KW2X – Smart Energy & Home Automation Solution from Freescale
What is KW2X?

• Extension of Kinetis line to include IEEE-802.15.4 Radio

• Primary use for ZigBee Smart Energy and Home Automation
Freescale Solutions Enabling the Smart Grid

Power Generation, Transmission, Monitoring & Control, Renewable Sources
MPC8xxx, QorIQ, Kinetis

Distribution & Substation Automation, Protection, Control and Monitoring
MSC9130, MPC8xxx, QorIQ, Kinetis

Data Concentrator
P102x, MPC8308, i.MX28

Neighborhood Area Network (NAN)
RF: Sub Gig 802.15.4g, Kinetis, S08
PLC: G3/ PRIME OFDM - Kinetis

Smart Electricity Meters
1-ph, 2-ph, 3-ph, Sub-Metering, Kinetis, Vybrid

Home Area Network (HAN)
ZigBee, <1GHz WM-Bus and Proprietary, Kinetis

Home Energy Management (HEM)
i.MX283 Vybrid
Freescale Smart Metering Solutions

Home Area Network

Kinetis

Software

MQX RTOS
Beekit
Comm Stacks
Metrology SW
Security
DLMS
KW20 HAN Use Cases

Adds Wireless Connectivity to:

- Smart Meters
- In Home Displays / Control Units
- AC units
- Smart plugs
- Appliances

For remote metering, energy management, building control and automation.
Kinetic MKW20 Wireless MCU

CPU
- 50 MHz Cortex M4 CPU core
- Up to 512KB Flash, 64KB SRAM, 32KB Flex Mem, 4KB EEPROM
- Typical current consume: 250 µA/Mhz run, 1.7uA RTC standby

Radio Transceiver, 2.4GHz
- IEEE-802.15.4 compliant
- -102 dBm Rx sensitivity and +10dBm Tx output power
- Peak typical current consume: 15mA Tx and 16.5mA Rx
- Dual Personal Area Network (PAN) support in hardware
  - Run two RF networks simultaneously
  - Antenna diversity with automatic antenna selection

Security
- Active and passive tamper detection with RTC timestamp
- Crypto engine: DES, 3DES, AES 128-256, SHA-1, SHA-256, MD5, RNG

Software
- 812.15.4 2006 MAC
- ZigBeePro, ZigBee IP
- Smart Energy 1.x & 2.0, HA 1.x, HC 1.0

System
- UART, SPI, I2C, optional USB 2.0 FS/LS H/D/OTG
- 16-bit ADC
- Operating range: 1.7V to 3.6V, -40C to +105C

<table>
<thead>
<tr>
<th>Device</th>
<th>Flash</th>
<th>RAM</th>
<th>Feature</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MKW21D256VHA5</td>
<td>256 KB</td>
<td>32 KB</td>
<td>No USB</td>
<td>8x8 56-pin LGA</td>
</tr>
<tr>
<td>MKW22D512VHA5</td>
<td>512 KB</td>
<td>64 KB</td>
<td>USB</td>
<td>8x8 56-pin LGA</td>
</tr>
<tr>
<td>MKW24D512VHA5</td>
<td>512 KB</td>
<td>64 KB</td>
<td>USB and Smart</td>
<td>8x8 56-pin LGA</td>
</tr>
<tr>
<td>Energy 2.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Cortex M4 MCU**

- **ARM Cortex M4 with DSP**
- **Supports up to 50Mhz (1.25 DMIPS/MHz)**
- **16-channel DMA**
  - Supports up to 128-bit data values
  - Programmable
- **Configurable nested vector interrupt controller (NVIC)**
- **Wake-up Interrupt Controller (WIC)**
- **Advanced debug and trace**
- **Hardware CRC**
- **Independent-clockced COP**
- **External watchdog**
- **10 low power modes**
  - Low-leakage wake-up, low power timer and low power RTC
  - Fast wakeup times
- **FlexTimers**
  - Programmable Interrupt Timer (PIT)
  - PWM support
- **Carrier Modulator Timer**

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**Diagram**

- **Core**
  - ARM® Cortex™-M4
  - 50 MHz
  - Debug Interfaces
  - DSP
  - Interrupt Controller
- **System**
  - Internal and External Watchdogs
  - DMA
  - Low-Leakage Wake-Up Unit
- **Memories**
  - Program Flash (Up to 512 KB)
  - FlexMemory 32 KB
  - 4 KB EE
  - SRAM (Up to 64 KB)
- **RF Transceiver**
  - IEEE 802.15.4 2006
  - 2.4GHz
  - 32 MHz OSC
  - 128 Byte RAM Buffers
- **Security and Integrity**
  - Cyclic Redundancy Check (CRC)
  - Tamper Detection
  - Cryptography Authentication Unit
  - Random Number Generator
- **Analog**
  - 16-bit A/D
  - D/A with 8-bit DAC
- **Timers**
  - FlexTimer
  - Programmable Delay Block
  - Periodic Interrupt Timers
  - Low-Power Timer
  - Independent Real Time Clock (RTC)
- **Communication Interfaces**
  - SPI
  - UART (ISO 7816)
  - USB Device Charger Detect (CDC)
  - USB On-the-Go (OTG)
  - USB Voltage Regulator
- **Clocks**
  - Phase-Locked Loop
  - Frequency-Locked Loop
  - Low/High-Frequency Oscillators
  - Internal Reference Clocks

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*Optional*
Connectivity and Communication

- **SPI**
  - Full-duplex
  - Master and slave mode
  - Buffered transmit and receive with FIFOs
  - DMA support for FIFOs
- **Inter-Integrated Circuit (I2C)**
- I2C SMBus version 2 compatible
- Up to 100 Kbps
- Multi-master operation
- DMA support
- **UART**
  - Full-duplex operation
  - Programmable TX/RX polarity
  - Idle line or address mark wakeup
  - Hardware parity
  - DMA request
- **USB Interface - OTG**
  - USB 2.0 compliant
  - On-chip FS and LS transceiver
  - USB host mode
  - USB device mode
  - Suspend mode /low power
  - Supports HS with off-chip transceiver

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Security and Reliability

- Tamper detect
  - External tamper detect
  - 256-bit secure storage (erased on tamper)
- CRC
- Hardware encryption
- Cryptography Acceleration Unit (CAU)
- Random Number Generator (RNG)
  - FIPS compliant
Transceiver Features

- 2.4 GHz frequency band
  - Supports 2.36 to 2.4 GHz Medical Band
- 802.15.4 compliant
  - 250 kbps data rate
  - O-QPSK modulation
  - DSSS with 5 MHz channels
  - 16 selectable channels
- Supports packet and bit stream mode
- 802.15.4 Packet Processor
- Output power variance +/- 2 dBm
- Programmable output power from -30 to +10 dBm
  - 2dB steps
- Low power receive mode
- 32 Mhz crystal oscillator with on board trim capability
RF Front End

- **Differential input/output port**
  - Supports external PA/LNA
- **Single ended antenna option**
  - Integrated transmit/receive switch
- **Antenna diversity option**
- **Automatic Gain Control (AGC)**
- **Receive Strength Signal Indicator (RSSI)**
- **Temperature compensation**
Diversity

- GPIO for Antenna Diversity control
- FAD (Fast Antenna Diversity)
  - Off
  - Preamble detect
Dual PAN

Ability to participate in two networks simultaneously
- Maintains two sets of network parameters
  - PAN, MAC address (short and long), Channel

2 channels, 2 PANs
- Manual mode – software controls which PAN is active
- Automatic mode – hardware controls which PAN is active
  - Time to dwell on channel can be set from .5 mS to 3.2 seconds
  - If PAN is active when timer expired, sequence will complete before channel switch occurs
- Channel switch is 56 uS
  - Time to switch, poll, receive packet and switch back is <10mS

1 channel, 2 PANs
- Address filtering is done simultaneously
- No channel switch is necessary

Dual Channel Example
Dual PAN Use Case

• Smart Energy Network (Utility)

• Home Automation Network (Home Owner)

• Dual PAN
  – Smart Energy & Home Automation

☐ Smart Energy
☐ Home Automation
☐ Dual PAN – SE/HA
## Transceiver Power Modes

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
<th>Power (typical 25°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RUN</td>
<td>All radio functions are available (TX)</td>
<td>15mA</td>
</tr>
<tr>
<td></td>
<td>All radio functions are available (RX)</td>
<td>16.5mA</td>
</tr>
<tr>
<td>Idle/Doze</td>
<td>Transceiver is in standby, XTAL is enabled</td>
<td>.3mA</td>
</tr>
<tr>
<td>Hibernate</td>
<td>Transceiver is off, XTAL is off</td>
<td>&lt;1uA</td>
</tr>
<tr>
<td>Reset</td>
<td>Radio GPIO are latched and registers are reset</td>
<td>&lt;150nA</td>
</tr>
</tbody>
</table>
## Features and Benefits

<table>
<thead>
<tr>
<th>Features</th>
<th>Benefits</th>
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<tbody>
<tr>
<td>MCU</td>
<td></td>
</tr>
<tr>
<td>• ARM® Cortex™-M4 core with DSP</td>
<td>• Up to 50 Mhz core provides a broad range of application support.</td>
</tr>
<tr>
<td>• Up to 512 KB of Flash and 64 KB of RAM</td>
<td>• Provides enough memory to run complicated protocols stacks and user</td>
</tr>
<tr>
<td></td>
<td>applications on a single IC.</td>
</tr>
<tr>
<td>• Up to 64 KB of FlexMemory</td>
<td>• FlexMemory provides user-segmentable byte write/erase EEPROM.</td>
</tr>
<tr>
<td>• Secure Flash</td>
<td>• Protects the code and data from unauthorized access or modification</td>
</tr>
<tr>
<td>• Tamper detect</td>
<td>• Protects critical IP by detecting tamper events</td>
</tr>
<tr>
<td>• Cryptography Acceleration Unit</td>
<td>• A co-processor that supports a set of specialized operations to improve</td>
</tr>
<tr>
<td></td>
<td>throughput of encryption/decryption operations as well as message</td>
</tr>
<tr>
<td></td>
<td>digest functions, including DES, 3DES, AES, MDA, and SHA algorithms.</td>
</tr>
<tr>
<td>• 128-bit Random Number Generator</td>
<td>• Meets the FIPS 140 Security Requirements for Cryptographic Modules</td>
</tr>
<tr>
<td>RF</td>
<td></td>
</tr>
<tr>
<td>• Diversity Support</td>
<td>• Freescale’s FAD (Fast Antenna Diversity) allows the hardware to</td>
</tr>
<tr>
<td></td>
<td>automatically select between 2 antennas, improving reliability in high</td>
</tr>
<tr>
<td></td>
<td>interference environments.</td>
</tr>
<tr>
<td>• Dual PAN support</td>
<td>• System can simultaneously participate in 2 ZigBee networks, eliminating</td>
</tr>
<tr>
<td></td>
<td>the need for multiple radios.</td>
</tr>
<tr>
<td>• Class-leading link budget</td>
<td>• 110 db link budge provides greater range, reducing the need for</td>
</tr>
<tr>
<td></td>
<td>external power amplifiers and lowering cost.</td>
</tr>
<tr>
<td>• 15mA TX / 16.5mA RX power consumption</td>
<td>• Significantly reduces power consumption and extends battery life.</td>
</tr>
<tr>
<td>• Compatible with Freescale Kinetis family of</td>
<td>• Software protocol stacks, tools, and IDE are compatible with the</td>
</tr>
<tr>
<td>MCUs</td>
<td>Kinetis MCUs including the KW20 Wireless MCU</td>
</tr>
</tbody>
</table>
KW20 Development Kit

Kit Features
- Can use PCB “F” antenna or bypass for external antenna via RF connector
- Open-SDA debugging
- USB port to interface with PC
- Configurable I/O access
- LEDs and switches for demonstration, monitoring and control
- BeeKit Tool with stacks and applications
  - ZigBeePro R20 with SE 1.1.x, HA 1.1, HC 1.0 profiles
  - Simple MAC and RF Test Tool
  - Dual-PAN example
  - Over-The-Air programming example
  - **Coming: ZigBeelP and SE 2.0 profile**
- Quick Start Guide

Tower Form Factor
- Use standalone or in Tower System
- Boards sold individually
- Combine as many boards as needed

TWR-KW21D256 or TWR-KW24D512

$99 each, suggested resale
Freescale Protocol Stacks

• A comprehensive and flexible protocol stack offering
  – Supports simple point-to-point to complex ZigBee networks
  – Designed for embedded processors
  – Extensive testing for interoperability including application profile certification testing
    ▪ ZigBee Certification Testing
      • Compliant Platforms
      • ZigBee HA, SE, HC and RF4CE
      • Certified Product testing
    ▪ Large network testing
  – Simplified Network Configuration reduces development time
    ▪ BeeKit provides simplified and flexible network configuration
    ▪ Provides Public Profiles and Sample Applications
Leveraging the Kinetis Ecosystem for KW20

<table>
<thead>
<tr>
<th>HW BDM Debugger/Emulators</th>
<th>IDE: Tools Compilers, Debuggers</th>
</tr>
</thead>
<tbody>
<tr>
<td>PE micro</td>
<td>CodeWarrior</td>
</tr>
<tr>
<td>IAR Systems</td>
<td>IAR Systems</td>
</tr>
<tr>
<td>SEGGER</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MQX RTOS</th>
<th>Security</th>
<th>Tower EVBs &amp; System Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>freescale™</td>
<td>mocana®</td>
<td>freescale™</td>
</tr>
</tbody>
</table>
KW2X – Summary/Advantages

• **M4 ARM**
  - Up to 50 Mhz core provides a broad range of application support

• **Dual PAN**
  - System can simultaneously participate in 2 ZigBee networks, eliminating the need for multiple radios

• **Antenna Diversity**
  - Fast Antenna Diversity allows the hardware to automatically select between 2 antennas

• **64K SRAM**
  - Provides enough memory to run complicated protocols stacks and user applications on a single IC

• **USB**
  - Additional Connectivity
KW01 – Sub GHz Smart Radio Solution from Freescale
The Internet of Things: Metropolitan Area Networks (MANs)

- MAN Network Characteristics:
  - Thousands of devices per gateway
  - Long distance between nodes
  - Many hops deep
What is KW01?

• World’s first integrated ARM Cortex-M0+ based sub-1 GHz smart radio
  - Integrates Kinetis MCU (ARM Cortex M0+ 128K Flash/16K RAM) with a sub 1 GHz transceiver

• Targeted for Automated Meter Reading and mesh-networked smart sensors applications
**Kinetis KW0x Sub-1 GHz Smart Radio**

Freescale offers the world’s first Kinetis ARM Cortex-M0+ based sub-1 GHz smart radio for automated meter reading and mesh-networked smart sensor applications in building/home control.

<table>
<thead>
<tr>
<th>Ultra Low Power</th>
<th>Performance &amp; Flexibility</th>
<th>Ease-of-Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market leading supplier provides best in class RF performance with 32-bit ARM Cortex-M0 for low-power, speed, MCU capability.</td>
<td>Flexibility to adapt to multiple communication protocols covering a wide range of frequencies worldwide.</td>
<td>Variety of development tools, software and documentation to accelerate the design cycle.</td>
</tr>
</tbody>
</table>
## Features and Benefits

<table>
<thead>
<tr>
<th>Features</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARM Cortex M0+ CPU core</td>
<td>Lowest power industry core</td>
</tr>
<tr>
<td>Single-chip with MCU + Radio + Memory</td>
<td>Save size and cost versus a 2 to 3 chip solution</td>
</tr>
<tr>
<td>High radio link budget</td>
<td>Very long point to point wireless range without the need for repeaters or costly amplifying devices.</td>
</tr>
<tr>
<td>Flexible RF configuration</td>
<td>Adapt to global standard requirements and local (regional) regulations</td>
</tr>
</tbody>
</table>
Kinetis KW01 Wireless MCU (Sub 1-GHz)

CPU
- 32-bit ARM Cortex M0+ 48MHz Core
- 128KB Flash and 16KB SRAM

Radio transceiver, Sub 1-GHz
- Supports 290-344MHz, 424-510MHz, and 862-1020MHz frequency bands
- FSK, GFSK, MSK, GMSK and OOK modulations up to 600kbps
- Up to -120dBm Rx sensitivity @ 1.2kbps
- -18 to +17dBm Tx output power in steps of 1dBm

Ultra low power for battery operated devices
- Typical consumption
  - 1.7μA standby with 4.3μs wake-up time
  - <50 uA/MHz CPU system run mode
  - 16 mA Rx peak
  - 20 mA Tx peak at 0 dBm, 33 mA at +10 dBm

Software
- Simple-MAC, user modifies for their proprietary protocols

System
- 16-bit ADC, Cap Touch Sensors, I2C, UART, SPI, Timers
- Operating Range: 1.8V to 3.6V, -40C to +85C
Sub-1 GHz Target Applications

**Metering and Building Control**
- Metering
- Thermostats
- Lighting control
- HVAC unit monitors
- Water heaters
- Window coverings
- Ceiling fan

**Fire/Security**
- Smoke/heat sensing and monitor
- Fire alarm
- Room occupancy
- Intruder alarms
- Motion detectors
- Access control

**Medical/Healthcare/Wellness**
- Glucose monitors
- Cardiac rhythm tracking
- Hearing appliance remotes
- Infusion pumps
- Blood pressure monitoring
- Pulse oximetry monitoring
- Weight management monitoring

**Wireless Sensors Networks**
- Liquid or gas flow detect and alarm
- Usage data collection
- Asset control (acceleration/theft)
- Maintenance monitoring
- Measurement data collection
- Humidity monitor and control
- Hazardous environment monitor
- Vibration alerts
MKW01 Target Markets and Applications

Adds Wireless Connectivity to:

Concentrators
Gateways

Meters

In Home Displays / Control Units

Sensors

For remote metering, energy management, building control and automation.

Up to several hundred meters
KW01 – Transceiver Features

• Frequency bands (61 Hz steps):
  - 290 to 340 MHz
  - 424 to 510 MHz
  - 862 to 1020 MHz
• Bitrate to 300 (MC12311) or 600 (MKW01) kbps
• -120 dBm @ 1.2kbps sensitivity
• IIP3 = -18 dBm, IIP2 = +35 dBm
• 16mA RX current
• AGC, AFC
• -18 to +17 dBm TX Pout
• FSK, GFSK, MSK, GMSK, OOK Modulation
• Built-in Bit Synchronizer, Packet Engine, AES128 encryption, FIFO.
• Built-in temperature sensor, low battery indicator
• Configurable for single TX/RX input/output for low parts count or separate TX out/RX in allowing off chip LNA, PA, switch, filter etc.
KW01 – MCU and common features

- 48 MHz CPU clock frequency/24 MHz bus frequency.
  - External crystal options 32 to 40 KHz or 3 to 32 MHz.
  - FLL, PLL & internal oscillator options.
- Vectored interrupt, Wake up & non-maskable Interrupts.
- DMA, SWD debug
- 128KB P-flash, 64 byte flash, 16 KB RAM
- Low leakage modes & standby memories.
- 16-bit ADC, 12-bit DAC
- High Speed Comparator with 6-bit DAC
- Several Timers
- SPI, IIC, UART (SPI MCU to XCVR interface on chip)
- GPIO, Touch Screen Sensor
- 1.8 to 3.6V Supply, -40 to +85 C temp range.
- 56 pin 8x8mm (+4) PLGA Package.
# KW01 MCU: Ultra-low Power Modes

<table>
<thead>
<tr>
<th>Mode</th>
<th>CPU/Bus Freq.</th>
<th>Details</th>
<th>Peripherals</th>
<th>Typical Idd @ 3V, 25C</th>
<th>Recovery Time</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RUN</strong></td>
<td>48/24 MHz</td>
<td>MAXIMUM CPU/Bus frequency. Compute clocking option SUPPORTED</td>
<td>ENABLED</td>
<td>6.38mA (133uA/MHz)</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>48/24 MHz</td>
<td></td>
<td>DISABLED</td>
<td>4.44mA (93uA/MHz)</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>48/- MHz</td>
<td></td>
<td>Compute Operation*</td>
<td>3.98mA (83uA/MHz)</td>
<td>-</td>
</tr>
<tr>
<td><strong>VLPR</strong></td>
<td>4/1 MHz</td>
<td>RESTRICTED CPU/Bus frequency. CPU in SLEEP, peripherals functional.</td>
<td>ENABLED</td>
<td>219uA (55uA/MHz)</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>4/1 MHz</td>
<td>Compute clocking option SUPPORTED</td>
<td>DISABLED</td>
<td>170uA (43uA/MHz)</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>4/- MHz</td>
<td>LVD OFF. Flash programming NOT supported</td>
<td>Compute Operation*</td>
<td>156uA (39uA/MHz)</td>
<td>-</td>
</tr>
<tr>
<td><strong>WAIT</strong></td>
<td>48/24 MHz</td>
<td>MAXIMUM CPU/Bus frequency. CPU in SLEEP, peripherals functional.</td>
<td>DISABLED</td>
<td>3.88mA</td>
<td>-</td>
</tr>
<tr>
<td><strong>VLPW</strong></td>
<td>4/1 MHz</td>
<td>RESTRICTED CPU/Bus frequency. CPU in SLEEP, peripherals functional.</td>
<td>DISABLED</td>
<td>112uA</td>
<td>4us</td>
</tr>
<tr>
<td><strong>STOP</strong></td>
<td>-</td>
<td>MCU in static state, LVD ON. Energy-saving peripherals functional with ADMA. AWIC detects wake-up source for CPU.</td>
<td>-</td>
<td>309uA</td>
<td>4.3us</td>
</tr>
<tr>
<td><strong>VLPS</strong></td>
<td>-</td>
<td>Same as STOP mode. LVD OFF.</td>
<td>-</td>
<td>2379nA</td>
<td>4.3us</td>
</tr>
<tr>
<td><strong>LLS</strong></td>
<td>-</td>
<td>MCU in low-leakage state retention power mode. LLWU detects wake-up source for CPU including LPTMR, RTC, TSI, CMP, and select pin interrupts. Fast wake-up.</td>
<td>-</td>
<td>1738nA</td>
<td>4.6us</td>
</tr>
<tr>
<td><strong>VLLS3</strong></td>
<td>-</td>
<td>MCU in low-leakage mode, most internal logic OFF. All RAM contents retained and I/O states held. LLWU controls wake-up source for CPU similar to LLS mode.</td>
<td>-</td>
<td>1344nA</td>
<td>53us</td>
</tr>
<tr>
<td><strong>VLLS1</strong></td>
<td>-</td>
<td>Similar to VLLS3</td>
<td>-</td>
<td>713nA</td>
<td>115us</td>
</tr>
<tr>
<td><strong>VLLS0</strong></td>
<td>-</td>
<td>Pin wakeup supported. LPTMR, RTC, TSI and CMP wake-up supported with external clock. Optional POR brown-out detection circuitry.</td>
<td>-</td>
<td>411nA (POR) / 205nA (no POR)</td>
<td>115us</td>
</tr>
</tbody>
</table>

*Compute Operation shuts off bus and system clock for lowest power core processing. Peripherals with an alternate asynchronous clock source can continue to operate.
MKW01 Product Differentiator

• Very low power suitable for battery operated equipments
  – Cortex M0+ Breakthrough power efficiency
  – Low-power features such as 100nA with radio configuration retention.

• High Integration Level
  – Includes the exclusive ARM Cortex M0+ core with up to 48MHz performance, embedded 128KB Flash and 16KB of RAM supporting wireless communication protocol + application in one chip

• Demonstrates exceptional RF performance with a budget link up to +137dB

• Flexibility and Compliancy with Multiple Standards

• Full set of peripherals
  – Offers multiple 16-bit timers, 13-bit port keyboard interrupt and Touch Sensing Interface, 16-bit ADC, SCI, I2C, SPI
KW01 – Development System

- Modular Reference Board (MRB).
- Can run stand-alone with on-board mini-USB.
- Can plug into TWR-RF.
- SMA for Antenna or cable.
- Available with 30 or 32 MHz XTAL for frequency/spurious management.
- Available for 868/915 MHz, 434 MHz bands, can be tuned to 315 MHz.
Leveraging the Kinetis Ecosystem for KW01

<table>
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<th>HW BDM Debugger/Emulators</th>
<th>IDE: Tools Compliers, Debuggers</th>
</tr>
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<tbody>
<tr>
<td>IAR Systems</td>
<td>IAR Systems</td>
</tr>
<tr>
<td>SEGGER</td>
<td></td>
</tr>
</tbody>
</table>

| Radio Test Tool           | IEEE 802.15.4g IPv6           | Tower EVBs & System Design |
| SMAC                      | IPv6/6loWPAN (Q4 ‘13)         |

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freescale™
Development Kits

• **Leverages the Tower system**
  - Quickly combine Tower Modules to build a prototype of your application
  - Software support from Freescale and Third Parties
  - Growing community of Third Party hardware support
  - On-line community: [www.towergeeks.org](http://www.towergeeks.org)

• **Kit Features**
  - Flash reprogramming and in-circuit hardware debugging
  - USB port to interface with PC
  - Configurable I/O access
  - LEDs and switches for demonstration, monitoring and control
  - Out-of-box application
  - Quick Start Guide

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**Part Number by region with default frequency**

- **North America** - MRB-KW019032NA
- **Europe** - MRB-KW019032EU
- **Japan** - MRB-KW019030JA
- **China** - MRB-KW014532CN
- **Universal** - MRB-KW013033UN

An antenna needs to be purchased before using this kit. In addition, customer requiring Tower integration need the RF kit (TWR-RF)
KW01 - Summary

• KW01 is World’s first Cortex M0+ based wireless MCU
  - Very low power suitable for battery operated equipments

• KW01 is Flexible and Compliant with Multiple Standards (including IEEE 802.15.4 for Smart Utility Networks)

• KW01 is a Modem-in-a-chip for easily adding connectivity to many applications
  - Smart Metering Last Mile connectivity
  - Sub-Metering
  - Building Control and Automation