

# Engineering Development Model

## Frequency Synthesizer

TSN-EDR10938/1

### Important Note

This model has been designed, built and tested in our engineering department. Performance data represents model capability. At present it is a non-catalog model. On request, we can supply a final specification sheet, part number and price/delivery information.



Please click "Back", and then click "Contact Us" for Applications support.

CASE STYLE : 99-01-1777

| ELECTRICAL SPECIFICATIONS 50Ω, over -45°C to +85°C |         |       |      |        |
|----------------------------------------------------|---------|-------|------|--------|
| Parameter                                          | Min.    | Typ.  | Max. | Units  |
| Frequency                                          | 1970    |       | 2250 | MHz    |
| Step size                                          |         | 10000 |      | kHz    |
| Settling Time Within ±1kHz                         |         | 2.5   |      | msec   |
| Output Power                                       | +10     | +14   | +18  | dBm    |
| Phase Noise                                        |         |       |      |        |
| at 100 Hz offset                                   |         | -89   |      | dBc/Hz |
| at 1 kHz offset                                    |         | -98   |      | dBc/Hz |
| at 10 KHz offset                                   |         | -99   |      | dBc/Hz |
| at 100 KHz offset                                  |         | -121  | -116 | dBc/Hz |
| at 1000 kHz offset                                 |         | -144  | -138 | dBc/Hz |
| Integrated SSB Phase Noise                         |         | -53   |      | dBc    |
| Ref & Comp Spurious Suppression                    |         | 102   |      | dBc    |
| Non-Harm. Spurious Suppression                     |         | -90   |      | dBc    |
| Harmonic Suppression                               |         | -33   | -24  | dBc    |
| Supply voltage VCO                                 |         | 5     |      | V      |
| Supply voltage PLL                                 |         | 3     |      | V      |
| Supply current VCO                                 |         | 59    | 68   | mA     |
| Supply current PLL                                 |         | 11    | 19   | mA     |
| Reference In (External) Frequency                  |         | 10    |      | MHz    |
| Amplitude                                          |         | 1     |      | Vp-p   |
| Impedance                                          |         | 100   |      | kΩ     |
| Ph. N @ 1kHz                                       |         | -145  |      | dBc/Hz |
| Input Logic Levels Logic high                      | 1.4     |       | 3    | V      |
| Logic Low                                          |         |       | 0.6  | V      |
| Digital Lock Detect Locked                         | 2.6     |       | 3    | V      |
| Unlocked                                           |         |       | 0.4  | V      |
| Frequency Synthesizer PLL                          | ADF4106 |       |      |        |

| ABSOLUTE MAXIMUM RATINGS    |                |
|-----------------------------|----------------|
| Operating Temperature       | -45°C to 85°C  |
| Storage Temperature         | -55°C to 100°C |
| VCO Supply Voltage          | 6V             |
| PLL Supply Voltage          | 4V             |
| Reference Frequency voltage | 3.6Vp-p        |
| Data, Clock & LE levels     | 3.3V           |

Power On sequence: Vcc VCO followed by Vcc PLL  
Power Off sequence: Vcc PLL followed by Vcc VCO

| PIN CONNECTIONS |    |                |            |
|-----------------|----|----------------|------------|
| RF OUT          | 13 | CLOCK          | 2          |
| VCC VCO         | 14 | DATA           | 3          |
| VCC PLL         | 15 | LOAD ENABLE    | 4          |
| REF IN          | 16 | V-TUNE MONITOR | 5          |
| LOCK DETECT     | 1  | GROUND         | 6-12,17-22 |

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REV. OR  
TSN-EDR01938/1  
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## Typical Performance Data

| FREQ.<br>(MHz) | POWER OUTPUT<br>(dBm) |        |        | HARMONICS |        |        |        |        |        | VCO CURRENT<br>(mA) |        |        | PLL CURRENT<br>(mA) |        |       |
|----------------|-----------------------|--------|--------|-----------|--------|--------|--------|--------|--------|---------------------|--------|--------|---------------------|--------|-------|
|                |                       |        |        | (dBc)     |        |        |        |        |        |                     |        |        |                     |        |       |
|                | F2                    |        |        | F3        |        |        |        |        |        |                     |        |        |                     |        |       |
| -45 °C         | +25°C                 | +85 °C | -45 °C | +25°C     | +85 °C | -45 °C | +25°C  | +85 °C | -45 °C | +25°C               | +85 °C | -45 °C | +25°C               | +85 °C |       |
| 1950           | 14.07                 | 14.15  | 14.09  | -38.48    | -38.84 | -41.02 | -33.08 | -33.46 | -33.97 | 57.24               | 59.02  | 59.42  | 9.47                | 10.41  | 11.81 |
| 1970           | 14.04                 | 14.07  | 14.02  | -33.23    | -34.25 | -36.22 | -33.97 | -34.74 | -34.54 | 57.38               | 59.13  | 59.51  | 9.53                | 10.48  | 11.88 |
| 1990           | 13.96                 | 14.02  | 13.97  | -37.51    | -37.28 | -39.39 | -34.74 | -34.37 | -34.97 | 57.56               | 59.28  | 59.62  | 9.59                | 10.53  | 11.94 |
| 2010           | 13.98                 | 14.05  | 14.00  | -32.13    | -32.29 | -34.36 | -33.35 | -32.79 | -33.64 | 57.76               | 59.41  | 59.73  | 9.40                | 10.33  | 11.74 |
| 2030           | 14.14                 | 14.21  | 14.15  | -34.98    | -34.74 | -36.03 | -33.30 | -34.49 | -35.37 | 57.83               | 59.41  | 59.70  | 9.52                | 10.45  | 11.86 |
| 2050           | 14.29                 | 14.38  | 14.30  | -32.88    | -32.73 | -34.90 | -33.77 | -34.30 | -35.32 | 57.74               | 59.28  | 59.56  | 9.58                | 10.52  | 11.93 |
| 2070           | 14.28                 | 14.38  | 14.29  | -33.74    | -33.78 | -35.82 | -33.17 | -33.96 | -34.52 | 57.80               | 59.32  | 59.57  | 9.63                | 10.58  | 11.99 |
| 2090           | 14.26                 | 14.34  | 14.24  | -32.28    | -32.61 | -34.04 | -34.26 | -34.86 | -35.81 | 57.85               | 59.38  | 59.64  | 9.47                | 10.41  | 11.81 |
| 2110           | 14.43                 | 14.49  | 14.37  | -30.30    | -30.23 | -31.98 | -36.66 | -36.04 | -36.34 | 57.67               | 59.23  | 59.50  | 9.59                | 10.52  | 11.94 |
| 2130           | 14.62                 | 14.68  | 14.53  | -33.53    | -33.25 | -35.53 | -35.76 | -35.77 | -34.86 | 57.40               | 58.93  | 59.22  | 9.66                | 10.59  | 12.01 |
| 2150           | 14.64                 | 14.70  | 14.53  | -29.54    | -30.82 | -31.91 | -34.88 | -34.93 | -34.38 | 57.28               | 58.80  | 59.10  | 9.71                | 10.65  | 12.06 |
| 2170           | 14.55                 | 14.61  | 14.42  | -32.54    | -32.70 | -34.90 | -35.79 | -35.46 | -34.75 | 57.35               | 58.85  | 59.15  | 9.53                | 10.46  | 11.86 |
| 2190           | 14.67                 | 14.70  | 14.48  | -30.23    | -31.29 | -32.66 | -37.33 | -37.51 | -35.95 | 57.11               | 58.63  | 58.98  | 9.65                | 10.57  | 11.98 |
| 2210           | 14.72                 | 14.74  | 14.46  | -31.41    | -31.95 | -34.23 | -37.69 | -36.50 | -34.53 | 56.83               | 58.35  | 58.81  | 9.71                | 10.65  | 12.06 |
| 2230           | 14.62                 | 14.62  | 14.3   | -33.51    | -34.3  | -36.74 | -36.68 | -35.03 | -32.93 | 56.82               | 58.35  | 58.85  | 9.76                | 10.69  | 12.11 |
| 2250           | 14.54                 | 14.52  | 14.17  | -30.86    | -32.79 | -34.84 | -35.82 | -33.17 | -32.28 | 56.78               | 58.34  | 58.9   | 9.59                | 10.52  | 11.93 |
| 2280           | 14.46                 | 14.40  | 14.01  | -31.55    | -33.31 | -35.60 | -36.06 | -32.56 | -31.86 | 56.63               | 58.29  | 58.93  | 9.74                | 10.67  | 12.09 |

| FREQ.<br>(MHz) | PHASE NOISE (dBc/Hz)<br>@ OFFSETS |         |         |         |         |        |         |         |         |         |        |         |         |         |         |
|----------------|-----------------------------------|---------|---------|---------|---------|--------|---------|---------|---------|---------|--------|---------|---------|---------|---------|
|                | -45 °C                            |         |         |         |         | +25 °C |         |         |         |         | +85 °C |         |         |         |         |
|                | 100Hz                             | 1kHz    | 10kHz   | 100kHz  | 1MHz    | 100Hz  | 1kHz    | 10kHz   | 100kHz  | 1MHz    | 100Hz  | 1kHz    | 10kHz   | 100kHz  | 1MHz    |
| 1950           | -90.33                            | -101.24 | -101.01 | -120.39 | -142.98 | -92.16 | -102.08 | -101.87 | -120.88 | -142.98 | -88.55 | -99.99  | -101.44 | -120.89 | -144.45 |
| 1970           | -89.20                            | -99.57  | -102.94 | -118.53 | -143.02 | -88.16 | -99.29  | -101.11 | -120.80 | -144.24 | -89.03 | -97.70  | -101.06 | -121.05 | -144.41 |
| 1990           | -89.07                            | -100.76 | -102.53 | -118.92 | -143.47 | -89.34 | -98.79  | -101.13 | -120.91 | -144.25 | -92.43 | -100.12 | -100.45 | -120.92 | -144.33 |
| 2010           | -90.88                            | -101.29 | -102.23 | -119.35 | -143.47 | -89.75 | -99.85  | -100.96 | -120.97 | -144.41 | -90.37 | -99.13  | -100.67 | -120.86 | -144.44 |
| 2030           | -88.88                            | -99.63  | -101.83 | -119.63 | -143.52 | -91.86 | -100.78 | -100.63 | -121.15 | -144.49 | -88.94 | -98.94  | -100.51 | -120.95 | -144.35 |
| 2050           | -87.65                            | -101.53 | -101.85 | -119.82 | -143.86 | -87.44 | -100.56 | -100.39 | -120.87 | -144.52 | -90.19 | -100.33 | -100.14 | -120.73 | -144.21 |
| 2070           | -89.30                            | -100.88 | -101.87 | -119.85 | -144.03 | -91.93 | -99.89  | -100.18 | -121.11 | -144.60 | -89.62 | -98.16  | -99.83  | -120.67 | -144.01 |
| 2090           | -89.70                            | -100.36 | -101.96 | -119.99 | -144.14 | -89.54 | -100.74 | -100.02 | -121.10 | -144.73 | -90.02 | -99.23  | -99.14  | -120.95 | -144.16 |
| 2110           | -90.09                            | -98.66  | -101.15 | -120.42 | -144.24 | -86.86 | -97.33  | -99.09  | -121.57 | -144.41 | -91.95 | -98.79  | -98.77  | -121.11 | -143.99 |
| 2130           | -88.79                            | -98.57  | -99.37  | -120.83 | -144.25 | -88.56 | -96.80  | -98.01  | -121.48 | -144.39 | -89.86 | -97.73  | -98.37  | -120.86 | -143.53 |
| 2150           | -87.80                            | -96.99  | -98.84  | -121.03 | -144.27 | -92.19 | -96.48  | -98.39  | -121.25 | -144.13 | -89.06 | -98.05  | -98.75  | -120.62 | -143.47 |
| 2170           | -89.17                            | -97.91  | -99.74  | -121.17 | -144.49 | -87.30 | -98.72  | -99.20  | -121.34 | -144.44 | -89.02 | -99.02  | -98.62  | -120.76 | -143.46 |
| 2190           | -87.47                            | -96.87  | -98.63  | -121.07 | -144.13 | -88.37 | -97.65  | -98.55  | -121.21 | -143.80 | -92.02 | -96.39  | -97.85  | -120.70 | -143.10 |
| 2210           | -89.02                            | -97.87  | -98.21  | -120.9  | -143.7  | -90.4  | -96.12  | -97.9   | -121.07 | -143.6  | -91.13 | -95.26  | -96.66  | -120.6  | -142.8  |
| 2230           | -89.55                            | -97.07  | -98.50  | -120.94 | -143.79 | -89.70 | -97.08  | -97.11  | -121.32 | -143.54 | -89.34 | -95.27  | -95.40  | -120.98 | -142.96 |
| 2250           | -87.91                            | -96.38  | -97.69  | -121.01 | -143.41 | -87.64 | -95.32  | -96.00  | -121.43 | -143.12 | -88.36 | -93.86  | -95.09  | -120.93 | -142.57 |
| 2280           | -85.88                            | -96.48  | -96.19  | -120.85 | -142.87 | -89.05 | -92.45  | -94.57  | -121.32 | -142.61 | -88.77 | -92.82  | -93.57  | -120.83 | -142.11 |

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## Typical Performance Data

| COMPARISON<br>SPURIOUS ORDER | COMPARISON & REFERENCE<br>SPURIOUS<br>@Fcarrier 1970 MHz±<br>(n*Fcomparison)<br>(dBc) NOTE 1 |         |         | COMPARISON & REFERENCE<br>SPURIOUS<br>@Fcarrier 2110 MHz±<br>(n*Fcomparison)<br>(dBc) NOTE 1 |         |         | COMPARISON & REFERENCE<br>SPURIOUS<br>@Fcarrier 2250 MHz±<br>(n*Fcomparison)<br>(dBc) NOTE 1 |         |         |
|------------------------------|----------------------------------------------------------------------------------------------|---------|---------|----------------------------------------------------------------------------------------------|---------|---------|----------------------------------------------------------------------------------------------|---------|---------|
|                              | -45 °C                                                                                       | +25°C   | +85 °C  | -45 °C                                                                                       | +25°C   | +85 °C  | -45 °C                                                                                       | +25°C   | +85 °C  |
| -5                           | -95.81                                                                                       | -100.15 | -97.13  | -106.51                                                                                      | -100.18 | -103.98 | -103.43                                                                                      | -106.75 | -121.38 |
| -4                           | -97.27                                                                                       | -100.83 | -97.68  | -108.95                                                                                      | -99.44  | -104.02 | -103.94                                                                                      | -107.62 | -121.04 |
| -3                           | -96.86                                                                                       | -105.67 | -98.06  | -116.73                                                                                      | -101.22 | -103.88 | -105.03                                                                                      | -115.04 | -116.11 |
| -2                           | -98.69                                                                                       | -102.49 | -97.78  | -106.13                                                                                      | -104.15 | -100.36 | -101.40                                                                                      | -116.15 | -113.01 |
| -1                           | -94.11                                                                                       | -93.24  | -101.18 | -101.09                                                                                      | -95.62  | -91.61  | -99.96                                                                                       | -96.13  | -95.05  |
| 0 <sup>note 2</sup>          | -                                                                                            | -       | -       | -                                                                                            | -       | -       | -                                                                                            | -       | -       |
| +1                           | -111.91                                                                                      | -108.06 | -95.21  | -97.03                                                                                       | -106.17 | -100.94 | -99.97                                                                                       | -101.98 | -101.27 |
| +2                           | -99.30                                                                                       | -103.98 | -99.31  | -99.54                                                                                       | -105.10 | -112.17 | -102.34                                                                                      | -115.68 | -114.71 |
| +3                           | -102.23                                                                                      | -104.40 | -101.00 | -101.04                                                                                      | -103.36 | -120.63 | -104.69                                                                                      | -122.85 | -108.15 |
| +4                           | -100.24                                                                                      | -99.20  | -100.49 | -99.63                                                                                       | -101.18 | -112.88 | -103.22                                                                                      | -109.59 | -105.57 |
| +5                           | -99.76                                                                                       | -99.12  | -98.84  | -98.72                                                                                       | -102.30 | -108.40 | -103.25                                                                                      | -118.29 | -104.96 |

Note 1: Comparison & Reference frequency 10 MHz

Note 2: All spurs are referenced to carrier signal (n=0).

### Notes

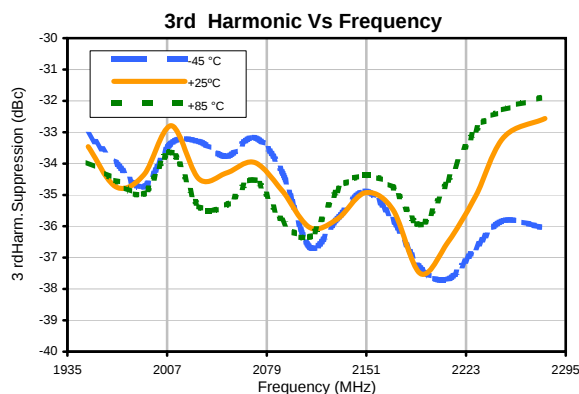
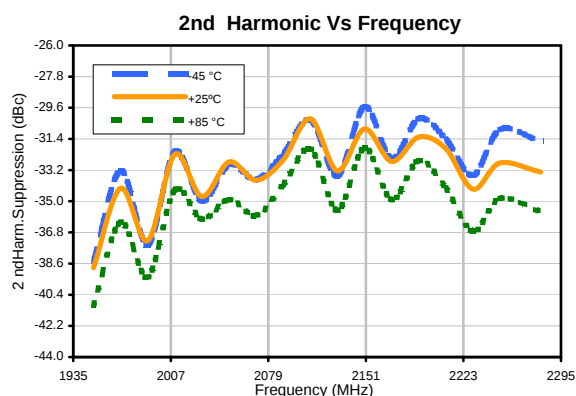
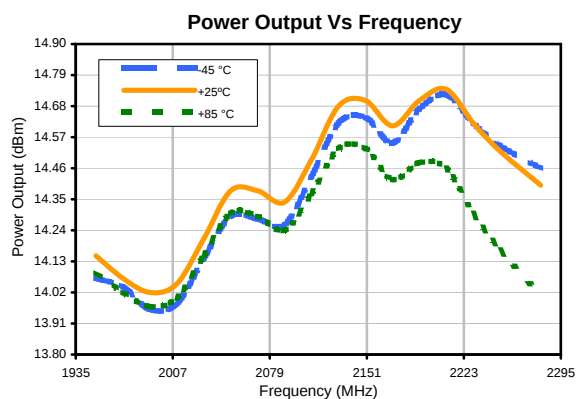
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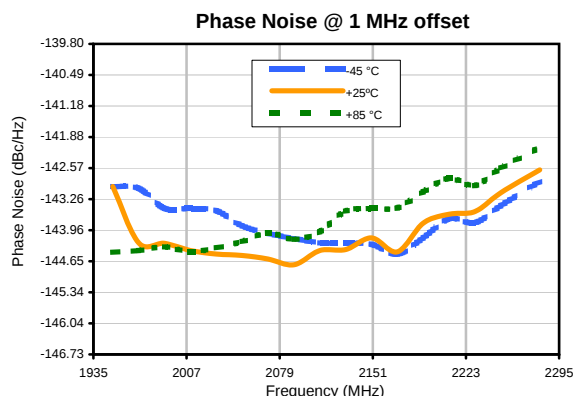
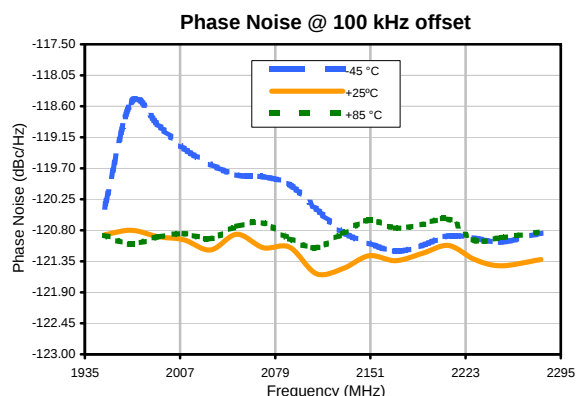
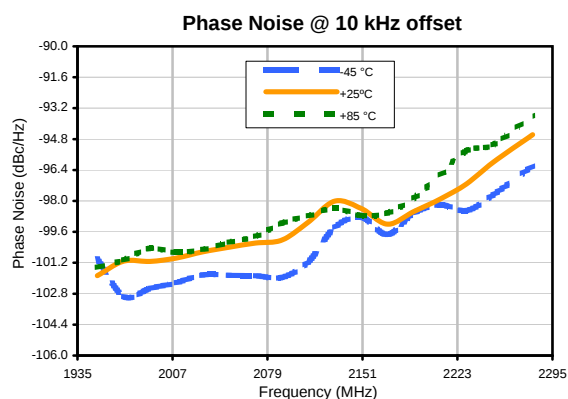
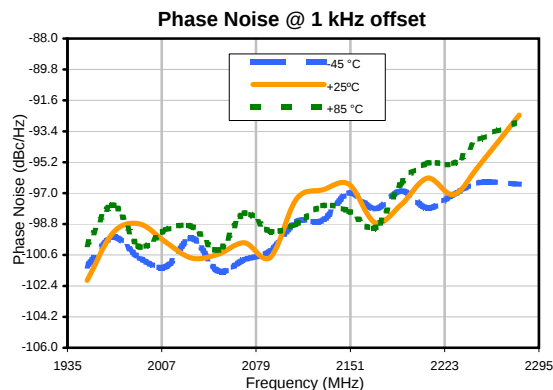
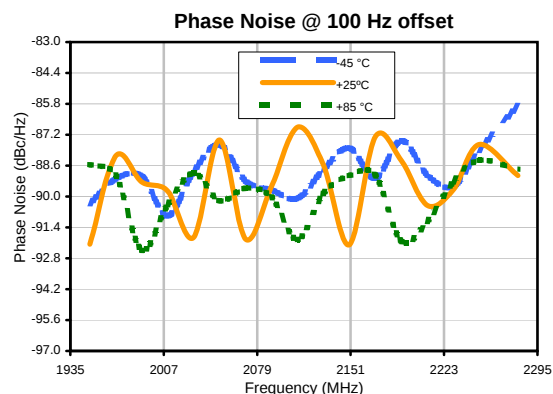
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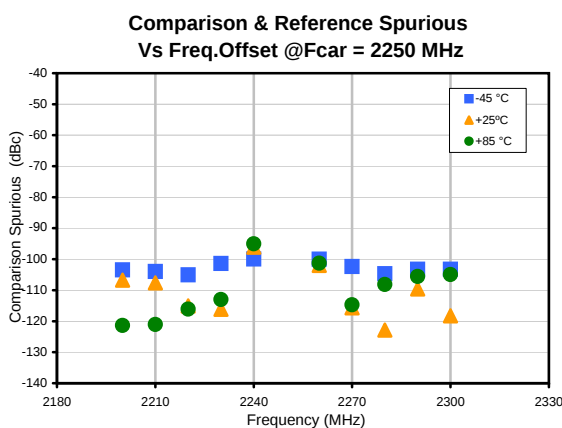
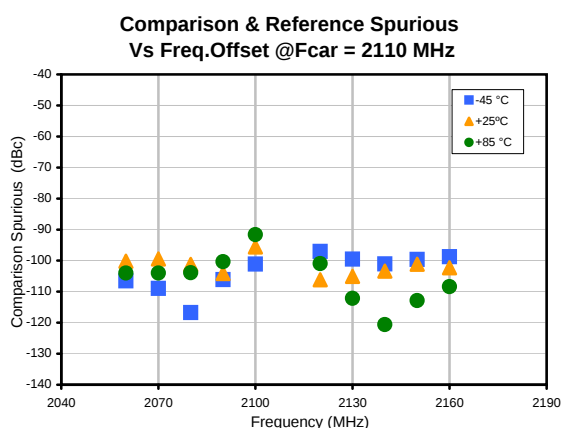
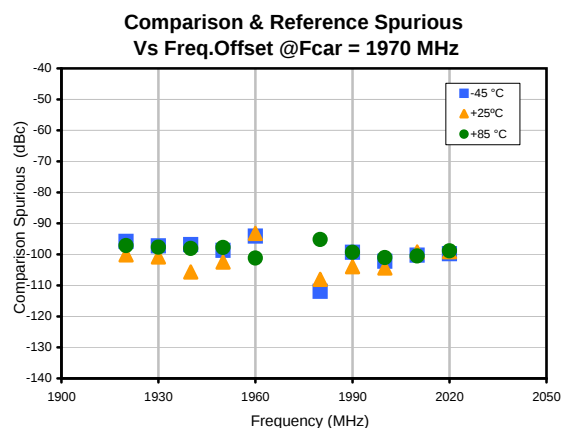
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All Mini-Circuits products are manufactured under exacting quality assurance and control standards, and are capable of meeting published specifications after being subjected to any or all of the following physical and environmental test.

| Specification                  | Test/Inspection Condition                                                                                                                                       | Reference/Spec                                                                                       |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| Operating Temperature          | -45° to 85°C<br>Ambient Environment                                                                                                                             | Individual Model Data Sheet                                                                          |
| Storage Temperature            | -55° to 100° C<br>Ambient Environment                                                                                                                           | Individual Model Data Sheet                                                                          |
| Humidity                       | 90 to 95% RH, 240 hours, 50°C                                                                                                                                   | MIL-STD-202, Method 103, Condition A, Except 50°C and end-point electrical test done within 12 hours |
| Thermal Shock                  | -55° to 100°C, 100 cycles                                                                                                                                       | MIL-STD-202, Method 107, Condition A-3, except +100°C                                                |
| Solder Reflow Heat             | Sn-Pb Eutectic Process: 225°C peak<br>Pb-Free Process, 245°C peak                                                                                               | J-STD-020, Table 4-1, 4-2 and 5-2, Figure 5-1                                                        |
| Solderability                  | 10X Magnification                                                                                                                                               | J-STD-002, Para 4.2.5, Test S, 95% Coverage                                                          |
| Vibration (High Frequency)     | 20g peak, 20-2000 Hz, 4 times in each of three axes (total 12)                                                                                                  | MIL-STD-883, Method 2007.3, Condition A                                                              |
| Mechanical Shock               | 50g, 11 ms, 1/2-sine, 18 shocks: 3 each direction, each of 3 axes                                                                                               | MIL-STD-202, Method 213, Condition A                                                                 |
| Marking Resistance to Solvents | Isopropyl alcohol + mineral spirits at 25°C; terpene defluxer at 25°C;<br>distilled water + proylene glycol monomethyl ether + monoethanolamine at 63°C to 70°C | MIL-STD-202, Method 215                                                                              |