



**RF CABLE ASSEMBLY, TNC, VERY HIGH POWER,
50 OHMS, SEMI-RIGID AND FLEXIBLE CABLE,
DC TO 8GHZ**

BASED ON TYPE TNC-VHP

ESCC Detail Specification No. 3408/001

Issue 2	July 2023
---------	-----------



LEGAL DISCLAIMER AND COPYRIGHT

European Space Agency, Copyright © 2023, All rights reserved.

The European Space Agency disclaims any liability or responsibility, to any person or entity, with respect to any loss or damage caused, or alleged to be caused, directly or indirectly by the use and application of this ESCC publication.

This publication, without the prior permission of the European Space Agency and provided that it is not used for a commercial purpose, may be:

- copied in whole, in any medium, without alteration or modification.
- copied in part, in any medium, provided that the ESCC document identification, comprising the ESCC symbol, document number and document issue, is removed.

DOCUMENTATION CHANGE NOTICE

(Refer to <https://escies.org> for ESCC DCR content)

DCR No.	CHANGE DESCRIPTION
1578	Specification updated to incorporate changes per DCR.

TABLE OF CONTENTS

1	GENERAL	5
1.1	SCOPE	5
1.2	APPLICABLE DOCUMENTS	5
1.3	TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS	5
1.4	THE ESCC COMPONENT NUMBER AND COMPONENT TYPE VARIANTS	5
1.4.1	The ESCC Component Number	5
1.4.1.2	Characteristics Codes	6
1.4.2	Component Type Variants and Range of Components	6
1.5	MAXIMUM RATINGS	8
1.6	PHYSICAL DIMENSIONS	9
1.6.1	Cable Assembly	9
1.6.2	Connectors	9
1.6.2.1	TNC-VHP, Male, Straight Plug for RG401 Semi-rigid Cable – used in Variants 01, 02	9
1.6.2.2	TNC-VHP, Male, Straight Plug for Flexible Cable Ø7.6mm – used in Variants 04, 05, 10, 11	10
1.6.2.3	TNC-VHP, Male, Right-Angle Plug for Flexible Cable Ø7.6mm – used in Variants 05, 06, 12, 13	10
1.6.2.4	TNC-VHP, Female, Straight Jack for RG401 Semi rigid Cable – used in Variants 02, 03	10
1.6.2.5	TNC-VHP, Female, Straight Jack for Flexible Cable Ø7.6mm – used in Variants 07, 08, 10, 12	11
1.6.2.6	TNC-VHP, Female, Right Angle Jack for Flexible Cable Ø7.6mm – used in Variants 08, 09, 11, 13	11
1.6.3	Connector Interface Dimensions and Connector Interface Gauge Dimensions	12
1.7	ADD-ON COMPONENTS	14
1.7.1	Connectors	14
1.7.2	Cable	14
1.8	MATERIALS AND FINISHES	14
1.8.1	Connectors	14
1.8.2	Cable	14
2	REQUIREMENTS	15
2.1	GENERAL	15
2.1.1	Deviations from the Generic Specification	15
2.2	MARKING	15
2.3	ENVIRONMENTAL AND MECHANICAL TESTS	15
2.4	ROOM TEMPERATURE ELECTRICAL MEASUREMENTS	17
2.5	INTERMEDIATE AND END-POINT ELECTRICAL MEASUREMENTS	17
APPENDIX A		21

1 GENERAL

1.1 SCOPE

This specification details the ratings, physical and electrical characteristics and test and inspection data for the component type variants and/or the range of components specified below. It supplements the requirements of, and shall be read in conjunction with, the ESCC Generic Specification listed under Applicable Documents.

1.2 APPLICABLE DOCUMENTS

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

- (a) ESCC Generic Specification No. [3408](#).

1.3 TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS

For the purpose of this specification, the terms, definitions, abbreviations, symbols and units specified in ESCC Basic Specification No. [21300](#) shall apply.

1.4 THE ESCC COMPONENT NUMBER AND COMPONENT TYPE VARIANTS

1.4.1 The ESCC Component Number

The ESCC Component Number shall be constituted as follows:

- (a) For cable assemblies with semi-rigid cable; Variants 01 to 03:

Example: 3408001015.00AB12345

- Detail Specification Reference: 3408001
- Component Type Variant Number: 01 (as required)
- Characteristic code: Total Length (2m): 2.00 (as required)
- Manufacturer Specific Component Identification: AB12345 (if applicable) where:
 - AB: First two letters of the applicable Manufacturer's name
 - 12345: A unique reference allocated by the Manufacturer to a specific component 3D design.

NOTE:

When a component is ordered without any custom 3D design the Manufacturer Specific Component Identification code shall be omitted from the ESCC Component Number.

- (b) For cable assemblies with flexible cable; Variants 04 to 13:

Example: 3408001045.00

- Detail Specification Reference: 3408001
- Component Type Variant Number: 04 (as required)
- Characteristic code: Total Length (5m): 5.00 (as required)

1.4.1.2 **Characteristics Codes**

Characteristics to be codified as part of the ESCC Component Number shall be as follows:

- (a) **Manufacturer Specific Component Identification (Code: AB12345):**
 Cable assemblies with semi-rigid cable (Variants 01 to 03) may be configured into a custom 3D design specified by the Orderer, subject to a feasibility review by the Manufacturer. A Specific Component Design Sheet that reflects the custom 3D design shall be produced by the Manufacturer after negotiation with the Orderer, and it shall be held under configuration control by the Manufacturer who will allocate a unique Manufacturer Specific Component Identification when a request for a custom cable assembly is received.

Each Specific Component Design Sheet shall detail the selected options applicable to the component design and include the following information as a minimum:

- The Manufacturer Specific Component Identification.
- The ESCC Detail Specification number and issue.
- The applicable Variant number.
- The applicable characteristic code for the total nominal length, L, of the cable assembly.
- A detail drawing of the 3D design including all dimensions.

- (b) **Total Length of Cable Assembly:**

The required total nominal length of the cable assembly, L, (Variants 01 to 13) expressed by means of the following codes. The unit quantity shall be metre (m).

Nominal Length L (m) (Note 1)	Code
0.XX	0.XX
X.XX	X.XX

NOTES:

1. See Para. 1.4.2 for the available limits for length L and Para. 1.6.1 for the tolerances on length L

1.4.2 **Component Type Variants and Range of Components**

The component type variants and range of components applicable to this specification are as follows:

Variant Number	Connector 1 Type (See Paras. 1.6.1 & 1.7.1)	Connector 2 Type (See Paras. 1.6.1 & 1.7.1)	Cable Type (See Para. 1.7.2)	Total Length L (m) (See Para. 1.6.1)	Weight Max (g)
01	TNC-VHP, Male, Straight Plug	TNC-VHP, Male, Straight Plug	RG401 Semi-rigid Cable Ø6.35mm	0.15 to 2 (Notes 1, 2)	Note 3
02	TNC-VHP, Male, Straight Plug	TNC-VHP, Female, Straight Jack	RG401 Semi-rigid Cable Ø6.35mm	0.15 to 2 (Notes 1, 2)	Note 3
03	TNC-VHP, Female, Straight Jack	TNC-VHP, Female, Straight Jack	RG401 Semi-rigid Cable Ø6.35mm	0.15 to 2 (Notes 1, 2)	Note 3
04	TNC-VHP, Male, Straight Plug	TNC-VHP, Male, Straight Plug	Flexible Cable Ø7.6mm	0.15 to 7 (Note 2)	Note 3
05	TNC-VHP, Male, Straight Plug	TNC-VHP, Male, Right-Angle Plug	Flexible Cable Ø7.6mm	0.15 to 7 (Note 2)	Note 3
06	TNC-VHP, Male, Right-Angle Plug	TNC-VHP, Male, Right-Angle Plug	Flexible Cable Ø7.6mm	0.15 to 7 (Note 2)	Note 3
07	TNC-VHP, Female, Straight Jack	TNC-VHP, Female, Straight Jack	Flexible Cable Ø7.6mm	0.15 to 7 (Note 2)	Note 3
08	TNC-VHP, Female, Straight Jack	TNC-VHP, Female, Right-Angle Jack	Flexible Cable Ø7.6mm	0.15 to 7 (Note 2)	Note 3

Variant Number	Connector 1 Type (See Paras. 1.6.1 & 1.7.1)	Connector 2 Type (See Paras. 1.6.1 & 1.7.1)	Cable Type (See Para. 1.7.2)	Total Length L (m) (See Para. 1.6.1)	Weight Max (g)
09	TNC-VHP, Female, Right-Angle Jack	TNC-VHP, Female, Right-Angle Jack	Flexible Cable Ø7.6mm	0.15 to 7 (Note 2)	Note 3
10	TNC-VHP, Male, Straight Plug	TNC-VHP, Female, Straight Jack	Flexible Cable Ø7.6mm	0.15 to 7 (Note 2)	Note 3
11	TNC-VHP, Male, Straight Plug	TNC-VHP, Female, Right-Angle Jack	Flexible Cable Ø7.6mm	0.15 to 7 (Note 2)	Note 3
12	TNC-VHP, Male, Right-Angle Plug	TNC-VHP, Female, Straight Jack	Flexible Cable Ø7.6mm	0.15 to 7 (Note 2)	Note 3
13	TNC-VHP, Male, Right-Angle Plug	TNC-VHP, Female, Right-Angle Jack	Flexible Cable Ø7.6mm	0.15 to 7 (Note 2)	Note 3

NOTES:

1. Cable assemblies with semi-rigid cable may be configured into a custom 3D design specified by the Orderer. Total length L applies to the cable assembly without any 3D design (see Para. 1.6.1).
2. Any length in the given range is available.
3. The cable assembly total maximum weight may be calculated from the connector weights, the cable weight and the accessories weight as follows:
 - each connector:

Connector Type	Weight Max (g)
TNC-VHP, Male, Straight Plug for RG401 Semi-rigid Cable	27
TNC-VHP, Male, Straight Plug for Flexible Cable Ø7.6mm	28
TNC-VHP, Male, Right-Angle Plug for Flexible Cable Ø7.6mm	54
TNC-VHP, Female, Straight Jack for RG401 Semi-rigid Cable	20
TNC-VHP, Female, Straight Jack for Flexible Cable Ø7.6mm	28
TNC-VHP, Female, Right-Angle Jack for Flexible Cable Ø7.6mm	47

- Cable weight:
 - Variants 01 to 03: 158g/m
 - Variants 04 to 13: 118g/m
- Accessories (solder and marking sleeve) weight:
 - Variants 01 to 03: 7g
 - Variants 04 to 13: 7g

1.5 MAXIMUM RATINGS

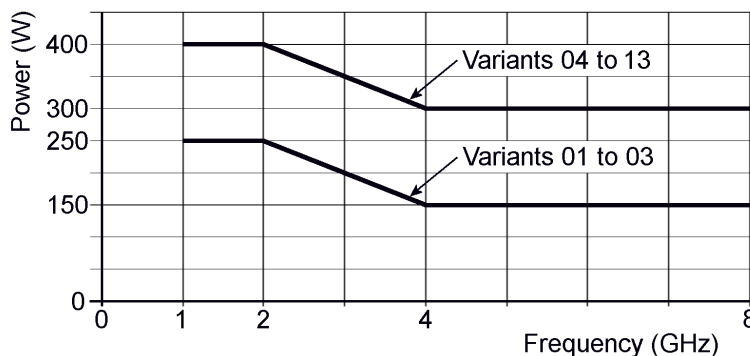
The maximum ratings shall not be exceeded at any time during use or storage.

Maximum ratings shall only be exceeded during testing to the extent specified in this specification and when stipulated in Test Methods and Procedures of the ESCC Generic Specification.

Characteristics	Symbols	Maximum Ratings	Units	Remarks
RF Pulse Power Variants 01 to 03: Variants 04 to 13:	P_{rfp}	2000 2000	Wpp	Note 1. Pulse conditions: 20 μ s, PRF = 1000Hz
RF Power (continuous) Variants 01 to 03: Variants 04 to 13:	P_{rf}	250 400	W	Notes 1,2; Over T_{op} Notes 1, 2, 3
Nominal Impedance	Z	50	Ω	
Operating Frequency Range	f_{op}	DC to 8	GHz	-
Corona Level	P_{co}	120	W	RF power level without corona breakdown
Minimum Bending Radius Variants 01 to 03: Variants 04 to 13:	R_{min}	35.2 80	mm	Dynamic bend radius
Operating Temperature Range Variants 01 to 03: Variants 04 to 13:	T_{op}	-60 to +100 -65 to +165	$^{\circ}$ C	T_{cable} , Note 3 T_{amb}
Storage Temperature Range Variants 01 to 03: Variants 04 to 13:	T_{stg}	-65 to +100 -65 to +165	$^{\circ}$ C	-
Coupling Nut Torque	Tq	339	N.cm	Coupling Proof Torque Note 4

NOTES:

- Derating with pressure is not required for ≤ 1.5 mPa.
- At $f = 2$ GHz. For $f > 2$ GHz, derate as shown below:

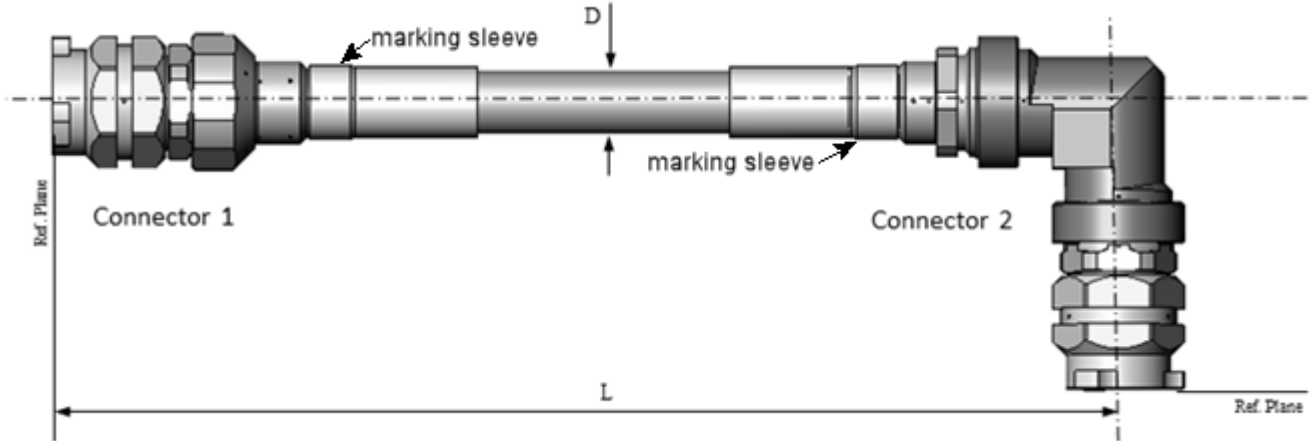


- At $T_{amb} = +100^{\circ}$ C. For $T_{amb} > +100^{\circ}$ C, derate linearly to 0W at $T_{amb} = +165^{\circ}$ C.
- For Semi-Rigid cable, when power is applied, the cable temperature shall be maintained (by cooling) at the ambient temperature and no greater than the maximum specified operating temperature.
- Whenever a test is performed on mated pairs of connectors, the pairs shall be torqued at 265N.cm.

1.6 PHYSICAL DIMENSIONS

1.6.1 Cable Assembly

EXAMPLE



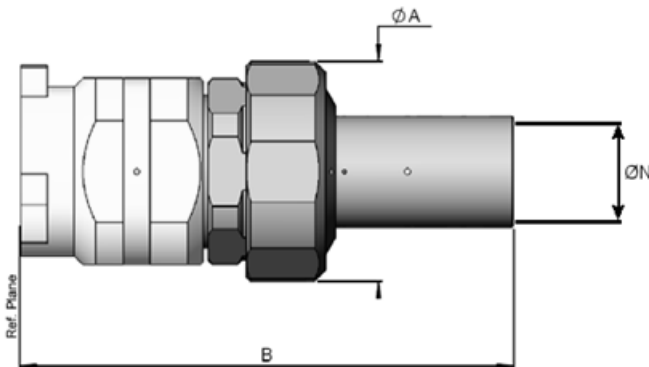
Variant Number	Symbols	Dimensions mm (Note 1)		Remarks
		Min	Max	
01 to 03	L	L - 0.5	L + 0.5	L = nominal length: 0.15 to 2m. Note 2
04 to 13		L + 0	L + 10	L = nominal length: 0.15 to 7m
01 to 03	ØD	-	6.375	Cable outer diameter
04 to 13		-	7.6	Cable outer diameter

NOTES:

- For connector dimensions, see Para. 1.6.2 (as applicable) and Para. 1.6.3.
- Total length L applies to the cable assembly without any 3D design.

1.6.2 Connectors

1.6.2.1 *TNC-VHP, Male, Straight Plug for RG401 Semi-rigid Cable – used in Variants 01, 02*

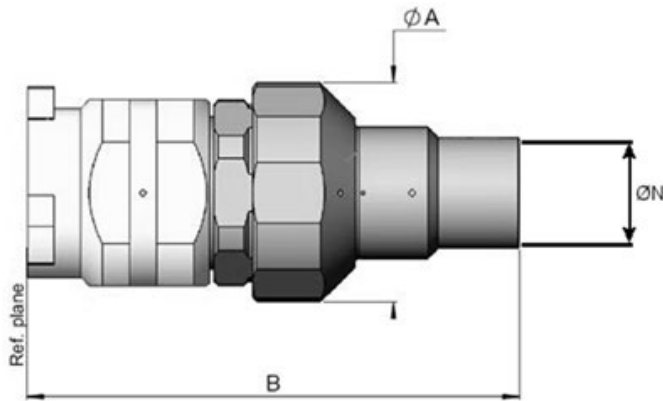


Symbols	Dimensions mm	
	Min	Max
ØA	16.4	16.6
B	-	38
ØN	6.45	6.5

NOTES:

- For connector interface dimensions, see Para. 1.6.3.

1.6.2.2 TNC-VHP, Male, Straight Plug for Flexible Cable Ø7.6mm – used in Variants 04, 05, 10, 11

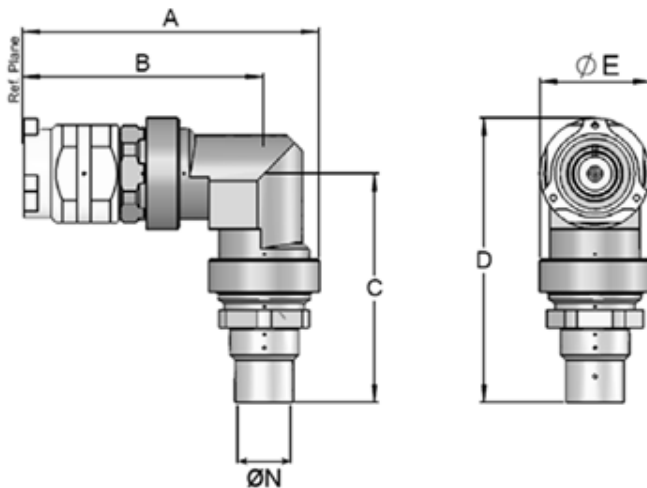


Symbols	Dimensions mm	
	Min	Max
ØA	16.4	16.6
B	-	38
ØN	6.7	7.1

NOTES:

1. For connector interface dimensions, see Para. 1.6.3.

1.6.2.3 TNC-VHP, Male, Right-Angle Plug for Flexible Cable Ø7.6mm – used in Variants 05, 06, 12, 13

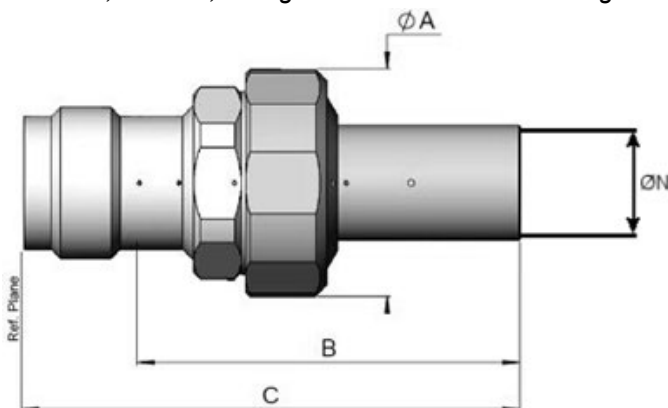


Symbols	Dimensions mm	
	Min	Max
A	-	43
B	-	35
C	-	33
D	-	41
ØE	15.9	16.1
ØN	6.7	7.1

NOTES:

1. For connector interface dimensions, see Para. 1.6.3.

1.6.2.4 TNC-VHP, Female, Straight Jack for RG401 Semi rigid Cable – used in Variants 02, 03

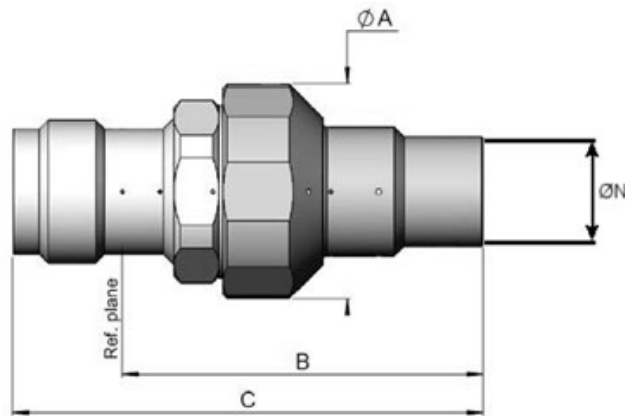


Symbols	Dimensions mm	
	Min	Max
ØA	16.4	16.6
B	-	28
C	-	37
ØN	6.45	6.50

NOTES:

1. For connector interface dimensions, see Para. 1.6.3.

1.6.2.5 TNC-VHP, Female, Straight Jack for Flexible Cable Ø7.6mm – used in Variants 07, 08, 10, 12

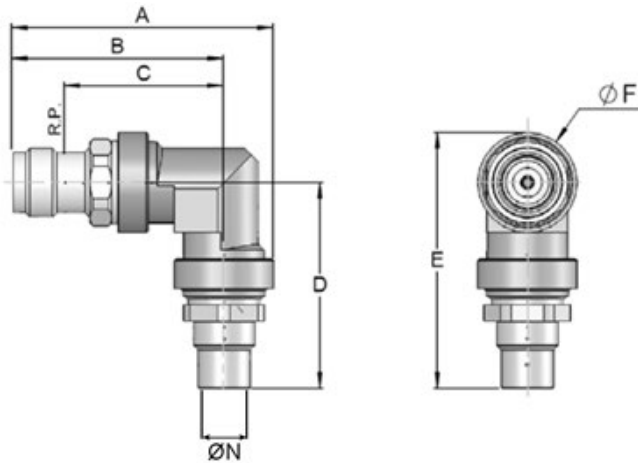


Symbols	Dimensions mm	
	Min	Max
ØA	16.4	16.6
B	-	28
C	-	37
ØN	6.7	7.1

NOTES:

1. For connector interface dimensions, see Para. 1.6.3.

1.6.2.6 TNC-VHP, Female, Right Angle Jack for Flexible Cable Ø7.6mm – used in Variants 08, 09, 11, 13



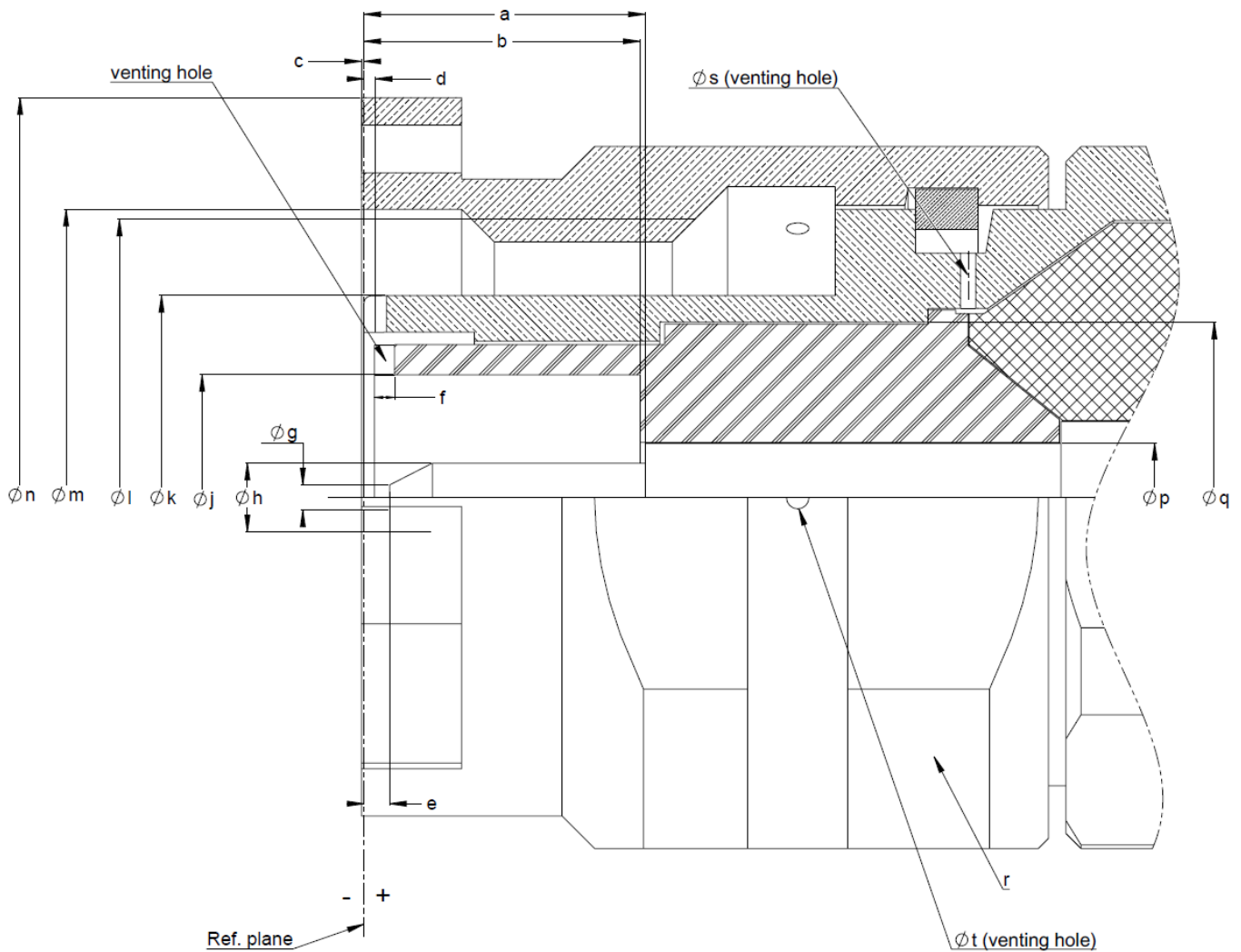
Symbols	Dimensions mm	
	Min	Max
A	-	43
B	-	35
C	-	26
D	-	33
E	-	41
ØE	15.9	16.1
ØN	6.7	7.1

NOTES:

1. For connector interface dimensions, see Para. 1.6.3.

1.6.3 Connector Interface Dimensions and Connector Interface Gauge Dimensions

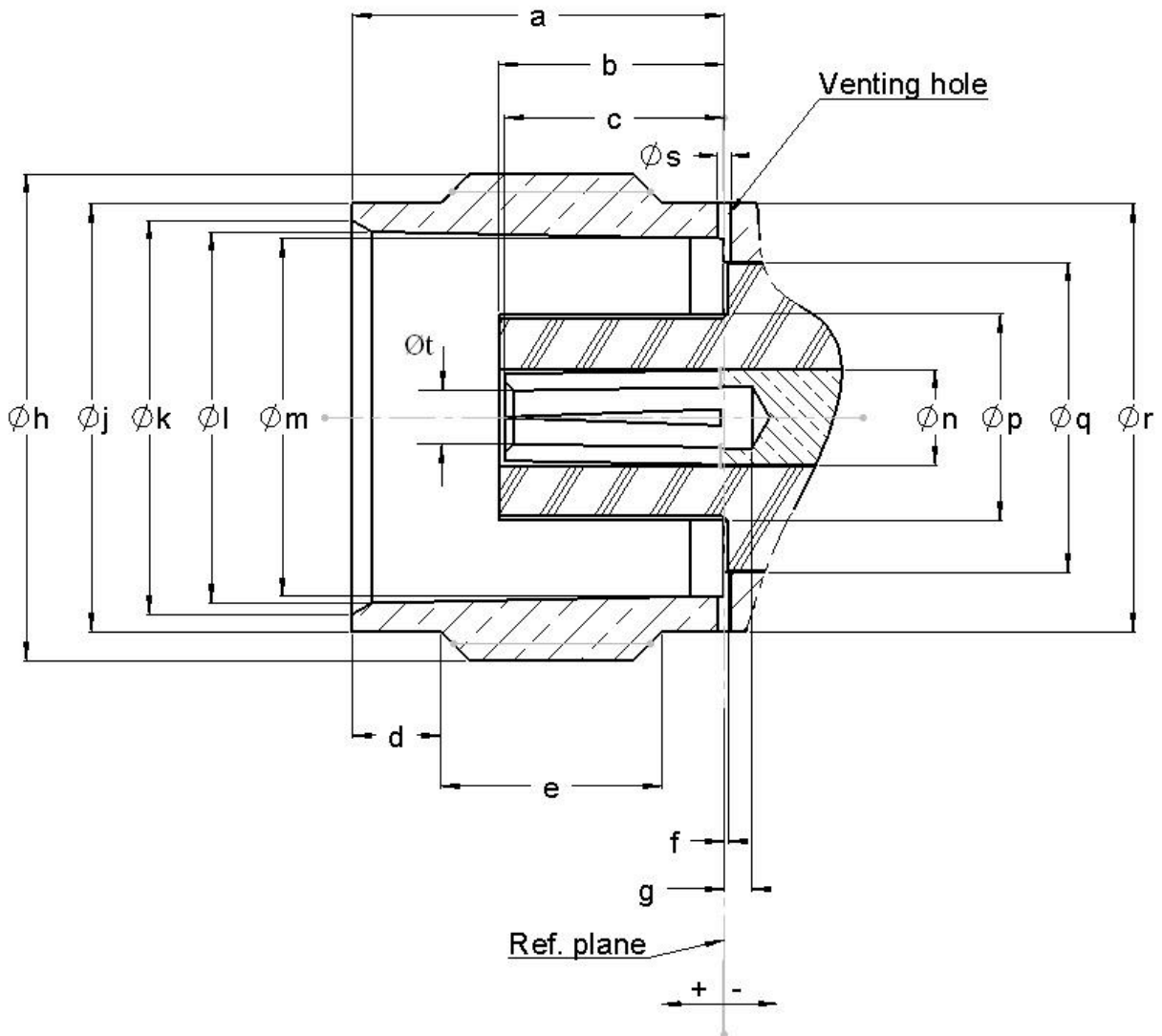
TNC MALE INTERFACE



Symbols	Dimensions (mm)		Remarks
	Min	Max	
a	5.35	5.85	
b	5.42	5.78	
c	+0.3	-0.55	
d	0.15	0.45	
e	0.1	0.9	
f	0.35 x 0.35	0.45 x 0.45	Venting hole
ϕg	0.35	0.65	
ϕh	1.32	1.37	
ϕj	4.88	4.92	

Symbols	Dimensions (mm)		Remarks
	Min	Max	
ϕk	8.03	8.09	
ϕl	7/16-28 UNEF-2B		
ϕm	11.4	11.6	
ϕn	-	16	
ϕp	2.14	2.18	
ϕq	6.975	7.025	
r	-	14	Square
ϕs	0.25	0.35	Venting hole
ϕt	0.4	0.5	Venting hole

TNC FEMALE INTERFACE



Symbols	Dimensions (mm)		Remarks
	Min	Max	
a	8.36	8.46	
b	4.97	5.23	
c	4.72	5.22	
d	1.8	2.2	
e	4.75	5.25	
f	-0.1	+0.05	
g	0.08	1.18	
Øh	7/16-28 UNEF-2A		
Øj	9.61	9.68	

Symbols	Dimensions (mm)		Remarks
	Min	Max	
Øk	8.8	9	
Øl	8.32	8.46	
Øm	8.1	8.15	
Øn	2.14	2.18	
Øp	4.62	4.72	
Øq	6.975	7.025	
Ør	9.61	9.68	
Øs	0.25	0.35	Venting hole
Øt	1.4	1.45	

1.7 ADD-ON COMPONENTS

1.7.1 Connectors

The connectors to be used in the components specified herein shall be RF coaxial connectors type TNC-VHP that meet the requirements of this specification and the ESCC Generic Specification.

1.7.2 Cable

The cable to be used in the components specified herein, as applicable, shall be as follows:

- For Variants 01 to 03: 6.35mm outer diameter, RG401 semi-rigid cable that meets the requirements of this specification and the ESCC Generic Specification.
- For Variants 04 to 13: be 7.6mm outer diameter, RF low density PTFE flexible coaxial cable that meets the requirements of this specification and the ESCC Generic Specification.

1.8 MATERIALS AND FINISHES

Materials and finishes shall be as follows.

1.8.1 Connectors

The materials and finishes applicable to the various connectors shall be as follows, as applicable to each connector type:

- (a) Body Shell: Beryllium copper; plated gold 2.5µm minimum over copper 2.5µm minimum.
- (b) Coupling Nut: Beryllium copper; plated silver 5µm minimum.
- (c) Centre Contact:
 - For straight plugs: Brass, plated silver 5µm minimum over copper 0.5µm minimum.
 - For straight jacks: Beryllium copper, plated silver 5µm minimum over copper 0.5µm minimum.
 - For right-angled plugs and jacks: Brass, plated gold 2.5µm minimum over copper 2.5µm minimum.
- (d) Soldering Sleeve: Beryllium copper; plated silver 5µm minimum over copper 0.5µm minimum.
- (e) Insulator: PTFE / Fluoroloy H
- (f) Marking Sleeve: Polyolefin sumitube; colour: white.

1.8.2 Cable

The materials and finishes applicable to the cable shall be as follows:

- (a) For Variants 01 to 03:
 - Centre Conductor: Copper, silver plated 2µm minimum.
 - Dielectric Core: Solid PTFE.
 - Outer Conductor: Copper.
- (b) For Variants 04 to 13
 - Centre Conductor: Solid SPC (silver plated copper), silver plated 2µm minimum.
 - Dielectric Core: Low density PTFE tape.
 - Inner Shield: SPC tape (silver plated copper), silver plated 2µm minimum.
 - Outer Shield: SPC braid (silver plated copper), silver plated 2µm minimum.
 - Outer Jacket: ETFE; colour: grey.

2 REQUIREMENTS

2.1 GENERAL

The complete requirements for procurement of the components specified herein are as stated in this specification and the ESCC Generic Specification. Permitted deviations from the Generic Specification, applicable to this specification only, are listed below.

Permitted deviations from the Generic Specification and this Detail Specification, formally agreed with specific Manufacturers on the basis that the alternative requirements are equivalent to the ESCC requirement and do not affect the component's reliability, are listed in the appendices attached to this specification.

2.1.1 Deviations from the Generic Specification

None.

2.2 MARKING

The marking shall be in accordance with the requirements of ESCC Basic Specification No. 21700 and as follows.

The information to be marked on the component shall be:

- (a) The ESCC qualified components symbol (for ESCC qualified components only).
- (b) The ESCC Component Number.
- (c) Traceability information.

2.3 ENVIRONMENTAL AND MECHANICAL TESTS

The following requirements apply to tests performed on the connector (and contact) lot, the cable lot and the cable assembly lot, as specified in the ESCC Generic Specification:

- (a) Para. 8.2, Contact Capability: Applicable only to connectors with female contacts. The following test requirements shall apply:

	Pick-up Test	Drop Test
Weight (g)	57	917
Test Pin Diameter (mm)	1.372 (+0.004 -0)	1.321 (+0 -0.013)
Insertion Depth (mm)	3.4 ±0.05	3 ±0.05

- (b) Para. 8.4, Plating Thickness: Plating thicknesses: see Para. 1.8.1.
- (c) Para. 8.5, Magnetism Level: When tested in accordance with the ESCC Generic Specification, the residual magnetism shall not exceed 20 gamma.
- (d) Para. 8.7, Insulation Flaws:
 - Variants 01 to 03: shall not be performed.
 - Variants 04 to 13:
 - Applied voltage: 1.5kV
 - Frequency: 2.5 ±1kHz
- (e) Para. 8.11, Adhesion of Inner Conductor:
 - Variants 01 to 03: 20N minimum.
 - Variants 04 to 13: 20N minimum.

- (f) Para. 8.12, Dielectric Strength of Jacket:
 - Variants 01 to 03: shall not be performed.
 - Variants 04 to 13:
 - Test voltage: 1.5kV
 - Frequency: 50Hz
- (g) Para. 8.13, Conductor Resistance:
 - Variants 01 to 03: 8.3Ω/km.
 - Variants 04 to 13: 4.23Ω/km.
- (h) Para. 8.14, Capacitance:
 - Variants 01 to 03: 95.2pf/m.
 - Variants 04 to 13: 79pf/m.
- (i) Para. 8.15, Characteristic Impedance: 50±1Ω.
- (j) Para. 8.17.2.1, Temperature Cycling I (Chart F4A): Applicable to all Variants.
- (k) Para. 8.18, Coupling Proof Torque: See Para. 1.5.
- (l) Para. 8.19, Mating and Unmating Forces: 22.6N.cm maximum.
- (m) Para. 8.21, Multipaction: Applicable to all Variants.
 - Multipaction classification of component type: 2
 - Operating frequency: 1GHz
- (n) Para. 8.26, Cable Retention Force:
 - Variants 01 to 03:
 - Force: 408N
 - Torque: 50N.cm
 - Variants 04 to 13: 50N
- (o) Para. 8.27, Radiation: Applicable to Variants 01 to 13:
 - Radiation dosage: 120Mrad.
- (p) Para. 8.32, Corona: Applicable to all Variants.
 - Applied RF power without corona breakdown: See Para. 1.5.
- (q) Para. 8.33, RF Power Handling: Applicable to all Variants.
 - Test temperature: +100°C.
 - Applied RF power (after thermal stabilisation):
 - Variants 01 to 03: 250W
 - Variants 04 to 13: 400W
 - Operating frequency: 2GHz
- (r) Para. 8.34, RF Power Cycling: Applicable to all Variants.
 - Test temperature: +100°C.
 - Applied RF power (after thermal stabilisation):
 - Variants 01 to 03: 250W
 - Variants 04 to 13: 400W
 - Operating frequency: 2GHz
- (s) Para. 8.36, Crimp Contact Tensile Strength: Not applicable.

2.4 ROOM TEMPERATURE ELECTRICAL MEASUREMENTS

The measurements shall be performed at $T_{amb} = +22 \pm 3^{\circ}C$.

Characteristics	Symbols	Test Method and Conditions	Limits		Units
			Min	Max	
Dielectric Withstanding Voltage	DWV	ESCC No. 3408 Note 1	1000	-	Vrms
Voltage Proof Leakage Current	I _{VPL}	Note 2	-	2	mA
Insulation Resistance	R _i	ESCC No. 3408	5000	-	MΩ
Voltage Standing Wave Ratio	VSWR	ESCC No. 3408 RF Power = 1mW			-
Variants 01 to 03:		f = DC to < 4GHz	-	1.3	
Variants 01 to 03:		f = 4 to ≤ 8GHz	-	1.45	
Variants 04 to 13:		f = DC to < 4GHz	-	1.25	
Variants 04 to 13:		f = 4 to ≤ 8GHz	-	1.45	
Insertion Loss	IL	ESCC No. 3408 f = DC to 8GHz	-	Note 3	dB

NOTES:

- Test voltage shall be applied between inner and outer conductors.
- Measured during Dielectric Withstanding Voltage.
- IL maximum limits, where the cable assembly length L is in metres and the test frequency f is in GHz, shall be calculated as follows:
 - Variants 01, 02, 03, 04, 05, 07, 08, 10, 11, 12:

$$IL \leq 0.035 \times \sqrt{f} + 0.192 \times \sqrt{f} \times L + 0.004 \times f \times L$$
 - Variants 06, 09, 13:

$$IL \leq 0.08 \times \sqrt{f} + 0.192 \times \sqrt{f} \times L + 0.004 \times f \times L$$

2.5 INTERMEDIATE AND END-POINT ELECTRICAL MEASUREMENTS

Unless otherwise specified, the measurements shall be performed at $T_{amb} = +22 \pm 3^{\circ}C$

Unless otherwise specified, test methods and test conditions shall be as per the corresponding test defined in Room Temperature Electrical Measurements.

Test Reference per ESCC No. 3408	Characteristics	Symbols	Limits		Units
			Min	Max	
Temperature Cycling (I & II) Final Measurements	Voltage Standing Wave Ratio	VSWR	Note 1		
	Insertion Loss	IL	Note 2		

Test Reference per ESCC No. 3408	Characteristics	Symbols	Limits		Units
			Min	Max	
Electrical Measurements at Room, High and Low Temperatures	At room temperature: $T_{amb} = +22 \pm 3^{\circ}\text{C}$				
	Dielectric Withstanding Voltage	DWV	Note 1		
	Voltage Proof Leakage Current	I_{VPL}	Note 1		
	Insulation Resistance	I_R	Note 1		
	Voltage Standing Wave Ratio	VSWR	Note 1		
	Insertion Loss	IL	Note 1		
	at high temperature (Note 3):				
	Dielectric Withstanding Voltage	DWV	Note 1		
	Voltage Proof Leakage Current	I_{VPL}	Note 1		
Insulation Resistance	I_R	Note 1			
Voltage Standing Wave Ratio	VSWR	Note 1			
Insertion Loss	IL	-	Note 5	dB	
at low temperature (Note 4):					
Dielectric Withstanding Voltage	DWV	Note 1			
Voltage Proof Leakage Current	I_{VPL}	Note 1			
Insulation Resistance	I_R	Note 1			
Voltage Standing Wave Ratio	VSWR	Note 1			
Insertion Loss	IL	-	Note 5	dB	
Shielding Effectiveness	Shielding Effectiveness Variants 01 to 03 Variants 04 to 13	SE	100 90	- -	dB
Cable Retention Force					
Initial Measurement	Voltage Standing Wave Ratio	VSWR	Note 1		
Final Measurement	Voltage Standing Wave Ratio	VSWR	Note 1		
	Insertion Loss	IL	Note 1		

Test Reference per ESCC No. 3408	Characteristics	Symbols	Limits		Units
			Min	Max	
Radiation Initial Measurement Final Measurement	Voltage Standing Wave Ratio	VSWR	Note 1		
	Insertion Loss	IL	Note 1		
	Dielectric Withstanding Voltage	DWV	Note 1		
	Voltage Proof Leakage Current	I _{VPL}	Note 1		
	Insulation Resistance	I _R	Note 1		
	Voltage Standing Wave Ratio	VSWR	Note 1		
	Insertion Loss	IL	Note 1		
Ageing	Voltage Standing Wave Ratio	VSWR	Note 1		
	Insertion Loss	IL	Note 1		
Bending	Voltage Standing Wave Ratio	VSWR	Note 1		
	Insertion Loss	IL	Note 1		
Random Vibration	Voltage Standing Wave Ratio	VSWR	Note 1		
	Insertion Loss	IL	Note 1		
Sine Vibration	Voltage Standing Wave Ratio	VSWR	Note 1		
	Insertion Loss	IL	Note 1		
Corona During Testing Final Measurement	Voltage Standing Wave Ratio	VSWR	Note 1		
	Insertion Loss	IL	Note 1		
	Dielectric Withstanding Voltage	DWV	Note 1		
	Voltage Proof Leakage Current	I _{VPL}	Note 1		
	Insulation Resistance	I _R	Note 1		
	Voltage Standing Wave Ratio	VSWR	Note 1		
	Insertion Loss	IL	Note 1		

Test Reference per ESCC No. 3408	Characteristics	Symbols	Limits		Units
			Min	Max	
RF Power Handling During Testing Final Measurement	Voltage Standing Wave Ratio	VSWR	Note 1		
	Insertion Loss	IL	Note 1		
	Dielectric Withstanding Voltage	DWV	Note 1		
	Voltage Proof Leakage Current	I _{VPL}	Note 1		
	Insulation Resistance	I _R	Note 1		
	Voltage Standing Wave Ratio	VSWR	Note 1		
	Insertion Loss	IL	Note 1		
RF Power Cycling During Testing Final Measurement	Voltage Standing Wave Ratio	VSWR	Note 1		
	Insertion Loss	IL	Note 1		
	Dielectric Withstanding Voltage	DWV	Note 1		
	Voltage Proof Leakage Current	I _{VPL}	Note 1		
	Insulation Resistance	I _R	Note 1		
	Voltage Standing Wave Ratio	VSWR	Note 1		
	Insertion Loss	IL	Note 1		

NOTES:

- The limits specified in Room Temperature Electrical Measurements shall apply.
- IL maximum limits to be applied during temperature cycling final measurements shall be as follows:
 - For test frequency $f \leq 5\text{GHz}$: as specified in Room Temperature Electrical Measurements.
 - For test frequency $f > 5\text{GHz}$: as specified in Room Temperature Electrical Measurements plus 20%.
- Electrical measurements at high temperature shall be performed as follows:
 - For Variants 01 to 03: $T_{\text{cable}} = +100 (+0 -5)^{\circ}\text{C}$
 - For Variants 04 to 13: $T_{\text{amb}} = +165 (+0 -5)^{\circ}\text{C}$
- Electrical measurements at low temperature shall be performed as follows:
 - For Variants 01 to 03: $T_{\text{cable}} = -60 (+5 -05)^{\circ}\text{C}$
 - For Variants 04 to 13: $T_{\text{amb}} = -65 (+5 -0)^{\circ}\text{C}$
- IL maximum limits at high and low temperatures shall be calculated using IL measured at room temperature and the applicable test temperature T in °C as follows:
 - $IL(\text{at } T) = 1.2 \times IL(\text{at } 22^{\circ}\text{C}) \times (1 + (T - 22) \times 0.002)$

APPENDIX A
AGREED DEVIATIONS FOR RADIALL (F)

Items Affected	Description of Deviations
Para. 1.5 Maximum Ratings Para. 2.3(q) Environmental and Mechanical Tests: RF Power Handling Para. 2.3(r) Environmental and Mechanical Tests: RF Power Cycling	<p>RF Power (continuous), P_{rf}, for Variants 04 to 13: Due to test equipment limitations, all tests required to be performed at rated RF Power of 400W at 2GHz (i.e. RF Power Handling and RF Power Cycling for Variants 04 to 13), may be performed at a reduced RF Power of 355W at 2GHz.</p> <p>Note: The required performance for Variants 04 to 13, up to the specified rated RF Power: 400W at 2GHz, was confirmed during the initial ESCC Qualification in 2018 by the use of simulation techniques. The simulated results correlate with the real qualification test results at 355W at 2GHz.</p> <p>There have been no changes in the material, process and design of the components since the initial qualification.</p>
Para. 1.7.2 Add-on Components: Cable	<p>Cable types as follows, as specified in the PID, shall apply:</p> <ul style="list-style-type: none"> • RG401 Semi-rigid cable: type RG401/U in accordance with RAD-APP-CABL-001 and RAD-DET-CABL-001. • Flexible Cable Ø7.6mm: type SHF 8MS in accordance with RAD-APP-CABL-002 and RAD-DET-CABL-002.