



## CRYSTAL UNITS IN METAL HOLDER,

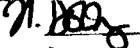
**BASED ON TYPE T807,**

**FREQUENCY RANGE 4.0 - 140MHZ**

## ESA/SCC Detail Specification No. 3501/018

**(Follow-up specification to ESA/SCC Detail Specification Nos. 3501/001,  
3501/008, 3501/011 and 3501/012)**



| Issue/Rev. | Date           | Approved by                                                                          |                                                                                       |
|------------|----------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|            |                | SCCG Chairman                                                                        | ESA Director General or his Deputy                                                    |
| Issue 2    | September 2002 |  |  |
|            |                |                                                                                      |                                                                                       |
|            |                |                                                                                      |                                                                                       |
|            |                |                                                                                      |                                                                                       |



**DOCUMENTATION CHANGE NOTICE**

| Rev.<br>Letter | Rev.<br>Date | Reference                                                                                        | CHANGE<br>Item                                                                                                         | Approved<br>DCR No. |
|----------------|--------------|--------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|---------------------|
|                |              | This Issue supersedes Issue 1 and incorporates all modifications defined in the following DCRS:- |                                                                                                                        |                     |
|                |              | Cover page                                                                                       |                                                                                                                        | None                |
|                |              | DCN                                                                                              |                                                                                                                        | None                |
|                |              | Para. 3                                                                                          | : Turning Point Temperature definition added                                                                           | 221686              |
|                |              | Table 1(a)                                                                                       | : New No. 3 added and all subsequent Items and Note references incremented by 1 except for Item No. 20 Note reference. | 221686              |
|                |              |                                                                                                  | : Alinea (b) deleted from Note 2                                                                                       | 221686              |
|                |              |                                                                                                  | : New Note 3 added and all subsequent Notes incremented by 1                                                           | 221686              |
|                |              |                                                                                                  | : Note 4 values rewritten                                                                                              | 221686              |
|                |              |                                                                                                  | : Note 5 rewritten                                                                                                     | 221686              |
|                |              |                                                                                                  | : Notes for "Not Applicable Items" and "Intended Application" reversed in sequence                                     | 221686              |
|                |              | Table 1(b)                                                                                       | : Note 1 expanded                                                                                                      | 221686              |
|                |              | Para. 4.6.1                                                                                      | : New sentence added                                                                                                   | 221686              |
|                |              | Para. 4.6.2                                                                                      | : In the second sentence, Item numbers amended                                                                         | 221686              |
|                |              | Para. 4.7.2                                                                                      | : Second sentence deleted and new text added                                                                           | 221686              |
|                |              | Table 2                                                                                          | : In Limits, Item references incremented by 1 after Item 1                                                             | 221686              |
|                |              | Table 3                                                                                          | : In Limits, Item references incremented by 1                                                                          | 221686              |
|                |              | Table 5                                                                                          | : Title and Condition amended and Note added                                                                           | 221686              |
|                |              | Para. 4.8.3                                                                                      | : Paragraph rewritten                                                                                                  | 221686              |



## TABLE OF CONTENTS

|                                                                                                | <u>Page</u> |
|------------------------------------------------------------------------------------------------|-------------|
| <b>1. <u>GENERAL</u></b>                                                                       | <b>5</b>    |
| 1.1 Scope                                                                                      | 5           |
| 1.2 Range of Components                                                                        | 5           |
| 1.3 Maximum Ratings                                                                            | 5           |
| 1.4 Physical Dimensions                                                                        | 5           |
| 1.5 Functional Diagram                                                                         | 5           |
| <b>2. <u>APPLICABLE DOCUMENTS</u></b>                                                          | <b>5</b>    |
| <b>3. <u>TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS</u></b>                          | <b>5</b>    |
| <b>4. <u>REQUIREMENTS</u></b>                                                                  | <b>11</b>   |
| 4.1 General                                                                                    | 11          |
| 4.2 Deviations from Generic Specification                                                      | 11          |
| 4.2.1 Deviations from Special In-process Controls                                              | 11          |
| 4.2.2 Deviations from Final Production Tests                                                   | 11          |
| 4.2.3 Deviations from Burn-in Tests                                                            | 11          |
| 4.2.4 Deviations from Qualification Tests                                                      | 11          |
| 4.2.5 Deviations from Lot Acceptance Tests                                                     | 11          |
| 4.3 Mechanical Requirements                                                                    | 11          |
| 4.3.1 Dimension Check                                                                          | 11          |
| 4.3.2 Weight                                                                                   | 11          |
| 4.3.3 Robustness of Terminations                                                               | 11          |
| 4.4 Materials and Finishes                                                                     | 11          |
| 4.4.1 Case                                                                                     | 12          |
| 4.4.2 Lead Material and Finish                                                                 | 12          |
| 4.5 Marking                                                                                    | 12          |
| 4.5.1 General                                                                                  | 12          |
| 4.5.2 Characteristics                                                                          | 12          |
| 4.5.3 Traceability Information                                                                 | 12          |
| 4.5.4 The SCC Component Number,                                                                | 12          |
| 4.5.5 Manufacturer's Name, Symbol and Code                                                     | 13          |
| 4.6 Electrical Measurements                                                                    | 13          |
| 4.6.1 Electrical Measurements at Reference Temperature                                         | 13          |
| 4.6.2 Electrical Measurements at High and Low Temperatures                                     | 13          |
| 4.6.3 Circuits for Electrical Measurements                                                     | 13          |
| 4.7 Burn-in Tests                                                                              | 13          |
| 4.7.1 Parameter Drift Values                                                                   | 13          |
| 4.7.2 Conditions for Burn-in                                                                   | 13          |
| 4.7.3 Electrical Circuits for Burn-in                                                          | 13          |
| 4.8 Environmental and Endurance Tests                                                          | 15          |
| 4.8.1 Measurements and Inspections on Completion of Environmental Tests                        | 15          |
| 4.8.2 Measurements and Inspections at Intermediate Points and on Completion of Endurance Tests | 15          |
| 4.8.3 Conditions for Operating Life Test                                                       | 15          |

|                                                                                  |                                                                                  |                                              |  |                   |
|----------------------------------------------------------------------------------|----------------------------------------------------------------------------------|----------------------------------------------|--|-------------------|
|  |  | ESA/SCC Detail Specification<br>No. 3501/018 |  | PAGE 4<br>ISSUE 2 |
|----------------------------------------------------------------------------------|----------------------------------------------------------------------------------|----------------------------------------------|--|-------------------|

Page

**TABLES**

|      |                                                                                                                                     |    |
|------|-------------------------------------------------------------------------------------------------------------------------------------|----|
| 1(a) | Format for Individual Tables 1(a)                                                                                                   | 6  |
| 1(b) | Maximum Ratings                                                                                                                     | 9  |
| 2    | Electrical Measurements at Reference Temperature                                                                                    | 14 |
| 3    | Electrical Measurements at High and Low Temperatures                                                                                | 14 |
| 4    | Parameter Drift Values                                                                                                              | 15 |
| 5    | Conditions for Burn-in and LAT Life Tests                                                                                           | 15 |
| 6    | Measurements and Inspections on Completion of Environmental Tests and at Intermediate Points and on Completion of Endurance Testing | 16 |

**FIGURES**

|   |                                              |     |
|---|----------------------------------------------|-----|
| 1 | Parameter Derating Information               | N/A |
| 2 | Physical Dimensions                          | 10  |
| 3 | Functional Diagram                           | 10  |
| 4 | Circuits for Electrical Measurements         | N/A |
| 5 | Electrical Circuit for Burn-in and Life Test | N/A |

**APPENDICES (Applicable to specific Manufacturers only)**

None.

## 1. GENERAL

### 1.1 SCOPE

This specification details the values, physical and electrical characteristics, test and inspection data for Crystal Units in Metal Holder, based on Type T807, Frequency Range 4.0 - 140MHz.

It shall be read in conjunction with ESA/SCC Generic Specification No. 3501, the requirements for which are supplemented herein.

This is a follow-up specification to ESA/SCC Detail Specification Nos. 3501/001, 3501/008, 3501/011 and 3501/012 which should be consulted by:-

- (a) Users seeking information concerning the availability of variants previously ordered to these specifications.
- (b) Manufacturers before introducing a new specific crystal identification as outlined in Para. 1.2.

### 1.2 RANGE OF COMPONENTS

The specific characteristics shall be negotiated between the Manufacturer and the Orderer on the basis of Table 1(a).

The contents of the individual tables shall relate to the design parameters of individual crystal units, optimised for the intended application.

The agreed table shall be held under configuration control by the Manufacturer who will allocate a specific crystal identification number sequentially when a request for a crystal is received.

### 1.3 MAXIMUM RATINGS

The maximum ratings, which shall not be exceeded at any time during use or storage, applicable to the crystal units specified herein, are as scheduled in Table 1(b).

### 1.4 PHYSICAL DIMENSIONS

The physical dimensions of the crystal units specified herein are shown in Figure 2.

### 1.5 FUNCTIONAL DIAGRAM

The functional diagram showing lead identification of the crystal units specified herein is shown in Figure 3.

## 2. APPLICABLE DOCUMENTS

The following documents form part of this specification and shall be read in conjunction with it:-

- (a) ESA/SCC Generic Specification No. 3501 for Quartz Crystal Units.

## 3. TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS

For the purpose of this specification, the terms, definitions, abbreviations, symbols and units specified in ESA/SCC Basic Specification No. 21300 shall apply. In addition, the following symbols are used:-

|                           |            |                       |           |
|---------------------------|------------|-----------------------|-----------|
| Resonance Frequency       | = $f_r$    | Static Capacitance    | = $C_o$   |
| Load Resonance Frequency  | = $f_L$    | Load Capacitance      | = $C_L$   |
| Reference Temperature     | = $T_o$    | Motional Capacitance  | = $C_1$   |
| Turning Point Temperature | = $T_{TP}$ | Motional Inductance   | = $L_1$   |
| Resonance Resistance      | = $R_r$    | Response Resistance   | = $R_p$   |
| Load Resonance Resistance | = $R_L$    | Response Impedance    | = $ Z_p $ |
| Rated Drive Level         | = $P_o$    | Insulation Resistance | = $R_i$   |



**TABLE 1(a) - FORMAT FOR INDIVIDUAL TABLES 1(a)**  
**SPECIFIC CRYSTAL IDENTIFICATION NUMBER -**

| No. | Characteristic                                                                                               | Symbol               | Limits |     | Unit      | Remarks                                            |
|-----|--------------------------------------------------------------------------------------------------------------|----------------------|--------|-----|-----------|----------------------------------------------------|
|     |                                                                                                              |                      | Min.   | Max |           |                                                    |
| 1   | Resonance Frequency                                                                                          | $f_r$ or $f_L$       |        |     | MHz       | Note 1                                             |
| 2   | Reference Temperature                                                                                        | $T_o$                |        |     | °C        | Note 2                                             |
| 3   | Turning Point Temperature                                                                                    | $T_{TP}$             |        |     | °C        | Note 3                                             |
| 4   | Overtone Order                                                                                               | -                    |        |     |           |                                                    |
| 5   | Load Capacitance                                                                                             | $C_L$                |        |     | pF        | Note 4                                             |
| 6   | Rated Drive Level                                                                                            | $P_o$                |        |     | mW        | Note 5                                             |
| 7   | Frequency Adjustment Tolerance                                                                               | $\frac{\Delta f}{f}$ |        |     | $10^{-6}$ | At $T_o$ °C Note 6                                 |
| 8   | Resonance Resistance                                                                                         | $R_r$ or $R_L$       |        |     | $\Omega$  | At $T_o$ °C Note 7                                 |
| 9   | Frequency Variation with Temperature over $T_{op}$                                                           | $\frac{\Delta f}{f}$ |        |     | $10^{-9}$ | From frequency measured at $T_o$ °C Note 8         |
| 10  | Resistance Variation with Temperature over $T_{op}$                                                          | $\frac{\Delta R}{R}$ |        |     | %         | From resistance measured at $T_o$ °C Note 8        |
| 11  | Operating Temperature Range                                                                                  | $T_{op}$             |        |     | °C        |                                                    |
| 12  | Frequency Variation with Drive Level                                                                         | $\frac{\Delta f}{f}$ |        |     | $10^{-6}$ | From $P_{S1} =$ mW to $P_{S2} =$ mW Note 9         |
| 13  | Resistance Variation with Drive Level                                                                        | $\frac{\Delta R}{R}$ |        |     | %         | From $P_{S1} =$ mW to $P_{S2} =$ mW Note 9         |
| 14  | Motional Inductance                                                                                          | $L_1$                |        |     | mH        | Notes 10 and 11                                    |
| 15  | Motional Capacitance                                                                                         | $C_1$                |        |     | fF        | Note 10                                            |
| 16  | Static Capacitance                                                                                           | $C_o$                |        |     | pF        | Note 10                                            |
| 17  | Q Factor                                                                                                     | Q                    |        |     | -         | Notes 10 and 12                                    |
| 18  | Ratio of Unwanted: Response Resistance to Resonance Resistance or Response Impedance to Resonance Resistance | $R_p/R$ or $iZ_p/R$  |        |     |           | In the frequency range: f - kHz to f + kHz Note 13 |
| 19  | Ageing                                                                                                       | $\frac{\Delta f}{f}$ |        |     | $10^{-6}$ | Note 14                                            |
| 20  | Physical Dimensions                                                                                          |                      |        |     |           | Note 15                                            |
| 21  | Intended Application                                                                                         |                      |        |     |           | Note 16                                            |

**NOTES:** See Pages 7 and 8.

**NOTES TO TABLE 1(a)**1. Resonance Frequency  $f_r$  or  $f_L$ 

- (a) If  $C_L$  is not specified, Symbol and measurement shall be  $f_r$ .  
(b) If  $C_L$  is specified, Symbol and measurement shall be  $f_L$ .

2. Reference Temperature  $T_0$ 

- (a) For a crystal unit functioning in a non-controlled temperature environment, the reference temperature is normally  $+25 \pm 2$  °C.

3. Turning Point Temperature  $T_{TP}$ 

- (a) For a crystal unit functioning in a temperature controlled environment (OCXO), the turning point temperature shall be within the limits specified for the reference temperature range.  
(b) To be specified for OCXO crystal units in addition to the reference temperature.

4. Load Capacitance  $C_L$ 

- (a) When a crystal unit must function at its series resonance frequency,  $C_L$  shall be infinite.  
(b) When a crystal unit must function with a load capacitance, the  $C_L$  value shall be specified.  
(c) When a crystal unit must function with an adjustable load capacitance, the minimum and maximum limits shall be specified.

**N.B.**

The tolerance on the load capacitance shall be that value which results in a frequency change not exceeding 10% of the frequency tolerance at  $T_0$  or 1% of the nominal load capacitance, whichever is smaller.

5. Rated Drive Level  $P_0$ 

The rated drive level shall be selected from the standard drive levels specified below:

- 0.25mW, 0.2mW, 0.1mW, 0.05mW, 0.02mW and 0.01mW at  $\pm 20\%$ .

6. Frequency Adjustment Tolerance

- (a) When a crystal unit must function at its series resonance frequency, the resonance frequency measured at  $T_0$  shall be within the tolerance specified. The standard value of the adjustment tolerance shall be  $\pm 10 \times 10^{-6}$ .  
(b) When a crystal unit has to function with a fixed load capacitance, the resonance frequency measured with this load at  $T_0$  shall be within the tolerance specified. The standard value of the adjustment tolerance shall be  $\pm 10 \times 10^{-6}$ .  
(c) When a crystal unit is required to operate with an adjustable load capacitance with the limits indicated in Item 5 of the Table, the resonance frequency shall be adjustable to its correct  $T_0$  value so the frequency adjustment tolerance does not need to be specified.

7. Resonance Resistance

- (a) Generally, the maximum value only is specified.  
(b)  $R_L$  may be calculated by  $R_L = R_r \left( 1 + \frac{C_0}{C_L} \right)^2$ .

8. Frequency and Resistance Variation with Temperature

These values shall be specified such that they are consistent with the operating temperature range.

|                                                                                  |                                                                                  |                                                      |  |                           |
|----------------------------------------------------------------------------------|----------------------------------------------------------------------------------|------------------------------------------------------|--|---------------------------|
|  |  | <p>ESA/SCC Detail Specification<br/>No. 3501/018</p> |  | <p>PAGE 8<br/>ISSUE 2</p> |
|----------------------------------------------------------------------------------|----------------------------------------------------------------------------------|------------------------------------------------------|--|---------------------------|

#### **NOTES TO TABLE 1(a) (Continued)**

9. Frequency and Resistance Variation with Drive Level

These limits and the Drive Level range ( $P_{S1}$  to  $P_{S2}$ ) shall be specified for very special crystals only (i.e. crystals used in very high stability oscillators).

10. Electrical Values

The electrical values shall be specified only when required for the correct functioning of the equipment in which the crystal is used.

11. Motional Inductance  $L_1$

Because the inductance value may be restricted by other chosen parameters, the Manufacturer shall propose the value of  $L_1$  in accordance with the Customer's requirements.

12. 'Q' Factor

If 'R' and 'L' have been already specified, it will not be necessary to specify the minimum value of the 'Q' factor.

The maximum value of the 'Q' factor is never specified.

13. Ratio of Unwanted Response Resistance to Resonance Resistance

The standard minimum value is 2, but it is possible to obtain higher values.

The frequency range within which the minimum value of the ratio is required shall also be specified.

14. Ageing

Specify limits under appropriate column and ageing period under "Remarks".

15. Physical Dimensions

The applicable Figure Number is to be specified.

16. Intended Application

For definitions of the selected symbol to be added, see ESA/SCC Generic Specification No. 3501, Para. 3.

17. Not Applicable Items

For all items where limits are not specified, "Not applicable" shall be entered in the Limits column.



**TABLE 1(b) - MAXIMUM RATINGS**

| No. | Characteristic              | Symbol           | Values        | Unit | Remarks |
|-----|-----------------------------|------------------|---------------|------|---------|
| 1   | Nominal Frequency Range     | f                | 4.0 to 140    | MHz  | Note 1  |
| 2   | Drive Level Range           | P                | Note 1        | mW   | Note 1  |
| 3   | Operating Temperature Range | T <sub>op</sub>  | -             | °C   | Note 2  |
| 4   | Storage Temperature Range   | T <sub>stg</sub> | - 65 to + 125 | °C   | Note 3  |
| 5   | Soldering Temperature       | T <sub>sol</sub> | + 260         | °C   | Note 4  |

**NOTES**

1.

| Fundamental and Overtone Order | Approx. Frequency Range (MHz) | Drive Level Range (mW) |
|--------------------------------|-------------------------------|------------------------|
| Fundamental                    | 4 - 35                        | 0.05 to 0.2            |
| 3                              | 30 - 100                      | 0.05 to 0.25           |
| 5                              | 80 - 140                      | 0.05 to 0.25           |

In use, the rated drive level shall not be exceeded.

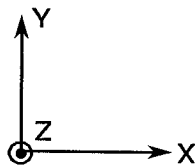
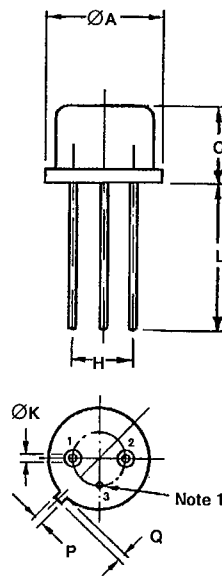
2. See Tables 1(a).
3. The duration at maximum storage temperature shall not exceed 16 hours.
4. Duration 10 seconds maximum at a distance of not less than 3.0mm from the device body and the same lead shall not be resoldered until 3 minutes have elapsed.

**FIGURE 1 - PARAMETER DERATING INFORMATION**

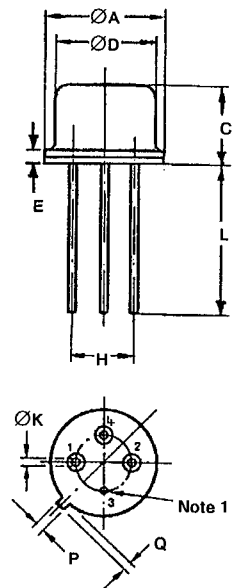
Not applicable.

**FIGURE 2 - PHYSICAL DIMENSIONS****FIGURE 2(a) - 3-PIN PACKAGE**  
**Variant 01**

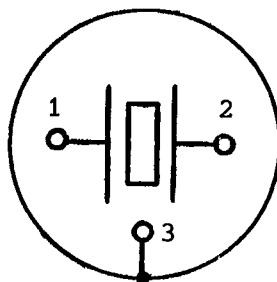
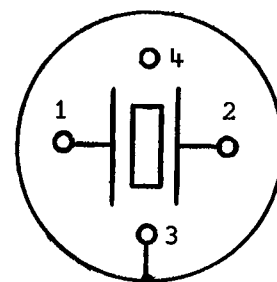
| Symbol          | Millimetres |       | Remarks         |
|-----------------|-------------|-------|-----------------|
|                 | Min.        | Max.  |                 |
| $\varnothing A$ | -           | 10.70 | -               |
| C               | -           | 6.80  | -               |
| H               | 4.83        | 5.33  | Pitch<br>5.08mm |
| $\varnothing K$ | 0.41        | 0.48  | -               |
| L               | 12.70       | -     | -               |
| P               | -           | 0.90  | Note 2          |
| Q               | -           | 0.90  | Note 2          |

**FIGURE 2(b) - 4-PIN PACKAGE**  
**Variant 02**

| Symbol          | Millimetres |       | Remarks |
|-----------------|-------------|-------|---------|
|                 | Min.        | Max.  |         |
| $\varnothing A$ | 8.51        | 10.70 | -       |
| C               | 6.10        | 6.90  | -       |
| $\varnothing D$ | 7.75        | 8.50  | -       |
| E               | 0.25        | 1.00  | -       |
| H               | 4.93        | 5.23  | -       |
| $\varnothing K$ | 0.41        | 0.48  | -       |
| L               | 12.70       | -     | -       |
| P               | -           | 0.90  | Note 2  |
| Q               | -           | 0.90  | Note 2  |

**NOTES**

1. Lead No. 3 is grounded to case.
2. The tag's position or presence is optional.

**FIGURE 3 - FUNCTIONAL DIAGRAM****FIGURE 3(a) - 3-PIN PACKAGE**(Bottom View)**FIGURE 3(b) - 4-PIN PACKAGE**(Bottom View)

|                                                                                                                                                                   |                                                      |                            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|----------------------------|
|   | <p>ESA/SCC Detail Specification<br/>No. 3501/018</p> | <p>PAGE 11<br/>ISSUE 2</p> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|----------------------------|

#### 4. REQUIREMENTS

##### 4.1 GENERAL

The complete requirements for procurement of the crystal units specified herein shall be as stated in this specification and ESA/SCC Generic Specification No. 3501 for Quartz Crystal Units. Deviations from the Generic Specification applicable to this specification only, are detailed in Para. 4.2.

Deviations from the applicable Generic Specification and this Detail Specification, formally agreed with specific Manufacturers on the basis that the alternative requirements are equivalent to the ESA/SCC requirements and do not affect the components' reliability, are listed in the appendices attached to this specification.

##### 4.2 DEVIATIONS FROM GENERIC SPECIFICATION

###### 4.2.1 Deviations from Special In-process Controls

None.

###### 4.2.2 Deviations from Final Production Tests (Chart II)

None.

###### 4.2.3 Deviations from Burn-in Tests (Chart III)

None.

###### 4.2.4 Deviations from Qualification Tests (Chart IV)

None.

###### 4.2.5 Deviations from Lot Acceptance Tests (Chart V)

None.

##### 4.3 MECHANICAL REQUIREMENTS

###### 4.3.1 Dimension Check

The dimensions of the crystal units specified herein shall be checked; they shall conform to those shown in Figure 2.

###### 4.3.2 Weight

The maximum weight of the crystal units specified herein shall be 2.0 grammes.

###### 4.3.3 Robustness of Terminations

The requirements for robustness of termination testing are specified in Section 9 of ESA/SCC Generic Specification No. 3501.

##### 4.4 MATERIALS AND FINISHES

The materials and finishes shall be as specified herein. Where a definite material is not specified, a material which will enable the crystal units specified herein to meet the performance requirements of this specification shall be used. Acceptance or approval of any constituent material does not guarantee acceptance of the finished product.

|                                                                                                                                                                   |                                                      |  |                            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|--|----------------------------|
|   | <p>ESA/SCC Detail Specification<br/>No. 3501/018</p> |  | <p>PAGE 12<br/>ISSUE 2</p> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|--|----------------------------|

#### 4.4.1 Case

##### 4.4.1.1 Cap

Copper, nickel plated or nickel and gold plated.

##### 4.4.1.2 Base

Kovar, nickel plated and gold plated.

#### 4.4.2 Lead Material and Finish

The lead material shall be Type 'D' with Type '2' finish in accordance with the requirements of ESA/SCC Basic Specification No. 23500.

#### 4.5 MARKING

##### 4.5.1 General

The marking of all components delivered to this specification shall be in accordance with the requirements of ESA/SCC Basic Specification No. 21700 and the following paragraphs. When the component is too small to accommodate all of the marking specified, as much as space permits shall be marked and the marking information, in full, shall accompany the component in its primary package.

The information to be marked and the order of precedence, shall be as follows:-

- (a) Characteristics.
- (b) Traceability Information.
- (c) The SCC Component Number.

##### 4.5.2 Characteristics

The characteristics to be marked are the frequency and the specific crystal identification number.

##### 4.5.2.1 Frequency

The resonance frequency of the crystal units shall be clearly specified in MHz. Where necessary, it shall be specified to 6 decimal places.

##### 4.5.2.2 Specific Crystal Identification Number

This identification shall be allocated by the Manufacturer (see Para. 1.2) and shall consist of the following:

- Letter : First letter of the crystal manufacturer's name.
- 4 digit number : Sequentially allocated by each Manufacturer.

##### 4.5.3 Traceability Information

Each component shall be marked in respect of traceability information in accordance with the requirements of ESA/SCC Basic Specification No. 21700.

##### 4.5.4 The SCC Component Number

Each component shall bear the SCC Component Number, which shall be constituted and marked as follows:-

350101801B

Detail Specification Number \_\_\_\_\_

Type Variant, (see Figure 2) \_\_\_\_\_

Testing Level (B or C, as applicable) \_\_\_\_\_

|                                                                                  |                                                                                  |                                                      |  |                            |
|----------------------------------------------------------------------------------|----------------------------------------------------------------------------------|------------------------------------------------------|--|----------------------------|
|  |  | <p>ESA/SCC Detail Specification<br/>No. 3501/018</p> |  | <p>PAGE 13<br/>ISSUE 2</p> |
|----------------------------------------------------------------------------------|----------------------------------------------------------------------------------|------------------------------------------------------|--|----------------------------|

#### 4.5.5 Manufacturer's Name, Symbol or Code

The Manufacturer's marking shall be in accordance with the requirements of ESA/SCC Basic Specification No. 21700.

#### 4.6 ELECTRICAL MEASUREMENTS

##### 4.6.1 Electrical Measurements at Reference Temperature

The parameters to be measured in respect of electrical characteristics are scheduled in Table 2.

The measurements shall be performed at the temperatures specified in the individual Tables 1(a), Item 2.

Measurements at reference temperature for OCXO crystal units shall be performed at  $T_{TP} \pm 1^{\circ}\text{C}$ .

##### 4.6.2 Electrical Measurements at High and Low Temperatures

The parameters to be measured at high and low temperatures are scheduled in Table 3. These measurements shall only be performed if values are specified in Tables 1(a) Items 9 and/or 10.

##### 4.6.3 Circuits for Electrical Measurements (Figure 4)

Not applicable.

#### 4.7 BURN-IN TESTS

##### 4.7.1 Parameter Drift Values

The parameter drift values applicable to burn-in are specified in Table 4 of this specification. Unless otherwise stated, measurements shall be performed at  $T_{amb} = T_o \pm 2^{\circ}\text{C}$ . The parameter drift values (Delta) applicable to the scheduled parameters shall not be exceeded. In addition to these drift value requirements for a given parameter, the appropriate limit value specified in Table 2 shall not be exceeded.

##### 4.7.2 Conditions for Burn-in

The requirements for burn-in are specified in Section 7 of ESA/SCC Generic Specification No. 3501.

The test shall be performed as a high temperature storage test and the temperature to be applied shall be as specified in Table 5 of this specification.

For a crystal unit functioning in a temperature controlled environment (OCXO), the test should preferably be performed as an operating life test in an oscillator, at the Turning Point Temperature, with a daily measurement of the resonance frequency of the oscillator.

##### 4.7.3 Electrical Circuits for Burn-in (Figure 5)

Not applicable.

**TABLE 2 - ELECTRICAL MEASUREMENTS AT REFERENCE TEMPERATURE**

| No. | Characteristics                                                                                                       | Symbol                                         | ESA/SCC 3501 Test Method | Limits                         | Unit             |
|-----|-----------------------------------------------------------------------------------------------------------------------|------------------------------------------------|--------------------------|--------------------------------|------------------|
| 1   | Resonance frequency at reference temperature and rated drive level<br>- with C <sub>O</sub><br>- with C <sub>L</sub>  | $f_r (T_o, P_o)$<br>$f_L (T_o, P_o)$           | Para. 9.2.1.1            | Table 1(a), Item 1<br>± Item 7 | MHz              |
| 2   | Resonance resistance at reference temperature and rated drive level<br>- with C <sub>O</sub><br>- with C <sub>L</sub> | $R_r (T_o, P_o)$<br>$R_L (T_o, P_o)$           | Para. 9.2.1.1            | Table 1(a), Item 8             | Ω                |
| 3   | Frequency variation with Drive Level                                                                                  | $\frac{\Delta f}{f} (T_o, \Delta P)$           | Para. 9.2.1.1            | Table 1(a), Item 12            | 10 <sup>-6</sup> |
| 4   | Resistance variation with Drive Level                                                                                 | $\frac{\Delta R}{R} (T_o, \Delta P)$           | Para. 9.2.1.1            | Table 1(a), Item 13            | %                |
| 5   | Motional Inductance                                                                                                   | L <sub>1</sub>                                 | Para. 9.2.1.3            | Table 1(a), Item 14            | mH               |
| 6   | Static Capacitance                                                                                                    | C <sub>o</sub>                                 | Para. 9.2.1.4            | Table 1(a), Item 16            | pF               |
| 7   | Unwanted response                                                                                                     | R <sub>p</sub> /R<br>or<br> Z <sub>p</sub>  /R | Para. 9.2.1.5            | Table 1(a), Item 18            | -                |
| 8   | Insulation Resistance                                                                                                 | R <sub>i</sub>                                 | Para. 9.2.1.6            | 500 Min.                       | MΩ               |

**TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES**

| No. | Characteristics                                            | Symbol                               | ESA/SCC 3501 Test Method | Limits             | Unit             |
|-----|------------------------------------------------------------|--------------------------------------|--------------------------|--------------------|------------------|
| 9   | Frequency variation with Temperature over T <sub>op</sub>  | $\frac{\Delta f}{f} (\Delta T, P_o)$ | Para. 9.2.1.2            | Table 1(a) Item 9  | 10 <sup>-6</sup> |
| 10  | Resistance variation with Temperature over T <sub>op</sub> | $\frac{\Delta R}{R} (\Delta T, P_o)$ | Para. 9.2.1.2            | Table 1(a) Item 10 | %                |

**FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS**

Not applicable.

**TABLE 4 - PARAMETER DRIFT VALUES**

| No. | Characteristics            | Symbol               | Spec. and/or Test Method | Test Conditions | Change Limits ( $\Delta$ )    | Unit              |
|-----|----------------------------|----------------------|--------------------------|-----------------|-------------------------------|-------------------|
| 1   | Resonance frequency drift  | $\frac{\Delta f}{f}$ | As per Table 2           | As per Table 2  | $\pm 2$                       | 10 <sup>-6</sup>  |
| 2   | Resonance resistance drift | $\frac{\Delta R}{R}$ | As per Table 2           | As per Table 2  | $\pm 10$<br>or (1)<br>$\pm 1$ | %<br><br>$\Omega$ |

**NOTES**

1. Whichever is the highest value.

**TABLE 5 - CONDITIONS FOR BURN-IN AND LAT LIFE TESTS**

| No. | Characteristics     | Symbol           | Condition (Note 1) | Unit |
|-----|---------------------|------------------|--------------------|------|
| 1   | Ambient Temperature | T <sub>amb</sub> | + 105 ( + 0-5)     | °C   |

**NOTES**

1. See Para. 4.7.2.

**FIGURE 5 - ELECTRICAL CIRCUIT FOR BURN-IN AND LIFE TEST**

Not applicable.

**4.8 ENVIRONMENTAL AND ENDURANCE TESTS (CHARTS IV AND V OF ESA/SCC GENERIC SPECIFICATION NO. 3501)**

**4.8.1 Measurements and Inspections on Completion of Environmental Tests**

The parameters to be measured and inspections to be performed on completion of environmental tests are scheduled in Table 6. Unless otherwise stated, the measurements shall be performed at T<sub>amb</sub> = T<sub>0</sub> ± 2 °C.

**4.8.2 Measurements and Inspections at Intermediate Points and on Completion of Endurance Tests**

The parameters to be measured and inspections to be performed at intermediate points and on completion of endurance tests are scheduled in Table 6. Unless otherwise stated, the measurements shall be performed at T<sub>amb</sub> = T<sub>0</sub> ± 2 °C.

**4.8.3 Conditions for Operating Life Test (Part of Endurance Testing)**

The requirements for the operating life test are specified in Section 9 of ESA/SCC Generic Specification No. 3501. The test shall be performed as a high temperature storage test and the test temperatures are specified in ESA/SCC Generic Specification No. 3501 for Qualification Testing and in Table 5 of this specification for LAT Testing.

For a crystal unit functioning in a temperature controlled environment (OCXO), the test should preferably be performed as an operating life test in an oscillator, at the Turning Point Temperature, with a daily measurement of the resonance frequency of the oscillator.



**TABLE 6 - MEASUREMENTS AND INSPECTIONS ON COMPLETION OF ENVIRONMENTAL TESTS  
AND AT INTERMEDIATE POINTS AND ON COMPLETION OF ENDURANCE TESTING**

| NO. | ESA/SCC GENERIC SPEC. NO. 3501                   |                            | MEASUREMENTS AND INSPECTIONS                                                                                                                                             |                                                                          | SYMBOL                                                                       | LIMITS                             |                                    | UNIT                                   |
|-----|--------------------------------------------------|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|------------------------------------------------------------------------------|------------------------------------|------------------------------------|----------------------------------------|
|     | ENVIRONMENTAL AND ENDURANCE TESTS (1)            | TEST METHOD AND CONDITIONS | IDENTIFICATION                                                                                                                                                           | CONDITIONS                                                               |                                                                              | Min.                               | Max.                               |                                        |
| 01  | Electrical Measurements at Reference Temperature | Para. 9.2.4                | Electrical Measurements                                                                                                                                                  | Table 2                                                                  |                                                                              | Table 1(a)                         |                                    |                                        |
| 02  | Shock                                            | Para. 9.3                  | <b>Initial Measurements</b><br>Resonance Frequency<br>Resonance Resistance<br><b>Final Measurements</b><br>Resonance Frequency<br>Drift<br>Resonance Resistance<br>Drift | Table 2 Item 1<br>Table 2 Item 2<br><br>Table 2 Item 1<br>Table 2 Item 2 | $f$<br>$R$<br><br>$\frac{\Delta f}{f}$<br>$\frac{\Delta R}{R}$<br>$\Delta R$ | <br><br><br>- 1.0<br>- 10<br>- 1.0 | <br><br><br>+ 1.0<br>+ 10<br>+ 1.0 | <br><br><br>$10^{-6}$<br>%<br>$\Omega$ |
| 03  | Vibration                                        | Para. 9.4                  | <b>Initial Measurements</b><br>Resonance Frequency<br>Resonance Resistance<br><b>Final Measurements</b><br>Resonance Frequency<br>Drift<br>Resonance Resistance<br>Drift | Table 2 Item 1<br>Table 2 Item 2<br><br>Table 2 Item 1<br>Table 2 Item 2 | $f$<br>$R$<br><br>$\frac{\Delta f}{f}$<br>$\frac{\Delta R}{R}$<br>$\Delta R$ | <br><br><br>- 1.0<br>- 10<br>- 1.0 | <br><br><br>+ 1.0<br>+ 10<br>+ 1.0 | <br><br><br>$10^{-6}$<br>%<br>$\Omega$ |
| 04  | Seal Test                                        | Para. 9.5                  | Fine Leak<br>Gross Leak                                                                                                                                                  | Para. 9.5.1<br>Para. 9.5.2                                               |                                                                              | Para. 9.5.1<br>Para. 9.5.2         |                                    |                                        |
| 05  | Permanence of Marking                            | Para. 9.8                  | <b>Final Measurements</b><br>Visual Examination                                                                                                                          | No corrosion or obliteration of marking                                  | -                                                                            | -                                  | -                                  | -                                      |
| 06  | External Visual Inspection                       | Para. 9.9                  | <b>Final Measurements</b><br>Visual Inspection                                                                                                                           | ESA/SCC No. 20500                                                        | -                                                                            | -                                  | -                                  | -                                      |
| 07  | Solderability                                    | Para. 9.13                 | -                                                                                                                                                                        | -                                                                        | -                                                                            | -                                  | -                                  | -                                      |

**NOTES**

1. The tests in this table refer to either Chart IV or V, and shall be used as applicable.
2. Whichever is the highest value.





**TABLE 6 - MEASUREMENTS AND INSPECTIONS ON COMPLETION OF ENVIRONMENTAL TESTS AND AT INTERMEDIATE POINTS AND ON COMPLETION OF ENDURANCE TESTING (Cont.)**

| NO. | ESA/SCC GENERIC SPEC. NO. 3501              |                            | MEASUREMENTS AND INSPECTIONS                                                                                                                                                                      |                                                                                                              | SYMBOL                                                                  | LIMITS                                                                   |                        | UNIT                             |
|-----|---------------------------------------------|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|--------------------------------------------------------------------------|------------------------|----------------------------------|
|     | ENVIRONMENTAL AND ENDURANCE TESTS (1)       | TEST METHOD AND CONDITIONS | IDENTIFICATION                                                                                                                                                                                    | CONDITIONS                                                                                                   |                                                                         | Min.                                                                     | Max.                   |                                  |
|     |                                             |                            |                                                                                                                                                                                                   |                                                                                                              |                                                                         |                                                                          |                        |                                  |
| 08  | Climatic Sequence<br>Dry Heat               | Para. 9.14<br>Para. 9.14.1 | <b>Initial Measurements</b><br>Resonance Frequency<br>Resonance Resistance<br><b>Final Measurements</b><br>Resonance Frequency<br>Drift<br>Resonance Resistance<br>Drift                          | Table 2 Item 1<br>Table 2 Item 2                                                                             | f<br>R                                                                  | Table 2 Item 1<br>Table 2 Item 2                                         |                        |                                  |
| 09  | Cold                                        | Para. 9.14.3               | <b>Initial Measurements</b><br>Resonance Frequency<br>Resonance Resistance<br><b>Final Measurements</b><br>Resonance Frequency<br>Drift<br>Resonance Resistance<br>Drift                          | Table 2 Item 1<br>Table 2 Item 2                                                                             | $\frac{\Delta f}{f}$<br>$\frac{\Delta R}{R}$<br>R<br>ΔR                 | - 2.0<br>- 10<br>or (2)<br>- 1.0                                         | + 2.0<br>+ 10<br>+ 1.0 | 10 <sup>-6</sup><br>%<br>Ω       |
|     |                                             |                            |                                                                                                                                                                                                   |                                                                                                              |                                                                         |                                                                          |                        |                                  |
|     |                                             |                            |                                                                                                                                                                                                   |                                                                                                              |                                                                         |                                                                          |                        |                                  |
|     |                                             |                            |                                                                                                                                                                                                   |                                                                                                              |                                                                         |                                                                          |                        |                                  |
| 10  | Damp Heat (Accelerated)<br>Remaining Cycles | Para. 9.14.4               | <b>Initial Measurements</b><br>Resonance Frequency<br>Resonance Resistance<br><b>Final Measurements</b><br>Resonance Frequency<br>Drift<br>Resonance Resistance<br>Drift<br>Insulation Resistance | Table 2 Item 1<br>Table 2 Item 2<br>Table 2 Item 1<br>Table 2 Item 2<br>Table 2 Item 8                       | f<br>R<br>$\frac{\Delta f}{f}$<br>$\frac{\Delta R}{R}$<br>R<br>ΔR<br>Ri | Para. 9.14.1.3<br>Final Measurements<br>- 2.0<br>- 10<br>or (2)<br>- 1.0 | + 2.0<br>+ 10<br>+ 1.0 | 10 <sup>-6</sup><br>%<br>Ω<br>MΩ |
|     |                                             |                            |                                                                                                                                                                                                   |                                                                                                              |                                                                         |                                                                          |                        |                                  |
|     |                                             |                            |                                                                                                                                                                                                   |                                                                                                              |                                                                         |                                                                          |                        |                                  |
|     |                                             |                            |                                                                                                                                                                                                   |                                                                                                              |                                                                         |                                                                          |                        |                                  |
|     |                                             |                            |                                                                                                                                                                                                   |                                                                                                              |                                                                         |                                                                          |                        |                                  |
|     |                                             |                            |                                                                                                                                                                                                   |                                                                                                              |                                                                         |                                                                          |                        |                                  |
|     |                                             |                            |                                                                                                                                                                                                   |                                                                                                              |                                                                         |                                                                          |                        |                                  |
|     |                                             |                            |                                                                                                                                                                                                   |                                                                                                              |                                                                         |                                                                          |                        |                                  |
| 11  | Rapid Change of<br>Temperature              | Para. 9.15                 | <b>Initial Measurements</b><br>Resonance Frequency<br>Resonance Resistance<br><b>Final Measurements</b><br>Resonance Frequency<br>Drift<br>Resonance Resistance<br>Drift                          | Table 2 Item 1<br>Table 2 Item 2<br>After minimum<br>Recovery of 2 hours<br>Table 2 Item 1<br>Table 2 Item 2 | f<br>R<br>$\frac{\Delta f}{f}$<br>$\frac{\Delta R}{R}$<br>R<br>ΔR       | Para. 9.14.4.2<br>Final Measurements<br>- 2.0<br>- 10<br>or (2)<br>- 1.0 | + 2.0<br>+ 10<br>+ 1.0 | 10 <sup>-6</sup><br>%<br>Ω       |
|     |                                             |                            |                                                                                                                                                                                                   |                                                                                                              |                                                                         |                                                                          |                        |                                  |
|     |                                             |                            |                                                                                                                                                                                                   |                                                                                                              |                                                                         |                                                                          |                        |                                  |
|     |                                             |                            |                                                                                                                                                                                                   |                                                                                                              |                                                                         |                                                                          |                        |                                  |
| 12  | Robustness of<br>Terminations               | Para. 9.16                 | Tensile Strength<br><br>Visual Examination<br>Bending<br><br>Visual Examination                                                                                                                   | Gen. 3501<br>Para. 9.16.1<br>No visible damage<br>Gen. 3501<br>Para. 9.16.2<br>No visible damage             |                                                                         |                                                                          |                        |                                  |

**NOTES**

1. The tests in this table refer to either Chart IV or V, and shall be used as applicable.
2. Whichever is the highest value.

|                                                                                  |            |                                              |                    |
|----------------------------------------------------------------------------------|------------|----------------------------------------------|--------------------|
|  | <b>SCC</b> | ESA/SCC Detail Specification<br>No. 3501/018 | PAGE 18<br>ISSUE 2 |
|----------------------------------------------------------------------------------|------------|----------------------------------------------|--------------------|

**TABLE 6 - MEASUREMENTS AND INSPECTIONS ON COMPLETION OF ENVIRONMENTAL TESTS  
AND AT INTERMEDIATE POINTS AND ON COMPLETION OF ENDURANCE TESTING (Cont.)**

| NO. | ESA/SCC GENERIC SPEC. NO. 3501        |                            | MEASUREMENTS AND INSPECTIONS                                                 |                | SYMBOL               | LIMITS |                | UNIT             |
|-----|---------------------------------------|----------------------------|------------------------------------------------------------------------------|----------------|----------------------|--------|----------------|------------------|
|     | ENVIRONMENTAL AND ENDURANCE TESTS (1) | TEST METHOD AND CONDITIONS | IDENTIFICATION                                                               | CONDITIONS     |                      | Min.   | Max.           |                  |
| 13  | Life Test                             | Para. 9.17                 | <b>Initial Measurements</b>                                                  |                |                      |        |                |                  |
|     |                                       |                            | Resonance Frequency                                                          | Table 2 Item 1 | f                    |        | Table 2 Item 1 |                  |
|     |                                       |                            | Resonance Resistance                                                         | Table 2 Item 2 | R                    |        | Table 2 Item 2 |                  |
|     |                                       |                            | <b>Intermediate Measurements</b>                                             | At 500 hours   |                      |        |                |                  |
|     |                                       |                            | Resonance Frequency                                                          | Table 2 Item 1 | $\frac{\Delta f}{f}$ | -2.0   | +2.0           | 10 <sup>-6</sup> |
|     |                                       |                            | Drift                                                                        |                |                      |        |                |                  |
|     |                                       |                            | Resonance Resistance                                                         | Table 2 Item 2 | $\frac{\Delta R}{R}$ | -10    | +10            | %                |
|     |                                       |                            | Drift                                                                        |                | $\Delta R$           | -1.0   | +1.0           | $\Omega$         |
|     |                                       |                            | <b>Intermediate Measurements (Chart IV) and Final Measurements (Chart V)</b> | At 1000 hours  |                      |        |                |                  |
|     |                                       |                            | Resonance Frequency                                                          | Table 2 Item 1 | $\frac{\Delta f}{f}$ | -2.5   | +2.5           | 10 <sup>-6</sup> |
|     |                                       |                            | Drift                                                                        |                |                      |        |                |                  |
|     |                                       |                            | Resonance Resistance                                                         | Table 2 Item 2 | $\frac{\Delta R}{R}$ | -10    | +10            | %                |
|     |                                       |                            | Drift                                                                        |                | $\Delta R$           | -1.0   | +1.0           | $\Omega$         |
|     |                                       |                            | <b>Final Measurements (Chart IV)</b>                                         | At 2000 hours  |                      |        |                |                  |
|     |                                       |                            | Resonance Frequency                                                          | Table 2 Item 1 | $\frac{\Delta f}{f}$ | -3.0   | +3.0           | 10 <sup>-6</sup> |
|     |                                       |                            | Drift                                                                        |                |                      |        |                |                  |
|     |                                       |                            | Resonance Resistance                                                         | Table 2 Item 2 | $\frac{\Delta R}{R}$ | -10    | +10            | %                |
|     |                                       |                            | Drift                                                                        |                | $\Delta R$           | -1.0   | +1.0           | $\Omega$         |

**NOTES**

1. The tests in this table refer to either Chart IV or V, and shall be used as applicable.
2. Whichever is the highest value.