

### Introduction

The IoT had connected over 22 billion devices globally in 2018 and is set to reach 38.6 billion connected devices by 2025<sup>1</sup>. 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. Following VDC Research, the installed base of LPWAN devices will exceed 2 billion units in 2025<sup>2</sup>.

Rakon is a global high tech company and a world leader in its field. The company designs and manufactures advanced frequency control and timing solutions. Products spanning RF modules, TCXOs, crystals, SAW filters, XOs and OCXOs that are used to enable communications networks around the globe. We offer a full range of solutions for your wireless IoT device, node and base station application requirements. We have five manufacturing plants, including two joint venture plants and six R&D centres. Customer support centres are located in 15 support offices worldwide.

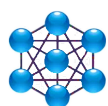
1 The Ultimate List of Internet of Things Statistics for 2022. Jack Steward  
2 The Global Market for LPWANs. VDC Research, © 2021

### Key applications

- ◆ **Wireless systems:** 850 – 950 MHz ISM band, alarm and security, IEEE 802.15.4, consumer, industrial, metering (AMR/AMI)
- ◆ **Wireless networks:** Existing 5G/NB-IOT/LTE-M cellular, mesh and ad hoc networks, geological/weather/telemetry sensors and smart grids
- ◆ Home and building automation, asset management and tracking
- ◆ Agricultural technology
- ◆ Automated meter reading
- ◆ Industrial monitoring and control
- ◆ Medical and healthcare

### Rakon and IoT ecosystem

#### IoT devices and modules



- ◆ Cost
- ◆ Power
- ◆ Size

#### IoT base stations & infrastructure



- ◆ Capacity
- ◆ Range
- ◆ Cost




Rakon is proud to be a member of the LoRa Alliance. Our frequency control solutions for the IoT ecosystem are SAW Filters, kHz & MHz Crystal Resonators, High Stability TCXOs, Ultra Stable TCXOs, Mercury/+™ IC OCXOs and Discrete OCXOs







## Rakon products

SAW Filters	Model	Package	Frequency	Band Width	Typical IL	Configuration
	TMX HT03	3.0 x 3.0 x 1.3 mm	433.92 MHz	1.6 MHz	2.20 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 IT03	1.4 x 1.1 x 0.7 mm	869.000 MHz	2.0 MHz	2.90 dB	S/S 50/50 (In/Out)
	TMX LT02	1.4 x 1.1 x 0.7 mm	915.000 MHz	26.0 MHz	2.70 dB	S/S 50/50 (In/Out)

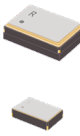
**Applications:** LP-WAN, WCDMA, CDMA, CDMA450, GSM/EDGE, WiMAX, OFDM, Zigbee, radio-links, VSAT, DBS receiving systems (LNB, multi-switches), remote controls, alarms, AMR, telemetry, wireless patient monitoring systems, and GNSS receivers.

kHz Crystals	Model	Package	Frequency	Stability (@ 25°C)	Parabolic Coefficient	Connections
	RTF3215	3.2 x 1.5 mm	32.768 kHz	±20 ppm	-0.03 (ppm/°C <sup>2</sup> )	2 pad
	RTF2012	2.0 x 1.2 mm	32.678 kHz	±20 ppm	-0.03 (ppm/°C <sup>2</sup> )	2 pad
	RTF1610	1.6 x 1.0 mm	32.678 kHz	±20 ppm	-0.03 (ppm/°C <sup>2</sup> )	2 pad

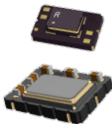
**Applications:** Microprocessors, mobile communications, DVC/DSC, SSD/HDD, GNSS and general purpose.

MHz Crystals	Model	Package	Frequency	Stability (-40 to 85°C)	Reflow shift	Connections
	QESM07	3.2 x 1.5 mm	16 – 64 MHz	±10 to 50 ppm	±1 ppm	4 pad
	QESM08	2.5 x 2.0 mm	12 – 54 MHz	±10 to 50 ppm	±1 ppm	4 pad
	QESM09	2.0 x 1.6 mm	16 – 62.5 MHz	±10 to 50 ppm	±1 ppm	4 pad
	QESM10	1.6 x 1.2 mm	24 – 54 MHz	±10 to 50 ppm	±1 ppm	4 pad


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

High Stability TCXOs	Model	Rakon P/N	Package	Frequency	Stability	Slope	Supply Power
	RST3225N	T6405	3.2 x 2.5 mm	32.000 MHz	±0.5 ppm (-40 to 85°C)	±0.1 ppm/°C	3.3 V
	RST2016N	T6393	2.0 x 1.6 mm	32.000 MHz	±0.5 ppm (-40 to 85°C)	±0.1 ppm/°C	1.7 – 3.3 V
		T6418		34.800 MHz	±0.5 ppm (-30 to 85°C)	±0.1 ppm/°C	1.7 – 3.6 V
		T6603		50.000 MHz	±0.5 ppm (-40 to 85°C)	±0.1 ppm/°C	1.7 – 3.3 V
		T6610		52.000 MHz	±0.5 ppm (-30 to 85°C)	±0.1 ppm/°C	1.7 – 3.6 V

**Applications:** LPWAN gateways, smart metering, smart grid network, Low-Power RF transceivers and Ultra Wide Band applications.

Ultra Stable TCXOs	Model	Package	Frequency	Stability	Slope	Supply Power
	RPT5032NR	5.0 x 3.2 mm	19.2 – 40 MHz	±100 to 500 ppb (-50 to 105°C)	±20 to ±100 ppb/°C	2.5 – 5.7 V
	RPT7050P	7.0 x 5.0 mm	19.2 – 40 MHz	±100 to 500 ppb (-50 to 105°C)	±20 to ±100 ppb/°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 defence.

IC & Discrete OCXOs	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 to 10 ppb (-40 to 85°C)	> 24 months	3.3 V

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

