

### Introduction

The IoT had connected over 5 billion devices globally in 2015 and is set to reach 20.8 billion connected devices by 2020. Low-Power Wide Area Network (LPWAN) technology is an area expecting the highest growth rates, where challenges lie in reliably and securely covering vast distances using the least power possible. Rakon is focused on delivering solutions for this growing and challenging market.

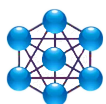
Rakon is a technology leader in timing and frequency control solutions spanning RF modules, TCXOs, crystals, SAW filters, XOs and OCXOs that are used to enable communications networks around the globe. The company offers a full range of solutions for your wireless IoT device, node and base station application requirements. Rakon has five manufacturing plants, including two joint venture plants and five research and development centres. Customer support centres are located in ten offices worldwide.

### Key Applications

- ◆ **Wireless Systems:**  
850 – 950 MHz ISM band, alarm and security, IEEE 802.15.4, consumer, industrial, metering (AMR/AMI).
- ◆ **Wireless Networks:**  
Existing 2G / 3G cellular, mesh and ad hoc networks, geological /weather/telemetry sensors and smart grids.
- ◆ Agricultural technology
- ◆ Home and building automation, asset management and tracking
- ◆ Automated meter reading,
- ◆ Industrial monitoring and control.

### Rakon and IoT Ecosystem

#### IoT Devices and Modules



- ◆ Cost
- ◆ Power
- ◆ Size

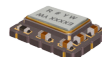
#### IoT Base Stations & Infrastructure



- ◆ Capacity
- ◆ Range
- ◆ Cost



#### Rakon Frequency Control Solutions for IoT Ecosystem

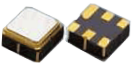


SAW Filter | kHz/MHz Crystal Resonator | Performance XO | High Stability TCXO | Ultra Stable TCXO | Mercury™ IC OCXO | Discrete OCXO




# The Internet of Things (IoT)


## Rakon Product Solutions

SAW Filter	Model	Package	Frequency	Band Width	Typical IL	Configuration
	TMX HT04	3.0 x 3.0 x 1.5 mm	458.000 MHz	20.0 MHz	1.90 dB	S/S 50/50 (In/Out)
	TMX W331	3.0 x 3.0 x 1.5 mm	869.000 MHz	2.0 MHz	2.50 dB	S/S 50/50 (In/Out)
	TMX W354	2.5 x 2.0 x 1.0 mm	881.500 MHz	25.0 MHz	2.10 dB	


**Applications:** LP-WAN, WCDMA, CDMA, CDMA450, GSM / EDGE, WiMAX, OFDM, Zigbee, radio-links, VSAT, DBS receiving systems (LNB, multi-switches), remote controls, alarms, AMR, telemetry, wireless patient monitoring systems, and GNSS receivers.

kHz Crystal	Model	Package	Frequency	Stability (@ 25°C)	Parabolic Coefficient	Connections
	RTF3215	3.2 x 1.5 mm	32.768 kHz	±10 to 100 ppm	-0.03 (ppm/°C <sup>2</sup> )	2 pad
	RTF2012	2.0 x 1.2 mm	32.678 kHz	±10 to 100 ppm	-0.03 (ppm/°C <sup>2</sup> )	2 pad

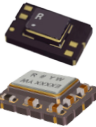
**Applications:** Microprocessors, mobil communications, DVC / DSC, SSD / HDD, GNSS and general purpose.

MHz Crystal	Model	Package	Frequency	Stability (-40 / 85°C)	Reflow shift	Connections
	RSX8	3.2 x 1.5 mm	16 – 52 MHz	±10 to 50 ppm	±1ppm	4 pad
	RSX10	2.5 x 2.0 mm	16.368 – 52 MHz	±10 to 50 ppm	±1ppm	4 pad
	RSX11	2.0 x 1.2 mm	19.2 – 52 MHz	±10 to 50 ppm	±1ppm	4 pad


**Applications:** Smart wireless devices, communications, PCMCIA, GNSS applications, automotive, and Wi-Fi.

High Stability TCXO	Industry Standard Model	High Performance Model	Package	Frequency	Stability	Slope	Supply Power
	RST2016CP	RIT2016C	2.0 x 1.6 mm	13 – 40 MHz	±0.5 ppm (-30 / 85°C)	±0.05 ppm/°C	1.2 V
					±0.5 ppm (-40 / 85°C)		
	RST2016FP	IT2100F	2.0 x 1.6 mm	13 – 52 MHz	±0.5 ppm (-30 / 85°C)	±0.1 ppm/°C	1.8 – 3.3 V
					±0.5 ppm (-40 / 85°C)		
RST2520KP	IT2200K/J	2.5 x 2.0 mm	10 – 40 MHz	±0.5 ppm (-30 / 85°C)	±0.05ppm/°C	1.8 – 3.3 V	
				±0.5 ppm (-40 / 85°C)			

**Applications:** Global Navigation Satellite System (GNSS) applications, GNSS modules, Internet of Things (IoT), smart grid network.

Ultra Stable TCXO	Model	Package	Frequency	Stability	Slope	Supply Power
	RPT5032NR	5.0 x 3.2 mm	19.2 – 40 MHz	±0.5 ppm (-20 / 70°C) ±1 ppm (-55 / 105°C)	±0.05 ppm/°C	2.4 – 3.3 V
	RPT7050P	7.0 x 5.0 mm	19.2 – 40 MHz	±0.5 ppm (-20 / 70°C) ±1 ppm (-55 / 105°C)	±0.05 ppm/°C	2.5 – 5.7 V

**Applications:** Telecommunications, stratum 3, IEEE 1588, SyncE, SONET, SDH, WDM, OTN, carrier networking, carrier ethernet, microwave, backhaul, transport equipment, small cells (WCDMA, LTE, LTE-A), enterprise networking, high reliability defense.

IC & Discrete OCXO	Model	Package	Frequency	Stability	Frequency Holdover	Supply Power
	RFPO40	9.7 x 7.5 mm	10 – 25 MHz	±10 ppb (-20 to 70°C) ±20 ppb (-40 to 85°C)	> 1 month	2.7 – 5.0 V
	ROM1490	14.5 x 9.6 mm	10 – 50 MHz	10 ppb pk-pk (-40 to 85°C)	> 1 month	2.7 – 5.0 V
	ROX2522	25 x 22 mm	10 – 40 MHz	±5 – 10 ppb (-40 to 85°C)	> 24 months	3.3 V

**Applications:** Ethernet switches and telecom D-PLLs, stratum 3/3E grade, LTE base stations, small cells, IEEE 1588 (G.8263, G.8273.x), SyncE and stratum 3E modules, time and frequency reference.

