

Frequency Components and Antennas
for
Smart Street Lighting
Application



Jan. 2023

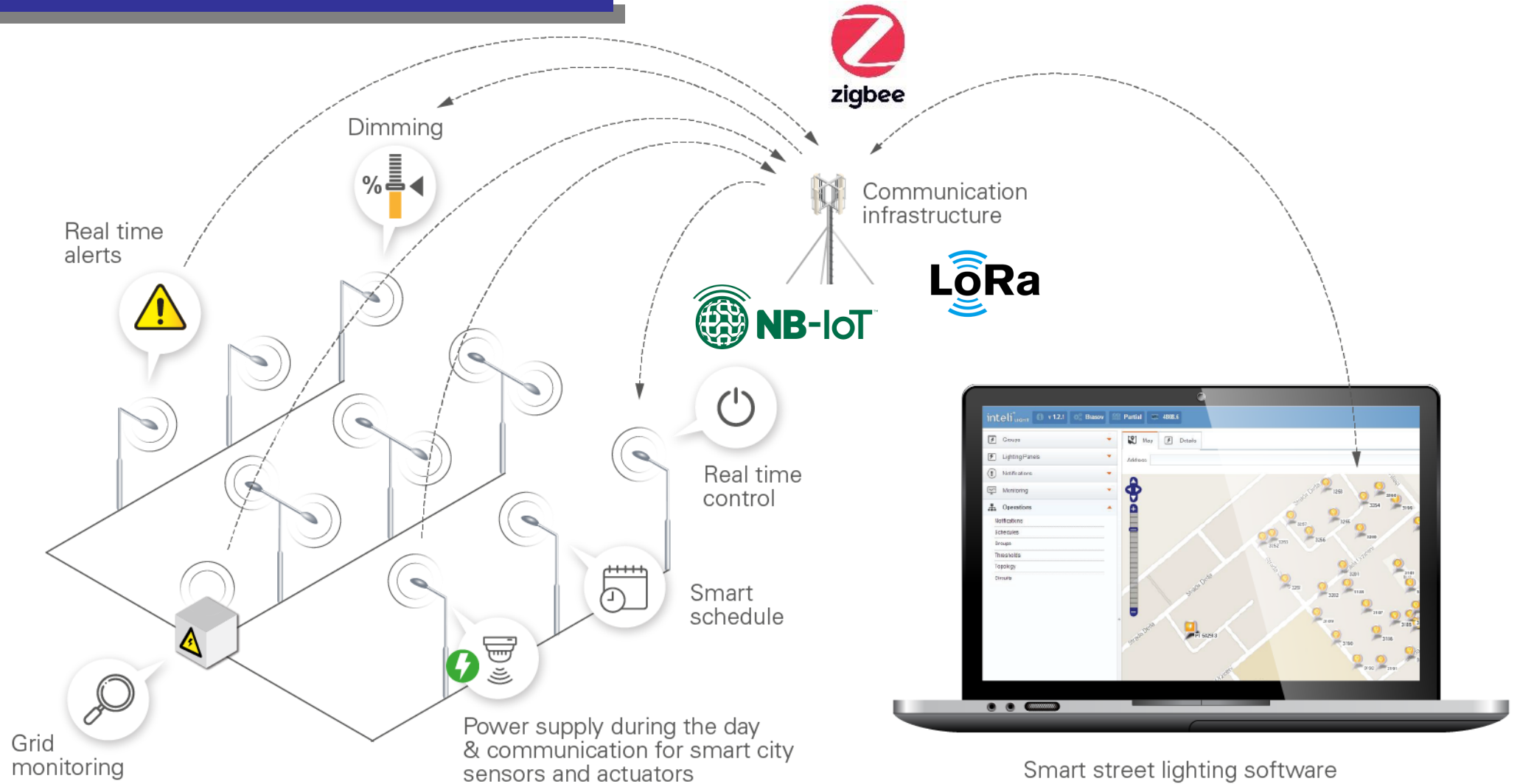
RALTRON

Introduction

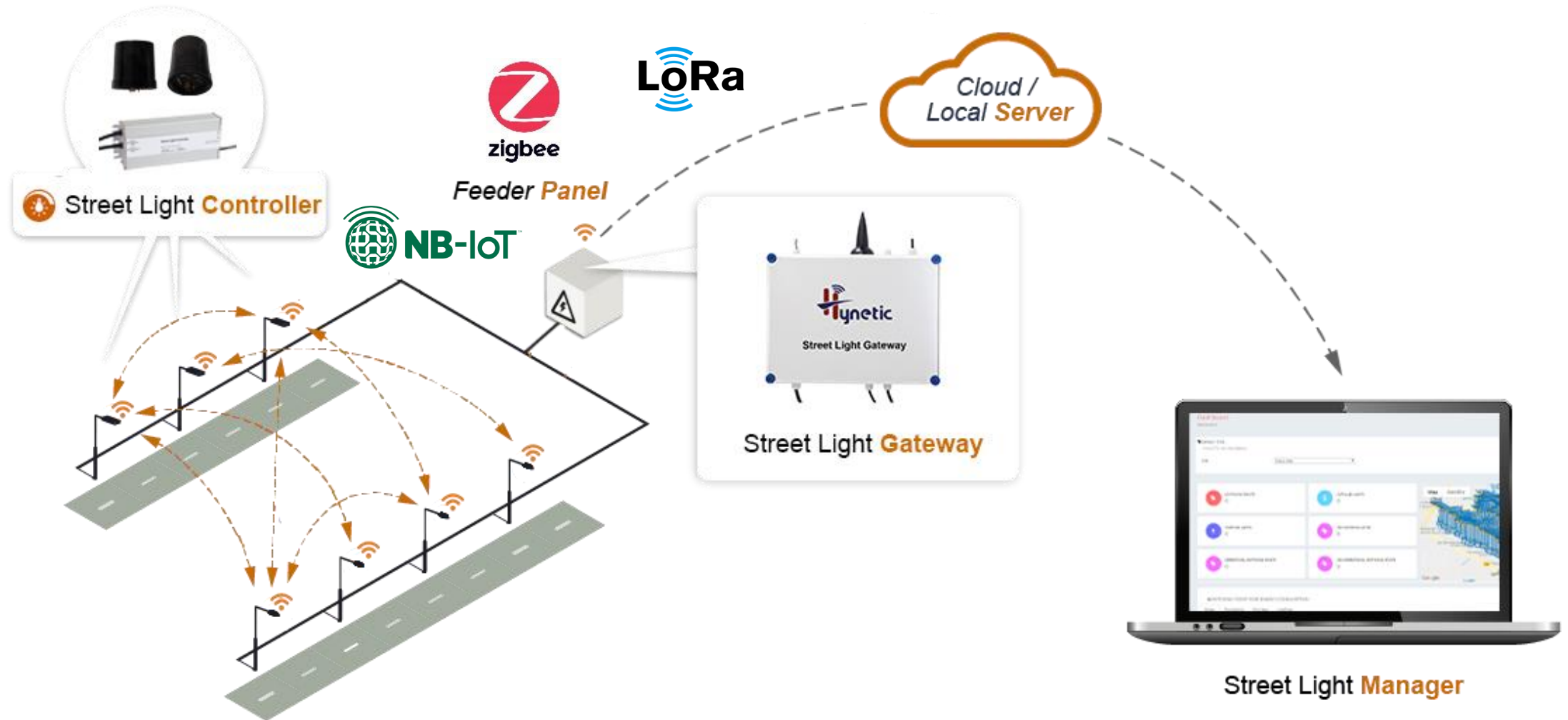


Raltron offers the most comprehensive line of frequency management components for Smart Street Lighting, from simple tuning fork crystals to high stability temperature compensated crystal oscillators and antennas. These products are designed to satisfy the ultra-low power, small footprint, and low-cost requirements of this growing market.

Smart Lighting System Node Architecture



Smart Lighting System Gateway Architecture



Solutions for NB-IoT Protocol

The NB-IoT Bands selected for North America are B4 (1700 MHz), B12 (700 MHz), B26 (850 MHz), B66 (1700 MHz) and B71 (600 MHz).

Some Typical Crystal or TCXO frequencies for **NB-IoT** Smart Street Lighting ICs:

Murata – LBAD0YW1SS - 26 MHz, 32.768 kHz

Murata – LBAD0XX1SC - 26 MHz, 32.768 kHz

- Antenna

Nordic Semiconductor - nRF9160 - 64 MHz, 32 MHz, 32.768 kHz

- SAW Filters
- 700 to 2200 MHz Antenna

MediaTek - MT2625 - 26MHz, 32.768-kHz

- Antenna

[See All Crystal Products](#)



Solutions for ZigBee Protocol

The ZigBee/IEEE 802.15.4 has three frequency bands, allowing operation in all regions of the world: 2.4 GHz for worldwide applications, 868 MHz for Europe and 915 MHz for the American.

Some Typical Crystal or TCXO frequencies for [ZigBee](#) Smart Street Lighting ICs :

Texas Instruments - CC2652RSIP - 48 MHz Crystal
48 MHz Crystal Oscillator
32.768 kHz Crystal Oscillator
- 2.4 GHz Inverted F Antenna

Nordic Semiconductor - nRF52832 - 64 MHz Crystal Oscillator
32 MHz Crystal, 32.768 kHz Crystal Oscillator
1 MHz/16 MHz/32 MHz Peripheral Clock
- 2.4 GHz Chip Antenna

NXP Semiconductors - JN5189 - 32 MHz Crystal Oscillator
32.768 kHz Crystal Oscillator
- 2.4 GHz Antenna

[See All Crystal Products](#)

[See Antenna Products for Zigbee](#)



Solutions for LoRa Protocol

Frequencies/bands used for LoRa: 433 MHz, 868 MHz and 915 MHz

Some Typical Crystal or TCXO frequencies for **LoRa** Smart Street Lighting ICs:

SEMTECH-SX1261 - 32.000 MHz Crystals or TCXOs
- 433/868/915 MHz SAW Filters

MICROCHIP-RN2903 - 32.768 kHz Crystal
- 915 MHz Antenna

MICROCHIP-RN2483 - 32.768 kHz Crystal Oscillators
- 433 MHz Antenna
- 868 MHz Antenna

[See All Crystal Products](#)

[See All Antenna for LoRa](#)



Raltron Solutions - MHz Crystals

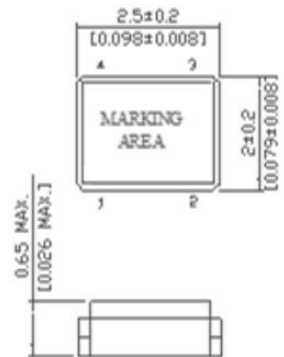
Raltron MHz Crystals IC Solutions

Part #	SIZE(mm)	FREQUENCY (MHz)
R2016-32.000-10-F-1010-TR-B1B RevB	1.60 x 1.20 x 0.32	32
R1612-32.000-10-F-1010-EXT-TR	1.60 x 1.20 x 0.32	32
R2016-48.000-8-F-1030-EXT-TR	2.00 x 1.60 x 0.50	48
R2520-16.000-10-2020-EXT-TR	2.50 x 2.00 x 0.65	16

[See All Crystal Products](#)

R2520 Specifications

PARAMETER	VALUE
FREQUENCY RANGE*	12.00 MHz to 80.00 MHz
MODE OF OSCILLATION	Fundamental
FREQUENCY TOLERANCE AT 25°C	±50 ppm max (±10, ±20, ±30ppm available)
FREQUENCY STABILITY OVER TEMPERATURE*	±50 ppm max (±10, ±20, ±30ppm available)
OPERATING TEMPERATURE RANGE*	-10°C to +60°C Standard ¹ -40°C to +85°C Extended ¹
STORAGE TEMPERATURE RANGE	-40°C to +85°C
AGING	±2 ppm 1st year max
LOAD CAPACITANCE	8 pF to 32 pF or Series
EQUIVALENT SERIES RESISTANCE	See Table 1
SHUNT CAPACITANCE	3.5 pF max
DRIVE LEVEL	100 µW max
SHOCK RESISTANCE	±5 ppm max 75 cm drop test onto a hard wood surface
REFLOW CONDITIONS	260°C for 10s max

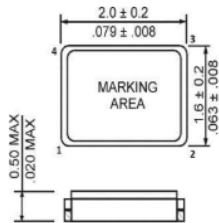


Typical Frequencies:

26 MHz, 32 MHz, 48 MHz, 64 MHz

PARAMETER	VALUE
NOMINAL FREQUENCY	48.000 MHz
MODE OF OSCILLATION	Fundamental
FREQUENCY TOLERANCE AT 25°C	±10 ppm max
FREQUENCY STABILITY OVER TEMPERATURE	±30 ppm max
OPERATING TEMPERATURE RANGE	-40°C to +85°C
STORAGE TEMPERATURE RANGE	-40°C to +85°C
AGING	±2 ppm first year max
LOAD CAPACITANCE	8 pF
EQUIVALENT SERIES RESISTANCE	60 Ω max
SHUNT CAPACITANCE	3.5 pF max
DRIVE LEVEL	100 µW max
REFLOW CONDITIONS	260°C for 10 sec max

R2016 Specifications



Raltron Solutions - TCXO s and VCTCXOs

Raltron TCXOs IC Solutions

Part #	Size(mm)
RTX-2016AF31-S-16.000-TR	2.0 x 1.6
RTX-2520AF31-S-32.000-TR	2.5 x 2.0
RTX-2520AF31-S-48.000-TR	2.5 x 2.0
RTX-1612AF31-S-48.000-TR	1.6 x 1.2

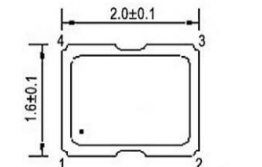
[See All TCXOs Products](#)



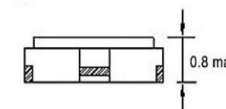
- Tighter Stability: ± 0.5 ppm ~ ± 2.5 ppm, $-40 \sim +85^{\circ}\text{C}$
- Improved Frequency Tuning Characteristic
- Superior Phase Noise Performance (-130 dBc/Hz on the floor)
- Range Supply Voltage: 1.8 V ~ 3.3 V
- Typical Frequencies: 10.0 MHz, 16.0 MHz, 19.2 MHz, 20.0 MHz, 26.0 MHz, 32.0 MHz, 38.4 MHz, 48.0 MHz, 50.0 MHz, 52.0 MHz

SERIES RTX/RTV-2016

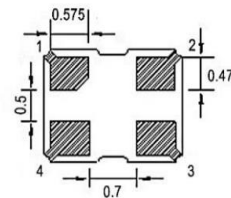
PARAMETER		VALUE
FREQUENCY RANGE		13 ~ 52 MHz
SUPPLY VOLTAGE		1.8 ~ 3.3 V
INPUT CURRENT		3.0 mA max
FREQUENCY STABILITY	vs. TEMPERATURE	$\pm 0.5 \sim \pm 2.5$ ppm
	vs. LOAD ($\pm 10\%$)	± 0.2 ppm max
	vs. SUPPLY VOLTAGE	± 0.2 ppm max
	AGING 1 st YEAR	± 1.0 ppm max
FREQUENCY TOLERANCE at 25°C AFTER 2 REFLAWS		± 2.5 ppm max
OPERATING TEMPERATURE RANGE ¹		$-40 \sim +85^{\circ}\text{C}$
STORAGE TEMPERATURE RANGE		$-40 \sim +85^{\circ}\text{C}$
CLIPPED SINEWAVE OUTPUT VOLTAGE		0.8 VP-P typ
OUTPUT LOAD		10 k Ω // 10 pF
START-UP TIME		5 ms max
FREQUENCY TUNING RANGE ²		$\pm 7 \sim \pm 16$ ppm
PHASE NOISE at 1 kHz OFFSET		-130 dBc/Hz max



OUTLINE TOLERANCE
IF NOT SPECIFIED:
 $\pm 0.015^{\circ}/0.4$ mm

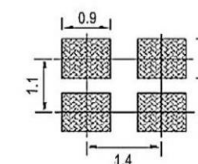


Pin Connections
1 : GND
2 : GND
3 : OUTPUT
4 : V_{cc}



(Bottom View)

Recommended Solder Pattern



*Add a 1000 pF DC-out capacitor to the output pad of the TCXO



Raltron Solutions - Tuning Fork 32.768 kHz

Raltron is offering 32.768 kHz tuning fork crystals in:

Ceramic Packages:

- 1.2 x 1.0 mm Raltron Tuning Fork Crystal - [RT1210](#)
- 1.6 x 1.0 mm Raltron Tuning Fork Crystal - [RT1610](#)
- 2.0 x 1.2 mm Raltron Tuning Fork Crystal - [RT2012](#)
- 3.2 x 1.5 mm Raltron Tuning Fork Crystal - [RT3215](#)

Plastic Molded Packages:

- 6.9 x 1.4 mm Raltron Tuning Fork Crystal - [RSE H14](#)
- 8.0 x 3.8 mm Raltron Tuning Fork Crystal - [RSM200S](#)

[See All Crystal Products](#)

Load capacitance values: 6 pF, 7 pF, 9 pF and 12.5 pF

Frequency Tolerances: ± 20 ppm and ± 10 ppm

Typical example of IC for Smart Home using a 32.768 kHz crystal as frequency reference:

Texas Instruments - CC1352P7

Using 32.768 kHz crystal

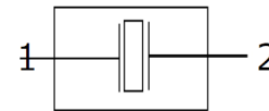
CL: 6, 7 or 12 pF

ESR: 90 k Ω max

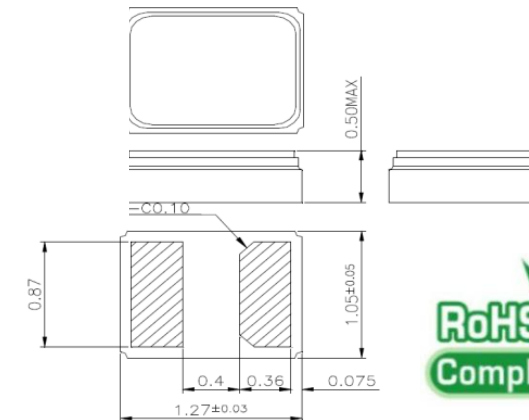
RT1210 Specifications

PARAMETER	VALUE
NOMINAL FREQUENCY	32.768 kHz
MODE OF OSCILLATION	Fundamental
FREQUENCY TOLERANCE AT 25°C $\pm 3^\circ\text{C}$	± 20 ppm *
FREQUENCY STABILITY OVER TEMPERATURE COEFFICIENT	-0.036 ppm / $^\circ\text{C}^2$ typ
OPERATING TEMPERATURE RANGE	-40°C to +85°C
STORAGE TEMPERATURE RANGE	-55°C to +125°C
AGING AT 25°C $\pm 3^\circ\text{C}$	± 5 ppm first year max
INSULATION RESISTANCE AT 100 VDC	500 M Ω
LOAD CAPACITANCE	6 pF to 12.5 pF
EQUIVALENT SERIES RESISTANCE	90 k Ω max
SHUNT CAPACITANCE	1.4 pF typ
DRIVE LEVEL	0.3 μw max

Internal Lead Connections



Unit: mm

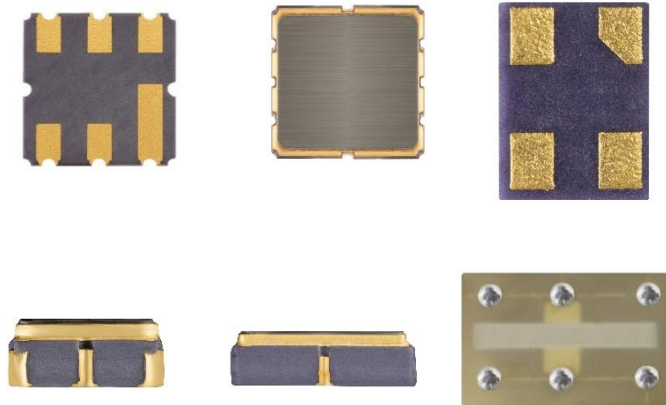


Raltron Solutions – SAW Filters

Raltron SAW Filter IC Solution

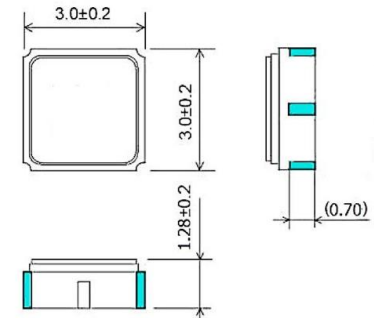
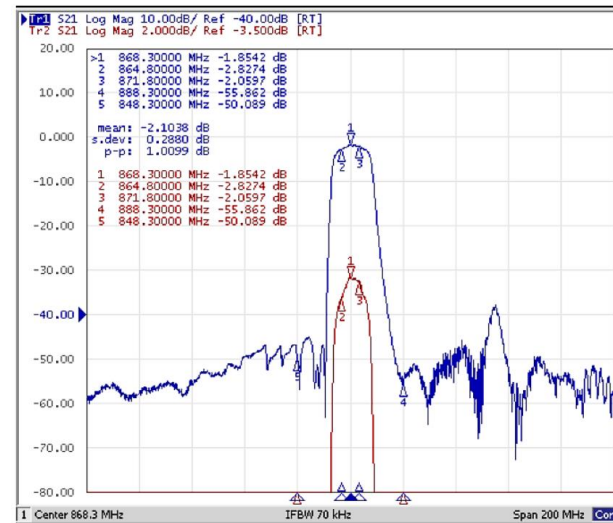
Part #	Size(mm)
RSF-916.500-5200-1411-TR-NS3	1.40 x 1.10 x 0.60
RSF-868.300-7000-3030-TR	3.00 x 3.00 x 1.28
RSF-915.000-926000-2016-TR	2.00 x 1.60 x 0.73

[See All SAW Filters Products](#)



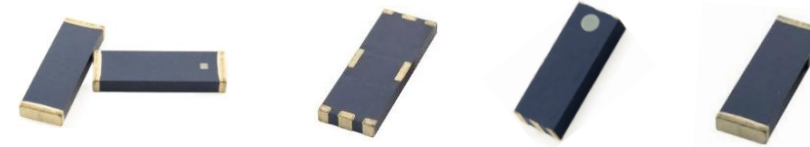
RSF-868.300-7000-3030-TR

Parameters	Value	Unit
Center Frequency (F ₀)	868.300	MHz
Insertion Loss (In F ₀ ± 3.5 MHz), typ/max	2.5 / 3.5	dB
Amplitude Ripple (In F ₀ ± 3.5 MHz), typ/max	1.2 / 2.0	dB
Attenuation min/typ	0.3 ~ F ₀ - 20 MHz	-40 / -50
	F ₀ + 20 ~ 1500 MHz	-40 / -50
In/Out Impedance	50	Ω
Power, max	10	dBm
Operating Temperature Range	-40 ~ +85	°C
Storage Temperature Range	-45 ~ +85	°C



Pin Description	
1,3,4,6	Ground
2	In
5	Out

Raltron Solutions – Antennas



Raltron Antennas Solutions for Zigbee

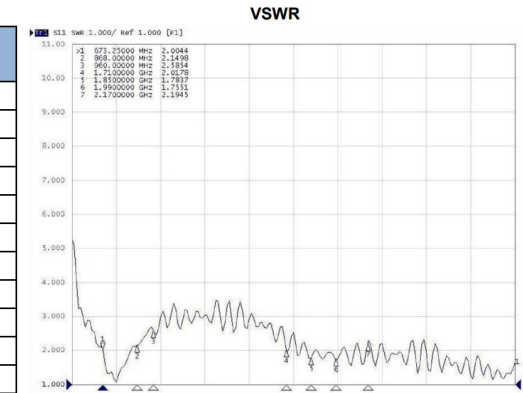
Part #	SIZE(mm)	FREQUENCY(GHz)
RCA-1004-RPF-TR	10 x 4 x 3	2.45 / 5~6
RCA-6050L0-TR	5.9 x 5.1 x 1.1	2.45/5.25/5.85
RST-W2-P-67-SMA-G	108.1 x 7.8 + 9.5	2.4 ~ 2.5 / 5.15~5.725

Raltron Antennas Solutions for LoRa and NB-IoT

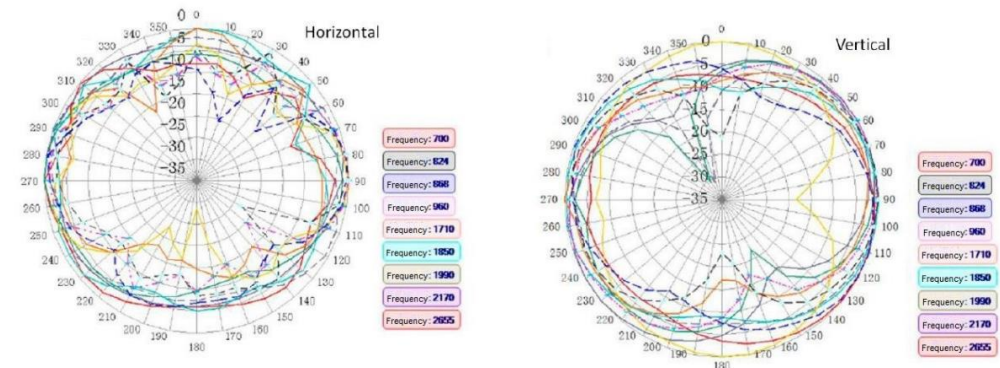
Part #	SIZE(mm)
RST-TA4-TB3-13380063-4-X-001	133.8 x Ø6.3
RDP-GPRS-P-300-SMAM-3000-M-H	300
RCA-868-P-1204-A37-G	12.0 x 4.0 x 1.60
RCA-915-7020-S1-S-TR	7.0 x 2.0 x 1.0

RST-TA4-TB3-13380063-4-X-001

PARAMETERS	VALUE	UNIT
Frequency Range	698 ~ 868 1850 ~ 2690	MHz
Polarization	Linear	-
Gain (Zenith)	2.0	dBi
VSWR, max	2.0	-
Impedance	50	Ω
Cable	RG174	-
Connector	MCX	-
Mounting Way	Magnet	-
Operating Temperature Range	-40 ~ +85	°C
Vibration (1.5 mm amplitude 2 hours)	10 ~ 55	Hz
Environmentally Friendly	RoHS Compliant	-



RADIATION PATTERN



[See All Antenna for LoRa](#) [See Antenna Products for Zigbee](#)

Raltron Solutions - RF Connectors and RF Cable Assemblies

Raltron RF connectors with low insertion loss and excellent voltage standing wave ratio support the high-level performance demanded by Smart Street Lighting.



SMA CONNECTORS - [RCN-1M-21419-K-001](#)

BNC CONNECTORS - [RCN-3F-3108-K-001](#)

MCX CONNECTORS - [RCN-4F-28012-K-001](#)

MMCX CONNECTORS - [RCN-5F-33106-K-001](#)

TNC CONNECTORS - [RCN-9M-16205-K-001](#)

N CONNECTORS - [RCN-17M-12816-K-001](#)

Raltron cable assemblies range from simple jumpers to power and high-speed data cables.

SMA TO IPEX CABLE - RCB-16-F-95-11-SD

MCX TO MCX CABLE - RCB-21-174-150-DO-001

MCX TO SMA CABLE - RCB-14-H-100-12-SD

MMCX TO SMA CABLE - RCB-15-A-100-12-SD

TNC TO SMA CABLE - RCB-13-J-600-13-SD

[CABLE ASSEMBLIES SHORT FORM CATALOG](#)



Contact



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