



**RELAYS ELECTROMAGNETIC,
RF COAXIAL SWITCH, LATCHING,
3/3/5 MATRIX, SMA CONNECTORS (B.B.M.),
WITH INDICATOR CIRCUIT
ESCC Detail Specification No. 3603/006**

**ISSUE 1
October 2002**



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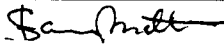

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**RELAYS ELECTROMAGNETIC,
RF COAXIAL SWITCH, LATCHING,
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ESA/SCC Detail Specification No. 3603/006**



**space components
coordination group**

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SCC

ESA/SCC Detail Specification
No. 3603/006

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DOCUMENTATION CHANGE NOTICE

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APPENDICES (Applicable to specific Manufacturers only)

None.

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1. **GENERAL**

1.1 **SCOPE**

This specification details the ratings, physical and electrical characteristics, test and inspection data for Relays Electromagnetic, RF Coaxial Switch, Latching, 3/3/5 Matrix, SMA connectors (B.B.M.), with Indicator Circuit. It shall be read in conjunction with ESA/SCC Generic Specification No. 3603, the requirements of which are supplemented herein.

1.2 **COMPONENT TYPE VARIANTS**

Variants of the basic type relays specified herein, which are also covered by this specification, are given in Table 1(a).

1.3 **MAXIMUM RATINGS**

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

1.4 **PARAMETER DERATING INFORMATION**

Parameter derating information applicable to the relays specified herein is shown in Figure 1.

1.5 **PHYSICAL DIMENSIONS**

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

1.6 **FUNCTIONAL DIAGRAM**

The functional diagram for the relays specified herein, is shown in Figure 3.

1.7 **CIRCUIT SCHEMATIC**

The circuit schematic, showing terminal identification, suppression diodes, telemetry contacts etc. for the relays specified herein, is shown in Figure 3(c).

2. **APPLICABLE DOCUMENTS**

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

- ESA/SCC Generic Specification No. 3603 for Relays Electromagnetic, RF Coaxial Switch, Latching.
- ESA/SCC Detail Specification No. 3401/001, Connectors, Electrical, Rectangular, Non-Removable Solder Bucket, PCB and Wire-Wrap Contacts and Removable Coaxial and Power Contacts, Based on Type D*M.
- ESA/SCC Detail Specification No. 3402/002 for RF Coaxial Connectors, Type SMA, 50Ω, (Female Contact).
- ESA/SCC Detail Specification No. 4001/001, Resistors, Fixed, Film Non-Hermetically Sealed, based on type RNC 55.
- ESA/SCC Detail Specification No. 5103/021, Diode, Silicon, Power Rectifier, Fast Recovery, Based on Types 1N5615/17/19/21/23.
- MIL-STD-202, Test Methods for Electronic and Electrical Component Parts.

TABLE 1(a) - TYPE VARIANTS

VARIANT No.	DESCRIPTION	FIGURE	WEIGHT (Max.) (g)
01	25 pin DEM connector, resistors in telemetry, without suppression diodes (1) (2) (3)	2	310
02	25 pin DEM connector, resistors in telemetry, with 2 suppression diodes per actuator command (1) (2) (3)	2	320
03	25 pin DEM connector, resistors in telemetry, with 4 suppression diodes (In quad configuration) per actuator command (1) (2) (3)	2	325

NOTES

1. Connectors shall be procured in accordance with ESA/SCC Detail Specification 3401/001.
2. Resistors shall be procured in accordance with ESA/SCC Detail Specification 4001/001.
3. Diodes shall be procured in accordance with ESA/SCC Detail Specification 5103/021.

TABLE 1(b) - MAXIMUM RATINGS

NO	CHARACTERISTICS	SYMBOL	MAXIMUM RATING	UNIT	REMARKS
1	Rated Coil Voltage (Actuation Voltage)	V_C	28	Vdc	
2	Maximum Coil Voltage	V_{Cmax}	32	Vdc	
3	Minimum Coil Voltage	V_{Cmin}	22	Vdc	
4	Coil Current	I_C	360 526	mA	Per switch matrix block (see functional diagram) At 28V and $T_{amb} = +23^{\circ}C$ At 32V and $T_{amb} = -30^{\circ}C$
5	Frequency Range	f	DC to 18.4	GHz	
6	RF Power	P_{RF}	1.0	W (CW)	Note 1
7	Indicator Circuit Voltage Current	V_{ind} I_{ind}	30 (2) 100 (2)	V mA	d.c. max or a.c. rms
8	RF Leakage	E	- 70 (3)	dB	
9	Operating Temperature Range	T_{op}	- 30 to + 85	$^{\circ}C$	
10	Storage Temperature Range	T_{stg}	- 40 to + 85	$^{\circ}C$	

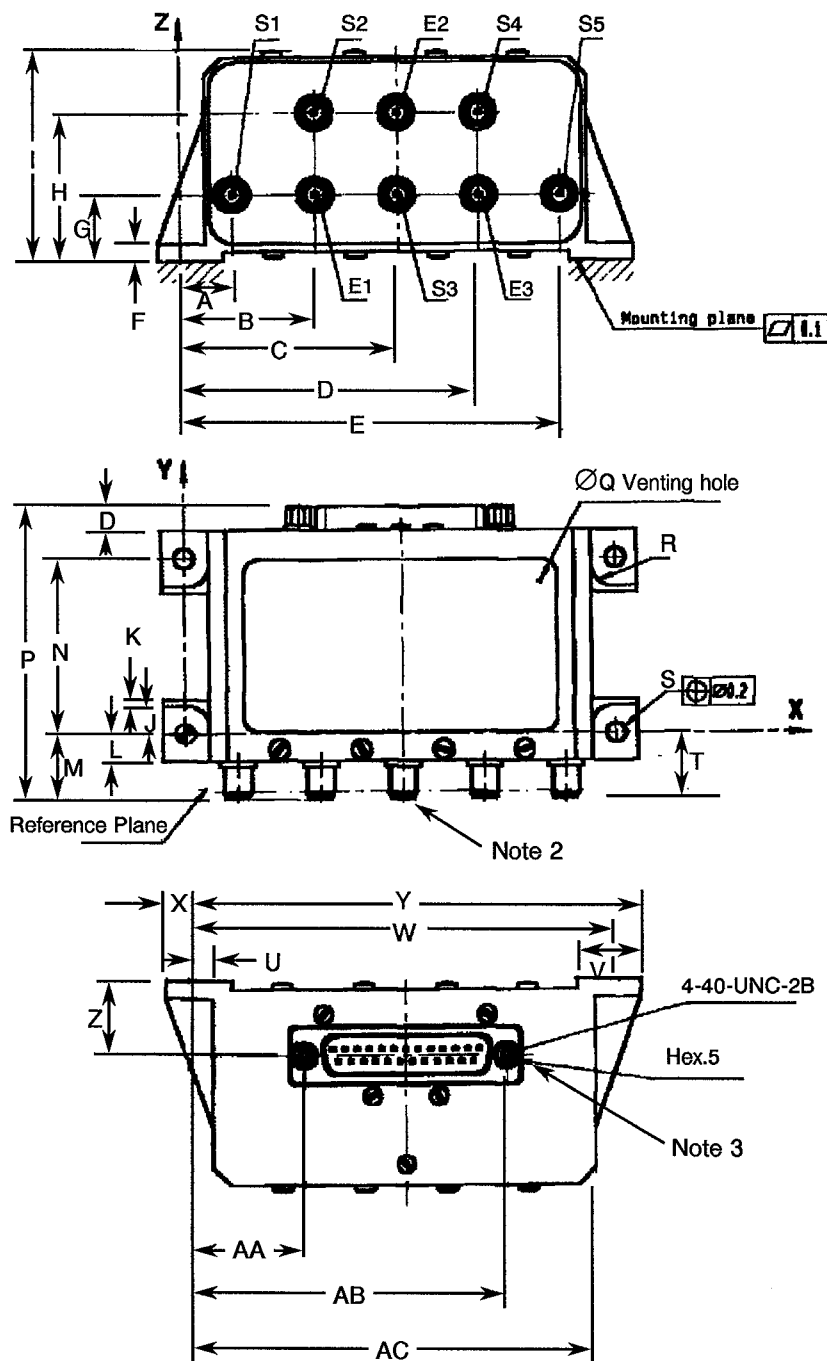
NOTES

1. In case of RF System breakdown, the switch matrix shall be capable of switching off the rated power once.
2. These values are the maximum ratings of telemetry contacts but shall be limited in order to limit the power in telemetry resistors to a maximum value of 0.1W.
3. See Figure 1.

FIGURE 1 - PARAMETER DERATING INFORMATION

FREQUENCY	RF LEAKAGE
0 - 9.369Hz	- 70
9.3 - 13.89Hz	- 60
13.8 - 18.49Hz	- 50

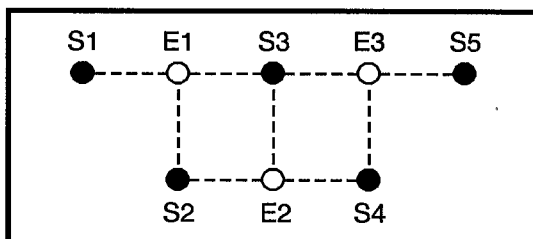
RF Leakage versus Frequency

FIGURE 2 - PHYSICAL DIMENSIONS


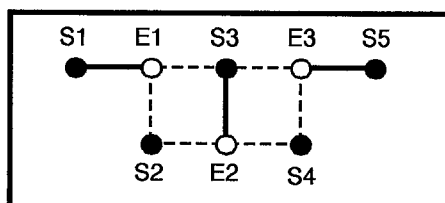
SYMBOL	MILLIMETRES		REMARKS
	MIN	MAX	
A	11.5	12.5	
B	30.5	31.5	
C	49.5	50.5	
D	68.5	69.5	
E	87.5	88.5	
F	3.5	4.5	
G	15.1	16.1	
H	34.1	35.1	
I	-	51.0	
J	6.0	7.0	Note 1
K	1.0	2.0	Note 1
L	6.0	7.0	Note 1
M	14.9	15.9	
N	41.0		
O	-	7.0	Note 1
P	-	71.0	
ØQ	0.5	0.7	Notes 1, 4
R	4.5	5.5	Note 1
S	4.4	4.6	
T	13.0	14.0	Note 1
U	5.2	6.2	Note 1
V	14.7	15.7	Note 1
W	100.0		
X	4.7	5.7	
Y	104.7	105.7	
Z	16.7	17.7	Note 1
AA	26.0	27.0	Note 1
AB	73.0	74.0	Note 1
AC	93.8	94.8	Note 1

NOTES

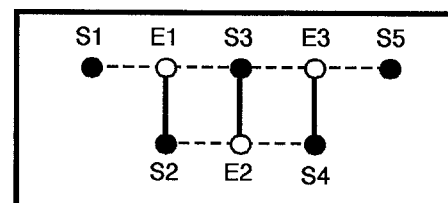
1. Guaranteed but not measured.
2. 8 SMA female connectors according to ESA/SCC No. 3402/002.
3. DBM male connector according to ESA/SCC No. 3401/001, Variant 01.
4. This hole shall be closed by a small piece of space approved adhesive tape up to integration of the component into the satellite.

FIGURE 3 - FUNCTIONAL DIAGRAM
FIGURE 3(a) - RF FUNCTIONAL DIAGRAM


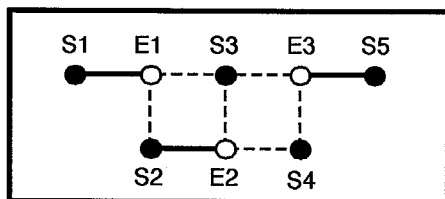
Combination 1



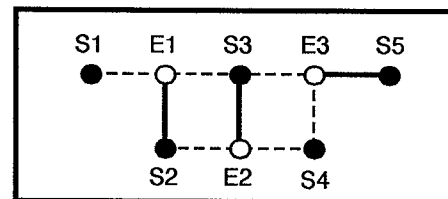
Combination 6



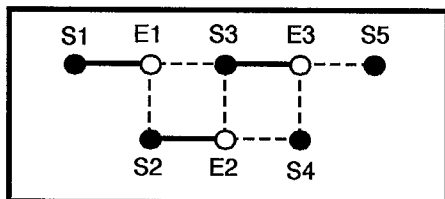
Combination 2



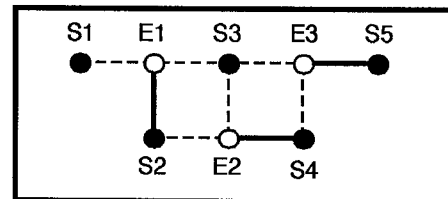
Combination 7



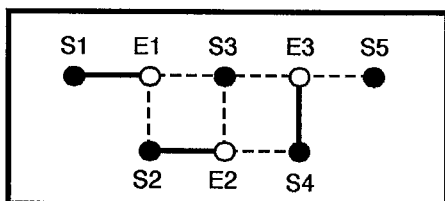
Combination 3



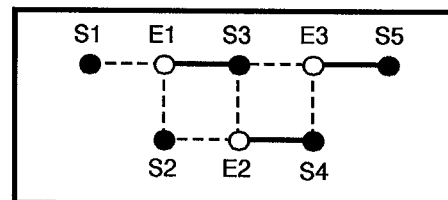
Combination 8



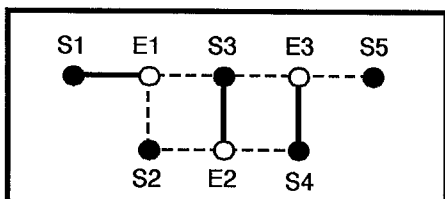
Combination 4



Combination 9



Combination 5



Combination 10

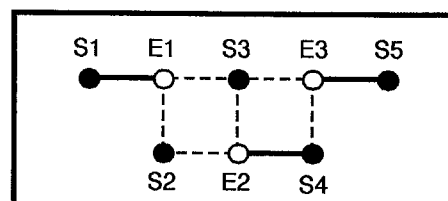
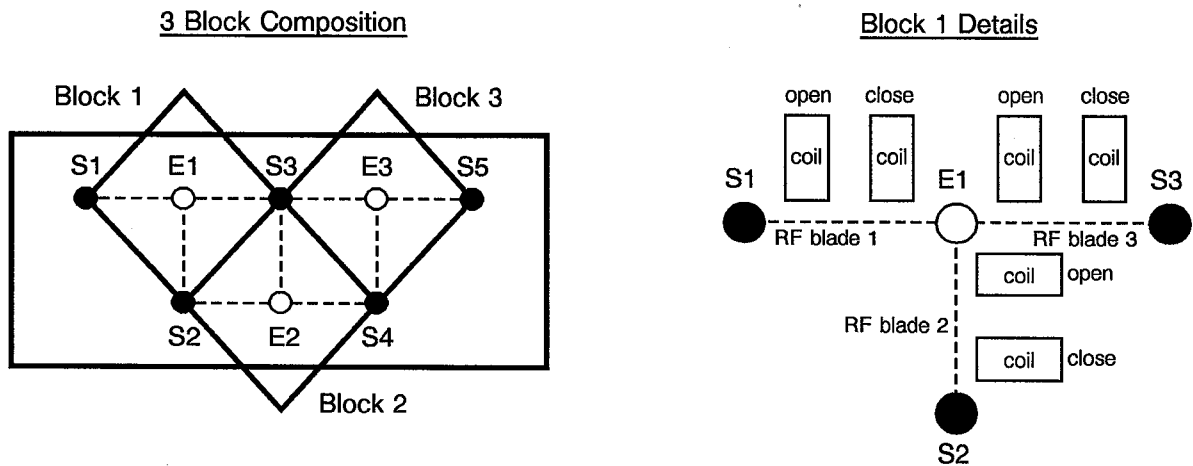


FIGURE 3 - FUNCTIONAL DIAGRAM (CONTINUED)
FIGURE 3(b) - COMMAND FUNCTIONAL DIAGRAM
FIGURE 3(b)1 - SWITCH MATRIX COMPOSITION

The switch matrix is considered as 3 independent blocks.


FIGURE 3(b)2 - COMMAND CONTROL

Each block can be commanded to three positions as per the Figure below, each position corresponding to one RF blade closed.

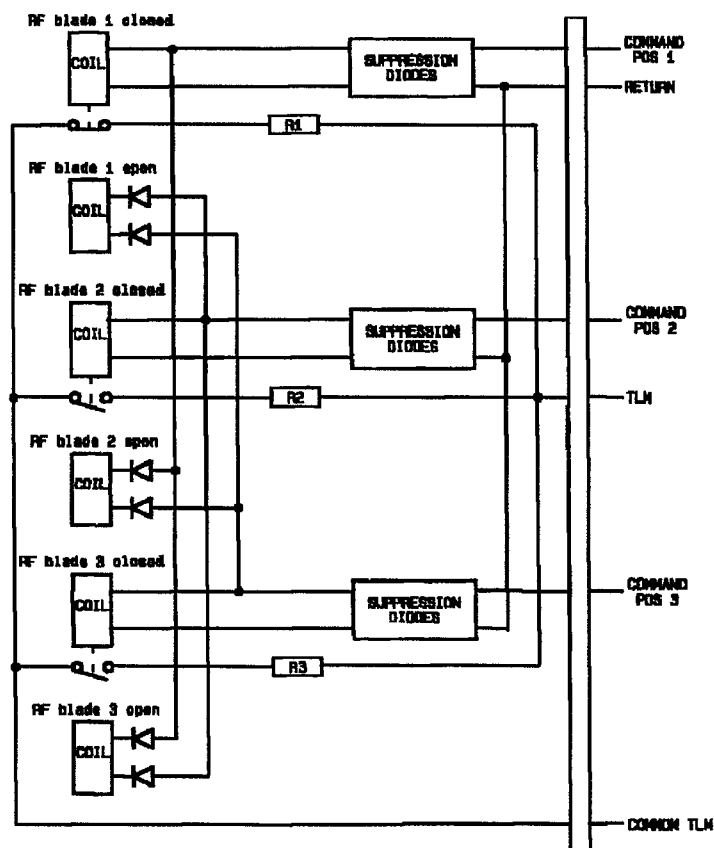




FIGURE 3(c)1 - CIRCUIT SCHEMATIC, VARIANT 01

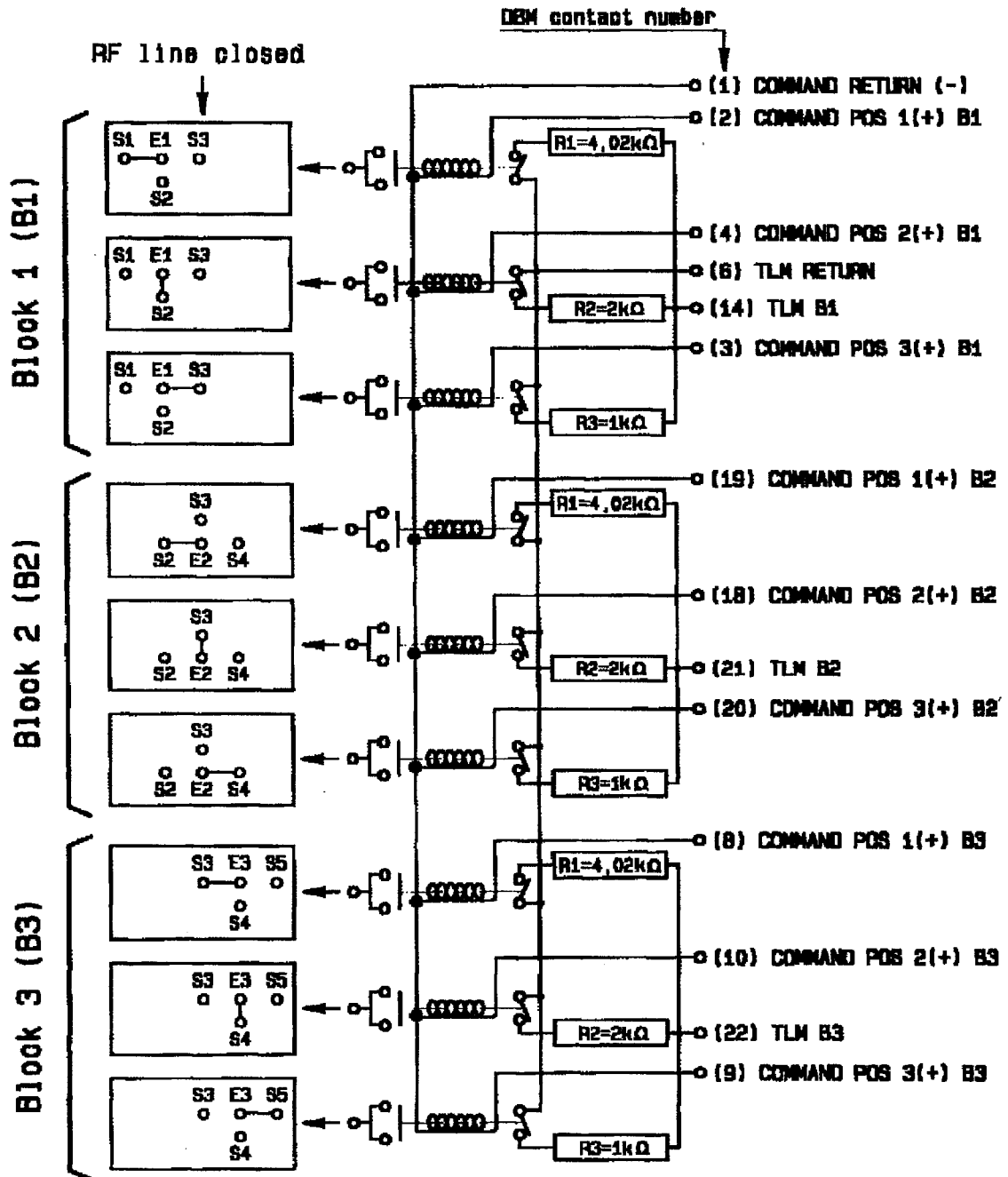




FIGURE 3(c)2 - CIRCUIT SCHEMATIC, VARIANT 02

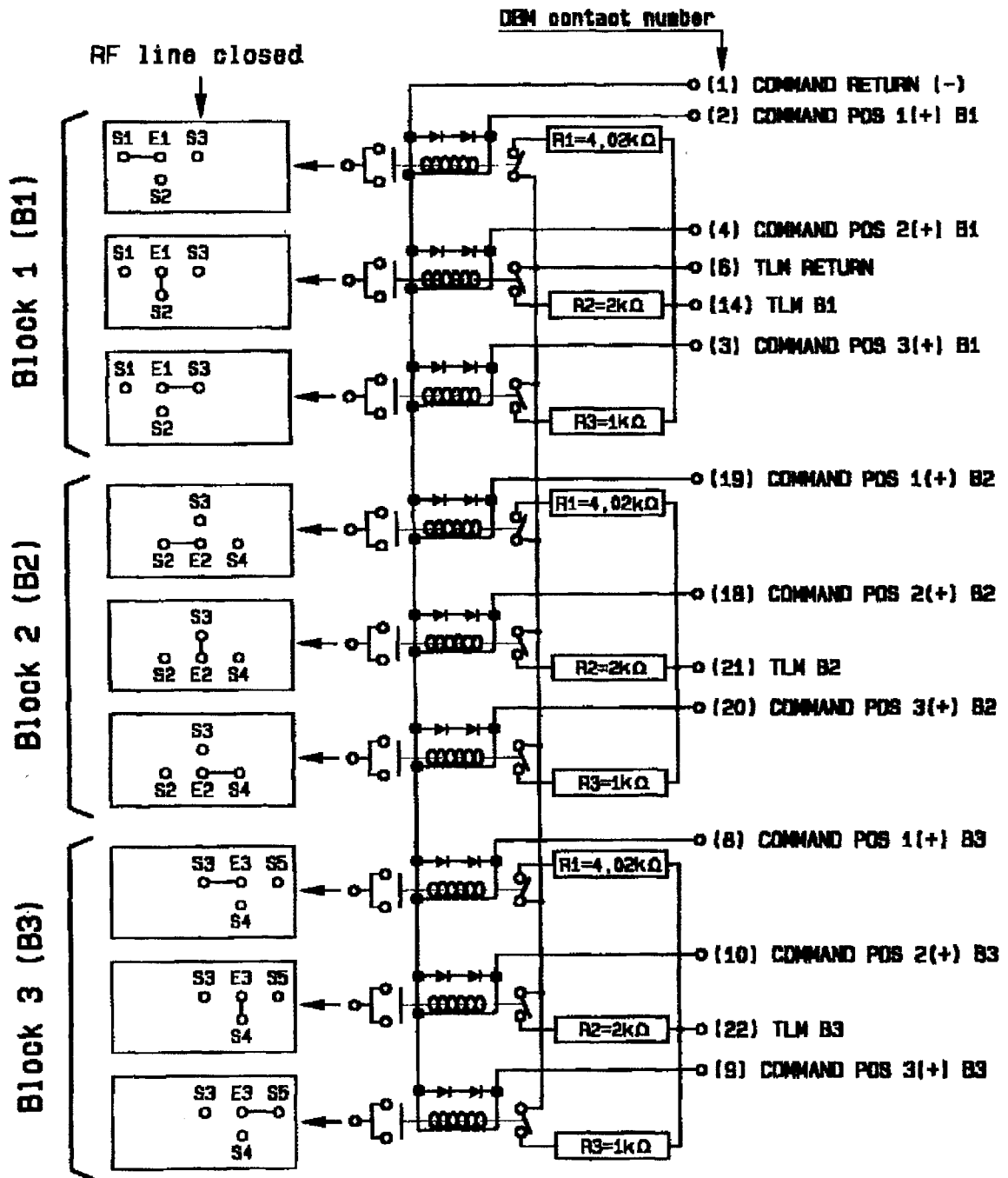
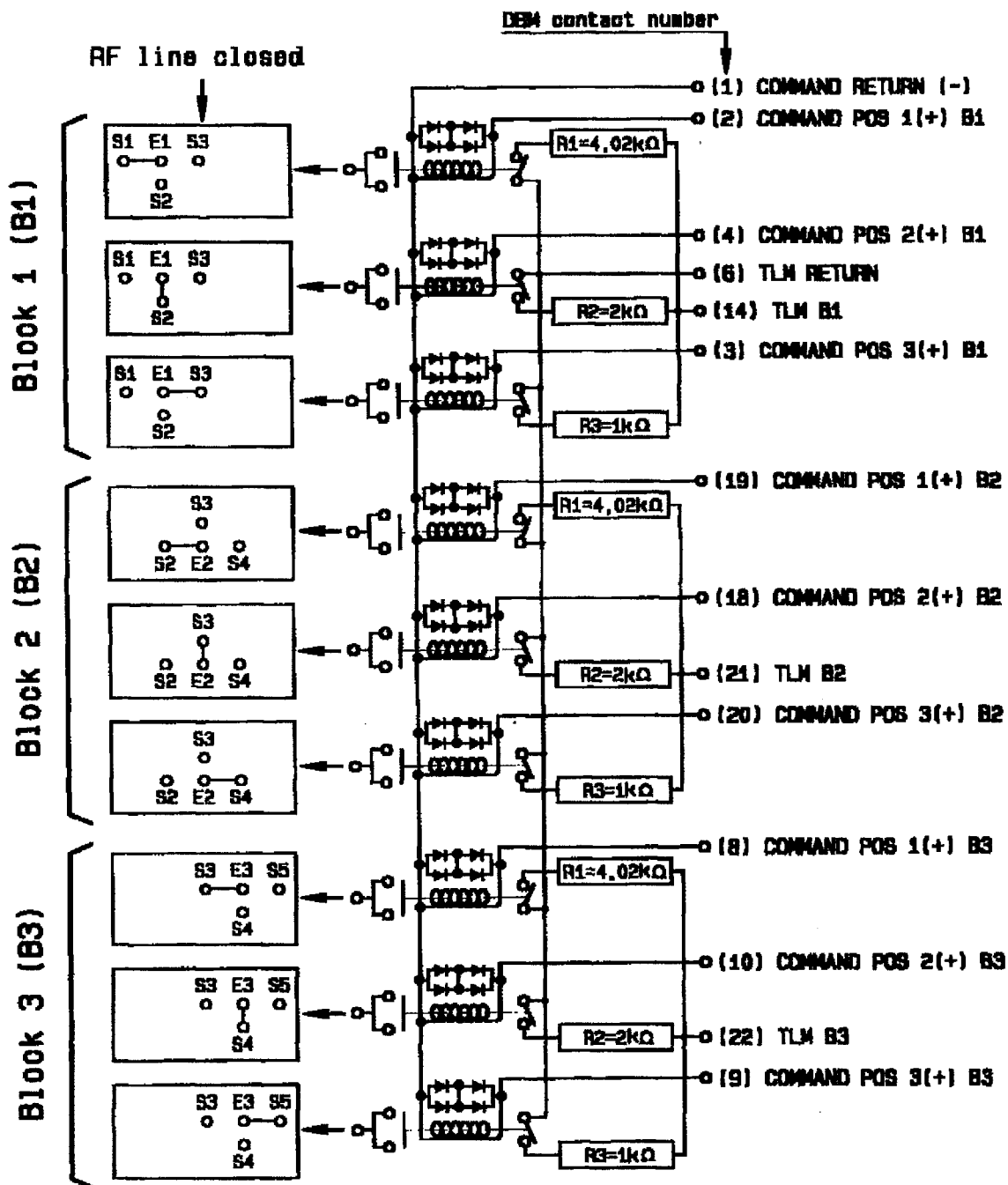




FIGURE 3(c)3 - CIRCUIT SCHEMATIC, VARIANT 03



**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:-

CW	=	Continuous Wave.
E	=	RF Leakage.
I_C	=	Coil Current.
I_{ind}	=	Indicator Circuit Current.
IL	=	Insertion Loss.
ISO	=	Isolation.
P_{RF}	=	RF Power.
R_C	=	Coil Resistance.
R_{Cind}	=	Contact Resistance Indicator Circuit.
R_{CRF}	=	Contact Resistance RF Path.
t_{op}	=	Operate Time.
U_p	=	Pick-up Voltage.
V_C	=	Coil Voltage.
V_{ind}	=	Indicator Circuit Voltage.
VSWR	=	Voltage Standing Wave Ratio.

4. REQUIREMENTS**4.1 GENERAL**

The complete requirements for procurement of the relays specified herein shall be as stated in this specification and ESA/SCC Generic Specification No. 3603 for Relays Electromagnetic, RF Coaxial Switch, Latching. Deviations from the Generic Specification, applicable to this specification only, are listed 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 effect 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 Screening and Electrical Measurements (Chart III)


None.

4.2.4 Deviations from Qualification Tests

(a) Para. 9.20, Mechanical Life: Not applicable.

4.2.5 Deviations from Lot Acceptance Tests (Chart V)

None.

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4.3 MECHANICAL REQUIREMENTS

4.3.1 Dimension Check

The dimensions of the relays specified herein shall be verified in accordance with the requirements set out in Para 9.3 of ESA/SCC Generic Specification No. 3603 and shall conform to those shown in Figure 2.

4.3.2 Weight

The maximum weight of the relays specified herein shall be as shown in Table 1(a).

4.3.3 Coupling Proof Torque (SMA Connectors)

In accordance with ESA/SCC Detail Specification No. 3402/002, Para. 4.3.3.

4.3.4 Mating and Unmating Forces (SMA Connectors and DBM Connectors)

In accordance with ESA/SCC Detail Specification No. 3402/002, Para. 4.3.5 for SMA connectors and Detail Specification No. 3401/001 for DBM connectors.

4.3.5 Contact Separation Force (SMA Connectors)

In accordance with ESA/SCC Detail Specification No. 3402/002, Para. 4.3.8(c).

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 relays 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.

4.4.1 Case

Aluminium, black anodised or chromated depending on customer requirement.

4.4.2 RF Body

Aluminium, electroless nickel plated.

4.4.3 RF Connectors

Connectors shall be in accordance with ESA/SCC Detail Specification No. 3402/002. Materials to be:

- Body: Passivated stainless steel.
- Centre Contact: BeCu gold plated.

4.5 MARKING

4.5.1 General

The marking of all components delivered to this specification shall be in accordance with 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:-

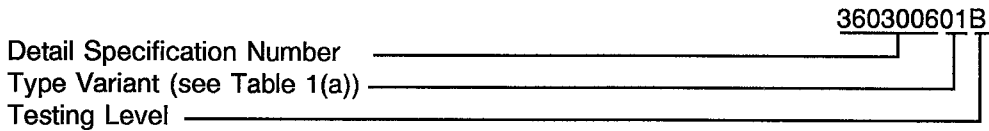
- (a) SMA Connector Identification.
- (b) The SCC Component Number.
- (c) Electrical Characteristics.
- (d) Traceability Information.

4.5.2 SMA Connector Identification

SMA connector identification shall be marked on the switch case in accordance with Figure 3(a).

4.5.3 The SCC Component Number

The SCC Component Number shall be constituted and marked as follows:-



4.5.4 Electrical Characteristics

The electrical characteristic to be marked is the maximum coil voltage. The information shall be constituted and marked as follows.

Coil Voltage	Code
28Vdc	28V

4.5.5 Traceability Information

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

4.6 ELECTRICAL MEASUREMENTS

4.6.1 Electrical Measurements at Room Temperature

The parameters to be measured at room temperature are scheduled in Table 2. Unless otherwise stated, the measurements shall be performed at $T_{amb} = +22 \pm 3$ °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. Unless otherwise stated, the measurements shall be performed at $T_{amb} = +85(+0-3)$ and $-30(+3-0)$ °C respectively.

4.7 SCREENING

4.7.1 Parameter Drift Values

The parameter drift values applicable to screening are as specified in Table 4 of this specification. Measurements shall be performed at $T_{amb} = +22 \pm 3$ °C. The parameter drift values (Δ) applicable to the parameters scheduled shall not be exceeded. In addition to these drift value requirements for a given parameter, the appropriate limit values specified in Table 2 shall not be exceeded.

4.7.2 Conditions for Screening

The requirements for screening are specified in Section 7 of ESA/SCC Generic Specification No. 3603. The conditions for screening shall be as specified in Para. 9.6 of ESA/SCC Generic Specification No. 3603.

4.7.3 Electrical Circuits for Screening (Figure 5)

Not applicable.

TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE - D.C. PARAMETERS

NO	CHARACTERISTICS	SYMBOL	ESA/SCC 3603 TEST METHOD	TEST CONDITION	LIMITS		UNIT
					MIN.	MAX.	
1	Pick-up Voltage	U_P	Para. 9.4.1.1	Para. 9.4.1.1	-	16	V
2	Operate Time (including bounce)	t_{op}	Para. 9.4.1.2	Para. 9.4.1.2	-	10	ms
3	Insulation Resistance	R_i	Para. 9.4.1.3	Para. 9.4.1.3	100	-	$M\Omega$
4	Voltage Proof Leakage Current	I_L	Para. 9.4.1.4	Para. 9.4.1.4 500Vrms	-	1.0	mA
5	Contact Resistance RF Path	R_{CRF}	Para. 9.4.1.5	Para. 9.4.1.5	-	0.05	Ω
	Indicator Circuit	R_{Cind}			Resistor value -5.0	Resistor value +5.0	%
6	Coil Resistance	R_C	Para. 9.4.1.6	Para. 9.4.1.6	70	90	Ω

TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE - RF PARAMETERS

NO	CHARACTERISTICS	SYMBOL	ESA/SCC 3603 TEST METHOD	TEST CONDITION	LIMITS		UNIT
					MIN.	MAX.	
7	Insertion Loss	IL	Para. 9.4.1.7	DC - 3.0GHz 3.0 - 4.2GHz 4.2 - 5.9GHz 5.9 - 10.7GHz 10.7 - 14.5GHz 14.5 - 18.4GHz	-	0.12 0.15 0.20 0.25 0.30 0.50	dB
8	Isolation	ISO	Para. 9.4.1.8	DC - 14.8GHz 14.8 - 18.4GHz	80 70	-	dB
9	Voltage Standing Wave Ratio	VSWR	Para. 9.4.1.9	DC - 3.0GHz 3.0 - 4.2GHz 4.2 - 5.9GHz 5.9 - 10.7GHz 10.7 - 14.5GHz 14.5 - 18.4GHz	-	1.10 1.12 1.15 1.20 1.25 1.35	-

TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

NO	CHARACTERISTICS	SYMBOL	ESA/SCC 3603 TEST METHOD	TEST CONDITION	LIMITS		UNIT
					MIN	MAX	
1	Pick-up Voltage	U_p	Para. 9.4.1.1	Para. 9.4.1.1	-	18.5	V
3	Insulation Resistance	R_i	Para. 9.4.1.3	Para. 9.4.1.3 (Note 1)	10	-	MΩ
5	Contact Resistance RF Path	R_{CRF}	Para. 9.4.1.5	Para. 9.4.1.5	-	0.050	Ω
	Indicator Circuit	R_{Cind}			Resistor value - 10	Resistor value + 10	%
6	Coil Resistance	R_C	Para. 9.4.1.6	Para. 9.4.1.6 (Note 2)	61	-	Ω

NOTES

1. This measurement shall be made only at the high temperature condition.
2. This measurement shall be made only at the low temperature condition.

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 (Δ)	UNIT
1	Pick-up Voltage Drift	$\frac{\Delta U_p}{U_p}$	As per Table 2	As per Table 2	± 15.0	%

TABLE 5 - CONDITIONS FOR LIFE TESTS



NO	CHARACTERISTICS	SYMBOL	CONDITION	UNIT
1	Ambient Temperature	T_{amb}	+ 22	°C
2	Indicator Circuit Voltage	V_{ind}	10 (Max) Note 1	V
	Current			mA
3	RF Contact Voltage	V	30 (max) (2) 10 (max) (2)	mV
	Current			mA

NOTES

1. Limited value due to the power handling capability of the resistors in the telemetry circuit.
2. Shall not be switched.

FIGURE 5 - ELECTRICAL CIRCUIT FOR LIFE TESTS

Not applicable.

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4.8 ENVIRONMENTAL AND ENDURANCE TESTS (CHARTS IV AND V OF ESA/SCC GENERIC SPECIFICATION NO. 3603)

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 of this specification. Unless otherwise stated, the measurements shall be performed at $T_{amb} = +22 \pm 3 \text{ }^{\circ}\text{C}$.

4.8.2 Measurements and Inspections during Endurance Tests

The parameters to be measured and inspections to be performed during endurance tests are scheduled in Table 6 of this specification. Unless otherwise stated, the measurements shall be performed at the applicable test temperature.

4.8.3 Measurements and Inspections on Completion of Endurance Tests

The parameters to be measured and inspections to be performed on completion of the endurance tests are scheduled in Table 6 of this specification. Unless otherwise stated, the measurements shall be performed at $T_{amb} = +22 \pm 3 \text{ }^{\circ}\text{C}$.

4.8.4 Conditions for Life Tests (Part of Endurance Testing)

The requirements for life testing are specified in Section 9 of ESA/SCC Generic Specification No. 3603 with the following difference:-

Number of cycles: 100 000 per RF path, i.e. a total of 900 000 operations.

The conditions for life testing shall be as specified in Table 5 of this specification.



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

NO	ESA/SCC GEN.SPEC.NO. 3603		MEASUREMENTS AND INSPECTIONS		SYMBOL	LIMITS		UNIT
	ENVIRONMENTAL AND ENDURANCE TESTS (1)	TEST METHOD AND CONDITIONS	IDENTIFICATION	CONDITIONS		MIN.	MAX.	
01	Vibration Sinusoidal	Para. 9.8 Para. 9.8.1	Measurements during Test Contact Monitoring	ESA/SCC 3603 Para. 9.8.1(c)	- -	- -	- -	
	Random	Para. 9.8.2	Final Measurements Visual Examination Measurements during Test Contact Monitoring Final Measurements Visual Examination Electr. Measurements	Loosening of parts ESA/SCC 3603 Para. 9.8.2(c) Loosening of parts Table 2, Items 1, 2	- - - -	- - - -	- - - Table 2 Items 1, 2	
02	Rapid Change of Temperature	Para. 9.9	During last cycle Electr. Measurements	Table 3	-		Table 3	
03	RF Leakage	Para. 9.10	R.F. Leakage	Table 1(b) Item 8	E		Table 1(b) Item 8	
04	Mechanical Shock	Para. 9.11	Measurements during Test Contact Monitoring	ESA/SCC 3603 Para. 9.11(c)				
			Final Measurements Visual Examination Electr. Measurements	Para. 9.8.1(d) Table 2	- -	- Table 2	- -	
05	Permanence of Marking	Para. 9.12	Final Measurements Visual Examination	No corrosion or obliteration of marking	-	-	-	
06	Solderability	Para. 9.13	Not applicable					
07	Resistance to Soldering Heat	Para. 9.14	Not applicable					
08	Terminal Strength	Para. 9.15 & Para. 4.3.3 of this spec.	Not applicable					
09	Coupling Proof Torque	Para. 9.16 & Para. 4.3.4 of this spec.	Connector Interface Dimension Check	ESA/SCC 3402 Para. 9.4	-		Para. 4.3.4	
10	Mating and Unmating Forces	Para. 9.17 & Para. 4.3.5 of this spec.	Force	Para. 4.3.5 of this spec.	F		Para. 4.3.5	
11	Damp Heat Steady State	Para. 9.18	Not applicable					

NOTES

1. The tests in this table refer to either Chart IV or Chart V and shall be used as applicable.

TABLE 6 - MEASUREMENTS AND INSPECTIONS ON COMPLETION OF ENVIRONMENTAL TESTS AND AT INTERMEDIATE POINTS AND ON COMPLETION OF ENDURANCE TESTING (CONT'D)

NO	ESA/SCC GEN.SPEC.NO. 3603		MEASUREMENTS AND INSPECTIONS		SYMBOL	LIMITS		UNIT
	ENVIRONMENTAL AND ENDURANCE TESTS (1)	TEST METHOD AND CONDITIONS	IDENTIFICATION	CONDITIONS		MIN.	MAX.	
12	Life	Para. 9.19 and Para. 4.2.4 of this spec.	Measurements during Test Contact Resistance RF Contacts Indicator Contacts Final Measurements Electr. Measurements RF Contacts Indicator Contacts Electr. Measurements	ESA/SCC 3603 Para. 9.19(e) Table 5 of this spec. Table 2, Items 1, 2, 3, 4 Table 2 Item 5 Table 2, Items 6, 7, 8, 9	R _{CRF} R _{Cind} - R _{CRF} R _{Cind} -	ESA/SCC 3603 Para. 9.19(e) - 0.1 Table 2, Item 5 Table 2, Items 1, 2, 3, 4 - 0.1 Table 2, Item 5 Table 2, Items 6, 7, 8, 9	Ω Ω	
13	Mechanical Life	Para. 9.20 and Para. 4.2.4 of this spec.	Not applicable					
14	Thermal Vacuum	Para. 9.21	Measurements during Test (Chart IV) RF Power Handling Electr. Measurements Final Measurements Electr. Measurements	ESA/SCC 3603 Para. 9.21(d) After each power handling Table 3 Table 2	- - -	Table 3 Table 2		
15	Seal Test (Non-vented Devices)	Para. 9.22	Not applicable					

NOTES

- The tests in this table refer to either Chart IV or Chart V and shall be used as applicable.