

CARDINAL COMPONENTS, INC.

SERIES CPP

FIELD PROGRAMMABLE OSCILLATOR

QUALIFICATION

REPORT

PREP. BY RZ	CARDINAL COMPONENTS, INC. 155 ROUTE 46 WEST WAYNE, N.J. 07470		
ENGINEERING DJB			
QUALITY ASSURANCE UP	DWG. NO. QR12856		REV.
PRODUCTION	SIZE A	SCALE	SHEET 1 OF 26

TABLE OF CONTENTS

CONTENT	PARAGRAPH NO.	PAGE NO.
Scope	1.0	3
Applicable Documents	2.0	3
Qualification Test	3.0	3
Vibration Test	3.1	3
Drop Test	3.2	5
Resistance to Soldering Heat	3.3	7
Package Leak Rate	3.4	9
Resistance to Heat	3.5	11
Resistance to Cold	3.6	12
Resistance to Thermal Shock	3.7	14
Resistance to Humidity	3.8	16
Aging	3.9	17
30 Day Aging and Projected Long Term Aging	3.10	18
Parameter Measurements over the Temperature Range	3.11	20
Frequency Deviation over the Temperature Range	3.12	21
Period Jitter	3.13	22

CARDINAL COMPONENTS, INC. 155 ROUTE 46 WEST WAYNE, N.J. 07470	SIZE A		DWG. NO. QR12856
	SCALE	REV.	SHEET 2 OF 26

1.0 SCOPE

1.1 This document is a detail qualification report for Cardinal Components, Inc. Oscillator Part Series CPP outlining the tests performed, a summary of the test results, and actual test data.

2.0 APPLICABLE DOCUMENTS

2.1 Unless otherwise specified, the following documents of the issue in effect at the date of the testing form a part of this report to the extent specified herein.

SPECIFICATIONS

MIL-O-55310 General Specification for Crystal Oscillators

MIL-STD-202 Test Methods for Electronic and Electrical Component Parts

3.0 QUALIFICATION TESTS

3.1 VIBRATION TEST

3.1.1 Test Procedure

3.1.1.1 Measure Frequency, V_{OH} , V_{OL} , Duty Cycle, Rise/Fall Time and current consumption.

3.1.1.2 Vibrate part in each X, Y, and Z axis
2 hours in each axis
Frequency: 10~55~10 Hz
Amplitude: 0.7~0.9 mm
Sweep: 1.0~2.0 minutes

3.1.1.3 Measure Frequency, V_{OH} , V_{OL} , Duty Cycle, Rise/Fall Time and current consumption.

CARDINAL COMPONENTS, INC. 155 ROUTE 46 WEST WAYNE, N.J. 07470	SIZE A		DWG. NO. QR12856
	SCALE	REV.	SHEET 3 OF 26

3.1.2 Test Performance Requirements and Results

3.1.2.1 Sample Size: 10

3.1.2.2 Frequency of unit under test: 50.00 MHz

3.2.2.3 Deviation Data

VIBRATION PERFORMANCE DEVIATION REQUIREMENTS	VIBRATION PERFORMANCE DEVIATION RESULTS			
TESTS	AVE.	STD.	MIN.	MAX.
Frequency Deviation: +/- 5.0 ppm maximum	-0.6 ppm	0.67 ppm	-1.7 ppm	0.7 ppm
Output Level Deviation, V _{OH} +/- 0.2 volts max.	0 volts	0 volts	0 volts	0 volts
Output Level Deviation, V _{OL} +/- 0.2 volts max.	0 volts	0 volts	0 volts	0 volts
Duty Cycle Ratio A Deviation: 3.0 % max.	-0.1 %	0.32 %	-1 %	0 %
Duty Cycle Ratio B Deviation: 3.0 % max.	0.1 %	0.32 %	0 %	1 %
Rise Time Deviation: 1 nsec max.	0.02 nsec	0.04 nsec	0 nsec	0.1 nsec
Fall Time Deviation: 1 nsec max.	-0.01 nsec	0.03 nsec	-0.1 nsec	0 nsec
Current Consumption Deviation: 1 ma max.	0.02 ma	0.04 ma	0 ma	0.1 ma

3.1.2.4 Results of Vibration Test

Number Units Pass: 10

Number Units Fail: 0

CARDINAL COMPONENTS, INC. 155 ROUTE 46 WEST WAYNE, N.J. 07470	SIZE A		DWG. NO. QR12856
	SCALE	REV.	SHEET 4 OF 26

3.1.3 Test Performance Requirements and Results

3.1.3.1 Sample Size: 10

3.1.3.2 Frequency of unit under test: 19.6608 MHz

3.2.3.3 Deviation Data

VIBRATION PERFORMANCE DEVIATION REQUIREMENTS	VIBRATION PERFORMANCE DEVIATION RESULTS			
TESTS	AVE.	STD.	MIN.	MAX.
Frequency Deviation: +/- 5.0 ppm maximum	0.21 ppm	0.38 ppm	-0.4 ppm	1.0 ppm
Output Level Deviation, V_{OH} +/- 0.2 volts max.	0 volts	0 volts	0 volts	0 volts
Output Level Deviation, V_{OL} +/- 0.2 volts max	0 volts	0 volts	0 volts	0 volts
Duty Cycle Ratio A Deviation: 3.0 % max.	0 %	0 %	0 %	0 %
Duty Cycle Ratio B Deviation: 3.0 % max.	0 %	0 %	0 %	0 %
Rise Time Deviation: 1 nsec max.	-0.02 nsec	0.04 nsec	-0.1 nsec	0nsec
Fall Time Deviation: 1 nsec max.	-0.02 nsec	0.04 nsec	-0.1 nsec	0 nsec
Current Consumption Deviation: 1 ma max.	0 ma	0. ma	0 ma	0 ma

3.1.3.4 Results of Vibration Test

Number Units Pass: 10

Number Units Fail: 0

CARDINAL COMPONENTS, INC.
155 ROUTE 46 WEST
WAYNE, N.J. 07470

SIZE
A

DWG. NO.
QR12856

SCALE

REV.

SHEET 5 OF 26

3.2 DROP -TEST

3.2.1 Test Procedure

3.2.1.1 Measure Frequency, V_{OH} , V_{OL} , Duty Cycle, Rise/Fall Time and current consumption.

3.2.1.2 Drop freely on a hard wooden plate three times from a height of 75 cm.

3.2.1.3 Measure Frequency, V_{OH} , V_{OL} , Duty Cycle, Rise/Fall Time and current consumption.

3.2.2 Test Performance Requirements and Results

3.2.2.1 Sample Size: 10

3.2.2.2 Frequency of unit under test: 50.00 MHz

3.2.2.3 Deviation Data

DROP TEST PERFORMANCE DEVIATION REQUIREMENTS	DROP TEST PERFORMANCE DEVIATION RESULTS			
TESTS	AVE.	STD.	MIN.	MAX.
Frequency Deviation: +/- 5.0 ppm maximum	-0.03 ppm	0.47 ppm	-0.8 ppm	0.8 ppm
Output Level Deviation, V_{OH} +/- 0.2 volts max	0 volts	0 volts	0 volts	0 volts
Output Level Deviation, V_{OL} +/- 0.2 volts max.	0 volts	0 volts	0 volts	0 volts
Duty Cycle Ratio A Deviation: 3.0 % max.	0.1 %	0.88 %	-1 %	1 %
Duty Cycle Ratio B Deviation: 3.0 % max.	-0.1 %	0.88 %	-1 %	1 %
Rise Time Deviation: 1 nsec max.	0 nsec	0.05 nsec	-0.1 nsec	0.1 nsec
Fall Time Deviation: 1 nsec max.	0.03 nsec	0.07 nsec	-0.1 nsec	0.1 nsec
Current Consumption Deviation: 1 ma max.	0.01 ma	0.17 ma	-0.3 ma	0.3 ma

3.2.2.4 Results of Drop Test

Number Units Pass: 10

Number Units Fail: 0

CARDINAL COMPONENTS, INC. 155 ROUTE 46 WEST WAYNE, N.J. 07470	SIZE A		DWG. NO. QR12856
	SCALE	REV.	SHEET 6 OF 26

3.2.3 Test Performance Requirements and Results

3.2.3.1 Sample Size: 10

3.2.3.2 Frequency of unit under test: 19.6608 MHz

3.2.3.3 Deviation Data

DROP TEST PERFORMANCE DEVIATION REQUIREMENTS	DROP TEST PERFORMANCE DEVIATION RESULTS			
TESTS	AVE.	STD.	MIN.	MAX.
Frequency Deviation: +/- 5.0 ppm maximum	0.03 ppm	0.54 ppm	-1.0 ppm	0.7 ppm
Output Level Deviation, V_{OH} +/- 0.2 volts max	0 volts	0 volts	0 volts	0 volts
Output Level Deviation, V_{OL} +/- 0.2 volts max.	0 volts	0 volts	0 volts	0 volts
Duty Cycle Ratio A Deviation: 3.0 % max.	-0.1 %	0.32 %	-1 %	0 %
Duty Cycle Ratio B Deviation: 3.0 % max.	0.1 %	0.32 %	0 %	1 %
Rise Time Deviation: 1 nsec max.	0.01 nsec	0.03 nsec	0 nsec	0.1 nsec
Fall Time Deviation: 1 nsec max.	0 nsec	0 nsec	0 nsec	0 nsec
Current Consumption Deviation: 1 ma max.	0.01 ma	0.03 ma	0 ma	0.1 ma

3.2.3.4 Results of Drop Test

Number Units Pass: 10

Number Units Fail: 0

CARDINAL COMPONENTS, INC.
155 ROUTE 46 WEST
WAYNE, N.J. 07470

SIZE
A

DWG. NO.
QR12856

SCALE

REV.

SHEET 7 OF 26

3.3 SOLDERABILITY AND RESISTANCE TO SOLDERING HEAT

3.3.1 Test Procedure

3.3.1.1 Measure Frequency, V_{OH} , V_{OL} , Duty Cycle, Rise/Fall Time and current consumption.

3.3.1.2 Prepare unit with solder paste on electrodes so that >95% of the electrode is covered with solder.

3.3.1.3 Let the unit pass through the reflow oven. Pre-heat at a temperature of $150 \pm 10^{\circ}\text{C}$ within 1 minute and reflow at a peak temperature of $230 \pm 5^{\circ}\text{C}$ for 10 seconds maximum.

3.3.1.4 Measure Frequency, V_{OH} , V_{OL} , Duty Cycle, Rise/Fall Time and current consumption.

3.3.2 Test Performance Requirements and Results

3.3.2.1 Sample Size: 10

3.3.2.2 Frequency of unit under test: 50.00 MHz

3.3.2.3 Deviation Data

RESISTANCE TO SOLDERING HEAT PERFORMANCE DEVIATION REQUIREMENTS	RESISTANCE TO SOLDERING HEAT PERFORMANCE DEVIATION RESULTS			
	TESTS	AVE.	STD.	MIN.
Frequency Deviation: ± 5.0 ppm maximum	0.08 ppm	0.48 ppm	-0.8 ppm	0.6 ppm
Output Level Deviation, V_{OH} ± 0.2 volts max.	0 volts	0 volts	0 volts	0 volts
Output Level Deviation, V_{OL} ± 0.2 volts max.	0 volts	0 volts	0 volts	0 volts
Duty Cycle Ratio A Deviation: 3.0 % max.	0 %	0.94 %	-1 %	2 %
Duty Cycle Ratio B Deviation: 3.0 % max.	0 %	0.94 %	-2 %	1 %
Rise Time Deviation: 1 nsec max.	0.01 nsec	0.06 nsec	-0.1 nsec	0.1 nsec
Fall Time Deviation: 1 nsec max.	0.03 nsec	0.07 nsec	-0.1 nsec	0.1 nsec
Current Consumption Deviation: 1 ma max.	0.03 ma	0.22 ma	-0.4 ma	0.3 ma

CARDINAL COMPONENTS, INC.
155 ROUTE 46 WEST
WAYNE, N.J. 07470

SIZE
A

DWG. NO.
QR12856

SCALE

REV.

SHEET 8 OF 26

3.3.2.4 Results of Resistance to Soldering Heat Test

Number Units Pass: 10

Number Units Fail: 0

3.3.2.5 Results of Solderability Test

All units solder area 100% covered

Number Units Pass: 10

Number Units Fail: 0

3.3.3 Test Performance Requirements and Results

3.3.3.1 Sample Size: 10

3.3.3.2 Frequency of unit under test: 19.6608 MHz

3.3.3.3 Deviation Data

RESISTANCE TO SOLDERING HEAT PERFORMANCE DEVIATION REQUIREMENTS	RESISTANCE TO SOLDERING HEAT PERFORMANCE DEVIATION RESULTS			
TESTS	AVE.	STD.	MIN.	MAX.
Frequency Deviation: +/- 5.0 ppm maximum	1.1 ppm	1.56 ppm	-0.3 ppm	4.2 ppm
Output Level Deviation, V_{OH} +/- 0.2 volts max.	0 volts	0 volts	0 volts	0 volts
Output Level Deviation, V_{OL} +/- 0.2 volts max.	0 volts	0 volts	0 volts	0 volts
Duty Cycle Ratio A Deviation: 3.0 % max.	0.1 %	0.32 %	0 %	1 %
Duty Cycle Ratio B Deviation: 3.0 % max.	-0.1 %	0.32 %	-1 %	0 %
Rise Time Deviation: 1 nsec max.	-0.01 nsec	0.03 nsec	-0.1 nsec	0 nsec
Fall Time Deviation: 1 nsec max.	0.01 nsec	0.03 nsec	0 nsec	0.1 nsec
Current Consumption Deviation: 1 ma max.	-0.01 ma	0.03 ma	-0.1 ma	0 ma

3.3.3.4 Results of Resistance to Soldering Heat Test

Number Units Pass: 10

Number Units Fail: 0

3.3.3.5 Results of Solderability Test

All units solder area 100% covered

Number Units Pass: 10

Number Units Fail: 0

CARDINAL COMPONENTS, INC. 155 ROUTE 46 WEST WAYNE, N.J. 07470	SIZE A		DWG. NO. QR12856
	SCALE	REV.	SHEET 9 OF 26

3.4 PACKAGE LEAK RATE

3.4.1 Test Procedure

3.3.1.1 Create a vacuum in the chamber.

3.3.1.2 Back fill chamber at 2 atm for 2 hours.

3.3.1.3 Check helium leak rate with mass spectrometer He leak detector.

3.3.1.4 Measure Frequency, V_{OH} , V_{OL} , Duty Cycle, Rise/Fall Time and current consumption.

3.4.2 Test Performance Requirements and Results

3.4.2.1 Sample Size: 10

3.4.2.2 Frequency of unit under test: 50.00 MHz

3.4.2.3 Test Results

LEAK TEST PERFORMANCE REQUIREMENTS	LEAK TEST PERFORMANCE RESULTS			
TESTS	AVE.	STD.	MIN.	MAX.
Leak Rate, $1 \times 10E-08$ atm-cc/sec He max.	4.89 E-09	0.18 E-09	4.6 E-09	5.1 E-09

3.4.2.1 Results of He Leak Test

Number Units Pass: 10

Number Units Fail: 0

3.4.3 Test Performance Requirements and Results

3.4.3.1 Sample Size: 10

3.4.3.2 Frequency of unit under test: 19.6608 MHz

3.4.3.3 Test Results

CARDINAL COMPONENTS, INC. 155 ROUTE 46 WEST WAYNE, N.J. 07470	SIZE A		DWG. NO. QR12856
	SCALE	REV.	SHEET 10 OF 26

LEAK TEST PERFORMANCE REQUIREMENTS	LEAK TEST PERFORMANCE RESULTS			
TESTS	AVE.	STD.	MIN.	MAX.
Leak Rate, 1 x 10E-08 atm-cc/sec He max.	4.87 E-09	0.16 E-09	4.7 E-09	5.1 E-09

3.4.3.1 Results of He Leak Test

Number Units Pass: 10

Number Units Fail: 0

CARDINAL COMPONENTS, INC. 155 ROUTE 46 WEST WAYNE, N.J. 07470	SIZE A		DWG. NO. QR12856
	SCALE	REV.	SHEET 11 OF 26

3.5 RESISTANCE TO HEAT

3.5.1 Test Procedure

3.5.1.1 Measure Frequency, V_{OH} , V_{OL} , Duty Cycle, Rise/Fall Time and current consumption at ambient temperature.

3.5.1.2 Place unit in chamber kept at a temperature of $+125 \pm 2^{\circ}\text{C}$ for 240 hours.

3.5.1.3 Remove from chamber and measure Frequency, V_{OH} , V_{OL} , Duty Cycle, Rise/Fall Time and current consumption after 1 hour at ambient temperature.

3.5.2 Test Performance Requirements and Results

3.5.2.1 Sample Size: 10

3.5.2.2 Frequency of unit under test: 50.00 MHz

3.5.2.3 Deviation Data

RESISTANCE TO HEAT PERFORMANCE DEVIATION REQUIREMENTS	RESISTANCE TO HEAT PERFORMANCE DEVIATION RESULTS			
TESTS	AVE.	STD.	MIN.	MAX.
Frequency Deviation: ± 5.0 ppm maximum	-0.07 ppm	0.36 ppm	-0.6 ppm	0.5 ppm
Output Level Deviation, V_{OH} ± 0.2 volts max.	0 volts	0 volts	0 volts	0 volts
Output Level Deviation, V_{OL} ± 0.2 volts max.	0 volts	0 volts	0 volts	0 volts
Duty Cycle Ratio A Deviation: 3.0 % max.	-0.1 %	0.32 %	-1 %	0 %
Duty Cycle Ratio B Deviation: 3.0 % max.	0.1 %	0.32 %	0 %	1 %
Rise Time Deviation: 1 nsec max.	0 nsec	0 nsec	0 nsec	0 nsec
Fall Time Deviation: 1 nsec max.	0.01 nsec	0.03 nsec	0 nsec	0.1 nsec
Current Consumption Deviation: 1 ma max.	0.01 ma	0.06 ma	-0.1 ma	0.1 ma

3.5.2.4 Results of Resistance to Heat Test

Number Units Pass: 10

Number Units Fail: 0

CARDINAL COMPONENTS, INC. 155 ROUTE 46 WEST WAYNE, N.J. 07470	SIZE A		DWG. NO. QR12856
	SCALE	REV.	SHEET 12 OF 26

3.5.3 Test Performance Requirements and Results

3.5.3.1 Sample Size: 10

3.5.3.2 Frequency of unit under test: 19.6608 MHz

3.5.3.3 Deviation Data

RESISTANCE TO HEAT PERFORMANCE DEVIATION REQUIREMENTS	RESISTANCE TO HEAT PERFORMANCE DEVIATION RESULTS			
TESTS	AVE.	STD.	MIN.	MAX.
Frequency Deviation: +/- 5.0 ppm maximum	-0.037 ppm	0.25 ppm	-0.4 ppm	0.2 ppm
Output Level Deviation, V _{OH} +/- 0.2 volts max.	0 volts	0 volts	0 volts	0 volts
Output Level Deviation, V _{OL} +/- 0.2 volts max.	0 volts	0 volts	0 volts	0 volts
Duty Cycle Ratio A Deviation: 3.0 % max.	0.1 %	0.32 %	0 %	1 %
Duty Cycle Ratio B Deviation: 3.0 % max.	-0.1 %	0.32 %	-0.1 %	0 %
Rise Time Deviation: 1 nsec max.	-0.2 nsec	-0.01 nsec	0.7 nsec	0.1 nsec
Fall Time Deviation: 1 nsec max.	0.02 nsec	0.04 nsec	0 nsec	0.1 nsec
Current Consumption Deviation: 1 ma max.	0 ma	0 ma	0 ma	0 ma

3.5.3.4 Results of Resistance to Heat Test

Number Units Pass: 10

Number Units Fail: 0

CARDINAL COMPONENTS, INC.
155 ROUTE 46 WEST
WAYNE, N.J. 07470

SIZE
A

DWG. NO.
QR12856

SCALE

REV.

SHEET 13 OF 26

3.6 RESISTANCE TO COLD

3.6.1 Test Procedure

3.6.1.1 Measure Frequency, V_{OH} , V_{OL} , Duty Cycle, Rise/Fall Time and current consumption at ambient temperature.

3.6.1.2 Place unit in chamber kept at a temperature of $-40 \pm 3^{\circ}\text{C}$ for 240 hours.

3.6.1.3 Remove from chamber and measure Frequency, V_{OH} , V_{OL} , Duty Cycle, Rise/Fall Time and current consumption after 1 hour at ambient temperature.

3.6.2 Test Performance Requirements and Results

3.6.2.1 Sample Size: 10

3.6.2.2 Frequency of unit under test: 50.00 MHz

3.6.2.3 Deviation Data

RESISTANCE TO COLD PERFORMANCE DEVIATION REQUIREMENTS	RESISTANCE TO COLD PERFORMANCE DEVIATION RESULTS			
TESTS	AVE.	STD.	MIN.	MAX.
Frequency Deviation: ± 5.0 ppm maximum	-0.09 ppm	0.59 ppm	-1.1 ppm	1.0 ppm
Output Level Deviation, V_{OH} ± 0.2 volts max.	0 volts	0 volts	0 volts	0 volts
Output Level Deviation, V_{OL} ± 0.2 volts max.	0 volts	0 volts	0 volts	0 volts
Duty Cycle Ratio A Deviation: 3.0 % max.	0 %	0.47 %	-1 %	1 %
Duty Cycle Ratio B Deviation: 3.0 % max.	0 %	0.47 %	-1 %	1 %
Rise Time Deviation: 1 nsec max.	0 nsec	0.05 nsec	-0.1 nsec	0.1 nsec
Fall Time Deviation: 1 nsec max.	0 nsec	0.05 nsec	-0.1 nsec	0.1 nsec
Current Consumption Deviation: 1 ma max.	0 ma	0.05 ma	-0.1 ma	0.1 ma

3.6.2.4 Results of Resistance to Cold Test

Number Units Pass: 10

Number Units Fail: 0

CARDINAL COMPONENTS, INC. 155 ROUTE 46 WEST WAYNE, N.J. 07470	SIZE A		DWG. NO. QR12856
	SCALE	REV.	SHEET 14 OF 26

3.6.3 Test Performance Requirements and Results

3.6.3.1 Sample Size: 10

3.6.3.2 Frequency of unit under test: 19.6608 MHz

3.6.3.3 Deviation Data

RESISTANCE TO COLD PERFORMANCE DEVIATION REQUIREMENTS	RESISTANCE TO COLD PERFORMANCE DEVIATION RESULTS			
TESTS	AVE.	STD.	MIN.	MAX.
Frequency Deviation: +/- 5.0 ppm maximum	-0.05 ppm	0.69 ppm	-1.5 ppm	1.0 ppm
Output Level Deviation, V _{OH} +/- 0.2 volts max.	0 volts	0 volts	0 volts	0 volts
Output Level Deviation, V _{OL} +/- 0.2 volts max.	0 volts	0 volts	0 volts	0 volts
Duty Cycle Ratio A Deviation: 3.0 % max.	0.1 %	0.32 %	0 %	1 %
Duty Cycle Ratio B Deviation: 3.0 % max.	-0.1 %	0.32 %	-1 %	1 %
Rise Time Deviation: 1 nsec max.	-0.01 nsec	0.03 nsec	-0.1 nsec	0 nsec
Fall Time Deviation: 1 nsec max.	0.03nsec	0.07 nsec	0 nsec	0.2 nsec
Current Consumption Deviation: 1 ma max.	-0.01 ma	0.03 ma	-0.1 ma	0 ma

3.6.3.4 Results of Resistance to Cold Test

Number Units Pass: 10

Number Units Fail: 0

3.7 RESISTANCE TO THERMAL SHOCK

3.7.1 Test Procedure

3.7.1.1 Measure Frequency, V_{OH}, V_{OL}, Duty Cycle, Rise/Fall Time and current consumption at ambient temperature.

3.7.1.2 Place unit in chamber and subject unit to 10 cycles of temperature as follows: -40°C for 30 minutes. Transfer to +85°C in 60 seconds and soak unit for 30 minutes. Transfer to -40°C in 60 seconds. Repeat cycle 10 times.

3.7.1.3 Remove from chamber and measure Frequency, V_{OH}, V_{OL}, Duty Cycle, Rise/Fall Time and current consumption after 1 hour at ambient temperature.

CARDINAL COMPONENTS, INC.
155 ROUTE 46 WEST
WAYNE, N.J. 07470

SIZE
A

DWG. NO.
QR12856

SCALE

REV.

SHEET 15 OF 26

3.7.2 Test Performance Requirements and Results

3.7.2.1 Sample Size: 10

3.7.2.2 Frequency of unit under test: 50.00 MHz

3.7.2.3 Deviation Data

RESISTANCE TO THERMAL SHOCK PERFORMANCE DEVIATION REQUIREMENTS	RESISTANCE TO THERMAL SHOCK PERFORMANCE DEVIATION RESULTS			
TESTS	AVE.	STD.	MIN.	MAX.
Frequency Deviation: +/- 5.0 ppm maximum	-0.07 ppm	0.36 ppm	-0.05 ppm	0.5 ppm
Output Level Deviation, V _{OH} +/- 0.2 volts max	0 volts	0 volts	0 volts	0 volts
Output Level Deviation, V _{OL} +/- 0.2 volts max.	0 volts	0 volts	0 volts	0 volts
Duty Cycle Ratio A Deviation: 3.0 % max.	0 %	0 %	0 %	0 %
Duty Cycle Ratio B Deviation: 3.0 % max.	0 %	0 %	0 %	0 %
Rise Time Deviation: 1 nsec max.	0.02 nsec	0.04 nsec	0 nsec	0.1 nsec
Fall Time Deviation: 1 nsec max.	-0.01 nsec	0.03 nsec	-0.1 nsec	0 nsec
Current Consumption Deviation: 1 ma max.	0 ma	0.07 ma	-0.1 ma	0.1 ma

3.7.2.4 Results of Resistance to Thermal Shock

Number Units Pass: 10

Number Units Fail: 0

CARDINAL COMPONENTS, INC.
155 ROUTE 46 WEST
WAYNE, N.J. 07470

SIZE
A

DWG. NO.
QR12856

SCALE

REV.

SHEET 16 OF 26

3.7.3 Test Performance Requirements and Results

3.7.3.1 Sample Size: 10

3.7.3.2 Frequency of unit under test: 19.6608 MHz

3.7.3.3 Deviation Data

RESISTANCE TO THERMAL SHOCK PERFORMANCE DEVIATION REQUIREMENTS	RESISTANCE TO THERMAL SHOCK PERFORMANCE DEVIATION RESULTS			
TESTS	AVE.	STD.	MIN.	MAX.
Frequency Deviation: +/- 5.0 ppm maximum	-0.42 ppm	0.76 ppm	-2.0 ppm	0.2 ppm
Output Level Deviation, V _{OH} +/- 0.2 volts max.	0 volts	0 volts	0 volts	0 volts
Output Level Deviation, V _{OL} +/- 0.2 volts max.	0 volts	0 volts	0 volts	0 volts
Duty Cycle Ratio A Deviation: 3.0 % max.	0.1 %	0.32 %	0 %	1 %
Duty Cycle Ratio B Deviation: 3.0 % max.	-0.1 %	0.32 %	-0.1 %	0 %
Rise Time Deviation: 1 nsec max.	-0.01 nsec	0.03 nsec	-0.1 nsec	0 nsec
Fall Time Deviation: 1 nsec max.	0.01 nsec	0.03 nsec	0 nsec	0.1 nsec
Current Consumption Deviation: 1 ma max.	0 ma	0 ma	0 ma	0 ma

3.7.3.4 Results of Resistance to Thermal Shock

Number Units Pass: 10

Number Units Fail: 0

CARDINAL COMPONENTS, INC.
155 ROUTE 46 WEST
WAYNE, N.J. 07470

SIZE
A

DWG. NO.
QR12856

SCALE

REV.

SHEET 17 OF 26

3.8 RESISTANCE TO HUMIDITY

3.8.1 Test Procedure

3.8.1.1 Measure Frequency, VOH, VOL, Duty Cycle, Rise/Fall Time and current consumption at ambient temperature.

3.8.1.2 Place unit in chamber kept at +40 +/- 2°C and humidity at 90 to 95 % for 240 hours.

3.8.1.3 Remove from chamber and measure Frequency, VOH, VOL, Duty Cycle, Rise/Fall Time and current consumption after 1 hour at ambient temperature.

3.8.2 Test Performance Requirements and Results

3.8.2.1 Sample Size: 10

3.8.2.2 Frequency of unit under test: 50.00 MHz

3.8.2.3 Deviation Data

RESISTANCE TO HUMIDITY PERFORMANCE DEVIATION REQUIREMENTS	RESISTANCE TO HUMIDITY PERFORMANCE DEVIATION RESULTS			
TESTS	AVE.	STD.	MIN.	MAX.
Frequency Deviation: +/- 5.0 ppm maximum	0.07 ppm	0.27 ppm	-0.035 ppm	0.6 ppm
Output Level Deviation, V _{OH} +/- 0.2 volts max.	0 volts	0 volts	0 volts	0 volts
Output Level Deviation, V _{OL} +/- 0.2 volts max.	0 volts	0 volts	0 volts	0 volts
Duty Cycle Ratio A Deviation: 3.0 % max.	-0.2 %	0.42 %	-1 %	0 %
Duty Cycle Ratio B Deviation: 3.0 % max.	0.2 %	0.42 %	0 %	1 %
Rise Time Deviation: 1 nsec max.	0.03 nsec	0.05 nsec	0 nsec	0.1 nsec
Fall Time Deviation: 1 nsec max.	0 nsec	0 nsec	0 nsec	0 nsec
Current Consumption Deviation: 1 ma max.	0.01 ma	0.03 ma	0 ma	0.1 ma

3.8.2.4 Results of Resistance to Humidity

Number Units Pass: 10

Number Units Fail: 0

CARDINAL COMPONENTS, INC. 155 ROUTE 46 WEST WAYNE, N.J. 07470	SIZE A		DWG. NO. QR12856
	SCALE	REV.	SHEET 18 OF 26

3.8.3 Test Performance Requirements and Results

3.8.3.1 Sample Size: 10

3.8.3.2 Frequency of unit under test: 19.6608 MHz

3.8.3.3 Deviation Data

RESISTANCE TO HUMIDITY PERFORMANCE DEVIATION REQUIREMENTS	RESISTANCE TO HUMIDITY PERFORMANCE DEVIATION RESULTS			
TESTS	AVE.	STD.	MIN.	MAX.
Frequency Deviation: +/- 5.0 ppm maximum	0.34 ppm	0.80 ppm	-1.0 ppm	1.5 ppm
Output Level Deviation, V_{OH} +/- 0.2 volts max.	0 volts	0 volts	0 volts	0 volts
Output Level Deviation, V_{OL} +/- 0.2 volts max.	0 volts	0 volts	0 volts	0 volts
Duty Cycle Ratio A Deviation: 3.0 % max.	0 %	0 %	0 %	0 %
Duty Cycle Ratio B Deviation: 3.0 % max.	0 %	0 %	0 %	0 %
Rise Time Deviation: 1 nsec max.	0 nsec	0 nsec	0 nsec	0 nsec
Fall Time Deviation: 1 nsec max.	0.01 nsec	0.07	-0.1 nsec	0.2 nsec
Current Consumption Deviation: 1 ma max.	-0.01 ma	0.03 ma	-0.1 ma	0 ma

3.8.3.4 Results of Resistance to Humidity

Number Units Pass: 10

Number Units Fail: 0

CARDINAL COMPONENTS, INC.
155 ROUTE 46 WEST
WAYNE, N.J. 07470

SIZE
A

DWG. NO.
QR12856

SCALE

REV.

SHEET 19 OF 26

3.9 AGING

3.9.1 Test Procedure

3.9.1.1 Measure Frequency at ambient temperature.

3.9.1.2 Place unit in chamber kept at +85 +/- 3°C under operating voltage for 720 hours.

3.9.1.3 Remove from chamber and measure Frequency after 1 hour at ambient temperature.

3.9.2 Test Performance Requirements and Results

3.9.2.1 Sample Size: 10

3.9.2.2 Frequency of unit under test: 50.00 MHz

3.9.2.3 Deviation Data

AGING PERFORMANCE DEVIATION REQUIREMENTS	AGING PERFORMANCE DEVIATION RESULTS		
TESTS	AVE.	MIN.	MAX.
Frequency Deviation: +/- 5.0 ppm maximum	-2.9 ppm	-3.7 ppm	-1.3 ppm

3.9.2.4 Results of Aging

Number Units Pass: 10

Number Units Fail: 0

CARDINAL COMPONENTS, INC.
155 ROUTE 46 WEST
WAYNE, N.J. 07470

SIZE
A

DWG. NO.
QR12856

SCALE

REV.

SHEET 20 OF 26

3.9.3 Test Performance Requirements and Results

3.9.3.1 Sample Size: 10

3.9.3.2 Frequency of unit under test: 19.6608 MHz

3.9.3.3 Deviation Data

AGING PERFORMANCE DEVIATION REQUIREMENTS	AGING PERFORMANCE DEVIATION RESULTS		
TESTS	AVE.	MIN.	MAX.
Frequency Deviation: +/- 5.0 ppm maximum	-3.9 ppm	-4.8 ppm	-2.1 ppm

3.9.3.4 Results of Aging

Number Units Pass: 10

Number Units Fail: 0

CARDINAL COMPONENTS, INC.
155 ROUTE 46 WEST
WAYNE, N.J. 07470

SIZE
A

DWG. NO.
QR12856

SCALE

REV.

SHEET 21 OF 26

3.10 30 DAY AGING RATE AND PROJECTED LONG TERM AGING

3.10.1 Test Procedure

3.10.1.1 Place unit in an individual chamber kept at +70 +/- 0.5°C. Maintain a temperature stability of +/-0.03°C. Operate unit under operating voltage for 30 days.

3.10.1.2 Measure the reference frequency after 2 hours warm-up.

3.10.1.3 Measure frequency two times per day for 30 days.

3.10.2 Test Performance Requirements and Results

3.10.2.1 Sample Size: 9

3.10.2.2 Frequency of units under test:

- 1 Unit at 21.884 MHz
- 3 Units at 10.000 MHz
- 2 Units at 66.000 MHz
- 3 Units at 125.000 MHz

3.10.2.3 Deviation Data

AGING PERFORMANCE DEVIATION REQUIREMENTS	AGING PERFORMANCE DEVIATION RESULTS			
TESTS	AVE.	STD.	MIN.	MAX.
Actual Frequency Aging Rate/Day after 30 days at +70°C: +/- 0.15 ppm/day maximum.	-0.037 ppm	-0.024ppm	-0.076ppm	-0.098ppm
Projected Total Frequency Aging at 1 year at +70°C: +/- 15 ppm maximum.	-4.40 ppm	3.26 ppm	-10.54 ppm	0.15 ppm
Projected Total Frequency Aging at 10 years at +70°C: +/- 25 ppm maximum.	-6.49 ppm	4.48 ppm	-14.88 ppm	0.1 ppm
Projected Total Frequency Aging at 15 years at +70°C: +/- 30 ppm maximum.	-6.83 ppm	4.74 ppm	-15.64 ppm	0.09 ppm

3.10.2.4 Results of Aging Rate and Projected Long Term Aging

Number Units Pass: 9
 Number Units Fail: 0

CARDINAL COMPONENTS, INC. 155 ROUTE 46 WEST WAYNE, N.J. 07470	SIZE A		DWG. NO. QR12856
	SCALE	REV.	SHEET 22 OF 26

3.11 PARAMETER MEASUREMENTS OVER THE TEMPERATURE RANGE

3.11.1 Test Procedure

3.11.1.1 Place unit in chamber; vary the chamber temperature from -40°C to +85°C in 5°C steps.

3.11.1.2 Measure Frequency Deviation, VOH, VOL, Duty Cycle, Rise/Fall Time and current consumption at each temperature step.

3.11.2 Test Performance Requirements and Results

3.11.2.1 Sample Size: 5

3.11.2.2 Frequency of unit under test: 19.6608 MHz

3.11.2.3 Test Results Summary

PARAMETER MEASUREMENTS OVER THE TEMPERATURE RANGE PERFORMANCE REQUIREMENTS	PARAMETER MEASUREMENTS OVER THE TEMPERATURE RANGE PERFORMANCE RESULTS	
TESTS	MIN.	MAX.
Frequency Deviation: +/- 50.0 ppm maximum	5.83 ppm	-12.34 ppm
Output Level Deviation, V _{OH} 2.9 volts min.	3.26 volts	3.34 volts
Output Level Deviation, V _{OL} 0.4 volts max.	-0.06 volts	0.02 volts
Duty Cycle Ratio: 45/55 % max.	48.4%	51.6 %
Rise Time: 4 nsec max.	1.27 nsec	1.74 nsec
Fall Time: 4 nsec max.	1.24 nsec	1.78 nsec
Current Consumption: 25 ma max.	2.00 ma	5.88 ma

3.11.2.4 Results of Parameter Measurement over the Temperature Range

Number Units Pass: 5

Number Units Fail: 0

CARDINAL COMPONENTS, INC. 155 ROUTE 46 WEST WAYNE, N.J. 07470	SIZE A		DWG. NO. QR12856
	SCALE	REV.	SHEET 23 OF 26

3.11.3 Test Performance Requirements and Results

3.11.3.1 Sample Size: 5

3.11.3.2 Frequency of unit under test: 34.000 MHz

3.11.3.3 Test Results Summary

PARAMETER MEASUREMENTS OVER THE TEMPERATURE RANGE PERFORMANCE REQUIREMENTS	PARAMETER MEASUREMENTS OVER THE TEMPERATURE RANGE PERFORMANCE RESULTS	
TESTS	MIN.	MAX.
Frequency Deviation: +/- 50.0 ppm maximum	7.72 ppm	-12.61 ppm
Output Level Deviation, V _{OH} 2.9 volts min.	3.30 volts	3.58 volts
Output Level Deviation, V _{OL} 0.4 volts max.	-1.08 volts	0.18 volts
Duty Cycle Ratio: 45/55 % max.	47.1 %	52.9 %
Rise Time: 4 nsec max.	1.28 nsec	1.66 nsec
Fall Time: 4 nsec max.	1.15 nsec	1.67 nsec
Current Consumption: 25 ma max.	4.71 ma	7.52 ma

3.11.3.4 Results of Parameter Measurement over the Temperature Range

Number Units Pass: 5

Number Units Fail: 0

CARDINAL COMPONENTS, INC.
155 ROUTE 46 WEST
WAYNE, N.J. 07470

SIZE
A

DWG. NO.
QR12856

SCALE

REV.

SHEET 24 OF 26

3.12 FREQUENCY DEVIATION OVER THE TEMPERATURE RANGE

3.12.1 Test Procedure

3.12.1.1 Place unit in chamber; vary the chamber temperature from -20°C to $+70^{\circ}\text{C}$ in 5°C and 10°C steps.

3.12.1.2 Measure Frequency Deviation from 44.736 at each temperature step.

3.12.2 Test Performance Requirements and Results

3.12.2.1 Sample Size: 24

3.12.2.2 Frequency of unit under test (f_0): 44.736 MHz

3.12.2.3 Test Results Summary

FREQUENCY DEVIATION OVER THE TEMPERATURE RANGE PERFORMANCE REQUIREMENTS	FREQUENCY DEVIATION OVER THE TEMPERATURE RANGE PERFORMANCE RESULTS			
TESTS	AVE.	STD.	MIN.	MAX.
Freq. Deviation at $+25^{\circ}\text{C}$: ± 20 ppm max.	-0.29 ppm	2.87 ppm	0 ppm	12.16 ppm
Freq. Dev. $> f_0$ over Temp.: ± 50 ppm max.	6.81 ppm	3.23 ppm	2.15 ppm	14.88 ppm
Freq. Dev. $< f_0$ over Temp.: ± 50 ppm max.	-4.50 ppm	2.60 ppm	-0.72 ppm	-10.01 ppm
Total Freq. Deviation : 100 ppm max.	11.30 ppm	4.73 ppm	6.01 ppm	24.89 ppm

3.12.2.4 Results of Parameter Measurement over the Temperature Range

Number Units Pass: 24

Number Units Fail: 0

CARDINAL COMPONENTS, INC.
155 ROUTE 46 WEST
WAYNE, N.J. 07470

SIZE
A

DWG. NO.
QR12856

SCALE

REV.

SHEET 25 OF 26

3.13 PERIOD JITTER

3.13.1 Test Procedure

3.13.1.1 Test unit at +25°C at nominal voltage and load.

3.13.1.2 Measure Period Jitter.

3.13.2 Test Performance Requirements and Results

3.13.2.1 Sample Size: 30

3.13.2.2 Test Results Summary

PERIOD JITTER PERFORMANCE REQUIREMENTS	FREQUENCY JITTER PERFORMANCE RESULTS
TESTS	AVE. STD. DEV.
10 MHz at 3.3 volts: Std. Dev., +/-50 ps	+/- 40.67
10 MHz at 5.0 volts: Std. Dev., +/-50 ps	+/- 10.42
33.33 MHz at 3.3 volts: Std. Dev., +/-40 ps	+/- 38.13
40.96 MHz at 5.0 volts: Std. Dev., +/-30 ps	+/- 17.85
66 MHz at 3.3 volts: Std. Dev., +/-40 ps	+/- 39.40
125 MHz at 5.0 volts: Std. Dev., +/-30 ps	+/- 28.76 ps

3.13.2.4 Results of frequency jitter

Number Units Pass: 30

Number Units Fail: 0

CARDINAL COMPONENTS, INC. 155 ROUTE 46 WEST WAYNE, N.J. 07470	SIZE A		DWG. NO. QR12856
	SCALE	REV.	SHEET 26 OF 26