Compliance Worldwide

ACCREDITED
CERTIFICATE NUMBER: 1673.01

TEST NUMBER - 368-00

# FEDERAL COMMUNICATIONS COMMISSION PART 68 TESTING

for

Clare Corporation
78 Cherry Hill Drive
Beverly, MA 01915
978-524-6777

of

CPC2420

on

November 8, 2000

Tested by

Mark R. McSweeney

Reviewed by:

*Larry K Stillings*

Larry K. Stillings

This test report has been approved for:

Clare Corporation

by _____

Printed: _____

## Table of Contents

TEST NUMBER: 368-00
MANUFACTURER: Clare Corporation
MODEL: CPC2420

# EXHIBIT D

## Exhibit D1 – Equipment Description

CONTENTS: Manufacturer's Technical Data Sheet(s)

NOTES:

1. For key systems submit a list of circuit card types.
2. For Private line ports submit Exhibit D1.

**The product description data sheet is submitted as a part of Exhibit J. Please see the Exhibit J for these documents.**

**The CPC2420 is not a PBX or a Key system thus neither a list of circuit card types nor Exhibit D1 are included herein.**

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MANUFACTURER: Clare Corporation
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## Exhibit D2 – System Block Diagram

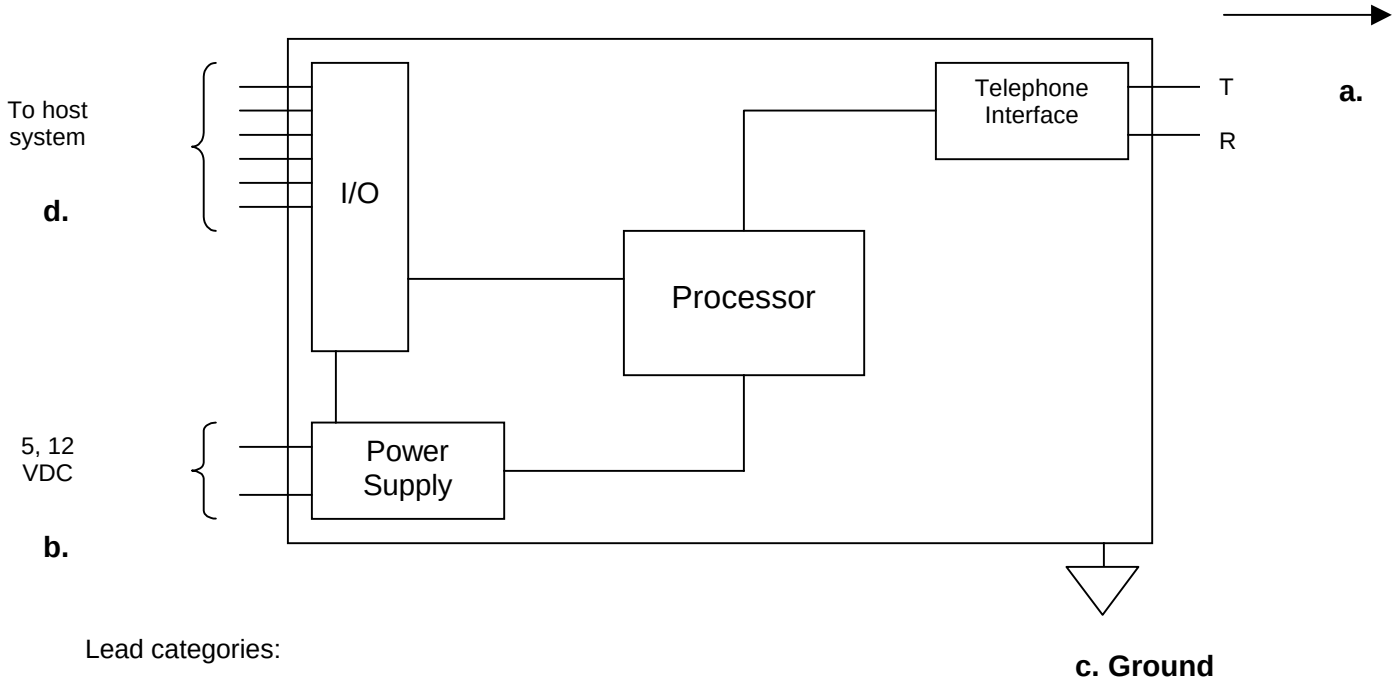
CONTENTS: System Block Diagram showing means for connecting the device to the telephone network.

NOTES:

1. Indicate whether any cross connect blocks used are protected or unprotected.
2. If the device is protective circuitry indicate the class(es) of devices or systems for which it has been designed to be connected to.

**The CPC2420 does not use any cross connect blocks and is not protective circuitry within the meaning of FCC rules part 68.**

### SYSTEM BLOCK DIAGRAM:




Lead categories:

a. all telephone connections (T+R's)
b. all power connections except ground
c. exposed conductive surfaces (ground)
d. all terminals for connection to certified protective circuitry or non-certified equipment.
e. all auxiliary leads
f. all E&M leads
g. all PR, PC, CY1 and CY2 leads

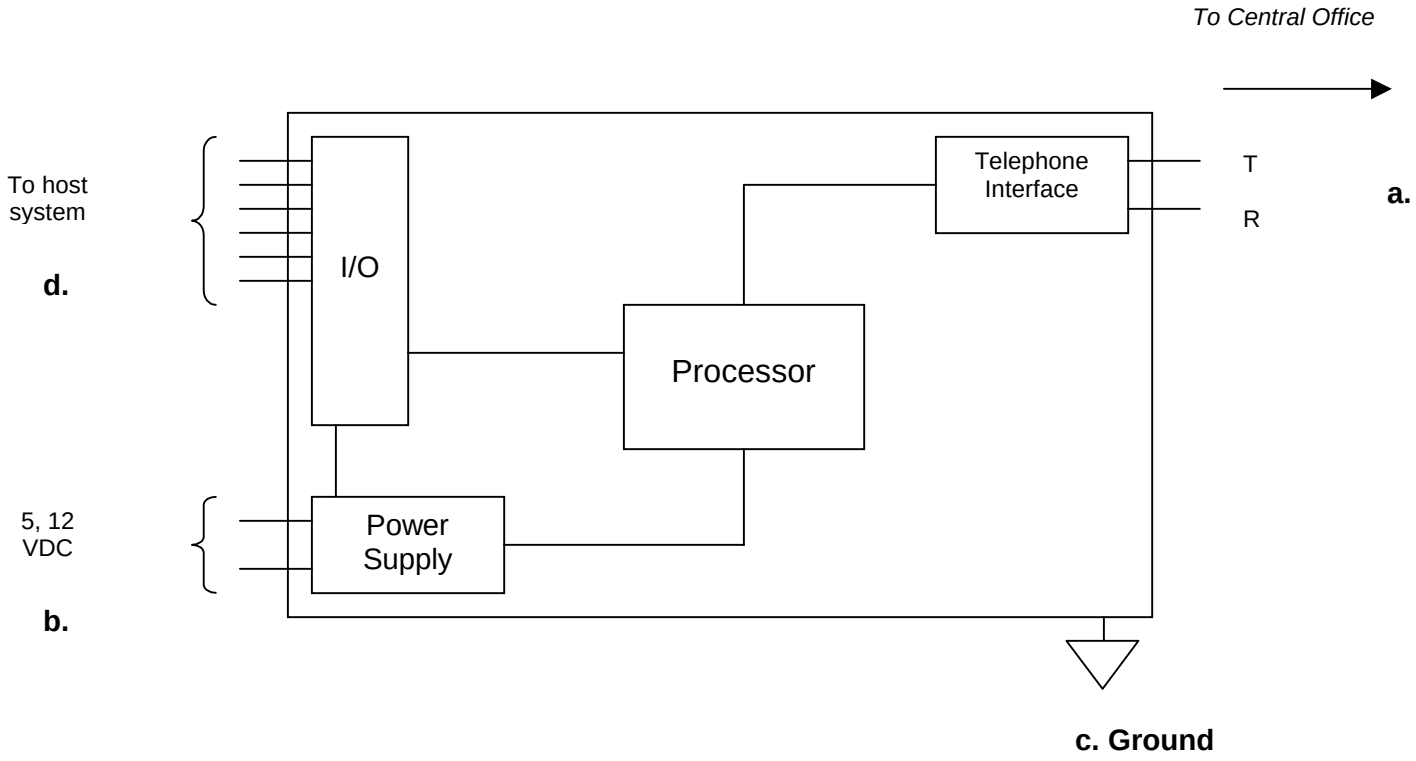
# EXHIBIT E

TEST NUMBER: 368-00
MANUFACTURER: Clare Corporation
MODEL: CPC2420

## Exhibit E1 – Telephone Interface Schematics

Contents: A complete schematic diagram of that part of the equipment which is designed to protect the telephone network from harm is shown below. Proprietary portions of that circuit have been shown in block diagram form or have been deleted from the drawing(s).

### TELEPHONE INTERFACE BLOCK DIAGRAM




Lead categories:

a. all telephone connections (T+R's)
b. all power connections except ground
c. exposed conductive surfaces (ground)
d. all terminals for connection to certified protective circuitry or non-certified equipment.
e. all auxiliary leads
f. all E&M leads
g. all PR, PC, CY1 and CY2 leads

## Exhibit E2 – Parts List

Contents: A parts list of all active and passive circuit elements that affect compliance with the Rules. Include voltage breakdown and/or current ratings. For parts that isolate the telephone connections from the rest of the circuit the voltage breakdown must be at least 1000 VDC.

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## Exhibit E3 – Power Supplies

Contents: Describe all power supplies used in connection with the network interface circuitry. Provide transformer dielectric ratings (1500 VDC minimum) and a schematic diagram.

X - Unit is powered from non-hazardous (less than 42.4 volts peak or 80 VDC) supply voltages.

_____ - EUT is powered from mains power

_____ - EUT is battery powered (Please specify) _____

_____ - EUT is line powered -48 VDC

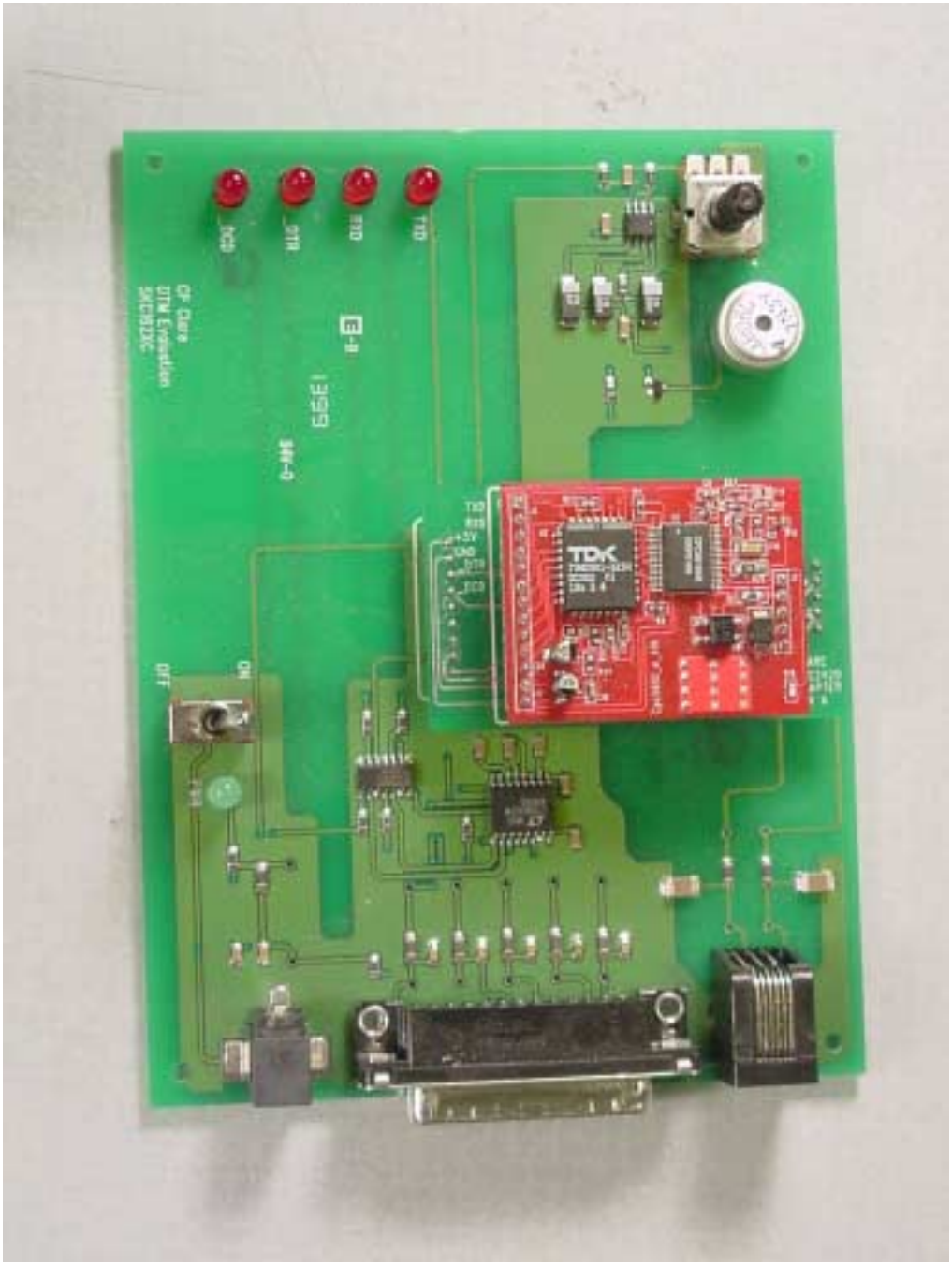
EUT is powered from an external power supply as follows:

| | | | |
|---|---|---|---|
| _____ | 12VAC | _____ | 12VDC |
| _____ | 9VAC | _____ | 9VDC |
| _____ | 6VAC | _____ | 6VDC |
| _____ | Other | X | Other |
| | (Please specify) | | (Please specify) |
| | | | 5, 12 VDC |

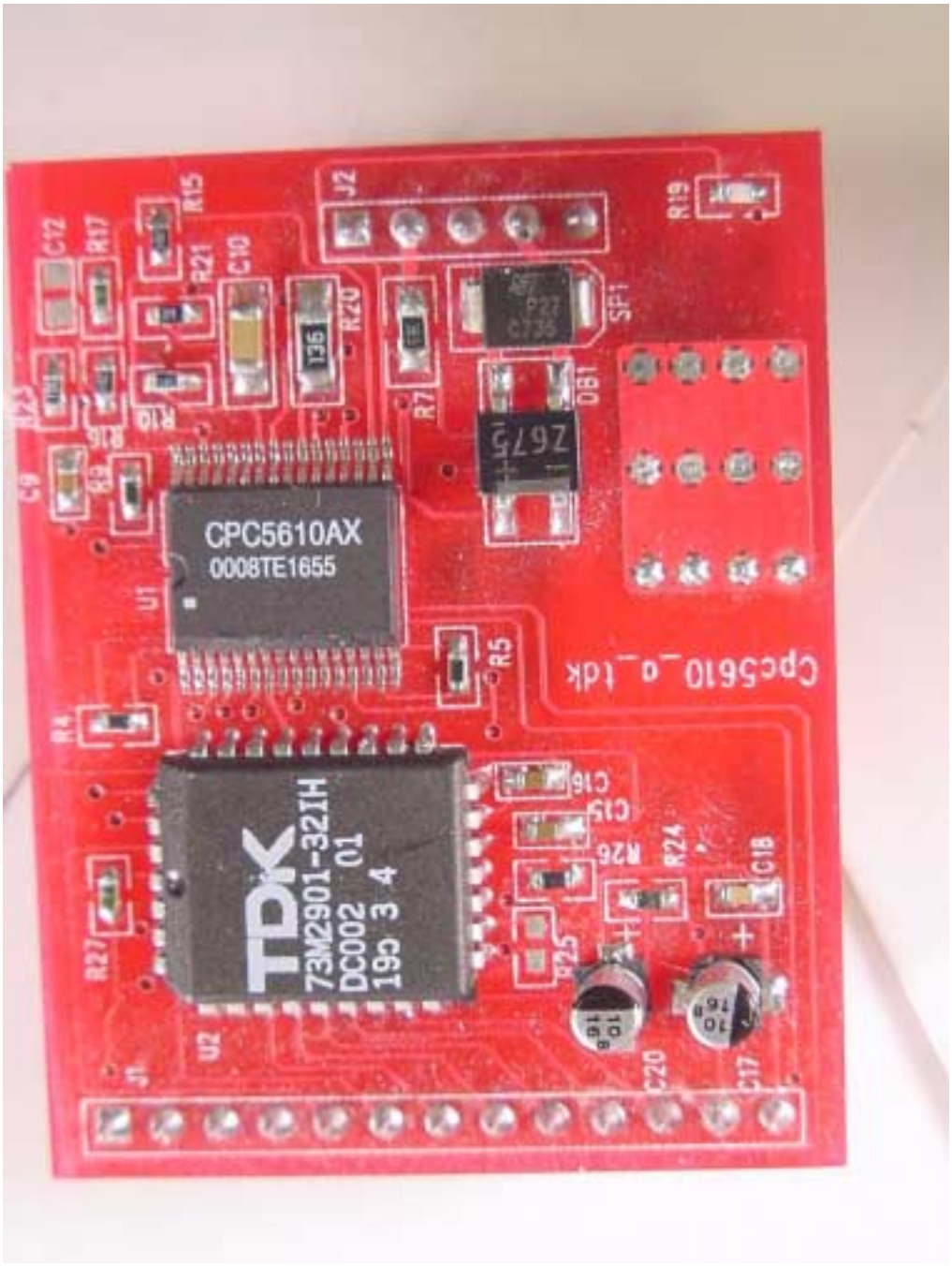
## Exhibit E4 - Photographs

Contents: Show photographs giving views of internal and external surfaces to depict component placement and wiring of telephone leads.

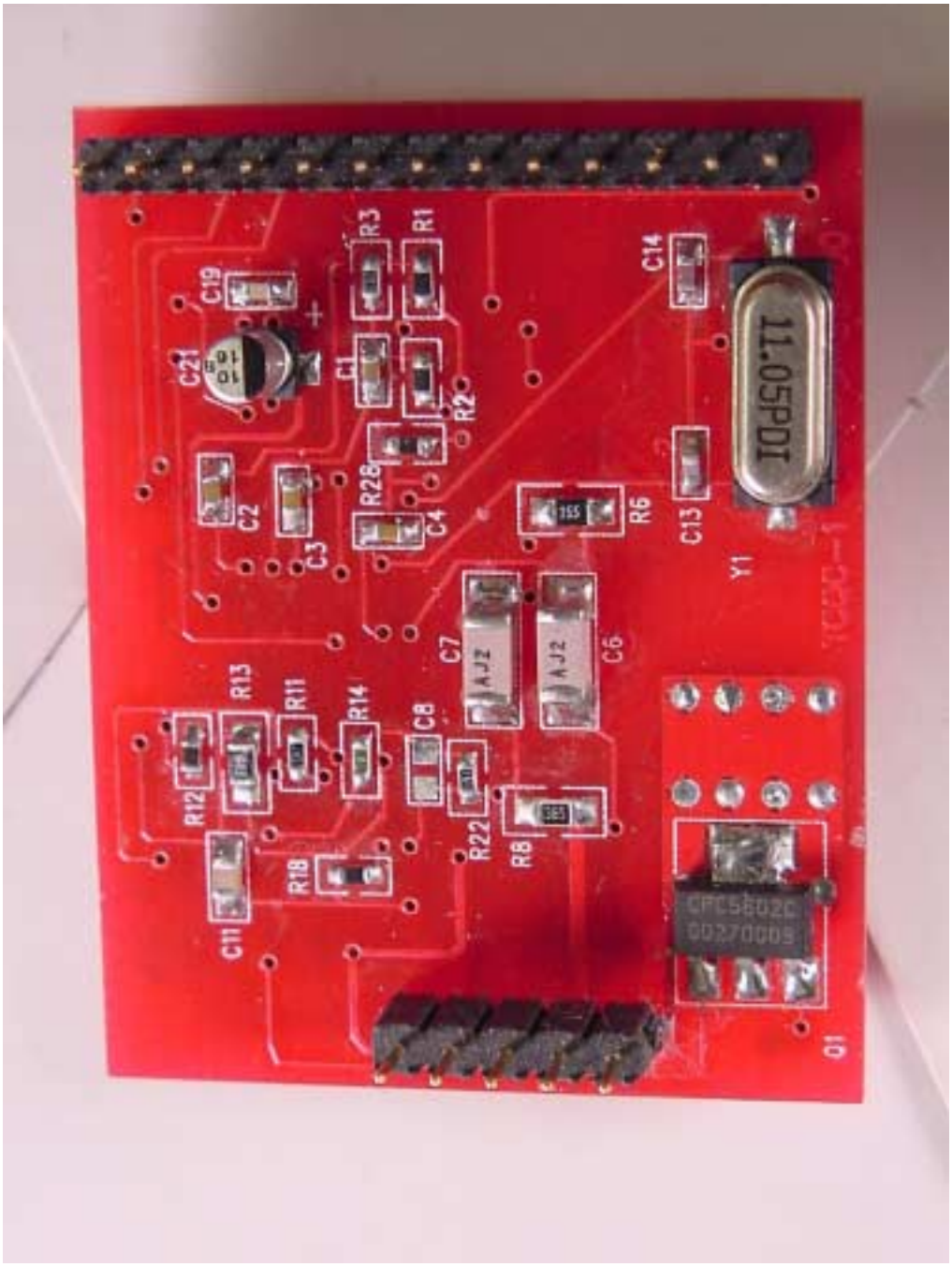
The CPC2420 consists of printed circuit card(s), packaged in accordance with standard industry methods and practices. The routing of the telephone leads maintains good physical separation from the power leads. The actual lead routing is shown in the photographs below.




**View of CPR 2420 installed in evaluation board (as tested)**




**Top view of CPC 2420 module**




**Bottom view of CPC 2420 module**

# EXHIBIT F

TEST NUMBER: 368-00
MANUFACTURER: Clare Corporation
MODEL: CPC2420

## Exhibit F1 – RFI Generation

Contents: Indicate whether any RFI generating circuitry is contained within the unit which may cause it to be subject to the Commission's rules pertaining to radio-frequency devices.

The CPC2420 does contain one (or more) internal crystal oscillators and may be subject to the Commission's rules pertaining to radio-frequency devices.

[ ] PART 15 TESTING NOT REQUIRED (NO OSCILLATOR).
[ ] CLASS A VERIFICATION HAS BEEN PERFORMED.
[ X ] CLASS B VERIFICATION HAS BEEN PERFORMED.
[ ] CLASS B DECLARATION OF CONFORMITY HAS BEEN PERFORMED.
[ ] CLASS B CERTIFICATION RECEIVED ID # _____
[ ] CLASS B CERTIFICATION IN PROCESS ID # _____
[ ] CLASS C CERTIFICATION IN PROCESS ID # _____
[ ] PRODUCT IS EXEMPT BECAUSE _____

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MANUFACTURER: Clare Corporation
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**Exhibit F2 – Test Procedures**

Contents: Submit a description of test procedures and circuits.

Tests required by 68.200(d) "description of test procedures" have been previously submitted to the commission. This document describes the test methods, circuits and so forth for the test data attached.

Section 2.909(d) requires a statement that shows the qualifications for Compliance Worldwide personnel. This has been previously submitted to the commission.

## Exhibit F3 – Test Plan

Contents: Submit a test plan which shows a block diagram, and an engineering analysis and rationale for compliance affecting circuit components.

The CPC2420 contains one or more telephone interface circuits. It is attached to the Tip and Ring connections of the telephone network. Please see the electrical diagram in Exhibit E1 and the schematic diagram of Exhibit E3 for a detailed diagram of the actual circuits used in the device.

TEST PLAN

The device will undergo all of the tests below except as noted.

- 68.302

  The EUT will be subjected to mechanical shock. Surges will be applied to Tip and Ring connections using the chassis as the ground connection. Phase to neutral power connections will be surged if the EUT is powered off AC mains.

- 68.304

  Leakage tests will be applied from Tip & Ring to ground.

- 68.306

  The network leads will be verified to have no hazardous voltages present.

- 68.308

  Signal power will be measured at Tip(s) and Ring(s).

- 68.310

  Transverse balance will be measured at Tip(s) and Ring(s).

- 68.312

  DC and AC on hook impedance will be measured at Tip and Ring.

- 68.314

  On hook level, line seizure characteristics and SF interference will be measured.

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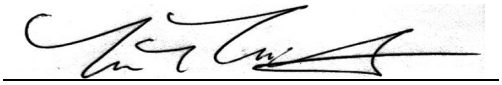
**Exhibit F4 – Analysis of Test Results**

LABORATORY CONDITIONS:

Ambient Temperature 19.7 **°C** Relative Humidity 39 **%**

***The test plan results were within acceptable limits.***

**Based on our analysis this device complies with and will continue to comply with FCC Part 68 rules.**

Test Engineer's signature: 

Mark R. McSweeney
November 8, 2000

## Exhibit F5 – Test Results

Contents: Report the pre and post environmental measured results and the required limit.

**The applicable test data results follow along with comparisons the required limit.**

TEST NUMBER: 368-00
MANUFACTURER: Clare Corporation
MODEL: CPC2420

F5.1 - Mechanical Shock

REFERENCE STANDARD: Part 68.302(a), EIA/TIA TSB31B Section 5.2

CRITERIA REQUIREMENT: See Table

Test Equipment: Cement floor

Data:

Weight of EUT - 0.1 kg (module only)

Handheld items used at head height:

n/a - (18) random 1.5m drops

Desk/Table Top Equipment:

n/a - (6) random 750mm drops

ANALYSIS: The CPC2420 has been examined and analyzed with results measured. The CPC2420 has met or exceeded the FCC requirements of this section.

Notes:

EUT is mounted onto a PCB.

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MODEL: CPC2420

F5.2 - Voltage Surge. (Type A)

REFERENCE STANDARD: Part 68.302(b)(1),(2), EIA/TIA TSB31B Section 5.3, 5.4

TEST EQUIPMENT: Compliance Design CDI-1000, 800V Waveshape Plug-in module, 1500V Waveshape Plug-in module, HP 54610B Digital Storage Oscilloscope

Data:

Tip-Ring Surge - 4 Surges - 800 V, 100 amp, 10x560µS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| On-Hook | X | X | | Off Hook | X | X | |
| | Positive | Negative | | | Positive | Negative | |

T,R-Ground Surge - 4 Surges - 1500 V, 200 amp, 10x160µS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| On-Hook | X | X | | Off Hook | X | X | |
| | Positive | Negative | | | Positive | Negative | |

T,R, to Non-certified leads Surge - 4 Surges - 1500, 200 amp, 10x160µS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| On-Hook | X | X | | Off Hook | X | X | |
| | Positive | Negative | | | Positive | Negative | |

ANALYSIS: The CPC2420 has been examined and analyzed with results measured. The CPC2420 has met or exceeded the FCC requirements of this section.

Notes:

None

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F5.3 - Voltage Surge. (Type B)

REFERENCE STANDARD: Part 68.302(c)(1),(2), EIA/TIA TSB31B Section 5.5, 5.6

TEST EQUIPMENT: Haefely PSurge 4.1 Surge Generator, HP 54610B Digital Storage Oscilloscope

Data:

Tip-Ring Surge - 4 Surges - 1000 V, 25 amp, 9x720µS

| | On-Hook | | Off Hook | |
|---|---|---|---|---|
| | Positive | Negative | Positive | Negative |
| | X | X | X | X |

T,R-Ground Surge - 4 Surges - 1500 V, 37.5 amp, 9x720µS

| | On-Hook | | Off Hook | |
|---|---|---|---|---|
| | Positive | Negative | Positive | Negative |
| | X | X | X | X |

T,R to Non-certified Leads Surge - 4 Surges - 1500 V, 37.5 amp, 9x720µS

| | On-Hook | | Off Hook | |
|---|---|---|---|---|
| | Positive | Negative | Positive | Negative |
| | X | X | X | X |

ANALYSIS: The CPC2420 has been examined and analyzed with results measured. The CPC2420 has met or exceeded the FCC requirements of this section.

Notes:

None

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F5.4 - Power Line Surge.

REFERENCE STANDARD: Part 68.302(d)(1), EIA/TIA TSB31B Section 5.7

TEST EQUIPMENT: Compliance Design CDI-1000, 2500V Waveshape Plug-in Waveshape module, HP 54610B Digital Storage Oscilloscope

Data:

Mains Power Surge (Phase-Neutral) - 6 Surges - 2500 V, 1000 amp, 2x10µS

On-Hook

| | | | |
|---|---|---|---|
| Positive | X | X | X |
| Negative | X | X | X |

Off-Hook

| | | | |
|---|---|---|---|
| Positive | X | X | X |
| Negative | X | X | X |

ANALYSIS: The CPC2420 has been examined and analyzed with results measured. The CPC2420 has met or exceeded the FCC requirements of this section.

Notes:

EUT is not directly AC mains powered.

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F5.5 - Leakage Current

REFERENCE STANDARD: Part 68.304, EIA/TIA TSB31B Section 6.0

CRITERIA REQUIREMENT: The leakage current to ground shall not exceed 10 mA.

Test Equipment: Compliance Design Leakage Tester, HP 34401A Digital Multimeter.

Data:

| *Leads* | *Applied Voltage* VAC | *Pre-Surge Current* mA | *Post Surge Current* mA |
|---|---|---|---|
| Telephone(a) to Mains Power(b) | 1500 | n/a | n/a |
| Telephone(a) to Surfaces(c) | 1000 | 1.0 | 1.0 |
| Telephone(a) to Non-certified(d) | 1000 | 1.0 | 1.0 |
| Telephone(a) to Aux leads(e) | 1000 | n/a | n/a |
| Telephone(a) to E&M leads(f) | 1000 | n/a | n/a |
| Telephone(a) to PR, PC, CY1, CY2 leads(g) | 1000 | n/a | n/a |
| Mains Power(b) to Surfaces(c) | 1500 | n/a | n/a |
| Mains Power(b) to Non-certified(d) | 1500 | n/a | n/a |
| Mains Power(b) to Aux leads(e) | 1500 | n/a | n/a |
| Mains Power(b) to E&M leads(f) | 1500 | n/a | n/a |
| Telephone(a) to PR, PC, CY1, CY2 leads(g) | 1500 | n/a | n/a |
| Surfaces(c) to Aux leads(e) | 1000 | n/a | n/a |
| Surfaces(c) to E&M leads(f) | 1000 | n/a | n/a |
| Non-certified(d) to Aux leads(e) | 1000 | n/a | n/a |
| Non-certified(d) to E&M leads(f) | 1000 | n/a | n/a |
| Aux leads(e) to E&M leads(f) | 1000 | n/a | n/a |

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MODEL: CPC2420

F5.5 - Leakage Current (cont.)

REFERENCE STANDARD: Part 68.304, EIA/TIA TSB31B Section 6.0

Lead categories:

a. all telephone connections (T+R's)
b. all power connections except ground
c. exposed conductive surfaces (ground)
d. all terminals for connection to registered protective circuitry or non-certified equipment.
e. all auxiliary leads
f. all E&M leads
g. all PR, PC, CY1 and CY2 leads

ANALYSIS: The CPC2420 has been examined and analyzed with results measured. The CPC2420 has met or exceeded the FCC requirements of this section.

Notes:

**If any lead has an intentional conducting path to ground it may be excluded from the leakage test.**

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MODEL: CPC2420

F5.6 - Hazardous Voltage Limitations.

REFERENCE STANDARD: Part 68.306b, EIA/TIA TSB31B Section 7.1.1

CRITERIA REQUIREMENT: No voltage on telephone leads more than 70 volts peak for more than one second.

Test Equipment: HP 54610B Digital Storage Oscilloscope

Data:

| *Leads* | *Pre-Surge Voltage* Volts | *Duration* mS | *Post Surge Voltage* Volts | *Duration* mS |
|---|---|---|---|---|
| Tip - Ring | < 70 | < 1000 | < 70 | < 1000 |
| Tip - Ground | < 70 | < 1000 | < 70 | < 1000 |
| Ring - Ground | < 70 | < 1000 | < 70 | < 1000 |

ANALYSIS: The CPC2420 has been examined and analyzed with results measured. The CPC2420 has met or exceeded the FCC requirements of this section.

Notes:

None

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MANUFACTURER: Clare Corporation
MODEL: CPC2420

F5.7 - Lead Separation

REFERENCE STANDARD: Part 68.306(b)(1), EIA/TIA TSB31B Section 7.2.1

Test Equipment: Engineering Analysis

Data:

Attention is called to the fact that Tip and Ring are routed away from mains power leads.

A good physical separation is maintained between telephone leads and leads to non-certified equipment that has hazardous voltages (greater than 42.4 volts peak or 80V DC).

Routing of leads is through back panel, then to the interface printed circuit board.

Additional Remarks:

None

ANALYSIS: The CPC2420 has been examined and analyzed with results measured. The CPC2420 has met or exceeded the FCC requirements of this section.

Notes:

None

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F5.8 - Intentional Protective Paths to Ground

REFERENCE STANDARD: Part 68.306(e)(2), EIA/TIA TSB31B Section 7.4.2

CRITERIA REQUIREMENT: The leakage current to ground for intentional DC protective paths to ground shall not exceed 10 mA.

Test Equipment: HP 34401A Digital Multimeter, Fluke 45 Digital Multimeter, Compliance Design Hazardous Voltage Analyzer.

Data:

| *Test Points* | *Applied Voltage*<br><br>*VAC* | *Pre-Surge Measured*<br>mA | *Post Surge Measured*<br>mA | *Limit*<br><br>mA |
|---|---|---|---|---|
| Tip – Ground | 120 | n/a | n/a | **10** |
| Ring – Ground | 120 | n/a | n/a | **10** |

ANALYSIS: The CPC2420 has been examined and analyzed with results measured. The CPC2420 has met or exceeded the FCC requirements of this section.

Notes:

EUT has no intentional protective paths to ground.

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F5.9 - Voiceband Metallic Signal Power

REFERENCE STANDARD: Part 68.308(b)(1), EIA/TIA TSB31B Section 8.1

CRITERIA REQUIREMENT: Non-network signals shall be less than -9 dbm.

Test Equipment: Compliance Design Wideband Receiver, HP 34401A Digital Multimeter, Krohn-Hite 3945 Programmable Filter.

Data:

| *Parameter* | *Pre-Surge* dBm | *Post Surge* dBm |
|---|---|---|
| Non-Live Voice | n/a | n/a |
| Data signals | -11.9 | -20.1 |
| Other Signals | -10.5 | -10.5 |

ANALYSIS: The CPC2420 has been examined and analyzed with results measured. The CPC2420 has met or exceeded the FCC requirements of this section.

Notes:

None

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MANUFACTURER: Clare Corporation
MODEL: CPC2420

F5.10 - Voiceband Signal Power Limiting

REFERENCE STANDARD: Part 68.308(b)(1), EIA/TIA TSB31B Section 8.2

CRITERIA REQUIREMENT: Connections from non-certified equipment must be appropriately limited.

**The CPC2420 does not connect uncertified equipment to the Public Switched Telephone Network within the meaning of the FCC Part 68 rules.**

ANALYSIS: The CPC2420 has been examined and analyzed with results measured. The CPC2420 has met or exceeded the FCC requirements of this section.

Notes:

None

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MODEL: CPC2420

F5.11 - Network Control Signals

REFERENCE STANDARD: Part 68.308(b)(2), EIA/TIA TSB31B Section 8.3

CRITERIA REQUIREMENT: CRITERIA REQUIREMENT: Network control signals shall be less than 0 dbm.

Test Equipment: Compliance Design Wideband Receiver, HP 34401A Digital Multimeter, Krohn-Hite 3945 Programmable Filter.

Data:

| DTMF Digit | *Low Frequency* Hz | *High Frequency* Hz | *Pre-Surge* dBm | *Post Surge* dBm |
|---|---|---|---|---|
| 0 | 932 | 1329 | -14.0 | -14.0 |
| 1 | 694 | 1210 | -14.0 | -14.0 |
| 2 | 694 | 1329 | -14.0 | -14.0 |
| 3 | 694 | 1467 | -14.0 | -14.0 |
| 4 | 774 | 1210 | -14.0 | -14.0 |
| 5 | 774 | 1329 | -14.0 | -14.0 |
| 6 | 774 | 1467 | -14.0 | -14.0 |
| 7 | 853 | 1210 | -14.0 | -14.0 |
| 8 | 853 | 1329 | -14.0 | -14.0 |
| 9 | 853 | 1467 | -14.0 | -14.0 |
| # | 932 | 1467 | -14.0 | -14.0 |
| * | 932 | 1210 | -14.0 | -14.0 |

ANALYSIS: The CPC2420 has been examined and analyzed with results measured. The CPC2420 has met or exceeded the FCC requirements of this section.

Notes:

None

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F5.12 - Signal Power 3995-4005 Hz

REFERENCE STANDARD: Part 68.308(c), EIA/TIA TSB31B Section 8.15

CRITERIA REQUIREMENT: Signal power from 3995-4005 Hz shall be less than -27 dBV.

Test Equipment: Compliance Design Wideband Receiver, HP 34401A Digital Multimeter, Krohn-Hite 3945 Programmable Filter.

Data:

| *State* | *Termination* ohms | *Measured Pre-Surge* dBV | *Measured Post-Surge* dBV | *Limit* dBV |
|---|---|---|---|---|
| On Hook | 600 | < -120 | < -120 | **-27** |
| Off Hook | 600 | -33.7 | -36.5 | **-27** |

ANALYSIS: The CPC2420 has been examined and analyzed with results measured. The CPC2420 has met or exceeded the FCC requirements of this section.

Notes:

None

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F5.13 - Longitudinal Voltage 0.1-4 kHz

REFERENCE STANDARD: Part 68.308(d), EIA/TIA TSB31B Section 8.16

CRITERIA REQUIREMENT: The Longitudinal Voltage from 0.1-4 kHz shall be less than -30 dBV.

Test Equipment: Compliance Design Wideband Receiver, HP 34401A Digital Multimeter, Krohn-Hite 3945 Programmable Filter.

Data:

**Pre-Surge**

| *State* | *Termination* ohms | *Measured* dBV | *Correction Factor* dB | *Corrected Reading* dBV | *Limit* dBV |
|---|---|---|---|---|---|
| On Hook | 500 | -87.7 | +3.1 | -84.6 | **-30** |
| Off Hook | 500 | -87.9 | +3.1 | -84.8 | **-30** |

**Post Surge**

| *State* | *Termination* ohms | *Measured* dBV | *Correction Factor* dB | *Corrected Reading* dBV | *Limit* dBV |
|---|---|---|---|---|---|
| On Hook | 500 | -62.4 | +3.1 | -59.3 | **-30** |
| Off Hook | 500 | -61.9 | +3.1 | -58.8 | **-30** |

ANALYSIS: The CPC2420 has been examined and analyzed with results measured. The CPC2420 has met or exceeded the FCC requirements of this section.

Notes:

None

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MANUFACTURER: Clare Corporation
MODEL: CPC2420

F5.14 - Metallic Voltage 4-6000 kHz

REFERENCE STANDARD: Part 68.308(e)(1), EIA/TIA TSB31B Section 8.17

CRITERIA REQUIREMENT: See Below

Test Equipment: Compliance Design Wideband Receiver, HP 34401A Digital Multimeter, Krohn-Hite 3945 Programmable Filter.

Data: **On-Hook, 56.5 VDC**

| *Band*<br>kHz | *Termination*<br>ohms | *Measured Pre-Surge*<br>dBV | *Measured Post-Surge*<br>dBV | *Limit*<br>dBV |
|---|---|---|---|---|
| 4 - 12 | 300 | < -120 | -77.9 | **-14 to -20*** |
| 12 - 90 | 135 | < -120 | -95.9 | **-20 to -55**** |
| 90 - 270 | 135 | -80.0 | -99.8 | **-55** |
| 270 – 6000 | 135 | -61.2 | -61.4 | **-15** |

**Off Hook, 56.5 VDC, 70 mA**

| *Band*<br>kHz | *Termination*<br>ohms | *Measured Pre-Surge*<br>dBV | *Measured Post-Surge*<br>dBV | *Limit*<br>dBV |
|---|---|---|---|---|
| 4 - 12 | 300 | -55.9 | -35.3 | **-14 to -20*** |
| 12 - 90 | 135 | -56.4 | -72.1 | **-20 to -55**** |
| 90 - 270 | 135 | -55.3 | -57.2 | **-55** |
| 270 – 6000 | 135 | -45.2 | -43.1 | **-15** |

ANALYSIS: The CPC2420 has been examined and analyzed with results measured. The CPC2420 has met or exceeded the FCC requirements of this section.

Notes:

* Limit from 4 kHz - 12 kHz = $-(6.4 + 12.6 \log f)$

** Limit from 12 kHz - 90 kHz = $(23 - 40 \log f)$

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MODEL: CPC2420

F5.15.1 - Longitudinal Voltage 4-6000 kHz

REFERENCE STANDARD: Part 68.308(e)(2), EIA/TIA TSB31B Section 8.18

CRITERIA REQUIREMENT: See Below

Test Equipment: Compliance Design Wideband Receiver, HP 34401A Digital Multimeter, Krohn-Hite 3945 Programmable Filter.

Data:

Pre-Surge On-Hook, 56.5 VDC

| *Band* kHz | *Termination* ohms | *Measured* dBV | *Correction Factor* dB | *Corrected Reading* dBV | *Limit* dBV |
|---|---|---|---|---|---|
| 4 - 12 | 500 | < -120 | +1.4 | < -120 | **-30 to -40 *** |
| 12 - 42 | 90 | < -120 | +4.0 | < -120 | **-40 to -62 **** |
| 42 - 270 | 90 | -81.9 | +4.0 | -77.9 | **-62** |
| 270 - 6000 | 90 | -58.3 | +4.0 | -54.3 | **-30** |

Pre-Surge Off Hook, 56.5 VDC, 70 mA

| *Band* kHz | *Termination* ohms | *Measured* dBV | *Correction Factor* dB | *Corrected Reading* dBV | *Limit* dBV |
|---|---|---|---|---|---|
| 4 - 12 | 500 | < -120 | +1.4 | < -120 | **-30 to -40 *** |
| 12 - 42 | 90 | < -120 | +4.0 | < -120 | **-40 to -62 **** |
| 42 - 270 | 90 | -111.0 | +4.0 | -107.0 | **-62** |
| 270 - 6000 | 90 | -56.7 | +4.0 | -52.7 | **-30** |

ANALYSIS: The CPC2420 has been examined and analyzed with results measured. The CPC2420 has met or exceeded the FCC requirements of this section.

Notes:

* Limit from 4 kHz - 12 kHz = -(18.4 + 20 log $f$)

** Limit from 12 kHz - 42 kHz = (3.0 - 40 log $f$)

TEST NUMBER: 368-00
MANUFACTURER: Clare Corporation
MODEL: CPC2420

F5.15.2 - Longitudinal Voltage 4-6000 kHz

REFERENCE STANDARD: Part 68.308(e)(2), EIA/TIA TSB31B Section 8.18

CRITERIA REQUIREMENT: See Below

Test Equipment: Compliance Design Wideband Receiver, HP 34401A Digital Multimeter, Krohn-Hite 3945 Programmable Filter.

Data:

Post Surge On-Hook, 56.5 VDC

| *Band* kHz | *Termination* ohms | *Measured* dBV | *Correction Factor* dB | *Corrected Reading* dBV | *Limit* dBV |
|---|---|---|---|---|---|
| 4 - 12 | 500 | -61.9 | +1.4 | | **-30 to -40 *** |
| 12 - 42 | 90 | -103.0 | +4.0 | | **-40 to -62 **** |
| 42 - 270 | 90 | -104.4 | +4.0 | | **-62** |
| 270 - 6000 | 90 | -62.7 | +4.0 | | **-30** |

Post Surge Off Hook, 56.5 VDC, 70 mA

| *Band* kHz | *Termination* ohms | *Measured* dBV | *Correction Factor* dB | *Corrected Reading* dBV | *Limit* dBV |
|---|---|---|---|---|---|
| 4 - 12 | 500 | < -120 | +1.4 | < -120 | **-30 to -40 *** |
| 12 - 42 | 90 | < -120 | +4.0 | < -120 | **-40 to -62 **** |
| 42 - 270 | 90 | -112.7 | +4.0 | -108.7 | **-62** |
| 270 - 6000 | 90 | -61.8 | +4.0 | -57.8 | **-30** |

ANALYSIS: The CPC2420 has been examined and analyzed with results measured. The CPC2420 has met or exceeded the FCC requirements of this section.

Notes:

* Limit from 4 kHz - 12 kHz = -(18.4 + 20 log $f$)

** Limit from 12 kHz - 42 kHz = (3.0 - 40 log $f$)

TEST NUMBER: 368-00
MANUFACTURER: Clare Corporation
MODEL: CPC2420

F5.16 - Transverse Balance

REFERENCE STANDARD: Part 68.310, EIA/TIA TSB31B Section 9.1

CRITERIA REQUIREMENT: On-hook balance 0.2 - 1 kHz 60 dB, 1 - 4 kHz 40 dB. Off hook balance 0.2 - 4 kHz 40 dB.

Test Equipment: HP 4395A Network/Spectrum Analyzer, Compliance Worldwide CW-TBA01 Balance Bridge.

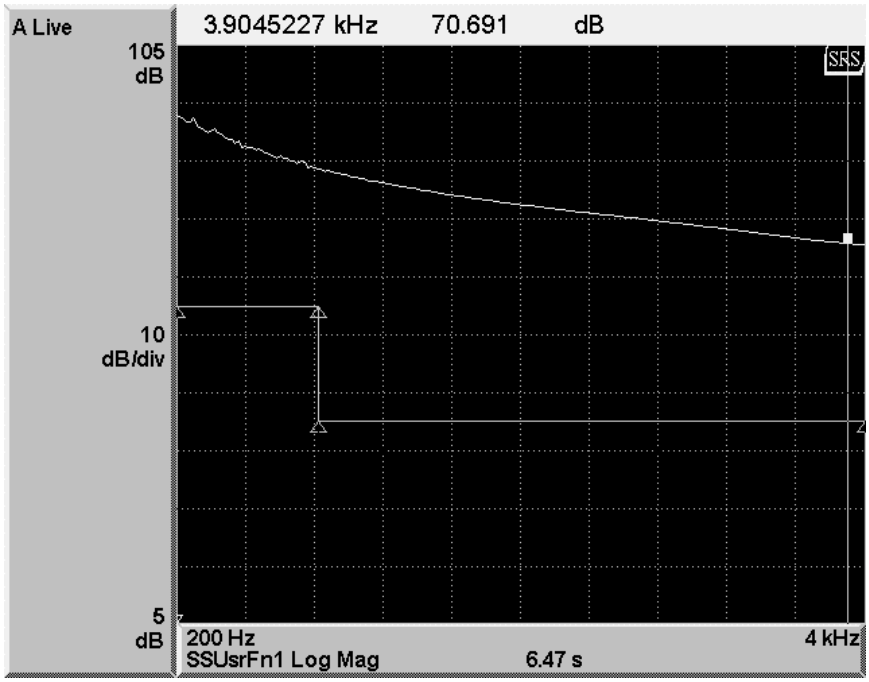
Data:

| *Frequency* Hertz | *On-Hook Limit* dB | *Off-Hook Limit* dB |
|---|---|---|
| 200 | **60** | **40** |
| 300 | **60** | **40** |
| 500 | **60** | **40** |
| 1000 | **40** | **40** |
| 2000 | **40** | **40** |
| 3000 | **40** | **40** |
| 4000 | **40** | **40** |

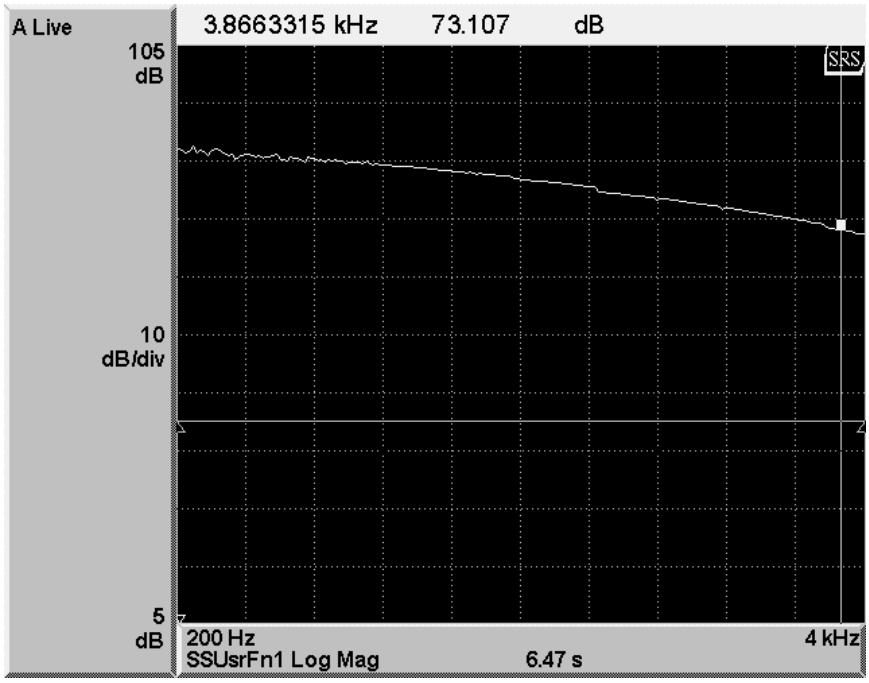
ANALYSIS: The CPC2420 has been examined and analyzed with results measured. The CPC2420 has met or exceeded the FCC requirements of this section.

Notes:

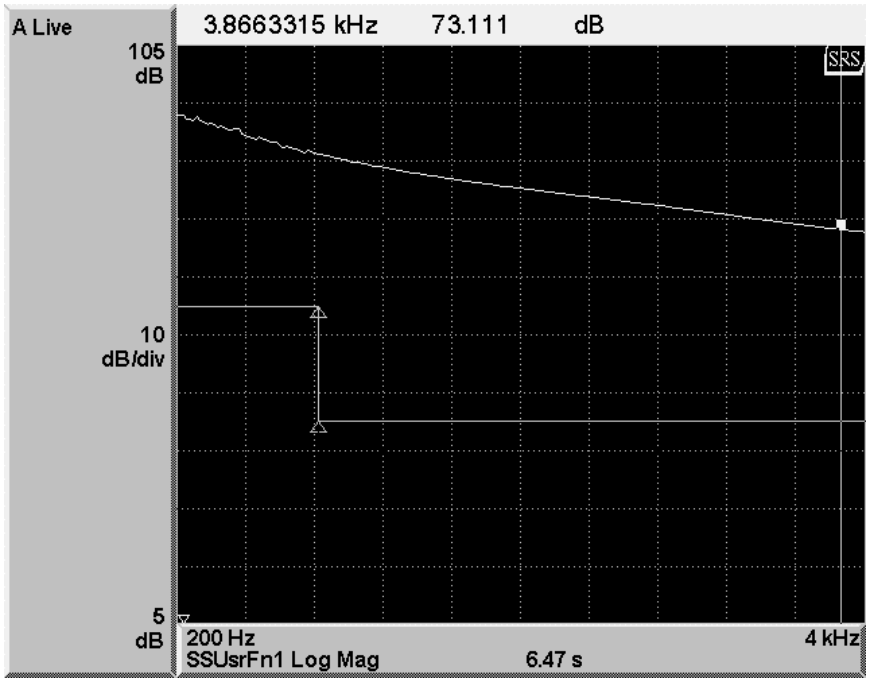
**Please see following pages for plots of Transverse Balance.**



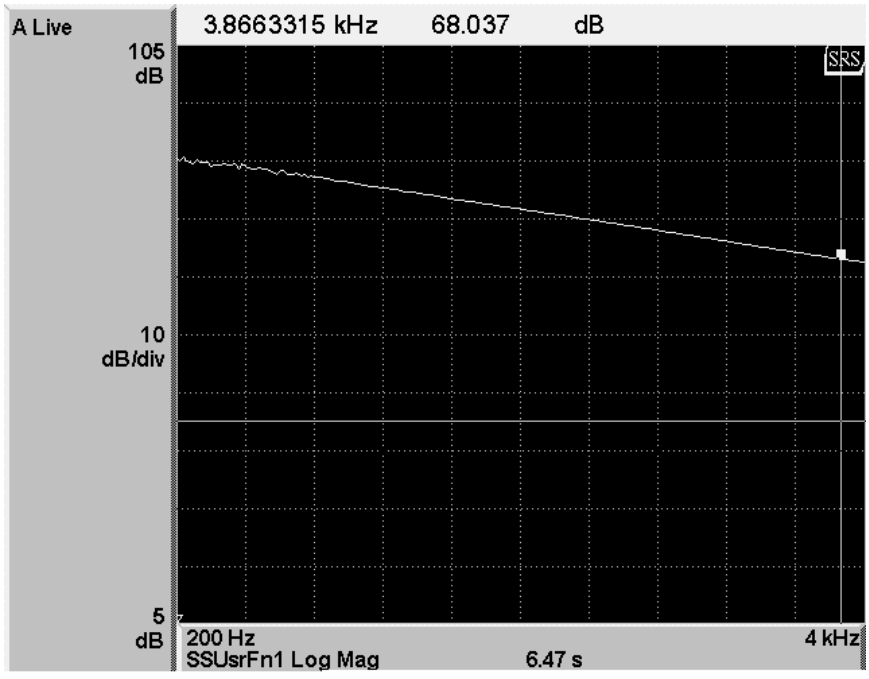

**On Hook Balance**




**Off Hook Balance**




**On Hook Balance Post Surge**




**Off Hook Balance Post Surge**

TEST NUMBER: 368-00
MANUFACTURER: Clare Corporation
MODEL: CPC2420

F5.17.1 - On-Hook DC Resistance (Pre-Surge)

REFERENCE STANDARD: Part 68.312(b), EIA/TIA TSB31B Section 10.1

CRITERIA REQUIREMENT: DC Impedance greater than 5 Megohms from 1-100 volts and 30 kohms at 150 and 200 VDC

Test Equipment: Compliance Design NA-100 Network Analyzer, HP 34401A Digital Multimeter

Data: **Pre-Surge**

| *Voltage* VDC | *Current* T-R mA | *Impedance* T-R ohms | *Current* T-Ground mA | *Impedance* T-Ground ohms | *Current* R-Ground mA | *Impedance* R-Ground ohms | *Minimum Z* ohms |
|---|---|---|---|---|---|---|---|
| 1 | *< 200 nA* | *> 5 M* | *< 200 nA* | *> 5 M* | *< 200 nA* | *> 5 M* | **5 M** |
| 10 | *< 2 µA* | *> 5 M* | *< 2 µA* | *> 5 M* | *< 2 µA* | *> 5 M* | **5 M** |
| 20 | *<4 µA* | *> 5 M* | *<4 µA* | *> 5 M* | *<4 µA* | *> 5 M* | **5 M** |
| 30 | *< 6 µA* | *> 5 M* | *< 6 µA* | *> 5 M* | *< 6 µA* | *> 5 M* | **5 M** |
| 40 | *< 8 µA* | *> 5 M* | *< 8 µA* | *> 5 M* | *< 8 µA* | *> 5 M* | **5 M** |
| 50 | *< 10 µA* | *> 5 M* | *< 10 µA* | *> 5 M* | *< 10 µA* | *> 5 M* | **5 M** |
| 60 | *< 12 µA* | *> 5 M* | *< 12 µA* | *> 5 M* | *< 12 µA* | *> 5 M* | **5 M** |
| 70 | *< 14 µA* | *> 5 M* | *< 14 µA* | *> 5 M* | *< 14 µA* | *> 5 M* | **5 M** |
| 80 | *< 16 µA* | *> 5 M* | *< 16 µA* | *> 5 M* | *< 16 µA* | *> 5 M* | **5 M** |
| 90 | *< 18 µA* | *> 5 M* | *< 18 µA* | *> 5 M* | *< 18 µA* | *> 5 M* | **5 M** |
| 100 | *< 20 µA* | *> 5 M* | *< 20 µA* | *> 5 M* | *< 20 µA* | *> 5 M* | **5 M** |
| 150 | *< 5 mA* | *> 30 K* | *< 5 mA* | *> 30 K* | *< 5 mA* | *> 30 K* | **30 K** |
| 200 | *< 6.7 mA* | *> 30 K* | *< 6.7 mA* | *> 30 K* | *< 6.7 mA* | *> 30 K* | **30 K** |

ANALYSIS: The CPC2420 has been examined and analyzed with results measured. The CPC2420 has met or exceeded the FCC requirements of this section.

Notes:

None

TEST NUMBER: 368-00
MANUFACTURER: Clare Corporation
MODEL: CPC2420

F5.17.2 - On-Hook DC Resistance (Post Surge)

REFERENCE STANDARD: Part 68.312(b), EIA/TIA TSB31B Section 10.1

CRITERIA REQUIREMENT: DC Impedance greater than 5 Megohms from 1-100 volts and 30 kohms at 150 and 200 VDC

Test Equipment: Compliance Design NA-100 Network Analyzer, HP 34401A Digital Multimeter

Data: **Post Surge**

| *Voltage* VDC | *Current* T-R mA | *Impedance* T-R ohms | *Current* T-Ground mA | *Impedance* T-Ground ohms | *Current* R-Ground mA | *Impedance* R-Ground ohms | *Minimum Z* ohms |
|---|---|---|---|---|---|---|---|
| 1 | *< 200 nA* | *> 5 M* | *< 200 nA* | *> 5 M* | *< 200 nA* | *> 5 M* | **5 M** |
| 10 | *< 2 µA* | *> 5 M* | *< 2 µA* | *> 5 M* | *< 2 µA* | *> 5 M* | **5 M** |
| 20 | *<4 µA* | *> 5 M* | *<4 µA* | *> 5 M* | *<4 µA* | *> 5 M* | **5 M** |
| 30 | *< 6 µA* | *> 5 M* | *< 6 µA* | *> 5 M* | *< 6 µA* | *> 5 M* | **5 M** |
| 40 | *< 8 µA* | *> 5 M* | *< 8 µA* | *> 5 M* | *< 8 µA* | *> 5 M* | **5 M** |
| 50 | *< 10 µA* | *> 5 M* | *< 10 µA* | *> 5 M* | *< 10 µA* | *> 5 M* | **5 M** |
| 60 | *< 12 µA* | *> 5 M* | *< 12 µA* | *> 5 M* | *< 12 µA* | *> 5 M* | **5 M** |
| 70 | *< 14 µA* | *> 5 M* | *< 14 µA* | *> 5 M* | *< 14 µA* | *> 5 M* | **5 M** |
| 80 | *< 16 µA* | *> 5 M* | *< 16 µA* | *> 5 M* | *< 16 µA* | *> 5 M* | **5 M** |
| 90 | *< 18 µA* | *> 5 M* | *< 18 µA* | *> 5 M* | *< 18 µA* | *> 5 M* | **5 M** |
| 100 | *< 20 µA* | *> 5 M* | *< 20 µA* | *> 5 M* | *< 20 µA* | *> 5 M* | **5 M** |
| 150 | *< 5 mA* | *> 30 K* | *< 5 mA* | *> 30 K* | *< 5 mA* | *> 30 K* | **30 K** |
| 200 | *< 6.7 mA* | *> 30 K* | *< 6.7 mA* | *> 30 K* | *< 6.7 mA* | *> 30 K* | **30 K** |

ANALYSIS: The CPC2420 has been examined and analyzed with results measured. The CPC2420 has met or exceeded the FCC requirements of this section.

Notes:

None

TEST NUMBER: 368-00
MANUFACTURER: Clare Corporation
MODEL: CPC2420

F5.18 - DC Current During Ringing

REFERENCE STANDARD: Part 68.312(b)(1)(iii), EIA/TIA TSB31B Section 10.2

CRITERIA REQUIREMENT: DC Current during ringing less than 3 mA.

Test Equipment: Compliance Design NA-100 Network Analyzer, HP 34401A Digital Multimeter, HP 3352A Function Generator.

Data:

**Test Conditions:** ***56.5VDC***

| *Frequency* Hertz | *AC Voltage* Volts | *Pre-Surge DC Current* mA | *Post Surge DC Current* mA | *Limit* mA |
|---|---|---|---|---|
| 15.3 | 40 / 130 | < 0.1 / < 0.1 | < 0.1 / < 0.1 | **3.0** |
| 20 | 40 / 130 | < 0.1 / < 0.1 | < 0.1 / < 0.1 | **3.0** |
| 30 | 40 / 130 | < 0.1 / < 0.1 | < 0.1 / < 0.1 | **3.0** |
| 40 | 65 / 130 | < 0.1 / < 0.1 | < 0.1 / < 0.1 | **3.0** |
| 50 | 65 / 150 | < 0.1 / < 0.1 | < 0.1 / < 0.1 | **3.0** |
| 68 | 65 / 150 | < 0.1 / < 0.1 | < 0.1 / < 0.1 | **3.0** |

ANALYSIS: The CPC2420 has been examined and analyzed with results measured. The CPC2420 has met or exceeded the FCC requirements of this section.

Notes:

None

TEST NUMBER: 368-00
MANUFACTURER: Clare Corporation
MODEL: CPC2420

F5.19.1 - Metallic AC Impedance

REFERENCE STANDARD: Part 68.312(b)(4), EIA/TIA TSB31B Section 10.3

CRITERIA REQUIREMENT: Tip-Ring AC current less than 62.5 mA.

Test Equipment: Compliance Design NA-100 Network Analyzer, HP 34401A Digital Multimeter, HP 33120A Function Generator.

Data: Test Conditions: *56.5 VDC*

Pre-Surge

| *Frequency* Hz | *Voltage* Volts | *Current* mA | *Impedance* kohms | *Voltage* Volts | *Current* mA | *Impedance* kohms |
|---|---|---|---|---|---|---|
| 15.3 | 40 | < 0.1 | > 400 | 130 | < 0.1 | > 1300 |
| 20 | 40 | < 0.1 | > 400 | 130 | < 0.1 | > 1300 |
| 30 | 40 | < 0.1 | > 400 | 130 | < 0.1 | > 1300 |
| 40 | 65 | < 0.1 | > 650 | 130 | < 0.1 | > 1300 |
| 50 | 65 | < 0.1 | > 650 | 150 | < 0.1 | > 1500 |
| 68 | 65 | < 0.1 | > 650 | 150 | < 0.1 | > 1500 |

Post-Surge

| *Frequency* Hz | *Voltage* Volts | *Current* mA | *Impedance* kohms | *Voltage* Volts | *Current* mA | *Impedance* kohms |
|---|---|---|---|---|---|---|
| 15.3 | 40 | < 0.1 | > 400 | 130 | < 0.1 | > 1300 |
| 20 | 40 | < 0.1 | > 400 | 130 | < 0.1 | > 1300 |
| 30 | 40 | < 0.1 | > 400 | 130 | < 0.1 | > 1300 |
| 40 | 65 | < 0.1 | > 650 | 130 | < 0.1 | > 1300 |
| 50 | 65 | < 0.1 | > 650 | 150 | < 0.1 | > 1500 |
| 68 | 65 | < 0.1 | > 650 | 150 | < 0.1 | > 1500 |

ANALYSIS: The CPC2420 has been examined and analyzed with results measured. The CPC2420 has met or exceeded the FCC requirements of this section.

Notes: **Use** 650k **ohms for REN calculation in Section F5.20.**

TEST NUMBER: 368-00
MANUFACTURER: Clare Corporation
MODEL: CPC2420

F5.19.2 - Longitudinal AC Impedance

REFERENCE STANDARD: Part 68.312(b)(4), EIA/TIA TSB31B Section 10.3

CRITERIA REQUIREMENT: Tip/Ring-Ground impedance shall be greater than 100k Ohms.

Test Equipment: Compliance Design NA-100 Network Analyzer, HP 34401A Digital Multimeter, HP 33120A Function Generator.

Data: **Pre-Surge**

| *Frequency* Hz | *Voltage* V | *Current Tip-Ground* µA | *Impedance Tip-Ground* Ohms | *Current Ring-Ground* µA | *Impedance Ring-Ground* Ohms | *Limit* ohms |
|---|---|---|---|---|---|---|
| 15.3 | 40 / 130 | *< 400 / < 1300* | *>100k* | *< 400 / < 1300* | *>100k* | **100k** |
| 20 | 40 / 130 | *< 400 / < 1300* | *>100k* | *< 400 / < 1300* | *>100k* | **100k** |
| 30 | 40 / 130 | *< 400 / < 1300* | *>100k* | *< 400 / < 1300* | *>100k* | **100k** |
| 40 | 65 / 130 | *< 650 / < 1300* | *>100k* | *< 650 / < 1300* | *>100k* | **100k** |
| 50 | 65 / 150 | *< 650 / < 1500* | *>100k* | *< 650 / < 1500* | *>100k* | **100k** |
| 68 | 65 / 150 | *< 650 / < 1500* | *>100k* | *< 650 / < 1500* | *>100k* | **100k** |

Data: **Post Surge**

| *Frequency* Hz | *Voltage* V | *Current Tip-Ground* µA | *Impedance Tip-Ground* Ohms | *Current Ring-Ground* µA | *Impedance Ring-Ground* Ohms | *Limit* ohms |
|---|---|---|---|---|---|---|
| 15.3 | 40 / 130 | *< 400 / < 1300* | *>100k* | *< 400 / < 1300* | *>100k* | **100k** |
| 20 | 40 / 130 | *< 400 / < 1300* | *>100k* | *< 400 / < 1300* | *>100k* | **100k** |
| 30 | 40 / 130 | *< 400 / < 1300* | *>100k* | *< 400 / < 1300* | *>100k* | **100k** |
| 40 | 65 / 130 | *< 650 / < 1300* | *>100k* | *< 650 / < 1300* | *>100k* | **100k** |
| 50 | 65 / 150 | *< 650 / < 1500* | *>100k* | *< 650 / < 1500* | *>100k* | **100k** |
| 68 | 65 / 150 | *< 650 / < 1500* | *>100k* | *< 650 / < 1500* | *>100k* | **100k** |

ANALYSIS: The CPC2420 has been examined and analyzed with results measured. The CPC2420 has met or exceeded the FCC requirements of this section.

Notes:

None

TEST NUMBER: 368-00
MANUFACTURER: Clare Corporation
MODEL: CPC2420

F5.20 - REN Calculation

REFERENCE STANDARD: Part 68.312(d), EIA/TIA TSB31B Section 10.4

CRITERIA REQUIREMENT: The Ringer Equivalence Number (R.E.N) is five times the impedance limitation listed in Table 68.312(a), divided by the minimum measured ac impedance measured in Section F5.19.1.

Data:

TABLE 68.312(a)

| Ringing type | Range of compatible ringing frequencies (Hz) | Simulated ringing voltage superimposed on 56.5 volts dc | Impedance limitations (ohms) |
|---|---|---|---|
| A | 20 ± 3<br>30 ± 3 | 40 to 130 volts rms<br>40 to 130 volts rms | 1400<br>1000 |
| B | 15.3 to 34<br>>34 to 49<br>>49 to 68 | 40 to 130 volts rms<br>62 to 130 volts rms<br>62 to 150 volts rms | 1600<br>1600<br>1600 |

## Ringer Equivalence Calculation

Minimum AC Impedance (from section F5.19.1) 650k Ohms

Ringer Type B Impedance Limitation 1600 ohms

Calculation:

8000 ohms / 650k ohms = 0.020

**REN = 0.0 B**

ANALYSIS: The CPC2420 has been examined and analyzed with results measured. The CPC2420 has met or exceeded the FCC requirements of this section.

Notes:

None

TEST NUMBER: 368-00
MANUFACTURER: Clare Corporation
MODEL: CPC2420

F5.21 - Call Duration

REFERENCE STANDARD: Part 68.314(a)(1), EIA/TIA TSB31B Section 11.2

CRITERIA REQUIREMENT: During the first two seconds of the call, the answering equipment must prevent both transmission and reception of data (68.314 a 2). The On-Hook level of the equipment shall be less than -55 dbm (68.314 b 1).

Test Equipment: Compliance Design Test Stand, HP 34401A Digital Multimeter, Krohn-Hite 3495 Programmable Filter, HP 54610B Oscilloscope.

Data:

**Pre-Surge:**

☑ No data passed during the first two seconds of the call.

**Post Surge:**

☑ No data passed during the first two seconds of the call.

ANALYSIS: The CPC2420 has been examined and analyzed with results measured. The CPC2420 has met or exceeded the FCC requirements of this section.

Notes:

None

TEST NUMBER: 368-00
MANUFACTURER: Clare Corporation
MODEL: CPC2420

F5.22 - On Hook Signal Level

REFERENCE STANDARD: Part 68.314(a)(1), EIA/TIA TSB31B Section 11.3

CRITERIA REQUIREMENT: On Hook signal level shall be less than -55 dBm.

Test Equipment: Compliance Design Test Stand, HP 34401A Digital Multimeter, Krohn-Hite 3495 Programmable Filter.

Data:

**Pre Surge**

| ***Band*** Hz | *Termination* ohms | ***Measured*** dBm | ***Limit*** dBm |
|---|---|---|---|
| **200 - 4000** | 600 | < -110 | **-55** |

**Post Surge**

| ***Band*** Hz | *Termination* ohms | ***Measured*** dBm | ***Limit*** dBm |
|---|---|---|---|
| **200 - 4000** | 600 | -90 | **-55** |

ANALYSIS: The CPC2420 has been examined and analyzed with results measured. The CPC2420 has met or exceeded the FCC requirements of this section.

Notes:

None

TEST NUMBER: 368-00
MANUFACTURER: Clare Corporation
MODEL: CPC2420

F5.23 - Loop Current Characteristics

REFERENCE STANDARD: Part 68.314(c), EIA/TIA TSB31B Section 11.4

CRITERIA REQUIREMENT: Current shall not increase more than 25% during the first 5 seconds of the call.

Test Equipment: Compliance Design Test Stand, HP 54610B Oscilloscope, HP 34401A Digital Multimeter.

Data:

**State 1 - Low Current**

| *Time* Seconds | *Pre-Surge Current* mA | *Post Surge Current* mA |
|---|---|---|
| 1 | 18.1 | 18.9 |
| 2 | 18.1 | 18.9 |
| 3 | 18.1 | 18.9 |
| 4 | 18.1 | 18.9 |
| 5 | 18.1 | 18.9 |

**State 2 - Midrange Current**

| *Time* Seconds | *Pre-Surge Current* mA | *Post Surge Current* mA |
|---|---|---|
| 1 | 31.6 | 32.3 |
| 2 | 31.6 | 32.3 |
| 3 | 31.6 | 32.3 |
| 4 | 31.6 | 32.3 |
| 5 | 31.6 | 32.3 |

**State 3 - High Current**

| *Time* Seconds | *Pre-Surge Current* mA | *Post Surge Current* mA |
|---|---|---|
| 1 | 68.1 | 69.1 |
| 2 | 68.1 | 69.1 |
| 3 | 68.1 | 69.1 |
| 4 | 68.1 | 69.1 |
| 5 | 68.1 | 69.1 |

ANALYSIS: The CPC2420 has been examined and analyzed with results measured. The CPC2420 has met or exceeded the FCC requirements of this section.

Notes:

None

TEST NUMBER: 368-00
MANUFACTURER: Clare Corporation
MODEL: CPC2420

F5.24 - Signaling Interference

REFERENCE STANDARD: Part 68.314(d), EIA/TIA TSB31B Section 11.5

CRITERIA REQUIREMENT: Unit shall not deliver signals in the band of 2450-2750 Hz unless equal or greater energy is present in the 800-2450 Hz band.

Test Equipment: Compliance Design Wideband Receiver, HP 34401A Digital Multimeter, Krohn-Hite 3945 Programmable Filter.

Data:

**Pre-Surge**

| *Band* Hz | *Level* dBm | *Limit* dBm |
|---|---|---|
| 800 - 2450 | -102 | **see below** |
| 2450 - 2750 | -105 | **< level in 800-2450 band** |

**Post Surge**

| *Band* Hz | *Level* dBm | *Limit* dBm |
|---|---|---|
| 800 - 2450 | -109 | **see below** |
| 2450 - 2750 | < -110 | **< level in 800-2450 band** |

ANALYSIS: The CPC2420 has been examined and analyzed with results measured. The CPC2420 has met or exceeded the FCC requirements of this section.

Notes:

None

TEST NUMBER: 368-00
MANUFACTURER: Clare Corporation
MODEL: CPC2420

F5.25 - Automatic Redialing

REFERENCE STANDARD: Part 68.318(b), EIA/TIA TSB31B Section 14.1

Data:

**The CPC2420 is not an automatic redialing device within meaning of FCC Part 68 rules.**

ANALYSIS: The CPC2420 has been examined and analyzed with results measured. The CPC2420 has met or exceeded the FCC requirements of this section.

Notes:

None

# Exhibit G

# Exhibit H

# Exhibit J