry</td>
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Digital PMR/LMR

**Evolution**

- **dPMR (Tier 1)** conceived for:
  - European 6.25kHz FDMA standard
  - 500mW restricted to internal antenna
  - Analogue PMR446/FRS replacement
  - Licence free channels
  - Peer-to-peer use only

- **dPMR has evolved to encompass (Tier 2-3):**
  - External antenna
  - High power Tx power
  - Use on license channels
  - Repeater use
  - Trunking use

- **Other digital PMR/LMR standards are emerging similar to dPMR**
  - China, Japan, USA
Digital PMR/LMR

More than dPMR

- FDMA based 6.25kHz and 12.5kHz channel bandwidths
- European and ROW standard
  - dPMR (Tier1) - ETSI TS 102 490)
  - dPMR (Tier2/3) – ETSI TS 102 658)
- China - Digital WT
- USA – NXDN digital radio
- Japan – DCR ARIB T98 digital radio
- Other emerging systems

CMX7131/7141 is a universal digital PMR/LMR platform capable of meeting the needs of all these systems
CMX7131
CMX7141
Digital PMR/LMR Processors
Product Information Pack
CMX7131/CMX7141 - Digital PMR/LMR Processors

The radio platform approach

The CMX7131 and CMX7141 redefine the way digital PMR/LMR radios are designed. Today the standard integrated options for the designer are: ASIC/ASSP, Structured ASIC, DSP and FPGA solutions. Each has its own benefits but in every case there are a number of trade-offs that must be considered. The CMX7131/CMX7141 sets out to rectify this position and provide the designer with all the benefits of the ASIC/ASSP, Structured ASIC, DSP and FPGA solutions, without the trade-offs.

Multi-standard radio opportunities is the key target area for the CMX7131/CMX7141 devices. The in-built flexibility allows the device’s functions to be enhanced and tailored to a specific target application. Allowing a digital radio to fall back to legacy analogue operation by uploading a different Function Image™. Adopting the device into a manufacturers’ base radio platform utilises this flexibility to the full.

Function Image™ is the mechanism that enables the CMX7131/CMX7141 devices to evolve with the designers needs. A Function Image™ is a data file that is uploaded into the device during power-up and configures sub-systems embedded in the devices, to provide the desired function and feature-set.

Flexibility, low product pricing, fast time-to-market, field upgradeable, function upgradeable, complete analogue/digital integration and very small packaging are just a few of the CMX7131/CMX7041 benefits.
Digital PMR/LMR

Product requirement

- Low component cost
- Lowest power operation
- Minimise host micro power consumption
- Small size
- Low implementation complexity
- Multi-standard capability
- Multi-mode digital/analogue operation
- Integration roadmap
- Fast time-to-market
CMX7131/CMX7141 - Digital PMR/LMR Processors

The designer’s choice

- CMX7131 - Maximum integration
  - Includes 2 RF Integer-N synthesisers on-chip
  - Targeted at small, low cost radio designs

- CMX7141 - Maximum flexibility
  - The designer can use their preferred type of synthesiser and its location relative to the baseband processing
CMX7131/CMX7141 - Digital PMR/LMR Processors

**Function Image™ upload**

- CMX7131/CMX7141 delivers a comprehensive and high performance set of standard features.
- The entire feature-set of the CMX7131/CMX7141 is determined by its Function Image™: a data file loaded into the device during initialisation.
- The Function Image™ configures the CMX7131/CMX7141 sub-systems and sets its specific feature-set.
- ‘Function Images’ can be hot swapped to enable new and enhanced product functions.

![Diagram of Function Image™ upload process]
1. Download Function Image™ file
2. Store the Function Image™ file in the host’s Flash or the optional E2PROM (Serial Flash) attached to the CMX7131/CMX7141
3. Two methods to upload the Function Image™ to the CMX7131/CMX7141 during device:
   - From the host’s Flash via C-BUS
   - From the optional E2PROM/Serial Flash
4. After the Function Image™ is uploaded, device operation is initiated by the application of the ‘Activation Code’ via C-BUS
CMX7131/CMX7141 - Digital PMR/LMR Processors

Typical configuration

- **FirmASIC® technology** provides maximum flexibility
- Swapping Function Image™ completely changes the device operation
- Minimal host μC support required
- Direct connection to Vocoder
- Auxiliary operations supporting RF section
CMX7131/CMX7141 - Digital PMR/LMR Processors

**Function Image™ availability**

<table>
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<tr>
<th>Analogue Two-Way Radio</th>
<th>Digital PMR/LMR</th>
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</thead>
<tbody>
<tr>
<td>Multi-Standard</td>
<td>dPMR</td>
<td>DCR</td>
<td>NXDN</td>
<td>?</td>
</tr>
<tr>
<td>Function Image™</td>
<td>7301/7041Fl-1.x.x.x</td>
<td>7131/7141Fl-1.x.x.x</td>
<td>7131/7141Fl-2.x.x.x</td>
<td>7131/7141Fl-3.x.x.x</td>
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<tr>
<td>Basic Configuration</td>
<td>Half duplex operation 3 analogue inputs Two-Point modulation drivers</td>
<td>Half duplex operation 3 analogue inputs Two-Point or I/Q modulation drivers</td>
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<td>Auxiliary Systems</td>
<td>DACs Raised Cosine and Programmable ramp ADCs Spot reading Level thresholds Averaging modes Clock PLL System Clocks GPIO</td>
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Conforms to dPMR ETSI standard TS 102 490
(Peer-to-Peer Digital Private Mobile Radio using FDMA with a channel spacing of 6.25 kHz with e.r.p. of up to 500 mW)

Implements core Air Interface physical and data link layers of TS 102 490

Conforms to ETSI standard TS 301 166
(Radio equipment for analogue and/or digital communication (speech and/or data) operating on narrow band channels)

Direct vocoder connection and management
Function Image™ Detail Example
7131/7141FI-1.x - dPMR

- **Tx Functions**
  - 72bit data buffer
  - Automatic preamble and frame sync insertion
  - Automatic Header Block handling simplifies host control
  - Built-in channel coding, FEC and interleaving
  - Voice data and packet data modes
  - 4FSK modulator
  - RRC and Sinc filters
  - Automatic Tx sequencer
  - Tx enable hardware signal and support including RAMDAC
  - Two-Point or IQ modulation outputs

- **Rx Functions**
  - Discriminator input with input amplifier and programmable gain adjustment
  - 72bit Rx data buffer
  - Automatic Frame Sync detection
  - Automatic Header Block handling
  - Built-in channel decoding, FEC and de-interleaving
  - Selectable squelch source
  - Root Raised Cosine (RRC) and Inverse Sinc filtering
  - 4FSK baseband demodulator
  - Hard or Soft data options
  - Rx enable hardware control signal
Digital PMR/LMR

Evaluation support

- Connects directly to a microcontroller DevKit/Emulator or via PE0002 to a PC for simple operation

DE6181
CMX7141 and CMX6181 Demonstration Kit

Microcontroller Emulator

OR

PE0002
Universal Interface Board
Digital FDMA LD Radio Architecture

CMX7131/CMX618 Application

Slide 17

IF IC – e.g. SA58640 or NE605

Murata CFWL455KJFA

Murata CFWL455KJFA

2nd LO

(Derive from system reference for stability)

Tx VCO ~ 446MHz

19.2MHz VCTCXO Reference (e.g. Golleg MA07855)

CMX7131 Digital PMR/LMR Processor

Aux DAC

RF Synth 1

RF Synth 2

PA – e.g RFMD RF5110G

VCO Mod

Reference Mod

2-point Modulation Outputs

Data (analogue)

Rx I/Ps

Audio I/P

Audio O/P

C-BUS

SPI

CMX618 RALCWI VOCDER

Host Controller

BP Filter – e.g. TAlSAW TA0381A

LNA – e.g. BFR520 transistor

BP Filter – e.g. TAlSAW TA0381A

IF Amp – e.g. BFR520 transistor

Crystal Filter 7.5kHz BW

RXVCO

To Rx Mixer

Example Ceramic Filters shown for 6.25kHz Channels

PA Control
ATB010 - RF Technology Demonstrator

Maximum support

- Small, low cost RF technology demonstrator
- Assistance to radio manufacturers:
  - Development of narrowband FDMA digital radios
  - Speed up time-to-market
- Designed to meet EN 301 166 and EN 300 296
- Interfaces directly to DE6181
  (CMX7141/CMX618 dPMR Demonstrator board)
- RF circuit area 50mm x 45mm
CMX7131/CMX7141 – Digital PMR/LMR Processor

Key benefits

- Integrates many subsystems
- Complete baseband processing
- Function Image™ availability
  - Supporting legacy analogue and digital PMR/LMR systems
- CMX7131 includes RF synthesisers
- Auxiliary system clocks
- Auxiliary ADCs and DACs for complete radio management
- Small packaging (VQFN and LQFP)
- Low power 3.3V operation
- Significantly reduces the end product component count, cost and size
- Flexibility, built on FirmASIC® technology
- RF demonstrator and design support available
Digital PMR/LMR

Complete Product Offering

CMX7131/CMX7141 Digital PMR Processor
Built on FirmASIC® technology

CMX618/CMX608 RALCWI Vocoder
(Robust Advanced Low Complexity Waveform Interpolation)
CMX608/CMX618 RALCWI Vocoders

Unique Selling Points

- No licensing or royalties
- Lowest cost Vocoder solution
- Viterbi soft decision decoding
- FEC 60ms and 80ms data packets
- 3 different redundancy modes
- Single IC solution - integrated audio codec
- FEC loop-through mode
- Small PCB footprint packages
- Field upgradeable
- Product roadmap
  - Voice storage feature
  - Duplex product release
CMX7131/CMX7141 Digital PMR/LMR Processor

Unique Selling Points

- Utilises limiter discriminator Rx architecture (Considered to be the lowest cost RF implementation)
- Lowest power solution
  - Low host microcontroller overhead
  - Utilises FirmASIC ® technology highly efficient processing techniques
- Easy implementation - Embedded system specific core air interface protocol
- Function Images available - dPMR, DCR, NXDN and analogue TWR
- Dual mode Analogue/Digital capability
- Flexibility
- Field Upgradable
- Auxiliary functions that reduce overall system cost
- Fast time-to-production
- Flexibility
- Field upgradeable
- Design future-proofing
- Customisation
- Low risk
Information on CML’s website www.cmlmicro.com

- Overview
- Datasheet
- Evaluation kit
- Register to download datasheets
- Sign up to get product update mailings

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