



The Infinite Bandwidth Company™

## Application Hint 38

### MICRF001 Crystal Selection

#### Micrel Crystal Suppliers

The following crystal manufacturers have been approved by Micrel Semiconductor. Micrel requires that *approved* crystal manufacturers test their crystals with the Micrel receiver over the operating temperature range.

Please refer to *Application Note 32: Receiver Crystal Selection* for crystal parameters. MICRF001 crystal Q must be greater than 115,000. ESR must be 100Ω or less.

#### Crystal Testing

The following is a quick crystal test and is only applicable with the Micrel receiver. An oscilloscope with a 300MHz, 8pF scope probe is all that is necessary to test the basic operation. In the *ac-coupled mode*, monitor the REF OSC pin and note the voltage. A sine wave of amplitude greater than ±200mV peak-to-peak for the MICRF001 must be observed. This takes into account the loading effect of the scope probe. Using a heat gun, apply heat and note that the reference oscillator has not stopped oscillating or decreased in voltage by more than 20%.

*Surface mount crystal have not yet been qualified. Contact Micrel applications for further details.*

#### Operating Frequency

Included are the common crystal frequencies used with the Micrel receivers. Also included are the appropriate formulas. Crystal accuracy must be to four decimal places

$$f_{LO} = \frac{f_{TX}}{1 + \frac{2.00}{390}}$$

$$f_T = \frac{f_{LO}}{130}, \text{ in MHz}$$

#### Nominal $f_{TX}$

315.00MHz ( $f_T = 2.4107\text{MHz}$ )

390.00MHz ( $f_T = 2.9847\text{MHz}$ )

418.00MHz ( $f_T = 3.1990\text{MHz}$ )

433.92MHz ( $f_T = 3.3208\text{MHz}$ )

#### Suggested Crystal Manufacturers

##### Quartztek

Contact: Michael Carpenito  
Precision Crystal Products  
20 South 48th Avenue  
Phoenix, AZ 95043  
tel: (602) 272-7944  
fax: (602) 233-2440  
www.quartztek.com

Crystal Frequency	Part Number	Transmit Frequency
2.4107MHz	F002A24107	315MHz
2.9847MHz	F002A29847	390MHz
3.1990MHz	F002A31990	418MHz
3.3208MHz	F002A33208	433.92MHz

##### Abrakon Corp

Contact: Chris Pollie  
125 Columbia  
Aliso Viejo, CA 92656  
tel: (949) 448-7070  
fax: (949) 448-8484  
http://www.abracon.com

Crystal Frequency	Part Number	Transmit Frequency
2.4107MHz	AB-2.4107MHz-20-D	315MHz
2.9847MHz	AB-2.9847MHz-20-D	390MHz
3.1990MHz	AB-3.1990MHz-20-D	418MHz
3.3208MHz	AB-3.3208MHz-20-D	433.92MHz

##### MMD Components

Contact: Jason Gann  
32-B Mauchly  
Irvine, CA 92618  
tel: (949) 753-5888  
fax: (949) 753-5889  
www.mmdcomp.com

Crystal Frequency	Part Number	Transmit Frequency
2.4107MHz	A15AC1-2.4107	315MHz
2.9847MHz	A15AC1-2.9847	390MHz
3.1990MHz	A15AC1-3.1990	418MHz
3.3208MHz	A15AC1-3.3208	433.92MHz

**ECS**

Contact: Dan Kelly  
1105 South Ridge View  
Olathe, KS 66062

tel: (913) 782-7787 ext. 111

fax: (913) 732-6991

<http://www.ecsxtal.com>

Crystal Frequency	Part Number	Transmit Frequency
2.4107MHz	ECS-24.107-CD-0151	315MHz
2.9847MHz	ECS-29.847-CD-0152	390MHz
3.1990MHz	ECS-31.990-CD-0153	418MHz
3.3208MHz	ECS-33.208-CD0154	433.92MHz

---

**MICREL INC. 1849 FORTUNE DRIVE SAN JOSE, CA 95131 USA**

TEL + 1 (408) 944-0800 FAX + 1 (408) 944-0970 WEB <http://www.micrel.com>

This information is believed to be accurate and reliable, however no responsibility is assumed by Micrel for its use nor for any infringement of patents or other rights of third parties resulting from its use. No license is granted by implication or otherwise under any patent or patent right of Micrel Inc.

© 1999 Micrel Incorporated